TRACY SUBBASIN

Groundwater Sustainability Plan

PREPARED FOR:

Banta-Carbona Irrigation District GSA

Byron-Bethany Irrigation District GSA

City of Lathrop GSA

City of Tracy GSA

County of San Joaquin GSA

Stewart Tract GSA

NOVEMBER 2021

Tracy Subbasin Groundwater Sustainability Plan

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Tracy Subbasin GSAs

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November 1, 2021

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Abbreviations and Acronyms

AB	Assembly Bill
Act	Delta Protection Act
AF	acre-feet
AFY	acre-feet per year
ASR	Aquifer Storage and Recovery
AWMP	Agricultural Water Management Plan
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin River Basins
BBID	Byron-Bethany Irrigation District
BCID	Banta-Carbona Irrigation District
bgs	below ground surface
BMP	Best Management Practice
C2VSim-CG	C2VSim Coarse Grid model, formerly called “CVGSM”
C2VSim-FG	C2VSim Fine Grid Version 1.0
Cal Water	California Water Service Company
CASGEM	California Statewide Groundwater Elevation Monitoring
CDFW	California Department of Fish and Wildlife
CDWA	Central Delta Water Agency
cfs	cubic feet per second
COCs	Constituents of Concern
County	San Joaquin County
CGPS	continuous global positioning system
CSA	county services area
CVGSM	California Central Valley Groundwater Surface Water Model, renamed the C2VSim Coarse Grid (C2VSim-CG) model
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DAC	Disadvantaged Communities
DBCP	dibromochloropropane
DDW	California Department of Water Resources Division of Drinking Water
Delta	San Joaquin Delta
DMC	Delta-Mendota Canal
DMS	data management system
DPC	Delta Protection Commission
DWR	California Department of Water Resources
EDB	ethylene dibromide
EPA	United States Environmental Protection Agency
ET	evapotranspiration
GAMA	USGS Groundwater Ambient Monitoring and Assessment
GDEs	groundwater dependent ecosystems
gpd/ft	gallons per day per foot
gpm	gallons per minute

GPS	Global Positioning System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrologic Conceptual Model
ID	identification
ILRP	Irrigated Lands Regulatory Program
InSAR	interferometric synthetic aperture radar
IRWMP	Integrated Regional Water Management Program
MAF	million acre-feet
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
MHI	Median Household Income
MOA	Memorandum of Agreement
msl	mean sea level
NASA JPL	National Aeronautics and Space Administration Jet Propulsion Laboratory
NCCAG	Natural Communities Commonly Associated with Groundwater
NJDD	New Jerusalem Drainage District
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
PCE	perchloroethylene
PFAS	perfluorooctanoic acids
Plan	Groundwater Sustainability Plan
PWS	public water supply
RD	Reclamation District
Reclamation	U.S. Bureau of Reclamation
RP	reference point
RWQCB	Regional Water Quality Control Board
SAGBI	Soil Agricultural Groundwater Banking Index
SB	Senate Bill
SB X7-7	Water Conservation Act of 2009
SCSWSP	South County Surface Water Supply Project
SCWSP	South County Water Supply Program
SDAC	Severely Disadvantaged Community
SDWA	South Delta Water Agency
SGMA	Sustainable Groundwater Management Act
SJCFCWCD	San Joaquin County Flood Control and Water Conservation District
SJRI	San Joaquin River Index
SLDMWA	San Luis Delta Mendota Water Authority
SMC	Sustainable Management Criteria
SSJID	South San Joaquin Irrigation District
State Water Board	California State Water Resources Control Board
Subbasin	Tracy Subbasin
SWP	State Water Project
TCE	trichloroethylene
TDS	Total Dissolved Solids

TNC	The Nature Conservancy
UNAVCO	University NAVSTAR Consortium
U.S.	United States
USACE	U.S. Army Corps of Engineers
USGS	United States Geologic Survey
UWMP	Urban Water Management Plan
W-SJ	Westside-San Joaquin
Water Code	State of California Water Code
WCR	well completion report
WSID-PID MA	West Side Irrigation District-Patterson Irrigation District Management Areas

Executive Summary

Introduction – Chapter 1

In 2014, the Sustainable Groundwater Management Act (SGMA) was signed by the governor, setting the framework for local agencies to sustainably manage California's groundwater basins. SGMA requires groundwater basins/subbasins designated by the California Department of Water Resources (DWR) as medium or high priority to follow four basic steps:

Step 1 – Form Groundwater Sustainability Agency(s) (GSA)

Step 2 – Develop and adopt a Groundwater Sustainability Plan (GSP or Plan)

Step 3 – Implement the Plan to achieve a sustainability goal and avoid undesirable results within 20 years

Step 4 – Report the implementation activities to DWR to document whether the sustainability goal and the avoidance of undesirable results has been achieved

Ultimately, six GSAs were formed to manage groundwater in the Tracy Subbasin (Subbasin), completing Step 1. Figure ES-1 shows the location of the Subbasin and the GSAs. This GSP and adoption by each GSA will complete Step 2. This GSP will be updated every 5 years as additional information becomes available. Steps 3 and 4 will be implemented over the next 20 years.

SGMA identified six sustainability indicators that, when there are no significant and undesirable results present, indicate a sustainable basin. The six sustainability indicators are:

- chronic lowering of groundwater levels
- reduction of storage
- land subsidence
- seawater intrusion
- degradation of water quality
- surface water depletion

For each sustainability indicator, the GSP must identify the significant and undesirable results (as locally defined), minimum thresholds, and measurable objectives that will be used to guide and define sustainable conditions and the overall groundwater management goals.

The Tracy Subbasin was designated by DWR as a "medium priority" subbasin and is therefore required to comply with SGMA. The Tracy Subbasin is bounded by three adjacent subbasins that were also designated as "medium" and "high priority" and are required to comply with SGMA. Two of these adjacent subbasins, the Eastern San Joaquin and Delta-Mendota subbasins, were designated as "high priority" and "critically over-drafted," submitted their GSPs to DWR in 2020. These two subbasins are currently implementing their plans. The East Contra Costa subbasin is a medium priority subbasin and is currently developing its GSP. Figure ES-1 shows the location of the Tracy Subbasin along with the adjacent subbasin names and locations.

Agency Information – Chapter 2

Six agencies (Banta-Carbona Irrigation District, Byron-Bethany Irrigation District, City of Lathrop, City of Tracy, San Joaquin County, and the Stewart Tract) comprise the six GSAs responsible for sustainability managing groundwater in the Subbasin. Figure ES-1 shows the areas managed by each GSA. SGMA requires the GSAs are to consider the interests of all beneficial users and uses in the Subbasin. Beneficial users and uses in the Subbasin include water for agricultural users, domestic well owners, public water systems, environmental users, surface water, federal government facilities, disadvantaged communities, and small community water systems. The GSAs have entered into a Memorandum of Agreement (MOA) to manage groundwater conditions with each GSA having jurisdiction within their respective areas.

The GSAs have elected San Joaquin County (County) to be the lead agency, to have primary point of contact with DWR. In this lead role, the County organized and lead the GSP development and, looking forward, can also contract for services and grants to implement this GSP. Fiscal budgets have been developed and the County will manage these funds. The MOA allows for the GSAs to elect an alternative lead agency.

A thorough budget was developed for implementation of this GSP, which includes annual operating budgets and costs for projects and management actions. The costs were divided into two categories: 1) local costs to be borne by each GSA, and 2) shared costs, those that benefit all GSAs. The average cost for the first 5 years of implementing the GSP is about $234,000 per year.

The GSAs discussed and agreed upon a cost sharing distribution. Some of the shared costs will be funded by the County through an existing Water Investigation Zone No. 2 funds, funds obtained from a Proposition 218 (Zone 2) that has been used for decades to fund water resources programs in the County. The remaining balance of the unfunded shared costs was distributed by GSA.

Plan Area – Chapter 3

The Tracy Subbasin boundaries follow the Old River on the northwest, the Coastal Range on the southwest and south, and the San Joaquin River on the east. The southeast boundary of the Subbasin, along the San Joaquin-Stanislaus county line, follows irregular water district boundaries. The Subbasin is almost entirely with San Joaquin County but includes a small triangular portion of Alameda County. About one-half of the Subbasin is a mix of Delta islands (mostly agriculture) and waterways while the other half is comprised of urban and agricultural communities (Non-Delta areas). Figure ES-2 shows the Delta and Non-Delta areas as designated by this GSP.

Surface water is available to most areas of the basin and is supplemented with groundwater. Groundwater levels within the Subbasin have been relatively stable and recover after periods of pumping with only a few areas indicating declining groundwater levels. About 2,400 wells (about 1,950 domestic and 450 agricultural, industrial and municipal wells) are present in the Subbasin and provide about 12,000 acre-feet annually for drinking water and irrigation, but this only constitutes about 3 percent of the total water supplies for the Subbasin. The remaining 97 percent of water used is surface water. Domestic wells, because of the small amount that they pump (less than 2 acre-feet per year), are considered to be de-minimis users. The agricultural, industrial, and municipal wells are considered high-capacity wells and their pumping can create significant changes in the groundwater levels.

Hydrogeologic Setting – Chapter 4

The Subbasin has two principal aquifers (Upper and Lower) which are separated by a low permeability Clay (the Corcoran Clay) that extends beyond the Subbasin into the San Joaquin Valley. The depth of the Corcoran Clay varies through the Subbasin but generally is about 200 feet below ground surface (bgs). The extent of the Corcoran Clay is not fully defined in the Subbasin.

The Upper aquifer provides water to domestic wells, groundwater dependent ecosystems and public and small community water systems. The Upper aquifer receives recharge from precipitation, deep percolation of applied water for agriculture and rivers. The Upper aquifer also discharges groundwater to the rivers.

The Lower aquifer is used by public water systems and agriculture. The aquifer is recharged from other subbasins south of the Subbasin. The Corcoran Clay is absent near the foothills where precipitation can also recharge the aquifers. Because the Corcoran Clay may be absent beneath the Delta islands and possible in the western portions of the Subbasin, groundwater from the Upper aquifer may also recharge the Lower aquifer.

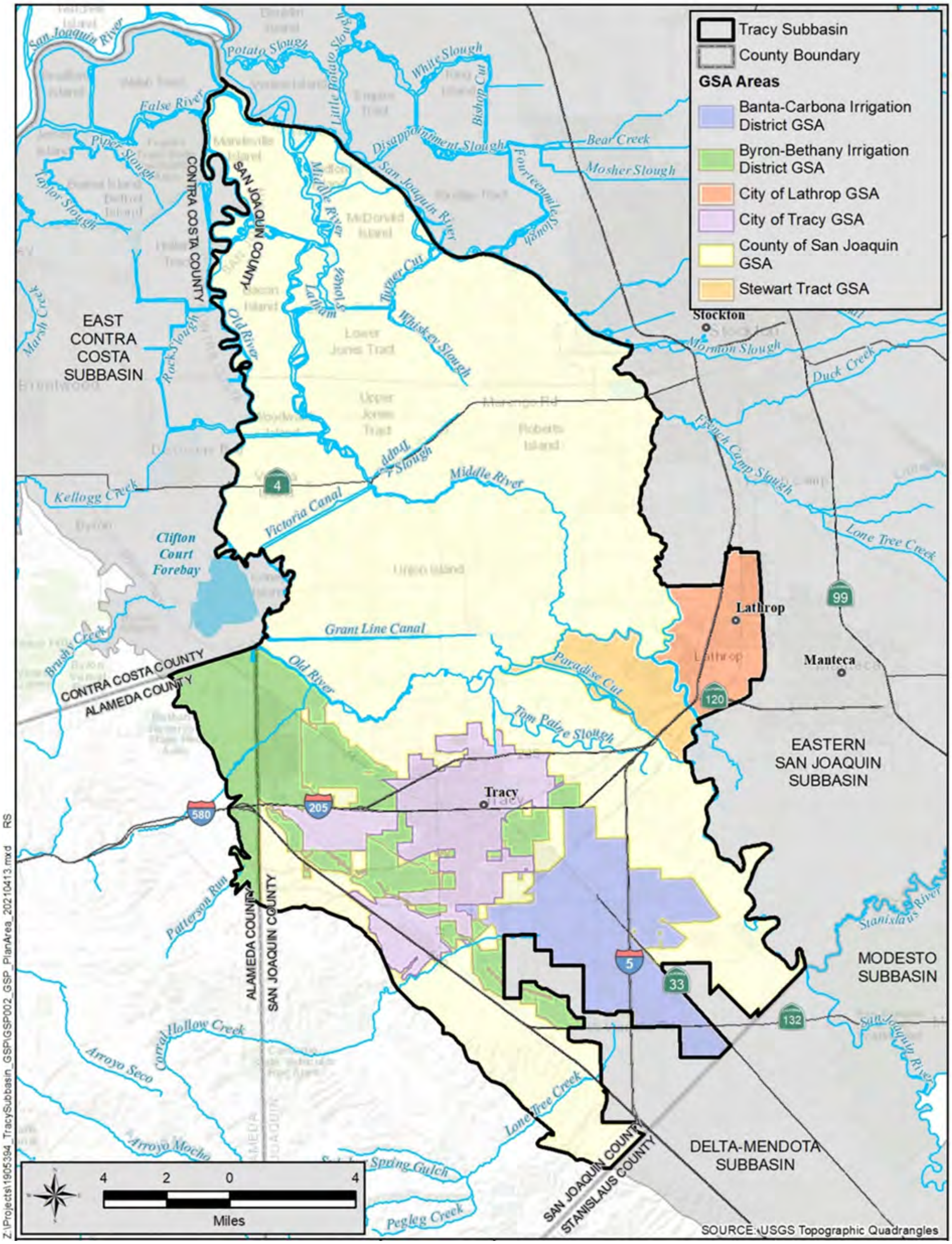

Figure ES-1. Tracy Subbasin GSAs

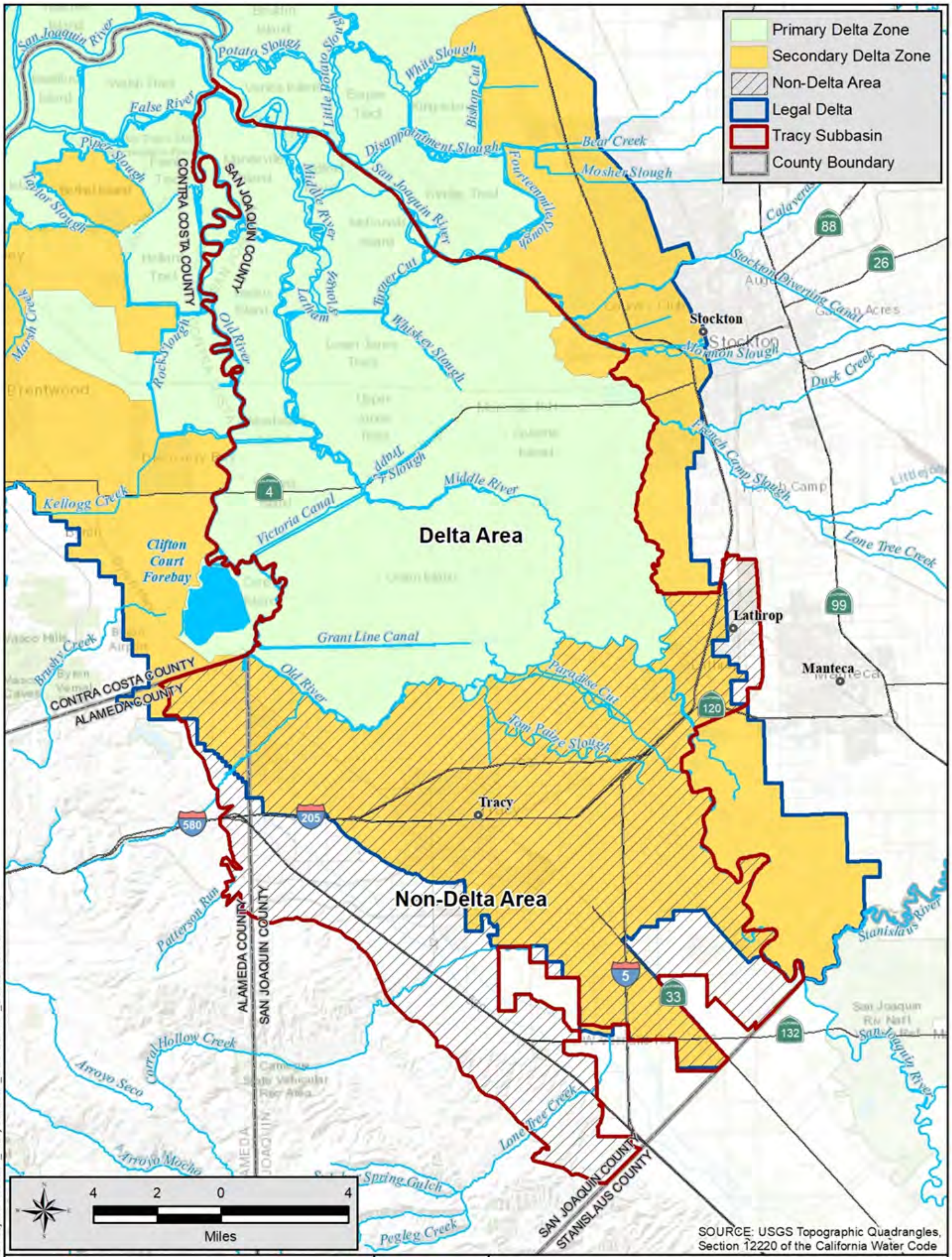

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Figure ES-2. Delta and Non-Delta Management Areas

Groundwater Conditions – Chapter 5

The depth to groundwater in the Upper aquifer varies from a few feet bgs in the Delta islands and near the rivers to as much as 80 feet bgs near the foothills. The depth to groundwater in the Lower aquifer is deeper, ranging from 20 feet bgs to as much as 270 feet bgs near the foothills. Groundwater levels in the Lower aquifer are above the Corcoran Clay; therefore, the potential for subsidence is low.

The groundwater flow direction in the Upper aquifer, in the Non-Delta areas, is generally from the foothills toward the rivers. Groundwater elevations in the Upper aquifer are higher than in the Lower aquifer so there is generally a downward flow of groundwater.

Groundwater in the Lower aquifer also has this same general flow direction but there is also flow from the south, from the Delta-Mendota subbasin. Groundwater from the Lower aquifer discharges into the Eastern San Joaquin Subbasin and into the East Contra Costa Subbasin.

Groundwater levels in most of the Subbasin are stable or rising, however, there are five wells based on long-term records (1998-2020), two in the southern portion of the Non-Delta Management area and three in the western portion of the Non-Delta Management area where groundwater levels are declining. The two southern area wells appear to be constructed in both the Upper and Lower aquifers and new monitoring wells are planned to replace them and to ascertain which aquifer is having declining levels. One of the wells in the western portion of the Subbasin has unknown construction details and two new monitoring wells are planned in this area to resolve which aquifer has groundwater levels declining. The other two wells with declining water levels are near the Old River and monitor the Upper aquifer and have declined by about 4 feet; in a predominately agricultural area with most of the area provided surface water by BBID.

The concentration and depth of the naturally occurring elements varies widely over the Subbasin at any given location. All water supplied by public water systems meets drinking water standards either naturally or is treated prior to being provided to the public. Groundwater quality in the Subbasin has locally exceeded the maximum contaminant levels (MCLs) for drinking water for specific elements, some exceedances are scattered, and some are clustered. Poor groundwater quality has been noted in the following general areas:

- Salinity, as represented by total dissolved solids (TDS), is high in both the Upper and Lower aquifers with a few areas with good quality water
- Elevated concentrations of sulfate are present near the foothills in both the Upper and Lower aquifers potentially from recharge water originating from the Coast Ranges
- Elevated concentrations of arsenic are only in the Upper aquifer and within the Delta area and not in the Lower aquifer
- Boron is present in the Upper aquifer. Most elevated concentrations are present in the Non-Delta areas and in the northern portions of the Delta area

- Elevated concentrations of arsenic are only in the Upper aquifer and within the Delta area and not in the Lower aquifer
- Elevated concentrations of iron and manganese are found randomly in the Subbasin in both aquifers. Elevated concentrations of manganese appear to be more prevalent in the Upper aquifer in the Delta area

Approximately 25 percent of domestic wells may have water quality risks for one or more constituents with an MCL. According to the State Water Resources Control Board, four constituents (arsenic, 1,2,3 TCP, nitrate, and gross alpha [radioactive elements]) account for 80 percent of elevated water quality risk. Of those wells with water quality analysis, up to 20 percent of those wells (domestic and municipal) have exceeded the MCL for these constituents other than for gross alpha which has only occasionally exceeded the MCL.

In addition to these constituents, localized areas of manmade contamination, including trihalomethanes, volatile organic compounds (solvents), and gasoline are present in the groundwater. In the City of Lathrop, uranium, and perfluorooctanoic acids (PFASs) are present in the groundwater above their MCLs. Locally, groundwater has been contaminated at the former Occidental Chemical Corporation site, Sharpe Army Depot, and the Army Tracy Depot. All of these sites are undergoing remediation of groundwater contamination and these cleanup efforts are being overseen by the state.

In order to resolve groundwater levels and supplement the monitoring network for surface water depletion and groundwater dependent ecosystems, six additional monitoring wells are needed to fill data gaps. Well construction information for public water supply systems are also needed to refine the representative water quality monitoring well network.

Management Area – Chapter 6

The Delta islands are a unique area in the state of California, where groundwater has to be drained or pumped away to maintain groundwater levels below ground surface. Most of the Delta islands ground surfaces are below sea level. The water is pumped back from the islands into the adjacent waterways. There is always a direct and constant connection between surface water and groundwater in the Delta Management area, requiring management of groundwater levels (dewatering) within the islands. There are hundreds of diversions that divert surface water from the adjacent waterways for agricultural purpose, and therefore groundwater pumping in these areas is minimum. The Delta islands area (Primary Management Zone, *refer to* Figure ES-2) have an enforceable long-term sustainable management plan to ensure coordinated action at the federal, state, and local levels (Delta Stewardship Council, *see* **Chapter 3.9.4 – Delta Protection Commission & Delta Stewardship Council**).

In contrast, the Non-Delta Management area of the Subbasin is where most agricultural, domestic and municipal wells are present and where groundwater is used.

The Delta Management area will not require active groundwater by the GSAs to maintain sustainability while the Non-Delta Management area may require active management to be sustainable.

Water Budgets – Chapter 7

Three water budgets were created for historic (1974-2015), current (2015-2019) and projected (50 years into the future, with climate change) conditions for the entire Subbasin were derived using a state developed groundwater model for the entire Central Valley (C2VSim-FG_v1.0). Water budgets for just the Non-Delta Management area shows the historic water budget to be in slight surplus but the projected water budget with climate change shows a slight deficient. The deficit, about 800 acre-feet per year (AFY), is occurring in the Upper aquifer, while the lower aquifer is showing a slight surplus of about 100 AFY. This is without implementing any projects or management actions.

The water budgets for the Non-Delta Management area with projected water demands and climate change show that in comparison to historic conditions depletion of surface water is projected to increase but is likely to change with updates to the model. Net outflow decreases by 4,000 AFY which may affect neighboring subbasins.

As with all groundwater models there are uncertainties and room for improvement. Opportunities to improve the model, for the required 5-year GSP update, are provided to improve the model's predictive ability, which may change the apparent increased surface water depletion and subsurface outflow projections. These model refinements are necessary for the Central Valley-wide model to better reflect the local conditions of the Tracy Subbasin.

Monitoring Networks – Chapter 8

Groundwater levels and water quality are currently being monitored by local agencies, and the County, state and federal entities. Representative monitoring wells were selected from this larger network that are spatially distributed, actively being monitored, and that have construction details to prove which aquifer they are monitoring. A total of 26 representative monitoring wells for groundwater levels (to monitor for chronic lowering of groundwater levels, reduction of storage, and surface water depletion) were selected and split with about 75 percent in the Upper aquifer and 25 percent in the Lower aquifer. The groundwater quality monitoring network consists of six public water supply wells. The water quality network is planned to be expanded to provide additional information about the Upper aquifer where most domestic wells obtain water. Representative monitoring wells were not selected to monitor for subsidence but instead will use satellite-based-radar measurements (InSAR, interferometric synthetic aperture radar, a state-funded program) to detect land elevation changes.

Sustainable Management Criteria – Chapter 9

The sustainability goal for the Non-Delta Management portions of the Subbasin is:

> *To provide reliable and sustainable groundwater resources for existing and future needs of all beneficial users in the Subbasin that does not degrade or decrease over-time and will continue to be sustained through continued local adaptive management of the resources.*

Significant and undesirable results (locally defined), minimum thresholds, and measurable objectives were developed for five of the six sustainability indicators: chronic lowering of groundwater levels, reduction of storage, land subsidence, degradation of water quality, and surface water depletion. Seawater intrusion has not occurred in the past and is unlikely to occur in the future and therefore sustainability criteria were not established for this sustainability indicator.

Undesirable results were defined for chronic lowering of groundwater levels and change in storage and surface water to be protective of most sensitive beneficial users. The most sensitive users to groundwater level changes were found to be domestic wells and environmental users. Because agricultural and municipal groundwater users typically have deeper wells, their interests would also be protected. Maintaining groundwater levels near their historic levels protects the area from subsidence.

Minimum thresholds (the maximum allowable groundwater level depth/elevation or poorest water quality) and measurable objectives (desired level or concentration) were then selected to avoid adverse effects to these sensitive users.

Ground levels minimum thresholds were established at similar levels to historic levels but were modified based on future groundwater modeling results and accounting for climate change, except for surface water depletion, where the minimum thresholds were established within one foot of historic levels. Because groundwater quality is marginal to poor in most of the Subbasin, minimum thresholds were established to not allow concentrations to increase above their current concentrations by more than 10 percent. Where good quality water is present, the MCL was used as the minimum threshold. Measurable objectives were also established along with interim milestones.

Projects and Management Actions – Chapter 10

The water budget (**Chapter 7**) showed that the Non-Delta Management Area may be about 800 AFY in deficit in the Upper aquifer while being a positive 100 AFY in the Lower aquifer. The GSAs have one project that can resolve the deficit, reducing groundwater pumping by 1,000 AFY. They also have two supplemental projects, one project that benefits the Upper aquifer by reducing pumping by up to 3,000 AFY and a second project that can increase recharge to the Lower aquifer by up to 3,000 AFY. However, the water budget also shows there may be two sustainability indicators, increased surface water depletion and a reduction of subsurface inflow and outflow, which may indicate the Subbasin is not sustainable in the long term, but due to uncertainties in the groundwater modeling and resulting water budgets does not currently allow for accurate confirmation of these results. Improvements to the groundwater model have been identified to resolve these uncertainties before the 5-year update to the GSP and additional projects may be required but until the water budgets reach a higher level of certainty, the GSAs are only committing to these two projects.

Both projects are to be funded by grants and the local GSAs who have the fiscal capacity to provide matching funding.

Future refinements of the groundwater model may show different effects and as necessary, the GSAs have supplemental projects that have been identified and could be implemented. Combination of groundwater modeling results from adjacent subbasin has yet to be performed and could affect the water budget for the Subbasin.

Outreach Efforts – Chapter 11

This GSP was developed with input from the public. The GSAs reached out to the public by developing a website and a list interested parties. The GSAs sought input from the stakeholders by notifying them of the status *via* newsletters (both English and Spanish) and direct mailer post cards. The GSAs developed information materials and held at over 40 public meetings (both at board and city councils and monthly technical committee meeting), workshops, and contact by trusted messengers to connect with hard-to-reach stakeholder groups.

The public had opportunities to comment directly on this GSP during individual releases of draft chapters followed by another opportunity to comment on the Public Draft GSP. If a comment was specific to an individual section of the GSP, the GSP text was revised. General comments that raised substantial technical or policy issues may have resulted changes to multiple GSP sections. Comments that were general in nature or that did raise substantial issues were noted, but no changes were made.

1. Introduction

In 2014, the Sustainable Groundwater Management Act (SGMA) was signed by the governor, setting the framework for attaining sustainably managed groundwater in California. SGMA's requirements apply to groundwater basins/subbasins designated by the California Department of Water Resources (DWR) as medium- or high-priority and consist of four basic steps: 1) creation of a Groundwater Sustainability Agency(s) (GSA); 2) development of a Groundwater Sustainability Plan (GSP or Plan); 3) implementation of the Plan and management to quantifiable objectives; and 4) reporting of the implementation activities to the DWR to document whether the basin is being sustainably managed.

The Tracy Subbasin (Subbasin) was designated by DWR as a 'medium priority' subbasin and is therefore required to comply with SGMA. Surrounding subbasins were also designated as medium and high priority and are required to comply with SGMA. **Figure 1-1** shows the location of the Subbasin and adjacent subbasins.

The Tracy Subbasin (No. 5-022.15) is bounded on the northwest by the Old River south to the tri-county confluence point; south of the Clifton Forebay where it then follows the Contra Costa-Alameda County line to the foothills of the Coastal Range mountains. The northeast boundary follows the San Joaquin River south to the San Joaquin County Line with a slight jog to include the City of Lathrop on the west side of the river. The southern border of the Subbasin generally follows the San Joaquin-Stanislaus County line, with some irregular areas belonging to the Delta-Mendota Subbasin to the south. The western border follows the Coastal Range foothills from the San Joaquin-Stanislaus County line; north to the Contra Costa-Alameda County line. The Subbasin is a mix of Delta islands (mostly agriculture) and waterways along with urban and agricultural communities on the southern edge. Surface water is available to most areas and supplemented with groundwater supplies in the southern portion of the Subbasin. Groundwater levels within the Subbasin have been relatively stable and recover after periods of pumping. About 2,400 wells are present in the Subbasin and provide about 12,000 acre-feet annually for drinking water and irrigation, but this only constitutes about 3 percent of the total water supplies for the Subbasin (DWR 2019a).

Initially seven public GSAs were voluntarily and cooperatively formed to continue to manage groundwater in the Subbasin, completing Step 1 of SGMA. During the preparation of this GSP, one of the GSAs service areas was acquired by another GSA reducing the number of GSAs in the Subbasin to six.

This GSP serves to complete Step 2 of the SGMA process – to identify the current basin conditions and develop a plan to sustainability manage the Subbasin for the next 50 years. This Plan was developed cooperatively by the GSAs, with input from stakeholders and in coordination with the adjacent subbasins, This GSP:

- Describes the geography, geologic features, and historic and current groundwater conditions in the Subbasin.
- Provides a historic water budget and forecasts future groundwater use for a 50-year period to assess whether groundwater conditions remain sustainable, even with urban growth and climate change.
- Describes locally defined sustainability goals and undesirable results for the six groundwater sustainability indicators identified by SGMA.
- Establishes management criteria, the operating range in which groundwater levels will be maintained, in the form of minimum thresholds and measurable objectives.
- Identifies projects and management actions intended to maintain groundwater within the sustainable operating range for the next 50 years. Costs for implementation of these projects and management actions were developed to assess fiscal impacts and to establish a strategy of how to fund and implement projects.
- Establishes an annual reporting mechanism to assess the management performance and sets forth procedures for 5-year updates of this GSP to adaptively maintain sustainability in the Subbasin.

Per SGMA statute, neither the GSAs nor this GSP, "…determines or alters surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights" [California Water Code Section 10720.5(b)].

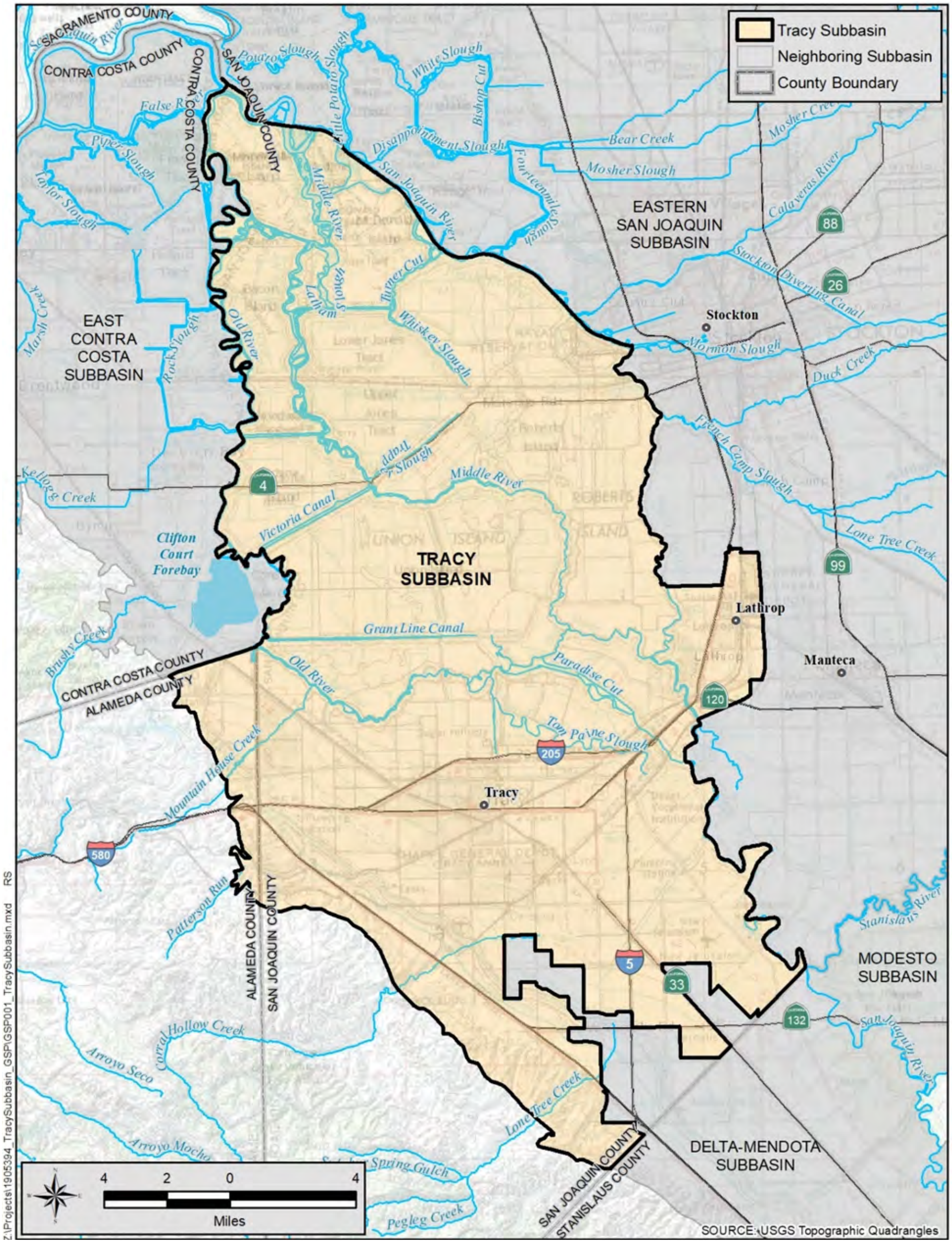

Figure 1-1. Tracy Subbasin

2. Agency Information

This section provides a description of GSAs in the Subbasin and their authority to implement the GSP, along with contact information for the elected basin coordinator (Agency), and legal authority to implement the GSP. A cost estimate for implementing the GSP is provided along with a general description of how the Agency plans to meet those costs.

2.1 GSA Organization and Management Structure

Six agencies filed with DWR to become GSAs to cover the entire Subbasin. DWR designated them as exclusive in 2016 and 2017. In 2018, the Subbasin boundaries were modified which resulted in the formation of the East Contra Costa Subbasin and inclusion of the City of Lathrop areas into the Tracy Subbasin. The six GSAs in the Subbasin are:

- Banta-Carbona Irrigation District
- Byron-Bethany Irrigation District
- City of Lathrop
- City of Tracy
- County of San Joaquin
- Stewart Tract

Figure 2-1 shows the areas covered by each GSA. All of the agencies have the legal authority to implement this GSP. None of the agencies have adopted any new bylaws, ordinances, or new authorities to manage or limit groundwater use since the adoption of SGMA in 2014. A brief description of each GSA is provided below.

2.1.1 *Banta-Carbona Irrigation District*

The Banta-Carbona Irrigation District (BCID) is an agricultural water purveyor in the Subbasin serving approximately 18,000 acres of agricultural land. BCID delivers surface water for agricultural uses in the Subbasin. BCID water supplies consist of a pre-1914 water right, two licenses, and a CVP DMC supplemental water contract. The pre-1914 water right and two licenses entitle the BCID to divert up to 204 cfs from the San Joaquin River in the south Delta. The CVP DMC contract provides up to 20,000 AFY from the DMC as hydrologic conditions permit. There are a few production wells located in the BCID that tend to be used only under drought conditions as the water contains boron and some salts. Also, some areas of the district are subject to shallow groundwater levels, which is controlled by a series of drains. Individual growers supplement their surface water supplies with groundwater, especially in drier years, when less surface water is available. BCID is looking to improve local groundwater level and groundwater quality conditions to enhance their long-term groundwater supply reliability, provide greater operational flexibility, and provide for greater drought resiliency.

2.1.2 *Byron-Bethany Irrigation District*

Byron-Bethany Irrigation District (BBID) provides surface water to irrigate approximately 8,000 acres of farmland within the Subbasin. BBID was formed in 1919 and was reorganized in 2004 to annex the territory of the Plain View Water District. The district encompasses about 29,000 acres within Alameda, Contra Costa, and San Joaquin counties and covers the six service areas listed below.

1. Byron Agricultural Service Area
2. Bethany Agricultural Service Area
3. Raw Water Service Area 1, serving the community of Mountain House
4. Raw Water Service Area 2, serving Tracy Hills, a development being constructed within the City of Tracy
5. Central Valley Project (CVP) Service Area, formerly the boundary of Plainview Water District
6. West Side Service Area, formerly The West Side Irrigation District

BBID's water supply is based upon a pre-1914 water right established by BBID, which does not apply to the former Plainview Water District area. The BBID asserts a claim under this pre-1914 water right in exchange for operational certainty, the BBID has agreed to limit the annual diversion to 50,000 AFY through an agreement with DWR. BBID delivers surface water for agricultural and some urban uses in the Subbasin. Because of its location, BBID uses very little groundwater. Individual growers periodically supplement their surface water supplies with groundwater, especially in drier years, when less surface water is available. BBID also has a CVP contract for 20,600 acre-feet for agriculture and municipal and industrial.

In 2020, BBID acquired The West Side Irrigation District (initially a GSA) and expanded BBID service area by about 6,800 acres with a significant portion located within the City of Tracy sphere of influence. The total irrigated acreage is about 5,700 acres. BBID also acquired 1916 water right to Old River of 82.5 cubic feet per second (cfs) between March 1 and Oct 31 and contracts for 2,500 acre-feet of agricultural water through 2030 from the CVP Delta-Mendota Canal (DMC).

2.1.3 *City of Lathrop*

The City of Lathrop is located just west of the City of Manteca and south of the City of Stockton. In 2019, the population of Lathrop was about 25,000. The City of Lathrop's water system serves approximately 7,300 metered service connections within 14,400-acre (22-square-mile) area of the Subbasin. Water sources include groundwater pumped by five wells and treated surface water purchased from SSJID through the SCWSP. The City receives surface water supplies from SSJID to help reduce its use of groundwater. Average water demand is about 9,000 acre-feet per year (AFY). The future (build-out) water demand for the City is estimated to be 20,000 AFY.

In 2012, the City of Lathrop constructed a centralized water treatment facility to remove arsenic from the groundwater. In prior years, high salinity was the primary water quality issue in the groundwater. Today, perfluorooctanoic acids (PFAS) has impacted the City of Lathrop's wells, emerging as a contaminant of concern. Also, uranium has been detected in a well (Well 21), manganese and nitrates are of concern. TDS concentration at the City of Lathrop's wells may require treatment within the next 10 years, which may be accomplished by blending with SCWSP water and/or treatment by reverse osmosis. The City does not foresee any immediate water reliability issues.

2.1.4 *City of Tracy*

The City of Tracy and surrounding urban areas encompass approximately 15,000 acres in the Subbasin. Tracy is in western San Joaquin County about 15 miles southwest of Stockton and overlies the southern part of the Subbasin. The City supplies, treats, and delivers potable water to its residents. Tracy has historically used groundwater to meet its municipal and industrial water needs. Currently, the City relies on a combination of surface water and groundwater to meet the water demands within its service area. The groundwater supply has elevated total dissolved solids (TDS) levels and requires blending with surface water. The City receives surface water supplies from the South San Joaquin Irrigation District (SSJID) through the South County Water Supply Program (SCWSP) to help reduce its use of groundwater.

Average water demand, as calculated from 2000 to 2004, is 16,400 acre-feet. The future (build-out) water demand for the City is estimated to be 35,700 acre-feet. The City has agreements with the agencies listed in **Table 2-1** for supplemental water supply.

Table 2-1. City of Tracy Water Supply Agreements

Agreement Agency	Purpose	Volume of Water (AF/Y)
U.S. Bureau of Reclamation (Reclamation)	M&I Reliability	10,000
Reclamation	Agricultural Reliability	10,000
SSJID	M&I	11,120

The City of Tracy operates an Aquifer Storage and Recovery project (one well) where high-quality water is injected into the confined aquifer and stored. The water is later pumped out and delivered to its customers.

2.1.5 *County of San Joaquin*

The county of San Joaquin (County) covers all of the Subbasin except for a small triangle of land within Alameda County. The San Joaquin County Public Works Division has been extensively involved in the formation and organizing of GSAs in the Subbasin. The County GSA area covers all areas not covered by other GSAs in the Subbasin. In general, the County GSA area is mostly the Delta portion of the Subbasin (lands within the Central and South Delta Water Agency) and areas along the San Joaquin River to the south. The County GSA also includes the Naglee Burk Irrigation District just south of the Delta and some highland areas south of Highway 580.

2.1.6 *Stewart Tract*

In 2017, Island Reclamation District 2062 (RD 2062) notified DWR of its decision to become a GSA under the name Stewart Tract GSA. RD 2062 was formed in 1922 as an independent public agency. RD 2062 is located within the City of Lathrop on Stewart Tract, bounded by the San Joaquin River, Paradise Cut, and Old River, and covers 14,000 acres. A portion of the Stewart Tract area is outside the boundaries of, and not served by, RD 2062, but is within RD 2107. The RD 2062 is authorized to acquire, build, and operate reclamation work as defined by the California Water Code. This includes flood control, drainage, and non-potable water supply infrastructure, as well as drains, canals, sluices, bulkheads, water gates, levees, embankments, pumping plants, dams, diversion works, and irrigation works. It also includes bridges and road systems to ensure access to the reclamation works. RD 2062 currently owns and operates approximately 17 miles of State Plan of Flood Control, project and non-project levees, several lakes, and several different pumping systems. The RD 2062 has both riparian and appropriative water rights and provides surface water from the San Joaquin River and Paradise Cut to their agricultural customers. The Stewart Tract GSA also contains Mossdale Reclamation District 2107, which entered into an agreement with RD 2062 in June 2017 to be included in the Stewart Tract GSA and allow RD 2062 to be the managing agency of the GSA. The boundaries of both RD 2062 and RD 2107 together include the entire Stewart Tract area, although only a portion of RD 2107 is located within the City of Lathrop. RD 2062 does not provide potable water. All potable water for development within the Stewart Tract is provide by the City of Lathrop. The River Islands Development project is located within the City of Lathrop, and is supplied potable water, sewer and recycled water from the City.

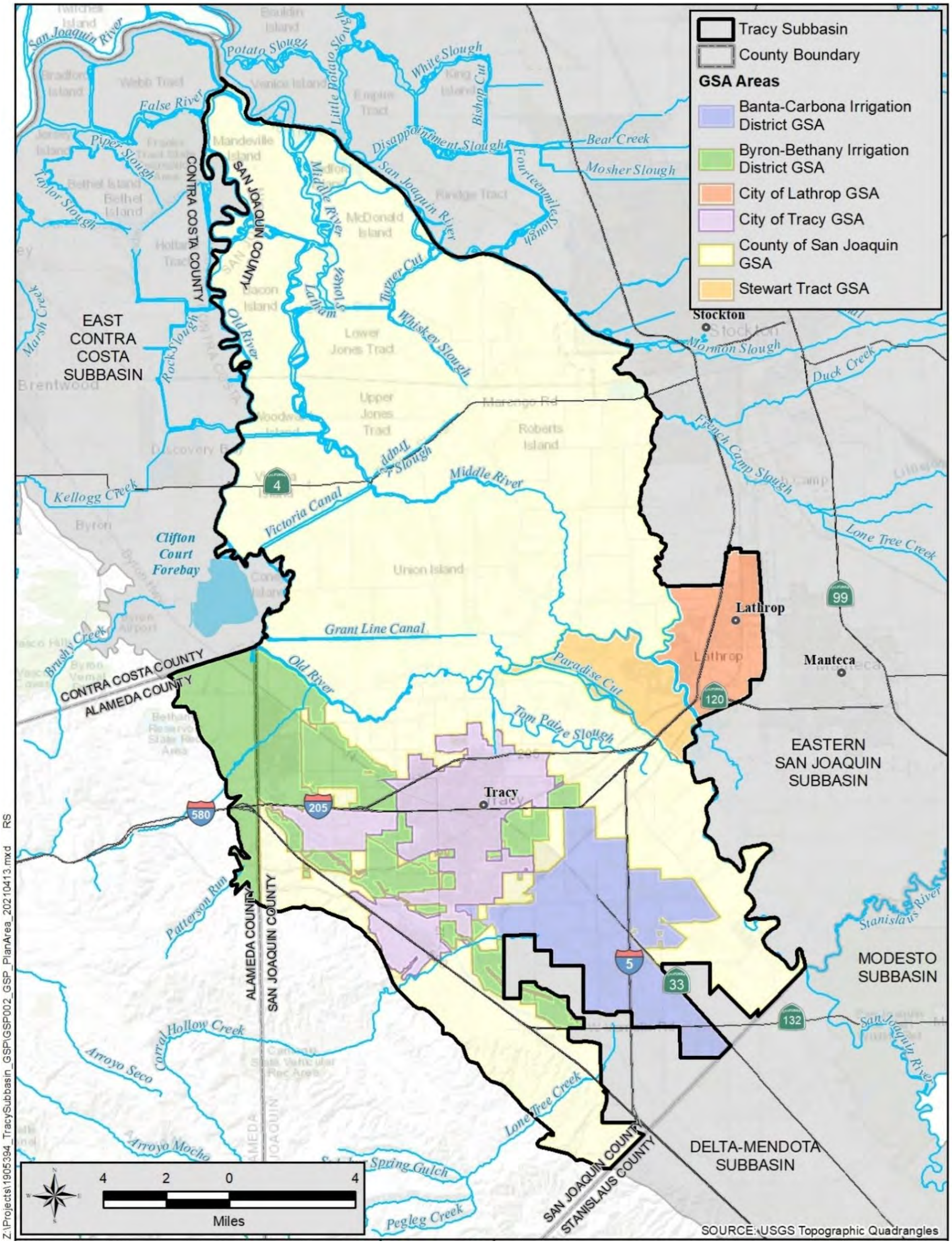

Figure 2-1. GSP Plan Area and GSAs

2.2 Plan Manager Contact Information

The County was elected by the six GSAs to be the plan manager and lead agency for the preparation of the Subbasin GSP and implementation. A copy of the Memorandum of Agreement (MOA) is contained in **Appendix A**. The contact information is provided below.

Agency's Name:	San Joaquin County Public Works Department
Agency's Address:	1810 East Hazelton Avenue, Stockton, CA 95205
Agency's Website:	https://www.sjgov.org
Contact person:	Matt Zidar
Phone Number:	(209) 953-7460
Email:	mzidar@sjgov.org

2.3 Implementation Authority

Any local public agency that has water supply, water management, or land use responsibilities in a basin can decide to become a GSA under SGMA. All six of the Tracy Subbasin GSAs meet at least one of these criteria and has legal authority to jointly prepare, adopt, and implement a GSP. Each GSAs has the legal authorities granted to a GSA under the California Water Code (Water Code) to sustainability manage groundwater in their area.

All six GSAs have entered into a MOA for the implementation of this GSP, which will include management of the Subbasin along with projects and management actions. The agencies have designated San Joaquin County as the lead agency with the option that this leadership can be changed. **Appendix A** provides a copy of the signed agreement.

2.4 GSP Implementation Costs

A thorough budget was developed for implementation of this GSP and includes costs for meeting regulatory requirements, program management and administrative fees, professional services, and projects and management actions. It includes costs for groundwater level and quality monitoring, annual reporting, 5-year GSP updates, public outreach and data gap resolution. A detailed budget for the first 5-years of GSP implementation is provided in **Appendix B, Table B-1**. The costs were divided into two categories: 1) local costs to be borne by each GSA, and 2) shared costs, those that benefit all GSAs.

Annual budgets were developed and classified as a local or shared cost. Annual shared costs for the first 5 years range from $147,000 to $326,000. To reduce the variability of annual costs, an average annual operating shared budget was developed and is about $234,000 per year. Some portion of the annual revenue fees may be spent or accumulated but at the end of the 5-year period the no funds are expected to remain. The budget will be updated in the 5-year GSP update and funding schedule re-established.

The GSAs are discussing shared costs funding distribution to generate revenue to fund GSP implementation. Some of the shared costs will be funded by an existing Water Investigation Zone No. 2

funds, funds obtained from a Proposition 218 that has been used to fund water resources programs in the County. The remaining balance of the unfunded shared costs were distributed by GSA. his cost sharing approach is documented in the MOA.

The GSAs decided that funds to implementation of projects to continue the sustainability of the Subbasin, detailed in **Chapter 10 – Projects and Management Actions**, would be a local GSA cost and not a shared cost. Therefore, **Table B-1** does not include these costs. Grant funding is planned to be sought after to fund portions of these projects.

3. Description of Plan Area

3.1 GSP Plan Area

The Subbasin encompasses an area of about 238,429 acres (370 square miles) in San Joaquin and Alameda counties, primarily between the eastern extent of the Coast Ranges on the south and the San Joaquin River on the east. The Subbasin is bounded on the north and the east by the San Joaquin River, on the south by the San Joaquin-Stanislaus counties border, and on the west by the aerial extent of sedimentary deposits bounded by the Coastal Ranges. The San Joaquin, Old, and Middle rivers are the principal rivers within or bordering the Subbasin. **Figure 3-1** shows the plan area of the Subbasin and surrounding groundwater basins as defined by DWR. The topography changes across the Subbasin are small. Ground surface elevations are the highest, approximately 200 feet above mean sea level (msl), on the southwestern side of the Subbasin, and gradually decline to the north and east.

Water uses in the Subbasin include agricultural, municipal, industrial, domestic, and native vegetation and aquatic species. Some water is also being used for managed habitats, mostly for migrating birds. Some water purveyors rely exclusively on either groundwater or surface water, but most rely on a combination of surface water and groundwater.

The Subbasin is about half Delta islands and waterways, generally north of the Old River and Tom Payne Slough, and the surrounding uplands areas (those lands at or above 5-foot elevation) to the south where agriculture dominates the area. **Figure 3-1** shows outline of the legal Delta Boundary (Section 12220 Water Code) and also the division between the lowlands and upland areas. The Subbasin also includes the cities of Lathrop and Tracy, the community of Mountain House, and the industrial area west of the City of Tracy. Most of the undeveloped land in the Subbasin is south of Highway 580, to the southern edge of the Subbasin. Most of the groundwater pumping occurs in the area south of Old River and east of the San Joaquin River (Lathrop). North of the Old River, surface water from the Sacramento-San Joaquin Delta, is used to meet most of the water demand.

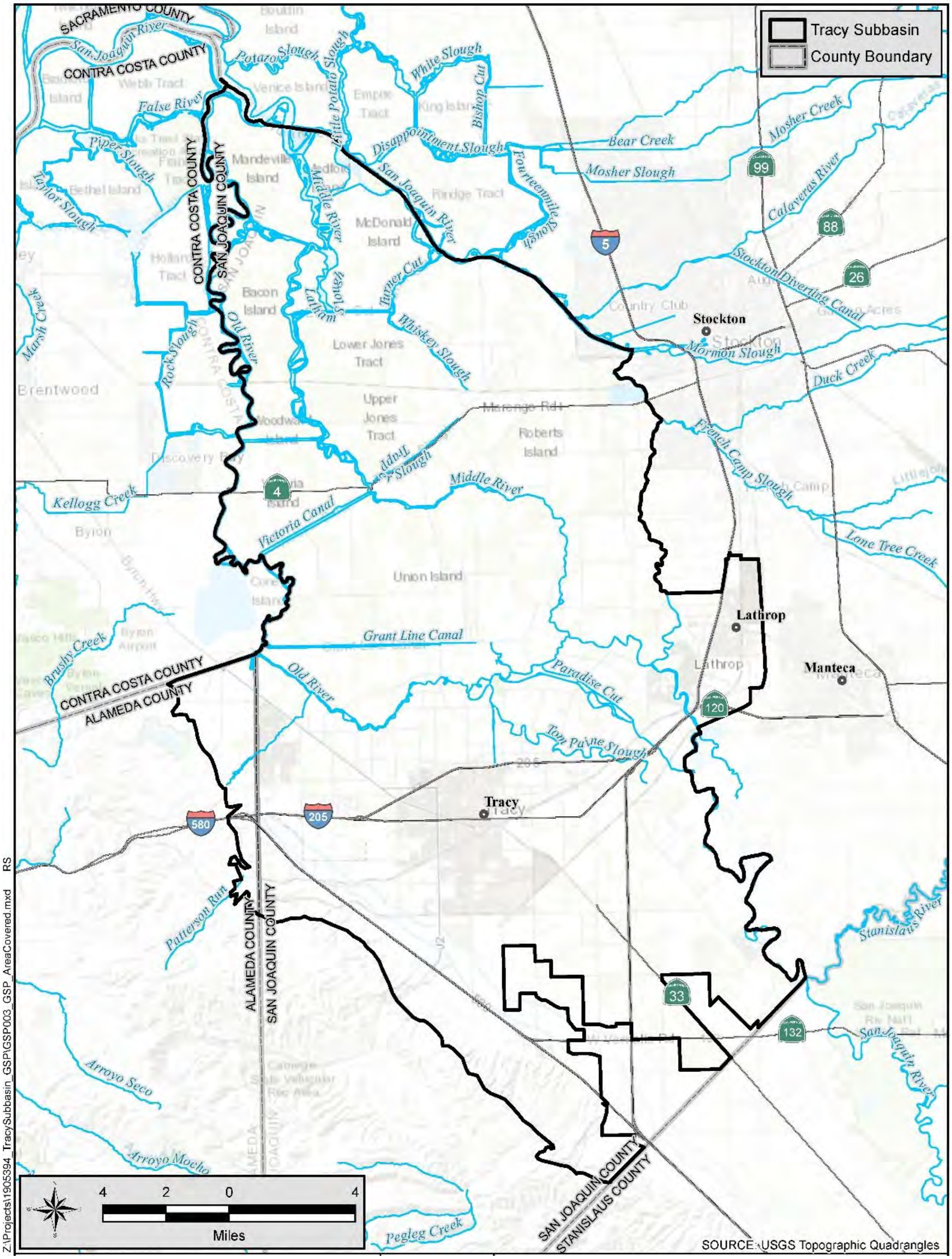

Figure 3-1. Area Covered by GSP

3.2 Adjudicated Areas

The Subbasin is not adjudicated, nor are the surrounding subbasins.

3.3 Jurisdictional Areas

Within the Subbasin, there are areas with federal, state, and county land-use jurisdictional responsibilities. Land use authorities belong to the counties of San Joaquin and Alameda and the cities of Lathrop and Tracy. Water districts or agencies provide potable water, and irrigation districts and some reclamation districts provide surface water for agriculture. Within many of the irrigation districts and cities are reclamation districts that are responsible for managing and maintaining the levees, freshwater channels, sloughs, canals, pumps, and other flood protection structures in the area. Drainage Districts (*refer to* **Section 3.3.11** for details) also maintain drainage pipelines to control shallow groundwater. The following sections describe the jurisdictional areas and agencies within the Subbasin. **Figure 3-2** through **Figure 3-4** show these jurisdictional areas.

All the GSAs, cities, water agencies, and reclamation districts have open communication with state and federal agencies to comply with reporting and permitting. Federal and state agencies have been included in the Subbasin communication and engagement plan and are on the interested parties list of notifications.

3.3.1 *Federal*

Several federal agencies have jurisdiction over lands and waterways in the Subbasin. The United States Army Corps of Engineers (USACE) has jurisdictional authorities on all navigable waterways in the Subbasin.

Reclamation owns the CVP canals. The San Luis Delta Mendota Water Authority operates the canal under agreement with Reclamation. The Delta-Mendota Canal crosses the entire length of the Subbasin south of Highway 580.

The federal government owns the Tracy and Sharpe Defense Distribution depots (USACE). The Sharpe Depot is expected to be decommissioned in the next 6 to 12 months as the Depot is closed and has been reported as Army excess property for property disposal through the General Services Administration. The City of Lathrop will then provide services to properties within former Sharpe Army Depot boundaries. The federal government also used to own land for a former naval base in Rough and Ready Island, opposite Stockton. The Stockton Port Authority currently owns the land but still has a federal designation. Federal ownership of lands is also indicated for some lands, but the ownership is uncertain. For example, two properties are reported as federal jurisdiction, but the records show the owners to be Contra Costa Water District and the City of San Francisco. Lands with unclear ownership are shown in **Figure 3-2**.

Figure 3-2 shows the federal lands in the Subbasin where SGMA does not apply. Federal government officials have been invited to assist in the development of this GSP.

3.3.2 *State of California*

The California State Department of Transportation has authority for lands occupied by freeways and highways and maintenance yards. Major roads crossing the Subbasin are Interstates 5, 205, and 580, Highway 4, and multiple bridges. The California State Department of Parks and Recreation has authority over the recreational areas along the San Joaquin River.

The state also has authority over some small specific conservation land and preserves. DWR has jurisdictional authority for maintaining levees associated with the State Plan of Flood Control. **Figure** 3-2 shows the state-owned lands in the Subbasin. State government officials have been invited to assist in the development of this GSP.

The California Aqueduct, a State Water Project (SWP) facility, is owned and operated by DWR. The Clifton Court Forebay, located just west of the Subbasin, takes water from the Delta and places it into the Aqueduct, which traverses the entire length of the Subbasin. Additional SWP facilities in the Subbasin include the Banks Pumping Plant and South Bay Aqueduct.

Deuel Vocational Institution is a state of California correctional facility is located west of Interstate 5 and south of the City of Lathrop. The facility uses four groundwater wells for water supply and has a sewage treatment plant that discharges the treated water to the Deuel Drain, which is tributary to the San Joaquin River. The state is planning to deactivate the institution by September 2021.

3.3.3 *California Native American Tribes*

There are no tribal lands within the Subbasin.

3.3.4 *County*

Most of the Subbasin is within San Joaquin County, plus a small triangular portion is in Alameda County. **Figure** 3-2 shows the county boundaries. Each of the counties has General Plans and land use authorities. Each plan has policies for protection and reasonable use of groundwater and protection of water quality.

The San Joaquin County General Plan describes the official county "blueprint" for the location of future land use, type of development encouraged, and decisions regarding resource conservation. Stakeholder input informed the development of the County's vision and guiding principles, which represent the County's core values and establish benchmarks for the General Plan's goals and policies. The General Plan encourages the preservation of the County's groundwater resources and states that future urban and agricultural growth should occur within the sustainable capacity of these resources.

3.3.5 *City*

There are three incorporated cities within the Subbasin, including the cities of Tracy, Lathrop, and a small portion of Stockton. Each of the cities has land use management and planning authority granted through the state of California, which is derivative of the city or county general police power. This power allows cities and counties to establish land use and zoning laws that govern development. Each of the land use agencies has existing policies in place that allow for future development to maintain a sustainable and reliable water supply through conjunctive use of surface water primarily and groundwater during drought, emergency, or stressed times. Each policy allows for protection and reasonable use of groundwater and protection of water quality.

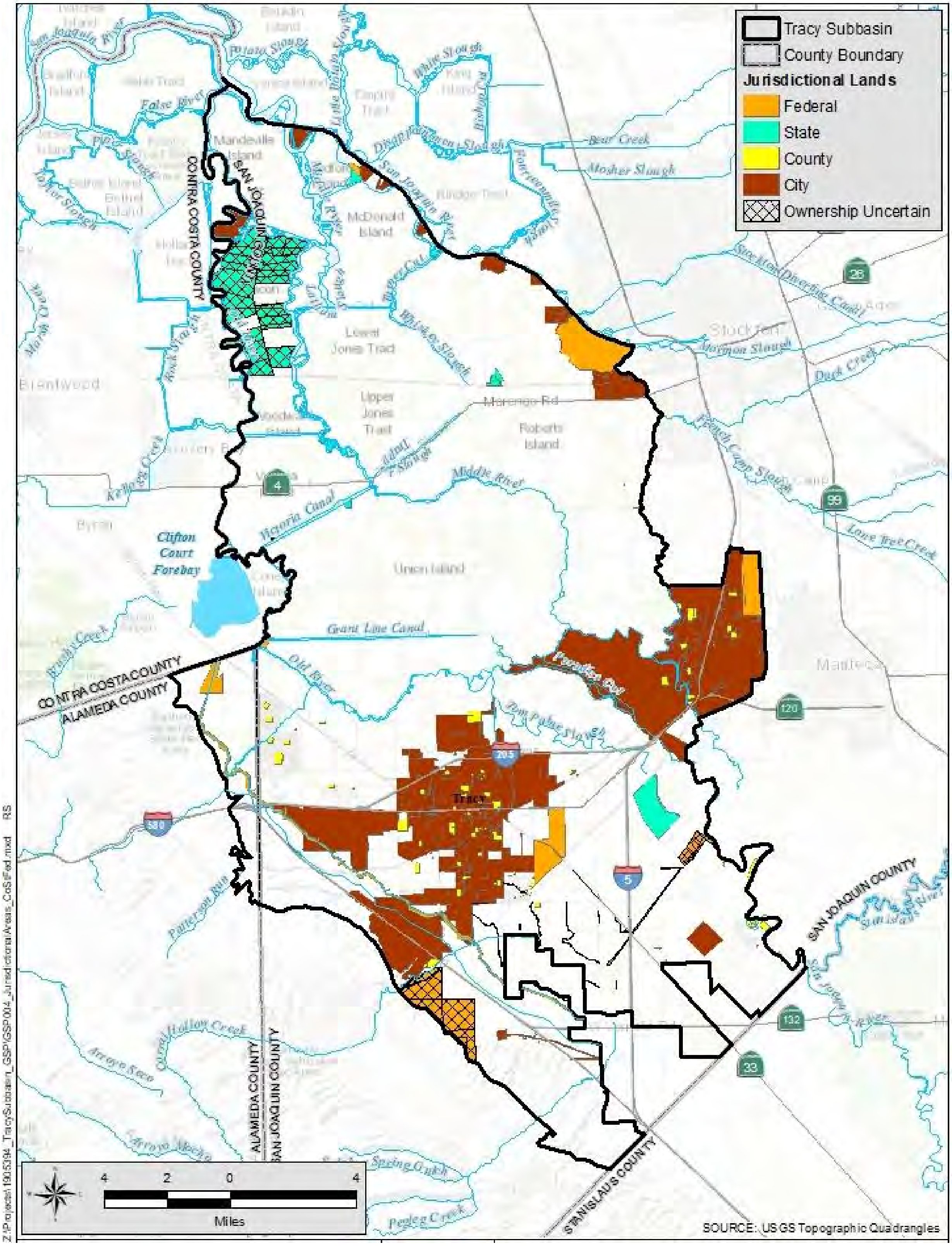

Figure 3-2. City, County, State, and Federal Jurisdictional Areas and Lands

3.3.6 *Water Agencies*

The Central and South Delta Water agencies are located within the Subbasin and represent surface water rights holders. **Figure 3-3** shows the location of water agencies, districts, and companies. Some are public water agencies, while others are private water companies.

The general purpose of the Central Delta Water Agency (CDWA) is for making and administering agreements for the provision of a dependable surface water supply to those within their boundaries. They advise and assist landowners and local districts in reclamation and flood control matters. The CDWA area encompasses a total of 52,000 acres in the northern half of the Subbasin. The primary land use in this area is agriculture with crops such as vineyards, fruit and nut trees, row crops, and field crops. CDWA protects water supply within its service area (which extends outside of the Subbasin), assists landowners and reclamation districts with water issues, and represents landowners in flood control matters. CDWA does not own any facilities, and surface water from the Delta is the area's only utilized source of water, along with limited private groundwater pumping.

The South Delta Water Agency (SDWA) is a municipal corporation that represents the interests of surface water rights holders in the Southern Sacramento-San Joaquin Delta. SDWA was initially formed to address local water supply and water quality concerns in the south Delta area. The SDWA encompasses a total of approximately 150,000 acres within its boundaries with most of the land, about 132,000 acres, in the Subbasin. SDWA does not own any facilities or water rights. Instead, SDWA protects property owners who have individual water rights. Surface water is the primary source of water used within the agency boundaries, given that most of the groundwater is highly saline.

3.3.7 *Community Water Systems*

Four community water system agencies are located within the Subbasin and provide potable water to residents (DWR 2019a) (*see* **Figure 3-3** for locations). Community water agencies include:

- City of Tracy
- City of Lathrop
- Mountain House Community Services District
- California Water Service Company (Cal Water)

Municipal water supplies are both surface and groundwater. The cities of Lathrop and Tracy receive water from the South San Joaquin Irrigation District' South County Water Supply Project. There are some multi-jurisdictional areas where potable water may be served by community water systems but raw water for irrigation on agricultural lands are provided by irrigation district or reclamation districts.

Cal Water provides water to a small area of the City of Stockton that extends west of the San Joaquin River in the Subbasin. The potable water is from treated surface water wholesaled by Stockton East Water District and groundwater wells within the East San Joaquin Subbasin. The area served is within the Stockton East Water District service area and is also within RD 0403.

The Deuel Vocational Institution and the Sharpe Defense Distribution Depot are also classified as community water system. Both rely on groundwater as their source of supply.

Disadvantaged Communities (DAC) communities in the cities of Lathrop and Tracy areas are provided water through the municipal water supply systems. Stockton East Water District also provides wholesale treated surface water which is retailed to Stockton area customers by the California Water Service Company including a small DAC area within the Delta area.

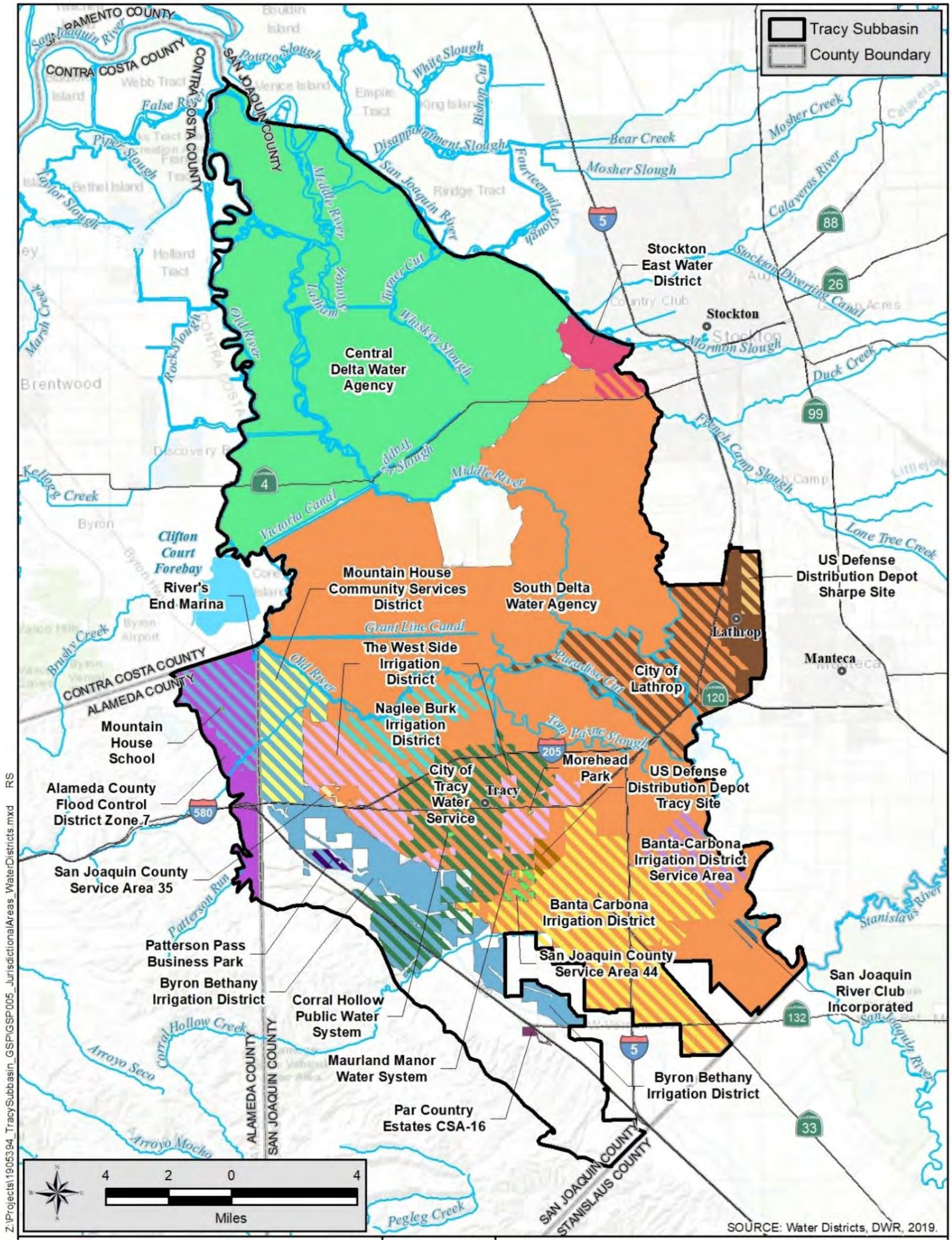

Figure 3-3. Water Districts Jurisdictional Areas

3.3.8 *Small Community Water Systems*

Community water services districts (non-community non-transient water systems) provide water to small communities and are under the jurisdiction of San Joaquin County (*refer to* **Figure 3-3**). They rely solely on groundwater supplies and include:

- Par County Estates County Service Area (CSA-16)
- CSA 50 (Patterson Industrial Park)
- Corral Hollow Public Water System
- San Joaquin CSA 35
- Morehead Park
- Maurland Manor Water System
- San Joaquin CSA 44

The San Joaquin River Club is also a small community water system but is not under County jurisdiction.

The Tracy Defense Distribution Depot system is classified as a non-community non-transient water system and uses three groundwater wells as their source of supply.

3.3.9 *Agricultural Water Providers*

There are several agricultural water purveyors in the Subbasin (*refer to* **Figure 3-3**). Surface water is supplied to agriculture by:

- Banta-Carbona Irrigation District
- Byron-Bethany Irrigation District
- Naglee-Burk Irrigation District
- Island Reclamation District 2062

The irrigation districts typically supply a significant portion of the water supplies for crops within their service areas. Crop irrigation demands not satisfied by surface water deliveries is provided by privately-owned wells. BBID provides raw surface water to the City of Tracy, Mountain House Community Services District and to CSA 50.

3.3.10 *Reclamation Districts*

RDs are a form of special-purpose districts in the United States that are responsible for reclaiming and/or maintaining land for agricultural, residential, commercial, or industrial use that is threatened by permanent or temporary flooding. Twenty-seven RD's cover almost the entire Delta region of the Subbasin including a few RDs south of the Delta along the San Joaquin River. **Figure 3-4** shows the locations of RDs in the Subbasin.

In the Delta islands networks of ditches collect and transport levee seepage and irrigation and precipitation deep percolation to pumps that discharge to adjacent channels. Because the islands are underlain by peat, and as the peat oxidizes and disappears, the drainage ditches are deepened to maintain sufficient unsaturated soils for crop production.

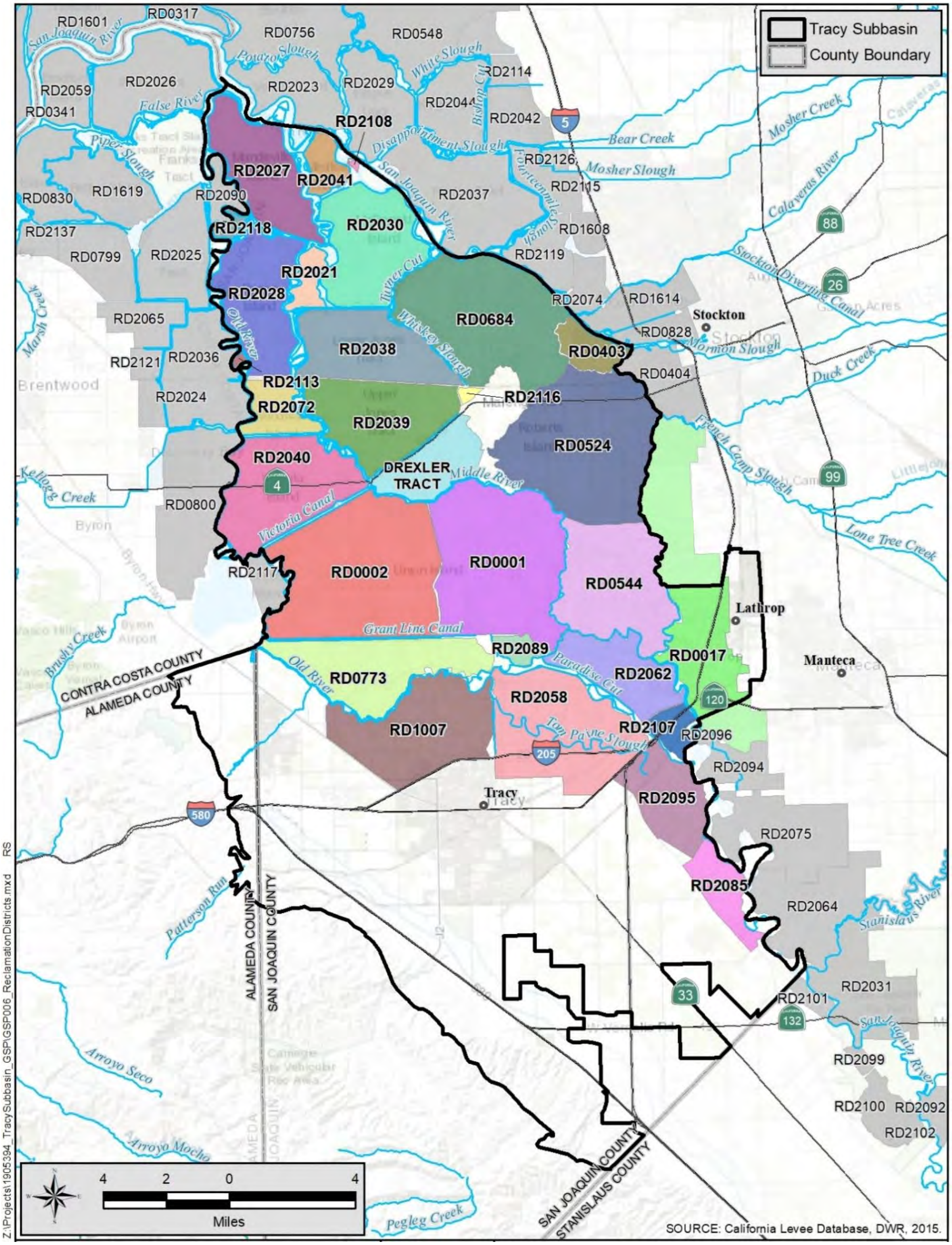

Figure 3-4. Reclamation Districts Jurisdictional Areas

3.3.11 *Drainage Districts*

Within RD 2085 is the New Jerusalem Drainage District (NJDD) collection system, which collects shallow groundwater and discharges the water to the San Joaquin River. The NJDD service area includes portions of the BCID service area as well as areas outside of the BCID service area, as shown in **Figure 3-5**. The areas outside the BCID service area extend to the southeast into the Vernalis Gas Field (a collection of wells that extract natural gas from the underlying marine sediments). NJDD's drainage collection facilities are located underground and collect shallow groundwater through collector pipes that farmers tie into their underground tile systems. **Figure 3-5** shows the location of the drainage collection system. BCID owns and operates five shallow wells to maintain groundwater levels below the root zone. All wells pump to the NJDD drains.

All of the RDs in the Delta islands have drainage canals that pump water over the levees and into the nearby channels. Drainage canals are also present in the non-Delta portions of RD 1007 and 2058, south of the Tom Paine Slough, and from non-RD lands south of RD 0773. The drainage system extends beneath the northern parts of the City of Tracy. Tile drains are also present in these areas, but their locations are poorly documented.

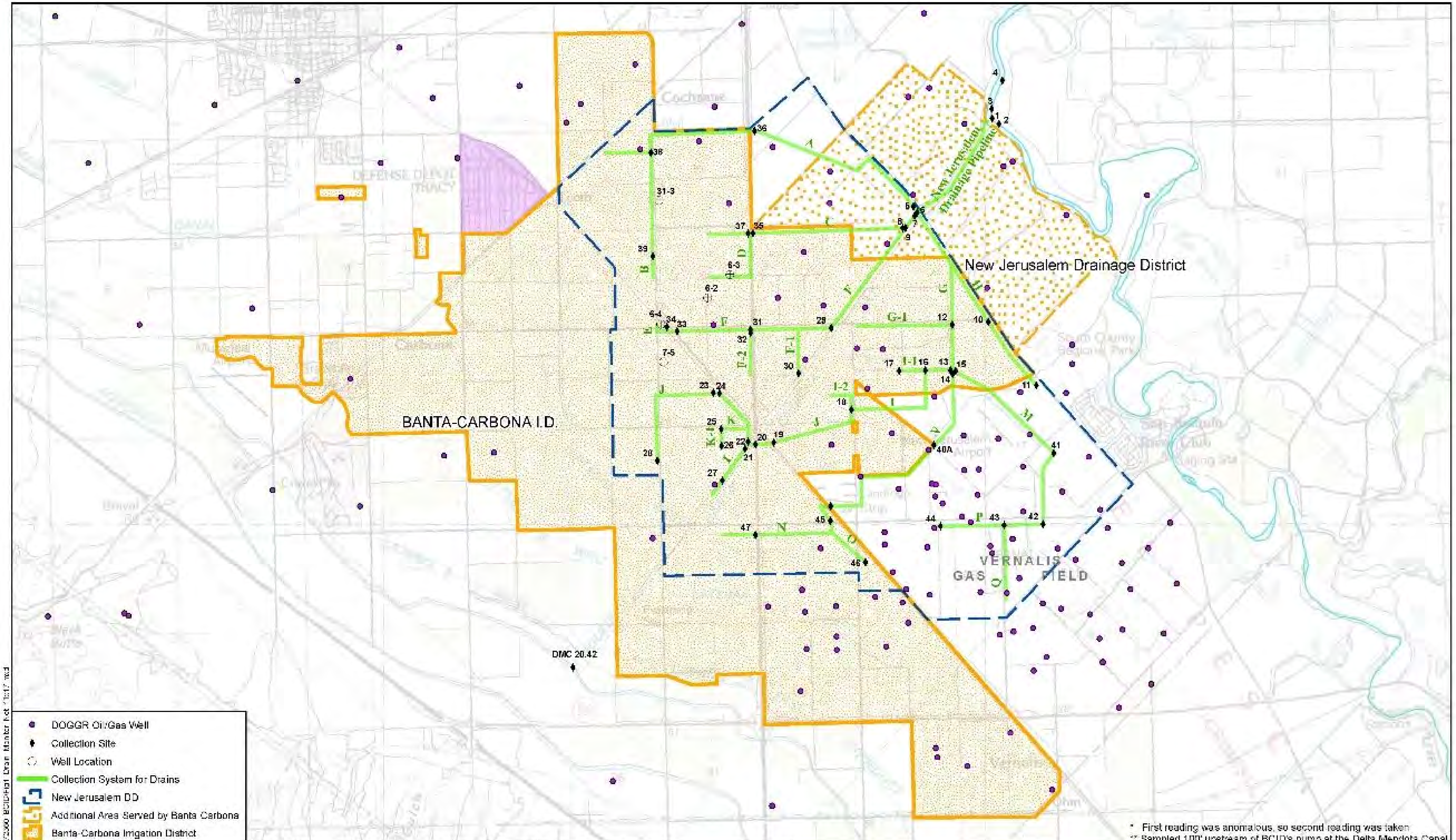

Figure 3-5. New Jerusalem Drainage Network

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3.4 Land Use

Historically, the Subbasin was dominated by perennial native grasslands, broad riparian zones, and freshwater marsh wetlands. During the 1800s, settlers drained wetland and riparian areas and converted the land for agriculture. Grasslands were similarly eliminated from the region as a result of concentrated grazing and agricultural conversion. Today, irrigated agriculture and urban land uses are the primarily developed land use within the Subbasin.

In 2014, the Subbasin was roughly about 7 percent urban, 60 percent farmland, and less than 1 percent managed habitats (riparian vegetation) (Land IQ 2017). About 32 percent of the land was not classified. The unclassified areas may include land being converted from agriculture to urban, such as the Stewart Tract development southwest of the City of Lathrop and undeveloped lands around the fringe of the basin and waterways in the Delta. **Figure 3-6** shows the 2014 land use in the Subbasin, based on satellite and airborne remote sensing data. The total acres by each significant land use category and crop types are summarized in **Table 3-1**. Riparian vegetation also occurs along the fringes of the rivers, canals, sloughs, and tributaries. The Land IQ data did not quantify or map these fringe areas in their survey and are not shown on **Figure 3-6**.

Future land use calculations were developed using estimates of expected land-use changes within the current sphere of influence for the cities and communities. **Figure 3-7** shows the locations of approved urban development areas in the Subbasin as identified from the Alameda and San Joaquin counties, General Plans. For projected agricultural land use conditions, the current crop mix was assumed to remain unchanged from current conditions other than for the conversion of agricultural land to urban. About 17,400 acres of land is expected to be urbanized, reducing agricultural land by about 10,000 acres of agricultural due to a high percentage of the proposed land being within the unclassified area (undeveloped land).

The counties have each prepared conservation and habitat plans to assess current preserves and easements and provide goals and plans for the next 50 years to continue to increase these areas (San Joaquin County Multi-Species Habitat Conservation and Open Space Plan 2000). Currently, the Subbasin has about 3,000 acres of habitat conservation preserves and easements (*see* **Figure 3-8** for locations).

Some grain crop land in the Subbasin maybe being managed for habitat, by flooding fields in the late fall to create habitat for migrating waterfowl. The areas where these activities are occurring are uncertain and are not shown on **Figure 3-8**.

Table 3-1. Land Use Summary

Land Use	Acres	Percent
Urban	**17,140**	**7.19%**
Urban	17,140	7.19%
Agriculture	**143,117**	**60.02%**
Citrus and Subtropical	477	0.20%
Deciduous Fruits and Nuts	13,604	5.71%
Field Crops	30,374	12.74%
Grain and Hay Crops	9,488	3.98%
Idle	9,688	4.06%
Pasture	45,246	18.98%
Rice	75	0.03%
Truck Nursery and Berry Crops	31,065	13.03%
Vineyard	2,886	1.21%
Young Perennial	213	0.09%
Managed Wetlands	**2,104**	**0.88%**
Riparian Vegetation	2,104	0.88%
Water Ways and Bodies	**0**	**0.00%**
No Data	0	0.00%
Not Classified	**76,068**	**31.90%**
No Data	76,068	31.90%
Total	**238,429**	**100%**

Source: Land IQ 2017

3.5 Disadvantaged Communities

DACs and Severely Disadvantaged Communities (SDACs) are present in the Subbasin (DWR 2018). **Figure 3-9** show their locations. Most are located within rural areas of the Delta as well as some along the San Joaquin River in the non-Delta areas. Some are located within the cities of Lathrop and Tracy where municipal water service is available.

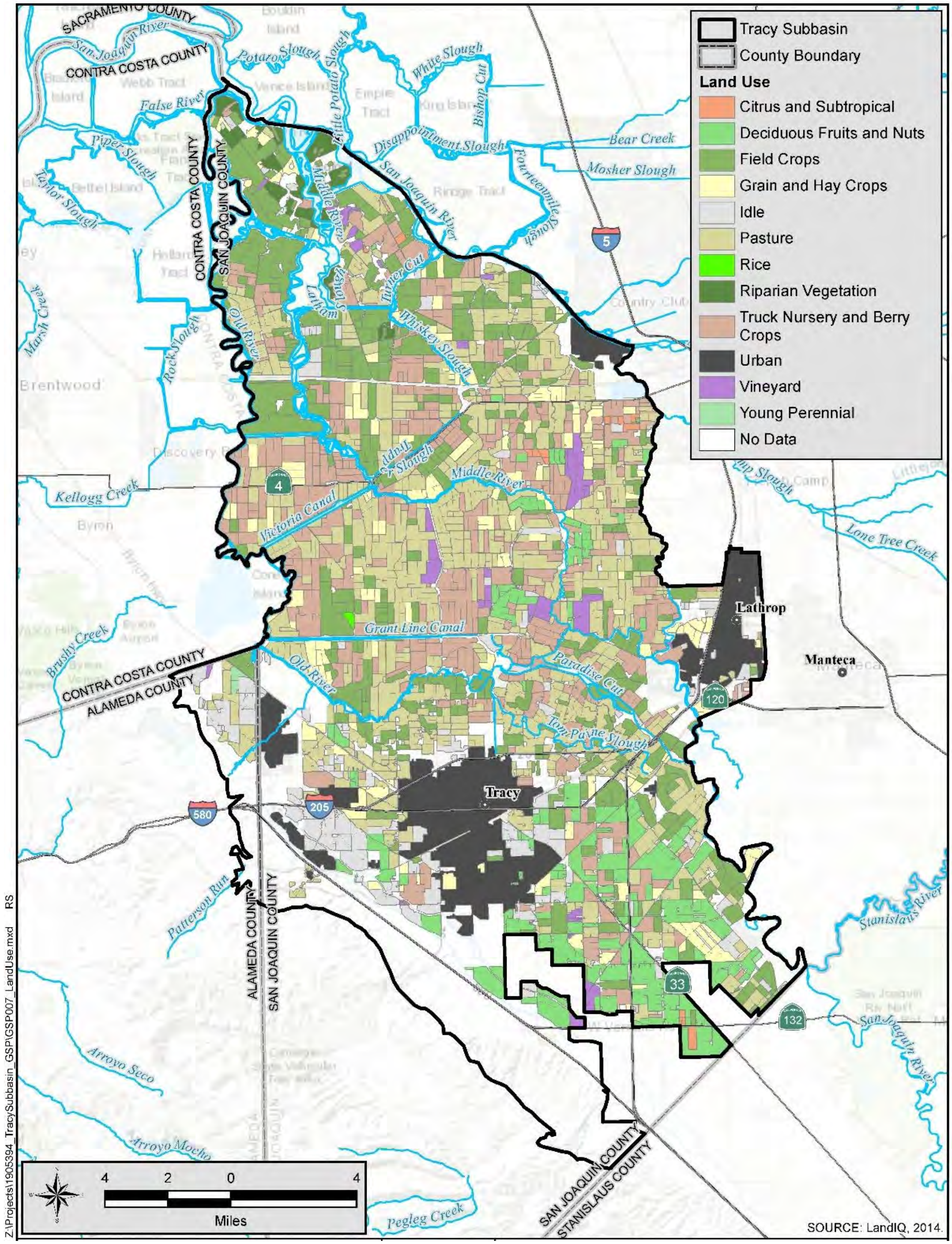

Figure 3-6. Existing Land Use 2014

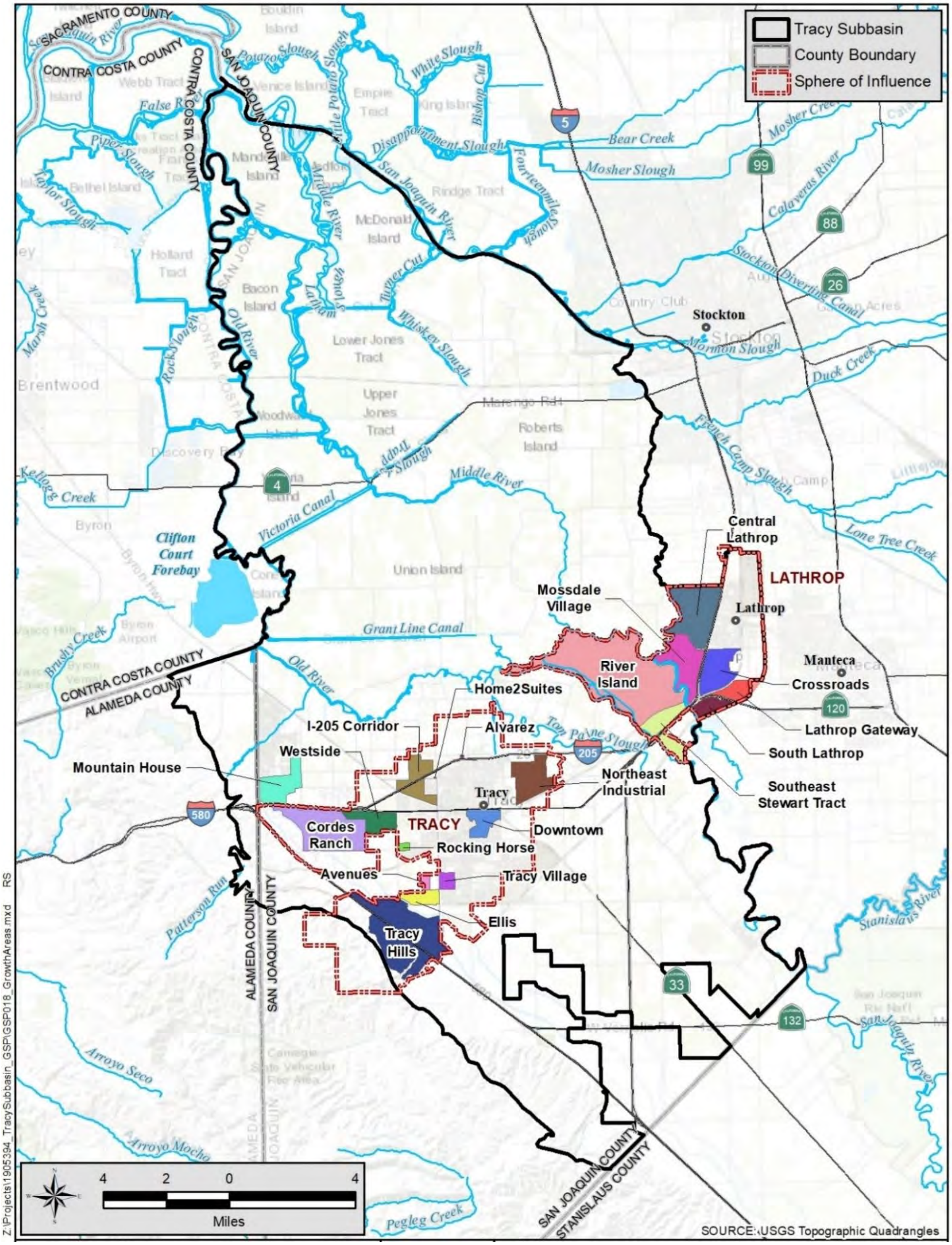

Figure 3-7. Growth Areas

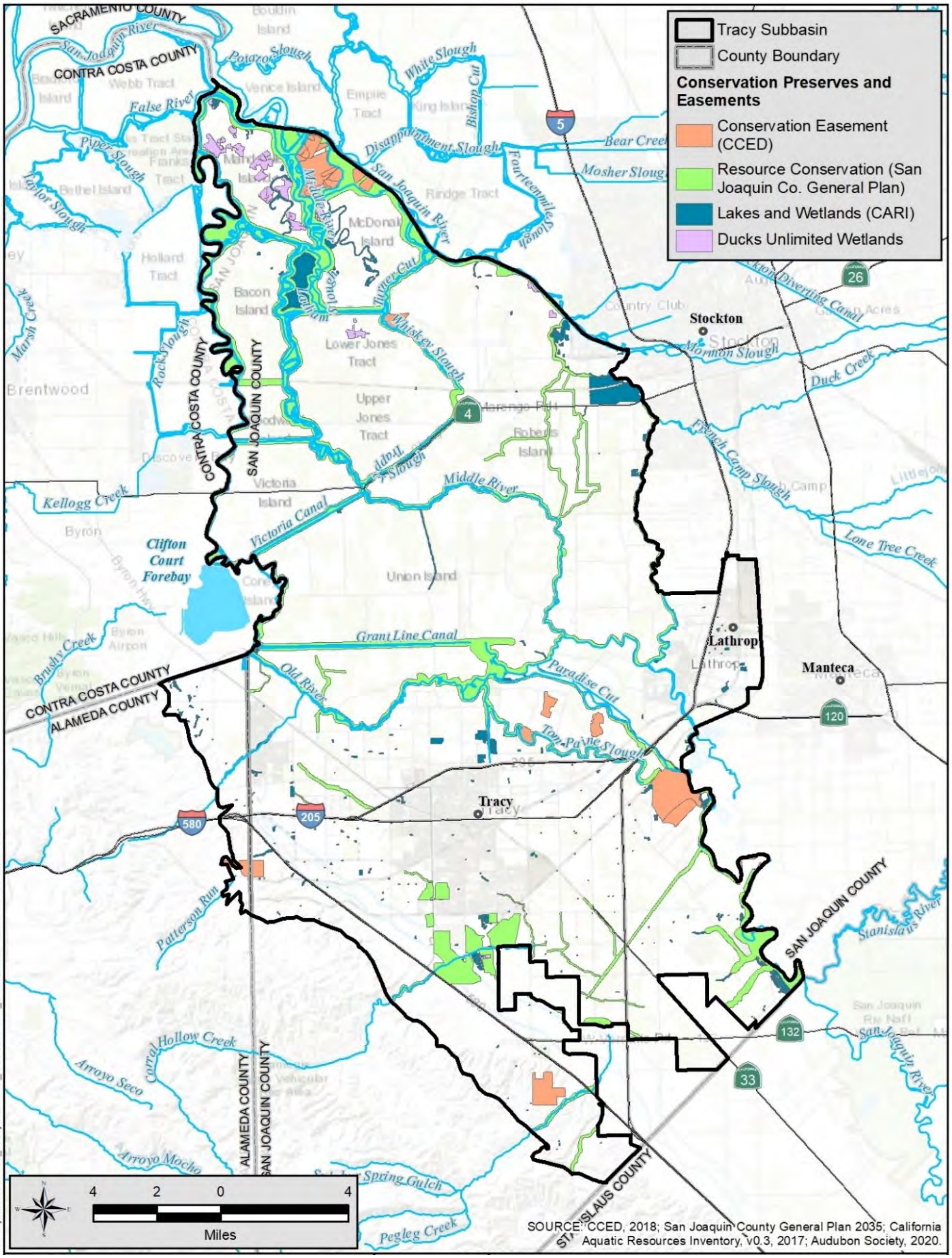

Figure 3-8. Habitat Conservation Preserves and Easements

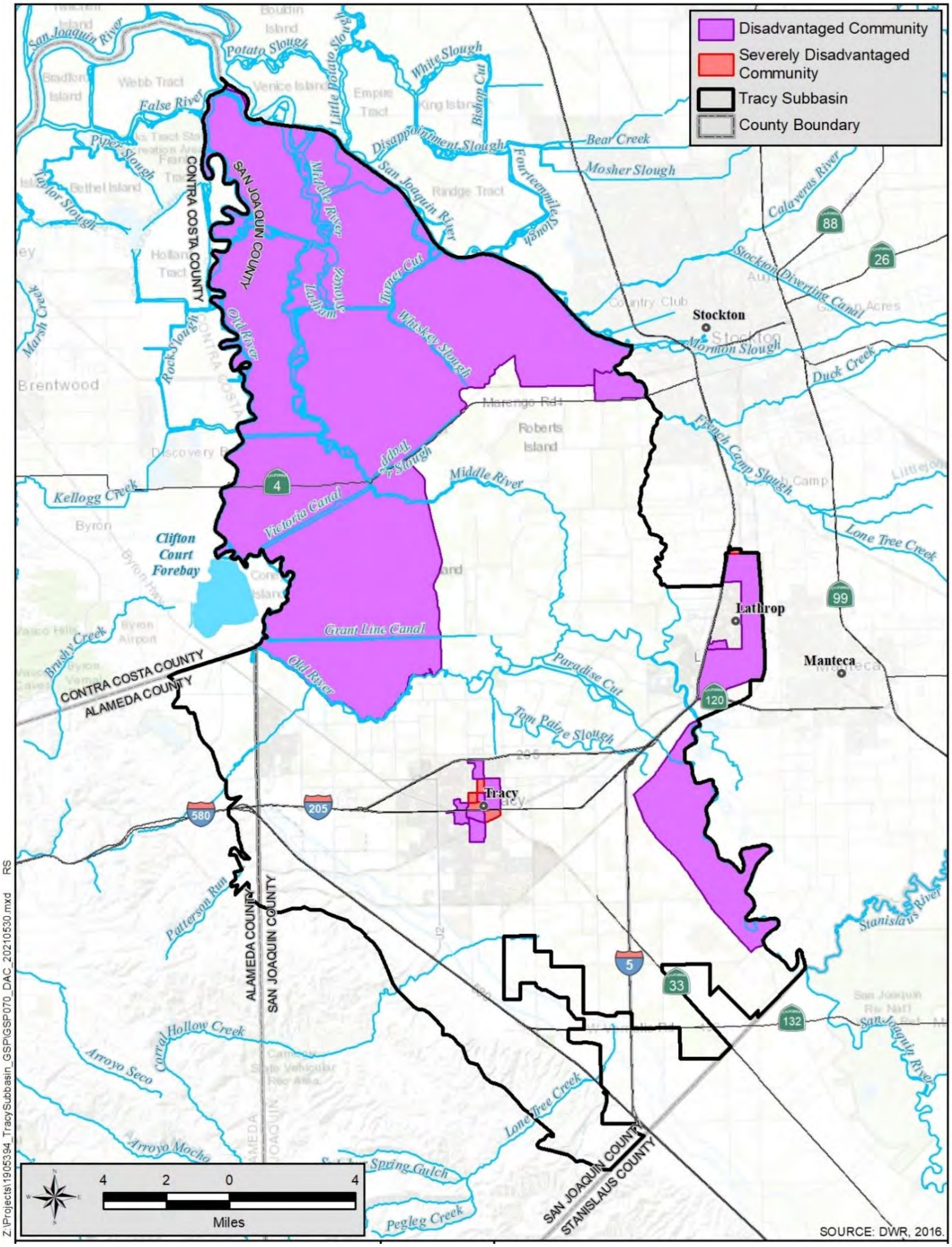

Figure 3-9. Disadvantaged and Severely Disadvantaged Communities

3.6 Water Use Sectors

Water for urban, agriculture, industrial, and native habitat use is a mixture of surface water only, groundwater only, and a combination of groundwater and surface water.

Figure 3-10. Agricultural and Municipal Water Source and Water Use

, shows the water supply types for agricultural and urban areas in the Subbasin. Most of the agricultural and urban areas have groundwater and surface water sources and, therefore, can conjunctively use these resources to manage groundwater in those areas. Rural area residents typically have domestic wells and rely upon groundwater (De minimis extractor). Domestic well use of groundwater is not shown on **Figure 3-10.** Agricultural and Municipal Water Source and Water Use

but the general distribution across the Subbasin is shown on **Figure 3-13**.

3.6.1 *Municipal and Industrial*

State and federal governments own properties (Deuel Vocational Institution, Sharpe and Tracy defense depots) within the Subbasin and use water for municipal and industrial purposes. These facilities use groundwater as their source of supply.

3.6.2 *Urban and Rural*

Portions of the non-Delta land areas, south of the Old River, contain urban developments including the cities of Lathrop and Tracy, and the community of Mountain House. These urban areas are served by three community water systems, as shown on **Figure 3-10.** Agricultural and Municipal Water Source and Water Use

.

The cities rely on a combination of surface water and groundwater to meet the water demands within their service area. Mountain House relies solely on surface water supplied through agreements with BBID. **Figure 3-10.** Agricultural and Municipal Water Source and Water Use

, shows the water sources in these urban areas.

There are multiple small community and transient water districts in the area that rely solely on groundwater. Rural property owners also rely solely on private wells and groundwater as their source of water throughout the Subbasin. Because of their wide distribution and limited groundwater use their uses of groundwater are not shown on **Figure 3-10.** Agricultural and Municipal Water Source and Water Use

.

3.6.3 *Agriculture*

Agriculture in the Subbasin uses surface water and groundwater. In the Delta area of the Subbasin, north of the Old River, agriculture predominately uses surface water. In non-Delta areas, essentially south of the Old River, BBID, and BCID supply surface water, which is augmented by private groundwater supply wells. Groundwater wells only supply about 2 percent of the total agricultural water demand with the remaining demand is met by surface water. Generally, areas above the DMC and California Aqueduct rely on groundwater in the unclassified areas of the Subbasin. A few areas rely solely on groundwater for agricultural purposes. **Figure 3-10.** Agricultural and Municipal Water Source and Water Use

, shows the availability of water sources for these agricultural areas.

3.6.4 *Native Vegetation and Aquatic Species*

About 500 plant and animal species inhabit the Delta. Rivers, sloughs, and canals in the Subbasin support more than 22 species of native and nonnative fish in the Delta. Subbasin currently contains a range of vegetation and habitat types, including riparian woodlands, seasonal wetlands, farmed wetlands, and non-native grasslands. **Figure 3-11.** NCCAG Vegetation and Wetlands and Managed Wetlands

shows these native vegetation and wetlands areas (NCCAG 2018.)

3.6.5 *Managed Habitat*

Some agriculture lands are also used for habitat. Surface water is used to create “managed” habitat areas for waterfowl on some of Delta islands such as Lower Jones Tract and Mandeville Island. After harvest, the fields are flooded to create habitat and allow migrating waterfowl to forage for corn, wheat, and barley that was not harvested.

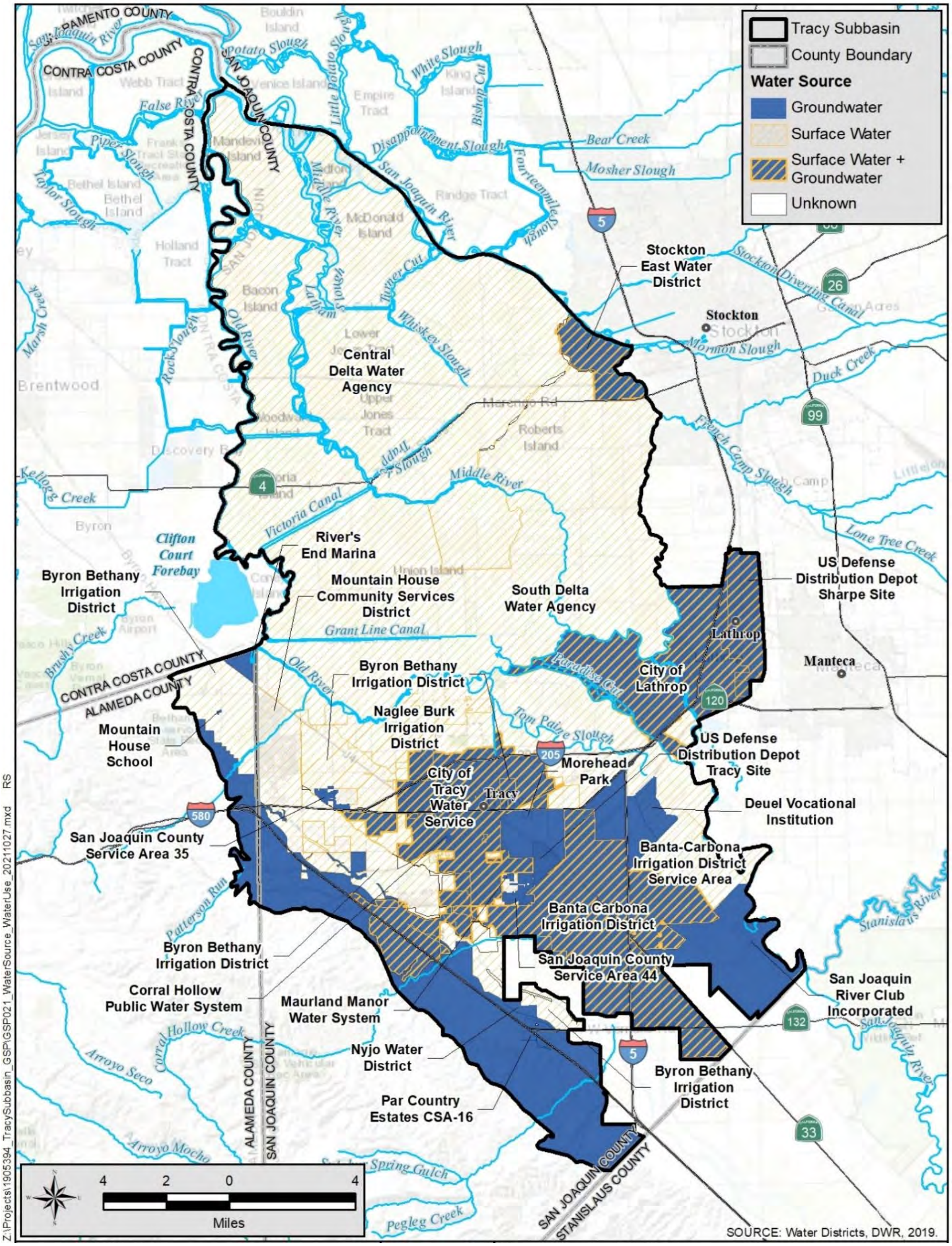

Figure 3-10. Agricultural and Municipal Water Source and Water Use

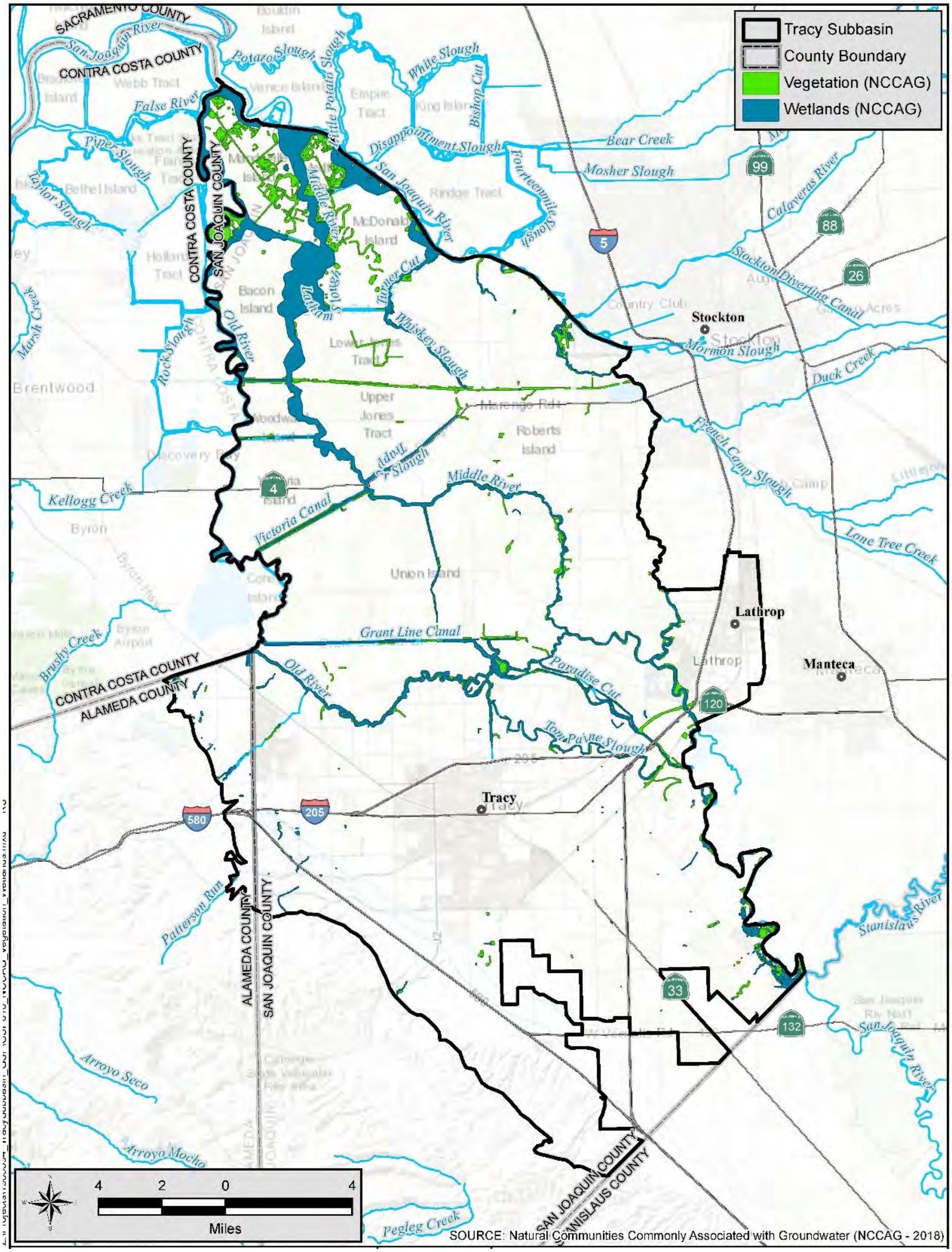

Figure 3-11. NCCAG Vegetation and Wetlands and Managed Wetlands

3.6.6 *Environmental Cleanup*

There are three large groundwater remediation sites with cleanup in progress in the Subbasin. Groundwater is extracted, treated, and then either placed into percolation basins or injected into the aquifers.

- **Tracy Defense Distribution Depot.** The federal government is in the process of remediating groundwater contamination beneath the 448-acre Tracy Defense Depot site. In 1990, Tracy Defense Depot installed remediation measures to control off-site migration of trichloroethylene (TCE) and perchloroethylene (PCE) to 5 parts per billion. This remedial system will operate up to 30 years to meet remediation goals. Since 1999, the Tracy Defense Depot treats about 90 AFY of groundwater. The treated water at times have been spread onto adjacent lands or injected back into the aquifers but is currently being placed into infiltration galleries, but in all cases returning the water to the aquifers. The pumping is expected to continue through 2026.
- **Sharpe Defense Distribution Depot.** The federal government is in the process of remediating groundwater contamination beneath portions of the 724-acre Sharpe Depot site. Groundwater is contaminated with volatile organic compounds, primarily TCE and PCE. Recent testing of the groundwater has also found the presence of perfluorooctanesulfonic and perfluorooctanoic acids, commonly known as PFOS and PFAS. In 2019, the remediation effort pumped about 900 AFY and it is expected to continue through at least 2040. Treated groundwater is placed into basins and allowed to percolate back into the aquifers.
- **Occidental.** The former Occidental Chemical manufacturing plant, now occupied by Simplot, is about 185 acres and is a Superfund site. Occidental Chemical is responsible for remediation of the contamination. Groundwater has been impacted by Sulfolane, dibromochloropropane (DBCP) and ethylene dibromide (EDB) along with the high concentration of ammonia, sulfate, and total dissolved solids (as high as 25,000 milligrams per liter [mg/L]). Groundwater remediation consists of pumping contaminated groundwater and treatment and then injecting the treated water into the aquifers below the Corcoran Clay. About 450 to 500 AFY of groundwater was extracted in 2018-2019 and treated before being injected back into the ground.

3.7 Water Source Types

In general, water agencies in the Subbasin as a whole, meet agricultural water demands almost entirely (97%) with surface water (about 403,500 AF) with minor amounts (12,797 AF) of groundwater (DWR BP 2019). The groundwater use is split about evenly between urban (5,501 AF) and agricultural (6,296 AF) use.

3.7.1 *Groundwater*

There are about 2,400 “production” wells in the subbasin, of which about 450 are production wells (agricultural and municipal), and about 1,950 domestic wells (DWR 2019b), although these estimates vary (DWR 2019a). DWR classifies wells as “production” wells if the well casing is greater than or equal to 4 inches in diameter, and the total depth is greater than or equal to 22 feet. Most of the production wells in the Subbasin are domestic wells, which may be classified as de-minimis extractors who pump less than 2 AFY. **Table 3-2** summarizes the number of wells by type.

The cities of Lathrop and Tracy rely, to some extent, on groundwater as well as agricultural (private well owners) in the non-Delta portions of the Subbasin. Where water services are not available, rural homeowners use domestic wells. The Deuel Vocational Institute and Sharpe and Tracy Defense depots also rely upon wells for their water supply. The Tracy Depot uses about 100 AFY.

There are seven active mining operations in the Subbasin. These quarries produce sand, gravel, and other aggregate. Three of the seven quarries are located at the intersection of Interstates 580 and 5, south of State Route 132. These quarries operate above historic groundwater levels in the area, so groundwater use is incidental to quarry operations and not due to dewatering operations. The remaining quarries are located near and around the Tracy Municipal Airport. The quarries use groundwater as their source of water supply. Additionally, the Brown Sand mining operation is located south of Interstate 5, between State Route 120 and Interstate 205. The pits expose the groundwater surface and mining is done via dredge lines under water.

Table 3-2. Well Type Summary

Well Type	Count
Production – Domestic	1,958
Production – Agriculture	373
Production – Municipal	74
Production Well Total	**2,405**

3.7.2 *Surface Water*

Surface water in the Subbasin is obtained from the Sacramento and San Joaquin rivers and the Delta, either directly or indirectly. Agriculture in the Delta-portion of the Subbasin obtains its surface water supplies directly from the rivers and the Delta, while the non-Delta portions of the Subbasin obtain the water either directly or indirectly from the CVP facilities and the Old River.

Water is imported into the Subbasin for municipal water from the Stanislaus River, by SSJID through the South County Surface Water Supply Project (SCSWSP). The SCSWSP supplies Stanislaus River water to the cities of Manteca, Escalon, Lathrop, and Tracy using SSJID pre-1914 water right to water from the Stanislaus River.

In the non-Delta regions of the Subbasin, BBID, BCID, and Naglee-Burk Irrigation District, hold pre- and post-1914 water rights contracts and other agreements to obtain water from the San Joaquin River, Old River and CVP. BBID has an agreement to provide Tracy with surface water, based on post-1914 water rights. BBID has a wholesale agreement with CSA 50, which is located just to the west of the City of Tracy and Mountain House Community Services District.

3.7.3 *Recycled Water*

The cities of Lathrop and Tracy have wastewater treatment plants and are actively pursuing recycled water supplies. **Figure 3-12** shows the location of the treatment plants. The cities are planning on recycled water use to offset potable water demands for future developments as well as for current uses such as parks, business park landscaping, and industry.

The City of Lathrop currently treats wastewater at its Consolidated Treatment Facility plant and supplies tertiary-treated water to several agricultural lands located within the City limits. The City has approximately 30 miles of recycled water pipes (purple pipes) installed and is ready to begin serving street landscape areas, parks, and playing fields.

The City of Tracy owns and operates the Tracy Wastewater Treatment Plant and discharges tertiary-treated wastewater to Old River. The City of Tracy has planned and constructed recycled water pipeline infrastructure, including recycled water transmission pipelines and pump stations, to provide recycled water to parks, professionally managed landscape areas, and other non-potable uses. The pipeline will eventually be extended to connect to the Central Valley Project Delta Mendota Canal. The recycled water pipeline and pump stations have been constructed but a permit has not yet to be obtained to use and distribute the recycled water. New developments in the City are required to include recycled water distribution systems in accordance with the City's Recycled and Non-Potable Water Ordinance.

Mountain House Community Services District currently owns and operates a wastewater treatment plant and discharges tertiary-treated wastewater to Old River. The District has no recycled water use and does not have any projects for any future recycled water use.

Both depots (Sharpe Defense Distribution and Tracy Defense) have wastewater treatment plants. The Sharpe Depot currently places its treated wastewater into percolation basins where the water returns to the aquifers. After the Depot is decommissioned, the City of Lathrop will convey the wastewater to the City of Manteca to provide treatment, outside of the Subbasin. At the Tracy Depot, about 20 AFY of treated wastewater is placed into percolation basins where it percolates back to the aquifers.

The Deuel Vocational Institution has a sewage treatment plant that discharges their treated water to the Deuel Drain, which is tributary to the San Joaquin River. The state is planning to deactivate Deuel Vocational Institution by September 2021.

3.7.4 *Water Reuse*

Excess applied surface water from agricultural fields and from urban areas in and around the cities either percolates into the soils or flows into drains where it is recaptured by the irrigation districts, drainage districts, or reclamation districts in the Subbasin. Shallow groundwater may also discharge to these drains, but only in areas where the groundwater surface is near the ground surface.

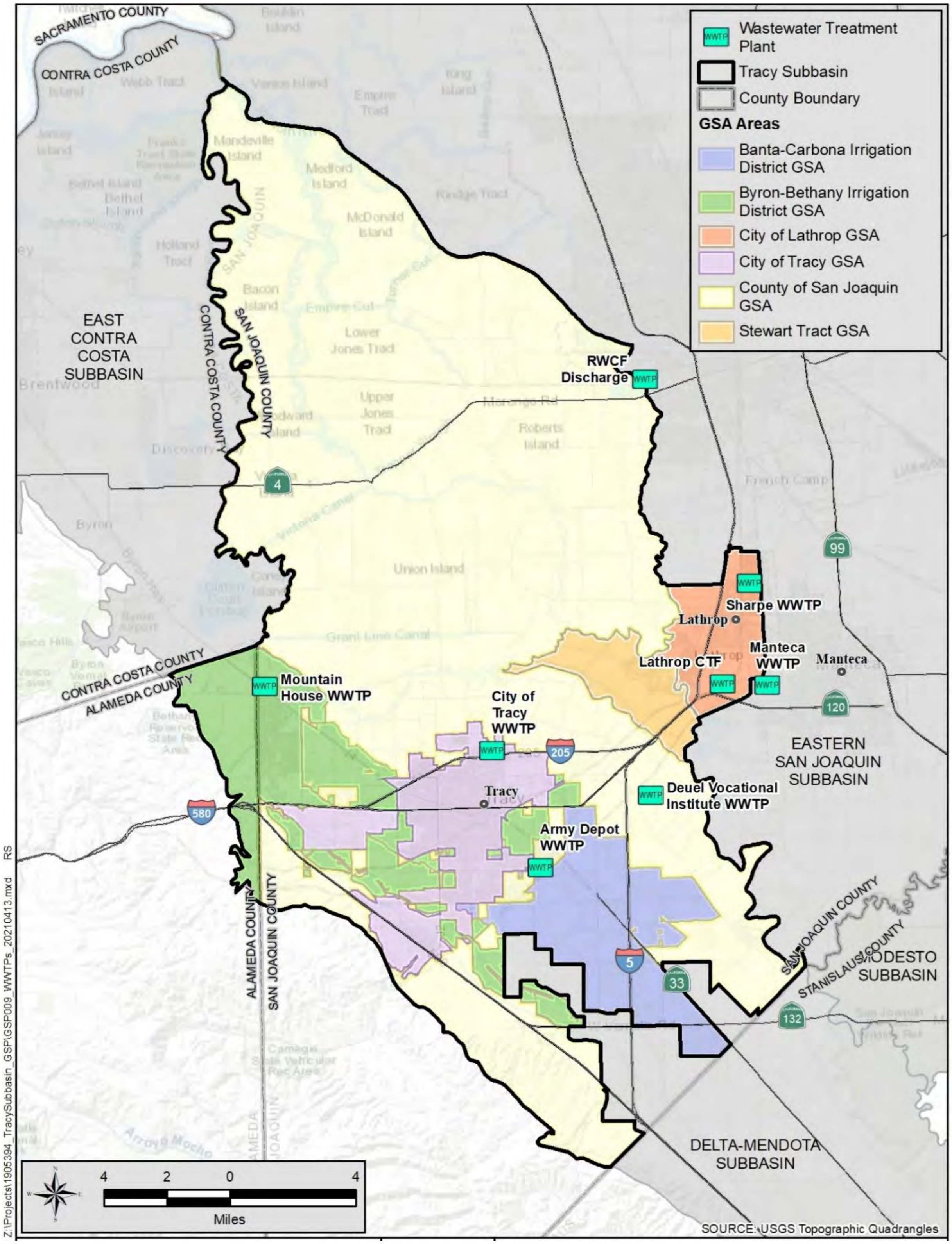

Figure 3-12. Wastewater Treatment Plants

3.8 Density of Wells

Groundwater in the Subbasin is used for municipal, industrial, irrigation, domestic, stock watering, frost protection, and other purposes (*refer to* **Table 3-2** which provides a summary of the number of wells by general types in the Subbasin). It should be noted that the number of wells is based on well logs filed and contained within DWR's Water Well Drillers Reports and may not reflect the actual number of active wells; many of the wells contained in DWR files may have been destroyed.

Figure 3-13 through **Figure 3-18** show the distribution of domestic, production, and municipal wells per square mile and the minimum depths of the wells (DWR 2019b). There are considerably more wells in the non-Delta areas, south of the Old River, than in the Delta area of the Subbasin. The depths of wells are generally deeper in the non-Delta portion of the Subbasin as compared to the Delta portion of the Subbasin. In general, the domestic wells are constructed to shallower depths than the production wells. It is unknown if this is an artifact of very old wells, pre-1950, being included in the database when groundwater levels were much shallower and may have since been destroyed due to lower groundwater levels. Overall, the municipal wells are constructed deeper than either the domestic or production wells.

Outlines of DACs and SDACs are also shown on the domestic and municipal well density. **Figures 3-12 and 3-16** show that within the Delta area, the communities are not dense residential areas and likely use domestic wells. There are many sections where disadvantage communities are designated but no domestic or municipal wells are present. A few DAC and SDAC communities are present within the cities of Lathrop and Tracy where municipal water supplies are available. In the southern portion of the Subbasin, adjacent to the San Joaquin River, there are a couple of large areas designated as DAC and SDACs. These areas have a relatively high density of domestic wells, (*see* **Figure 3-12**), which likely provide water to people in these areas.

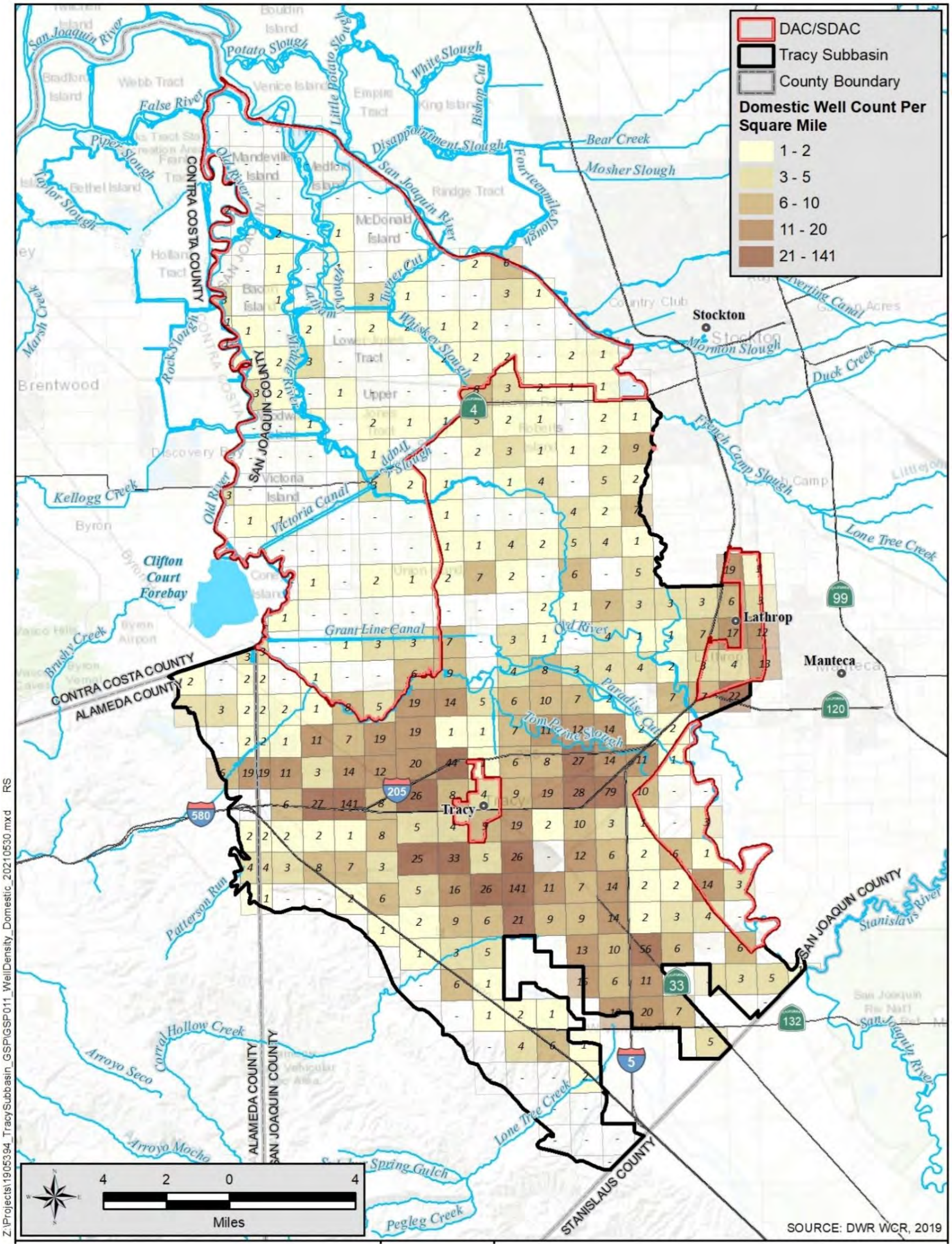

Figure 3-13. Density of Domestic Wells Per Square Mile

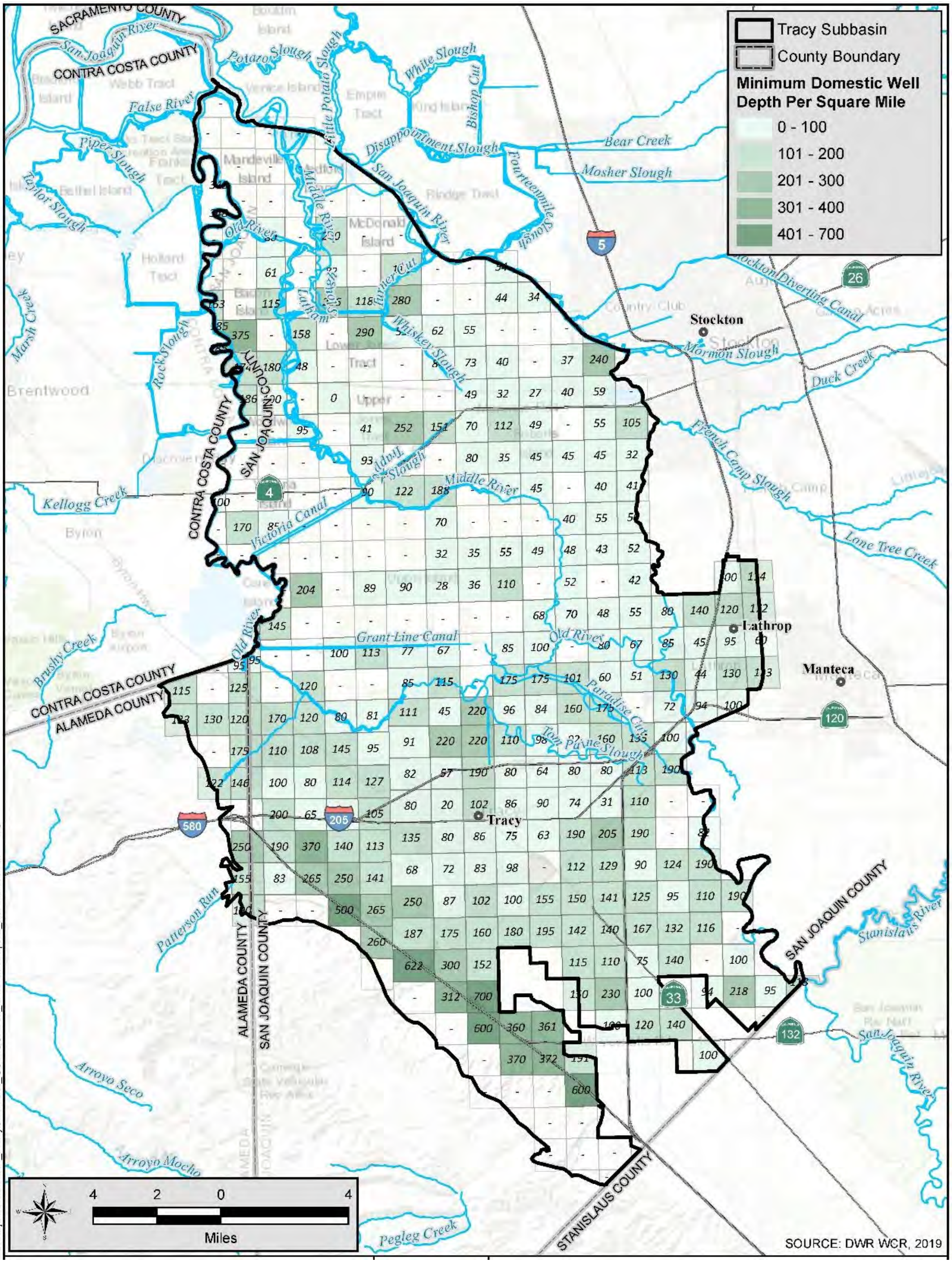

Figure 3-14. Minimum Depths of Domestic Wells Per Square Mile

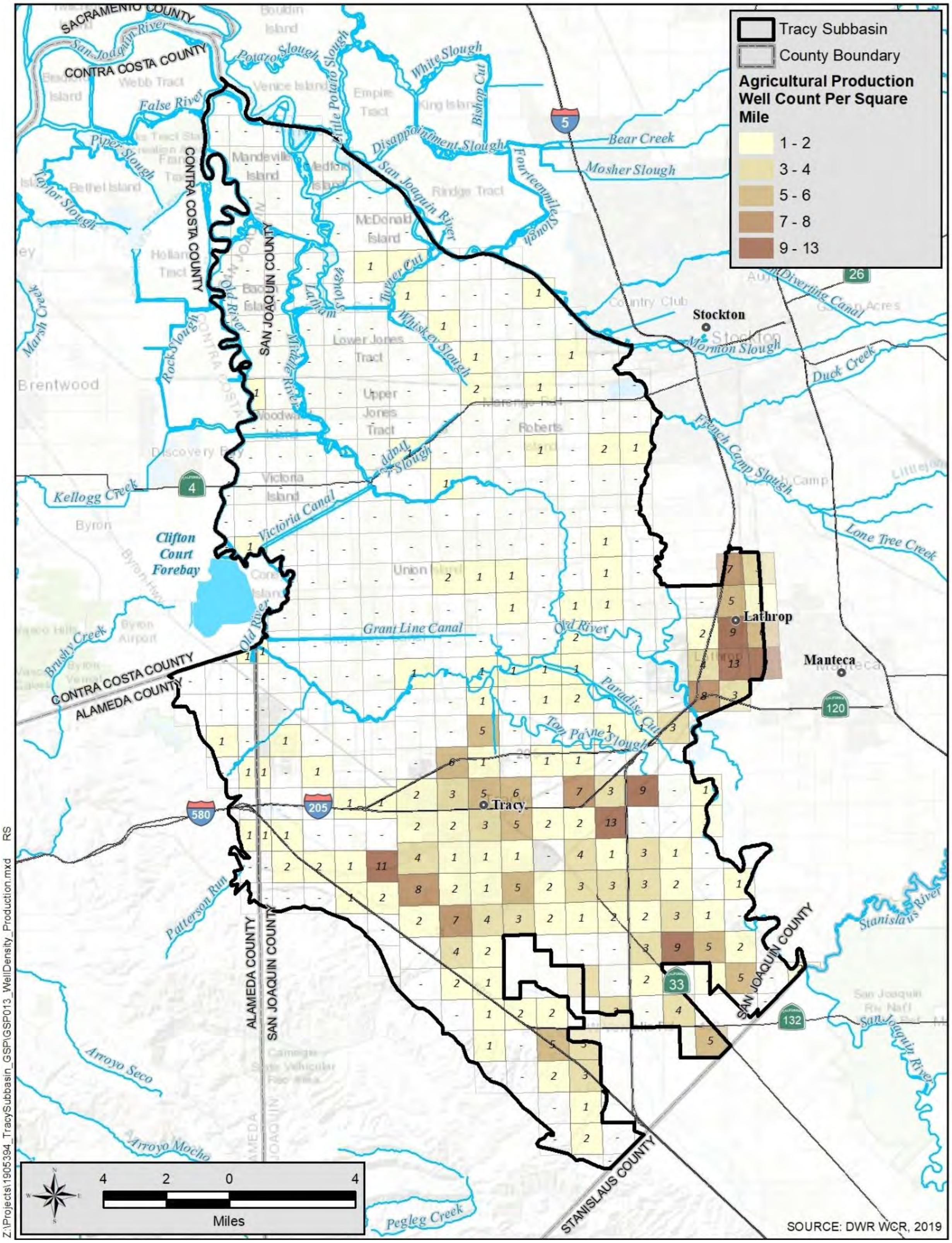

Figure 3-15. Density of Production Wells Per Square Mile

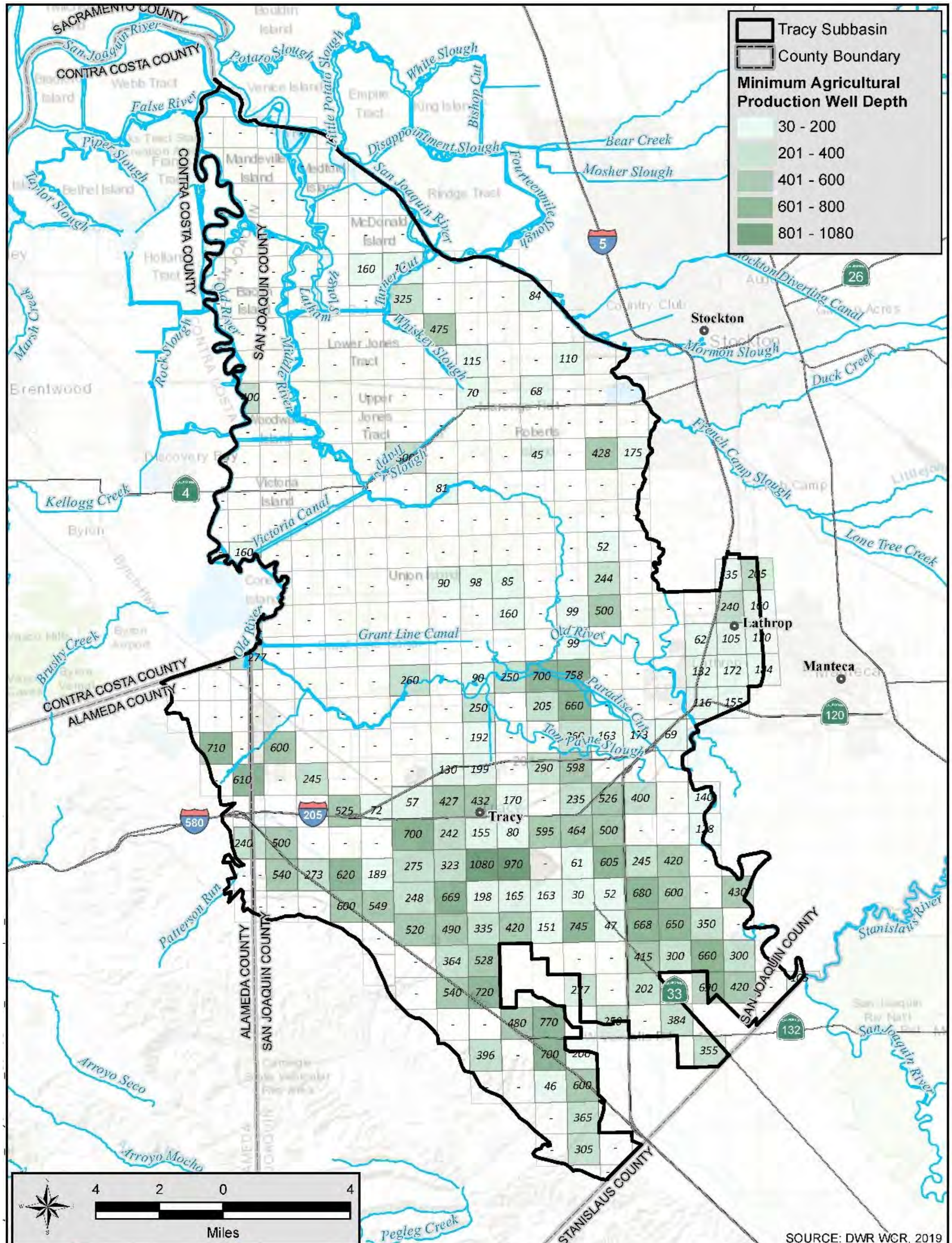

Figure 3-16. Minimum Depths of Production Wells Per Square Mile

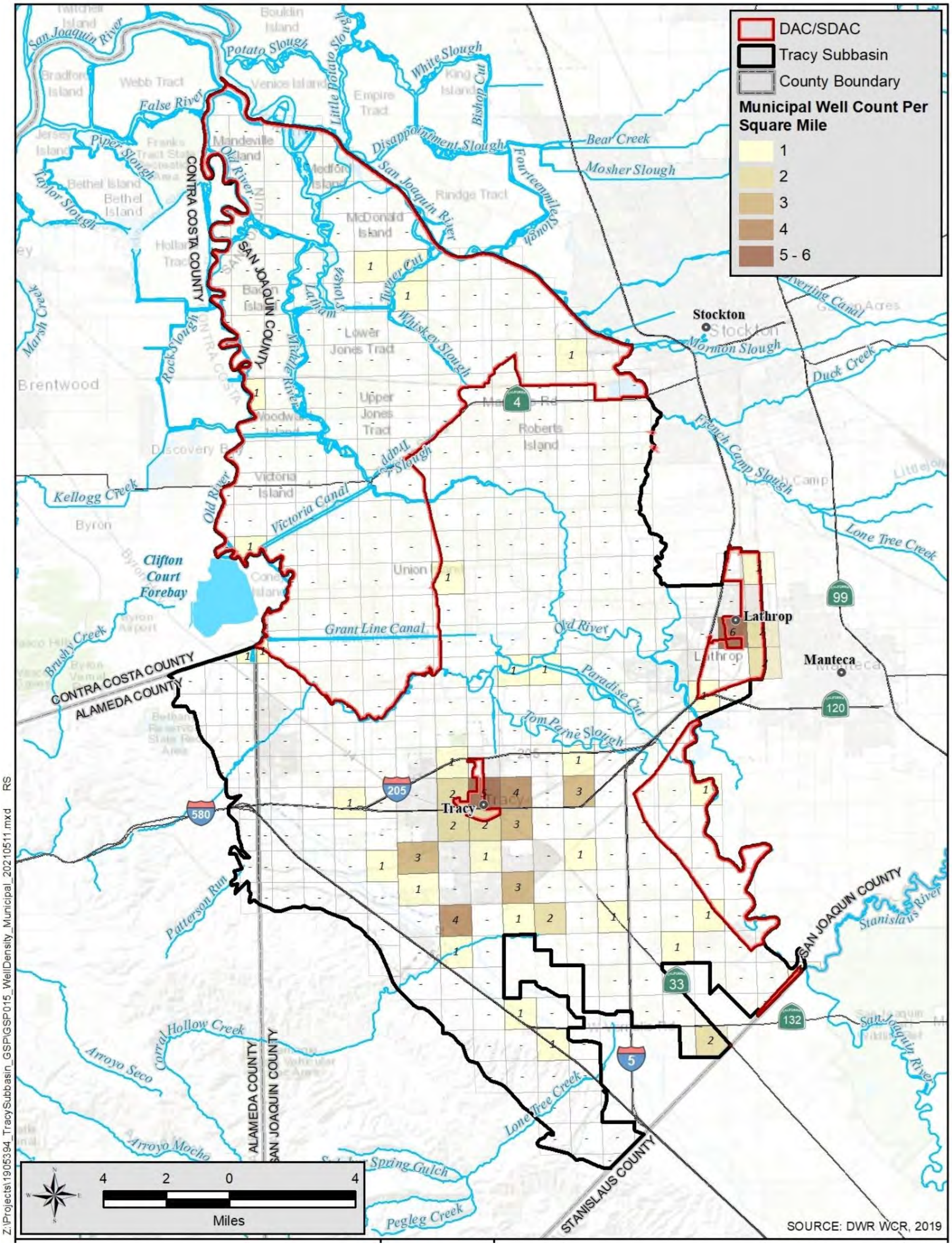

Figure 3-17. Density of Municipal Wells Per Square Mile

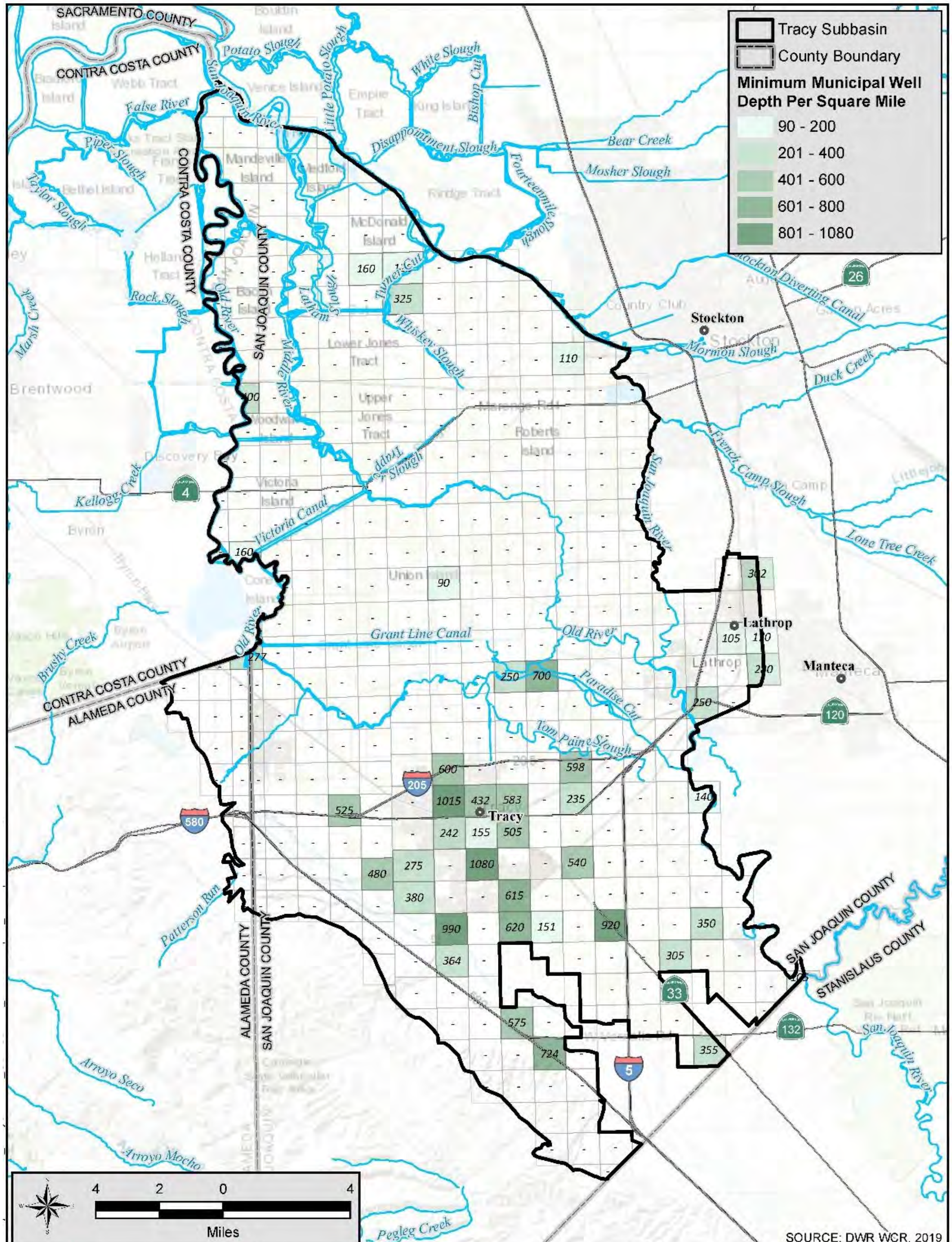

Figure 3-18. Minimum Depths of Municipal Wells Per Square Mile

3.9 Existing Water Resources Management Plans

In 1992, the California State Legislature adopted Assembly Bill (AB) 3030, and in 2002 the Legislature enacted Senate Bill (SB) 1938. SB 1938 provides that the adoption of a groundwater management plan will be a prerequisite to obtaining funding assistance for groundwater projects from funds administered by DWR. These two pieces of legislation were incorporated into the State Water Code, Section 10753, to encourage local public agencies/water purveyors to voluntarily adopt formal plans to manage groundwater resources within their jurisdictions. The 2007 Tracy Regional Groundwater Management Plan covers the entire Subbasin. This existing Groundwater Management Plan will be replaced with this GSP. The following subsections provide a summary of other existing groundwater management plans that the GSAs plan to incorporate and use in the development of this GSP to manage groundwater resources in the Subbasin.

3.9.1 *Westside-San Joaquin County Integrated Regional Water Management Plan*

The Westside-San Joaquin (W-SJ) Integrated Regional Water Management Plan (IRWMP) covers a large planning area and includes much of the Subbasin and the Delta Mendota Subbasin to the south. The IRWMP covers the areas within BBID, BCID, and the City of Tracy, but does not include the Delta portion or fringe areas in the Subbasin. The City of Lathrop belongs to the Eastern San Joaquin Integrated Regional Water Management Plan.

The 2019 W-SJ IRWMP emphasizes multiagency collaboration, stakeholder involvement, regional approaches to water management, water management involvement in land use decisions, and project monitoring to evaluate results of current practices. The W-SJ IRWMP identifies projects that help achieve regional objectives while working to address water-related challenges in the region.

The San Luis Delta Mendota Water Authority (SLDMWA), acting as the Regional Water Management Group for the region, has coordinated the evolution of planning documents and regional objectives since 2001. Plan development and updates have been iterative and driven by stakeholder participation resulting in an overarching goal of providing a more reliable water supply, protecting agricultural, municipal, and environmental water uses, and meeting community needs (including DACs), by improving water supply sustainability, water quality, and drainage.

The IRWMP also includes specific projects and implementation programs and agreements between different affected agencies to identify projects to put conjunctive use in place.

3.9.2 *Urban Water Management Plans*

The Urban Water Management Planning Act was developed in response to the state's water shortages, droughts, and other factors. Every urban water supplier that provides over 3,000 acre-feet of water annually or serves more than 3,000 urban connections is required to submit an Urban Water Management Plan (UWMP). UWMP requirements include updating water shortage contingency plans, extended drought risk assessments, and energy intensity reporting. UWMP plans include a report on the progress that urban water suppliers are making in meeting their water use targets, current and projected water demands, current and projected water sources, water management actions to improve supply reliability, and an evaluation of the sufficiency of supplies to meet the forecasted demands under both normal and drought conditions. Entities within the Subbasin with UWMP plans include:

- City of Tracy
- City of Lathrop
- Mountain House Community Services District

UWMP plans from 2015 were used to develop this GSP. Updated UWMP plans were adopted in 2021, but due to their recent release date, the information from these plans could not be incorporated into this GSP. The 5-year GSP update will include information from these plans.

Each of the cities have developed and are implementing water conservation measures to promote efficient water management practices as required by the Water Conservation Act of 2009 and documented in each of their UWMP plans. The agencies have developed Water Shortage Continency Plans that comply with the 2015 California State Water Resources Control Board (State Water Board) mandated water conservation standards set during the recent drought.

3.9.3 *Agricultural Water Management Plans*

The Water Conservation Act of 2009 (SB X7-7) requires agricultural water suppliers serving more than 25,000 irrigated acres (excluding recycled water deliveries) to adopt an Agricultural Water Management Plan (AWMP) and submit to DWR. These plans must include reports on the implementation status of specific Efficient Water Management Practices required under SB X7-7. Required components of an AWMP include:

- Annual water budget
- Identification of water management objectives to improve system efficiency
- Quantification of water use efficiency with all water uses being accounted for include crop water use, agronomic use, environmental use, and recoverable surface flows
- A Drought Plan, for periods of limited water supplies, that describes actions for drought preparedness

Districts which have adopted AWMPs are:

- BBID
- BCID

The BBID and BCID AWMPs comply with SB X7-7 of 2009.

3.9.4 *Delta Protection Commission & Delta Stewardship Council*

The Delta Protection Commission (DPC) is an organization established by the Delta Protection Act of 1992, to develop a long-term resource management plan for the Delta Primary Zone. The primary goal of the DPC is to, "…protect, maintain and, where possible, enhance and restore the overall quality of the delta environment" The regional plan is to protect agricultural land within the Primary Zone from the intrusion of nonagricultural uses.

The Delta Stewardship Council is a California State Agency formed as a result of the Delta Reform Act in November 2009. The Council is made up of seven members who provide a broad, statewide perspective and diverse expertise spanning agriculture, science, the environment, public service, and beyond. The membership is made up of four governor appointees, one Senate and one Assembly appointee, with the final member being the Chair of the DPC.

The Council was created to advance the state's coequal goals for the Delta – a more reliable statewide water supply and a healthy and protected ecosystem, both achieved in a manner that protects and enhances the unique characteristics of the Delta as an evolving place. To do this, the Delta Reform Act required that the Council develop an enforceable long-term sustainable management plan for the Delta to ensure coordinated action at the federal, state, and local levels. The Delta Plan, adopted in 2013, includes both regulatory policies and non-binding recommendations (Delta Stewardship Council 2013).

3.9.5 *Salt/Nutrient Management Plan*

In February 2009, the State Water Board adopted Resolution No. 2009-011, which established a statewide Recycled Water Policy. Central to this Policy was the requirement that local water and wastewater entities, together with local salt- and nutrient-contributing stakeholders, develop a Salt and Nutrient Management Plan for each groundwater basin and subbasin in California. The plans include management strategies, plans for stormwater and recycled water use, a monitoring program, and an antidegradation analysis.

In response, the San Joaquin County & Delta Water Quality Coalition was established to help irrigated agriculture meet the requirements of the California Regional Water Quality Control Board's (RWQCB) Irrigated Lands Regulatory Program (ILRP) in San Joaquin County (including all of the Subbasin), Calaveras County, and Contra Costa County. The Coalition is operated and governed by the San Joaquin County Resource Conservation District. The Central Valley Regional Water Quality Control Board (CVRWQCB) approved a new General Order for the San Joaquin County and Delta Watershed area on March 12, 2014.

The Coalition developed a Groundwater Quality Assessment Report and a comprehensive Groundwater Quality Management Plan. The Groundwater Quality Management Plan presents a baseline picture of groundwater quality, establishes a framework under which salt and nutrient issues can be managed, and streamlines the permitting process of new recycled water projects while meeting water quality objectives and protecting beneficial uses.

3.9.6 *Water Quality Control Plan*

In 2018, the CVRWQCB prepared a Water Quality Control Plan for the Sacramento and the San Joaquin River Basins (Basin Plan) along with subsequent amendments (CVRWQCB, 2018). The objective of the Basin Plan is to show how the quality of the surface water and groundwater in the San Joaquin and Sacramento regions should be managed to provide the highest water quality reasonably possible. Water uses and water benefits vary depending upon the location in the basins. Water quality is an important factor in determining use and benefit. For example, drinking water must be of higher quality than the water used to irrigate pastures. Both are legitimate uses, but the quality requirements for irrigation are different from those for domestic use. The Basin Plan recognizes such variations.

The Basin Plan lists beneficial users, describes the water quality which must be maintained to allow those uses, and contains an implementation plan, State Water Board and CVRWQCB plans and policies to protect water quality, and statewide surveillance and monitoring as well as regional surveillance and monitoring programs. Present and potential beneficial uses for inland waters in the basins are listed below:

- Surface water and groundwater as municipal (water for community, military, or individual water supplies)
- Agricultural
- Groundwater recharge
- Recreational water contact and non-contact
- Sport fishing
- Warm freshwater habitat
- Wildlife habitat
- Rare, threatened, or endangered species
- Spawning, reproduction, and/or early development of fish

Water Quality Objectives for both groundwater (drinking water and irrigation) and surface water are provided in the Basin Plan.

3.10 Existing Water Resources Monitoring Programs

Existing management and monitoring plans in the Subbasin are described below. Some of the programs will be incorporated into the GSP monitoring network or were used to develop this GSP.

3.10.1 *Groundwater Level Monitoring Programs and Networks*

Historical groundwater level data measurements were made by DWR, local water districts, and the United States Geological Survey (USGS). Information from these monitoring programs have been incorporated into this GSP.

Groundwater level monitoring is being performed by designated monitoring entities in the Subbasin as part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program. This network of groundwater level monitoring wells provides data that is the foundation for many groundwater management decisions. San Joaquin County is the designated reporting agency in the Subbasin. DWR continues to monitor groundwater levels in the Subbasin. The CASGEM groundwater level monitoring network is shown on **Figure 3-19**.

The San Joaquin County Flood Control and Water Conservation District (SJCFCWCD) publishes semi-annual groundwater reports covering groundwater conditions in San Joaquin County. These reports include tables, hydrographs, and maps on groundwater levels. Groundwater level results from each semi-annual report are compared with values from the previous period. Groundwater level data collected by the district include CASGEM and additional data. The data are maintained by the SJCFCWCD.

Appendix C provides the groundwater level monitoring well construction details. Some, not all, of the wells are dedicated nested monitoring wells (small diameter wells that are screened opposite individual aquifers).

There are three large remediation programs with extensive monitoring networks in the Subbasin (refer to **Chapter 3.6.6 – Environmental Cleanup**). Selected wells from these sites have been incorporated into the Subbasin monitoring network. In addition to these monitoring wells, the City of Lathrop has a monitoring well network associated with the distribution of recycled water onto agricultural lands. Some of these wells have also been incorporated into the monitoring network.

USGS monitors thousands of wells across the United States including10 wells within the Subbasin which have been incorporated into the monitoring network. The extensive water data, which includes manual measurements of depth to groundwater in wells throughout California, are stored in the National Water Information System (NWIS) online database. The database stores historical observations of active and discontinued sites in addition to current conditions with measurements transmitted hourly. Groundwater level measurements at these wells are taken approximately once per quarter.

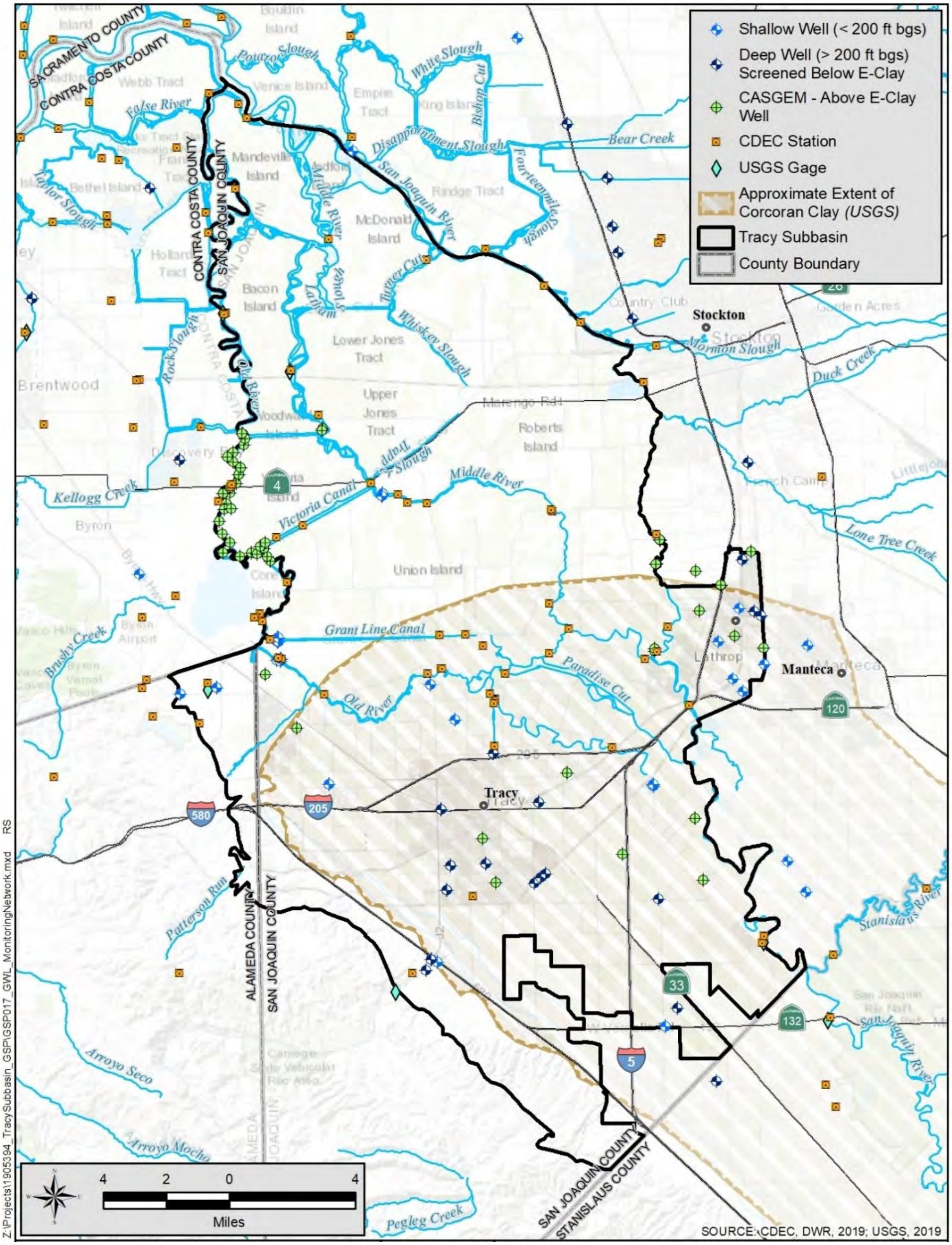

Figure 3-19. Groundwater Level Monitoring Network

3.10.2 *Groundwater Quality Monitoring Programs and Network*

Groundwater quality is monitored under several different programs and by different agencies, including:

- **Municipal and community water purveyors**. Municipal and community water purveyors (serving 15 or more connections) must collect water quality samples on a routine basis for compliance monitoring and reporting to State Water Board's Division of Drinking Water (DDW).
- **USGS Groundwater Ambient Monitoring and Assessment (GAMA)**. The USGS collects water quality data on a routine basis under the GAMA program. The previously discussed USGS NWIS contains groundwater quality data in addition to groundwater level measurements. Groundwater quality results in NWIS relate to GAMA records, but there is no direct link between the two databases. Some NWIS sites have a state identification (ID) listed, which is a common identifier used for wells. This indicates these wells can be connected to other databases using the state ID information. However, differences in the format of the state ID between NWIS and other databases create challenges in cross-referencing between databases. In this GSP, NWIS water quality measurements are utilized for basin characterization but are acquired from other programs.
- **Irrigated Lands Regulatory Program**. As part of the ILRP, the San Joaquin County & Delta Water Quality Coalition members monitor drinking water wells on enrolled parcels for nitrates. This requirement began January 1, 2019, based on the February 7, 2018, revision of ILRP Waste Discharge Requirements for the Eastern San Joaquin River Watershed by the State Water Board. The ILRP program is in the process of developing a comprehensive monitoring network for future use to address the ILRP data objectives. The San Joaquin County & Delta Water Quality Coalition members also monitor domestic wells for nitrate in high vulnerability areas.

Figure 3-20 shows the location of these water quality monitoring wells, just those that are municipal water supply wells with known construction details that could be assigned to a single aquifer. Information collected by these programs have been incorporated into this GSP. Due to most of these wells being community water supply wells, their construction details are not provided.

In addition to these monitoring programs, there are multiple sites that are monitoring groundwater quality as part of investigation or compliance monitoring programs through the CVRWQCB.

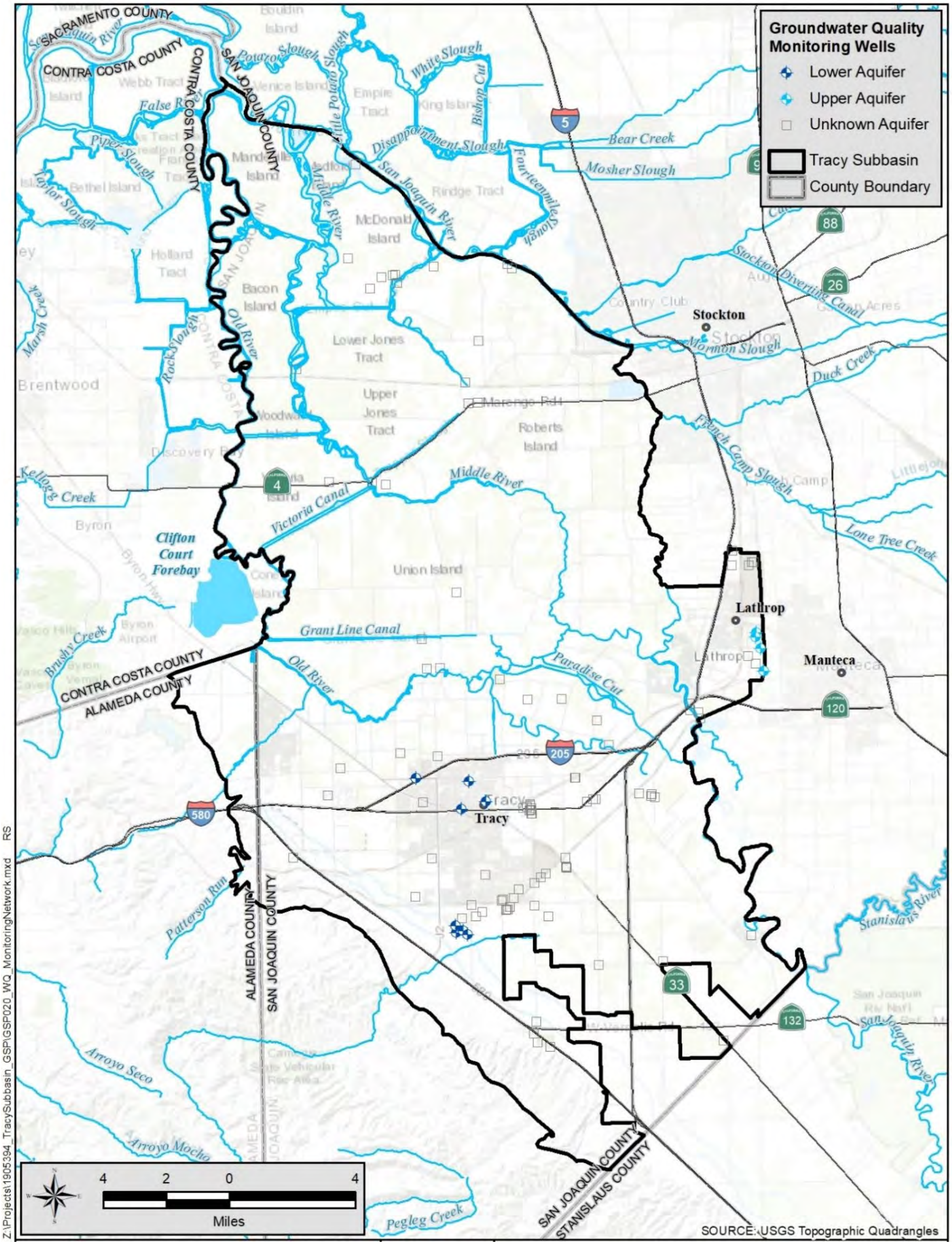

Figure 3-20. Groundwater Quality Monitoring Network

3.10.3 *Surface Water Monitoring Networks*

DWR and USGS maintain surface water gages along the rivers, creeks, and sloughs in the Subbasin. Dependent upon the station, DWR or the USGS may measure just the level of water (stage) or the discharge. **Figure 3-21** shows the location of these gages. This GSP uses the data collected by these agencies from some of these gages.

3.10.4 *Precipitation Monitoring Network*

Precipitation is measured at two stations located in the Subbasin (*see* **Figure 3-21**). This GSP uses the data collected by various agencies that maintain and report the data.

The Tracy Carbona rain station (TCR, Index Number 04-899-05) has the Subbasin's longest and most continuous record of precipitation, from 1935 through present. It is located in the southern portion of the Subbasin (*see* **Figure 3-21**) and is considered representative of the entire Subbasin. The average precipitation, for this 69-year period is 10.83 inches. Using the state climatologist definition of a recent representative period of years, water year 1988-89 through 2008-09, is 10.95 inches at this location. **Figure 3-22** shows the annual precipitation for water years (October 1 – September 31 of any given year).

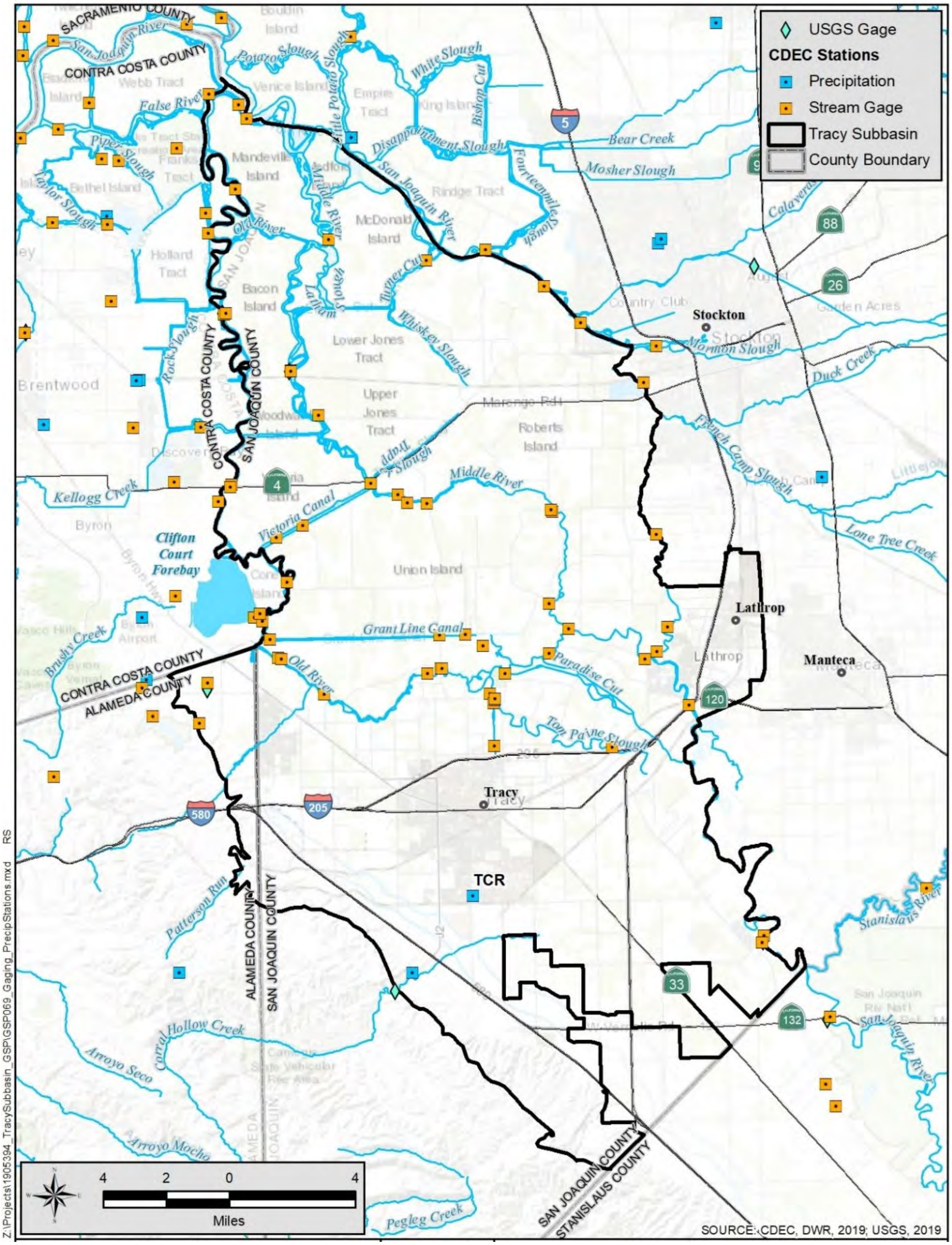

Figure 3-21. River Gages and Precipitation Stations

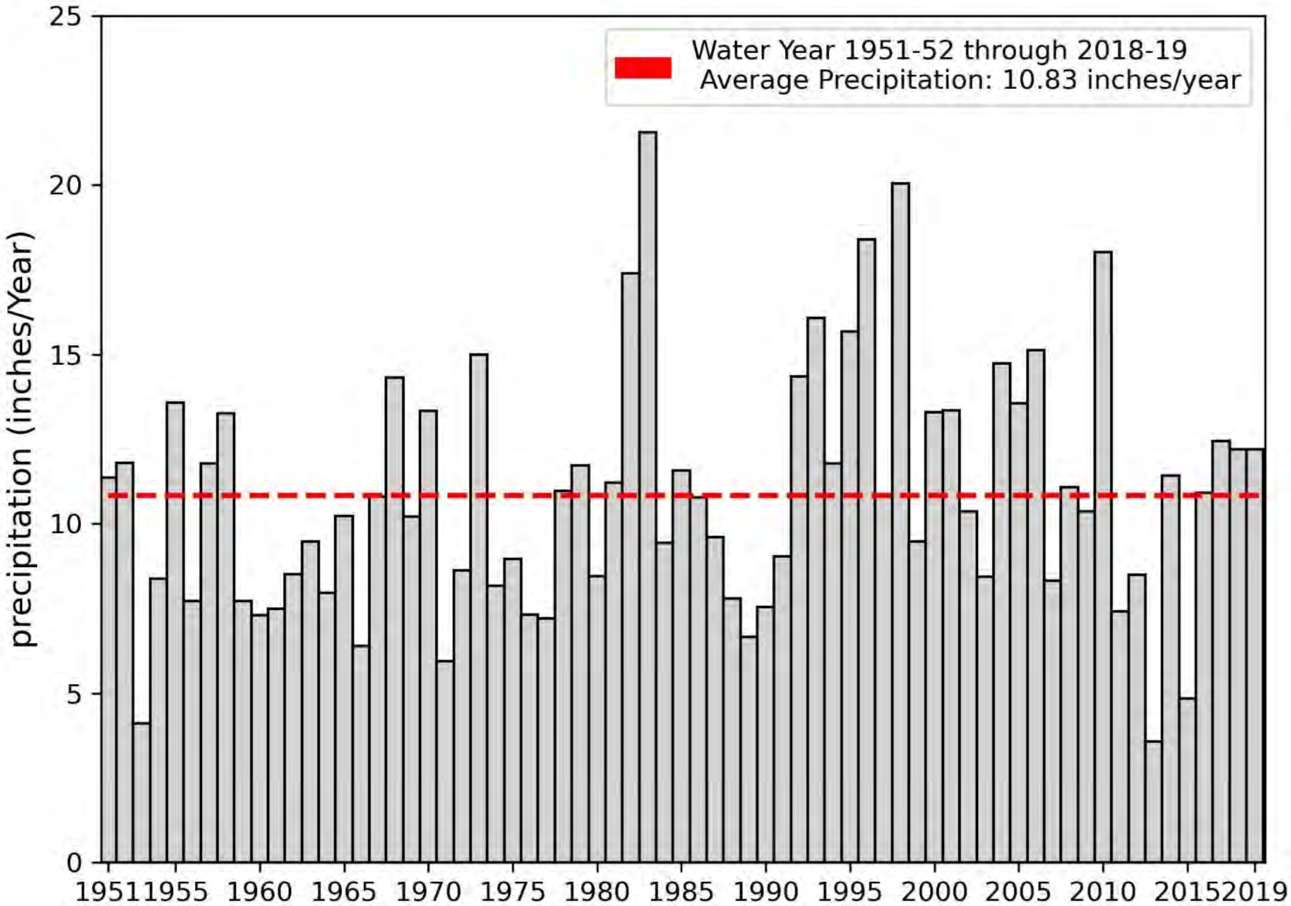

Figure 3-22. Water Year Precipitation

3.10.5 *Subsidence Monitoring Network*

Local and regional subsidence monitoring is being performed in the Subbasin. The City of Tracy has six benchmarks that have been repeatedly surveyed up to 2005. The San Luis Delta-Medota Water Authority also has a series of benchmarks along the DMC. The location of these benchmarks is shown on **Figure 3-23**. Subsidence monitoring is also performed using continuous global positioning system (CGPS) stations.

University NAVSTAR Consortium's (UNAVCO) Plate Boundary Observatory Program (formerly University Navigation Satellite Timing and Ranging or NAVSTAR Consortium), reporting since 2004, consists of a network of about 1,100 CGPS and meteorology stations in the western United States to measure deformation resulting from the constant motion of the Pacific and North American tectonic plates. Stations located within the Subbasin contain data from at least 2006 to current and include station P257 in the western portion of the City of Tracy. The location of this station is shown on **Figure 3-23**. Other stations are also available near the Subbasin in the East Contra Costa County (P256), and in the East San Joaquin (P273) and Delta Mendota (P255) subbasins.

Subsidence analyses have also been conducted using satellite-based methods over limited time periods, as described below.

- **United States Geological Survey** – The USGS report Land Subsidence along the Delta-Mendota Canal in the Northern Part of the San Joaquin Valley, California, 2003-2010 (Sneed et al. 2013) presents land subsidence data in the southwestern portion of the Subbasin from 2007 to 2010.
- **Other** – DWR has made two InSAR datasets available for SGMA application: TRE Altamira, Inc.'s InSAR point and raster data and National Aeronautics and Space Administration Jet Propulsion Laboratory (NASA JPL) raster data (Farr, et. al. 2016). Vertical displacement approximations in both datasets are collected by the European Space Agency's Sentinel-1A satellite. The two different datasets represent two different processing results, one by TRE Altamira and one by NASA JPL. The TRE Altamira data have coverage between January 2015 to present. Both annual and total raster datasets from TRE Altamira are available and represent interpolations of the vertical displacement point features. The NASA JPL processed dataset spans Spring of 2015 to Fall of 2020 (DWR 2020).

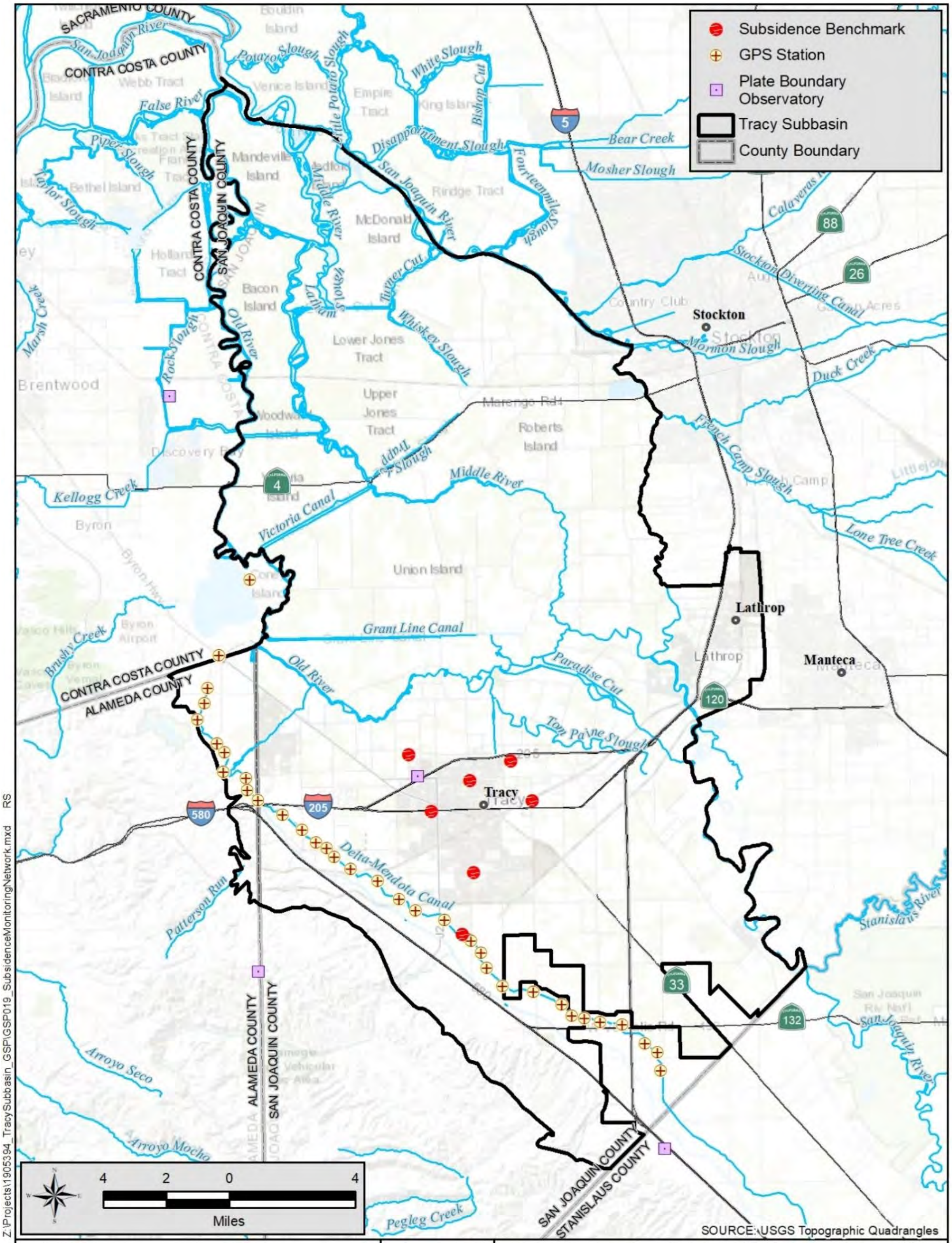

Figure 3-23. Subsidence Monitoring Network

3.11 Limits to Operational Flexibility

Overall, the Subbasin has senior water rights to surface water and along with generally moderate to poor-quality water; therefore, groundwater pumping is relatively small, only about 3 percent of the total supply. The limits to operational flexibility (based on the existing water resources management plans and monitoring programs to implement this GSP) are, as follows:

- The City of Tracy currently has a General Order Permit for using Aquifer Storage and Recovery (ASR) wells to recharge groundwater. The permit limits the water source for injection purposes to water from the San Joaquin Irrigation District, from the Stanislaus River. The City of Tracy also has water rights from the Delta-Mendota canal and an existing treatment plant. This limits the potential expansion of their ASR program. RWQCB appears willing to create a new permit to allow use of Delta-Mendota canal water.
- SGMA required DWR to develop and provide tools for GSAs to use in the development of GSPs. The C2VSim Fine Grid Version 1.0 groundwater model was provided but many subbasins developed different groundwater models and not reflected in the state's groundwater model making an evaluation of adjacent subbasin GSP implementation effects on adjacent subbasin impossible. An update of the state's model is needed to incorporate all the different models.
- The ILRP reports are indicating that groundwater levels are being collected when access is available. However, the groundwater level measurements are currently not being recorded on a website to provide use by this GSP.
- The current land use planning does not provide the ability to manage groundwater resources. The ability of agricultural users to convert from row crops to orchards and increase and harden water supply demand, without the GSAs having the ability to know if this increased use is being provided with surface water or groundwater and whether that increase pumping will exceed the sustainable yield of the Subbasin, until after the orchards are planted.
- Well permitting agencies do not have any requirements, considerations or special provisions for construction of wells near rivers or groundwater dependent ecosystem areas.

3.12 Conjunctive Use Programs

Conjunctive use is the planned, coordinated use of groundwater and surface water to optimize available water supplies. Surface water is used when it is available; groundwater is used when surface water supplies are reduced or not available. The aquifer is utilized as a storage reservoir that can be recharged from precipitation, subsurface inflow, applied surface water, or injection wells. This stored water is then available when needed.

Although not a formal program, irrigation districts and mutual water companies in the Subbasin also provide conjunctive use by increasing their deliveries of surface water during times of surplus, thereby reducing the amount of groundwater pumped by private well owners. The City of Tracy operates an aquifer storage and recovery program, currently using only one well out of nine.

3.13 Land Use Plans

A land use management and planning authority allows cities and counties to establish land use and zoning laws that govern development. Agencies with land use authority in the Subbasin are the cities of Lathrop and Tracy and the counties of San Joaquin and Alameda. The City of Tracy is considered a charter City, which provides additional constitutional freedoms to govern municipal affairs, even if a conflict with state law exists. General Plans and UWMP plans have been developed by the cities of Lathrop and Tracy and by San Joaquin County. Their planning horizons (to 2040) include the anticipated planned growth in the region. The Sharpe Depot is expected to be decommissioned in the next 6 to 12 months after which the City of Lathrop will provide services to properties within former Sharpe Army Depot boundaries.

Water purveyors also have a voice in land use planning, but not necessarily an authority. Because the purveyors provide water supply, any new development is required to demonstrate that adequate water supply will be made available to serve the project and, therefore, may affect land use. Proof of adequate water supplies is required as defined under California Water Code Section 10910 et seq and Government Code section 66473.7, which are intended to assist water suppliers, cities, and counties with integrating water and land use planning.

Current water demands for the cities and communities in Subbasin are shown in **Table 3-3** for comparison to projected future water supplies. Water supplies for new developments will be a mixture of surface water, groundwater, and recycled water. Surface water and recycled water use is planned to increase based on UWMPs. Groundwater use is also planned to increase by about 8,500 AF above current levels but then stabilize. **Table 3-3** summarizes the projected groundwater supplies for the next 20 years.

Table 3-3. Projected Water Supplies

Agency	Acre-Feet						
	2015	2020	2025	2030	2035	2040	Buildout
City of Tracy							
Surface Water	13,522	18,455	19,260	20,065	20,871	21,677	28,325
Groundwater	519	767	837	907	977	1,046	1,423
Recycled Water	0	963	1,926	2,889	3,851	4,814	7,696
City of Lathrop							
Surface Water	241	6,760	6,811	6,863	6,887	10,671	10,671
Groundwater	3,204	6,253	7,060	7,060	7,060	7,060	7,060
Recycled Water	429	1,159	1,067	1,067	1,067	1,067	2,350
Mountain House							
Surface Water	2,394	5,120	6,394	7,666	8,938	10,172	10,172
Groundwater	0	0	0	0	0	0	0
Recycled Water	0	0	0	0	0	0	0
Unincorporated County							
Surface Water	0	0	0	0	0	0	0
Groundwater	0	0	0	0	0	0	0
Recycled Water	0	0	0	0	0	0	0
Total Projected Growth on Surface Water	**16,157**	**30,335**	**32,465**	**34,594**	**36,696**	**42,520**	**49,168**
Total Projected Growth on Groundwater	**3,723**	**7,020**	**7,897**	**7,967**	**8,037**	**8,106**	**8,483**
Total Projected Growth on Recycled Water	**429**	**2,122**	**2,993**	**3,956**	**4,918**	**5,881**	**10,046**

Note: Projected normal year supplies from the City of Lathrop's Water Master Plan (Table 5-8 in the Plan) only reflect the supplies from the City of Lathrop's sources and do not include those from industrial, domestic, and agricultural groundwater users.

3.14 GSP Implementation Effects on Land Use

The General Plans in the Subbasin provide guidelines to facilitate anticipated growth within the sustainable capacity of existing resources. Successful land use planning promotes sustainable water supply and use within the region. Due to the complementary nature of the General Plans and the GSP, the goals and policies in the General Plans support the ability of the GSAs to achieve sustainability.

Implementation of this GSP, including changes in groundwater management, may influence the type of land use and location of future development. The result will depend on the level of changes set forth by this GSP such as enacted programs, plans, and policies. While General Plan implementation may result in land use changes and changes in water consumption, minimal change in water demand is expected from GSP implementation. The potential for future management actions, which could impact water supplies and development, is discussed in **Chapter 10 – Projects and Management Actions**.

Most of the land within the Subbasin is currently developed to some use (*refer to* Section 3.4), and conversion from agricultural uses to urban uses is not anticipated to increase overall water demand significantly. However, conversion from agriculture to urban use may have an effect on water source and depending on the location in the Subbasin, may shift supply from groundwater to surface water.

3.15 GSP Implementation Effects on Water Supply

The water budgets for the Subbasin show that it is currently within balance and that projected conditions with climate change results in only a slight imbalance of about 800 AFY (refer to **Chapter 7 – Water Budgets**). One project is planned that can bring the water budget into balance and within its sustainable yield. Therefore, with these conditions this GSP does not intend to curtain groundwater use. Two supplemental projects are also under consideration in case physical measurements require additional management actions.

3.15.1 *Urban Water Supply*

The reliability of urban supplies is expected to improve with implementation of this GSP. The City of Tracy is planning to increase recharge to the aquifers by using Aquifer Storage and Recovery wells (*see* **Chapter 10 – Projects and Management Actions**) with the ultimate goal of matching pumping and recharge. With this approach the City may essentially reduce its current net groundwater pumping effects of 18,000 AFY to zero. The City's initial project is to reduce pumping by 3,000 AFY.

3.15.2 *Agricultural Water Supply*

Agricultural uses mostly surface water to grow crops. The irrigation districts have very senior water rights, pre-1914, and therefore their supplies are very reliable. Because this is expected to continue, groundwater pumping for agricultural purposes is not anticipated to increase. Therefore, implementation of this GSP is should not affect agricultural water supply.

3.15.3 *Domestic Water Supply*

Groundwater levels are expected to remain near their current levels and therefore no domestic wells are projected to go dry.

3.15.4 *Environmental Water Supplies*

As stated above, groundwater levels are expected to remain near their current levels and therefore groundwater supply to potential groundwater dependent ecosystems is not expected to be lowered or reduced during implementation of this GSP.

Surface water depletion may increase in the Non-Delta Management Area based on current water budget projections, but the groundwater model needs further improvements before this projection can be relied upon. These depletions can be offset with discharges of treated recycled water, which originated as imported surface water, to the waterways and the decrease of pumping due to expansion of BCIDs service area to provide surface water to replace groundwater pumping.

3.16 Water Well Permitting

DWR has responsibility for developing standards for wells for the protection of water quality under California Water Code Section 231. Counties, cities, and water agencies, where appropriate, were required to adopt a well ordinance that meets or exceeds DWR well standards. Both San Joaquin and Alameda counties have well-permitting authority in the Subbasin.

3.16.1 *San Joaquin County*

San Joaquin County oversees a well permitting program for construction of any new, replacement, back-up, and de minimis wells. The purpose of this program is to prevent groundwater contamination and safety hazards by regulation of the location, construction, repair, and destruction of water supply, monitoring, and geophysical wells and borings. Pursuant to Water Code §13808, all new wells that do not meet the exemption criteria must submit additional information prior to the issuance of a permit by the San Joaquin County Environmental Health Department. The permit program is enforced by Ordinance Code of San Joaquin County §9-1115. Applicants must provide information about groundwater elevation estimates, land elevation estimates, extraction volume estimates, depth of Corcoran Clay, and other basic well characteristics.

The San Joaquin County Well Standards contains requirements for well location (minimum distances from potential sources of contamination and pollution), construction or repair, well disinfection, sampling, construction and abandonment of geophysical or seismological test holes or wells, and monitoring wells. Special requirements for well construction in San Joaquin County include determination of water quality during construction, depth limitations, perforation specification, and sealing-off strata listed in Bulletin 74-81 (DWR 1990), which was approved by DWR. To prohibit intermingling of poor-quality aquifers above and below the Corcoran Clay layer, wells constructed and perforated below the Corcoran Clay layer shall have sealing requirements determined on a site specific basis and approved by the Director.

County Zoning Code (Division 11: Infrastructure Standards and Requirements, Chapter 9-1115) states that a well permit may be approved by the Director of Environmental Health Division only if the following conditions are met:

- The proposed well shall not be offensive, dangerous, or injurious to health, or create a nuisance
- The proposed water complies in all respects to the standards of the Environmental Health Division for the construction of wells
- Upon completion of the well, the applicant or the Well Contractor shall file a copy of a Well Drillers Report with the Environmental Health Division, where these report forms will be furnished by the Director of Environmental Health Division or the State Water Board.

Policy IS-4.15 of the County General Plan states that prior to issuing building permits for new development that will rely on groundwater, the County shall require confirmation for existing wells and test wells for new wells to ensure that water quality and quantity are adequate to meet the needs of existing, proposed, and planned future development.

There are minimum setbacks requirements for construction of supply wells near the rivers, creeks, streams and canals of 50 feet but these may not be sufficient to maintain or reduce surface water depletion or protection of groundwater dependent ecosystems. All aquifers containing saline water shall be properly sealed off to prevent intermingling.

3.16.2 *Alameda County*

Alameda County oversees a well permitting program for construction of any new, replacement, back-up, and de minimis wells. The purpose of this program is to prevent groundwater contamination and safety hazards by regulation of the location, construction, repair, and destruction of water supply, monitoring, and geophysical wells and borings. The conditions to permit and construct a new or replacement wells is contained in Alameda County, Code of Ordinances, Title 6- Health and Safety, Chapter 6.88 – Water Wells.

The administering agency may designate special requirement areas where special well construction techniques and/or well seal(s) are required to prevent spreading of contaminants or mixing of water between water-bearing zones. These areas are typically areas where one or more underlying aquifers of differing water quality are separated from each other by a zone of low permeability. The administering agency, in consultation with applicable agencies, shall identify the boundaries of these areas of special concern. Where an applicant proposes well construction, reconstruction, or destruction work in such an area, the administering agency may require the applicant to provide a report prepared by a registered Professional Geologist or registered Professional Civil Engineer (California Business and Professions Code Sections 7850 and 6762, respectively) that identifies the affected water bearing and non-water bearing strata, as well as the zone(s) of contamination or poor quality water, and recommends construction techniques and seal location(s) designed to prevent the spread of the contamination or poor quality water by the well or during well construction. All aquifers containing saline water shall be properly sealed off to prevent intermingling.

There are no setbacks or special investigation requirements for construction of supply wells near the rivers or tributaries to maintain or reduce surface water depletion or protection of groundwater dependent ecosystems.

3.16.3 *Aquifer Storage and Recovery Wells*

The State Water Board permits use of Aquifer Storage and Recovery wells under a statewide General Order. The order requires technical studies prior to approval of the well for injecting water into the aquifers. The well also must be registered with the United States Environmental Protection Agency (EPA).

3.17 Land Use Plans Outside of the Subbasin

This GSP has not evaluated land use implementation plans outside the Subbasin.

4. Hydrogeologic Conceptual Model

4.1 Basin Boundaries

The Tracy Subbasin (Subbasin No. 5-22.15) lies in the northwestern portion of the San Joaquin Valley Groundwater Basin west of the San Joaquin River, except for the City of Lathrop area which lies east of the river. Aquifers beneath the Subbasin extend into the adjacent Eastern San Joaquin, Delta-Mendota, and the East Contra Costa subbasins. The Tracy Subbasin, along its southwestern border, is bounded by non-water bearing rocks of the Coast Ranges. **Figure 4-1** shows the Tracy Subbasin and the surrounding subbasins.

The bottom of the Subbasin is the base of fresh water which is generally positioned at the top of the marine sediments that contain saline water. The base of freshwater is the boundary between water of TDS of about 2,000 mg/L and higher. In the Tracy Subbasin, the mapped base of freshwater ranges from about -400 to -2,000 feet elevation beneath the Subbasin (Page 1968, Berkstresser 1973). **Figure 4-2** shows the irregular base of freshwater as defined by two different authors with a slight gap in coverage between the two studies.

4.2 Topography

The Tracy Subbasin generally slopes downward from the south to the north. The topography of the Subbasin is shown in **Figure 4-3**. The Subbasin is drained by the San Joaquin River and Old River and westside tributaries; Corral Hollow, Mountain House, Lone Tree and Patterson Run creeks which drain water from the Coast Ranges. The San Joaquin River flows northward into and through the Sacramento and San Joaquin deltas and discharges into the San Francisco Bay.

Ground surface elevations are the highest, approximately 200 feet above msl, on the southwestern side of the Subbasin and gradually decline to sea level to the north and east. Portions of the Delta islands north of the river are below sea level.

4.3 Surface Water Bodies

Major water bodies within the Subbasin consist of the San Joaquin, Old, and Middle rivers along with various sloughs, canals, and cuts as the waters converge and flow within the Delta. **Figure 4-3** shows the location of these surface water bodies. The San Joaquin River makes up almost the entire eastern boundary of the Subbasin except for the City of Lathrop, which was recently introduced into the Subbasin through a basin boundary modification. The Old River diverges from the San Joaquin River near the City of Lathrop and meanders west until turning north and eventually rejoining the San Joaquin River. It feeds water into the SWP Clifton Court Forebay, which is located just west of the Subbasin. The Middle River also diverges from the San Joaquin River near the City of Lathrop and meanders northwest through the Delta before connecting with the Old River.

Two major pump stations lift water out of the Old River from the Clifton Court Forebay into two large canals: the California Aqueduct and the Delta-Mendota Canal. Although these canals are not a natural part of the Subbasin surface water system, these large canals traverse the southwestern portion of the Subbasin, transporting water from the Delta to portions of BBID and to BCID that lie within the Subbasin, and to other agricultural and urban water suppliers in the San Joaquin Valley and southern California.

In addition to the major natural waterways that surround the majority of the Subbasin, there are networks of agricultural irrigation canals that convey surface water to agricultural lands.

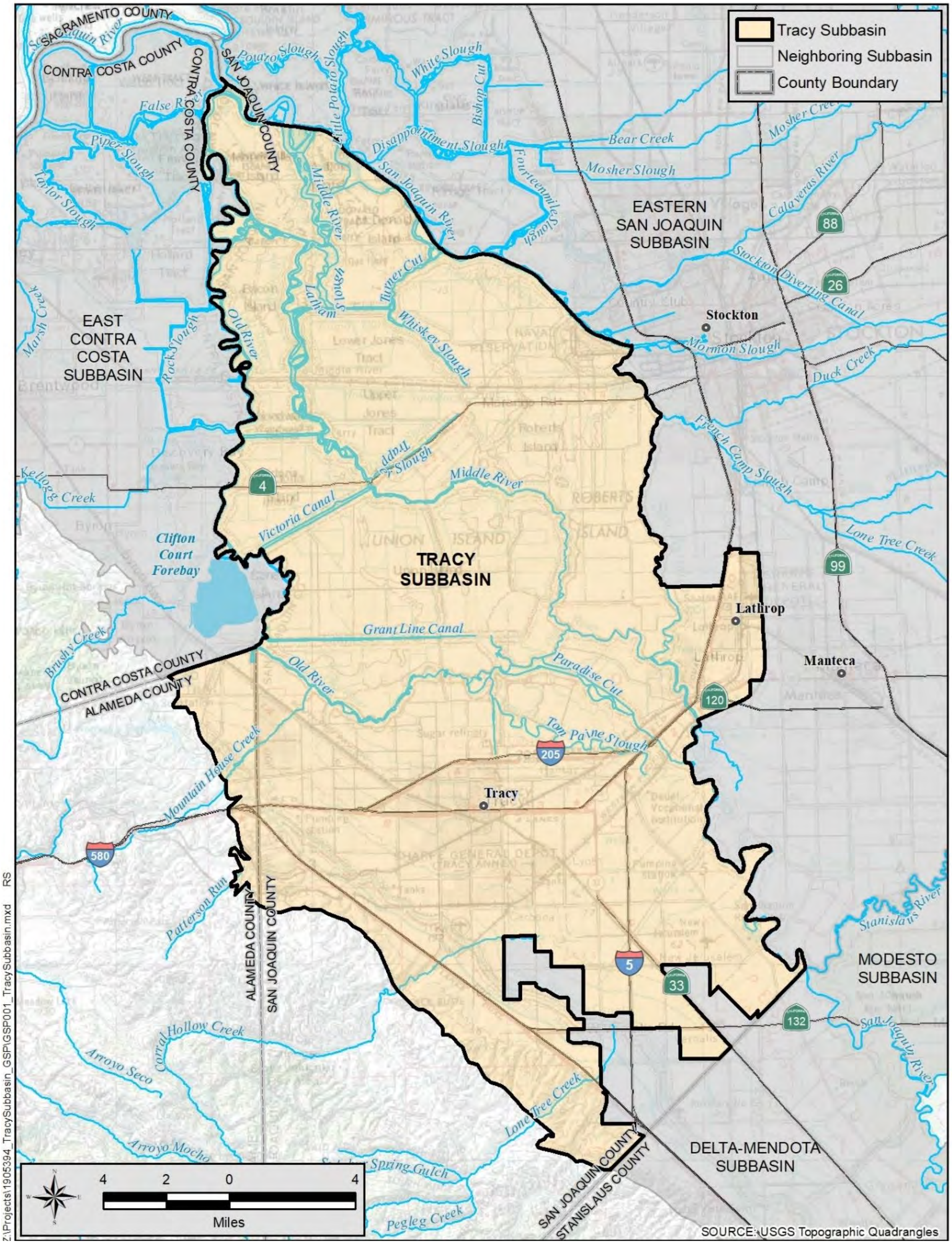

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Figure 4-1. Tracy Subbasin

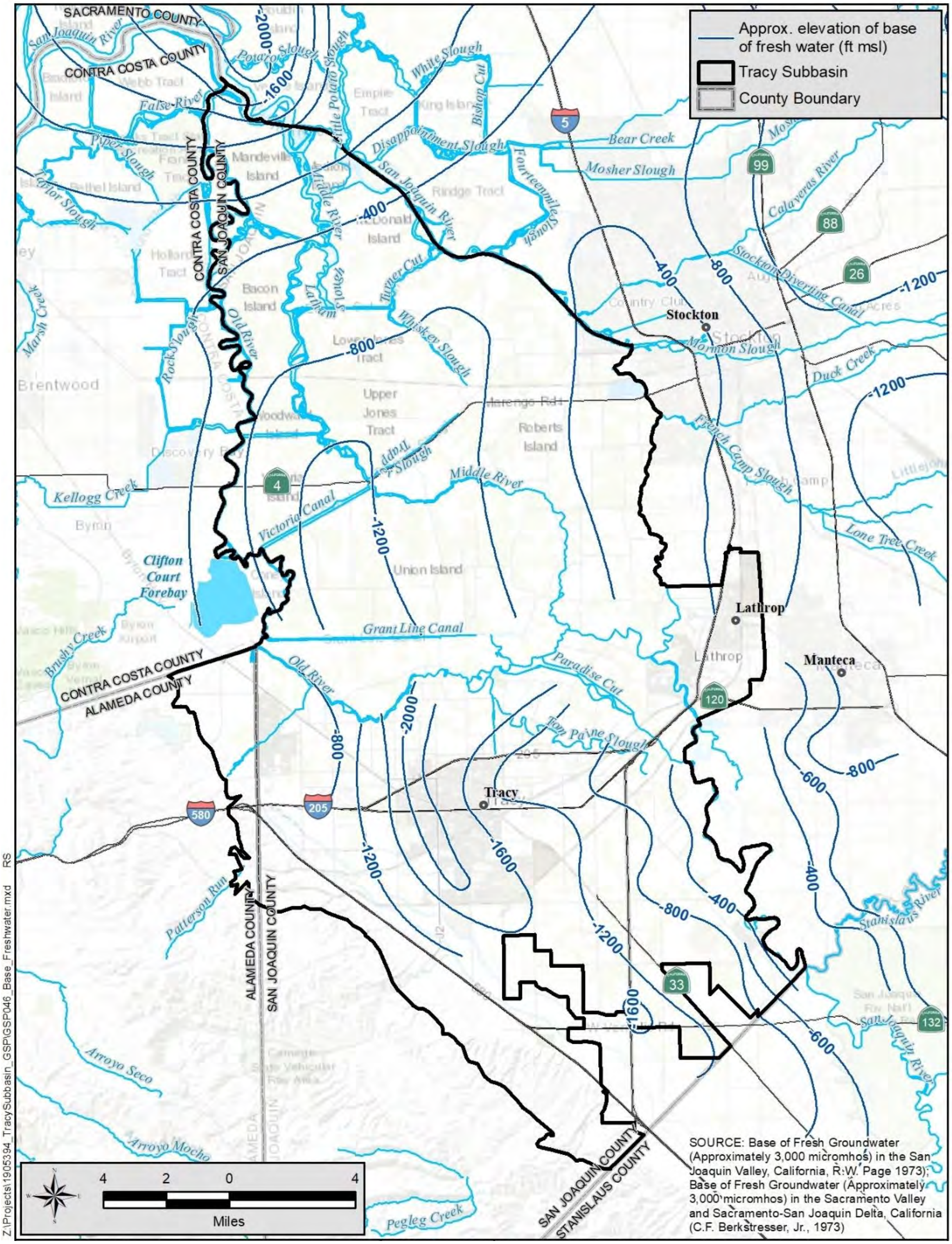

Figure 4-2. Base of Freshwater

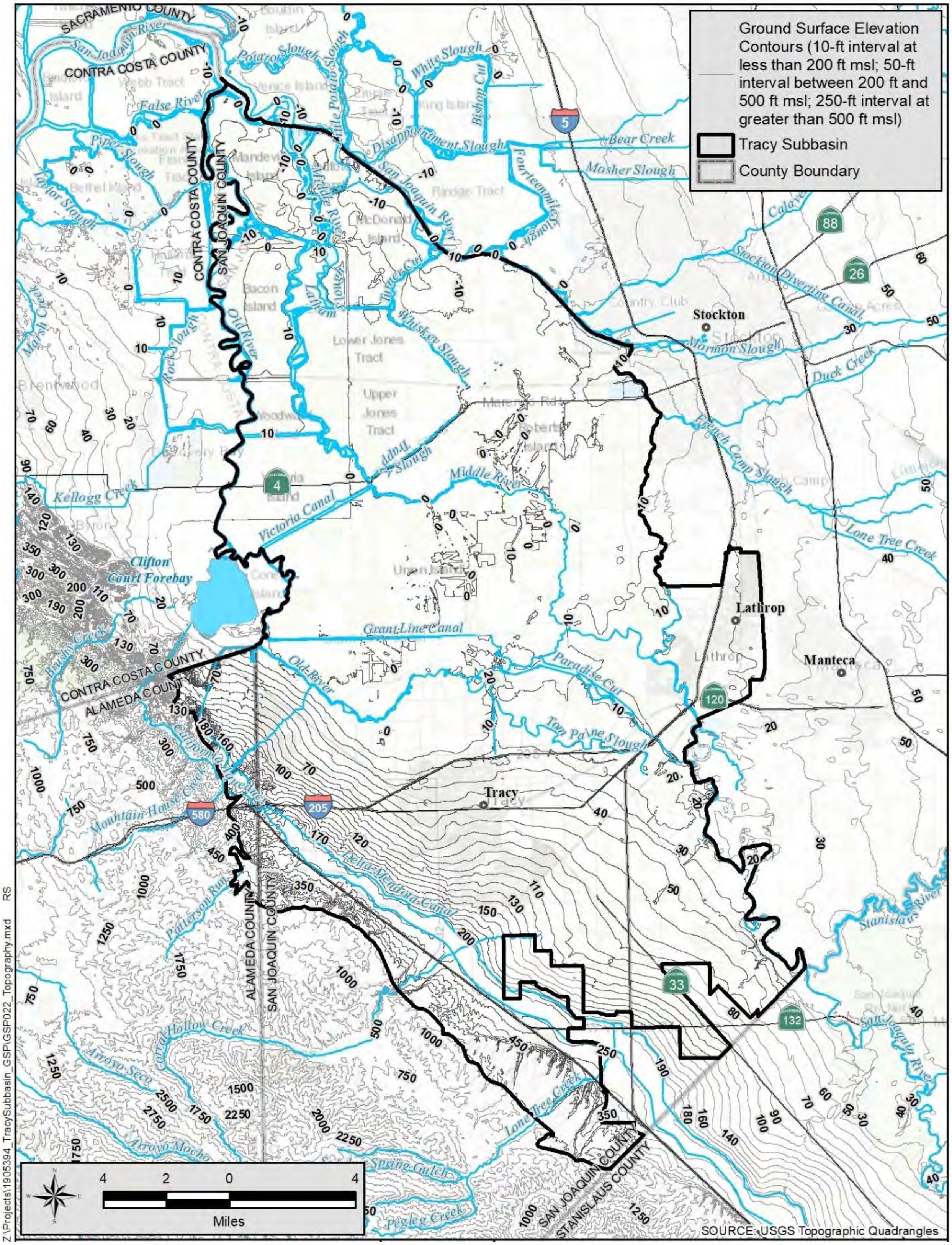

Figure 4-3 Topography

4.4 Soils

The Subbasin is underlain by alluvial soils whose age generally corresponds with the relative age of the alluvial geologic units. The oldest soils lie along the southwestern margin of the subbasin where alluvial fans from the Coast Range ranges are exposed above the valley, with progressively younger soils toward the north and east near the rivers and Delta.

Surface recharge potential in the Subbasin is a function of soil type. The surface recharge potential of the soil was interpreted based on the hydrologic soil group as mapped and categorized by the U.S. Department of the Agriculture's Natural Resources Conservation Service (SSURGO 2019). Hydrologic soil groups are classified according to their ability to infiltrate water and affect runoff. The soils are grouped according to the amount of water infiltration when the soils are thoroughly wet and receive additional precipitation. The four primary hydrologic soil groups are:

Group A: Soils having a high infiltration rate (low runoff potential) when thoroughly wet

Group B: Soils having a moderate infiltration rate when thoroughly wet

Group C: Soils having a slow infiltration rate when thoroughly wet

Group D: Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet

Figure 4-4 shows the hydrologic soil groups in the Subbasin. The area associated with soils with highest infiltration rate (Group A) is along Corral Hollow, within the City of Lathrop and extending to the west along the southern portions of the Old and Middle Rivers. The rest of the Subbasin has Group C or D type soils with low to very low infiltration rates.

The Soil Agricultural Groundwater Banking Index (SAGBI), developed by researchers at UC Davis (O'Greene, et al. 2015), is a suitability index for groundwater recharge on agricultural land and takes into account the effects of agricultural modifications (deep ripping) to the native soils. The SAGBI is based on five major factors that are critical to successful agricultural groundwater banking: deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. **Figure 4-5** shows the SAGBI index classified soil distribution in the Subbasin.

Most of the Delta area of the Subbasin is covered with "Poor" rated soils due to the low possibility of deep percolation and root zone residence time. This Poor rating is due to the fine silts and clays brought in by the rivers. While these less permeable soil types often inhibit flow to the subsurface, these soils classifications are generalizations of soil types and localized windows of connection to the underlying aquifers can exist, particularly when streams are incised through the soil profile. Most of these coarse-grained, well-drained soil windows occur along the southern extent of the Old and Middle rivers and east into the City of Lathrop area. These windows are rated as "Excellent".

The non-Delta area of the Subbasin has more favorable areas for groundwater recharge. The area consists of both Moderately Poor to Very Poor and some pockets of Moderate Good to Excellent ranked soils. There are pockets of Excellent rated soils are along some of the tributary channels from the Coast Ranges.

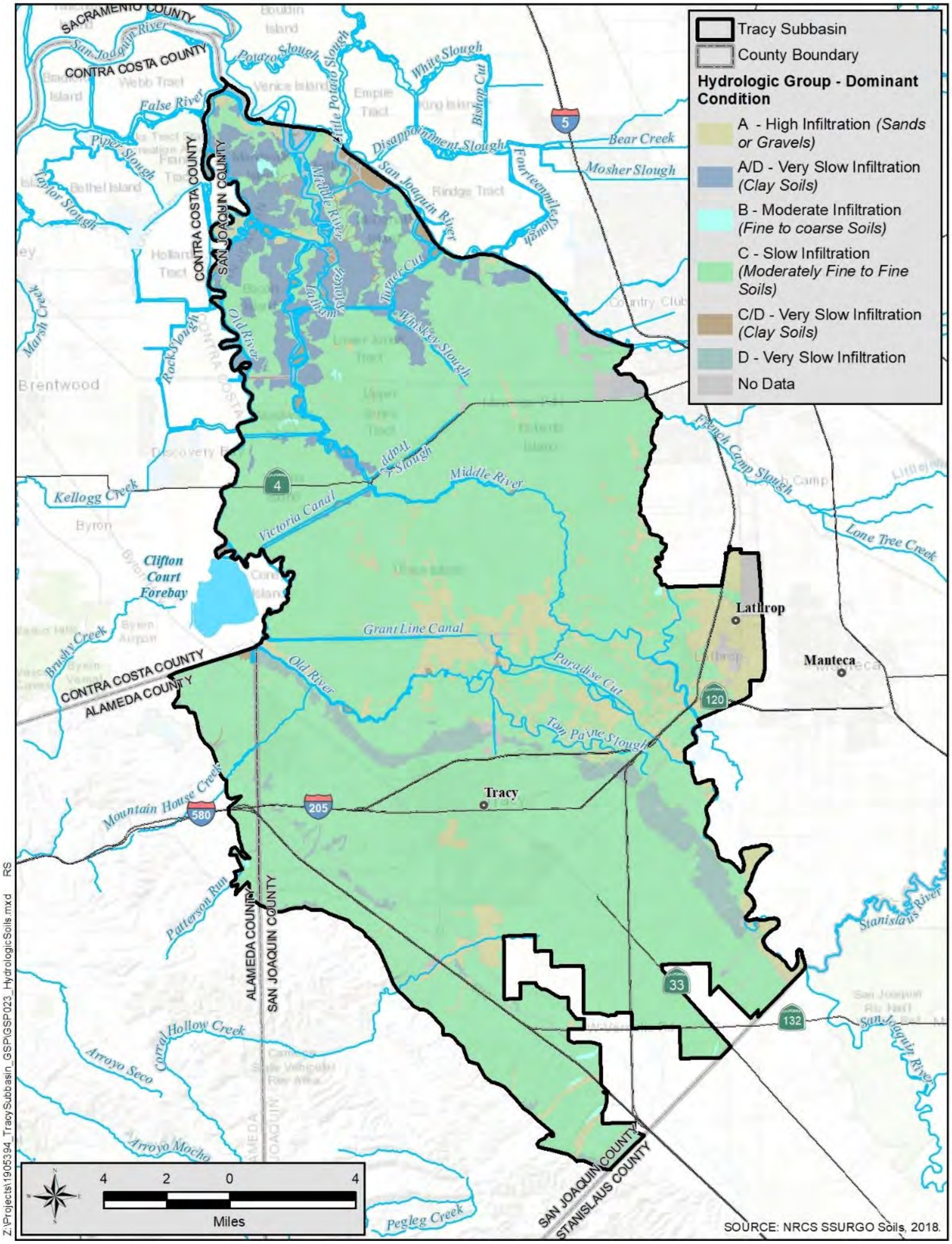

Figure 4-4 SSURGO Hydrologic Soils Classification

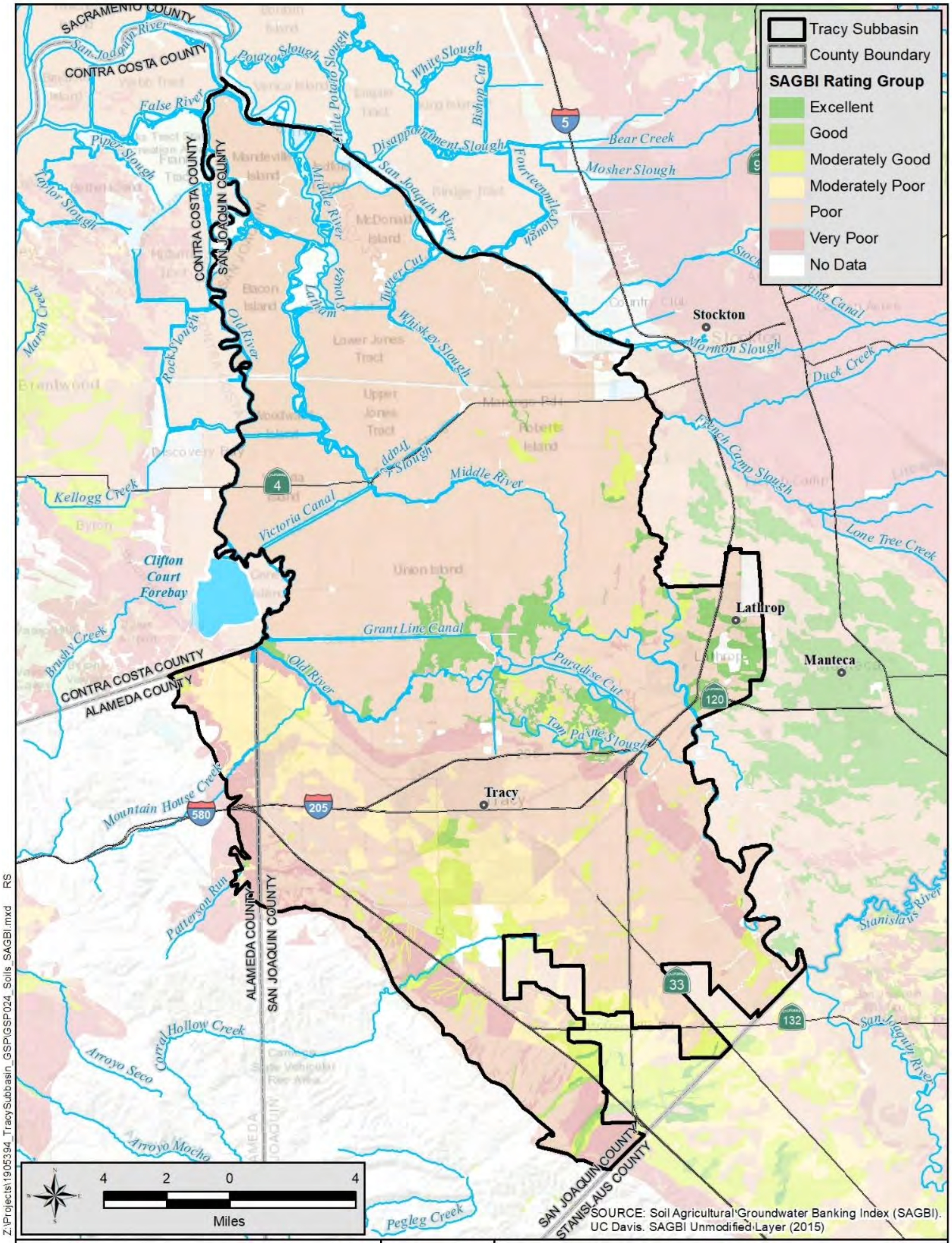

Figure 4-5 SAGBI Soils

4.5 Regional Geology

The San Joaquin Valley is a large structural depression bounded on the east by the Sierra Nevada, whose rocks extend beneath the valley. The Sierra Nevada consists of metamorphic rocks intruded by igneous rocks. The San Joaquin Valley is bounded on the west by the Coast Ranges which contain old sedimentary formations, metamorphic and igneous rocks.

The younger river and creek lain deposits comprise the major portion of the San Joaquin Valley's fresh-water aquifer system. The sediments in the valley depict a regional change in the environments, from one dominated initially by marine sedimentary processes to continental sedimentary processes. The San Joaquin Valley, including the Tracy Subbasin, are filled with marine sedimentary rocks that still contain ancient seawater and traps of natural gases. Some of these marine sediments are exposed in the Coast Ranges. As the valley began filling with continentally derived sediments there were periods of intense erosion that resulted in sand and gravel deposits. Large freshwater lakes also formed in the valley which accumulated fine-grained sediments (silts and clays). Some lakes extended throughout the central and western portions of the valley while others were smaller and more localized. One of the more regional lake beds extends into the Subbasin. These lakebed deposits have since been covered by hundreds of feet of sediments, some of which eroded and removed the lakebed deposits.

4.6 Freshwater-Bearing Formations

Freshwater-bearing sediments in the Subbasin, from youngest to oldest, include Alluvium, Flood Basin and Intertidal deposits, Alluvial Fan Deposits, Older Alluvium, Modesto Formation, Los Banos Alluvium, Tulare Formation, and Fanglomerates. These formations, except for the Tulare Formation, are shown on **Figure 4-6**. The Tulare Formation is not exposed at ground surface but is buried by the other sediments. The cumulative thickness of these deposits increases from a few hundred feet near the Coast Range foothills on the south to about 2,000 feet just north of Tracy. Information regarding the water-bearing units and groundwater conditions were taken from several sources (Hotchkiss and Balding 1971, Bertoldi et al. 1991, Davis G.H. et al. 1959) and sorted to agree with more recent geologic map compilation (Wagner et al. 1991).

4.6.1 *Alluvium*

The Alluvium (Q), due to its limited extent, is not shown on **Figure 4-6**. It includes sediments deposited in the channels of active streams as well as overbank deposits and terraces of those streams. They are present along Corral Hollow Creek and consist of unconsolidated silt, sand, and gravel. Sand and gravel zones in the younger alluvium are highly permeable and yield significant quantities of water to wells. The thickness of the younger alluvium in the Tracy Subbasin is less than 100 feet (DWR 2006).

4.6.2 *Flood Basin and Intertidal Deposits*

The Flood Basin Deposits (Dos Palos Alluvium [Qdp]) and Intertidal Deposits (Qi) are located in the Delta portions of the Subbasin. They consist of peaty mud, clay, silt, sand and organic materials. Stream-channel deposits of coarse sand and gravel are also included in this unit. The flood basin deposits have low permeability and generally yield low quantities of water to wells due to their fine-grained nature. Flood basin deposits generally contain poor quality groundwater with occasional zones of fresh water. The maximum thickness of the unit is about 1,400 feet (DWR 2006).

4.6.3 *Alluvial Fan Deposits*

Along the southern margin of the Subbasin, in the Non-Delta uplands areas of the Subbasin are fan deposits (Qf) from the Coast Ranges. These deposits consist of loosely to moderately compacted sand, silt, and gravel deposited in alluvial fans during the Pliocene and Pleistocene ages. The fan deposits likely interfinger with the Flood Basin Deposits. The thickness of these fans is about 150 feet (DWR 2006).

4.6.4 *Modesto Formation*

The Modesto Formation (Qm) is located along the east side of the San Joaquin River and is slightly older that the Alluvial Fan Deposits. The formation consists of granitic sands over stratified silts and sands. Near the southern margin of the Subbasin, there are small occurrences of Los Banos Alluvium (Qlb) and Older Alluvium (Qo) that are of similar age as the Modesto Formation.

4.6.5 *Tulare Formation*

The Tulare Formation is Pleistocene in age and consists of semi consolidated, poorly sorted, discontinuous deposits of clay, silt, sand and gravel. The Tulare Formation is not exposed at ground surface in the Subbasin. The Tulare Formation sand and gravel deposits are moderately permeable, and most of the larger agricultural, municipal, and industrial operations extract from this formation. Wells completed in this zone can produce up to 3,000 gallons per minute (gpm). The thickness of the Tulare Formation is about 1,400 feet. Specific yield values for water-bearing deposits in the San Joaquin Valley and Delta area range from about 7 to 10 percent.

The lower portion of the Tulare Formation is typically coarser than the upper portion of the formation. The sediments consist of sand and gravel beds that are interbedded with clays and silt.

Within the Tulare Formation is the Corcoran Clay, one of the largest lakebed deposits in the San Joaquin Valley. The clay is about 60 to 100 feet thick in the Subbasin**. Figure 4-7** shows the extent and structure of the Corcoran Clay based on geologic profiles and geophysical logs as well as USGS datasets in the Subbasin. The clay is present beneath most of the non-Delta areas and extends into the southern portions of the Delta areas. Near the southern edge of the Subbasin the Corcoran Clay appears to be absent due to the presence of older fanglomerates (Mf). The fanglomerate gravels are a potential conduit to convey water below the Corcoran Clay. The extent of the Corcoran Clay is not fully characterized to the west and north (Page 1986) due to the lack of deep wells. However, geologic sections have shown the clay likely continues to the west, into the East Contra Costa Subbasin (GEI 2007).

4.6.6 *Fanglomerate*

Older fan deposits (Mf) are also present in the non-Delta portions of the Subbasin, along portions of the southern fringe of the Subbasin adjacent to the Coast Ranges. The Mf are Miocene age and predate the

Tulare Formation indicating the Corcoran Clay may not extend to the edge of the Subbasin and could be a conduit to recharge aquifers below the clay.

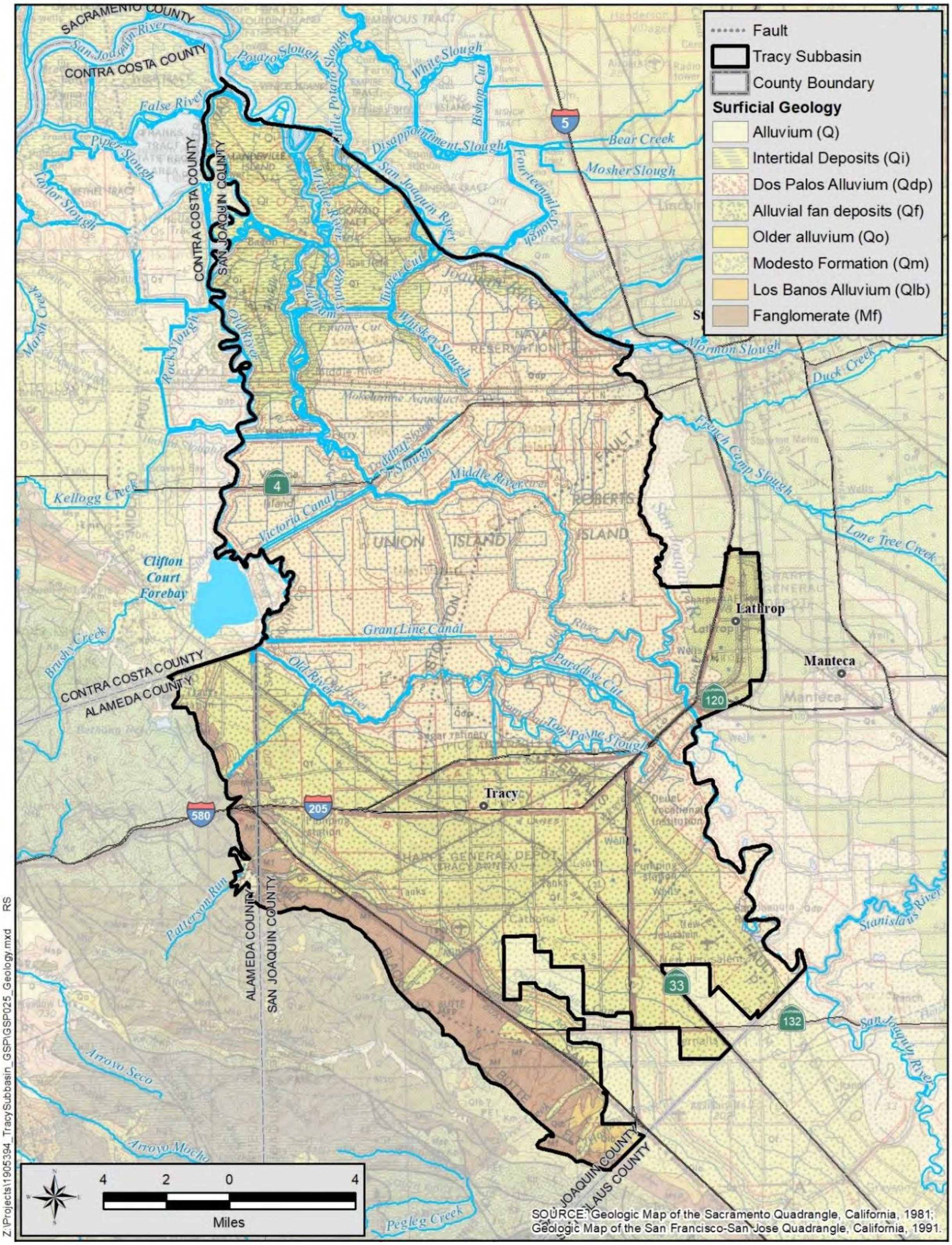

Figure 4-6 Surface Geology

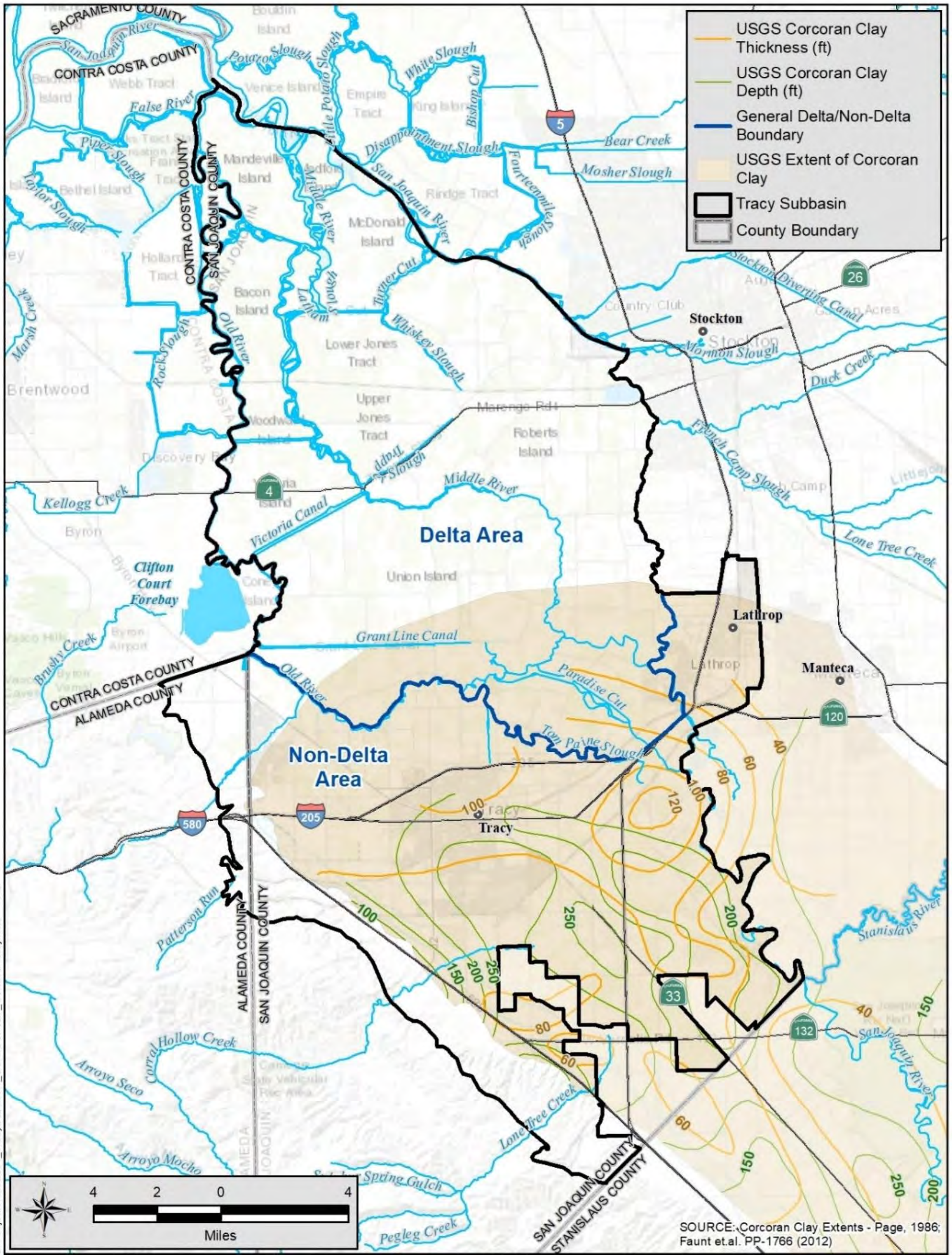

Figure 4-7 Corcoran Clay Extent

4.7 Non-Water or Non-Freshwater Bearing Formations

All of the freshwater bearing formations and sediments mentioned above are underlain by various marine formations and/or igneous and metamorphic rocks, potentially similar to those exposed in the Coast Ranges. The uppermost beds of the San Joaquin Formation underlie the freshwater bearing sediments (Hotchkiss and Balding 1971). It is predominantly marine in origin and contains ancient sea water. Multiple other older marine formations underlie the San Joaquin Formation and contain natural gases. **Figure 4-8** show the locations of natural gas wells within the Subbasin.

The old, consolidated sediment, metamorphic and igneous rocks, exposed in the Coast Ranges are typically considered to be non-water bearing, as the water is only contained in joint and fractures and is of limited quantity.

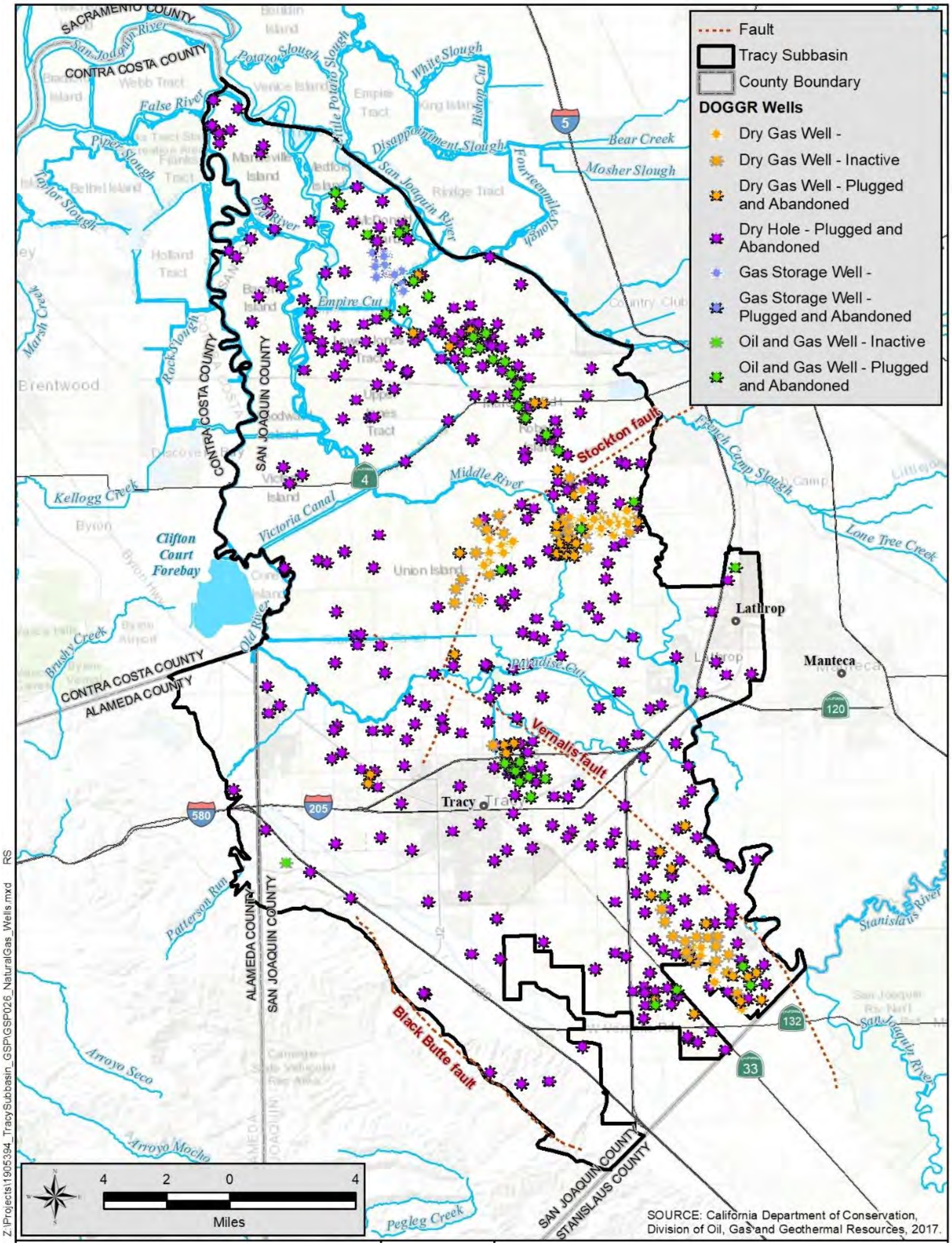

Figure 4-8. Natural Gas Wells

4.8 Geologic Structure

The Tracy Subbasin has a few geologic structures that may restrict flow in the aquifers or possibly affect water quality.

Impermeable/semi-permeable clay layers are present throughout the Tracy Subbasin, but the only regionally significant layer is the Corcoran Clay, which is present throughout the southern portion of the Subbasin. The clay deposits have a low permeability, hydraulically separating aquifers above and below the clay. The extent of the clay is uncertain in the northern portions of the Subbasin. Near the foothills the clay layers interfingers with coarse grained Mf from the Coast Ranges. The clay extends into portions of the Eastern San Joaquin and Delta Mendota subbasins. The aquifers beneath the clay are confined and generally under pressure.

Faults may affect groundwater flow by bringing geologic materials with different hydraulic properties into contact across the fault plane or by fracturing the sediments, which could either increase or decrease permeability, depending on the degree of fracturing. Faults might, therefore, act as a boundary or barrier affecting the lateral flow of groundwater between adjacent areas and could act as a conduit allowing vertical upward flow within the fault zone. Although there are faults in the Subbasin, none are known to act as barriers to groundwater flow in the freshwater bearing formations. Springs are not present uphill or near the exposures of the Black Butte Fault supporting the non-barrier classification.

The Stockton and Vernalis faults may indirectly affect groundwater quality. Neither fault has a surface trace and their positions have only been determined from natural gas well logs, where the faults have created offset of the marine sediments (Bartow 1985). These faults may act as a conduit allowing vertical upward flow of water from the underlying marine sediments into the freshwater bearing aquifers.

4.9 Regional Geologic Sections

Geologic sections (cross-sections or sections) have been developed for the Subbasin as shown on **Figure 4-9**, all crossing the entire length of the Subbasin to show the relationship of the geologic units. The longest and most detailed sections were prepared for the Tracy Subbasin Groundwater Management Plan (GEI 2007) and were used for this GSP with modifications to reflect additional information obtained since 2007. Lithologic information from well logs available in the area was normalized and digitized to generally conform with the Unified Soil Classification System. Lithology and well screens from dedicated groundwater monitoring wells constructed since the sections were created were also added to the geologic sections. The profiles are presented to illustrate the subsurface relationships and distribution of the formations and coarse-grained sediments that constitute the principal aquifers. **Figures 4-10** through **4-14** illustrate the subsurface and show sediment types, the base of freshwater, and the general contact between the Tulare Formation sediments and younger formations. The profiles also show the presence and extent of the Corcoran Clay. The sections were created from water well drillers reports, which are attached in **Appendix D**.

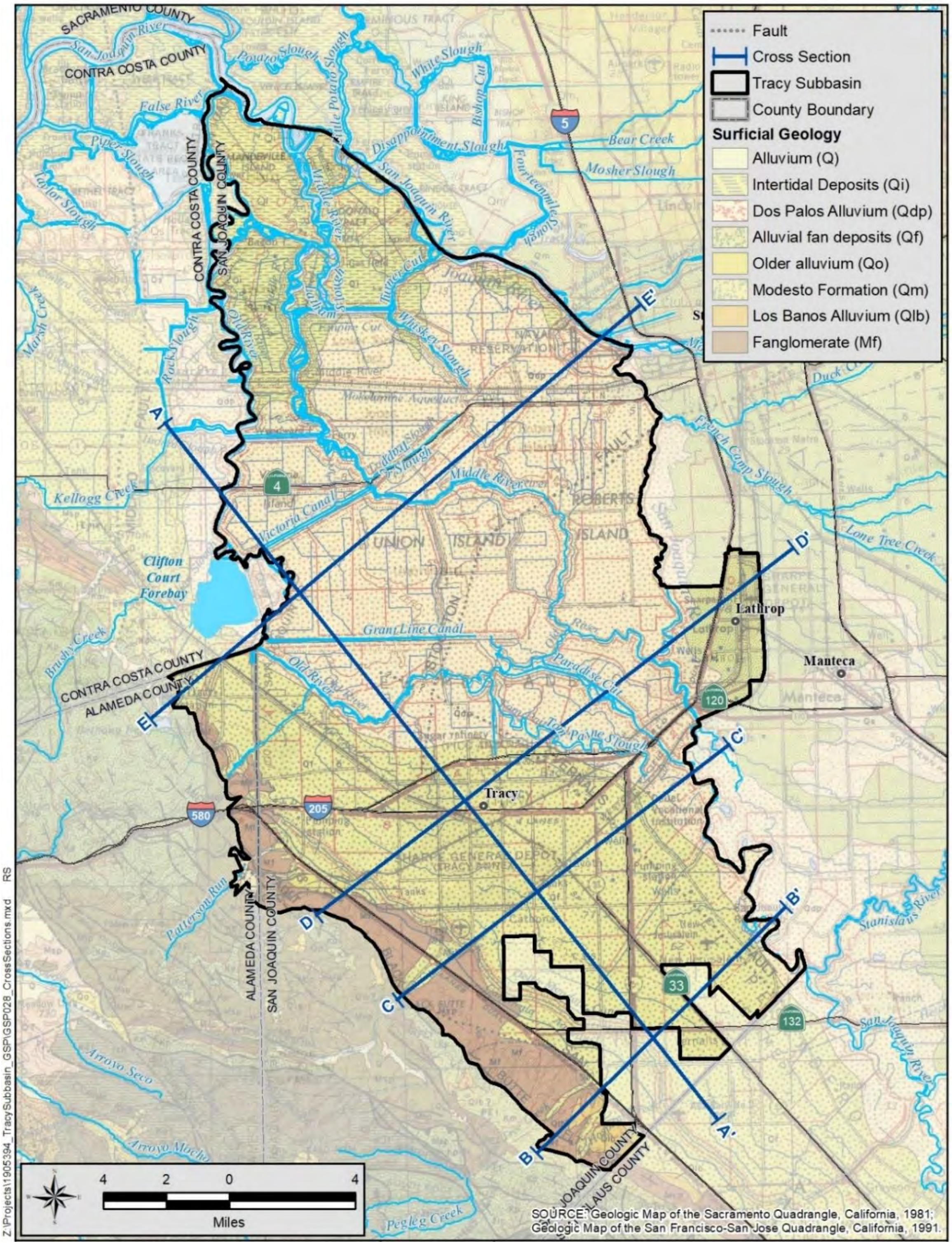

Figure 4-9. Geologic Section Locations

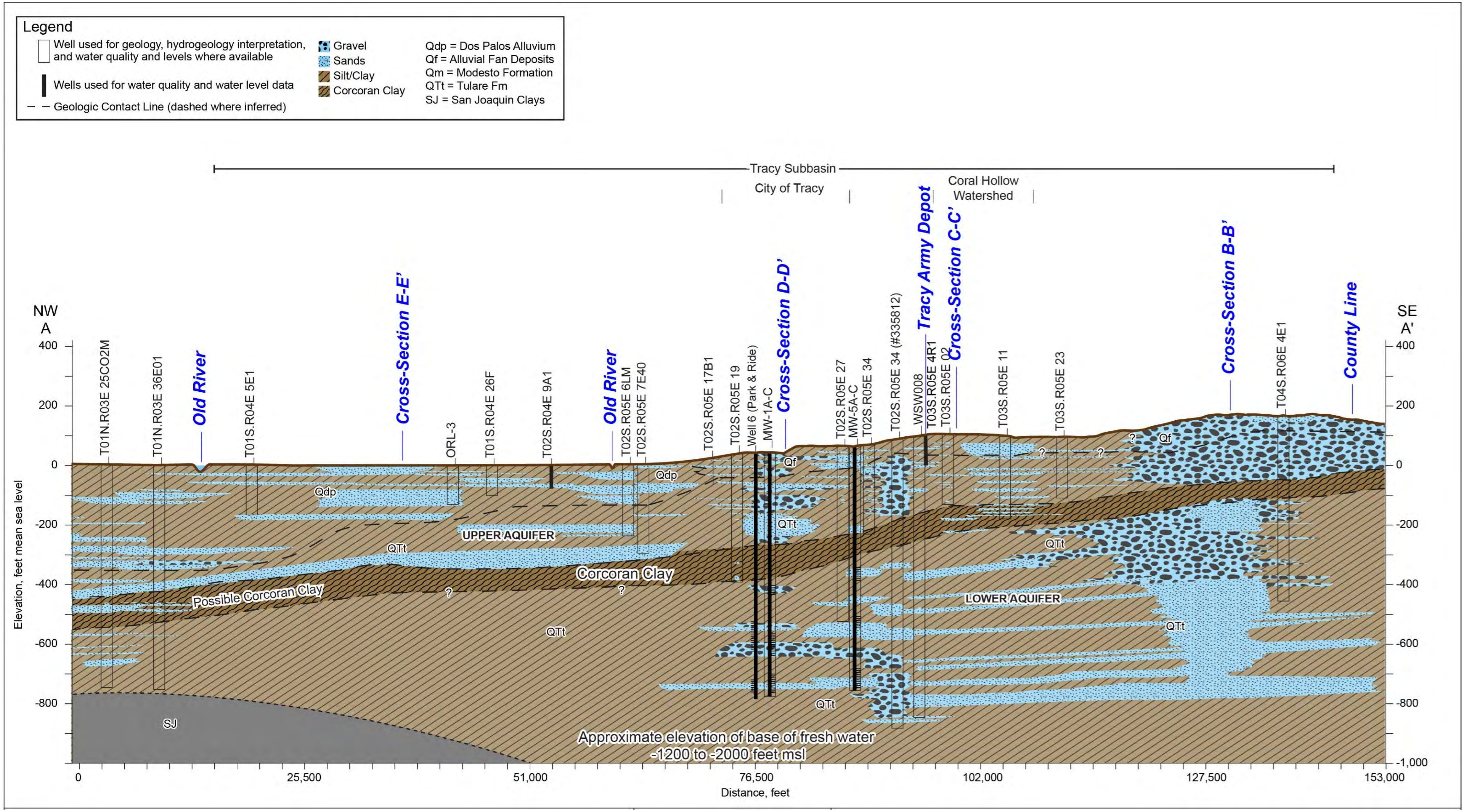

Figure 4-10. Geologic Section A-A'

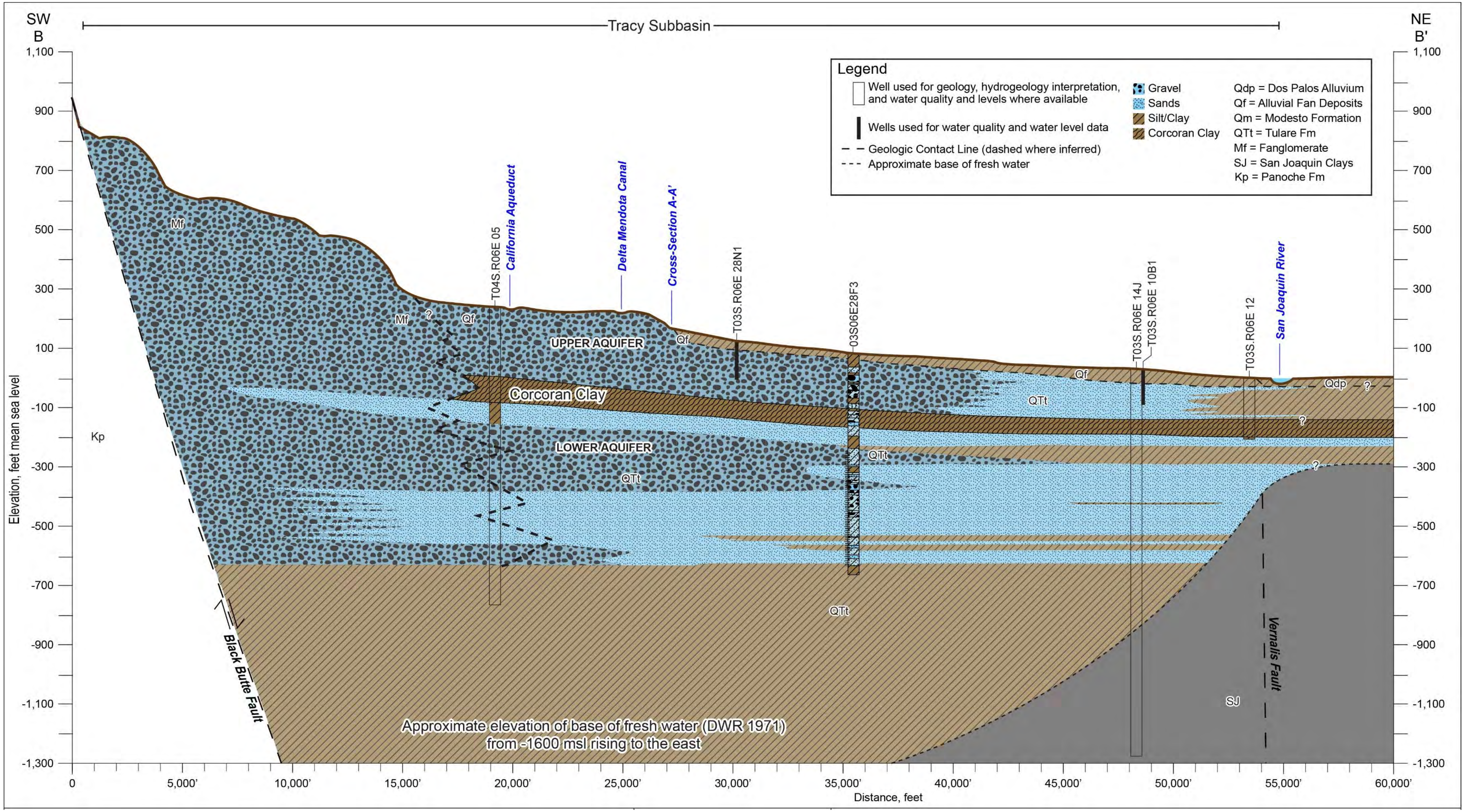

Figure 4-11. Geologic Section B-B'

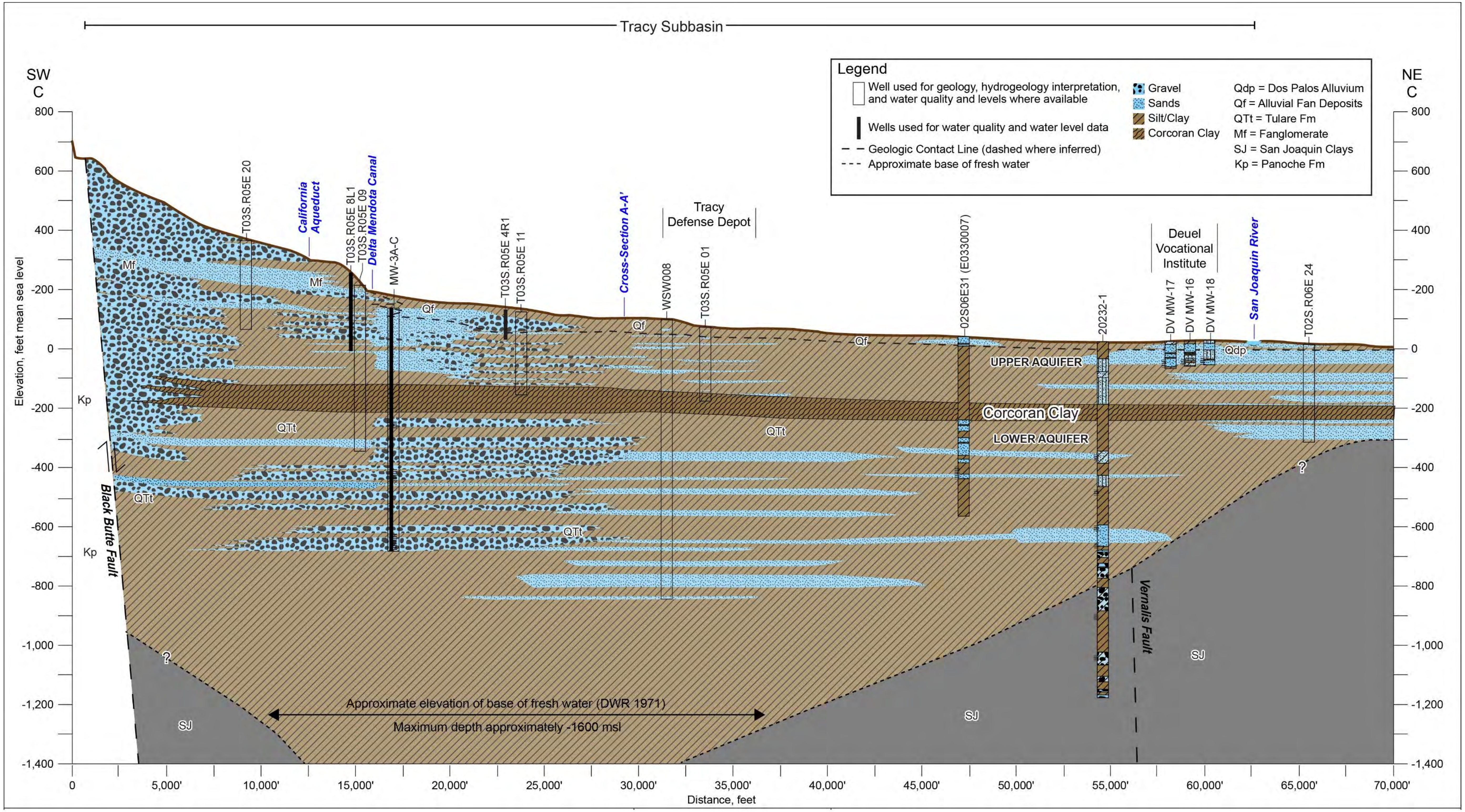

Figure 4-12. Geologic Section C-C'

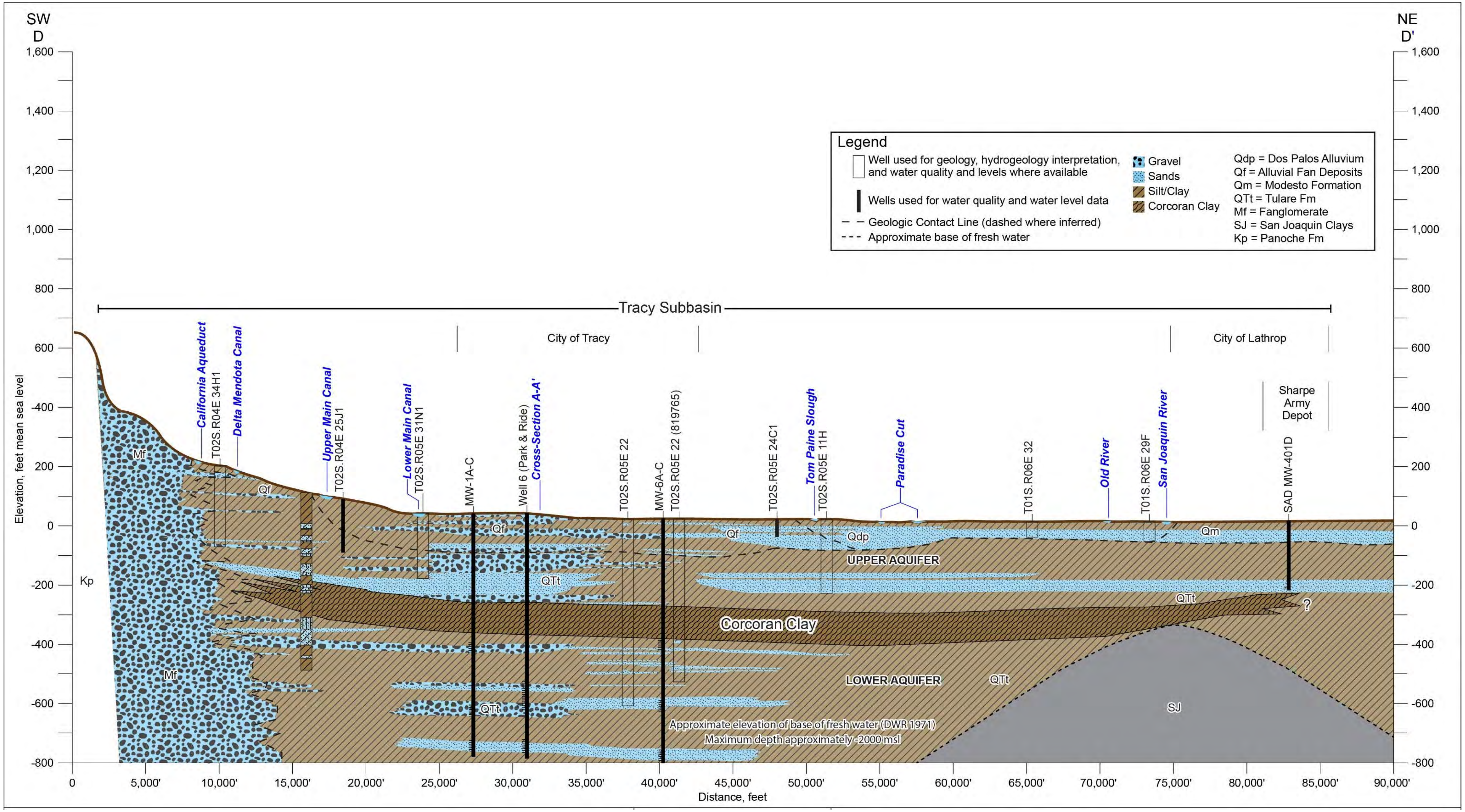

Figure 4-13. Geologic Section D-D'

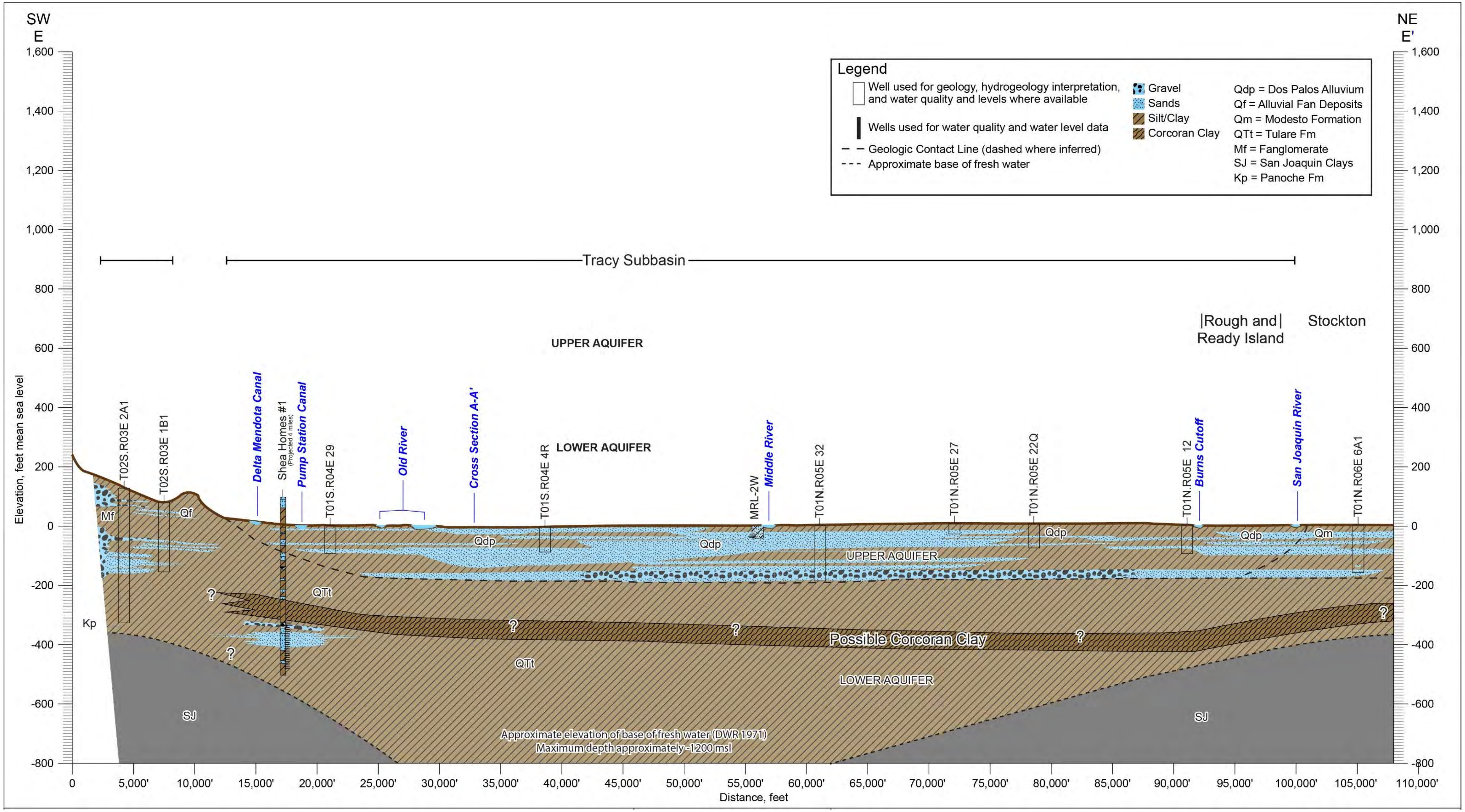

Figure 4-14. Geologic Section E-E'

Figure 4-10 shows Geologic Section A-A', a regional northwest-southeast profile through the non-Delta and Delta portions of the Subbasin. Section A-A' shows that the area generally has clays and silts (shown in brown color), low permeability sediments near surface but permeable sediments (sands and gravels shown in light blue) throughout the depth profile. Continuous layers of sand and gravels, other than one at the top of the Corcoran Clay are not identified likely due the sinusoidal nature of the river channels, and flood deposits associated with these types of sediments. The Corcoran Clay or its equivalent appears to extend to the west and into the East Contra Costa Subbasin, based on three new well logs. In the southern non-Delta portion of the Subbasin, fine-grained sediments are more prevalent and, supported by groundwater levels and water quality information, suggest that the shallow aquifer is unconfined and separate from the deeper confined aquifer.

Geologic sections B-B' through E-E' (**Figures 4-11 through 4-14**) are all sections with a northeast-south west orientation across the entire subbasin, including Delta and non-Delta areas. They show the types of sediments, relationship between the Coastal Range mountains and the valley sediments as affected by the Black Butte Fault, the base of freshwater, as well as portraying the extent of the Corcoran Clay. The sections show:

The Corcoran Clay extends from near the western edge of the Subbasin across the Subbasin, Geologic Sections B-B' through D-D', in agreement with historic projections but there are no well logs to confirm the clay's present on Geologic Section D-D'. Section E-E' shows the location of the Corcoran Clay or its equivalent near the southern margin of the Subbasin. Within the northern portions of the Subbasin, where the clay location is uncertain, no wells were present that penetrated deep enough to confirm its presence or absence.

Sand and gravel are exposed at ground surface in the southern edge of the Subbasin adjacent to the foothills and represent the older fanglomerates (Mf). There are only a few wells in this area to confirm whether the Mf are continuous and can convey recharge water to beneath the Corcoran Clay.

Sand layers beneath the Corcoran Clay, Geologic Sections B-B' and C-C', show sand layers are in contact with the underlying San Joaquin Formation (SJ) marine sediments that could allow saline marine water to migrate into the freshwater aquifers. They also show the Vernalis Fault is located in the area, potentially providing a vertical conduit for saline water to move vertically into the freshwater bearing aquifers.

The bottom of the Flood Basin Deposits was selected based on a relatively continuous sand and gravel bed, although it may be as much as 1,400-feet deep according to some authors.

The base of fresh water varies throughout the Subbasin and is shown on the sections. It is as shallow as -400 feet msl to as much as -2,000 feet msl.

4.10 Principal Aquifers

All sediments, to some extent, contain groundwater in the pores between the particles. Near ground surface sediment pores are filled with mostly air but have some moisture. This moisture will gradually migrate down to the groundwater-surface interface where the pores will be entirely filled with water. At times there are low permeability sediment layers with a limited horizontal extent, where the moisture accumulates and fully fills the sediment pores, but the underlying sediments and pores are not filled with water. These occurrences are called perched water and do not constitute a principal aquifer. At the edges of these low permeability sediments, the water may then resume its vertical path to the groundwater surface. Aquifers are those coarse-grained sediment layers whose pores are completely filled with water and can be managed.

Sand and gravel beds are generally grouped together to form aquifers that may display similar characteristics. The aquifers are separated by single or multiple clay layers (or aquitards) that can slow or prevent vertical movement of groundwater between aquifers. The Corcoran Clay acts as a regional low permeability layer that limits vertical movement of groundwater.

The Tracy Subbasin has two principal aquifers; an Upper unconfined to semi-confined aquifer and a Lower confined aquifer that are separated by the Corcoran Clay. Where the clay is absent, which is the condition within most of the Delta area, only the Upper aquifer is present. However, the assessment is limited due to the lack of deep wells to fully define the aquifers in the Delta areas.

The Upper and Lower aquifers merge where the Corcoran Clay is absent, near the southwestern portion of the subbasin adjacent to the foothills, in the area where the Mf are present. In this area the aquifers would be unconfined and are considered to be part of the Upper aquifer. The Upper and Lower aquifers also merge north of the Old River in the northern portion of the Subbasin.

Upper Aquifer

The Upper aquifer is an unconfined to semi-confined aquifer above the Corcoran Clay or where the clay is absent. It is present in the Alluvial Fan Deposits, Intertidal Deposits, Modesto Formation, Flood Basin Deposits and the upper portions of the Tulare Formation and the Fanglomerate.

Although there are multiple coarse-grained sediment layers that make up the unconfined aquifer, the water levels are generally similar. Generally, with depth the aquifer confinement may increase to semi-confined conditions. There is generally a downward gradient in the aquifers (Hotchkiss and Balding 1971) in the non-Delta areas and range from a few feet bgs to as much as 70 feet bgs. The groundwater levels in the Upper aquifer are typically higher than in the Lower aquifer, by about 10 to 30 feet. In the Delta groundwater levels are typically at sea level and artesian flowing wells are common in the center of the islands (Hydrofocus 2015).

Aquifer characteristics are few. Using undisturbed cores collected on Twitchell Island, north of the Subbasin, within 10 feet of land surface, the USGS estimated horizontal hydraulic conductivity values for organic sediments ranging from 0.0098 ft/d to 133.86 ft/d (Hydrofocus 2015). The hydraulic characteristics of the unconfined aquifer are highly variable. Wells in the unconfined aquifer produce 6 to 5,300 gpm; however, pumping test data are limited. The transmissivity of the unconfined aquifers, including the recent alluvium and upper portions of the Tulare Formation, ranges between 600 to greater than 2,300 gallons per day per foot (gpd/ft). The storativity is about 0.05. Where thicker sequences of sand are present, the transmissivity may be higher.

Water quality in the Upper aquifer is mostly transitional types of water with no single predominate anion. Most water are characterized as sulfate bicarbonate and chloride bicarbonate type (Hotchkiss and Balding 1971). The TDS of these transitional water ranges between 400 to 4,200 mg/L. Nitrate is typically high in the Upper aquifer in the non-Delta portions of the Subbasin while in the Delta portions it is low.

The Upper aquifer is typically used by domestic, small community and community water systems and for agriculture. The Upper aquifer also supports native vegetation where groundwater levels are less than 30 feet bgs.

Lower Aquifer

The Lower aquifer is primarily comprised of the lower portions of the Tulare Formation and is below the Corcoran Clay and extends to the base of fresh water. The clay is present in the southern third of the basin and its extent to the west and north is uncertain and has been estimated to have a vertical permeability ranging from 0.01 to 0.007 feet per day (Burow et al. 2004).

The groundwater levels are generally deeper than water levels in the Upper aquifer (Hotchkiss and Balding 1971). The City of Tracy is the principal water agency that actively monitors water levels in the confined aquifer. Groundwater levels in the confined aquifer are about -25 to -75 feet msl. The groundwater levels are always above the top of the Corcoran Clay by about 60 to 200 feet.

Aquifer characteristic in for the Lower aquifer are few. Wells in the Lower aquifer produce about 700 to 2,500 gpm. The transmissivity ranges from about 12,000 to 37,000 gpd/ft and could go as high as 120,000 gpd/ft. The storage coefficient or storativity, obtained through aquifer tests, was measured as 0.0001 (Padre 2004).

Water quality in the Lower aquifer in the western portions are chloride type water but mostly transitional type of sulfate chloride near the valley margins and sulfate bicarbonate and bicarbonate sulfate near the San Joaquin River (Hotchkiss and Balding 1971). In general, the TDS ranges between 400 and 1,600 mg/L. Nitrate is typically low in the Lower aquifer. Wells completed below the Corcoran Clay sometimes have elevated levels sulfate and total dissolved solids above the drinking water MCLs. Only at one deep location, east of Tracy, are chloride levels elevated.

The Lower aquifer is typically used by community water systems (City of Tracy) and possibly by some agriculture.

4.11 Naturally Occurring Elements

The concentration of the naturally occurring elements varies widely over the Subbasin and also with depth at any given location. Groundwater quality in the Subbasin has locally exceeded the MCLs for drinking water for specific elements, some exceedances are scattered, and some are clustered. Poor groundwater quality has been noted in the following general areas:

- Salinity, as represented by TDS, is high in both the Upper and Lower aquifers with a few areas with good quality water.

- Elevated concentrations of sulfate are present near the foothills in both the Upper and Lower aquifers potentially as a result of recharge water originating from the Coast Ranges.
- Elevated concentrations of arsenic are only in the Upper aquifer and within the Delta area and not in the Lower aquifer.
- Boron is present in the Upper aquifer. Most elevated concentrations are present in the non-Delta areas and in the northern portions of the Delta area.

4.12 Groundwater Recharge and Discharge Areas

Groundwater recharge occurs throughout the Subbasin with varying amounts based on the SAGBI hydrologic classification for soils, as shown on **Figure 4-5**. The soil's ability to allow water to migrate to the aquifers is significantly reduced if the soils have been covered by impermeable surfaces such as roads and houses, in suburban areas such as the cities of Tracy, Lathrop, and the community of Mountain House. In some cases, although the soils may be classified as being more permeable, recharge may be limited due to underlying low permeability sediments (clays), especially along the delta rivers and creeks.

Recharge areas in the Subbasin have been defined based on the soils' hydrologic classifications along with a variety of techniques, including water quality, groundwater levels correlated to the river or creek stages, well logs and geologic sections showing coarse-grained sediments near ground surface, crop types, and groundwater modeling. Overall, no geologic sediments within the Subbasin are impermeable, so some recharge occurs in all areas that are not covered by impermeable surfaces.

4.12.1 *Delta Area Recharge*

Soil investigations throughout the San Joaquin valley have been performed, providing detailed soil profiles that allow for assessment of where coarse-grained sediments are present and the relative permeability of the soil to allow for percolation of water into the Upper aquifer. **Figure 4-15** shows the combination of these studies, referenced sources and recharge areas, including reaches of the rivers and some creeks. **Figure 4-15** shows a concentration of these soil-based recharge areas adjacent to rivers near the transition zone between the Delta and non-Delta areas.

4.12.2 *Non-Delta Recharge Areas*

Soils investigations (SAGBI) were used in the non-Delta areas to identify recharge areas, areas with coarse grained soils or those finer grained soils that may have had the permeability modified through agricultural processes as shown on **Figure 4-15**. No soils are impermeable, so some recharge can occur, even where soils are classified as poor for recharge. These areas can recharge the Upper aquifer with water from precipitation, stormwater runoff and excess agriculturally applied water along with where canals cross those coarser grained soil areas.

Beneath the non-Delta areas of the Subbasin is the Corcoran Clay which separates the unconfined Upper aquifer from the confined Lower aquifer. This means that sands and gravels that make up the Lower aquifer are not in direct connection with the land surface or potential sources of recharge from the coarse-grained topsoils that may lie on the ground surface above them, except for area where the Mf are exposed along the foothills, where the clay is absent. Water recharge sources in these areas is limited to precipitation and perennial streams.

Groundwater recharge to the Lower confined aquifer occurs in the foothills adjacent to the Coast Ranges through the fanglomerate, a geologic formation of coarse-grained materials that acts to bypass the confining nature of the Corcoran Clay and infiltrate water into the Lower aquifer. Although there are some areas where the soil permeability is suitable for recharge, the extent of the Corcoran Clay acts as a barrier to recharge from these sources, and therefore only recharges the Upper aquifer. Recharge also occurs in some areas through wells that are screened in both the unconfined and confined aquifers. **Figure 4-16** shows the potential recharge area to the Lower aquifer. Groundwater recharge areas within the Delta can also contribute water to the Lower aquifer where the Corcoran Clay is not present, but the natural gradient would have to be reversed by pumping.

Aquifers in the Subbasin extend beyond the Subbasin boundary and into adjacent subbasins and, dependent upon the groundwater gradients, groundwater may flow into or leave the Subbasin. Therefore, recharge could occur outside of the subbasin and is based on groundwater contours and groundwater flow direction, which will be completely described in **Chapter 5 – Groundwater Conditions**. Groundwater contours developed for the Subbasin, show:

- Subsurface inflow in the Upper aquifer from the Contra Costa Subbasin within the Delta area is due to a pumping depression in the Eastern San Joaquin Subbasin, therefore a recharge area in the Contra Costa Subbasin is present that is contributing water to the Subbasin. Other than this area, the rest of the recharge areas to the Upper aquifer are within the Subbasin where the soils have moderately good to excellent hydrologic properties, as shown on **Figure 4-5**.
- Groundwater in the Lower Aquifer is leaving the Tracy subbasin into the Delta Mendota Subbasin (Woodard & Curran 2019) therefore, no recharge areas to the Lower Aquifer beneath the Tracy Subbasin occur in that subbasin.
- The groundwater flow direction in the Lower aquifer, south of Lathrop, show some groundwater is entering the is Subbasin from recharge areas outside and southeast of the Subbasin, possibly from the Eastern San Joaquin Subbasin but more likely from the Modesto Subbasin.

4.12.3 *Groundwater Discharge Areas*

Groundwater discharge occurs along the islands, creeks, drains, sloughs, canals, and rivers in the Subbasin. The conditions may change seasonally from recharge to discharge conditions. **Figure 4-15** shows this area, which extends over the northern subbasin as it represents topographic lows where the groundwater surface from the non-Delta highland areas drains towards these low land areas and may intersect the ground surface, except where soil permeability may allow percolation to the upper aquifer.

Groundwater discharges to ditches and drainage canals in the Delta islands where it is collected and pumped back to adjacent surface water bodies. It is common to have artesian flowing wells in the center of the islands. Artesian conditions are defined by groundwater levels in wells screened in the aquifer underlying the organic deposits that rise above the bottom of the organic deposits. Artesian conditions are a clear demonstration of the influence of adjacent channels on island groundwater levels and upward flowing groundwater (Hydrofocus 2015). Outside the artesian areas, where groundwater elevations are below sea level, there is also upward flowing groundwater. Where land-surface elevations are about 5feet above sea level or less, groundwater flows upward towards drainage ditches from tens of feet below land surface.

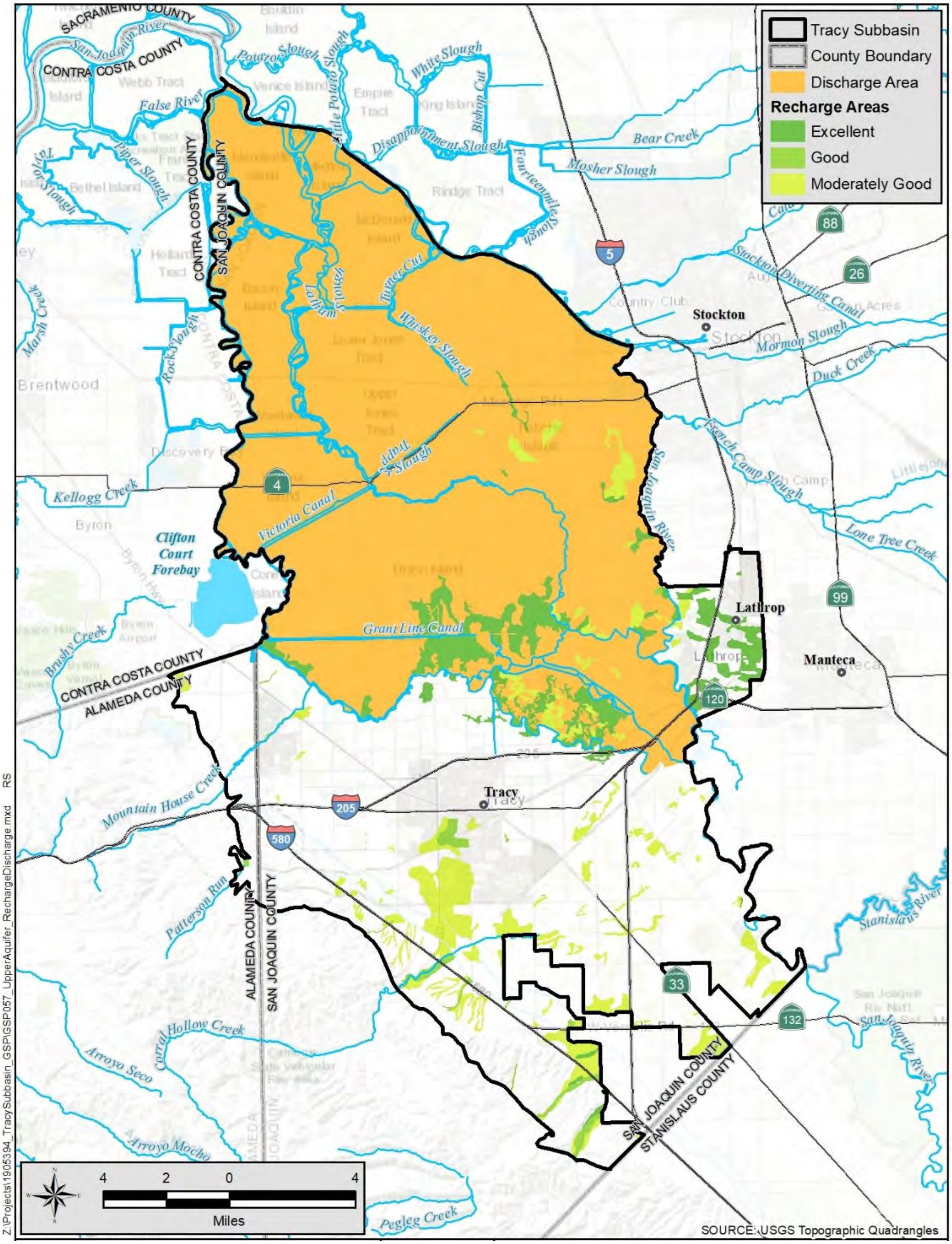

Figure 4-15. Upper Aquifer Recharge and Discharge Areas

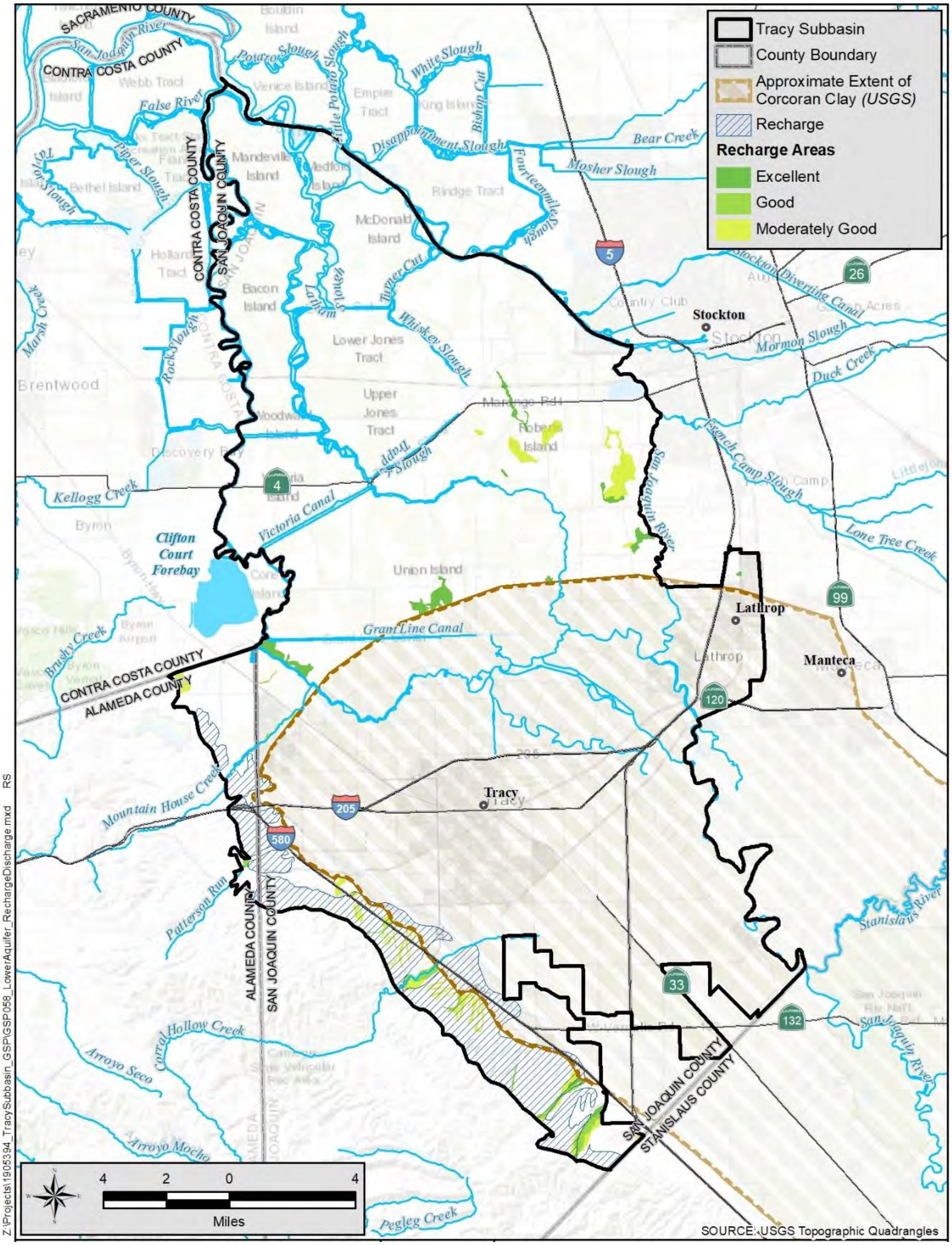

Figure 4-16. Lower Aquifer Recharge and Discharge Areas

4.13 Imported Water Supplies

For purposes of this GSP, “imported water” is defined as water that is brought in from areas outside of the Subbasin, in contrast to “diversions” that represent water diverted from rivers or tributaries within and adjacent to the Subbasin. There are over one-hundred riparian and appropriative diversions throughout the Delta area (DWR 1995). Diversions from local waterways also occur and used to serve non-Delta regions. Water from the DMC is also considered to be a diversion and not imported water.

Water is imported into the area from the Stanislaus River, via Woodward Reservoir, to the cities of Lathrop and Tracy where it is used by their customers within their service area. The points of delivery are shown on **Figure 4-17**.

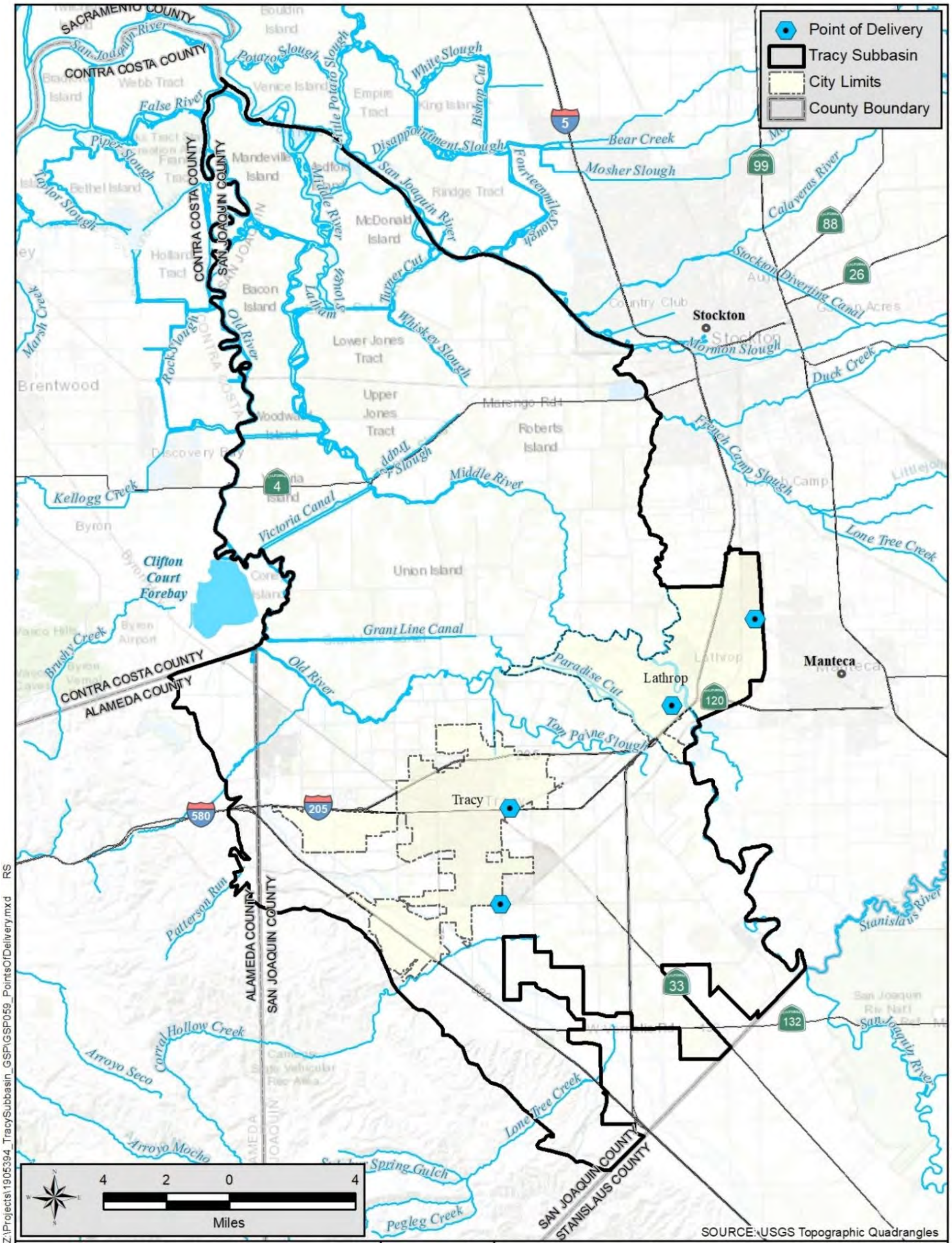

Figure 4-17. Imported Water Points of Delivery

4.14 Data Gaps

The hydrogeologic conditions in the Subbasin have been investigated and documented since the early 20th century and continues through the present. Improvement plans have been made for construction of new monitoring wells in strategic areas in the subbasin to improve the quality and extent of groundwater level data collection. At this time there are no data gaps that would affect the ability to sustainably manage the Subbasin. Data collection that would improve the hydrogeologic understanding of the Subbasin are:

- Improving the characterization of water quality in each principal aquifer. There are over 120 public water supply (PWS) wells with water quality data with water quality data that could not be assigned to a principal aquifer. Further evaluation of the public supply wells is warranted to make better use of this data and to provide a more complete picture of the water quality in each aquifer.
- Further research of boring logs for the Delta Tunnel project is warranted. The extent of the Corcoran Clay beneath the Delta is unconfirmed due to the lack of deep wells.
- Construction of monitoring wells screened within the Upper and Lower aquifers near the west side of the Subbasin, to confirm the presence of the Corcoran Clay and to provide additional groundwater level control in this area.

5. Groundwater Conditions

This chapter provides a description of historic and current groundwater conditions in the Tracy Subbasin. From a water resources standpoint, the Subbasin can be divided into two areas (Delta and non-Delta) based on the differences in groundwater conditions. Groundwater conditions between areas vary due to a number of reasons, the primary reason being the extent of the Corcoran Clay and the extent of surface water and groundwater interconnection.

In the Delta areas, groundwater is continuously fed by the surrounding water ways and has to be pumped out of the islands to allow the land to be used for agriculture purposes. Groundwater use is minimal, as evidenced by the low density of wells which are mostly for domestic purposes as shown on **Figures 3-12 through 3-17**. As a result, groundwater levels typically fluctuate by less than 10 feet and coincident with oceanic tides. In the non-Delta areas, surface water is also available in most areas which means groundwater use is minimal, primarily for domestic purposes. Urban and industrial areas rely on a combination of groundwater and surface water.

5.1 Groundwater Levels

Groundwater levels (water table and peizometric heads) have been recorded at over 226 wells in the Subbasin and reported to DWR's CASGEM or Water Data Library systems; however, some wells were only measured a few times or measurements were discontinued many years ago, resulting in a partial record of groundwater conditions. Only wells with known total depths or that have construction details and that were assigned to a principal aquifer were used to evaluate groundwater levels for this GSP. To supplement these wells, additional monitoring wells were located that are being used for other regulatory driven programs: environmental site assessment and cleanup, irrigated lands regulatory program, and monitoring of applied treated wastewater. A few wells in adjacent subbasins were used to provide additional information near the subbasin boundaries. This GSP evaluated groundwater levels at 95 CASGEM and additional monitoring wells to illustrate groundwater conditions.

Figure 5-1 shows the location of wells in the Subbasin that have long-term records and dedicated monitoring wells with shorter-term records. The locations of the wells and their names, coded by principal aquifer, are shown on **Figure 5-1**. A table correlating the well names to CASGEM identification numbers is provided in **Appendix C** with well construction details and the principal aquifer monitored. **Appendices E and F** contain time-series groundwater level measurements (hydrographs) for wells by principal aquifer.

The extent of the principal aquifers is not consistent across the Subbasin. Both the Upper and Lower aquifers are present in the non-Delta portions of the Subbasin whereas only the Upper aquifer is present in the Delta areas. **Figure 5-2** provides a schematic of the general locations of the aquifers.

5.1.1 *Upper Aquifer*

The depths to groundwater and trends vary based on location in the Subbasin. In general, the groundwater levels in the Delta portions of the subbasin are near ground surface, indicating an abundance of surface water and groundwater that are interconnected. Conversely, groundwater levels are much deeper in the non-Delta upland portions of the Subbasin where groundwater levels are affected by pumping, discontinuous recharge disconnect from streams and channels, and deep percolation of water from agricultural fields.

In the Delta areas, groundwater levels are stable and have historically been near the surface. Groundwater levels typically range from about ground surface to 15 feet bgs (**Figure 5-3**). In the islands, groundwater levels can be above ground surface and some wells flow artesian, due to the Delta islands being surrounded by waterways and some islands being below msl. The groundwater levels typically fluctuate by about 5 feet due to tidal influence (**Figure 5-4**). In 2010, groundwater levels declined by about 5 feet, near the southern edge of the Delta, and have remained at this level ever since, possibly due to lowering of a drain.

In the non-Delta areas, groundwater levels are deeper towards the south and shallower near the San Joaquin and Old rivers (**Figure 5-2**). Currently, the groundwater levels in the Upper aquifer range from 80 feet bgs near the foothills to within 5 feet of ground surface near the San Joaquin River. Groundwater levels typically have greater seasonal fluctuations, locally up to 40 feet, due to groundwater pumping and seasonal recharge. Even with these seasonal changes the depths to groundwater have remained similar, except for those near the southeastern portion of the Subbasin where groundwater levels started to decline around 2010 (to present), due to increased and apparent continued reliance of groundwater since the drought (**Figure 5-4**). The declines are not exceeding 15 feet. Long-term groundwater level trends (1998-2020) were developed (DWR 2021) for wells with levels throughout this period (**Figure 5-5**). Four wells are confirmed to be in the Upper aquifer with two of the wells near the Old River are showing declining water levels by about 4 feet; in a predominately agricultural area with most of the area provided surface water by BBID. The other two wells, in the City of Lathrop, have stable groundwater levels.

5.1.2 *Lower Aquifer*

The depths to groundwater in the Lower confined aquifer are typically deeper than those in the Upper aquifer. Groundwater levels (piezometric heads) range from about 20 to 270 feet bgs (**Figure 5-6**) and in some locations, are below sea level. **Figure 5-7** shows the groundwater level trends in the Lower aquifer. Groundwater elevations in the Lower aquifer are about -60 to 80 feet. The groundwater levels are always above the top of the Corcoran Clay by about 200 to 240 feet.

The groundwater levels vary by up to 30 feet seasonally. Groundwater levels trended upward from 2004 through 2012, declined during the subsequent drought, and regained an upward trend in 2017 (**Figure 5-7)**. The upward trend during the 2004 to 2012 included years when the City of Tracy increased pumping from 5,800 to nearly 8,000 AFY (2001-2005) and reduced pumping at the start of imported surface water from SSJID in 2005. Groundwater levels in the Lower aquifer increased by about 30 feet near the foothills in 2017, in response to recharge from precipitation during the wet hydrologic conditions in winter of 2017. The long-term hydrographs shown on **Figure 5-7** do show some lowering of groundwater levels, by about 15 feet in the southern portion of the Subbasin, adjacent to the Delta-Mendota Subbasin.

Long-term groundwater level trends (1998-2020) were developed (DWR 2021) for wells with levels throughout this period (**Figure 5-5**). Wells with shorter periods of records, as those wells near the City of Tracy, were not used in their trend analysis. Two wells in the Lower aquifer both near the southern end of the basin in the non-Delta area, show either no trend or a downward trend. The well with the downward trend is not sealed through the Corcoran clay. A new monitoring well is planned in this area to verify if the downward trend is in the Upper or Lower aquifers.

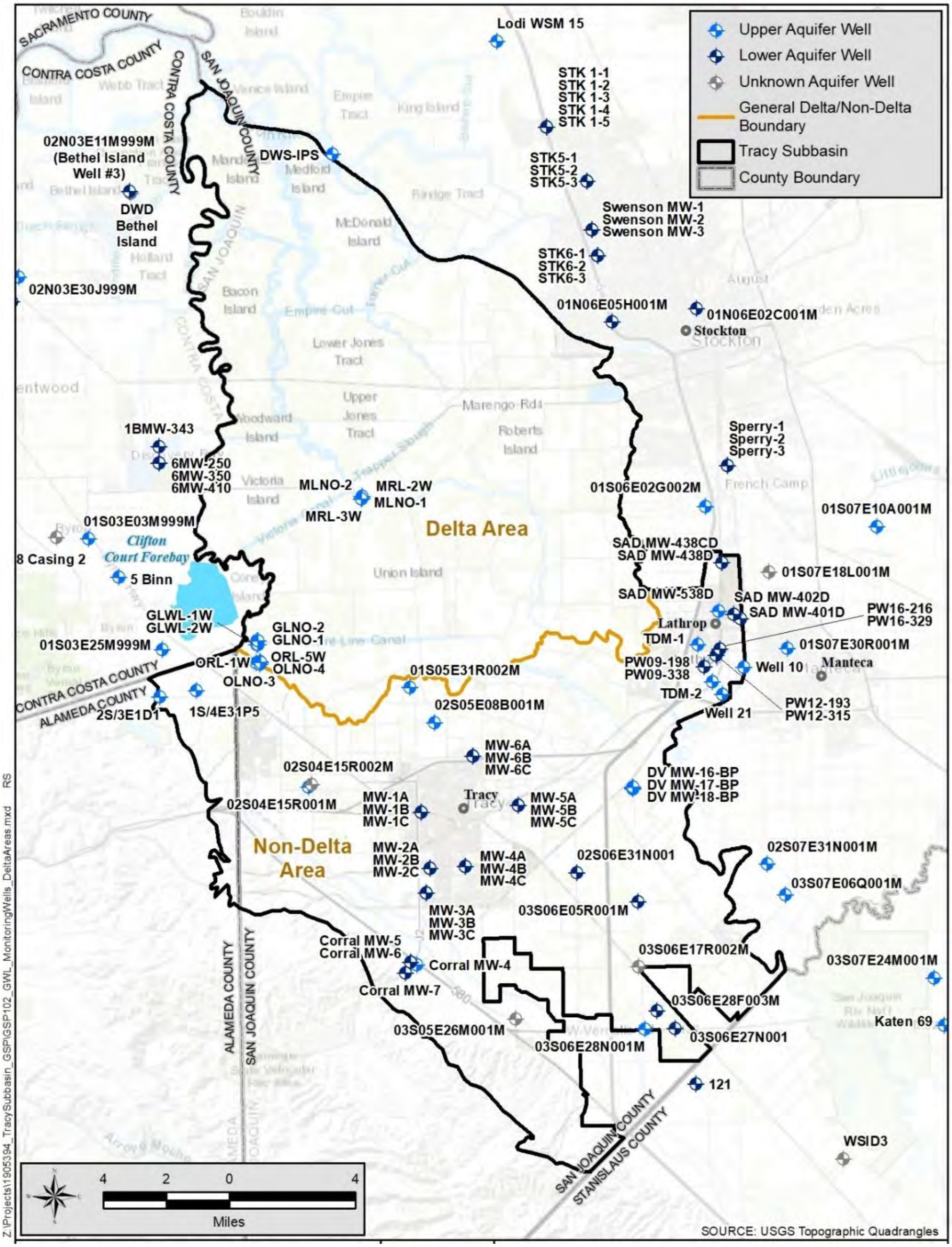

Figure 5-1. Groundwater Level Monitoring Wells

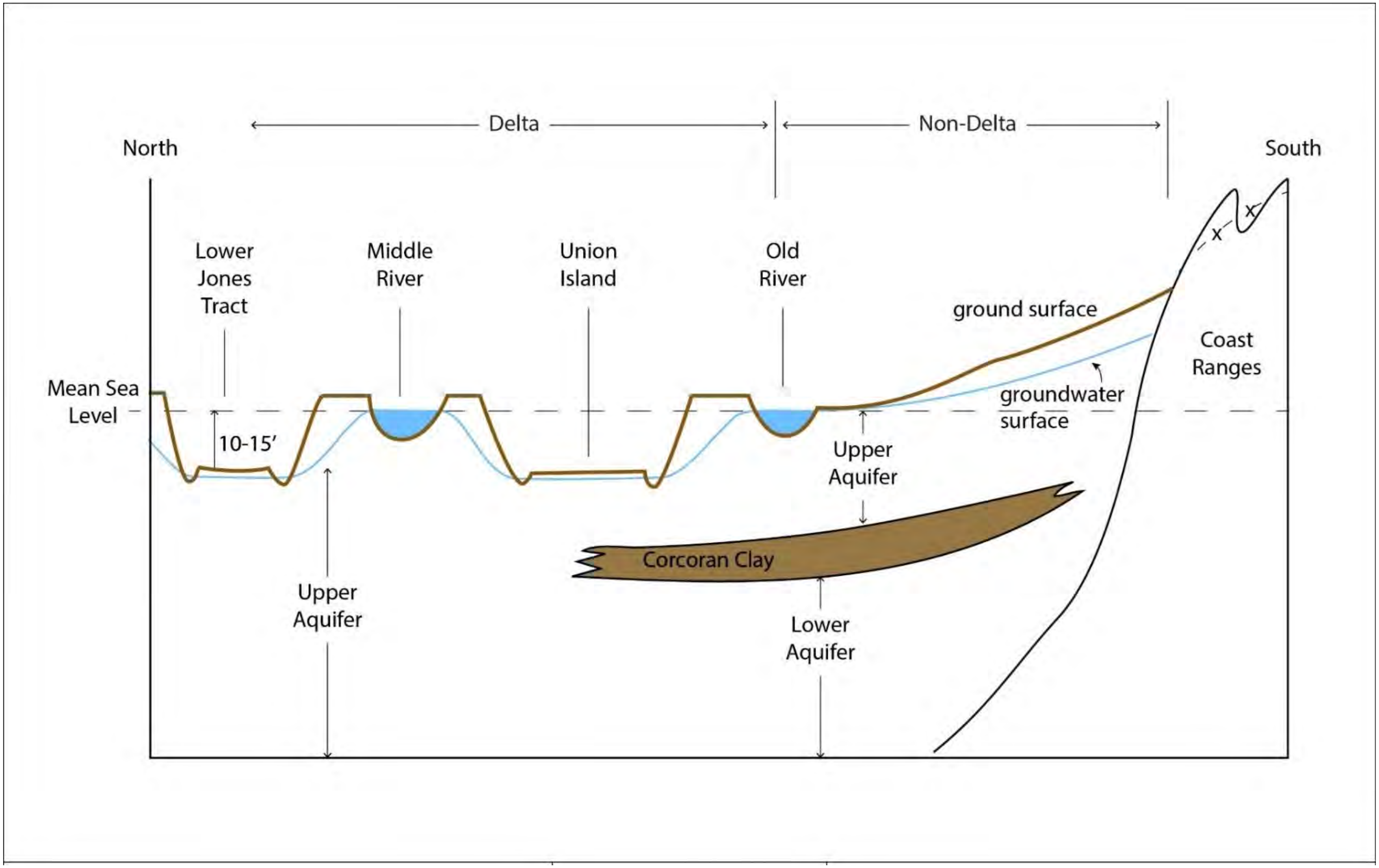

Figure 5-2. Principal Aquifer Schematic

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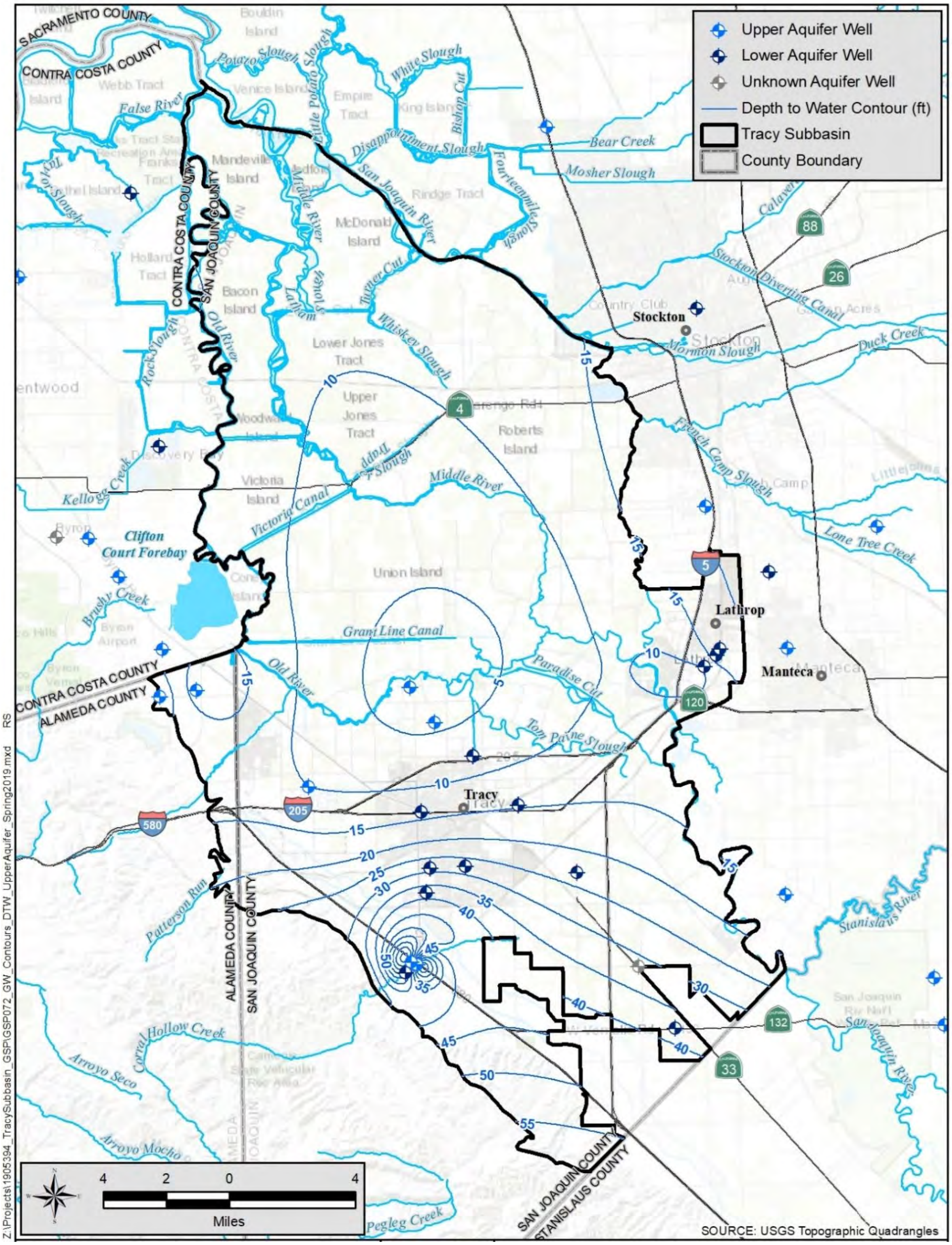

Figure 5-3. Upper Aquifer Depth to Groundwater – Spring 2019

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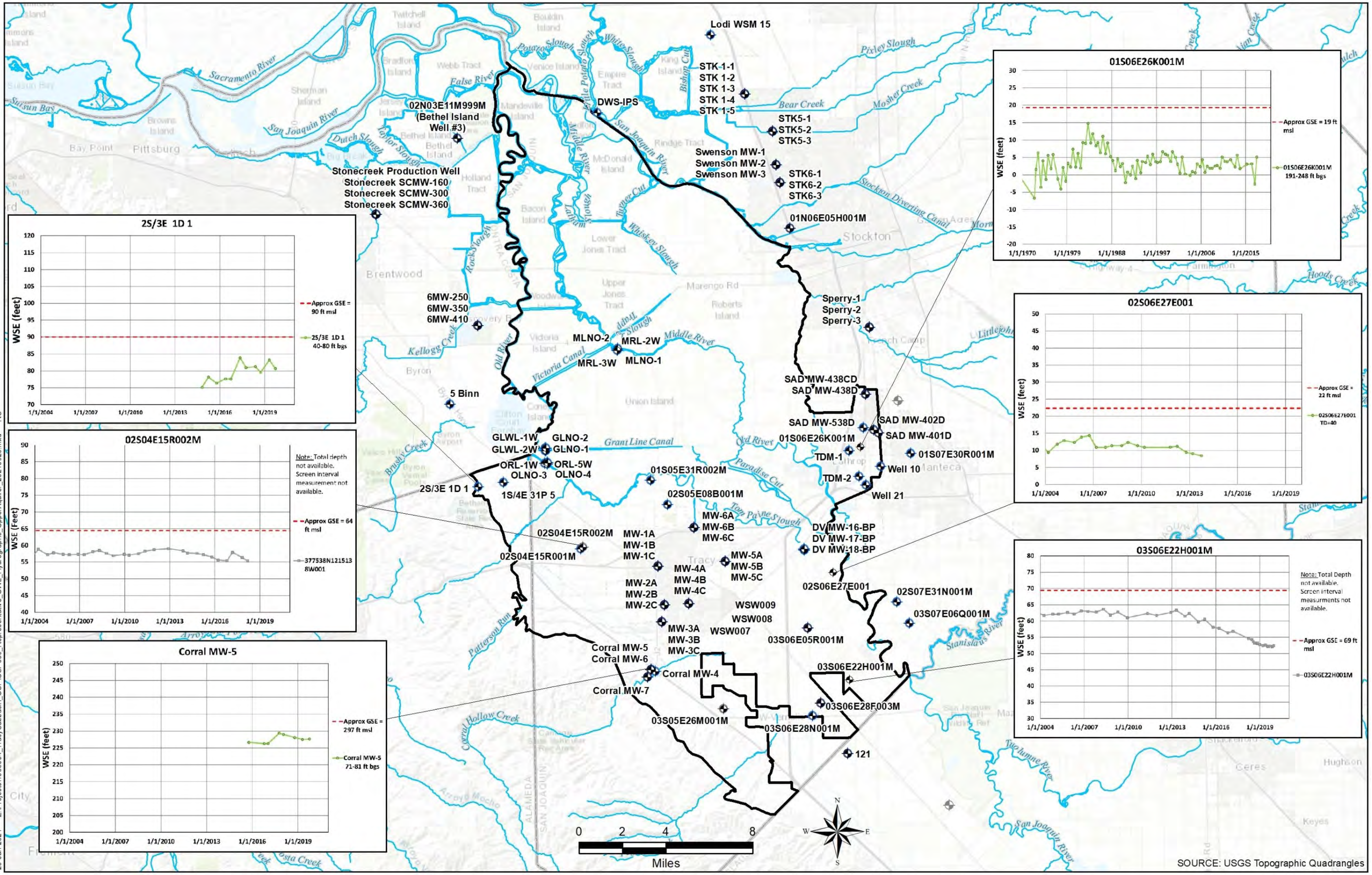

Figure 5-4. Selected Upper Aquifer Groundwater Level Hydrographs

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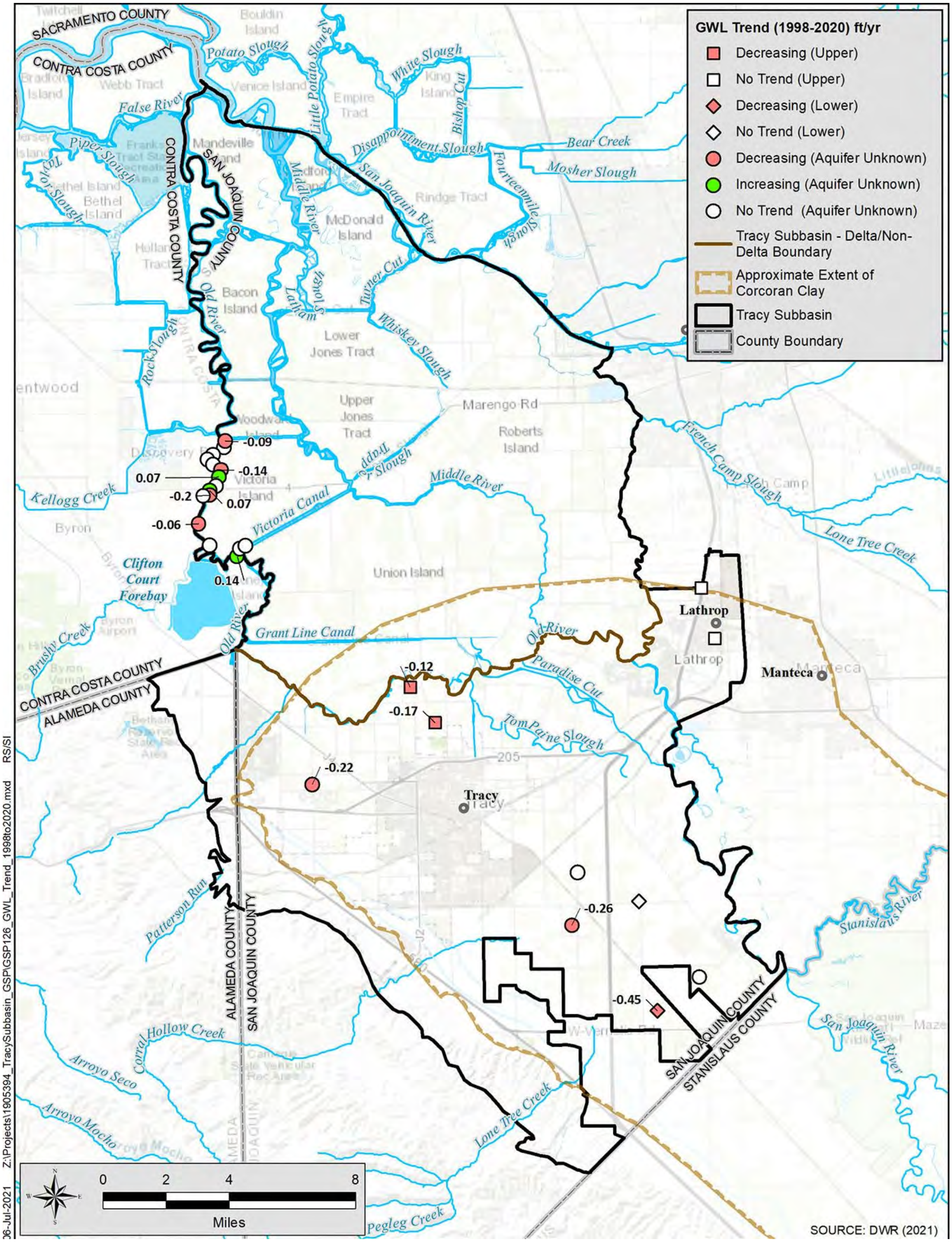

Figure 5-5. Groundwater Level Trends

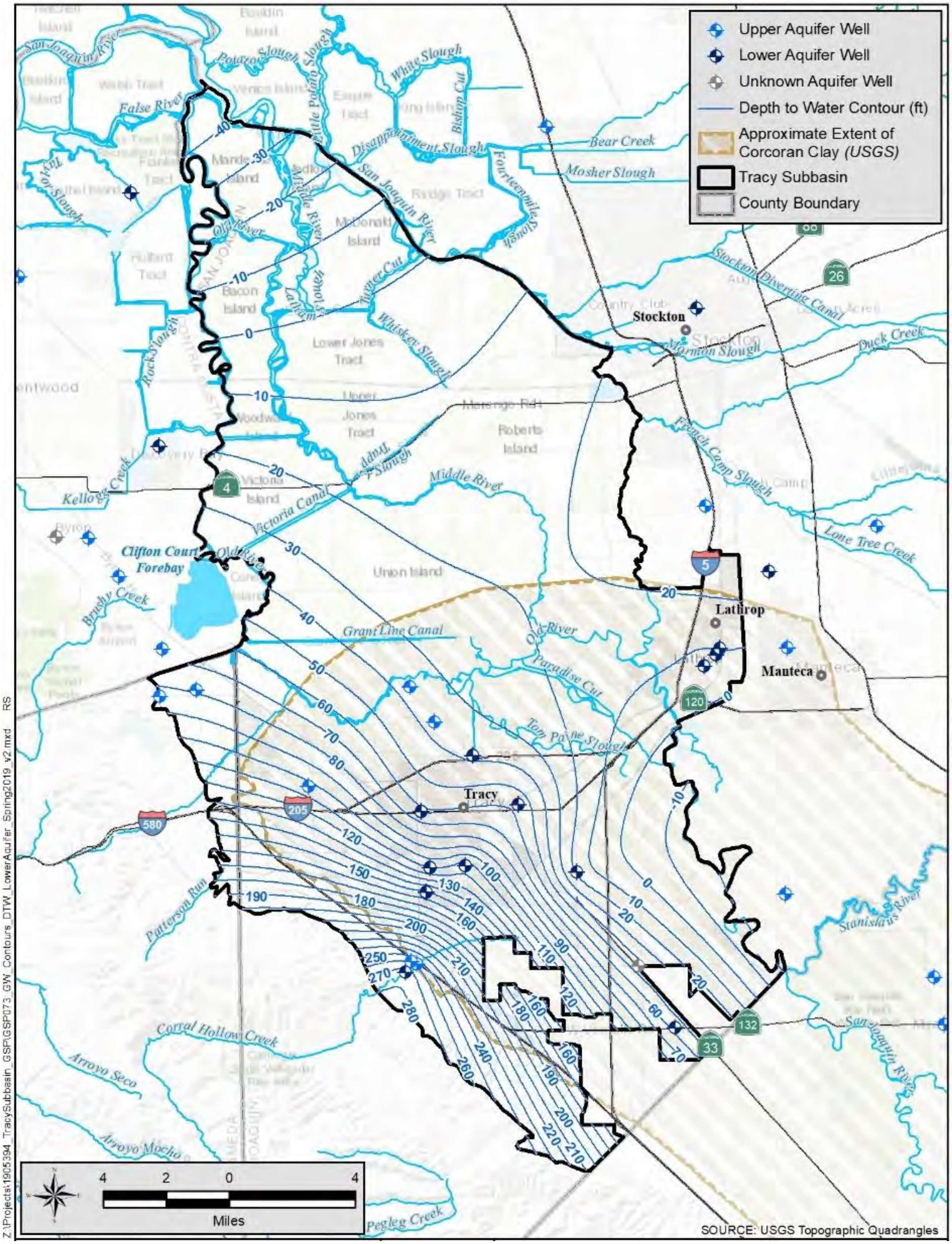

Figure 5-5. Lower Aquifer Depth to Groundwater – Spring 2019

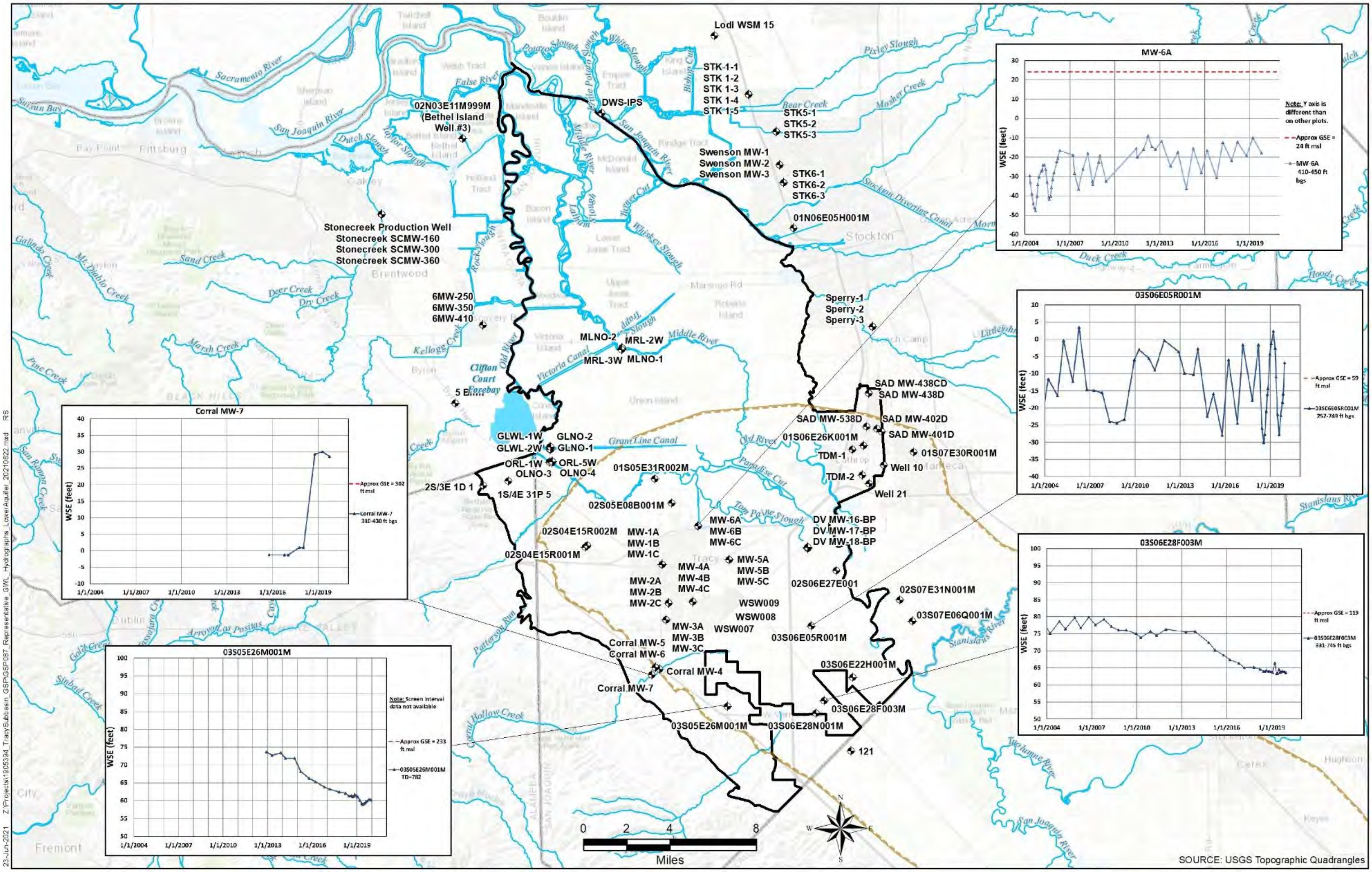

Figure 5-6. Selected Lower Aquifer Groundwater Level Hydrographs

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5.2 Current Groundwater Contours

Groundwater elevation contours were developed to show the current seasonal high and lows, groundwater flow directions, and regional pumping effects for both the Upper and Lower aquifers. The contours were developed using wells in the Subbasin and wells near the fringes of surrounding subbasins adjacent to the Tracy Subbasin, after receiving further confirmation of the aquifers monitored. Groundwater contours were developed for both the Upper and Lower aquifers for spring and fall 2015, the historic low since the start of SGMA, and for spring and fall 2019, to illustrate current groundwater conditions and groundwater high conditions (**Figures 5-8 through 5-15**). The contours were compared to surrounding subbasins with completed GSPs for general comparison and to support future evaluations.

Upper Aquifer

In the Delta area, groundwater elevations are mostly below sea level due to two main factors: the ground surface in the islands having subsided to below sea level, and the drains within the island which keep groundwater levels bgs to allow for farming. **Figure 5-2** generally illustrates the groundwater surface, in profile, expected at each island. Each island has its own unique groundwater elevations and contours, but similar hydraulics are present on all islands. **Figure 5-16** shows a detailed groundwater contour map for a Stewart Tract island, where some crops are being irrigated with recycled water. Groundwater contours are higher near the island edges adjacent to waterways and generally deepen coincident with the deepest land surface and drain. This type of pattern is expected at each island, but the depth will vary dependent on the elevations of the drains. Groundwater elevations in the islands are managed by the elevations of the drains and canals and there is very little to no pumping of wells for agriculture. Because drains and canals control the groundwater elevations and gradients, groundwater contours were not developed for each of the Delta islands. Information from the Stewart Tract island is used as representative for the conditions of the other islands. Although groundwater contours produced for the adjacent Eastern San Joaquin Subbasin show a groundwater pumping depression that extends from the subbasin across the Tracy Subbasin and into the East Contra Costa Subbasin, such a depression is unlikely due to all of the recharge provided by the waterways and does not correlate with the groundwater contours within each island, as described above.

In the non-Delta areas west of the San Joaquin River, groundwater contours for the Upper aquifer indicate groundwater elevations are highest near the Coast Ranges and decrease toward the Delta. Flow directions suggest that recharge areas are present along the foothills and that groundwater discharges into the Old River or Tom Paine Slough. Evidence of recharge is observed near Corral Hollow where apparently perched groundwater is present, as indicated by groundwater levels being 140 feet higher than adjacent wells (**Figure 5-10 and 5-12**). Groundwater gradients in the non-Delta portions of the Subbasin are the steepest, at about 0.008 foot/foot. East of the San Joaquin River, near Lathrop, the river recharges the Upper aquifer beneath the City and aquifers in the Eastern San Joaquin Subbasin, towards a pumping depression near Stockton (**Figure 5-17**). Groundwater contours at the southeastern edge of the Subbasin, adjacent to the Delta Mendota Subbasin, are perpendicular to the Stanislaus-San Joaquin County line, indicating there is no flow in the Upper aquifer between the subbasins, other than the finger areas of the Delta Mendota Subbasin north of the County line, where water flows into and out of both subbasins.

Lower Aquifer

The Corcoran Clay extends throughout most of the, if not all, of the non-Delta areas and only slightly into the Delta area, at Union Island. Groundwater contours for the Lower aquifer were developed with data from CASGEM monitoring wells constructed below the Corcoran Clay and supplemented by data from municipal wells to provide additional details. Groundwater monitoring well data from the adjacent Delta Mendota Subbasin were also used to assist in the contouring.

Two wells (376129N1212942W001 and 376388N1213056W001) from the Delta Mendota Subbasin showed elevations similar to the Upper aquifer. Upon further evaluation, the one well was found to be screened in both the Upper and Lower aquifers and the other well had a gravel pack that extended across both aquifers. Therefore, the two wells were removed from the contouring set. This resulted in a different, and more representative, pattern and flow direction than those presented in the Northern & Central Delta-Mendota GSP (Woodard and Curran, 2019).

Reference point elevations for Corral Hollow MW-7 in CASGEM were found to be about 50 feet different than in monitoring reports for the landfill that originally constructed the well. Reference point elevations were adjusted accordingly to match landfill records.

Groundwater contours in the Lower aquifer suggest groundwater is entering the subbasin from the south (Delta Mendota Subbasin) and from the east (Eastern San Joaquin Subbasin). Pumping in the vicinity of the City of Tracy has modified this overall regional flow gradient resulting in a pumping depression which is creating radial flow towards the City. Near the northern edge of the Corcoran Clay extent, the groundwater levels are expected to be at sea level, suggesting groundwater from the Delta could recharge the Lower aquifers.

The groundwater gradient in Fall 2019 from the Delta Mendota and the Eastern San Joaquin subbasins is about 0.0009 foot/foot into the Tracy Subbasin. The gradient increases around the City of Tracy due to the pumping depression. The gradient near the western edge of the subbasin cannot be determined at this time due to the lack of monitoring wells constructed below the Corcoran Clay.

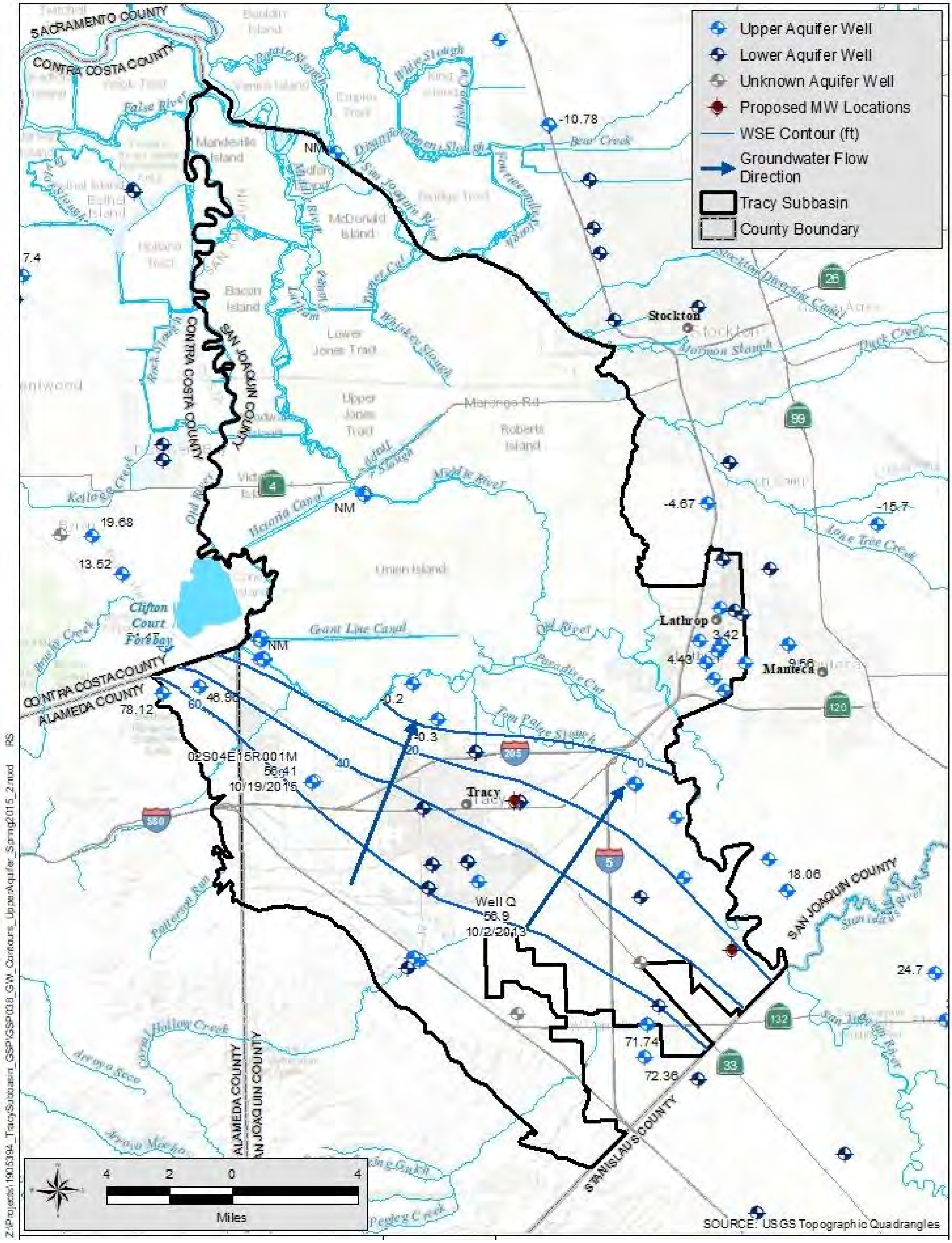

Figure 5-7. Upper Aquifer Groundwater Contours – Spring 2015

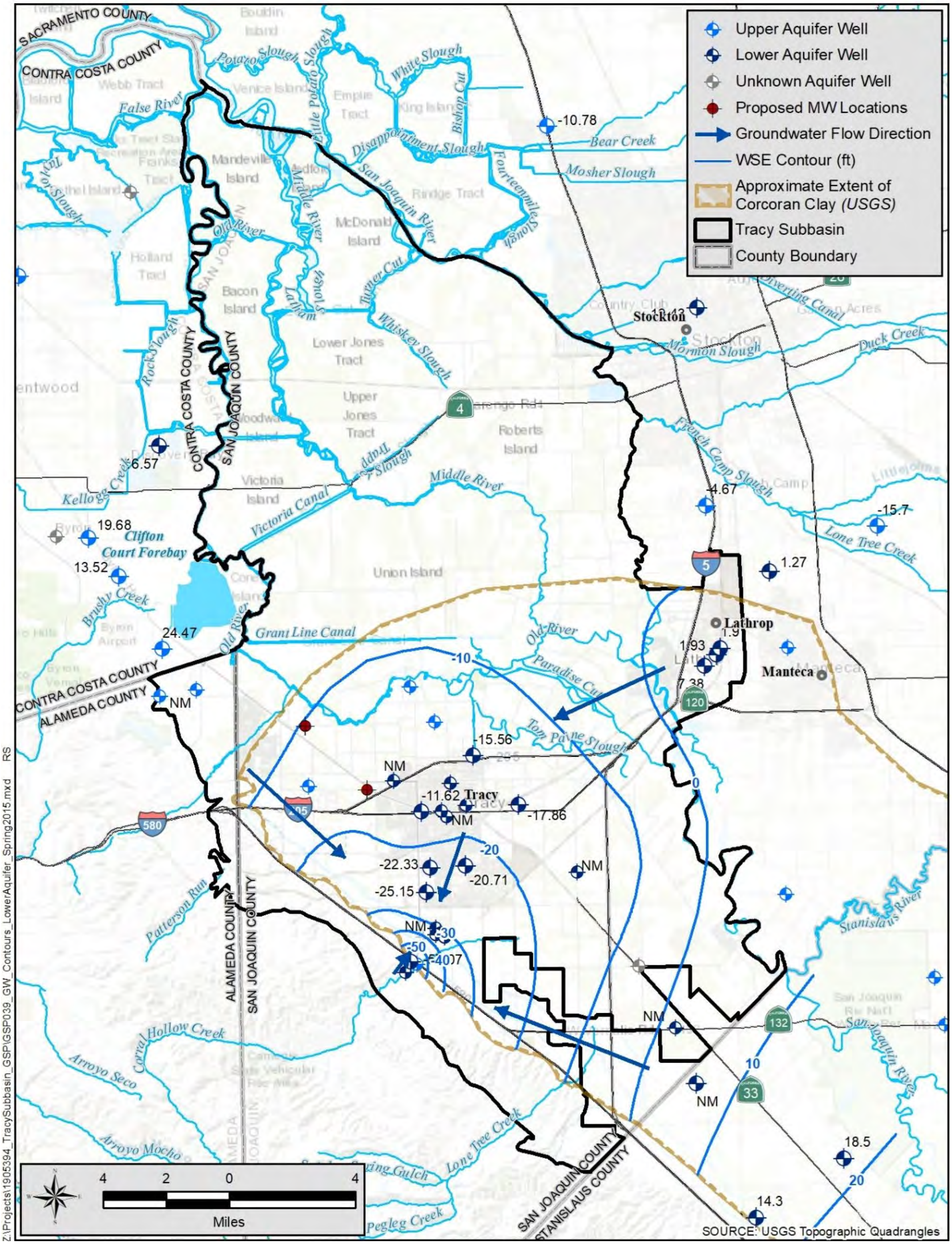

Figure 5-8. Lower Aquifer Groundwater Contours – Spring 2015

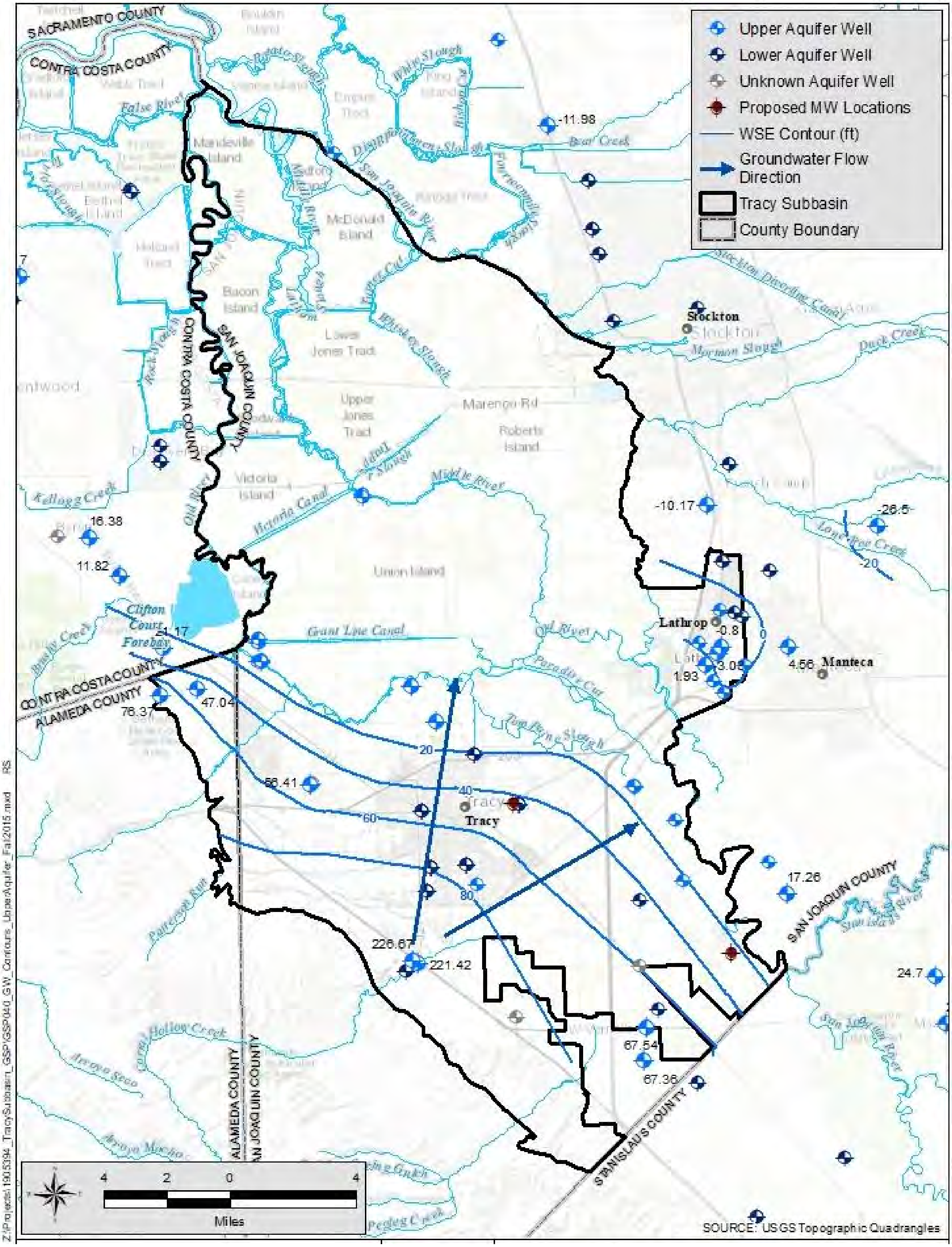

Figure 5-9. Upper Aquifer Groundwater Contours – Fall 2015

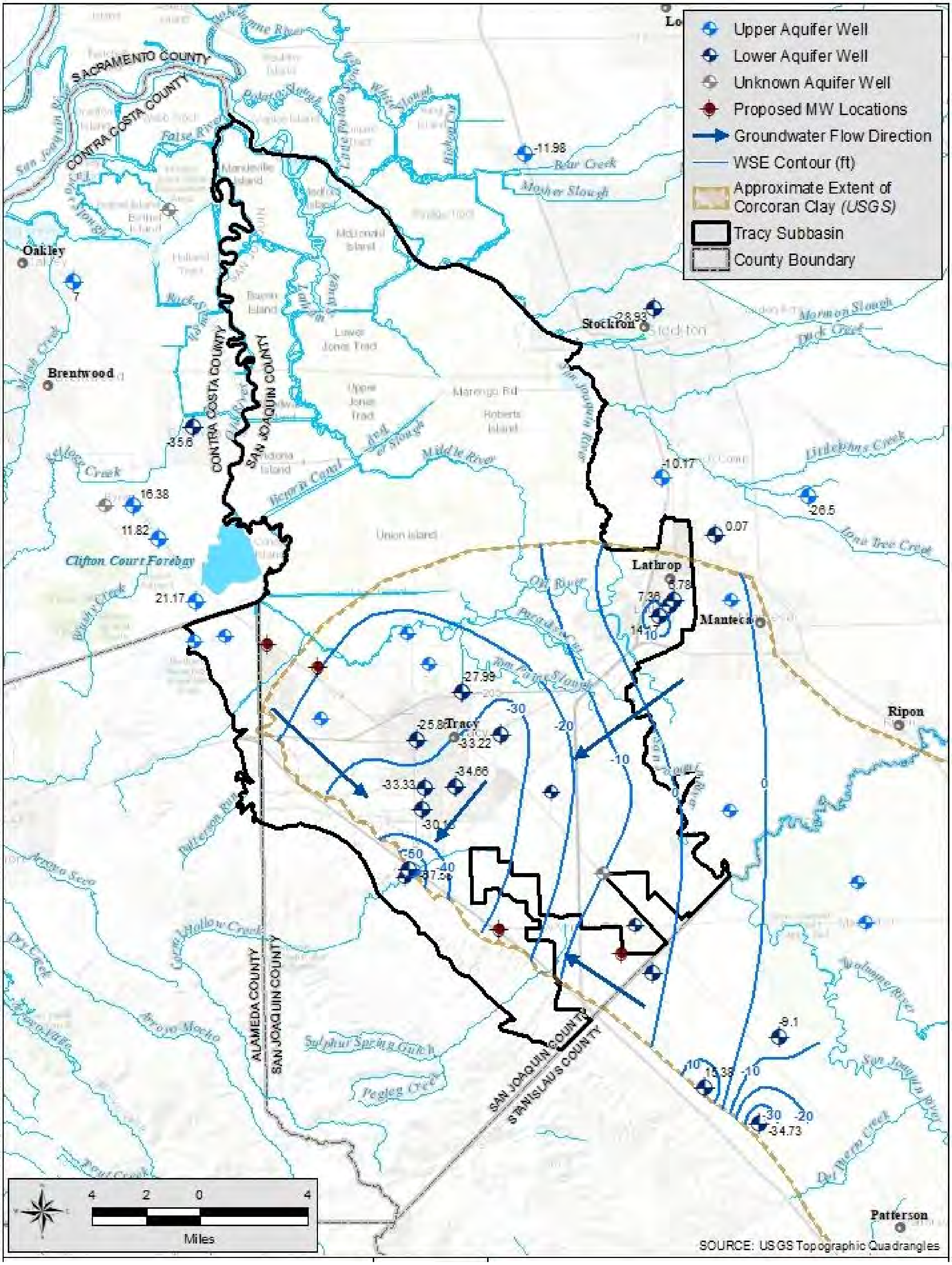

Figure 5-10. Lower Aquifer Groundwater Contours – Fall 2015

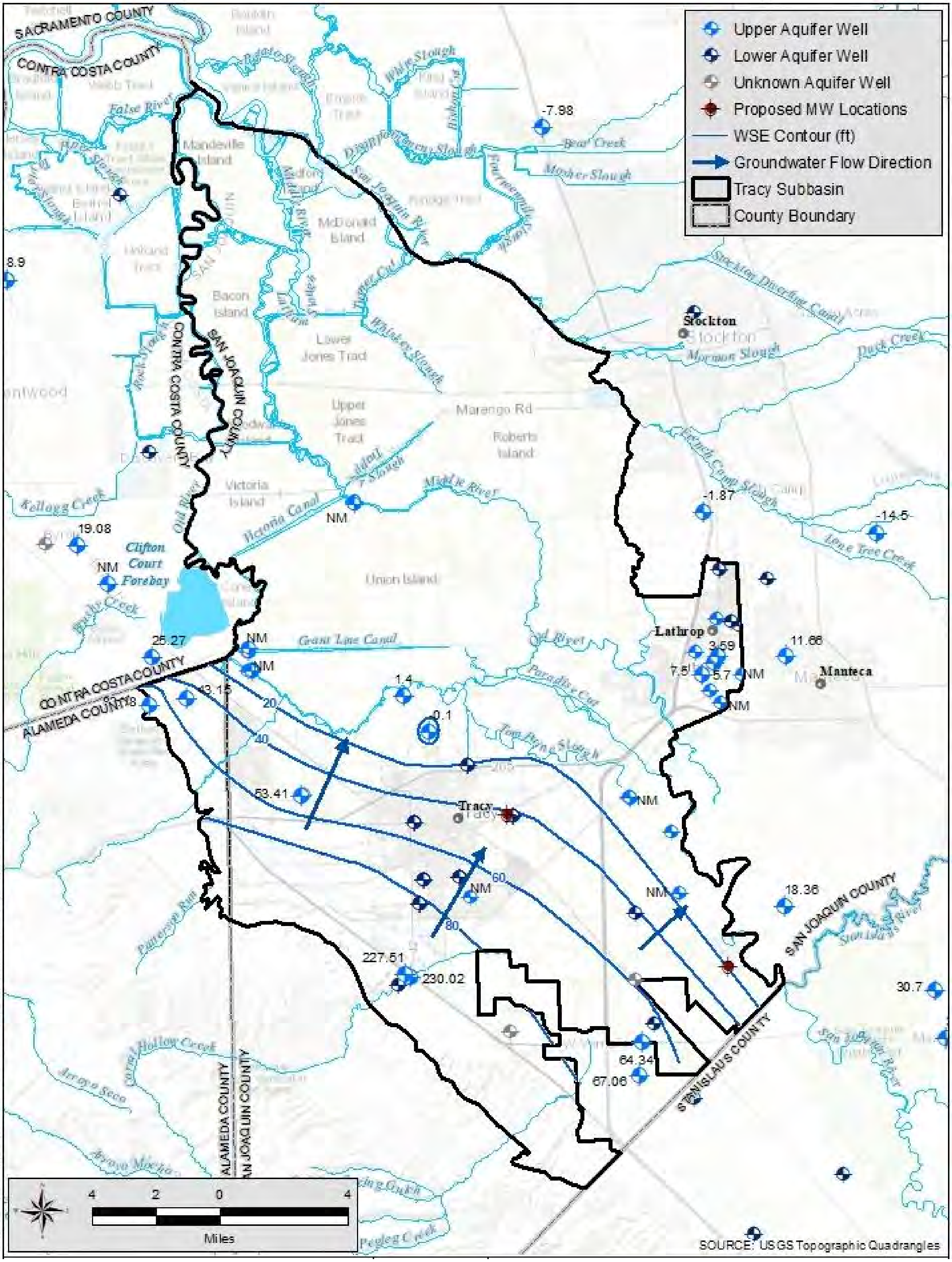

Figure 5-11. Upper Aquifer Groundwater Contours – Spring 2019

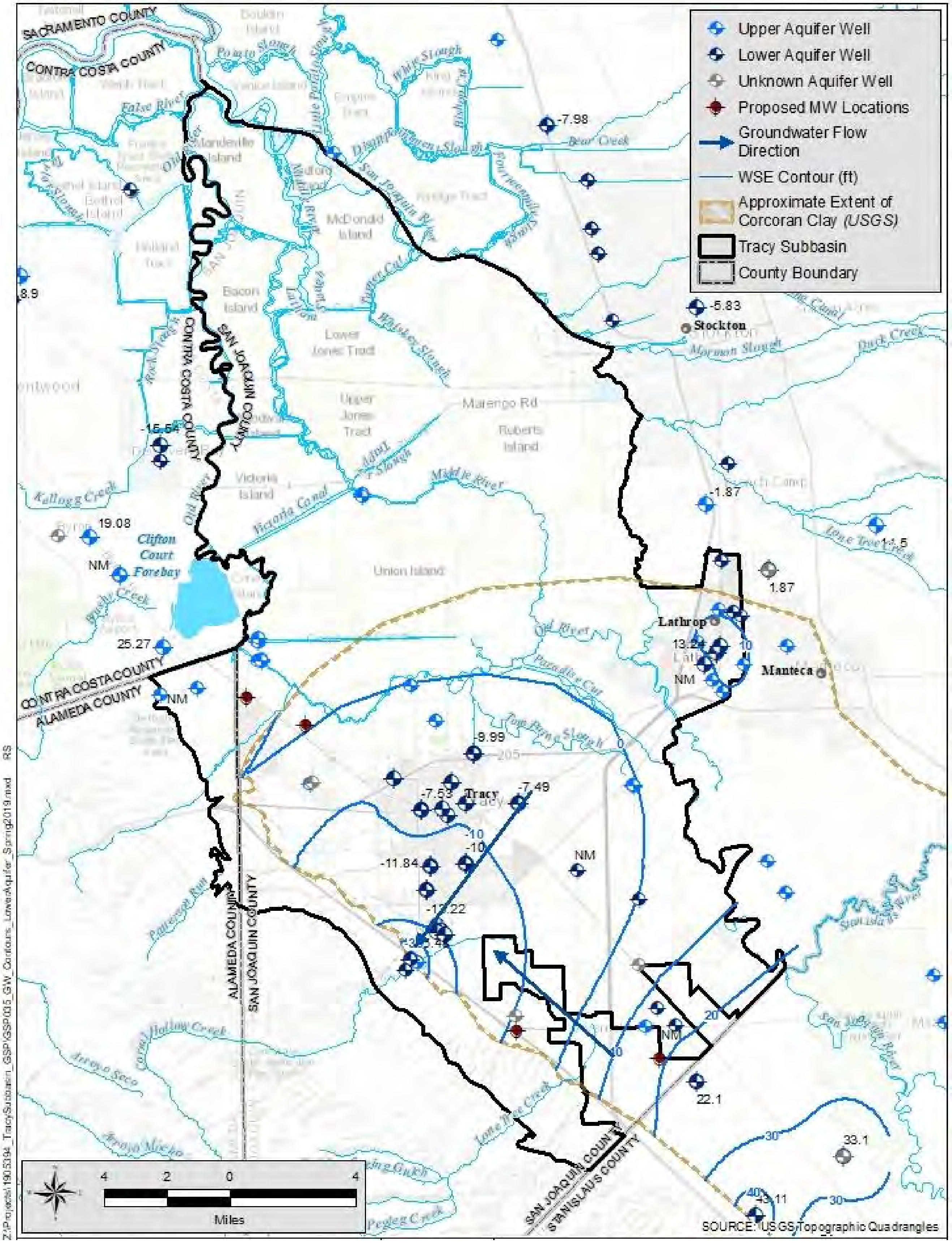

Figure 5-12. Lower Aquifer Groundwater Contours – Spring 2019

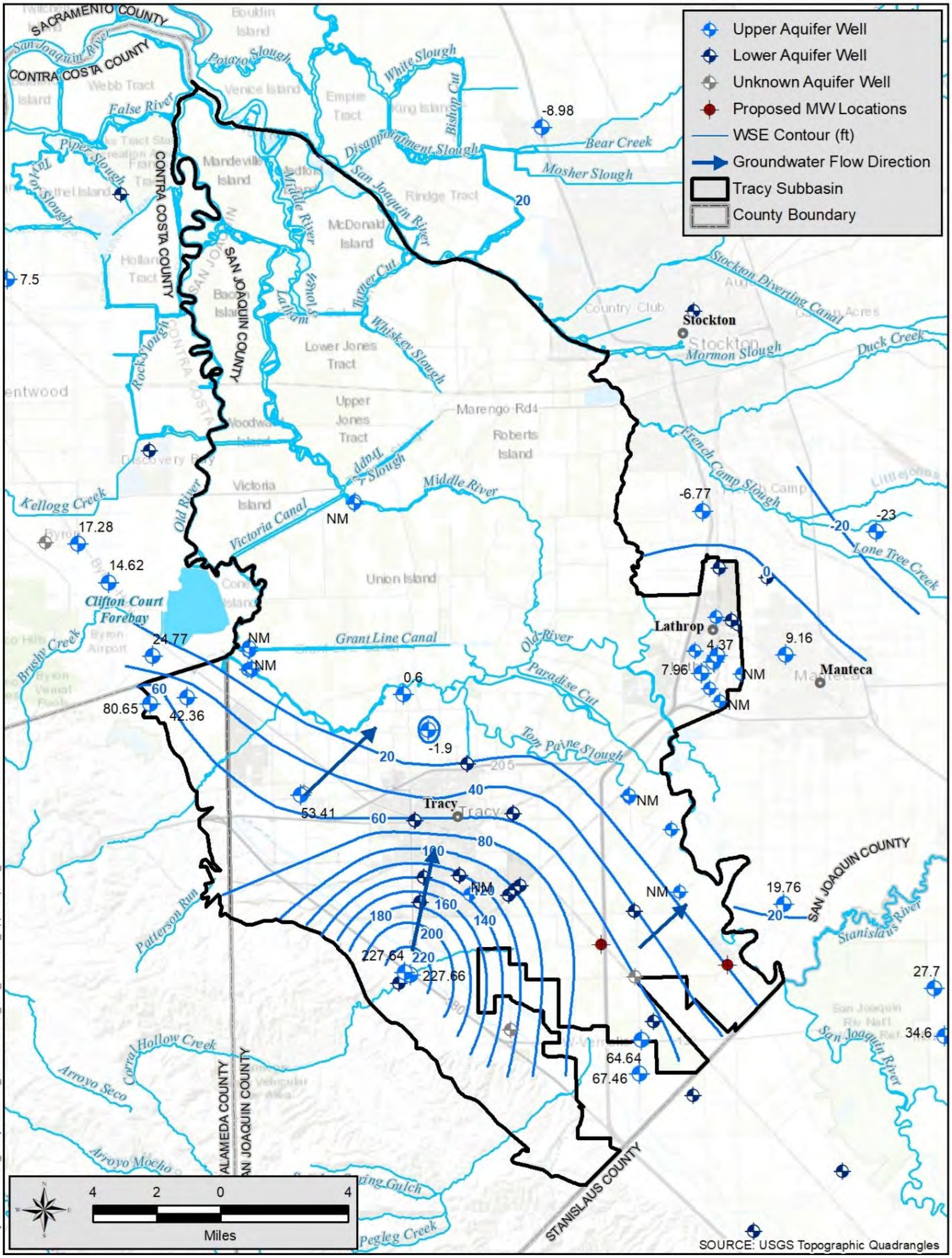

Figure 5-13. Upper Aquifer Groundwater Contours – Fall 2019

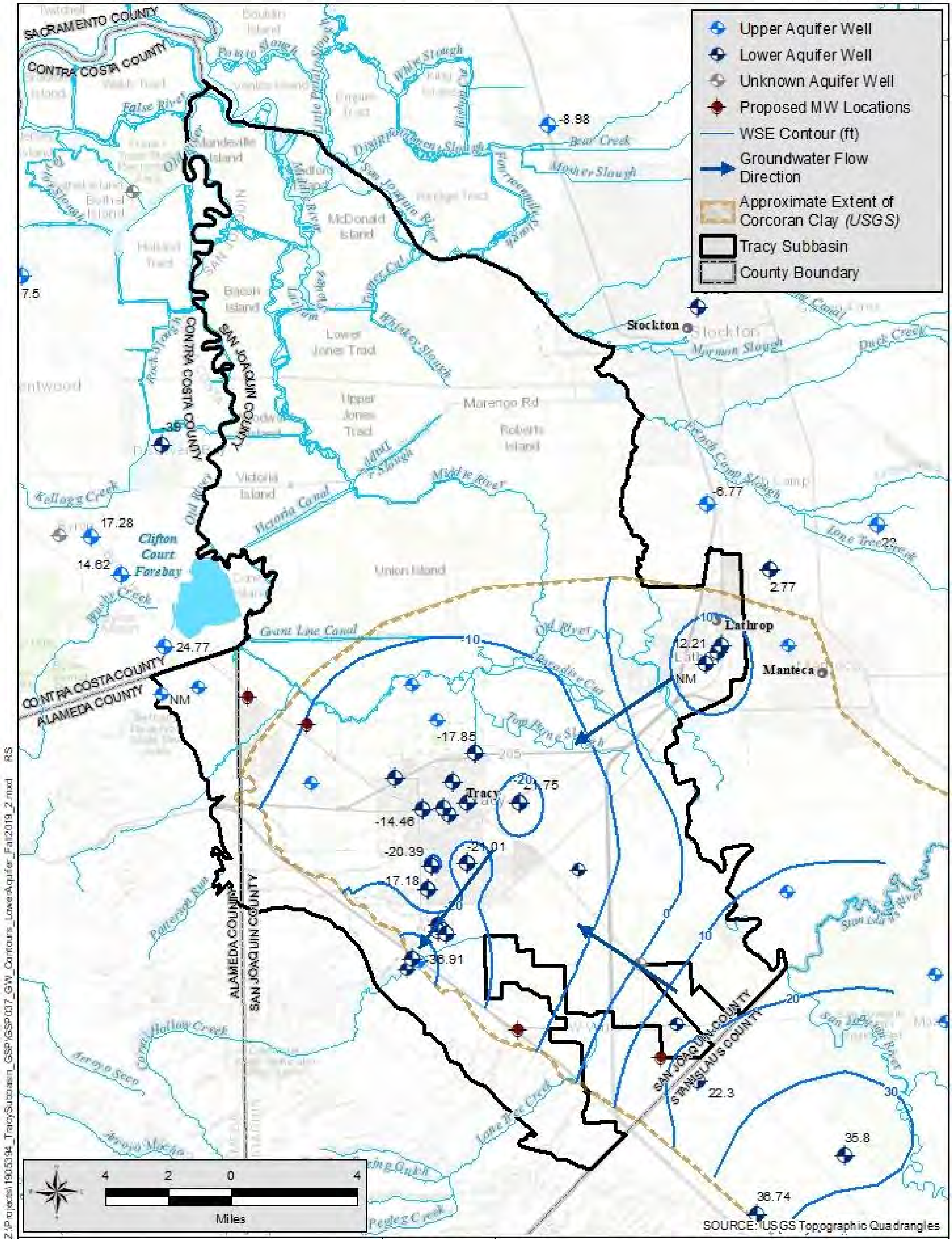

Figure 5-14. Lower Aquifer Groundwater Contours – Fall 2019

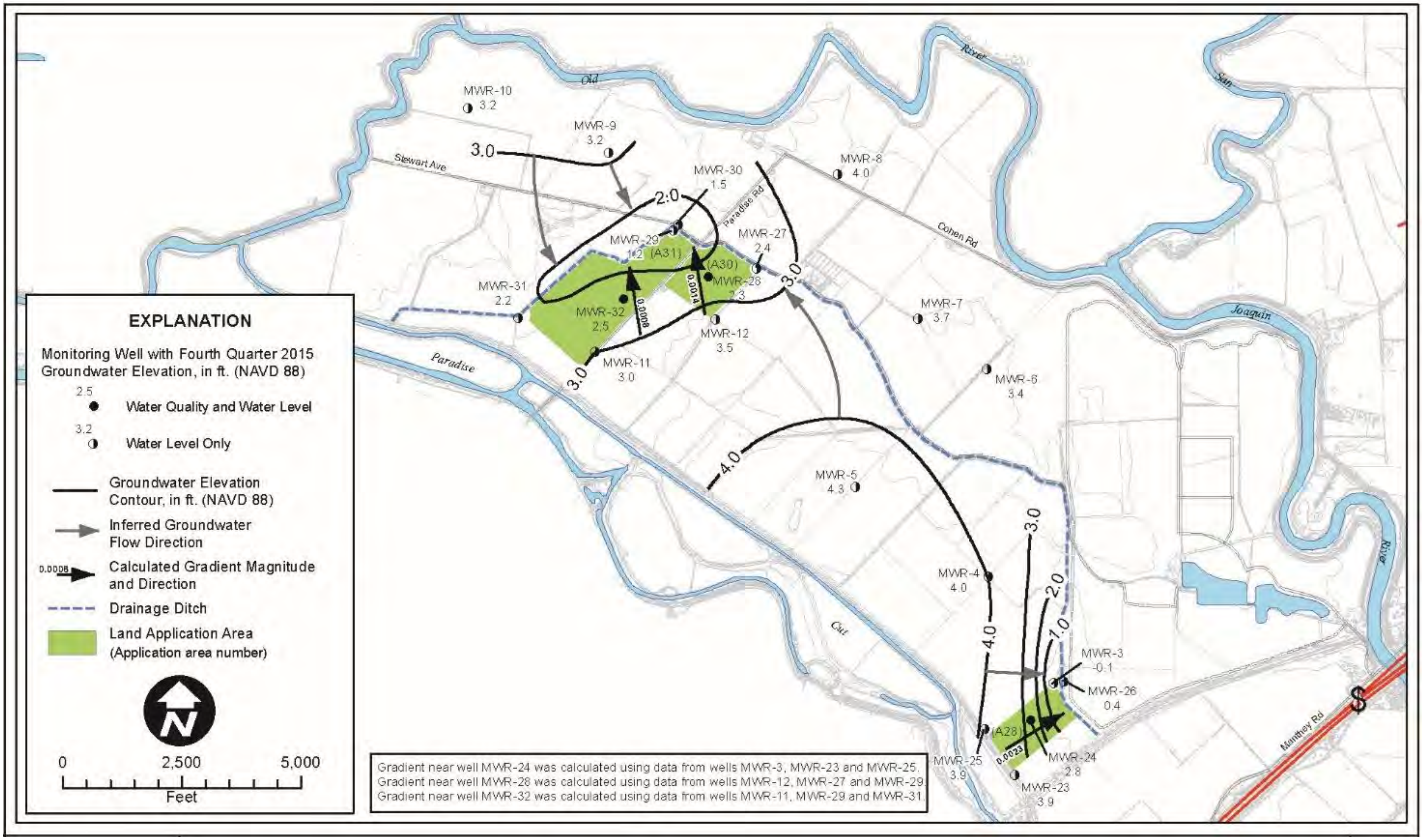

Figure 5-15. Stewart Tract Groundwater Contours – November 2015

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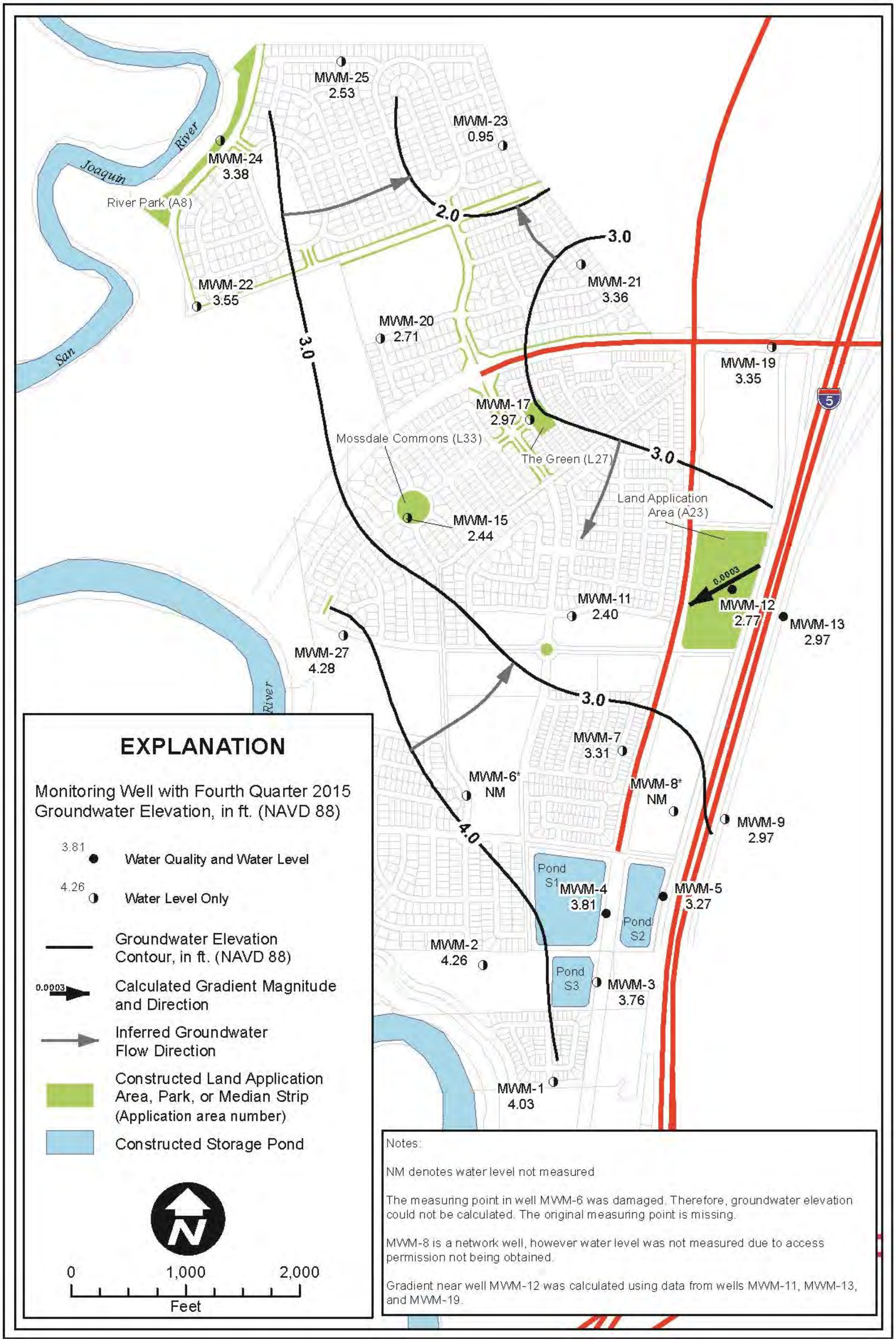

Figure 5-16. Groundwater Contours – Lathrop (Mossdale) November 2015

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5.3 Hydraulic Gradients Between Aquifers

Dedicated monitoring wells were constructed to monitor discrete intervals within the aquifers. These monitoring wells were used to evaluate vertical groundwater gradients within and between the aquifers. There are 16 nested and clustered monitoring well locations in the Subbasin that measure groundwater levels at up to four depths in the aquifers. **Appendix G** contains the hydrographs for each set of nested or clustered wells. In some cases, the clustered or nested wells are all in the same aquifer.

Upper Aquifer

Four sets of clustered monitoring wells are present in the Upper aquifer. Vertical gradients within the Upper aquifer vary in direction (upward or downward) based on their location in the subbasin and time.

- In the Delta area, MRL-2W, MRL-3W, MLNO-1, and MLNO-2 hydrographs show there is a downward gradient ranging from 1–10 feet.
- In the Delta area, ORL-1W, ORL-5W, OLNO-3, and OLNO-4 hydrographs show a mixture of upward and downward gradients with upward gradient present in the early 2000s and downward gradients of 5–10 feet since about 2010.
- In the non-Delta area, clustered well 02S04E15R001 and 02S04E15R002M hydrographs show a downward gradient of 2–7 feet.

Lower Aquifer

Six sets of clustered monitoring wells (MW-1A, B, and C through MW-6A, B, and C) are present in the Lower aquifer, around the City of Tracy. These wells monitor groundwater levels at different depths below the Corcoran Clay.

- Groundwater levels in the Lower aquifer show a mixture of downward and upward gradients that range from 1–9 feet between each coarse-grained sedimentary layer.
- There is a consistent downward gradient between the individual aquifers (MW-1, -2, and -4) in the southern and western portions of the City, with an upward gradient (MW-5 and -6) between the deeper two aquifers in the eastern and northern portions of the City.
- The gradients at MW-3 occasionally reverse but are mostly downward.

The upward gradients could be an indicator of upwelling of water from deeper marine sediments. Downward gradients may indicate potential recharge areas.

Upper to Lower Aquifers

Figure 5-18 provides a graphic representation of the vertical groundwater gradients (heads) between the Upper and Lower aquifers in Fall 2019, just after high groundwater use in the summer months, when the difference in groundwater levels are typically the greatest. **Appendix G** provides the hydrographs.

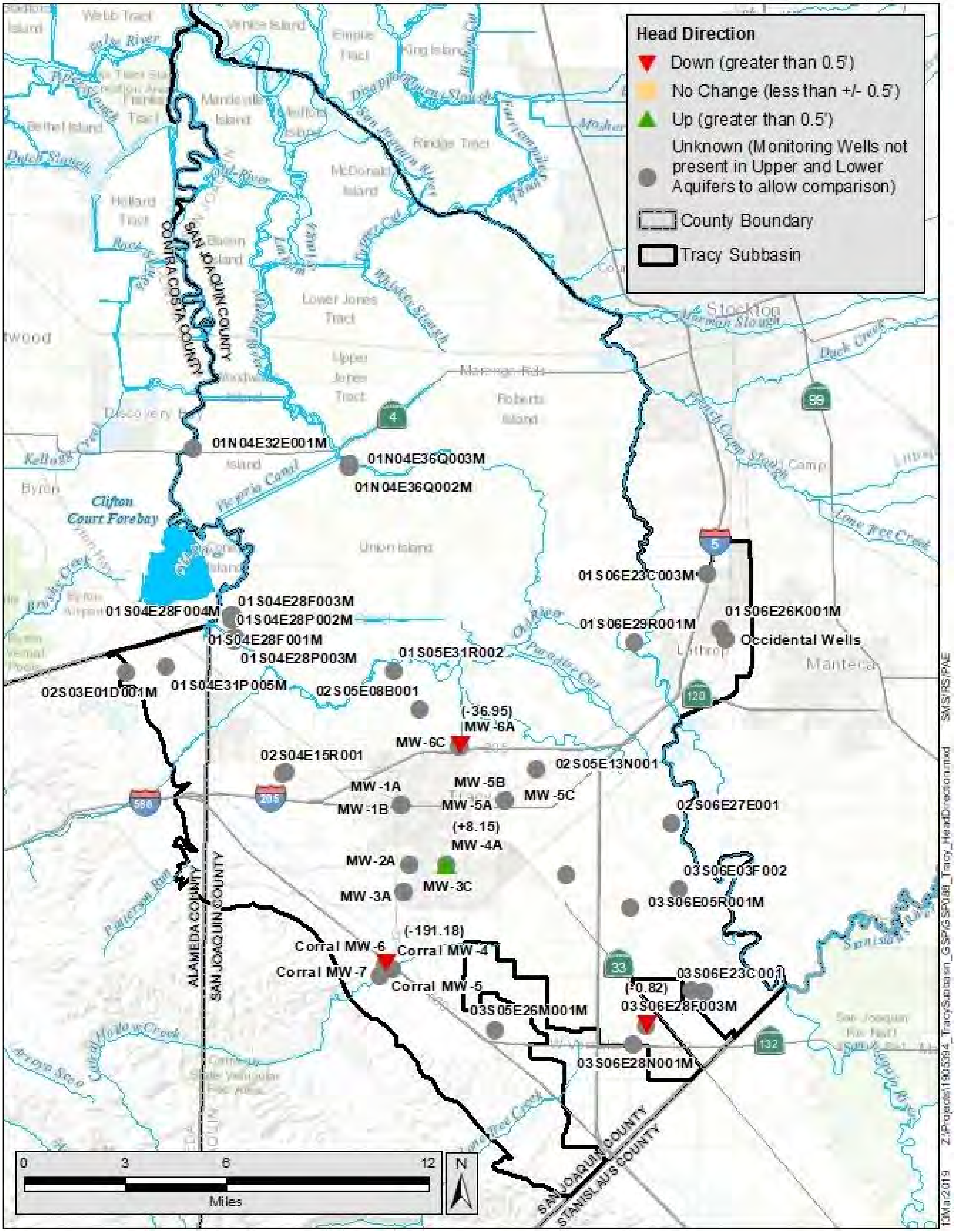

Figure 5-17. Vertical Gradients Between Upper and Lower Aquifers

Five sets of clustered monitoring wells are present in the non-Delta region of the Subbasin. The wells show a variety of conditions and vertical gradients:

- Near the foothills, where the clay is believed to be absent, the Corral Hollow wells show a downward gradient of with groundwater levels in the Upper aquifer at around 220 to 230 feet msl, while the deeper wells, are between -20 to -60 feet msl, a downward gradient of about 200 feet.
- In the central portion of the City of Tracy, where the Corcoran Clay is present, wells MW-4A and BC-19 show the Upper aquifer groundwater levels are about 55 feet msl while the Lower aquifer groundwater elevations are between 55 and 75 feet msl, an upward gradient of about 0 to 20 feet.
- In the northern portion of the City of Tracy, where the Corcoran Clay is present, wells MW-6A and BW-4 show the Upper aquifer groundwater levels are about 5 feet msl while the confined aquifer groundwater elevations at between -20 to -50 feet msl, a downward gradient of about 20 to 50 feet.
- Near the southern end of the Subbasin, where the Corcoran Clay is present, wells 03S06E26N001M and 03S06E28F003M show a slight downward gradient of about 1 to 3 feet and at times the heads are equal with no vertical gradient.
- Near the City of Lathrop, at the former Occidental chemical site where the Corcoran Clay is present, show there is an upward vertical gradient.

Even though the vertical gradient may change locally, the groundwater levels (piezometric) in the Lower aquifer are always above the Corcoran Clay, except near the foothills, indicating the aquifer is confined. Near the foothills the clay is absent and recharge to the confined aquifer can occur.

5.4 Hydraulic Characteristics

The hydraulic characteristics of sediments and aquifers provide the foundation for predicting the potential effects of groundwater management options. They are used to estimate speed and direction of groundwater movement, groundwater storage, and the potential effects of groundwater pumping on groundwater levels. Several hydraulic characteristic terms are used.

- **Hydraulic conductivity** is the ability of the sediments to transmit water in sediments.
- **Transmissivity** is the hydraulic conductivity multiplied by the thickness of the sediments capable of storing water.
- **Porosity** is the void space between the particles of sediments. Water in the void spaces cannot be entirely removed.
- **Storage coefficient** is the percentage of water that can be removed from the pores by gravity drainage and is applied when describing unconfined aquifers.
- **Storativity** is similar to storage coefficient but is the percentage of water that can be released from the pores by a decrease in pressure. Storativity is used when referring to semi-confined or confined aquifers.

The hydraulic characteristics of the Upper unconfined aquifer are highly variable. Wells in the unconfined aquifer produce 6 to 5,300 gpm; however, pumping test data are limited. The transmissivity of the unconfined aquifers, including the recent alluvium and upper portions of the Tulare Formation, ranges from 600 to greater than 2,300 gpd/ft (DWR 2006). The storativity is about 0.05. Where thicker sequences of sand are present, the transmissivity may be higher. Wells in the Lower confined aquifer produce about 700 to 2,500 gpm. The transmissivity ranges from about 12,000 to 37,000 gpd/ft and may go as high as 120,000 gpd/ft. The storage coefficient or storativity, obtained through aquifer tests, was measured as 0.0001 (Padre 2004).

The Corcoran Clay is a regional layer, a confining bed, that restricts movement between the Upper unconfined and Lower confined aquifers. Because the clay is permeable to some degree, water can migrate vertically through the layer but typically at very slow rates and only in areas where there is a downward gradient. Although this migration rate is very slow, the amount of water moving through the clay can be significant given the large area covered by the clay and head differences across the clay. No test data are available for the Corcoran Clay but estimates of the vertical permeability range from 0.01 to 0.007 feet per day (Burow et al. 2004). Modern wells are typically screened either above or below the Corcoran Clay which preserves the clay's low permeability nature. This is a good practice and protects the aquifers from cross-contamination. However, some wells have been constructed with screens or gravel packs across the clay which provides a vertical conduit that creates an opportunity for groundwater of poor quality to mix with groundwater of better quality.

5.5 Change in Storage

The change in groundwater storage was estimated for the entire Subbasin using DWR's California Central Valley Groundwater-Surface Water Simulation Model (C2VSim-FG_v1.0) groundwater model data. The model includes estimated groundwater pumping from municipal water purveyors and agricultural areas, as well as relevant climate data, simulated surface water deliveries, and streamflow.

Figure 5-19 shows the cumulative change in groundwater storage for the entire Subbasin for the water years 1975 through 2015 along with the San Joaquin River Index for the same years. The water year types as defined by the San Joaquin River Index (SJRI) are noted on the right-hand side of the chart. As the chart illustrates, there is a strong correlation between the SJRI and the changes in groundwater storage; periods of declining groundwater storage reflect the dry hydrologic cycles, and periods of gaining groundwater storage reflect the wet hydrologic cycles. Generally, groundwater levels trends would also mimic the change in storage. The cumulative change in storage during this period, which included most of the recent drought, increased on average by about 3,000 AF per year.

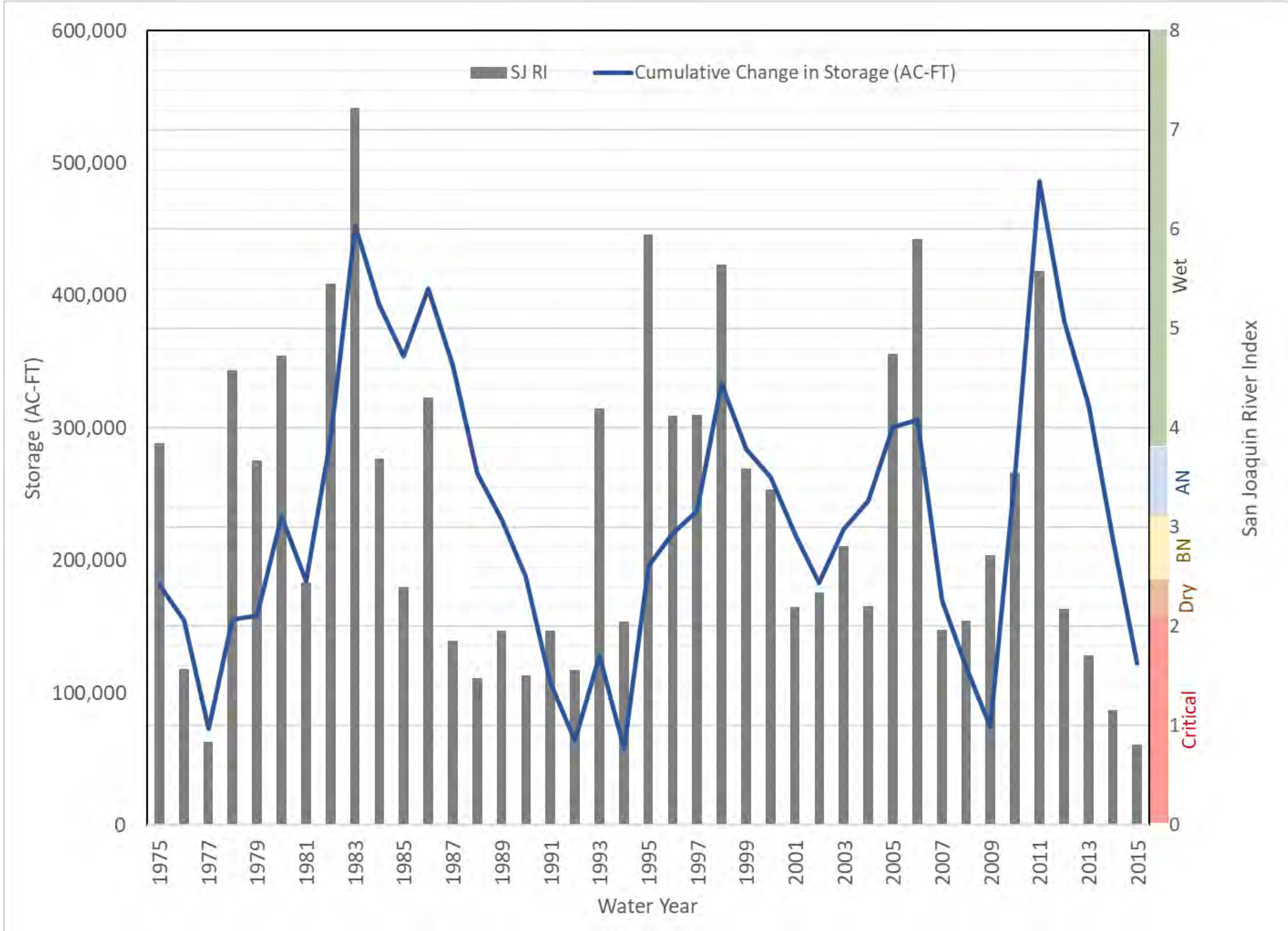

Figure 5-18. Cumulative Change in Groundwater Storage

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5.6 Groundwater Quality

Groundwater quality in the Tracy Subbasin is variable. Good quality water, from a salinity aspect (TDS) being below the recommended drinking water standard, is locally present in both the confined and unconfined aquifers in the southern portion of the Subbasin. In the remaining portions of the Subbasin, groundwater quality is marginal to poor due to naturally occurring high concentrations of salts from various sources and is part of the reason that the cities have obtained surface water supplies. The concentration of the other naturally occurring constituents varies widely over the Subbasin and also with depth at any given location. This may affect the supply, beneficial uses, and potential management of groundwater in the Subbasin.

Local occurrences of PFAS, uranium, nitrates, manganese have been detected above the MCL, as discussed in **Chapter 4 – Hydrologic Conceptual Model**. Although these elements and compounds may have been detected, the community water systems only supply drinking water that meets all water quality standards. When an element is detected above the MCL, the wells have been brought offline until treatment or remediation has been implemented to meet the drinking water standards.

5.6.1 *General Water Quality*

Groundwater in the Tracy subbasin is variable with some localized areas of good quality. Good quality water is locally present in both the confined and unconfined aquifers near the southwestern margin of the Subbasin, near the foothills. In the remaining portions of the Subbasin the groundwater is marginal to poor. The concentration of the naturally occurring constituents varies widely over the Subbasin and also with depth at any given location.

Problem constituents (constituents of concern [COCs]) include:

- In the non-Delta portion of the Subbasin (generally south of the Old River) TDS, nitrates, boron, chloride, and sulfate (GEI 2007). In addition to these constituents, localized areas of manmade contamination, including trihalomethanes, volatile organic compounds (solvents), and gasoline are present. In the City of Lathrop, uranium and PFASs are present in the groundwater above their MCLs.
- In the Delta portions of the Subbasin (generally north of the Old River), the key COCs are dissolved organic carbon, methyl mercury, and salts which originate from the oxidation of drained peat soils (Hydrofocus 2015).
- Domestic wells are present in both Delta and non-Delta regions of the Subbasin. Water quality test results from domestic wells are very limited. Where public supply well water quality data is available it can be used as a proxy for domestic well water quality, but most domestic wells obtain water from shallow aquifers while public supply wells are typically constructed into deeper aquifers. Approximately 25 percent of domestic wells may have water quality risks for one or more constituents with an MCL. Four constituents (arsenic, 1,2,3- TCP, nitrate, and gross alpha [radioactive elements]) account for 80 percent of elevated water quality risk (State Water Board SAFER Workshop 2020).

Testing for EDB, DBCP, and simazine in the Subbasin have been at less than detectable levels, except near the former Occidental Chemical site, based on Geotracker database 2009 through 2013 (Hydrofocus 2015). No further assessment for pesticides was performed during GSP development, other than for 1,2,3 TCP.

The types of sediments composing the geologic formations can affect groundwater quality. Some soils and sediments in the Subbasin are derived from marine rocks in the Coast Range have notably high concentrations of naturally occurring nitrogen, with particularly higher nitrate concentrations in younger alluvial sediments (Strathouse and Sposito 1980, and Sullivan et al. 1979). These naturally occurring nitrogen sources may contribute to nitrate concentrations in groundwater within the Subbasin, although it is not well known where this may occur and to what degree. Naturally high concentrations of TDS in groundwater are known to have existed historically within parts of the Subbasin due to:

- The types of Coast Range rocks (e.g., marine sediments, volcanics)
- The resulting naturally high TDS of recharge derived from Coast Range streams
- The dissolvable materials within the alluvial fan complexes
- The naturally poor draining conditions which tend to concentrate salts in the system

The water quality and chemical makeup in westside streams can be highly saline, especially in more northern streams, including Corral Hollow Creek, where historical baseflow TDS concentrations, from representative shallow wells, have typically exceeded 350 mg/L with measured concentrations as high as 1,500 mg/L (Davis et al 1959). The contribution of water associated with these Coast Range sediments has resulted in naturally high salinity in groundwater within and around the Tracy Subbasin, which has been recognized as early as the 1900s (Mendenhall et al. 1916).

Groundwater in some areas within the immediate vicinity of the San Joaquin River, near Lathrop, is influenced by lower-salinity surface water discharging from the east side of the San Joaquin Valley Groundwater Basin (Davis et al. 1959).

Groundwater quality in this GSP was developed from the State Water Board's DDW, which maintains a database of public water systems' water quality analyses (referred to hereafter as the "DDW database"). State Water Board's DDW requires each public water system to analyze water quality for over 300 elements at intervals ranging from weekly to every 3 years. Because large portions of the Subbasin are agricultural, public water systems are scarce; therefore, the State Water Board's DDW database was supplemented with wells monitored by DWR, City of Tracy, NWIS database, and from the Irrigated Lands Regulatory Program (2 wells). Pesticides (EDB and DBCP) extent and concentrations were assessed using the California Department of Pesticide Regulations. The database of wells was then assigned to its principal aquifers if total depth of the well or well logs were available.

Table 5-1 provides a list of these elements, the number of samples analyzed, their minimum and maximum concentrations, the number of wells with samples exceeding the MCL, and the classification of analyses by principal aquifer. Most of the analyses were performed in wells with unknown depths, although some of these can be assigned once well construction logs are located. Further analyses of the water quality by principal aquifer excluded the use of these wells with unknown depths, but their locations are shown on the maps. Also, due to the lack of or limited number of wells with detections that could be identified by principal aquifer, gross alpha, hexavalent chromium and selenium were not plotted.

Figures 5-20 through 5-28 show the most recent analyses and distribution of these elements in the Subbasin by principal aquifer. Where multiple nested wells are present at a single location, only the shallowest well water quality is shown. The most recent analysis was extracted from the datasets for each well to demonstrate current conditions. The analyses dates range from 1944 to 2020. **Appendix H** provides a detailed list of the water quality analyses and wells used to create the figures. The figures show:

- Salinity as represented by TDS (**Figure 5-20**) is high in both the Upper and Lower aquifers with a few areas with good quality water.
- Elevated concentrations of chloride (**Figure 5-21**) and sulfate (**Figure 5-22**) are present in the Upper aquifer but do not show a distinct pattern. Chloride and sulfate concentrations in the Lower aquifer are quite variable. Chloride concentrations are for the most part all low except for one deep nested monitoring well located on the east side of Tracy (not shown on **Figure 5-20**) where the most recent concentration is 460 mg/L. Elevated concentrations of sulfate are present near the foothills potentially as a results of recharge water originating from the Coast Ranges.
- Nitrate (**Figure 5-23**) concentrations are low in the basin and other than a few wells, nitrate does not appear to be adversely impacting water quality.
- Elevated concentrations of arsenic (**Figure 5-24**) are only in the Upper aquifer and within the Delta area and not in the Lower aquifer.
- Boron (**Figure 5-25**) is present in the Upper aquifer. Most elevated concentrations are present in the non-Delta areas and in the northern portions of the Delta area.
- Elevated concentrations of iron and manganese (**Figures 5-26 and 5-27**) are found randomly in the Subbasin in both aquifers. Elevated concentrations of manganese appear to be more prevalent in the Upper aquifer in the Delta area.
- 1,2,3 TCP (**Figure 5-28**) was detected in both the Upper and Lower aquifers, but at concentrations below the MCL.

It should be noted that water quality beneath the Corcoran Clay is limited to the area around Tracy which could affect the interpretation of water quality beneath the clay.

Table 5-1. General Water Quality Summary

Element	Units	MCL or Notification Level (NL)	Number of Wells with Analytical Results	Minimum Concentration [4]	Maximum	Number of Wells with Analyses Exceeding MCL or NL	Analyses Date Range		Number of Wells with Analytical Results by Aquifer		
									Upper Aquifer Wells	Lower Aquifer Wells	Unknown Aquifer
Plotted											
Arsenic	ug/L	10	195	<2.0	54	32	7/1/59	1/14/20	28	26	141
Boron	mg/L	1 [1]	584	<0.1	10	227	6/5/45	12/2/19	90	26	468
Chloride	mg/L	250 [3]	664	1.1	2,400	210	6/5/45	1/14/20	91	26	547
Iron	ug/L	300	206	<0.03	25,700	34	6/28/53	1/14/20	38	26	142
Manganese	ug/L	50	190	<0.01	17,600	67	5/4/50	1/14/20	29	26	135
Nitrate as Nitrogen	mg/L	10	537	<0.02	81	21	11/26/47	2/14/20	71	26	440
TDS	mg/L	500 [3]	376	82	4,500	269	3/29/44	1/14/20	68	26	282
Sulfate	mg/L	250 [3]	465	0.2	1,420	122	3/29/44	12/9/19	72	26	367
1,2,3TCP	ug/L	0.005	126	<0.001	0.500	25	8/27/84	2/11/20	9	8	109
Not Plotted											
Gross Alpha	pCi/L	15	118	0	36	2	1/19/88	2/4/20	5	26	87
Selinum	ug/L	50	136	0	35	0	7/1/59	12/9/19	10	8	118
Hexavalent Chromium	ug/L	10 [2]	75	<0.05	29	5	5/1/01	10/5/18	5	8	62

Notes:

1 = Notification Level, no MCL

2 = No MCL, previous MCL shown

3 = Secondary Standard, Recommended level shown

4 = Current Reporting Limit, may vary with historic analysis

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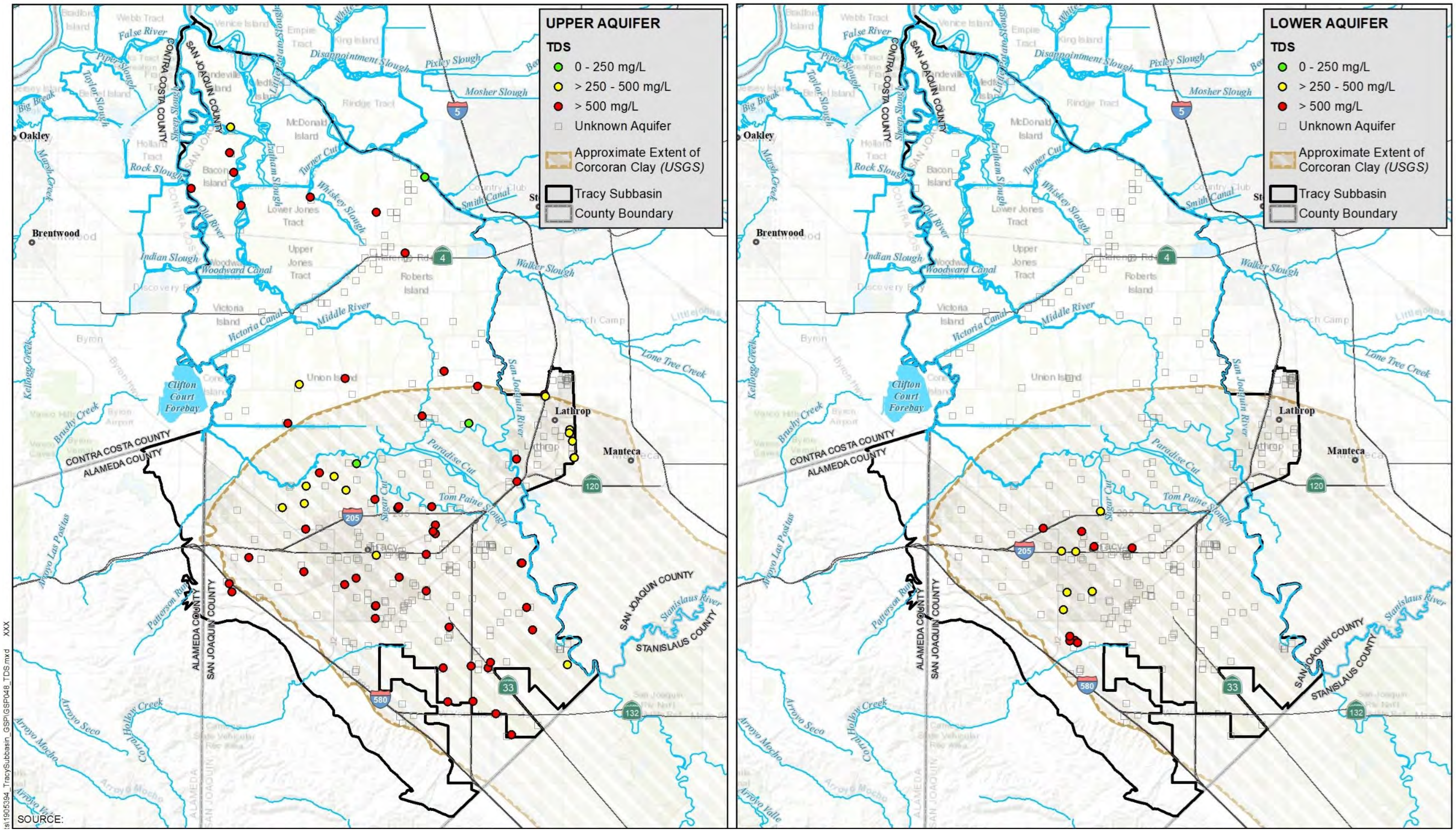

Figure 5-19. Distribution of TDS Concentrations

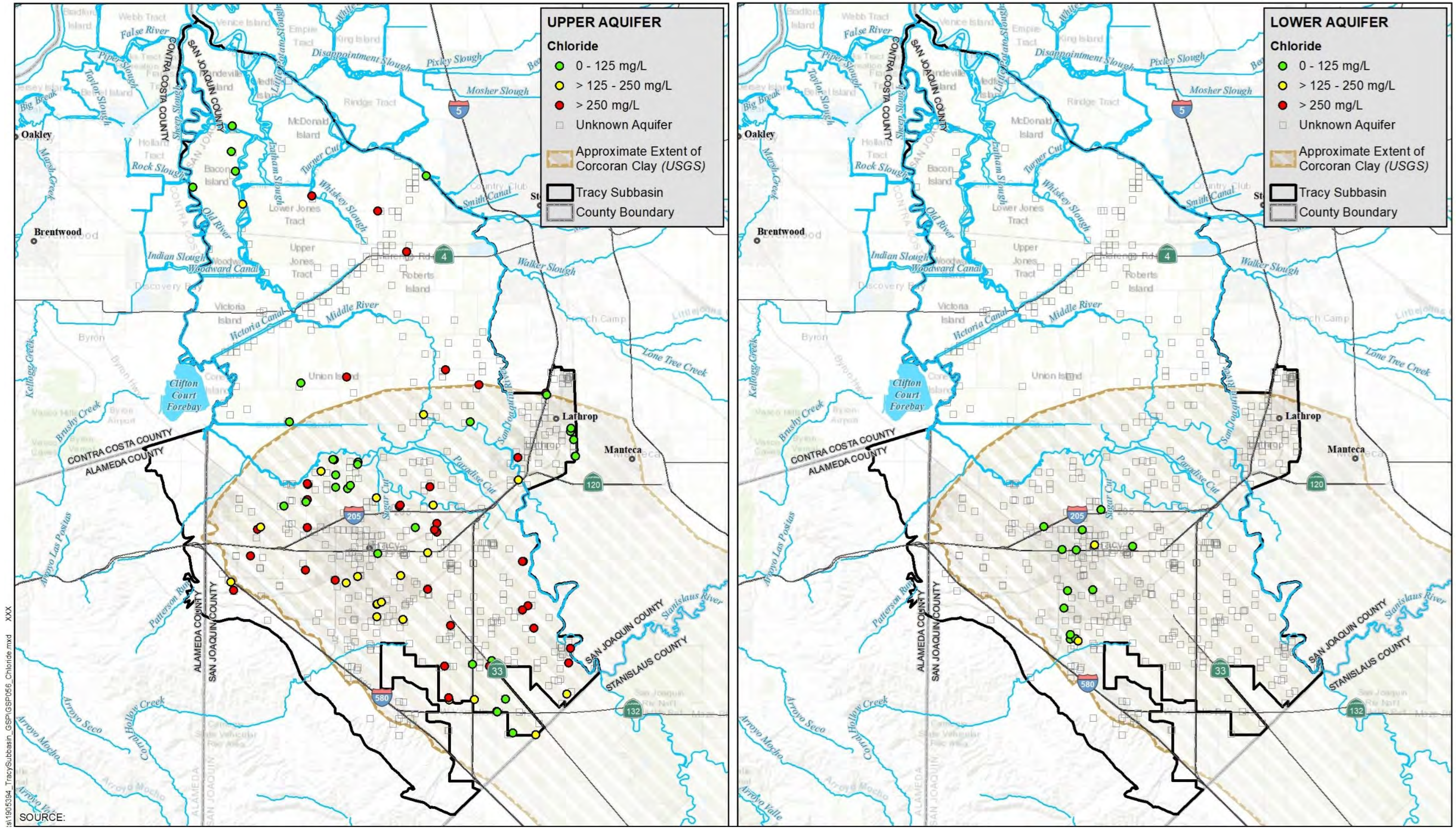

Figure 5-20. Distribution of Chloride Concentrations

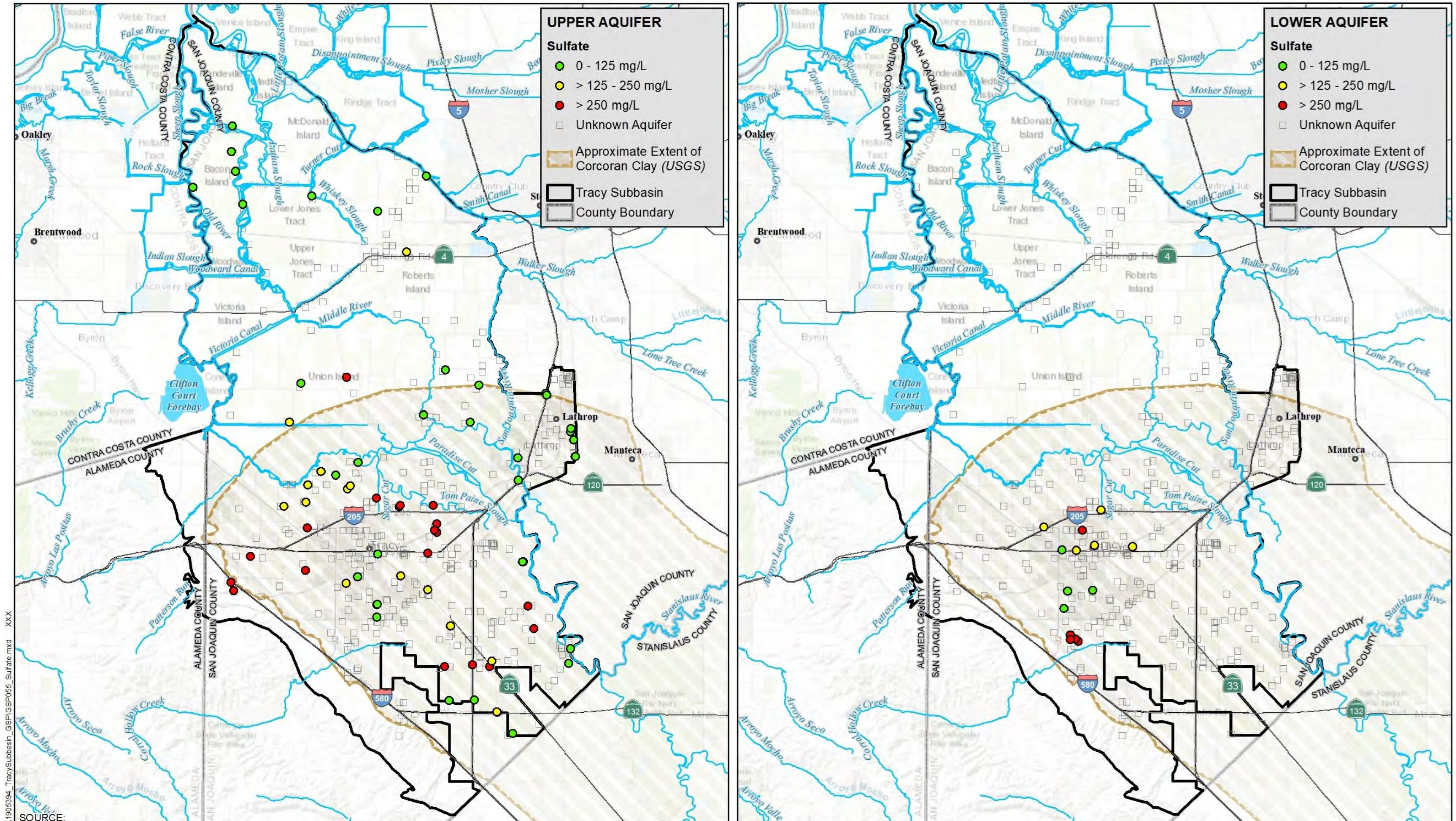

Figure 5-21. Distribution of Sulfate Concentrations

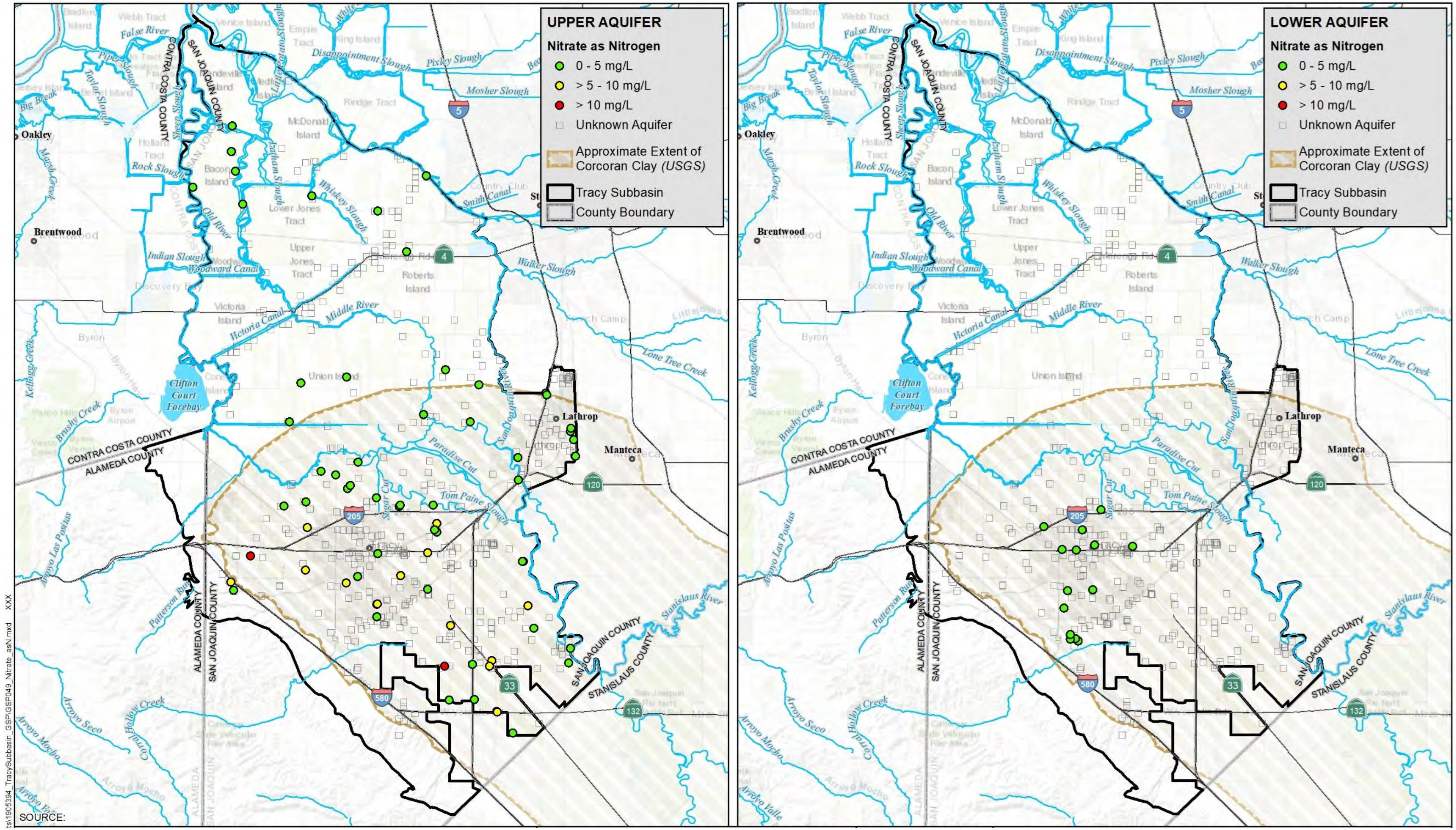

Figure 5-22. Distribution of Nitrate as Nitrogen Concentrations

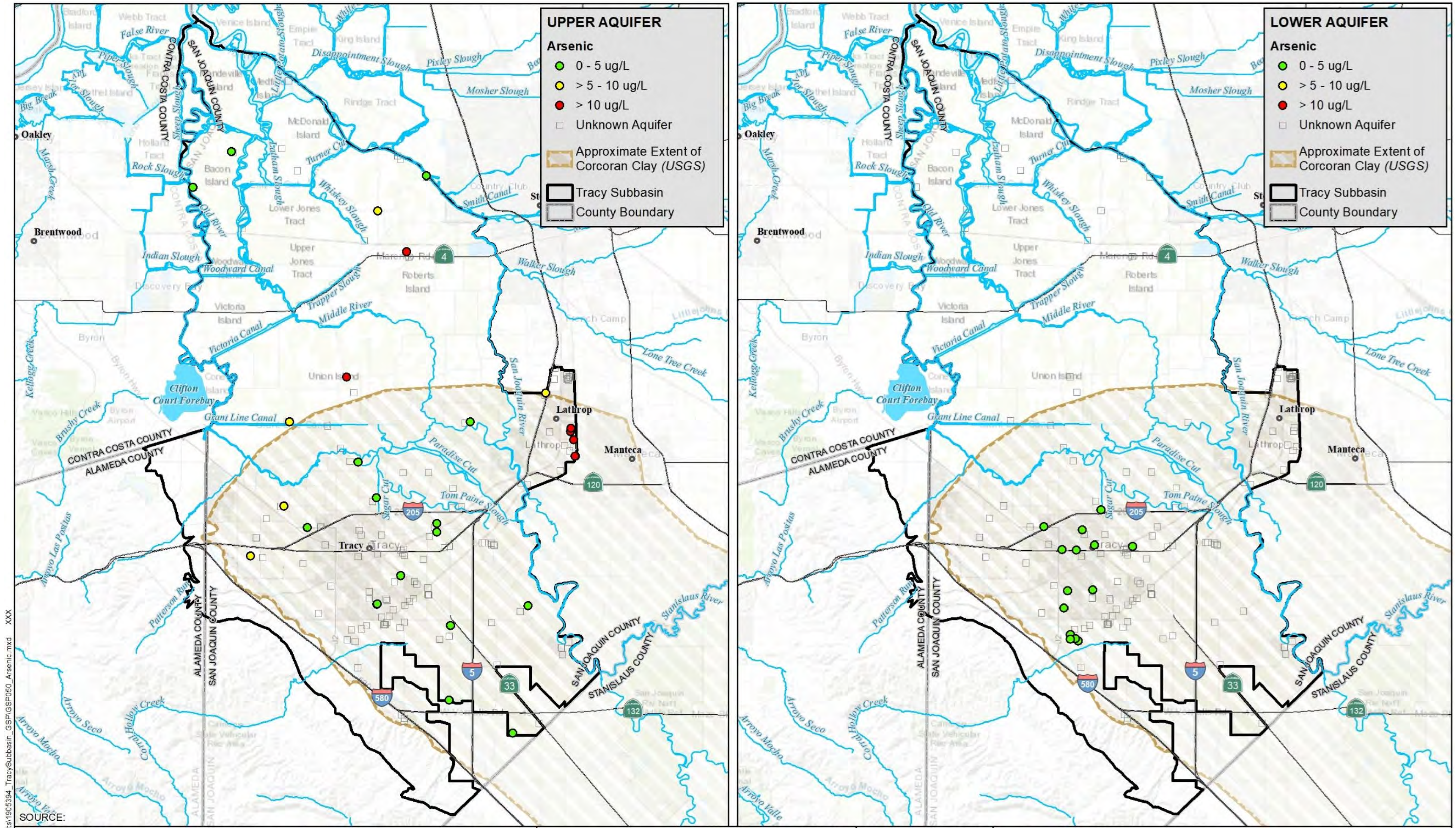

Figure 5-23. Distribution of Arsenic Concentrations

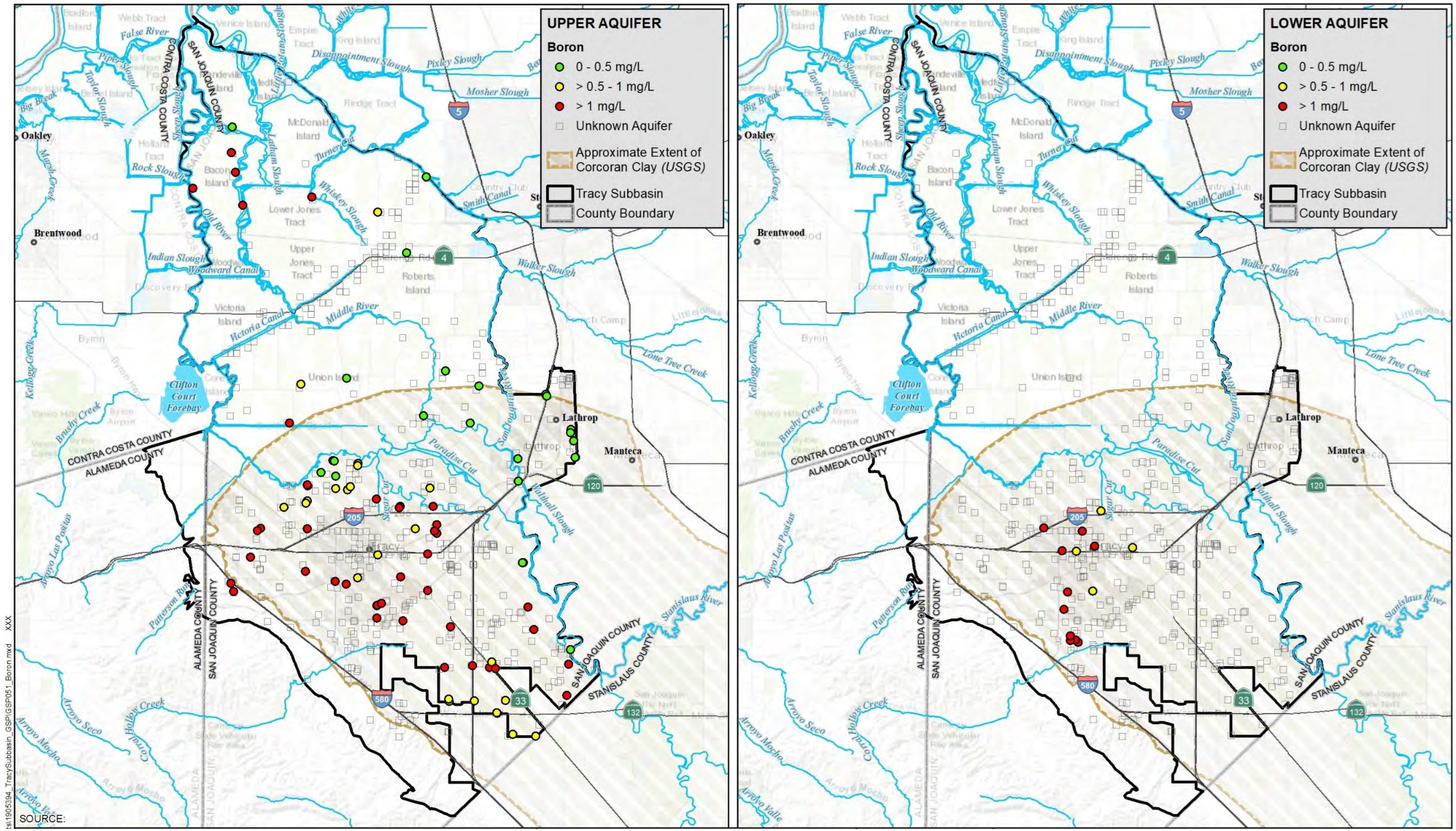

Figure 5-24. Distribution of Boron Concentrations

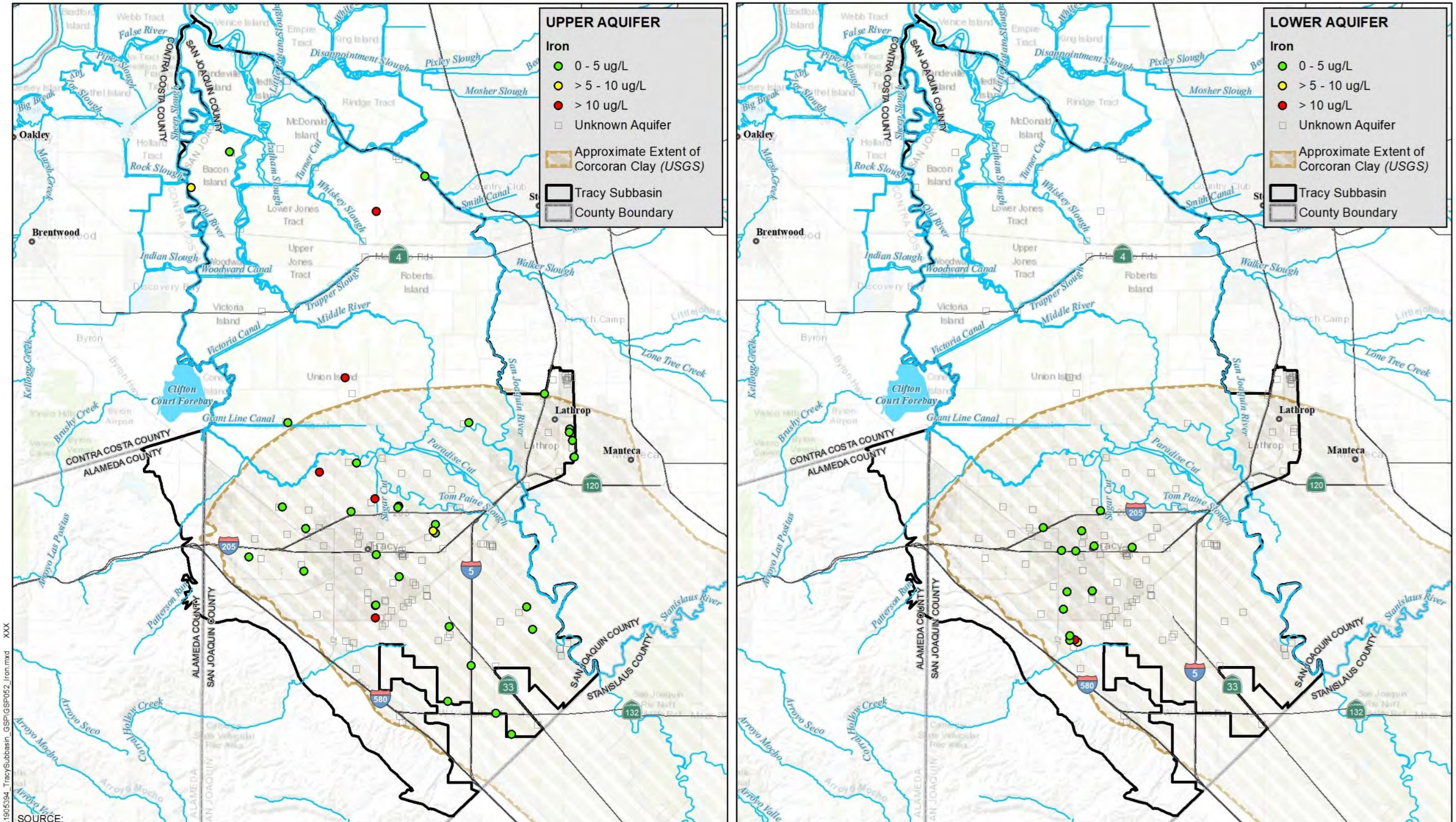

Figure 5-25. Distribution of Iron Concentrations

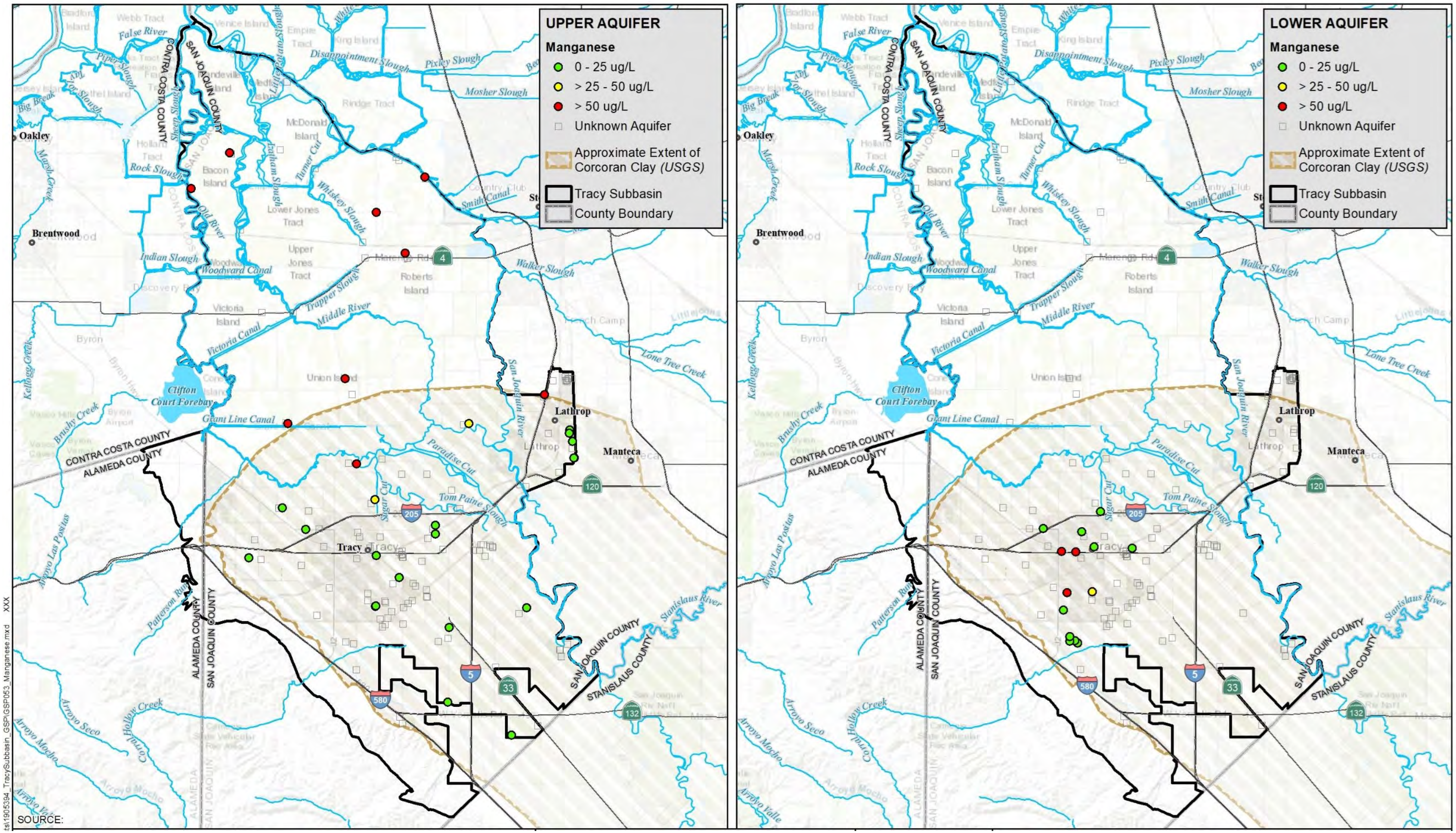

Figure 5-26. Distribution of Manganese Concentrations

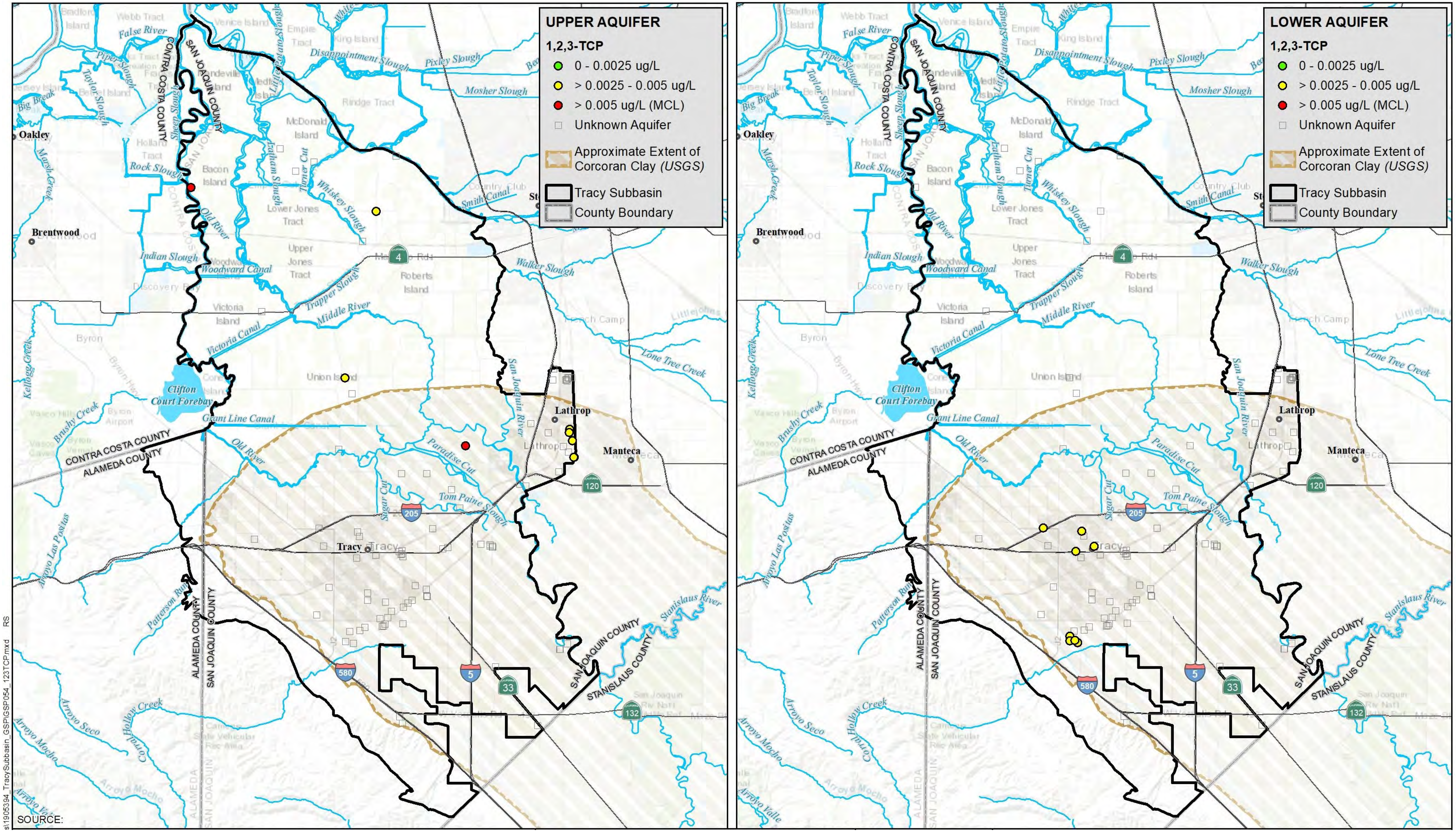

Figure 5-27. Distribution of 1,2,3 TCP Concentrations

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5.6.2 *Groundwater Quality Trends*

Water quality trends in the Subbasin have been evaluated only by a few studies. These studies indicate the following trends:

- In the City of Tracy, an evaluation of their Production Well #5 showed concentrations of manganese below the Corcoran Clay have been increasing.
- Recent studies by the City of Lathrop have also shown nitrate, manganese and iron are increasing.
- A Groundwater Assessment Report for most of the Westside San Joaquin River Watershed Coalition was performed as part of the Irrigated Lands Regulatory Program, and extends into the San Joaquin County, in the finger portion of the Delta Mendota Subbasin. The analysis used all wells in the GAMA data files (Luhdorff and Scalmanini 2015). It used a linear regression to assess trends. Only one well was present in this area and showed, a mildly increasing trend for both TDS and nitrate.

Groundwater quality trends were developed using data from PWS wells, and USGS and DWR wells and City of Tracy monitoring wells with known construction details and that could be assigned to the principal aquifer. A statistical trend analysis of the data was performed using the Mann-Kendall method when the well had more than five samples for a given element. This method is a non-parametric (for example, does not assume a distribution in the data) test for identifying trends in time-series data. **Appendix I** provides the analysis and trend graphs for each constituent and are grouped by principal aquifer**. Figures 5-28 through 5-36** show the trends for each element by principal aquifer. **Table 5-2** provides a summary of the analysis. The analysis shows that most wells with water quality data could not be assigned to an aquifer. Increasing trends are most prevalent for arsenic, iron, and manganese. Concentrations of 1,2,3 TCP are also rising in a few wells.

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Table 5-2. Water Quality Trend Summary

Element	Units	Number of Wells with +5 Samples			Number of Wells Known Aquifers	
		Unkown Aquifer	Upper Aquifer	Lower Aquifer	Increasing Trends	No or Decreasing Trends
Arsenic	ug/L	49	5	26	11	69
Boron	mg/L	25	6	26	3	54
Chloride	mg/L	35	9	26	9	61
Iron	ug/L	38	4	26	12	56
Manganese	ug/L	38	4	26	15	53
Nitrate as Nitrogen	mg/L	111	7	26	24	120
TDS	mg/L	36	5	26	11	56
Sulfate	mg/L	33	7	26	7	59
1,2,3 TCP	ug/L	49	5	8	5	57

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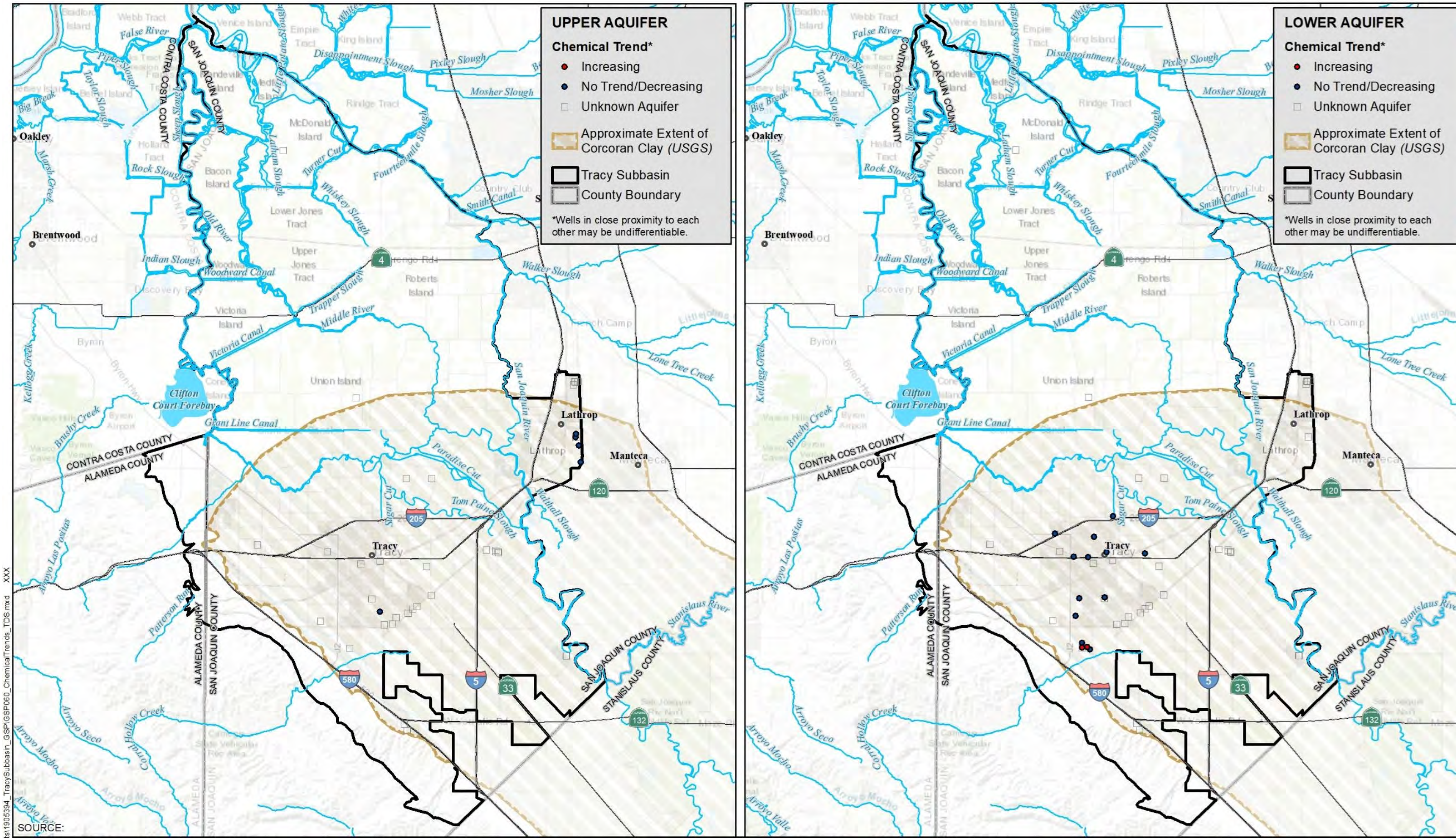

Figure 5-28. TDS Trends by Principal Aquifer

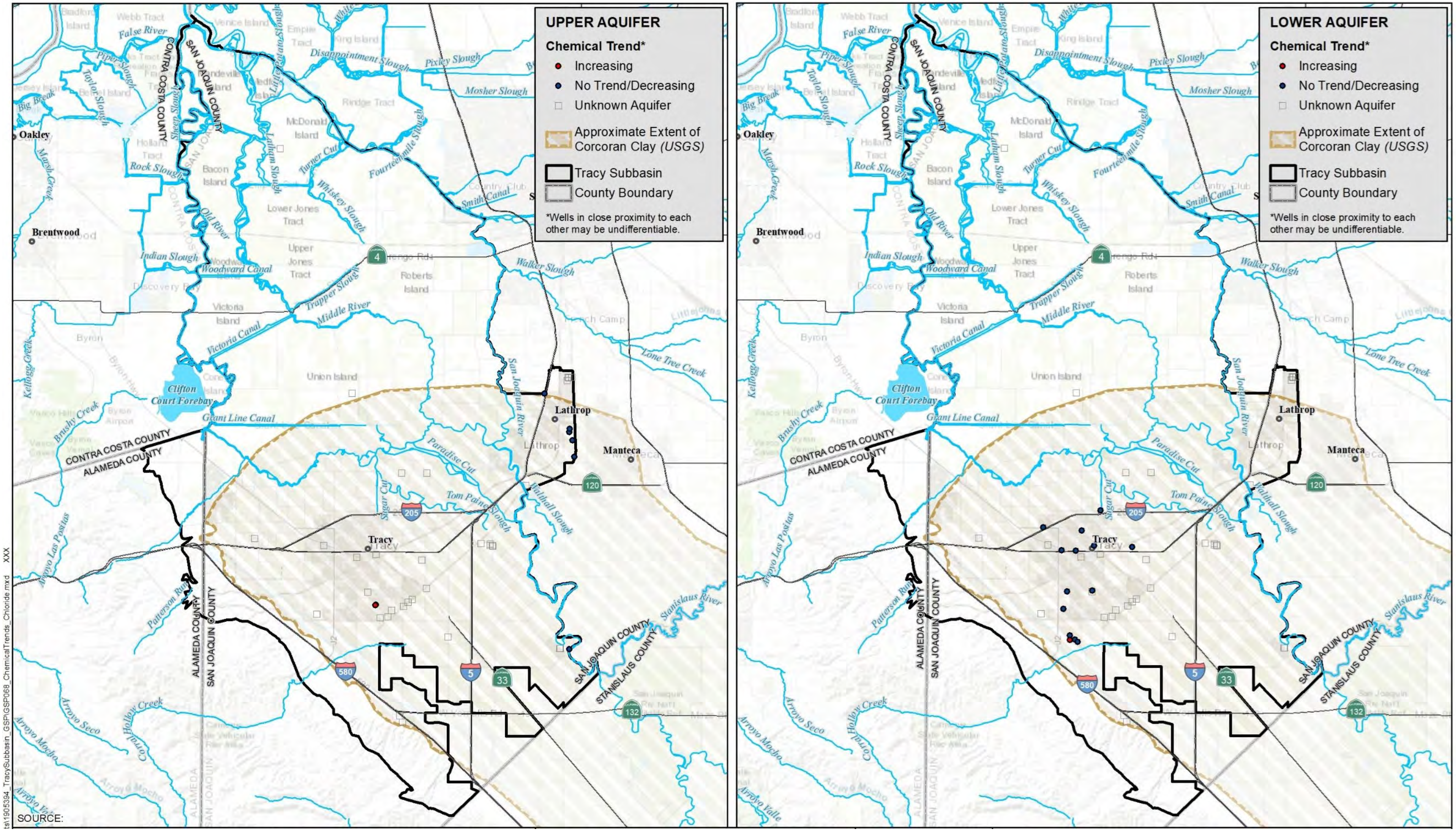

Figure 5-29. Chloride Trends by Principal Aquifer

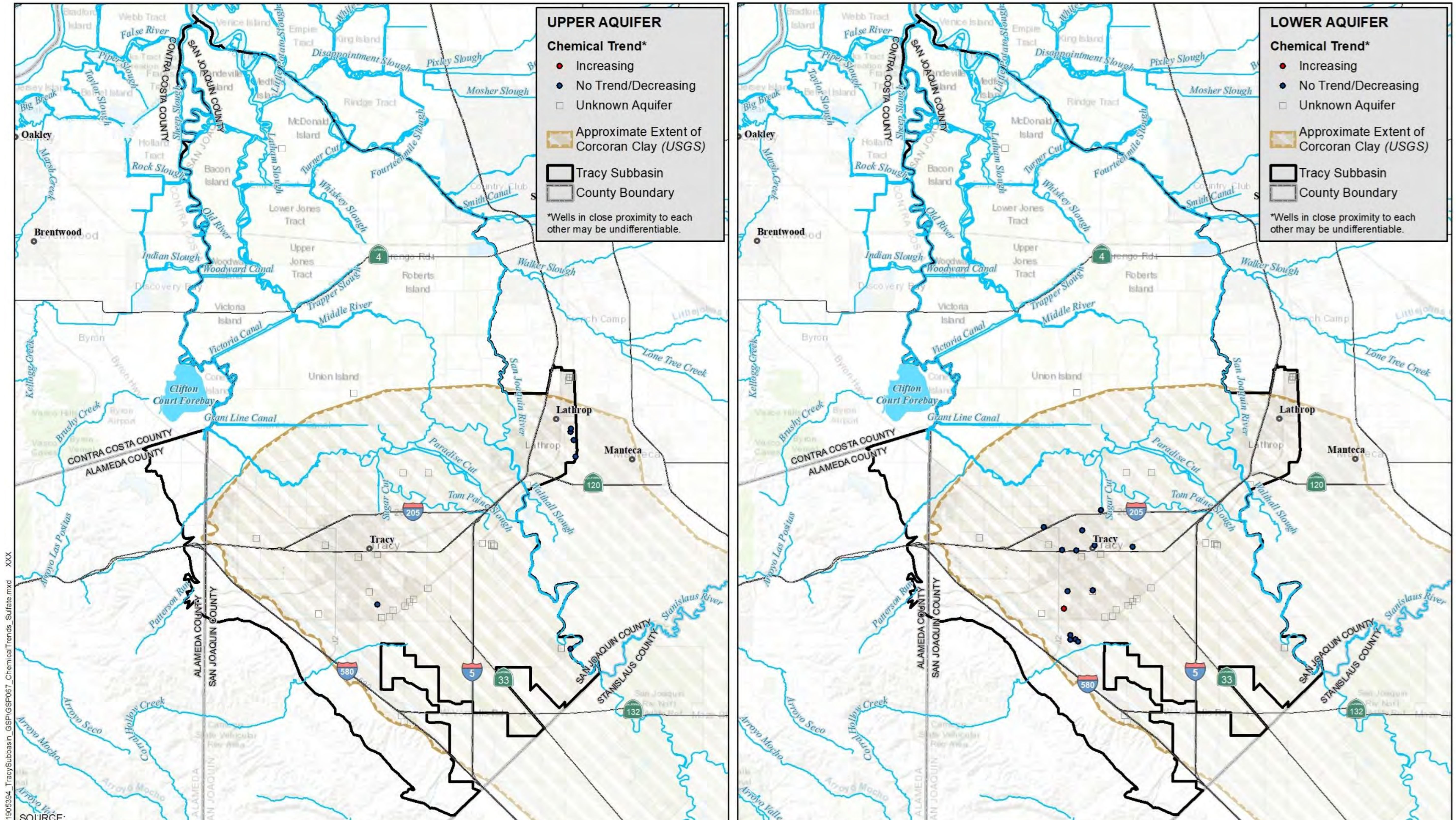

Figure 5-30. Sulfate Trends by Principal Aquifer

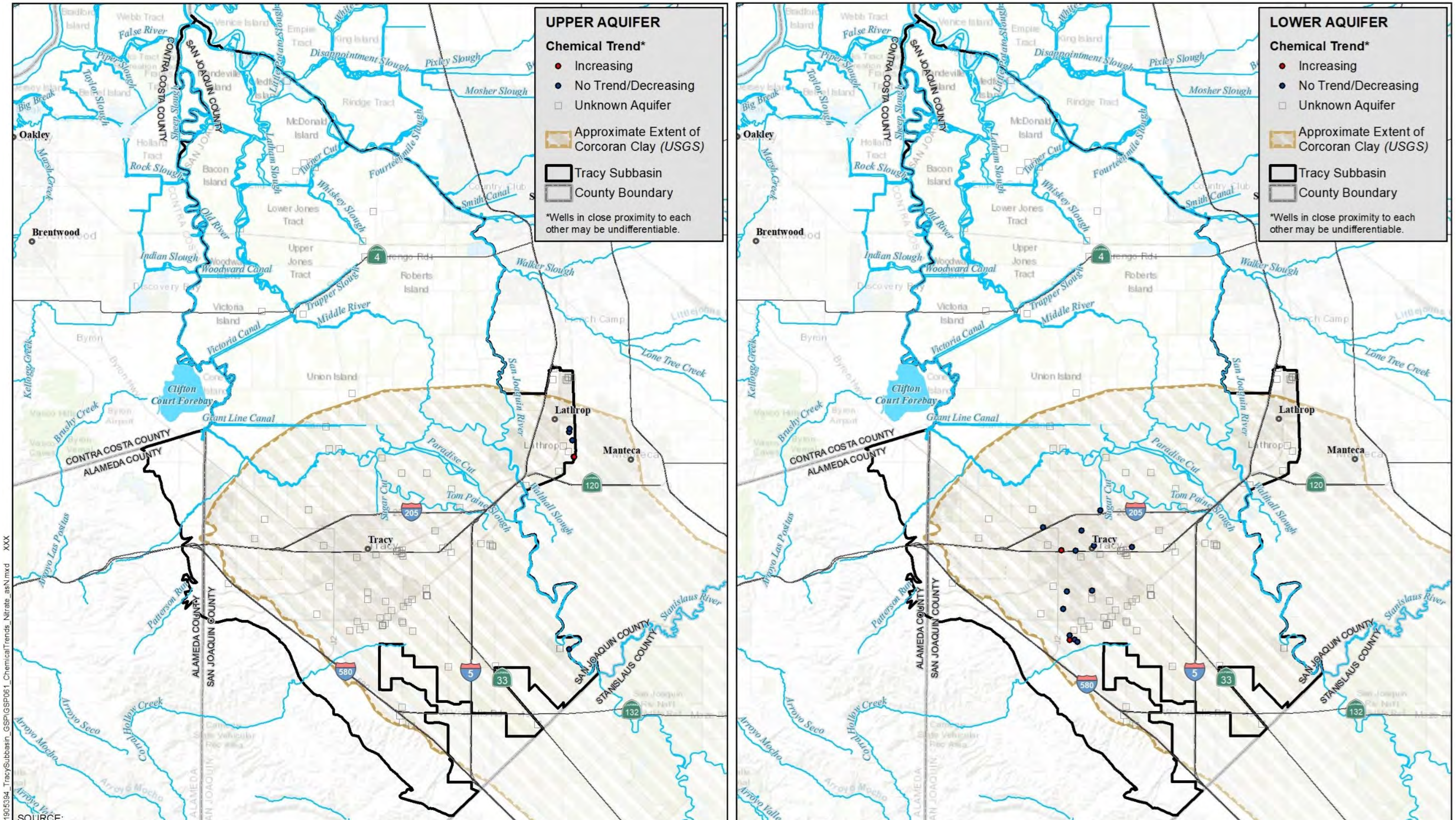

Figure 5-31. Nitrate as Nitrogen Trends by Principal Aquifer

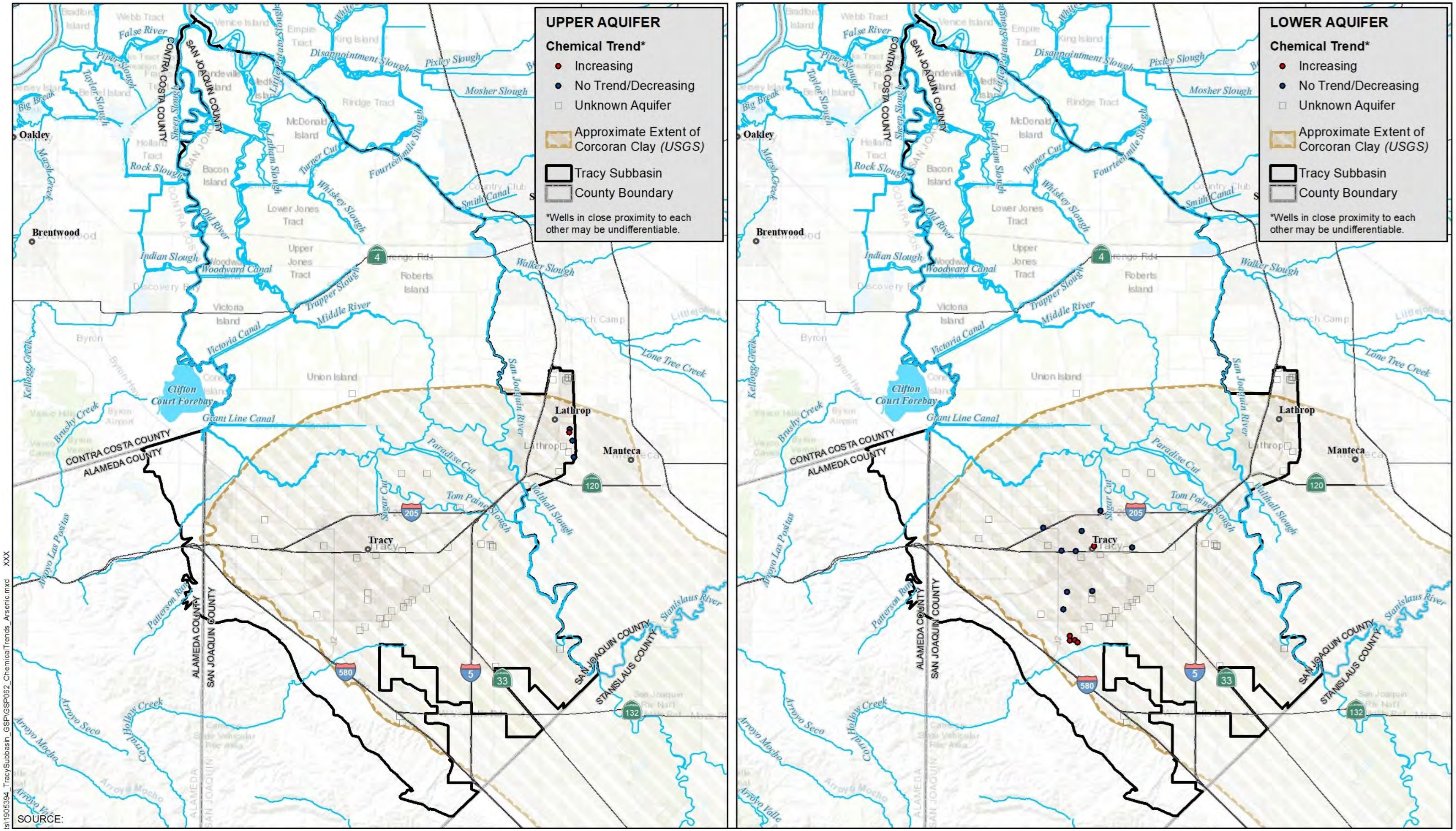

Figure 5-32. Arsenic Trends by Principal Aquifer

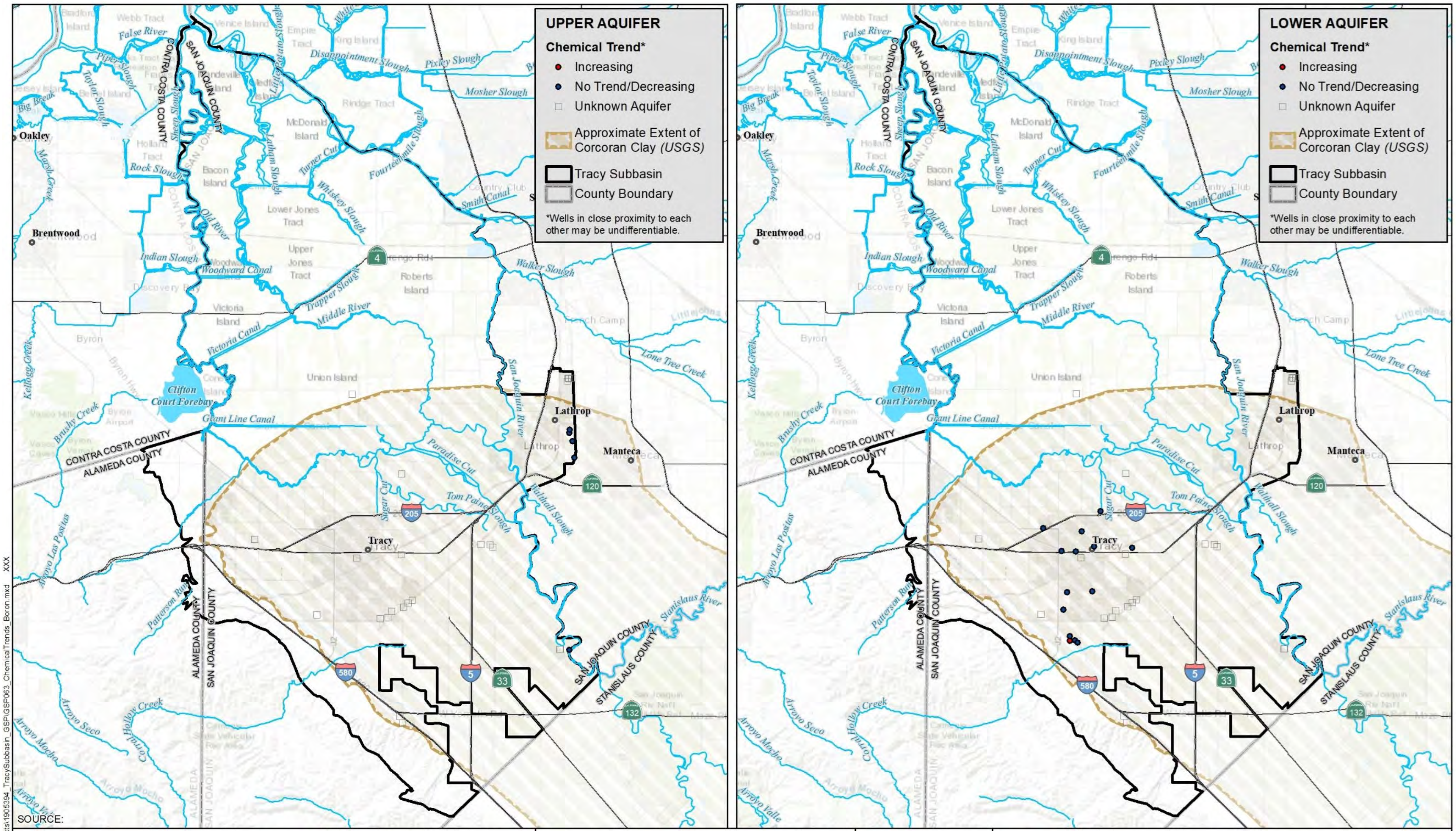

Figure 5-33. Boron Trends by Principal Aquifer

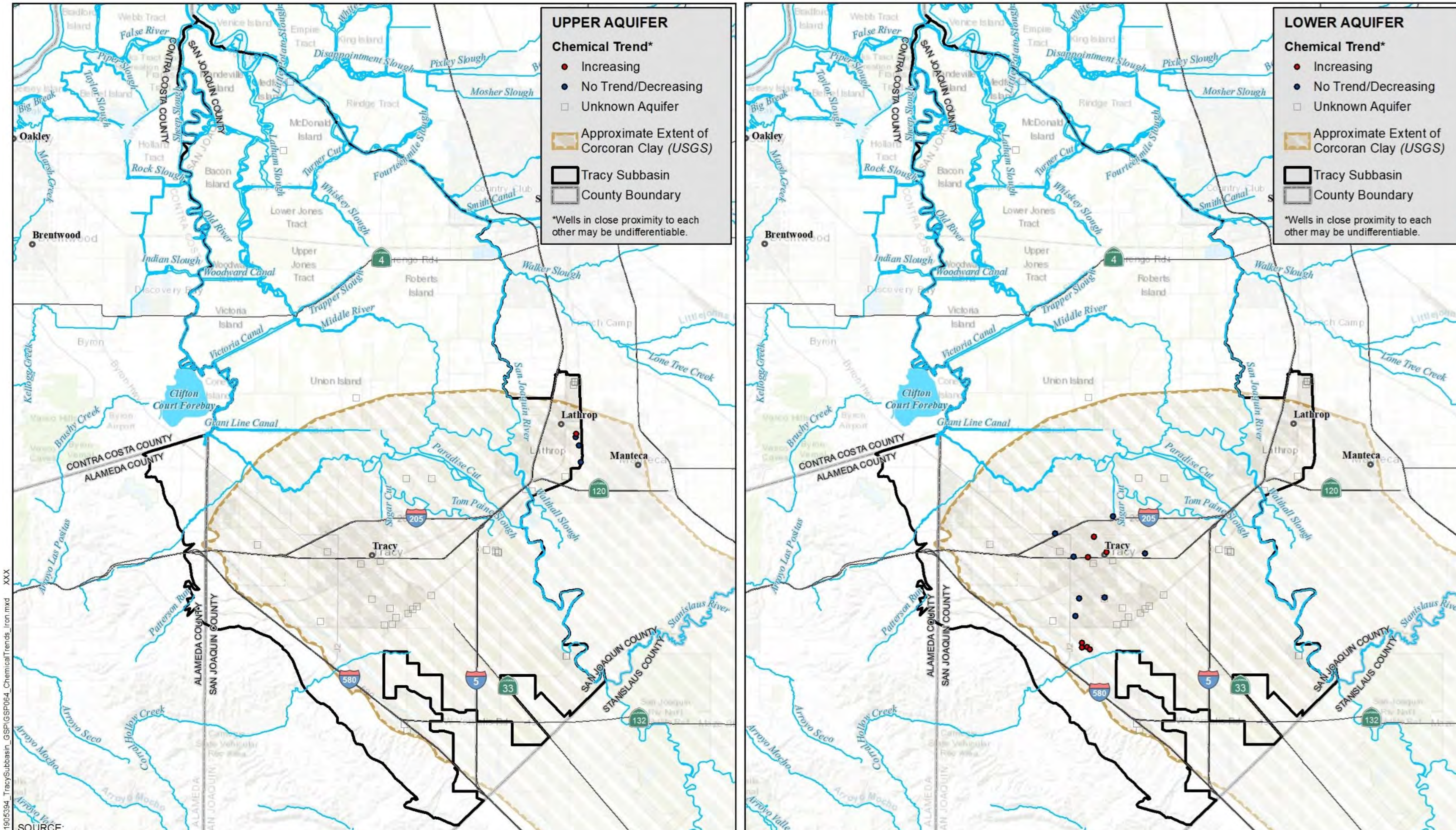

Figure 5-34. Iron Trends by Principal Aquifer

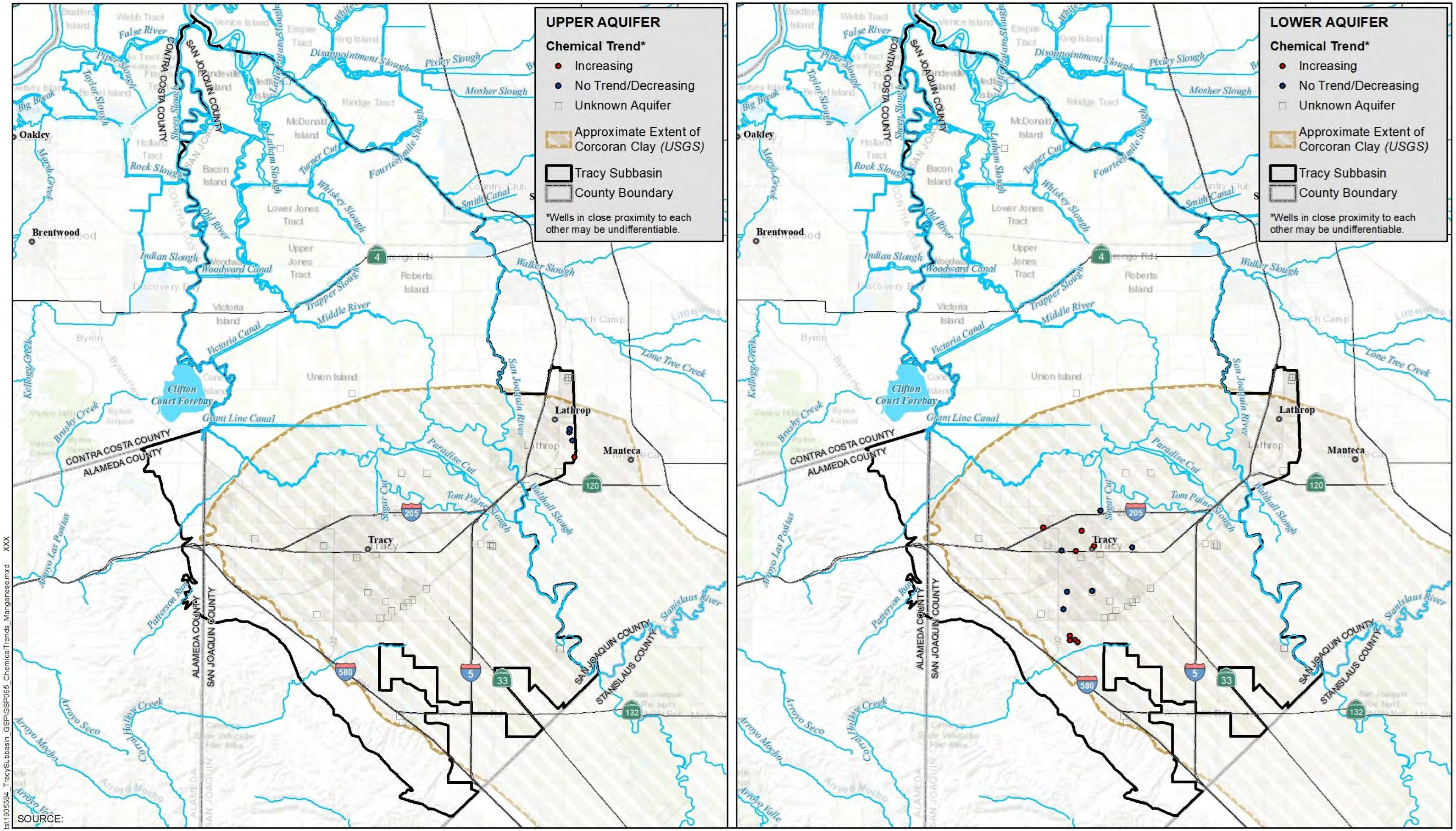

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Figure 5-35. Manganese Trends by Principal Aquifer

5.6.3 *Groundwater Contamination Sites and Plumes*

In the Tracy Subbasin there are a few large and known groundwater contamination sites that could affect supply and beneficial uses of groundwater in the Subbasin. The most significant of these sites are former Occidental Chemical Corporation site, Sharpe Army Depot site, and the Army Tracy Depo (**Figure 5-37**). Cleanup activities have been in progress for multiple years and contaminants appear to be contained, although off site at some locations, based on reports submitted for regulatory purposes.

There are over 100 small sites that may present threats to local groundwater quality. These sites may have leaking underground storage tanks, improperly stored pesticides, leaking dry cleaning solvents, or other point sources of contamination. While the threat from many of these sites can be mitigated, the aggregate impact from undetected point-source contamination of groundwater quality in the basin cannot be determined.

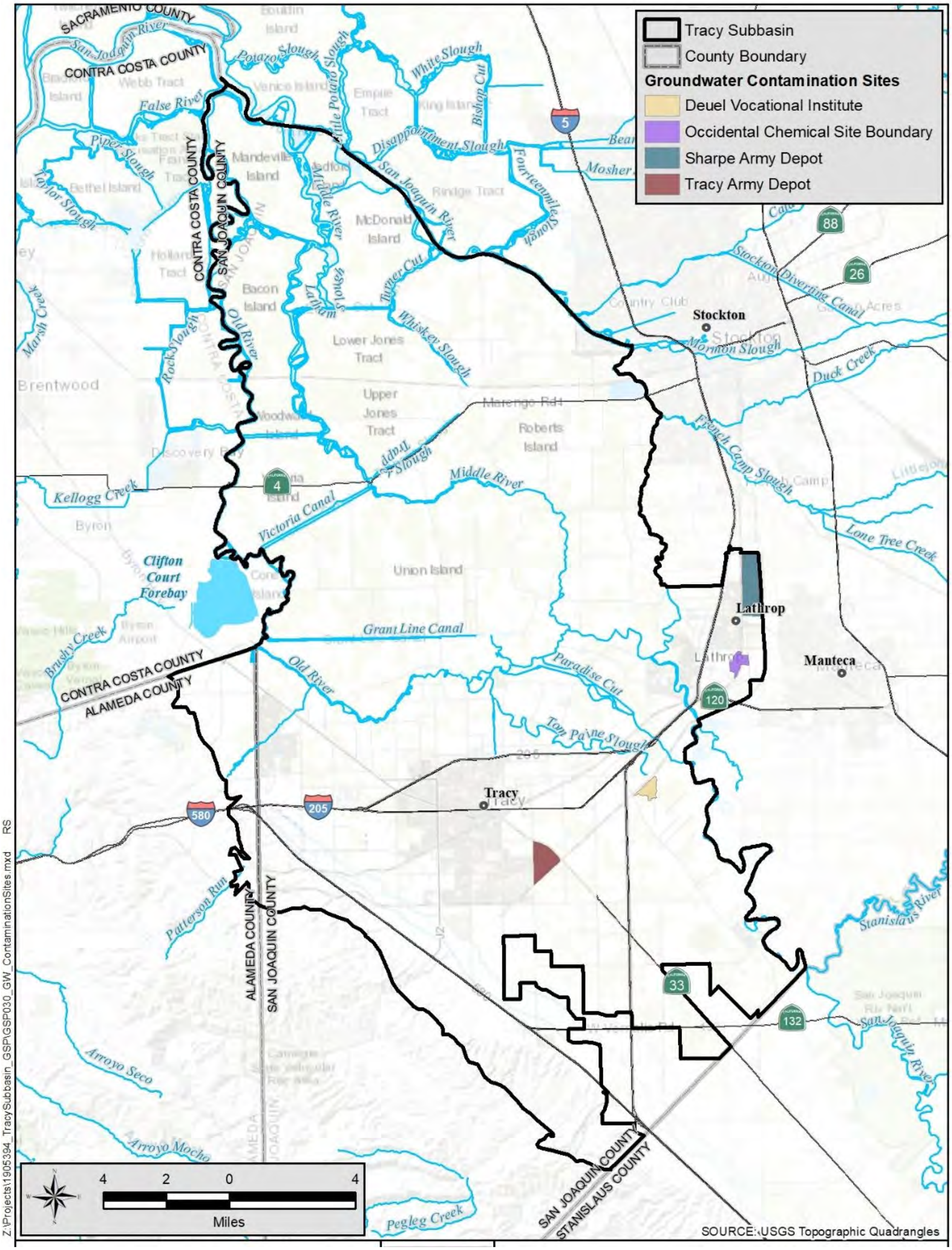

Figure 5-36. Groundwater Contamination Sites

5.7 Seawater Intrusion

Seawater enters the San Francisco Bay estuary and mixes with freshwater from the Sacramento and San Joaquin Rivers to become brackish water. Brackish water salt concentrations can vary greatly but in the Delta area those concentrations are typically far less salty than pure seawater. The Tracy Subbasin is in the Delta area where brackish water (chloride levels greater than 1,000 mg/L) has migrated into the Delta waterways and potentially infiltrated into the aquifers prior to construction of Shasta Dam in 1943. Prior to 1943, brackish water had entered the surface waterways throughout the Delta areas of the Subbasin, except for portions of Union Island, Upper Roberts Island, and the Stewart Tract (DWR 1995). While the Delta ecosystem evolved with a natural salinity cycle that brought brackish tidal water in from the San Francisco Bay, levees installed to allow development of agriculture, followed by development and operation of the Central Valley Project and the State Water Project, have altered the inward movement of seawater through the Delta. Current management practices endeavor to maintain freshwater flows through a combination of hydraulic and physical barriers and alterations to existing channels (Water Education Foundation 2019). Seawater in the Delta waterways since 1943 has been limited to the areas west of the Subbasin, west of Discovery Bay. With saltwater in surface water, some saltwater may have historically infiltrated into the aquifers and locally affected groundwater quality.

Portions of the Tracy Subbasin and neighboring Eastern San Joaquin Subbasin do, however, experience groundwater quality issues related to elevated levels of chloride and TDS (salinity). The elevated levels in the Eastern San Joaquin Subbasin, and likely in the Tracy Subbasin, are due to three causes (Izbicki, et al. 2006):

- Evaporated irrigation return water in shallow wells. However, increases in chloride concentrations from evaporation of irrigation water are small compared to chloride inputs from the Delta and underlying deposits.
- Entrainment of seawater in Delta deposits during deposition of Delta sediments or more recently.
- Groundwater in deeper aquifers being affected by underlying marine sediments.

Although there may be migration of groundwater from underlying marine sediments, it is important to note that this is not considered sea water intrusion but would be water quality degradation, if occurring.

5.8 Subsidence

Subsidence monitoring in the Tracy Subbasin consists of a continuously recording CGPS station and over 30 benchmarks or stations that are surveyed on an irregular basis. UNAVCO’s Plate Boundary Observatory Program (formerly University Navigation Satellite Timing and Ranging or NAVSTAR Consortium), constructed a continuous recording CGPS station (P257) in the Subbasin for precise determination of plate motion, transient deformation related to earthquakes and subsidence along with multiple other potential uses. The SLDMWA makes periodic surveys using GPS along the DMC to identify key areas of active land subsidence and to estimate subsidence rates. When the City of Tracy increased their pumping from 5,800 to nearly 8,000 AFY (2001-2005), six benchmarks were installed near their monitoring wells and annually surveyed during this period. **Figure 5-38** shows these benchmark station locations. **Appendix J** contains benchmark elevation correlations to groundwater levels.

The TRE Altamira InSAR subsidence dataset also provides subsidence monitoring in California and the results are displayed on DWR's SGMA Data Viewer. The tested accuracy of the InSAR was 0.06 feet (18 millimeters) vertical accuracy at a 95 percent confidence level. This statement of accuracy applies to the state-wide dataset and may vary for regional or localized area subsets. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95 percent confidence level. Therefore, adding to two accuracy factors together, the error factor in the InSAR data is about 0.1 feet. A land surface change of less than 0.1 feet is therefore within the noise of the data and is not evidence of subsidence in the Subbasin.

Based on the geologic conditions and causes, the subsidence discussion below is divided into the Delta and non-Delta areas.

Delta Area

Delta peat and mud deposits formed during the last 7,000 years under tidal wetland conditions (Atwater 1982). The area of peat soils encompasses about 200,000 acres (Deverel and Leighton 2010). Plant material decayed and accumulated under anaerobic conditions as sea level increased (Shlemon and Begg 1975). Peat thicknesses generally decrease from the west to east and towards the periphery of the Delta. Peat thickness ranges from less than 3 feet on the eastern, southern, and northern margins of the Delta to over 30 feet in the western Delta.

Oxidation of the peat deposits (organic carbon), the primary cause of subsidence (Deverel and Rojstaczer 1996), began in the late 1800s as the nutrient-rich soils were cleared and dewatered for agriculture. Since then, island elevations have decreased to as much as 25 feet below sea level. Drainage of soils for agriculture has increased microbial oxidation of organic carbon which resulted in land subsidence at rates of less than 0.5 to over 1 inch per year (Deverel and Leighton 2010). Based on the NASA JPL data, the Delta area of the Subbasin subsided between 4 and 8 inches (~0.25 to 0.5 feet per year) between May 2015 and September 2016 (Farr et al 2016). As there is little to no groundwater pumping in the Delta, this subsidence is related to peat oxidization.

Non-Delta Area

There are a series of GPS benchmark stations along the DMC, with subsidence monitoring data that extends from 1984 to 2018. **Figure 5-38** shows locations of the stations and changes in ground surface as they relate to subsidence in the area. Over the 34-year data period, the ground surface level has dropped about 0.25 feet in the western portion of the Subbasin, (~0.01 feet per year) to as much as 0.71 feet (0.022 feet per year) near the southeastern end of the Subbasin. Within San Joaquin County, but outside of the Subbasin, there has been as much as 1.27 feet (0.035 feet per year) of subsidence at one station near the Stanislaus county line. **Appendix J** provides groundwater levels as they relate to subsidence at these benchmarks.

Between 2007 and 2010 land-surface deformation measurements indicated that much of the northern portion of the Delta-Mendota Canal was minimally subsiding on an annual basis; some areas showed seasonal periods of subsidence and of uplift, which resulted in either no longer-term elevation change or a slight loss in elevation. However, many wells in this area did not reach historical lows during this time period (Sneed et al. 2013).

DWR SGMA Data Viewer for land subsidence summarizes the annual (12-month periods) vertical displacement during selected time periods ranging from January 1, 2015 through October 1, 2020 (DWR 2020). **Figure 5-39** shows the vertical displacements from 2015 through 2020. Vertical displacements within the non-Delta portion of the Subbasin for the first 12 months shortly after SGMA was passed, from January 1, 2015 through January 1, 2016, ground surface elevation changes ranged from +0.014 to -0.025 feet. For the total period of record January 1, 2015 through October 1, 2020 subsidence ranged from +0.006 to -0.128 feet, or about +0.001 to -0.03 feet per year. The highest values were near the Delta-Mendota canal near the southern edge of the Subbasin and are likely real due to the values exceeding the error factor, in the InSAR data. As shown on **Figure 5-7** groundwater levels in the Lower aquifer have only declined in this area by about 15 feet and are still above the top of the Corcoran Clay, suggesting the subsidence in this area may not be related to groundwater level declines. A new monitoring well is proposed for this area better assess groundwater level changes.

The continuous recording CGPS station P257 provides for a relatively long-term assessment, 2006 through present, including the recent drought when reliance on groundwater was higher. **Figure 5-40** shows the measurements along with groundwater levels in a nearby monitoring well screened below the Corcoran Clay. From 2006 thru 2012 there was no apparent inelastic subsidence. During the drought groundwater levels in the Lower aquifer declined by about 15 feet, but were still above historic low levels, and there was an apparent subsidence of about 0.04 feet. The land surface has not rebounded to pre-2012 levels but groundwater levels are slowly rising. Since 2016, there does not appear to be any inelastic subsidence, only elastic, even though groundwater levels have recovered to within 5 feet of 2012 levels. Because groundwater levels are rising it does not appear that the subsidence is related to groundwater pumping.

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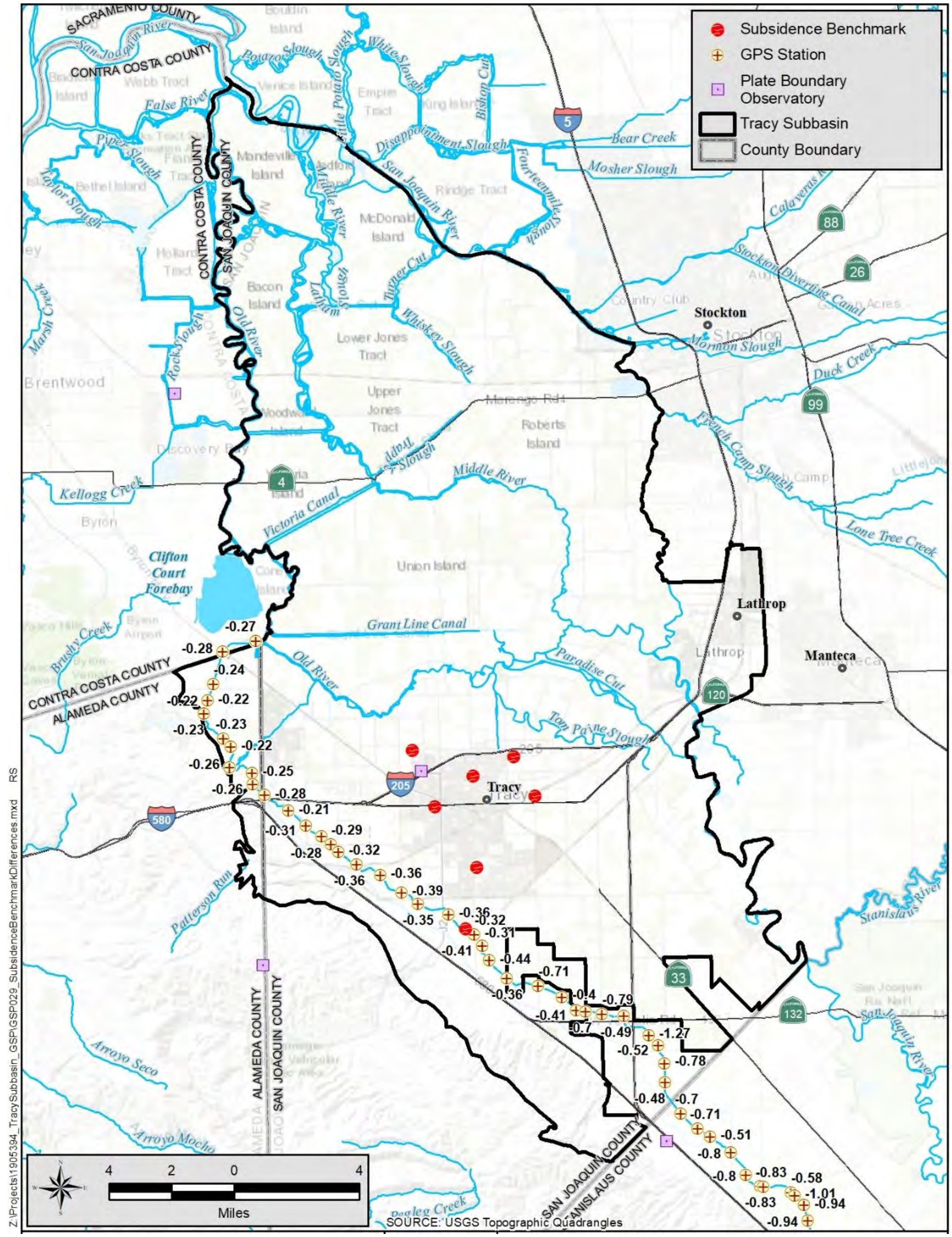

Figure 5-37. Benchmark Differences 1984-2018 (in Feet)

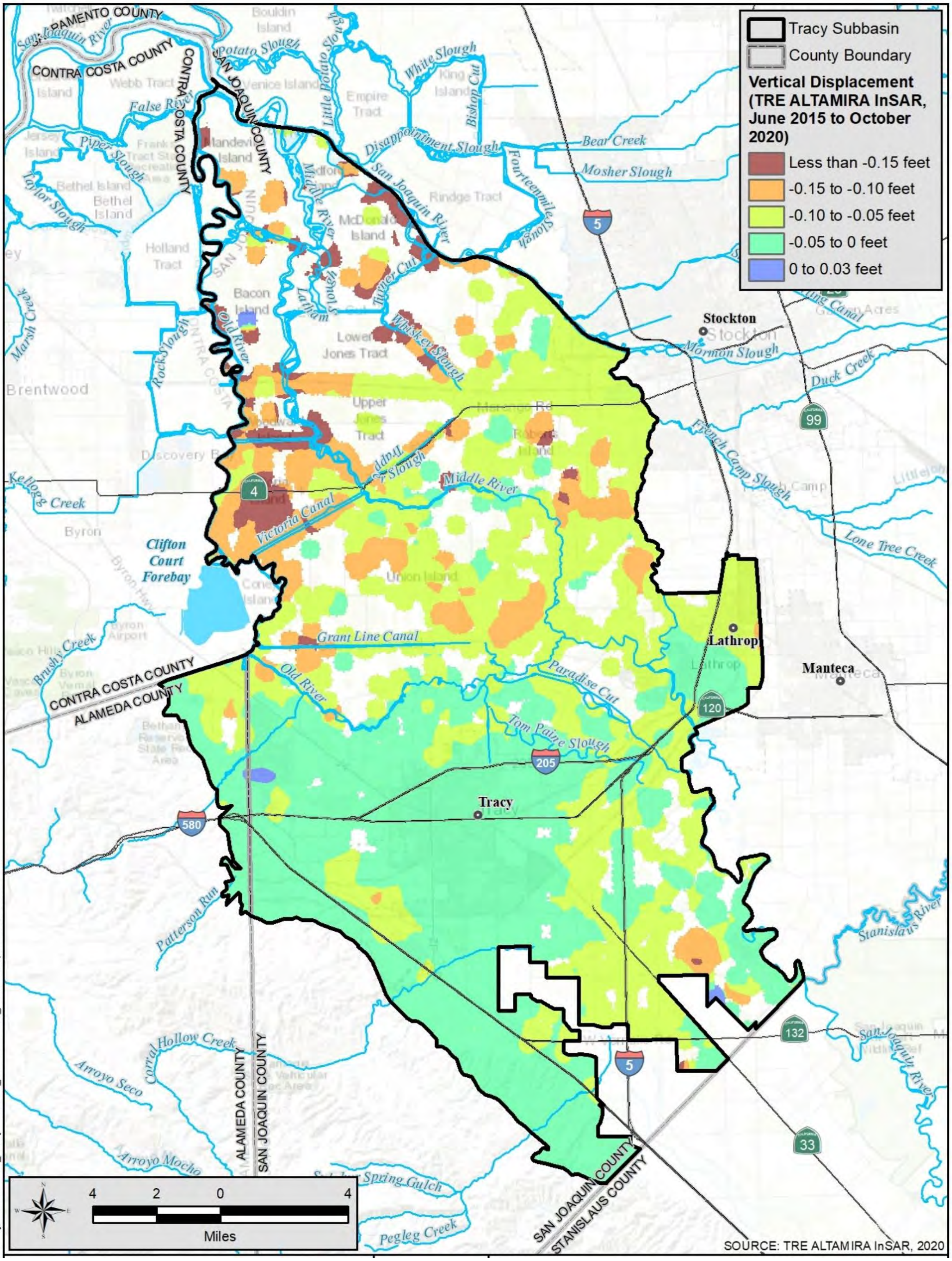

Figure 5-38 InSAR Imagery Subsidence

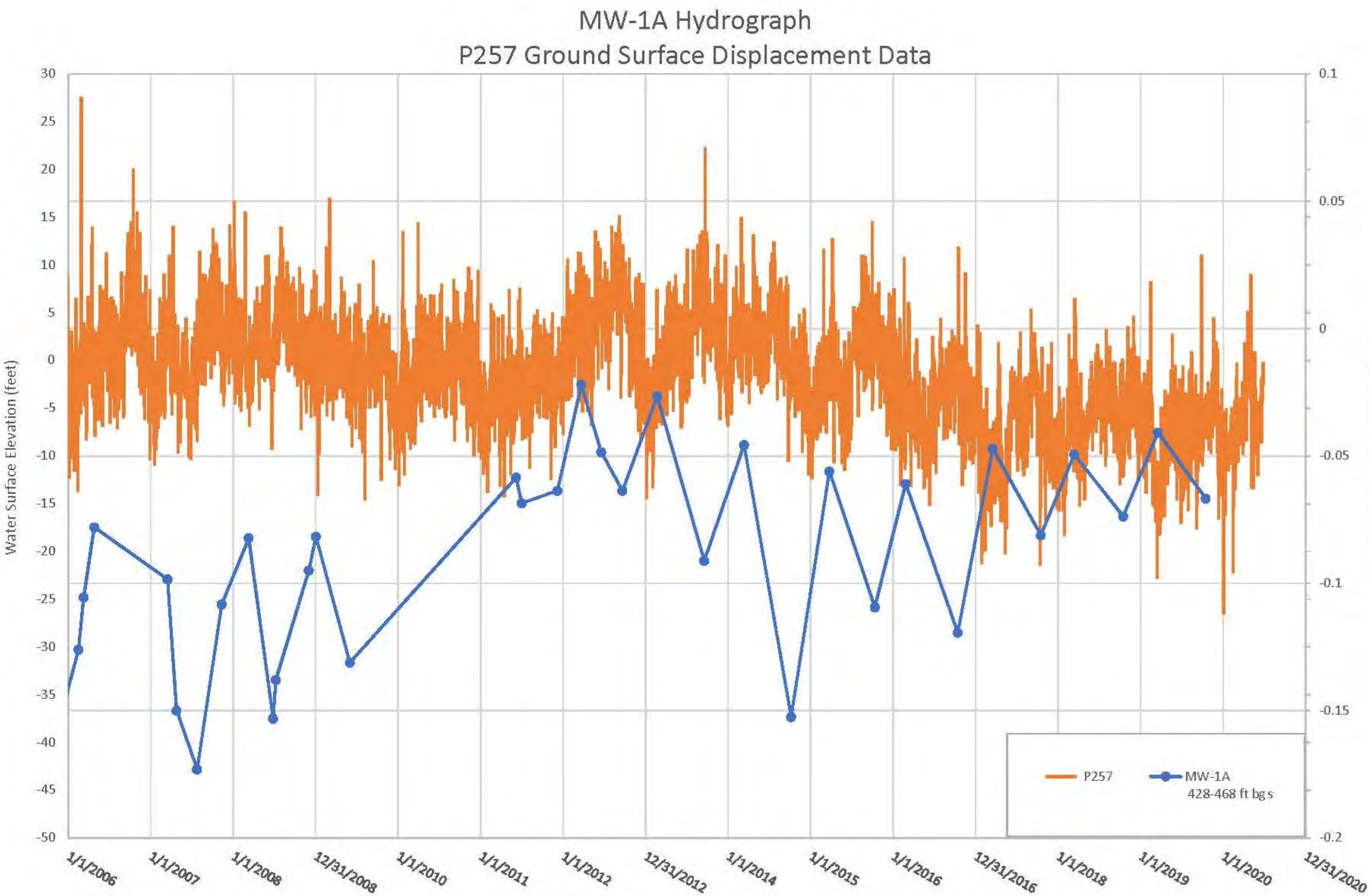

Figure 5-39 Continuous Reading CGPS Station *versus* Groundwater Levels

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5.9 Interconnected Surface Water

Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted (CCR 2014). The groundwater elevation map for the Upper aquifer provides an initial indication of whether the rivers and creeks are interconnected or disconnected in the Tracy Subbasin. For purposes of this GSP the rivers and creeks were assumed to be interconnected to the aquifers when the depth to water is less than 20 feet bgs.

Delta Area

In general, surface water and groundwater are interconnected along the San Joaquin and Old rivers, channels, and within the Delta islands portion of the Tracy Subbasin.

Non-Delta Area

As discussed in **Chapter 4 – Hydrogeologic Conceptual Model**, the non-Delta area of the Subbasin are the lands south of the Old River and Tom Paine Slough, where ground surface is higher in elevation and groundwater surface elevations are lower. As shown on **Figure 5-41**, along the rivers and sloughs groundwater is interconnected with some areas gaining and loosing. Although the data set for interconnectedness along Old River has “no groundwater data”, there are sufficient groundwater level measurements (01S05E31R002 and 2S05E08B001) to indicate the conditions along this portion of the river, but it is likely to be likely connected and is a losing interval based on groundwater elevations. **Appendix K** hydrographs for the non-Delta area shows most areas with monitoring wells are losing intervals, where groundwater levels are lower than the surface water elevations. In some cases, where multiple wells can show the gradient, near GLC river gage, the gradient from the non-Delta area is toward the river suggesting a gaining interval. The creeks in the non-Delta are intermittent, not flowing year-round, and along with the depth to water, surface water in Corral Hollow and Lone Tree Creek are considered to be disconnected from groundwater. Gages are not present along these creeks to illustrate when they cease to flow.

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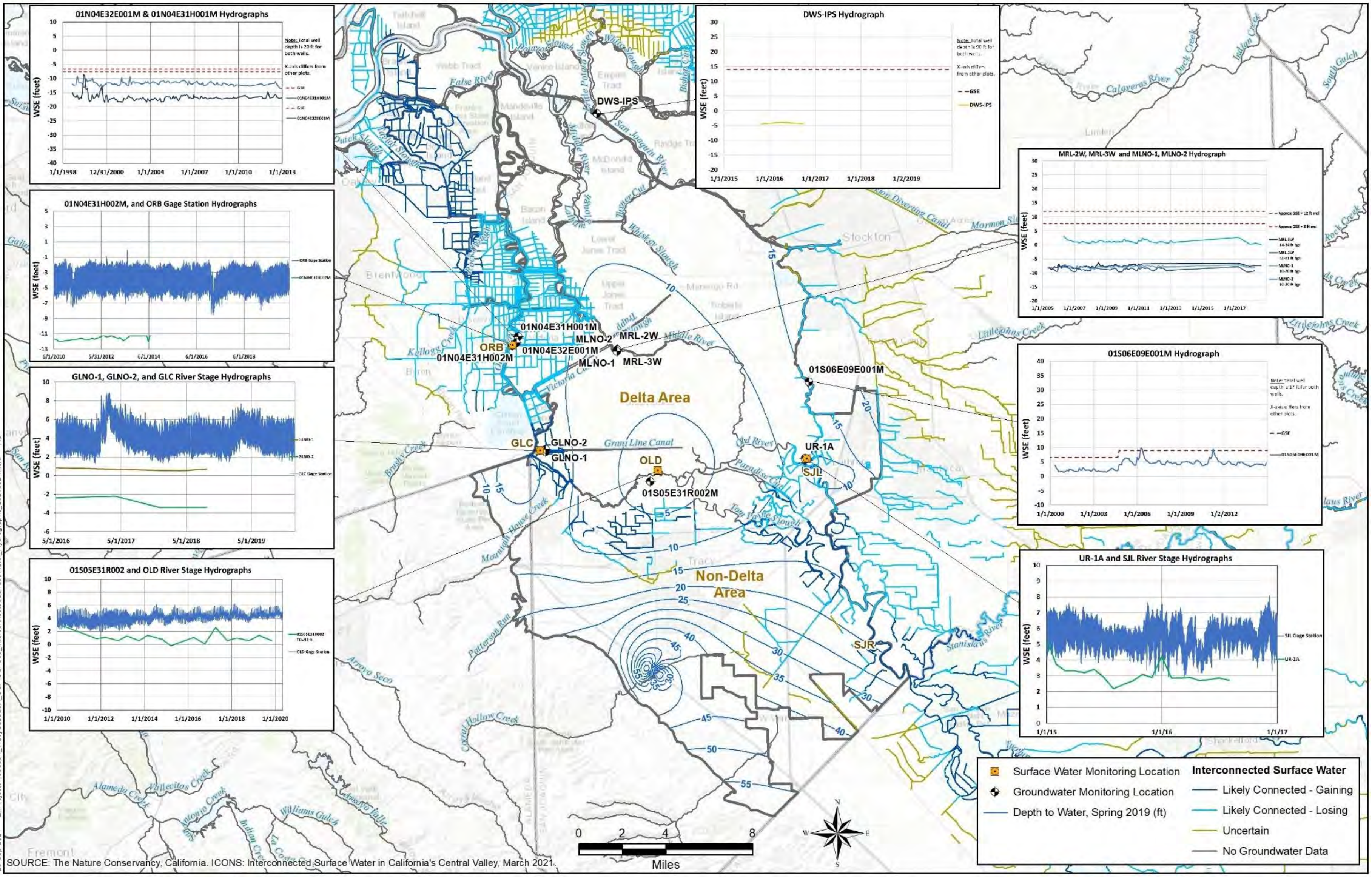

Figure 5-40 . Interconnected Surface Water

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5.10 Groundwater Dependent Ecosystems

Groundwater-dependent ecosystems (GDEs) are defined in the GSP regulations as, "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface." GDEs, species and native vegetation, are a beneficial user of groundwater. Managed wetlands may also be GDEs or may be supported by pumped groundwater or delivered surface water supplies.

GDEs exist where native vegetation accesses shallow groundwater for survival. This GSP identifies GDEs within the Tracy Subbasin based on a determination of the areas where vegetation is dependent on groundwater.

The Natural Communities Commonly Associated with Groundwater (NCCAG) database was used as a starting point to identify potential GDEs within the Subbasin. The NCCAG database was developed by a working group comprised of DWR, California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC). The working group reviewed publicly available datasets which mapped California vegetation, wetlands, springs, and seeps and conducted a screening process to retain communities known to be commonly associated with groundwater. The NCCAG database defines two habitat classes: wetland and vegetative. The wetland class includes wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions. The vegetative class includes vegetation types commonly associated with the shallow subsurface presence of groundwater (phreatophytes). Potential GDEs were identified from NCCAG Vegetation and Wetlands mapping are shown on **Figure 5-42**. Managed wetlands were also added to this figure from the Land IQ dataset (2017) and those provided by the Audubon Society. All potential GDEs identified from NCCAG were kept at this time but may be revisited in the future.

Most potential GDEs are located adjacent to the San Joaquin River and other waterways and within the Delta islands and as such are supported by both surface water and groundwater. No further assessments were made to better quantify potential or actual GDEs. Few potential GDEs are located in the non-Delta areas where depths to groundwater are greater than 20 feet and may be evaluated in the future to more clearly demonstrate whether the GDEs are groundwater dependent.

The distribution of freshwater fish and wildlife species that may be dependent on GDEs is not well known and is not included in this analysis. A list of threatened and endangered species that may be in the Tracy Subbasin or its waterways is provided in **Appendix L**.

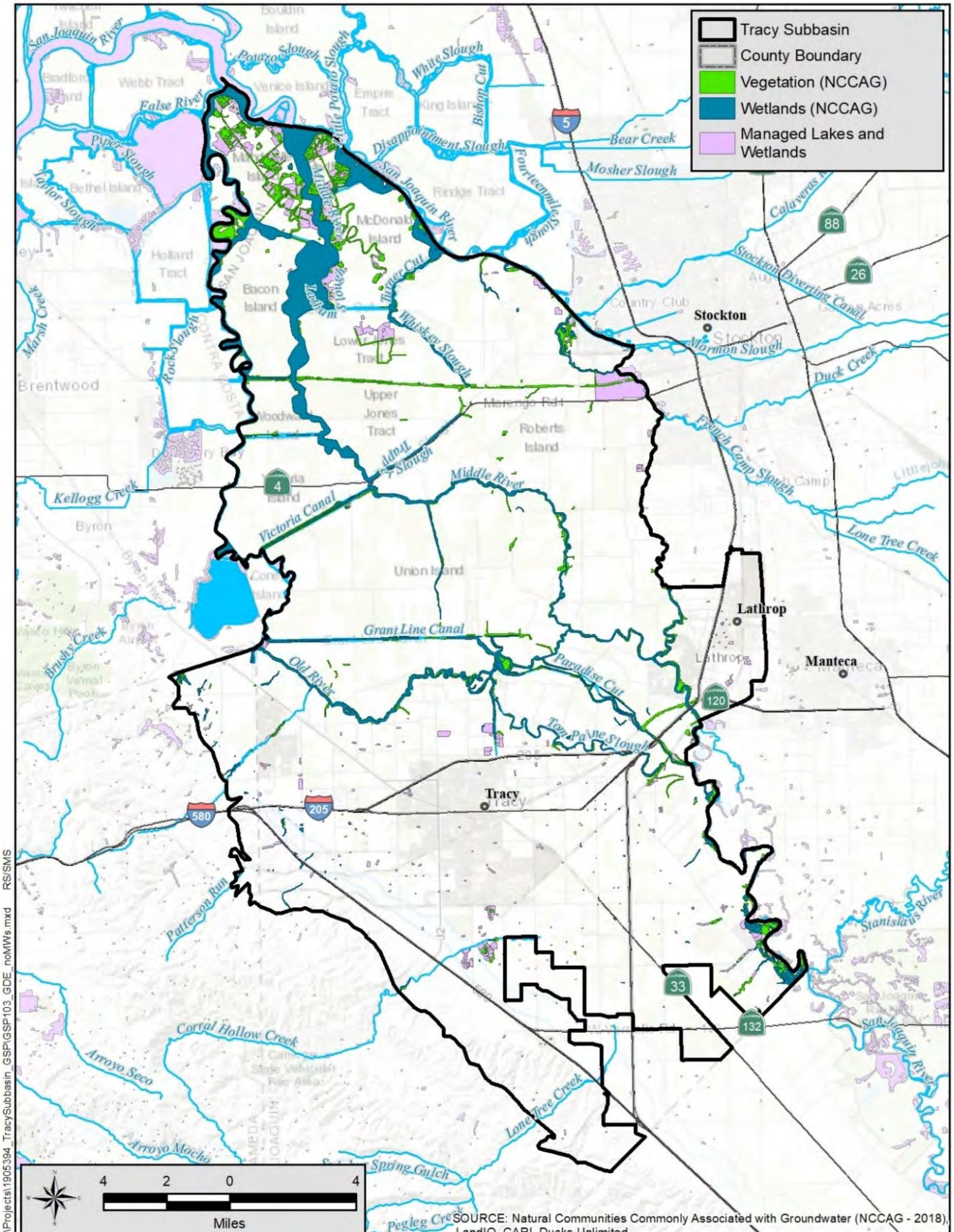

Figure 5-41. Potential Groundwater Dependent Ecosystems

5.11 Data Gaps

Groundwater conditions in the Tracy Subbasin have been investigated and documented since the early 20th century and through the present. Data collection may be improved with the following monitoring network enhancements:

- Construction of monitoring wells screened in the Lower aquifer near the west side of the Subbasin will confirm the presence of the Corcoran Clay and provide additional groundwater level control in this area.
- Evaluate, purchase and installation of transducers into monitoring well ORL-1W to improve the correlation of groundwater to surface water. Currently, groundwater levels in monitoring wells near gaging stations are only being measured semi-annually whereas surface water gages are monitored every 15 minutes. The difference in frequency makes it difficult to correlate groundwater and surface water data which is necessary for assessment of surface water depletion. Although other wells are being considered for surface water depletion monitoring, transducers cannot be installed into domestic wells due to their lack of access.
- The areas (NCCAG dataset) identified as GDEs have not been validated. In the 5-year update the groundwater elevations will be subtracted from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape to further refine determination of GDEs and interconnected surface water (Mountain House Creek). The evaluation may consider seasonal data to different water year types if available.

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6. Management Areas

As described in the previous chapters, the Delta and non-Delta areas at the Tracy Subbasin have different hydrogeologic and hydraulic conditions. In consideration of these different conditions, two management areas are defined for the Tracy Subbasin. The following information from the GSP Emergency Regulations are provided for guidance for the development of Management Areas and whether monitoring would be required along with establishment of sustainability criteria. According to the GSP's Emergency Regulations Monitoring Network and Sustainable Management Criteria Subarticles, monitoring networks, minimum thresholds, and measurable objectives do not have to be established if undesirable results are not present or likely to occur:

> *Section 354.20. Management Areas.*
>
> *(a) …Management areas may define different minimum thresholds and be operated to differently measurable objects than the basin at large, provided that undesirable results are defined consistently throughout the basin.*
>
> *(b) A basin that includes one or more management areas shall describe the following in the Plan:*
>
> > *(1) The reason for the creation of each management area.*
> >
> > *(2) The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.*
> >
> > *(3) The level of monitoring and analysis appropriate for each management area.*
> >
> > *(4) An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area*
>
> *(c) If a Plan includes one or more management areas, the Plan shall include descriptions, maps and other information required by this Subarticle sufficient to describe conditions in those areas.*
>
> *Subarticle 4. Monitoring Networks. Section 354.34 (j) An agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26 shall not be required to establish a monitoring network related to those sustainability indicators.*
>
> *Subarticle 3. Sustainable Management Criteria. Section 354.26(d) An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators and are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.*

6.1 Reason for Management Areas

The Tracy Subbasin encompasses an area of about 370 square miles in San Joaquin and Alameda counties. The Delta area consists of numerous islands within an area of about 187 square miles. Waterways surrounding each island provide a constant source of recharge to the groundwater system. Most of the Tracy Subbasin is within the legally defined Delta Boundary (**Figure 6-1**).

In the previous sections, Delta and Non-Delta areas were described for this GSP. These areas are similar to the definition of the legal Delta in Water Code 12200, Delta Primary and Secondary Zones. The Delta Protection Commission was established by the Delta Protection Act (Act) of 1992. The Commission is to develop a long-term resources management plan for the Delta Primary Zone. As stated in the Act the goals of this regional plan are to "protect, maintain and, where possible enhance and restore the overall quality of the delta environment, including, but not limited to, agriculture, wildlife habitat and recreational activities." The Act acknowledges that agricultural land within the Delta is of significant value as open space and habitat for waterfowl using the Pacific Flyway. As such, the regional plan is to protect agricultural land within the Primary Zone from intrusion of non-agricultural uses (DWR 1995). Therefore, land use within the Delta Primary Zone, are not expected to change. Flows in the Delta waterways are maintained at levels to maintain freshwater in these waterways and prevent salinity intrusion. For this GSP, the Delta area is similar to Primary Zone within the Legal Delta Boundary, but the Non-Delta area includes both the Secondary Zone areas and those areas that extend outside of the Legal Delta Boundary to the edge of the Subbasin.

6.2 Delta Management Area

The Delta islands are a unique area in the state of California, where groundwater has to be drained or pumped away to maintain groundwater levels bgs. Most of the Delta islands ground surfaces are below sea level. The water is pumped back from the islands into the adjacent waterways. There is always a direct and constant connection between surface water and groundwater, requiring management of groundwater levels (dewatering) within the islands. There are hundreds of diversions that divert surface water from the adjacent waterways surrounding the islands for agricultural purposes, as shown on **Figure 6-2**, and therefore groundwater use in these areas is minimal.

Beneficial users of groundwater in the Delta islands are agriculture, domestic, municipal, and environmental uses. However, the users of groundwater are sparse:

- About 50% of the area (~ 91 square miles) have no domestic wells and another 20% of the area (38 square miles) have only one domestic well per square mile (**Figure 3-12**).
- Over 80% of the area (155 square miles) have no agricultural wells. Where present, 15% of the area has a density of 1 well per square mile (29 square miles) and only 6 square miles have 2 to 3 wells per square mile (**Figure 3-14**).
- Over 96% of the area (187 square miles) have no municipal supply wells (only 7 wells in the entire area and where present occur at a frequency of 1 per square mile) (**Figure 3-16**).

- Most potential GDEs and managed wetlands in the Subbasin occur in this area, due to the shallow and stable groundwater and plentiful surface water (**Figure 5-41**).
- Most of the DACs in the Subbasin are in this area and rely upon domestic wells or are importing water as many areas have no domestic wells. No wells were reported to have gone dry during the 2012 to 2016 drought years.

There are no foreseeable significant changes to land use in the Delta area other than expansion of ecosystem restoration. No new urban area developments will occur within the islands (per the Act) other than the current planned River Islands development in the Stewart Tract which is in the Non-Delta area. If the Delta Tunnels are constructed, dewatering and increased groundwater use will have to be mitigated by the owners.

There have been no undesirable results in the Delta area (as defined in **Chapter 9 – Sustainable Management Criteria**) as related to sustainability indicators and no undesirable results are likely to occur in this management area due to the Act:

- There has been no chronic lowering of groundwater levels. Groundwater levels fluctuate with tidal levels in the adjacent waterways, always remaining within a narrow range. Because of the adjacent waterways the groundwater level (shown in yellows and green colors) trends are flat (**Figure 6-3**). River gage stage data are also shown on some of these hydrographs (blue color) to illustrate the relatively constant heads.
- There has been no reduction in storage (as shown by hydrographs on **Figure 6-3**).
- There is no surface water depletion. The entire area is connected to surface water and water that is pumped out of the islands is returned to the adjacent waterways. Otherwise, the islands would become submerged.
- Land subsidence has not occurred due to groundwater extraction. Subsidence is due to natural oxidization of naturally occurring peat (decaying organic layers) (as described in **Chapter 5.8 – Subsidence**).
- Groundwater quality is naturally poor quality (TDS exceeding the secondary recommended MCL, along with other elements as shown on **Figures 5-19 through 5-26**) due to natural conditions (peat deposits). There are no known manmade contamination plumes within the Delta and therefore groundwater would not be degraded with Projects or Management Actions.
- No seawater intrusion. The area is not in a coastal area near sea water. Surface water invasion of brackish water has been resolved by construction and managed releases from dams to maintain freshwater in the waterways (as discussed in **Chapter 5.7 – Seawater Intrusion**) and is not likely to reoccur in the future.

Because there have been no undesirable results for each of the sustainability indicators in the Delta area and none are likely to occur in the future, groundwater monitoring is not necessary in this portion of the Subbasin for it to remain sustainable. As such, minimum thresholds and measurable objectives will not be established for the Delta management area.

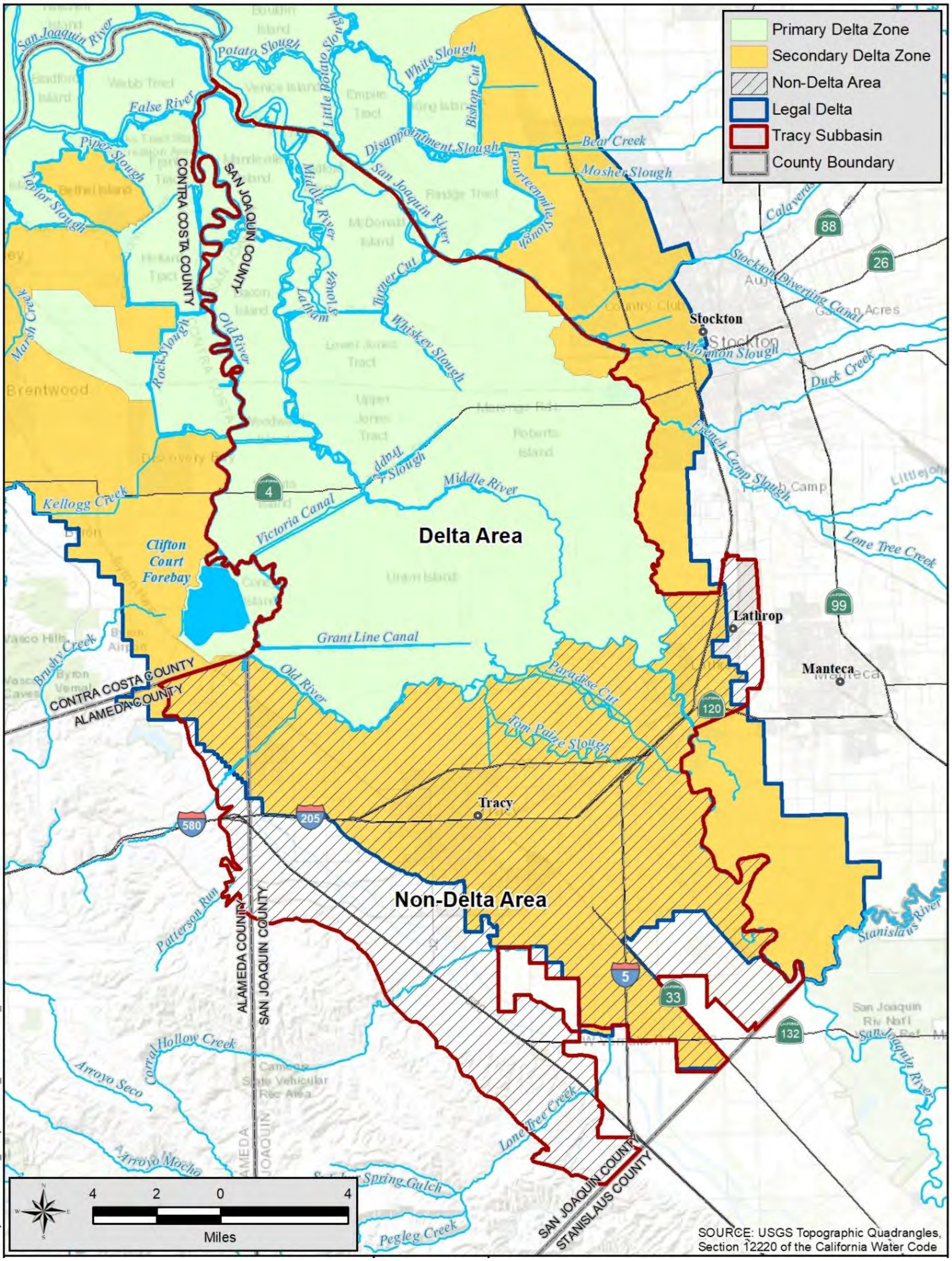

Figure 6-1. Delta and Non-Delta Areas

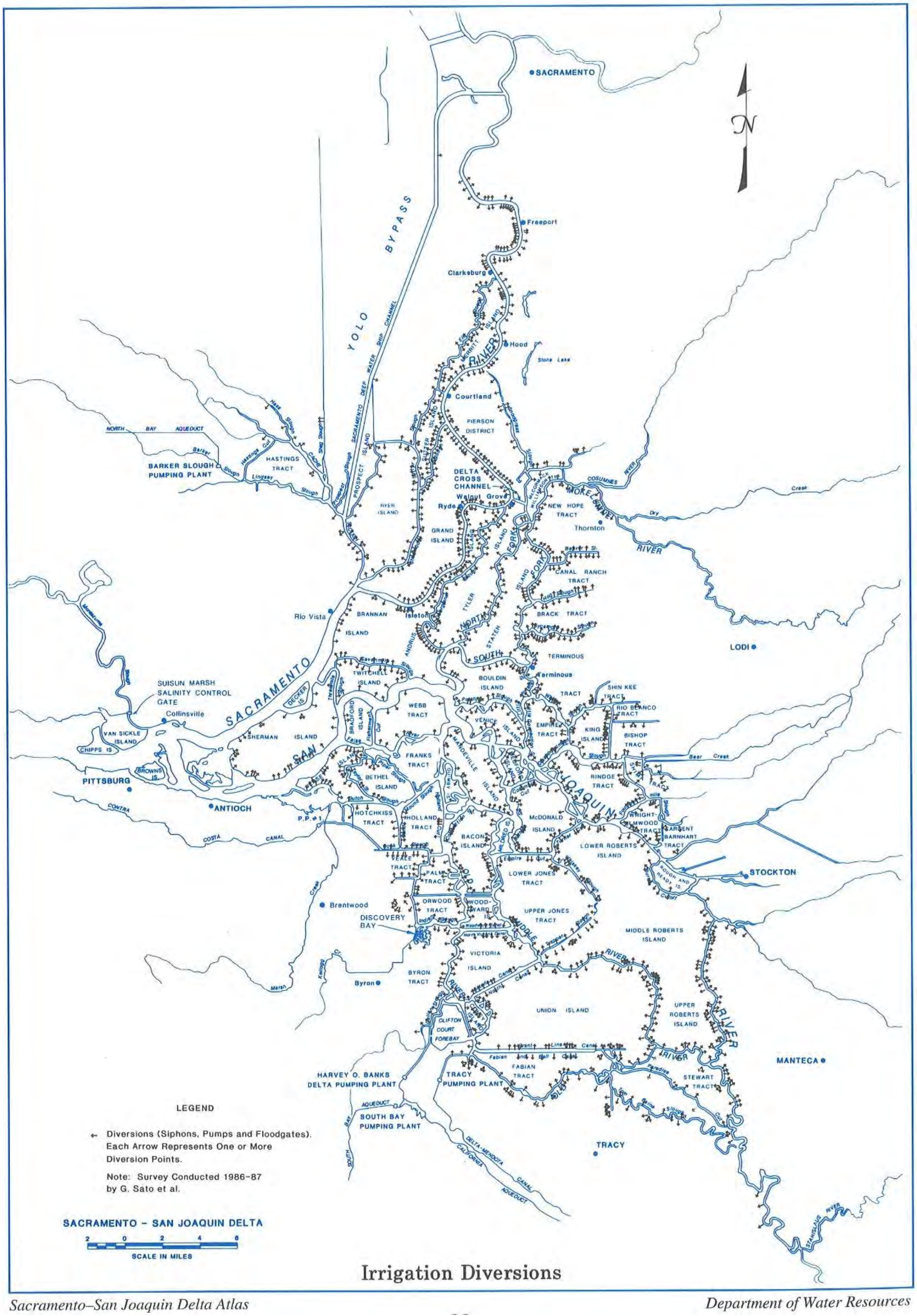

Figure 6-2. Surface Water Diversions

6.3 Non-Delta Management Area

The Non-Delta areas of the Subbasin is where most agricultural, domestic and municipal wells are present and where groundwater is used. The area may have had potential impacts from groundwater use.

Each of the sustainability indicators in the Non-Delta Management area are summarized below and described in detail in **Chapter 9 – Sustainable Management Criteria**:

- There has been some lowering of groundwater levels and some areas are experiencing a downward trend.
- There has been a slight reduction in storage, but this has been refilling and is being used for aquifer storage and recovery program.
- There may be surface water depletion. The Upper aquifer is interconnected with groundwater along the Old River and Tom Payne Slough and the Lower aquifer is interconnected potentially north of the Corcoran Clay extent. Groundwater pumping in these aquifers could deplete surface water.
- Land subsidence has occurred due to groundwater extraction.
- Groundwater quality is of naturally poor quality (TDS exceeding the secondary recommended MCL, along with other elements) due to natural conditions.
- No seawater intrusion has occurred.

As such, excessive groundwater use in the Non-Delta area could have undesirable results on beneficial groundwater uses such as domestic, agricultural and municipal well owners, along with surface water, and GDEs. A groundwater monitoring network with representative wells with minimum thresholds and measurable objectives will be established for this management area as described in **Chapter 8 – Monitoring Network** and **Chapter 9 – Sustainable Management Criteria**.

Minimum thresholds and measurable objectives for this area can be different than in the adjacent Delta area. For the Non-Delta areas, groundwater gradients in the Upper aquifer will be maintained to continue contributions to Old River, Tom Payne Slough, and the San Joaquin River. In the Lower aquifer, groundwater levels will be maintained to prevent additional surface water depletion from the Delta area, in those areas beyond the extent of the Corcoran Clay.

6.4 Summary

In conclusion, the Delta area will not require active groundwater management to maintain sustainability while the Non-Delta areas will require management to be sustainable. **Table 6-1** compares Delta and Non-Delta areas as related to the sustainability indicators.

Table 6-1. Delta and Non-Delta Comparison of Sustainability Indicators

Sustainability Indicators	Delta Area	Non-Delta Area
Chronic Lowering of Groundwater Levels	No chronic lowering	Some lowering of groundwater levels
Reduction of Storage	No reduction in storage	Slight reduction in storage
Surface Water Depletion	No surface water depletion	May be surface water depletion
Degraded Water Quality	Naturally poor quality	Naturally poor quality
Sea Water Intrusion	No sea water intrusion	No sea water intrusion
Subsidence	No land subsidence due to groundwater extraction	Land subsidence due to groundwater extraction

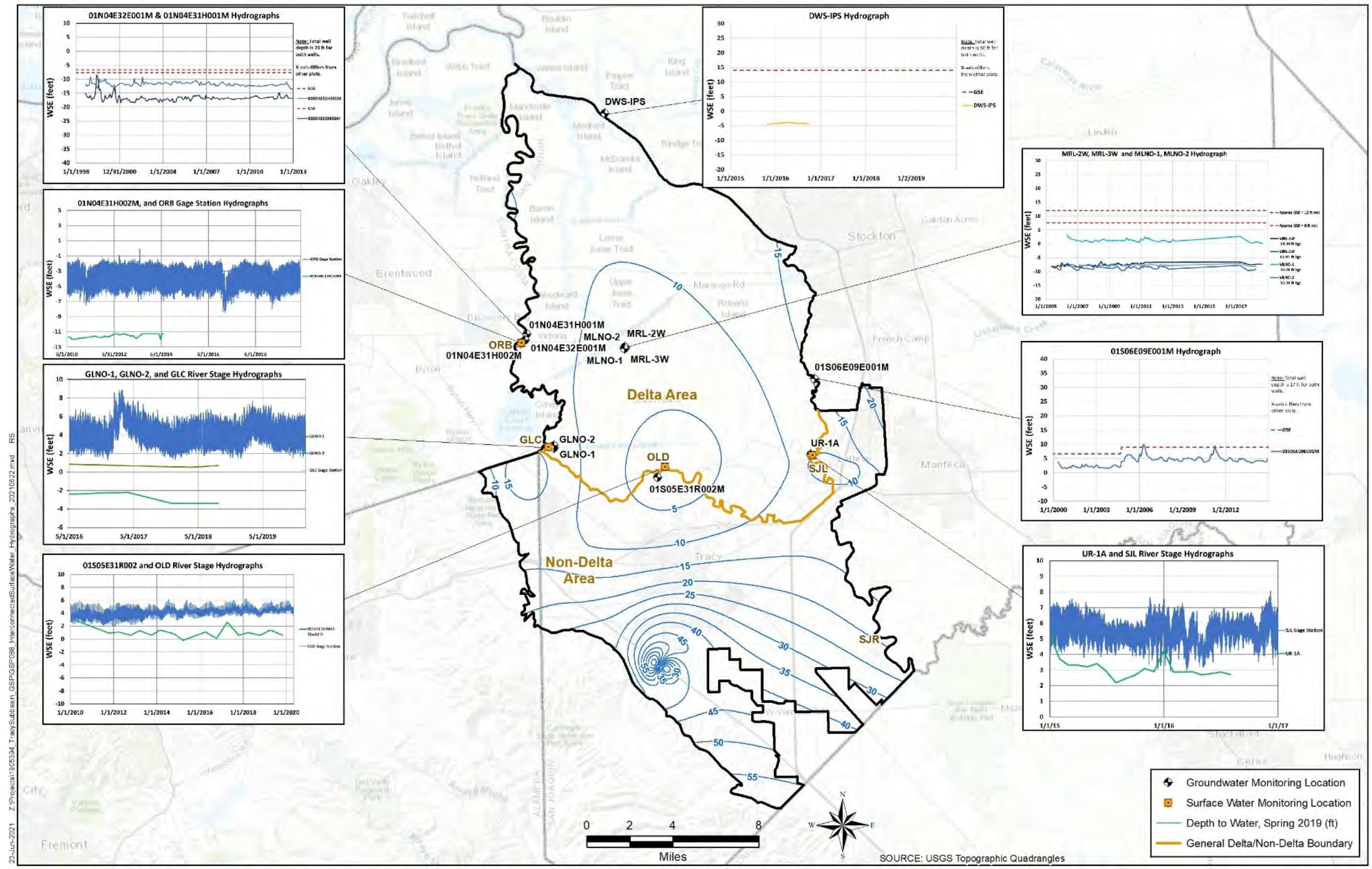

Figure 6-3. Delta Area Hydrographs

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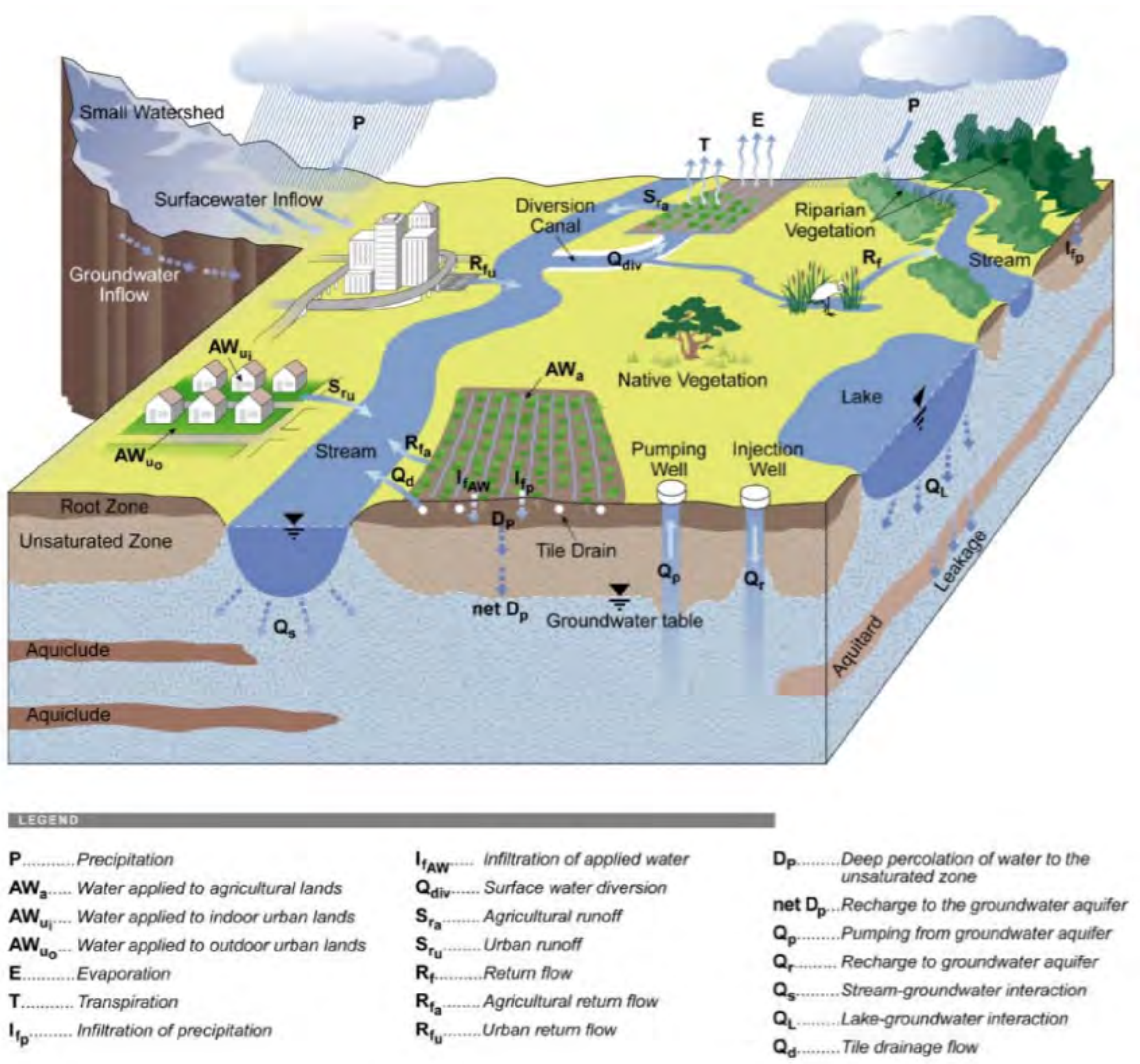
7. Water Budgets

Water budgets were developed to provide a quantitative accounting of surface water and groundwater entering and leaving the Subbasin. Water entering the Subbasin includes both water entering at the surface and through the subsurface. Similarly, water leaving the Subbasin leaves both at the surface and through the subsurface. Water enters and leaves naturally, through precipitation and streamflow, and through human activities, such as pumping and recharge from irrigation. **Figure 7-1** presents a schematic of a vertical slice through the land surface and aquifer to summarize the water balance components used in this analysis.



Source: DWR 2014

Figure 7-1. Water Budget Components

The values presented in the water budget provides information on historical, current, and projected conditions as they relate to hydrology, water demand, water supply, land use, population, climate change, groundwater and surface water interaction, and subsurface groundwater flow. The water budgets are presented by water years (the 12 months spanning from October 1 of the previous year to September 30 of the following year). The annual water budgets are based on monthly estimates. The water budgets assist in management of the Subbasin by identifying whether the water budget is in surplus or deficit and to identify potential opportunities to improve water supply conditions and availability.

The water budgets were developed using a model developed by DWR for the entire Central Valley called the C2VSim and was used to extract a water budget for the Subbasin (described below). A base period was also selected so the water budget would be representative of long-term average climatic conditions to estimate the sustainable yield of the Subbasin.

7.1 Hydrologic Periods

Hydrologic periods were selected to meet the needs of developing historical, current, and projected water budgets. Precipitation data from the Tracy Carbona precipitation station (Station number 048999) were used to identify hydrologic periods that would provide a balance of wet and dry periods and long-term average conditions needed for budget analyses. Analysis of a period that is unusually wet or unusually dry would provide information that is not indicative of long-term conditions.

The annual rainfall for the Tracy Carbona Station from 1951 to 2019 is shown in **Figure 7-2**. The average annual precipitation during this period was 10.83 inches, and the average annual temperatures ranged from 54 to 56 degrees Fahrenheit (NOAA 2016).

For the calibration of the C2VSim Fine Grid Version 1.0 (C2VSim-FG_v1.0) model, DWR used the period of 1974 to 2015. This period was used based on the quality and availability of various datasets, such as land-use surveys, groundwater elevations, and surface water diversions. The data quality and availability are critical for the model calibration process. The historical water balance for the Subbasin uses this calibration period as the simulation period. The average precipitation in the Subbasin for the period of 1974 to 2015 was 11.37, which is about 0.5 inches (or 5%) greater than the long-term average.

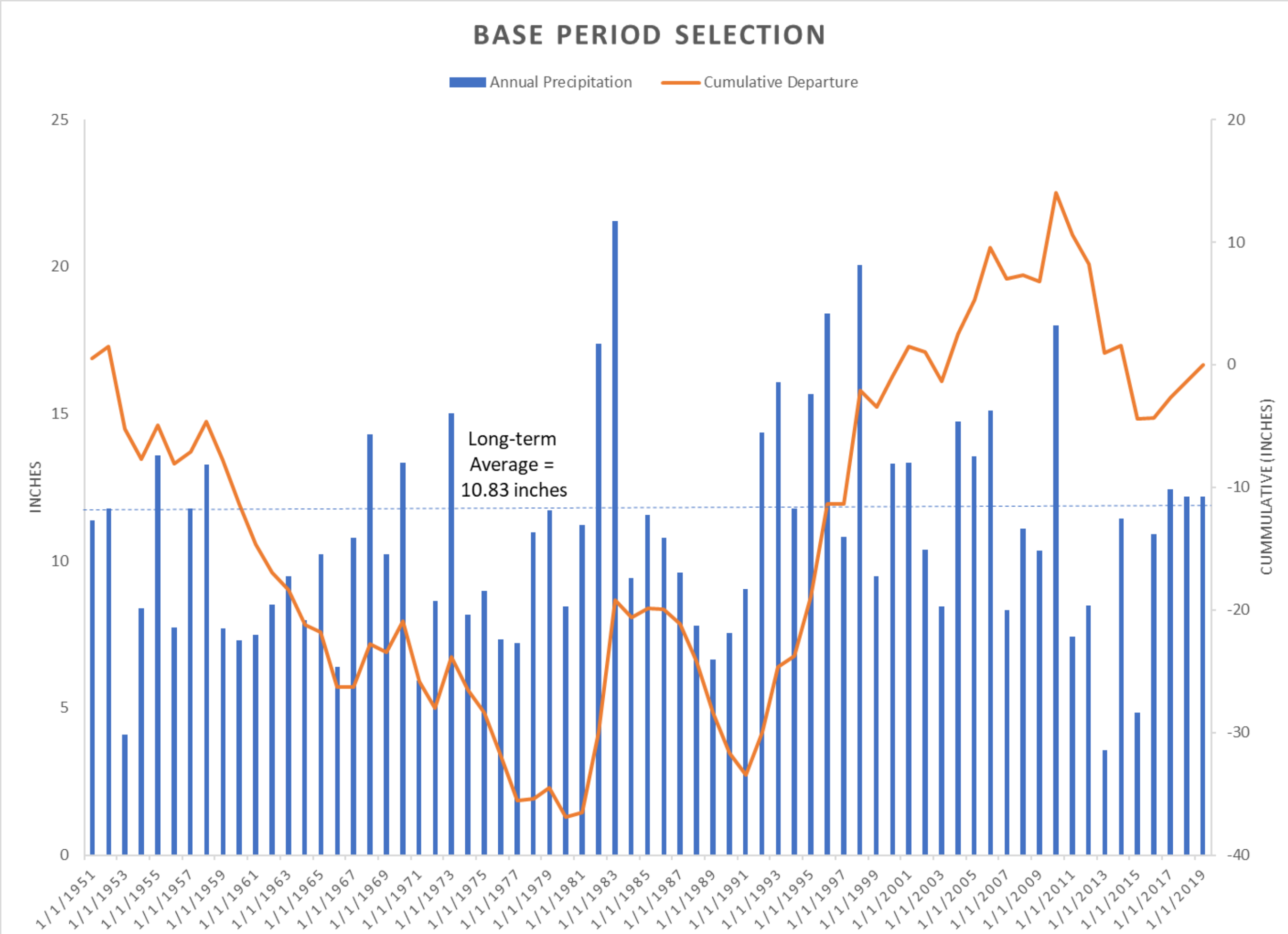


Figure 7-2. Tracy Carbona Precipitation

7.2 Groundwater Model

In 1990, DWR, Reclamation, and the State Water Board joined together to develop the Central Valley Groundwater Surface Water Model (CVGSM). In 2005, the CVGSM model was upgraded to the Integrated Water Flow Model platform and was renamed the C2VSim Coarse Grid (C2VSim-CG) model. The C2VSim-CG model was adopted by DWR and many other regional and State-wide agencies, as well as non-governmental organizations, to evaluate various water management scenarios throughout the Central Valley.

The C2VSim-CG model dynamically calculates crop water demands; allocates contributions from precipitation, soil moisture, and surface water diversions; and calculates the groundwater pumpage required to meet the remaining demand. Agricultural groundwater pumping is typically not metered in the Central Valley, and the C2VSim-CG model provides some of the best estimates of this pumping because the pumping is constrained spatially and temporally by estimated demand and by surface water supplies. The model can also be used to calculate the changes in aquifer storage and can be used to estimate the water flows between rivers and groundwater aquifers.

The model has gone through numerous upgrades and refinements over the last couple of decades. DWR currently maintains the C2VSim-FG_v1.0 groundwater flow model.

- The latest version of the C2VSim-FG_v1.0 was released by DWR in November 2020 and was used to develop the water budget for the Subbasin. The C2VSim-FG_v1.0 consist of a finite element grid covering the entire Central Valley that uses 30,179 nodes to form 32,537 irregular elements over an area of 20,742 square miles, and 4,634 river nodes to delineate 110 river reaches. The C2VSim-FG_v1.0 model simulates the aquifer system of the Central Valley using three aquifer layers. Aquifer layer one represents the unconfined portion of the aquifer, and aquifer layers two and three represent the confined portions. Layer 3 generally represents the portion of the aquifer that is not pumped. In addition, the model includes an aquiclude layer between aquifer one and two that represents the Corcoran Clay layer present intermittently within the Central Valley.
- C2VSim-FG_v1.0 has a finer resolution along the major streams and canals to simulate stream-aquifer interaction and assessment of impacts of groundwater pumping on stream flows. The C2VSim-FG_v1.0 also provides more detailed water budget information for some surface processes, including land and water use system, stream and canal systems, groundwater system and soil system that are useful for illustrating some of the issues of interest.
- Model data include input files from 1922 to 2015, but the calibrated simulation spans from 1974-2015.
- C2VSim is anticipated to be DWR's primary tool for evaluating water management in the Central Valley and is specifically referenced in the GSP regulations for application to GSP water budgets.

As described in the previous chapters, the Delta and Non-Delta Management Areas in the Subbasin have different hydrogeologic and hydraulic conditions. In consideration of these different conditions, the Delta and Non-Delta Management Areas were defined as shown in **Figure 7-3**. The Delta area will not require active groundwater management to maintain sustainability, while the Non-Delta area will require management to be sustainable. Water budgets were created for the entire Subbasin and for each of these management areas to allow for better quantification of the water budget in each management area to be able to develop projects and management actions to solve any deficit, if present.

Four water budgets were developed using the model for historical, current, projected, and projected with climate change conditions, which are discussed in the following sections:

- For the historical water budget, the historical simulation, which covers water years 1974 to 2015 was used. This historical simulation is a calibrated numerical model representation of historical hydrologic, land use, and water demand conditions within the Subbasin.
- For the current water budget, a base period of 2003-2013 was selected as representative of current conditions. This period is representative of the historical rainfall, as shown in **Figure 7-2**, and is consistent to the base period selected by the Delta-Mendota Subbasin.
- For the projected water budget, the model was modified to represent foreseeable future level of development (2065 level of demands) over long-term hydrologic and climate conditions. The simulation was performed to represent the 2016-2065 hydrologic period (a 50-year projection).

- For the projected with climate change water budget, the model was modified using publicly available climate change projections for evapotranspiration (ET) and precipitation, while maintaining the projections for development and corresponding surface water deliveries. As with the projected water budget, this simulation was performed to represent the 2016-2065 hydrologic period (a 50-year projection).

Water budgets for each of these projections were developed for the entire Subbasin. A breakdown of the water budgets for projected with climate change for each of the management areas, and by principal aquifer is also provided.

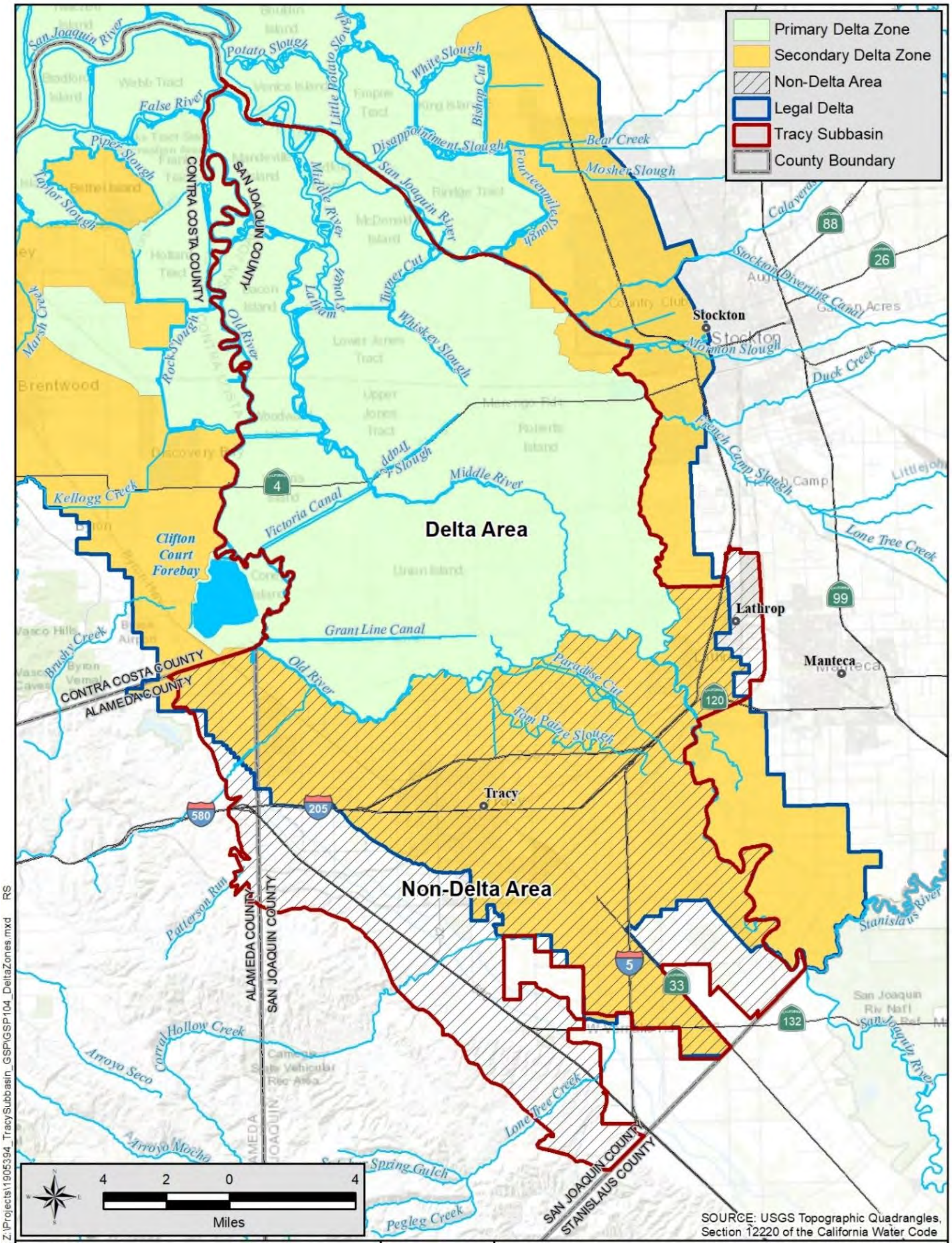


Figure 7-3. Delta and Non-Delta Areas

7.3 Historical Water Budget

The water budget for the historical period was obtained from the calibrated C2VSim-FG_v1.0 groundwater model and was selected to demonstrate sustainability from 1974 to 2015, a period of 40 years. During the historical simulation, urban demands increased steadily from around 20,000 AFY in 1974 to a maximum of 48,000 AFY in 2007 before dropping down to 36,000 AFY in 2015. Agricultural demands oscillated between periods of weather and cropping pattern changes but averaged around 360,000 AFY.

Detailed documentation for the C2VSIM-FG_v1.0 development, data collection, and methods can be found in the model documentation.[1] A summary of the data included in the model is provided below:

- State Data Sources: CalSim II, CalSim 3.0, Cal-SimETAW, DWR land Use Program, and the California Water Plan.
- Federal Data Sources: Stream inflows, groundwater level observations, land use data, and data included in the Central Valley Hydrologic Model.
- Local Data Sources and Models: Groundwater Management Plans, Integrated Regional Water Management Plans, AWMPs, and Groundwater Sustainability Plans.

The water balances for the Subbasin were developed by post-processing the outputs from C2VSim-FG_v1.0 model and summarizing the results for the elements within the Subbasin boundaries. The elements used for the Subbasin water budget are provided in **Appendix M**. It should be noted that some of the elements extend beyond the Subbasin boundaries.

The annual total inflows, outflows, and cumulative change in storage for the historical period are shown on **Figure 7-4**. **Table 7-1** contains the summary of the annual water budget averages from 1974 to 2015. Detailed tables showing annual inflows and outflows are include in **Appendix M**.

[1] https://data.cnra.ca.gov/dataset/c2vsimfg-version-1-0

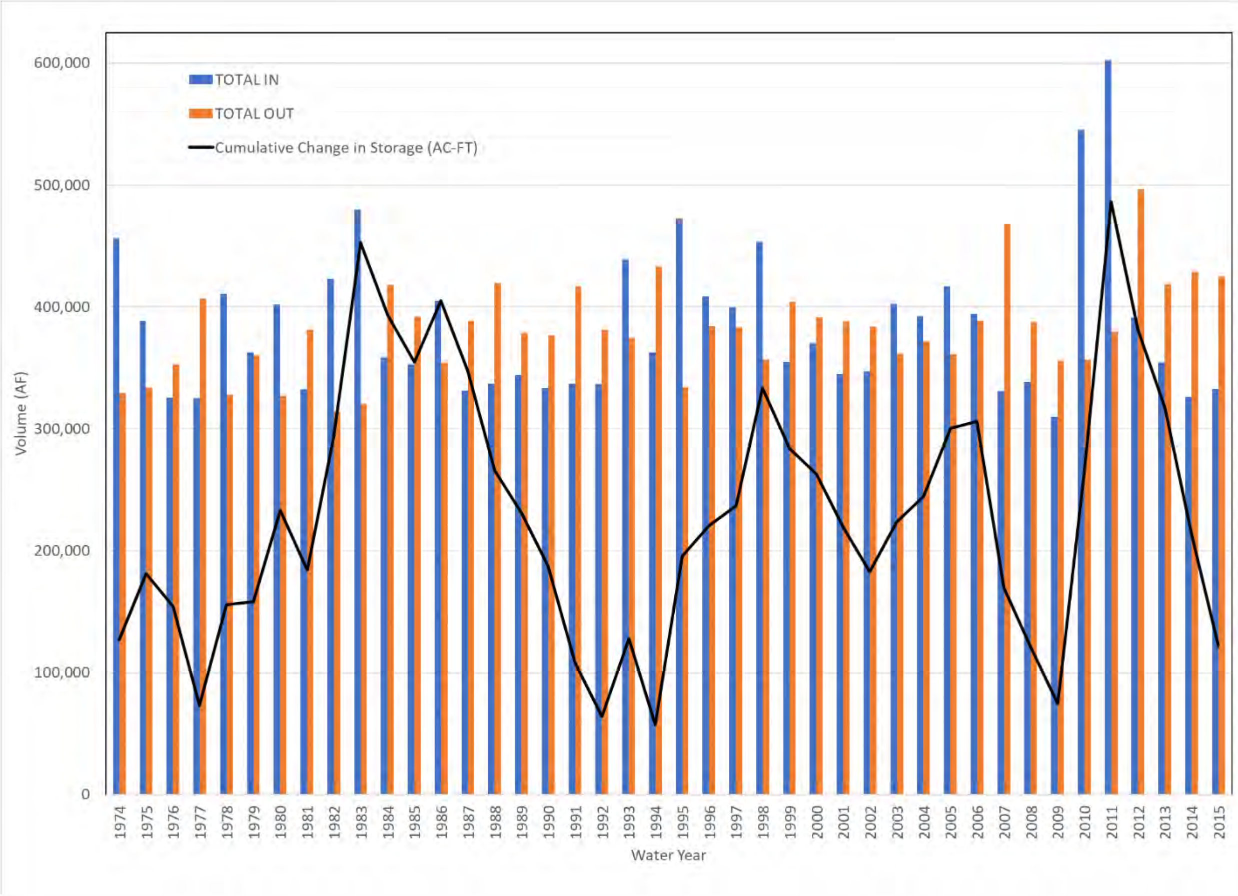


Figure 7-4. Historical Tracy Subbasin Water Budget – 1974-2015

Table 7-1. Historical Tracy Subbasin Water Budget – Annual Averages – 1974-2015

INFLOWS (AFY)		OUTFLOWS (AFY)	
Streams/Rivers	40,183	*Streams/Rivers*	103,997
Deep Percolation	173,537	*Pumping*	167,378
Small Watersheds	6,423		
Diversion Recharge	62,035		
Subsidence	1,366		
Subsurface	100,608	*Subsurface*	109,868
Total IN	**384,151**	***Total OUT***	**381,243**

On average, almost 90 percent of the total inflow to the Subbasin is from three sources of water: net deep percolation, subsurface inflow, and diversion recoverable gains (losses from canals). The water budget shows the largest inflow component is deep percolation (a combination of deep percolation from rain and agricultural activities). Deep percolation constitutes about 45 percent of total inflow and ranges from 122,000 to 253,000 AFY. Pumping is the largest outflow component and constitutes 44 percent of the total outflow. *The resulting average surplus for the historical water budget is about 2,900 AFY.*

Table 7-2 below provides an overview of the variability of surface water and groundwater in relationship to the water year types as defined by the SJRI. Within the simulation period, there were 15 years that were classified as "wet" and 14 years that were classified as "critical." As the table shows, drier periods tend to result in more groundwater extraction as compared to wet periods.

Table 7-2. Historical Tracy Subbasin Water Budget – Annual Averages – 1974-2015

	Water Year Type (San Joaquin River Index)					
Component	***Wet***	***Above Normal***	***Below Normal***	***Dry***	***Critical***	***42-Year***
Number of years	15	5	2	6	14	42
Total Demand (AFY)	***363,090***	***379,703***	***356,239***	***400,306***	***430,139***	***392,407***
Urban	31,969	33,679	40,281	34,437	33,347	33,381
Agricultural	331,121	346,023	315,958	365,869	396,791	359,027
Total Water Supplies[1] (AFY)	***426,915***	***440,740***	***409,969***	***457,965***	***489,354***	***453,002***
Total Surface Water Supplies	*277,530*	*279,349*	*257,007*	*279,357*	*303,248*	*285,603*
Urban Surface Water	6,065	6,642	15,125	7,565	9,446	7,906
Agricultural Surface Water	271,464	272,707	241,882	271,792	293,802	277,696
Total Groundwater Supplies	*149,385*	*161,391*	*152,962*	*178,608*	*186,106*	*167,400*
Urban Groundwater	25,887	27,033	25,172	26,878	23,908	25,471
Agricultural Groundwater	123,498	134,358	127,790	151,730	162,198	141,928
Change in Groundwater Storage	***85,555***	***12,240***	***-2,502***	***-42,052***	***-68,934***	***2,908***

Notes: C2VSim-FG_v1.0 shows the total annual water supplies exceeding the basin demands in the Subbasin. The excess water supplies are a feature of the C2VSim_FG_v1.0 model and not necessarily reflective of water management.
See **Chapter 7.8 – Opportunities for Improvement**.

The water agencies in the Subbasin have very reliable surface water supplies, with all having senior, pre-1914 water rights. **Table 7-3** shows the most recent 10 years of surface water supply deliveries, by surface water source and water year type (based on the SJRI) for deliveries in the Non-Delta Management Area. This 10-year period only had 2 water years which were classified as "wet" and the rest are below normal, dry, and three critically dry years. In this 10-year period an additional source of water has been added from SSJID, starting in 2017. During the 10-year period water supplies in years with below normal SJRI averaged about 62,890 AF. Even during the most recent drought surface water supplies were only 9,600 to 12,700 AF less than average, a reduction of supplies by 15 to 20 percent.

Table 7-3. Historical Surface Water Deliveries in Tracy Subbasin

Water Years	Water Year Type (SJRI)	Total Annual (Water Year)	Water Agency: BCID - Service Area	BCID - Kasson Area	BBID - Bethany	BBID - MHCSD	BBID	The West Side ID	The West Side ID	Tracy	SSJID to Lathrop	SSJID to Tracy
Water Source			S.J. River	S.J. River				DMC	Old River	DMC CVP	Stanislaus	Stanislaus
Units		AF	AF	AF	AF	AF	AF	AF	AF	AF	AF	AF
2008-09	C	75,641	44,693	7,262	17,675	2,705	1,697			0	1,609	0
2009-10	D	64,784	41,851	6,267	10,371	2,508	2,414			0	1,374	0
2010-11	BN	61,476	40,921	5,522	8,547	2,590	2,824			0	1,072	0
2011-12	W	83,170	50,954	7,538	15,999	2,982	4,931			0	767	0
2012-13	BN	70,841	45,975	6,331	11,346	3,207	3,403			0	580	0
2013-14	D	63,748	38,799	6,863	10,301	2,905	4,353			0	527	0
2014-15	C	53,557	34,190	4,146	9,322	2,386	3,286			0	226	0
2015-16	C	50,435	32,525	6,493	5,584	2,652	2,932			0	248	0
2016-17	BN	62,559	30,164	5,031	5,039	3,123	5,139			4,455	300	9,308
2017-18	W	72,638	35,054	7,497	3,436	3,238	5,795			5,465	921	11,234
2018-19	BN	68,576	30,084	6,101	4,318	3,898	4,638			8,954	2,892	7,691

Notes: Westside Irrigation District deliveries unavailable.
SSJID deliveries began in water year 2004-2005.
Surface water deliveries do not include riparian diversions

7.4 Current Water Budget

The current water budget is based on the historical C2VSim-FG_v1.0 simulation period of 2003 to 2013. This period is representative of the long-term average for precipitation and is consistent with the Delta Mendota Subbasin. The average precipitation for the 2003 to 2013 was 10.82 inches, which is consistent with the long-term average of 10.83 inches (1951-2019). Were the current period to be extended to include 2015, the information would be skewed by the recent drought and not representative of current conditions. The Delta Mendota Basin submitted their GSP in 2020 and selected the same period to represent their current budget.

The annual total inflows, outflows, and cumulative change in storage for the current period are, along with the historical period, shown on **Figure 7-4**. **Table 7-4** contains the summary of the annual water budget averages from 2003 to 2013. The composition of inflows and outflows is very similar to the historical period. *The average surplus for the current water budget is 12,200 AFY.*

Table 7-4. Current Tracy Subbasin Water Budget – Annual Averages – 2003-2013

INFLOWS (AFY)		OUTFLOWS (AFY)	
Streams/Rivers	42,349	*Streams/Rivers*	96,702
Deep Percolation	178,805	*Pumping*	178,281
Small Watersheds	1,488		
Diversion Recharge	79,301		
Subsidence	137		
Subsurface	105,141	*Subsurface*	120,006
Total IN	**407,221**	***Total OUT***	**394,989**

7.5 Projected Water Budget

The projected water budget was developed using the C2VSim-FG_v1.0 model and adjusting the historical data, along with expectations of future developments and population growth, to estimate future conditions in the Subbasin using a 50-year planning period. A summary of the data sources and adjustments is provided below:

- *Land Use and Cropping Patterns*: The non-urban areas in the model, which include agricultural, native, and riparian areas, were represented by using the land use designations as simulated at the end of the historical period. Urban areas were expanded within the cities of Tracy and Lathrop sphere of influence for planned future developments. Additionally, the urban populations were increased based on the 2015 UWMP plans projections for population at buildout. The land-use and populations were then held constant for the 50-year simulation.
- *Stream Flows*: The stream flows from the historical period of 1953 to 2003 were used to represent future hydrologic conditions.
- *Surface Water Deliveries*: Surface water deliveries within the Tracy Subbasin were represented by using data from the historical simulation. However, the periods used to project a 50-year planning period varied based on the history of each respective diversion. There were municipal and industrial diversions that were formalized after 2000, while there are agricultural diversions that date back to the 1980's. Each diversion data set was assessed, and periods were selected for projection. Additionally, surface water diversions for the City of Tracy were increased based on projections in the UWMP and the known dependence of the increased urbanization on increased surface water availability (i.e., the development will not proceed without securing the additional surface water).
- *Climate Data*: The precipitation and ET data from the historical simulation for the period of 1953–2003 were used to project conditions for the 50-year period.

The annual total inflows, outflows, and cumulative change in storage for the projected period are shown on **Figure 7-5**. **Table 7-5** contains the summary of the annual water budget averages from 2016 to 2065. Detailed tables showing annual inflows and outflows are include in **Appendix M**.

Recharge from net deep percolation, subsurface inflow and diversion recoverable gains made up about 85 percent of the subbasin inflows (similar to the historical water budget). The water budget shows the largest inflow component is deep percolation. Similarly, pumping is again the largest outflow component and constitutes 47 percent of the total outflow. *The resulting average surplus for the projected water budget is 4,800 AFY.*

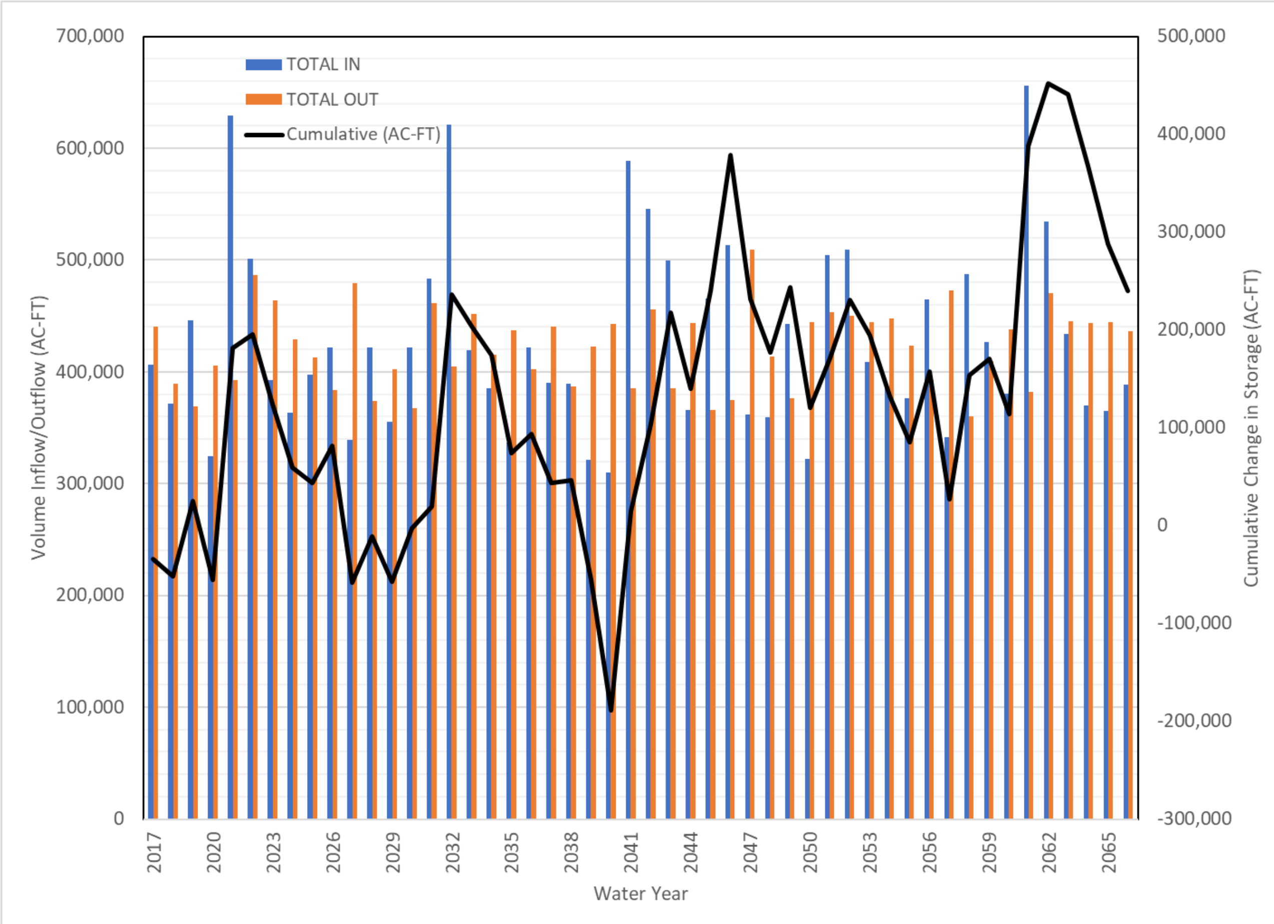


Figure 7-5. Projected Tracy Subbasin Water Budget - 2016-2065

Table 7-5. Projected Tracy Subbasin Water Budget – Annual Averages – 2016-2065

INFLOWS (AFY)		**OUTFLOWS (AFY)**	
Streams/Rivers	58,633	*Streams/Rivers*	93,446
Deep Percolation	180,334	*Pumping*	199,549
Small Watersheds	6,458		
Diversion Recharge	74,015		
Subsidence	608		
Subsurface	107,290	*Subsurface*	129,538
Total IN	**427,338**	***Total OUT***	**422,532**

7.6 Projected Water Budget with Climate Change Approach

The projected with climate change water budget was developed using much of the same data and assumptions as the projected simulation, but with considerations for climate change. The key differences between the projected and projected with climate change scenarios are described below:

- *Climate Data:* The precipitation and ET data from the historical simulation for the period of 1953 to 2003 were again used, but the data was adjusted based on outputs from a DWR study using climate models to predict future changes (DWR 2018). The DWR datasets provided precipitation and reference ET packaged as monthly change factor ratios to be used to perturb historical data to represent projected future conditions. The change factors are provided spatially and were applied to the historical data in the C2VSim-FG_v1.0 model.
    - DWR provided two future climate period conditions for use, including one scenario for 2030 and three scenarios for 2070 (wet conditions, central tendency, and extreme warming). The 2070 central tendency of the ensemble of general circulation models was used for this analysis. The 2070 scenarios were preferred for a long-term planning horizon, and the central tendency was selected as a reasonable projection. The other two scenarios for 2070 included wetter conditions and extreme warming. The central tendency scenario also included warmer, drier conditions, and changes in precipitation patterns, but to a less extreme degree than the extreme warming scenario.

The annual total inflows, outflows, and cumulative change in storage for the projected period are shown on **Figure 7-6**. **Table 7-6** contains the summary of the annual water budget averages from 2016 to 2065 with climate change. Detailed tables showing annual inflows and outflows are include in **Appendix M**. The composition of inflows and outflows is very similar to the projected period. However, the key difference is the average annual pumping increased to over 50 percent of the total outflows (up from 45%), and the deep percolation decreased to 40 percent (from 45%). The reasons for this shift in the water budget are attributed to increases in ET (due to warmer and drier temperatures) and shifting patterns in precipitation. *The resulting average surplus for the projected with climate change water budget is 1,000 AFY.*

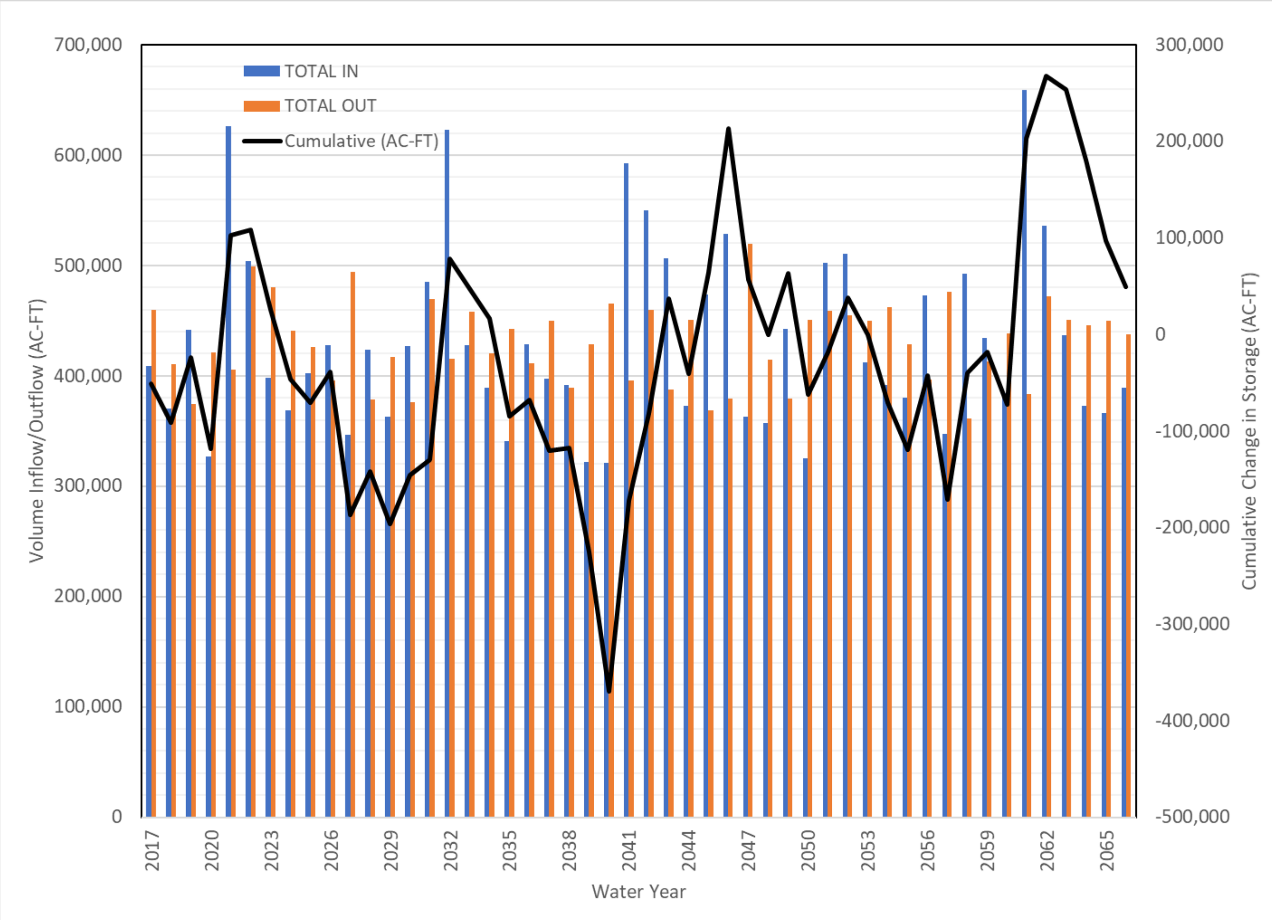


Figure 7-6. Projected with Climate Change Tracy Subbasin Water Budget – 2016-2065

Table 7-6. Projected with Climate Change Tracy Subbasin Water Budget – Annual Averages – 2016-2065

INFLOWS (AFY)		OUTFLOWS (AFY)	
Streams/Rivers	65,375	*Streams/Rivers*	85,610
Deep Percolation	176,342	*Pumping*	221,393
Small Watersheds	6,458		
Diversion Recharge	73,972		
Subsidence	1,552		
Subsurface	107,543	*Subsurface*	123,251
Total IN	**431,242**	***Total OUT***	**430,254**

7.6.1 *Water Budgets by Management Areas*

This section provides the projected with climate change conditions broken down by the Delta and Non-Delta Management Areas to specifically assess the conditions within the Non-Delta Management Area to understand if projects and management actions are needed to maintain the sustainability in this area where groundwater can be managed.

For the Non-Delta Management Area, the water budgets were also separated into the Upper unconfined aquifer (Layer 1), and Lower confined aquifer (Layer 2) to be able to further assess if either aquifer has a deficit, which may be being masked by a combined water budget. The Lower aquifer is below the Corcoran Clay layer.

7.6.1.1 Delta Management Area – Projected with Climate Change

Figure 7-7 shows the annual inflows and outflows, and the cumulative change in storage for the Delta Area for the projected with climate change scenario. Within the Delta Management Area for the projected with climate change scenario, there is an annual average groundwater surplus of around 1,700 AFY. The main contributor to inflow is deep percolation, and the primary source of outflow is pumping. Much of the pumping in the Delta is likely being simulated to represent the current operations employed in the Management Area to maintain groundwater levels bgs and the water is being returned to the adjacent waterways. The summary of the annual water budget averages from 2016 to 2065 are shown in **Table 7-7**.

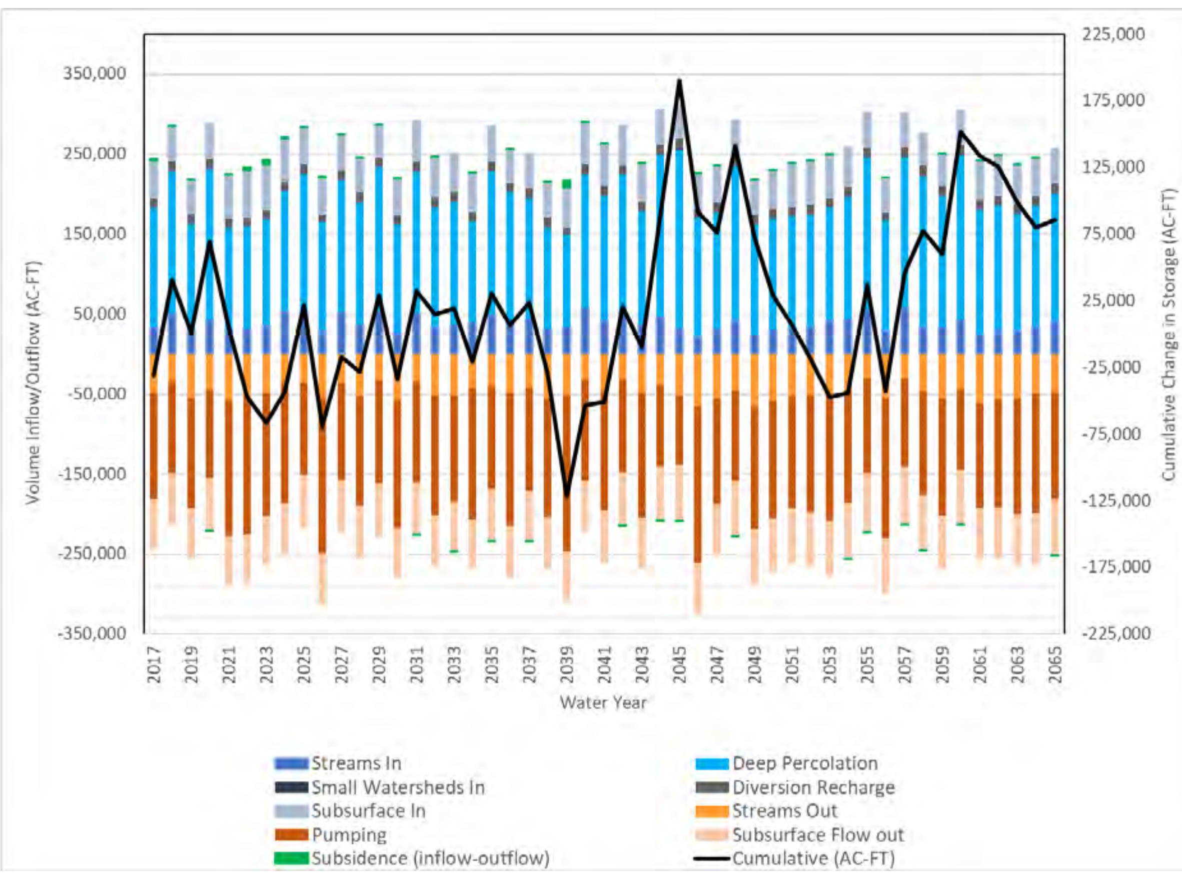


Figure 7-7. Projected with Climate Change Delta Area Water Budget - 2016-2065

Table 7-7. Projected with Climate Change Delta Area Water Budget – Annual Averages – 2016-2065

INFLOWS (AFY)		OUTFLOWS (AFY)	
Streams/Rivers	38,710	*Streams/Rivers*	47,927
Deep Percolation	157,086	*Pumping*	140,806
Small Watersheds	60		
Diversion Recharge	13,044		
Subsidence	829		
Subsurface	46,099	*Subsurface*	65,383
Total IN	**255,828**	***Total OUT***	**254,116**

7.6.1.2 Non-Delta Management Area – Projected with Climate Change

Figure 7-8 shows the annual inflows and outflows, and the cumulative change in storage for the Non-Delta Area for the projected with climate change scenario. Within the Non-Delta Management Area for the projected with climate change scenario there is an annual average groundwater deficit of approximately 700 AFY. The primary sources for both inflow and outflow are subsurface flows to and from the neighboring areas. The summary of the annual water budget averages from 2016 to 2065 are shown in **Table 7-8**. To better understand the projected groundwater deficit, the unconfined (Upper) and the confined (Lower) aquifers were also analyzed.

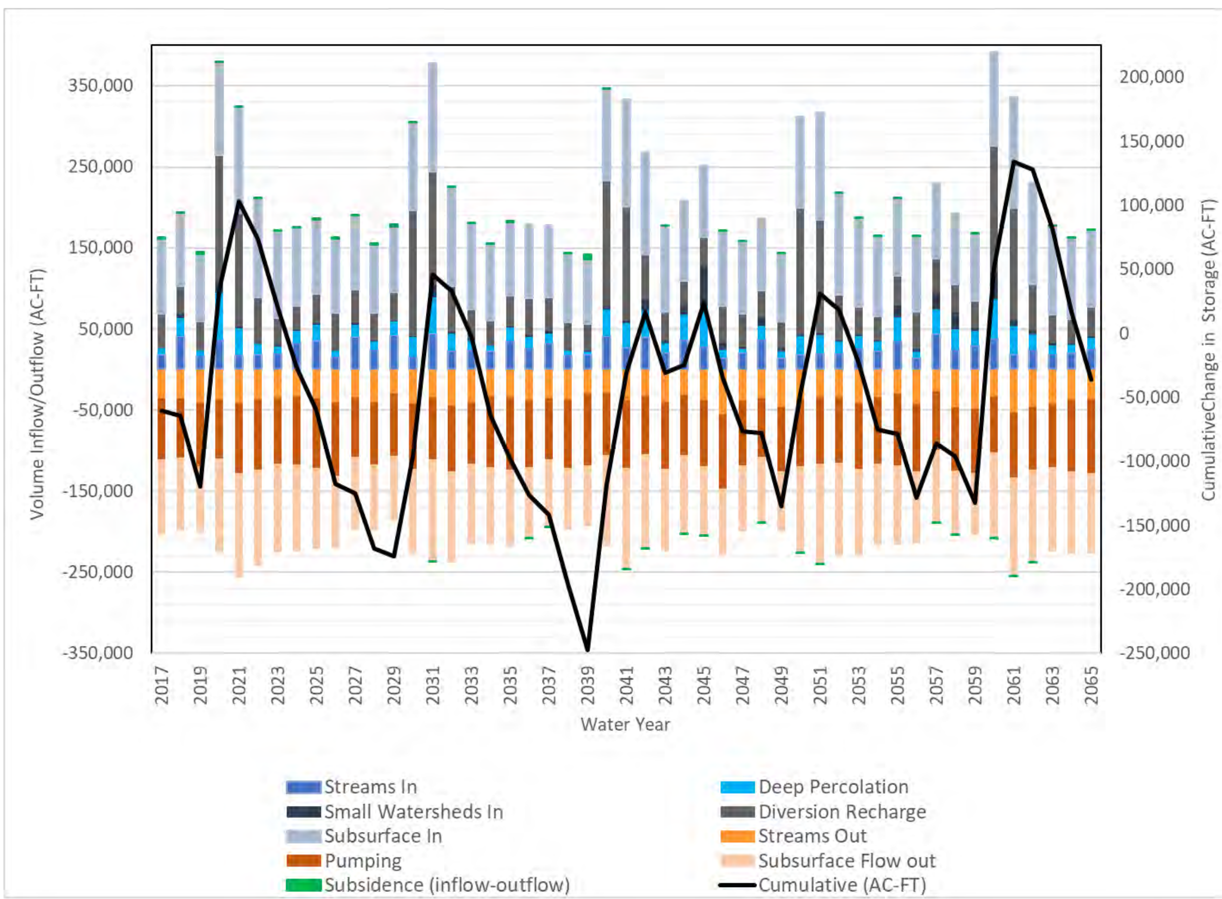


Figure 7-8. Projected with Climate Change Non-Delta Area Water Budget – 2016-2065

Table 7-8. Projected with Climate Change Non-Delta Area Water Budget – Annual Averages – 2016-2065

INFLOWS (AFY)		OUTFLOWS (AFY)	
Streams	26,665	*Streams*	37,682
Deep Percolation	19,255	*Pumping*	80,586
Small Watersheds	6,398		
Diversion Recharge	60,928		
Subsidence	723		
Subsurface	101,912	*Subsurface*	98,337
Total IN	**215,881**	***Total OUT***	**216,605**

Figure 7-9 shows the annual average inflows and outflows for each layer within the Non-Delta Management Area. Layer one in the model represents the unconfined Upper aquifer and shows an annual deficit of 800 AFY, while layer two, the confined Lower aquifer, has a surplus of 100 AFY. The water budgets illustrate that the Upper aquifer (Layer 1) has connectivity with waterways and channels through inflows and outflows to streams, as well as the rootzone with deep percolation. The Lower aquifer (Layer 2) is disconnected from these processes as it is below the Corcoran Clay layer. It appears the modelers extended the Corcoran Clay or another low permeability layer beneath the Delta Management Area, from the previous known extent (*refer to* **Figure 4-7)**. Within both layers subsurface flows are the driving forces behind the inflows and outflows. Pumping is present in both layers but is a larger component in layer one. The summaries of the annual water budget averages from 2016 to 2065 for both layers are shown in **Tables 7-9** and **7-10**.

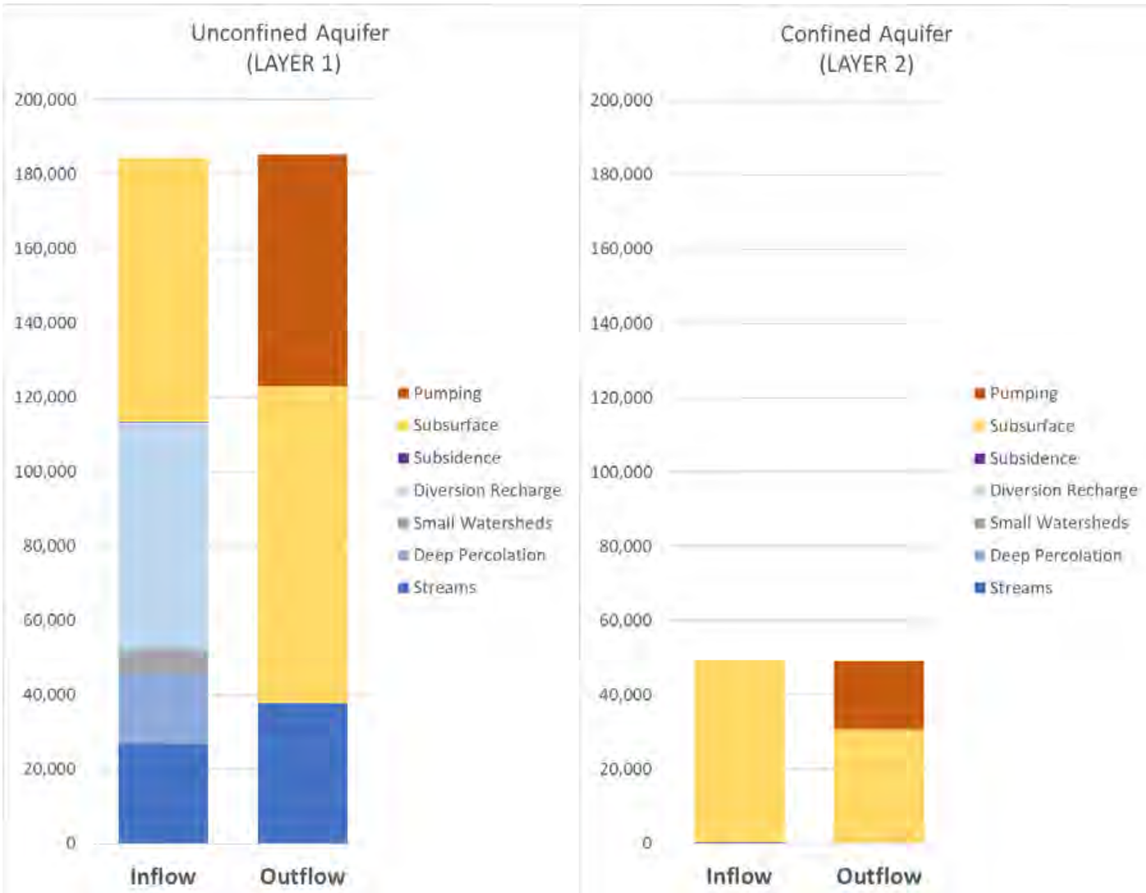


Figure 7-9. Projected with Climate Change Non-Delta Area Water Budget- Annual Averages by Layer – 2016-2065

Table 7-9. Projected with Climate Change Non-Delta Area Water Budget Layer 1 – Annual Averages – 2016-2065

INFLOWS (AFY)		OUTFLOWS (AFY)	
Streams	26,665	*Streams*	37,682
Deep Percolation	19,255	*Pumping*	62,161
Small Watersheds	6,398		
Diversion Recharge	60,927		
Subsidence	76		
Subsurface	71,054	*Subsurface*	85,381
Total IN	**184,375**	***Total OUT***	**185,224**

Table 7-10. Projected with Climate Change Non-Delta Area Water Budget Layer 2 – Annual Averages – 2016-2065

INFLOWS (AFY)		OUTFLOWS (AFY)	
Streams		*Streams*	
Deep Percolation		*Pumping*	18,424
Small Watersheds			
Diversion Recharge			
Subsidence	226		
Subsurface	49,066	*Subsurface*	30,731
Total IN	**49,292**	***Total OUT***	**49,155**

Table 7-11 shows a comparison of inflows and outflows for the Non-Delta Management Area water budget results for historic (H1), projected (P1) and projected with climate change (P1+CC) to assess changes. The percent difference from historic to projected with climate change is also shown to help assess where significant changes are occurring. It shows surface water depletion (a combination of increased inflow and decreased outflow) will increase, into and from the Upper aquifer. It also shows that subsurface inflow is expected to increase by about 5,000 AFY. Adjacent subbasins are not expected to be impacted as the subsurface outflow is expected to increase by about 18,000 AFY.

Table 7-11. Non-Delta Management Area Scenario Comparisons

Non-Delta Management Area Groundwater Inflow/Outflows (AFY)				
	H1	**P1**	**P1+CC**	**H1 - P1+CC % Change**
Inflow	***187,327***	***216,108***	***215,881***	***15%***
Streams	16,435	24,668	26,665	62%
Deep Percolation	19,486	20,608	19,255	-1%
Small Watersheds	6,352	6,398	6,398	1%
Diversion Recharge	47,821	60,875	60,928	27%
Subsidence	971	315	723	-26%
Subsurface	96,261	103,245	101,912	6%
Outflow	**189,730**	**215,107**	**216,605**	**14%**
Streams	50,048	40,737	37,682	-25%
Pumping	69,618	75,832	80,586	16%
Subsurface	70,064	98,537	98,337	40%
Total	***-2,403***	***1,001***	***-724***	***-70%***

7.7 Sustainable Yield

SGMA of 2014 defined sustainable yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result." An undesirable result means one or more of the following effects caused by groundwater conditions occurred throughout the basin: chronic lowering of groundwater levels, depletion of interconnected surface water, significant and unreasonable loss of storage, subsidence, saltwater intrusion, and degradation of water quality. None of these undesirable results have been observed in the Subbasin in the recent past.

A base period was selected to estimate the sustainable yield that have the following conditions:

- As recent time period as possible to reflect current conditions.
- Precipitation is close to the long-term average.
- Prior to the start and end of the base period the cumulative departure from normal has a similar slope such that water in transit in the vadose zone is approximately equal and the period contains at least one wet period and dry period.

These conditions were met, based on **Figure 7-2**, and a base period of 2003 to 2013 was selected. This base period was also selected by the Northern Delta-Mendota GSP as their representative base-period. Other adjacent subbasins selected other base periods due to local climatic conditions.

The average quantity of groundwater extracted during the base period was 178,000 AFY for the entire Subbasin. The average quantity of groundwater extracted during the base period for just the Non-Delta Management Area was 62,100 AFY. During this period undesirable results, as currently defined, were not observed by the GSAs. Groundwater levels provided in **Appendices G and H** show stable or upward trends in groundwater levels during this period of time.

The sustainable yield can be increased if conjunctive use projects are implemented to increase recharge to the Subbasin. The annual reports and 5-year update will document any conjunctive use changes or revisions to this GSP.

7.8 Opportunities for Improvement

As discussed in earlier sections, DWR's C2VSim-FG_v1.0 was used to develop the water budgets described in this chapter. The goal with using this particular tool was to rely on the efforts and expertise of DWR (best available science) to model the Subbasin to provide a conceptual understanding of current conditions in the subbasin and potential future conditions. There is a general acknowledgement by stakeholders in the subbasin that there are minimal concerns for groundwater overdraft, and that this initial round of the GSP process can serve to improve understanding and knowledge and to potentially vet and improve existing tools. C2VSim-FG performs reasonably well in the Subbasin in terms of the agreement of the simulated water budget components as compared to historical data, and the simulated groundwater levels provide a reasonable approximation of observed groundwater levels.

Through the process of post-processing the historical model run and preparing data and input files for the projected simulations, there were items in the model and associated data that were noted within the Subbasin as areas of uncertainty and identified as potential future improvements. These items are described briefly below and discussed in greater detail in **Appendix M**. Future GSP updates will refine some of these uncertainties and improve the modeling representation of the Subbasin. However, overall, the C2VSim-FG_v1.0 is a reliable and defensible tool to support planning future groundwater conditions and estimating the potential hydrological impacts of future climate conditions and management actions at the subbasin level. It is currently the best available quantitative tool for assessing projected future groundwater conditions under SGMA. This model and water budget needs to be further proofed at a subbasin level.

Opportunities for Future Improvements:

- Historical Diversion Data: The C2VSim model includes diversion files with specifications for locations, quantities, timing, and distribution of surface water deliveries. Examining the diversion data for the Subbasin area specifically highlighted questions related to the representation of the actual diversion points, delivery locations, and quantities of water delivered. This will be explored in future GSP updates.
- Historical Agricultural Demands: Agricultural demands in the Subbasin were based on land-use surveys and climate data. Review of agricultural demands in some areas of the Subbasin and comparing with relevant planning documents revealed there may be a need to refine the data used for estimating demands to better match the agricultural demands.
- Historical Urban Land Use: The areas designated as urban developments in the historical model are held constant for the entire simulation period (1974-2015). The urban demands do increase over time due to population growth and the related water use per capita, but the land-use does not change. Since 1974, there has been increased urbanization in the areas surrounding Tracy and Lathrop where areas previously utilized for agriculture have been developed. This land-use trend and associated impacts to water management should be considered for future refinements to the model.
- Historical Pumping and Groundwater Elevations: There are areas in the Subbasin that the C2VSim-FG_v1.0 is simulating pumping where it is known that little or no pumping is occurring, (i.e., south of Highway 580 where aerial photographs show no agricultural development) and is also pumping water in excess of the simulated demands. Due to a combination of the increased demands and various simulated aquifer parameters, the model results show excessive drawdown (pumping depressions) and groundwater extraction far more than known agricultural demands for groundwater. Further examination of the model files and physical land use conditions should be considered in future refinements of the model.
- Model Elements: Realign the elements to conform with the Subbasin boundaries and to the extent possible aligning the nodes by GSA areas.
- Groundwater Pumping: Groundwater pumping for the entire Subbasin, as shown in Appendix M, ranges from 150,000 to 220,000 AFY, while the Basin Prioritization files indicate the groundwater pumping to be 12,000 AFY. Check of the urban pumping generally agrees with the Basin Prioritization volumes. The higher pumping may be resolved during the Historical Agricultural Demands improvements.

8. Monitoring Networks

The Tracy Subbasin groundwater-level monitoring program has evolved over the years to include only wells that with adequate construction details, including wells in the CASGEM program and monitoring wells constructed by the City of Tracy and local agencies. The groundwater level monitoring network is supplemented with monitoring wells constructed by various parties as part of compliance regulatory programs overseen by the State Board. Groundwater levels in these wells are monitored by various agencies including each of the GSAs, DWR, USGS, County and other parties. Separately, groundwater quality is monitored (PWS agencies) as part of compliance with drinking water standards and the ILRP.

For purposes of monitoring SGMA sustainability indicators as defined in this GSP, representative monitoring wells were selected from this broader network to assess groundwater levels and groundwater quality. The representative monitoring well network are those wells that will be used to track changes for each of the sustainability indicators in the Subbasin to assess short- and long-term trends for lowering of groundwater levels, reduction in storage, depletion of interconnected surface water, subsidence and water quality degradation. A monitoring network was not selected for sea water intrusion, as it is not likely to occur in the future (*refer to* **Chapter 5.7 – Seawater Intrusion** for further details).

Representative monitoring wells are only in the Non-Delta Management Area for each of the sustainability indicators where minimum thresholds and measurable objectives will be established (*see* **Chapter 9 – Sustainable Management Criteria**). Representative monitoring wells are not included in the Delta Management Area for the reasons discussed in **Chapter 6 –Management Areas**. Representative monitoring wells are discussed for each of the sustainability indicators in the following sections along with evidence that the wells are reflective of conditions in the principal aquifers.

8.1 Objectives

The objectives of the monitoring well network, for the Non-Delta Management Area, are:

- Have monitoring wells distributed throughout the Subbasin and in the two principal aquifers to assess changing conditions that could affect beneficial users or uses and evaluate the effects of or need for projects and management actions.
- Monitoring protocol with standard and repeatable methods to obtain accurate measurements.
- Provide physical measurements of the groundwater conditions to demonstrate if the Subbasin is being sustainably managed within the locally established minimum thresholds and measurable objectives.
- Provide measurements for future refinements of the groundwater models and water budgets.

8.2 Chronic Lowering of Groundwater Levels

The groundwater monitoring network for the Tracy Subbasin is organized to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers. Well selection is based on having a sufficient number of wells in each principal aquifer to show groundwater flow directions. A summary of the groundwater conditions in each principal aquifer is provided along with areas of interest.

The principal aquifers and monitoring network are based on the USGS definition of the extent of the Corcoran Clay as shown on **Figure 4-7**.

Groundwater levels in the Upper aquifer show a consistent trend of groundwater levels higher near the foothills and shallower near the Old River (see **Figure 5-3**). The Upper aquifer is interconnected to surface water and locally supports potential GDEs (groundwater dependent ecosystems). Two areas are showing groundwater level declines in the Upper aquifer, one near the northwestern corner of the Subbasin (near well 04S01E31P005M as shown on **Figure 8-1**), within Alameda County and near GDEs, and a second area near the southeastern corner of the Subbasin (near well 03S06E28N001M) near an area where subsidence is occurring.

Groundwater levels in the Lower aquifer show a pumping depression has formed beneath the City of Tracy, which is creating radial flow towards this location. In the early 2000s, this depression also included areas beneath the central portions of the City of Tracy. Since the mid-2000s groundwater levels in the central portions of the City have risen by over 20 feet (GEI, 2007). Because there is radial flow into the depression, some groundwater migrates into the area from the north, from the Delta area where, due to unknown extent of the Corcoran Clay, the rivers may also provide recharge to the Lower aquifer.

8.2.1 *Monitoring Network*

The groundwater level monitoring network has changed over the years with mostly a reduction in the number of production wells and some movement towards dedicated monitoring wells. The initial groundwater level monitoring network for the Subbasin was developed by DWR in 1952 and generally consisted of monitoring existing agricultural water supply wells. In the 1960's San Joaquin County developed a monitoring network and has continued to monitor most of these wells since that time. In 2002, the City of Tracy constructed dedicated monitoring wells to monitor groundwater levels in the Lower aquifer, below the Corcoran Clay. In 2012, with the advent of CASGEM the monitoring network was reviewed and only those wells with known construction details or at least total depth were identified for each of the principal aquifers with the attempt to keep wells with long-term groundwater levels. DWR, is currently reviewing and revising their monitoring network. The wells have been used for decades to illustrate groundwater flow directions, change in storage, and their relationship to surface water. As has been the practice in the Subbasin, additional monitoring wells were selected from groundwater quality monitoring programs overseen by the Regional Water Quality Control Board and other agencies to supplement the CASGEM monitoring network.

The current groundwater level monitoring network for the Subbasin, which only includes wells with known construction details and/or at least the total depth of the well, consists of a total of 41wells at 22 locations. There are 18 monitoring wells in the Upper aquifer and 23 wells in the Lower aquifer in the non-Delta area which covers an area of about 186 square miles. Groundwater level measurements from these wells can be used for multiple purposes including to show groundwater occurrence, flow directions, and horizontal and vertical gradients. Establishing groundwater levels in these wells can be used to be protective of sensitive beneficial uses and users including surface water depletion, GDEs, and domestic wells. The locations of these monitoring wells are shown on **Figures 8-1 and 8-2**, but it should be noted that many of the monitoring wells are at the same location (nested or clustered), therefore the figures show fewer wells than the total actually present.

Table 8-1 provides a summary of the groundwater level monitoring well types, distribution, and protection of beneficial users in the Subbasin. **Table 8-2** provides a table with the monitoring well attributes, their purpose, and other pertinent details. The monitoring wells are sufficient to monitor and demonstrate groundwater occurrence and flow directions, both horizontal and vertical gradients (seven sets nested and clustered wells), and water table levels near surface water.

Table 8-1. Monitoring Well Types and Distribution

Monitoring Wells	Non-Delta Area
Total Upper Aquifer Monitoring Wells	22
Observation/Monitoring Wells [1]	11
Voluntary Wells	11
Total Lower Aquifer Monitoring Wells	26
Observation/Monitoring Wells [1]	23
Voluntary Wells	3
Total Wells without Construction Details or Depths	0
Vertical Gradient Nested or Clustered Well Loctions	7

Notes: [1] Dedicated monitoring wells owned by GSA or other agencies under regulatory programs

Table 8-2. Groundwater Level Monitoring Well Network

CASGEM ID	Local Name	Latitude	Longitude	Reference Point Elevation (ft)	Screened Interval (ft bgs)	Total Depth (ft bgs)	Period of Record	Well Type	Current Monitoring Frequency
Upper Aquifer Wells									
377341N1213039W001	Well N	37.7341	-121.3039	23.36	Unknown	40	1960-2019	R	Semi-Ann
377061N1214199W001	Well Q	37.7061	-121.4199	121.41	120-140	140	1972-2020	R	Semi-Ann
377951N1216011W001	02S03E01D001M	37.79512	-121.60111	90	40-80	80	2014-2020	I	Semi-Ann
377813N1214420W001	02S05E08B001M	37.7813	-121.442	4.3	50-80	80	1960-2019	R	Semi-Ann
377976N1214560W001	01S05E31R002M	37.7976	-121.456	4.6	Unknown	92	1960-2019	R	Semi-Ann
376388N1213233W001	03S06E28N001M	37.6388	-121.3233	148.24	107-128	128	2012-2020	O	Semi-Ann
377528N1215156W001	02S04E15R001M	37.7528	-121.5156	63.41	0.1-45	45	2011-2019	U	Semi-Ann
378103N1215449W001	ORL-1W	37.81031	-121.54489	16.6	86-106	106	2005-2018	O	None
377979N1215800W001	01S04E31P005M	37.79791	-121.58003	60	8-23	24	2014-2020	O	Semi-Ann
376713N1214580W001	Corral MW-5	37.67134	-121.45799	297.89	71-81	87	2015-2019	O	Active
376700N1214547W001	Corral MW-4	37.66997	-121.45466	243.74	16.5-26.5	27	2015-2019	O	Active
	Glori MW-2	37.68056	-121.34394	77.83	20-35	35	2020-future	O	Quarterly/Cont.
	DV MW-16-BP	37.74927	-121.32764	18	60-85	85	1995-2020	O	Quarterly
	MWM-24	37.81657	-121.31459	16.88	10-20	21	2005-2020	O	Quarterly
	MWR-25	37.78232	-121.33303	16.25	11-21	22	2005-2020	O	Quarterly
	PW11-031	37.81163	-121.28417	20.42	23-28	31	1980-2019	O	Quarterly
	PW16-216	37.81305	-121.27582	23.26	208-213	216	1980-2019	In	Quarterly
	SJCDW00034	37.6891	-121.3607		Unknown	180	2018-2020	O	Annual
	SJCDW00032	37.766	-121.5308		Unknown	125	2018-2020	O	Annual
	SAD MW-438D	37.85253	-121.27371	21.42	260-280	280	Unknown	O	Semi-Ann
	SAD MW-401D	37.82681	-121.26346	24.46	230.25-240	240	Unknown	O	Semi-Ann
	SAD MW-402D	37.82872	-121.26737	24.52	260-270	270.5	2004-2020	O	Semi-Ann
Lower Aquifer Wells									
376713N1214581W001	Corral MW-6	37.67127	-121.45809	303.33	455-475	477	2015-2018	O	Quarterly
376664N1214612W001	Corral MW-7	37.66645	-121.46123	304.97	310-330, 360-380, 410-430	430	2015-2019	O	Quarterly
377402N1214508W001	MW-1A	37.74019	-121.45076	49.25	428-468	480	2012-2019	O	Semi-Ann
377402N1214508W003	MW-1C	37.74019	-121.45076	51.2	748-788	800	2012-2019	O	Semi-Ann
377402N1214508W002	MW-1B	37.74019	-121.45076	50.09	618-658	670	2012-2019	O	Semi-Ann
377143N1214459W001	MW-2A	37.71431	-121.44591	92.58	426-466	480	2012-2019	O	Semi-Ann
377143N1214459W002	MW-2B	37.71431	-121.44591	92.53	634-674	690	2012-2019	O	Semi-Ann
377143N1214459W003	MW-2C	37.71431	-121.44591	92.53	770-810	820	2012-2019	O	Semi-Ann
377031N1214485W001	MW-3A	37.70306	-121.44854	137.86	382-402	415	2012-2019	O	Semi-Ann
377031N1214485W002	MW-3B	37.70306	-121.44854	138.08	540-580	595	2012-2019	O	Semi-Ann
377031N1214485W003	MW-3C	37.70306	-121.44854	138.22	770-810	820	2012-2019	O	Semi-Ann
377149N1214257W001	MW-4A	37.71487	-121.42567	104.08	450-490	505	2012-2019	O	Semi-Ann
377149N1214257W002	MW-4B	37.71487	-121.42567	102.75	680-700	715	2012-2019	O	Semi-Ann
377149N1214257W003	MW-4C	37.71487	-121.42567	103.11	770-810	820	2012-2019	O	Semi-Ann
377427N1213943W001	MW-5A	37.74266	-121.39432	48.39	406-446	460	2012-2019	O	Semi-Ann
377427N1213943W002	MW-5B	37.74266	-121.39432	47.82	576-616	640	2012-2019	O	Semi-Ann
377427N1213943W003	MW-5C	37.74266	-121.39432	48.06	770-810	820	2012-2019	O	Semi-Ann
377656N1214199W001	MW-6A	37.76563	-121.41992	26.52	410-450	465	2012-2019	O	Semi-Ann
377656N1214199W002	MW-6B	37.76563	-121.41992	26.65	590-630	645	2012-2019	O	Semi-Ann
377656N1214199W003	MW-6C	37.76563	-121.41992	26.8	755-795	810	2012-2019	O	Semi-Ann
376444N1213980W001	03S05E26M001M	37.6444	-121.398	234.09	Unknown	782	2012-2020	I	Semi-Ann
376974N1213258W001	03S06E05R001M	37.6974	-121.3258	59.69	252-275, 295-340, 395-436, 487-537, 589-597, 623-698, 724-749	775	1959-2020	U	Semi-Ann
376470N1213162W001	03S06E28F003M	37.647	-121.3162	119.82	331-715, 726-745	745	1999-2020	I	Semi-Ann
	PW12-315	37.81006	-121.2779	21.62	307-312	315	2009-2019	O	Quarterly
	PW16-329	37.81305	-121.27582	23.25	321-326	329	2009-2019	O	Quarterly
	PW20-500	37.8076	-121.2997	15.82	300-500	497.5	2009-2019	O	Quarterly

Notes: I = Irrigation well; O = Observation/Monitoring well; U = Unknown
In = Industrial; R = Residential well

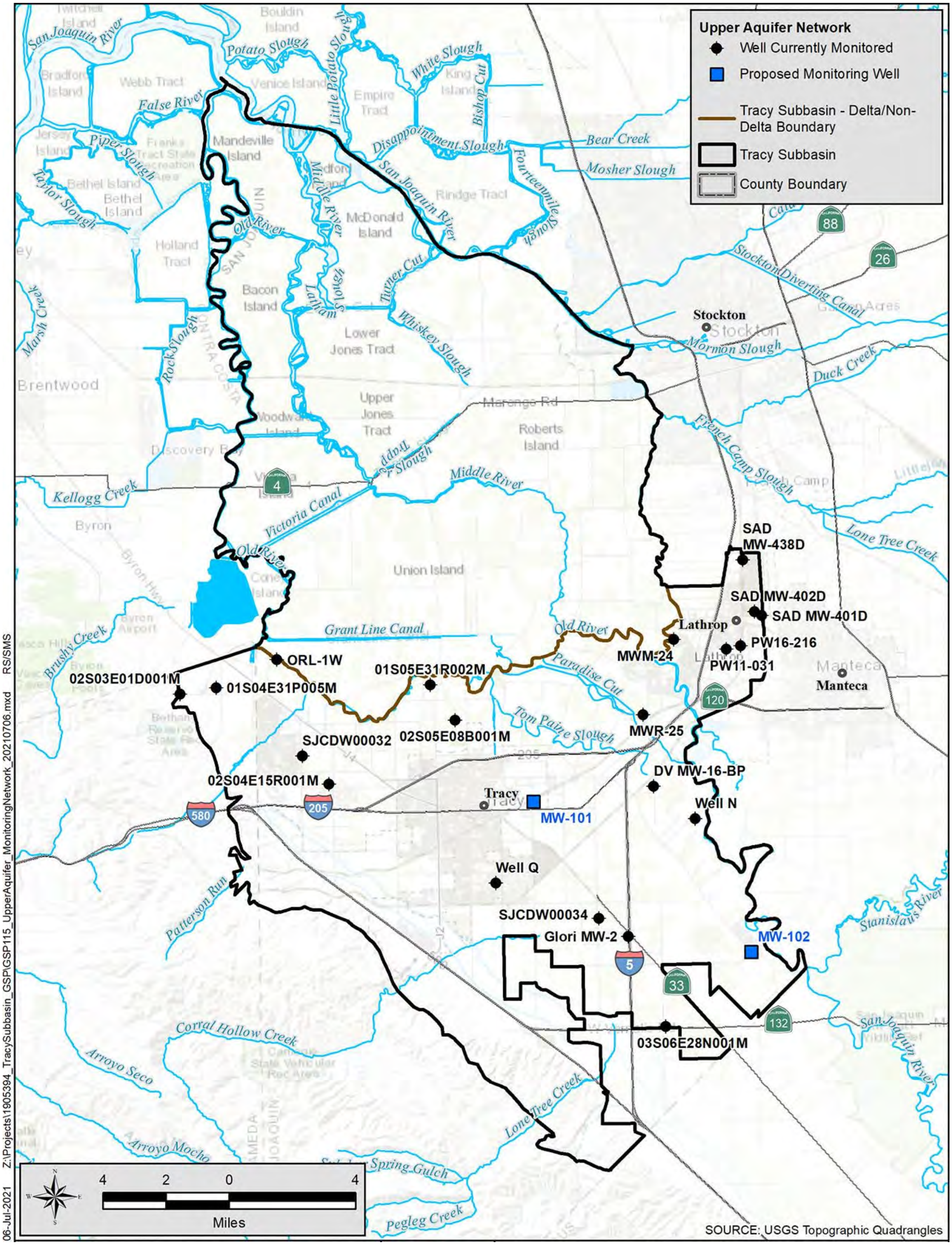


Figure 8-1. Upper Aquifer Groundwater Level Monitoring Wells

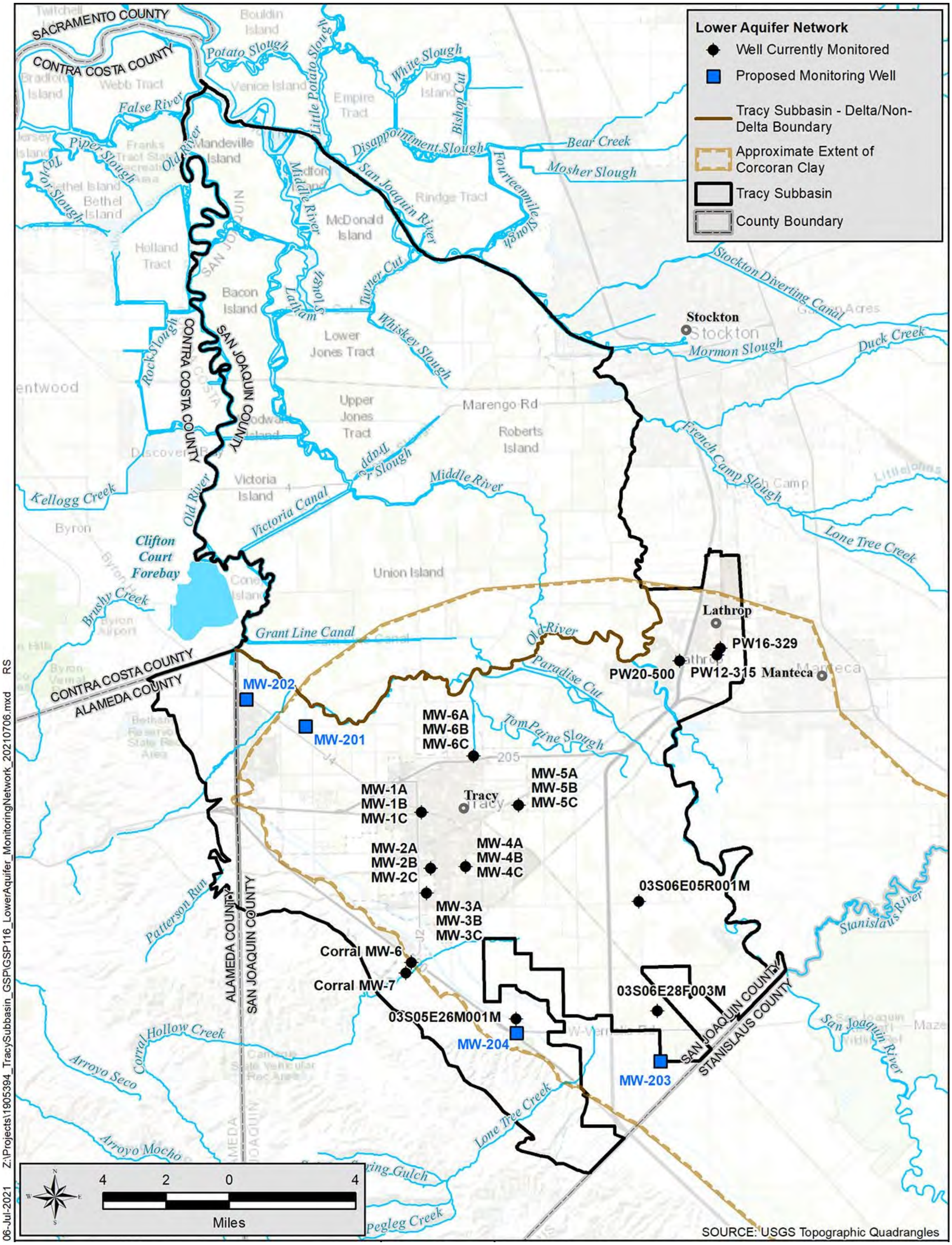


Figure 8-2. Lower Aquifer Groundwater Level Monitoring Wells

8.2.2 *Representative Monitoring Wells*

The entire monitoring well network as shown on **Figures 8-1 and 8-2** was evaluated and a subset of the monitoring sites were selected to be representative of the groundwater level conditions in the Non-Delta Management Area portions of the Subbasin. **Figures 8-3 through 8-9** illustrate the distribution of the representative groundwater level monitoring wells. Criteria considered for selecting the wells included the following:

- Wells having construction information or total well depth to confirm which principal aquifer the wells are monitoring
- Ability to monitor changes in groundwater levels in the two principal aquifers, in areas where potential undesirable results may occur
- Dedicated monitoring wells as opposed to voluntary wells which may be being used for water supply and affected by pumping

Groundwater level representative monitoring wells were selected to be protective of the sensitive beneficial users (domestic well owners, GDEs and wells in areas solely supplied by groundwater). Protection of these sensitive beneficial users would then be protective of agriculture and municipal well owners as their wells are typically deeper. Wells were also selected near Subbasin boundaries to track inflow and outflow from adjacent subbasins and in areas where groundwater levels are declining. A brief discussion of the criteria used for selection of the monitoring wells for each aquifer is provided below.

8.2.2.1 Upper Aquifer

The criteria used to select groundwater level representative monitoring wells in the Upper aquifer was to select wells near sensitive beneficial users (domestic well owners, GDEs and wells in areas solely supplied by groundwater). Protection of these sensitive beneficial users would then be protective of agriculture and municipal well owners as their wells are typically deeper.

The representative groundwater level monitoring well network was selected to be protective of domestic well owners. **Figure 8-3** shows the density of the domestic wells in the Non-Delta Management Area portion of the Subbasin, locations of selected representative monitoring wells to be protective of these users and a radius of 2.5 miles around each monitoring well, which is equivalent to five wells per 100 square miles, to illustrate whether the Subbasin has an adequate monitoring network. **Figure 8-4** provides the minimum depths of these domestic wells (indicating all are in the Upper aquifer except near the foothills) along with the depths of the representative monitoring wells, illustrating the selected monitoring wells are at similar depths as the domestic well owners. **Figure 8-5** shows domestic well minimum depths in comparison to both agriculture and municipal well depths to illustrate that selection of representative monitoring well using domestic wells would be protective of municipal and agricultural wells. It should be noted that Corral MW-6, by which depth is in the Lower aquifer, and was selected because it has similar depths as the domestic wells in the area. It was selected to be a representative monitoring well for protection of domestic well owners and its location is shown on **Figure 8-7**.

GDEs are a sensitive beneficial user and their locations are shown on **Figure 8-6**, along with managed wetlands (that may or may not be GDEs). Since GDEs typically have shallow rooting depths (less than

30 feet), Upper aquifer representative monitoring wells were selected near the GDEs that monitor water table conditions (well depths less than 100 feet).

Some portions of the Tracy Subbasin rely solely on groundwater as their source of water (**Figure 8-7)**. Representative monitoring wells, in the Upper aquifer since the shallowest wells are the most susceptible, were confirmed to be present near these areas (similar wells as developed and shown on **Figure 8-3**).

The combination of the representative monitoring wells for the Upper aquifer for tracking of lowering of groundwater levels is shown on **Figure 8-8**. **Table 8-3** provides a list of representative monitoring wells for the Upper aquifer.

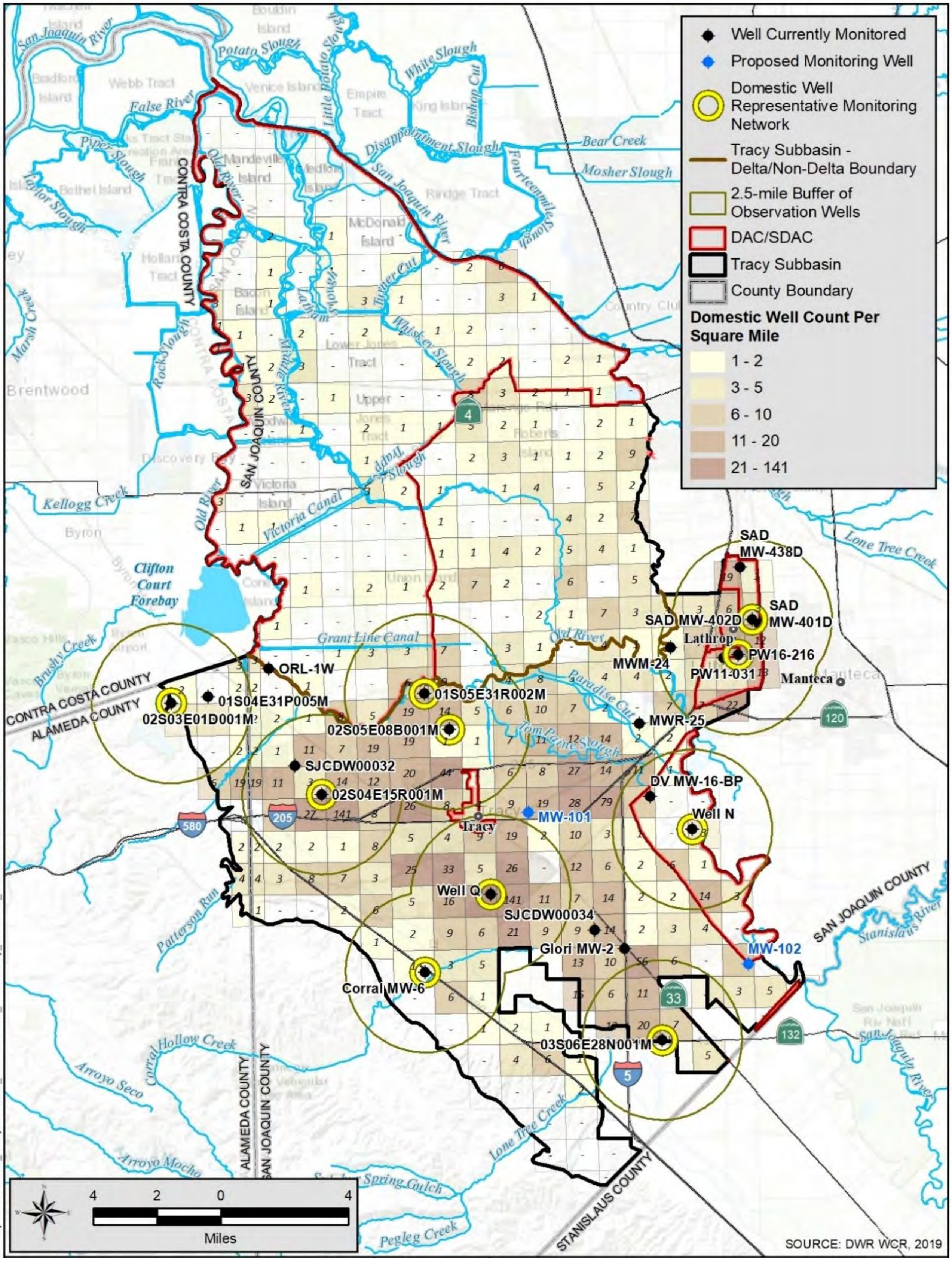


Figure 8-3. Groundwater Level Representative Monitoring Wells for Domestic Wells

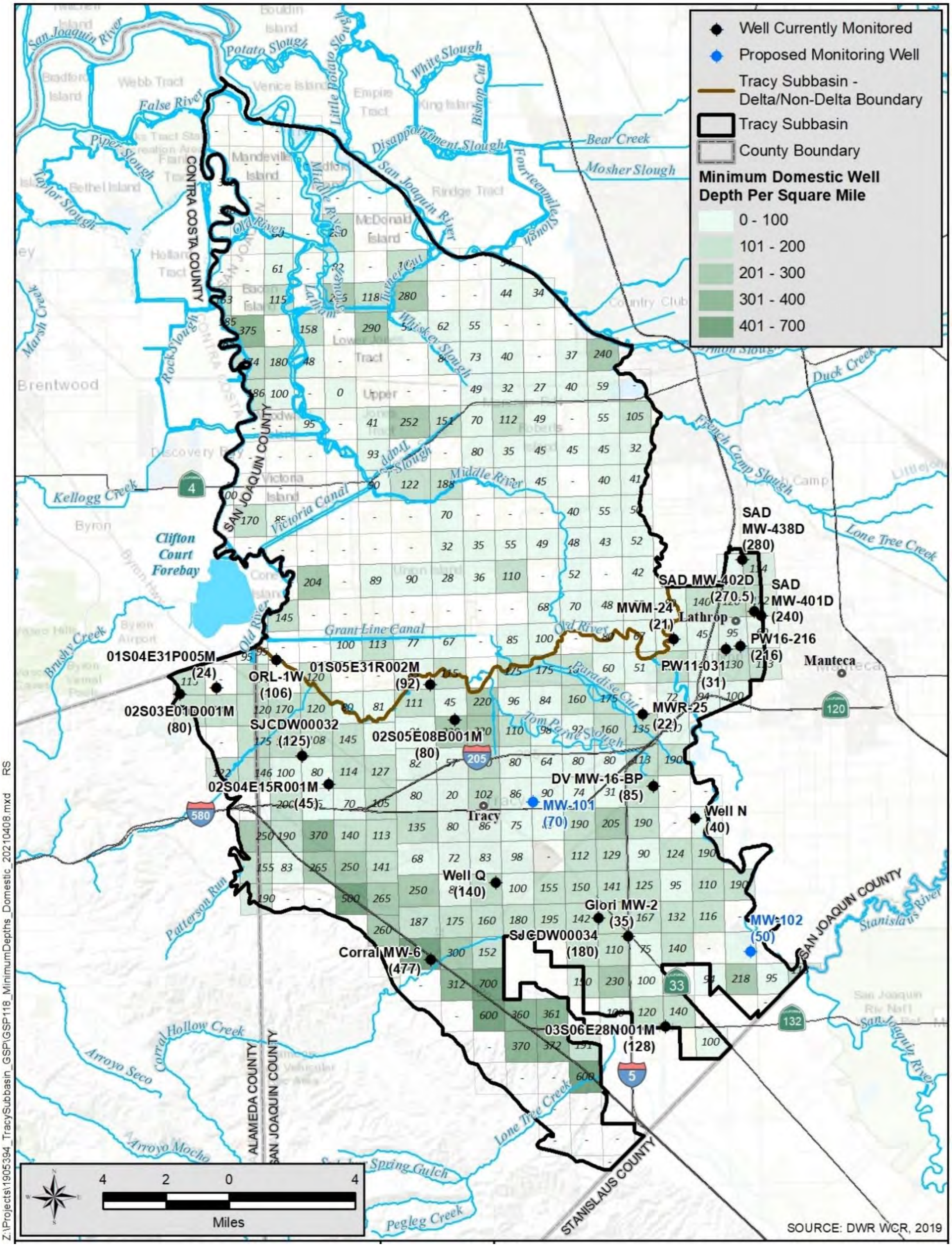


Figure 8-4. Groundwater Level Representative Monitoring Well Depths to Domestic Wells

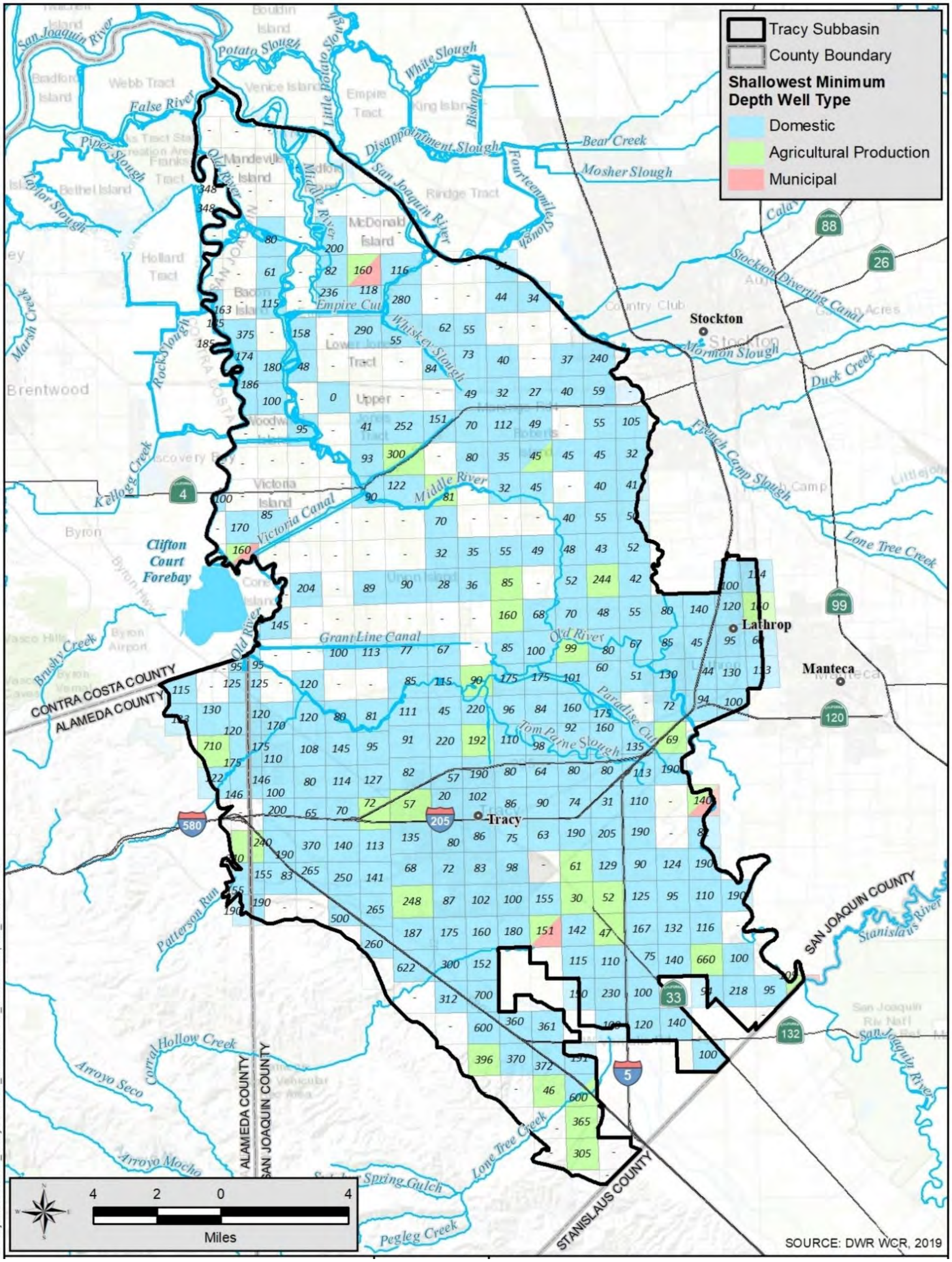


Figure 8-5. Comparison of Domestic Minimum Depths to Agricultural and Municipal Wells

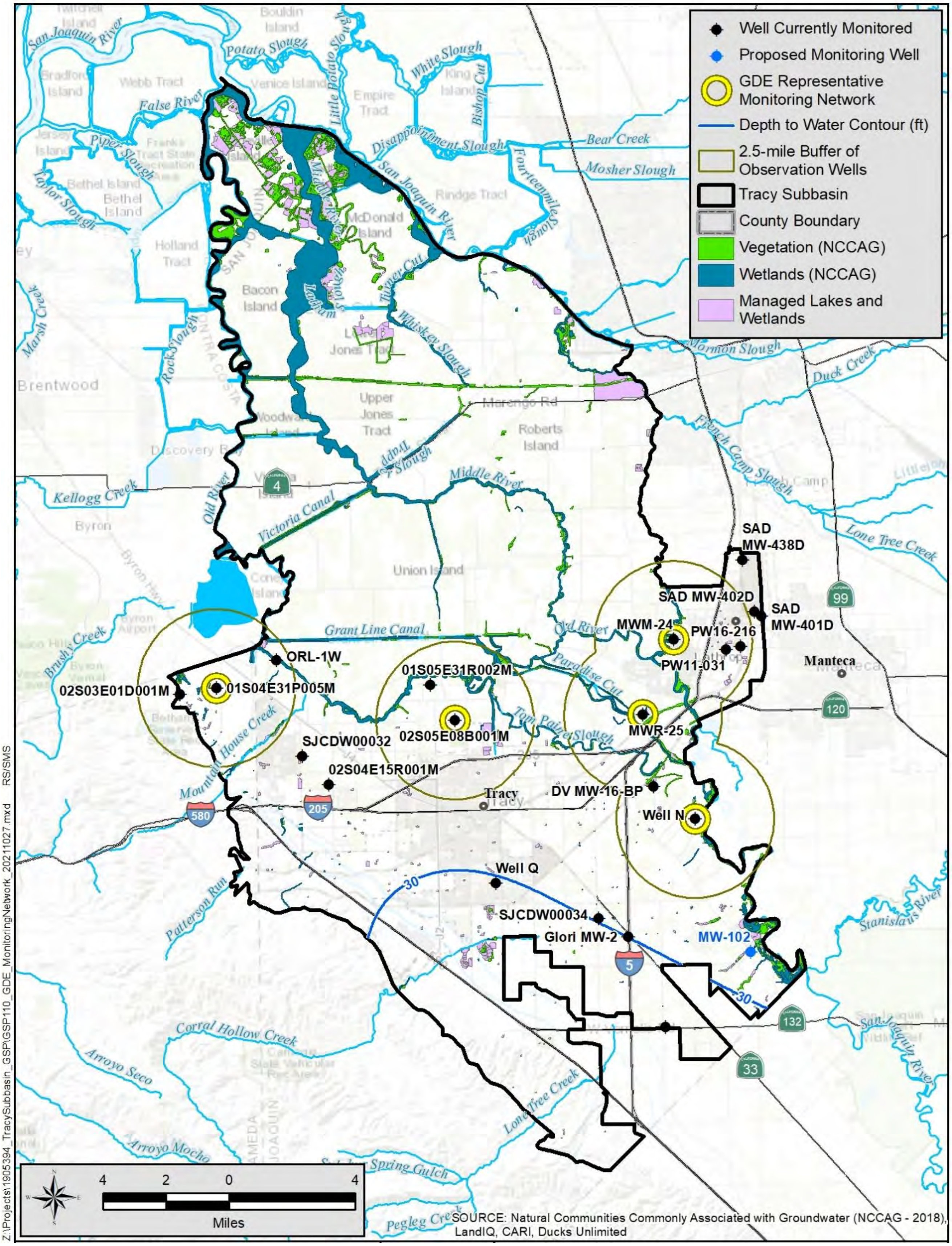


Figure 8-6. Groundwater Level Representative Monitoring Well for Potential GDEs

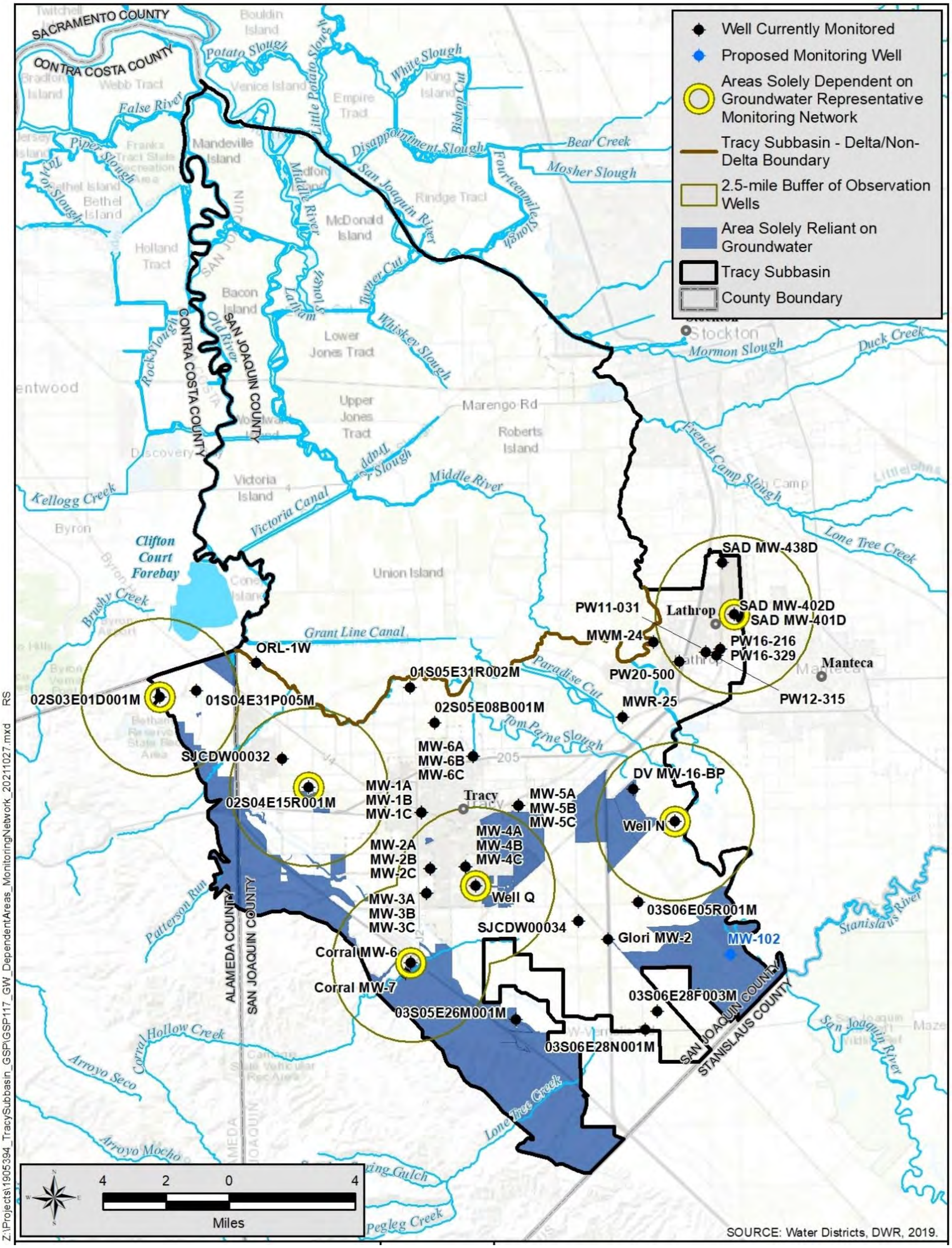


Figure 8-7. Groundwater Level Representative Monitoring Wells for Areas Solely Reliant on Groundwater

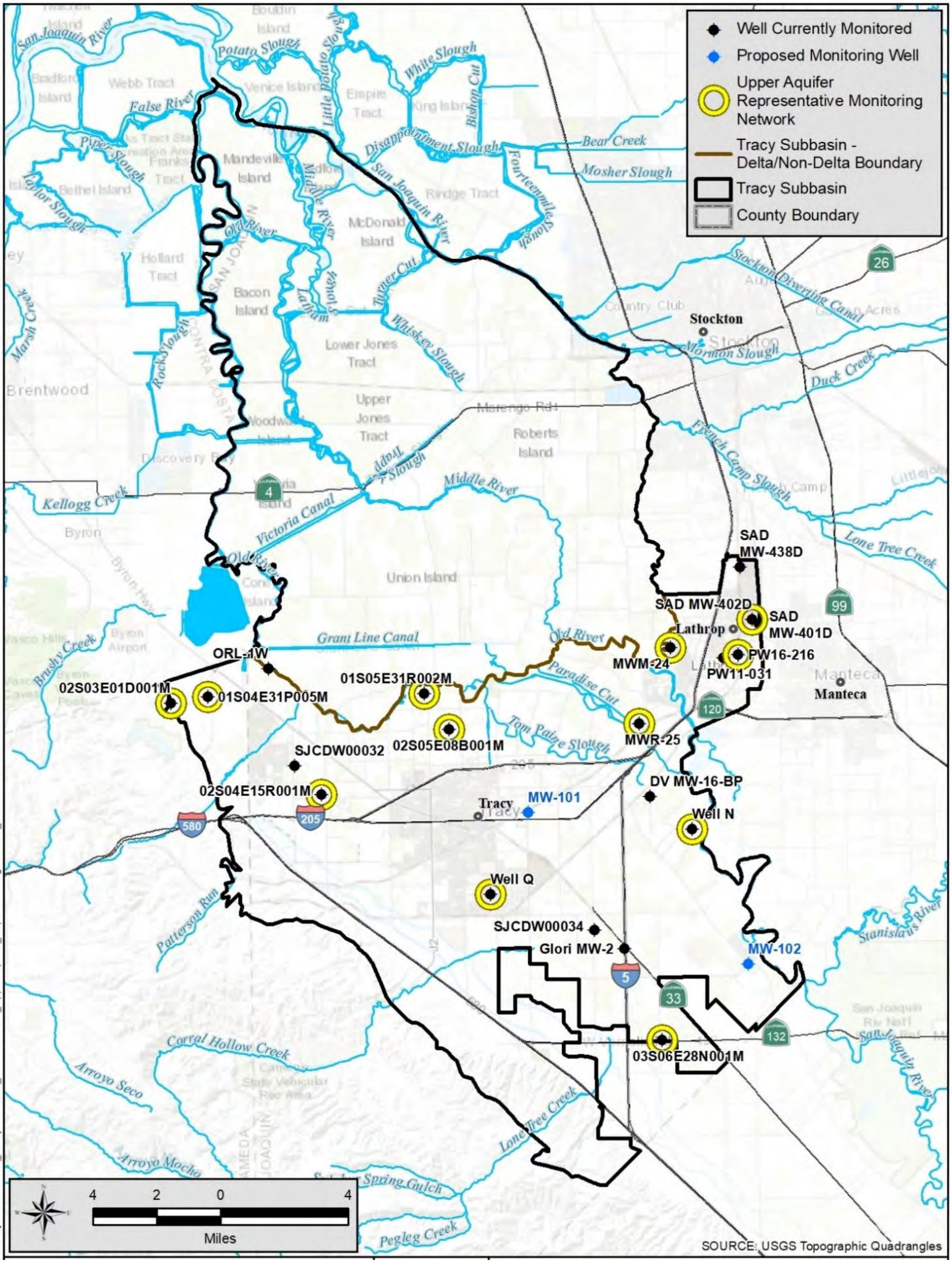


Figure 8-8. Upper Aquifer Groundwater Level Representative Monitoring Wells

Table 8-3. Representative Monitoring Wells for Chronic Lowering of Groundwater

Representative Wells for Chronic Lowering of Groundwater Levels						Purpose for Monitoring				
CASGEM ID	Local Name	Latitude	Longitude	Screened Interval (ft bgs)	Total Depth (ft bgs)	Domestic Wells	GDE	Areas Soley Dependent On GW	Agricultural, Municipal, and Industral Wells	Frequency of Monitoring
Upper Aquifer Wells										
377341N1213039W001	Well N	37.7341	-121.3039	Unknown	40	X	X	X	X	Monthly
377061N1214199W001	Well Q	37.7061	-121.4199	120-140	140	X		X	X	Semi-Annual
377951N1216011W001	02S03E01D001M	37.79512	-121.6011	40-80	80	X		X	X	Semi-Annual
377813N1214420W001	02S05E08B001M	37.7813	-121.442	50-80	80	X	X		X	Monthly
377976N1214560W001	01S05E31R002M	37.7976	-121.456	Unknown	92	X			X	Semi-Annual
376388N1213233W001	03S06E28N001M	37.6388	-121.3233	107-128	128	X			X	Semi-Annual
377528N1215156W001	02S04E15R001M	37.7528	-121.5156	0.1-45	45	X		X	X	Semi-Annual
377979N1215800W001	01S04E31P005M	37.79791	-121.58	8-23	24		X		X	Monthly
	MWM-24	37.81657	-121.3146	10-20	21		X			Monthly
	MWR-25	37.78232	-121.333	11-21	22		X			Monthly
	PW16-216	37.81305	-121.2758	208-213	216	X			X	Semi-Annual
	SAD MW-402D	37.82872	-121.2674	260-270	270.5	X		X	X	Semi-Annual
Lower Aquifer Wells										
376713N1214581W001	Corral MW-6	37.67127	-121.4581	455-475	477	X		X	X	Semi-Annual
377402N1214508W002	MW-1B	37.74019	-121.4508	618-658	670				X	Semi-Annual
377031N1214485W002	MW-3B	37.70306	-121.4485	540-580	595				X	Semi-Annual
377427N1213943W002	MW-5B	37.74266	-121.3943	576-616	640				X	Semi-Annual
377656N1214199W002	MW-6B	37.76563	-121.4199	590-630	645				X	Semi-Annual
	PW20-500	37.8076	-121.2997	300-500	498				X	Quarterly
376974N1213258W001	03S06E05R001M	37.6974	-121.3258	252-749	775				X	Semi-Annual

8.2.2.2 Lower Aquifer

Groundwater in the Lower aquifer does not support GDEs and typically are not used by domestic wells except near the foothills. Most of the use of the Lower aquifer is by agriculture, municipal users (City of Tracy), and some industrial users.

There are several clustered monitoring wells in the City of Tracy, below the Corcoran Clay, which monitor distinct intervals (distinguished by A, B, and C). The groundwater levels from the various depths in the monitoring wells are relatively similar (*see* **Appendix E**) and therefore only the "B" level at each well was included in the representative monitoring network. The Lower aquifer representative monitoring wells were selected to be able to show the groundwater occurrence, flow directions, recharge areas, and monitor pumping below the clay. **Figure 8-9** shows representative monitoring wells for the Lower aquifer. **Table 8-3** lists the representative monitoring wells.

Although voluntary irrigation wells, 03S05E26M001M and 03S06E28F003M (*refer to* **Table 8-3**) total well depths are below the Corcoran Clay and at least in one case appears to be screened just below the Corcoran Clay, groundwater levels are more similar to the Upper aquifer and suggest the wells may not be sealed through the Corcoran Clay. Well 03S06E28F003M does not have a sanitary seal and is gravel packed across the clay. These wells may not be representative of the Lower aquifer water levels. However, both wells are showing declining groundwater levels (*see* **Appendix E**). These wells have not been selected as part of the representative monitoring network at this time but in the future may be replaced with dedicated monitoring wells. Well 03S06E05R0001M well type is unknown but due to its highly variable groundwater levels suggest that it is being pumped and levels may not be representative of static conditions.

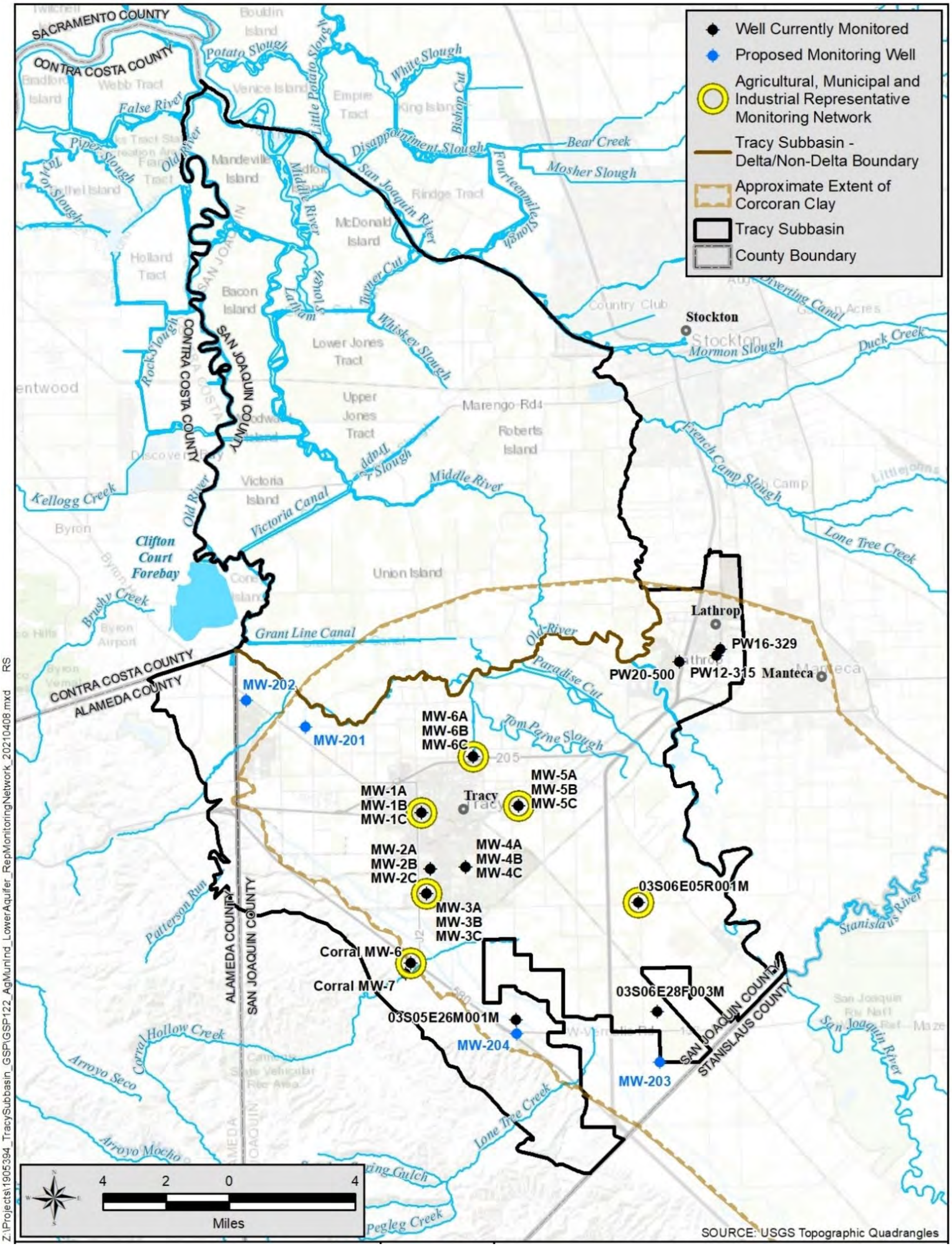


Figure 8-9. Lower Aquifer Groundwater Level Representative Monitoring Wells

8.2.3 *Groundwater Level Monitoring Frequency*

Frequency of groundwater level monitoring is cited in the Monitoring Networks and Identification of Data Gaps Best Management Practice (BMP) (DWR 2016a) which presents guidance on monitoring frequency based on the type of monitoring, aquifer type, confinement, recharge rate, hydraulic conductivity, and withdrawal rate. Historically, DWR has monitored groundwater levels on a semi-annual basis. Because groundwater levels are being used to assess sustainability indicators, more frequent monitoring at some locations is warranted. Sampling frequencies were developed based on this guidance in combination with a consideration of monitoring costs.

Based on the analysis of groundwater level monitoring data in the Subbasin, dating back several decades, the GSA's have determined that semi-annual groundwater level measurements are sufficient to identify groundwater level trends that may threaten the sustainability of the Subbasin's for most beneficial users. Monthly monitoring is proposed for wells that have been identified near GDEs. **Table 8-3** provides the monitoring schedule by representative well.

Semi-annual groundwater levels will be collected by the GSAs or DWR in the spring and fall. In the spring groundwater levels are typically higher than any other time of the year and groundwater pumping stresses are usually minimal. Therefore, measurements at individual wells may be more representative of regional conditions than at times when nearby wells are producing more water. Likewise, fall measurements are taken after the heaviest pumping has occurred for the dry season and before substantial recharge has occurred from precipitation. The fall measurement can be considered to be the regional minimum groundwater level for a given year, indirectly measuring the effects of annual groundwater use. The work will be completed during a 2-week window on either side of target dates (March 15 & October 15) to accommodate inclement weather and scheduling conflicts. This frequency of monitoring is more than sufficient to demonstrate seasonal, short-term (1-5 years), and long-term (5-10 years) trends in groundwater and related surface conditions and yield representative information about groundwater conditions.

Depending on the needs of the beneficial users of a well, the monitoring frequency maybe adjusted to better track the data. Wells monitoring in more sensitive areas, such as GDE's and surface water interaction areas, may require more frequent monitoring and would be equipped appropriately.

8.2.4 *Groundwater Level Monitoring Spatial Density*

The Tracy Subbasin extends over an area of about 373 square miles (238,429 acres) and supplies 11,797 acre-feet of groundwater annually for drinking water and irrigation (DWR, BP 2019). Most of the pumping occurs in the Non-Delta Management Area portion of the Subbasin, in an area of about 186 square miles.

A groundwater level well monitoring density goal ranges from 0.2 to 10 wells per 100 square miles (DWR 2016). The monitoring well density goals can also be based on the amount of groundwater use. For basins where groundwater pumping is between 1,000 and 10,000 AFY per 100 square miles, two wells per 100 square miles is recommended. Professional judgement will be essential to determining an adequate level of monitoring, frequency, and density based on the need to observe aquifer response near high pumping areas, cones of depression, significant recharge areas, and specific projects.

There are 13 representative monitoring wells for the Upper aquifer or a density of about seven wells per 100 square miles in just the Non-Delta Management Area. In the Lower aquifer, seven representative monitoring wells were selected, equating to a density of about three wells per 100 square miles. The density of the representative monitoring wells meets the density goal, but as illustrated on the previous figures, there are areas where additional wells are needed based on professional judgement.

8.2.5 *Data Gaps*

As illustrated on **Figures 8-3 through 8-7**, there are some areas where new monitoring wells are needed in both the Upper and Lower aquifers to protect beneficial uses and users and to be representative monitoring wells. New monitoring wells are proposed:

- In the Lower aquifer (MW-201 through -204) are needed to be protective of agricultural users and to resolve gradients (subsurface inflow and outflow) near the edges of the Subbasin. Two of these proposed monitoring wells are scheduled for the replacement of wells 03S05E26M001M and 03S06E28F003M to resolve questionable measurements.

- In the Upper aquifer (MW-101) to monitor groundwater levels to track changes near and protect domestic well owners.

- In the Upper aquifer (MW-102) to monitor groundwater levels to track changes near GDEs near the San Joaquin River. The well is positioned to also be used for surface water depletions when coupled with the SJR river gage. This well can also be used to assess conditions and be protective of domestic well owners. A transducer, capable of recording measurements frequently, is planned to be installed in this well to track seasonal changes.

Table 8-4 lists these new monitoring wells and their purpose. These wells may be constructed by DWR as part of their Technical Support Services or as local funding becomes available. Once completed and along with at least 5 years of measurements minimum thresholds and measurable objectives may be established at these wells.

Two existing wells (SJCDW00032, and SJCDW00034), listed in **Table 8-2,** may be added in the future as representative wells to supplement the monitoring network to protect domestic well owners and track groundwater levels near GDEs. However, currently the wells have only a few groundwater level measurements. During the 5-year GSP update measurements minimum thresholds and measurable objectives may be established at these wells. Well DVMW-16-BP is located at the Deuel Vocational Institution, but the facility is scheduled to be de-activated in September 2021. The well is in an ideal location for protection of domestic wells, but at this time cannot be relied upon for long-term monitoring.

In addition to the new monitoring wells further refinement of potential GDEs is needed and potentially inclusion of ecological monitoring to further refine significant and undesirable definition. A thorough review of all GDEs vegetation types and rooting zone depths in the Non-Delta Management Areas has not been completed to assess rooting zone in each different polygon. The health of the vegetation also has not been assessed. A review of the vegetation types, rooting zone depths, health, and depth to groundwater using a digital elevation model will be performed during the next 5 years to improve the selection of minimum thresholds.

Table 8-4. Data Gap Monitoring Wells

Figure No.	Total Depth (feet bgs)	Location	Benefit
Upper Aquifer			
8-3 shown as MW-101 (new)	70	Install on City of Tracy Property, adjacent to Lower aquifer nested well MW-5.	Provides monitoring for protection of domestic well owners. Provides for vertical heads between Upper and Lower Aquifers.
8-6 shown as MW-102 (new)	50	Install in San Joaquin County Road easement.	Provides monitoring for protection of groundwater dependent ecosystems and assessement of surface water depletion when compared with SJC River gage.
Lower Aquifer			
8-9 shown as MW-201 (new)	805	Install in Banta-Carbona canal easement.	Provides monitoring for protection of agriculture wells. Needed to define extent of Corcoran clay and gradient leaving basin.
8-9 shown as MW-202 (new)	1100	Install in Mountain House water treatment facility.	Provides monitoring for protection of agriculture wells. Needed to define extent of Corcoran clay and gradient leaving basin.
8-9 shown as MW-203 (new)	750	Install in south portion of the subbasin, to replace 03S05E26M001M. Approximate location.	Provides monitoring for protection of agriculture wells. Needed to resolve gradient between subbasins (TSb and DMSb).
8-9 shown as MW-204 (new)	800	Install in south portion of the subbasin to replace 03S06E28F003M. Approximate location.	Provides monitoring for protection of agriculture wells. Needed to resolve gradient between subbasins (TSb and DMSb).

8.3 Reduction in Groundwater Storage Monitoring Network

Change in groundwater storage monitoring network will use the groundwater level representative monitoring network described above in **Chapter 8.2.2 – Representative Monitoring Wells**. The DWR has utilized for decades changes in groundwater elevations along with specific yield estimates to estimate changes in storage annually.

Because groundwater levels are used in the calculations, they will be used as a proxy for groundwater storage changes, discussions of monitoring frequency and spatial density will be the same as for chronic lowering of groundwater levels as described in **Chapter 8.2.3 – Groundwater Level Monitoring Frequency and Chapter 8.2.4 – Groundwater Level Monitoring Spatial Density**.

8.4 Seawater Intrusion Monitoring Network

As stated previously, the Subbasin is not located near the Pacific Ocean which precludes the consideration of seawater intrusion as a sustainability indicator. The closest area where saline water intrusion is present is about 20 miles west of the Subbasin boundary, near the City of Antioch. Therefore, seawater intrusion is not present and is not likely to occur in the Subbasin and a monitoring network and monitoring is not required.

8.5 Degraded Groundwater Quality Monitoring Network

The groundwater quality in the basin is generally adequate to meet the needs of urban, municipal, industrial and agricultural uses in the basin. The concentration of the naturally occurring elements varies widely over the Subbasin and also with depth at any given location. Groundwater quality in the Subbasin has locally exceeded the MCLs for drinking water for specific elements, some exceedances are scattered, and some are clustered. Poor groundwater quality has been noted in the following general areas:

- Salinity, as represented by TDS, is high in both the Upper and Lower aquifers with a few areas with good quality water. Sources of high salinity are from the Coast Ranges, underlying marine sediments, and from agricultural practices.
- Nitrate concentrations are low in the subbasin and other than a few scattered wells, nitrate does not appear to be adversely impacting water quality.
- Elevated concentrations of sulfate are present near the foothills in both the Upper and Lower aquifers potentially as a result of recharge water originating from the Coast Ranges.
- Elevated concentrations of arsenic are only in the Upper aquifer and mostly within the Delta area (arsenic is present in the Lathrop area) and not in the Lower aquifer.
- Boron is present in the Upper aquifer. Most elevated concentrations are present in the Non-Delta Management Area and in the northern portions of the Delta area.
- PFAS and uranium are present in the groundwater in some wells in the City of Lathrop. PFAS have also been detected in City of Tracy wells. Both PFAS and uranium are widespread throughout the Central Valley and are not unique to Lathrop or Tracy.

It should be noted that in the event that any contaminants are detected above the MCL in a municipal water supply well, the water is treated to meet drinking water standards or the source is taken off-line until treatment is available.

8.5.1 *Monitoring Network Groundwater Quality*

Groundwater quality in the Subbasin is monitored in 125 PWS wells and in two wells designated for the ILRP (wells SJCDW00032 and SJCDW00034). **Figure 8-10** shows the locations of the PWS wells and ILRP wells (light gray boxes are those wells with unknown construction details, colored wells have construction details). Construction details for most wells have yet to be acquired. Water quality is monitored for various other regulatory programs regulated by State Water Board but typically for just specific water quality contaminants of concern. As demonstrated in **Chapter 4 – Hydrogeologic**

Conceptual Model, the network is sufficient to identify groundwater level trends that may threaten the sustainability of the basin's groundwater resources.

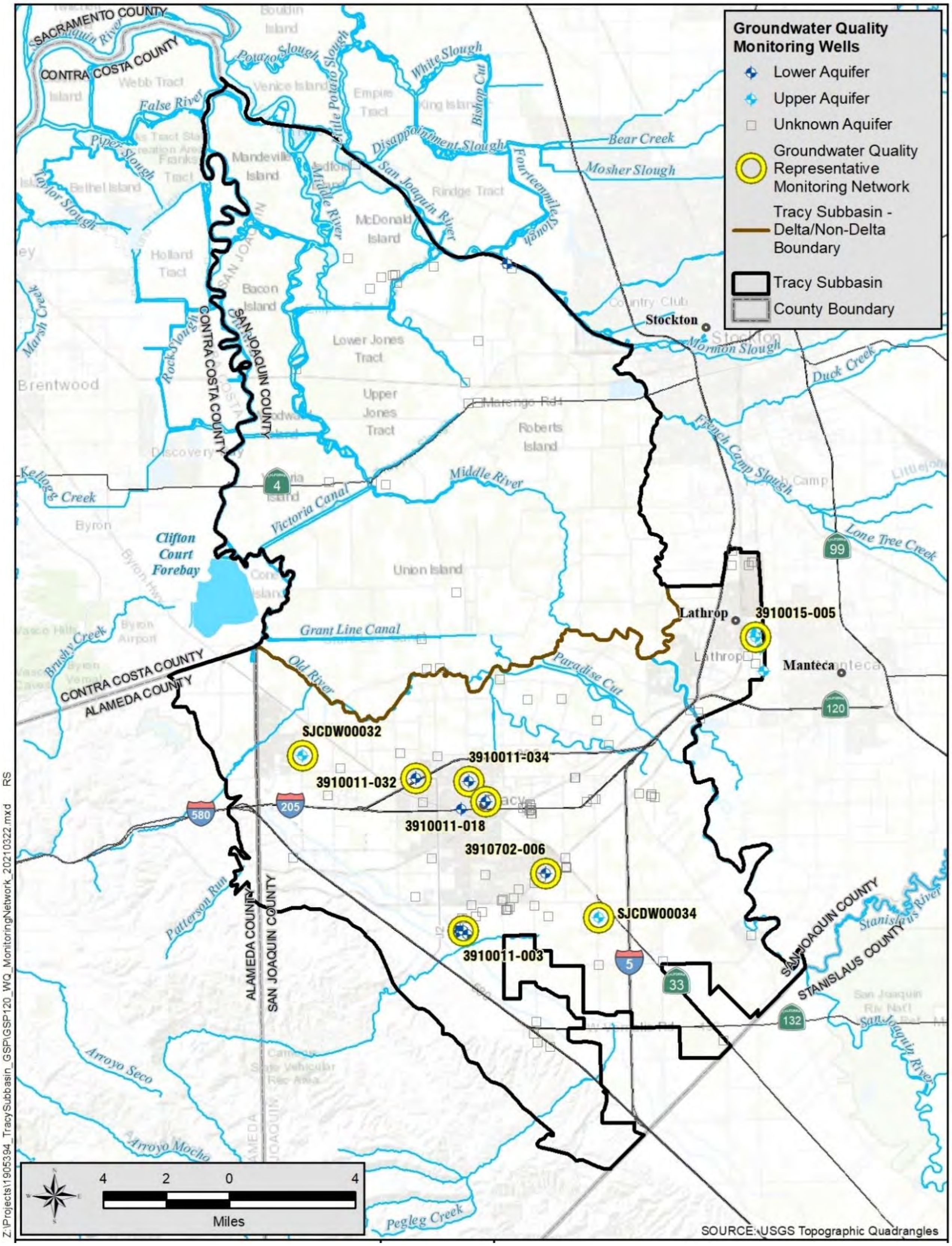


Figure 8-10. Water Quality Monitoring Network and Representative Monitoring Network

8.5.2 *Degraded Groundwater Quality Representative Monitoring Wells*

Criteria used to select the representative monitoring well network selected for the Tracy Subbasin is based on the availability of well construction details and whether the wells could be assigned to a principal aquifer. Nine representative monitoring wells (PWS and ILRP) were selected to assess groundwater quality degradation as listed in **Table 8-5** and shown on **Figure 8-10**.

Table 8-5. Degraded Water Quality Representative Monitoring Wells

PWS Code	Local Name	Total Depth (ft bgs)	Frequency of Monitoring
Upper Aquifer Wells			
	SJCDW00032	125	Annual
	SJCDW00034	180	Annual
3910015-005	WELL 06	270	3-years
Lower Aquifer Wells			
3910702-006	WSW009	930	3-years
3910011-003	PRODUCTION WELL 01	980	3-years
3910011-018	WELL 04R - NEW LINCOLN	980	3-years
3910011-032	PRODUCTION WELL 06	1196	3-years
3910011-034	PRODUCTION WELL 07	874	3-years

Table 8-6 provides a summary of the groundwater quality monitoring well types, distribution, and whether the ILRP and PWS wells are representative of water quality for other beneficial users, namely domestic well users in the Subbasin. Based on the depth of domestic wells in the Subbasin, **Figure 8-4** shows that most domestic wells are constructed to depths of about 80 to 200 feet in the Non-Delta Management Area, with depths increasing towards the higher topography of the foothills and coastal mountain ranges to the south-west portion of the Subbasin. The select representative monitoring network is representative and protective of domestic wells.

Table 8-6. Water Quality Monitoring Well Summary

Description	Non-Delta Area
Representative Groundwater Quality Wells	9
Range of Public Water Service Well Depths	125-1,196 ft bgs
Range of Domestic Well Minimum Depths	32-622 feet bgs
Number of Wells less than 200 Feet Deep	3
Number of Wells greater than 200 Feet Deep	6
Number of Wells with Unknown Depths	116

8.5.3 *Groundwater Quality Monitoring Frequency*

The State Water Board's DDW requires monitoring of PWS wells for Title 22 requirements (such as organic and inorganic compounds, metals, microbial, and radiological analytes). Data is available for active and inactive drinking water sources for water systems that serve the public: defined as serving 15 or more connections or more than 25 people per day.

Each of the PWS wells is used to produce drinking water and is required to be monitored for water quality by the State Water Board's DDW. The monitoring schedule and constituent varies by public water system but for TDS and boron but typically at least once every 3 years, and nitrate typically not less than annually. ILRP wells are monitored on an annual basis. The frequency of monitoring is provided in **Table 8-5**.

8.5.4 *Groundwater Quality Monitoring Well Spatial Density*

DWR's Monitoring Networks and Identification of Data Gaps BMP identifies different sources and calculations for establishing monitoring network densities on a Subbasin-specific case (DWR 2016a). A specific density of water quality monitoring wells was not provided by DWR, but methods are available based by performing a water quality needs assessment.

The Groundwater Assessment Report prepared for the ILRP and subsequent Water Quality Trends Monitoring Program designated two monitoring wells in the Upper aquifer in the Non-Delta Management Area, or two wells per 100 square miles, and no wells in the Lower aquifer. This GSP has three wells per 100 square miles for the Upper aquifer. Six wells were selected to monitor water quality in the Lower aquifer or three wells per 100 square miles. The water quality well density in the Subbasin, as shown in **Table 8-7**, is sufficient to assess trends for water quality indicators at this time, but more regional distribution of the monitoring is needed.

8.5.5 *Data Gaps*

At this time, there is abundant water quality data through State Water Board's DDW, but the well construction details are currently unknown for more than 50 PWS wells, within the Non-Delta Management Area. Within the next 5 years, construction details will be located so that water quality results can be sorted by principal aquifers to improve the distribution of representative monitoring wells for water quality and trend assessment in the Subbasin. As necessary groundwater quality sampling in monitoring wells may be added.

8.6 Land Subsidence Monitoring Network

There are two land subsidence monitoring networks that are publicly available: (1) a CGPS station in the Subbasin that is part of the UNAVCO Plate Boundary Observatory network of CGPS stations, and (2) Interferometric Synthetic Aperture Radar (InSAR) data that are collected by the European Space Agency Sentinel-1A satellite and processed by TRE Altamira Inc..

1. The CGPS data are a subset of Plate Boundary Observatory GPS with near real-time data streams made available by UNAVCO. The data is provided as elevation (Z) and longitude

(X) and latitude (Y). There is one CGPS stations (P-257) in the Non-Delta Management Area, on the west side of the City of Tracy that can be used to assess subsidence.

2. Through a contract with TRE Altamira Inc. and as part of DWR's SGMA technical assistance for GSP development and implementation, DWR has made available measurements of vertical ground surface displacement in the Subbasin (https://data.cnra.ca.gov/dataset/tre-altamira-insar-subsidence). Vertical displacement estimates are derived from Interferometric Synthetic Aperture Radar (InSAR) data that are collected by the European Space Agency Sentinel-1A satellite and processed by TRE Altamira. The InSAR dataset has also been checked to best available independent data. The current data covers the months between January 2015 and October 2020, and DWR is planning on supporting updating the dataset on an annual basis through 2022.

In addition to these datasets, the Delta-Mendota Water Authority surveys the Delta-Mendota Canal alignment, and the City of Tracy has established benchmarks, that have been historically used to assess subsidence related to groundwater pumping.

8.6.1 *Subsidence Monitoring Network*

The InSAR subsidence dataset will be the monitoring network for the Subbasin.

8.6.2 *Land Subsidence Representative Monitoring Locations*

The InSAR subsidence dataset will be used by the Subbasin GSAs annually to evaluate this sustainability criteria. Should the InSAR data indicate subsidence greater than the minimum threshold then a review of CPGS data and groundwater elevations will be performed to confirm that subsidence has occurred and if it is related to groundwater pumping. As necessary, benchmarks along the Delta-Mendota Canal alignment and the City of Tracy benchmarks may also be resurveyed.

8.6.3 *Land Subsidence Monitoring Frequency*

The InSAR subsidence dataset will be used by the Subbasin GSAs annually (October 1 of any given year through October 1 of the following year) to roughly match water years.

8.6.4 *Land Subsidence Monitoring Spatial Density*

The InSAR subsidence dataset covers the entire Subbasin.

8.6.5 *Data Gaps*

Since the InSAR dataset covers the entire Subbasin there are no data gaps.

8.7 Surface Water Depletion Monitoring Network

Groundwater levels measurements will be used as a proxy for surface water depletion. Temporal changes in river flows volumes from gaging stations cannot be used to assess surface water depletion due to the relatively small volumes of groundwater gains and losses in comparison to the volume of water in the rivers. The uncertainty in the accuracy of the volume increases due to the complex nature of merging rivers and canals, ungagged small tributaries, subdrains and tailwater releases.

As described and illustrated in **Chapter 5.9 – Interconnected Surface Water**, groundwater levels in monitoring wells in the Upper aquifer near rivers correlate to changes in elevations of surface water at river gages. Increasing the depth to groundwater will increase groundwater gradient away from the rivers and increase the amount of surface water depletions. Therefore, use of groundwater levels as a proxy for surface water depletion is appropriate. Gage station data on Mountain House and Corral Hollow creeks is not available to correlate for temporal changes and groundwater extraction although only a small portion of the creeks may be interconnected.

The groundwater flow direction in the Lower aquifer shows a radial pattern with potential recharge from the Delta area where the Corcoran Clay maybe absent. Increasing the depth to groundwater will increase groundwater gradient and may increase the amount of surface water depletions.

8.7.1 *Surface Water Depletion Representative Monitoring Locations*

Recommended monitoring components for a surface water depletion monitoring network (DWR 2016) should include:

- Use of existing stream gaging and groundwater level monitoring networks to the extent possible.
- Establish stream gaging along sections of known surface water groundwater connection.
- Establish a shallow groundwater monitoring well network to characterize groundwater levels adjacent to connected streams and hydrogeologic properties.
- Identify and quantify both timing and volume of groundwater pumping within approximately 3 miles of the stream or as appropriate for the flow regime.

Representative monitoring wells were selected near and within 3 miles of the rivers to assess the groundwater gradient towards or away from the rivers. Monitoring wells along tributaries were not selected as the tributaries only flow for short periods after rain events and are not connected by a continuous saturated interval with the principal aquifers, other than possibly near the rivers.

Four existing Upper aquifer shallow monitoring wells are located along the San Joaquin and Old rivers and near river gages. These wells can be clustered into three groups to develop gradients towards or away from the rivers. **Table 8-7** provides the well construction details, attributes, and monitoring frequencies. **Figure 8-11** shows the locations of the surface water depletion representative monitoring wells for the Upper aquifer.

Three existing Lower aquifer monitoring wells are located south of the Old River and can be used to develop gradients towards or away from the Delta area rivers, canals and sloughs where the Corcoran Clay may be absent allowing interconnection of the Upper and Lower aquifers and the possibility that use of groundwater from the Lower aquifer could deplete surface water. These wells can also be clustered into a group to develop gradients towards or away from the rivers. **Table 8-7** provides the well construction details and attributes. **Figure 8-12** shows the locations of the surface water depletion monitoring wells for the Lower aquifer.

Table 8-7. Surface Water Depletion Representative Monitoring Wells

CASGEM ID	Local Name	Latitude	Longitude	Screened Interval (ft bgs)	Total Depth (ft bgs)	Frequency of Monitoring
Upper Aquifer Wells						
377341N1213039W001	Well N	37.7341	-121.3039	Unknown	40	Monthly
377813N1214420W001	02S05E08B001M	37.7813	-121.442	50-80	80	Monthly
377976N1214560W001	01S05E31R002M	37.7976	-121.456	Unknown	92	Monthly
377979N1215800W001	01S04E31P005M	37.79791	-121.58	8-23	24	Monthly
378103N1215449W001	ORL-1W	37.81031	-121.5449	86-106	106	Monthly
377979N1215800W001	01S04E31P005M	37.79791	-121.58	8-23	24	Monthly
	MWM-24	37.81657	-121.3146	10-20	21	Monthly
	MWR-25	37.78232	-121.333	11-21	22	Monthly
	PW11-031	37.81163	-121.2842	23-28	31	Quarterly
Lower Aquifer Wells						
377402N1214508W002	MW-1B	37.74019	-121.4508	618-658	670	Monthly
377427N1213943W002	MW-5B	37.74266	-121.3943	576-616	640	Monthly
377656N1214199W002	MW-6B	37.76563	-121.4199	590-630	645	Monthly

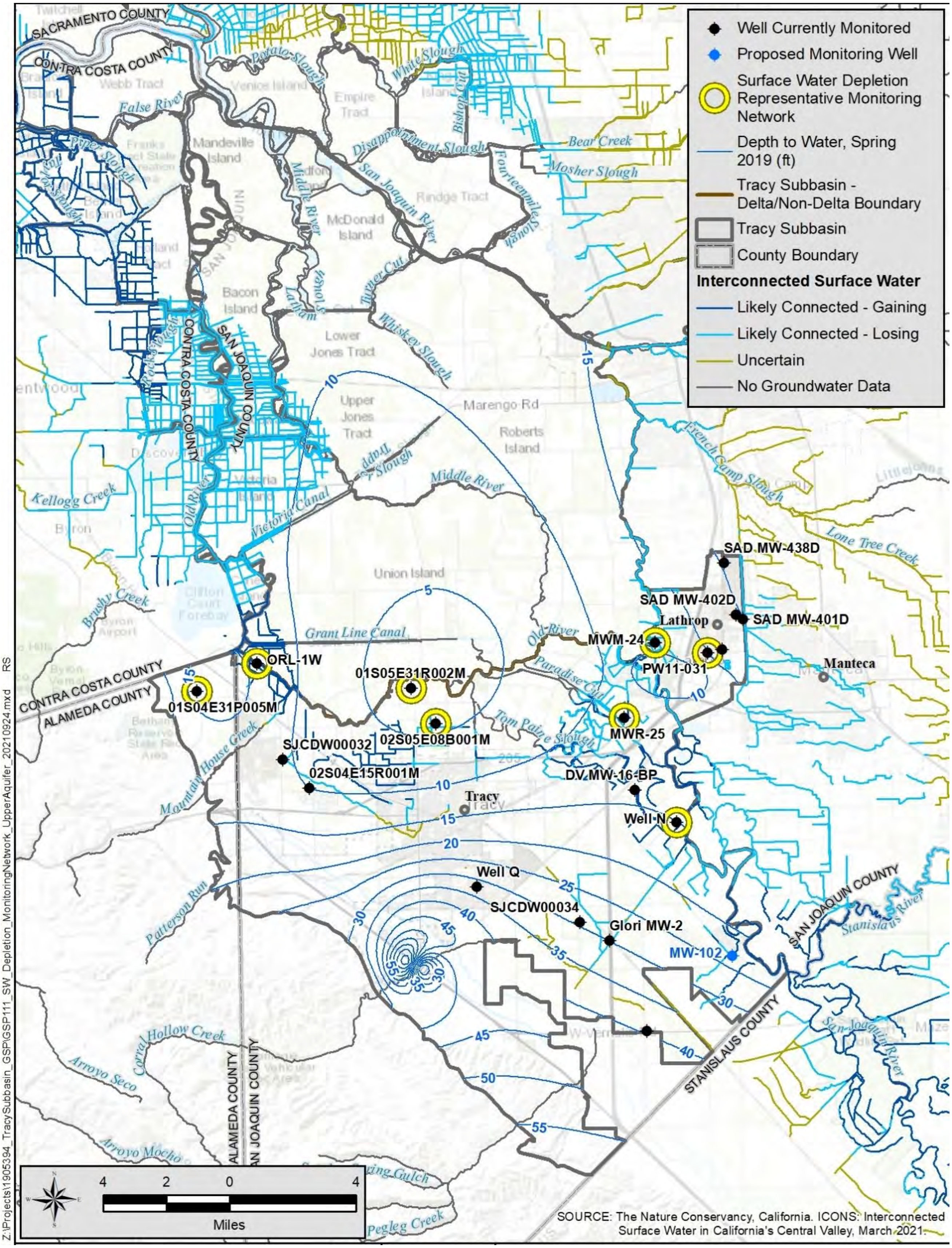


Figure 8-11. Upper Aquifer Surface Water Depletion Representative Monitoring Wells

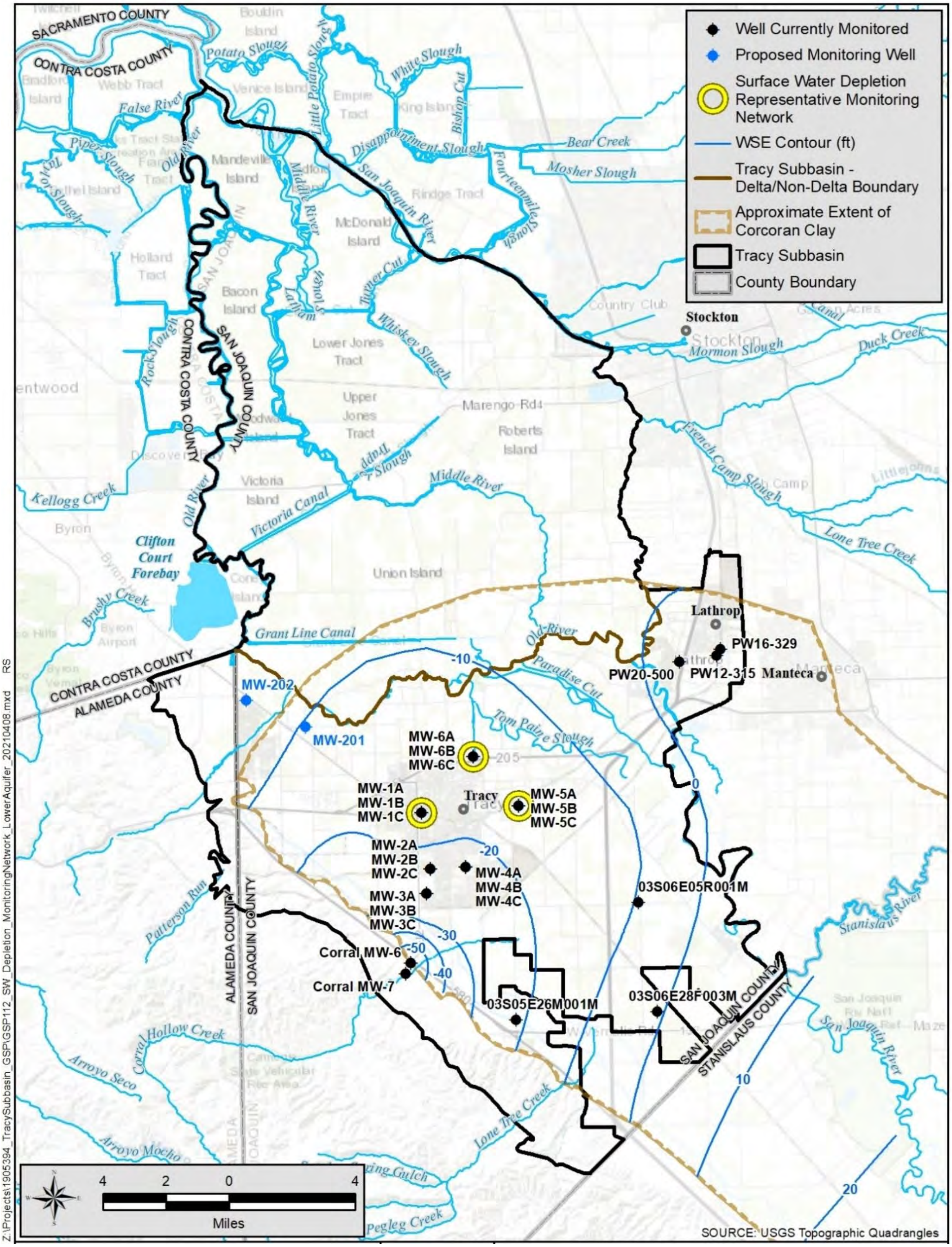


Figure 8-12. Lower Aquifer Surface Water Depletion Representative Monitoring Wells

8.7.2 *Surface Water Depletion Monitoring Frequency*

Groundwater levels in the selected monitoring wells are being monitored by DWR and San Joaquin County staff to obtain measurements on a semi-annual frequency, quarterly at wells in regulatory monitoring programs. Since the wells being monitored are residential or irrigation wells, installation of transducers is not feasible. The frequency of monitoring at these wells will be increased to monthly to better evaluate gradients during the summer months.

8.7.3 *Surface Water Depletion Monitoring Spatial Density*

No specific density of monitoring well spatial density guidance has been provided by DWR.

There are about 30 miles of rivers (San Joaquin and Old Rivers) along the Non-Delta Management Area boundary. Four monitoring wells in the Upper aquifer are located within 1 mile of the rivers. These four wells monitoring wells are paired with inland wells to establish gradients resulting in about one well per every 8 miles of river frontage.

8.7.4 *Data Gaps*

Proposed new monitoring well MW-102 is needed to address depletion along the southern end of the San Joaquin River and will be used in conjunction with surface water gaging station SJC to assess the groundwater flow to or from the San Joaquin River. This well was proposed in **Chapter 8.25 – Data Gaps, Table 8-4,** for lowering of groundwater levels and could be used for dual purposes to address surface water depletion and groundwater dependent ecosystems to fill this monitoring gap. During the 5-year GSP update additional wells may be recommended.

8.8 Monitoring Protocols

The following technical protocols provide guidance based upon existing professional standards and are commonly adopted in various groundwater-related programs. The protocols provide clear techniques to yield quality data for use in the various components of this GSP. The following monitoring protocol were developed using DWR's BMPs for Monitoring Protocols, Standards and Sites (Monitoring Protocols), (DWR 2016b) with additions from other existing programs.

8.8.1 *Groundwater Levels*

The following monitoring protocol was developed for the CASGEM monitoring programs by San Joaquin County and the San Luis Delta Mendota Water Authority and will be used to measure groundwater levels in the monitoring wells using a water level sounder or pressure transducers.

8.8.1.1 Water Level Sounders

Groundwater level measurements must be collected with consistency and with sufficient additional data that those who use the data understand its usefulness and limitations. Field notes which document the data collection are therefore required.

To assure that the same well is being measured each time, the monitoring entity will create a Well Identification Sheet, which will be used to track the monitoring at each well site. The following information will be recorded on the Well Identification Sheet: well number, date of survey, latitude and longitude, reference point (RP) elevation and description, location description and map, well type and use, well completion type, and, if available, total depth, screened intervals, and well completion report number. A close-up photo of the well showing the access port for measuring groundwater levels and a photo of the well from a distance should be included for confirmation that the correct well is being monitored and that measurements are made consistently at the same locations.

The following data is collected on standard forms in the field to establish a dependable groundwater level measurement:

- Name of person collecting data and agency association
- Well name/identification
- Date and time of measurement
- Type of equipment used to measure the depth to water
- RP used at each well
- Nearby conditions which confirm (or not) that measurement is static water level and are noted by a Questionable Measurement Code
- Measurement from the RP to the water surface
- Weather and other conditions that may affect the ability to obtain a good measurement
- If a measurement cannot be made information is provided using a No Measurement Code

Additional steps are taken in the field to:

- Ensure the safety of staff collecting the data.
- Ensure the integrity of the data collection process.
- Maintain hygienic conditions in the wells.
- Maintain good relations with property owners.

Groundwater level measurements will be made using the following protocol (DWR 2016b):

- Depth to groundwater will be measured from an established RP on the well casing. The RP will be identified with a permanent marker, paint spot, or a notch in the lip of the well casing. If no mark is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing.
- The sampler will remove the appropriate cap, lid, or plug that covers the monitoring access point listening for pressure release. If a pressure release is evident, the measurement will be delayed for a short period of time to allow the water level to equilibrate.
- Measurements of depth to groundwater and land surface will be measured and reported in feet to an accuracy of at least 0.01 feet and the method of measurement will be noted on the record (i.e., electric sounder, steel tape, acoustic sounder).

- The sampler will replace any well caps or plugs and lock any well buildings or covers after taking a measurement.
- The water level probe should be cleaned after measuring each well.
- All data will be entered into the Tracy Subbasin data management system (DMS) as soon as possible. Care will be taken to avoid data entry mistakes and the entries will be checked by a second person for accuracy.

By following these monitoring protocols, the GSAs ensure that its groundwater level measurements are appropriate for use in conjunction with other groundwater level data from other groundwater management entities. Monitoring protocols shall be reviewed at least every 5 years as part of the periodic evaluation and update of this Plan and modified as necessary.

8.8.1.2 Pressure Transducers

Groundwater levels may be measured using pressure transducers. When relying on pressure transducers and data loggers, manual measurements of groundwater levels will be taken during installation to synchronize the transducer system and, periodically (semi-annually), to ensure monitoring equipment does not allow a "drift" in the actual values.

The following protocols from DWR's BMP for Monitoring Protocols, Standards and Sites, (DWR, 2016b) will be followed when installing a pressure transducer in a monitoring well and during routine monitoring and downloads:

- The sampler will use an electronic sounder or chalked steel tape to measure the depth to groundwater level from the RP. The groundwater elevation will be calculated by subtracting the depth to groundwater from the RP elevation. These values will be used as references to synchronize the transducer system in the monitoring well.
- The sampler will record the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and other pertinent information in the log.
- The sampler will record whether the pressure transducer uses a vented or non-vented cable for barometric compensation. Vented cables are preferred, but non-vented cables are acceptable if the transducer data are properly corrected for natural fluctuations in barometric pressure, which requires commensurate logging of barometric pressures.
- Transducers will be able to record groundwater levels with an accuracy of at least 0.1 feet. Various factors will be considered in the selection of the transducer system, including battery life, data storage capacity, range of groundwater level fluctuations, and natural pressure drift of the transducers.
- Follow manufacturer specifications for installation, calibration, battery life, correction procedure (for non-vented cables), and anticipated life expectancy to ensure optimal use of the equipment.
- Secure the cable to the wellhead with a well dock or another reliable method. Mark the cable at the elevation of the reference point with tape or an indelible marker to allow estimates of future cable slippage.

- The transducer data will be checked periodically against hand-measured groundwater levels to monitor electronic drift or cable movement. This check will not occur during routine site visits, but at least annually.
- The data will be downloaded regularly to ensure data are not lost and entered into the DMS following the quality assurance and quality control program established for the GSP. Data from non-vented cables will be corrected for atmospheric barometric pressure changes, as appropriate. After ensuring the transducer data have been downloaded and stored in the DMS, the data will be deleted from the data logger to ensure that adequate data logger memory remains for future measurements.

8.8.2 *Water Quality*

All designated water quality monitoring wells are part of PWS systems. The state of California requires that public water systems maintain a level of water quality monitoring that ensures the public is provided with a safe, reliable drinking water supply. Specifically, public water systems must collect and analyze samples from their producing wells to determine the concentration of a broad range of constituents on a scheduled basis as detailed in Title 22 of the California Code of Regulations. The sampling events are carried out under detailed sampling plans which comply with state requirements. All analyses will be performed by a laboratory certified under the State Environmental Laboratory Accreditation Program.

Laboratory bottles labels are filled out prior to collection of the samples. The labels are to include: the well name, sampler initials, date and time of collection of the samples, preservative used, and the type of analysis to be performed.

All public water system operators have been trained for water quality sampling and required to obtain certifications by the State. Public water supply wells are purged for about 15 minutes prior to collection of samples, the samples are collected from dedicated sampling ports near the well head, the samples will be collected directly into laboratory prepared bottles, cooled to 4 degrees Celsius and then transported (shipped) to an Environmental Laboratory Accreditation Program certified laboratory under standard chain of custody.

8.9 Data Reporting

All of the groundwater level measurements collected by the GSAs and DWR will either be reported to CASGEM and or stored in the DMS developed for the Subbasin. Water quality data will be reported to the GAMA database.

A DMS has been developed for the Subbasin that access publicly available data (DWR, CASGEM, GAMA, and USGS databases) and to store historic and future local data including water supply information. All data is recorded in standard units for water volumes and flow and depths and elevations (NAVD88). All measurement locations are geographic referenced. Monitoring data stored in the DMS will be submitted electronically to DWR annually.

The data will be analyzed and reported in Annual Reports and shared with Stakeholders. The data will be used to update the groundwater model.

8.10 Monitoring Network Improvements

An assessment of the existing monitoring network shows the following improvements will need to be made to improve the accuracy and extent of the monitoring network. The following items will be accomplished, assuming DWR Technical Support Services can construct the proposed monitoring wells, within the next 5 years:

- Two new Upper aquifer monitoring wells are needed to assess conditions and be protective of beneficial users, domestic wells and GDEs as described in **Table 8-4**.
- Four additional Lower aquifer monitoring wells are needed to assess inflow and outflow from adjacent subbasins and for refinement of the groundwater model as described in **Table 8-4**.
- Well construction details are currently unknown for 116 PWS wells. A search of the County well files will be performed and if details are not found State Water Board's DDW will be requested to provide Drinking Water Source Assessment Program, Well Data Sheets to obtain the information.
- Obtain groundwater level measurements from IRLP wells SJCDW00032 and SJCDW00034.

The Tracy Subbasin agencies have already received general approval for construction of the new monitoring wells. Site specific information is being prepared and will be submitted shortly.

Every 5-years the agencies will re-evaluate the monitoring network for uncertainties and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goals for the Subbasin. As necessary the Subbasin GSAs may adjust the monitoring frequency to provide an adequate level of detail to assess the effectiveness of its projects and management actions. They may also adjust the monitoring network to adaptively manage minimum threshold exceedances, varying temporal conditions, reported adverse impacts to beneficial uses and users and effects from adjacent subbasins.

9. Sustainable Management Criteria

This chapter describes the criteria and the approach by which the GSAs and stakeholders established sustainability goals for the entire Subbasin; and for each of the six sustainability indicators, selected significant and undesirable results, developed minimum thresholds, and measurable objectives. The six sustainability indicators are chronic lowering of groundwater levels, reduction of storage, land subsidence, seawater intrusion, degradation of water quality, and surface water depletion.

A section for each of the sustainability indicator is provided that presents justification for locally defined, significant and undesirable results, minimum thresholds and measurable objectives, and interim milestones. Included is a discussion of how these thresholds and objectives affects other sustainability indicators.

The development of thresholds and measurable objectives took into consideration various components such as historical, current and future water budgets, seasonal and long-term trends, and periods of drought, while being commensurate with levels of uncertainty. The thresholds and objectives considered various approaches. Ultimately, thresholds and levels were established to protect the beneficial uses and users which are directly linked to the six sustainability indicators.

Sustainable management criteria for the Tracy Subbasin were developed based on:

- Technical information included in:
  - Chapter 4 – Hydrogeologic Conceptual Model
  - Chapter 5 – Groundwater Conditions
  - Chapter 6 – Management Areas
  - Chapter 7 – Water Budgets
  - Chapter 8 – Monitoring Networks
- Input from interested parties at workshops, public meetings and from comments to draft GSP chapters

Specific definitions are provided in GSP regulations for undesirable results, minimum thresholds and measurable objectives:

- Undesirable results occur when long-term levels are detrimental to beneficial users
- Minimum thresholds are established at quantifiable levels at a site that when exceeded, either individually or at a combination of sites that may cause undesirable results
- Measurable objectives are established at quantifiable levels for the maintenance or improvements of groundwater conditions to achieve the sustainability goal for the Subbasin

Local definition of undesirable results, minimum thresholds and measurable objectives were developed only for the Non-Delta Management Areas as undesirable results are not expected to occur in the Delta Management Area (*see* **Chapter 6 – Management Areas**).

9.1 Sustainability Goals

The sustainability goals for the Tracy Subbasin are:

> *To provide reliable and sustainable groundwater resources for existing and future needs of all beneficial users in the Subbasin that does not degrade or decrease over-time and will continue to be sustained through continued local adaptive management of the resources.*

Implementing projects and management actions to achieve these goals will avoid the occurrence of undesirable results during the 20-year implementation period and will result in long-term sustainable groundwater in the Non-Delta Management Area of the Subbasin.

All of the GSAs intend to implement measures such that undesirable results are avoided and such that the overall groundwater elevations remain relatively stable over time as compared to current conditions in the Subbasin. The Subbasin will be managed such that the groundwater levels may vary and be drawn down during drier years when surface water supplies may be reduced and temporarily replaced by increased relative use of groundwater supplies; and allowing for recovery of groundwater levels when above normal conditions exist and surface water is available. This type of conjunctive use operation will maximize use of available surface and groundwater supplies and has historically been practiced. The goal remains to avoid undesirable results as discussed in this chapter.

Measures to be implemented in the Subbasin to ensure its sustainability include:

- Routine monitoring and analysis of groundwater levels and quality along with a comparison to minimum thresholds and measurable objectives
- Regular meetings with GSAs to discuss monitoring findings and, as necessary, adaptively adjust management activities to resolve adverse or undesirable groundwater conditions
- Implementation of necessary projects and management actions (*see* **Chapter 10 – Projects and Management Actions**), as necessary, based on physical measurements of groundwater conditions at representative monitoring wells
- Continued implementation of conjunctive use programs

9.2 Sustainability Indicators

Groundwater sustainability indicators, as defined by SGMA legislation, are one of six effects caused by groundwater conditions that, when significant and unreasonable, cause undesirable results. The six sustainability indicators are:

1. **Chronic lowering of groundwater levels** – indicating a significant and unreasonable depletion of supply, exceeding the sustainable yield of the Subbasin, if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.
2. **Reduction of groundwater storage** – resulting from chronic lowering of groundwater levels.
3. **Seawater intrusion** – the advancement of seawater into a groundwater supply that results in degradation of water quality in the basin and includes seawater from any source.
4. **Degraded water quality** – including the migration of contaminant plumes that impair water supplies.
5. **Land subsidence** – caused by groundwater declines that substantially interferes with surface land uses.
6. **Depletions of interconnected surface water** – reductions in flow or levels of surface water that is hydrologically connected to the principal aquifers such that the reduced surface water flow or levels caused by groundwater pumping have a significant and unreasonable adverse impact on beneficial uses of the surface water.

Each of these sustainability indicators are discussed in detail in the following sections for the Non-Delta Management Area. A general discussion of the conditions in the Subbasin is provided to define the current state of the Subbasin and potential issues. For each sustainability indicator a description of how locally defined significant and undesirable results, and how minimum threshold and measurable objectives were established for each of the sustainability criteria. Evidence from previous chapters is provided to demonstrate that groundwater levels can and will be used as a proxy for land subsidence, reduction of storage, and depletion of interconnected surface water.

9.3 Chronic Lowering of Groundwater Levels

The chronic lowering of groundwater elevations can have adverse impacts ranging from increased energy costs to the need to deepen existing wells or even construct new ones. Lowering of groundwater levels can also increase depletion from surface water and potentially create adverse impacts to groundwater dependent ecosystems, fishery resources, and riparian or related habitats. Lower groundwater elevations can also create groundwater quality problems by accelerating the migration of poor-quality groundwater or contaminant plumes. Lowering of groundwater levels could also lead to invasion of brackish connate water from underlying marine sediments into freshwater aquifers.

Groundwater levels are related to maintaining sustainable conditions without undesirable results for reduction of groundwater storage, land subsidence, and depletion of surface water. They were considered during development of this section but are discussed separately in subsequent sections.

9.3.1 *General Conditions*

The groundwater conditions in the Subbasin vary based on location and by principal aquifer. Groundwater use in the Subbasin is low, only about 12,000 AFY or about 3 percent of the total water use in the Subbasin and is only expected to increase by 4,400 AFY by 2040, based on projected urban growth (*refer to* **Table 3-3**).

Upper Aquifer

In the Non-Delta Management Area west of the San Joaquin River, groundwater levels are deeper towards the foothills and shallower near the San Joaquin and Old rivers (*refer to* **Figure 5-3**). Currently, the groundwater levels in the Upper aquifer range from 80 feet bgs near the foothills to within 5 feet of ground surface near the San Joaquin River. Groundwater levels typically have greater seasonal fluctuations, locally up to 40 feet, due to groundwater pumping and seasonal recharge. Even with these seasonal pumping and recharge fluctuations the depths to groundwater have remained stable.

East of the San Joaquin River, near Lathrop, the river recharges the Upper aquifer beneath the City and aquifers in the Eastern San Joaquin Subbasin, towards a pumping depression near Stockton.

Lower Aquifer

The Lower aquifer is present beneath the Corcoran Clay, but the clay may not extend across the entire Subbasin, allowing the Lower aquifer to become hydraulically connected to the Upper aquifer. Pumping of the Lower aquifer could therefore transfer groundwater impacts to the Upper aquifer.

The depths to groundwater in the Lower confined aquifer are typically deeper than those in the Upper aquifer. Groundwater levels (piezometric heads) range from about 20 to 270 feet bgs (*refer to* **Figure 5-5**) and in some locations, are below sea level. The groundwater levels vary by up to 30 feet seasonally. Pumping by agriculture and the City of Tracy and has resulted in a pumping depression. Regionally groundwater levels have been consistently above the top of the Corcoran. Groundwater levels beneath the clay have generally been rising over the past 20 years, except for those near the southeastern portion of the Subbasin where groundwater levels have been declining since around 2010 due to pumping in the Subbasin or adjacent northern portions of the Delta-Mendota Subbasin.

9.3.2 *Undesirable Results*

Groundwater beneficial users include humans, groundwater dependent ecosystems, and aquatic species. Groundwater in the Subbasin is used by rural homeowners, agricultural users, and municipal entities for drinking water, industrial users for manufacturing or processing food, and environmental uses for ecosystems supporting groundwater dependent plants and species.

The GSAs approached definition of undesirable results and what is considered to be significant and unreasonable, through a discussion of potential undesirable results by the GSAs and along with a workshop to seek stakeholder input on January 21, 2021, as documented in **Chapter 11 – Notices and Communications**.

The causes of chronic lowering of groundwater levels could be over-pumping of the groundwater within the Subbasin or from over-pumping of groundwater in adjacent subbasins depleting the subsurface inflow into the Subbasin. Reduction of recharge caused by various natural and man-created actions (climatic changes, urban development paving over recharge areas, agricultural irrigation practices changing to drip irrigation) could also lead to lowering of groundwater levels during extended periods of droughts if pumping is not reduced to match these changes or projects and management actions are not implemented to increase recharge and maintain a balance of pumping to recharge.

The criteria used to define significant and undesirable results by chronic lowering of groundwater levels are:

- Domestic and irrigation wells go dry (lowering pumps, cost to construct new wells)
- Increased costs to pump groundwater (including power, lowering or replacement of pumps, and new motors)
- Surface water is depleted such that creeks go dry (in periods other than severe climate conditions)
- Groundwater supported vegetation die or cannot repopulate (reduction or elimination of GDEs)
- Groundwater quality is degraded by increasing the salt content (lowering of groundwater levels increases and changes in pressure allows saline water from underlying marine sediments to increase and intrude into freshwater aquifers
- Groundwater quality becomes unusable because contaminants spread vertically and horizontally (contaminants from the large and known plumes spread and degrade water quality so that it cannot be used without treatment)

The potential effects of chronic lowering of groundwater levels are provided in the bullet list above.

Based on the criteria that could result in undesirable results, significant and undesirable results identified for the Subbasin for chronic lowering of groundwater levels will occur when groundwater levels exceed 30 feet bgs in areas currently supporting GDEs or when groundwater levels decline that cause domestic wells to go dry. The level when there would be a significant undesirable result will be:

When 25 percent or more of the representative monitoring wells (5 out of 21 wells) record groundwater levels that exceed the minimum thresholds for more than 2 consecutive years that are categorized as non-dry years (below-normal, above-normal, or wet), according to the San Joaquin Valley Water Year Hydrologic Classification. The lowering of groundwater levels during consecutive dry or critically-dry years is not considered to be unreasonable, and would therefore not be considered an undesirable result, unless the levels do not rebound to above the thresholds following those consecutive non-dry years.

The consecutive 2-year period allows time to assess the conditions and to potentially develop actions to resolve the declining levels. After the initial detection of a minimum threshold exceedance the GSAs will:

- Take a confirmation measurement
- If the measurement is confirmed, notify the GSAs
- If the measurement is confirmed, initiate an investigation to assess the cause of the exceedance
- Provide the results to the GSAs and adaptively manage

If groundwater levels were to reach levels causing undesirable results, the effects to beneficial users could include replacement of wells and pumps and higher energy cost to pump the water, potential land subsidence, and migration of poor-quality water. This could cause adverse effects personal and reginal economy and affect property values and the regional economy. The effects would also lead to increased depletion of surface and loss of GDE habitat.

9.3.3 *Criteria Considered to Establish Minimum Thresholds*

Criteria considered by the GSAs and stakeholders to establish minimum thresholds were based on the protection of the most sensitive beneficial users in the Subbasin. The criteria selected for the development of minimum thresholds for lowering of groundwater levels (or the maximum allowable groundwater level depth/elevation) were based on:

- The minimum depths of domestic wells (*refer to* **Figure 3-13**) to maintain groundwater levels 20 feet above the bottom of the well to allow for submergence of a pump and to allow continued use of the wells. No wells in the Subbasin were reported to have gone dry during the 2012 to 2016 drought. All wells do fail at some point due to corrosion of the casing or plugging of the well screens which are not related to groundwater levels. These selection criteria for minimum thresholds may be modified if the minimum well depth well was found to be:
    - Less than the current or historic groundwater levels during the drought years, 2012 to 2016.
    - Less than 40 feet because state and local ordinances require a 20-foot minimum sanitary seal depth for domestic wells and allowance for 20 feet for pump submergence.
- Rooting zone depths of GDEs vary based on types of species. A thorough review of all GDEs vegetation types has not been completed to assess rooting zone depths, due to budget constraints and the overall limited presence of GDEs within the Non-Delta Management Area. Minimum thresholds will typically vary with shallower levels near water bodies and decreasing with depth away from the water bodies. The selection criteria for minimum thresholds were established:
    - At up to 3 feet below historical groundwater levels (2010-2020) where current groundwater levels are less than 10 feet bgs
    - At an average depth of 30 feet bgs for California phreatophytes, and when groundwater levels (2010 to 2020) are greater than 10 feet bgs

It should be noted that the minimum well depth dataset has not been thoroughly vetted and may contain data about wells that are improperly located, no longer present, misclassified, or were constructed using cable tool methods where an open borehole provides water to the well from greater depths. Minimum thresholds may be re-evaluated and modified in the next 5 years as the datasets are reviewed and proofed.

Groundwater modeling results for projected conditions and with climate change were also considered during the development of minimum thresholds. Many of the model calibration wells are representative wells selected for this GSP and thus their projected difference in groundwater levels were also used during consideration to establish minimum levels. The model projected some groundwater levels to decline by 1 to 7 feet. Some selected representative monitoring wells were not in the model calibration and therefore to remain similar to other modeling results the groundwater levels were forecasted to be lower by 2 to 3 feet.

9.3.4 *Minimum Thresholds*

Minimum thresholds for chronic lowering of groundwater levels were established at varying levels throughout the Subbasin to achieve sustainable conditions and avoid undesirable results. The minimum thresholds were established at representative monitoring wells where well construction details are known and in monitoring wells with similar depths to protect beneficial users as described in **Chapter 8 – Monitoring Network**. **Figures 8-8 and 8-9** show the representative monitoring network for lowering of groundwater levels for the Upper and Lower aquifers.

Table 9-1 provides a list of these representative monitoring wells and selected minimum thresholds based on the criteria described above to avoid undesirable results for chronic lowering of groundwater levels as well as how these relate to other sustainability indicators and their selection of minimum thresholds and measurable objectives. **Appendix N** provides hydrographs of these wells illustrating the minimum thresholds to historical groundwater levels. Where more than one sensitive beneficial user is present, the more conservative level was selected. Minimum thresholds selected in adjacent subbasins are also provided for reference and comparison to those established for the Tracy Subbasin.

Figures 9-1 and 9-2 illustrates the minimum thresholds in representative wells as a contoured surface across the Subbasin in comparison to current groundwater levels (fall 2019). Minimum thresholds for representative wells in adjacent subbasins are also included to assess the effects on adjacent subbasins. As shown, the difference of the proposed minimum thresholds results in a groundwater surface similar to current conditions and without sharp differences in groundwater levels and therefore is reasonable.

The selection of the minimum thresholds was based on evaluating the individual and multiple beneficial users and selection of the shallowest level established for all users which establishes a conservative level to prevent undesirable results in the Subbasin, as shown in **Table 9-1**. Final selected minimum thresholds at each representative monitoring well, combining all sustainability indicators, are provided on the right side of the **Table 9-1**. Overall, in areas with GDEs and surface water minimum thresholds were established within 1-foot of historic groundwater levels and therefore potential impacts to GDEs and surface water depletion should be minimal. Minimum thresholds selected for subsidence, as discussed in **Chapter 9.7 – Land Subsidence**, are based on historic groundwater lows in the Subbasin. The minimum thresholds selected for surface water depletion, as discussed in **Chapter 9.8 – Depletion of Surface Water**, uses similar wells for chronic lowering of groundwater levels, GDEs in the Upper aquifer and wells in the Lower aquifer.

Table 9-1. Minimum Thresholds and Measurable Objectives – Groundwater Levels

Representative Wells			Purpose for Monitoring					Selection Criteria													Final Selection		MO Interim Milestones (ft msl or rates of subsidence ft/yr)		
			Lowering of Groundwater Levels					Lowering of Groundwater Level											Surface Water Depletion						
CASGEM ID	Local Name	Reference Point Elevation (ft)	Domestic Wells	GDE	Areas Soley Dependent On GW	Agricultural, Municipal, and Industral Wells	Surface Water Depletion	GWL Ave Spring (2010-2020) (ft msl)	GWL Historic Low Fall (2010-2020) (ft msl)	GWL Modeled Spring Low (ft msl)	GWL Modeled Fall Low (ft msl)	Minimum Domestic or Ag Well Depth (ft bgs)	Minimum Depth with Pump (ft bgs)	Minimum Domestic or Ag + Pump (ft msl)	GDEs GWL Min (2010-2020) (ft msl)	GDEs GWL Max (ft msl)	Groundwater Sole Areas Minimum Well Depths (ft bgs)	Groundwater Sole Areas Minimum Well + Pump (ft msl)	GWL Ave Spring (2010-2020) -1 feet (ft msl)	Historical Groundwater Level Low - 1 feet (ft msl)	Selected MTs (ft msl)	Selected MOs (ft msl)	Year 5 (ft msl)	Year 10 (ft msl)	Year 15 (ft msl)
Upper Aquifer Wells																									
377341N1213039W001	Well N	23.36		X			X	8	6	7	3	82	62	-39	8	-3			7	5	**5**	**7**	**7**	**7**	**7**
377061N1214199W001	Well Q	121.41	X		X			60	58	57	55	103	83	17			83	17			**55**	**57**	**57**	**57**	**57**
377951N1216011W001	02S03E01D001M	90	X		X			82	75	80	73	113	93	-3			113	-3			**73**	**80**	**82**	**82**	**82**
377813N1214420W001	02S05E08B001M	4.3	X	X			X	0	-6	-1	-7	45	25	-21	0	-36			0	-7	**-7**	**0**	**0**	**0**	**0**
377976N1214560W001	01S05E31R002M	4.6	X				X	1	0	-6	-7	85	65	-61					0	-1	**-1**	**0**	**0**	**0**	**0**
376388N1213233W001	03S06E28N001M	148.24	X					68	64	64	58	100	80	53							**58**	**64**	**68**	**68**	**68**
377528N1215156W001	02S04E15R001M	63.41	X		X			53	48	48	43	65	45	18			65	18			**43**	**48**	**48**	**48**	**48**
377979N1215800W001	01S04E31P005M	60		X			X	46	42						47	30			45	41	**41**	**45**	**45**	**45**	**45**
378103N1215449W001	ORL-1W	16.6					X	0	-2	-1	-3								-1	-3	**-3**	**-1**	**-1**	**-1**	**-1**
	MWM-24	16.88		X			X	4	0						4	-13			3	-1	**-1**	**3**	**3**	**3**	**3**
	MWR-25	16.25		X			X	5	4						10	-14			4	3	**3**	**4**	**4**	**4**	**4**
	SAD MW-402D	24.52	X					5	0	3	-2	60	40	-15							**-2**	**3**	**5**	**5**	**5**
	PW11-031	20.42					X	5	1										4	0	**0**	**4**	**4**	**4**	**4**
	PW16-216	23.26	X					2	-17	0	-19	85	65	-42							**-19**	**0**	**0**	**0**	**0**
Lower Aquifer Wells																									
376713N1214581W001	Corral MW-6	303.33	X		X	X		-36	-58	-38	-60	600	580	-280			600	-280			**-60**	**-38**	**-38**	**-38**	**-38**
377402N1214508W002	MW-1B	50.09				X	X	-19	-68	-21	-35	155	135	-80					-20	-69	**-69**	**-20**	**-15**	**-20**	**-20**
377031N1214485W002	MW-3B	138.08				X		-20	-59	-22	-40	248	228	-92							**-40**	**-22**	**-22**	**-22**	**-22**
377427N1213943W002	MW-5B	47.82				X	X	-16	-59	-18	-42	235	215	-160					-17	-60	**-60**	**-17**	**-17**	**-17**	**-17**
377656N1214199W002	MW-6B	26.65				X	X	-19	-66	-21	-46	658	400	-329					-20	-67	**-67**	**-20**	**-20**	**-20**	**-20**
376974N1213258W001	03S06E05R001M	59.69				X		-5	-31	-7	-33	300	280	-220							**-33**	**-7**	**-7**	**-7**	**-7**
	PW20-500	119.82				X		2	-8	0	-10	62	42	-27			62	-27			**-10**	**0**	**0**	**0**	**0**

Notes: Used to select MTs, MOs, and Interim Milestones

Well not used in calibration of model, no hydrograph to assess projected future conditions, estimated for projected with climate change. Vaulue subject to change.

All modeled hydrograph levels subject to change based on model revisions

Corresponding Tracy Rep Well Local Name	Other Subbasin Well Name	Selected MTs (ft msl)	Selected MOs (ft msl)	Year 5 (ft msl)	Year 10 (ft msl)	Year 15 (ft msl)
Delta Mendota Subbasin - Upper Aquifer						
03S06E28N001M	06-004	**14.8**	**38.9**			
Lower Aquifer						
03S06E05R001M	01-007	**-12**	**15.5**			
03S06E05R001M	04-001	**-6.1**	**7.8**			
Eastern San Joaquin Subbasin - Upper Aquifer						
PW16-216	Manteca 18	**-16**	**5.8**	**9.1**	**9.1**	**7.5**
Well N	02S07E31N001	**1.5**	**13**	**13.8**	**13.8**	**13.4**
	Swenson-3	**-26.6**	**-19.3**	**-19.3**	**-19.3**	**-19.3**

Notes: Only one principal aquifer defined. Lower aquifer not defined in this Subbasin

Notes: The minimum threshold is set at the deeper of 1992 and 2015-2016 groundwater levels with a buffer of 100 percent of historical range applied, or the 10th percentile domestic well depth, whichever is shallower. In municipalities with ordinances requiring the use of City water, the 10th percentile municipal well depth is used in place of the 10th percentile domestic well depth criteria.

Notes: 5-year milestones are assumed to remain similar to current for the first 10 years and then follow along a linear trend between the current condition and the measurable objective

		Selected MTs	Selected MOs	Year 5	Year 10	Year 15
East Contra Costa Subbasin - Upper Aquifer						
5 Binn (about 4 miles west of 31P05)		**-4**	**16**			
Lower Aquifer (not defined in GSP)						
	None					

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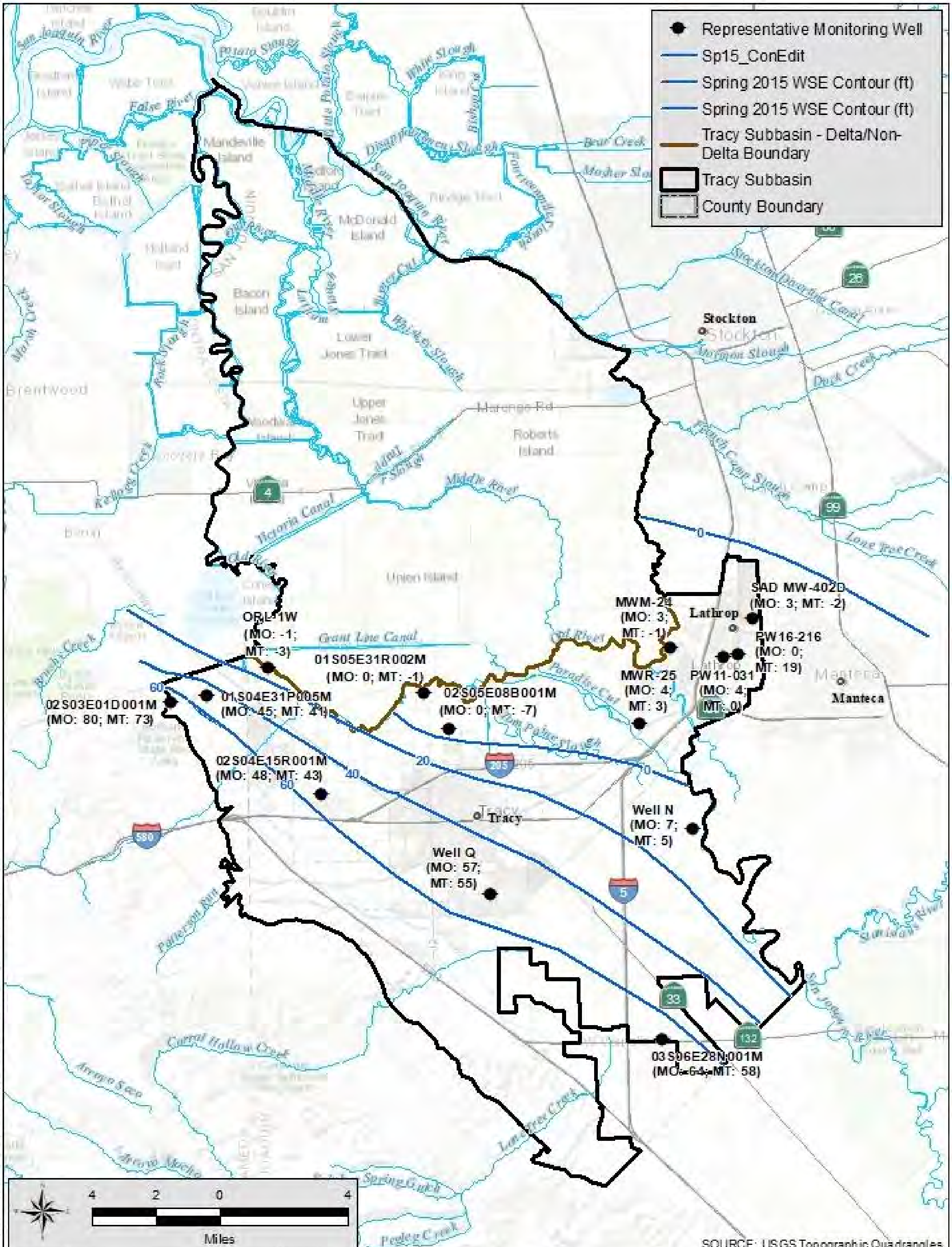

Figure 9-1. Upper Aquifer Groundwater Levels to Minimum Thresholds

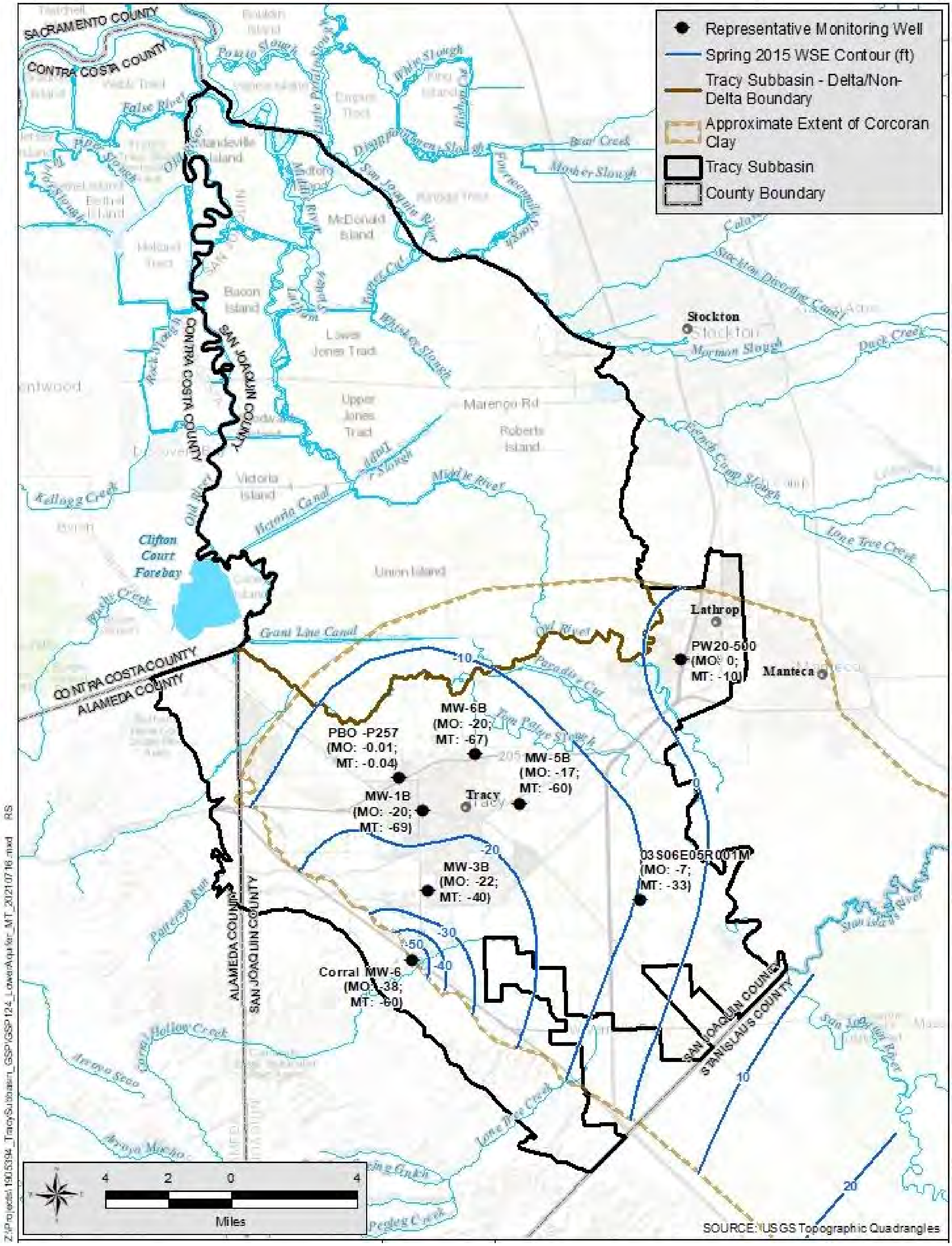

Figure 9-2. Lower Aquifer Groundwater Levels to Minimum Thresholds

9.3.5 *Minimum Thresholds Effects*

Because the establishment of these minimum thresholds were based on beneficial users, and are similar to historic groundwater levels, there should be no adverse effects on beneficial uses and users, land uses, or property interests in the Subbasin.

The potential effects of establishing minimum thresholds for chronic lowering of groundwater on other sustainability indicators, as shown in **Table 9-1**, were considered with the minimum threshold being set at the most conservative level preventing conflicts.

Groundwater minimum thresholds for adjacent subbasins were obtained for wells in adjacent subbasins near the commonly shared boundaries. Similar minimum thresholds are present in the Eastern San Joaquin and East Contra Costa subbasins. Minimum thresholds for the Lower Aquifer are much deeper in the Northern & Central Delta-Mendota subbasin than are projected in the Tracy Subbasin due to uses of different wells for contouring and the need to install dedicated monitoring wells to resolve groundwater levels in this area, as described in **Section 5.2. Current Groundwater Contours** for the Lower aquifer.

9.3.6 *Relevant State, Federal and Local Standards*

No federal, state, or local standards exist for chronic lowering of groundwater elevations.

9.3.7 *Measurable Objectives*

Groundwater levels measurable objectives were set above the minimum threshold to meet the water needs of a multi-year drought. The measurable objectives groundwater levels were established based on:

- Average historical spring groundwater level within the last 10 years (2010-2020 to reflect current conditions and as some wells were not measured in 2015 at the start of SGMA), because at these levels:
    - There were sufficient groundwater reserves that undesirable results (no dry wells) were not reported during the recent drought
    - Near potential GDEs, groundwater levels were shallow enough to allow for continued growth and promote regrowth
    - Agriculture can still maintain unsaturated root zones and allow farming to continue

Table 9-1 provides a listing of the selected measurable objectives at each representative monitoring well. Using average historical spring groundwater levels (2010 through 2020) rather than historic spring low levels provides a margin of safety.

Interim milestones were established at the average spring groundwater levels for the next 15 years (similar to time frame projections as the Eastern San Joaquin Subbasin GSP). As illustrated in **Table 9-1**, interim milestones likely be achieved as the current groundwater levels are similar to current levels. Interim milestones through 2042 will be developed after the initial years of GSP implementation and additional knowledge is obtained by filling of data gaps.

9.4 Reduction of Storage

For decades the DWR has utilized changes in groundwater elevations along with specific yield estimates to estimate changes in storage. In **Chapter 5.5 – Change in Storage**, groundwater levels were demonstrated to be directly correlated to reduction of groundwater storage. Therefore, groundwater levels will be used as a proxy to establishing minimum thresholds and measurable objectives rather than attempting to quantify volumes or acceptable rates.

9.4.1 *General Conditions*

The entire Tracy Subbasin has been estimated to contain over 42 million acre-feet, (MAF) based on the C2VSIM groundwater model, but only a fraction of this groundwater can be used without potentially creating undesirable results. Based on the same groundwater model, groundwater storage in the Non-Delta Management Area portions of the Subbasin has averaged almost 16 MAF, without creating historic undesirable results, or about 37 percent of the groundwater in the Subbasin.

The average quantity of groundwater extracted during the base period of 2003 to 2013, the sustainable yield, was for just the Non-Delta Management Area was 62,100 AFY (**Chapter 7.7 – Sustainable Yield**). During this period undesirable results, as currently defined, were not observed by the GSAs. Groundwater levels provided in **Appendices G and H** show stable or upward trends in groundwater levels during this period of time.

9.4.2 *Undesirable Results*

Significant and undesirable result for the reduction of groundwater storage in the Tracy Subbasin is experienced if groundwater storage volumes are insufficient to satisfy beneficial uses within the Subbasin over the planning and implementation horizon of this GSP.

Significant and undesirable results from chronic lowering of groundwater levels (**Chapter 9.3.2 – Undesirable Results**) were established to protect beneficial users and would create similar undesirable results for change in storage. A long-term reduction of groundwater in storage may result in deepening wells and increases in pumping costs for groundwater users. Undesirable results defined for chronic lowering of groundwater apply and are not repeated.

9.4.3 *Criteria Considered to Establish Minimum Thresholds*

The sustainable yield is the total volume of groundwater that can be pumped annually from the basin without leading to undesirable results. The water budget information included in **Chapter 5 – Groundwater Conditions**, was used to establish the sustainable yield for the basin and identify associated groundwater levels. Using groundwater levels as a proxy, the potential groundwater storage minimum thresholds criteria considered were:

- Historical deepest groundwater levels in wells throughout the Subbasin
- Groundwater levels at the start of SGMA, in spring 2015
- Groundwater levels at the end of the drought in fall 2016

- Groundwater levels that protect beneficial uses and users

Criteria selected for reduction in storage were the groundwater levels in the Subbasin that are protective of beneficial uses and users, similar to those for selected for chronic lowering of groundwater levels.

9.4.4 *Minimum Thresholds*

The minimum threshold for reduction of groundwater storage is a volume of groundwater that can be withdrawn from a basin or management area, based on measurements from multiple representative monitoring sites, without leading to undesirable results. Contrary to the general rule for setting minimum thresholds, the reduction of groundwater storage minimum threshold is not set at individual monitoring sites. Rather, the minimum threshold is set for the Subbasin or management area (DWR 2017).

The sustainable yield is the total volume of groundwater that can be pumped annually from the basin without leading to undesirable results. The water budget information included in **Chapter 7 – Water Budgets** was used to establish the sustainable yield for the basin and identify associated groundwater levels. Using groundwater levels as a proxy, the minimum thresholds for reduction in storage for the Tracy Subbasin are the same as those developed for chronic lowering of groundwater levels provided in **Table 9-1**.

9.4.5 *Minimum Thresholds Effects*

Because the establishment of these minimum thresholds were based on beneficial users, and are similar to historic groundwater levels, there should be no adverse effects on beneficial uses and users, land uses or property interests in the Subbasin.

9.4.6 *Relevant State, Federal and Local Standards*

No federal, state, or local standards exist for reduction of groundwater storage.

9.4.7 *Measurable Objectives*

The measurable objective groundwater levels for reduction of storage are the same as those developed for chronic lowering of groundwater levels, as provided in **Table 9-1**. Using average historical groundwater levels rather than historic high levels provides an operational margin of safety.

Interim milestones for reduction of storage are the same as those developed for chronic lowering of groundwater levels, as provided in **Table 9-1.**

9.5 Seawater Intrusion

Seawater intrusion is not an applicable sustainability indicator as the nearest occurrence of saline water intrusion into surface waterways is about 20 miles west of the northern Subbasin boundary near the City of Antioch. The Delta has been protected from saline water intrusion for nearly 80 years due to construction of dams and sustained inflow of water to the Delta from the San Joaquin and Sacramento rivers. Seawater intrusion is unlikely to occur during the planning horizon of this GSP.

9.5.1 *Undesirable Results*

No locally defined significant and undesirable results for sea water intrusion were developed for the Subbasin.

9.5.2 *Minimum Thresholds*

No locally minimum thresholds were developed for sea water intrusion for the Subbasin.

9.5.3 *Measurable Objectives*

No locally measurable objectives were developed for sea water intrusion for the Subbasin.

9.6 Degraded Water Quality

Groundwater beneficial users in the Subbasin include domestic well owners, agriculture, and municipal entities for drinking water, industrial for manufacturing or processing food, native plants, aquatic species and crop water requirements. Groundwater quality can affect surface water if the groundwater is discharging to surface water and contains high concentrations of nutrients (e.g., nitrate).

9.6.1 *General Conditions*

The groundwater quality in the basin is generally adequate to meet the needs of environmental, domestic, municipal, industrial and agricultural uses in the basin. The concentration of the naturally occurring elements varies widely over the Subbasin and also with depth at any given location. Groundwater quality in the Subbasin has locally exceeded the MCLs for drinking water for specific elements, some exceedances are scattered, and some are clustered. Because of the generally poorer groundwater quality surface water is used for most water supplies and groundwater use is small, about 3 percent of the total annual water use in the Subbasin. **Chapter 5.6 – Groundwater Quality**, provide a detailed description of the water quality, concentrations, trends and distribution. Salinity is generally high across the Subbasin and can affect the use of the water for both agricultural and drinking water. Nitrate concentrations are generally low but can be used as an indicator of effects of farming, confined animal operations and septic systems. Boron is present at levels that could affect agriculture.

Salinity

Salinity, as represented by TDS, is relatively high in the Subbasin ranging from 82 mg/L to as high as 4,500 mg/L (*see* **Appendix H**) using samples collected by DWR, USGS and from PWS wells. Upward trends are present in 11 out of 56 monitoring and public supply wells (*refer to* **Chapter 5.6.2 - Groundwater Quality Trends**).

TDS has established secondary drinking water MCLs which were established for aesthetic reasons such as taste, odor, and color and are not based on public health concerns. TDS has a recommended drinking water MCL of 500 mg/L, an upper level of 1,000 mg/L and a short-term standard of 1,500 mg/L. TDS tolerance levels for agricultural is generally less than 1,000 mg/L as shown in **Table 9-2.** TDS in the Subbasin is mostly above the recommended MCL in both the Upper and Lower aquifers except for a few areas with good quality water as shown on **Figure 5-19**. TDS in some areas is above the upper MCL but mostly less than the agricultural tolerance levels.

There are over 120 public supply wells in Subbasin that are overseen by the State Water Board's DDW, but currently well construction details are few to be able to sort the data by aquifer. Water purveyors have managed to find aquifers that provide water that is above the recommended secondary MCL of 500 mg/L but below the upper MCL of 1,000 mg/L in most of the Subbasin, but in the City of Lathrop water quality is better and is typically below the recommended MCL. The average TDS in PWS wells in the Subbasin is 766 mg/L. Sources of high salinity are from stormwater runoff from the Coast Ranges, underlying marine sediments, evaporation of shallow groundwater and from agricultural activities.

TDS is monitored in PWS wells under drinking water quality programs administered under the State Water Board's DDW and by the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) and the ILRP.

Nitrate

Nitrate concentrations are low in the Subbasin, as shown on **Figure 5-23**, and other than a few wells, nitrate does not appear to be adversely impacting water quality, but upward trends are present in 24 out of 120 monitoring and public supply wells (*refer to* **Chapter 5.6.2 – Groundwater Quality Trends**). The primary drinking water standard is 10 mg/L. Both salinity and nitrates are being managed through existing management and regulatory programs within the Subbasin, such as the CV-SALTS and the ILRP, which focus on improving water quality by managing septic and agricultural sources of salinity and nitrate.

Boron

The most prevalent sources of boron in drinking water are from the leaching of rocks and soils, wastewater, and fertilizers/pesticides. In the Non-Delta Management Area, portions of the Upper and Lower aquifers boron commonly exceed 1.0 mg/L. Boron is an unregulated chemical without an established MCL but has a Notification Level of 1.0 mg/L.

Boron is essential to plant growth but may be toxic to many sensitive plants. The agricultural water quality objective for boron in irrigation water is 0.7 mg/L (Ayers and Westcot, 1985). **Table 9-2** provides a summary of the crop types grown in the Subbasin and boron tolerances to irrigation water containing boron. As shown in the table there is no one predominant crop type in the Subbasin.

The average boron concentration from PWS wells used for drinking water is 0.1 mg/L. Upward trends are present in only 3 out of 57 wells (*refer to* **Chapter 5.6.2 – Groundwater Quality Trends**).

Fertilizers and pesticide applications are regulated under the California Department of Pesticide Regulations and use is reported to county agricultural commissioners and CV-SALTS. Naturally occurring sources of boron in the Subbasin is from marine sediments in the Coast Ranges and volcanic rocks potentially imported into the Subbasin as sediments were deposited. Subsurface inflow from the Delta-Mendota Subbasin could also bring boron into the Subbasin.

Point Source Contamination Sources

Point-source contamination and plume migration are managed and regulated through a variety of programs by the Regional Water Quality Control Board, Department of Toxic Substances Control, and the EPA. The locations of major contaminant sources are described in **Chapter 6.6.3 – Groundwater Contamination Sites and Plumes**. Through coordination with these agencies and continuing monitoring, the Subbasin GSAs will know if existing regulations are being met or groundwater pumping activities in the Subbasin are contributing to significant and unreasonable undesirable effects related to degraded water quality.

Table 9-2. Crop Types and Water Quality Tolerance Levels

Land Use	Acres	Percent of Subbasin	Salinity Tolerance Levels (mg/L)	Boron Tolerance Levels (mg/L)
Agriculture	**143,117**	**60.02%**		
Citrus and Subtropical	477	0.20%	900	1.0
Deciduous Fruits and Nuts	13,604	5.71%	1,000	0.5-0.75
Field Crops	30,374	12.74%	1,100	0.75-15.0
Grain and Hay Crops	9,488	3.98%	1,400	0.75-15.0
Idle	9,688	4.06%		
Pasture	45,246	18.98%		0.75-15.0
Rice	75	0.03%	1,700	0.75-15.0
Truck Nursery and Berry Crops	31,065	13.03%		
Vineyard	2,886	1.21%	1,100	
Young Perennial	213	0.09%		

Source: TDS values are estimated based on applied irrigation water electrical conductivity values for a 90 percent crop yield potential (Texas A&M AgriLife Extension, 2003, adapted from Ayers and Westcott, 1976).

9.6.2 *Undesirable Results*

The GSAs approached definition of undesirable results for water quality and what is considered to be significant and unreasonable, through a discussion of potential undesirable results by the GSAs and along with a workshop to seek stakeholder input.

An undesirable result for degraded water quality in the Tracy Subbasin is experienced if SGMA-related groundwater management activities cause significant and unreasonable impacts to the long-term viability of domestic, agricultural, municipal, environmental, or other beneficial uses over the planning and implementation horizon of this GSP. Undesirable results may result from increases of salinity, nitrate and boron to above upper, secondary or primary drinking water standards, notification limits or agricultural irrigation water quality objectives for crops grown in the Subbasin.

The criteria used to define when and where groundwater conditions cause undesirable results for degraded water quality are the California secondary (Upper) or primary drinking water standards, notification limits or agricultural irrigation water quality objectives, where the groundwater concentrations have not been already exceeded, that prevent the water for being used for drinking water or agricultural purposes.

Undesirable results, that were determined to be significant and unreasonable for degraded water quality are:

- *The average TDS concentration in representative monitoring wells increases and exceed the secondary upper drinking water MCL of 1,000 mg/L unless the concentration is already above the MCL*
- *The average nitrate concentration in representative monitoring wells to exceed the primary MCL of 10 mg/L*
- *The average boron concentrations to exceed the Long-Term Health Advisory level of 2.0 mg/L, in representative monitoring wells unless concentrations already are above this level*
- *When concentrations of TDS and nitrate in more than 25% of the representative monitoring wells increase above the MCL, agricultural water objective or Health Advisory level, unless the concentration already have been exceeded*

Other constituents such as arsenic and uranium are scattered occurrences and although may locally affect groundwater quality cannot be managed on a regional basis. Therefore, undesirable results were not considered for these elements.

The potential causes leading to undesirable results would be retainage of salts within the Subbasin due to lowering of groundwater levels and a reduction of storage that could lead to accumulation of salts, nitrate and boron in the Subbasin. If groundwater quality were to reach levels causing undesirable results, effects could include requiring well head water quality treatment and loss of the ability to grow crops resulting in economic burden on domestic well owners and loss of revenue and agricultural jobs. This could cause adverse effects to property values and the regional economy Potential salinization or nitrification of groundwater discharging to the tributaries could cause loss of habitat for GDEs and aquatic species.

9.6.3 *Criteria Considered to Establish Minimum Thresholds*

Criteria considered by GSAs and stakeholders for the development of minimum thresholds for groundwater quality are:

- Groundwater quality objectives contained in the Water Quality Control Plan for the Sacramento and San Joaquin River Basins (CVRWQCB, 2018 and subsequent amendments)
- Drinking water quality standards for PWS wells with published primary and secondary MCLs and Notification Levels (as listed in California Code of Regulations, Title 22)
- Irrigation water quality objectives for agricultural vary by crop but generally crop yields are not affected until TDS concentrations exceed 1,000 mg/L as illustrated in **Table 9-2** and when boron exceeds 0.7 mg/L
- Plants and species water quality standards (State Water Board 2017)

The highest beneficial use and water quality protection in the Subbasin is for agricultural, municipal and domestic uses (CVRWQCB 2018) and therefore drinking water regulations were applied to establish measurable objectives, but much of the groundwater in the Subbasin already exceeds these standards. Maintaining salinity concentrations below the drinking water standards (Secondary Maximum Contaminant Level, upper recommended level) would be protective of most agriculture uses, which cover about 60 percent of the entire Subbasin. Using agricultural water quality objectives for boron is more protective of beneficial users than using the drinking water Notification Levels.

9.6.4 *Minimum Thresholds*

Salinity (as represented by TDS), nitrate and boron are relatively high in the Subbasin and are the only water quality constituents for which minimum thresholds were established in the Tracy Subbasin. **Table 9-3** provides a listing of the historic concentrations at each representative well along with minimum thresholds. **Appendix O** contains the graphs showing the historic data and selected representative minimum thresholds.

Because water quality varies throughout the Subbasin, the minimum thresholds for degraded groundwater quality also vary throughout the Subbasin. Where concentrations are:

- Below the MCL or agricultural water quality objective, the minimum threshold concentrations were established at the MCL or agricultural water quality objective
- Above the MCL or agricultural water quality objective, minimum thresholds were established at the 10% higher than the maximum concentrations historically found representative monitoring wells. The increase of 10% above the historical levels was developed based on uncertainty in concentrations and in some cases due to only one sample being obtained

This approach was taken because maximum historical concentrations at representative wells were used due to most wells having concentrations already above the MCLs or Notification Levels and would be consistent with the State Water Board Anti-degradation Policy (State Water Board 1968) which is to preserve water quality at the observed levels, even when these levels are above the MCL.

It should be noted that wells SJCDW00032 and SJCDW00034 have only one measurement, and therefore both the historic maximum and minimum concentrations are the same.

Minimum thresholds may need to be adjusted in the future, after more samples are analyzed and a more representative dataset is acquired. The approach to setting the minimum thresholds for these wells were established using the same approach described above.

Concentrations will be obtained and evaluated from the State Water Board GAMA database website.

9.6.5 *Minimum Thresholds Effects*

The practical effect of the degraded groundwater quality undesirable result is that it may reduce or limit the potential uses for groundwater to meet the beneficial users or land uses.

Groundwater quality minimum thresholds for adjacent subbasins are provided in **Table 9-3** for comparison to those established for the Tracy Subbasin. Because of the highly variable water quality in adjacent subbasins, the concentrations selected in those subbasins are higher than those selected for the Tracy Subbasin. Subsurface inflow from these adjacent subbasins, based on groundwater contours provided in **Chapter 5 – Groundwater Conditions**, and with their higher concentrations could affect minimum thresholds in the Tracy Subbasin, which may require future revisions of the water quality minimum thresholds.

9.6.6 *Relevant State, Federal and Local Standards*

Th degraded groundwater quality MTs specifically incorporate state drinking water standards.

9.6.7 *Measurable Objectives*

The measurable objectives for degraded water quality were established at the maximum concentration at each representative monitoring well, with the goal of maintaining, to the extent possible, groundwater quality at its current concentrations. This approach is being conservative and consistent with State Water Board Anti-degradation Policy, rather than using the average of all concentrations.

Table 9-3 provides a listing of the historic concentrations at each representative well and selected measurable objectives. **Appendix O** contains the graphs showing the historic data and selected representative minimum thresholds and measurable objectives.

Interim milestones were set at the current concentrations for TDS, nitrate and boron to maintain water quality in the Subbasin, as shown in **Table 9-3**. As such, the concentrations are likely to be maintained over the planning horizon and allow for some operational flexibility to allow concentrations to increase by up to 10%. This approach was also taken by adjacent subbasins with available information.

Table 9-3. Minimum Thresholds and Measurable Objectives – Water Quality

PWS Code	Local Name	TDS (Secondary Upper MCL = 1,000 mg/L)				Nitrate (mg/L) (Primary MCL = 10 mg/L)				Boron (Irrigation Objective 0.7 mg/L)				MO Interim Milestones (TDS, Nitrate, Boron)		
		Historical Maximum (mg/L)	Historical Minimum (mg/L)	**Selected MTs (mg/L)**	**Selected MOs (mg/L)**	Historical Maximum (mg/L)	Historical Minimum (mg/L)	**Selected MTs (mg/L)**	**Selected MOs (mg/L)**	Historical Maximum (mg/L)	Historical Minimum (mg/L)	**Selected MTs (mg/L)**	**Selected MOs (mg/L)**	**Year 5 (mg/L)**	**Year 10 (mg/L)**	**Year 15 (mg/L)**
Upper Aquifer Wells																
	SJCDW00032	1100	1100	**1210**	**1100**	7.8	7.8	**10**	**7.8**	3.8	3.8	**4.2**	**3.8**	**1100, 7.8, 3.8**	**1100, 7.8, 3.8**	**1100, 7.8, 3.8**
	SJCDW00034	1200	1200	**1320**	**1200**	13.0	13.0	**14**	**13**	0.9	0.9	**1.0**	**0.9**	**1200, 13, 0.9**	**1200, 13, 0.9**	**1200, 13, 0.9**
3910015-005	WELL 06	470	350	**500**	**470**	6.3	2.6	**10**	**6.3**	0.2	0	**0.7**	**0.2**	**470, 6.3 , 0.2**	**470, 6.3 , 0.2**	**470, 6.3 , 0.2**
Lower Aquifer Wells																
3910702-006	WSW009	733	460	**1000**	**733**	2.0	<1.0	**10**	**2.0**	1.5	0.3	**1.7**	**1.5**	**733, 10, 1.5**	**733, 10, 1.5**	**733, 10, 1.5**
3910011-003	PRODUCTION WELL 01	910	728	**1000**	**910**	4.6	<1.0	**10**	**4.6**	2.6	2.3	**2.9**	**2.6**	**910, 10, 2.6**	**910, 10, 2.6**	**910, 10, 2.6**
3910011-018	WELL 04R -NEW LINCOLN	850	740	**1000**	**850**	3.0	<1.0	**10**	**3.0**	1.3	1.2	**1.4**	**1.3**	**850, 10, 1.3**	**850, 10, 1.3**	**850, 10, 1.3**
3910011-032	PRODUCTION WELL 06	760	538	**1000**	**760**	1.3	0.7	**10**	**1.3**	1.4	0.9	**1.5**	**1.4**	**760, 10, 1.4**	**760, 10, 1.4**	**760, 10, 1.4**
3910011-034	PRODUCTION WELL 07	830	290	**1000**	**830**	1.9	0.4	**10**	**1.9**	1.8	0.45	**2.0**	**1.8**	**830, 10, 1.8**	**830, 10, 1.8**	**830, 10, 1.8**

Upper Aquifer Wells - Delta Mendota Subbasin																
	06-004			**4000**	**4000**			**80**	**80**			**3.0**	**3.0**	Current groundwater quality		
Lower Aquifer Wells - Delta Mendota Subbasin																
	01-007			**2000**	**2000**			**50**	**50.0**			**3.0**	**3.0**	Current groundwater quality		
	04-001			**4000**	**4000**			**70**	**70.0**			**0.7**	**0.6**	Current groundwater quality		

Notes: Interim milestones for degraded water quality are set for years 5 through 15 to maintain current groundwater quality.

Wells - Eastern San Joaquin Subbasin																
	Well 16			**280**	**600**									**360**	**440**	**520**
	Stockton SSS-8			**370**	**600**									**427**	**485**	**543**

Notes: Only one principal aquifer defined. Lower aquifer not defined in this Subbasin.

Upper Aquifer Wells - East Contra Costa Subbasin																
	No wells near boarder			**1000**	**---**			**10**	**---**			**5**	**---**			
Lower Aquifer Wells - East Contra Costa Subbasin																
	None			**---**	**---**			**---**	**---**			**---**	**---**			

Notes: MOs = average concentrations 2013 to 2017

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9.7 Land Subsidence

Historical land surface subsidence within the Non-Delta Management Area of the Subbasin has been minimal except for in the southern portions of the Tracy Subbasin and northern portions of the Delta-Mendota Subbasin as discussed in **Chapter 5.8 – Subsidence**. Because the Tracy Subbasin and Delta-Mendota Subbasin interfinger, minimum thresholds and measurable objectives from the Northern & Central Delta-Mendota Region GSP (Woodard and Curran, 2019) were reviewed, and applicable portions were documented in this section.

9.7.1 *General Conditions*

Subsidence is currently being monitored by satellite-based surveys (InSAR), benchmark surveys along the Delta-Mendota canal and a continuous recording global position radar station (CGPS) established for plate boundary observations.

In the San Joaquin Valley, where the Corcoran Clay is present, lowering of groundwater levels due to pumping below the clay has resulted in large amounts of subsidence (up to about 30 feet). The Corcoran Clay is present in much of the Non-Delta portions of the Subbasin. Therefore, the subsidence could occur in the Subbasin.

The highest rates of subsidence, based on satellite data, are within in the Delta portions of the Subbasin and is due to oxidization of peat, not due to lowering of groundwater levels. Some high rates are also present in the Non-Delta Management Area, near the margins of the Delta and are likely due to peat layers in these areas based on NASA JPL satellite data.

Groundwater levels in the Lower aquifer in the Tracy Subbasin are above the Corcoran Clay reducing the potential for subsidence. Groundwater levels below the Corcoran Clay are stable and rising in most areas other than in the southern area of the Subbasin (area where Delta-Mendota Subbasin interfingers with Tracy Subbasin) and where groundwater levels may have (measured in wells not fully sealed just within the Lower aquifer) declined but only by up to 15 feet.

In this southern area, according to the Northern and Central Delta-Mendota Region GSP, minimal land subsidence has previously been observed in the West Side Irrigation District-Patterson Irrigation District Management Areas (WSID-PID MA). Both WSID and PID receive sufficient surface water supplies via the San Joaquin River and the CVP to meet demands within the districts, meaning Lower aquifer groundwater pumping (which may result in inelastic land subsidence) within this management area is minimal (Woodard & Curran 2019). As shown on **Figure 5-38**, subsidence along the canal was 1.27 feet, outside of the Subbasin but near the boundary with the Northern & Central Delta-Mendota Region GSP (Woodard and Curran 2019), using data from the San Luis Delta-Mendota Water Authority and also up to -1.28 feet over a 5-year period based on InSAR data.

Satellite-based surveys (NASA JPL) of the Central Valley from May 2015 to September 2016 showed 0.07 to 0.8 feet subsidence occurred in about 16 months, or an annual rate of about 0.06 to 0.5 feet per year, (*refer to* **Figure 5-39**).

InSAR data showed low rates of annual subsidence, within the instrument and processing error factor of the dataset, but after 5 years the data showed potential subsidence, which exceeded the error factor near the southern margin of the Subbasin and is likely real. Groundwater levels in the area have only declined by about 15 feet in that area suggesting it may not be related to groundwater pumping. Two new monitoring wells are proposed for that area.

At the plate boundary station (*refer to* **Figure 5-39**) during the drought, between 2012 and 2016, groundwater levels declined by about 15 feet, but were still above historic low levels, and there was an apparent subsidence of about 0.04 ft/yr. It is possible the subsidence was due to a delayed reaction caused by lowering of groundwater levels between 2006 and 2009. The slight change in groundwater levels, especially when they are not lowering groundwater levels below the Corcoran clay does not suggest the decline in levels are related to subsidence due to groundwater pumping.

Table 9-3 provides a summary of the historic rates of subsidence in the Subbasin along with minimum thresholds and measurable objectives established in adjacent basins. It shows the variance of subsidence estimates based on the various methods.

Table 9-3. Rates of Subsidence

Source	Historical Rate of Subsidence (ft/yr)	Selected Subsidence Rates		MO Interim Milestones (rates of subsidence ft/yr)			
		MT Rate of Subsidence (ft/yr)	MO Rate of Subsidence (ft/yr)	Year 5	Year 10	Year 15	Year 20
PBO Station (P257) Subsidence Rates							
2006 to 2012	0						
2014 to 2015	-0.04						
2006 to 2020	-0.03						
Satellite-Based Subsidence Rates							
May 2015 to Sep 2016	-0.08 to -0.70						
InSAR Subsidence Rates in Tracy Subbasin [2]							
January 2015 to January 2016	+0.014 to -0.025	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
January 2015 to October 2020	+0.006 to -0.128						
Delta-Mendota Canal Benchmarks in Tracy Subbasin							
1984-2018	-0.21 to -0.71						
Delta-Mendota Canal Benchmarks in Delta-Mendota Subbasin [1]							
01-010 (Subsidence Monitoring Point #1)	-0.13	-0.13	-0.11	-0.12	-0.12	-0.11	
01-013 (Subsidence Monitoring Point #4)	-0.13	-0.13	-0.11	-0.12	-0.12	-0.11	

Notes: 1 = From Northern & Central Delta-Mendota Subbasin GSP

2 = The estimated error in the InSAR data is 0.1 foot

9.7.2 *Undesirable Results*

Figure 5-37 show the locations of some of the infrastructure (canals and highways) in the Subbasin that could be affected by subsidence. Over 60 percent of the land use in the area is agriculture, as shown on **Figure 3-6,** which would not be significantly impacted by subsidence, but may require releveling of fields and deepening of earthen canals.

The criteria used to define significant and undesirable results for subsidence (due to groundwater extractions) are:

- The ability to deliver surface water supplies in the Delta-Mendota Canal and California Aqueduct
- Impacts to sewer and storm drains preventing proper drainage
- Replacement of pavement on Highway 580 and Interstate 5 due to cracking induced by subsidence
- Lowering of levee crowns adjacent to rivers allowing flooding to occur

For the Tracy Subbasin, undesirable results would be an increase from historic rates of subsidence (refer to ***Table 9-3****) in the Non-Delta Management Area caused by lowering of groundwater levels that impacts infrastructure.*

Potential causes that may create these undesirable results could be from groundwater pumping below the Corcoran Clay resulting in groundwater levels dropping below historic lows which may result in inelastic land subsidence.

The potential effects of this undesirable result occurring would be cracking of road pavement, damage to buildings, cracking and loss of capacity in the Delta-Mendota canal and California Aqueduct and flooding which could all affect property values.

9.7.3 *Criteria Considered to Establish Minimum Thresholds*

There are multiple sources of data (satellite-based surveys, benchmark surveys along the Delta-Mendota canal and a continuous recording global position radar established for plate boundary observations) that could be used to evaluate subsidence and establish minimum thresholds. The InSAR tool is currently the only tool available which provides Subbasin wide subsidence consistently each year.

Criteria considered for development of subsidence minimum thresholds include:

- Subsidence data across the entire Subbasin and not at just single points
- Timely availability of data to assess if undesirable results may occur
- Other information that can be used to evaluate if subsidence is due to groundwater pumping
- Acknowledgement that inelastic subsidence is occurring in the Subbasin due to natural conditions (oxidization of peat, plate tectonics) and that is not necessarily related to groundwater extraction

9.7.4 *Minimum Thresholds*

The minimum threshold for land subsidence in the Subbasin is set at nor more than -0.03 feet (rounded up from -0.025 feet observed in 2015-2016) in any single year (October 1 – October 1 to match the water year) and a cumulative -0.13 feet in any 5-year period, similar to historic subsidence levels. The cumulative amount would exceed the estimation error in the InSAR data of 0.1 foot and would therefore be valid. The InSAR tool is currently the only tool available which provides Subbasin wide subsidence consistently each year.

The InSAR subsidence dataset will be used by the Subbasin GSAs annually (October 1 – October 1 to match the water years) to evaluate this sustainability criteria. Should the InSAR data indicate subsidence greater than the minimum threshold then a review of CPGS data and groundwater elevations will be performed to confirm that subsidence has occurred and if it is related to groundwater pumping. As necessary, benchmarks canal alignment along the Delta-Mendota canal alignment and the City of Tracy benchmarks may also be resurveyed.

9.7.5 *Minimum Thresholds Effects*

Staying above the minimum threshold will avoid the subsidence and undesirable results and protect the beneficial uses and users in the Tracy Subbasin from impacts to infrastructure and interference with surface land uses.

Based on information provided in **Table 9-3**, annual subsidence rates selected by the Delta-Mendota Subbasin are higher than in the Tracy Subbasin. The minimum thresholds in the Tracy Subbasin are more conservative and should have no adverse effects on the Delta-Mendota Subbasin.

9.7.6 *Relevant State, Federal and Local Standards*

No federal, state, or local standards exist for land subsidence.

9.7.7 *Measurable Objectives*

The guiding measurable objective of this GSP for land subsidence in the Subbasin is the maintenance of subsidence rates as present at the start of SGMA, at less than -0.25 feet/year. The measurable objective avoids significant and unreasonable rates of land subsidence in the Subbasin, which could lead to permanent subsidence that impacts infrastructure and agricultural production. As this subsidence measurable objective is essentially already being met, the specific goal is to maintain this level of land subsidence, through the GSP implementation.

The measurable objective established by the Northern and Central Delta-Mendota Region GSP, in the fingered areas with the southern portions of the Tracy Subbasin, "…is set as no loss in distribution capacity as a result of subsidence resulting from groundwater pumping. Numerical values for this criterion to be determined based on data collection between 2020 and 2025." Measurable objectives and interim milestones as rates of depletion were set at benchmark stations along the canal and are provided in **Table 9-3**.

Interim milestones are the same as the current rate of subsidence based on InSAR data and are likely to be maintained due to the low groundwater pumping in the Subbasin.

9.8 Depletion of Surface Water

Depletions of surface water are a reduction in flow or levels of surface water caused by groundwater extraction. The reduction in surface water flow or levels, at certain magnitudes or timing, may have adverse impacts on beneficial uses of surface water and related resources, and could lead to undesirable results.

The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of surface water and may lead to undesirable results (CCR, 2016). An equally effective tool is to use groundwater levels as a proxy to surface water depletion rates or volumes. By lowering of groundwater levels, the gradient away from rivers increases and so does the depletion from the river. Using groundwater levels to assess surface water depletion is an equally effective method.

9.8.1 *General Conditions*

Beneficial users in the Subbasin have reliable good quality surface water supplies. Overall, there are limited numbers of agricultural or municipal groundwater wells near the rivers that could lower groundwater levels and increase surface water depletion because most growers in these areas have surface water riparian rights. As shown on **Figure 3-13**, most agricultural wells are at least 2 miles from the rivers and waterways. Municipal supply wells, shown on **Figure 3-16** are also removed from the waterways by 1 to 2 miles. Surface water in the rivers and waterways are controlled by releases of water from dams to maintain salinity intrusion in the rivers near Antioch.

Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.

Creeks in the Subbasin, from the foothills to the rivers, are seasonal, only flowing after rains and therefore are not connected by a continuous saturated zone to the principal aquifers (*refer to* **Chapter 5.9 – Interconnected Surface Water**), except for potentially Mountain House Creek. Along the San Joaquin and Old rivers and waterways, hydrographs of wells and surface water gaging stations were shown to correlate and therefore the surface water in these rivers and waterways are hydraulically connected to the principal aquifers (*refer to* **Figure 5-41**). Water in the rivers and sloughs are from reservoir releases that the GSAs cannot control, with minor contribution from groundwater in comparison to the total flow in the rivers and sloughs.

Historical and future surface water depletion were evaluated using a groundwater model (*refer to* **Chapter 7 – Water Budgets**). The groundwater model for projected with climate change suggests that surface water depletion will increase (combination of increased surface water inflow and a decrease of surface water discharges). As discussed in this chapter there are some uncertainties in the model (**Chapter 7.8 – Opportunities for Improvements**) that once resolved may reduce this projected surface water depletion. Until the groundwater model and water budget are validated the amount of projected surface water depletion cannot be relied upon and minimum thresholds and measurable objectives were established near historic levels.

Because the Corcoran Clay may not extend entirely across the Subbasin, the Lower aquifer pumping could potentially deplete surface water in the Delta management area where the Upper and Lower aquifers are hydraulically connected. Therefore, minimum thresholds and measurable objectives using groundwater levels at representative monitoring wells (in the Non-Delta Management Area) will be established for the Lower aquifer.

As illustrated in **Chapter 5 – Groundwater Conditions**, for the Upper aquifer, groundwater levels near the rivers fluctuate with river stage levels and therefore groundwater levels can be used as a proxy to determine the rate or volume of surface water depletion.

9.8.2 *Undesirable Results*

Depletions of interconnected surface water significant and undesirable results were developed based on available technical information included in the draft GSP, input to the Sustainable Management Criteria Worksheet, a public meeting, and discussions with GSA staff. In discussions of interconnected surface water, GSA staff and stakeholders did not indicate any observed undesirable results from historical depletions.

The criteria used to define significant and undesirable result for depletions of interconnected surface water in the Tracy Subbasin are:

- Rivers dry up and cannot support aquatic species, water supply and recreation.
- Allow saline water to intrude into waterways in the Tracy Subbasin, allowing for recharge of degrade water quality to the aquifers
- Increased surface water depletion that would require additional releases of surface water from dams or a reduction of surface water diversions in order to repel saline water
- If groundwater extraction resulted in a depletion of surface water that causes significant impacts to aquatic species or wildlife

The potential causes of increased surface water depletion are an increase of groundwater pumping and lowering of groundwater levels near the surface water bodies leading to additional surface water depletion.

Significant and undesirable results would be if groundwater levels in 25 percent of the representative wells in normal years, excluding drought years, would decline below the minimum thresholds for 2 consecutive years.

If depletions of interconnected surface water were to reach levels causing undesirable results, effects could include reduced flow and stage within rivers and streams in the Subbasin to the extent that insufficient surface water would be available to support diversions for agricultural or urban uses or to support regulatory environmental requirements. This could result in increased groundwater production, changes in irrigation practices and crops grown, and could cause adverse effects to property values and the regional economy. Reduced flows and stage, along with potential associated changes in water temperature, could also negatively impact aquatic species in the rivers and streams. Such impacts are tied to the inability to meet minimum flow requirements, which are defined for the San Joaquin River, which in turn, are managed through operations of multiple reservoirs and would have far greater effect on flows than groundwater discharges.

9.8.3 *Criteria Considered to Establish Minimum Thresholds*

Criteria considered by the GSAs and stakeholders to establish minimum thresholds were:

- Timely availability of data to assess if undesirable results may occur (groundwater modeling or measurements of groundwater levels)

- Most wells only have semi-annual measurements limiting the ability to fully assess the groundwater lows that may occur in the spring and summer months when groundwater pumping would be at its maximum
- Setting minimum thresholds near the river but also inland to develop gradients
- Selection of minimum thresholds at the historical low groundwater levels or in 2015 near the end of the recent drought
- Depletion of surface water by lowering of groundwater levels could also affect GDEs

9.8.4 *Minimum Thresholds*

This GSP uses historic low groundwater levels as a proxy to establish minimum thresholds for the depletions of interconnected surface water and as the sustainability indicator as groundwater levels have been confirmed to react similarly to river stages (*see* **Section 5.9. Interconnected Surface Water**). **Table 9-1** lists the minimum thresholds at representative monitoring wells in both the Upper and Lower aquifers. The minimum thresholds rely on historic fall measurements with allowance for one foot of additional decline until there are sufficient monthly measurements to better quantify the range of groundwater levels. As shown in the table, selected groundwater levels in the Upper aquifer are similar to those selected for GDEs.

In the unlikely event that groundwater level minimum thresholds are exceeded, groundwater gradients calculated by using up to three monitoring wells will be used to assess if the gradient exceeds historical ranges. Calculation of gradients can be used as a proxy to groundwater levels as long as the rivers remain in constant hydraulic communication with the groundwater. If the gradients are steeper this could lead to undesirable results. **Table 9-4** lists the groundwater gradients based on available data.

Every 5 years the groundwater model will be run and estimates of annual rates and volumes of surface water depletion will be developed and compared to historical data to confirm that maintaining groundwater levels at the established minimum thresholds has indeed not increased surface water depletions significantly.

9.8.5 *Minimum Thresholds Effects*

Based on this input, this GSP assumes that historical conditions are protective of beneficial uses related to interconnected surface water. If groundwater levels were to fall lower than historical levels, there is an associated level of additional depletions that could occur which could affect aquatic species. The increase in surface water depletion would not affect property interests.

Table 9-4. Groundwater Gradients

Date	River Stage (ft msl)	Groundwater Elevation (ft msl)	Groundwater Elevation (ft msl)	Groundwater Elevation (ft msl)	Approximate Hydraulic Gradient (ft/ft)	Flow Direction (Degrees)	Toward or Away from River
	ODM [2]	ORL-1W	01S04E31P005M [1]	----			
9/20/2019	0.88		42.36		0.0038		Toward
10/24/2014	0.88		47.72		0.0043		Toward
	OLD	01S05E31P002M	02S05E08B001M	----			
10/19/2011	5.9	0.9	-1.2		0.0016	225	Away
10/18/2017	3.4	0.6	-2.3		0.0009	206	Away
	MSD [2]	Well N	Glori MW-2	MW-102 (Proposed)			
10/18/2018	5	6.0			0.0005		Away
10/4/1960	5	19.63			0.0069		Away
	----	MW-6B	MW-1B	MW-5B			
10/6/2014		-45.85	-52.05	-41.35	0.0007	266	Away
2/25/2016		-18.84	-21.15	-18.64	0.0002	234	Away

Notes: 1 = Only 11 measurements available to estimate range, none at same date as ORL-1W.
2= Approximate surface water elevation at time of groundwater level measurement

9.8.6 *Relevant State, Federal and Local Standards*

No federal, state, or local standards exist for surface water depletion.

9.8.7 *Measurable Objectives*

As groundwater levels are being used as a proxy for depletions of interconnected surface water, the measurable objectives and interim milestones for the depletions of interconnected surface water are the same as the measurable objectives developed for the chronic lowering of groundwater levels developed to be protective of GDEs, as listed in **Table 9-1**. Using average historical spring groundwater levels (2010 through 2020) rather than historic spring low levels provides a margin of safety.

Interim milestones for surface water depletion are the same as those developed for chronic lowering of groundwater levels, as provided in **Table 9-1.**

9.9 Effect of Minimum Thresholds on Neighboring Subbasins

As displayed throughout this chapter minimum thresholds established by the Tracy Subbasin are not expected to produce adverse effects on adjacent subbasins as the minimum thresholds established are similar to historic levels and are more conservative than in adjacent subbasins.

The Subbasin coordinated with the Northern & Central Delta-Mendota Region GSP technical team to attempt to resolve whether groundwater in the Lower aquifer is flowing from the Subbasin into the Delta-Mendota Subbasin or the reverse. This GSP performed a detailed examination of several wells being used by the Delta-Mendota subbasin for their contouring and based on construction details, that the groundwater levels were similar to Upper aquifer levels, and that the use of these wells created a sharp decline of groundwater levels in the Lower aquifer at the Subbasin boundary this GSP did not use these wells measurements for contouring purposes. As a result, this approach, there is a discrepancy of whether subsurface inflow is to or from the Delta-Mendota subbasin but should be resolvable once new dedicated monitoring wells are constructed. The minimum threshold established by the Subbasin maintain groundwater levels near historic levels and should not affect the inflow or outflow from the Delta-Mendota subbasin.

The Subbasin also coordinated with the Eastern San Joaquin subbasin where that subbasin is projecting for an additional 6,000 AFY of subsurface outflow from the Subbasin. Additional modeling in the Eastern San Joaquin subbasin is needed to evaluate where this additional subsurface outflow is occurring and whether this subsurface outflow may affect the minimum threshold established by the Subbasin. Once identified and along with suggested improvements to the C2VSim-FG_v1.0 model, minimum threshold effects will need to be re-evaluated during the 5-year update.

Currently, minimum thresholds in the Eastern Contra Costa subbasin were not available to evaluate potential effects from those established by the Subbasin.

As discussed in **Chapter 11 – Notices and Communications**, the Subbasin plans to continue to coordinate with adjacent subbasins during implementation of the GSPs. BBID and County Subbasin GSAs also have representatives in two of the surrounding subbasins making this coordination and communication easy.

10. Projects and Management Actions

Projects and management actions were selected by the GSAs for implementation to meet measurable objectives by 2042 and to maintain groundwater levels above minimum thresholds. The Subbasin Non-Delta Management Area is projected to have a deficit of about 700 AFY based on projected changes in the Subbasin including climate change forecasted for 2065. Assessing the deficit by principal aquifer has shown the Upper aquifer has a deficit of about 800 AFY while the Lower aquifer is in surplus by 100 AFY. Because the aquifers are so close to being in balance and within the uncertainty of the model, projects are proposed for both aquifers. The project selected is to augment water supplies to resolve chronic lowering of groundwater levels and change in storage in the Upper aquifer. Management actions have been selected to limit the potential to increase surface water depletion with additional benefits towards GDEs.

10.1 Groundwater Management

The GSAs have been managing their groundwater and surface water resources for decades through development of UWMP plans, AWMPs, and General Plans. Below are some highlights of these activities:

- The City of Tracy has planned and constructed recycled water pipeline infrastructure, including recycled water transmission pipelines and pump stations, to provide recycled water to parks, professionally managed landscape areas, and other non-potable uses. The pipeline will eventually be extended to connect to the Central Valley Project Delta Mendota Canal. The recycled water pipeline and pump stations have been constructed but a permit has not yet to be obtained to use and distribute the recycled water. The City of Lathrop has planned and constructed advanced wastewater treatment and recycled water infrastructure to provide recycled water to new development areas for parks, streetscapes, and other non-potable uses to reduce groundwater pumping
- Both the cities of Tracy and Lathrop obtained contracts for SSJID surface water to augment their water supplies and reduce groundwater pumping
- Both the cities of Tracy and Lathrop have improved water efficiency by requiring new developments to have low flow toilets and other water conservation measures
- The City of Tracy has been implementing ASR at one well of nine wells for nearly 10 years
- Many agricultural users have converted from flood irrigation to drip irrigation to use water supplies more efficiently
- The County an approved Proposition 218 tax for benefiting groundwater management

These management activities were incorporated into the water budgets if the activities were identified in the current UWMP, AWMPs, and General Plans and have already been implemented. Projects and management actions presented in this chapter are those that have evolved since the latest publication (prior to 2020) of these plans.

10.2 List of Projects and Management Actions

The GSAs created a list of 18 initial projects that were refined to the current list that could be implemented to resolve shortfalls in either the Upper or Lower aquifers. These projects or the ones contained in **Table 10-1** were not listed in the Westside-San Joaquin Integrated Regional Water Management Plan (Woodard and Curran 2019). Each GSA member agency listed as the Owner will manage the permitting, design, and construction and operation of the project or management action shown on **Table 10-1** along with their measurable objectives, potential implementation timeline, groundwater recharge potential, and estimated costs. The location of the projects is illustrated on **Figure 10-1**.

Table 10-1 Projects and Management Actions

Project or Management Action No.	Owner	Project or Management Action Description	Potential Implementation Time (yrs)	Measurable Objective	Potential Recharge (AFY)	Potential Cost
Projects						
P1	BCID	Conjunctive Use - Expansion of distribution facilities to provide surface water to areas previously reliant on groundwater. Benefits Upper Aquifer.	2023-2030	Chronic Lowering of Groundwater Levels	1,000	$1,500,000
Management Actions						
MA-1	County	Modify Well Ordinance - 1) Create surface water depletion protection zones near rivers and sloughs. Minimum sanitary seal and screen depth requirements to limit direct interconnection to surface water. Benefits Upper Aquifer and potentially to GDE's. 2) Well spacing requirements for high-capacity irrigation or municipal wells from domestic wells. Benefits domestic well owners.	2023-2025	Surface Water Depletion		$20,000

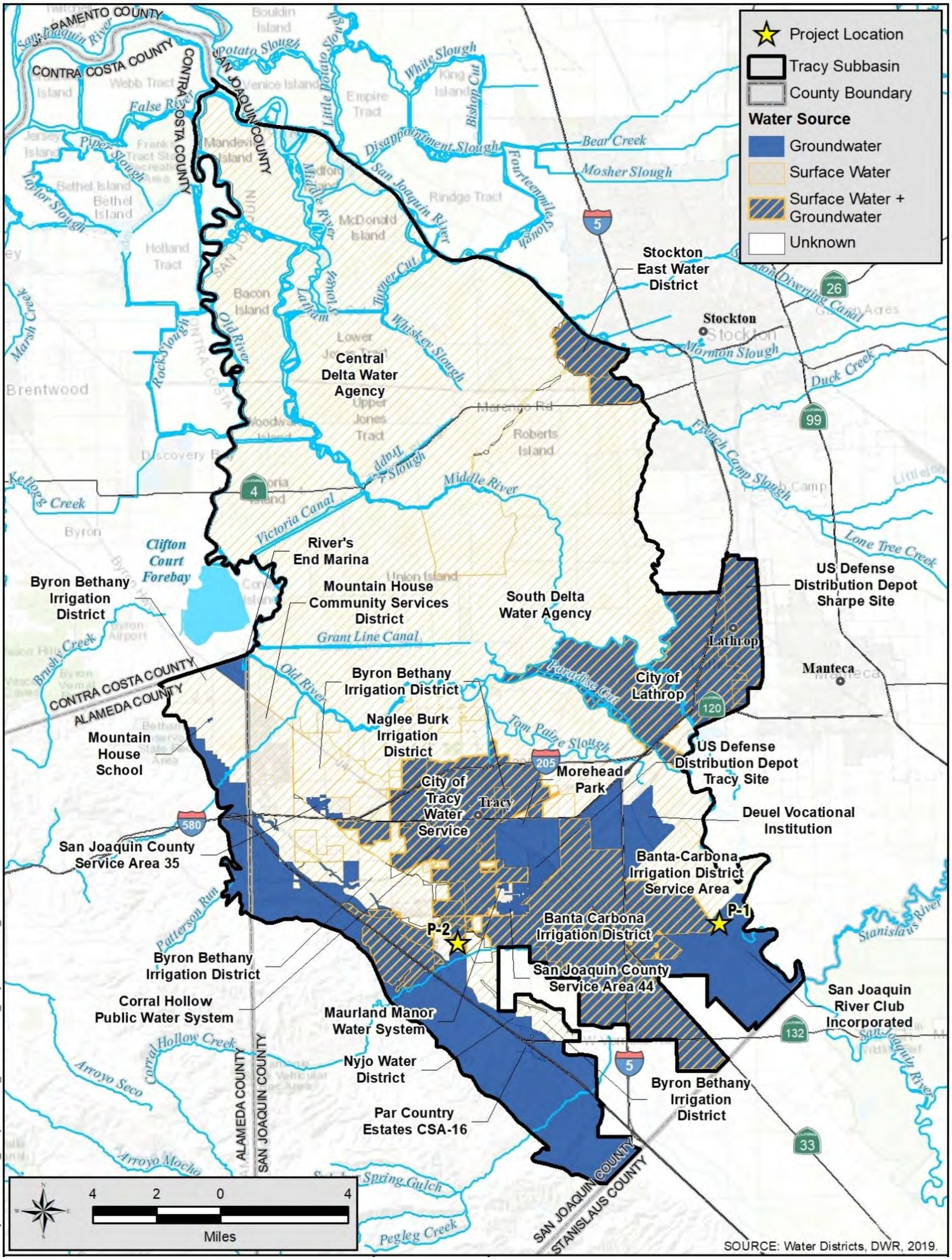

Figure 10-1 Locations of Projects

10.2.1 *Project 1: Reduction of Groundwater Pumping*

Project Description: This project will consist of expansion of the BCID distribution facilities to provide surface water to up to about 500 acres of agricultural land that is currently solely reliant on groundwater. The project requires construction of new lateral pipelines, establishment of new turnouts to deliver water to the agricultural properties, and enlargement of a pump station tied to an existing main lift canal.

Measurable Objective Expected to Benefit: This project addresses chronic lowering of groundwater levels in the Subbasin by reducing groundwater pumping by up to 1,000 AFY.

Project Status: The expansion of the distribution facilities project is currently under review by BCID Board of Directors. Construction is expected to begin in 2023 and be completed by 2030.

Permitting and Regulatory Process: Permitting for the project is on-going. Required permits and approvals will be obtained prior to the project starting construction.

Public Noticing: This project is on the agenda of the monthly BCID Board meetings which occur on a monthly basis and all meetings are open to the public. All Board meeting Agendas are publicly noticed in accordance with the Ralph M. Brown Act (Brown Act).

Timetable for Implementation: Completion of construction is anticipated to occur by about 2030.

Expected Benefits and Evaluation: This project is anticipated to reduce groundwater demand by up to 1,000 AFY in an area adjacent to BCID service area and within 3 miles of the San Joaquin River. Benefits are expected to accrue for 50 years or more as the area is as defined by San Joaquin County General Plan is agriculture. Benefits to groundwater levels will be evaluated by quantifying the volume of surface water delivered.

Potential Impacts: The existing groundwater supply will be replaced with surface water delivered through a pressurized pipeline which will allow growers to use highly efficient drip irrigation which will limit overapplication of water and deep percolation to the groundwater. Therefore, the potential impacts are less than significant when considering potential changes to water quality and affecting domestic well owners.

How the Project will be Accomplished: BCID will be the owner and use construction contractors, engineers, and consultants to construct the project.

Legal Authority: BCID is a public special district formed under California law and has pre-1914 water rights to draw water from the San Joaquin River to serve the lands on the westerly side of the San Joaquin River.

Estimated Costs and Funding Plan: Estimated costs to build the pumping plant and pipeline to 500 acres is approximately $1,500,000. Grants will be applied for and the landowners in the project area will provide the cost share portion of any grants awarded. GSAs may also contribute funding.

Circumstances for Implementation: This project is in the planning process and is anticipated to move forward once grant funds are secured.

Trigger for Implementation and Termination: The trigger for implementation is when funds have been secured for design and construction of the project.

Process for Determining Conditions Requiring the Project to Occur: This is a project in the planning process that is anticipated to move forward.

10.2.2 *Management Action 1: Modify Well Ordinance*

Management Action Description: This management action may consist of revising the existing San Joaquin County Well Ordinance to create surface water protection zones near rivers, canals, and sloughs in the Non-Delta Management Area. Minimum sanitary seal and screen depth requirements will be developed to limit wells from using shallow aquifers directly connected to surface water. The project will require development of technical information to support the development of protection zones and modification of the Well Ordinance. Exemptions may be allowed for replacement of existing wells. The well ordinance may also be modified to include special study requirements for high-capacity wells to assess their potential effects on nearby domestic wells.

Measurable Objective Expected to Benefit: This project prevents future increases in surface water depletion by restricting direct connection of wells to rivers, canal, and sloughs. It also reduces the potential impacts to domestic well owners from newly constructed wells.

Project Status: The new California Well Standards are expected to be released in 2022 and will require revisions and adoption of local well ordinances to meet the minimum standards. The proposed surface water protection zones and special studies can be incorporate developed into this revised document.

Permitting and Regulatory Process: As part of the well standard revision CEQA documentation will be prepared and posted for public review and comment prior to adoption.

Public Noticing: This management action will be on the San Joaquin County Board of Supervisors monthly Board meetings which are open to the public and are publicly noticed in accordance with the Brown Act. The management action will be noticed to the public in accordance with CEQA requirements.

Timetable for Implementation: Completion of development of the new San Joaquin County well ordinance is anticipated to occur by about 2024.

Expected Benefits and Evaluation: This project is anticipated to maintain surface water depletion at current levels. Benefits are expected to accrue for 50 years or more.

How the Project will be Accomplished: San Joaquin County staff prepare the well ordinance revisions by initially assessing other permitting agencies rules. The staff may use the technical resources to develop evidence to prove the protection zones are reasonable around the water ways and domestic wells.

Legal Authority: The County has land use management and planning authority granted through the State of California. This power allows the County to establish land use and zoning laws that govern development. The County is an existing well permitting agency under the California Water Code Section 13801; Ordinance Code of San Joaquin County Section 9-1115, Municipal Codes of Stockton, Lodi, Manteca, Tracy, Escalon, Ripon and Lathrop.

Estimated Costs and Funding Plan: Estimated costs to revise the existing well ordinance to include a surface water protection zone is approximately $20,000 when included with required revisions of the California Well Standards. San Joaquin County will use administrative funds collected under Proposition 218. Fees generated by the well permitting will pay for administrative costs of this program.

Circumstances for Implementation: This management action will be implemented once the California Well Standards are released, the ordinance has been through CEQA and has been adopted by the Board of Supervisors.

Trigger for Implementation and Termination: The trigger for implementation is when the public draft of the California Well Standards is released. The trigger for termination may occur if a new California Well Standard is developed. Updates to the standard occurs about every 10 to 20 years.

Process for Determining Conditions Requiring the Management Action to Occur: This management action is based on best available science but must obtain CEQA approval for the management action to occur.

10.3 List of Supplemental Projects

The GSAs have additional supplemental projects that could be implemented if groundwater level monitoring were to show groundwater levels are declining and have a potential to exceed minimum thresholds. The supplemental projects that could be implemented to resolve shortfalls in either the Upper or Lower aquifers as listed in **Table 10-2.** Project PS-1 is a further expansion of BCID's service area to 1,500 acres with a reduction in groundwater pumping of 3,000 AFY. The second supplemental project is the expansion of the City of Tracy's ASR program. This project could address chronic lowering of groundwater levels in the Subbasin by injecting an approximate volume of water equal to the City's groundwater pumping, by up to an average of 3,000 AFY. At full buildout, and with the addition of four new planned wells the recharge could approach 16,000 AFY. The location of the supplemental projects is illustrated on **Figure 10-1**.

Table 10-2 Supplemental Projects

Supplemental Projects	Owner	Project or Management Action Description	Potential Implementation Time (yrs)	Measurable Objective	Potential Recharge (AFY)	Potential Cost
Projects						
SP1	BCID	Conjunctive Use - Expansion of distribution facilities to provide surface water to areas previously reliant on groundwater. Benefits Upper Aquifer.	2023-2030	Chronic Lowering of Groundwater Levels	3,000	$2,500,000
SP2	City of Tracy	Conjunctive Use – Convert existing Production Wells to Aquifer Storage and Recovery wells to store surface water in the Aquifer for later use. Benefits Lower Aquifer.	2025-2040	Chronic Lowering of Groundwater Levels	3,000 to 16,000	$2,000,000

11. Notices and Communications

The GSAs in the Tracy Subbasin conducted a number of activities to engage beneficial users of groundwater, interested parties, and the general public in the development of the GSP. Each GSA was responsible for conducting outreach and engagement related to SGMA within its service area. Recognizing efficiencies in pooling resources and the importance of consistent messaging, the GSAs also coordinated basin-wide outreach activities. This chapter describes the coordinated tools, methods, and activities the GSAs used to inform and engage stakeholders in development of the GSP.

11.1 GSAs Decision Making Process

The GSAs executed a MOU for development of the GSP on September 4, 2019. The MOU formed the GSP Coordination Committee, which oversees development and implementation of the GSP. The GSP Coordination Committee includes participation from each of the GSAs. In accordance with the MOU, each GSA has designated a principal contact person to participate in the Committee and undertake actions on the GSA's behalf. Each GSA is entitled to one vote in decisions made by the GSP Coordination Committee, except for decisions that will have a disproportionate effect on the financial obligations of the GSA. In this case, votes are cast in weighted proportion to the financial obligation or benefit of the GSA.

To provide a venue for discussion of technical topics related to development of the GSP, the GSAs also formed a Technical Committee. The Technical Committee provides recommendations to the GSP Coordination Committee. Membership of the Technical Committee is not defined in the MOU, but generally includes one participating representative from each of the Subbasin GSAs.

Both GSP Coordination Committee and Technical Committee meetings are open to the public. These meetings are further described in **Chapter 11.4 – List of Public Meetings**.

11.2 Groundwater Beneficial Use and Users

A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests and the nature of consultation with those parties.

Beneficial users and uses of groundwater were identified and engaged by the GSAs based on the place- and interest-based categories described in SGMA and codified in Water Code Section 10723.2:

- (a) Holders of overlying groundwater rights, including:
  - (1) Agricultural users, including farmers, ranchers, and dairy professionals
  - (2) Domestic well owners
- (b) Municipal well owners
- (c) Public water systems
- (d) Local land use planning agencies

(e) Environmental users of groundwater

(f) Surface water users, if there is a hydrologic connection between surface water bodies and groundwater

(g) The federal government, including, but not limited to, the military and managers of federal lands

(h) California Native American tribes

(i) Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems

(j) Entities listed in Section 10927 that are monitoring and reporting groundwater elevations in all or a part of a groundwater basin managed by the groundwater sustainability agency

Beneficial users and uses representing these categories and nature of consultation with these users are further described below and identified in **Table 11-1**.

Table 11-1. Nature of Consultation with Beneficial Users of Groundwater

Beneficial User Category	Beneficial Users	Nature of Consultation: Membership on GSP Coordination Committee	Interested Parties Database	GSP Coordination and Technical Committee Meetings	Public Workshops	Other Public Meetings	Targeted Outreach to Representatives of Beneficial Users
Agricultural	Agricultural water users (farmers, ranchers)		X	X	X	X	X
Domestic	Domestic well owners		X	X	X	X	X
Municipal	City of Lathrop	X	X	X	X	X	
	City of Tracy	X	X	X	X	X	
	Small community water systems		X	X	X		X
Industrial	Sharpe Army Defense Depot		X	X	X		X
	Tracy Defense Distribution Depot		X	X	X		X
	Deuel Vocational Institution		X	X	X		X
	Independent gravel mining operations			X	X		
Public Water Systems	Cal Water		X	X	X		
	City of Lathrop	X	X	X	X	X	
	City of Tracy	X	X	X	X	X	
	Corral Hallow Public Water System			X	X		
	CSA 50 (Patterson Irrigation Park)		X	X	X		
	Morehead Park			X	X		
	Maurland Manor Water System			X	X		
	Mountain House Community Services District		X	X	X		X
	Par County Estates CSA-16			X	X		
	San Joaquin Service Area 35			X	X		
	San Joaquin Service Area 44			X	X		
	San Joaquin River Club			X	X		X
	Tracy Defense Distribution Depot		X	X	X		
Local Land Use Planning Agencies	City of Lathrop Planning Commission		X	X	X		X
	City of Tracy Planning Commission		X	X	X		X
	County of San Joaquin Planning Commission			X	X		X
	San Joaquin County Local Agency Formation Commission			X	X		X
Environmental Users of Groundwater	California Department of Fish and Wildlife			X	X		
	California Sportfishing Protection Alliance		X	X	X		
	The Nature Conservancy		X	X	X		
Surface Water Users	Banta-Carbona Irrigation District	X	X	X	X	X	
	Byron-Bethany Irrigation District	X	X	X	X	X	
	Island Reclamation District 2062	X	X	X	X	X	
	City of Lathrop	X	X	X	X	X	
	City of Tracy	X	X	X	X	X	
	Individual landowners		X	X	X		
Federal Government	Sharpe Army Defense Depot		X	X	X		X
	Tracy Defense Distribution Depot		X	X	X		X
	US Department of the Interior, Bureau of Reclamation			X	X		
Disadvantaged Communities (Census Designated Tracts)	Census Designated Tract GeoID 06077003900			X	X		
	Census Designated Tract GeoID 06077000801			X	X		
	Census Designated Tract GeoID 6077000900			X	X		
	Census Designated Tract GeoID 06077003803			X	X		
	Census Designated Tract GeoID 06077003803			X	X		
	Census Designated Tract GeoID 06077005303			X	X		
	Census Designated Tract GeoID 6077005501			X	X		
Groundwater Monitoring and Reporting Entities	County of San Joaquin	X	X	X	X	X	
	San Joaquin County Flood Control and Water Conservation District			X	X		

11.2.1 *Agricultural Users*

Farmland accounts for about 60 percent of the land area within the entire Subbasin. Agricultural water users primarily include farmers and ranchers. They are represented in the Subbasin by agricultural and irrigation water providers, including the Banta-Carbona Irrigation District, Byron-Bethany Irrigation District, Central Delta Water Agency, Island Reclamation District 2062, Naglee-Burk Irrigation District, South Delta Water Agency, and various Reclamation Districts.

Agricultural interests are represented on the GSP Coordination Committee by the Banta-Carbona Irrigation District GSA, Byron-Bethany Irrigation District GSA, County of San Joaquin GSA (County), and Stewart Tract GSA. Representatives from the County consulted with the Central Delta Water Agency and South Delta Water Agency through personal communications with agency staff and presentations at meetings of the agencies' boards of directors. The GSAs coordinated with San Joaquin Farm Bureau Federation to promote workshops and other opportunities for public engagement.

11.2.2 *Domestic Well Owners*

Private domestic well operators within the Subbasin primarily include rural residents interspersed with active farmlands. There are considerably more wells in the non-Delta area, south of the Old River, than in the Delta area of the Subbasin. These wells are concentrated in and around the cities of Tracy and Lathrop and unincorporated areas of the County. Domestic well owners within the cities of Tracy and Lathrop are represented on the GSP Coordination Committee by their respective GSAs. Owners in the unincorporated areas are represented by the County.

Domestic well owners had the opportunity to consult on the GSP during public workshops and monthly GSP Coordination Committee and Technical Committee meetings. All interested parties were also provided the opportunity to comment on the GSP during the public comment periods, further described in **Chapter 11.5 – GSP Comments and Responses**.

11.2.3 *Municipal and Industrial Well Owners*

Municipal well owners within the Subbasin include the cities of Lathrop and Tracy and several small community water systems primarily located with the County jurisdiction. The Sharpe Army Defense Depot, Tracy Defense Distribution Depot, and Deuel Vocational Institute provide water for both municipal and industrial facilities and use groundwater as their source of supply. Other industrial groundwater users include seven gravel mines within the Subbasin with active mining operations.

Municipal well owners are represented on the GSP Coordination Committee by the City of Lathrop GSA, City of Tracy GSA, and the County. Industrial water users are included on the Interested Parties Database and had to opportunity to consult on the GSP during GSP Coordination Committee and Technical Committee meetings and public workshops. Representatives of the Sharpe and Tracy Defense depots attended Committee meetings and consulted with GSA representatives.

11.2.4 *Public Water Systems*

Public water systems in the Subbasin include the cities of Tracy and Lathrop, Corral Hollow Public Water System, CSA 50 (Patterson Industrial Park), Maurland Manor Water System, Morehead Park, Mountain

House Community Services District, Par County Estates CSA-16, San Joaquin CSA 44, San Joaquin Service Area 35, San Joaquin River Club, and Tracy Defense Distribution Depot System. Cal Water also provides water to a small area of the City of Stockton that extends west of the San Joaquin River in the Subbasin.

The cities of Lathrop and Tracy are represented on the GSP Coordination Committee and Technical Committee. The County represents CSAs within the County's jurisdiction and public water systems within the County area. The GSAs consulted with the Mountain House Community Services District through meetings and personal communications with District staff. Representatives of public water systems were also invited to participate in monthly committee meetings and public workshops and had the opportunity to provide comment on draft GSP chapters.

11.2.5 *Local Land Use Planning Agencies*

Local land use and planning agencies in the Subbasin include the Planning Commissions of the cities of Lathrop and Tracy, the County, and the San Joaquin County Local Agency Formation Commission. These agencies are represented on the GSP Coordination Committee by the cities of Lathrop and Tracy GSAs, and the County. The GSAs kept local Planning Commissions informed about development of the GSP through staff briefings and individual communications.

11.2.6 *Environmental Users of Groundwater*

Organizations representing environmental and ecosystem interests in Subbasin include the CDFW, California Sportfishing Protection Alliance, and TNC. Representatives from the California Sportfishing Protection Alliance and TNC are included in the Interested Parties Database. Representatives from organizations representing environmental uses of groundwater were provided the opportunity to participate in monthly meetings and public workshops and provide comment on draft GSP chapters.

11.2.7 *Surface Water Users*

Surface water is used in the Subbasin to meet demands for urban, agricultural, and environmental purposes. In many areas of the Subbasin, surface water is also used conjunctively with groundwater to manage groundwater in those areas. Surface water users include the cities of Lathrop and Tracy, farmers and ranchers, and municipal and industrial water users in the unincorporated area of the County.

The cities and Lathrop and Tracy receive supplies from the South San Joaquin Irrigation District through the South County Water Supply Program. Surface water purveyors with water rights include in the Banta-Carbona Irrigation District, Byron-Bethany Irrigation District, and Island Reclamation District 2062. The Central and South Delta Water Agencies also represent surface water rights holders in the Delta area of the Subbasin.

Surface water users are represented on the GSP Coordination Committee by all six GSAs. The County consulted the Central and South Delta Water Agencies through staff briefings and presentations at meetings of the agencies' boards of directors. Individuals representing agencies and Reclamation Districts in the Delta area also participated in GSP Coordination Committee meetings and workshops.

11.2.8 *Federal Government*

The Tracy and Sharpe Army Defense Distribution depots are located within the Subbasin boundaries. Reclamation owns the CVP canals, including the Delta-Mendota Canal which crosses the entire length of the Subbasin south of Highway 580.

Representatives from the depots participated in GSP Coordination Committee meetings and are on the Interested Parties Database. Federal agencies were also provided the opportunity to consult in development of this GSP through commenting on draft GSP chapters and participating in public workshops and committee meetings.

11.2.9 *California Native American Tribes*

There are no California Native American Tribes with tribal lands located within the Subbasin.

11.2.10 *Disadvantaged Communities*

Data published by the U.S. Census Bureau in 2018 show seven Census Designated Tracts within the Subbasin that meet the annual Median Household Income (MHI) criteria[2] to be considered a DAC or SDAC by the state. A map and description of these communities is provided in **Chapter 3.5 – Disadvantaged Communities**. Two of these areas are located within and receive water from the cities of Lathrop and Tracy. These communities are represented by the cities Lathrop and Tracy GSAs. The other communities are located within the County unincorporated area and receive water from small community water systems or domestic wells. These communities are represented by their local water purveyor and were represented on the GSP Coordination Committee by the County.

Water users in DACs and SDACs were notified about development of the GSP through notices distributed by the GSA representing the area and information posted on the GSA and the Subbasin website. They also had the opportunity to participate in monthly public meetings and public workshops and provide comment on draft GSP chapters. In addition, the San Joaquin County GSA distributed a bilingual (English-Spanish) postcard in July 2021 to over 360 landowners in communities designated as disadvantaged and with a concentration of domestic wells. The postcard notified landowners about development the GSP and directed them about who to contact for more information. The GSAs also followed best practices for engaging underrepresented and disadvantaged communities, such as holding public workshops in the evening, providing language interpretation at public workshops, translating materials into languages other than English, and conducting targeted outreach to local and regional community organizations.

11.2.11 *Groundwater Elevation Monitoring and Reporting Entities*

The County is the designated reporting agency in the Subbasin for the CASGEM. San Joaquin County Flood Control and Water Conservation District publishes semiannual groundwater reports covering

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[2] A DAC is defined as a census geography community with an annual MHI that is less than 80% of the statewide annual MHI (PRC Section 75005(g))]. A SDAC is a census geography community with an annual MHI that is less than 60% of the statewide annual MHI. The statewide MHI for the U.S. Census Bureau American Community Survey 5-Year Data: 2014 – 2018 is $71,228. Therefore, the calculated DAC and SDAC thresholds are $56,982and $42,737, respectively.

groundwater conditions in San Joaquin County. The County represents groundwater elevation monitoring and reporting entities on the GSP Coordination Committee.

11.3 Public Engagement

Identification of opportunities for public engagement and a discussion of how public input and response will be used.

The GSAs utilized a variety of tools and activities to encourage the active involvement of diverse social, cultural, and economic elements of the population within the Subbasin. These activities were guided by the Tracy Subbasin Communication and Engagement Plan, which is provided in **Appendix P.** The activities identified in the Communication and Engagement Plan were adapted in accordance with state and local social distancing requirements resulting from the COVID-19 pandemic.

To support execution of the activities identified in the plan and ensure a collaborative and inclusive GSP development process, the GSAs utilized DWR's Facilitation Support Services. Facilitation and outreach support were provided by Stantec Consulting Services, Inc.

11.3.1 *Outreach Tools*

The GSAs used several tools to support communication and engagement activities with stakeholders in the Subbasin. These tools include the following:

- **Subbasin Website**: The Subbasin website (tracysubbasin.org) is the primary location for beneficial users and interested parties to stay informed about GSP development and opportunities for engagement. The website serves a repository for public workshop and meeting materials, outreach collateral, draft and final GSP chapters and appendices, and other key documents. During GSP development, members of the public could review and provide comments on draft GSP chapters using a virtual public comment form. The public comment process is described further in **Chapter 11.5 – GSP Comments and Responses**.
- **Interested Parties Database**: Pursuant to the requirements of SGMA, the GSAs developed and maintained an Interested Parties Database (Database). Beneficial users and members of the public can self-subscribe to the Database by signing up on the Tracy Subbasin website. The Database is used to notify beneficial users of public meetings and workshops, opportunities for public comment, and other GSA outreach actions. It is also used to distribute meeting agendas and other key materials.
- **Informational Materials**: The GSAs developed a suite of materials aimed at informing interested parties about topics related to SGMA and GSP development. These materials include a fact sheet, frequently asked questions, and recorded presentations on SGMA and sustainable management criteria.

11.3.2 *Outreach Activities*

The GSAs conducted variety of outreach activities to provide opportunities for interested parties and stakeholders to stay informed and engaged in the development of the GSP. These activities sought to build public awareness of the GSAs and SGMA and to actively engage key stakeholder groups to coordinate and collaborate on technical issues important for GSP development. Outreach activities included:

- **Public Meetings:** The primary way for members of the public to provide input on development of the GSP was by attending and providing public comment at regular GSP Coordination Committee and Technical Committee meetings. In addition, GSA representatives and consultant staff conducted periodic presentations at public meetings of the GSA governing bodies and organizations and agencies representing beneficial users in the Subbasin. These meetings are described in more detail in **Chapter 11.4 – List of Public Meetings**.
- **GSP Development Workshops:** In support of GSP development, the GSAs hosted public workshops aimed at informing members of the public about key GSP topics and to solicit input on technical content and draft GSP chapters. These workshops are described in more detail about **Chapter 11.4.2 – Public Workshops**.
- **Partnerships with Trusted Messengers:** The Subbasin GSAs utilized partnerships with trusted messengers in the Subbasin to broaden the dissemination of SGMA information and connect with hard-to-reach stakeholder groups. This included disseminating information through the Mountain House Community Services District, San Joaquin Farm Bureau Federation, Sikhs of Tracy, and Stockton East Water District. San Joaquin County staff also provided updates on development of the GSP at monthly San Joaquin County Advisory Water Commission meetings. The Advisory Water Commission includes representation from local cities, water agencies, flood control districts, environmental organizations, and the construction industry.

11.4 List of Public Meetings

To consult beneficial users in development of the GSP and make decisions in a transparent and inclusive setting, the GSAs coordinated monthly Subbasin public meetings and annual public workshops. In addition, the GSA representatives provided presentations on the GSP at public meetings of their governing bodies and parties representing beneficial users. **Table 11-2** provides a list of the public meetings where the GSP was discussed or considered by the GSAs.

Table 11-2. List of Public Meetings

Date	Format	Topic(s)	Location
07/10/2019	BCID Board of Directors	GSP development update	BCID
07/17/2019	BCID Board of Directors	GSP development update	BCID
08/14/2019	BCID Board of Directors	GSP development update	BCID
09/11/2019	BCID Board of Directors	GSP development update	BCID
10/16/2019	BCID Board of Directors	GSP development update	BCID
11/13/2019	BCID Board of Directors	GSP development update	BCID
12/18/2019	BCID Board of Directors	GSP development update	BCID
01/15/2020	BCID Board of Directors	GSP development update	BCID
03/05/2020	Lathrop City Council	GSP development update	Lathrop

Date	Format	Topic(s)	Location
03/19/2020	Technical Committee	GSP development	BCID
04/15/2020	BCID Board of Directors	GSP development update	Virtual
04/16/2020	Technical Committee	GSP development	Virtual
05/06/2020	South Delta Water Agency Board of Directors	GSP development	Virtual
05/13/2020	BCID Board of Directors	GSP development update	Virtual
05/21/2020	GSP Coordination Committee	GSP development	Virtual
06/17/2020	BCID Board of Directors	GSP development update	Virtual
06/18/2020	GSP Coordination Committee	GSP development, Subbasin governance	Virtual
07/15/2020	BCID Board of Directors	GSP development update	Virtual
07/16/2020	Technical Committee	GSP development, HCM	Virtual
07/21/2020	Stockton East Water District Board of Directors	GSP development update, public workshop promotion	Virtual
07/21/2020	Public workshop	Introduction to SGMA, GSP development process	Virtual
08/12/2020	BCID Board of Directors	GSP development update	Virtual
08/20/2020	Coordination Committee	GSP development, HCM	Virtual
09/02/2020	South Delta Water Agency	GSP development update	Virtual
09/16/2020	BCID Board of Directors	Banta-Carbona Irrigation District Board of Directors	Virtual
09/17/2020	Technical Committee	HCM, groundwater monitoring network, SMC	Virtual
10/14/2020	BCID Board of Directors	Banta-Carbona Irrigation District Board of Directors	Virtual
10/15/2020	Technical Committee	Management areas, groundwater monitoring network, SMC	Virtual
11/11/2020	BCID Board of Directors	Banta-Carbona Irrigation District Board of Directors	Virtual
11/19/2020	GSP Coordination Committee	Management areas, groundwater monitoring network, SMC	Virtual
12/16/2020	BCID Board of Directors	Banta-Carbona Irrigation District Board of Directors	Virtual
12/17/2020	Technical Committee	Inter-basin coordination, groundwater monitoring network, SMC, water budgets, projects. and management actions	Virtual
01/13/2021	BCID Board of Directors	GSP development update	Virtual
01/21/2021	Technical Committee	SMC	Virtual
01/21/2021	Public workshop	SMC	Virtual
02/16/2021	Tracy City Council	GSP development update	Virtual
02/17/201	BCID Board of Directors	GSP development update	Virtual
02/18/2021	GSP Coordination Committee	SMC, water budgets, projects, and management actions	Virtual

Date	Format	Topic(s)	Location
03/17/2021	BCID Board of Directors	GSP development update	Virtual
03/18/2021	Technical Committee	Water budgets, projects, and management actions	Virtual
04/14/2021	BCID Board of Directors	GSP development update	Virtual
04/15/2021	GSP Coordination Committee	Water budgets, management actions, GSP implementation funding, and governance	Virtual
05/12/2021	BCID Board of Directors	GSP development update	Virtual
05/20/2021	GSP Coordination Committee	Water budgets, projects and management actions, GSP implementation funding	Virtual
06/16/2021	BCID Board of Directors	GSP development update	Virtual
06/17/2021	GSP Coordination Committee	Water budgets, projects and management actions, MOA	Virtual
07/12/2021	City of Lathrop City Council	GSP development update	Virtual
07/14/2021	BCID Board of Directors	GSP development update	Virtual
07/15/2021	GSP Coordination Committee	GSP and groundwater modeling, MOA, GSP implementation funding	Virtual
08/10/2021	Public Workshop	Draft GSP content and public comment process	Virtual
08/11/2021	BCID Board of Directors	GSP development update	Virtual
08/19/2021	GSP Coordination Committee	Public comments on Draft GSP, MOA	Virtual
09/15/2021	BCID Board of Directors	GSP development update	Virtual
09/16/2021	GSP Coordination Committee	Responses to public comments, GSP implementation funding, MOA	Virtual
10/05/2021	GSP Coordination Committee	Responses to public comments Draft GSP, GSP implementation funding, MOA	Virtual
10/13/2021	BCID Board of Directors	GSP development update	Virtual
10/21/2021	GSP Coordination Committee	Responses to public comments Draft GSP, GSP implementation funding, MOA	Virtual

Key:
BCID = Banta-Carbona Irrigation District, GSP = Groundwater Sustainability Plan,
HCM = Hydrologic Conceptual Model, MOA = Memorandum of Agreement, SMC = Sustainable Management Criteria, SGMA = Sustainable Groundwater Management Act

11.4.1 *Groundwater Sustainability Plan Coordination Committee and Technical Meetings*

GSP Coordination Committee and Technical Committee meetings served as key opportunities for beneficial users and interested parties to track the process and consult in development of the GSP. Both committee meetings were open for members of the public to listen and provide comments. Comments on items on the agenda may be provided after GSA discussion on the item. There was also a set aside time for members of the public to provide comment on items not on the agenda. Public comments are recorded in the meeting minutes, which are posted on the Subbasin website. Comments were also recorded and considered by the planning team when developing and revising the GSP chapters.

The GSP Coordination Committee met, at a minimum, once a quarter during GSP development. GSP Coordination Committee meetings were held and noticed in accordance with the Brown Act. The Technical Committee met every third month or in months without a GSP Coordination Committee meeting. Although not subject to the Brown Act, Technical Committee meetings were held following Brown Act best practices for public noticing and engagement.

The meetings were initially held in-person at the BCID office at 3514 W Lehman Rd, Tracy, CA 95304. In April 2020, the meetings were shifted to a virtual platform due to local social distancing requirements and temporary changes in Brown Act requirements resulting from the COVID-19 pandemic. Members of the public were able to provide comment at the meetings *via* calling into the meeting or typing comments in the chat box in the virtual meeting platform.

The GSAs noticed the meetings *via* a posting on the Subbasin website and email distributed to the Interested Parties Database. A notice was also posted at the BCID office for in-person meetings. Meeting agendas and materials were distributed to the Interested Parties Database and posted on the Subbasin website prior to each meeting.

11.4.2 *Public Workshops*

The GSAs held three public workshops to inform beneficial users and interested parties about the GSP development process and collect input on topics central to the development of the GSP and groundwater management practices. Workshops were held in July 2020 (focus was on the GSP development process), and January 2021 (focus was the Sustainable Management Criteria) and August 2021 (focus was on the Public Draft GSP and public comment process). **Table 11-2** identifies the workshop dates, topics, and locations.

Due to state and local social distancing requirements, both workshops were held virtually using virtual meeting and webinar platforms. Members of the public could submit comments verbally using their computer or phone audio; or submit written comments in the virtual meeting platform or texting the workshop facilitator. Questions and comments submitted by members of the public was recorded by the planning and outreach staff and included in the workshop summaries. A summary of feedback provided by workshop participants was provided at GSP Coordination Committee and Technical Committee meetings.

The GSAs noticed the public workshops *via* a bilingual Spanish and English flyer posted on the Subbasin and GSAs' websites, GSAs' social media sites, and distributed to the Interested Parties Database. The GSAs also reached out directly to organizations representing beneficial users inviting them to the upcoming workshops and requesting that the organizations distribute the flyer to their contact database. This included targeted outreach to the Mountain House Community Services District, Reclamation Districts, San Joaquin County Farm Bureau Federation, San Joaquin River Club, Sikhs of Tracy, Stockton East Water District, and individual landowners in areas dependent on groundwater.

11.4.3 *Other Public Meetings*

In addition to monthly public meetings and annual workshops, the GSA representatives also discussed the GSP at public meetings of their governing bodies, local and regional planning commissions, and other agencies or organizations representing beneficial users within the Subbasin. **Table 11-2** provides a list of other public meetings during which the GSP was discussed.

11.5 GSP Comments and Responses

This section describes the process the GSAs used to solicit and respond to comments on the draft GSP. The draft GSP chapters were released for public review and comment as they were developed. In addition, the GSAs held a 30-day public comment period on the Public Draft GSP from August 9, 2021 through September 9, 2021. Public comments were collected *via* a virtual public comment form, email, and US mail. In addition, interested parties could provide input during monthly GSP Coordination Committee meetings and public workshops. Comments that raised substantive technical or policy issues resulted in revisions to the Draft GSP and are reflected in the final plan.

11.5.1 *Public Comment Process*

The GSAs used a serial public comment process to provide beneficial users and member of the public multiple opportunities to review and provide comment on the draft GSP. Draft GSP chapters were released for public review and comment as they were completed. Each chapter was posted on the Subbasin website (tracysubbasin.org) for public comment for a minimum of 30 days. Members of the public were notified of the public comment period through an email distributed to the Interested Parties Database.

Comments were collected in a virtual public comment form, which could be accessed on the front-page of the website. Comments were also collected at regular GSP Coordination Committee and Technical Committee meetings and public workshops. At the close of the GSP chapter public comment period, received comments were reviewed by the planning staff and chapter was revised to address comments that raised credible technical or policy issues.

After all individual chapters had been reviewed, a complete Public Draft GSP was released for public review on August 9, 2021 and followed by a 30-day public comment period. The public comment period ended on September 9, 2021. Interested parties could submit comments on the Public Draft GSP *via* the virtual public comment form, US mail, or email.

The release of the Public Draft GSP and public comment period were noticed *via* an email sent to the Interested Parties Database, postings on the Tracy Subbasin website, and notices distributed by each of the GSAs via their email lists, social media accounts, and websites. Two additional emails were sent to the Interested Parties Database to remind individuals of the comment deadline. The GSAs also held an informational public workshop on August 10, 2021 to inform interested parties about the content of the draft GSP, explain the public comment process, and answer questions about the plan. A recording of the workshop was posted on the Tracy Subbasin website, Additional outreach was conducted to promote the workshop, including targeted outreach to individuals and organizations representing beneficial users of groundwater in the Subbasin.

11.5.2 *Comments Received*

The GSAs received three comment letters during the Public Draft GSP public comment period (August 9 – September 9, 2021). Two comments were received via email. A second comment letter was received via the virtual public comment form. The list of comment letters received is provided in **Table 11-3.**

Planning staff reviewed the letters and identified 37 unique comments. A summary of topics addressed by the comments is provided in **Appendix Q**. A copy of the comment response matrix is provided in **Appendix Q**.

Table 11-3. Comments Received on the Public Draft GSP

Name of Author	Agency/Organization	Submission Method	Date Received/Post Marked
Jenny Wood	None provided	Virtual public comment form	08/28/2021
Ngodoo Atume, Samantha Arthur, E.J. Remson, Melissa M. Rohde, J. Pablo Ortiz-Partida, Danielle V. Dolan	Clean Water Action/Clean Water Fund, Audubon California, The Nature Conservancy, Union of Concerned Scientists, Local Government Commission	Email	09/03/2021
Bobby Pierce	West Stanislaus Irrigation District GSA on behalf of Northern & Central Delta-Mendota GSP Group Northern Management Committee	Email	09/09/2021
Aaron Barcellos	Central Delta-Mendota Multi-Agency GSA on behalf of Northern & Central Delta-Mendota GSP Group Central Management Committee		

11.5.3 *Comment Review and Response*

Public comments on the individual GSP chapters and Public Draft GSP were handled in three different ways depending on how the information was submitted. Verbal comments provided at public meetings or workshops were recorded in the meeting minutes or workshop summary and reviewed by planning staff. If a comment was specific to an individual section of the GSP, the GSP text was revised. General comments that raised substantial technical or policy issues may have resulted changes to multiple GSP sections.

Comments submitted using the virtual comment form were collated into a database. Comments received in a letter format were dissected and input into the comment database. Planning staff reviewed each comment and provided a response in the database. A copy of the comment response database is provided in **Appendix Q**. The database and draft comment responses were reviewed by each GSA in the Subbasin and discussed at public GSP Coordination Committee meetings. If a change was made to the GSP to respond to the comment, a note was provided in the database indicating where the change was made. Comments general in nature or that did raise substantial issues were noted, but no changes were made.

11.5.1 *Comment Review and Response*

Public comments on the individual GSP chapters and Public Draft GSP were handled in three different ways depending on how the information was submitted. Verbal comments provided at public meetings or workshops were recorded in the meeting minutes or workshop summary and reviewed by planning staff. If a comment was specific to an individual section of the GSP, the GSP text was revised. General comments that raised substantial technical or policy issues may have resulted changes to multiple GSP sections.

Comments submitted using the virtual comment form were collated into a database. Comments received in a letter format were dissected and input into the comment database. Planning staff reviewed each comment and provided a response in the database. A copy of the comment response database is provided in **Appendix Q**. The database and draft comment responses were reviewed by each GSA in the Subbasin and discussed at public GSP Coordination Committee meetings. If a change was made to the GSP to respond to the comment, a note was provided in the database indicating where the change was made. Comments general in nature or that did raise substantial issues were noted, but no changes were made.

11.5.2 *Resolution to Adopt GSP*

The GSAs agreed to an Intent to Adopt the Tracy Subbasin GSP on August 6, 2021 and notified by email and U.S. mail Alameda County, City of Lathrop, City of Tracy and San Joaquin County. No responses were received from any party after a 90-day period. **Appendix R** contains the Intent to Adopt the GSP

Following incorporation of public comments into the GSP each GSA board or supervisors, in a public meeting, approved to adopt the GSP. **Appendix R** contains the resolutions to adopt the GSP.

11.6 Inter-Basin Coordination

The Tracy Subbasin GSAs also engaged GSAs in adjacent groundwater basins during development of the GSP. Representatives of the Tracy and Delta-Mendota Subbasins met in November 2020 to discuss inflows and outflows between the two subbasins and monitoring near the basin boundaries. The Tracy Subbasin GSAs plan to meet with representatives of the Delta-Mendota and East Contra Costa Subbasins in Fall/Winter 2021 to continue to discuss data sharing, groundwater monitoring, and practices for long-term coordination between the basins. In the Eastern San Joaquin Subbasin, San Joaquin County staff and Tracy Subbasin consultants provided updates about development of the Tracy Subbasin GSP at meetings of the Eastern San Joaquin Groundwater Authority. In addition, representatives from adjacent subbasins regularly attended and had the opportunity to provide input during monthly GSP Coordination Committee meetings and public workshops. The GSAs will continue to coordinate with the adjacent subbasins throughout GSP implementation.

11.7 Public Involvement During GSP Implementation

The GSAs will keep members of the public and interested parties informed about progress implementing the GSP *via* email to the Interested Parties Database, quarterly public meetings, and annual workshops. The GSAs will continue to maintain the Subbasin website (tracysubbasin.org) and Interested Parties Database. Emails will be distributed to the Interested Parties Database on regular basis to inform interested parties about upcoming meetings and public workshops, GSP implementation milestones, and the status of projects and management actions. The website will be updated on an as-needed basis to include information on and announcements pertaining to GSP implementation. The website will also serve as a repository for copies of the Tracy Subbasin Annual Reports and other materials developed during GSP implementation.

It is anticipated that the GSP Coordination Committee will continue to meet on a quarterly basis. Committee meetings will be noticed on the Subbasin website (tracysubbasin.org) and *via* an email to the Interested Parties Database. The GSAs will also hold annual public workshops to keep members of the public and interested parties informed about progress implementing the GSP. It is anticipated that the workshops will be aligned with completion of the Annual Reports. The GSAs will notice the workshops *via* posting on the website, email, and targeted outreach to organizations and agencies representing beneficial users in the Subbasin.

Additional public outreach activities may be conducted to support planning, design, and construction activities related to the groundwater management projects. Such activities will be noticed on the website and *via* email to the Interested Parties Database.

12. Interagency Agreements

The Tracy Subbasin GSAs have elected to develop one-GSP for the entire Subbasin. The Subbasin GSAs have reached out to and formed relationships with adjacent subbasins. This section provides the status of agreements for both interbasin and intrabasin agreements.

12.1 Interbasin Agreements

The Tracy Subbasin GSAs have been communicating and sharing information with adjacent Subbasins since 2018. The Tracy Subbasin GSAs sent letters of support for the Northern Delta Mendota and Eastern San Joaquin Subbasins GSPs in 2019.

During preparation of the Tracy Subbasin GSP interbasin coordination meetings to share approaches and information were held with the neighboring subbasins as follows:

- East Contra Costa Subbasin – Groundwater modeling approach discussion, Feb 12, 2020 and August 30, 2020
- Eastern San Joaquin County Groundwater Authority – Summary of Tracy Subbasin GSP findings August 11, 2021
- Northern Delta Mendota Groundwater Subbasin – Groundwater levels, November 6, 2020

In addition to these coordinating activities Tracy GSA representatives or communications coordinator have also attended and have shared pertinent information with other adjacent subbasins during their monthly to quarterly meetings and have brought information back to the Subbasin Technical Coordination Committee as follows:

- Eastern San Joaquin Groundwater Authority - 2018 to present (Matt Zidar, San Joaquin County)
- East Contra Costa Subbasin – (Rick Gilmore or Greg Young, BBID)
- Northern Delta Mendota Subbasin – (Kirsten Pringle, Stantec)

At this time, all subbasins have agreed that formal interbasin agreements are not needed. All GSAs have agreed to coordinate to share information about groundwater conditions, water quality, and well permitting activity.

12.2 Intrabasin Coordination Agreements

The Tracy Subbasin GSAs have elected to develop one-GSP and entered into a Memorandum of Agreement to develop and implement this Plan. Because only one GSP was developed for the entire Subbasin intrabasin coordinating agreements are not required. **Chapter 2 - Agency Information** provides further details about the MOA agreement by the six GSAs.

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None.

Chapter 12 – Interagency Coordination

None.

Appendix A – Memorandum of Agreement

(copy provided in separate pdf)

Appendix B – GSP Implementation Fiscal Budgets

(copy provided in separate pdf)

Appendix C – Monitoring Well Construction Details

(copy provided in separate pdf)

Appendix D – Geologic Section Well Logs

(copy provided in separate pdf)

Appendix E – Upper Aquifer Hydrographs

(copy provided in separate pdf)

Appendix F – Lower Aquifer Hydrographs

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Appendix G – Vertical Gradients

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Appendix H – Summary of Water Quality Detections

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Appendix I – Water Quality Trend Graphs

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Appendix J – Subsidence

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Appendix K – Surface Water Interaction

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Appendix L – Potential GDE Species

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Appendix M – Detailed Water Budgets

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Appendix N – Groundwater Level Minimum Thresholds and Measurable Objectives

(copy provided in separate pdf)

Appendix O – Water Quality Minimum Thresholds and Measurable Objectives

(copy provided in separate pdf)

Appendix P – Public Outreach

(copy provided in separate pdf)

Appendix Q – Public Comments

(copy provided in separate pdf)

Appendix R – Resolutions to Adopt GSP

(copy provided in separate pdf)

APPENDIX A
MOA FOR GSP IMPLEMENTATION

AMENDMENT NO. 1
TO MEMORANDUM OF AGREEMENT
FOR DEVELOPMENT OF THE TRACY SUBBASIN
GROUNDWATER SUSTAINABILITY PLAN

This Amendment No. 1 to the Memorandum of Agreement for Development of the Tracy Subbasin Groundwater Sustainability Plan ("**Amendment**") is entered into by and between the Banta-Carbona Irrigation District Groundwater Sustainability Agency ("**GSA**"), Byron-Bethany Irrigation District GSA, City of Tracy GSA, City of Lathrop GSA, County of San Joaquin GSA, and Stewart Tract GSA (all hereafter known individually as "**Partner**" or "**GSA**," and collectively known as "**Partners**" or "**GSAs**").

WHEREAS, on or about September 24, 2019 the Banta-Carbona Irrigation District GSA, Byron-Bethany Irrigation District GSA, City of Tracy GSA, City of Lathrop GSA, County of San Joaquin GSA, Stewart Tract GSA, and The West Side Irrigation District GSA entered into a Memorandum of Agreement ("**Agreement**") for Development of the Tracy Subbasin Groundwater Sustainability Plan, a copy of which is attached hereto as Attachment 1 and incorporated herein by reference, for purposes of establishing a framework for preparing a single Groundwater Sustainability Plan for the Tracy Subbasin;

WHEREAS, the Byron-Bethany Irrigation District and The West Side Irrigation District consolidated as a single entity on September 29, 2020;

WHERAS, the Partners developed a single Groundwater Sustainability Plan for the for the Tracy Subbasin ("**Tracy Subbasin GSP**");

WHERAS, the Partners desire to continue cooperating on the Tracy Subbasin GSP pursuant to the framework established by the Agreement on an interim basis regardless of the date of any approval of the Tracy Subbasin GSP by the California Department of Water Resources;

WHEREAS, the Partners desire, through this Amendment, to allocate the shared costs necessary to meet the regulatory requirements of the 2014 Sustainable Groundwater Management Act, including updates to and implementation of the Tracy Subbasin GSP, monitoring, preparation of annual reports, program management, administrative expenses, professional services, and other activities as may be deemed necessary by all GSAs for preparation and implementation of the Tracy Subbasin GSP, excluding costs related to local monitoring and implementation of local projects and management actions that a Partner agrees to pay;

NOW, THEREFORE, in consideration of the mutual promises, covenants and conditions contained herein and these Recitals, which are hereby incorporated herein by this reference, it is agreed by and among the Partners as follows:

1. Article I: Term of Agreement of the Agreement shall hereafter be and read as follows:

   This Agreement shall be effective as of the Effective Date and shall continue until terminated by a majority vote of the Partners. However, in the event of termination each of the Partners will remain responsible for its proportionate share of any obligation or liability duly incurred by them under this Agreement.

2. Article II: GSP Development Funding of the Agreement is hereby deleted and replaced in its entirety with the following:

ARTICLE II: GSP DEVELOPMENT AND IMPLEMENTATION FUNDING

A. Fiscal Year. The Fiscal Year of the GSP Coordination Committee ("**Committee**") shall be July 1 through June 30. Each Fiscal Year, using the defined Cost Allocation, the Committee shall develop a recommended budget for meeting the regulatory requirements of the 2014 Sustainable Groundwater Management Act, including updates to and implementation of the Tracy Subbasin GSP, monitoring, preparation of annual reports, program management, administrative expenses, professional services, and other activities as may be deemed necessary by all GSAs for preparation and implementation of the Tracy Subbasin GSP, excluding costs related to local monitoring and implementation of local projects and management actions that a Partner agrees to pay ("**Shared Costs**") for consideration for each Partner. On an annual basis, the Committee and/or contracting agent shall provide the Partners with a record of expenditures from the previous Fiscal Year related to this Agreement.

B. Cost Allocation. Any Shared Costs shall be apportioned among and paid by the Partners based on a cost allocation methodology proportionate to 60% of each Partner's groundwater use, 20% on each Partner's gross acreage within its GSA, and 20% on each Partner's population in the Non-Delta Management Area of the Tracy Subbasin. The Non-Delta Management Area includes the area of the Subbasin generally south of the Old River, including portions of the Middle River (between the Old River and the San Joaquin River) and portions of the Subbasin that extend east of the San Joaquin River to include the City of Lathrop. On an annual basis, the Committee shall reevaluate and approve each Partner's percentage contribution to the total Shared Costs using the most recently available data regarding each apportioned category representing current average conditions. The cost allocation methodology for Shared Costs shall be approved only upon a two-thirds (2/3) super majority vote of the Committee.

C. Payment. The GSAs shall pay any invoice associated with this Amendment within thirty (30) days of the date of the invoice.

D. Noncompliance. In the event any Partner fails to pay its agreed upon contributions when due, such Partner shall be subject to involuntary removal of a Partner by a majority vote of the remaining Partners.

3. Article IX: General Provisions of the Agreement shall hereafter be and read as follows:

A. Counterparts: This Amendment may be executed in any number of counterparts. When at least one such counterpart has been signed by each Party, this Amendment shall be deemed to have been fully executed, each counterpart shall be deemed to be an original, and all counterparts shall be deemed to be one and the same agreement.

B. Continued Validity. Except as otherwise provided in this Amendment the Agreement shall continue in full force and effect and govern this transaction.

IN WITNESS WHEREOF, the Partners have executed this Amendment as of the day and year first above written.

SIGNATURES CONTAINED ON FOLLOWING PAGES

COUNTY OF SAN JOAQUIN

____
Chair, Board of Supervisors
County of San Joaquin, a political subdivision of the State of California,
acting in its capacity as a Groundwater Sustainability Agency within the Tracy Subbasin

ATTEST:

____
Clerk of the Board of Supervisors

RECOMMENDED FOR APPROVAL

____
Director of Public Works

APPROVED AS TO FORM

____

BANTA-CARBONA IRRIGATION DISTRICT
a political subdivision of the State of California,
acting in its capacity as a Groundwater Sustainability Agency within the Tracy Subbasin

By: ________________________________
President

ATTEST: ___________________________________

BYRON-BETHANY IRRIGATION DISTRICT
a political subdivision of the State of California,
acting in its capacity as a Groundwater Sustainability Agency within the Tracy Subbasin

By: ________________________________
Rick Gilmore, General Manager

ATTEST: ___________________________________
Secretary

CITY OF TRACY GROUNDWATER SUSTAINABILITY AGENCY

By: ________________________________
Mayor

ATTEST: ___________________________________
City Clerk

Approved as to Form:

____
City Attorney

CITY OF LATHROP GROUNDWATER SUSTAINABILITY AGENCY

By: ________________________________
City Manager

ATTEST: ___________________________________
City Clerk

Approved as to Form:

____
City Attorney

STEWART TRACT GROUNDWATER SUSTAINABILITY AGENCY

By: ________________________________
President

ATTEST: ___________________________________
Secretary

APPENDIX B
GSP IMPLEMENTATION
FISCAL BUDGETS

Table B-1 TSb GSP Implementation Fiscal Budgets

Description	Local	Shared GSA	DWR Services/Grant Funded/TSS	2022	2023	2024	2025	2026
EXPENSES								
Regulatory Requirements								
Monthly Groundwater Level Monitoring								
San Joaquin County (4 wells monthly)	X			$11,520	$11,520	$11,520	$11,520	$11,520
BBID (3 well monthly)	X			$8,640	$8,640	$8,640	$8,640	$8,640
BCID (2 new well, monthly)	X			$2,880	$2,880	$2,880	$2,880	$2,880
City of Tracy (5 wells monthly)	X			$14,400	$14,400	$14,400	$14,400	$14,400
City of Lathrop (no wells)	X			$0	$0	$0	$0	$0
Regulatory Compliance (9 wells quarterly)	X							
DWR (6 wells quarterly)			X	$2,880	$2,880	$2,880	$2,880	$2,880
Annual Water Quality Monitoring	X							
PWS Wells:	X							
City of Tracy (4 wells)	X			$1,460	$1,460	$1,460	$1,460	$1,460
City of Lathrop (1 well)	X			$365	$365	$365	$365	$365
IRLP Wells (2 wells)	X			$0	$0	$0	$0	$0
Annual Reports		**X**		**$70,000**	**$50,000**	**$50,000**	**$50,000**	**$50,000**
GSP Revisions (DWR comments)		**X**				**$10,000**		
5-Year GSP Update		**X**	X					**$100,000**
Modeling		**X**	X			**$100,000**	**$100,000**	**$100,000**
DMS maintenance	X	**X**		**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$10,000**
Data Gaps:		**X**		**$15,000**				
New Monitoring Wells:								
MW-101 (Tracy)	X		X	$5,000				
MW-102 (County)	X		X	$5,000				
MW-201 (BBID)	X		X	$5,000				
MW-202 (BBID/Mtn House)	X		X	$5,000				
MW-203 (BCID)	X		X	$5,000				
MW-204 (County)	X		X	$5,000				
GDE Assessment		**X**				**$30,000**		
Program Management and Administrative Expenses								
Quarterly TSb Tech Coordination Meetings (4)								
Public Outreach		**X**		**$500**	**$500**	**$500**	**$500**	**$500**
Hydrographs+ MT and MO (22)		**X**		**$6,600**	**$6,600**	**$6,600**	**$6,600**	**$6,600**
Water quality		**X**		**$500**	**$500**	**$500**	**$500**	**$500**
Progress Towards Filling Data Gaps		**X**		**$500**	**$500**	**$500**	**$500**	**$500**
Progress Towards Projects and Actions		**X**		**$500**	**$500**	**$500**	**$500**	**$500**
Meeting Minutes		**X**		**$500**	**$500**	**$500**	**$500**	**$500**
TSb Tech Comm Meetings (Semi - Annual instead of quarterly)								
Annual Public Meetings				**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**
Interbasin Quarterly Meeting Attendance								
ECCC Subbasin (BBID)	X							
ESSJ Subbasin (SJC)	X							
DMSb (???)		**X**		**$1,440**	**$1,440**	**$1,440**	**$1,440**	**$1,440**
Solano Subbasin (???)		**X**		**$1,440**	**$1,440**	**$1,440**	**$1,440**	**$1,440**
Interbasin Annual Meeting Attendance								
Administrative								
Lead Agency (San Joaquin County)		**X**		**$50,000**	**$50,000**	**$50,000**	**$50,000**	**$50,000**
BBID	X			$4,600	$4,600	$6,200	$7,800	$7,800
BCID	X			$4,600	$4,600	$6,200	$7,800	$7,800
City of Tracy	X			$4,600	$4,600	$6,200	$7,800	$7,800
City of Lathrop	X			$4,600	$4,600	$6,200	$7,800	$7,800
Stewart Tract	X			$4,600	$4,600	$6,200	$7,800	$7,800
San Joaquin County	X							
Professional Services								
Communications Specialist		**X**						
Hydrogeologist		**X**						
Legal (San Joaquin)	X			$10,000				
Project Development Work for Grant Development		**X**						
Grant Writing		**X**						
Project and Management Actions								
Project 1: BCID Expansion of Facilities	X		X					
Project 2: City of Tracy ASR wells	X		X					
Project 3:								
Management Action 1: Amend Well Ordinance		**X**		**$10,000**	**$10,000**			
Total Expenses				$287,125	$212,125	$350,125	$318,125	$408,125

Table B-1 TSb GSP Implementation Fiscal Budgets

Description	Local	Shared GSA	DWR Services/Grant Funded/TSS	2022	2023	2024	2025	2026
Shared Costs - Annual Expenses				**$181,980**	**$146,980**	**$276,980**	**$236,980**	**$326,980**
5-year Cost								$1,169,900
Average 5-year Cost				$233,980	$233,980	$233,980	$233,980	$233,980
Local Costs - Annual Expenses				$105,145	$65,145	$73,145	$81,145	$81,145
BBID	X			$23,240	$13,240	$14,840	$16,440	$16,440
BCID	X			$12,480	$7,480	$9,080	$10,680	$10,680
City of Tracy	X			$25,460	$20,460	$22,060	$23,660	$23,660
City of Lathrop	X			$4,965	$4,965	$6,565	$8,165	$8,165
Stewart Tract	X			$4,600	$4,600	$6,200	$7,800	$7,800
San Joaquin County	X			$31,520	$11,520	$11,520	$11,520	$11,520
DWR			X	$2,880	$2,880	$2,880	$2,880	$2,880
REVENUE - For Shared Costs Only								
Grant Funded (assume only 50%)								
Zone 2 Funding				$85,000	$85,000	$85,000	$85,000	$85,000
Funds from GSAs (total)				$148,980	$148,980	$148,980	$148,980	$148,980
Total Costs (Zone 2 + Grants + Funds from GSAs)				$233,980	$233,980	$233,980	$233,980	$233,980

Notes:

First 5 years no increase for inflation, thereafter 3% markup per year

Annual Reports due April 1 and 5-year GSP Updates due January 31

Accuracy of estimate should be rounded upward to nearest $10,000

Grant funds assume 50% local cost match, shared by all GSAs

2042 costs are not averaged over a 5-year period

APPENDIX C
MONITORING WELL CONSTRUCTION DETAILS

Table C-1 Groundwater Level Well Construction Details

CASGEM ID	Local Name	State Well Number	Latitude	Longitude	Reference Point Elevation (ft)	Screened Interval (ft bgs)	Total Depth (ft bgs)	Period of Record	Well Type	Status of Monitoring
Upper Aquifer Wells										
377341N1213039W001	Well N	02S06E27E001M	37.7341	-121.3039	23.36	Unknown	40	1960-2019	R	Active
377951N1216011W001	02S03E01D001M	02S03E01D001M	37.79512	-121.60111	90	40-80	80	2014-2020	I	Active
377813N1214420W001	02S05E08B001M	02S05E08B001M	37.7813	-121.442	4.3	50-80	80	1960-2019	R	Active
377976N1214560W001	01S05E31R002M	01S05E31R002M	37.7976	-121.456	4.6	Unknown	92	1960-2019	R	Active
	Glori MW-2		37.68056	-121.34394		20-35	35	2020-future	O	
	DV MW-16-BP		37.74927	-121.32764	18	60-85	85	1995-2020	O	
376388N1213233W001	03S06E28N001M	03S06E28N001M	37.6388	-121.3233	148.24	107-128	128	2012-2020	O	Active
	SJCDW00034		37.6891	-121.3607		Unknown	180	2018-2020	O	
	SJCDW00032		37.766	-121.5308		Unknown	125	2018-2020	O	
377528N1215156W001	02S04E15R001M	02S04E15R001M	37.7528	-121.5156	63.41	0.1-45	45	2011-2019	U	Active
377061N1214199W001	Well Q	03S05E04H001M	37.7061	-121.4199	121.41	120-140	140	1972-2020	R	Active
378410N1212865W001	01S06E23C003M	01S06E23C003M	37.841	-121.2865	15.83	125-145	145	1979-2016	R	Active
378177N1212791W001	01S06E26K001M	01S06E26K001M	37.8177	-121.2791	19.84	191-195, 208-248	248	1963-2017	I	Active
	MWM-24		37.81657	-121.31459		10-20	21	2005-2020	O	
	MWR-25		37.78232	-121.33303	16.25	10.5-20.5	21.5	2005-2020	O	
378103N1215449W001	ORL-1W	01S04E28P002M	37.81031	-121.54489	16.6	86-106	106	2005-2018	O	Active
377979N1215800W001	01S04E31P005M	01S04E31P005M	37.79791	-121.58003	60	8-23	24	2014-2020	O	Inactive
	PW11-031									
	PW16-216		37.81305	-121.27582		208-213	216	1980-2019	In	
	SAD MW-402D		37.82872	-121.26737		260-270	270.5	Unknown	O	
Lower Aquifer Wells										
376713N1214581W001	Corral MW-6		37.67127	-121.45809	303.33	455-475	477	2015-2018	O	Active
376470N1213162W001	03S06E28F003M	03S06E28F003M	37.647	-121.3162	119.82	331-715, 726-745	745	1999-2020	I	Active
377402N1214508W002	MW-1B		37.74019	-121.45076	50.09	618-658	670	2012-2019	O	Active
377143N1214459W002	MW-2B		37.71431	-121.44591	92.53	634-674	690	2012-2019	O	Active
377031N1214485W002	MW-3B		37.70306	-121.44854	138.08	540-580	595	2012-2019	O	Active
377149N1214257W002	MW-4B		37.71487	-121.42567	102.75	680-700	715	2012-2019	O	Active
377427N1213943W002	MW-5B		37.74266	-121.39432	47.82	576-616	640	2012-2019	O	Active
377656N1214199W002	MW-6B		37.76563	-121.41992	26.65	590-630	645	2012-2019	O	Active
377402N1214508W003	MW-1C		37.74019	-121.45076	51.2	748-788	800	2012-2019	O	Active
377031N1214485W003	MW-3C		37.70306	-121.44854	138.22	770-810	820	2012-2019	O	Active
376664N1214612W001	Corral MW-7		37.66645	-121.46123	304.97	310-330, 360-380, 410-430	430	2015-2019	O	Active
377402N1214508W001	MW-1A		37.74019	-121.45076	49.25	428-468	480	2012-2019	O	Active
377143N1214459W001	MW-2A		37.71431	-121.44591	92.58	426-466	480	2012-2019	O	Active
377143N1214459W002	MW-2B		37.71431	-121.44591	92.53	634-674	690	2012-2019	O	Active
377143N1214459W003	MW-2C		37.71431	-121.44591	92.53	770-810	820	2012-2019	O	Active
377031N1214485W001	MW-3A		37.70306	-121.44854	137.86	382-402	415	2012-2019	O	Active
377149N1214257W001	MW-4A		37.71487	-121.42567	104.08	450-490	505	2012-2019	O	Active
377149N1214257W002	MW-4B		37.71487	-121.42567	102.75	680-700	715	2012-2019	O	Active
377149N1214257W003	MW-4C		37.71487	-121.42567	103.11	770-810	820	2012-2019	O	Active
377427N1213943W001	MW-5A		37.74266	-121.39432	48.39	406-446	460	2012-2019	O	Active
377427N1213943W003	MW-5C		37.74266	-121.39432	48.06	770-810	820	2012-2019	O	Active
377656N1214199W001	MW-6A		37.76563	-121.41992	26.52	410-450	465	2012-2019	O	Active
377656N1214199W003	MW-6C		37.76563	-121.41992	26.8	755-795	810	2012-2019	O	Active
376974N1213258W001	03S06E05R001M	03S06E05R001M	37.6974	-121.3258	59.69	252-275, 295-340, 395-436, 487-537, 589-597, 623-698, 724-749	775	1959-2020	U	Active
	PW09-338		37.80492	-121.28526			338	Unknown	In	Active
	PW12-315		37.81006	-121.2779			315	Unknown	In	Active
	PW16-329		37.81305	-121.27582			329	Unknown	In	Active
	PW20-500		37.81305	-121.27582	119.82	331-715, 726-745	745	1999-2020	U	Active
	WSW007		37.70556	-121.39764			810	Unknown	M	Unknown
	WSW008		37.70815	-121.39388			905	Unknown	M	Unknown
	WSW009		37.70997	-121.3908		420-480, 570-590, 640-700, 740-800, 850-910	930	Unknown	M	Unknown
376444N1213980W001	03S05E26M001M	03S05E26M001M	37.6444	-121.398	234.09	Unknown	782	2012-2020	I	Active
Unknown Aquifer Wells										
377538N1215138W001		02S04E15R002M	37.7538	-121.5138	65.11	Unknown	Unknown	1958-2018	Unknown	Active
376388N1213056W001	03S06E27N001	03S06E27N001M	37.6388	-121.3056	118.23	100-300	300	2011-2020	R	Active
377112N1213611W001	02S06E31N001	02S06E31N001M	37.7112	-121.3611	67.38	50-500	500	1956-2020	I	Active
376444N1213980W001	03S05E26M001M	03S05E26M001M	37.6444	-121.398	234.09	Unknown	782	2012-2020	I	Active
377443N1213797W001		02S05E24M001M	37.7443	-121.3797	45.37	Unknown	745	1989-2005	I	Active
376444N1213980W001	03S05E26M001M	03S05E26M001M	37.6444	-121.398	234.09	Unknown	782	2012-2020	U	Active
376619N1212848W001	03S06E23C001	03S06E23C001M	37.6619	-121.2848	68.2	Unknown	Unknown	1960-2013	I	Active
376622N1212916W001		03S06E22H001M	37.6622	-121.2916	69.9	Unknown	Unknown	1959-2020	U	Active
366673N1213260W001	03S06E17R002M	03S06E17R002M	37.6674	-121.3262	85	Unknown	Unknown	2013-2020	R	Active

APPENDIX D
GEOLOGIC SECTION WELL LOGS

Geologic Section A-A’

ORIGINAL
File with DWR

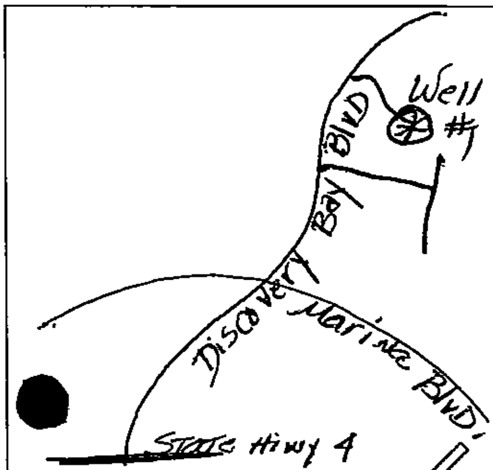
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in
No. 181517

[redacted] of Intent No. ____
[redacted] Permit No. or Date ____

State Well No. ____
Other Well No. 01N03E25C02M

(2) LOCATION OF WELL (See instructions):
County Contra Costa Owner's Well Number 1-Redrill
Well address if different from above Discovery Bay
Township 1N Range 3E Section 25C02
Distance from cities, roads, railroads, fences, etc. ____



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well X Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal X
Other ☐

(5) EQUIPMENT:
Rotary ☐ Reverse X
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK: Monterey Sand
Yes X No ☐ Size 12x20
Diameter of bore 28
Packed from 0 to 348 ft.

(7) CASING INSTALLED:
Steel X Plastic ☐ Concrete ☐

(8) PERFORATIONS: Superflo
Type of perforation or size of screen

From ft.	To ft.	ID Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
+2	192	18"	.250	192	197	.030"
197	267	18"	.250	267	292	.030"
292	318	18"	.250	318	343	.030"
343	348	18"	.250			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes X No ☐ If yes, to depth 75 ft.
Were strata sealed against pollution? Yes ☐ No X Interval ____ ft.
Method of sealing 30" Steel Conductor w/pumped grout

(10) WATER LEVELS:
Depth of first water, if known ____ ft.
Standing level after well completion ____ ft.

(11) WELL TESTS:
Was well test made? Yes X No ☐ If yes, by whom? WDC
Type of test Pump X Bailer ☐ Air lift ☐
Depth to water at start of test ____ ft. At end of test ____ ft
[redacted]ge 2500 gal/min after 200 ft. hours PWL Water temperature ____
[redacted] analysis made? Yes ☐ No X If yes, by whom? ____
Was electric log made? Yes ☐ No X If yes, attach copy to this report

(12) WELL LOG: Total depth 750 ft. Depth of completed well 348 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	Peat Top Soil
3	85	Brown Clay
85	95	Blue Gray Clay
95	107	Blue Green Clay
107	130	Sand
130	185	Blue Green Clay
185	192	Green Brown Clay
192	197	Sand
197	199	Brown Clay
199	201	Sand
201	210	Brown Clay
210	215	Blue Clay
215	220	Dark Brown Clay
220	240	Blue Clay
240	255	Sand
255	270	Blue Clay
270	292	Sand
292	308	Blue Clay
308	315	Sand
315	320	Clay
320	342	Sand & Gravel
342	346	Brown Clay
346	383	Blue Clay
383	395	Sand
395	402	Sandy Clay (Blue)
402	435	Sand w/Clay stringers
435	460	Blue Clay
460	461	Sand
461	463	BlueGreen Clay
463	488	Sand w/Some Clay
488	490	Coarse Sand
490	510	Brown Clay
510	565	Blue Gray Clay
565	572	Sand
572	608	Sandy Clay-Blue Grayw/sand streaks
608	610	Sand
610	620	Green Clay (very plastic)
620	630	Brown Clay

Work started July 23 19 85 Completed Oct. 11 19 85

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
SIGNED [signature] (Well Driller)
NAME The Water Development Corp. (Person, firm, or corporation) (Typed or printed)
Address 220 N. East St./P.O. Box 888
City Woodland, CA Zip 95695
License No. 283326 Date of this report Oct. 30, 1985

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL

File with DWR

[redacted] of Intent No.

[redacted] Permit No. or Date

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in

No. 181530

State Well No.

Other Well No. 01N03E36E01

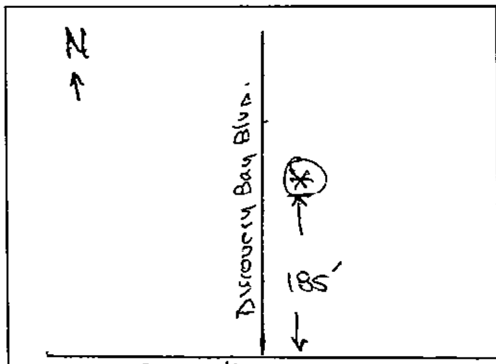
(2) LOCATION OF WELL (See instructions):

County Contra Costa Owner's Well Number 4

Well address if different from above Dis covery Bay Blvd.

Township Range Section

Distance from cities, roads, railroads, fences, etc. 785' North of State Route Highway 4 and approximately 150' East of Discovery Bay Blvd.



[redacted] ee attached As-Built Drawing

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well XX Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐

Irrigation ☐

Industrial ☐

Test Well ☐

Stock ☐

Municipal ☒

Other ☐

(5) EQUIPMENT:

Rotary ☐ Reverse ☒

Cable ☐ Air ☐

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes XX No ☐ Size 8 x 16

Diameter of bore 28

Packed from 380 to 50 ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

(8) PERFORATIONS:

Type of perforation or size of screen Super flo louver

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
+2	318	16"	.250	318	358	.050"
358	363	16"	.250			

(9) WELL SEAL:

Was surface sanitary seal provided? Yes XX No ☐ If yes, to depth 50 ft.

Were strata sealed against pollution? Yes ☒ No ☐ Interval 26-29 ft.

Method of sealing Pumped grout - see drawing

(10) WATER LEVELS:

Depth of first water, if known 4' ft.

Standing level after well completion 4' ft.

(11) WELL TESTS:

Was well test made? Yes XX No ☐ If yes, by whom? WDC

Type of test Pump XX Bailer ☐ Air lift ☐

Depth to water at start of test 4 ft. At end of test 4 ft

[redacted] charge 1500 gal/min after 30 hours Water temperature

[redacted] analysis made? Yes ☒ No ☐ If yes, by whom?

Was electric log made? Yes ☒ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 750 ft. Depth of completed well 363 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	25	brown clay
25	29	coarse sand and gravel
29	40	brown clay
40	60	brown clay
60	80	brown clay
80	85	sand
85	90	brown clay
90	97	sand
97	112	sand with clay
112	117	sandy clay
117	129	coarse sand
129	189	gray clay
189	215	brown clay
215	239	blue clay
239	269	clay brown (sandy)
269	275	brown clay (silty)
275	300	fine sand
300	303	coarse sand - gravel
303	318	brown gray clay
318	333	coarse sand - gravel
333	350	coarse sand
350	380	gray clay
380	400	gray clay
400	420	fine sand
420	435	sandy clay
435	454	blue clay, minor sand
454	457	pea gravel and sand
457	460	blue clay
460	465	sandy
465	478	blue clay
478	486	sandy
486	492	clay - brown
492	497	rough hard sandstone and sand
497	500	brown clay
500	512	sandy brown clay
512	520	clay
520	535	sandy clay
535	550	blue clay (redwood chips) (over)

Work started Feb. 10 1986 Completed April 30 1986

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED
(Well Driller)

NAME The Water Development Corp.
(Person, firm, or corporation) (Typed or printed)

Address P.O. Box 888

City Woodland, Calif. Zip 95695

License No. 283326 Date of this report May 5, 1986

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

181530

1380 Galazy Way

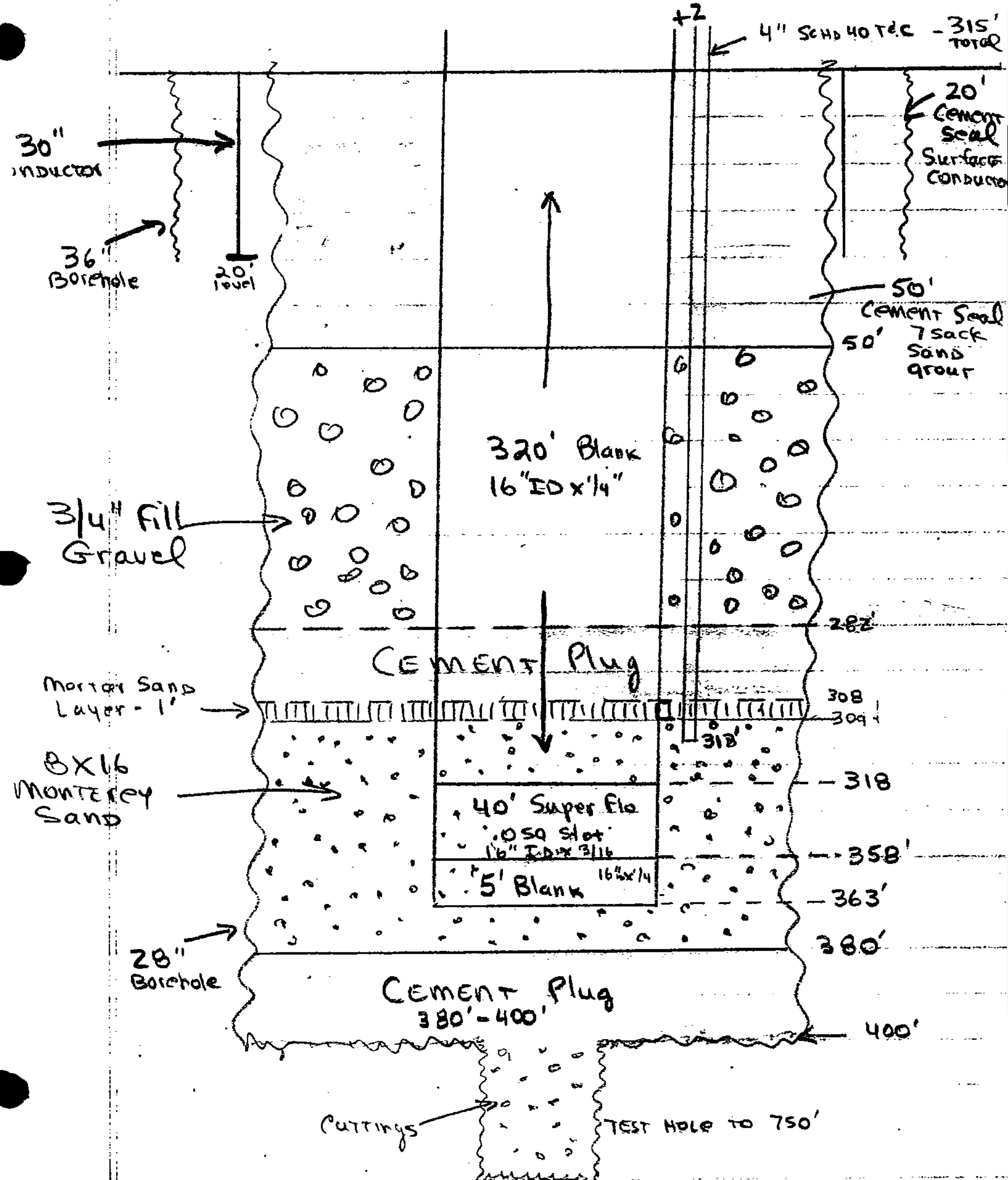
181530

181530

550 - 570	loose brown clay, misc. sand and redwood chips
570 - 572	sandstone
572 - 580	brown sandy clay
580 - 600	blue clay
600 -620	blue clay, minor sand
620 - 640	blue clay
640 - 650	gray to tan clay, some sand
650 - 675	tan clay
675 - 676	shale
676 - 710	brown clay
710 - 755	brown clay, minor sand

Discovery Bay #4 Well
As Built Drawing

181530
01N03E36E01M



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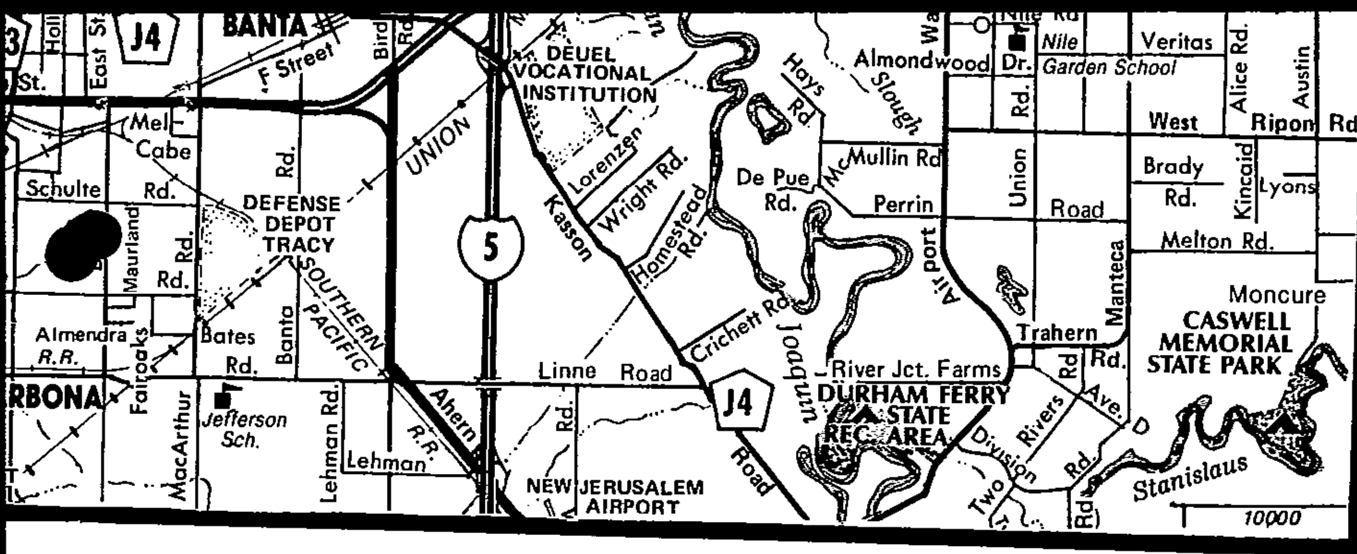

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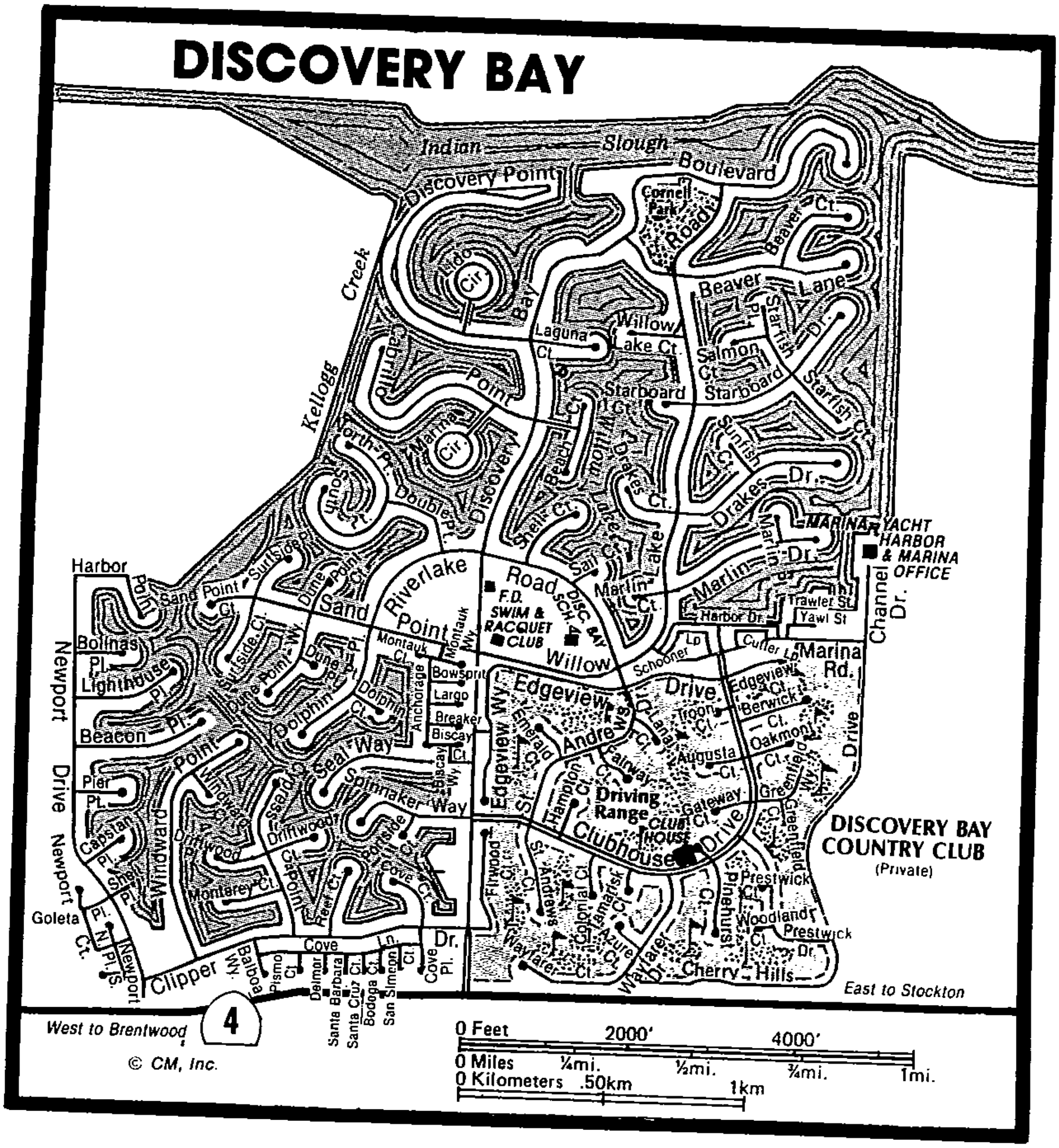


ORIGINAL
File Original, Duplicate and Triplicate with the
DIVISION OF WATER RESOURCES
P. O. BOX 1079
SACRAMENTO 5, CALIFORNIA

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

DIVISION OF WATER RESOURCES

Sheet 39-1171

LOCATION NOT CHECKED

Do Not Fill In
State Well No.
Other Well No. 1S/4E-5E1
Region 1S/4E-5E1

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

(1) Driller:
Name S.C.Baker
Address Holt, Calif.

License No. 129141 Classification C 57

Owner:
Name
Address

(2) Proposed use or uses *(check)*:
Domestic [X] Municipal [ ]
Irrigation [ ] Industrial [ ]
Domestic and Irrigation [ ] Test well [ ]
Other

(3) Equipment used *(check)*:
Rotary [X]
Cable [ ]
Dug well [ ]
Other

(4) Type of work *(check)*:
New well [X] Reconditioning of well [ ]
Deepening existing well [ ]

(5) Well log:
Total depth of well 166 ft.

Give details of formations penetrated, such as silt, peat, muck, sand, gravel, clay, shale, sandstone, hardpan, rock. Include size of gravel (diameter) and sand (fine, medium, coarse), color of material, structure (loose, packed, cemented, soft, hard, brittle).

Depth From Ground Surface		
0 ft.	to 18 ft.	peat
18	24	mud
24	36	sand, fine
36	54	clay
54	65	sand, coarse
65	164	clay
164	170 plus	sand, some small gravel

FOR OFFICIAL USE ONLY

If additional space is required, continue on DWR Form No. 246—Supplement, and attach to respective report copies.

(6) Casing left in well:

RECEIVED

LENGTH FT.	DIAMETER INCHES	SINGLE, DOUBLE, WELDED, OTHER	LBS. PER FOOT OR GAGE OF CASING	SEATING BELOW GROUND SURFACE, FT.
160	2	standard water pipe		159

Type and size of shoe or well ring none Welded joints—[ ] Yes [ ] No threaded

39-1171 ~~483~~

15-4E-5E1

Report No. ___

Owner ___

Pump No. ___

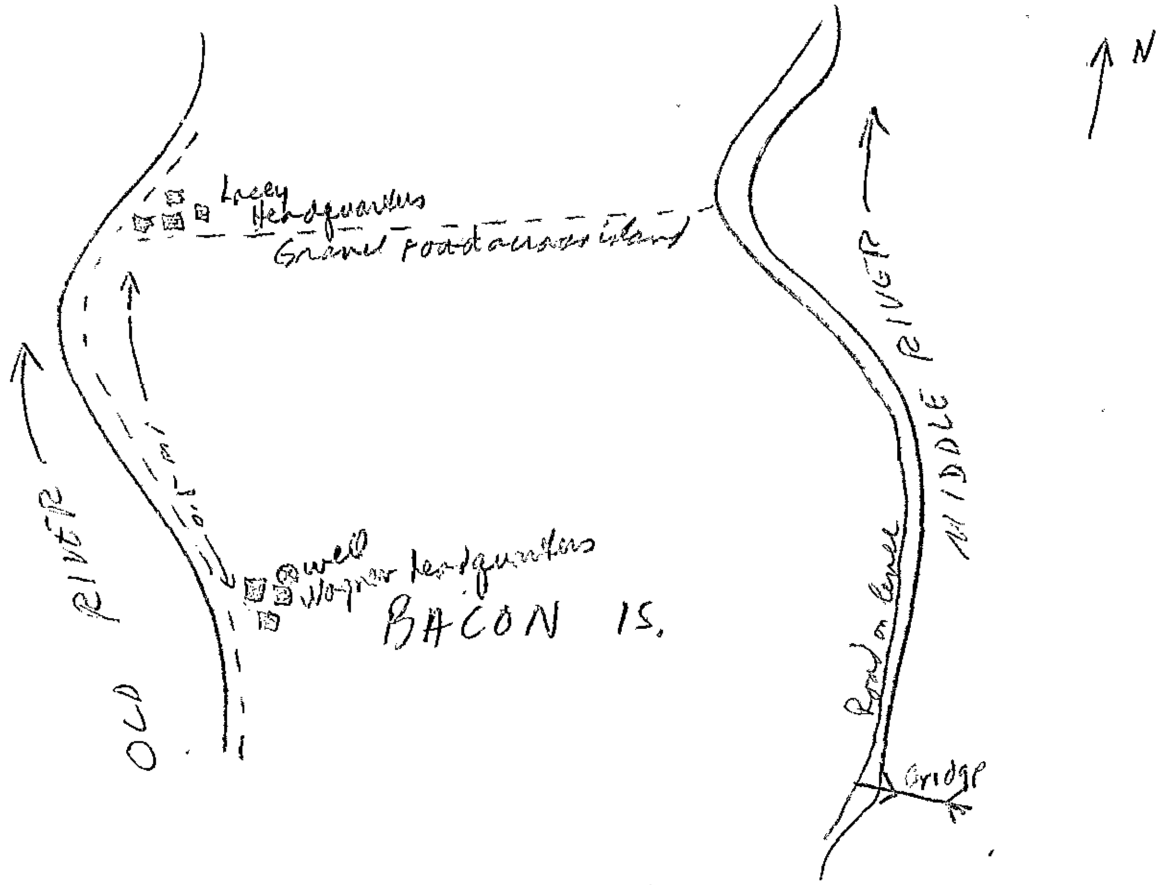
Meter No. ___

Region ___; County San Joaquin

Township 1S, Range 4E, Section 5, MD B&M.

2800 ft. north, 4500 ft. west from southeast corner of Section.

SKETCH



DESCRIPTION OR REMARKS

Checked by R Ford Date 12/1/54

ORIGINAL
File Original, Duplicate and Triplicate with the
DIVISION OF WATER RESOURCES
P. O. BOX 1079
SACRAMENTO 5, CALIFORNIA

39-1171

SHEET 2

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

Do Not Fill In
State Well No.
Other Well No.
Region

(7) Perforations:

Type of perforator used None

Perforated ft.	to ft.	Hole size	No. of holes
"	" "	" " "	" " "
"	" "	" " "	" " "
"	" "	" " "	" " "
"	" "	" " "	" " "
"	" "	" " "	" " "
"	" "	" " "	" " "
"	" "	" " "	" " "
"	" "	" " "	" " "
"	" "	" " "	" " "

(8) Water levels:

Depth at which water first encountered 24 ft.
Depth to water before perforating ft.
Depth to water after perforating ft.
Note any change in water level while drilling

(9) Well pumping test:

Date of test 5-4 By whom driller
Depth to water when test started 3 ft.
G.P.M. at beginning of test 30
Drawdown from standing level ? ft.
G.P.M. at completion of test 30
Drawdown at completion of test ? ft.
Length of time tested 3 hrs.
Temperature of water
Was gas present in water? ☐ Yes ☒ No

(10) General:

Was well gravel packed? no Size of rock Thickness of pack
Was a surface sanitary seal provided? casing driven tight in clay
Were any strata sealed against pollution? ☐ Yes ☒ No If yes, attach detailed description.
Strata sealed
Was analysis made of water? ☐ Yes ☐ No If yes, attach copy. Salinity driller field test
Was electric log made of well? ☐ Yes ☐ No If yes, attach copy. 140 ppm
If well abandoned, was it plugged and sealed? FOR OFFICIAL USE ONLY
Method of plugging and sealing

(11) Location:

North

1 MILE

Section No. 8
Township 1 N
Range 4 E
Base & Meridian
Show location of well in Section, thus (X)
Distances to section lines from well, N or S 100 ft. and E or W 1200 ft.
Show location of nearest known well, thus (O)
Distance to nearest known well ft.

(12) Time of work:

Work started date 4-16 Completed date 5-4
Date of this report 5-24-54

WELL DRILLER'S STATEMENT:

This well was drilled by my rig *and this report is true to the best of my knowledge and belief.*

[SIGNED] S. B. Baker
Well Driller

By
License No. 29141 Classification C57
Dated 5-24-54, 19

D.W.R. FORM NO. 246

REGIONAL WATER POLLUTION CONTROL BOARD COPY

23972 3-50 40M QUIN SPO

01505E29E ?

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

ORIGINAL
File with DWR

Do Not Fill In

№ 89328

State Well No.

Other Well No. 1S/4E-26F

(1) OWNER:

N
A

(2) LOCATION OF WELL:

County San Joaquin Owner's number, if any

Township, Range, and Section

Distance from cities, roads, railroads, etc. Grimes Rd & Tracy Blvd. Grimes Rd-1st house on rt. Off Tracy Blvd.

(3) TYPE OF WORK (check):

New Well [X] Deepening [ ] Reconditioning [ ] Destroying [ ]

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic [X] Industrial [ ] Municipal [ ]
Irrigation [ ] Test Well [ ] Other [ ]

(5) EQUIPMENT:

Rotary [X]
Cable [ ]
Other [ ]

(6) CASING INSTALLED:

STEEL: X OTHER:
SINGLE [X] DOUBLE [ ]

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
				If gravel packed		
0	56	6½	.12	10	0	56

Size of shoe or well ring: Size of gravel: pea

Describe joint welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen slot

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
46	56			1/8 x 3"

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes [X] No [ ] To what depth 30 ft.

Were any strata sealed against pollution? Yes [ ] No [ ] If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing Bentonite

(9) WATER LEVELS:

Depth at which water was first found, if known ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing 10 ft.

(10) WELL TESTS:

Was pump test made? Yes [ ] No [X] If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.

Temperature of water Was a chemical analysis made? Yes [ ] No [X]

Was electric log made of well? Yes [ ] No [X] If yes, attach copy

(11) WELL LOG:

Total depth 100 ft. Depth of completed well 56 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to ft.

Log

0-3	Top soil
3-13	Clay
13-22	Blue Clay & Sand
22-24	Sand-blue
24-33	Clay-blue
33-37	Clay & Sand
37-52	Sand-coarse
52-54	Shale
54-55½	Sand
55½-57	Clay
57-67	Sand-fine
67-100	Clay-blue

CONFIDENTIAL
Water Code Sec. 13752

Work started 9-15 1973, Completed 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Hennings Bros. Drilling Co., Inc.
(Person, firm, or corporation) (Typed or printed)

Address 2500 W. Rumble Rd.
Modesto, Calif. 95350

[SIGNED] Madeline Roddy - Sec.
(Well Driller)

License No. 116322 Dated 9-26, 1973

SKETCH LOCATION OF WELL ON REVERSE SIDE

ORIGINAL
File with DWR

CO[illegible]
Water Co[illegible]

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 89033

State Well No.
Other Well No. 2S/4E-9A40

(2) LOCATION OF WELL:

County San Joaquin — Owner's number, if any

Township, Range, and Section T2S R4E S 9

Distance from cities, roads, railroads, etc. Patterson Pass & Byron Rds. 18621 Patterson Pass Rd-½mi S of Byron Rd-West side

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☒
Cable ☐
Other ☐

(6) CASING INSTALLED:

STEEL X OTHER:
SINGLE ☒ DOUBLE ☐

If gravel packed

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0	100	6-5/8	10	11	0	100

Size of shoe or well ring: — Size of gravel: pea

Describe joint welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen slot

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
80	100			1/8 x 3"

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth 50 ft.

Were any strata sealed against pollution? Yes ☐ No ☐ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing Bentonite

(9) WATER LEVELS:

Depth at which water was first found, if known ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing 18 ft.

(10) WELL TESTS:

Was pump test made? Yes ☐ No ☒ If yes, by whom?

gal./min. with ft. drawdown after hrs.

Temperature of water — Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 110 ft. Depth of completed well 100 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to ft.

Log

ft. to ft.	Formation
0-6	Top soil
6-33	Clay
33-35	Sand
35-50	Clay
50-60	Sand
60-79	Clay
79-100	Sand
100-110	Clay

Work started 8-7 1973, Completed 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Hennings Bros. Drilling Co., Inc.
(Person, firm, or corporation) (*Typed or printed*)

Address 2500 W. Rumble Rd.
Modesto, Calif. 95350

[SIGNED] Madeline Roddy - Sec.
(Well Driller)

License No. 116322 Dated 9-4, 1973

SKETCH LOCATION OF WELL ON REVERSE SIDE

CONFIDENTIAL LOG
Water Code Sec. 13752

DWR 188 (REV. 9-68)

25179-950 9-68 50M TRIP △D DSP

ORIGINAL

File with DWR

[redacted] of Intent No. ____

[redacted] Permit No. or Date 86-186

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 191154

State Well No. ____

Other Well No. 02S05E06

(2) LOCATION OF WELL (See instructions):

County San Joaquin Owner's Well Number ____

Well address if different from above 12201 Lammers Rd.

Township Tracy Range ____ Section ____

Distance from cities, roads, railroads, fences, etc. 2 Mi. West of Corral Hollow Rd. north side

WELL LOCATION SKETCH

[redacted]

(3) TYPE OF WORK:

New Well ☒ Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☒

Irrigation ☐

Industrial ☐

Test Well ☐

Stock ☒

Municipal ☐

Other ☐

(5) EQUIPMENT:

Rotary ☒ Reverse ☐

Cable ☐ Air ☐

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size Sand & Gravel

Diameter of bore 13"

Packed from 205 to 290 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

(8) PERFORATIONS:

Type of perforation or size of screen ____

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	290	8	290	260	290	Scrren

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 205 ft.

Were strata sealed against pollution? Yes ☐ No ☐ Interval ____ ft.

Method of sealing Bentonite

(10) WATER LEVELS:

Depth of first water, if known ____ ft.

Standing level after well completion 14 ft.

(11) WELL TESTS:

Was well test made? Yes ☐ No ☒ If yes, by whom? ____

Type of test Pump ☐ Bailer ☐ Air lift ☐

Depth to water at start of test ____ ft. At end of test ____ ft

[redacted] ____ gal/min after ____ hours Water temperature ____

[redacted] analysis made? Yes ☐ No ☒ If yes, by whom? ____

Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 290 ft. Depth of completed well 290 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	6	Top Soil
6	58	Clay
58	75	Sand
75	115	Blue Sand
115	117	Clay
117	127	Fine Sand
127	175	Clay
175	182	Fine Sand
182	190	Clay
190	201	Fine Sand
201	208	Clay
208	226	Fine Sand
226	265	Clay
265	285	Sand

Work started May 3 1986 Completed ____ 19__

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED [signature] (Well Driller)

NAME HENNINGS BROS. DRILLING CO., INC.
(Person, firm, or corporation) (Typed or printed)

Address 3525 PELANDALE AVE.

City MODESTO, CA Zip 95356

License No. 290813 Date of this report MAY 23, 1986

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED. USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0169248

DWR Use Only – Do Not Fill In		
02S 05E07		
State Well Number/Site Number		
374618 N	1212833 W	
Latitude	Longitude	
APN/TRS/Other		

Page ________ of ________

Owner's Well Number ____________

Work Began 01/14/2013 Date Work Ended 1/19/2013

l Permit Agency San Joaquin Environmental Health Dept.

Permit Number 66292 Permit Date ____________

Geologic Log

Orientation ⦿ Vertical ○ Horizontal ○ Angle Specify ______

Drilling Method mud rotary Drilling Fluid Fresh Water

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	2	topsoil
2	12	clay
12	18	sand/gravel
18	91	clay
91	110	sand
110	182	clay
182	186	sand
186	215	clay
215	265	sand
265	288	clay
288	292	sand
292	312	clay
312	325	clay/sand streaks
325	240	clay/sand
340	344	sand
344	370	clay
370	375	sand
375	385	clay

Total Depth of Boring 385 Feet

Total Depth of Completed Well 270 Feet

Well Owner

Well Location

Address 20632 S. Lammers Rd.

City Tracy County San Joaquin

Latitude ____ Deg. ____ Min. ____ Sec. N Longitude ____ Deg. ____ Min. ____ Sec. W

Datum ______ Decimal Lat. ______ Decimal Long. ______

APN Book 212 Page 030 Parcel 08

Township ______ Range ______ Section ______

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

West

East

South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⦿ New Well
○ Modification/Repair
○ Deepen
○ Other ______
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

⦿ Water Supply
☑ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other ______

Water Level and Yield of Completed Well

Depth to first water ____________ (Feet below surface)

Depth to Static Water Level 10 (Feet) Date Measured ______

Estimated Yield * ______ (GPM) Test Type ______

Test Length ______ (Hours) Total Drawdown ______ (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	230	14	blank	PVC	.332	8		
230	270	14	screen	PVC	.332	8		0.045

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	100		quik grout
100	270		6x8 sand pack

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other ______

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Hennings Bros. Drilling Co.,Inc.
Person, Firm or Corporation

3525 Pelandale Ave. Modesto CA 95356
Address City State Zip

Signed [signature] 02/06/2013 290813
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

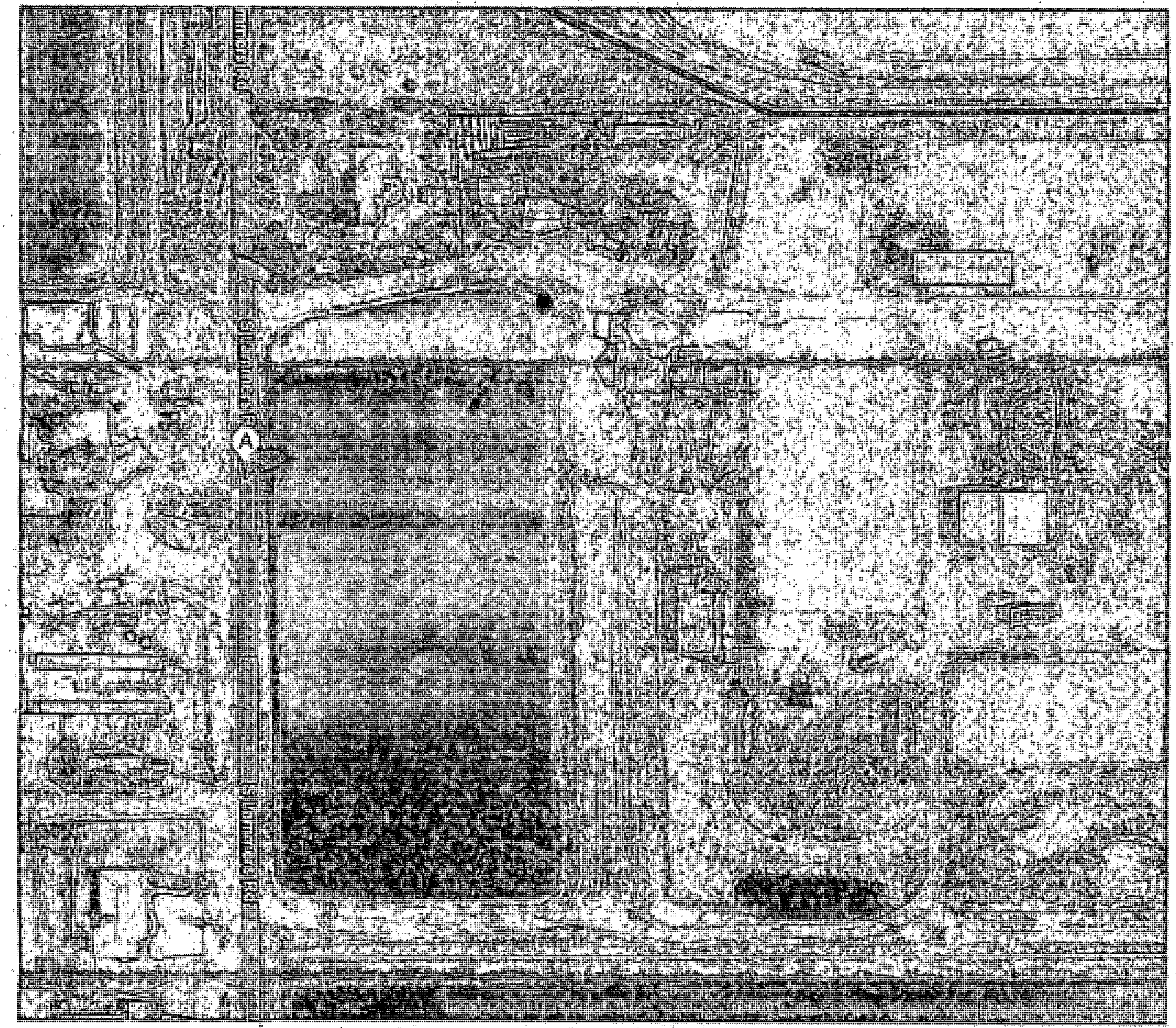
DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

To see all the details that are visible on the screen, use the "Print" link next to the map.

Google

e0169248



ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 5
(Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

LOCATION NOT CHECKED
Do Not Fill In
Nº 10997
State Well No. 2S/5E-17B1
Other Well No. 2S/5E-17B

(2) LOCATION OF WELL:
County San Joaquin Owner's number, if any—
R. F. D. or Street No. Larch Rd. ½ mile West Tracy Rd. 1 mile northeast of Tracy
TB 10935 W LARCH RD

(3) TYPE OF WORK (check):
New well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☑
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☑ DOUBLE ☐
From 0 ft. to 90 ft. 6⅝ diam. 12 Gage or Wall

If gravel packed
Diameter of Bore 9½ from 0 ft. to 90 ft.

Type and size of shoe or well ring
Size of gravel: pea
Describe joint Welded

(7) PERFORATIONS:
Type of perforator used Cutting torch
Size of perforations 3/16 in., length, by 5 in.
From 84 ft. to 90 ft. 6 Perf. per row 1½ Rows per ft.

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☑ Yes ☐ No To what depth 50 ft.
Were any strata sealed against pollution? ☑ Yes ☐ No If yes, note depth of strata
From 21 ft. to 23 41 ft. 50
" 25 " 27
Method of Sealing Rotary mud

(9) WATER LEVELS:
Depth at which water was first found 21 ft.
Standing level before perforating 10 ft.
Standing level after perforating 10 ft.

(10) WELL TESTS:
Was a pump test made? ☐ Yes ☑ No If yes, by whom? —
Yield: — gal./min. with — ft. draw down after — hrs.
Temperature of water — Was a chemical analysis made? ☐ Yes ☑ No
Was electric log made of well? ☐ Yes ☑ No

(11) WELL LOG:
Total depth 90 ft. Depth of completed well 90 ft.
Formation: Describe by color, character, size of material, and structure.

From (ft.)	To (ft.)	Formation
0	21	yellow clay
21	23	fine sand
23	25	clay
25	27	fine sand
27	41	yellow clay
41	50	coarse sand
50	86	yellow clay
86	88	sand & gravel
88	90	clay

CONFIDENTIAL Section 7076.1, Water Code

Work started Nov. 9 1954 Completed Nov. 11 1954

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Modesto Well Drillers
(Person, firm, or corporation) (Typed or printed)
Address 316 Carmo
Modesto, Calif.
[SIGNED] Loyd A. Bennefield
Well Driller
License No. 135518 Dated Nov. 29, 1954

95680 3-54 50M QUIN SPO
DWR FORM No. 246 (REV. 3-54)

10997

house

DESCRIPTION OR REMARKS

Drilled By Modesto Well drillers in 1954
Depth 90'

Checked by John Wilks Date 9/30/57

ORIGINAL
File with DWR

Page ___ of ___

Owner's Well No. ___

Date Work Began June 7, 2000 , Ended June 14, 2000

Local Permit Agency San Joaquin Co. Health Dept.

Permit No. 22986-W/22987-WD Permit Date ___

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 819759

DWR USE ONLY — DO NOT FILL IN
02S05E19A
STATE WELL NO./STATION NO.
LATITUDE | LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD Mud Rotary FLUID Bentonite & Water

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	2	Top Soil
2	17	Clay
17	19	Sand
19	35	Clay
35	41	Sand & Gravel
41	65	Clay
65	68	Sand & Gravel
68	90	Clay
90	95	Sand & Gravel
95	147	Clay
147	149	Sand & Gravel
149	165	Clay
165	170	Sand
170	177	Clay
177	180	Sand
180	195	Clay
195	197	Sand
197	215	Clay
215	217	Sand
217	305	Clay
305	359	Blue Clay
359	364	Sand
364	405	Clay
405	419	Sand
419	430	Clay

TOTAL DEPTH OF BORING 430 (Feet)

TOTAL DEPTH OF COMPLETED WELL 420 (Feet)

WELL OWNER

WELL LOCATION

Address 2748 Byron Rd.

City Tracy

County San JOaquin

APN Book 238 Page 050 Parcel 03

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WELL ABANDONMENT

0-3' Cut Casing/Dug Down/Mushroom Top 3'

3-95' 9-Sack Mix Cement Slurry

95' Bottom of Well

6" STEEL DIAMETER

WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

X DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 63 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	40	12"	X				PVC	6"	160CI	
40	240	12"	X				PVC	6"	200CI	
240	400	12"	X				PVC	6"	160CI	
400	420	12"		X			PVC	6"	160CI	45/1000

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	200	X			9-sack mix
200	420			X	Sand/Gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME HENNINGS BROS. DRILLING CO., INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

3525 PELANDALE AVE. MODESTO CA 95356-9781
ADDRESS CITY STATE ZIP

Signed Cathalene Wenzel JULY 10,2000 290813
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

231

RECEIVED
MAY 26 1994
D.W.R.

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in

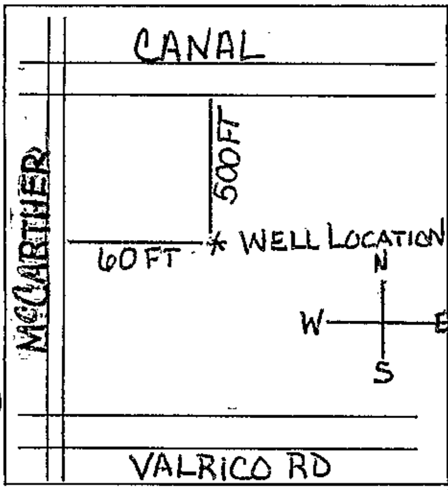
No. 335812

Notice of Intent No. 248527
Local Permit No. or Date 2635

State Well No. 02S05E34
Other Well No.

(1
A
Ci

(2) LOCATION OF WELL (See instructions):
County ~~LASSEN~~ San Joaquin   Owner's Well Number
Well address if different from above NORTH OF VALRICO RD.
Township 02-SOUTH   Range 05-EAST   Section 34
Distance from cities, roads, railroads, fences, etc.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☒
Industrial ☐
Test Well ☐
Municipal ☐
Other ☒
(Describe)

(5) EQUIPMENT:
Rotary ☐ Reverse ☒
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size 3/8MINUS
Diameter of bore
Packed from 970 to 250 ft.

(7) CASING INSTALLED:
Steel ☒ Plastic ☐ Concrete ☐

(8) PERFORATIONS: LOUVERED
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
+1	394	18	.312	394	954	.090

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 250 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.
Method of sealing PUMP

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion 136.9 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? SARGENT
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 136.90 At end of test 195.95 ft.
Discharge 3600 gal/min after 12 hours Water temperature 72
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 970 ft. Completed depth 958 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	50	CLAY, SAND, GRAVEL
50	250	ROCK, TRACES OF CLAY
250	340	BROWN STICKY CLAY
340	410	BLUE CLAY
410	430	FINE SANDS, TRACE OF CLAY
430	490	BLUE CLAY, BLUE SAND
490	550	BROWN CLAY, SAND LAYERS
550	590	SMALL SAND TRACES
590	610	STICKY CLAY
610	630	BROWN CLAY
630	670	SAND, GRAVEL, CLAY LAYERS
670	710	BROWN CLAY
710	720	CLAY
720	765	GRAVELS
765	780	CLAY & SHALE MIXED SANDS
780	790	GRAVEL, SAND
790	795	BROWN CLAY
795	830	GRAVEL, SAND
830	930	GRAVEL, CLAY, SANDY CLAY
930	935	BROWN CLAY
935	948	SAND, GRAVEL
948	970	BROWN CLAY

CONFIDENTIAL
NOT FOR PUBLIC
WATER CODE SEC. 13752

Work started APRIL 6 1994 Completed MAY 3 1994

WELL DRILLER'S STATEMENT: 1519
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed (Well Driller)
NAME SARGENT DRILLING, INC
(Person, firm, or corporation) (Typed or printed)
Address 9955 NORTH VIRGINIA STREET
City RENO, NEVADA ZIP 89506
License No. 479054 Date of this report MAY 6, 1994

DWR 188 (REV. 12-86)   IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM   86 96355

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. 95215

Date Work Began 9/17/01, Ended 9/21/01

Local Permit Agency Public Health Services

Permit No. 27190 Permit Date 8/22/01

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 736771

DWR USE ONLY — DO NOT FILL IN

0215 0156 34

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID Mud

DEPTH FROM SURFACE Ft. to	Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	10	Fill Dirt
10	27	Clay
27	43	Sand
43	55	Clay
55	58	Sand
58	60	Clay
60	100	Sand
100	115	Clay
115	130	Blue Clay
130	145	Brown Clay
145	155	Brown Sand
155	196	Clay Blue
196	210	Sand
210	220	Clay
220	226	Sand
226	229	Clay
229	260	Sand
260	285	Clay

TOTAL DEPTH OF BORING 285 (Feet)

TOTAL DEPTH OF COMPLETED WELL 262 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address 20269 S. Mac Arthur Dr.

City Tracy CA

County San Joaquin

APN Book ___ Page ___ Parcel ___

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY

✓ Domestic ___ Public

___ Irrigation ___ Industrial

MONITORING ___

TEST WELL ___

CATHODIC PROTECTION ___

HEAT EXCHANGE ___

DIRECT PUSH ___

INJECTION ___

VAPOR EXTRACTION ___

SPARGING ___

REMEDIATION ___

OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE 1

DEPTH OF STATIC WATER LEVEL 18 (Ft.) & DATE MEASURED 9/21/01

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft. to	Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	242	12	✓				PLASTIC	6	160	
242	262			✓						.045

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to	Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	114		✓		
114	262			✓	GRAVEL

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analysis

___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME MASELLIS DRILLING, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

119 Albers Rd. Modesto CA 95357
ADDRESS CITY STATE ZIP

Signed [signature] 09/26/01 668622
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

736771

GEOGRAPHICAL INFORMATION: COORDINATES X*_____ Y_____ TOWNSHIP_____ RANGE_____ SECTION_____

TYPE OF WELL: ☒ NEW WELL ☐ REPLACEMENT WELL ☐ MONITORING WELL #_____ ☐ OTHER_____

INSTALLATION: ☐ WELL SYSTEM REPAIR ☐ CROSS-CONNECT REPAIR ☐ VAPOR EXTRACTION WELL #_____

TYPE OF PUMP: ☒ NEW ☐ REPAIR H.P. 2 DEPTH PUMP SET 100 FT. FIRST WATER LEVEL_____

☐ OUT-OF-SERVICE WELL ☐ GEOTECHNICAL #_____ ☐ SOIL BORING_____ ☐ DESTRUCTION:_____

INTENDED USE	TYPE OF WELL	CONSTRUCTION SPECIFICATION
☐ INDUSTRIAL	☐ OPEN BOTTOM	WELL EXCAVATION DIA 12 CONDUCTOR CASING DIA_____
☒ DOMESTIC PRIVATE	☒ GRAVEL PACK/SIZE_____	WELL CASING TYPE PVC WELL CASING DIA 6 inch
☐ PUBLIC/MUNICIPAL	☐ DRIVEN	GROUT SEAL DEPTH 100 ft SPECIFICATION Benseal
☐ IRRIGATION/AG		OTHER GROUT BRAND NAME_____
☐ MONITORING		GROUT SEAL PUMPED: ☒ YES ☐ NO
☐ CHRISTY BOX ☐ STOVE PIPE		CONCRETE PEDESTAL BY DRILLER: ☐ YES ☒ NO

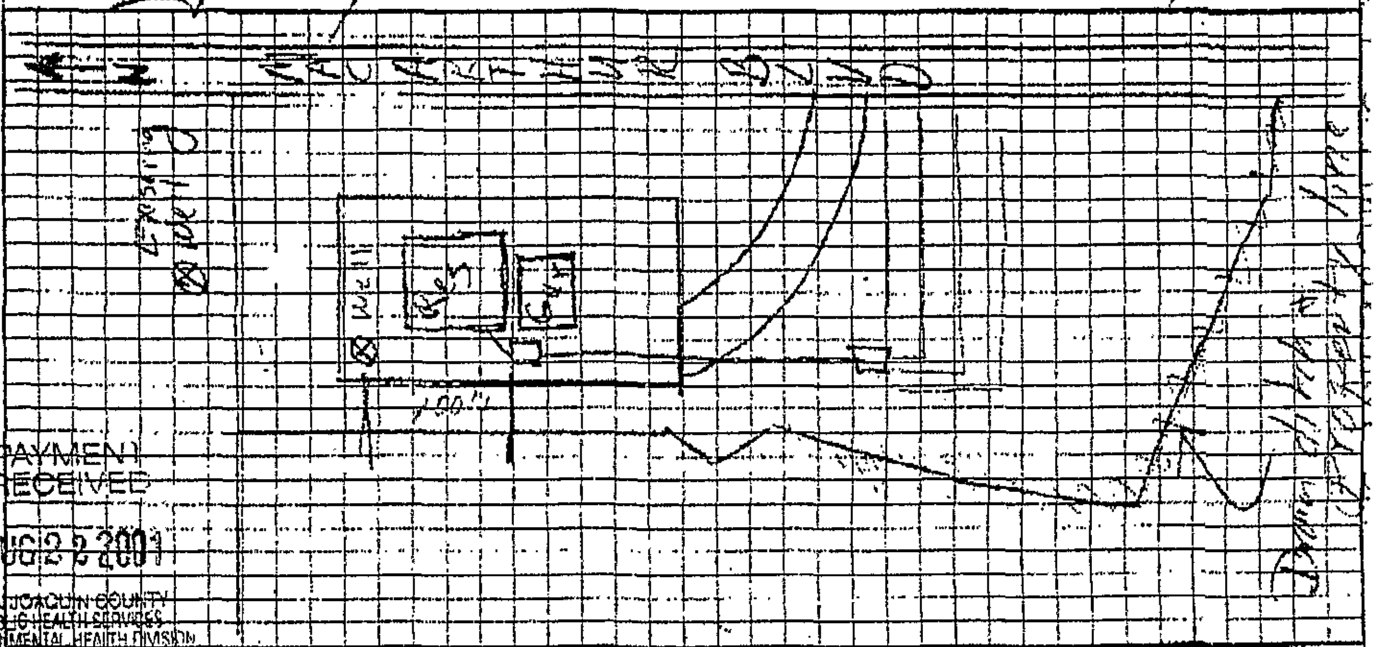
APPROXIMATE WELL DEPTH 270 feet

PROPOSED CONSTRUCTION/DRILLING METHOD: MUD ROTARY ✓ AIR ROTARY_____ AUGER_____ CABLE_____ OTHER_____

I HEREBY CERTIFY THAT I HAVE PREPARED THIS APPLICATION AND THAT THE WORK WILL BE DONE IN ACCORDANCE WITH SAN JOAQUIN COUNTY ORDINANCES, STATE LAWS, AND RULES AND REGULATIONS. I ALSO CERTIFY THAT MY C-57 LICENSE IS CURRENT AND ACTIVE WITH THE CALIFORNIA CONTRACTORS STATE LICENSE BOARD AND THAT I AM IN COMPLIANCE WITH ALL WORKMAN'S COMPENSATION LAWS.

MINIMUM 24 HOUR ADVANCE NOTICE REQUIRED FOR INSPECTIONS

SIGNED [signature] TITLE W/S Contractor DATE 8/21/01



PAYMENT RECEIVED

AUG 22 2001

SAN JOAQUIN COUNTY PUBLIC HEALTH SERVICES ENVIRONMENTAL HEALTH DIVISION

DEPARTMENT USE ONLY

Application Accepted By [signature] Date 8/22/01 Area 216 EMPID# 7380

Grout Inspection By_____ Date_____ Pump Inspected By_____ Date_____

Destruction Inspection By_____ Date_____

COMMENTS:_____

PE CODES	SC INFO	AMOUNT REMITTED	CHECK#/CASH	RECEIVED BY	DATE	PERMIT/SERVICE REQUEST #	INVOICE #	WELL ID#
4366	180.00	225.00	[illegible]	[illegible]	[illegible]	SR0027190		
4380	050	50.00	↓	↓	↓	SR0027191		

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR R: 10/5/16

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0274869

Page 1 of 1

Owner's Well Number ______

Date Work Began 7/7/15 Date Work Ended 8/12/15

Local Permit Agency SAN JOAQUIN COUNTY ENVIRONMENTAL HEALTH

Permit Number SR0072412 Permit Date 6/5/15

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ⦿ Vertical ○ Horizontal ○ Angle Specify ______

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	23	hard tan clay
23	28	course sand black-gray
28	41	large rock gravel
41	66	course sand
66	104	tan clay with gravel-clay mix
104	121	course sand large gravel
121	142	tan clay with layers small sand fine
142	151	large gravel
151	180	brown clay gravel mix
180	190	sand coarse with gravel
190	200	brown clay
200	206	fine sand
206	220	brown clay
220	230	fine sand
230	360	brown clay
360	390	blue clay
390	405	fine sand mix with gravel
405	420	blue clay
420	459	course gravel
459	479	blue clay
479	488	coarse sand
488	542	blue clay
542	580	course gravel
580	635	brown clay
635	644	fine sand with clay
644	670	brown clay
670	682	course sand with gravel
682	700	brown clay

Total Depth of Boring 700 Feet

Total Depth of Completed Well 592 Feet

Well Location

Address 7500 West Linne Road

City Tracy County San Joaquin

Latitude ___ Deg ___ Min ___ Sec N Longitude ___ Deg ___ Min ___ Sec W

Datum ______ Dec. Lat. ______ Dec. Long. ______

APN Book 253 Page 32 Parcel 018

Township ______ Range ______ Section ______

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

West East

South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. **Please be accurate and complete.**

Activity

☑ New Well
○ Modification/Repair
○ Deepen
○ Other ______
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

⦿ Water Supply
☐ Domestic ☑ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other ______

Water Level and Yield of Completed Well

Depth to first water ______ (Feet below surface)

Depth to Static Water Level 168 (Feet) Date Measured 8/31/15

Estimated Yield * 150 (GPM) Test Type Pump

Test Length 4 (Hours) Total Drawdown 238 (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	542	22	Solid	Steel	.250	8-5/8		
542	582	22	Slotted	Steel	.188	8-5/8	Milled	.060
582	592	22	Solid	Steel	.250	8-5/8		

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	480	Grout	Sand Cement
480	590	Sand	#6 & #8 Blend
592	700	Gravel	Birds Eye

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other ______

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Martell Water Systems, Inc.
Person, Firm or Corporation

1818 Loveridge Rd (Address) Pittsburge (City) CA (State) 94565 (Zip)

Signed [signature] C-57 Licensed Water Well Contractor 09/17/2015 (Date Signed) 510952 (C-57 License Number)

DWR 188 REV 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. LM-128C

Date Work Began 6/14/93, Ended 6/16/93

Local Permit Agency San Joaquin County Environmental Health Div.

Permit No. 93980 Permit Date 6/01/93

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 495830

DWR USE ONLY — DO NOT FILL IN

03S05E02E M

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER 39.2 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)
0.0	3.0	Clayey SILT (ML)
3.0	6.0	Silty SAND (SM)
6.0	32.5	Clayey SILT (ML)
32.5	44.0	Gravelly SAND (SW)
44.0	48.5	Silty SAND (SM)
48.5	50.0	SAND (SW)
50.0	66.0	Gravelly SAND (SP)
66.0	71.2	Sandy CLAY (CL)
71.2	76.0	Silty SAND (SM)
76.0	85.0	Sandy SILT (ML)
85.0	86.5	Interbedded SILT (ML) and SAND (SP)
86.5	88.0	SAND (SP)
88.0	94.0	very gravelly SAND (SP/GP)
94.0	98.0	Clayey SILT (ML)
xxxx	xxxxx	
98.0	104.0	Silty SAND (SM)
104.0	106.8	SAND (SP)
106.8	115.5	Silty Sandy GRAVEL (GP)
115.5	133.0	Silty SAND (SM)
133.0	134.0	SAND (SP)
134.0	139.5	Sandy GRAVEL (GP)
139.5	142.5	Gravelly SAND (SP)
142.5	153.5	Sandy GRAVEL/Gravelly SAND (GP/SP)

TOTAL DEPTH OF BORING 153.5 (Feet)

TOTAL DEPTH OF COMPLETED WELL 150.0 (Feet)

WELL OWNER

City State Zip

WELL LOCATION

Address DDRW-Tracy, 25600 So. Chrisman Rd.

City Tracy, CA.

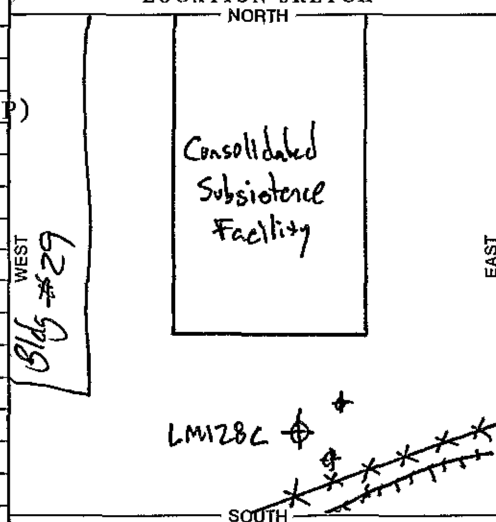
County San Joaquin County

APN Book ___ Page ___ Parcel ___

or Township T3S Range R5E Section 2

or Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH



Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

X MONITORING

WATER SUPPLY

___ Domestic

___ Public

___ Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD AR Rotary Casing Hammer FLUID none

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 39.8 (Ft.) & DATE MEASURED 7/17/93

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL/GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0.0	138.5	10	x				PVC	4	sch 40	
138.5	150.0	10		x			PVC	4	sch 40	0.010

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0.0	129.0	x			
129.0	135.0		x		
135.0	150.0				#2/16 Sand

ATTACHMENTS (✓)

X Geologic Log

X Well Construction Diagram

X Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Water Development Corp. 109
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

1202 Kentucky Ave Woodland CA 95776
ADDRESS CITY STATE ZIP

Signed [signature] 9-14-94 C283326
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

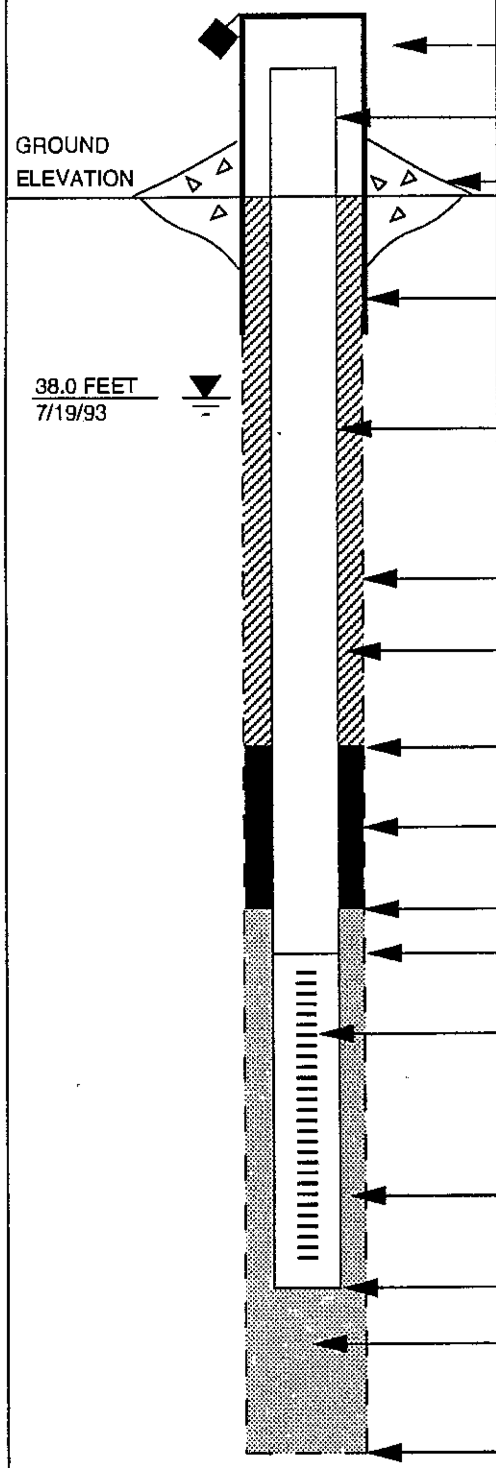
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

495830

BORING NO. LM128C

MONITORING WELL SHEET

PROJECT: TRACY PHASE I RI	LOCATION: BACKGROUND	DRILLER: R.J. VANNUCCI
PROJECT NO.: 1587.1001	BORING: LM-128C	DRILLING METHOD: AIR ROTARY CASING HAMMER
ELEVATION: G.S. 104.36 FT. ABOVE MSL (NGVD 88)	DATE: 6/25/93-6/29/93	DEVELOPMENT METHOD: SWAB AND PUMP
FIELD GEOLOGIST: MARC LOMBARDI		



ELEVATION OF TOP OF RISER PIPE (FT. ABOVE MSL): 106.22

STICK - UP RISER PIPE: 1.86 FT.

TYPE OF SURFACE SEAL: CONCRETE PAD

I.D. OF SURFACE CASING: 8 INCHES

TYPE OF SURFACE CASING: STEEL CONDUCTOR CASING

RISER PIPE I.D.: 4 INCHES

TYPE OF RISER PIPE: SCH 40 PVC

BOREHOLE DIAMETER: 10 INCHES

TYPE OF BACKFILL: NEAT CEMENT GROUT

DEPTH OF SEAL: 125.0 FT. BGS

TYPE OF SEAL: BENTONITE CHIPS

DEPTH TOP OF SAND PACK: 130.0 FT. BGS

DEPTH TOP OF SCREEN: 135.5 FT. BGS

TYPE OF SCREEN: SLOTTED SCH 40 PVC

SLOT SIZE x LENGTH 0.010 INCHES X 10 FEET

I.D. OF SCREEN 4 INCHES

TYPE OF SAND PACK: #2/16 LONESTAR SAND

DEPTH BOTTOM OF SCREEN: 145.5 FT. BGS

DEPTH BOTTOM OF SAND PACK: 147.5 FT. BGS

TYPE OF BACKFILL BELOW OBSERVATION WELL: #2/16 LONESTAR SAND

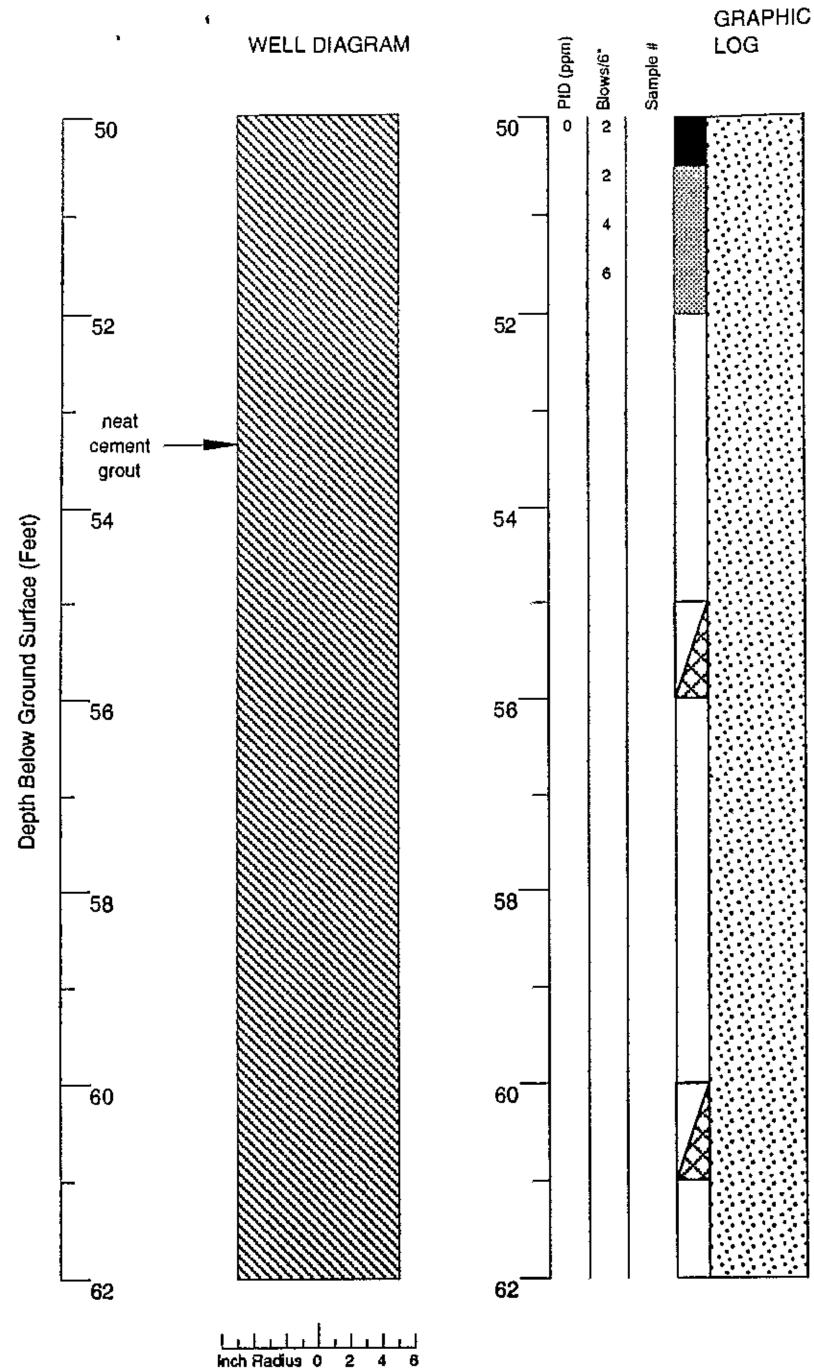
DEPTH OF HOLE: 147.5 FT. BGS

05/94.TR

NOTES:
- SCREENED ZONE DETERMINED BY INTERPRETATION OF LOWER HORIZON FROM 134-149 FEET BGS, TEST HOLE LM127B/LM128C.
- CENTRALIZERS PLACED AT TOP AND BOTTOM OF SCREEN AND EVERY 40 FEET THEREAFTER.

675830

03505E02E



DESCRIPTION

Start time 16:30 on 6/14/93

See log for well LM-126A for description from 0 to 50 ft.

Gravelly SAND (SP); dark brown to gray; wet; sand fine to coarse, predominantly medium (0.5-0.75 mm), 30% gravel subangular to subrounded, ranges from 5-40 mm, predominantly 25-30 mm, some localized silt zones.

Gravelly SAND (SP); as above.

Also Attached -
- LM126A log (0-50')
- LM128C Well Completion Diagram
- LM128C Geophysical Log (gamma Ray)

Gravelly SAND (SP); as above.

Continues

Geologist:	Paul Murphy	Drilling Company:	Water Development Corp.	Type of Sampler:	2 inch diam. split spoon sampler
Project Mgr:	Sue Tiffany	Drilling Method:	Air Rotary Casing Hammer	TD (Total Depth):	147.0 ft. below ground surface
Dates Drilled:	6/14/93 - 6/16/93	Driller:	Tom Moreland		
		Drill Rig:	Dresser T70W Arch		

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered core sample
- Location of sample sealed for chemical analysis
- Particle size sample (See Appendix L)
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- NR No recovery
- Grab sample from cyclone

HP-5

MONTGOMERY WATSON

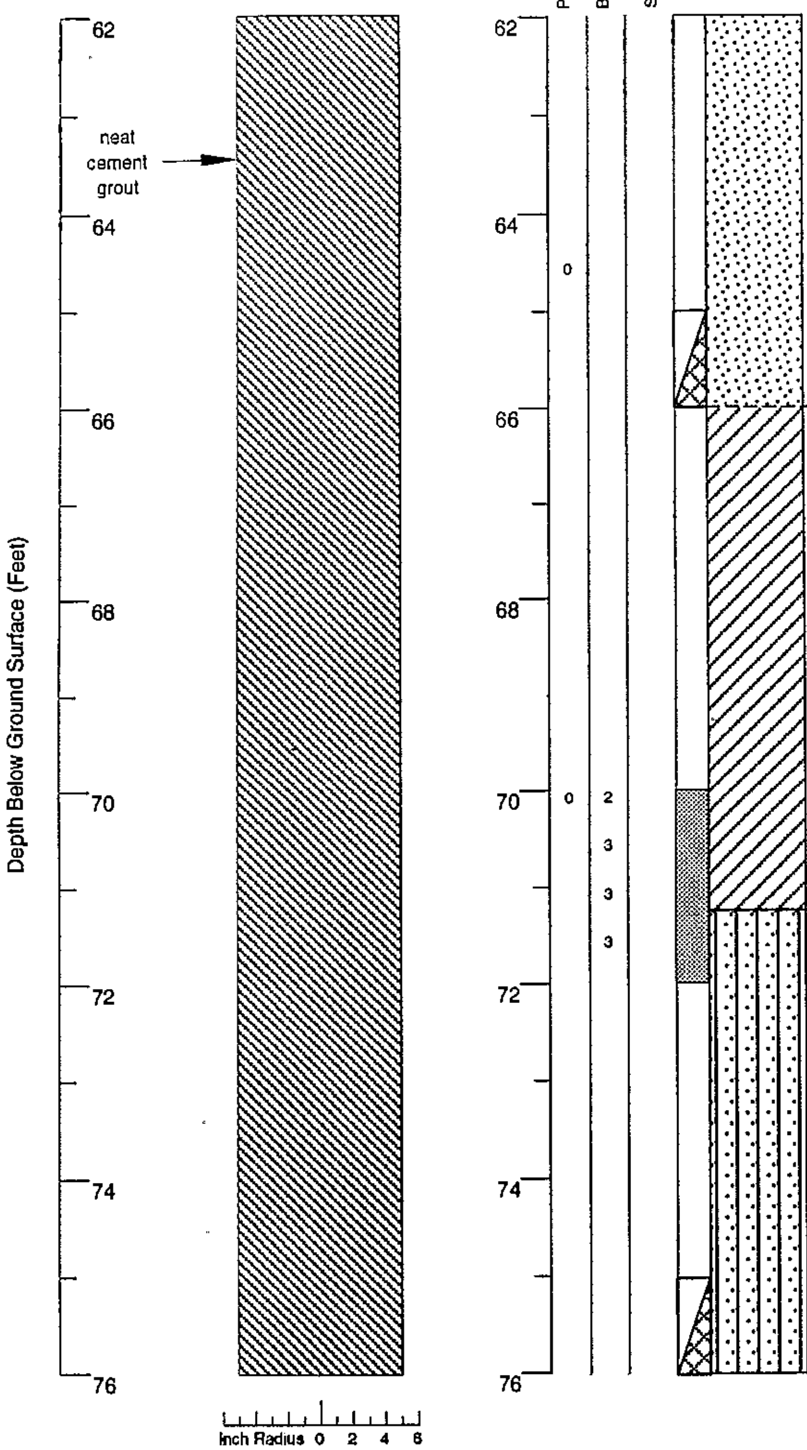
BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE

LM-127B
LM-128C

495830

WELL DIAGRAM | PID (ppm) | Blows/6" | Sample # | GRAPHIC LOG | DESCRIPTION



Gravelly SAND (SP); as above.

Increase in brownish-yellow clay.

Contact inferred by drilling rate.

Sandy CLAY (CL); brownish yellow; soft; some silt; some fine gravel up to 10 mm; low plasticity.

CLAY (CL); as above; moist; some white calcareous masses, slight blocky structure.

Silty SAND (SM); brown; wet; some silt; very fine to fine grained; some moderately cemented calcareous zones.

Color becoming more yellowish-red; increasing silt.

Continues

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered core sample
- Location of sample sealed for chemical analysis
- Particle size sample (See Appendix L)
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- NR No recovery
- Grab sample from cyclone

HP-5

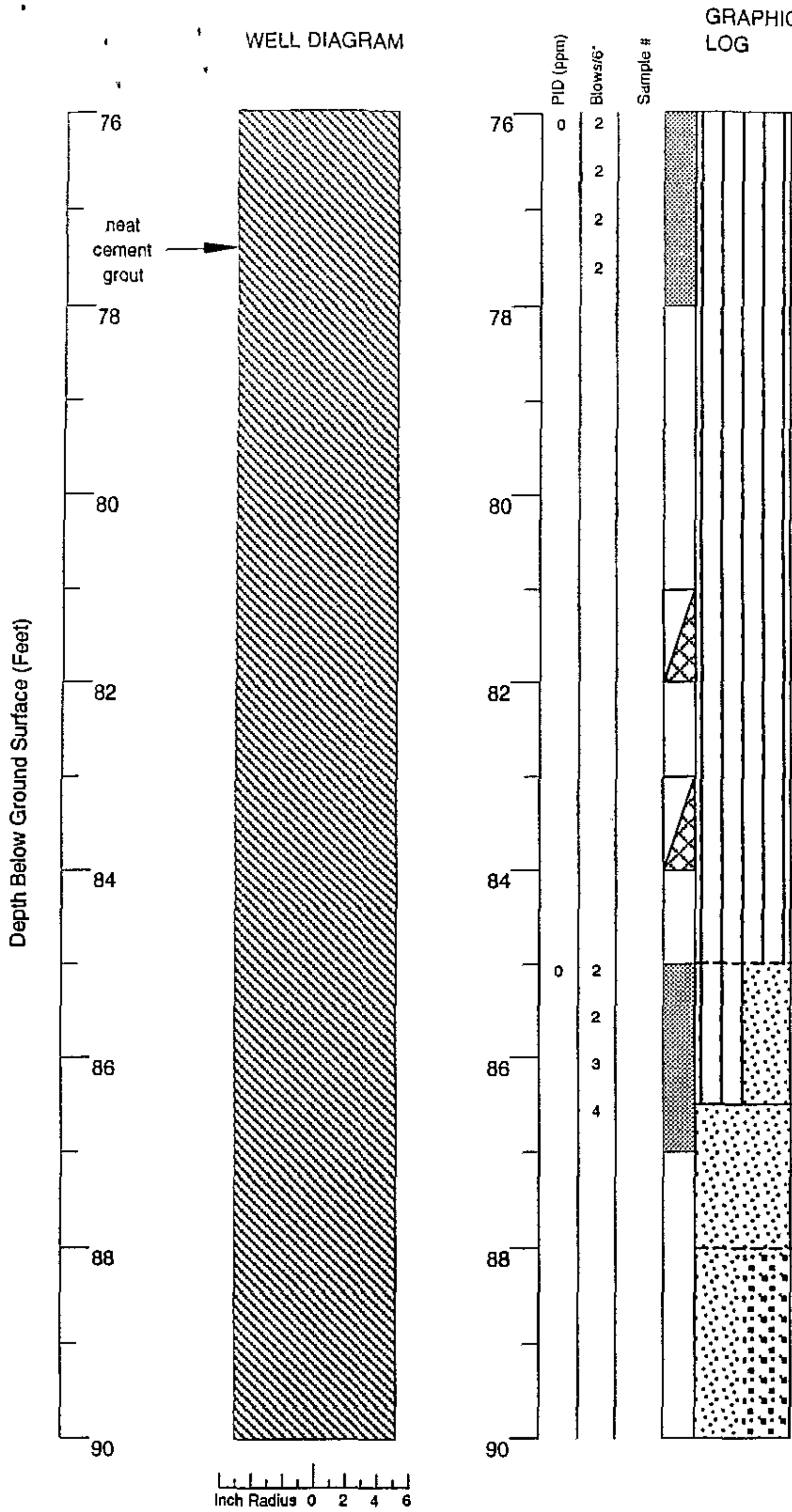
MONTGOMERY WATSON

BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE

LM-127B
LM-128C

495830



DESCRIPTION

Sandy SILT (ML); brown; low plasticity; moist; some fine sand; abundant calcareous seams & masses.

Sandy SILT (ML); as above, but with trace fine gravel (5-10 mm).

Slight increase in fine sand.

Interbedded SILT (ML) and SAND (SP); silt as above; sand is moist; fine and medium-grained; fine gravels throughout (approximately 5%); interbeds are 3-6" thick.

SAND (SP); brown; some silt; wet; fine to medium, predominantly fine; 10% gravel up to 30 mm, predominantly 10 mm.

Increase in gravels to a very gravelly SAND (SP/GP); gravels range from 5-45 mm, predominantly 25 mm, subrounded to subangular.

Interpretation: Middle Horizon.

Continues

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered core sample
- Location of sample sealed for chemical analysis
- Particle size sample (See Appendix L)
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- NR No recovery
- Grab sample from cyclone

HP-5

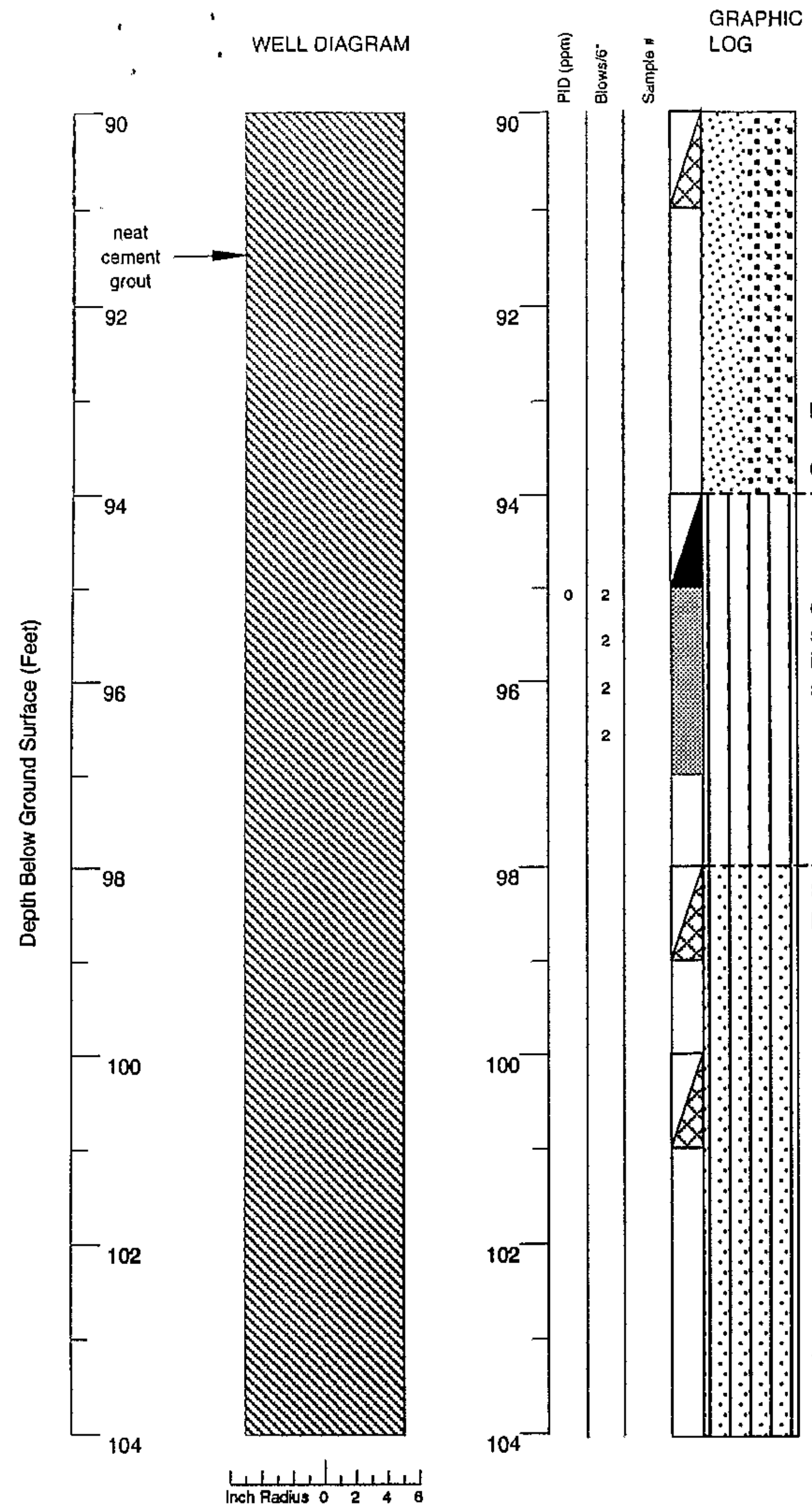
MONTGOMERY WATSON

BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE

LM-127B
LM-128C

495830



DESCRIPTION

Increase in brown clayey silt.

Contact inferred by drilling rate.

Clayey SILT (ML); brown; medium stiff; moist; some fine sand; abundant calcareous seams; increase in sand to sandy SILT at 96.5 ft.; sand predominantly fine-grained.

Silty SAND (SM); increase in fine and medium sand, predominantly fine; trace fine gravel (5-10 mm).

Abundant fine and medium SAND (SM); trace silt; abundant dark minerals; decrease in gravel to none.

Continues

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered core sample
- Location of sample sealed for chemical analysis
- Particle size sample (See Appendix L)
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- NR No recovery
- Grab sample from cyclone

HP-5

MONTGOMERY WATSON

BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE

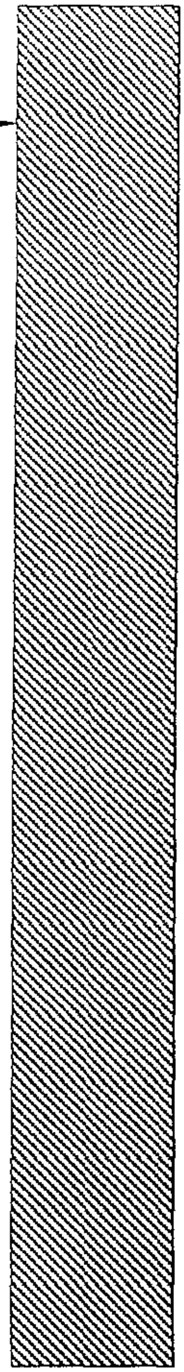
LM-127B
LM-128C

495830

Depth Below Ground Surface (Feet)

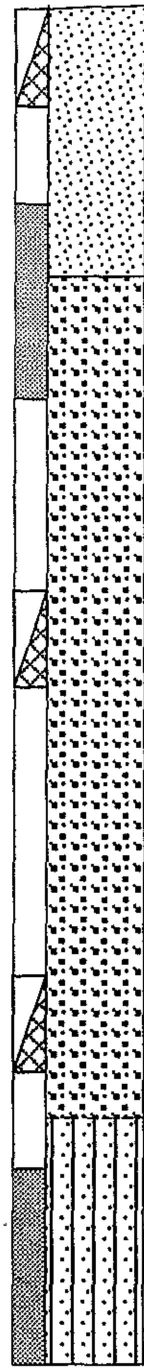
WELL DIAGRAM

neat cement grout →



Inch Radius 0 2 4 6

Depth (ft)	PID (ppm)	Blows/6"	Sample #	GRAPHIC LOG / DESCRIPTION
104				SAND (SP); predominantly medium, some coarse.
106	0	2		
		2		Silty Sandy GRAVEL (GP); wet; subangular to subrounded gravel up to 40 mm, predominantly 25 mm; matrix supported with a silty sand; sand fine and medium grained.
		6		
		8		
108				[10 ft. of heave when sampling]
110				Abundant gravels at 110 ft. (sample at 106-107 may have been heave material from ≈100 ft.).
112				
114				Increase in silt and sand content; sand predominantly fine-grained.
				Silty SAND (SM); brown to brownish-yellow; medium dense; moist; predominantly fine-grained, some medium grains; some calcareous seams and masses; trace coarse (2 mm) sand.
116	0	2		
		4		
		4		
		5		
118				



Continues

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered core sample
- Location of sample sealed for chemical analysis
- Particle size sample (See Appendix L)
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- NR No recovery
- Grab sample from cyclone

HP-5

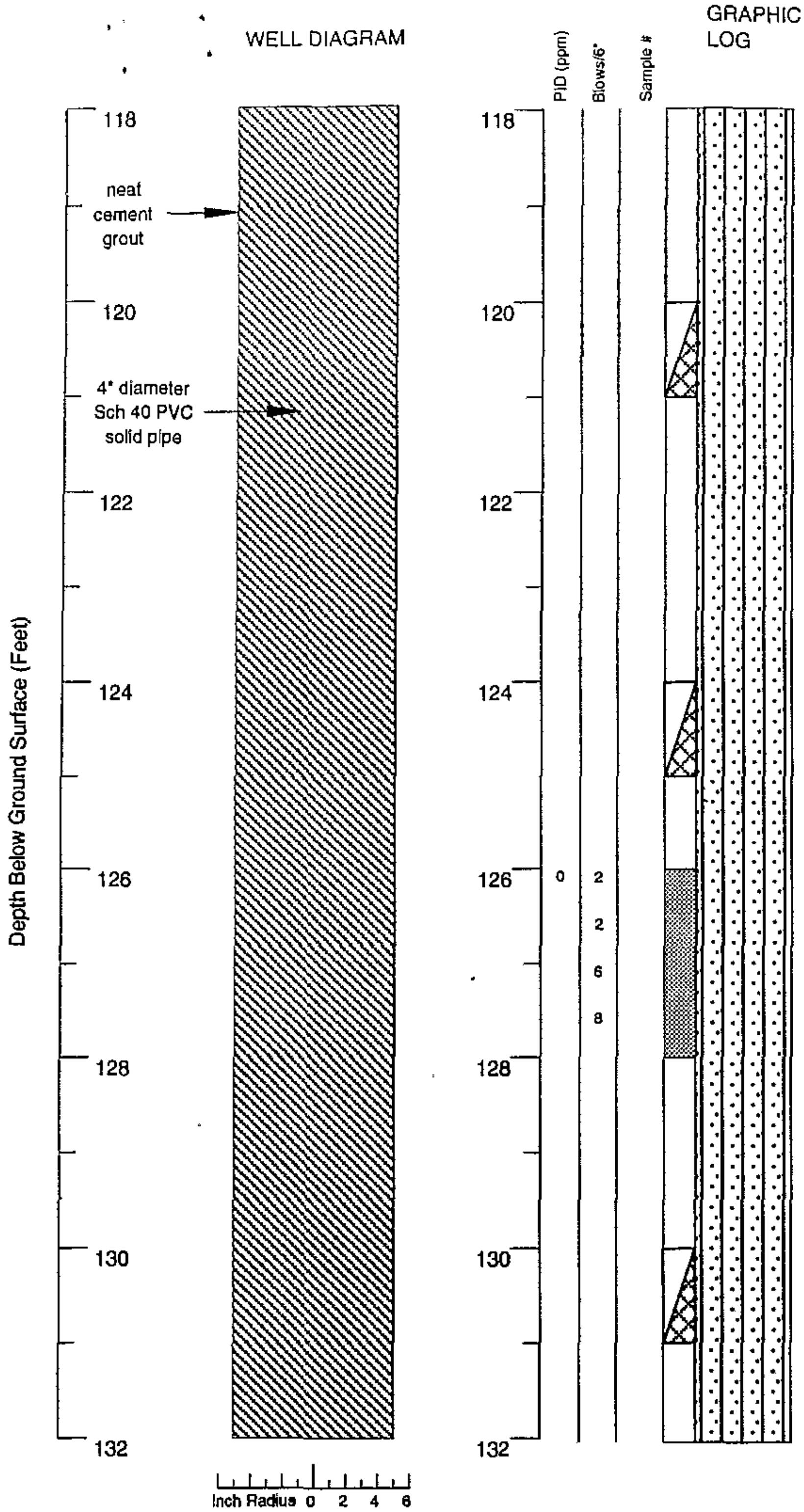
MONTGOMERY WATSON

BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE

LM-127B
LM-128C

495830



DESCRIPTION

Silty SAND (SM); as above.

Silty SAND (SM); as above, but with slight increase in silty clay.

Silty SAND (SM); as above.

Silty SAND (SM); as above.

Continues

EXPLANATION

Water level during drilling	Contacts: Solid where certain
Water level in completed well	Dotted where approximate
Location of recovered core sample	Dashed where uncertain
Location of sample sealed for chemical analysis	Hachured where gradational
Particle size sample (See Appendix L)	NR No recovery
Grab sample	Grab sample from cyclone

HP-5

MONTGOMERY WATSON

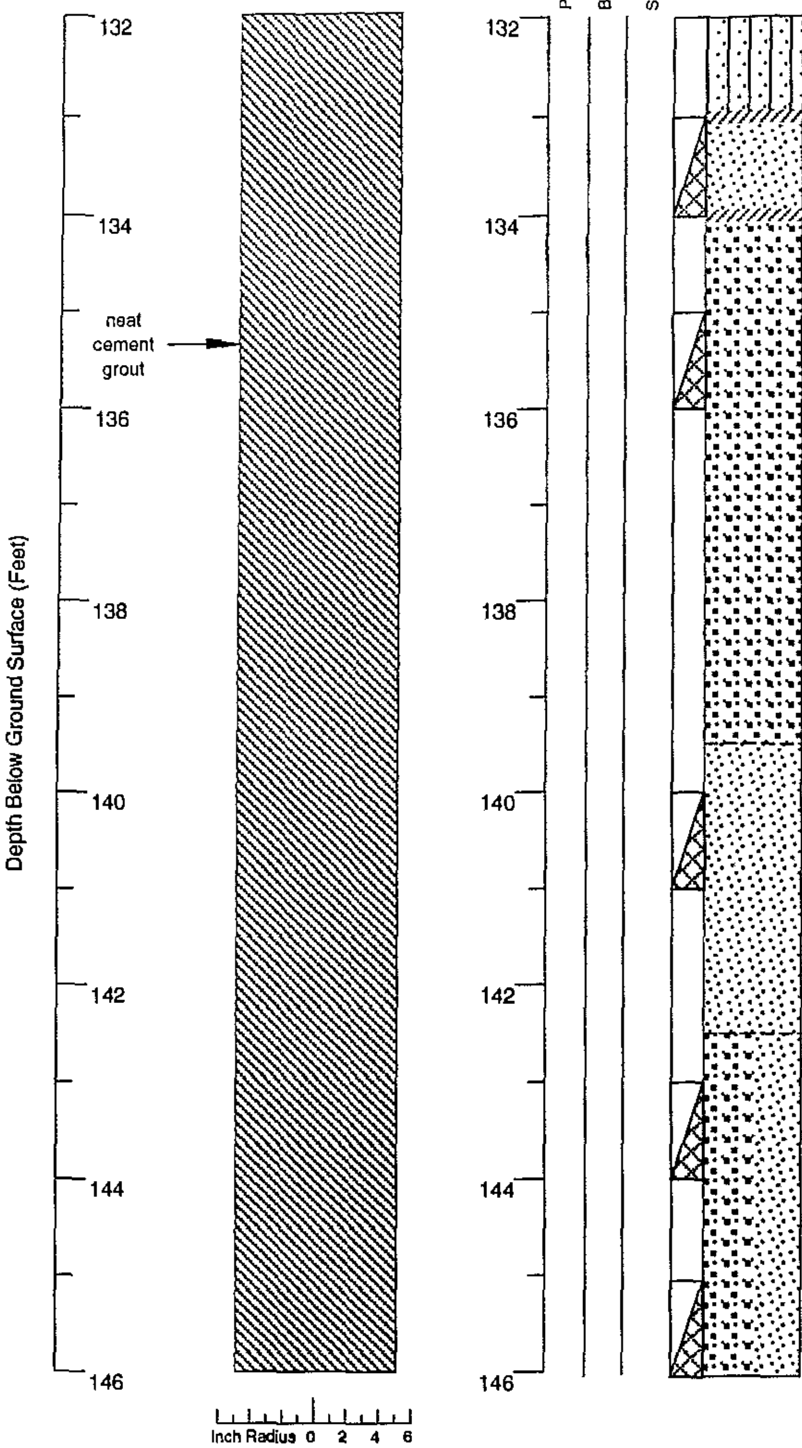
BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE

LM-127B
LM-128C

495830

WELL DIAGRAM | PID (ppm) | Blows/6" | Sample # | GRAPHIC LOG | DESCRIPTION



Silty SAND (SM); as above; increase in fine gravels and medium sand; trace silt.

Increase in gravel and medium and coarse SAND (SP).

Sandy GRAVEL (GP); subangular to subrounded; ranges from 5-50 mm, predominantly 25-30 mm; sand is wet; some silt; predominantly medium.

Stop drilling ≈136 ft. 6/15/93
Resume drilling 6/16/93 @ 09:15

Interpretation: Lower Horizon.

Decrease in gravel increase in sand to a gravelly SAND (SP); sand predominantly medium-grained, 20% gravel from 5-25 mm; some clayey silt; trace calcareous masses.

Sandy GRAVEL/Gravelly SAND (GP/SP); sand predominantly medium-grained, some coarse grains, 40-50% subangular to subrounded; gravel from 5-50 mm, predominantly 10-20 mm.

Interpretation: Lower Horizon.

Continues

EXPLANATION

- Water level during drilling
- Water level in completed well
- Location of recovered core sample
- Location of sample sealed for chemical analysis
- Particle size sample (See Appendix L)
- Grab sample

Contacts:
- Solid where certain
- Dotted where approximate
- Dashed where uncertain
- Hachured where gradational
- NR No recovery
- Grab sample from cyclone

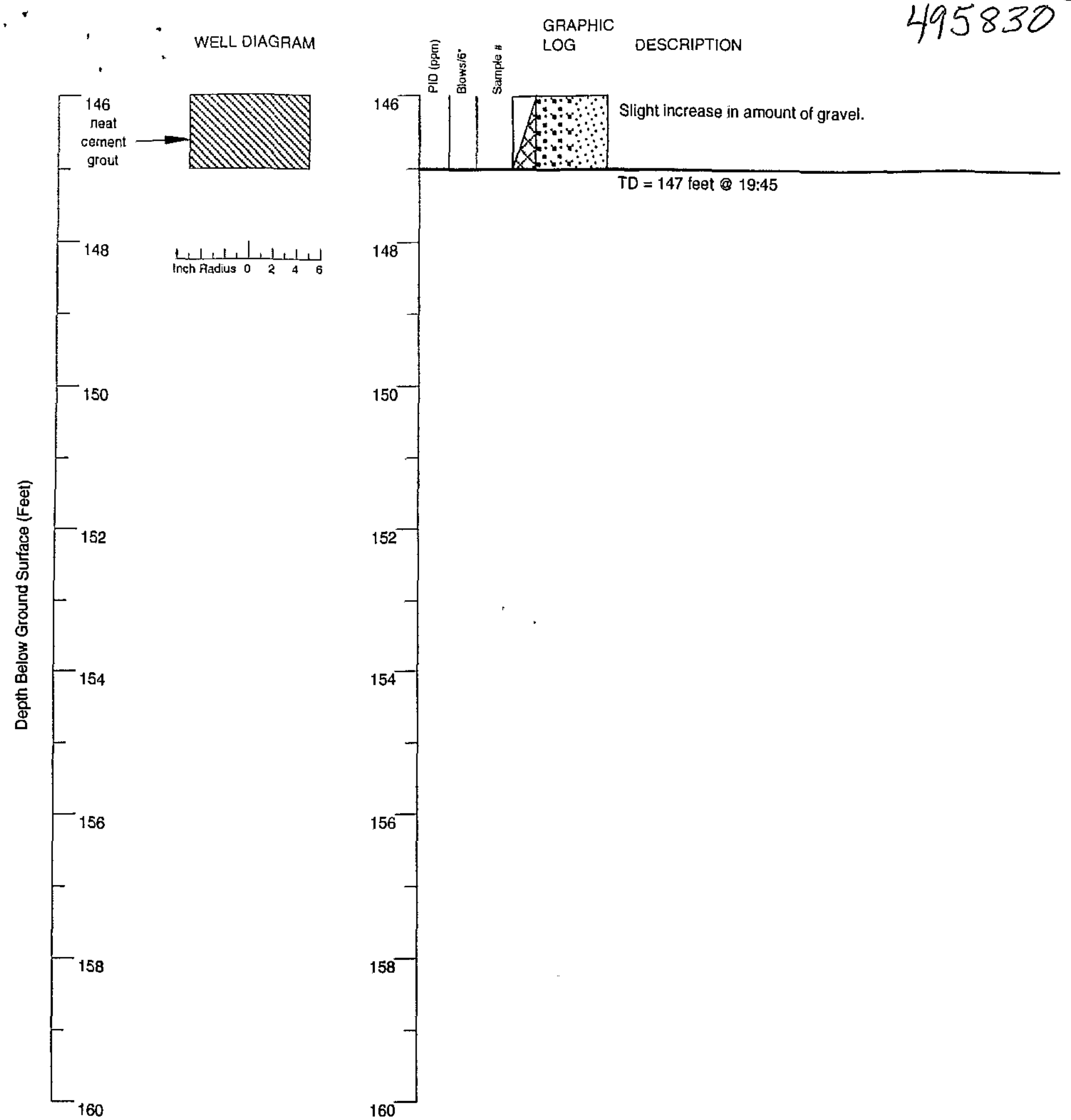
HP-5

MONTGOMERY WATSON

BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE
LM-127B
LM-128C

495830



EXPLANATION

	Water level during drilling		Contacts: Solid where certain
	Water level in completed well		Dotted where approximate
	Location of recovered core sample		Dashed where uncertain
	Location of sample sealed for chemical analysis		Hachured where gradational
	Particle size sample (See Appendix L)	NR	No recovery
	Grab sample		Grab sample from cyclone

HP-5

MONTGOMERY WATSON

BACKGROUND
Boring Log
LM-127B/LM-128C
Tracy Remedial Investigation

TEST HOLE

LM-127F
LM-128C

095830

welenco

GAMMA RAY LOG

FILING NO.		
	COMPANY	MONTGOMERY WATSON AMERICAS, INC.
	WELL	LM-128C
	FIELD	TRACY
	COUNTY	SAN JOAQUIN STATE CALIFORNIA

	LOCATION	OTHER SERV:
JOB NO. 21769	LOCATION: DEFENSE DISTRIBUTION DEPOT WEST SEC N/A TWP N/A RGE N/A	NONE

PERMANENT DATUM: G.L. ELEV: N/A

LOG MEASURED FROM TOC FT ABOVE PERM DATUM

DRILLING MEASURED FROM G.L.: 104.36 ft above msl

ELEVATION: KB. ____ DF. ____ GL. ____

DATE	07-21-93		
TYPE OF LOG	GAMMA RAY		
RUN NO.	ONE		
DEPTH - DRILLER	N/A		
DEPTH - LOGGER	148.1'		
BOTTOM LOGGED INT	147.1'		
TOP LOGGED INT	1.5'		
TYPE FLUID IN HOLE	WATER		
FLUID LEVEL	N/A		
MAX TEMP DEG F	N/A		
OPERATING RIG TIME	N/A		
EQUIP. LOCATION	L-17 BFL.		
OPERATOR	M.SHARPLESS		
WITNESSED BY	N/A		

RUN	BORE HOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE	TYPE	FROM	TO
01	N/A	N/A	N/A	4"	PVC	SURF	TD

495830

EQUIPMENT DATA

LOG TYPE	GAMMA RAY		
RUN NO.	ONE		
TOOL MODEL NO.	GCN27XU		
TOOL SERIAL NO.	T112		
DIAMETER	1.75"		
DETECTOR TYPE	G.M.		
DETECTOR LENGTH	18"		
UNITS/DIV.	5 API		
SENSITIVITY	100/223		
TIME CONSTANT	2		
ZERO DIV L OR R	4-L		
SPEED-FPM	20		
SAMPLES/FT.	5		
FORMATION FACTOR	N/A		
PUMP RATE-GPM	N/A		
PUMP RATE-GPM	N/A		
PUMP RATE-GPM	N/A		

SOURCE TYPE	STRENGTH	SPACING	MODEL NO	SERIAL NO.
N/A	N/A	N/A	N/A	N/A

PERFORATIONS: N/A

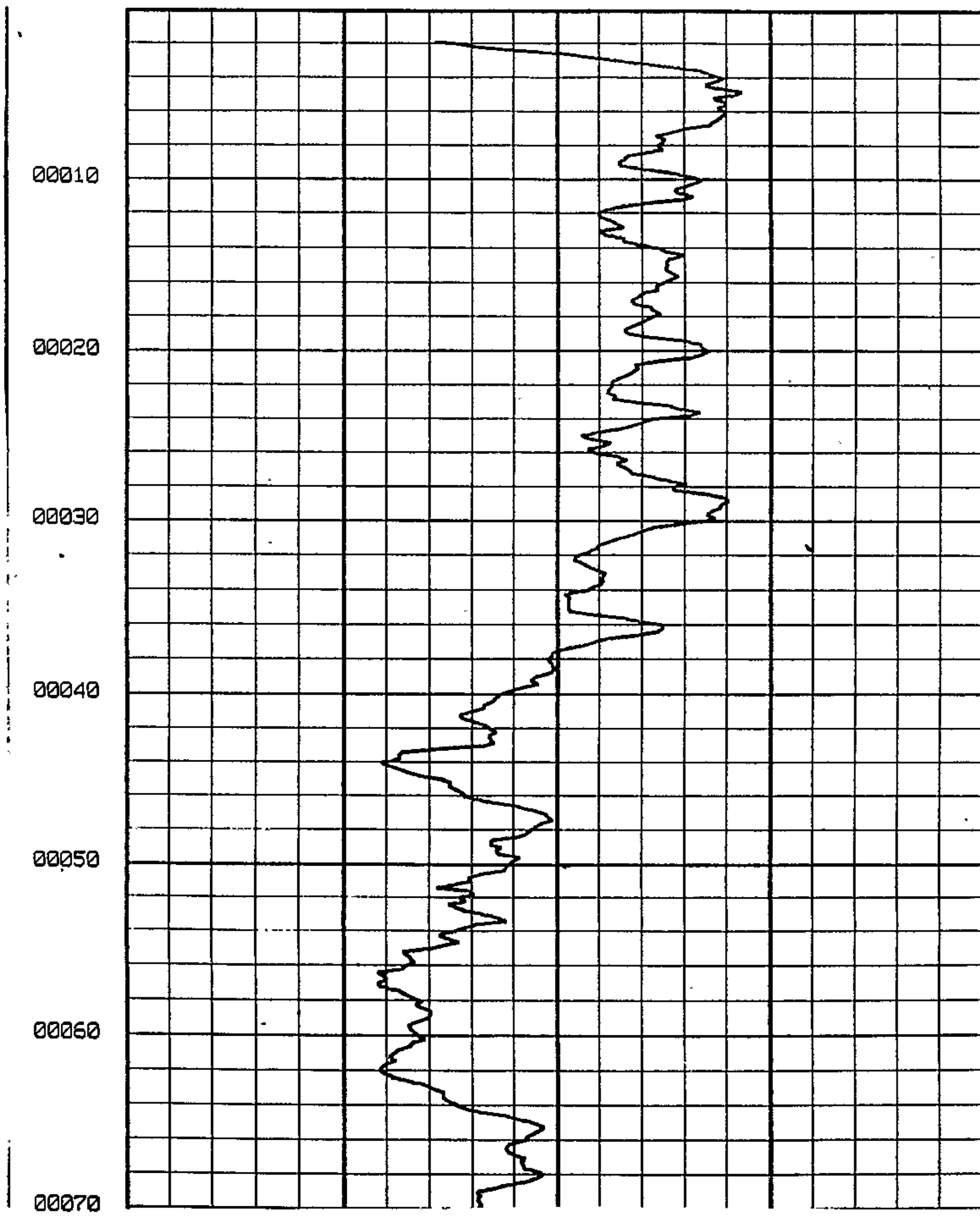
REMARKS:

NOTICE:
All interpretations are opinions based on inferences from electrical or other measurements and we cannot, and do not guarantee the accuracy or correctness of any interpretations, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages or expenses incurred or sustained by anyone resulting from any interpretation made by one of our officers, agents or employees. These interpretations are also subject to our General Terms and Conditions as set out in our current Price Schedule.

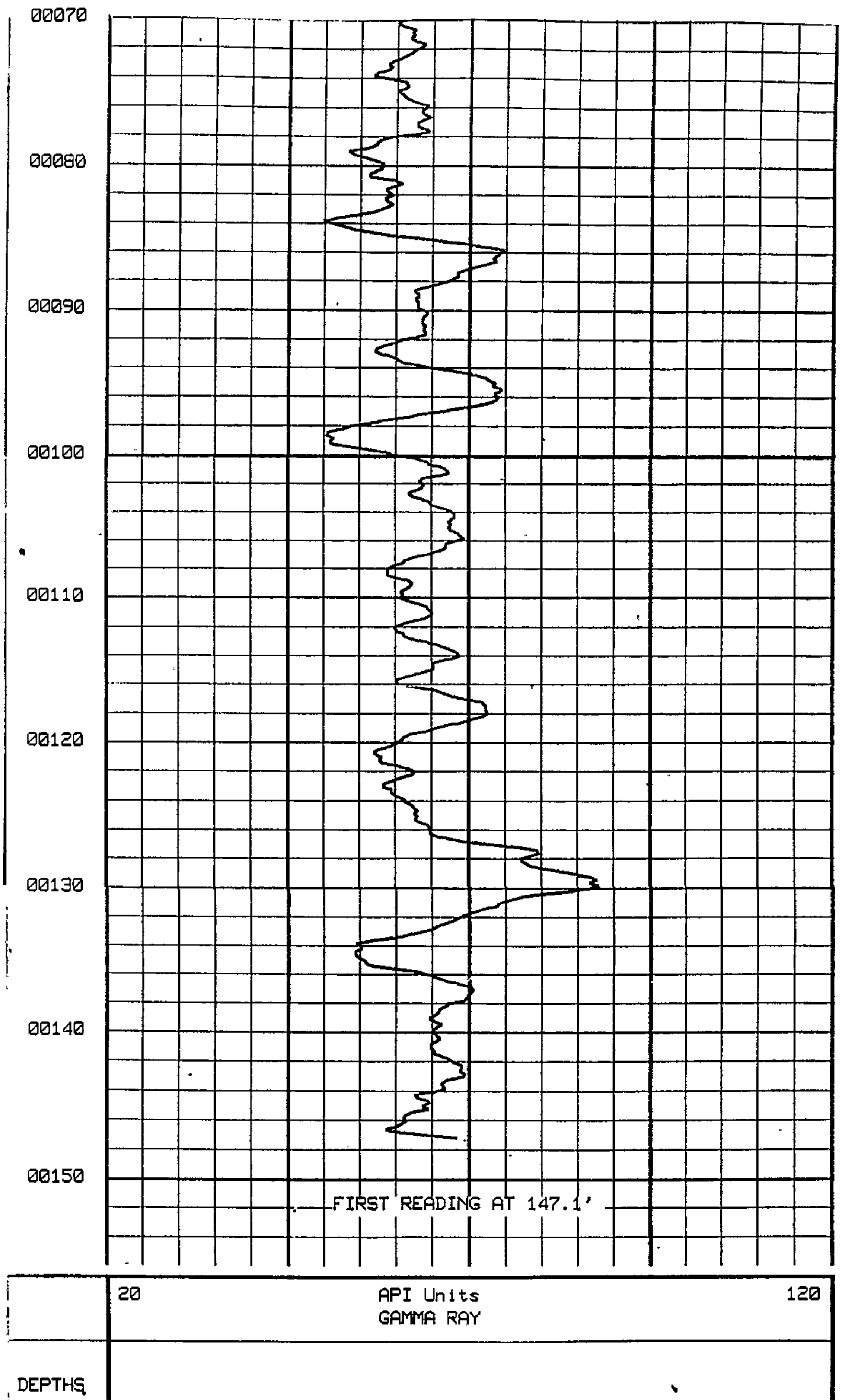
WELENCO, INC.

495830

DEPTHS	
	GAMMA RAY 20 API Units 120



495830


00070
00080
00090
00100
00110
00120
00130
00140
00150
FIRST READING AT 147.1'
20
API Units
GAMMA RAY
120
DEPTHS

ORIGINAL
File with DWR
Page 1 of 2

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 774071

DWR USE ONLY — DO NOT FILL IN
0 3 S 0 5 E 2 3
STATE WELL NO./STATION NO.
LATITUDE | LONGITUDE
APN/TRS/OTHER

Owner's Well No. 95215
Date Work Began 8/21/00, Ended 8/23/00
Local Permit Agency Public Health Services
Permit No. 23780 Permit Date 8/18/00

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID Mud

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	5	Soil
5	12	Clay
12	14	Sand
14	58	clay
58	60	Sand
60	175	Clay
175	176	Coarse Sand
176	200	Clay & Sand Streaks
200	285	Clay

TOTAL DEPTH OF BORING 285 (Feet)
TOTAL DEPTH OF COMPLETED WELL 210 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address 6500 W. Durham Ferry
City Tracy CA
County San Joaquin
APN Book 253 Page 280 Parcel 22
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH
WEST
EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE 1
DEPTH OF STATIC WATER LEVEL 80 (Ft.) & DATE MEASURED 8/23/00
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
*May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	170	12	✓				PLASTIC	6	160	160
170	210			✓						

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	106		✓		
106	210			✓	GRAVEL

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME MASELLIS DRILLING, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
119 Albers Rd. Modesto CA 95357
ADDRESS CITY STATE ZIP
Signed [signature] 08/31/00 668622
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

4/6-4E1 (CONT.) ②

7-359 (Rev.51)
Bureau of Reclamation

WELL LOG

County San Joaquin Owner U.S.B.R. No. 4-6-4E1
Dist. Delta Use Irrigation Local No. Well #2
Quad. Carbona Driller Western, San Jose Date April 12 - May 1, 1947
Location 2500' S, 100' E., NW corner

Surf. Elev. /180 Groundwater elev. Date
Depth 623 Groundwater elev. Date
Yield Aquifers
Drawdown Artesian head Date
Casing See sheet 1 % Sand-gravel

Source of data Western's files Type drill Rotary Diam. hole

Depth	Elev.	Thick	Description	Perforation Log
359-383			extra hard cemented clay and boulders	
383-395			clay and gravel - hard	68-72
395-398			cemented clay and gravel - hard	132-178
398-403			clay	192-210
403-411			streaks of gravel and some clay	228-240
411-415			extra hard cemented clay and boulders	252-264
415-418			hard cemented clay and boulders	276-294
418-423			clay	312-348
423-428			"	360-372
428-470			hard cemented clay and gravel	384-398
470-478			hard cemented clay and gravel	404-418
478-479			extra hard rocks	432-444
479-484			clay	456-468
484-486			cemented clay and gravel	480-496
486-489			cemented clay and boulders	504-516
489-492			clay	532-544
492-495			gravel and boulders - hard	552-596
495-497			" " " "	
497-505			clay	
505-526			hard clay and gravel	
526-533			clay	
533-541			free gravel	
541-546			tight gravel	
546-554			clay	
554-557			clay and gravel	
557-570			streaks good gravel and some clay	
570-590			clay and gravel	
590-618			" " "	
618-623			" " "	

D	C
E	F

 NW¼, 4-6-4

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW#1A

Date Work Began 8/5/02, Ended 8/9/02

Local Permit Agency SAN JOAQUIN CO ENV. HEALTH

Permit No. SRO030323 Permit Date 6/27/02

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 788418

DWR USE ONLY — DO NOT FILL IN M

02S05E12Q

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0	20	BASE ROCK AND CLAY
20	40	SMALL AND 3/8" GRAVEL
40	80	SMALL GRAVEL AND BROWN CLAY
80	100	BROWN CLAY
100	160	BROWN CLAY AND SMALL GRAVEL
160	280	BROWN CLAY AND 3/8" GRAVEL
280	300	GRAY CLAY AND 3/8" ROCK
300	480	GRAY CLAY

TOTAL DEPTH OF BORING 480 (Feet)

TOTAL DEPTH OF COMPLETED WELL 468 (Feet)

CITY STATE ZIP

WELL LOCATION

Address WEST ELEVENTH ST. E. CORRAL HOLLOW

City TRACY CA

County SAN JOAQUIN

APN Book 232 Page 170 Parcel 18

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

*May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE: BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	428	14	✓				STEEL	6 5/8	.188	
428	468	14		✓			STEEL	6 5/8	.188	0.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	400	✓			
400	480			✓	8/16 SILICA

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

17702 BALDWIN MADERA CA 93638
ADDRESS CITY STATE ZIP

Signed [signature] 10/21/02 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. **788417**

DWR USE ONLY — DO NOT FILL IN

M

0|2|S|0|5|E|2|0| | |

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

Owner's Well No. MW#1B

Date Work Began 8/5/02 ; Ended 8/9/02

Local Permit Agency SAN JOAQUIN CO. ENV. HEALTH

Permit No. SRO030323 Permit Date 6/27/02

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0	20	BASE ROCK AND CLAY
20	40	SMALL AND 3/8" GRAVEL
40	80	SMALL GRAVEL AND BROWN CLAY
80	100	BROWN CLAY
100	160	BROWN CLAY AND SMALL GRAVEL
160	280	BROWN CLAY AND 3/8" GRAVEL
280	300	GRAY CLAY AND 3/8" ROCK
300	560	GRAY CLAY
560	600	GRAY CLAY AND SMALL GRAVEL
600	620	GRAY CLAY
620	660	GRAY CLAY AND SMALL GRAVEL
660	700	GRAY CLAY
700	720	GRAY CLAY AND MUDSTONE

TOTAL DEPTH OF BORING 670 (Feet)

TOTAL DEPTH OF COMPLETED WELL 658 (Feet)

CITY STATE ZIP

WELL LOCATION

Address WEST ELEVENTH ST. E. CORRAL HOLLOW

City TRACY CA

County SAN JOAQUIN

APN Book 232 Page 170 Parcel 18

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	618	14	✓				STEEL	6 5/8	.188	
618	658	14		✓			STEEL	6 5/8	.188	0.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	590	✓			
590	670			✓	8/16 SILICA

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

17702 BALDWIN MADERA CA 93638
ADDRESS CITY STATE ZIP

Signed Rebecca L. Dixon 10/21/02 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 1

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 788416

DWR USE ONLY — DO NOT FILL IN

02S05E20 M

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

Owner's Well No. MW#1C

Date Work Began 8/5/02, Ended 8/9/02

Local Permit Agency SAN JOAQUIN CO. ENV. HEALTH

Permit No. SRO030323 Permit Date 6/27/02

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft. to	Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	20	BASE ROCK AND CLAY
20	40	SMALL AND 3/8" GRAVEL
40	80	SMALL GRAVEL AND BROWN CLAY
80	100	BROWN CLAY
100	160	BROWN CLAY AND SMALL GRAVEL
160	280	BROWN CLAY AND 3/8" GRAVEL
280	300	GRAY CLAY AND 3/8" ROCK
300	560	GRAY CLAY
560	600	GRAY CLAY AND SMALL GRAVEL
600	620	GRAY CLAY
620	660	GRAY CLAY AND SMALL GRAVEL
660	700	GRAY CLAY
700	820	GRAY CLAY AND MUDSTONE

TOTAL DEPTH OF BORING 820 (Feet)

TOTAL DEPTH OF COMPLETED WELL 788 (Feet)

CITY STATE ZIP

WELL LOCATION

Address WEST ELEVENTH ST. E. CORRAL HOLLOW

City TRACY CA

County SAN JOAQUIN

APN Book 232 Page 170 Parcel 18

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
- ___ Deepen
- ___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
- ___ Domestic ___ Public
- ___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft. to	Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	748	14	✓				STEEL	6 5/8	.188	
748	788	14		✓			STEEL	6 5/8	.188	0.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to	Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	720	✓			
720	800			✓	8/16 SILICA

ATTACHMENTS (✓)

- ___ Geologic Log
- ___ Well Construction Diagram
- ___ Geophysical Log(s)
- ___ Soil/Water Chemical Analysis
- ___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 17702 BALDWIN CITY MADERA STATE CA ZIP 93638

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE

DATE SIGNED 10/21/02 C-57 LICENSE NUMBER 414178

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW#5C

Date Work Began 9/10/02, Ended 9/11/02

Local Permit Agency SAN JOAQUIN CO. ENV. HEALTH

Permit No. SROO30784 Permit Date 8/7/02

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 788422

M

DWR USE ONLY — DO NOT FILL IN

02505E23

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID ___

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	20	CONDUCTOR
20	40	BROWN CLAY & SMALL GRAVEL
40	60	COARSE SANDS & SMALL GRAVEL
60	220	BROWN CLAY & SOME SMALL GRAVEL
220	440	BLUE GRAY CLAY
440	480	BLUE CLAY
480	500	COARSE SANDS
500	560	SANDS & BLUE CLAY
560	580	CLAY & SMALL GRAVEL
580	600	SAND & SOME CLAY
600	640	SMALL GRAVEL
640	660	SMALL GRAVEL & MEDIUM SANDS
660	680	SMALL GRAVEL & CLAY
680	700	COARSE SANDS
700	720	COARSE SANDS & SMALL GRAVEL
720	760	BROWN CLAY
760	780	CLAY & SAND MIXED
780	820	COARSE SANDS & SMALL GRAVEL

TOTAL DEPTH OF BORING 820 (Feet)

TOTAL DEPTH OF COMPLETED WELL 810 (Feet)

WELL OWNER

WELL LOCATION

Address 7301 E. ELEVENTH S ST

City TRACY CA

County SAN JOAQUIN

APN Book 250 Page 030 Parcel 07

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
- ___ Deepen
- ___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
- ___ Domestic ___ Public
- ___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	770	8 3/4	✓				STEEL	6 5/8	.188	
770	810	8 3/4		✓			STEEL	6 5/8	.188	0.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	750	✓			
750	820			✓	8/16 SILICA

ATTACHMENTS (✓)

- ___ Geologic Log
- ___ Well Construction Diagram
- ___ Geophysical Log(s)
- ___ Soil/Water Chemical Analysis
- ___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

17702 BALDWIN MADERA CA 93638
ADDRESS CITY STATE ZIP

Signed [signature] 10/21/02 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

E06dərv

State of California
The Resources Agency
Department of Water Resources

State Well No. 01S04E28P004M

DISTRICT Central

WELL DATA

Owner
Address
Tenant
Address

State Well No. 01S04E28P004M
Other No. OLNO-3

Type of Well: Hydrograph [x] Key [ ] Index [ ] Semiannual [ ]
Location: County San Joaquin Basin San Joaquin Valley – Tracy Subbasin No. 5-22.15
U.S.G.S. Quad. Bethany Quad. No. 463d

SE 1/4 SW ¼ Section 28, Township. 01S, Range. 04E MD SB H Base & Meridian

Description Piezometer constructed of 2" diameter PVC casing and perforated interval within a yellow, 8" square monument casing standing approximately 3 feet above ground surface. Locking lid with padlock (key available at Central District). Well is located on the left levee.

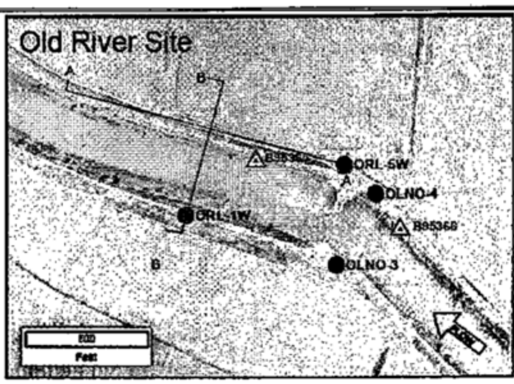
Survey Location, NAD83 CaSP Zone 3, feet: 2118970.8603 N, 6260429.3475 E

Reference Point description Black RP mark on well dock or slip cap at top of casing.

Which is 2.3 ft. Above/Below land surface. Ground Elevation 14.1 ft.
Reference Point Elev. 16.4 ft. Determined from DWR Survey Unit NAVD88
Well: Use Monitoring Condition Fair Depth 21 ft.
Casing, size 2 in., perforations 10-20 ft bgs

Measurement By: DWR [x] USGS [ ] USBR [ ] County [ ] Irr. Dist. [ ] Water Dist. [ ] Cons. Dist. [ ]
Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.
Type of Material Perm. Rating Thickness
Gravel Packed? Yes [x] No [ ] Depth to Top Gr. 8 ft Depth to Bot. Gr. 21 ft
Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.
Driller Layne-Christensen
Date drilled September 14, 2002 Log, filed no Open (1) Confidential (2)
Equipment: Pump, type Make
Serial No. Size of discharge pipe in.
Power, Kind Make
H.P. Motor Serial No.
Elec. Meter No. Transformer No.
Yield GPM Pumping level ft.

Water Analysis: Min. (1) San. (2) H.M.(3)
Water Levels Available: Yes (1) x No
Period of Record: Begin Feb. 21, 2006 End active
Collecting Agency California Department of Water Resources
Prod. Rec. (1) Pump Test (2) Yield (3)



REMARKS

This well is one of 4 wells at this site on Old River and one of 2 wells on the left/south side of the river. The wells were installed to monitor groundwater levels. The well is equipped with a data logger which records 15 minute groundwater levels. This data can be found on the internet in the DWR Water Data Library.

Recorded by: Mark Souverville
Date: 08/20/07

E068045

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

DRILL HOLE LOG

SHEET 1 of 2
HOLE NO. OLNO-3
ELEV. 14.0 (Survey) FEET
DEPTH 21.0 FEET

PROJECT Delta Facilities
FEATURE Fish Control Structure - Old River (DMC)
LOCATION N. 2,118,970.6 E. 6,260,429.5
CONTR. Layne Christensen DRILL RIG CME-850

DATE DRILLED 09/14/2005
ATTITUDE Vertical
LOGGED BY F. Nasirian
DEPTH TO WATER 20.5 9/14/05

DR- Standard Penetration Test
P- Push
B- Bag Sample
NS- No Sample
S- Shelby Tube
AD- Auger Drilling
PP- Pocket Penetrometer
SV- Shear Vane
*Installed Piezometer

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
0.0 (14.0)	ML/OL	EMBANKMENT 0.0 to 12.5' 0.0 to 5.0' Silt with Clay Layers, (ML/CL): About 50% silt and about 50% lean clay; micaceous; dry; brown.	Box 1	P 1.7/2.5	Began drilling using 8.25-inch augers.
			B-1	DR	2.3 to 4.0' Recovery- 0.6' 7/6/7 N= 13
			NS	AD	
5.0	ML	5.0 to 12.5' Silt, (ML): About 90% nonplastic fines; rapid dilatancy; about 10% low plasticity fines; micaceous; moist; brown.	Box 1	P 2.5/2.5	5.0 to 7.5' 500 psi
			B-2	DR	7.5 to 9.0' Recovery- 0.5' 4/3/5 N= 8
			NS	AD	
10.0 (4.0)		10.0 to 12.5' As above; wet. QUATERNARY ALLUVIUM 12.5 to 21.0'	Box 1	P 2.5/2.5	10.0 to 12.5' 500 psi
	OH	12.5 to 21.0' Organic Clay, (OL): About 95% light plasticity; medium to high toughness; about 5% nonplastic fines; slight micaceous; wet; grayish black to black.	B-3	DR	12.5 to 14.0' Recovery- 1.1' 3/2/3 N= 5 Tip contains peat.
			NS	AD	
15.0			Box 1	P	
16.0					

E068008

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
DRILL HOLE LOG

SHEET 2 of 2
HOLE NO. OLNO-3

PROJECT & FEATURE Delta Facilities - Fish Control Structure - Old River (DMC)

DEPTH (ELEV.)	LOG	FIELD CLASSIFICATION AND DESCRIPTION	SAMPLE NO.	MODE	REMARKS
16.0 17.0		QUATERNARY ALLUVIUM 12.5 to 21.0' 12.5 to 21.0' Organic Clay, (OH): (cont.)	Box 1	2.5 2.5	
	OH		B-4	DR	17.5 to 19.0' Recovery- 1.1' 4/4/6 N= 10
20.0 (-6.0)	▽ OH		NS	AD	
21.0 (-7.0)		Hole bottomed at 21.0' on 9/14/05.			Installed piezometer 2" Slotted PVC (10.0 to 20.0) 2" Solid PVC (0.0 to 10.0) #3 Sand (8.0 o 21.0) Bentonite Chips (6.5 to 8.0) 5% Cement and bentonite mix grout (0.0 to 6.5') Stick-up (2.3')

DWR 825 (2) (Rev. 9-84)

ZIM INDUSTRIES, INC.

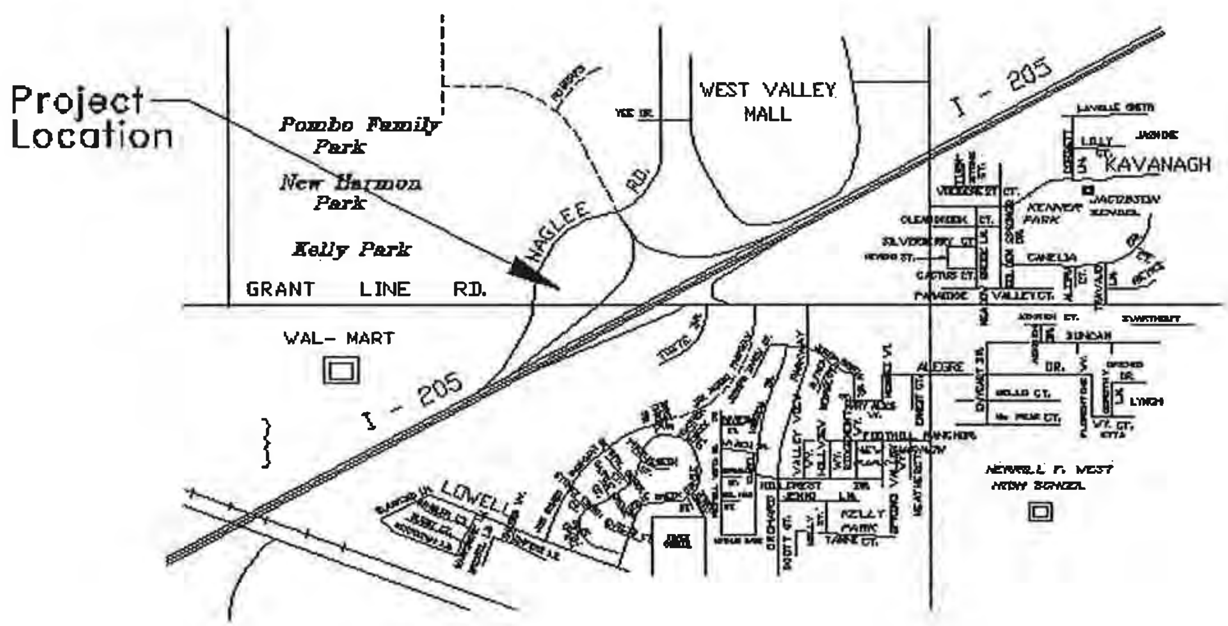
4545 E. Lincoln • Fresno, CA 93725

Fax Cover Sheet

To: Company:
Attention: Richard Slatz
Fax No: 916-852-6385
Date: 12-14-01
Subject: TRACY Park & Ride well

From: Sender: Brian Z.
# of Pages: 10
(including cover sheet)

Screen sections 1196-1176
1122-1014
982-966
796-774
754-738
678-656
636-610
598-550



Project Location
Pombo Family Park
New Harmon Park
Kelly Park
GRANT LINE RD.
NAGLEE RD.
WEST VALLEY MALL
I - 205
I - 205
WAL- MART
KAVANAGH
LOWELL

welenco

ELECTRIC LOG

FILING NO.

COMPANY ZIM INDUSTRIES INC.
WELL PARK & RIDE TEST WELL
FIELD CITY OF TRACY
COUNTY SAN JOAQUIN STATE CALIFORNIA
LOCATION: GRANT LINE ROAD & HWY 205
OTHER SERV: 6' LATERAL

JOB NO. 34326

SEC ____ TWP ____ RGE ____

Permanent Datum: G.L. Elev: ____ K.B. ____
Log Measured From G.L. Ft Above Perm Datum D.F. ____
Drilling Measured From G.L. G.L. ____

Date	OCT. 15, 2001	OCT. 15, 2001	
Run No.	TWO (E-LOG)	TWO (LATERAL)	
Depth - Driller	1240'	1240'	
Depth - Logger	1242'	1242'	
Btm. Log Inter.	1241'	1241'	
Top Log Inter.	50'	50'	
Casing-Driller	36" at 50'	36" at 50'	at
Casing-Logger	36" at 50'	36" at 50'	at
Bit Size	17.5"	17.5"	
Type Fluid In Hole	BENT/POLY.	BENT/POLY.	
Dens. | Visc.	N/A |	N/A |	|
pH | Fluid Loss	N/A | ml	N/A | ml	| ml
Source of Sample	PIT	PIT	
Rm at Meas.Temp	12.6 at 75 F	12.6 at 75 F	at F
Rmf at Meas.Temp	N/A at F	N/A at F	at F
Rmc at Meas.Temp	N/A at F	N/A at F	N/A at F
Source: Rmf Rmc	MEAS |	MEAS |	MEAS |
Rm at BHT	N/A at F	N/A at F	N/A at F
Time Since Circ.	N/A	N/A	
Max. Rec. Temp.	N/A F	N/A F	F
Equip | Location	L-22 | SNS	L-18 | SNS	|
Recorded By	SHARPLESS	SHARPLESS	
Witnessed By	K.WORSTER	K.WORSTER	

Fold Here — This Heading and Log Conform To API RP 31

Changes in Mud Type or Additional Samples

Date | Sample No.		
Depth-Driller		
Type Fluid in Hole		
Dens. | Visc.		
ph | Fluid Loss	ml	ml
Source of Sample		
Rm at Meas. Temp.	at F	at F
Rmf at Meas. Temp.	at F	at F
Rmc at Meas. Temp.	at F	at F
Source: Rmf | Rmc		
Rm at BHT	at F	at F
Rmf at BHT	at F	at F
Rmc at BHT	at F	at F

Scale Changes

Type Log	Depth	Scale Up Hole	Scale Down Hole

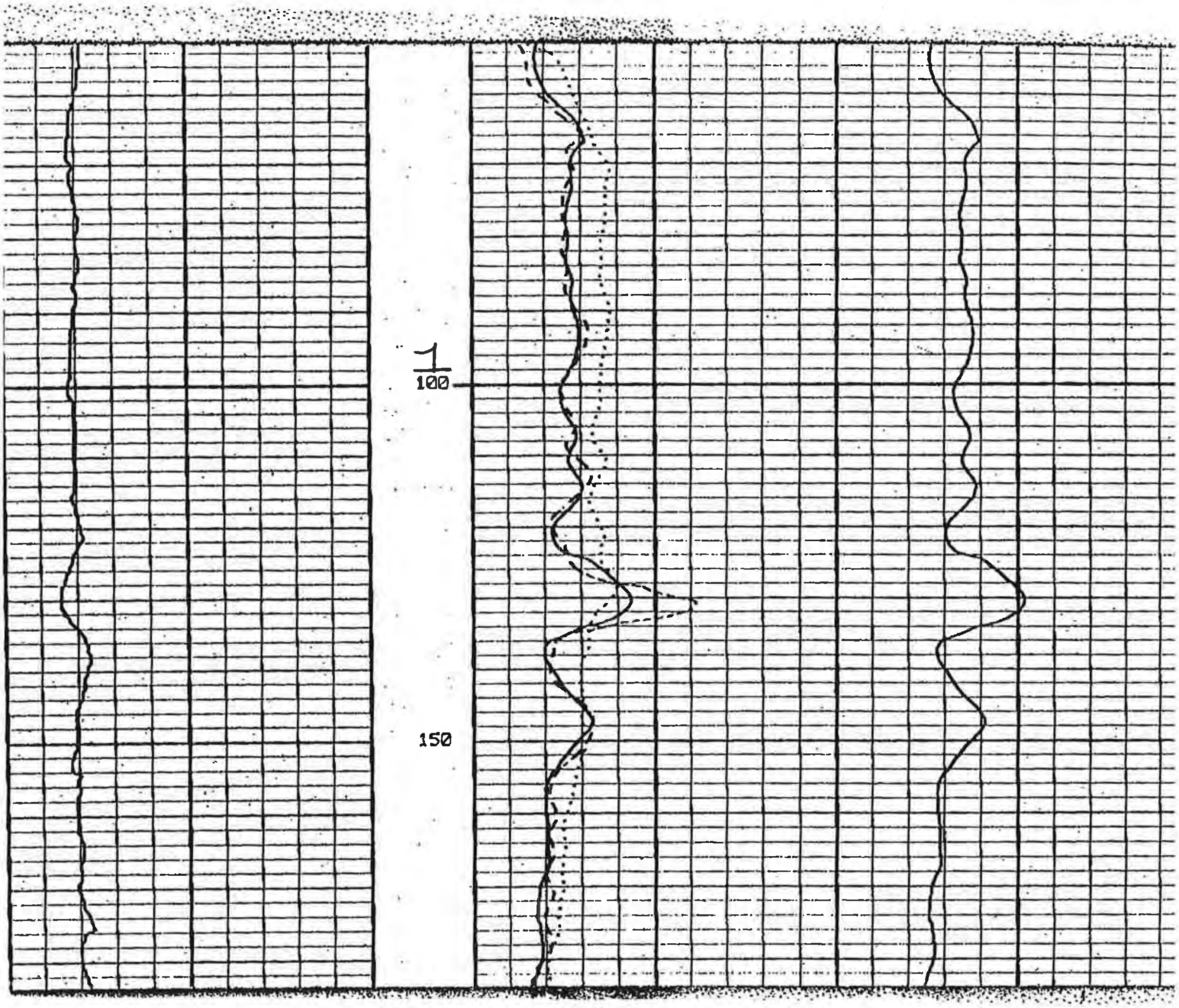
Equipment Data

Run No.	Tool Type	PadType	Tool Pos	Other
ONE	ELECTRIC		FREE	

REMARKS: WELL DRILLED BY ZIM INDUSTRIES, INC.

6' LATERAL SUPERIMPOSED OVER 16-64" NORMALS. PRESENTED AS A DASHED CURVE

SPONTANEOUS POTENTIAL millivolts	DEPTHS	RESISTIVITY ohmmeters2 /meter	RESISTANCE ohms
- |←5→| +		SHORT NORMAL 16 Inch: 0 — 50	
		x10 BACK UP: 0 — 500	
		LONG NORMAL 64 Inch: 0 — 50	SINGLE POINT Detail Curve
		x10 BACK UP: 0 — 500	



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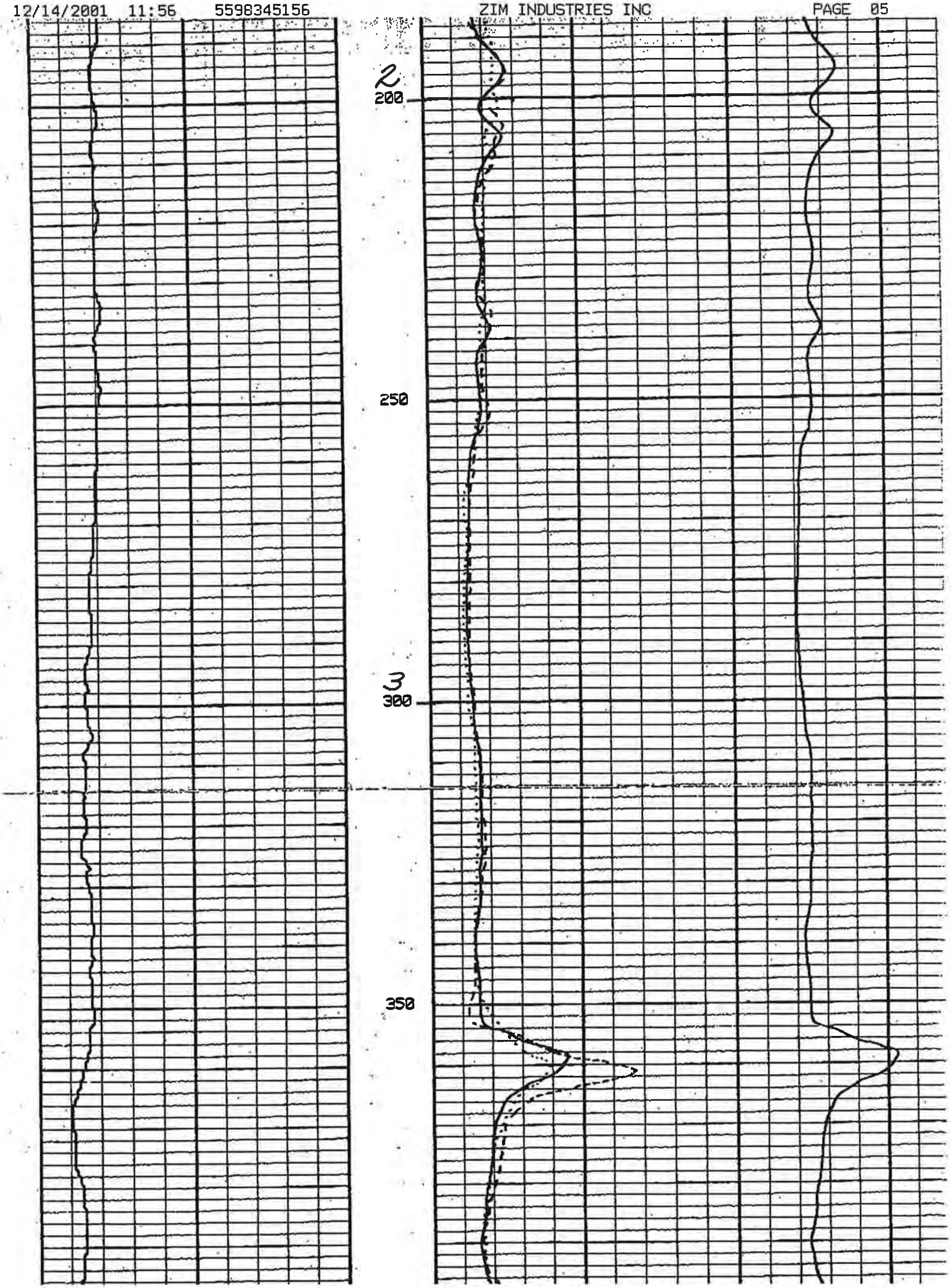
100
150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200
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3
300
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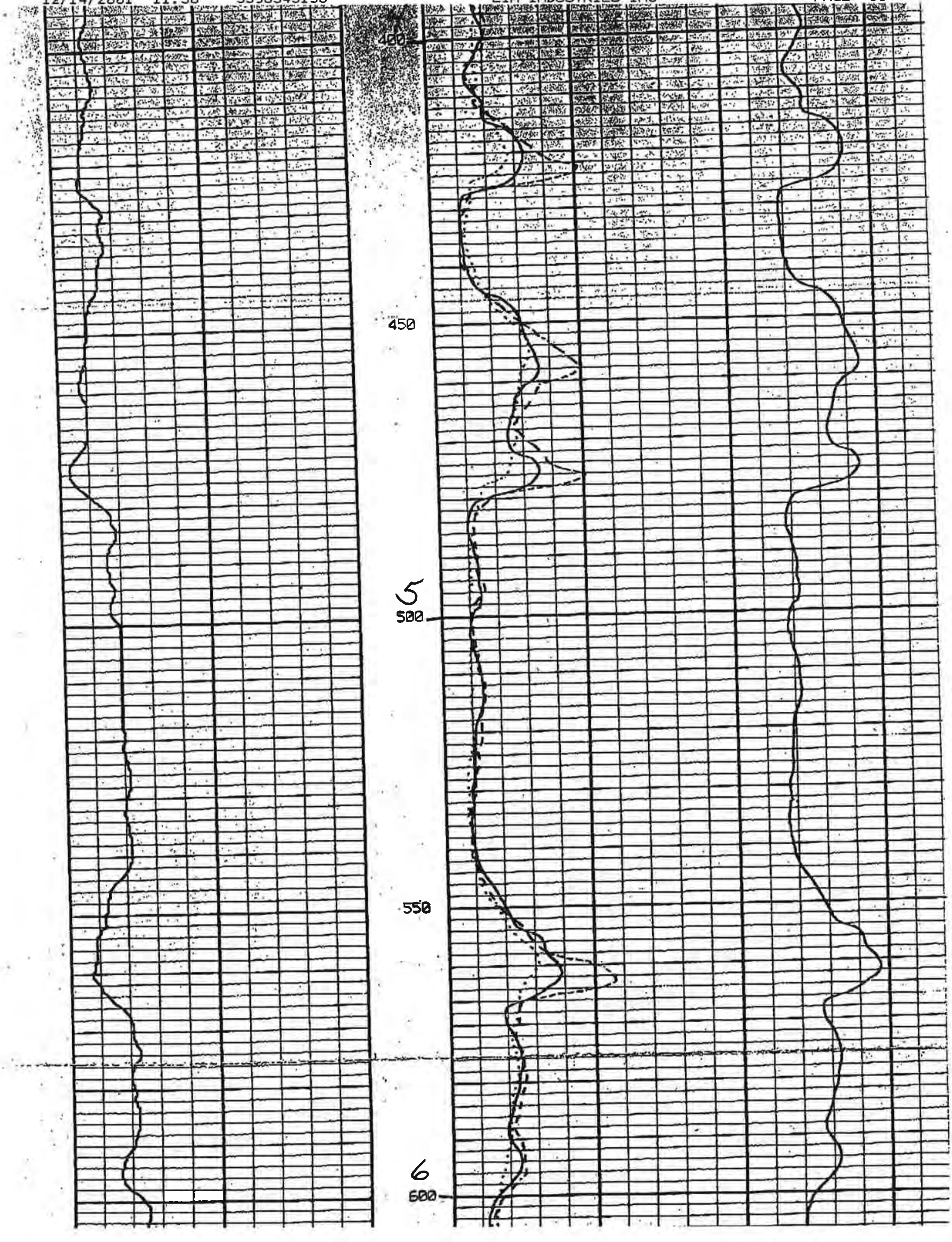
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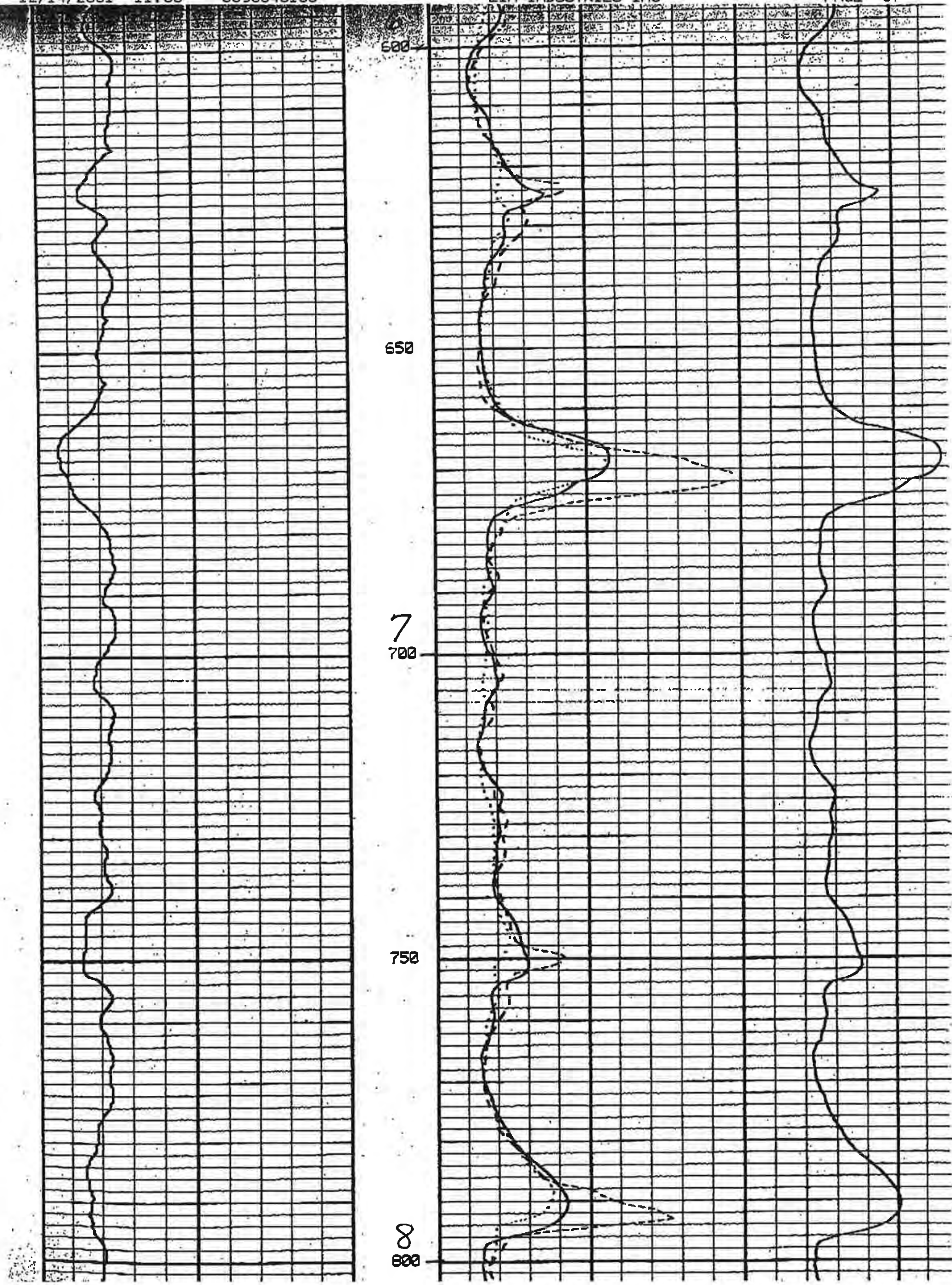
450
5
500
550
6
600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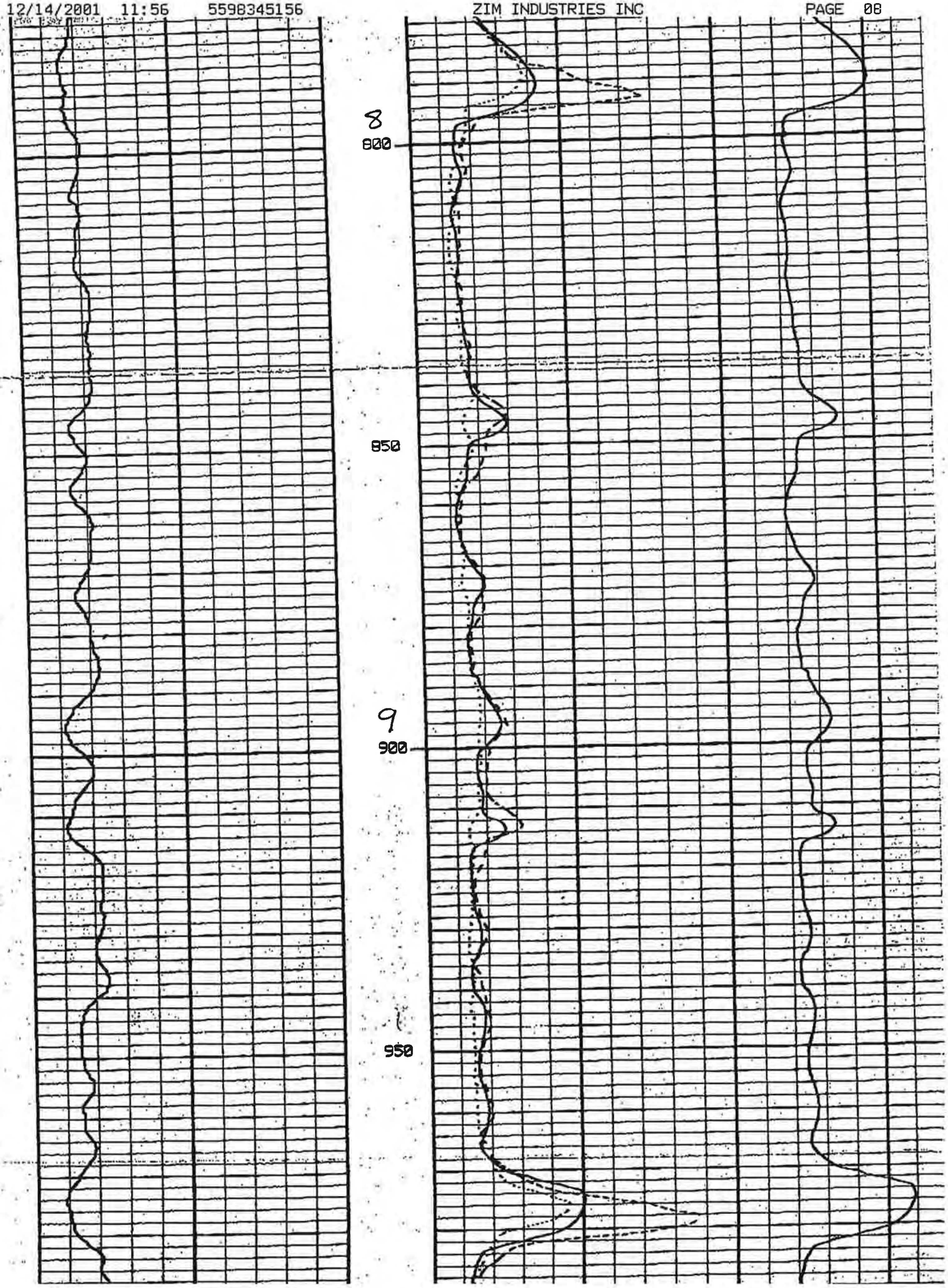
650
7
700
750
8
800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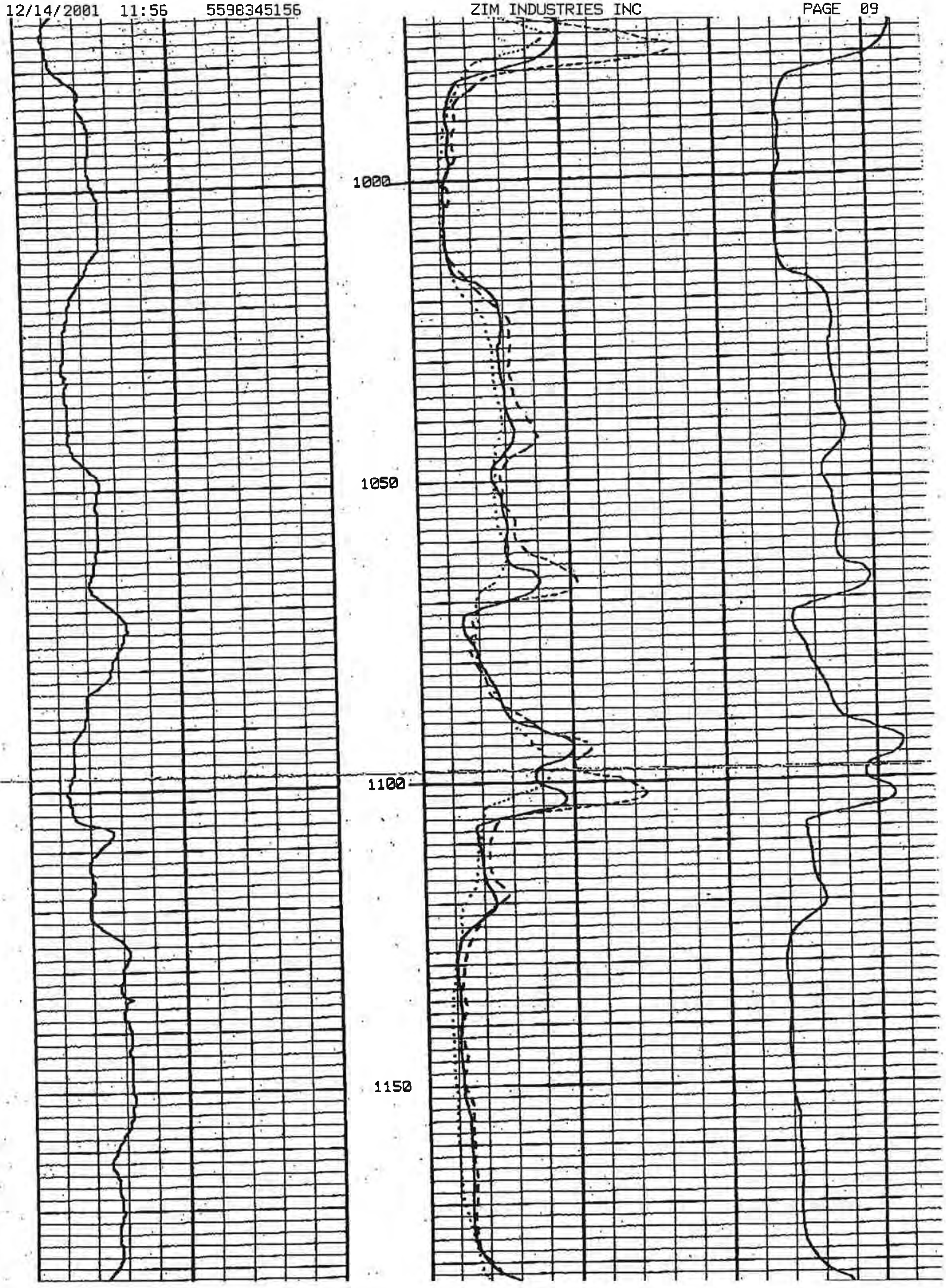
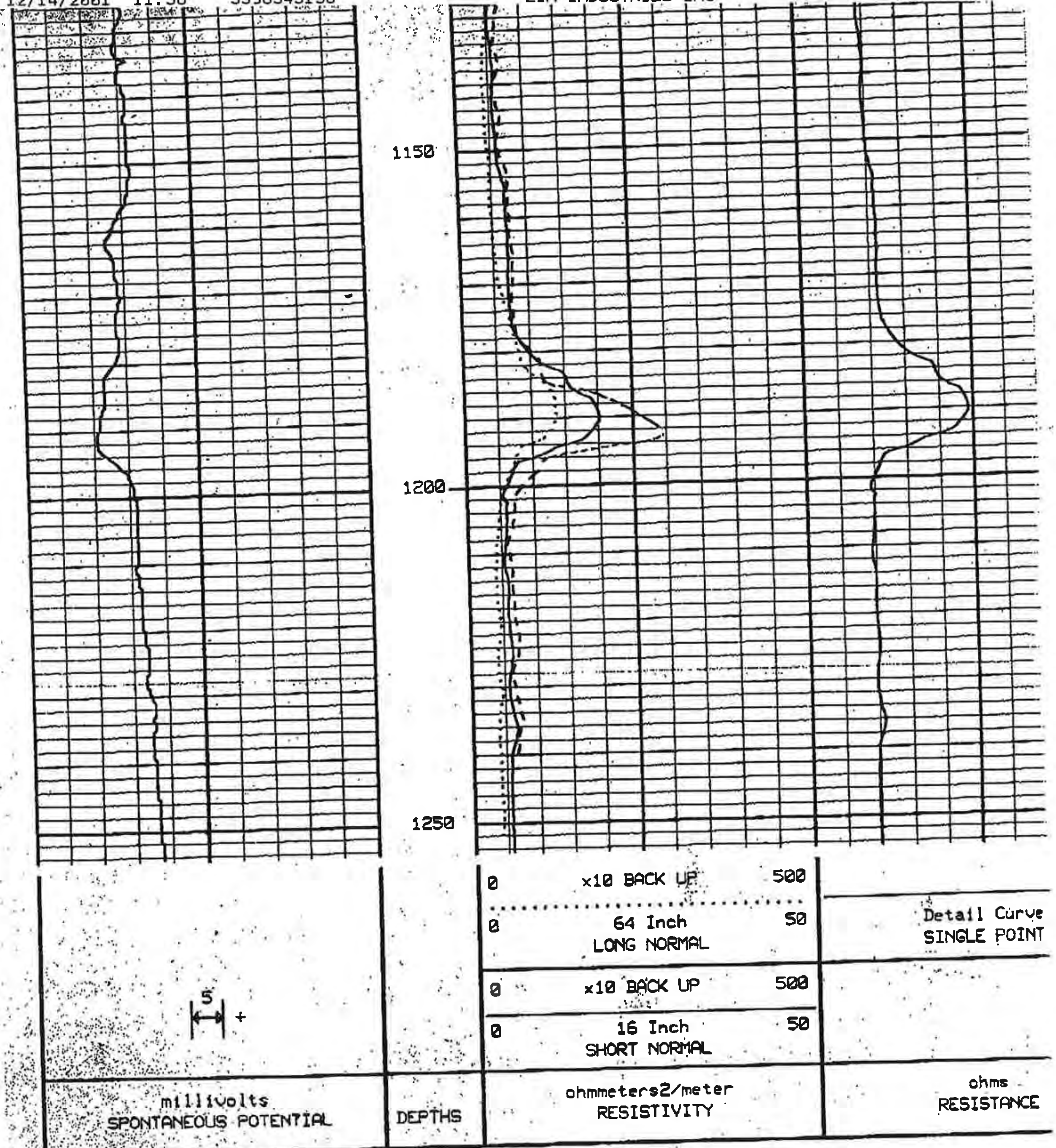
800
850
9
900
950


1000
1050
1100
1150


1150
1200
1250
0 x10 BACK UP 500
0 64 Inch LONG NORMAL 50
0 x10 BACK UP 500
0 16 Inch SHORT NORMAL 50
Detail Curve SINGLE POINT
5
+
millivolts
SPONTANEOUS POTENTIAL
DEPTHS
ohmmeters2/meter
RESISTIVITY
ohms
RESISTANCE

Geologic Section B-B’

ORIGINAL TEST HOLE ONLY
File with DWR

Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 547580

DWR USE ONLY — DO NOT FILL IN
0350 6E10 M
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. ____
Date Work Began 10/04/94, Ended 10/04/94
Local Permit Agency San Joaquin County Public Health
Permit No. 015107 Permit Date 07/22/94

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ____ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)
0	19	Clay
19	35	Blue & Grey Clay
35	45	Blue Sand w/ Clay Streaks
45	137	Blue & Grey Sand
137	150	Blue Clay

TOTAL DEPTH OF BORING 150 (Feet)
TOTAL DEPTH OF COMPLETED WELL ____ (Feet)

WELL OWNER

WELL LOCATION

Address 28864 Kasson Rd.
City Tracy
County San Joaquin
APN Book 241 Page 380 Parcel 002
Township 03S Range 06E Section 10
Latitude ____ NORTH (DEG. MIN. SEC.) Longitude ____ WEST (DEG. MIN. SEC.)

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
___ Irrigation
___ Industrial
X "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary FLUID Mud

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ____ (Ft.) & DATE MEASURED ____
ESTIMATED YIELD* ____ (GPM) & TEST TYPE ____
TEST LENGTH ____ (Hrs.) TOTAL DRAWDOWN ____ (Ft.)
* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Calwater Drilling Co., Inc. 911
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

300 S. Kilroy Turlock CA. 95380
ADDRESS CITY STATE ZIP

Signed [signature] 11/10/94 434218
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page ____ of ____

Owner's Well No. ________

Date Work Began May 16,1994 , Ended ________

Local Permit Agency San Joaquin Co. Health Dept.

Permit No. 2991 Permit Date ________

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 583000

DWR USE ONLY — DO NOT FILL IN

03S06E12J M

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER 11 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)
0	2	Top Soil
2	15	Clay
15	20	Blue Sand
20	55	Sand
55	65	Blue Sand
65	70	Blue Clay
70	76	Blue Sand
76	85	Clay
85	100	Sand
100	112	Gravel & Sand
112	115	Clay
115	122	Gravel & Sand
122	137	Blue Clay
137	171	Sand
171	175	Clay

TOTAL DEPTH OF BORING 175 (Feet)

TOTAL DEPTH OF COMPLETED WELL 155 (Feet)

WELL OWNER

WELL LOCATION

Address Airport Way

City Manteca

County San JOaquin

APN Book 241 Page 370 Parcel 012

Township 03S Range 06E Section 12 J

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY

X Domestic

___ Public

___ Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD Mud Rotary FLUID Bentonite/Water

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ________ (Ft.) & DATE MEASURED ________

ESTIMATED YIELD* ________ (GPM) & TEST TYPE ________

TEST LENGTH ____ (Hrs.) TOTAL DRAWDOWN ____ (Ft.)

** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL/GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	145	12	X				PVC	6"	160sch	
145	155	12		X			PVC	6"	160sch	Screen

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	115		X		
115	155			X	Sand/Gravel

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other ________

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME HENNINGS BROS. DRILLING CO, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

3525 PELANDALE AVE. MODESTO CA 95356
ADDRESS CITY STATE ZIP

Signed [signature] MAY 25,1994 290813
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0957331

DWR USE ONLY — DO NOT FILL IN
03S06E14
STATE WELL NO./STATION NO.
LATITUDE | LONGITUDE
APN/TRS/OTHER

Owner's Well No. DETERMINATION
Date Work Began 5/3/2010, Ended 5/5/2010
Local Permit Agency SAN JOAQUIN CO EHD
Permit No. SR0059837 Permit Date 4/28/2010

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID MUD

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	50	CLAY
50	58	SAND, CLAY STREAKS
58	72	BLUE CLAY
72	77	SAND, GRAVEL
77	110	BLUE/BROWN CLAY
110	181	SAND STREAKS, BLUE CLAY
181	192	POSSIBLE SAND
192	285	BLUE/BROWN CLAY
285	297	BROWN COARSE SAND
297	299	CLAY
299	307	COARSE SAND
307	320	CLAY

TOTAL DEPTH OF BORING 320 (Feet)
TOTAL DEPTH OF COMPLETED WELL 310 (Feet)

WELL OWNER

WELL LOCATION

Address 31710 S. DETERMINATION DRIVE
City TRACY CA 95376
County SAN JOAQUIN
APN Book 255 Page 340 Parcel 05
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

COPY OF PERMIT ATTACHED

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 84 (Ft.) & DATE MEASURED 5/5/2010
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	280	12 1/4"	✓				PLASTIC	8"	SDR26	
280	310	12 1/4"		✓			PLASTIC	8"	SDR26	.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	100		✓		
100	310				8X16 GRAVEL

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME CALWATER DRILLING CO., INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
300 S. Kilroy Rd. Turlock CA 95380
ADDRESS CITY STATE ZIP
Signed ___ WELL DRILLER/AUTHORIZED REPRESENTATIVE
05/06/10 DATE SIGNED
434218 C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Driller – PAT #09570331 — MIKWAY 513e 3:30 per Tammy

WELL/PUMP PERMIT

San Joaquin County Environmental Health Department — 600 East Main Street - Stockton CA 95202 - (209) 468-3420

NON-REFUNDABLE PERMIT — CALL (209) 953-7697 FOR INSPECTIONS — EXPIRES 1 YEAR FROM DATE ISSUED

SITE ADDRESS:

Job Address: 31780 Determination Dr — City/Zip: Tracy 95376

Cross Street: Durham Ferry — APN: 255-340-05 — Parcel Size: 40.96 — Land Use Application #

Owner Name

Owner Address

Contractor: Calvert Drilling — Phone: 667-7732

Contractor Address: 3?0 S. Kilroy — City/State/Zip: Turlock Ca 95380

Subcontractor — Phone

Subcontractor Address — City/State/Zip

License: ☑ C-57 ☐ C-61 ☐ D-09 ☐ Other — Number: 434218 — Expiration Date: 5/31/2011

Geographical Information: Coordinates X — Y — Township — Range — Section

Intended Use ☑ Domestic/Private ☐ Irrigation/Agricultural ☐ Industrial ☐ Water Quality Monitoring ☐ Soil Sampling/Characterization
☐ Public Water System (If different from Owner) — Water System Name — Contact Name or Phone Number

Type Of Work ☑ New Well ☐ Replacement Well ☐ Well Alteration/Modification ☐ Other
☐ Monitoring Well(s) # of wells ☐ Soil Boring(s) # of borings ☐ Geotechnical # of borings
☐ Out-Of-Service Well ☐ Out-Of-Service Well Renewal ☐ Cross-Connection Repair
☐ New Pump ☐ Pump Replacement ☐ Pump Repair ☐ Raise Well Casing

Well Construction
Drilling Method ☑ Mud Rotary ☐ Air Rotary ☐ Auger ☐ Cable Tool ☐ Push Point ☐ Other
Proposed Well Depth 200 ft Excavation 12 in diameter ☐ Open Bottom ☑ Gravel Pack/Gravel Size #6 in diameter
☐ Conductor Casing ___ in diameter / Conductor Casing Depth ___ ft
Well Casing Diameter 8 in. Thickness/Gauge/ASTM Sched 160 PSI ☐ Steel ☑ Plastic ☐ Stainless Steel ☐ Other
Grout Seal Depth 100 ft ☐ Neat Cement (94 lb bag/5-10 gal water) ☐ Sand Cement ___ sack mix/7 gal water
☑ Bentonite (20% solids) ☐ Other
Grout Placement Method ☑ Pumped ☐ Free Fall ☐ Other ☐ Retardant / Accelerator (name)

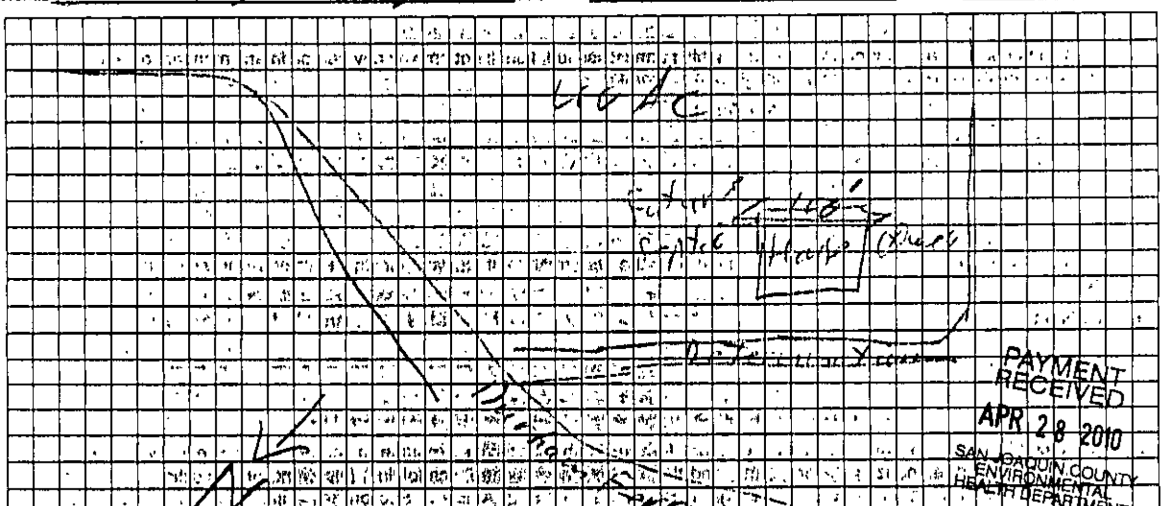
Pedestal Installed By ☐ Driller ☐ Pump Contractor ☑ Other
☐ Concrete Pedestal Dimensions: Width ft Length ft Thick in. ☐ Christy Box ☐ Stove Pipe

Pump ☐ Submersible ☐ Turbine ☐ Other — HP — Pump Set ft — Standing Water Level ft

I HEREBY CERTIFY THAT I HAVE PREPARED THIS APPLICATION AND THAT THE WORK WILL BE DONE IN ACCORDANCE WITH SAN JOAQUIN COUNTY ORDINANCES, STATE LAWS, AND RULES AND REGULATIONS. I ALSO CERTIFY THAT MY REQUIRED LICENSE IS CURRENT AND ACTIVE WITH THE CALIFORNIA CONTRACTORS STATE LICENSE BOARD AND THAT I AM IN COMPLIANCE WITH ALL WORKERS COMPENSATION LAWS.

MINIMUM 24 HOUR ADVANCE NOTICE REQUIRED FOR INSPECTIONS - PLEASE CALL (209) 953-7697

Signed — Title: W/ Agent — Date: 4-28-10



PAYMENT RECEIVED APR 28 2010 SAN JOAQUIN COUNTY ENVIRONMENTAL HEALTH DEPARTMENT

DEPARTMENT USE ONLY

Application Accepted By: MOL — Date: 4/28/10 — Area — Employee ID#: 4045

Grout Inspection By — Date — ☐ Special Well Permit

Pump Inspection By — Date — ☐ Waiver Received

Soil Boring Inspection By — Date — Constructed Well Depth ___ ft

Comments: WELL SITE NOT LOCATED IN THE FLOOD PLAIN

PE Codes	SC Info	Received By	Check#/ Cash	Amount Remitted	Date	Permit/ Service Request #	Invoice #	Well ID#
4366	780	LB	# 34247	$325.00	4/28/10	SR0059837		

EHD 43-06
8/26/09

WELL/PUMP PERMIT

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 141770

WM State Well No. 3S/6E-28F3

Other Well No. 3S/6E-28

Well #2

(2) LOCATION OF WELL:

County San Joaquin Owner's number, if any

Township, Range, and Section 33600 Koster Rd

Distance from cities, roads, railroads, etc.

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☒
Cable ☐
Other ☐

(6) CASING INSTALLED:

STEEL: OTHER:
SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	If gravel packed: From ft.	To ft.
0	330	16	1/4	26	0	730
330	331	16x12" reducer				
331	726	12"				

Size of shoe or well ring: Size of gravel: 5/16x1/8 Pea

Describe joint Weld

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
331	715	8	4.5	1/8 Std Louvre

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing ft.

(10) WELL TESTS: TO BE TESTED

Was pump test made? Yes ☐ No ☐ If yes, by whom?

Yield: gal./min. with ft. drawdown after hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☒ No ☐ If yes, attach copy

(11) WELL LOG:

Total depth 745 ft. Depth of completed well 726 ft.

Formation: *Describe by color, character, size of material, and structure*

0 ft. to 10 yellow clay ft.
10' - 39' Fine sand & clay
39' - 45' Yellow clay
45' - 65' Sand & Clay
65' - 72' Yellow clay
72' - 95' Gravel
95' - 100' Yellow clay
100' - 105' Gravel
105' - 111' Gravel & yellow clay
111' - 115' Gravel & some clay
115' - 120' Gravel
120' - 122' Gravel & clay
122' - 125' Yellow clay
125' - 145' Yellow clay & gravel
145' - 149' Gravel & clay
149' - 165' Yellow clay & shale
165' - 168' Yellow clay
168' - 170' Hard sand
170' - 185' Fine & coarse sand
185' - 193' Yellow clay
193' - 205' Yellow clay & gravel
205' - 216' Sandy yellow clay
216' - 230' Yellow clay & gravel
230' - 243' Sand & gravel
243' - 278' Light grey clay, shale & some gravel
278' - 319' Blue clay & shale
319' - 340' Fine sand, blue clay & shale
340' - 353' Fine & coarse sand, hard some clay
353' - 365' Yellow clay, some sand, strks blue clay
365' - 375' Yellow clay, some sand
375' - 381' Fine & coarse sand (hard)clay
381' - 400' Yellow clay & shale, some sand strks , blue clay
400' - 408' Yellow clay & sand
408' - 415' Fine & coarse sand (hard)

Work started 4/13 1977, Completed 4/29 1977

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Salinas Pump Co
(Person, firm, or corporation) (Typed or printed)

Address 1128 Madison Lane
Salinas, Ca. 93901

[SIGNED] [signature]
(Well Driller)

License No. 273053 Dated 5/4, 1977

SKETCH LOCATION OF WELL ON REVERSE SIDE CONTINUED ON BACK SIDE

DWR 188 (REV. 9-68) 8-72 30M TRIP OSP

14/770

WELL LOCATION SKETCH

NORTH BOUNDARY OF SECTION

NW ¼ | NE ¼ | ½ MILE

SW ¼ | SE ¼ | ½ MILE

½ MILE ½ MILE

A. Location of well in sectionized areas. Sketch roads, railroads, streams, or other features as necessary.

NORTH

WEST EAST

SOUTH

B. Location of well in areas not sectionized. Sketch roads, railroads, streams, or other features as necessary. Indicate distances.

Township 3 N/S

Range 6 E/W

Section No.

415'	- 425'	Fine & coarse sand & clay
425'	- 435'	Gravel & clay
435'	- 440'	Fine sand & clay
440'	- 443'	Gravel & fine sand
443'	- 455'	Gravel
455'	- 460'	Gravel & some sand
460'	- 470'	Gravel & clay
470'	- 476'	Clay & sand
476'	- 485'	Clay & gravel
485'	- 505'	Clay & some sand & gravel
505'	- 528'	Gravel & clay
528'	- 536'	Sand & clay
536'	- 550'	Gravel & clay
550'	- 565'	Sand & clay
565'	- 569'	Yellow clay, sand & st blue shale
569'	- 575'	Fine coarse sand & cla
575'	- 595'	Yellow clay & sand
595'	- 605'	Sand & clay
605'	- 613'	Clay & sand, strks blu shale
613'	- 617'	Sand & clay
617'	- 619'	Yellow clay
619'	- 645'	Yellow clay, sand, str blue shale
645'	- 647'	Yellow clay & sand
647'	- 656'	Sand (hard)
656'	- 679'	Yellow clay, sand, str blue shale
679'	- 692'	Fine & coarse sand (Ha strks)
692'	- 715'	Yellow clay, sand & st blue shale
715'	- 745'	Yellow clay & some san

8

ORIGINAL
File with DWR
Page 1 of 2
Owner's Well No.
Date Work Began July 2,1992 Ended July 6, 1992
Local Permit Agency San JOaquin Co. Health Dept.
Permit No. 92-2375 Permit Date

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 488341

DWR USE ONLY — DO NOT FILL IN
04S06E05Q M
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DEPTH TO FIRST WATER 146 (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)
0	2	Top Soil
2	19	Gravel
19	20	Clay Streak
20	70	Gravel
70	89	Clay
89	114	Clay & Gravel
114	119	Gravel
119	121	Clay
121	122	Gravel
122	125	Clay
125	145	Gravel
145	150	Clay
150	153	Gravel
153	169	Clay
169	180	Gravel
180	182	Clay
182	185	Gravel
185	200	Clay
200	204	Gravel
204	261	Clay
261	290	Gravel
290	295	Clay
295	301	Gravel
301	314	Clay & Gravel
314	332	Gravel
332	333	Clay
333	339	Gravel
339	343	Clay
343	375	Gravel
375	382	Clay

TOTAL DEPTH OF BORING 510' (Feet)
TOTAL DEPTH OF COMPLETED WELL 510' (Feet)

WELL OWNER

WELL LOCATION

Address 37437 S. Koster Rd.
City Tracy
County San Joaquin
APN Book 265 Page 090 Parcel 006
Township 04S Range 06E Section 05 Q/R
Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH
WEST EAST
SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
X Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Reverse FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL DEVELOPING TO BE DONE BY (Ft.) & DATE MEASURED HOWK SYSTEMS
ESTIMATED YIELD* ___ (GPM) & TEST TYPE
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	295	24"	X				STEEL	14"	¼"ga	
295	505	24"		X			"	14"	¼"ga	Reg.Perf.
505	510	24"	X				"	14"	¼"ga	
0	120					X	PVC	4"	80ga	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	100	X			
100	510			X	Birdseye Gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME HENNINGS BROS. DRILLING CO., INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
3525 PELANDALE AVE. MODESTO CA 95356
ADDRESS CITY STATE ZIP
Signed [signature] JULY 30,1992 290813
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR
Page 2 of 2
Owner's Well No. ____
Date Work Began ____, Ended ____
Local Permit Agency ____
Permit No. ____ Permit Date ____

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 488341

DWR USE ONLY — DO NOT FILL IN
045O6E05Q M
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ____ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
382	399	Gravel
399	414	Clay
414	440	Gravel
440	451	Clay
451	456	Gravel
456	462	Clay
462	463	Gravel
463	468	Clay
468	470	Gravel
470	480	Clay
480	491	Gravel
491	495	Clay
495	499	Gravel
499	507	Clay
507	510	Gravel

TOTAL DEPTH OF BORING ____ (Feet)
TOTAL DEPTH OF COMPLETED WELL ____ (Feet)

WELL OWNER

Name ____
Mailing Address ____
CITY ____ STATE ____ ZIP ____

WELL LOCATION

Address ____
City ____
County ____
APN Book 265 Page 090 Parcel 006
or
Township 04S Range 06E Section 05
or
Latitude ____ DEG. MIN. SEC. NORTH Longitude ____ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH
WEST EAST
SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
___ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD ____ FLUID ____

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ____ (Ft.) & DATE MEASURED ____
ESTIMATED YIELD* ____ (GPM) & TEST TYPE ____
TEST LENGTH ____ (Hrs.) TOTAL DRAWDOWN ____ (Ft.)
** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME ____
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS ____ CITY ____ STATE ____ ZIP ____

Signed ____
WELL DRILLER/AUTHORIZED REPRESENTATIVE ____ DATE SIGNED ____ C-57 LICENSE NUMBER ____

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Geologic Section C-C’

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW-16

Date Work Began 4-17-95, Ended 5-2-95

Local Permit Agency San Joaquin Public Health Services

Permit No. 5716 Permit Date 4-10-95

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 453726

DWR USE ONLY — DO NOT FILL IN

02S06E20H M

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	See Geologic Log

TOTAL DEPTH OF BORING 90 (Feet)

TOTAL DEPTH OF COMPLETED WELL 85 (Feet)

WELL OWNER

WELL LOCATION

Address 23500 Kasson Rd.

City Tracy

County San Joaquin

APN Book 239 Page 120 Parcel 001

or Township 02S Range 06E Section 20H

or Latitude ___ NORTH Longitude ___ WEST

DEG. MIN. SEC. DEG. MIN. SEC.

LOCATION SKETCH

NORTH

See Site Map

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
- ___ Deepen
- ___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

X MONITORING

WATER SUPPLY
- ___ Domestic
- ___ Public
- ___ Irrigation
- ___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD Direct Rotory FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE: BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60	14.75	x				PVC	8	Sch 80	
60	85	"		x			"	"	"	.020

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	55	x			
55	90				8x16

ATTACHMENTS (✓)

- X Geologic Log
- ___ Well Construction Diagram
- ___ Geophysical Log(s)
- ___ Soil/Water Chemical Analyses
- X Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Layne-Western Co. 147
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

275 County Rd. 98 Woodland Ca. 95695
ADDRESS CITY STATE ZIP

Signed [signature] 5-20-96 510011
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

453726

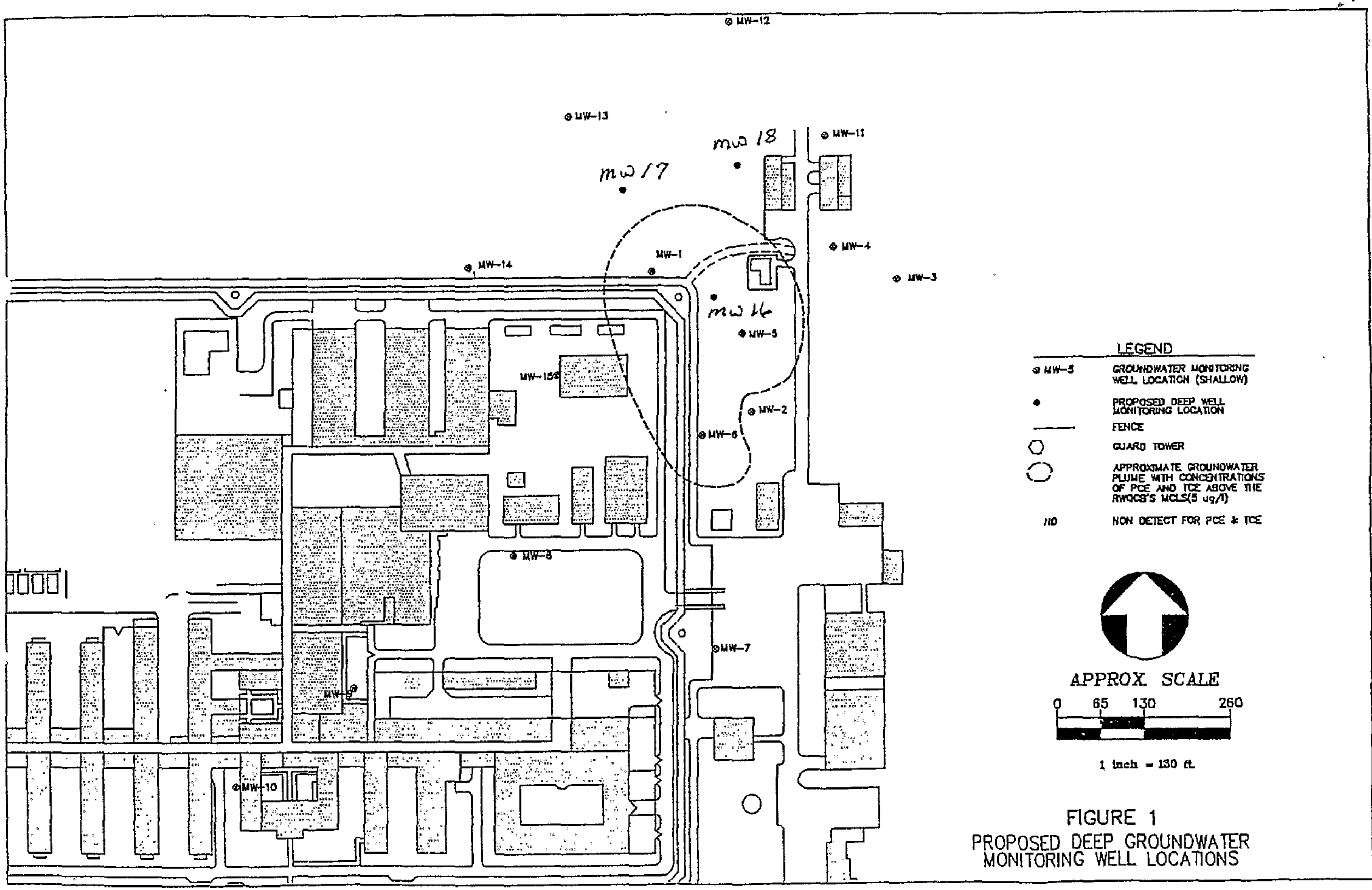


FIGURE 1
PROPOSED DEEP GROUNDWATER MONITORING WELL LOCATIONS

453726

02506E20H

BORING LOG

Project Name:		Project Number: 4034.02	
Soil Boring ☐	Monitoring Well ☒	Boring/Well Number: MW-16	Sheet 1 of 3

Boring Location: SEE FIGURE 1		Elevation and Datum:	
Drilling Contractor: LAYNE	Driller: MARK PEARSON	Date Started: 4/17/95	Date Finished: 5/2/95
Drilling Equipment: FAILING 1500	Borehole Diameter: 14 3/4	Completed Depth (feet): 85	Water Depth (feet):
Sampling Method: California Modified ☐ Shelby Tube ☐ Split Spoon ☐		WELL CONSTRUCTION	
Drilling Fluid: MUD (BENTONITE)		Type and Diameter of Well Casing: 8-INCH SCHED. 80 PVC	
Backfill Material: CEMENT GROUT		Slot Size: 0.02"	Filter Material: #3 "MONTEREY
Logged By: P. NOVELLY	Checked By: S. ANDERSON	Development Method: BAILING-DEVEL. RIG	

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
		SOIL AT SURFACE							
	SC	CLAYEY SAND, BROWN, DRY, FINE, MINOR SILTY CLAY							OVM READING 0 PPM IN BREATHING ZONE
5		INCREASED SILTY CLAY							
10	SP	SAND, BROWN, WET, FINE, MICACEOUS, INTERBEDDED SILTY CLAY (0-2 FEET THICK)							
15									
20		BECOMING SILTY MINOR MEDIUM TO COARSE SAND							OVM READING 0 PPM IN BREATHING ZONE
25									
30									

453726

02506E20H

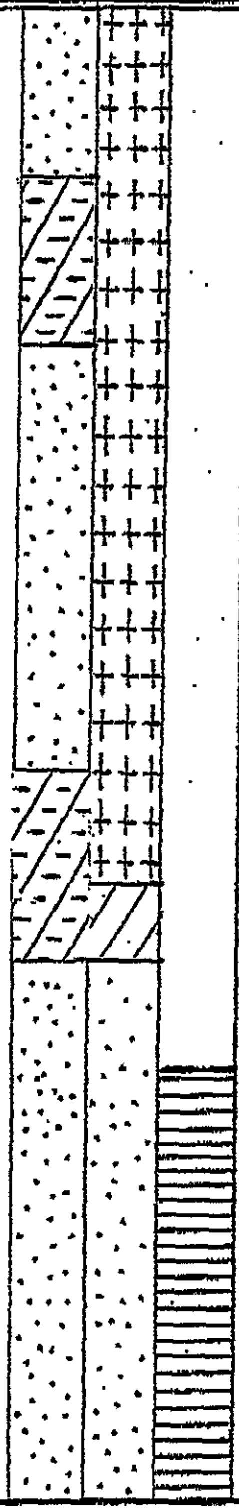
BORING LOG

Project Name: ______ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-16 Sheet 2 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID/FID Readings	Remarks
	SP	SAND, BROWN, WET, FINE, MICACEOUS MINOR SILTY CLAY				OVM READING 0 PPM IN BREATHING ZONE
35	CL	SILTY CLAY, BROWN, WET, FIRM				
40	SP	SAND, BROWN, WET, FINE TO VERY FINE				
45		BECOMING TAN, FINE TO MEDIUM, SILTY				
50	CL	SILTY CLAY, BROWN, WET, STIFF				OVM READING 0 PPM IN BREATHING ZONE
55	SP	SAND, TAN TO GRAY, WET, MEDIUM TO COARSE				
60						
65						
70						

Graphic Log: Lithology, Annulus, Casing



453726

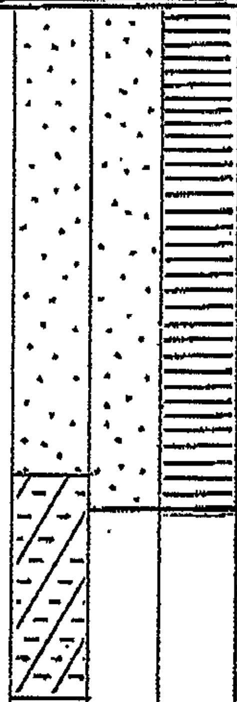
02506E20H

BORING LOG

Project Name ____________ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-16 Sheet 3 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
	SP	SAND, TAN TO GRAY, WET, MEDIUM TO COARSE							OVM READING 0 PPM IN BREATHING ZONE
75		BECOMING SILTY							75 TO 80 FEET FAST DRILLING- GOOD SAND UNIT
80									
	CL	SILTY CLAY, BLUE GRAY, WET, FIRM							
85									
90									
95									
100									



ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW-17

Date Work Began 4-18-95, Ended 4-27-95

Local Permit Agency San Joaquia Public Health Services

Permit No. 5716 Permit Date 4-10-95

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 453724

DWR USE ONLY — DO NOT FILL IN

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STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	See Geologic Log

TOTAL DEPTH OF BORING 85 (Feet)

TOTAL DEPTH OF COMPLETED WELL 80 (Feet)

WELL LOCATION

Address 23500 Kesson Rd.

City Tracy

County San Joaquin

APN Book 239 Page 120 Parcel 001

Township 02S Range 06E Section 20

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

See Site Map

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

X MONITORING

WATER SUPPLY

___ Domestic

___ Public

___ Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD Direct Rotory FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE: BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60	12.25	X				PVC	5	Sch 80	
60	80	"		X			"	"	"	.020

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	55	X			
55	85				8X16

ATTACHMENTS (✓)

X Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

X Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Layne-Western Co. 147
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

275 County Rd. 98 Woodland Ca. 95695
ADDRESS CITY STATE ZIP

Signed [signature] 5-20-96 510011
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

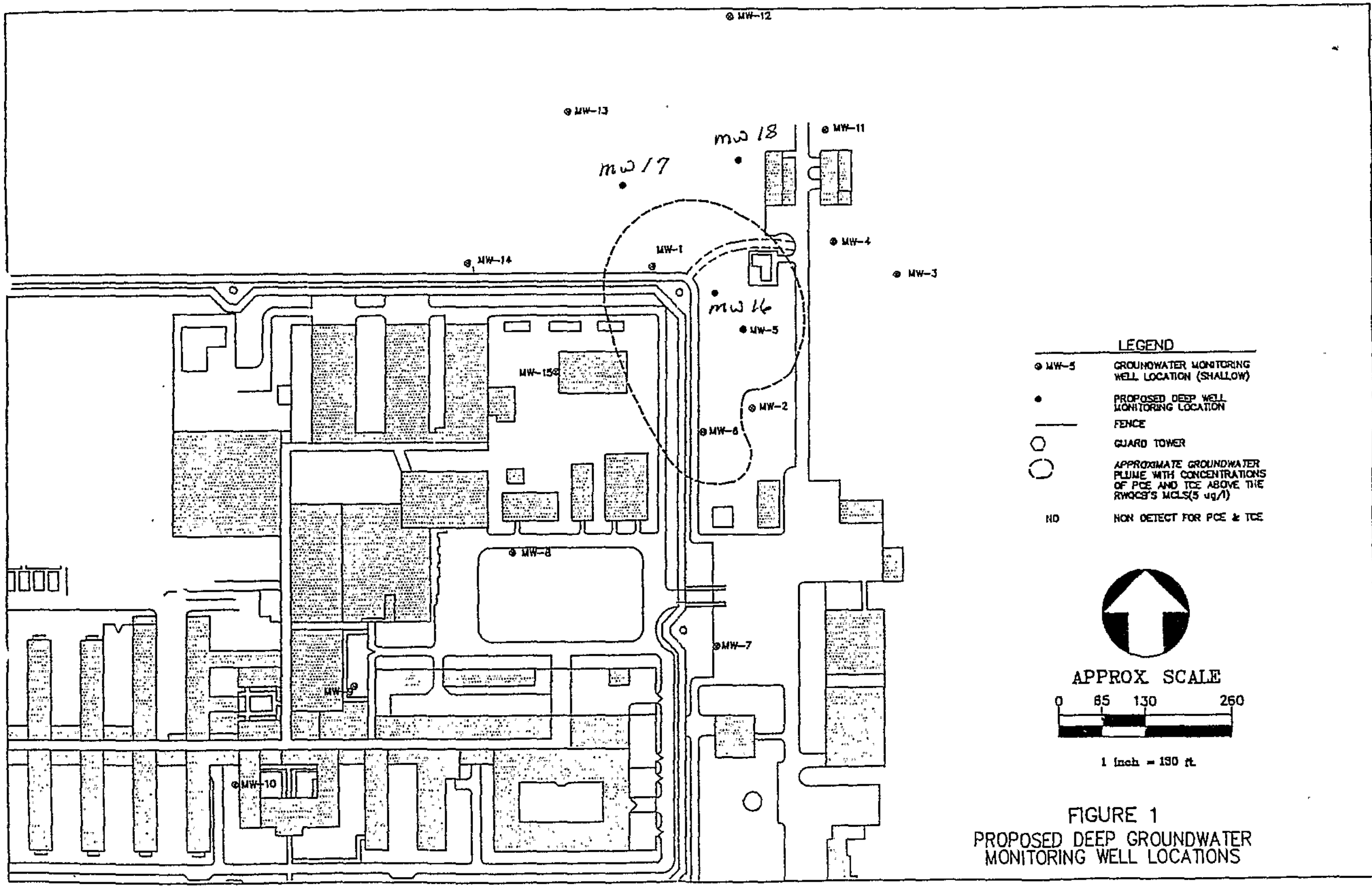

FIGURE 1
PROPOSED DEEP GROUNDWATER MONITORING WELL LOCATIONS

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BORING LOG

Project Name: Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-17 Sheet 1 of 3

Boring Location: SEE FIGURE 1	Elevation and Datum:
Drilling Contractor: LAYNE — Driller: MARK PEARSON	Date Started: 4/18/95. — Date Finished: 4/27/95
Drilling Equipment: FAILING 1500 — Borehole Diameter: 12¼"	Completed Depth (feet) 80 — Water Depth (feet)
Sampling Method: California Modified ☐ Shelby Tube ☐ Split Spoon ☐	WELL CONSTRUCTION
Drilling Fluid: MUD - BENTONITE	Type and Diameter of Well Casing: 5 INCH SCHED. 80 PVC
Backfill Material: CEMENT GROUT	Slot Size: 0.02" — Filter Material: #3 MONTEREY
Logged By: P. NOVELLY — Checked By: S. ANDERSON	Development Method: BAILING-DEVEL. RIG

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
		SOIL AT SURFACE							
0	CL	SILTY CLAY, BROWN, SLIGHTLY MOIST, FIRM							OVM READING 0 PPM IN BREATHING ZONE
5		MINOR SAND							
10	SP	SAND, BROWN, WET, FINE, MICACEOUS, INTERBEDDED THIN CLAY UNITS							
15									
20									OVM READING 0 PPM IN BREATHING ZONE
25									
30									

453724

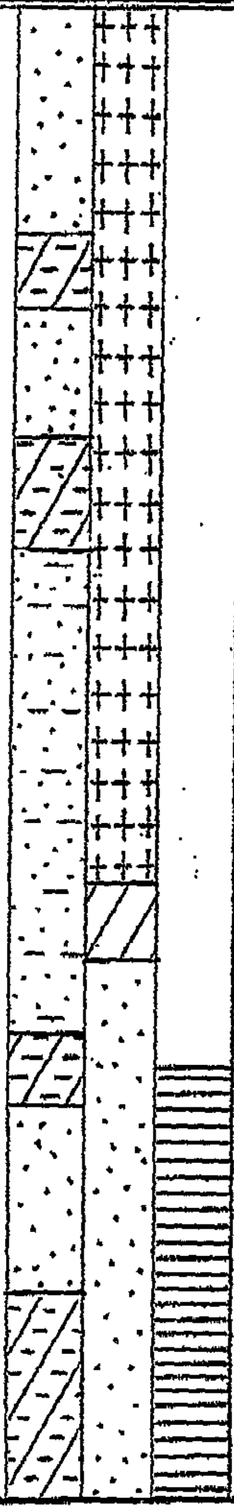
02906E20H

BORING LOG

Project Name: ______ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-17 Sheet 2 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology / Annulus / Casing	PID/FID Readings	Remarks
	SP	SAND, BROWN, WET, FINE, MINOR SILTY CLAY					OVM READING 0 PPM IN BREATHING ZONE
35							
	CL	SILTY CLAY, BROWN, WET, FIRM					
40	SP	SAND, BROWN, WET, FINE, MINOR SILTY CLAY					
	CL	SILTY CLAY, BROWN, WET, FIRM, MINOR FINE SAND					
45							
	SM	SILTY SAND, TAN, WET, FINE TO MEDIUM					
50							OVM READING 0 PPM IN BREATHING ZONE
55							
60	CL	SILTY CLAY, BROWN, WET, FIRM					
	SP	SAND, TAN, WET, FINE, MINOR SILT					
65							
	CL	SILTY CLAY, GRAY, WET, FIRM MINOR FINE SAND					
70							



453734

02506E20H

BORING LOG

Project Name: ______________ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-17 Sheet 3 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
	SM	SILTY SAND, TAN TO GRAY, WET, FINE TO MEDIUM, MICACEOUS; MINOR CLAY							OVM READING 0 PPM IN BREATHING ZONE
75									
80	CL	SILTY CLAY, GRAY, WET, FIRM							
85									
90									
95									
100									

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW-18

Date Work Began 4-19-95 , Ended 4-25-95

Local Permit Agency San Joaquin Public Health Services

Permit No. 5716 Permit Date 4-10-95

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 453725

DWR USE ONLY — DO NOT FILL IN

02S06E20H M

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	See Geologic Log

TOTAL DEPTH OF BORING 85 (Feet)

TOTAL DEPTH OF COMPLETED WELL 80 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address 23500 Kasson Rd.

City Tracy

County San Joaquin

APN Book 239 Page 120 Parcel 001

Township 02S Range 06E Section 20

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

See Site Map

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

X MONITORING

WATER SUPPLY
___ Domestic
___ Public
___ Irrigation
___ Industrial

___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Direct Rotory FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60	12.25	X				PVC	~~12.25~~ 5"	Sch80	
60	80	"		X			"	5"	"	.020

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	55	X			
55	85				8x16

ATTACHMENTS (✓)

X Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Layne-Western Co. 147
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

275 County Rd. 98 Woodland Ca. 95695
ADDRESS CITY STATE ZIP

Signed [signature] 5-20-96 510011
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

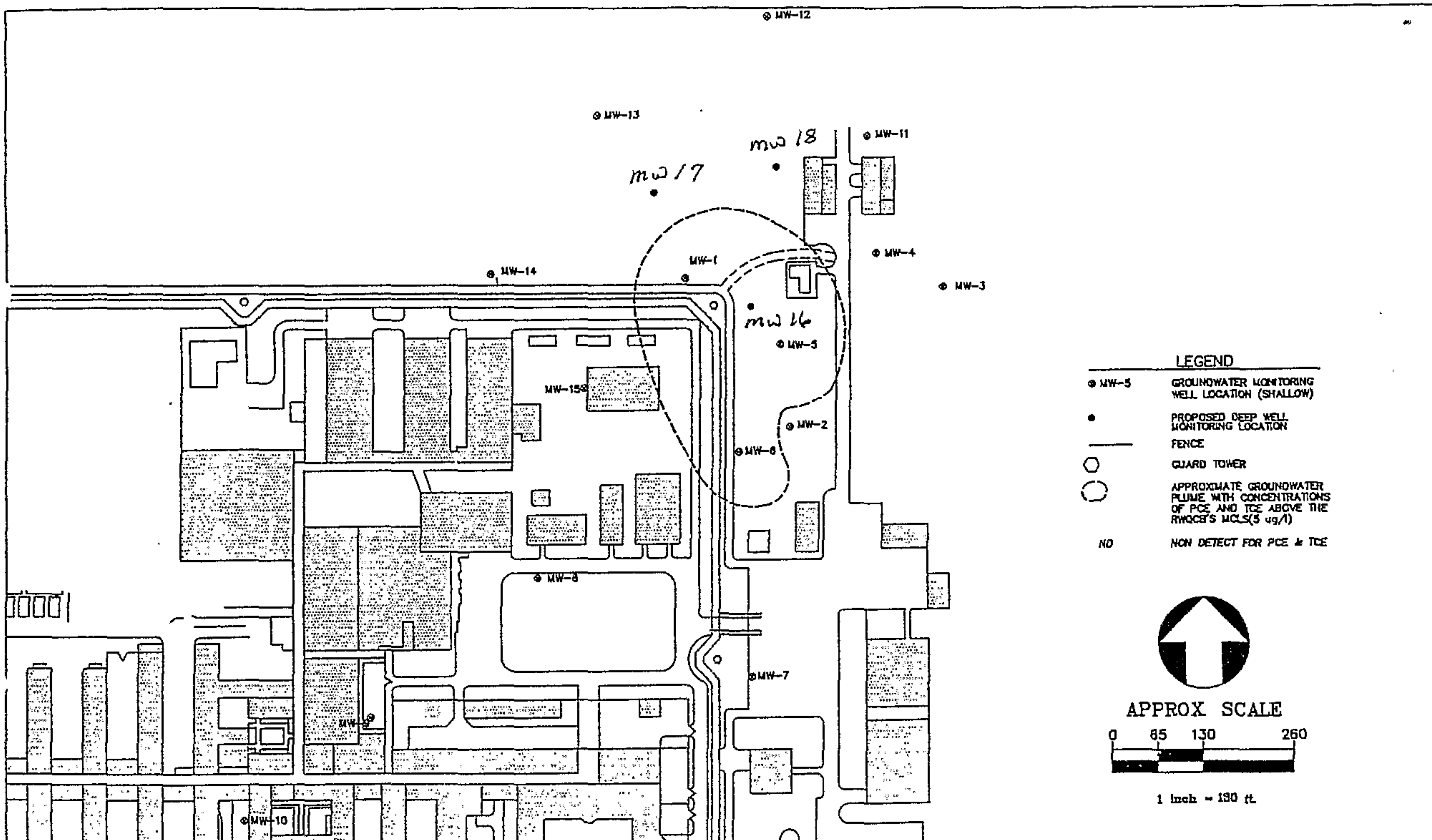


FIGURE 1
PROPOSED DEEP GROUNDWATER MONITORING WELL LOCATIONS

453725

BORING LOG   02S06E20H

Project Name: Project Number: 4034.02

Soil Boring ☐   Monitoring Well ☒   Boring/Well Number: MW-18   Sheet 1 of 3

Boring Location: SEE FIGURE 1		Elevation and Datum:	
Drilling Contractor: LAYNE	Driller: MARK PEARSON	Date Started: 4/19/95	Date Finished: 4/25/95
Drilling Equipment: FAILING 1500	Borehole Diameter: 12½"	Completed Depth (feet) 80	Water Depth (feet)
Sampling Method: California Modified ☐ Shelby Tube ☐ Split Spoon ☐		WELL CONSTRUCTION	
Drilling Fluid: MUD-BENTONITE		Type and Diameter of Well Casing: 5-INCH SCHED. 80 PVC	
Backfill Material: CEMENT GROUT		Slot Size: 0.02"	Filter Material: #3 MONTEREY
Logged By: P. NOVELLY	Checked By: S. ANDERSON	Development Method: BAILING - DEVEL. RIG	

Depth (feet)	USG Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
		SOIL AT SURFACE							
0	SM	SILTY SAND, BROWN, FINE, SLIGHTLY MOIST, INTERBEDDED CLAY LAYERS							OVM READING 0 PPM IN BREATHING ZONE
5									
10	SP	SAND, BROWN, FINE TO VERY FINE, SLIGHTLY MOIST, MICACEOUS, MINOR CLAY.							
15									
18									OVM READING 0 PPM IN BREATHING ZONE
20									
25									
30									

95 3725

BORING LOG

02906E20H

Project Name: ________ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-18 Sheet 2 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
	SM	SILTY SAND, BROWN, WET, FINE INTERBEDDED CLAY UNITS							OVM READING 0 PPM IN BREATHING ZONE
35									
40									
45		BECOMING TAN, FINE TO MEDIUM							
50									OVM READING 0 PPM IN BREATHING ZONE
55									
		THIN SILTY CLAY LAYERS							
60									
	CL	SILTY CLAY, BROWN, WET, FIRM							
65	SP	SAND, TAN, WET, FINE, MINOR SILT							
70									

06-08-1995 11:03AM RUACON CORP.

County

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0330007

Page 1 of 1

Owner's Well Number

Date Work Began 08/15/2016 Date Work Ended 11/4/2016

Local Permit Agency San Joaquin County Environmental Health Dept.

Permit Number SR0073695 Permit Date 11/18/15

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Reverse Rotary Drilling Fluid Water

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	20	Sand
20	26	Clay
26	30	Sand
30	282	Clay
282	295	Sand
295	301	Clay
301	319	Sand
319	342	Clay
342	357	Sand
357	360	Clay
360	402	Sand
402	412	Clay
412	427	Sand
427	464	Clay
464	480	Sand
480	605	Clay

Total Depth of Boring 605 Feet

Total Depth of Completed Well 480 Feet

Well Location

Address 26200 S Bird Rd

City Tracy County San Joaquin

Latitude Deg. Min. Sec. N Longitude Deg. Min. Sec. W

Datum Dec. Lat. Dec. Long.

APN Book 239 Page 190 Parcel 05

Township Range Section

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North / West / East / South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply
☐ Domestic ☐ Public
☑ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 96 (Feet) Date Measured 11/04/2016

Estimated Yield * 1,340 (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	280	26	Blank	Mild Steel	.25	16		
280	440	26	Ful-Flo	Mild Steel	.25	16		0.090
440	480	26	Modi Perf	Mild Steel	.25	16		0.090
0	50	36	Conductor	Mild Steel	.25	30		

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	50	Cement	10.3 Sack
50	480	filter pack	No.6 Sand pack

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Hennings Bros. Drilling Co., Inc.
Person, Firm or Corporation

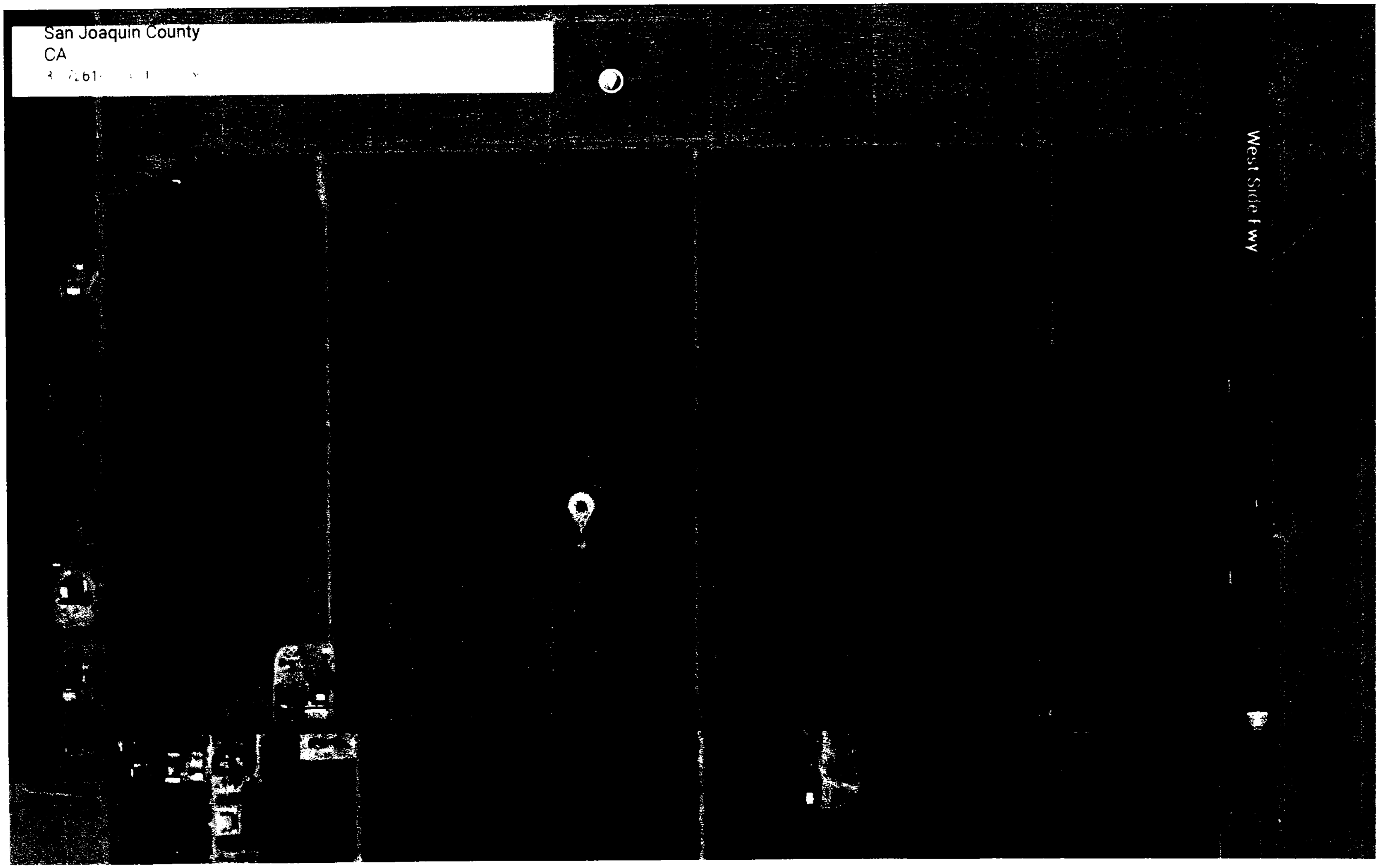
1930 Ladd Rd Modesto CA 95356
Address City State Zip

Signed [signature] 11-28-16 290813
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

N ↑



*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0088570

DWR Use Only – Do Not Fill In	
03S05E04	State Well Number/Site Number
N	W
Latitude	Longitude
	APN/TRS/Other

Page 1 of 1

Owner's Well Number TW-2

Date Work Began 02/11/2009 Date Work Ended 2/12/2009

Local Permit Agency San Joaquin County Environmental Health Department

Permit Number 056428 Permit Date 1/30/09

Geologic Log

Orientation ⦿ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Hollow Stem Auger Drilling Fluid

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
		Destruction off 2-in monitoring well TW- 2 with Hollow Stem Augers. Over-drill monitoring well with 8-inch augers to the original installation depth: 70 feet bgs, plus an additional foot to a total depth of 71 feet bgs. Then remove casing rods and PVC well casing and screen and auger flights. Tremie grout boring with neat cement grout to the ground surface using Portland Type II cement with 5% bentonite. Mixture ratio of (1) 94 -lbs bag of cement to 5-6 gallons water. Soil derived cuttings will be sampled and stockpiled in a secured roll-off bin onsite, pending laboratory results, for proper profiling and disposal offsite.

Total Depth of Boring 71-ft bgs Feet

Total Depth of Completed Well 0 Feet

Well Owner

Well Location

Address 400 W Gandy Dancer Drive

City Tracy County San Joaquin

Latitude 37 Deg. 42 Min. 18 Sec. N Longitude 121 Deg. 25 Min. 57 Sec. W

Datum NAD83 Decimal Lat. 6291934.04 Decimal Long. 2080629.9

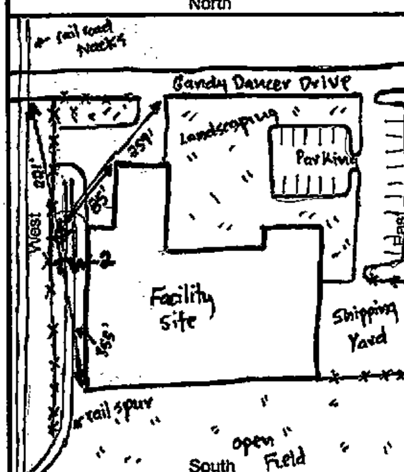
APN Book 248 Page 03 Parcel 02

Township T3S Range R5E Section 4 MDBM

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North



South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

○ New Well
○ Modification/Repair
○ Deepen
○ Other
⦿ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
⦿ Other Post Monitoring

Water Level and Yield of Completed Well

Depth to first water ______ (Feet below surface)

Depth to Static Water Level ______ (Feet) Date Measured ______

Estimated Yield * ______ (GPM) Test Type ______

Test Length ______ (Hours) Total Drawdown ______ (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	71	Cement	Neat Cement: Portland Type II w/ 5% bentonite (Mix: 94-lb bag to 5-6 gallons water)

Attachments

☑ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☑ Other Site Map

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name RSI Drilling
Person, Firm or Corporation

220 N East Street Woodland CA 95776
Address City State Zip

Signed ______ 5/22/09 802334
C-57 Licensed Water Well Contractor Date Signed C-57 License Number

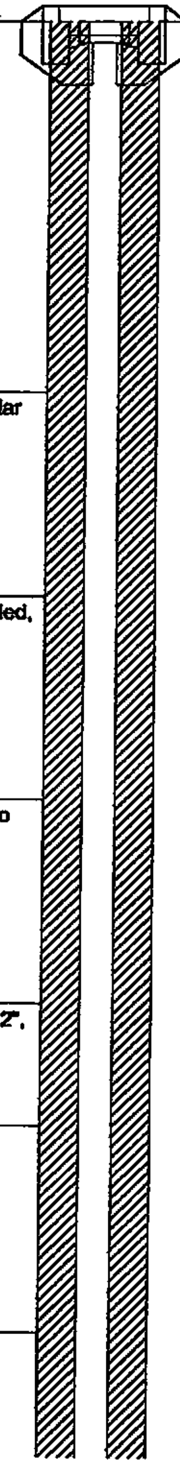
DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

e0088570

Monitoring Well TW-2

DEPTH IN FEET	TYPE OF SAMPLER	RESISTANCE (blows per foot)	PID READING (parts per million)	SYMBOL	DESCRIPTION
0				GP	GRAY SANDY GRAVEL, dry, compacted at top [FILL]
10	CA	11 13 18		SP	BROWN GRAVELLY COARSE TO MEDIUM SAND, moist, gravels subangular to subrounded, up to 2", dense
15	CA	37 37 50		GM	BROWN SANDY GRAVEL with trace silt, gravels up to 2.5", mainly subrounded, moist
20	CA	15 26 50		SP	BROWN MEDIUM TO COARSE SAND with limestone cobble lens at 19.75' to 20', moist to wet sand, trace silt, cobbles subrounded to rounded
25	CA	10 22 31		GP	BROWN FINE TO COARSE GRAVEL, with coarse sand, trace cobbles up to 2", moist, cobbles subrounded to subangular, limestone, quartz
30	CA	28 30 38		SP	BROWN FINE TO COARSE SAND with trace fine gravel and gray limestone cobbles at 29', moist to wet sand, very dense
35	CA	11 5		ML	BROWN SILT with fine sand, trace medium to coarse sand, angular to subangular, moist to wet, slight mottling with light brown



Continued Next Page

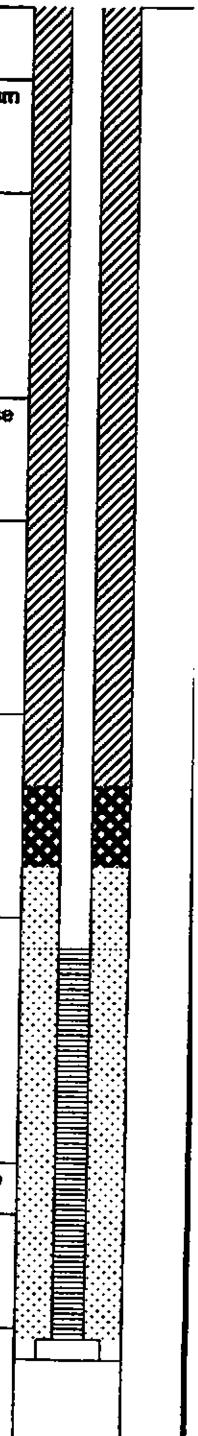
Log of Boring

Job No: 10000117.00000 Serial No.:		
Date Completed: 11/14/02 Boring Depth: 70.0 ft.	Driller: Gregg Drilling Logged By: Steve McKnight Drilling Method: HSA	Location: Tracy, CA
Top of Casing Elev: 0 ft. Casing Depth: 68.0 ft.	Casing Type: Sch 40 PVC Casing Diam: 2.0 in. Screened Interval: 58-68 ft. Effective Interval: 68-68 ft.	Slot Size: 0.020 in. Sand Pack: 2/12 Lonestar

w088570

Monitoring Well TW-2

DEPTH IN FEET	TYPE OF SAMPLER	RESISTANCE (blows per foot)	PID READING (parts per million)	SYMBOL	DESCRIPTION
35		6			
	CA	21 28 22		SP	DARK BROWN MEDIUM TO FINE SAND with trace subangular quartz, medium to coarse gravel, moist, no odor, no fines, dense
40				CL	BROWN SILTY CLAYwith trace fine sand, moist, soft
	CA	9 10 14			
45				CL	BROWN SILTY CLAY with trace fine sand, moist, soft, trace subangular, coarse quartz sand, stiff, less moist, medium stiff
	CA	21 55 32		GP	BROWN SANDY COARSE GRAVEL with some cobbles, moist, no fines, subangular, no odor
50				CL	BROWN SILTY CLAY, medium stiff, less moist
	CA	14 10 23			
55				SP	BROWN GRAVELLY SAND with gravel up to 2", gravel broken, moist to wet, dense
	CA	20 23 26			
60					
	CA	15 17 22		GP	GRAY SANDY FINE GRAVEL with silt, trace coarse travel, gravel subangular to subrounded, wet
65				SP	DARK BROWN MEDIUM SAND with coarse sand to fine gravel, wet, loose, no fines
	CA	40 50		GP	BROWN SANDY GRAVEL with large cobbles (4") at 69.5', wet loose, trace silt
70					End of Borehole at 70 ft. Setting well screen from 68 ft. to 58 ft.

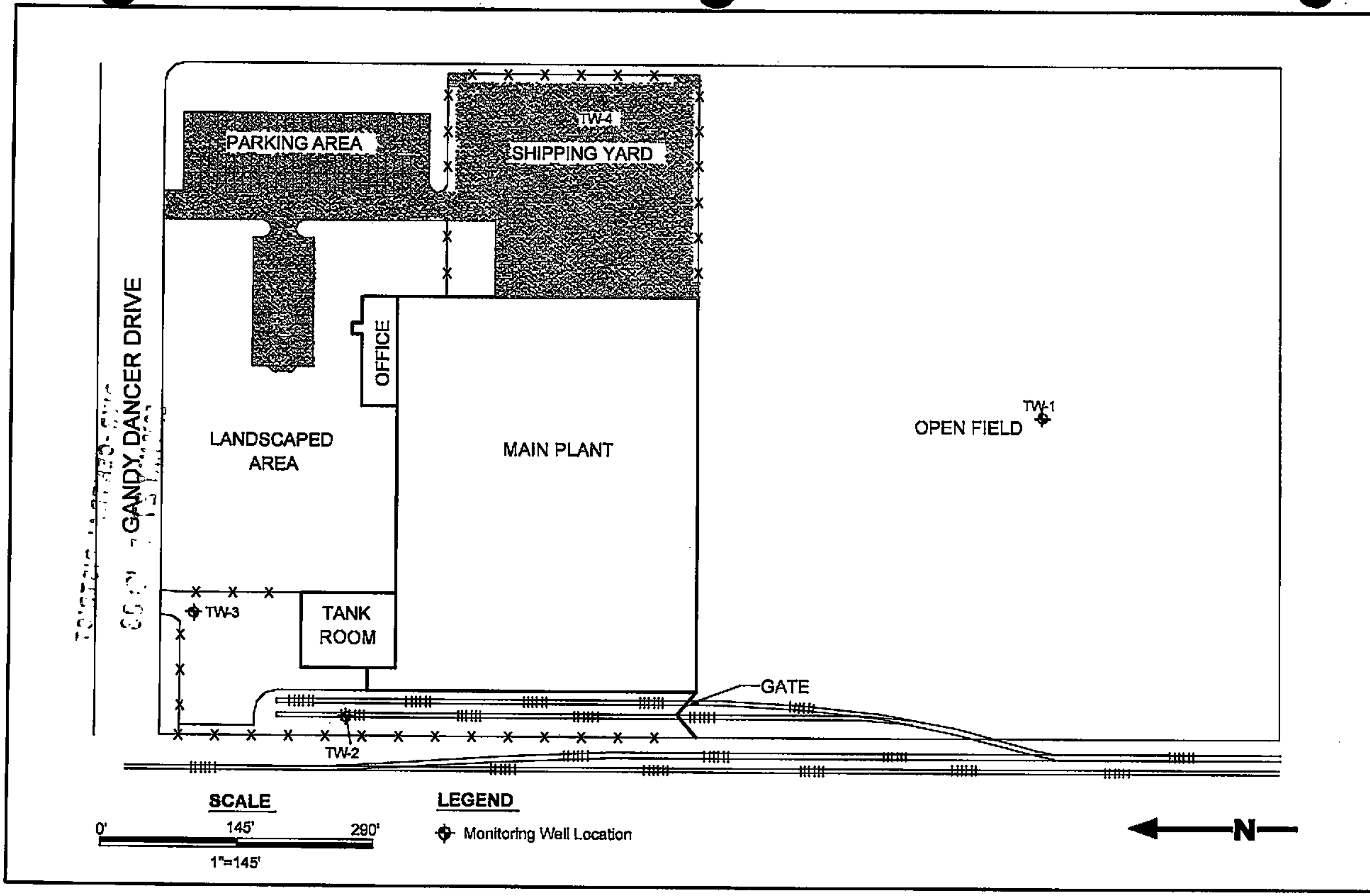


Job No: 10000117.00000
Pt. ID: CELOTEX.GPJ / TW-2

URS

Log of Boring

Log Template: 14AW



MONITORING WELL LOCATIONS

March 2003
10000117.00000

Subsurface Investigation
Tracy, California

URS

Figure 4-2

V:\Union Carbide\Celotex\Figure4-2.dwg

ORIGINAL
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
CONTROL BOARD No. 5
(Insert appropriate number)

WATER WELL DRILLERS REPORT
(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

LOCATION NOT CHECKED
Do Not Fill In
Nº 24181
State Well No.
Other Well No. 3S/[illegible] 0B2

) OWNER:

(2) LOCATION OF WELL:
County San Joaquin Owner's number, if any— yr 1956
R. F. D. or Street No. 1320 FT S of Linne Rd on E/S of Corral Hollow Rd

(3) TYPE OF WORK (*check*):
New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (*check*):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☒
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☒ DOUBLE ☐

From ft.	to ft.	Diam. (in.)	Gage or Wall
0	309	16	1/4
309	784	12	1/4

If gravel packed

Diameter of Bore	from ft.	to ft.
30"	0	314
26"	314	784

Type and size of shoe or well ring none
Size of gravel: 1/4 x 1/2
Describe joint buttweld

(7) PERFORATIONS:
Type of perforator used Factory saw slot
Size of perforations 2½ in., length, by 1/8 in.

From ft.	to ft.	Perf. per row	Rows per ft.
174	198	15	45
294	305	"	"
309	348	"	"
373	390	"	"
442	489	"	"

Continued

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☒ No To what depth ft.
Were any strata sealed against pollution? ☐ Yes ☒ No If yes, note depth of strata
From ft. to ft.
Method of Sealing

(9) WATER LEVELS:
Depth at which water was first found not available ft.
Standing level before perforating " " ft.
Standing level after perforating " " ft.

(10) WELL TESTS:
Was a pump test made? ☒ Yes ☐ No If yes, by whom? driller
Yield: 2000 gal./min. with P.L. 182 ft. drawdown after 79 hrs.
Temperature of water Was a chemical analysis made? ☐ Yes ☒ No
Was electric log made of well? ☐ Yes ☒ No

(11) WELL LOG:
Total depth 784 ft. Depth of completed well 784 ft.
Formation: *Describe by color, character, size of material, and structure.*

From ft.	to ft.	Formation
0	1	Top Soil
1	10	Sandy Clay
10	13	Sand & Boulders
13	36	Sand & Gravel
36	42	Yellow Clay
42	57	Gravel & Boulders
57	74	Sandy Clay & Gravel
74	82	Gravel
82	85	Sandy Clay
85	110	Gravel
110	116	Sandy Clay
116	117	Boulders
117	122	Boulders & Gravel
122	151	Brown Sandy Clay & Boulders
151	172	Yellow Clay
172	177	Gravel
177	212	Yellow Clay
212	245	Gray Clay
245	269	Clay
269	277	Dry Clay
277	297	Blue Clay
297	317	Gravel
317	342	Blue Clay & Gravel
342	348	Gravel
348	375	Yellow Clay & Gravel
375	387	Hard Dry Clay
387	397	Sandy Clay
397	439	Soft Yellow Clay
439	449	Gravel
449	451	Cemented Gravel
451	465	Gravel
465	477	Clay & Gravel
477	487	Gravel
487	504	Clay
504	537	Clay & Gravel
537	539	Boulders
539	553	Gravel
553	563	Cemented Gravel
563	583	Cemented Clay & Gravel (Hard)
583	600	Gravel
600	608	Hard Clay & Gravel
608	620	Clay & Gravel

Continued

CONFIDENTIAL Section 7076.1, Water Code

Work started Sept. 3, 1956. Completed Oct. 26, 1956

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME WESTERN WELL DRILLING CO., LTD.
(Person, firm, or corporation) *(Typed or printed)*
Address P. O. Box 47
San Jose, Calif.
[SIGNED] [signature]
Well Driller
License No. R-59381 Dated Nov. 6, 1956

95689 3-54 50M QUIN SPO
DWR FORM NO. 246 (REV. 3.54)

24181

3/5E-8

(11) WELL LOG (CONT'D)

620 ft	to	626 ft		Gravel
626 "	"	635 "		Clay & Gravel
635 "	"	638 "		Cemented Gravel
638 "	"	651 "		Sandy Clay & Gravel
651 "	"	660 "		Cemented Gravel
660 "	"	706 "		Yellow Sticky Clay & Gravel
706 "	"	726 "		Sand
726 "	"	734 "		Sticky Clay
734 "	"	744 "		Clay
744 "	"	777 "		Clay & Gravel
777 "	"	784 "		Clay & Boulders

(7) PERFORATIONS (CONT'D)

533	to	555'	15 per row	rows 45/per ft
579	"	626'		
646	"	665'		
705	"	724'		
744	"	764'		

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. 2

Date Work Began 8/17/2004 Ended 8/19/2004

Local Permit Agency SAN JOAQUIN CO EHD

Permit No. 38926 Permit Date 7/26/2004

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 1095328

DWR USE ONLY — DO NOT FILL IN

0135056111

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID MUD

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	10	CLAY
10	24	GRAVEL
24	27	BROWN CLAY
27	65	GRAVEL
65	100	RED CLAY
100	110	GRAVEL
110	133	RED CLAY
133	138	GRAVEL
138	160	RED CLAY
160	170	GARVEL
170	187	RED CLAY
187	192	GRAVEL
192	198	RED CLAY
198	203	GRAVEL
203	208	RED CLAY
208	216	GRAVEL
216	221	RED CLAY
221	228	GRAVEL
228	240	RED CLAY
240	253	GRAVEL
253	290	RED CLAY

TOTAL DEPTH OF BORING 290 (Feet)

TOTAL DEPTH OF COMPLETED WELL 255 (Feet)

WELL OWNER

WELL LOCATION

Address 29400 S CHRISMAN RD

City TRACY CA 95376

County SAN JOAQUIN

APN Book 253 Page 230 Parcel 02

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST

COPY OF PERMIT ATTACHED

EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
— Deepen
— Other (Specify)

— DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 54 (Ft.) BELOW SURFACE 1

DEPTH OF STATIC WATER LEVEL 54 (Ft.) & DATE MEASURED 8/19/2004

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	235	12	✓				PLASTIC	6	SDR26	
235	255	12		✓			PLASTIC	6	SDR26	.058

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	100		✓		
100	255				6X16 GRAVEL

ATTACHMENTS (✓)

Geologic Log
— Well Construction Diagram
— Geophysical Log(s)
— Soil/Water Chemical Analysis
— Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME CALWATER DRILLING CO., INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

300 S. Kilroy Rd. Turlock CA 95380
ADDRESS CITY STATE ZIP

Signed [signature] 10/31/04 434218
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

SAN JOAQUIN COUNTY ENVIRONMENTAL HEALTH DEPARTMENT

WELL / PUMP PERMIT

304 E WEBER AVE 3RD FL - STOCKTON CA 95202 - (209) 468-3420

NON-REFUNDABLE PERMIT — CALL (209) 953-7697 FOR INSPECTIONS — EXPIRES 1 YEAR FROM DATE ISSUED

1095328

SITE ADDRESS: 29400 S. Chrisman

JOB ADDRESS 29400 S Chrisman Rd. CITY/ZIP Tracy

CROSS STREET S. of Linne APN 253-230-02 PARCEL SIZE 1 ac.

OWNER NAME ______ PHONE ______

OWNER ADDRESS Same. CITY/STATE/ZIP ______

CONTRACTOR Colwater Drilling PHONE 667-7932

CONTRACTOR ADDRESS 300 S. Kilroy CITY/STATE/ZIP Turlock, Ca. 95380

SUBCONTRACTOR ______ PHONE ______

SUBCONTRACTOR ADDRESS ______ CITY/STATE/ZIP ______

LICENSE ☒ C-57 ☐ C-61 ☐ D-09 ☐ Other ______ NUMBER 434218 EXPIRATION DATE ______

GEOGRAPHICAL INFORMATION: Coordinates X ______ Y ______ Township ______ Range ______ Section ______

INTENDED USE ☒ Domestic/Private ☐ Irrigation/Agricultural ☐ Industrial ☐ Water Quality Monitoring ☐ Soil Sampling/Characterization
☐ Public Water System (If different from Owner:) ______ Water System Name ______ Contact Name or Phone Number

TYPE OF WORK ☐ New Well ☒ Replacement Well ☐ Well Alteration/Modification ☐ Test Hole ☐ Other ______
☐ Monitoring Well(s) ______ number of wells ☐ Soil Boring(s) ______ number of borings ☐ Geotechnical ______ number of borings
☐ Well Destruction ☐ Out-Of-Service Well ☐ Out-Of-Service Well Renewal
☐ New Pump ☐ Pump Replacement ☐ Pump Repair ☐ Cross-Connection Repair

WELL CONSTRUCTION
Drilling Method ☒ Mud Rotary ☐ Air Rotary ☐ Auger ☐ Cable Tool ☐ Push Point ☐ Other ______
Proposed Well Depth 200 ft Excavation 10" in diameter ☐ Open Bottom ☒ Gravel Pack / Gravel Size #6 in diameter
☐ Conductor Casing ______ in diameter / Conductor Casing Depth ______ ft
Well Casing Diameter 6" in Thickness/Gauge/ASTM Sched ______ ☐ Steel ☒ Plastic ☐ Stainless Steel ☐ Other ______
Grout Seal Depth 100 ft ☐ Neat Cement *(94 lb bag / 5-10 gal water)* ☐ Sand Cement ______ *sack mix / 7 gal water*
☒ Bentonite (20% solids) ☐ Manufacturer Spec % solids ______ % Name ______ ☐ Specs on File ☐ Specs Submitted
Grout Placement Method ☐ Pumped ☐ Free Fall ☐ Other ______ ☐ Retardant / Accelerator (name) ______

PEDESTAL **Installed By** ☐ Driller ☐ Pump Contractor ☐ Other ______
☐ Concrete Pedestal Dimensions: Width ______ ft Length ______ ft Thick ______ in ☐ Christy Box ☐ Stove Pipe

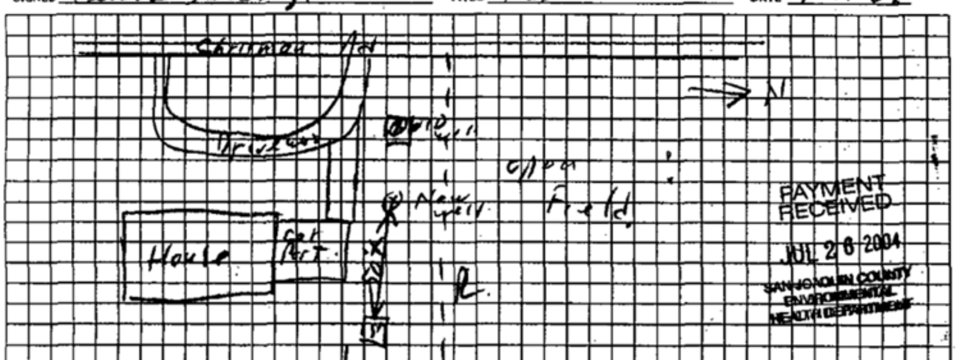
PUMP ☐ Submersible ☐ Turbine ☐ Other ______ HP ______ Pump Set ______ ft Standing Water Level ______ ft

WELL DESTRUCTION ☐ Open Bottom ☐ Gravel Pack ☐ Uncased ☐ Other ______
Well Diameter 6" in Total Depth 80 ? ft Depth to Water ______ ft ☐ Casing to be Perforated from ______ ft to ______ ft
Sealing Material ☐ Neat Cement *(94 lb bag / 5-10 gal water)* ☐ Sand Cement ______ *sack mix / 7 gal water* ☐ Bentonite Pellets
☒ Bentonite (20% solids) ☐ Manufacturer Spec % solids ______ % Name ______ ☐ Specs on File ☐ Specs Submitted
Placement Method ☐ Pumped ☐ Free Fall ☐ Other ______
☐ Complete with Mushroom Cap ______ ft below grade ☐ Complete to Existing Surface Pad

I HEREBY CERTIFY THAT I HAVE PREPARED THIS APPLICATION AND THAT THE WORK WILL BE DONE IN ACCORDANCE WITH SAN JOAQUIN COUNTY ORDINANCES, STATE LAWS, AND RULES AND REGULATIONS. I ALSO CERTIFY THAT MY REQUIRED LICENSE IS CURRENT AND ACTIVE WITH THE CALIFORNIA CONTRACTORS STATE LICENSE BOARD AND THAT I AM IN COMPLIANCE WITH ALL WORKERS COMPENSATION LAWS.

MINIMUM 24 HOUR ADVANCE NOTICE REQUIRED FOR INSPECTIONS – PLEASE CALL (209) 953-7697

SIGNED [signature] TITLE Pres DATE 7-14-04



DEPARTMENT USE ONLY

Application Accepted By [signature] Date 7/26/04 Area 216 Employee ID# 1456 5/99

Grout Inspection By ______ Date ______ ☐ SPECIAL Well Permit

Pump Inspection By ______ Date ______ ☐ WAIVER Received

Destruction Inspection By ______ Date ______ Constructed Well Depth ______ ft

COMMENTS Old lot of record.

PE Codes	SC Info	Received By	Check#/Cash	Amount Remitted	Date	Permit/Service Request #	Invoice #	Well ID#
43.70	180	[initials]	39226	$225.00	7/26/04	SR0038926		
43.68	060		39227	$93.00		SR0038927		

EHD 43-02-006
12/6/2002

MASTER WATER WELL PERMIT

ORIGINAL
File with DWR

Page ___ of ___

Owner's Well No. ___

Date Work Began 2-12-03, Ended 2-21-03

Local Permit Agency SAN JOAQUIN COUNTY

Permit No. SR0031883 Permit Date 11-13-02

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 559325

DWR USE ONLY — DO NOT FILL IN

03S05E20

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.		DESCRIPTION *Describe material, grain size, color, etc.*
1	10	Clay
10	65	Clay with Big Gravel
65	85	Clay
85	121	Sand & Clay
121	150	Sand & Gravel
150	180	Clay
180	210	Gravel with Clay
210	228	Sand & Gravel
228	300	Clay with Gravel

TOTAL DEPTH OF BORING 300 (Feet)

TOTAL DEPTH OF COMPLETED WELL 300 (Feet)

WELL OWNER

WELL LOCATION

Address I-580 & S. TRACY BLVD.

City TRACY

County SAN JOAQUIN

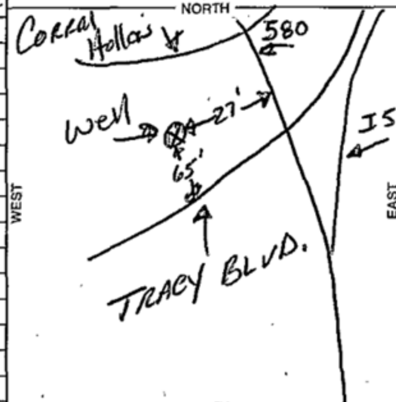
APN Book 253 Page 090 Parcel 23

Township 3S Range 5E Section 20

Latitude ___ NORTH Longitude ___ WEST (DEG. MIN. SEC.)

LOCATION SKETCH

NORTH



WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING

WATER SUPPLY
___ Domestic
___ Public
___ Irrigation
___ Industrial

___ "TEST WELL"

X CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD ROTARY FLUID DRILLING MUD

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	150	12			X		PVC	6	SCH 40	N/A
150	300	9 7/8								

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
4	127	X			10 SACK SAND SLURRY
150	300			X	COKE BREEZE

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME FARWEST CORROSION CONTROL CO.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

4114 ARMOUR AVE. BAKERSFIELD, CA 93308
ADDRESS CITY STATE ZIP

Signed [signature] 5-12-03 248232
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 2

Owner's Well No. 20232-1

Date Work Began 4/16/02 Ended 5/10/02

Local Permit Agency SAN JOAQUIN CTY HEALTH

Permit No. 29355 Permit Date 4/5/02

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 808108

DWR USE ONLY — DO NOT FILL IN

20/21/28/29

02S06E		
STATE WELL NO./STATION NO.		
LATITUDE		LONGITUDE
APN/TRS/OTHER		

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD MUD ROTARY FLUID WATER/BENT

DEPTH FROM SURFACE Ft. to	Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	5	BLACK CLAY
5	10	BROWN CLAY
10	15	BROWN SILTY CLAY
15	20	BROWN CLAY
20	30	BROWN CLAY & SILTY CALY
30	50	BROWN CLAY
50	55	BLUE CLAY & SANDY CLAY
55	80	FINE SAND & SAND
80	90	SAND
90	100	BLUE CLAY & SANDY CLAY
100	110	BLUE CLAY
110	120	FINE SANDY CLAY & FINE SAND
120	130	FINE SAND & SAND
130	210	GRAY SAND
210	320	BROWN CLAY
320	340	BROWN/BLUE CLAY
340	370	BLUE CLAY
370	390	BLUE CLAY & SILTY CLAY
390	410	BLUE CLAY & SANDY CLAY
410	450	BLUE CLAY & SHALE
450	470	BLUE SILTSTONE
470	490	BLUE CLAY & SILTY CLAY
490	570	BLUE CLAY
570	620	CLAY
620	690	SAND & GRAVEL
690	705	BROWN CLAY
705	710	SAND & GRAVEL
710	715	SAND, GRAVEL & CLAY
715	730	BROWN CLAY & GRAVEL

TOTAL DEPTH OF BORING 1205 (Feet)

TOTAL DEPTH OF COMPLETED WELL 1100 (Feet)

WELL OWNER

WELL LOCATION

Address 23500 KASSON RD

City TRACY

County SAN JOAQUIN

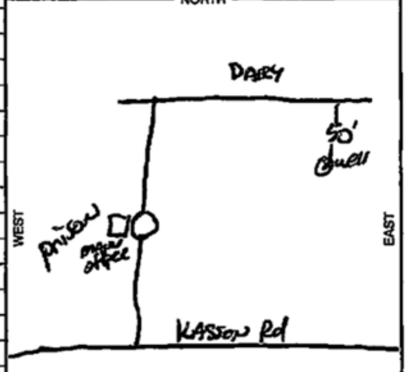
APN Book 239 Page 120 Parcel 01

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH



SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING X
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 37 (Ft.) & DATE MEASURED 05/14/02

ESTIMATED YIELD * 30+ (GPM) & TEST TYPE TEST PUMPING

TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN 32 (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	380	12 1/4	X				PVC	5	SDR-21	
380	400	12 1/4		X			PVC	5	SDR-21	.032
400	500	12 1/4	X				PVC	5	SDR-21	
500	520	12 1/4		X			PVC	5	SDR-21	.032
520	620	12 1/4	X				PVC	5	SDR-21	
620	640	12 1/4		X			PVC	5	SDR-21	.032
640	680	12 1/4	X				PVC	5	SDR-21	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	110	XX			10 sack
110	1205		XX		8 x 16

ATTACHMENTS (✓)

___ Geologic Log
X Well Construction Diagram
X Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME MAGGIORA BROS. DRILLING, INC. (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 595 AIRPORT BLVD. CITY WATSONVILLE, STATE CA ZIP 95076

Signed [signature] WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED 05/14/02 C-57 LICENSE NUMBER 249957

DWR 188 REV. 11-97 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

20/21/28/209

ORIGINAL
File with DWR

Page 2 of 2

Owner's Well No. 20232-1

Date Work Began 4/16/02, Ended 5/10/02

Local Permit Agency 29355 SAN JOAQUIN CTY HEALTH

Permit No. ______ Permit Date 8/7/97

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 808108

DWR USE ONLY — DO NOT FILL IN

02S 06E

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD MUD ROTARY FLUID WATER/BENT

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
730	750	GRAVEL & CLAY
750	760	GRAVEL & SAND
760	765	BROWN CLAY
765	770	GRAVEL
770	800	GRAVEL & CLAY
800	810	BROWN CLAY
810	820	BROWN CLAY & GRAVEL
820	830	CLAY & GRAVEL
830	910	GRAVEL & BROWN CLAY
910	930	CLAY & GRAVEL
930	950	BROWN CLAY & GRAVEL
950	970	BLUE CLAY & GRAVEL
970	1030	BLUE CLAY
1030	1050	BLUE CLAY & GRAVEL
1050	1093	GRAVEL & GRAY CLAY
1093	1110	SAND & CLAY
1110	1130	BROWN CLAY & GRAVEL
1130	1150	GRAVEL & CLAY
1150	1175	BLUE CLAY
1175	1180	ROCK & GRAVEL
1180	1185	GRAVEL & BLUE CLAY
1185	1193	BROWN/BLUE CLAY
1193	1205	HARD DRY CLAY & ROCK

TOTAL DEPTH OF BORING 1205 (Feet)

TOTAL DEPTH OF COMPLETED WELL 1100 (Feet)

WELL OWNER

WELL LOCATION

Address 23500 KASSON RD

City TRACY

County SAN JOAQUIN

APN Book ______ Page ______ Parcel ______

Township ______ Range ______ Section ______

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING X
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ______ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ______ (Ft.) & DATE MEASURED ______

ESTIMATED YIELD * ______ (GPM) & TEST TYPE ______

TEST LENGTH ______ (Hrs.) TOTAL DRAWDOWN ______ (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
680	700	12-1/4		X			PVC	5	SDR-21	.032
700	920	12-1/4	X				PVC	5	SDR-21	
920	940	12-1/4		X			PVC	5	SDR-21	.032
940	1060	12-1/4	X				PVC	5	SDR-21	
1060	1080	12-1/4		X			PVC	5	SDR-21	.032
1080	1100	12-1/4	X				PVC	5	SDR-21	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	110	XX			10 sack
110	1205			XX	8 x 16

ATTACHMENTS (✓)

___ Geologic Log
X Well Construction Diagram
X Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ______

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME MAGGIORA BROS. DRILLING, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

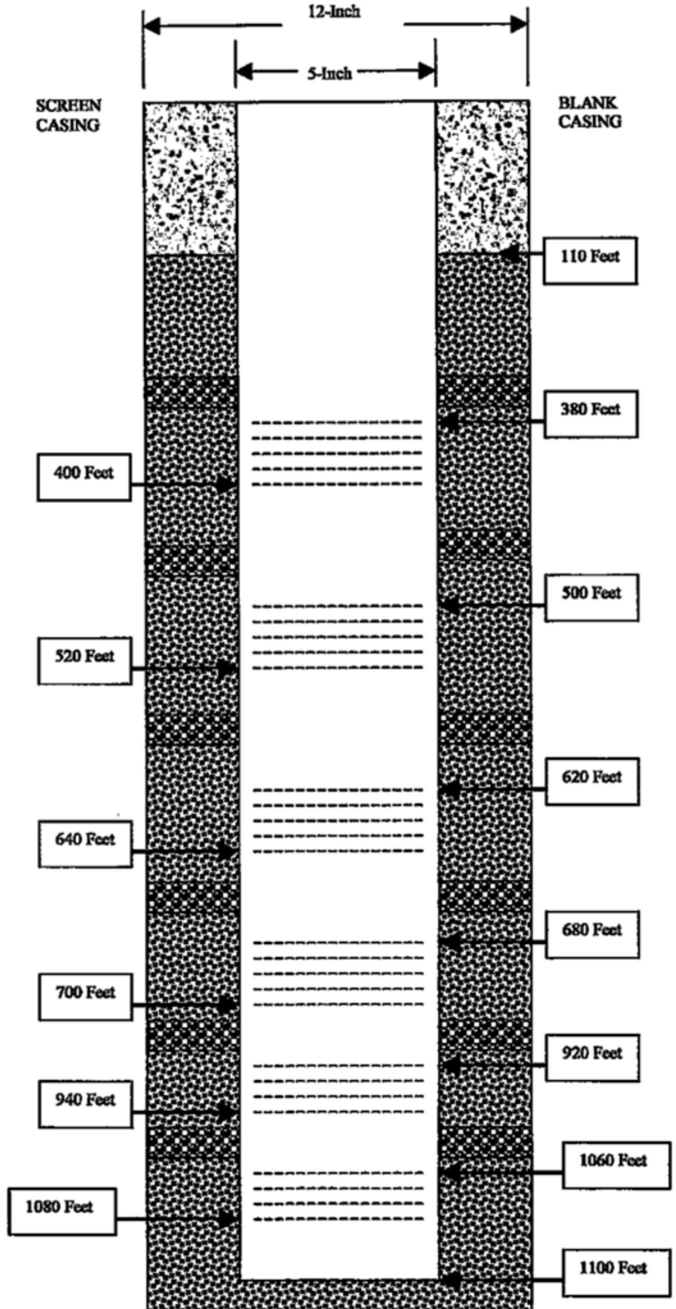
595 AIRPORT BLVD. WATSONVILLE, CA 95076
ADDRESS CITY STATE ZIP

Signed [signature] 5/14/02 249957
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

808108

Maggiora Bros. Drilling, Inc.
Well Design



KEY

- Concrete seal
- Gravel Pack
- Bentonite
- Blank Casing
- Screen Casing

Construction Materials

Screen	5" PVC SDR21 0.032
Blank	5" PVC SDR21
Bottom	5" PVC cap
Gravel	8 x 16
Seal	10 Sack sand slurry
Bentonite	340-360, 440-460, 560-580, 650-670 820-840, 1010-1030

Permit #	29355
County	San Joaquin
Owner	Deuel Vocational Inst.
Site	23500 Kasson Rd
City	Tracy
Job #	20232-1

NOT TO SCALE

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW-16

Date Work Began 4-17-95 , Ended 5-2-95

Local Permit Agency San Joaquin Public Health Services

Permit No. 5716 Permit Date 4-10-95

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 453726

DWR USE ONLY — DO NOT FILL IN

02S06E20H M

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) x VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
	See Geologic Log

TOTAL DEPTH OF BORING 90 (Feet)

TOTAL DEPTH OF COMPLETED WELL 85 (Feet)

WELL OWNER

WELL LOCATION

Address 23500 Kasson Rd.

City Tracy

County San Joaquin

APN Book 239 Page 120 Parcel 001

or Township 02S Range 06E Section 20H

or Latitude ___ NORTH Longitude ___ WEST

DEG. MIN. SEC. DEG. MIN. SEC.

LOCATION SKETCH

NORTH

See Site Map

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
- ___ Deepen
- ___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

X MONITORING

WATER SUPPLY
- ___ Domestic
- ___ Public
- ___ Irrigation
- ___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD Direct Rotory FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60	14.75	x				PVC	8	Sch 80	
60	85	"		x			"	"	"	.020

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	55	x			
55	90				8x16

ATTACHMENTS (✓)

- X Geologic Log
- ___ Well Construction Diagram
- ___ Geophysical Log(s)
- ___ Soil/Water Chemical Analyses
- X Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Layne-Western Co. 147
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

275 County Rd. 98 Woodland Ca. 95695
ADDRESS CITY STATE ZIP

Signed [signature] 5-20-96 510011
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

453726

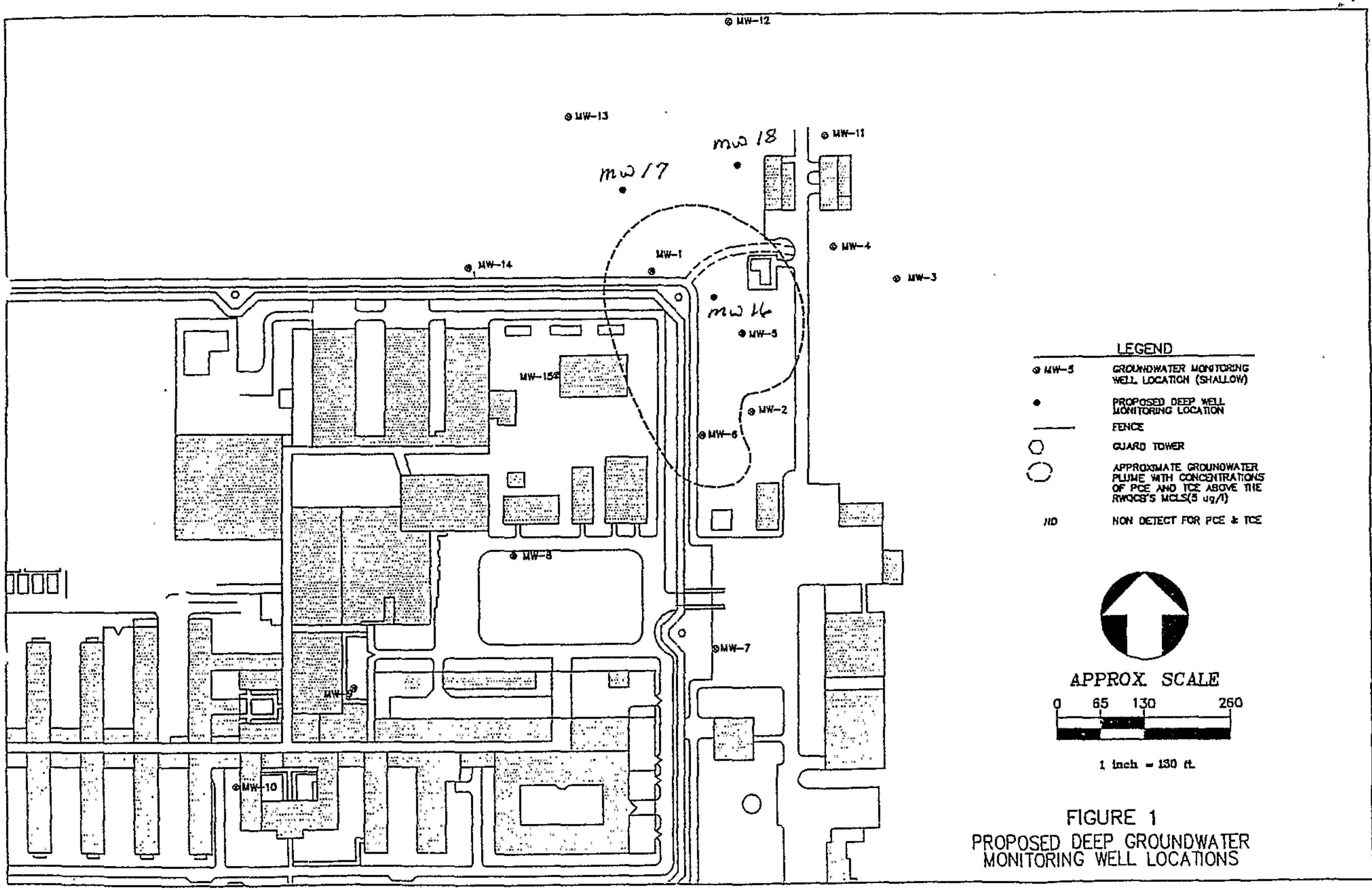


FIGURE 1
PROPOSED DEEP GROUNDWATER MONITORING WELL LOCATIONS

453726

02506E20H

BORING LOG

Project Name: ______________________ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-16 Sheet 1 of 3

Boring Location: SEE FIGURE 1		Elevation and Datum:
Drilling Contractor: LAYNE	Driller: MARK PEARSON	Date Started: 4/17/95 — Date Finished: 5/2/95
Drilling Equipment: FAILING 1500	Borehole Diameter: 14 3/4	Completed Depth (feet): 85 — Water Depth (feet):
Sampling Method: California Modified ☐ Shelby Tube ☐ Split Spoon ☐		WELL CONSTRUCTION
Drilling Fluid: MUD (BENTONITE)		Type and Diameter of Well Casing: 8-INCH SCHED. 80 PVC
Backfill Material: CEMENT GROUT		Slot Size: 0.02" — Filter Material: #3 "MONTEREY
Logged By: P. NOVELLY	Checked By: S. ANDERSON	Development Method: BAILING-DEVEL. RIG

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
		SOIL AT SURFACE							
0	SC	CLAYEY SAND, BROWN, DRY, FINE, MINOR SILTY CLAY							OVM READING 0 PPM IN BREATHING ZONE
5		INCREASED SILTY CLAY							
10	SP	SAND, BROWN, WET, FINE, MICACEOUS, INTERBEDDED SILTY CLAY (0-2 FEET THICK)							
15									
20		BECOMING SILTY MINOR MEDIUM TO COARSE SAND							OVM READING 0 PPM IN BREATHING ZONE
25									
30									

453726

BORING LOG

02506E204

Project Name: Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-16 Sheet 2 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
33–36	SP	SAND, BROWN, WET, FINE, MICACEOUS MINOR SILTY CLAY							OVM READING 0 PPM IN BREATHING ZONE
36–40	CL	SILTY CLAY, BROWN, WET, FIRM							
40–45	SP	SAND, BROWN, WET, FINE TO VERY FINE							
45–52		BECOMING TAN, FINE TO MEDIUM, SILTY							
52–57	CL	SILTY CLAY, BROWN, WET, STIFF							OVM READING 0 PPM IN BREATHING ZONE
57–71	SP	SAND, TAN TO GRAY, WET, MEDIUM TO COARSE							

453726

02S06E20H

BORING LOG

Project Name ____________ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-16 Sheet 3 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
	SP	SAND, TAN TO GRAY, WET, MEDIUM TO COARSE							OVM READING 0 PPM IN BREATHING ZONE
75		BECOMING SILTY							75 TO 80 FEET FAST DRILLING- GOOD SAND UNIT
80									
85	CL	SILTY CLAY, BLUE GRAY, WET, FIRM							
90									
95									
100									

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW-17

Date Work Began 4-18-95, Ended 4-27-95

Local Permit Agency San Joaquia Public Health Services

Permit No. 5716 Permit Date 4-10-95

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 453724

DWR USE ONLY — DO NOT FILL IN

02S06E20H M

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
	See Geologic Log

TOTAL DEPTH OF BORING 85 (Feet)

TOTAL DEPTH OF COMPLETED WELL 80 (Feet)

WELL LOCATION

Address 23500 Kesson Rd.

City Tracy

County San Joaquin

APN Book 239 Page 120 Parcel 001

Township 02S Range 06E Section 20

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

See Site Map

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

X MONITORING

WATER SUPPLY

___ Domestic

___ Public

___ Irrigation

___ Industrial

___ "TEST WELL"

___ CATHODIC PROTECTION

___ OTHER (Specify)

DRILLING METHOD Direct Rotory FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

** May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60	12.25	X				PVC	5	Sch 80	
60	80	"		X			"	"	"	.020

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	55	X			
55	85				8X16

ATTACHMENTS (✓)

X Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

X Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Layne-Western Co. 147
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

275 County Rd. 98 Woodland Ca. 95695
ADDRESS CITY STATE ZIP

Signed [signature] 5-20-96 510011
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

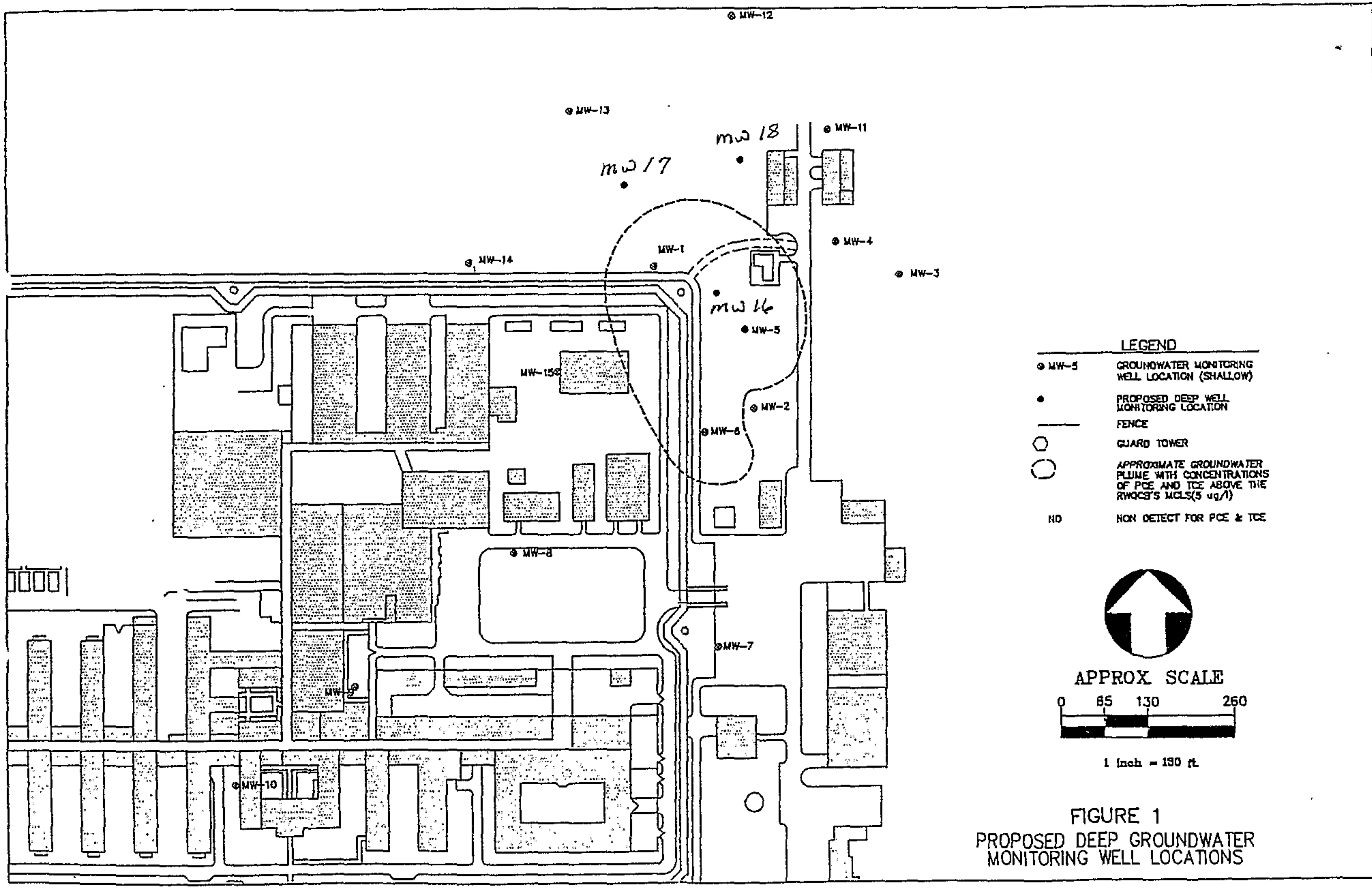


FIGURE 1
PROPOSED DEEP GROUNDWATER MONITORING WELL LOCATIONS

45 37 24

45372

02506E20 H

BORING LOG

Project Name: 　　　　　　　　 Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-17 Sheet 1 of 3

Boring Location: SEE FIGURE 1		Elevation and Datum:	
Drilling Contractor: LAYNE	Driller: MARK PEARSON	Date Started: 4/18/95	Date Finished: 4/27/95
Drilling Equipment: FAILING 1500	Borehole Diameter: 12¼"	Completed Depth (feet): 80	Water Depth (feet):
Sampling Method: California Modified ☐ Shelby Tube ☐ Split Spoon ☐		WELL CONSTRUCTION	
Drilling Fluid: MUD - BENTONITE		Type and Diameter of Well Casing: 5 INCH SCHED. 80 PVC	
Backfill Material: CEMENT GROUT		Slot Size: 0.02"	Filter Material: #3 MONTEREY
Logged By: P. NOVELLY	Checked By: S. ANDERSON	Development Method: BAILING-DEVEL. RIG	

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
		SOIL AT SURFACE							
	CL	SILTY CLAY, BROWN, SLIGHTLY MOIST, FIRM							OVM READING 0 PPM IN BREATHING ZONE
5		MINOR SAND							
10	SP	SAND, BROWN, WET, FINE, MICACEOUS, INTERBEDDED THIN CLAY UNITS							
15									
20									OVM READING 0 PPM IN BREATHING ZONE
25									
30									

45372

02906E20H

BORING LOG

Project Name: ______________ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-17 Sheet 2 of 3

Depth (feet)	USG Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
	SP	SAND, BROWN, WET, FINE, MINOR SILTY CLAY							OVM READING 0 PPM IN BREATHING ZONE
35									
	CL	SILTY CLAY, BROWN, WET, FIRM							
40	SP	SAND, BROWN, WET, FINE, MINOR SILTY CLAY							
	CL	SILTY CLAY, BROWN, WET, FIRM, MINOR FINE SAND							
45									
	SM	SILTY SAND, TAN, WET, FINE TO MEDIUM							
50									
									OVM READING 0 PPM IN BREATHING ZONE
55									
60	CL	SILTY CLAY, BROWN, WET, FIRM							
	SP	SAND, TAN, WET, FINE, MINOR SILT							
65									
	CL	SILTY CLAY, GRAY, WET, FIRM MINOR FINE SAND							
70									

453724

02506E20H

BORING LOG

Project Name: ____________ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-17 Sheet 3 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
75	SM	SILTY SAND, TAN TO GRAY, WET, FINE TO MEDIUM, MICACEOUS, MINOR CLAY							OVM READING 0 PPM IN BREATHING ZONE
80	CL	SILTY CLAY, GRAY, WET, FIRM							
85									
90									
95									
100									

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW-18

Date Work Began 4-19-95, Ended 4-25-95

Local Permit Agency San Joaquin Public Health Services

Permit No. 5716 Permit Date 4-10-95

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 453725

DWR USE ONLY — DO NOT FILL IN

02S06E20H M

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
	See Geologic Log

TOTAL DEPTH OF BORING 85 (Feet)

TOTAL DEPTH OF COMPLETED WELL 80 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address 23500 Kasson Rd.

City Tracy

County San Joaquin

APN Book 239 Page 120 Parcel 001

Township 02S Range 06E Section 20

Latitude ___ DEG. MIN. SEC. NORTH Longitude ___ DEG. MIN. SEC. WEST

LOCATION SKETCH

NORTH

See Site Map

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

X MONITORING

WATER SUPPLY
___ Domestic
___ Public
___ Irrigation
___ Industrial

___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Direct Rotory FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD* ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60	12.25	X				PVC	~~12.25~~ 5"	Sch80	
60	80	"		X			"	5"	"	.020

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	55	X			
55	85				8x16

ATTACHMENTS (✓)

X Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
X Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Layne-Western Co. 147
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

275 County Rd. 98 Woodland Ca. 95695
ADDRESS CITY STATE ZIP

Signed [signature] 5-20-96 510011
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

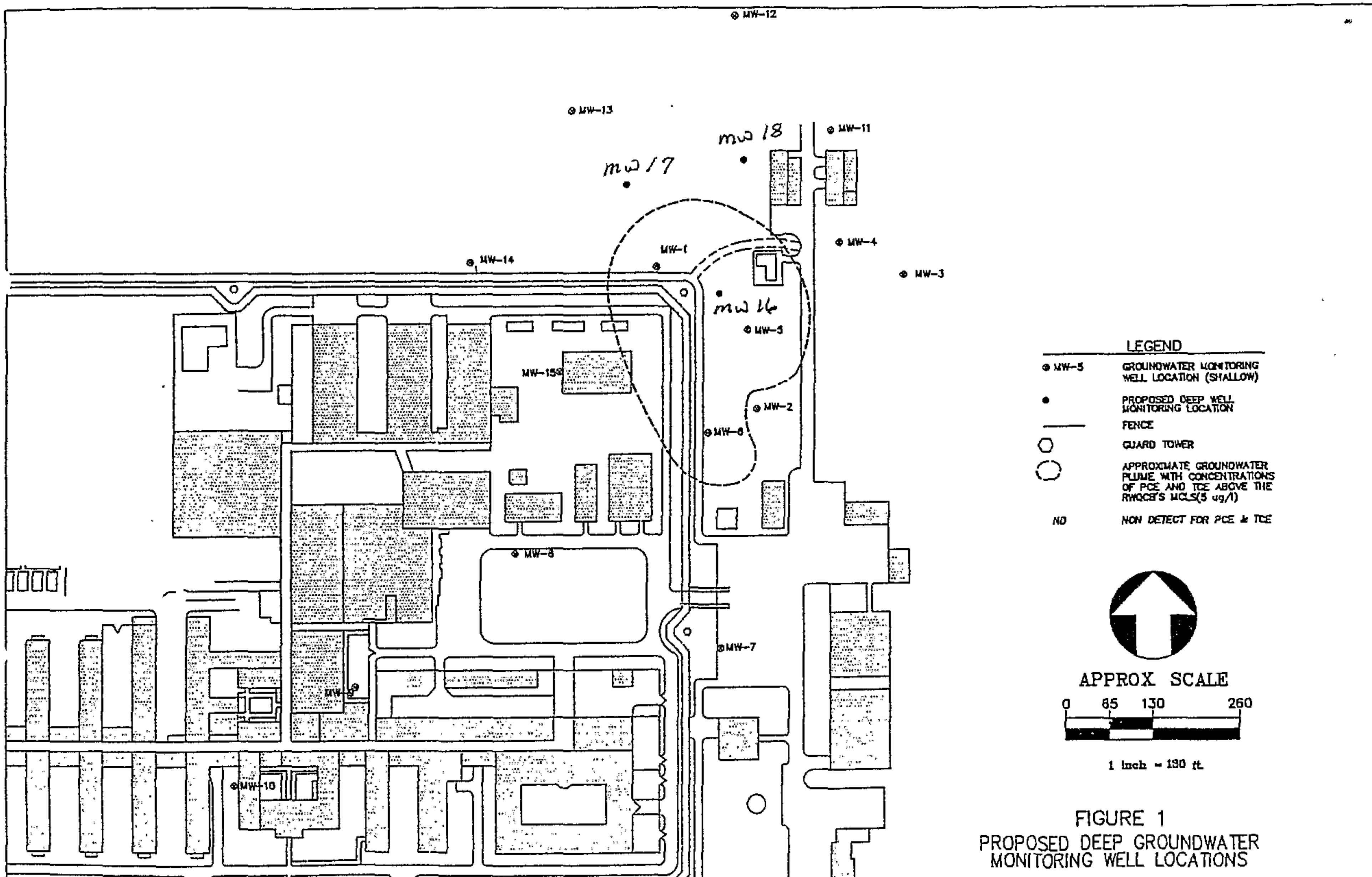


FIGURE 1
PROPOSED DEEP GROUNDWATER MONITORING WELL LOCATIONS

453725

BORING LOG 02S06E20H

Project Name: Project Number: 4034.02

Soil Boring [ ] Monitoring Well [X] Boring/Well Number: MW-18 Sheet 1 of 3

Boring Location: SEE FIGURE 1		Elevation and Datum:	
Drilling Contractor: LAYNE	Driller: MARK PEARSON	Date Started: 4/19/95	Date Finished: 4/25/95
Drilling Equipment: FAILING 1500	Borehole Diameter: 12½"	Completed Depth (feet) 80	Water Depth (feet)
Sampling Method: California Modified [ ] Shelby Tube [ ] Split Spoon [ ]		WELL CONSTRUCTION	
Drilling Fluid: MUD-BENTONITE		Type and Diameter of Well Casing: 5-INCH SCHED. 80 PVC	
Backfill Material: CEMENT GROUT		Slot Size: 0.02"	Filter Material: #3 MONTEREY
Logged By: P. NOVELLY	Checked By: S. ANDERSON	Development Method: BAILING - DEVEL. RIG	

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
		SOIL AT SURFACE							
	SM	SILTY SAND, BROWN, FINE, SLIGHTLY MOIST, INTERBEDDED CLAY LAYERS							OVM READING 0 PPM IN BREATHING ZONE
5									
10	SP	SAND, BROWN, FINE TO VERY FINE, SLIGHTLY MOIST, MICACEOUS, MINOR CLAY.							
15									
									OVM READING 0 PPM IN BREATHING ZONE
20									
25									
30									

953725

BORING LOG

02906E20H

Project Name: ______ Project Number: 4034.02

Soil Boring ☐ Monitoring Well ☒ Boring/Well Number: MW-18 Sheet 2 of 3

Depth (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Lithology	Graphic Log: Annulus	Graphic Log: Casing	PID/FID Readings	Remarks
	SM	SILTY SAND, BROWN, WET, FINE INTERBEDDED CLAY UNITS							OVM READING 0 PPM IN BREATHING ZONE
35									
40									
45		BECOMING TAN, FINE TO MEDIUM							
50									OVM READING 0 PPM IN BREATHING ZONE
55									
		THIN SILTY CLAY LAYERS							
60									
	CL	SILTY CLAY, BROWN, WET, FIRM							
65	SP	SAND, TAN, WET, FINE, MINOR SILT							
70									

ORIGINAL
File with DWR
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. E005374

DWR USE ONLY — DO NOT FILL IN
03S05E05
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. MW3-A
Date Work Began 11/4/2003, Ended 11/6/2003
Local Permit Agency SAN JOAQUIN COUNTY ENV. HEALTH
Permit No. SR0035657 Permit Date 10/18/2003

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	20	CONDUCTOR
20	40	GRAVEL MIX IN CLAY AND SMALL COBBLES
40	60	MEDIUM SAND, GRAVEL AND SMALL CLAY STREAK
60	80	GRAVEL AND MEDIUM SAND
80	120	GRAVEL AND CLAY MIX
120	140	SMALL GRAVEL AND CLAY STREAK
140	160	MEDIUM SAND AND SMALL GRAVEL
160	180	LARGE GRAVEL AND COARSE SAND
180	220	LARGE GRAVEL AND CLAY MIX
220	260	CLAY
260	300	CLAY MIX, SMALL GRAVEL
300	320	BLUE GRAY CLAY
320	340	CLAY AND MEDIUM SAND, SMALL GRAVEL
340	380	SMALL GRAVEL
380	400	COARSE SAND AND SMALL GRAVEL
400	415	MEDIUM SAND AND SMALL GRAVEL MIX

TOTAL DEPTH OF BORING 415 (Feet)
TOTAL DEPTH OF COMPLETED WELL 405 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address PEONY RD. AT CHATEAU LN
City TRACY CA
County SAN JOAQUIN
APN Book 244 Page 020 Parcel 24
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH
WEST
EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
— Deepen
— Other (Specify)
— DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
— Domestic — Public
— Irrigation — Industrial
MONITORING ✓
TEST WELL —
CATHODIC PROTECTION —
HEAT EXCHANGE —
DIRECT PUSH —
INJECTION —
VAPOR EXTRACTION —
SPARGING —
REMEDIATION —
OTHER (SPECIFY) —

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	380	14	✓				STEEL	6 5/8	.188	
380	400	14		✓			STEEL	6 5/8	.188	0.05
400	405	14	✓				STEEL	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	370	✓			
370	405			✓	GRAVEL 8X16

ATTACHMENTS (✓)

— Geologic Log
— Well Construction Diagram
— Geophysical Log(s)
— Soil/Water Chemical Analysis
— Other ___
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
3625 S. HIGHLAND DEL REY CA 93616
ADDRESS CITY STATE ZIP
Signed Rebecca L Dunn 03/19/04 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. E005373

DWR USE ONLY — DO NOT FILL IN
03S05E05
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. MW3-B
Date Work Began 11/7/2003, Ended 11/9/2003
Local Permit Agency SAN JOAQUIN COUNTY ENV. HEALTH
Permit No. SR0035657 Permit Date 10/18/2003

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain, size, color, etc.)
0	20	CONDUCTOR
20	40	GRAVEL MIX IN CLAY AND SMALL COBBLES
40	60	MEDIUM SAND, GRAVEL AND SMALL CLAY STREAK
60	80	GRAVEL AND MEDIUM SAND
80	120	GRAVEL AND CLAY MIX
120	140	SMALL GRAVEL AND CLAY STREAK
140	160	MEDIUM SAND AND SMALL GRAVEL
160	180	LARGE GRAVEL AND COARSE SAND
180	220	LARGE GRAVEL AND CLAY MIX
220	260	CLAY
260	300	CLAY MIX, SMALL GRAVEL
300	320	BLUE GRAY CLAY
320	340	CLAY AND MEDIUM SAND, SMALL GRAVEL
340	380	SMALL GRAVEL
380	400	COARSE SAND AND SMALL GRAVEL
400	420	MEDIUM SAND AND SMALL GRAVEL MIX
420	440	COARSE SAND AND GRAVEL
440	460	COARSE SAND AND GRAVEL STREAK
460	480	GRAVEL AND COARSE SAND
480	500	GRAVEL
500	520	COARSE SAND AND SMALL GRAVEL
520	540	GRAVEL AND MEDIUM SAND
540	560	MEDIUM SAND AND SMALL GRAVEL
560	580	MEDIUM SAND MIX GRAVEL AND CLAY STREAK
580	595	GRAVEL

TOTAL DEPTH OF BORING 595 (Feet)
TOTAL DEPTH OF COMPLETED WELL 580 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address PEONY RD. AT CHATEAU LN
City TRACY CA
County SAN JOAQUIN
APN Book 244 Page 020 Parcel 24
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH
WEST EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	540	14	✓				STEEL	6 5/8	.188	
540	580	14		✓			STEEL	6 5/8	.188	0.05
580	585	14	✓				STEEL	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	530	✓			
530	585			✓	GRAVEL 8X16

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other ___
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 3625 S. HIGHLAND CITY DEL REY STATE CA ZIP 93616
Signed Rebecca L. Dunn (WELL DRILLER/AUTHORIZED REPRESENTATIVE) DATE SIGNED 03/19/04 C-57 LICENSE NUMBER 414178

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. E005370

DWR USE ONLY — DO NOT FILL IN
0|3|S|0|5|E|05 STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. MW3-C
Date Work Began 10/20/2003, Ended 10/22/2003
Local Permit Agency SAN JOAQUIN COUNTY ENV. HEALTH
Permit No. SR0035657 Permit Date 10/18/2003

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0	20	CONDUCTOR
20	40	GRAVEL MIX IN CLAY AND SMALL COBBLES
40	60	MEDIUM SAND, GRAVEL AND SMALL CLAY STREAK
60	80	GRAVEL AND MEDIUM SAND
80	120	GRAVEL AND CLAY MIX
120	140	SMALL GRAVEL AND CLAY STREAK
140	160	MEDIUM SAND AND SMALL GRAVEL
160	180	LARGE GRAVEL AND COARSE SAND
180	220	LARGE GRAVEL AND CLAY MIX
220	260	CLAY
260	300	CLAY MIX, SMALL GRAVEL
300	320	BLUE GRAY CLAY
320	340	CLAY AND MEDIUM SAND, SMALL GRAVEL
340	380	SMALL GRAVEL
380	400	COARSE SAND AND SMALL GRAVEL
400	420	MEDIUM SAND AND SMALL GRAVEL MIX
420	440	COARSE SAND AND GRAVEL
440	460	COARSE SAND AND GRAVEL STREAK
460	480	GRAVEL AND COARSE SAND
480	500	GRAVEL
500	520	COARSE SAND AND SMALL GRAVEL
520	540	GRAVEL AND MEDIUM SAND
540	560	MEDIUM SAND AND SMALL GRAVEL
560	580	MEDIUM SAND MIX GRAVEL AND CLAY STREAK
580	600	GRAVEL
600	620	COARSE SAND AND SMALL GRAVEL
620	660	MEDIUM SAND MIX SMALL GRAVEL
660	680	GRAVEL
680	700	MEDIUM SAND AND GRAVEL MIX

TOTAL DEPTH OF BORING 820 (Feet)
TOTAL DEPTH OF COMPLETED WELL 815 (Feet)

WELL OWNER

WELL LOCATION

Address PEONY RD. AT CHATEAU LN
City TRACY CA
County SAN JOAQUIN
APN Book 244 Page 020 Parcel 24
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH
WEST EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	770	14	✓				STEEL	6 5/8	.188	
760	810	14		✓			STEEL	6 5/8	.188	0.05
810	815	14	✓				STEEL	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	760	✓			
760	815			✓	GRAVEL 8X16

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
3625 S. HIGHLAND, DEL REY, CA 93616
ADDRESS CITY STATE ZIP
Signed Rebecca L. Dunn — WELL DRILLER/AUTHORIZED REPRESENTATIVE
03/19/04 DATE SIGNED
414178 C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 2 of 2

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. E005370 pg. 2

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. MW3-C
Date Work Began 10/20/2003, Ended 10/22/2003
Local Permit Agency SAN JOAQUIN COUNTY ENV. HEALTH
Permit No. SR0035657 Permit Date 10/18/2003

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft	to Ft	DESCRIPTION Describe material, grain, size, color, etc.
700	720	CLAY
720	740	CLAY AND SMALL GRAVEL
740	760	SMALL GRAVEL
760	780	GRAVEL AND CLAY STREAK, MEDIUM SAND
780	800	MEDIUM SAND AND SMALL GRAVEL
800	820	MEDIUM SAND, SMALL GRAVEL AND CLAY

TOTAL DEPTH OF BORING 820 (Feet)
TOTAL DEPTH OF COMPLETED WELL 815 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address PEONY RD. AT CHATEAU LN
City TRACY CA
County SAN JOAQUIN
APN Book 244 Page 020 Parcel 24
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH
WEST
EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	770	14	✓				STEEL	6 5/8	.188	
760	810	14		✓			STEEL	6 5/8	.188	0.05
810	815	14	✓				STEEL	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	760	✓			
760	815			✓	GRAVEL 8X16

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

3625 S. HIGHLAND DEL REY CA 93616
ADDRESS CITY STATE ZIP

Signed Rebecca L. Dunn 03/19/04 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

Table A-1. (Continued)

Well Name	Installation Date	Geologic Horizon	Northing[a]	Easting[a]	Surface Elevation[b] (msl)	TOC[b] Elevation (msl)	Total Well Depth (ft bgs)	Screen Beginning Depth (ft bgs)	Screen End Depth (ft bgs)	Screen Beginning Elevation (ft msl)	Screen End Elevation (ft msl)	Well Diameter (inches)	Screen Slot Size (inches)	Well Type	Sample Method	Sample Elevation (ft msl)	Status
PZ7[d]	6/5/2001	AU/U	2090392.48	6312458.1	49.13	48.76	18.5	13	18	36.13	31.13	1	0.01	PZ	NS		Well decommissioned March 2004.
PZ7R	7/23/2004	AU/U	2090393.41	6312493.2	48.96	48.62	18	--	--	35.96	30.96	0.75	0.01	PZ	NS		Replacement well for PZ7.
PZ8	6/6/2001	AU/U	2082408.4	6312422.1	67.37	67.17	19.5	14	19.0.0	53.37	48.37	1	0.01	PZ	NS		
PZ9	6/6/2001	AU/U	2077358.78	6307144.2	97.17	96.65	28	22.5	27.5	74.67	69.67	1	0.01	PZ	NS		
PZ10	6/6/2001	AU/U	2082333.5	6307142.9	80.26	80.07	31	25.5	30.5	54.76	49.76	1	0.01	PZ	NS		
PZ11	6/8/2001	AU/U	2077379.51	6301852.3	118.97	118.82	32	26.5	31.5	92.47	87.47	1	0.01	PZ	NS		
PZ12	6/8/2001	AU/U	2082453.96	6300833.9	102.27	102.11	64	58.5	63.5	43.77	38.77	1	0.01	PZ	NS		
PZ13	6/8/2001	AU/U	2090199.75	6307173.98	56.92	56.66	19.5	14	19	42.92	37.92	1	0.01	PZ	NS		
PZ14	6/7/2001	AU/U	2085211.76	6301863.13	86.36	86.24	23	31.8	36.8	54.56	49.56	1	0.01	PZ	NS		
PZ15	6/7/2001	AU/U	2087766.74	6301352.1	73.29	73.15	58	52.5	57.5	20.79	15.79	1	0.01	PZ	NS		
PZ16	6/7/2001	AU/U	2087771.01	6300674.5	73.86	73.72	30	24.5	29.5	49.36	44.36	1	0.01	PZ	NS		
PZ17	6/7/2001	AU/U	2090432.25	6301888.8	60.52	60.3	29	23.5	28.5	37.02	32.02	1	0.01	PZ	NS		
PZ18	7/20/2004	AU	2087741.57	6303906.6	69.41	72.58	35.5	--	--	39.41	34.41	1	0.02	PZ	NS		
PZ19	7/20/2004	AU	2087744.72	6303939.5	68.99	71.98	35.6	--	--	38.99	33.99	1	0.02	PZ	NS		
PZ20	7/20/2004	AU	2087741.47	6304014.2	69.17	72.31	35.5	--	--	39.17	34.17	1	0.02	PZ	NS		
PZ21	7/20/2004	AU	2087741.79	6304079.6	69	71.66	32.5	--	--	42	37	1	0.002	PZ	NS		
PZ22	7/21/2004	AU	2087740.35	6304152.5	69.34	72.5	32.5	--	--	42.34	37.34	1	0.02	PZ	NS		
PZ23	7/21/2004	AU	2087740.62	6304183.1	69.33	72.42	32.5	--	--	42.33	37.33	1	0.02	PZ	NS		
TW001	5/19/1986	UK	2083562.91	6302668.7	89.74	92.04	75	55	75	34.74	14.74	6	0.01	TW	NS		Decommission 9/19/08.
WSW004[d]	1/1/1943	UK	2085939.36	6304177.6	--	--	--	--	--	--	--	--	--	WSW			Well decommissioned.
WSW007	1/1/1950	UK	2080608.64	6301986.1	110.59	--	810	--	--	--	--	--	--	WSW	NS		Tracy Site water supply well not sampled as part of the Well Monitoring Program.
WSW008	11/25/1992	UK	2081541.12	6303080.1	101	--	905	--	--	--	--	18	--	WSW	NS		Tracy Site water supply well not sampled as part of the Well Monitoring Program.
WSW009	11/25/1992	UK	2082203.04	6303982.7	96.61	--	930	420	480	--	--	16	--	WSW	NS		Tracy Site water supply well not sampled as part of the Well Monitoring Program.
								570	590								
								640	700								
								740	800								
								850	910								

Geologic Section D-D’

ORIGINAL
File with DWR

Page ____ of ____

Owner's Well No. ____

Date Work Began ____, Ended ____

Local Permit Agency ____

Permit No. 91-1372 Permit Date ____

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 427218

DWR USE ONLY — DO NOT FILL IN

01S06E29F M

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ____ VERTICAL ____ HORIZONTAL ____ ANGLE ____ (SPECIFY)

DEPTH TO FIRST WATER ____ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	5	Sandy soil
5	27	Clay
27	35	Sand/clay streaks
35	66	Sand
66	67	Clay

TOTAL DEPTH OF BORING 67 (Feet)

TOTAL DEPTH OF COMPLETED WELL 60 (Feet)

WELL OWNER

Address 2796 W. Undine Rd.

City Stockton

County San Joaquin

APN Book 191 Page 170 Parcel 001

Township 01S Range 06E Section 29 F

Latitude ____ NORTH Longitude ____ WEST

DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST

EAST

SOUTH

Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

____ Deepen

____ Other (Specify)

____ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USE(S) (✓)

____ MONITORING

WATER SUPPLY

X Domestic

____ Public

____ Irrigation

____ Industrial

____ "TEST WELL"

____ CATHODIC PROTECTION

____ OTHER (Specify)

DRILLING METHOD Rotary FLUID Bentonite

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 13 (Ft.) & DATE MEASURED ____

ESTIMATED YIELD* ____ (GPM) & TEST TYPE ____

TEST LENGTH ____ (Hrs.) TOTAL DRAWDOWN ____ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL/GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	40	12"	X				PVC	6"	160	
40	60	12"		X			PVC	6"	160	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	23		X		
23	60				sand/gravel

ATTACHMENTS (✓)

____ Geologic Log

____ Well Construction Diagram

____ Geophysical Log(s)

____ Soil/Water Chemical Analyses

____ Other ____

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Hennings Bros. Drilling Co.,Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

3525 Pelandale Ave. Modesto CA 95356
ADDRESS CITY STATE ZIP

Signed Madeline Eddy 8-5-91 290813
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 7-90

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e076050

DWR Use Only – Do Not Fill In

0 1 S 0 6 E 3 4

State Well Number/Site Number

N Latitude W Longitude

APN/TRS/Other

Page ______ of ______

Owner's Well Number SP-20

Date Work Began 06/24/2008 Date Work Ended 6/27/2008

Local Permit Agency San Joaquin County

Permit Number SR# 054635 Permit Date 6/20/08

Geologic Log

Orientation ⦿ Vertical ○ Horizontal ○ Angle Specify ______

Drilling Method Hollow Stem Auger Drilling Fluid ______

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	25	Sandy silt

Total Depth of Boring 25 Feet

Total Depth of Completed Well 25 Feet

Well Owner

Name

Mailing Address

City

Well Location

Address Harlan Road (16500 South I-5

City Lathrop County San Joaquin

Latitude ___ Deg. ___ Min. ___ Sec. N Longitude ___ Deg. ___ Min. ___ Sec. W

Datum ______ Decimal Lat. ______ Decimal Long. ______

APN Book 198 Page 210 Parcel 17

Township ______ Range ______ Section ______

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

West

East

South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⦿ New Well
○ Modification/Repair
○ Deepen
○ Other ______
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
⦿ Sparging
○ Test Well
○ Vapor Extraction
○ Other ______

Water Level and Yield of Completed Well

Depth to first water ______ (Feet below surface)

Depth to Static Water Level ______ (Feet) Date Measured ______

Estimated Yield * ______ (GPM) Test Type ______

Test Length ______ (Hours) Total Drawdown ______ (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	23	8	Blank	PVC		3/4		
23	25	8	Screen	Ceramic Plug		2		

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	19	Cement	
19	21	Bentonite	
21	25	Fill	Sand # 2/12

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☑ Other Site Map

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Cascade Drilling, Inc
Person, Firm or Corporation

3632 Omec Circle (Address) Rancho Cordova (City) CA (State) 95742 (Zip)

Signed [signature] C-57 Licensed Water Well Contractor

7/14/2008 Date Signed

717510 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Origin with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e054608

DWR Use Only – Do Not Fill In

02S04E25

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Page ____ of ____

Owner's Well Number ____

Date Work Began 6/13/07 Date Work Ended 6/19/07

Local Permit Agency San JoaQUIN Health Dept.

Permit Number 50895 Permit Date ____

Geologic Log

Orientation: ◉ Vertical ○ Horizontal ○ Angle Specify ____

Drilling Method mud rotary Drilling Fluid water

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	2	topsoil
2	55	clay
55	65	sand/gravel
65	155	clay
155	185	blue clay
185	200	blue shale
200	212	blue shale/sand streaks
212	230	brown clay
230	245	sand sand
245	270	clay
270	305	shale
305	325	sand/small gravel
325	340	clay

Total Depth of Boring 340 Feet

Total Depth of Completed Well 325 Feet

Well Owner

N

M

C

Well Location

Address 25267 S. Lammers Rd.

City Tracy County San Joaquin

Latitude ____ Deg. ____ Min. ____ Sec. N Longitude ____ Deg. ____ Min. ____ Sec. W

Datum ____ Decimal Lat. ____ Decimal Long. ____

APN Book 209 Page 250 Parcel 38

Township ____ Range ____ Section ____

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

West

East

South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

☒ New Well

○ Modification/Repair

○ Deepen

○ Other ____

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply

☒ Domestic ☐ Public

☐ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other ____

Water Level and Yield of Completed Well

Depth to first water ____ (Feet below surface)

Depth to Static Water Level 88' (Feet) Date Measured ____

Estimated Yield * ____ (GPM) Test Type ____

Test Length ____ (Hours) Total Drawdown ____ (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)
0	305	14	blank	PVC	SDR26	88		
305	325	14	screen	PVC	SDR26	8	45/	1000

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	100		quik grout
100	325		No 8 sand & gravel

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☐ Other ____

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Hennings Bros. Drilling Co., Inc.

Person, Firm or Corporation

3525 Pelandale Ave. Modesto CA 95356

Address City State Zip

Signed [signature] 6/27/07 290813

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

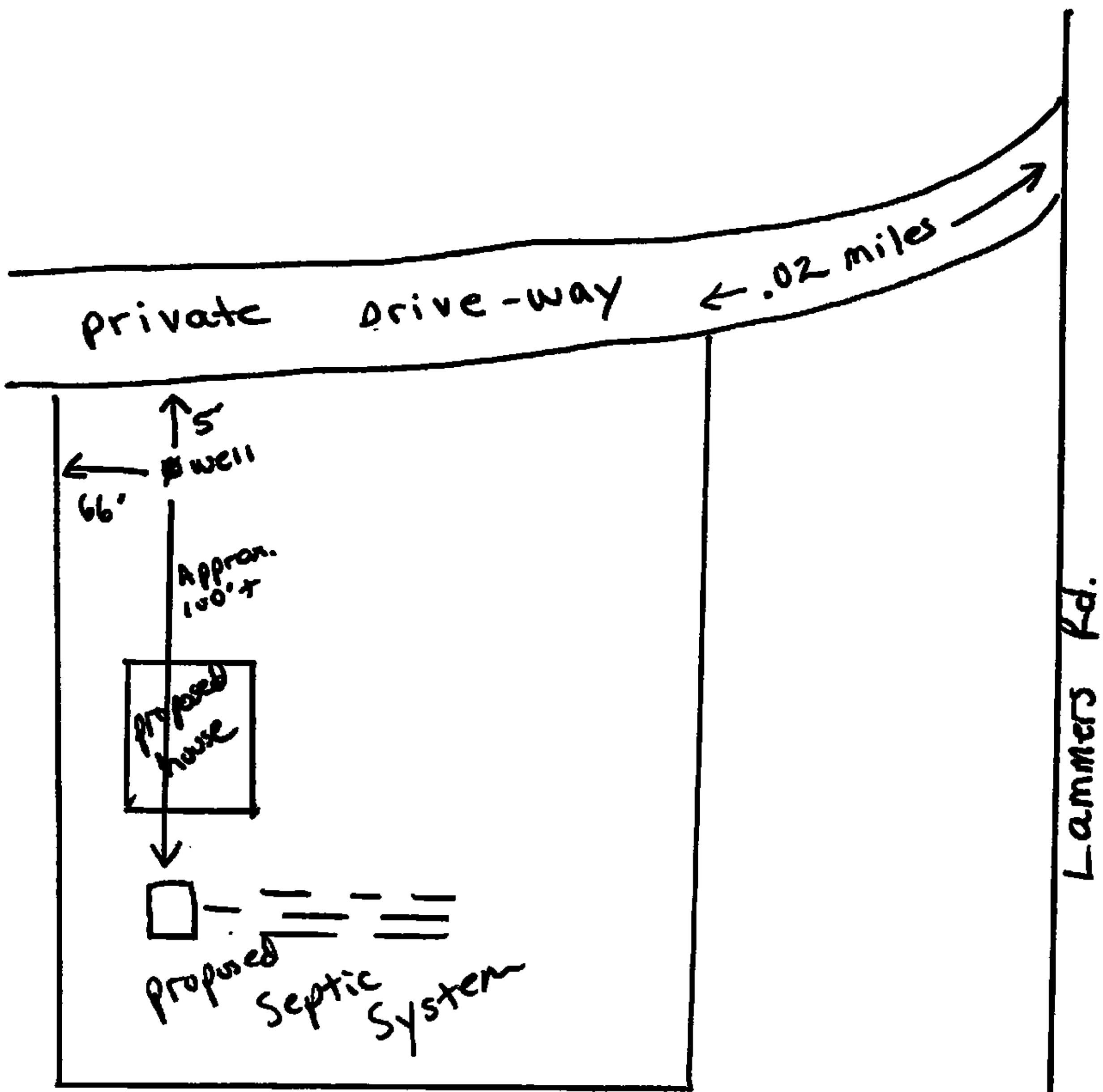
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

e054608

8" PVC
est. 250'

↑
N

LOC: 25267 S. Lammers Rd.
tracy



approx. 1/4 mile
N of Schulte Rd.

39-597

R7-259 (Dec.51)
Bureau of Reclamation

WELL LOG

County San Joaquin | Owner [illegible] | U.S.B.R. No. 25/4E 2-4-34H1
Dist. Delta | Use stock | Local No. None
Quad. Tracy | Driller Green & Berry | Date December 1927
Location 900' W, 2500' S, NE corner

Surf. Elev. ±220 | Groundwater elev. ±05 | Date Dec. 1927
Depth 273 | Groundwater elev. | Date
Yield | Aquifers
Drawdown | Artesian head | Date
Casing | % Sand-gravel

Source of data Green & Berry's files Type drill Cable tool Diam. hole

Depth	Elev.	Material	Description
0-3		top soil	Well Measuring No. 2-4-34
3-24		sandy clay	
24-33		rock, gravel w/s hardset	No perforation log
33-35		hardset sand	
35-40		rock (gravel)	No pump test
40-51		clay	
51-91		sticky clay	No E-log
91-96		rock (gravel)	
96-150		hard clay	Collected by Woolfe in Modesto,
150-152		rock (gravel)	March 22, 1951
152-160		clay	
160-162		sandy clay	$893.00 cost of drilling well
162-168		brown shale (clay)	plus casing etc.
168-175		blue shale (clay)	
175-180		clay and rock (gravel)	
180-209		blue clay	
209-215		[illegible] clay	
215-250		blue shale	
250-252		hardset sand	
252-255		rock and sand	
255-265		hardset shale	
265-273		rock, shale and sand	

B	A
G	H

NE¼, 2-4-34

39-597

Division of Resources Planning
Water Well Construction and Sanitary Survey

State No. 2S / 4E-34H1 M.D. County ____

Investigation ____ G.W. Basin S.J. Valley No. 5-22

Region 5 U.S.G.S. Quad ____ Scale ____

Owner ____

Location 900' west of Hansen Road, 0.45 mile south of Schulte Road

Use Stock - Domestic Depth 273' Diameter ____ Method of const. ____ Gravel Packed

1. Distance from contamination 10'* Source ____
2. Drainage toward casing ____ away X subject to flooding ____ well pit No
3. Type of platform wood ____ concrete X metal ____ pump mounted on casing ____ not on casing ____
4. Height of casing above ground surface 3"
5. Seal between casing and platform Concrete
6. Seal between pump base and platform No
7. Seal between casing and down pipe (pump off-set) ____
8. Well vent No if so, screened ____
9. Measuring hole No if so, capped ____
10. Evidence of oil leaking into well NO- JET
11. Can bacterial sample be taken at well No
12. Sample Point Garden Tap at house

Remarks *From animal yards

Log Yes Source B-R

Log ____ Source ____

Casing type ____

Casing seat ____

Casing depth ____

Type joint ____

Annular seals ____ Depth ____

Conductor pipe ____ Depth ____

Casing Reduction ____

Perforations type ____

Remarks ____

Mineral Analysis ____ Date ____

Bacterial Analysis ____ Date ____

ORIGINAL
File with DWR

Page 1 of 2

Owner's Well No.

Date Work Began July 10,2000, Ended July 21, 2000

Local Permit Agency San Joaquin Co. Health Dept.

Permit No. 23267 Permit Date

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 819765

DWR USE ONLY — DO NOT FILL IN

02S05E22

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD Mud Rotary FLUID Bentonite & Water

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	2	Top Soil
2	14	Clay
14	19	Sand
19	48	Clay
48	65	Sand & Gravel
65	104	Clay
104	106	Sand
106	110	Clay
110	115	Clay & Sand Streaks
115	120	Clay
120	122	Sand
122	127	Clay & Shale
127	138	Clay
138	140	Sand
140	145	Clay & Shale
145	148	Sand
148	154	Clay
154	160	Clay with Sand Streaks
160	230	Clay & Shale
230	320	Blue Clay
320	322	Blue Sand
322	330	Blue Clay
330	332	Blue Sand
332	338	Blue Clay
338	343	Blue Sand
343	347	Blue Clay
347	349	Blue Sand
349	355	Blue Clay
355	362	Blue Shale
362	412	Blue Clay

TOTAL DEPTH OF BORING 550 (Feet)

TOTAL DEPTH OF COMPLETED WELL 520 (Feet)

WELL OWNER

WELL LOCATION

Address 23833 Chrisman Rd.

City Tracy

County San Joaquin

APN Book 250 Page 140 Parcel 14

Township ___ Range ___ Section ___

Latitude ___ NORTH DEG. MIN. SEC. Longitude ___ WEST DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY

X Domestic X Public

___ Irrigation ___ Industrial

MONITORING ___

TEST WELL ___

CATHODIC PROTECTION ___

HEAT EXCHANGE ___

DIRECT PUSH ___

INJECTION ___

VAPOR EXTRACTION ___

SPARGING ___

REMEDIATION ___

OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 90' (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	100	14"	X				PVC	8"	160C1	
100	300	14"	X				PVC	8"	200C1	
300	480	14"	X				PVC	8"	160C1	
480	520	14"		X			PVC	8"	160C1	45/1000

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	200		X		
200	520			X	Sand/Gravel

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME HENNINGS BROS. DRILLING CO., INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

3525 PELANDALE AVE. MODESTO CA 95356-9781
ADDRESS CITY STATE ZIP

Signed Catharine Wengel JULY 26,2000 290813
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 2 of 2

Owner's Well No. ____

Date Work Began ____, Ended ____

Local Permit Agency ____

Permit No. ____ Permit Date ____

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 819765 pg. 2

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ___ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ____ FLUID ____

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
412	420	Blue Sand
420	435	Blue Clay
435	445	Blue Sand
445	484	Blue Clay
484	494	Clay
494	497	Sand
497	500	Clay
500	509	Sand
509	512	Clay
512	516	Sand
516	550	Clay

TOTAL DEPTH OF BORING ____ (Feet)

TOTAL DEPTH OF COMPLETED WELL ____ (Feet)

WELL OWNER

WELL LOCATION

Address ____

City ____

County ____

APN Book ____ Page ____ Parcel ____

Township ____ Range ____ Section ____

Latitude ____ NORTH (DEG. MIN. SEC.) Longitude ____ WEST (DEG. MIN. SEC.)

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

PLANNED USES (✓)

WATER SUPPLY

___ Domestic ___ Public

___ Irrigation ___ Industrial

MONITORING ___

TEST WELL ___

CATHODIC PROTECTION ___

HEAT EXCHANGE ___

DIRECT PUSH ___

INJECTION ___

VAPOR EXTRACTION ___

SPARGING ___

REMEDIATION ___

OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ____ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ____ (Ft.) & DATE MEASURED ____

ESTIMATED YIELD * ____ (GPM) & TEST TYPE ____

TEST LENGTH ____ (Hrs.) TOTAL DRAWDOWN ____ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE: CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME ____ (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS ____ CITY ____ STATE ____ ZIP ____

Signed ____ WELL DRILLER/AUTHORIZED REPRESENTATIVE ____ DATE SIGNED ____ C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

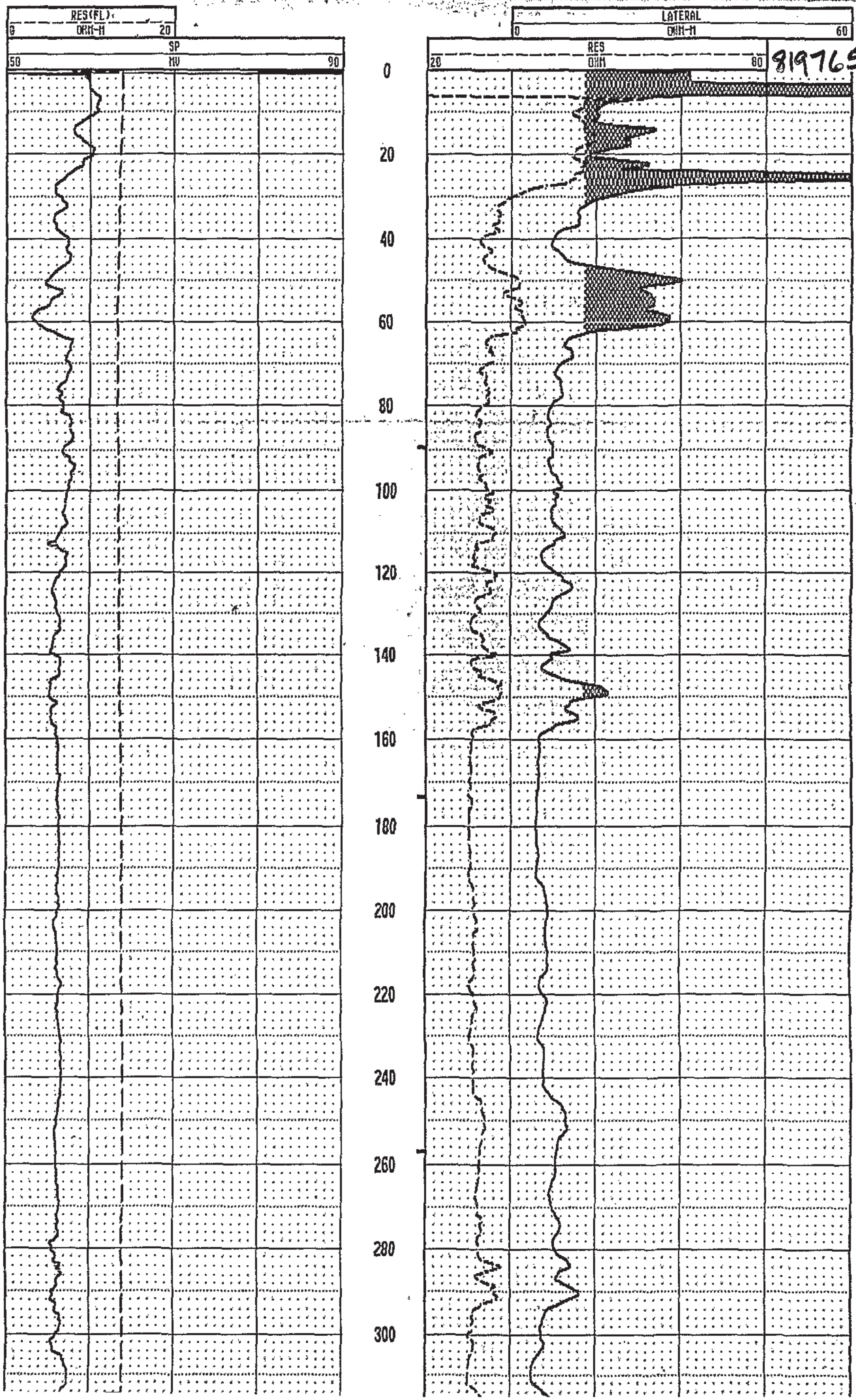
819765

GEO-HYDRO-DATA
INCORPORATED

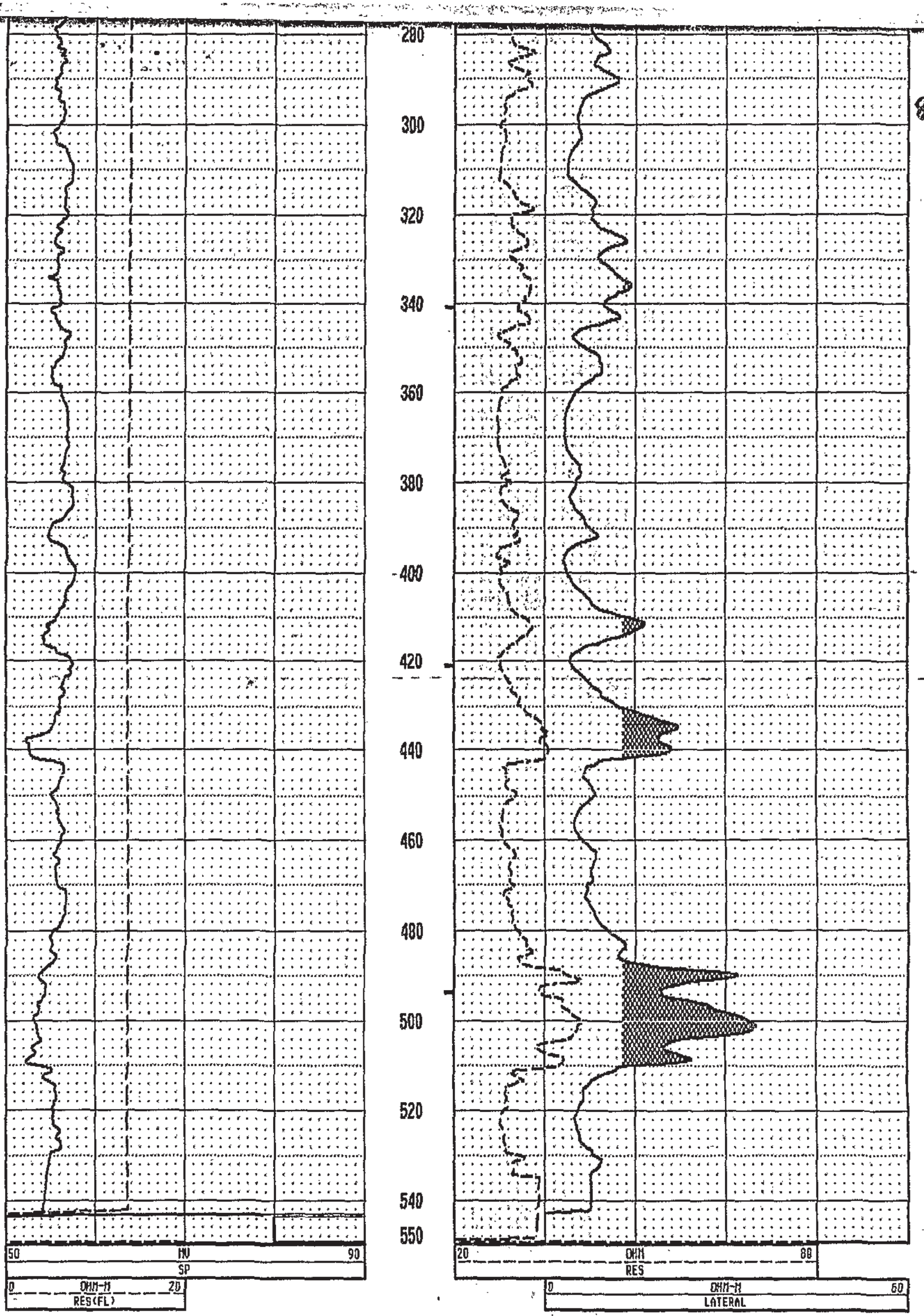
GROUNDWATER LOG

COMPANY	: NAVARRA BROS.			OTHER SERVICES:	
WELL	: 3			INVOICE	
LOCATION/FIELD	: TRACY/CHRISMAN AND 11TH			11258	
COUNTY	: SAN JOAQUIN			1000-D	
STATE	: CA.				
SECTION	: N/A	TOWNSHIP	: N/A	RANGE	: N/A
DATE	: 07/12/00	PERMANENT DATUM	: G.L.	ELEVATIONS	
DEPTH DRILLER	: 533 FEET	ELEV. PERM. DATUM	: G.L.	KB	: N/A
LOG BOTTOM	: 549.60	LOG MEASURED FROM	: G.L.	DF	: N/A
LOG TOP	: 0.40	DRL MEASURED FROM	: G.L.	GL	: N/A
CASING DRILLER	: -	LOGGING UNIT	: 4		
CASING TYPE	: -	FIELD OFFICE	: CLEMENTS,CA		
CASING THICKNESS	: -	RECORDED BY	: D.SHANHOLTZR		
BIT SIZE	: 8	BOREHOLE FLUID	: CLAY/GEL	FILE	: ORIGINAL
MAGNETIC DECL.	: -	RM	: -	TYPE	: 9041A
MATRIX DENSITY	: -	RM TEMPERATURE	: -	LOG	: 2
FLUID DENSITY	: -	MATRIX DELTA T	: -	PLOT	: 1 4
NEUTRON MATRIX	: N/A	FLUID DELTA T	: -	THRESH	: 5000

REMARKS :
- DRILL-HENNINGS BROS. MODESTO,CA.
WATER QUALITY-ABOVE 200'-VERY POOR-1000-1200,BELOW-FAIR-600-800 PPM TDS


RES(FL)
OHM-M
0
20
SP
MV
50
90
LATERAL
OHM-M
0
60
RES
OHM
20
80
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300

819765


280
300
320
340
360
380
400
420
440
460
480
500
520
540
550
50 MV 90
SP
0 OHM-M 20
RES(FL)
20 OHM 80
RES
0 OHM-M 60
LATERAL

819765

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

Page 2 of ________

Owner's Well Number ________

Date Work Began 7/28/06 Date Work Ended 8/3/06

Local Permit Agency San Joaquin Health dept.

Permit Number 47310 Permit Date ________

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e041925

DWR Use Only – Do Not Fill In

0 2 S 0 5 E 2 4

State Well Number/Site Number

Latitude ____ N Longitude ____ W

APN/TRS/Other

Geologic Log

Orientation ⊗ Vertical ○ Horizontal ○ Angle Specify ________

Drilling Method mud rotary Drilling Fluid water

Depth from Surface Feet	to Feet	Description (Describe material, grain size, color, etc)
0	3	topsoil
3	17	clay
17	35	sand
35	40	clay
40	135	sand
135	140	clay
140	160	blue shale
160	190	clay
190	286	blue clay
286	292	blue sand
292	298	blue clay
298	305	blue sand
305	498	blue clay/shale
498	510	sand/gravel

Total Depth of Boring 510 Feet

Total Depth of Completed Well 510 Feet

Well Owner

N

M

C

Well Location

Address 22519 S. Sixth St.

City Tracy County San Joaquin

Latitude ____ Deg. ____ Min. ____ Sec. N Longitude ____ Deg. ____ Min. ____ Sec. W

Datum ____ Decimal Lat. ____ Decimal Long. ____

APN Book 250 Page 050 Parcel 08

Township ____ Range ____ Section ____

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

West East

South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

⊗ New Well

○ Modification/Repair

○ Deepen

○ Other ________

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply

☒ Domestic ☐ Public

☐ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

○ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other ________

Water Level and Yield of Completed Well

Depth to first water ________ (Feet below surface)

Depth to Static Water Level 66' (Feet) Date Measured ________

Estimated Yield * ________ (GPM) Test Type ________

Test Length ________ (Hours) Total Drawdown ______ (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	490	12	blank	PVC	SDR17	6		
490	510	12	screen	PVC	SDR17	6		45/1000

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	200		quik grout
200	510		No 8 sand & gravel

Attachments

☐ Geologic Log

☐ Well Construction Diagram

☐ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☐ Other ________

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Hennings Bros. Drilling Co., Inc.

Person, Firm or Corporation

3525 Pelandale Ave. Modesto CA 95356

Address City State Zip

Signed [signature] 9/1/06 290813

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

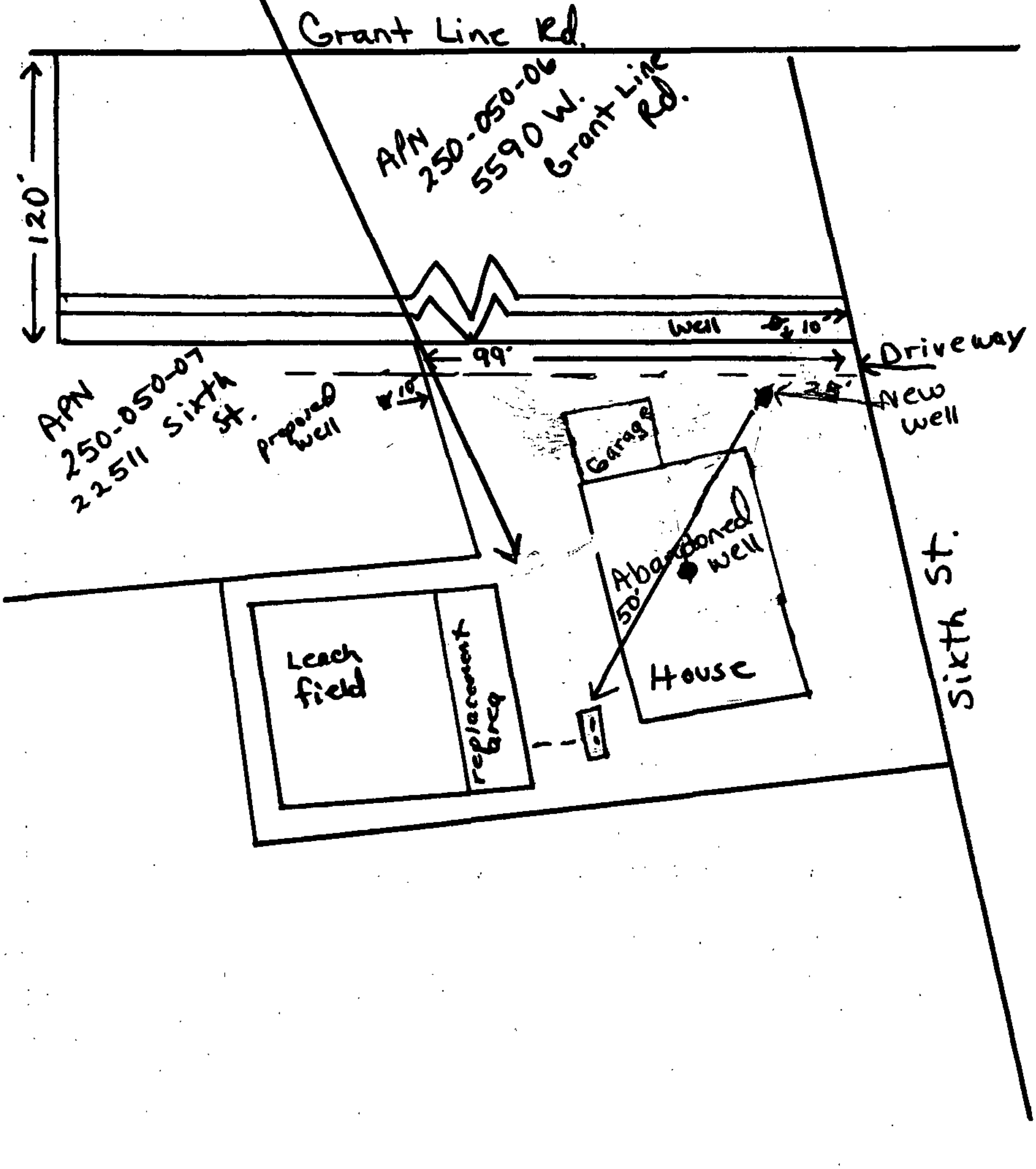
E041910

tina Duncan

6" PVC
est. 500'

N

LOC: 225A Sixth St.
tracy APN 250-050-08



ORIGINAL
File Original, Duplicate and Triplicate with the
DIVISION OF WATER RESOURCES
P. O. BOX 1079
SACRAMENTO 5, CALIFORNIA

WATER WELL DRILLERS RE[PORT]

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA—DEPARTMENT OF PUBLIC WORKS

JAN 2 2 1960 DIVISION OF WATER RESOURCES 2580

39-1139

[LOCATI]ON NOT CHECKED

Do Not Fill In

[Stat]e Well No. 2/5E

Other Well No.

Region C5

(1) DRILLER: (person, firm, or corporation)
Name O. H. Hurd
Address Box 34
Patterson Cal

OW[NER:]
Na[me]
Ad[dress]

(2) Proposed Use (Check)

Domestic	☒	Industrial	☐
Irrigation	☐	Test Well	☐
Municipal	☐	Other	☐

Equipment

Rotary	☐
Cable	☒
Dug Well	☐
Other	☐

(3) CASING:
60 ft. of 7 in 12 No./ga. casing 60 left in well

Type and size of shoe or well ring Collar welded on bottom

(4) PERFORATIONS:
Type of perforator used Factory
Perforated 18 ft. to [illegible] ft. [illegible] holes per in.

Diameter of perforations in., length in.

(5) WATER LEVELS:
Was electric log made of well? ☐ Yes ☒ No If yes, attach copy.
Depth at which water was first found 11 ft.
Standing level before perforating 11 ft.
Standing level after perforating 11 ft.
Note your observation of any change in water level while drilling No change
Was a surface sanitary seal provided? casing welded
[illegible]

(6) WELL PUMPING TEST:
Capacity gal./min. ft. draw down
Was well gravel packed?
Are any strata sealed against pollution?
Temperature Was a chemical analysis made? Attach copy
If abandoned was well capped?

(7) TYPE OF WORK (check):
New well ☒ Reconditioning of well ☐
Deepening existing well ☐

(8) LOCATION OF WELL:
County San Joaquin
R. F. D. or Street No. at
Bonita welding and machine works
well South east corner of shop

(9) WELL LOG:
Total depth of well ft.
Formation: Mention size of water gravel—

ft. to	ft.	
0	12	soft dirt
12	24	fine gravel and sand
24	27	yellow clay
27	40	[illegible] mixed
40	60	fine sand and small gravel

CONFIDENTIAL Section 7076.1, Water Code

FOR OFFICIAL USE ONLY

Work started July 14 1952 Completed July 16 1952
Date of Report Aug. 14 1952

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

[SIGNED] O. H. Hurd
Well Driller

By
License No. Classification
Dated , 19

46370 7-51 30M QUIN SPO

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 145635

[redacted] of Intent No. ______

[redacted] Permit No. or Date ______

State Well No. ______

Other Well No. 2S/5E-31N/41

(1) ______

Address ______

City ______

(2) LOCATION OF WELL (See instructions):

County San Joaquin Owner's Well Number ______

Well address if different from above ______

Township ______ Range ______ Section ______

Distance from cities, roads, railroads, fences, etc. 13203 W. Valpico Rd.- East of Lammers Rd.

[redacted]

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐

Irrigation ☐

Industrial ☐

Test Well ☐

Stock ☐

Municipal ☐

Other heat pump ☒

(5) EQUIPMENT:

Rotary ☒ Reverse ☐

Cable ☐ Air ☐

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size birdseye

Diameter of bore 14"

Packed from 50 to 83 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	83	6	160	68	83	hand cut

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 50 ft.

Were strata sealed against pollution? Yes ☐ No ☐ Interval ______ ft.

Method of sealing Bentonite

(10) WATER LEVELS:

Depth of first water, if known ______ ft.

Standing level after well completion ______ ft.

(11) WELL TESTS:

Was well test made? Yes ☐ No ☒ If yes, by whom? ______

Type of test Pump ☐ Bailer ☐ Air lift ☐

Depth to water at start of test ______ ft. At end of test ______ ft

[redacted] gal/min after ______ hours Water temperature ______

[redacted] analysis made? Yes ☐ No ☒ If yes, by whom? ______

Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 83 ft. Depth of completed well 83 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	-10	Clay
10	-17	Gravel
17	-23	Clay
23	-31	Gravel
31	-49	Clay
49	-53	Gravel
53	-70	Clay
70	-80	Gravel
80-83	-	Clay

Work started 2-2 1978 Completed ______ 19__

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Madeline Roddy Sec.
(Well Driller)

NAME Hennings Bros. Drilling Co.,Inc.
(Person, firm, or corporation) (Typed or printed)

Address 3525 Pelandale Ave.

City Modesto, Ca. Zip 95350

License No. 290813 Date of this report 2-14-78

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Owner's Well No. MW#1A

Date Work Began 8/5/02, Ended 8/9/02

Local Permit Agency SAN JOAQUIN CO ENV. HEALTH

Permit No. SRO030323 Permit Date 6/27/02

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 788418

DWR USE ONLY — DO NOT FILL IN

0250[?]05E120 M

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain, size, color, etc.*
0	20	BASE ROCK AND CLAY
20	40	SMALL AND 3/8" GRAVEL
40	80	SMALL GRAVEL AND BROWN CLAY
80	100	BROWN CLAY
100	160	BROWN CLAY AND SMALL GRAVEL
160	280	BROWN CLAY AND 3/8" GRAVEL
280	300	GRAY CLAY AND 3/8" ROCK
300	480	GRAY CLAY

TOTAL DEPTH OF BORING 480 (Feet)

TOTAL DEPTH OF COMPLETED WELL 468 (Feet)

WELL LOCATION

Address WEST ELEVENTH ST. E. CORRAL HOLLOW

City TRACY CA

County SAN JOAQUIN

APN Book 232 Page 170 Parcel 18

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
- ___ Deepen
- ___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
- ___ Domestic ___ Public
- ___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	428	14	✓				STEEL	6 5/8	.188	
428	468	14		✓			STEEL	6 5/8	.188	0.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	400	✓			
400	480			✓	8/16 SILICA

ATTACHMENTS (✓)

- ___ Geologic Log
- ___ Well Construction Diagram
- ___ Geophysical Log(s)
- ___ Soil/Water Chemical Analysis
- ___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

17702 BALDWIN MADERA CA 93638
ADDRESS CITY STATE ZIP

Signed [signature] 10/21/02 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. **788417**

DWR USE ONLY — DO NOT FILL IN
0 2 S 0 5 E 2 0 M
STATE WELL NO./STATION NO.
LATITUDE | LONGITUDE
APN/TRS/OTHER

Owner's Well No. MW#1B
Date Work Began 8/5/02; Ended 8/9/02
Local Permit Agency SAN JOAQUIN CO. ENV. HEALTH
Permit No. SRO030323 Permit Date 6/27/02

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0	20	BASE ROCK AND CLAY
20	40	SMALL AND 3/8" GRAVEL
40	80	SMALL GRAVEL AND BROWN CLAY
80	100	BROWN CLAY
100	160	BROWN CLAY AND SMALL GRAVEL
160	280	BROWN CLAY AND 3/8" GRAVEL
280	300	GRAY CLAY AND 3/8" ROCK
300	560	GRAY CLAY
560	600	GRAY CLAY AND SMALL GRAVEL
600	620	GRAY CLAY
620	660	GRAY CLAY AND SMALL GRAVEL
660	700	GRAY CLAY
700	720	GRAY CLAY AND MUDSTONE

TOTAL DEPTH OF BORING 670 (Feet)
TOTAL DEPTH OF COMPLETED WELL 658 (Feet)

CITY ___ STATE ___ ZIP ___

WELL LOCATION

Address WEST ELEVENTH ST. E. CORRAL HOLLOW
City TRACY CA
County SAN JOAQUIN
APN Book 232 Page 170 Parcel 18
Township ___ Range ___ Section ___
Latitude ___ DEG. MIN. SEC. ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	618	14	✓				STEEL	6 5/8	.188	
618	658	14		✓			STEEL	6 5/8	.188	0.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	590	✓			
590	670			✓	8/16 SILICA

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
17702 BALDWIN MADERA CA 93638
ADDRESS CITY STATE ZIP
Signed Rebecca L. Divin 10/21/02 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW#1C

Date Work Began 8/5/02, Ended 8/9/02

Local Permit Agency SAN JOAQUIN CO. ENV. HEALTH

Permit No. SRO030323 Permit Date 6/27/02

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 788416

DWR USE ONLY — DO NOT FILL IN

02S05E20 — STATE WELL NO./STATION NO.

LATITUDE / LONGITUDE

APN/TRS/OTHER

M

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain, size, color, etc.)
0	20	BASE ROCK AND CLAY
20	40	SMALL AND 3/8" GRAVEL
40	80	SMALL GRAVEL AND BROWN CLAY
80	100	BROWN CLAY
100	160	BROWN CLAY AND SMALL GRAVEL
160	280	BROWN CLAY AND 3/8" GRAVEL
280	300	GRAY CLAY AND 3/8" ROCK
300	560	GRAY CLAY
560	600	GRAY CLAY AND SMALL GRAVEL
600	620	GRAY CLAY
620	660	GRAY CLAY AND SMALL GRAVEL
660	700	GRAY CLAY
700	820	GRAY CLAY AND MUDSTONE

TOTAL DEPTH OF BORING 820 (Feet)

TOTAL DEPTH OF COMPLETED WELL 788 (Feet)

CITY STATE ZIP

WELL LOCATION

Address WEST ELEVENTH ST. E. CORRAL HOLLOW

City TRACY CA

County SAN JOAQUIN

APN Book 232 Page 170 Parcel 18

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. Longitude ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	748	14	✓				STEEL	6 5/8	.188	
748	788	14		✓			STEEL	6 5/8	.188	0.050

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	720	✓			
720	800			✓	8/16 SILICA

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

ADDRESS 17702 BALDWIN CITY MADERA STATE CA ZIP 93638

Signed Rebecca L Dunn — WELL DRILLER/AUTHORIZED REPRESENTATIVE — DATE SIGNED 10/21/02 — C-57 LICENSE NUMBER 414178

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

Page 1 of 1

Owner's Well No. MW6-A

Date Work Began 1/9/2004, Ended 1/15/2004

Local Permit Agency SAN JOAQUIN COUNTY ENV. HEALTH

Permit No. SR0035977 Permit Date 11/7/2003

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. E005366

DWR USE ONLY — DO NOT FILL IN

0215056331

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain, size, color, etc.)
0	20	CONDUCTOR
20	40	CLAY AND FINE SAND
40	60	MEDIUM SAND
60	80	CLAY AND FINE SAND
80	100	FINE SAND
100	140	FINE SAND AND CLAY STREAK
140	160	MEDIUM SAND AND SMALL GRAVEL
160	300	SILTY CLAY
300	320	SILTY FINE SAND
320	400	SILTY CLAY
400	460	MEDIUM AND FINE SAND
460	465	MEDIUM AND COARSE SAND/CLAY STREAKS

TOTAL DEPTH OF BORING 465 (Feet)

TOTAL DEPTH OF COMPLETED WELL 455 (Feet)

WELL OWNER

CITY STATE ZIP

WELL LOCATION

Address 311 E. LARCH ROAD

City TRACY CA 95304

County SAN JOAQUIN

APN Book 212 Page 230 Parcel 05

Township ___ Range ___ Section ___

Latitude ___ DEG. MIN. SEC. ___ DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
- ___ Deepen
- ___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___

ESTIMATED YIELD * ___ (GPM) & TEST TYPE ___

TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)

*May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	410	14	✓				STEEL	6 5/8	0.188	
410	450	14		✓			STEEL	6 5/8	0.188	0.05
450	455	14	✓				STEEL	6 5/8	0.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	390	✓			
390	450			✓	GRAVEL 8X16

ATTACHMENTS (✓)

- ___ Geologic Log
- ___ Well Construction Diagram
- ___ Geophysical Log(s)
- ___ Soil/Water Chemical Analysis
- ___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME BRADLEY & SONS
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

3625 S. HIGHLAND DEL REY CA 93616
ADDRESS CITY STATE ZIP

Signed [signature] 03/19/04 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 11-97

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL 500 W Arbor Ave
File with DWR
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No E005367

DWR USE ONLY — DO NOT FILL IN
02S05E16
STATE WELL NO / STATION NO
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No MW6 B
Date Work Began 1/11/2004 Ended 1/13/2004
Local Permit Agency SAN JOAQUIN COUNTY ENV HEALTH
Permit No SR0035977 Permit Date 11/7/2003

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft	to Ft	DESCRIPTION (Describe material, grain size, color, etc)
0	20	CONDUCTOR
20	40	CLAY AND FINE SAND
40	60	MEDIUM SAND
60	80	CLAY AND FINE SAND
80	100	FINE SAND
100	140	FINE SAND AND CLAY STREAK
140	160	MEDIUM SAND AND SMALL GRAVEL
160	300	SILTY CLAY
300	320	SILTY FINE SAND
320	400	SILTY CLAY
400	460	MEDIUM AND FINE SAND
460	500	MEDIUM SAND AND CLAY
500	520	MEDIUM AND COARSE SAND
520	540	COARSE SAND AND GRANITE
540	560	GRAVEL MIX AND CLAY
560	580	MEDIUM SAND AND SMALL GRAVEL
580	600	FINE AND MEDIUM SAND
600	620	MEDIUM SAND AND SMALL GRAVEL
620	645	COARSE SAND AND SMALL GRAVEL

TOTAL DEPTH OF BORING 645 (Feet)
TOTAL DEPTH OF COMPLETED WELL 635 (Feet)

WELL OWNER

WELL LOCATION

Address 311 E LARCH ROAD
City TRACY CA 95304
County SAN JOAQUIN
APN Book 212 Page 230 Parcel 05
Township ___ Range ___ Section ___
Latitude ___ DEG MIN SEC Longitude ___ DEG MIN SEC

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ✓
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
May not be representative of a well's long term yield

CASING (S)

DEPTH FROM SURFACE Ft	to Ft	BORE HOLE DIA (Inches)	BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	590	14	✓				STEEL	6 5/8	0.188	
590	630	14		✓			STEEL	6 5/8	0 188	0 05

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft	to Ft	CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	560	✓			
560	635			✓	GRAVEL 8X16

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analysis
___ Other
ATTACH ADDITIONAL INFORMATION IF IT EXISTS

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief
NAME BRADLEY & SONS
(PERSON, FIRM OR CORPORATION) (TYPED OR PRINTED)
3625 S HIGHLAND — DEL REY — CA — 93616
ADDRESS CITY STATE ZIP
Signed Rebecca L Dunn — 03/19/04 — 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE — DATE SIGNED — C-57 LICENSE NUMBER

DWR 188 REV 11 97
IF ADDITIONAL SPACE IS NEEDED USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL 500 W Arbor Ave
File with DWR
Page 1 of 1
Owner's Well No MW6 C
Date Work Began 1/26/2004 Ended 1/28/2004
Local Permit Agency SAN JOAQUIN COUNTY ENV. HEALTH
Permit No SR0035977 Permit Date 11/7/2003

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No E005368

DWR USE ONLY — DO NOT FILL IN
02S05E16
STATE WELL NO / STATION NO
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID WATER

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)
0	20	CONDUCTOR
20	40	CLAY AND FINE SAND
40	60	MEDIUM SAND
60	80	CLAY AND FINE SAND
80	100	FINE SAND
100	140	FINE SAND AND CLAY STREAK
140	160	MEDIUM SAND AND SMALL GRAVEL
160	300	SILTY CLAY
300	320	SILTY FINE SAND
320	400	SILTY CLAY
400	460	MEDIUM AND FINE SAND
460	500	MEDIUM SAND AND CLAY
500	520	MEDIUM AND COARSE SAND
520	540	COARSE SAND AND GRANITE
540	560	GRAVEL MIX AND CLAY
560	580	MEDIUM SAND AND SMALL GRAVEL
580	600	FINE AND MEDIUM SAND
600	620	MEDIUM SAND AND SMALL GRAVEL
620	640	MEDIUM SAND COARSE SAND AND SMALL GRAVEL
640	660	SILTY CLAY
660	720	SILTY CLAY MIX FINE AND MEDIUM SAND
720	760	CLAY AND MEDIUM SAND
760	800	MEDIUM AND COARSE SAND
800	820	CLAY AND COARSE SAND MIX

TOTAL DEPTH OF BORING 810 (Feet)
TOTAL DEPTH OF COMPLETED WELL 800 (Feet)

WELL OWNER

WELL LOCATION

Address 311 E LARCH ROAD
City TRACY CA 95304
County SAN JOAQUIN
APN Book 212 Page 230 Parcel 05
Township ___ Range ___ Section ___
Latitude ___ DEG MIN SEC Longitude ___ DEG MIN SEC

LOCATION SKETCH

NORTH / WEST / EAST / SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.**

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
— Deepen
— Other (Specify)
— DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
— Domestic — Public
— Irrigation — Industrial
MONITORING ✓
TEST WELL —
CATHODIC PROTECTION —
HEAT EXCHANGE —
DIRECT PUSH —
INJECTION —
VAPOR EXTRACTION —
SPARGING —
REMEDIATION —
OTHER (SPECIFY) —

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL ___ (Ft.) & DATE MEASURED ___
ESTIMATED YIELD ___ (GPM) & TEST TYPE ___
TEST LENGTH ___ (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
May not be representative of a well's long term yield

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE HOLE DIA (Inches)	BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	755	14	✓				STEEL	6 5/8	0.188	
755	795	14		✓			STEEL	6 5/8	0.188	0.05
795	800	14	✓				STEEL	6 5/8	0.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	730	✓			
730	800			✓	GRAVEL 8X16

ATTACHMENTS (✓)

— Geologic Log
— Well Construction Diagram
— Geophysical Log(s)
— Soil/Water Chemical Analysis
— Other
ATTACH ADDITIONAL INFORMATION IF IT EXISTS

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief
NAME BRADLEY & SONS
(PERSON, FIRM OR CORPORATION) (TYPED OR PRINTED)
3625 S HIGHLAND — DEL REY — CA — 93616
ADDRESS CITY STATE ZIP
Signed Rebecca L Dunn — 03/19/04 — 414178
WELL DRILLER/AUTHORIZED REPRESENTATIVE — DATE SIGNED — C-57 LICENSE NUMBER

DWR 188 REV 11 97
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ZIM INDUSTRIES, INC.

4545 E. Lincoln • Fresno, CA 93725

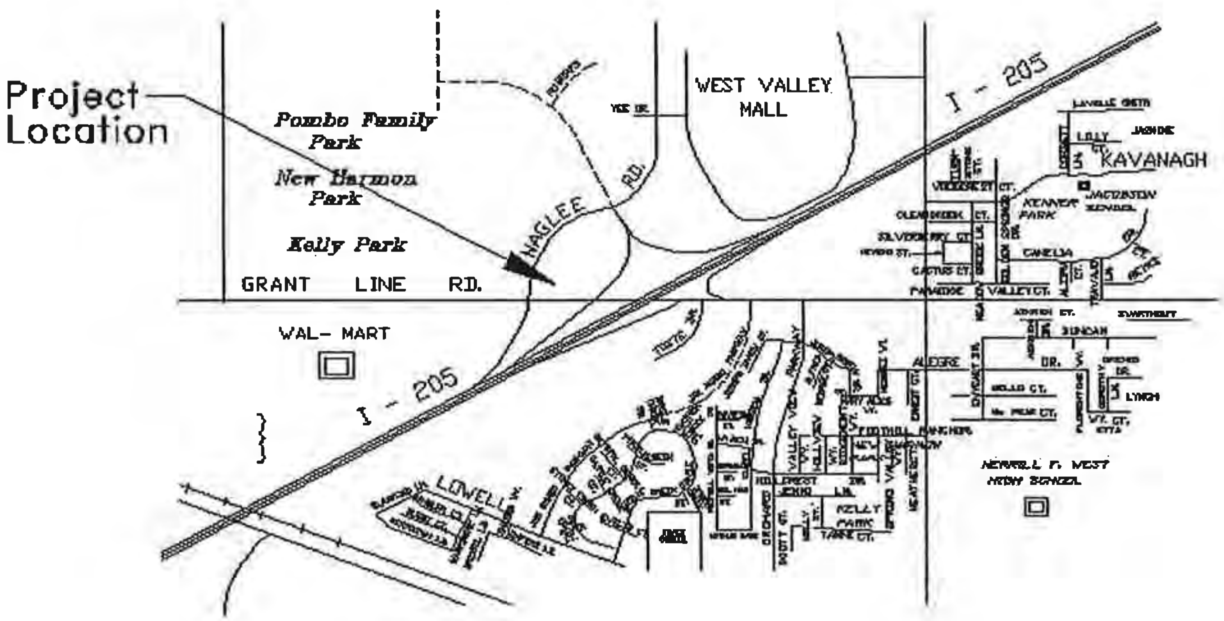
Fax Cover Sheet

To: Company:
Attention: Richard Slatz
Fax No: 916-852-6385
Date: 12-14-01
Subject: TRACY Park & Ride well

From: Sender: Brian Z.
# of Pages: 10
(including cover sheet)

Screen sections 1196-1176
1122-1014
982-966
796-774
754-738
678-656
636-610
598-550

Zim Industries, Inc. Phone (559)834-1551 Fax (559)834-5156


Project Location
Pombo Family Park
New Harmon Park
Kelly Park
GRANT LINE RD.
NAGLEE RD.
WEST VALLEY MALL
I - 205
I - 205
WAL- MART
KAVANAGH
LOWELL

welenco

ELECTRIC LOG

FILING NO.

COMPANY ZIM INDUSTRIES INC.
WELL PARK & RIDE TEST WELL
FIELD CITY OF TRACY
COUNTY SAN JOAQUIN STATE CALIFORNIA
LOCATION: GRANT LINE ROAD & HWY 205
OTHER SERV: 6' LATERAL

JOB NO. 34326

SEC ____ TWP ____ RGE ____

Permanent Datum: G.L. ____ Elev: ____ K.B. ____
Log Measured From G.L. ____ Ft Above Perm Datum D.F. ____
Drilling Measured From G.L. ____ G.L. ____

Date	OCT. 15, 2001	OCT. 15, 2001	
Run No.	TWO (E-LOG)	TWO (LATERAL)	
Depth - Driller	1240'	1240'	
Depth - Logger	1242'	1242'	
Btm. Log Inter.	1241'	1241'	
Top Log Inter.	50'	50'	
Casing-Driller	36" at 50'	36" at 50'	at
Casing-Logger	36" at 50'	36" at 50'	at
Bit Size	17.5"	17.5"	
Type Fluid In Hole	BENT/POLY.	BENT/POLY.	
Dens. | Visc.	N/A |	N/A |	|
pH | Fluid Loss	N/A | ml	N/A | ml	| ml
Source of Sample	PIT	PIT	
Rm at Meas.Temp	12.6 at 75 F	12.6 at 75 F	at F
Rmf at Meas.Temp	N/A at F	N/A at F	at F
Rmc at Meas.Temp	N/A at F	N/A at F	N/A at F
Source: Rmf Rmc	MEAS |	MEAS |	MEAS |
Rm at BHT	N/A at F	N/A at F	N/A at F
Time Since Circ.	N/A	N/A	
Max. Rec. Temp.	N/A F	N/A F	F
Equip | Location	L-22 | SNS	L-18 | SNS	|
Recorded By	SHARPLESS	SHARPLESS	
Witnessed By	K.WORSTER	K.WORSTER	

Fold Here — This Heading and Log Conform To API RP 31

Changes in Mud Type or Additional Samples				
Date | Sample No.				
Depth-Driller				
Type Fluid in Hole				
Dens. | Visc.				
ph | Fluid Loss		ml		ml
Source of Sample				
Rm at Meas. Temp.	at	F	at	F
Rmf at Meas. Temp.	at	F	at	F
Rmc at Meas. Temp.	at	F	at	F
Source: Rmf | Rmc				
Rm at BHT	at	F	at	F
Rmf at BHT	at	F	at	F
Rmc at BHT	at	F	at	F

Scale Changes			
Type Log	Depth	Scale Up Hole	Scale Down Hole

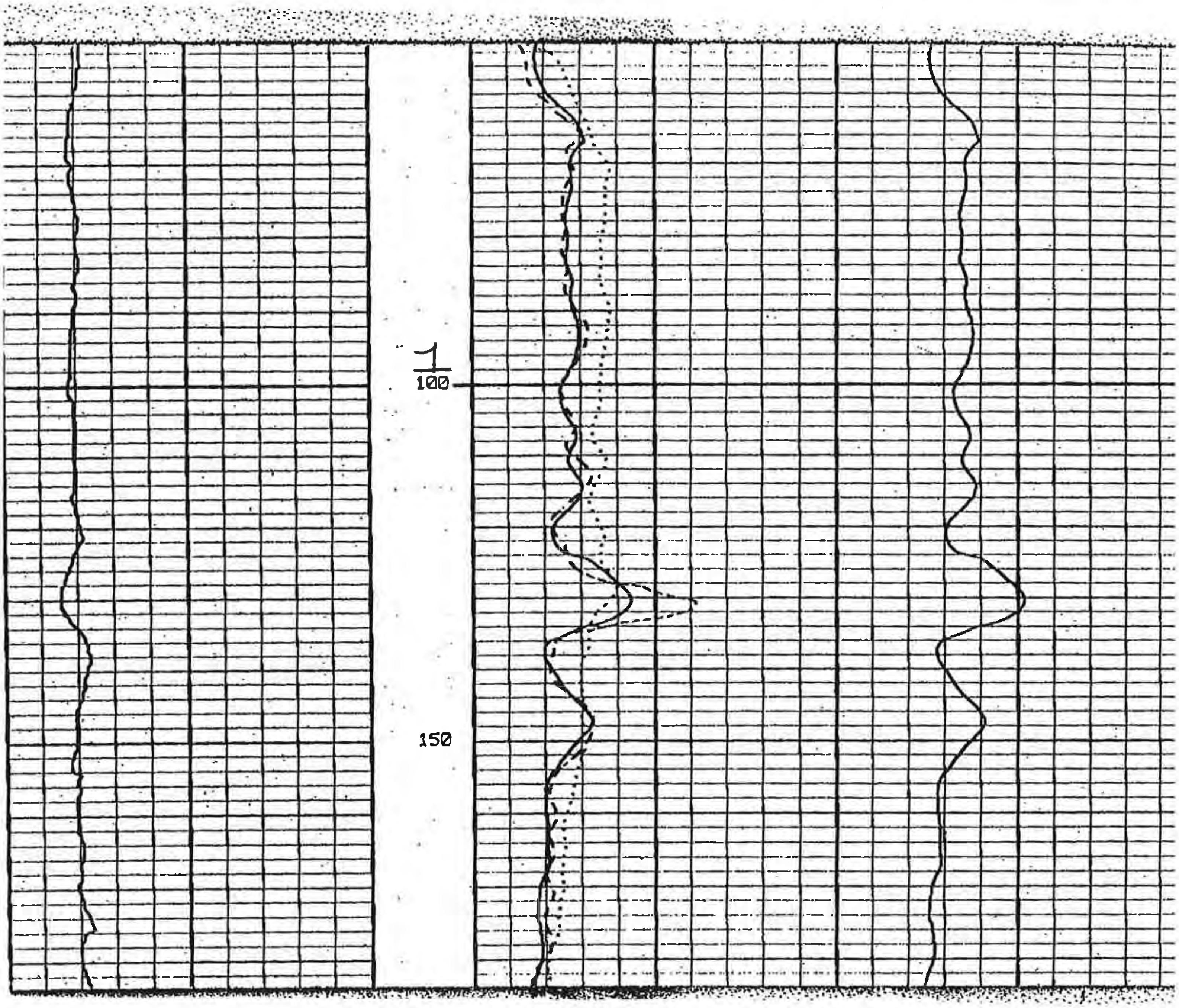
Equipment Data				
Run No.	Tool Type	PadType	Tool Pos	Other
ONE	ELECTRIC		FREE	

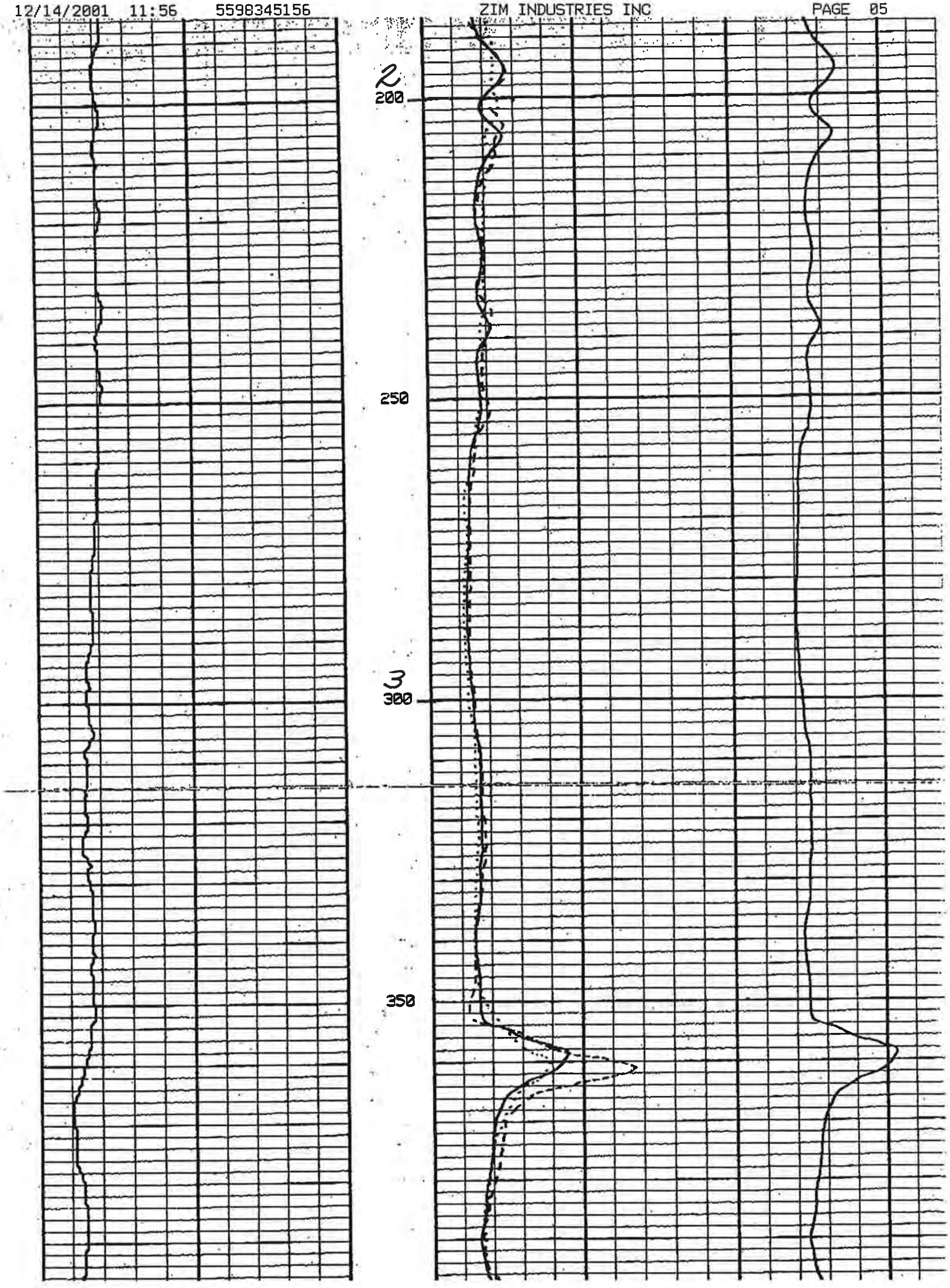
REMARKS: WELL DRILLED BY ZIM INDUSTRIES, INC.

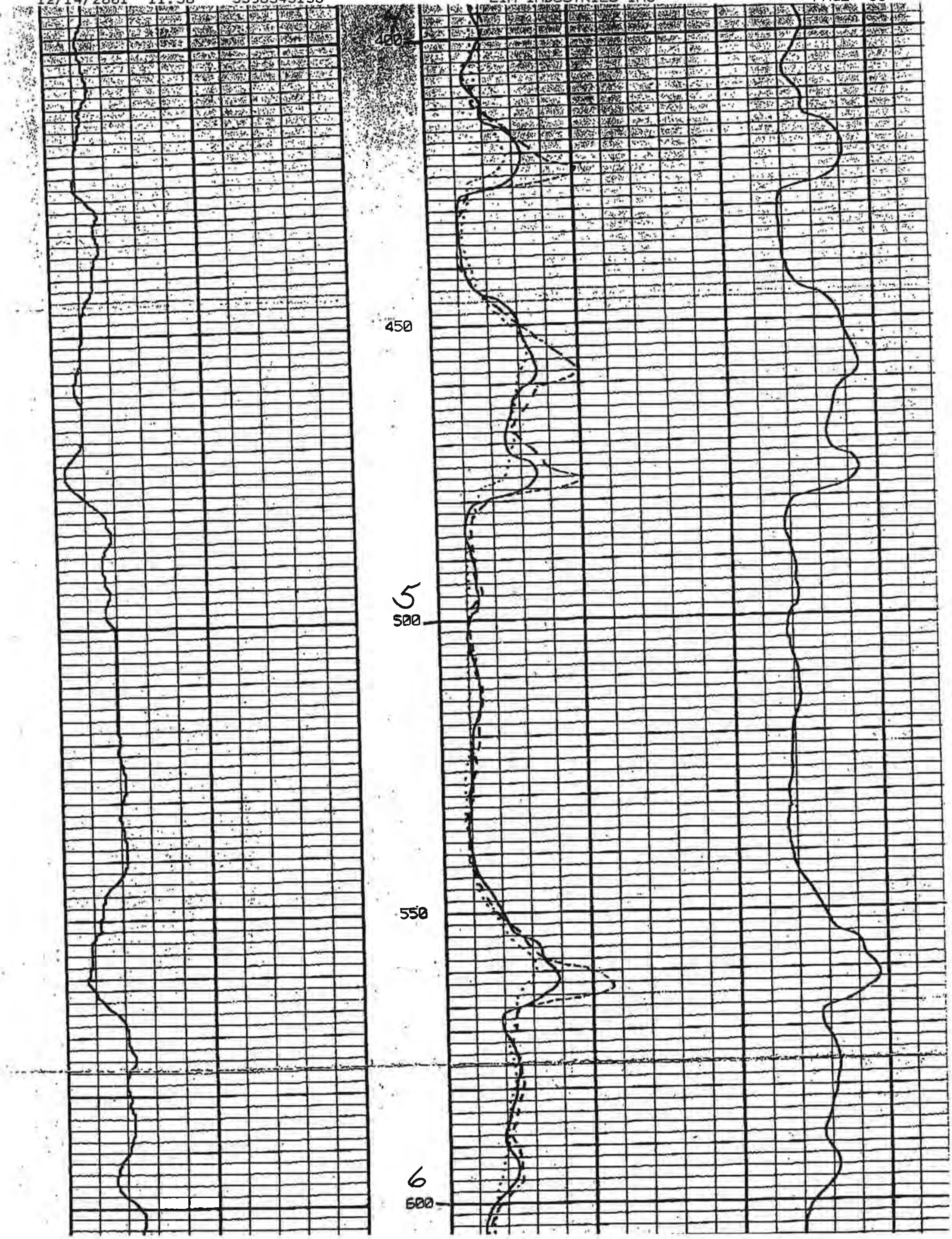
6' LATERAL SUPERIMPOSED OVER 16-64" NORMALS. PRESENTED AS A DASHED CURVE

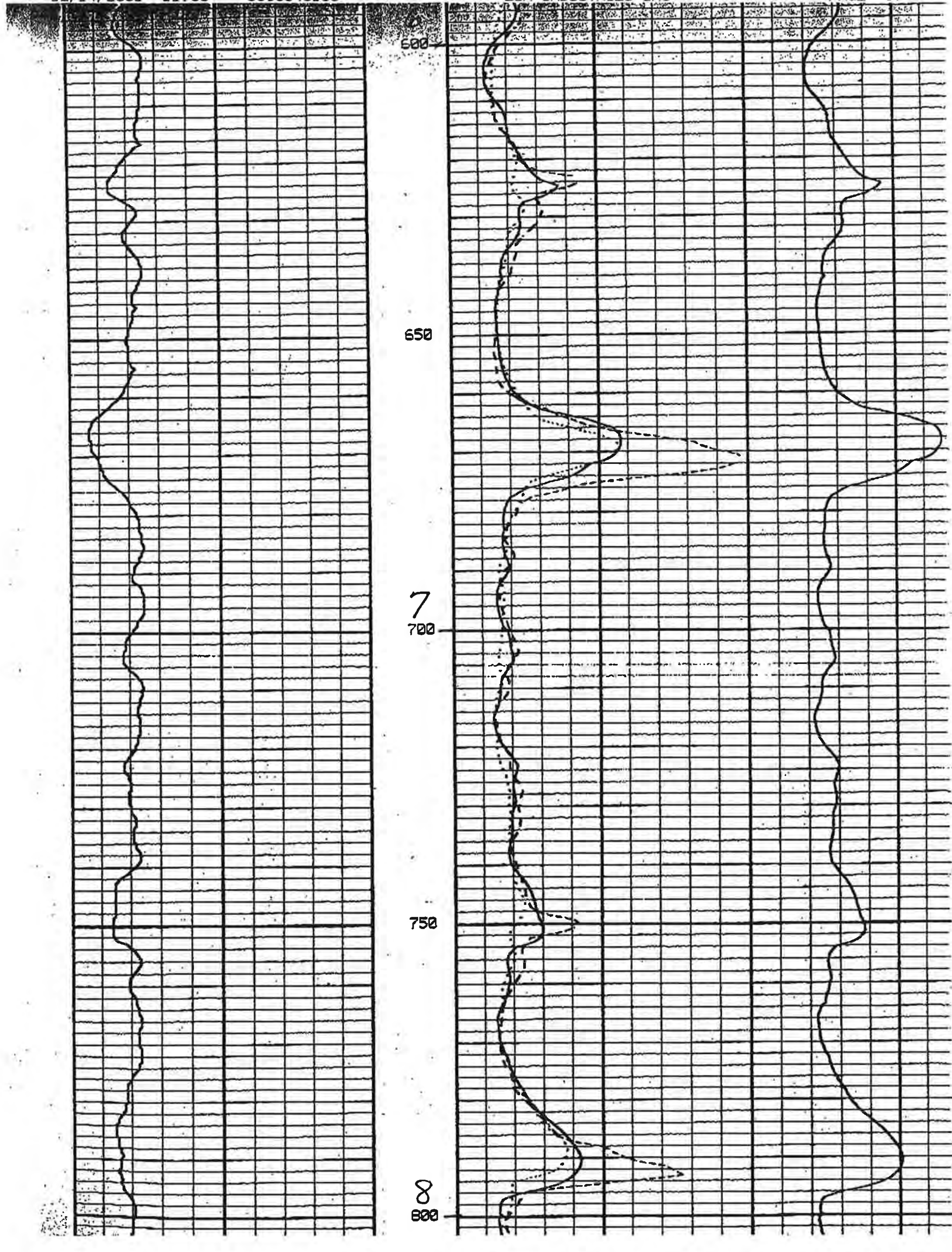
SPONTANEOUS POTENTIAL millivolts	DEPTHS	RESISTIVITY ohmmeters2 /meter	RESISTANCE ohms
− |←5→| +		SHORT NORMAL 16 Inch: 0 … 50	
		x10 BACK UP: 0 … 500	
		LONG NORMAL 64 Inch: 0 … 50	SINGLE POINT Detail Curve
		x10 BACK UP: 0 … 500	

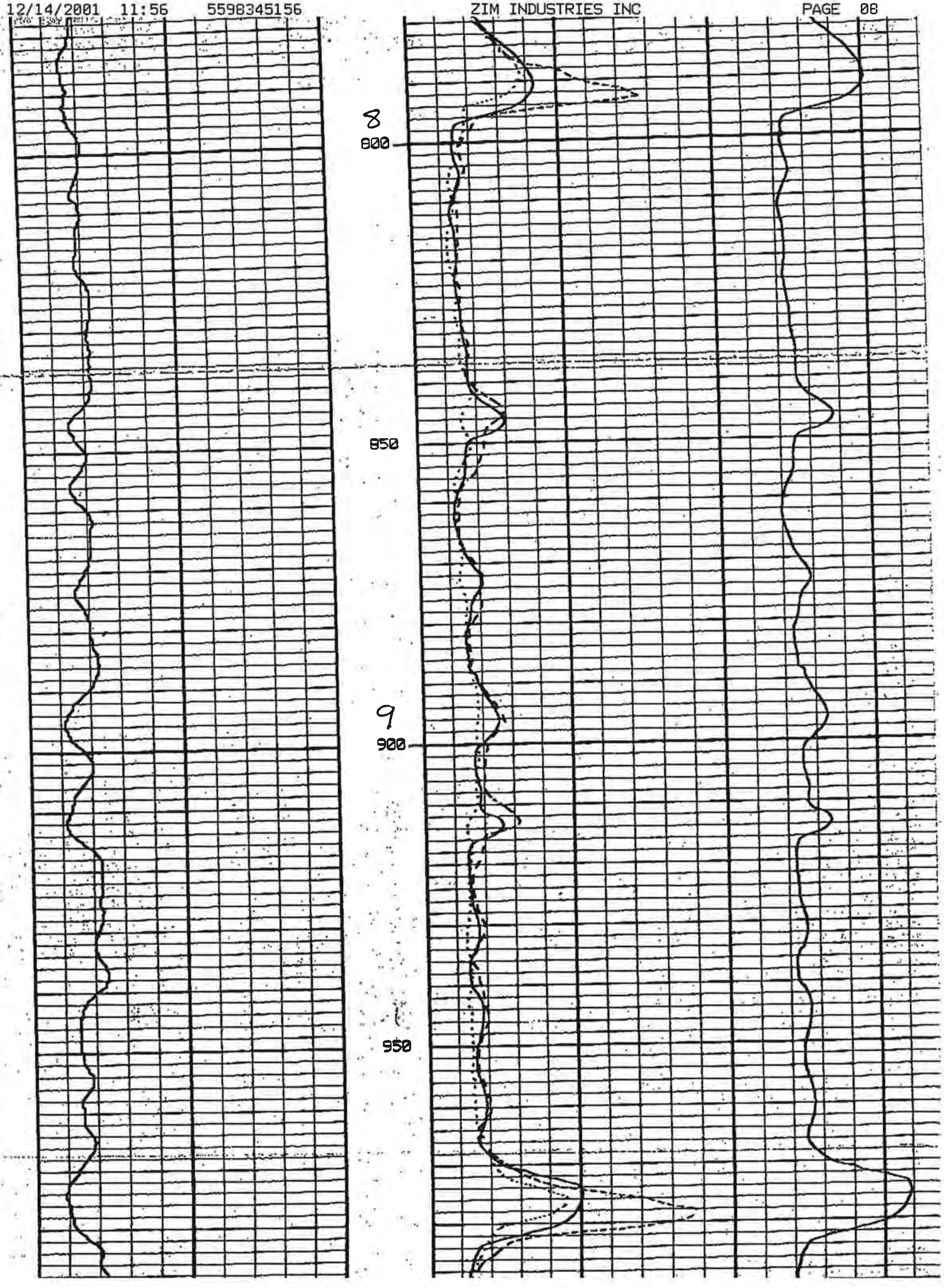
50

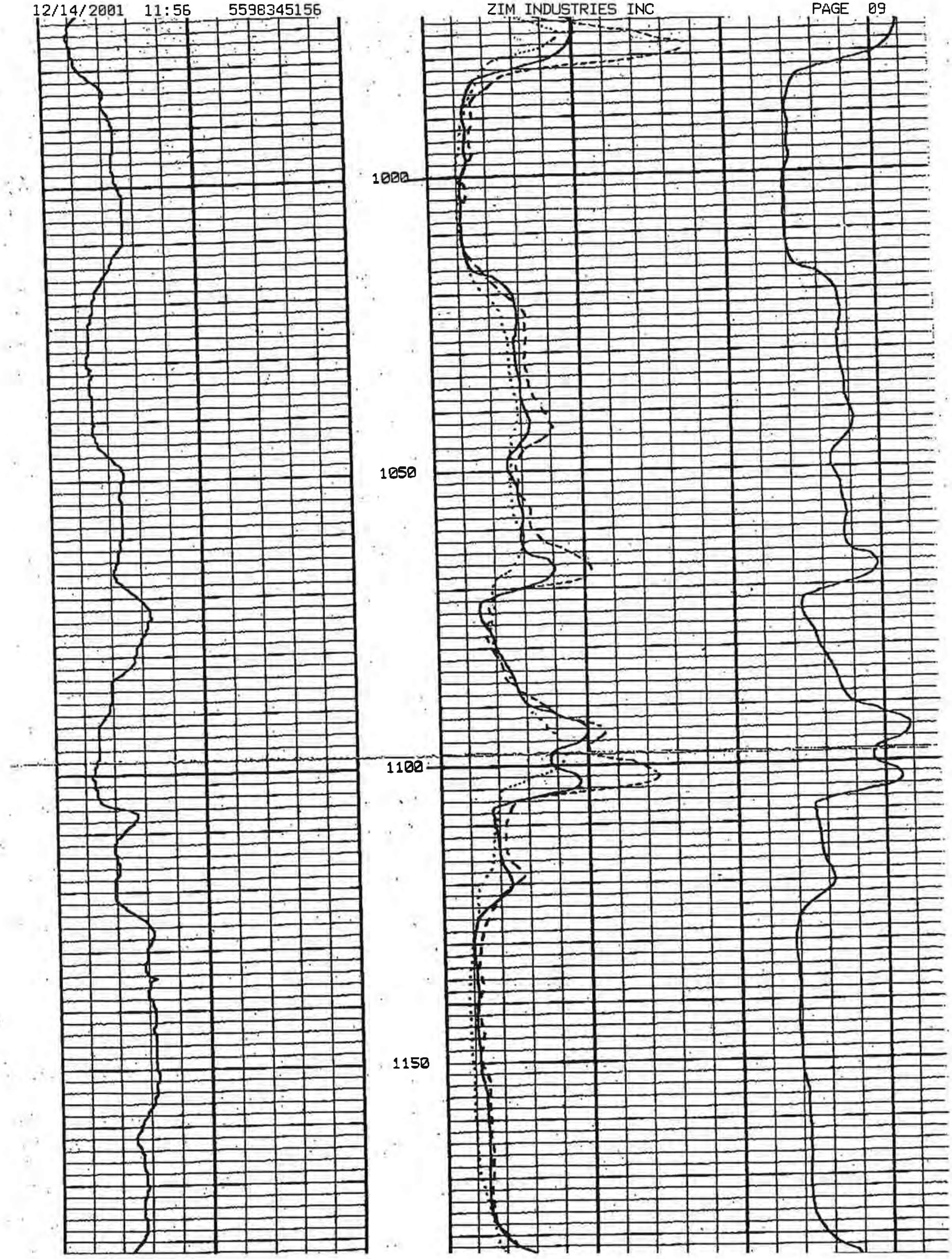

1
100
150

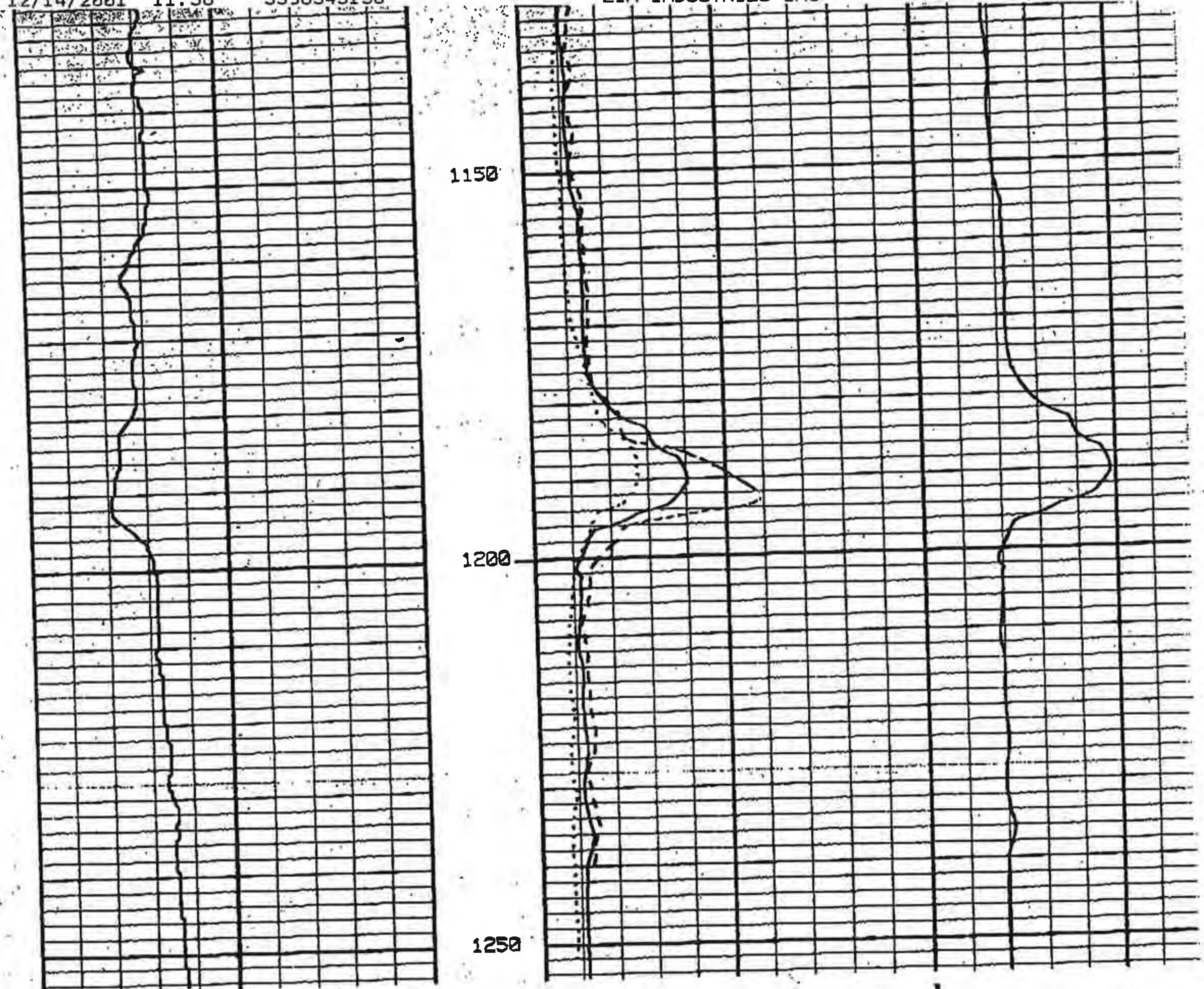

2
200
250
3
300
350


400
450
5
500
550
6
600


600
650
7
700
750
8
800


8
800
850
9
900
950


1000
1050
1100
1150



5 + millivolts SPONTANEOUS POTENTIAL	DEPTHS	0 x10 BACK UP 500 0 64 Inch LONG NORMAL 50 0 x10 BACK UP 500 0 16 Inch SHORT NORMAL 50 ohmmeters2/meter RESISTIVITY	Detail Curve SINGLE POINT ohms RESISTANCE

Geologic Section E-E’

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 340962

Notice of Intent No. ______
Local Permit No. or Date 90-1004

131 –

State Well No. ______
Other Well No. 01N05E12C

(1) OWNER: Name ______
Address ______
City ______

(2) LOCATION OF WELL (See instructions):
County San Joaquin Owner's Well Number ______
Well address if different from above Base of levee, north of Burns cut-off, no. of Jacord
Township Stockton Range ______ Section ______
Distance from cities, roads, railroads, fences, etc. ______

WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well XX Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic Public XX
Irrigation ☐
Industrial ☐
Test Well ☐
Municipal ☐
Other ☒
(Describe)

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes XX No ☐ Size 6-12 sand
Diameter of bore 13"
Packed from 50 to 85 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic ☒ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	85	8"	160	65	85	
			PVC			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes XX No ☐ If yes, to depth 50 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ______ ft.
Method of sealing Bentonite

(10) WATER LEVELS:
Depth of first water, if known ______ ft.
Standing level after well completion ______ ft.

(11) WELL TESTS:
Was well test made? Yes ☐ No ☐ If yes, by whom? ______
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test ______ ft. At end of test ______ ft.
Discharge ______ gal/min after ______ hours Water temperature ______
Chemical analysis made? Yes ☐ No ☐ If yes, by whom? ______
Was electric log made Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 110 ft. Completed depth 85 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	Top soil clay
3	6	Peat moss
6	40	Blue clay
40	43	Blue sand
43	72	Blue clay
72	80	Blue sand
80	110	Blue clay

Work started ______ 19__ Completed 5-8 19 90

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed Willadeen Chandler, Bkkpr.
(Well Driller)

NAME Calwater Drilling Co., Inc.
(Person, firm, or corporation) (Typed or printed)
Address 300 S. Kilroy
City Turlock, Ca. ZIP 95380
License No. 321252 Date of this report 5-10-90

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

ORIGINAL
File Original, Duplicate and Triplicate with the REGIONAL WATER POLLUTION CONTROL BOARD No. 5
(Insert appropriate number)

WATER WELL DRILLERS REPORT

(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA

682

LOCATION NOT CHECKED
Do Not Fill In
№ 21456
State Well No. /
Other Well No. [illegible]

[redacted] OWNER:

(2) LOCATION OF WELL:
County San Joaquin   Owner's number, if any—
R. F. D. or Street No. Route 5
Headquarters camp, 1 mile south of Holt, ¼ mile S.E. of Uncle Tom's Cabin. Turn left off main Highway from Stockton at Uncle Tom's.

(3) TYPE OF WORK (check):
New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☒
Cable ☐
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☒ DOUBLE ☐
If gravel packed: no

From ft.	to ft.	Diam.	Gage or Wall	Diameter of Bore	from ft.	to ft.
6	105	2-in				
[redacted] Standard Gal Pipe						

Type and size of shoe or well ring: none   Size of gravel:
Describe joint: threaded

(7) PERFORATIONS: none
Type of perforator used
Size of perforations   in., length, by   in.
From   ft. to   ft.   Perf. per row   Rows per ft.

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☐ Yes ☒ No To what depth   ft.
Were any strata sealed against pollution? ☐ Yes ☒ No If yes, note depth of strata
From   ft. to   ft.
Method of Sealing

(9) WATER LEVELS:
Depth at which water was first found 28 ft.
Standing level before perforating   ft.
[redacted]ing level after perforating   ft.

NOV 10 1955
RECEIVED

(10) WELL TESTS: Salinity 600 ppm
Was a pump test made? ☒ Yes ☐ No If yes, by whom? driller
Yield: 30 gal./min. with   ft. draw down after   hrs.
Temperature of water   Was a chemical analysis made? ☐ Yes ☐ No
Was electric log made of well? ☐ Yes ☐ No

(11) WELL LOG:
Total depth 112 ft. Depth of completed well 110 ft.
Formation: *Describe by color, character, size of material, and structure.*

ft.	to ft.	Formation
1	28	Silty clay
28	39	Sand, medium
39	40	Clay
40	52	Sand, fine
52	91	Clay, blue
91	92	Sand, medium
92	102	Clay, soft
102	108	Clay, hard
108	112	Sand, medium
112 plus		Clay, blue

CONFIDENTIAL
Section 7076.1, Water Code

FOR OFFICIAL USE ONLY

Work started 2-14 1955. Completed 2-19-55 19

WELL DRILLER'S STATEMENT:
This well was drilled by my rig *and this report is true to the best of my knowledge and belief.*

NAME S.C.Baker
(Person, firm, or corporation) (Typed or printed)
Address Holt, Calif

[SIGNED] S. C. Baker
Well Driller

License No. 129141 Dated 2-10, 1955

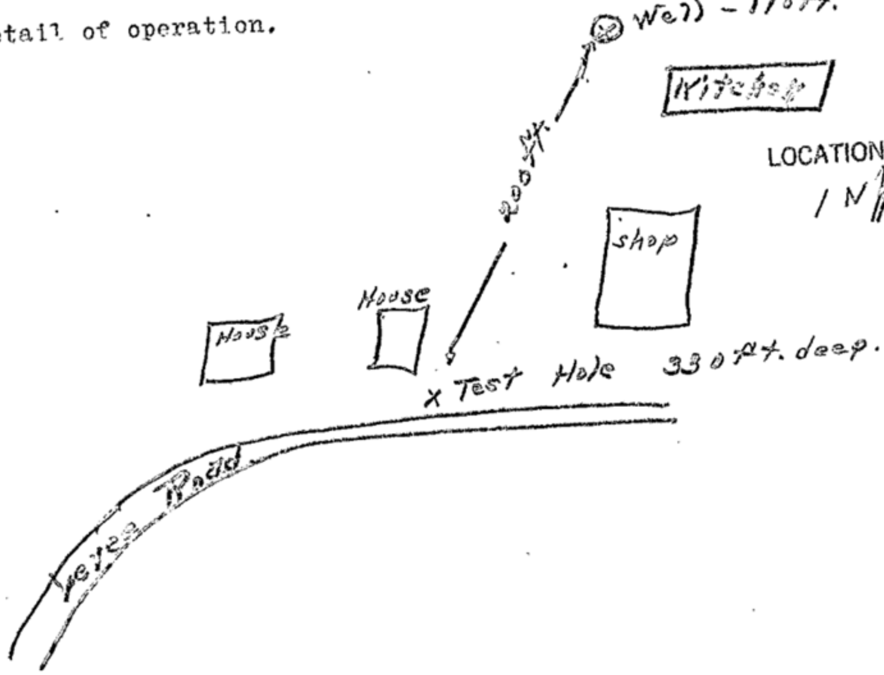
95689 3-54 50M QUIN SPO   DWR FORM No. 246 (REV. 3-54)

21456

De Candia Farms, near Holt. Hdqts. Camp.

Detail of operation.

LOCATION NOT CHECKED
1N/5E-22



Test hole drilled to 160 ft. Sand 155-160 ft. Developed gas that would no flash when trapped in jar. Salt 500 ppm. Drilling continued to 330 ft. No sand available for well. 2-inch hole. Casing pulled.

C O N F I D E N T I A L
Section 7076 1, Water Code

ORIGINAL

File with DWR

[redacted] of Intent No. 159626

[redacted] Permit No. or Date 78-347

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 129405

State Well No. ____

Other Well No. 1N|5E-27

(2) LOCATION OF WELL (See instructions):

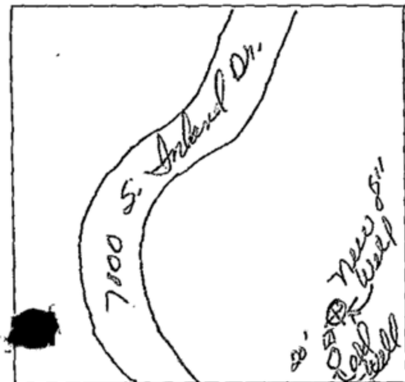
County San Joaquin Owner's Well Number ____

Well address if different from above ____

Township Roberts Island Range ____ Section ____

Distance from cities, roads, railroads, fences, etc. Same address.
300 feet E. of road

[redacted]



WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☒

Irrigation ☐

Industrial ☐

Test Well ☐

Stock ☐

Municipal ☐

Other ☐

(5) EQUIPMENT:

Rotary ☒ Reverse ☐

Cable ☐ Air ☐

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size pea

Diameter of bore 12

Packed from 20 to 35 ft.

(7) CASING INSTALLED:

Steel ☐ Plastic ☒ Concrete ☐

(8) PERFORATIONS:

Type of perforation or size of screen ____

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	15	8"	PVC			
15	19	8"	ID Steel			

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.

Were strata sealed against pollution? Yes ☐ No ☒ Interval ____ ft.

Method of sealing bentonite

(10) WATER LEVELS:

Depth of first water, if known ____ ft.

Standing level after well completion ____ ft.

(11) WELL TESTS:

Was well test made? Yes ☐ No ☒ If yes, by whom? ____

Type of test Pump ☐ Bailer ☐ Air lift ☐

Depth to water at start of test ____ ft. At end of test ____ ft

Discharge ____ gal/min after ____ hours Water temperature ____

[redacted] al analysis made? Yes ☐ No ☐ If yes, by whom? ____

Was electric log made? Yes ☐ No ☐ If yes, attach copy to this report

(12) WELL LOG: Total depth 35 ft. Depth of completed well 35 ft.

from ft. to ft. Formation (Describe by color, character, size or material)

from ft.	to ft.	Formation
0	20	Clay, brown and blue
20	22	Sand and clay, blue
22	35	Blue sand

A proper well cover was installed on this well and I am not responsible for any altering or removing of the seal or casing.

Work started 3/14/ 1978 Completed 3/14/ 1978

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED [signature] (Well Driller)

NAME Panero Well Drilling, Inc.
(Person, firm, or corporation) (Typed or printed)

Address 31450 E. Lone Tree Road

City Oakdale, Calif. Zip 95361

License No. 333114 VIEB Date of this report 3/18/78

ORIGINAL,
File Original, Duplicate and Triplicate with the
REGIONAL WATER POLLUTION
[redacted]TROL BOARD No. 5
[redacted](Insert appropriate number)

WATER WELL DRILLERS REPORT
(Sections 7076, 7077, 7078, Water Code)

STATE OF CALIFORNIA 1357

Do Not Fill In
№ 76908
State Well No.
Other Well No. 1N/5E-32

(2) LOCATION OF WELL:
County Owner's number, if any—
R. F. D. or Street No.
½ mile East of Tracy Island road ½ mile south of Highway 4

(3) TYPE OF WORK (check):
New well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic ☑ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☐
Cable ☒
Dug Well ☐

(6) CASING INSTALLED:
SINGLE ☒ DOUBLE ☐

From ft. to	ft.	Diam.	Gage or Wall
[redacted]0 - 188		8"	12

If gravel packed

Diameter of Bore	from ft.	to ft.

Type and size of shoe or well ring 8 X 4 X ½
Size of gravel:
Describe joint

(7) PERFORATIONS:
Type of perforator used
Size of perforations 1/8 X 1 in., length, by in.

From ft. to	ft.	Perf. per row	Rows per ft.
148 - 176		7	1

(8) CONSTRUCTION:
Was a surface sanitary seal provided? ☑ Yes ☐ No To what depth 6' ft.
Were any strata sealed against pollution? ☒ Yes ☐ No If yes, note depth of strata
From 0 ft. to ~~188~~ 148 ft.
Method of Sealing Shoe & Solid Casing

(9) WATER LEVELS:
Depth at which water was first found 16' ft.
[redacted]ding level before perforating ft.
ding level after perforating 2' ft.

(10) WELL TESTS:
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. draw down after hrs.
Temperature of water Was a chemical analysis made? ☒ Yes ☐ No
Was electric log made of well? ☐ Yes ☒ No

(11) WELL LOG:
Total depth 188 ft. Depth of completed well ft.
Formation: Describe by color, character, size of material, and structure.

ft. to ft.	
0-6	Peat soil
6-20	silt
20-80	sand
80-86	clay
86-88	sand
88-116	clay
116-176	silty sand
176-177	clay
177-157	sand
157-174	coarse sand & P. Gravel
174-178	clay
178-186	silty sand
186-188	clay

FOR OFFICIAL USE ONLY

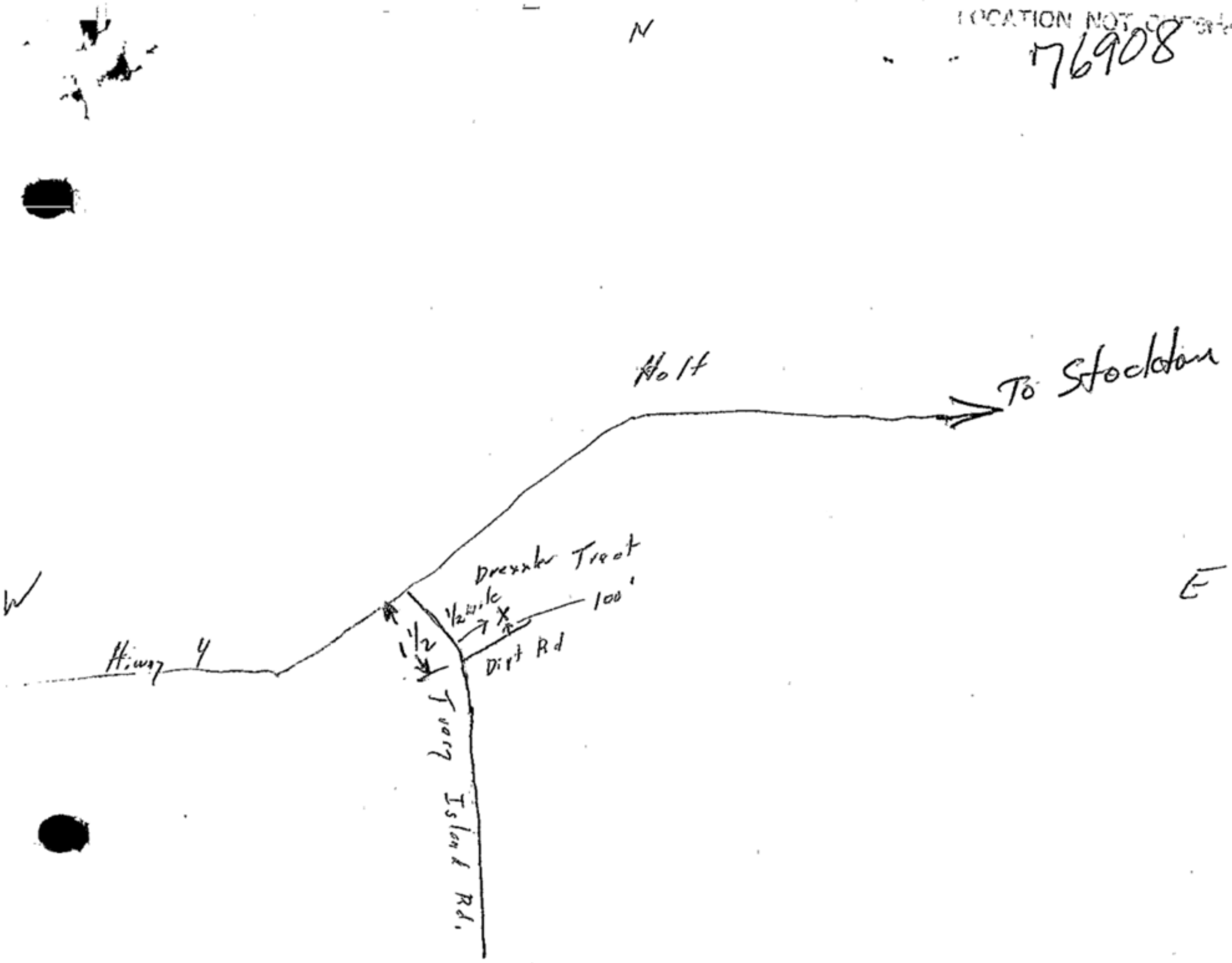
Work started 3-1 19 63 Completed 3-4 19 63

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Valley Water Well Drilling & Pump Co.
(Person, firm, or corporation) (Typed or printed)
Address Rt 7 Box 112
Modesto, California
[SIGNED] (signature)
Well Driller
License No. 191653-8-57 Dated 4/19, 19 63

57025 6-57 60M QUIN SPO DWR 188 (REV. 3-54)

LOCATION NOT [illegible]

76908



5 miles west of Holt, Calif.

off Tracy Island Rd.

5.

REGION 5

COUNTY San Joaquin

NEAR Stockton

DIVISION OF WATER RESOURCES

DEPARTMENT OF PUBLIC WORKS

STATE OF CALIFORNIA

WELL LOG

39-1052

1N/6E-6D1 B & M

EAMOD

OTHER Nos. 1N/6E/6 A1

Not used.

LOCATION

OWNER

DRILLED BY ADDRESS

DRILLING METHOD GRAVEL PACKED DATE COMPLETED

SIZE OF CASING DEPTH STRUCK WATER AT

PERFORATIONS SIZE No.

WATER LEVEL BEFORE PERFORATING AFTER

TEST DATA: DISCHARGE G. P. M. DRAWDOWN FT. HOURS RUN

OTHER DATA AVAILABLE: WATER LEVEL RECORD ANALYSIS

SURFACE ELEV. DATUM SOURCE OF INFORMATION

DEPTH	ELEV. OF BOTTOM OF STRATUM	MATERIAL	THICK-NESS	SP. YIELD %	
0-13		Clay			
13-22		Sandy clay			
22-42		Sand			
42-52		Soft clay			
52-64		Sand			
64-77		Clay			
77-83		Sand			
83-98		Sand and clay breaks			
98-134		Clay			
135-140		Sand			
140-150		Soft clay			
150-160		Sand			

FOR FIELD COPIES USE ALTERNATE LINES

LOG OBTAINED BY DATE SHEET 1 OF

FORM 263, 47085 7-51 5M SPO

ORIGINAL

File with DWR

...of Intent No. 159605

...rmit No. or Date 78-101

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
WATER WELL DRILLERS REPORT

Do not fill in

No. 121039

State Well No.

Other Well No. 1S/4E-4R

(12) WELL LOG: Total depth 85 ft. Depth of completed well 85 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	Clay
3	20	Sand
20	30	Clay
30	40	Sand
40	50	Brown clay
50	70	Clay
70	85	Sand

A proper well cover was installed on this well and I am not responsible for any altering or removing of the seal or casing.

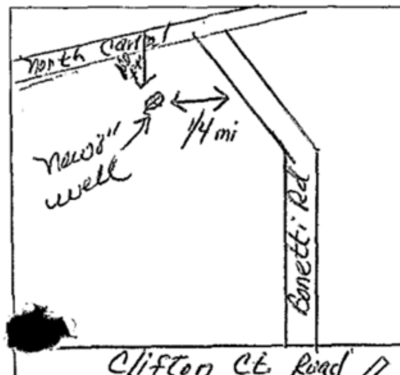
(2) LOCATION OF WELL (See instructions):

County San Joaquin Owner's Well Number

Well address if different from above

Township Union Island Range Section

Distance from cities, roads, railroads, fences, etc. North end of Bonetti Road on Union Island.



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well XX Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic X
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:
Rotary X Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes X No ☐ Size pea
Diameter of bore 12"
Packed from 50 to 85 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic XX Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen saw cut

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	85	8	160 PSI	65	85	3/16"x3"

CONFIDENTIAL NOT FOR PUBLIC USE WATER CODE SEC. 13752

(9) WELL SEAL:
Was surface sanitary seal provided? Yes X No ☐ If yes, to depth 50 ft.
Were strata sealed against pollution? Yes ☐ No X Interval ft.
Method of sealing cement

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion 12 ft.

(11) WELL TESTS:
Was well test made? Yes ☐ No X If yes, by whom?
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test ft. At end of test ft
Discharge gal/min after hours Water temperature
... analysis made? Yes ☐ No ☐ If yes, by whom?
... electric log made? Yes ☐ No ☐ If yes, attach copy to this report

Work started 2/14/ 1978 Completed 2/14 1978

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED [signature] (Well Driller)

NAME Panero Well Drilling, Inc.
(Person, firm, or corporation) (Typed or printed)

Address 31450 E. Lone Tree Road

City Oakdale, Calif. Zip 95361

License No. 333114 Date of this report 2/19/78

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in
No. 071432

[redacted] of Intent No.
[redacted] Permit No. or Date 80-143

State Well No.
Other Well No. 01504E29

(1) OWNER:
Address
City

(2) LOCATION OF WELL (See instructions):
County San Joaquin Owner's Well Number
Well address if different from above
Township Range 04E Section
Distance from cities, roads, railroads, fences, etc. end of Kelso Rd., 1 mile off Byron Highway

WELL LOCATION SKETCH

[redacted]

(3) TYPE OF WORK:
New Well ☑ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☑
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☑
Municipal ☐
Other ☐

(5) EQUIPMENT:
Rotary ☑ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☑ No ☐ Size Birdseye
Diameter of bore 13"
Packed from 30 to 95 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic ☐ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	95	8	160	75	95	screen

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☑ No ☐ If yes, to depth 50 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ft.
Method of sealing Bentonite

(10) WATER LEVELS:
Depth of first water, if known ft.
Standing level after well completion 18 ft.

(11) WELL TESTS:
Was well test made? Yes ☐ No ☑ If yes, by whom?
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test ft. At end of test ft
gal/min after hours Water temperature
[redacted] analysis made? Yes ☐ No ☑ If yes, by whom?
Was electric log made? Yes ☐ No ☑ If yes, attach copy to this report

(12) WELL LOG: Total depth 95 ft. Depth of completed well 95 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	top soil
2	10	clay
10	16	sand
16	60	clay
60	65	sand
65	80	clay
80	92	fine sand
92	95	clay

Work started March 11 19 80 Completed 19

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Marie Feuerstein
(Well Driller)

NAME Hennings Bros. Drilling Co., Inc.
(Person, firm, or corporation) (Typed or printed)
Address 3525 Pelandale Avenue
City Modesto, California Zip 95356
License No. 290813 Date of this report March 19, 1980

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 361926

Notice of Intent No. ____
Local Permit No. or Date 90558

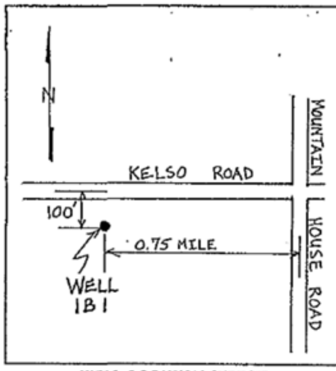
State Well No. 2S/3E 1B1
Other Well No. ____

(12) WELL LOG: Total depth 235 ft. Completed depth 60 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3	Top Soil
3	11	Clay
11	12	Sand
12	30	Clay
30	35	Sand Streaks
35	44	Blue Clay
44	46	Blue Sand
46	130	Blue Clay
130	135	Blue Set-up Sand
135	145	Blue Shale
145	150	Sand Streaks
150	154	Blue Clay
154	159	Sand Streaks
159	169	Blue Clay
169	205	Blue Shale
205	207	Set Sand
207	210	Blue Clay
210	213	Blue Sand
213	235	Blue Clay

Work started Sept. 20 19 90 Completed ____ 19__

(2) LOCATION OF WELL (See instructions):
County Alameda Owner's Well Number ____
Well address if different from above Kelso Rd.
Township ____ Range ____ Section ____
Distance from cities, roads, railroads, fences, etc. 3/4 Mi. West of Mountain House Rd.-across from 15616 Kelso south side



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well XX Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Municipal ☐
Other ☒
(Describe)

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☐ Size Sand Gravel
Diameter of bore 12"
Packed from 20 to 60 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic XX Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	60	6	160	30	60	Screen

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ____ ft.
Method of sealing CEMENT

(10) WATER LEVELS:
Depth of first water, if known ____ ft.
Standing level after well completion 22' ft.

(11) WELL TESTS:
Was well test made? Yes ☐ No ☒ If yes, by whom? ____
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test ____ ft. At end of test ____ ft.
Discharge ____ gal/min after ____ hours Water temperature ____
Chemical analysis made? Yes ☐ No ☒ If yes, by whom? ____
Was electric log made Yes ☐ No ☒ If yes, attach copy to this report

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed [signature] (Well Driller)
NAME HENNINGS BROS. DRILLING CO., INC. (Person, firm, or corporation) (Typed or printed)
Address 3525 PELANDALE AVE.
City MODESTO, CA ZIP 95356
License No. 290813 Date of this report OCT. 3, 1990

DWR 188 (REV. 12-86) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 86 96355

QUADRUPLICATE
Use to comply with local requirements

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

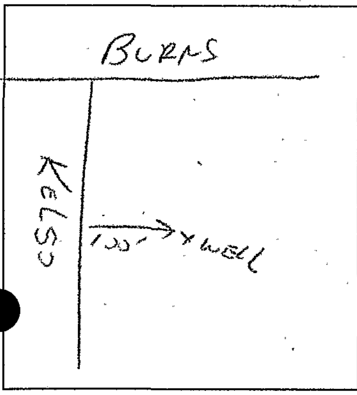
Do not fill in

No. **374016**

Notice of Intent No. ______
Local Permit No. or Date 93088

State Well No. 2S/3E 2A 1
Other Well No. ______

(2) LOCATION OF WELL (See instructions):
County ______ Owner's Well Number ______
Well address if different from above ______
Township ______ Range ______ Section ______
Distance from cities, roads, railroads, fences, etc. ______



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☒
Irrigation ☒
Industrial ☐
Test Well ☐
Municipal ☐
Other ☒
(Describe)

(12) WELL LOG: Total depth 455 ft. Completed depth 80 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
1	32	clay
33	38	Rocks
39	47	clay
48	50	Rocks
51	60	clay Blue
61	79	clay
80	115	clay Gray
116	168	clay Rock at times
169	178	Rocks
179	220	clay
221	233	sand stone
234	238	clay
239	270	sand stone
271	273	clay
274	290	sand stone
291	296	Rock hard
297	305	clay
306	455	Gray shell

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☒ No ☒ Size ______
Diameter of bore 12
Packed from 52 to 22 ft.

(7) CASING INSTALLED:
Steel ☐ Plastic ☒ Concrete ☐

(8) PERFORATIONS:
Type of perforation or size of screen ______

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
1	80	6		40	80	32

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 25 ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ______ ft.
Method of sealing Cement

(10) WATER LEVELS:
Depth of first water, if known 7' 8" ft.
Standing level after well completion ______ ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Contr
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 8 ft. At end of test 24 ft.
Discharge 15 gal/min after 8 hours Water temperature ______
Chemical analysis made? Yes ☒ No ☐ If yes, by whom? Contr
Was electric log made Yes ☐ No ☐ If yes, attach copy to this report

Work started ______ 19__ Completed 3-15 1993

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed [signature] (209) 334-4725
(Well Driller)
NAME A+A Gross Drilling 1425
(Person, firm, or corporation) (Typed or printed)
Address PO Box 178
City Woodbridge ZIP 95258
License No. 377255 Date of this report 3-30-93

E0 68053A

State of California
The Resources Agency
Department of Water Resources

State Well No. 01N04E36Q001M

DISTRICT Central

WELL DATA

Owner
Address
Tenant
Address

State Well No. 01N04E36Q001M
Other No. MRL-2W

Type of Well: Hydrograph [x] Key [ ] Index [ ] Semiannual [ ]
Location: County San Joaquin Basin San Joaquin Valley -- Tracy Subbasin No. 5-22.15
U.S.G.S. Quad. Holt Quad. No. 462b

SW 1/4 SE ¼ Section 36 , Township. 01N , Range. 04E MD SB H Base & Meridian

Description Piezometer constructed of 2" diameter PVC casing and perforated interval within a yellow, 8" square monument casing standing approximately 3 feet above ground surface. Locking lid with padlock (key available at Central District). Well is located on the right levee.

Survey Location, NAD83 CaSP Zone 3, feet: 2146580.5359 N, 6278327.0376 E

Reference Point description Black RP mark on well dock or slip cap at top of casing.

Which is 2.2 ft. Above / Below land surface. Ground Elevation 6.9 ft.
Reference Point Elev. 9.1 ft. Determined from DWR Survey Unit NAVD88
Well: Use Monitoring Condition Good Depth 83 ft.
Casing, size 2 in., perforations 61-81 ft bgs

Measurement By: DWR [x] USGS [ ] USBR [ ] County [ ] Irr. Dist. [ ] Water Dist. [ ] Cons. Dist. [ ]
Chief Aquifer: Name Depth to Top Aq. Depth to Bot. Aq.
Type of Material Perm. Rating Thickness
Gravel Packed? Yes [x] No [ ] Depth to Top Gr. 58 ft Depth to Bot. Gr. 83 ft
Supp. Aquifer Depth to Top Aq. Depth to Bot. Aq.
Driller Layne-Christensen
Date drilled September 18, 2002 Log, filed no Open (1) Confidential (2)
Equipment: Pump, type Make
Serial No. Size of discharge pipe in.
Power, Kind Make
H.P. Motor Serial No.
Elec. Meter No. Transformer No.
Yield GPM Pumping level ft.

Water Analysis: Min. (1) San. (2) H.M.(3)
Water Levels Available: Yes (1) x No
Period of Record: Begin April 29, 2005 End active
Collecting Agency California Department of Water Resources
Prod. Rec. (1) Pump Test (2) Yield (3)

REMARKS

This well is one of 4 wells at this site on Middle River and one of 2 wells at the south-west end of Middle Roberts Island. The wells were installed to monitor groundwater levels. The well is equipped with a data logger which records 15 minute groundwater levels. This data can be found on the internet in the DWR Water Data Library.

Recorded by: Mark Souverville
Date: 08/20/07

Pilot Hole Data

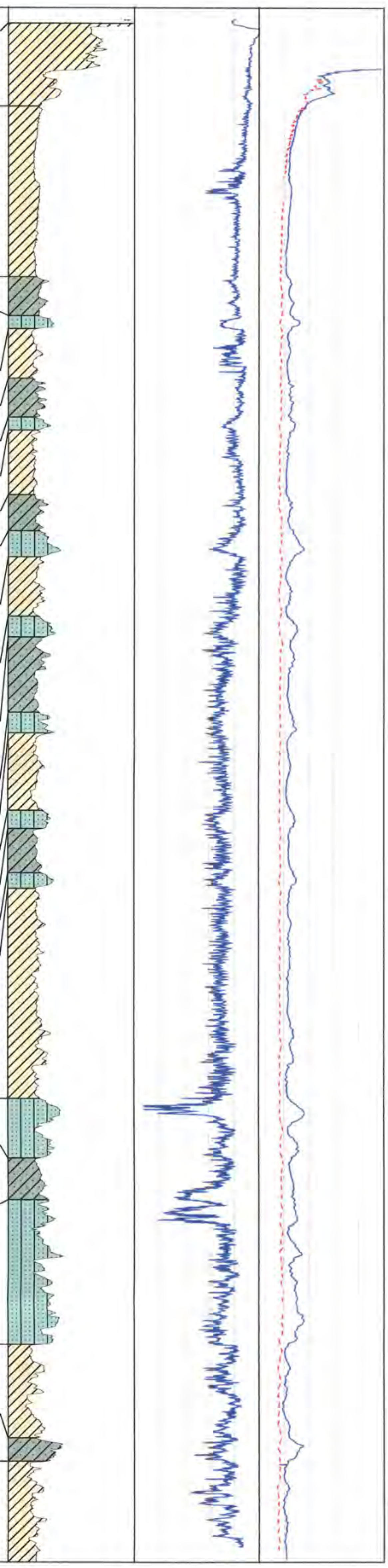
Geophysical Log by: Dewey Data

Depth (ft).	Lithology	USCS S Pt. Resistivity (0–50 ohms)	Spontaneous Potential (1 division = 20 millivolts)	Resistivity (0–50 ohm-meters); Short Normal ——; Long Normal - - -

Lithology

- TOP SOIL (no sample)
- Sandy CLAY (CL); light brownish-gray (10YR 6/2); very soft; fine to coarse-grained, subrounded to rounded sand.
- CLAY with Sand (CL); light brownish-gray (10YR 6/2); very soft; subrounded, up to 10% fine to coarse-grained sand.
- Clayey SAND (SC); light brownish-gray (10YR 6/2); very soft clay; subrounded, fine to coarse-grained sand; loose.
- Silty SAND (SM); light olive-brown (2.5Y 5/4) clay with patches of brownish-yellow (10YR 6/6) clayey-silt and yellowish-red (5YR 5/6) sand (oxidized); soft; 5% fine gravel; fine to coarse-grained sand; loose.
- CLAY with Sand (CL); light olive-brown (2.5Y 5/4); soft; up to 10% fine-grained sand.
- Clayey SAND (SC); pale brown (10YR 6/3); very soft; fine-grained sand; loose.
- Silty SAND (SM); pale brown (10YR 6/3); very soft silt; fine-grained sand; loose.
- CLAY with Sand (CL); light yellowish-brown (10YR 6/4); soft; subrounded, fine to coarse-grained sand.
- Clayey SAND (SC); light yellowish-brown (10YR 6/4); soft clay; subrounded, fine to coarse-grained sand; loose.
- Silty SAND (SM); light yellowish-brown (10YR 6/4); very soft clay; 10% fine, subangular to subrounded gravel; 1/2-inch max. diameter; fine to coarse-grained, subrounded sand; loose; well-indurated greywacke and fine-grained sandstone.
- CLAY with Sand (CL); light olive-brown (2.5Y 5/4) clay with patches of brownish-yellow (10YR 6/6) clay-silt and yellowish-red (5YR 5/6) sand; soft; 5% fine gravel; up to 10% fine to coarse-grained sand.
- Silty SAND with Gravel (SM); light yellowish-brown (10YR 6/4); very soft silt; approx. 15% fine, subangular to subrounded gravel; 2/3-inch max. diameter; approx. 60% fine to coarse-grained, subangular to subrounded sand; loose.
- Clayey SAND (SC); light yellowish-brown (10YR 6/4); very soft clay; trace fine, subrounded gravel; 1/2-inch max. diameter; trace coarse-grained and 60% fine to medium-grained, subrounded sand; loose.
- Silty SAND (SM); light yellowish-brown (10YR 6/4); soft silt; fine to medium-grained and trace coarse-grained sand; loose.
- CLAY with Sand(CL); light yellowish-brown (10YR 6/4); soft; fine to coarse-grained sand.
- Silty SAND (SM); brown (7.5YR 5/4); soft silt; fine to medium-grained and trace coarse-grained sand; loose.
- Clayey SAND (SC); light yellowish-brown (10YR 6/4); very soft clay; fine-grained sand; loose.
- Silty SAND (SM); light yellowish-brown (10YR 6/4); very soft silt; fine-grained sand; loose.
- CLAY with Sand (CL); yellowish-brown (10YR 5/4); very soft; 20% fine-grained sand.
- Silty SAND (SM); light yellowish-brown (10YR 6/4); very soft silt; 5% fine gravel; 1/2-inch max. diameter; fine to coarse-grained sand; loose.
- Clayey SAND (SC); light yellowish-brown (10YR 6/4) with patches of yellowish-brown (10YR 5/8); very soft clay; 5% fine to coarse gravel; 1-inch max. diameter; fine to coarse-grained sand; medium stiff silt; loose.
- Silty Sand (SM); brownish-yellow (10YR 6/6); 5% fine, subangular to subrounded, well-indurated mudstone and greywacke gravel; 1/3-inch max. diameter; fine to coarse-grained sand; loose; medium stiff silt; very soft clay.

  470 - 490 feet: Approx. 5-foot thick clayey sand and gravelly sand lenses.
- CLAY with Sand (CL); yellowish-brown (10YR 5/4); very soft; 15% fine to medium-grained sand.
- Clayey SAND (SC); light pale brown (10YR 7/3); soft clay; 90% fine to coarse-grained sand (mostly coarse); 1/5-inch max. diameter; loose.
- CLAY with Sand (CL); light pale brown (10YR 7/3); very soft; fine to coarse-grained sand.



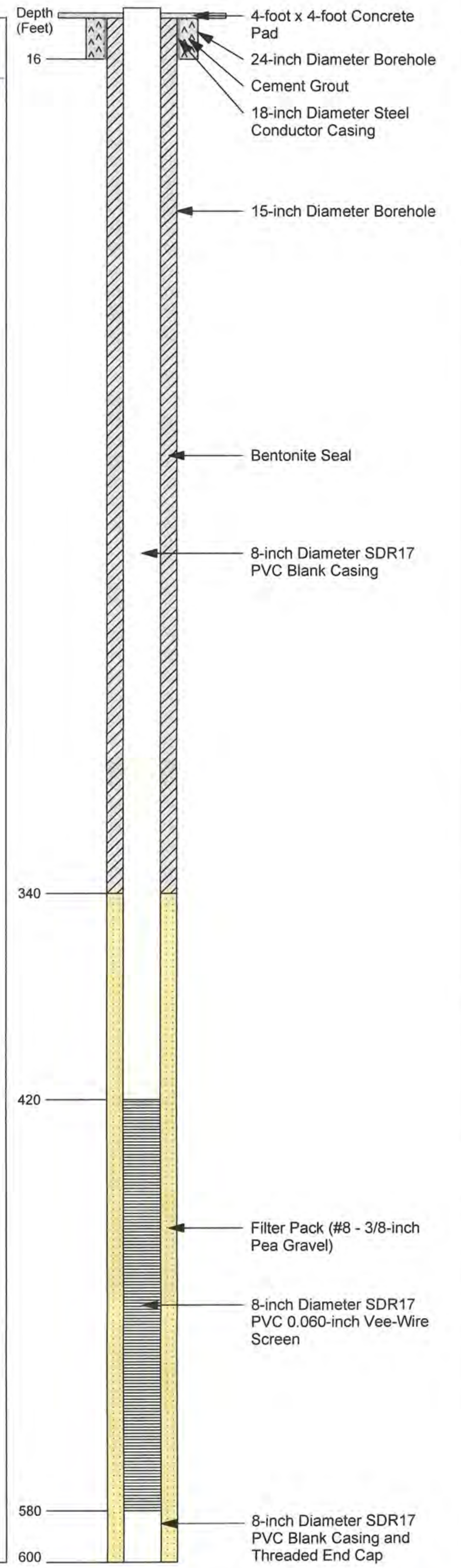
Well Construction

Drilling Contractor: Canepa Sons

Drilling Method: Mud Rotary

Date Started: 09/16/2014

Date Completed: 09/17/2014



209-450-033

Vertical Scale:	**Location:** APN: 204-450-033 Mountain House, California	**Shea Homes #1**
Owner: Mt. House Developers TLC		**MHCSD Groundwater Evaluation Test Well Evaluation**
Permit No.: SR00070517	**TRS:** S16 T2S R4E	Shea Homes #1
State Well No.: Unknown	**Coordinate System:** Unknown	Lithologic Log/Well Construction Diagram
Project No.: 223-12-15-48	**X:** Unknown **Y:** Unknown **Elevation:** Unknown	

<File Name and Path>

APPENDIX E

UPPER AQUIFER WELLS WITH HYDROGRAPHS

DELTA AREA WELLS

APPENDIX E

UPPER AQUIFER
WELLS ABOVE CORCORAN CLAY
WITH HYDROGRAPHS

LEGEND:

(green)	Above Corcoran-Clay
(blue)	Below Corcoran-Clay
(gray)	Wells with Unknown Construction Details

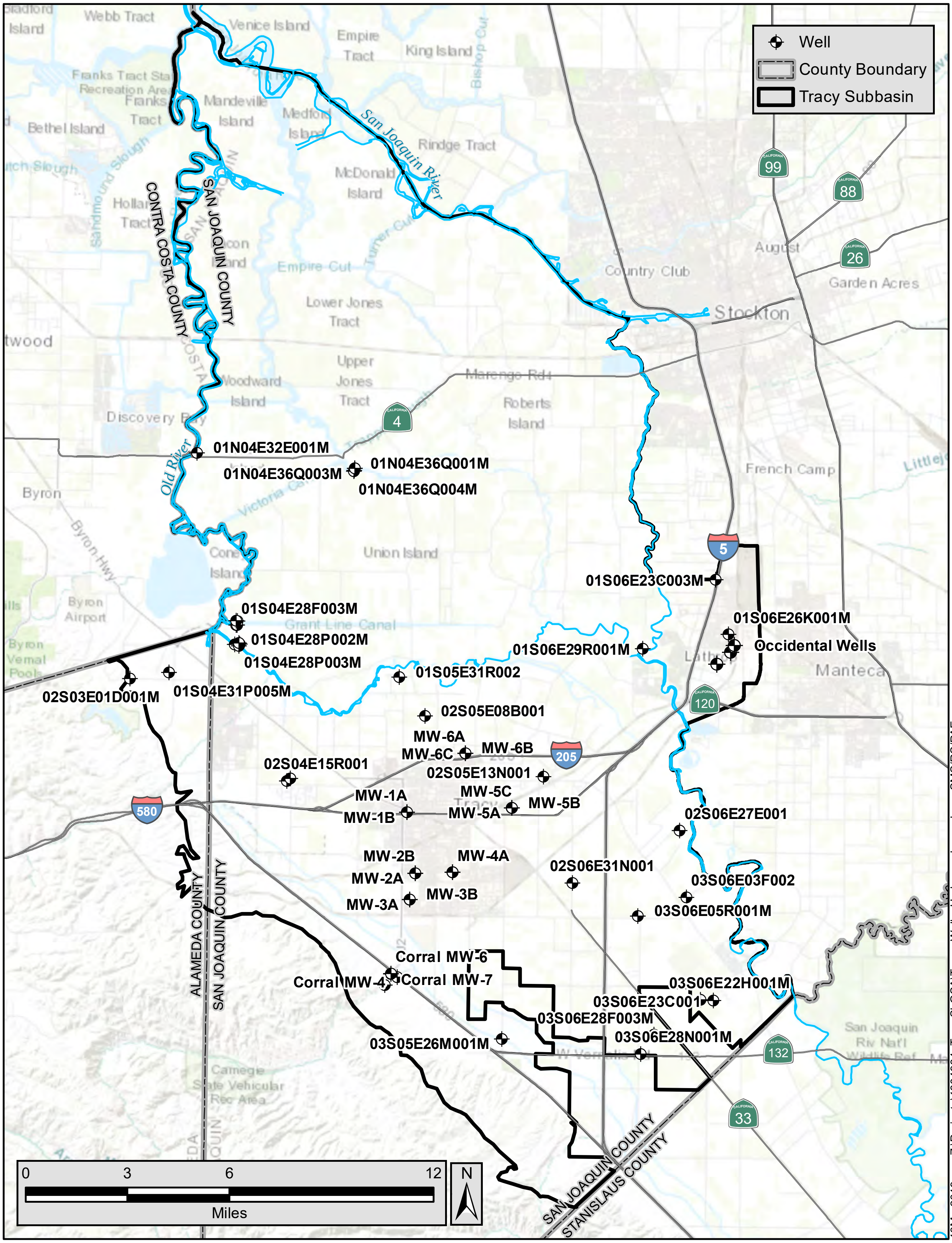
Long-Term Hydrographs

Years Displayed	1970 to 2020
Vertical Axis	50 feet

Unless otherwise noted

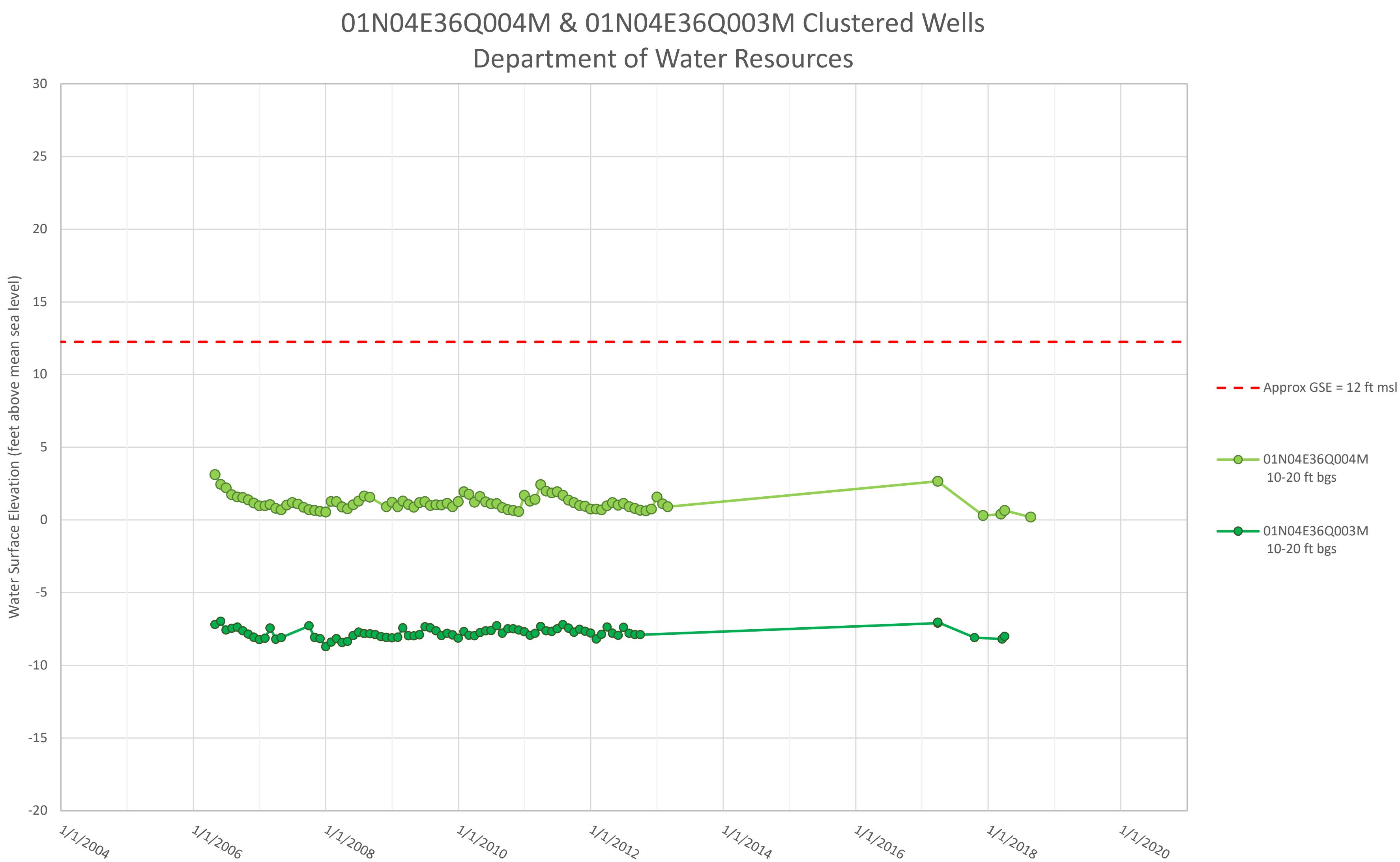
Short Term Hydrographs

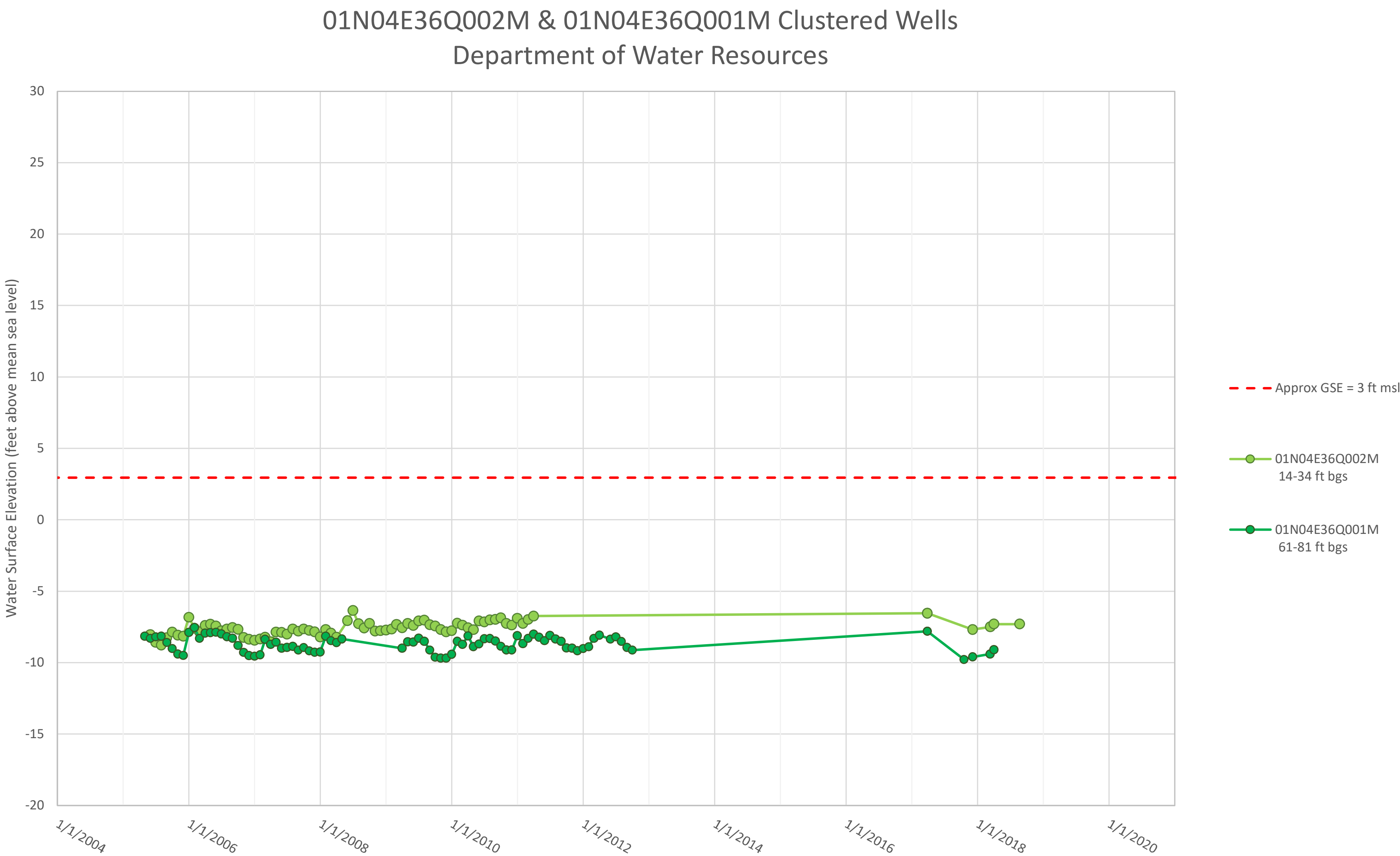
Years Displayed	2004 to 2020 Unless otherwise noted
Vertical Axis	50 feet Unless otherwise noted



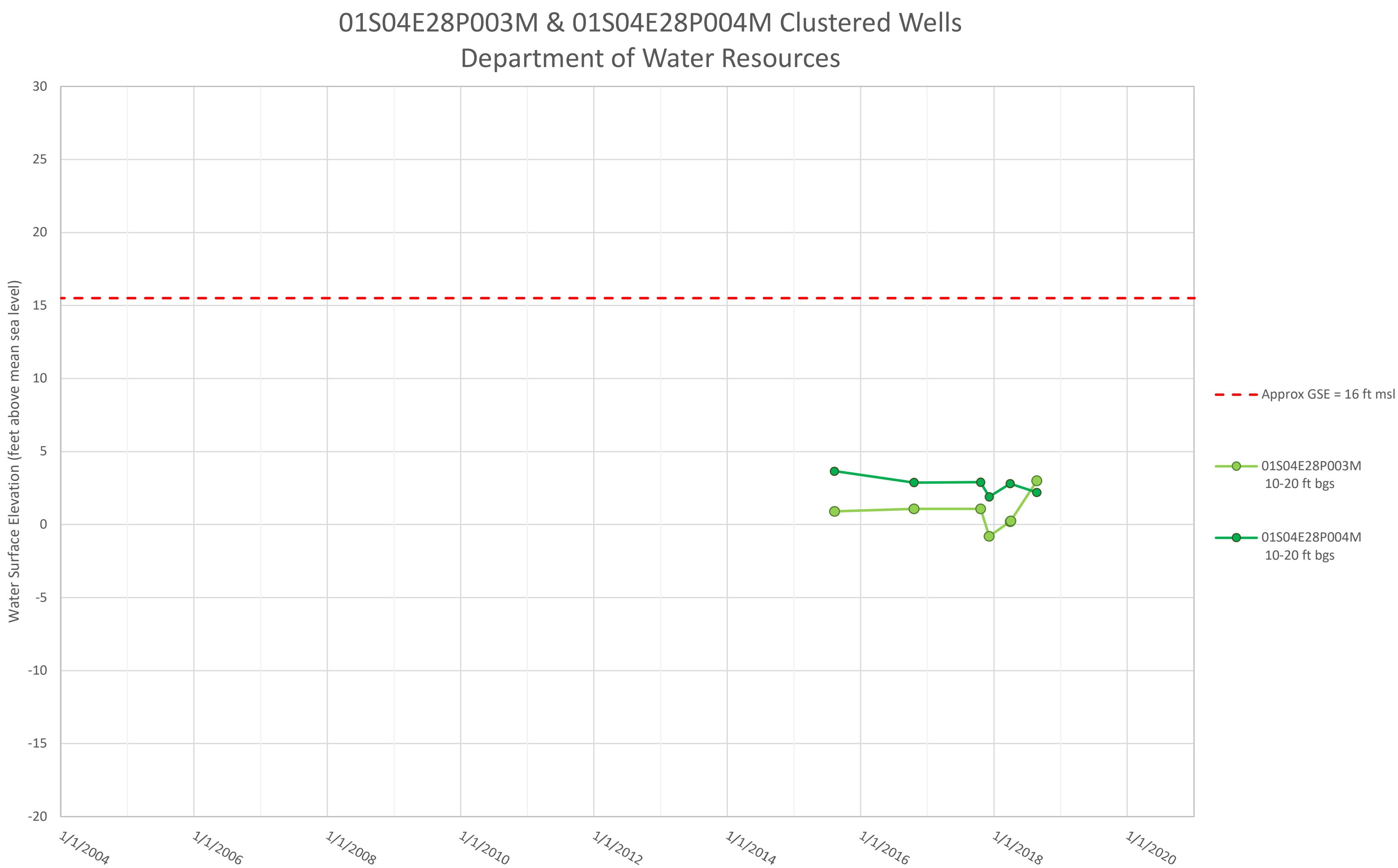
Z:\Projects\1804984_TracySbGSA\Tracy_Wells_Hydrographs.mxd
SMS/RS/PAE
13Mar2019

Tracy Subbasin San Joaquin County, CA	GEI Consultants	Wells with Hydrographs
Tracy Subbasin GSAs		JUNE 2020

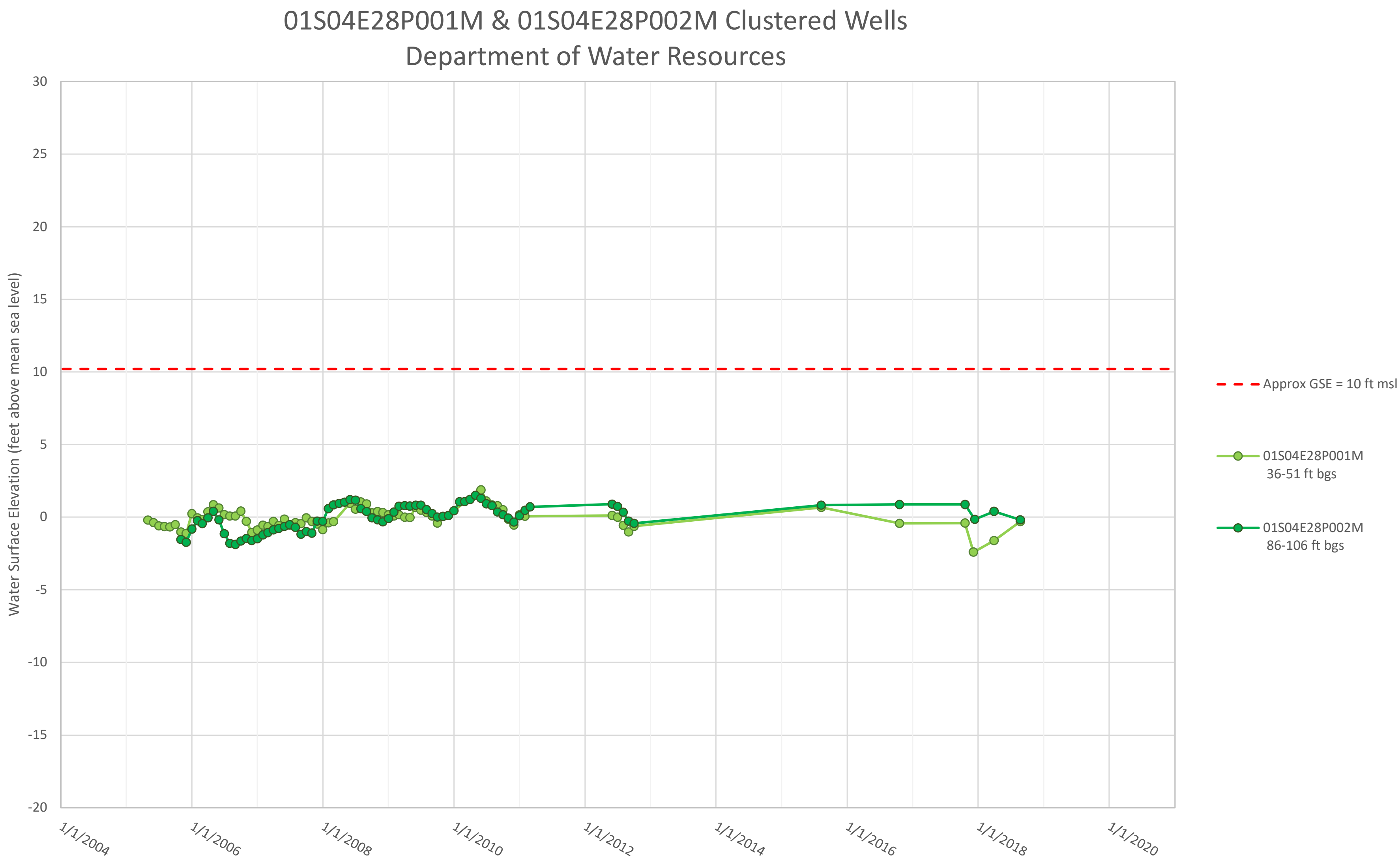

01N04E36Q004M & 01N04E36Q003M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 12 ft msl
01N04E36Q004M
10-20 ft bgs
01N04E36Q003M
10-20 ft bgs

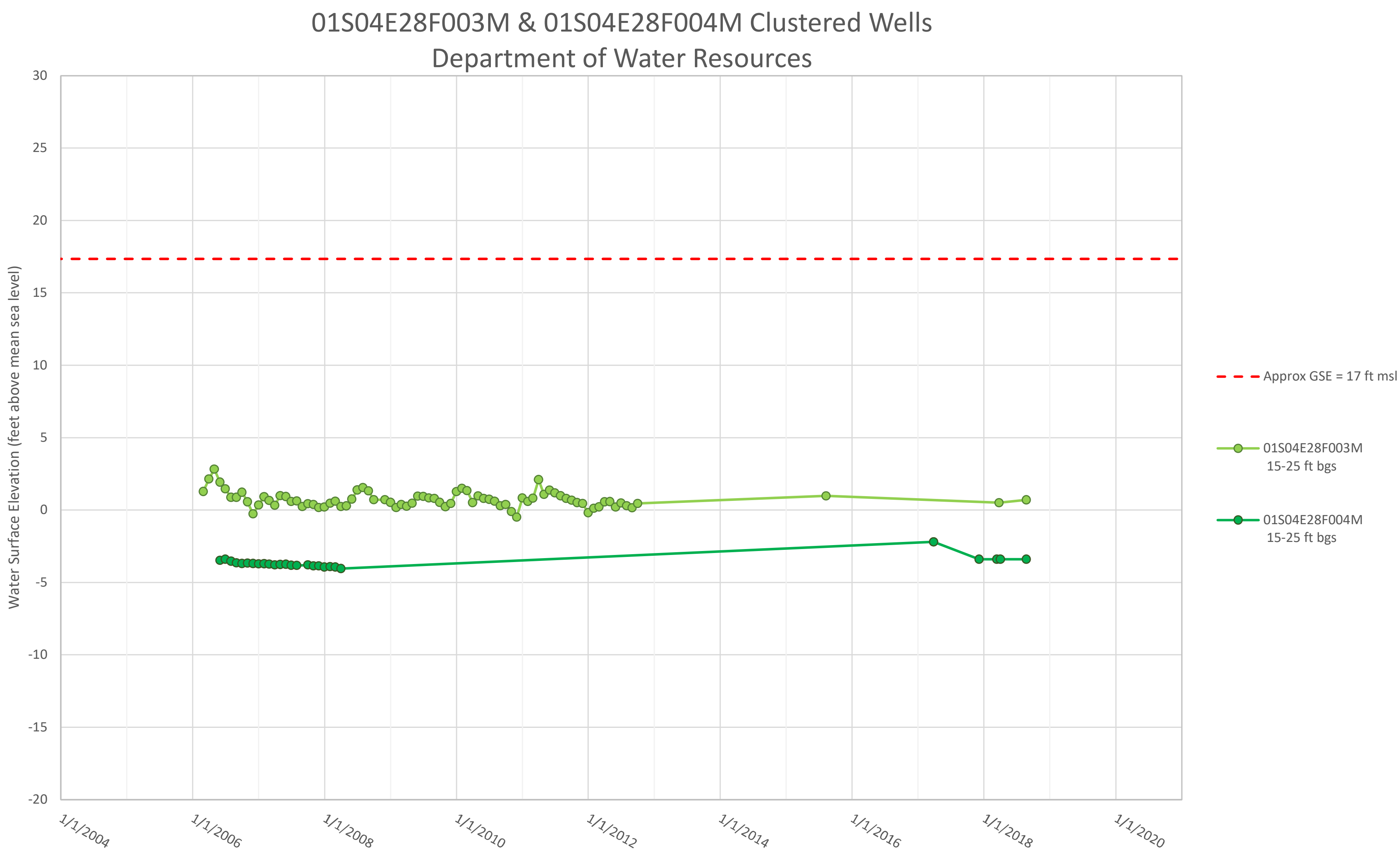


01N04E36Q002M & 01N04E36Q001M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 3 ft msl
01N04E36Q002M
14-34 ft bgs
01N04E36Q001M
61-81 ft bgs

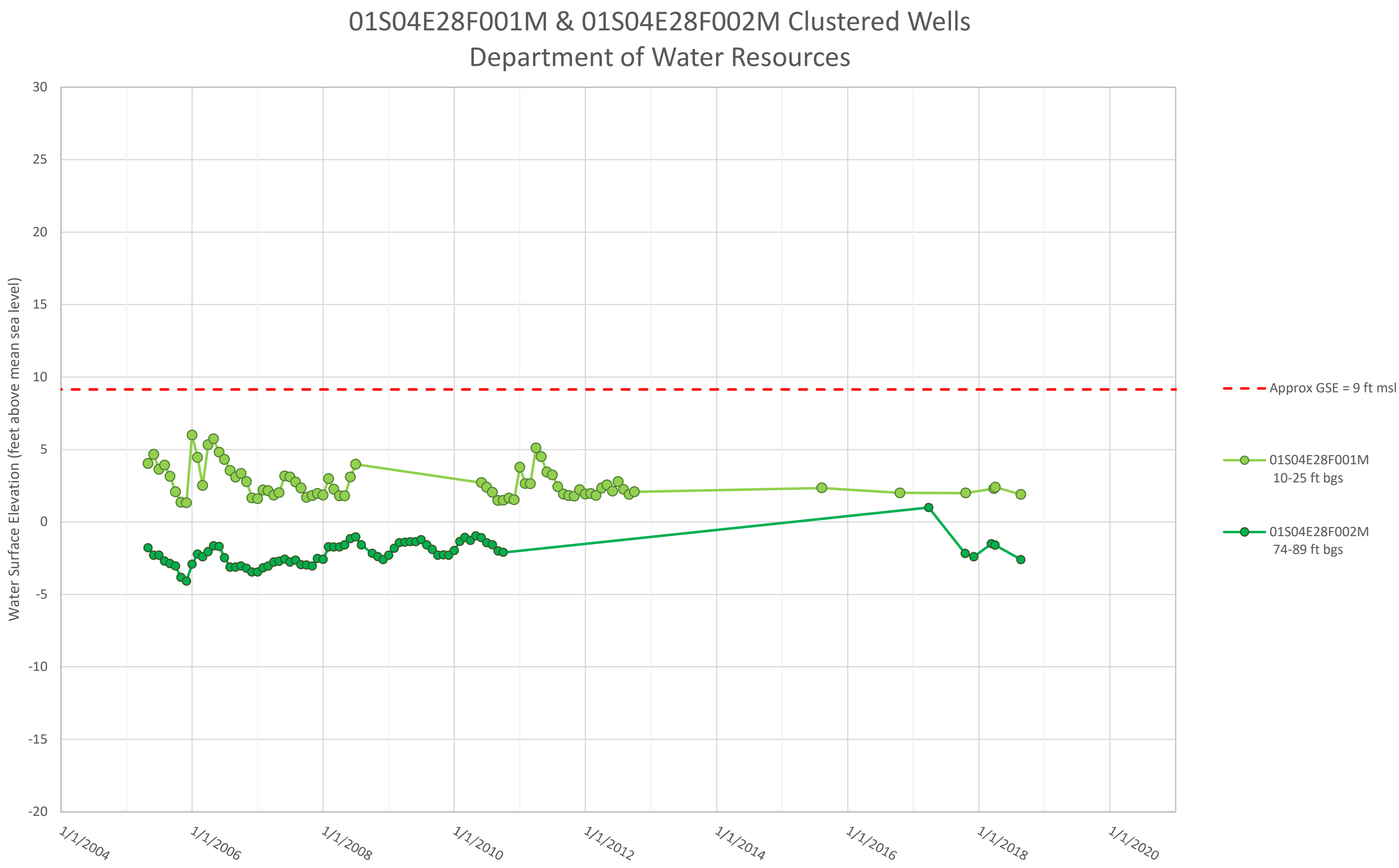


01S04E28P003M & 01S04E28P004M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 16 ft msl
01S04E28P003M
10-20 ft bgs
01S04E28P004M
10-20 ft bgs

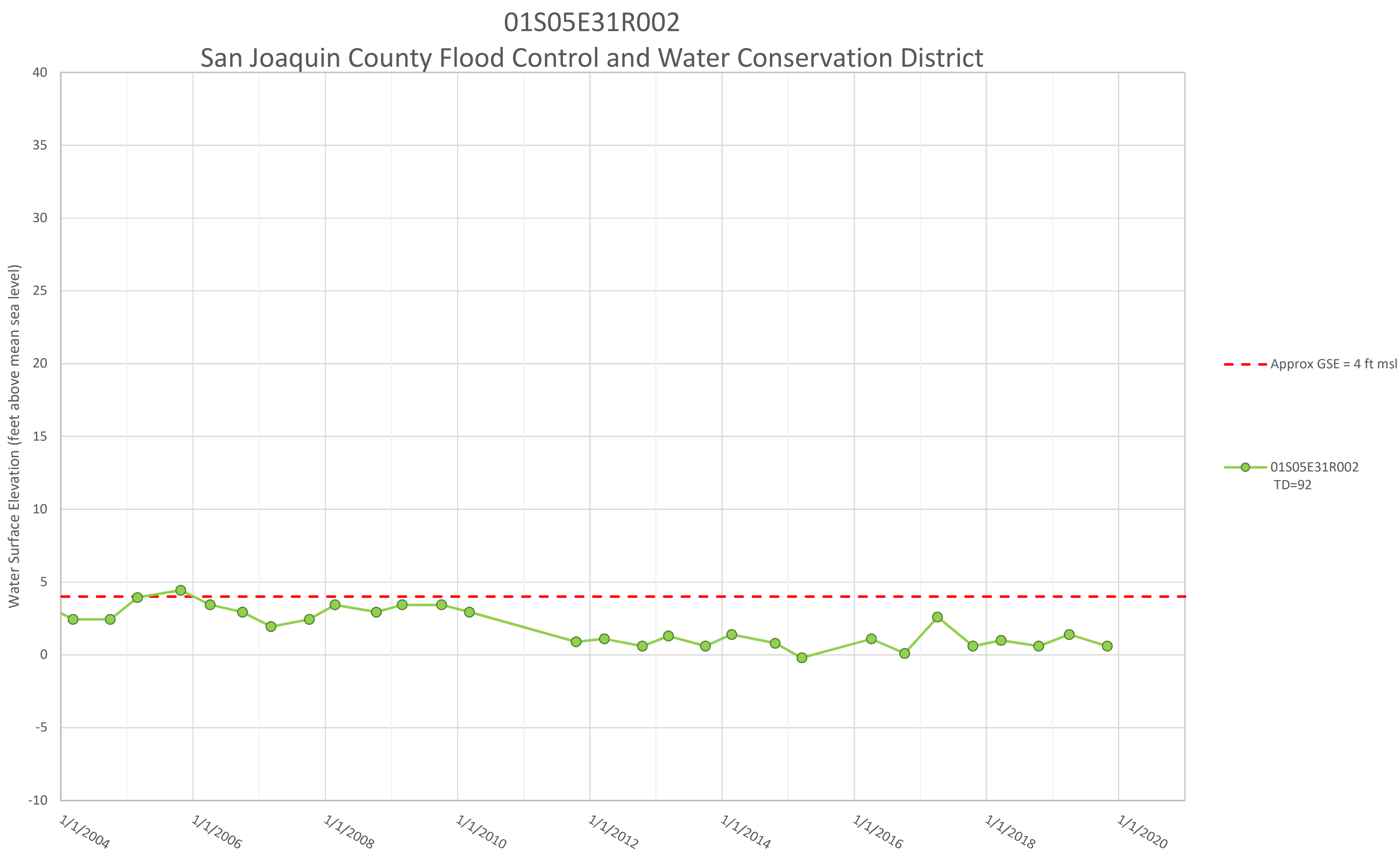

01S04E28P001M & 01S04E28P002M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 10 ft msl
01S04E28P001M
36-51 ft bgs
01S04E28P002M
86-106 ft bgs



01S04E28F003M & 01S04E28F004M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 17 ft msl
01S04E28F003M
15-25 ft bgs
01S04E28F004M
15-25 ft bgs

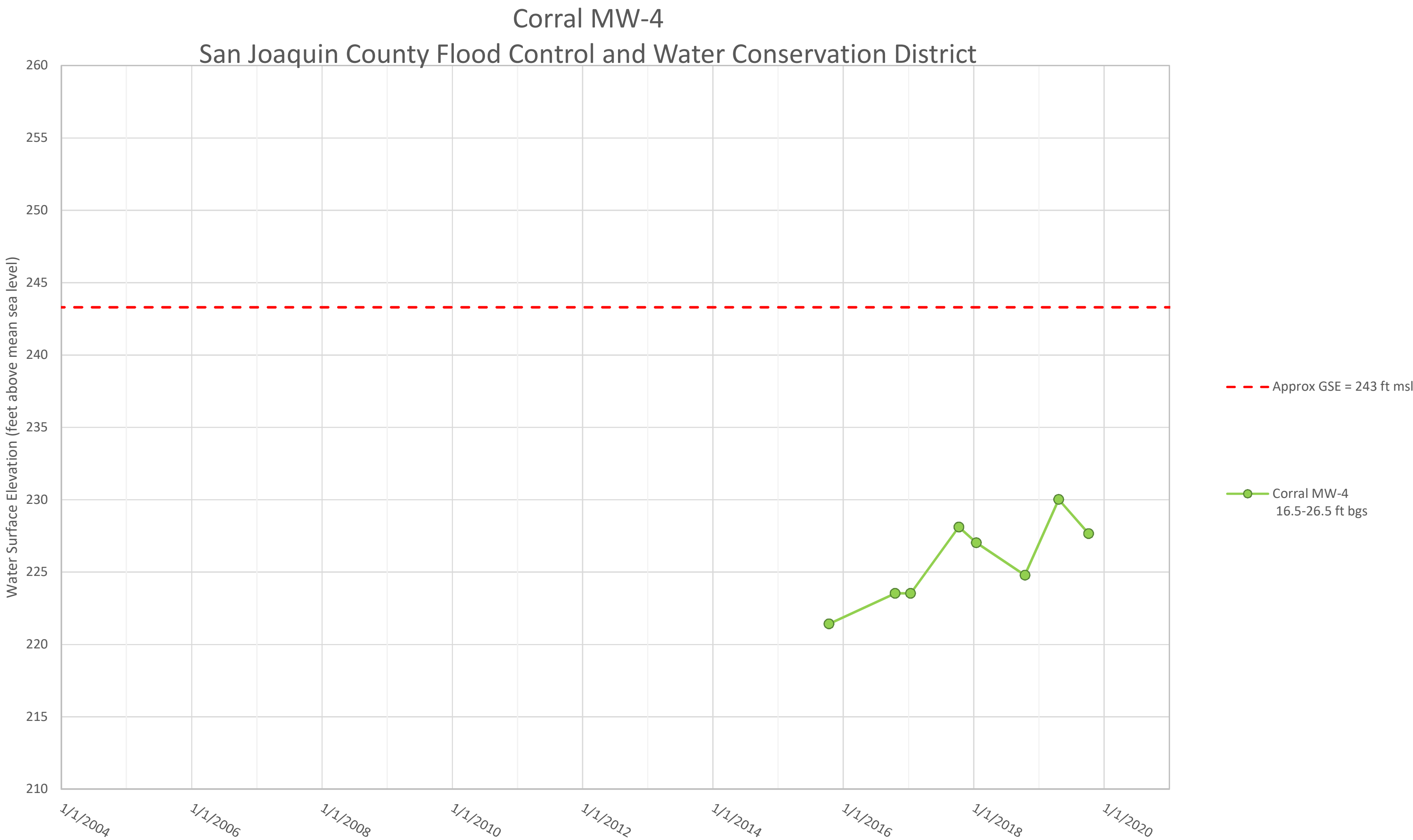


01S04E28F001M & 01S04E28F002M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 9 ft msl
01S04E28F001M
10-25 ft bgs
01S04E28F002M
74-89 ft bgs

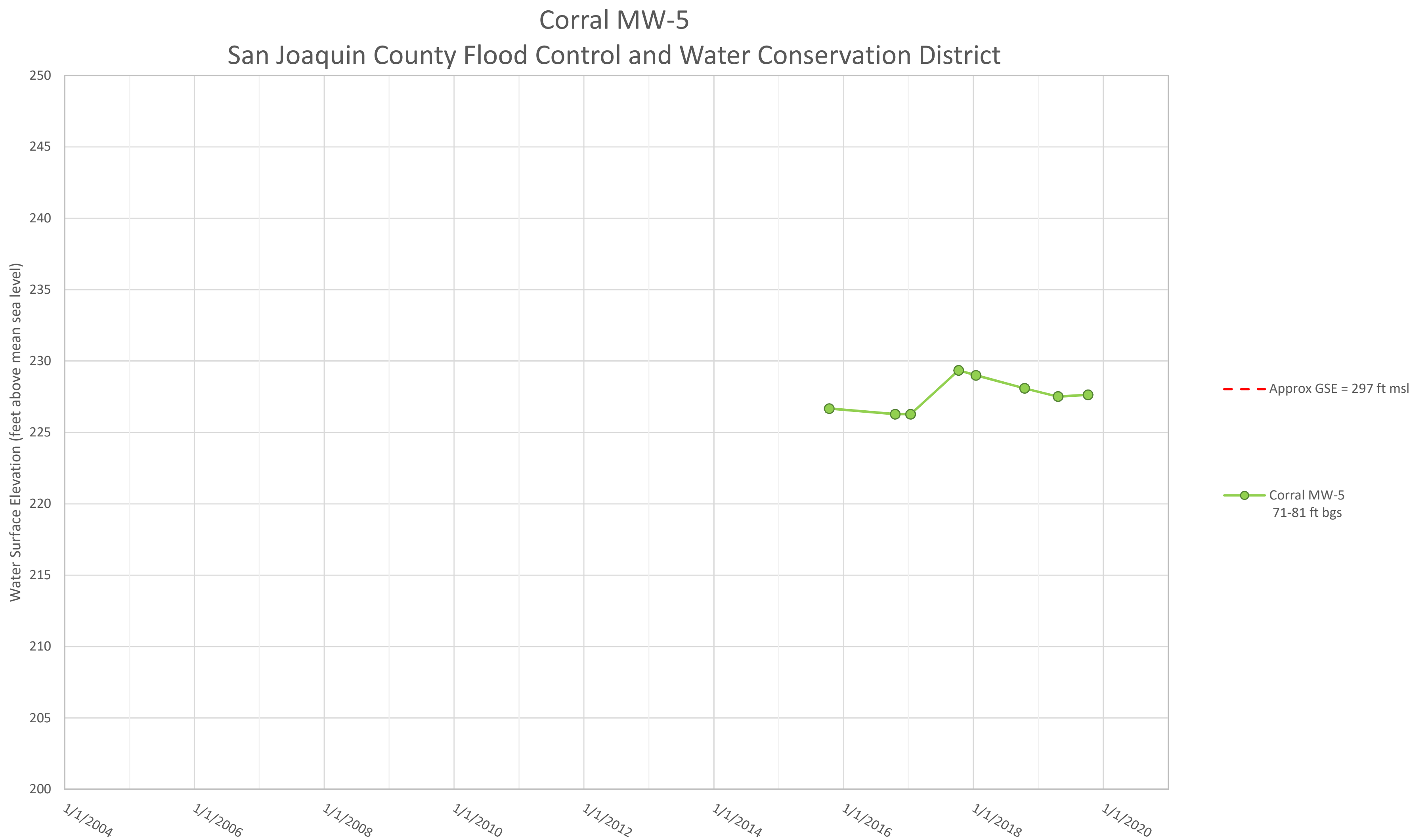


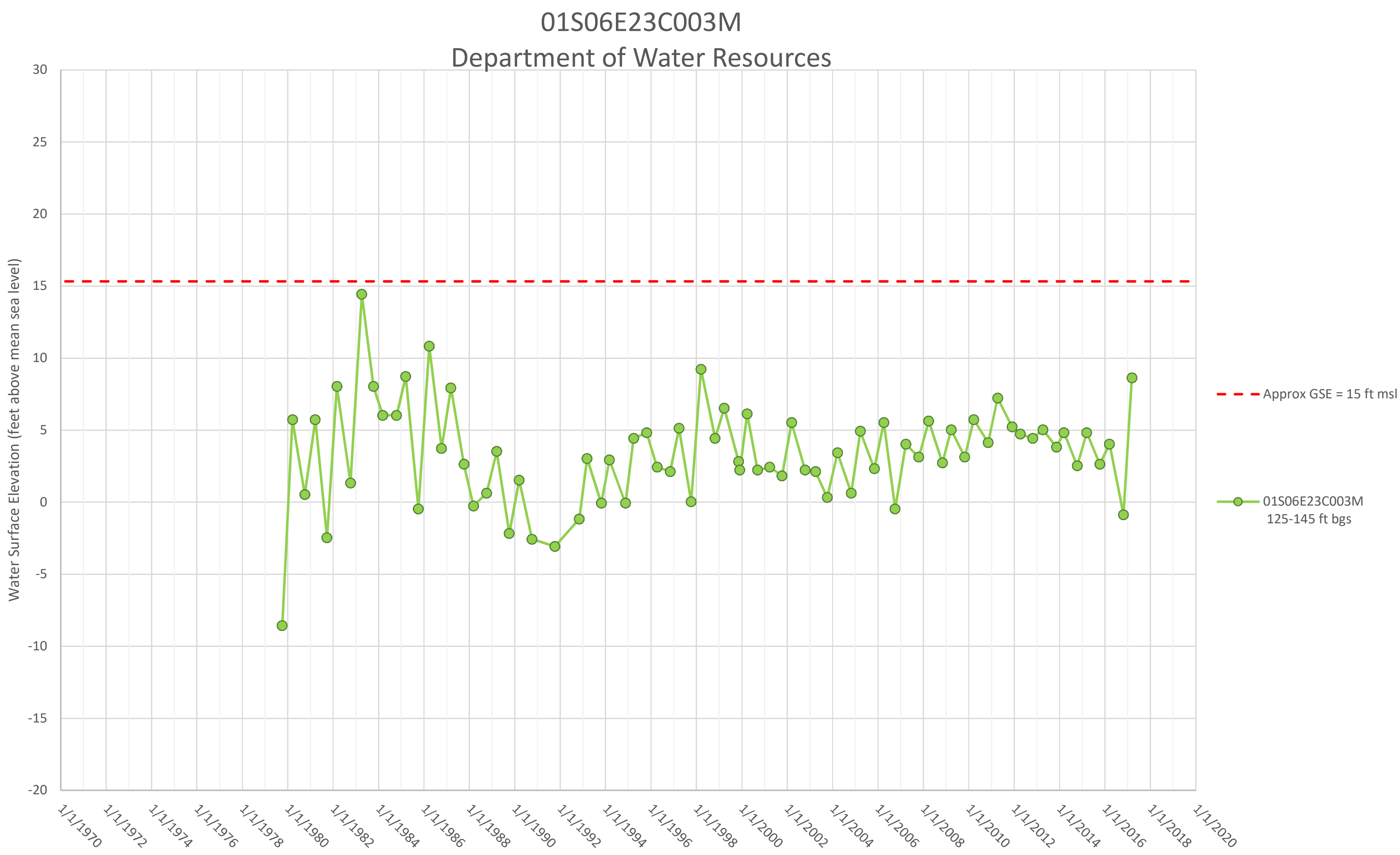
01S05E31R002
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
40
35
30
25
20
15
10
5
0
-5
-10
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 4 ft msl
01S05E31R002
TD=92

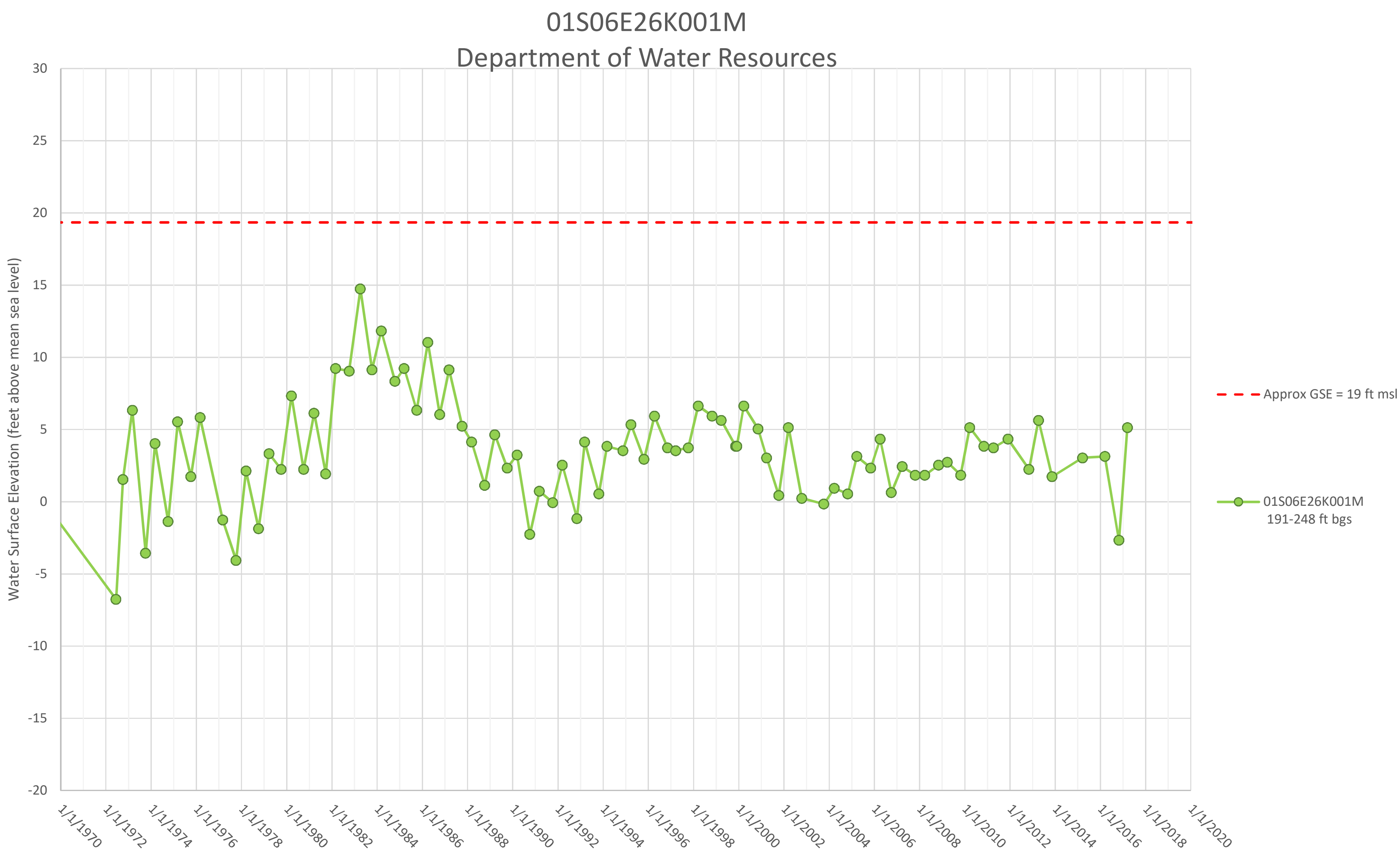
NON-DELTA AREA WELLS



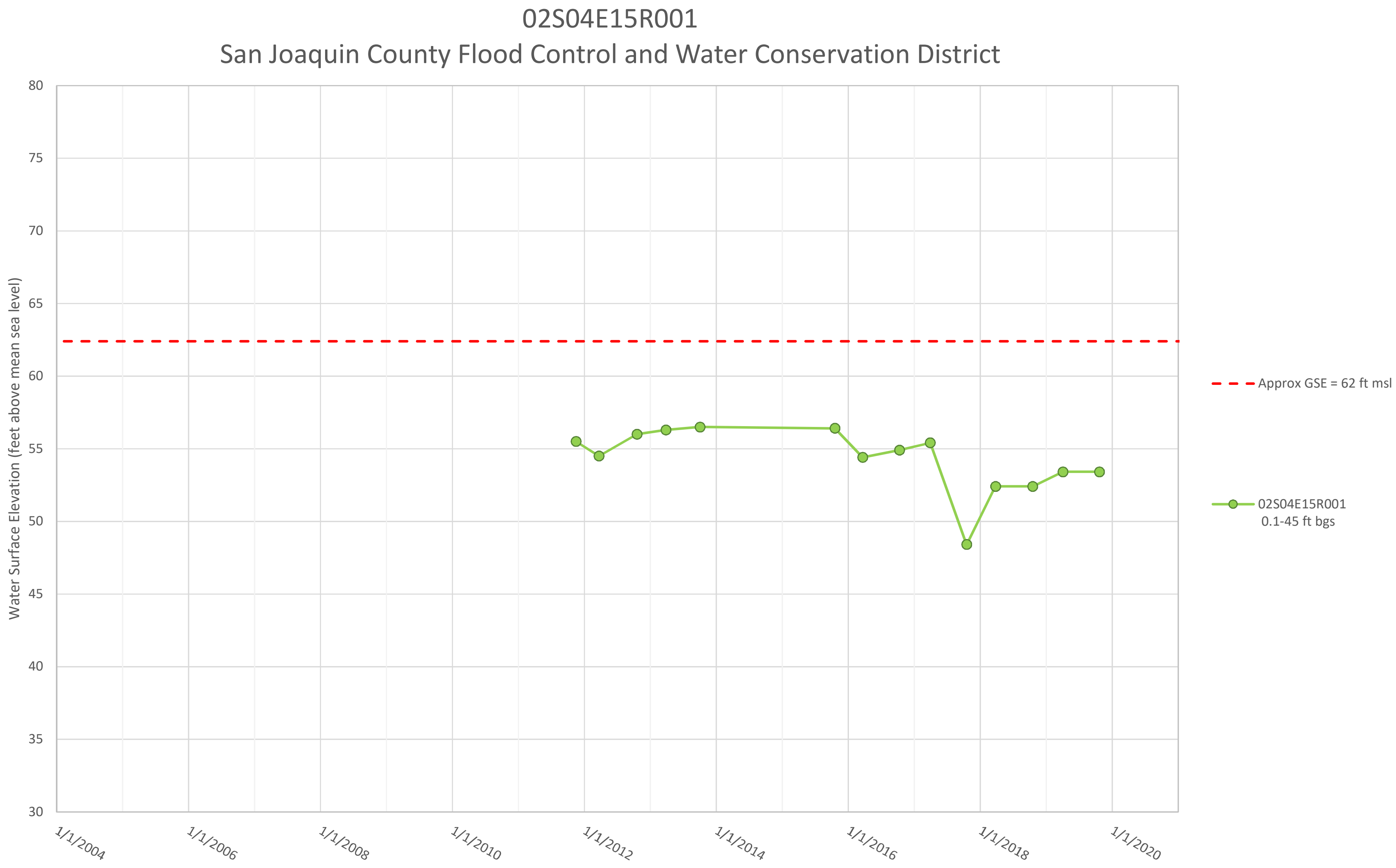
Corral MW-4
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
260
255
250
245
240
235
230
225
220
215
210
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 243 ft msl
Corral MW-4
16.5-26.5 ft bgs


Corral MW-5
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
250
245
240
235
230
225
220
215
210
205
200
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 297 ft msl
Corral MW-5
71-81 ft bgs

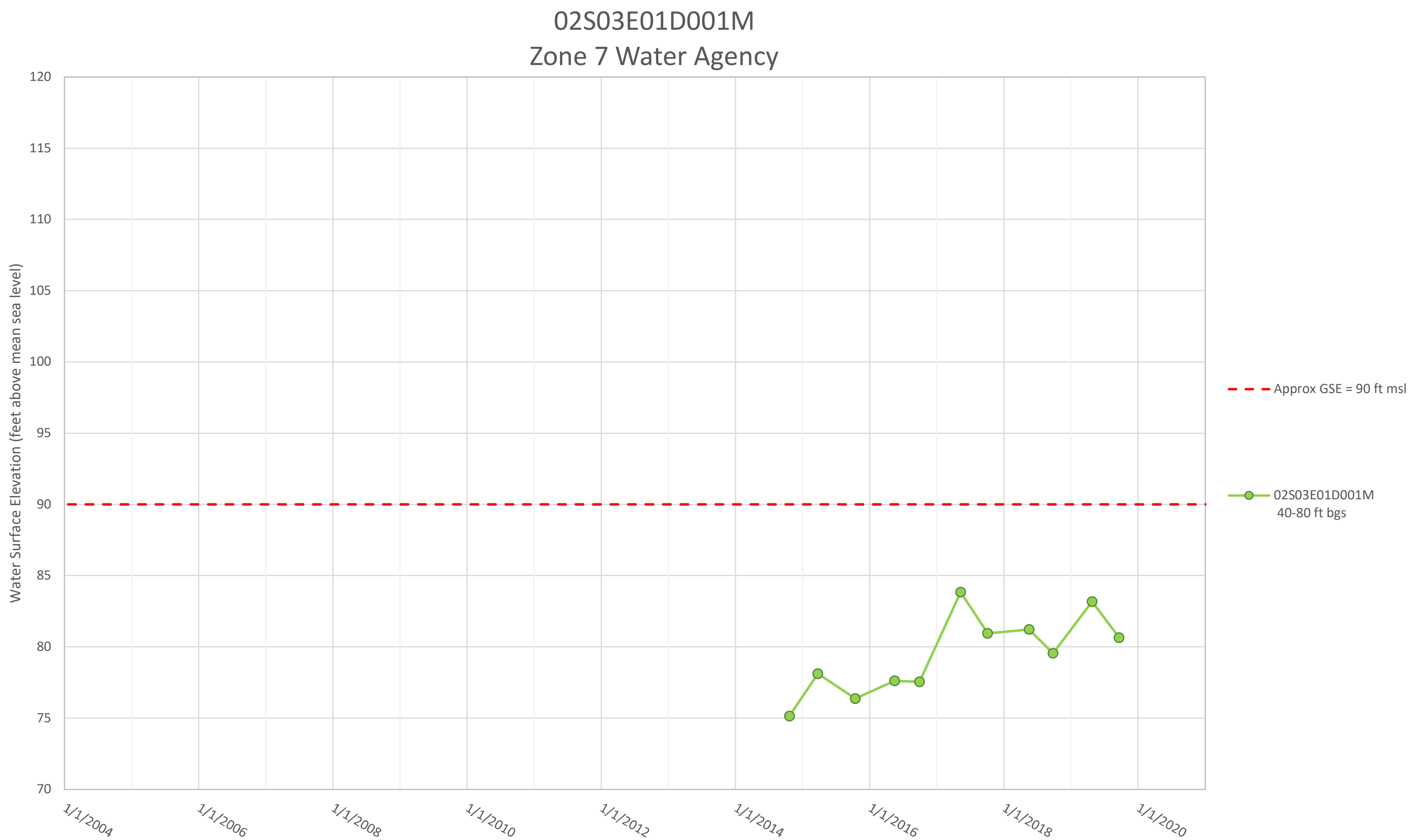

01S06E23C003M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 15 ft msl
01S06E23C003M
125-145 ft bgs

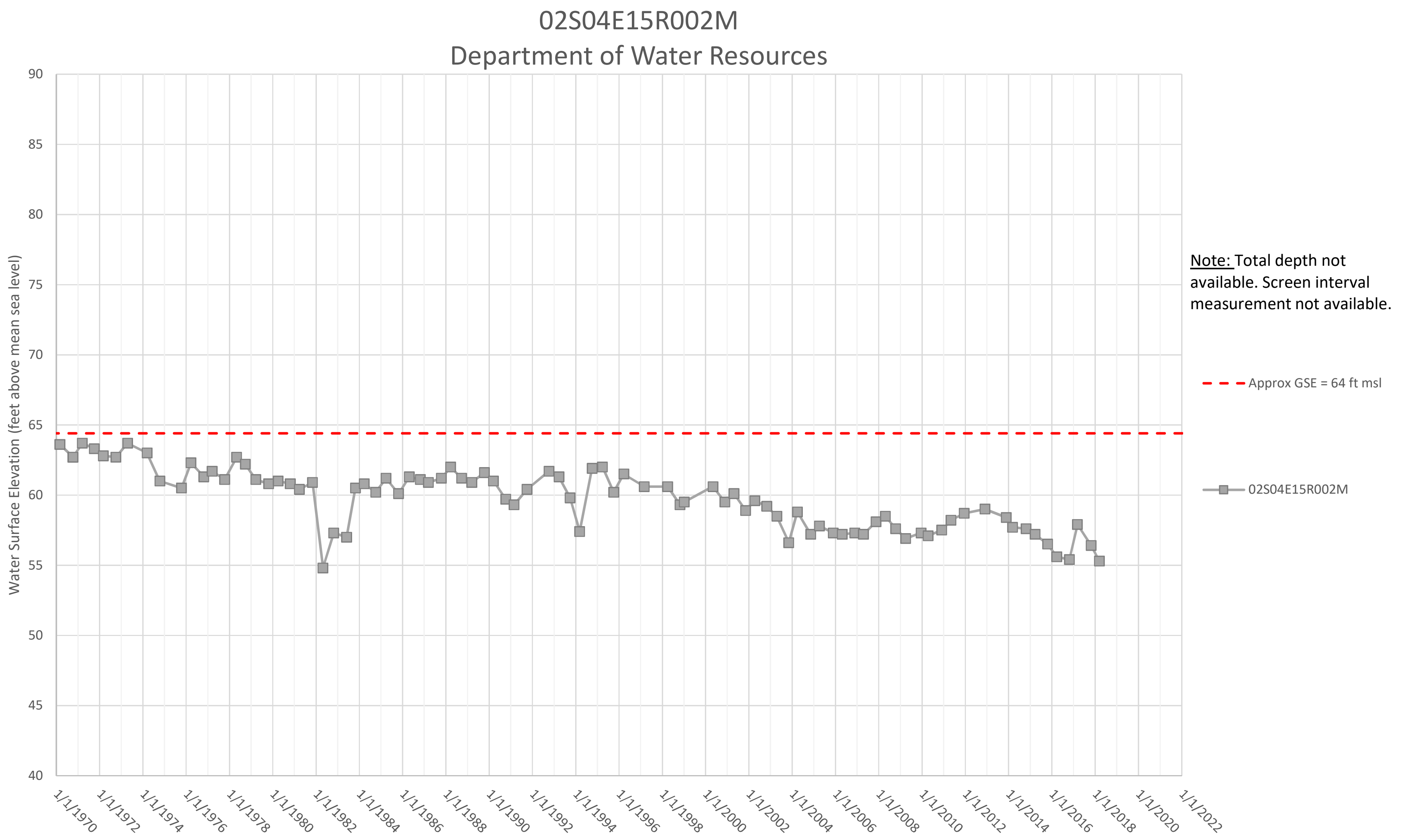


01S06E26K001M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 19 ft msl
01S06E26K001M
191-248 ft bgs

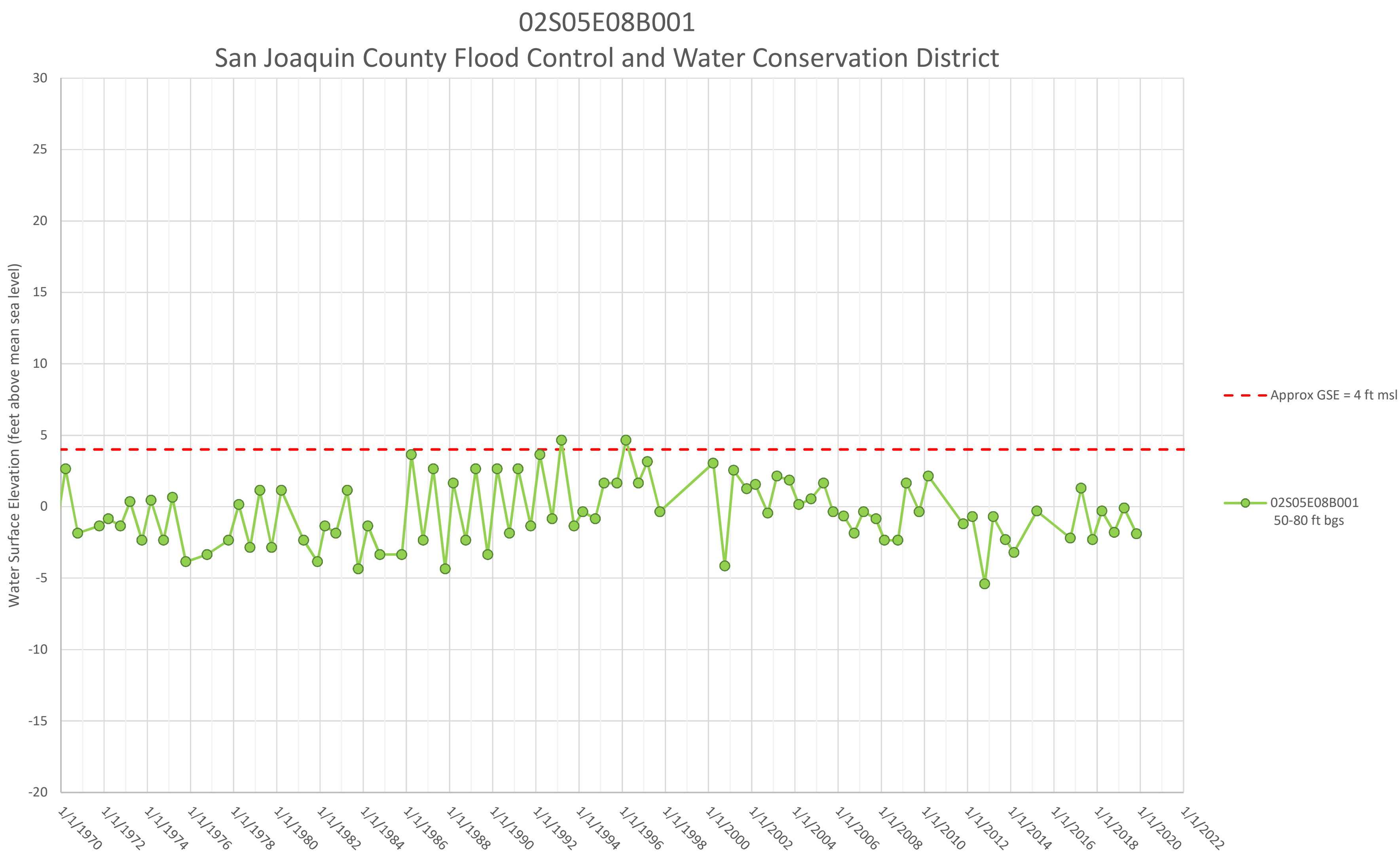


02S04E15R001
San Joaquin County Flood Control and Water Conservation District
80
75
70
65
60
55
50
45
40
35
30
Water Surface Elevation (feet above mean sea level)
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 62 ft msl
02S04E15R001
0.1-45 ft bgs

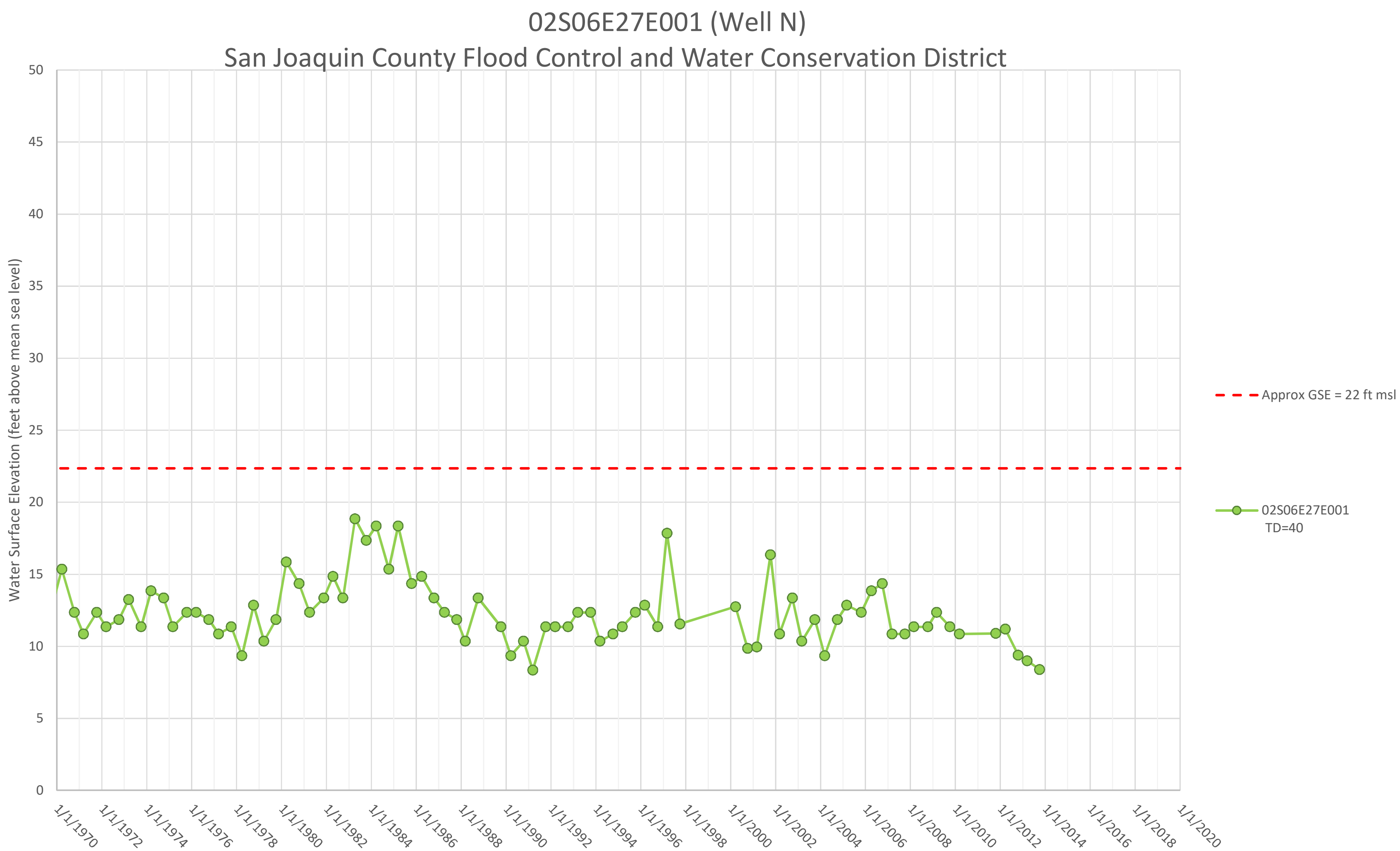

02S03E01D001M
Zone 7 Water Agency
Water Surface Elevation (feet above mean sea level)
120
115
110
105
100
95
90
85
80
75
70
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 90 ft msl
02S03E01D001M
40-80 ft bgs



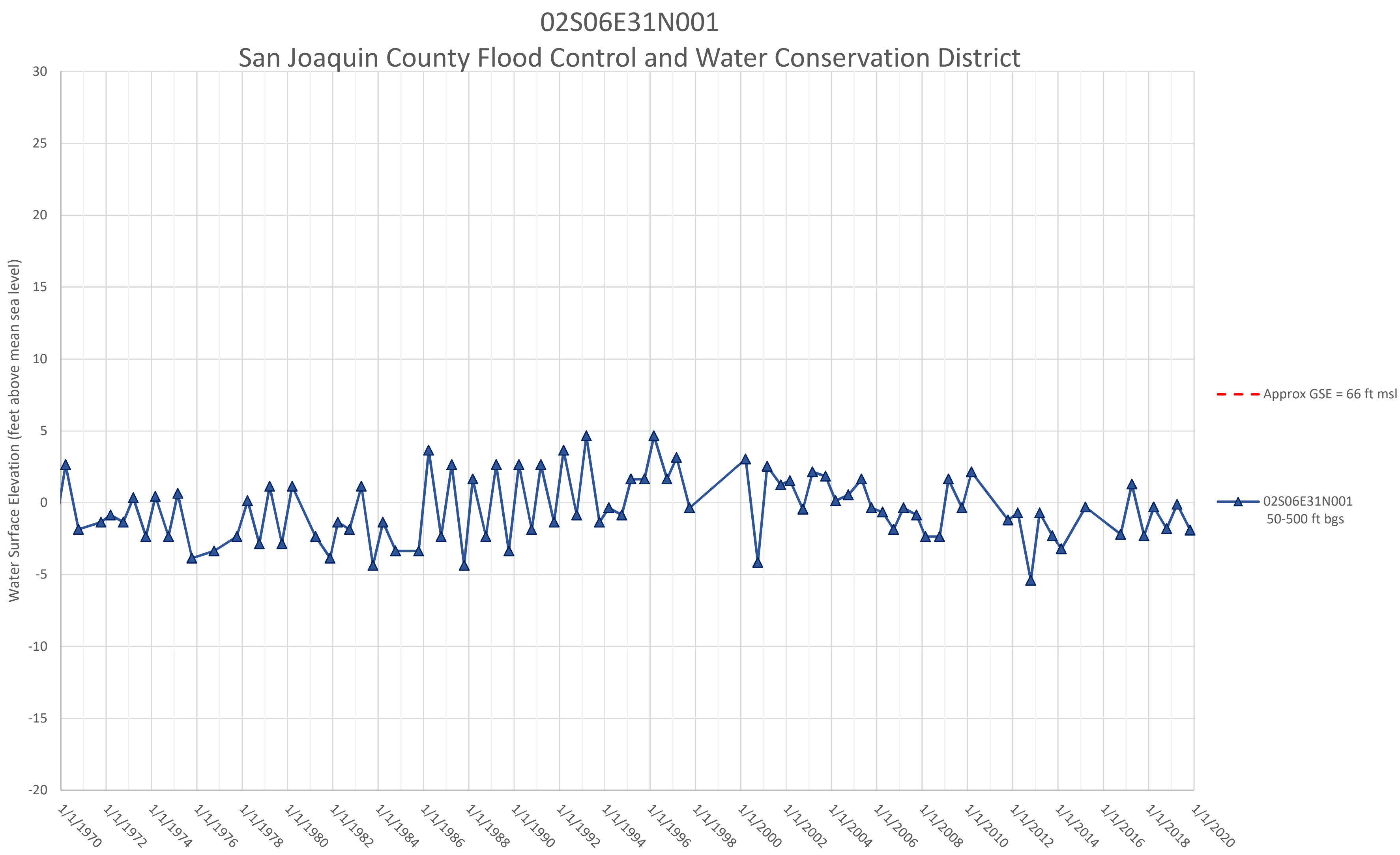
02S04E15R002M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
90
85
80
75
70
65
60
55
50
45
40
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
1/1/2022
Note: Total depth not available. Screen interval measurement not available.
Approx GSE = 64 ft msl
02S04E15R002M



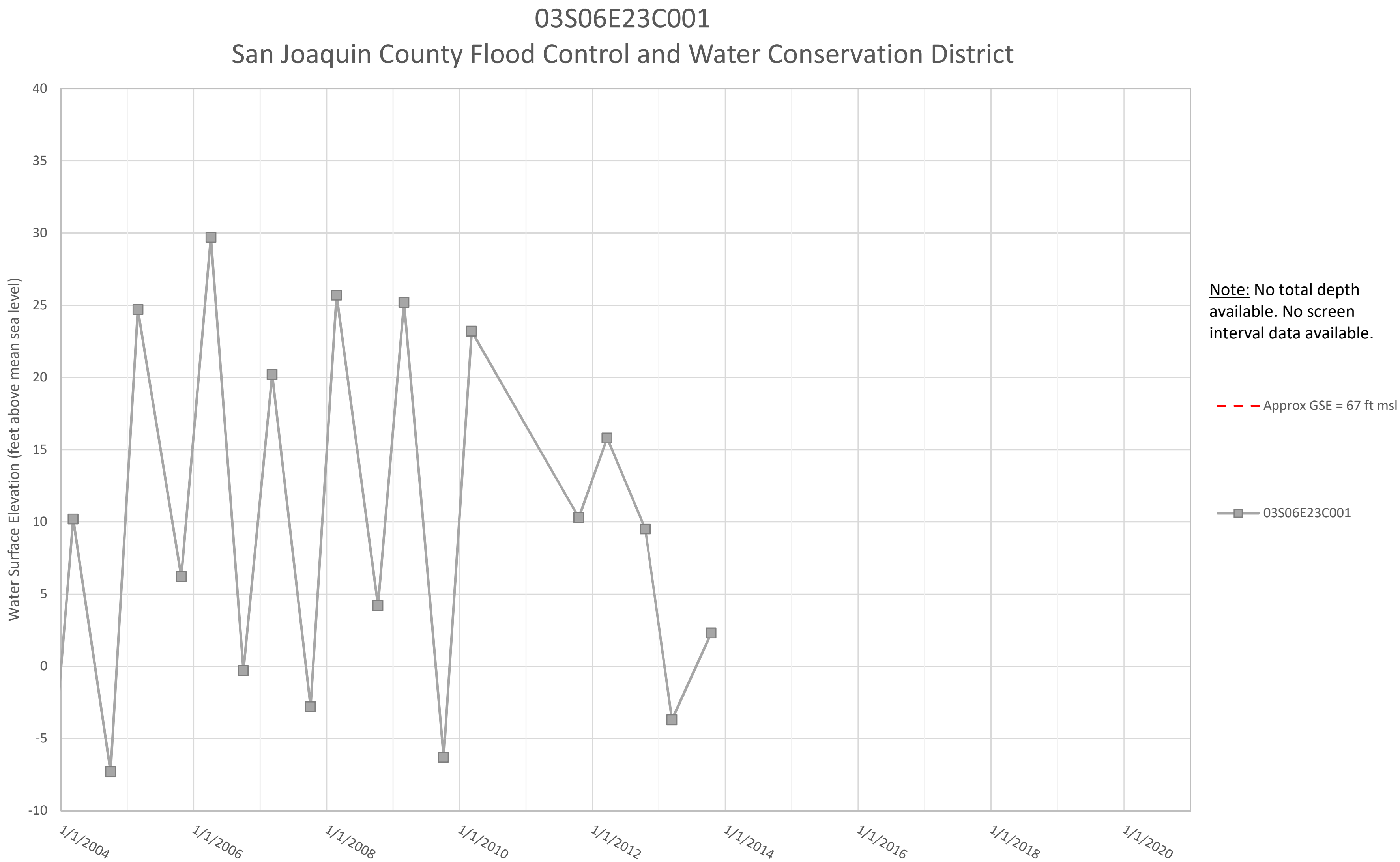
02S05E08B001
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
1/1/2022
Approx GSE = 4 ft msl
02S05E08B001
50-80 ft bgs



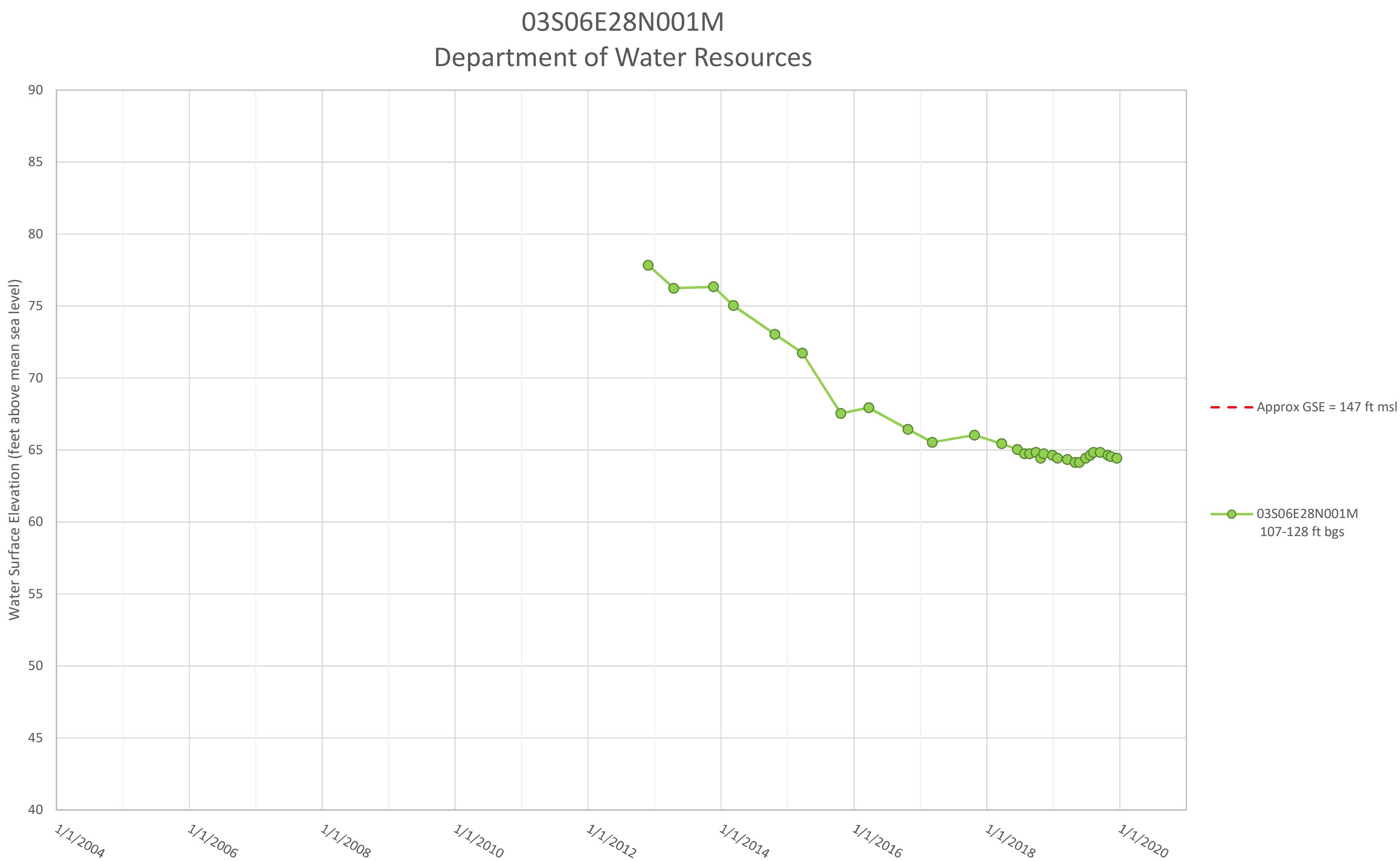
02S06E27E001 (Well N)
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
0
5
10
15
20
25
30
35
40
45
50
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 22 ft msl
02S06E27E001
TD=40



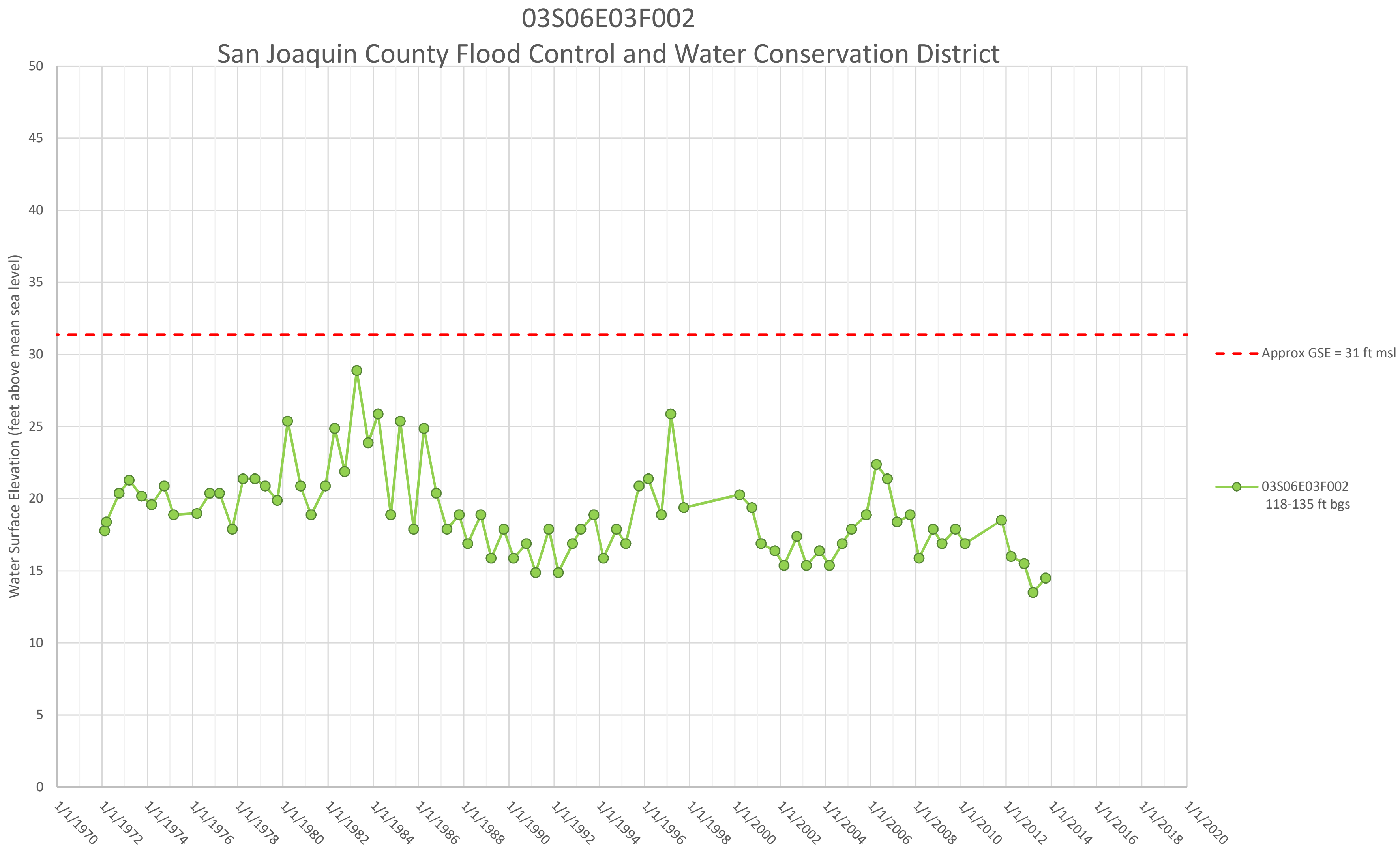
02S06E31N001
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 66 ft msl
02S06E31N001
50-500 ft bgs



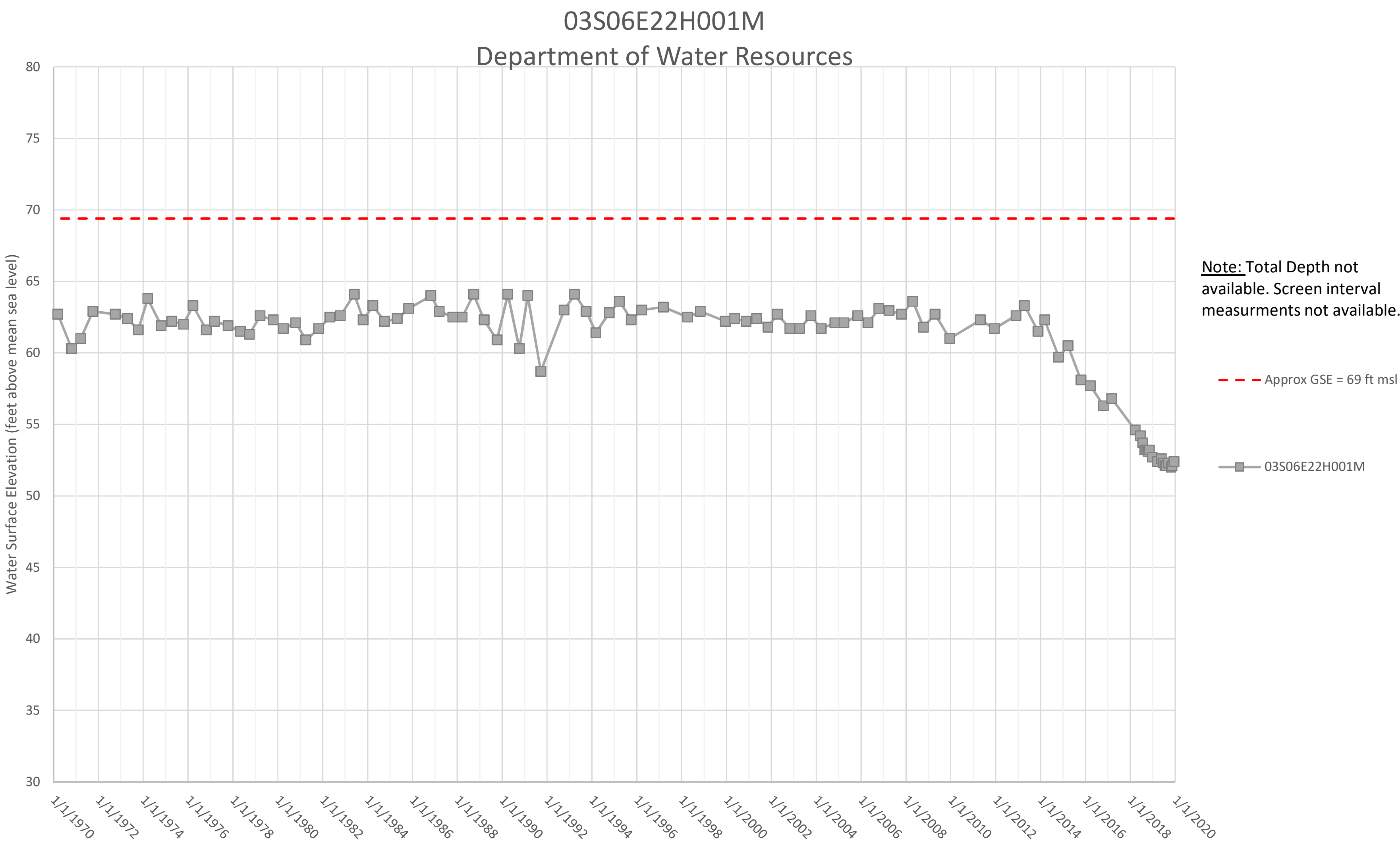
Note: No total depth available. No screen interval data available.



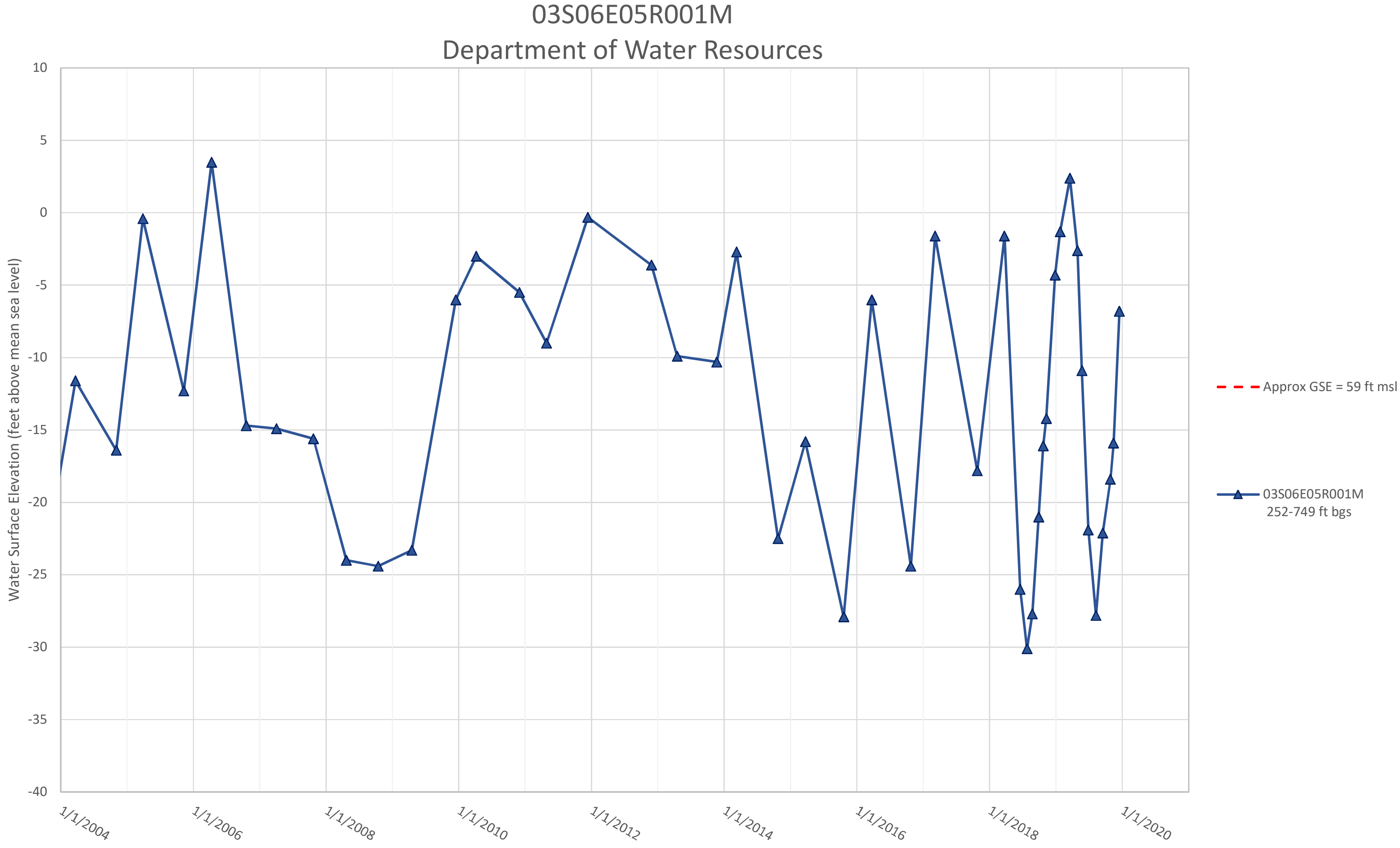
03S06E28N001M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
90
85
80
75
70
65
60
55
50
45
40
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 147 ft msl
03S06E28N001M
107-128 ft bgs



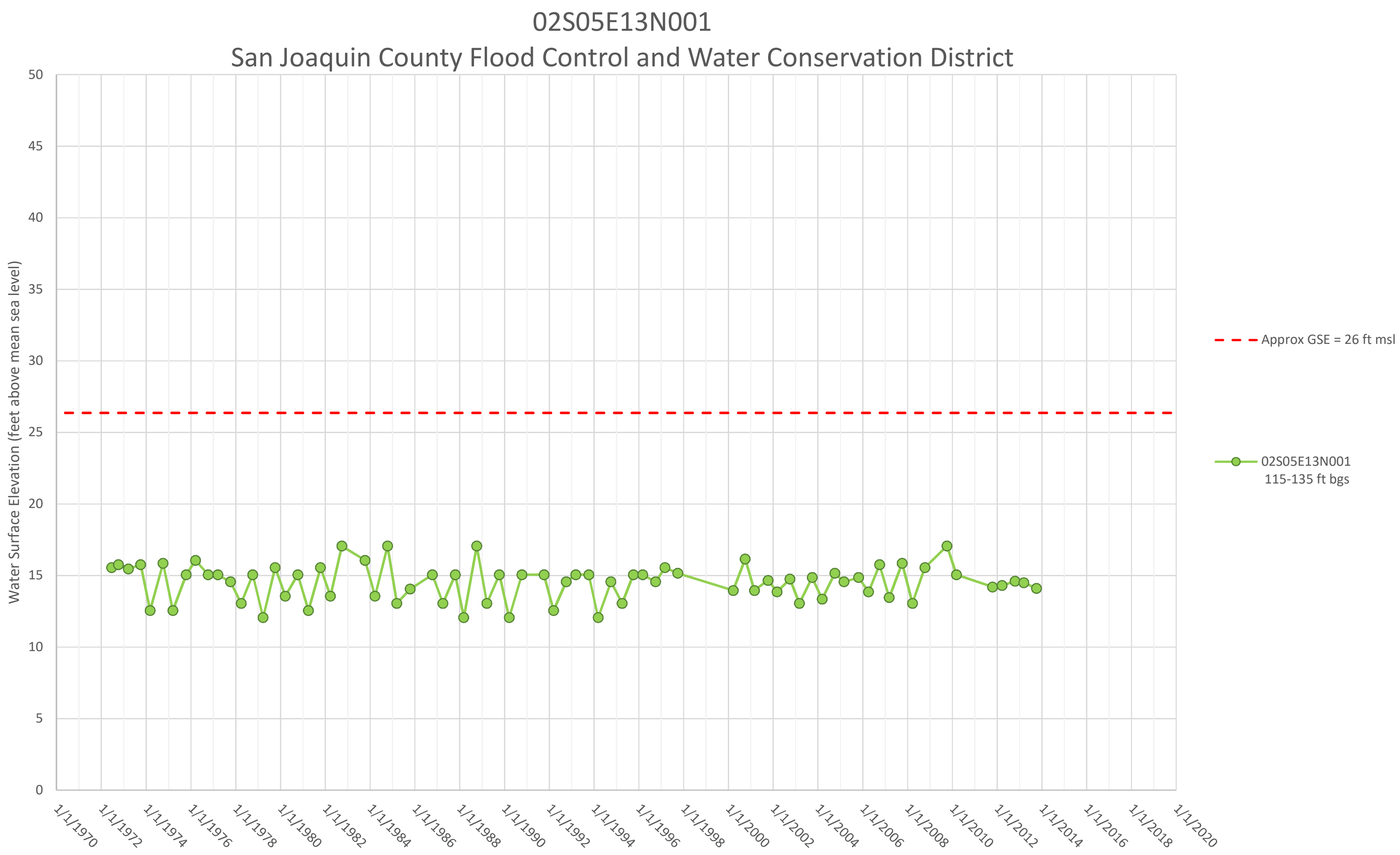
03S06E03F002
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
50
45
40
35
30
25
20
15
10
5
0
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 31 ft msl
03S06E03F002
118-135 ft bgs



03S06E22H001M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
80
75
70
65
60
55
50
45
40
35
30
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Total Depth not available. Screen interval measurments not available.
Approx GSE = 69 ft msl
03S06E22H001M



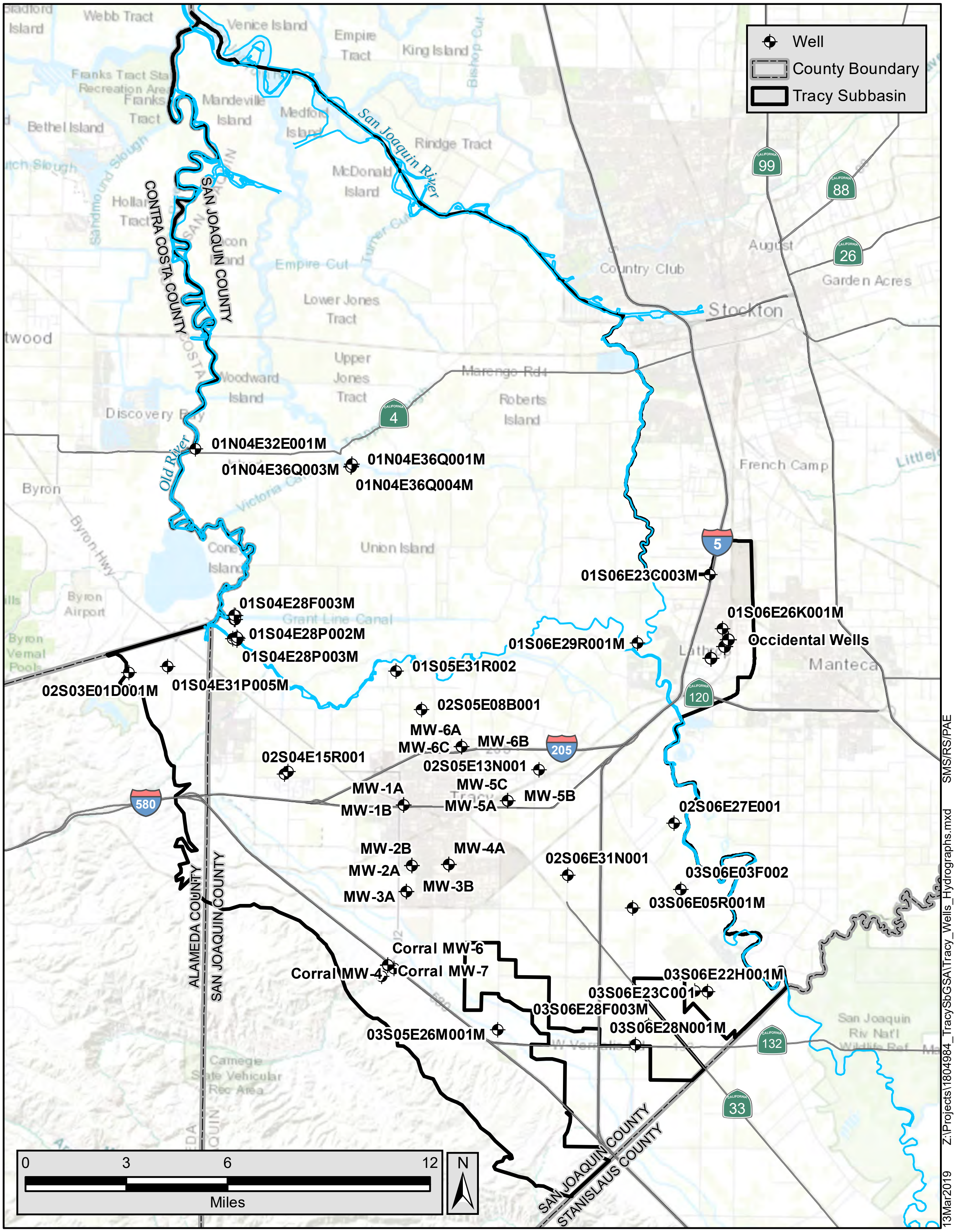
03S06E05R001M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 59 ft msl
03S06E05R001M
252-749 ft bgs



02S05E13N001
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
50
45
40
35
30
25
20
15
10
5
0
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 26 ft msl
02S05E13N001
115-135 ft bgs

APPENDIX F

LOWER AQUIFER
(BELOW CORCORAN CLAY)
WELLS WITH HYDROGRAPHS



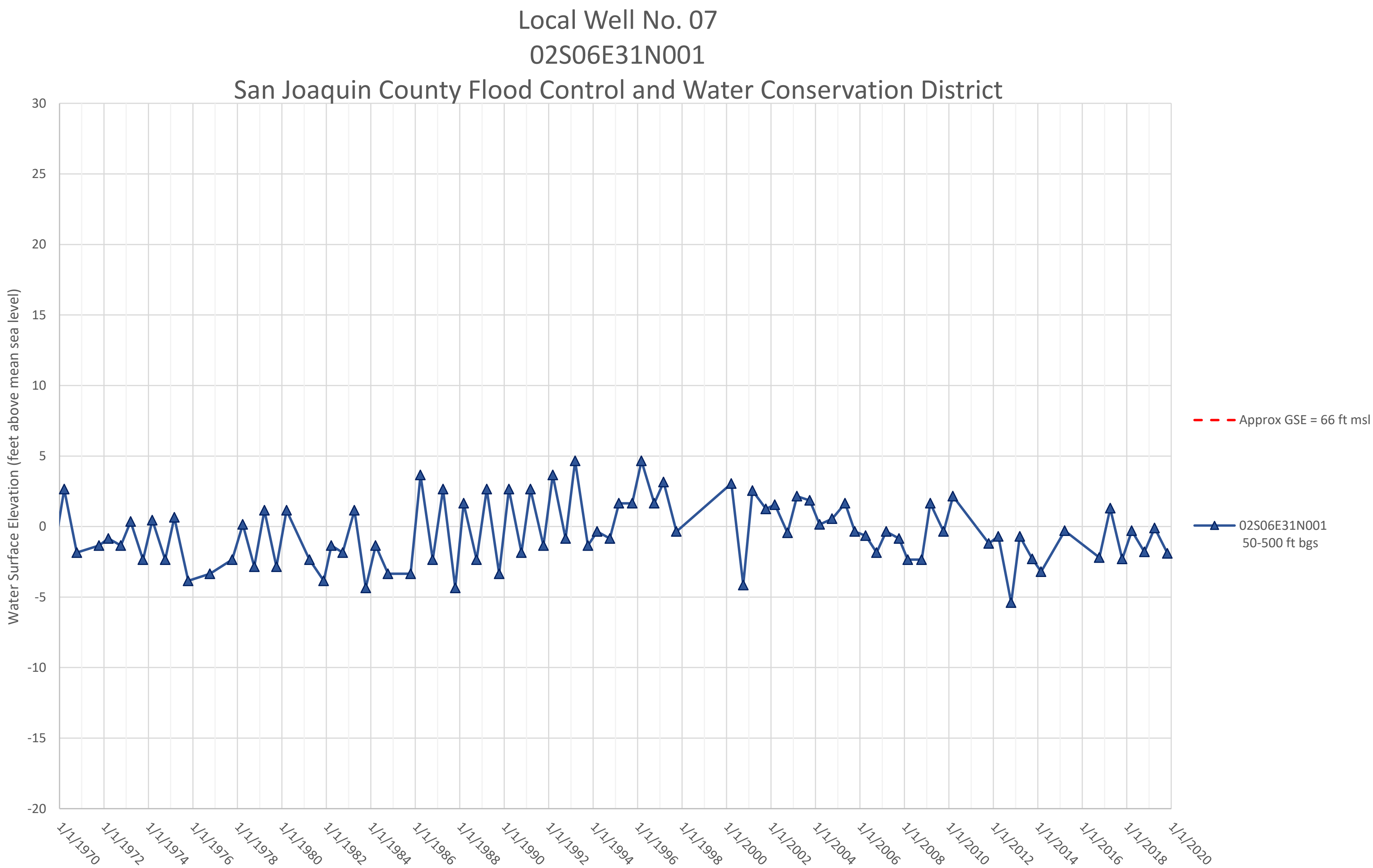
Tracy Subbasin
San Joaquin County, CA

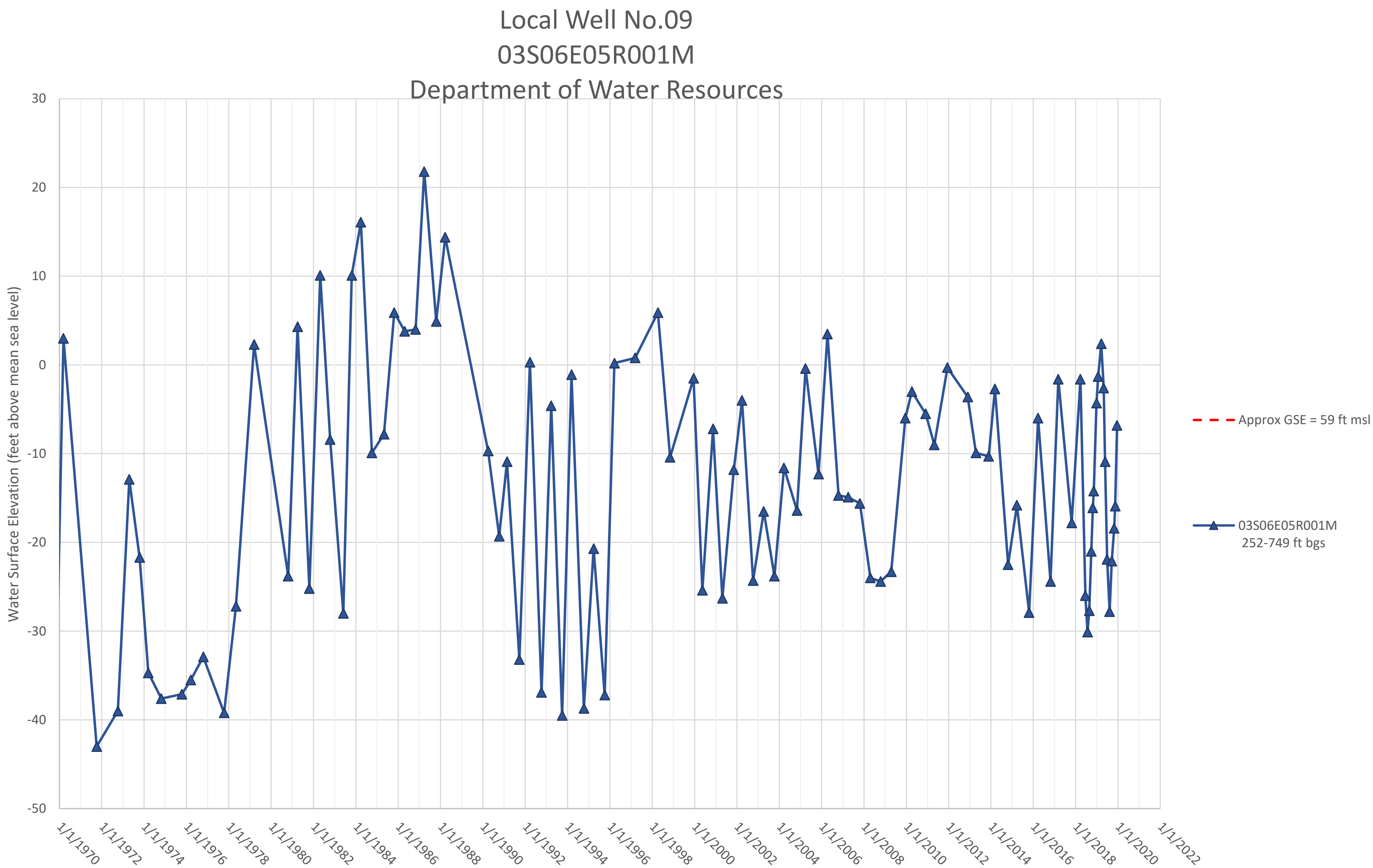
Tracy Subbasin GSAs

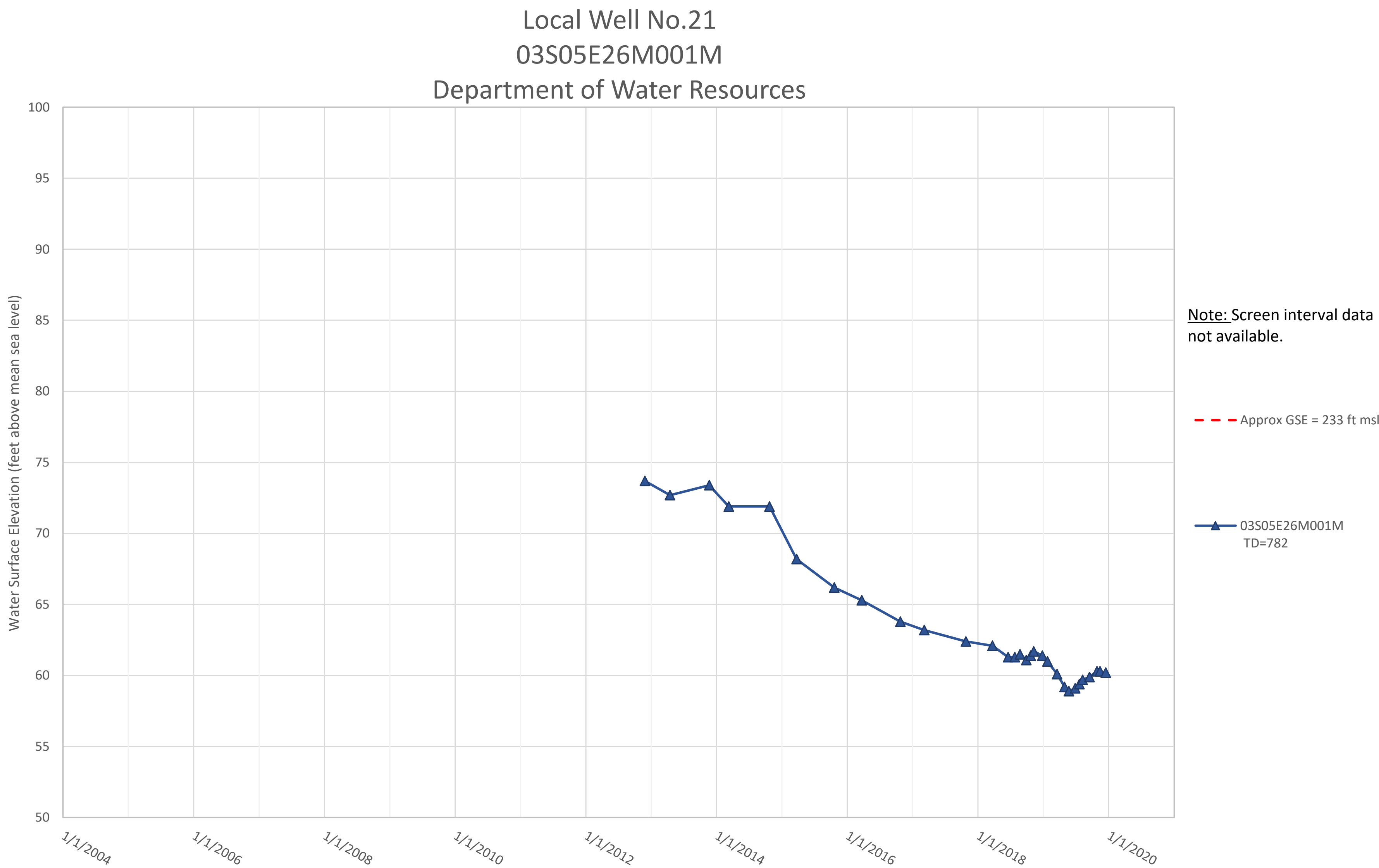
GEI Consultants

Wells with Hydrographs

JUNE 2020

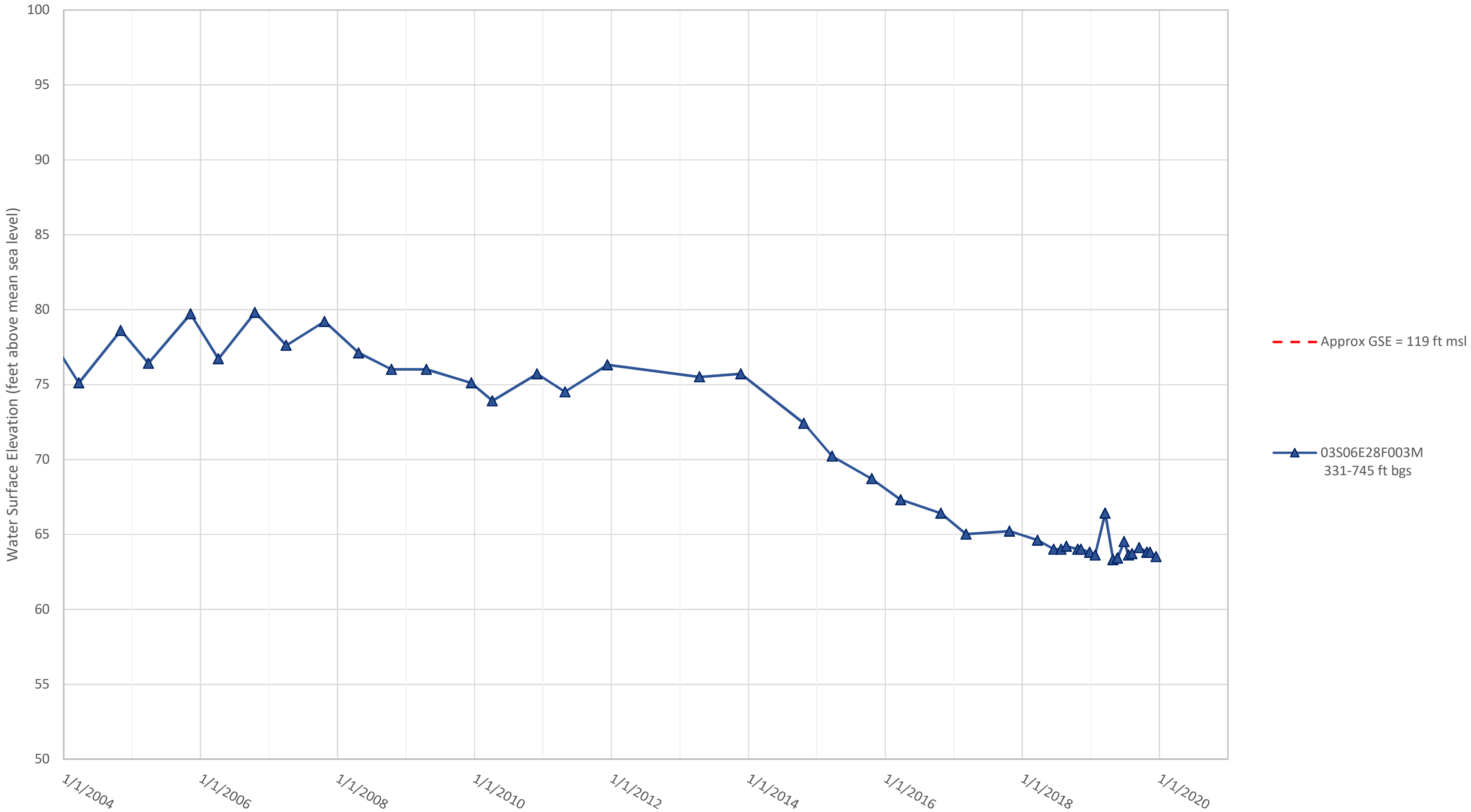

Local Well No. 07
02S06E31N001
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 66 ft msl
02S06E31N001
50-500 ft bgs

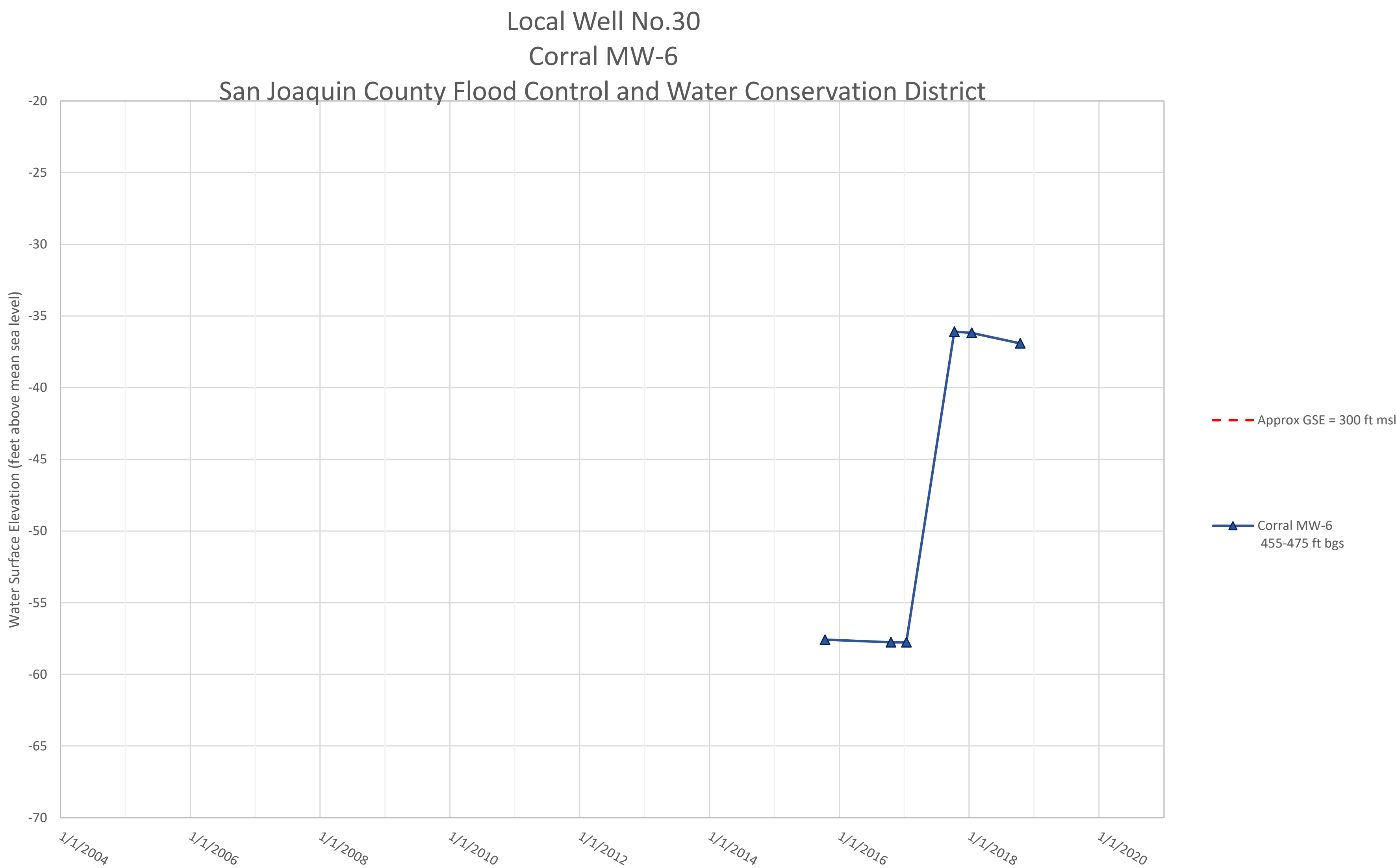

Local Well No.09
03S06E05R001M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
20
10
0
-10
-20
-30
-40
-50
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
1/1/2022
Approx GSE = 59 ft msl
03S06E05R001M
252-749 ft bgs



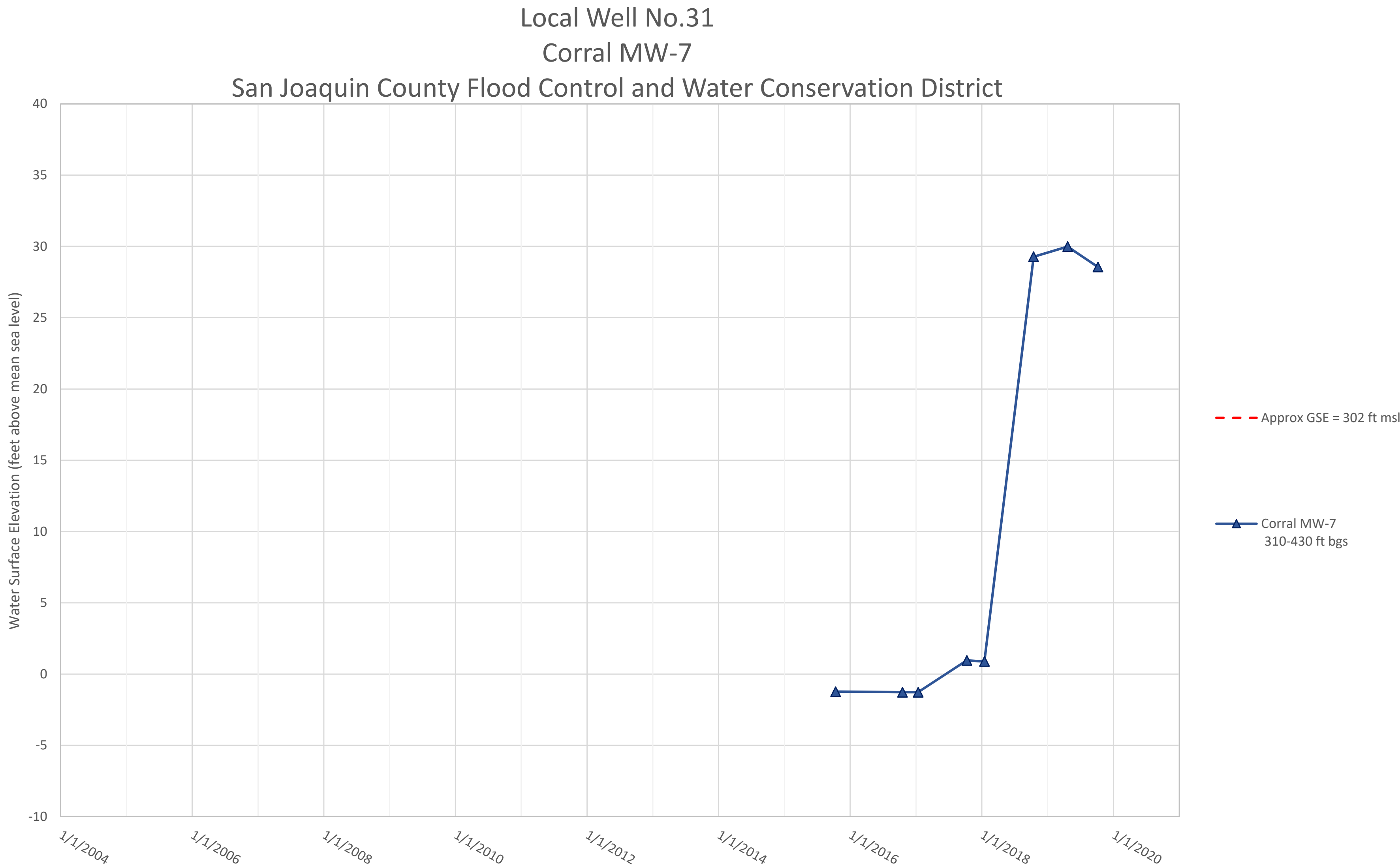
Local Well No.21
03S05E26M001M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
100
95
90
85
80
75
70
65
60
55
50
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Screen interval data not available.
Approx GSE = 233 ft msl
03S05E26M001M
TD=782

Local Well No.26
03S06E28F003M
Department of Water Resources

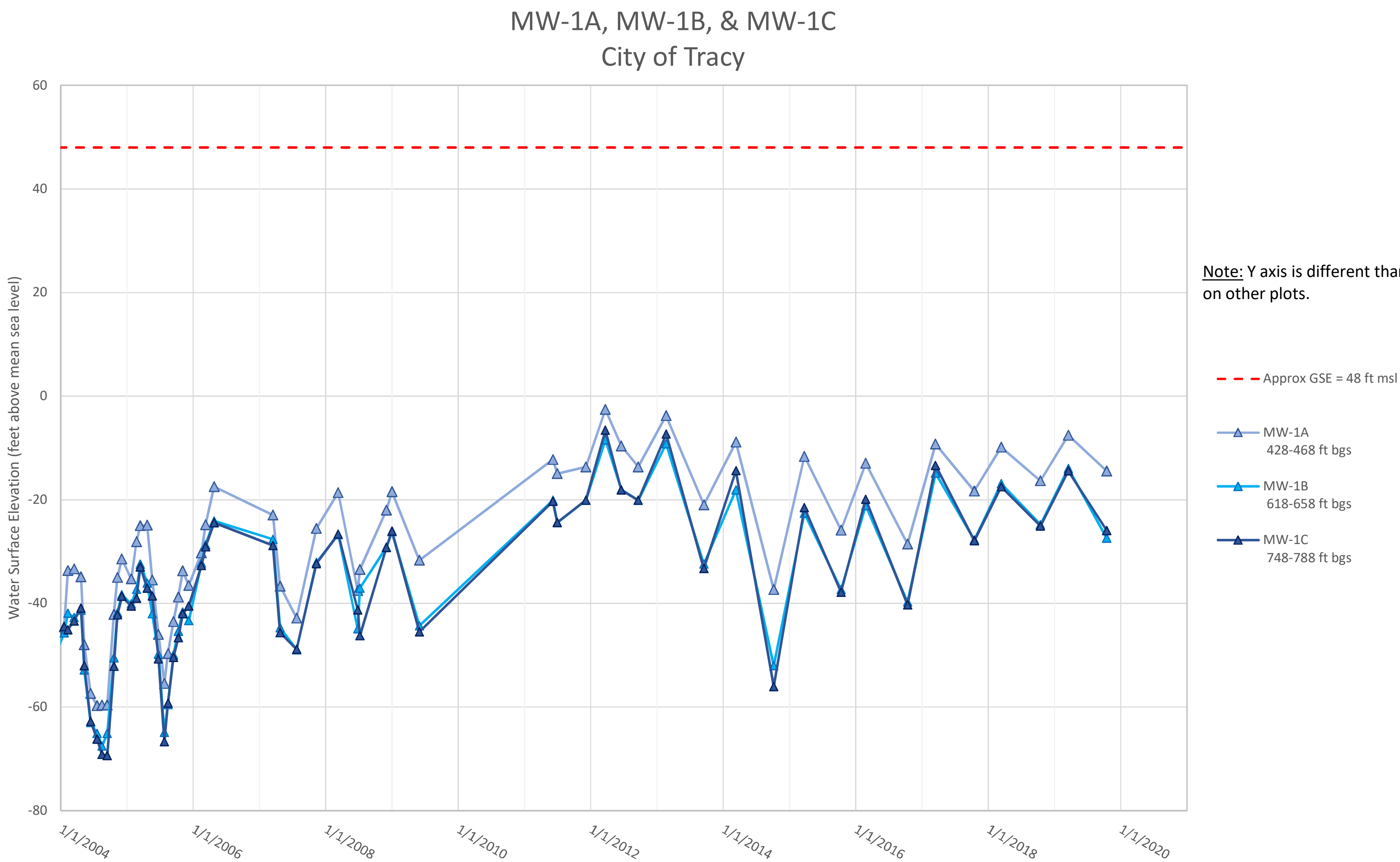




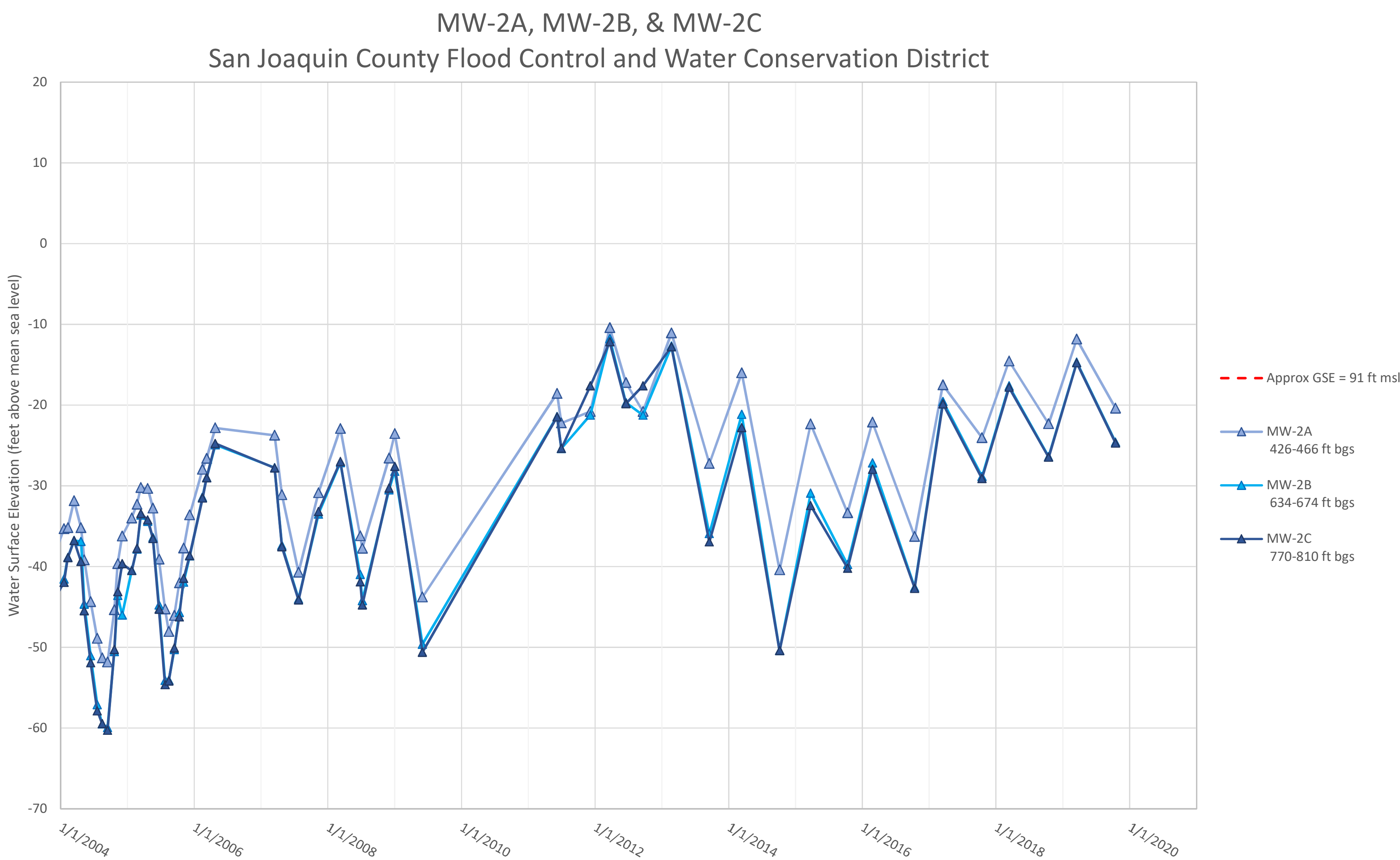
Local Well No.30
Corral MW-6
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 300 ft msl
Corral MW-6
455-475 ft bgs



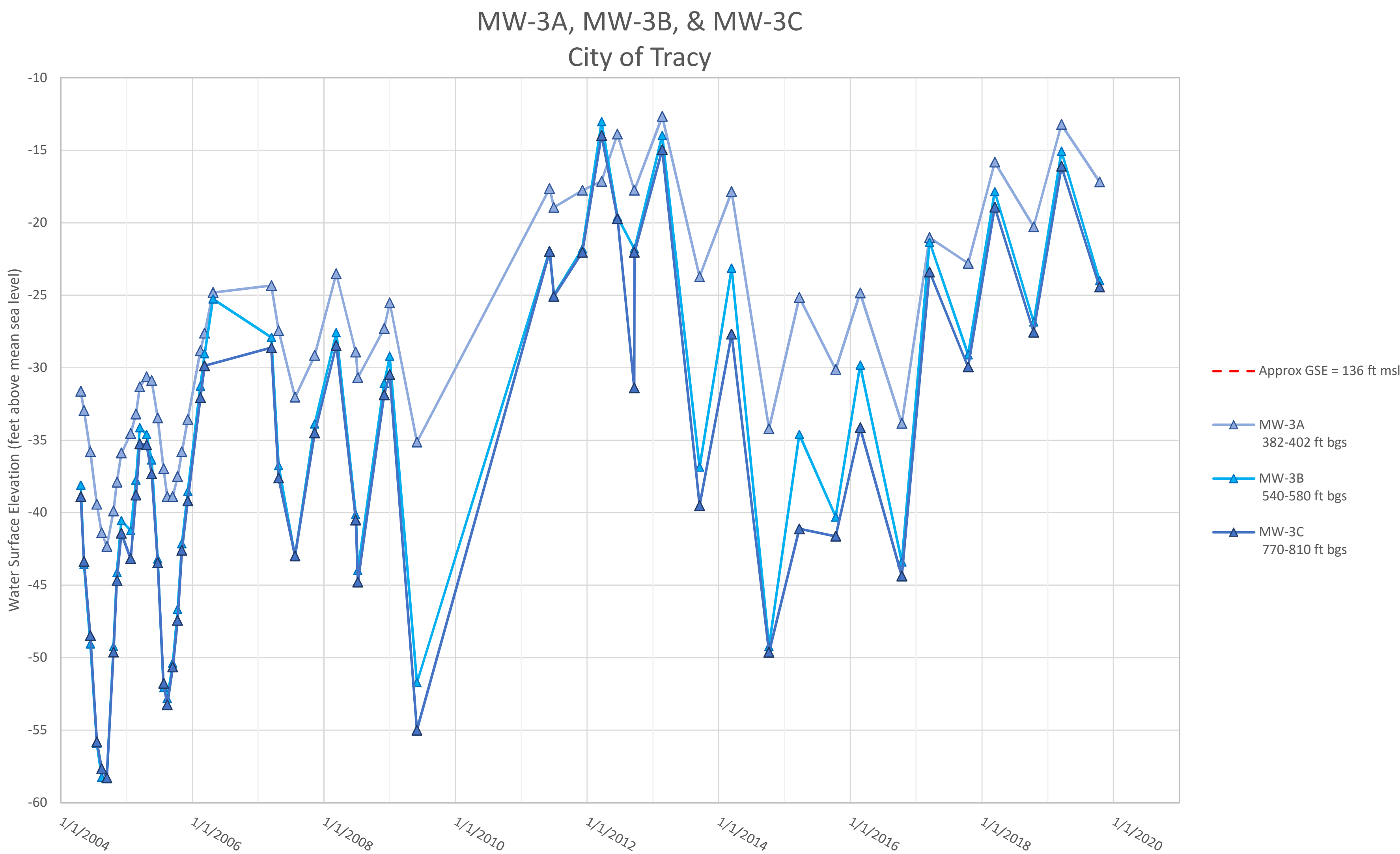
Local Well No.31
Corral MW-7
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
40
35
30
25
20
15
10
5
0
-5
-10
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 302 ft msl
Corral MW-7
310-430 ft bgs



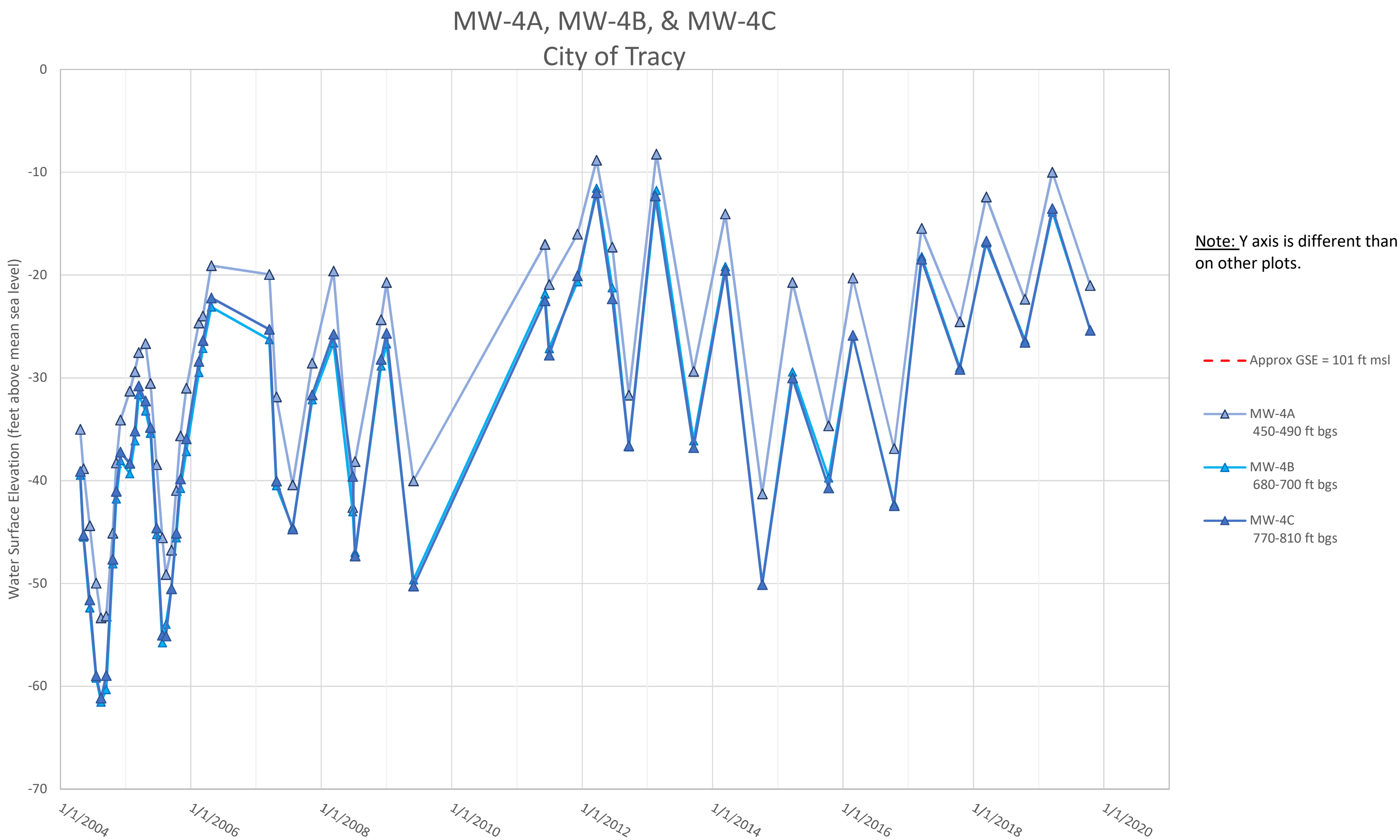
Note: Y axis is different than on other plots.



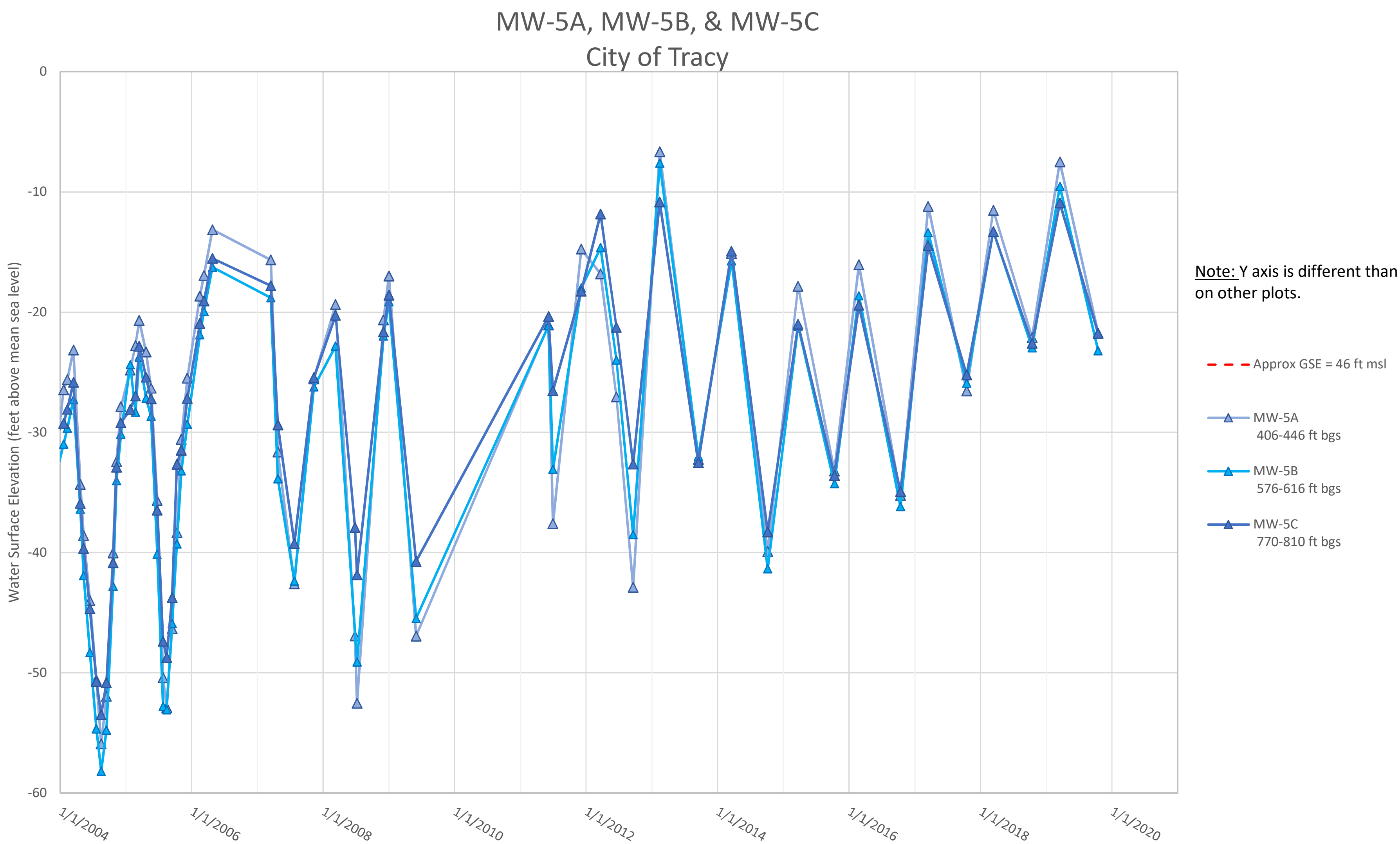
MW-2A, MW-2B, & MW-2C
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
20
10
0
-10
-20
-30
-40
-50
-60
-70
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 91 ft msl
MW-2A
426-466 ft bgs
MW-2B
634-674 ft bgs
MW-2C
770-810 ft bgs



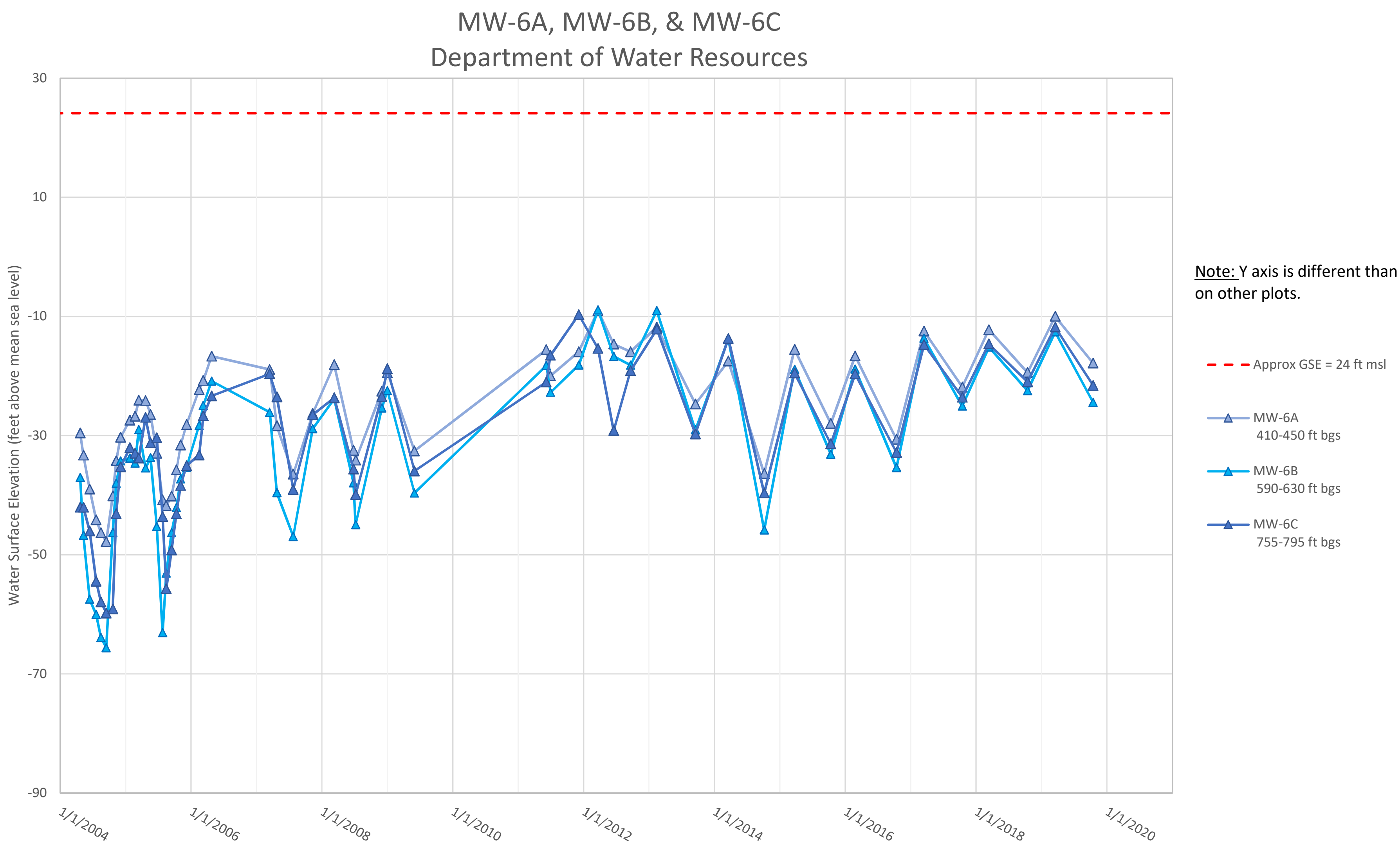
MW-3A, MW-3B, & MW-3C
City of Tracy
Water Surface Elevation (feet above mean sea level)
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 136 ft msl
MW-3A
382-402 ft bgs
MW-3B
540-580 ft bgs
MW-3C
770-810 ft bgs



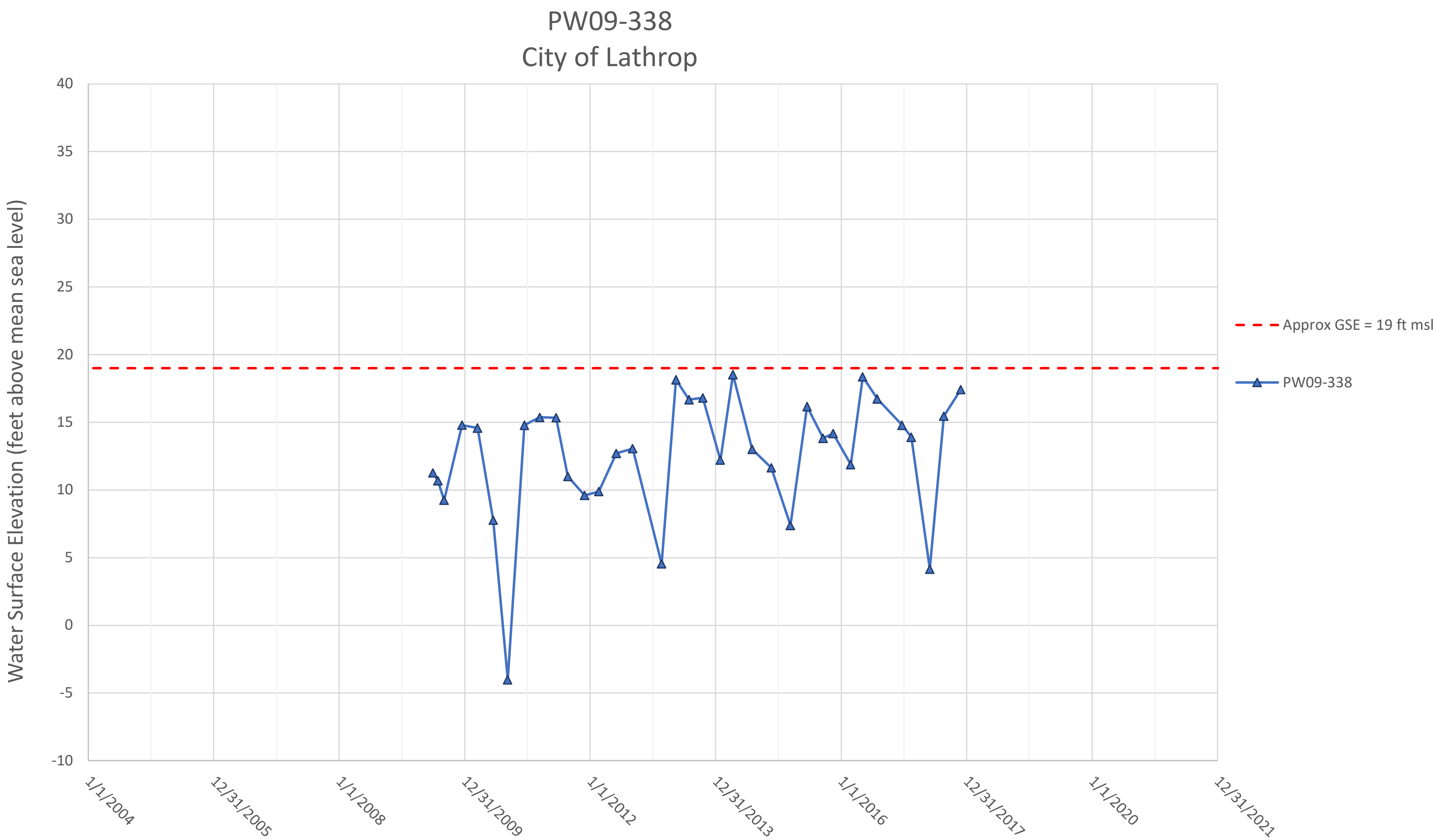
MW-4A, MW-4B, & MW-4C
City of Tracy
Water Surface Elevation (feet above mean sea level)
0
-10
-20
-30
-40
-50
-60
-70
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Y axis is different than on other plots.
Approx GSE = 101 ft msl
MW-4A 450-490 ft bgs
MW-4B 680-700 ft bgs
MW-4C 770-810 ft bgs

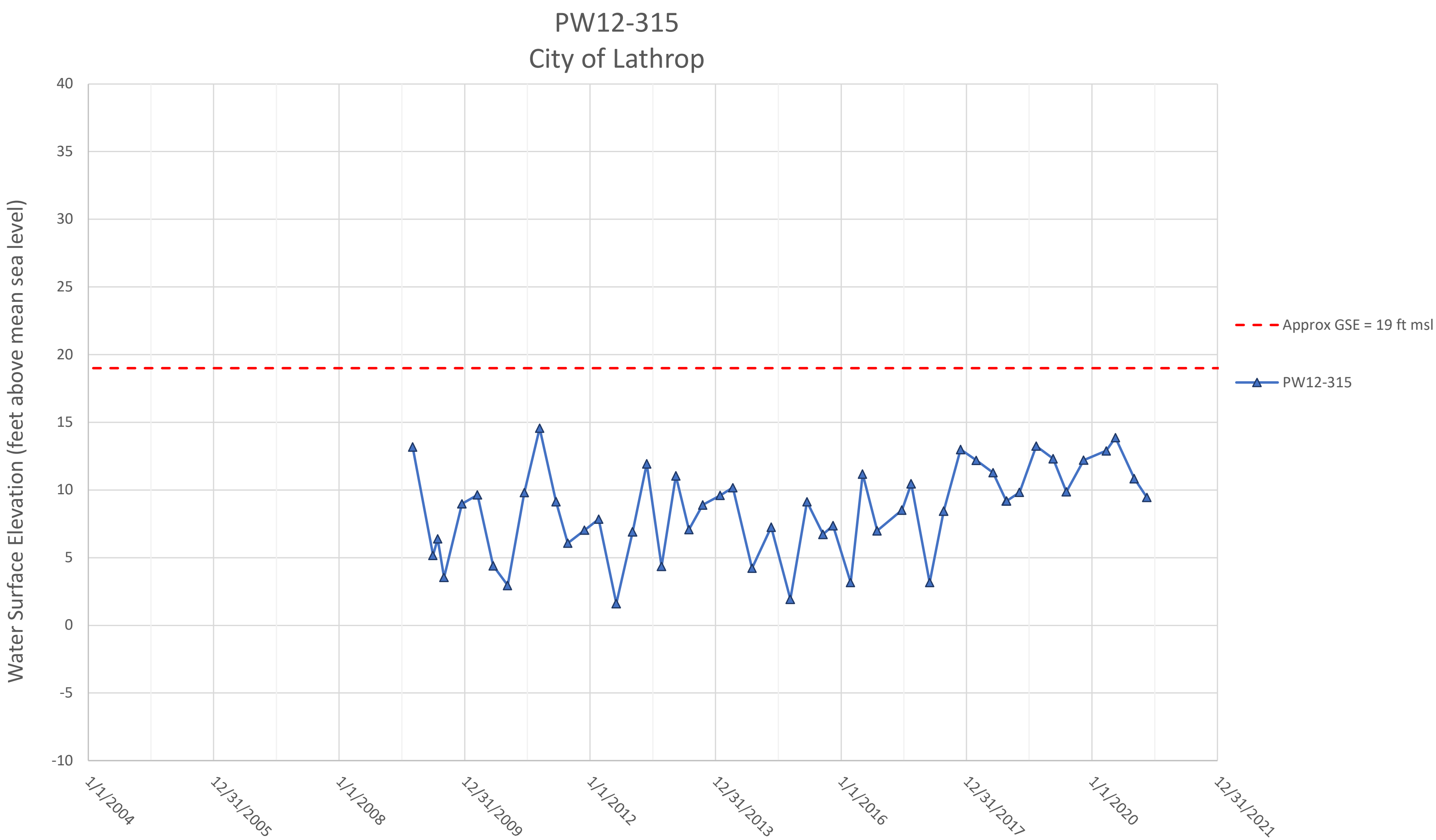


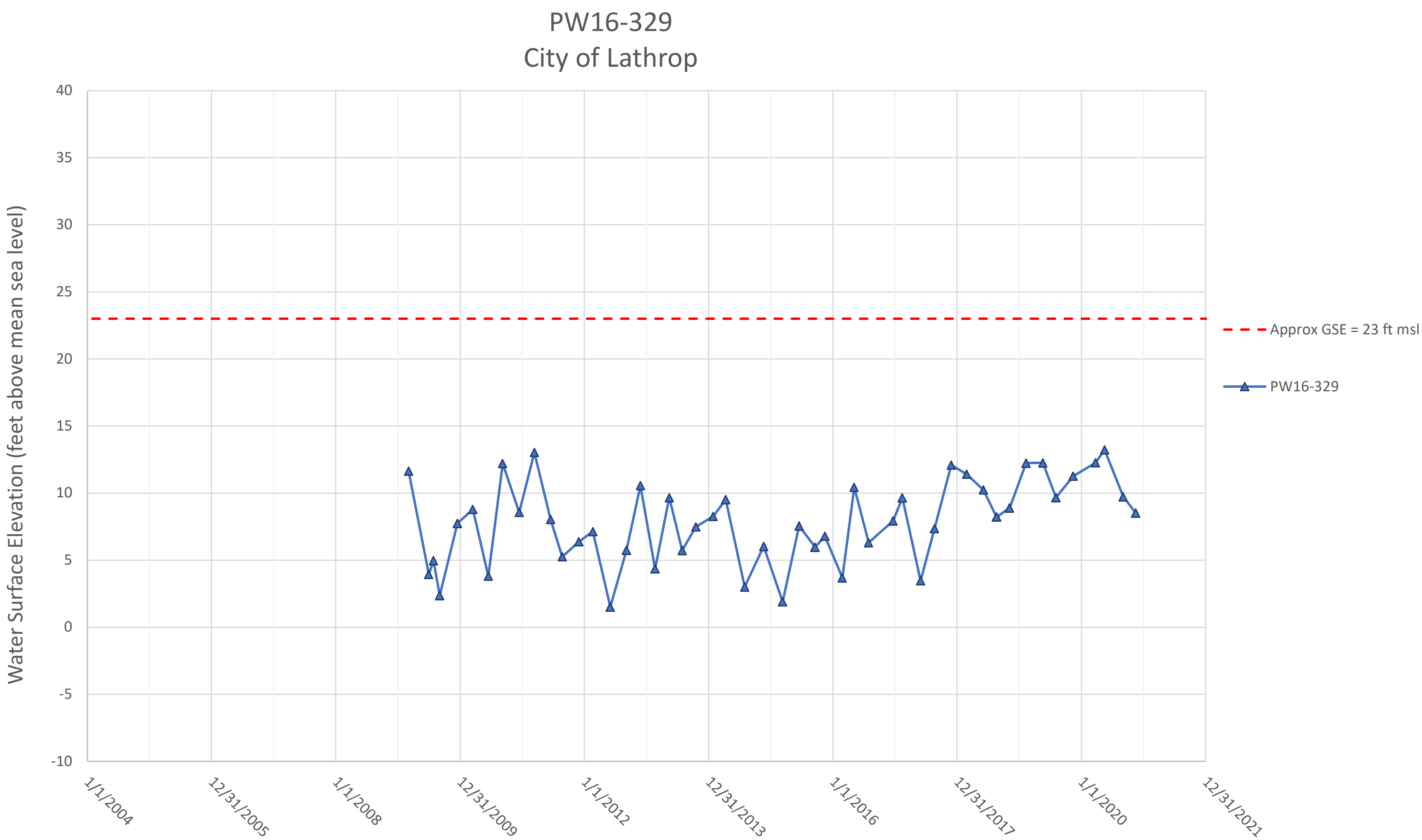
MW-5A, MW-5B, & MW-5C
City of Tracy
Water Surface Elevation (feet above mean sea level)
0
-10
-20
-30
-40
-50
-60
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Y axis is different than on other plots.
Approx GSE = 46 ft msl
MW-5A 406-446 ft bgs
MW-5B 576-616 ft bgs
MW-5C 770-810 ft bgs

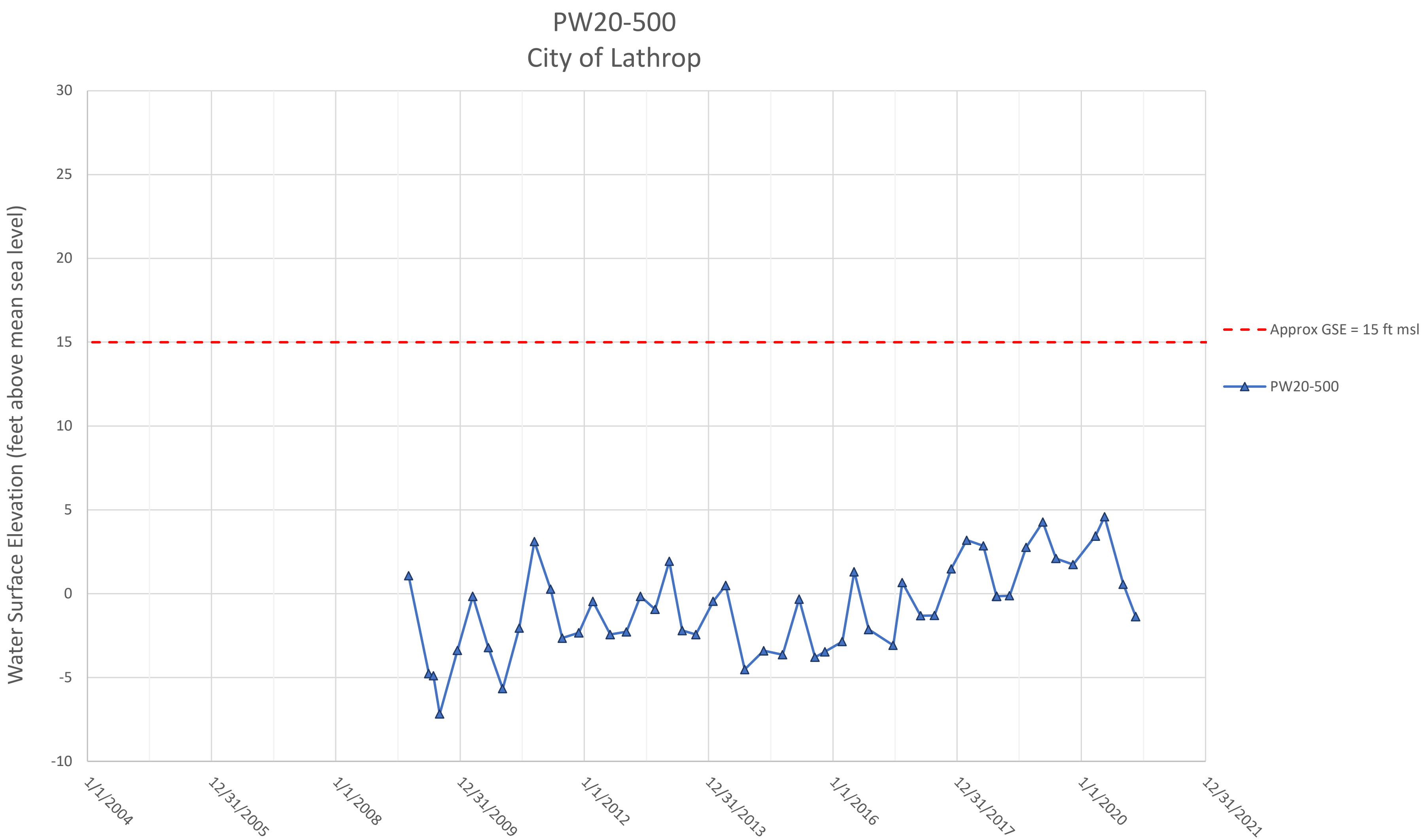


Note: Y axis is different than on other plots.


PW09-338
City of Lathrop
Water Surface Elevation (feet above mean sea level)
40
35
30
25
20
15
10
5
0
-5
-10
1/1/2004
12/31/2005
1/1/2008
12/31/2009
1/1/2012
12/31/2013
1/1/2016
12/31/2017
1/1/2020
12/31/2021
Approx GSE = 19 ft msl
PW09-338


PW12-315
City of Lathrop
Water Surface Elevation (feet above mean sea level)
40
35
30
25
20
15
10
5
0
-5
-10
1/1/2004
12/31/2005
1/1/2008
12/31/2009
1/1/2012
12/31/2013
1/1/2016
12/31/2017
1/1/2020
12/31/2021
Approx GSE = 19 ft msl
PW12-315


PW16-329
City of Lathrop
Water Surface Elevation (feet above mean sea level)
40
35
30
25
20
15
10
5
0
-5
-10
1/1/2004
12/31/2005
1/1/2008
12/31/2009
1/1/2012
12/31/2013
1/1/2016
12/31/2017
1/1/2020
12/31/2021
Approx GSE = 23 ft msl
PW16-329


PW20-500
City of Lathrop
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
1/1/2004
12/31/2005
1/1/2008
12/31/2009
1/1/2012
12/31/2013
1/1/2016
12/31/2017
1/1/2020
12/31/2021
Approx GSE = 15 ft msl
PW20-500

APPENDIX G

VERTICAL GRADIENTS
CLUSTERED OR NESTED WELLS
WITH HYDROGRAPHS

APPENDIX G

VERTICAL GRADIENTS
CLUSTERED OR NESTED
WELLS WITH HYDROGRAPHS

LEGEND:

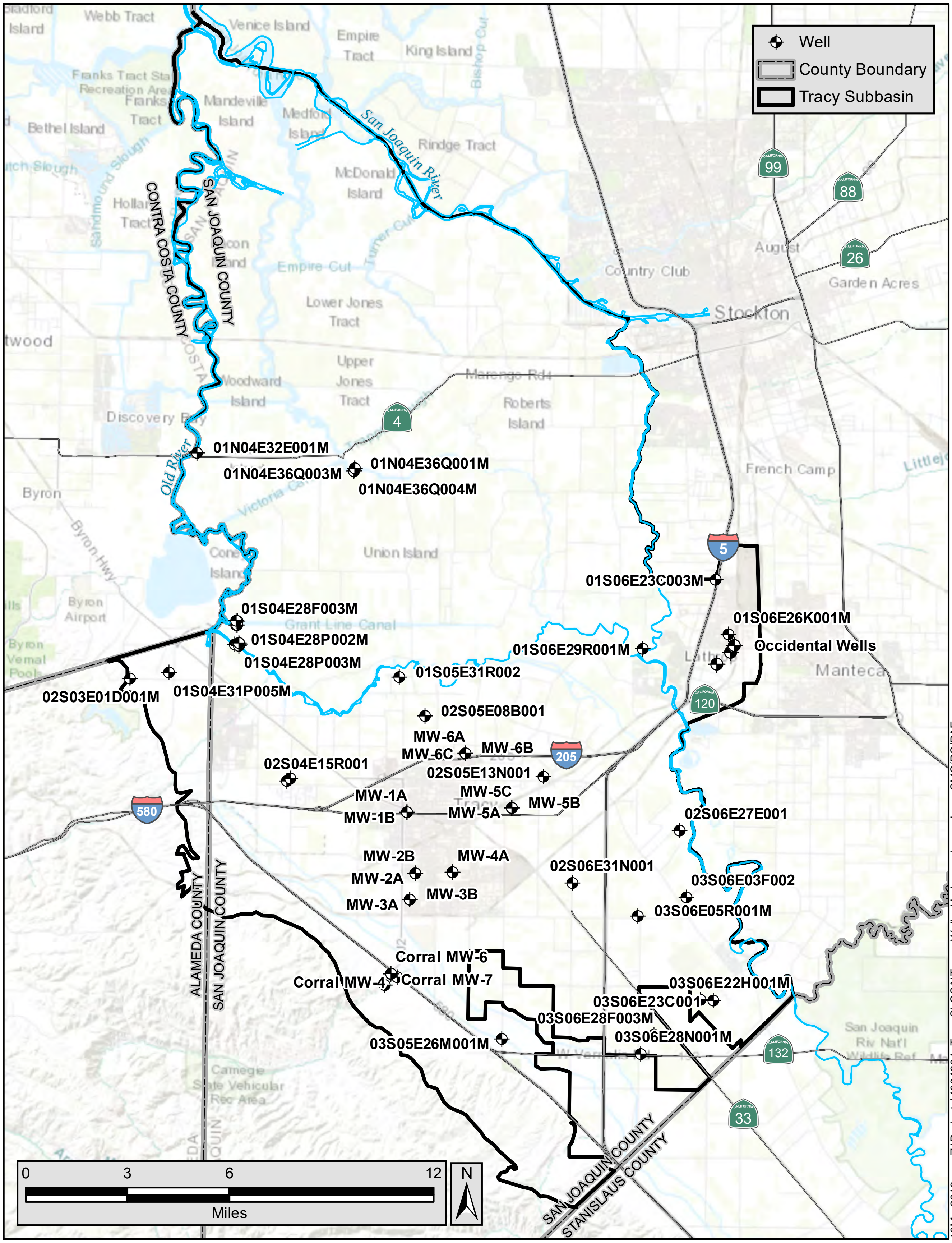
(green)	Above Corcoran-Clay
(blue)	Below Corcoran-Clay

Long-Term Hydrographs

Years Displayed	1970 to 2020	
Vertical Axis	50 feet	
	Unless otherwise noted	

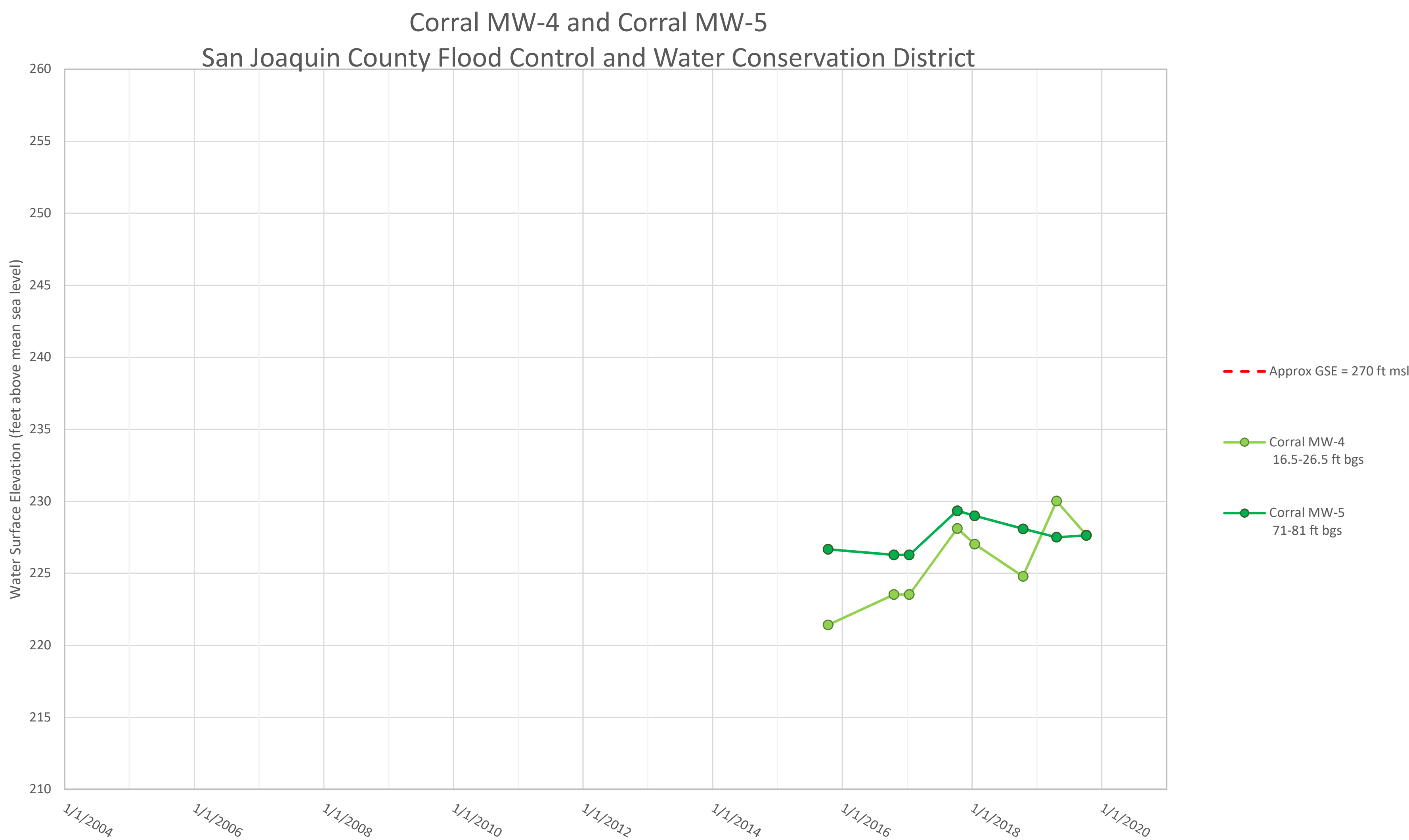
Short Term Hydrographs

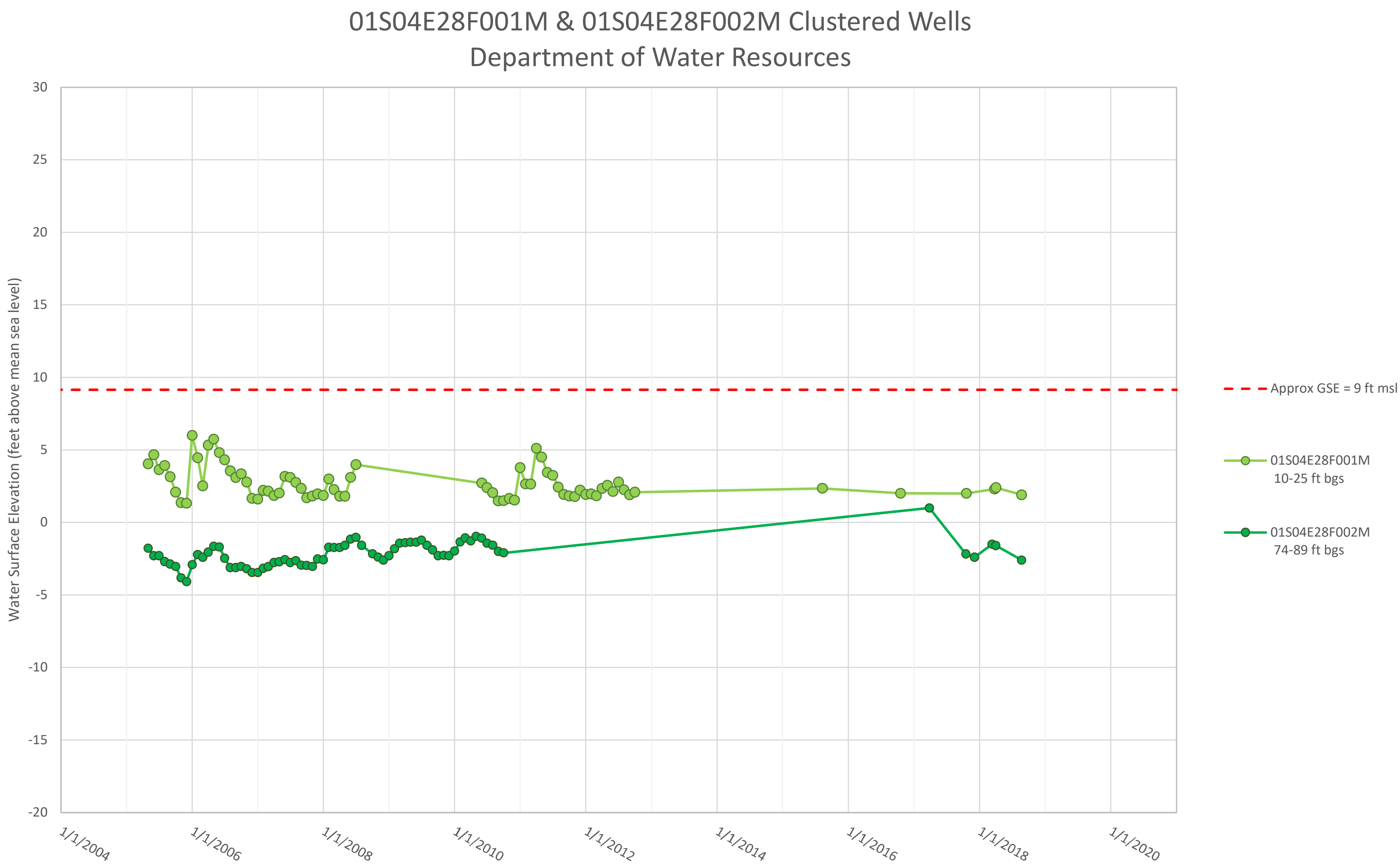
Years Displayed	2004 to 2020
	Unless otherwise noted
Vertical Axis	50 feet
	Unless otherwise noted



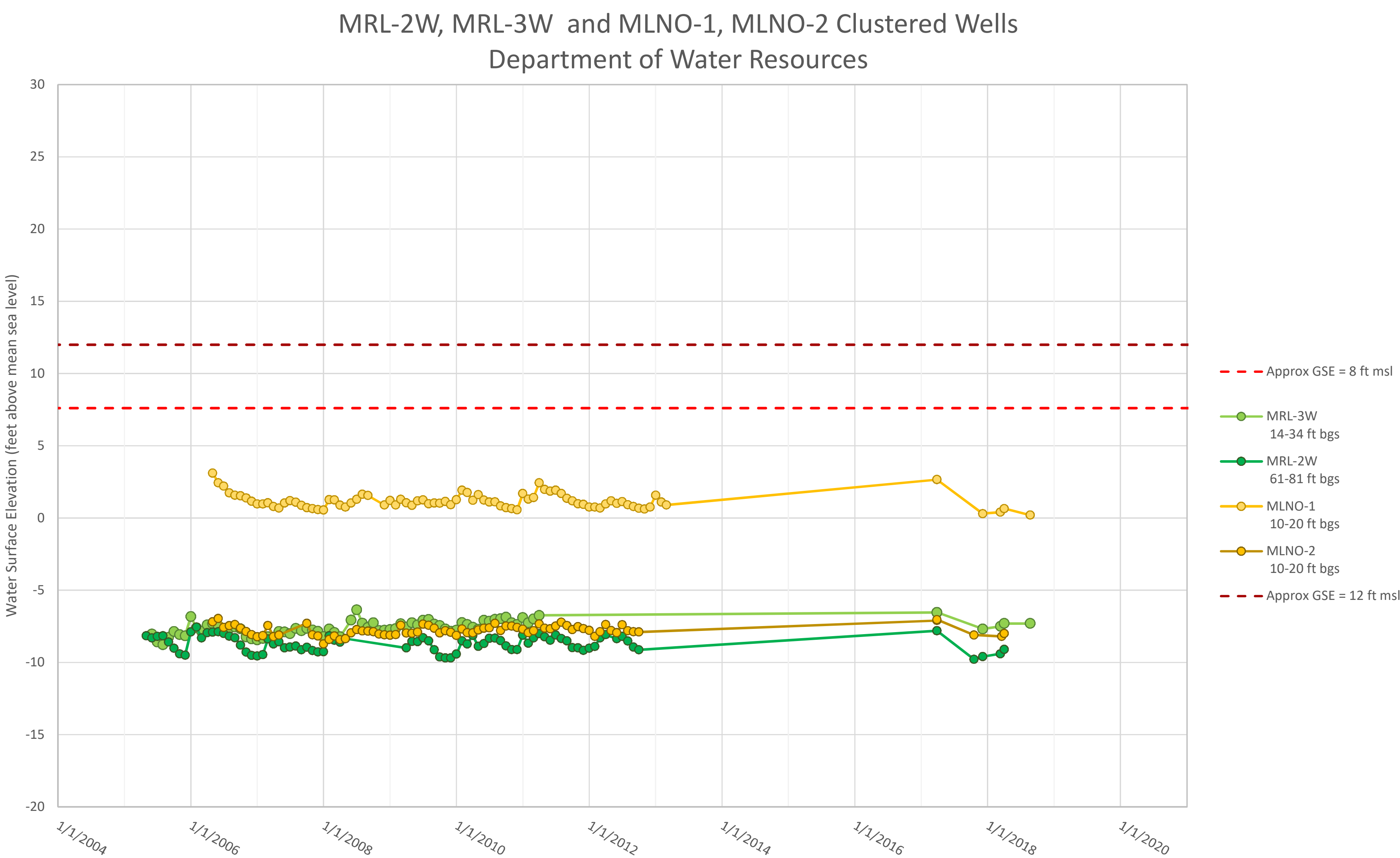
Tracy Subbasin San Joaquin County, CA	GEI Consultants	Wells with Hydrographs
Tracy Subbasin GSAs		JUNE 2020

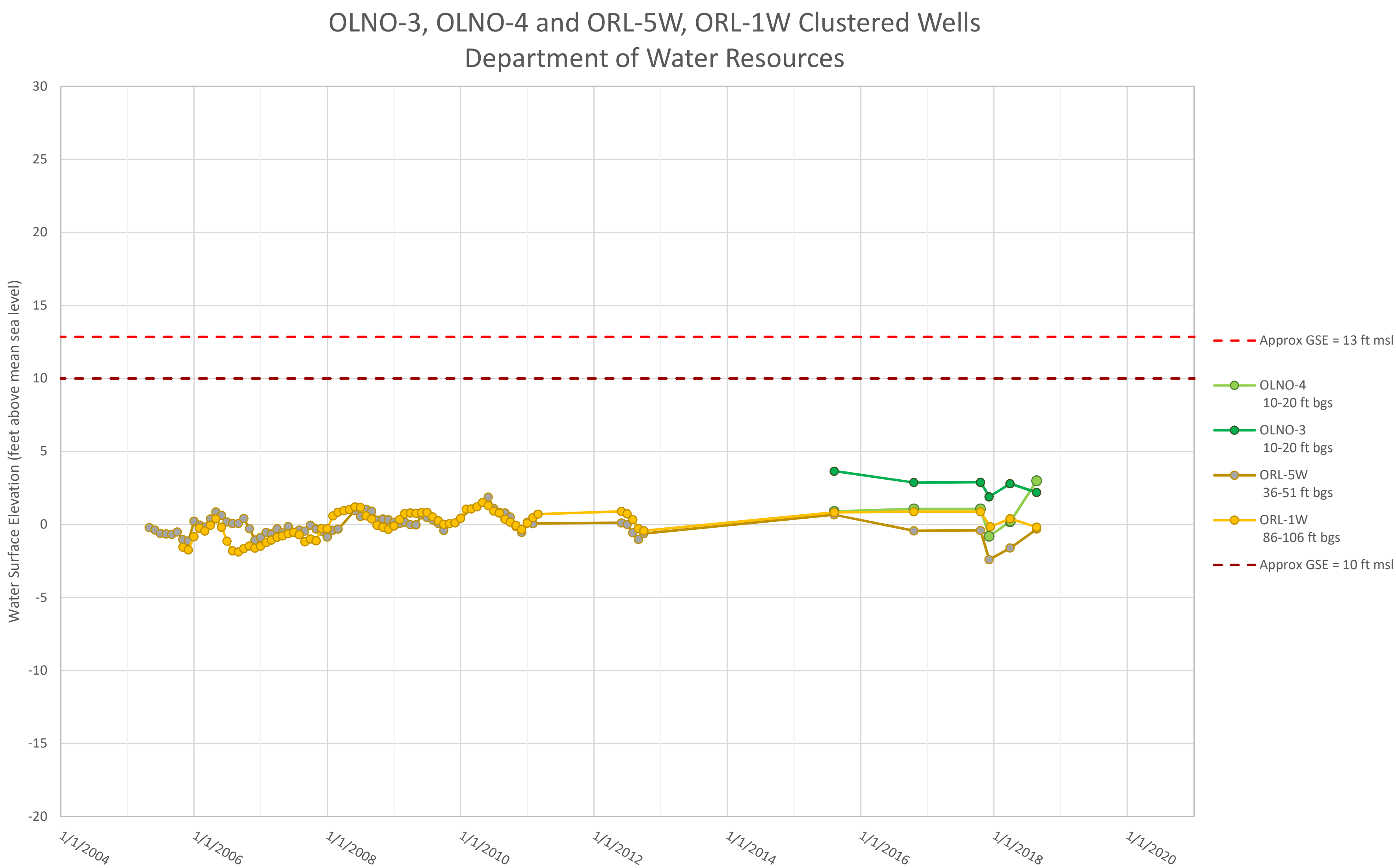
UPPER AQUIFER


Corral MW-4 and Corral MW-5
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
260
255
250
245
240
235
230
225
220
215
210
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 270 ft msl
Corral MW-4
16.5-26.5 ft bgs
Corral MW-5
71-81 ft bgs



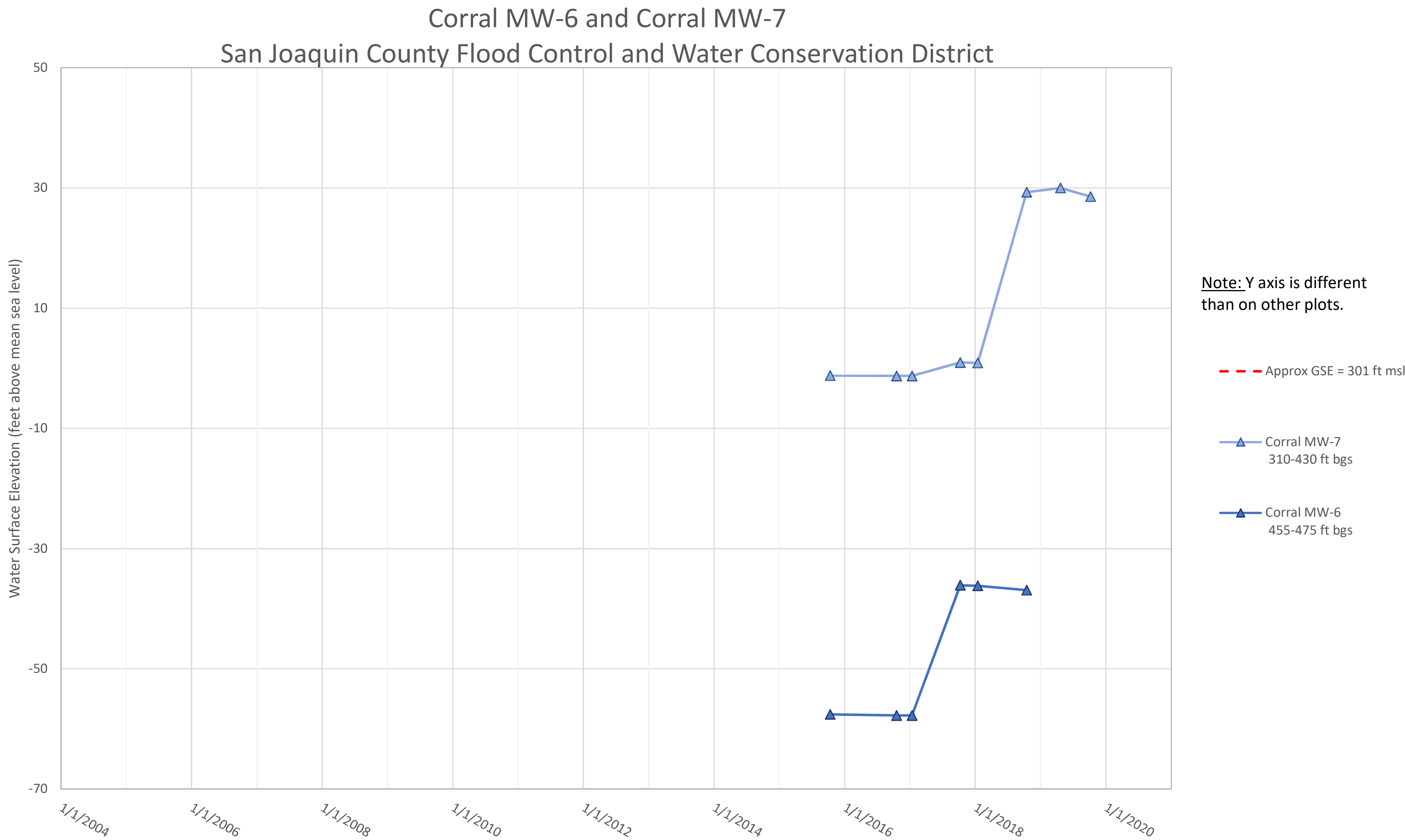
01S04E28F001M & 01S04E28F002M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 9 ft msl
01S04E28F001M
10-25 ft bgs
01S04E28F002M
74-89 ft bgs


MRL-2W, MRL-3W and MLNO-1, MLNO-2 Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 8 ft msl
MRL-3W
14-34 ft bgs
MRL-2W
61-81 ft bgs
MLNO-1
10-20 ft bgs
MLNO-2
10-20 ft bgs
Approx GSE = 12 ft msl

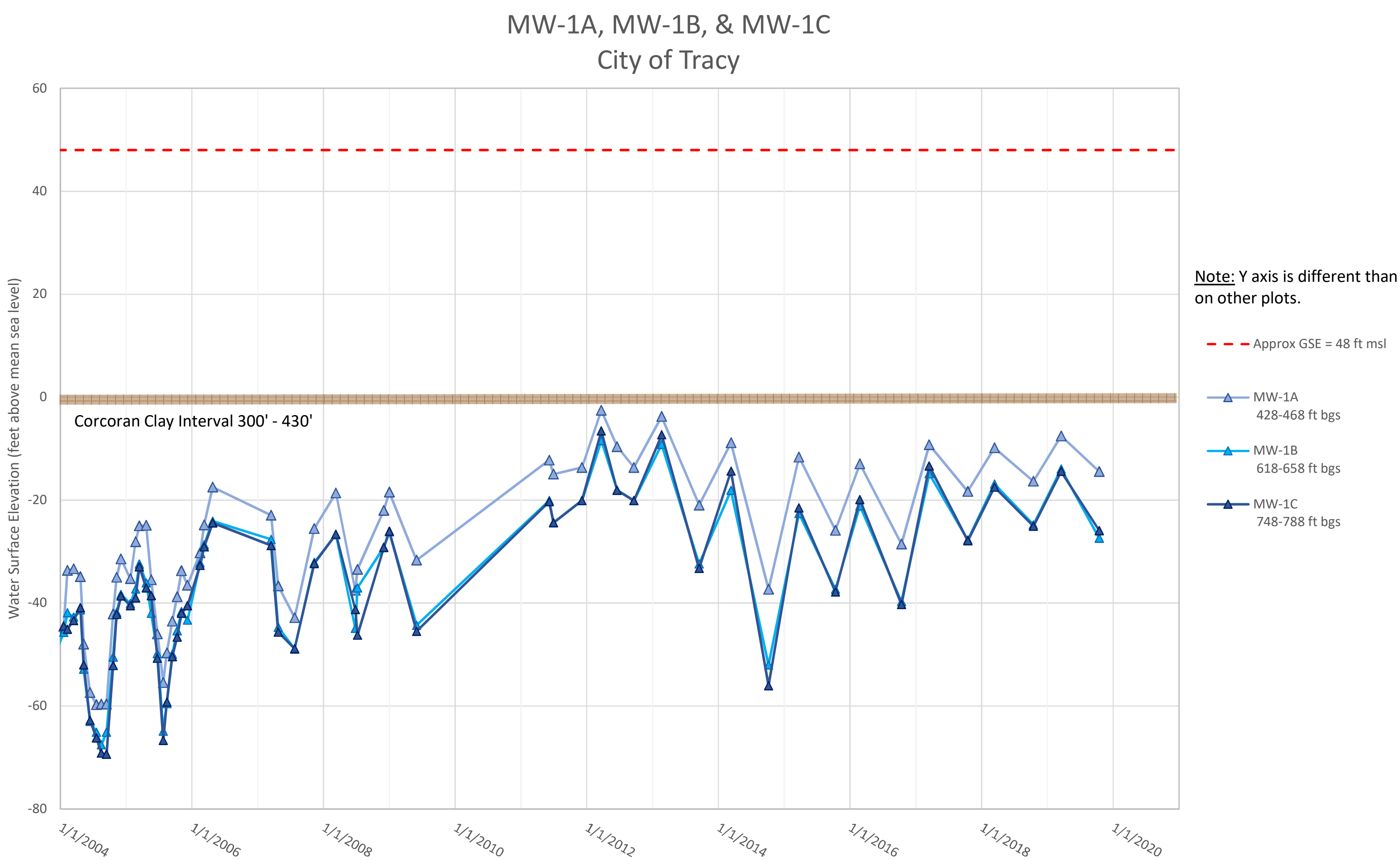


OLNO-3, OLNO-4 and ORL-5W, ORL-1W Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 13 ft msl
OLNO-4
10-20 ft bgs
OLNO-3
10-20 ft bgs
ORL-5W
36-51 ft bgs
ORL-1W
86-106 ft bgs
Approx GSE = 10 ft msl

LOWER AQUIFER

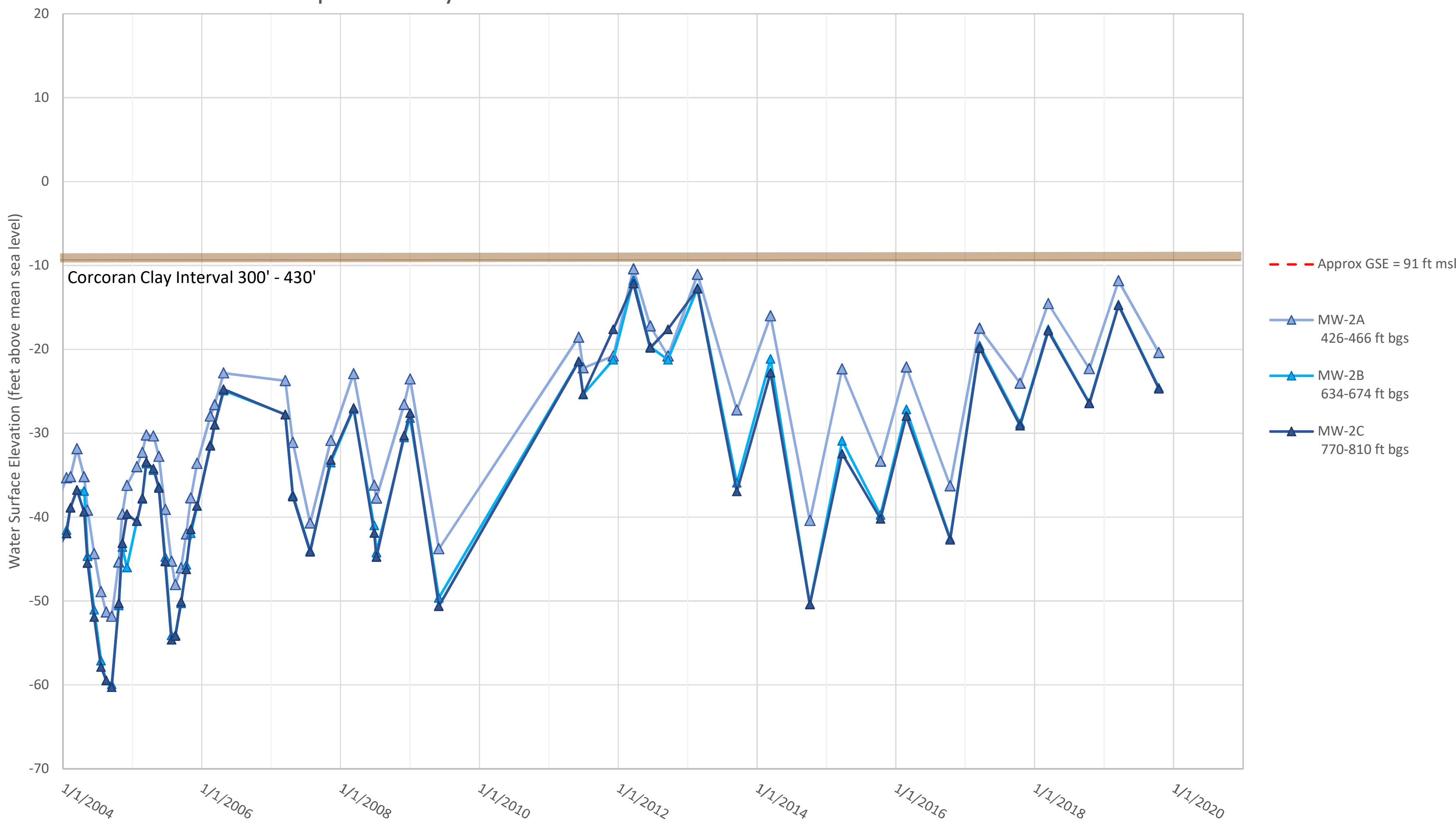


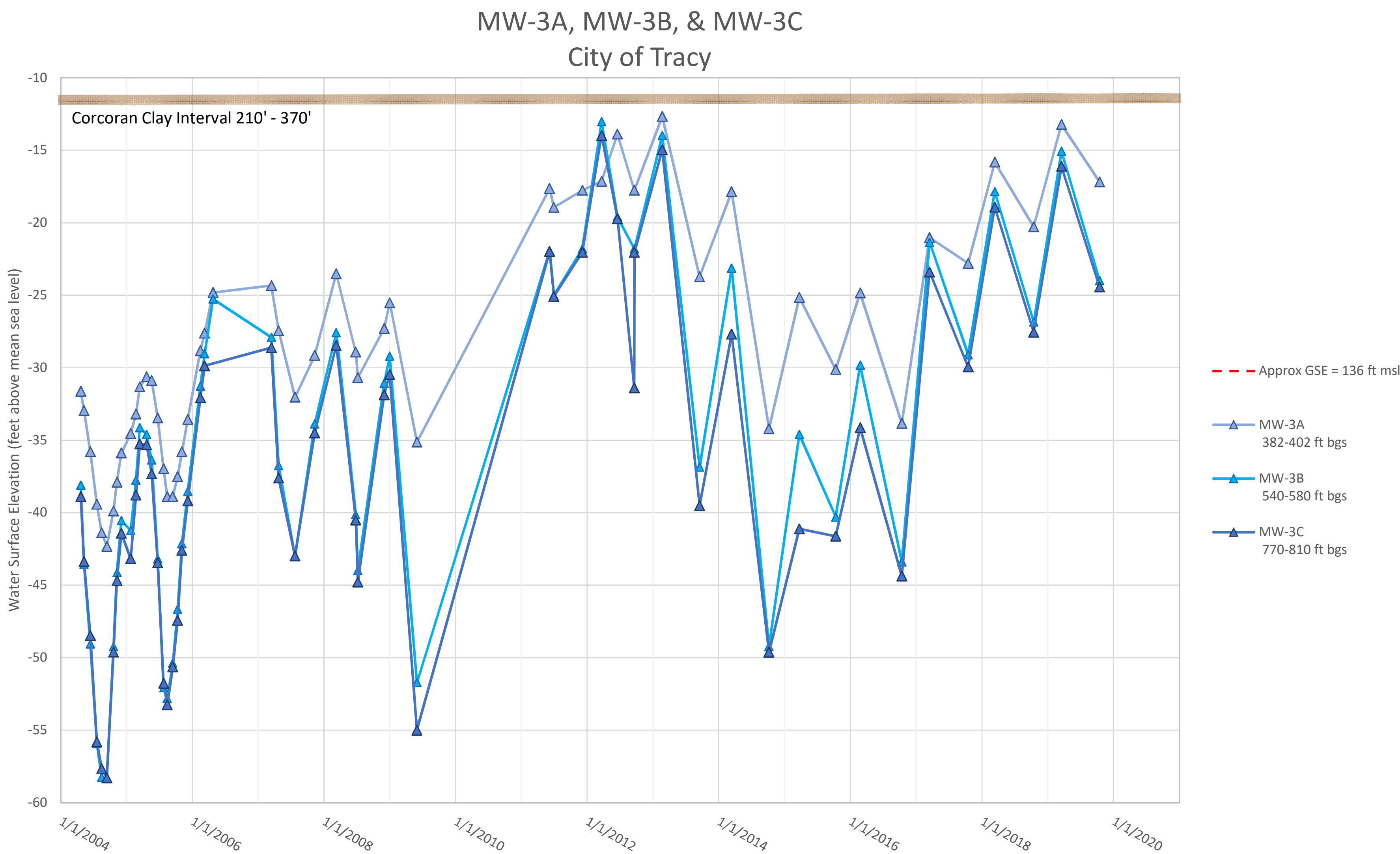
Corral MW-6 and Corral MW-7
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
50
30
10
-10
-30
-50
-70
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Y axis is different than on other plots.
Approx GSE = 301 ft msl
Corral MW-7
310-430 ft bgs
Corral MW-6
455-475 ft bgs



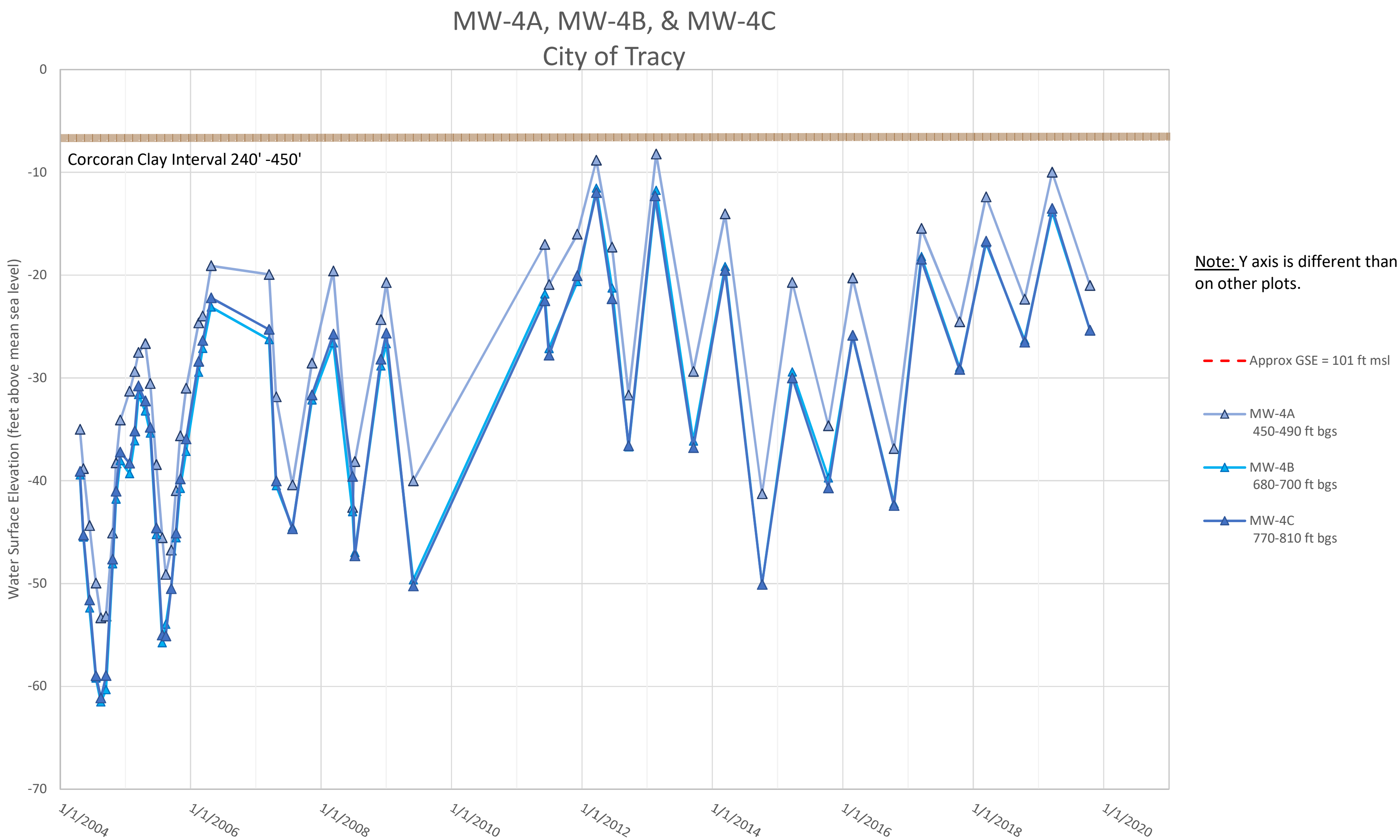
MW-1A, MW-1B, & MW-1C
City of Tracy
Water Surface Elevation (feet above mean sea level)
60
40
20
0
-20
-40
-60
-80
Corcoran Clay Interval 300' - 430'
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Y axis is different than on other plots.
Approx GSE = 48 ft msl
MW-1A
428-468 ft bgs
MW-1B
618-658 ft bgs
MW-1C
748-788 ft bgs

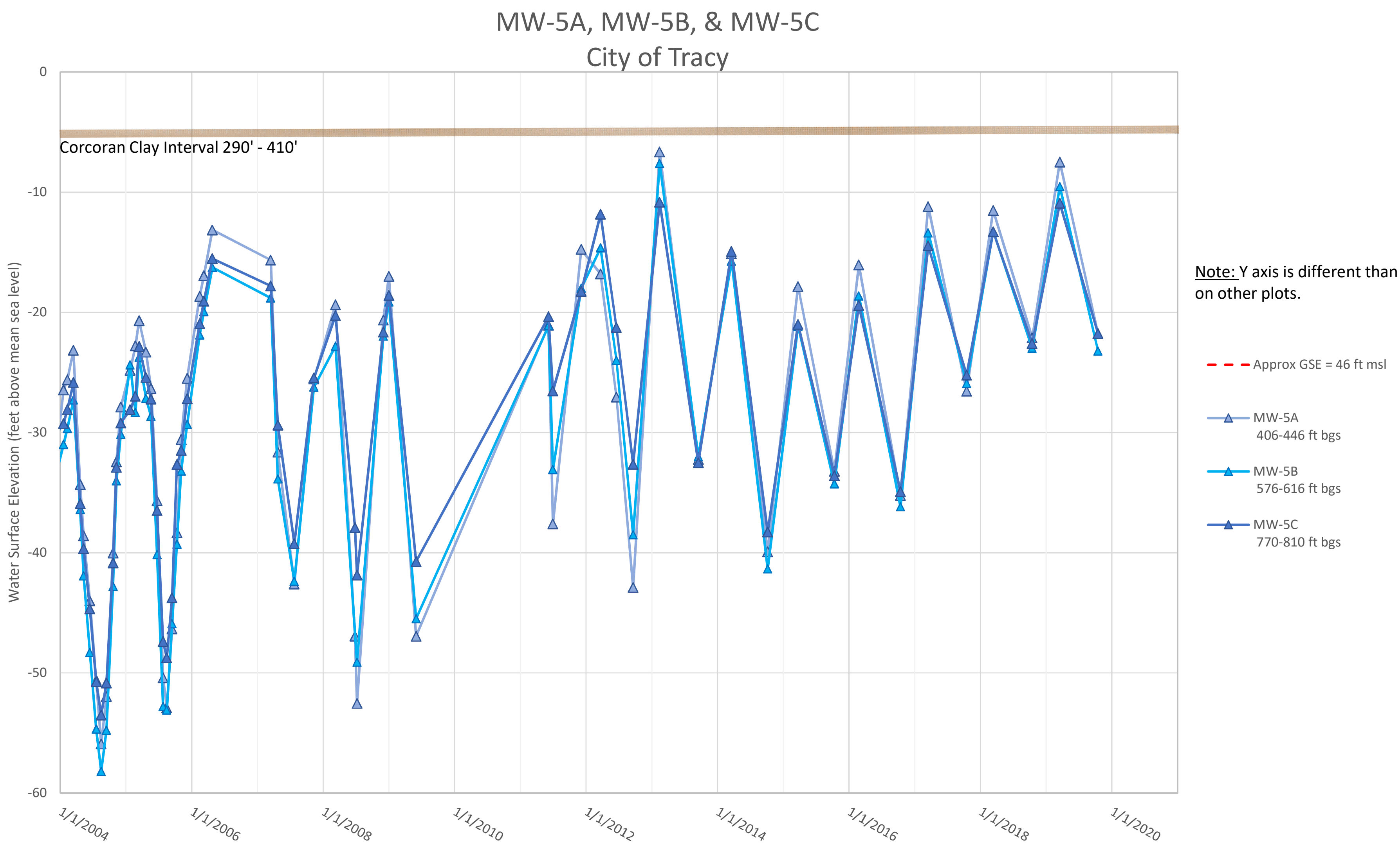
MW-2A, MW-2B, & MW-2C
San Joaquin County Flood Control and Water Conservation District



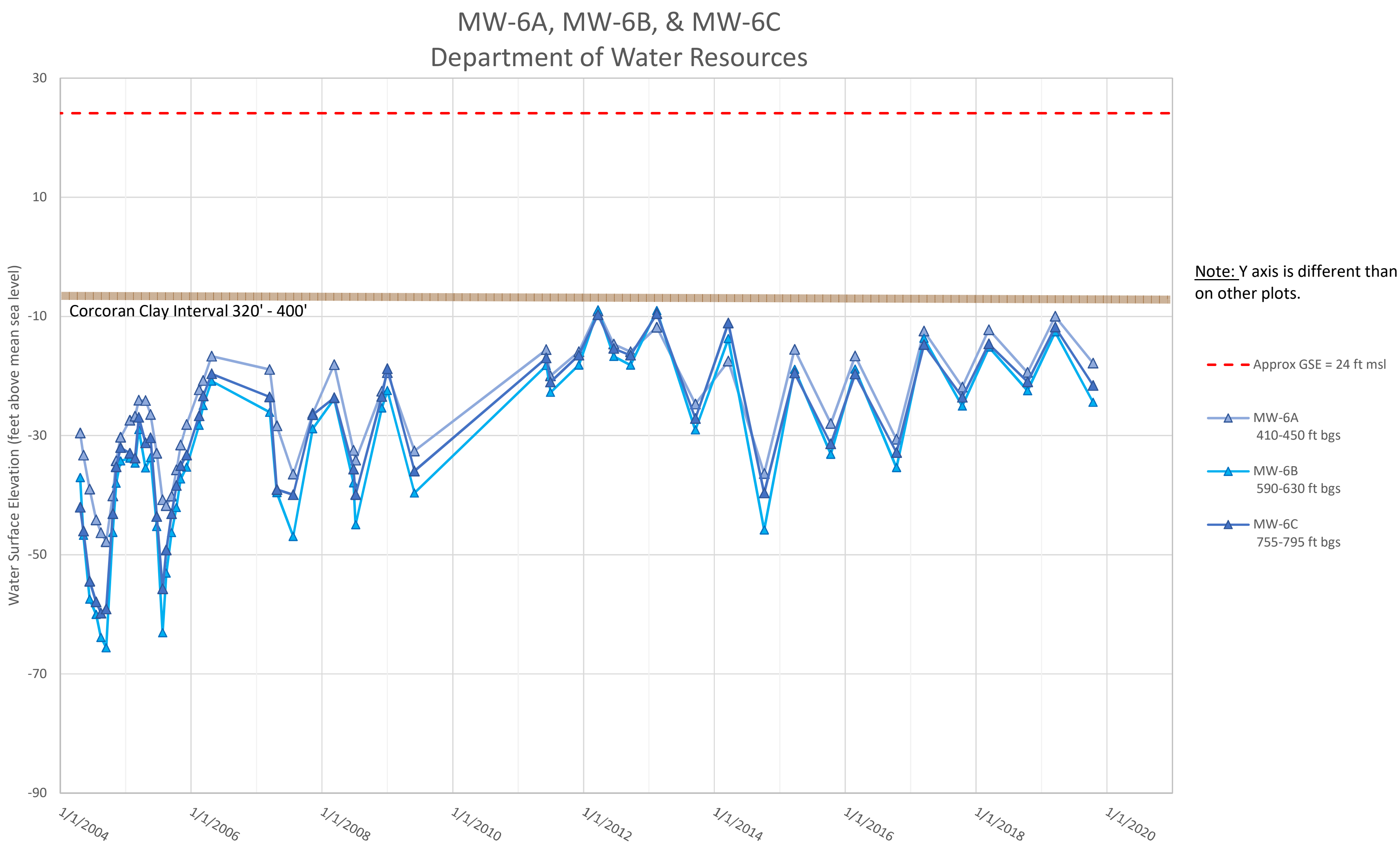


MW-3A, MW-3B, & MW-3C
City of Tracy
Corcoran Clay Interval 210' - 370'
Water Surface Elevation (feet above mean sea level)
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 136 ft msl
MW-3A
382-402 ft bgs
MW-3B
540-580 ft bgs
MW-3C
770-810 ft bgs


MW-4A, MW-4B, & MW-4C
City of Tracy
Corcoran Clay Interval 240' -450'
Water Surface Elevation (feet above mean sea level)
0
-10
-20
-30
-40
-50
-60
-70
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Y axis is different than on other plots.
Approx GSE = 101 ft msl
MW-4A 450-490 ft bgs
MW-4B 680-700 ft bgs
MW-4C 770-810 ft bgs

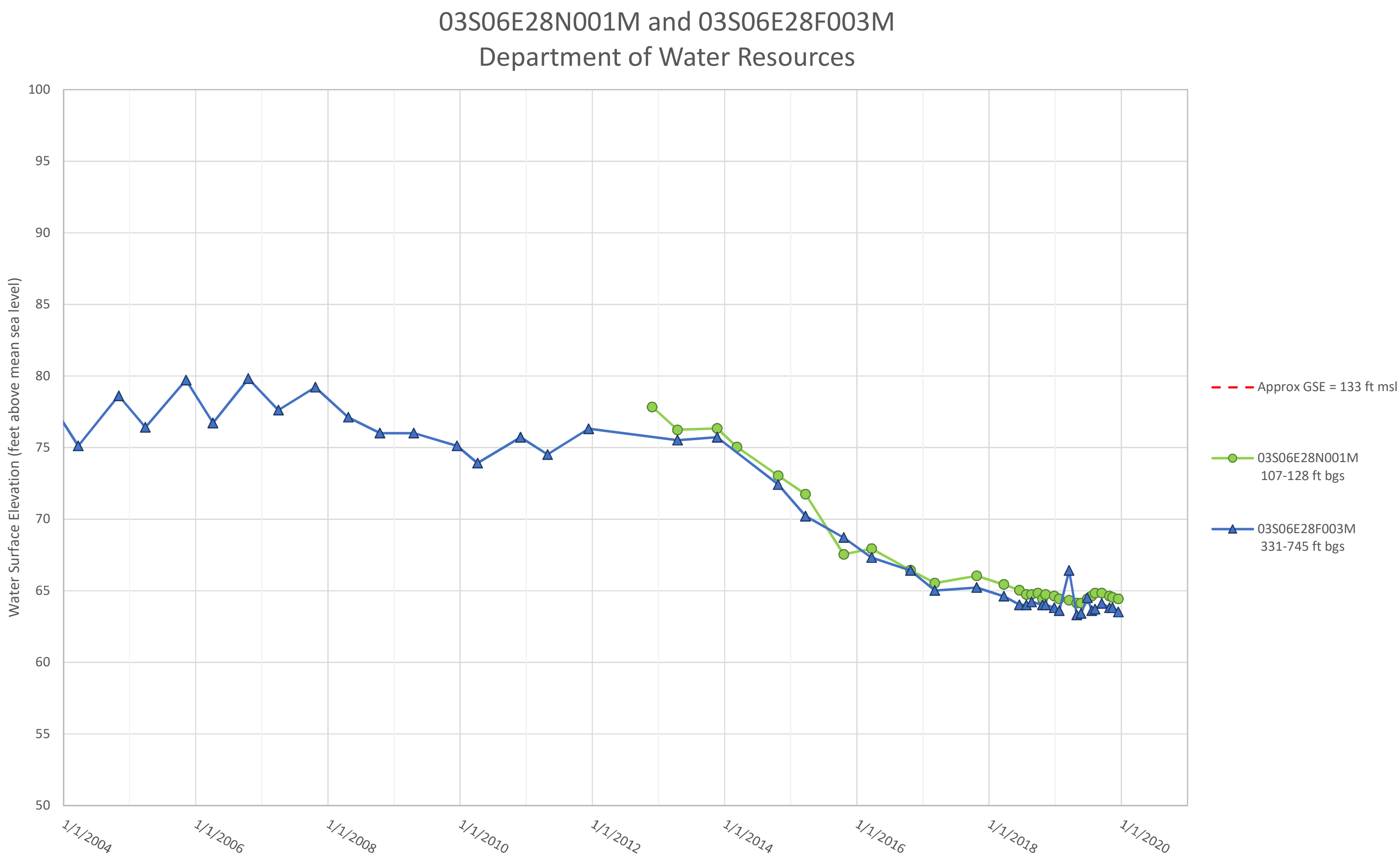


MW-5A, MW-5B, & MW-5C
City of Tracy
Corcoran Clay Interval 290' - 410'
Water Surface Elevation (feet above mean sea level)
0
-10
-20
-30
-40
-50
-60
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Y axis is different than on other plots.
Approx GSE = 46 ft msl
MW-5A 406-446 ft bgs
MW-5B 576-616 ft bgs
MW-5C 770-810 ft bgs

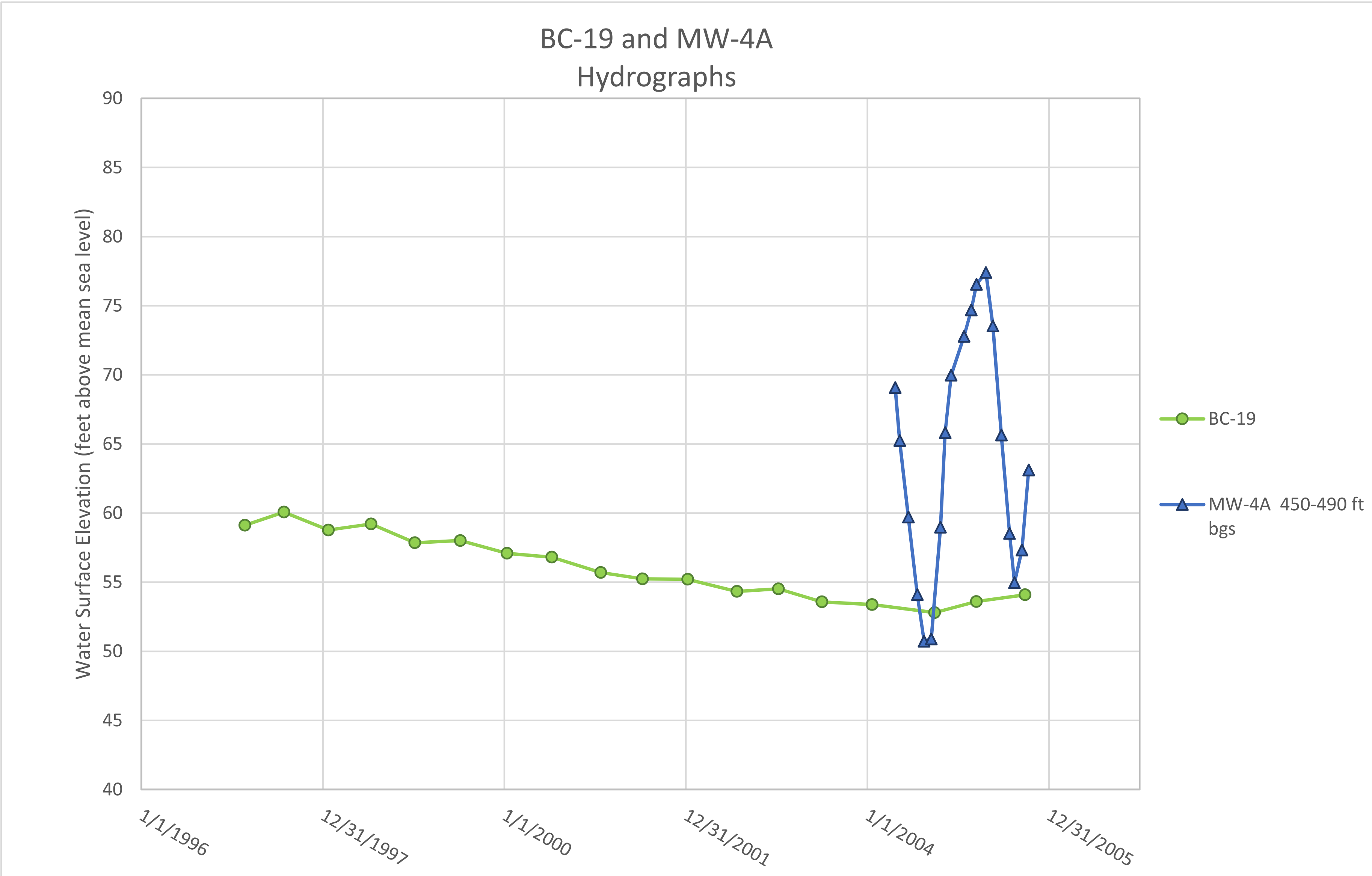


Note: Y axis is different than on other plots.

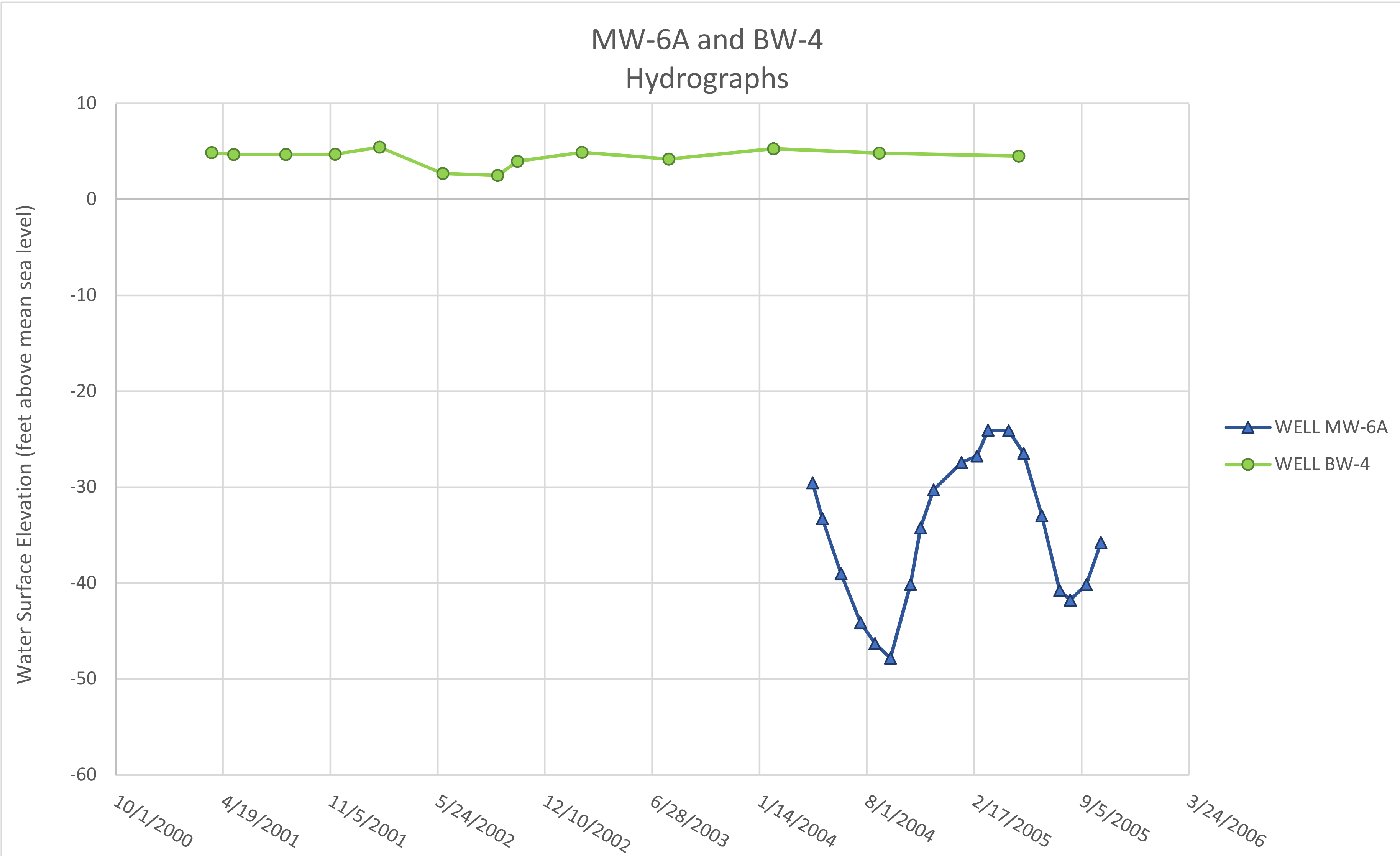
UPPER TO LOWER AQUIFERS



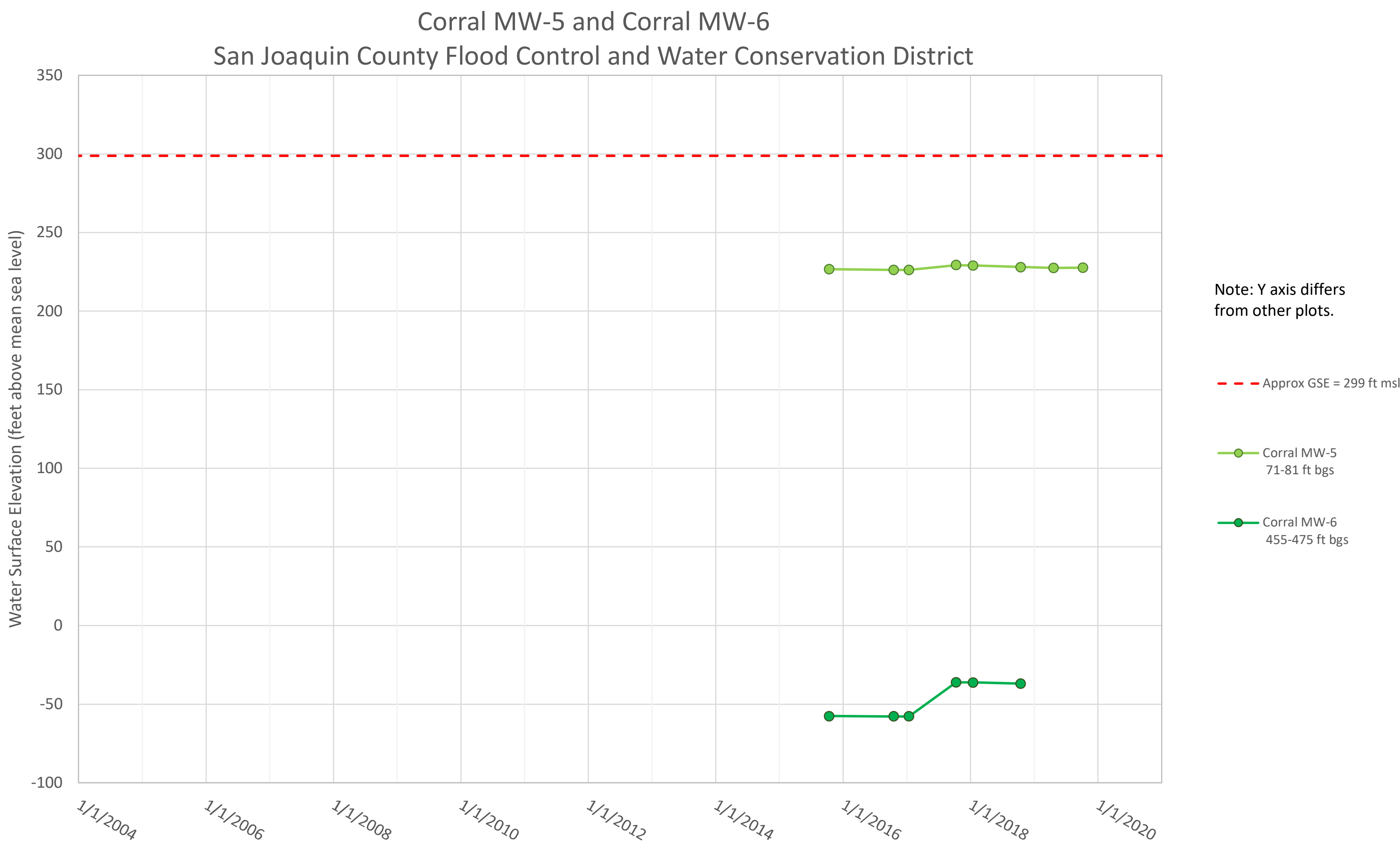
03S06E28N001M and 03S06E28F003M
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
100
95
90
85
80
75
70
65
60
55
50
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 133 ft msl
03S06E28N001M
107-128 ft bgs
03S06E28F003M
331-745 ft bgs



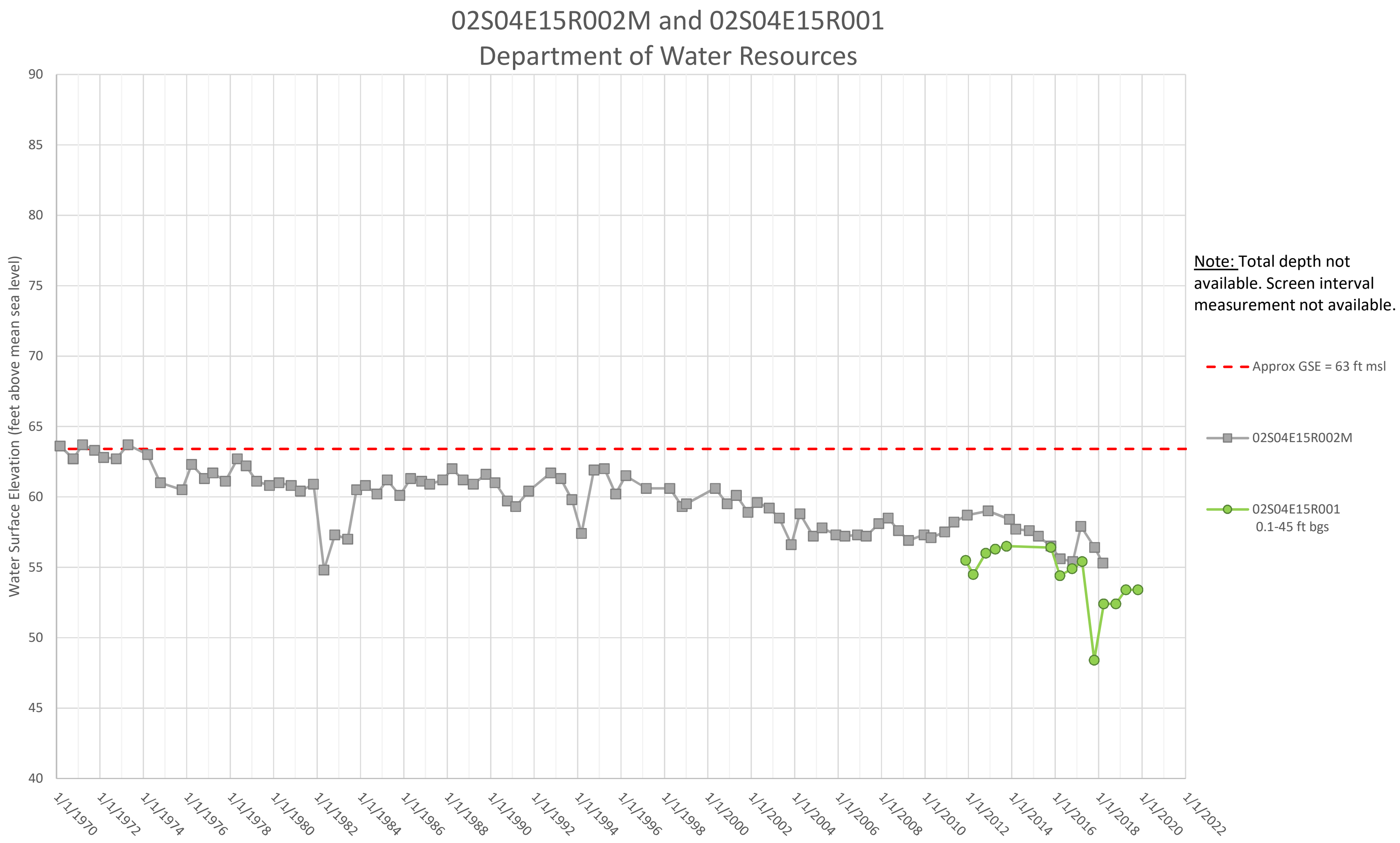
BC-19 and MW-4A
Hydrographs
Water Surface Elevation (feet above mean sea level)
90
85
80
75
70
65
60
55
50
45
40
1/1/1996
12/31/1997
1/1/2000
12/31/2001
1/1/2004
12/31/2005
BC-19
MW-4A 450-490 ft bgs



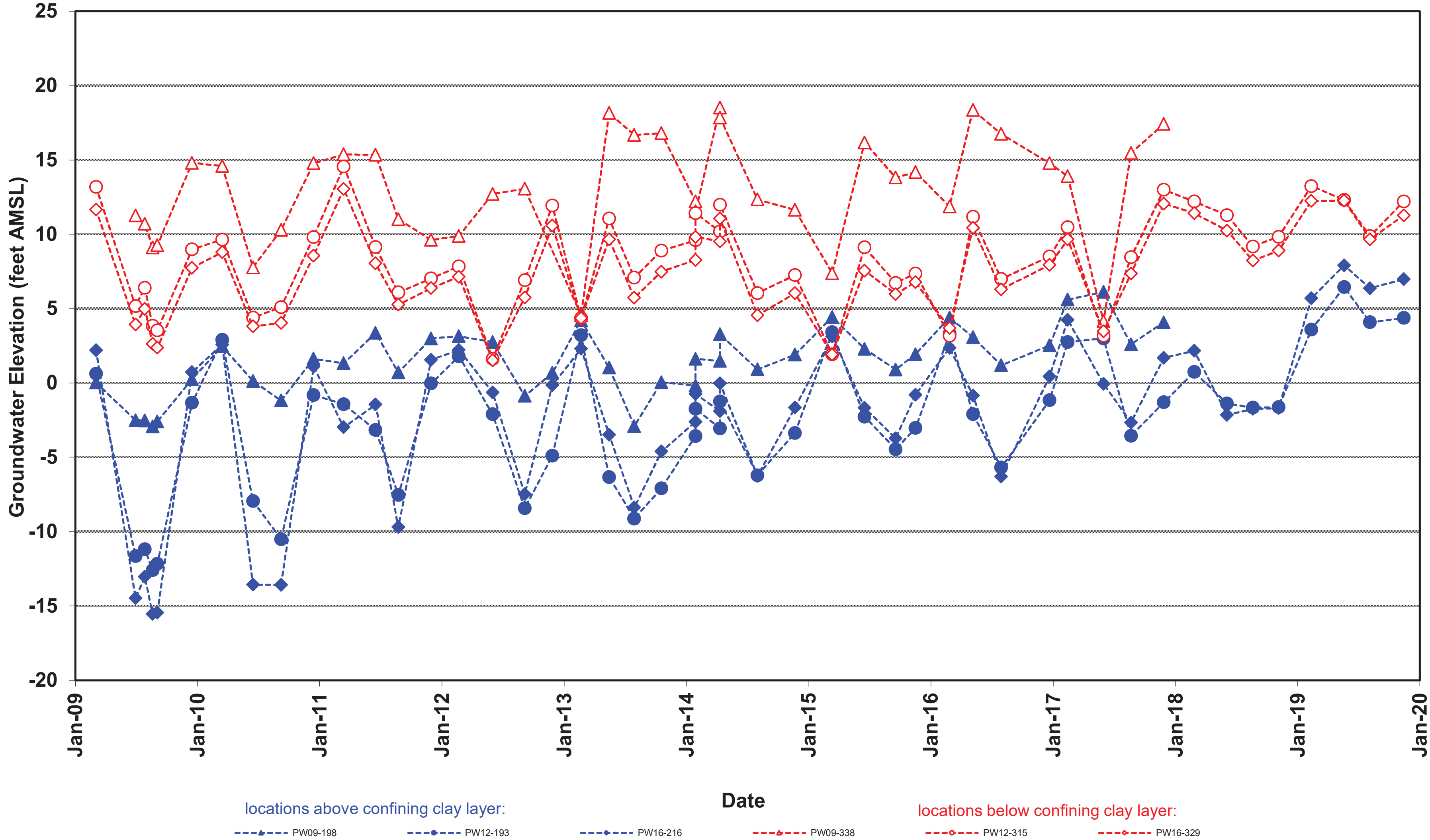
MW-6A and BW-4
Hydrographs
Water Surface Elevation (feet above mean sea level)
10
0
-10
-20
-30
-40
-50
-60
10/1/2000
4/19/2001
11/5/2001
5/24/2002
12/10/2002
6/28/2003
1/14/2004
8/1/2004
2/17/2005
9/5/2005
3/24/2006
WELL MW-6A
WELL BW-4



Corral MW-5 and Corral MW-6
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
350
300
250
200
150
100
50
0
-50
-100
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Note: Y axis differs from other plots.
Approx GSE = 299 ft msl
Corral MW-5 71-81 ft bgs
Corral MW-6 455-475 ft bgs



02S04E15R002M and 02S04E15R001
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
90
85
80
75
70
65
60
55
50
45
40
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
1/1/2022
Note: Total depth not available. Screen interval measurement not available.
Approx GSE = 63 ft msl
02S04E15R002M
02S04E15R001
0.1-45 ft bgs



Notes: Groundwater elevations collected quarterly beginning 2004.

Groundwater levels collected monthly for 3 months (June, July and August 2009) following the start-up of EW-08A and EW-08B.

Groundwater level not collected at PW09-338 on March 2009 and November 2012 due to technical issues.

PW09-198 and PW09-338 were buried during 2018 and no groundwater levels were collected, and inaccessible due to vault restrictions during the 2019 reporting period

COMPARISON OF WATER LEVEL ELEVATION DATA FOR
WELLS SCREENED ABOVE AND BELOW THE CONFINING CLAY LAYER
GROUNDWATER REMEDIAL PROGRAM

Former Occidental Chemical Corporation Facility, Lathrop, California

APPENDIX H
SUMMARY OF WATER QUALITY DETECTIONS

WELL_NAME	LONGITUDE_NAD83	LATITUDE_NAD83	AS_Date	AS	B_Date	B	CL_Date	CL	CR6_Date	CR6	MN_Date	MN	FE_Date	FE	NO3N_Date	NO3N	SE_Date	SE	SO4_Date	SO4	TCPR123_D	TCPR123	TDS_Date	TDS
3910701-003	-121.2682	37.85144	1/7/2020	17.2	2/3/2015	0.3	7/25/2017	16.1	7/25/2017	0.94	7/25/2017	20	7/25/2017	100	7/2/2019	2.49	7/25/2017	5	7/25/2017	23.2	12/4/2018	0.005	7/25/2017	374
3910701-005	-121.2673	37.851301	1/7/2020	21.9	2/3/2015	0.22	7/25/2017	18.6	7/25/2017	0.98	7/25/2017	20	7/25/2017	100	7/2/2019	2.52	7/25/2017	5	7/25/2017	21.1	12/4/2018	0.005	7/25/2017	312
3910015-008	-121.262514	37.801132	12/9/2019	10	4/3/2017	0.14	4/3/2017	60	8/4/2014	1	4/3/2017	28	4/3/2017	100	4/1/2019	3.1	4/3/2017	5	4/3/2017	27	4/1/2019	0.005	4/3/2017	400
3901348-003	-121.409917	37.698742	7/8/2019	2	7/8/2019	1	7/8/2019	93	8/21/2017	3	7/8/2019	20	7/8/2019	100	7/8/2019	4	7/8/2019	6	7/8/2019	310	12/4/2018	0.005	7/8/2019	750
3901348-004	-121.416153	37.698147	2/5/2019	2	2/5/2019	0.8	2/5/2019	105	8/21/2017	3.7	2/5/2019	20	2/5/2019	280	2/4/2020	2.9	2/5/2019	5	2/5/2019	337	12/4/2018	0.005	2/5/2019	710
3910702-003	-121.39764	37.705557	8/6/2019	2	8/6/2019	1.2	8/6/2019	220	7/3/2017	9.09	8/6/2019	20	8/6/2019	110	8/6/2019	7.97	8/6/2019	5	8/6/2019	167	10/1/2019	0.005	8/6/2019	877
3100014-001	-121.379533	37.716956	3/26/2018	0	3/26/2018	0.11	3/26/2018	1.1	5/4/2017	0	3/26/2018	0	3/26/2018	0	2/24/2019	0	3/26/2018	0	3/26/2018	2.7	3/28/2018	0.005	3/26/2018	92
3900702-001	-121.407056	37.990639	2/16/2017	3	2/16/2017	0.8	2/16/2017	81	8/18/2014	1.28	2/16/2017	30	2/16/2017	30	2/5/2019	4.6	2/16/2017	1	2/16/2017	164	12/4/2018	0.005	2/16/2017	500
3901172-003	-121.39736	37.632289	2/13/2018	2	2/13/2018	1.4	2/13/2018	81	8/12/2014	1.01	2/13/2018	20	11/14/2019	190	2/5/2019	3.5	2/13/2018	5	2/13/2018	287	12/4/2018	0.005	2/13/2018	770
3901172-002	-121.399544	37.636324	2/13/2018	2	2/13/2018	1	2/13/2018	89	9/26/2014	0.74	2/13/2018	20	2/13/2018	100	2/4/2020	6.8	2/13/2018	10	2/13/2018	437	12/4/2018	0.005	2/13/2018	1020
3910015-005	-121.266705	37.816859	4/1/2019	17	4/3/2017	0.15	4/3/2017	82	8/4/2014	2.8	4/3/2017	20	4/3/2017	100	1/6/2020	4.4	4/3/2017	5	4/3/2017	24	4/1/2019	0.005	4/3/2017	430
3900810-002	-121.271346	37.808086	12/19/2018	8					12/12/2014	0.5					3/7/2018	12.2	3/7/2018	5			11/15/2018	0.005		
3910018-004	-121.272761	37.679705	10/6/2017	0	12/4/2003	1.9	10/6/2017	310	10/5/2018	14	10/6/2017	0	10/6/2017	0	1/3/2020	4.9	10/6/2017	5.8	10/6/2017	310	11/12/2018	0	10/6/2017	1300
3910018-001	-121.272617	37.679751	11/3/2017	0	12/4/2003	2.3	12/15/2017	340	10/5/2018	11	11/3/2017	0	12/15/2017	470	1/3/2020	3.1	11/3/2017	7.9	12/15/2017	320	12/7/2018	0	11/3/2017	1200
3910011-034	-121.434603	37.752802	6/21/2018	2	6/21/2018	1.6	6/21/2018	120	9/21/2017	7.8	6/21/2018	20	6/21/2018	100	6/12/2019	1.7	6/21/2018	5	6/21/2018	290	6/21/2018	0.005	6/21/2018	810
3910011-004	-121.436988	37.682308	7/11/2018	2	6/7/2018	2	6/7/2018	140	9/14/2017	4.6	7/11/2018	20	12/5/2019	200	6/12/2019	2.9	7/11/2018	5	6/7/2018	280	6/7/2018	0.005	6/7/2018	850
3910011-003	-121.439427	37.683959	6/7/2018	2	6/7/2018	2.3	6/7/2018	120	9/14/2017	4.9	6/7/2018	20	12/5/2019	740	6/12/2019	2.3	6/7/2018	5	6/7/2018	300	6/7/2018	0.005	6/7/2018	870
3910011-005	-121.443313	37.683353	6/7/2018	2	6/7/2018	2.5	6/7/2018	120	9/14/2017	5.8	6/7/2018	20	6/7/2018	100	6/12/2019	2.4	6/7/2018	5	6/7/2018	300	6/7/2018	0.005	6/7/2018	910
3910011-006	-121.443515	37.686539	6/7/2018	2	6/7/2018	2	6/7/2018	110	10/5/2017	3.8	6/7/2018	20	6/7/2018	100	6/12/2019	3.6	6/7/2018	5	6/7/2018	260	6/7/2018	0.005	6/7/2018	800
3910011-018	-121.424805	37.743262	6/6/2018	2.5	6/6/2018	1.2	6/6/2018	180	9/21/2017	1	6/6/2018	20	6/6/2018	100	6/12/2019	2.1	6/6/2018	5	6/6/2018	230	6/6/2018	0.005	6/6/2018	790
3901320-008	-121.378815	37.712313	6/12/2017	3			6/14/2011	150	6/12/2017	1	6/14/2011	49	6/14/2011	0	6/12/2019	1.2	6/12/2017	5	6/14/2011	210	12/10/2018	0.005	6/14/2011	680
3910011-032	-121.465249	37.754682	6/6/2018	3	6/6/2018	1.2	6/6/2018	120	9/21/2017	4.2	6/6/2018	20	6/6/2018	100	6/12/2019	1.2	6/6/2018	5	6/6/2018	240	6/6/2018	0.005	6/6/2018	700
3901338-007	-121.414274	37.693257	4/12/2017	2					2/11/2015	2.15	4/10/2019	20	4/10/2019	100	2/11/2019	3.37	4/12/2017	5			2/11/2019	0.005		
3910005-044	-121.300937	37.782808	1/7/2020	12.4			2/13/2018	20	12/16/2014	1.6	2/13/2018	0	2/13/2018	0	1/27/2020	6.2	2/13/2018	0	2/13/2018	25	1/13/2020	0.008	2/13/2018	300
3901181-001	-121.428055	37.692555	3/23/2017	0					12/11/2014	2.1					12/9/2019	9.8	3/23/2017	7			11/12/2018	0		
3910011-030	-121.439285	37.740208	3/8/2017	2.8	3/8/2017	0.92	3/8/2017	83	11/20/2014	1	3/8/2017	160	3/8/2017	100	6/26/2019	0.4	3/8/2017	5	3/8/2017	140	9/17/2019	0.005	3/8/2017	500
3900991-001	-121.461428	37.743544	12/9/2019	0			12/9/2019	180	12/18/2014	7	12/9/2019	0	12/9/2019	0	12/9/2019	9	12/9/2019	0	12/9/2019	120	12/10/2018	0	12/9/2019	670
3910015-016	-121.262596	37.80114	4/1/2019	12	4/3/2017	0.17	4/3/2017	61	8/4/2014	1	4/3/2017	20	4/3/2017	100	5/6/2019	4.1	4/3/2017	5	4/3/2017	21	4/1/2019	0.005	4/3/2017	380
3400391-001	-121.456832	37.717581	7/3/2018	12	7/3/2018	0					7/3/2018	0	7/3/2018	0	3/11/2019	1.4	7/3/2018	0			12/4/2018	0		
3901305-007	-121.399277	37.741365	3/6/2018	4.87			4/5/2010	129	12/1/2014	0.1	12/8/2015	20	12/8/2015	100	2/11/2019	1.97	3/6/2018	5	4/5/2010	267	2/11/2019	0.005	4/1/2013	724
3901035-001	-121.450392	37.805066	5/7/2013	4					10/7/2014	1.99					5/14/2019	0.4	5/7/2013	1			2/11/2020	0.005		
3900810-001	-121.267078	37.804543	12/13/2018	18	7/24/2003	0.14			11/14/2014	0.5					3/7/2018	5.4	3/7/2018	5			11/15/2018	0.005		
3901420-001	-121.432012	37.690618	6/8/2017	2					9/10/2014	1.64					6/6/2019	2.6	6/8/2017	5			12/6/2018	0.005		
3900993-001	-121.323805	37.668527	10/10/2017	2	10/4/2003	1.2			2/11/2015	0.1	3/5/2014	20	3/5/2014	100	2/11/2019	5.43	10/10/2017	5			2/11/2019	0.005		
3901309-008	-121.411996	37.694682	3/8/2019	2	3/2/2004	0.9	3/2/2004	97	11/19/2014	0.6	3/2/2004	120	3/2/2004	6270	3/8/2019	3.3	3/8/2019	5	3/2/2004	158	12/20/2018	0.005	3/2/2004	500
3900558-002	-121.4	37.79	2/21/2018	5	5/9/2018	0.1	5/9/2018	8	8/19/2014	0.05	5/9/2018	120	5/9/2018	130	2/5/2020	0.4	2/21/2018	5	5/9/2018	6.8	12/10/2018	0.005	5/9/2018	170
3901107-013	-121.39788	37.695101	2/13/2019	6			4/5/2010	47.9	11/12/2014	0.5	4/5/2010	25	4/5/2010	100	2/13/2019	0.4	2/13/2019	5	4/5/2010	228	11/15/2018	0.005	4/5/2010	565
3910800-006	-121.329167	37.744722	1/14/2020	9	9/3/2019	0.5	1/14/2020	1590	12/4/2014	2.6	1/14/2020	750	1/14/2020	250	4/9/2019	0.4	9/3/2019	28	9/3/2019	144	11/13/2018	0.005	1/14/2020	4290
3910800-004	-121.336213	37.74591	1/14/2020	9	12/12/2018	0.5	1/14/2020	1310	12/4/2014	1	1/14/2020	270	1/14/2020	640	4/9/2019	0.4	7/7/2018	35	12/12/2018	130	11/13/2018	0.005	1/14/2020	3990
3910800-002	-121.32701	37.744188	1/14/2020	7	12/12/2018	0.4	1/14/2020	530	12/4/2014	1	1/14/2020	490	1/14/2020	260	4/9/2019	0.4	7/7/2018	10	12/12/2018	138	11/13/2018	0.005	1/14/2020	1780
3910015-007	-121.263915	37.811547	12/9/2019	13	4/3/2017	0.19	4/3/2017	27	8/4/2014	1	5/7/2018	20	4/3/2017	100	1/6/2020	4.9	4/3/2017	5	4/3/2017	24	4/1/2019	0.005	4/3/2017	380
3901378-002	-121.362772	37.743671	6/10/2019	2.2					9/8/2014	8.5					12/9/2019	0.4	6/10/2019	6.7			11/16/2018	0		
3910015-006	-121.266416	37.818884	4/1/2019	21	4/3/2017	0.16	4/3/2017	37	11/18/2014	1	4/3/2017	20	4/3/2017	100	4/1/2019	3.2	4/3/2017	5	4/3/2017	15	4/1/2019	0.005	4/3/2017	320
3900719-001	-121.35325	37.7685	6/28/2017	2.8			6/28/2017	4.1	11/12/2014	0	6/28/2017	0	6/28/2017	0	3/19/2019	0.4	6/28/2017	0	6/28/2017	2.7	12/10/2018	0	6/28/2017	82
3901405-001	-121.28975	37.631512	3/6/2014	2	3/6/2014	0.4	3/6/2014	36	3/6/2014	9.68	3/6/2014	20	3/6/2014	100	3/6/2014	4.11	3/6/2014	5	3/6/2014	90	6/20/2006	0.5	3/6/2014	360
3900559-001	-121.38	37.79	3/1/2017	0	10/8/2003	0	3/1/2017	5.5	11/12/2014	0	3/1/2017	0	3/1/2017	0	3/13/2019	1.7	3/1/2017	0	3/1/2017	7.8	11/13/2018	0	3/1/2017	159
4300611-002	-121.499722	37.994444	10/22/2018	0			10/22/2018	20	12/10/2014	0	10/22/2018	0	10/22/2018	0	10/28/2019	2.3	10/22/2018	0	10/22/2018	39	8/27/2019	0	10/22/2018	290
3910800-003	-121.32897	37.74545	1/14/2020	10	12/2/2019	0.4	1/14/2020	664	12/11/2014	1	1/14/2020	540	1/14/2020	320	12/2/2019	0.4	7/7/2018	10	12/2/2019	128	11/13/2018	0.005	1/14/2020	1980
3910702-006	-121.390802	37.709972	8/13/2019	2	8/13/2019	1.07	8/13/2019	47.9	7/3/2017	0.1	8/13/2019	31.7	8/13/2019	100	8/13/2019	1.97	8/13/2019	5	8/13/2019	188	10/8/2019	0.005	8/13/2019	1660
3910701-007	-121.265247	37.851431	2/6/2007	25	2/6/2007	0.254	2/6/2007	11.8	5/1/2001	0	2/6/2007	48	2/6/2007	282	2/6/2007	0.5	2/6/2007	5	2/6/2007	11.2	3/19/2002	0.04	11/1/2005	292
3910701-001	-121.268763	37.849584	8/3/2010	21	8/3/2010	0.25	8/3/2010	18	5/1/2001	2	8/3/2010	20	8/3/2010	100	8/3/2010	2.85	8/3/2010	5	8/3/2010	22.9	3/19/2002	0.04	8/3/2010	304
3910702-005	-121.393881	37.708149	8/6/2019	2.18	8/6/2019	0.987	8/6/2019	69.3	7/3/2017	0.1	8/6/2019	1280	8/6/2019	146	8/6/2019	0.43	8/6/2019	5	8/6/2019	177	10/1/2019	0.005	8/6/2019	551
3901398-001	-121.379533	37.716956	3/10/2014	0			12/8/1999	170	8/5/2014	8.9	12/8/1999	10	12/8/1999	30	11/5/2019	8.1	3/10/2014	0	12/8/1999	0.5	3/7/2011	0	12/8/1999	720
3901409-001	-121.426004	37.709642	4/12/2017	2					12/1/2014	5.03	4/10/2019	20	4/10/2019	414	2/11/2019	2.89	4/12/2017	5			2/11/2019	0.005		
3910015-013	-121.274608	37.792108	2/25/2014	9.1	11/21/2011	0.2	11/21/2011	102			2/25/2014	350	11/21/2011	50	2/25/2014	6.8	11/21/2011	2	11/21/2011	45	2/1/2012	0.5	11/21/2011	520
3900805-008	-121.398465	37.737601	6/7/2019	2	6/7/2019	1.1	6/7/2019	129	11/18/2014	3.5	6/7/2019	20	6/7/2019	100	6/7/2019	2.2	6/7/2019	5	6/7/2019	307	12/12/2018	0.005	6/7/2019	760
3900805-002	-121.399853	37.73886	8/1/2019	2	8/1/2019	1.1	8/1/2019	169	1/28/2015	13	8/1/2019	80	8/1/2019	990	8/1/2019	7.7	8/1/2019	5	8/1/2019	134	3/28/2018	0.005	8/1/2019	720
3901336-009	-121.401135	37.740646	4/10/2019	2					2/11/2015	3.67	7/7/2010	20	7/7/2010	100	2/11/2019	1.09	4/10/2019	5			2/11/2019	0.005		
3901348-002	-121.406986	37.702894	8/21/2017	2	8/21/2017	1.1	8/21/2017	128	8/21/2017	4.8	8/21/2017	20	8/21/2017	120	8/6/2019	4.1	8/21/2017	6	8/21/2017	217	12/4/2018	0.005	8/21/2017	700
3901396-001	-121.279555	37.856888	5/10/2011	15.1					12/18/2002	3					2/7/2011	5.2	2/7/2011	0			2/7/2011	0		
3301280-002	-121.37925	37.712773	1/25/2008	2			1/25/2008	11			1/25/2008	130	1/25/2008	200	8/6/2009	0.05	1/25/2008	5	1/25/2008	1.1			1/25/2008	190
3901216-002	-121.516649	37.74753	7/15/2014	5	2/13/2018	2.4	2/13/2018	457	8/18/2014	0.05	2/13/2018	50	2/13/2018	280	2/4/2020	1.6	7/15/2014	8	2/13/2018	515	12/4/2018	0.005	2/13/2018	1640
3900010-001	-121.494583	38.037472	10/14/2010	26	10/14/2010	0.3	10/14/2010	42			4/5/2018	378	4/5/2018	1010	4/5/2018	0.4	5/11/2009	2	10/14/2010	2			10/14/2010	310
3901204-001	-121.27	37.85	2/26/2009	34.6			1/30/2008	24			1/30/2008	10	1/30/2008	20	2/26/2009	1.9	1/30/2008	5	1/30/2008	15	12/30/2005	0.5	1/30/2008	350
3900557-002	-121.4	37.79	12/10/2007	8	2/8/2005	1.2	12/13/2001	118			12/13/2001	0	12/13/2001	0	10/15/2007	0.09	12/13/2001	0	12/13/2001	246	12/13/2001	0	12/13/2001	730
4110013-014	-121.466667	37.7	4/10/2013	2	11/10/2005	0.025	4/10/2013	94	5/13/2015	29	4/10/2013	20	4/10/2013	100	7/1/2015	38.4	4/10/2013	5	4/10/2013	35	11/10/2005	0.005	4/10/2013	530
3901397-007	-121.508982	37.759762	11/5/2018	6					11/18/2014	0.5					9/5/2019	0.4	11/5/2018	5						
3901378-001	-121.361388	37.743611													6/8/2012	9.69								
3900713-001	-121.44	37.84	5/13/2009	26	12/9/2008	0.1	12/9/2008	1020			12/9/2008	17600	12/9/2008	25700	5/13/2009	0.09	5/13/2009	5	12/9/2008	920	5/13/2009	0.5	12/9/2008	3020
3901338-001	-121.413813	37.693705	5/9/2008	2											2/4/2013	2.46	5/9/2008	10						
3901327-001	-121.44	37.69	3/6/2007	2	6/10/2002	0.00045			6/10/2002	2.9					9/5/2007	12.9	3/6/2007	2			3/11/2003	0.5		
3901336-008	-121.401267	37.7408	4/1/2013	2	7/25/2007	1.11	7/25/2007	146			7/25/2007	100	7/25/2007	50	2/4/2013	1.8	4/1/2013	5	7/25/2007	230	7/27/2004	0.5	4/1/2013	753
3901405-007	-121.289884	37.631659	3/22/2017	2					12/15/2014	9					3/19/2019	4.7	3/22/2017	5			11/20/2018	0.005		
3900555-001	-121.35325	37.7685	11/21/2008	6	11/21/2008	0.8	11/21/2008	272			11/21/2008	190	11/21/2008	400	10/22/2009	0.2	11/21/2008	4	11/21/2008	178	11/21/2008	0.5	11/21/2008	790
3900557-001	-121.38	37.79	12/10/2007	7	2/8/2005	1.1	12/13/2001	124			12/13/2001	0	12/13/2001	0	10/15/2007	0.47	12/13/2001	0	12/13/2001	248	12/13/2001	0	12/13/2001	710
2900540-001	-121.426004	37.709642	12/6/2016	0			6/26/2014	13	2/17/2015	0	6/26/2014	0	6/26/2014	0	12/20/2017	2.23	12/6/2016	0	6/26/2014	31	3/1/2007	0	6/26/2014	386
377402N1214508W002	-121.450762	37.740187	11/17/2016	0.43	11/17/2016	1.6	11/17/2016	89			11/17/2016	22	11/17/2016	0.23	11/17/2016	0.2			11/17/2016	170			11/17/2016	460
377402N1214508W003	-121.450762	37.740187	11/17/2016	0.11	11/17/2016	1.1	11/17/2016	100			11/17/2016	51	11/17/2016	5.7	11/17/2016	0.2			11/17/2016	110			11/17/2016	390
377402N1214508W001	-121.450762	37.740187	11/17/2016	3.2	11/17/2016	1	11/17/2016	52			11/17/2016	98	11/17/2016	1.4	11/17/2016	0.2			11/17/2016	86			11/17/2016	390
377031N1214485W001	-121.448544	37.703055	11/17/2016	0.27	11/17/2016	0.93	11/17/2016	63			11/17/2016	15	11/17/2016	0.99	11/17/2016	0.2			11/17/2016	89			11/17/2016	330
377031N1214485W002	-121.448544	37.703055	11/17/2016	0.5	11/17/2016	1.2	11/17/2016	120			11/17/2016	23	11/17/2016	0.48	11/17/2016	0.2			11/17/2016	99			11/17/2016	450
377031N1214485W003	-121.448544	37.703055	11/17/2016	0.24	11/17/2016	1.4	11/17/2016	100			11/17/2016	24	11/17/2016	0.75	11/17/2016	0.2			11/17/2016	110			11/17/2016	410
377143N1214459W003	-121.445905	37.714305	11/17/2016	0.88	11/17/2016	1.3	11/17/2016	110			11/17/2016	89	11/17/2016	1.7	11/17/2016	0.51			11/17/2016	260			11/17/2016	690
377149N1214257W001	-121.425674	37.714872	11/17/2016	1.2	11/17/2016	0.77	11/17/2016	72			11/17/2016	9.5	11/17/2016	0.31	2/20/2013	0.2			11/17/2016	35			11/17/2016	300
377143N1214459W002	-121.445905	37.714305	11/16/2016	0.79	11/16/2016	1.8	11/16/2016	120			11/16/2016	260	11/16/2016	1.4	11/16/2016	0.16			11/16/2016	270			11/16/2016	700
377149N1214257W002	-121.425674	37.714872	11/17/2016	0.46	11/17/2016	0.8	11/17/2016	67			11/17/2016	32	11/17/2016	2.1	11/17/2016	0.2			11/17/2016	43			11/17/2016	290
377149N1214257W003	-121.425674	37.714872	11/17/2016	0.9	11/17/2016	0.8	11/17/2016	110			11/17/2016	13	11/17/2016	0.28	11/17/2016	0.2			11/17/2016	120			11/17/2016	410
377143N1214459W001	-121.445905	37.714305	11/16/2016	2.8	11/16/2016	0.84	11/16/2016	60			11/16/2016	12	11/16/2016	2.2	11/16/2016	0.2			11/16/2016	110			11/16/2016	330
377656N1214199W001	-121.41992	37.765631	4/16/2014	1	4/16/2014	0.99	4/16/2014	120			4/16/2014	17	4/16/2014	0.26	4/16/2014	0.2			4/16/2014	100			4/16/2014	410
377656N1214199W002	-121.41992	37.765631	6/7/2011	1	6/7/2011	0.94	6/7/2011	120			6/7/2011	9.9	6/7/2011	0.5	6/7/2011	0.2			6/7/2011	160			6/7/2011	500
377656N1214199W003	-121.41992	37.765631	11/14/2019	0.45	11/14/2019	1.2	11/14/2019	150			11/14/2019	1.4	11/14/2019	0.16	11/14/2019	0.2			11/14/2019	62			11/14/2019	530
377427N1213943W003	-121.394318	37.742656	11/15/2016	1.1	11/15/2016	1.1	11/15/2016	470			11/15/2016	7.4	11/15/2016	0.53	11/15/2016	0.25			11/15/2016	77			11/15/2016	960
377427N1213943W002	-121.394318	37.742656	11/15/2016	0.69	11/15/2016	1	11/15/2016	100			11/15/2016	22	11/15/2016	0.63	11/15/2016	5.7			11/15/2016	240			11/15/2016	680
377427N1213943W001	-121.394318	37.742656	11/15/2016	5	11/15/2016	1	11/15/2016	140			11/15/2016	10	11/15/2016	0.71	11/15/2016	0.25			11/15/2016	200			11/15/2016	590
USGS-375000121260001	-121.4457778	37.8499722	2/8/2005	23.6	2/8/2005	0.077	2/8/2005	1020			2/8/2005	17100	2/8/2005	24500	2/8/2005	0	2/8/2005	1.9	2/8/2005	750	2/8/2005	0	2/8/2005	2740
3900818-001	-121.28	37.85	12/1/2008	30	7/21/2008	0.2	7/21/2008	77			7/21/2008	10	7/21/2008	50	7/13/2009	2.1	7/21/2008	2	7/21/2008	20	7/21/2008	0.5	7/21/2008	390
USGS-374100121260001	-121.4433333	37.6834167	2/11/2014	0.73	2/11/2014	2.23	2/11/2014	119			2/11/2014	0	2/11/2014	9.3	2/11/2014	2.53	2/11/2014	1.7	2/11/2014	292	2/11/2014	0	2/11/2014	835
USGS-374000121260001	-121.437	37.6822778	1/5/2005	0.8	1/5/2005	2.31	1/5/2005	124			1/5/2005	1.46	1/5/2005	14.9	1/5/2005	1.86	1/5/2005	1.6	1/5/2005	309	1/5/2005	0	1/5/2005	889
USGS-374509121260001	-121.43475	37.7528611	1/4/2005	1.3	1/4/2005	1.34	1/4/2005	114			1/4/2005	0	1/4/2005	0	1/4/2005	1.69	1/4/2005	1.3	1/4/2005	252	1/4/2005	0	1/4/2005	721
USGS-375700121250001	-121.4223333	37.9554167	1/3/2005	7.2	1/3/2005	0.738	1/3/2005	2400			1/3/2005	2480	1/3/2005	1240	1/3/2005	0	1/3/2005	0	1/3/2005	62.9	1/3/2005	0	1/3/2005	4350
3910011-010	-121.435351	37.736372	10/14/2004	4.1	10/14/2004	1.2	10/14/2004	96	8/7/2002	7.6	10/14/2004	67	10/14/2004	680	10/14/2004	1.79	10/14/2004	5	10/14/2004	160	9/4/2002	0	10/14/2004	560
3900589-001	-121.305584	37.783862	9/21/2005	7	9/26/2003	0	8/18/2004	332.5			3/14/2005	1454	3/14/2005	1942	2/6/2006	0.5	8/18/2004	5	8/18/2004	70	8/18/2004	0	8/18/2004	883
3901348-001	-121.412023	37.708679	10/19/2005	2	10/19/2005	1	10/19/2005	102	2/25/2003	6.9	2/29/2008	108	11/22/2006	3130	2/29/2008	3.91	10/19/2005	3	10/19/2005	137	12/14/2006	0.5	10/19/2005	550
3900556-001	-121.36	37.78	12/13/2001	0	2/8/2005	0.88	12/13/2001	73			12/13/2001	0	12/13/2001	0	10/11/2006	0.09	12/13/2001	0	12/13/2001	198	12/13/2001	0	12/13/2001	620
3910800-001	-121.327221	37.744746	8/17/2000	0	5/2/1995	0.49	3/14/2001	1700			3/14/2001	1000	3/14/2001	390	11/28/2001	0	8/17/2000	0	3/14/2001	160	3/14/2001	0	3/14/2001	4500
3910011-007	-121.426009	37.714471	4/30/2001	7.9			4/30/2001	72	6/11/2001	3.4	4/30/2001	40	4/30/2001	0	4/30/2001	0.795	4/30/2001	0	4/30/2001	142	5/9/2001	0	4/30/2001	490
3910011-017	-121.419962	37.738215	4/30/2001	0			4/30/2001	170	6/11/2001	8.3	4/30/2001	0	4/30/2001	0	4/30/2001	5.47	4/30/2001	0	4/30/2001	98	5/9/2001	0	4/30/2001	630
3700922-001	-121.432917	37.936417	4/8/1999	2			4/8/1999	37.7			4/8/1999	20	4/8/1999	100	5/15/2003	2	4/8/1999	5	4/8/1999	12.2	8/19/1999	0	4/8/1999	196
3910018-003	-121.271667	37.675556	1/25/1989	10			1/25/1989	392			1/25/1989	10	1/25/1989	100	1/25/1989	3.8	1/25/1989	5	1/25/1989	295				
3910011-013	-121.433333	37.75	3/23/1989	10			3/23/1989	106			10/31/1996	110	10/31/1996	0	5/6/1997	0.895	3/23/1989	5	3/23/1989	203	9/10/1992	0	3/23/1989	613
3910018-002	-121.266667	37.683333	3/26/1992	10			3/26/1992	977			3/26/1992	30	3/26/1992	100	3/26/1992	5.74	3/26/1992	5	3/26/1992	436	4/25/1991	0	3/26/1992	2412.2
4110013-009	-121.466667	37.7	11/9/1994	0			11/9/1994	76			11/9/1994	0	11/9/1994	0	11/9/1994	13	11/9/1994	0	11/9/1994	18	7/6/1994	0	11/9/1994	350
3910023-002	-121.297222	37.822222													3/17/1998	0					3/5/1990	0		
3910702-002	-121.388194	37.719444	9/28/1989	10			9/28/1989	107			9/28/1989	608	3/13/1990	100	9/28/1989	7.3	9/28/1989	5	9/28/1989	208	1/10/1990	0	9/28/1989	627
3910011-009	-121.433333	37.75	4/28/1992	0			4/28/1992	102			4/28/1992	30	4/28/1992	100	4/28/1992	4.1	4/28/1992	0	4/28/1992	185	9/10/1992	0	4/28/1992	645
3910011-014	-121.416667	37.75	3/5/1990	5			3/5/1990	140			3/5/1990	14	3/5/1990	250	3/5/1990	2.9	3/5/1990	5	3/5/1990	190			3/5/1990	710
3910015-003	-121.266667	37.816667	9/8/1988	20.9			9/8/1988	50.9			9/8/1988	10	9/8/1988	100	7/25/2001	0	9/8/1988	5	9/8/1988	24.6	12/12/1989	0	9/8/1988	409
3910701-002	-121.269167	37.850278	1/19/1988	27			1/19/1988	27.1			1/19/1988	100	1/19/1988	3083	1/19/1988	0.2	1/19/1988	5	1/19/1988	18.4	2/15/1990	0	1/19/1988	272
3900583-001	-121.44	37.84	3/20/2019	11	11/2/2005	0.8	11/2/2005	980	11/24/2014	0.5	3/20/2019	938	3/20/2019	530	3/20/2019	0.4	3/20/2019	14	11/2/2005	7	5/25/2018	0.005	11/2/2005	2000
3901484-001	-121.530755	37.943625	11/17/2017	3	11/17/2017	0.1	11/17/2017	45	9/24/2014	0.05	11/17/2017	170	11/17/2017	2340	12/16/2019	0.4	11/17/2017	5	11/17/2017	18.1			11/17/2017	200
USGS-375800121340001	-121.570361	37.9691944	2/11/2014	0.17	2/11/2014	1.43	2/11/2014	78.5			2/11/2014	218	2/11/2014	166	2/11/2014	0	2/11/2014	0	2/11/2014	14.5	2/11/2014	0	2/11/2014	570
TRCY-10	-121.5703611	37.96919444	2/11/2014	0.17	2/11/2014	1.43	2/11/2014	78.5			2/11/2014	218	2/11/2014	166	2/11/2014	0.04	2/11/2014	0.05	2/11/2014	14.5	2/11/2014	0.006	2/11/2014	570
TRCY-03	-121.4433333	37.68341667	2/11/2014	0.73	2/11/2014	2.23	2/11/2014	119			2/11/2014	0.4	2/11/2014	9.3	2/11/2014	2.53	2/11/2014	1.7	2/11/2014	292	2/11/2014	0.006	2/11/2014	835
USGS-374500121220001	-121.3749722	37.7554722	2/10/2014	7	2/10/2014	0.774	2/10/2014	88.2			2/10/2014	205	2/10/2014	9	2/10/2014	0	2/10/2014	0.06	2/10/2014	217	2/10/2014	0	2/10/2014	619
TRCY-11	-121.3749722	37.75547222	2/10/2014	7	2/10/2014	0.774	2/10/2014	88.2			2/10/2014	205	2/10/2014	9	2/10/2014	0.04	2/10/2014	0.06	2/10/2014	217	2/10/2014	0.006	2/10/2014	619
ESJ-01	-121.2666667	37.81683333	2/10/2014	16.3	2/10/2014	0.154	2/10/2014	72			2/10/2014	1.04	2/10/2014	4	2/10/2014	4.43	2/10/2014	0.83	2/10/2014	22.2	2/10/2014	0.006	2/10/2014	409
USGS-374900121160001	-121.2666667	37.8168333	2/10/2014	16.3	2/10/2014	0.154	2/10/2014	72			2/10/2014	1.04	2/10/2014	0	2/10/2014	4.43	2/10/2014	0.83	2/10/2014	22.2	2/10/2014	0	2/10/2014	409
3601013-001	-121.460778	37.818722	1/28/2013	36											6/25/2012	20								
378410N1212865W001	-121.2865	37.841	9/19/2012	7	9/19/2012	0.3	9/19/2012	438			9/19/2012	326	9/19/2012	5	9/19/2012	0.05			9/19/2012	22			9/19/2012	1450
377061N1214199W001	-121.4199	37.7061	9/19/2012	2	9/19/2012	1.5	9/19/2012	248			9/19/2012	0	9/19/2012	0	9/19/2012	8.63			9/19/2012	170			9/19/2012	1040
3900616-001	-121.407055	37.990638	4/18/2012	54											4/10/2019	1	4/4/2012	5						
3900616-002	-121.404525	37.988607	4/18/2012	14							3/14/2018	2900	3/14/2018	17000	4/10/2019	0.4	4/4/2012	5						
USGS-374908121155901	-121.2663889	37.8189444	2/7/2012	23.4	2/7/2012	0.13	2/7/2012	26.9			2/7/2012	0.47	2/7/2012	4.7	2/7/2012	3	2/7/2012	0.55	2/7/2012	14.8			2/7/2012	299
02S05E25D002M	-121.3833	37.7351	9/27/2011	12	9/27/2011	0.8	9/27/2011	74			9/27/2011	109	9/27/2011	48	9/27/2011	0			9/27/2011	163			9/27/2011	520
3601152-001	-121.366611	37.742639	4/29/2010	0	4/29/2010	0	4/29/2010	9.3	10/15/2014	1.8	4/29/2010	0	4/29/2010	0	4/1/2019	1.7	4/29/2010	0	4/29/2010	8.2	10/9/2018	0	4/29/2010	180
3901320-001	-121.379138	37.712722	11/8/2007	2	11/13/2002	1.1			11/13/2002	14.02					4/1/2009	7.27	4/9/2003	5			11/13/2002	0		
USGS-375027121170701	-121.286455	37.8409264	8/15/2006	4.9	8/15/2006	0.234	8/15/2006	601			8/15/2006	606	8/15/2006	0	8/15/2006	0			8/15/2006	26.7			8/15/2006	1160
3901342-001	-121.487177	37.980357	5/3/2006	9.4											7/10/2019	0.4	5/3/2006	10			5/3/2006	0.5		
USGS-375600121250001	-121.4329722	37.9364722	2/9/2005	4.7	2/9/2005	0.194	2/9/2005	108			2/9/2005	519	2/9/2005	4180			2/9/2005	0.2	2/9/2005	34	2/9/2005	0	2/9/2005	414
TRCY-09	-121.4329722	37.93647222	2/9/2005	4.7	2/9/2005	0.194	2/9/2005	108			2/9/2005	519	2/9/2005	4180			2/9/2005	0.2	2/9/2005	34	2/9/2005	0.005	2/9/2005	414
TRCY-07	-121.4457778	37.84997222	2/8/2005	23.6	2/8/2005	0.077	2/8/2005	1020			2/8/2005	17100	2/8/2005	24500	2/8/2005	0.034	2/8/2005	1.9	2/8/2005	750	2/8/2005	0.005	2/8/2005	2740
TRCYFP-04	-121.437	37.68227778	1/5/2005	0.8	1/5/2005	2.31	1/5/2005	124			1/5/2005	1.46	1/5/2005	14.9	1/5/2005	1.86	1/5/2005	1.6	1/5/2005	309	1/5/2005	0.005	1/5/2005	889
TRCYFP-05	-121.4248056	37.74311111	1/5/2005	1.7	1/5/2005	1.18	1/5/2005	168			1/5/2005	2.1	1/5/2005	6			1/5/2005	3.2	1/5/2005	244	1/5/2005	0.18	1/5/2005	778
USGS-374400121250001	-121.4248056	37.7431111	1/5/2005	1.7	1/5/2005	1.18	1/5/2005	168			1/5/2005	2.1	1/5/2005	0			1/5/2005	3.2	1/5/2005	244	1/5/2005	0	1/5/2005	778
TRCYFP-03	-121.4654722	37.75486111	1/5/2005	2.5	1/5/2005	1.18	1/5/2005	126			1/5/2005	1.89	1/5/2005	8.6			1/5/2005	1.7	1/5/2005	223	1/5/2005	0.18	1/5/2005	675
USGS-374500121270001	-121.4654722	37.7548611	1/5/2005	2.5	1/5/2005	1.18	1/5/2005	126			1/5/2005	1.89	1/5/2005	8.6			1/5/2005	1.7	1/5/2005	223	1/5/2005	0	1/5/2005	661
TRCYFP-02	-121.43475	37.75286111	1/4/2005	1.3	1/4/2005	1.34	1/4/2005	114			1/4/2005	0.2	1/4/2005	3.3	1/4/2005	1.69	1/4/2005	1.3	1/4/2005	252	1/4/2005	0.18	1/4/2005	721
TRCYFP-01	-121.4223333	37.95541667	1/3/2005	7.2	1/3/2005	0.738	1/3/2005	2400			1/3/2005	2480	1/3/2005	1240	1/3/2005	0.06	1/3/2005	1.2	1/3/2005	62.9	1/3/2005	0.005	1/3/2005	4350
3901309-002	-121.413059	37.693618	3/11/2003	2	6/10/2002	0.00121			6/10/2002	7.2					3/2/2004	10.6	3/11/2003	9			3/11/2003	0.5		
3900543-001	-121.412714	37.709513	12/3/2002	2	12/3/2002	1.46	12/3/2002	410	2/25/2003	6.6	12/3/2002	10	12/3/2002	50	12/3/2002	12.5	12/3/2002	5	12/3/2002	220			12/3/2002	1440
3910702-001	-121.39	37.721111	11/4/1985	5			11/4/1985	113			11/4/1985	30	5/27/1986	768	11/4/1985	1.3	5/27/1986	5	11/4/1985	207			5/27/1986	658
3910701-004	-121.270278	37.852778	10/28/1985	25.6			10/28/1985	17			10/28/1985	30	10/28/1985	184	10/28/1985	0.43	10/28/1985	2	10/28/1985	15			10/28/1985	267
3910015-002	-121.283333	37.816667	9/6/1985	10			9/6/1985	309.5			9/6/1985	100	9/6/1985	100	7/25/2001	0	9/6/1985	5	9/6/1985	37.399	8/27/1984	0.5		
USGS-374445121200001	-121.3343875	37.745762	5/21/1985	5	5/21/1985	0.57	5/21/1985	78			5/21/1985	150	5/21/1985	47	5/21/1985	0	5/21/1985	0	5/21/1985	140			5/21/1985	511
USGS-373957121260101	-121.4346659	37.6657636	3/28/1985	0	3/28/1985	3	3/28/1985	130			3/28/1985	2	3/28/1985	5	3/28/1985	1.4	3/28/1985	2	3/28/1985	330			3/28/1985	930
USGS-374528121221801	-121.3727219	37.7577064	3/28/1985	0	3/28/1985	2.2	3/28/1985	420			3/28/1985	0	3/28/1985	30	3/28/1985	9.3	3/28/1985	4	3/28/1985	320			3/28/1985	1420
USGS-374136121213601	-121.3610538	37.6932629	3/11/1985	1	3/11/1985	1.6	3/11/1985	320			3/11/1985	10	3/11/1985	30	3/11/1985	6.4	3/11/1985	2	3/11/1985	230			3/11/1985	1090
USGS-374222121175401	-121.299386	37.7060403	6/13/1979	3	6/13/1979	4.9	6/13/1979	610			6/13/1979	0	6/13/1979	20	6/13/1979	7.2			6/13/1979	760			6/13/1979	2480
USGS-373845121213801	-121.3616085	37.6457636	6/13/1979	0	6/13/1979	0.5	6/13/1979	43			6/13/1979	0	6/13/1979	0	6/13/1979	3.2			6/13/1979	43			6/13/1979	564
USGS-373731121183401	-121.310496	37.6252082	6/13/1979	2	6/13/1979	0.7	6/13/1979	120			6/13/1979	0	6/13/1979	0	6/13/1979	4.3			6/13/1979	93			6/13/1979	559
03S06E03F001M	-121.3055	37.7026	6/13/1979	3	6/13/1979	4.9	6/13/1979	610			6/13/1979	0	6/13/1979	20	6/13/1979	7.2			6/13/1979	760			6/13/1979	2480
USGS-374604121293801	-121.494947	37.7677065	6/12/1979	8	6/12/1979	0.8	6/12/1979	64			6/12/1979	0	6/12/1979	0	6/12/1979	1.6			6/12/1979	180			6/12/1979	492
03S05E12J002M	-121.3695	37.6845	6/12/1979	0	6/17/1980	1	8/13/1998	226			6/12/1979	10	6/12/1979	10	6/12/1979	11			6/17/1980	444			6/17/1980	1370
USGS-374223121250601	-121.4193886	37.7063185	6/12/1979	1	8/4/2004	1.55	8/4/2004	183			6/12/1979	0	6/12/1979	0	9/14/1982	6.33			9/14/1982	110			9/14/1982	733
01S06E36B001M	-121.2642	37.8073	6/12/1979	10	6/12/1979	0.1	6/12/1979	18			6/12/1979	10	6/12/1979	10	6/12/1979	2.7			6/12/1979	22			6/12/1979	276
02S04E11R001M	-121.4976	37.7676	6/12/1979	0	6/12/1979	0.8	6/12/1979	64			6/12/1979	0	6/12/1979	0	6/12/1979	1.6			6/12/1979	180			6/12/1979	492
01S06E14P001M	-121.2872	37.8399	6/12/1979	0	6/12/1979	0	6/12/1979	310			6/12/1979	450	6/12/1979	450	6/12/1979	0.05			6/12/1979	37			6/12/1979	816
USGS-374111121213901	-121.361887	37.6863186	6/12/1979	0	7/27/2004	0.892	7/27/2004	318			6/12/1979	0	6/12/1979	0	6/12/1979	11			6/12/1979	470			6/12/1979	1380
01S05E32R001M	-121.4427	37.7965	6/6/1979	0	6/6/1979	0.2	6/6/1979	17			6/6/1979	90	6/6/1979	0	6/6/1979	0			6/6/1979	5			6/6/1979	164

WELL_NAME	LONGITUDE_NAD83	LATITUDE_NAD83	AS_Date	AS	B_Date	B	CL_Date	CL	CR6_Date	CR6	MN_Date	MN	FE_Date	FE	NO3N_Dat	NO3N	SE_Date	SE	SO4_Date	SO4	TCPR123_D	TCPR123	TDS_Date	TDS
01S06E30A001M	-121.3512	37.8218	6/6/1979	0	6/6/1979	0.2	6/6/1979	50			6/6/1979	40	6/6/1979	10	6/6/1979	0			6/6/1979	10			6/6/1979	206
USGS-374921121204401	-121.3466115	37.822427	6/6/1979	4	6/6/1979	0.2	6/6/1979	50			6/6/1979	40	6/6/1979	0	6/6/1979	0			6/6/1979	10			6/6/1979	198
USGS-374746121260601	-121.4360573	37.7960389	6/6/1979	3	6/6/1979	0.2	6/6/1979	17			6/6/1979	90	6/6/1979	0	6/6/1979	0			6/6/1979	5			6/6/1979	164
01S04E25D001M	-121.4931	37.8218	6/5/1979	10	6/5/1979	1.3	6/5/1979	57			6/5/1979	150	6/5/1979	40	6/5/1979	0.02			6/5/1979	130			6/5/1979	543
USGS-374916121292401	-121.491059	37.8210384	6/5/1979	10	6/5/1979	1.3	6/5/1979	57			6/5/1979	150	6/5/1979	40	6/5/1979	0.02			6/5/1979	130			6/5/1979	545
USGS-374410121311201	-121.5210581	37.7360405	5/24/1979	10	5/24/1979	2.8	5/24/1979	440			5/24/1979	0	5/24/1979	20	5/24/1979	19			5/24/1979	260			5/24/1979	1370
02S04E26D001M	-121.5114	37.7351	5/24/1979	10	5/24/1979	2.8	5/24/1979	440			5/24/1979	10	5/24/1979	20	5/24/1979	19			5/24/1979	260			5/24/1979	1400
02S04E25H001M	-121.4793	37.7315	5/24/1979	0	5/24/1979	2.9	5/24/1979	450			5/24/1979	0	5/24/1979	10	5/24/1979	20			5/24/1979	680			5/24/1979	2060
377546N1214764W001	-121.4764	37.7546	5/23/1979	0	5/23/1979	1.7	5/23/1979	420			5/23/1979	20	5/23/1979	10	5/23/1979	9.7			5/23/1979	390			5/23/1979	1600
USGS-374625121251201	-121.4210566	37.7735395	5/23/1979	2	5/23/1979	2.2	5/23/1979	240			5/23/1979	40	5/23/1979	610	5/23/1979	2.5			5/23/1979	280			5/23/1979	1120
02S05E09J001M	-121.4244	37.7712	5/23/1979	0	5/23/1979	2.2	5/23/1979	240			5/23/1979	40	5/23/1979	610	5/23/1979	2.5			5/23/1979	280			5/23/1979	1120
USGS-374508121221801	-121.3727218	37.7521509	5/23/1979	1	5/23/1979	2.6	5/23/1979	410			5/23/1979	0	5/23/1979	0	5/23/1979	0.99			5/23/1979	350			5/23/1979	1550
USGS-374328121240001	-121.4010552	37.7243737	5/23/1979	1	5/23/1979	1.4	5/23/1979	240			5/23/1979	0	5/23/1979	0	5/23/1979	9			5/23/1979	130			5/23/1979	924
02S05E24C002M	-121.3787	37.7495	5/23/1979	0	5/23/1979	2.6	5/23/1979	410			5/23/1979	10	5/23/1979	10	5/23/1979	0.99			5/23/1979	350			5/23/1979	1550
02S05E34A001M	-121.4061	37.7206	5/23/1979	0	5/23/1979	1.4	5/23/1979	240			5/23/1979	10	5/23/1979	0	5/23/1979	9			5/23/1979	130			5/23/1979	924
USGS-374516121283001	-121.4760574	37.7543735	5/23/1979	1	5/23/1979	1.7	5/23/1979	420			5/23/1979	20	5/23/1979	0	5/23/1979	9.7			5/23/1979	390			5/23/1979	1400
02S06E07P001M	-121.3604	37.7676	5/22/1979	0	5/22/1979	0.8	5/22/1979	73			5/22/1979	80	5/22/1979	0	5/22/1979	0.52			5/22/1979	210			5/22/1979	554
USGS-374607121210801	-121.3532772	37.7685394	5/22/1979	5	5/22/1979	0.8	5/22/1979	73			5/22/1979	80	5/22/1979	0	5/22/1979	0.52			5/22/1979	210			5/22/1979	573
01N05E14P001M	-121.397	37.9266	5/2/1979	30	5/2/1979	0	5/2/1979	410			5/2/1979	3100			5/2/1979	0			5/2/1979	160			5/2/1979	1300
USGS-375548121235201	-121.3988369	37.9299244	5/2/1979	38	5/2/1979	0	5/2/1979	410			5/2/1979	3100			5/2/1979	0			5/2/1979	160			5/2/1979	1300
02N04E28G001M	-121.5388	37.9916	6/13/1978	0	6/13/1978	1.7	6/13/1978	78			6/13/1978	210	6/13/1978	30	6/13/1978	0			6/13/1978	0.5			6/13/1978	604
02N05E36E003M	-121.3833	37.9771	6/13/1978	0	6/13/1978	0.3	6/13/1978	37			6/13/1978	120	6/13/1978	60	6/13/1978	0.05			6/13/1978	32			6/13/1978	203
USGS-375841121225701	-121.3835597	37.9779788	6/13/1978	3	6/13/1978	0.3	6/13/1978	37			6/13/1978	120	6/13/1978	60	6/13/1978	0.05			6/13/1978	32			6/13/1978	203
USGS-375932121322001	-121.5399517	37.9921448	6/13/1978	0	6/13/1978	1.7	6/13/1978	78			6/13/1978	210	6/13/1978	30	6/13/1978	0			6/13/1978	0.5			6/13/1978	606
03S05E11D001M	-121.4016	37.6917	5/13/1971	0													5/13/1971	0						
03S05E35C080M	-121.397	37.6339	5/12/1971	0													5/12/1971	10						
01N04E03N001M	-121.5297	37.9555	8/29/1967	10	6/21/1989	1.5	6/21/1989	176							6/20/1974	1.6			6/21/1989	8			6/21/1989	758
03S06E04N001M	-121.3284	37.6954	7/1/1959	20	5/2/1968	0.93	5/2/1968	330							5/2/1968	2.5	7/1/1959	0	5/2/1968	271				
AGC100012333-SJCDW00034	-121.36065	37.68909			10/22/2018	0.9	10/22/2018	240											10/22/2018	500			10/22/2018	1200
AGC100012333-SJCDW00032	-121.53086	37.76603			10/22/2018	3.8	10/22/2018	300											10/22/2018	260			10/22/2018	1100
3900807-001	-121.432916	37.936416			12/17/2013	0.2	12/17/2013	138			9/16/2019	470	9/16/2019	3570	9/16/2019	0.4			12/17/2013	49			12/17/2013	410
USGS-374046121155401	-121.2650278	37.6793611			1/6/2009	0.5	1/6/2009	490							1/6/2009	0			1/6/2009	210				
USGS-374046121155402	-121.2650278	37.6793611			1/6/2009	0.15	1/6/2009	600							1/6/2009	0.94			1/6/2009	89				
USGS-374036121155601	-121.2655556	37.6766667			9/25/2008	1.59	9/25/2008	410							9/25/2008	0			9/25/2008	100				
3901449-001	-121.512766	37.891449			6/27/2005	0.1	6/27/2005	8			6/27/2005	10	6/27/2005	50	2/19/2019	0.6			6/27/2005	2			6/27/2005	190
3901291-001	-121.27	37.85			11/4/2003	0.4									2/20/2003	2.62					11/4/2003	0.005		
3901401-001	-121.480458	37.985559			5/28/2003	0.4			5/28/2003	1					7/10/2019	0.4								
3901308-001	-121.431152	37.926727			5/15/2003	0.18	5/15/2003	198			1/24/2014	1200	1/24/2014	22700	10/18/2019	0.4			5/15/2003	122			5/15/2003	630
3900805-001	-121.398677	37.737586			10/15/2001	0.87	10/15/2001	84			10/15/2001	10	10/15/2001	50	10/15/2001	4.47			10/15/2001	147			10/15/2001	530
03S06E17K001M	-121.3375	37.6701			6/19/1989	1	6/19/1989	120							7/21/1970	4.5			6/19/1989	127			6/19/1989	613
02N05E35L001M	-121.397	37.9735			5/27/1982	1.7	5/27/1982	608											5/27/1982	193			5/27/1982	1840
01S05E14G001M	-121.3924	37.8471			11/10/1981	0.1	11/10/1981	310							4/12/1977	2.2			11/10/1981	128			11/10/1981	808
01N05E15E002M	-121.4199	37.9338			11/9/1981	0.2	4/9/1981	77																
01N05E15F002M	-121.4153	37.9338			11/9/1981	0.2	4/17/1981	248															4/17/1981	1220
01N05E21N001M	-121.4382	37.9121			11/6/1981	0.2																	4/9/1981	200
01N05E15F001M	-121.4153	37.9338			11/6/1981	0.3	11/6/1981	868							10/17/1978	1.4			10/17/1978	514			11/6/1981	2350
02N05E35Q002M	-121.3924	37.9699			11/6/1981	0.9	11/6/1981	1220							4/5/1978	0.54			6/14/1976	272			11/6/1981	2760
01N05E29G001M	-121.4473	37.9049			11/6/1981	0.2	4/7/1981	178															4/7/1981	852
01N05E15G001M	-121.4107	37.9338			4/17/1981	0.2	4/17/1981	622							4/11/1978	0.47			4/19/1977	358			4/17/1981	2020
02N05E35P002M	-121.397	37.9699			4/9/1981	0.3	4/9/1981	496											4/9/1981	342			4/9/1981	1640
01N05E31E001M	-121.4748	37.8904			4/9/1981	0.5	4/12/1978	145							4/12/1978	1.5								
01S05E12B001M	-121.3741	37.8651			4/9/1981	0.4	7/2/1976	147							4/12/1977	1.2			7/2/1976	99			7/2/1976	513
01N05E30R002M	-121.461	37.8977			4/7/1981	0.3	10/24/1980	161															10/24/1980	880
01N05E02F001M	-121.397	37.9627			4/7/1981	0.4	6/15/1976	147							9/16/1976	0.05			6/15/1976	191			6/15/1976	630
01N05E16J001M	-121.4244	37.9302			4/7/1981	0.2	9/20/1976	424							6/16/1976	0.2			6/16/1976	647			6/16/1976	1760
01N05E31D001M	-121.4748	37.894			11/25/1980	0.5	4/17/1979	81							4/17/1979	1.9								
01S04E22L001M	-121.5251	37.829			11/24/1980	0.4	4/9/1980	140															4/9/1980	478
01S04E04R001M	-121.5342	37.8688			11/20/1980	0.3	10/13/1978	72							10/13/1978	2.2								
01S04E09B001M	-121.5388	37.8651			11/20/1980	0.4	4/13/1978	179							4/13/1978	0.07								
01S04E03K001M	-121.5205	37.8724			11/20/1980	2.1	4/11/1978	89							4/11/1978	4.7								
01S05E26E001M	-121.4016	37.8182			11/13/1980	0.5	4/5/1978	252							4/5/1978	0.07								
01N04E35R001M	-121.4976	37.8832			11/3/1980	0.4	4/11/1978	163							4/11/1978	0.25								
01N05E29F001M	-121.4519	37.9049			11/3/1980	0.6	9/13/1977	98							9/13/1977	1.7								
01N05E21E003M	-121.4382	37.9193			11/3/1980	0.2	4/13/1978	73							4/13/1978	5								
01N05E29C002M	-121.4519	37.9085			10/24/1980	0.3	9/13/1977	74							9/13/1977	3.4								
01S05E13A002M	-121.3695	37.8507			10/24/1980	0.1	7/6/1976	92							7/6/1976	0.38								
01N05E21M002M	-121.4382	37.9157			10/24/1980	0.2	4/11/1978	73							4/11/1978	0.07								
01S06E05B001M	-121.3375	37.8796			10/24/1980	0.6	10/24/1980	603							10/17/1978	81.1			6/16/1976	186			10/24/1980	3630
02N05E35P001M	-121.397	37.9699			10/23/1980	0.2	10/23/1980	167							4/5/1978	0.63			4/5/1978	663			10/23/1980	726
02N05E35B002M	-121.3924	37.9807			10/23/1980	0.7	6/14/1976	182							9/16/1976	0.77			6/3/1975	181			6/3/1975	896
01N05E34M001M	-121.4199	37.8868			4/10/1980	0.1	4/10/1980	358							9/13/1977	0.59							4/10/1980	1020
01N05E30L001M	-121.4702	37.9013			4/8/1980	0.1	4/8/1980	71															4/8/1980	260
02N05E26Q002M	-121.3924	37.9844			4/4/1980	0.4	9/7/1977	68							9/7/1977	5.2								
02N05E35Q001M	-121.3924	37.9699			4/3/1980	0.9	4/3/1980	382							7/7/1976	1			7/7/1976	207			4/3/1980	1250
01N06E31L001M	-121.3604	37.8868			10/16/1979	0.2	4/12/1978	363							10/17/1978	30.7			6/16/1976	225			6/16/1976	1350
01N05E03R001M	-121.4061	37.9555			10/11/1979	0.6	10/11/1979	400							4/5/1978	0.81			10/11/1979	456			10/11/1979	1550
USGS-374003121194301	-121.3296638	37.6674299			6/13/1979	2.1	6/13/1979	270							6/13/1979	7.5			6/13/1979	260			6/13/1979	1090
USGS-373847121202601	-121.341608	37.6463191			6/13/1979	1	6/13/1979	130							6/13/1979	5			6/13/1979	80			6/13/1979	591
03S05E13R002M	-121.3696	37.6665			6/13/1979	2.1	6/13/1979	490											6/13/1979	660			6/13/1979	2090
USGS-374016121193701	-121.3279971	37.6710409			6/13/1979	0.9	6/13/1979	76							6/13/1979	5.65			6/13/1979	140			6/13/1979	583
USGS-374002121215201	-121.3654979	37.6671522			6/13/1979	2.1	6/13/1979	490							6/13/1979	24			6/13/1979	660			6/13/1979	2090
01S06E33R001M	-121.3146	37.7965			6/12/1979	0.2	6/12/1979	280											6/12/1979	16			6/12/1979	788
USGS-374054121233401	-121.393832	37.6815965			6/12/1979	1	6/12/1979	200							6/12/1979	2.5			6/12/1979	310			6/12/1979	1060
03S05E20A001M	-121.4428	37.6628			6/12/1979	3.3	6/12/1979	130							8/29/1957	0.61			6/12/1979	340			6/12/1979	894
USGS-374800121182701	-121.3085546	37.7999274			6/12/1979	0.2	6/12/1979	280							6/12/1979	0.02			6/12/1979	16			6/12/1979	788
01S05E36N001M	-121.3833	37.7965			6/6/1979	1	6/6/1979	230											6/6/1979	150			6/6/1979	773
USGS-374751121224101	-121.3791117	37.7974276			6/6/1979	1	6/6/1979	230							6/6/1979	0.02			6/6/1979	150			6/6/1979	773
USGS-374936121225901	-121.3841124	37.8265936			6/6/1979	0.2	6/6/1979	130							6/6/1979	0.99			6/6/1979	88			6/6/1979	591
USGS-375119121215701	-121.3668903	37.855204			6/6/1979	0.4	6/6/1979	550							6/6/1979	0			6/6/1979	26			6/6/1979	1240
01S06E17L001M	-121.3421	37.8435			6/6/1979	0.3	6/6/1979	1500											6/6/1979	8			6/6/1979	3050
01S05E23R002M	-121.3878	37.8254			6/6/1979	0.2	6/6/1979	130											6/6/1979	88			6/6/1979	591
01S05E12R001M	-121.3695	37.8543			6/6/1979	0.4	6/6/1979	550											6/6/1979	26			6/6/1979	1220
USGS-375045121202001	-121.339945	37.8457597			6/6/1979	0.3	6/6/1979	1500							6/6/1979	0			6/6/1979	8			6/6/1979	3050
USGS-375045121285301	-121.4824482	37.84576			6/5/1979	0.9	6/5/1979	57							6/5/1979	0			6/5/1979	68			6/5/1979	426
01S04E13K003M	-121.4839	37.8435			6/5/1979	0.9	6/5/1979	57											6/5/1979	68			6/5/1979	443
USGS-374310121320801	-121.5366138	37.719374			5/24/1979	3.2	5/24/1979	240							5/24/1979	9.9			5/24/1979	470			5/24/1979	1360
02S04E33B001M	-121.5388	37.7206			5/24/1979	3.2	5/24/1979	240							5/24/1979	9.9			5/24/1979	470			5/24/1979	1360
USGS-374303121294801	-121.4977238	37.7174297			5/24/1979	3.7	5/24/1979	420							5/24/1979	9.9			5/24/1979	1300			5/24/1979	2730
02S04E35H001M	-121.4976	37.717			5/24/1979	3.7	5/24/1979	420							5/24/1979	9.9			5/24/1979	1300				
USGS-374258121224201	-121.3793879	37.7160404			5/23/1979	1.9	5/23/1979	360							5/23/1979	2.7			5/23/1979	230			5/23/1979	1400
USGS-374716121271001	-121.4538353	37.7877059			5/23/1979	0.5	5/23/1979	48							5/23/1979	0			5/23/1979	40			5/23/1979	286
USGS-374610121222901	-121.3757777	37.7693728			5/23/1979	2.2	5/23/1979	240							5/23/1979	2.7			5/23/1979	460			5/23/1979	1280
02S06E30E001M	-121.365	37.7315			5/23/1979	0.8	5/23/1979	370							5/23/1979	1.7			5/23/1979	160			5/23/1979	1080
USGS-374310121263701	-121.4446672	37.7193739			5/23/1979	1.1	5/23/1979	200							5/23/1979	9.9			5/23/1979	150			5/23/1979	830
02S05E32F001M	-121.4519	37.717			5/23/1979	1.1	5/23/1979	200							5/23/1979	9.9			5/23/1979	150			5/23/1979	830
02S05E12N001M	-121.3833	37.7676			5/23/1979	2.2	5/23/1979	240							5/23/1979	2.7			5/23/1979	460			5/23/1979	1420
USGS-374357121213601	-121.3610545	37.732429			5/23/1979	0.8	5/23/1979	370							5/23/1979	1.7			5/23/1979	160			5/23/1979	1080
02S05E06R001M	-121.461	37.7821			5/23/1979	0	5/23/1979	48							5/23/1979	0			5/23/1979	40			5/23/1979	286
02S05E36M001M	-121.3833	37.7134			5/23/1979	1.9	5/23/1979	360							5/23/1979	2.7			5/23/1979	230			5/23/1979	1400
02S06E04R001M	-121.3146	37.7821			5/22/1979	0.2	5/22/1979	250							5/22/1979	0.02			5/22/1979	20			5/22/1979	678
USGS-374709121182501	-121.3079988	37.7857611			5/22/1979	0.2	5/22/1979	250							5/22/1979	0.02			5/22/1979	20			5/22/1979	613
USGS-375753121282701	-121.475228	37.9646457			5/2/1979	1.1	5/2/1979	340							5/2/1979	0.29			5/2/1979	3			5/2/1979	910
01N05E06E002M	-121.4748	37.9627			5/2/1979	1.1	5/2/1979	340							5/2/1979	0.29			5/2/1979	3			5/2/1979	977
01S04E09A001M	-121.5342	37.8651			4/17/1979	2.6	4/17/1979	526							4/17/1979	1.2			4/17/1979	709			4/17/1979	2190
01N05E22E001M	-121.4199	37.9193			10/12/1978	0.2	10/12/1978	622							10/12/1978	0.99			10/12/1978	603			10/12/1978	1990
02N04E21G001M	-121.5388	38.006			6/13/1978	0.1	6/13/1978	42							6/13/1978	0.02			6/13/1978	0.2			6/13/1978	418
USGS-375847121320801	-121.5366181	37.9796452			6/13/1978	1.6	6/13/1978	56							6/13/1978	0			6/13/1978	47			6/13/1978	527
02N04E33G002M	-121.5388	37.9771			6/13/1978	1.6	6/13/1978	56							6/13/1978	0			6/13/1978	47			6/13/1978	538
USGS-380030121321801	-121.5393963	38.0082554			6/13/1978	0.1	6/13/1978	42							6/13/1978	0.02			6/13/1978	0.2			6/13/1978	418
01N05E15L002M	-121.4153	37.9302			4/13/1978	0.2	4/13/1978	201							4/13/1978	0.05			7/16/1976	78			7/16/1976	542
01N04E34H001M	-121.5159	37.8904			4/12/1978	0.2	4/12/1978	93							4/12/1978	0.36								
01N05E21F001M	-121.4336	37.9193			4/11/1978	0.2	6/17/1976	75							6/17/1976	0.7			6/3/1975	126			12/8/1975	738
01S05E06Q001M	-121.4748	37.8796			4/11/1978	0.2	4/11/1978	93							4/11/1978	0.25			4/11/1978	354			4/11/1978	936
01N05E10Q001M	-121.4107	37.941			4/5/1978	0.2	4/5/1978	179							4/5/1978	0								
02N05E35K001M	-121.3924	37.9735			4/5/1978	0.2	4/5/1978	210							4/5/1978	8.8								
01N05E36M001M	-121.3833	37.8868			4/5/1978	0.3	4/5/1978	403							4/5/1978	11			4/13/1977	267			4/13/1977	1330
01N05E10P001M	-121.4153	37.941			4/5/1978	0.1	6/15/1976	209							4/5/1978	1.9			6/3/1975	435			12/9/1975	1600
01N05E31P001M	-121.4702	37.8832			9/8/1977	0.1	9/8/1977	56							9/8/1977	0.63								
02S06E20L001M	-121.3421	37.7423			8/3/1977	0.8	2/25/1980	349			8/3/1977	160			8/3/1977	0			8/3/1977	174			8/3/1977	1060
02S06E20R003M	-121.3329	37.7387			8/3/1977	0.5	2/25/1980	120			8/3/1977	170			8/3/1977	0.27			8/3/1977	157			8/3/1977	551
02S06E20K001M	-121.3375	37.7423			8/3/1977	0.6	2/25/1980	68			8/3/1977	120			8/3/1977	0.25			8/3/1977	149			8/3/1977	480
01S04E21Q001M	-121.5388	37.8254			4/13/1977	0.4	4/13/1977	547							4/13/1977	0			4/13/1977	1420			4/13/1977	3220
01S05E24Q001M	-121.3741	37.8254			4/13/1977	0	11/13/1980	1560							9/13/1977	3.4			4/13/1977	648			4/13/1977	4050
01S06E05L001M	-121.3421	37.8724			4/13/1977	0.4	4/13/1977	818							4/13/1977	0.25			4/13/1977	260			4/13/1977	2180
01S05E12D001M	-121.3833	37.8651			4/12/1977	0.2	4/12/1977	166							4/12/1977	0								
01N05E03Q001M	-121.4107	37.9555			4/11/1977	0	4/11/1977	260							4/11/1977	0.05			4/11/1977	546			4/11/1977	1380
01N05E03N001M	-121.4199	37.9555			4/11/1977	0.4	4/11/1977	388							4/11/1977	1.6								
01N05E15L003M	-121.4153	37.9302			9/21/1976	0.2	7/16/1976	102							7/16/1976	0.56							6/24/1975	693
01N05E15L001M	-121.4153	37.9302			9/21/1976	0.1	7/16/1976	117							7/16/1976	0.7							7/24/1975	631
02S06E20R001M	-121.3329	37.7387			9/20/1976	0.4	9/20/1976	87			9/20/1976	180			9/20/1976	0.27			9/20/1976	153			9/20/1976	539
01S04E09C001M	-121.5434	37.8651			9/17/1976	0.9	9/17/1976	93							9/17/1976	0.5							6/3/1975	909
02N05E35G001M	-121.3924	37.9771			9/15/1976	0.4	7/7/1976	117							7/7/1976	0.97								
01N05E14F001M	-121.397	37.9338			9/14/1976	0.3	6/30/1976	118							9/14/1976	0.54								
01N05E10A001M	-121.4061	37.9518			7/7/1976	0.4	7/7/1976	132							4/11/1977	9.3			6/3/1975	121			12/9/1975	506
02N05E26Q003M	-121.3924	37.9844			7/7/1976	0.2	7/7/1976	69							7/7/1976	0.56							7/2/1975	426
01N05E20M001M	-121.4565	37.9157			7/6/1976	0.1	7/6/1976	152							9/20/1976	0.95								
01S05E26B001M	-121.3924	37.8218			7/2/1976	0.2	9/10/1976	293							9/10/1976	0.66								
01S04E21F001M	-121.5434	37.8326			7/2/1976	0.1	7/2/1976	101							4/19/1977	1.9								
01S05E02E002M	-121.4016	37.876			7/2/1976	0.1	7/2/1976	53							9/17/1976	0.63								
01S06E08C001M	-121.3421	37.8651			7/2/1976	0.4	7/2/1976	104							4/13/1977	4.5								
01S05E24P001M	-121.3787	37.8254			7/2/1976	0.3	9/13/1976	314							7/2/1976	0.54			7/2/1976	190			7/2/1976	1080
01N05E30Q001M	-121.4656	37.8977			7/1/1976	0.2	7/1/1976	131							4/13/1977	2.7								
01S04E16J001M	-121.5342	37.8435			7/1/1976	0.1	7/1/1976	194							7/1/1976	0.81								
01N04E36N001M	-121.4931	37.8832			7/1/1976	0.1	7/1/1976	46							7/1/1976	0.9								
01S04E03P002M	-121.5251	37.8688			7/1/1976	0.4	7/1/1976	96							9/17/1976	1							12/8/1975	406
01S04E02C001M	-121.5068	37.8796			7/1/1976	0.1	7/1/1976	49							7/1/1976	0.95								
01N04E25K001M	-121.4839	37.9013			6/30/1976	0.1	6/30/1976	93							6/30/1976	0.88								
01N05E20A001M	-121.4427	37.9229			6/30/1976	0.2	6/30/1976	180							6/30/1976	0.7								
01N04E36K003M	-121.4839	37.8868			6/30/1976	0.1	6/30/1976	48							6/30/1976	0.79							12/8/1975	256
01N05E30Q003M	-121.4656	37.8977			6/17/1976	0	6/17/1976	100							4/13/1977	4.7			6/17/1976	72			6/17/1976	598
01S05E25D001M	-121.3833	37.8218			6/16/1976	0.1	9/10/1976	431							6/16/1976	0.1			6/16/1976	208			6/16/1976	1420
01N05E34H001M	-121.4061	37.8904			6/16/1976	0.4	6/16/1976	96							6/16/1976	0.2			6/16/1976	13			6/16/1976	351
01N05E10P002M	-121.4153	37.941			6/26/1975	0.3	6/15/1976	174							6/15/1976	0.02			6/26/1975	180			12/9/1975	906
01N04E36A001M	-121.4793	37.894			5/5/1975	0.5	5/5/1975	96							5/5/1975	0.43			5/5/1975	109			5/5/1975	562
02S06E20K002M	-121.3375	37.7423			11/28/1974	0.7	11/28/1974	721			11/28/1974	220			11/28/1974	0.79			11/28/1974	137			11/28/1974	1580
02S05E21Q001M	-121.429	37.7387			8/7/1974	1.14	8/7/1974	158							8/7/1974	3.2			8/7/1974	182				
02S05E21R001M	-121.4244	37.7387			8/7/1974	1.07	8/7/1974	138							8/7/1974	4.3			8/7/1974	134				
02S05E28E001M	-121.4382	37.7315			8/7/1974	1.39	8/7/1974	118							8/7/1974	1			8/7/1974	271				
02S05E28A001M	-121.4244	37.7351			8/7/1974	0.96	8/7/1974	140							8/7/1974	5.2			8/7/1974	96				

WELL_NAME	LONGITUDE_NAD83	LATITUDE_NAD83	AS_Date	AS	B_Date	B	CL_Date	CL	CR6_Date	CR6	MN_Date	MN	FE_Date	FE	NO3N_Date	NO3N	SE_Date	SE	SO4_Date	SO4	TCPR123_D	TCPR123	TDS_Date	TDS
02S05E20R001M	-121.4427	37.7387			8/7/1974	1.25	8/7/1974	96							8/7/1974	0.7			8/7/1974	218				
02S05E21A001M	-121.4244	37.7495			8/7/1974	1.01	8/7/1974	156							8/7/1974	5.2			8/7/1974	94				
02S05E22D001M	-121.4199	37.7495			8/7/1974	1.12	8/7/1974	228							8/7/1974	0.9			8/7/1974	214				
02S05E21D001M	-121.4382	37.7495			8/7/1974	1.21	8/7/1974	98							8/7/1974	0.7			8/7/1974	180				
02S05E28L001M	-121.4336	37.7279			8/7/1974	1.02	8/7/1974	126					7/18/1958	0	8/7/1974	3.2			8/7/1974	137				
USGS-375732121314501	-121.5302288	37.9588124			6/20/1974	1.5	6/20/1974	170							6/20/1974	1.63			6/20/1974	5.9			6/20/1974	733
02S05E29D002M	-121.4565	37.7351			7/27/1972	1.4	7/27/1972	270							7/27/1972	1.6			7/27/1972	203			7/27/1972	1256
02S06E20R002M	-121.3329	37.7387			6/20/1972	0.5	6/20/1972	62							6/20/1972	0.5			6/20/1972	172			6/20/1972	476
USGS-375024121170501	-121.2857772	37.8399265			5/13/1971	0.2	6/10/1975	110							5/13/1971	0			5/13/1971	8.9			5/13/1971	324
03S05E11D080M	-121.4016	37.6917			5/13/1971	1.8	5/13/1971	220							5/13/1971	8.6			5/13/1971	116			5/13/1971	763
02S06E30G001M	-121.3558	37.7315			5/13/1971	2.2	5/13/1971	332							5/13/1971	10			5/13/1971	303			5/13/1971	1360
376371N1213889W001	-121.3889	37.6371			5/12/1971	1.2	5/12/1971	58							5/12/1971	6.6			5/12/1971	786			5/12/1971	1480
USGS-374421121224301	-121.3796661	37.7390956			8/12/1969	1.3	6/10/1975	240							8/12/1969	6.78			8/12/1969	300			8/12/1969	1060
03S06E09D001M	-121.3284	37.6917			8/12/1969	0.5	6/10/1975	55							8/12/1969	5.9			8/12/1969	62			8/12/1969	344
376444N1213980W001	-121.398	37.6444			9/19/1968	1.1	9/19/1968	148							7/27/1962	5.6			7/27/1962	371			7/27/1962	832
02S05E22Q001M	-121.4107	37.7387			8/29/1968	1.1	8/29/1968	252							7/31/1963	4.5			7/31/1963	169			7/31/1963	841
USGS-374503121292301	-121.4907799	37.7507625			5/3/1968	1.2	5/3/1968	480					5/3/1968	70	5/3/1968	6.55			5/3/1968	320			5/3/1968	1360
02S05E10R002M	-121.4061	37.7676			5/3/1968	2.38	5/3/1968	256							5/3/1968	1.9			5/3/1968	354				
376688N1213442W001	-121.3442	37.6688			5/3/1968	1.27	6/10/1969	171							5/3/1968	5			5/3/1968	318				
02S05E10R001M	-121.4061	37.7676			5/3/1968	2.79	5/3/1968	280							5/3/1968	2.1			5/3/1968	432				
USGS-373819121192001	-121.3232743	37.6385414			5/3/1968	0.71	5/3/1968	120					5/3/1968	50	5/3/1968	5.42			5/3/1968	190			5/3/1968	628
376388N1213233W001	-121.3233	37.6388			5/3/1968	0.71	6/10/1969	110							5/3/1968	5.4			5/3/1968	189				
USGS-374007121203201	-121.3432752	37.668541			5/3/1968	1.3	5/3/1968	120					5/3/1968	50	5/3/1968	4.97			5/3/1968	320			5/3/1968	852
USGS-374609121240401	-121.4021672	37.7690951			5/3/1968	2.8	5/3/1968	280					5/3/1968	10	5/3/1968	2.08			5/3/1968	430			5/3/1968	1370
USGS-374606121240601	-121.4027227	37.7682618			5/3/1968	2.4	5/3/1968	260					5/3/1968	0	5/3/1968	1.85			5/3/1968	350			5/3/1968	1230
02S04E13N001M	-121.4931	37.7532			5/3/1968	1.21	5/3/1968	485							5/3/1968	6.6			5/3/1968	318				
USGS-374148121191001	-121.3204974	37.6965961			5/2/1968	0.93	5/2/1968	330					5/2/1968	0	5/2/1968	2.48			5/2/1968	270			5/2/1968	1040
USGS-374131121173601	-121.2943857	37.6918738			5/1/1968	5	5/1/1968	900					5/1/1968	0	5/1/1968	3.61			5/1/1968	740			5/1/1968	2760
03S06E10B001M	-121.3009	37.6917			5/1/1968	4.96	5/1/1968	905							5/1/1968	3.6			5/1/1968	735				
USGS-374339121283401	-121.477168	37.7274295			4/30/1968	2.7	4/30/1968	300					4/30/1968	20	4/30/1968	6.1			4/30/1968	390			4/30/1968	1250
377532N1213725W001	-121.3725	37.7532			4/30/1968	2.24	4/30/1968	310							4/30/1968	3.2			4/30/1968	291				
02S05E06F001M	-121.4702	37.7893			4/30/1968	0.47	4/30/1968	160							4/30/1968	0.38			4/30/1968	231				
USGS-374513121222401	-121.3743885	37.7535398			4/30/1968	2.2	4/30/1968	310					4/30/1968	190	4/30/1968	3.16			4/30/1968	290			4/30/1968	1150
03S05E04R001M	-121.4244	37.6954			4/30/1968	1.24	4/30/1968	190							4/30/1968	3.8			4/30/1968	96				
USGS-374154121250801	-121.419944	37.698263			4/30/1968	1.2	4/30/1968	190					4/30/1968	780	4/30/1968	3.84			4/30/1968	96			4/30/1968	713
377277N1214775W001	-121.4775	37.7277			4/30/1968	2.7	6/11/1969	296							4/30/1968	6.1			4/30/1968	387				
USGS-374724121275201	-121.4655023	37.7899281			4/30/1968	0.47	4/30/1968	160					4/30/1968	2800	4/30/1968	3.84			4/30/1968	230			4/30/1968	821
USGS-374046121262201	-121.4404997	37.6793745			4/30/1968	1.1	4/30/1968	100					4/30/1968	350	4/30/1968	3.39			4/30/1968	210			4/30/1968	654
USGS-374444121193501	-121.3274429	37.7454842			4/30/1968	0.52	4/30/1968	76					4/30/1968	60	4/30/1968	0.023			4/30/1968	160			4/30/1968	516
USGS-374012121155601	-121.266607	37.6699296			7/24/1967	1.5	7/24/1967	260							7/1/1954	2.48			7/1/1954	89			7/1/1954	370
03S06E13N001M	-121.2733	37.6665			7/24/1967	1.5	7/24/1967	257																
376963N1213269W001	-121.3269	37.6963			7/24/1967	1.1	7/24/1967	95											2/25/1948	210				
USGS-373728121172801	-121.2921623	37.6243748			7/20/1967	0.6	7/20/1967	190																
02S06E20J005M	-121.3329	37.7423			6/20/1967	0.7	6/20/1967	266																
USGS-374403121180801	-121.3032755	37.7340954			6/16/1967	0.3	6/16/1967	350							7/1/1954	0.813			7/1/1954	69			7/1/1954	564
377341N1213039W001	-121.3039	37.7341			6/16/1967	0.3	6/16/1967	351							7/1/1954	0.81			7/1/1954	69			9/30/1963	960
377112N1213611W001	-121.3611	37.7112			6/15/1967	1	6/15/1967	219							7/22/1959	2.3								
USGS-374358121203201	-121.3432763	37.7327067			6/15/1967	0.9	6/15/1967	260							5/31/1951	3.16			5/31/1951	280				
377330N1213436W001	-121.3436	37.733			6/15/1967	0.9	6/15/1967	256							9/13/1963	2.5			9/13/1963	200			9/13/1963	1070
03S04E02P001M	-121.5068	37.6954			6/15/1967	4.5	6/15/1967	272																
USGS-374001121192601	-121.3249415	37.6668743			6/14/1967	1.2	6/14/1967	180																
376599N1212730W001	-121.273	37.6599			6/14/1967	0.8	6/14/1967	1060																
USGS-373931121162601	-121.2749403	37.6585409			6/14/1967	0.8	6/14/1967	1100																
376680N1213267W001	-121.3267	37.668			6/14/1967	1.2	6/10/1969	235							7/22/1959	1								
USGS-373849121185601	-121.3166076	37.6468746			6/12/1967	0.8	6/12/1967	110																
376471N1213172W001	-121.3172	37.6471			6/12/1967	0.8	6/12/1967	114																
USGS-373851121213901	-121.3618863	37.6474303			6/12/1967	0.8	6/12/1967	390																
USGS-374054121162201	-121.2738295	37.6815961			6/8/1967	1.2	6/8/1967	330							7/1/1964	1.36			7/1/1964	260			7/1/1964	958
01S05E35Q003M	-121.3924	37.7965			6/8/1967	1.2	6/8/1967	137																
03S06E14A002M	-121.2781	37.6773			6/8/1967	1.2	6/8/1967	332																
USGS-374751121231001	-121.3871674	37.7974277			6/8/1967	1.2	6/8/1967	140																
USGS-373901121160001	-121.2677178	37.6502077			6/7/1967	2.4	6/7/1967	230																
376505N1212680W001	-121.268	37.6505			6/7/1967	2.4	6/7/1967	226																
USGS-374328121255401	-121.4327226	37.7243738			6/7/1967	1.1	6/7/1967	260																
USGS-374316121270801	-121.4532785	37.7210406			6/7/1967	1.2	6/7/1967	380																
377246N1214336W001	-121.4336	37.7246			6/7/1967	1.1	6/7/1967	263																
377324N1213622W001	-121.3622	37.7324			6/7/1967	0.7	6/7/1967	64																
USGS-374358121214001	-121.3621656	37.7327068			6/7/1967	0.7	6/7/1967	64																
377216N1214544W001	-121.4544	37.7216			6/7/1967	1.2	6/7/1967	381																
03S06E17D001M	-121.3466	37.6773			6/6/1967	0.9	6/6/1967	59							4/10/1959	1.9			4/10/1959	203				
03S06E14M001M	-121.2917	37.6701			6/6/1967	0.6	6/6/1967	819																
USGS-374019121170801	-121.2866074	37.6718741			6/6/1967	0.6	6/6/1967	820																
USGS-374155121192601	-121.324942	37.6985405			6/6/1967	0.8	6/6/1967	60																
377513N1214705W001	-121.4705	37.7513			6/6/1967	1.3	6/6/1967	158							7/17/1958	3.2			7/17/1958	157				
03S06E08R001M	-121.3329	37.6809			6/6/1967	0.8	6/6/1967	60																
USGS-374042121201601	-121.3388308	37.6782631			6/6/1967	0.9	6/6/1967	59							4/10/1959	1.85			4/10/1959	200			4/10/1959	550
03S06E04P001M	-121.3238	37.6954			6/5/1967	0.6	6/5/1967	376																
376966N1214378W001	-121.4378	37.6966			5/18/1967	1.3	6/11/1969	110																
USGS-374146121261401	-121.4382777	37.6960409			5/18/1967	1.3	5/18/1967	120																
USGS-373736121213801	-121.3616082	37.6265973			5/17/1967	0.3	5/17/1967	77																
376268N1213622W001	-121.3622	37.6268			5/17/1967	0.3	5/17/1967	77																
USGS-374227121245401	-121.4160552	37.7074296			5/12/1967	1.3	5/12/1967	220																
03S05E03D002M	-121.4199	37.7062			5/12/1967	1.3	5/12/1967	224																
376952N1214683W001	-121.4683	37.6952			5/12/1967	2.6	5/12/1967	122																
02S05E29A001M	-121.4427	37.7351			5/10/1967	1	5/10/1967	126																
USGS-374418121250601	-121.4193892	37.7382624			5/10/1967	0.9	5/10/1967	120			5/4/1950	0	6/28/1953	70	6/28/1953	4.52			6/28/1953	100			6/28/1953	419
02S05E28C001M	-121.4336	37.7351			5/10/1967	1	5/10/1967	169							6/28/1953	2.8			6/28/1953	18			6/28/1953	464
02S05E28A002M	-121.4244	37.7351			5/10/1967	0.9	5/10/1967	117																
USGS-374431121251201	-121.421056	37.7418735			5/10/1967	1	5/10/1967	78					6/28/1953	50	6/28/1953	3.84			6/28/1953	100			6/28/1953	423
USGS-374555121262001	-121.4399457	37.7652064			5/9/1967	0.9	5/9/1967	70					3/19/1959	120	3/19/1959	1.54			3/19/1959	110			3/19/1959	384
02S05E17B001M	-121.4473	37.764			5/9/1967	0.9	5/9/1967	70							5/24/1966	2.7			5/24/1966	240			5/24/1966	766
USGS-374645121263501	-121.4441127	37.7790949			5/8/1967	0.7	5/8/1967	56							7/8/1954	1.74			7/8/1954	130			7/8/1954	403
377813N1214420W001	-121.442	37.7813			5/8/1967	0.7	5/8/1967	56							7/8/1954	1.7			7/8/1954	129				
02S05E05J001M	-121.4427	37.7857			5/7/1967	0.7	5/7/1967	81																
02S05E14P001M	-121.397	37.7532			5/7/1967	0.9	5/7/1967	95																
USGS-374651121223801	-121.378278	37.7807614			5/7/1967	0.7	5/7/1967	390																
USGS-374710121260501	-121.4357794	37.7860392			5/7/1967	0.7	5/7/1967	81							7/30/1953	2.71			7/30/1953	130			7/30/1953	464
USGS-374741121260701	-121.436335	37.7946501			5/7/1967	0.7	5/7/1967	94																
USGS-374518121232001	-121.3899444	37.7549287			5/7/1967	0.9	5/7/1967	95																
02S05E12D001M	-121.3833	37.7784			5/7/1967	0.7	5/7/1967	387																
02S05E05A001M	-121.4427	37.7929			5/7/1967	0.7	5/7/1967	94																
USGS-374654121283001	-121.4760579	37.781595			5/6/1967	0.6	5/6/1967	63											7/31/1953	130			7/31/1953	399
377718N1214767W001	-121.4767	37.7718			5/6/1967	1	5/6/1967	335																
02S05E06N003M	-121.4748	37.7821			5/6/1967	3.4	5/6/1967	949																
02S05E07A001M	-121.461	37.7784			5/6/1967	0.6	5/6/1967	66																
USGS-374656121283101	-121.4763357	37.7821505			5/6/1967	3.4	5/6/1967	950																
02S05E06N002M	-121.4748	37.7821			5/6/1967	0.6	5/6/1967	63											7/31/1953	135				
USGS-374648121271001	-121.4538352	37.7799283			5/6/1967	0.6	5/6/1967	66																
USGS-374619121283001	-121.4760578	37.771873			5/6/1967	1	5/6/1967	340																
02S05E01N001M	-121.3833	37.7821			5/5/1967	1	5/5/1967	118							3/26/1956	0.05			3/26/1956	230				
377976N1214560W001	-121.456	37.7976			5/5/1967	0.2	5/5/1967	15																
USGS-374700121223601	-121.3777225	37.7832613			5/5/1967	1	5/5/1967	120							9/12/1957	0.203			9/12/1957	220			9/12/1957	670
USGS-374751121271401	-121.4549467	37.7974278			5/5/1967	0.2	5/5/1967	15																
02S06E06L001M	-121.3604	37.7857			5/5/1967	4.5	5/5/1967	655																
USGS-374148121235201	-121.3988324	37.6965963			5/2/1967	1.3	5/2/1967	240																
03S05E03R003M	-121.4061	37.6954			5/2/1967	1.3	5/2/1967	241																
02S04E33J001M	-121.5342	37.7134			4/28/1967	5	4/28/1967	505							7/15/1954	0.2			7/15/1954	968				
USGS-374251121315901	-121.5341136	37.7140963			4/28/1967	5	4/28/1967	500							7/15/1954	0.181			7/15/1954	970			7/15/1954	2620
USGS-374342121304401	-121.51328	37.7282628			4/27/1967	2.6	4/27/1967	360																
377288N1215136W002	-121.5136	37.7288			4/27/1967	2.6	6/11/1969	354																
USGS-374409121315401	-121.532725	37.7357627			4/27/1967	4.4	4/27/1967	260							3/20/1959	0.565								
377360N1215328W001	-121.5328	37.736			4/27/1967	4.4	4/27/1967	264							5/24/1966	0.2			5/24/1966	739			5/24/1966	1820
USGS-374516121304401	-121.5132805	37.7543735			4/25/1967	2.4	4/25/1967	150																
377528N1215156W001	-121.5156	37.7528			4/25/1967	2.4	6/11/1969	284																
USGS-374614121283501	-121.4774467	37.7704842			4/6/1967	0.6	4/6/1967	62							7/31/1953	2.94			7/31/1953	140			7/31/1953	476
02S04E12J001M	-121.4793	37.7712			4/6/1967	0.6	4/6/1967	62																
02S05E21M001M	-121.4382	37.7423			4/5/1967	0.8	4/5/1967	87																
02S05E21J001M	-121.4244	37.7423			4/5/1967	1.2	4/5/1967	124							5/20/1959	3.2			5/20/1959	118			6/28/1953	541
USGS-374442121260001	-121.4343897	37.7449291			4/5/1967	0.8	4/5/1967	87					6/28/1953	100	6/28/1953	3.39			6/28/1953	110			6/28/1953	443
02S05E21K001M	-121.429	37.7423			4/5/1967	1.1	4/5/1967	119																
USGS-374436121245801	-121.417167	37.7432624			4/5/1967	1.2	4/5/1967	120					6/28/1953	100	7/1/1959	0.904			5/20/1959	120			5/20/1959	458
USGS-374445121252401	-121.4243895	37.7457624			4/5/1967	1.1	4/5/1967	120																
USGS-374618121292001	-121.4899469	37.7715953			4/4/1967	0.7	4/4/1967	57																
02S04E12L001M	-121.4885	37.7712			4/4/1967	0.7	4/4/1967	57																
377724N1215305W002	-121.5305	37.7724			4/4/1967	3.8	4/4/1967	136																
USGS-374619121314601	-121.5305034	37.771873			4/4/1967	3.8	4/4/1967	140																
02S05E16C001M	-121.4336	37.764			11/28/1966	8	11/28/1966	405							7/1/1954	5.2			7/1/1954	991				
02S05E16C002M	-121.4336	37.764			11/28/1966	6.8	11/28/1966	340																
03S06E09E001M	-121.3284	37.6881			6/9/1966	0.6	6/9/1966	294							6/9/1966	2.5			6/9/1966	265			6/9/1966	1060
02S06E30M001M	-121.3613	37.7297			6/9/1966	0.5	6/9/1966	108							6/9/1966	1			6/9/1966	200			6/9/1966	619
03S06E05E080M	-121.3467	37.7026			6/9/1966	0.7	6/9/1966	159							6/9/1966	4.3			6/9/1966	230			6/9/1966	781
03S06E16N003M	-121.3283	37.6665			5/25/1966	0.9	5/25/1966	67							5/25/1966	4.7			5/25/1966	142			5/25/1966	572
02S04E01P001M	-121.4885	37.7821			5/24/1966	0.6	8/30/1968	50							5/24/1966	1			5/24/1966	127			5/24/1966	386
03S05E13R001M	-121.3696	37.6665			5/22/1966	2	5/22/1966	332							5/22/1966	21			5/22/1966	491			5/22/1966	1690
02S06E20H080M	-121.3329	37.7459			3/15/1966	0.7	3/15/1966	900							3/15/1966	0.93			3/15/1966	260			3/15/1966	2360
02S06E20J004M	-121.328	37.7458			2/14/1966	0.8	2/14/1966	185							2/14/1966	0.02			2/14/1966	196			2/14/1966	736
01S06E09F001M	-121.3238	37.8615			10/4/1965	0.1	10/4/1965	76							10/4/1965	0			10/4/1965	35			10/4/1965	392
USGS-374048121161601	-121.2721628	37.6799295			6/1/1965	0.9	6/1/1965	220							6/1/1965	3.84			6/1/1965	340			6/1/1965	1150
USGS-374425121243001	-121.409389	37.7402068			5/28/1965	1.3	5/28/1965	240							5/28/1965	4.52			5/28/1965	160			5/28/1965	906
02S06E19P001M	-121.3604	37.7387			5/28/1965	2.2	5/28/1965	316							5/28/1965	6.6			5/28/1965	277				
USGS-374433121211801	-121.3560546	37.7424288			5/28/1965	2.2	5/28/1965	320							5/28/1965	6.55			5/28/1965	280			5/28/1965	1230
02S05E22P080M	-121.4153	37.7387			5/28/1965	1.3	5/28/1965	239							5/28/1965	4.5			5/28/1965	156				
01S06E13D002M	-121.2734	37.8507			5/26/1965	0.24	5/26/1965	28							5/26/1965	2			5/26/1965	8			10/13/1960	243
02S05E01R080M	-121.3695	37.7821			5/24/1965	1.3	5/24/1965	253							5/24/1965	0.9			5/24/1965	558				
01S06E13D001M	-121.2734	37.8507			5/17/1965	0.6	5/17/1965	26							5/17/1965	7.2			5/17/1965	37				
377116N1213428W001	-121.3428	37.7116			10/11/1963	1.3	10/11/1963	174															10/11/1963	765
03S06E06C001M	-121.3604	37.7062			10/11/1963	2.7	10/11/1963	571							10/11/1963	7			10/11/1963	224			10/11/1963	1660
02S06E31K001M	-121.3558	37.7134			10/11/1963	2.3	10/11/1963	346															10/11/1963	1160
02S06E21J001M	-121.3146	37.7423			9/30/1963	0.19	9/30/1963	224							7/1/1954	0.56			7/1/1954	7			9/30/1963	682
02S06E33K001M	-121.3192	37.7134			9/30/1963	3.4	9/30/1963	318							7/1/1954	5.9			7/1/1954	216			9/30/1963	1860
02S06E04R002M	-121.3146	37.7821			9/27/1963	0.33	9/27/1963	344															9/27/1963	786
02S06E17B001M	-121.3375	37.764			9/27/1963	0.83	9/27/1963	93							7/9/1954	0.2			7/9/1954	158			9/27/1963	586
02S06E04J001M	-121.3146	37.7857			9/27/1963	0.15	9/27/1963	258															9/27/1963	655
02S06E17L001M	-121.3421	37.7568			9/27/1963	1.2	9/27/1963	360							7/9/1954	0.47			7/9/1954	178			9/27/1963	1320
02S06E19E001M	-121.365	37.7459			9/27/1963	1.3	9/27/1963	331															9/27/1963	1140
02S06E20J001M	-121.3329	37.7423			9/13/1963	0.5	9/13/1963	833							9/13/1963	0.09			9/13/1963	177			9/13/1963	1770
02S06E30K001M	-121.3558	37.7279			9/13/1963	0.98	9/13/1963	297															9/13/1963	948
02S05E24R001M	-121.3695	37.7387			8/8/1963	1.9	8/8/1963	213							8/8/1963	3.2			8/8/1963	178			8/8/1963	832
02S05E23P001M	-121.397	37.7387			7/31/1963	2	8/29/1968	198					7/18/1958	0	7/31/1963	7.9			7/31/1963	237			7/31/1963	1200

WELL_NAME	LONGITUDE_NAD83	LATITUDE_NAD83	AS_Date	AS	B_Date	B	CL_Date	CL	CR6_Date	CR6	MN_Date	MN	FE_Date	FE	NO3N_Date	NO3N	SE_Date	SE	SO4_Date	SO4	TCPR123_D	TCPR123	TDS_Date	TDS
03S06E07F001M	-121.3604	37.6881			7/26/1963	2	8/29/1968	420					7/29/1958	60	7/26/1963	5			7/26/1963	204			7/26/1963	1110
01S06E35N001M	-121.2918	37.7965			6/20/1963	0.2	6/20/1963	156							6/20/1963	0.61			6/20/1963	14			6/20/1963	472
01S06E34E001M	-121.3101	37.8037			6/15/1963	0.2	6/15/1963	133							6/15/1963	0			6/15/1963	24			6/15/1963	424
02S05E06H001M	-121.461	37.7893			3/21/1963	0.4	3/21/1963	70																
02S05E24H080M	-121.3695	37.7459			3/21/1963	1.7	3/21/1963	498																
03S05E34H080M	-121.4062	37.6303			3/21/1963	1.1	3/21/1963	86																
02S04E15B080M	-121.5205	37.764			3/21/1963	3.7	3/21/1963	285																
02S04E27H080M	-121.5159	37.7315			3/21/1963	2.8																		
02S05E18G001M	-121.4656	37.7604			3/21/1963	1.2																		
03S05E33A080M	-121.4245	37.6339			3/21/1963	1.5	3/21/1963	244																
03S04E12C001M	-121.4885	37.6917			3/20/1963	1.6																		
03S05E19E080M	-121.4747	37.6592			3/20/1963	9.6	3/20/1963	294																
03S05E17A080M	-121.4428	37.6773			3/19/1963	1.7	3/19/1963	131											7/21/1953	206				
03S05E15D080M	-121.4198	37.6773			3/19/1963	1.1	3/19/1963	169											7/20/1953	107				
03S05E35B080M	-121.3924	37.6339			3/19/1963	0.9	3/19/1963	76																
03S05E05Q080M	-121.4473	37.6954			3/19/1963	1.5	3/19/1963	123											7/21/1953	229				
03S05E16A001M	-121.4245	37.6773			3/19/1963	1.2	3/19/1963	128																
03S05E17R001M	-121.4428	37.6665			3/15/1963	3.1	3/15/1963	120																
02S05E16Q080M	-121.429	37.7532			3/15/1963	1.8	1/28/1963	170							9/12/1957	2.9			9/12/1957	174				
USGS-374652121291801	-121.4893916	37.7810395			3/15/1963	0.8	3/15/1963	76							4/21/1959	1.22			4/21/1959	140			4/21/1959	395
02S04E01P002M	-121.4885	37.7821			3/15/1963	0.7																		
USGS-373952121260401	-121.4354993	37.6643747			3/15/1963	3.2	3/15/1963	130							8/29/1957	0.61			8/29/1957	310			8/29/1957	907
02S04E24A080M	-121.4793	37.7495			3/15/1963	1.2	3/15/1963	165																
USGS-374000121261801	-121.4393883	37.6665969			3/15/1963	3.1	3/15/1963	120																
02S04E13L001M	-121.4885	37.7568			3/14/1963	1	3/14/1963	239																
USGS-374524121292401	-121.4910578	37.7565957			3/14/1963	1	3/14/1963	240																
USGS-374413121265501	-121.4496676	37.7368737			3/13/1963	2	3/13/1963	290							4/21/1959	7.23			4/21/1959	190			4/21/1959	1250
02S05E32R001M	-121.4427	37.7098			3/12/1963	1.3	4/22/1959	148							4/22/1959	4.7			4/22/1959	88				
USGS-374241121260201	-121.4349446	37.7113185			3/12/1963	1.3	3/12/1963	180							4/22/1959	4.74			4/22/1959	88			4/22/1959	607
03S05E05H080M	-121.4427	37.7026			3/12/1963	0.9	3/12/1963	193											7/21/1953	61				
02S05E28P002M	-121.4336	37.7243			3/12/1963	1.6	8/30/1957	175							8/30/1957	3.2			8/30/1957	107				
02S05E17Q082M	-121.4473	37.7532			3/11/1963	1.9	1/28/1963	260							3/19/1959	2.3								
USGS-374349121253001	-121.4260559	37.730207			3/11/1963	0.6	1/1/1963	180							7/8/1954	3.39			7/8/1954	98			7/8/1954	479
02S05E17A080M	-121.4427	37.764			3/11/1963	0.4																		
02S05E29A003M	-121.4427	37.7351			3/11/1963	1.3	1/28/1963	110							6/17/1959	3.6			5/20/1959	89			6/28/1953	468
02S05E09Q002M	-121.429	37.7676			3/8/1963	5.5	3/8/1963	265																
02S05E17Q081M	-121.4473	37.7532			3/8/1963	0.6	1/28/1963	100							3/19/1959	2.7			3/19/1959	112				
USGS-374616121251601	-121.4221677	37.7710395			3/8/1963	6.1	1/28/1963	160																
02S05E09K081M	-121.429	37.7712			3/8/1963	6.1	7/8/1954	279							7/8/1954	3.2			7/8/1954	705				
02S05E17P001M	-121.4519	37.7532			3/8/1963	0.8	1/28/1963	100							4/14/1959	1								
01S06E22Q001M	-121.3009	37.8254			8/7/1961	0.62	8/7/1961	34							8/7/1961	2.5			8/7/1961	117				
USGS-373728121184801	-121.314385	37.6243749			4/28/1961	0.34	4/28/1961	32											4/28/1961	110			4/28/1961	476
03S05E02E001M	-121.3969	37.7066			10/13/1960	0.9	10/13/1960	85							10/13/1960	5.4			10/13/1960	256			10/13/1960	659
01S06E13F001M	-121.2688	37.8471			10/13/1960	0.1	10/13/1960	10					10/13/1960	10	10/13/1960	0.81			10/13/1960	11			10/13/1960	217
01S06E13F002M	-121.2688	37.8471			10/13/1960	0.1	10/13/1960	20					10/13/1960	10	10/13/1960	0.97			10/13/1960	10			10/13/1960	225
01S06E13E001M	-121.2734	37.8471			10/13/1960	0.1	10/13/1960	22							10/13/1960	0.86			10/13/1960	11			10/13/1960	222
02S06E08Q001M	-121.3375	37.7676			9/7/1960	1.2	9/7/1960	266																
377030N1213044W001	-121.3044	37.703			9/7/1960	2.5	9/7/1960	341																
376443N1212717W001	-121.2717	37.6443			9/7/1960	2	9/7/1960	215																
02S05E23D001M	-121.4016	37.7495			8/4/1960	1.92	8/4/1960	301							8/4/1960	3.4			8/4/1960	212				
03S05E35D001M	-121.4015	37.6339			8/4/1960	0.92	8/4/1960	74							8/4/1960	3.8			8/4/1960	343				
03S07E18Q001M	-121.2459	37.6665			8/19/1959	0.09	8/19/1959	34							8/19/1959	0.56								
USGS-374213121234801	-121.3977214	37.7035407			8/6/1959	1																	8/6/1959	660
01S06E08K001M	-121.3375	37.8579			4/22/1959	0.42	7/1/1959	1138							4/22/1959	0.38			4/22/1959	15				
USGS-374239121304001	-121.5121685	37.7107631			4/21/1959	1.7	4/21/1959	450							4/21/1959	0.904			4/21/1959	540			4/21/1959	1810
377110N1215122W001	-121.5122	37.711			4/21/1959	1.7																		
03S06E16L001M	-121.3238	37.6701			4/10/1959	0.56	4/10/1959	37							4/10/1959	0.95			4/10/1959	151				
USGS-374018121185001	-121.3149413	37.6715964			4/10/1959	0.56	4/10/1959	37							4/10/1959	0.949			4/10/1959	150			4/10/1959	462
03S06E05Q001M	-121.3375	37.6954			4/10/1959	0.61	4/10/1959	40							4/10/1959	2.55								
03S06E15M001M	-121.31	37.6701			4/10/1959	0.94	4/10/1959	103							4/10/1959	2.2			4/10/1959	178				
01S06E23Q001M	-121.2826	37.8254			4/9/1959	0.37	4/9/1959	109							4/9/1959	0.32			4/9/1959	12				
USGS-374345121213601	-121.3610544	37.7290957			4/9/1959	0.81	4/9/1959	98							4/9/1959	0.904			4/9/1959	210			4/9/1959	623
03S06E17G001M	-121.3375	37.6737			4/9/1959	1.1	4/9/1959	65							4/9/1959	3.8			4/9/1959	237				
02S05E09Q080M	-121.429	37.7676			3/19/1959	6.3	3/19/1959	251							3/19/1959	3.6			3/19/1959	595				
02S06E03F001M	-121.3055	37.7893			3/19/1959	0.28	3/19/1959	34							3/19/1959	0.1			3/19/1959	8.7				
377391N1214400W001	-121.44	37.7391			7/17/1958	1.2	7/17/1958	320							7/17/1958	5.2			7/17/1958	149				
02S06E20J003M	-121.3329	37.7423			9/13/1957	0.42	9/13/1957	50							9/13/1957	0.1			9/13/1957	152				
03S06E15D080M	-121.31	37.6773			9/13/1957	0.45	9/13/1957	255							9/13/1957	1.3			9/13/1957	151				
02S05E12D002M	-121.3833	37.7784			9/12/1957	1.1	9/12/1957	119							9/12/1957	0.2			9/12/1957	225				
02S05E16N002M	-121.4382	37.7532			9/12/1957	0.43	9/12/1957	117							9/12/1957	3.2			9/12/1957	244				
01S06E35D001M	-121.2918	37.8073			9/6/1957	0.14	10/4/1976	436							10/4/1976	0.9			10/4/1976	58			10/22/1975	1165
03S05E03N001M	-121.4199	37.6954			8/29/1957	1.1	3/16/1966	144							8/29/1957	12			8/29/1957	106				
03S06E06C080M	-121.3604	37.7062			8/20/1957	2	8/20/1957	375							8/20/1957	2.5			8/20/1957	178				
02S05E17R001M	-121.4427	37.7532			8/13/1957	1.7	8/13/1957	62							8/13/1957	2.7			8/13/1957	115				
02S05E22P001M	-121.4153	37.7387			8/1/1957	0.72	8/1/1957	215							8/1/1957	2.9			8/1/1957	148				
02S05E32R010M	-121.4427	37.7098			8/1/1957	0.56	8/1/1957	149							8/1/1957	4.5			8/1/1957	93				
03S06E03M080M	-121.3101	37.699			4/25/1956	0.56	9/8/1959	245							4/25/1956	0.2			4/25/1956	126				
02S06E03C001M	-121.3055	37.7929			8/23/1954	1	8/23/1954	54							8/23/1954	0.02			8/23/1954	16				
01S06E19H001M	-121.3512	37.8326			7/26/1954	0.36	7/26/1954	925							7/26/1954	0.07			7/26/1954	31				
01S06E17D001M	-121.3467	37.8507			7/26/1954	0.11	7/26/1954	1270							7/26/1954	0.61			7/26/1954	40			7/26/1954	2140
03S05E35N001M	-121.4015	37.6231			7/14/1954	0.89	7/14/1954	71							7/14/1954	4.7			7/14/1954	342				
02S05E35E001M	-121.4016	37.717			7/8/1954	0.83	7/8/1954	90							7/8/1954	4.1			7/8/1954	259				
01N04E15F001M	-121.5251	37.9338			7/2/1954	1.4	7/2/1954	133							7/2/1954	1.3			7/2/1954	0.4				
01N04E17K001M	-121.5571	37.9302			7/2/1954	3.8	7/2/1954	82							7/2/1954	0.1			7/2/1954	101				
03S06E13N080M	-121.2733	37.6665			7/1/1954	0.41	7/1/1954	28							7/1/1954	2.5			7/1/1954	89				
03S06E02K001M	-121.2826	37.699			7/1/1954	0.01	7/1/1954	56							7/1/1954	0.02			7/1/1954	12				
02S05E16F001M	-121.4336	37.7604			7/1/1954	1.3	7/1/1954	105							7/1/1954	1.2			7/1/1954	226				
01N05E19F001M	-121.4702	37.9193			7/1/1954	0.7	7/1/1954	136							7/1/1954	0.1			7/1/1954	75				
01N05E20E001M	-121.4565	37.9193			7/1/1954	0.86	7/1/1954	226							7/1/1954	0.2			7/1/1954	83				
01N04E23M001M	-121.5114	37.9157			7/1/1954	0.16	7/1/1954	57							7/1/1954	0.52			7/1/1954	27				
03S06E10J001M	-121.2963	37.6845			7/1/1954	0.77	7/1/1954	46							7/1/1954	2.3			7/1/1954	173				
02S05E17Q080M	-121.4473	37.7532			6/30/1954	0.9	6/30/1954	70							6/30/1954	2.2			6/30/1954	135				
01N05E16R001M	-121.4244	37.9266			6/30/1954	0.4	6/30/1954	354							6/30/1954	0.43			6/30/1954	42				
01N05E21A001M	-121.4244	37.9229			6/29/1954	0.55	6/29/1954	574							6/29/1954	0.7			6/29/1954	50				
02S04E12J080M	-121.4793	37.7712			7/31/1953	0.44	7/31/1953	81							7/31/1953	2.9			7/31/1953	145				
02S05E07C001M	-121.4702	37.7784			7/31/1953	0.41	7/31/1953	65											7/31/1953	128				
02S05E18R001M	-121.461	37.7532			7/31/1953	0.85	7/31/1953	90											7/31/1953	148				
02S05E04E001M	-121.4382	37.7893			7/30/1953	0.44	7/30/1953	185											7/30/1953	305				
02S04E01N001M	-121.4931	37.7821			7/28/1953	0.6	7/28/1953	82											7/28/1953	194				
03S06E08L080M	-121.3421	37.6845			7/24/1953	0.92	7/24/1953	92							7/24/1953	9			7/24/1953	123				
USGS-374325121260401	-121.4355004	37.7235405			7/24/1953	0.72	7/24/1953	220							7/24/1953	3.39			7/24/1953	95			7/24/1953	879
377235N1214358W001	-121.4358	37.7235			7/24/1953	0.72	7/24/1953	215							7/24/1953	3.4			7/24/1953	95				
03S06E23H080M	-121.2781	37.6592			7/23/1953	0.39	7/23/1953	575											7/23/1953	137				
03S06E14N002M	-121.2917	37.6665			7/23/1953	0.56	7/23/1953	542											7/23/1953	196				
03S06E14N001M	-121.2917	37.6665			7/23/1953	0.84	7/23/1953	600							7/23/1953	1.7			7/23/1953	175				
03S06E23K080M	-121.2826	37.6556			7/23/1953	0.42	7/23/1953	200											7/23/1953	191				
03S05E10E080M	-121.4199	37.6881			7/22/1953	0.33	7/22/1953	405											7/22/1953	162				
03S06E07Q080M	-121.3558	37.6809			7/22/1953	2.8	7/22/1953	1100							7/22/1953	30.7			7/22/1953	604				
03S05E09E080M	-121.4382	37.6881			7/22/1953	0.31	7/22/1953	108											7/22/1953	177				
376674N1213612W001	-121.3612	37.6674			7/22/1953	1.5	7/22/1953	185											7/22/1953	305				
03S05E20H080M	-121.4428	37.6592			7/21/1953	1.6	7/21/1953	128											7/21/1953	321				
03S05E09B080M	-121.429	37.6917			7/21/1953	0.27	7/21/1953	136											7/21/1953	49				
03S05E26E080M	-121.4015	37.6447			7/17/1953	0.4	7/17/1953	55											7/17/1953	285				
02S06E19L001M	-121.3604	37.7423			11/30/1951	0.7	11/30/1951	250																
USGS-374352121213401	-121.3604989	37.7310401			11/30/1951	0.5	11/30/1951	73																
03S05E08E001M	-121.4565	37.6881			9/26/1951	0.2	9/26/1951	74.7							9/26/1951	0.99			9/26/1951	42				
03S06E05G001M	-121.3375	37.7026			9/6/1951	0.7	9/6/1951	77.2							9/6/1951	7.14			9/6/1951	72				
376810N1214253W001	-121.4253	37.681			7/26/1951	0.01	7/26/1951	74															7/26/1951	923
USGS-374048121252401	-121.4243882	37.67993			7/26/1951	1.1	7/26/1951	74																
03S06E04H001M	-121.3146	37.7026			7/26/1951	0.4	7/26/1951	29							7/26/1951	3.66			7/26/1951	35			5/26/1950	237
01S06E08Q080M	-121.3375	37.8543			6/30/1947	1.1	6/30/1947	920											6/30/1947	160				
03S06E08M001M	-121.3467	37.6845			7/27/1946	0.51	7/27/1946	43											7/27/1946	183				
01S06E34B080M	-121.3009	37.8073			6/5/1945	0.28	6/5/1945	485											6/5/1945	50				
3901426-007	-121.415735	37.799466					7/13/2016	22			7/13/2016	181	7/13/2016	0	8/12/2019	0.4			7/13/2016	10			7/13/2016	300
3901116-007	-121.399009	37.739222					2/28/2010	133			2/28/2010	20	2/28/2010	172	2/11/2019	0.4	2/28/2010	5	2/28/2010	287	2/11/2019	0.005	2/28/2010	776
3901116-001	-121.399037	37.739218					6/20/2007	240							2/4/2013	0.5			6/20/2007	168				
3901017-001	-121.39	37.63					11/4/2002	45.2							2/3/2003	9.7								
03S06E17Q001M	-121.3375	37.6665					6/13/1979	270											6/13/1979	260			6/13/1979	1020
01S06E25M002M	-121.2734	37.8146					10/7/1976	64							10/7/1976	0.9			10/7/1976	16			10/23/1975	367
01S06E26H001M	-121.278	37.8182					10/7/1976	48							10/7/1976	0.2			10/7/1976	11			10/23/1975	293
01S06E26L001M	-121.2872	37.8146					10/7/1976	308							10/7/1976	1			10/7/1976	40			10/23/1975	832
01S06E23L001M	-121.2872	37.829					10/6/1976	550							10/6/1976	2			10/6/1976	58			10/22/1975	1542
01S06E36G001M	-121.2642	37.8037					10/4/1976	20							10/4/1976	0.7			10/4/1976	16			10/22/1975	284
01S06E26D002M	-121.2918	37.8218					10/4/1976	674							10/4/1976	1			10/4/1976	79			10/22/1975	1355
01S06E35E004M	-121.2918	37.8037					10/4/1976	548							10/4/1976	2			10/4/1976	263			10/2/1974	1354
01N05E21A002M	-121.4244	37.9229					12/8/1975	215															12/8/1975	733
01S06E34E004M	-121.3101	37.8037					10/22/1975	520							10/22/1975	5.4			10/22/1975	355			10/22/1975	1944
376674N1213583W001	-121.3583	37.6674					3/16/1966	208																
376388N1213056W001	-121.3056	37.6388					3/16/1966	204																
02S06E33K002M	-121.3192	37.7134					11/26/1963	345																
01S06E34A001M	-121.2963	37.8073					1/28/1963	210																
01S06E35D080M	-121.2918	37.8073					1/28/1963	400																
01S06E35E002M	-121.2918	37.8037					1/28/1963	200																
02S05E21B001M	-121.429	37.7495					1/28/1963	100																
02S05E09K080M	-121.429	37.7712					1/28/1963	160																
01S06E27Q002M	-121.3009	37.811					1/28/1963	210																
01S06E34K080M	-121.3009	37.8001					1/28/1963	170																
01S06E35E003M	-121.2918	37.8037					1/28/1963	160																
01S06E34L001M	-121.3055	37.8001					1/28/1963	200																
01S06E27J001M	-121.2963	37.8146					1/28/1963	540																
01S06E35R080M	-121.278	37.7965					1/28/1963	30																
01S06E35E001M	-121.2918	37.8037					1/28/1963	180																
01S06E11Q080M	-121.2826	37.8543					12/12/1962	60																
01S06E27R001M	-121.2963	37.811					12/12/1962	170																
01S06E23F080M	-121.2872	37.8326					12/12/1962	1040																
01S06E23F002M	-121.2872	37.8326					12/12/1962	365																
01S06E23P002M	-121.2872	37.8254					12/3/1962	200																
01S06E27A001M	-121.2963	37.8218					12/3/1962	290							4/9/1959	5.08								
01S06E35B001M	-121.2826	37.8073					12/3/1962	120							7/27/1962	0.1			7/27/1962	85			7/27/1962	618
01S06E25N001M	-121.2734	37.811					12/3/1962	25																
01S06E23P001M	-121.2872	37.8254					12/3/1962	100																
01S06E23E001M	-121.2918	37.8326					12/3/1962	560																
01S06E26D001M	-121.2918	37.8218					12/3/1962	330																
USGS-374212121181001	-121.3038305	37.7032626					9/7/1960	340																
02S06E28Q080M	-121.3192	37.7243					9/8/1959	283																
03S06E14A005M	-121.2781	37.6773					7/25/1959	84							7/25/1959	0.56								
03S05E13M001M	-121.3832	37.6701					7/22/1959	336							7/22/1959	6.8								
03S06E07M001M	-121.365	37.6845					7/18/1959	165							7/18/1959	2.3								
02S04E28P001M	-121.5434	37.7243					7/16/1959	120							7/16/1959	0.56								

WELL NAME	LONGITUDE NAD83	LATITUDE NAD83	AS Date	AS	B Date	B	CL Date	CL	CR6 Date	CR6	MN Date	MN	FE Date	FE	NO3N Date	NO3N	SE Date	SE	SO4_Date	SO4	TCPR123 D	TCPR123	TDS_Date	TDS
03S06E13E080M	-121.2733	37.6737					7/10/1957	151																
03S06E24Q080M	-121.2642	37.652					7/8/1957	181																
02S06E34J080M	-121.2963	37.7134					7/8/1957	178																
02S06E33A080M	-121.3146	37.7206					5/22/1957	39																
02S06E33Q001M	-121.3192	37.7098					9/6/1955	274																
01S06E31E001M	-121.365	37.8037					6/11/1954	595																
01S06E19E001M	-121.365	37.8326					6/11/1954	825																
02S06E04E001M	-121.3284	37.7893					6/11/1954	72.6							6/11/1954	13			6/11/1954	48				
01S06E20E001M	-121.3467	37.8326					6/11/1954	957																
01S06E23C001M	-121.2872	37.8362					5/25/1954	118																
01S06E35C001M	-121.2872	37.8073					5/25/1954	168																
01S06E34G002M	-121.3009	37.8037					5/25/1954	242																
01S06E23L002M	-121.2872	37.829					5/25/1954	212																
01S06E23F003M	-121.2872	37.8326					5/25/1954	332																
01S06E23F001M	-121.2872	37.8326					5/25/1954	94																
01S06E34G001M	-121.3009	37.8037					5/24/1954	332																
01S06E22L001M	-121.3055	37.829					5/24/1954	1380																
01S06E22G001M	-121.3009	37.8326					5/24/1954	704																
01N05E27B001M	-121.4107	37.9085					12/17/1952	1230																
01N05E23E001M	-121.4016	37.9193					12/15/1952	970																
377385N1213789W001	-121.3789	37.7385					5/22/1951	180							5/22/1951	2.5			5/22/1951	220			5/22/1951	860
01S06E06M002M	-121.365	37.8724					5/10/1950	281																
03S06E03A080M	-121.2963	37.7062					1/26/1950	46											3/29/1944	130			3/29/1944	480
376966N1213986W001	-121.3986	37.6966					11/26/1947	44.6							11/26/1947	9.8			11/26/1947	212				
3901406-001	-121.474027	37.766333									6/18/2018	0	6/18/2018	280	12/9/2019	10								
3900593-001	-121.488002	37.891215									2/19/2018	80.9	2/19/2018	1000	10/21/2019	0.4								
3900759-003	-121.471581	37.982798									12/18/2017	410	12/18/2017	430	4/22/2019	0.4								
02S05E19D001M	-121.4748	37.7495											7/17/1958	20										
3901388-007	-121.474094	37.986365													2/14/2020	0								
3901355-001	-121.48	37.89													1/22/2020	0.4								
3901430-001	-121.512766	37.891449													1/22/2020	0.4					8/12/2019	0.005		
3600756-001	-121.494583	38.037472													1/22/2020	3.2								
3900588-001	-121.36	37.74													1/13/2020	9.6								
3901015-001	-121.450392	37.805066													1/13/2020	0.4								
3901011-001	-121.434174	37.695843													1/13/2020	1.5								
3901301-001	-121.425948	37.927085													12/18/2019	0.4								
3901283-001	-121.361198	37.667467													12/10/2019	8.6								
3900974-001	-121.366611	37.742638													12/10/2019	10								
3901435-007	-121.397886	37.64166													12/9/2019	6.4								
3901447-007	-121.415735	37.799466													11/7/2019	0.4								
3901310-007	-121.403473	37.740293													10/7/2019	4.2								
3901299-007	-121.373063	37.753588													8/12/2019	0.4								
3902191-001	-121.452762	37.764586													7/23/2019	0.4								
3900998-001	-121.460777	37.818722													7/8/2019	1								
3901328-005	-121.4166	37.697811													5/28/2019	1.4								
3901006-001	-121.537176	37.718897													5/22/2019	3.5								
3902187-001	-121.398542	37.740091													3/6/2019	0.4								
3901106-008	-121.458072	37.804969													2/7/2019	0.4								
3901299-001	-121.372933	37.753624													8/17/2017	1								
3900731-001	-121.27	37.85													6/6/2016	2.6								
3901419-001	-121.306083	37.787083													1/21/2015	0.09								
3901310-001	-121.403277	37.740277													10/2/2012	3.03								
3901383-001	-121.424888	37.955403													7/17/2012	0.09								
3900651-002	-121.45	37.99													8/13/2008	0.09								
3901388-001	-121.472503	37.98639													3/4/2008	0.25					1/8/2018	0.005		
3901001-002	-121.39	37.69													12/13/2005	10.2								
3900904-001	-121.3	37.78													9/16/2003	0.27								
3900737-001	-121.343333	37.949444													8/21/2003	0.1								
3900737-002	-121.343333	37.949444													8/21/2003	0.1								
3901106-002	-121.456666	37.805													8/14/2002	0.09								
3901001-001	-121.398611	37.696111													5/21/2002	2.85								
3910015-001	-121.266667	37.816667													7/25/2001	2								
USGS-373700121170001	-121.2899167	37.6316667																			2/8/2005	0		
TRCY-08	-121.2899167	37.63166667																			2/8/2005	0.18		
USGS-374828121205301	-121.3490556	37.8078056																			1/6/2005	0		
TRCYFP-06	-121.3490556	37.80780556																			1/6/2005	0.18		
TRCY-01	-121.3270833	37.74419444																			1/5/2005	0.18		
USGS-374439121193401	-121.3270833	37.7441944																			1/5/2005	0		
1.All Data																								
Min			7/1/1959	0	6/5/1945	0	6/5/1945	1.1	5/1/2001	0	5/4/1950	0	6/28/1953	0	11/26/1947	0	7/1/1959	0	3/29/1944	0.2	8/27/1984	0	3/29/1944	82
Max			1/14/2020	54	12/2/2019	9.6	1/14/2020	2400	10/5/2018	29	1/14/2020	17600	1/14/2020	25700	2/14/2020	81.1	12/9/2019	35	12/9/2019	1420	2/11/2020	0.5	1/14/2020	4500
Units in Raw Data				ug/l		mg/l		mg/l		ug/l		ug/l		ug/l		mg/l		ug/l		mg/l		ug/l		mg/l
MCL				10		1		250		10		50		300		10		50		250		0.005		4500
Above MCL				32		227		210		5		67		34		21		0		122		25		269
# of wells with analytical results				195		584		664		75		190		206		537		136		465		126		376
Average				6.11		1.1		243.59		3.63		450.52		817.7		3.04		4.1		197.8		0.059		932.68
2.Public Supply and IRLP wells (1/1/2010-Present)																								
Min			4/29/2010	0	4/29/2010	0	2/28/2010	1.1	3/6/2014	0	2/28/2010	0	2/28/2010	0	8/3/2010	0	2/28/2010	0	2/28/2010	2	2/7/2011	0	2/28/2010	82
Max			1/14/2020	54	12/2/2019	2.5	1/14/2020	1590	10/5/2018	29	1/14/2020	2900	1/14/2020	22700	2/14/2020	38.4	12/9/2019	35	12/9/2019	515	2/11/2020	0.5	1/14/2020	4290
Units in Raw Data				ug/l		mg/l		mg/l		ug/l		ug/l		ug/l		mg/l		ug/l		mg/l		ug/l		mg/l
MCL				10		1		250		10		50		300		10		50		250		0.005		4500
Above MCL				17		16		58		4		20		14		3		0		16		6		0
# of wells with analytical results				76		45		58		63		69		69		114		75		58		68		59
Average				6.73		0.82		160.06		3.32		173.71		831.02		3.18		5.08		149.28		0.0115		766.41

APPENDIX I
WATER QUALITY TREND GRAPHS

APPENDIX F – WATER QUALITY TRENDS

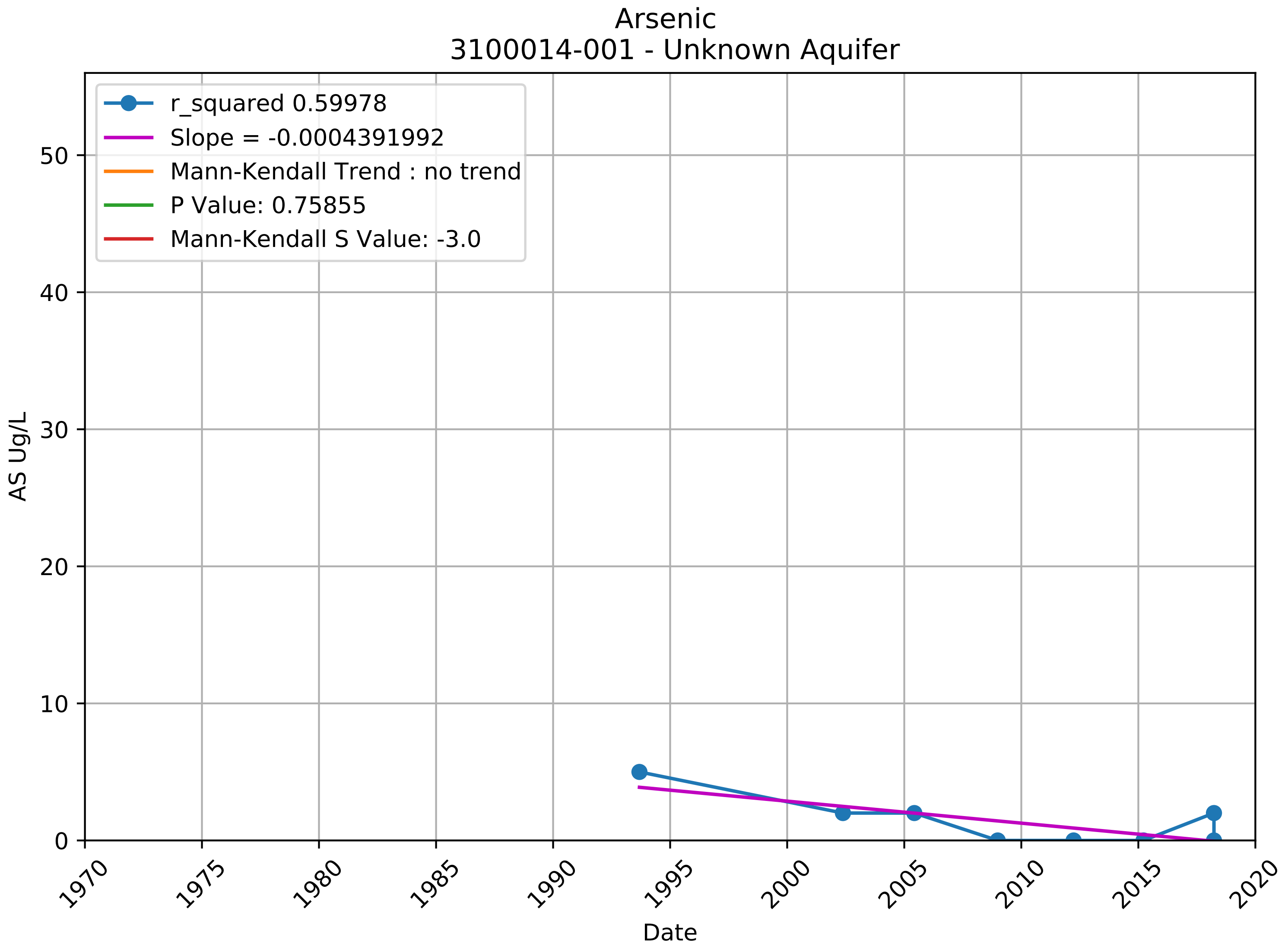
METHODS AND APPROACH

A statistical trend analysis of the data was performed using the Mann-Kendall method when the well had more than five samples for a given element. This method is a nonparametric (for example, does not assume a distribution in the data) test for identifying trends in time-series data. The Mann-Kendall test for trend detection assumes that the sample data are serially independent since the presence of positive serial correlation increases the probability that the Mann-Kendall test detects trend even though no such trend exists. The accepted approach is to remove the serial correlation from the time series before application of the test. This process is called the pre-whitening (Zhang et al. 2001; Burn and Elnur 2002). After removing the effect of serial correlation from the respective time series by pre-whitening, the Mann-Kendall test compares the relative magnitudes of sample data rather than the data values themselves. The initial value of the Mann-Kendall statistic, S, was assumed to be 0 (that is, no trend). If a concentration from a later sampling event is higher than a concentration from an earlier sampling event, S is incremented by 1. Conversely, if the concentration from a later sampling event is lower than a concentration sampled earlier, S is decremented by 1. The final value of S is equal to the net result of all such increments and decrements. A positive S indicates an increasing trend.

Arsenic

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
3910011-007	37.714471	-121.426009	AS	FALSE	0.203	-11	-0.393	no trend	61.667	-1.273	Unknown
3910011-010	37.736372	-121.435351	AS	FALSE	0.471	17	0.142	no trend	492.333	0.721	Unknown
3910702-003	37.705557	-121.39764	AS	TRUE	0	978	0.317	increasing	46807.33	4.516	Unknown
3910701-003	37.85144	-121.2682	AS	FALSE	0.271	-237	-0.088	no trend	45903	-1.102	Unknown
3910701-001	37.849584	-121.268763	AS	FALSE	0.721	45	0.035	no trend	15144.33	0.358	Unknown
3910011-017	37.738215	-121.419962	AS	FALSE	0.462	-4	-0.4	no trend	16.667	-0.735	Unknown
3910018-001	37.679751	-121.272617	AS	FALSE	0.127	-18	-0.4	no trend	124	-1.527	Unknown
4300611-002	37.994444	-121.499722	AS	FALSE	0.242	-5	-0.333	no trend	11.667	-1.171	Unknown
3910015-005	37.816859	-121.266705	AS	TRUE	0.02	254	0.235	increasing	11884	2.321	Upper
3910011-003	37.683959	-121.439427	AS	TRUE	0.006	136	0.335	increasing	2383.333	2.765	Lower
3910800-002	37.744188	-121.32701	AS	FALSE	0.19	105	0.149	no trend	6297.667	1.311	Unknown
3910800-003	37.74545	-121.32897	AS	FALSE	0.788	16	0.037	no trend	3124	0.268	Unknown
3910800-001	37.744746	-121.327221	AS	FALSE	0.734	-2	-0.333	no trend	8.667	-0.34	Unknown
3910800-004	37.74591	-121.336213	AS	TRUE	0.028	183	0.247	increasing	6829	2.202	Unknown
3100014-001	37.716956	-121.379533	AS	FALSE	0.759	-3	-0.143	no trend	42.333	-0.307	Unknown
3910701-005	37.851301	-121.2673	AS	TRUE	0.022	-464	-0.187	decreasing	40576.67	-2.298	Unknown
3910011-004	37.682308	-121.436988	AS	TRUE	0.001	123	0.446	increasing	1384.333	3.279	Lower
3910011-006	37.686539	-121.443515	AS	TRUE	0.014	91	0.303	increasing	1334.333	2.464	Lower
3910011-005	37.683353	-121.443313	AS	TRUE	0	200	0.43	increasing	2803.333	3.759	Lower
3910015-006	37.818884	-121.266416	AS	FALSE	0.203	-144	-0.128	no trend	12636	-1.272	Upper
3910015-007	37.811547	-121.263915	AS	FALSE	0.993	2	0.002	no trend	12624	0.009	Upper
3910015-008	37.801132	-121.262514	AS	FALSE	0.104	-156	-0.173	no trend	9110.667	-1.624	Upper
3910011-018	37.743262	-121.424805	AS	TRUE	0.002	133	0.443	increasing	1786.333	3.123	Lower
3910018-004	37.679705	-121.272761	AS	FALSE	0.649	-4	-0.19	no trend	43.333	-0.456	Unknown
3910701-007	37.851431	-121.265247	AS	FALSE	0.626	-27	-0.067	no trend	2839	-0.488	Unknown
3910702-006	37.709972	-121.390802	AS	TRUE	0	979	0.362	increasing	42417.67	4.749	Unknown
3910702-005	37.708149	-121.393881	AS	TRUE	0	836	0.318	increasing	42831.33	4.035	Unknown
4110013-014	37.7	-121.466667	AS	FALSE	0.077	26	0.394	no trend	199.333	1.771	Unknown
3900993-001	37.668527	-121.323805	AS	FALSE	0.217	7	0.467	no trend	23.667	1.233	Unknown
3901396-001	37.856888	-121.279555	AS	FALSE	0.228	-23	-0.253	no trend	333.667	-1.204	Unknown
3901398-001	37.716956	-121.379533	AS	FALSE	0.734	-2	-0.333	no trend	8.667	-0.34	Unknown
3900991-001	37.743544	-121.461428	AS	FALSE	0.086	-8	-0.8	no trend	16.667	-1.715	Unknown
3910011-030	37.740208	-121.439285	AS	FALSE	0.986	-2	-0.005	no trend	3122	-0.018	Lower
3900719-001	37.7685	-121.35325	AS	FALSE	0.462	-4	-0.4	no trend	16.667	-0.735	Unknown
3901348-002	37.702894	-121.406986	AS	FALSE	1	0	0	no trend	28.333	0	Unknown
3901181-001	37.692555	-121.428055	AS	FALSE	0.371	-3	-0.5	no trend	5	-0.894	Unknown
3900818-001	37.85	-121.28	AS	FALSE	0.764	3	0.143	no trend	44.333	0.3	Unknown
3901409-001	37.709642	-121.426004	AS	FALSE	1	0	0	no trend	16.667	0	Unknown
3901204-001	37.85	-121.27	AS	FALSE	0.212	11	0.393	no trend	64.333	1.247	Unknown
3901305-007	37.741365	-121.399277	AS	FALSE	0.734	2	0.333	no trend	8.667	0.34	Unknown
3900713-001	37.84	-121.44	AS	FALSE	0.271	19	0.244	no trend	267.667	1.1	Unknown
3901378-002	37.743671	-121.362772	AS	FALSE	0.124	-66	-0.22	no trend	1785.333	-1.538	Unknown
3901172-002	37.636324	-121.399544	AS	FALSE	1	0	0	no trend	16.667	0	Unknown
3901172-003	37.632289	-121.39736	AS	FALSE	1	0	0	no trend	28.333	0	Unknown
3900702-001	37.990639	-121.407056	AS	FALSE	0.436	5	0.333	no trend	26.333	0.779	Unknown
3900583-001	37.84	-121.44	AS	FALSE	0.086	8	0.8	no trend	16.667	1.715	Unknown
3900810-001	37.804543	-121.267078	AS	TRUE	0.002	-310	-0.313	decreasing	10404	-3.029	Unknown
3901216-002	37.74753	-121.516649	AS	FALSE	0.308	-4	-0.667	no trend	8.667	-1.019	Unknown
3900559-001	37.79	-121.38	AS	FALSE	0.308	-4	-0.667	no trend	8.667	-1.019	Unknown
3900558-002	37.79	-121.4	AS	FALSE	0.096	-7	-0.7	no trend	13	-1.664	Unknown
3910011-034	37.752802	-121.434603	AS	FALSE	0.058	79	0.225	no trend	1695	1.895	Lower
3910011-032	37.754682	-121.465249	AS	FALSE	0.441	34	0.113	no trend	1833.333	0.771	Lower
3901348-003	37.698742	-121.409917	AS	FALSE	1	1	0.048	no trend	27.667	0	Unknown
3901348-004	37.698147	-121.416153	AS	FALSE	1	1	0.067	no trend	19.667	0	Unknown
3900810-002	37.808086	-121.271346	AS	FALSE	0.195	-108	-0.146	no trend	6811.333	-1.296	Unknown
3910015-013	37.792108	-121.274608	AS	FALSE	0.298	-20	-0.22	no trend	332.667	-1.042	Unknown
377427N1213943W002	37.742656	-121.394318	AS	FALSE	0.1	-34	-0.324	no trend	402.667	-1.645	Lower
377427N1213943W001	37.742656	-121.394318	AS	FALSE	0.767	7	0.067	no trend	408.333	0.297	Lower
377427N1213943W003	37.742656	-121.394318	AS	FALSE	0.367	-19	-0.181	no trend	397.667	-0.903	Lower
377402N1214508W001	37.740187	-121.450762	AS	FALSE	0.138	-31	-0.295	no trend	408.333	-1.485	Lower
377143N1214459W002	37.714305	-121.445905	AS	FALSE	0.304	-21	-0.2	no trend	379	-1.027	Lower
377143N1214459W003	37.714305	-121.445905	AS	FALSE	0.2	-26	-0.248	no trend	380	-1.282	Lower
377402N1214508W003	37.740187	-121.450762	AS	FALSE	0.802	-6	-0.057	no trend	397.333	-0.251	Lower
377402N1214508W002	37.740187	-121.450762	AS	FALSE	0.057	-39	-0.371	no trend	399	-1.902	Lower
377143N1214459W001	37.714305	-121.445905	AS	FALSE	0.276	23	0.219	no trend	408.333	1.089	Lower
3901309-008	37.694682	-121.411996	AS	FALSE	0.242	-5	-0.333	no trend	11.667	-1.171	Unknown
3901397-007	37.759762	-121.508982	AS	FALSE	1	-1	-0.167	no trend	7.667	0	Unknown
377656N1214199W001	37.765631	-121.41992	AS	FALSE	0.111	-23	-0.348	no trend	190.333	-1.595	Lower
377656N1214199W002	37.765631	-121.41992	AS	FALSE	0.303	-12	-0.267	no trend	114	-1.03	Lower
377656N1214199W003	37.765631	-121.41992	AS	TRUE	0.03	-36	-0.462	decreasing	259.333	-2.173	Lower
377149N1214257W003	37.714872	-121.425674	AS	FALSE	0.134	-22	-0.333	no trend	196.667	-1.497	Lower
377149N1214257W002	37.714872	-121.425674	AS	FALSE	0.778	-5	-0.076	no trend	201.667	-0.282	Lower
377149N1214257W001	37.714872	-121.425674	AS	FALSE	0.383	-15	-0.192	no trend	257.667	-0.872	Lower

377031N1214485W002	37.703055	-121.448544	AS	FALSE	0.234	-20	-0.256	no trend	255.333	-1.189	Lower
377031N1214485W001	37.703055	-121.448544	AS	TRUE	0.038	-34	-0.436	decreasing	252.667	-2.076	Lower
377031N1214485W003	37.703055	-121.448544	AS	TRUE	0.014	-40	-0.513	decreasing	250	-2.467	Lower
3910005-044	37.782808	-121.300937	AS	TRUE	0.002	-2043	-0.163	decreasing	450746.3	-3.042	Unknown
3910800-006	37.744722	-121.329167	AS	TRUE	0.028	149	0.266	increasing	4550.333	2.194	Unknown
3901420-001	37.690618	-121.432012	AS	FALSE	1	0	0	no trend	8.667	0	Unknown
3910015-016	37.80114	-121.262596	AS	FALSE	0.109	-46	-0.269	no trend	790	-1.601	Upper



Arsenic
3100014-001 - Unknown Aquifer
r_squared 0.59978
Slope = -0.0004391992
Mann-Kendall Trend : no trend
P Value: 0.75855
Mann-Kendall S Value: -3.0
AS Ug/L
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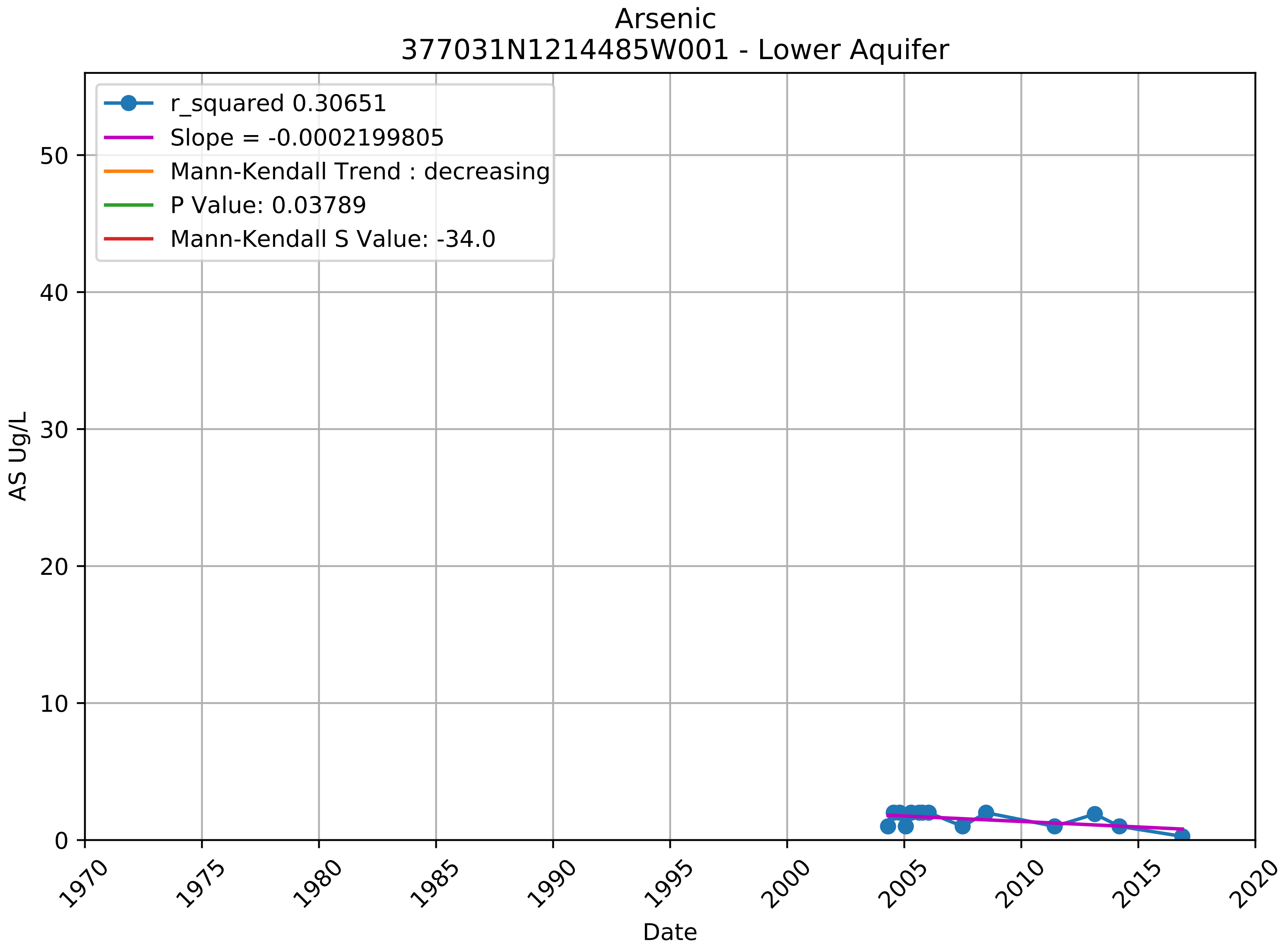
Arsenic
377031N1214485W001 - Lower Aquifer
r_squared 0.30651
Slope = -0.0002199805
Mann-Kendall Trend : decreasing
P Value: 0.03789
Mann-Kendall S Value: -34.0
AS Ug/L
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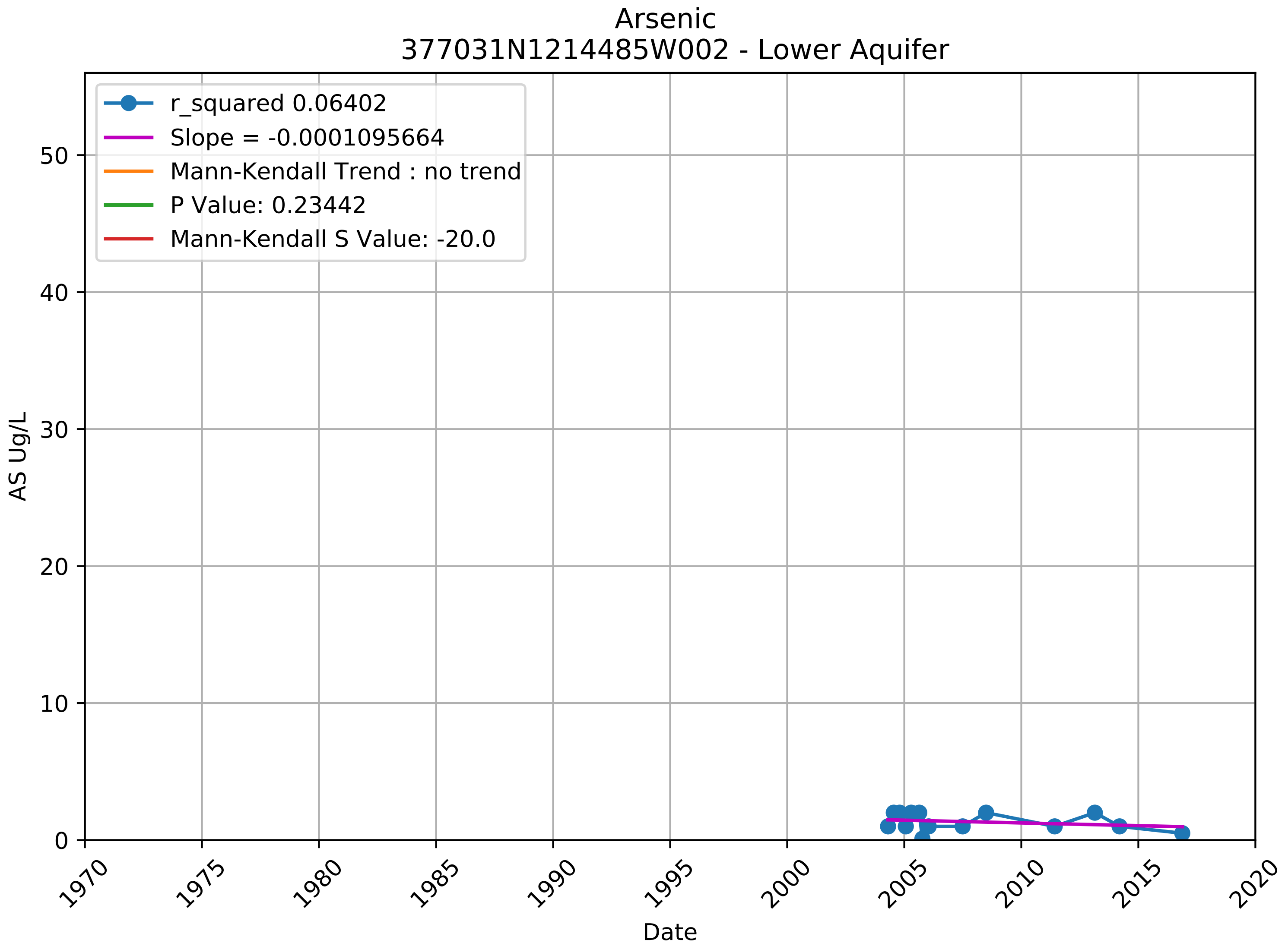

Arsenic
377031N1214485W002 - Lower Aquifer
r_squared 0.06402
Slope = -0.0001095664
Mann-Kendall Trend : no trend
P Value: 0.23442
Mann-Kendall S Value: -20.0
AS Ug/L
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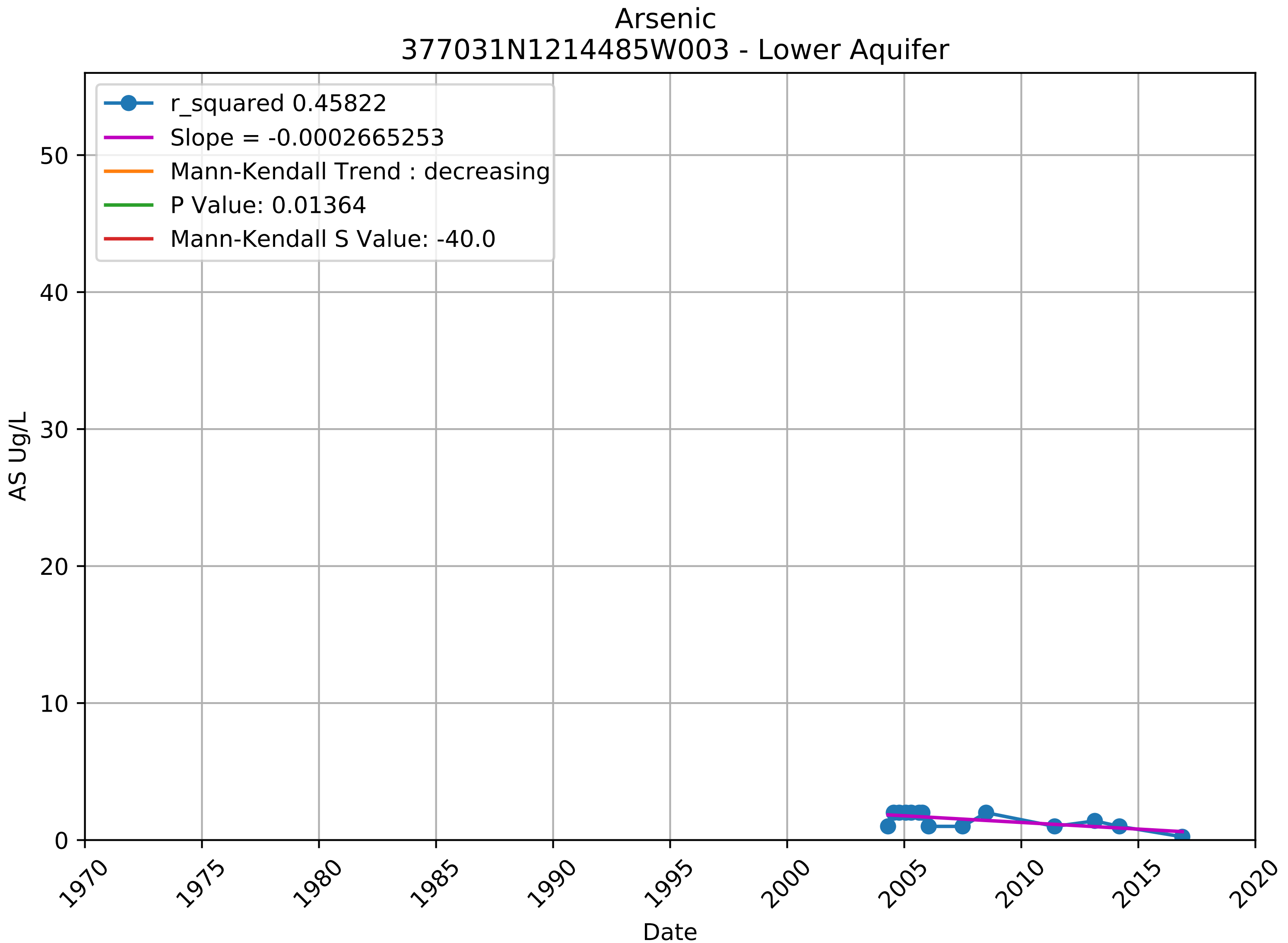

Arsenic
377031N1214485W003 - Lower Aquifer
r_squared 0.45822
Slope = -0.0002665253
Mann-Kendall Trend : decreasing
P Value: 0.01364
Mann-Kendall S Value: -40.0
AS Ug/L
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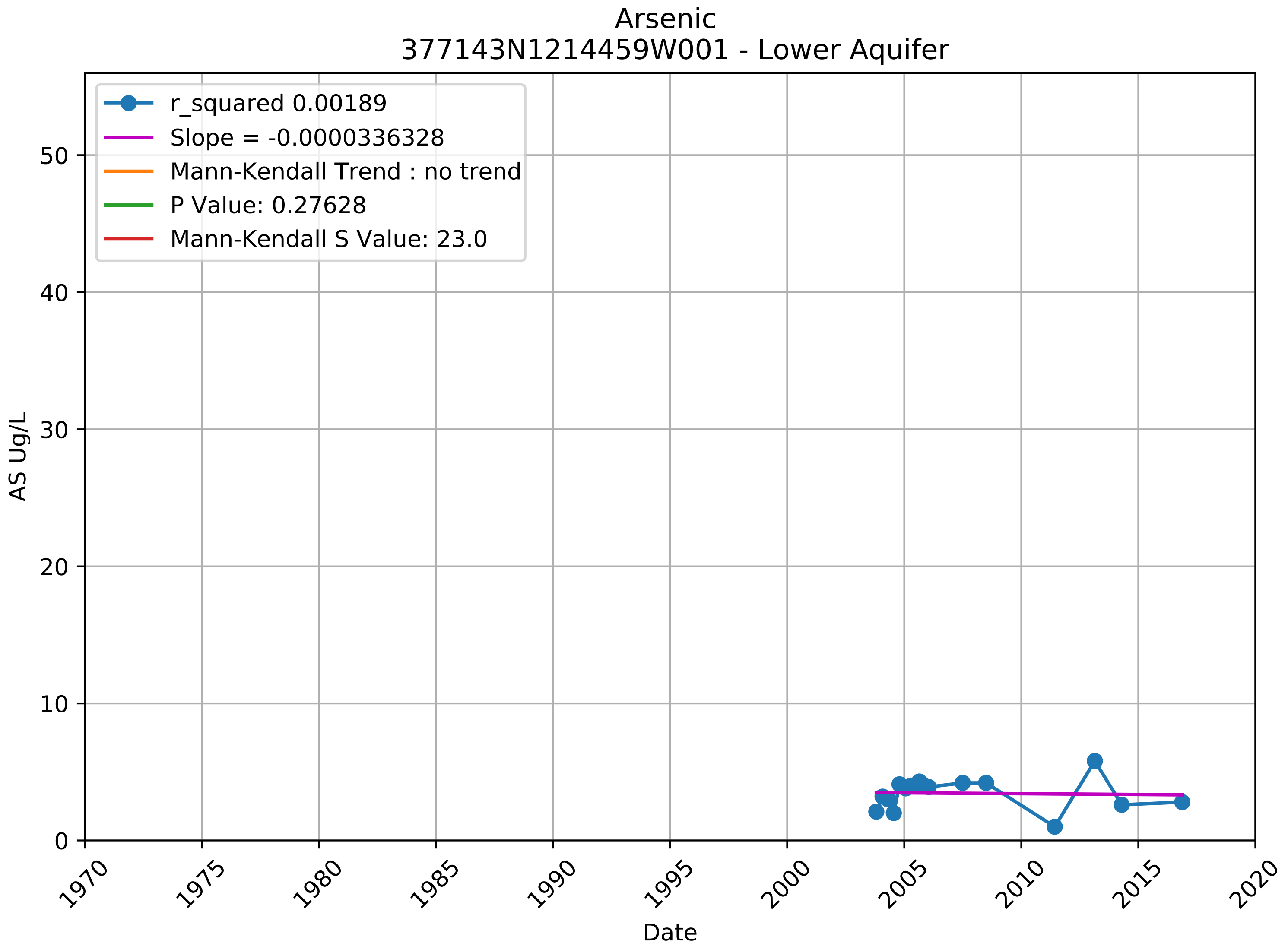

Arsenic
377143N1214459W001 - Lower Aquifer
r_squared 0.00189
Slope = -0.0000336328
Mann-Kendall Trend : no trend
P Value: 0.27628
Mann-Kendall S Value: 23.0
AS Ug/L
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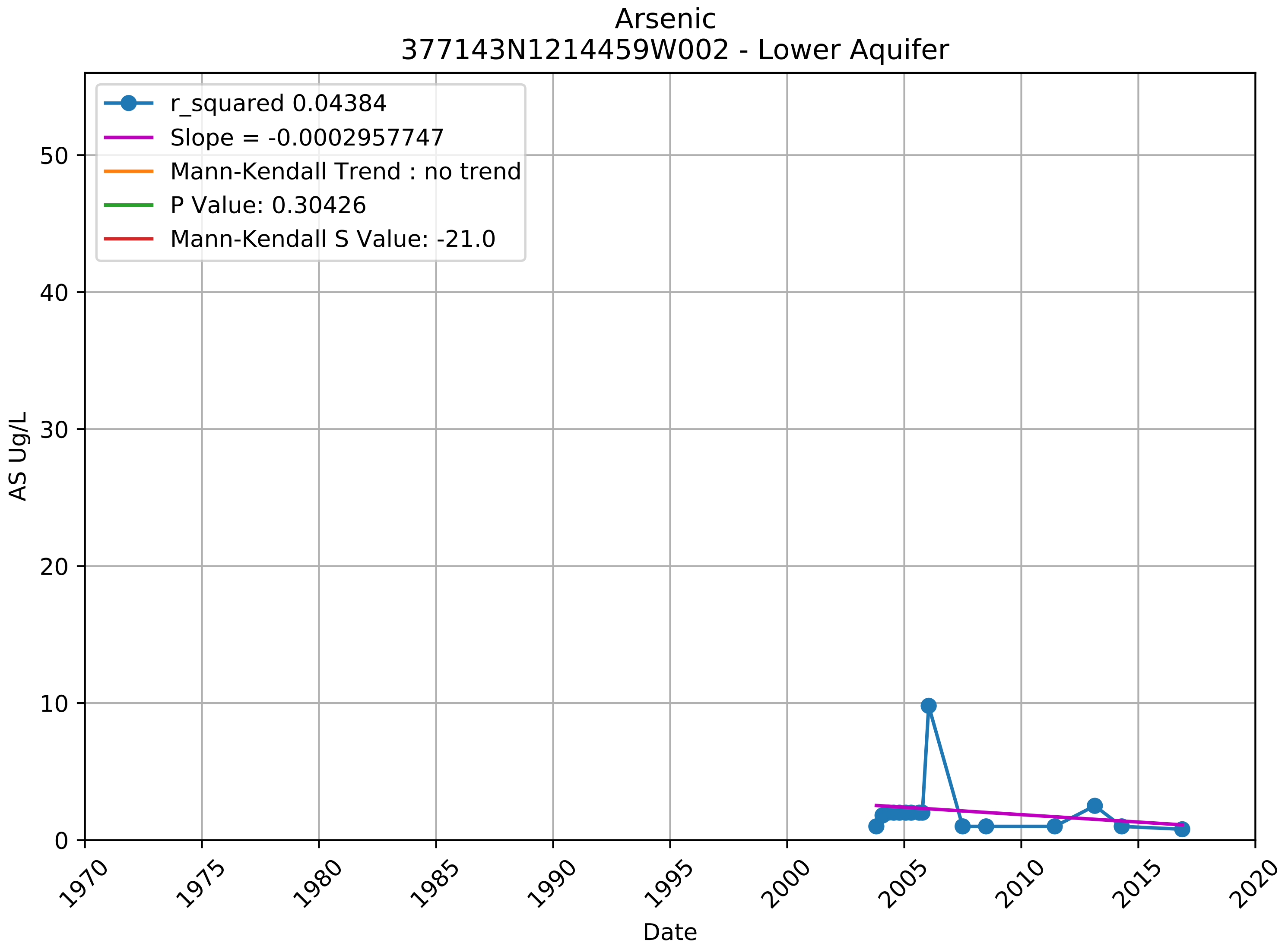

Arsenic
377143N1214459W002 - Lower Aquifer
r_squared 0.04384
Slope = -0.0002957747
Mann-Kendall Trend : no trend
P Value: 0.30426
Mann-Kendall S Value: -21.0
AS Ug/L
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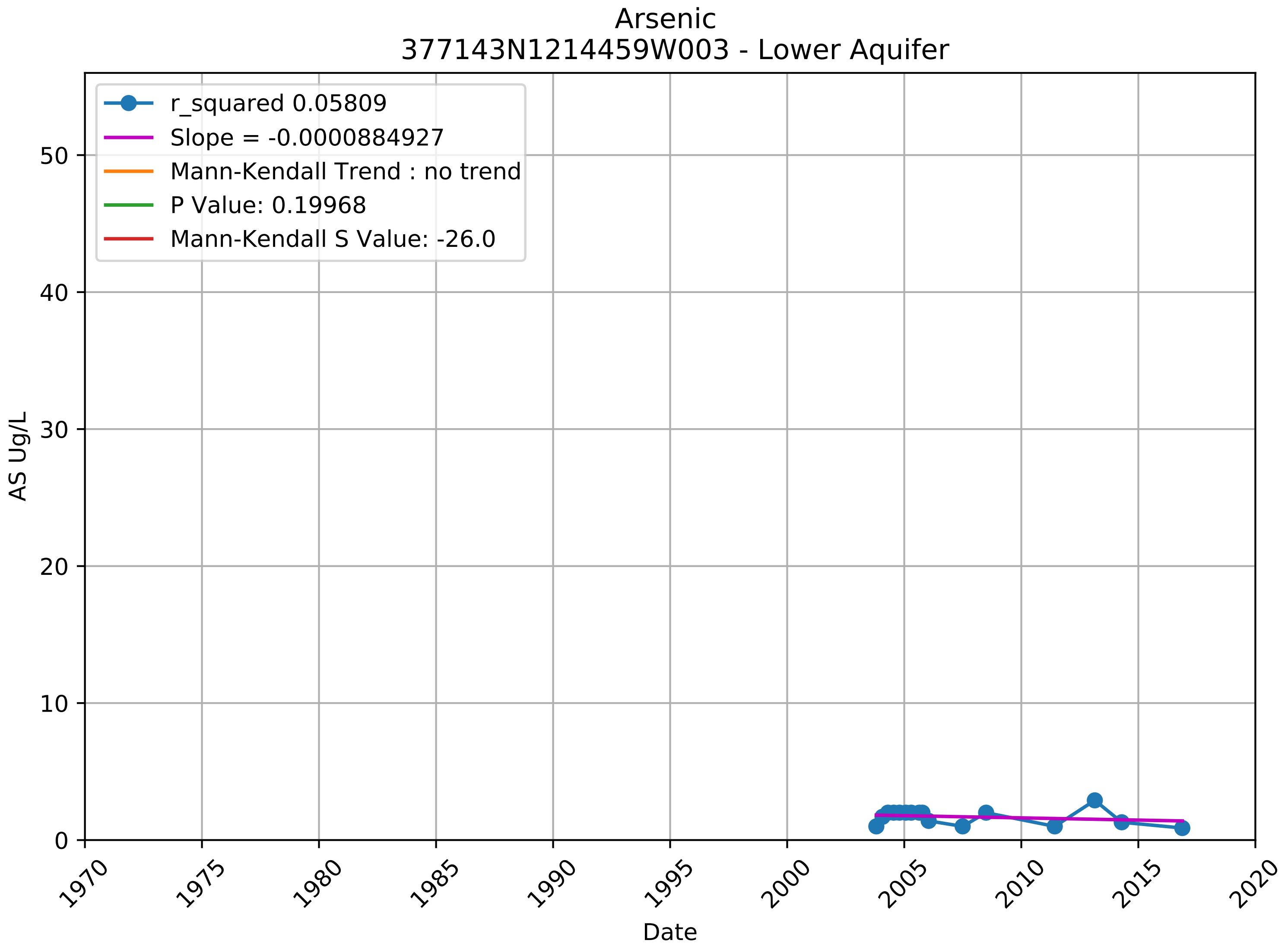

Arsenic
377143N1214459W003 - Lower Aquifer
r_squared 0.05809
Slope = -0.0000884927
Mann-Kendall Trend : no trend
P Value: 0.19968
Mann-Kendall S Value: -26.0
AS Ug/L
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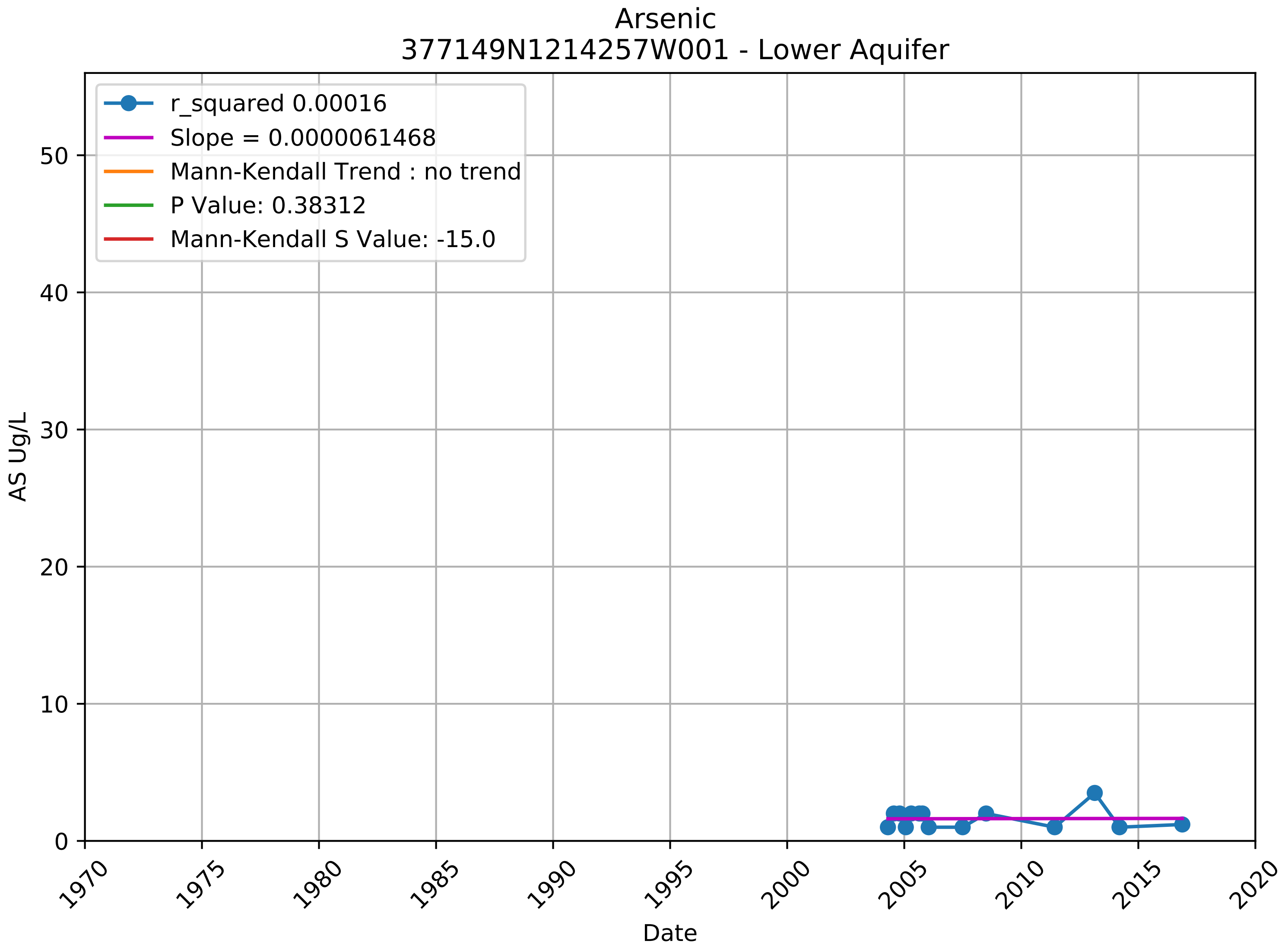

Arsenic
377149N1214257W001 - Lower Aquifer
r_squared 0.00016
Slope = 0.0000061468
Mann-Kendall Trend : no trend
P Value: 0.38312
Mann-Kendall S Value: -15.0
AS Ug/L
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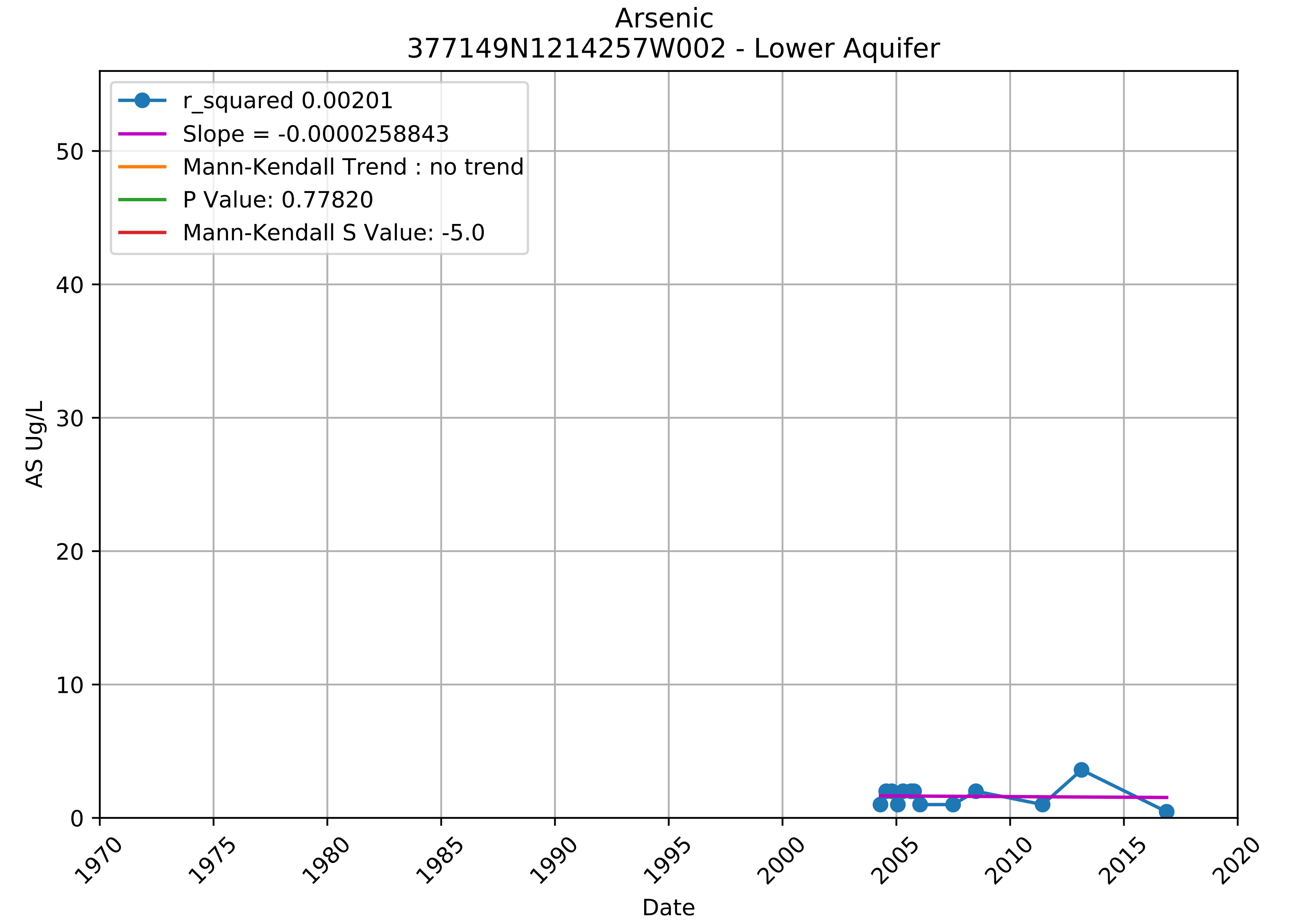

Arsenic
377149N1214257W002 - Lower Aquifer
r_squared 0.00201
Slope = -0.0000258843
Mann-Kendall Trend : no trend
P Value: 0.77820
Mann-Kendall S Value: -5.0
AS Ug/L
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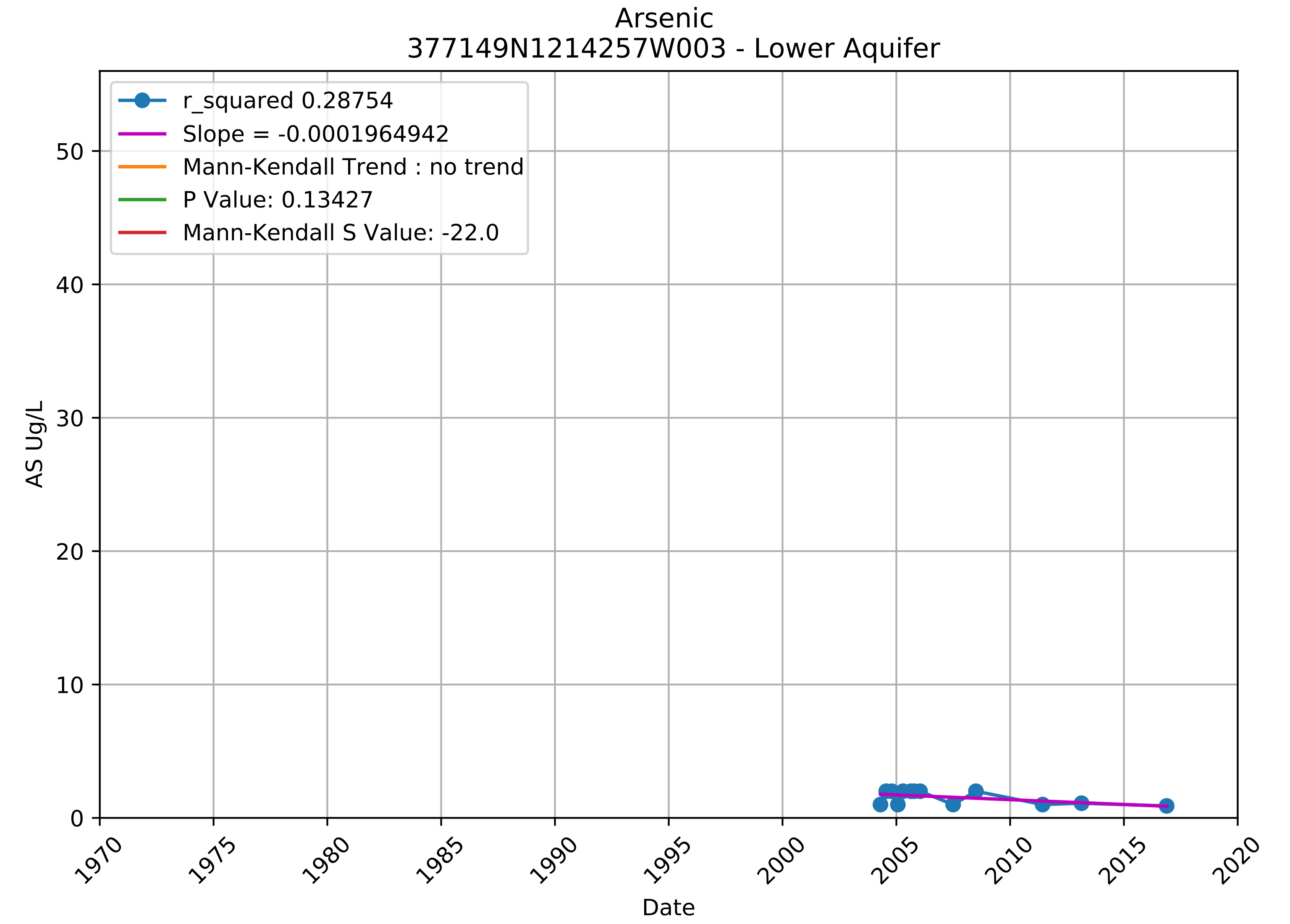

Arsenic
377149N1214257W003 - Lower Aquifer
r_squared 0.28754
Slope = -0.0001964942
Mann-Kendall Trend : no trend
P Value: 0.13427
Mann-Kendall S Value: -22.0
AS Ug/L
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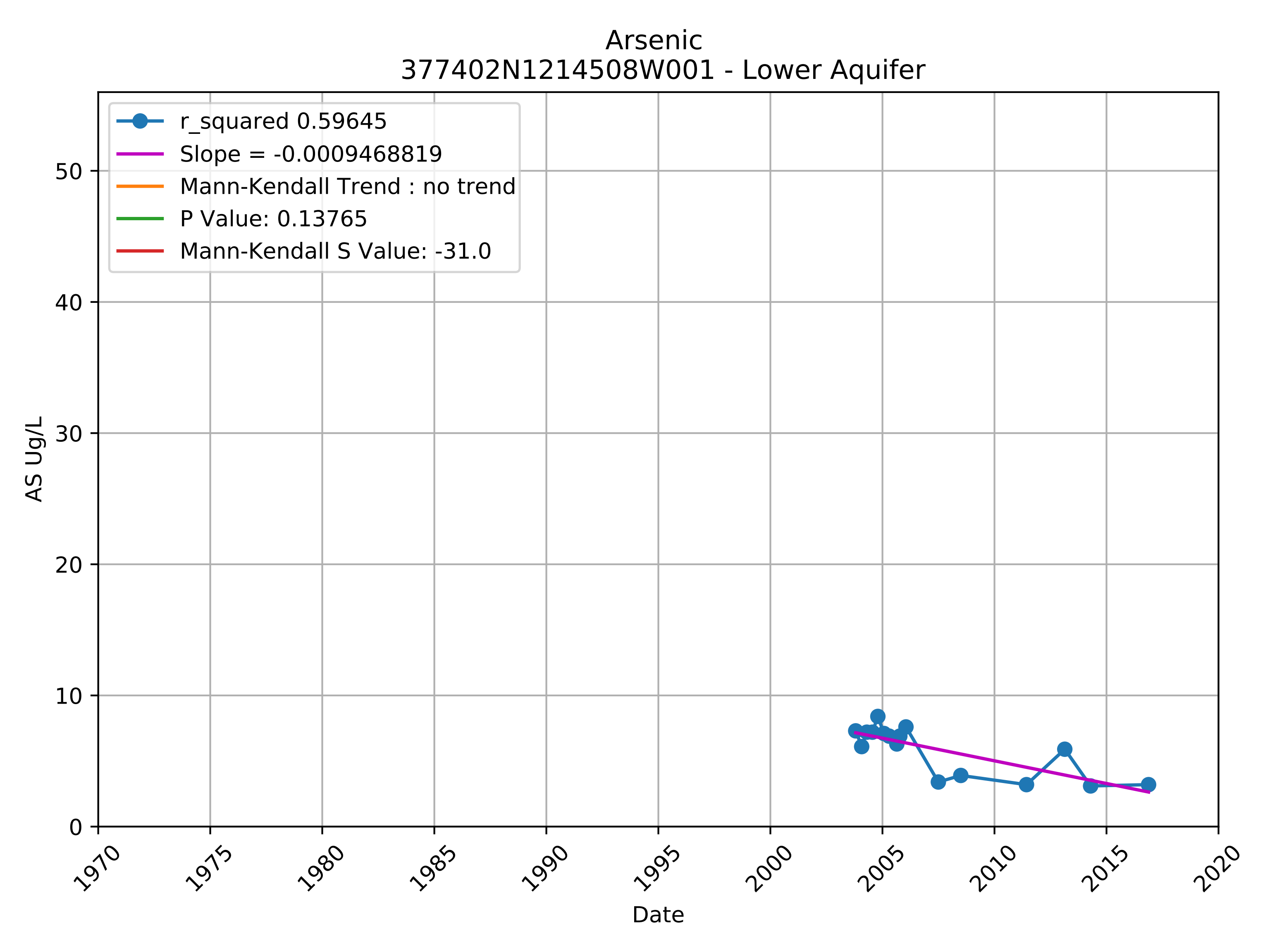

Arsenic
377402N1214508W001 - Lower Aquifer
r_squared 0.59645
Slope = -0.0009468819
Mann-Kendall Trend : no trend
P Value: 0.13765
Mann-Kendall S Value: -31.0
AS Ug/L
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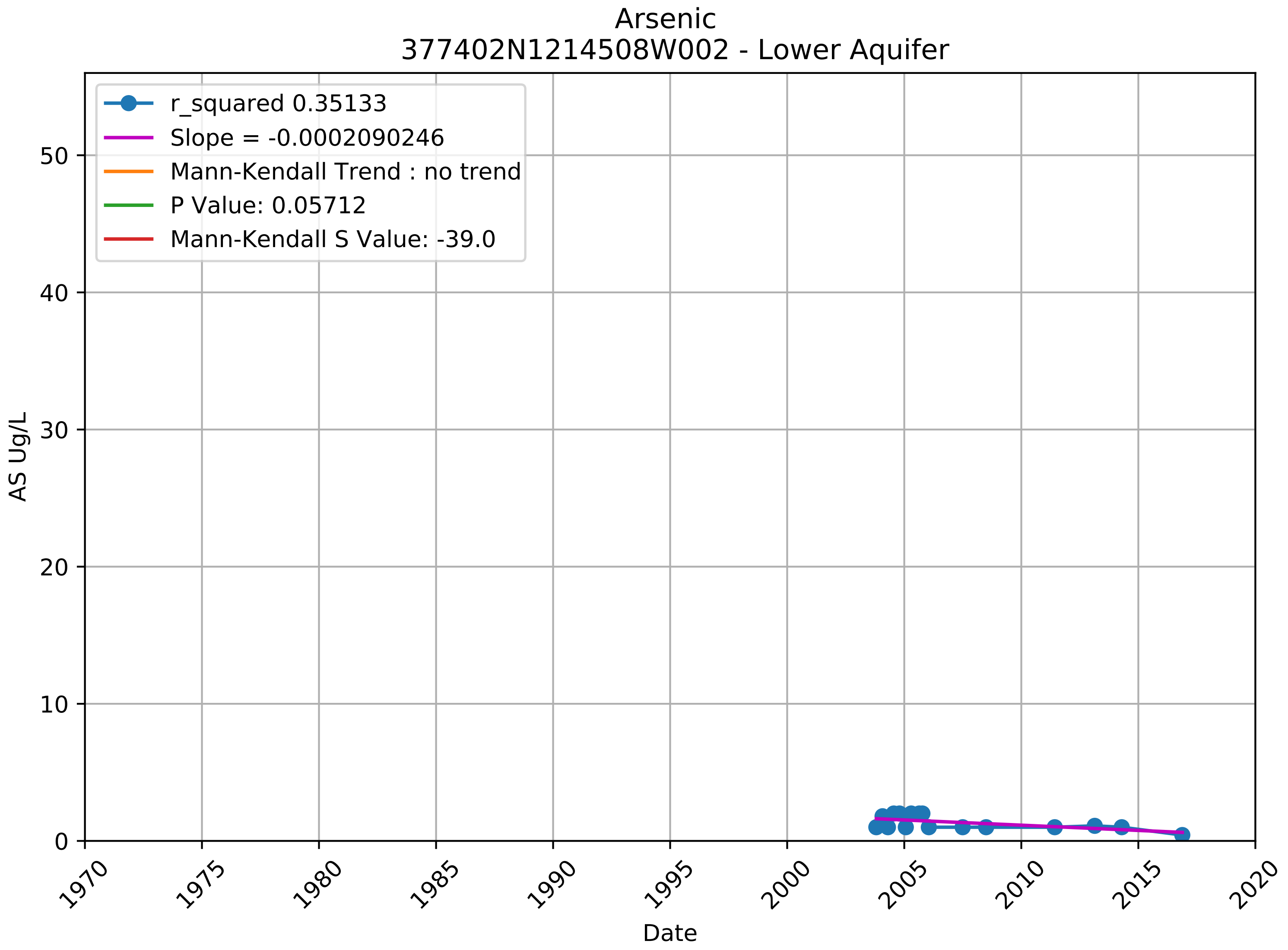

Arsenic
377402N1214508W002 - Lower Aquifer
r_squared 0.35133
Slope = -0.0002090246
Mann-Kendall Trend : no trend
P Value: 0.05712
Mann-Kendall S Value: -39.0
AS Ug/L
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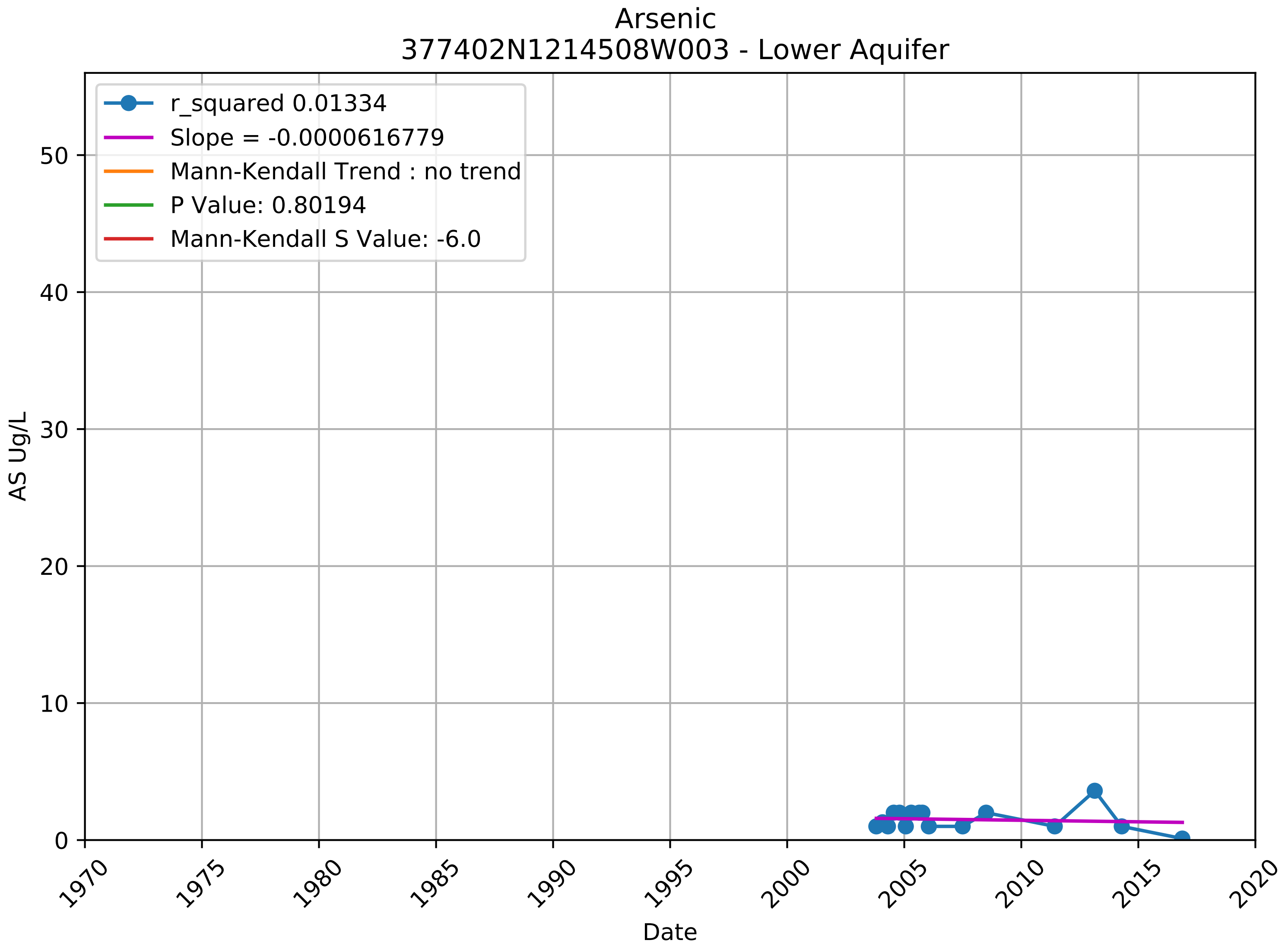
Arsenic
377402N1214508W003 - Lower Aquifer
r_squared 0.01334
Slope = -0.0000616779
Mann-Kendall Trend : no trend
P Value: 0.80194
Mann-Kendall S Value: -6.0
AS Ug/L
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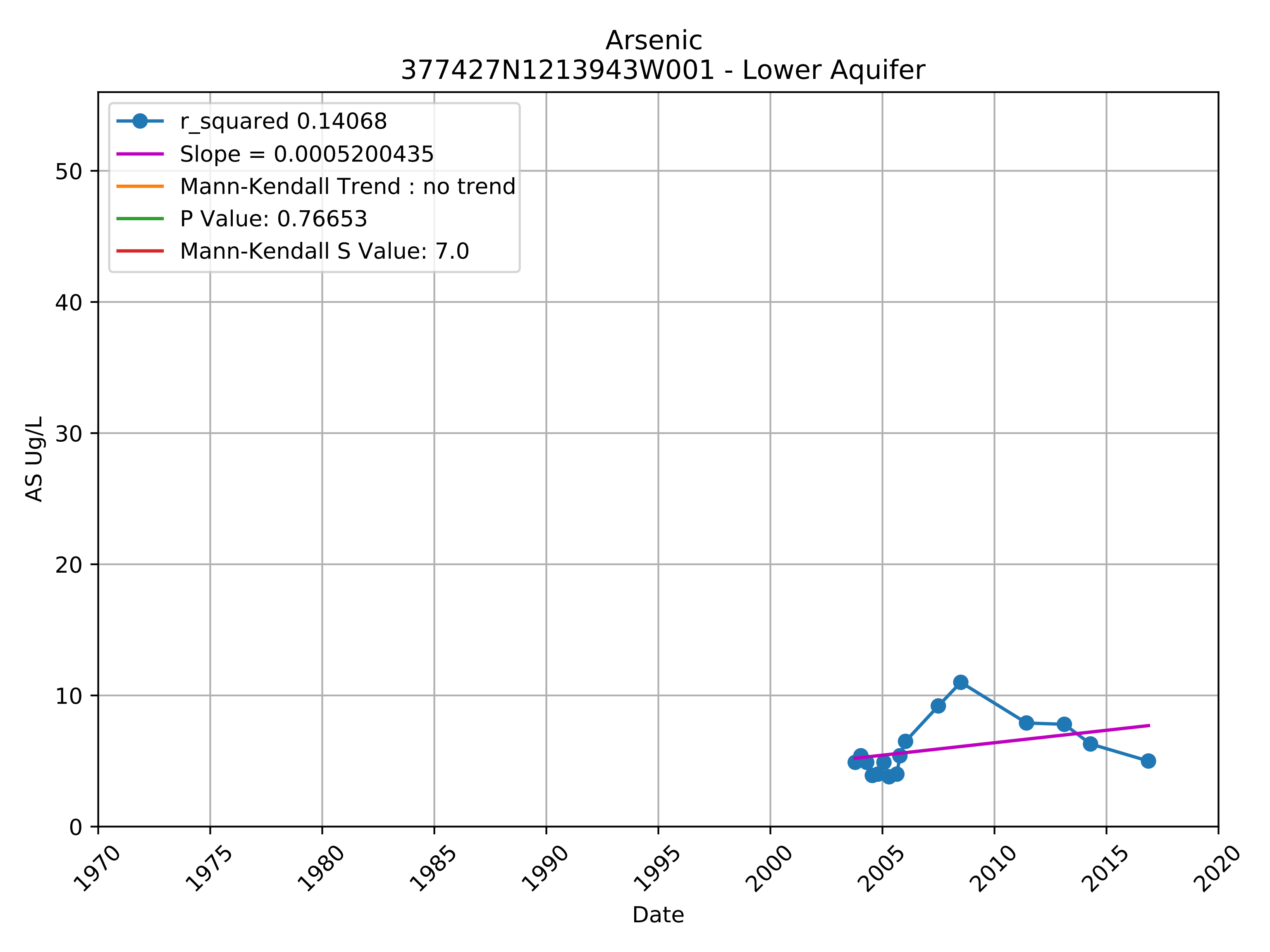
Arsenic
377427N1213943W001 - Lower Aquifer
r_squared 0.14068
Slope = 0.0005200435
Mann-Kendall Trend : no trend
P Value: 0.76653
Mann-Kendall S Value: 7.0
AS Ug/L
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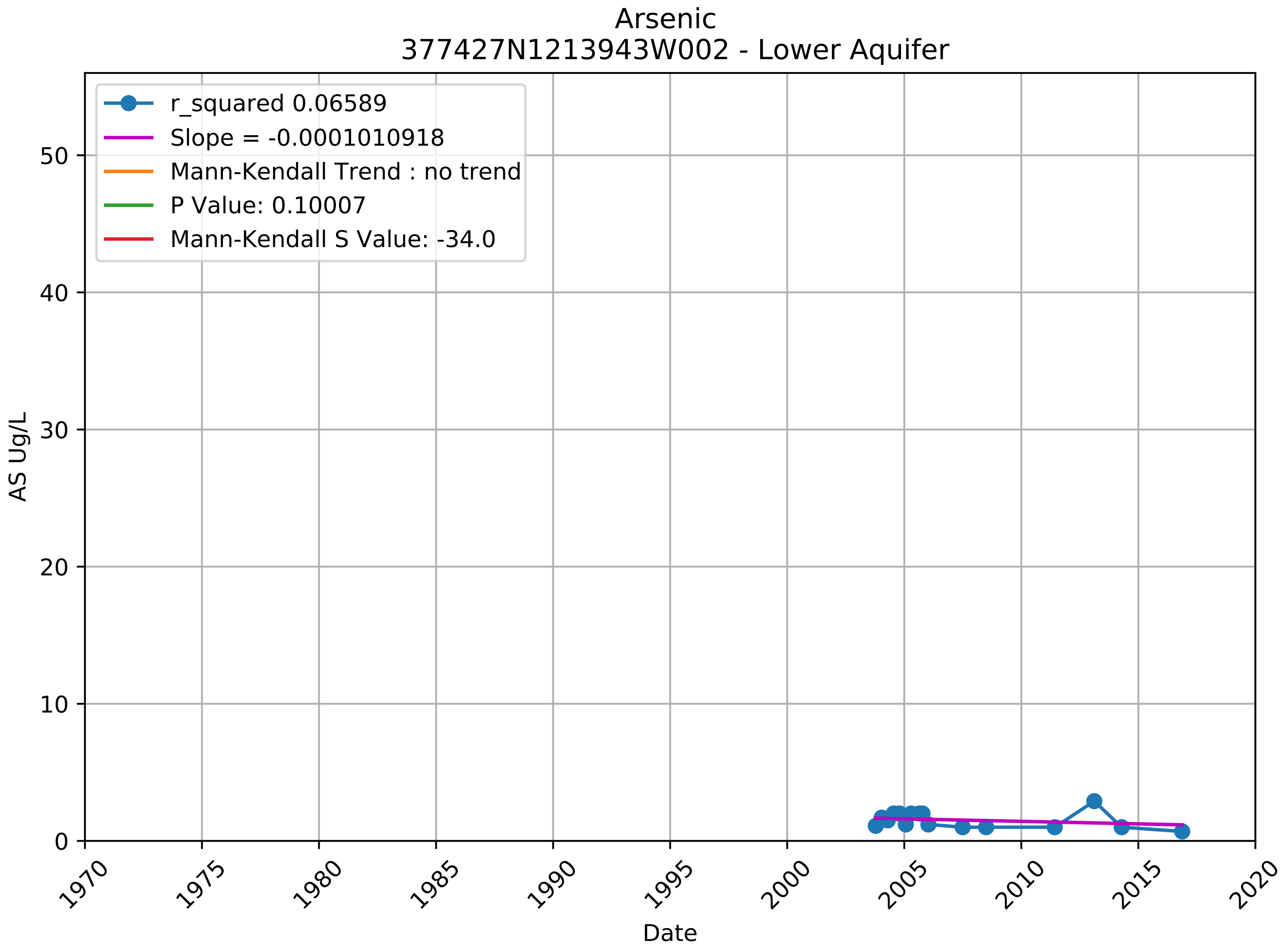

Arsenic
377427N1213943W002 - Lower Aquifer
r_squared 0.06589
Slope = -0.0001010918
Mann-Kendall Trend : no trend
P Value: 0.10007
Mann-Kendall S Value: -34.0
AS Ug/L
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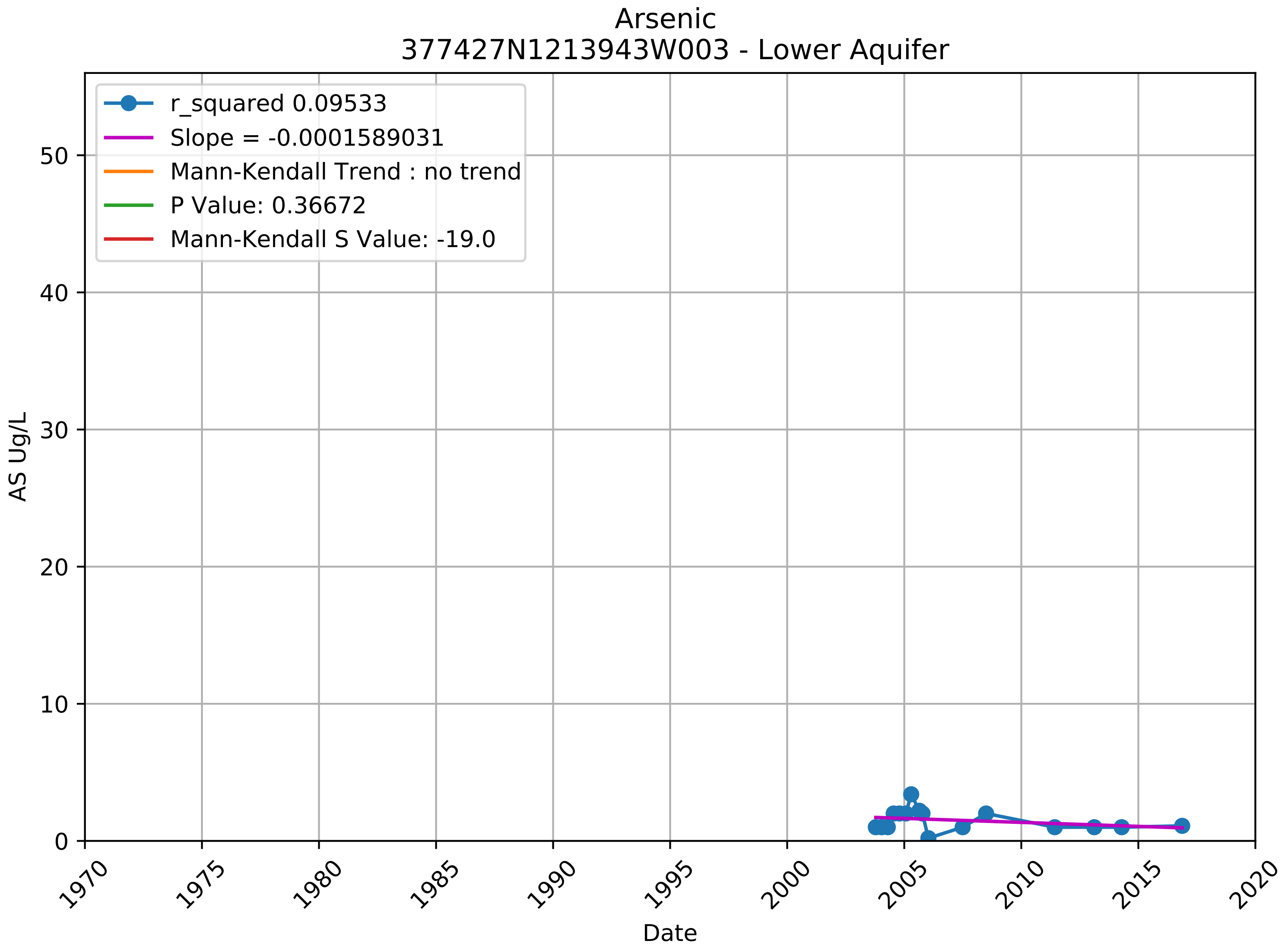
Arsenic
377427N1213943W003 - Lower Aquifer
r_squared 0.09533
Slope = -0.0001589031
Mann-Kendall Trend : no trend
P Value: 0.36672
Mann-Kendall S Value: -19.0
AS Ug/L
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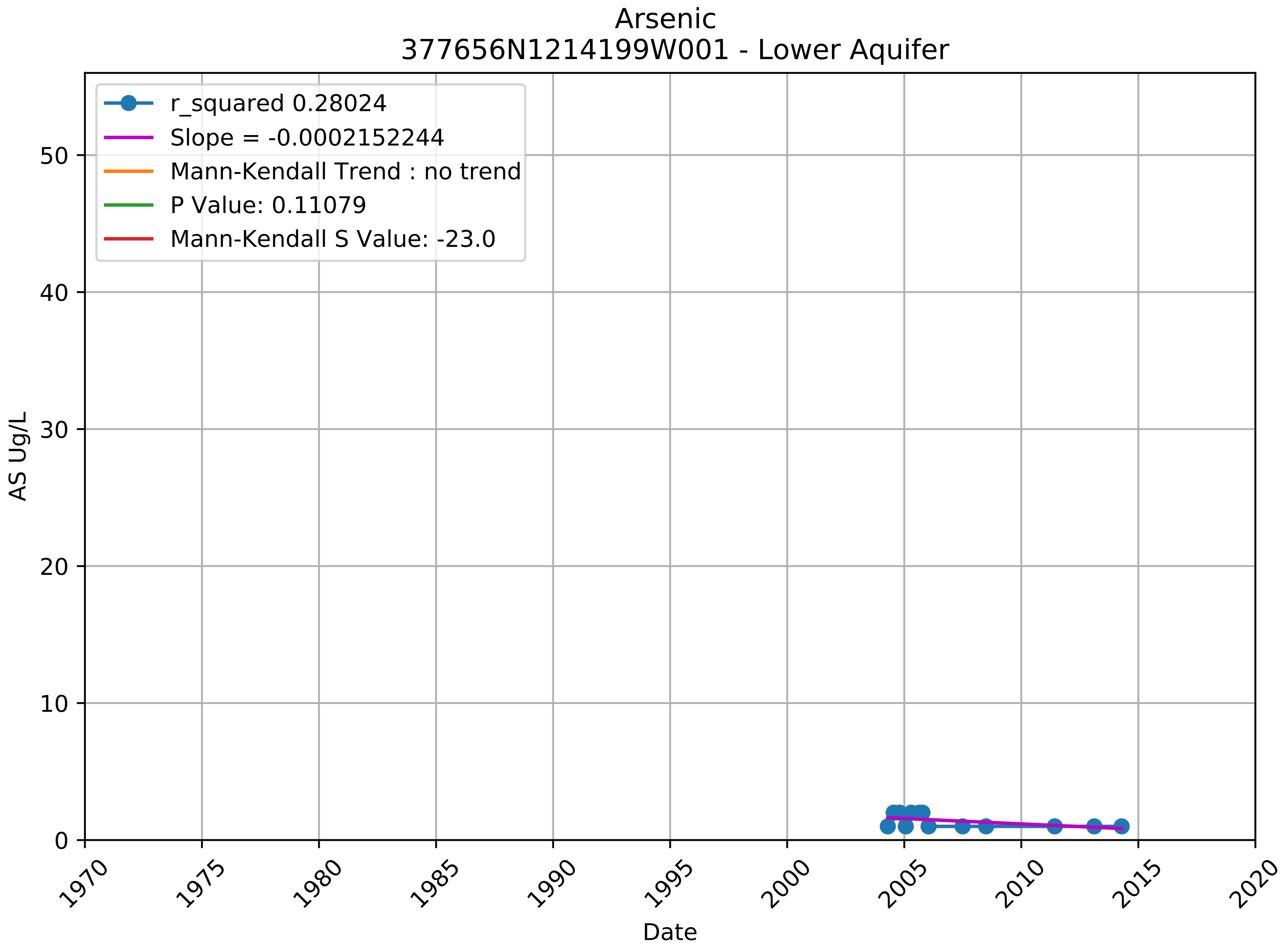

Arsenic
377656N1214199W001 - Lower Aquifer
r_squared 0.28024
Slope = -0.0002152244
Mann-Kendall Trend : no trend
P Value: 0.11079
Mann-Kendall S Value: -23.0
AS Ug/L
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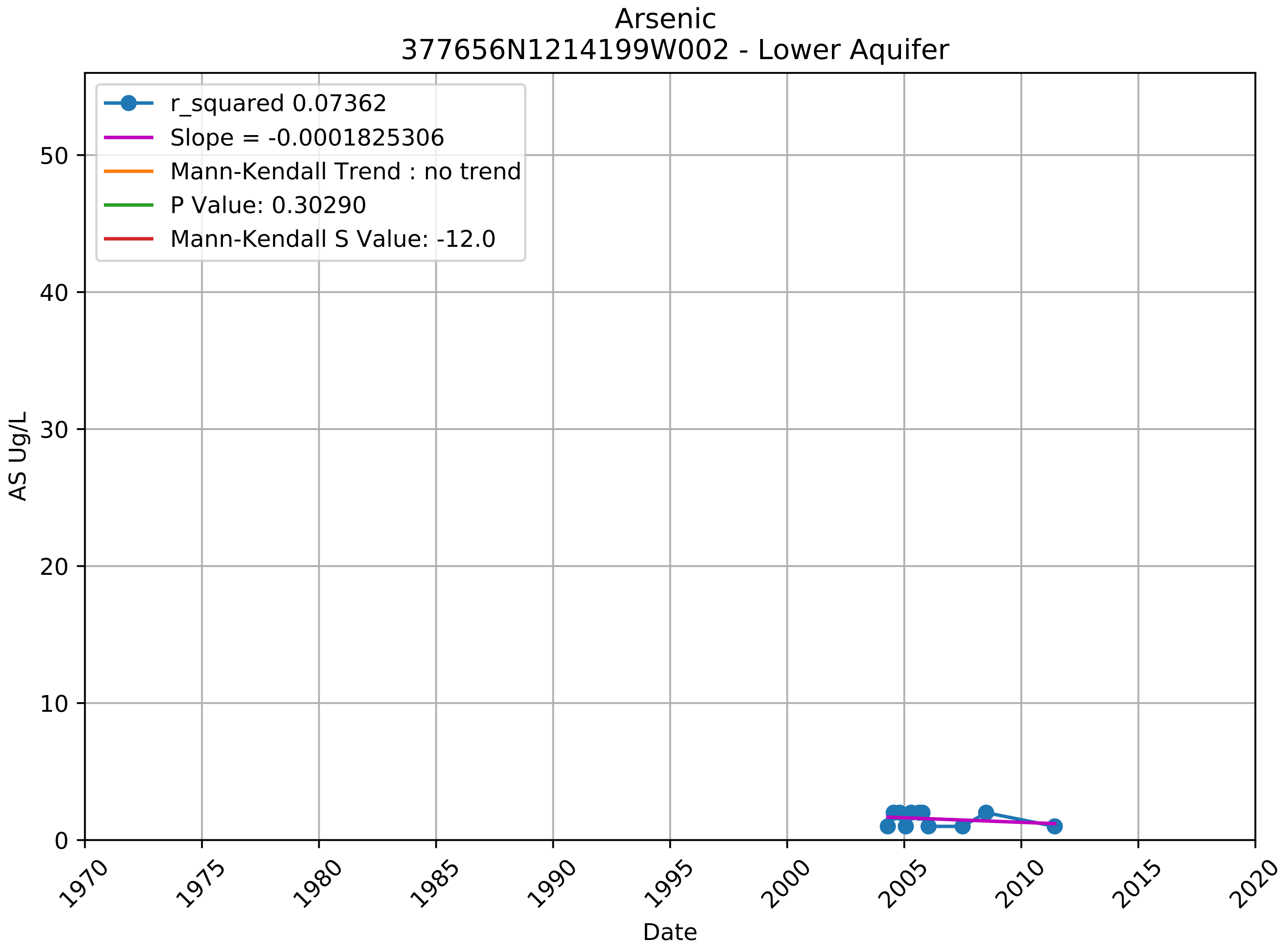

Arsenic
377656N1214199W002 - Lower Aquifer
r_squared 0.07362
Slope = -0.0001825306
Mann-Kendall Trend : no trend
P Value: 0.30290
Mann-Kendall S Value: -12.0
AS Ug/L
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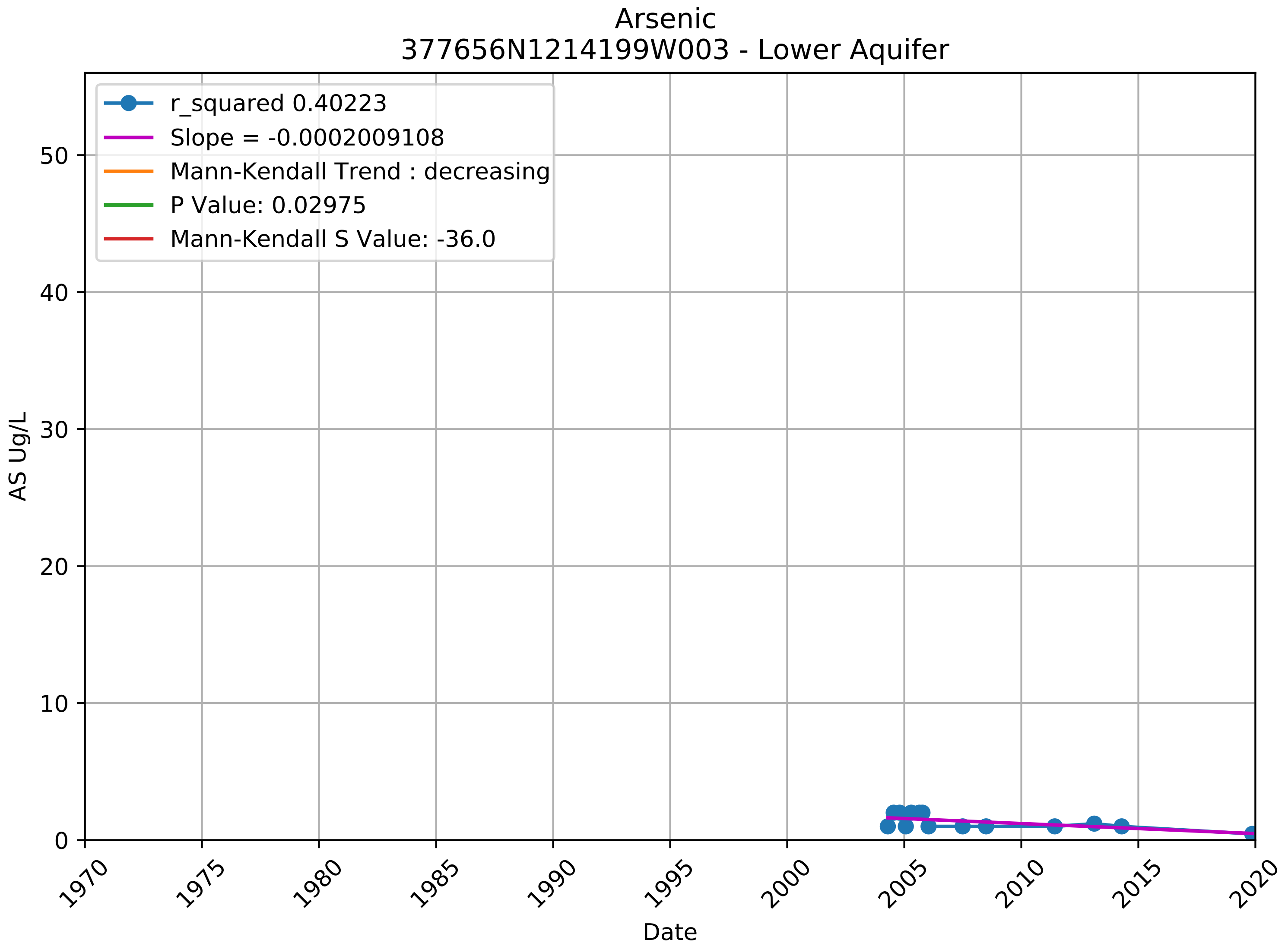

Arsenic
377656N1214199W003 - Lower Aquifer
r_squared 0.40223
Slope = -0.0002009108
Mann-Kendall Trend : decreasing
P Value: 0.02975
Mann-Kendall S Value: -36.0
AS Ug/L
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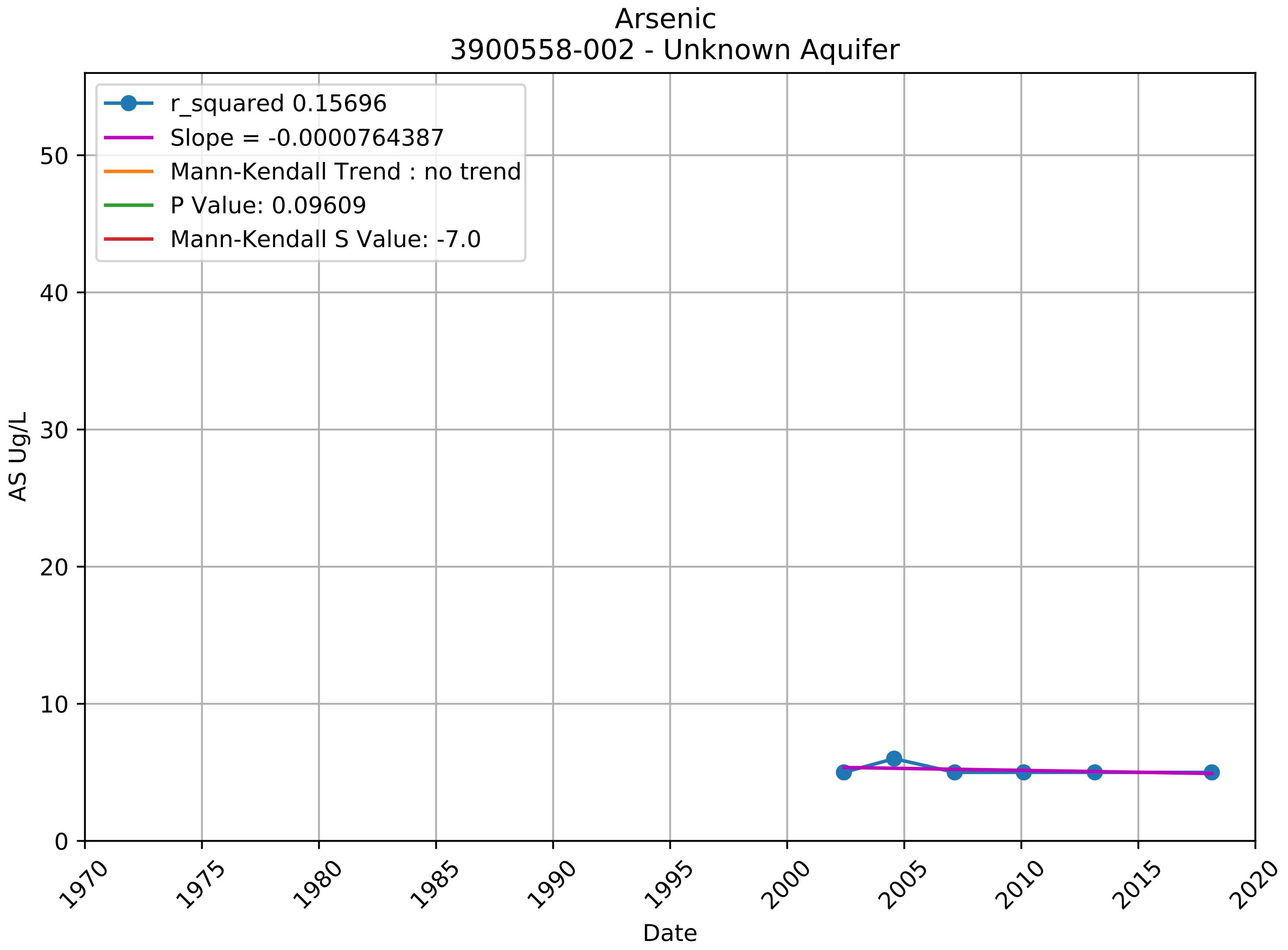
Arsenic
3900558-002 - Unknown Aquifer
r_squared 0.15696
Slope = -0.0000764387
Mann-Kendall Trend : no trend
P Value: 0.09609
Mann-Kendall S Value: -7.0
AS Ug/L
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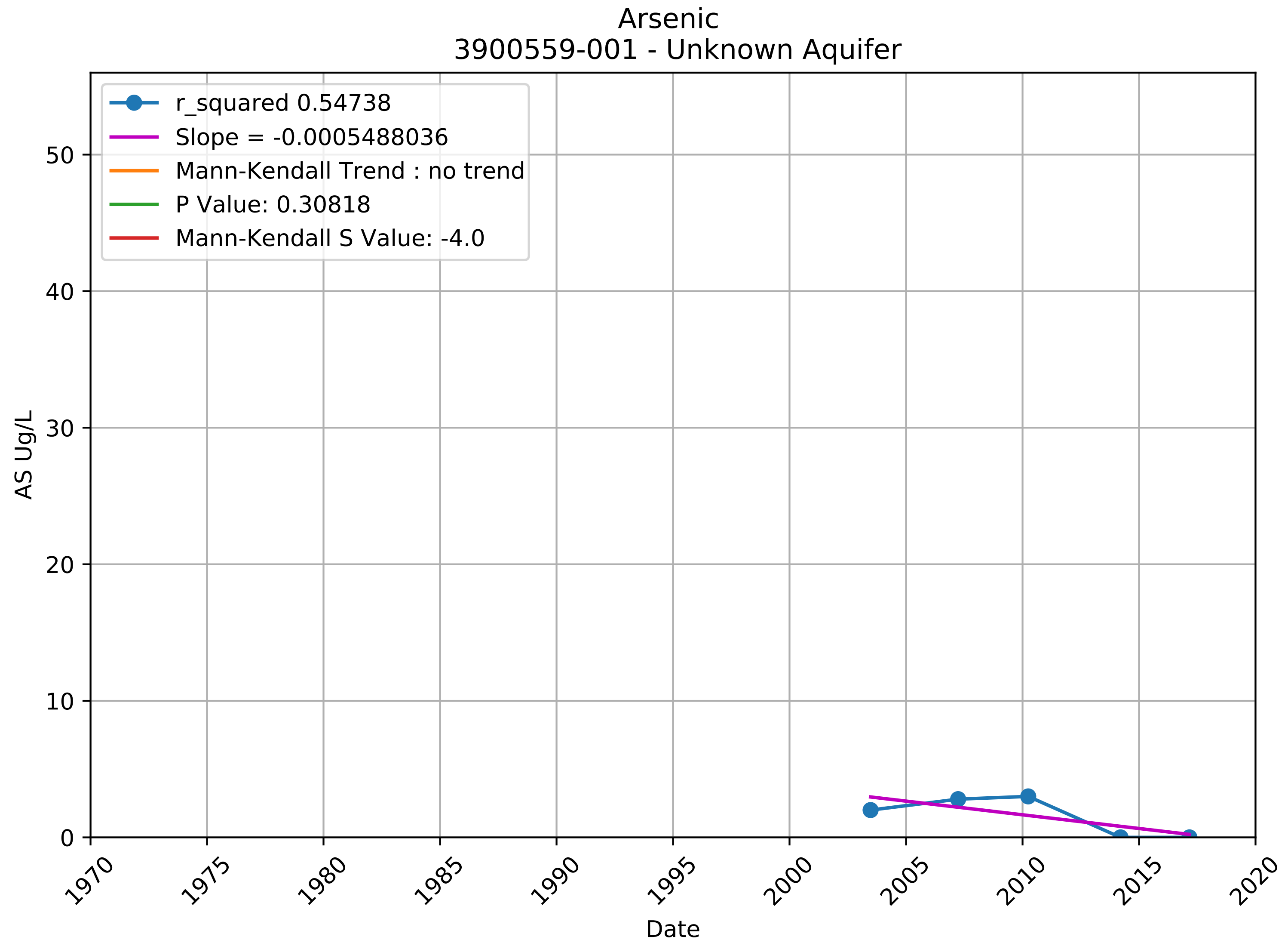

Arsenic
3900559-001 - Unknown Aquifer
r_squared 0.54738
Slope = -0.0005488036
Mann-Kendall Trend : no trend
P Value: 0.30818
Mann-Kendall S Value: -4.0
AS Ug/L
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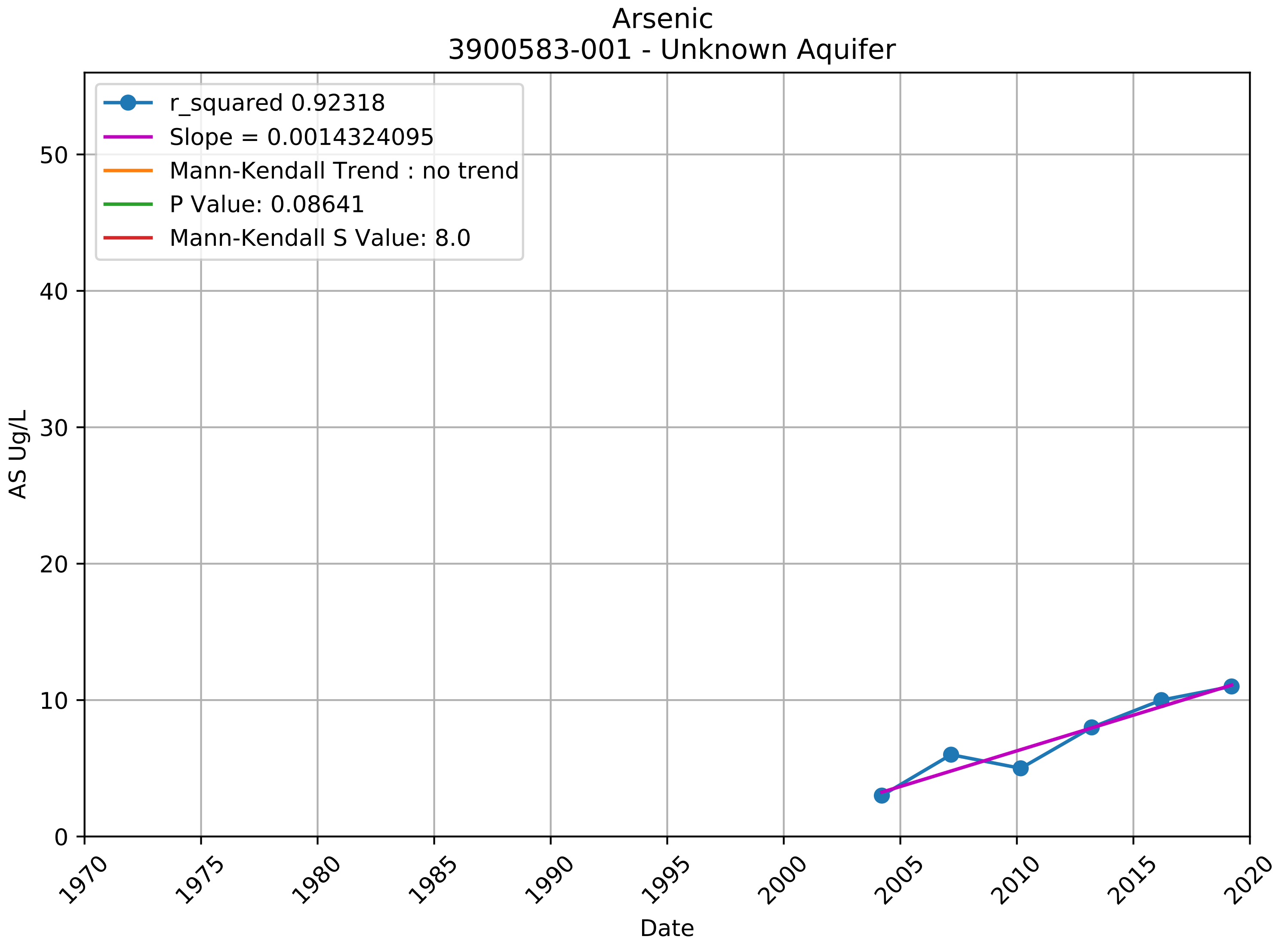
Arsenic
3900583-001 - Unknown Aquifer
r_squared 0.92318
Slope = 0.0014324095
Mann-Kendall Trend : no trend
P Value: 0.08641
Mann-Kendall S Value: 8.0
AS Ug/L
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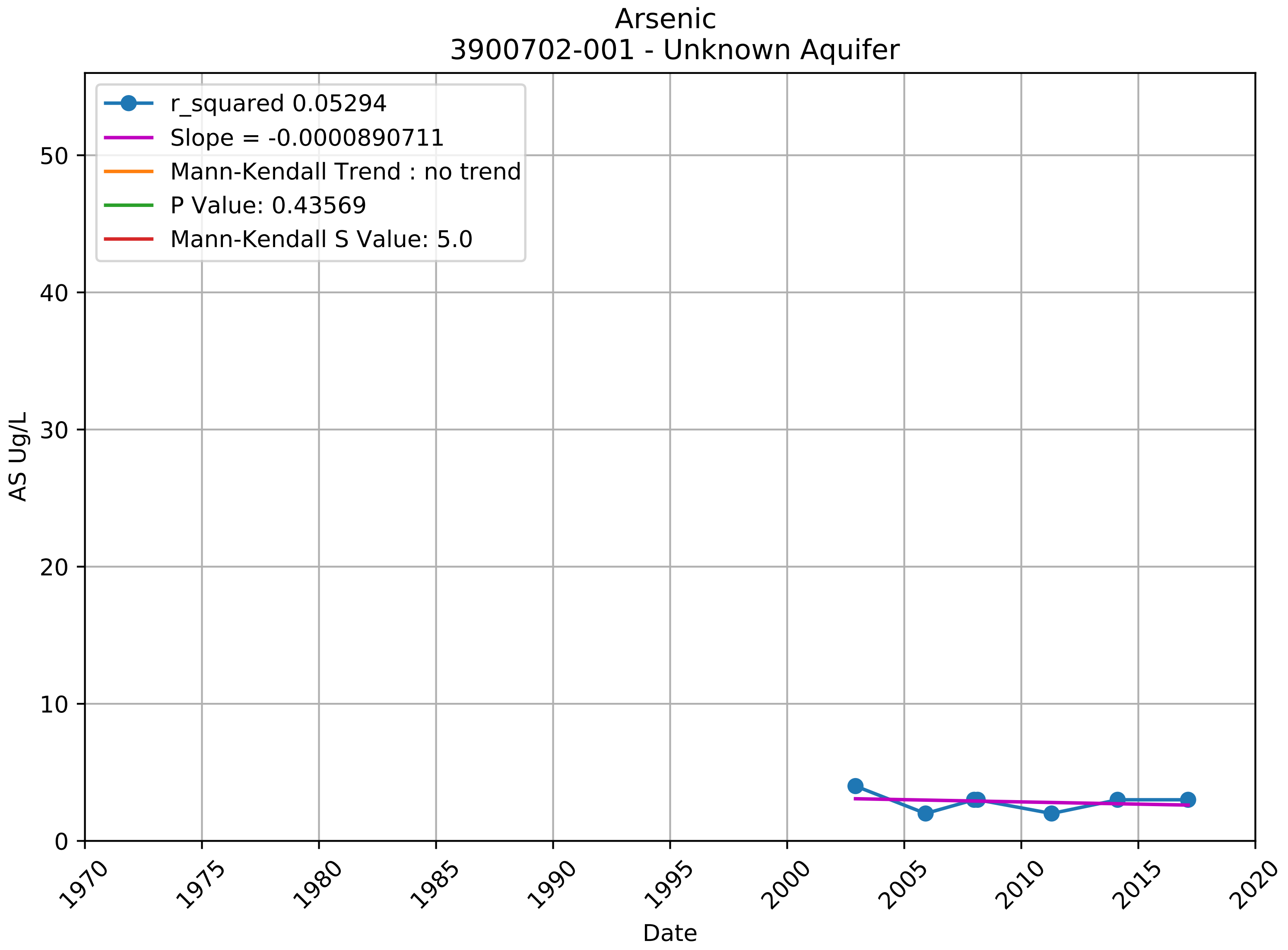

Arsenic
3900702-001 - Unknown Aquifer
r_squared 0.05294
Slope = -0.0000890711
Mann-Kendall Trend : no trend
P Value: 0.43569
Mann-Kendall S Value: 5.0
AS Ug/L
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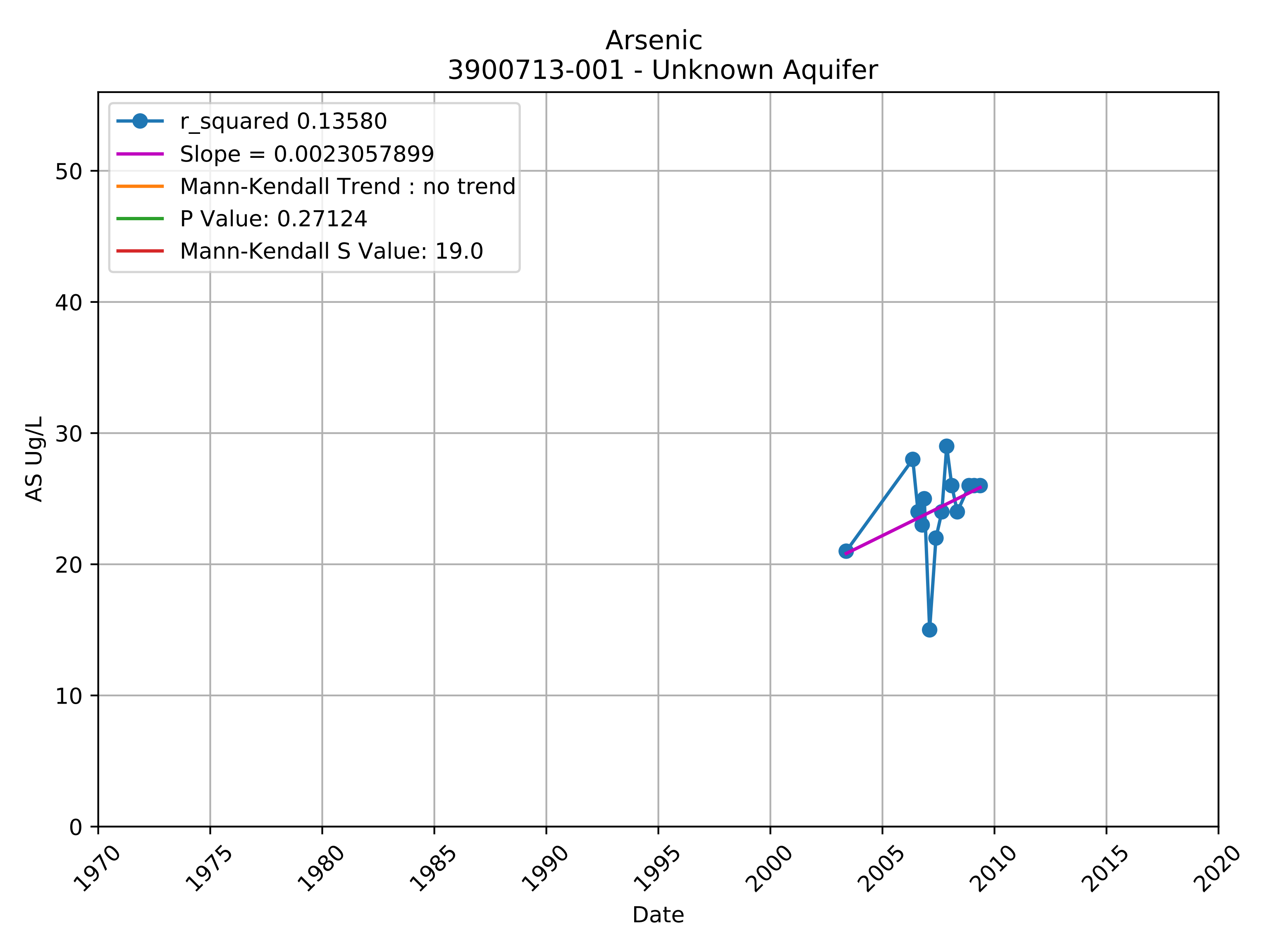

Arsenic
3900713-001 - Unknown Aquifer
r_squared 0.13580
Slope = 0.0023057899
Mann-Kendall Trend : no trend
P Value: 0.27124
Mann-Kendall S Value: 19.0
AS Ug/L
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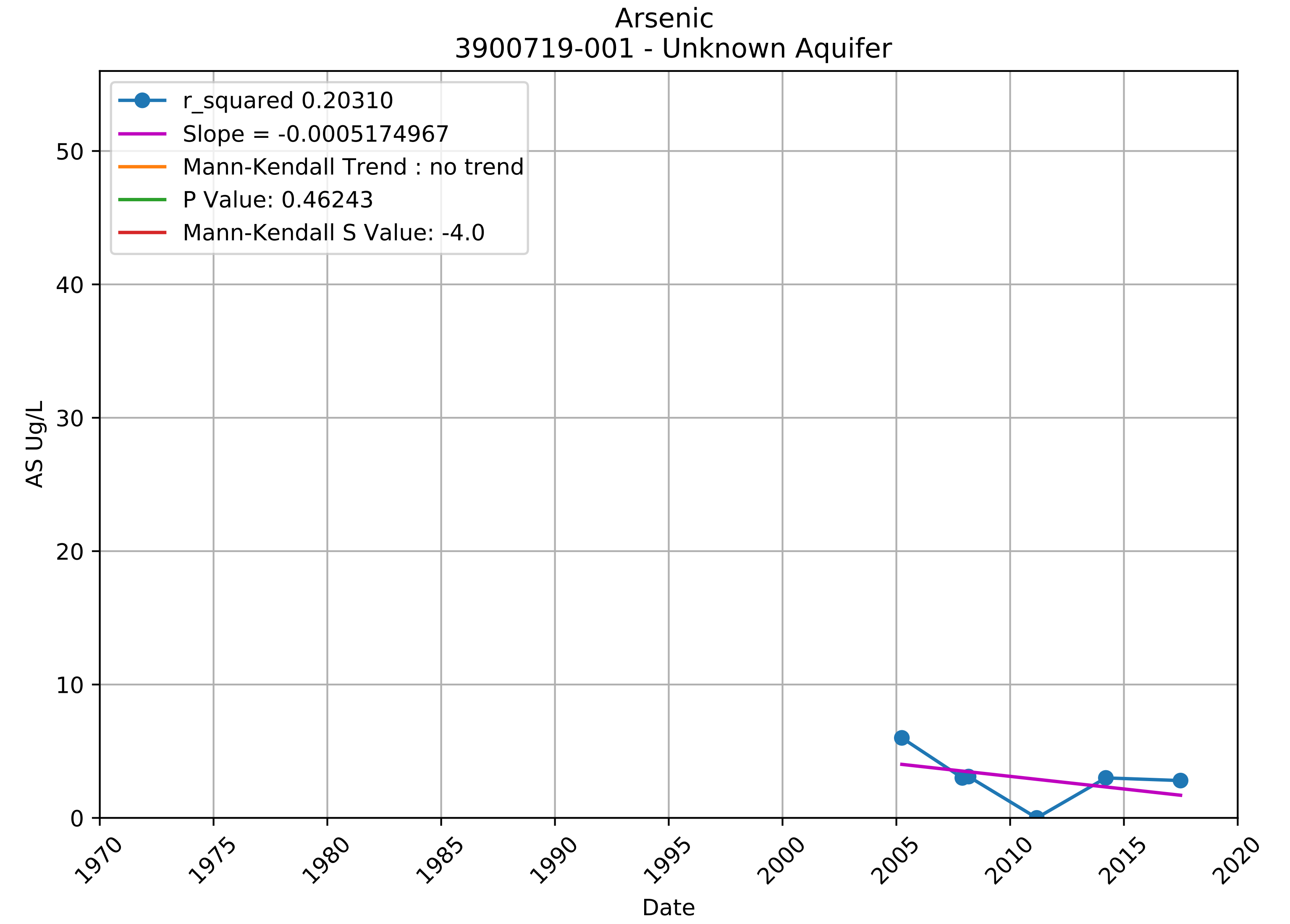

Arsenic
3900719-001 - Unknown Aquifer
r_squared 0.20310
Slope = -0.0005174967
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: -4.0
AS Ug/L
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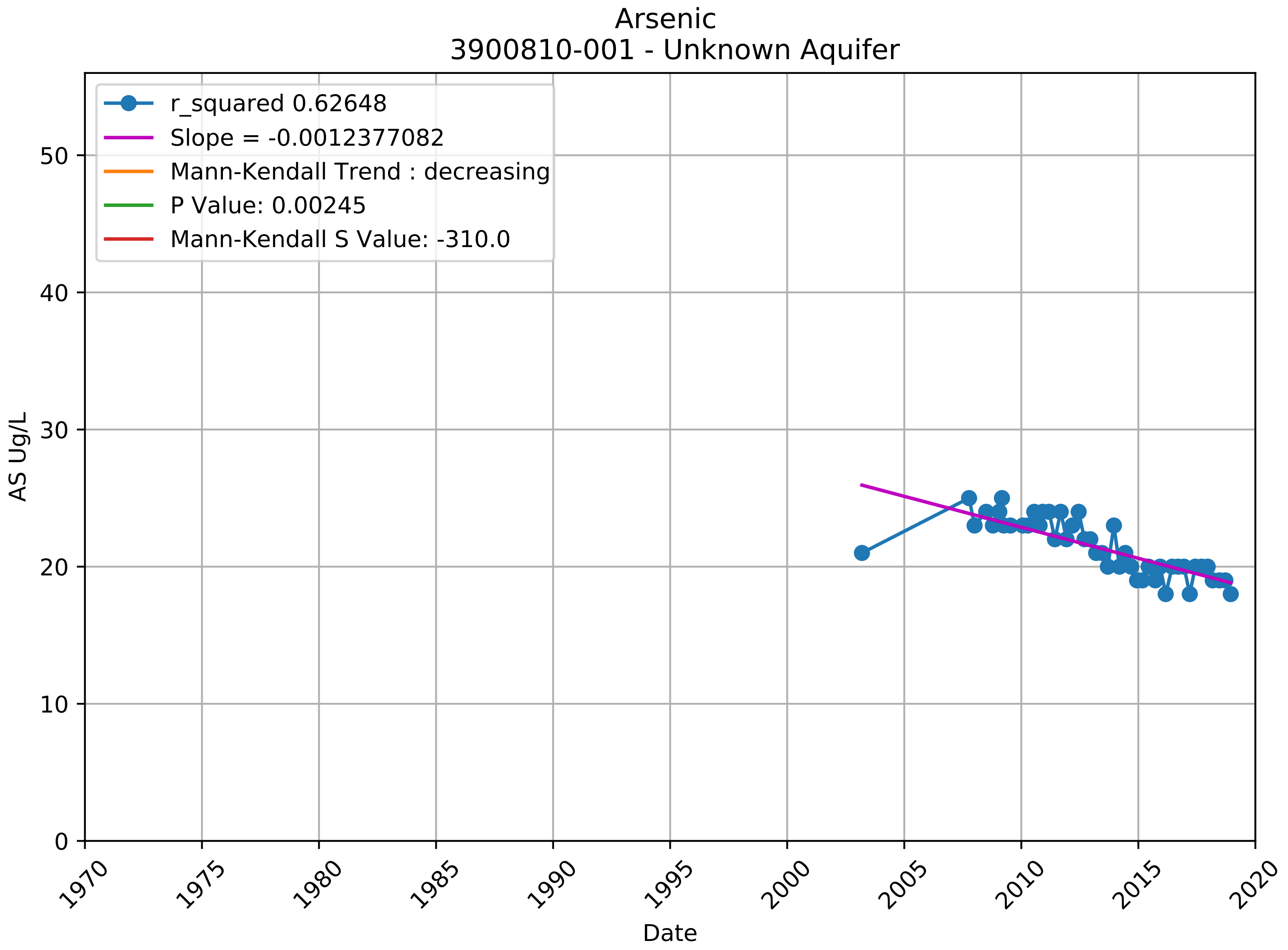

Arsenic
3900810-001 - Unknown Aquifer
r_squared 0.62648
Slope = -0.0012377082
Mann-Kendall Trend : decreasing
P Value: 0.00245
Mann-Kendall S Value: -310.0
AS Ug/L
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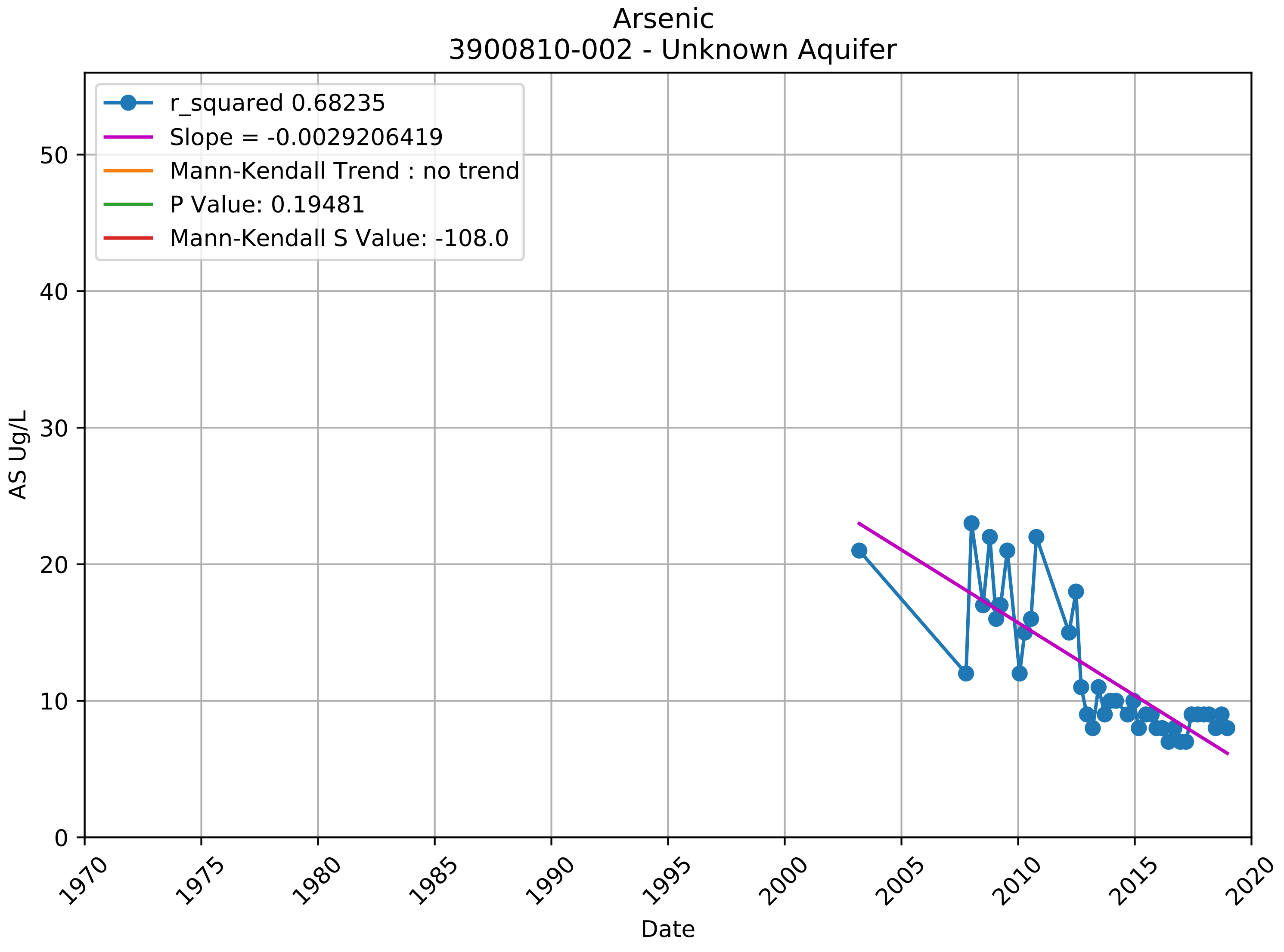

Arsenic
3900810-002 - Unknown Aquifer
r_squared 0.68235
Slope = -0.0029206419
Mann-Kendall Trend : no trend
P Value: 0.19481
Mann-Kendall S Value: -108.0
AS Ug/L
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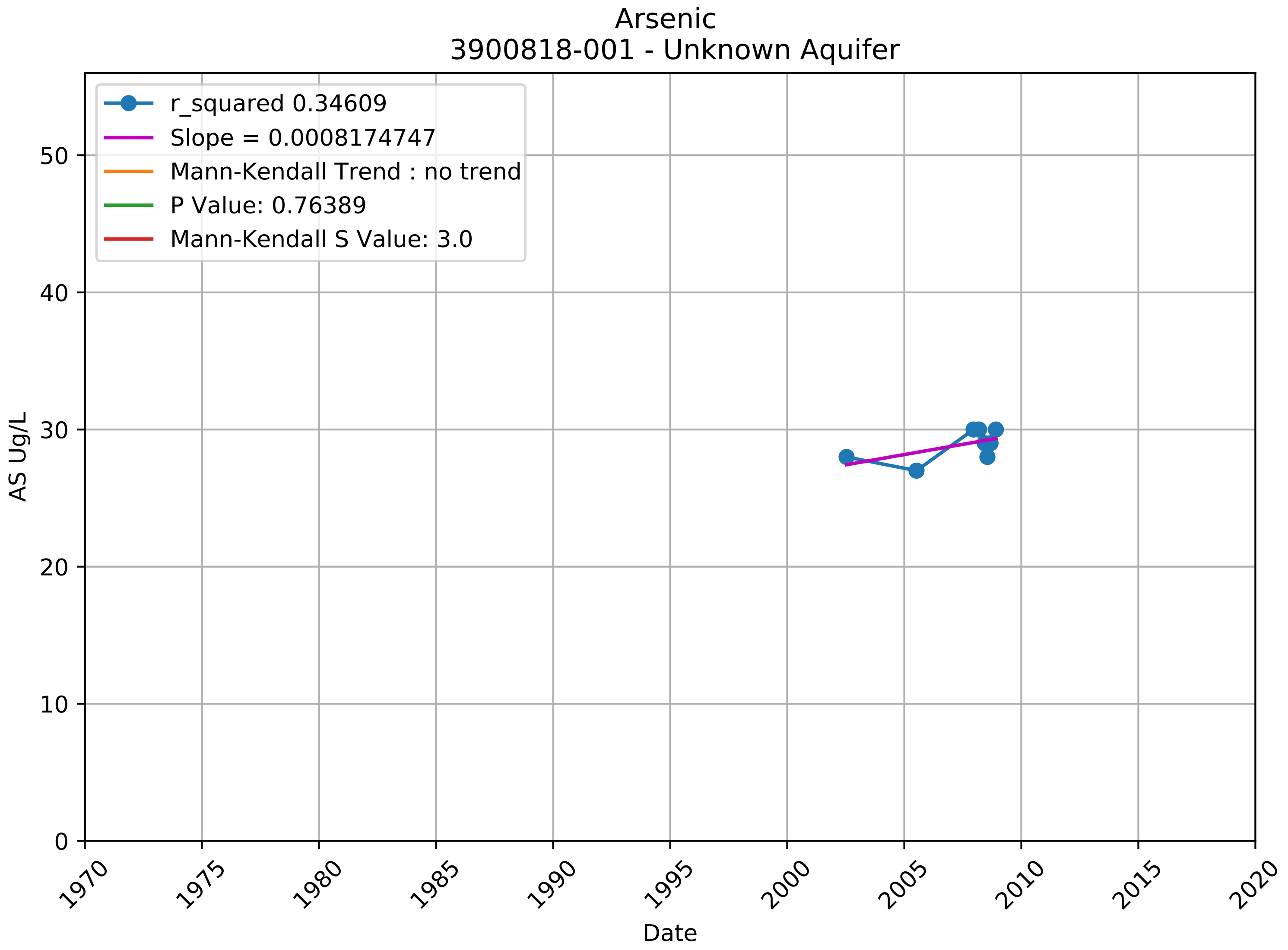

Arsenic
3900818-001 - Unknown Aquifer
r_squared 0.34609
Slope = 0.0008174747
Mann-Kendall Trend : no trend
P Value: 0.76389
Mann-Kendall S Value: 3.0
AS Ug/L
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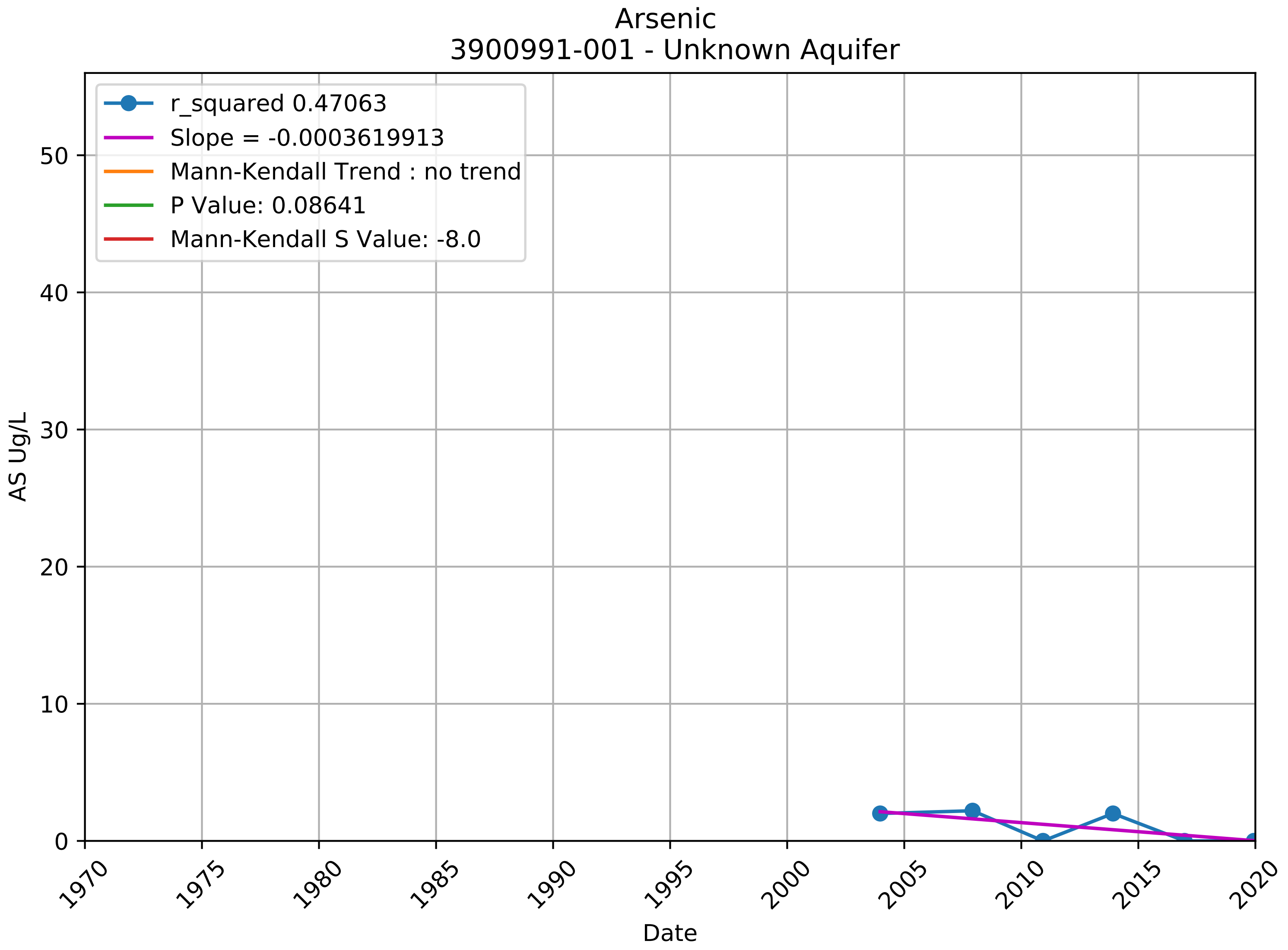

Arsenic
3900991-001 - Unknown Aquifer
r_squared 0.47063
Slope = -0.0003619913
Mann-Kendall Trend : no trend
P Value: 0.08641
Mann-Kendall S Value: -8.0
AS Ug/L
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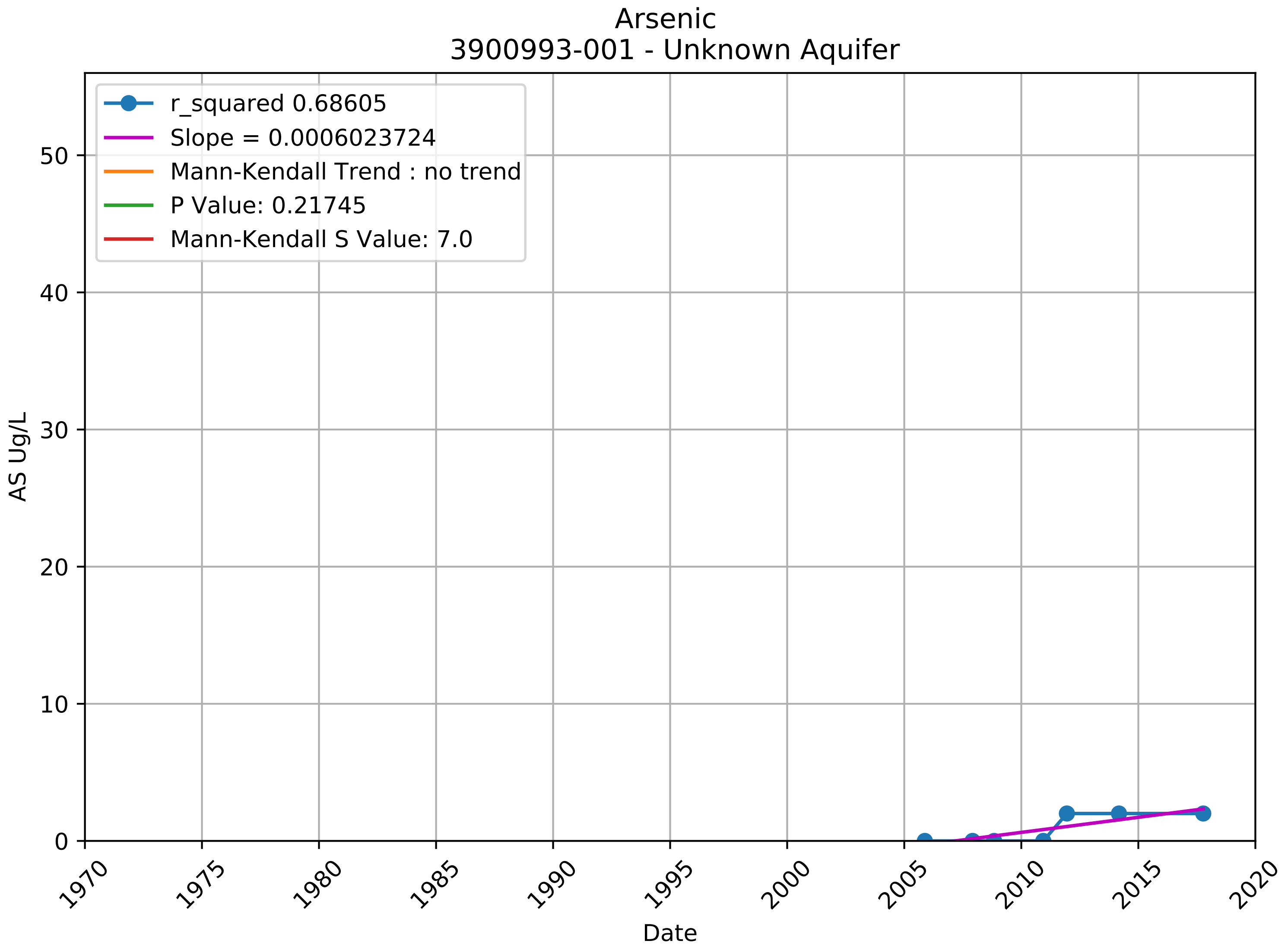

Arsenic
3900993-001 - Unknown Aquifer
r_squared 0.68605
Slope = 0.0006023724
Mann-Kendall Trend : no trend
P Value: 0.21745
Mann-Kendall S Value: 7.0
AS Ug/L
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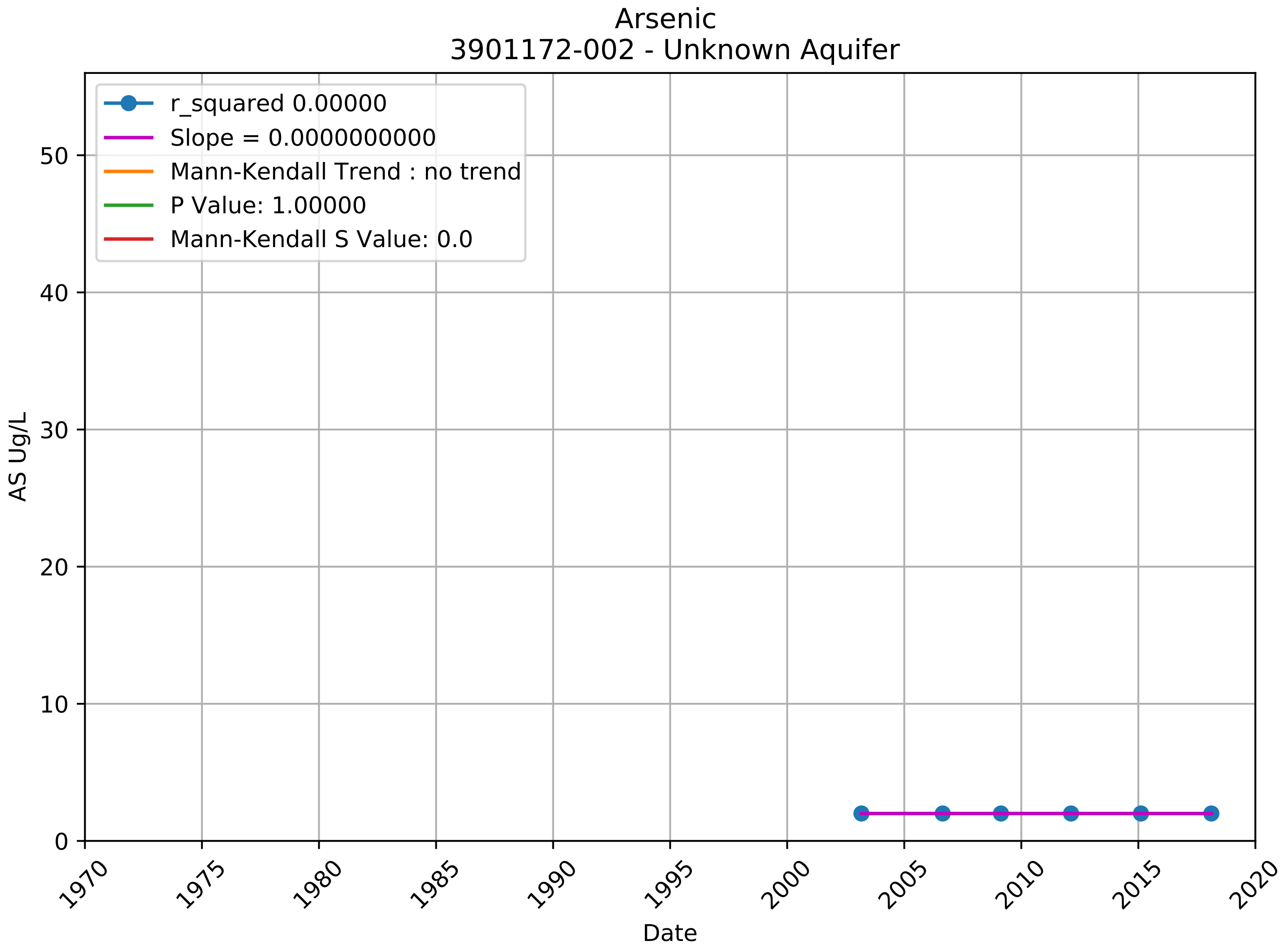
Arsenic
3901172-002 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
AS Ug/L
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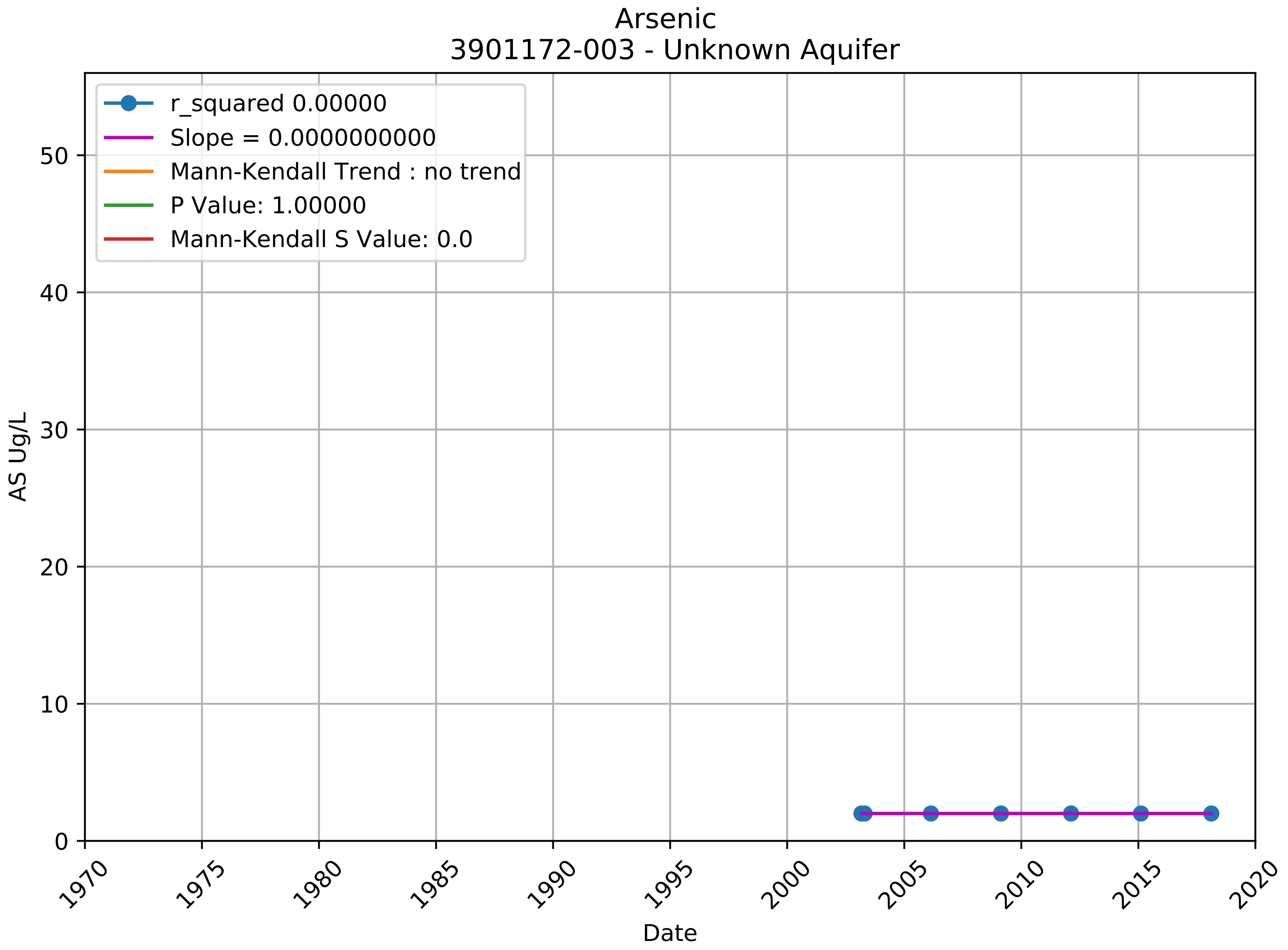

Arsenic
3901172-003 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
AS Ug/L
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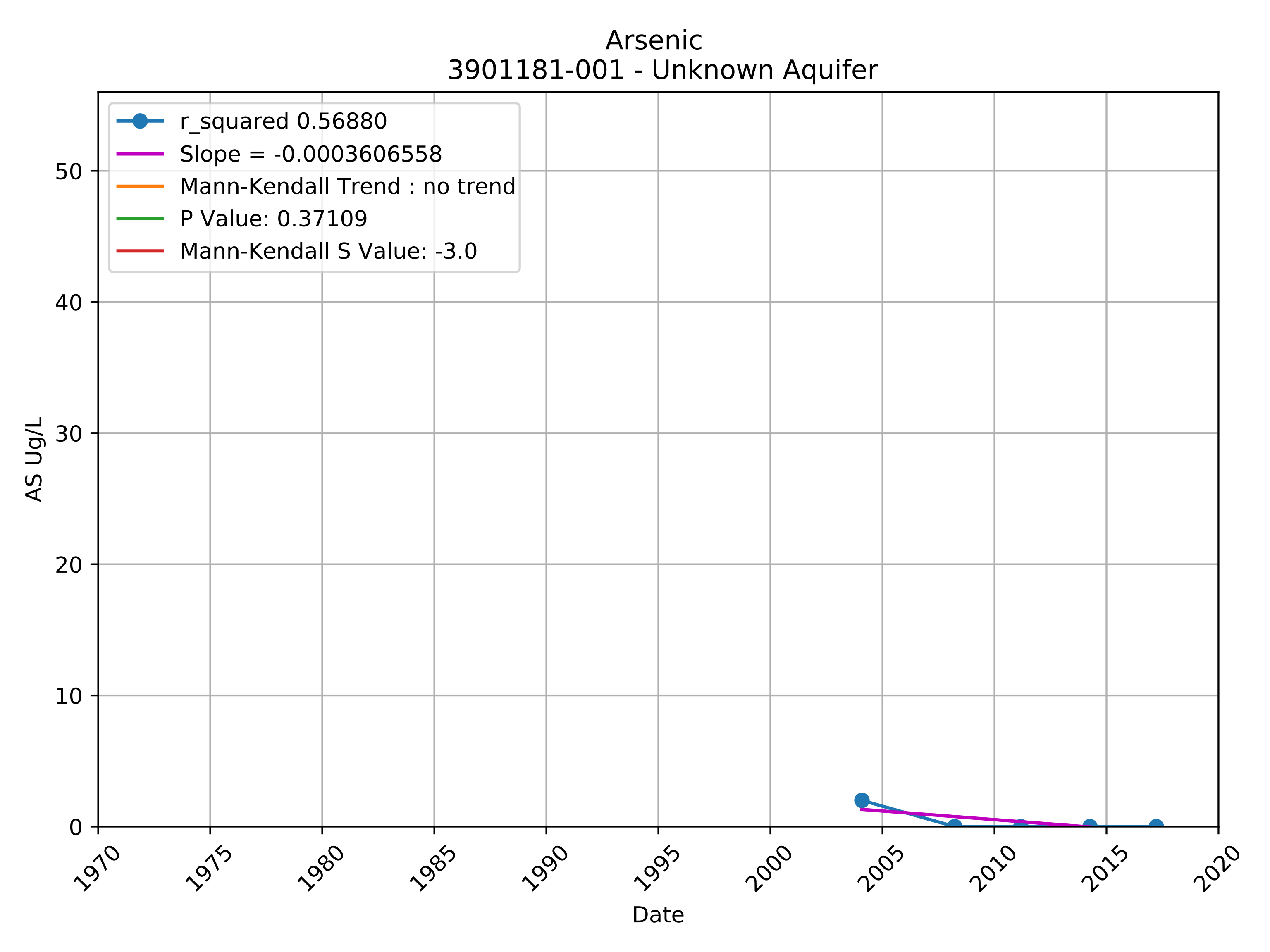

Arsenic
3901181-001 - Unknown Aquifer
r_squared 0.56880
Slope = -0.0003606558
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: -3.0
AS Ug/L
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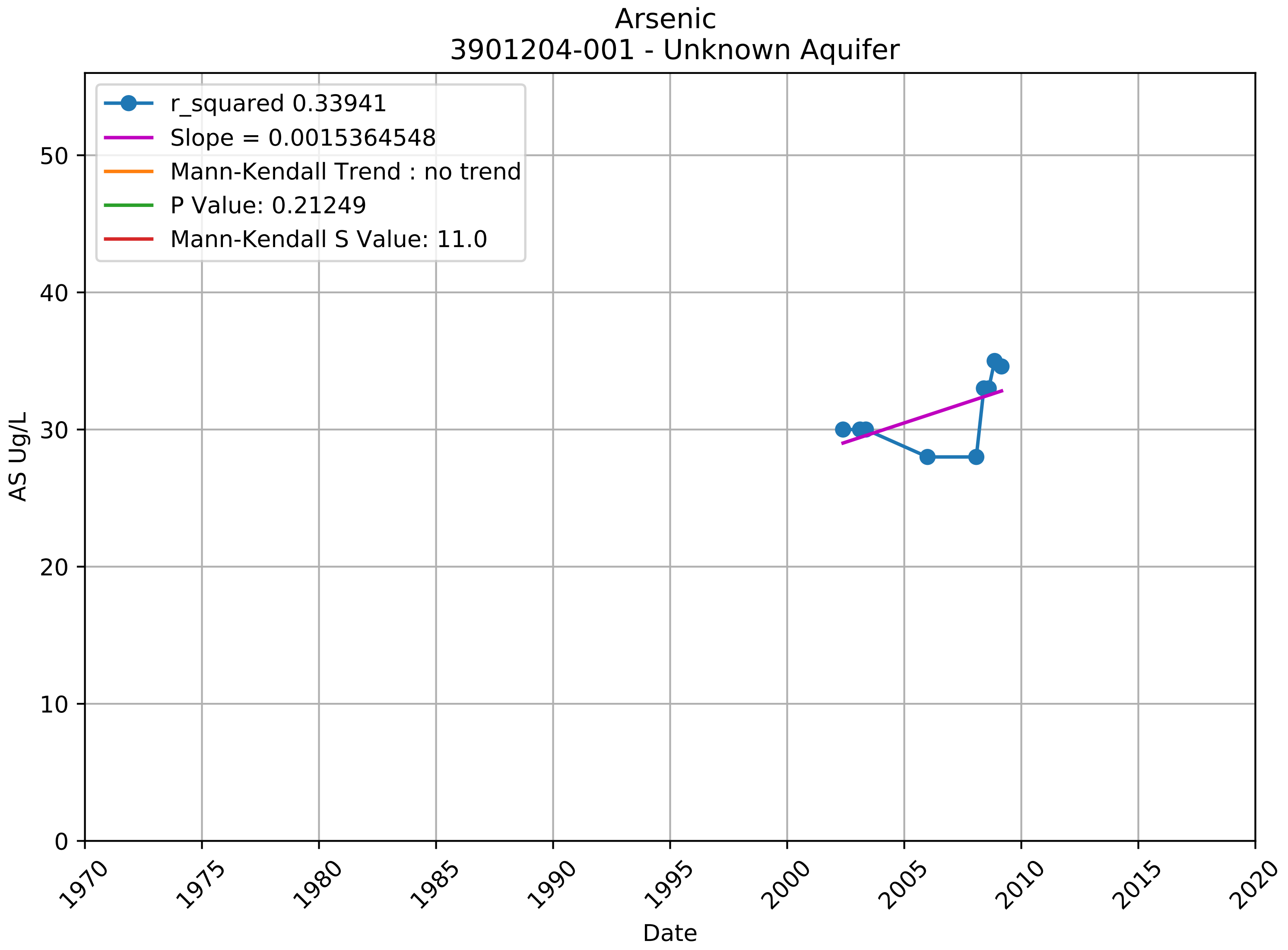
Arsenic
3901204-001 - Unknown Aquifer
r_squared 0.33941
Slope = 0.0015364548
Mann-Kendall Trend : no trend
P Value: 0.21249
Mann-Kendall S Value: 11.0
AS Ug/L
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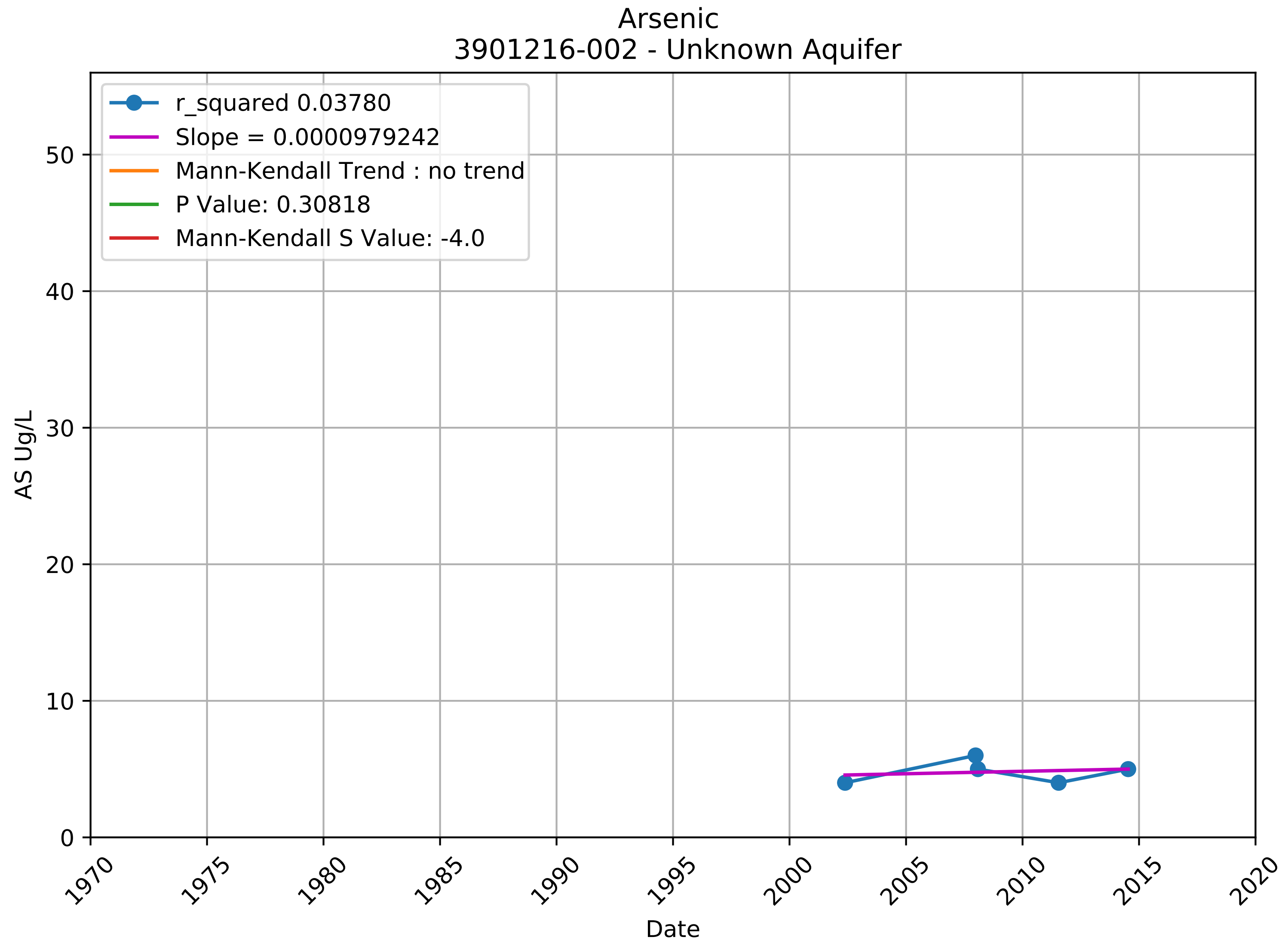
Arsenic
3901216-002 - Unknown Aquifer
r_squared 0.03780
Slope = 0.0000979242
Mann-Kendall Trend : no trend
P Value: 0.30818
Mann-Kendall S Value: -4.0
AS Ug/L
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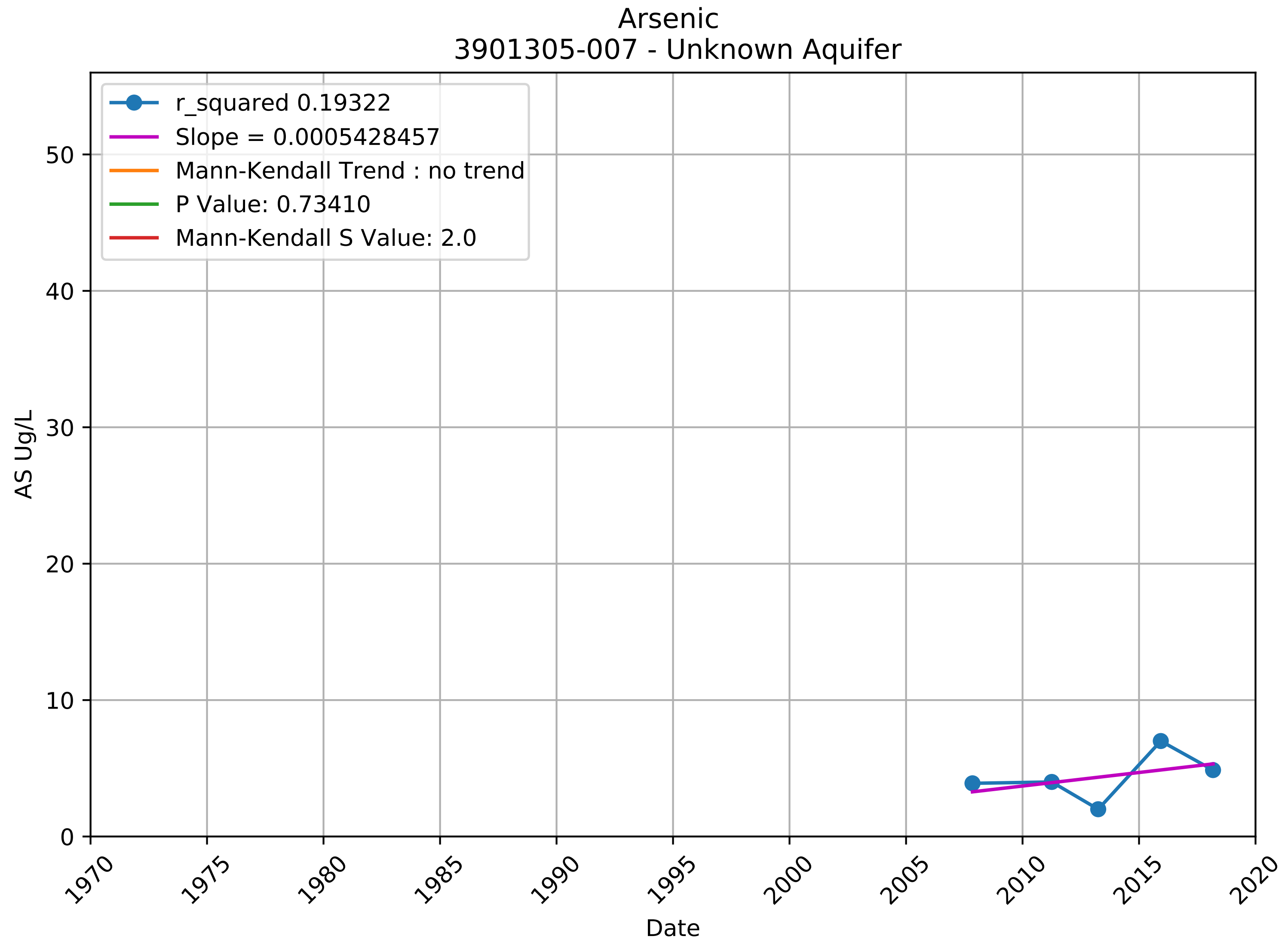
Arsenic
3901305-007 - Unknown Aquifer
r_squared 0.19322
Slope = 0.0005428457
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: 2.0
AS Ug/L
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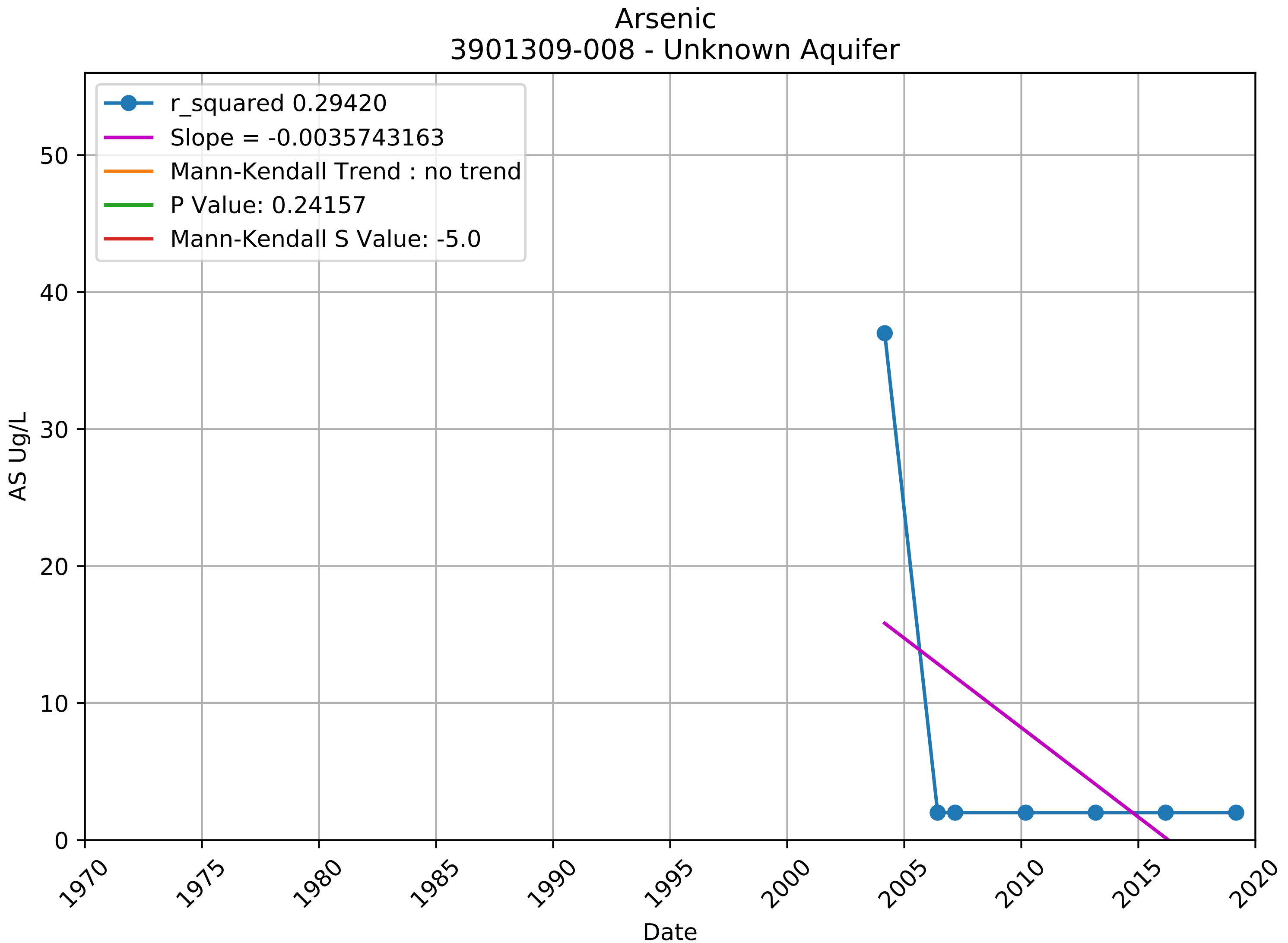

Arsenic
3901309-008 - Unknown Aquifer
r_squared 0.29420
Slope = -0.0035743163
Mann-Kendall Trend : no trend
P Value: 0.24157
Mann-Kendall S Value: -5.0
AS Ug/L
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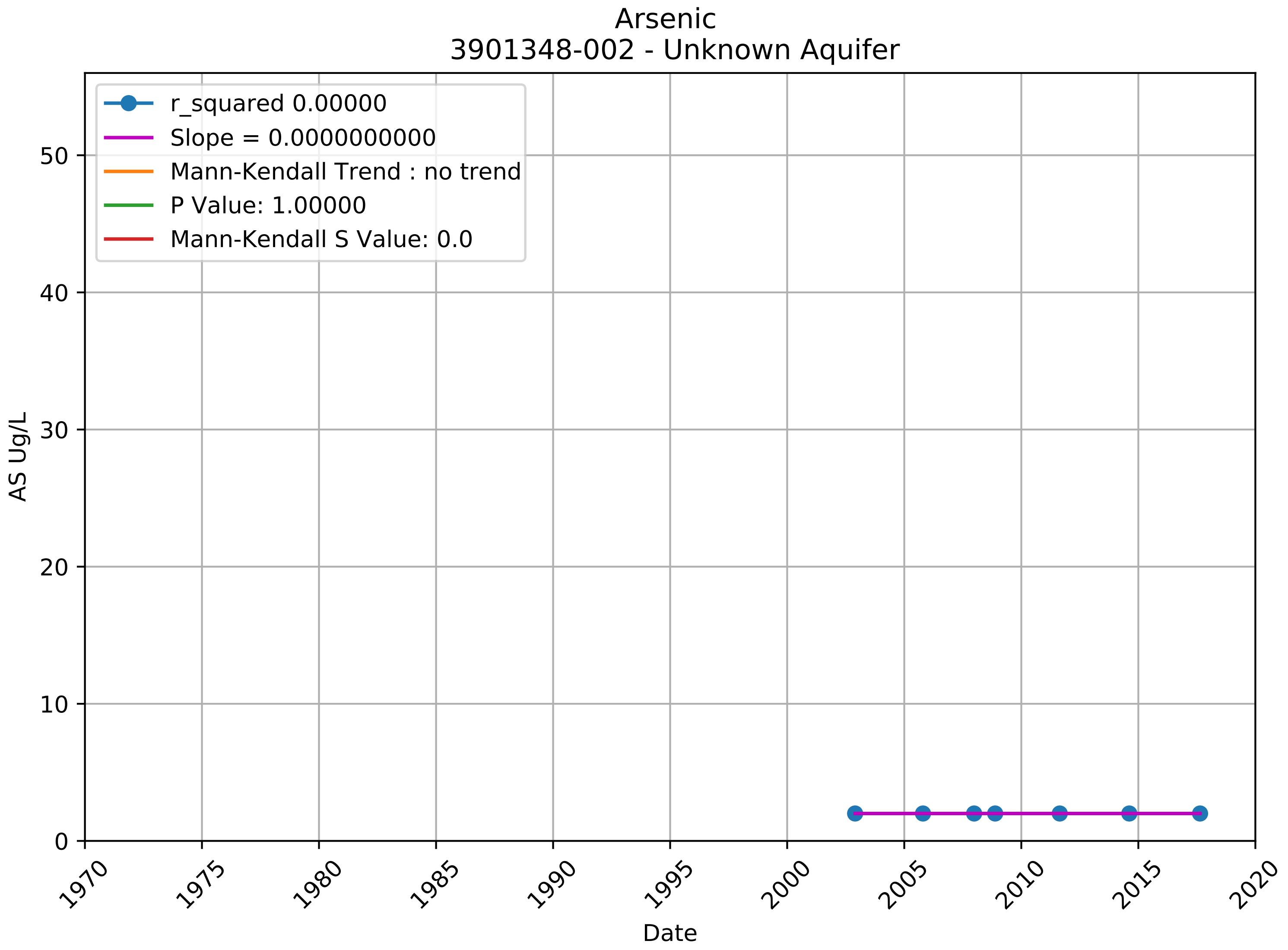

Arsenic
3901348-002 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
AS Ug/L
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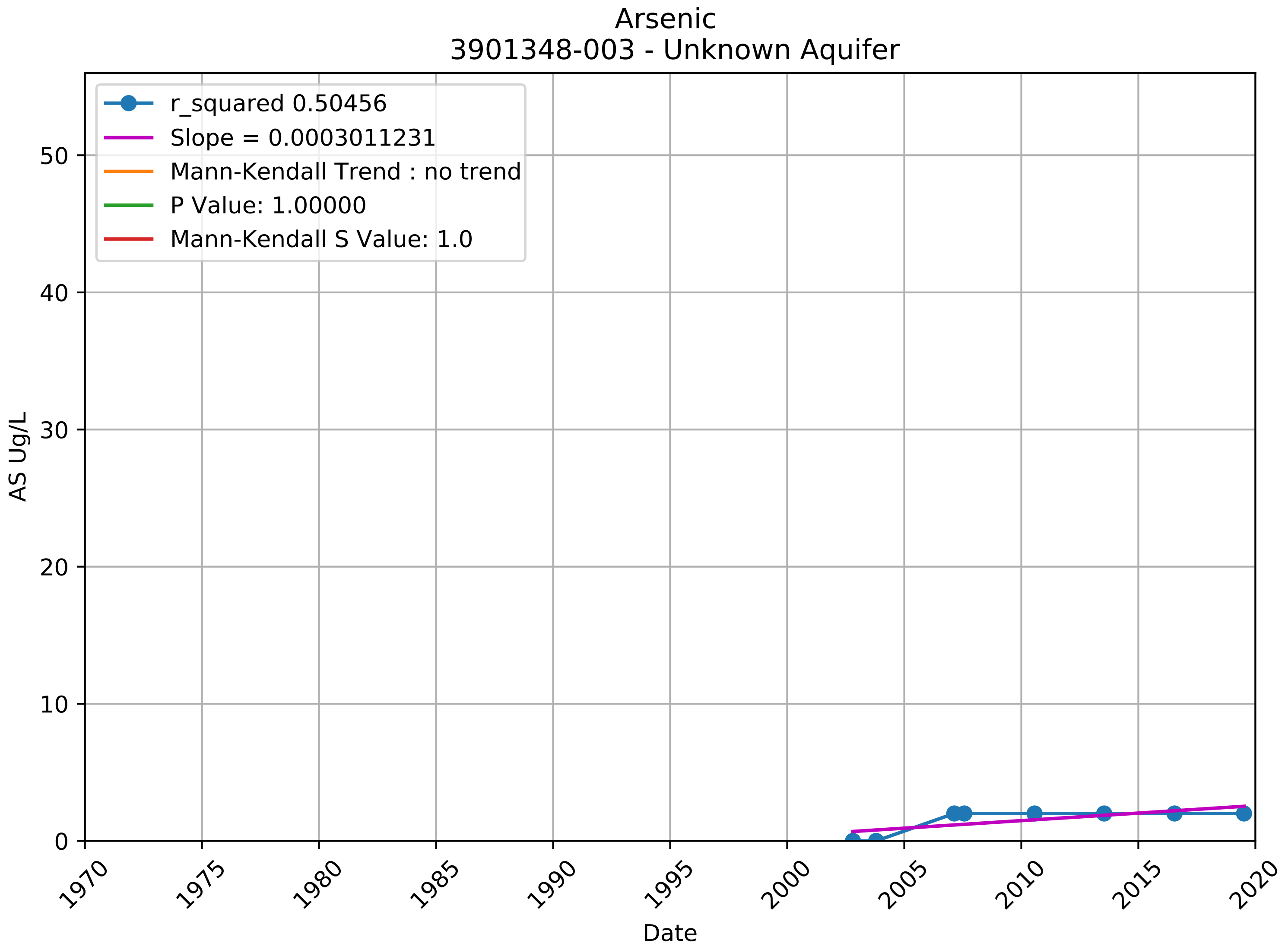
Arsenic
3901348-003 - Unknown Aquifer
r_squared 0.50456
Slope = 0.0003011231
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
AS Ug/L
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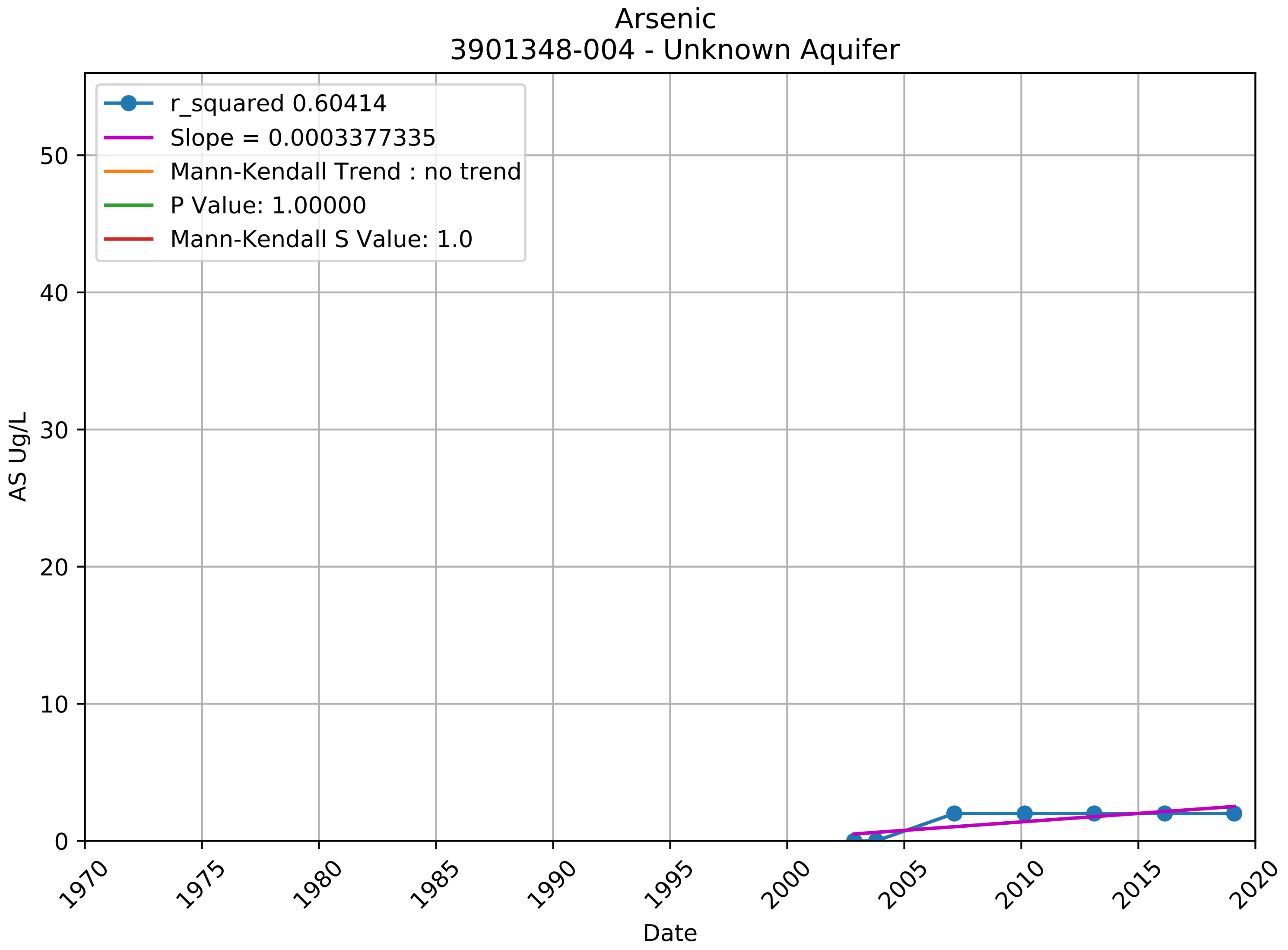

Arsenic
3901348-004 - Unknown Aquifer
r_squared 0.60414
Slope = 0.0003377335
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
AS Ug/L
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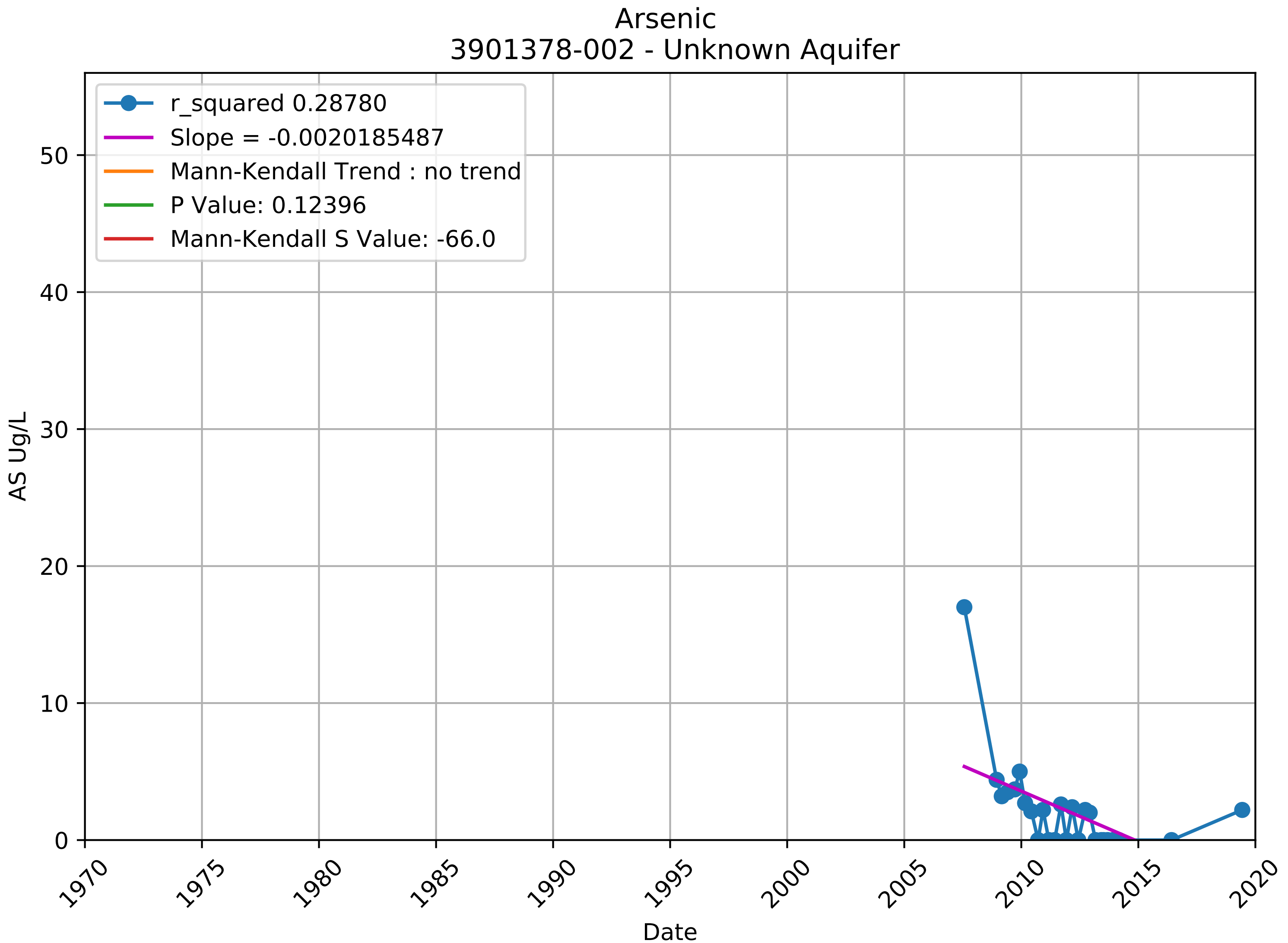

Arsenic
3901378-002 - Unknown Aquifer
r_squared 0.28780
Slope = -0.0020185487
Mann-Kendall Trend : no trend
P Value: 0.12396
Mann-Kendall S Value: -66.0
AS Ug/L
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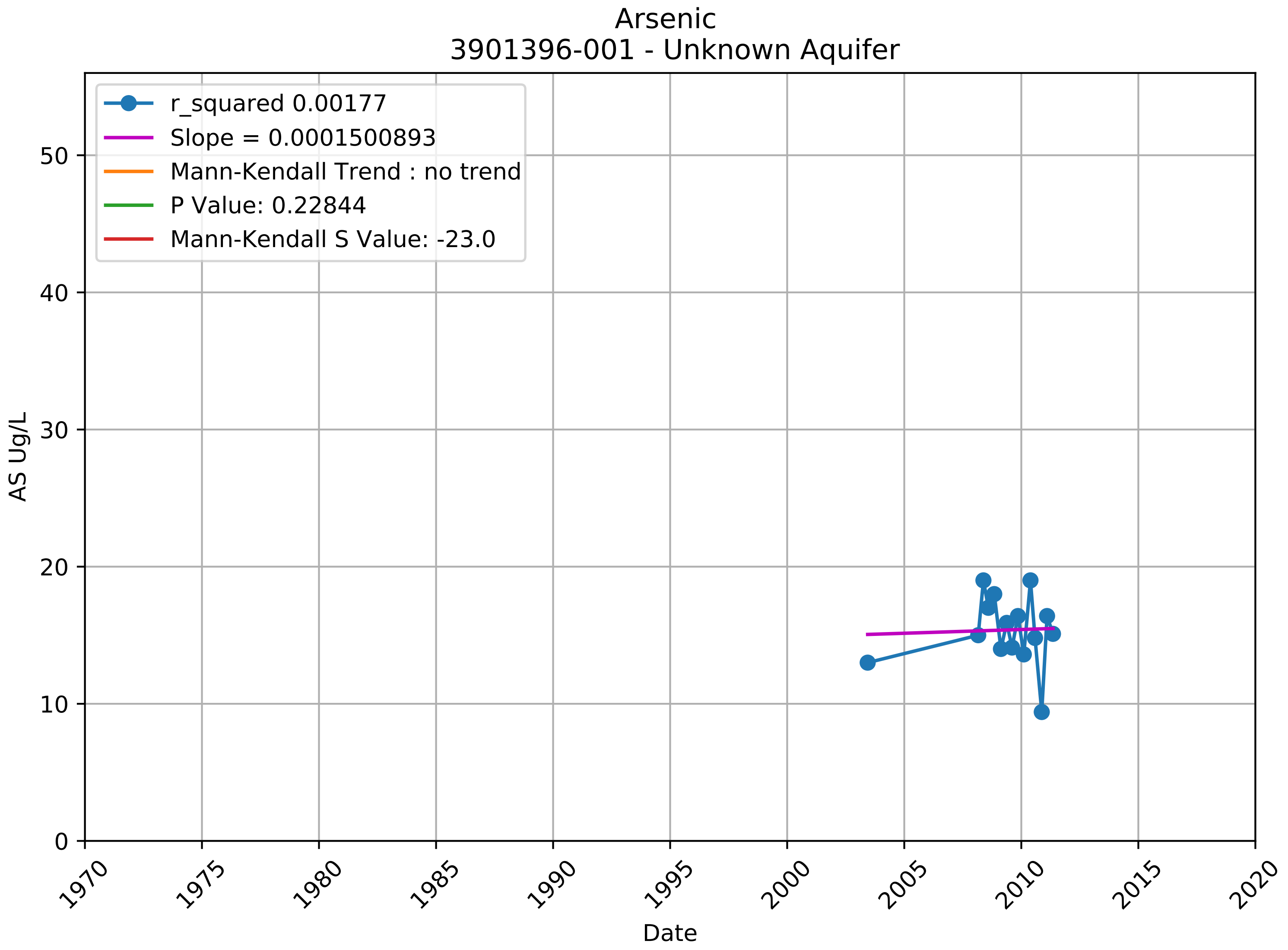

Arsenic
3901396-001 - Unknown Aquifer
r_squared 0.00177
Slope = 0.0001500893
Mann-Kendall Trend : no trend
P Value: 0.22844
Mann-Kendall S Value: -23.0
AS Ug/L
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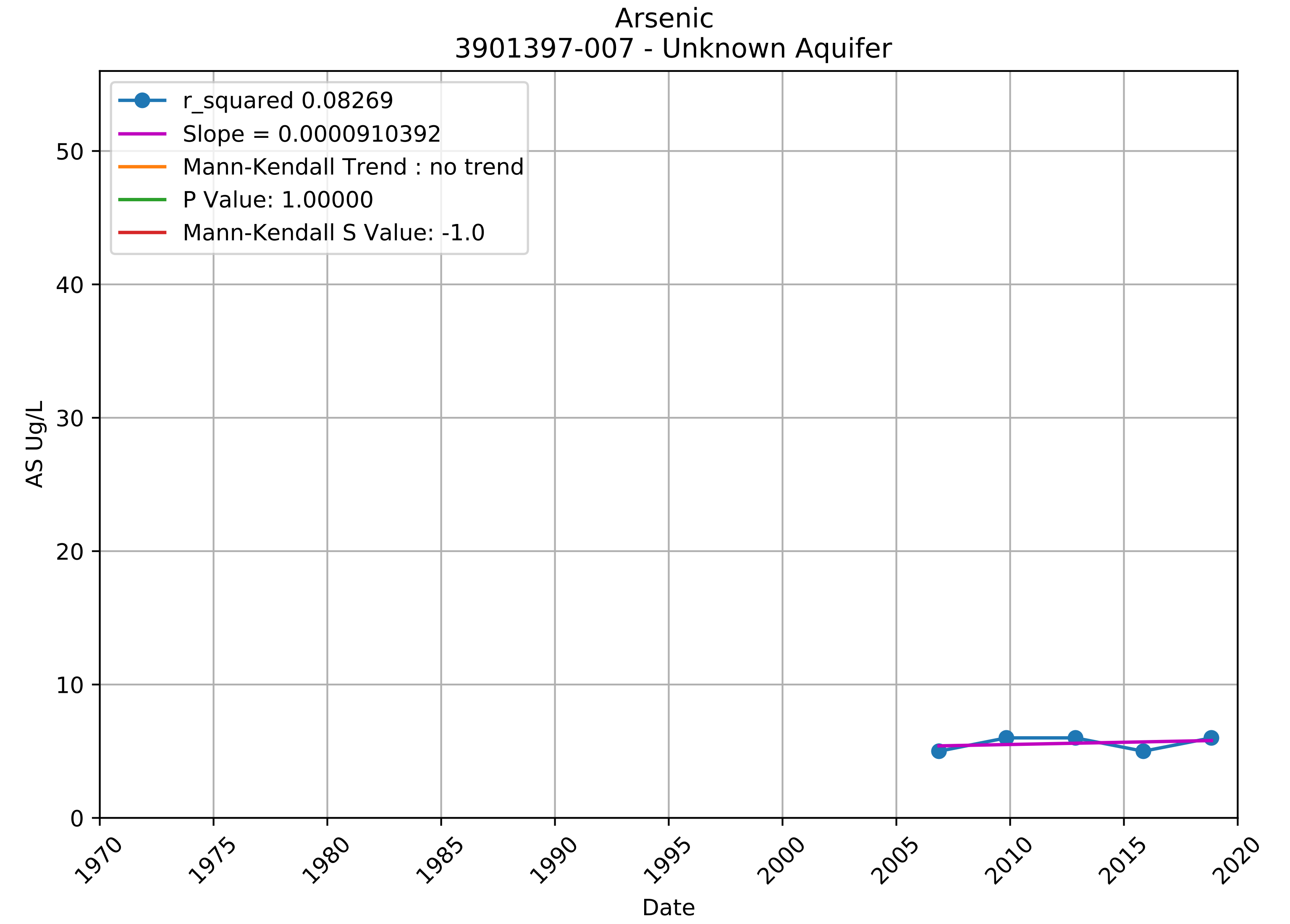
Arsenic
3901397-007 - Unknown Aquifer
r_squared 0.08269
Slope = 0.0000910392
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
AS Ug/L
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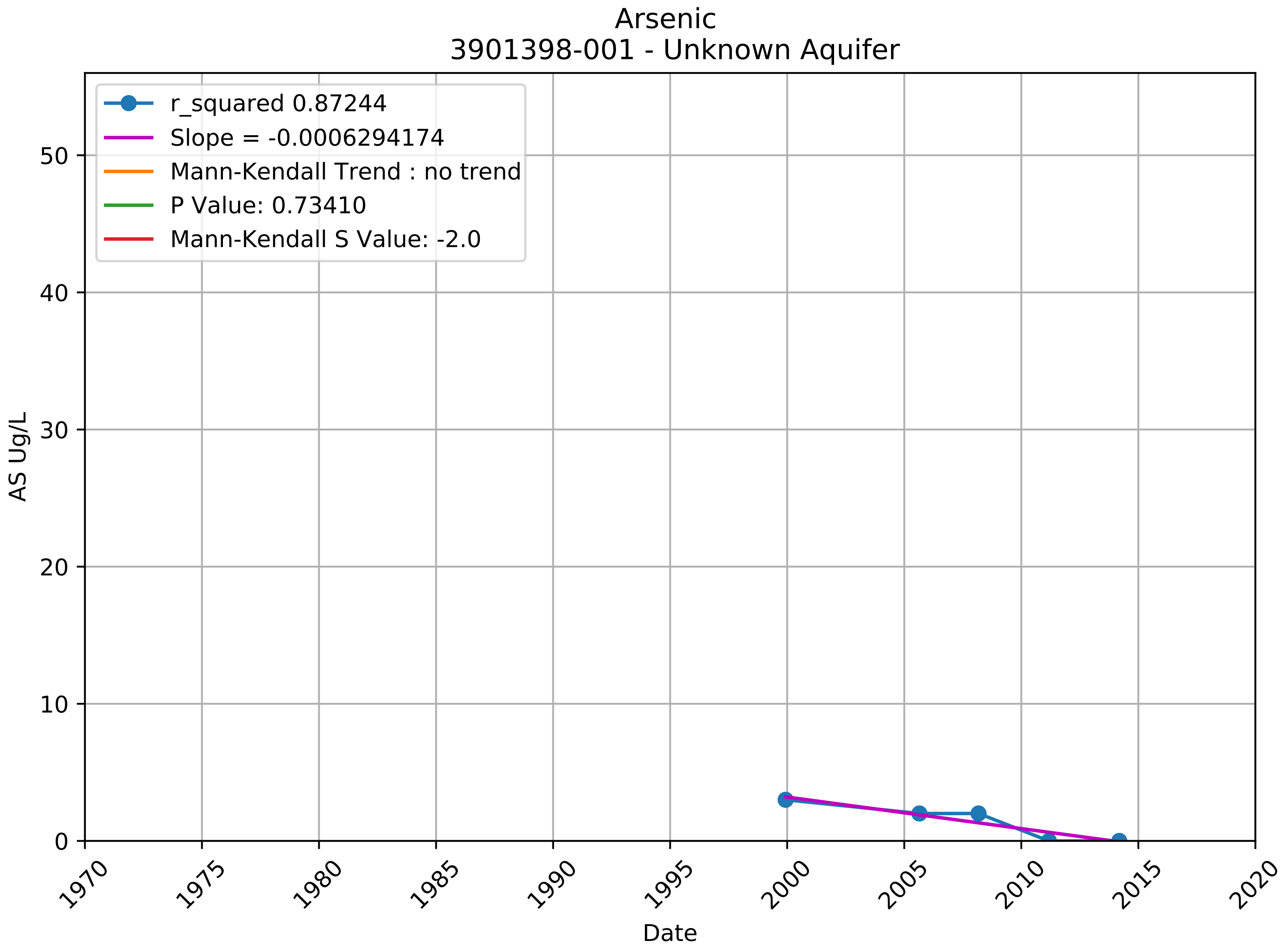
Arsenic
3901398-001 - Unknown Aquifer
r_squared 0.87244
Slope = -0.0006294174
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: -2.0
AS Ug/L
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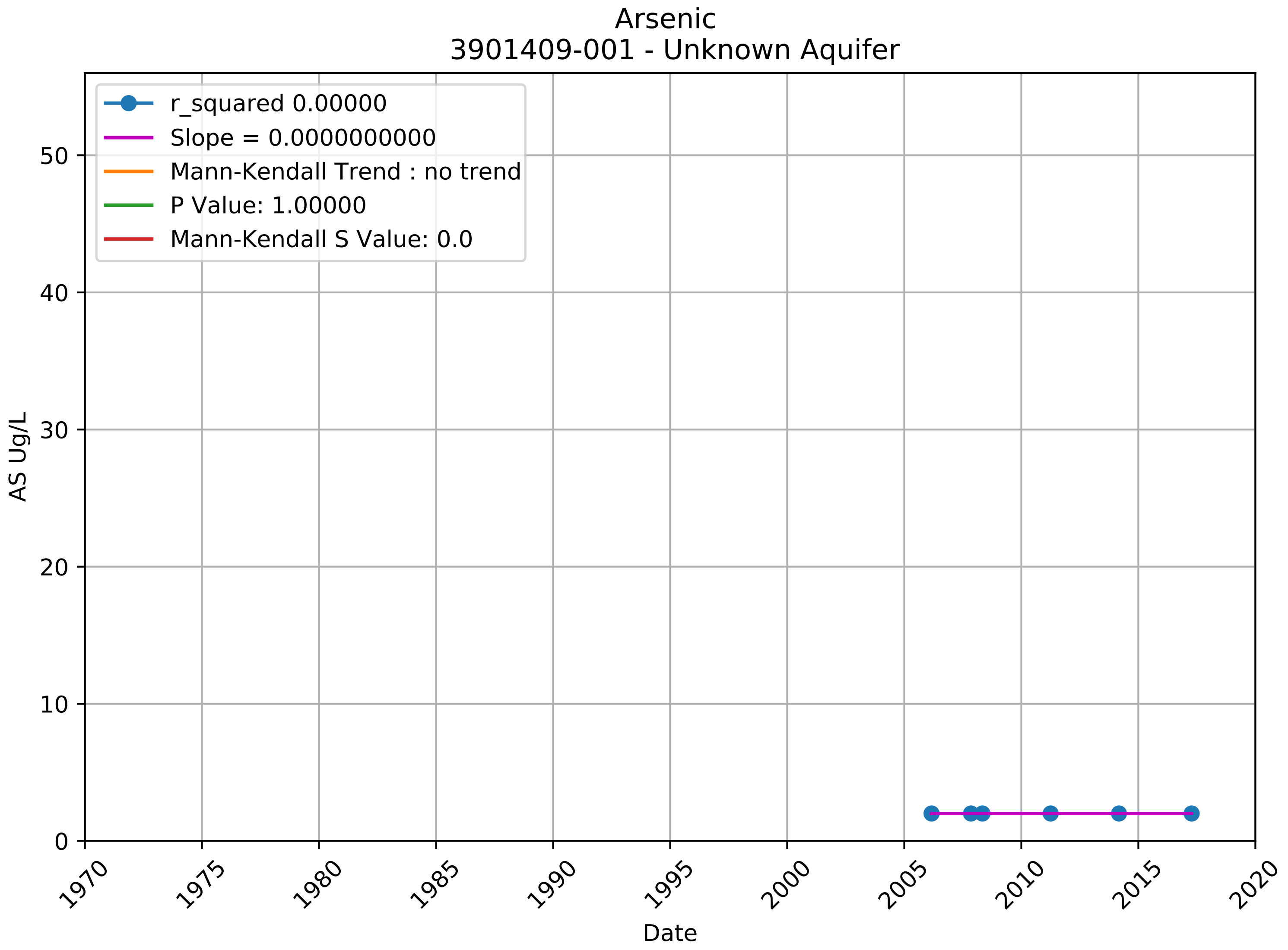
Arsenic
3901409-001 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
AS Ug/L
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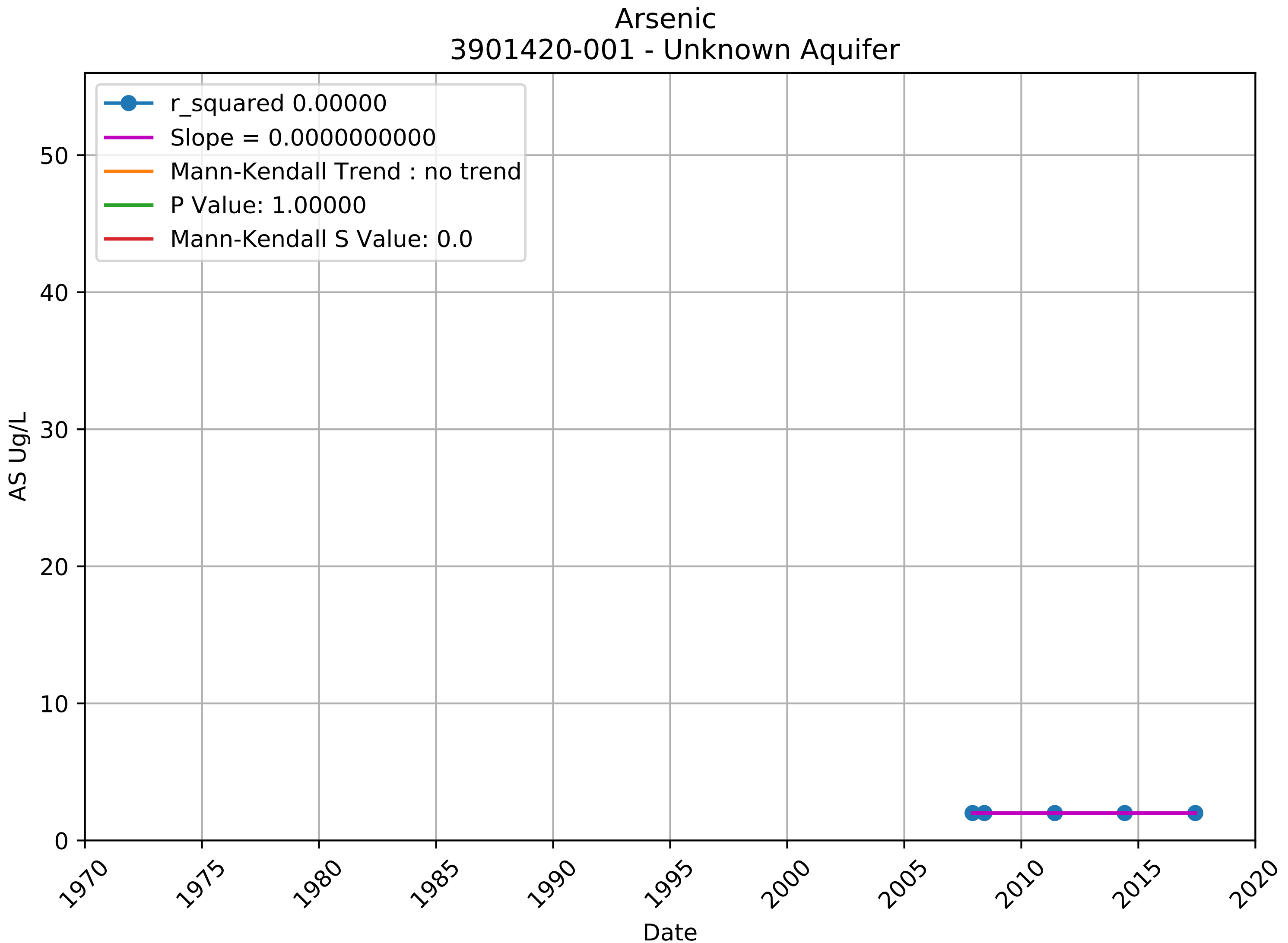

Arsenic
3901420-001 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
AS Ug/L
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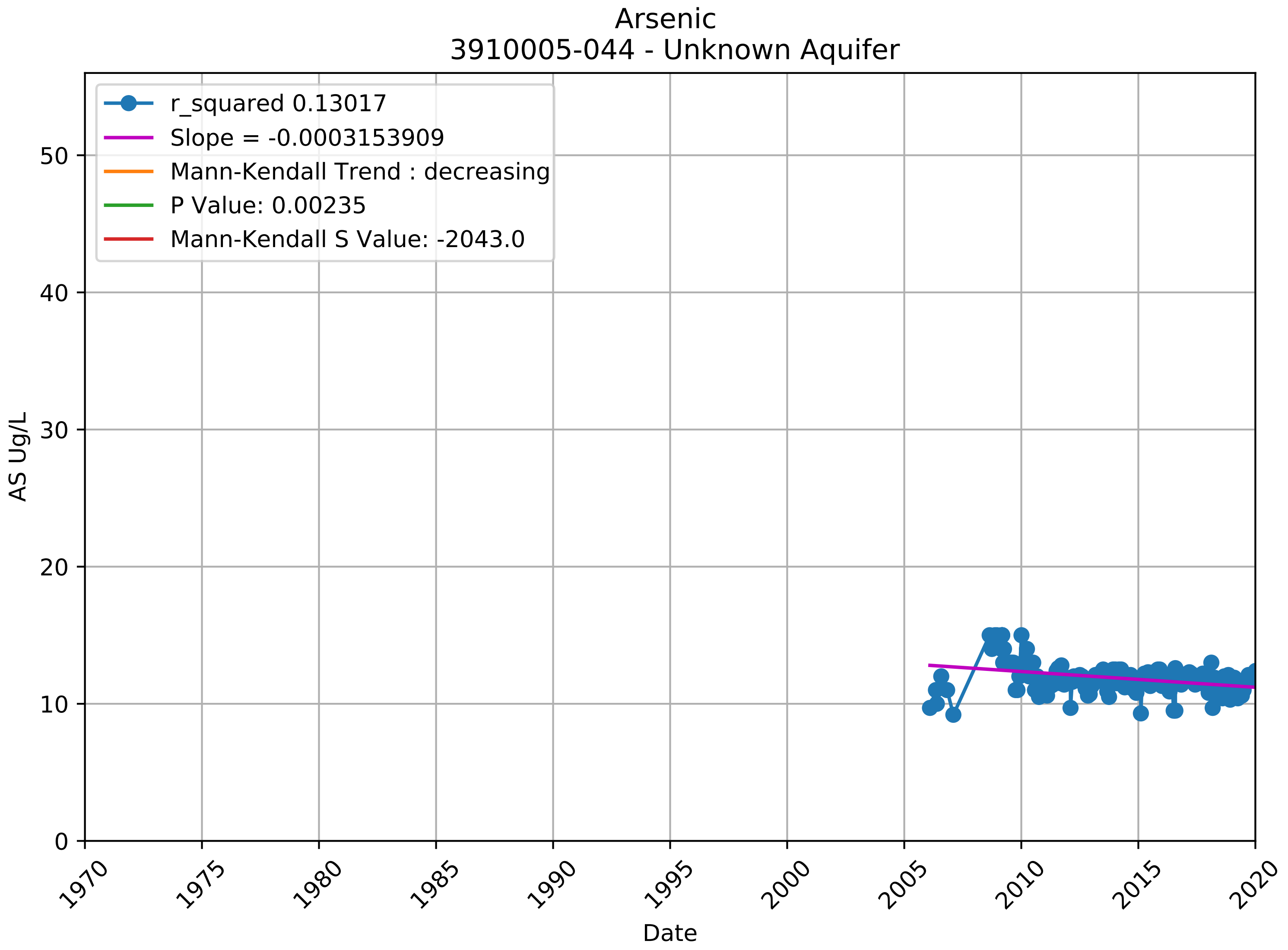

Arsenic
3910005-044 - Unknown Aquifer
r_squared 0.13017
Slope = -0.0003153909
Mann-Kendall Trend : decreasing
P Value: 0.00235
Mann-Kendall S Value: -2043.0
AS Ug/L
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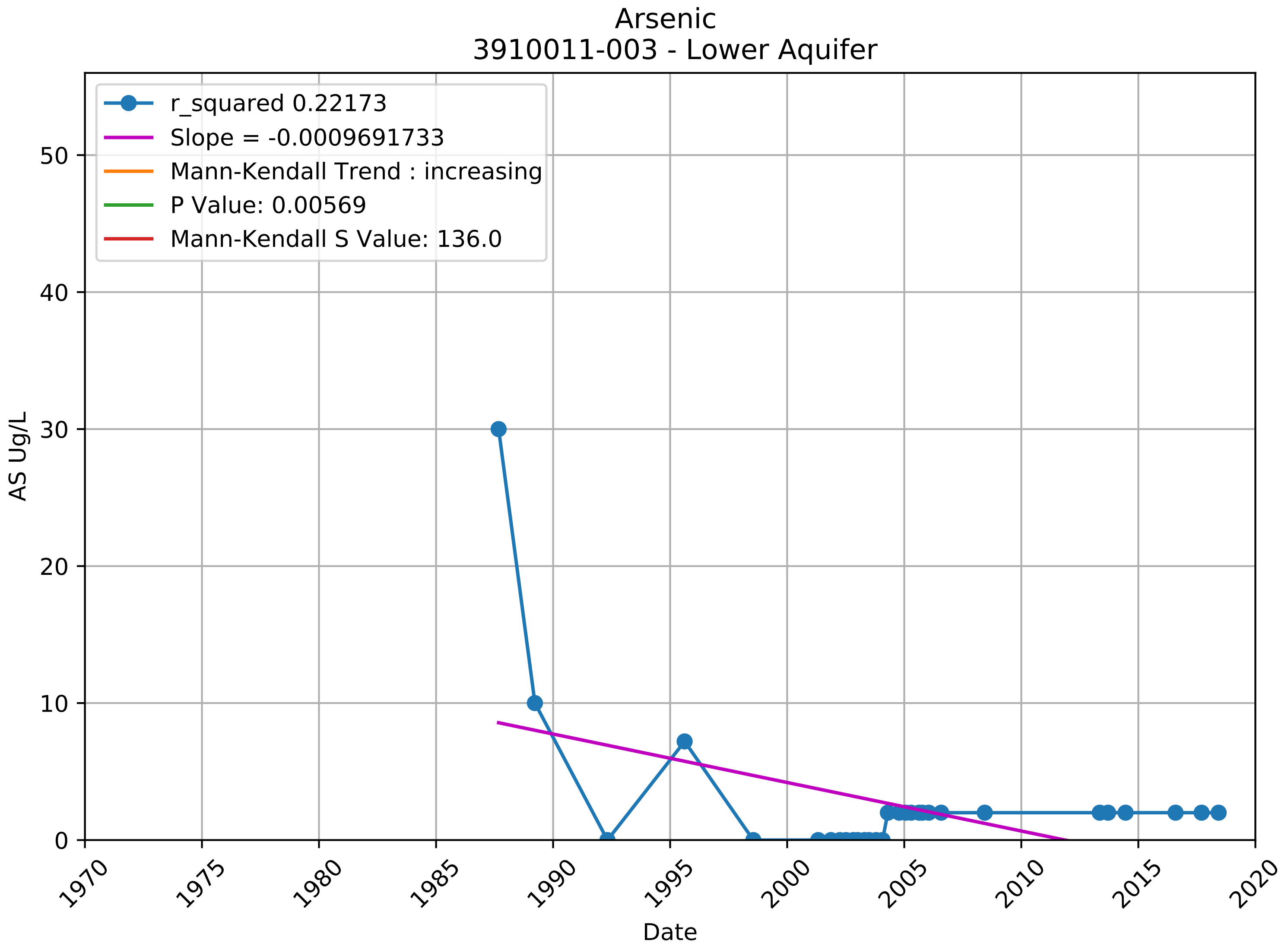

Arsenic
3910011-003 - Lower Aquifer
r_squared 0.22173
Slope = -0.0009691733
Mann-Kendall Trend : increasing
P Value: 0.00569
Mann-Kendall S Value: 136.0
AS Ug/L
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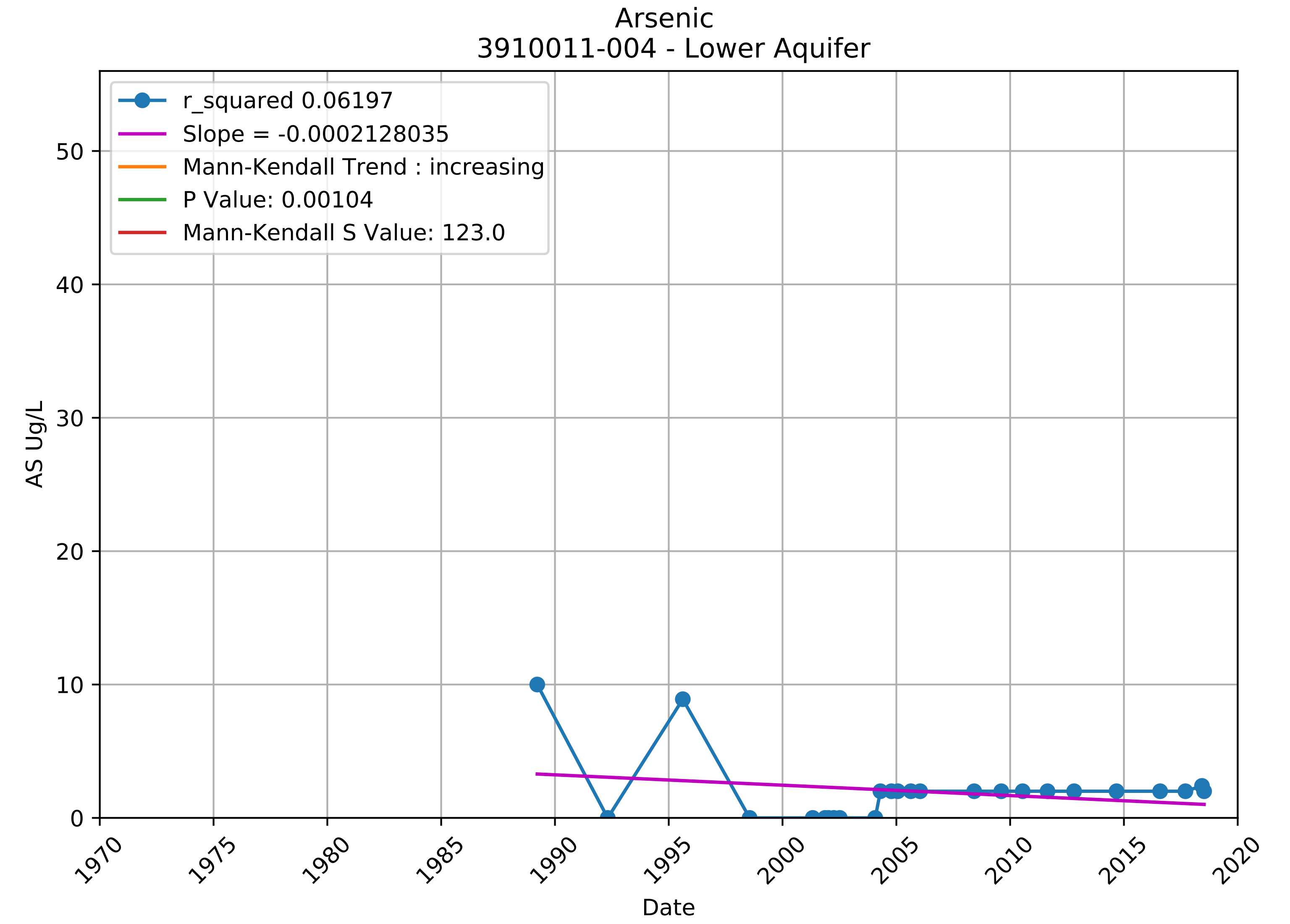

Arsenic
3910011-004 - Lower Aquifer
r_squared 0.06197
Slope = -0.0002128035
Mann-Kendall Trend : increasing
P Value: 0.00104
Mann-Kendall S Value: 123.0
AS Ug/L
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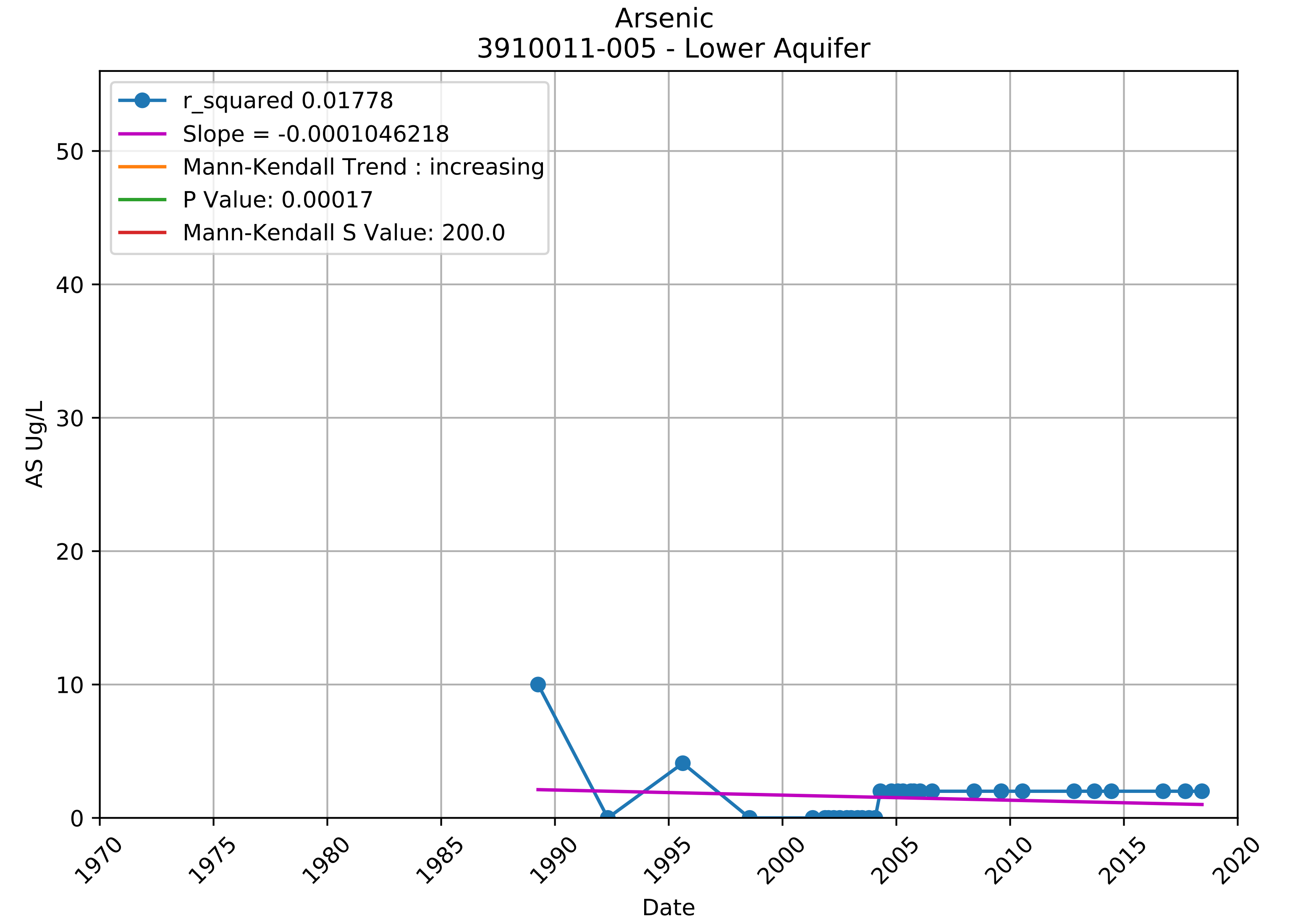
Arsenic
3910011-005 - Lower Aquifer
r_squared 0.01778
Slope = -0.0001046218
Mann-Kendall Trend : increasing
P Value: 0.00017
Mann-Kendall S Value: 200.0
AS Ug/L
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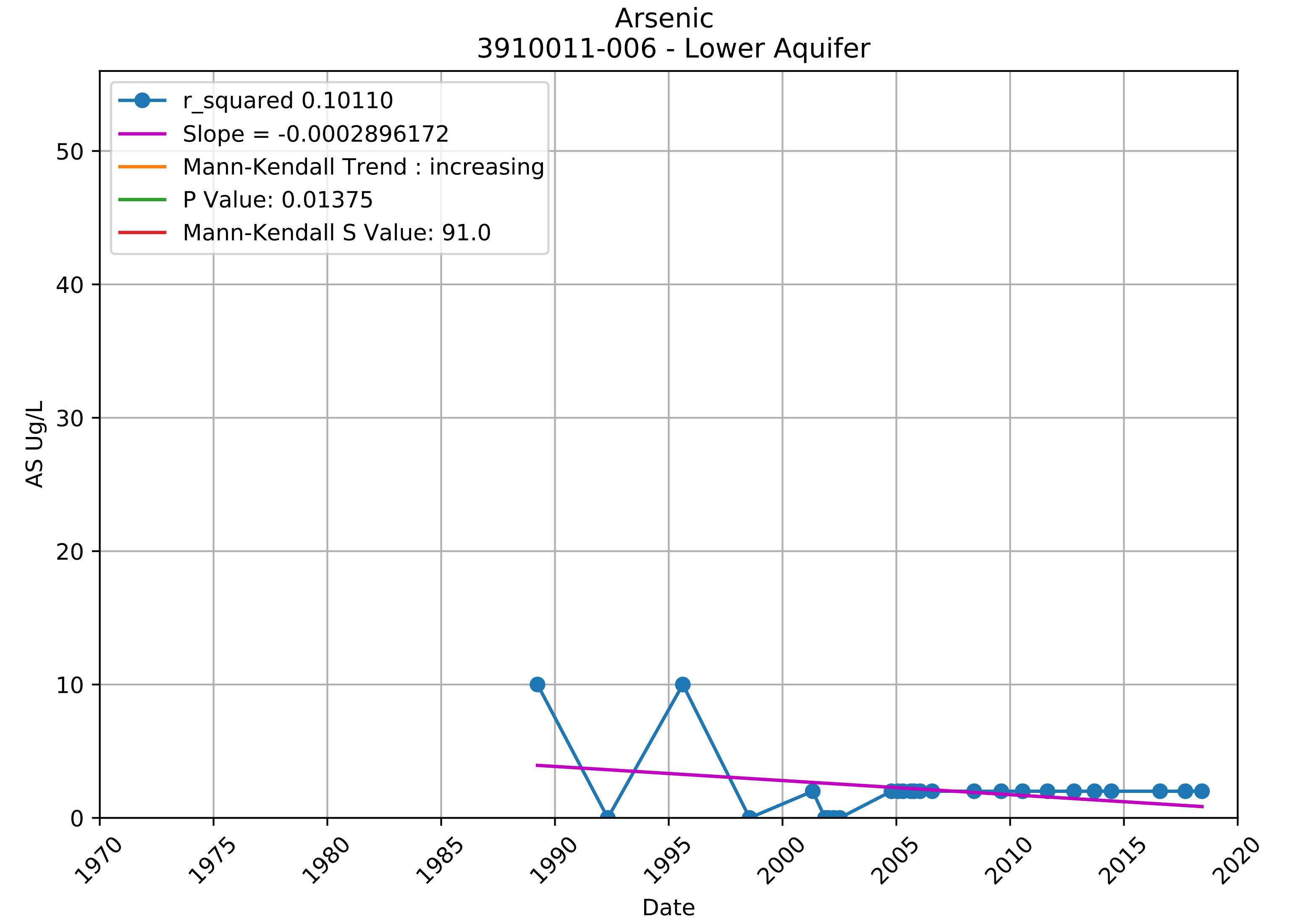

Arsenic
3910011-006 - Lower Aquifer
r_squared 0.10110
Slope = -0.0002896172
Mann-Kendall Trend : increasing
P Value: 0.01375
Mann-Kendall S Value: 91.0
AS Ug/L
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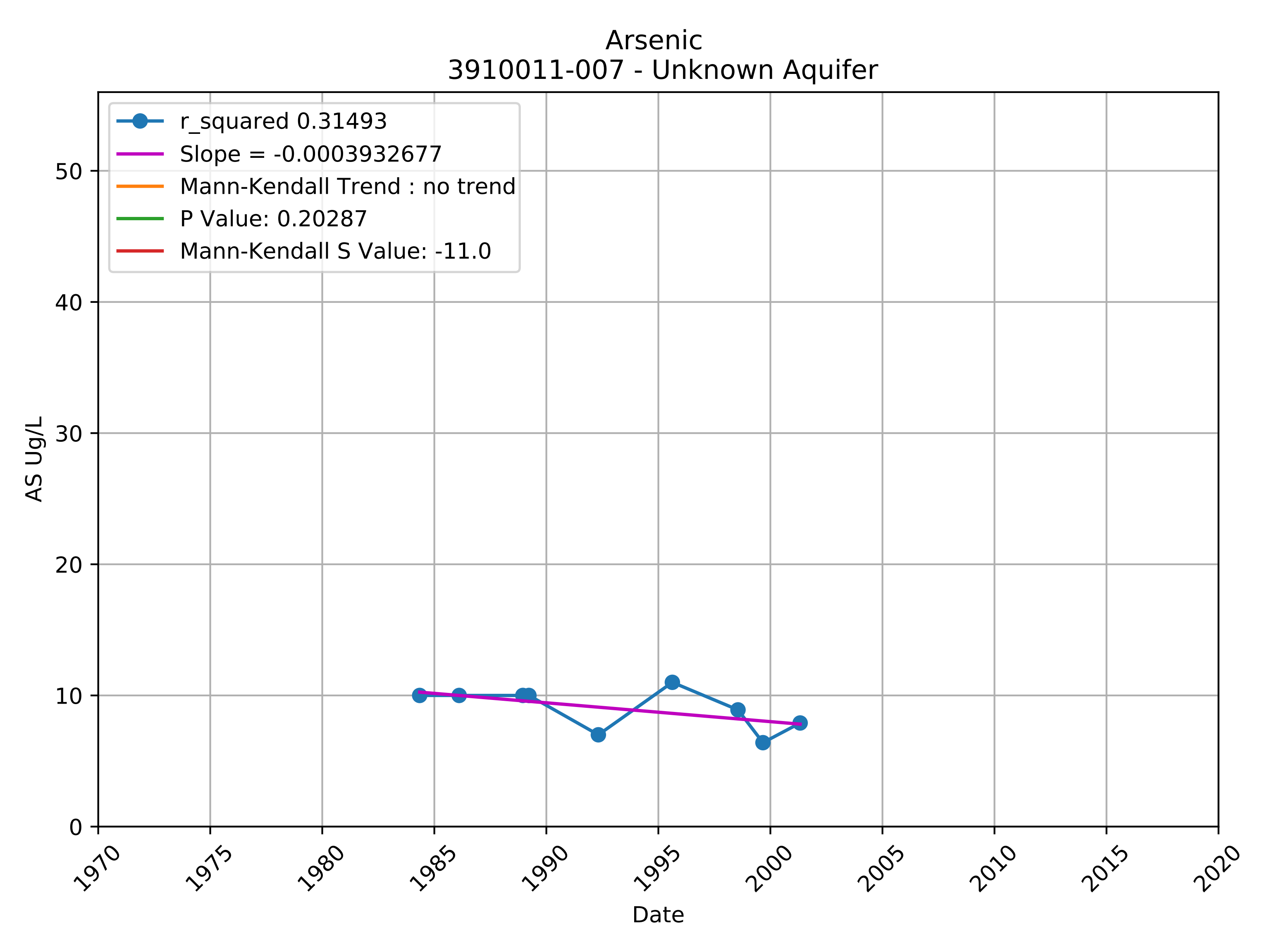
Arsenic
3910011-007 - Unknown Aquifer
r_squared 0.31493
Slope = -0.0003932677
Mann-Kendall Trend : no trend
P Value: 0.20287
Mann-Kendall S Value: -11.0
AS Ug/L
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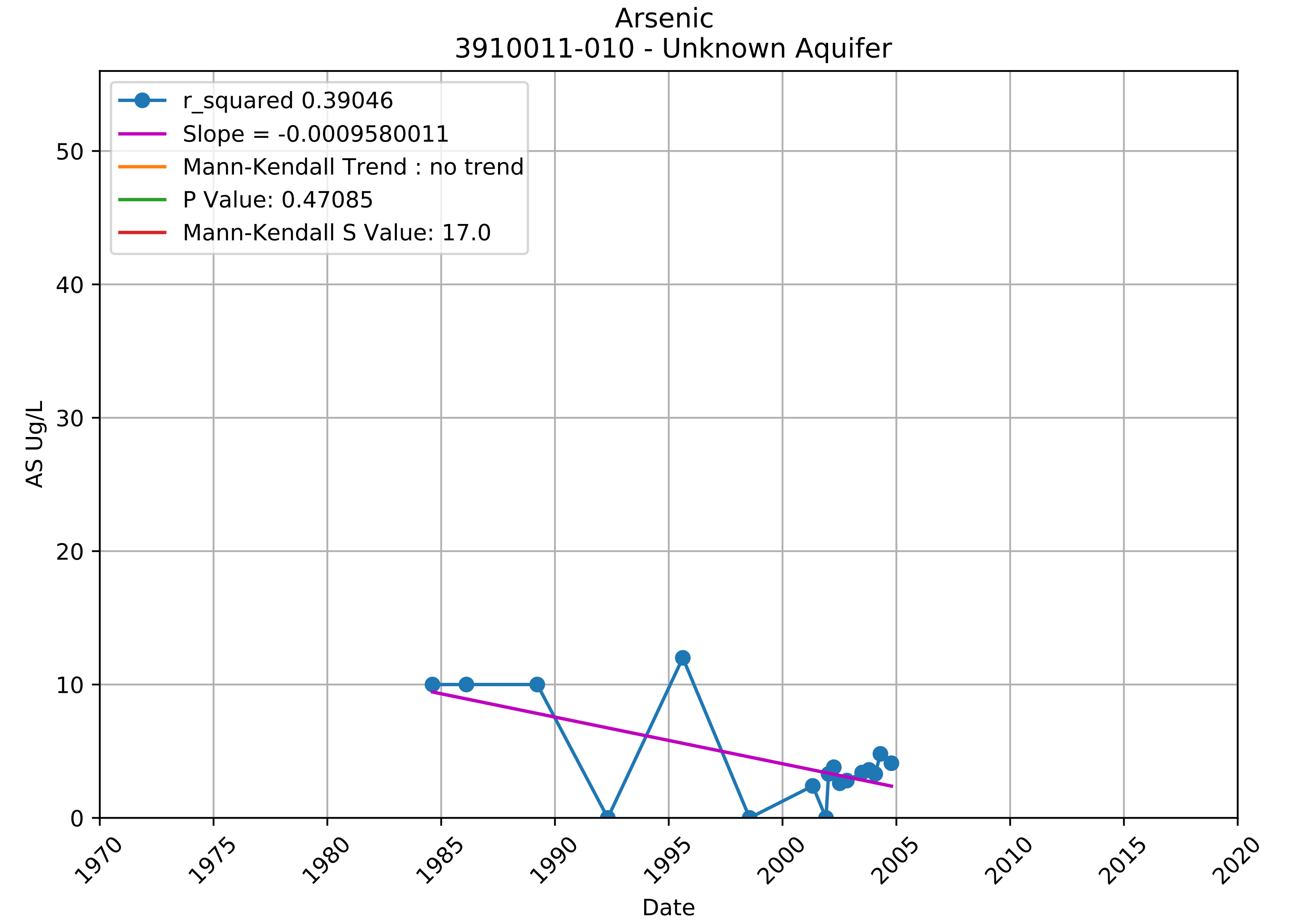

Arsenic
3910011-010 - Unknown Aquifer
r_squared 0.39046
Slope = -0.0009580011
Mann-Kendall Trend : no trend
P Value: 0.47085
Mann-Kendall S Value: 17.0
AS Ug/L
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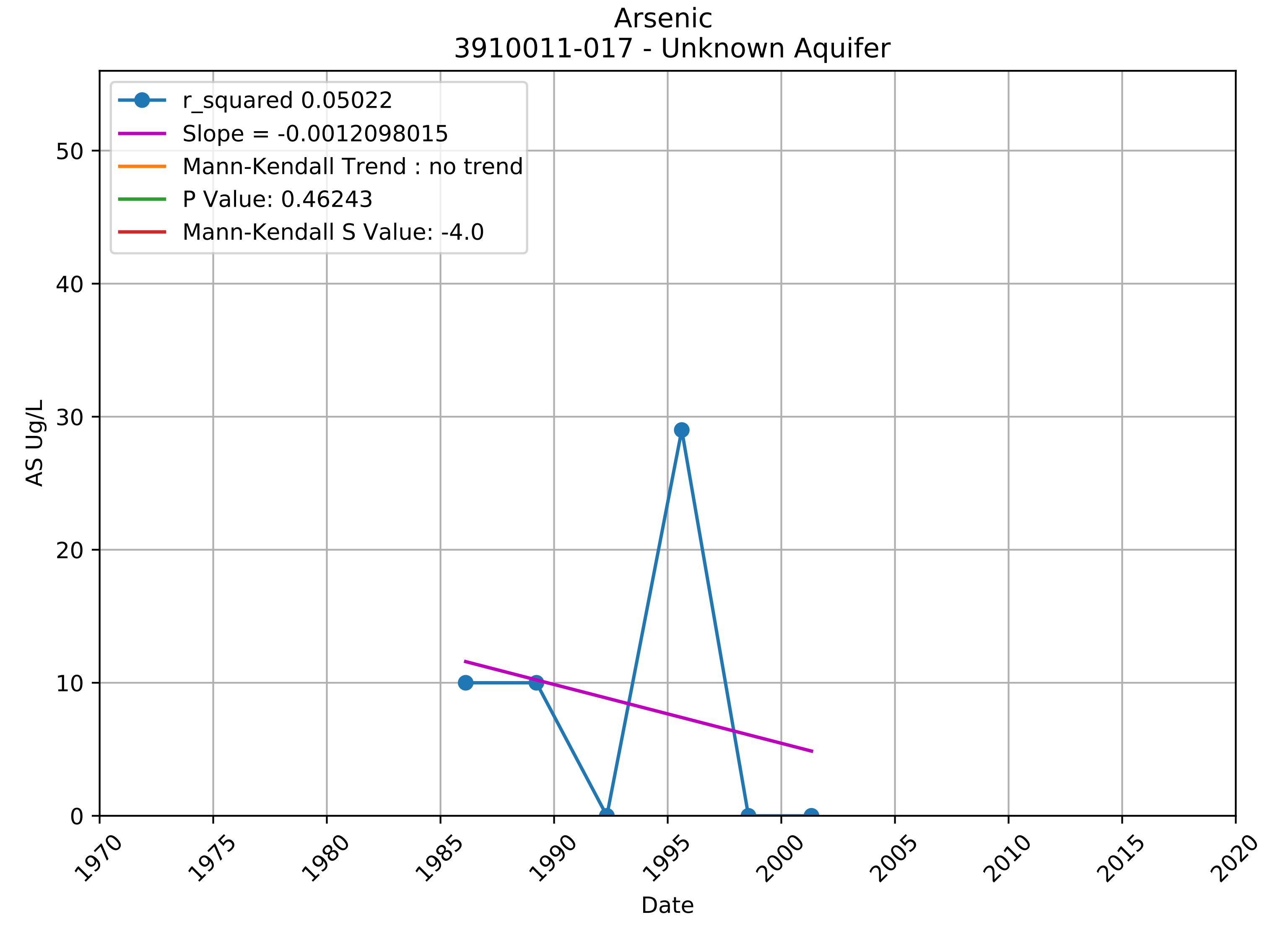
Arsenic
3910011-017 - Unknown Aquifer
r_squared 0.05022
Slope = -0.0012098015
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: -4.0
AS Ug/L
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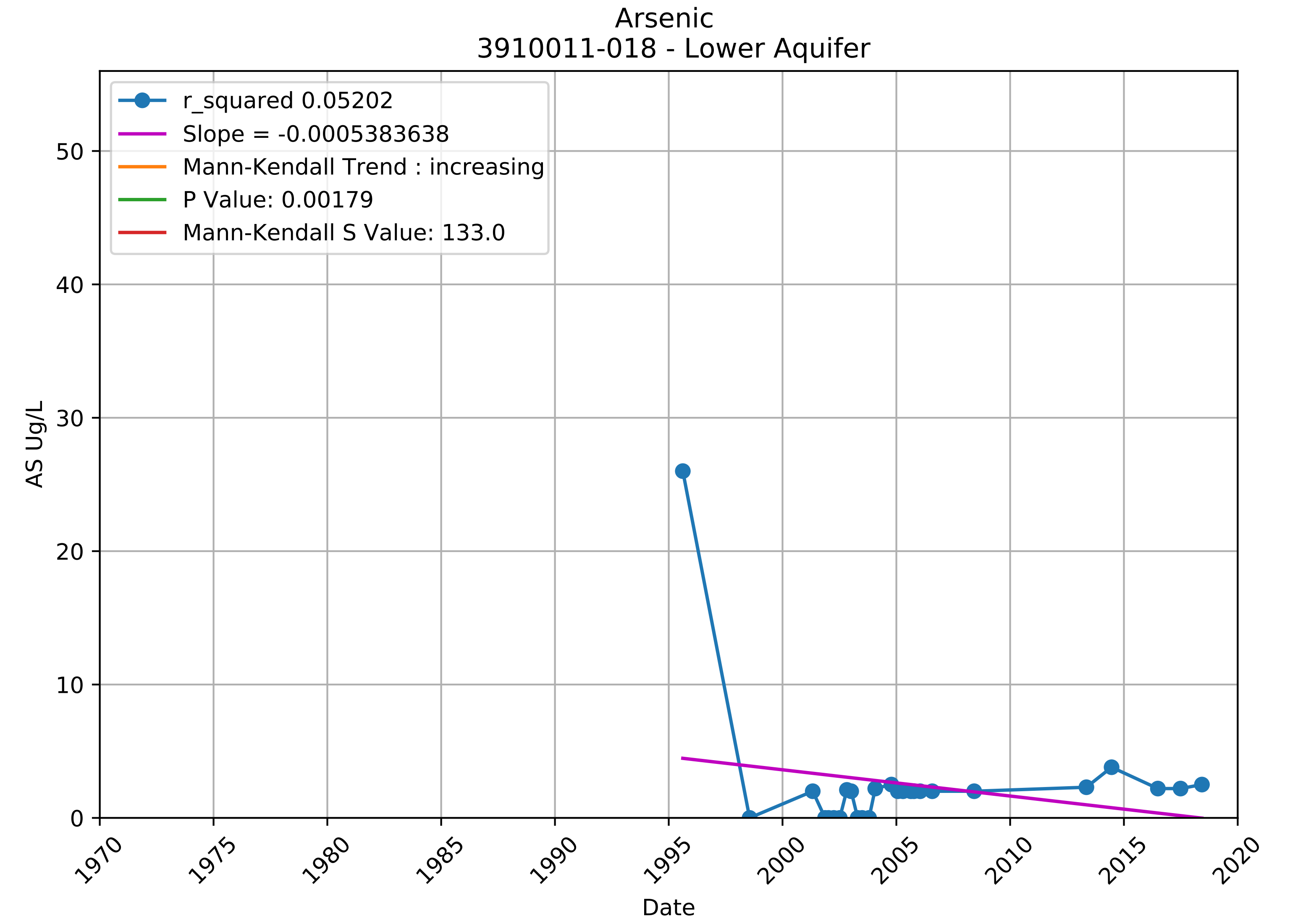

Arsenic
3910011-018 - Lower Aquifer
r_squared 0.05202
Slope = -0.0005383638
Mann-Kendall Trend : increasing
P Value: 0.00179
Mann-Kendall S Value: 133.0
AS Ug/L
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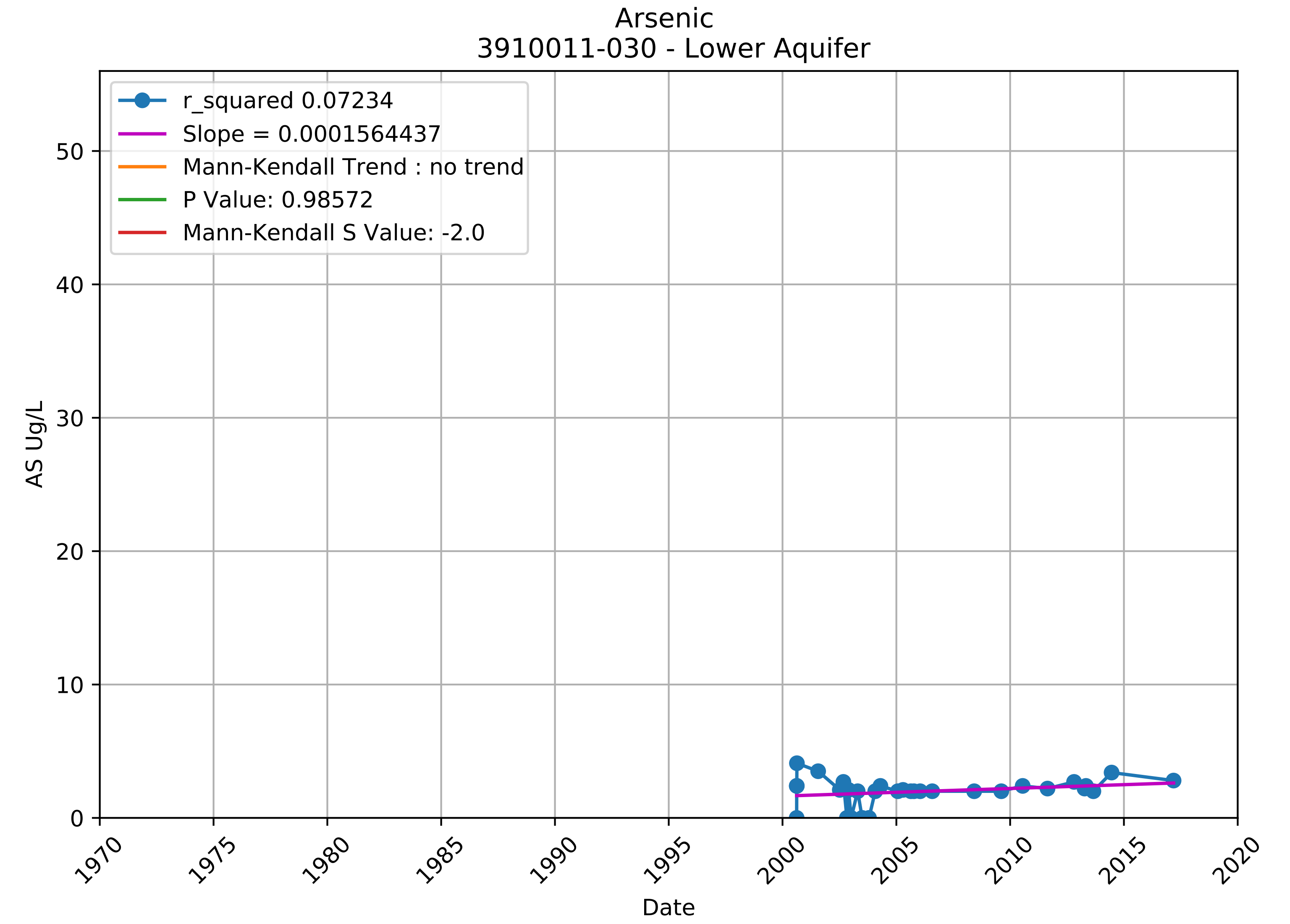

Arsenic
3910011-030 - Lower Aquifer
r_squared 0.07234
Slope = 0.0001564437
Mann-Kendall Trend : no trend
P Value: 0.98572
Mann-Kendall S Value: -2.0
AS Ug/L
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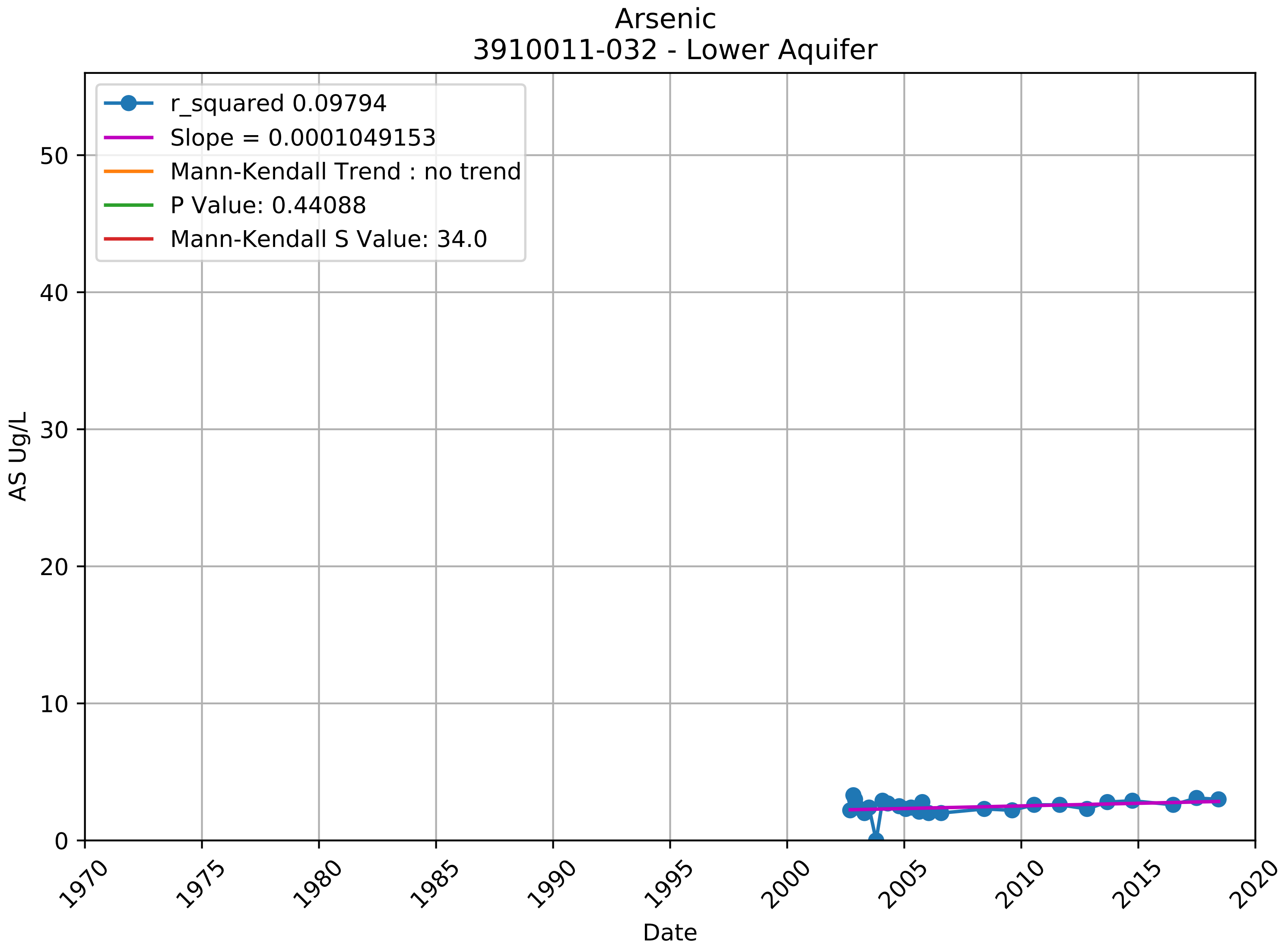

Arsenic
3910011-032 - Lower Aquifer
r_squared 0.09794
Slope = 0.0001049153
Mann-Kendall Trend : no trend
P Value: 0.44088
Mann-Kendall S Value: 34.0
AS Ug/L
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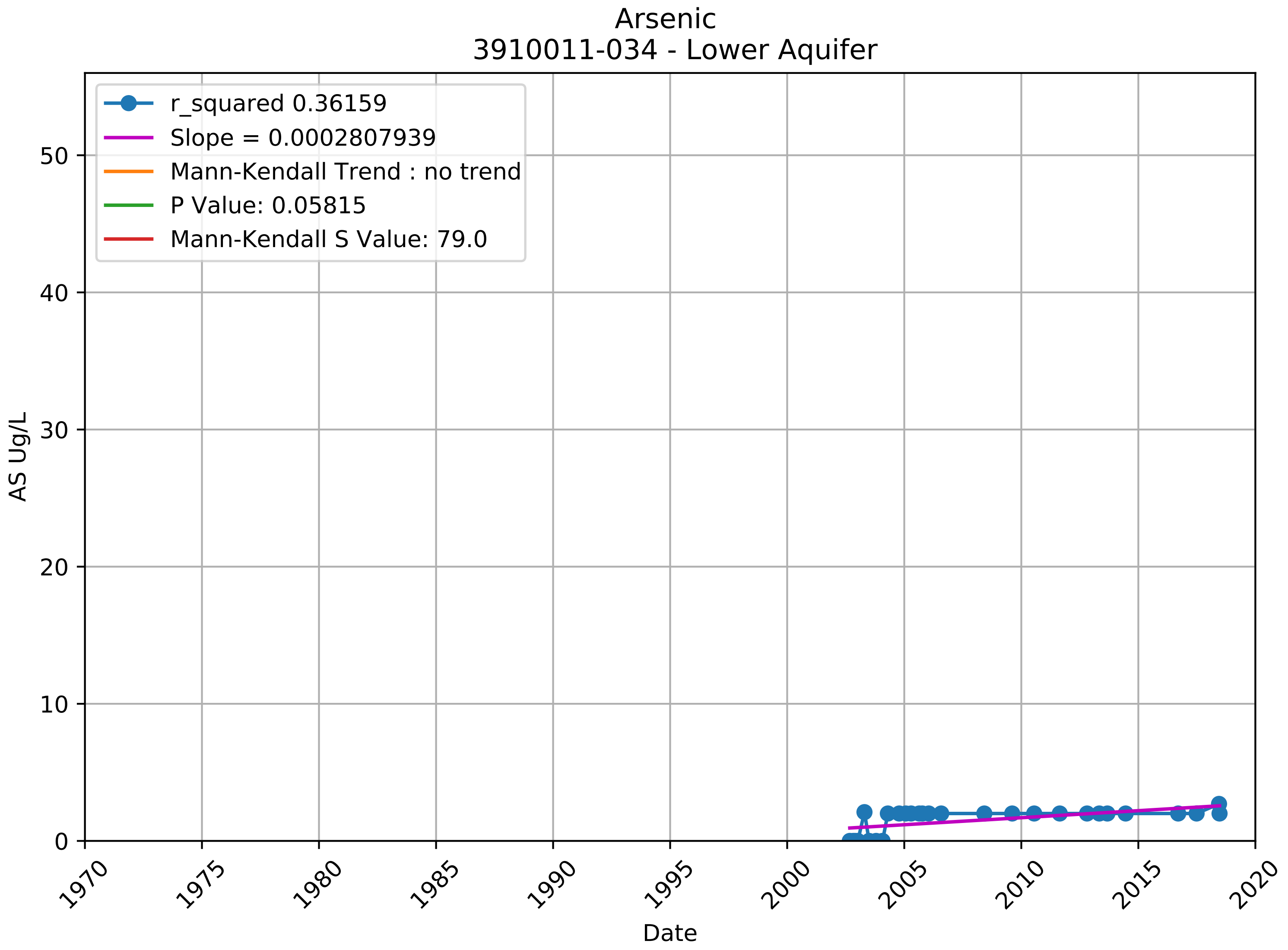

Arsenic
3910011-034 - Lower Aquifer
r_squared 0.36159
Slope = 0.0002807939
Mann-Kendall Trend : no trend
P Value: 0.05815
Mann-Kendall S Value: 79.0
AS Ug/L
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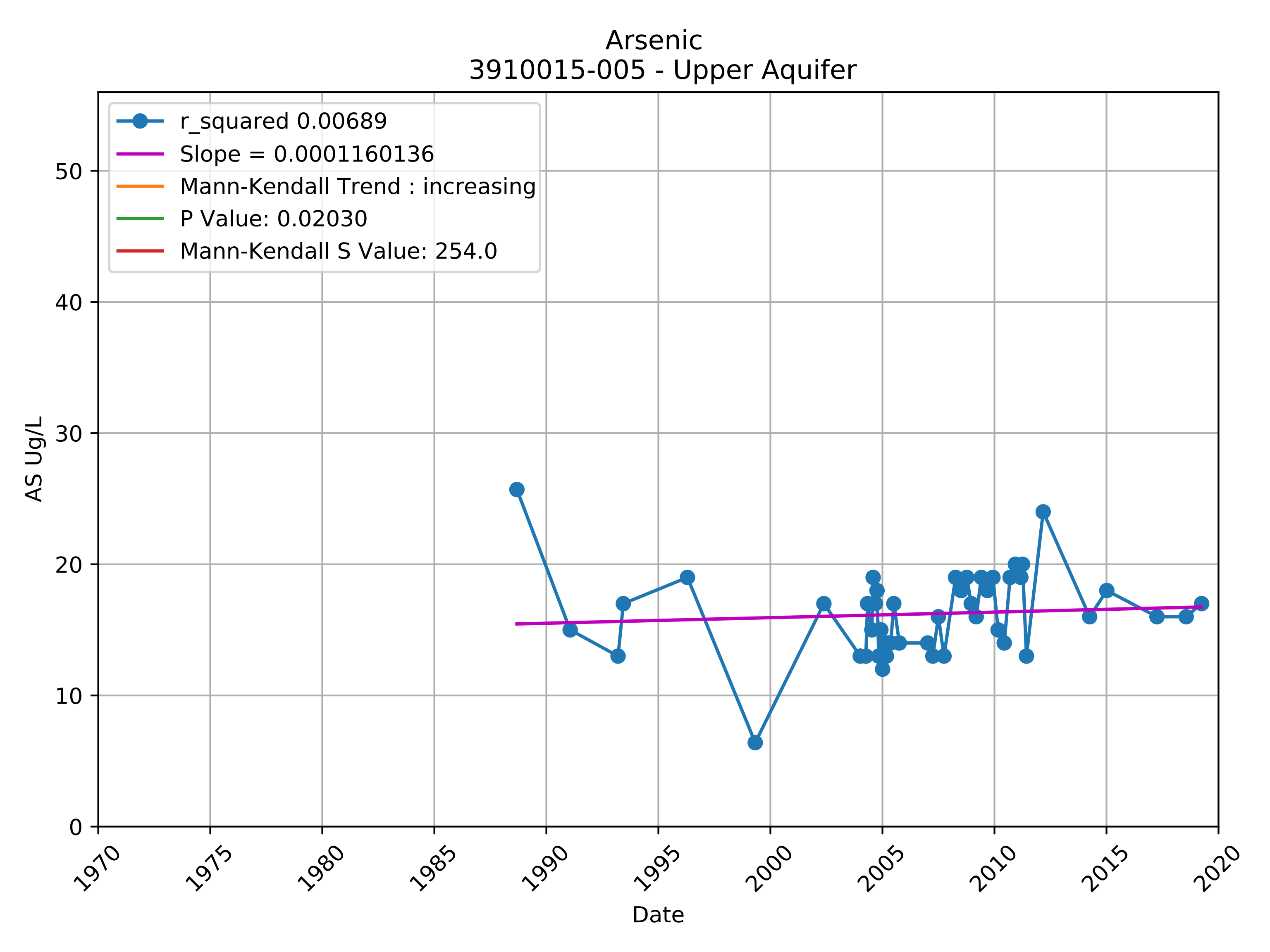

Arsenic
3910015-005 - Upper Aquifer
r_squared 0.00689
Slope = 0.0001160136
Mann-Kendall Trend : increasing
P Value: 0.02030
Mann-Kendall S Value: 254.0
AS Ug/L
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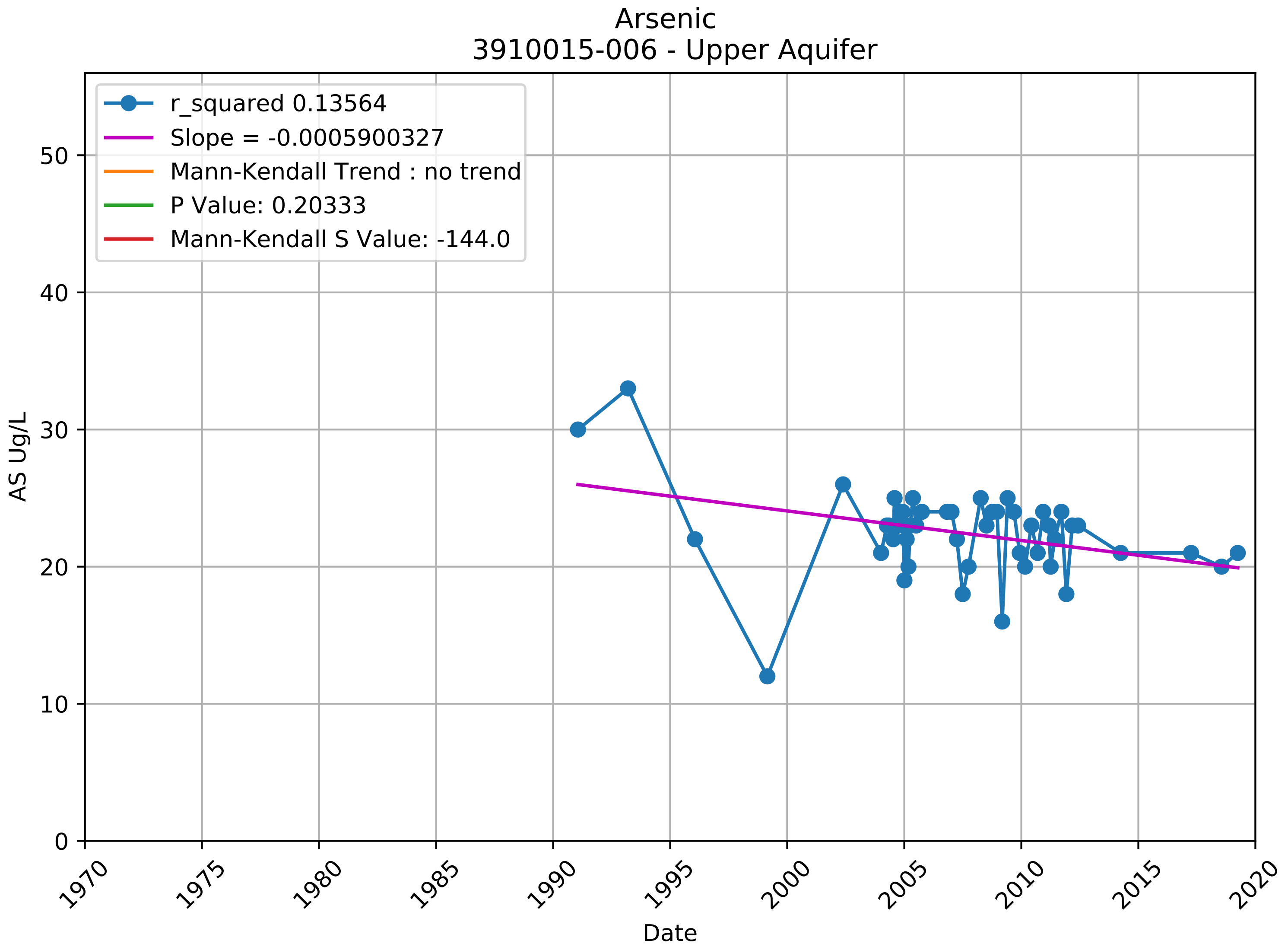

Arsenic
3910015-006 - Upper Aquifer
r_squared 0.13564
Slope = -0.0005900327
Mann-Kendall Trend : no trend
P Value: 0.20333
Mann-Kendall S Value: -144.0
AS Ug/L
Date
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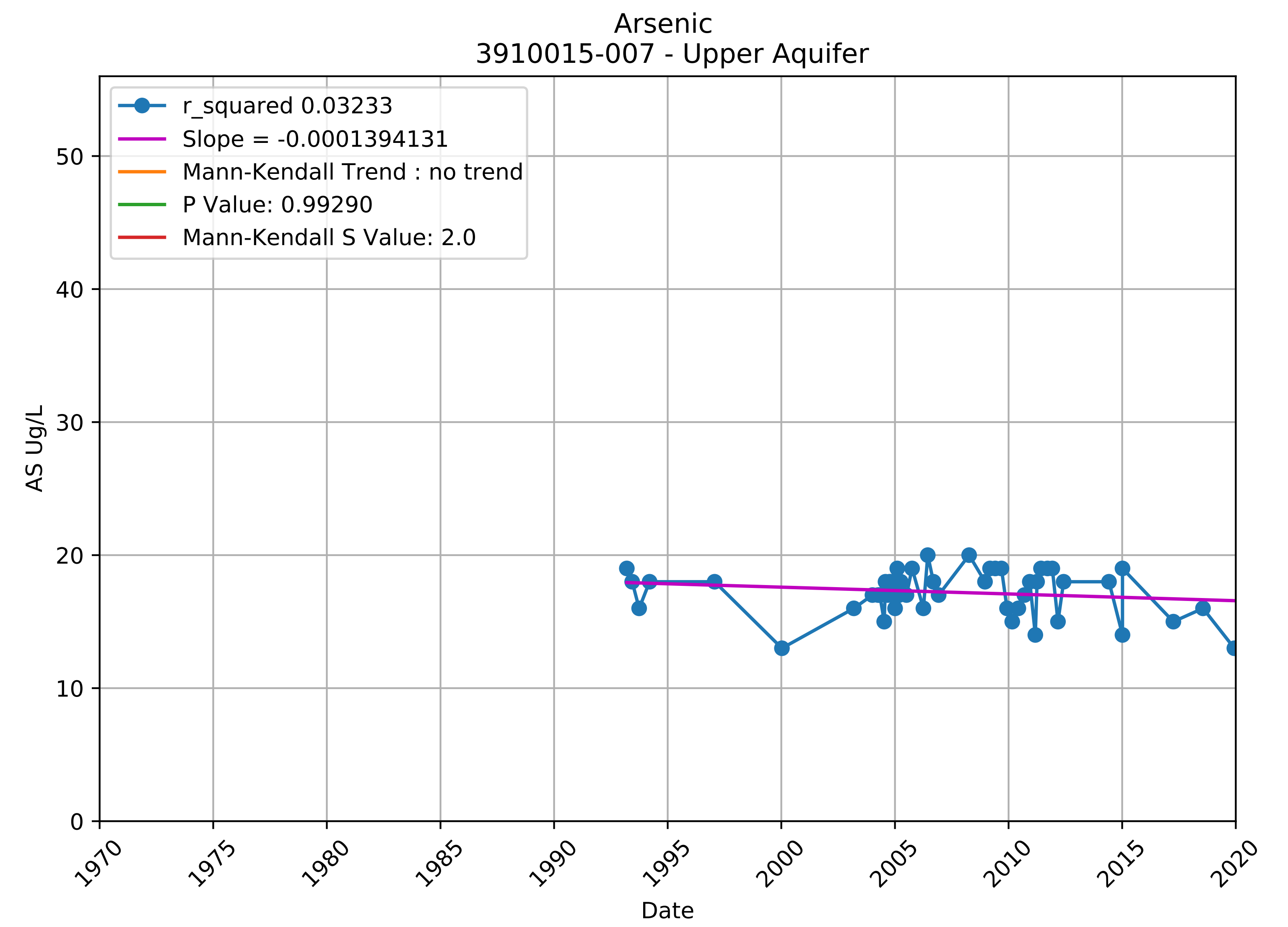

Arsenic
3910015-007 - Upper Aquifer
r_squared 0.03233
Slope = -0.0001394131
Mann-Kendall Trend : no trend
P Value: 0.99290
Mann-Kendall S Value: 2.0
AS Ug/L
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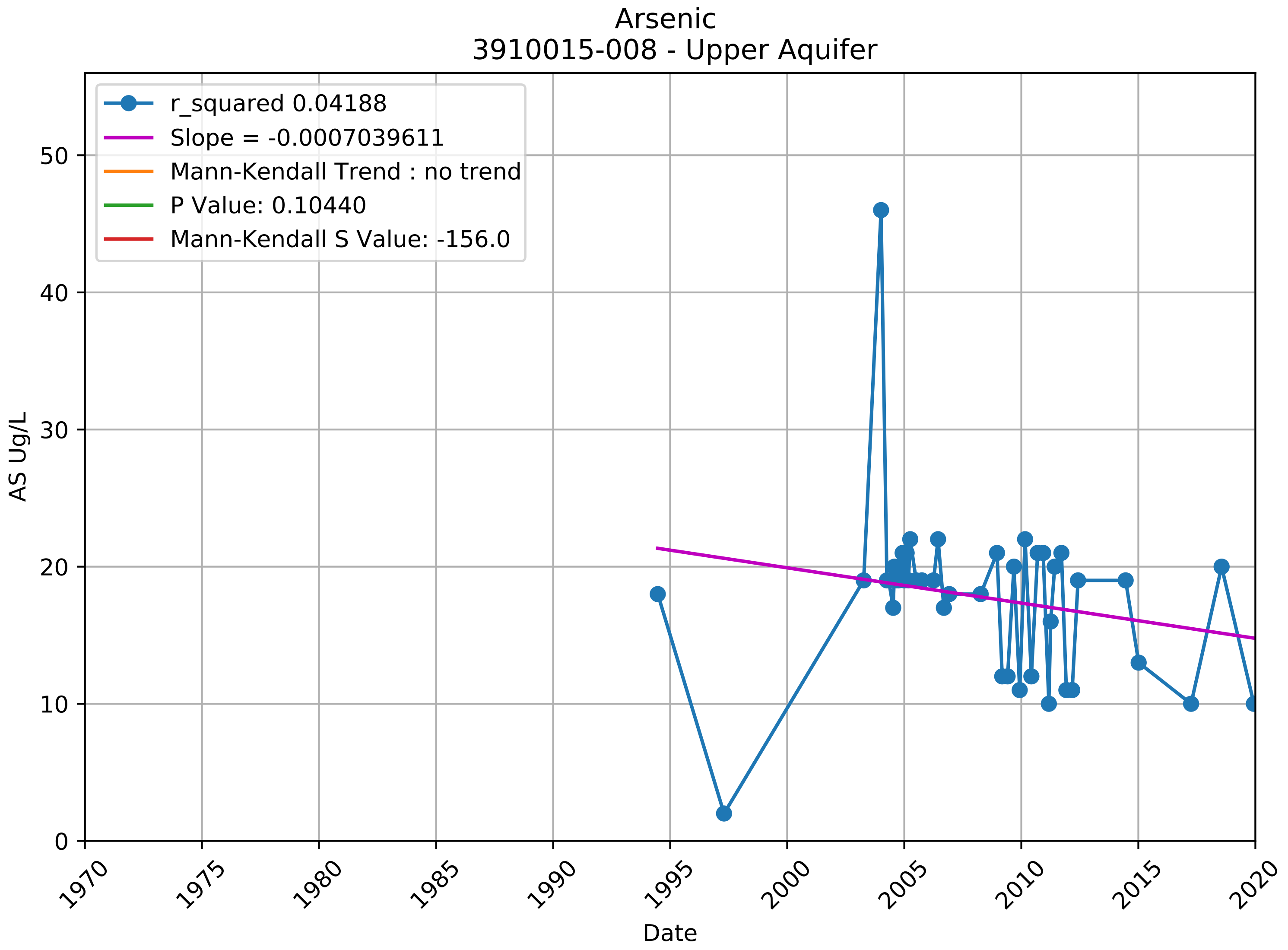

Arsenic
3910015-008 - Upper Aquifer
r_squared 0.04188
Slope = -0.0007039611
Mann-Kendall Trend : no trend
P Value: 0.10440
Mann-Kendall S Value: -156.0
AS Ug/L
Date
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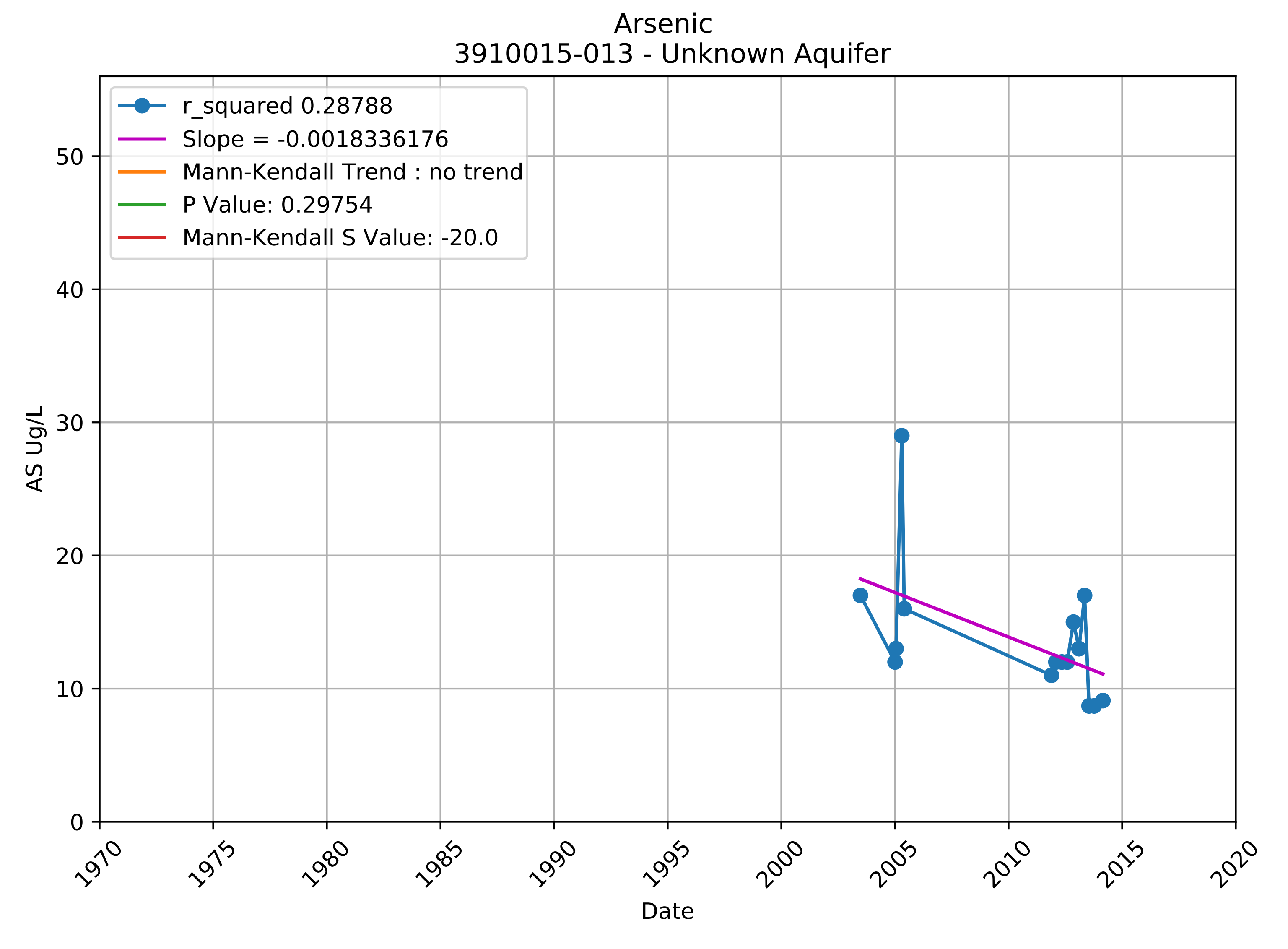

Arsenic
3910015-013 - Unknown Aquifer
r_squared 0.28788
Slope = -0.0018336176
Mann-Kendall Trend : no trend
P Value: 0.29754
Mann-Kendall S Value: -20.0
AS Ug/L
Date
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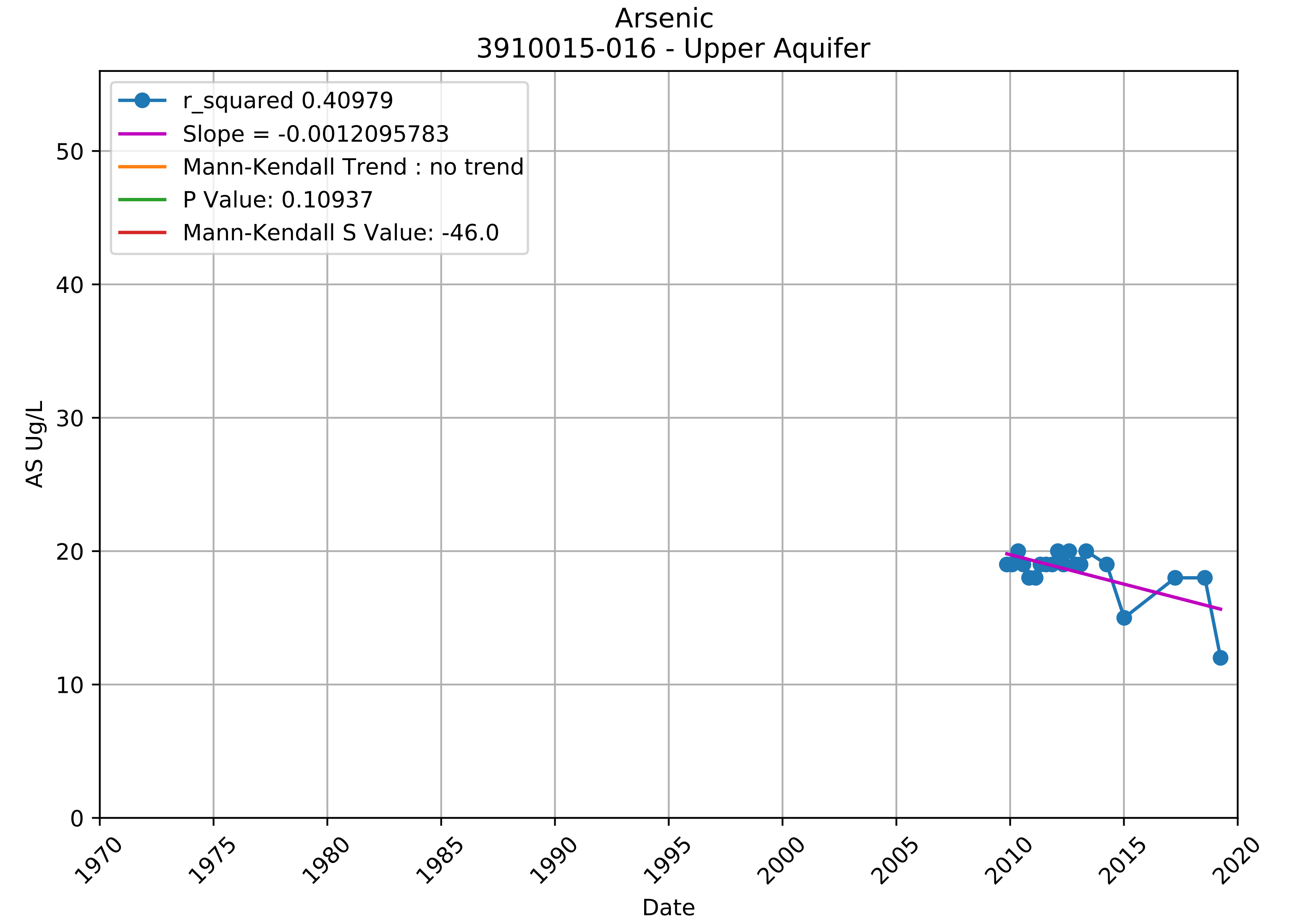

Arsenic
3910015-016 - Upper Aquifer
r_squared 0.40979
Slope = -0.0012095783
Mann-Kendall Trend : no trend
P Value: 0.10937
Mann-Kendall S Value: -46.0
AS Ug/L
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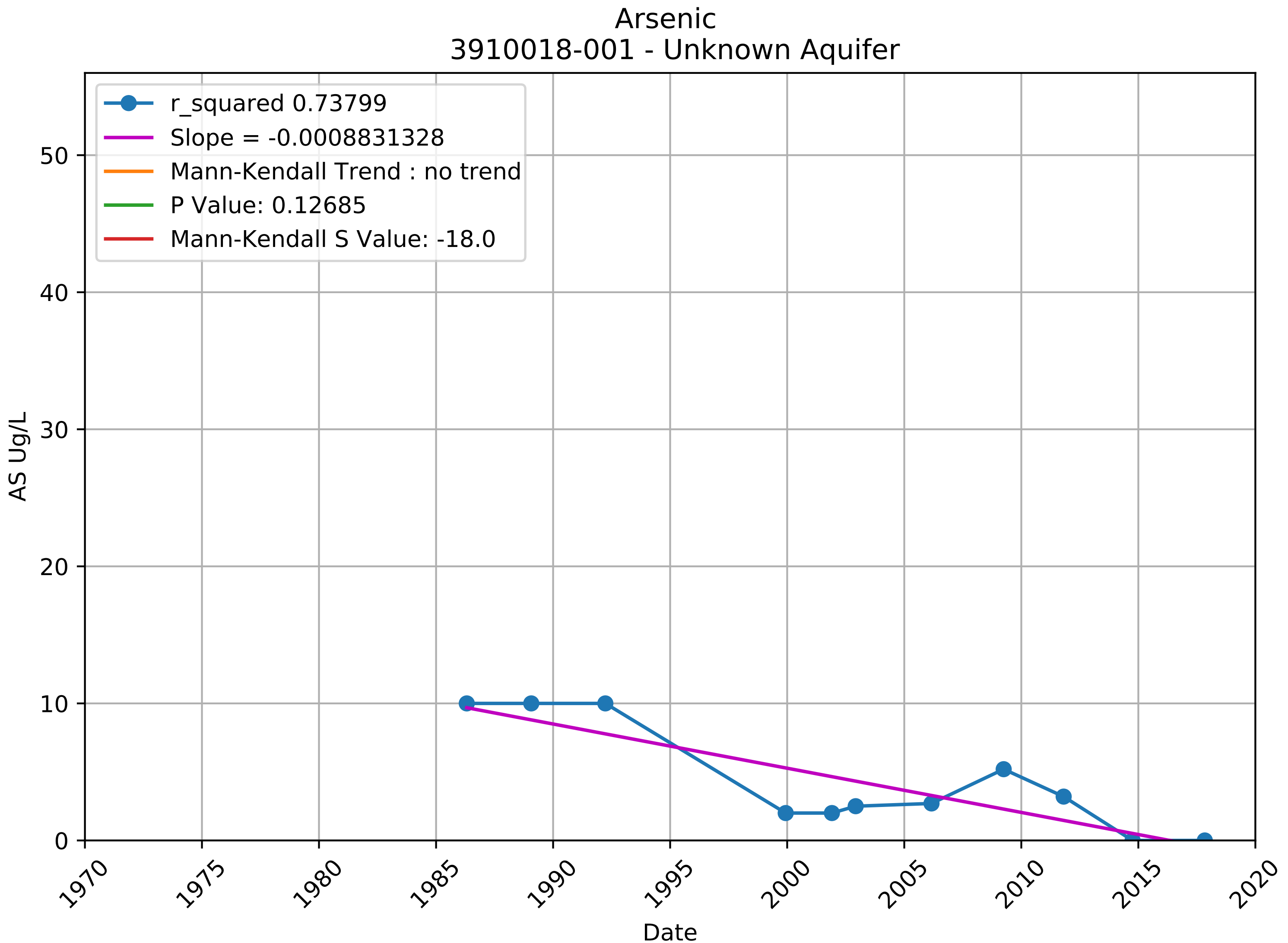

Arsenic
3910018-001 - Unknown Aquifer
r_squared 0.73799
Slope = -0.0008831328
Mann-Kendall Trend : no trend
P Value: 0.12685
Mann-Kendall S Value: -18.0
AS Ug/L
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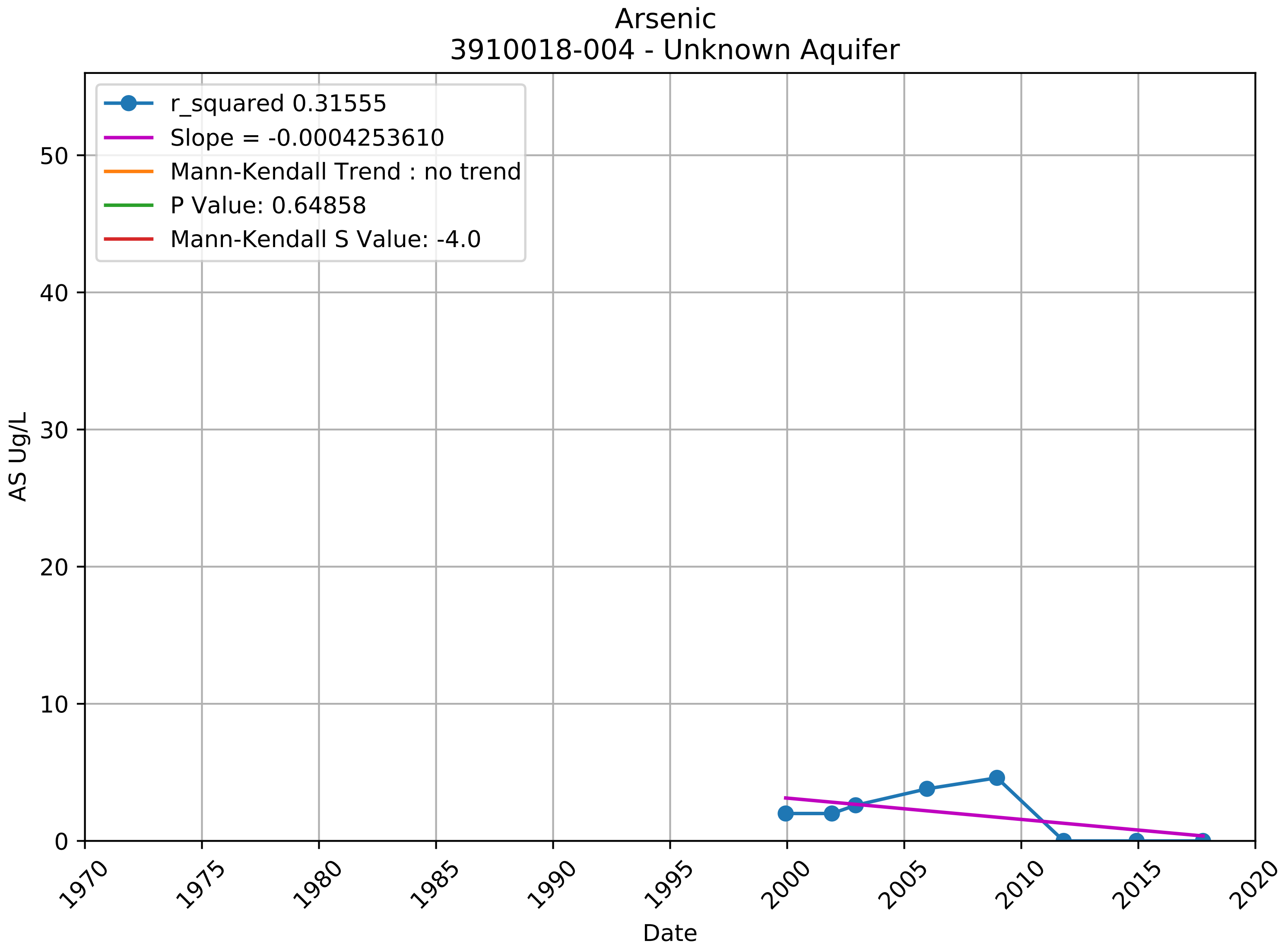

Arsenic
3910018-004 - Unknown Aquifer
r_squared 0.31555
Slope = -0.0004253610
Mann-Kendall Trend : no trend
P Value: 0.64858
Mann-Kendall S Value: -4.0
AS Ug/L
Date
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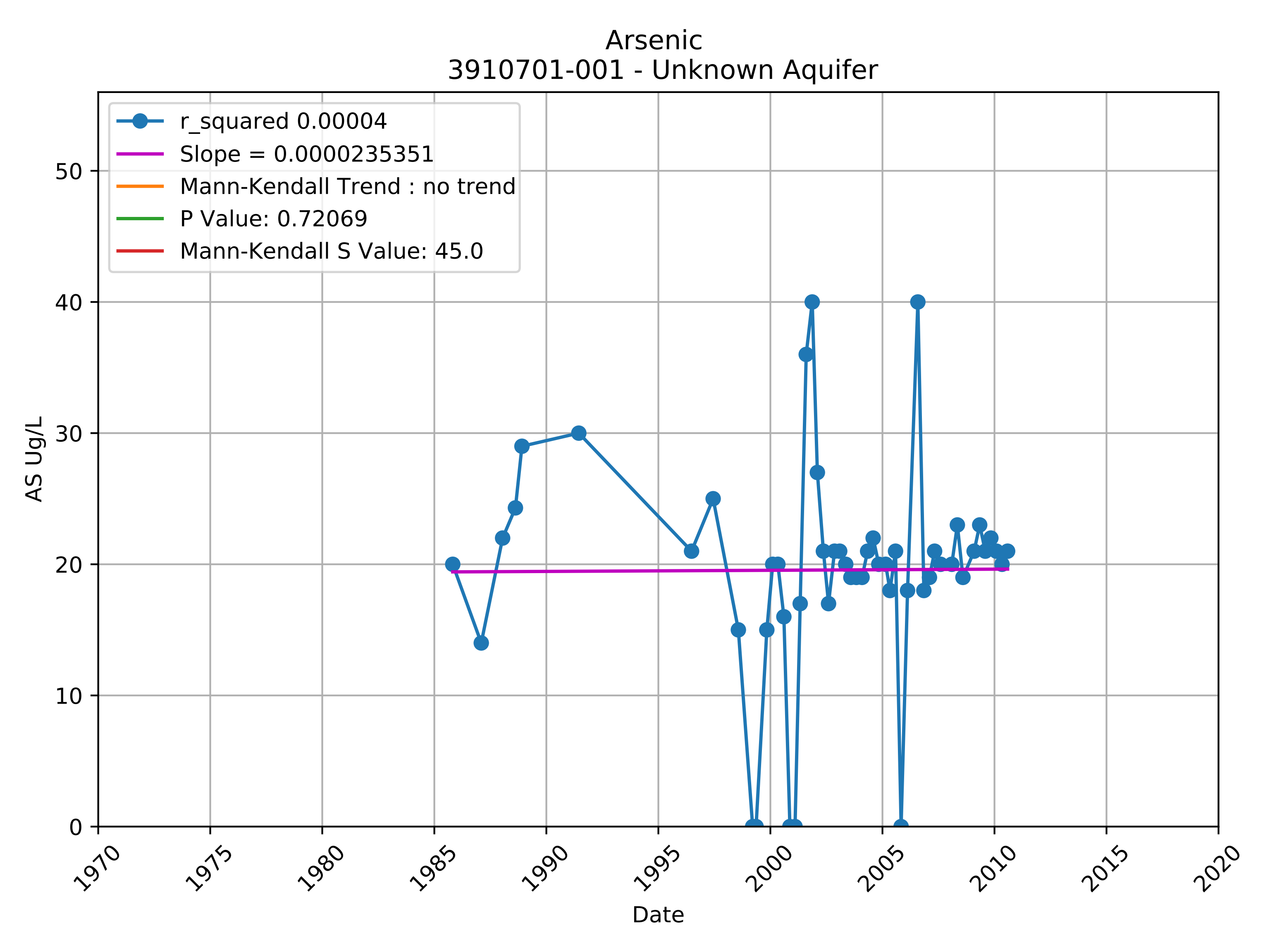

Arsenic
3910701-001 - Unknown Aquifer
r_squared 0.00004
Slope = 0.0000235351
Mann-Kendall Trend : no trend
P Value: 0.72069
Mann-Kendall S Value: 45.0
AS Ug/L
Date
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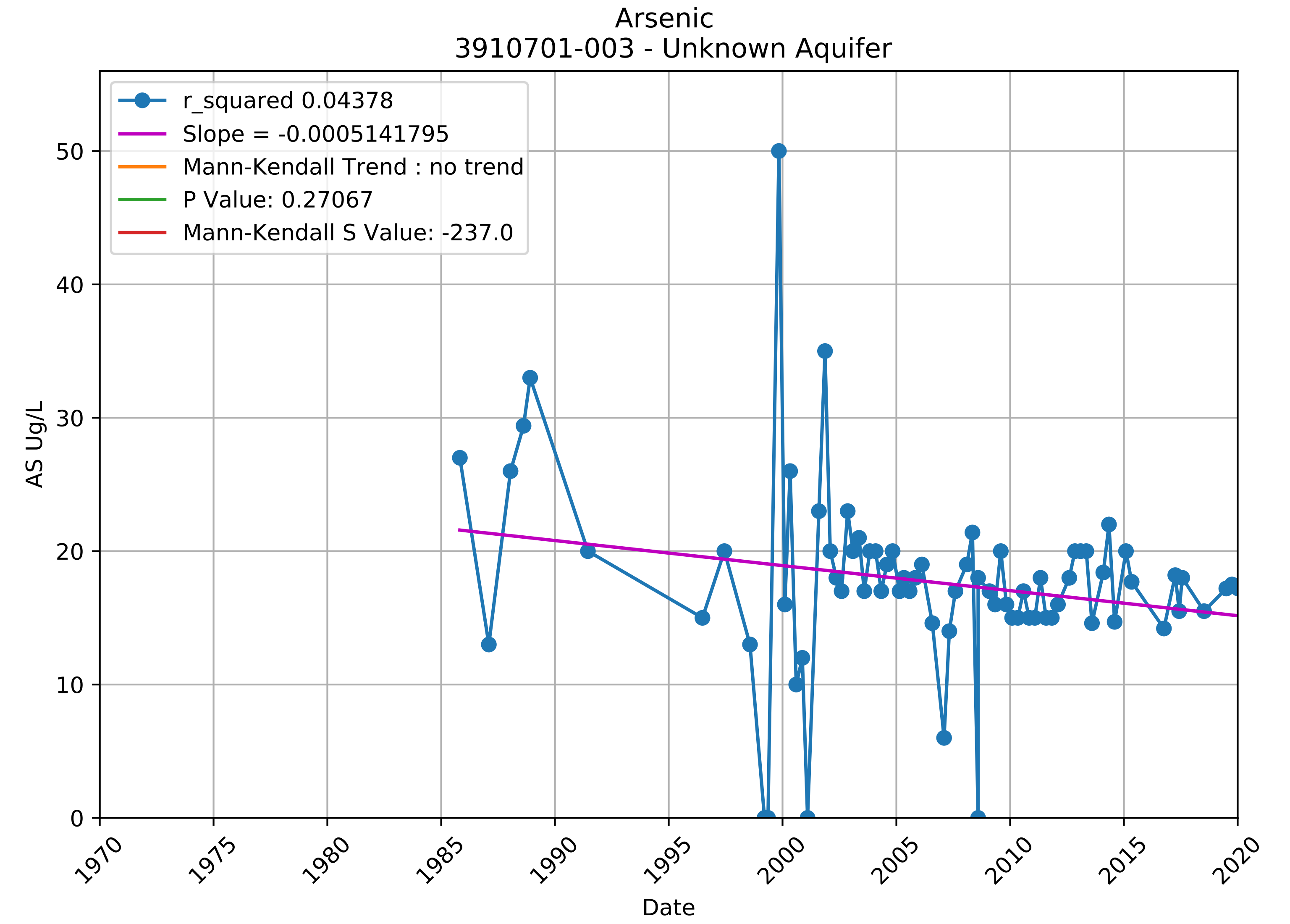

Arsenic
3910701-003 - Unknown Aquifer
r_squared 0.04378
Slope = -0.0005141795
Mann-Kendall Trend : no trend
P Value: 0.27067
Mann-Kendall S Value: -237.0
AS Ug/L
Date
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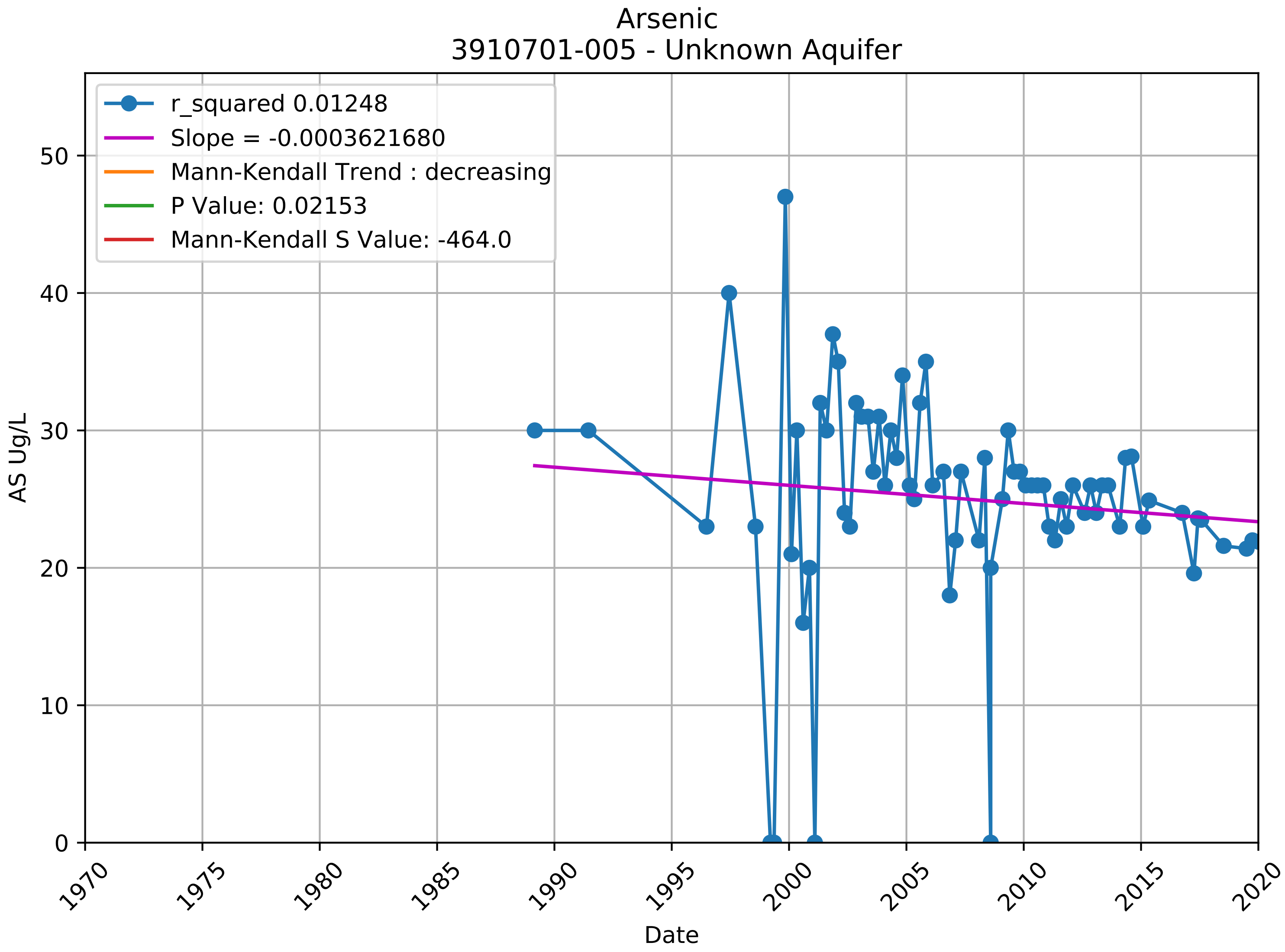

Arsenic
3910701-005 - Unknown Aquifer
r_squared 0.01248
Slope = -0.0003621680
Mann-Kendall Trend : decreasing
P Value: 0.02153
Mann-Kendall S Value: -464.0
AS Ug/L
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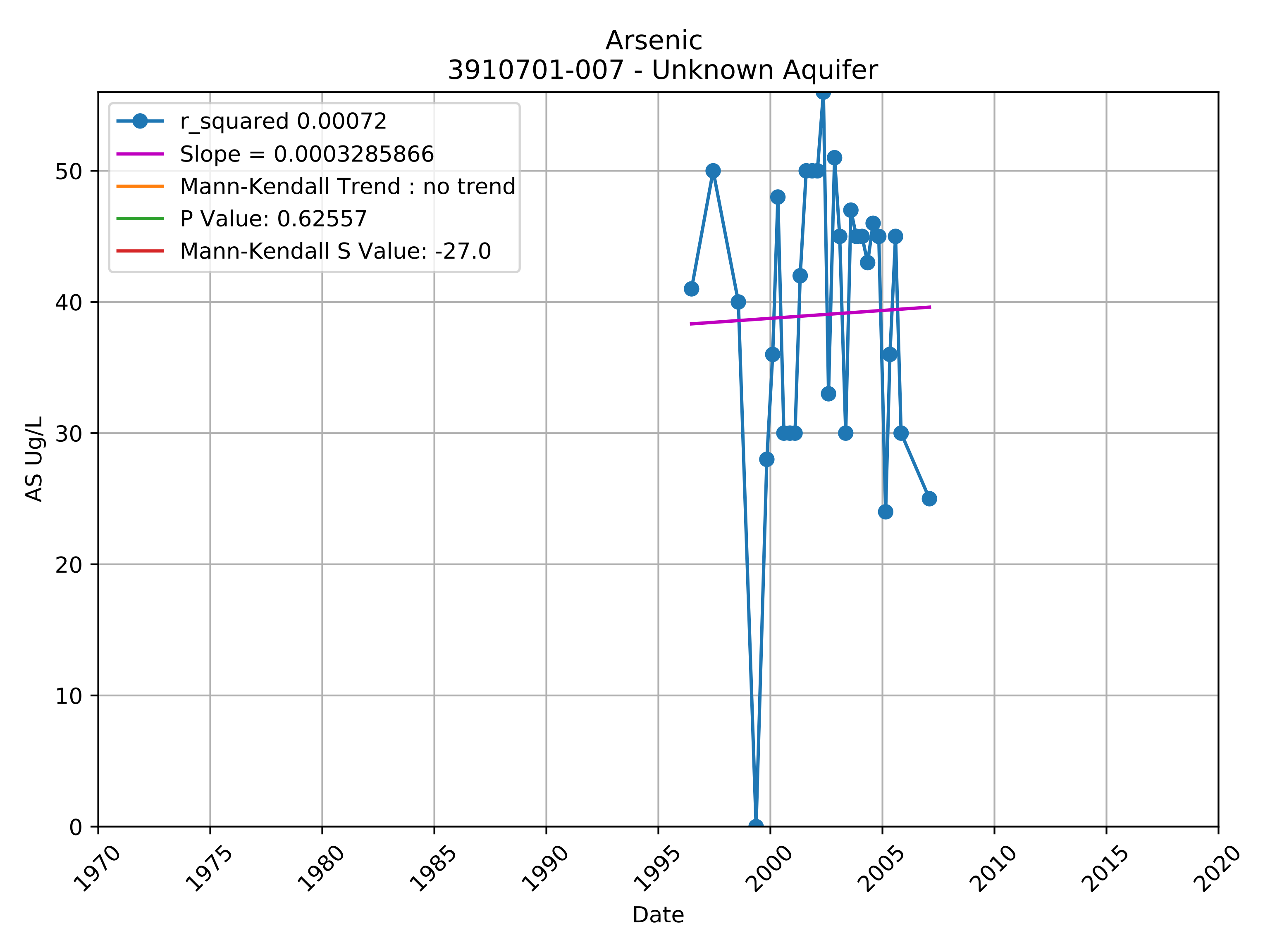

Arsenic
3910701-007 - Unknown Aquifer
r_squared 0.00072
Slope = 0.0003285866
Mann-Kendall Trend : no trend
P Value: 0.62557
Mann-Kendall S Value: -27.0
AS Ug/L
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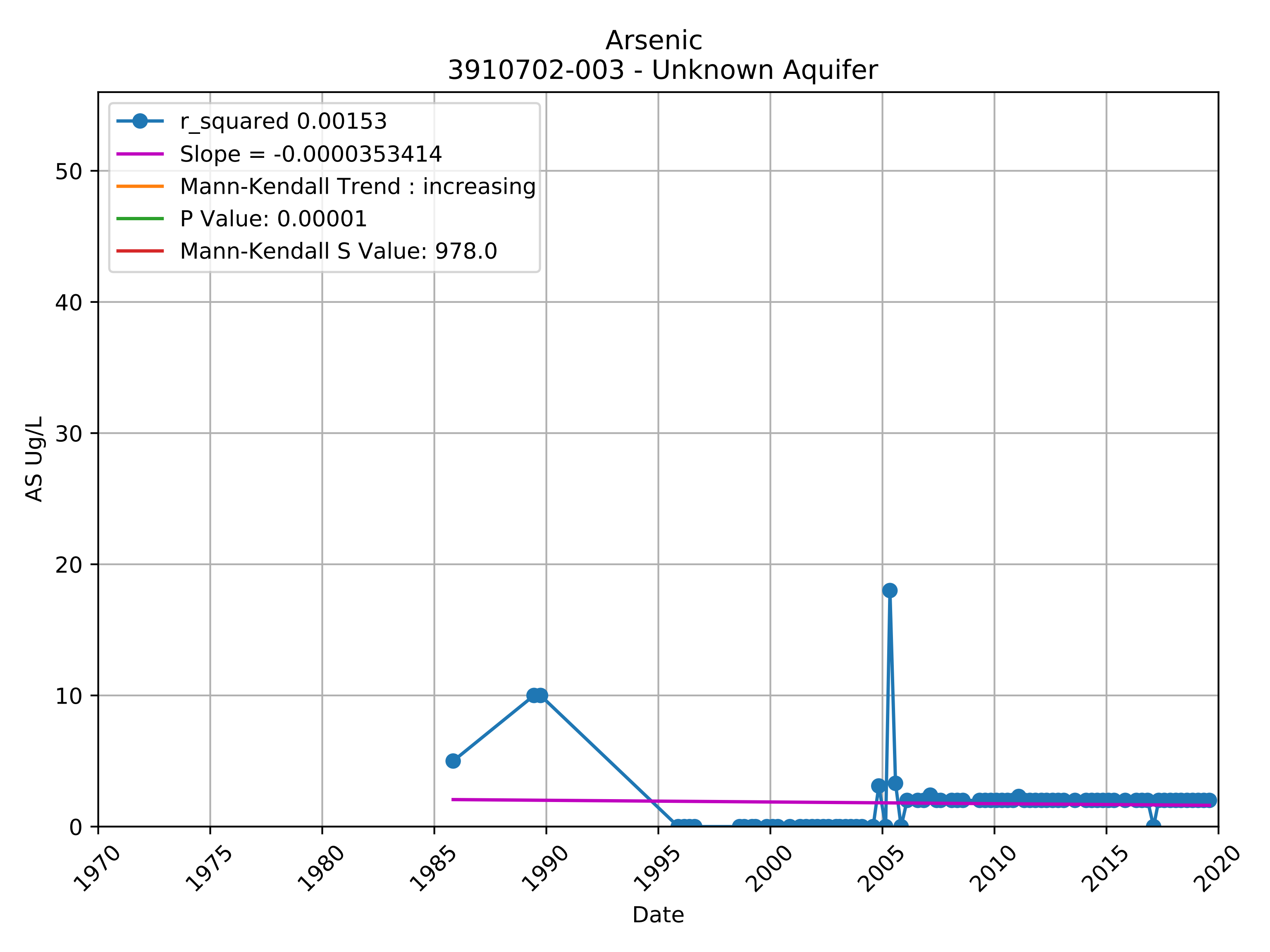

Arsenic
3910702-003 - Unknown Aquifer
r_squared 0.00153
Slope = -0.0000353414
Mann-Kendall Trend : increasing
P Value: 0.00001
Mann-Kendall S Value: 978.0
AS Ug/L
Date
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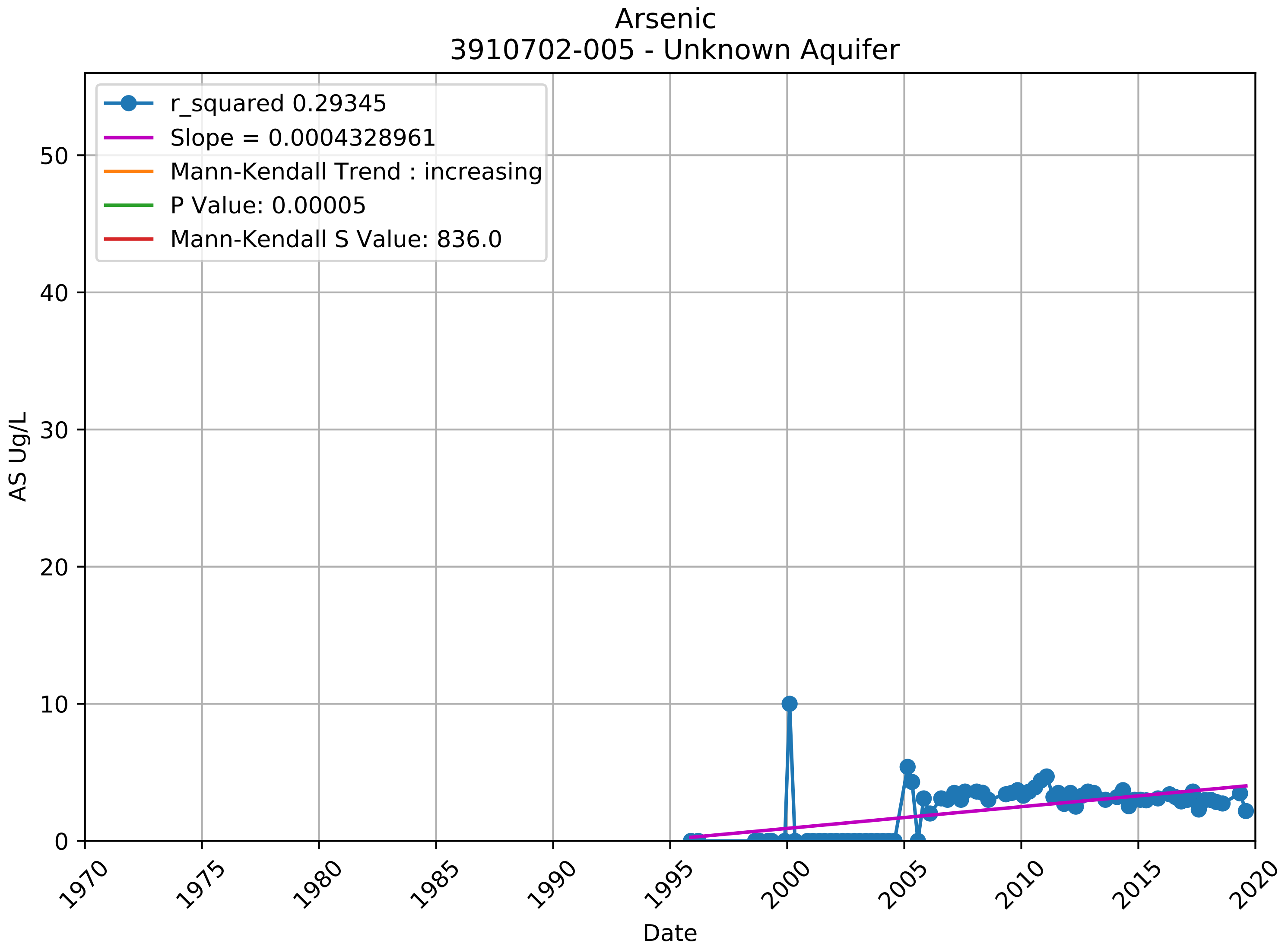

Arsenic
3910702-005 - Unknown Aquifer
r_squared 0.29345
Slope = 0.0004328961
Mann-Kendall Trend : increasing
P Value: 0.00005
Mann-Kendall S Value: 836.0
AS Ug/L
Date
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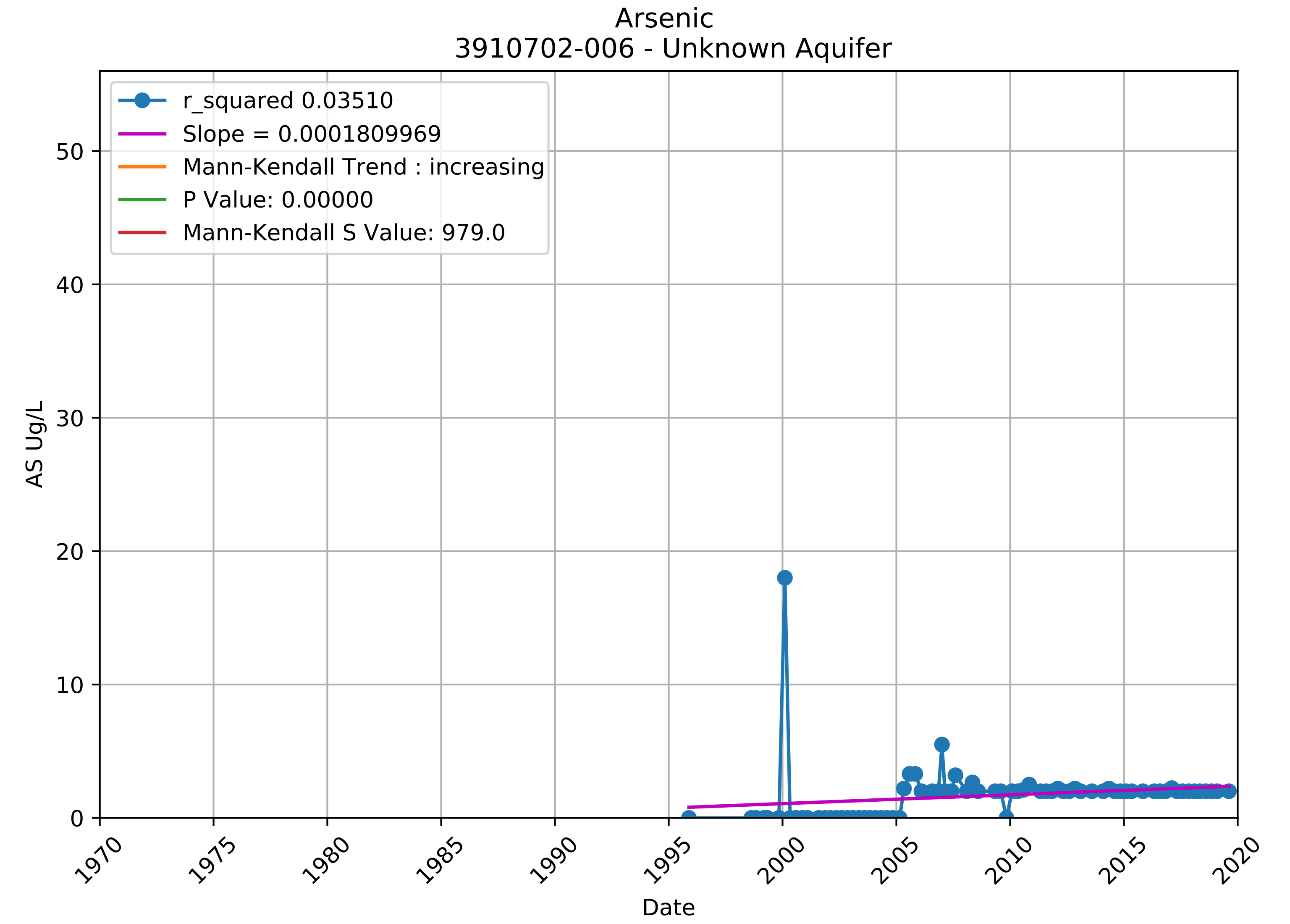

Arsenic
3910702-006 - Unknown Aquifer
r_squared 0.03510
Slope = 0.0001809969
Mann-Kendall Trend : increasing
P Value: 0.00000
Mann-Kendall S Value: 979.0
AS Ug/L
Date
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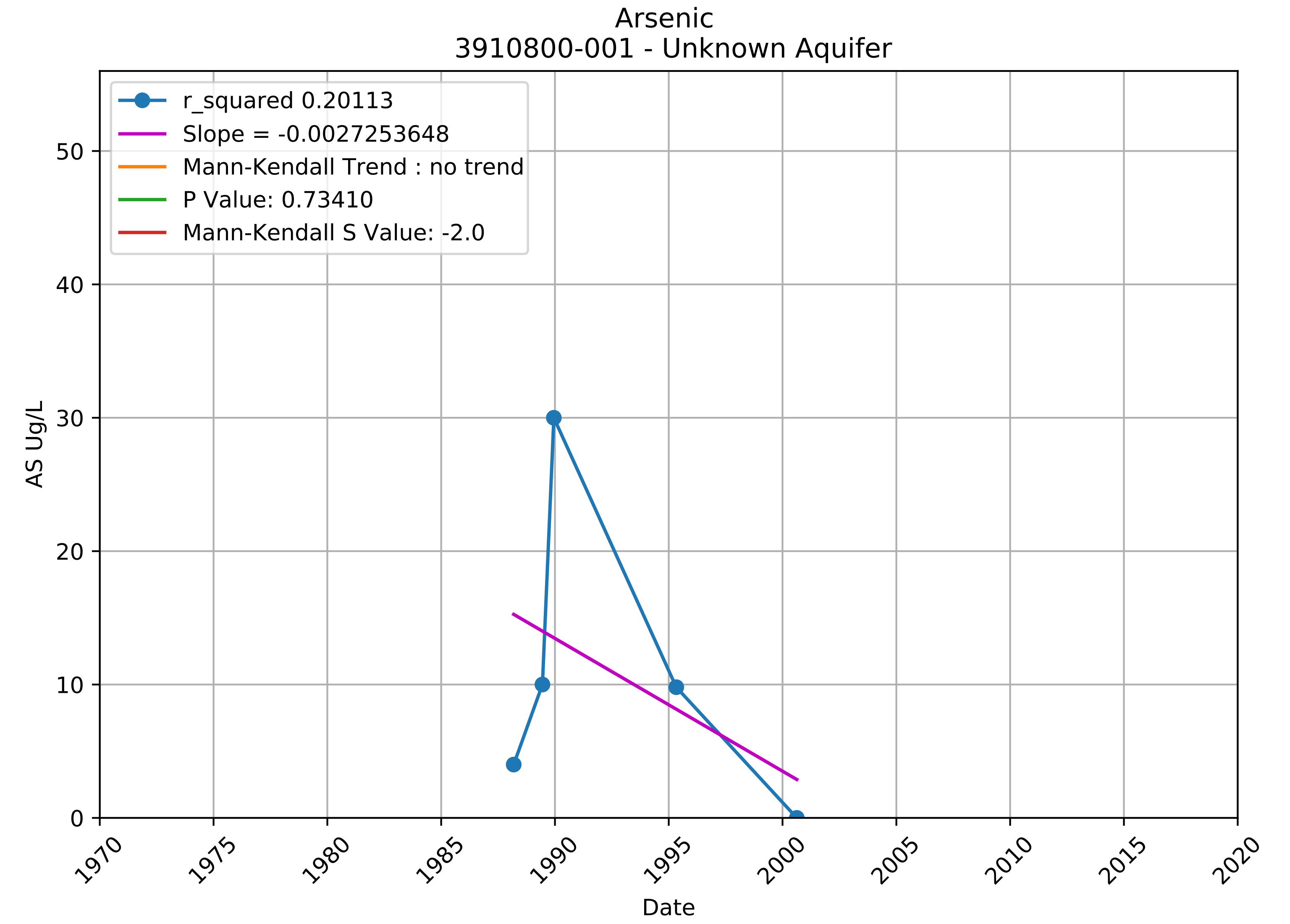
Arsenic
3910800-001 - Unknown Aquifer
r_squared 0.20113
Slope = -0.0027253648
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: -2.0
AS Ug/L
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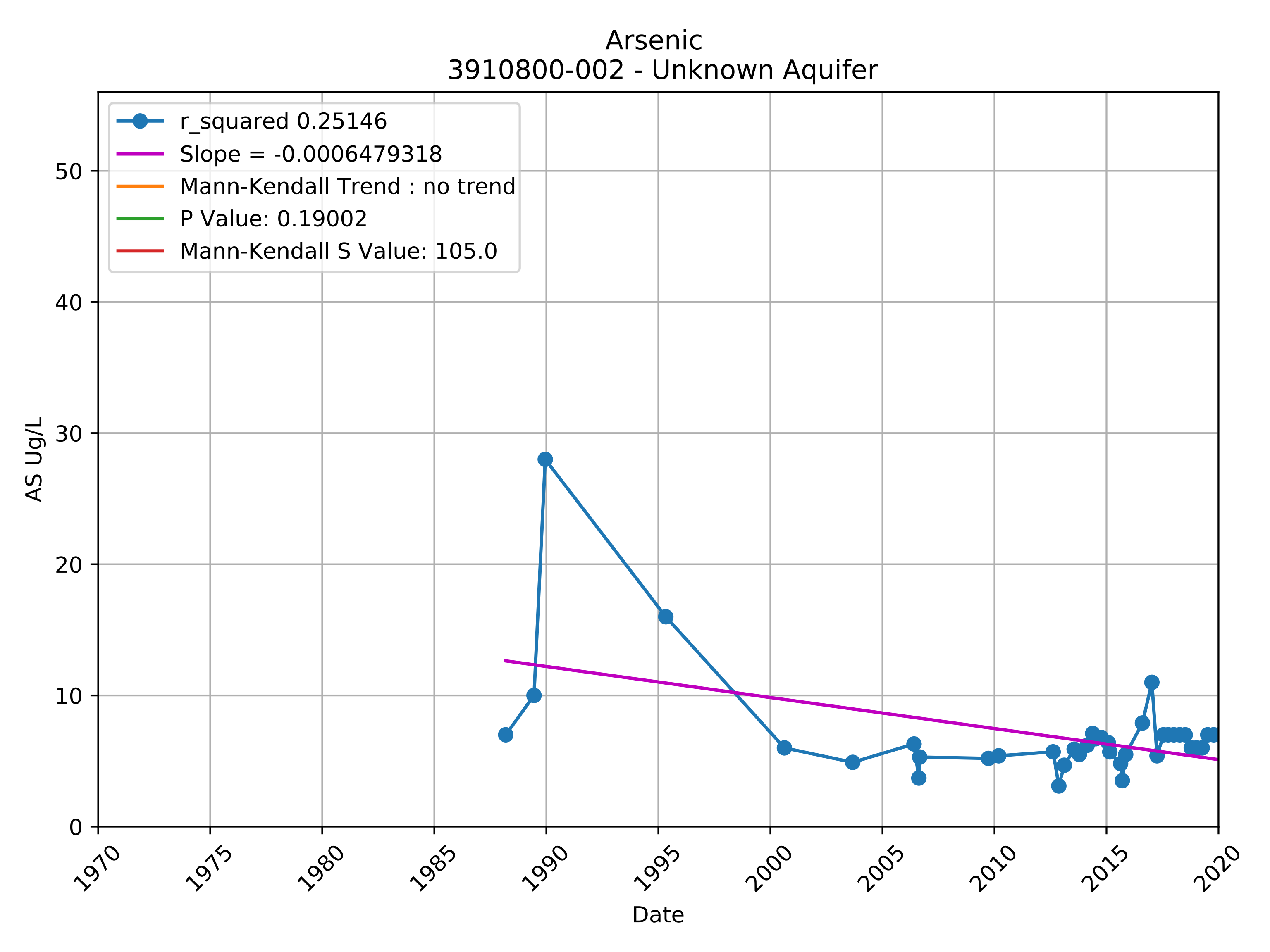
Date



Arsenic
3910800-002 - Unknown Aquifer
r_squared 0.25146
Slope = -0.0006479318
Mann-Kendall Trend : no trend
P Value: 0.19002
Mann-Kendall S Value: 105.0
AS Ug/L
Date
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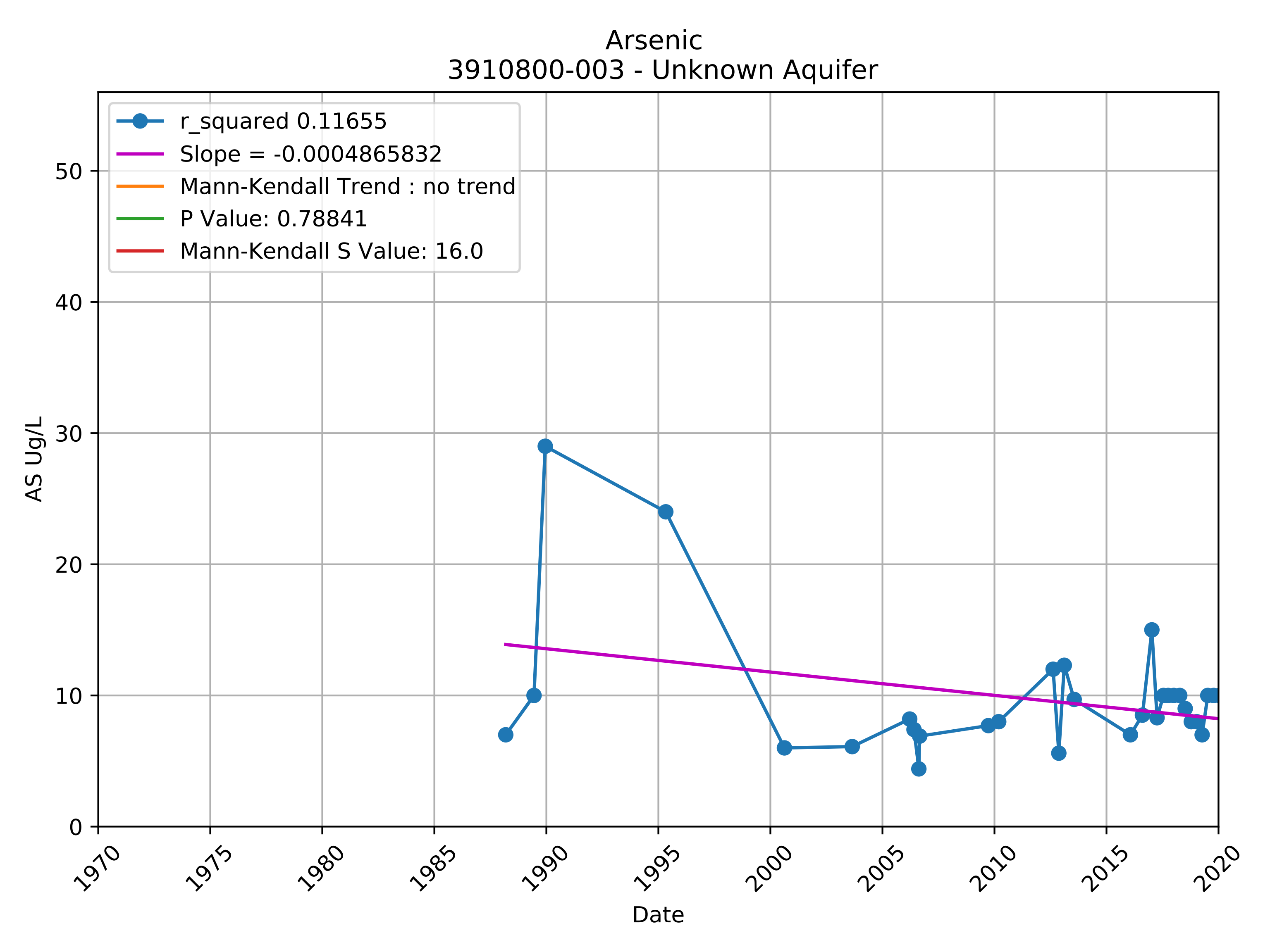

Arsenic
3910800-003 - Unknown Aquifer
r_squared 0.11655
Slope = -0.0004865832
Mann-Kendall Trend : no trend
P Value: 0.78841
Mann-Kendall S Value: 16.0
AS Ug/L
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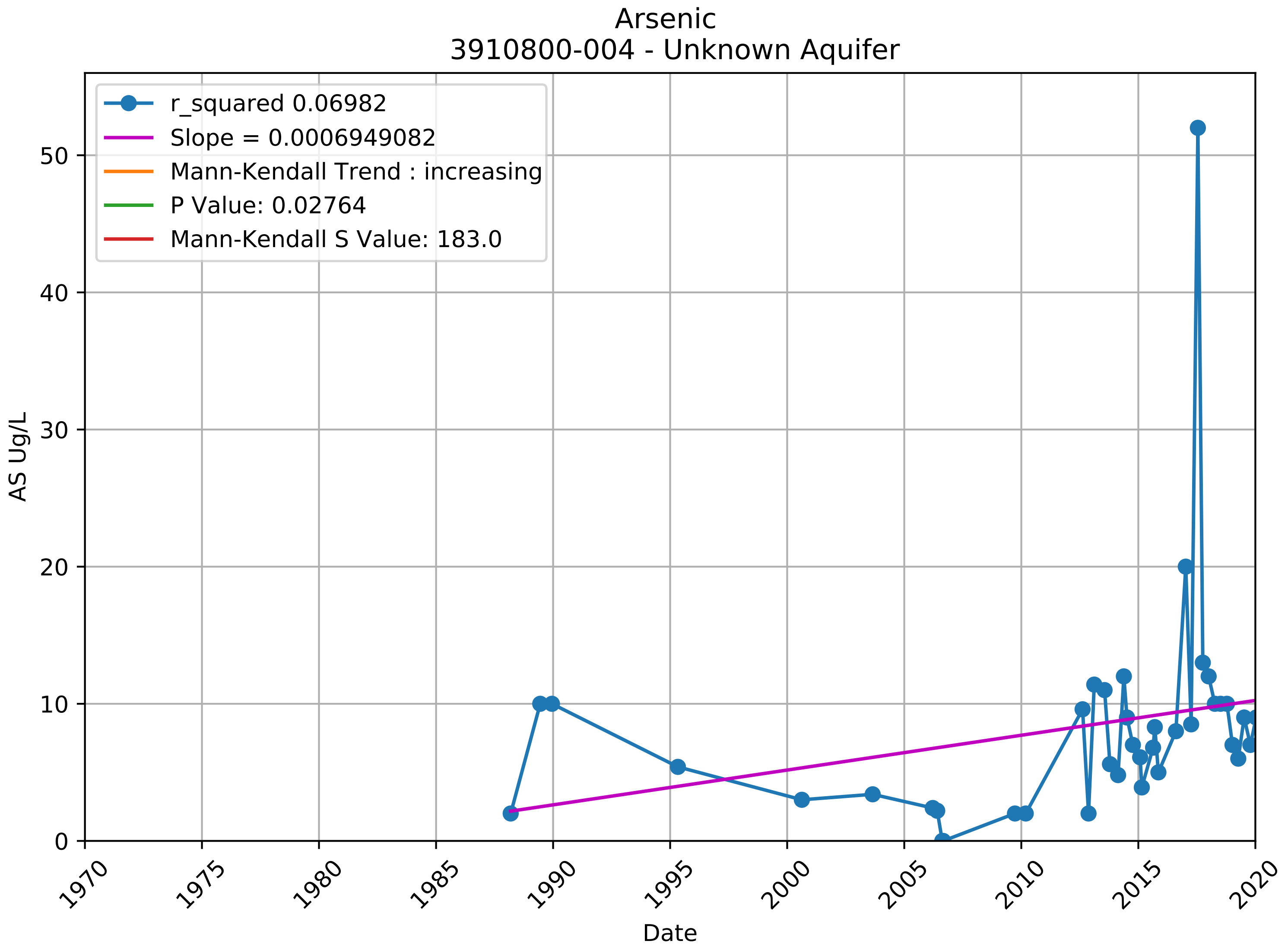

Arsenic
3910800-004 - Unknown Aquifer
r_squared 0.06982
Slope = 0.0006949082
Mann-Kendall Trend : increasing
P Value: 0.02764
Mann-Kendall S Value: 183.0
AS Ug/L
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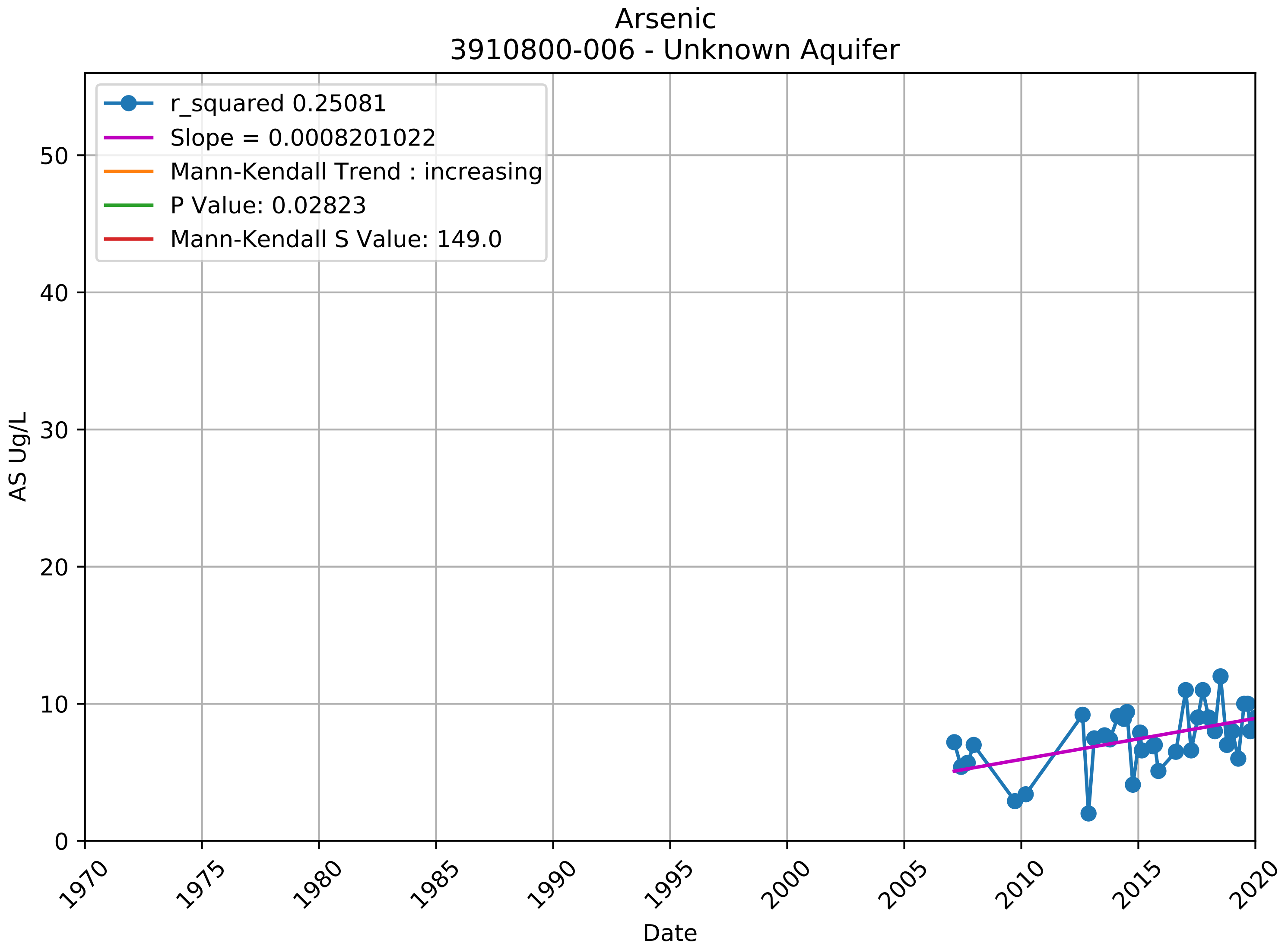

Arsenic
3910800-006 - Unknown Aquifer
r_squared 0.25081
Slope = 0.0008201022
Mann-Kendall Trend : increasing
P Value: 0.02823
Mann-Kendall S Value: 149.0
AS Ug/L
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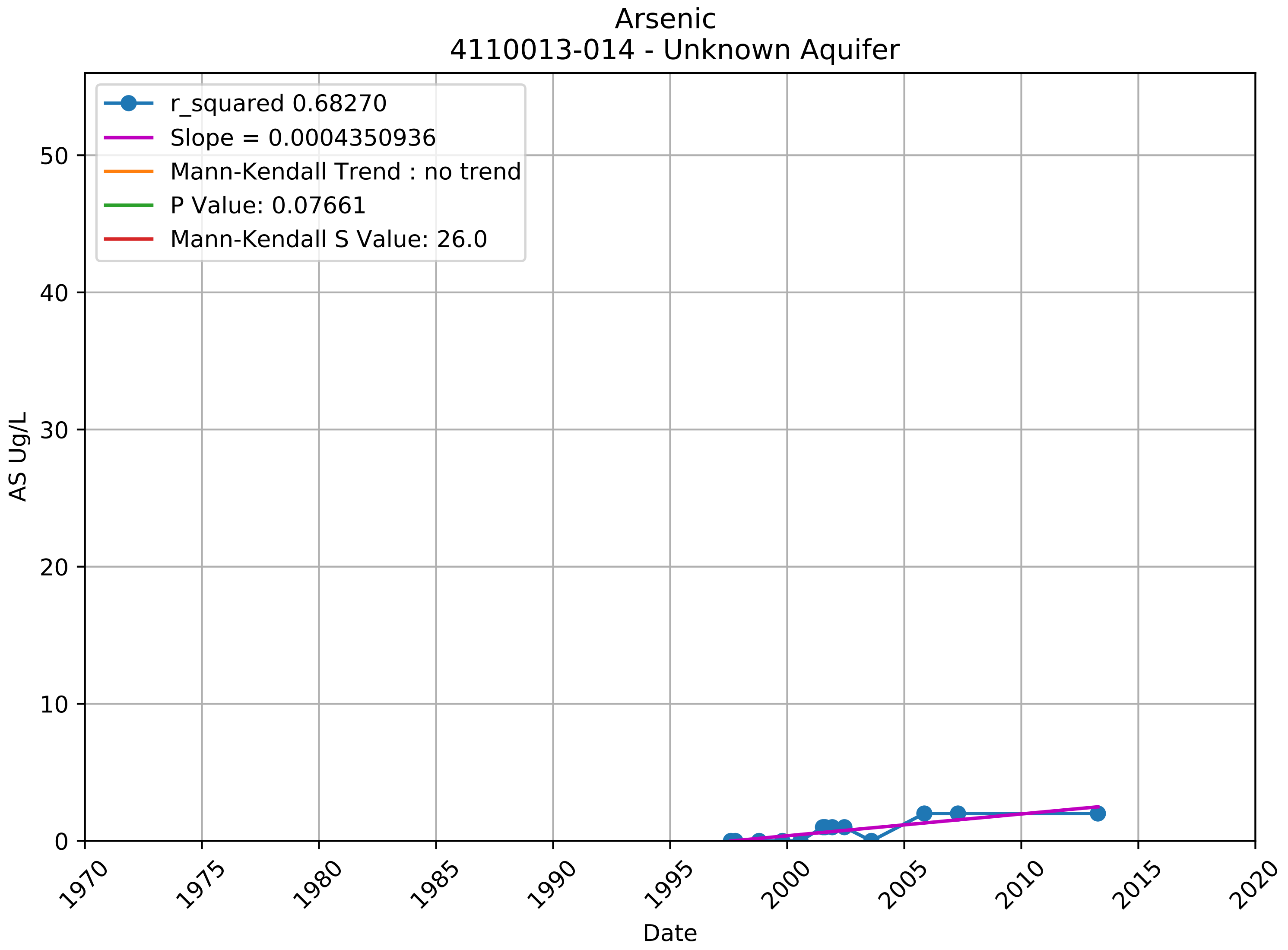
Arsenic
4110013-014 - Unknown Aquifer
r_squared 0.68270
Slope = 0.0004350936
Mann-Kendall Trend : no trend
P Value: 0.07661
Mann-Kendall S Value: 26.0
AS Ug/L
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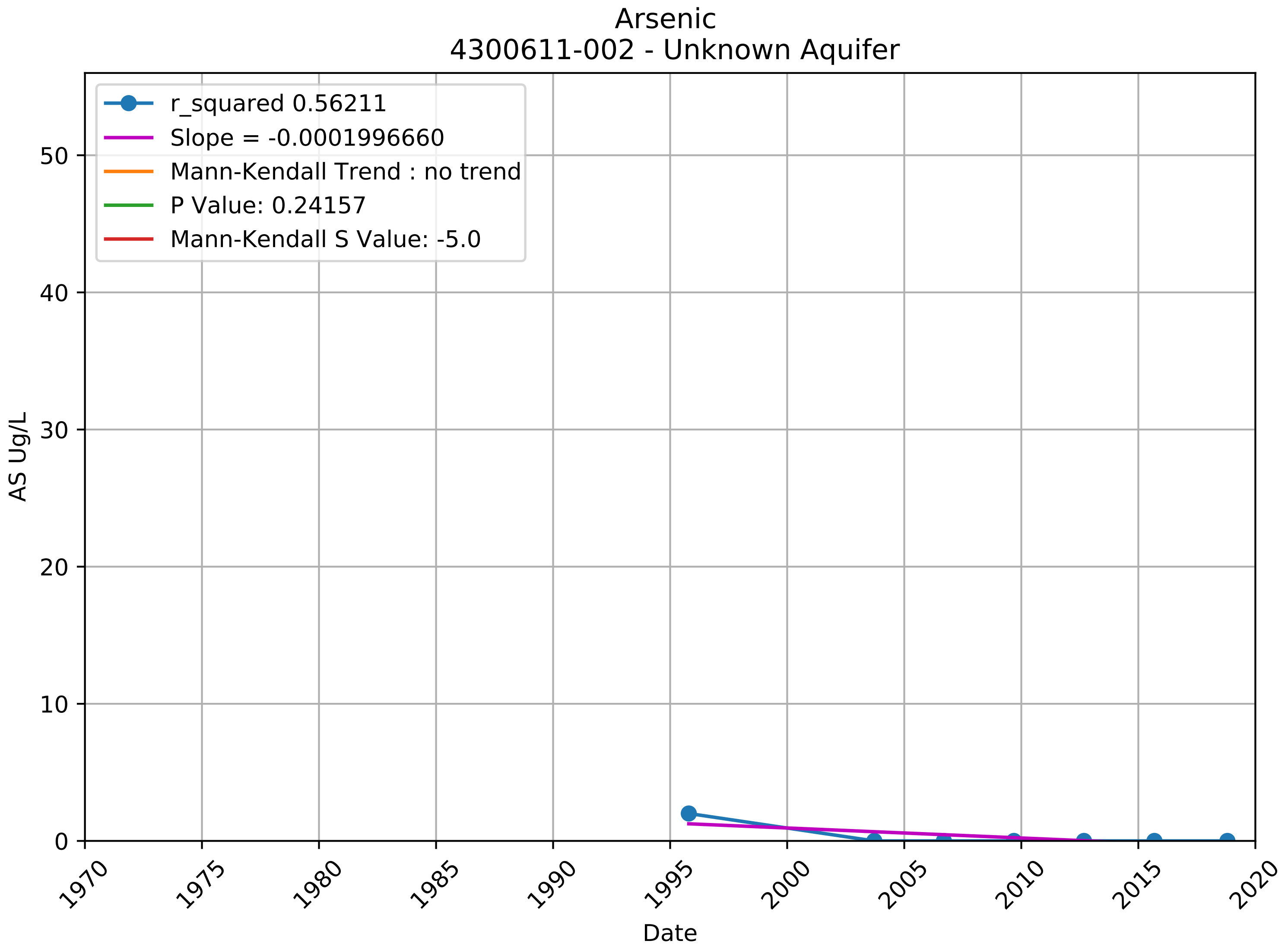

Arsenic
4300611-002 - Unknown Aquifer
r_squared 0.56211
Slope = -0.0001996660
Mann-Kendall Trend : no trend
P Value: 0.24157
Mann-Kendall S Value: -5.0
AS Ug/L
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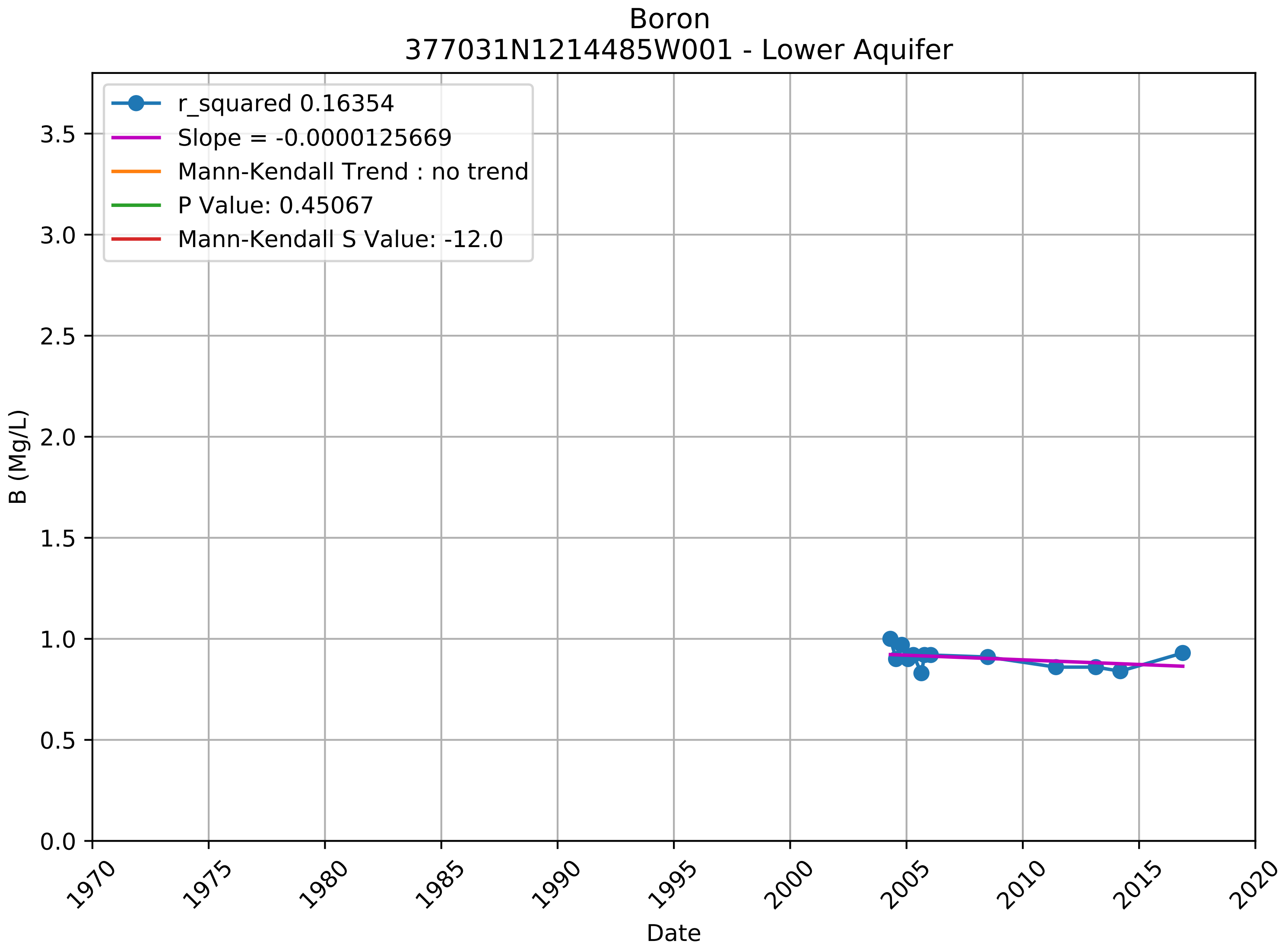
Date

Boron

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
3910011-010	37.736372	-121.435351	B	FALSE	0.585	-8	-0.145	no trend	164	-0.547	Unknown
3910702-003	37.705557	-121.39764	B	FALSE	0.175	263	0.112	no trend	37272.33	1.357	Unknown
3910701-003	37.85144	-121.2682	B	TRUE	0.001	459	0.309	increasing	18975	3.325	Unknown
3910701-001	37.849584	-121.268763	B	TRUE	0.004	267	0.31	increasing	8514.333	2.883	Unknown
3910018-001	37.679751	-121.272617	B	FALSE	0.308	4	0.667	no trend	8.667	1.019	Unknown
3910015-005	37.816859	-121.266705	B	FALSE	0.454	7	0.25	no trend	64.333	0.748	Upper
3910011-003	37.683959	-121.439427	B	FALSE	0.484	-29	-0.105	no trend	1598.333	-0.7	Lower
3910800-002	37.744188	-121.32701	B	FALSE	0.308	-4	-0.667	no trend	8.667	-1.019	Unknown
3910800-003	37.74545	-121.32897	B	FALSE	0.308	-4	-0.667	no trend	8.667	-1.019	Unknown
3910800-004	37.74591	-121.336213	B	FALSE	0.308	-4	-0.667	no trend	8.667	-1.019	Unknown
3910701-005	37.851301	-121.2673	B	FALSE	0.534	89	0.058	no trend	20019	0.622	Unknown
3910011-004	37.682308	-121.436988	B	FALSE	0.095	-52	-0.274	no trend	933.333	-1.669	Lower
3910011-006	37.686539	-121.443515	B	FALSE	0.843	-8	-0.035	no trend	1252.667	-0.198	Lower
3910011-005	37.683353	-121.443313	B	TRUE	0.043	103	0.272	increasing	2533	2.027	Lower
3910015-006	37.818884	-121.266416	B	FALSE	0.395	9	0.25	no trend	88.333	0.851	Upper
3910015-007	37.811547	-121.263915	B	FALSE	0.578	-7	-0.156	no trend	116.333	-0.556	Upper
3910015-008	37.801132	-121.262514	B	FALSE	0.063	18	0.5	no trend	83.333	1.862	Upper
3910011-018	37.743262	-121.424805	B	FALSE	0.716	14	0.051	no trend	1279.333	0.363	Lower
3910018-004	37.679705	-121.272761	B	FALSE	1	1	0.167	no trend	7.667	0	Unknown
3910701-007	37.851431	-121.265247	B	FALSE	0.156	69	0.197	no trend	2299	1.418	Unknown
3910702-006	37.709972	-121.390802	B	FALSE	0.551	116	0.049	no trend	37275.33	0.596	Unknown
3910702-005	37.708149	-121.393881	B	FALSE	0.33	185	0.081	no trend	35687.67	0.974	Unknown
4110013-014	37.7	-121.466667	B	FALSE	1	1	0.022	no trend	116.333	0	Unknown
3910011-030	37.740208	-121.439285	B	FALSE	0.051	-89	-0.274	no trend	2041.667	-1.948	Lower
3901348-002	37.702894	-121.406986	B	FALSE	0.794	2	0.2	no trend	14.667	0.261	Unknown
3900713-001	37.84	-121.44	B	FALSE	0.523	-7	-0.194	no trend	88.333	-0.638	Unknown
3901172-002	37.636324	-121.399544	B	FALSE	1	1	0.1	no trend	15.667	0	Unknown
3901172-003	37.632289	-121.39736	B	FALSE	0.566	4	0.267	no trend	27.333	0.574	Unknown
3900702-001	37.990639	-121.407056	B	FALSE	1	0	0	no trend	16.667	0	Unknown
3900805-002	37.73886	-121.399853	B	FALSE	0.734	2	0.333	no trend	8.667	0.34	Unknown
3900583-001	37.84	-121.44	B	FALSE	0.13	-7	-0.7	no trend	15.667	-1.516	Unknown
3901216-002	37.74753	-121.516649	B	FALSE	0.848	-2	-0.133	no trend	27.333	-0.191	Unknown
3900558-002	37.79	-121.4	B	FALSE	0.806	-2	-0.2	no trend	16.667	-0.245	Unknown
3910011-034	37.752802	-121.434603	B	FALSE	0.722	-18	-0.051	no trend	2289.333	-0.355	Lower
3910011-032	37.754682	-121.465249	B	FALSE	0.573	-25	-0.083	no trend	1813.667	-0.564	Lower
3901348-003	37.698742	-121.409917	B	FALSE	0.368	-7	-0.333	no trend	44.333	-0.901	Unknown
3901348-004	37.698147	-121.416153	B	FALSE	0.452	-5	-0.333	no trend	28.333	-0.751	Unknown
377427N1213943W002	37.742656	-121.394318	B	FALSE	0.722	-7	-0.077	no trend	283.667	-0.356	Lower
377427N1213943W001	37.742656	-121.394318	B	FALSE	0.078	-33	-0.363	no trend	329.667	-1.762	Lower
377427N1213943W003	37.742656	-121.394318	B	FALSE	0.196	-24	-0.264	no trend	316.667	-1.292	Lower
377402N1214508W001	37.740187	-121.450762	B	FALSE	0.324	19	0.209	no trend	333.667	0.985	Lower
377143N1214459W002	37.714305	-121.445905	B	FALSE	0.741	-7	-0.077	no trend	329.667	-0.33	Lower
377143N1214459W003	37.714305	-121.445905	B	FALSE	0.158	-26	-0.286	no trend	313.333	-1.412	Lower
377402N1214508W003	37.740187	-121.450762	B	FALSE	0.296	-20	-0.22	no trend	330.667	-1.045	Lower
377402N1214508W002	37.740187	-121.450762	B	TRUE	0.016	-43	-0.473	decreasing	304.333	-2.408	Lower
377143N1214459W001	37.714305	-121.445905	B	FALSE	0.228	-23	-0.253	no trend	333.667	-1.204	Lower
377656N1214199W001	37.765631	-121.41992	B	FALSE	0.755	5	0.091	no trend	165	0.311	Lower
377656N1214199W002	37.765631	-121.41992	B	FALSE	0.917	2	0.056	no trend	92	0.104	Lower
377656N1214199W003	37.765631	-121.41992	B	FALSE	0.173	20	0.303	no trend	194	1.364	Lower
377149N1214257W003	37.714872	-121.425674	B	FALSE	0.062	-25	-0.455	no trend	165	-1.868	Lower
377149N1214257W002	37.714872	-121.425674	B	FALSE	1	-1	-0.018	no trend	165	0	Lower
377149N1214257W001	37.714872	-121.425674	B	FALSE	0.492	-11	-0.167	no trend	211.667	-0.687	Lower
377031N1214485W002	37.703055	-121.448544	B	FALSE	0.562	9	0.136	no trend	190.333	0.58	Lower
377031N1214485W001	37.703055	-121.448544	B	FALSE	0.451	-12	-0.182	no trend	212.667	-0.754	Lower
377031N1214485W003	37.703055	-121.448544	B	FALSE	1	1	0.015	no trend	203	0	Lower
USGS-374046121155402	37.6793611	-121.2650278	B	FALSE	0.944	3	0.018	no trend	817	0.07	Upper
USGS-374046121155401	37.6793611	-121.2650278	B	FALSE	1	-1	-0.006	no trend	817	0	Upper



Boron
377031N1214485W001 - Lower Aquifer
r_squared 0.16354
Slope = -0.0000125669
Mann-Kendall Trend : no trend
P Value: 0.45067
Mann-Kendall S Value: -12.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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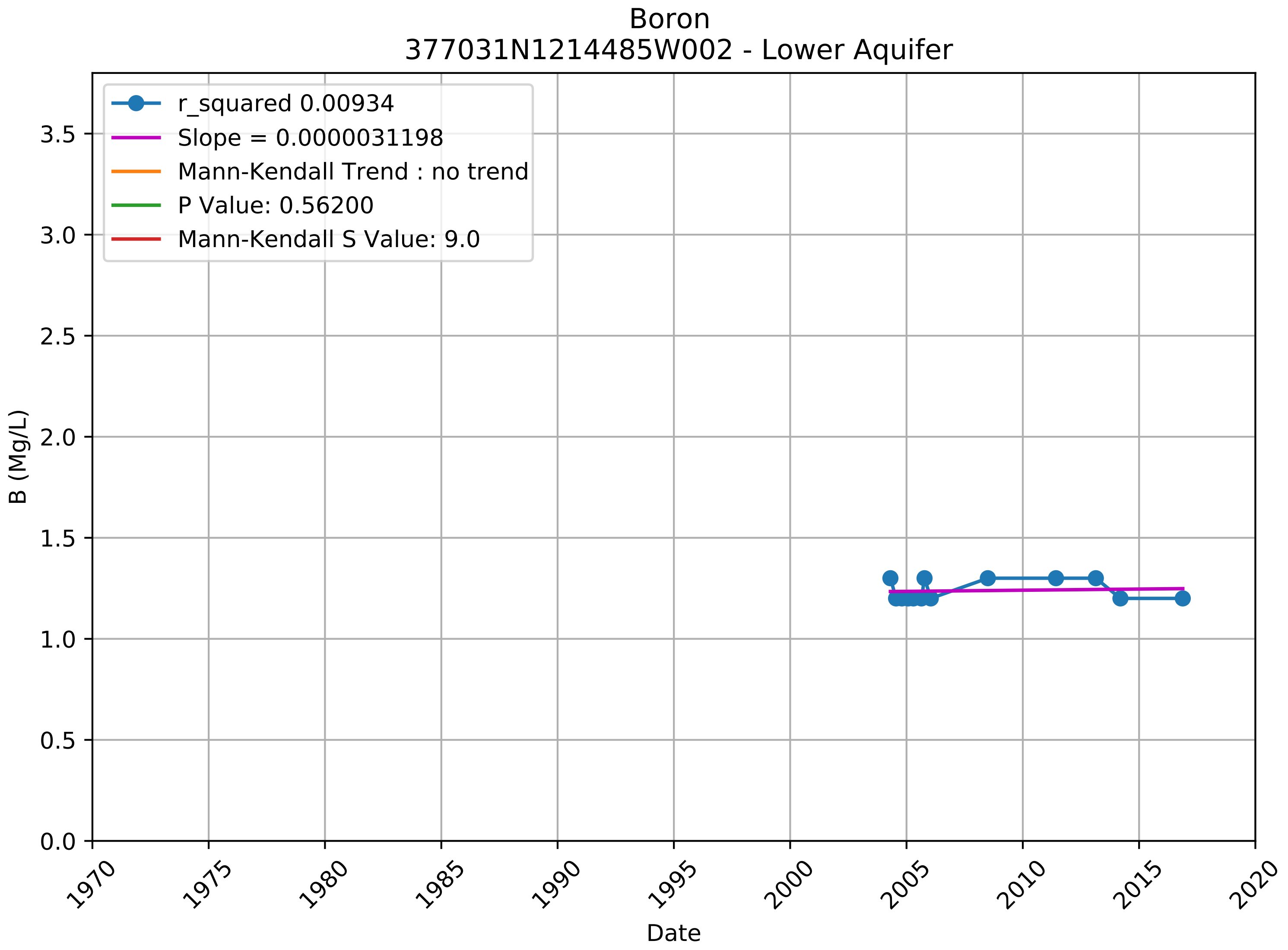
Boron
377031N1214485W002 - Lower Aquifer
r_squared 0.00934
Slope = 0.0000031198
Mann-Kendall Trend : no trend
P Value: 0.56200
Mann-Kendall S Value: 9.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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1990
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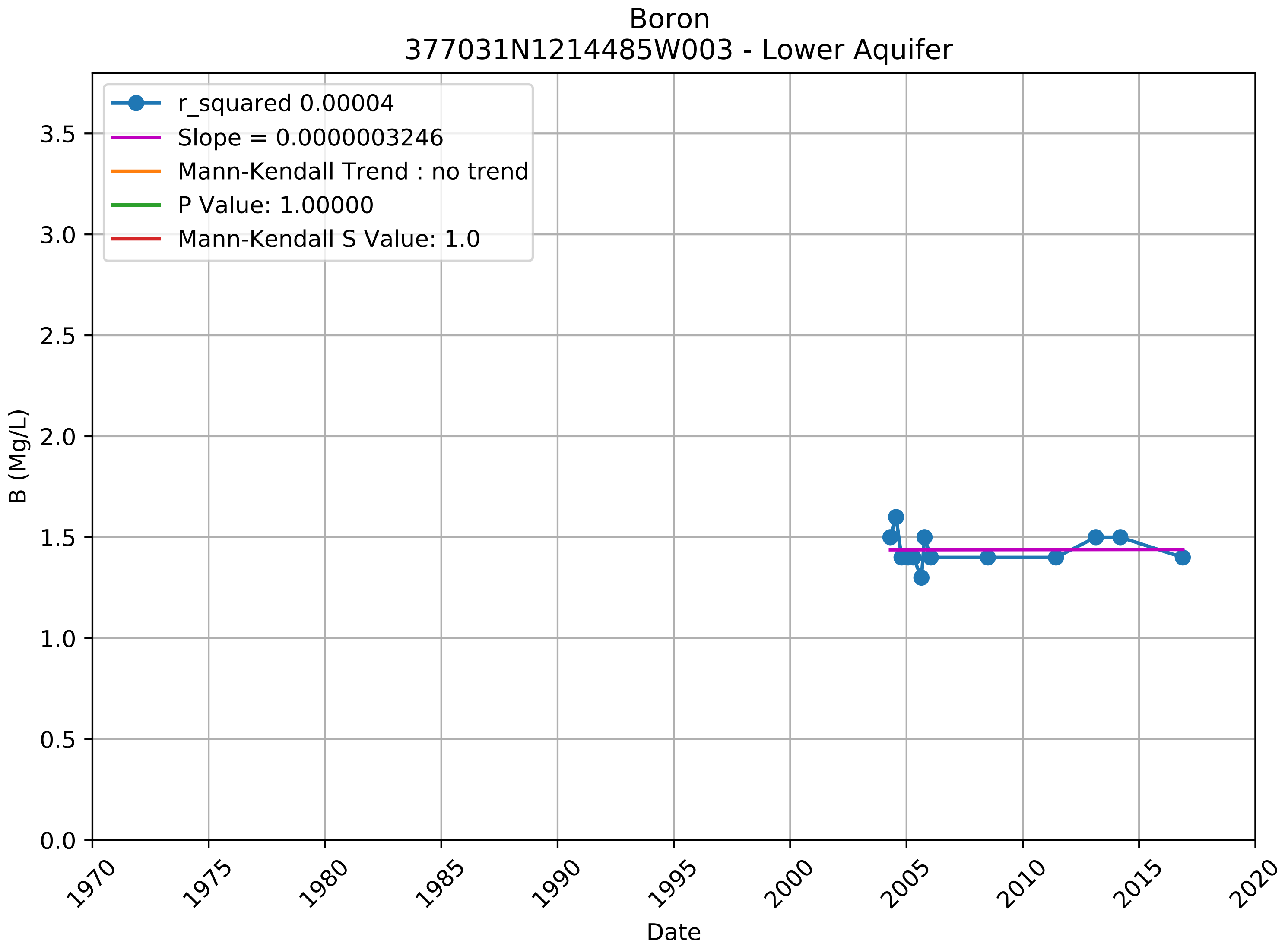

Boron
377031N1214485W003 - Lower Aquifer
r_squared 0.00004
Slope = 0.0000003246
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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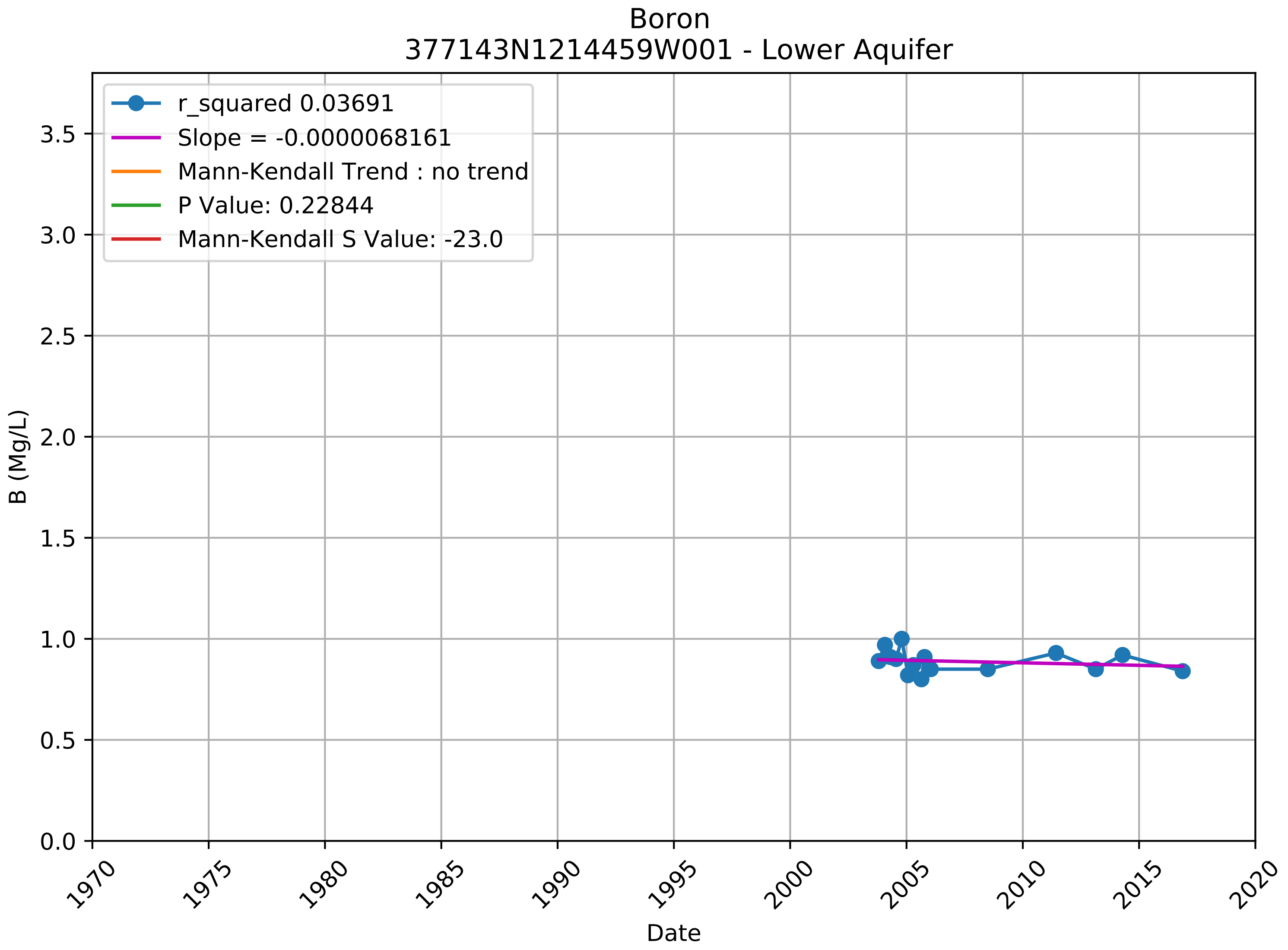

Boron
377143N1214459W001 - Lower Aquifer
r_squared 0.03691
Slope = -0.0000068161
Mann-Kendall Trend : no trend
P Value: 0.22844
Mann-Kendall S Value: -23.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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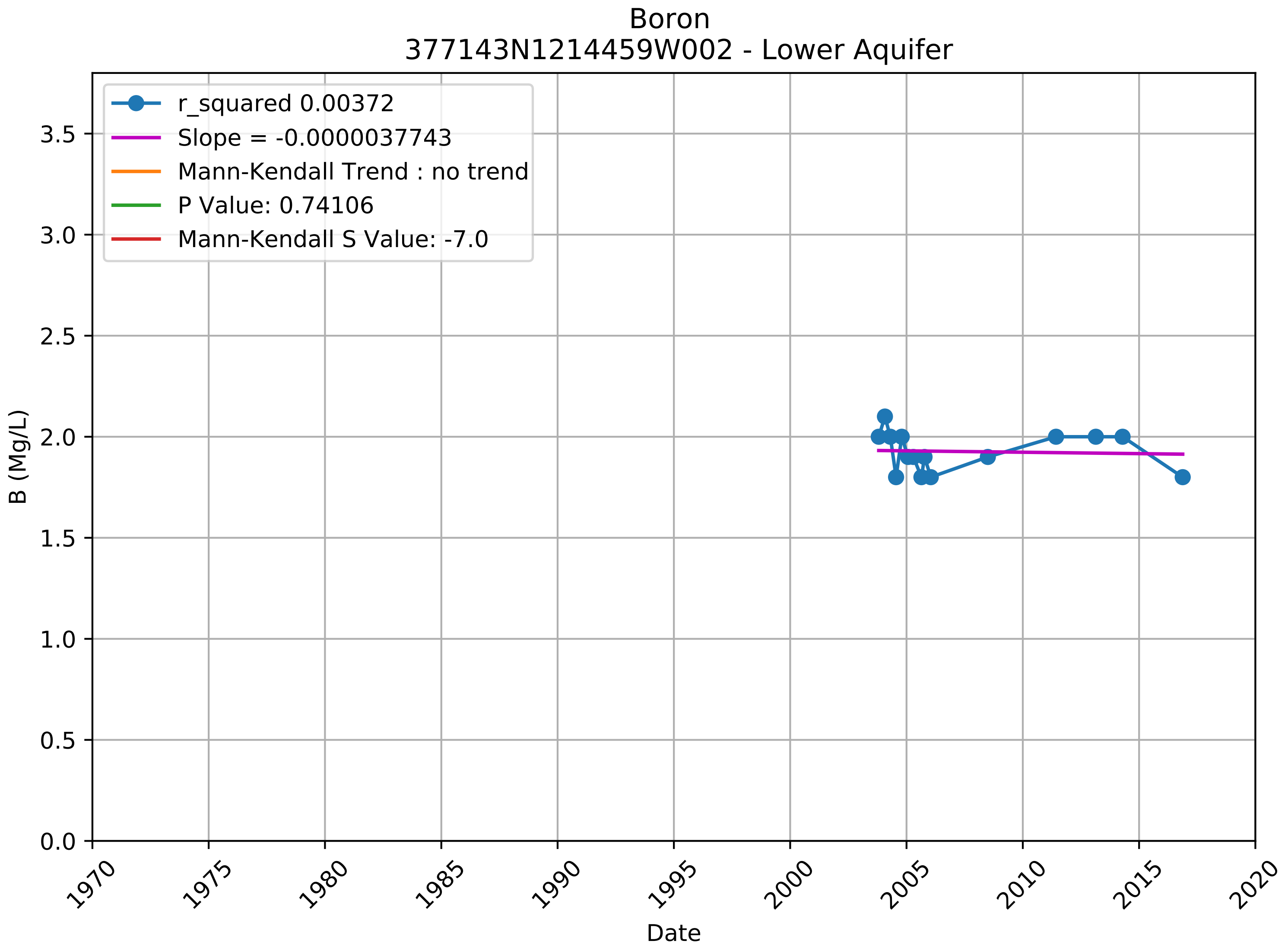

Boron
377143N1214459W002 - Lower Aquifer
r_squared 0.00372
Slope = -0.0000037743
Mann-Kendall Trend : no trend
P Value: 0.74106
Mann-Kendall S Value: -7.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
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2.5
3.0
3.5
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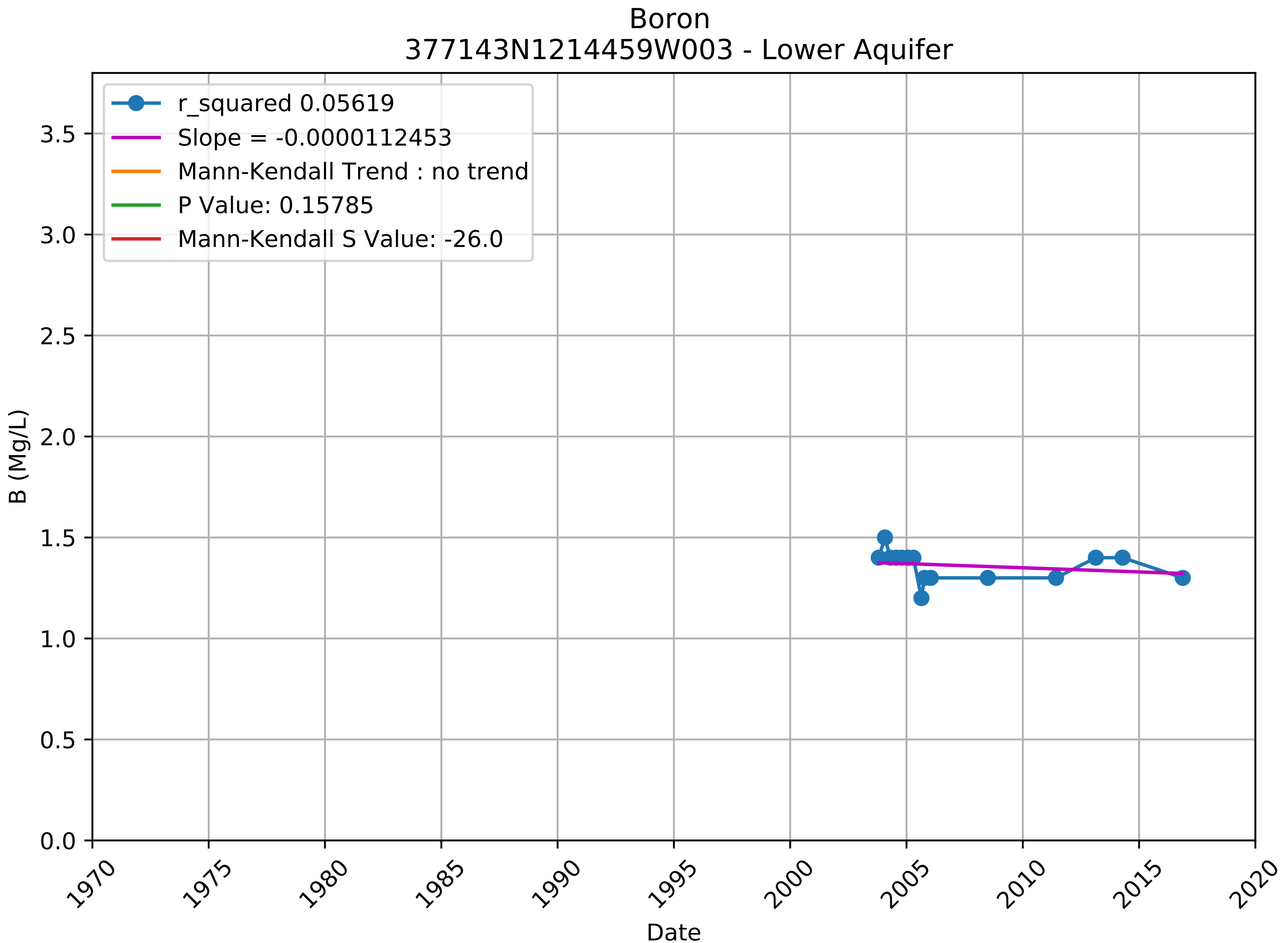
Boron
377143N1214459W003 - Lower Aquifer
r_squared 0.05619
Slope = -0.0000112453
Mann-Kendall Trend : no trend
P Value: 0.15785
Mann-Kendall S Value: -26.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
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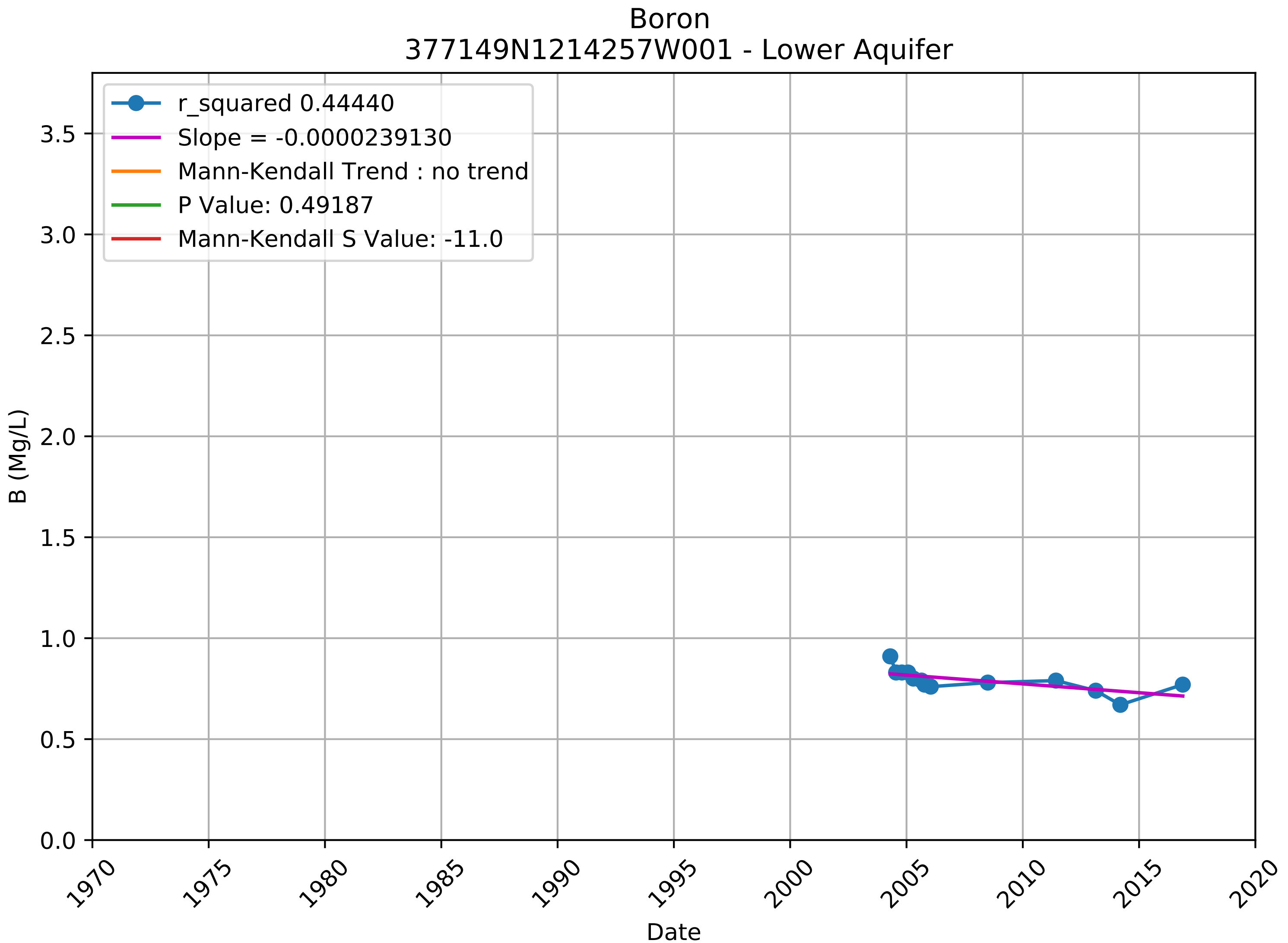

Boron
377149N1214257W001 - Lower Aquifer
r_squared 0.44440
Slope = -0.0000239130
Mann-Kendall Trend : no trend
P Value: 0.49187
Mann-Kendall S Value: -11.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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1980
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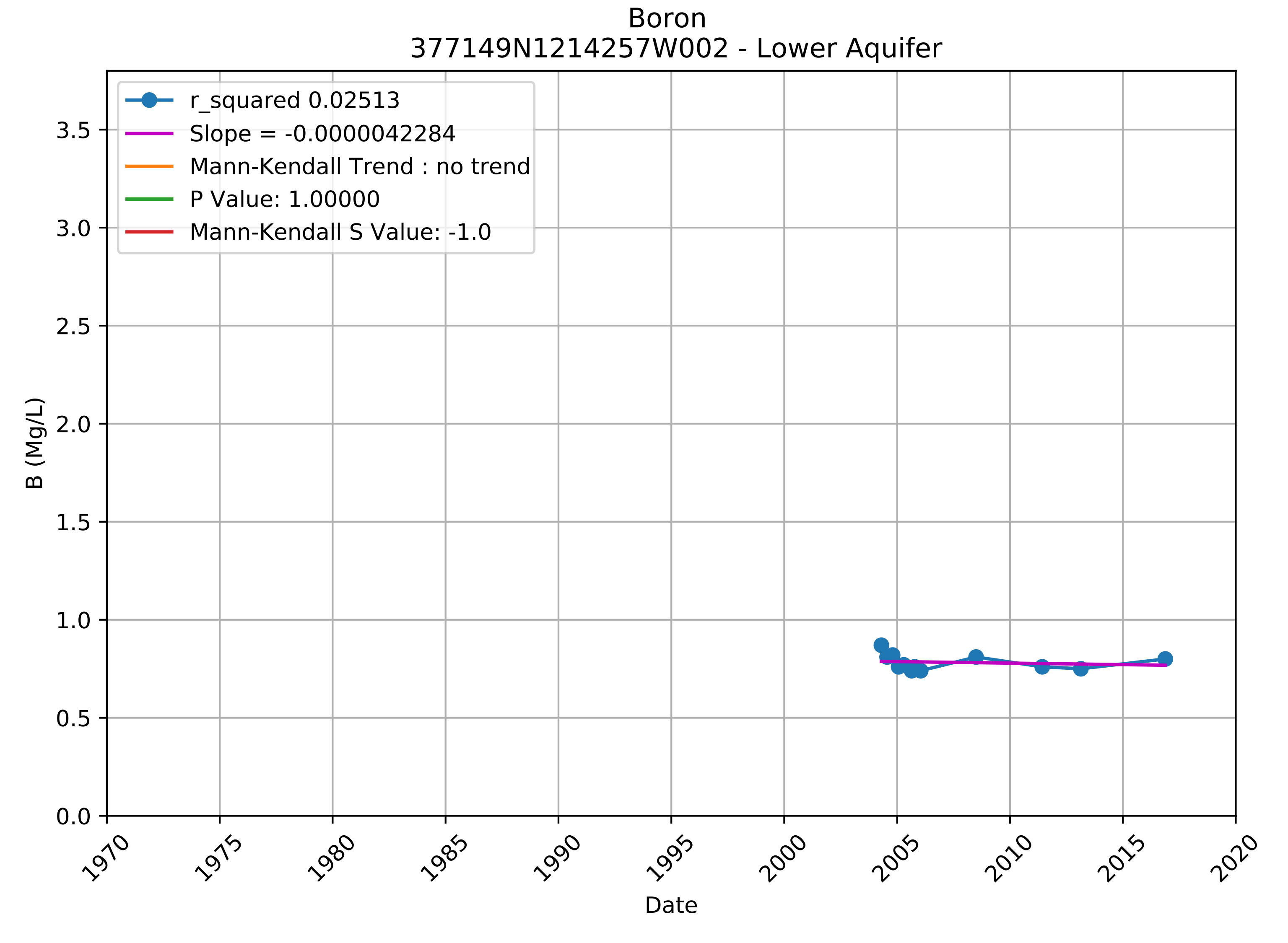
Date



Boron
377149N1214257W002 - Lower Aquifer
r_squared 0.02513
Slope = -0.0000042284
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
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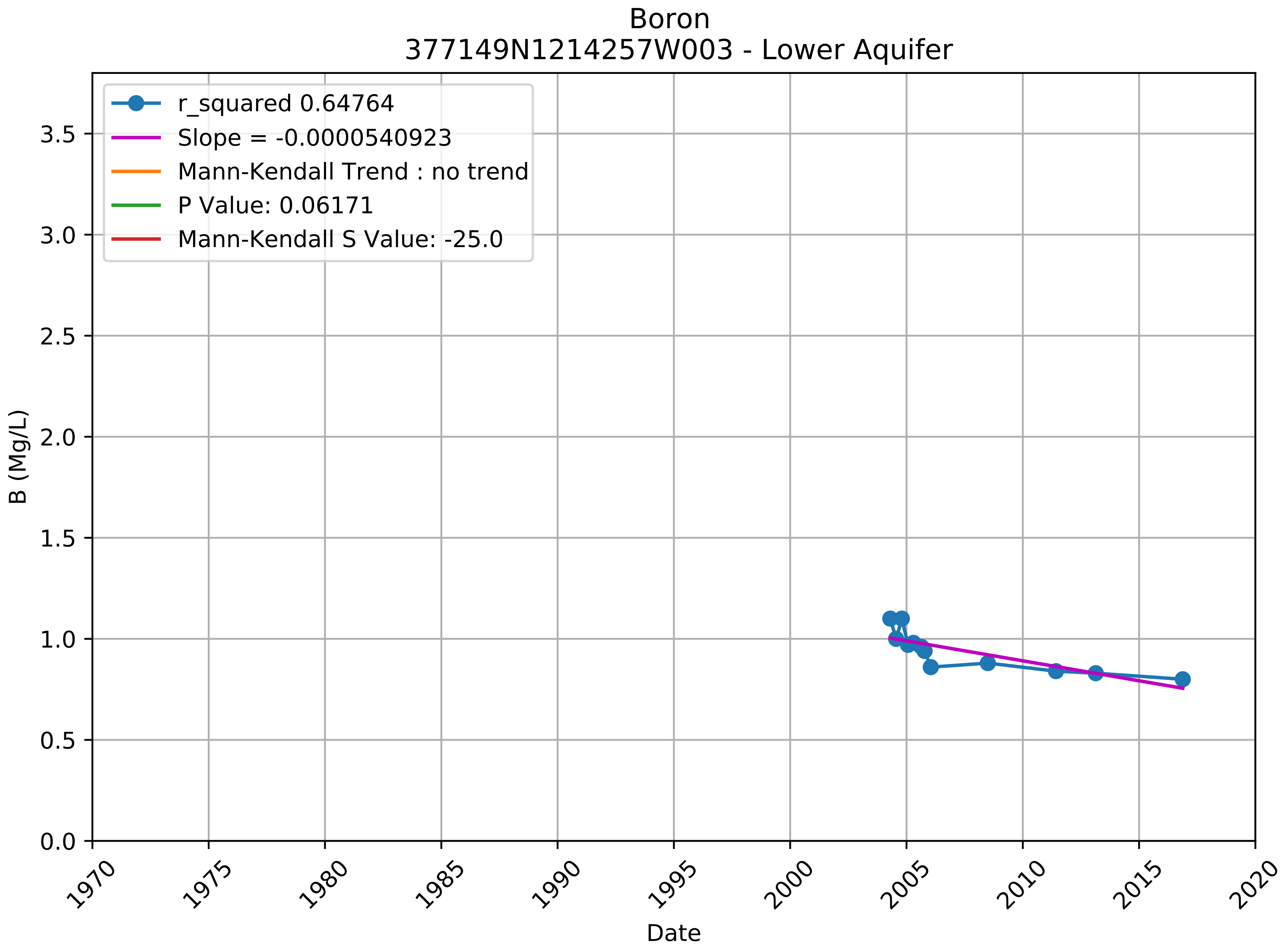

Boron
377149N1214257W003 - Lower Aquifer
r_squared 0.64764
Slope = -0.0000540923
Mann-Kendall Trend : no trend
P Value: 0.06171
Mann-Kendall S Value: -25.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
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2.5
3.0
3.5
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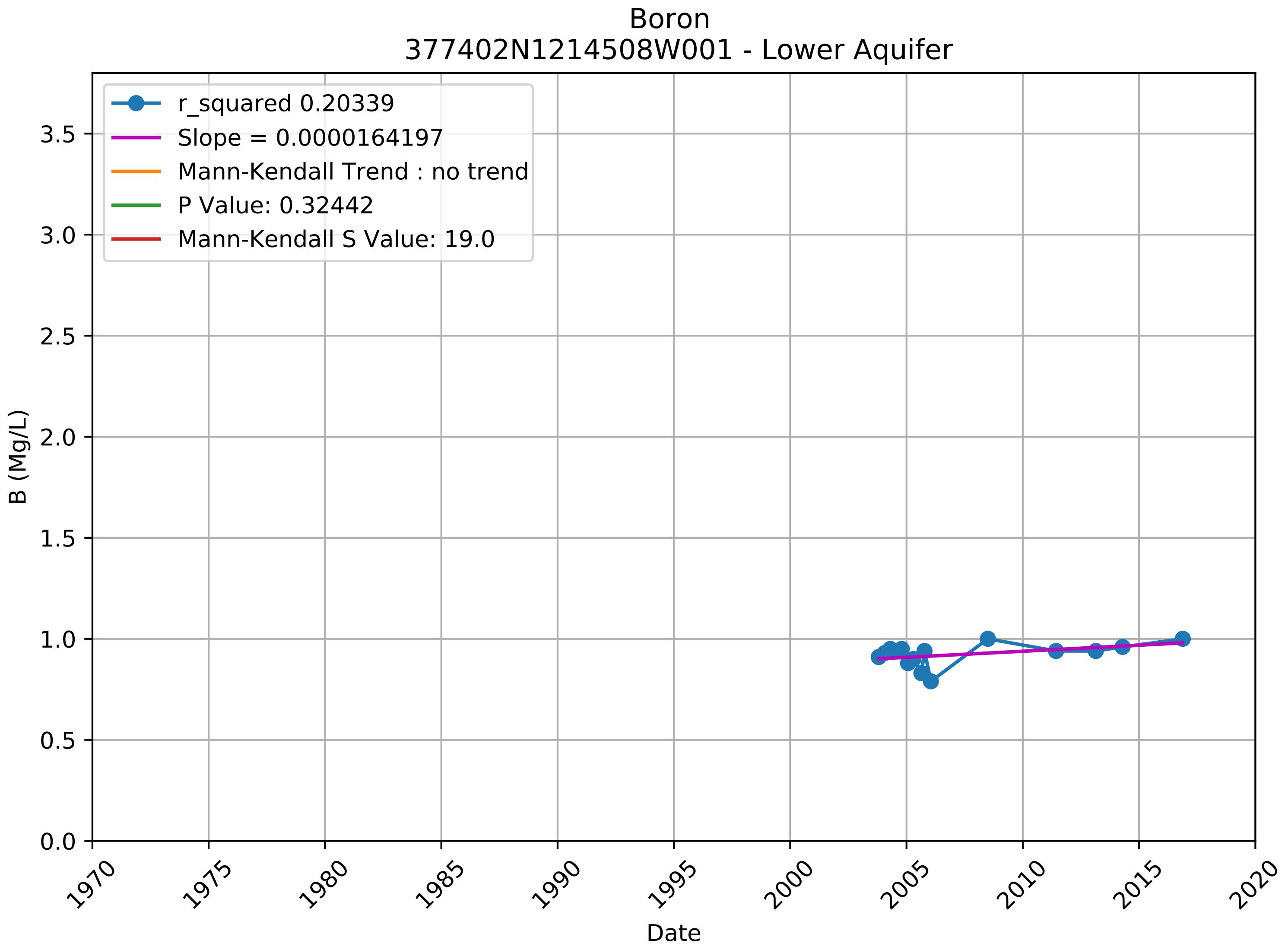

Boron
377402N1214508W001 - Lower Aquifer
r_squared 0.20339
Slope = 0.0000164197
Mann-Kendall Trend : no trend
P Value: 0.32442
Mann-Kendall S Value: 19.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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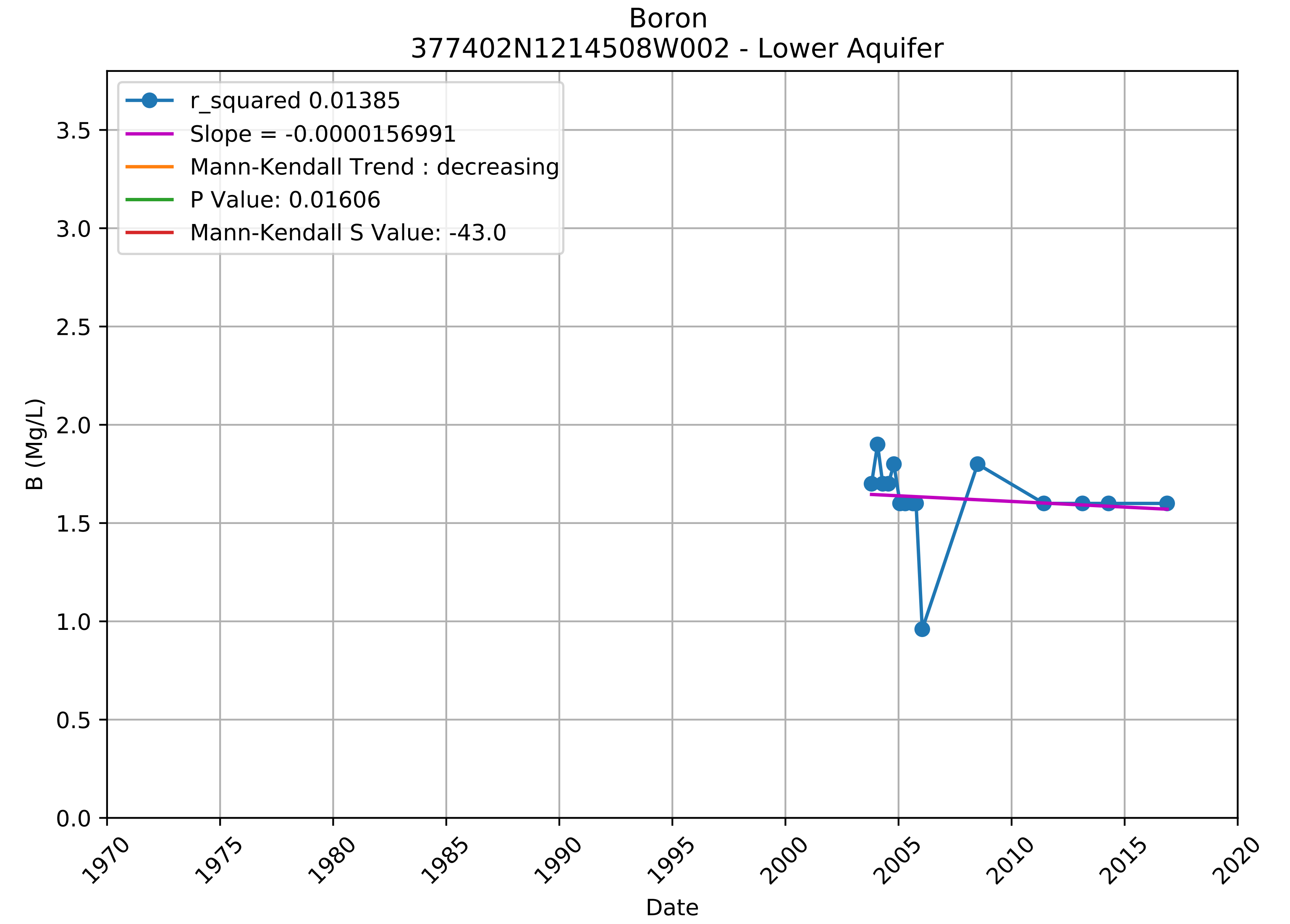

Boron
377402N1214508W002 - Lower Aquifer
r_squared 0.01385
Slope = -0.0000156991
Mann-Kendall Trend : decreasing
P Value: 0.01606
Mann-Kendall S Value: -43.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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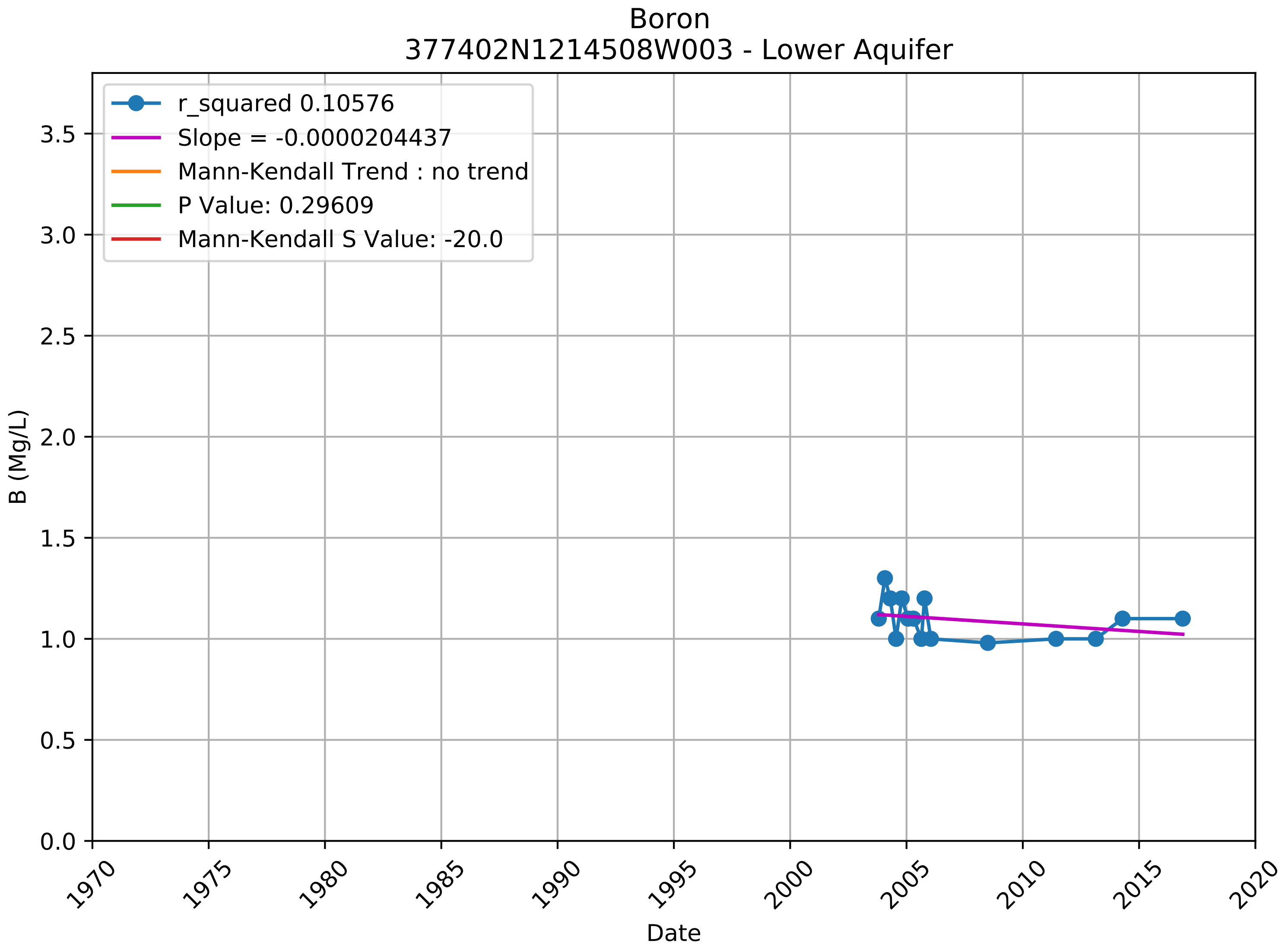
Date


Boron
377402N1214508W003 - Lower Aquifer
r_squared 0.10576
Slope = -0.0000204437
Mann-Kendall Trend : no trend
P Value: 0.29609
Mann-Kendall S Value: -20.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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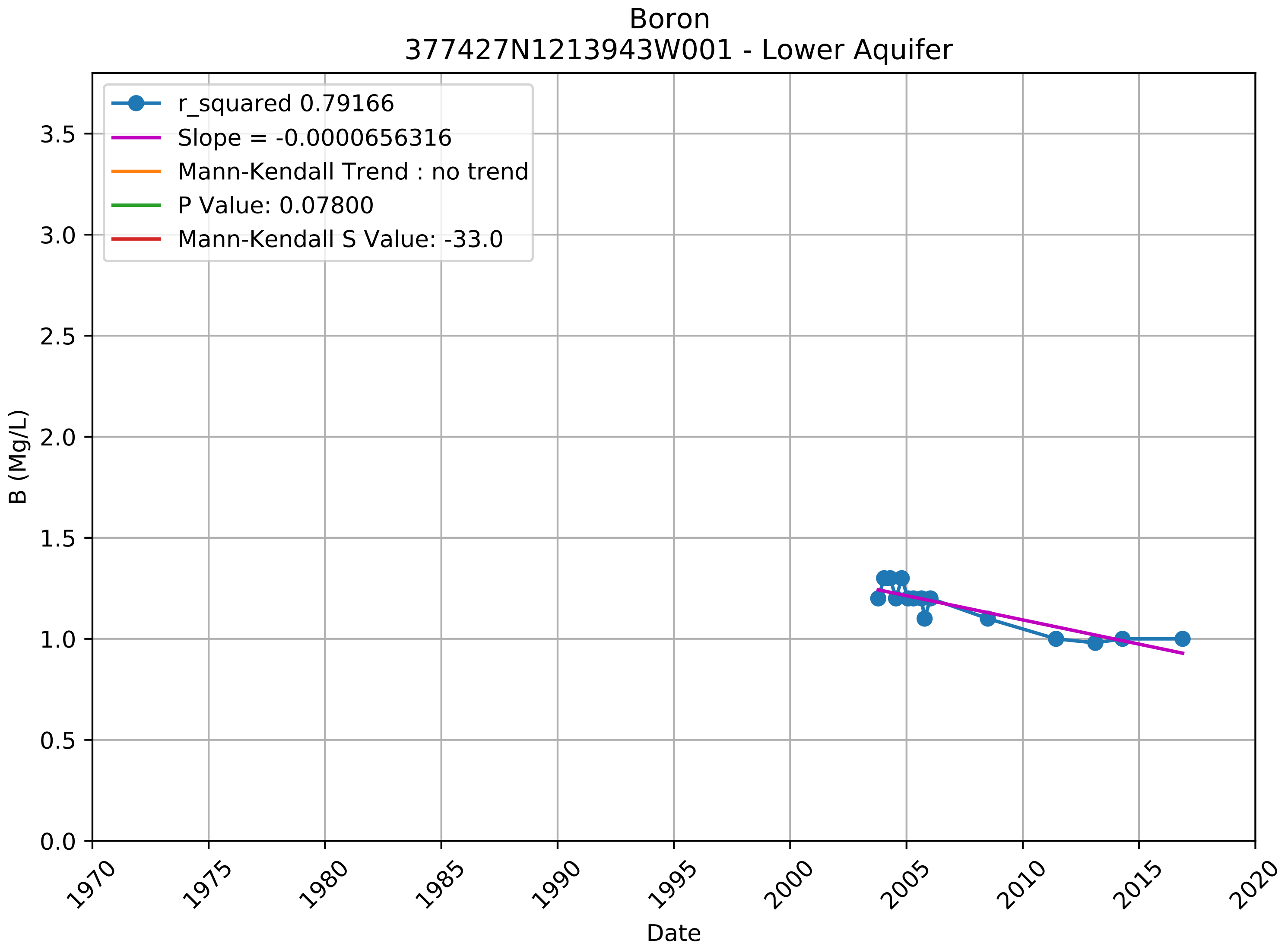
Boron
377427N1213943W001 - Lower Aquifer
r_squared 0.79166
Slope = -0.0000656316
Mann-Kendall Trend : no trend
P Value: 0.07800
Mann-Kendall S Value: -33.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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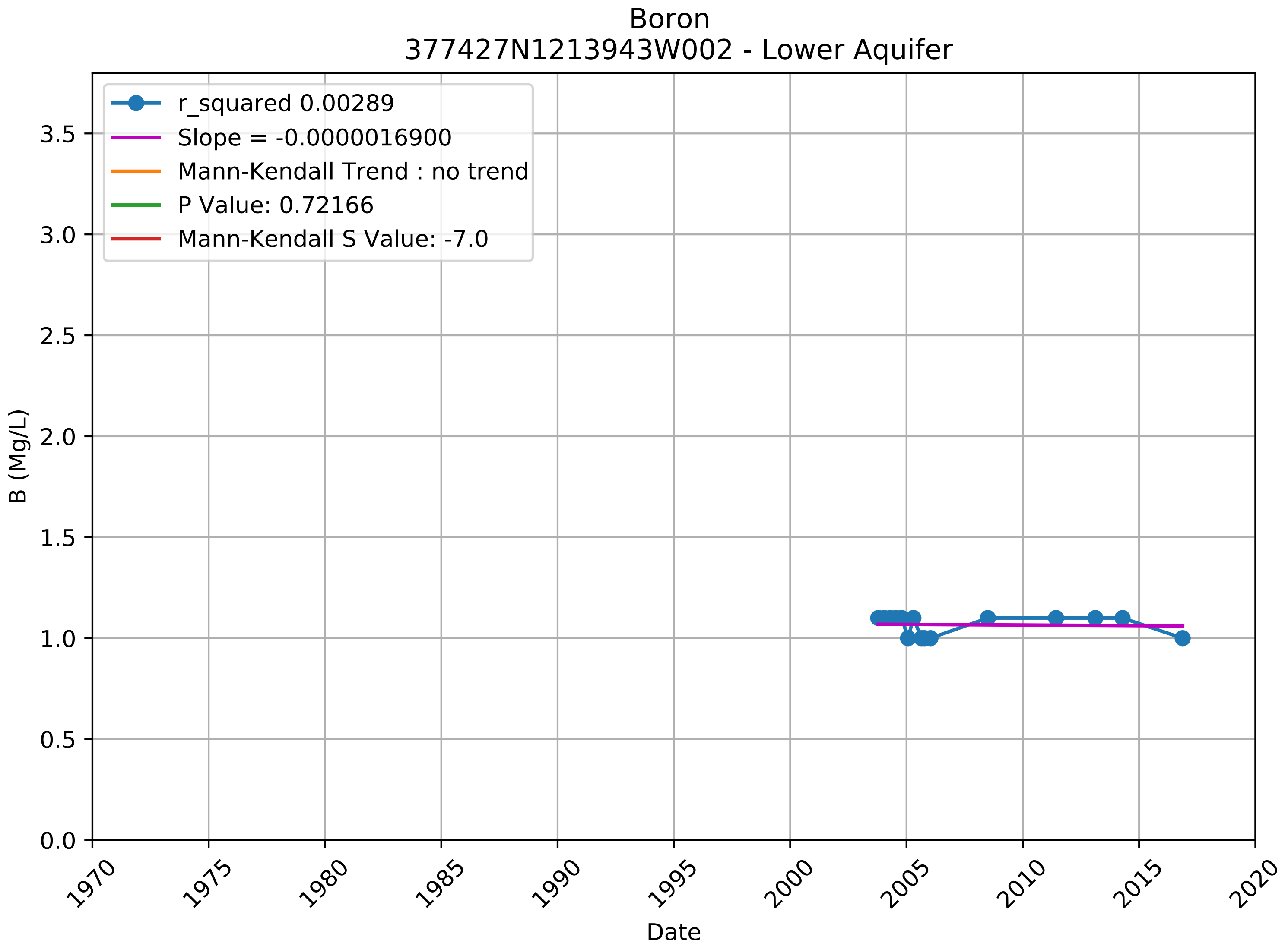
2020
Date



Boron
377427N1213943W002 - Lower Aquifer
r_squared 0.00289
Slope = -0.0000016900
Mann-Kendall Trend : no trend
P Value: 0.72166
Mann-Kendall S Value: -7.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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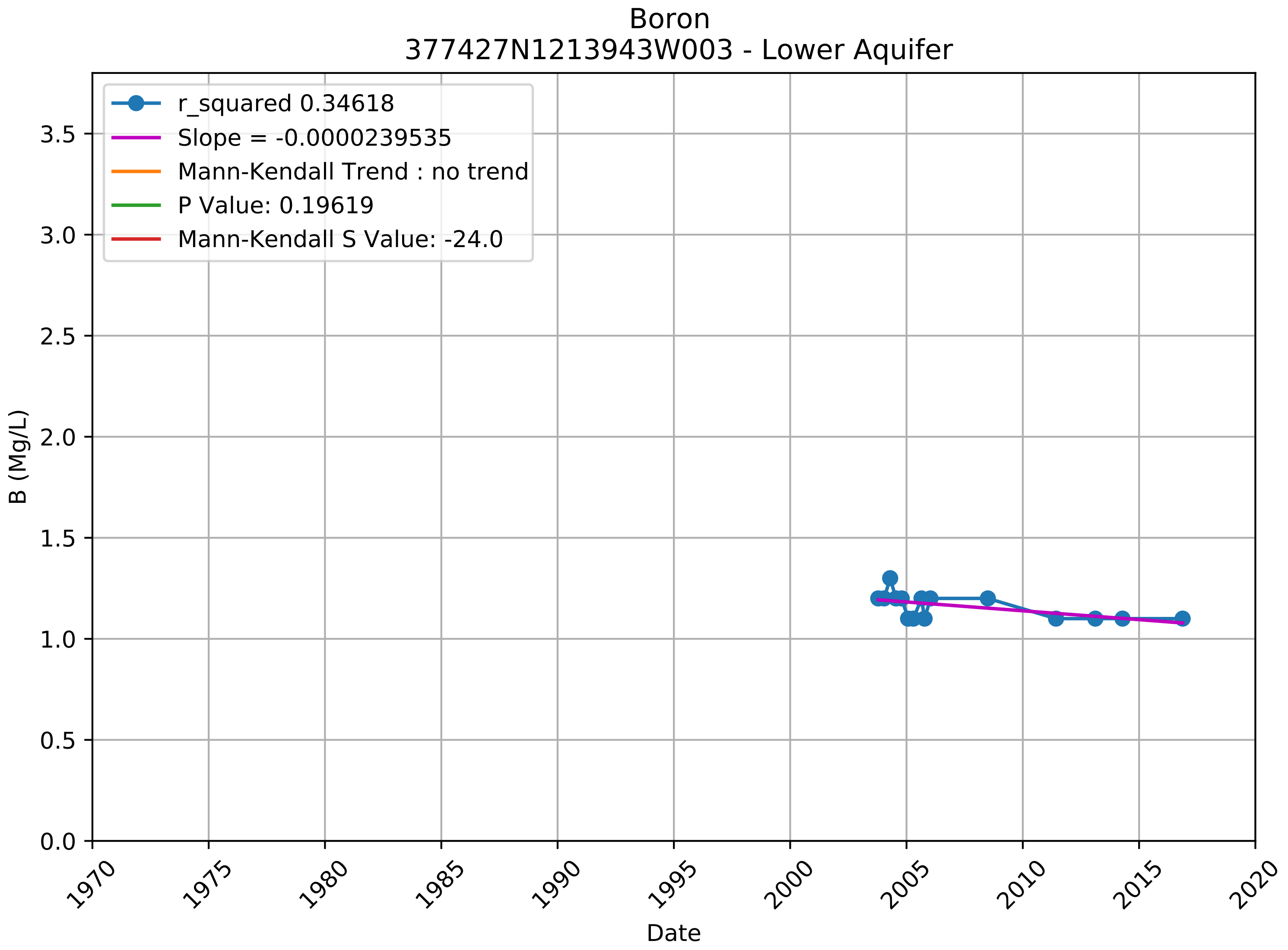
2020
Date



Boron
377427N1213943W003 - Lower Aquifer
r_squared 0.34618
Slope = -0.0000239535
Mann-Kendall Trend : no trend
P Value: 0.19619
Mann-Kendall S Value: -24.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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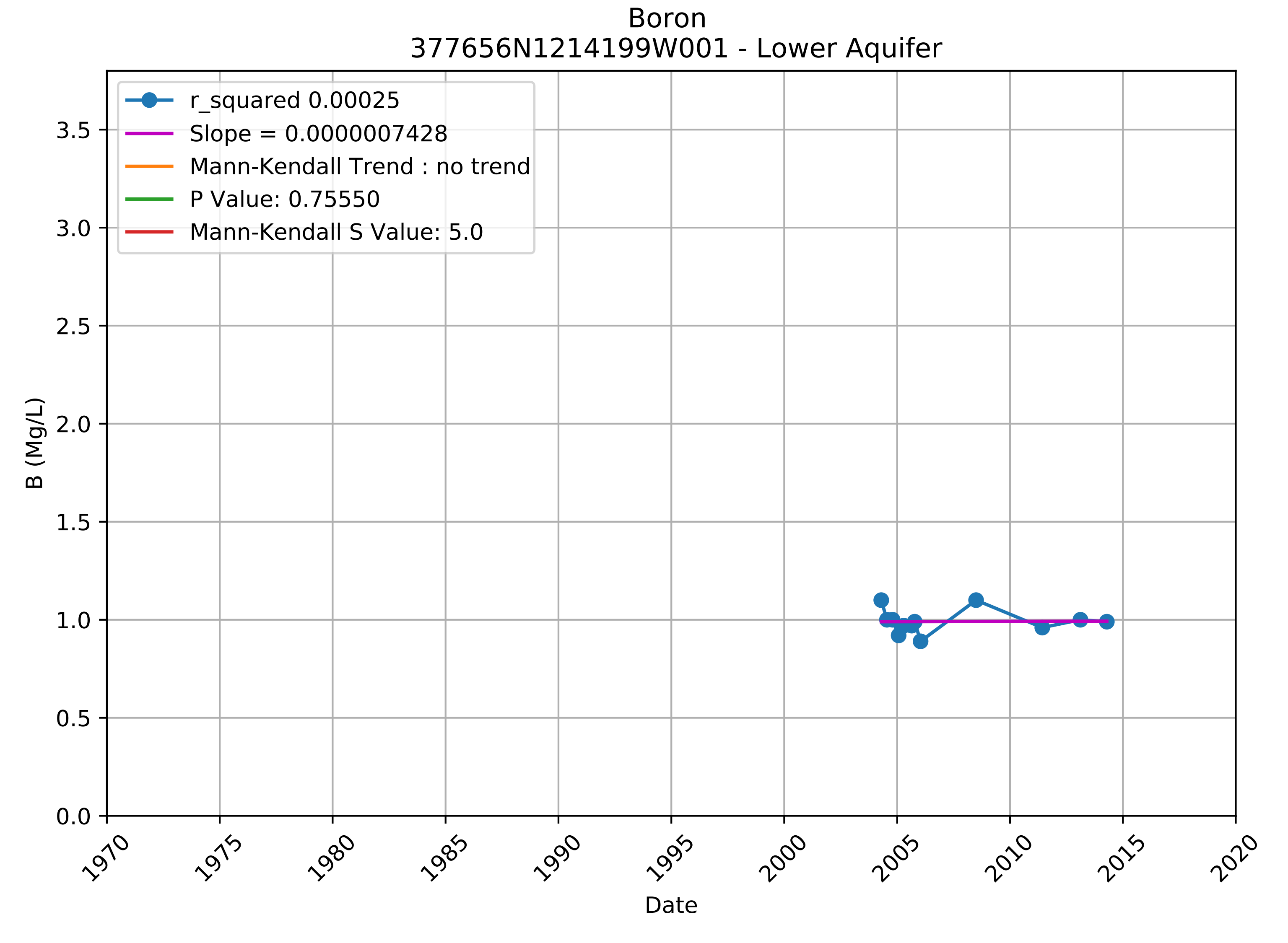

Boron
377656N1214199W001 - Lower Aquifer
r_squared 0.00025
Slope = 0.0000007428
Mann-Kendall Trend : no trend
P Value: 0.75550
Mann-Kendall S Value: 5.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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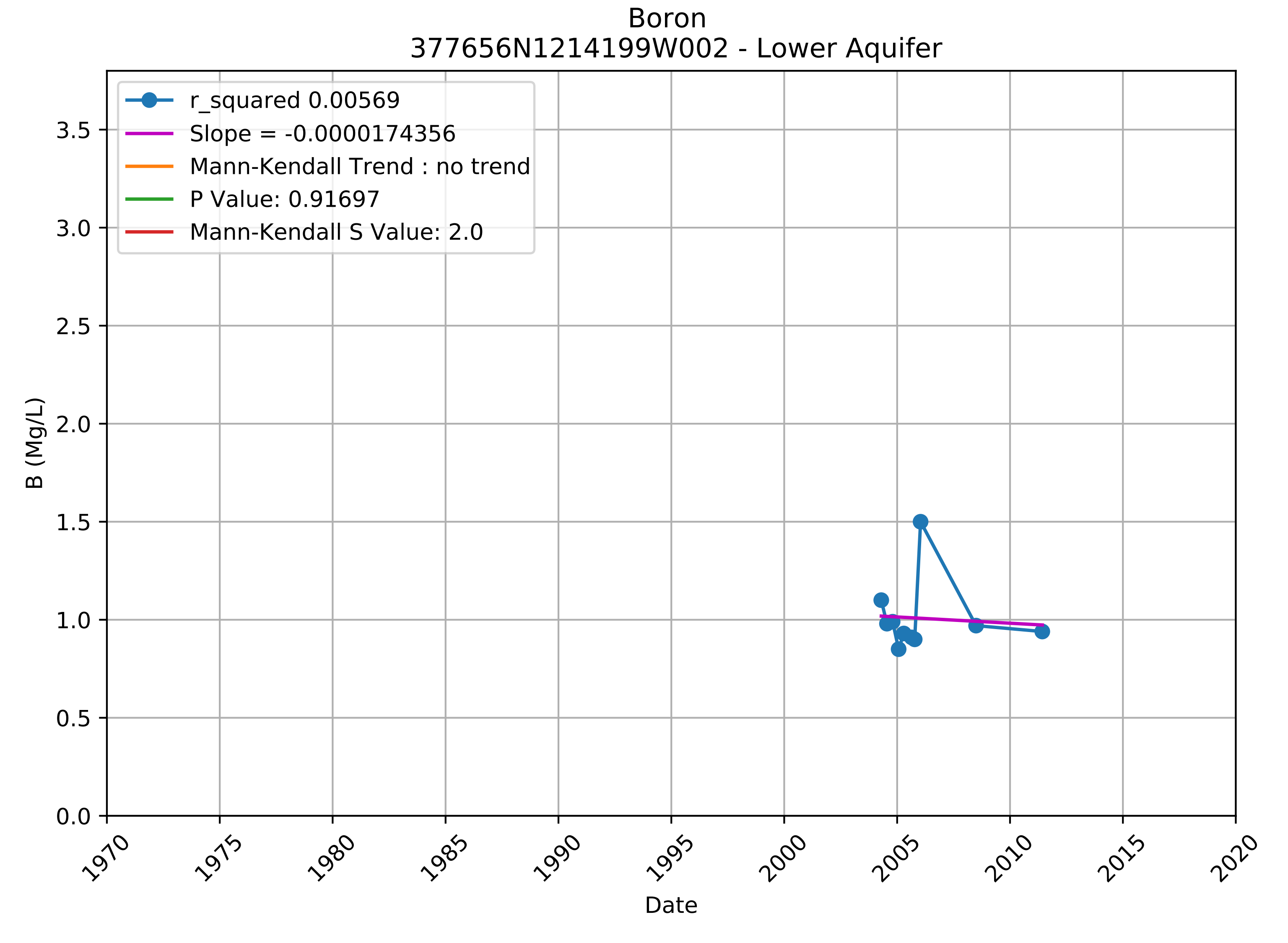

Boron
377656N1214199W002 - Lower Aquifer
r_squared 0.00569
Slope = -0.0000174356
Mann-Kendall Trend : no trend
P Value: 0.91697
Mann-Kendall S Value: 2.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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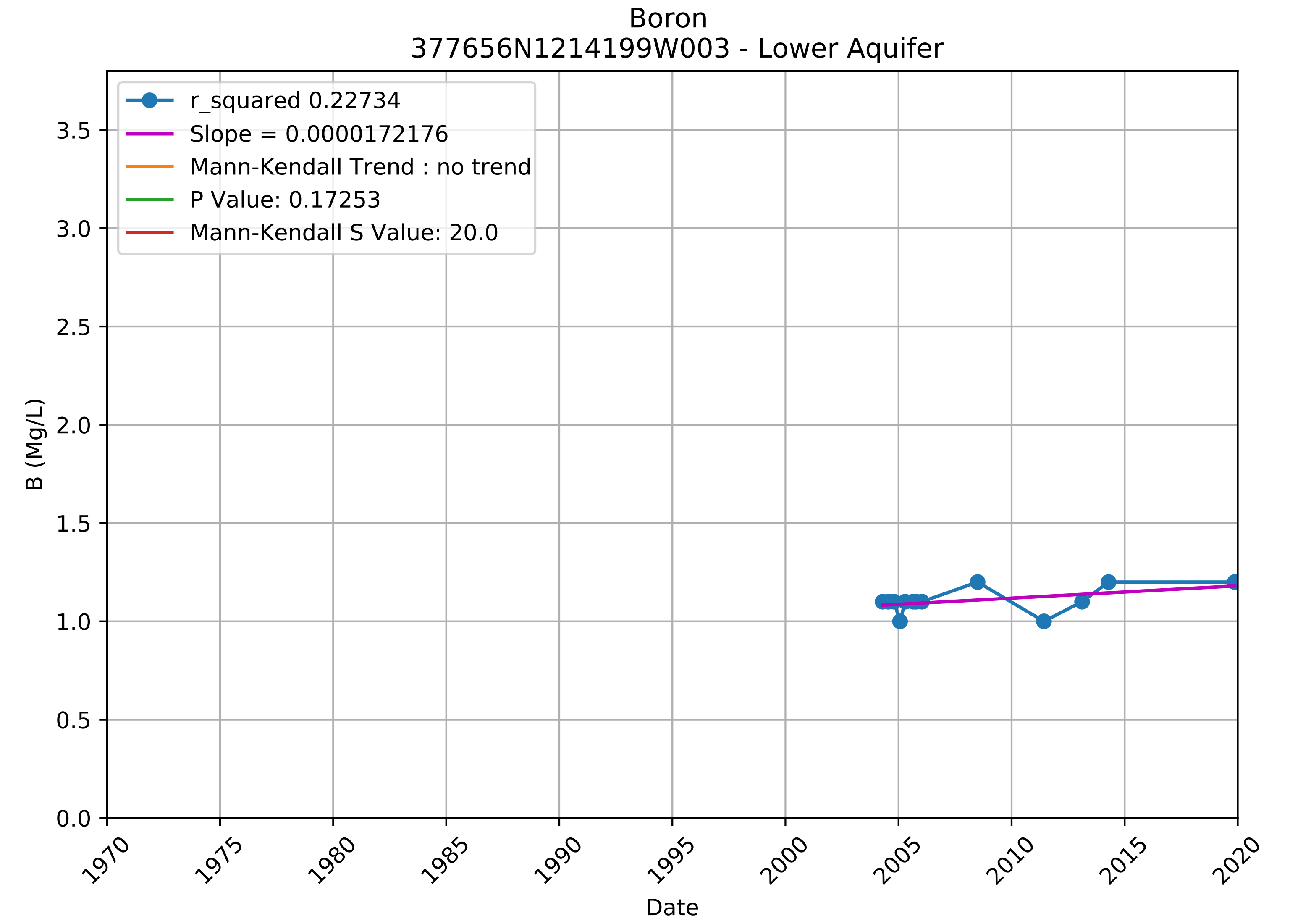
Date


Boron
377656N1214199W003 - Lower Aquifer
r_squared 0.22734
Slope = 0.0000172176
Mann-Kendall Trend : no trend
P Value: 0.17253
Mann-Kendall S Value: 20.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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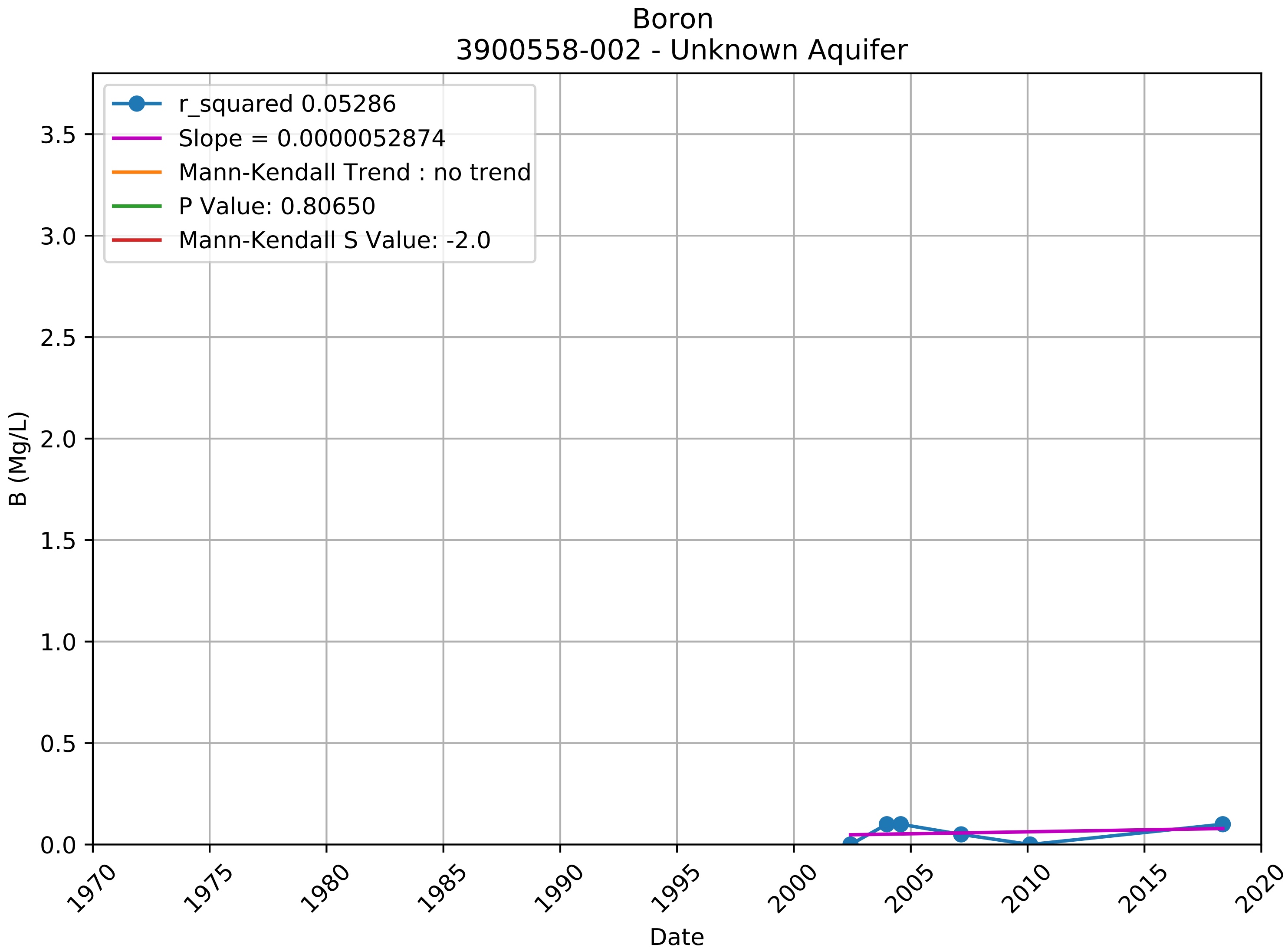

Boron
3900558-002 - Unknown Aquifer
r_squared 0.05286
Slope = 0.0000052874
Mann-Kendall Trend : no trend
P Value: 0.80650
Mann-Kendall S Value: -2.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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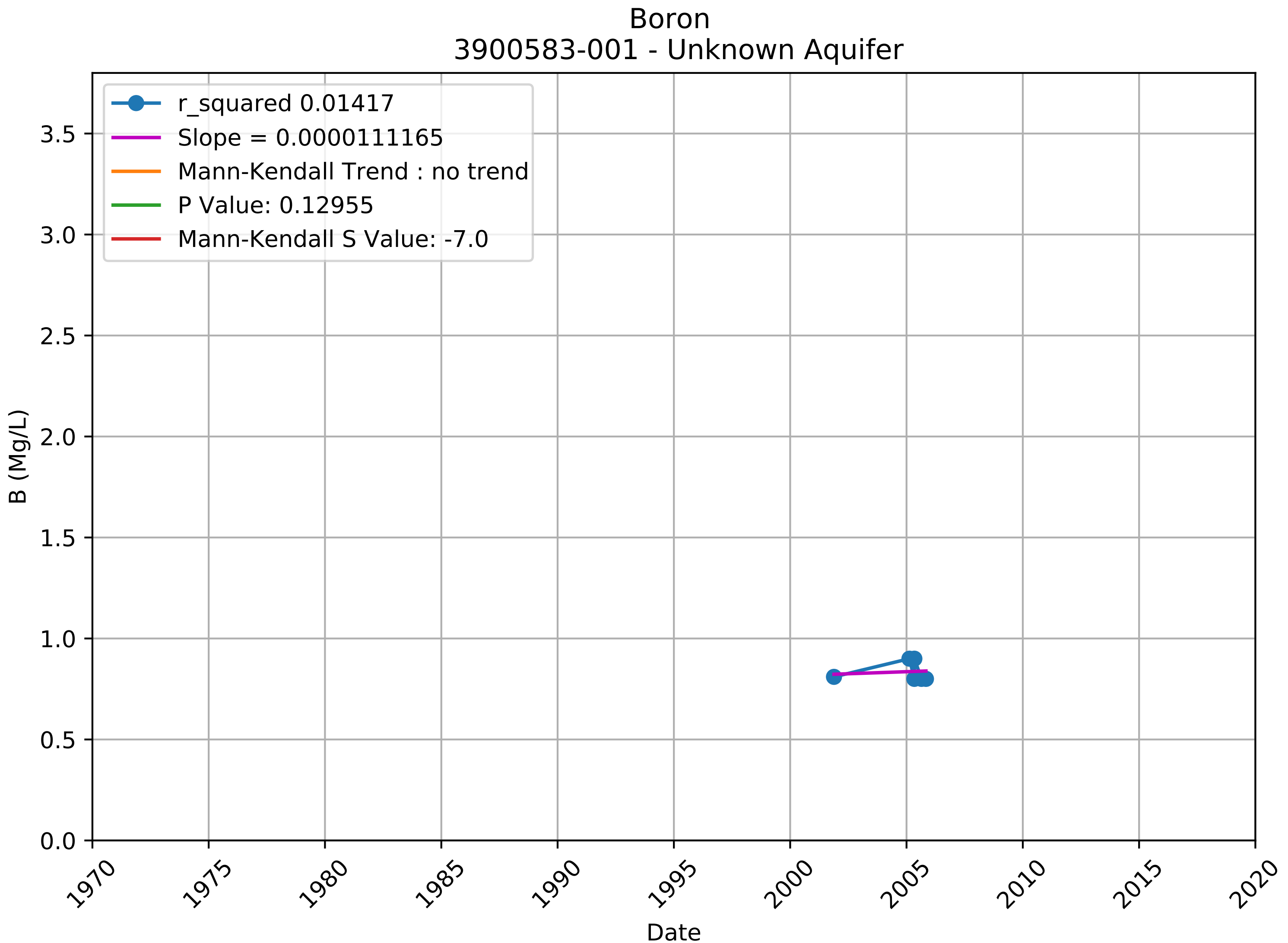

Boron
3900583-001 - Unknown Aquifer
r_squared 0.01417
Slope = 0.0000111165
Mann-Kendall Trend : no trend
P Value: 0.12955
Mann-Kendall S Value: -7.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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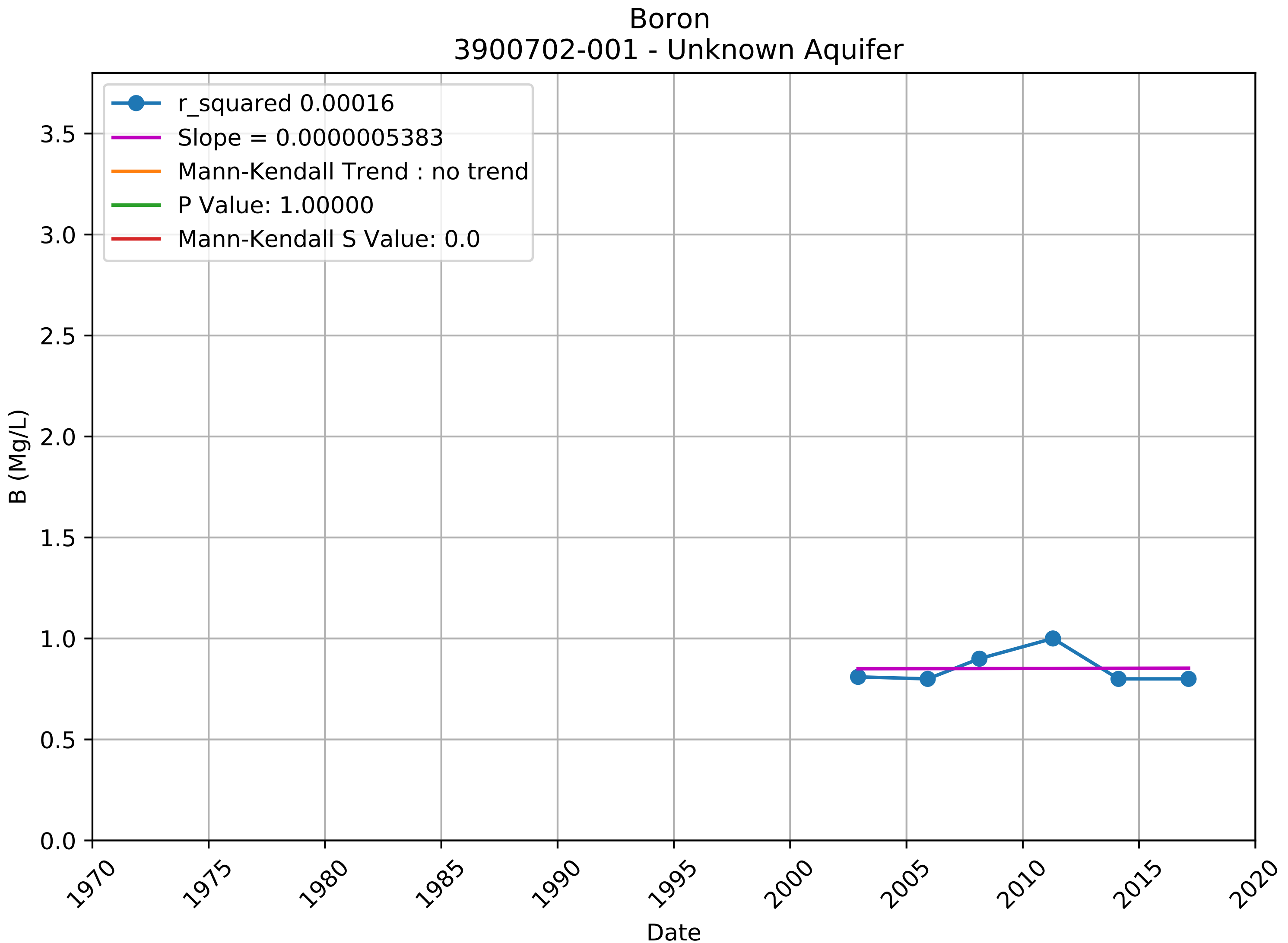

Boron
3900702-001 - Unknown Aquifer
r_squared 0.00016
Slope = 0.0000005383
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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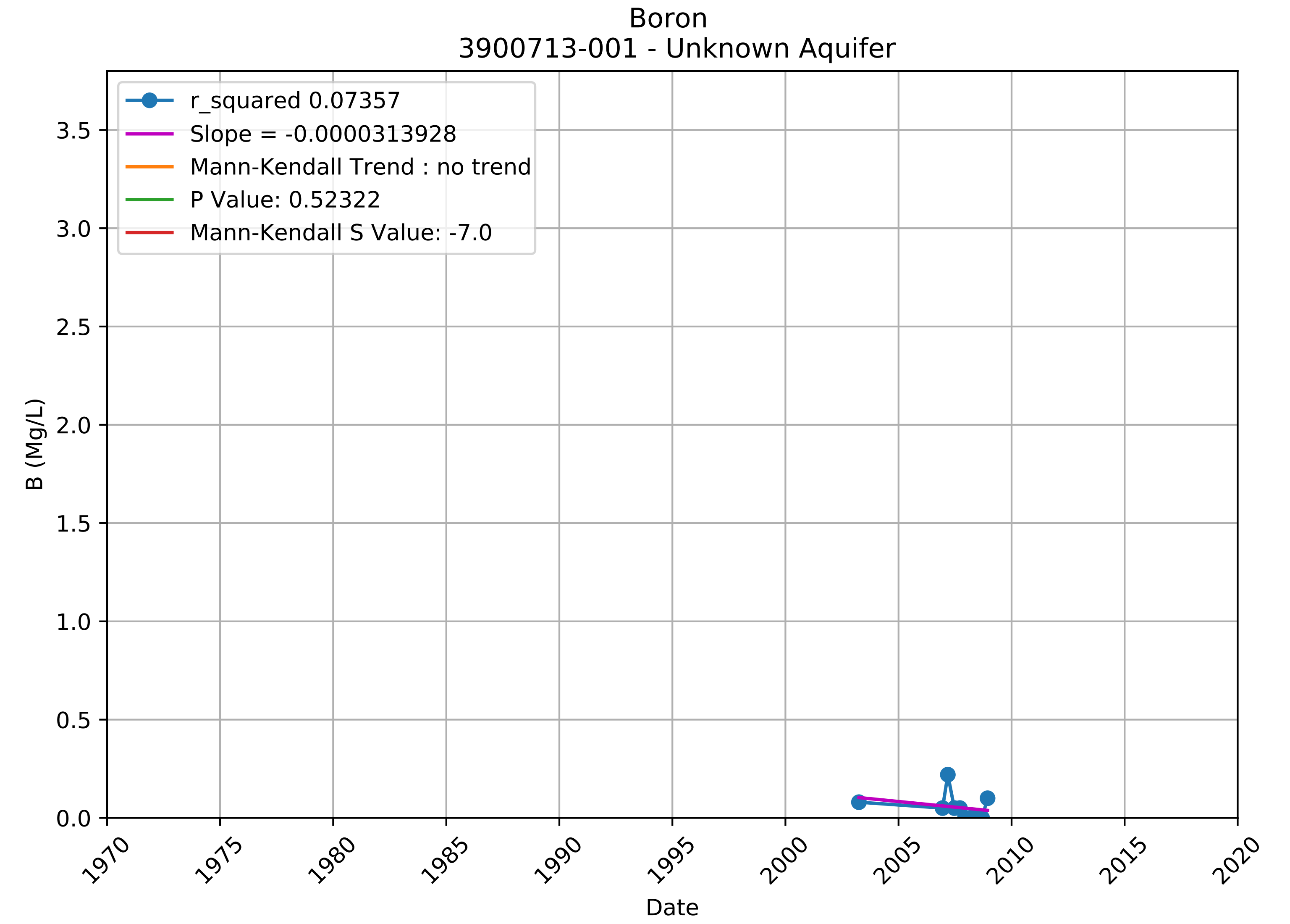
2020
Date



Boron
3900713-001 - Unknown Aquifer
r_squared 0.07357
Slope = -0.0000313928
Mann-Kendall Trend : no trend
P Value: 0.52322
Mann-Kendall S Value: -7.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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1995
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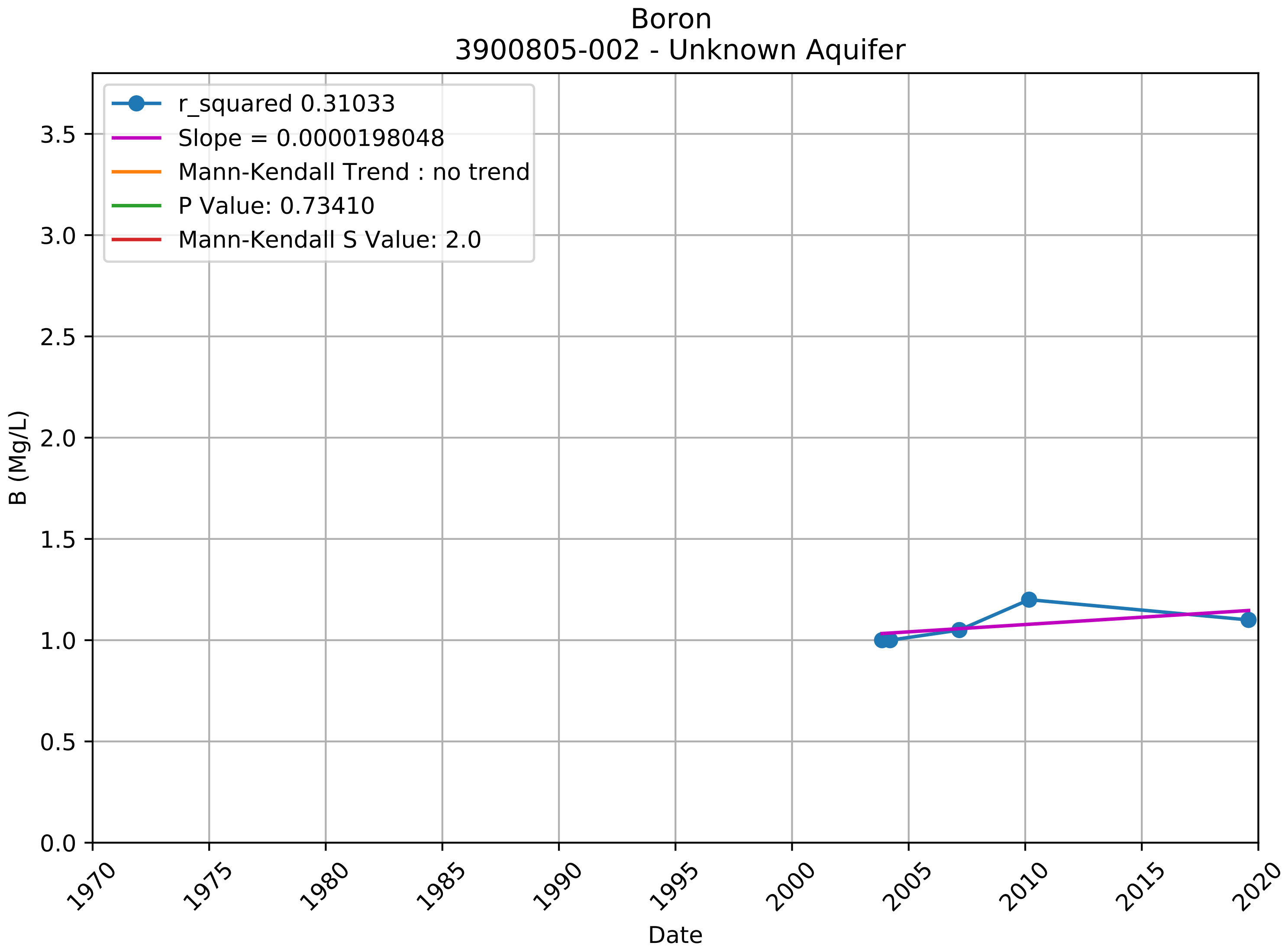

Boron
3900805-002 - Unknown Aquifer
r_squared 0.31033
Slope = 0.0000198048
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: 2.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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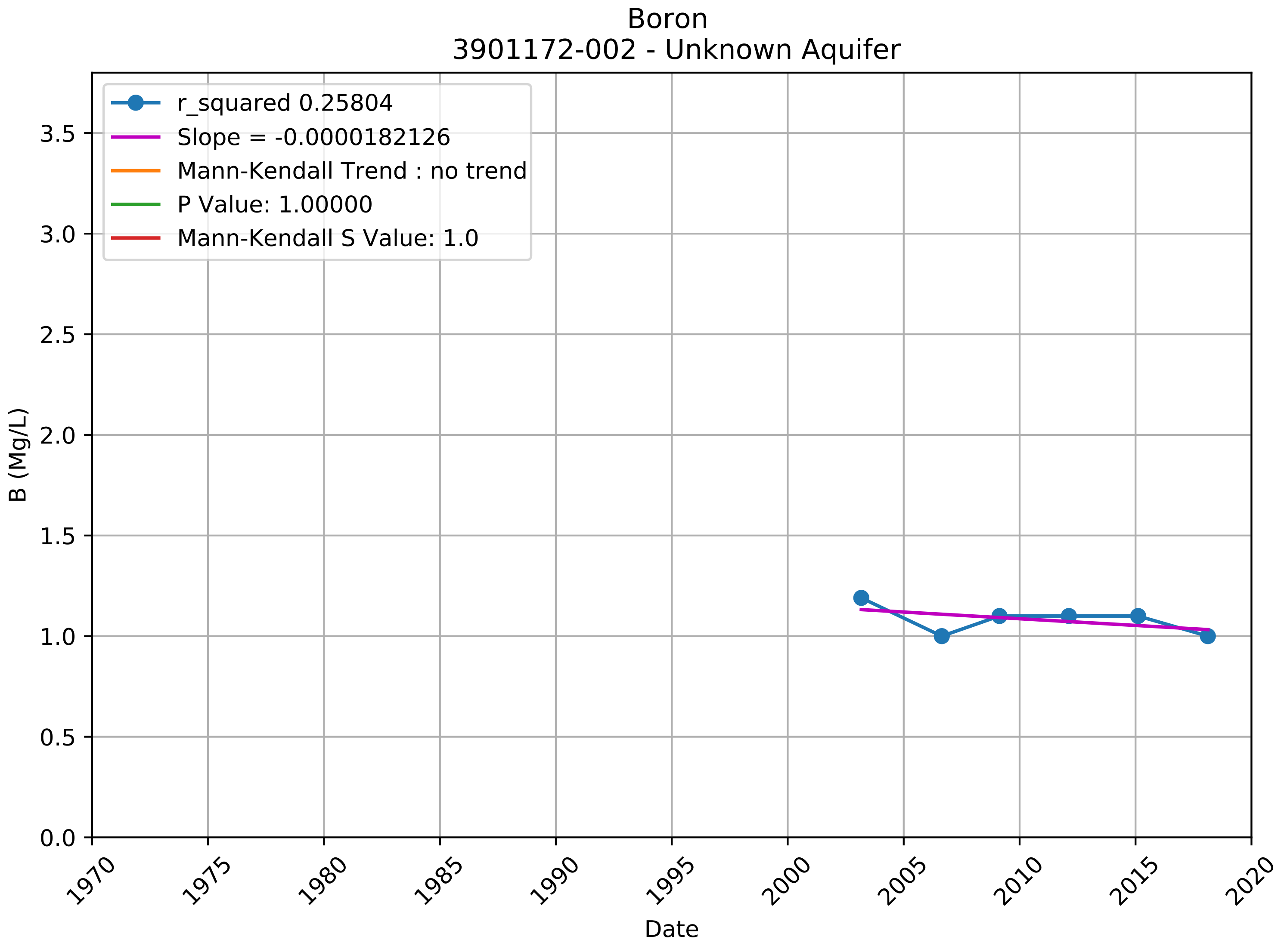
2020


Boron
3901172-002 - Unknown Aquifer
r_squared 0.25804
Slope = -0.0000182126
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Date
1970
1975
1980
1985
1990
1995
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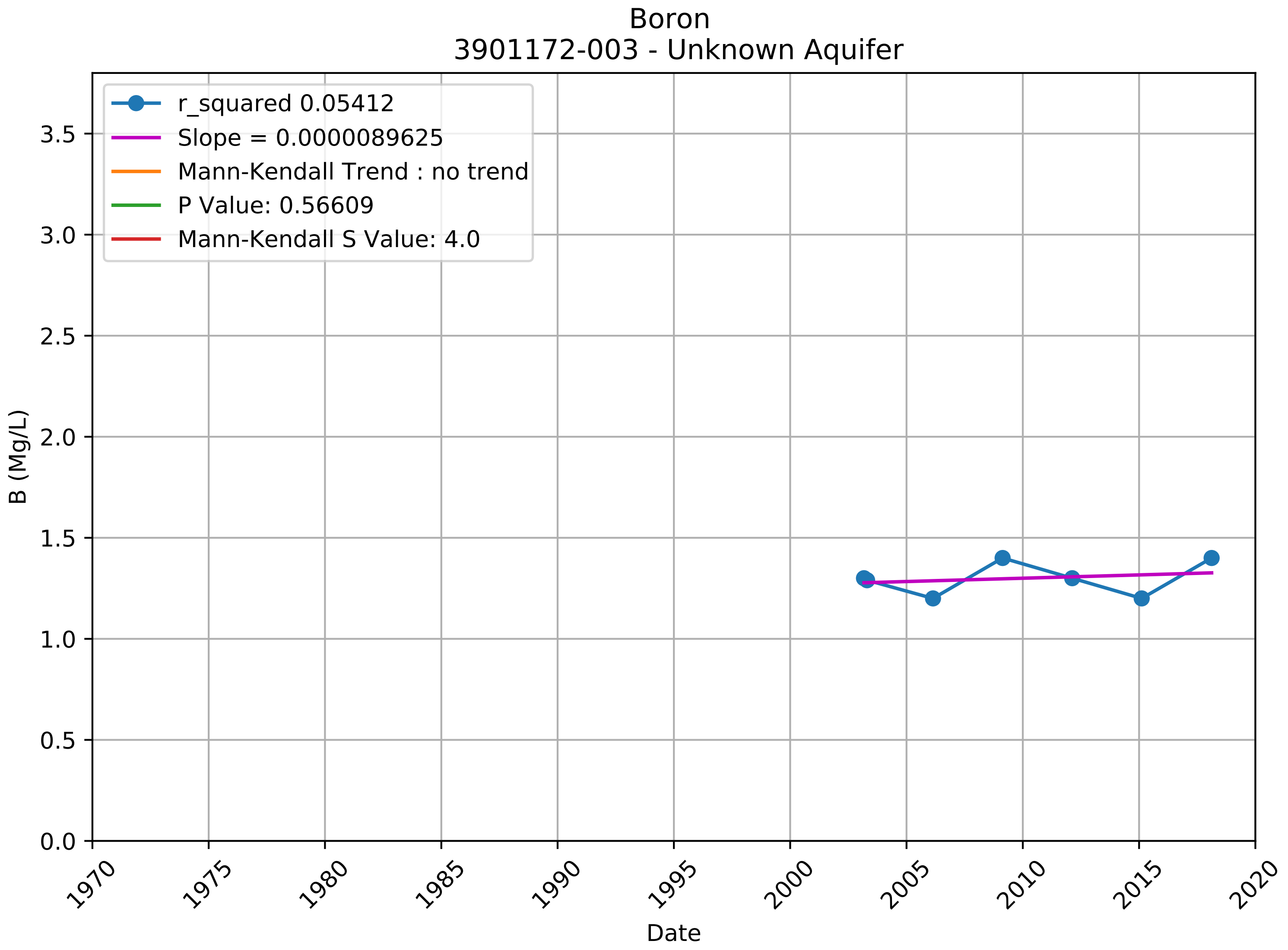
2005
2010
2015
2020



Boron
3901172-003 - Unknown Aquifer
r_squared 0.05412
Slope = 0.0000089625
Mann-Kendall Trend : no trend
P Value: 0.56609
Mann-Kendall S Value: 4.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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1990
1995
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2010
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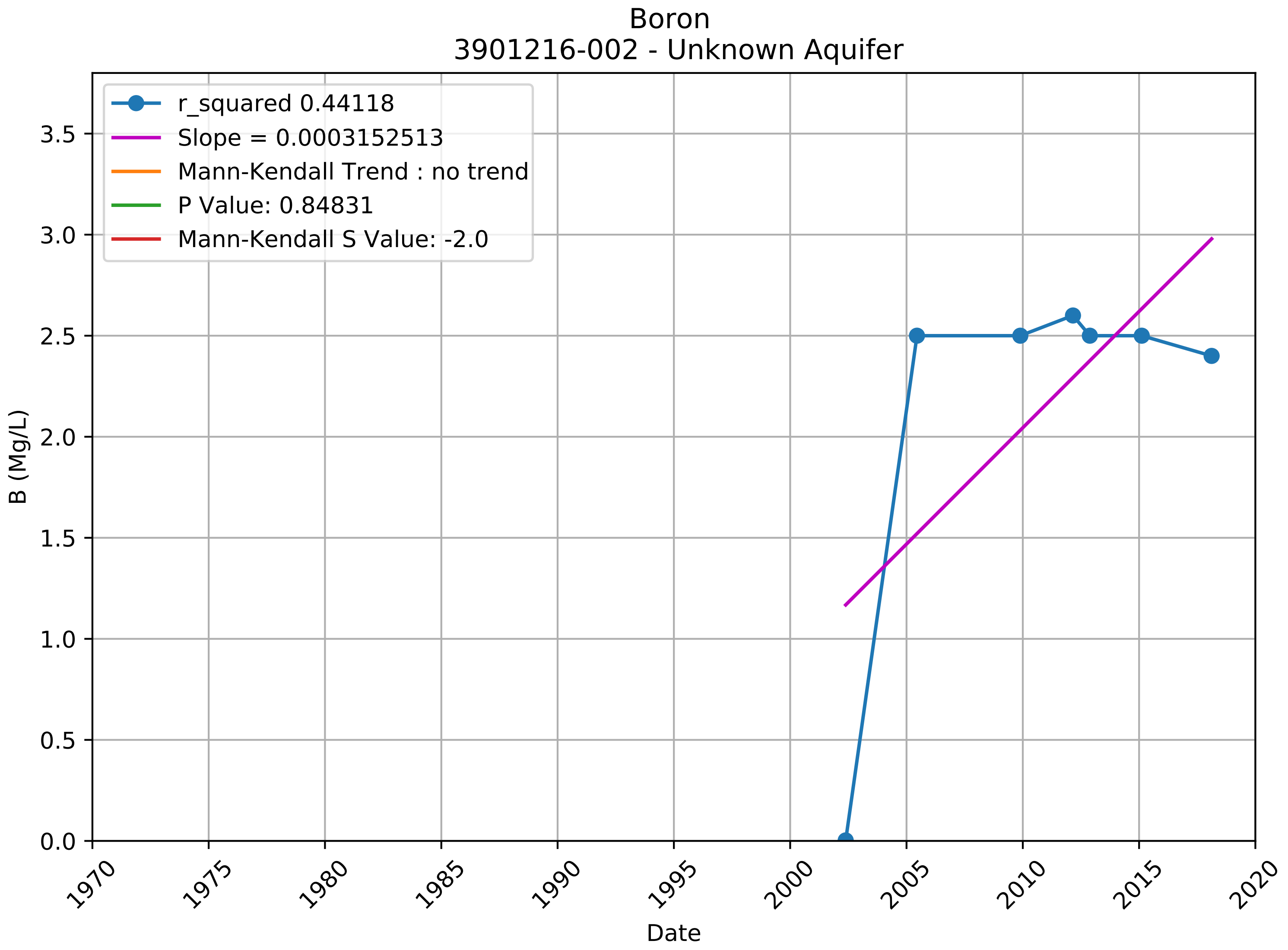
2020
Date



Boron
3901216-002 - Unknown Aquifer
r_squared 0.44118
Slope = 0.0003152513
Mann-Kendall Trend : no trend
P Value: 0.84831
Mann-Kendall S Value: -2.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
1985
1990
1995
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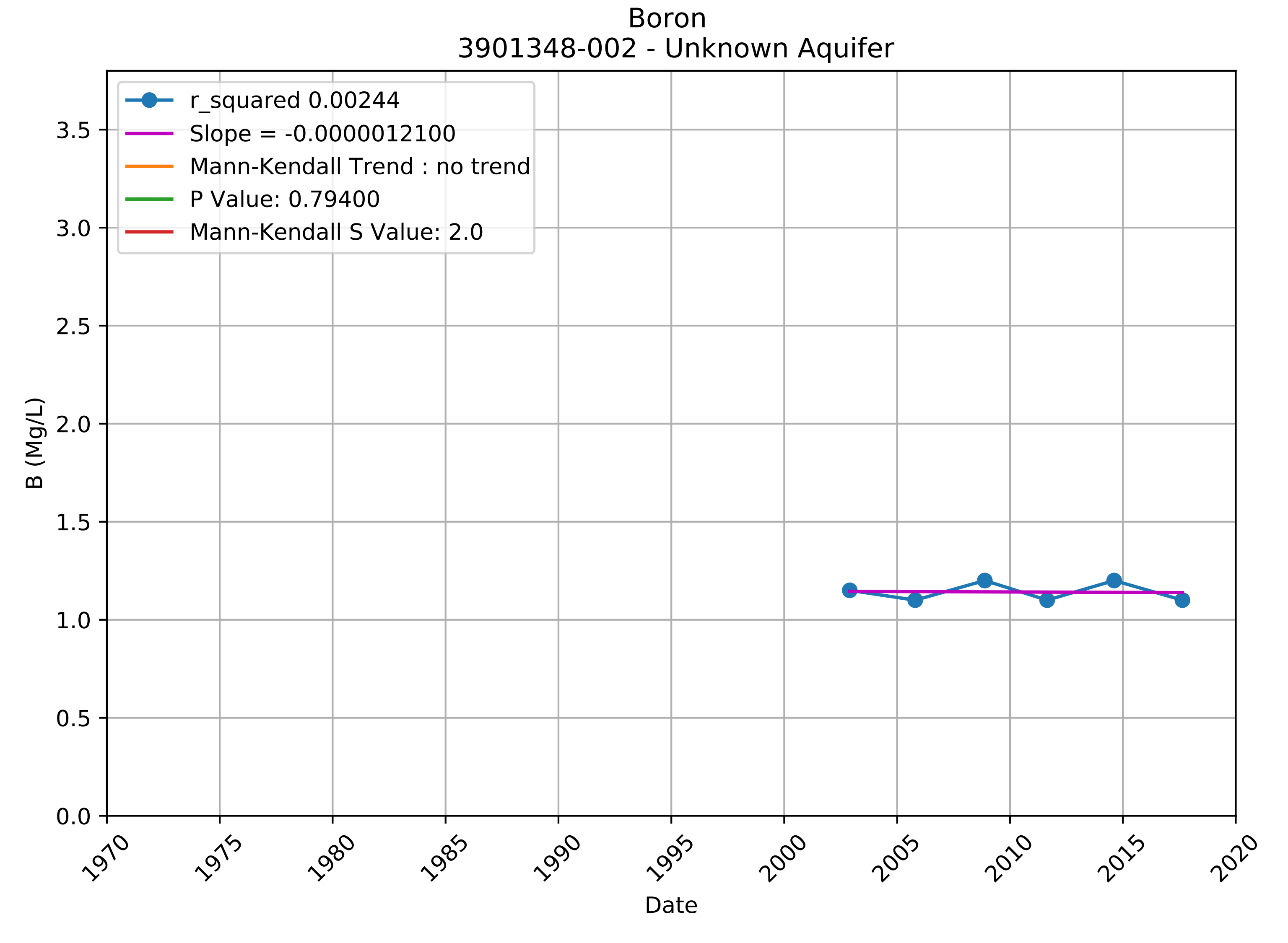
2005
2010
2015
2020



Boron
3901348-002 - Unknown Aquifer
r_squared 0.00244
Slope = -0.0000012100
Mann-Kendall Trend : no trend
P Value: 0.79400
Mann-Kendall S Value: 2.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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1985
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1995
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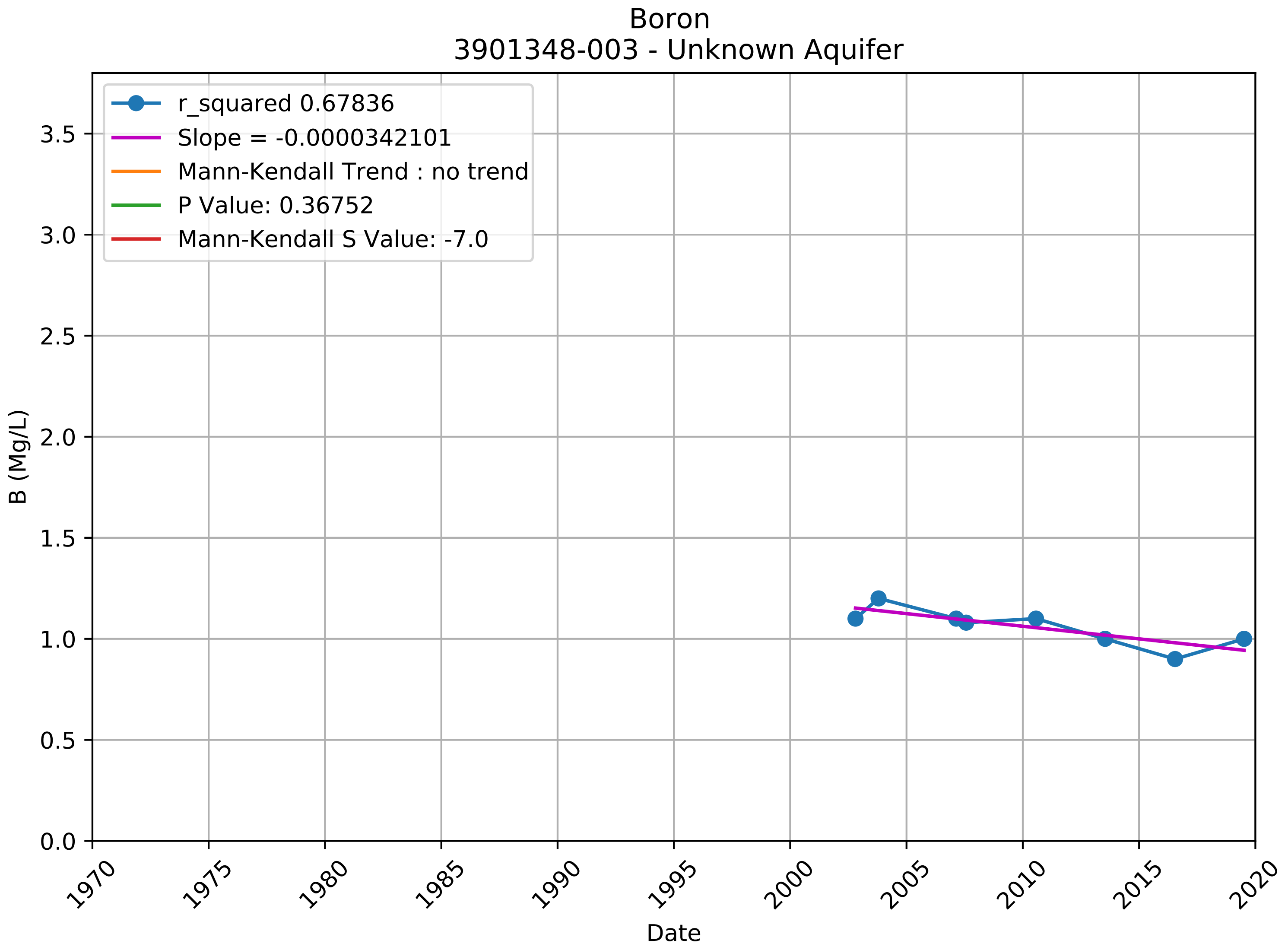
2005
2010
2015
2020



Boron
3901348-003 - Unknown Aquifer
r_squared 0.67836
Slope = -0.0000342101
Mann-Kendall Trend : no trend
P Value: 0.36752
Mann-Kendall S Value: -7.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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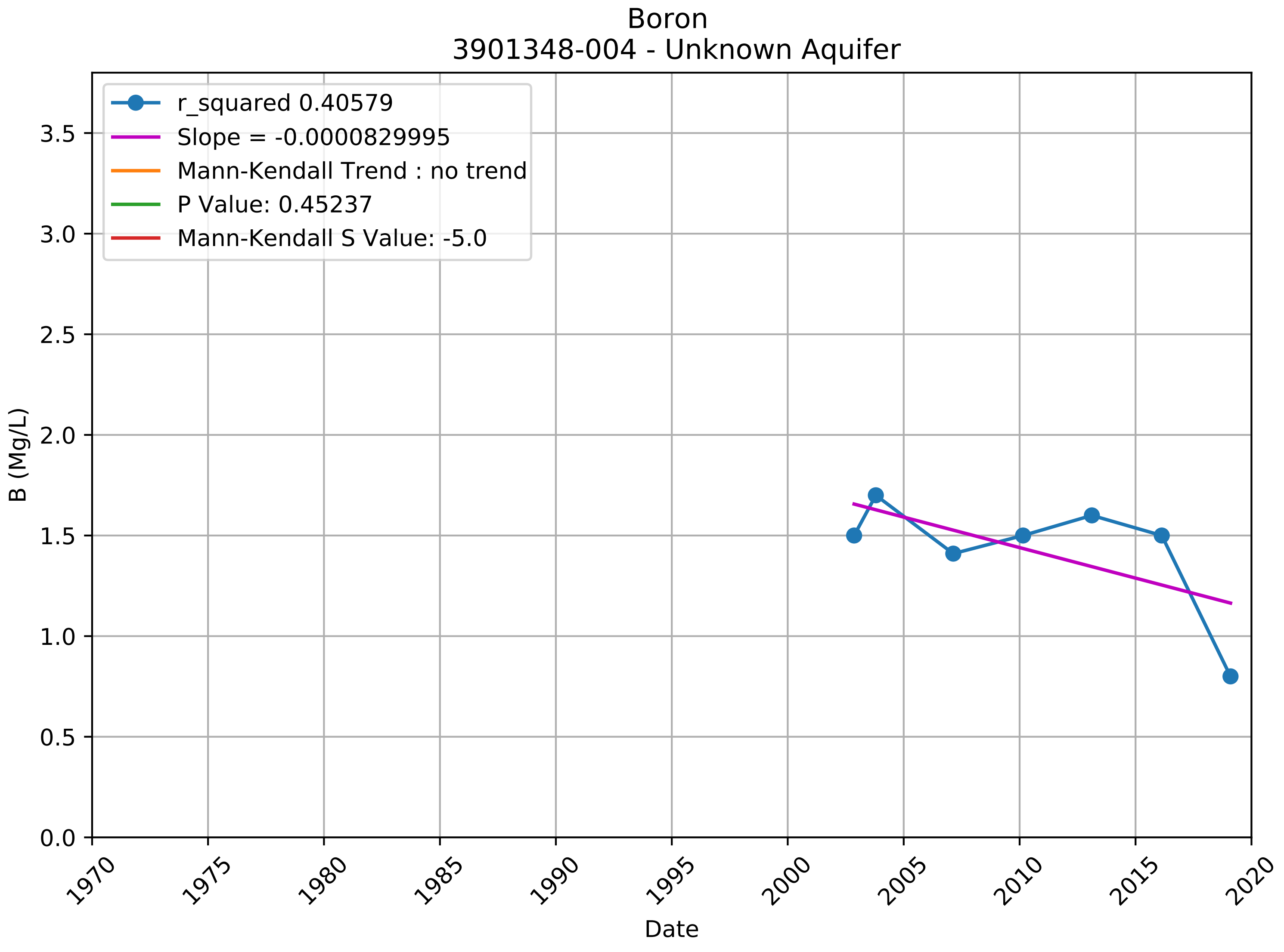
2020
Date



Boron
3901348-004 - Unknown Aquifer
r_squared 0.40579
Slope = -0.0000829995
Mann-Kendall Trend : no trend
P Value: 0.45237
Mann-Kendall S Value: -5.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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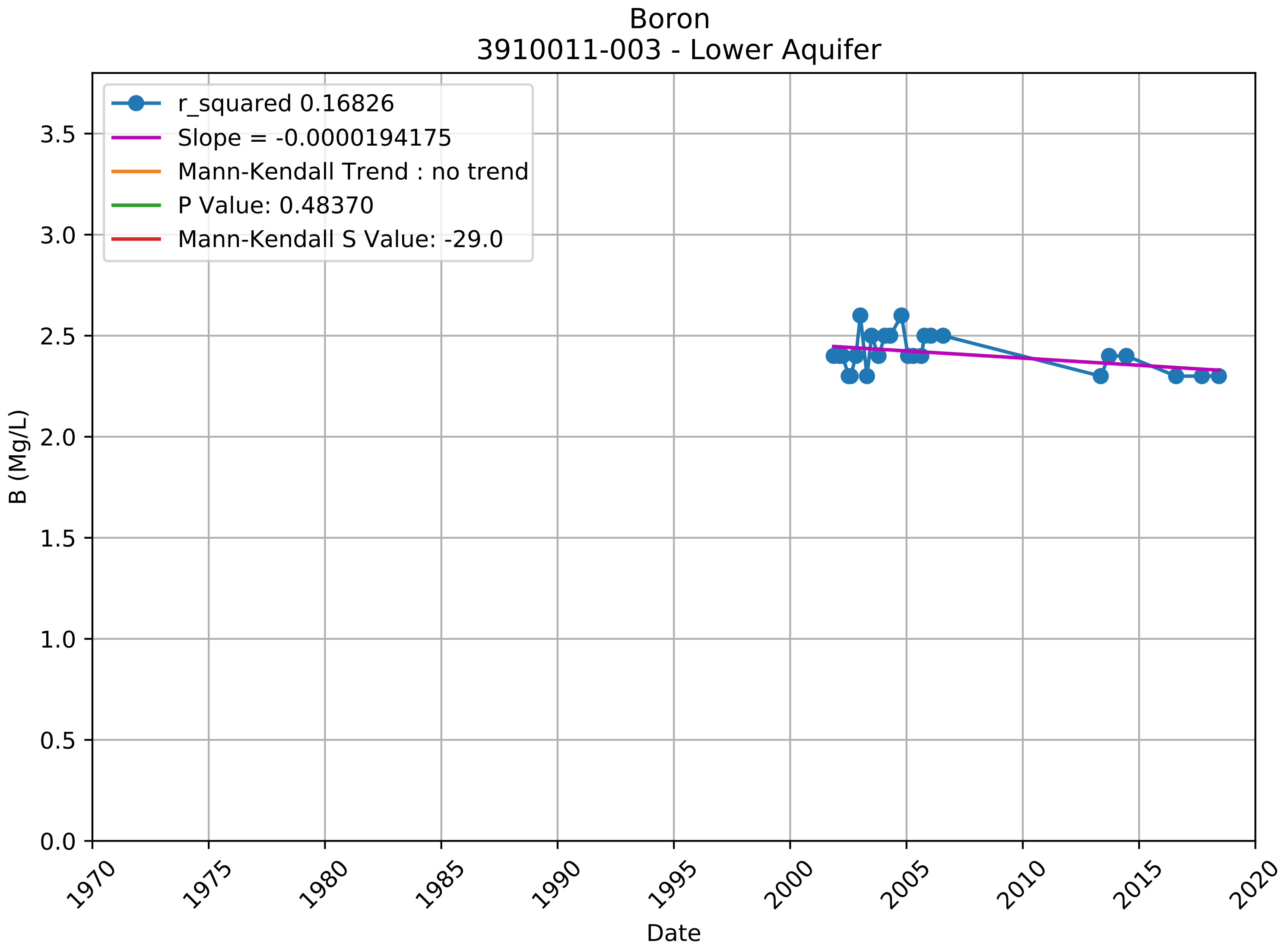
2020


Boron
3910011-003 - Lower Aquifer
r_squared 0.16826
Slope = -0.0000194175
Mann-Kendall Trend : no trend
P Value: 0.48370
Mann-Kendall S Value: -29.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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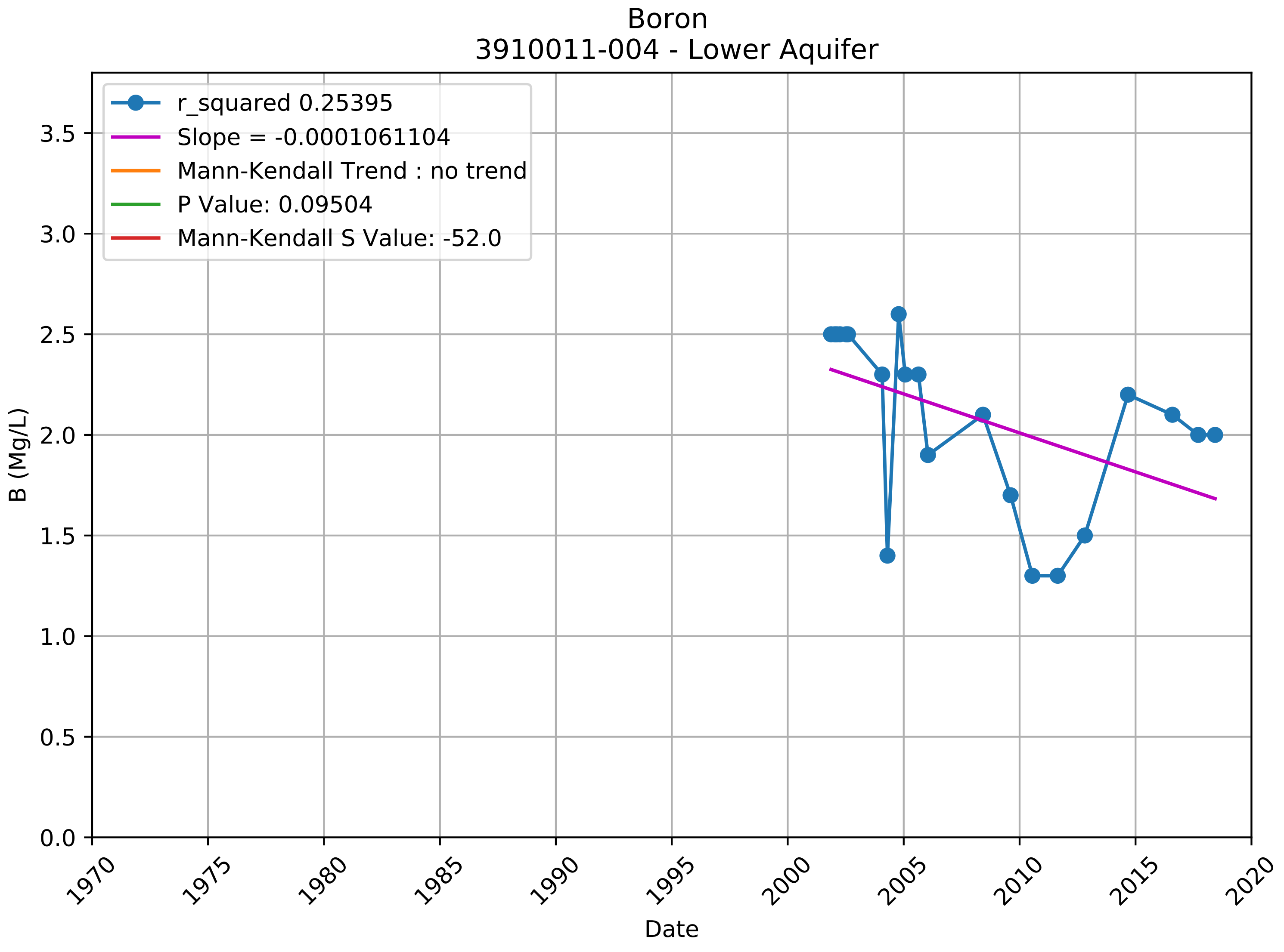

Boron
3910011-004 - Lower Aquifer
r_squared 0.25395
Slope = -0.0001061104
Mann-Kendall Trend : no trend
P Value: 0.09504
Mann-Kendall S Value: -52.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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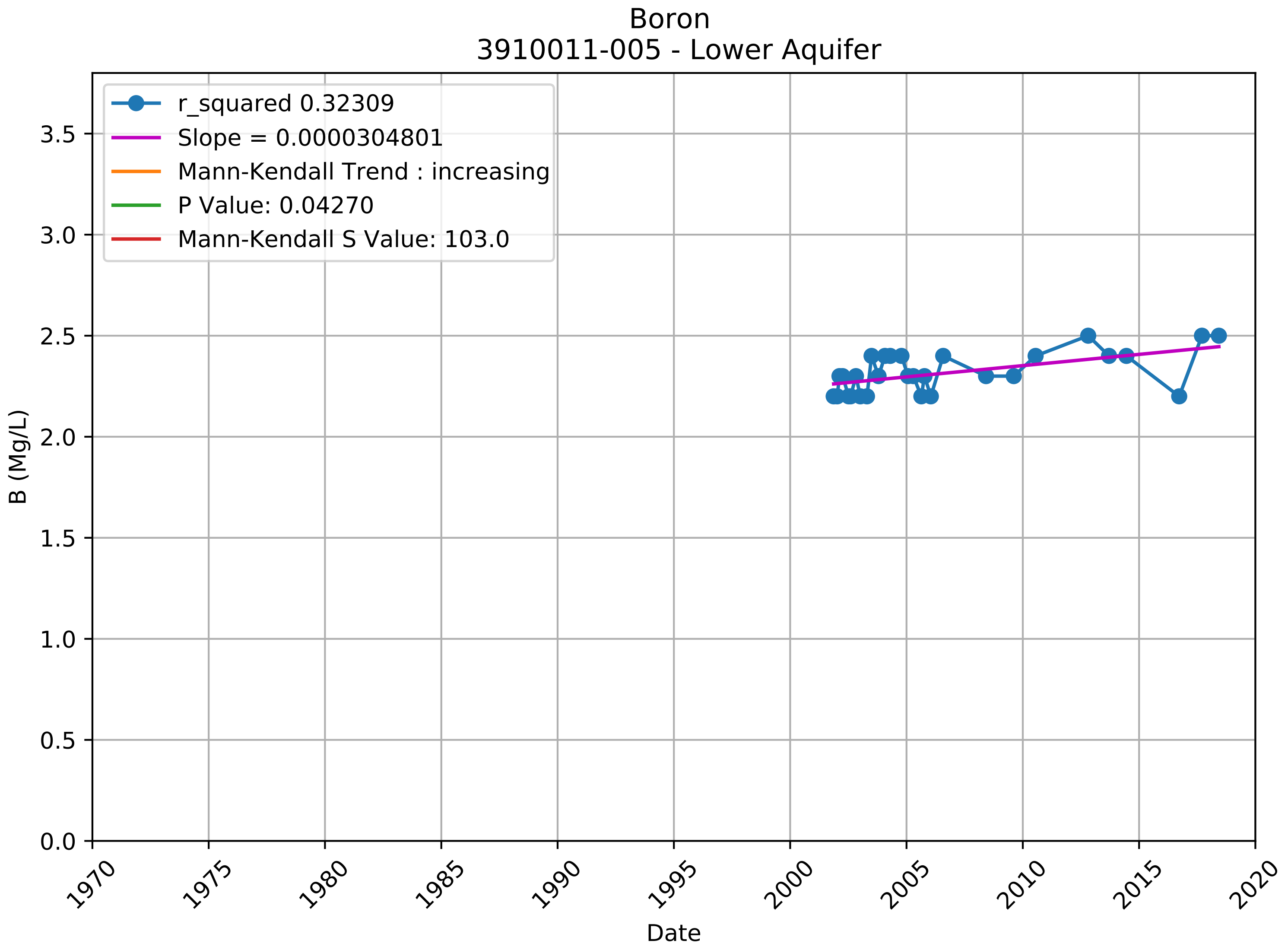
Boron
3910011-005 - Lower Aquifer
r_squared 0.32309
Slope = 0.0000304801
Mann-Kendall Trend : increasing
P Value: 0.04270
Mann-Kendall S Value: 103.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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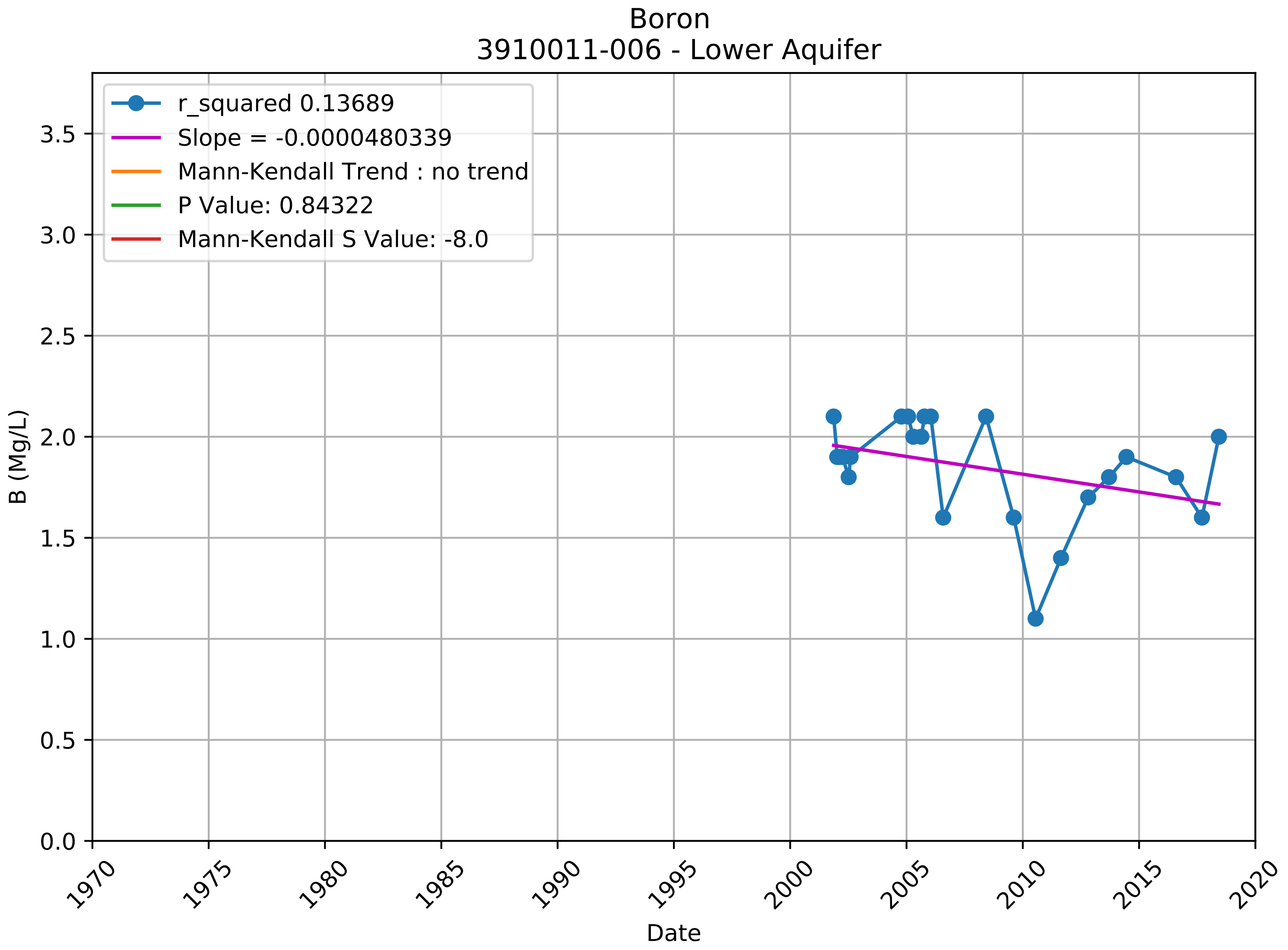
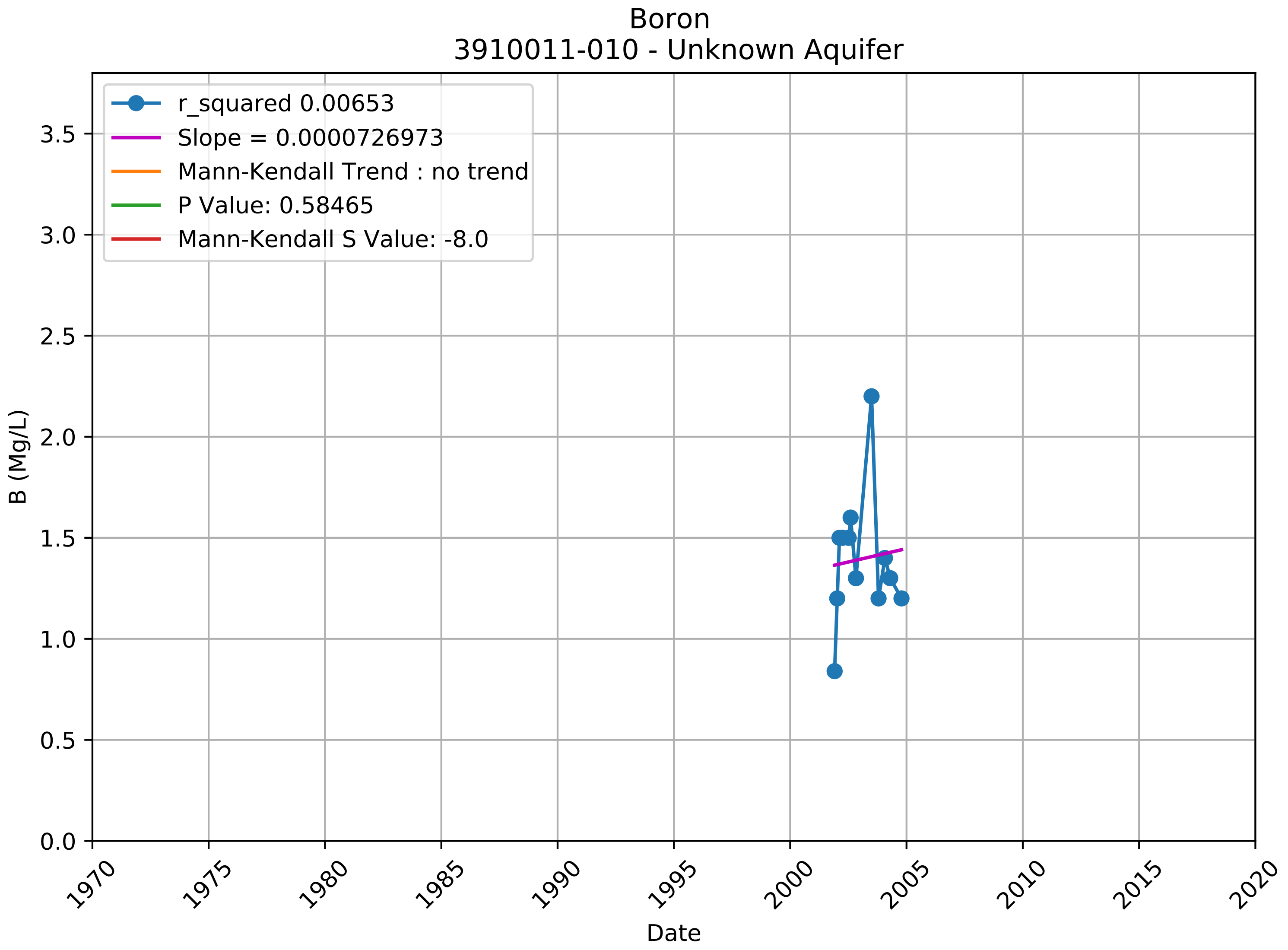
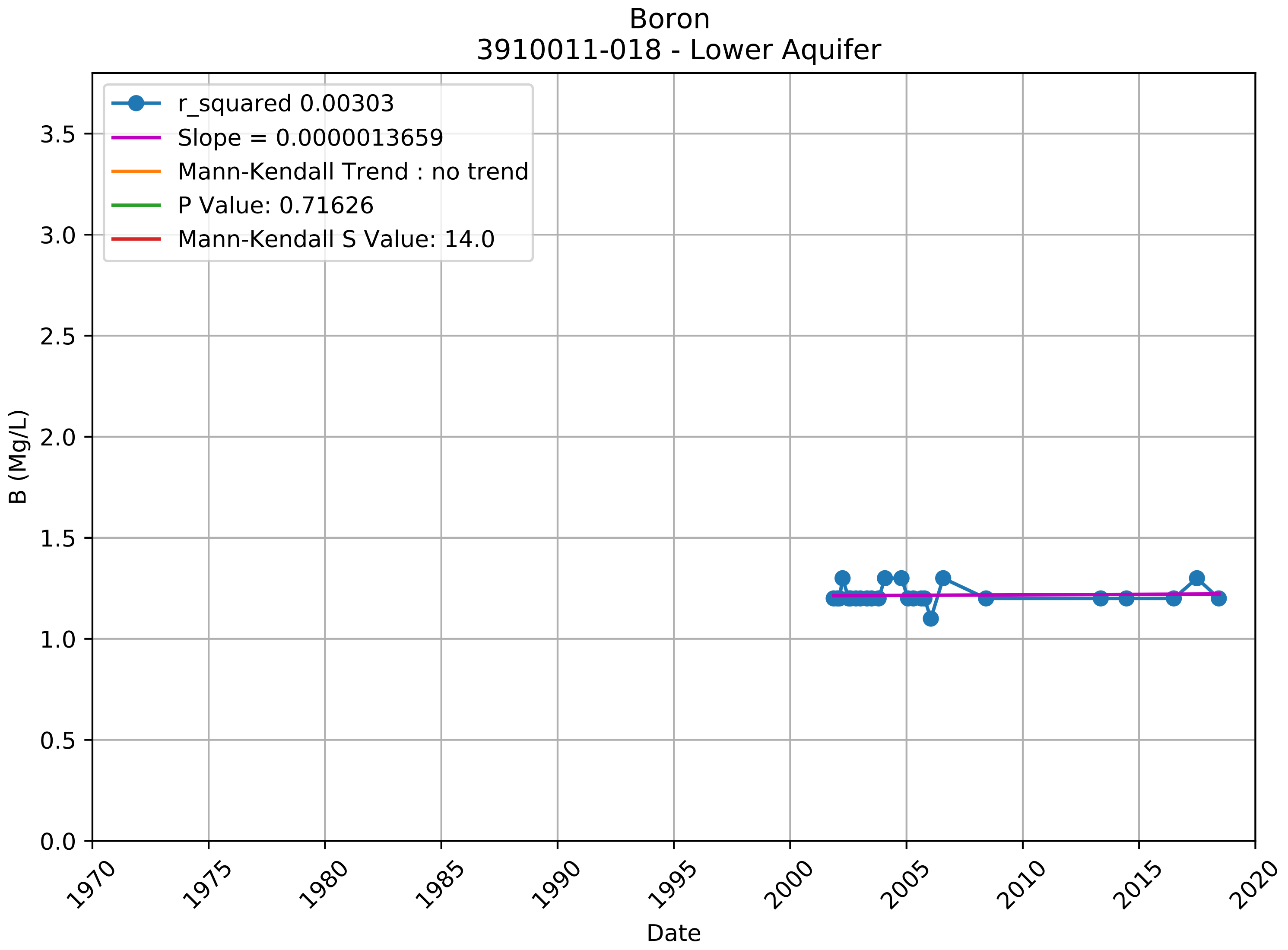
2020
Date


Boron
3910011-006 - Lower Aquifer
r_squared 0.13689
Slope = -0.0000480339
Mann-Kendall Trend : no trend
P Value: 0.84322
Mann-Kendall S Value: -8.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



Boron
3910011-010 - Unknown Aquifer
r_squared 0.00653
Slope = 0.0000726973
Mann-Kendall Trend : no trend
P Value: 0.58465
Mann-Kendall S Value: -8.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



Boron
3910011-018 - Lower Aquifer
r_squared 0.00303
Slope = 0.0000013659
Mann-Kendall Trend : no trend
P Value: 0.71626
Mann-Kendall S Value: 14.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
1985
1990
1995
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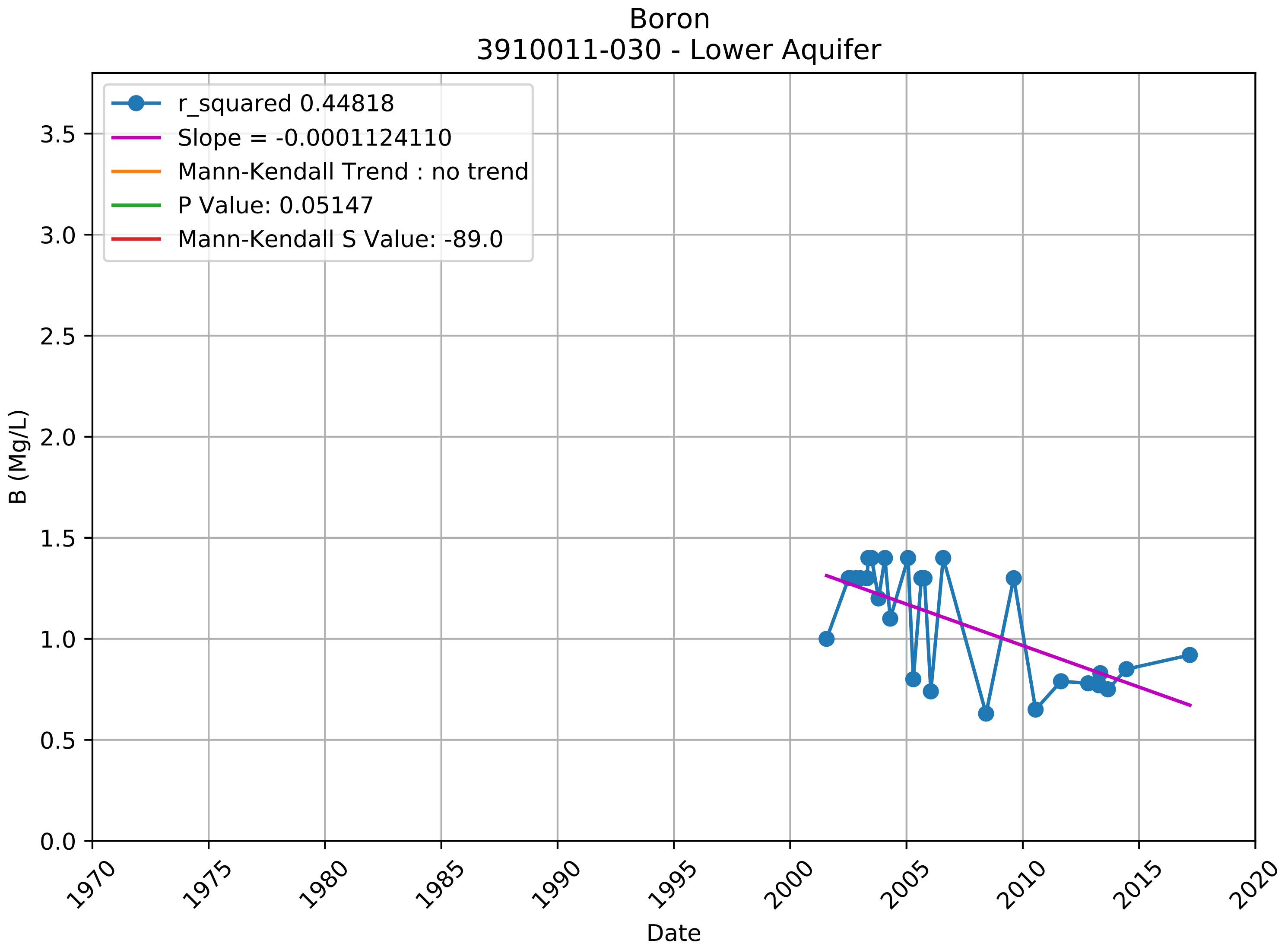
2010
2015
2020



Boron
3910011-030 - Lower Aquifer
r_squared 0.44818
Slope = -0.0001124110
Mann-Kendall Trend : no trend
P Value: 0.05147
Mann-Kendall S Value: -89.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
1985
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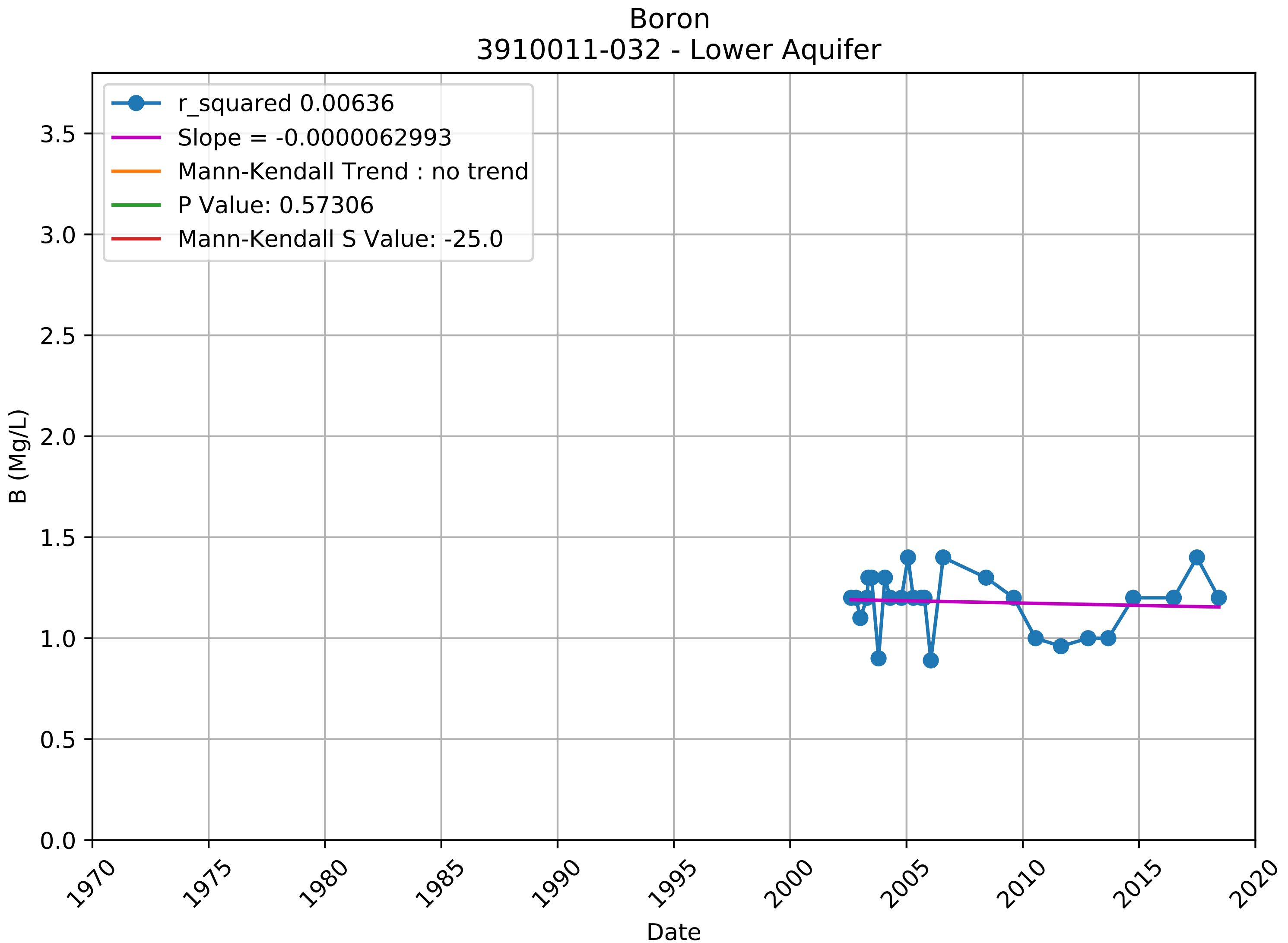
2005
2010
2015
2020



Boron
3910011-032 - Lower Aquifer
r_squared 0.00636
Slope = -0.0000062993
Mann-Kendall Trend : no trend
P Value: 0.57306
Mann-Kendall S Value: -25.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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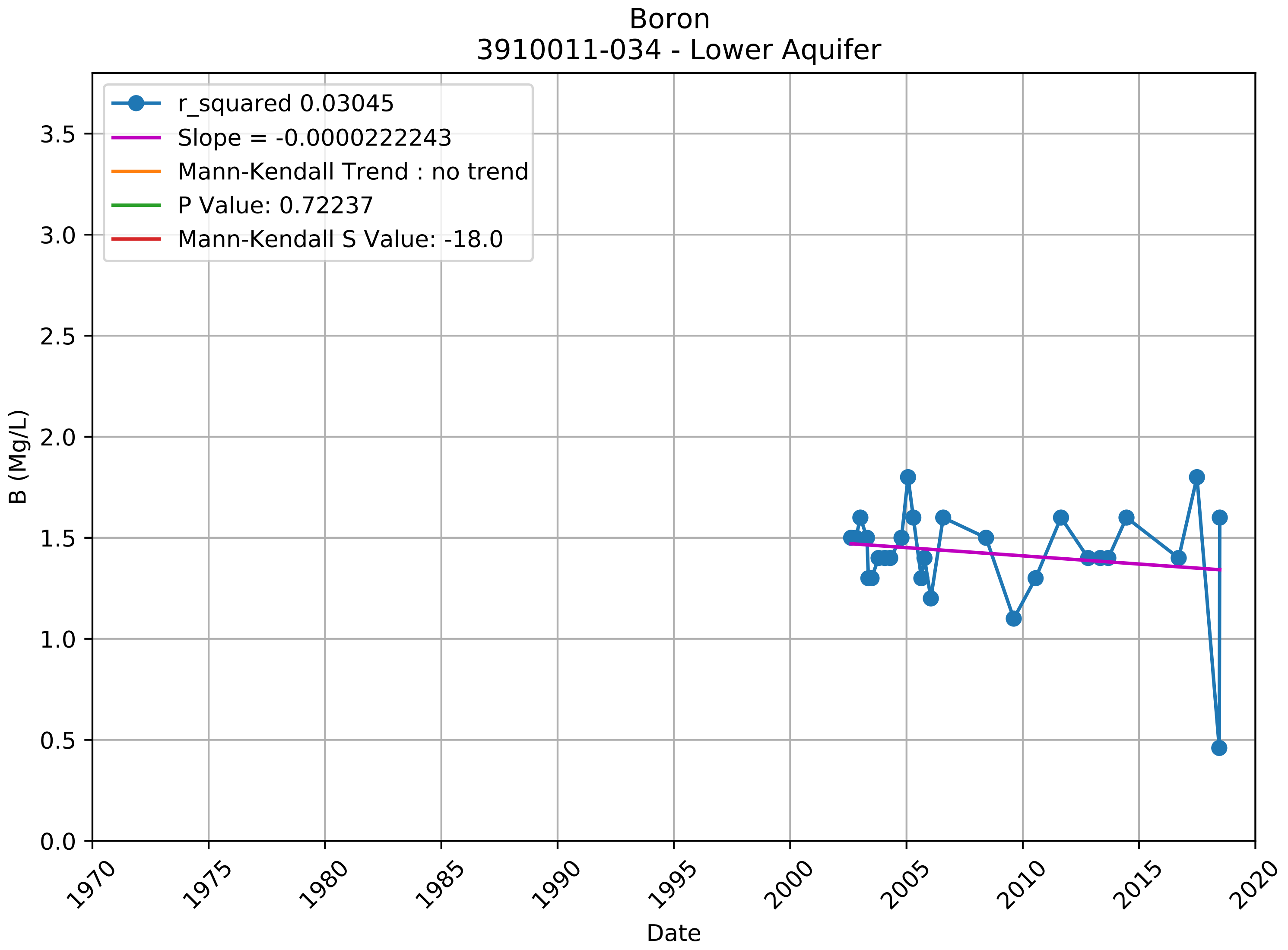
2005
2010
2015
2020



Boron
3910011-034 - Lower Aquifer
r_squared 0.03045
Slope = -0.0000222243
Mann-Kendall Trend : no trend
P Value: 0.72237
Mann-Kendall S Value: -18.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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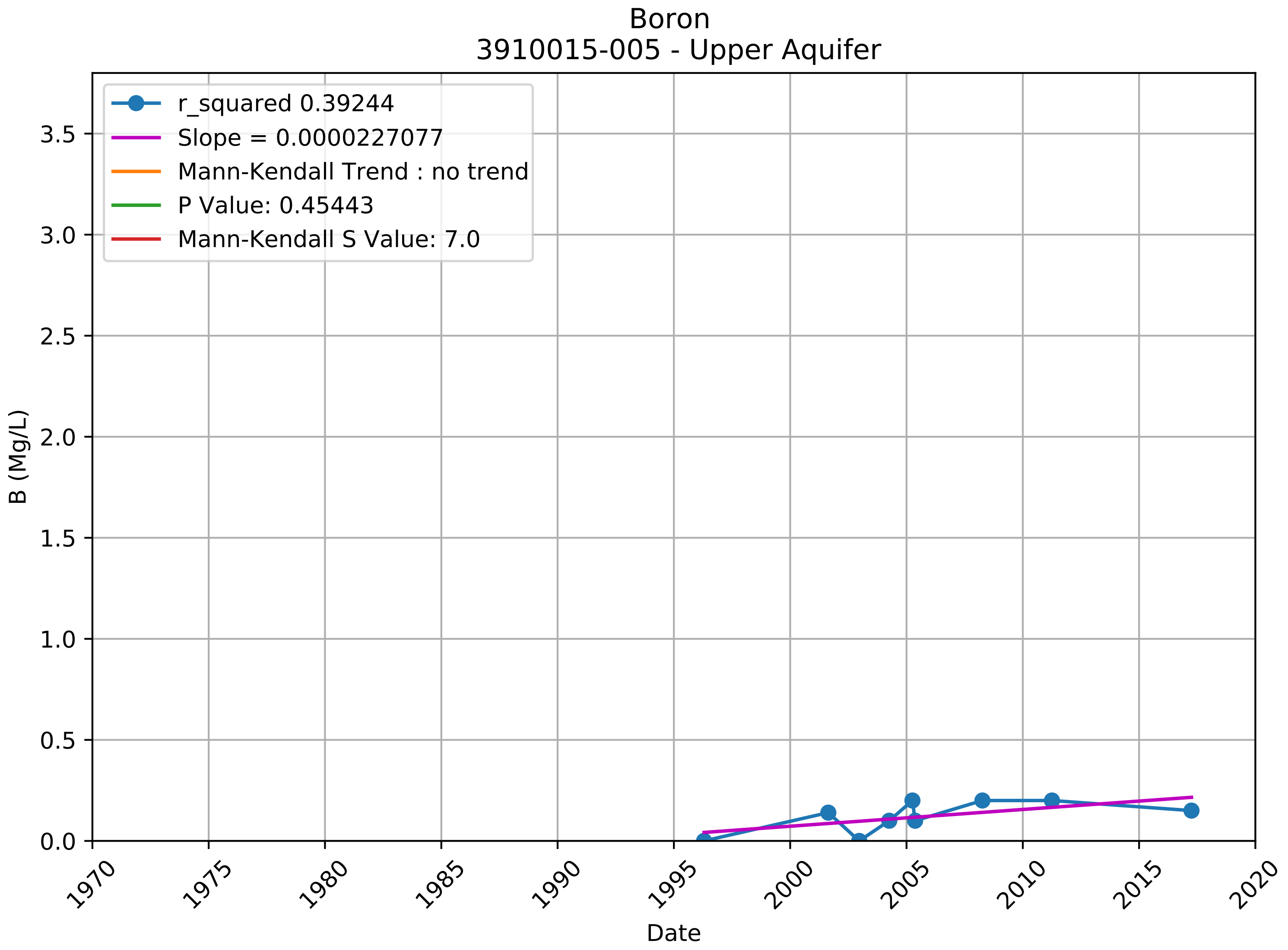
1995
2000
2005
2010
2015
2020


Boron
3910015-005 - Upper Aquifer
r_squared 0.39244
Slope = 0.0000227077
Mann-Kendall Trend : no trend
P Value: 0.45443
Mann-Kendall S Value: 7.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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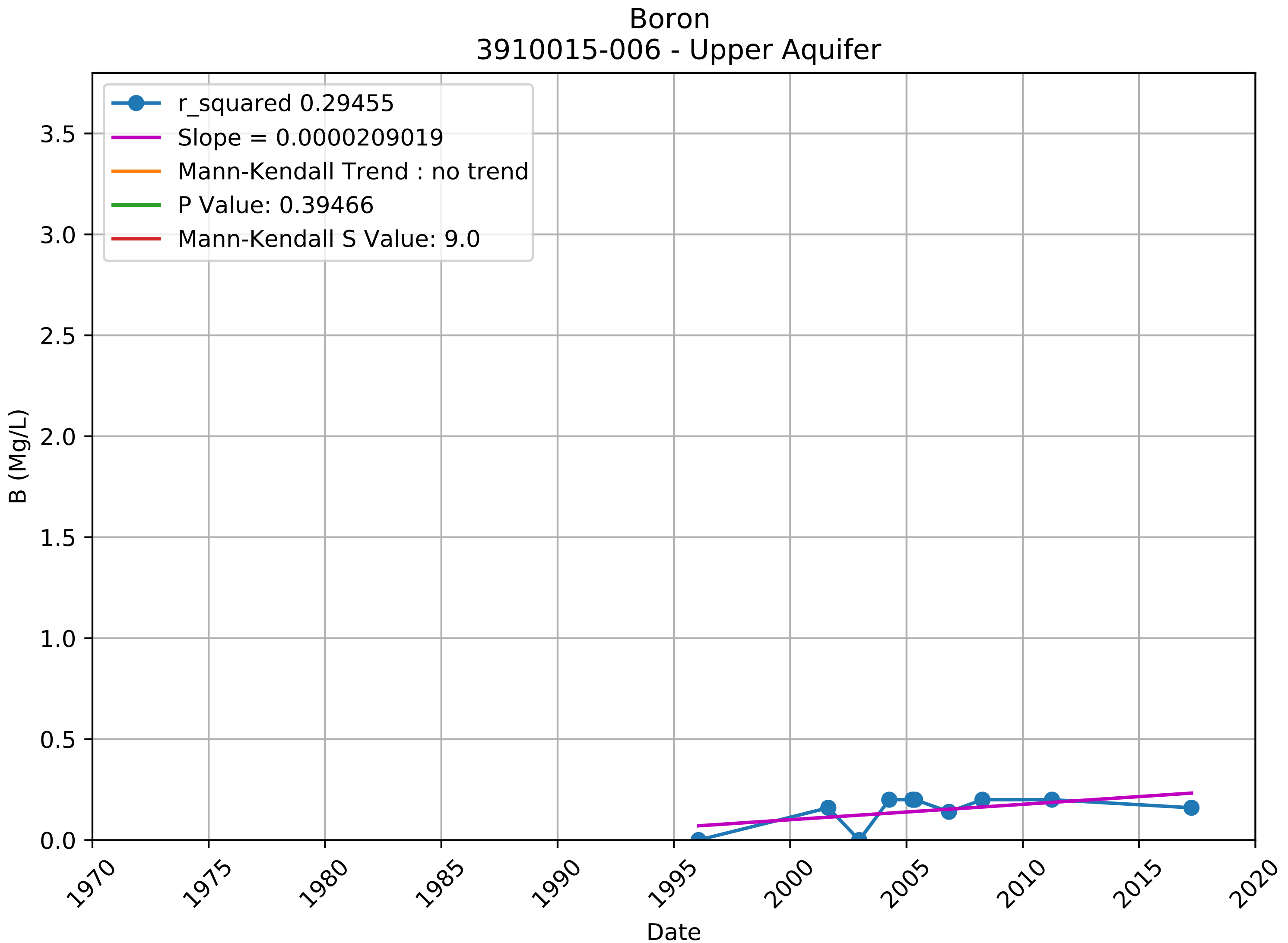
1995
2000
2005
2010
2015
2020


Boron
3910015-006 - Upper Aquifer
r_squared 0.29455
Slope = 0.0000209019
Mann-Kendall Trend : no trend
P Value: 0.39466
Mann-Kendall S Value: 9.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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1995
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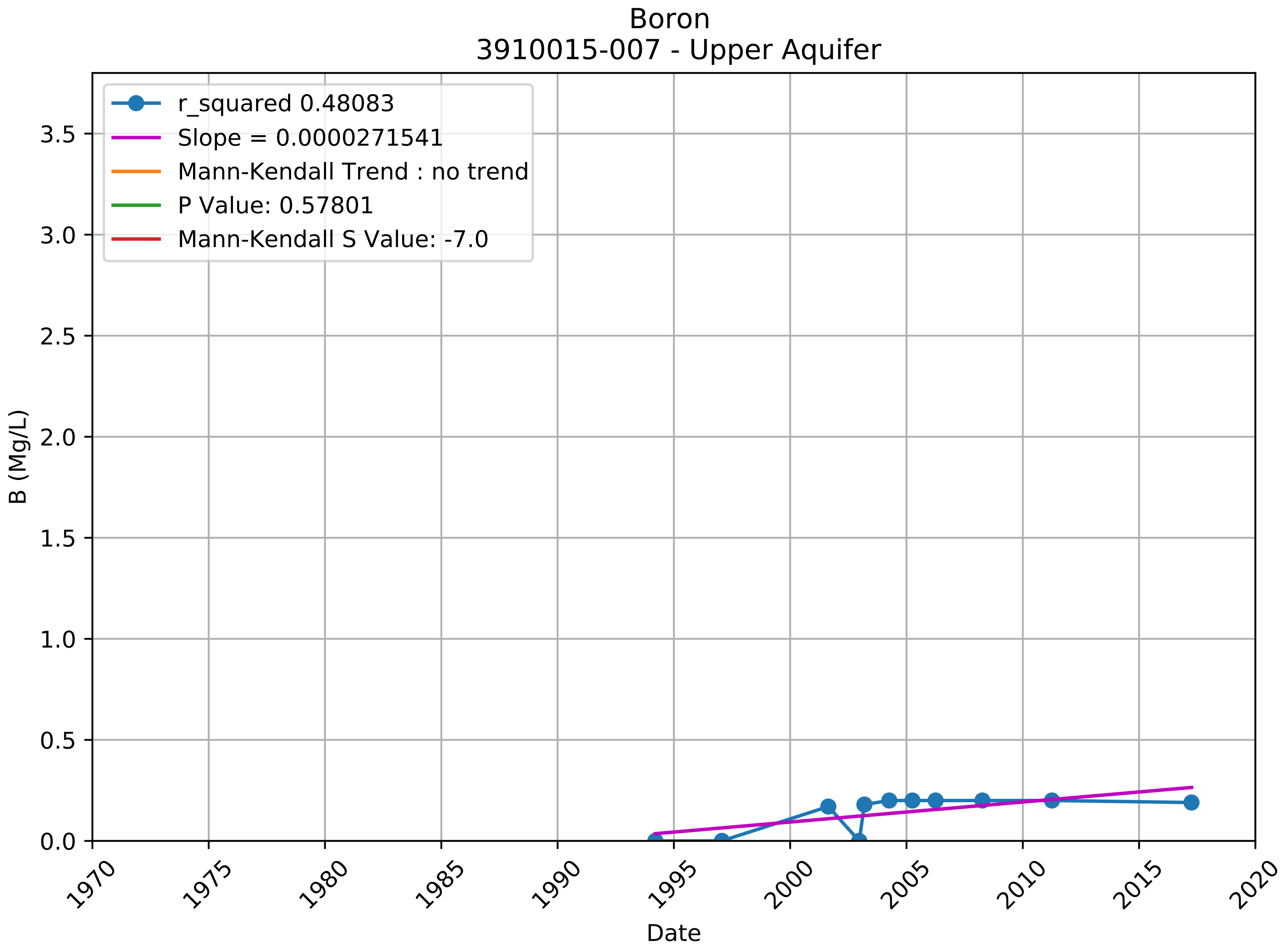
2005
2010
2015
2020



Boron
3910015-007 - Upper Aquifer
r_squared 0.48083
Slope = 0.0000271541
Mann-Kendall Trend : no trend
P Value: 0.57801
Mann-Kendall S Value: -7.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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1980
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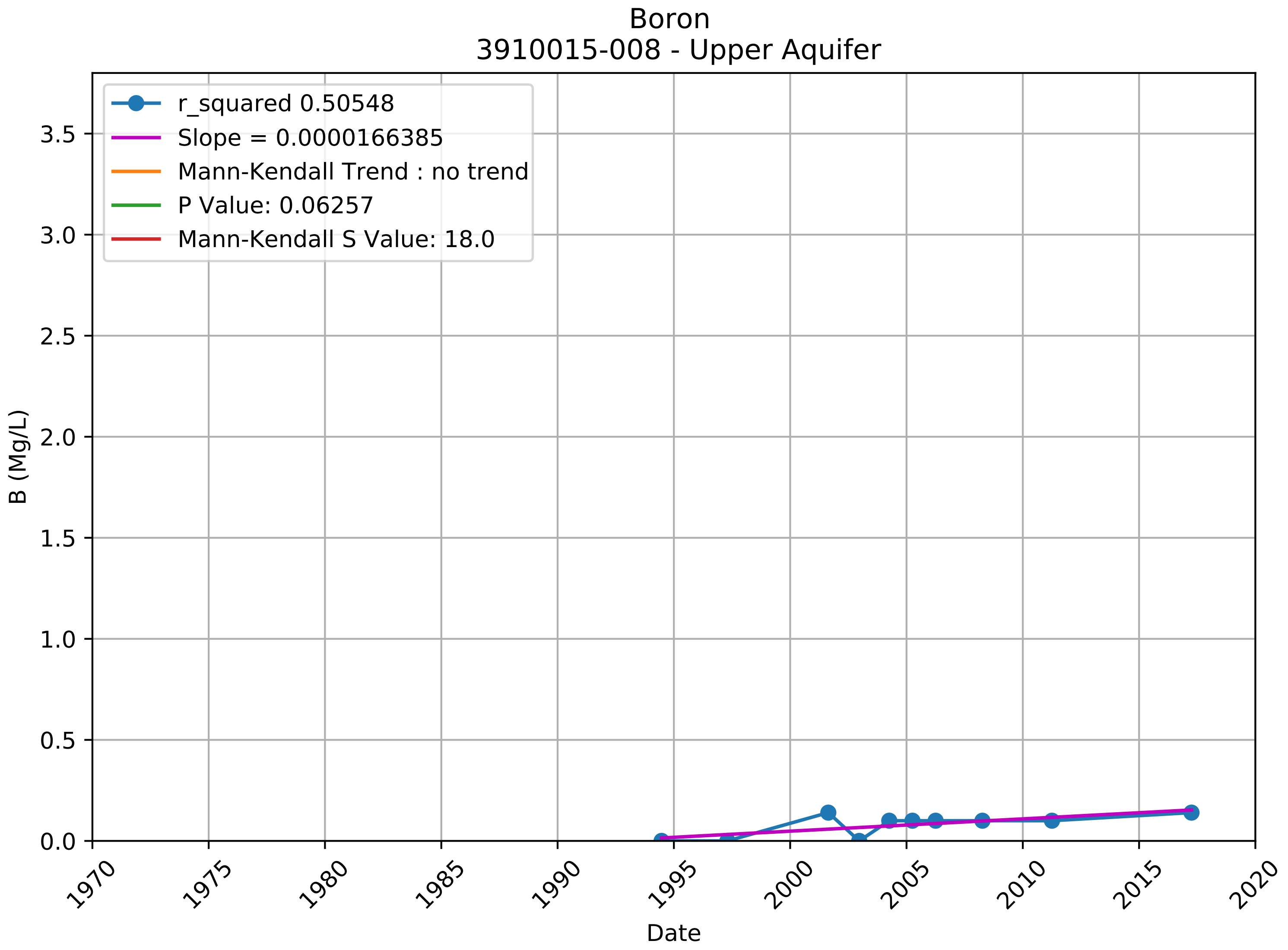
1990
1995
2000
2005
2010
2015
2020



Boron
3910015-008 - Upper Aquifer
r_squared 0.50548
Slope = 0.0000166385
Mann-Kendall Trend : no trend
P Value: 0.06257
Mann-Kendall S Value: 18.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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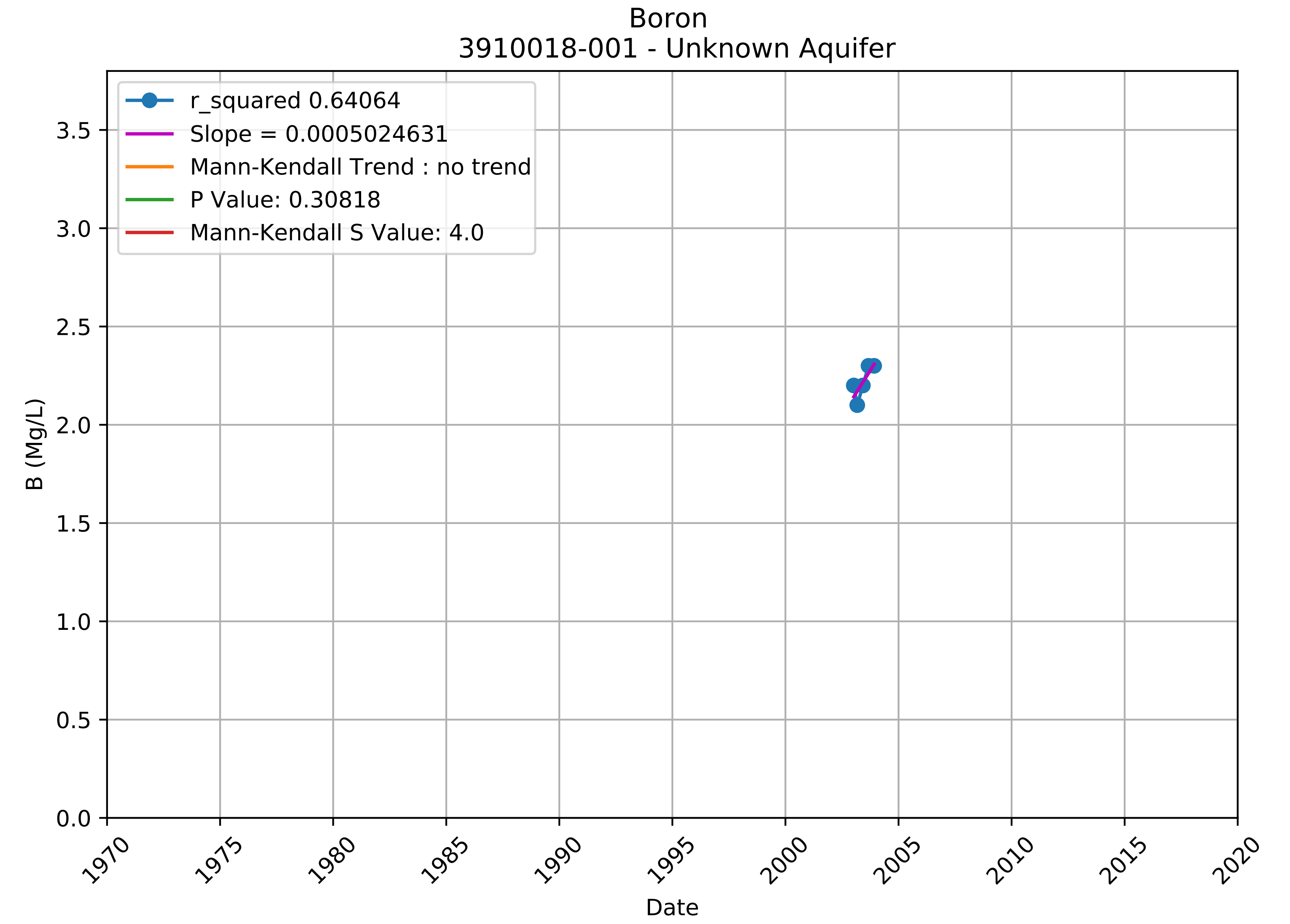
2015
2020



Boron
3910018-001 - Unknown Aquifer
r_squared 0.64064
Slope = 0.0005024631
Mann-Kendall Trend : no trend
P Value: 0.30818
Mann-Kendall S Value: 4.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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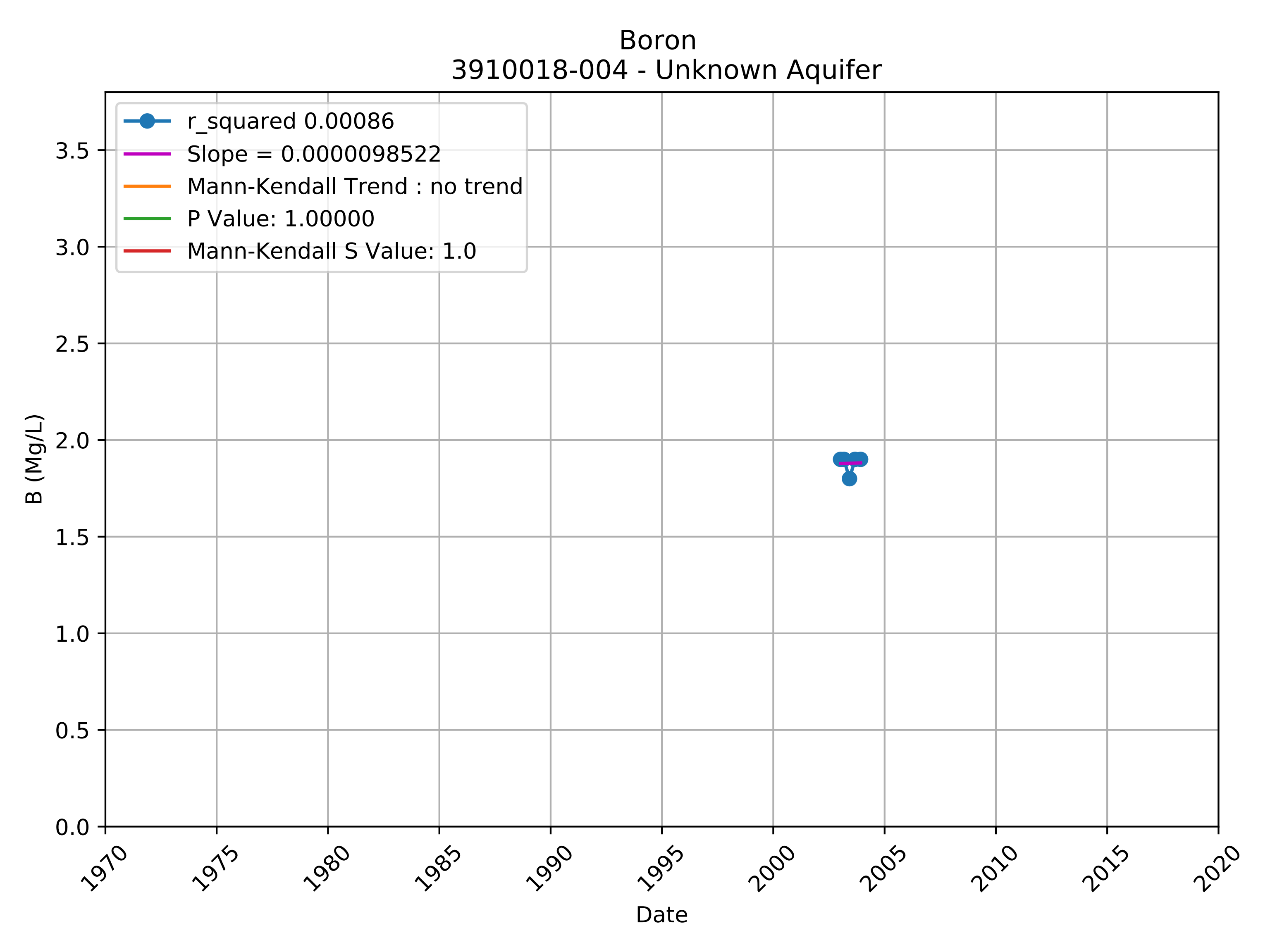
1990
1995
2000
2005
2010
2015
2020


Boron
3910018-004 - Unknown Aquifer
r_squared 0.00086
Slope = 0.0000098522
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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1995
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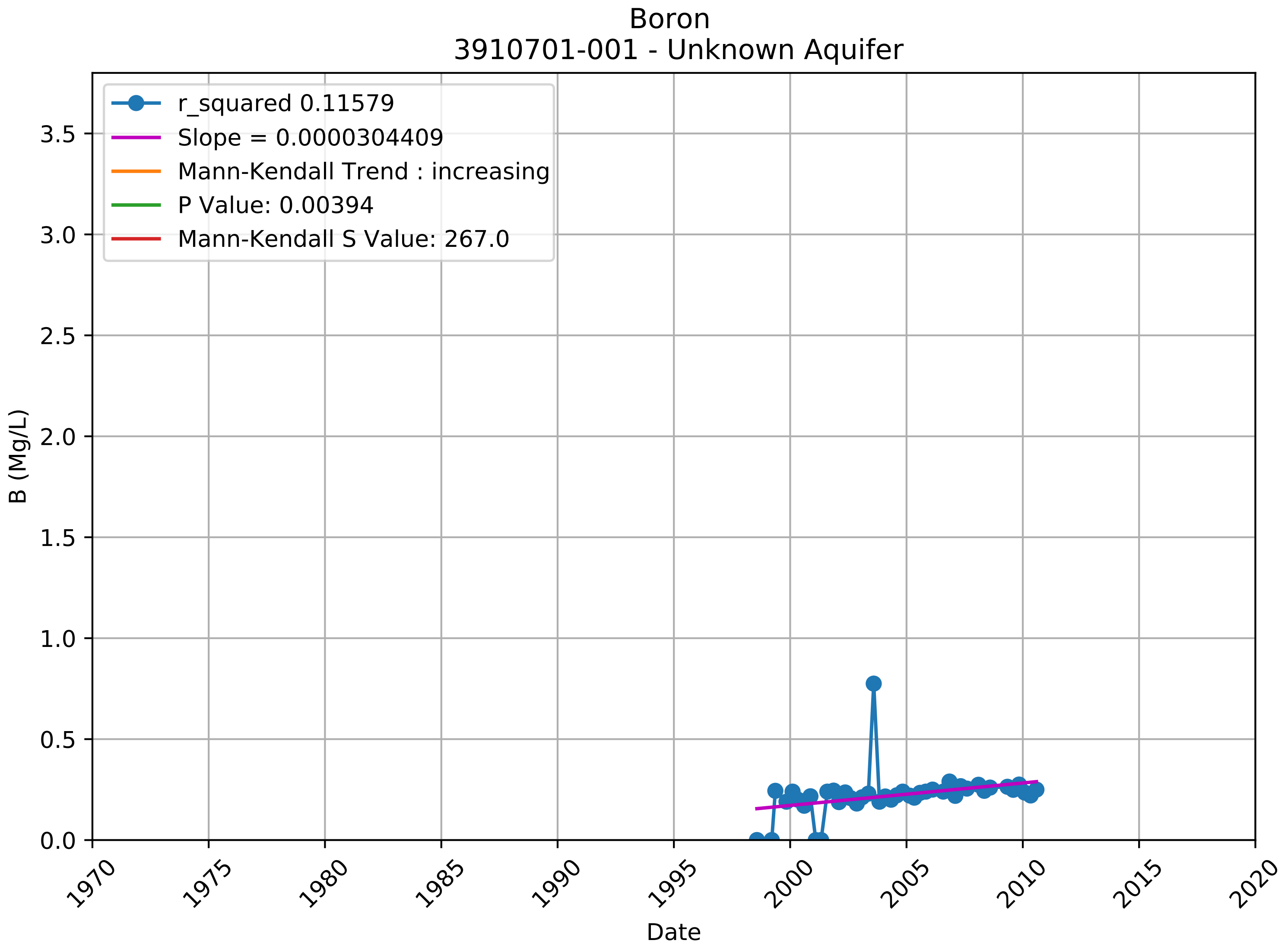
2010
2015
2020



Boron
3910701-001 - Unknown Aquifer
r_squared 0.11579
Slope = 0.0000304409
Mann-Kendall Trend : increasing
P Value: 0.00394
Mann-Kendall S Value: 267.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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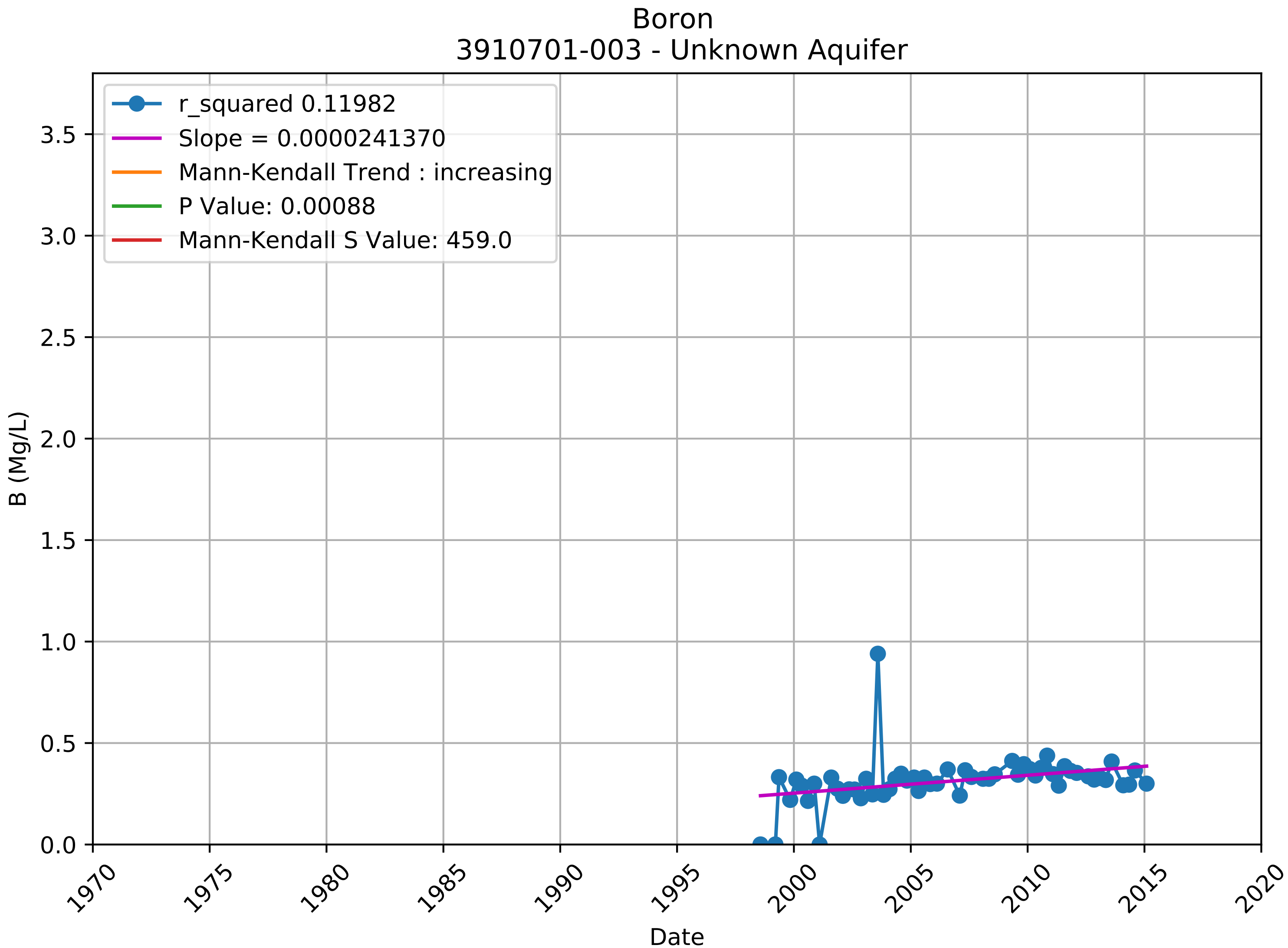
2015
2020



Boron
3910701-003 - Unknown Aquifer
r_squared 0.11982
Slope = 0.0000241370
Mann-Kendall Trend : increasing
P Value: 0.00088
Mann-Kendall S Value: 459.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Date
1970
1975
1980
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1995
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2010
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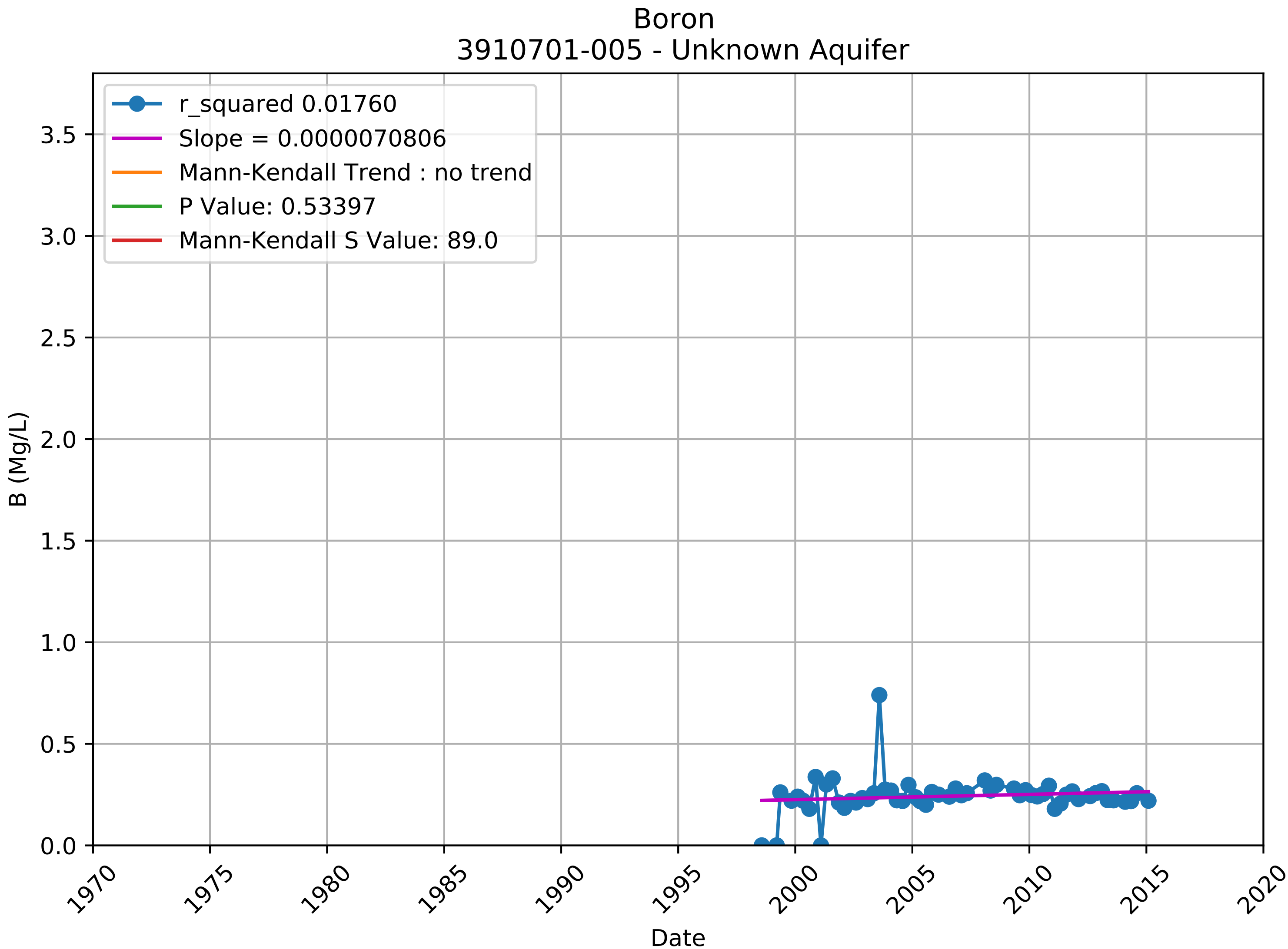
2020



Boron
3910701-005 - Unknown Aquifer
r_squared 0.01760
Slope = 0.0000070806
Mann-Kendall Trend : no trend
P Value: 0.53397
Mann-Kendall S Value: 89.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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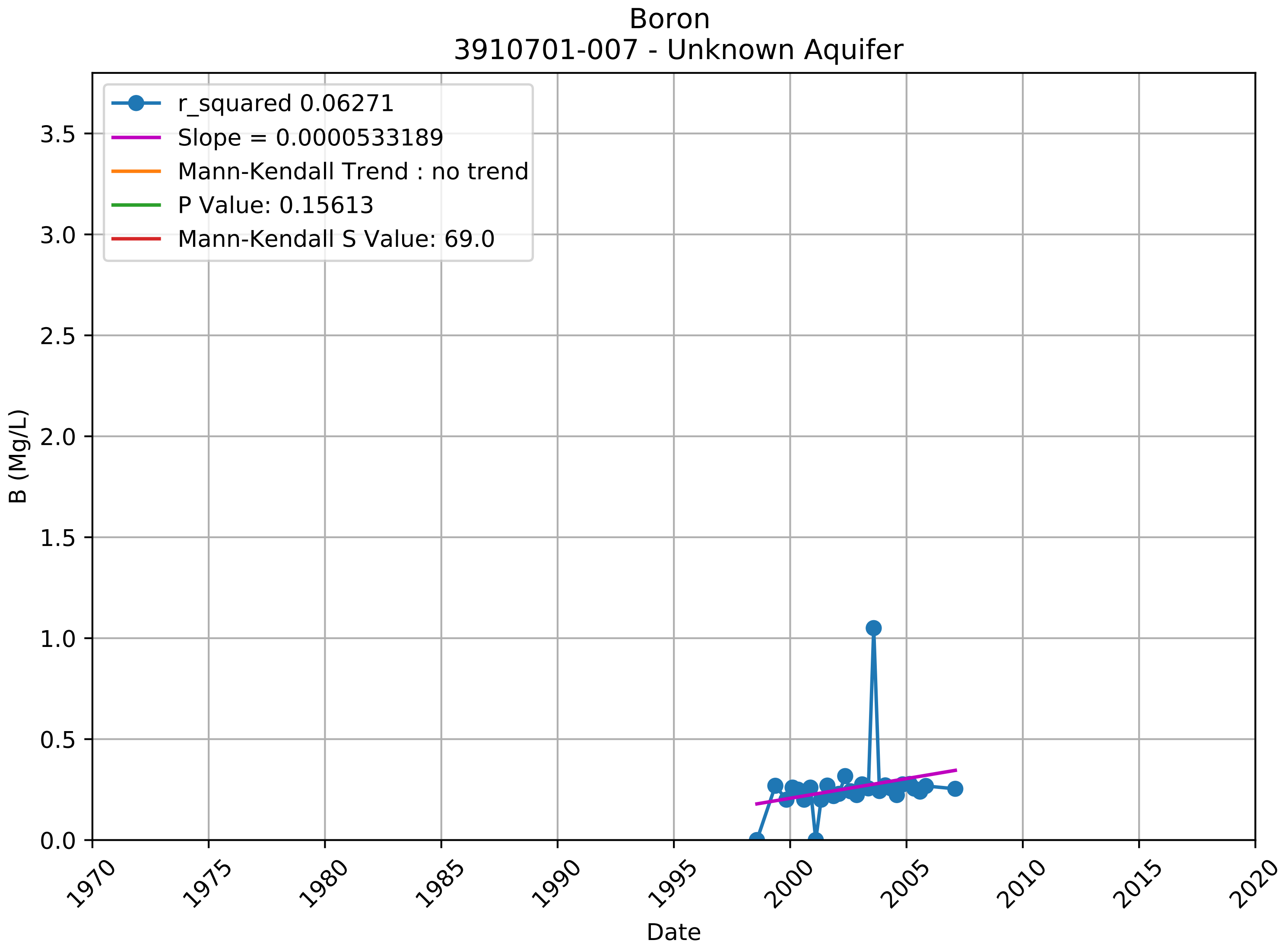

Boron
3910701-007 - Unknown Aquifer
r_squared 0.06271
Slope = 0.0000533189
Mann-Kendall Trend : no trend
P Value: 0.15613
Mann-Kendall S Value: 69.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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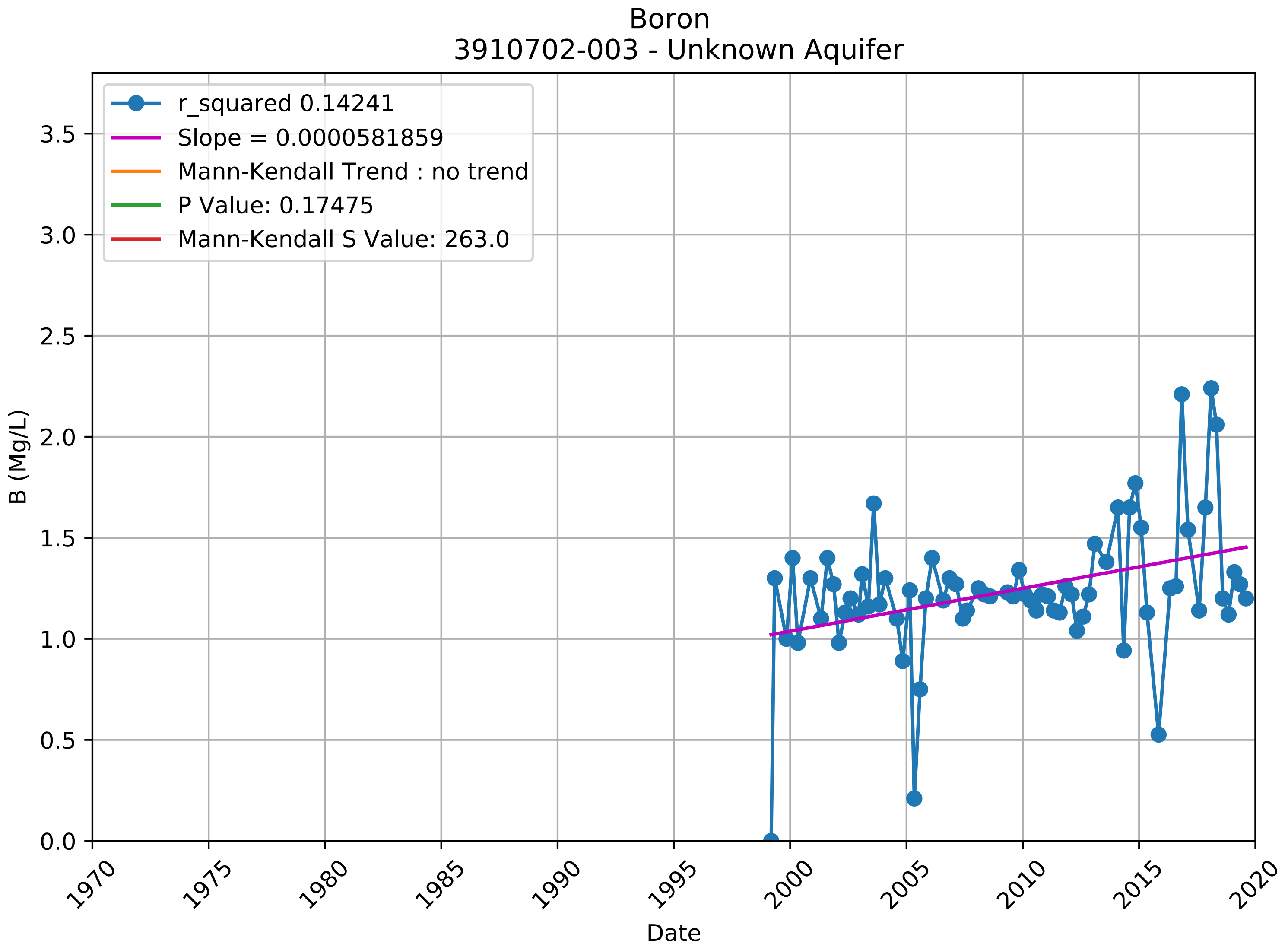
2020



Boron
3910702-003 - Unknown Aquifer
r_squared 0.14241
Slope = 0.0000581859
Mann-Kendall Trend : no trend
P Value: 0.17475
Mann-Kendall S Value: 263.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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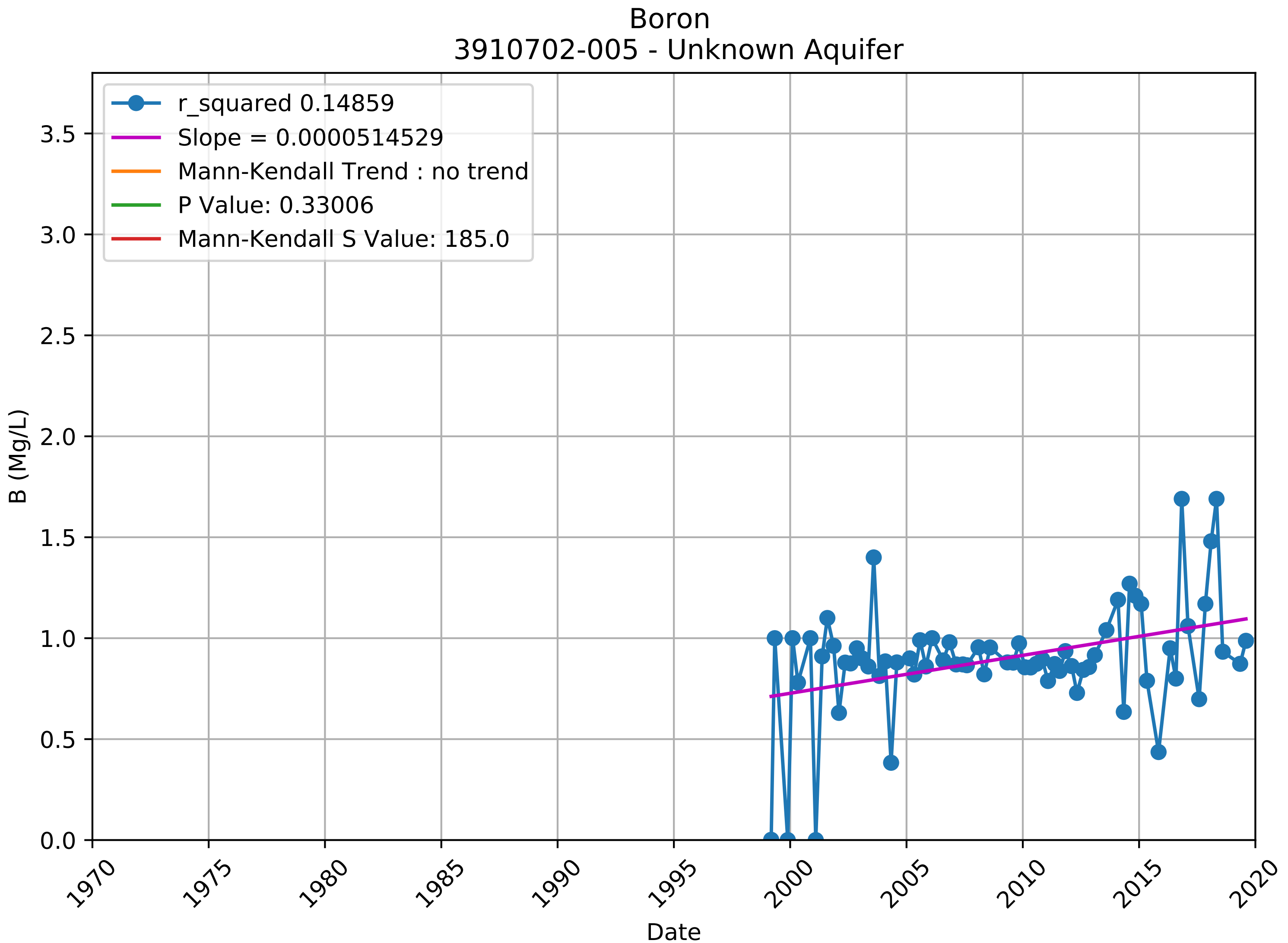
2020


Boron
3910702-005 - Unknown Aquifer
r_squared 0.14859
Slope = 0.0000514529
Mann-Kendall Trend : no trend
P Value: 0.33006
Mann-Kendall S Value: 185.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
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1995
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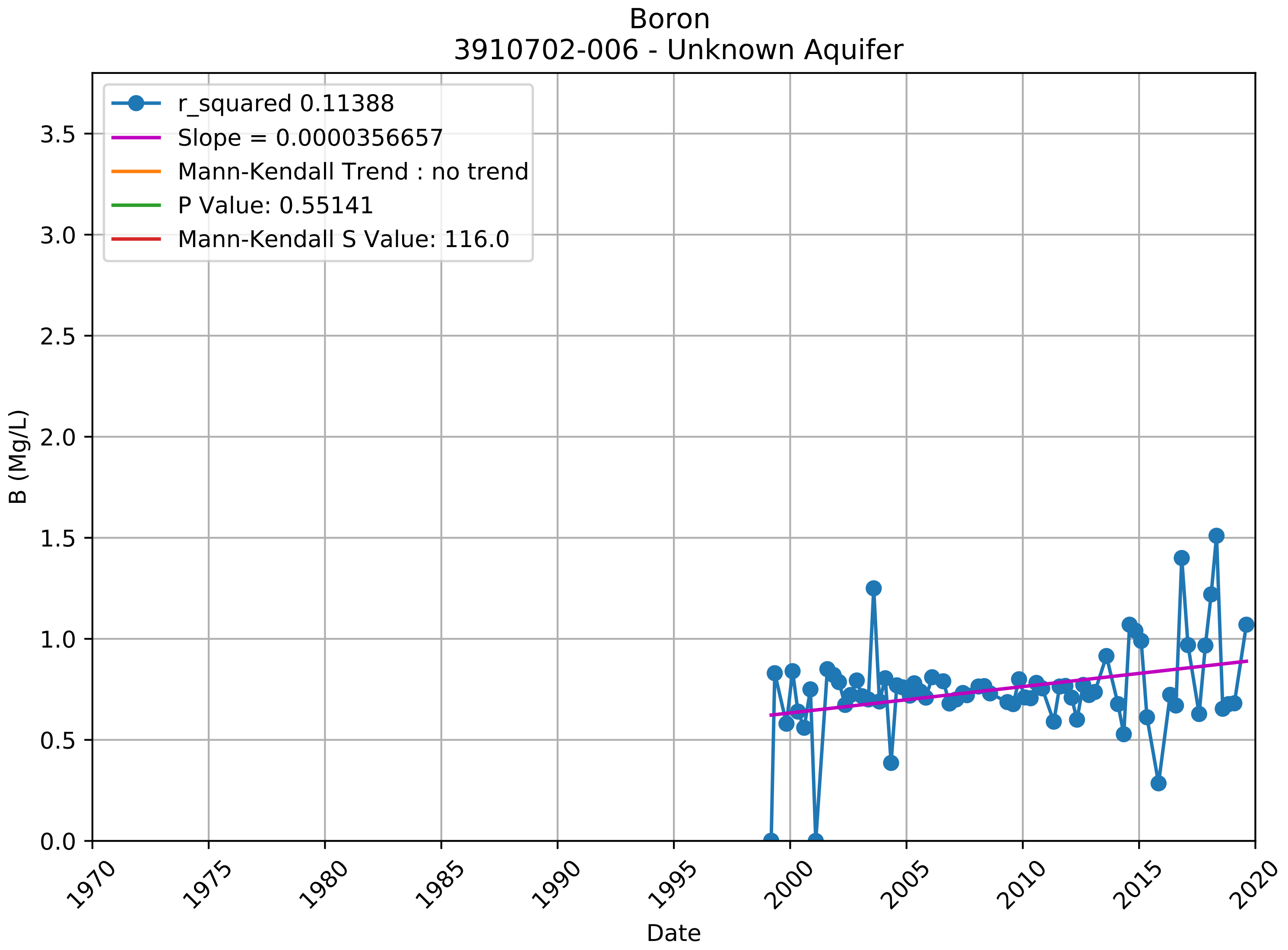
2005
2010
2015
2020


Boron
3910702-006 - Unknown Aquifer
r_squared 0.11388
Slope = 0.0000356657
Mann-Kendall Trend : no trend
P Value: 0.55141
Mann-Kendall S Value: 116.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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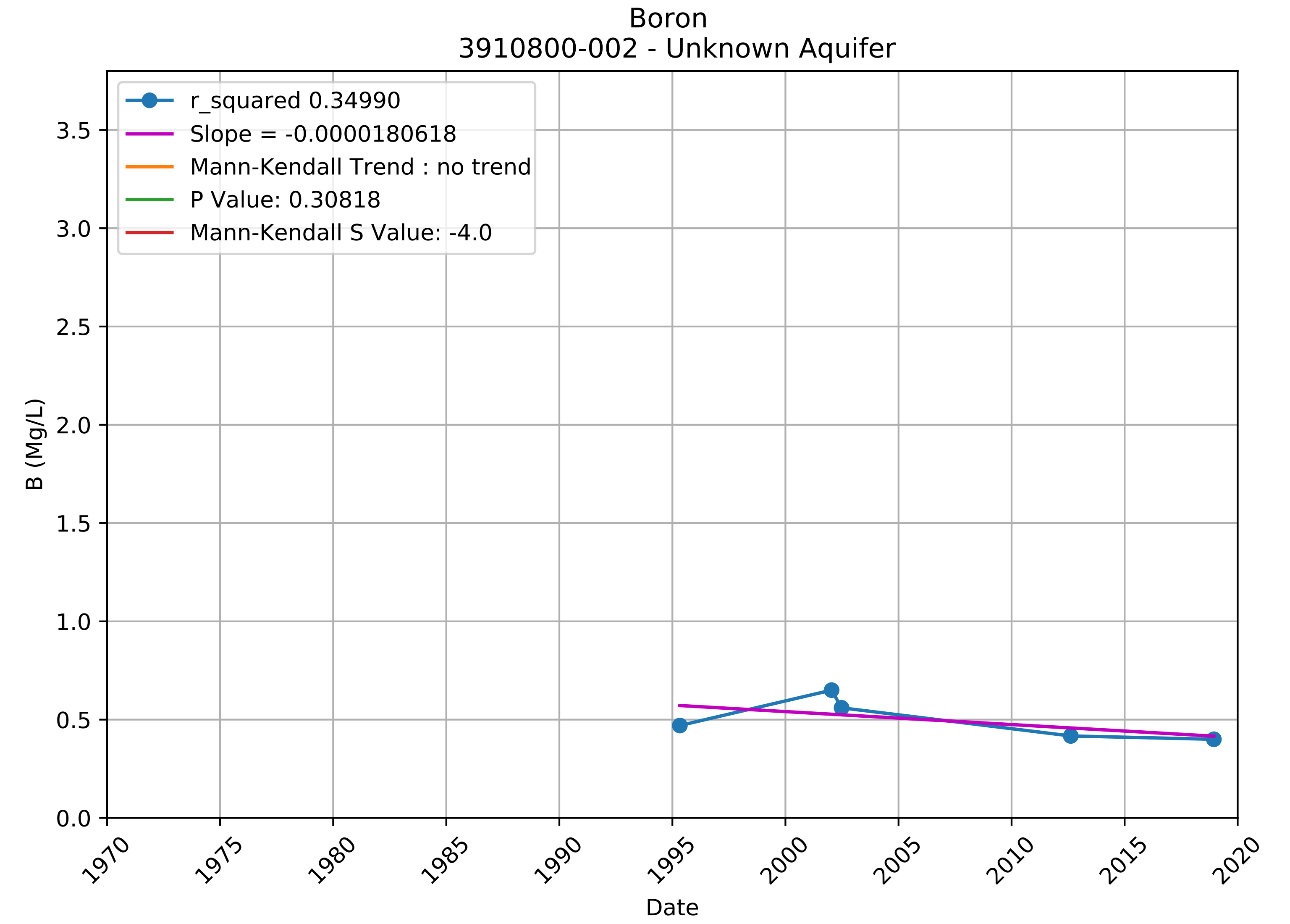
2010
2015
2020



Boron
3910800-002 - Unknown Aquifer
r_squared 0.34990
Slope = -0.0000180618
Mann-Kendall Trend : no trend
P Value: 0.30818
Mann-Kendall S Value: -4.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
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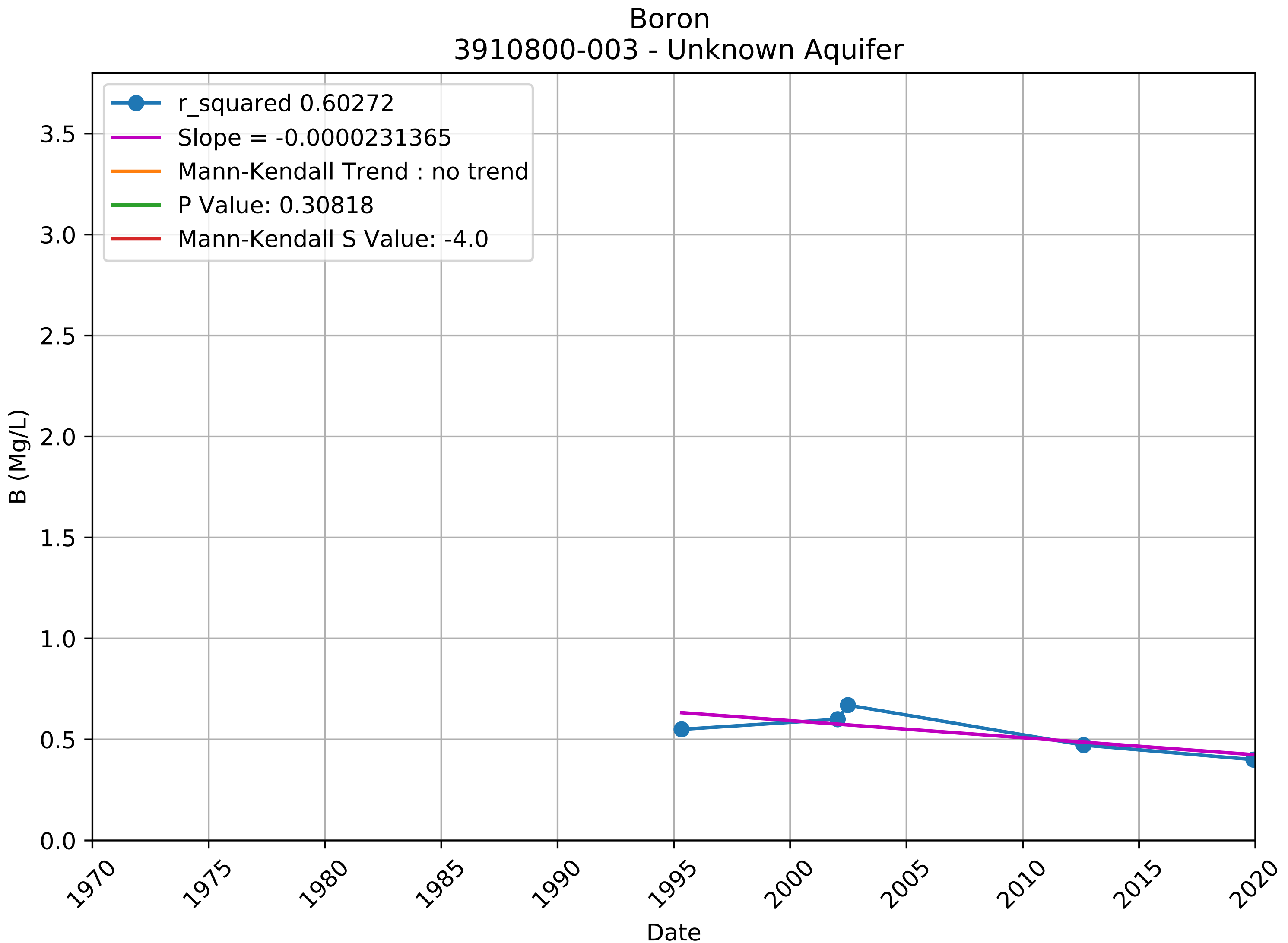
2020


Boron
3910800-003 - Unknown Aquifer
r_squared 0.60272
Slope = -0.0000231365
Mann-Kendall Trend : no trend
P Value: 0.30818
Mann-Kendall S Value: -4.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
1985
1990
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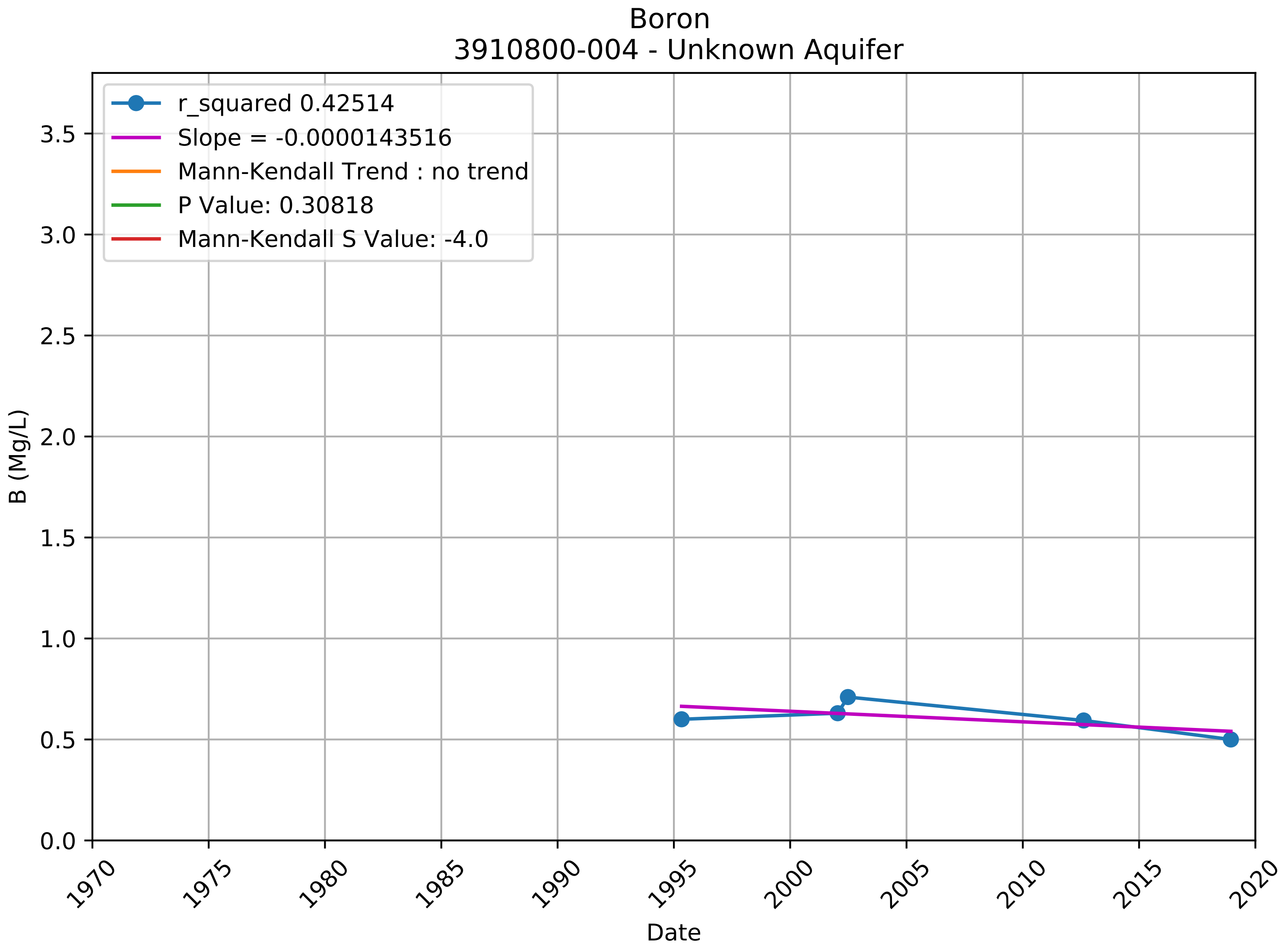
2010
2015
2020
Date



Boron
3910800-004 - Unknown Aquifer
r_squared 0.42514
Slope = -0.0000143516
Mann-Kendall Trend : no trend
P Value: 0.30818
Mann-Kendall S Value: -4.0
B (Mg/L)
Date
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
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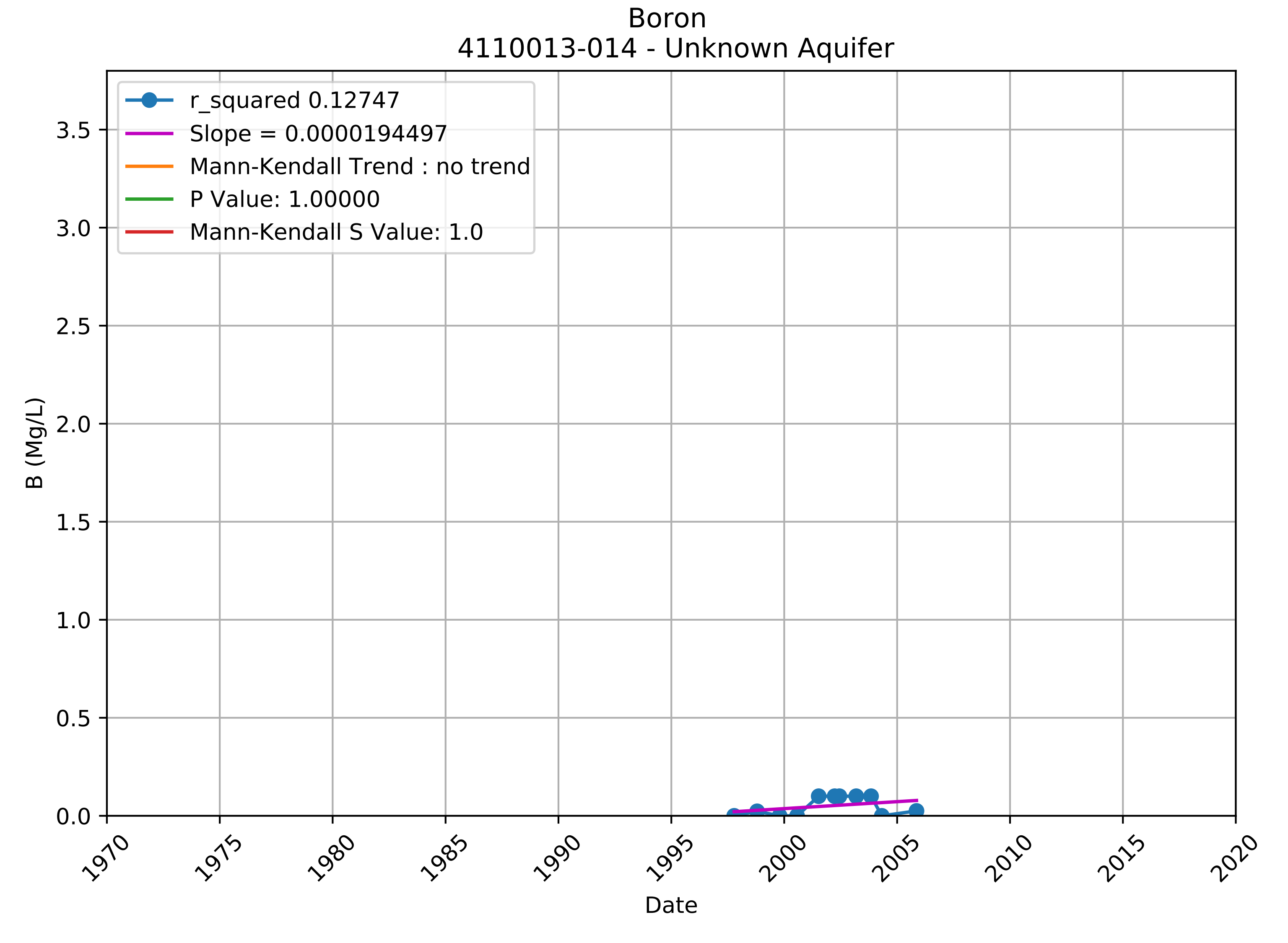
2020



Boron
4110013-014 - Unknown Aquifer
r_squared 0.12747
Slope = 0.0000194497
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Date
1970
1975
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1990
1995
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2005
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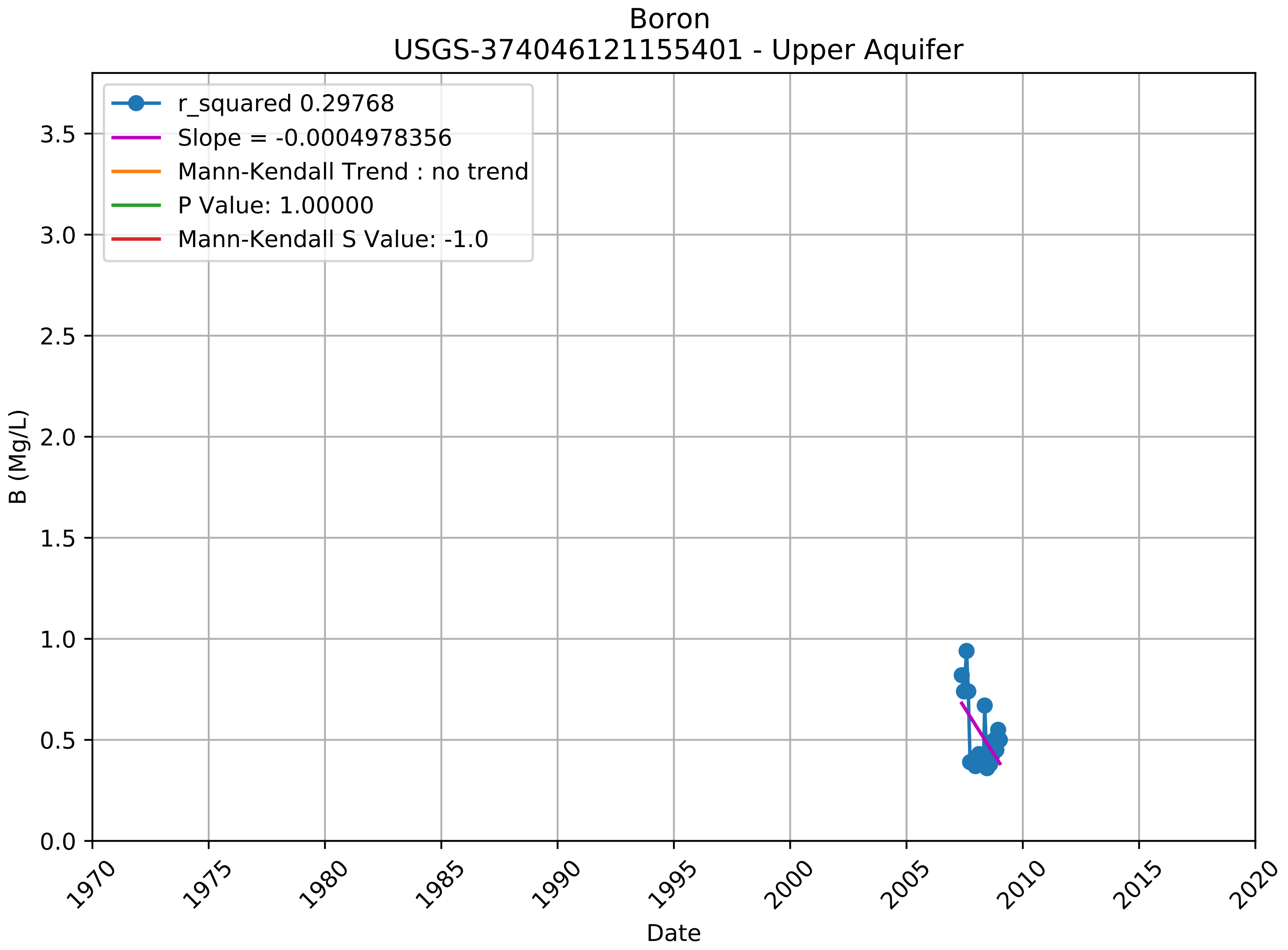
2020



Boron
USGS-374046121155401 - Upper Aquifer
r_squared 0.29768
Slope = -0.0004978356
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
1970
1975
1980
1985
1990
1995
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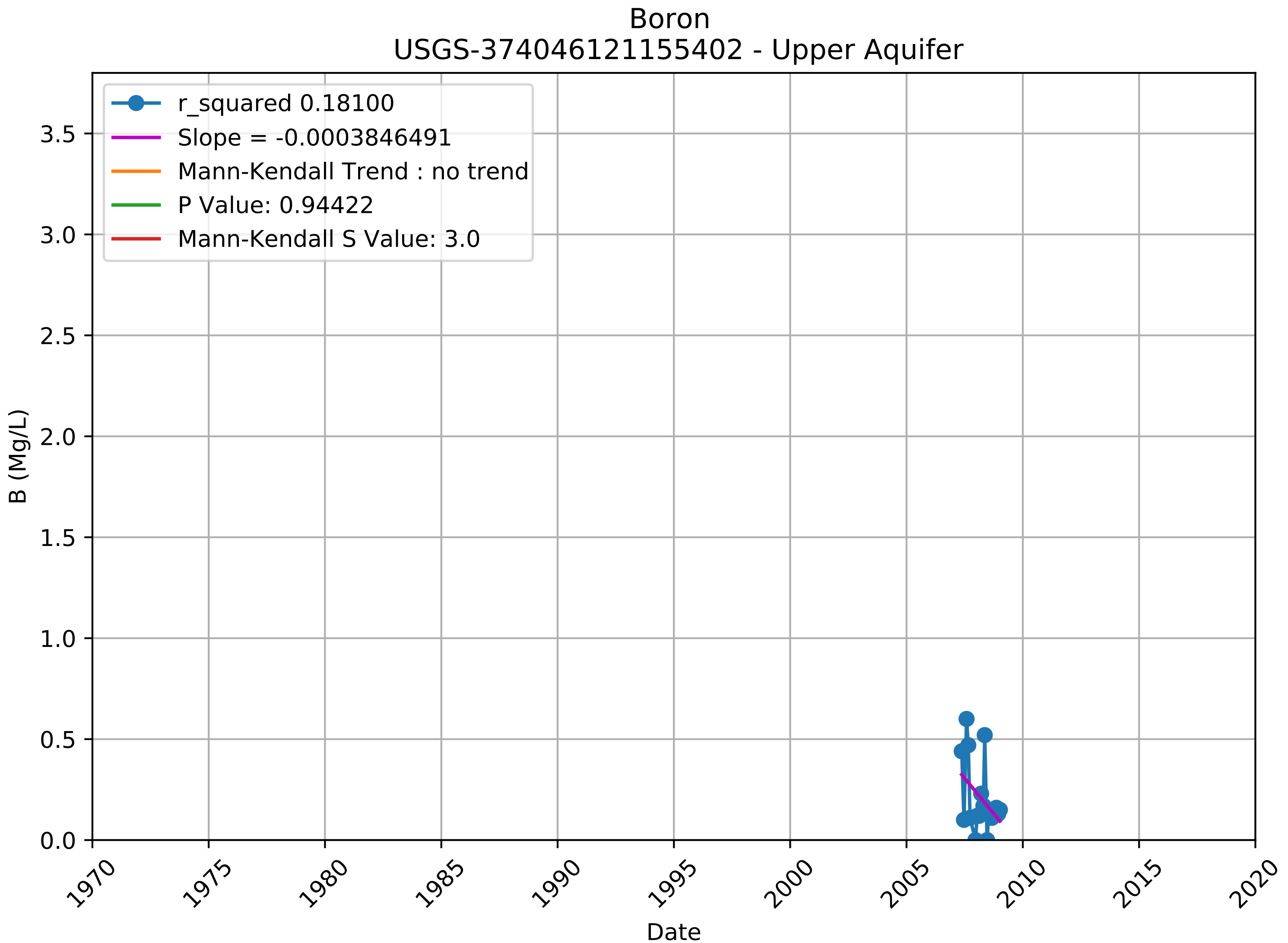
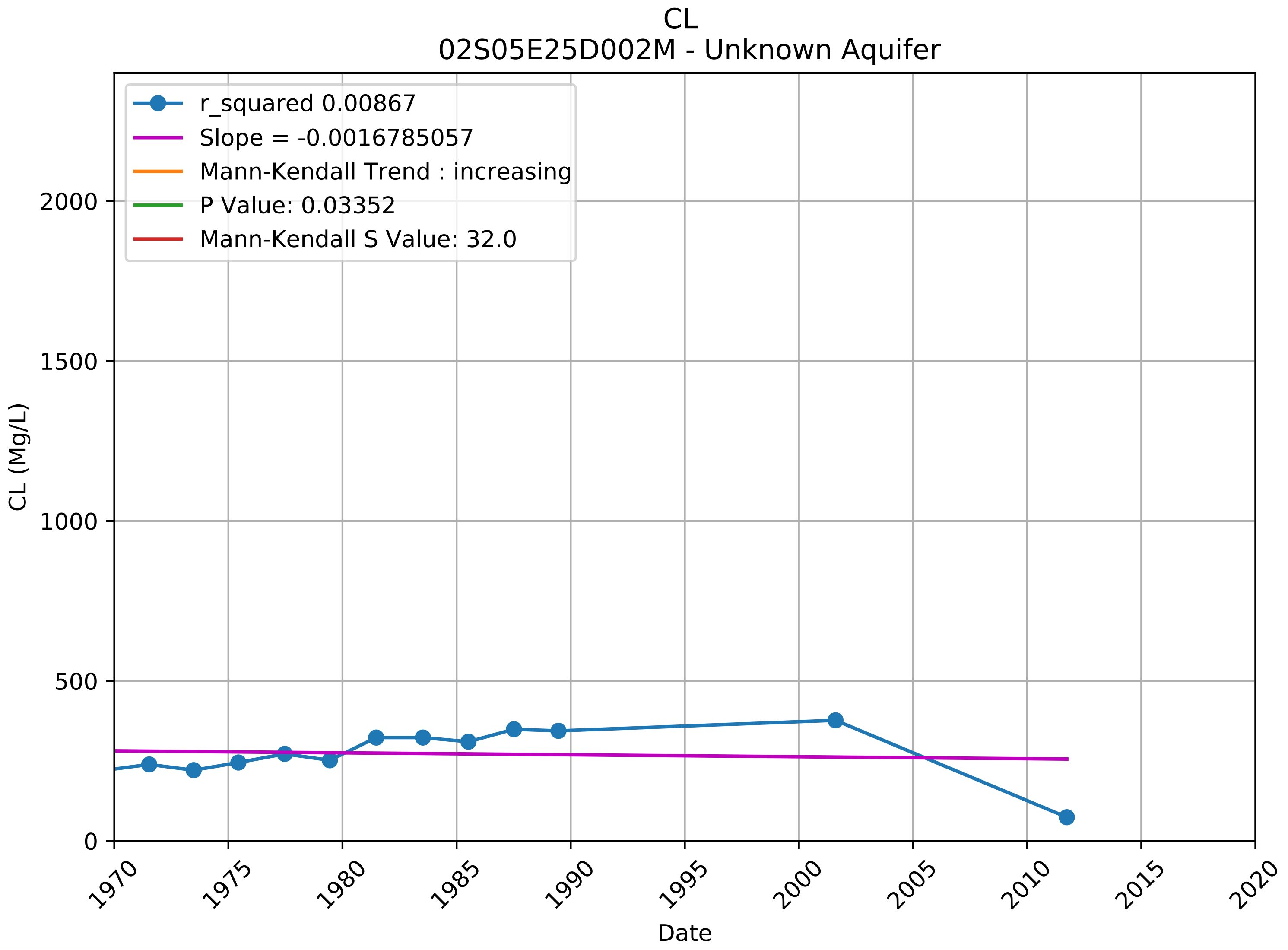
2015
2020
Date



Boron
USGS-374046121155402 - Upper Aquifer
r_squared 0.18100
Slope = -0.0003846491
Mann-Kendall Trend : no trend
P Value: 0.94422
Mann-Kendall S Value: 3.0
B (Mg/L)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Date
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

Chloride

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
02S05E25D002M	37.7351	-121.3833	CL	TRUE	0.034	32	0.485	increasing	212.667	2.126	Unknown
377061N1214199W001	37.7061	-121.4199	CL	TRUE	0.024	34	0.515	increasing	212.667	2.263	Upper
USGS-374223121250601	37.7063185	-121.4193886	CL	FALSE	0.348	10	0.278	no trend	92	0.938	Upper
USGS-374111121213901	37.6863186	-121.361887	CL	FALSE	0.221	6	0.6	no trend	16.667	1.225	Unknown
378410N1212865W001	37.841	-121.2865	CL	FALSE	0.26	7	0.467	no trend	28.333	1.127	Upper
3910011-007	37.714471	-121.426009	CL	FALSE	0.386	-8	-0.286	no trend	65.333	-0.866	Unknown
3910011-010	37.736372	-121.435351	CL	FALSE	0.62	-12	-0.1	no trend	491.333	-0.496	Unknown
3910702-003	37.705557	-121.39764	CL	TRUE	0	1159	0.358	increasing	60117	4.723	Unknown
3910701-003	37.85144	-121.2682	CL	TRUE	0.001	-571	-0.292	decreasing	28421	-3.381	Unknown
3910701-001	37.849584	-121.268763	CL	FALSE	0.054	-224	-0.19	no trend	13441.33	-1.923	Unknown
3910011-017	37.738215	-121.419962	CL	FALSE	0.086	8	0.8	no trend	16.667	1.715	Unknown
3910018-001	37.679751	-121.272617	CL	FALSE	0.755	-5	-0.091	no trend	165	-0.311	Unknown
4300611-002	37.994444	-121.499722	CL	FALSE	0.764	-3	-0.143	no trend	44.333	-0.3	Unknown
3910015-005	37.816859	-121.266705	CL	FALSE	0.127	-26	-0.333	no trend	268.667	-1.525	Upper
3910011-003	37.683959	-121.439427	CL	FALSE	0.727	19	0.047	no trend	2661	0.349	Lower
3910800-002	37.744188	-121.32701	CL	TRUE	0.034	176	0.238	increasing	6832.667	2.117	Unknown
3910800-003	37.74545	-121.32897	CL	TRUE	0.007	153	0.352	increasing	3141.667	2.712	Unknown
3910800-001	37.744746	-121.327221	CL	FALSE	0.221	6	0.6	no trend	16.667	1.225	Unknown
3910800-004	37.74591	-121.336213	CL	FALSE	0.242	109	0.127	no trend	8514.333	1.17	Unknown
3100014-001	37.716956	-121.379533	CL	FALSE	0.371	3	0.5	no trend	5	0.894	Unknown
3910701-005	37.851301	-121.2673	CL	TRUE	0.044	-325	-0.178	decreasing	25822.33	-2.016	Unknown
3910011-004	37.682308	-121.436988	CL	FALSE	0.853	-8	-0.032	no trend	1419.333	-0.186	Lower
3910011-006	37.686539	-121.443515	CL	FALSE	0.638	-21	-0.07	no trend	1803	-0.471	Lower
3910011-005	37.683353	-121.443313	CL	TRUE	0.014	145	0.312	increasing	3442.333	2.454	Lower
3910015-006	37.818884	-121.266416	CL	FALSE	1	-1	-0.015	no trend	211.667	0	Upper
3910015-007	37.811547	-121.263915	CL	FALSE	0.625	9	0.115	no trend	267.667	0.489	Upper
3910015-008	37.801132	-121.262514	CL	FALSE	0.118	16	0.444	no trend	92	1.564	Upper
3910011-018	37.743262	-121.424805	CL	FALSE	0.061	81	0.27	no trend	1830.333	1.87	Lower
3910018-004	37.679705	-121.272761	CL	FALSE	0.764	-3	-0.143	no trend	44.333	-0.3	Unknown
3910701-007	37.851431	-121.265247	CL	FALSE	0.051	-105	-0.259	no trend	2841	-1.951	Unknown
3910702-006	37.709972	-121.390802	CL	TRUE	0.022	482	0.183	increasing	44092	2.291	Unknown
3910702-005	37.708149	-121.393881	CL	TRUE	0.013	-520	-0.198	decreasing	44092	-2.472	Unknown
4110013-014	37.7	-121.466667	CL	TRUE	0.049	23	0.511	increasing	125	1.968	Unknown
3900991-001	37.743544	-121.461428	CL	FALSE	0.089	6	1	no trend	8.667	1.698	Unknown
3910011-030	37.740208	-121.439285	CL	TRUE	0.007	-124	-0.382	decreasing	2057.333	-2.712	Lower
3901348-002	37.702894	-121.406986	CL	FALSE	0.086	-8	-0.8	no trend	16.667	-1.715	Unknown
3900713-001	37.84	-121.44	CL	FALSE	0.251	12	0.333	no trend	92	1.147	Unknown
3901172-002	37.636324	-121.399544	CL	FALSE	0.221	6	0.6	no trend	16.667	1.225	Unknown
3901172-003	37.632289	-121.39736	CL	FALSE	0.707	3	0.2	no trend	28.333	0.376	Unknown
3900702-001	37.990639	-121.407056	CL	FALSE	0.613	-3	-0.3	no trend	15.667	-0.505	Unknown
3900583-001	37.84	-121.44	CL	FALSE	0.221	6	0.6	no trend	16.667	1.225	Unknown
3901216-002	37.74753	-121.516649	CL	FALSE	0.26	7	0.467	no trend	28.333	1.127	Unknown
3900559-001	37.79	-121.38	CL	FALSE	0.734	-2	-0.333	no trend	8.667	-0.34	Unknown
3900558-002	37.79	-121.4	CL	FALSE	0.806	2	0.2	no trend	16.667	0.245	Unknown
3910011-034	37.752802	-121.434603	CL	FALSE	0.374	43	0.123	no trend	2234.333	0.889	Lower
3910011-032	37.754682	-121.465249	CL	FALSE	0.113	-68	-0.227	no trend	1786.667	-1.585	Lower
3901348-003	37.698742	-121.409917	CL	FALSE	0.548	-5	-0.238	no trend	44.333	-0.601	Unknown
3901348-004	37.698147	-121.416153	CL	FALSE	0.707	-3	-0.2	no trend	28.333	-0.376	Unknown
377427N1213943W002	37.742656	-121.394318	CL	FALSE	0.837	5	0.048	no trend	379	0.205	Lower
377427N1213943W001	37.742656	-121.394318	CL	FALSE	0.76	7	0.067	no trend	384.333	0.306	Lower
377427N1213943W003	37.742656	-121.394318	CL	TRUE	0.033	-44	-0.419	decreasing	407.333	-2.131	Lower
377402N1214508W001	37.740187	-121.450762	CL	FALSE	0.181	-28	-0.267	no trend	407.333	-1.338	Lower
377143N1214459W002	37.714305	-121.445905	CL	FALSE	0.088	34	0.324	no trend	373.333	1.708	Lower
377143N1214459W003	37.714305	-121.445905	CL	FALSE	0.915	3	0.029	no trend	351.667	0.107	Lower
377402N1214508W003	37.740187	-121.450762	CL	FALSE	0.69	9	0.086	no trend	403.667	0.398	Lower
377402N1214508W002	37.740187	-121.450762	CL	TRUE	0.018	-49	-0.467	decreasing	408.333	-2.375	Lower
377143N1214459W001	37.714305	-121.445905	CL	FALSE	0.4	-18	-0.171	no trend	407.333	-0.842	Lower
377656N1214199W001	37.765631	-121.41992	CL	FALSE	0.073	-25	-0.379	no trend	179.667	-1.791	Lower
377656N1214199W002	37.765631	-121.41992	CL	FALSE	1	-1	-0.022	no trend	111.667	0	Lower
377656N1214199W003	37.765631	-121.41992	CL	FALSE	0.673	7	0.09	no trend	202.333	0.422	Lower
377149N1214257W003	37.714872	-121.425674	CL	FALSE	1	-1	-0.015	no trend	47.667	0	Lower
377149N1214257W002	37.714872	-121.425674	CL	FALSE	0.492	-11	-0.167	no trend	211.667	-0.687	Lower
377149N1214257W001	37.714872	-121.425674	CL	FALSE	0.169	-21	-0.318	no trend	211.667	-1.375	Lower
377031N1214485W002	37.703055	-121.448544	CL	FALSE	0.137	-25	-0.321	no trend	260.333	-1.487	Lower
377031N1214485W001	37.703055	-121.448544	CL	TRUE	0.007	-45	-0.577	decreasing	267.667	-2.689	Lower
377031N1214485W003	37.703055	-121.448544	CL	FALSE	0.204	-20	-0.256	no trend	223.333	-1.271	Lower
3910005-044	37.782808	-121.300937	CL	FALSE	0.371	-3	-0.5	no trend	5	-0.894	Unknown
3910800-006	37.744722	-121.329167	CL	TRUE	0	212	0.456	increasing	3444	3.595	Unknown
USGS-374046121155402	37.6793611	-121.2650278	CL	FALSE	0.327	29	0.17	no trend	817	0.98	Upper
USGS-374046121155401	37.6793611	-121.2650278	CL	FALSE	0.972	-2	-0.012	no trend	816	-0.035	Upper



CL
02S05E25D002M - Unknown Aquifer
r_squared 0.00867
Slope = -0.0016785057
Mann-Kendall Trend : increasing
P Value: 0.03352
Mann-Kendall S Value: 32.0
CL (Mg/L)
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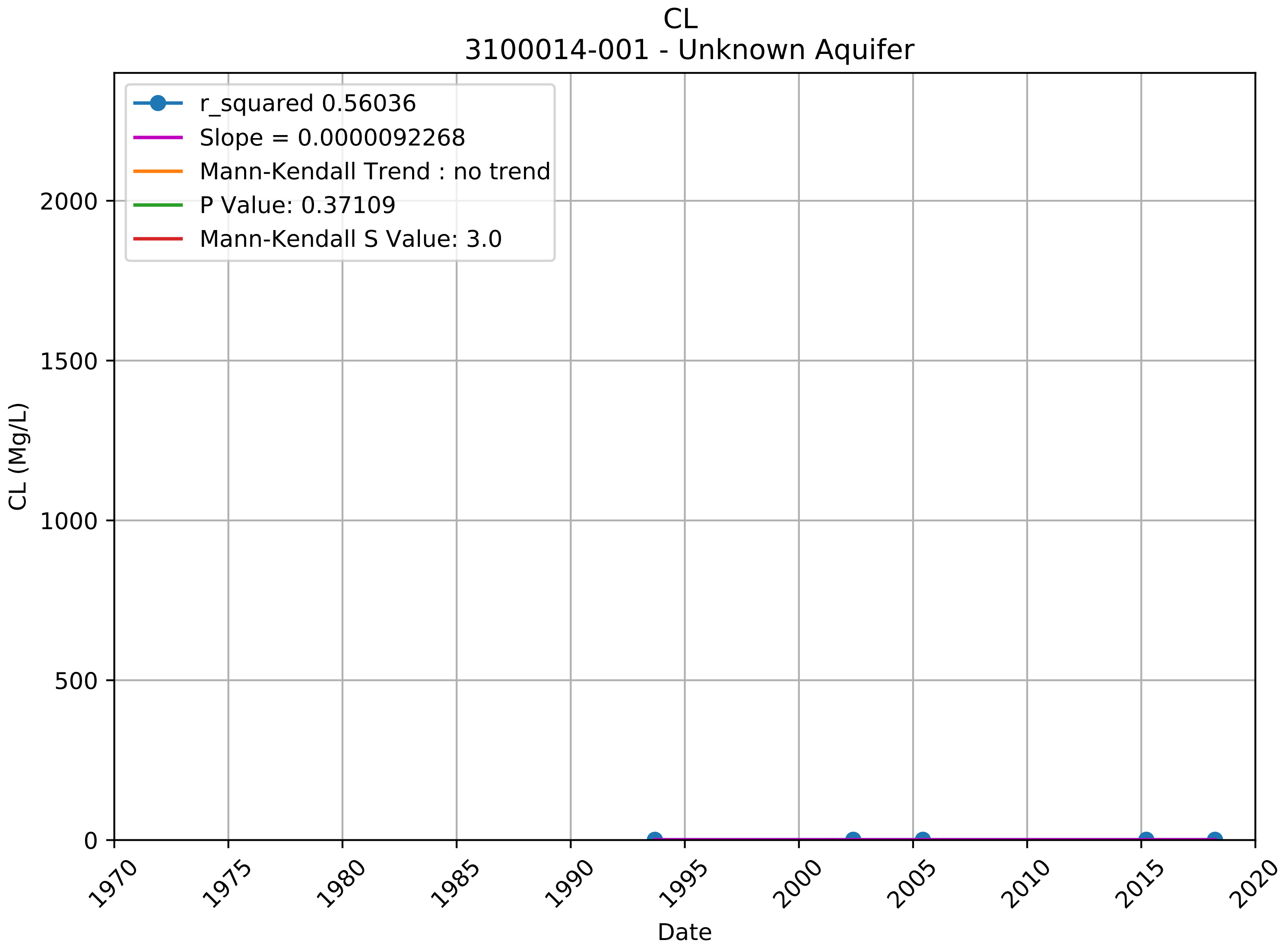
Date


CL
3100014-001 - Unknown Aquifer
r_squared 0.56036
Slope = 0.0000092268
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: 3.0
CL (Mg/L)
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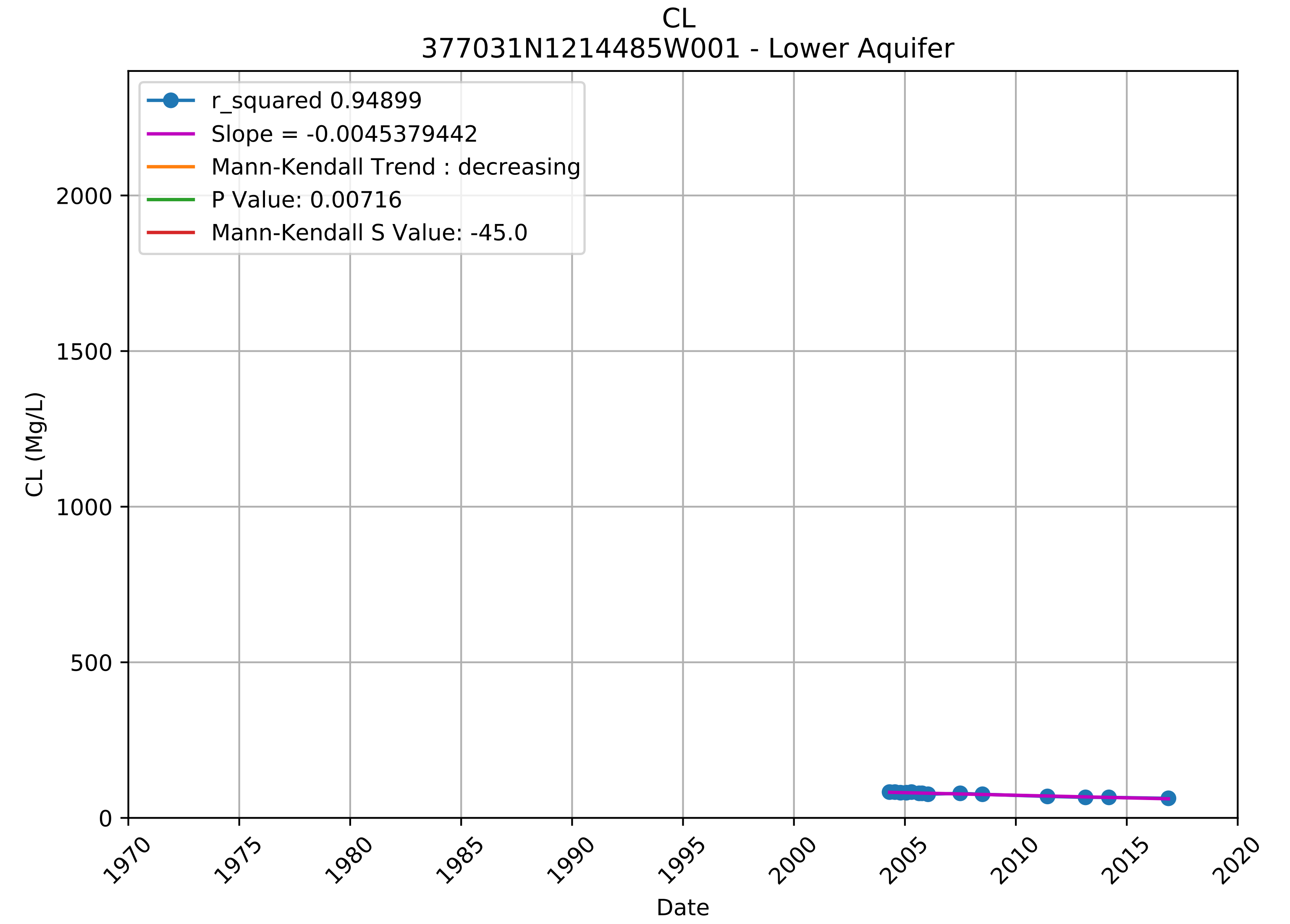
Date



CL
377031N1214485W001 - Lower Aquifer
r_squared 0.94899
Slope = -0.0045379442
Mann-Kendall Trend : decreasing
P Value: 0.00716
Mann-Kendall S Value: -45.0
CL (Mg/L)
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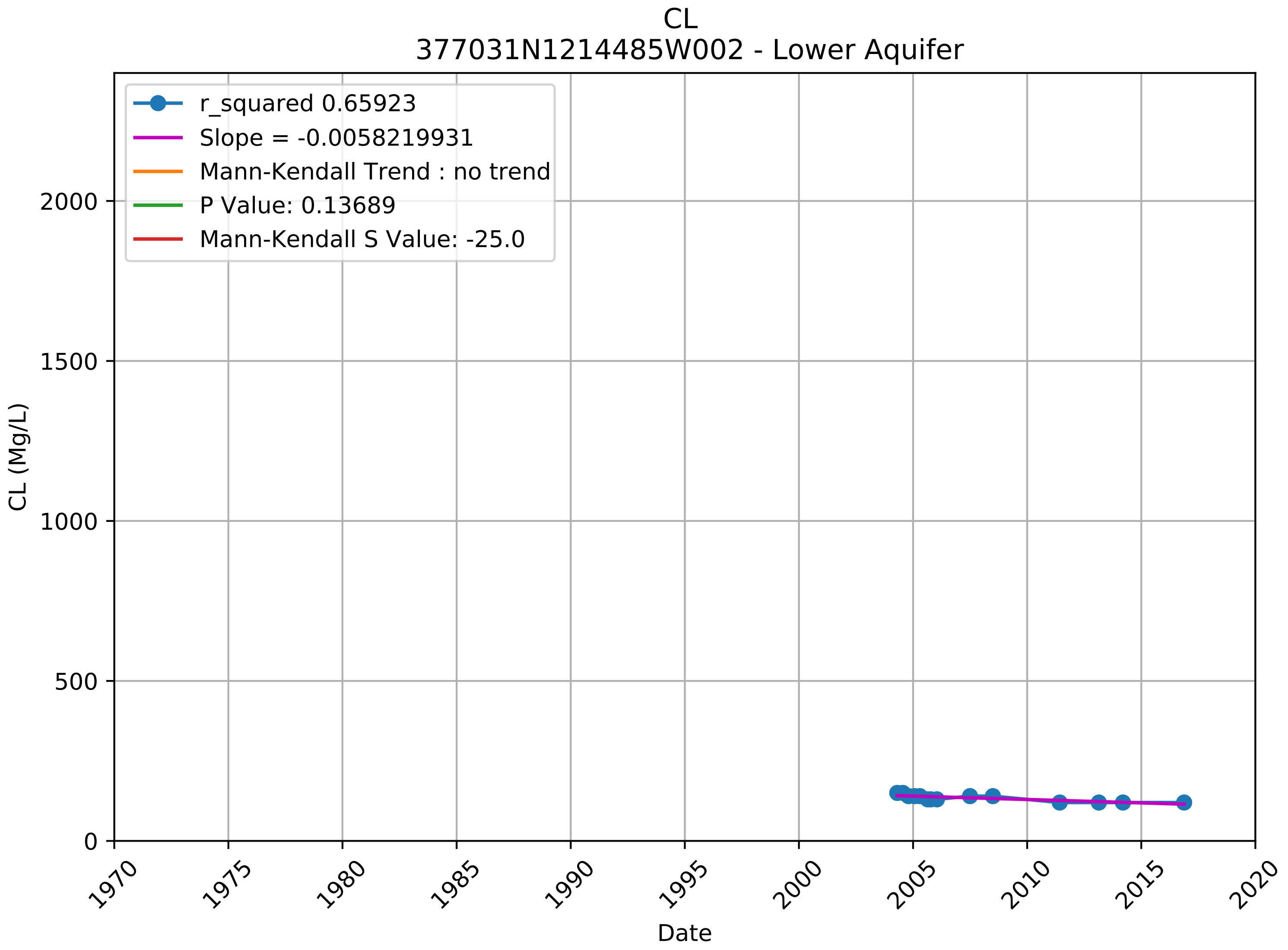
Date



CL
377031N1214485W002 - Lower Aquifer
r_squared 0.65923
Slope = -0.0058219931
Mann-Kendall Trend : no trend
P Value: 0.13689
Mann-Kendall S Value: -25.0
CL (Mg/L)
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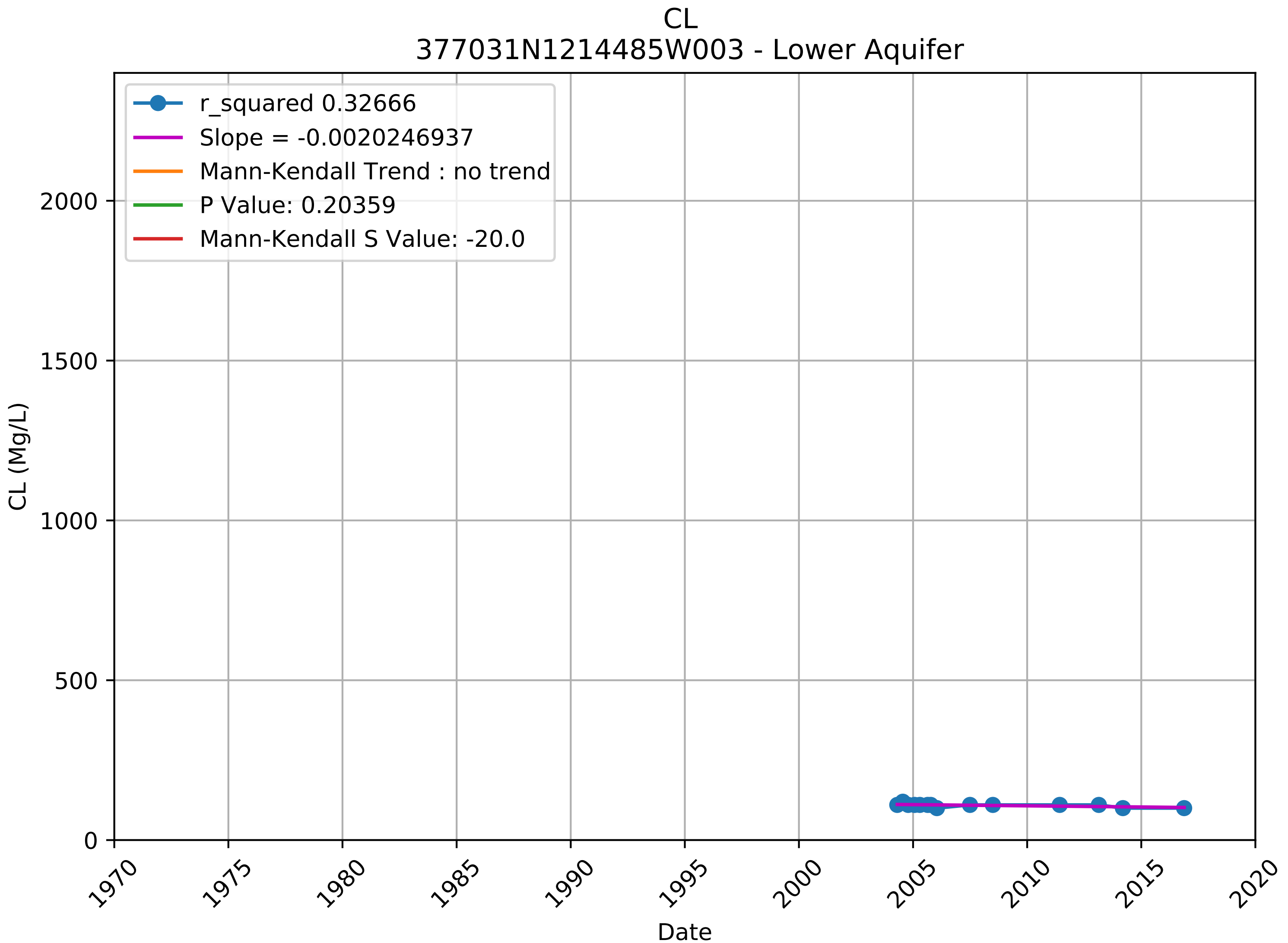
Date


CL
377031N1214485W003 - Lower Aquifer
r_squared 0.32666
Slope = -0.0020246937
Mann-Kendall Trend : no trend
P Value: 0.20359
Mann-Kendall S Value: -20.0
CL (Mg/L)
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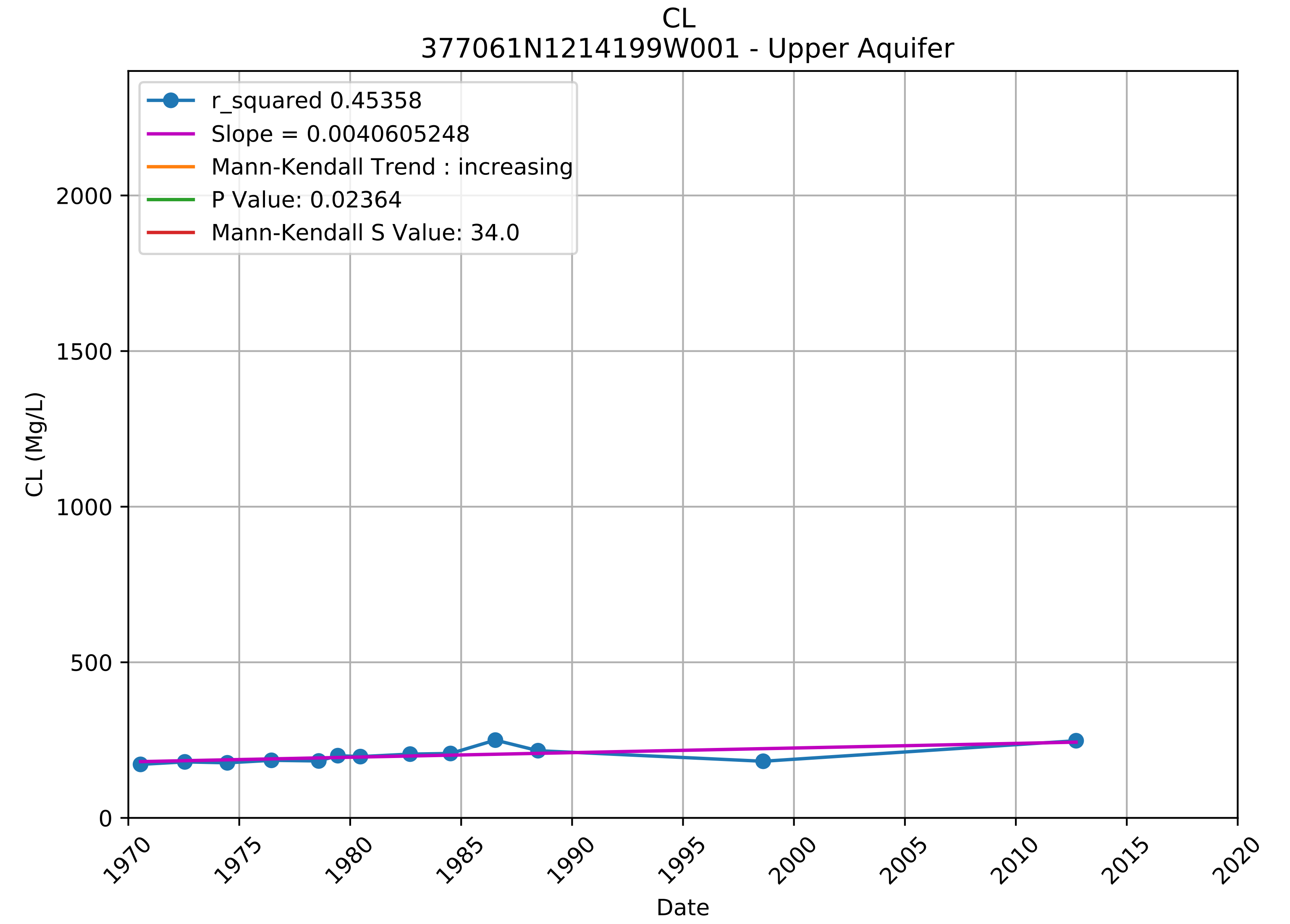

CL
377061N1214199W001 - Upper Aquifer
r_squared 0.45358
Slope = 0.0040605248
Mann-Kendall Trend : increasing
P Value: 0.02364
Mann-Kendall S Value: 34.0
CL (Mg/L)
0
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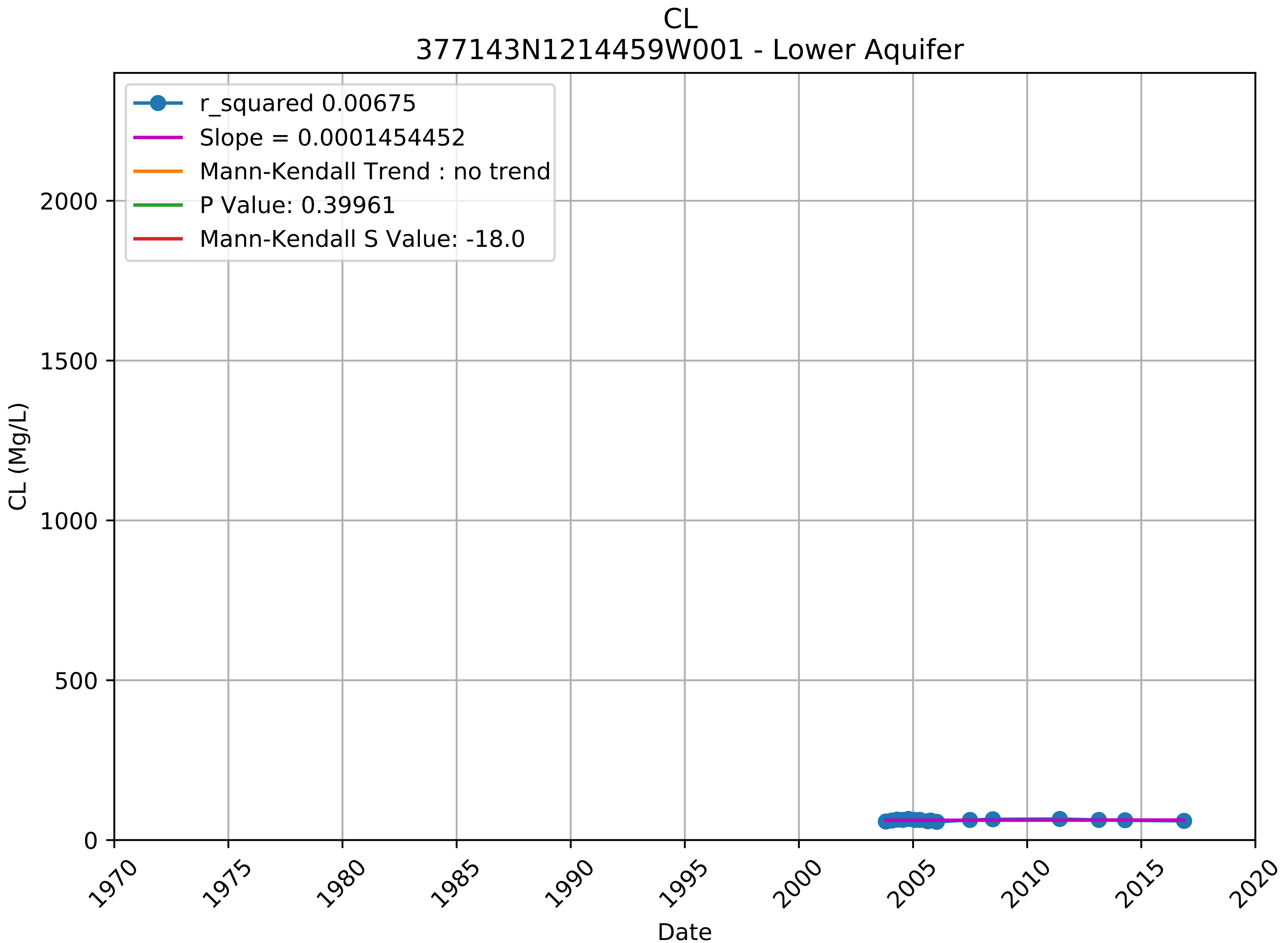
Date


CL
377143N1214459W001 - Lower Aquifer
r_squared 0.00675
Slope = 0.0001454452
Mann-Kendall Trend : no trend
P Value: 0.39961
Mann-Kendall S Value: -18.0
CL (Mg/L)
0
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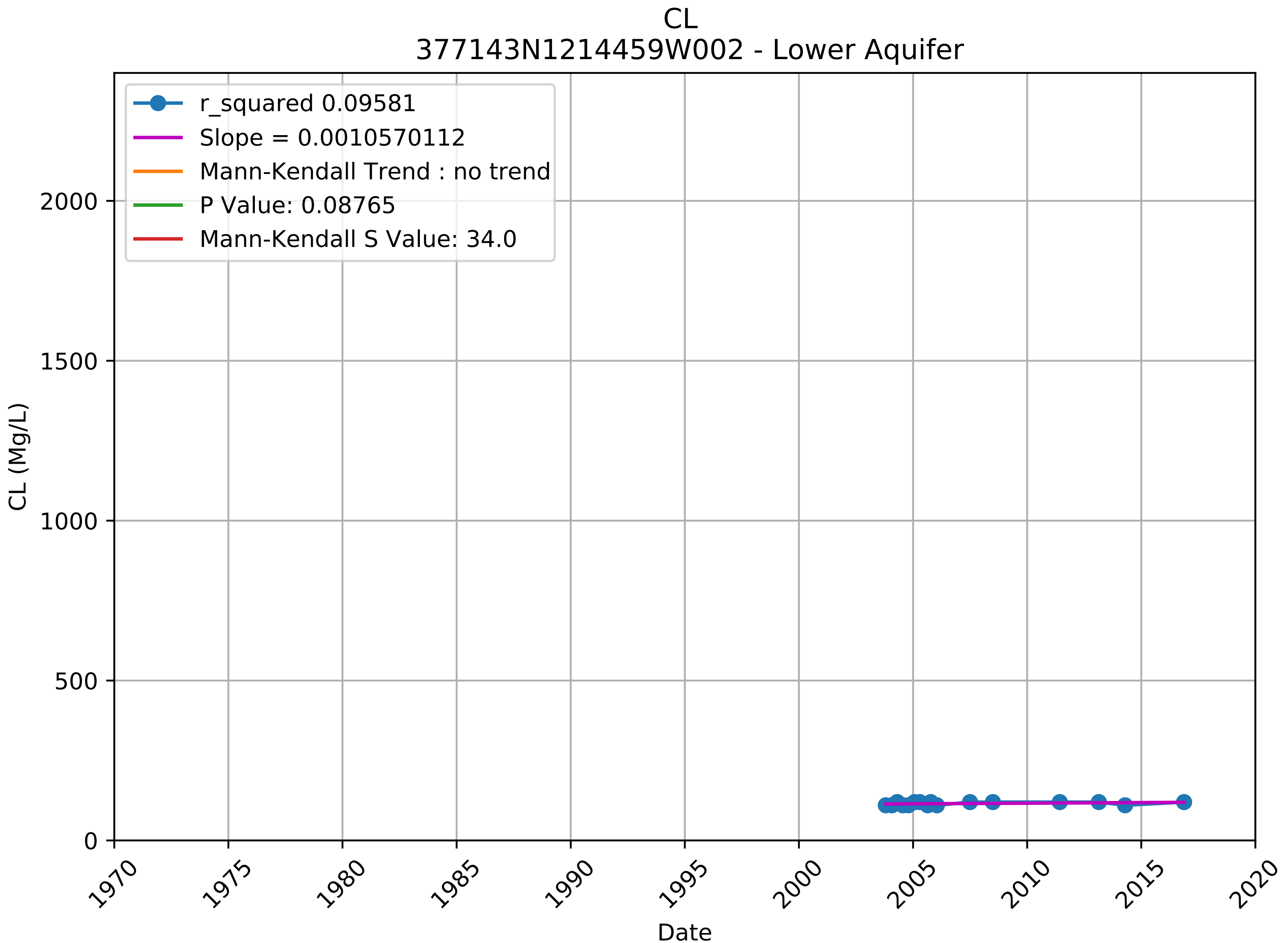

CL
377143N1214459W002 - Lower Aquifer
r_squared 0.09581
Slope = 0.0010570112
Mann-Kendall Trend : no trend
P Value: 0.08765
Mann-Kendall S Value: 34.0
CL (Mg/L)
Date
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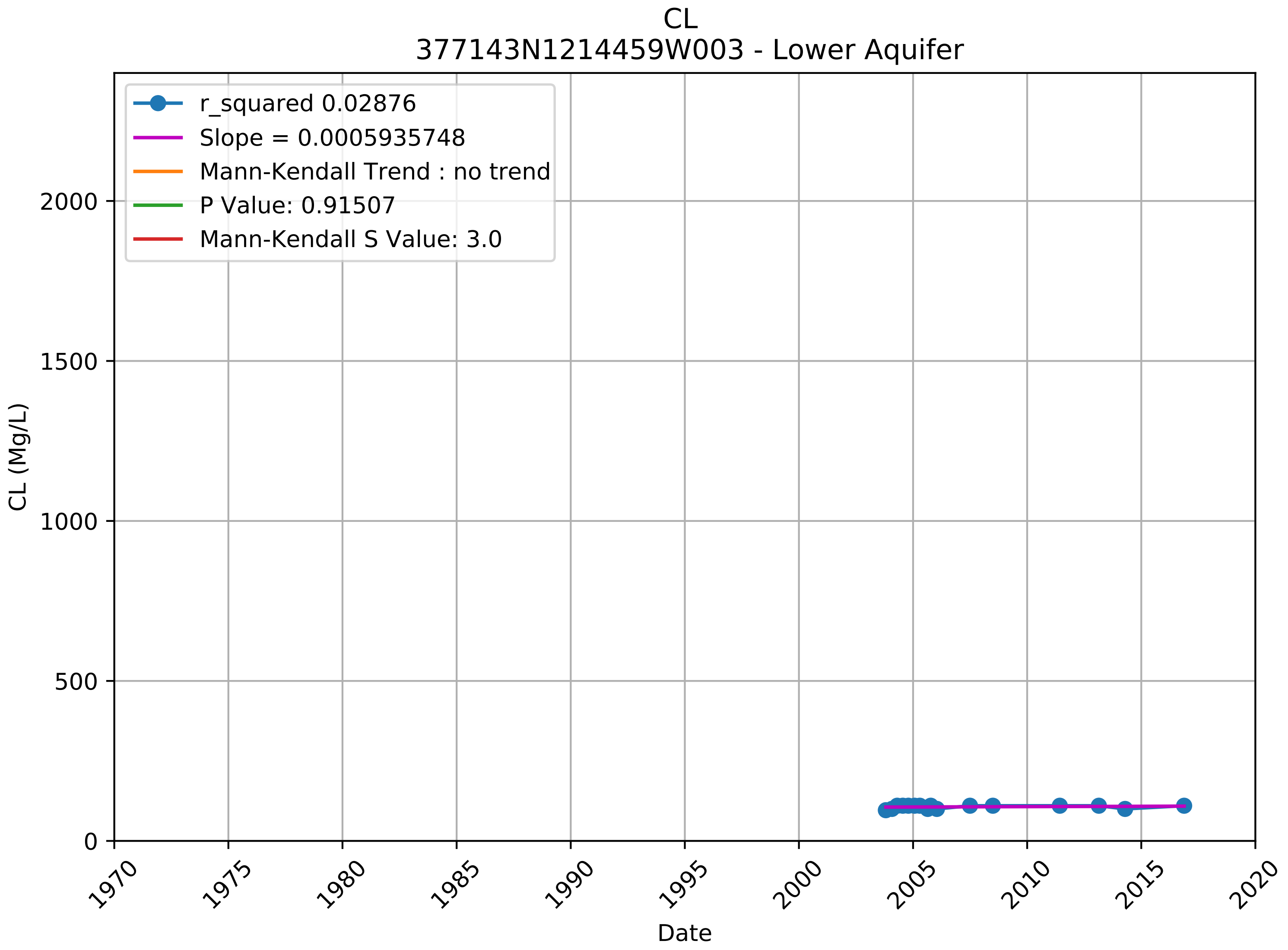
CL
377143N1214459W003 - Lower Aquifer
r_squared 0.02876
Slope = 0.0005935748
Mann-Kendall Trend : no trend
P Value: 0.91507
Mann-Kendall S Value: 3.0
CL (Mg/L)
0
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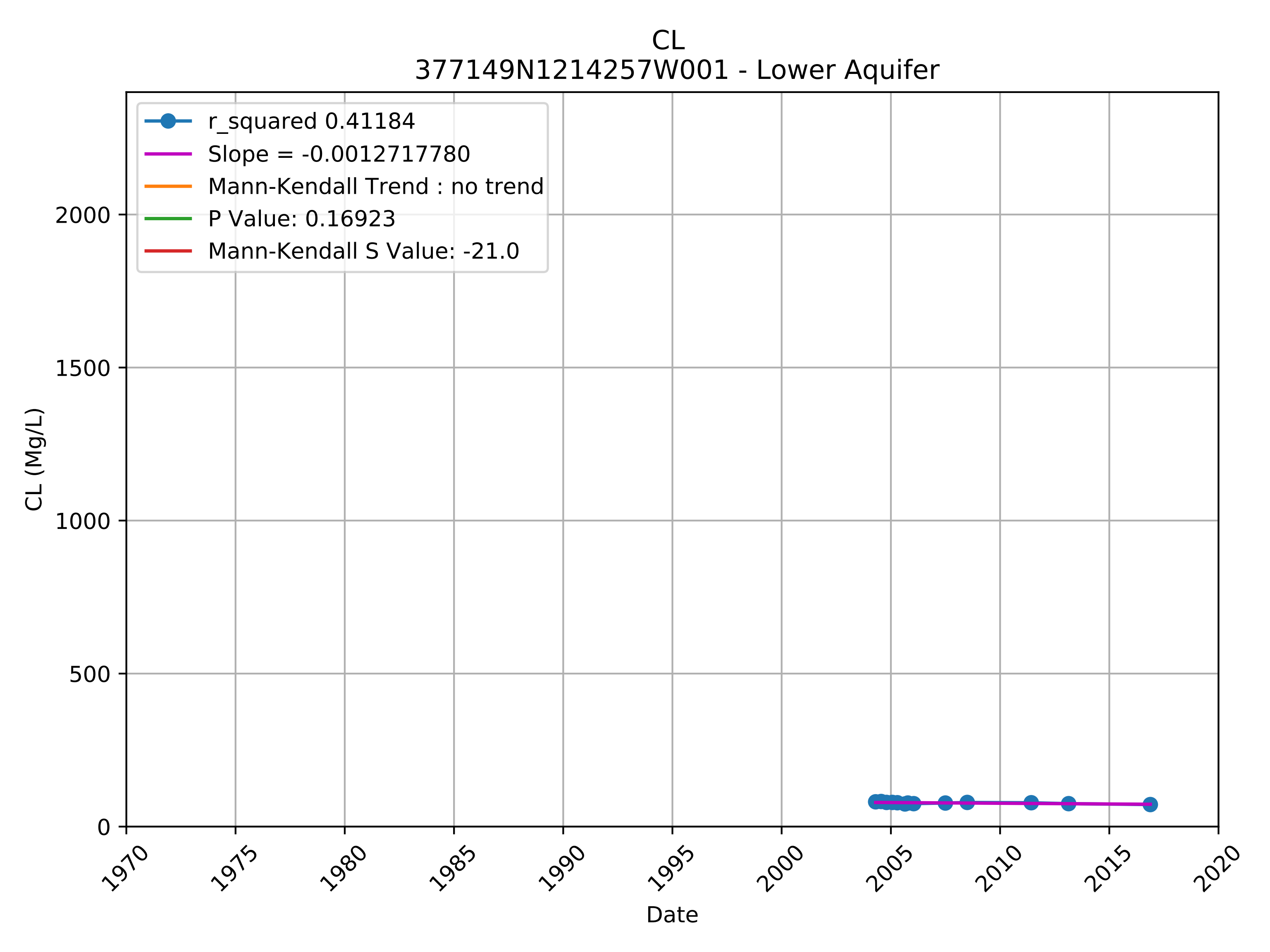

CL
377149N1214257W001 - Lower Aquifer
r_squared 0.41184
Slope = -0.0012717780
Mann-Kendall Trend : no trend
P Value: 0.16923
Mann-Kendall S Value: -21.0
CL (Mg/L)
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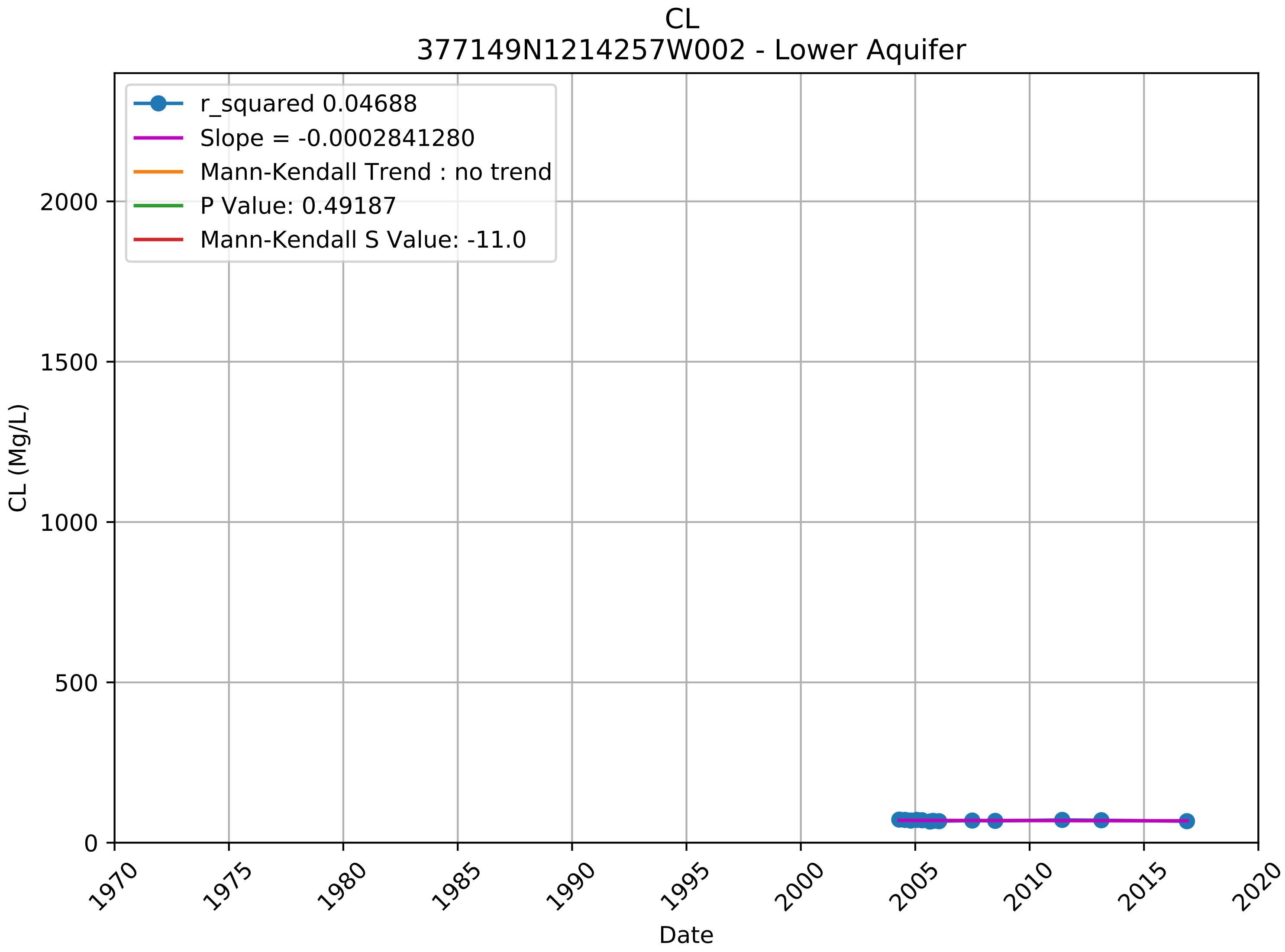
CL
377149N1214257W002 - Lower Aquifer
r_squared 0.04688
Slope = -0.0002841280
Mann-Kendall Trend : no trend
P Value: 0.49187
Mann-Kendall S Value: -11.0
CL (Mg/L)
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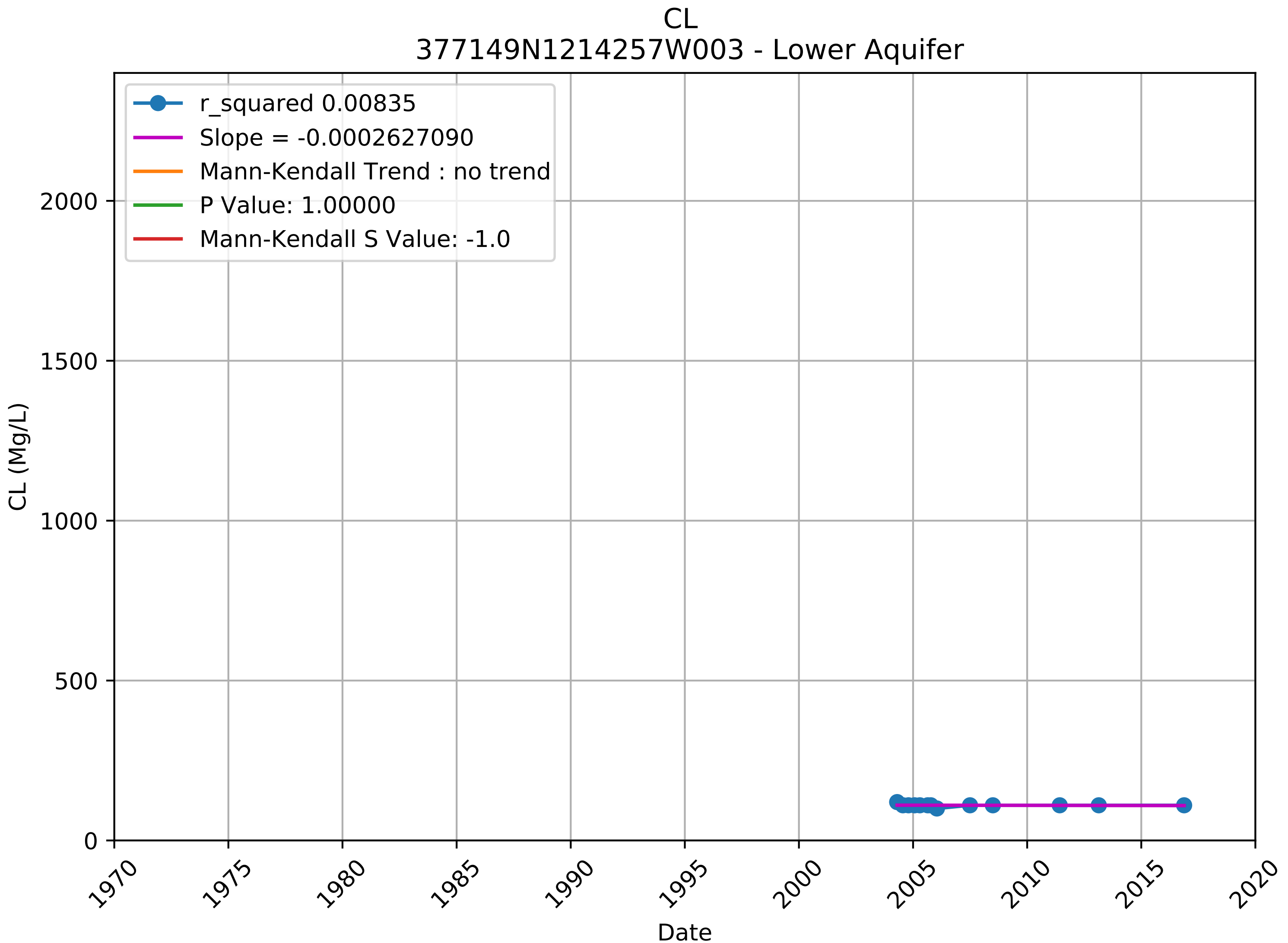

CL
377149N1214257W003 - Lower Aquifer
r_squared 0.00835
Slope = -0.0002627090
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
CL (Mg/L)
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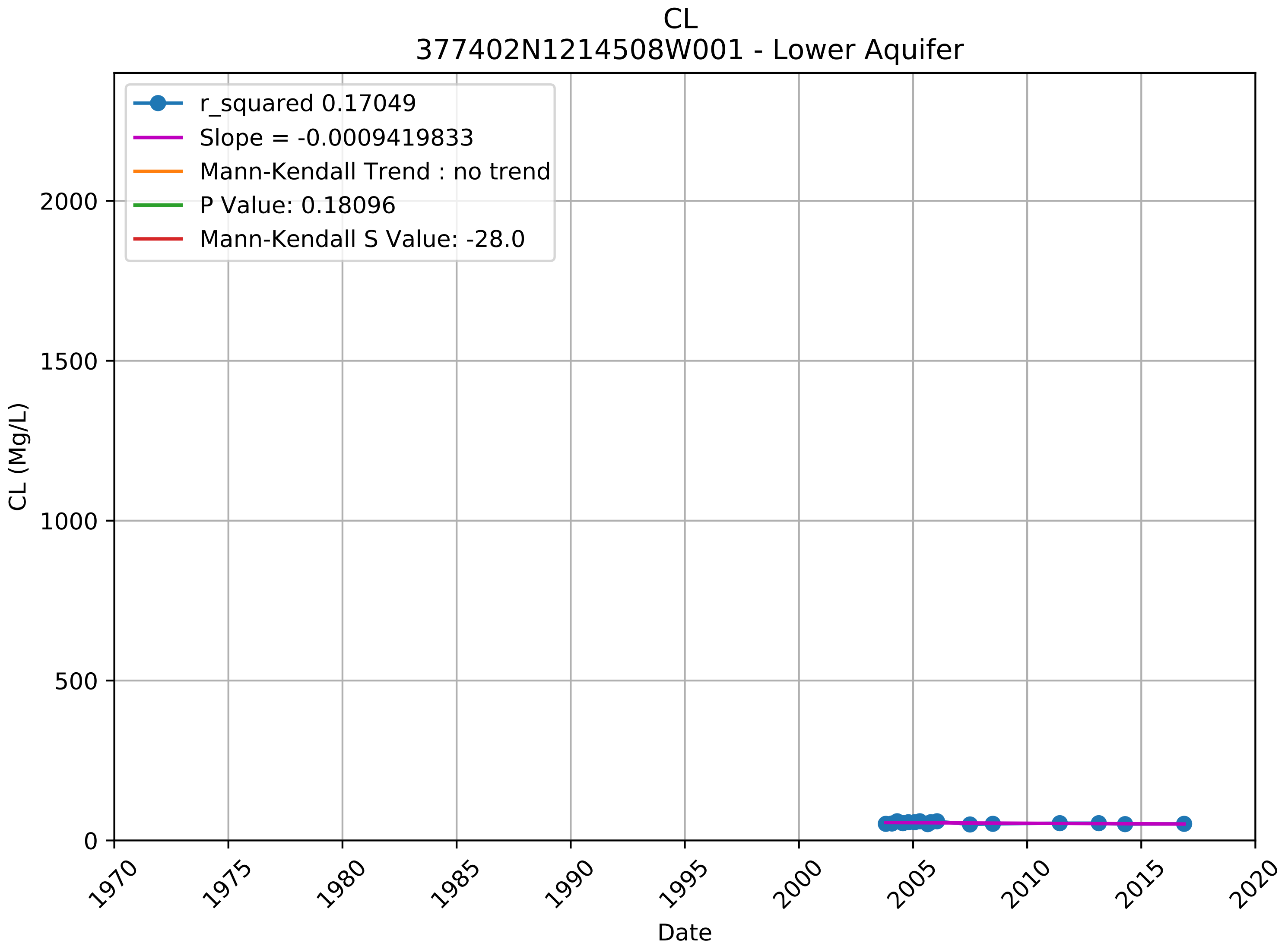
CL
377402N1214508W001 - Lower Aquifer
r_squared 0.17049
Slope = -0.0009419833
Mann-Kendall Trend : no trend
P Value: 0.18096
Mann-Kendall S Value: -28.0
CL (Mg/L)
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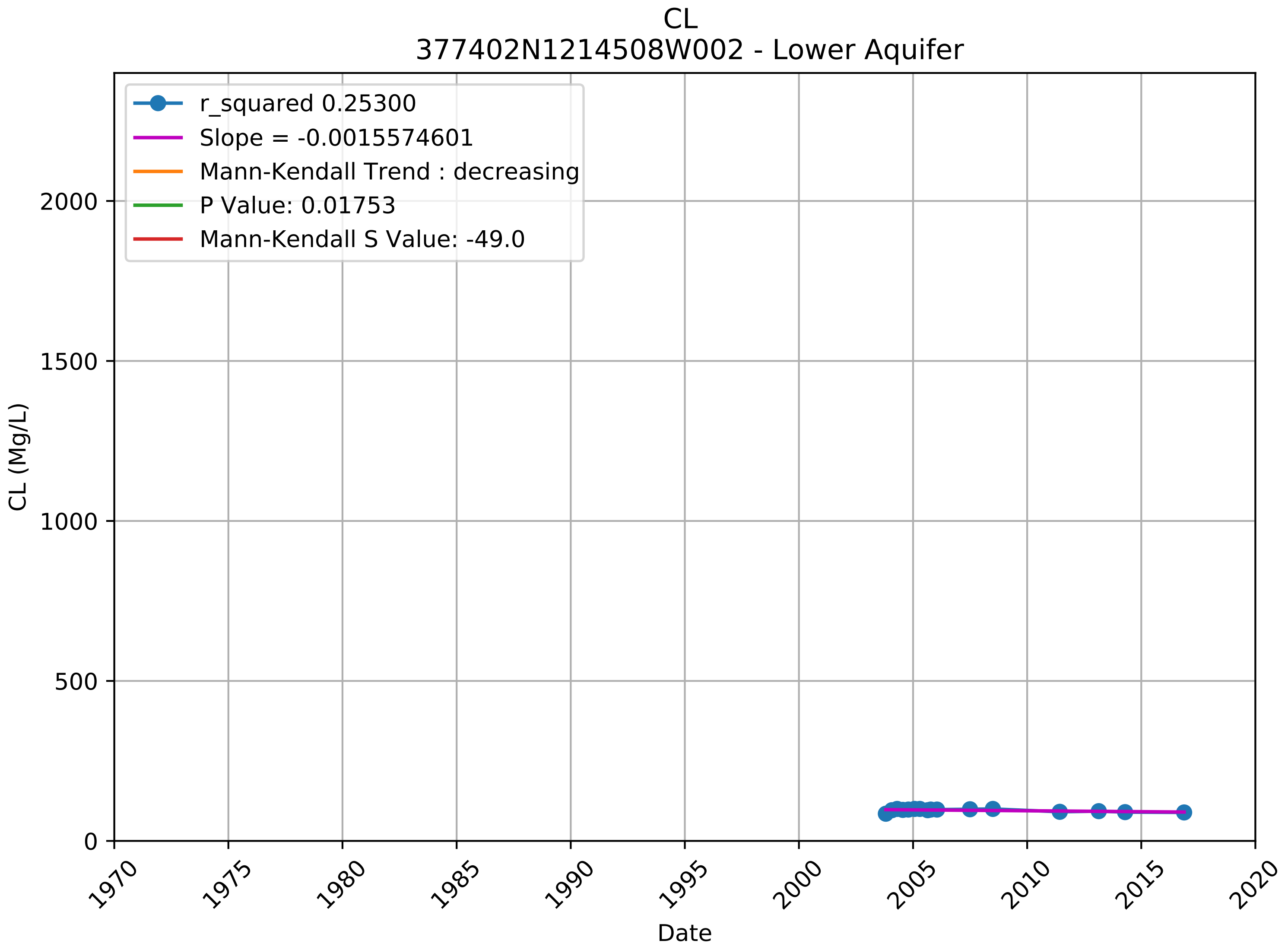
CL
377402N1214508W002 - Lower Aquifer
r_squared 0.25300
Slope = -0.0015574601
Mann-Kendall Trend : decreasing
P Value: 0.01753
Mann-Kendall S Value: -49.0
CL (Mg/L)
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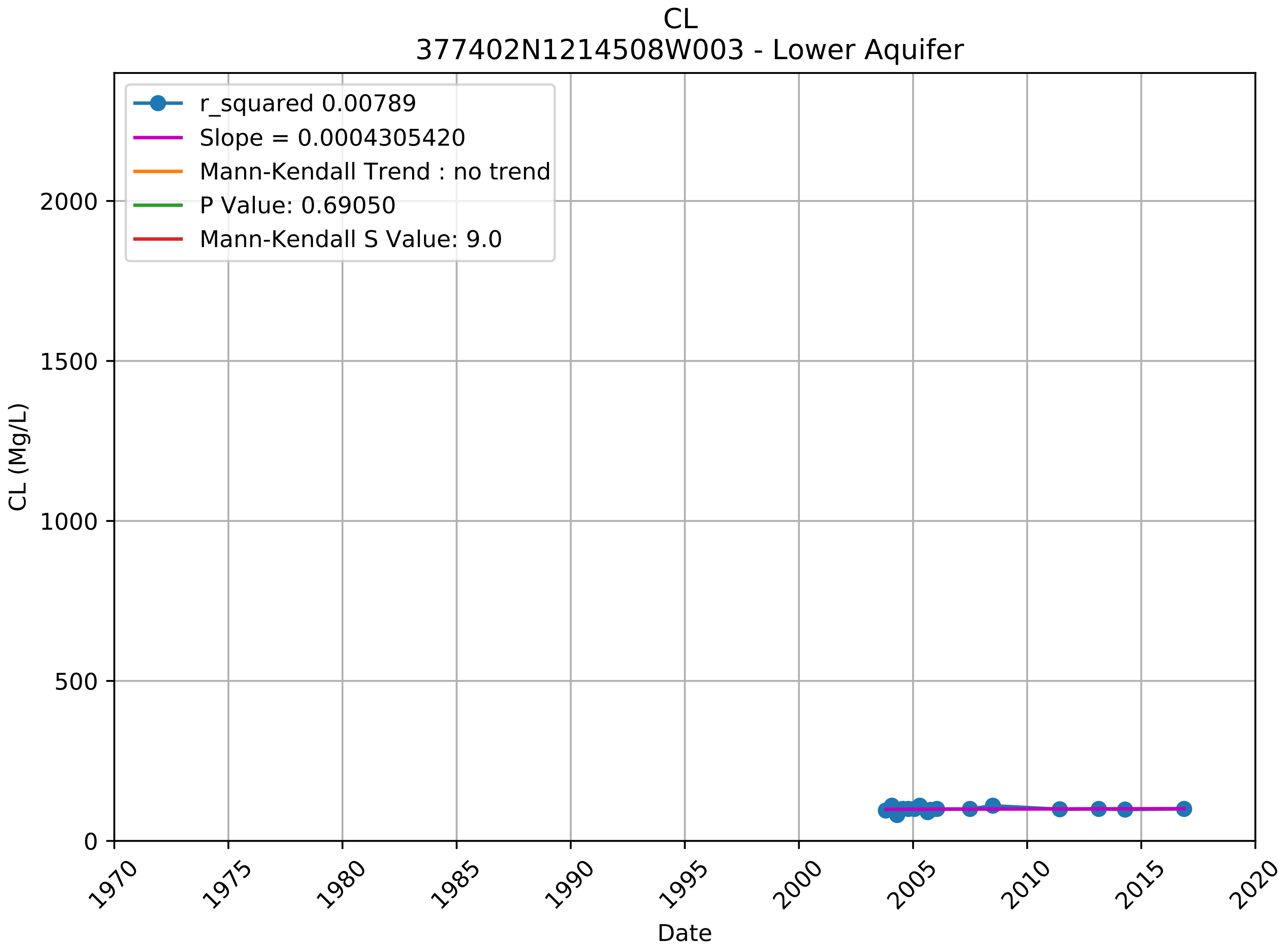

CL
377402N1214508W003 - Lower Aquifer
r_squared 0.00789
Slope = 0.0004305420
Mann-Kendall Trend : no trend
P Value: 0.69050
Mann-Kendall S Value: 9.0
CL (Mg/L)
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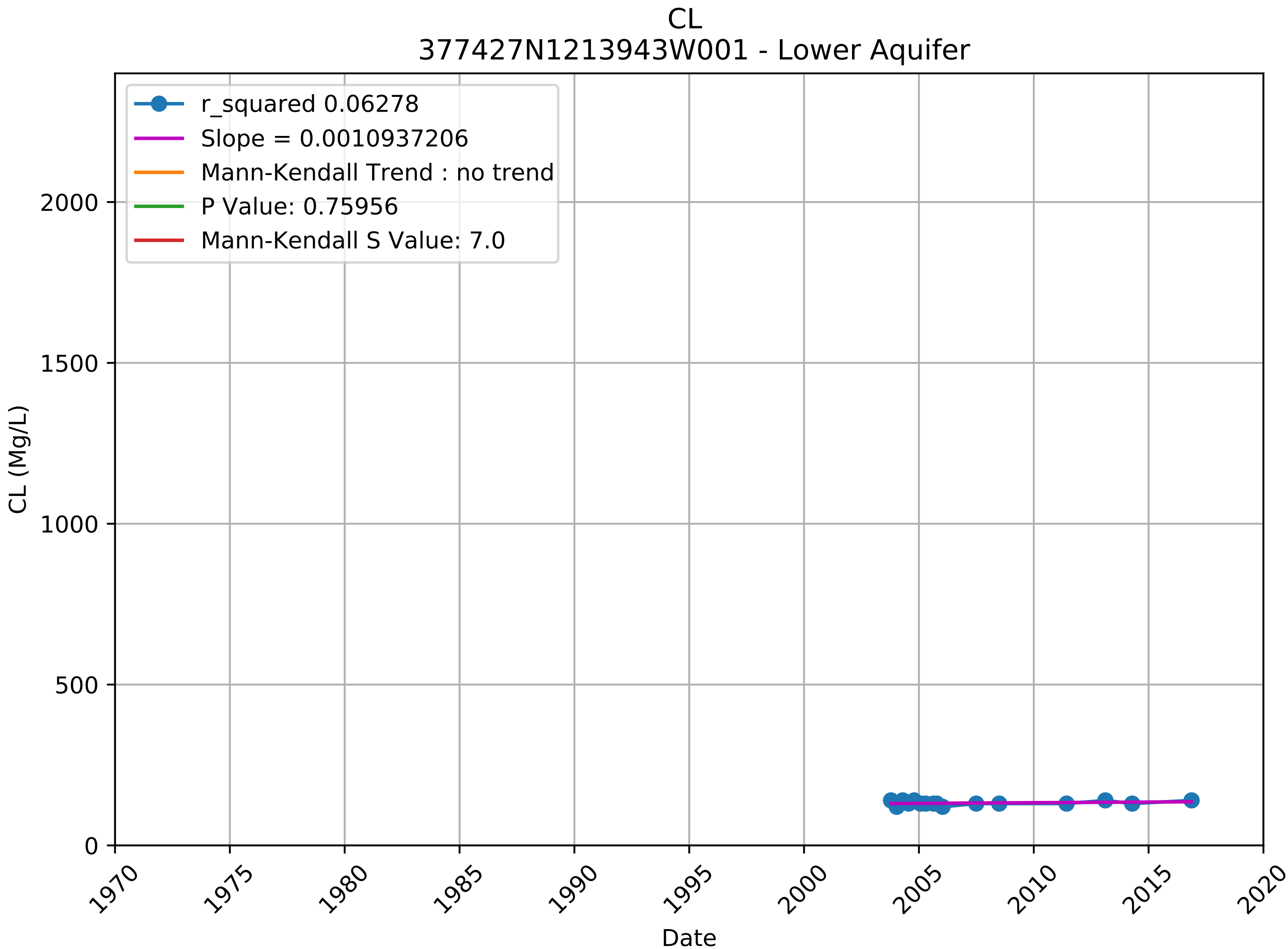
CL
377427N1213943W001 - Lower Aquifer
r_squared 0.06278
Slope = 0.0010937206
Mann-Kendall Trend : no trend
P Value: 0.75956
Mann-Kendall S Value: 7.0
CL (Mg/L)
Date
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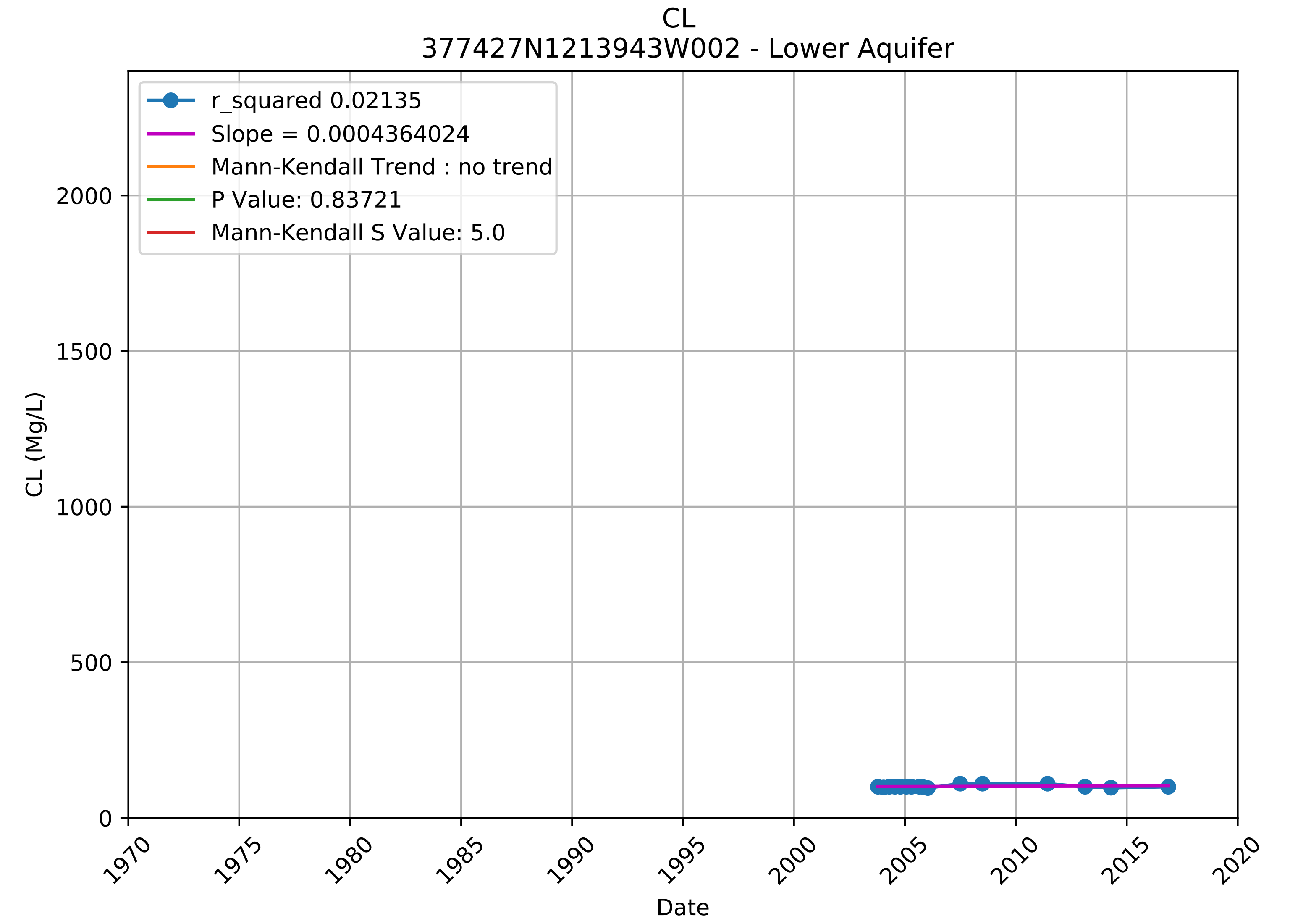
CL
377427N1213943W002 - Lower Aquifer
r_squared 0.02135
Slope = 0.0004364024
Mann-Kendall Trend : no trend
P Value: 0.83721
Mann-Kendall S Value: 5.0
CL (Mg/L)
Date
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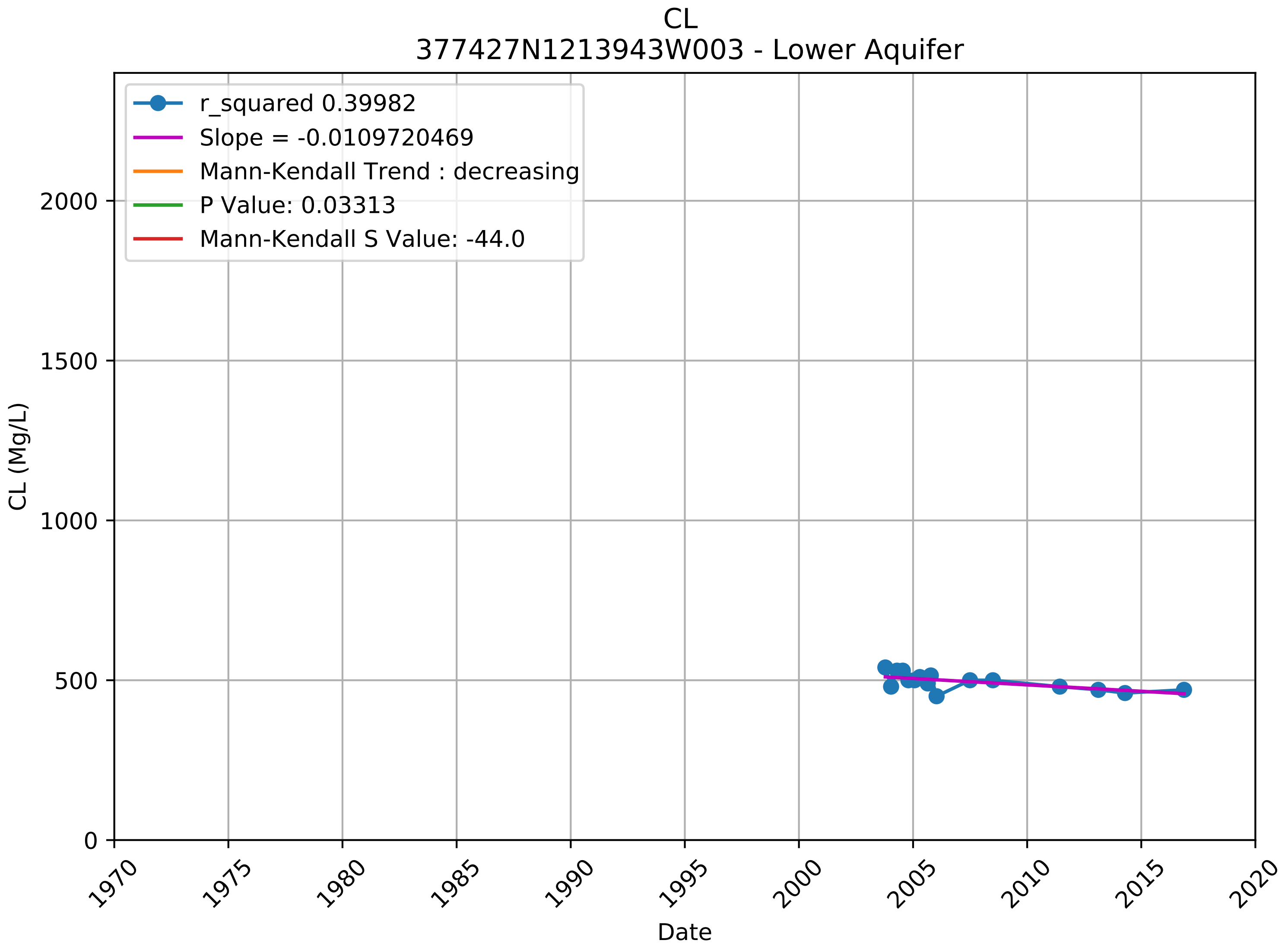
CL
377427N1213943W003 - Lower Aquifer
r_squared 0.39982
Slope = -0.0109720469
Mann-Kendall Trend : decreasing
P Value: 0.03313
Mann-Kendall S Value: -44.0
CL (Mg/L)
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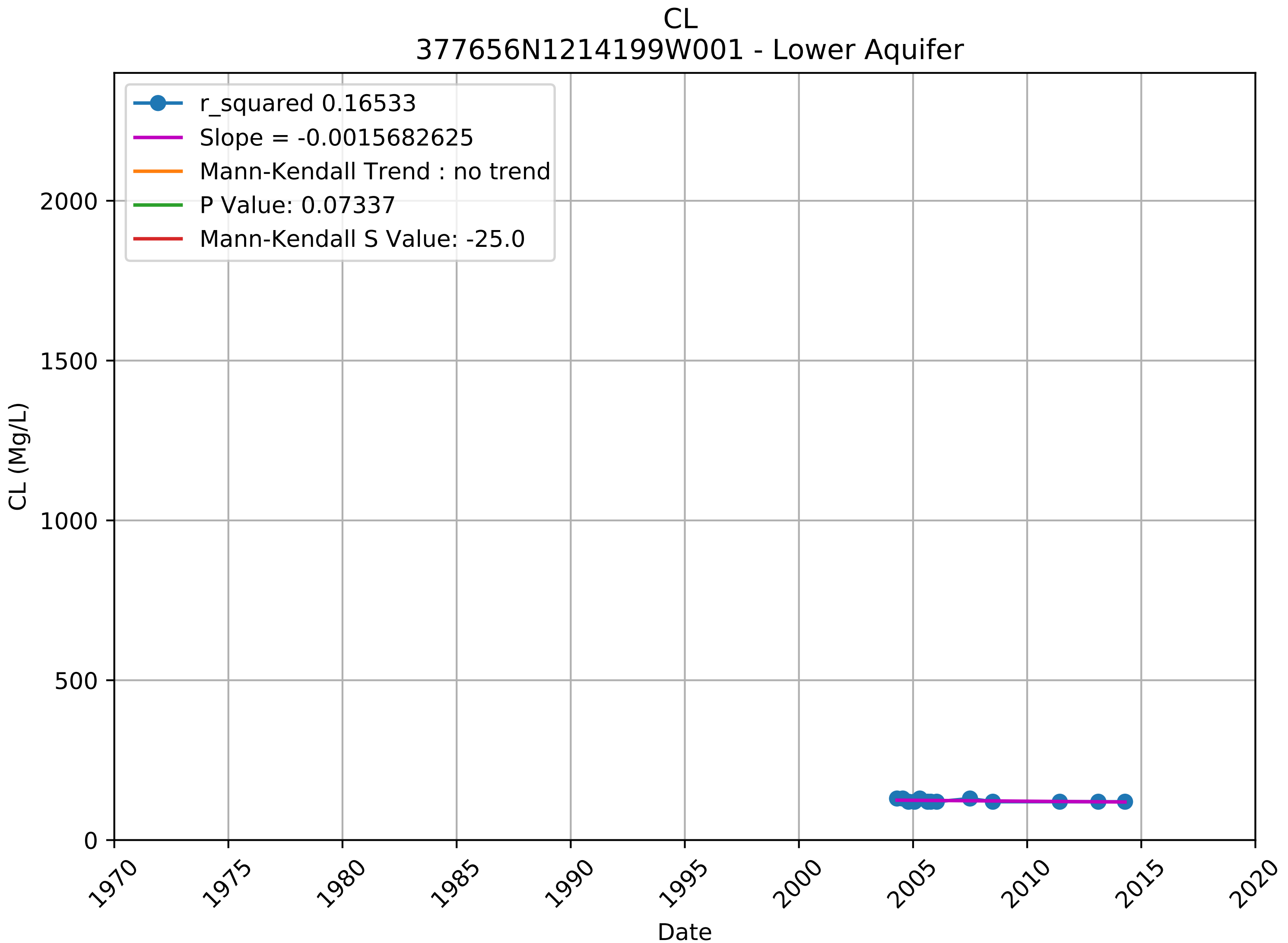

CL
377656N1214199W001 - Lower Aquifer
r_squared 0.16533
Slope = -0.0015682625
Mann-Kendall Trend : no trend
P Value: 0.07337
Mann-Kendall S Value: -25.0
CL (Mg/L)
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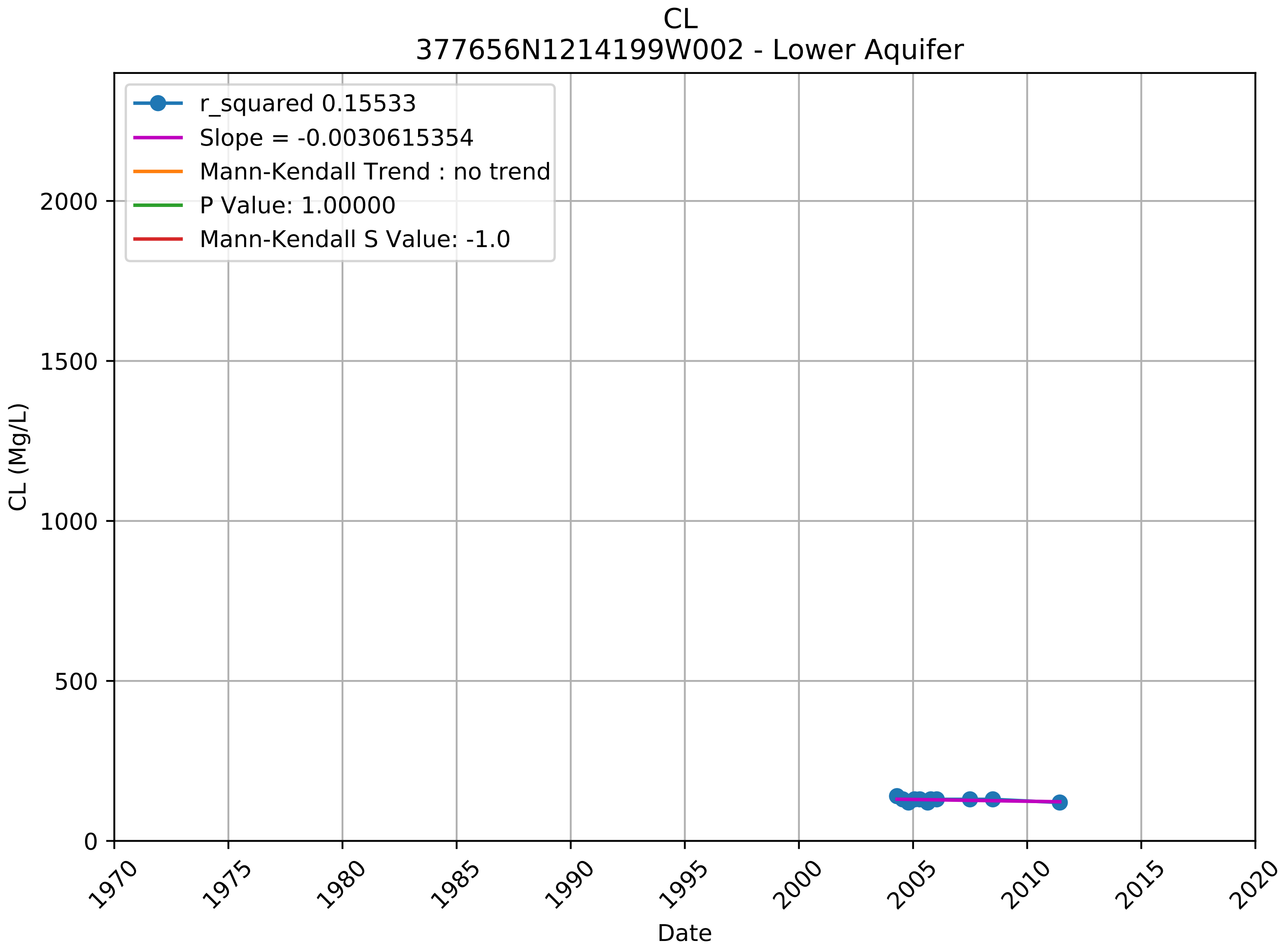

CL
377656N1214199W002 - Lower Aquifer
r_squared 0.15533
Slope = -0.0030615354
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
CL (Mg/L)
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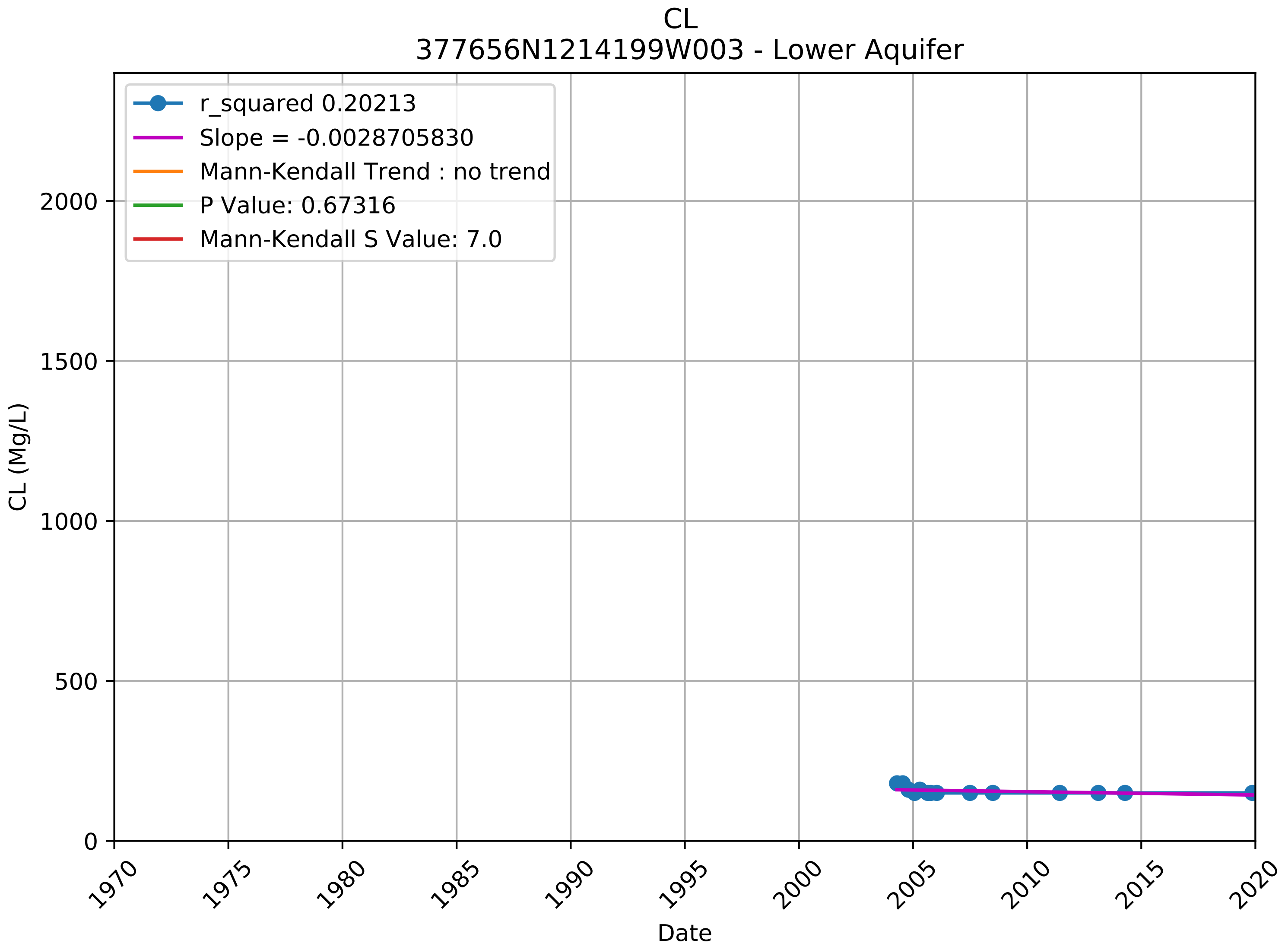
CL
377656N1214199W003 - Lower Aquifer
r_squared 0.20213
Slope = -0.0028705830
Mann-Kendall Trend : no trend
P Value: 0.67316
Mann-Kendall S Value: 7.0
CL (Mg/L)
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Date
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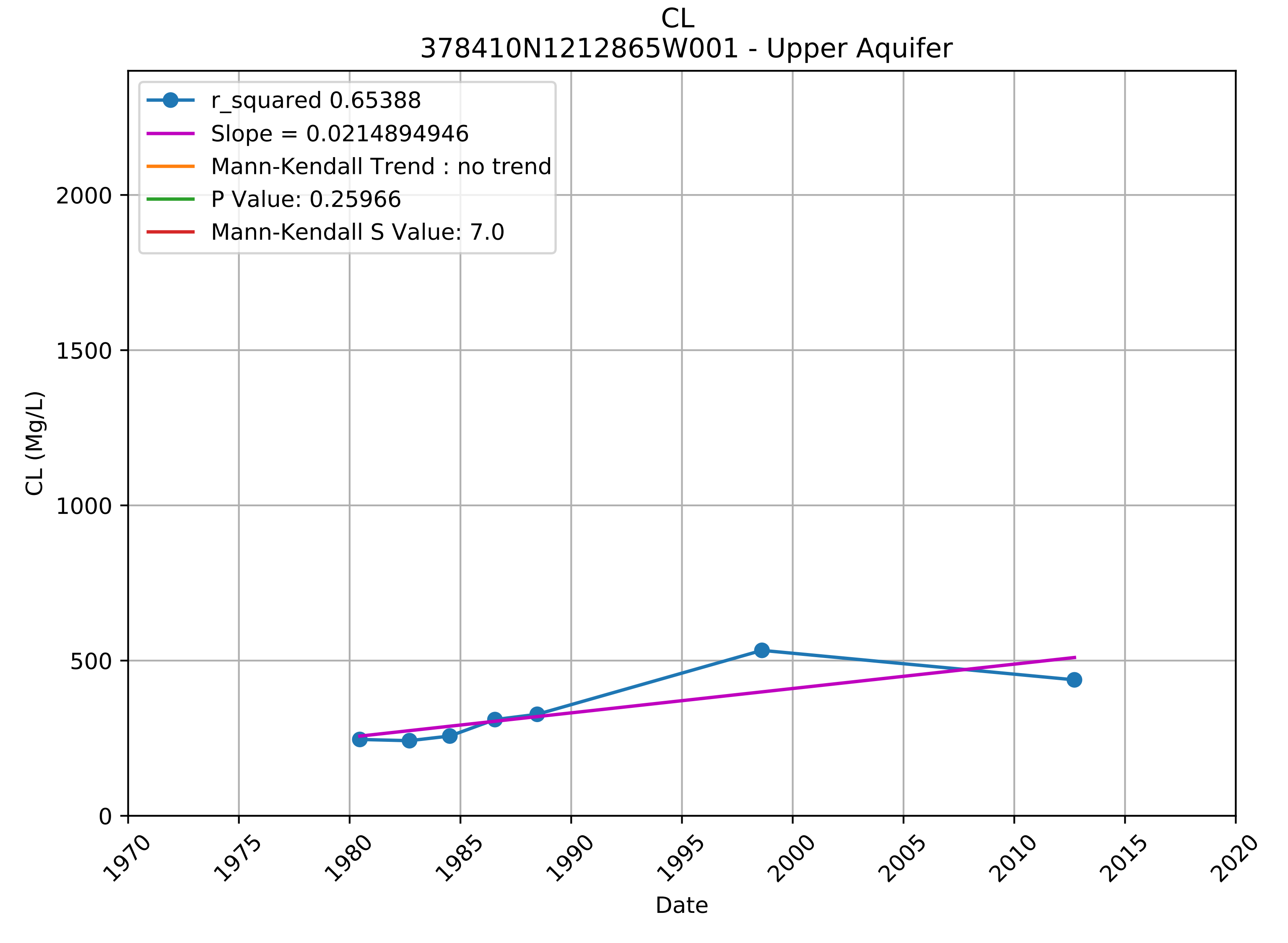

CL
378410N1212865W001 - Upper Aquifer
r_squared 0.65388
Slope = 0.0214894946
Mann-Kendall Trend : no trend
P Value: 0.25966
Mann-Kendall S Value: 7.0
CL (Mg/L)
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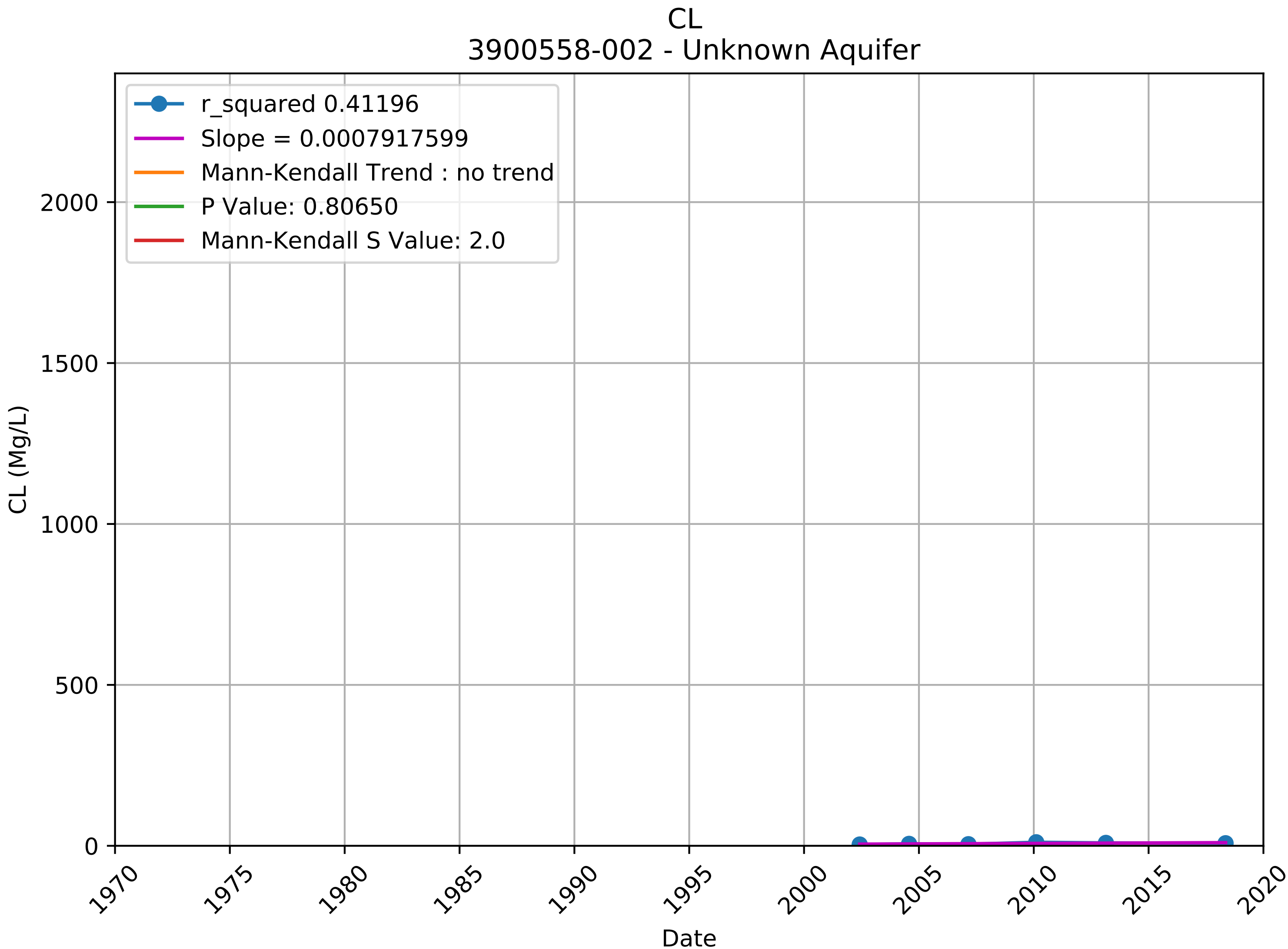

CL
3900558-002 - Unknown Aquifer
r_squared 0.41196
Slope = 0.0007917599
Mann-Kendall Trend : no trend
P Value: 0.80650
Mann-Kendall S Value: 2.0
CL (Mg/L)
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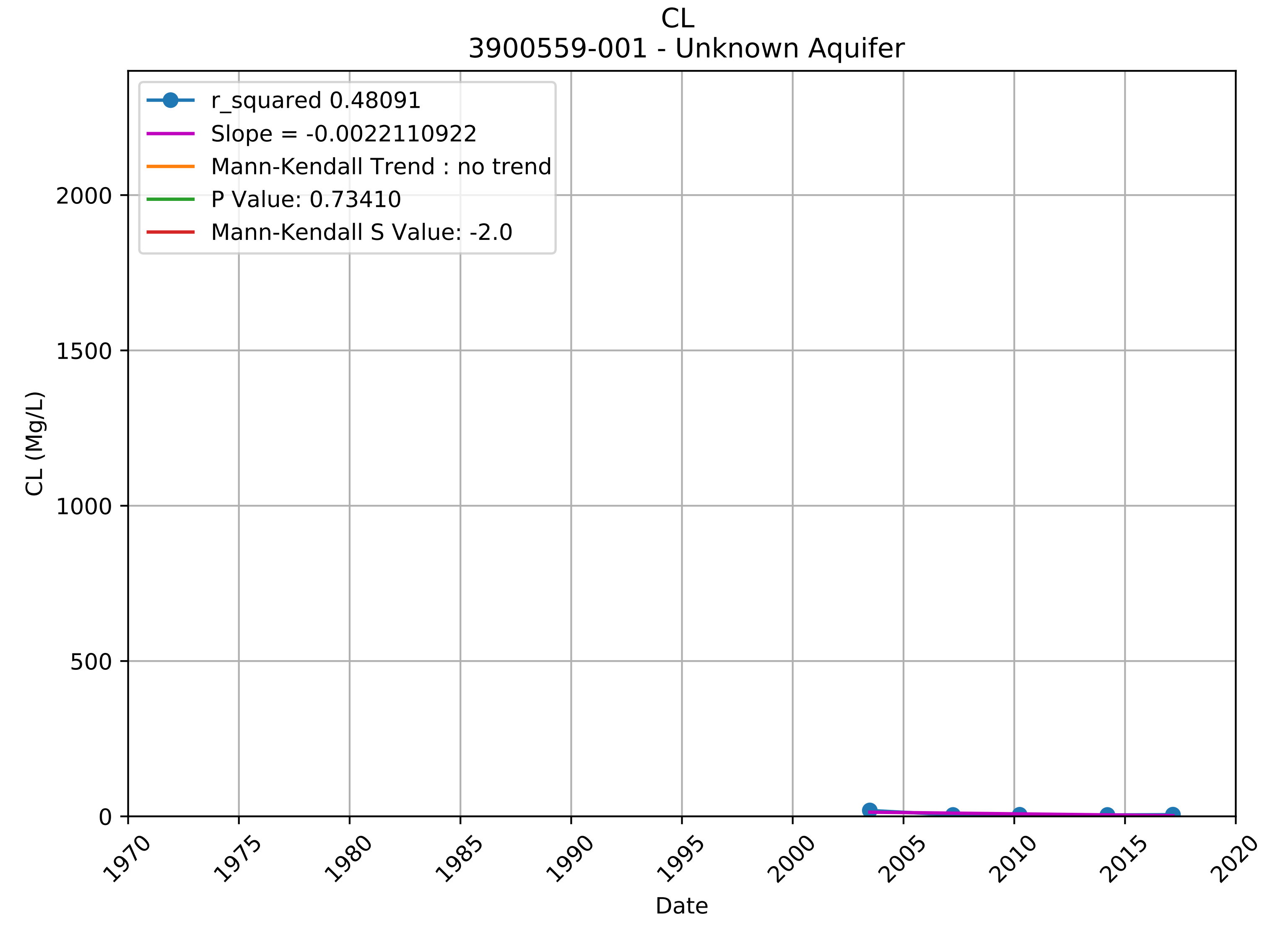
Date



CL
3900559-001 - Unknown Aquifer
r_squared 0.48091
Slope = -0.0022110922
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: -2.0
CL (Mg/L)
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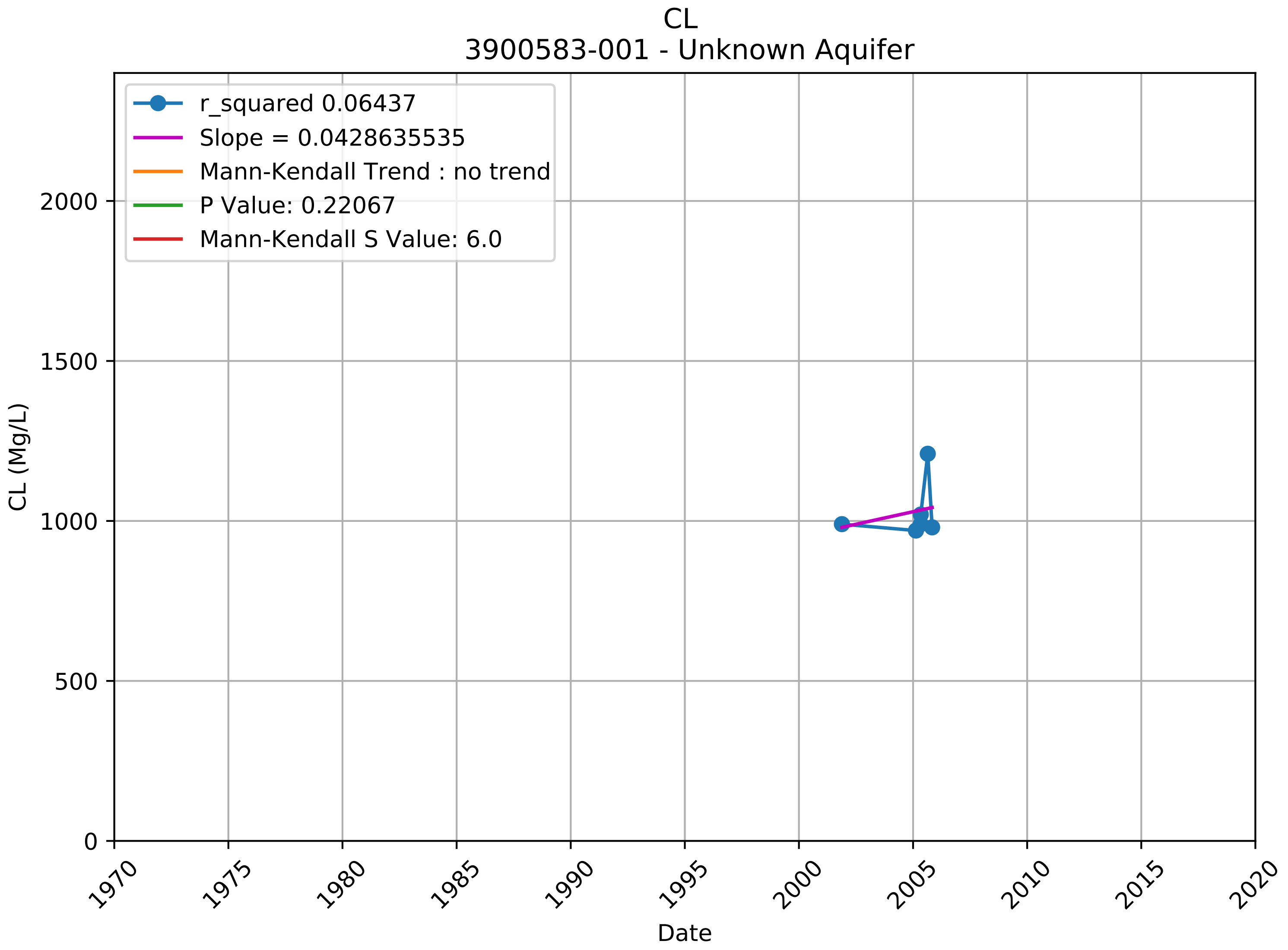
Date


CL
3900583-001 - Unknown Aquifer
r_squared 0.06437
Slope = 0.0428635535
Mann-Kendall Trend : no trend
P Value: 0.22067
Mann-Kendall S Value: 6.0
CL (Mg/L)
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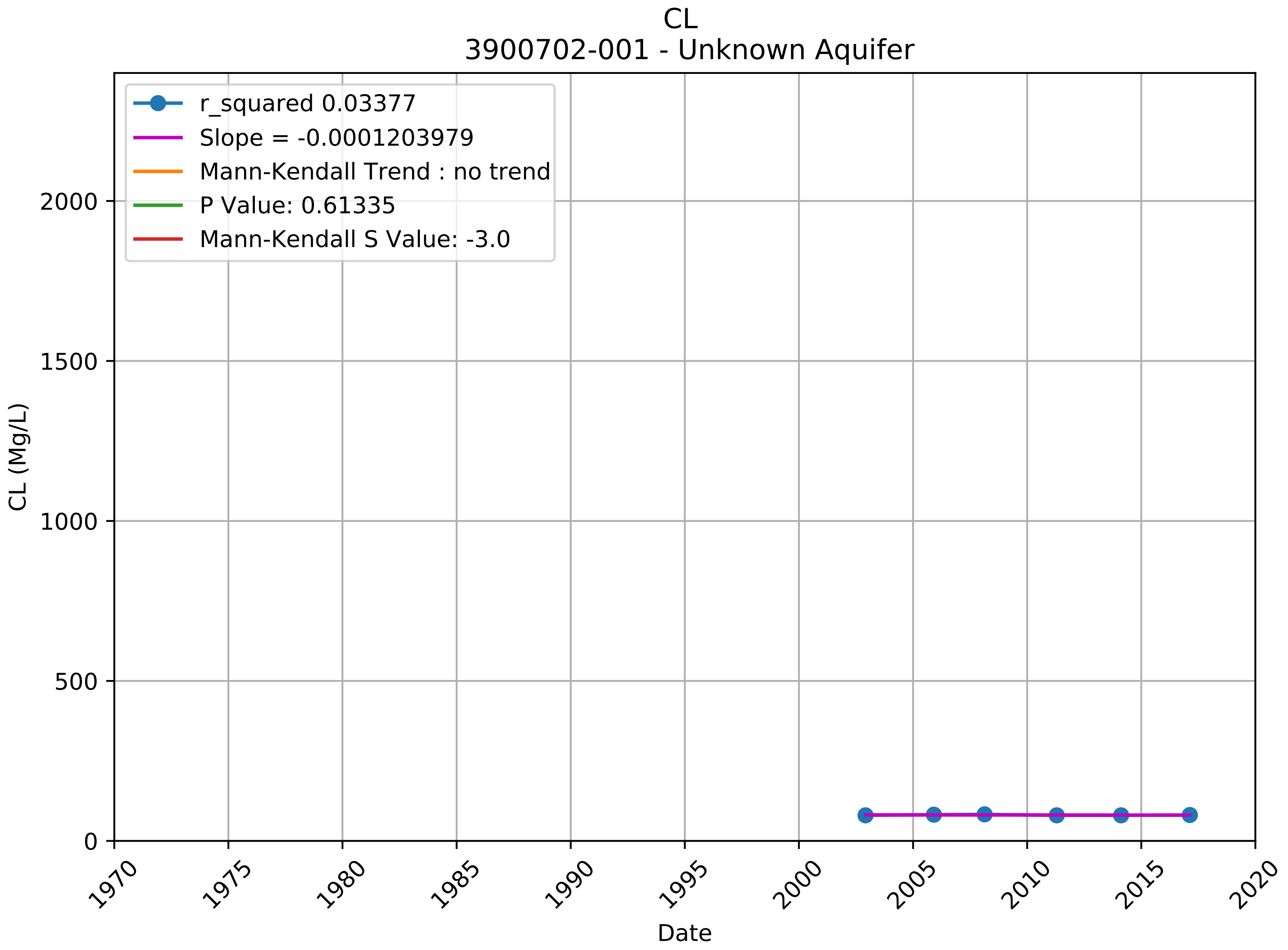
Date



CL
3900702-001 - Unknown Aquifer
r_squared 0.03377
Slope = -0.0001203979
Mann-Kendall Trend : no trend
P Value: 0.61335
Mann-Kendall S Value: -3.0
CL (Mg/L)
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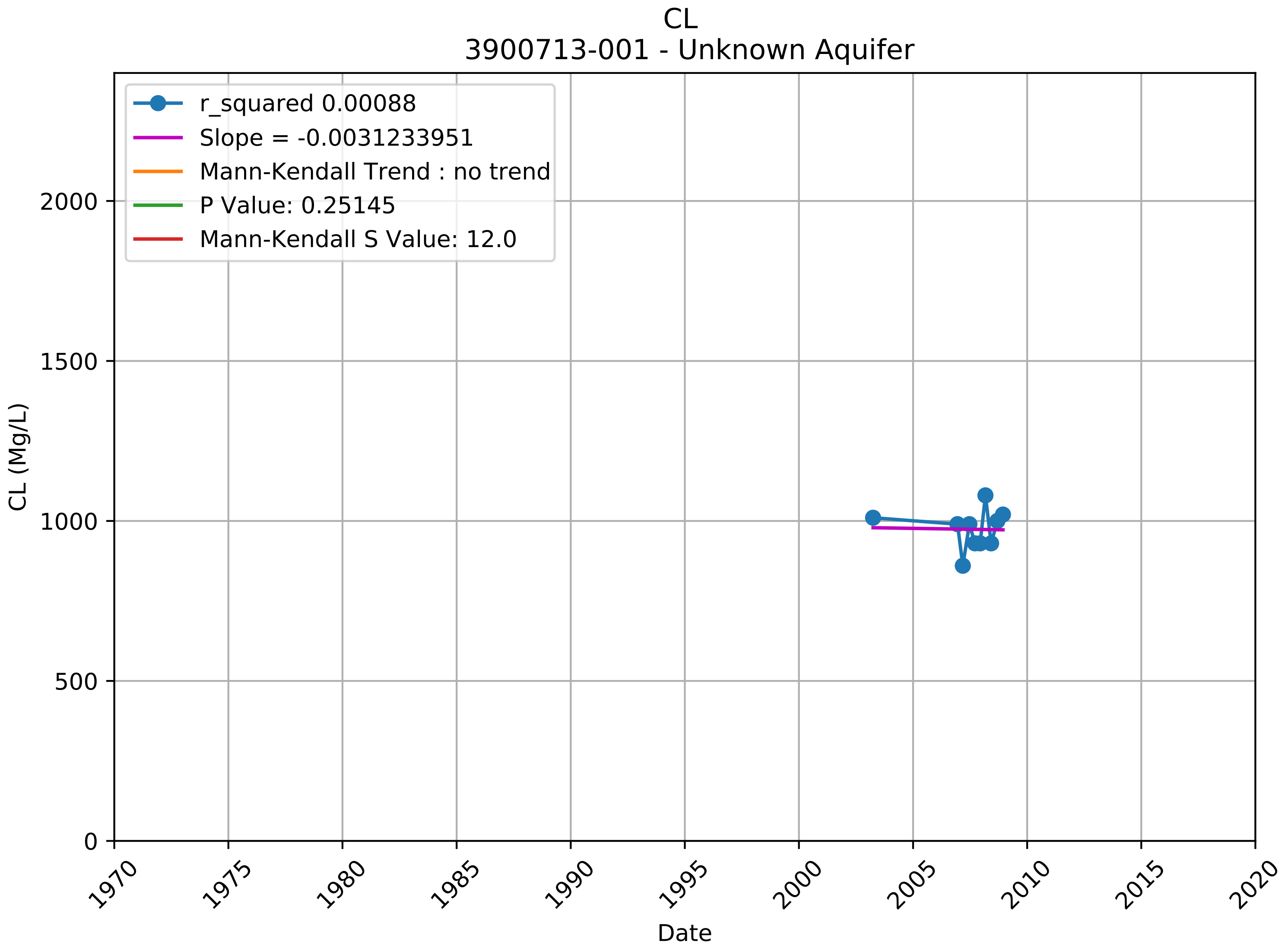
Date


CL
3900713-001 - Unknown Aquifer
r_squared 0.00088
Slope = -0.0031233951
Mann-Kendall Trend : no trend
P Value: 0.25145
Mann-Kendall S Value: 12.0
CL (Mg/L)
0
500
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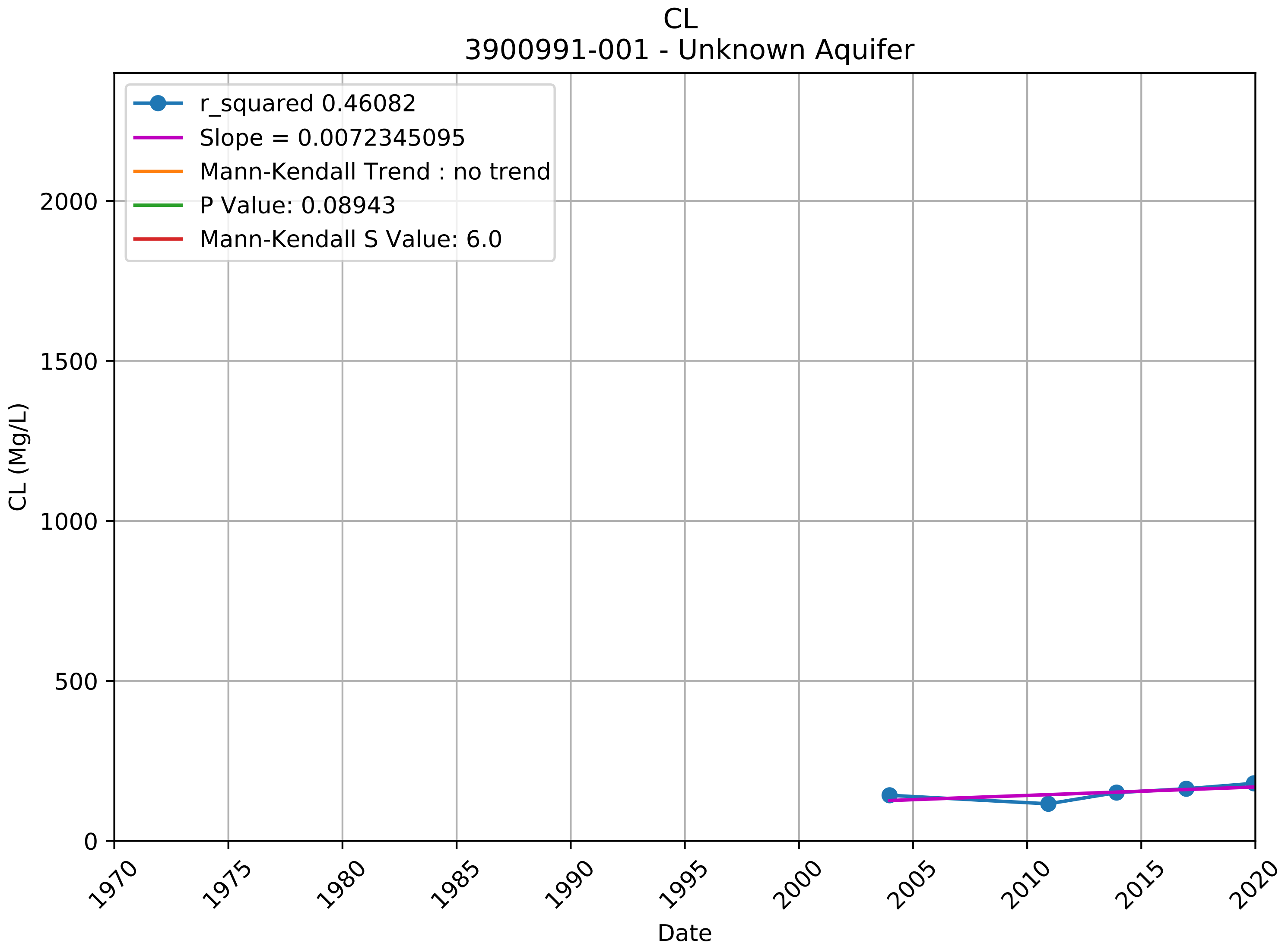

CL
3900991-001 - Unknown Aquifer
r_squared 0.46082
Slope = 0.0072345095
Mann-Kendall Trend : no trend
P Value: 0.08943
Mann-Kendall S Value: 6.0
CL (Mg/L)
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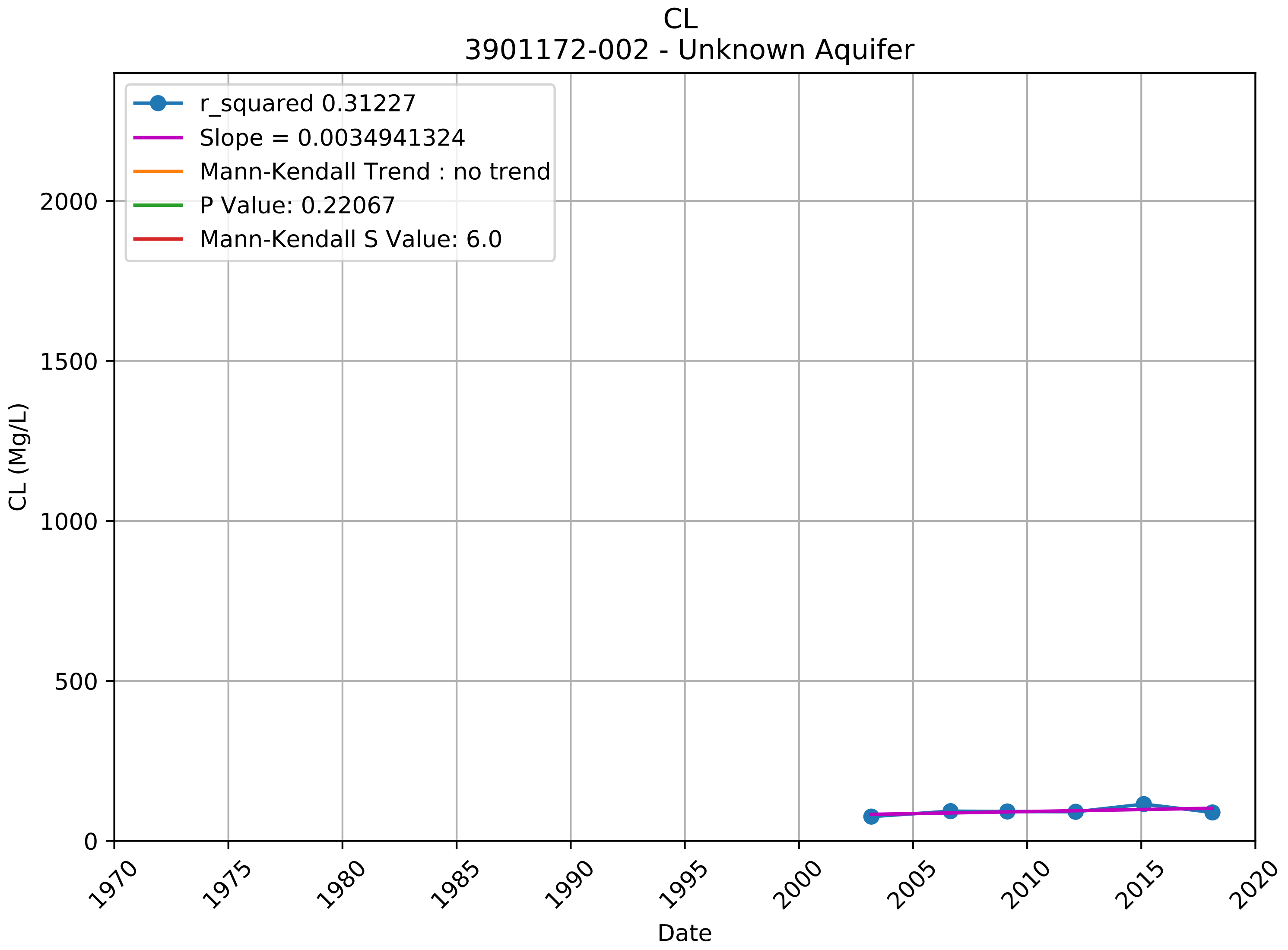

CL
3901172-002 - Unknown Aquifer
r_squared 0.31227
Slope = 0.0034941324
Mann-Kendall Trend : no trend
P Value: 0.22067
Mann-Kendall S Value: 6.0
CL (Mg/L)
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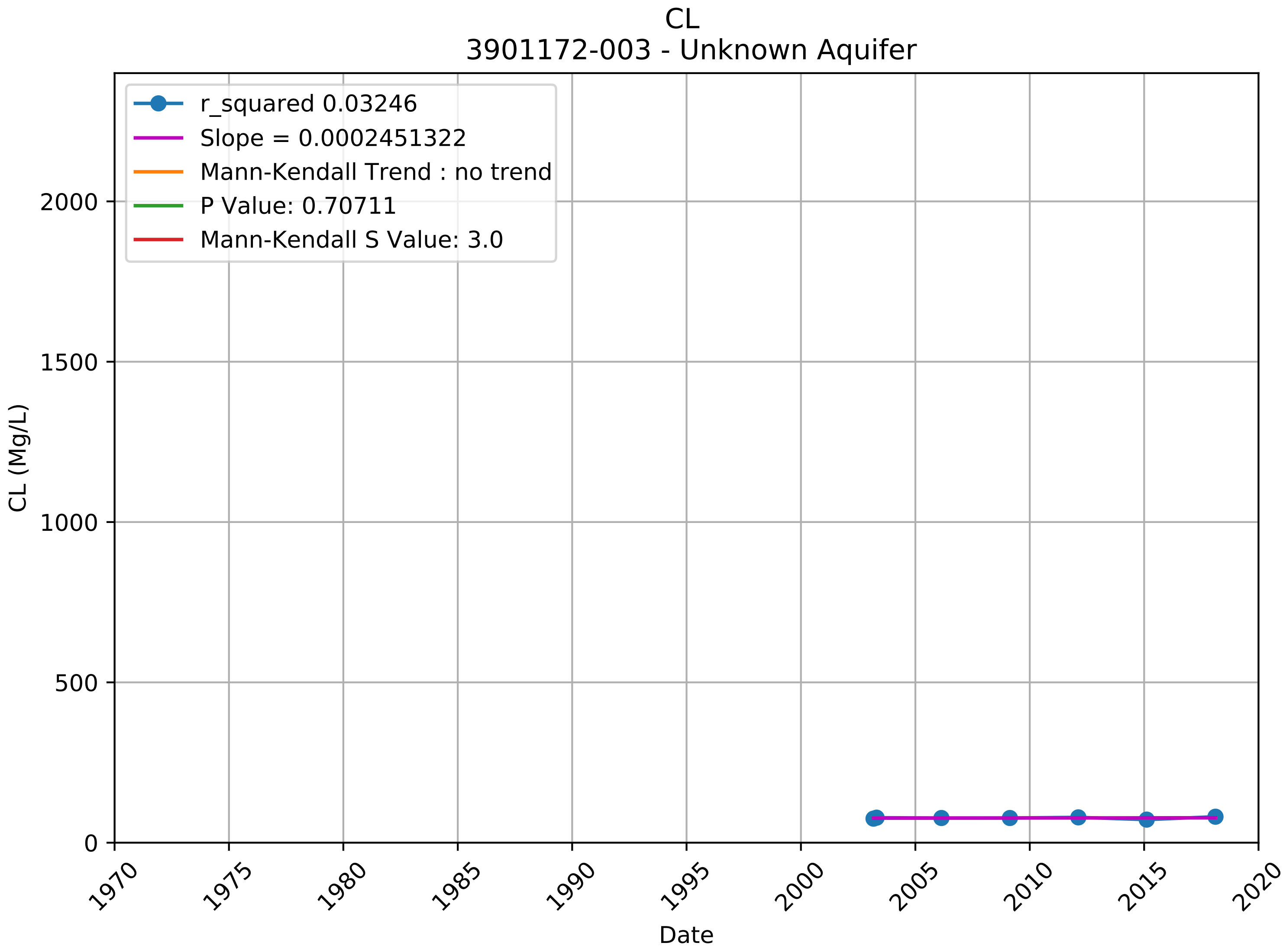
Date



CL
3901172-003 - Unknown Aquifer
r_squared 0.03246
Slope = 0.0002451322
Mann-Kendall Trend : no trend
P Value: 0.70711
Mann-Kendall S Value: 3.0
CL (Mg/L)
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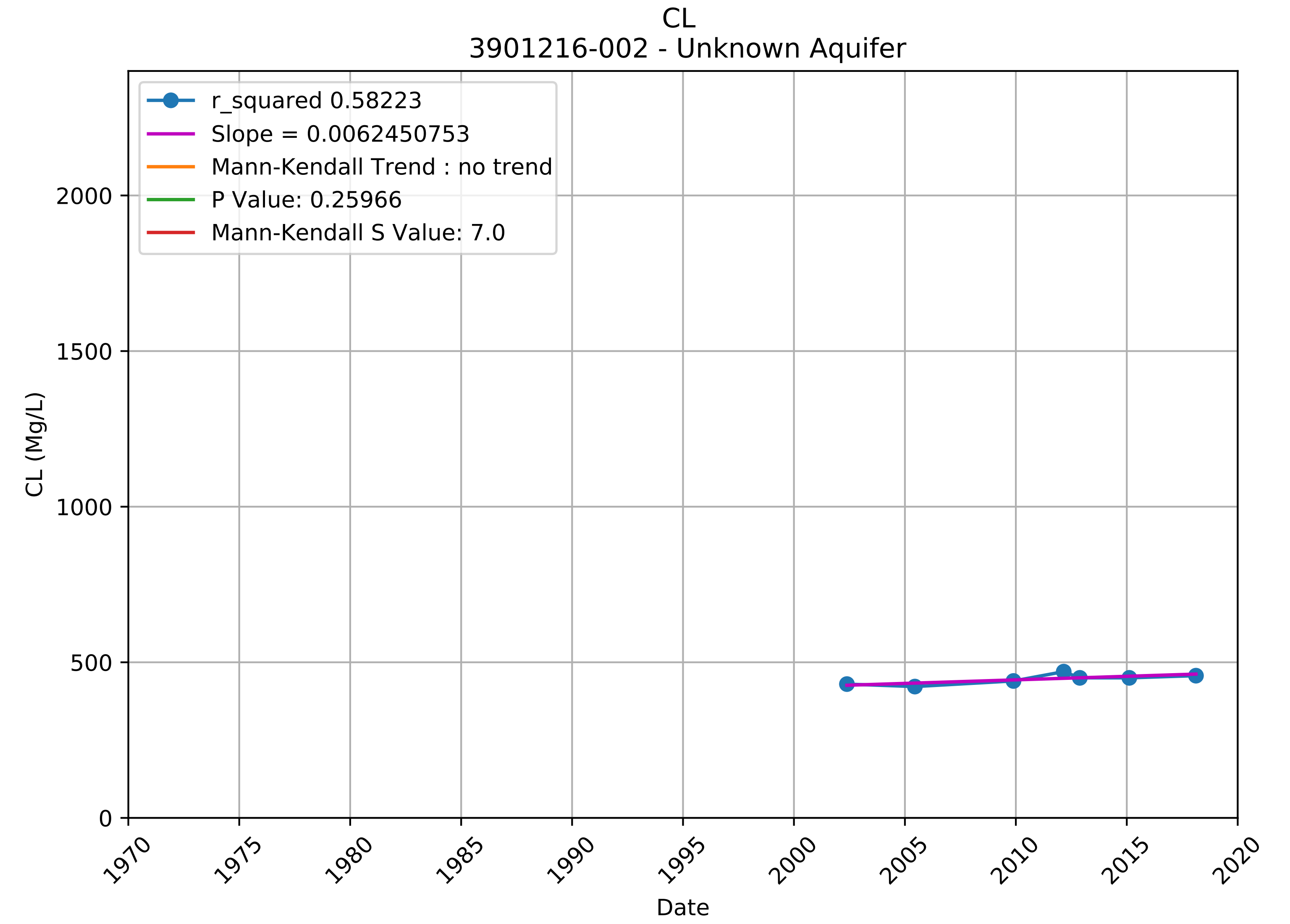
Date



CL
3901216-002 - Unknown Aquifer
r_squared 0.58223
Slope = 0.0062450753
Mann-Kendall Trend : no trend
P Value: 0.25966
Mann-Kendall S Value: 7.0
CL (Mg/L)
Date
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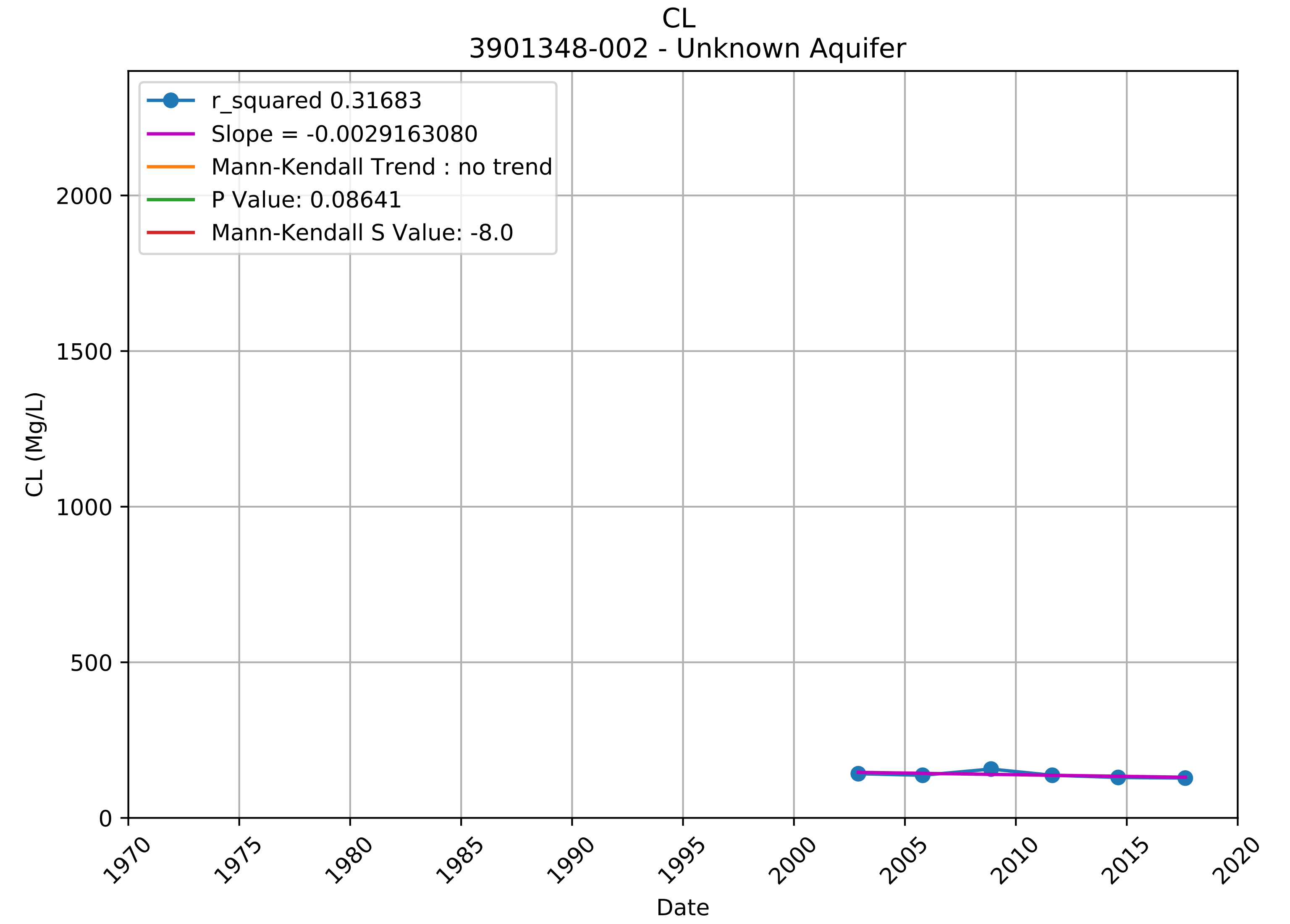

CL
3901348-002 - Unknown Aquifer
r_squared 0.31683
Slope = -0.0029163080
Mann-Kendall Trend : no trend
P Value: 0.08641
Mann-Kendall S Value: -8.0
CL (Mg/L)
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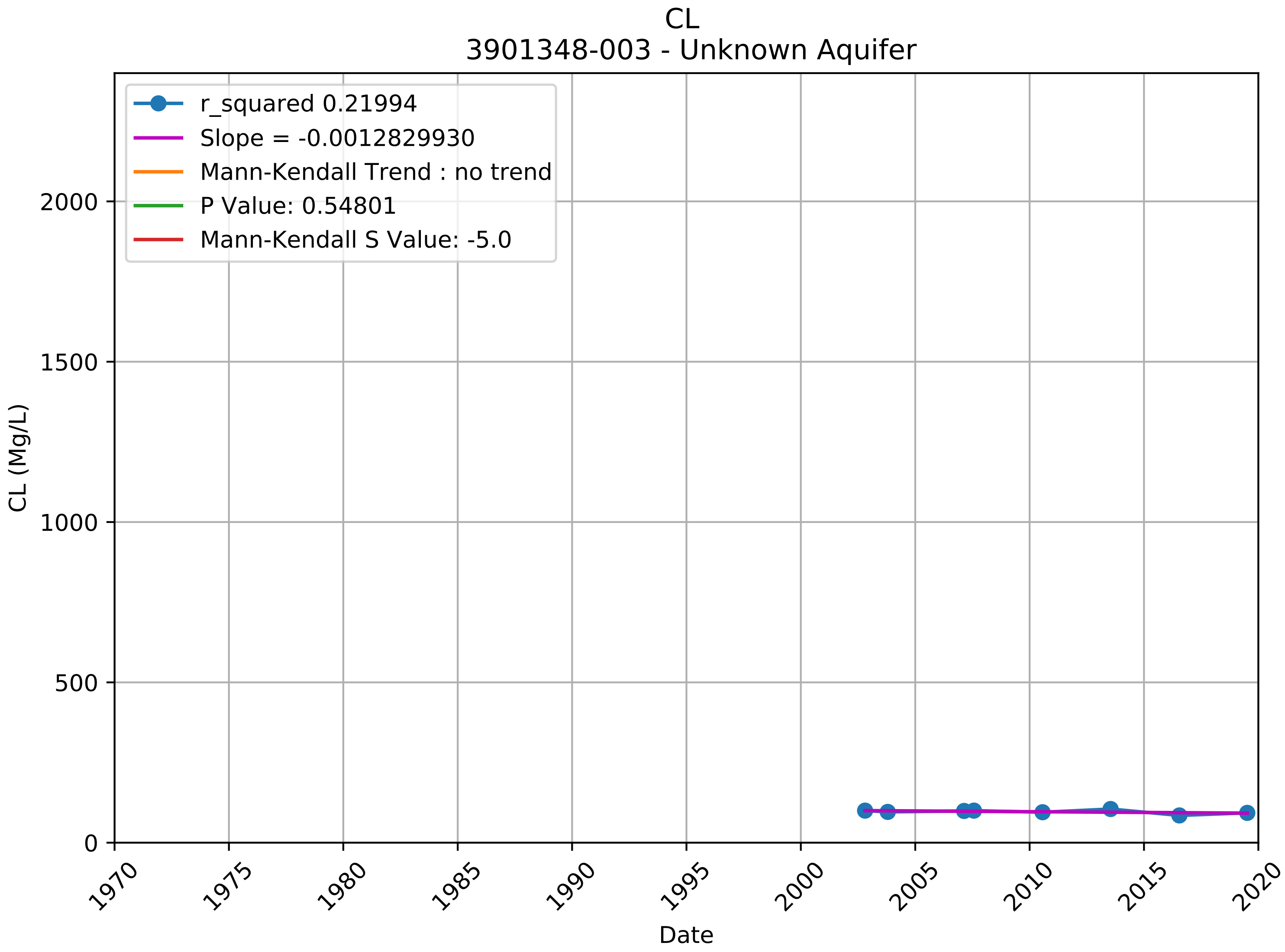
CL
3901348-003 - Unknown Aquifer
r_squared 0.21994
Slope = -0.0012829930
Mann-Kendall Trend : no trend
P Value: 0.54801
Mann-Kendall S Value: -5.0
CL (Mg/L)
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Date
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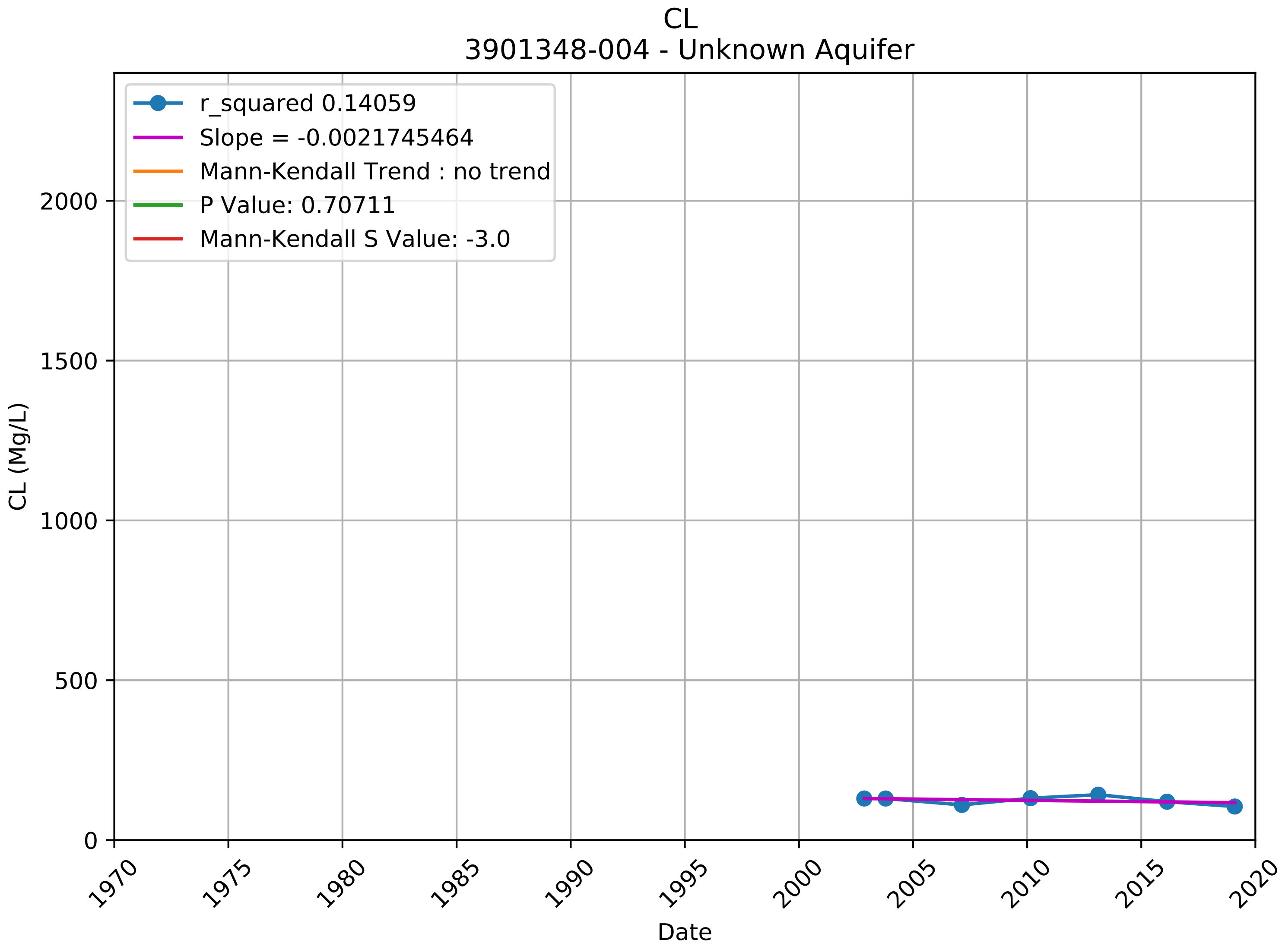

CL
3901348-004 - Unknown Aquifer
r_squared 0.14059
Slope = -0.0021745464
Mann-Kendall Trend : no trend
P Value: 0.70711
Mann-Kendall S Value: -3.0
CL (Mg/L)
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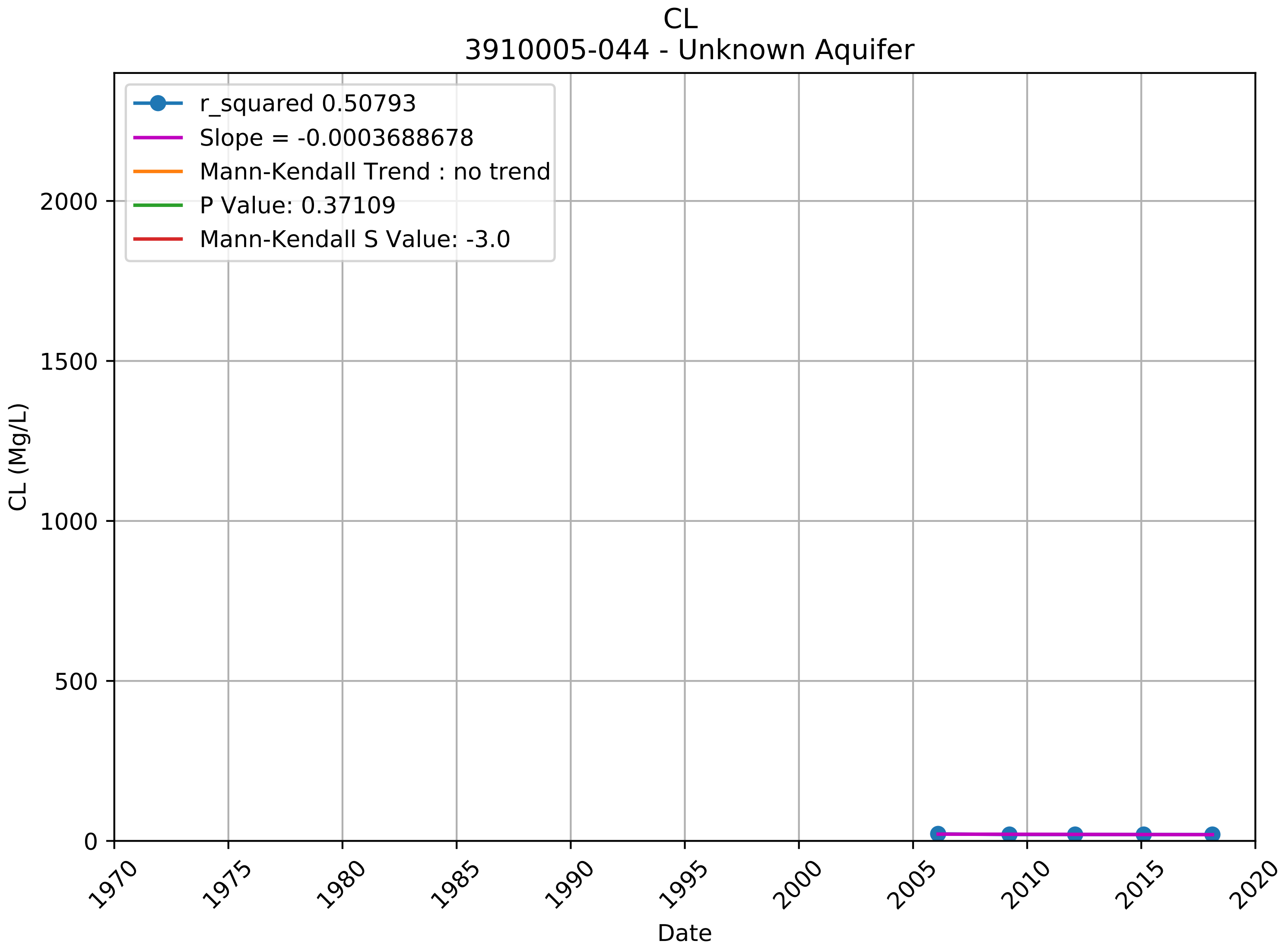

CL
3910005-044 - Unknown Aquifer
r_squared 0.50793
Slope = -0.0003688678
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: -3.0
CL (Mg/L)
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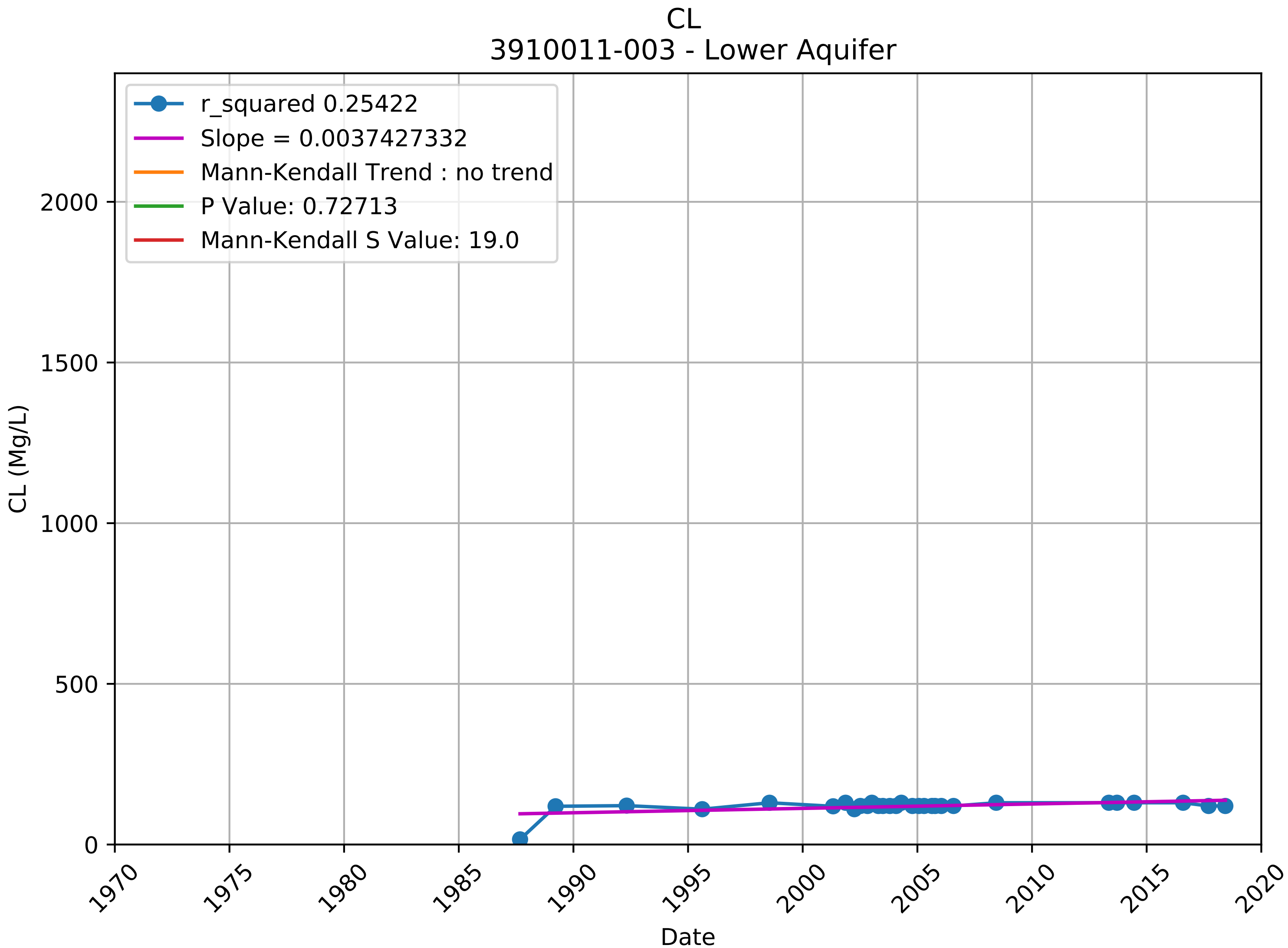
CL
3910011-003 - Lower Aquifer
r_squared 0.25422
Slope = 0.0037427332
Mann-Kendall Trend : no trend
P Value: 0.72713
Mann-Kendall S Value: 19.0
CL (Mg/L)
Date
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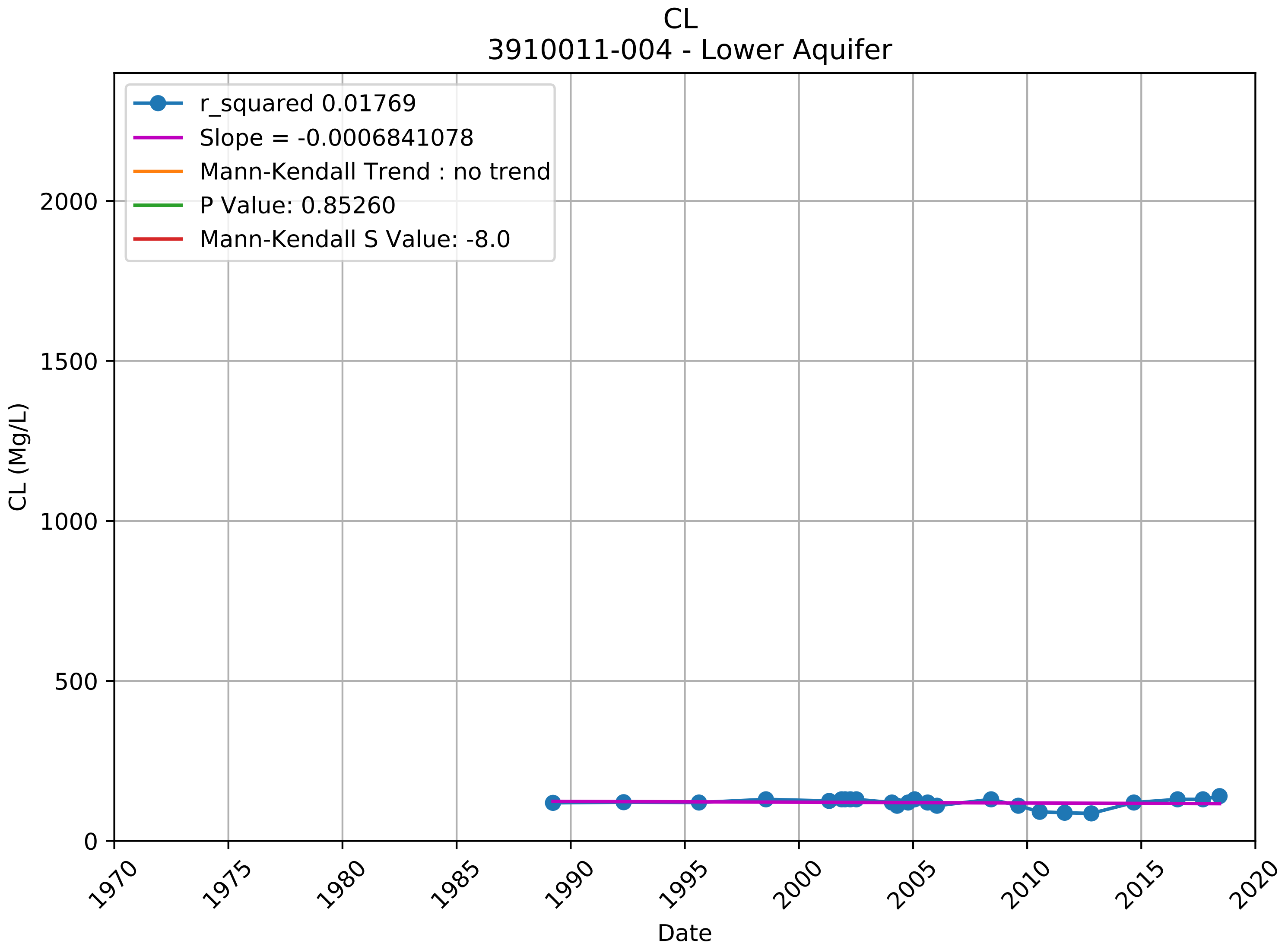

CL
3910011-004 - Lower Aquifer
r_squared 0.01769
Slope = -0.0006841078
Mann-Kendall Trend : no trend
P Value: 0.85260
Mann-Kendall S Value: -8.0
CL (Mg/L)
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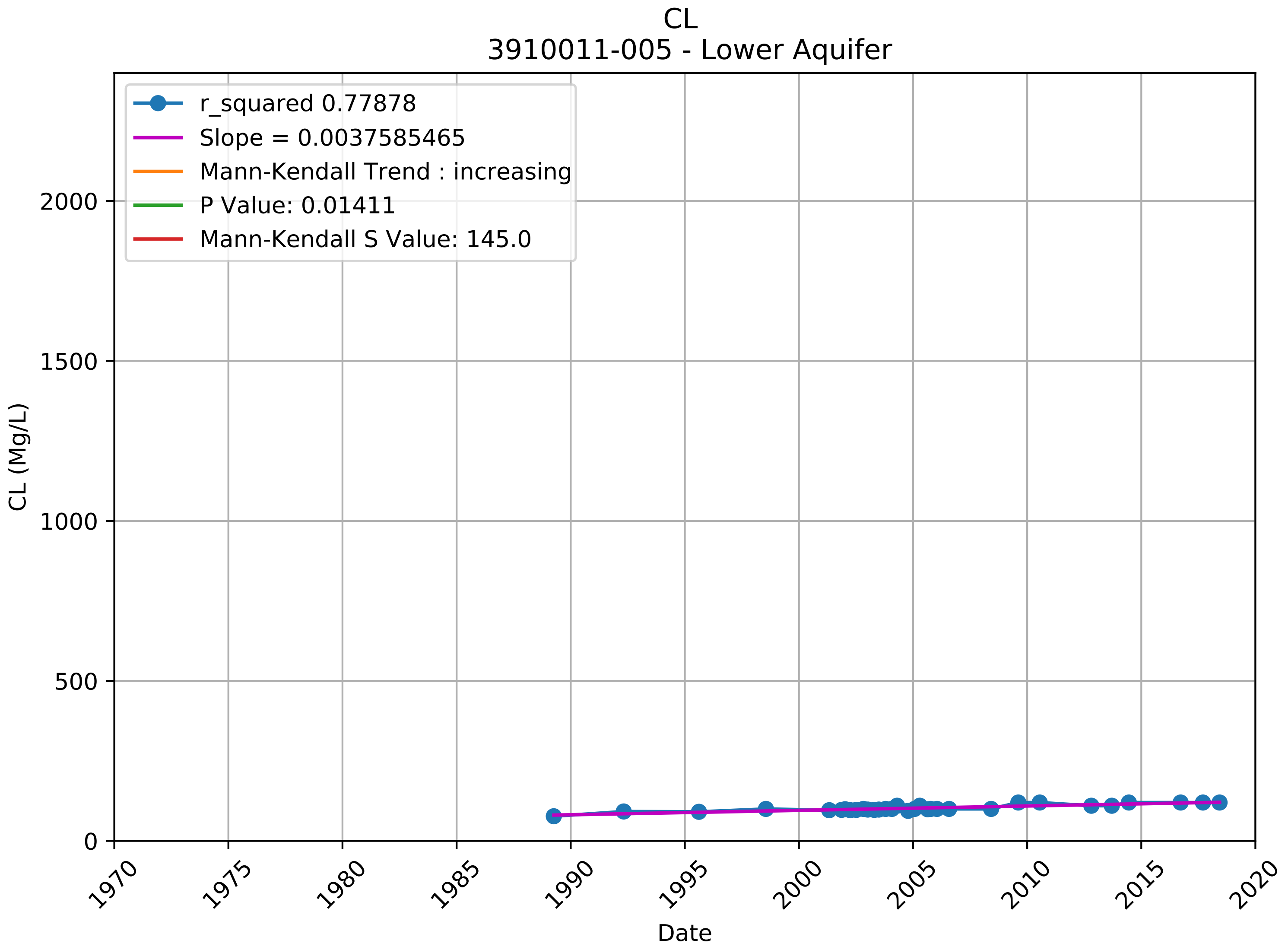
Date


CL
3910011-005 - Lower Aquifer
r_squared 0.77878
Slope = 0.0037585465
Mann-Kendall Trend : increasing
P Value: 0.01411
Mann-Kendall S Value: 145.0
CL (Mg/L)
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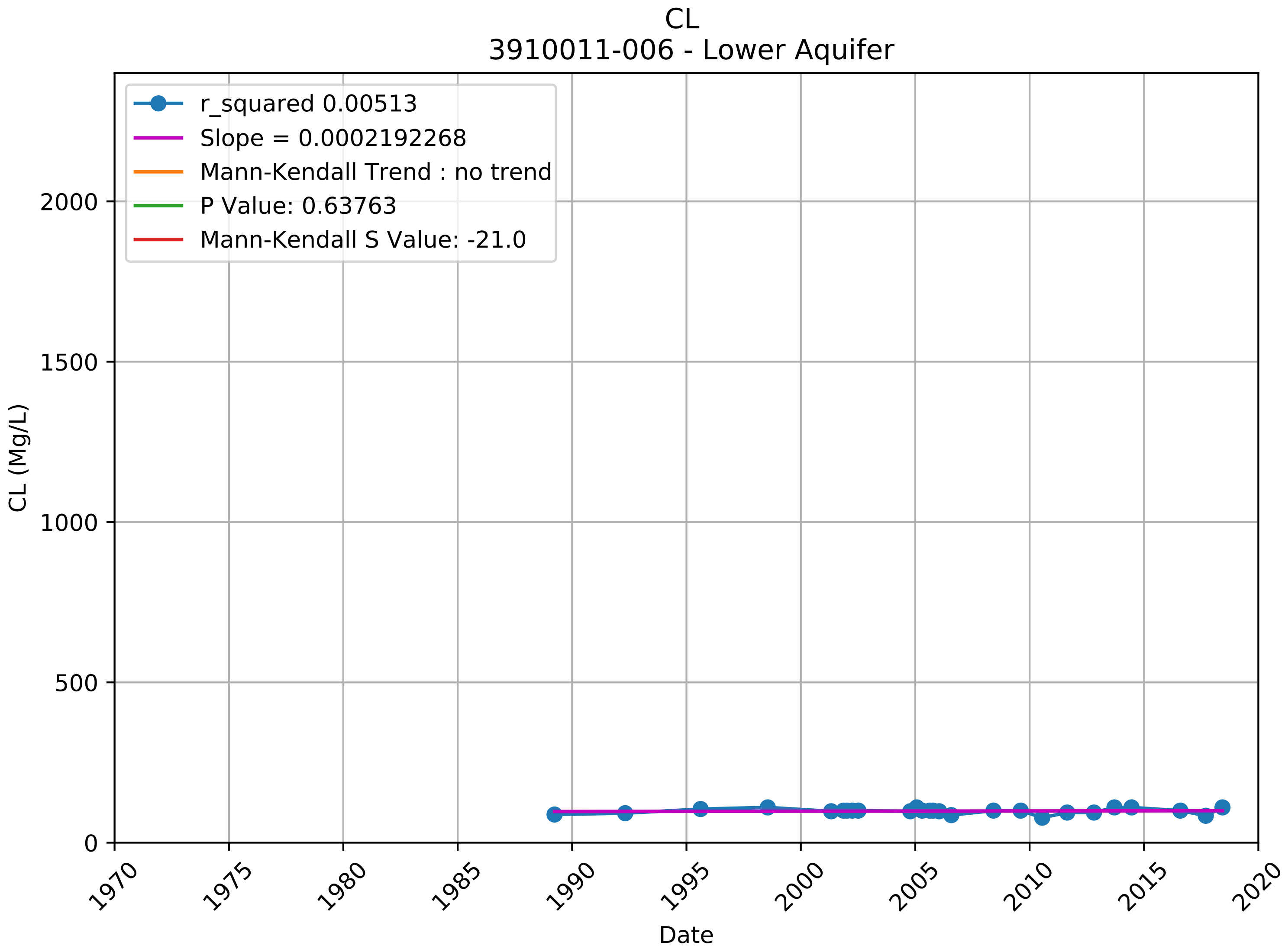
Date



CL
3910011-006 - Lower Aquifer
r_squared 0.00513
Slope = 0.0002192268
Mann-Kendall Trend : no trend
P Value: 0.63763
Mann-Kendall S Value: -21.0
CL (Mg/L)
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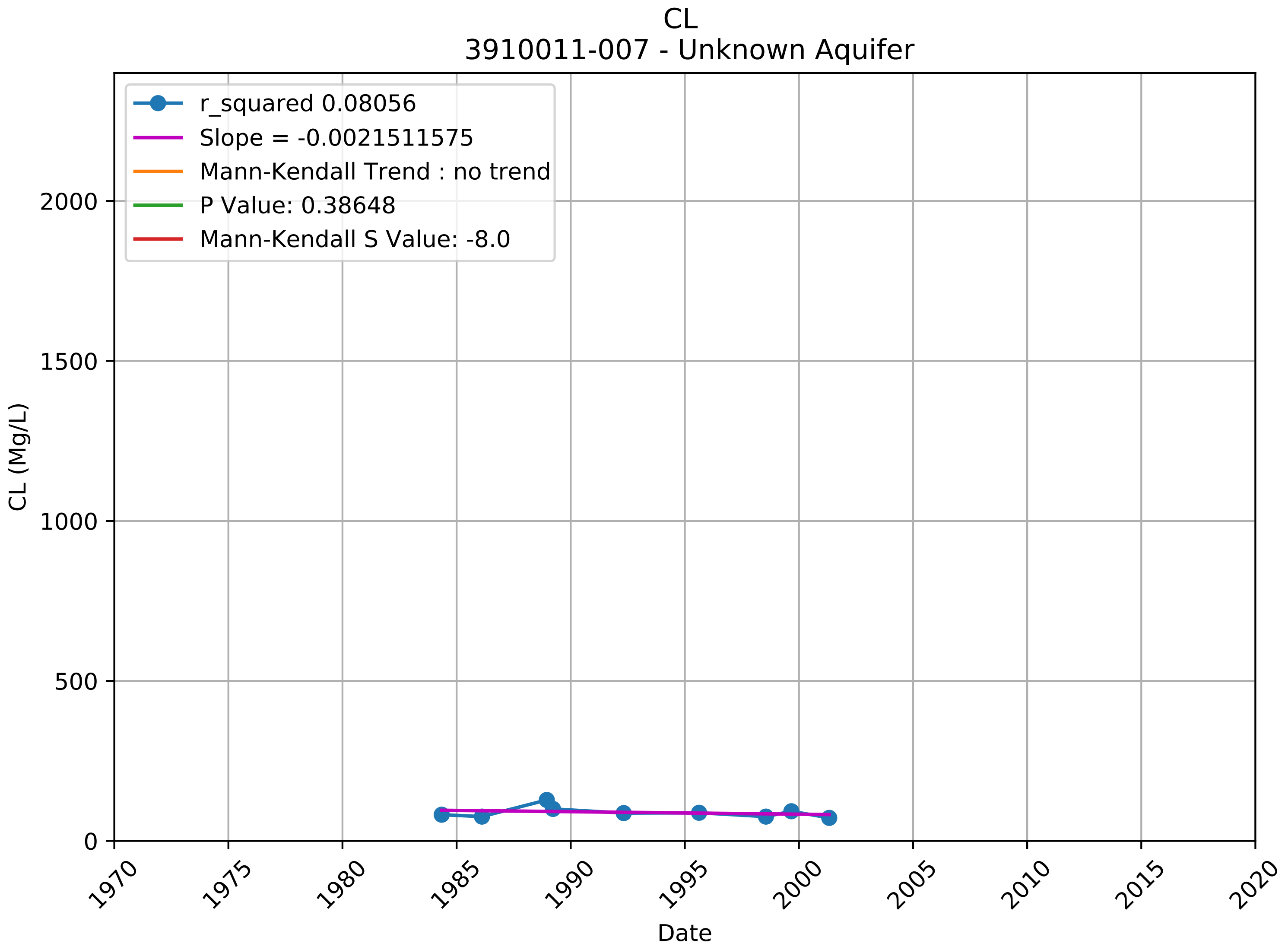

CL
3910011-007 - Unknown Aquifer
r_squared 0.08056
Slope = -0.0021511575
Mann-Kendall Trend : no trend
P Value: 0.38648
Mann-Kendall S Value: -8.0
CL (Mg/L)
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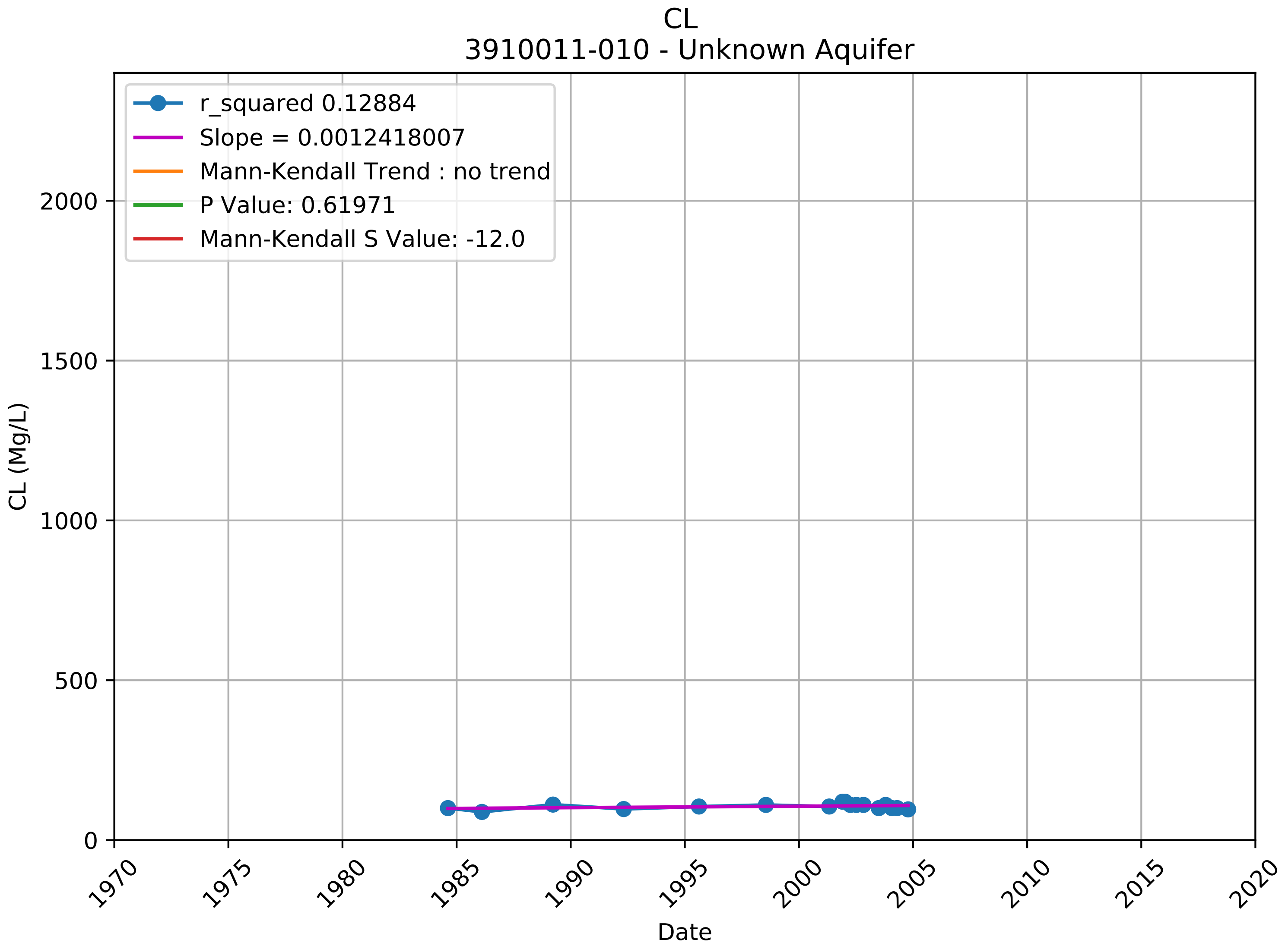
CL
3910011-010 - Unknown Aquifer
r_squared 0.12884
Slope = 0.0012418007
Mann-Kendall Trend : no trend
P Value: 0.61971
Mann-Kendall S Value: -12.0
CL (Mg/L)
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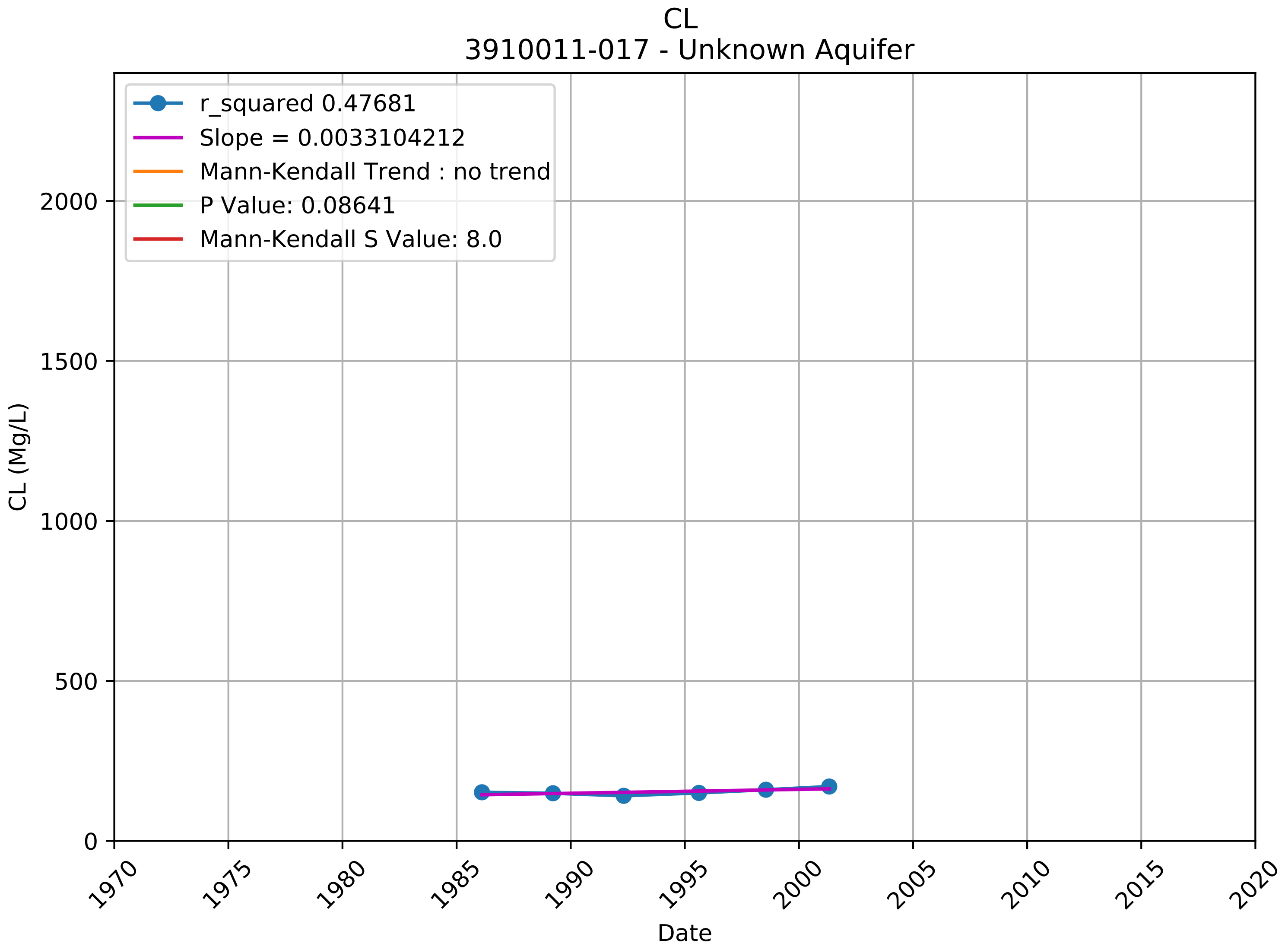

CL
3910011-017 - Unknown Aquifer
r_squared 0.47681
Slope = 0.0033104212
Mann-Kendall Trend : no trend
P Value: 0.08641
Mann-Kendall S Value: 8.0
CL (Mg/L)
Date
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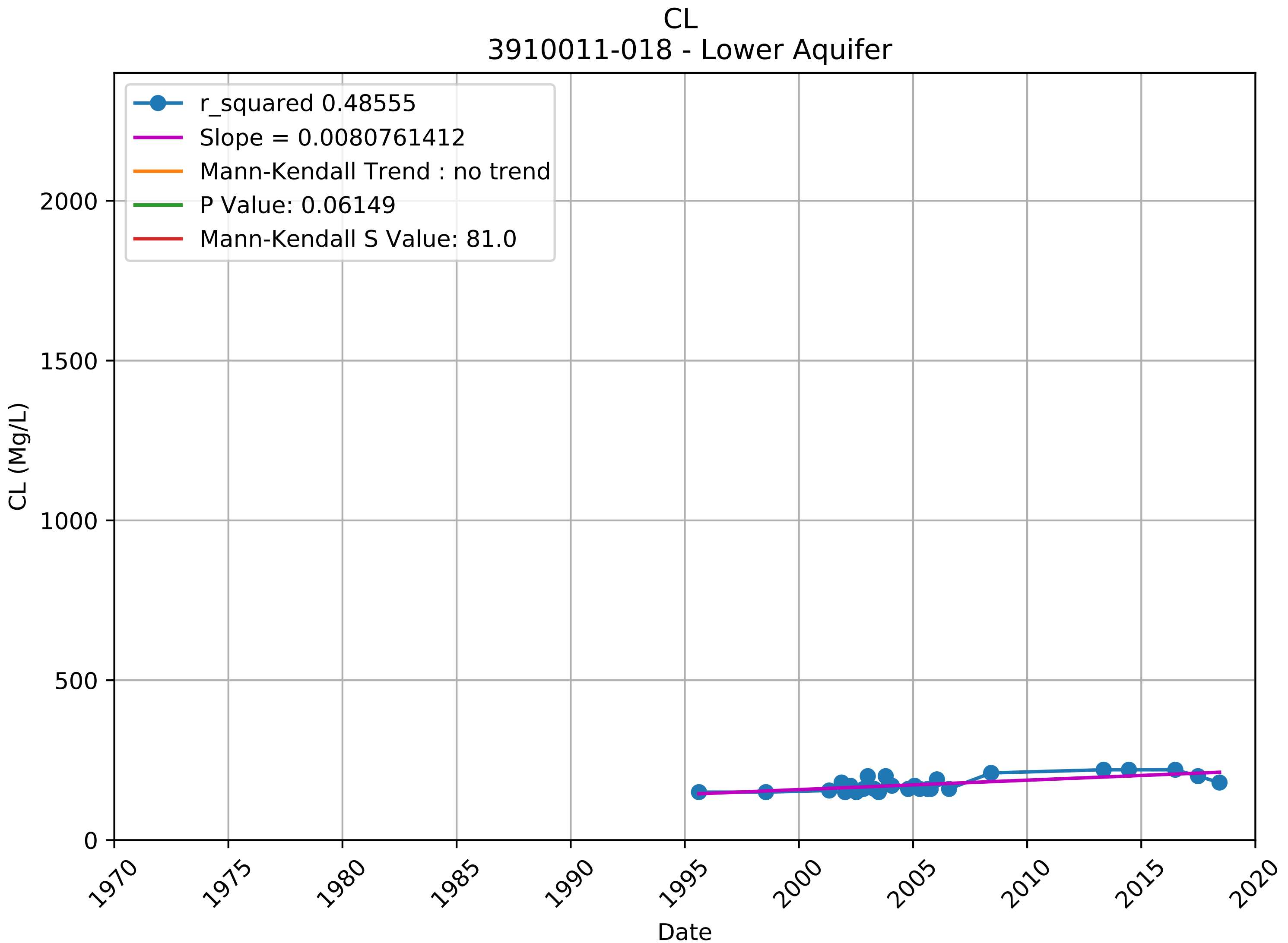

CL
3910011-018 - Lower Aquifer
r_squared 0.48555
Slope = 0.0080761412
Mann-Kendall Trend : no trend
P Value: 0.06149
Mann-Kendall S Value: 81.0
CL (Mg/L)
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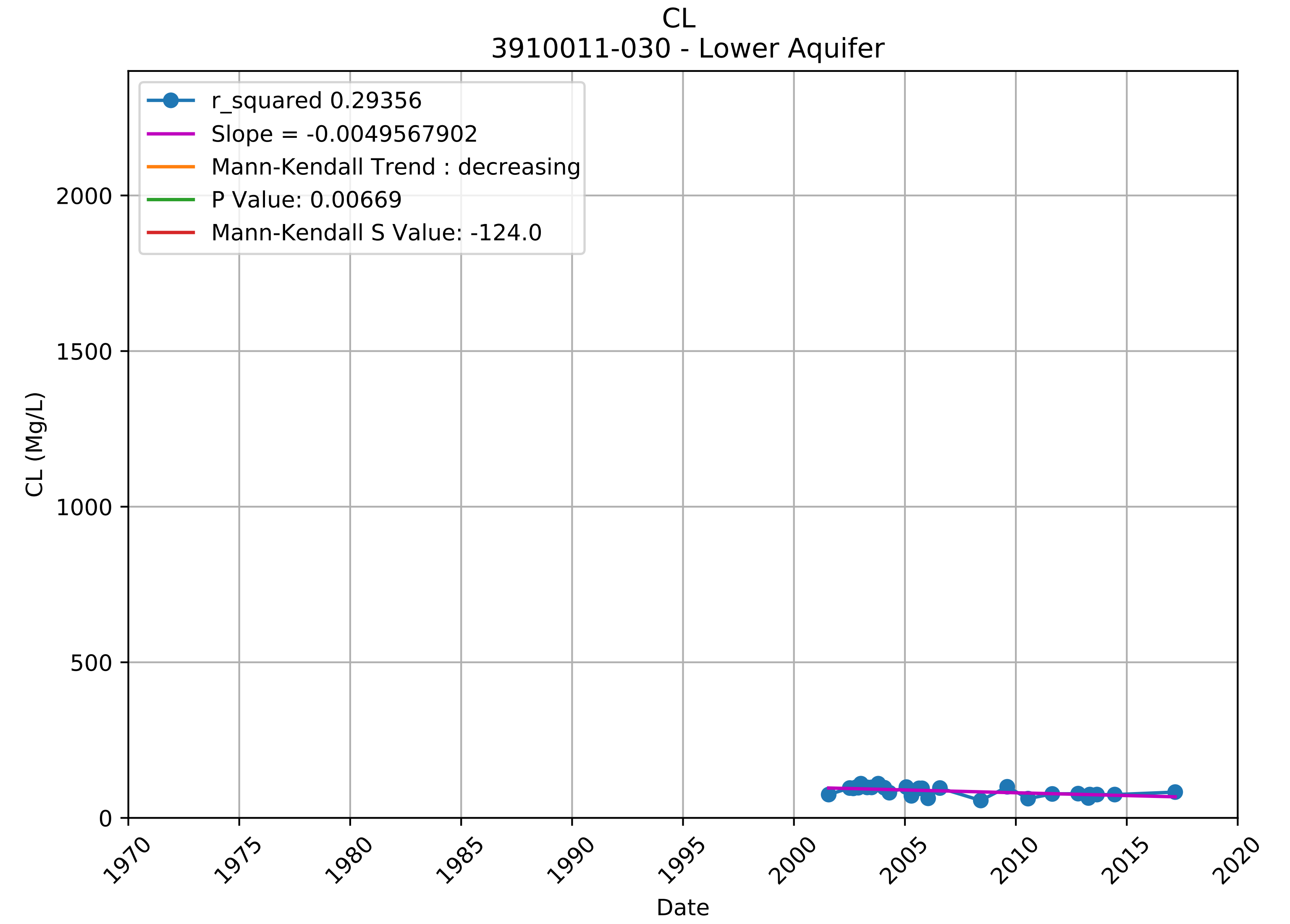
Date



CL
3910011-030 - Lower Aquifer
r_squared 0.29356
Slope = -0.0049567902
Mann-Kendall Trend : decreasing
P Value: 0.00669
Mann-Kendall S Value: -124.0
CL (Mg/L)
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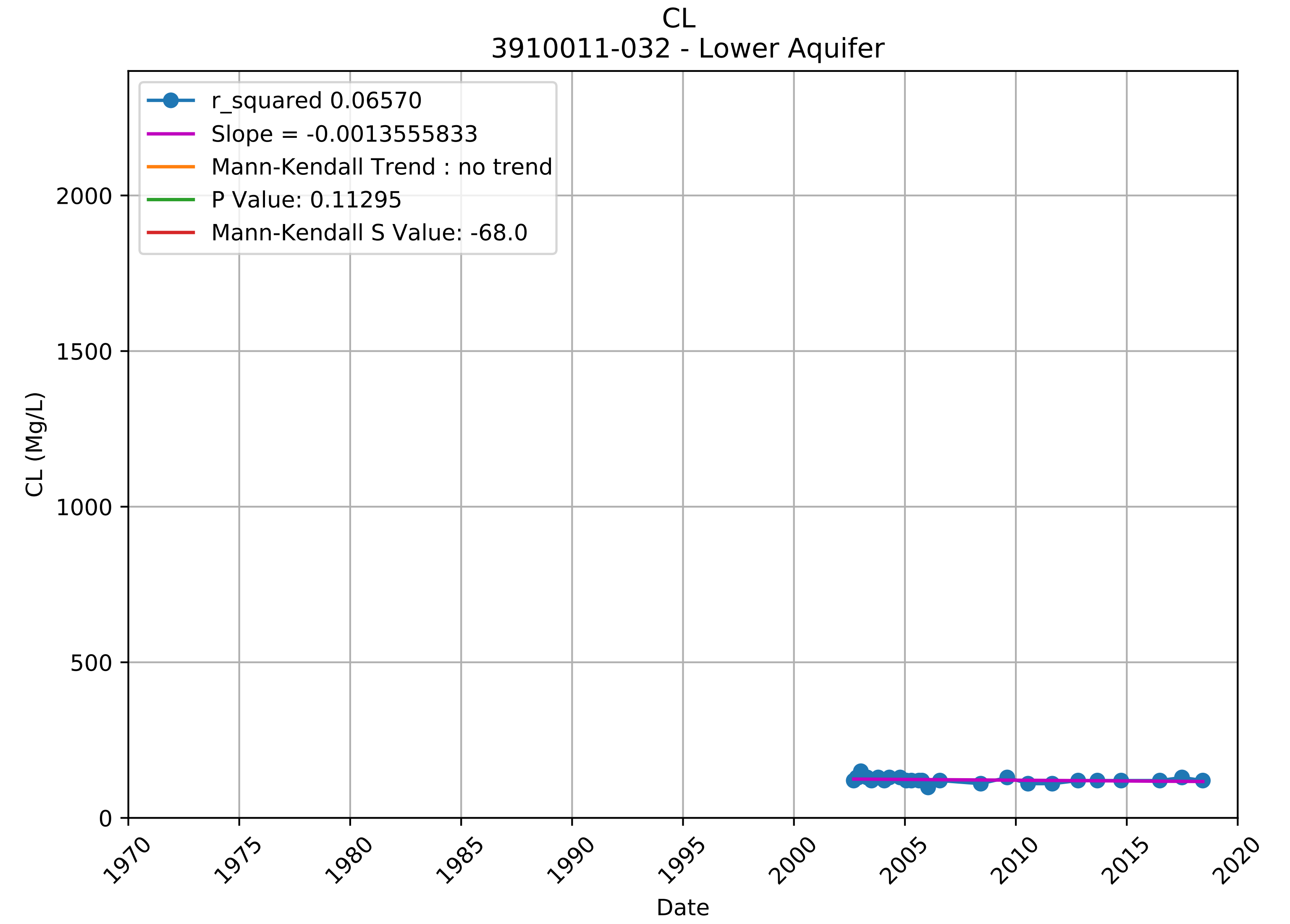

CL
3910011-032 - Lower Aquifer
r_squared 0.06570
Slope = -0.0013555833
Mann-Kendall Trend : no trend
P Value: 0.11295
Mann-Kendall S Value: -68.0
CL (Mg/L)
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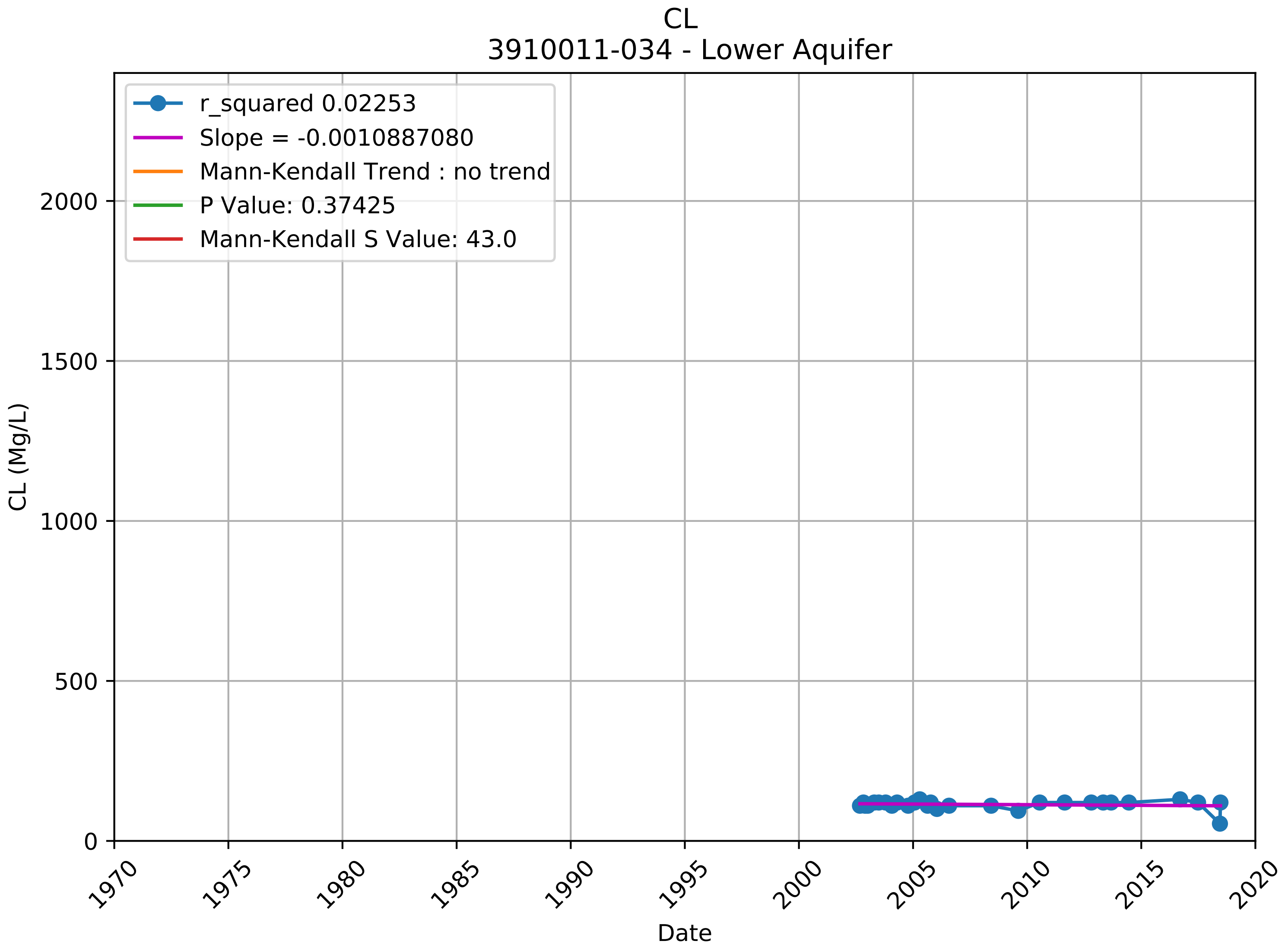

CL
3910011-034 - Lower Aquifer
r_squared 0.02253
Slope = -0.0010887080
Mann-Kendall Trend : no trend
P Value: 0.37425
Mann-Kendall S Value: 43.0
CL (Mg/L)
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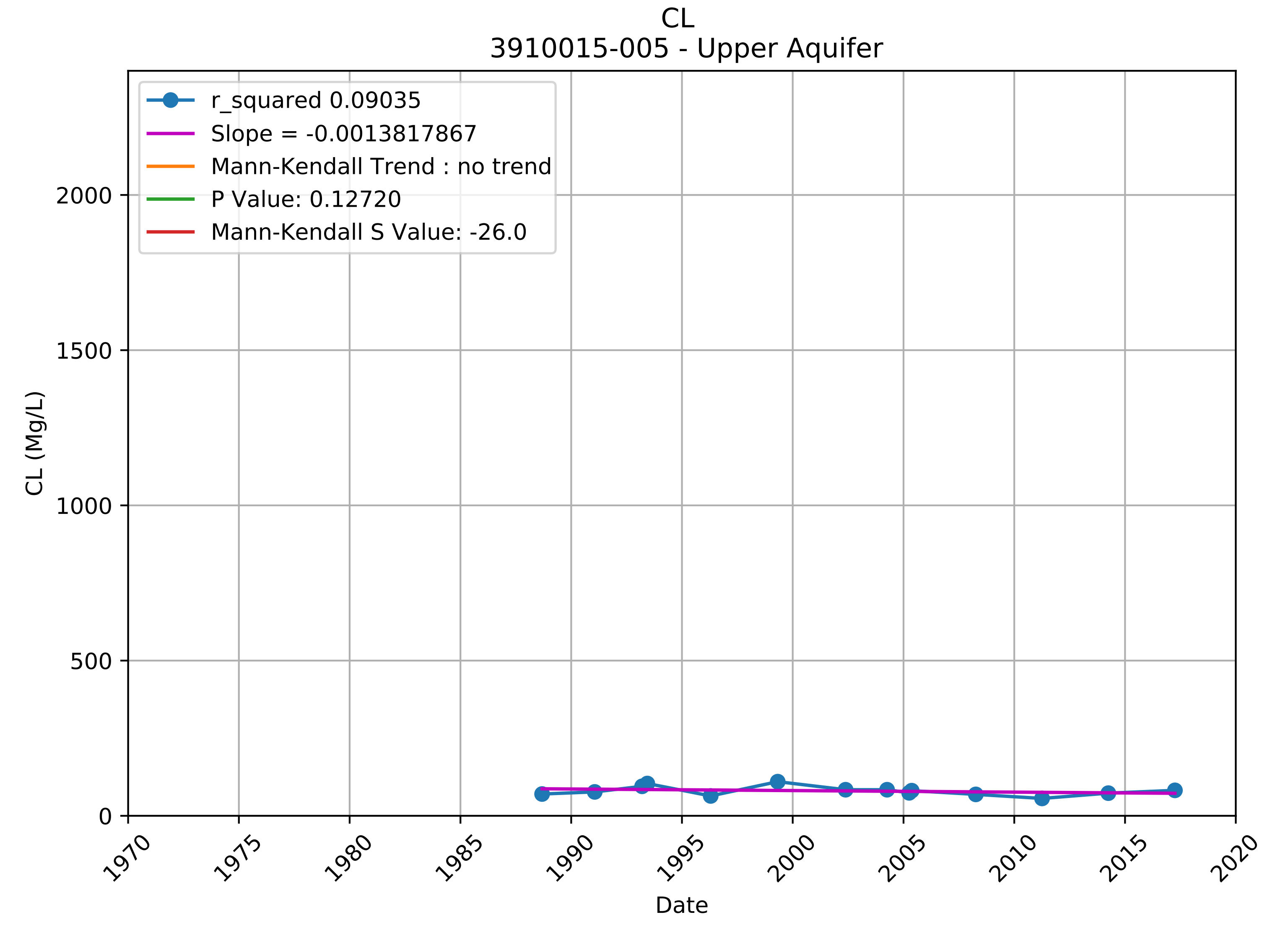
Date



CL
3910015-005 - Upper Aquifer
r_squared 0.09035
Slope = -0.0013817867
Mann-Kendall Trend : no trend
P Value: 0.12720
Mann-Kendall S Value: -26.0
CL (Mg/L)
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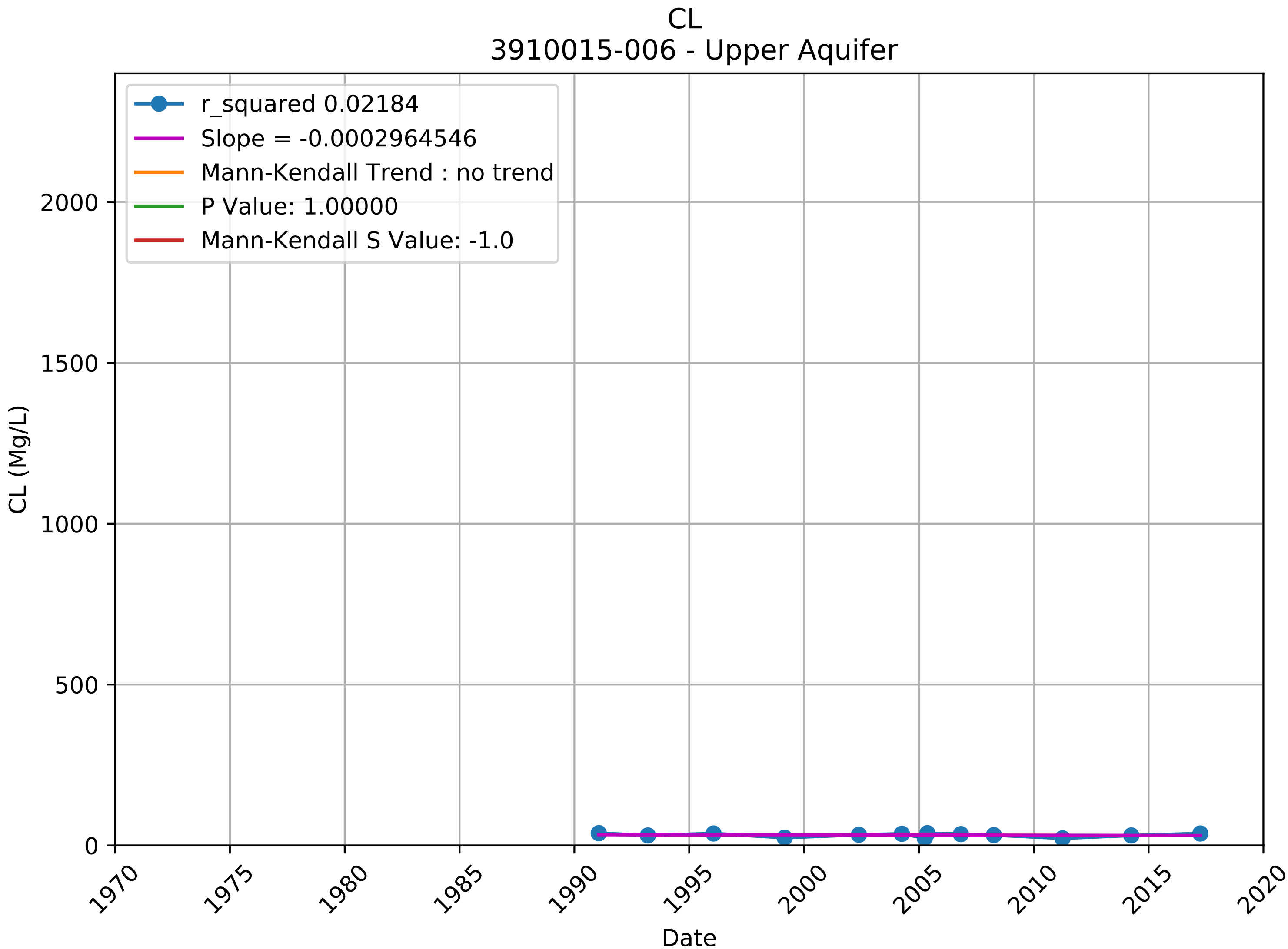

CL
3910015-006 - Upper Aquifer
r_squared 0.02184
Slope = -0.0002964546
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
CL (Mg/L)
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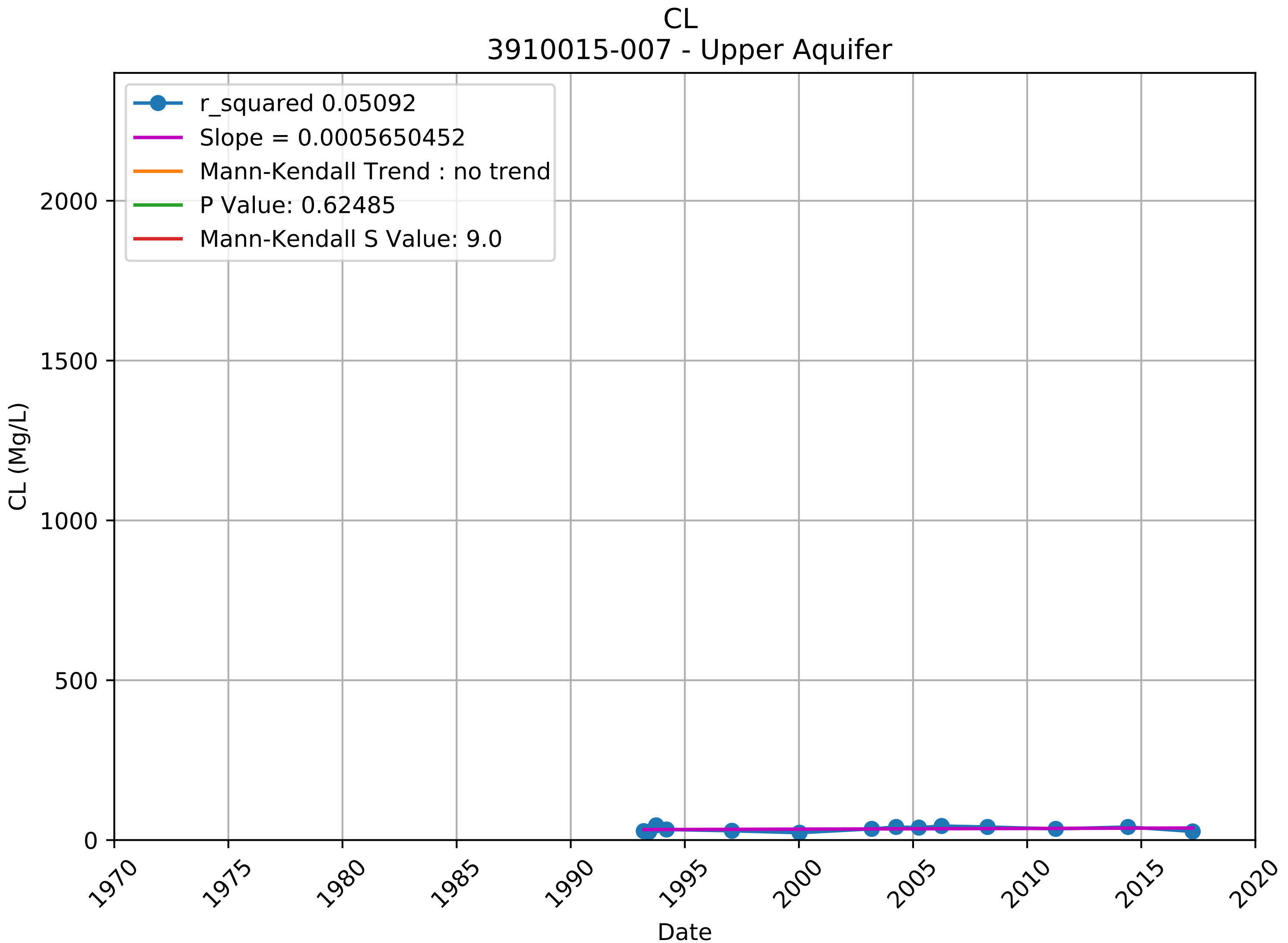

CL
3910015-007 - Upper Aquifer
r_squared 0.05092
Slope = 0.0005650452
Mann-Kendall Trend : no trend
P Value: 0.62485
Mann-Kendall S Value: 9.0
CL (Mg/L)
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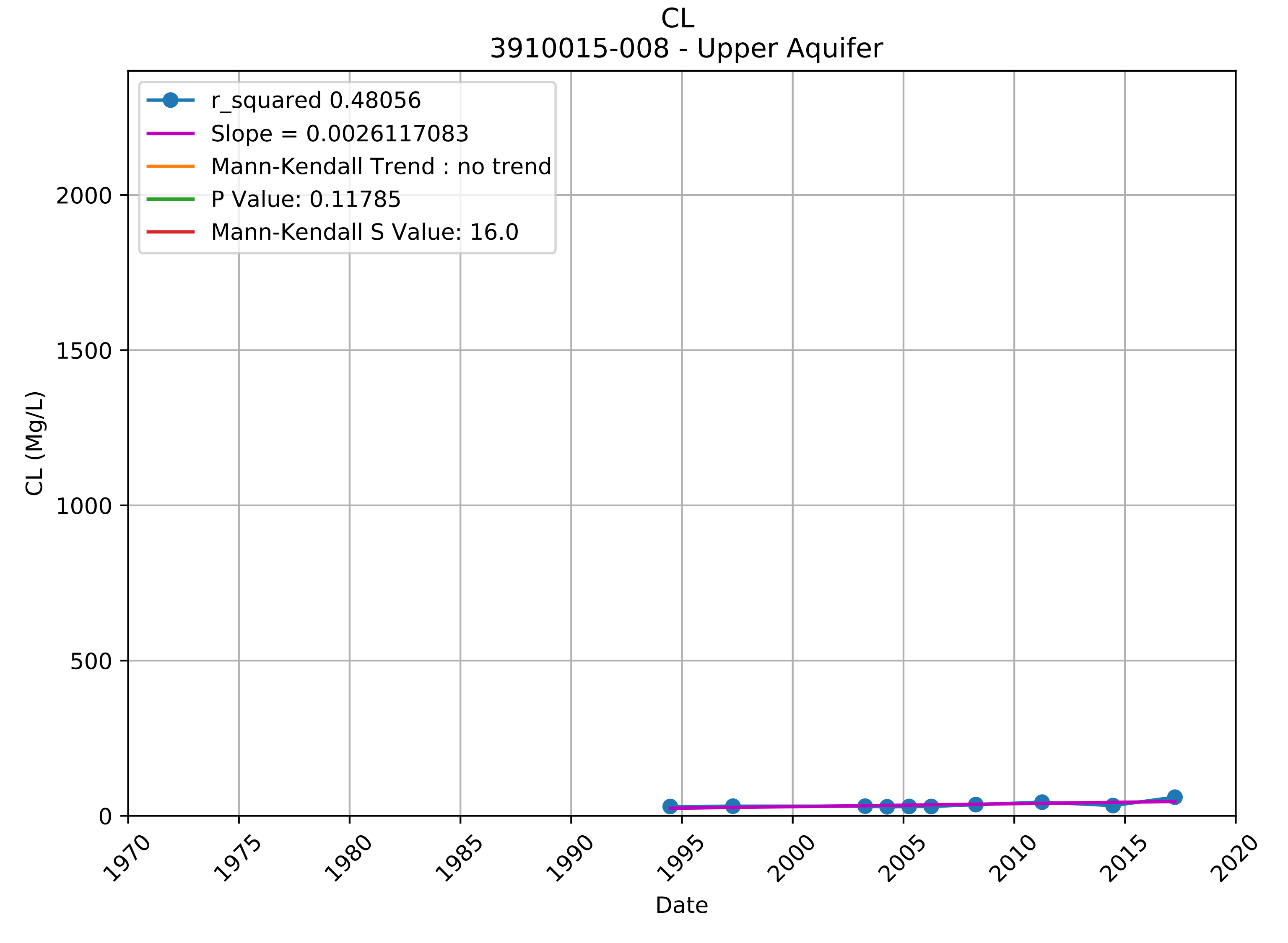
CL
3910015-008 - Upper Aquifer
r_squared 0.48056
Slope = 0.0026117083
Mann-Kendall Trend : no trend
P Value: 0.11785
Mann-Kendall S Value: 16.0
CL (Mg/L)
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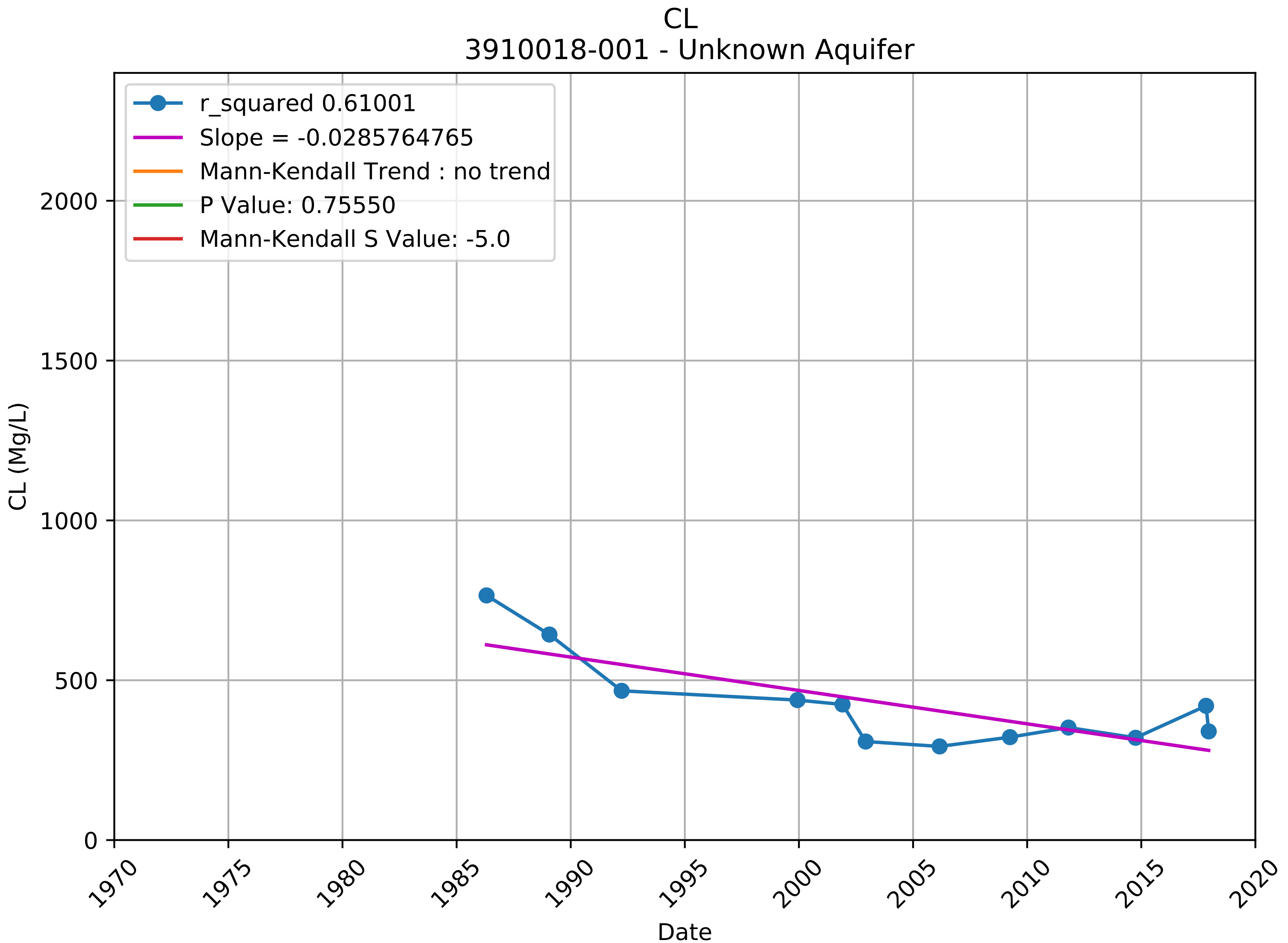

CL
3910018-001 - Unknown Aquifer
r_squared 0.61001
Slope = -0.0285764765
Mann-Kendall Trend : no trend
P Value: 0.75550
Mann-Kendall S Value: -5.0
CL (Mg/L)
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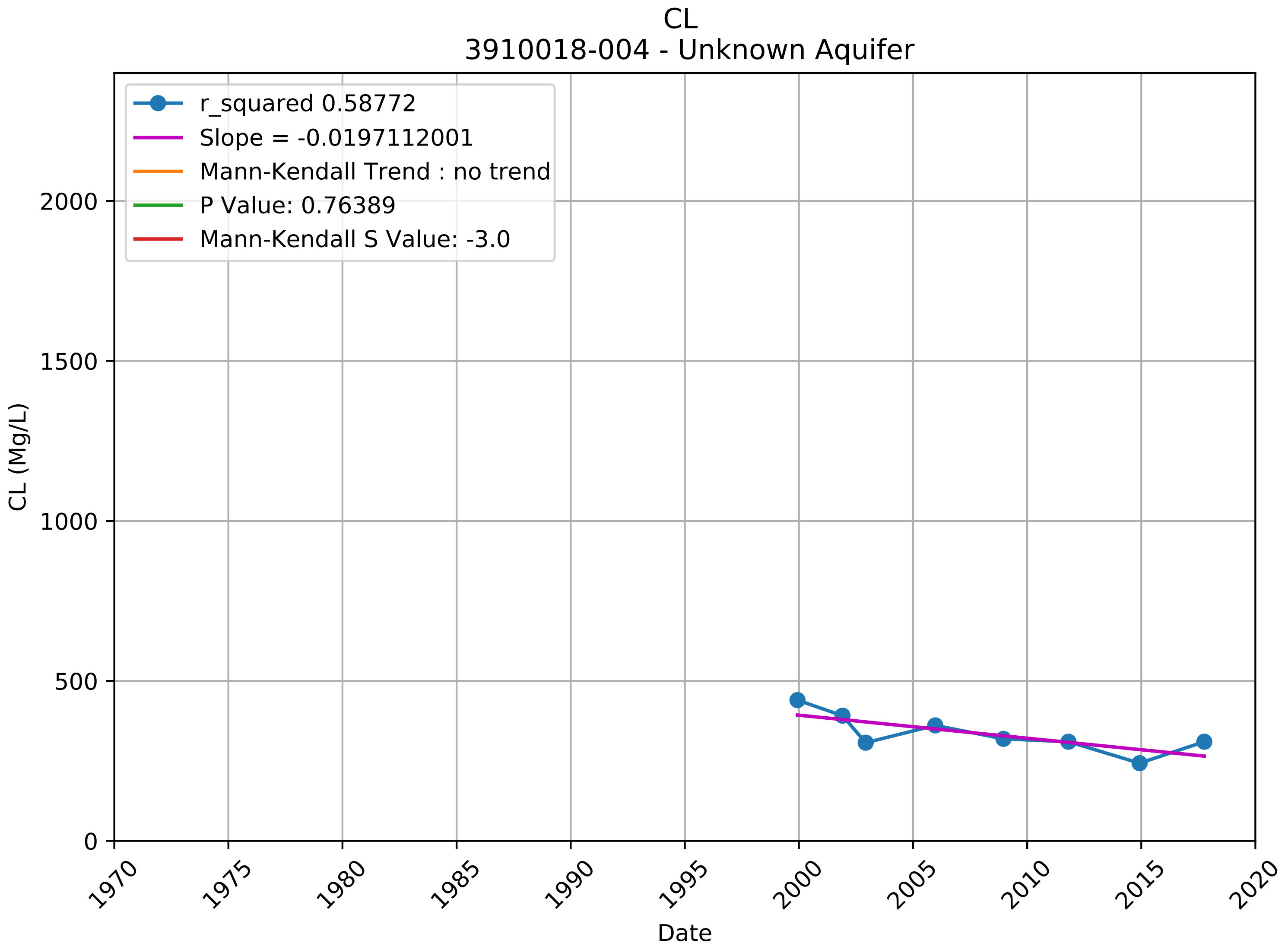
CL
3910018-004 - Unknown Aquifer
r_squared 0.58772
Slope = -0.0197112001
Mann-Kendall Trend : no trend
P Value: 0.76389
Mann-Kendall S Value: -3.0
CL (Mg/L)
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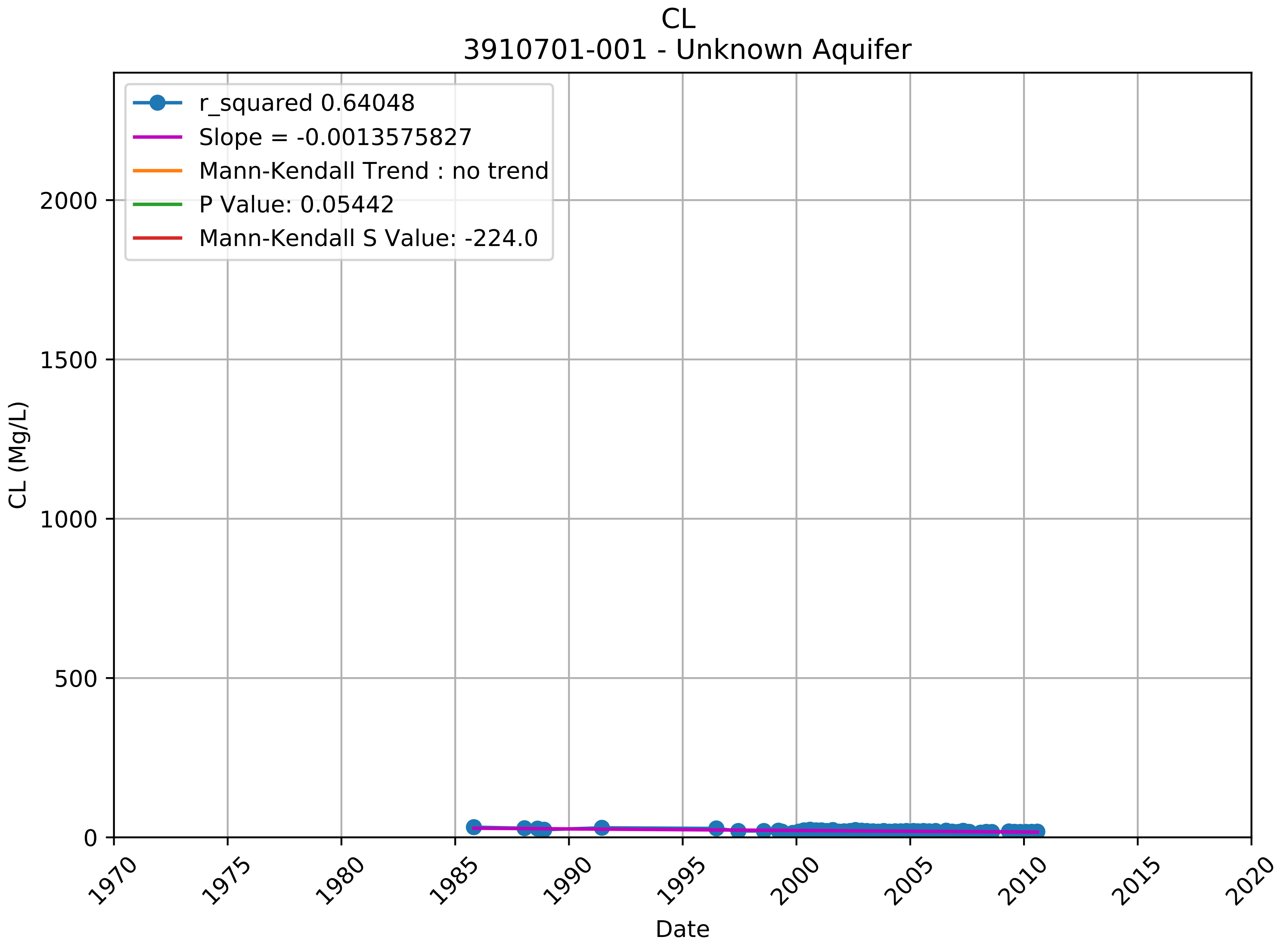
CL
3910701-001 - Unknown Aquifer
r_squared 0.64048
Slope = -0.0013575827
Mann-Kendall Trend : no trend
P Value: 0.05442
Mann-Kendall S Value: -224.0
CL (Mg/L)
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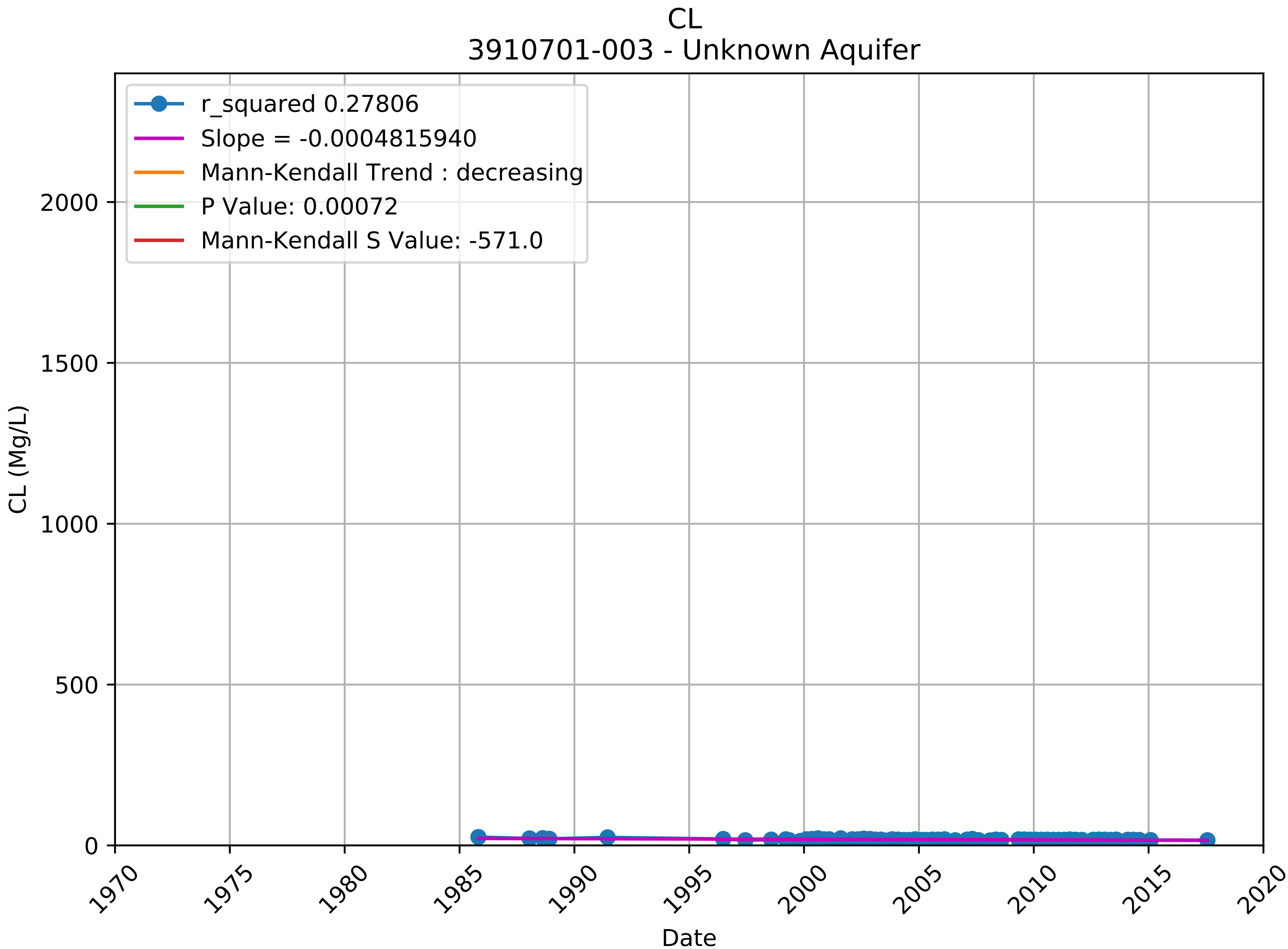
CL
3910701-003 - Unknown Aquifer
r_squared 0.27806
Slope = -0.0004815940
Mann-Kendall Trend : decreasing
P Value: 0.00072
Mann-Kendall S Value: -571.0
CL (Mg/L)
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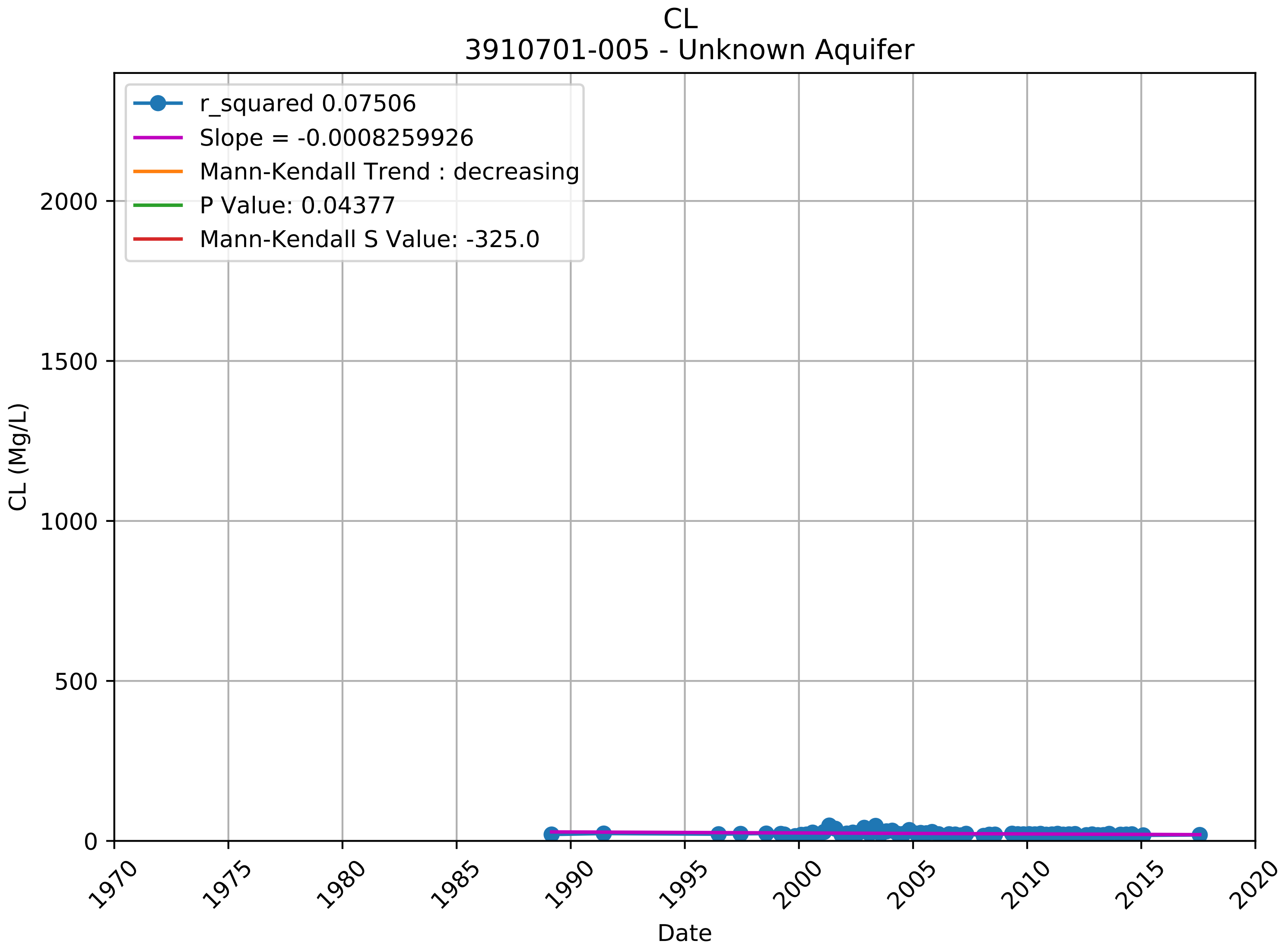

CL
3910701-005 - Unknown Aquifer
r_squared 0.07506
Slope = -0.0008259926
Mann-Kendall Trend : decreasing
P Value: 0.04377
Mann-Kendall S Value: -325.0
CL (Mg/L)
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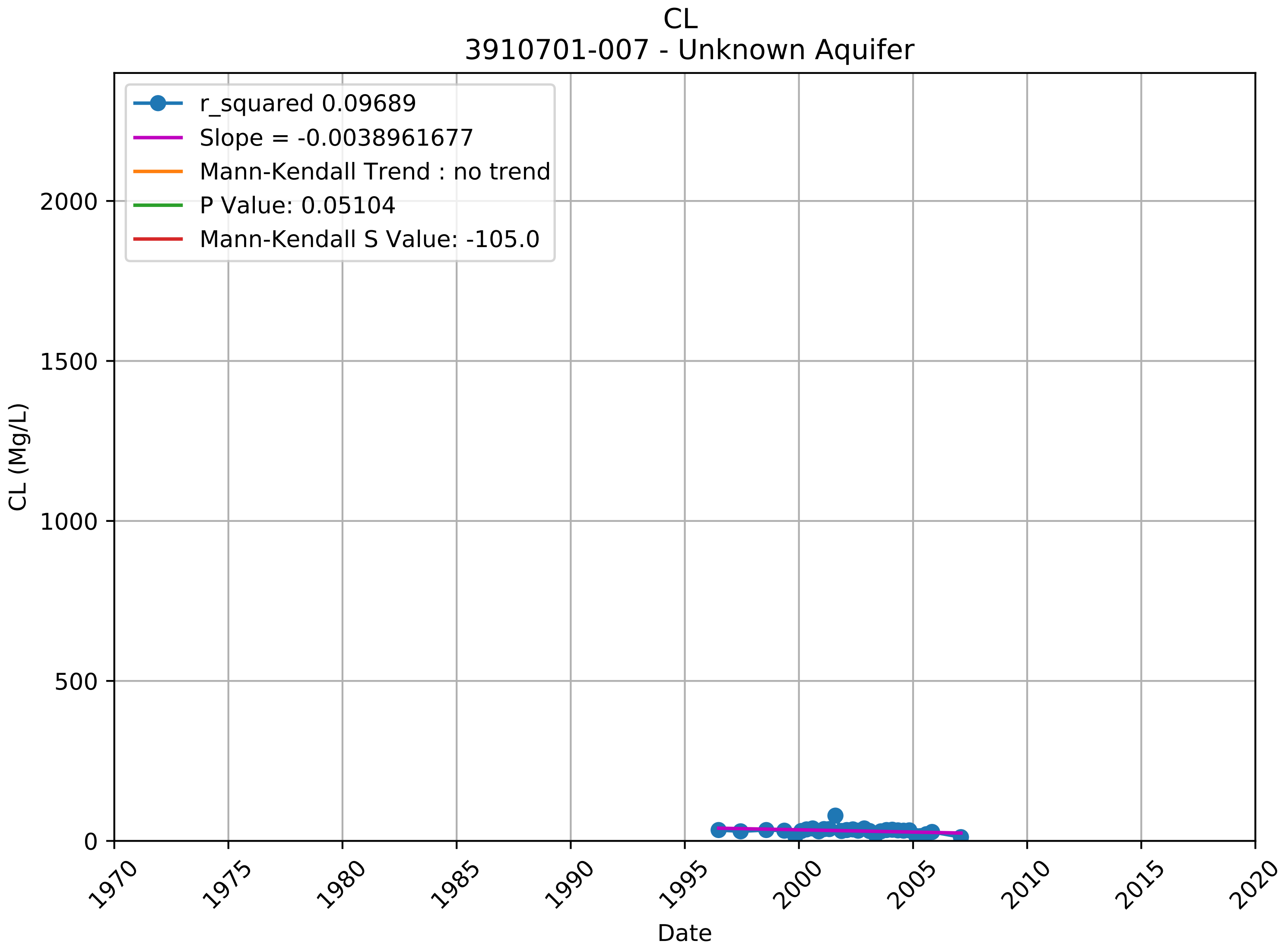

CL
3910701-007 - Unknown Aquifer
r_squared 0.09689
Slope = -0.0038961677
Mann-Kendall Trend : no trend
P Value: 0.05104
Mann-Kendall S Value: -105.0
CL (Mg/L)
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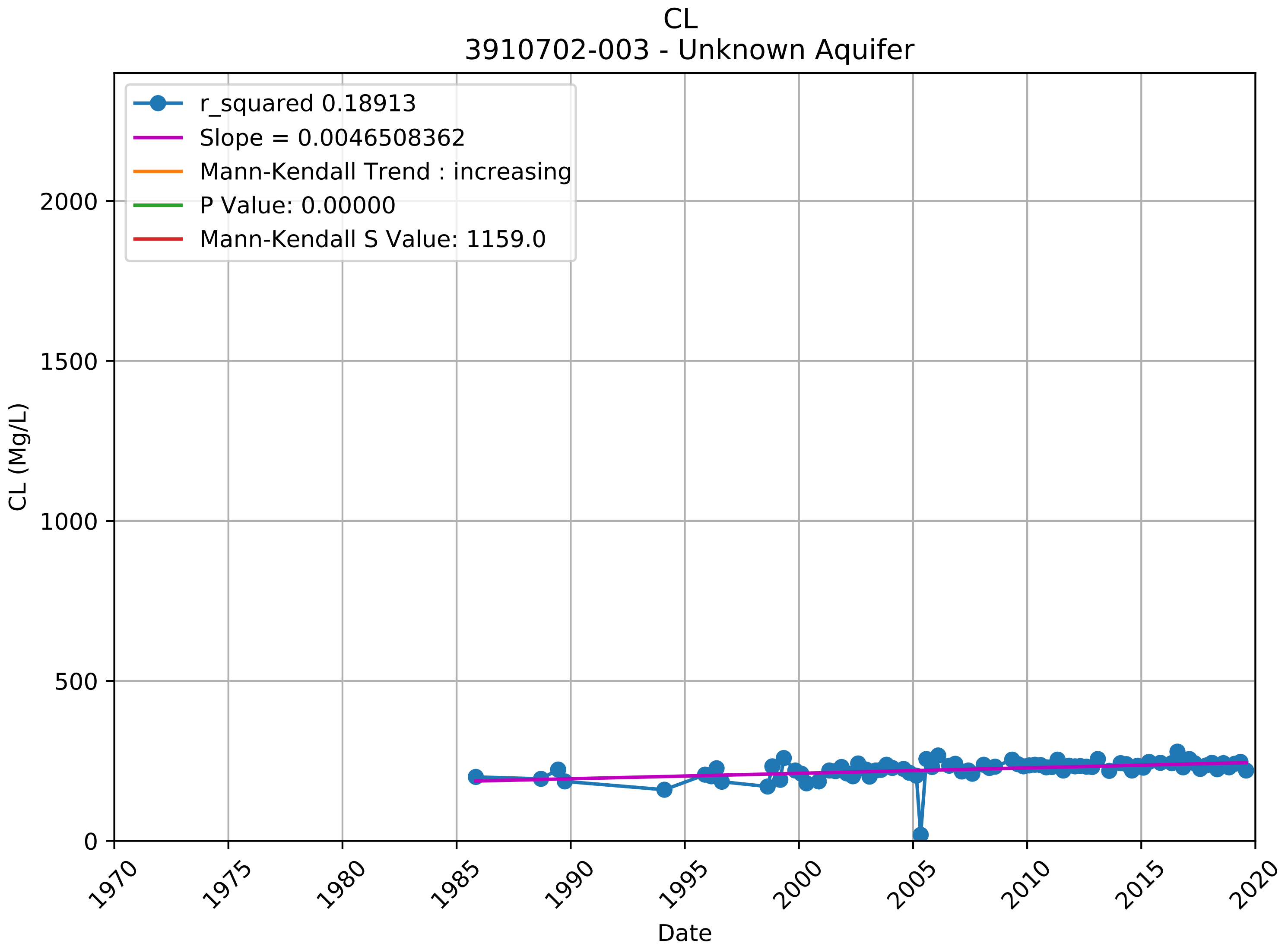

CL
3910702-003 - Unknown Aquifer
r_squared 0.18913
Slope = 0.0046508362
Mann-Kendall Trend : increasing
P Value: 0.00000
Mann-Kendall S Value: 1159.0
CL (Mg/L)
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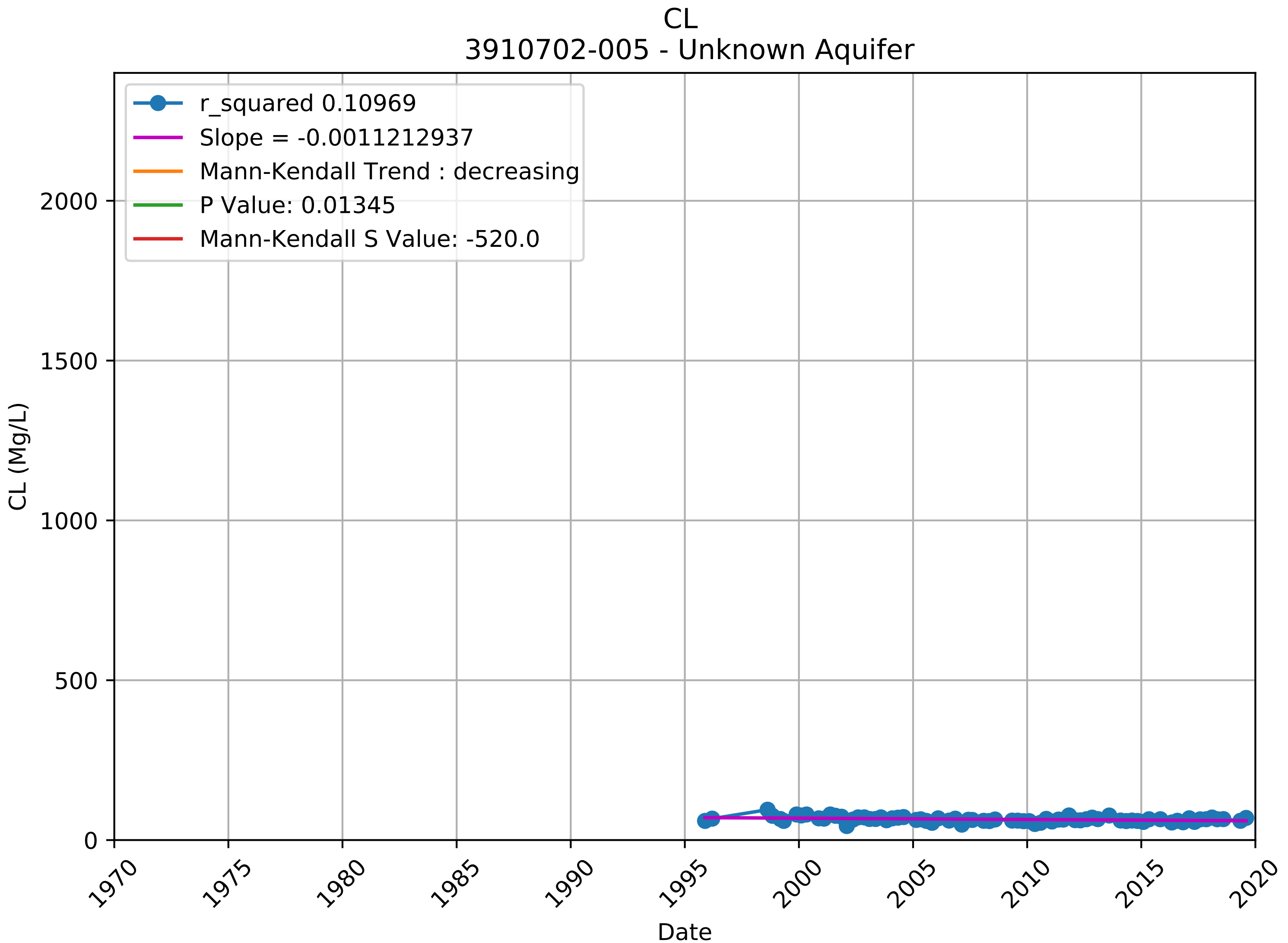
CL
3910702-005 - Unknown Aquifer
r_squared 0.10969
Slope = -0.0011212937
Mann-Kendall Trend : decreasing
P Value: 0.01345
Mann-Kendall S Value: -520.0
CL (Mg/L)
Date
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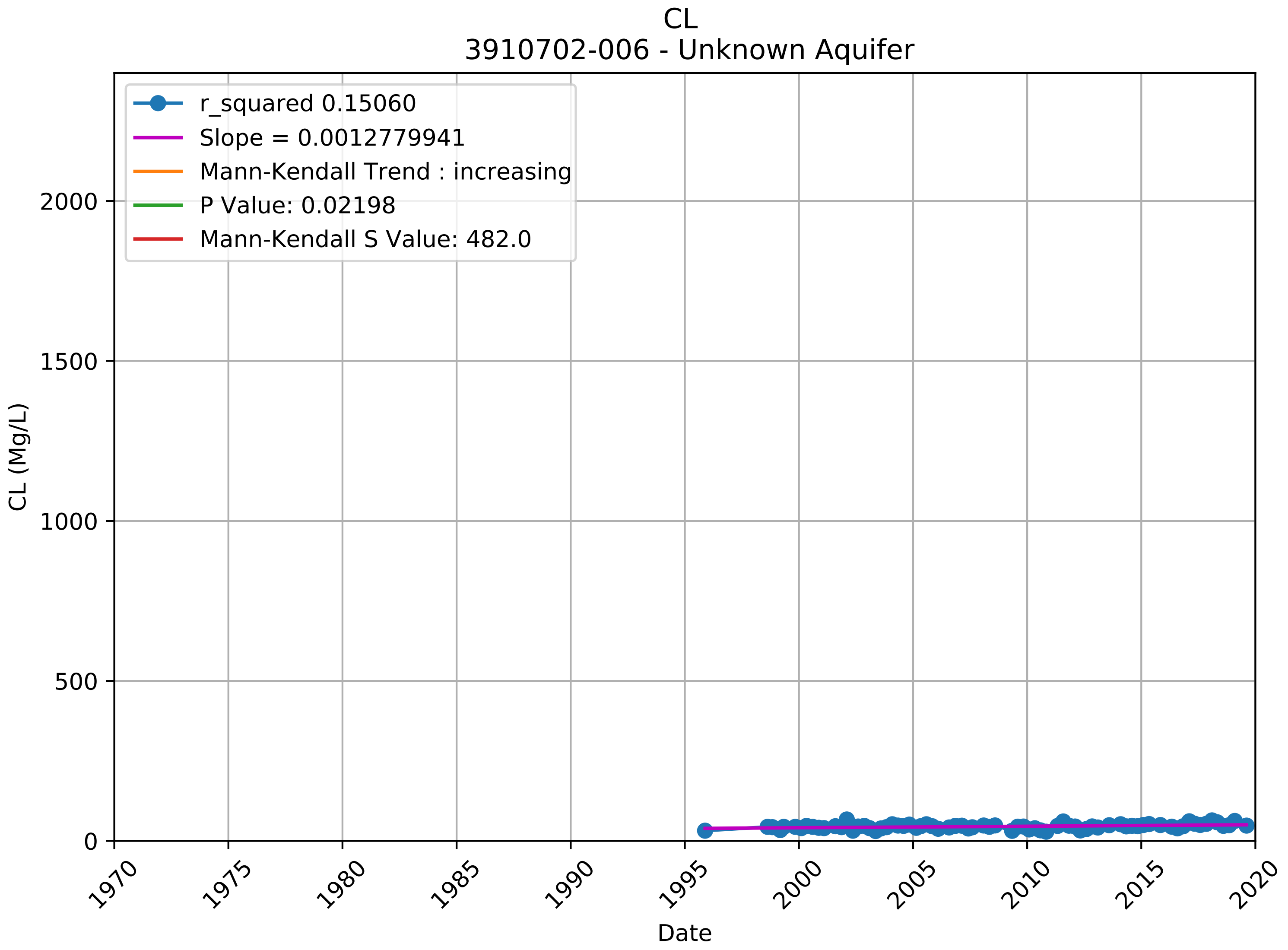

CL
3910702-006 - Unknown Aquifer
r_squared 0.15060
Slope = 0.0012779941
Mann-Kendall Trend : increasing
P Value: 0.02198
Mann-Kendall S Value: 482.0
CL (Mg/L)
0
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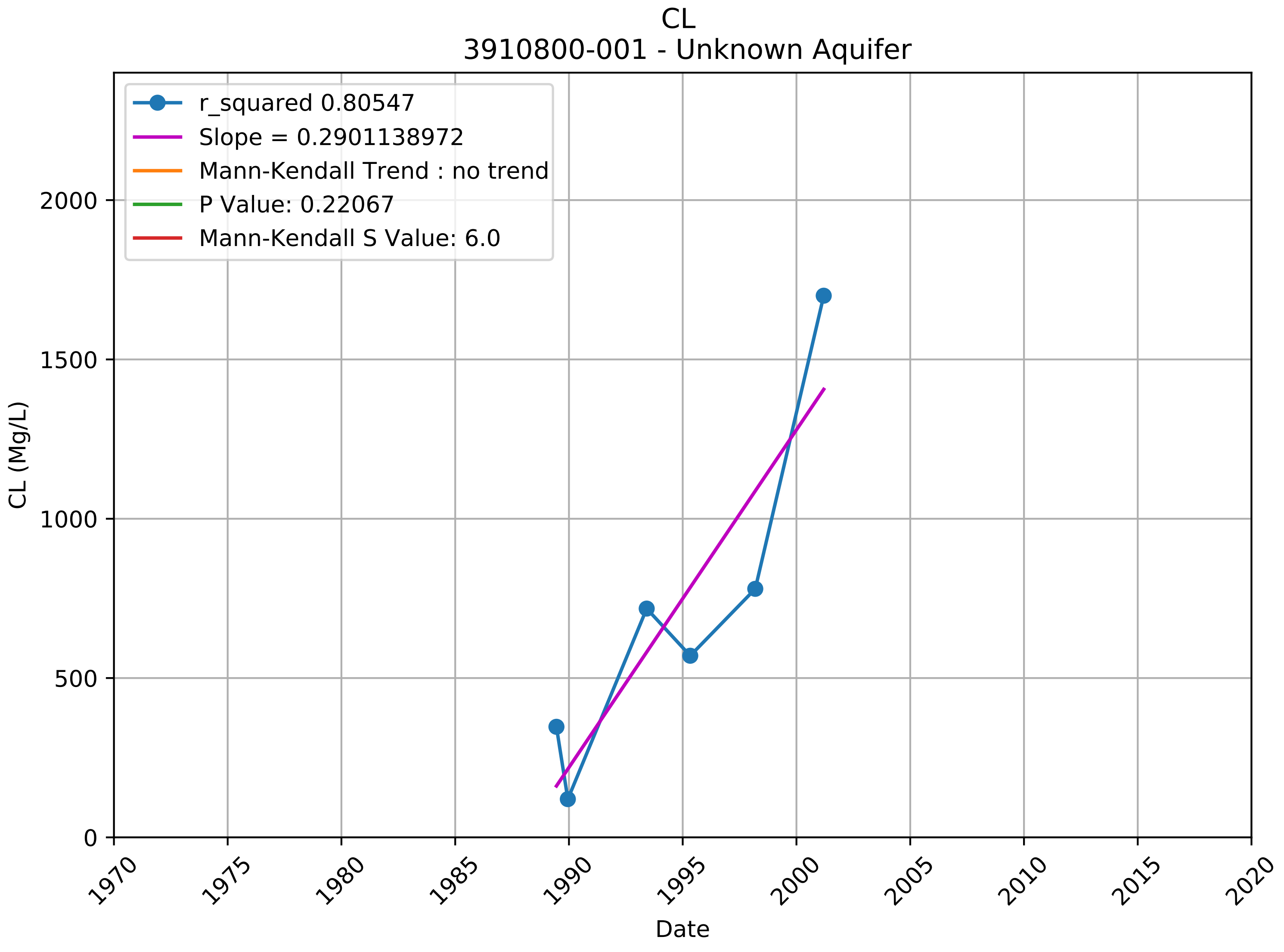

CL
3910800-001 - Unknown Aquifer
r_squared 0.80547
Slope = 0.2901138972
Mann-Kendall Trend : no trend
P Value: 0.22067
Mann-Kendall S Value: 6.0
CL (Mg/L)
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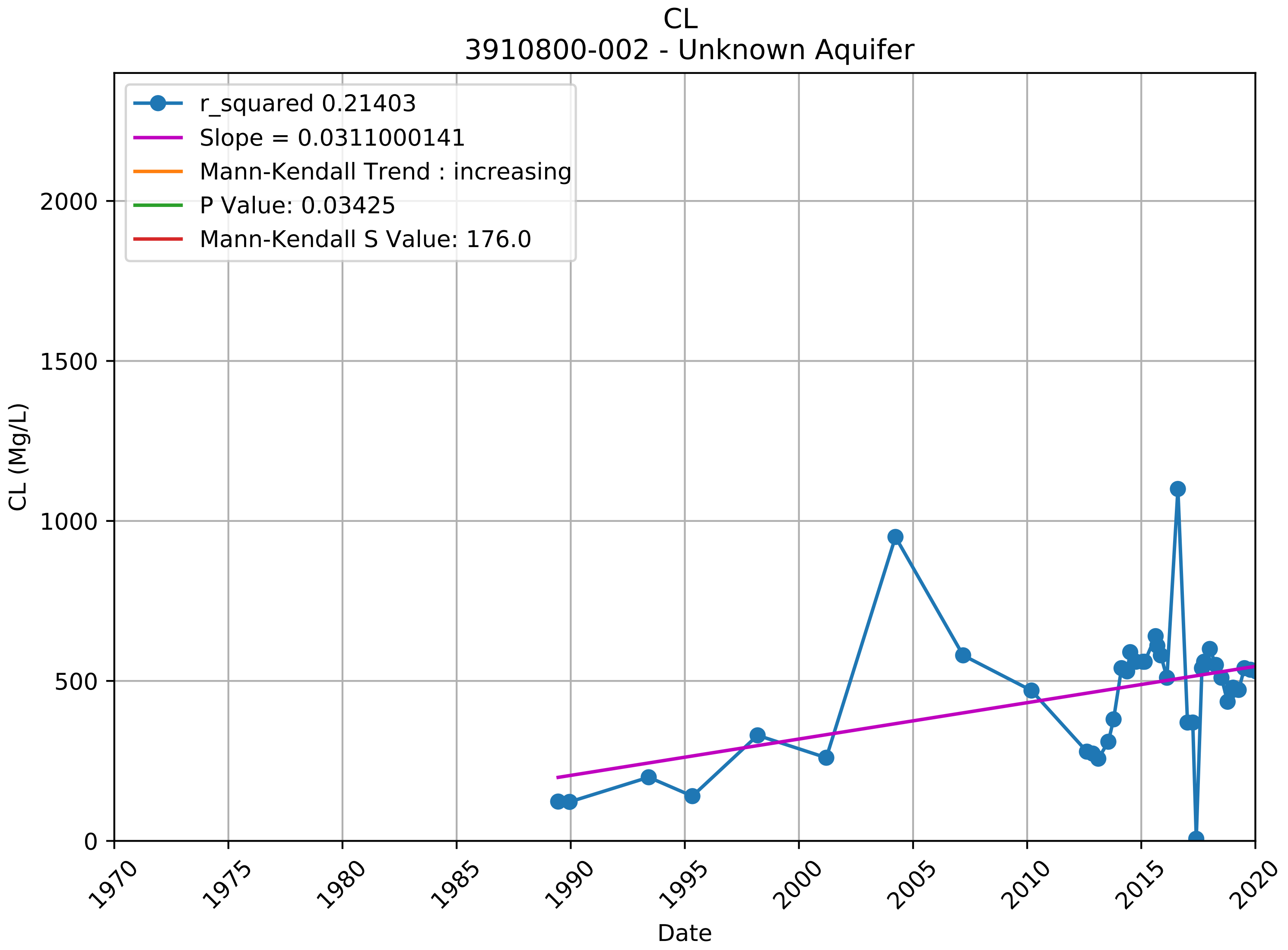

CL
3910800-002 - Unknown Aquifer
r_squared 0.21403
Slope = 0.0311000141
Mann-Kendall Trend : increasing
P Value: 0.03425
Mann-Kendall S Value: 176.0
CL (Mg/L)
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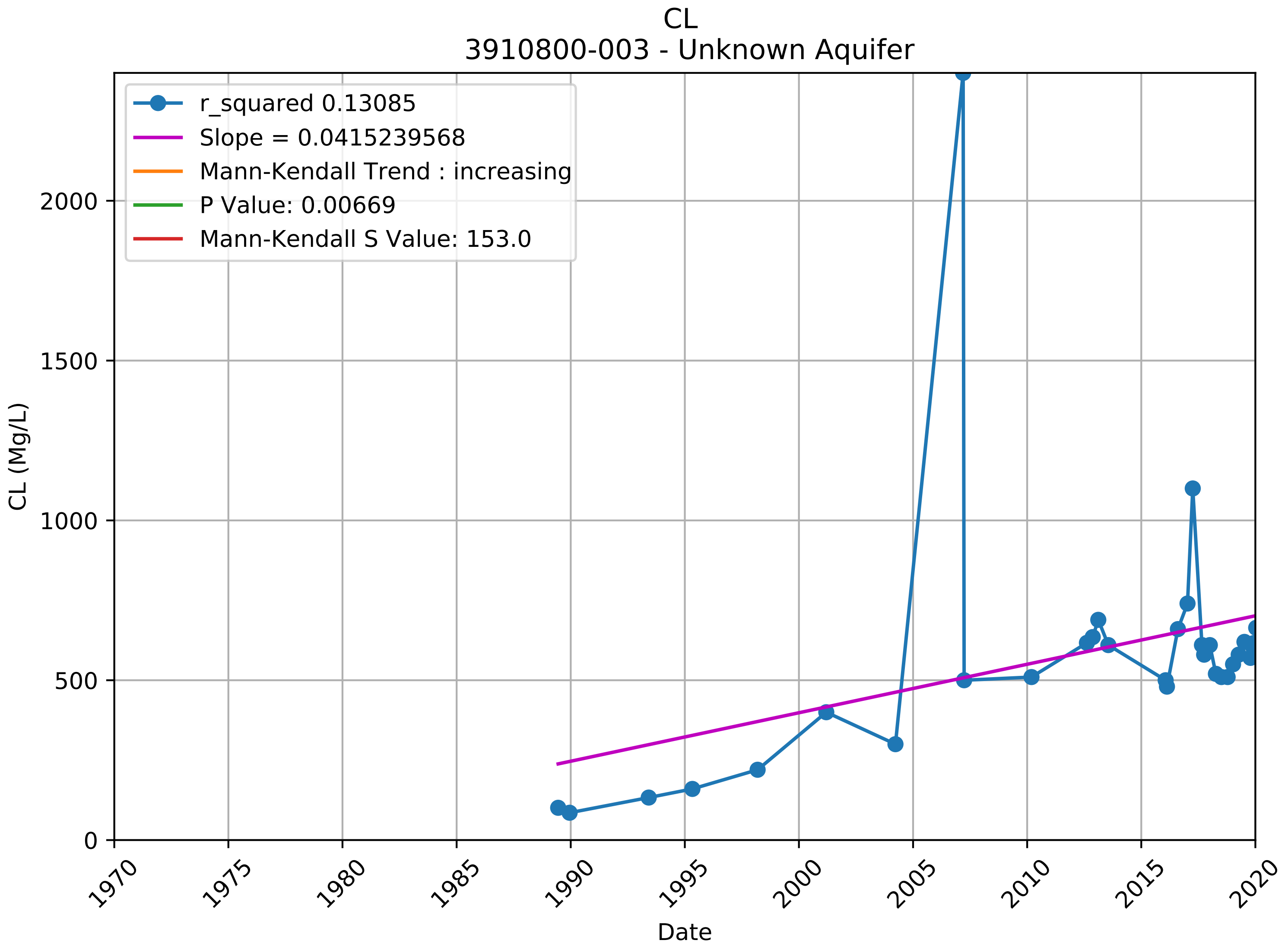
CL
3910800-003 - Unknown Aquifer
r_squared 0.13085
Slope = 0.0415239568
Mann-Kendall Trend : increasing
P Value: 0.00669
Mann-Kendall S Value: 153.0
CL (Mg/L)
0
500
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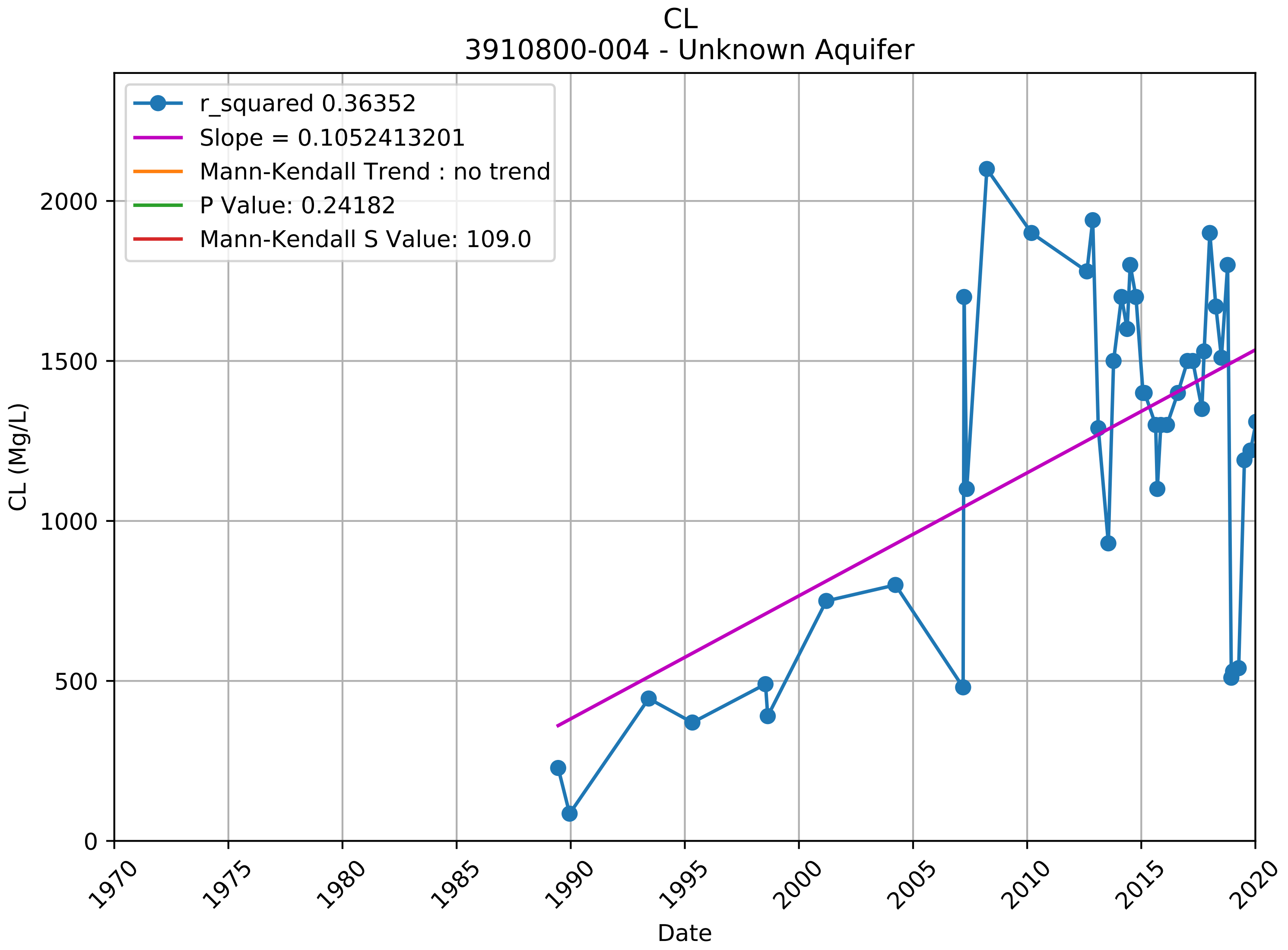
2020
Date



CL
3910800-004 - Unknown Aquifer
r_squared 0.36352
Slope = 0.1052413201
Mann-Kendall Trend : no trend
P Value: 0.24182
Mann-Kendall S Value: 109.0
CL (Mg/L)
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500
1000
1500
2000
1970
1975
1980
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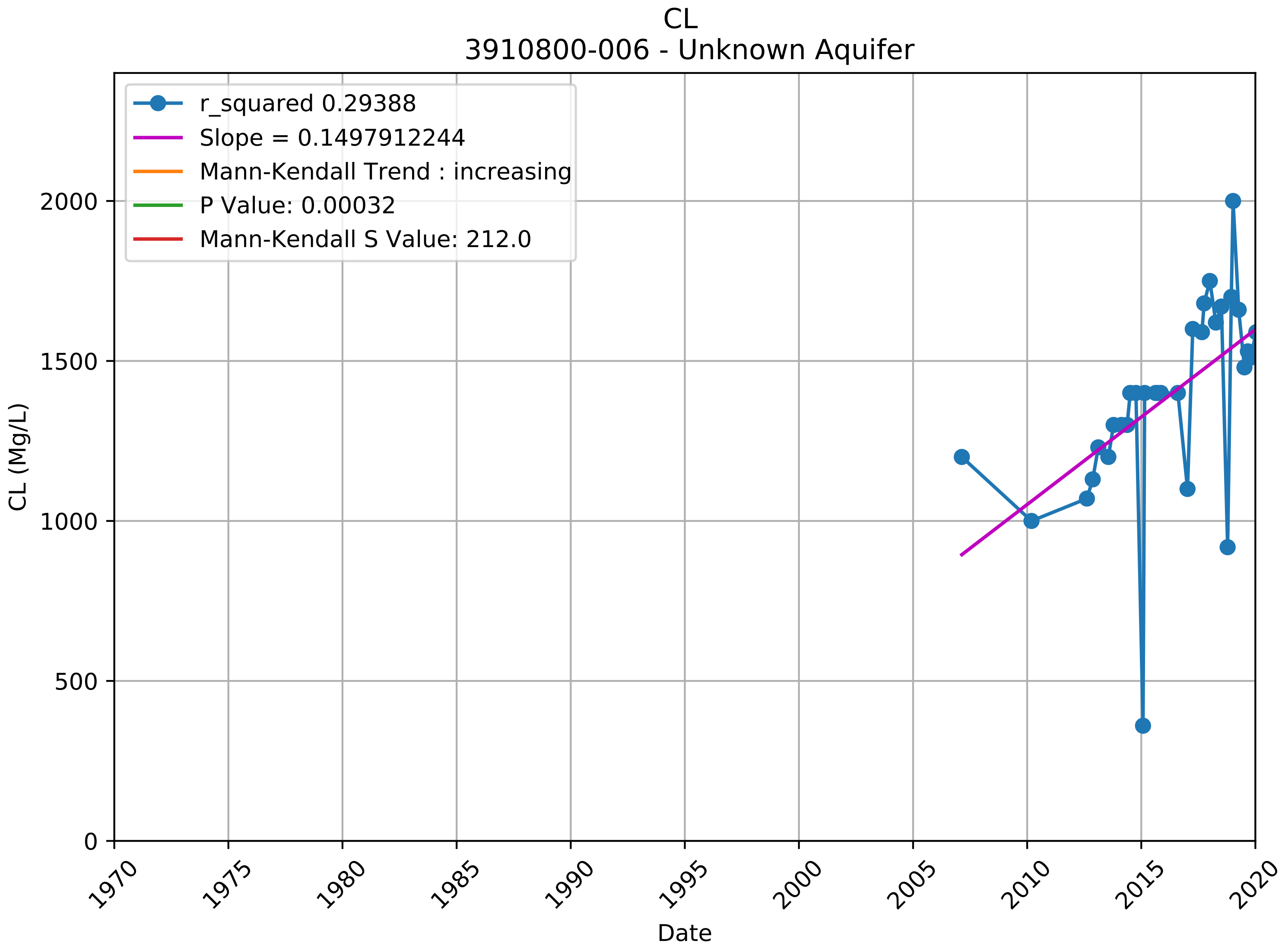
Date



CL
3910800-006 - Unknown Aquifer
r_squared 0.29388
Slope = 0.1497912244
Mann-Kendall Trend : increasing
P Value: 0.00032
Mann-Kendall S Value: 212.0
CL (Mg/L)
Date
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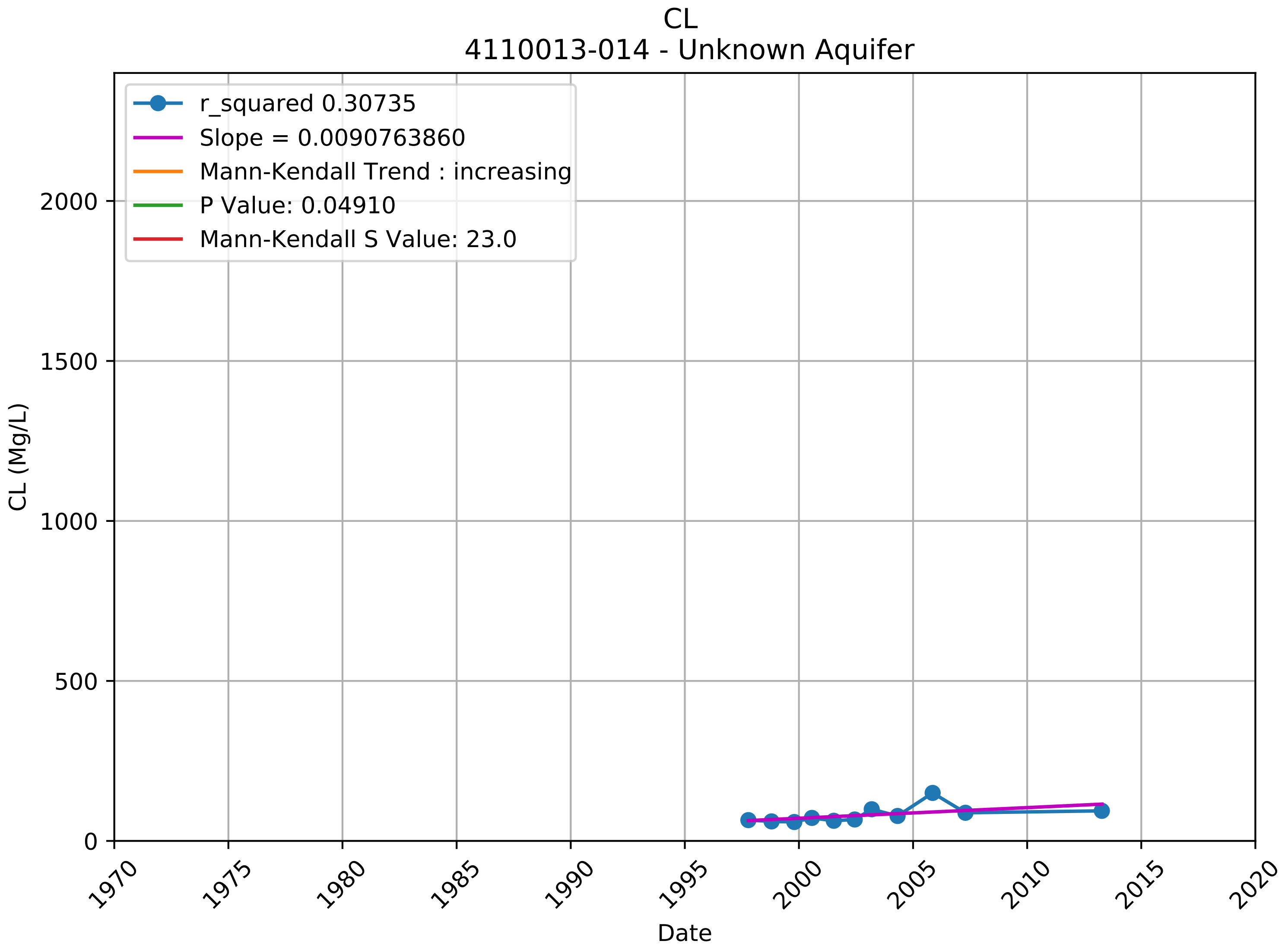

CL
4110013-014 - Unknown Aquifer
r_squared 0.30735
Slope = 0.0090763860
Mann-Kendall Trend : increasing
P Value: 0.04910
Mann-Kendall S Value: 23.0
CL (Mg/L)
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500
1000
1500
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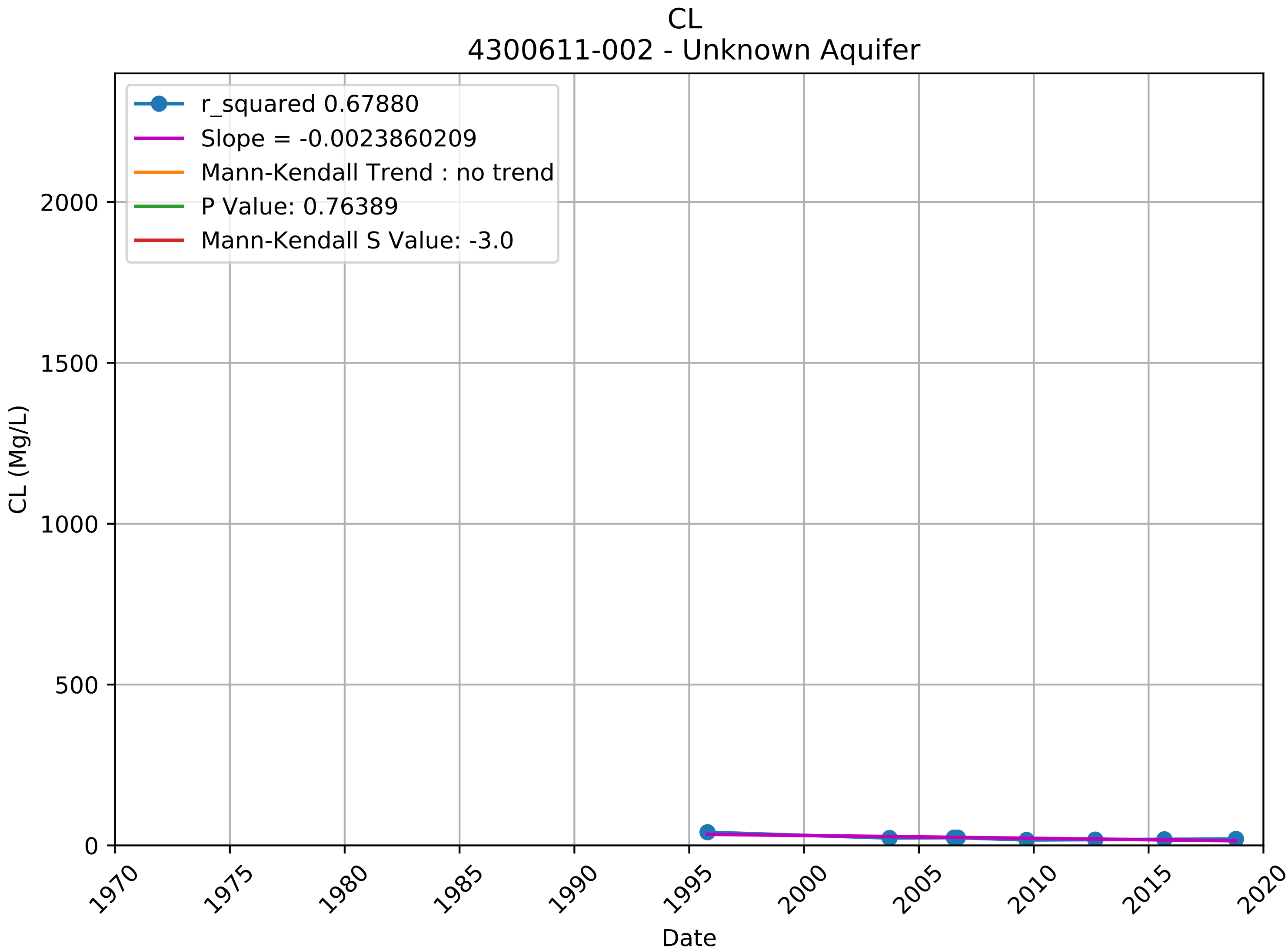
Date



CL
4300611-002 - Unknown Aquifer
r_squared 0.67880
Slope = -0.0023860209
Mann-Kendall Trend : no trend
P Value: 0.76389
Mann-Kendall S Value: -3.0
CL (Mg/L)
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1500
1000
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1970
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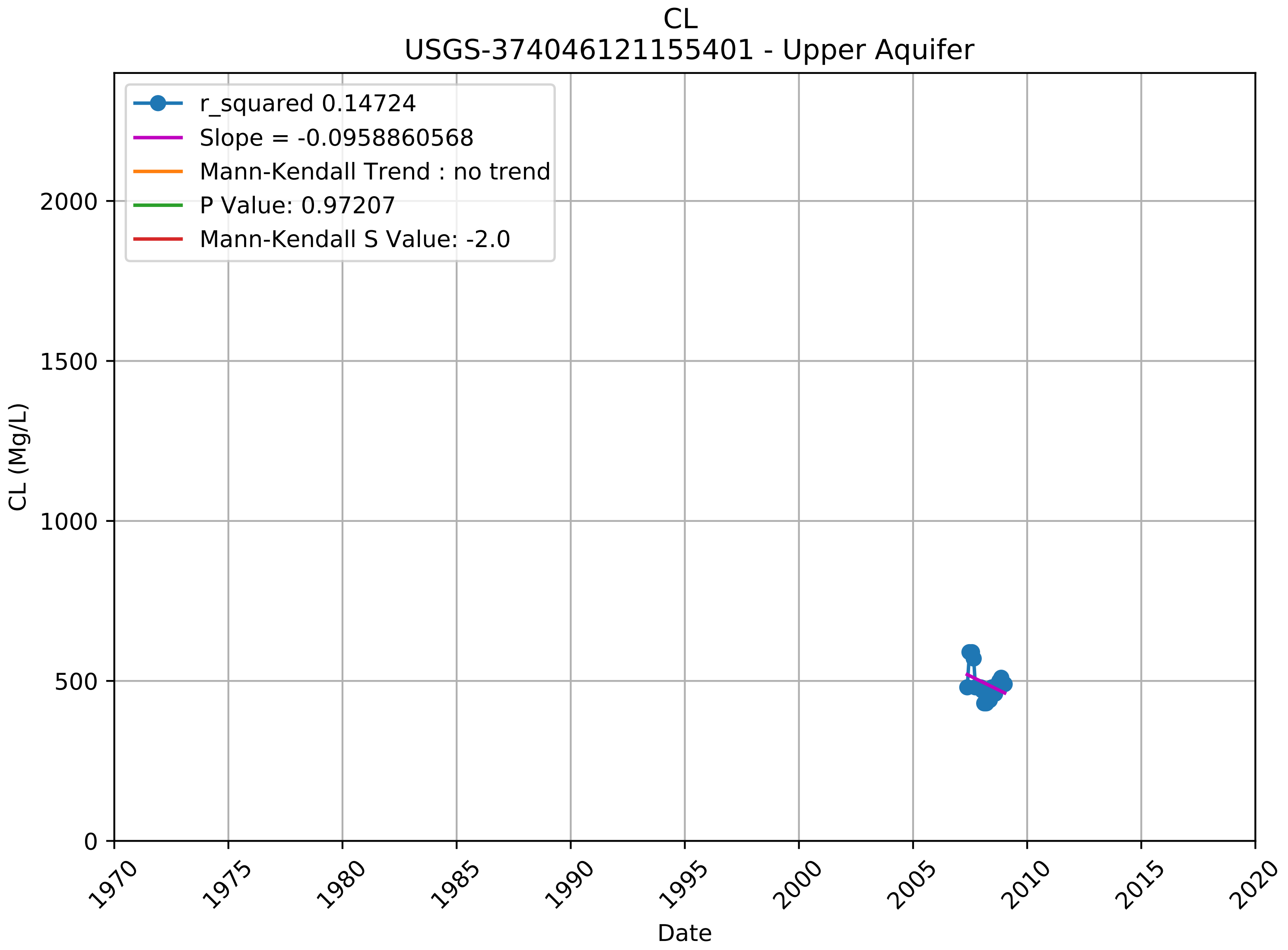
2015
2020
Date



CL
USGS-374046121155401 - Upper Aquifer
r_squared 0.14724
Slope = -0.0958860568
Mann-Kendall Trend : no trend
P Value: 0.97207
Mann-Kendall S Value: -2.0
CL (Mg/L)
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500
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Date
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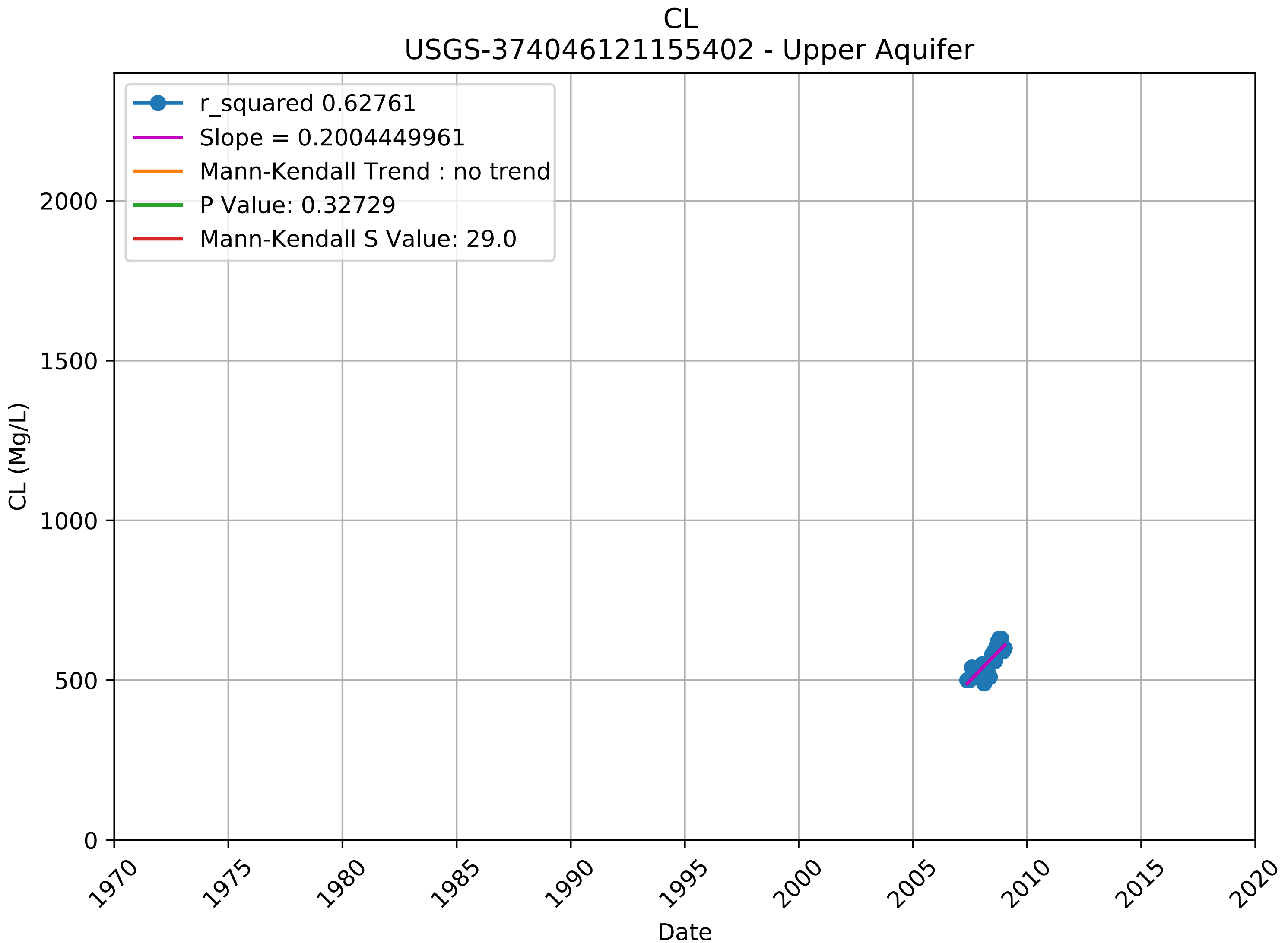

CL
USGS-374046121155402 - Upper Aquifer
r_squared 0.62761
Slope = 0.2004449961
Mann-Kendall Trend : no trend
P Value: 0.32729
Mann-Kendall S Value: 29.0
CL (Mg/L)
0
500
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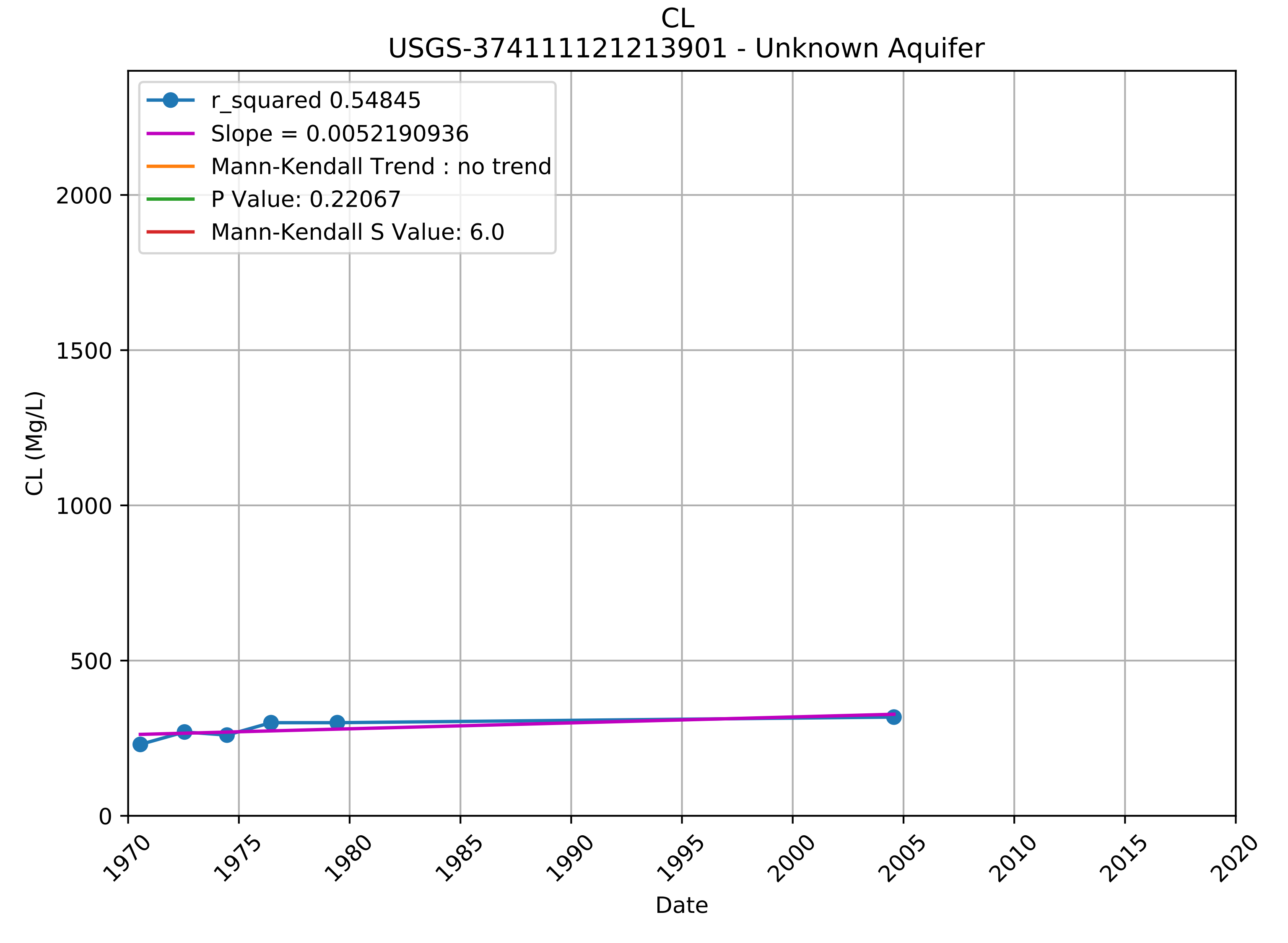
Date


CL
USGS-374111121213901 - Unknown Aquifer
r_squared 0.54845
Slope = 0.0052190936
Mann-Kendall Trend : no trend
P Value: 0.22067
Mann-Kendall S Value: 6.0
CL (Mg/L)
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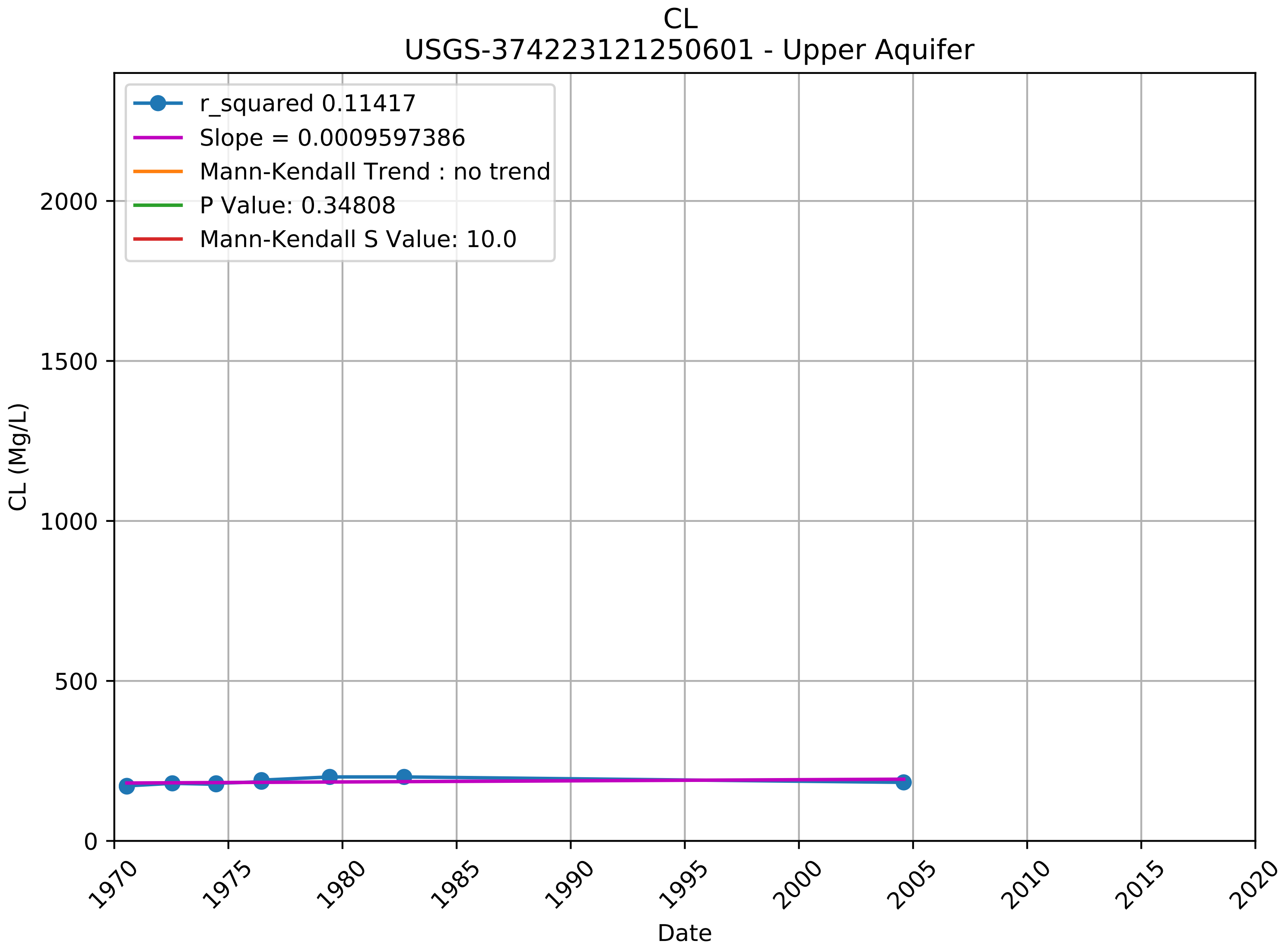
Date


CL
USGS-374223121250601 - Upper Aquifer
r_squared 0.11417
Slope = 0.0009597386
Mann-Kendall Trend : no trend
P Value: 0.34808
Mann-Kendall S Value: 10.0
CL (Mg/L)
Date
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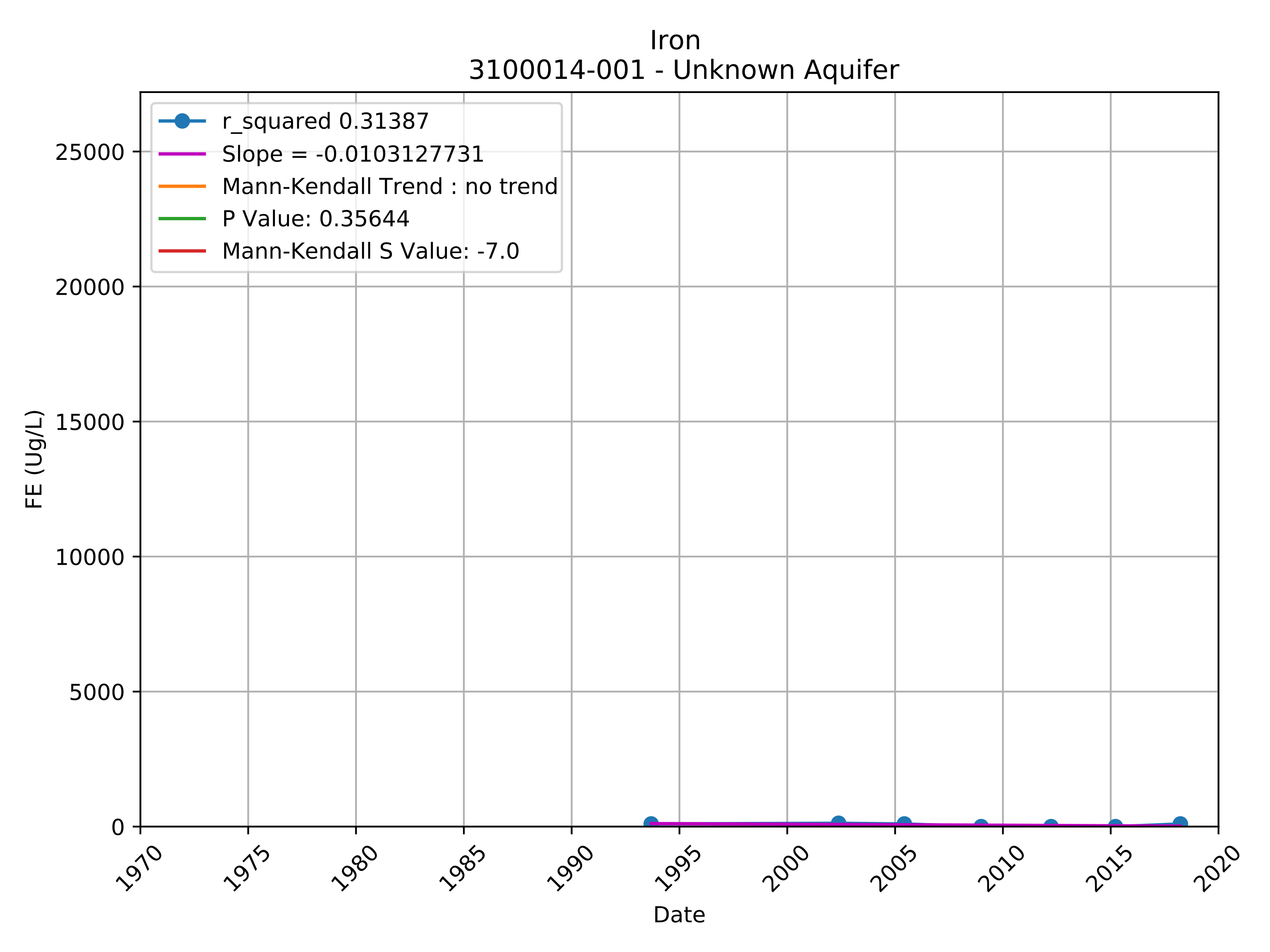
Iron

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
3910011-007	37.714471	-121.426009	FE	FALSE	0.348	-10	-0.278	no trend	92	-0.938	Unknown
3910011-010	37.736372	-121.435351	FE	FALSE	0.247	29	0.213	no trend	585.667	1.157	Unknown
3910702-003	37.705557	-121.39764	FE	TRUE	0.032	533	0.16	increasing	61902.33	2.138	Unknown
3910701-003	37.85144	-121.2682	FE	TRUE	0.042	332	0.17	increasing	26391.33	2.037	Unknown
3910701-001	37.849584	-121.268763	FE	FALSE	0.123	172	0.146	no trend	12294	1.542	Unknown
3910011-017	37.738215	-121.419962	FE	FALSE	0.613	-3	-0.3	no trend	15.667	-0.505	Unknown
3910018-001	37.679751	-121.272617	FE	FALSE	0.31	14	0.255	no trend	164	1.015	Unknown
4300611-002	37.994444	-121.499722	FE	FALSE	0.242	-5	-0.333	no trend	11.667	-1.171	Unknown
3901010-001	38.037472	-121.494583	FE	FALSE	1	0	0	no trend	16.667	0	Unknown
3910015-005	37.816859	-121.266705	FE	FALSE	0.096	52	0.206	no trend	939.333	1.664	Upper
3910011-003	37.683959	-121.439427	FE	TRUE	0	270	0.405	increasing	5556	3.609	Lower
3910800-002	37.744188	-121.32701	FE	FALSE	0.93	8	0.011	no trend	6324	0.088	Unknown
3910800-003	37.74545	-121.32897	FE	FALSE	0.213	64	0.169	no trend	2562	1.245	Unknown
3910800-001	37.744746	-121.327221	FE	FALSE	0.26	7	0.467	no trend	28.333	1.127	Unknown
3910800-004	37.74591	-121.336213	FE	FALSE	0.2	107	0.144	no trend	6833.667	1.282	Unknown
3100014-001	37.716956	-121.379533	FE	FALSE	0.356	-7	-0.333	no trend	42.333	-0.922	Unknown
3910701-005	37.851301	-121.2673	FE	TRUE	0	578	0.316	increasing	23130	3.794	Unknown
3910011-004	37.682308	-121.436988	FE	TRUE	0.007	151	0.347	increasing	3069	2.708	Lower
3910011-006	37.686539	-121.443515	FE	TRUE	0	183	0.521	increasing	2200.333	3.88	Lower
3910011-005	37.683353	-121.443313	FE	TRUE	0	231	0.438	increasing	3544.333	3.863	Lower
3910015-006	37.818884	-121.266416	FE	TRUE	0.03	75	0.325	increasing	1165.667	2.167	Upper
3910015-007	37.811547	-121.263915	FE	FALSE	0.218	44	0.174	no trend	1220	1.231	Upper
3910015-008	37.801132	-121.262514	FE	FALSE	0.387	20	0.117	no trend	483.333	0.864	Upper
3910011-018	37.743262	-121.424805	FE	TRUE	0.009	105	0.35	increasing	1576.333	2.619	Lower
3910018-004	37.679705	-121.272761	FE	FALSE	0.188	-9	-0.429	no trend	37	-1.315	Unknown
3910701-007	37.851431	-121.265247	FE	FALSE	0.354	49	0.121	no trend	2677	0.928	Unknown
3910702-006	37.709972	-121.390802	FE	FALSE	0.952	14	0.005	no trend	45916	0.061	Unknown
3910702-005	37.708149	-121.393881	FE	FALSE	0.14	-310	-0.118	no trend	43821.33	-1.476	Unknown
4110013-014	37.7	-121.466667	FE	FALSE	0.308	9	0.321	no trend	61.667	1.019	Unknown
3900991-001	37.743544	-121.461428	FE	FALSE	0.794	-2	-0.2	no trend	14.667	-0.261	Unknown
3910011-030	37.740208	-121.439285	FE	TRUE	0.019	99	0.305	increasing	1753.667	2.34	Lower
3901348-002	37.702894	-121.406986	FE	FALSE	0.462	-4	-0.4	no trend	16.667	-0.735	Unknown
3900589-001	37.783862	-121.305584	FE	FALSE	0.592	-7	-0.156	no trend	125	-0.537	Unknown
3900713-001	37.84	-121.44	FE	FALSE	0.35	13	0.236	no trend	165	0.934	Unknown
3901172-002	37.636324	-121.399544	FE	FALSE	0.462	-4	-0.4	no trend	16.667	-0.735	Unknown
3901172-003	37.632289	-121.39736	FE	FALSE	0.527	-33	-0.087	no trend	2561	-0.632	Unknown
3900702-001	37.990639	-121.407056	FE	FALSE	0.086	-8	-0.8	no trend	16.667	-1.715	Unknown
3900583-001	37.84	-121.44	FE	FALSE	0.721	-5	-0.111	no trend	125	-0.358	Unknown
3901348-001	37.708679	-121.412023	FE	FALSE	0.23	9	0.429	no trend	44.333	1.202	Unknown
3901216-002	37.74753	-121.516649	FE	FALSE	0.248	-69	-0.148	no trend	3461.667	-1.156	Unknown
3900559-001	37.79	-121.38	FE	FALSE	0.47	-3	-0.5	no trend	7.667	-0.722	Unknown
3900558-002	37.79	-121.4	FE	FALSE	0.302	-56	-0.138	no trend	2842	-1.032	Unknown
3900616-002	37.988607	-121.404525	FE	FALSE	1	0	0	no trend	16.667	0	Unknown
3910011-034	37.752802	-121.434603	FE	TRUE	0.002	121	0.345	increasing	1439.667	3.163	Lower
3910011-032	37.754682	-121.465249	FE	FALSE	0.152	124	0.144	no trend	7373.333	1.432	Lower
3901348-003	37.698742	-121.409917	FE	FALSE	0.875	-2	-0.095	no trend	40.667	-0.157	Unknown
3901348-004	37.698147	-121.416153	FE	FALSE	0.133	9	0.6	no trend	28.333	1.503	Unknown
3910015-013	37.792108	-121.274608	FE	FALSE	0.089	-6	-1	no trend	8.667	-1.698	Unknown
377427N1213943W002	37.742656	-121.394318	FE	FALSE	1	-1	-0.01	no trend	408.333	0	Lower
377427N1213943W001	37.742656	-121.394318	FE	FALSE	0.373	-19	-0.181	no trend	408.333	-0.891	Lower
377427N1213943W003	37.742656	-121.394318	FE	FALSE	0.075	-37	-0.352	no trend	408.333	-1.782	Lower
377402N1214508W001	37.740187	-121.450762	FE	FALSE	0.198	27	0.257	no trend	408.333	1.287	Lower
377143N1214459W002	37.714305	-121.445905	FE	FALSE	0.322	-21	-0.2	no trend	408.333	-0.99	Lower
377143N1214459W003	37.714305	-121.445905	FE	FALSE	0.138	-31	-0.295	no trend	408.333	-1.485	Lower
377402N1214508W003	37.740187	-121.450762	FE	FALSE	0.113	-33	-0.314	no trend	408.333	-1.584	Lower
377402N1214508W002	37.740187	-121.450762	FE	TRUE	0.029	-45	-0.429	decreasing	408.333	-2.177	Lower
377143N1214459W001	37.714305	-121.445905	FE	FALSE	0.373	-19	-0.181	no trend	408.333	-0.891	Lower
377656N1214199W001	37.765631	-121.41992	FE	FALSE	0.086	-26	-0.394	no trend	212.667	-1.714	Lower
377656N1214199W002	37.765631	-121.41992	FE	FALSE	1	-1	-0.022	no trend	125	0	Lower
377656N1214199W003	37.765631	-121.41992	FE	FALSE	0.127	-26	-0.333	no trend	268.667	-1.525	Lower
377149N1214257W003	37.714872	-121.425674	FE	FALSE	0.373	14	0.212	no trend	212.667	0.891	Lower
377149N1214257W002	37.714872	-121.425674	FE	FALSE	0.304	16	0.242	no trend	212.667	1.029	Lower
377149N1214257W001	37.714872	-121.425674	FE	FALSE	0.951	-2	-0.026	no trend	268.667	-0.061	Lower
377031N1214485W002	37.703055	-121.448544	FE	FALSE	0.1	-28	-0.359	no trend	268.667	-1.647	Lower
377031N1214485W001	37.703055	-121.448544	FE	FALSE	0.951	-2	-0.026	no trend	268.667	-0.061	Lower
377031N1214485W003	37.703055	-121.448544	FE	FALSE	0.428	-14	-0.179	no trend	268.667	-0.793	Lower
3910005-044	37.782808	-121.300937	FE	TRUE	0.019	-24	-0.533	decreasing	96.667	-2.339	Unknown
3910800-006	37.744722	-121.329167	FE	TRUE	0.001	181	0.416	increasing	3141.667	3.211	Unknown



Iron
3100014-001 - Unknown Aquifer
r_squared 0.31387
Slope = -0.0103127731
Mann-Kendall Trend : no trend
P Value: 0.35644
Mann-Kendall S Value: -7.0
FE (Ug/L)
0
5000
10000
15000
20000
25000
1970
1975
1980
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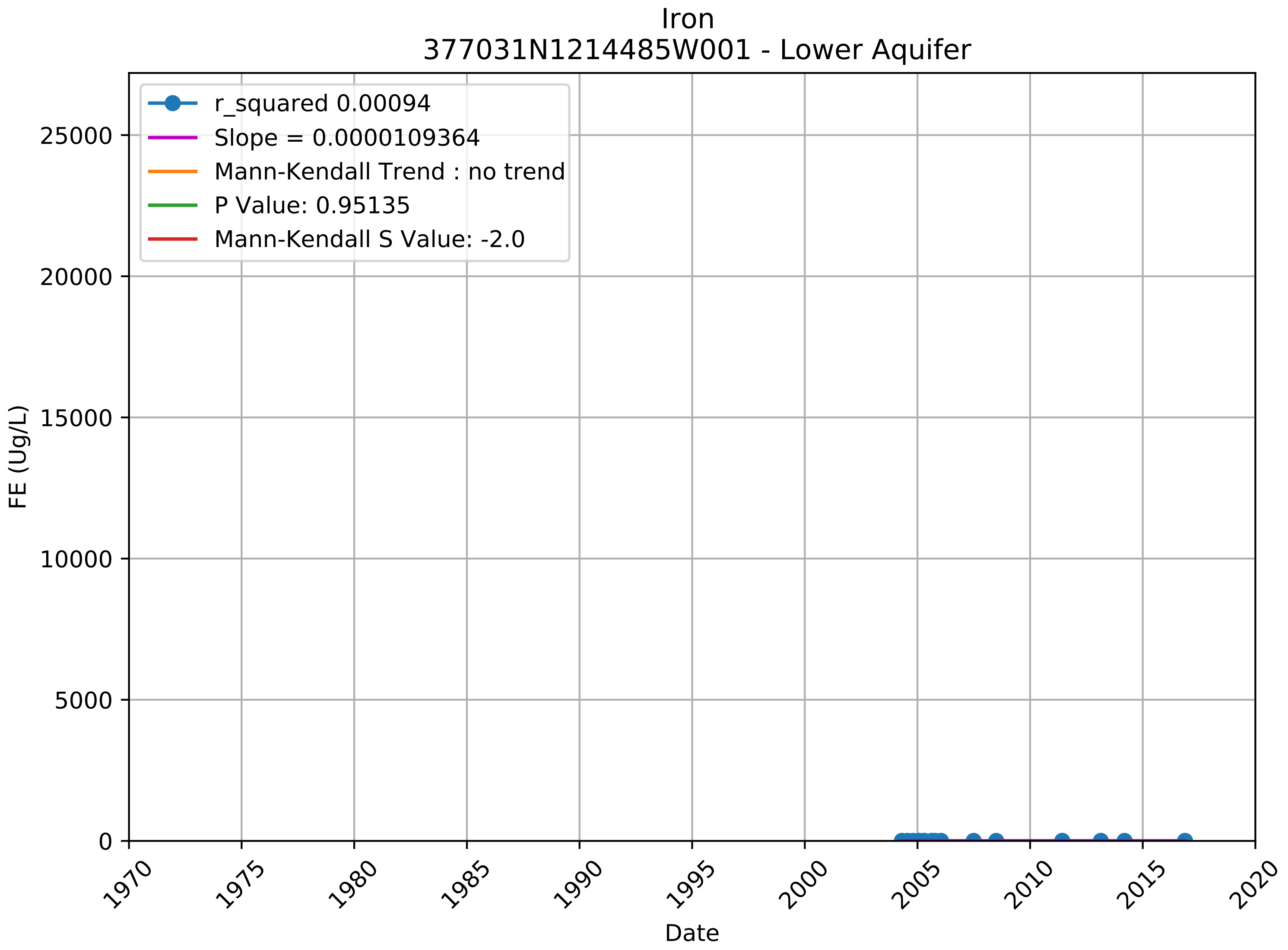
Date



Iron
377031N1214485W001 - Lower Aquifer
r_squared 0.00094
Slope = 0.0000109364
Mann-Kendall Trend : no trend
P Value: 0.95135
Mann-Kendall S Value: -2.0
FE (Ug/L)
Date
0
5000
10000
15000
20000
25000
1970
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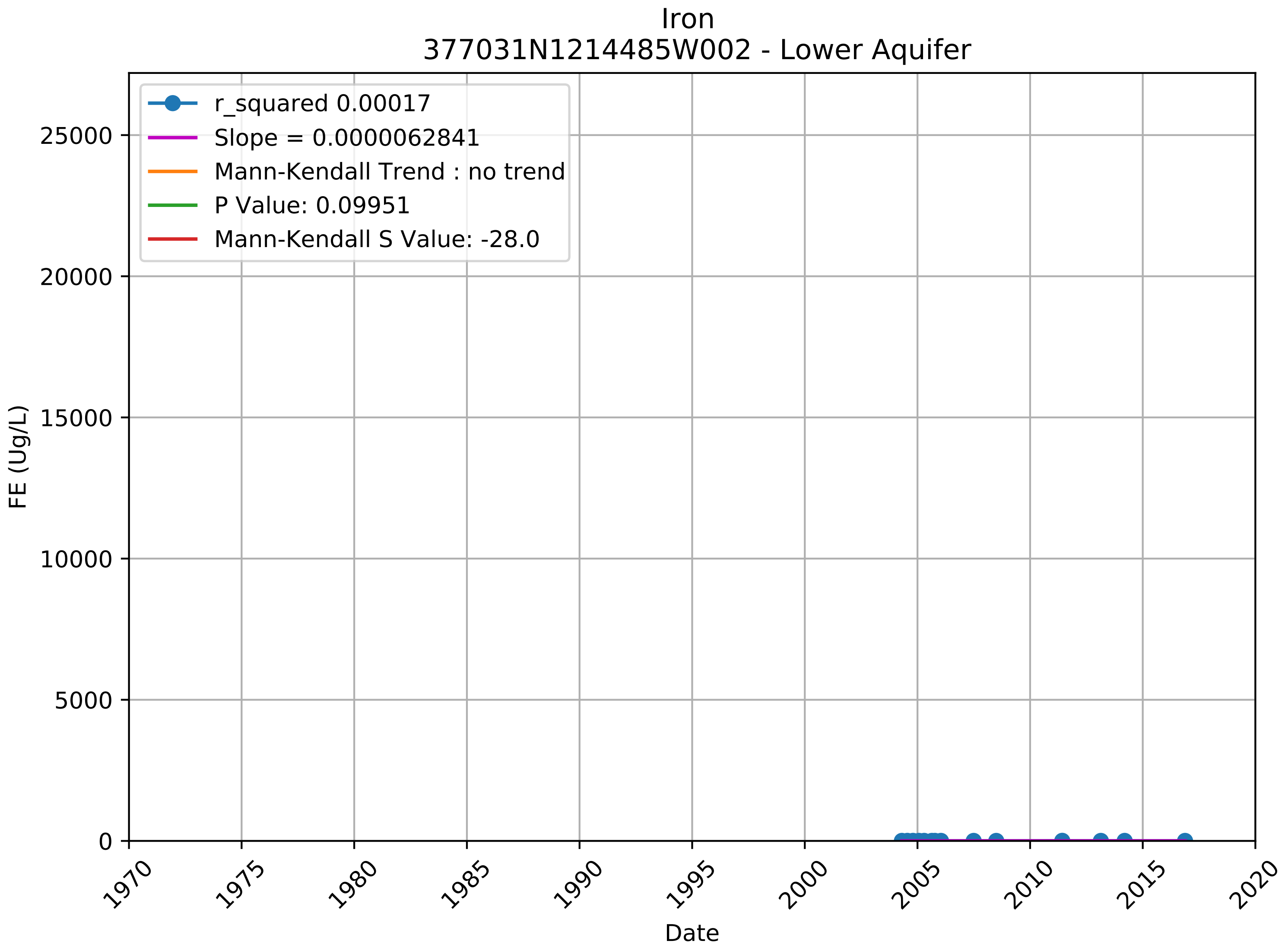
Iron
377031N1214485W002 - Lower Aquifer
r_squared 0.00017
Slope = 0.0000062841
Mann-Kendall Trend : no trend
P Value: 0.09951
Mann-Kendall S Value: -28.0
FE (Ug/L)
Date
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10000
15000
20000
25000
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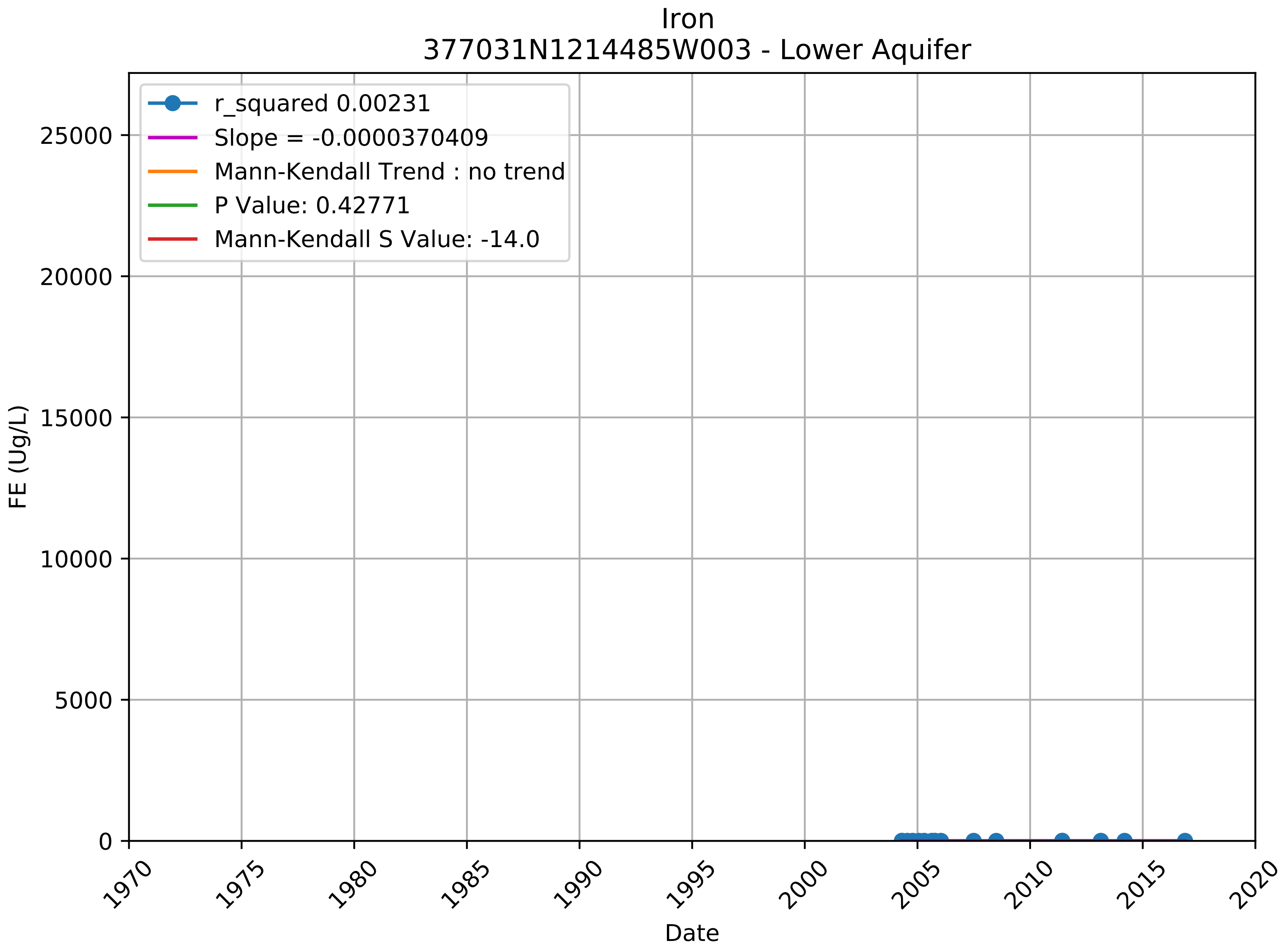
2015
2020


Iron
377031N1214485W003 - Lower Aquifer
r_squared 0.00231
Slope = -0.0000370409
Mann-Kendall Trend : no trend
P Value: 0.42771
Mann-Kendall S Value: -14.0
FE (Ug/L)
25000
20000
15000
10000
5000
0
1970
1975
1980
1985
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1995
2000
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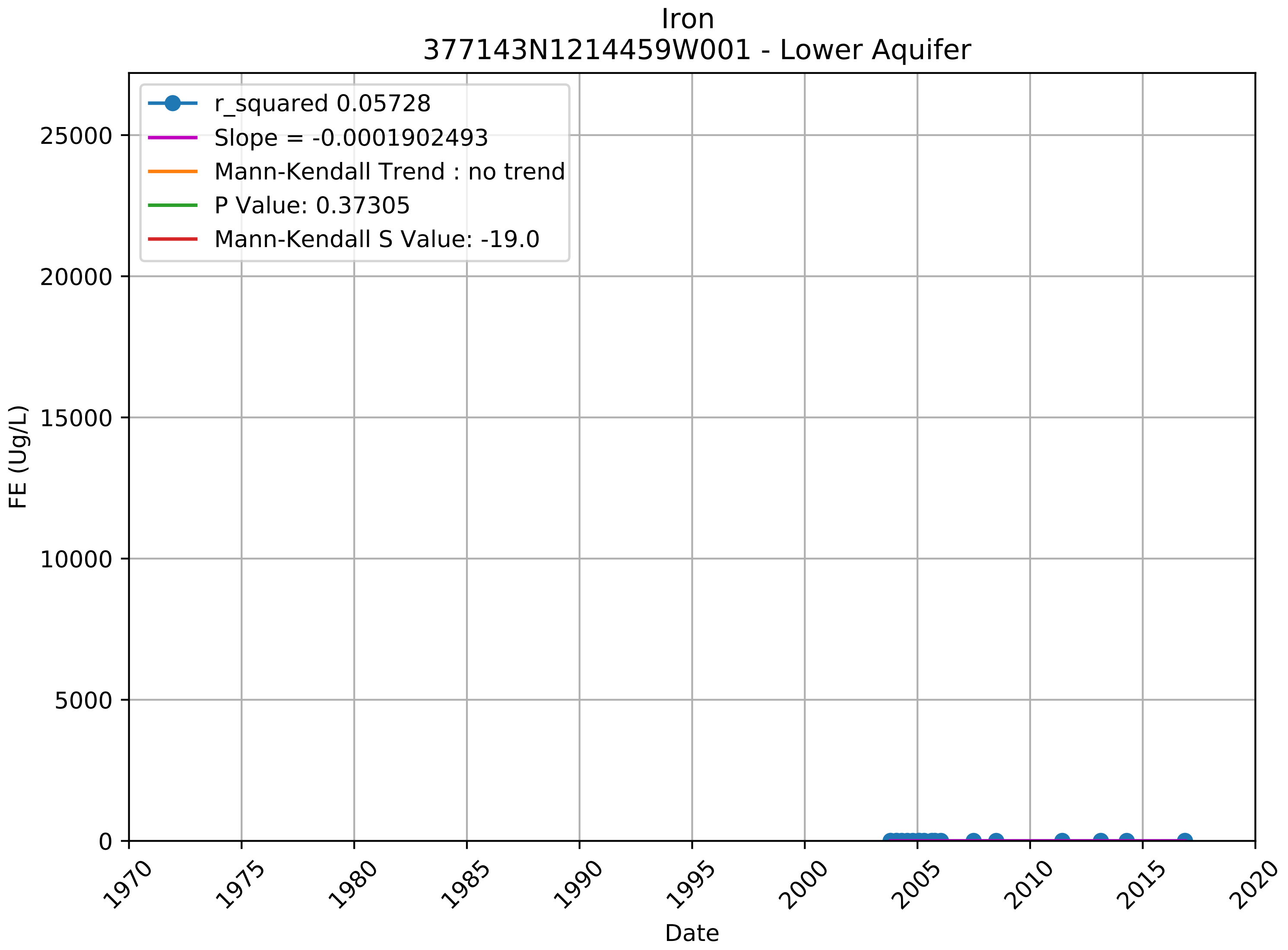
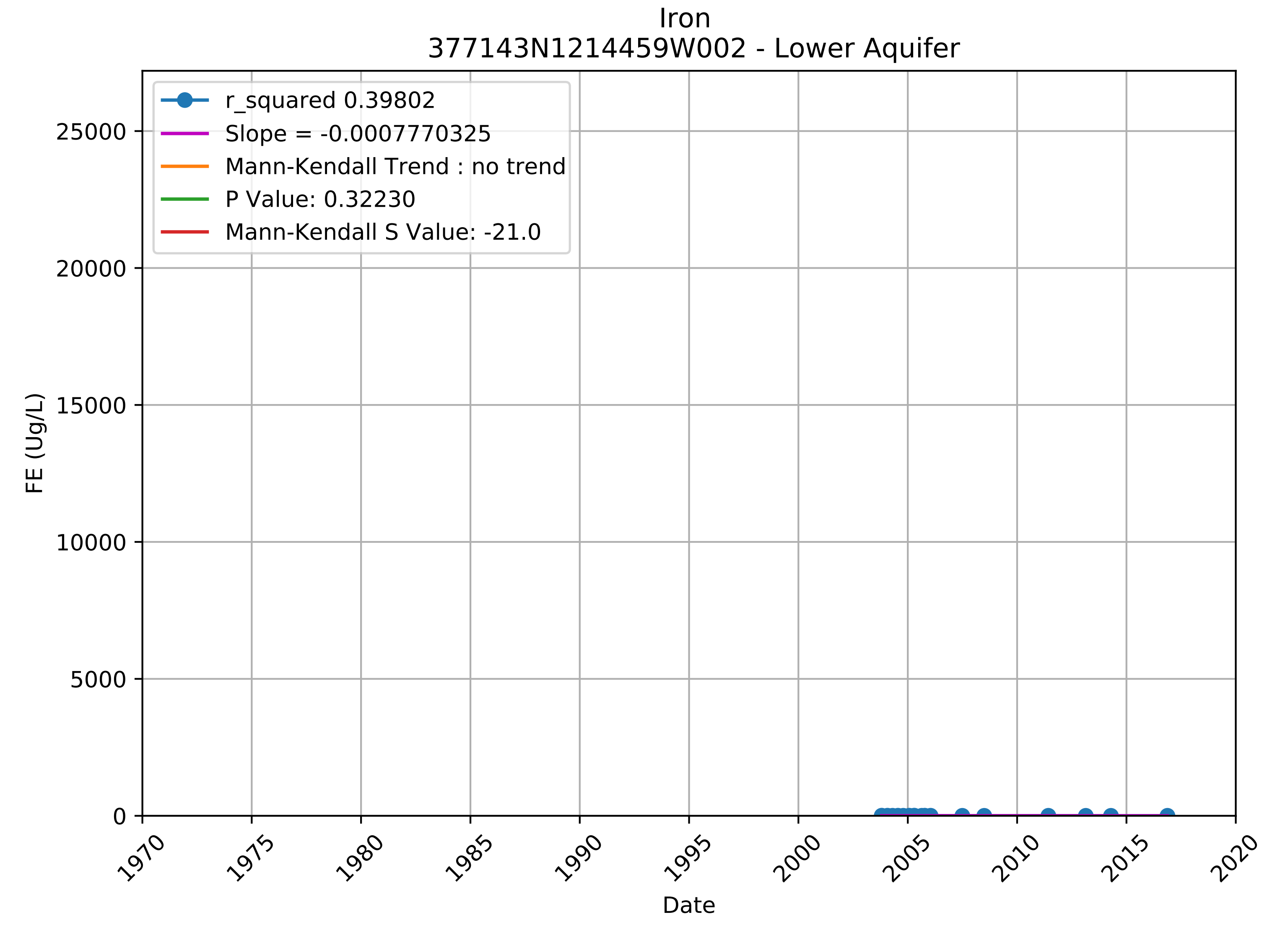
2010
2015
2020
Date



Iron
377143N1214459W001 - Lower Aquifer
r_squared 0.05728
Slope = -0.0001902493
Mann-Kendall Trend : no trend
P Value: 0.37305
Mann-Kendall S Value: -19.0
FE (Ug/L)
25000
20000
15000
10000
5000
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



Iron
377143N1214459W002 - Lower Aquifer
r_squared 0.39802
Slope = -0.0007770325
Mann-Kendall Trend : no trend
P Value: 0.32230
Mann-Kendall S Value: -21.0
FE (Ug/L)
Date
0
5000
10000
15000
20000
25000
1970
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2010
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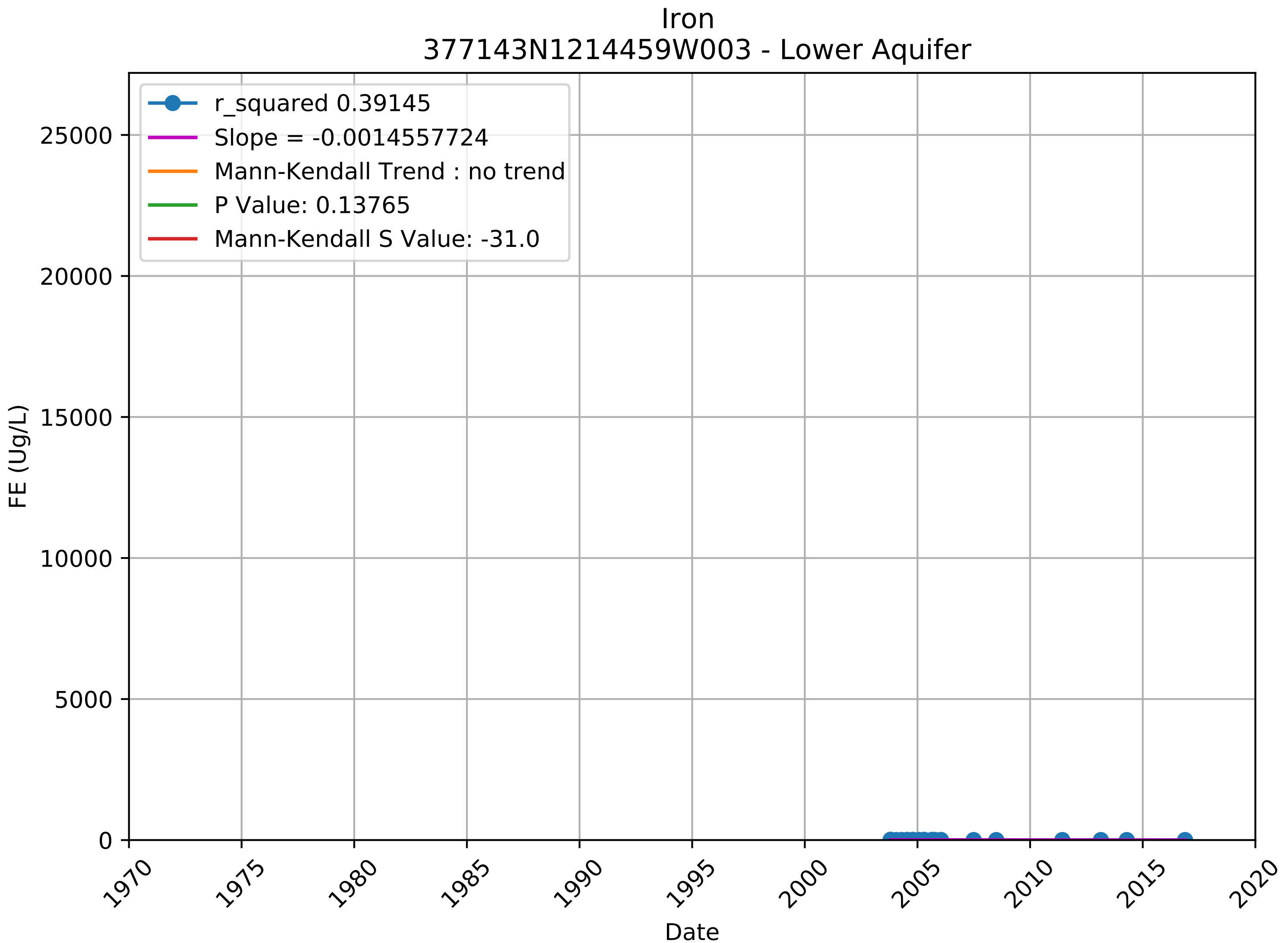
2020



Iron
377143N1214459W003 - Lower Aquifer
r_squared 0.39145
Slope = -0.0014557724
Mann-Kendall Trend : no trend
P Value: 0.13765
Mann-Kendall S Value: -31.0
FE (Ug/L)
25000
20000
15000
10000
5000
0
1970
1975
1980
1985
1990
1995
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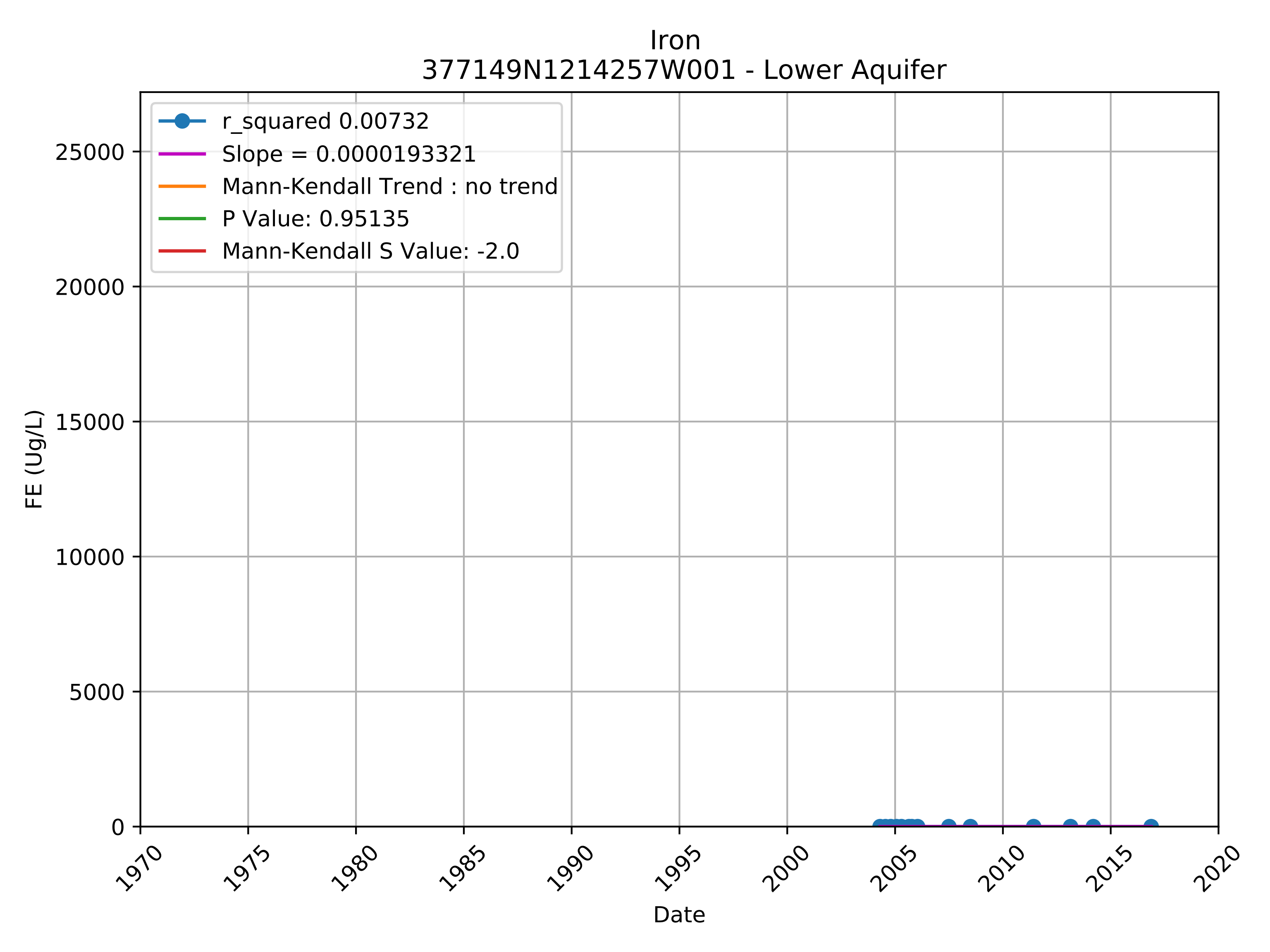
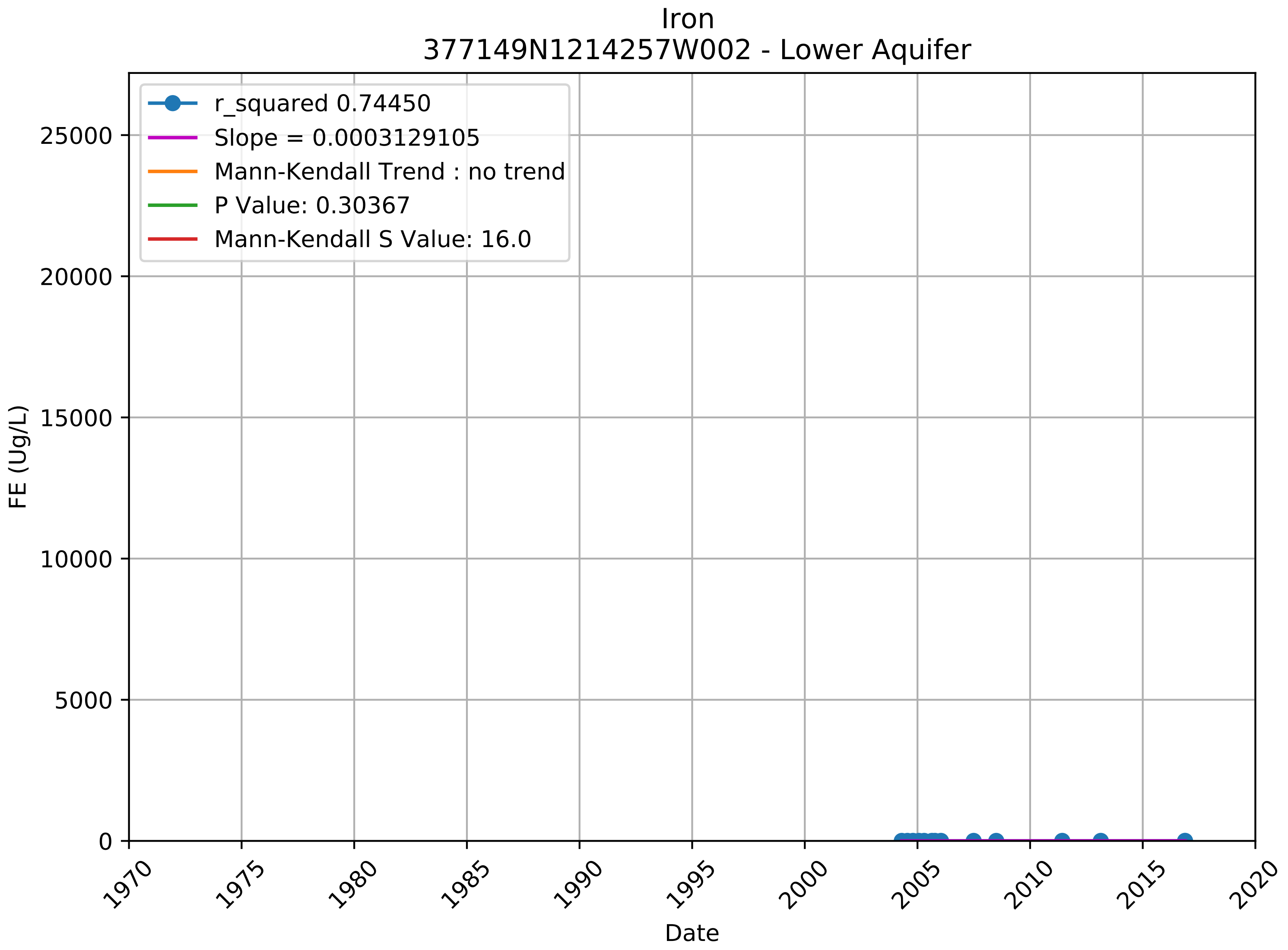
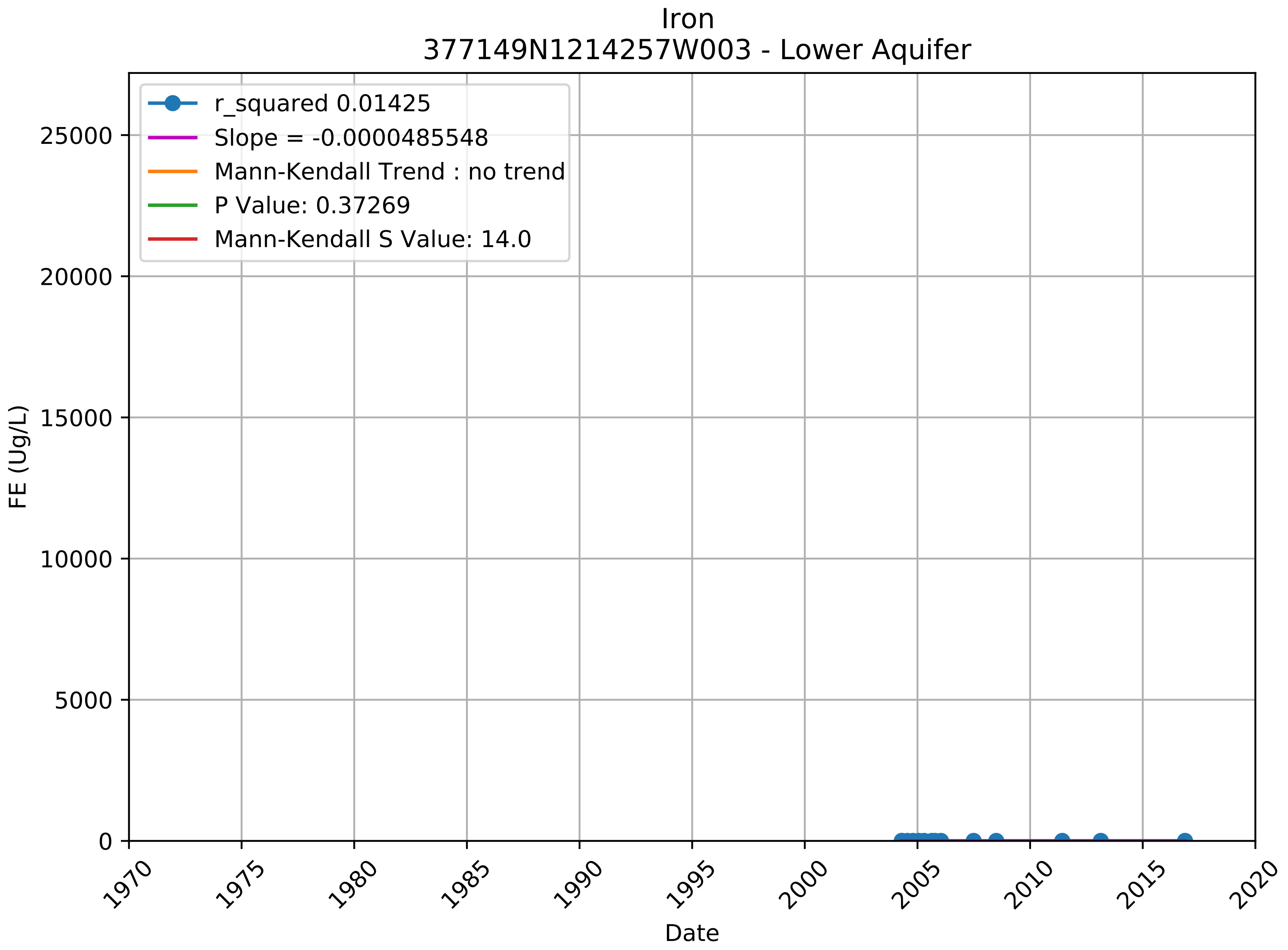
2005
2010
2015
2020
Date



Iron
377149N1214257W001 - Lower Aquifer
r_squared 0.00732
Slope = 0.0000193321
Mann-Kendall Trend : no trend
P Value: 0.95135
Mann-Kendall S Value: -2.0
FE (Ug/L)
25000
20000
15000
10000
5000
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



Iron
377149N1214257W002 - Lower Aquifer
r_squared 0.74450
Slope = 0.0003129105
Mann-Kendall Trend : no trend
P Value: 0.30367
Mann-Kendall S Value: 16.0
FE (Ug/L)
25000
20000
15000
10000
5000
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



Iron
377149N1214257W003 - Lower Aquifer
r_squared 0.01425
Slope = -0.0000485548
Mann-Kendall Trend : no trend
P Value: 0.37269
Mann-Kendall S Value: 14.0
FE (Ug/L)
25000
20000
15000
10000
5000
0
1970
1975
1980
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1995
2000
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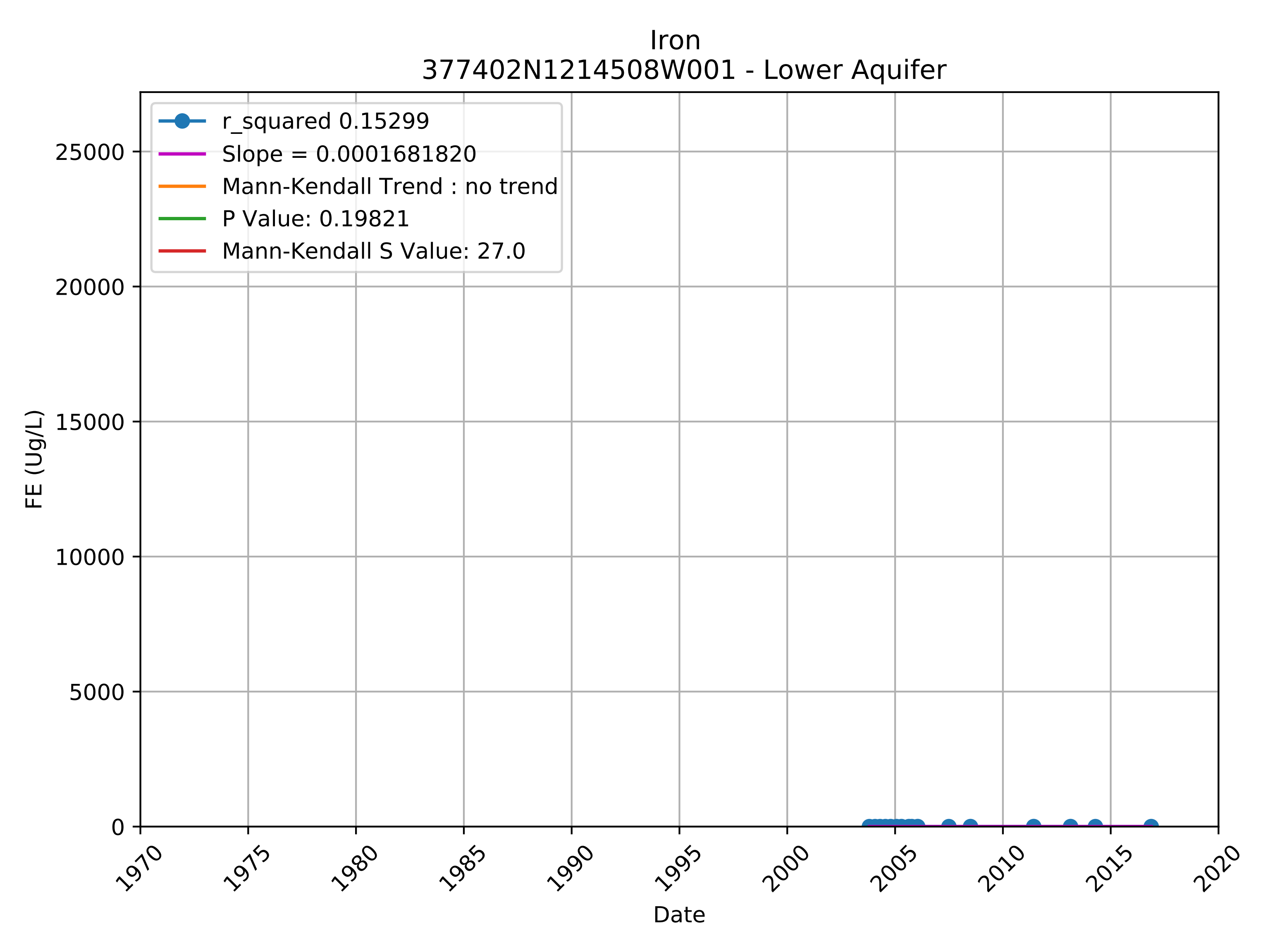
2010
2015
2020
Date



Iron
377402N1214508W001 - Lower Aquifer
r_squared 0.15299
Slope = 0.0001681820
Mann-Kendall Trend : no trend
P Value: 0.19821
Mann-Kendall S Value: 27.0
FE (Ug/L)
0
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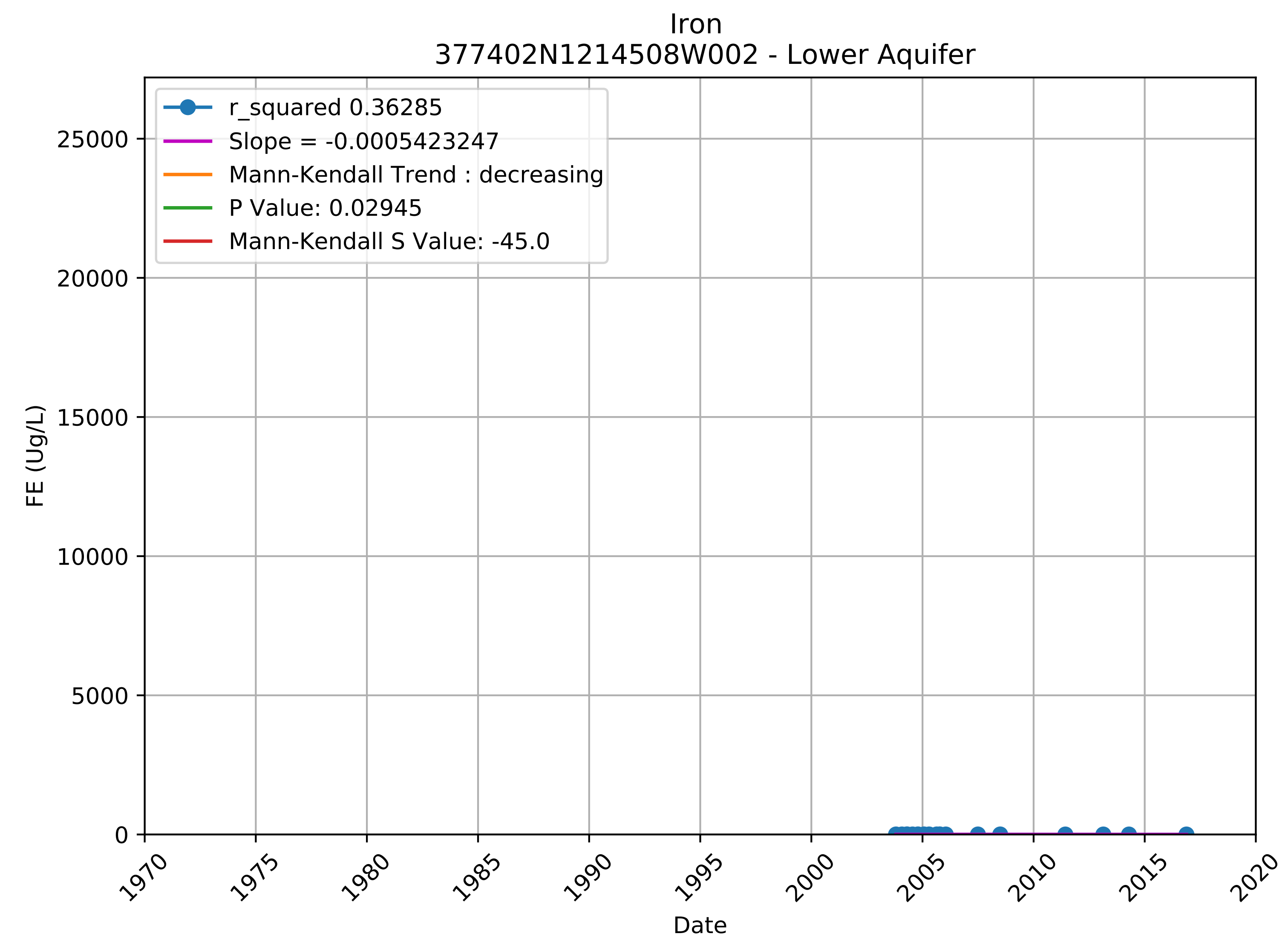
10000
15000
20000
25000
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



Iron
377402N1214508W002 - Lower Aquifer
r_squared 0.36285
Slope = -0.0005423247
Mann-Kendall Trend : decreasing
P Value: 0.02945
Mann-Kendall S Value: -45.0
FE (Ug/L)
Date
0
5000
10000
15000
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2015
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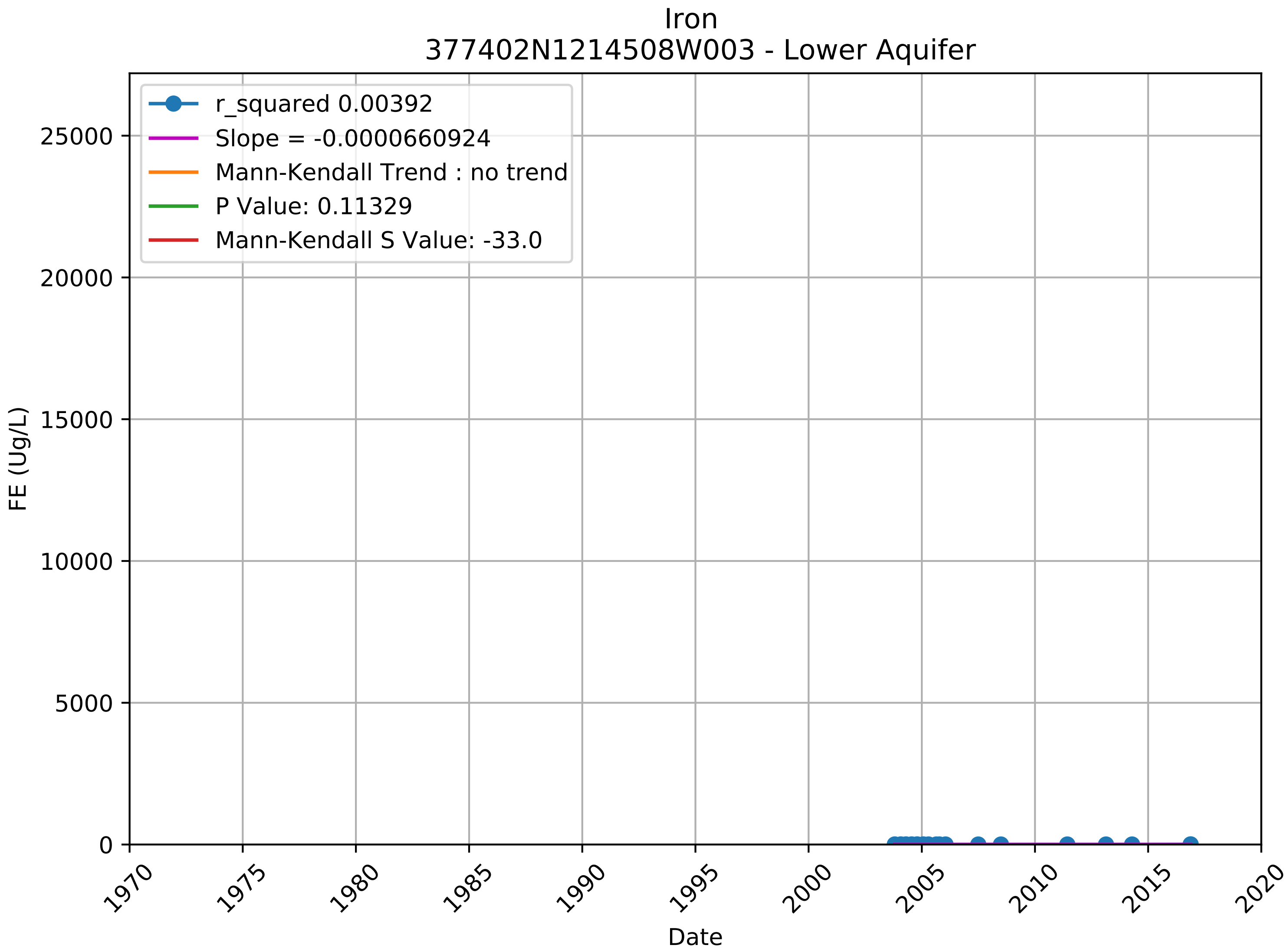
Iron
377402N1214508W003 - Lower Aquifer
r_squared 0.00392
Slope = -0.0000660924
Mann-Kendall Trend : no trend
P Value: 0.11329
Mann-Kendall S Value: -33.0
FE (Ug/L)
25000
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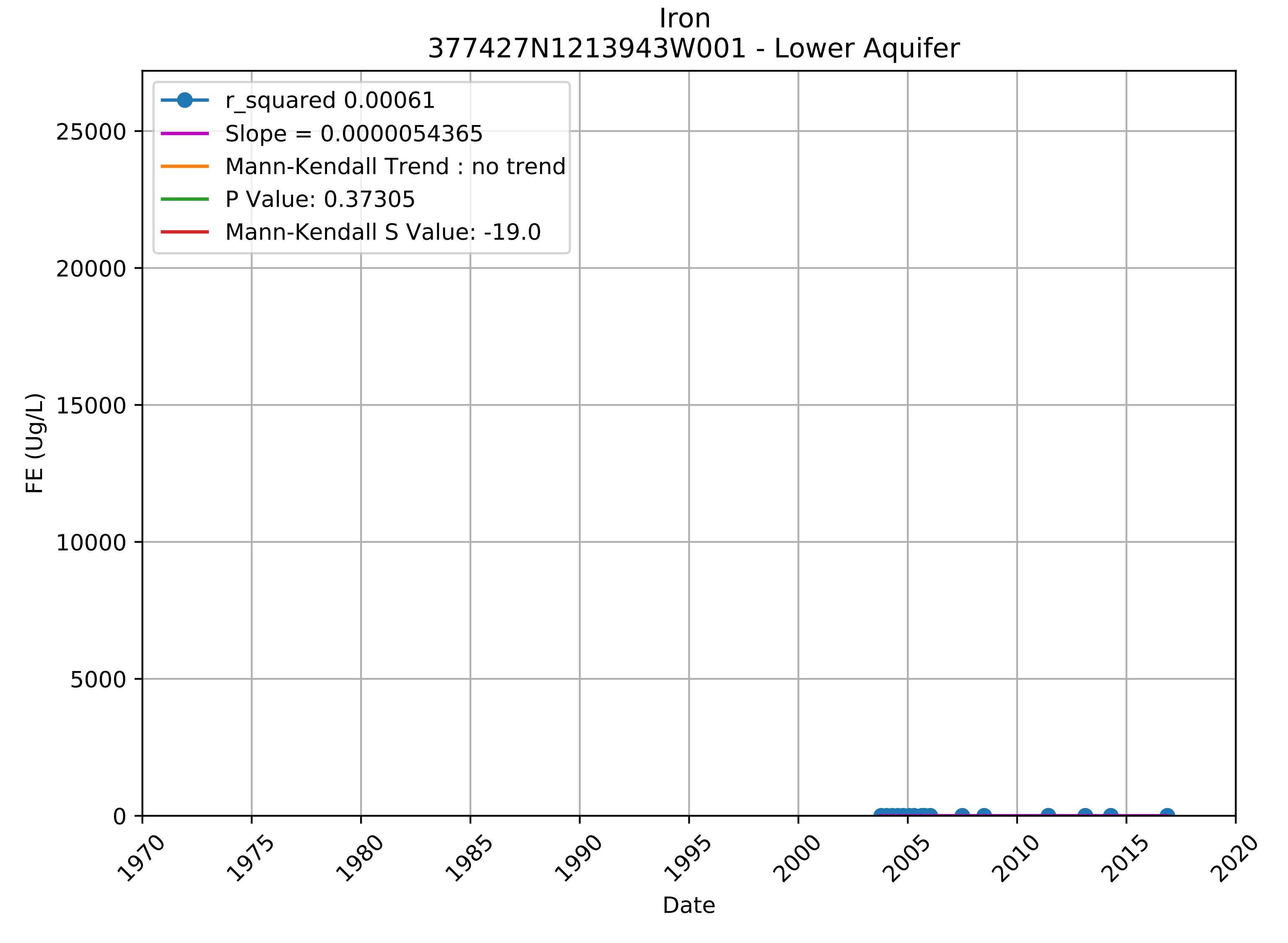
Date



Iron
377427N1213943W001 - Lower Aquifer
r_squared 0.00061
Slope = 0.0000054365
Mann-Kendall Trend : no trend
P Value: 0.37305
Mann-Kendall S Value: -19.0
FE (Ug/L)
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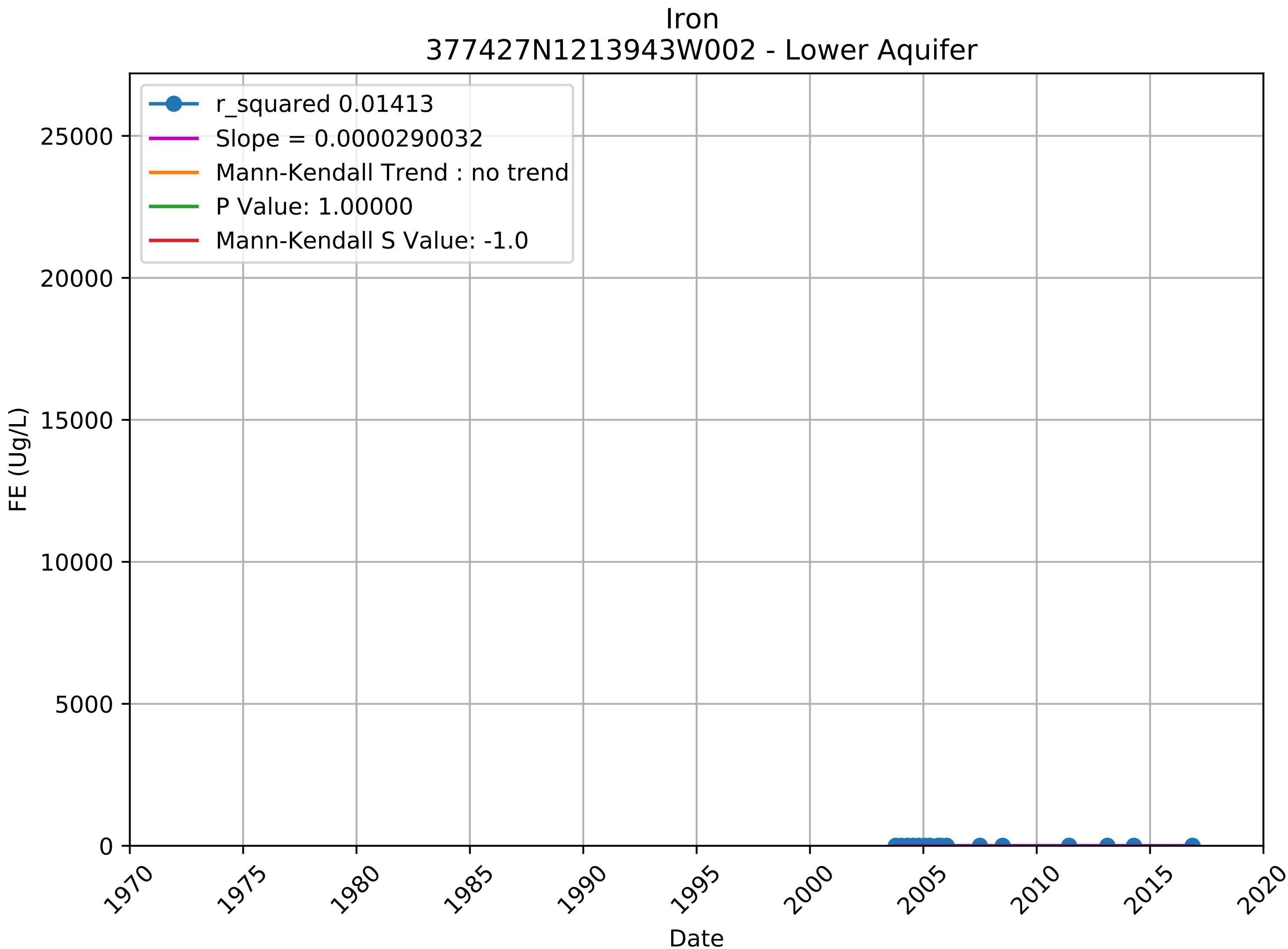

Iron
377427N1213943W002 - Lower Aquifer
r_squared 0.01413
Slope = 0.0000290032
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
FE (Ug/L)
Date
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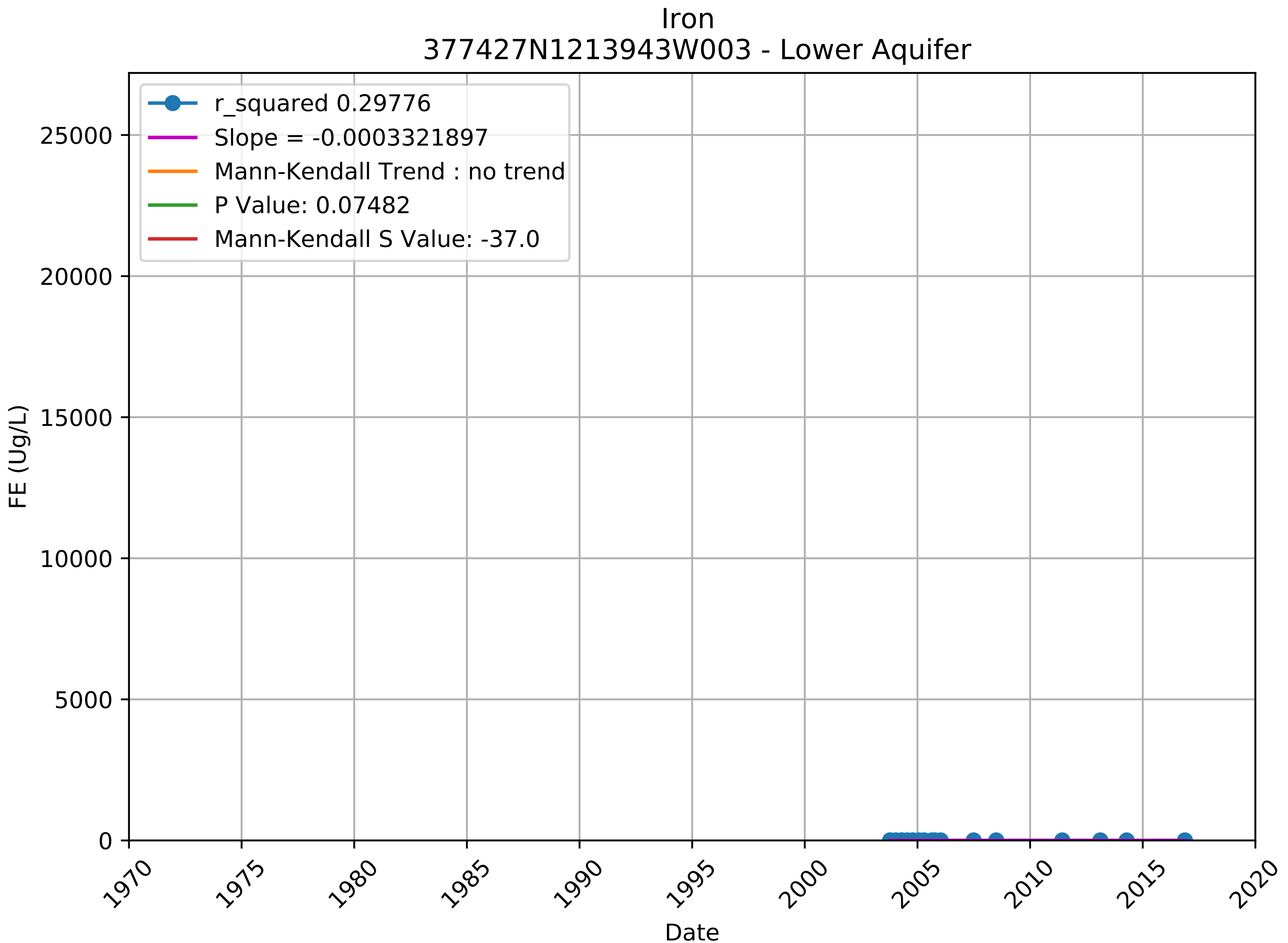
Iron
377427N1213943W003 - Lower Aquifer
r_squared 0.29776
Slope = -0.0003321897
Mann-Kendall Trend : no trend
P Value: 0.07482
Mann-Kendall S Value: -37.0
FE (Ug/L)
Date
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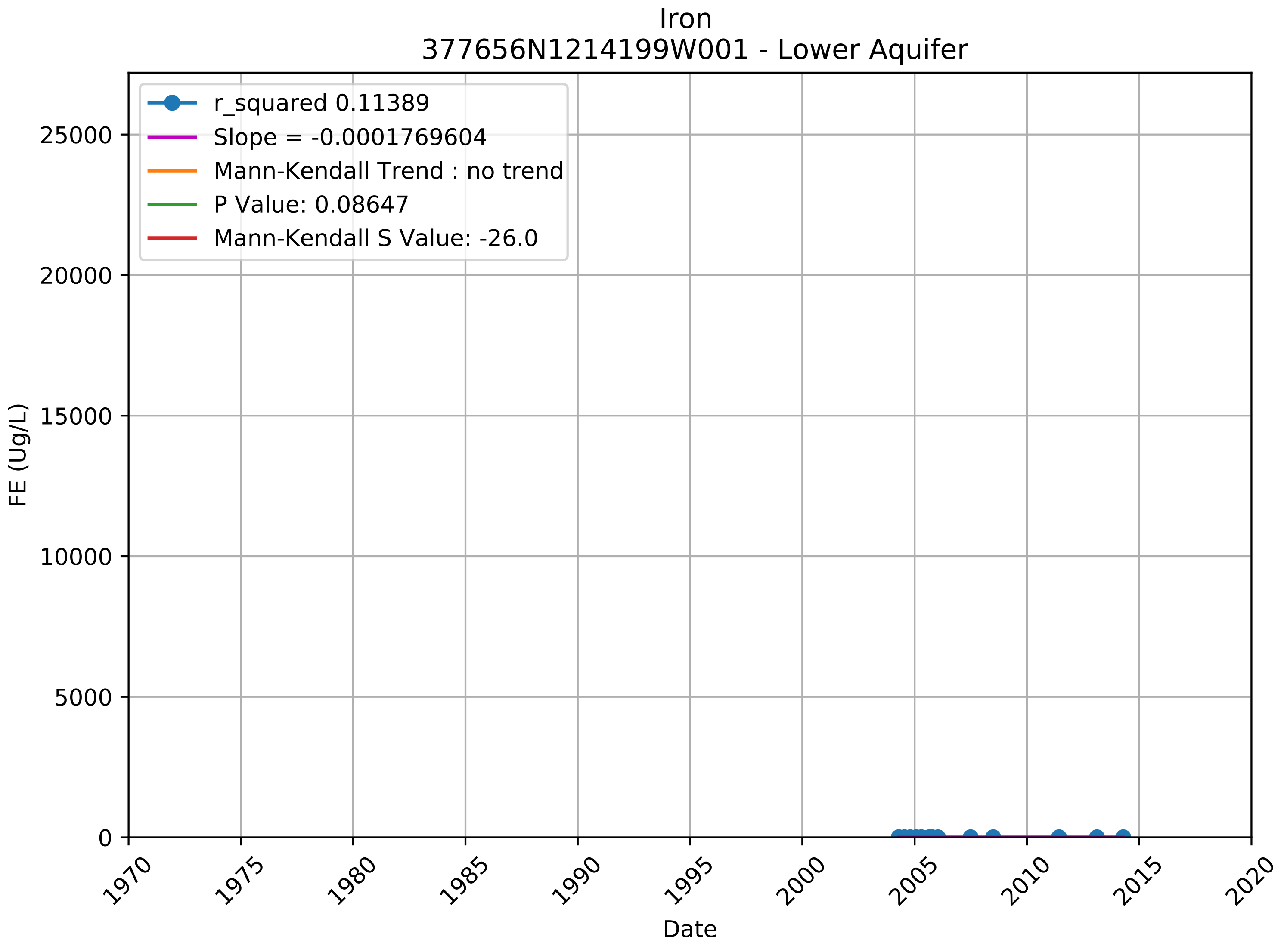

Iron
377656N1214199W001 - Lower Aquifer
r_squared 0.11389
Slope = -0.0001769604
Mann-Kendall Trend : no trend
P Value: 0.08647
Mann-Kendall S Value: -26.0
FE (Ug/L)
Date
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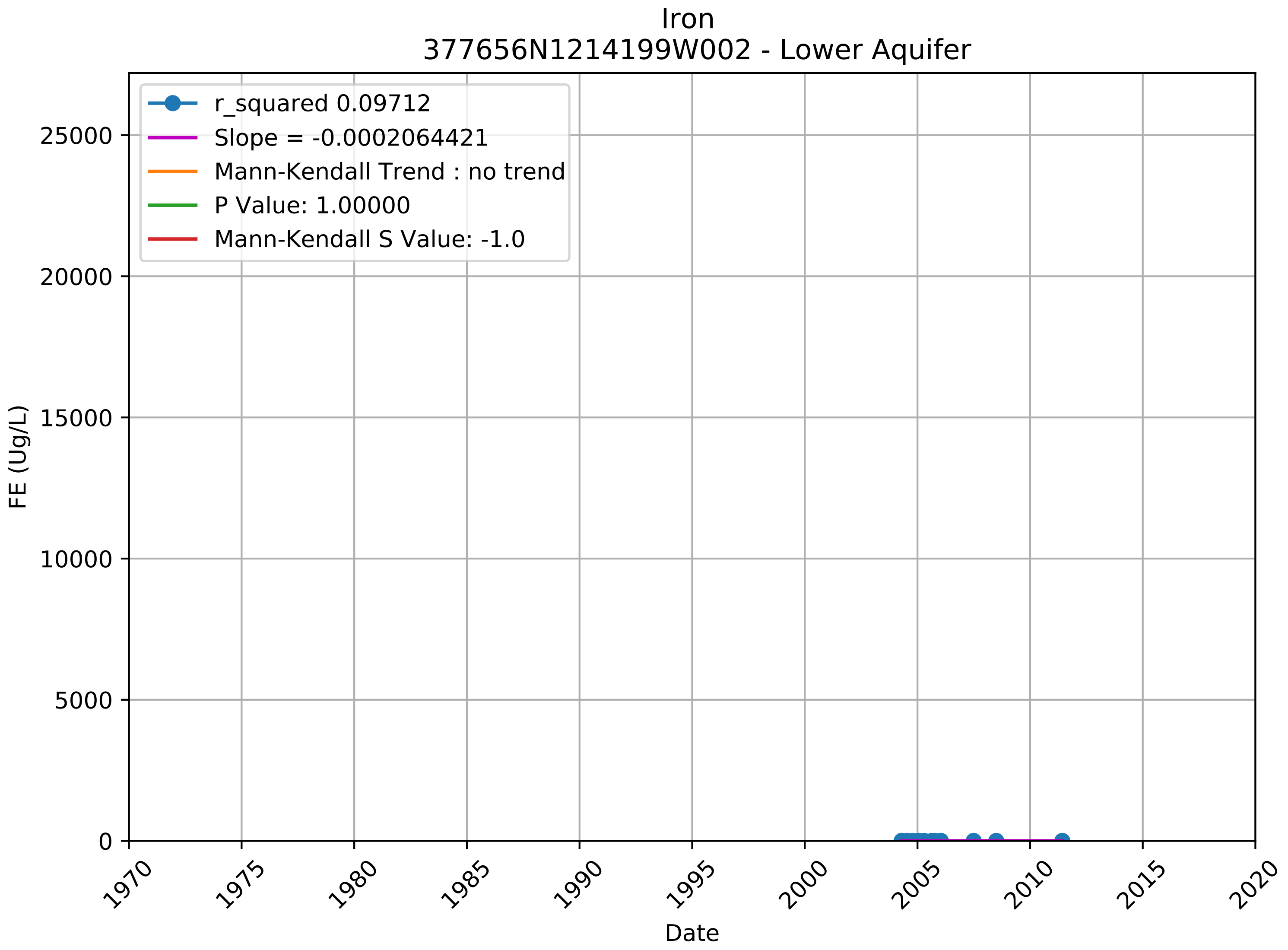

Iron
377656N1214199W002 - Lower Aquifer
r_squared 0.09712
Slope = -0.0002064421
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
FE (Ug/L)
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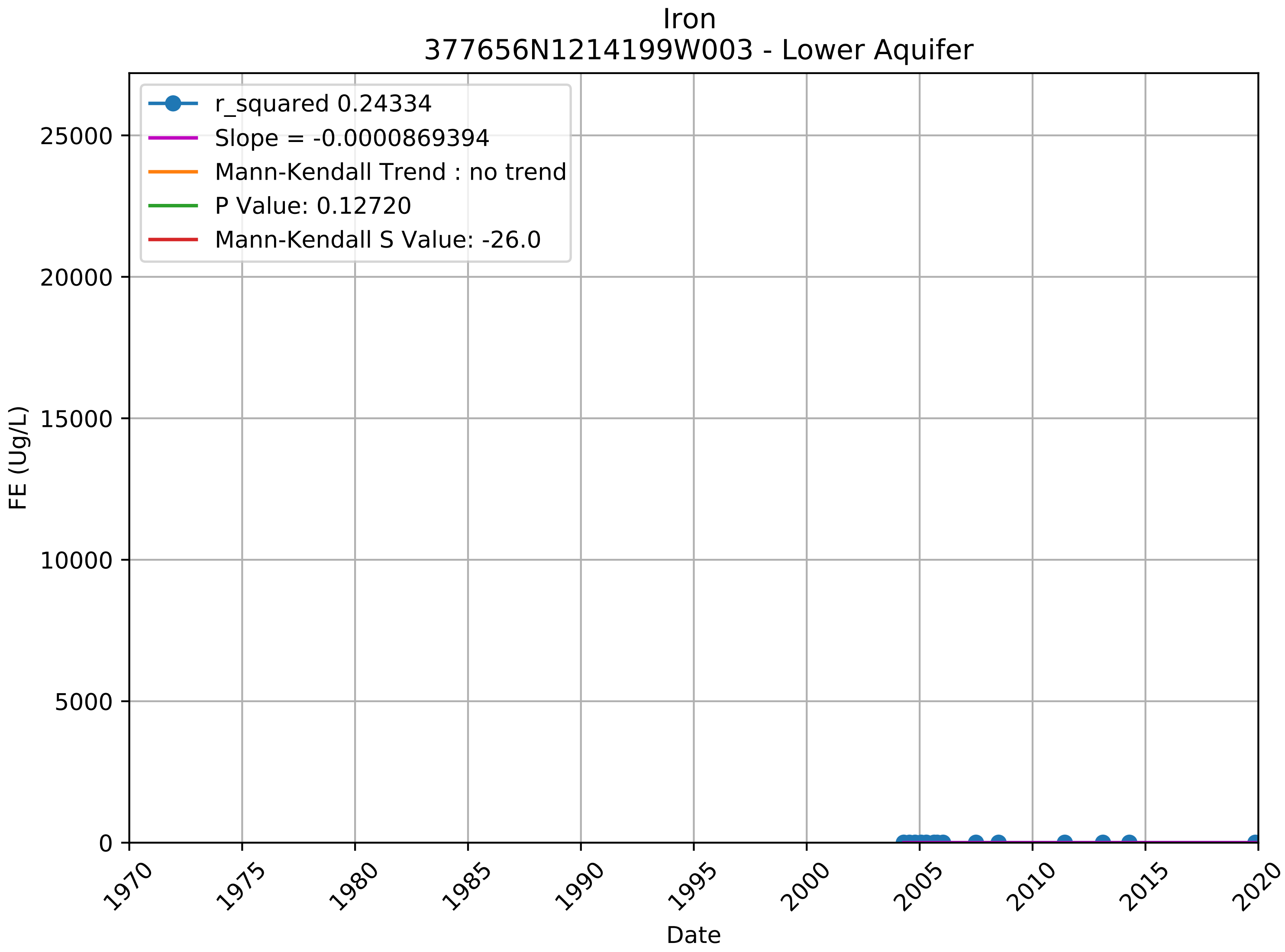

Iron
377656N1214199W003 - Lower Aquifer
r_squared 0.24334
Slope = -0.0000869394
Mann-Kendall Trend : no trend
P Value: 0.12720
Mann-Kendall S Value: -26.0
25000
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FE (Ug/L)
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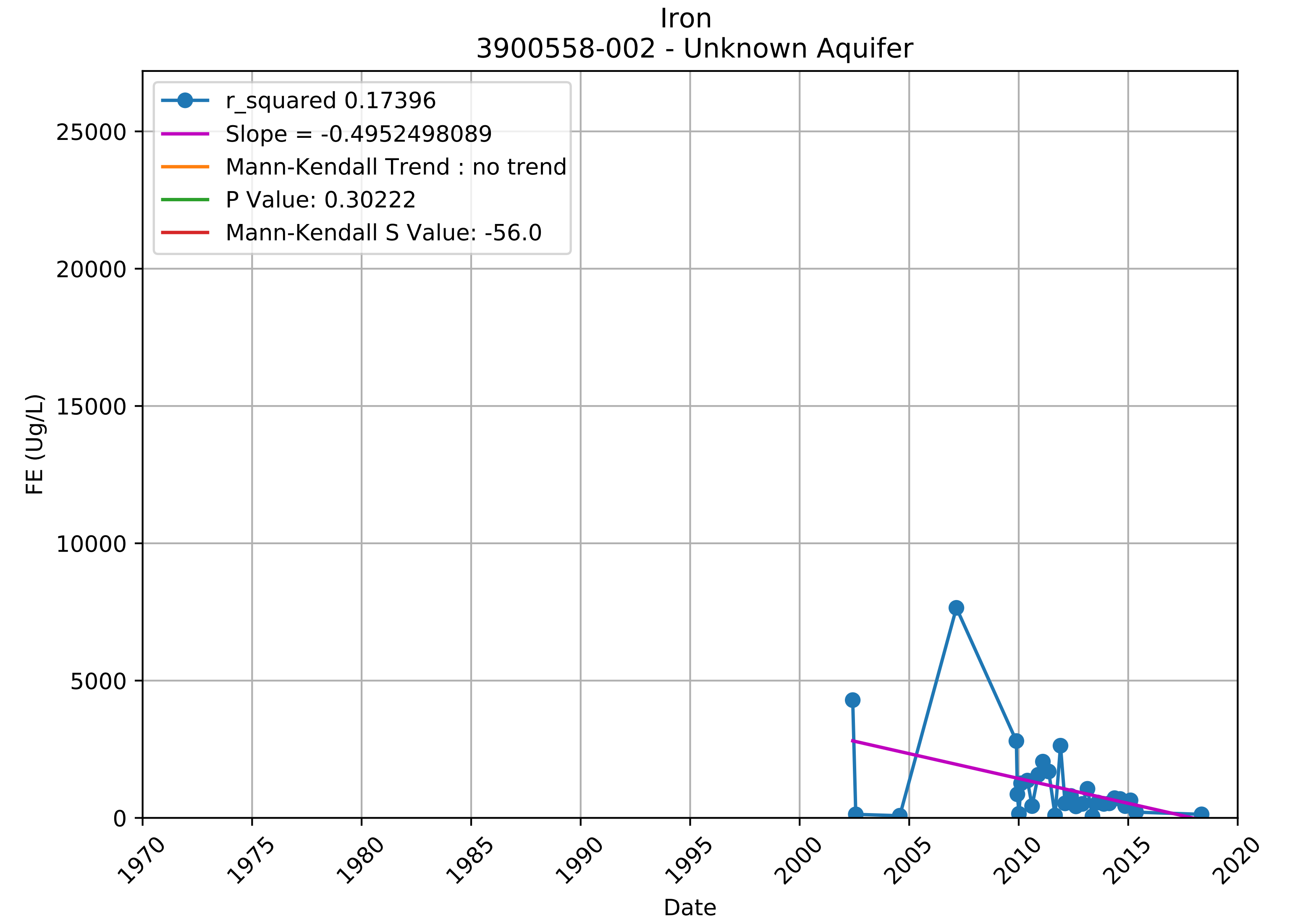

Iron
3900558-002 - Unknown Aquifer
r_squared 0.17396
Slope = -0.4952498089
Mann-Kendall Trend : no trend
P Value: 0.30222
Mann-Kendall S Value: -56.0
FE (Ug/L)
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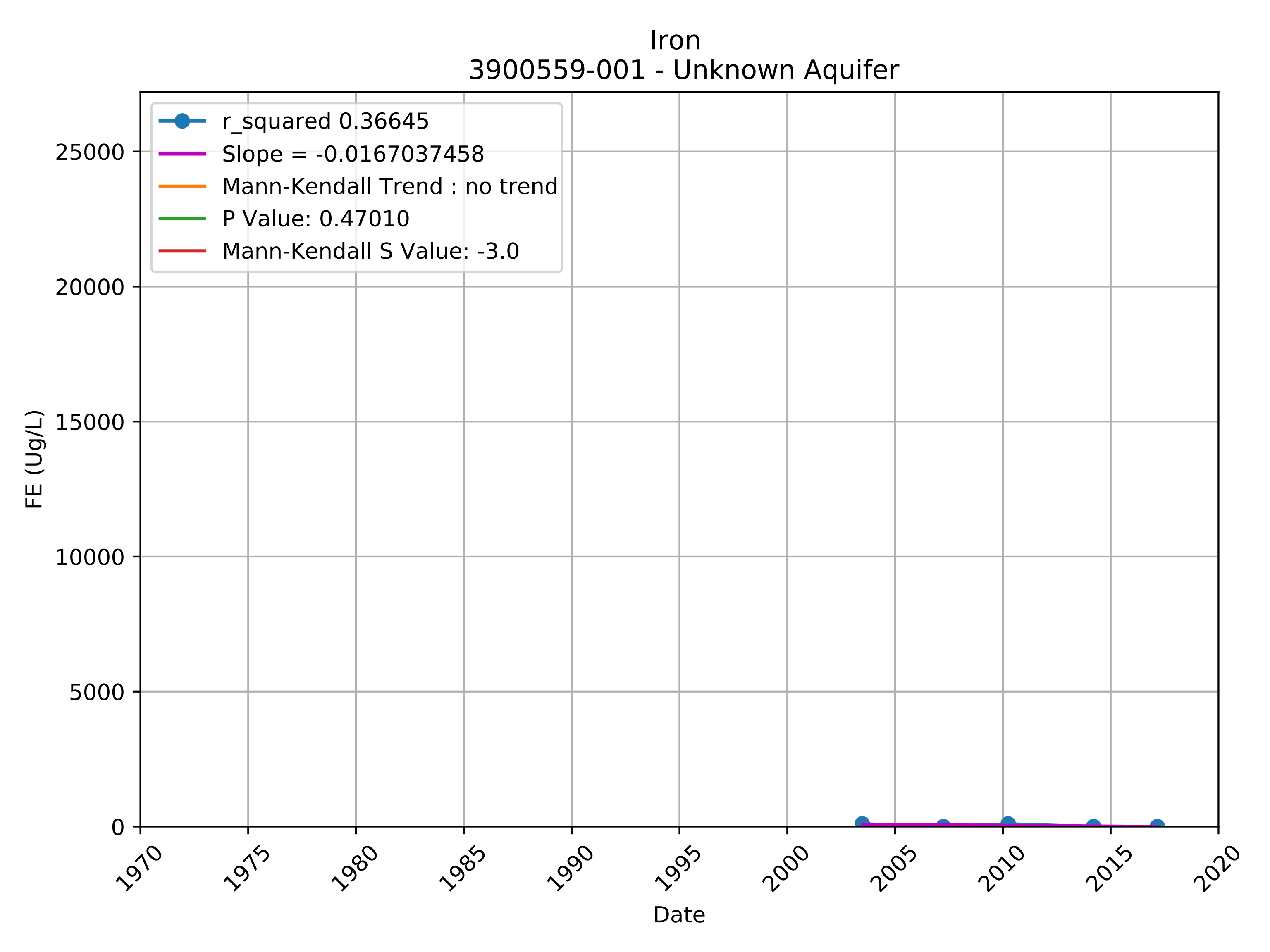

Iron
3900559-001 - Unknown Aquifer
r_squared 0.36645
Slope = -0.0167037458
Mann-Kendall Trend : no trend
P Value: 0.47010
Mann-Kendall S Value: -3.0
FE (Ug/L)
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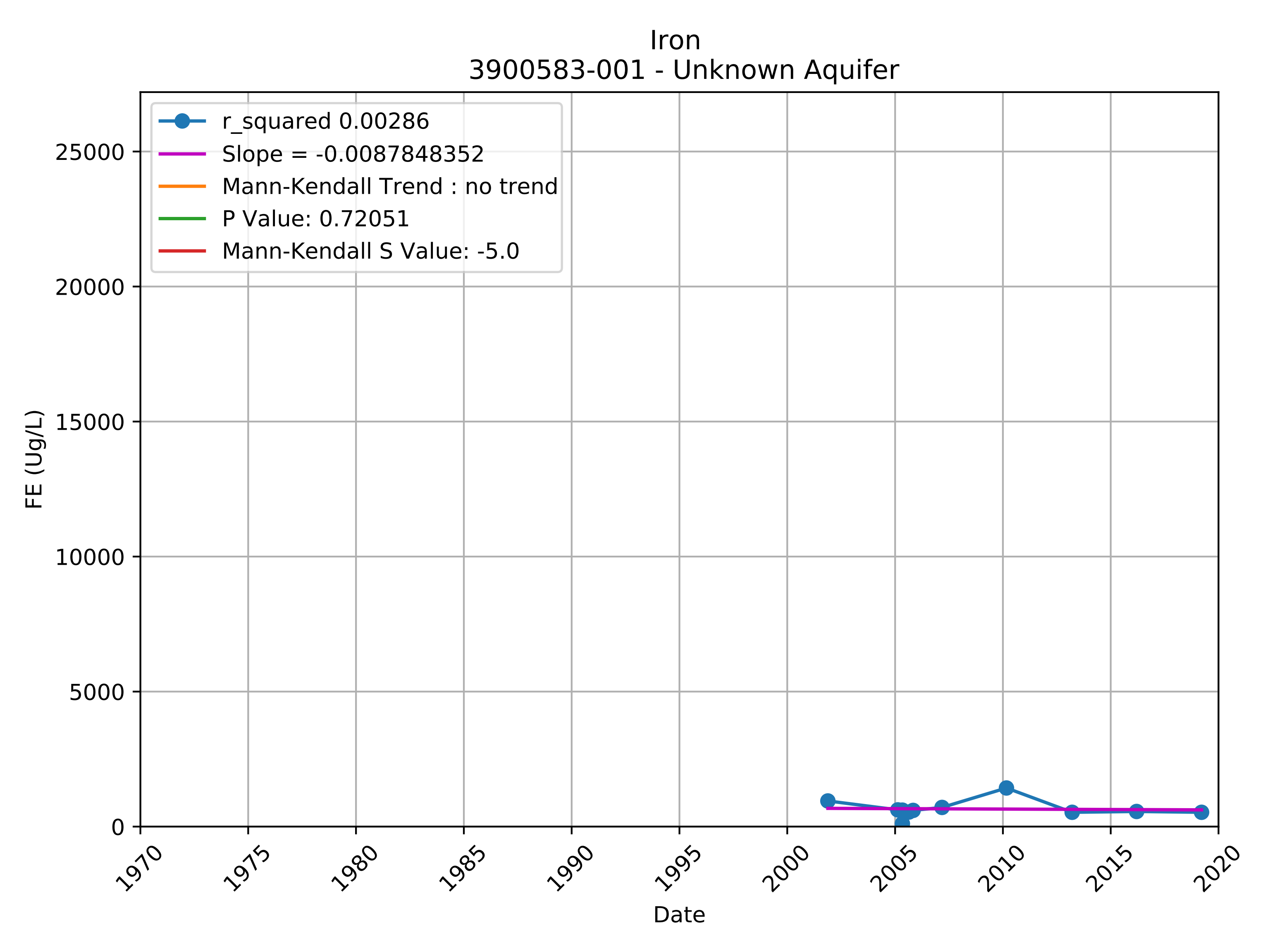

Iron
3900583-001 - Unknown Aquifer
r_squared 0.00286
Slope = -0.0087848352
Mann-Kendall Trend : no trend
P Value: 0.72051
Mann-Kendall S Value: -5.0
FE (Ug/L)
Date
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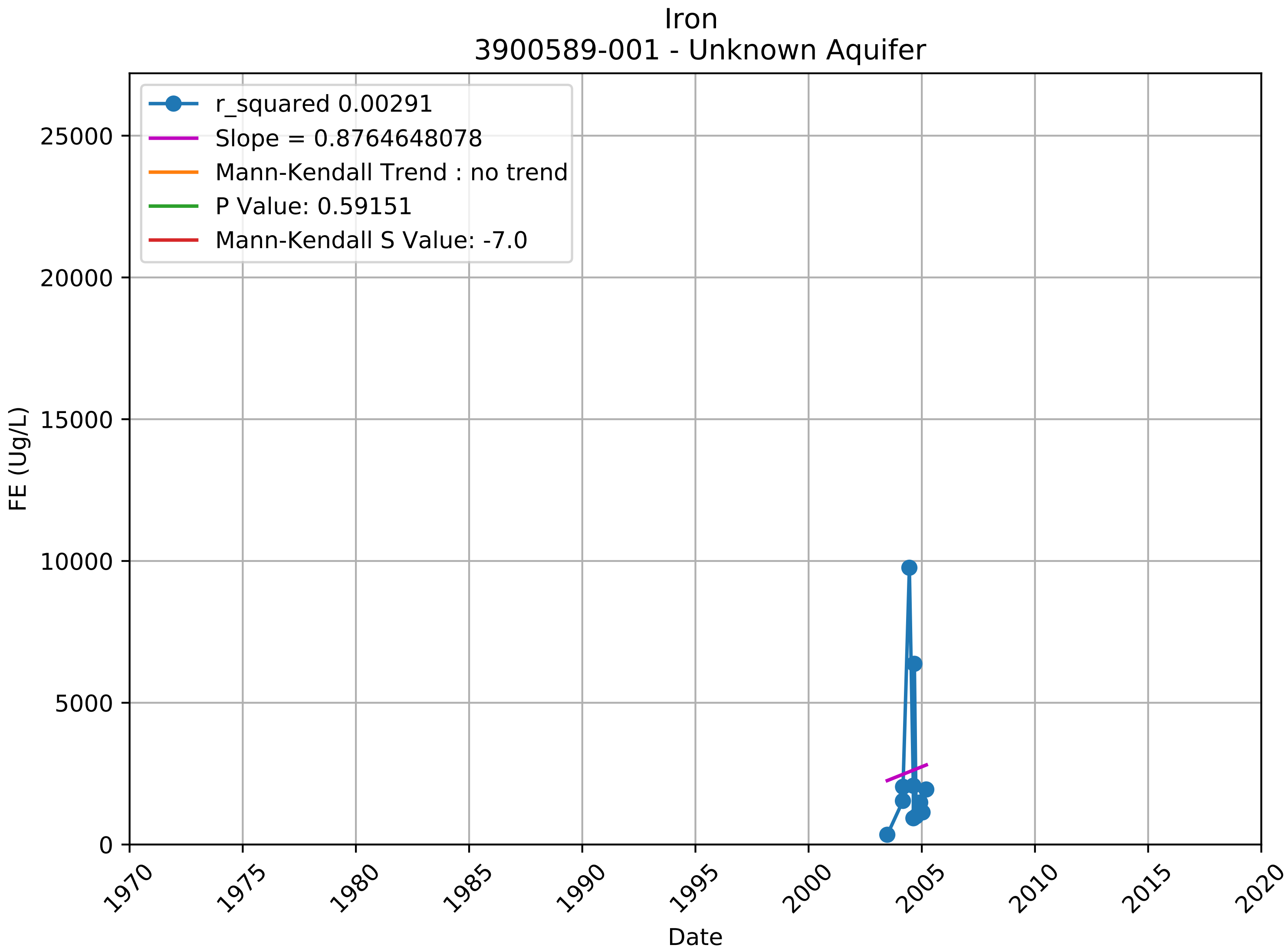

Iron
3900589-001 - Unknown Aquifer
r_squared 0.00291
Slope = 0.8764648078
Mann-Kendall Trend : no trend
P Value: 0.59151
Mann-Kendall S Value: -7.0
FE (Ug/L)
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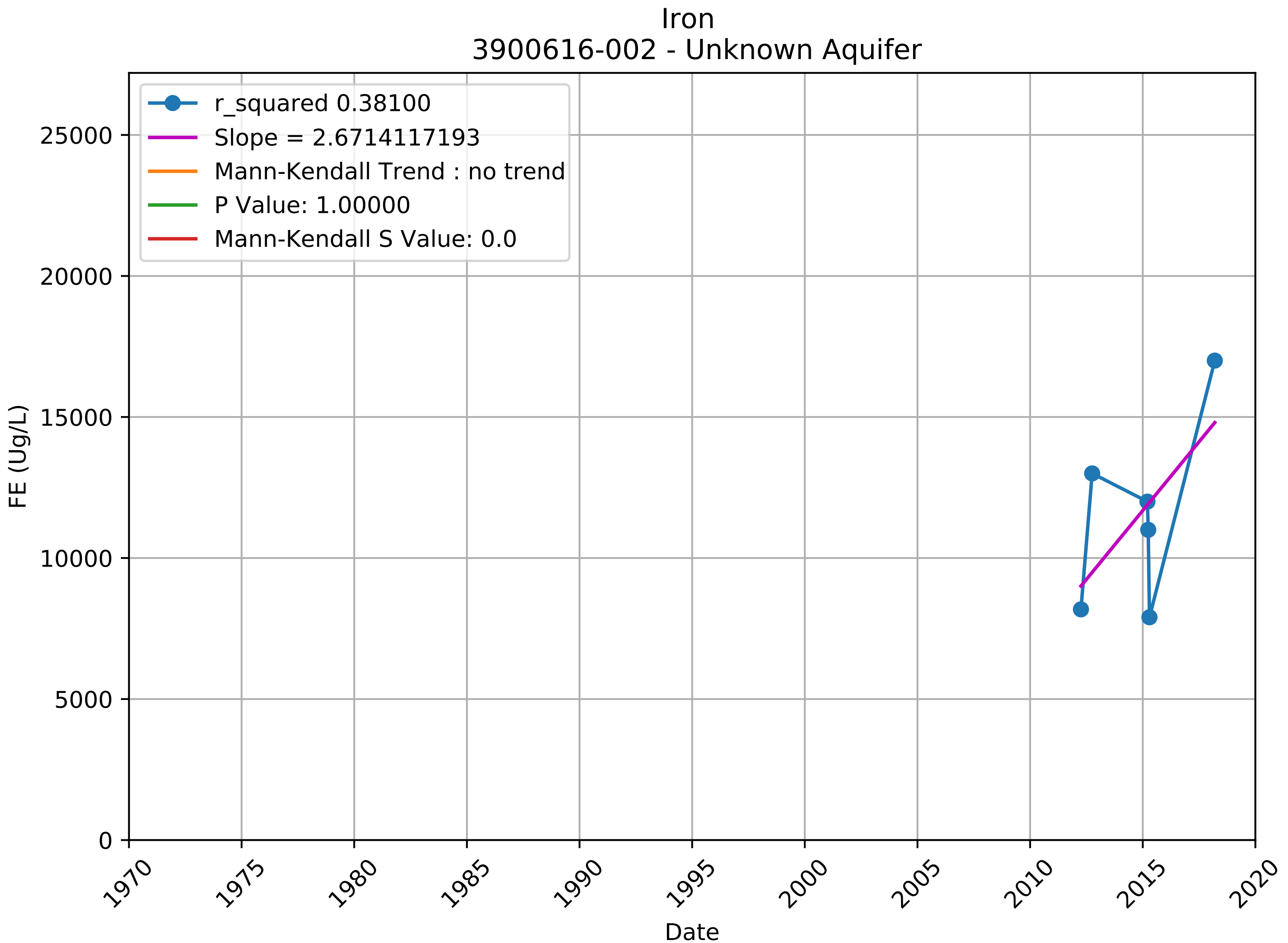

Iron
3900616-002 - Unknown Aquifer
r_squared 0.38100
Slope = 2.6714117193
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
FE (Ug/L)
Date
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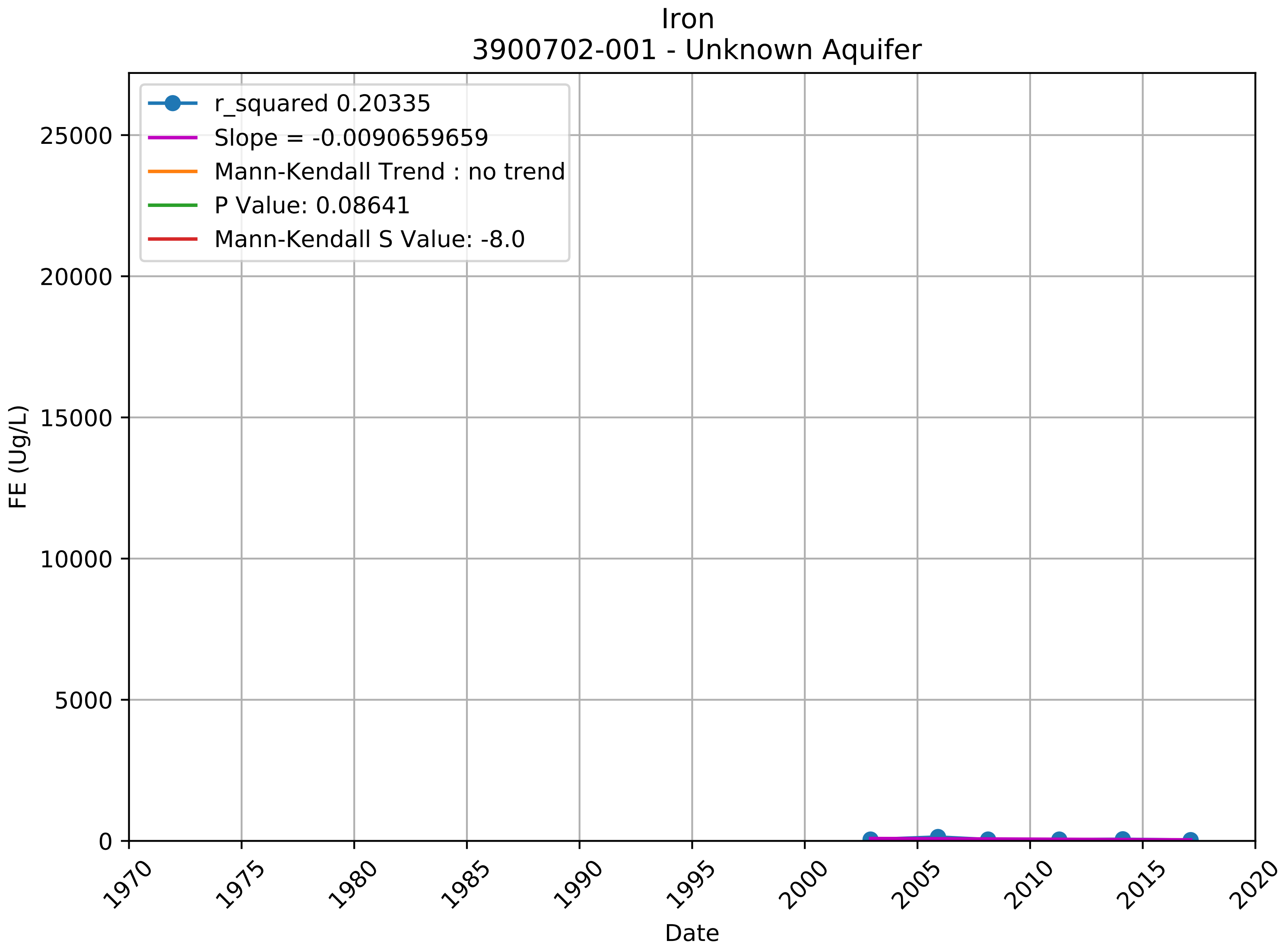

Iron
3900702-001 - Unknown Aquifer
r_squared 0.20335
Slope = -0.0090659659
Mann-Kendall Trend : no trend
P Value: 0.08641
Mann-Kendall S Value: -8.0
FE (Ug/L)
Date
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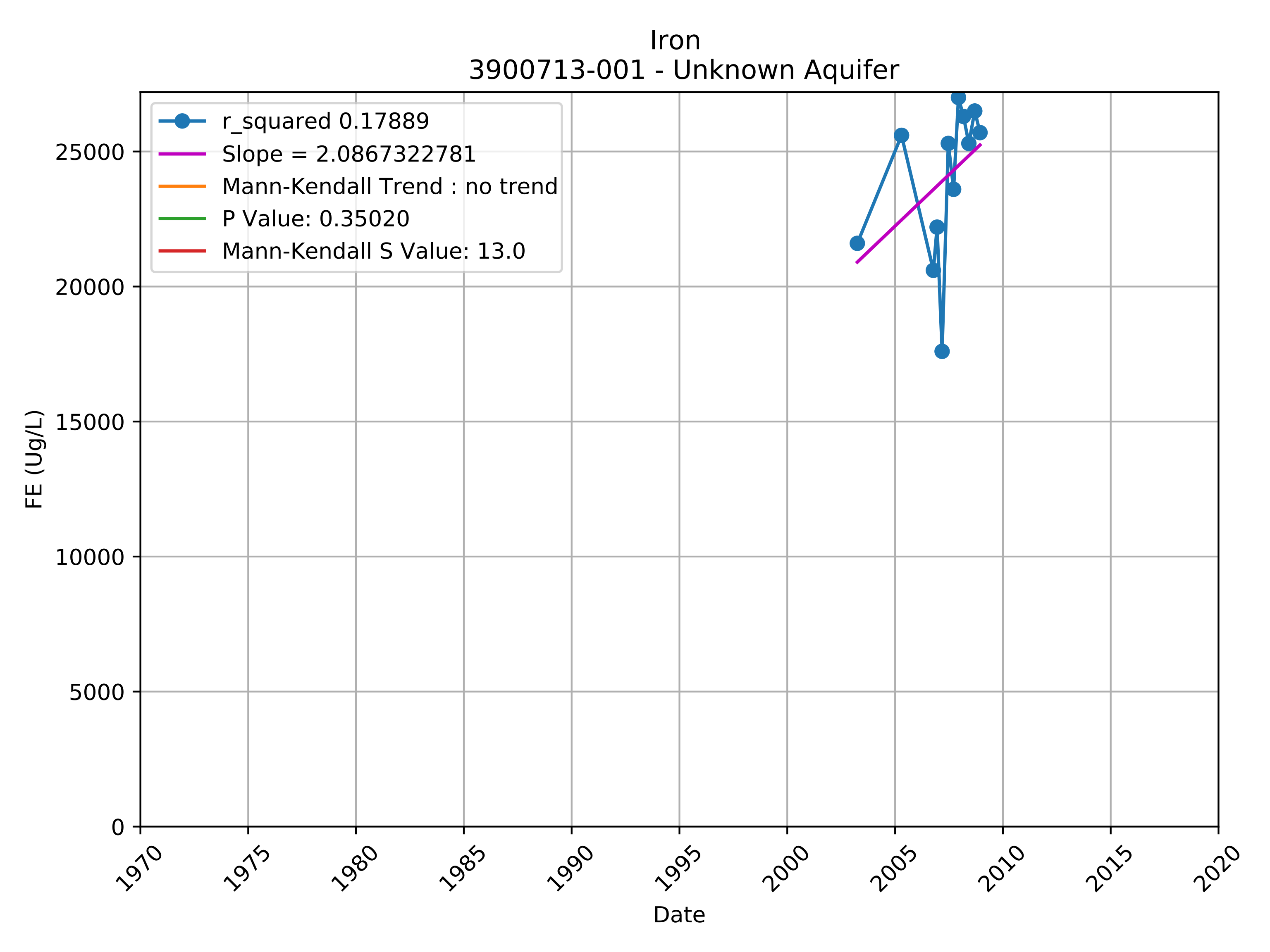

Iron
3900713-001 - Unknown Aquifer
r_squared 0.17889
Slope = 2.0867322781
Mann-Kendall Trend : no trend
P Value: 0.35020
Mann-Kendall S Value: 13.0
FE (Ug/L)
Date
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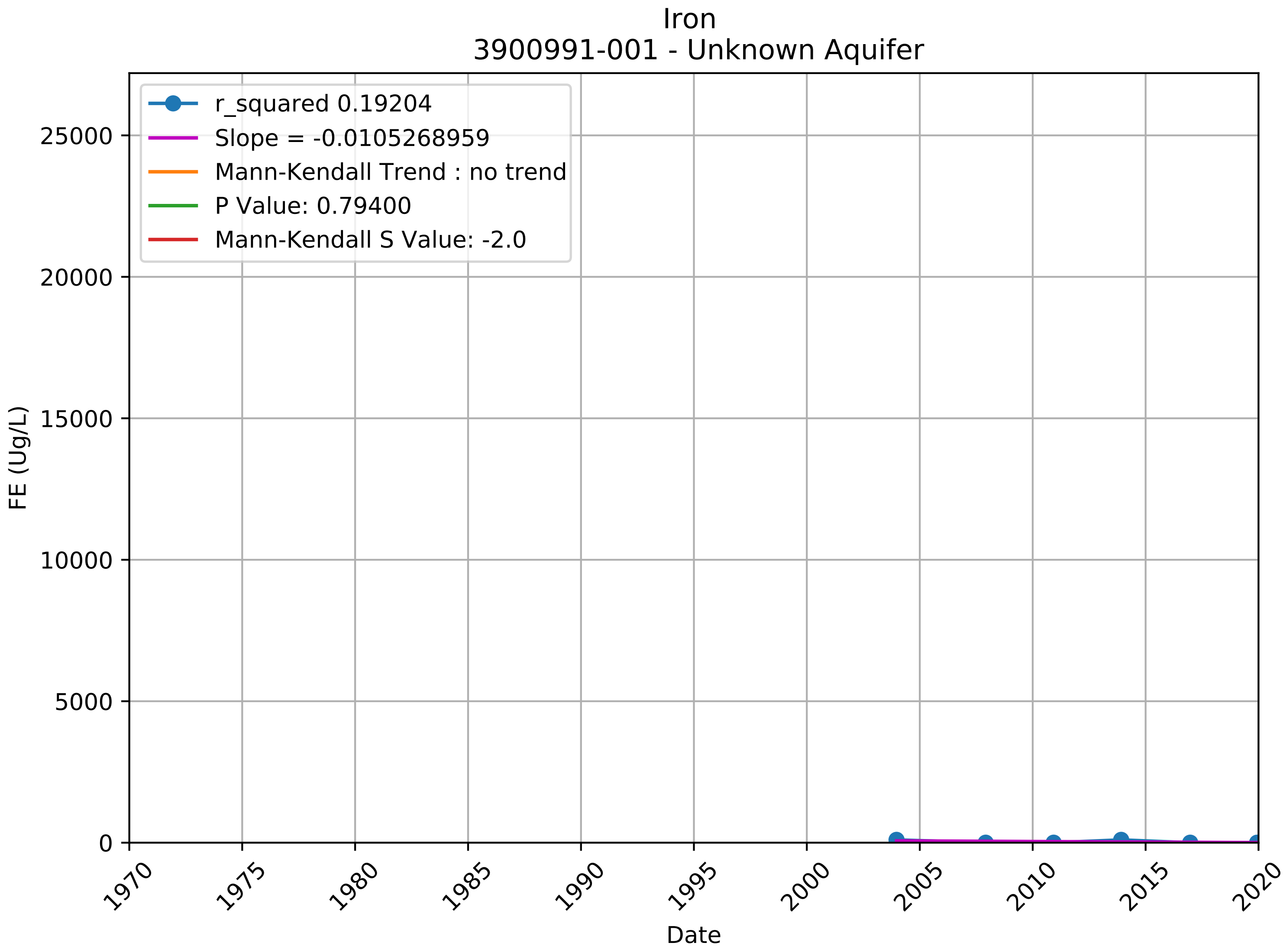

Iron
3900991-001 - Unknown Aquifer
r_squared 0.19204
Slope = -0.0105268959
Mann-Kendall Trend : no trend
P Value: 0.79400
Mann-Kendall S Value: -2.0
FE (Ug/L)
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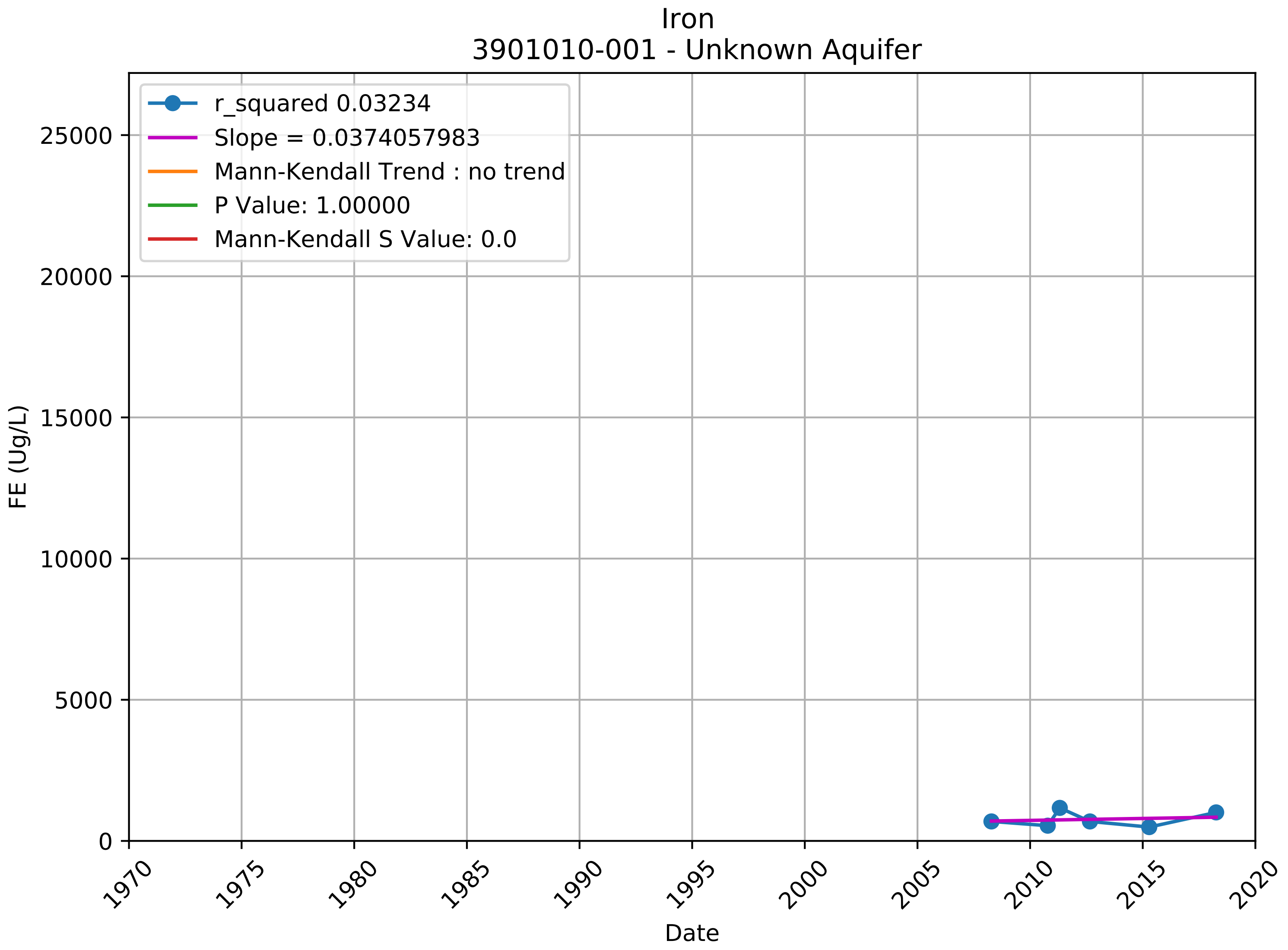

Iron
3901010-001 - Unknown Aquifer
r_squared 0.03234
Slope = 0.0374057983
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
FE (Ug/L)
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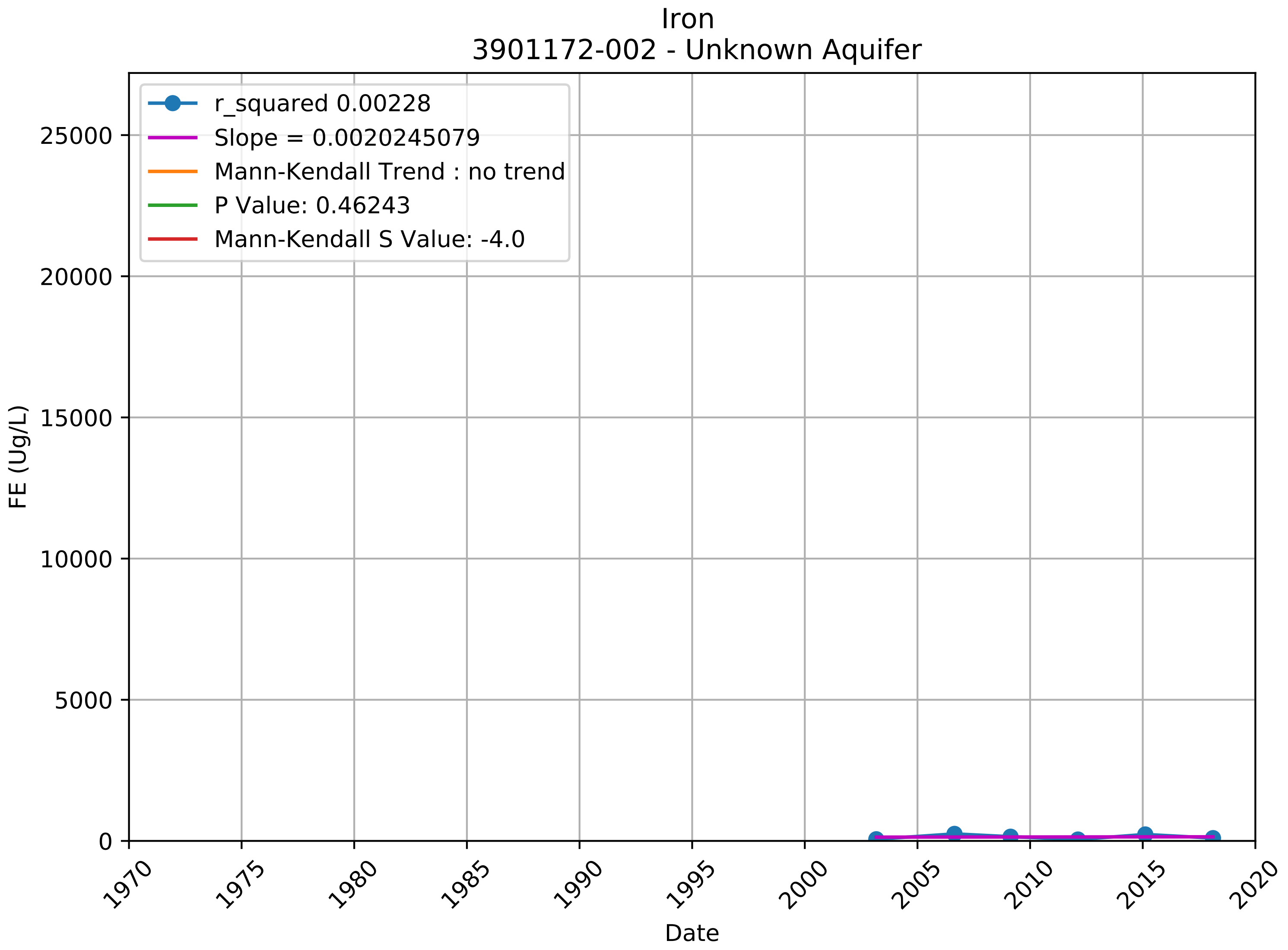

Iron
3901172-002 - Unknown Aquifer
r_squared 0.00228
Slope = 0.0020245079
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: -4.0
FE (Ug/L)
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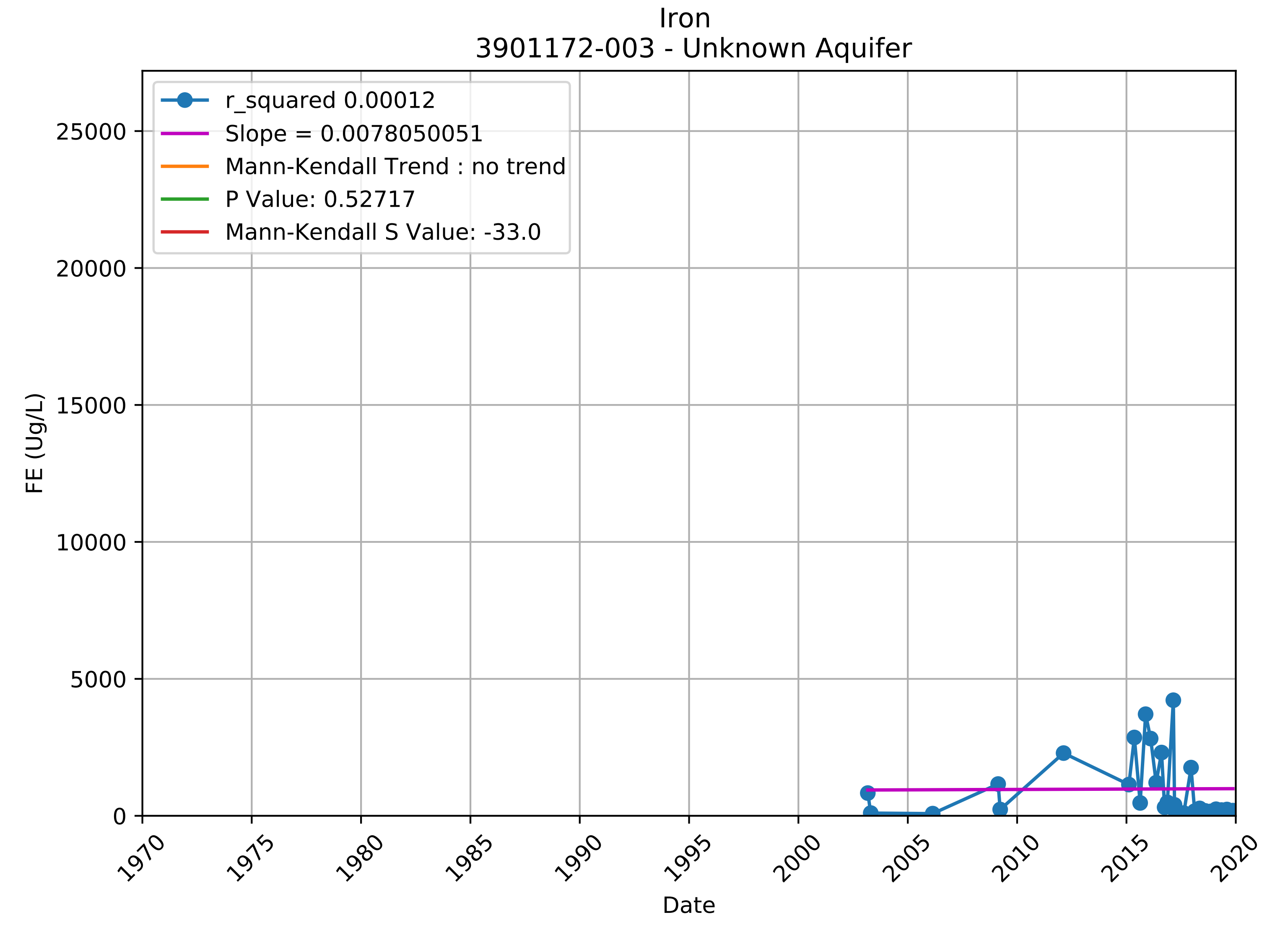

Iron
3901172-003 - Unknown Aquifer
r_squared 0.00012
Slope = 0.0078050051
Mann-Kendall Trend : no trend
P Value: 0.52717
Mann-Kendall S Value: -33.0
FE (Ug/L)
Date
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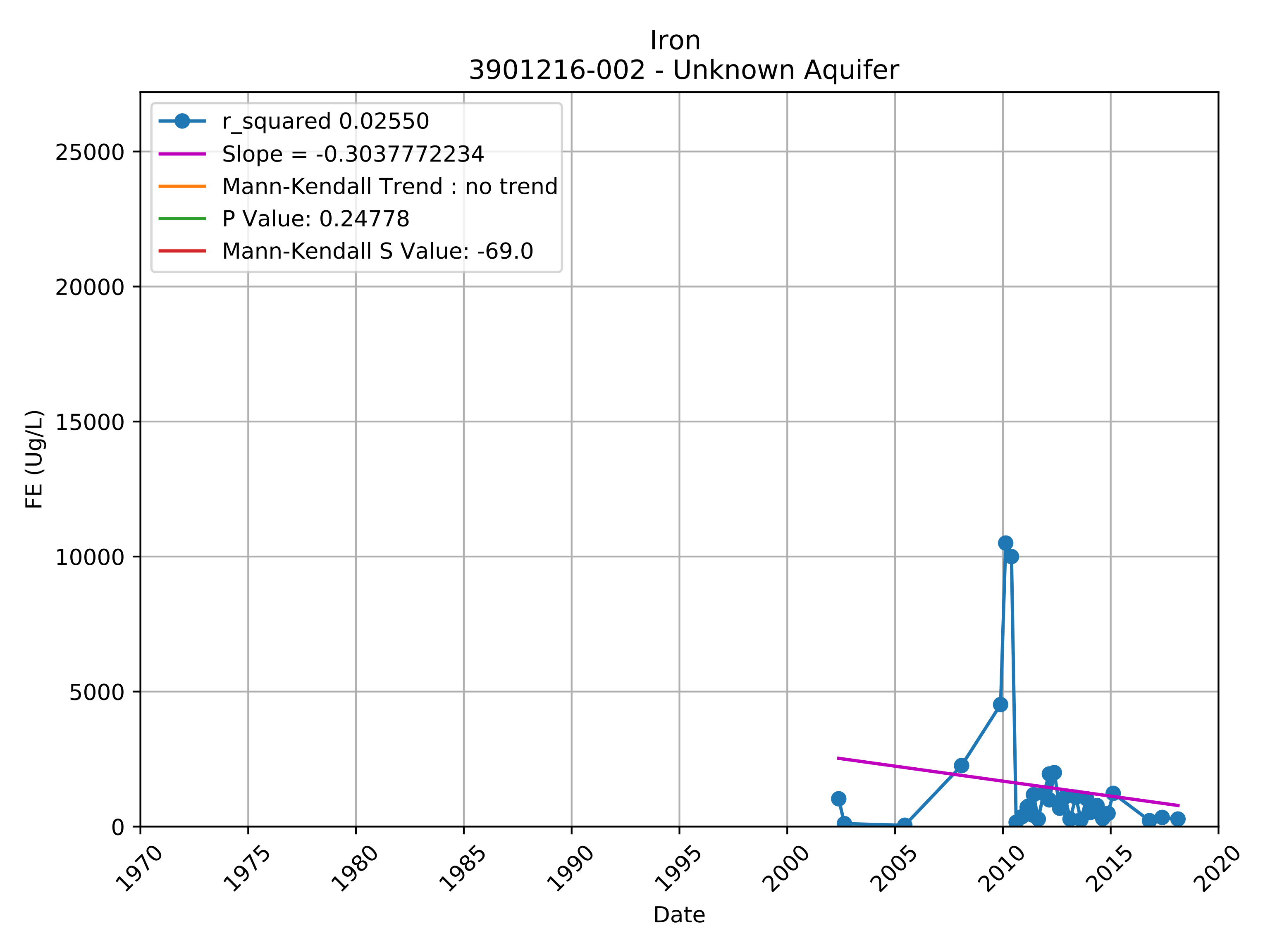

Iron
3901216-002 - Unknown Aquifer
r_squared 0.02550
Slope = -0.3037772234
Mann-Kendall Trend : no trend
P Value: 0.24778
Mann-Kendall S Value: -69.0
FE (Ug/L)
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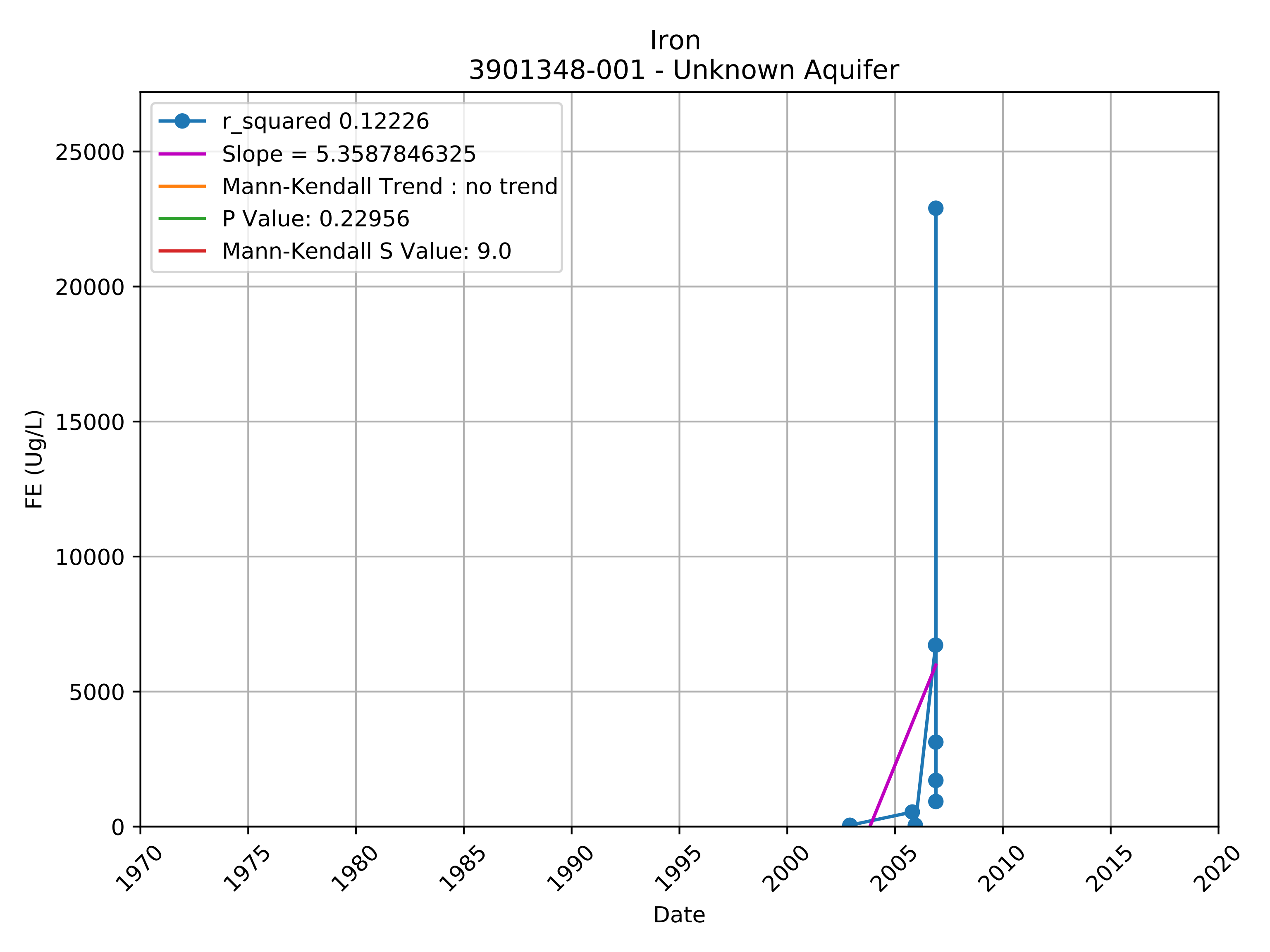

Iron
3901348-001 - Unknown Aquifer
r_squared 0.12226
Slope = 5.3587846325
Mann-Kendall Trend : no trend
P Value: 0.22956
Mann-Kendall S Value: 9.0
FE (Ug/L)
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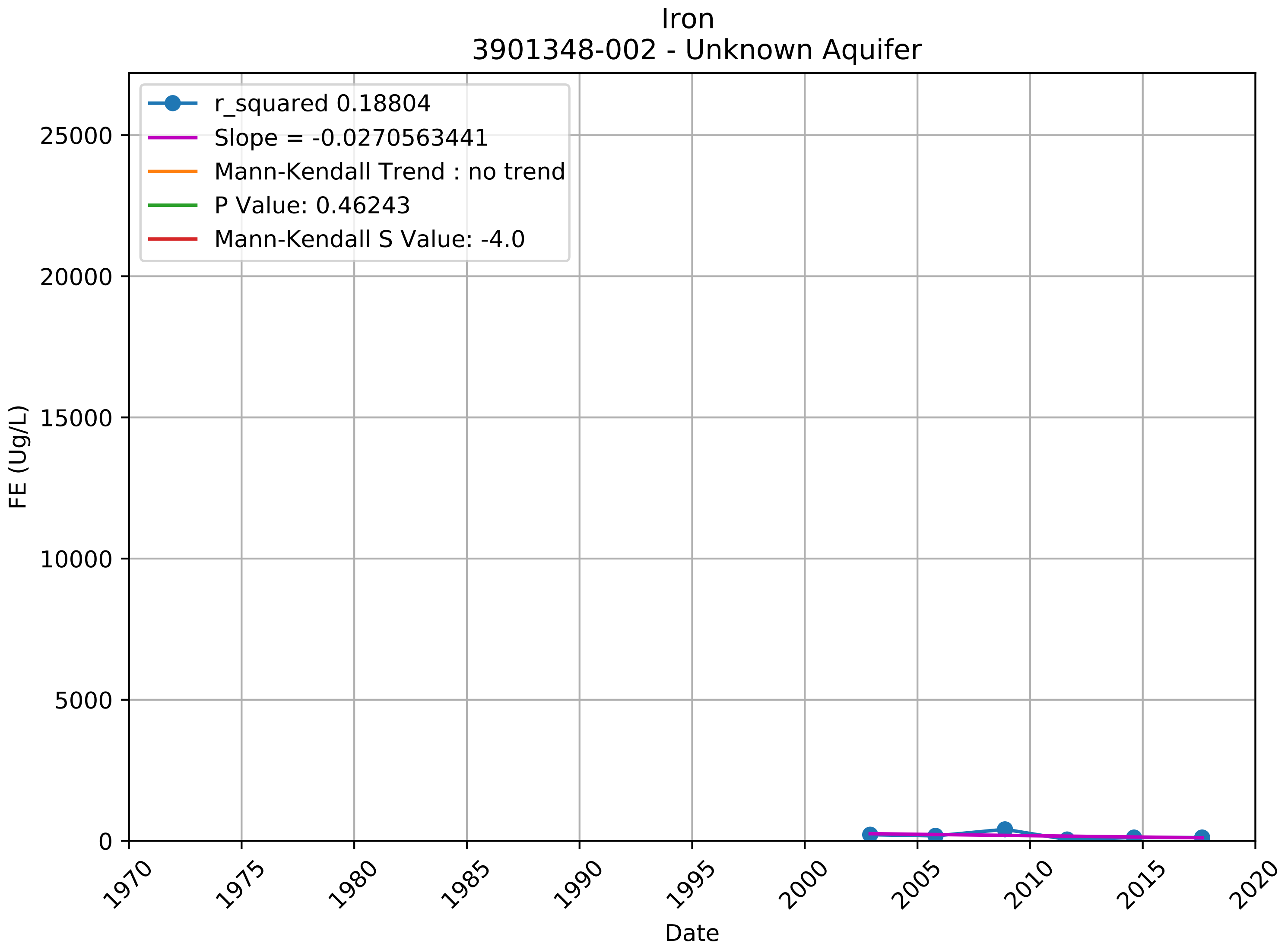

Iron
3901348-002 - Unknown Aquifer
r_squared 0.18804
Slope = -0.0270563441
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: -4.0
FE (Ug/L)
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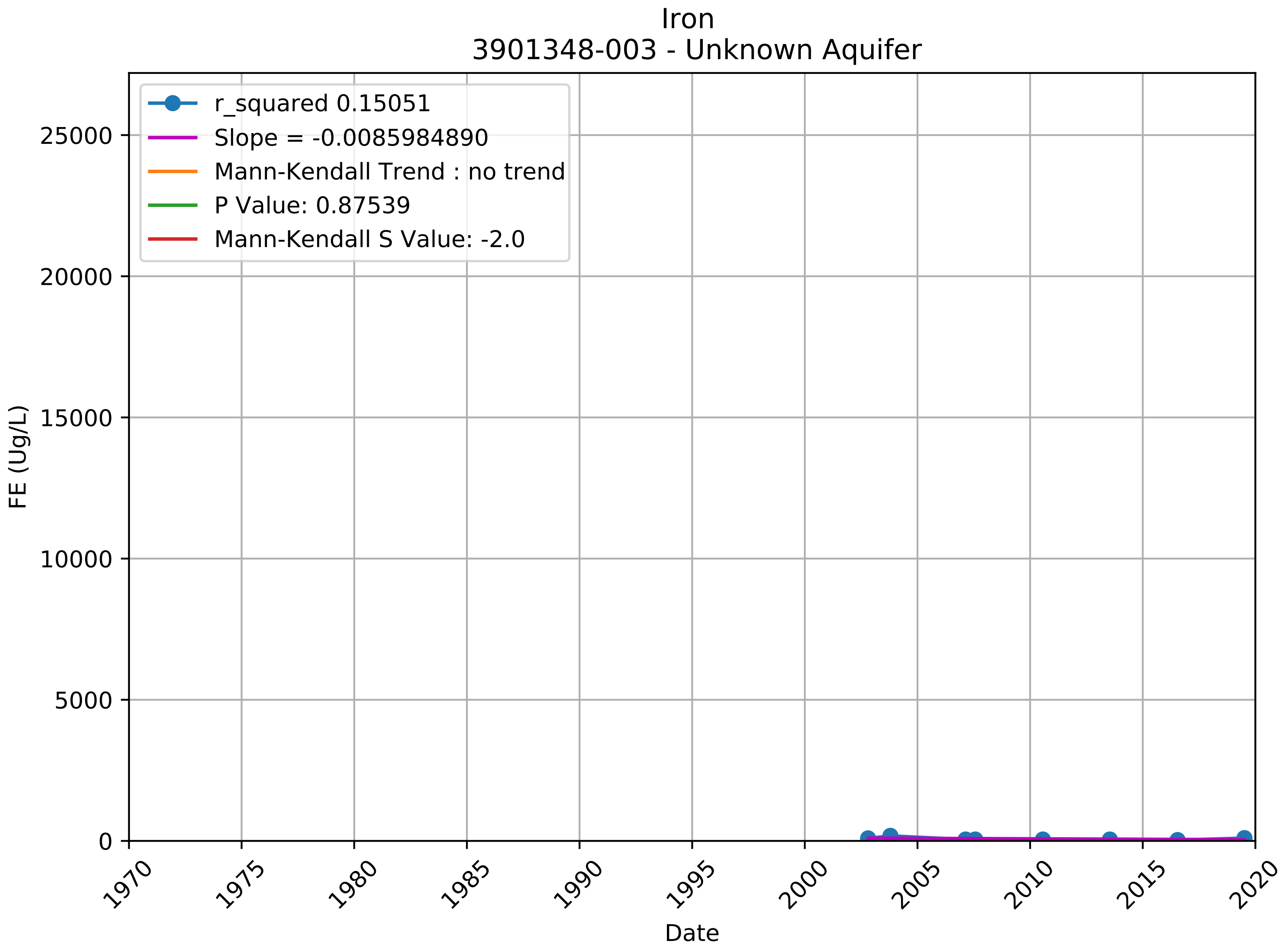

Iron
3901348-003 - Unknown Aquifer
r_squared 0.15051
Slope = -0.0085984890
Mann-Kendall Trend : no trend
P Value: 0.87539
Mann-Kendall S Value: -2.0
FE (Ug/L)
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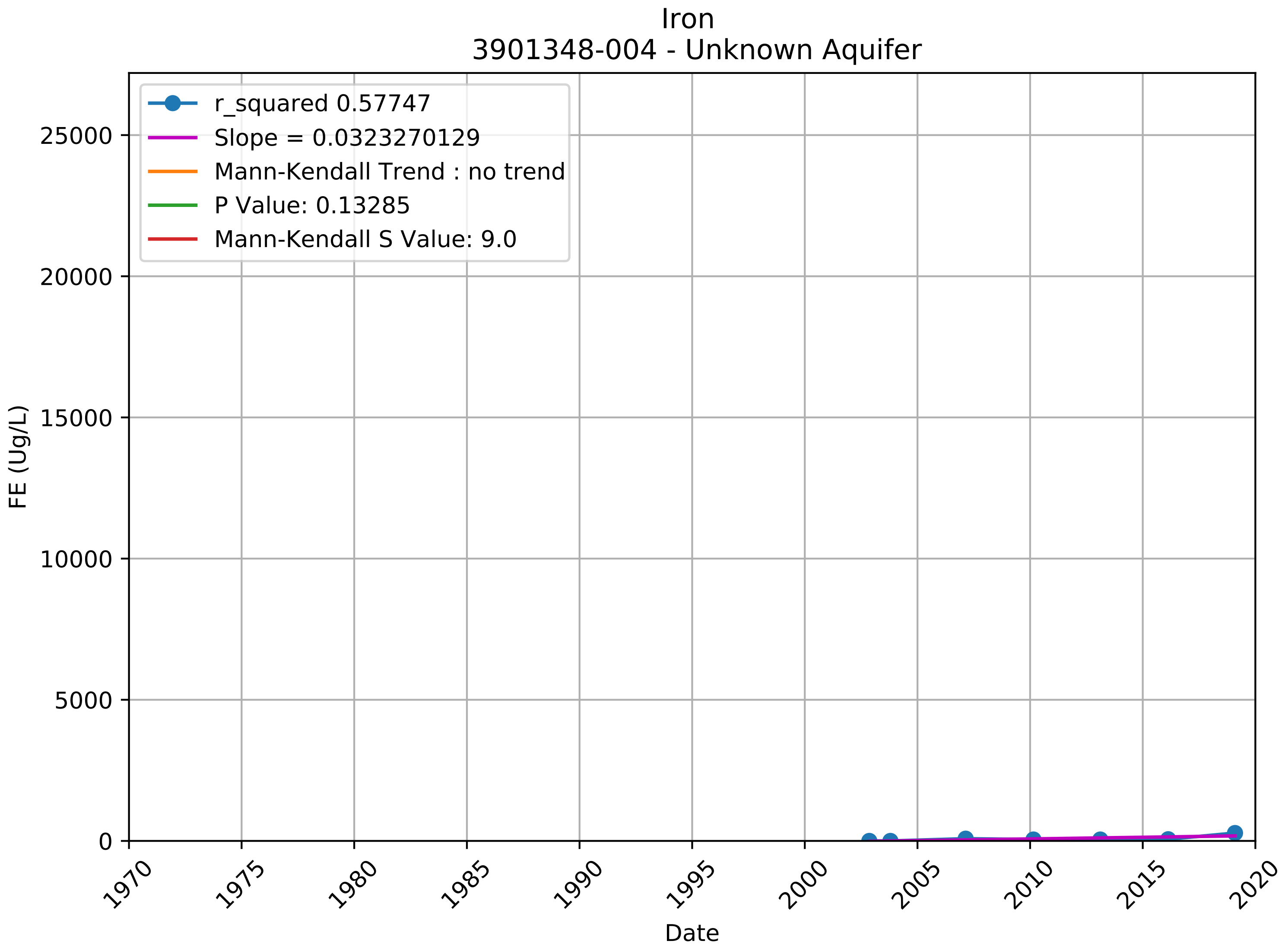
Iron
3901348-004 - Unknown Aquifer
r_squared 0.57747
Slope = 0.0323270129
Mann-Kendall Trend : no trend
P Value: 0.13285
Mann-Kendall S Value: 9.0
FE (Ug/L)
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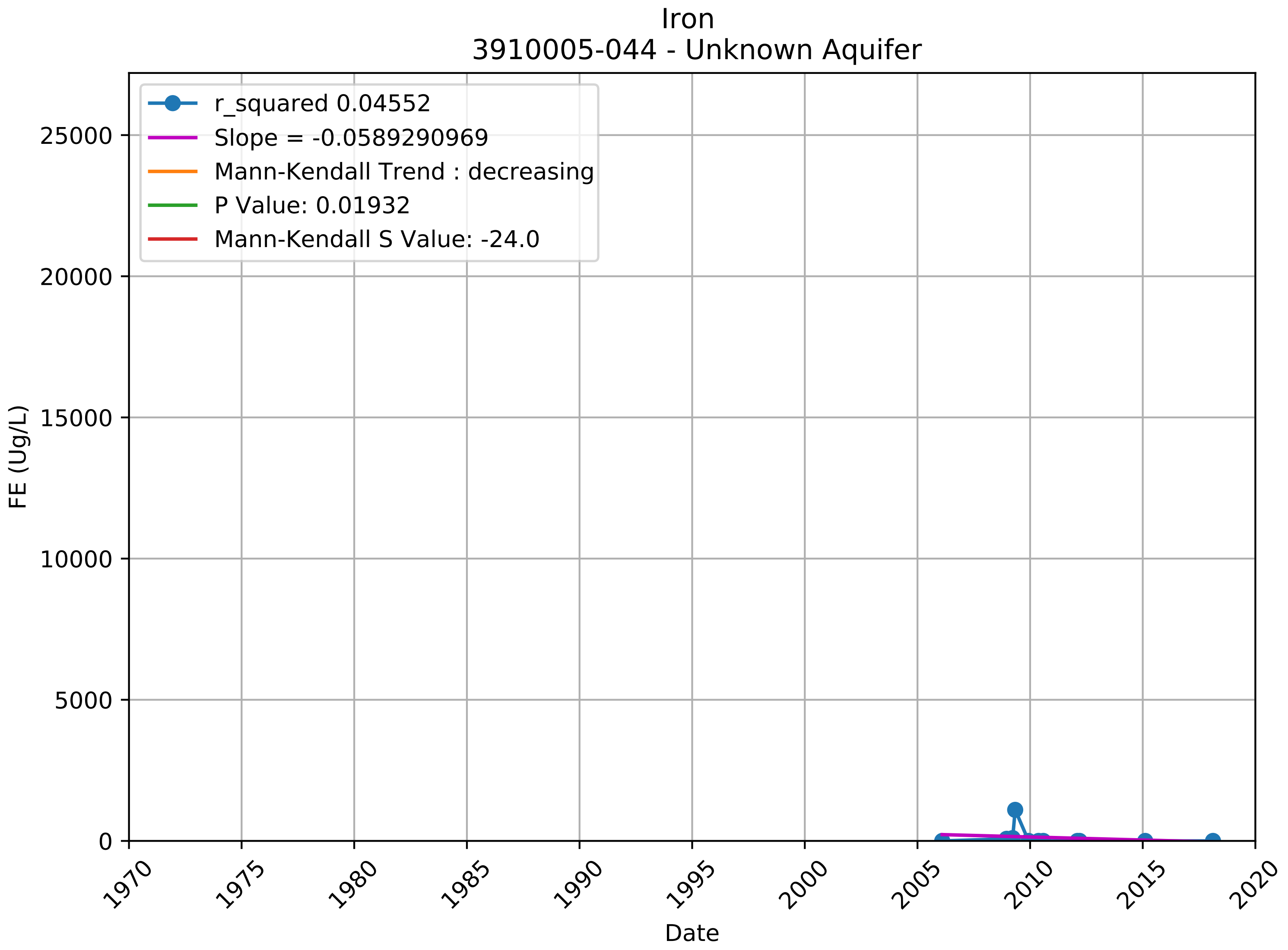

Iron
3910005-044 - Unknown Aquifer
r_squared 0.04552
Slope = -0.0589290969
Mann-Kendall Trend : decreasing
P Value: 0.01932
Mann-Kendall S Value: -24.0
FE (Ug/L)
Date
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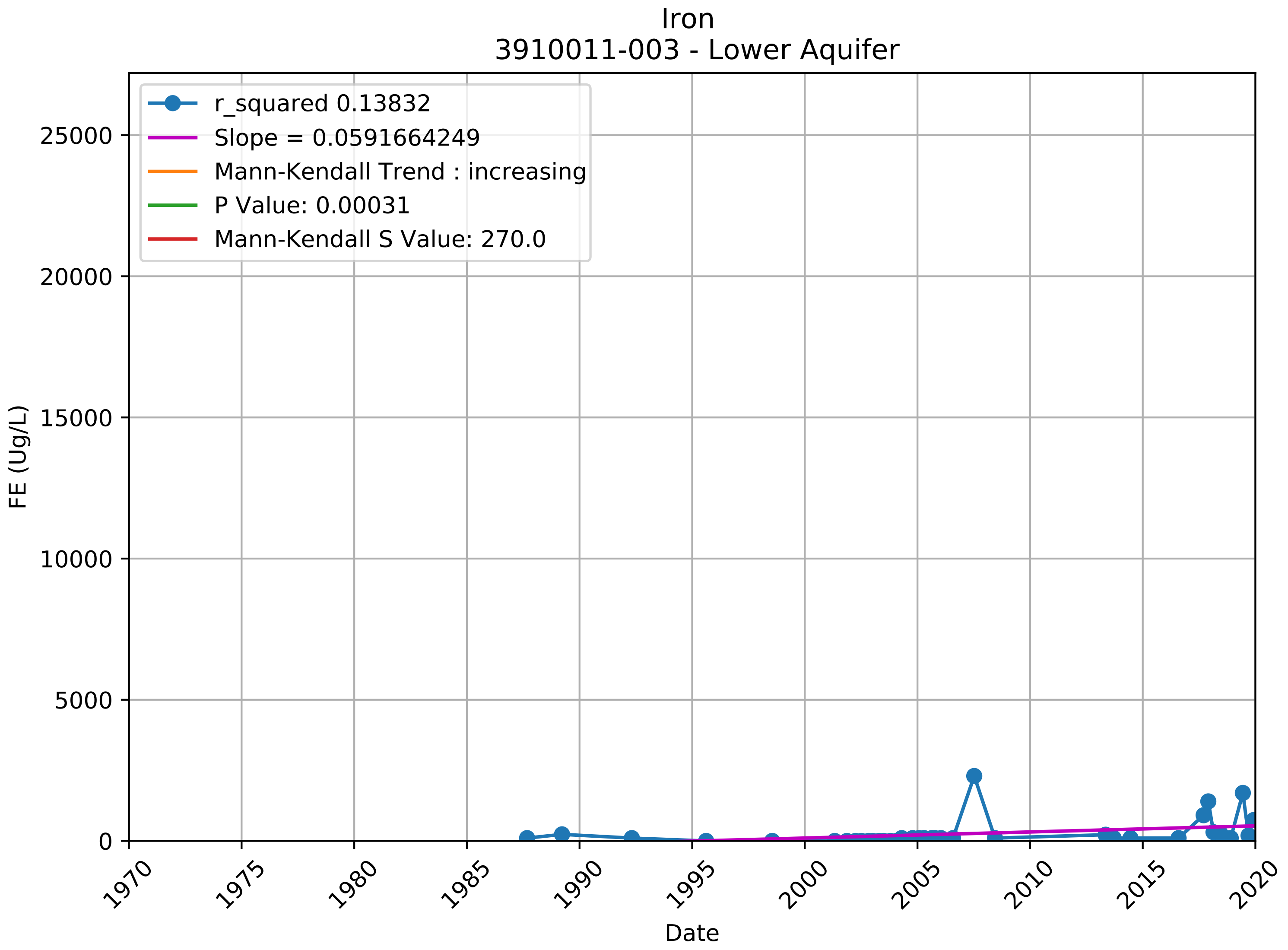

Iron
3910011-003 - Lower Aquifer
r_squared 0.13832
Slope = 0.0591664249
Mann-Kendall Trend : increasing
P Value: 0.00031
Mann-Kendall S Value: 270.0
FE (Ug/L)
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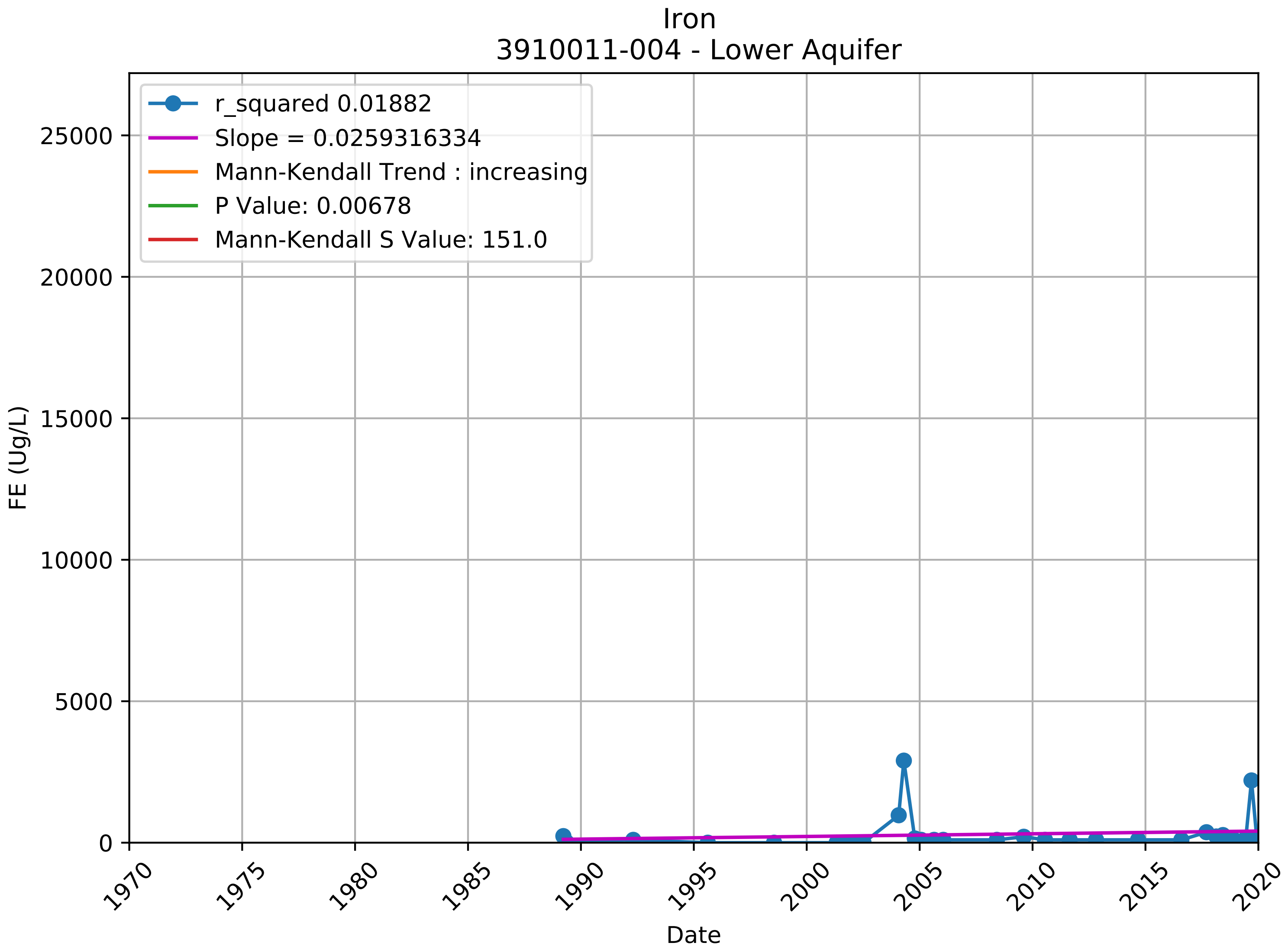

Iron
3910011-004 - Lower Aquifer
r_squared 0.01882
Slope = 0.0259316334
Mann-Kendall Trend : increasing
P Value: 0.00678
Mann-Kendall S Value: 151.0
FE (Ug/L)
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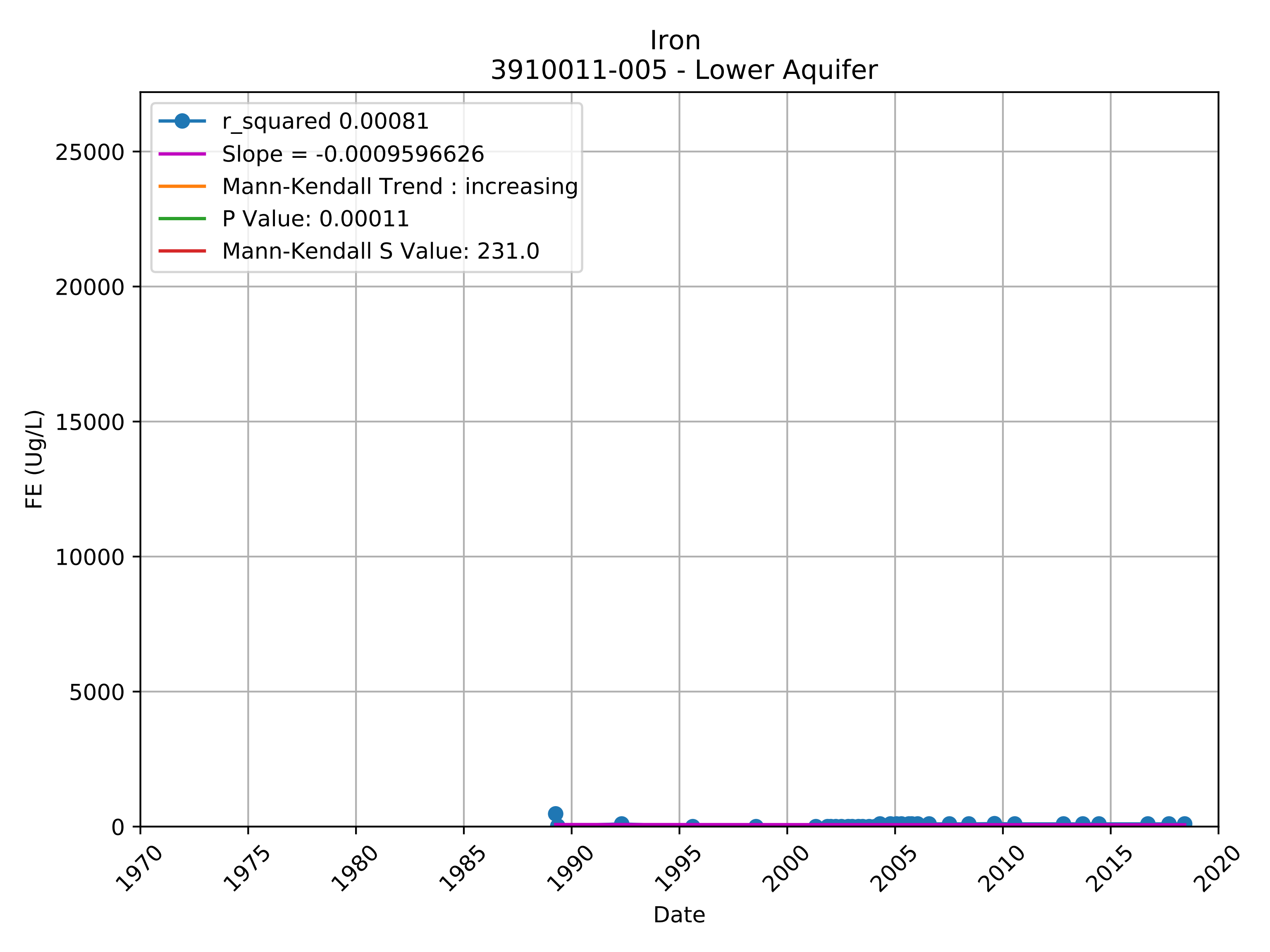

Iron
3910011-005 - Lower Aquifer
r_squared 0.00081
Slope = -0.0009596626
Mann-Kendall Trend : increasing
P Value: 0.00011
Mann-Kendall S Value: 231.0
25000
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FE (Ug/L)
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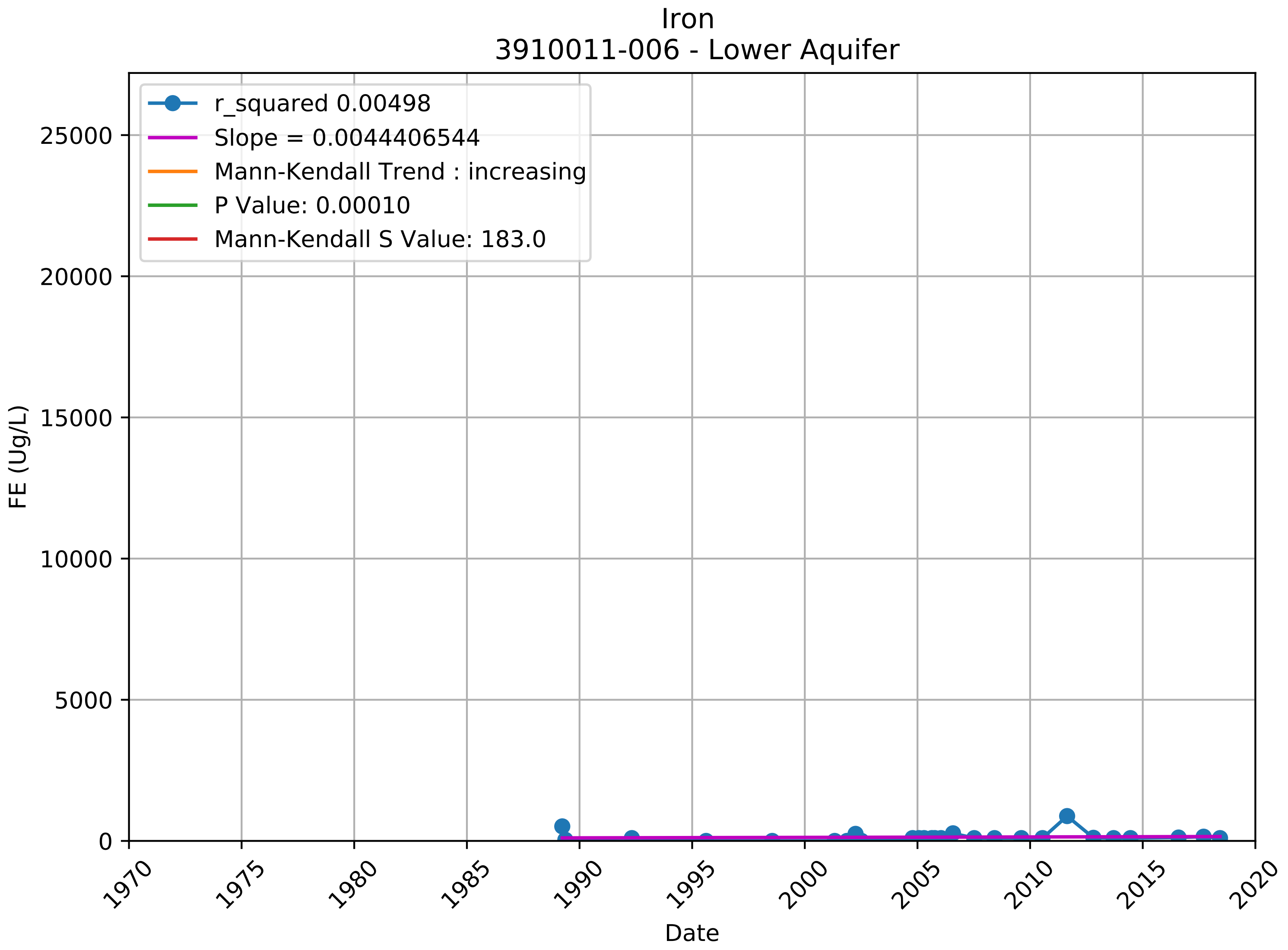

Iron
3910011-006 - Lower Aquifer
r_squared 0.00498
Slope = 0.0044406544
Mann-Kendall Trend : increasing
P Value: 0.00010
Mann-Kendall S Value: 183.0
FE (Ug/L)
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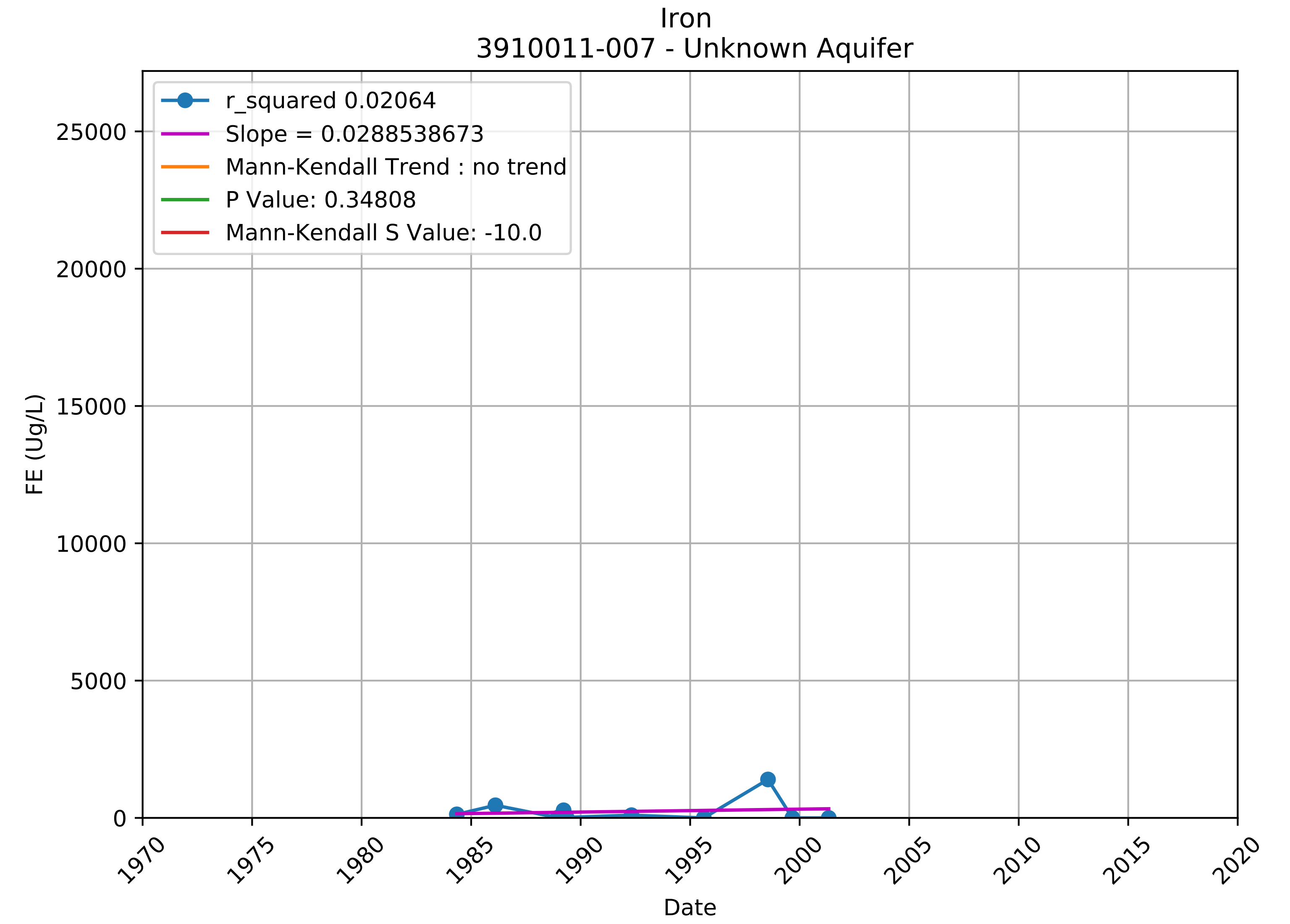
Iron
3910011-007 - Unknown Aquifer
r_squared 0.02064
Slope = 0.0288538673
Mann-Kendall Trend : no trend
P Value: 0.34808
Mann-Kendall S Value: -10.0
FE (Ug/L)
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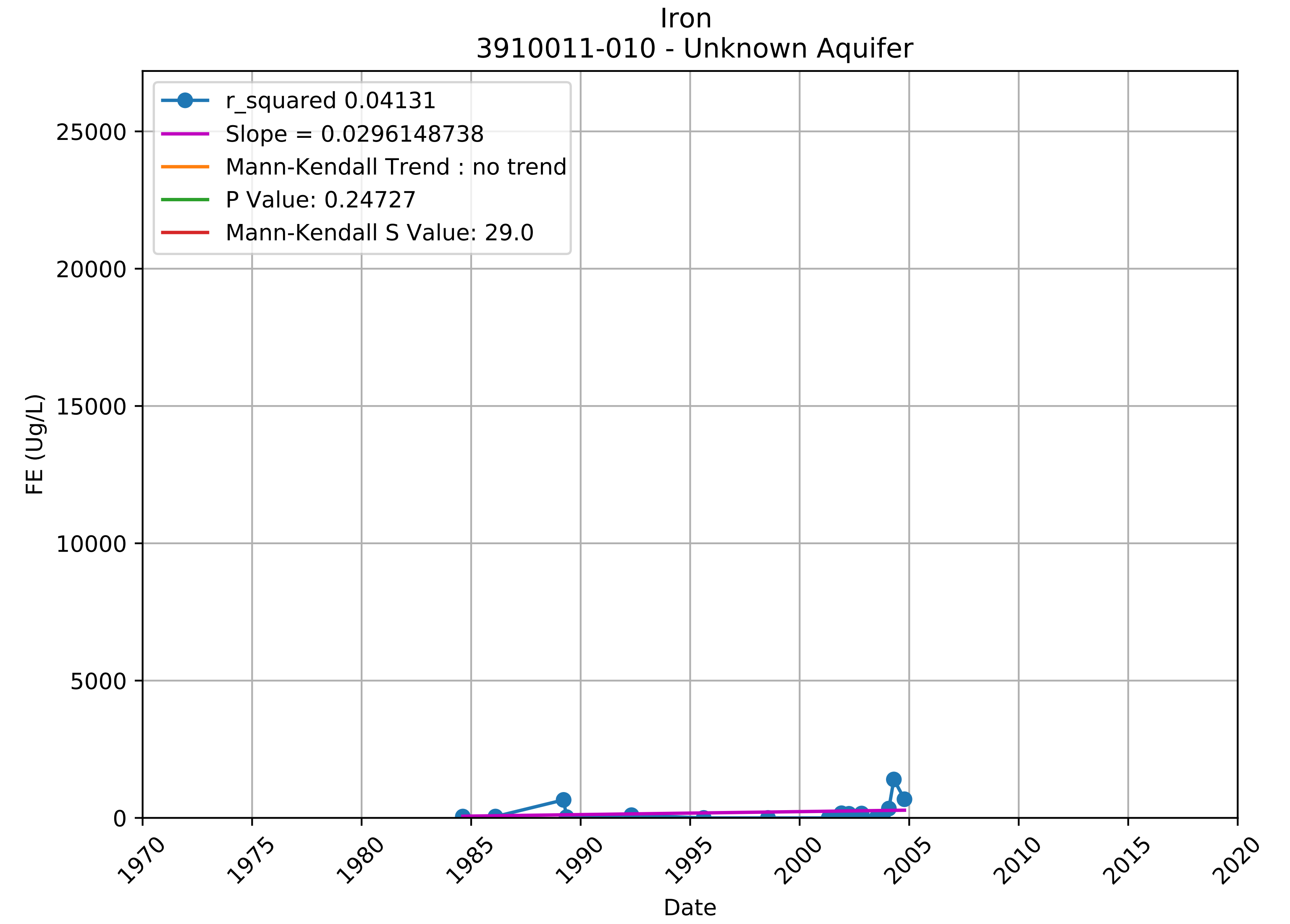

Iron
3910011-010 - Unknown Aquifer
r_squared 0.04131
Slope = 0.0296148738
Mann-Kendall Trend : no trend
P Value: 0.24727
Mann-Kendall S Value: 29.0
FE (Ug/L)
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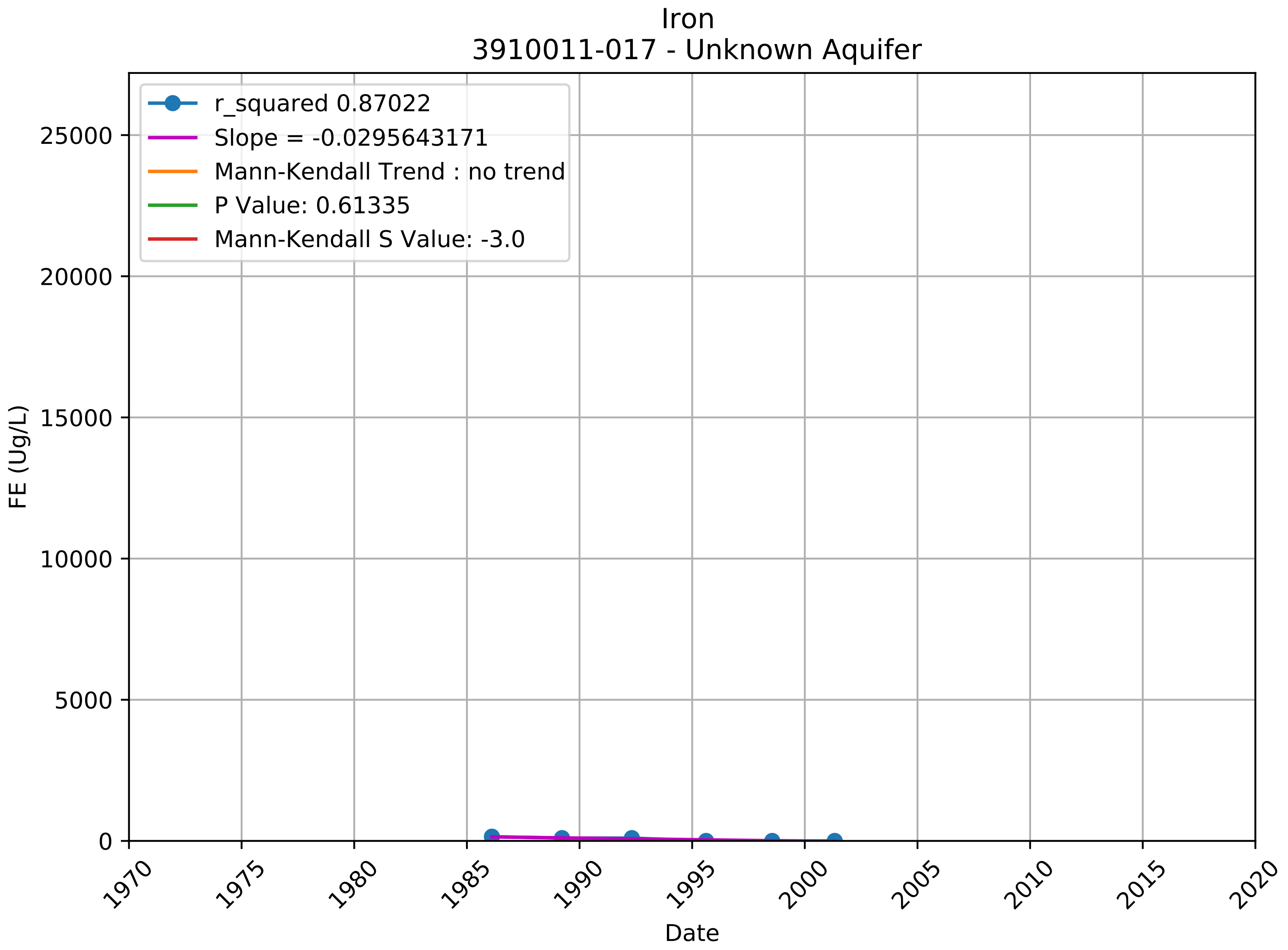

Iron
3910011-017 - Unknown Aquifer
r_squared 0.87022
Slope = -0.0295643171
Mann-Kendall Trend : no trend
P Value: 0.61335
Mann-Kendall S Value: -3.0
FE (Ug/L)
Date
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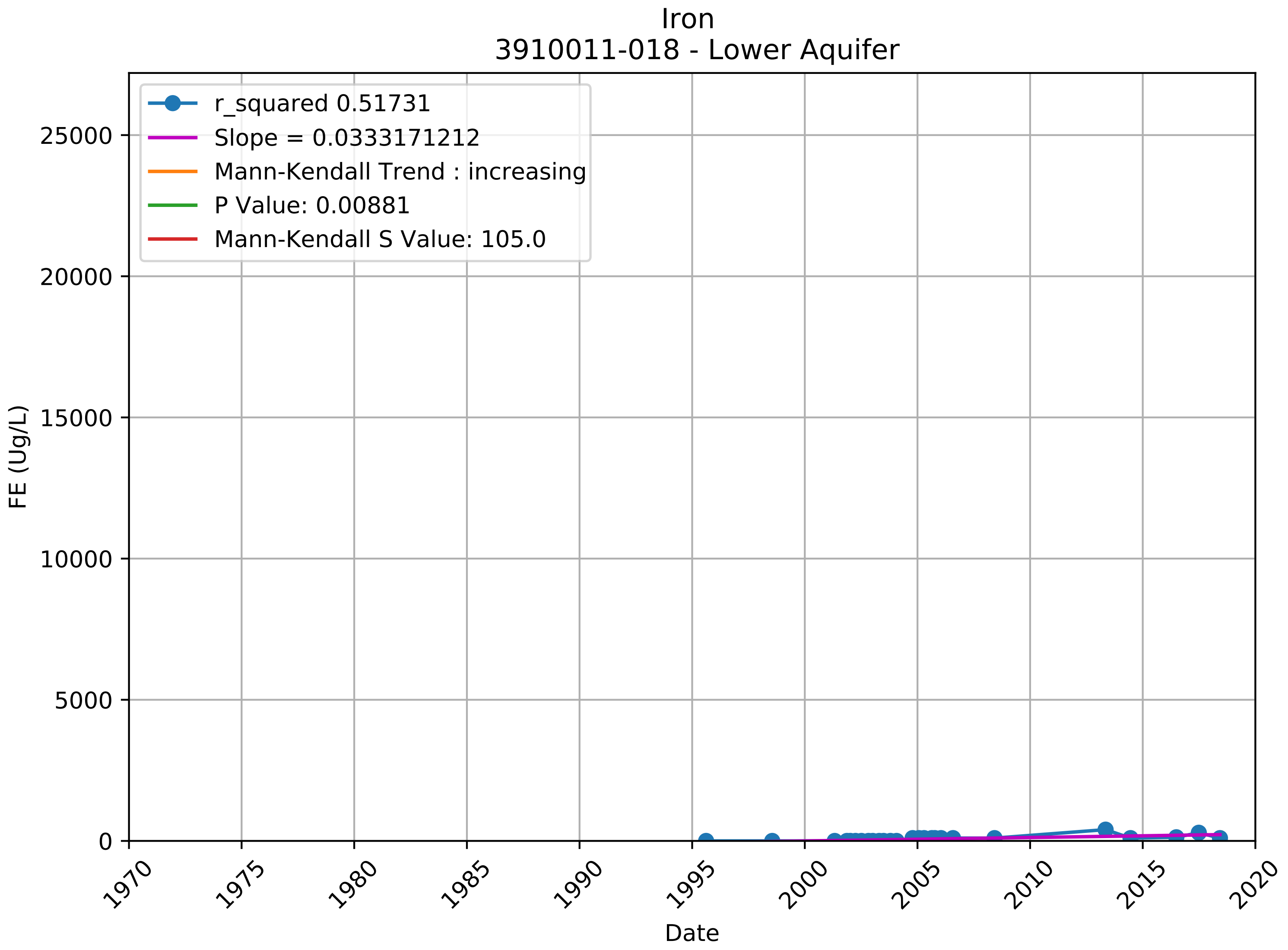

Iron
3910011-018 - Lower Aquifer
r_squared 0.51731
Slope = 0.0333171212
Mann-Kendall Trend : increasing
P Value: 0.00881
Mann-Kendall S Value: 105.0
FE (Ug/L)
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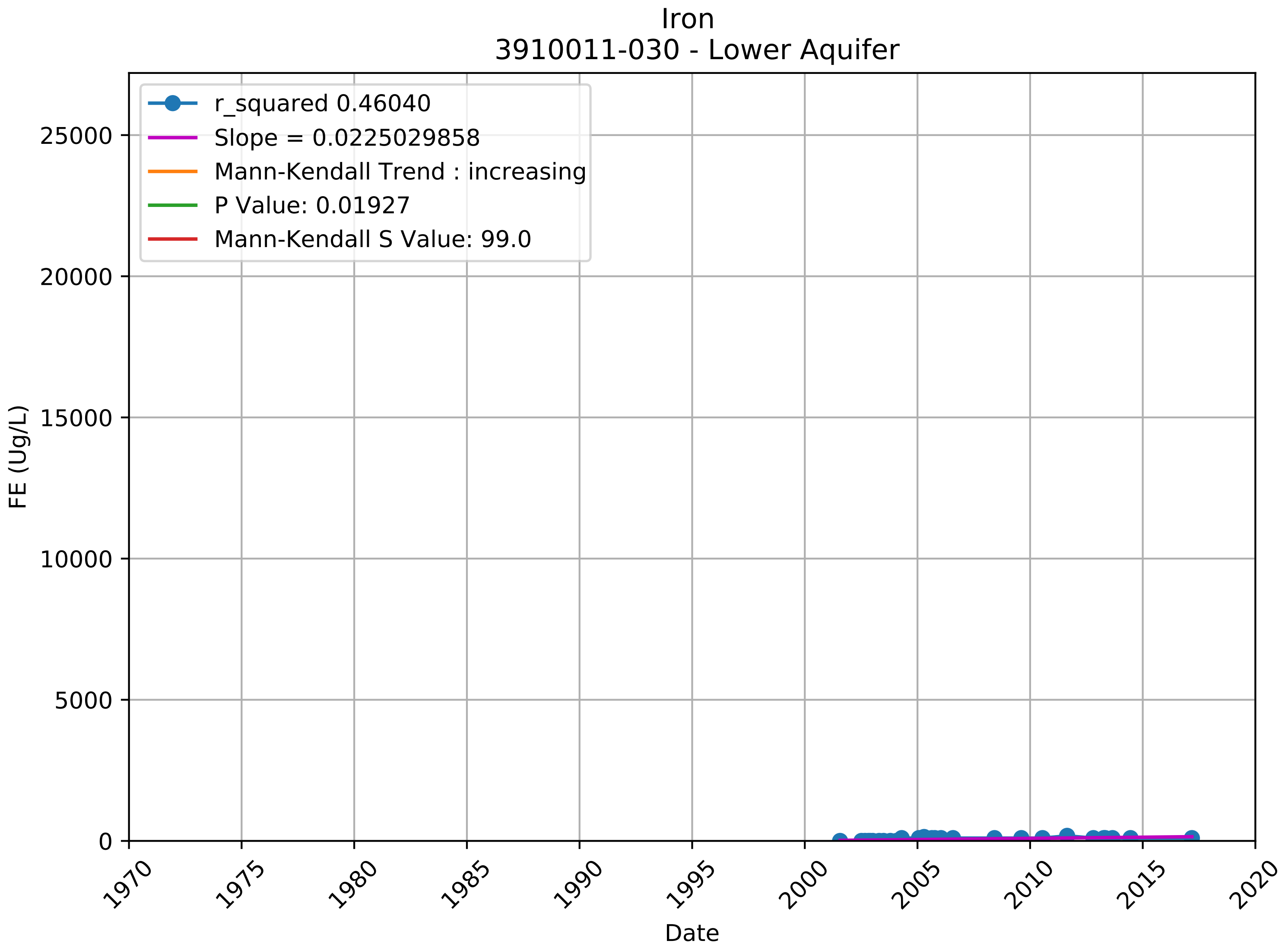

Iron
3910011-030 - Lower Aquifer
r_squared 0.46040
Slope = 0.0225029858
Mann-Kendall Trend : increasing
P Value: 0.01927
Mann-Kendall S Value: 99.0
FE (Ug/L)
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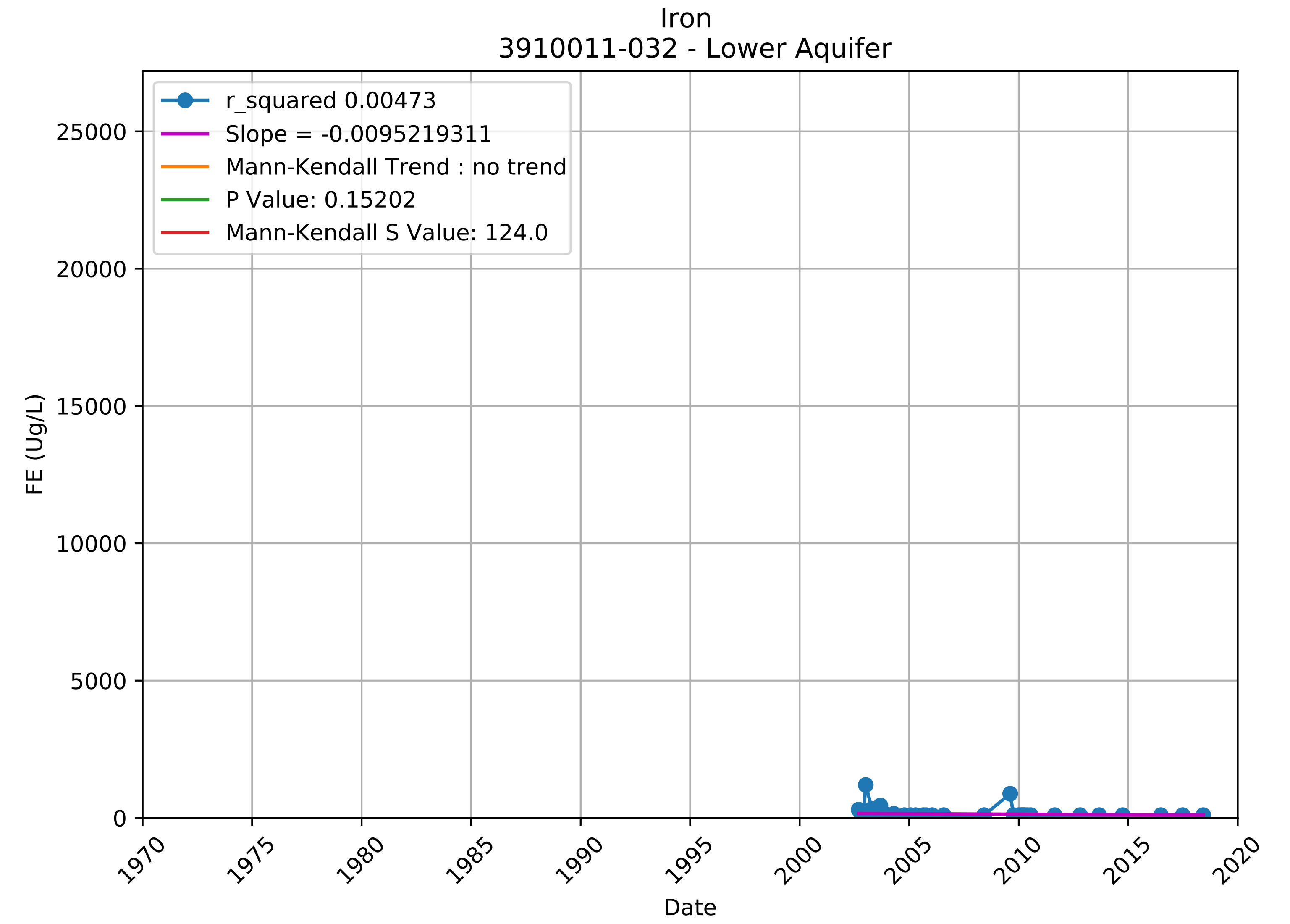
Date



Iron
3910011-032 - Lower Aquifer
r_squared 0.00473
Slope = -0.0095219311
Mann-Kendall Trend : no trend
P Value: 0.15202
Mann-Kendall S Value: 124.0
FE (Ug/L)
Date
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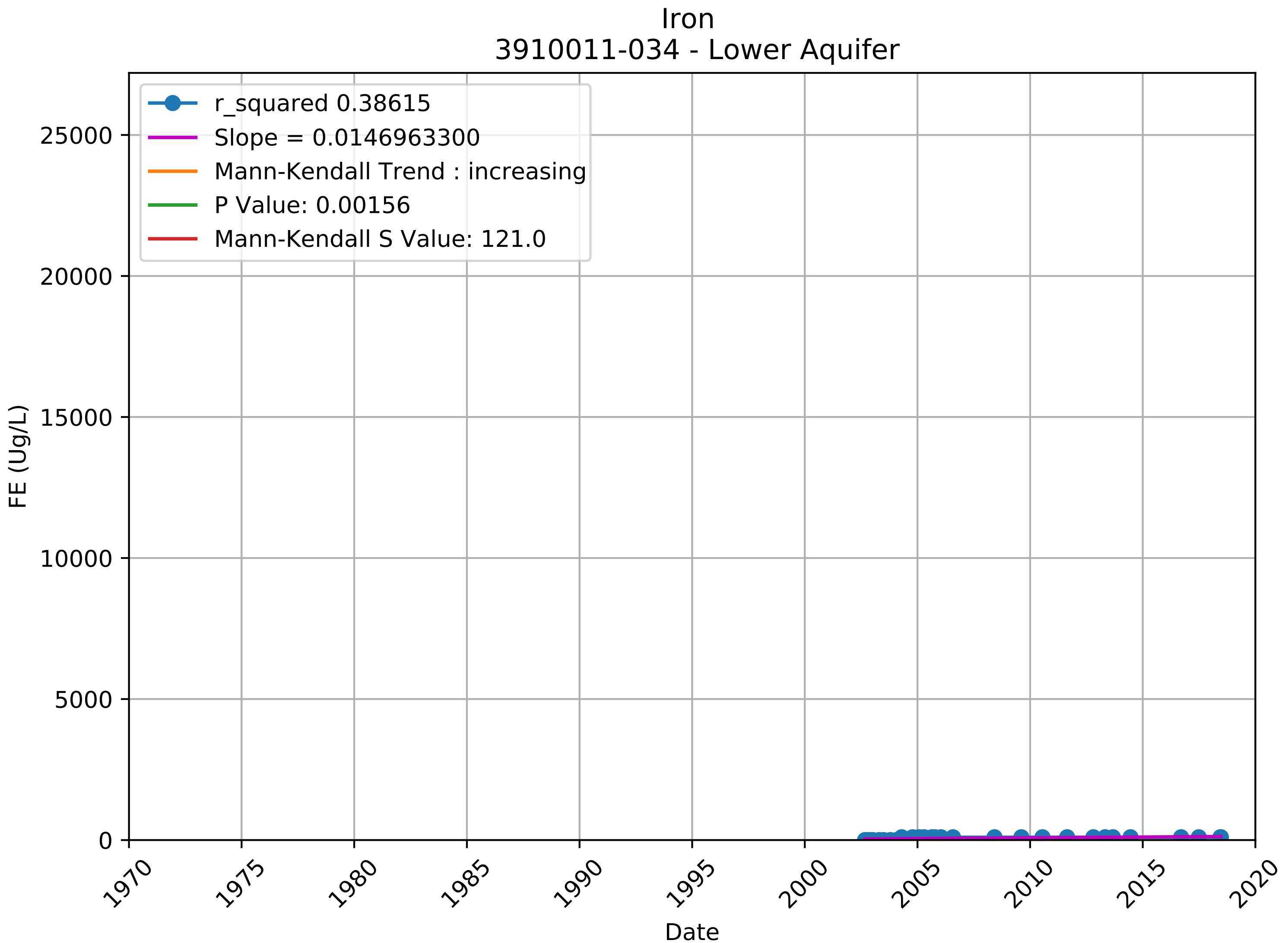

Iron
3910011-034 - Lower Aquifer
r_squared 0.38615
Slope = 0.0146963300
Mann-Kendall Trend : increasing
P Value: 0.00156
Mann-Kendall S Value: 121.0
FE (Ug/L)
Date
0
5000
10000
15000
20000
25000
1970
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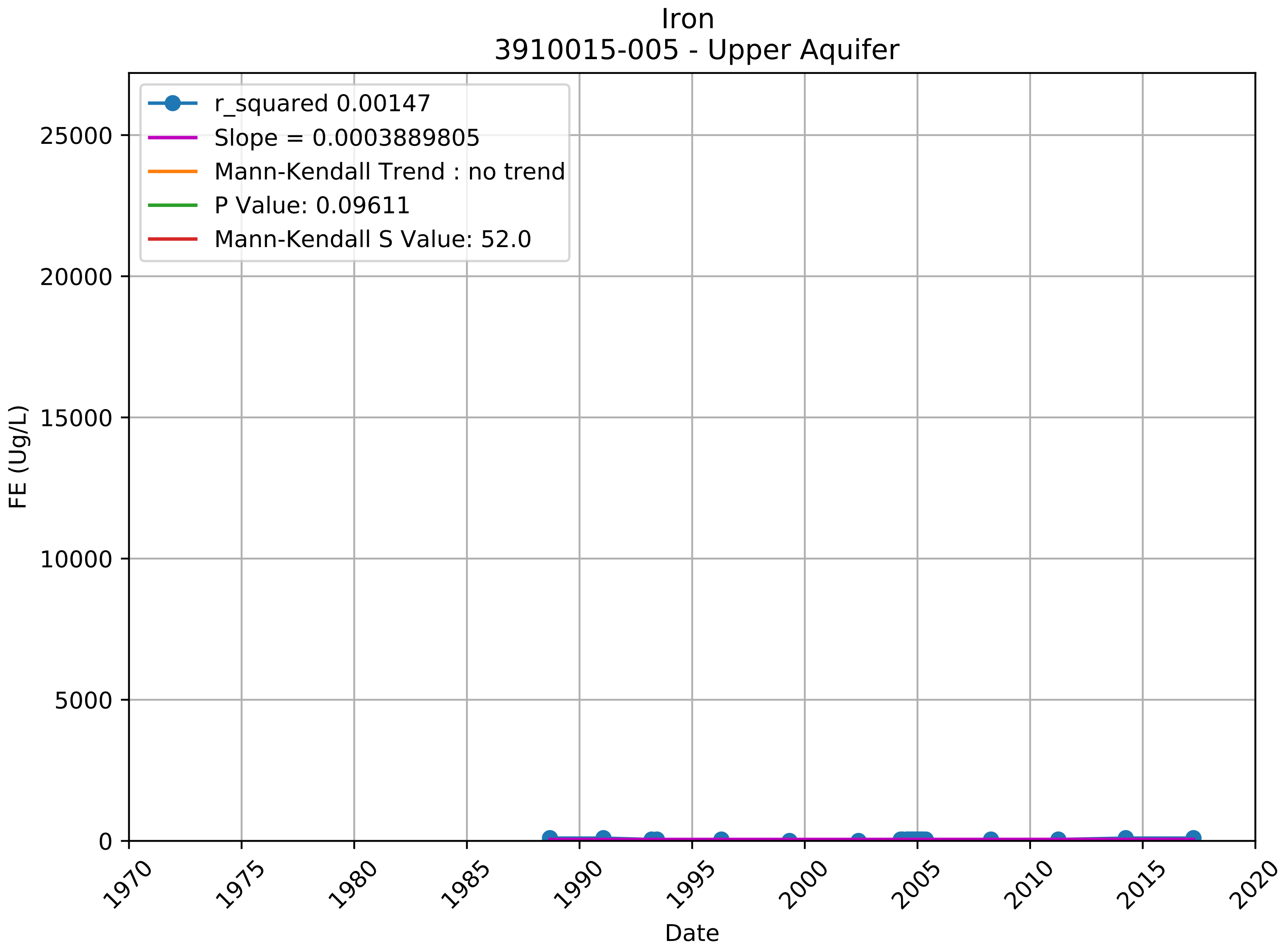
Iron
3910015-005 - Upper Aquifer
r_squared 0.00147
Slope = 0.0003889805
Mann-Kendall Trend : no trend
P Value: 0.09611
Mann-Kendall S Value: 52.0
FE (Ug/L)
25000
20000
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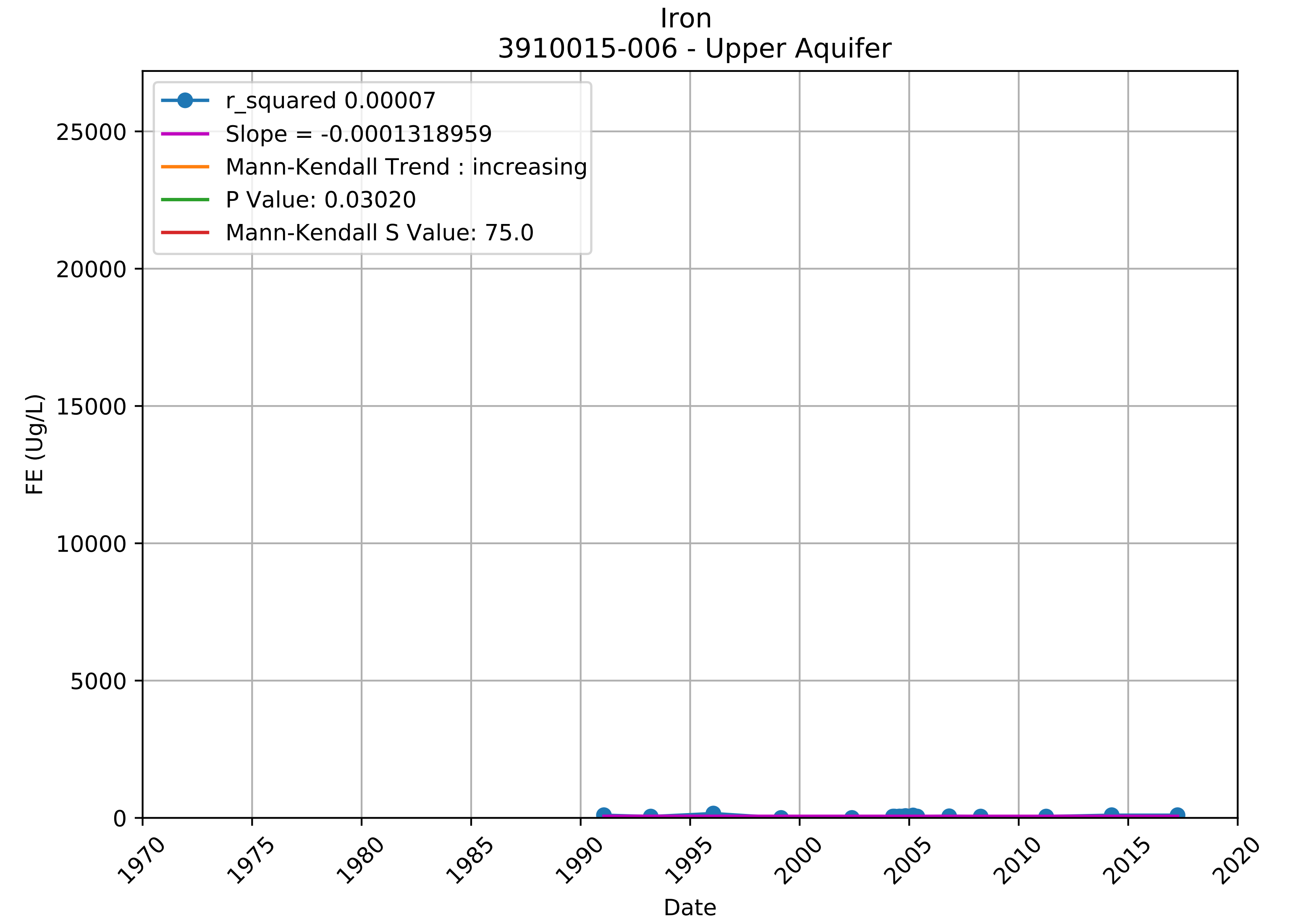
Date



Iron
3910015-006 - Upper Aquifer
r_squared 0.00007
Slope = -0.0001318959
Mann-Kendall Trend : increasing
P Value: 0.03020
Mann-Kendall S Value: 75.0
FE (Ug/L)
Date
25000
20000
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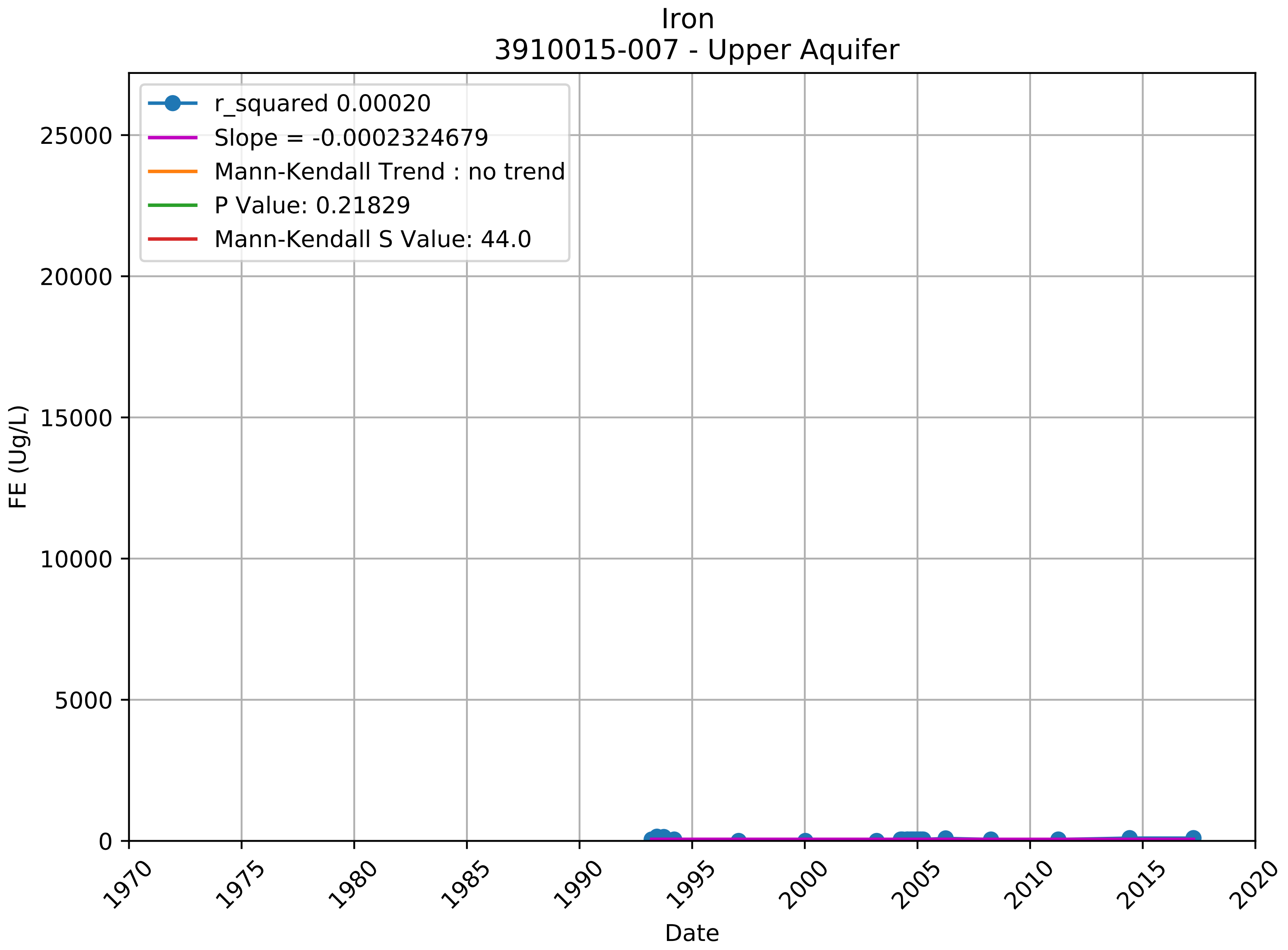

Iron
3910015-007 - Upper Aquifer
r_squared 0.00020
Slope = -0.0002324679
Mann-Kendall Trend : no trend
P Value: 0.21829
Mann-Kendall S Value: 44.0
FE (Ug/L)
Date
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5000
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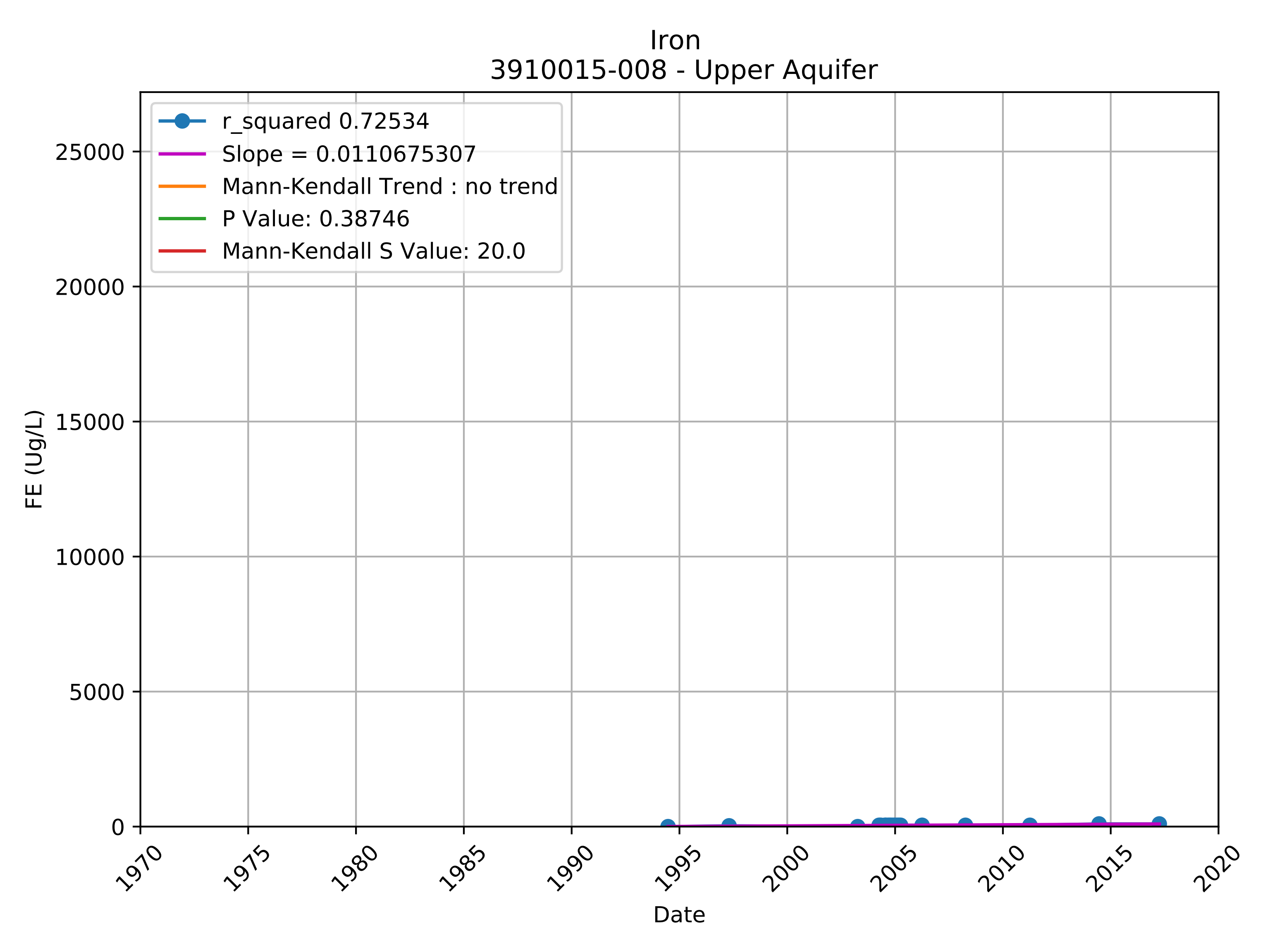

Iron
3910015-008 - Upper Aquifer
r_squared 0.72534
Slope = 0.0110675307
Mann-Kendall Trend : no trend
P Value: 0.38746
Mann-Kendall S Value: 20.0
FE (Ug/L)
25000
20000
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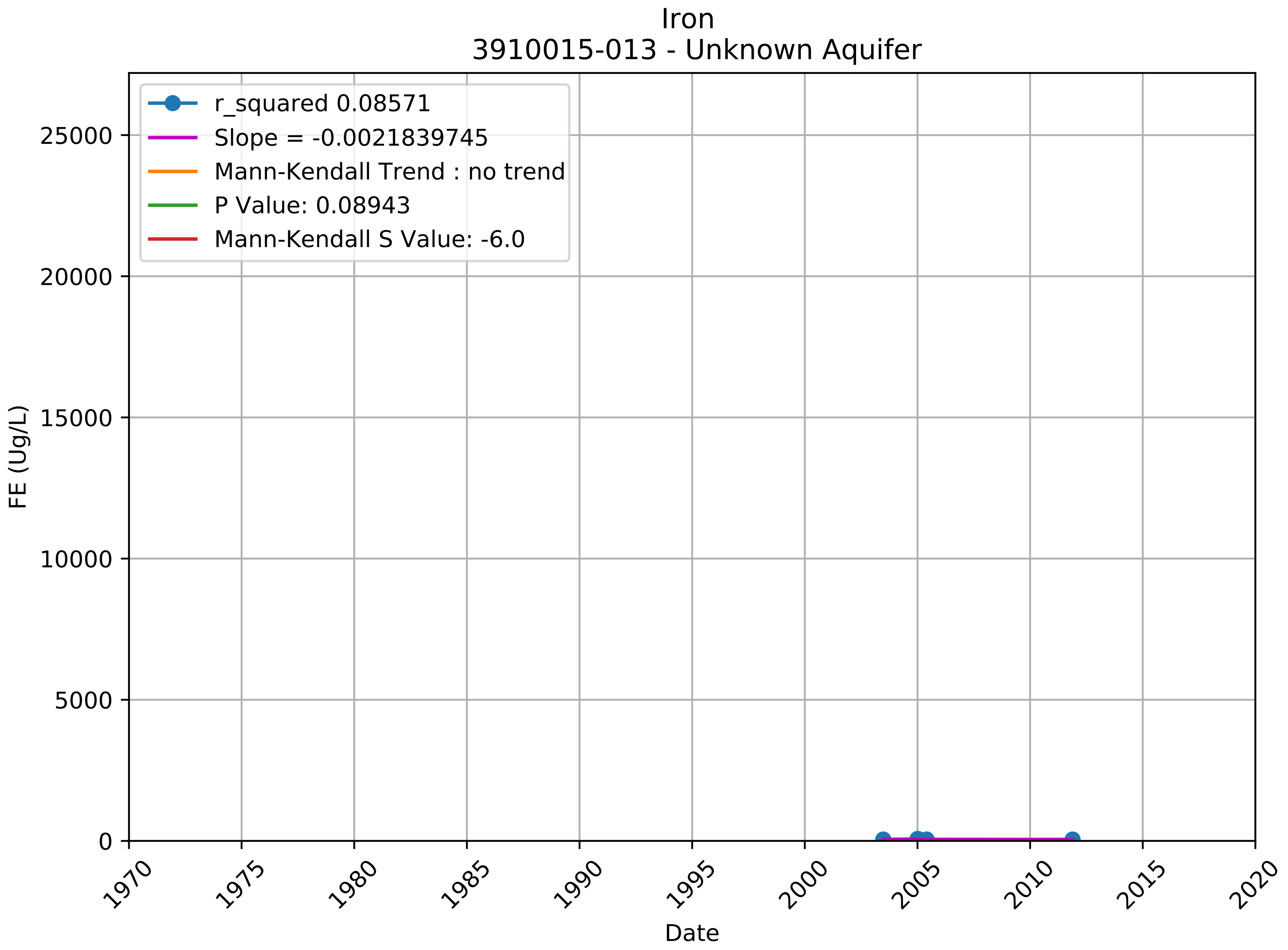
Date


Iron
3910015-013 - Unknown Aquifer
r_squared 0.08571
Slope = -0.0021839745
Mann-Kendall Trend : no trend
P Value: 0.08943
Mann-Kendall S Value: -6.0
FE (Ug/L)
Date
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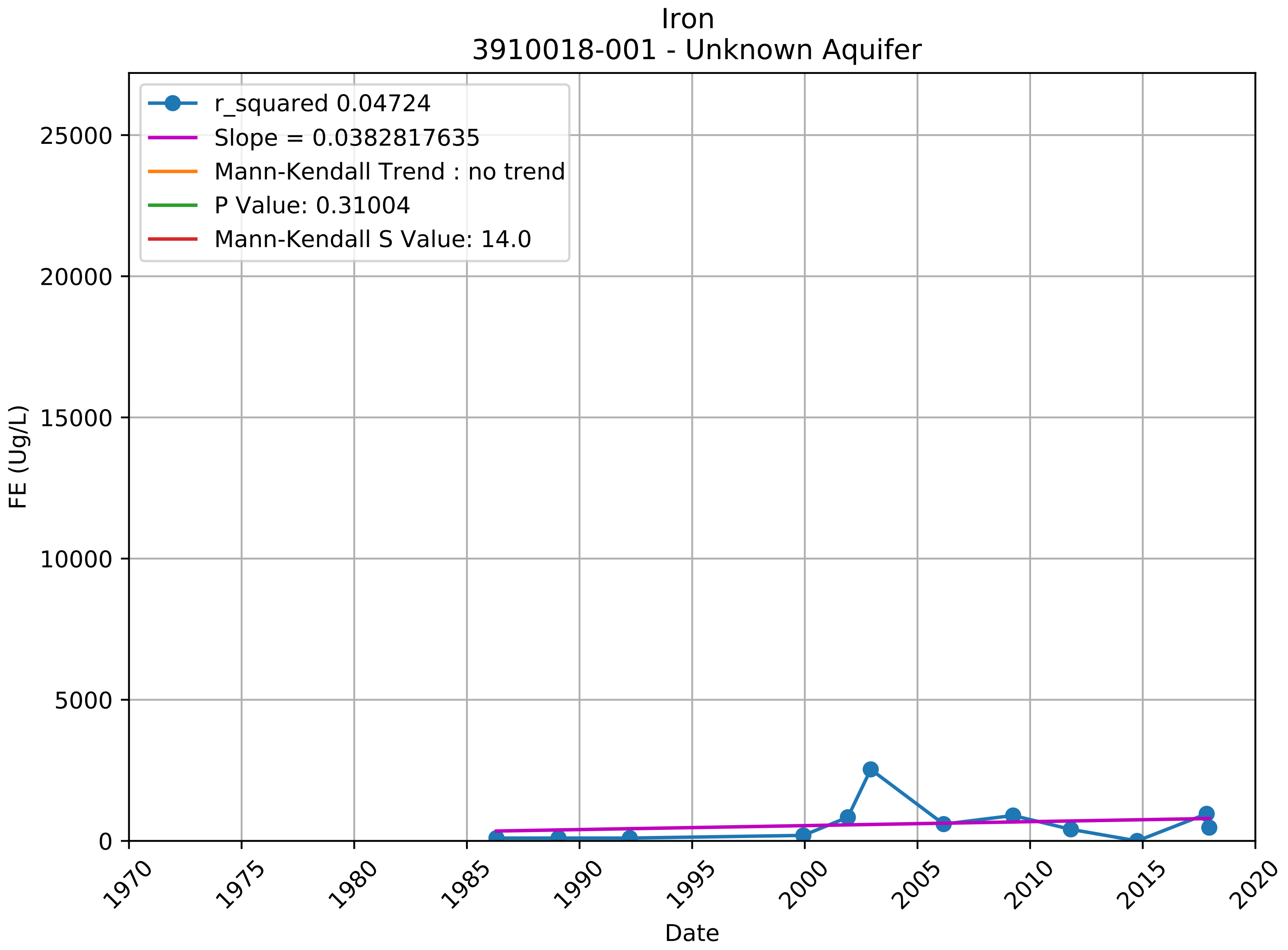

Iron
3910018-001 - Unknown Aquifer
r_squared 0.04724
Slope = 0.0382817635
Mann-Kendall Trend : no trend
P Value: 0.31004
Mann-Kendall S Value: 14.0
FE (Ug/L)
25000
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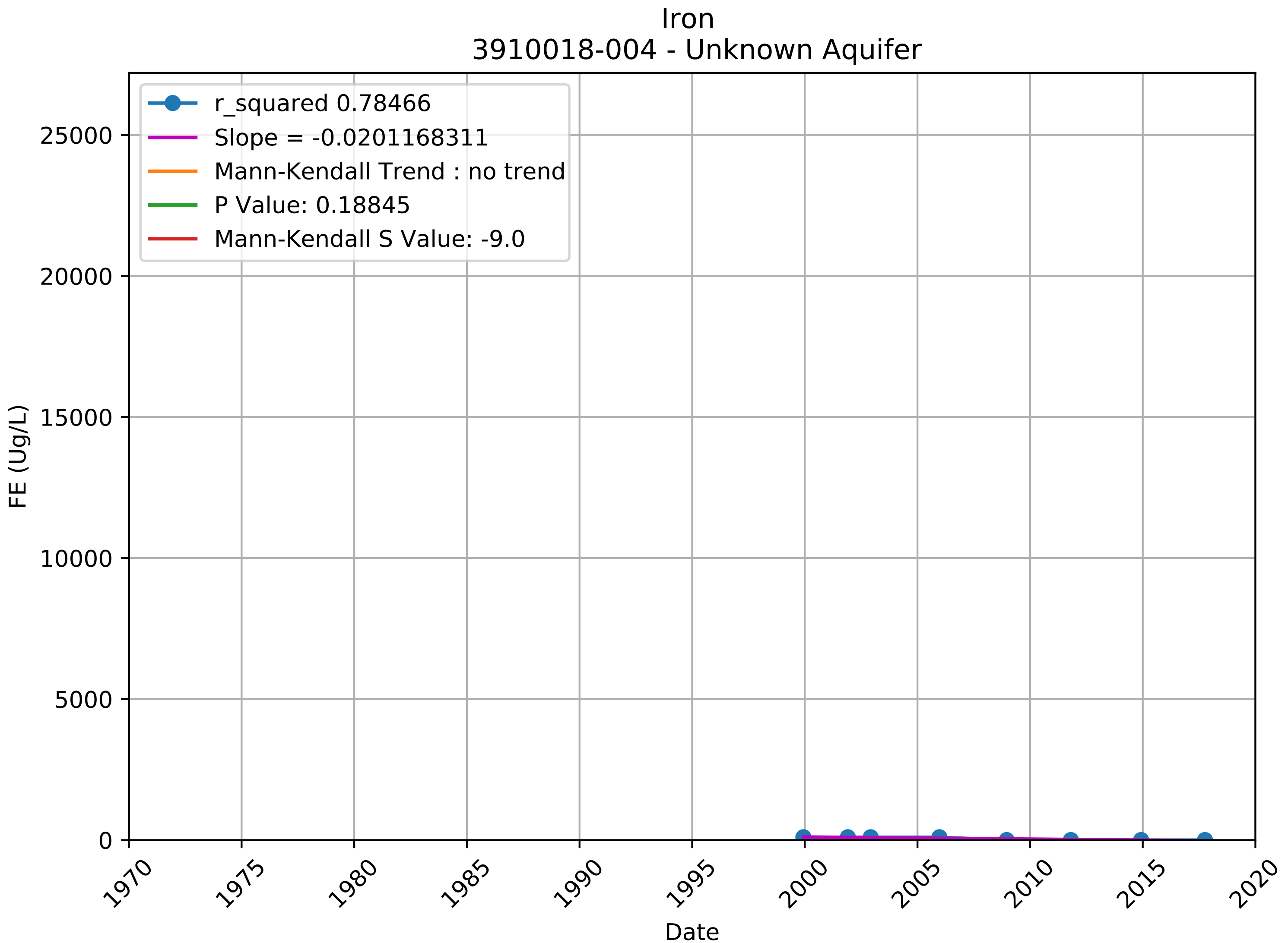
Date


Iron
3910018-004 - Unknown Aquifer
r_squared 0.78466
Slope = -0.0201168311
Mann-Kendall Trend : no trend
P Value: 0.18845
Mann-Kendall S Value: -9.0
FE (Ug/L)
Date
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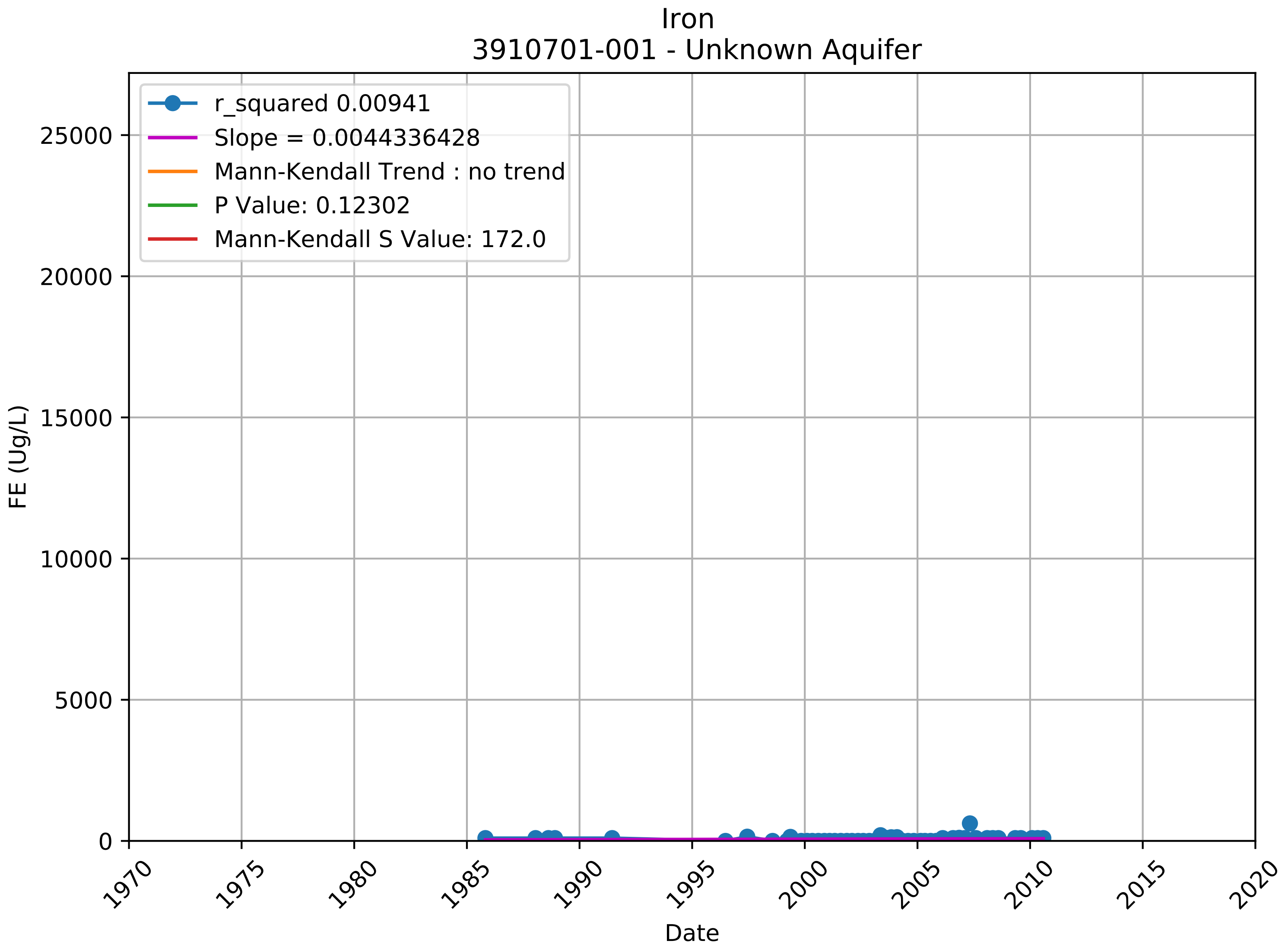

Iron
3910701-001 - Unknown Aquifer
r_squared 0.00941
Slope = 0.0044336428
Mann-Kendall Trend : no trend
P Value: 0.12302
Mann-Kendall S Value: 172.0
FE (Ug/L)
Date
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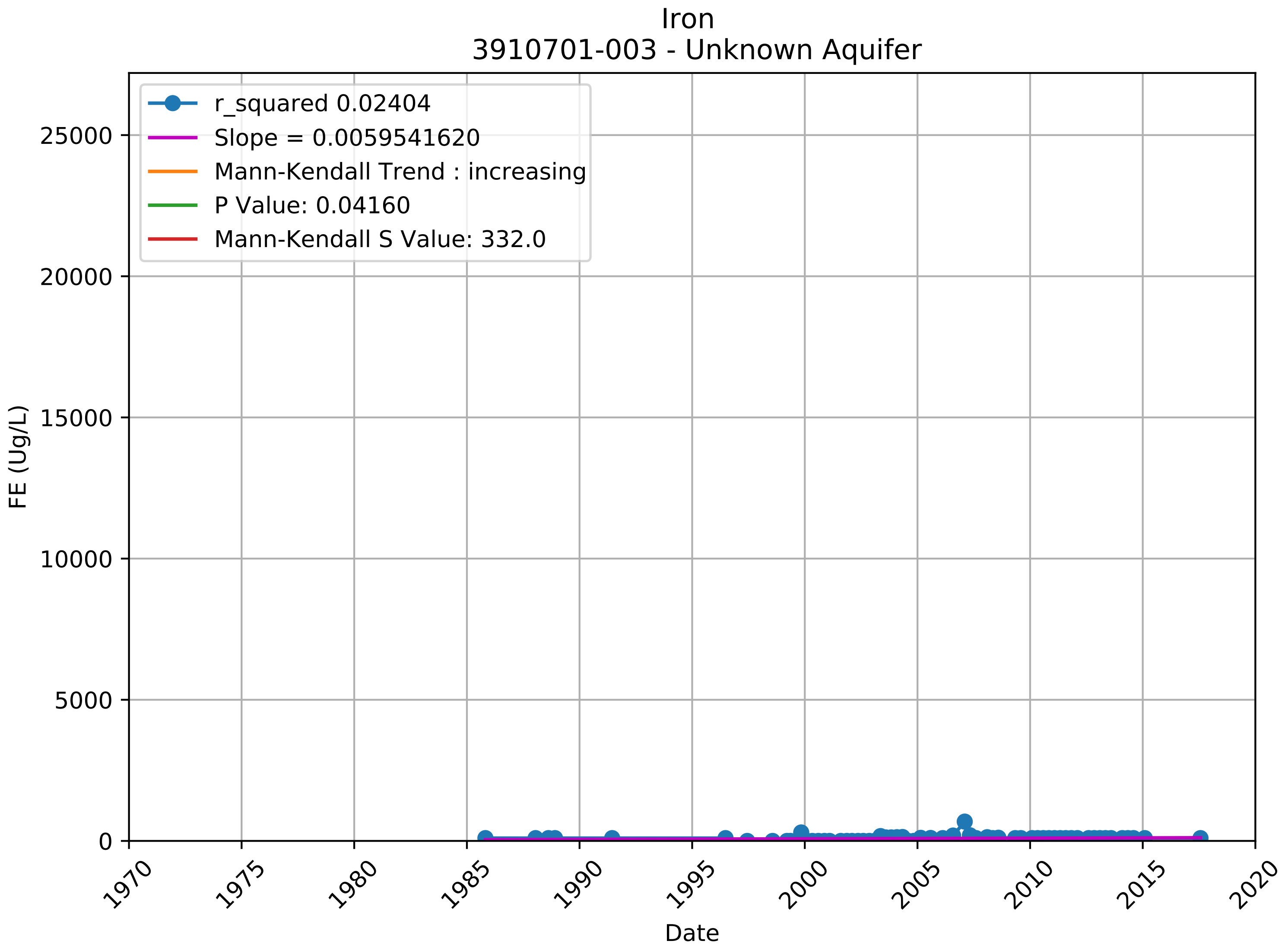

Iron
3910701-003 - Unknown Aquifer
r_squared 0.02404
Slope = 0.0059541620
Mann-Kendall Trend : increasing
P Value: 0.04160
Mann-Kendall S Value: 332.0
FE (Ug/L)
25000
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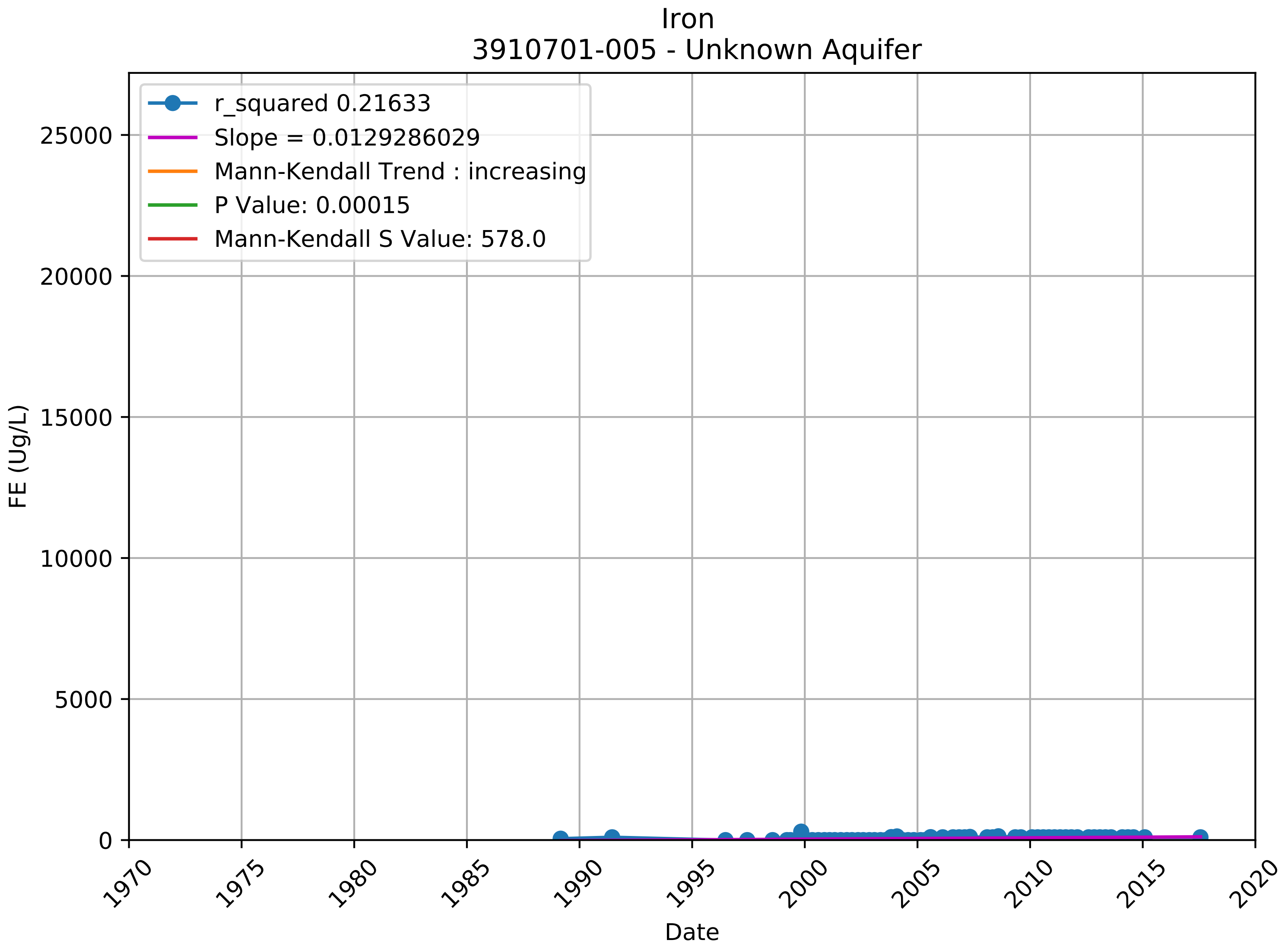
Date



Iron
3910701-005 - Unknown Aquifer
r_squared 0.21633
Slope = 0.0129286029
Mann-Kendall Trend : increasing
P Value: 0.00015
Mann-Kendall S Value: 578.0
FE (Ug/L)
Date
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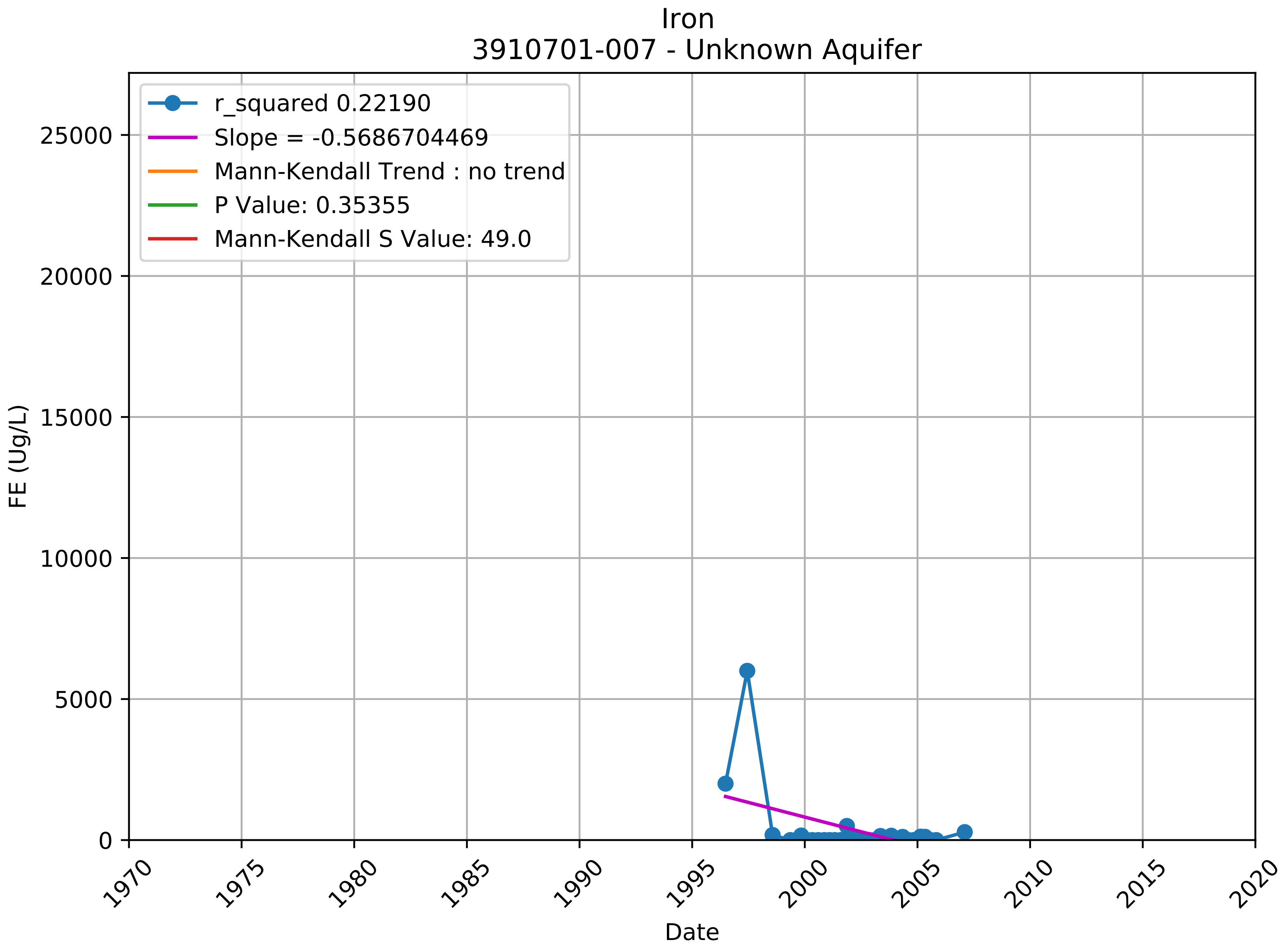

Iron
3910701-007 - Unknown Aquifer
r_squared 0.22190
Slope = -0.5686704469
Mann-Kendall Trend : no trend
P Value: 0.35355
Mann-Kendall S Value: 49.0
FE (Ug/L)
Date
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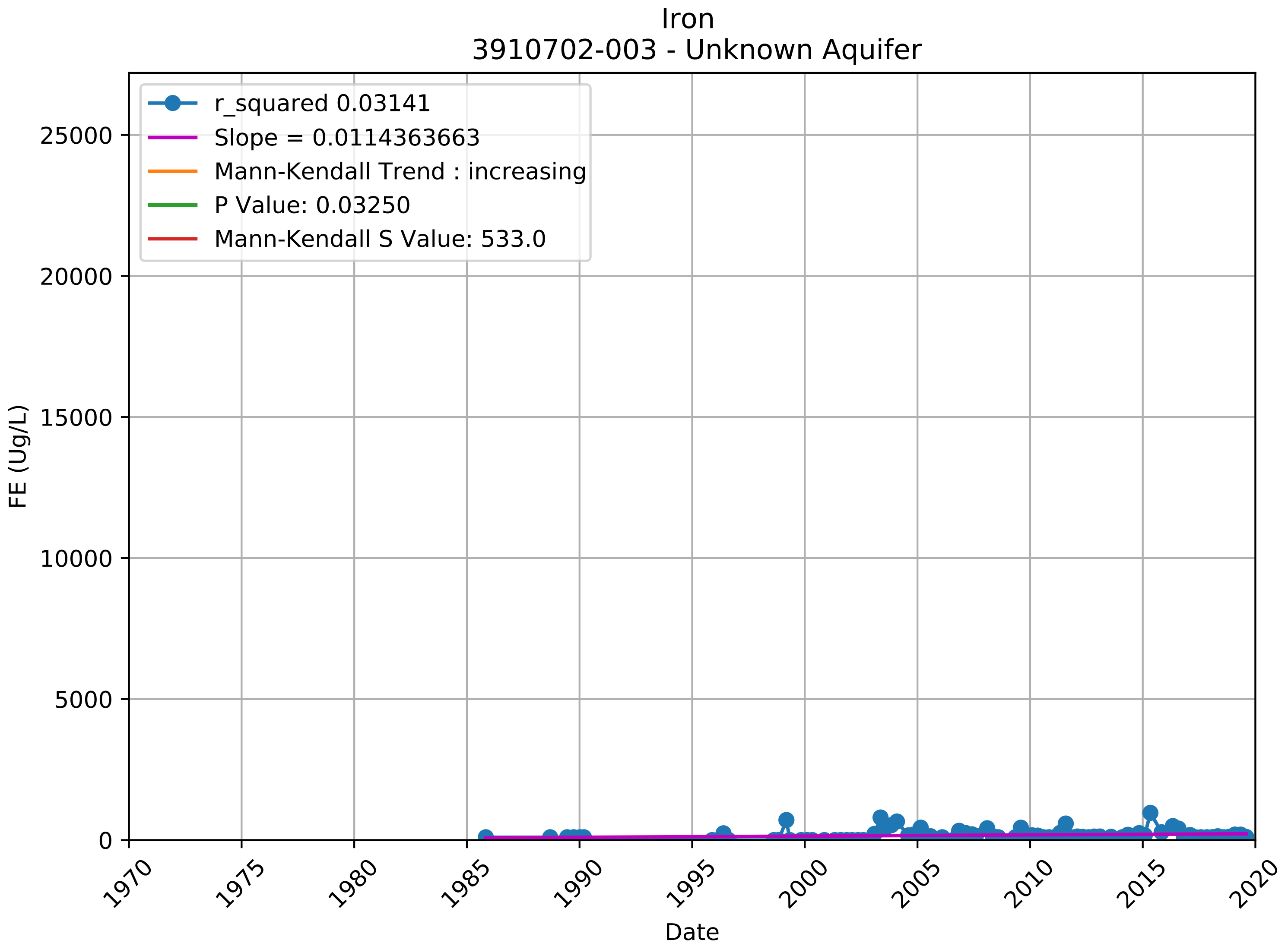

Iron
3910702-003 - Unknown Aquifer
r_squared 0.03141
Slope = 0.0114363663
Mann-Kendall Trend : increasing
P Value: 0.03250
Mann-Kendall S Value: 533.0
FE (Ug/L)
25000
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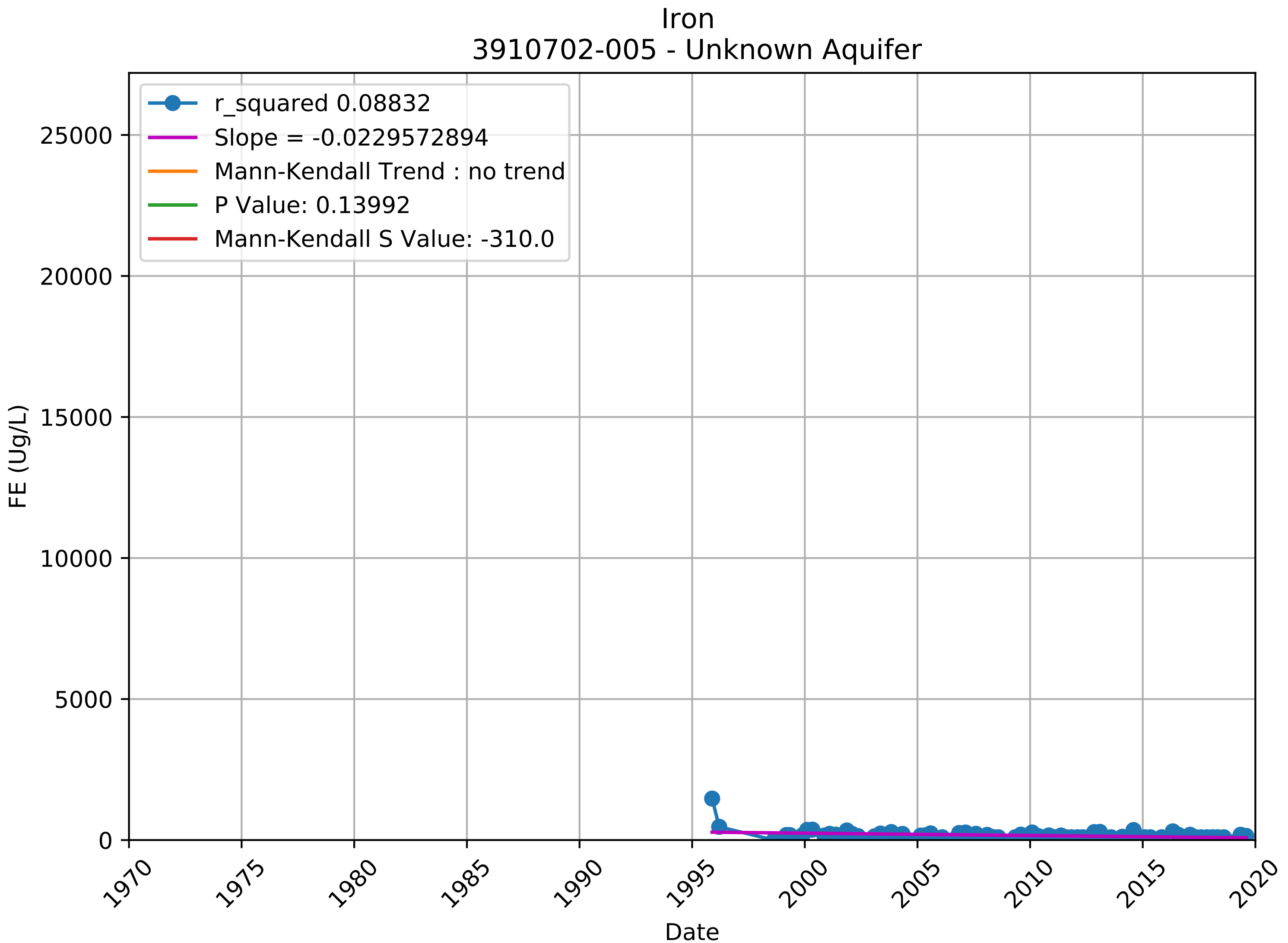
Date


Iron
3910702-005 - Unknown Aquifer
r_squared 0.08832
Slope = -0.0229572894
Mann-Kendall Trend : no trend
P Value: 0.13992
Mann-Kendall S Value: -310.0
FE (Ug/L)
Date
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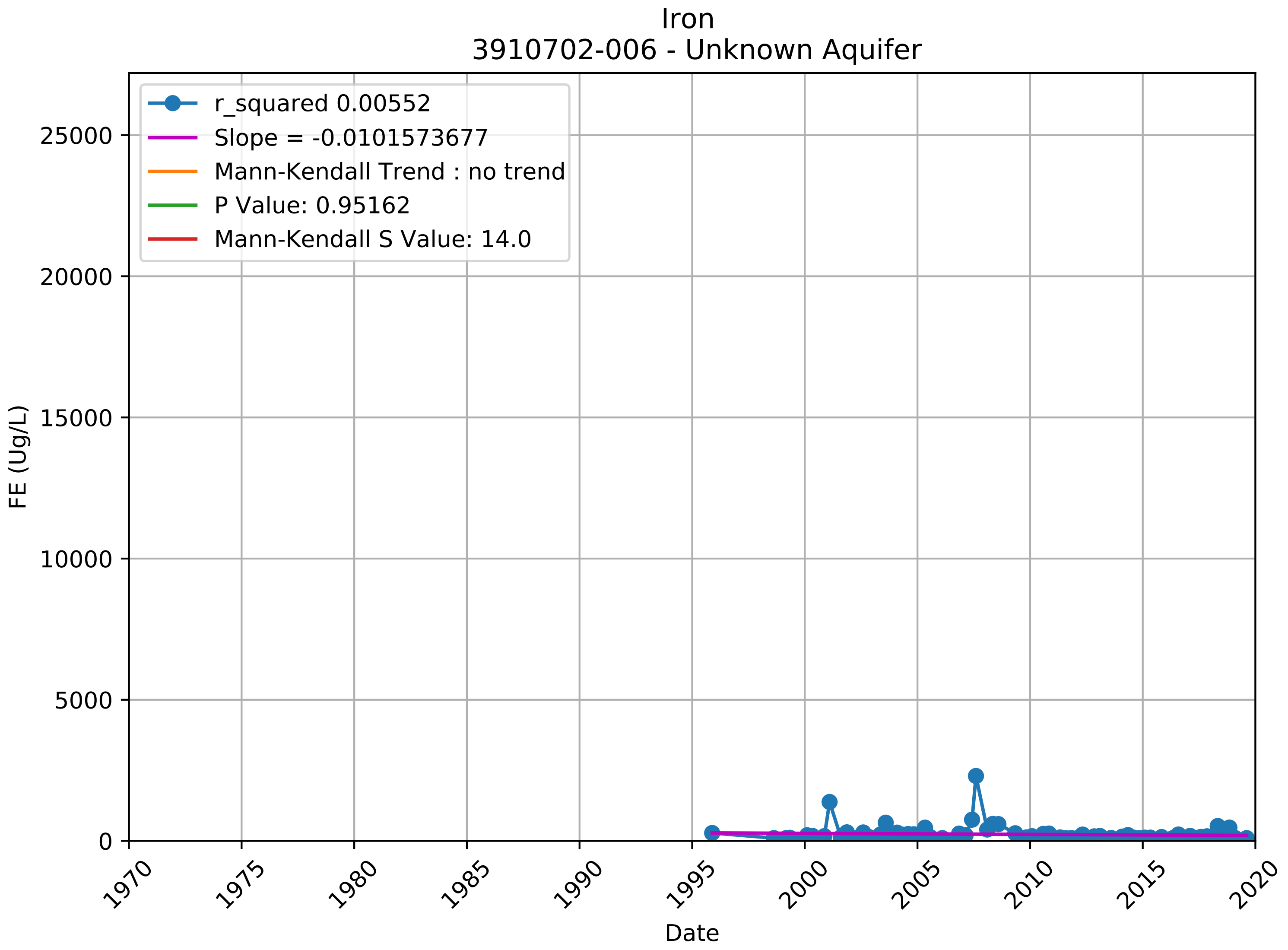
Iron
3910702-006 - Unknown Aquifer
r_squared 0.00552
Slope = -0.0101573677
Mann-Kendall Trend : no trend
P Value: 0.95162
Mann-Kendall S Value: 14.0
FE (Ug/L)
Date
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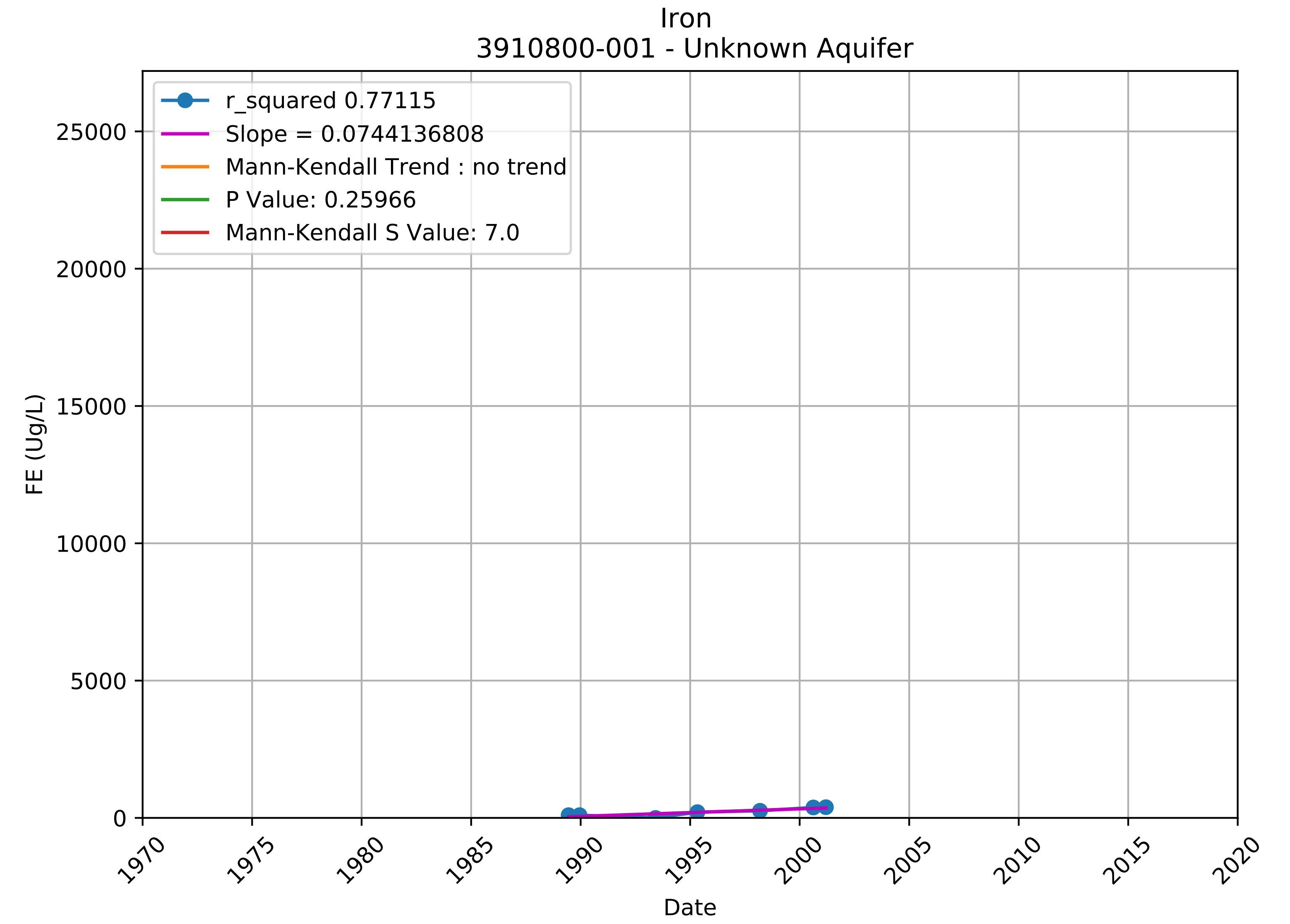

Iron
3910800-001 - Unknown Aquifer
r_squared 0.77115
Slope = 0.0744136808
Mann-Kendall Trend : no trend
P Value: 0.25966
Mann-Kendall S Value: 7.0
FE (Ug/L)
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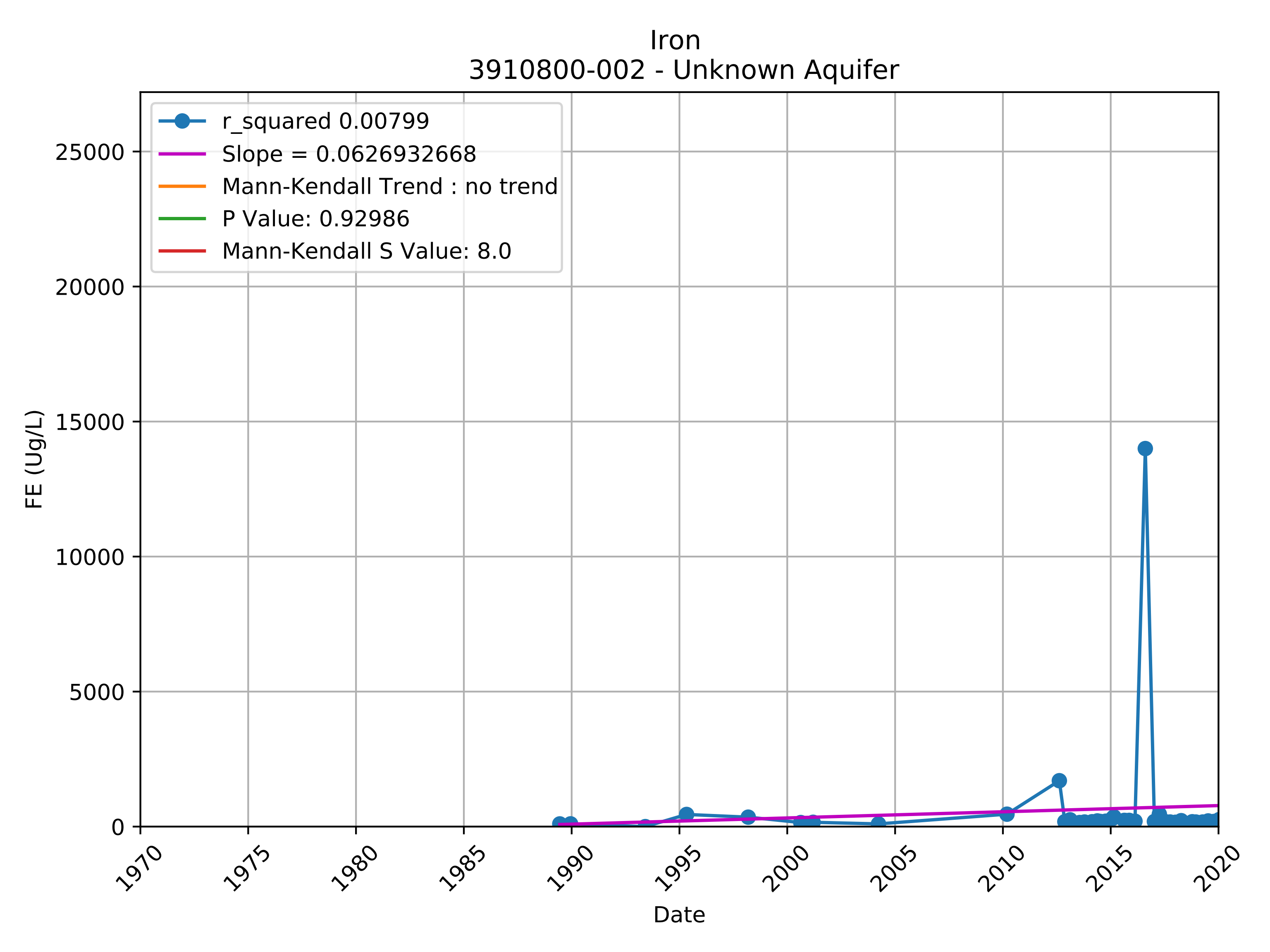
Date



Iron
3910800-002 - Unknown Aquifer
r_squared 0.00799
Slope = 0.0626932668
Mann-Kendall Trend : no trend
P Value: 0.92986
Mann-Kendall S Value: 8.0
FE (Ug/L)
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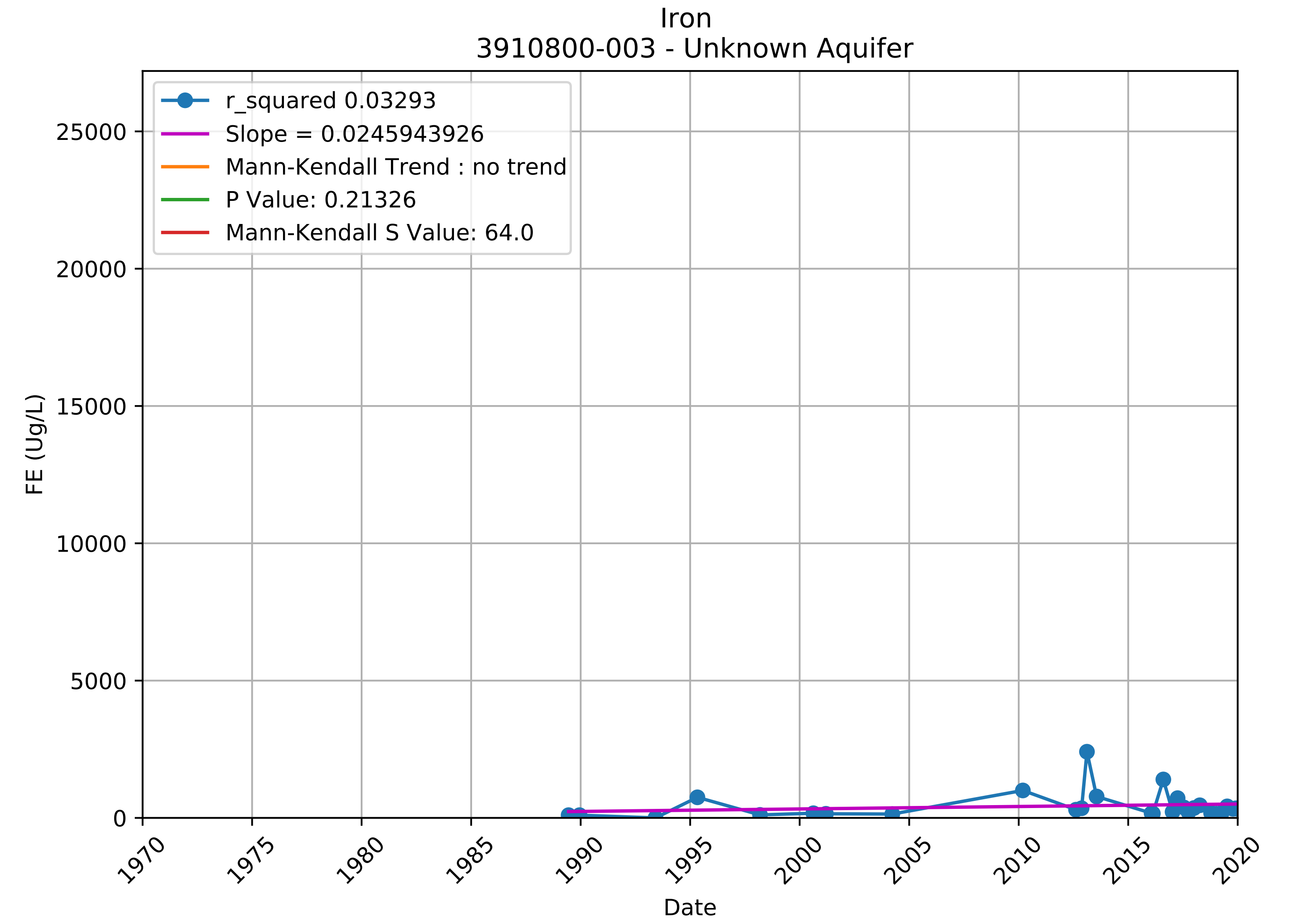

Iron
3910800-003 - Unknown Aquifer
r_squared 0.03293
Slope = 0.0245943926
Mann-Kendall Trend : no trend
P Value: 0.21326
Mann-Kendall S Value: 64.0
FE (Ug/L)
Date
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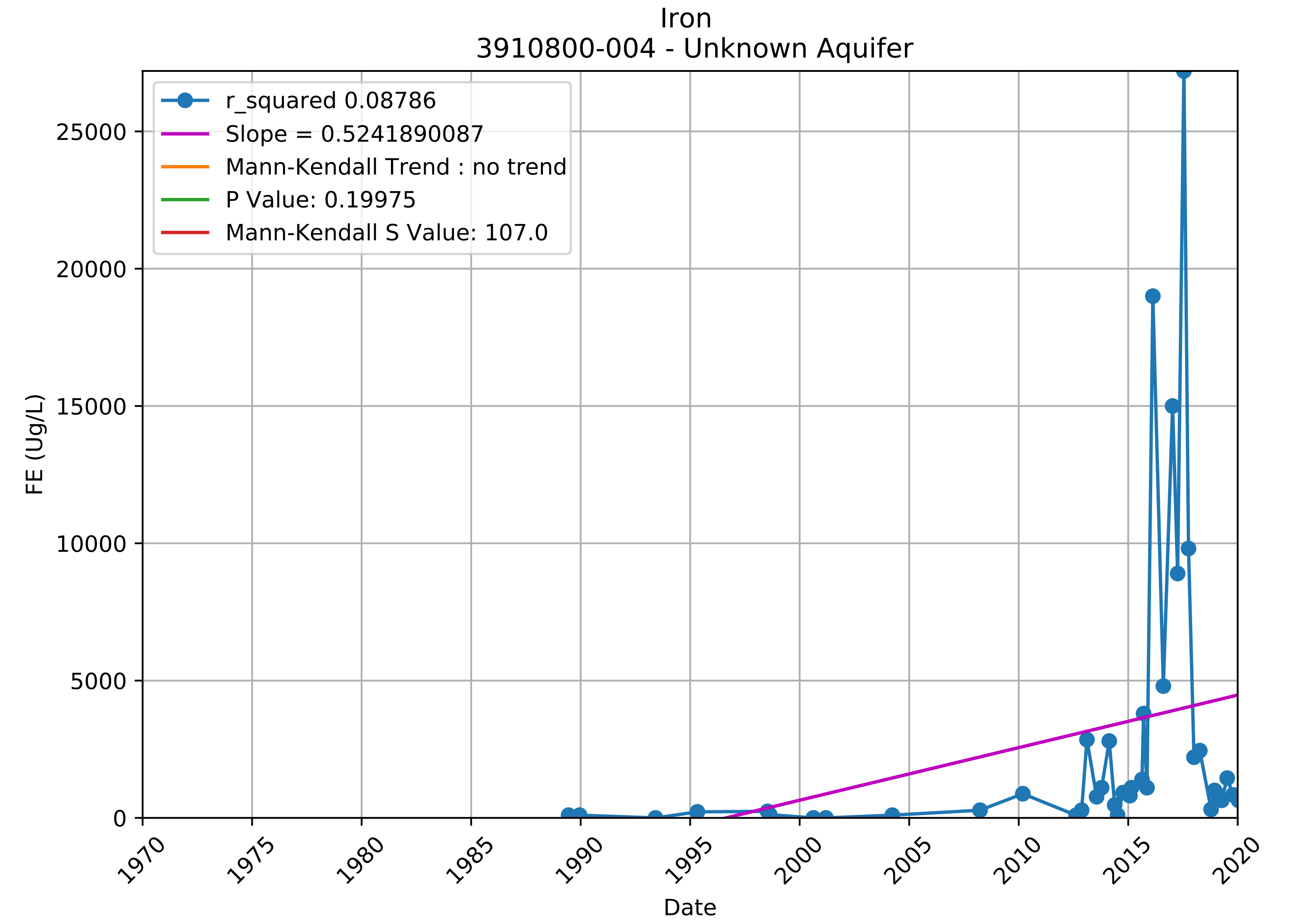

Iron
3910800-004 - Unknown Aquifer
r_squared 0.08786
Slope = 0.5241890087
Mann-Kendall Trend : no trend
P Value: 0.19975
Mann-Kendall S Value: 107.0
FE (Ug/L)
0
5000
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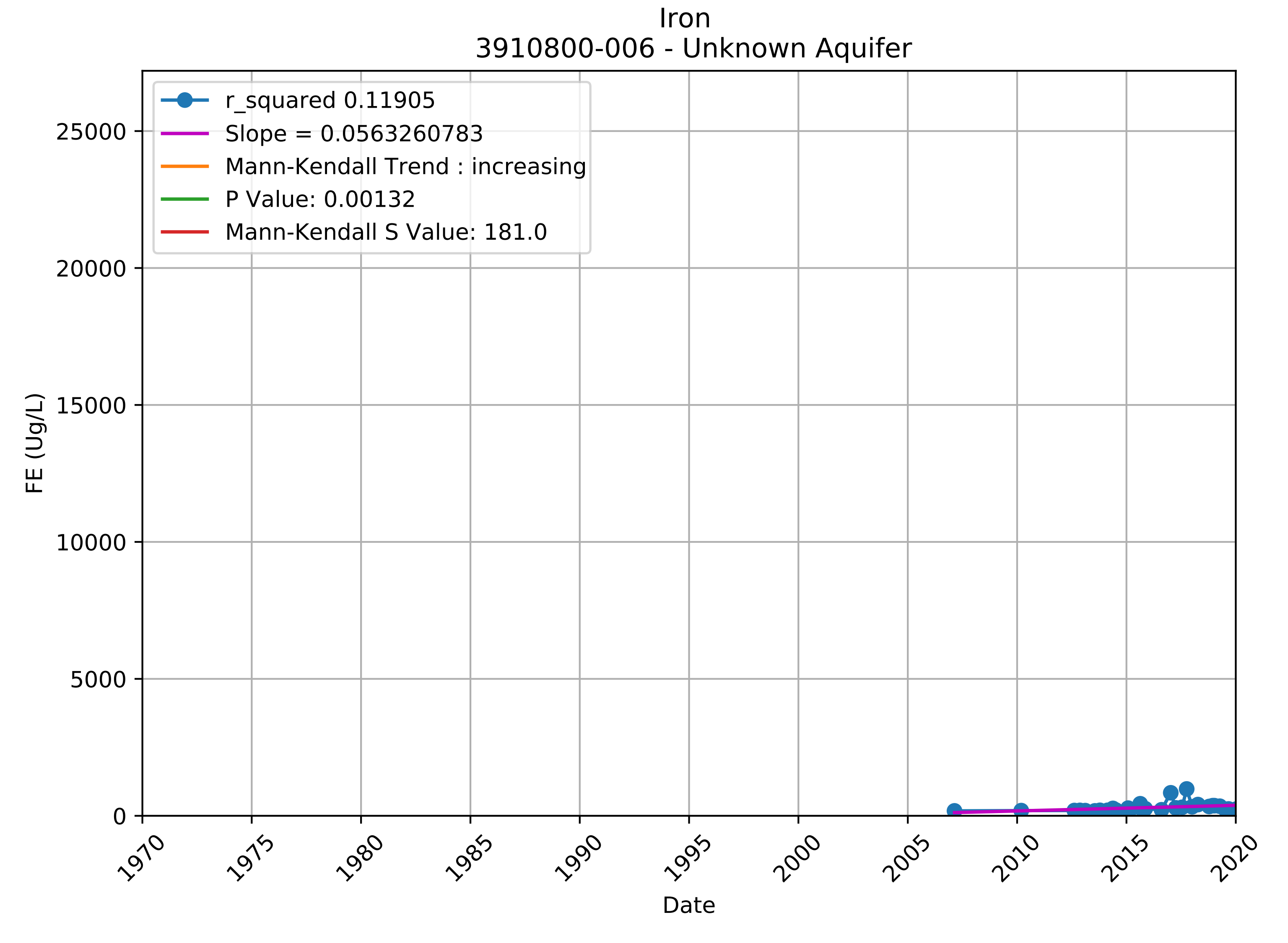
Date



Iron
3910800-006 - Unknown Aquifer
r_squared 0.11905
Slope = 0.0563260783
Mann-Kendall Trend : increasing
P Value: 0.00132
Mann-Kendall S Value: 181.0
FE (Ug/L)
25000
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10000
5000
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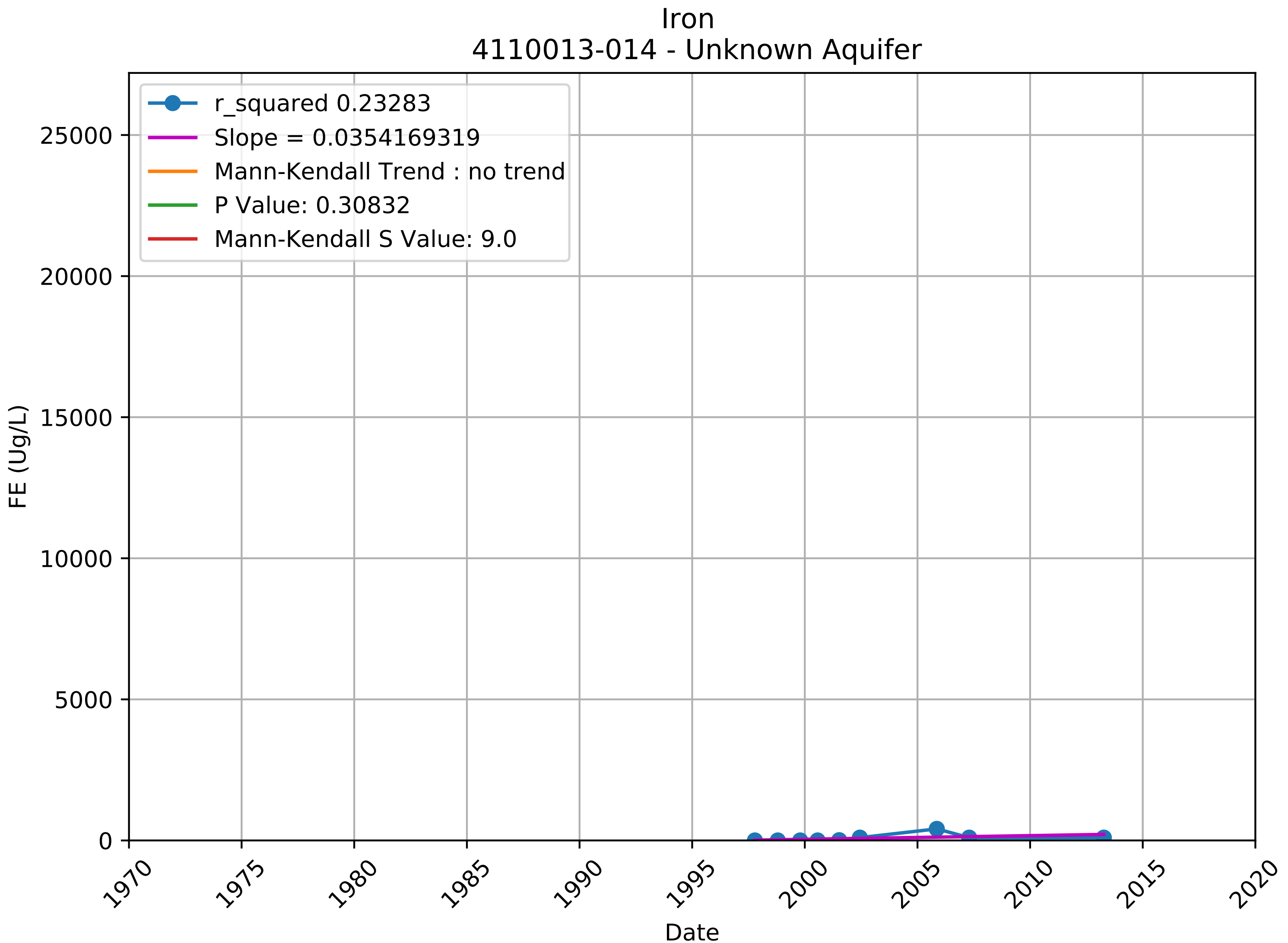
Date



Iron
4110013-014 - Unknown Aquifer
r_squared 0.23283
Slope = 0.0354169319
Mann-Kendall Trend : no trend
P Value: 0.30832
Mann-Kendall S Value: 9.0
FE (Ug/L)
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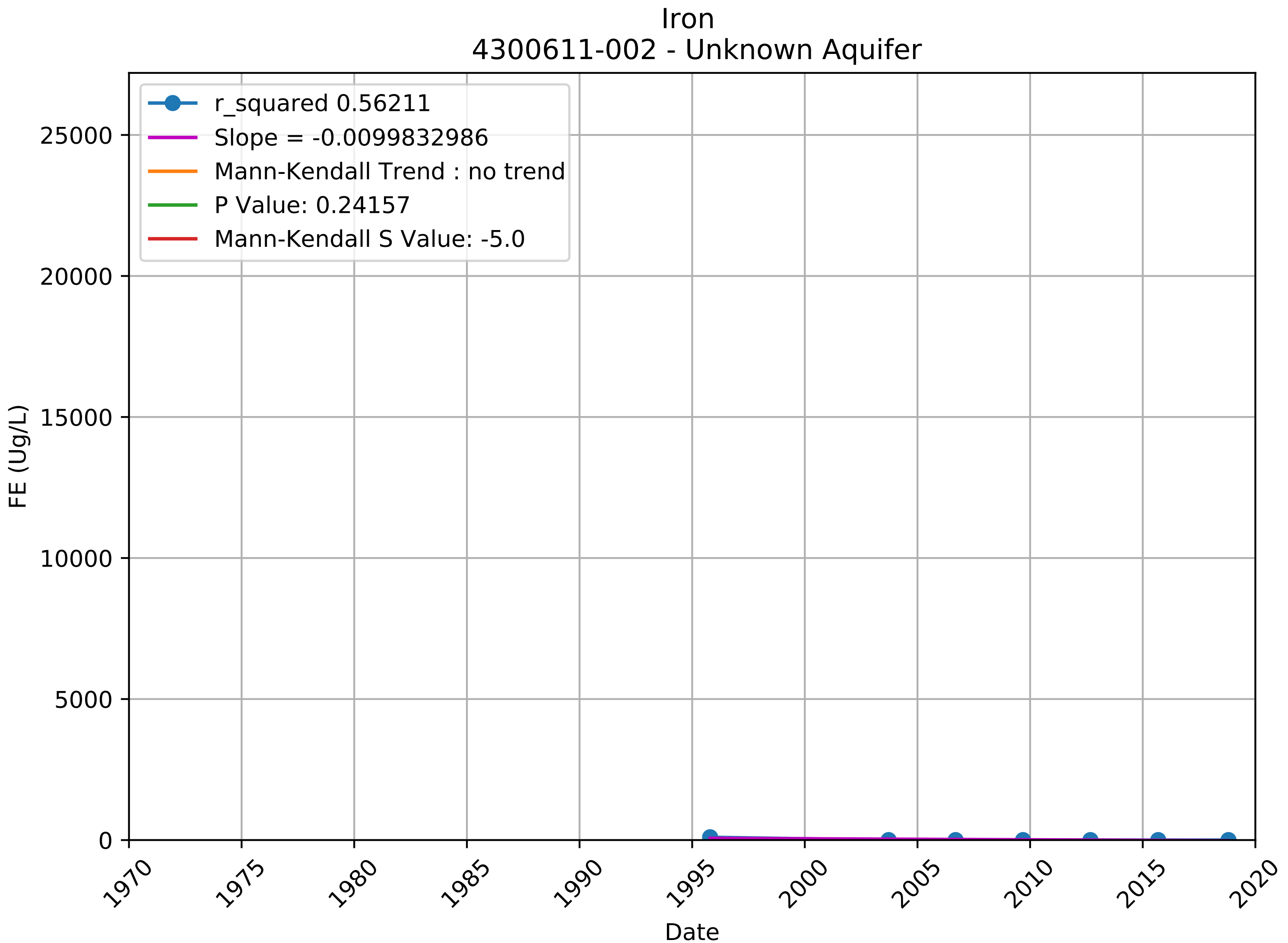
Date



Iron
4300611-002 - Unknown Aquifer
r_squared 0.56211
Slope = -0.0099832986
Mann-Kendall Trend : no trend
P Value: 0.24157
Mann-Kendall S Value: -5.0
FE (Ug/L)
25000
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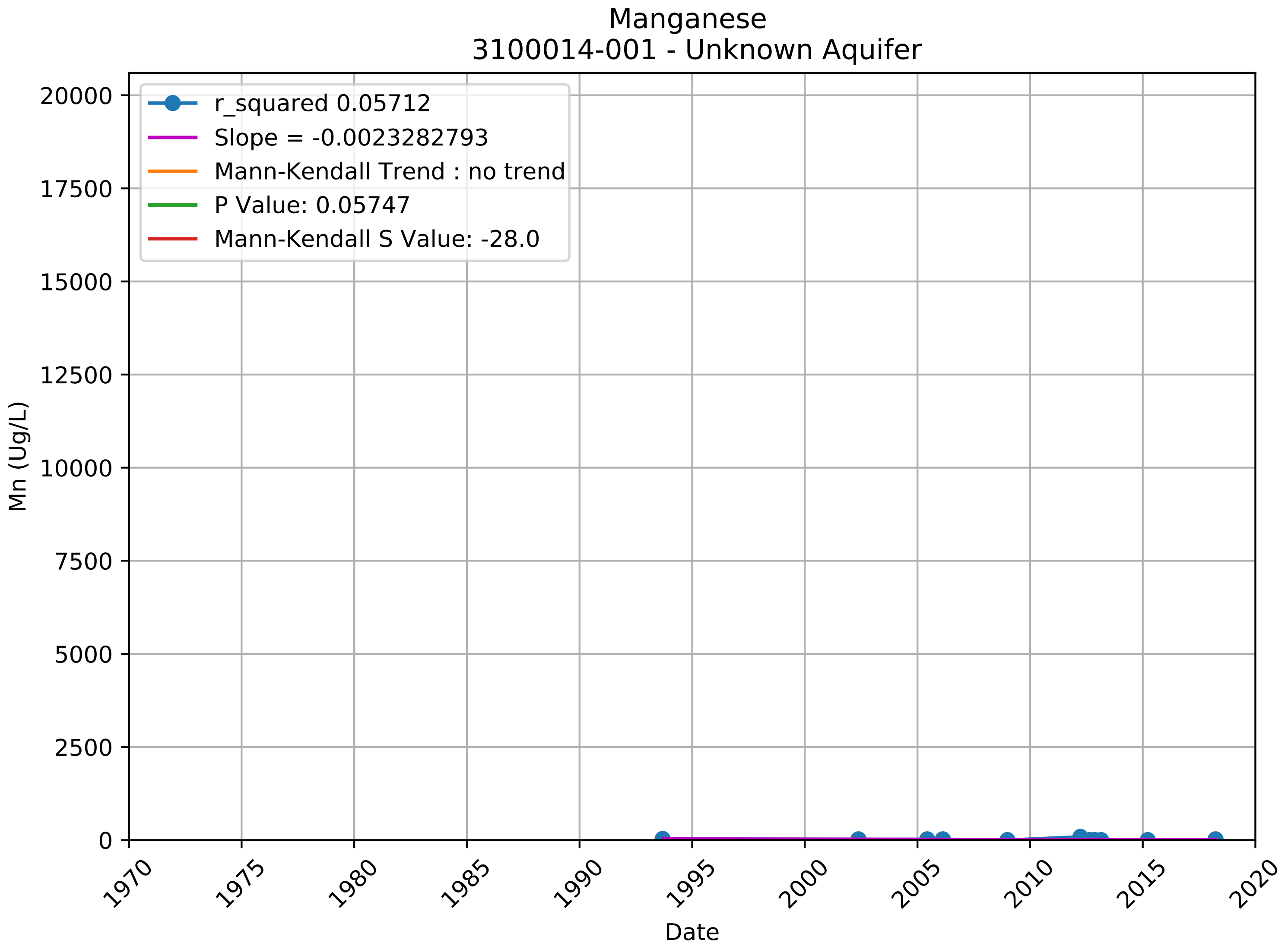
2015
2020
Date

Manganese

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
3910011-007	37.714471	-121.426009	MN	FALSE	0.076	18	0.5	no trend	92	1.772	Unknown
3910011-010	37.736372	-121.435351	MN	FALSE	0.62	12	0.1	no trend	493.333	0.495	Unknown
3910702-003	37.705557	-121.39764	MN	TRUE	0	1150	0.364	increasing	49767.33	5.15	Unknown
3910701-003	37.85144	-121.2682	MN	TRUE	0	580	0.297	increasing	25158	3.65	Unknown
3910701-001	37.849584	-121.268763	MN	TRUE	0.015	270	0.22	increasing	12328.67	2.423	Unknown
3910011-017	37.738215	-121.419962	MN	FALSE	0.13	-7	-0.7	no trend	15.667	-1.516	Unknown
3910018-001	37.679751	-121.272617	MN	TRUE	0.032	-25	-0.556	decreasing	125	-2.147	Unknown
4300611-002	37.994444	-121.499722	MN	FALSE	0.133	-9	-0.6	no trend	28.333	-1.503	Unknown
3901010-001	38.037472	-121.494583	MN	FALSE	1	0	0	no trend	16.667	0	Unknown
3910015-005	37.816859	-121.266705	MN	FALSE	0.653	-17	-0.067	no trend	1265	-0.45	Upper
3910011-003	37.683959	-121.439427	MN	TRUE	0	186	0.428	increasing	2641.333	3.6	Lower
3910800-002	37.744188	-121.32701	MN	FALSE	0.063	149	0.212	no trend	6327	1.861	Unknown
3910800-003	37.74545	-121.32897	MN	FALSE	0.055	98	0.259	no trend	2562	1.916	Unknown
3910800-001	37.744746	-121.327221	MN	FALSE	0.26	7	0.467	no trend	28.333	1.127	Unknown
3910800-004	37.74591	-121.336213	MN	FALSE	0.077	147	0.198	no trend	6833.667	1.766	Unknown
3100014-001	37.716956	-121.379533	MN	FALSE	0.057	-28	-0.424	no trend	202	-1.9	Unknown
3910701-005	37.851301	-121.2673	MN	TRUE	0	763	0.417	increasing	22732.33	5.054	Unknown
3910011-004	37.682308	-121.436988	MN	TRUE	0.004	105	0.38	increasing	1312.333	2.871	Lower
3910011-006	37.686539	-121.443515	MN	TRUE	0.019	91	0.28	increasing	1460.333	2.355	Lower
3910011-005	37.683353	-121.443313	MN	TRUE	0	200	0.403	increasing	3000.667	3.633	Lower
3910015-006	37.818884	-121.266416	MN	FALSE	0.516	22	0.095	no trend	1044	0.65	Upper
3910015-007	37.811547	-121.263915	MN	FALSE	0.689	21	0.056	no trend	2493	0.401	Upper
3910015-008	37.801132	-121.262514	MN	TRUE	0.002	82	0.48	increasing	692	3.079	Upper
3910011-018	37.743262	-121.424805	MN	TRUE	0.018	94	0.313	increasing	1555.333	2.358	Lower
3910018-004	37.679705	-121.272761	MN	FALSE	0.188	-9	-0.429	no trend	37	-1.315	Unknown
3910701-007	37.851431	-121.265247	MN	TRUE	0.023	-122	-0.3	decreasing	2842	-2.27	Unknown
3910702-006	37.709972	-121.390802	MN	TRUE	0.013	-533	-0.197	decreasing	45917	-2.483	Unknown
3910702-005	37.708149	-121.393881	MN	FALSE	0.771	-62	-0.024	no trend	44088	-0.291	Unknown
4110013-014	37.7	-121.466667	MN	TRUE	0.022	19	0.679	increasing	61.667	2.292	Unknown
3900991-001	37.743544	-121.461428	MN	FALSE	0.794	-2	-0.2	no trend	14.667	-0.261	Unknown
3910011-030	37.740208	-121.439285	MN	TRUE	0.005	175	0.353	increasing	3801.667	2.822	Lower
3901348-002	37.702894	-121.406986	MN	FALSE	0.794	2	0.2	no trend	14.667	0.261	Unknown
3900589-001	37.783862	-121.305584	MN	FALSE	0.108	-14	-0.5	no trend	65.333	-1.608	Unknown
3900713-001	37.84	-121.44	MN	FALSE	0.276	15	0.273	no trend	165	1.09	Unknown
3901172-002	37.636324	-121.399544	MN	FALSE	0.289	4	0.4	no trend	8	1.061	Unknown
3901172-003	37.632289	-121.39736	MN	FALSE	0.1	9	0.6	no trend	23.667	1.644	Unknown
3900702-001	37.990639	-121.407056	MN	TRUE	0.049	-23	-0.511	decreasing	125	-1.968	Unknown
3900583-001	37.84	-121.44	MN	FALSE	0.107	-19	-0.422	no trend	125	-1.61	Unknown
3901348-001	37.708679	-121.412023	MN	FALSE	1	1	0.022	no trend	125	0	Unknown
3901216-002	37.74753	-121.516649	MN	FALSE	1	-1	-0.067	no trend	28.333	0	Unknown
3900559-001	37.79	-121.38	MN	FALSE	0.47	-3	-0.5	no trend	7.667	-0.722	Unknown
3900558-002	37.79	-121.4	MN	FALSE	0.844	-12	-0.028	no trend	3140.667	-0.196	Unknown
3900616-002	37.988607	-121.404525	MN	FALSE	0.806	-2	-0.2	no trend	16.667	-0.245	Unknown
3910011-034	37.752802	-121.434603	MN	TRUE	0.01	106	0.302	increasing	1667.333	2.571	Lower
3910011-032	37.754682	-121.465249	MN	TRUE	0.002	109	0.363	increasing	1199.667	3.118	Lower
3901348-003	37.698742	-121.409917	MN	FALSE	0.211	6	0.286	no trend	16	1.25	Unknown
3901348-004	37.698147	-121.416153	MN	FALSE	0.411	5	0.333	no trend	23.667	0.822	Unknown
3910015-013	37.792108	-121.274608	MN	FALSE	0.074	21	0.467	no trend	125	1.789	Unknown
377427N1213943W002	37.742656	-121.394318	MN	FALSE	0.092	-35	-0.333	no trend	408.333	-1.683	Lower
377427N1213943W001	37.742656	-121.394318	MN	FALSE	0.092	-35	-0.333	no trend	408.333	-1.683	Lower
377427N1213943W003	37.742656	-121.394318	MN	FALSE	0.276	-23	-0.219	no trend	408.333	-1.089	Lower
377402N1214508W001	37.740187	-121.450762	MN	FALSE	0.921	3	0.029	no trend	406.333	0.099	Lower
377143N1214459W002	37.714305	-121.445905	MN	FALSE	0.092	-35	-0.333	no trend	408.333	-1.683	Lower
377143N1214459W003	37.714305	-121.445905	MN	FALSE	0.322	21	0.2	no trend	408.333	0.99	Lower
377402N1214508W003	37.740187	-121.450762	MN	FALSE	0.373	-19	-0.181	no trend	408.333	-0.891	Lower
377402N1214508W002	37.740187	-121.450762	MN	FALSE	0.457	-16	-0.152	no trend	407.333	-0.743	Lower
377143N1214459W001	37.714305	-121.445905	MN	FALSE	0.138	-31	-0.295	no trend	408.333	-1.485	Lower
377656N1214199W001	37.765631	-121.41992	MN	FALSE	0.193	-20	-0.303	no trend	212.667	-1.303	Lower
377656N1214199W002	37.765631	-121.41992	MN	FALSE	0.371	-11	-0.244	no trend	125	-0.894	Lower
377656N1214199W003	37.765631	-121.41992	MN	FALSE	0.177	-23	-0.295	no trend	265	-1.351	Lower
377149N1214257W003	37.714872	-121.425674	MN	FALSE	0.115	-24	-0.364	no trend	212.667	-1.577	Lower
377149N1214257W002	37.714872	-121.425674	MN	FALSE	0.783	-5	-0.076	no trend	211.667	-0.275	Lower
377149N1214257W001	37.714872	-121.425674	MN	FALSE	0.085	-29	-0.372	no trend	265	-1.72	Lower
377031N1214485W002	37.703055	-121.448544	MN	TRUE	0.044	-34	-0.436	decreasing	268.667	-2.013	Lower
377031N1214485W001	37.703055	-121.448544	MN	FALSE	0.2	-22	-0.282	no trend	268.667	-1.281	Lower
377031N1214485W003	37.703055	-121.448544	MN	FALSE	0.127	-26	-0.333	no trend	268.667	-1.525	Lower
3910005-044	37.782808	-121.300937	MN	FALSE	0.525	-8	-0.178	no trend	121.333	-0.635	Unknown
3910800-006	37.744722	-121.329167	MN	TRUE	0.034	114	0.281	increasing	2842	2.12	Unknown



Manganese
3100014-001 - Unknown Aquifer
r_squared 0.05712
Slope = -0.0023282793
Mann-Kendall Trend : no trend
P Value: 0.05747
Mann-Kendall S Value: -28.0
Mn (Ug/L)
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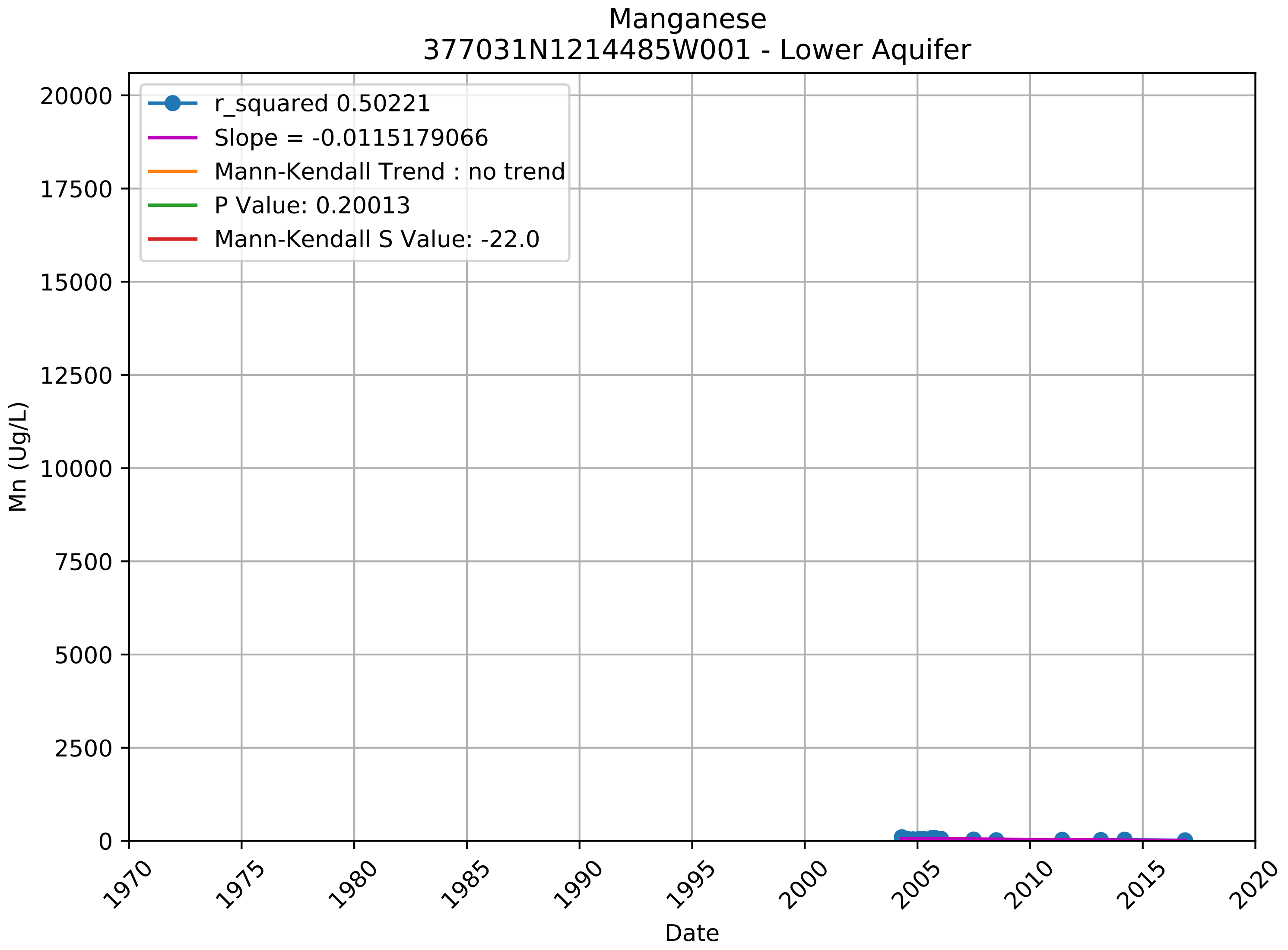

Manganese
377031N1214485W001 - Lower Aquifer
r_squared 0.50221
Slope = -0.0115179066
Mann-Kendall Trend : no trend
P Value: 0.20013
Mann-Kendall S Value: -22.0
Mn (Ug/L)
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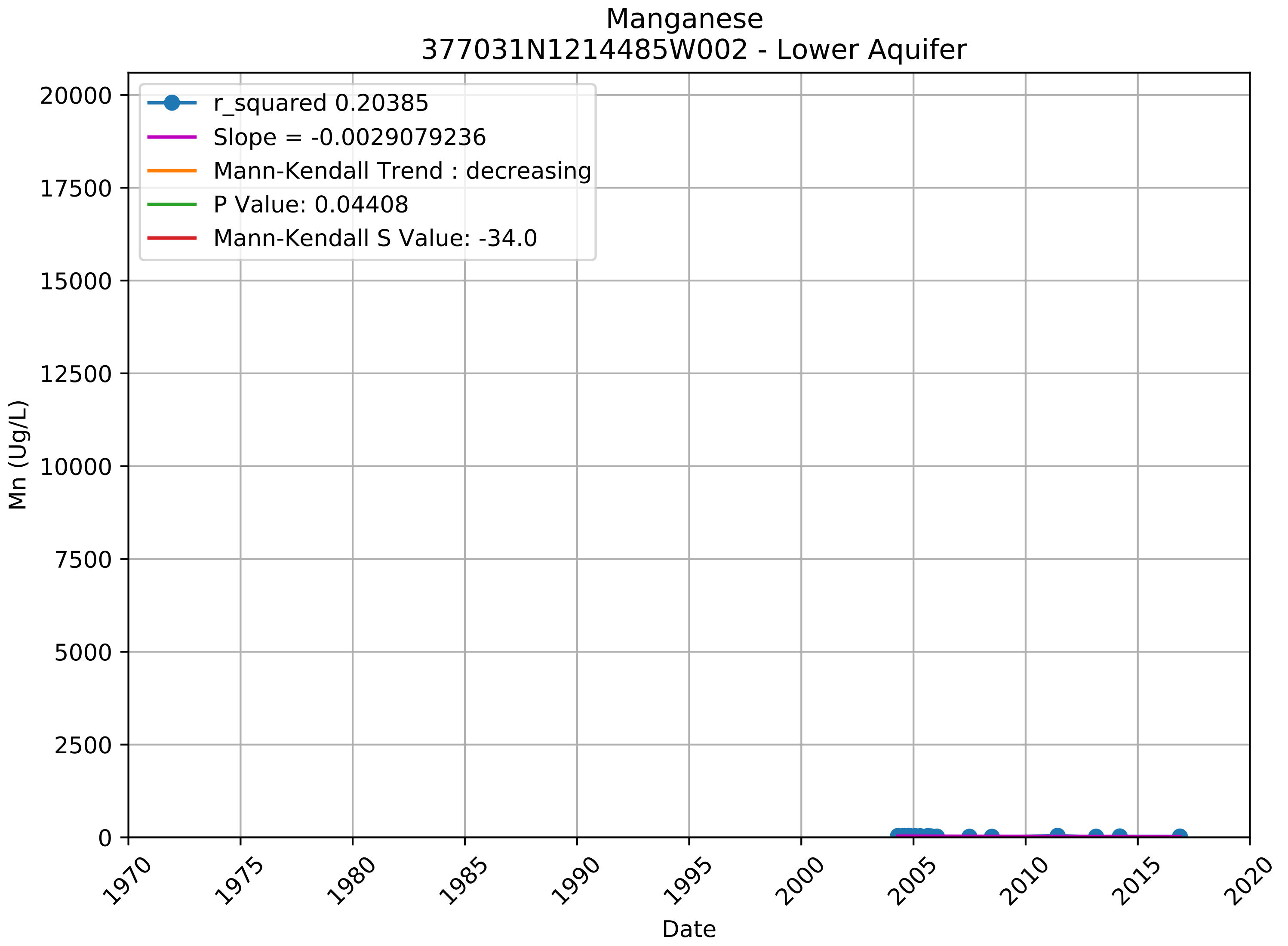

Manganese
377031N1214485W002 - Lower Aquifer
r_squared 0.20385
Slope = -0.0029079236
Mann-Kendall Trend : decreasing
P Value: 0.04408
Mann-Kendall S Value: -34.0
Mn (Ug/L)
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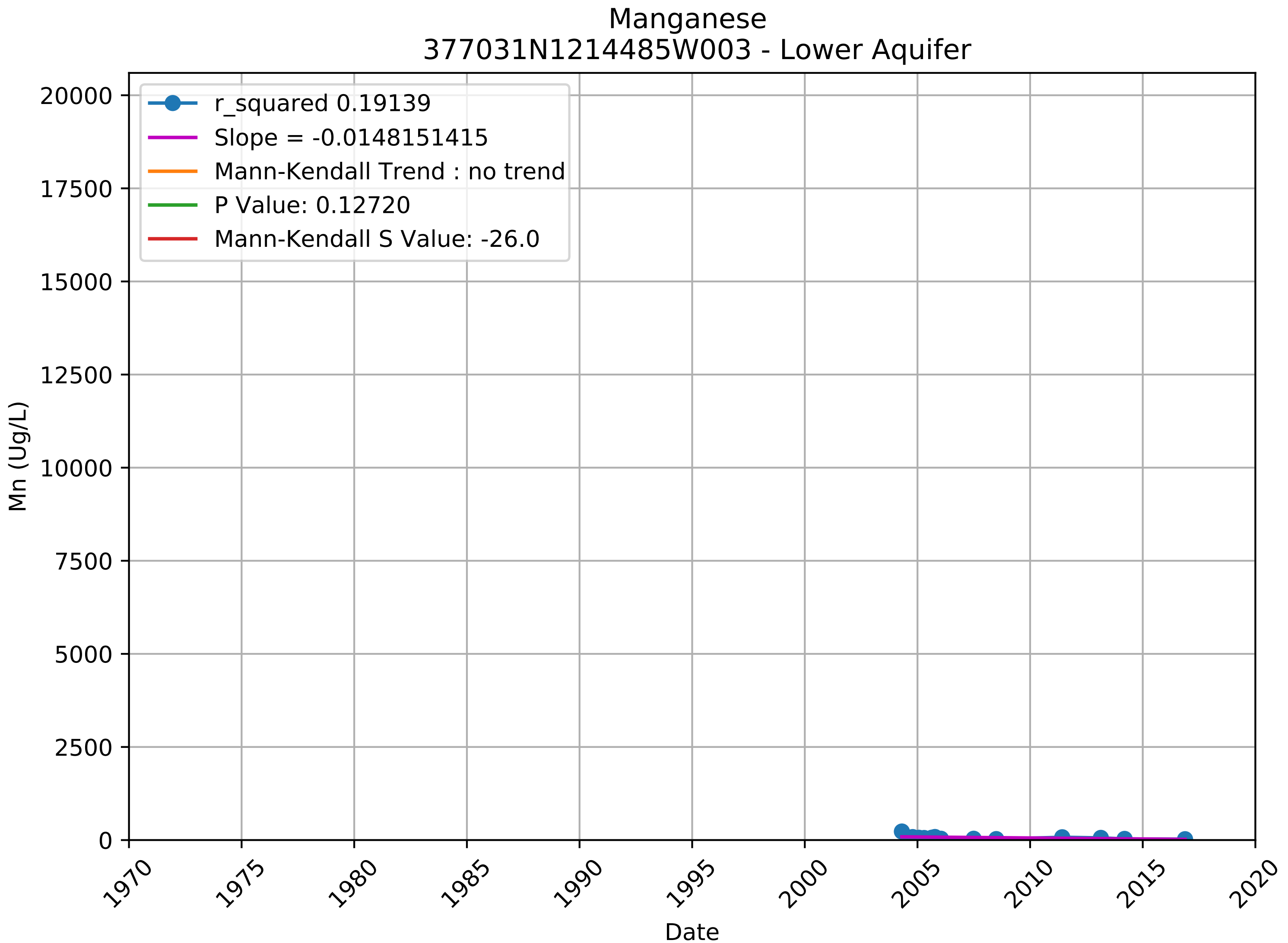

Manganese
377031N1214485W003 - Lower Aquifer
r_squared 0.19139
Slope = -0.0148151415
Mann-Kendall Trend : no trend
P Value: 0.12720
Mann-Kendall S Value: -26.0
Mn (Ug/L)
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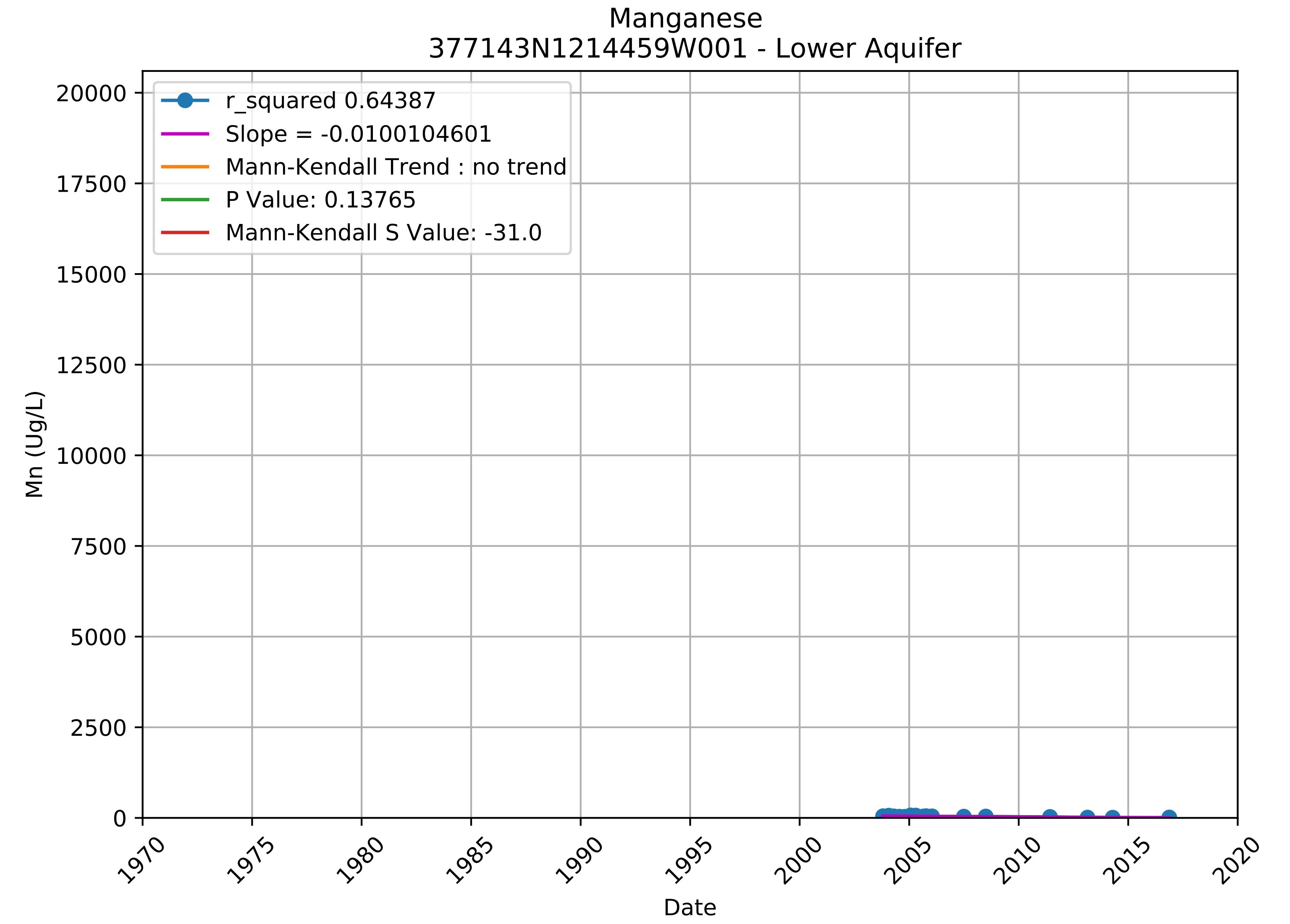
Manganese
377143N1214459W001 - Lower Aquifer
r_squared 0.64387
Slope = -0.0100104601
Mann-Kendall Trend : no trend
P Value: 0.13765
Mann-Kendall S Value: -31.0
Mn (Ug/L)
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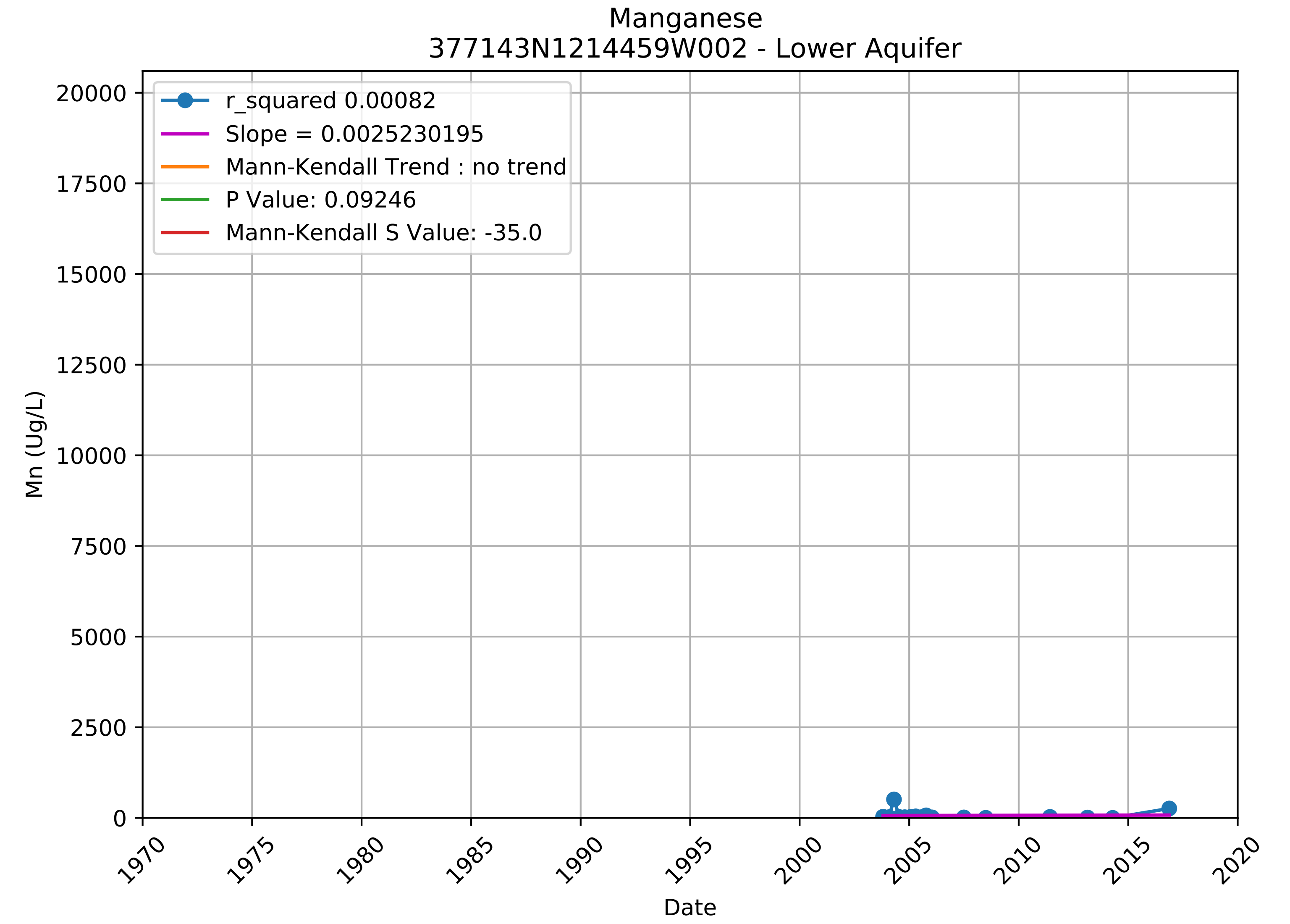

Manganese
377143N1214459W002 - Lower Aquifer
r_squared 0.00082
Slope = 0.0025230195
Mann-Kendall Trend : no trend
P Value: 0.09246
Mann-Kendall S Value: -35.0
Mn (Ug/L)
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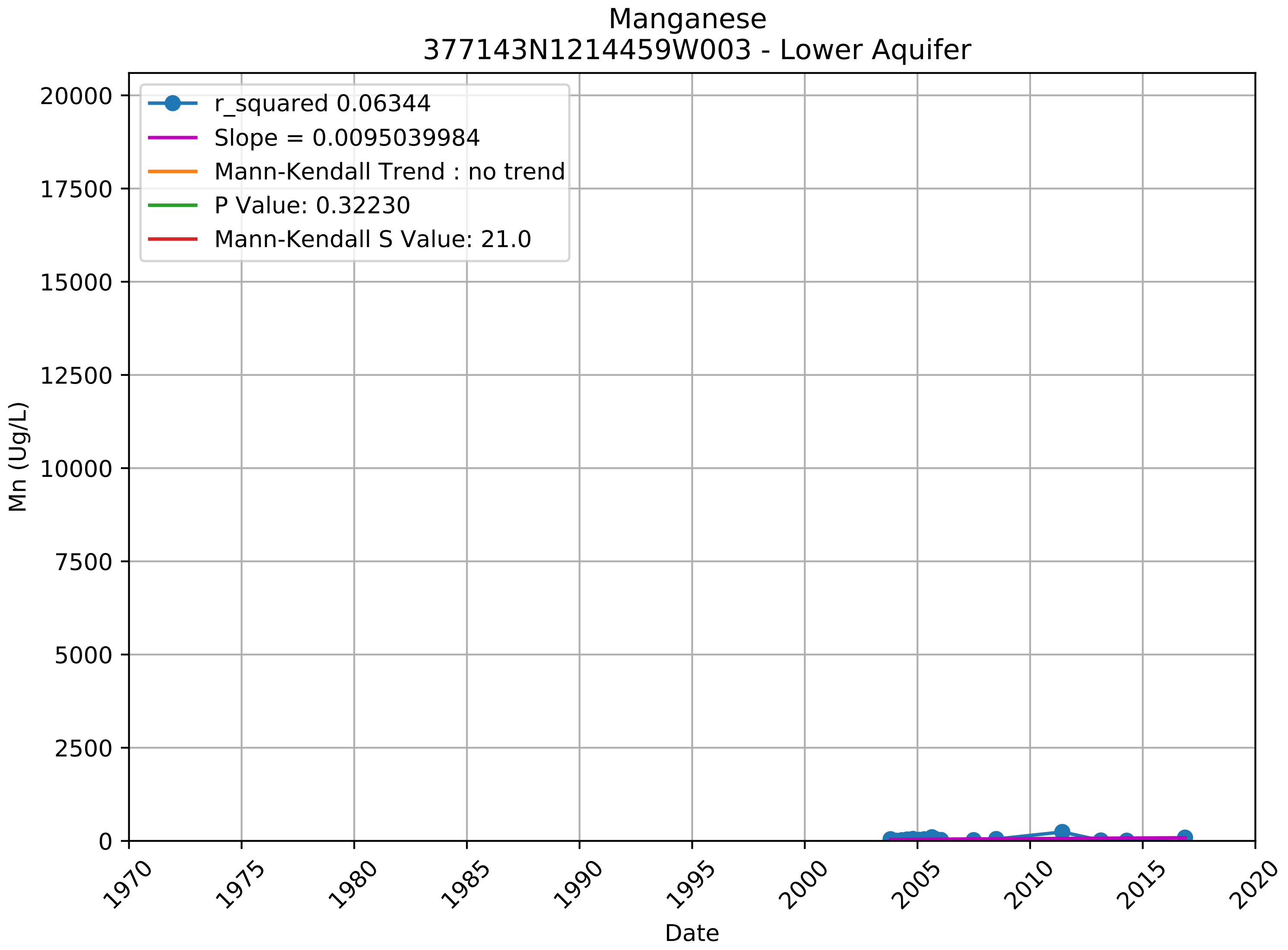

Manganese
377143N1214459W003 - Lower Aquifer
r_squared 0.06344
Slope = 0.0095039984
Mann-Kendall Trend : no trend
P Value: 0.32230
Mann-Kendall S Value: 21.0
Mn (Ug/L)
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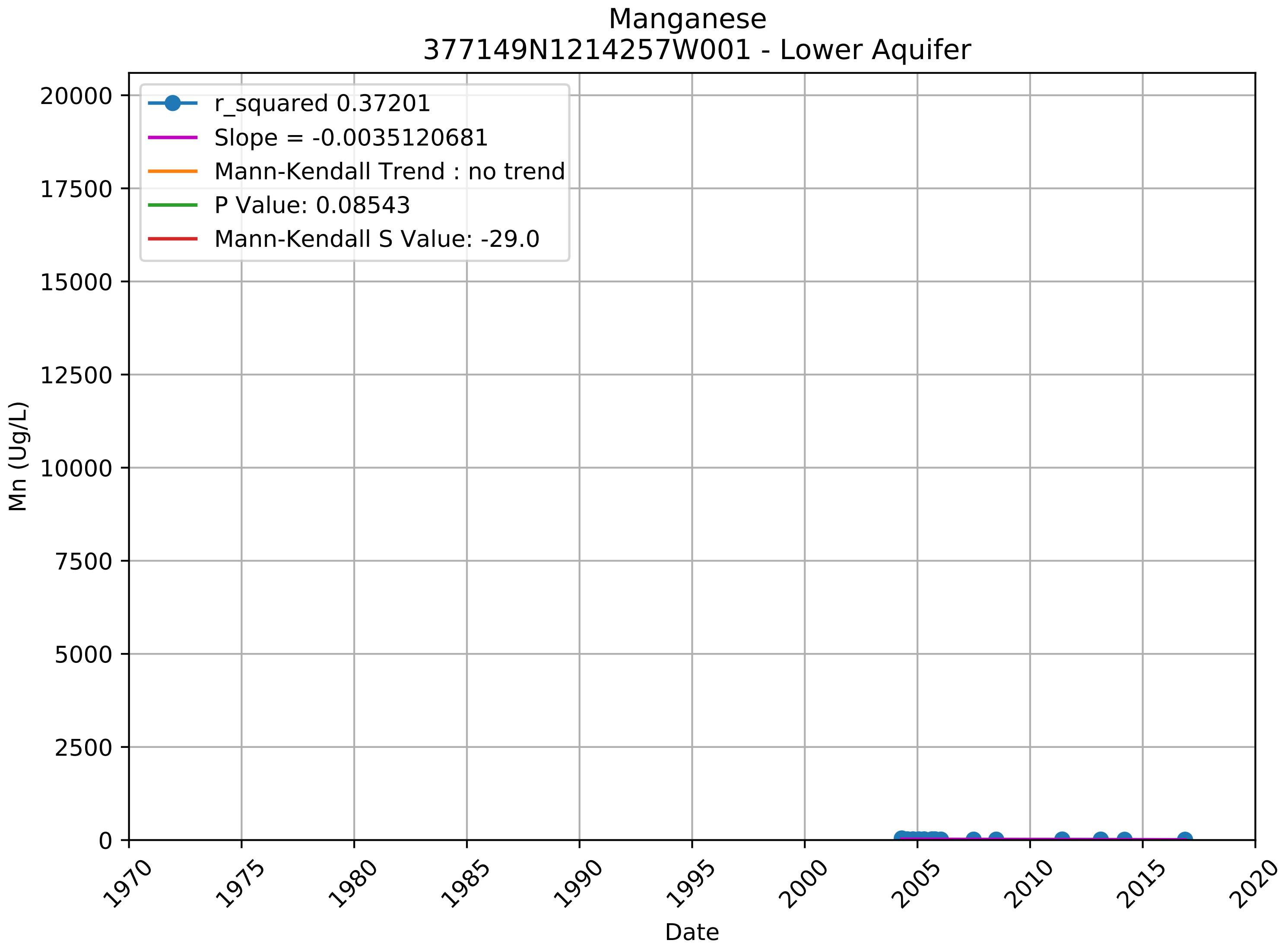
Manganese
377149N1214257W001 - Lower Aquifer
r_squared 0.37201
Slope = -0.0035120681
Mann-Kendall Trend : no trend
P Value: 0.08543
Mann-Kendall S Value: -29.0
Mn (Ug/L)
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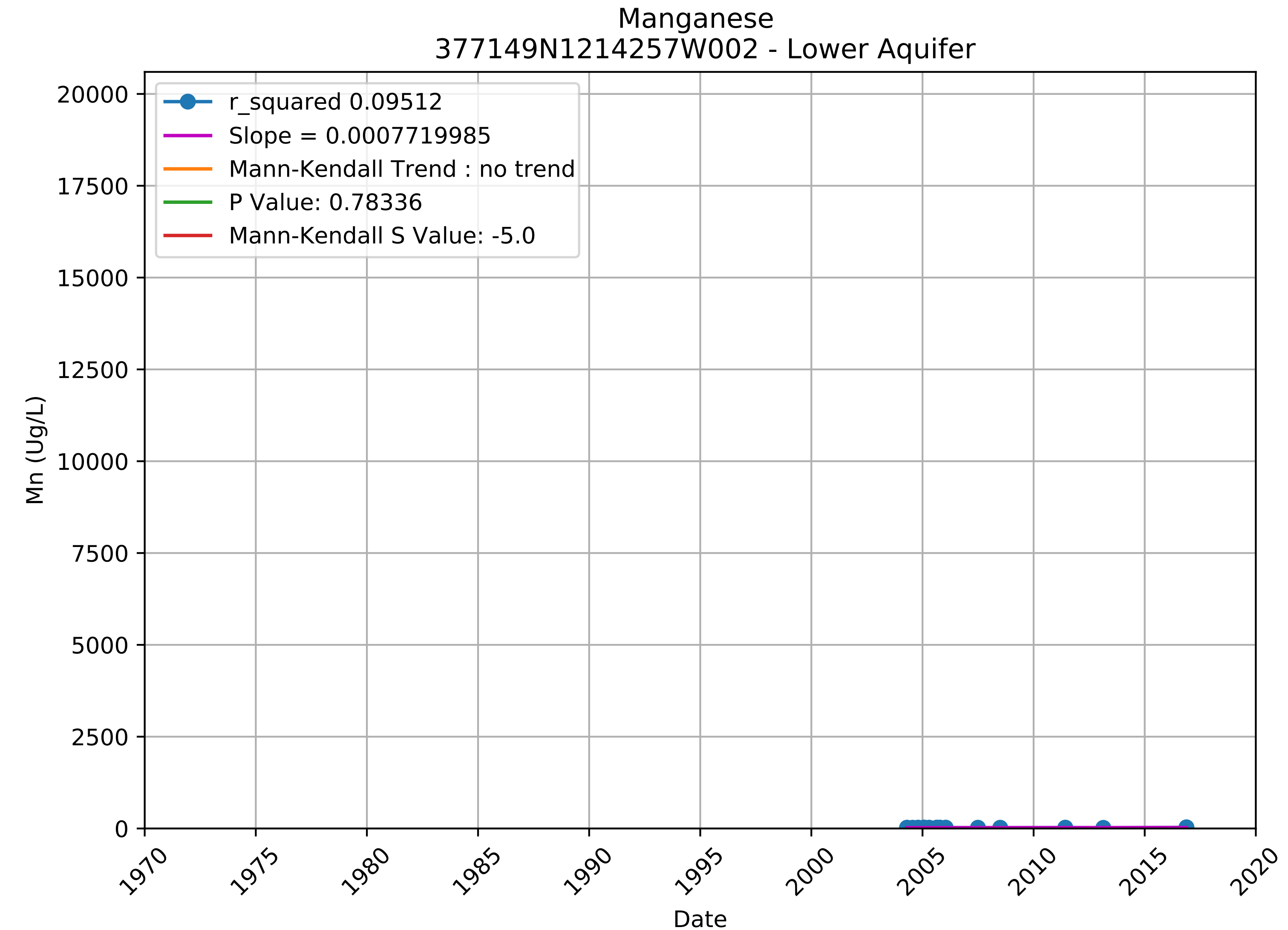
Manganese
377149N1214257W002 - Lower Aquifer
r_squared 0.09512
Slope = 0.0007719985
Mann-Kendall Trend : no trend
P Value: 0.78336
Mann-Kendall S Value: -5.0
Mn (Ug/L)
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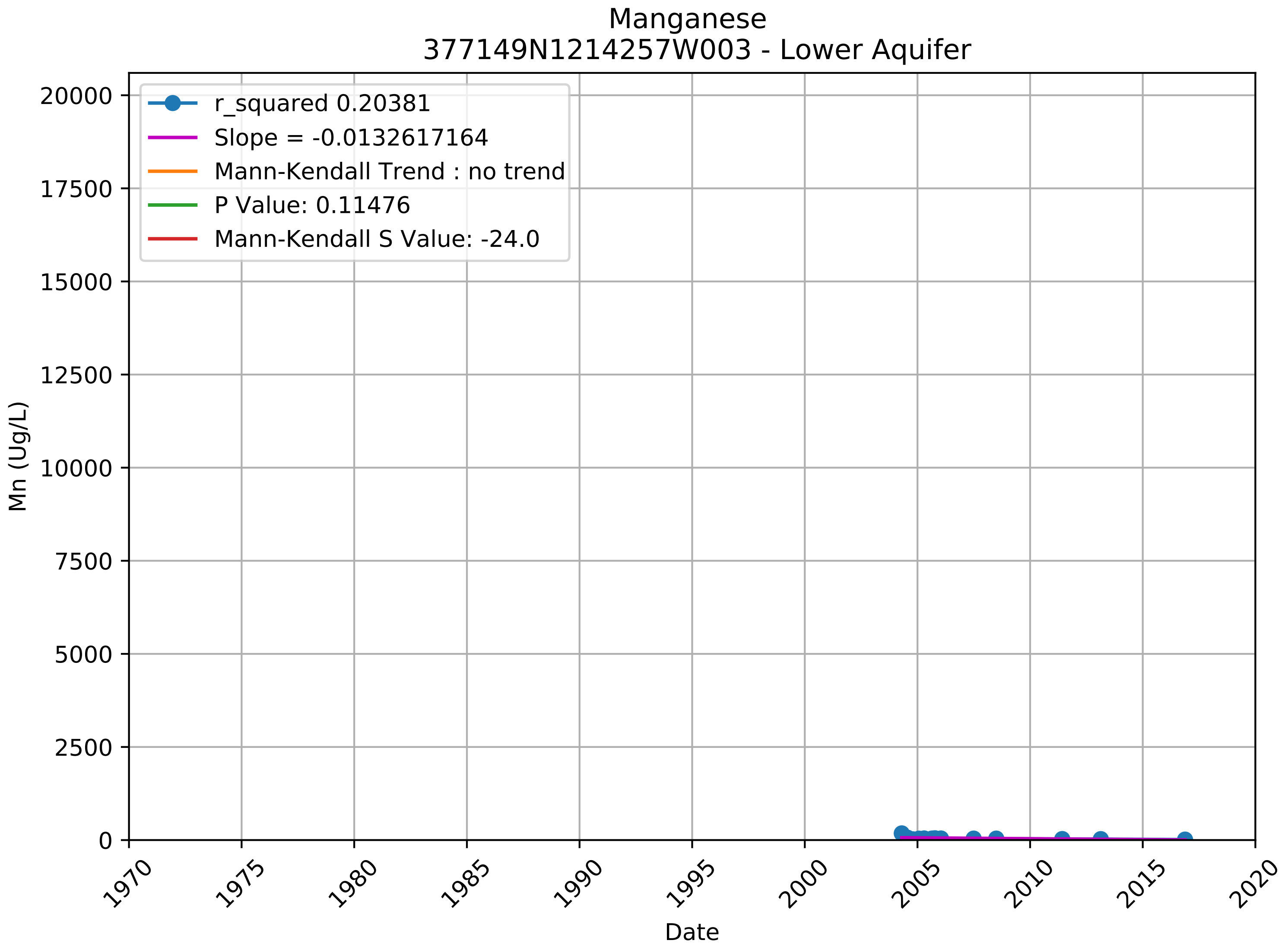

Manganese
377149N1214257W003 - Lower Aquifer
r_squared 0.20381
Slope = -0.0132617164
Mann-Kendall Trend : no trend
P Value: 0.11476
Mann-Kendall S Value: -24.0
Mn (Ug/L)
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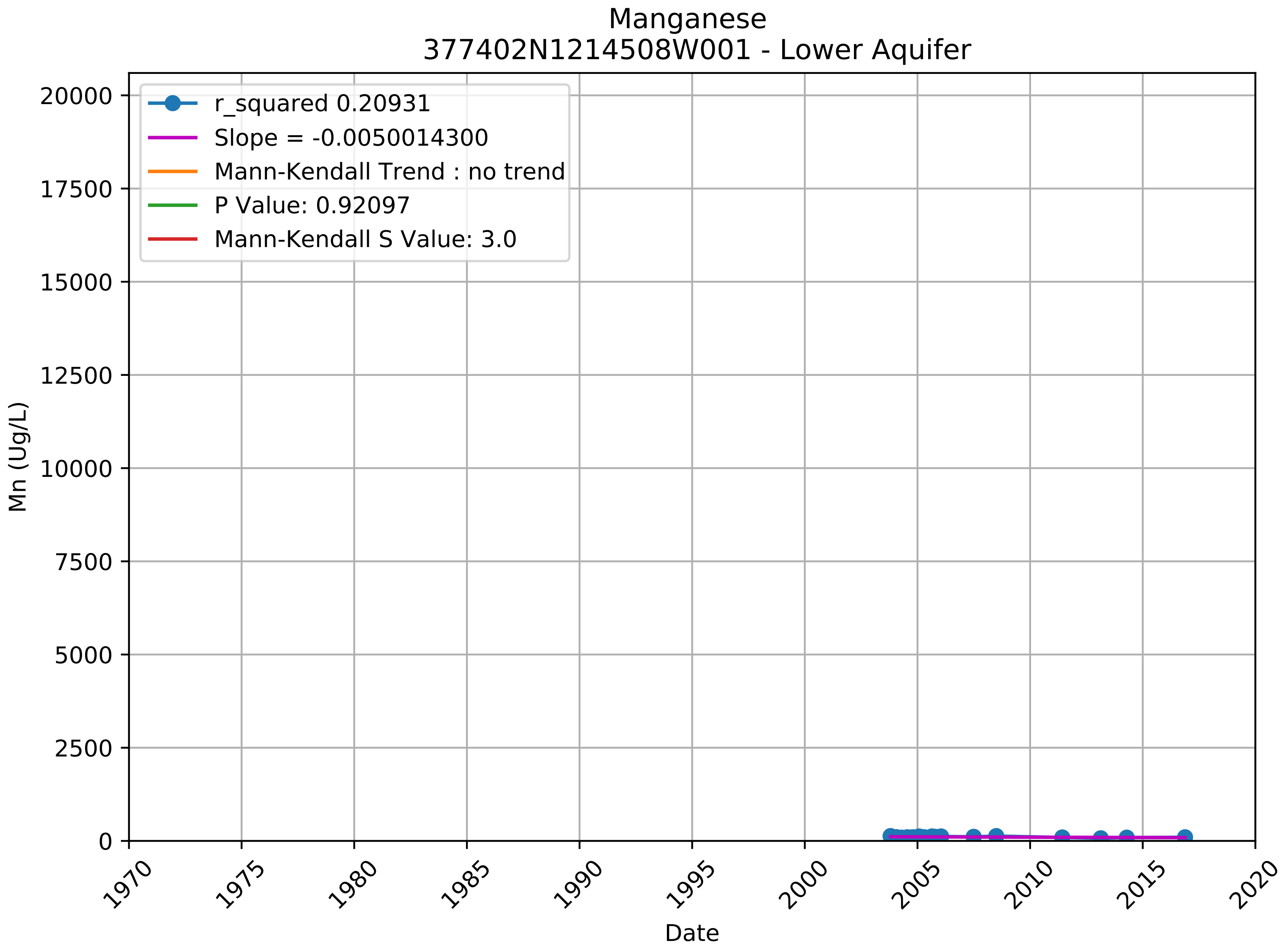
Manganese
377402N1214508W001 - Lower Aquifer
r_squared 0.20931
Slope = -0.0050014300
Mann-Kendall Trend : no trend
P Value: 0.92097
Mann-Kendall S Value: 3.0
Mn (Ug/L)
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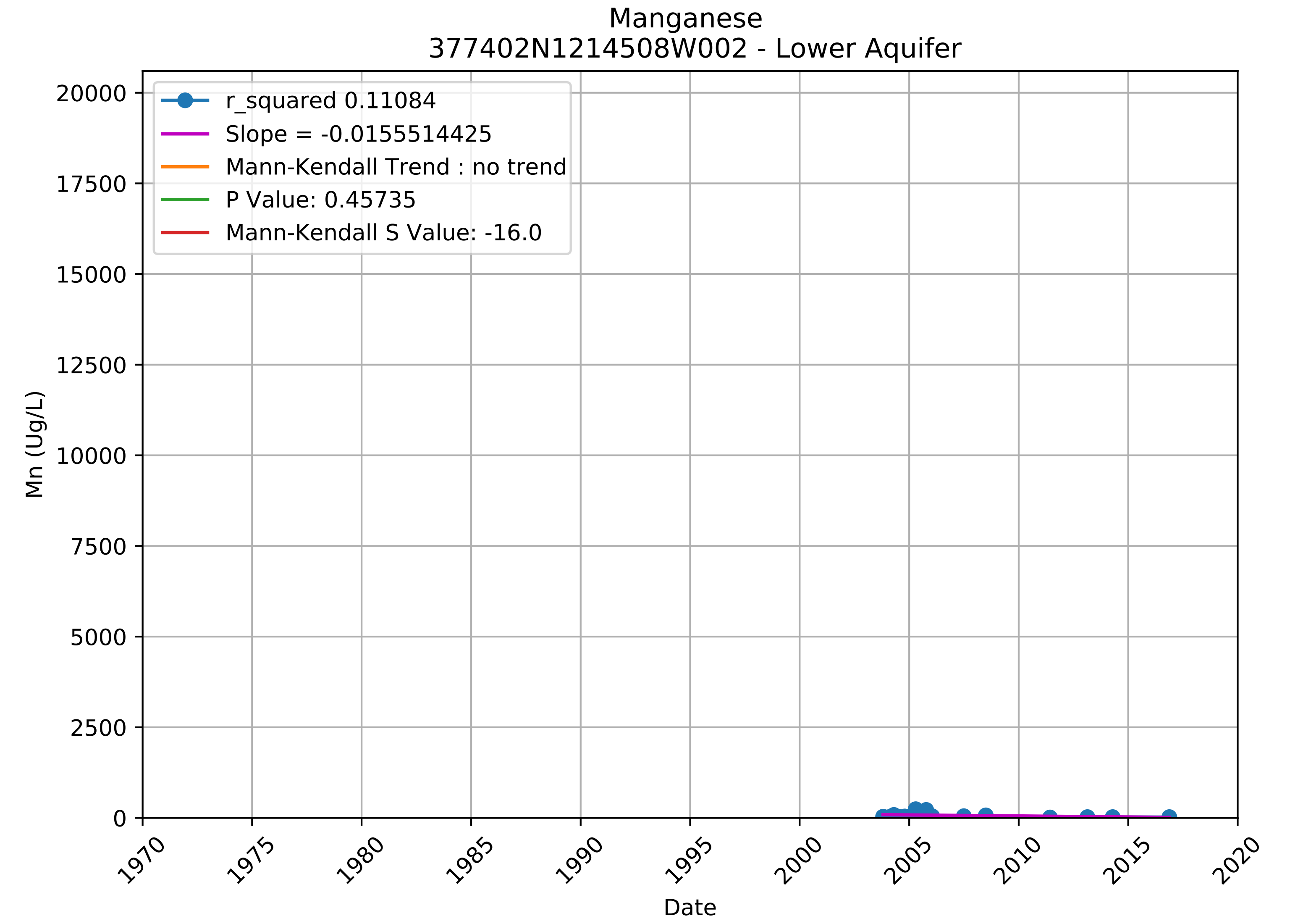

Manganese
377402N1214508W002 - Lower Aquifer
r_squared 0.11084
Slope = -0.0155514425
Mann-Kendall Trend : no trend
P Value: 0.45735
Mann-Kendall S Value: -16.0
Mn (Ug/L)
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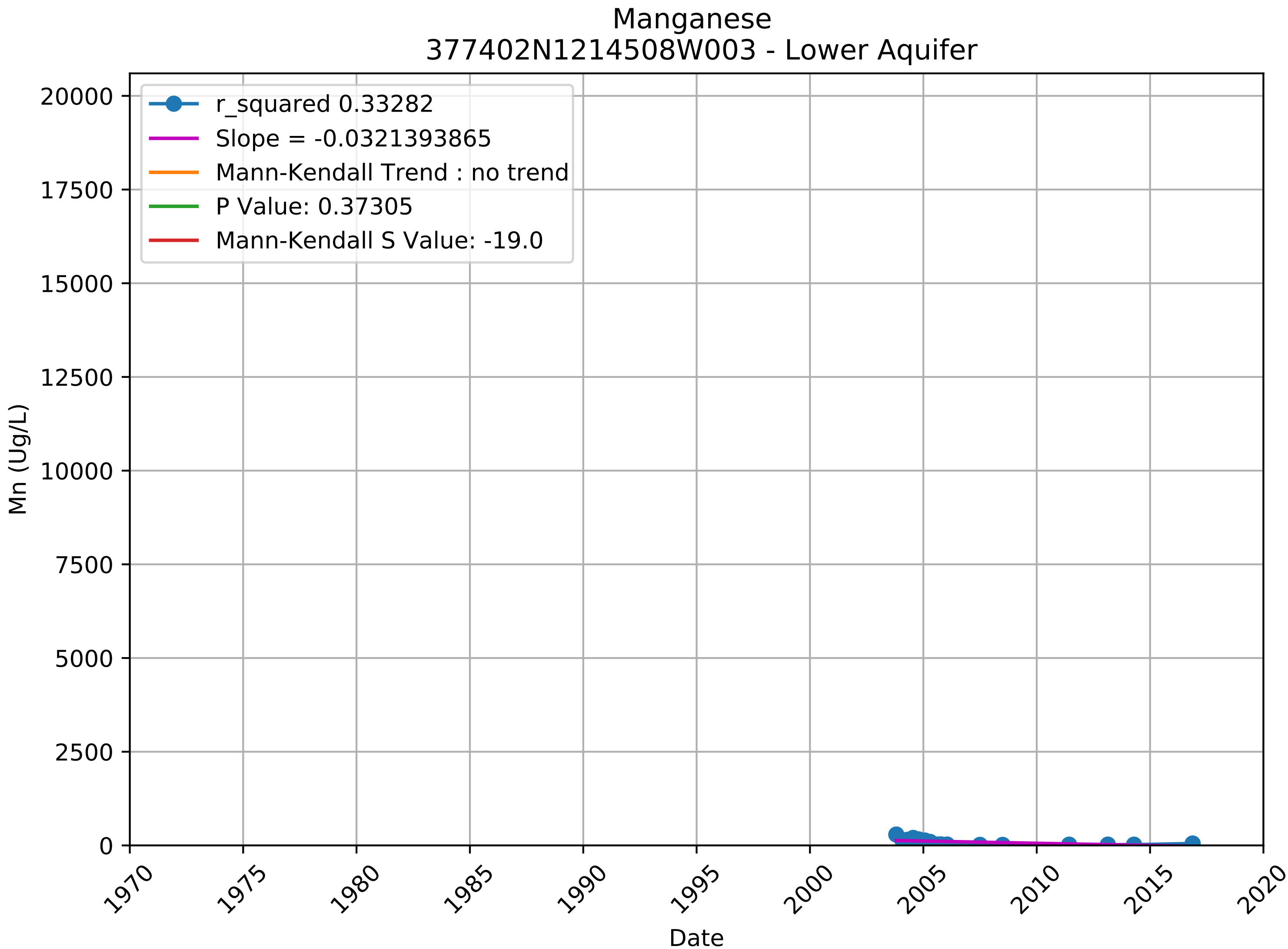

Manganese
377402N1214508W003 - Lower Aquifer
r_squared 0.33282
Slope = -0.0321393865
Mann-Kendall Trend : no trend
P Value: 0.37305
Mann-Kendall S Value: -19.0
Mn (Ug/L)
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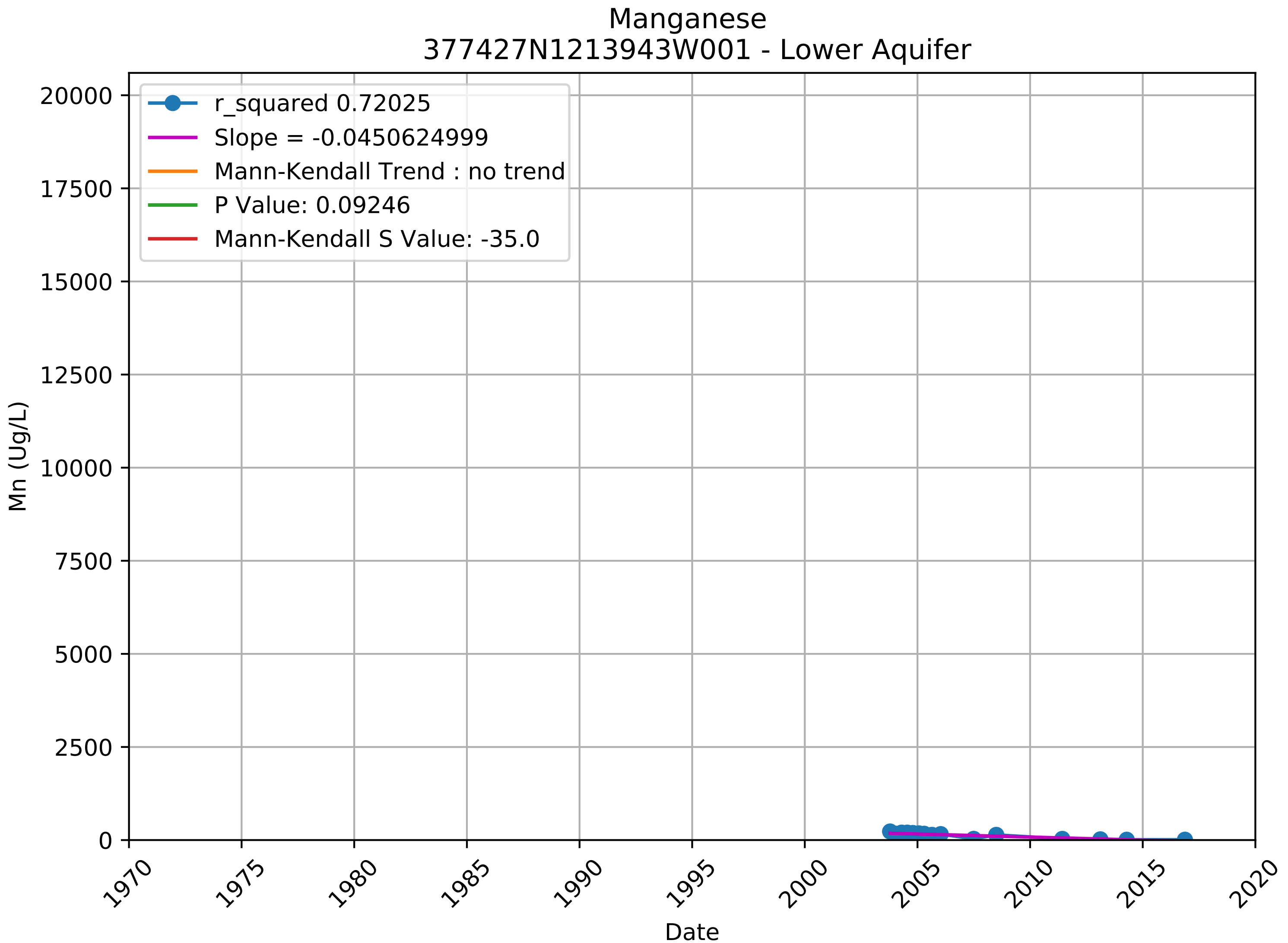

Manganese
377427N1213943W001 - Lower Aquifer
r_squared 0.72025
Slope = -0.0450624999
Mann-Kendall Trend : no trend
P Value: 0.09246
Mann-Kendall S Value: -35.0
Mn (Ug/L)
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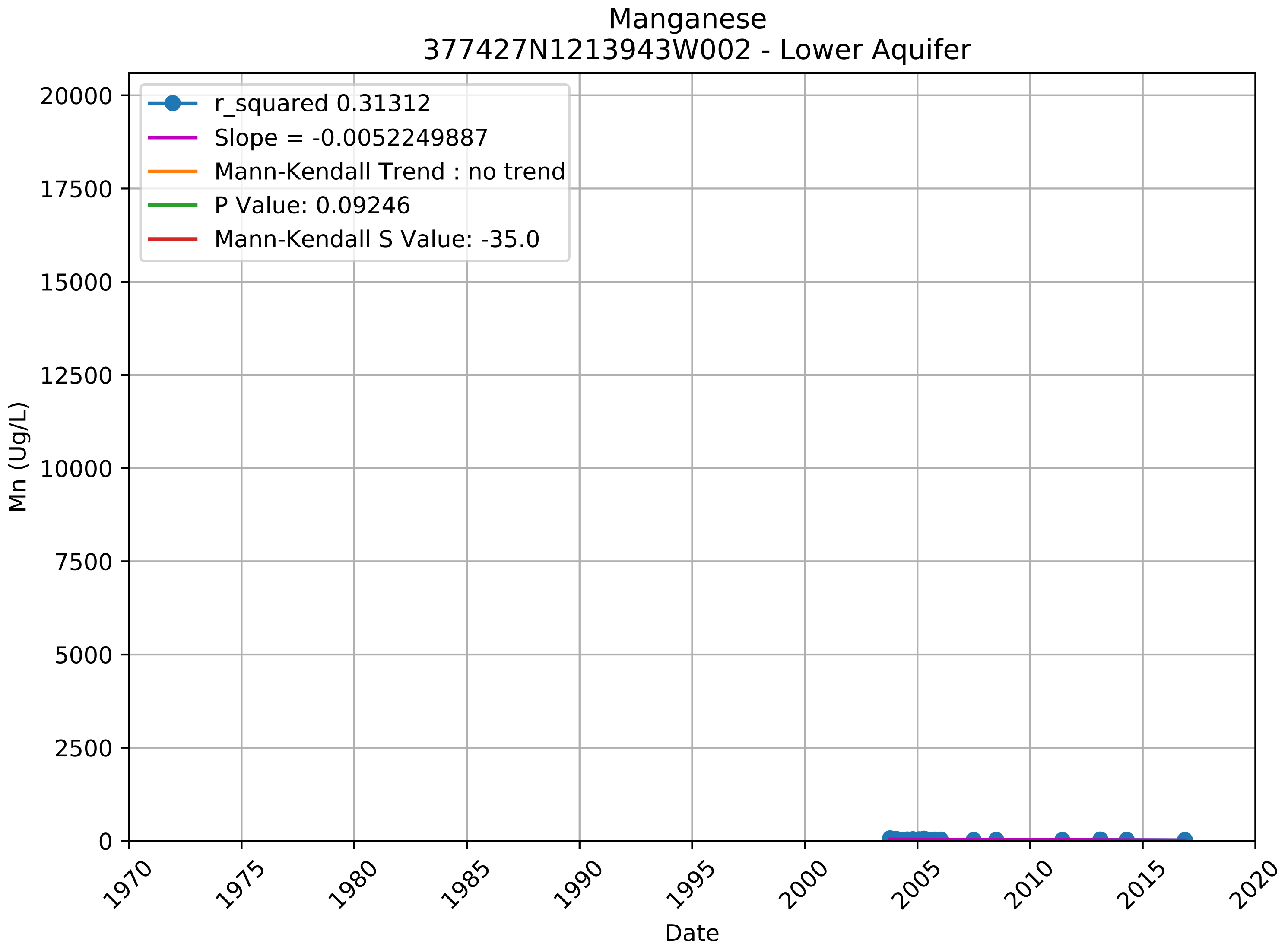

Manganese
377427N1213943W002 - Lower Aquifer
r_squared 0.31312
Slope = -0.0052249887
Mann-Kendall Trend : no trend
P Value: 0.09246
Mann-Kendall S Value: -35.0
Mn (Ug/L)
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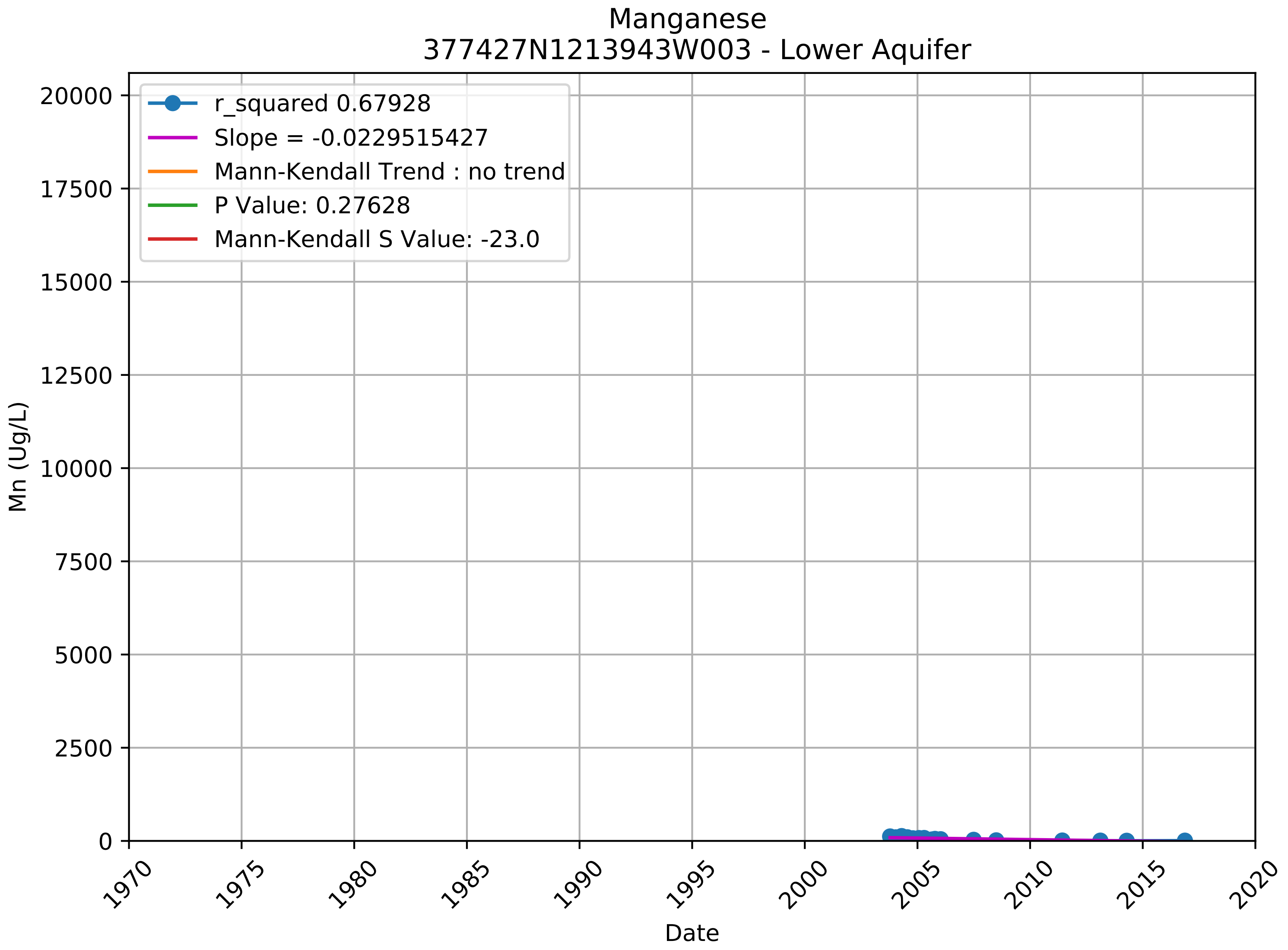

Manganese
377427N1213943W003 - Lower Aquifer
r_squared 0.67928
Slope = -0.0229515427
Mann-Kendall Trend : no trend
P Value: 0.27628
Mann-Kendall S Value: -23.0
Mn (Ug/L)
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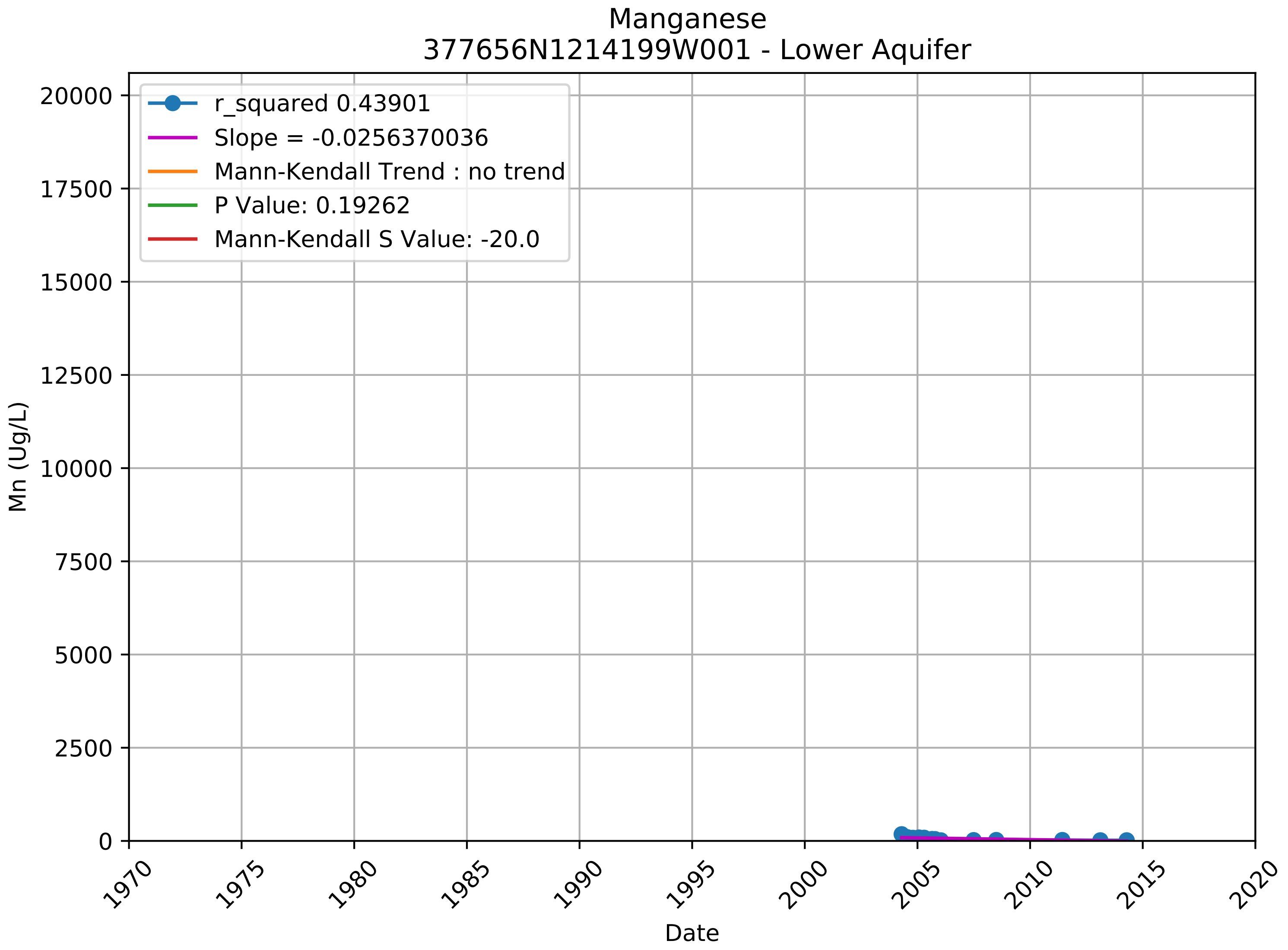

Manganese
377656N1214199W001 - Lower Aquifer
r_squared 0.43901
Slope = -0.0256370036
Mann-Kendall Trend : no trend
P Value: 0.19262
Mann-Kendall S Value: -20.0
Mn (Ug/L)
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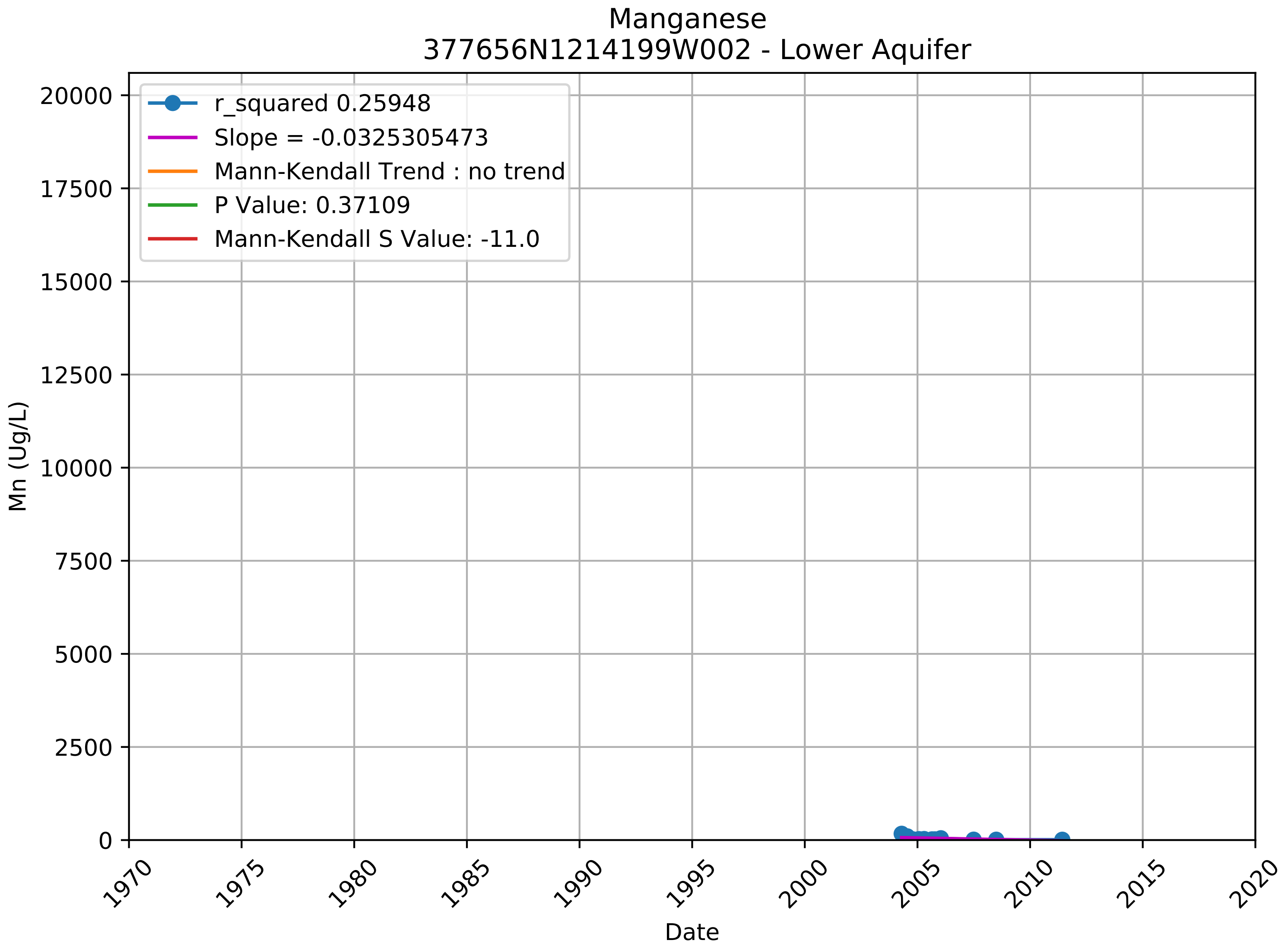
Manganese
377656N1214199W002 - Lower Aquifer
r_squared 0.25948
Slope = -0.0325305473
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: -11.0
Mn (Ug/L)
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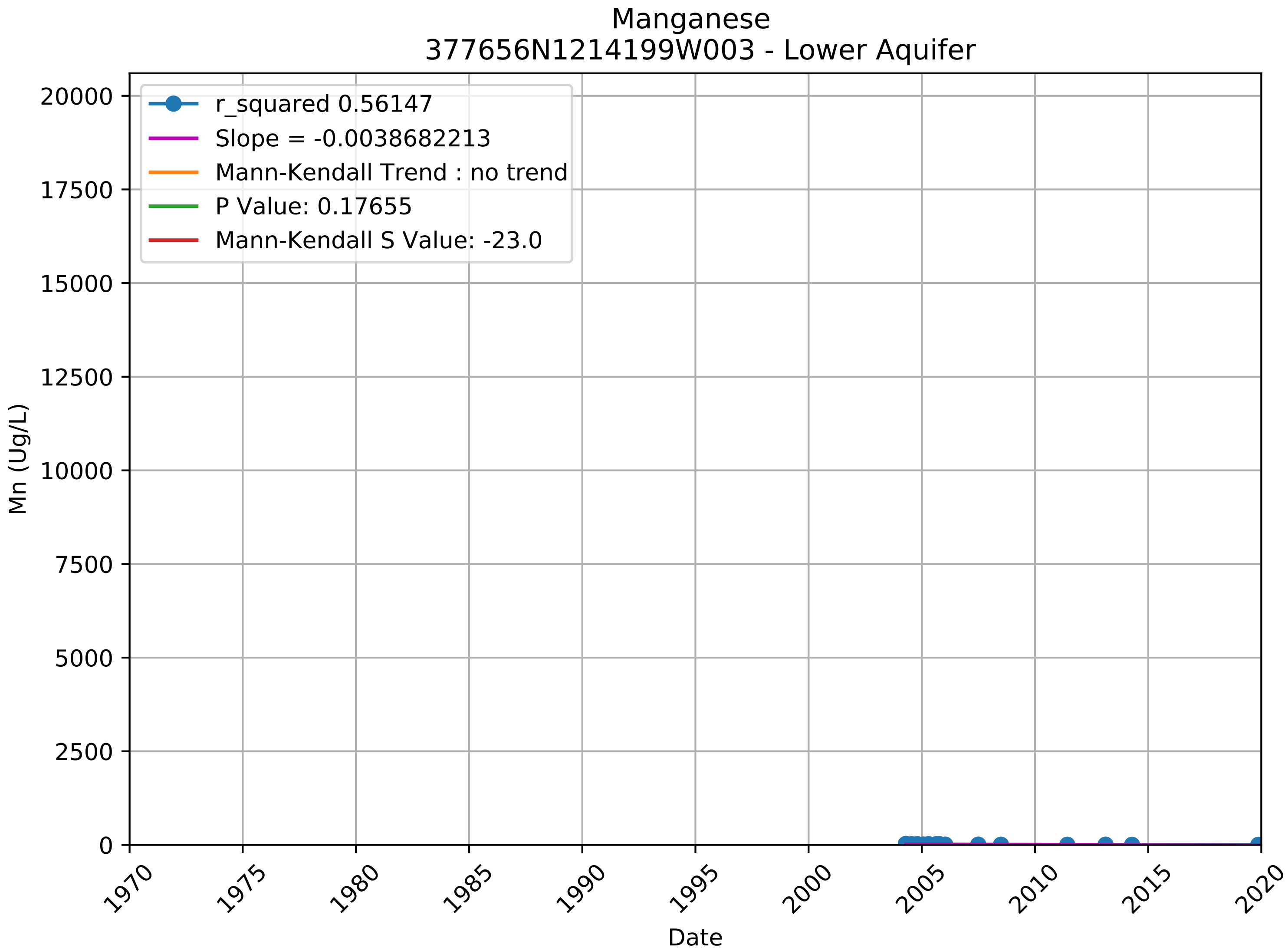

Manganese
377656N1214199W003 - Lower Aquifer
r_squared 0.56147
Slope = -0.0038682213
Mann-Kendall Trend : no trend
P Value: 0.17655
Mann-Kendall S Value: -23.0
Mn (Ug/L)
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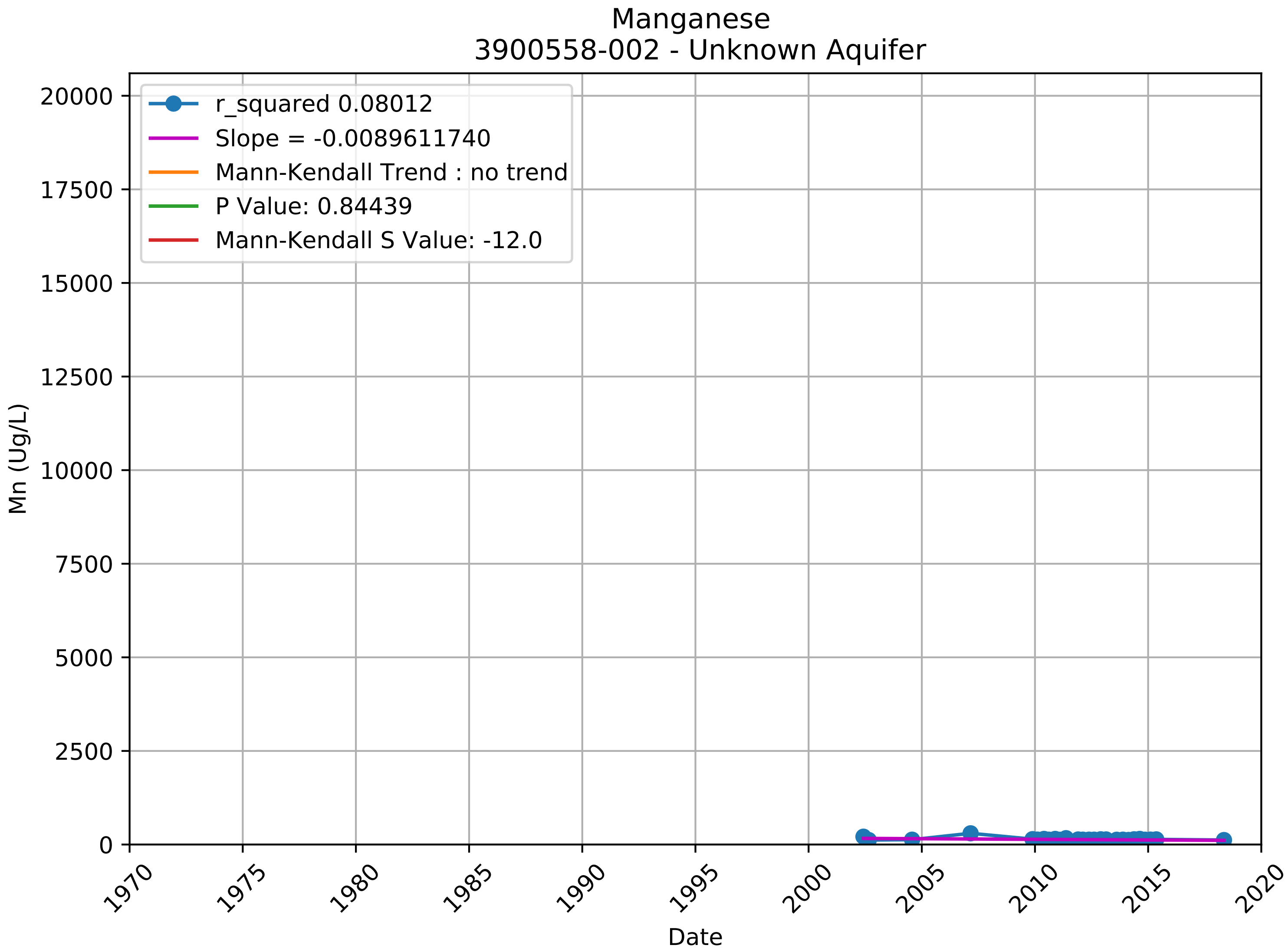
Manganese
3900558-002 - Unknown Aquifer
r_squared 0.08012
Slope = -0.0089611740
Mann-Kendall Trend : no trend
P Value: 0.84439
Mann-Kendall S Value: -12.0
Mn (Ug/L)
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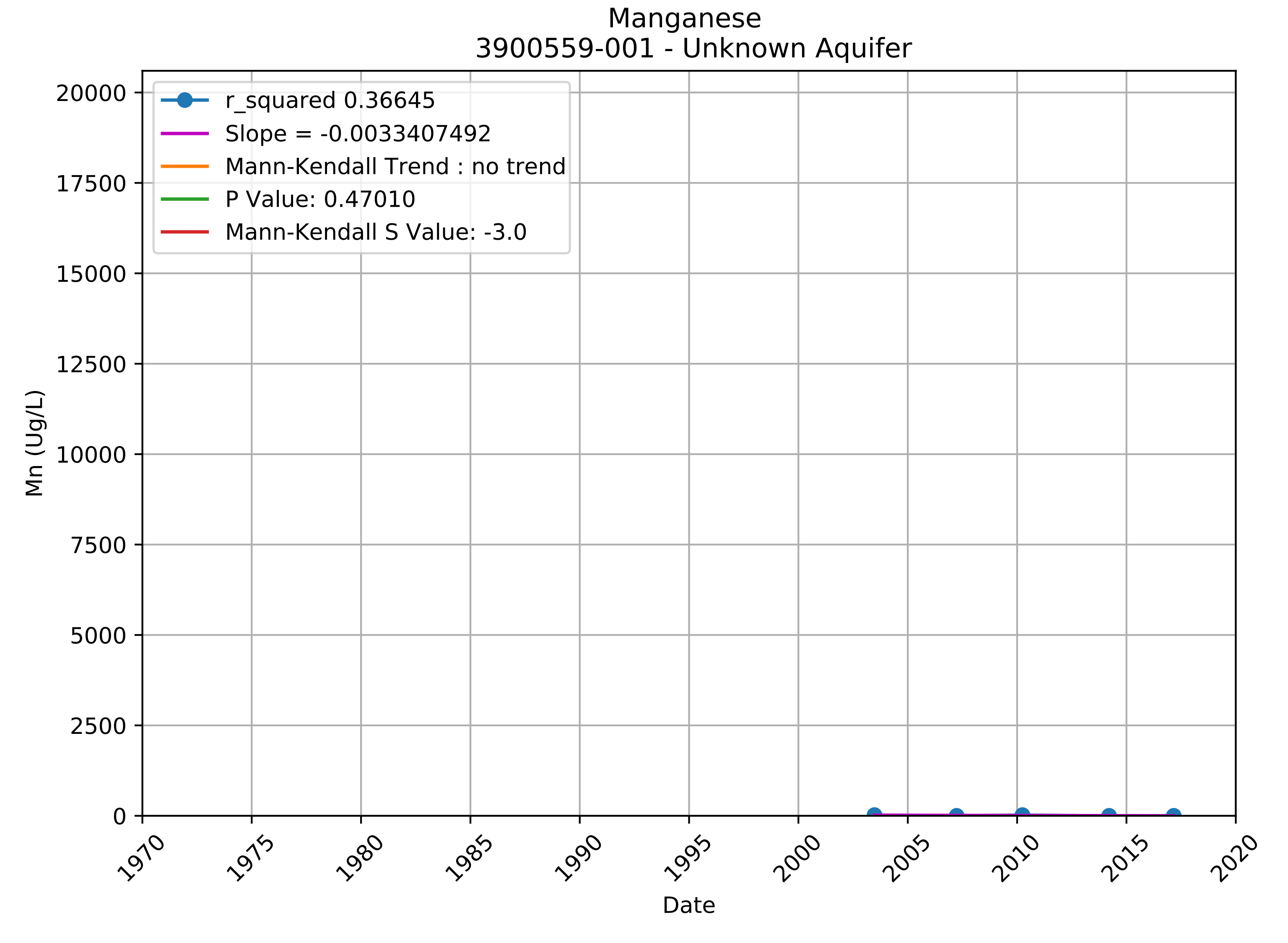

Manganese
3900559-001 - Unknown Aquifer
r_squared 0.36645
Slope = -0.0033407492
Mann-Kendall Trend : no trend
P Value: 0.47010
Mann-Kendall S Value: -3.0
Mn (Ug/L)
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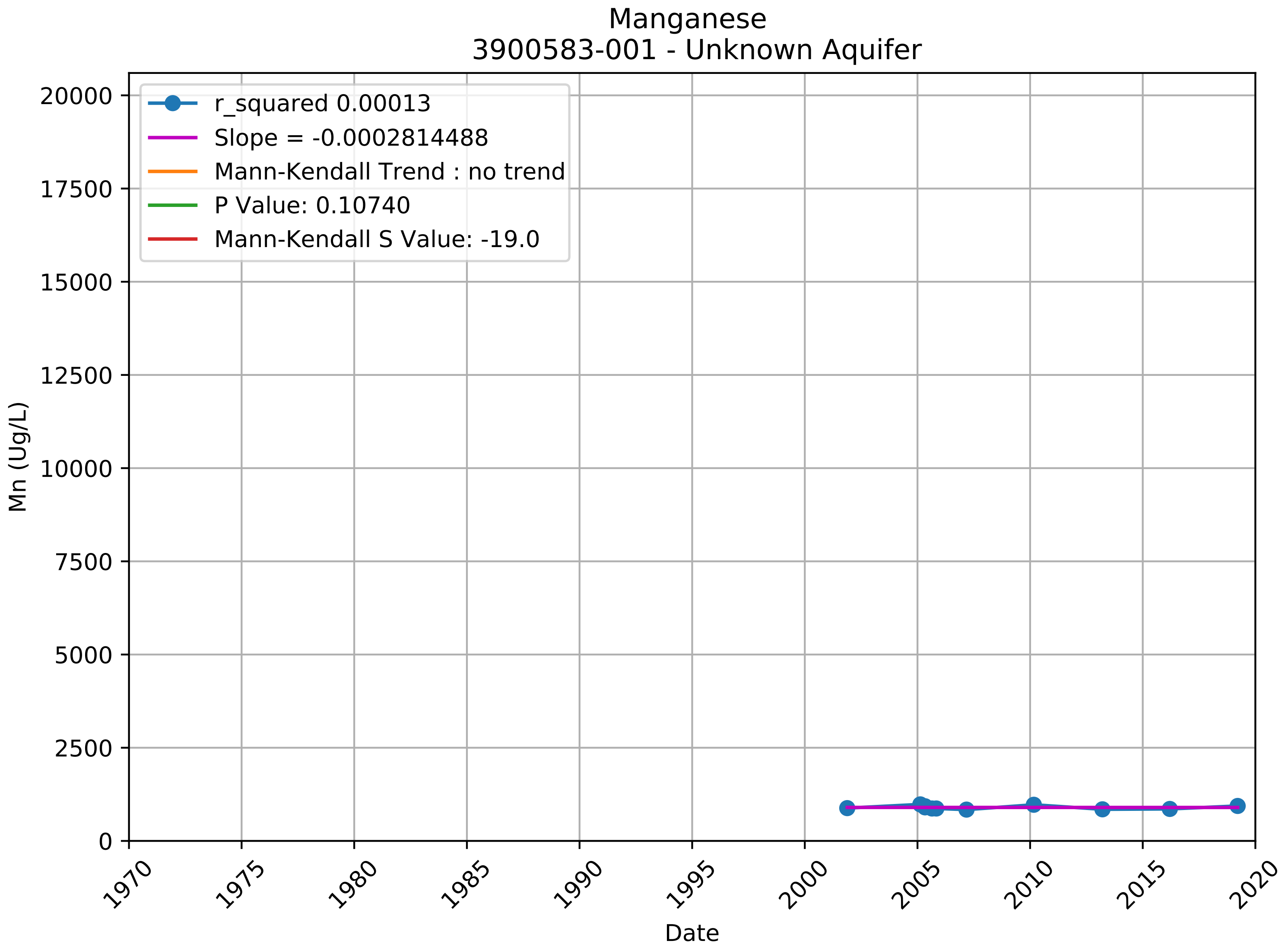

Manganese
3900583-001 - Unknown Aquifer
r_squared 0.00013
Slope = -0.0002814488
Mann-Kendall Trend : no trend
P Value: 0.10740
Mann-Kendall S Value: -19.0
Mn (Ug/L)
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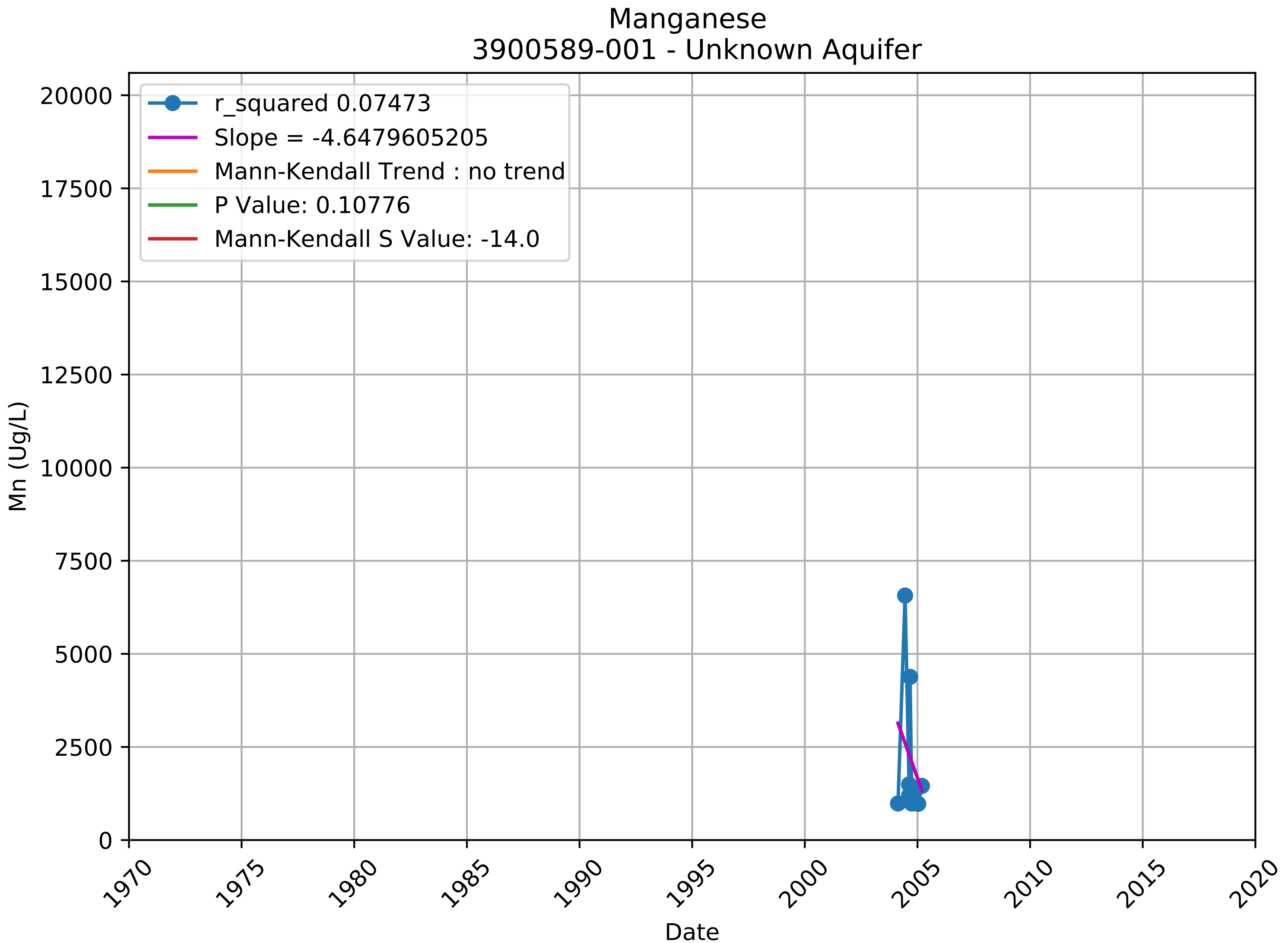

Manganese
3900589-001 - Unknown Aquifer
r_squared 0.07473
Slope = -4.6479605205
Mann-Kendall Trend : no trend
P Value: 0.10776
Mann-Kendall S Value: -14.0
Mn (Ug/L)
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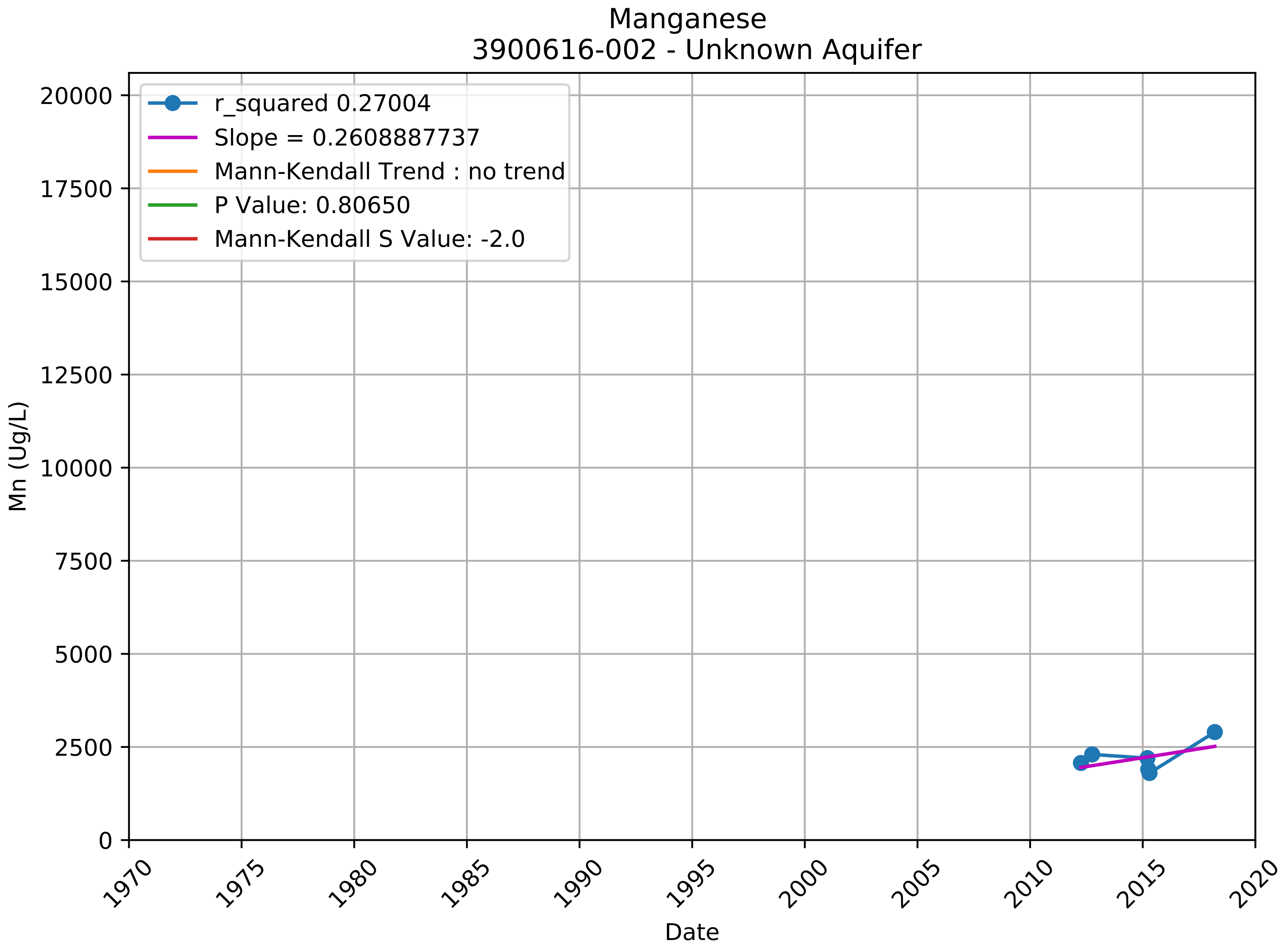

Manganese
3900616-002 - Unknown Aquifer
r_squared 0.27004
Slope = 0.2608887737
Mann-Kendall Trend : no trend
P Value: 0.80650
Mann-Kendall S Value: -2.0
Mn (Ug/L)
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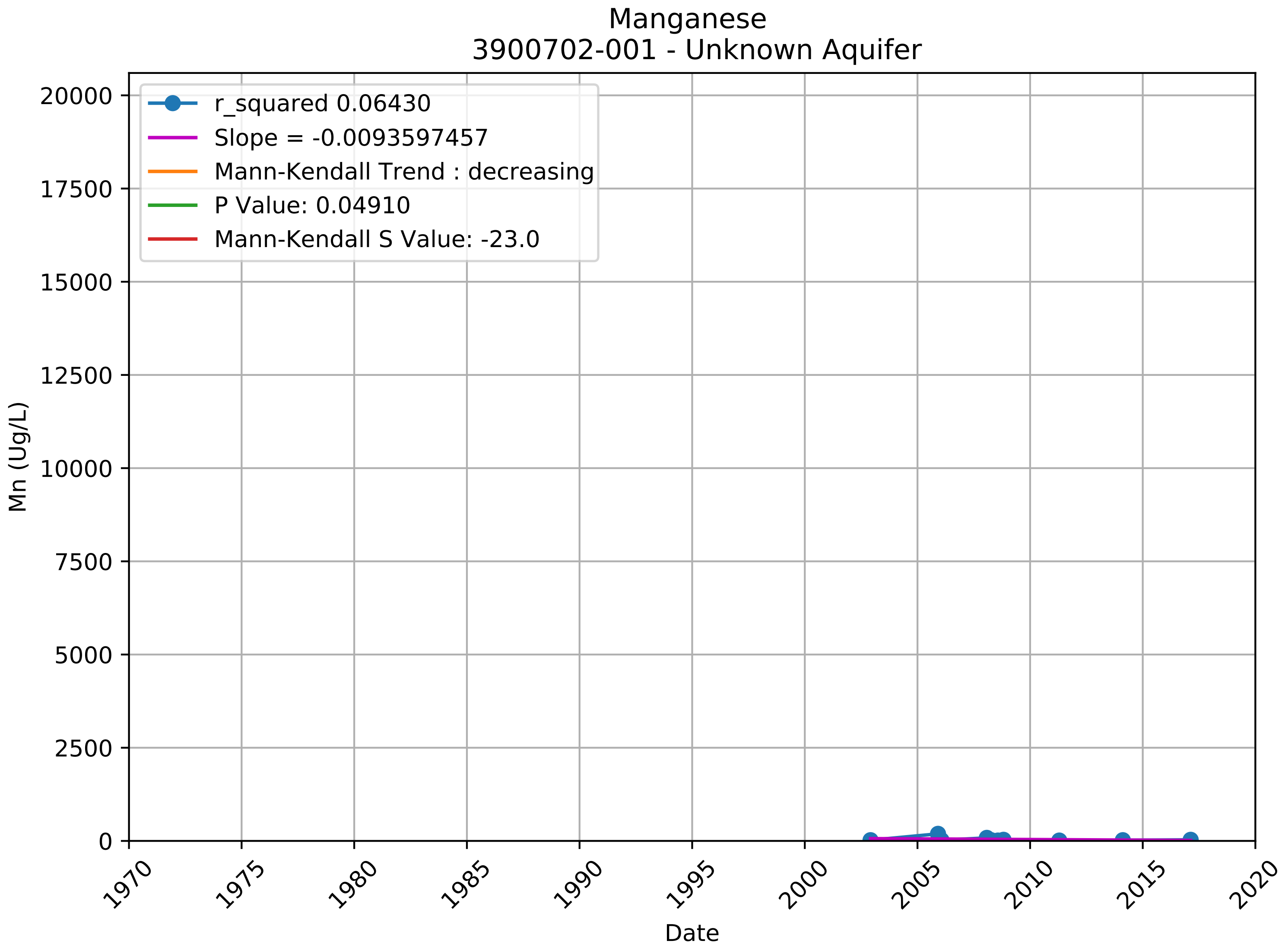
Manganese
3900702-001 - Unknown Aquifer
r_squared 0.06430
Slope = -0.0093597457
Mann-Kendall Trend : decreasing
P Value: 0.04910
Mann-Kendall S Value: -23.0
Mn (Ug/L)
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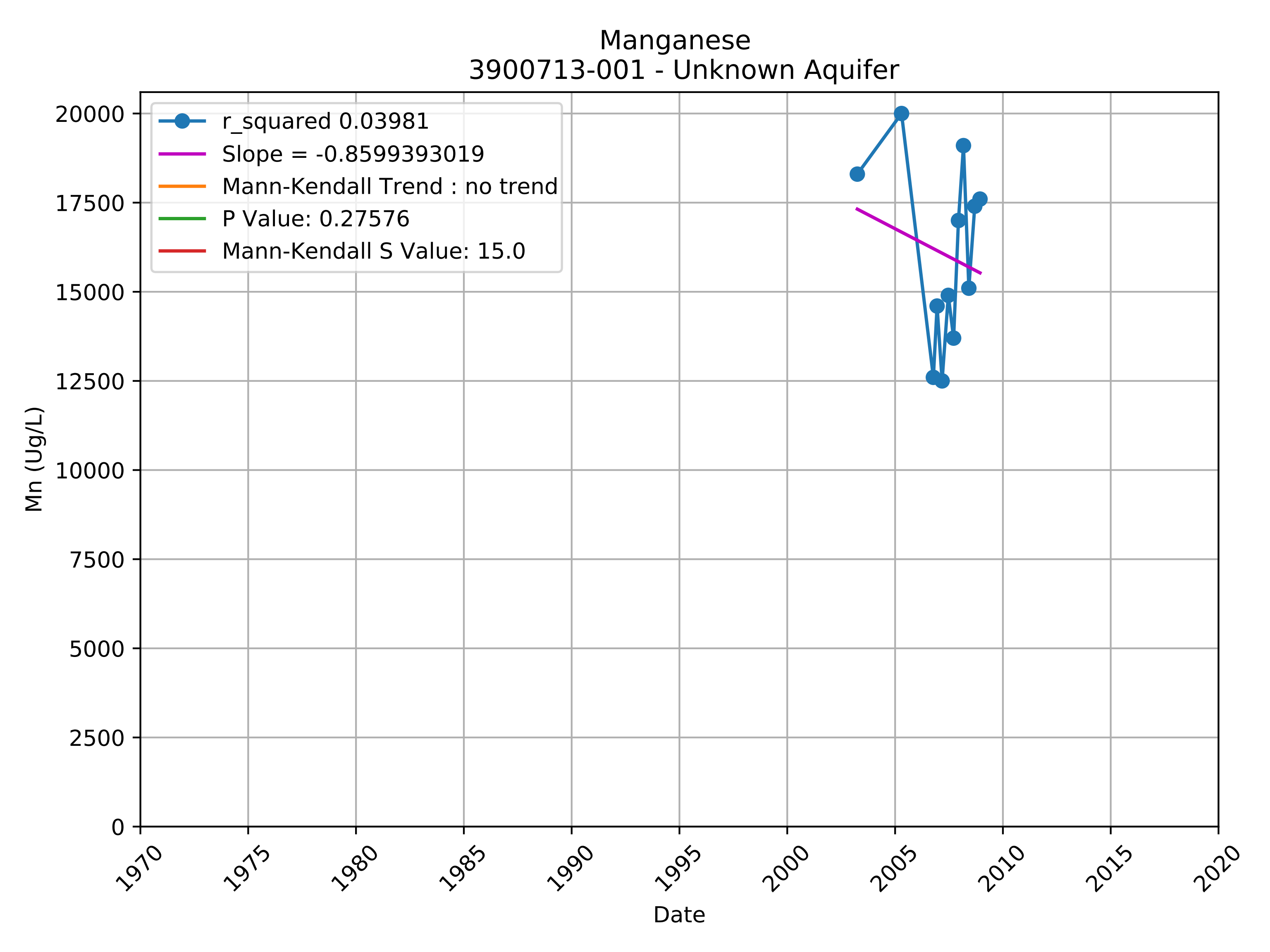

Manganese
3900713-001 - Unknown Aquifer
r_squared 0.03981
Slope = -0.8599393019
Mann-Kendall Trend : no trend
P Value: 0.27576
Mann-Kendall S Value: 15.0
Mn (Ug/L)
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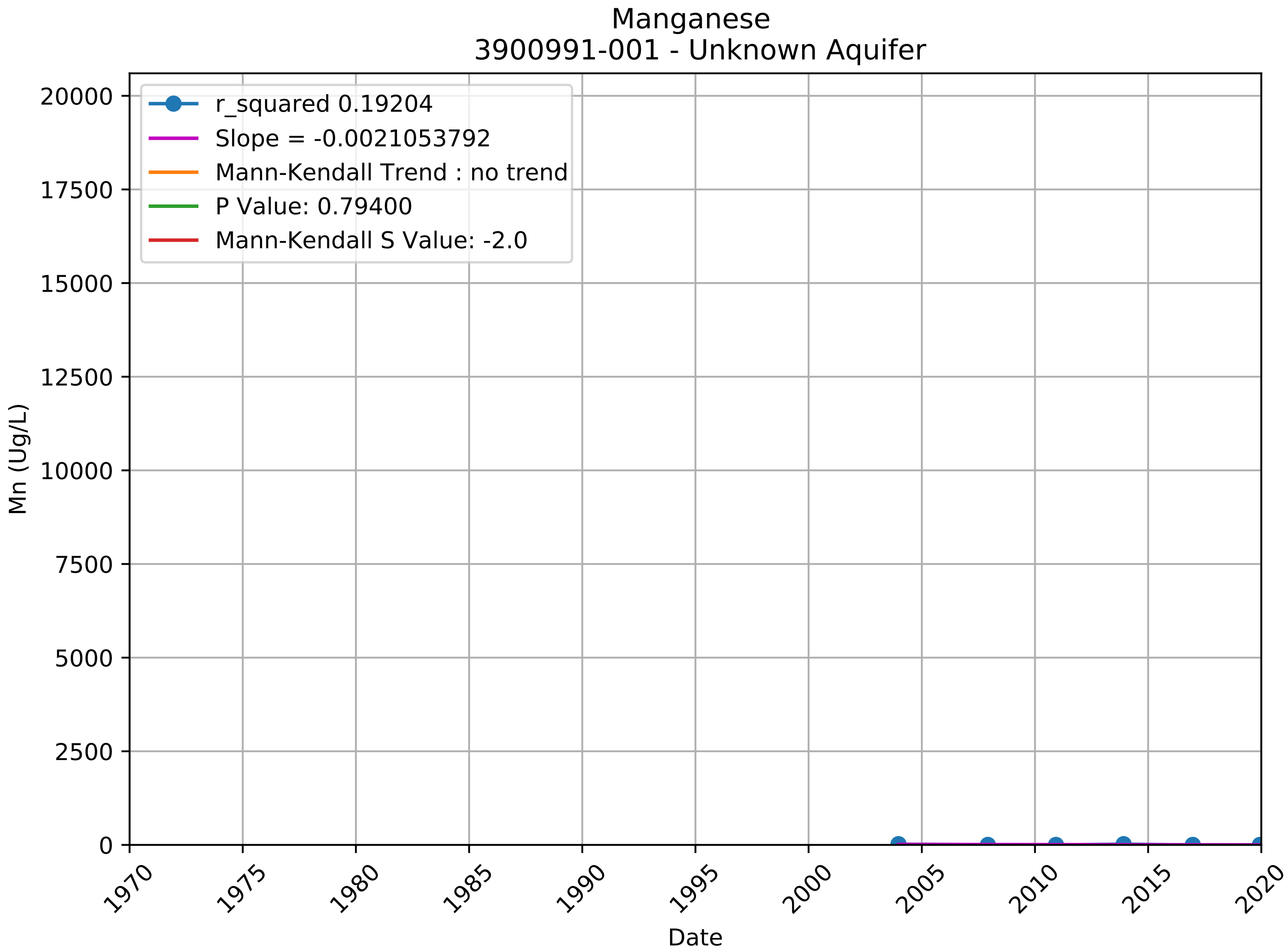
Manganese
3900991-001 - Unknown Aquifer
r_squared 0.19204
Slope = -0.0021053792
Mann-Kendall Trend : no trend
P Value: 0.79400
Mann-Kendall S Value: -2.0
Mn (Ug/L)
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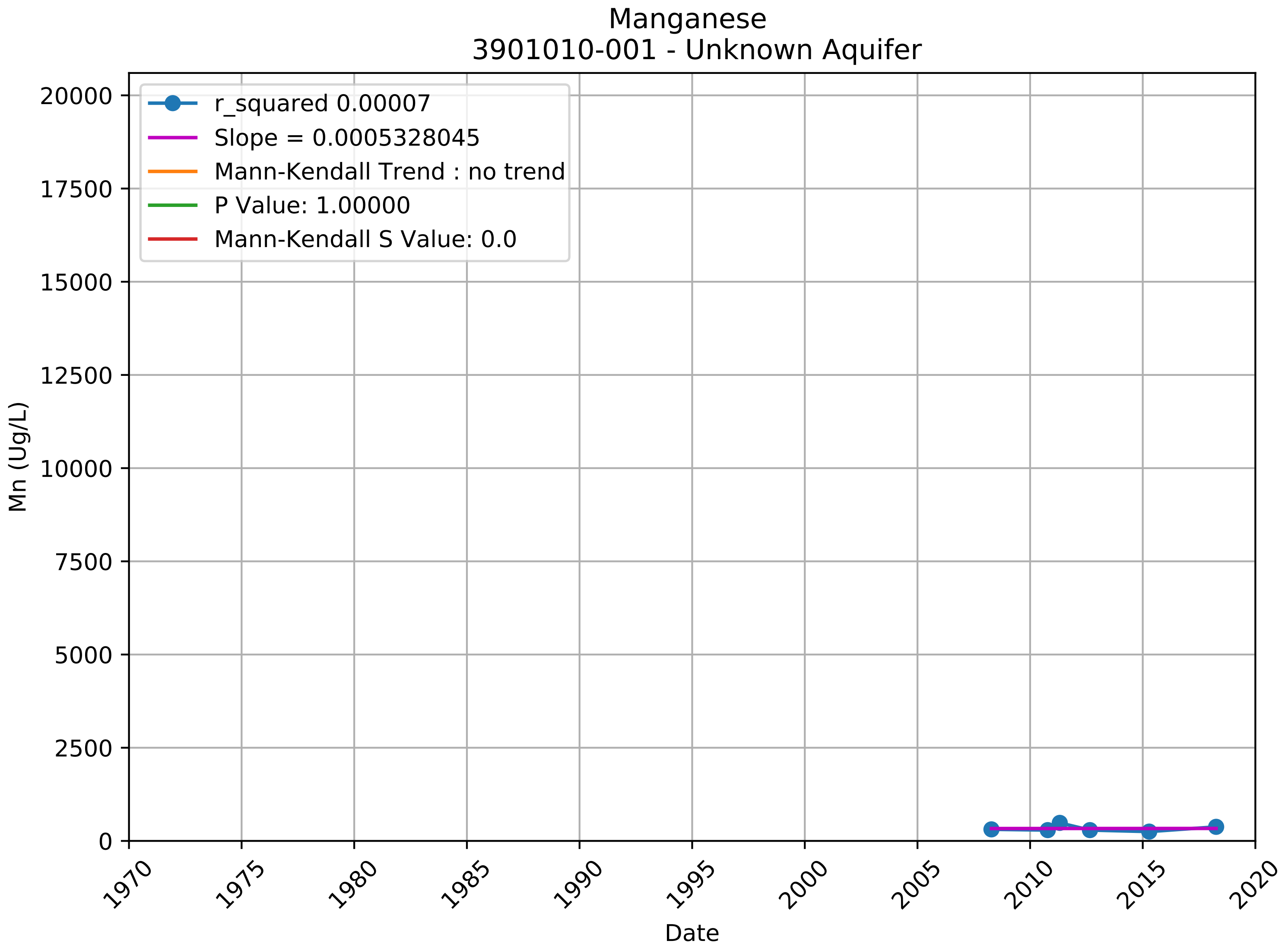
Manganese
3901010-001 - Unknown Aquifer
r_squared 0.00007
Slope = 0.0005328045
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
Mn (Ug/L)
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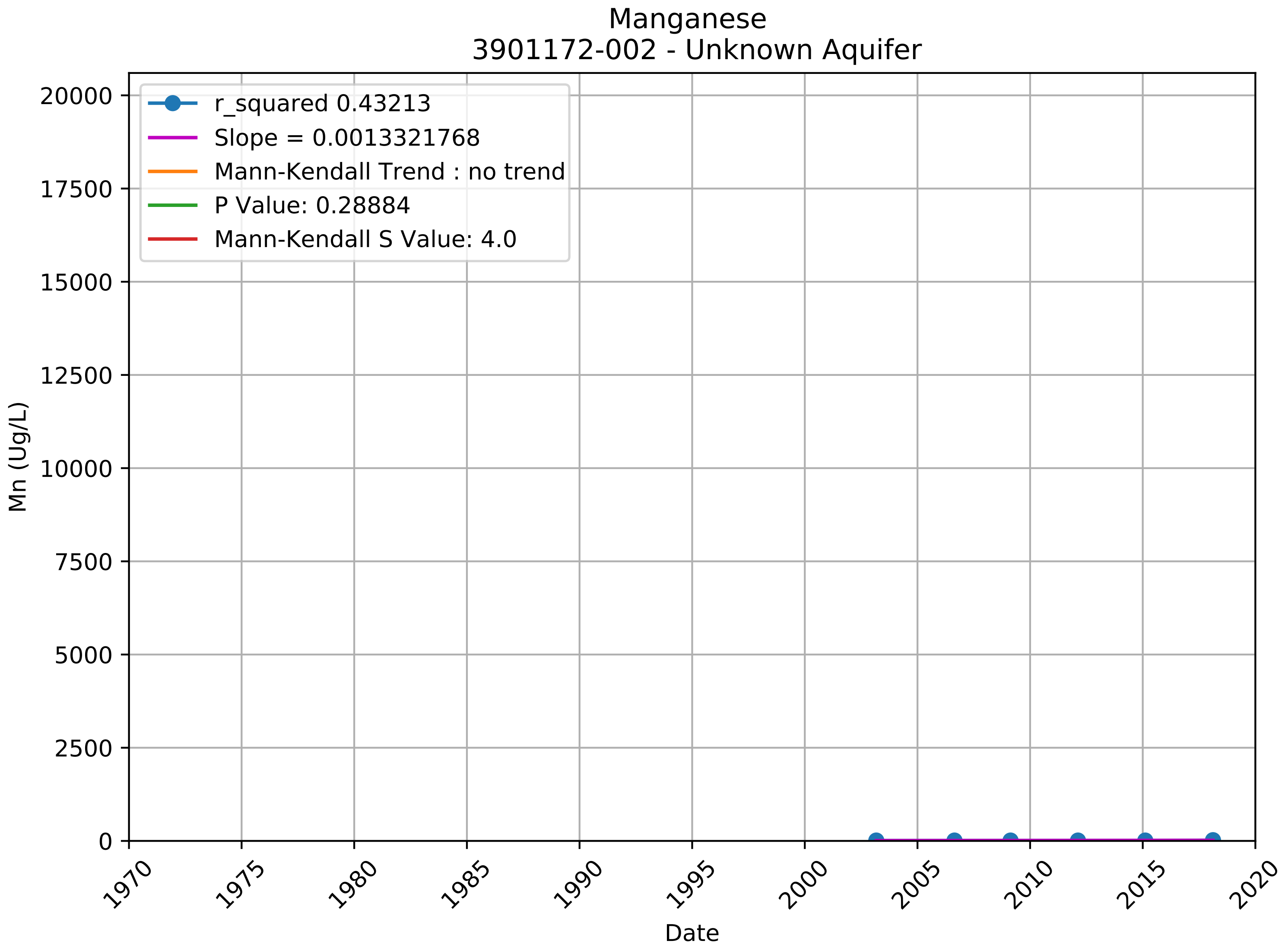

Manganese
3901172-002 - Unknown Aquifer
r_squared 0.43213
Slope = 0.0013321768
Mann-Kendall Trend : no trend
P Value: 0.28884
Mann-Kendall S Value: 4.0
Mn (Ug/L)
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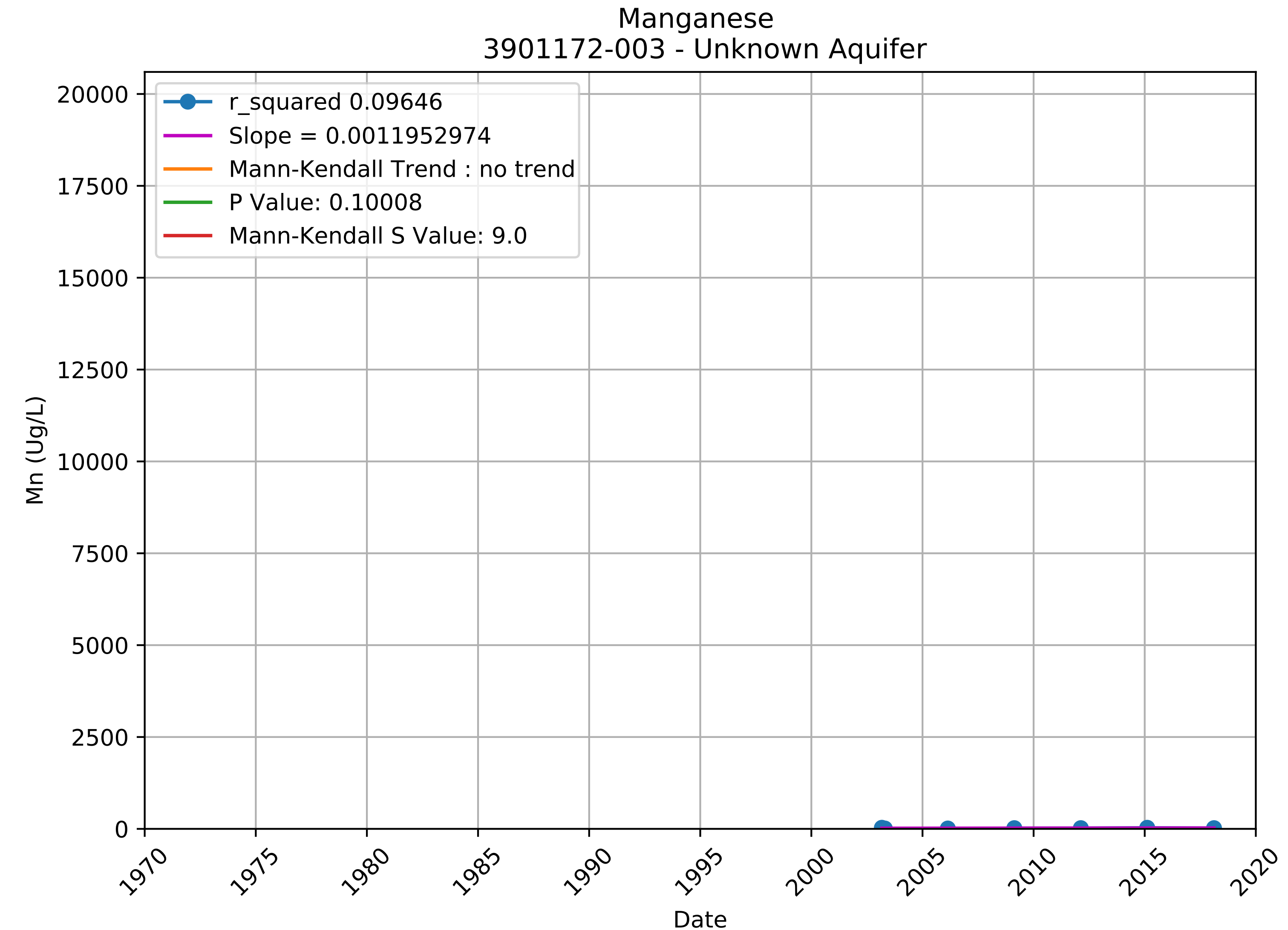

Manganese
3901172-003 - Unknown Aquifer
r_squared 0.09646
Slope = 0.0011952974
Mann-Kendall Trend : no trend
P Value: 0.10008
Mann-Kendall S Value: 9.0
Mn (Ug/L)
20000
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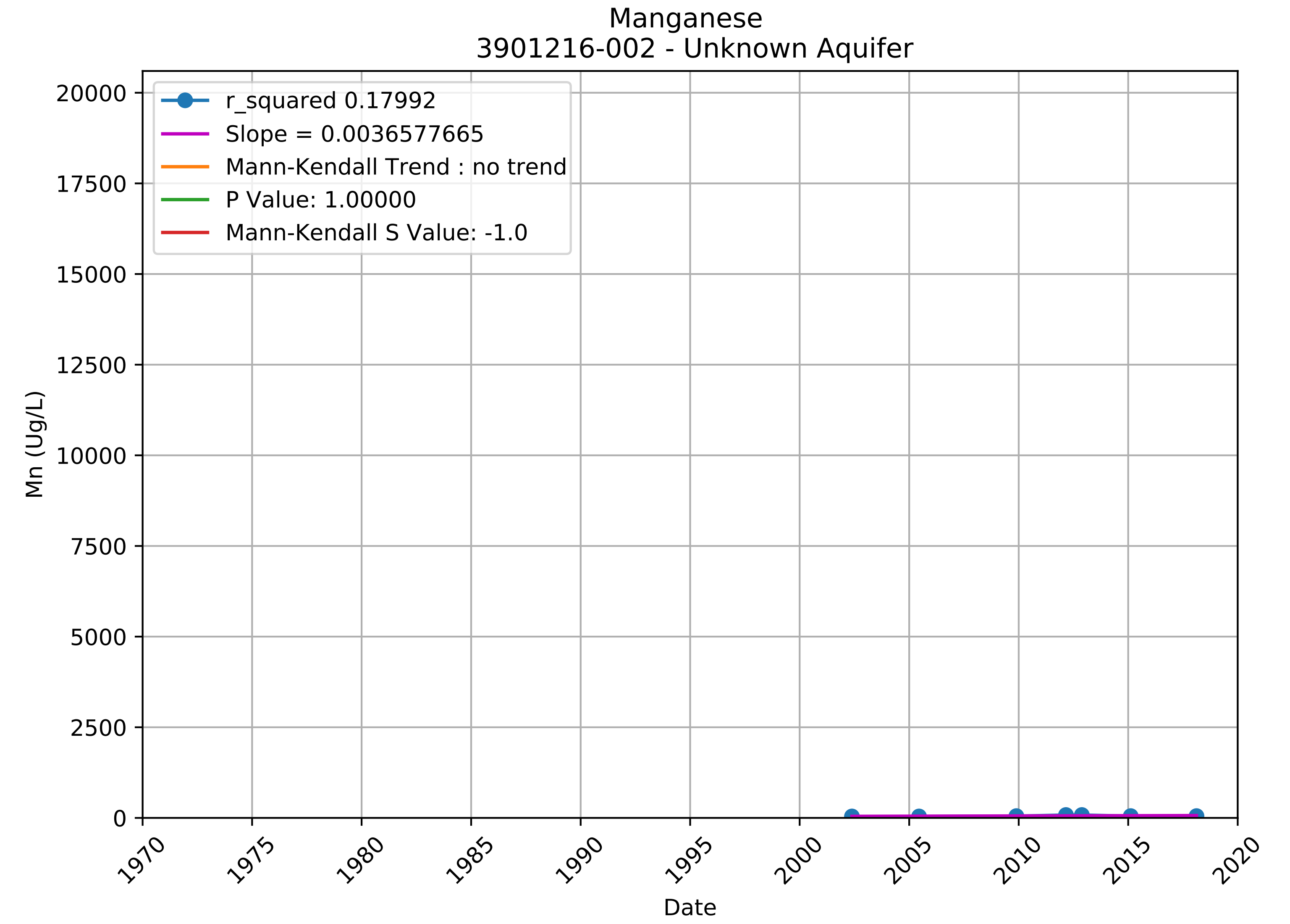

Manganese
3901216-002 - Unknown Aquifer
r_squared 0.17992
Slope = 0.0036577665
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
Mn (Ug/L)
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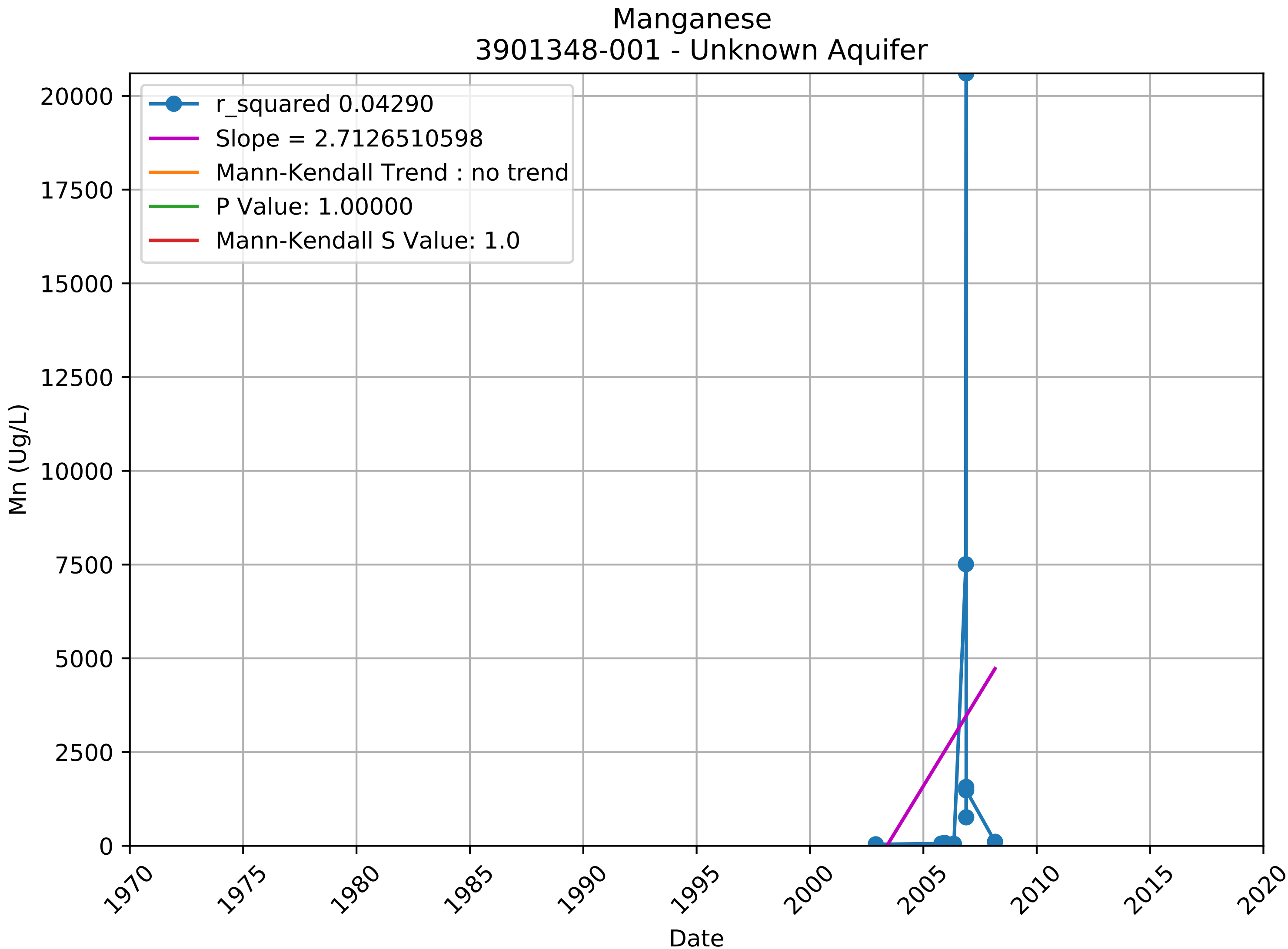

Manganese
3901348-001 - Unknown Aquifer
r_squared 0.04290
Slope = 2.7126510598
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
Mn (Ug/L)
Date
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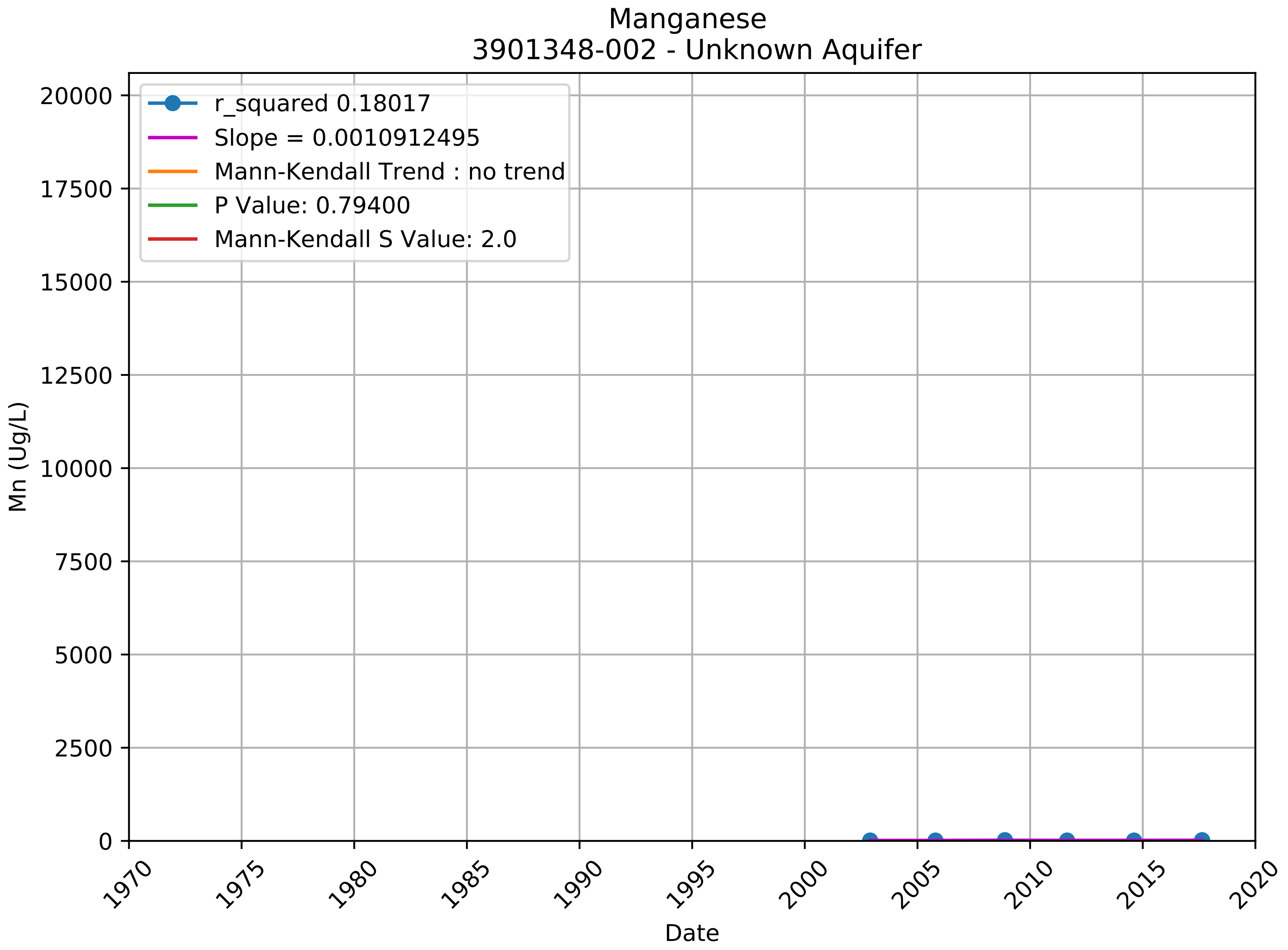

Manganese
3901348-002 - Unknown Aquifer
r_squared 0.18017
Slope = 0.0010912495
Mann-Kendall Trend : no trend
P Value: 0.79400
Mann-Kendall S Value: 2.0
Mn (Ug/L)
Date
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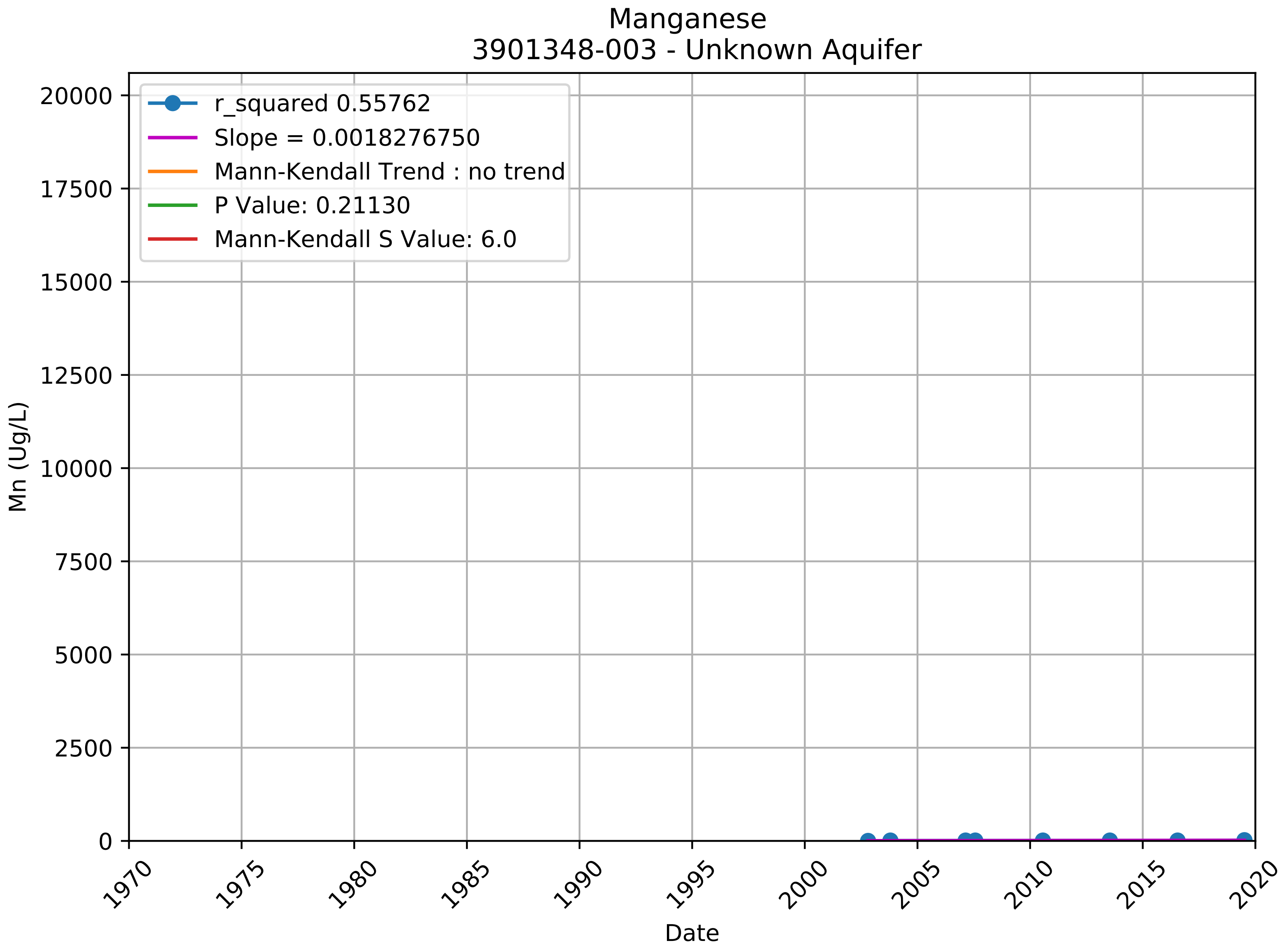

Manganese
3901348-003 - Unknown Aquifer
r_squared 0.55762
Slope = 0.0018276750
Mann-Kendall Trend : no trend
P Value: 0.21130
Mann-Kendall S Value: 6.0
Mn (Ug/L)
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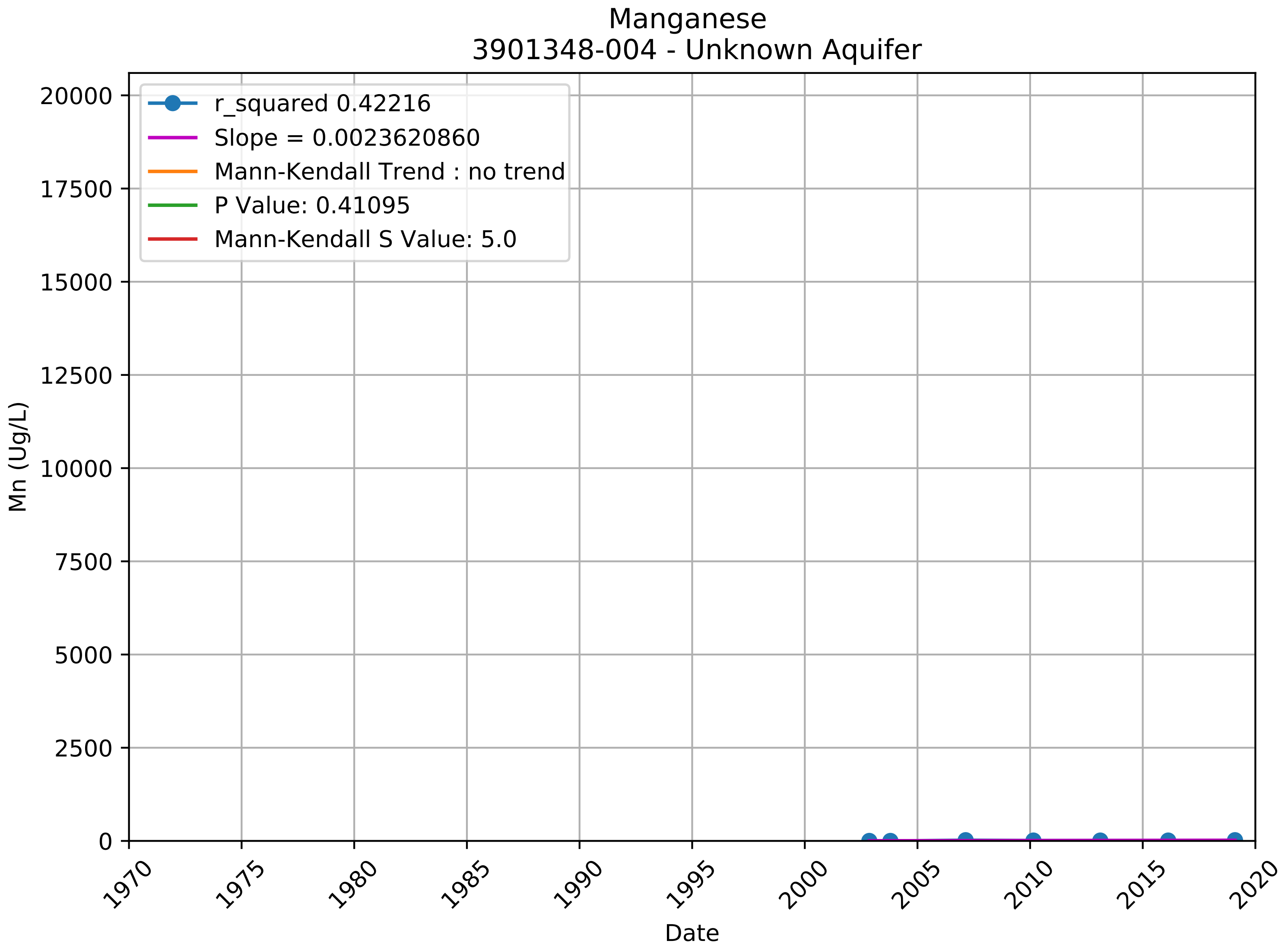

Manganese
3901348-004 - Unknown Aquifer
r_squared 0.42216
Slope = 0.0023620860
Mann-Kendall Trend : no trend
P Value: 0.41095
Mann-Kendall S Value: 5.0
Mn (Ug/L)
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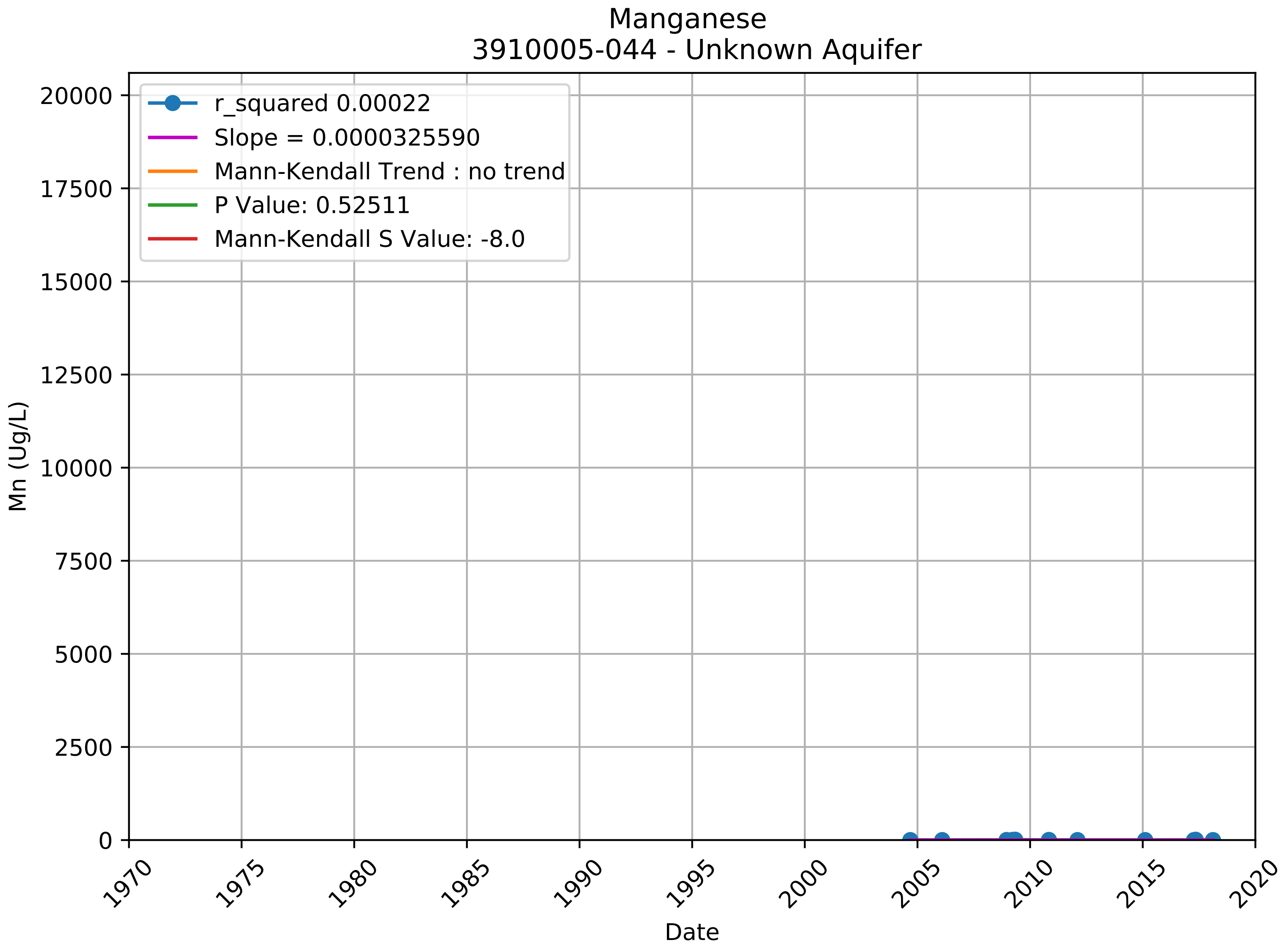

Manganese
3910005-044 - Unknown Aquifer
r_squared 0.00022
Slope = 0.0000325590
Mann-Kendall Trend : no trend
P Value: 0.52511
Mann-Kendall S Value: -8.0
Mn (Ug/L)
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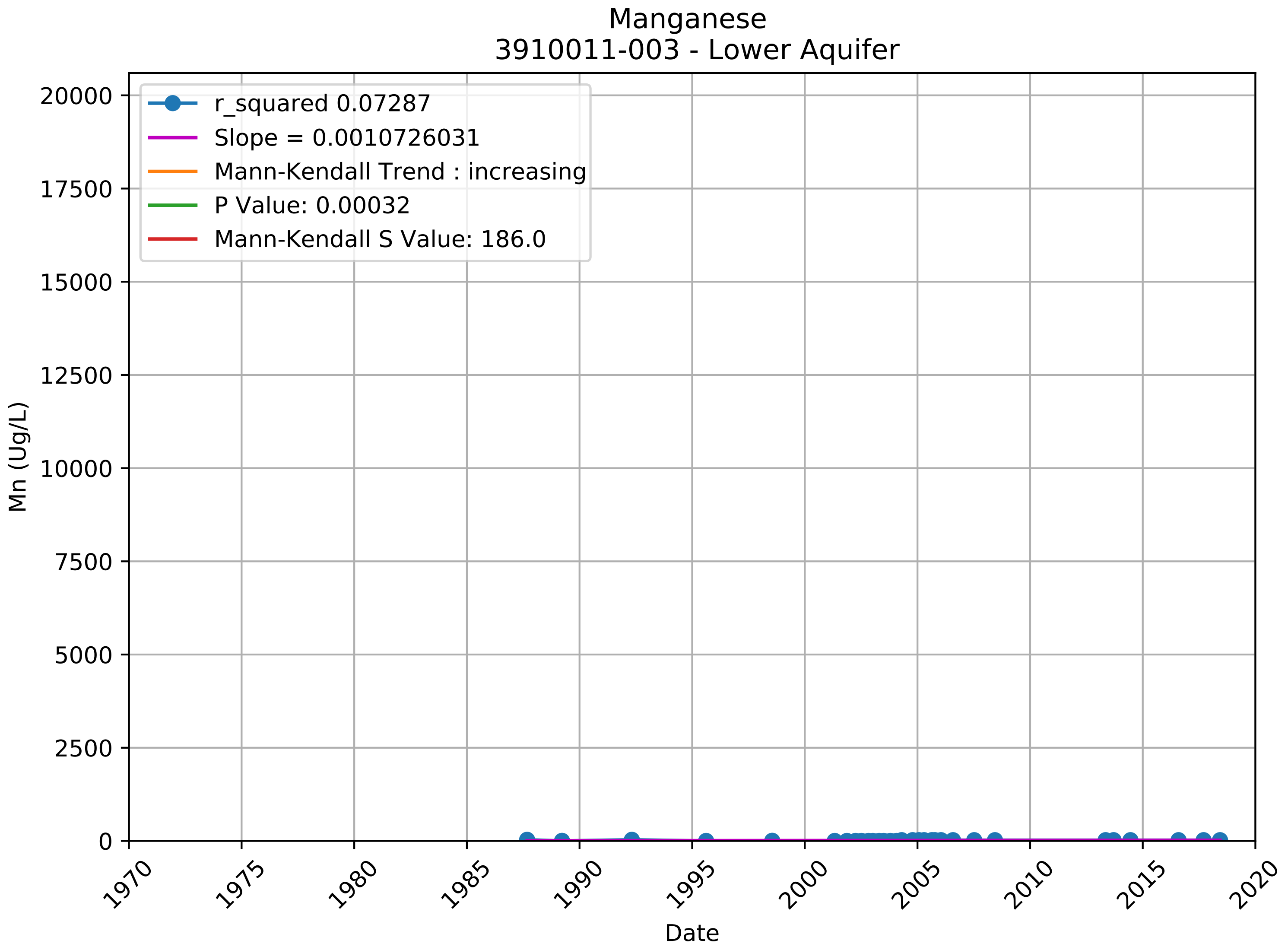
Manganese
3910011-003 - Lower Aquifer
r_squared 0.07287
Slope = 0.0010726031
Mann-Kendall Trend : increasing
P Value: 0.00032
Mann-Kendall S Value: 186.0
Mn (Ug/L)
Date
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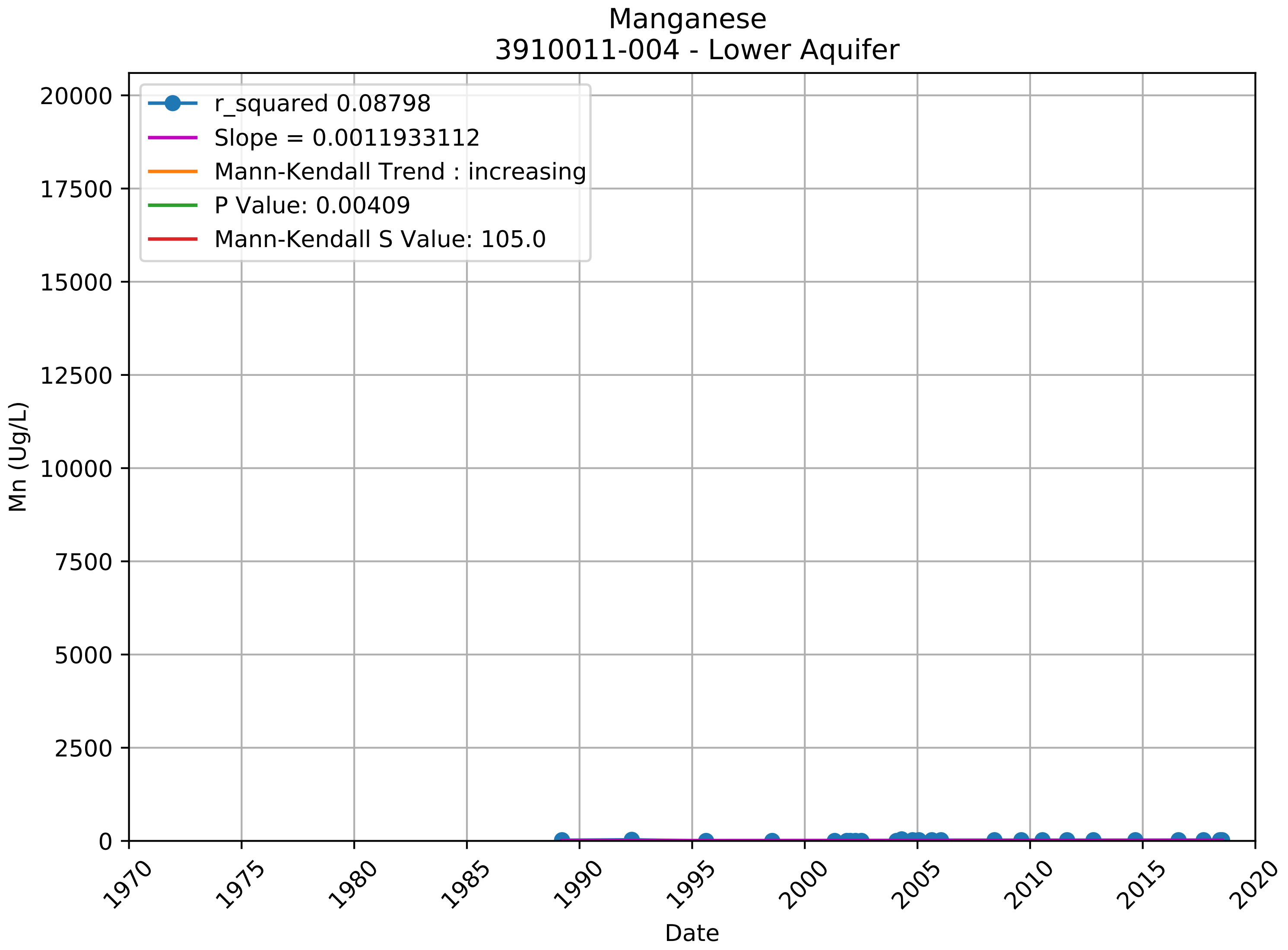

Manganese
3910011-004 - Lower Aquifer
r_squared 0.08798
Slope = 0.0011933112
Mann-Kendall Trend : increasing
P Value: 0.00409
Mann-Kendall S Value: 105.0
Mn (Ug/L)
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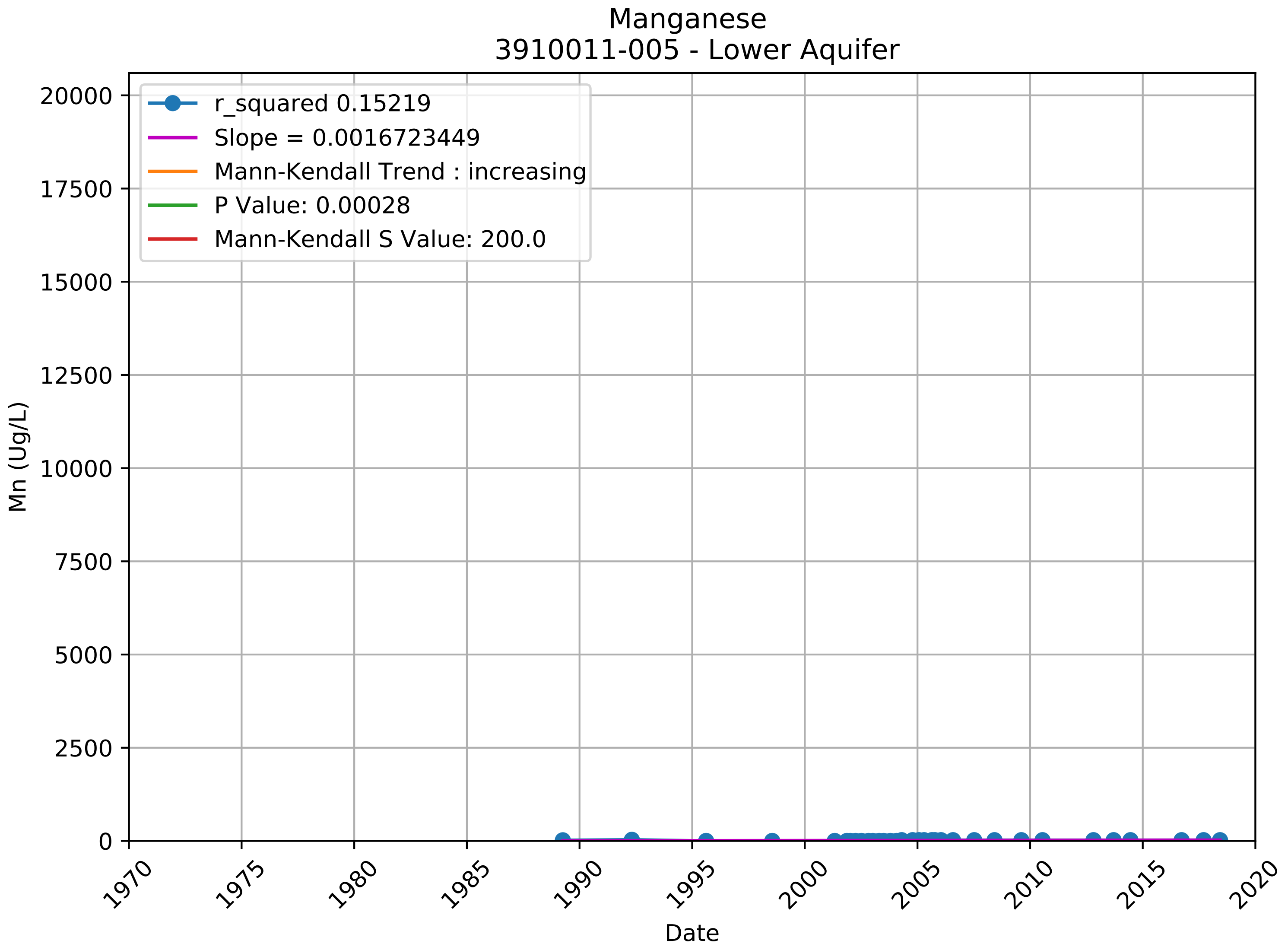

Manganese
3910011-005 - Lower Aquifer
r_squared 0.15219
Slope = 0.0016723449
Mann-Kendall Trend : increasing
P Value: 0.00028
Mann-Kendall S Value: 200.0
Mn (Ug/L)
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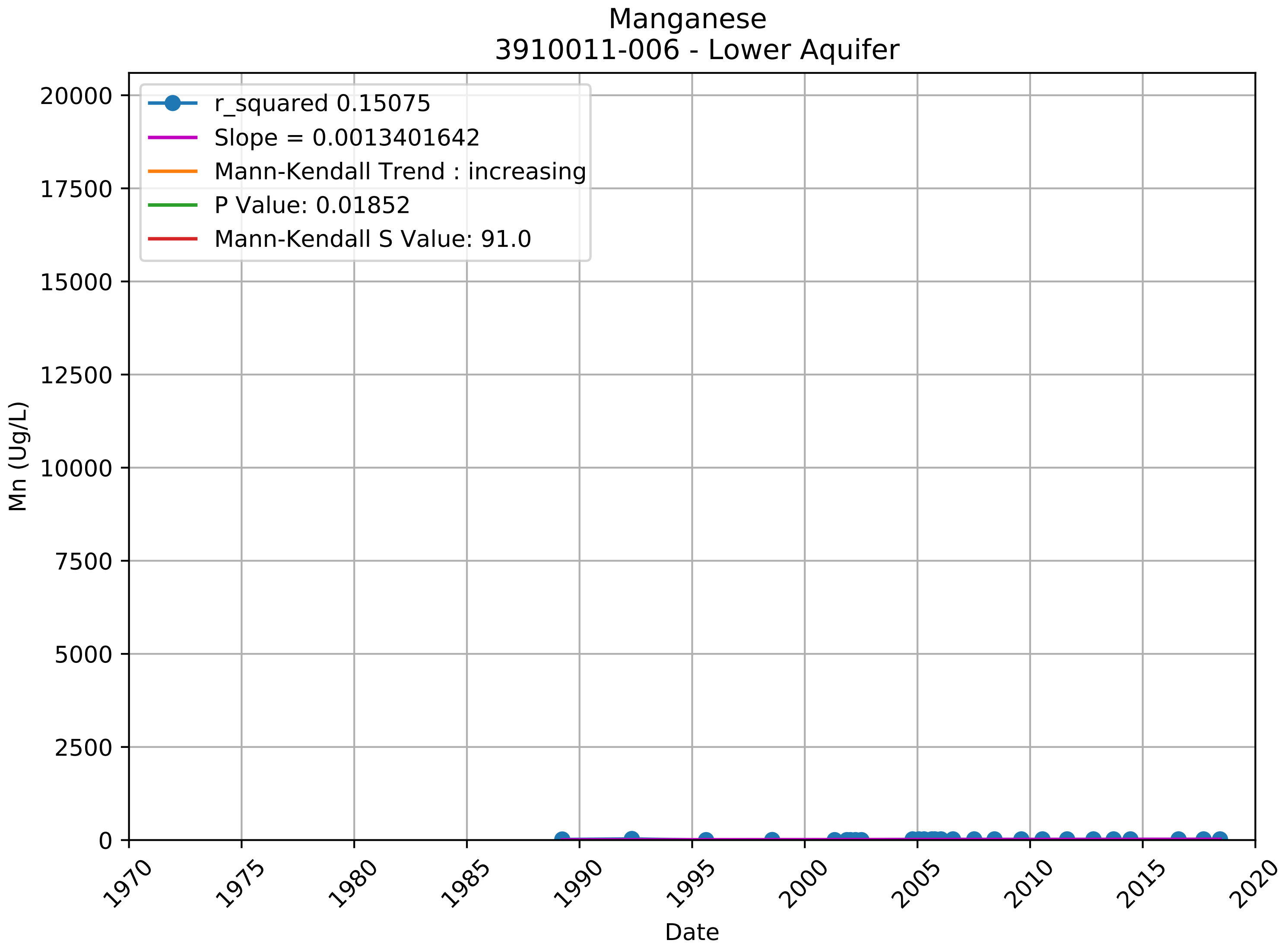

Manganese
3910011-006 - Lower Aquifer
r_squared 0.15075
Slope = 0.0013401642
Mann-Kendall Trend : increasing
P Value: 0.01852
Mann-Kendall S Value: 91.0
Mn (Ug/L)
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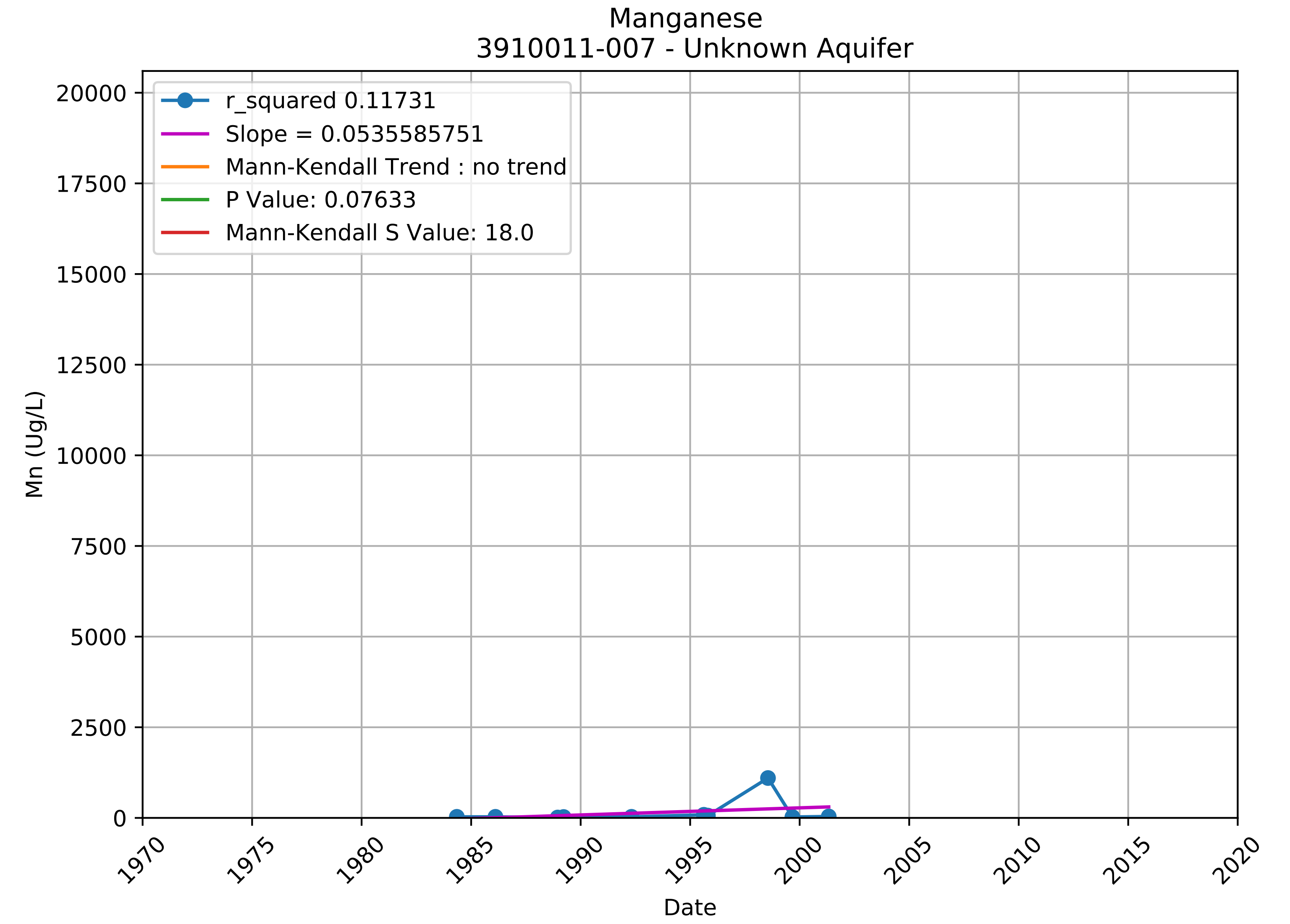

Manganese
3910011-007 - Unknown Aquifer
r_squared 0.11731
Slope = 0.0535585751
Mann-Kendall Trend : no trend
P Value: 0.07633
Mann-Kendall S Value: 18.0
Mn (Ug/L)
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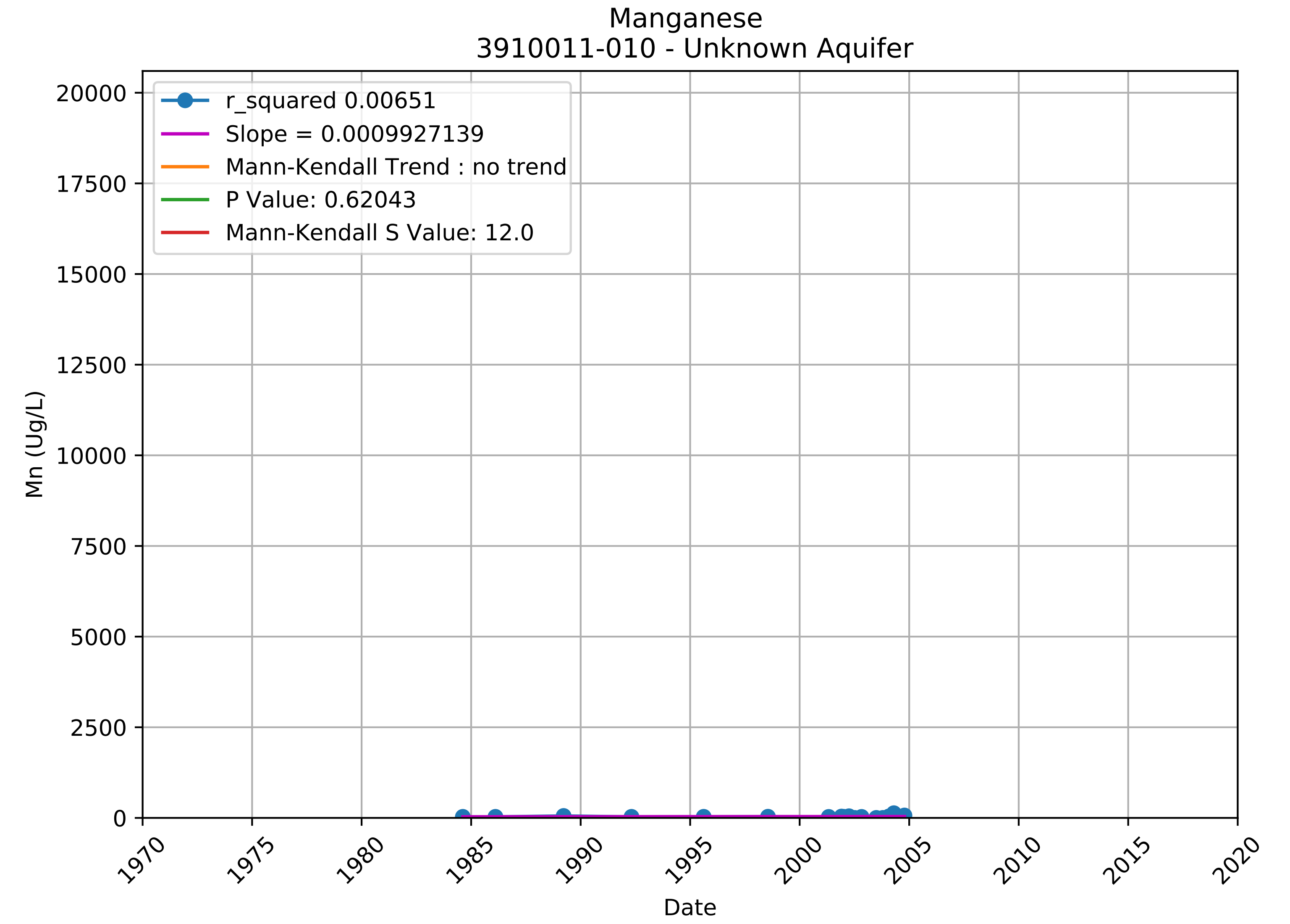

Manganese
3910011-010 - Unknown Aquifer
r_squared 0.00651
Slope = 0.0009927139
Mann-Kendall Trend : no trend
P Value: 0.62043
Mann-Kendall S Value: 12.0
Mn (Ug/L)
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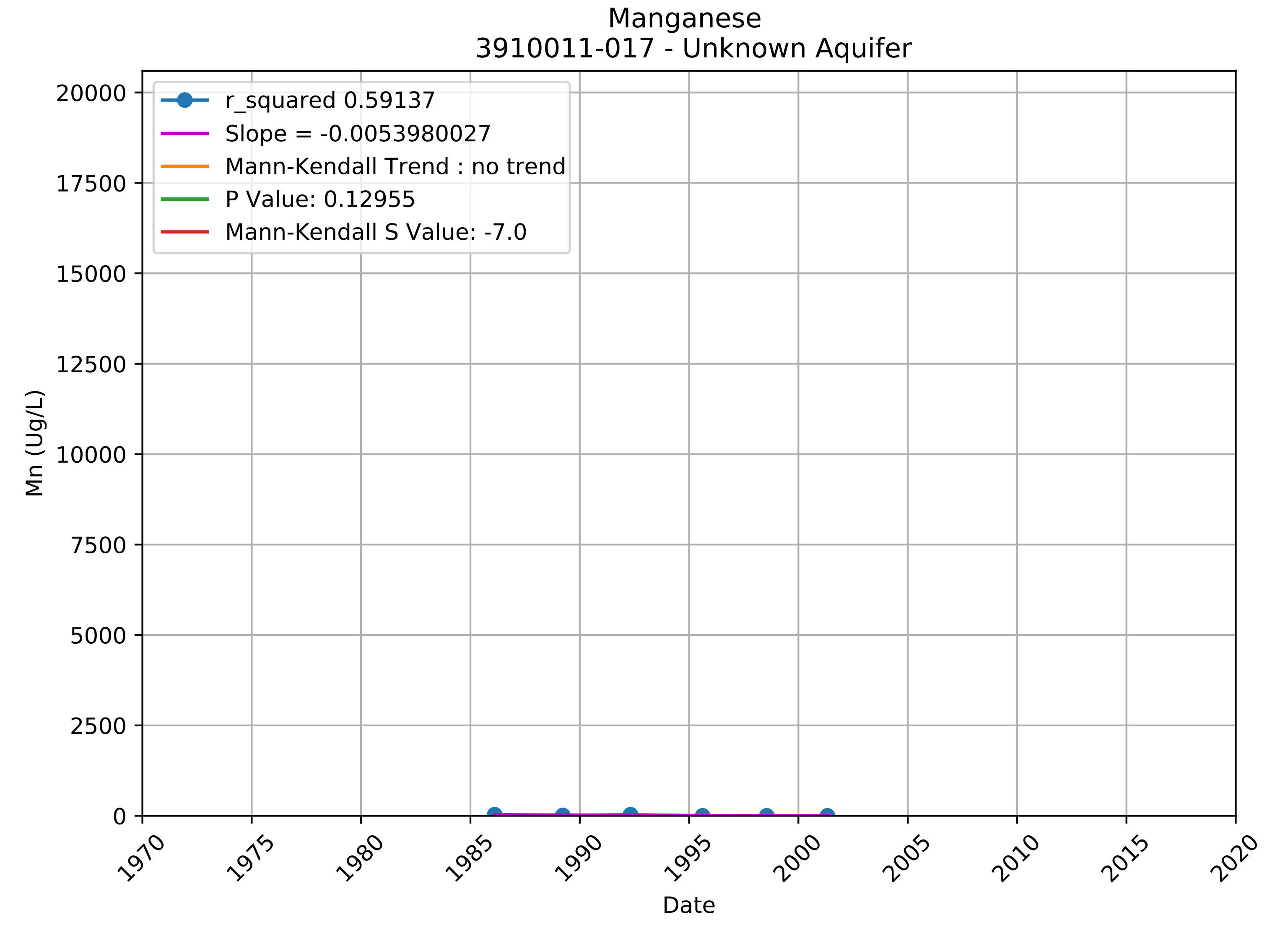
Manganese
3910011-017 - Unknown Aquifer
r_squared 0.59137
Slope = -0.0053980027
Mann-Kendall Trend : no trend
P Value: 0.12955
Mann-Kendall S Value: -7.0
Mn (Ug/L)
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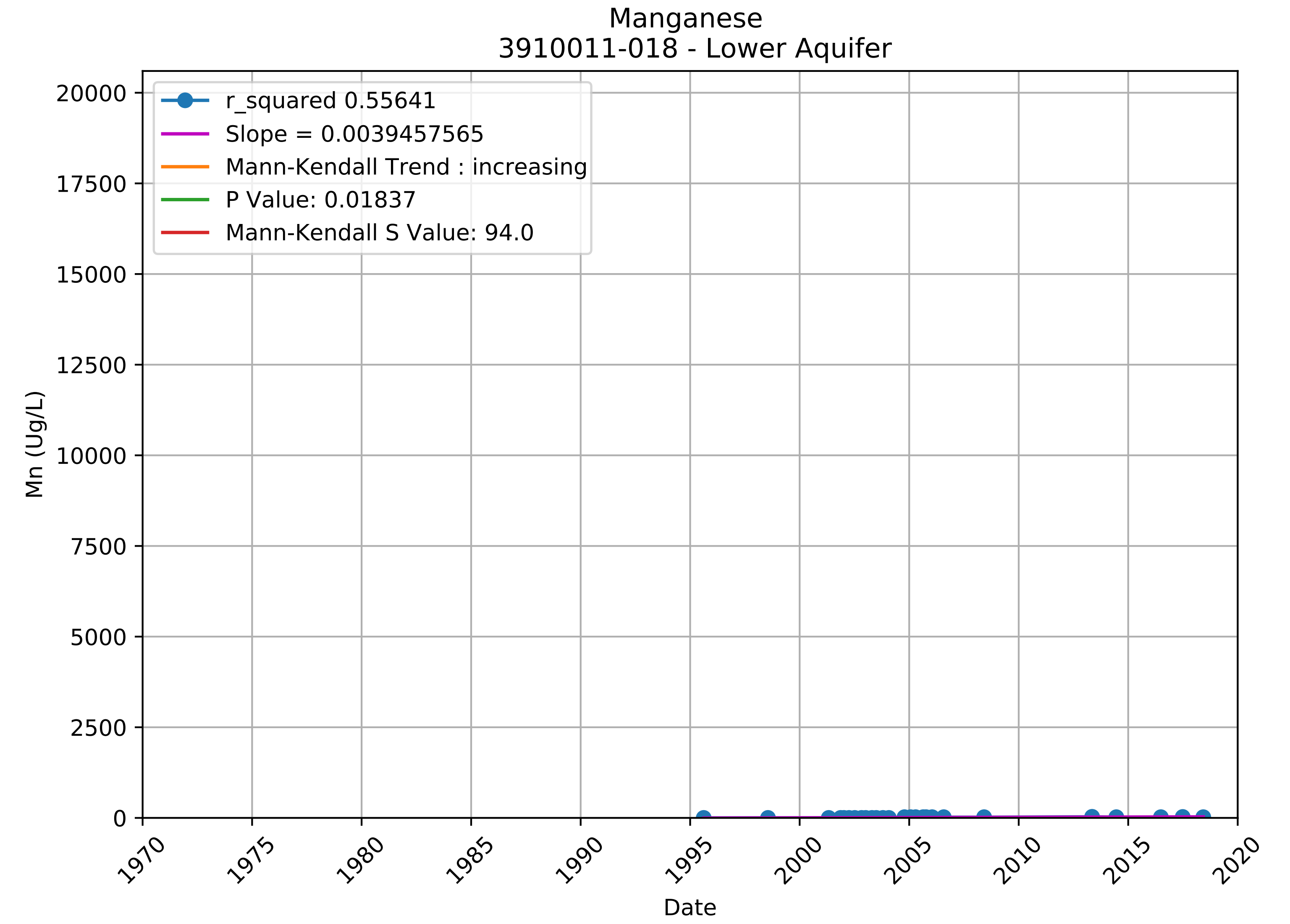

Manganese
3910011-018 - Lower Aquifer
r_squared 0.55641
Slope = 0.0039457565
Mann-Kendall Trend : increasing
P Value: 0.01837
Mann-Kendall S Value: 94.0
Mn (Ug/L)
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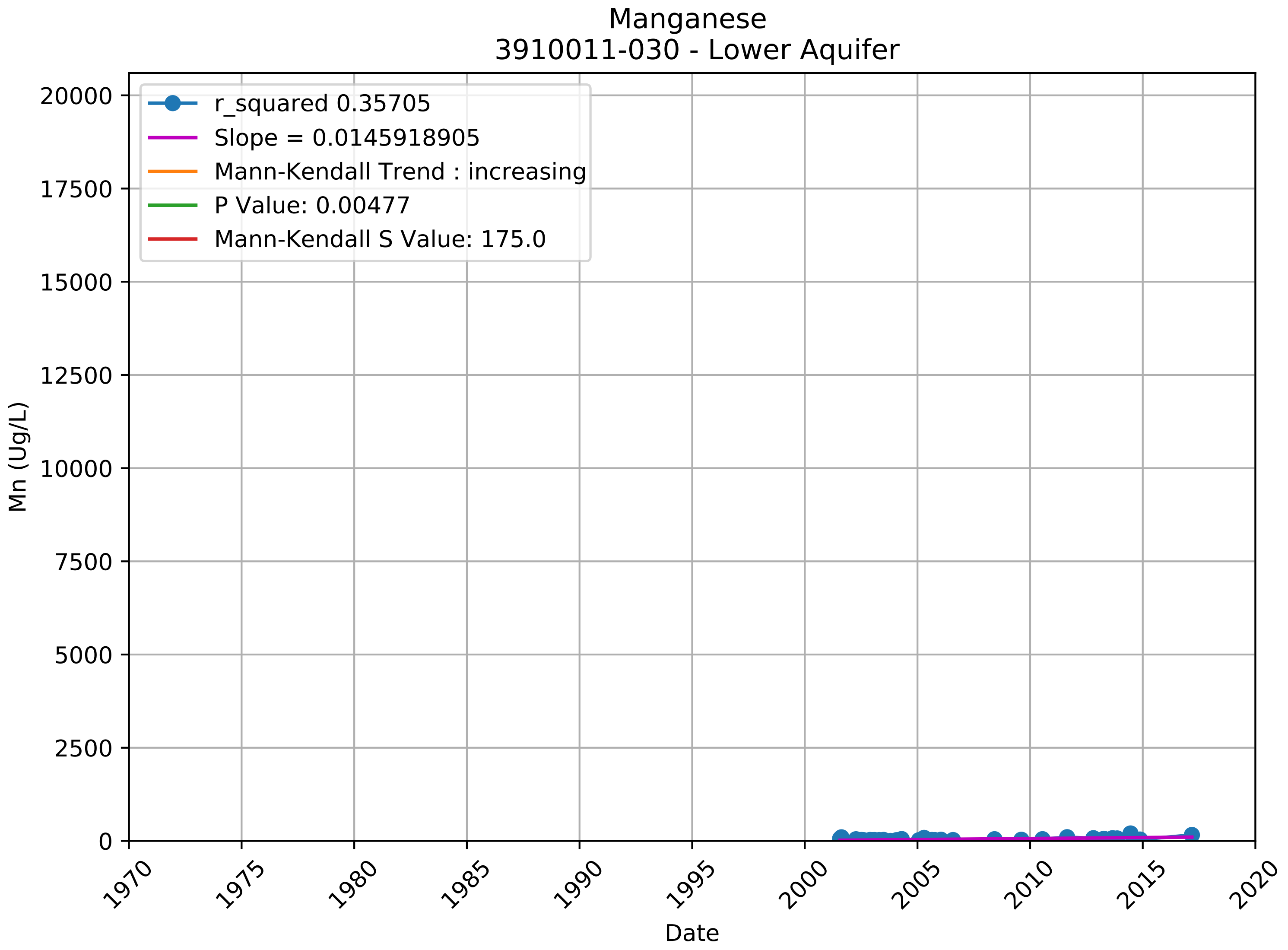
Manganese
3910011-030 - Lower Aquifer
r_squared 0.35705
Slope = 0.0145918905
Mann-Kendall Trend : increasing
P Value: 0.00477
Mann-Kendall S Value: 175.0
Mn (Ug/L)
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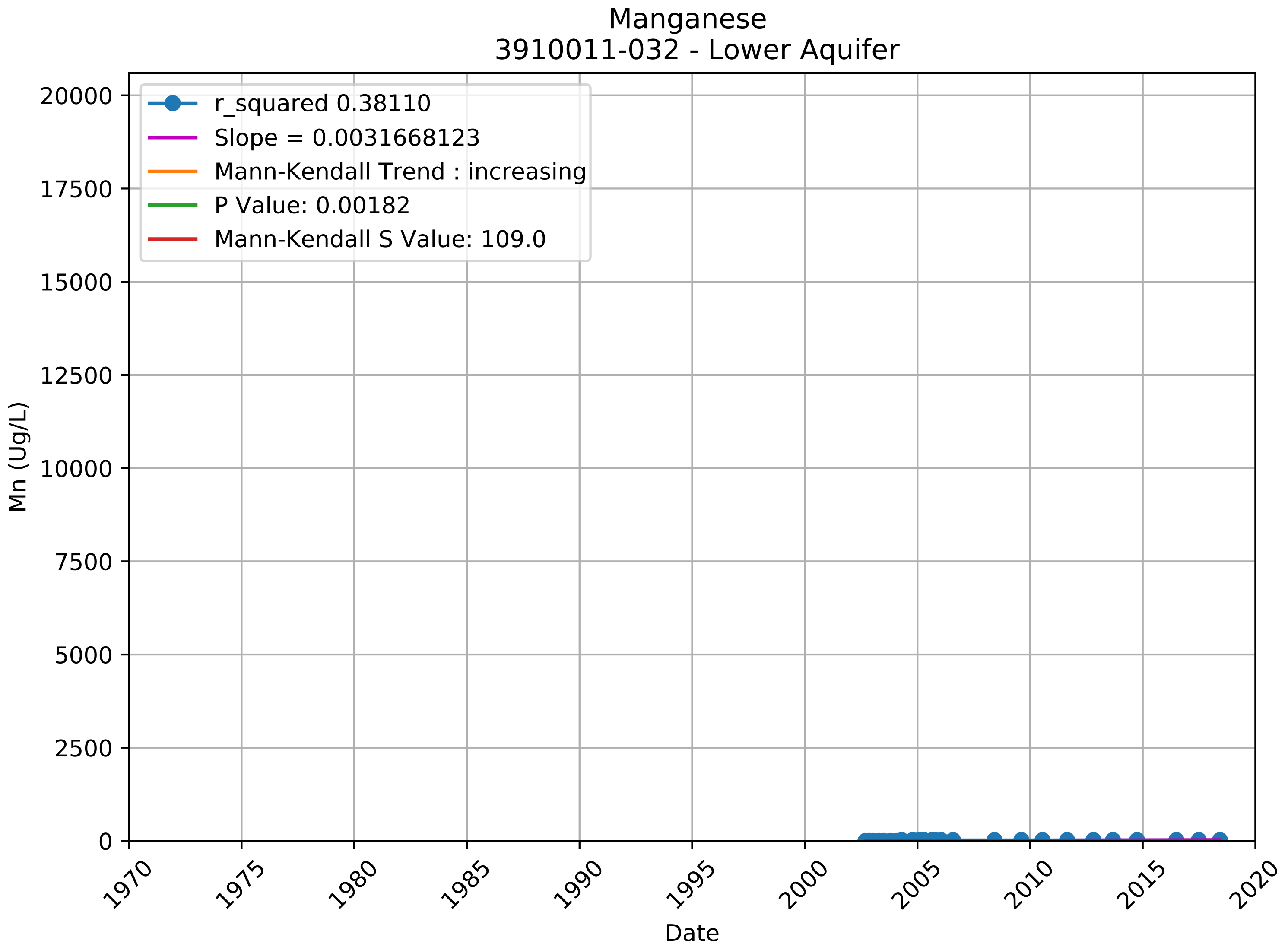

Manganese
3910011-032 - Lower Aquifer
r_squared 0.38110
Slope = 0.0031668123
Mann-Kendall Trend : increasing
P Value: 0.00182
Mann-Kendall S Value: 109.0
Mn (Ug/L)
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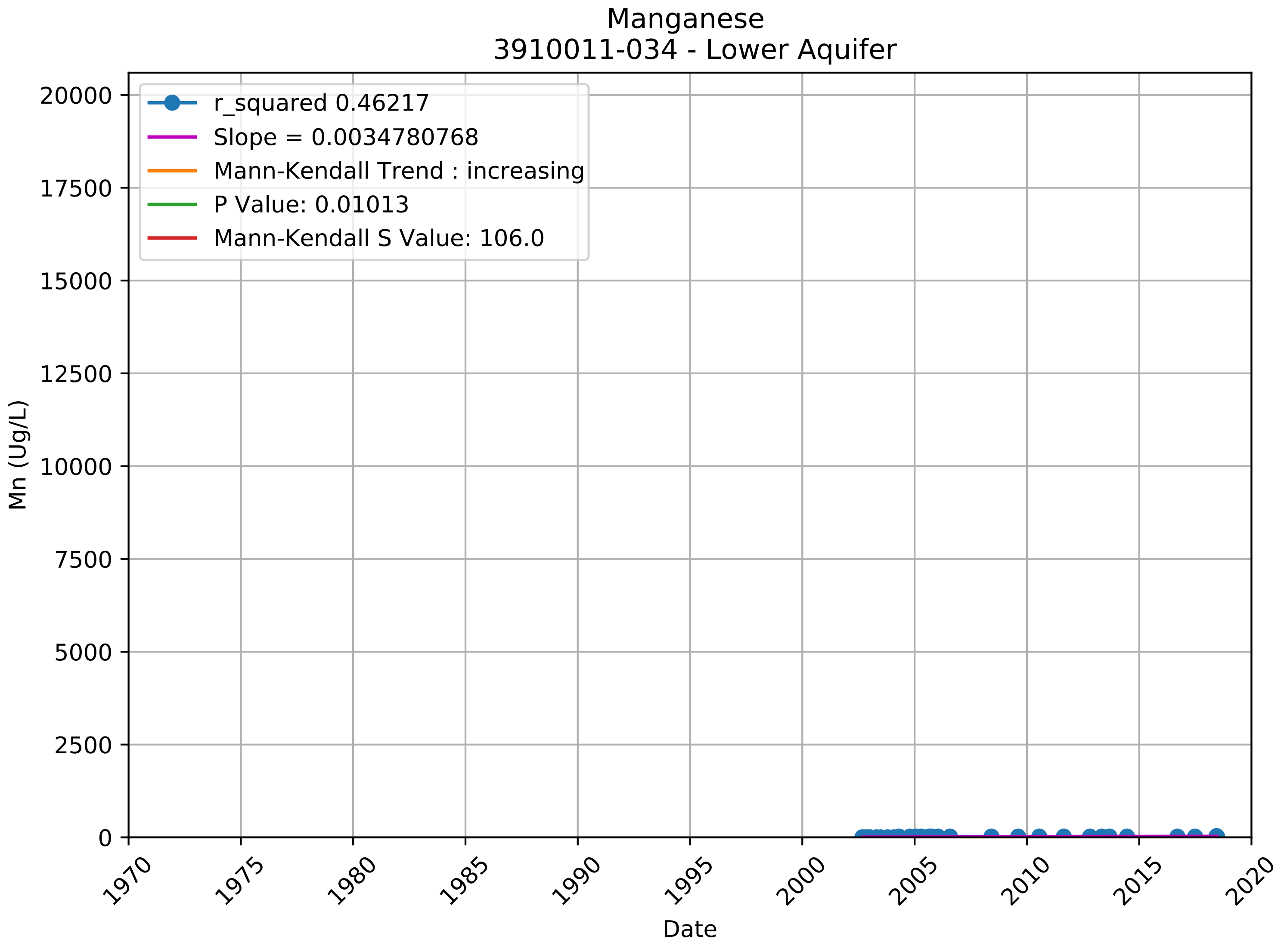
Manganese
3910011-034 - Lower Aquifer
r_squared 0.46217
Slope = 0.0034780768
Mann-Kendall Trend : increasing
P Value: 0.01013
Mann-Kendall S Value: 106.0
Mn (Ug/L)
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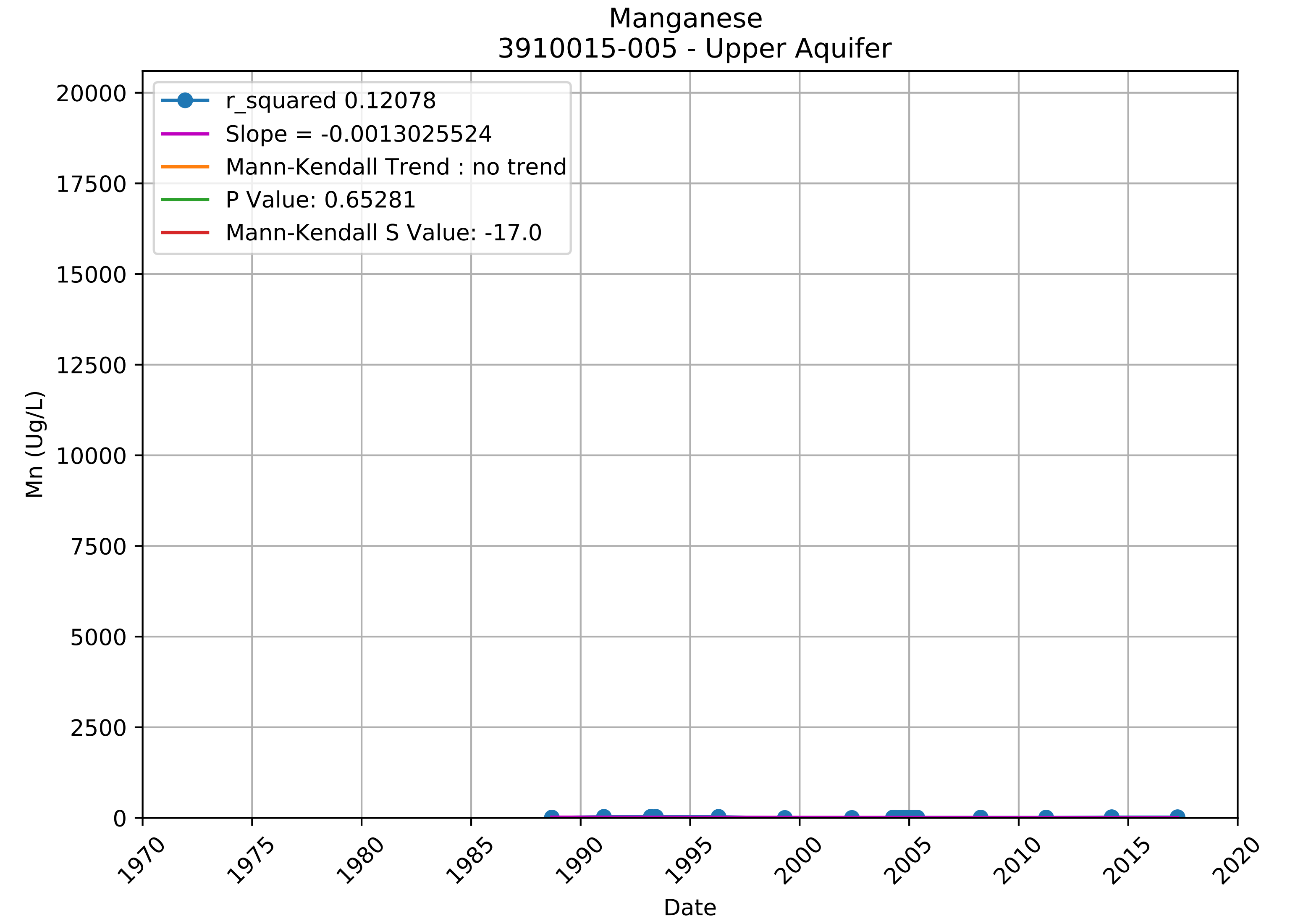
Manganese
3910015-005 - Upper Aquifer
r_squared 0.12078
Slope = -0.0013025524
Mann-Kendall Trend : no trend
P Value: 0.65281
Mann-Kendall S Value: -17.0
Mn (Ug/L)
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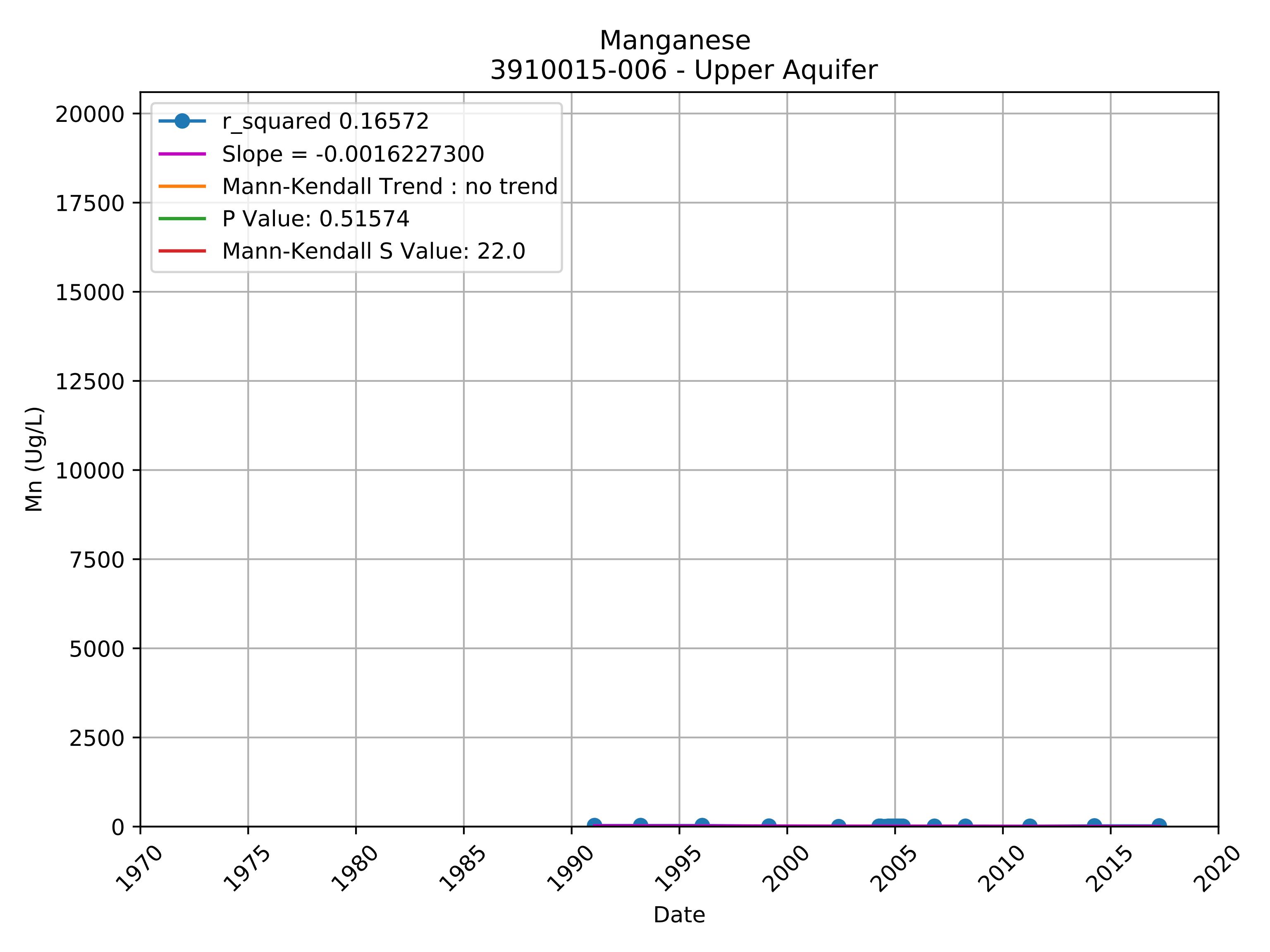

Manganese
3910015-006 - Upper Aquifer
r_squared 0.16572
Slope = -0.0016227300
Mann-Kendall Trend : no trend
P Value: 0.51574
Mann-Kendall S Value: 22.0
Mn (Ug/L)
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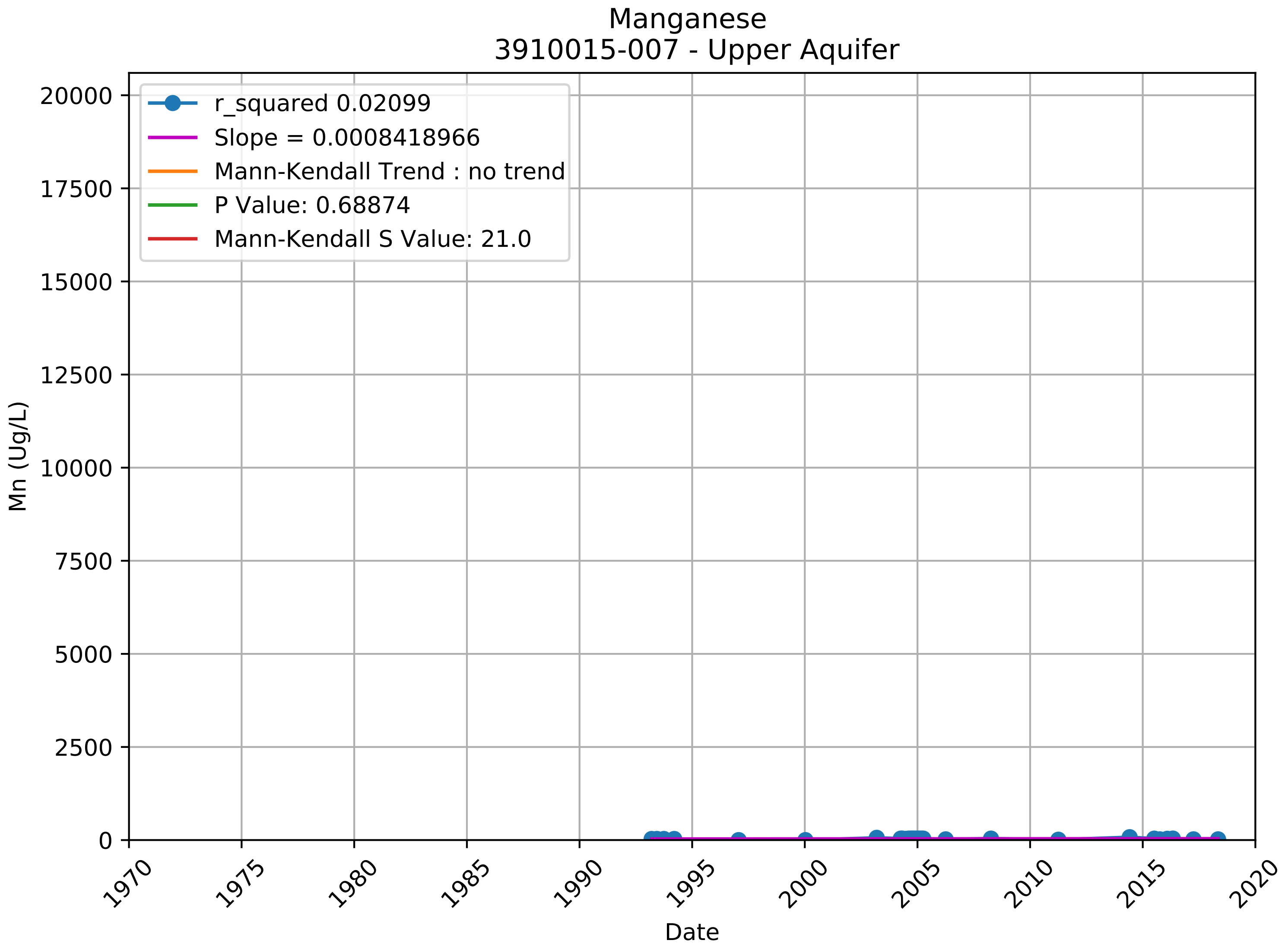
Manganese
3910015-007 - Upper Aquifer
r_squared 0.02099
Slope = 0.0008418966
Mann-Kendall Trend : no trend
P Value: 0.68874
Mann-Kendall S Value: 21.0
Mn (Ug/L)
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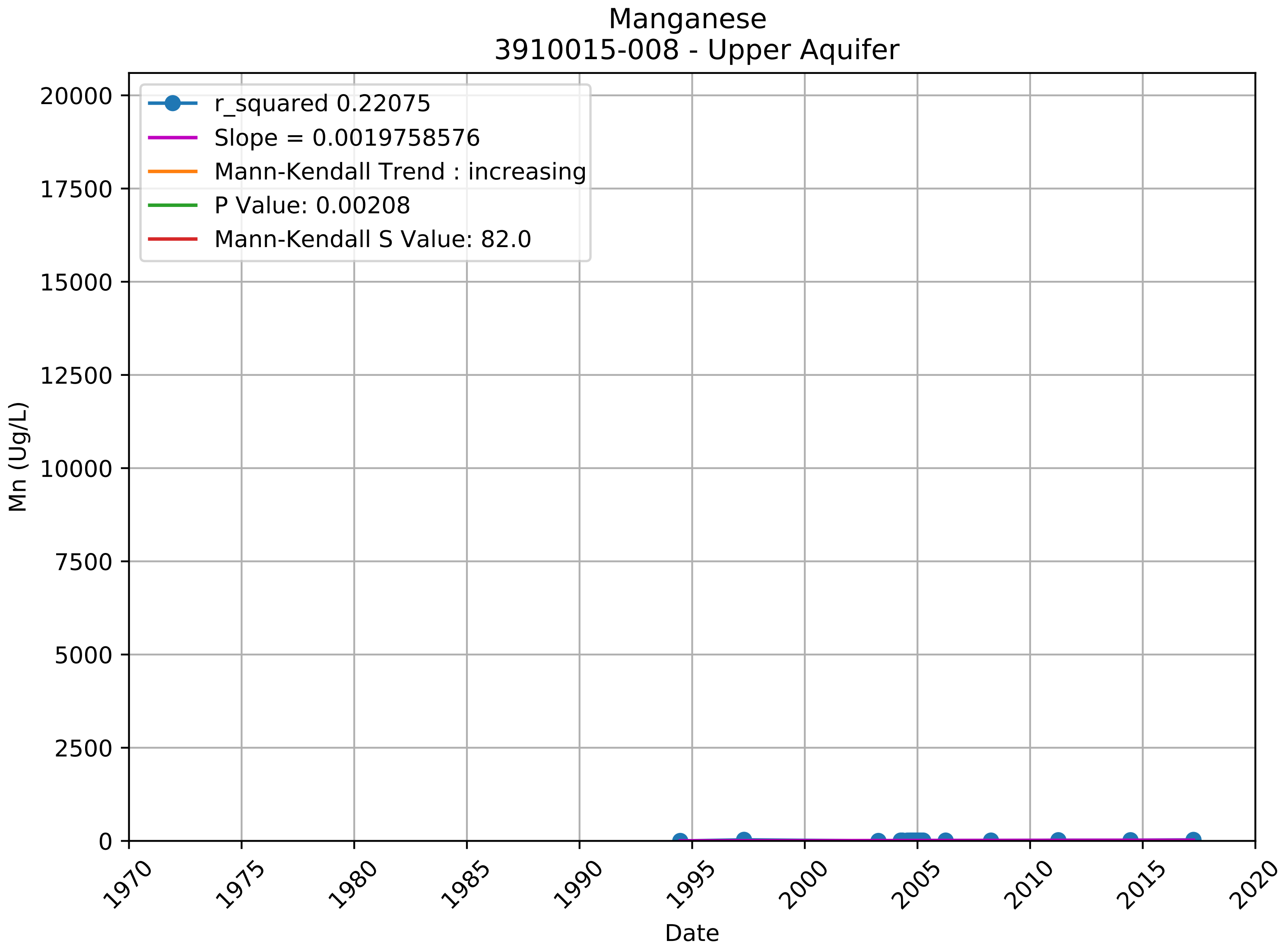

Manganese
3910015-008 - Upper Aquifer
r_squared 0.22075
Slope = 0.0019758576
Mann-Kendall Trend : increasing
P Value: 0.00208
Mann-Kendall S Value: 82.0
Mn (Ug/L)
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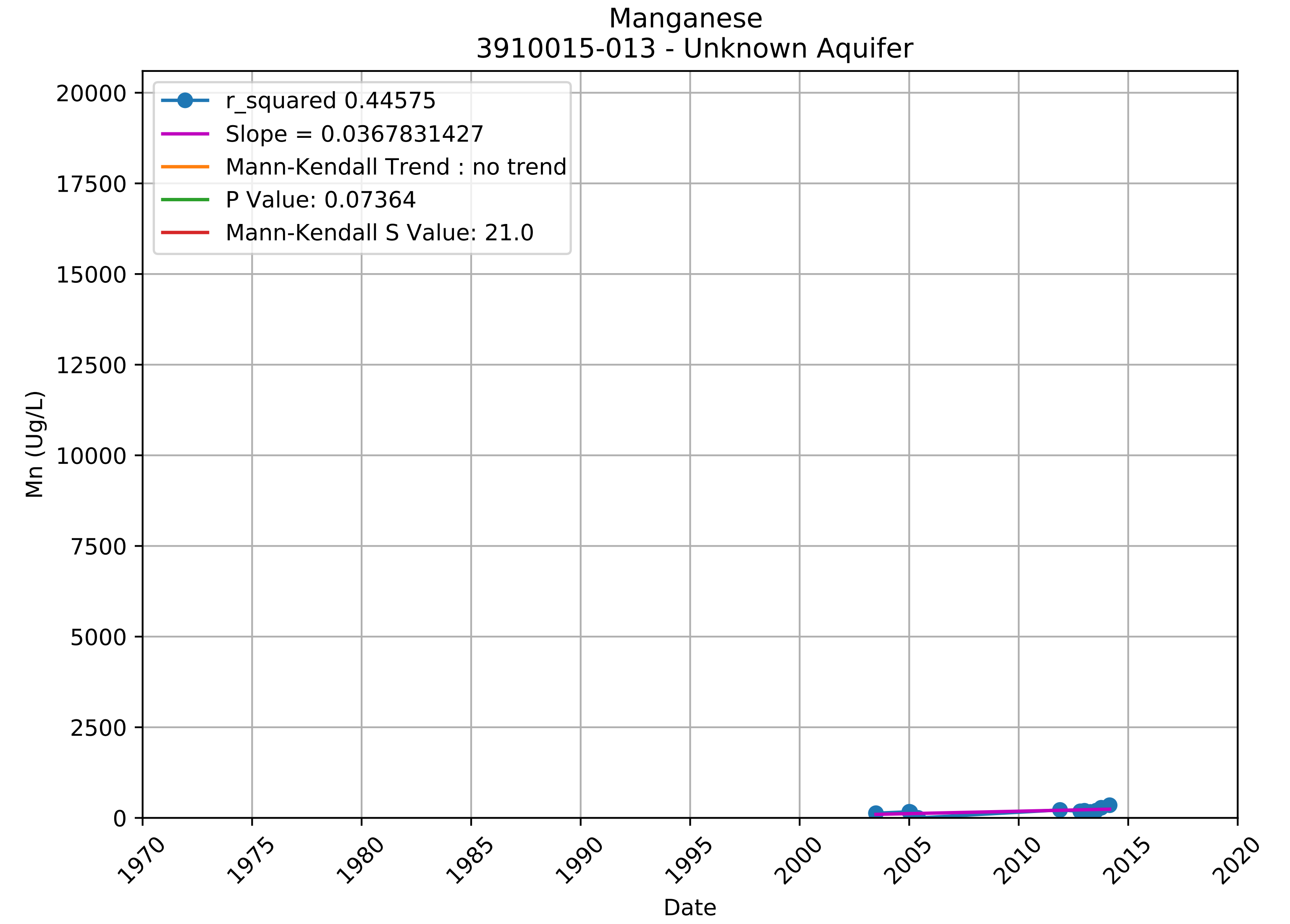

Manganese
3910015-013 - Unknown Aquifer
r_squared 0.44575
Slope = 0.0367831427
Mann-Kendall Trend : no trend
P Value: 0.07364
Mann-Kendall S Value: 21.0
Mn (Ug/L)
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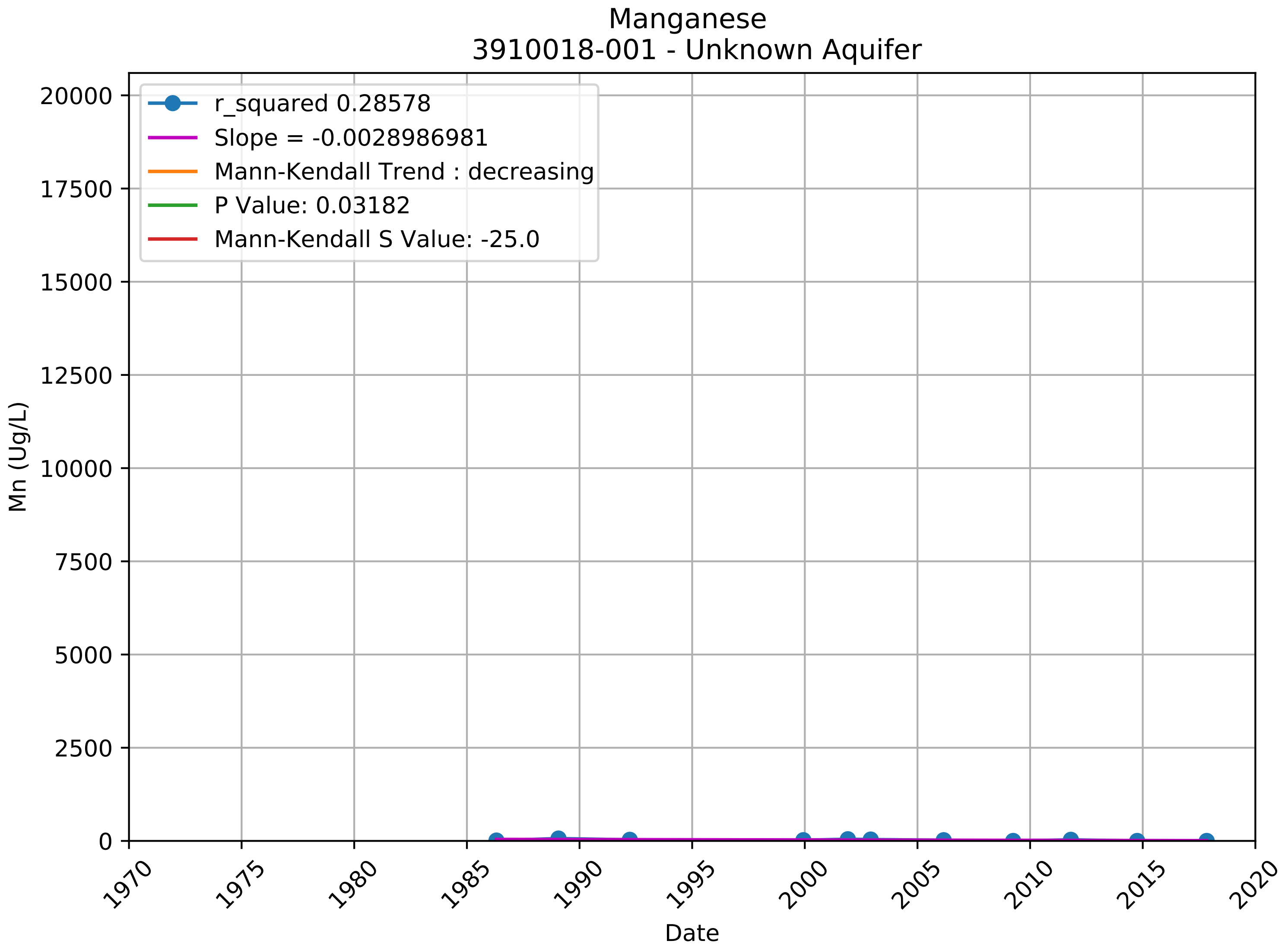
Manganese
3910018-001 - Unknown Aquifer
r_squared 0.28578
Slope = -0.0028986981
Mann-Kendall Trend : decreasing
P Value: 0.03182
Mann-Kendall S Value: -25.0
Mn (Ug/L)
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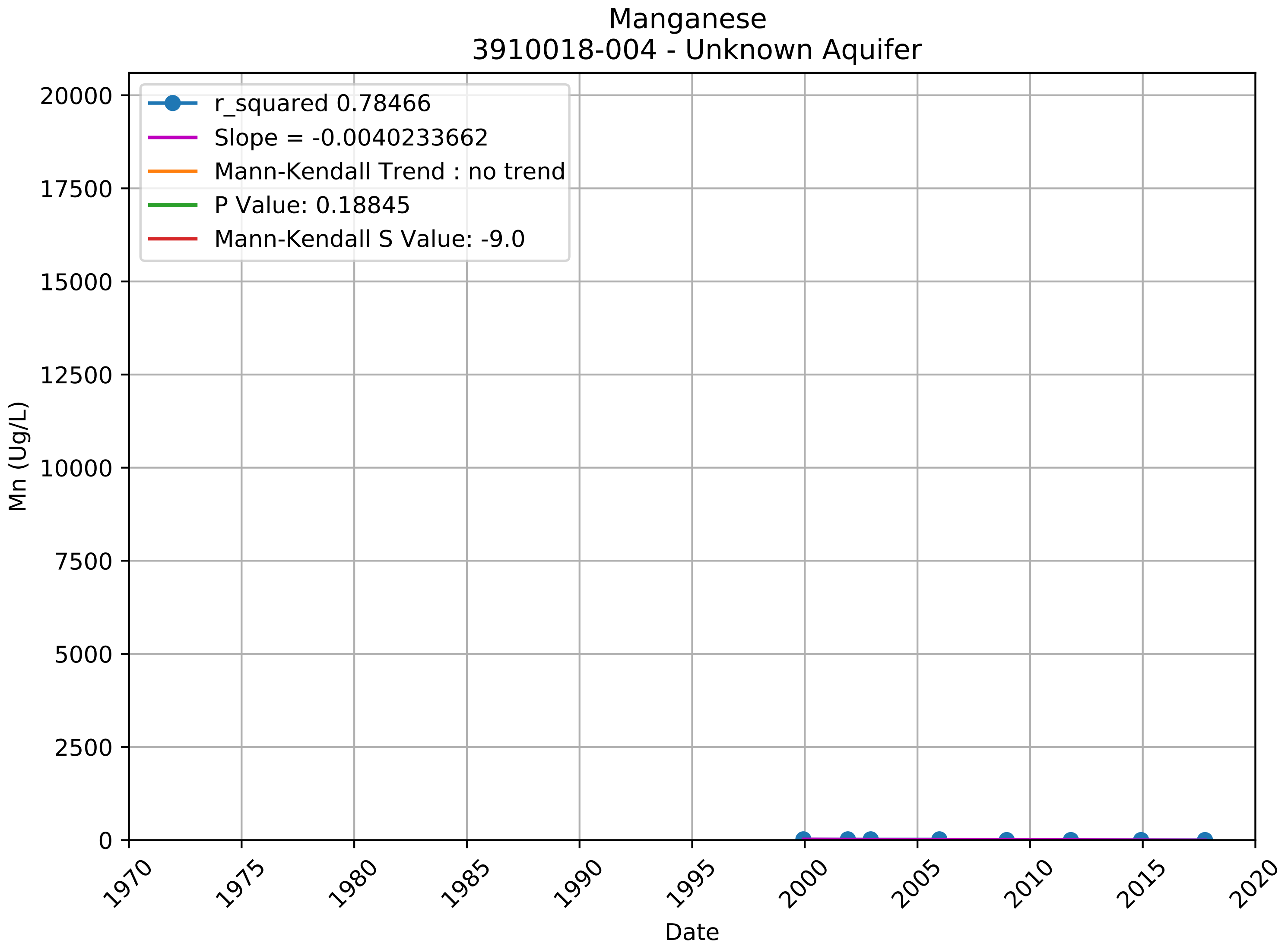
Manganese
3910018-004 - Unknown Aquifer
r_squared 0.78466
Slope = -0.0040233662
Mann-Kendall Trend : no trend
P Value: 0.18845
Mann-Kendall S Value: -9.0
Mn (Ug/L)
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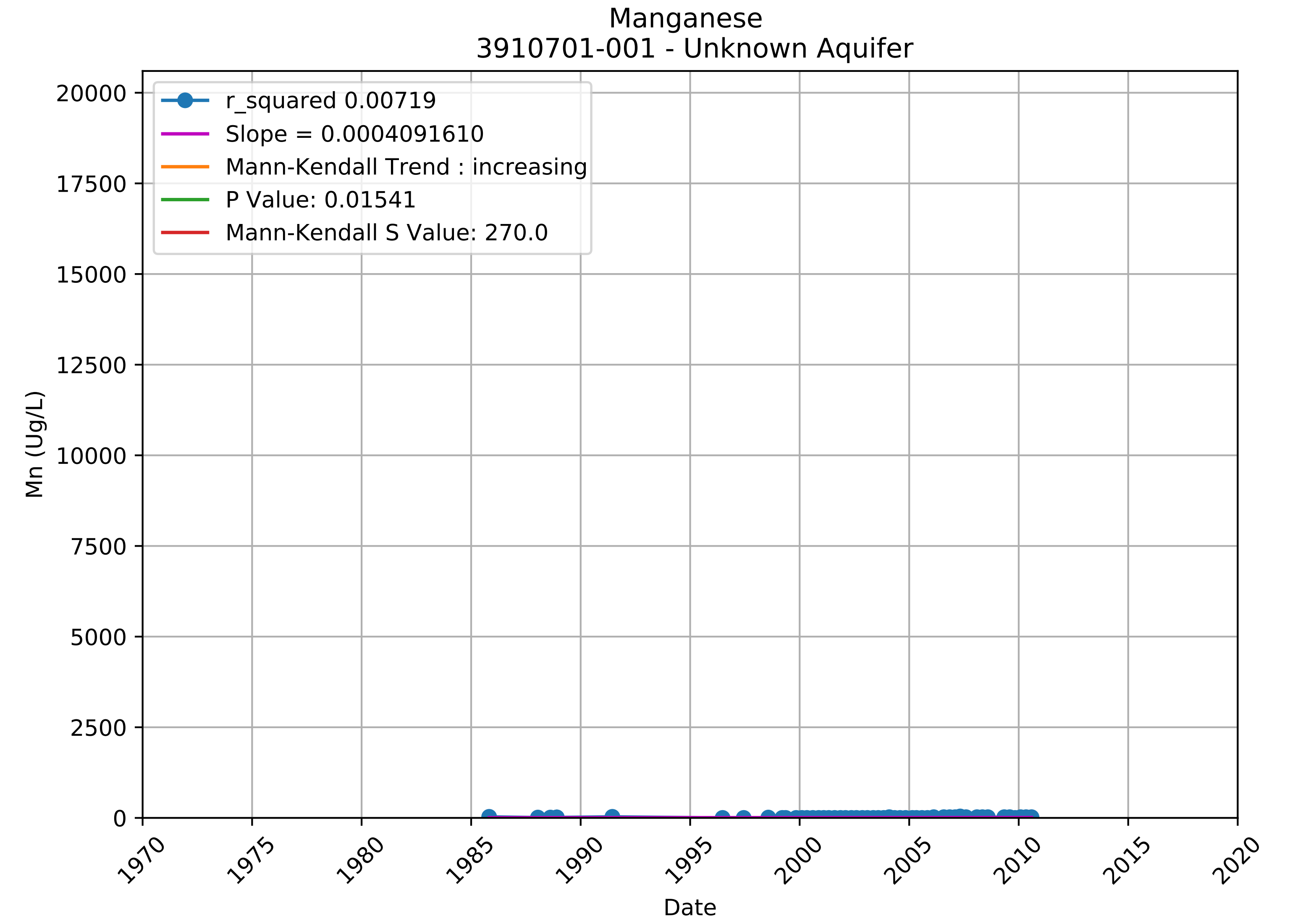

Manganese
3910701-001 - Unknown Aquifer
r_squared 0.00719
Slope = 0.0004091610
Mann-Kendall Trend : increasing
P Value: 0.01541
Mann-Kendall S Value: 270.0
Mn (Ug/L)
Date
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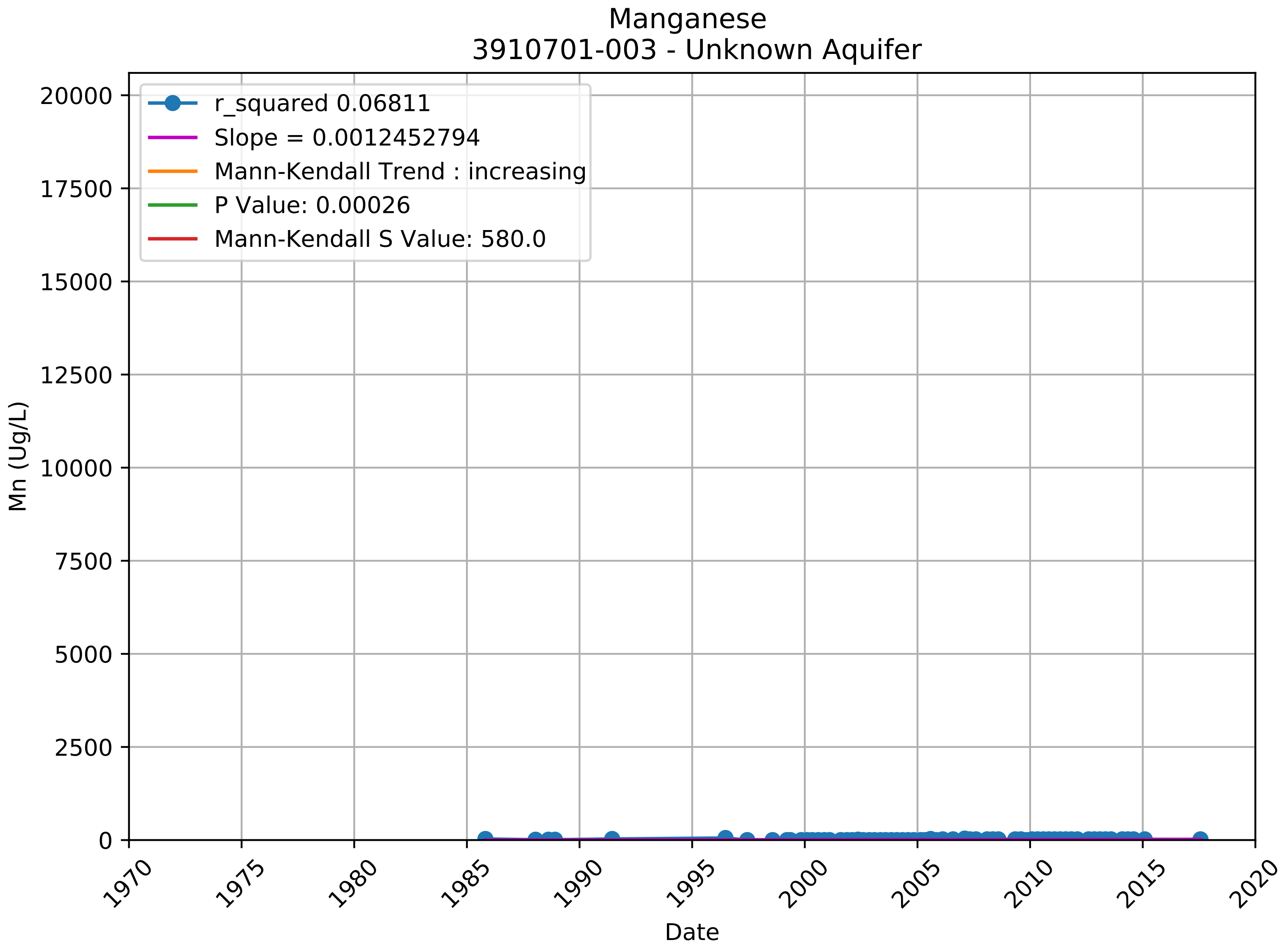
Manganese
3910701-003 - Unknown Aquifer
r_squared 0.06811
Slope = 0.0012452794
Mann-Kendall Trend : increasing
P Value: 0.00026
Mann-Kendall S Value: 580.0
Mn (Ug/L)
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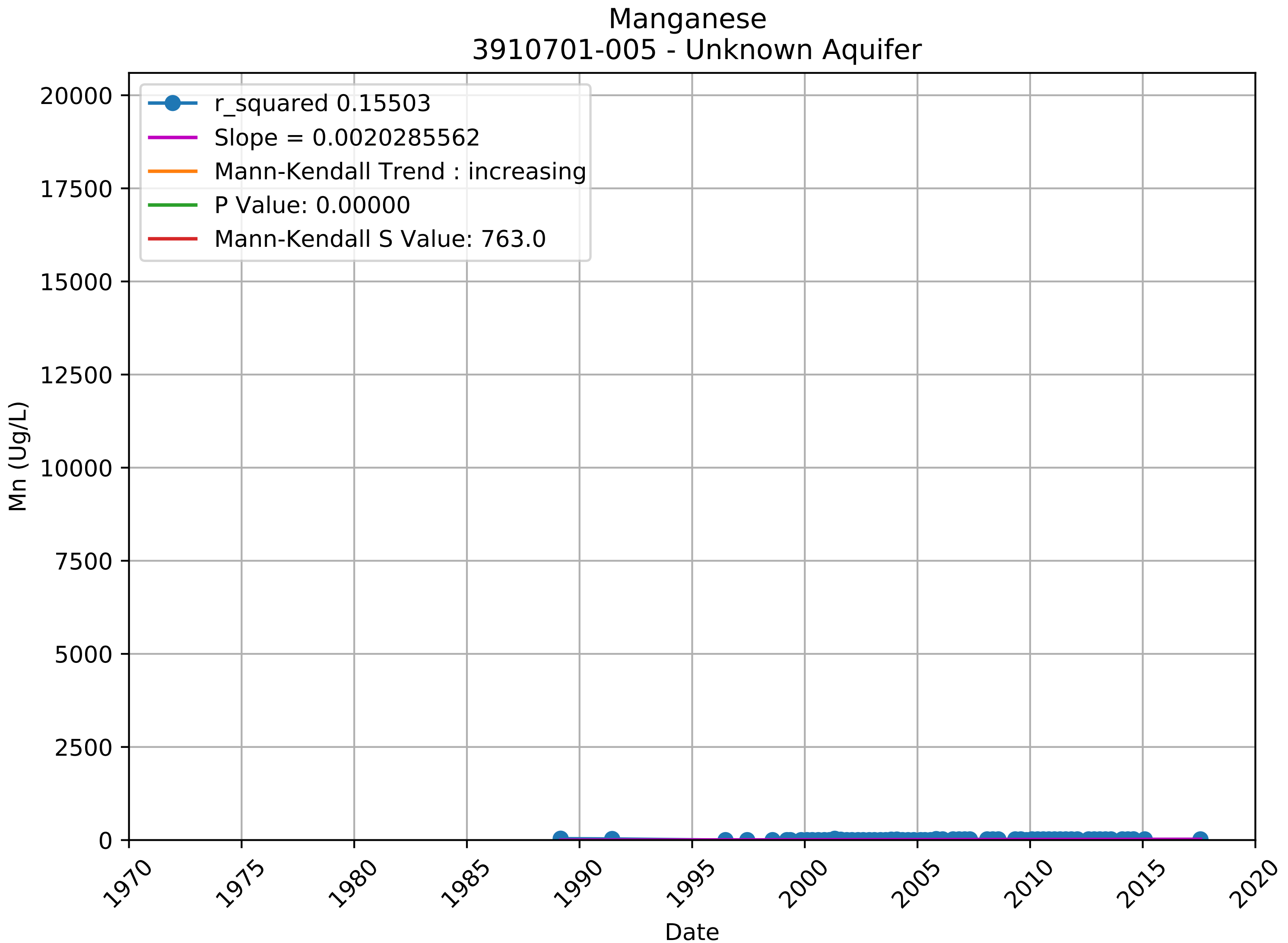
Manganese
3910701-005 - Unknown Aquifer
r_squared 0.15503
Slope = 0.0020285562
Mann-Kendall Trend : increasing
P Value: 0.00000
Mann-Kendall S Value: 763.0
Mn (Ug/L)
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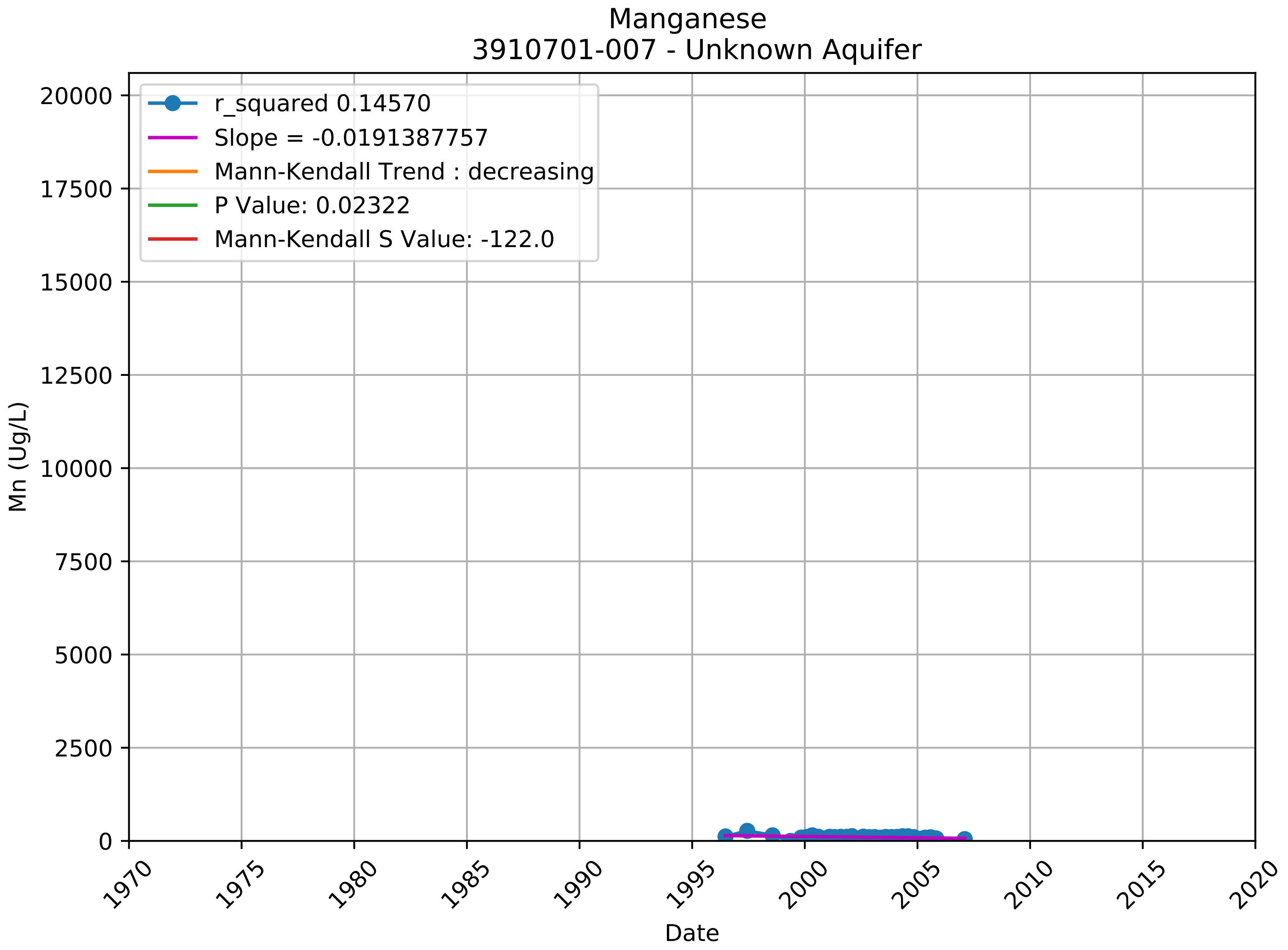

Manganese
3910701-007 - Unknown Aquifer
r_squared 0.14570
Slope = -0.0191387757
Mann-Kendall Trend : decreasing
P Value: 0.02322
Mann-Kendall S Value: -122.0
Mn (Ug/L)
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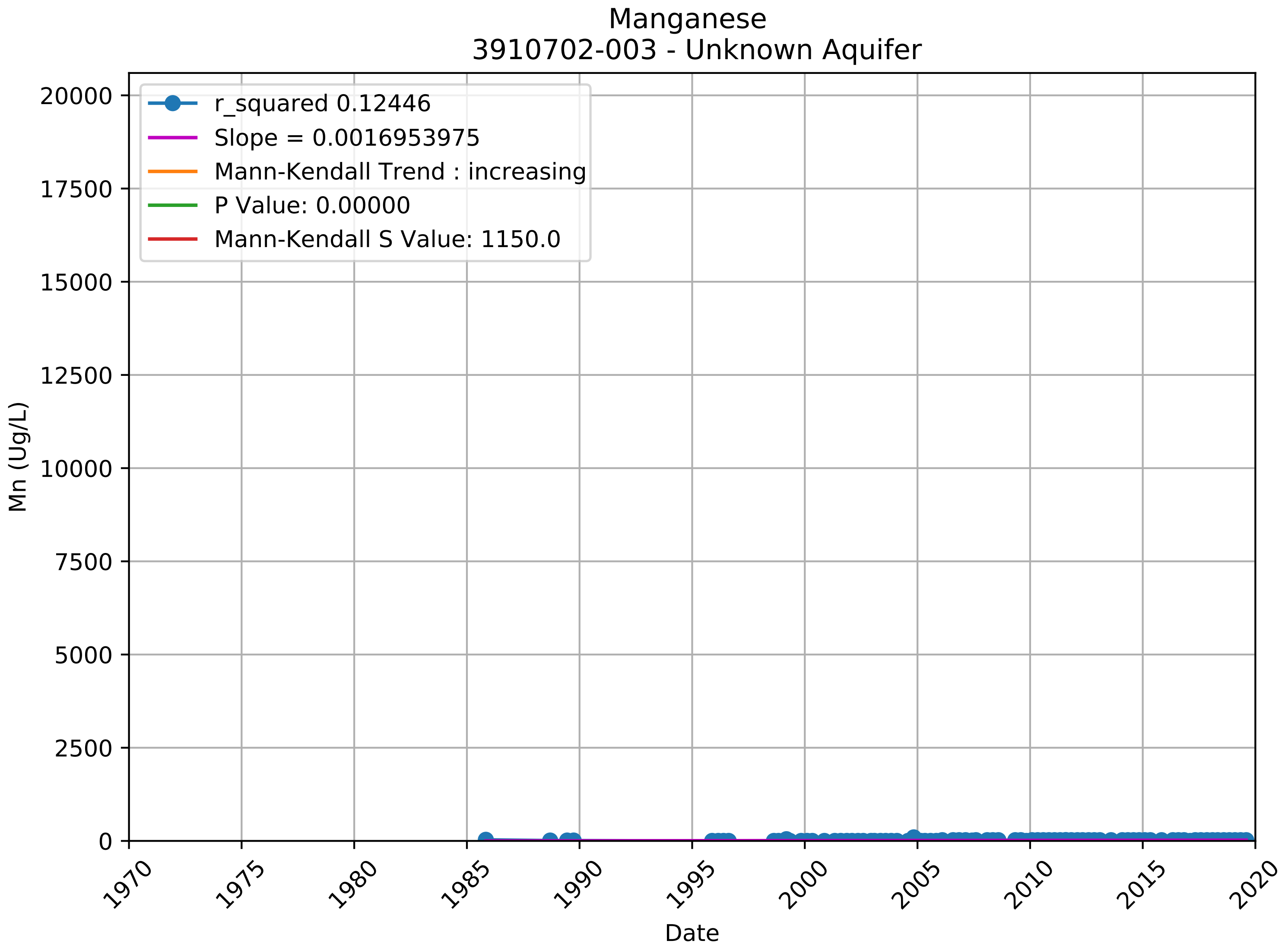
Manganese
3910702-003 - Unknown Aquifer
r_squared 0.12446
Slope = 0.0016953975
Mann-Kendall Trend : increasing
P Value: 0.00000
Mann-Kendall S Value: 1150.0
Mn (Ug/L)
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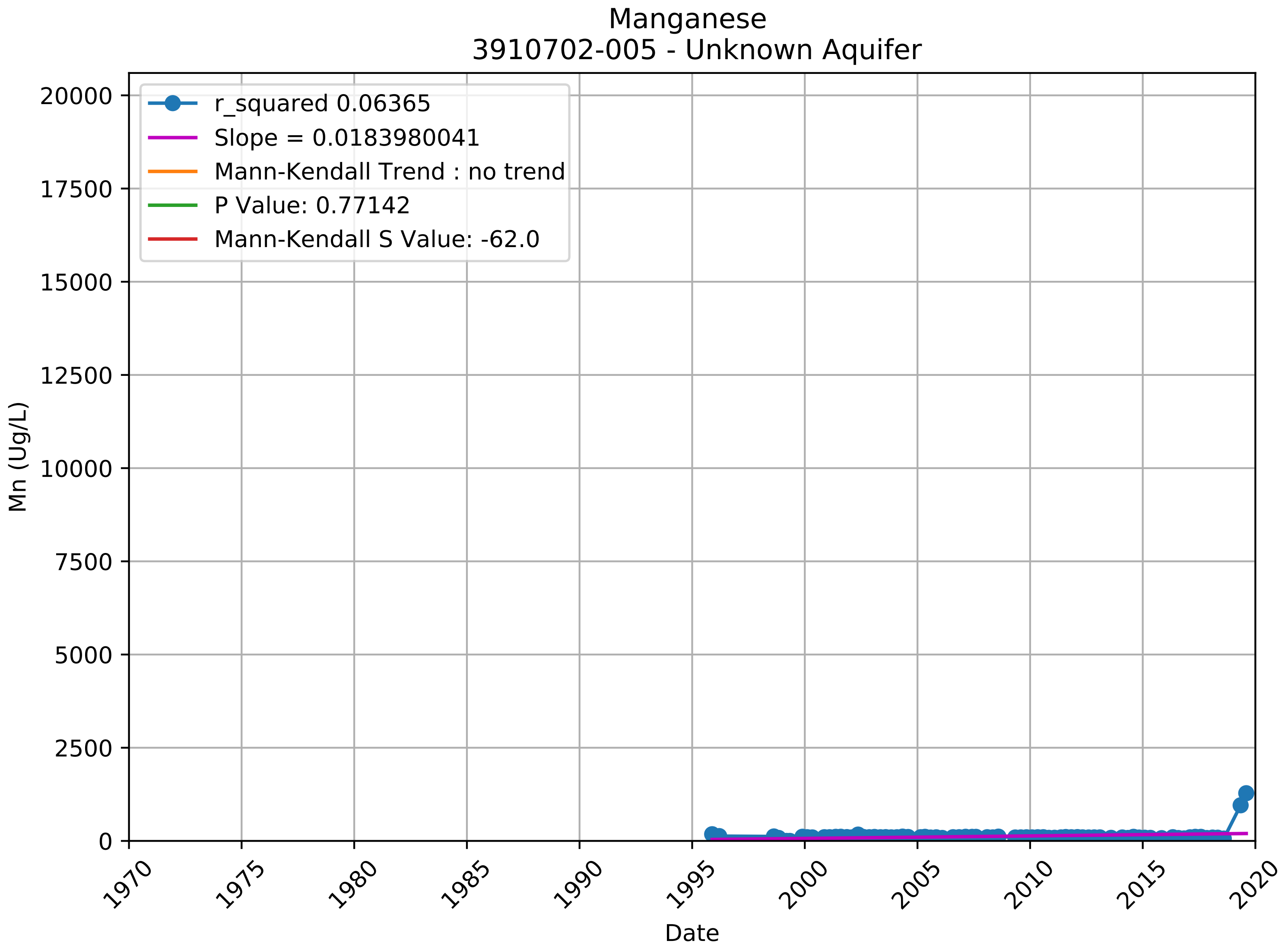

Manganese
3910702-005 - Unknown Aquifer
r_squared 0.06365
Slope = 0.0183980041
Mann-Kendall Trend : no trend
P Value: 0.77142
Mann-Kendall S Value: -62.0
Mn (Ug/L)
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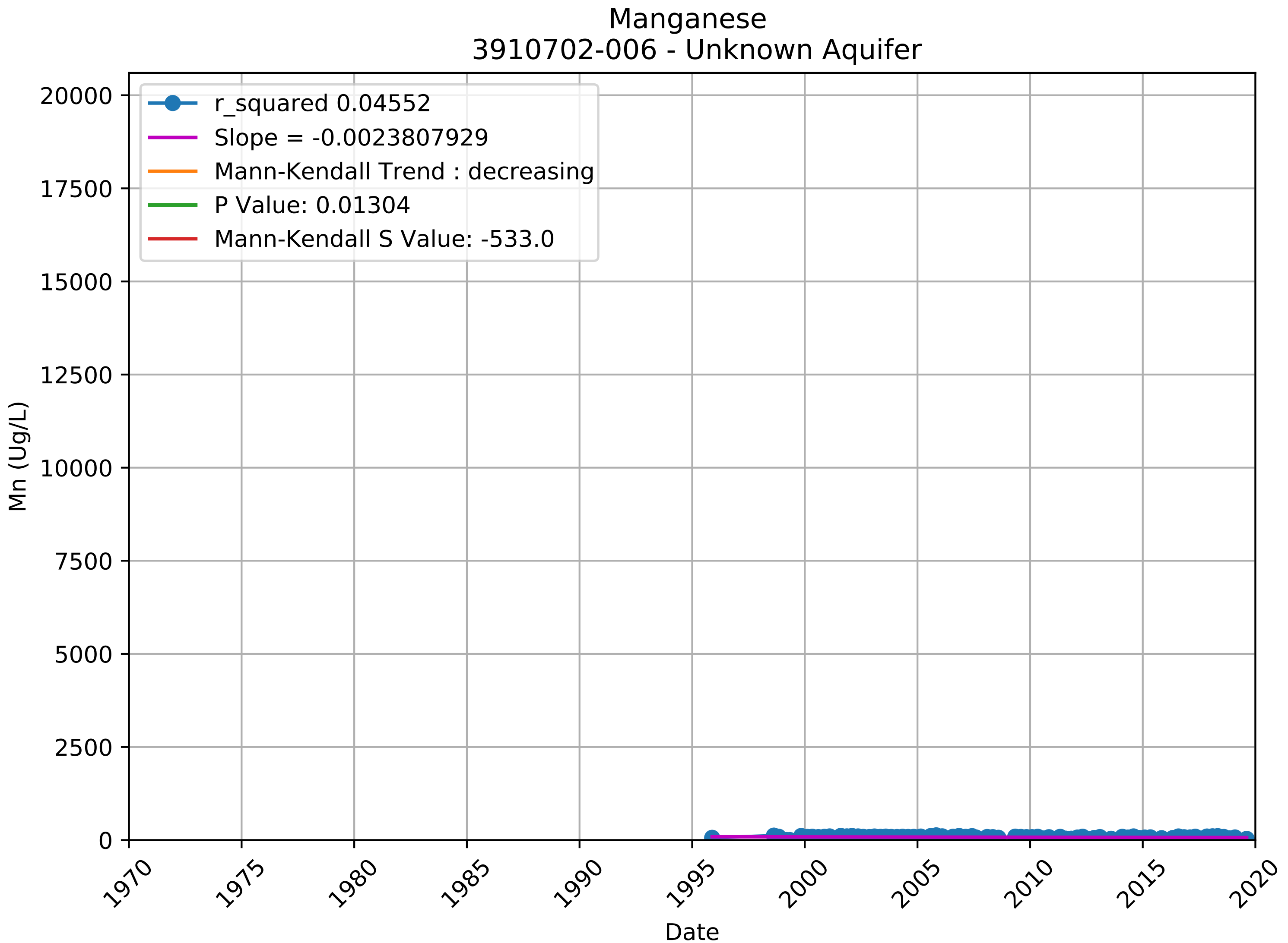

Manganese
3910702-006 - Unknown Aquifer
r_squared 0.04552
Slope = -0.0023807929
Mann-Kendall Trend : decreasing
P Value: 0.01304
Mann-Kendall S Value: -533.0
Mn (Ug/L)
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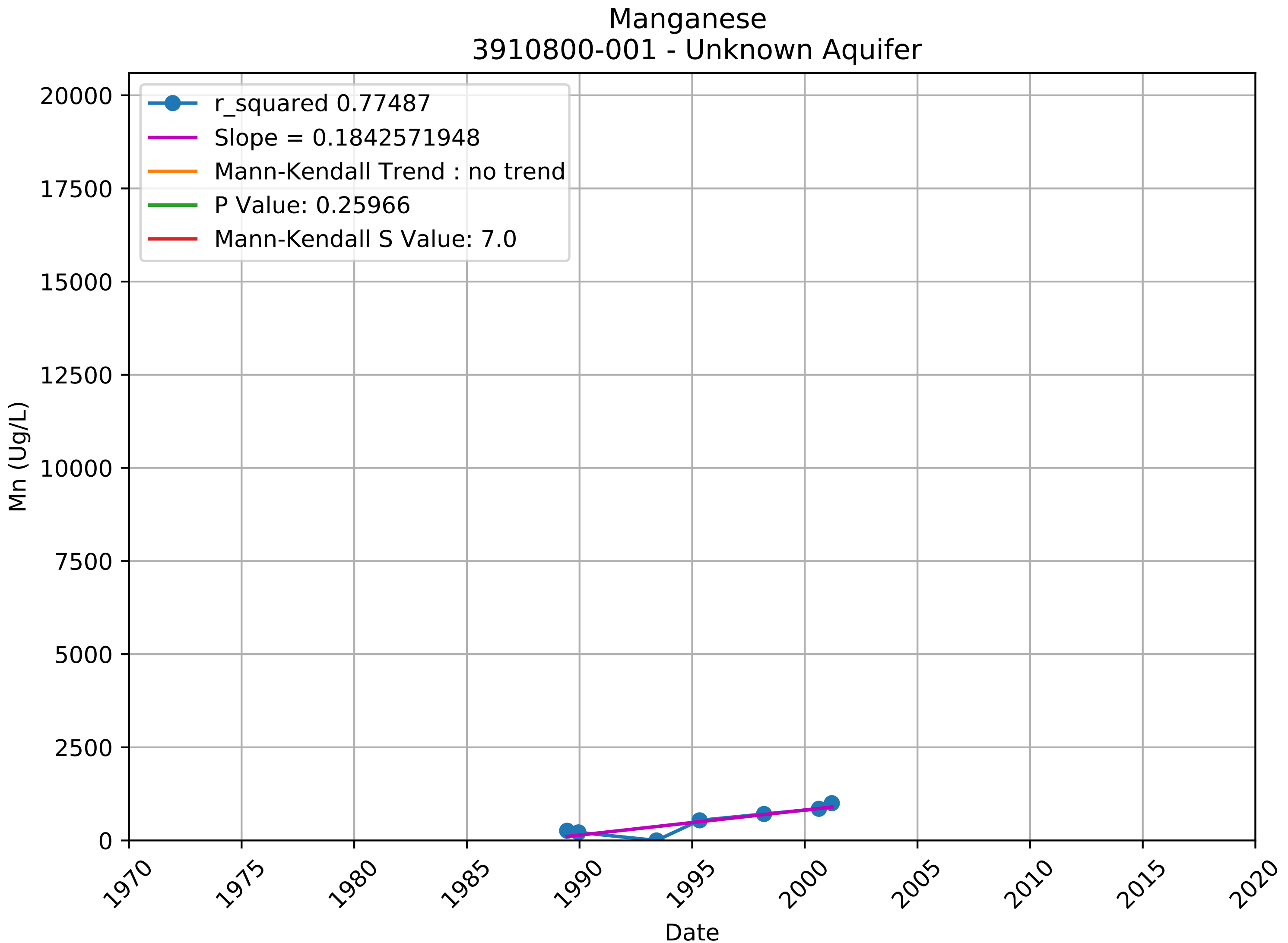

Manganese
3910800-001 - Unknown Aquifer
r_squared 0.77487
Slope = 0.1842571948
Mann-Kendall Trend : no trend
P Value: 0.25966
Mann-Kendall S Value: 7.0
Mn (Ug/L)
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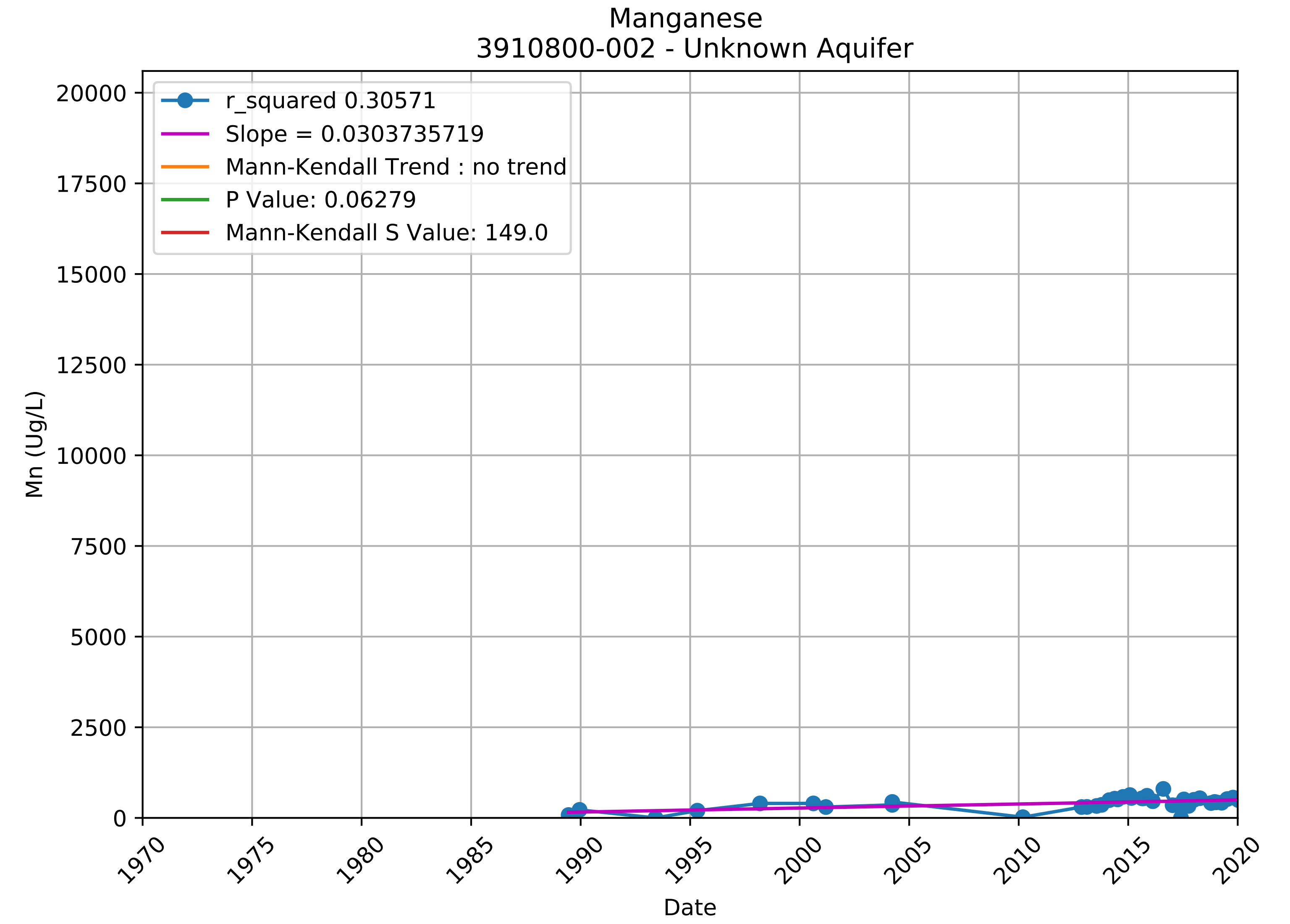

Manganese
3910800-002 - Unknown Aquifer
r_squared 0.30571
Slope = 0.0303735719
Mann-Kendall Trend : no trend
P Value: 0.06279
Mann-Kendall S Value: 149.0
Mn (Ug/L)
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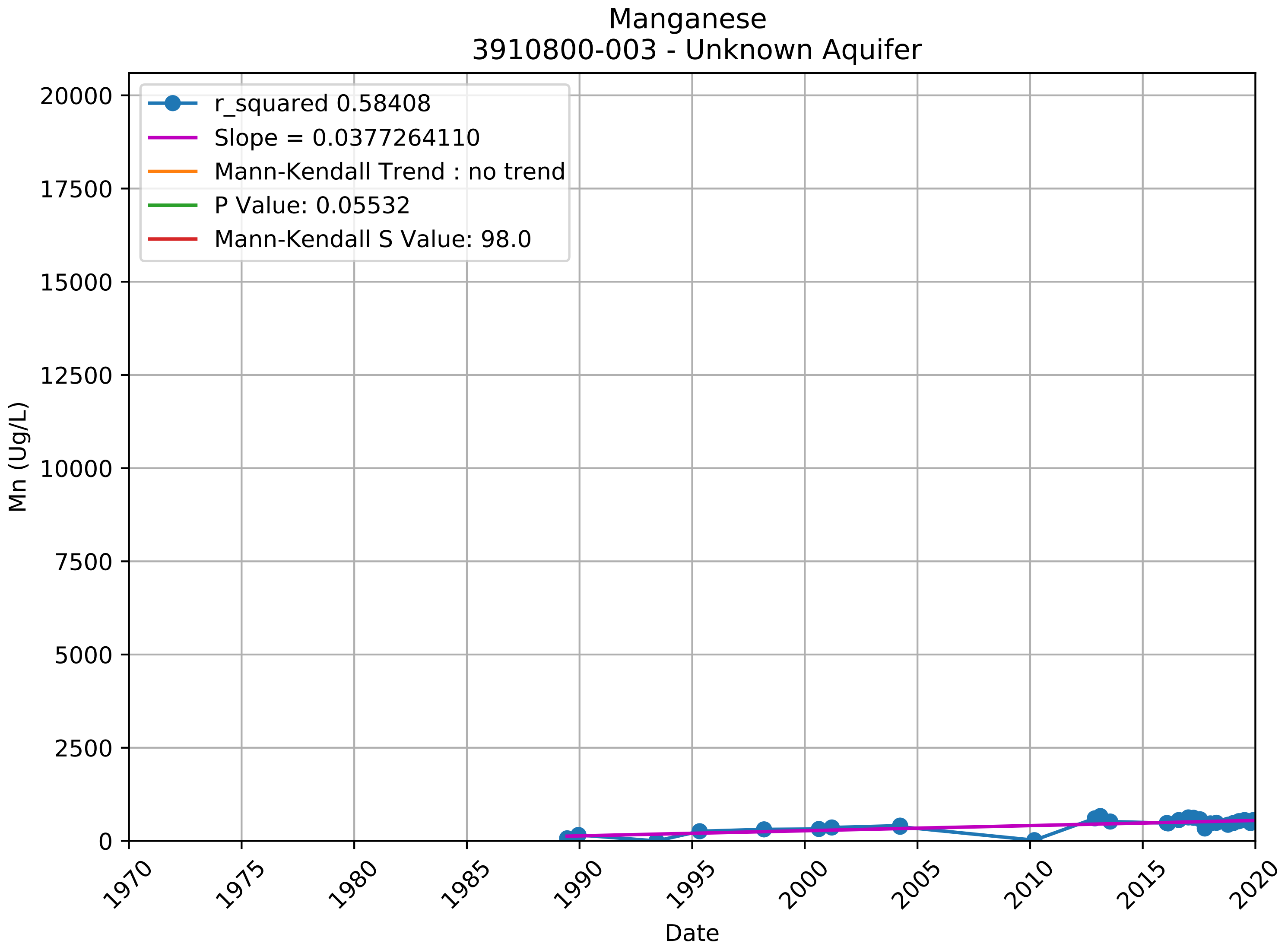
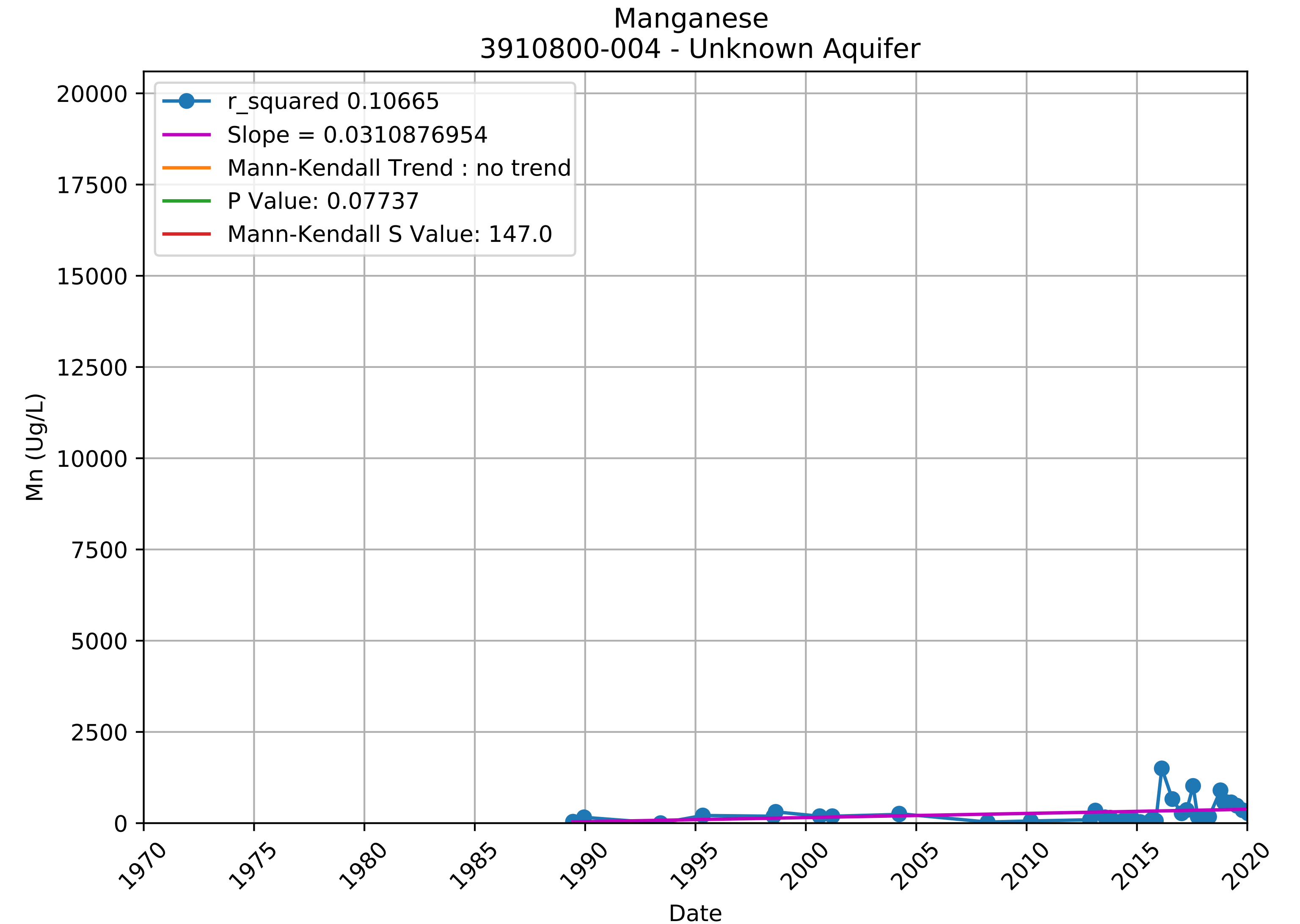
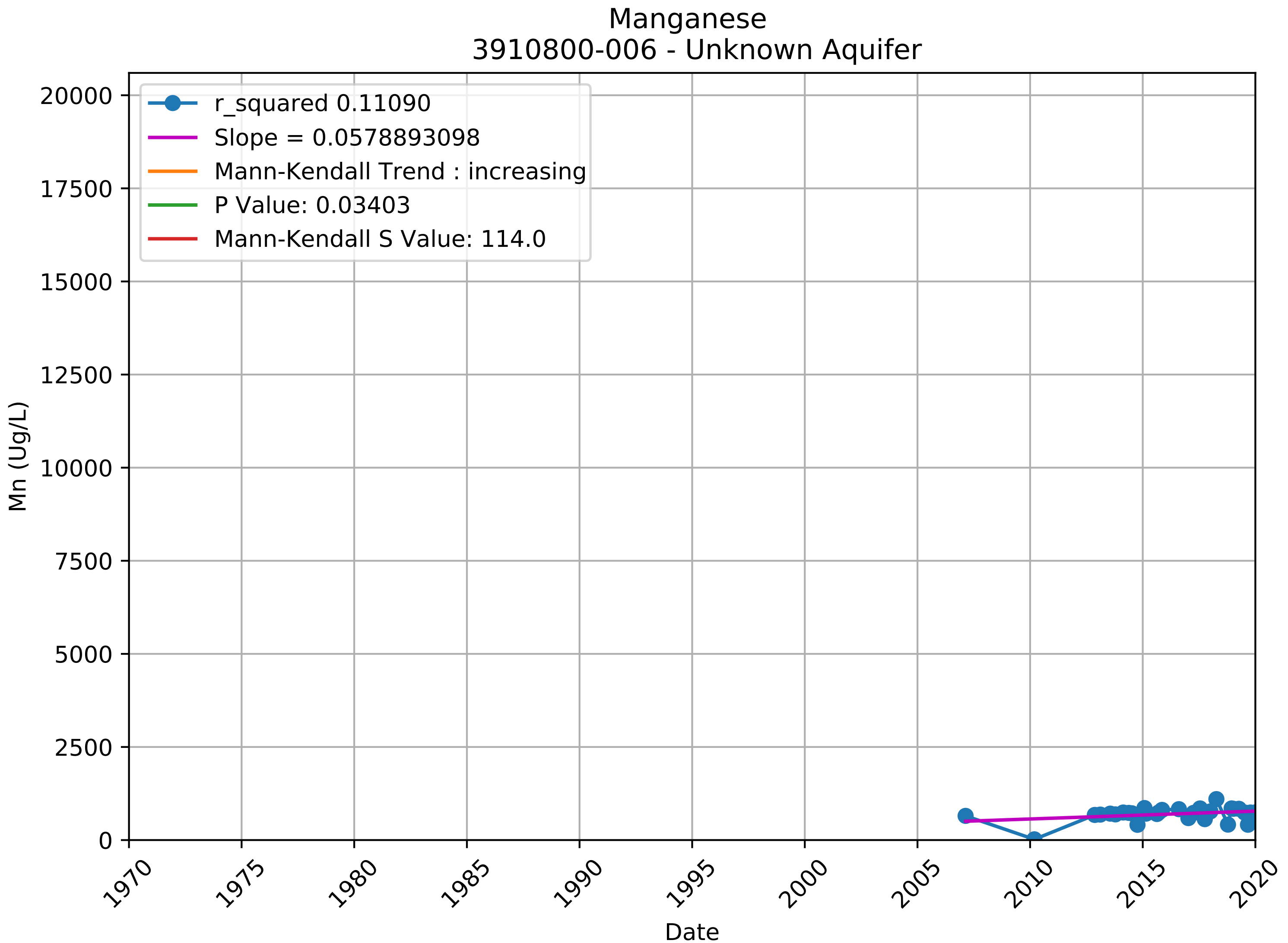


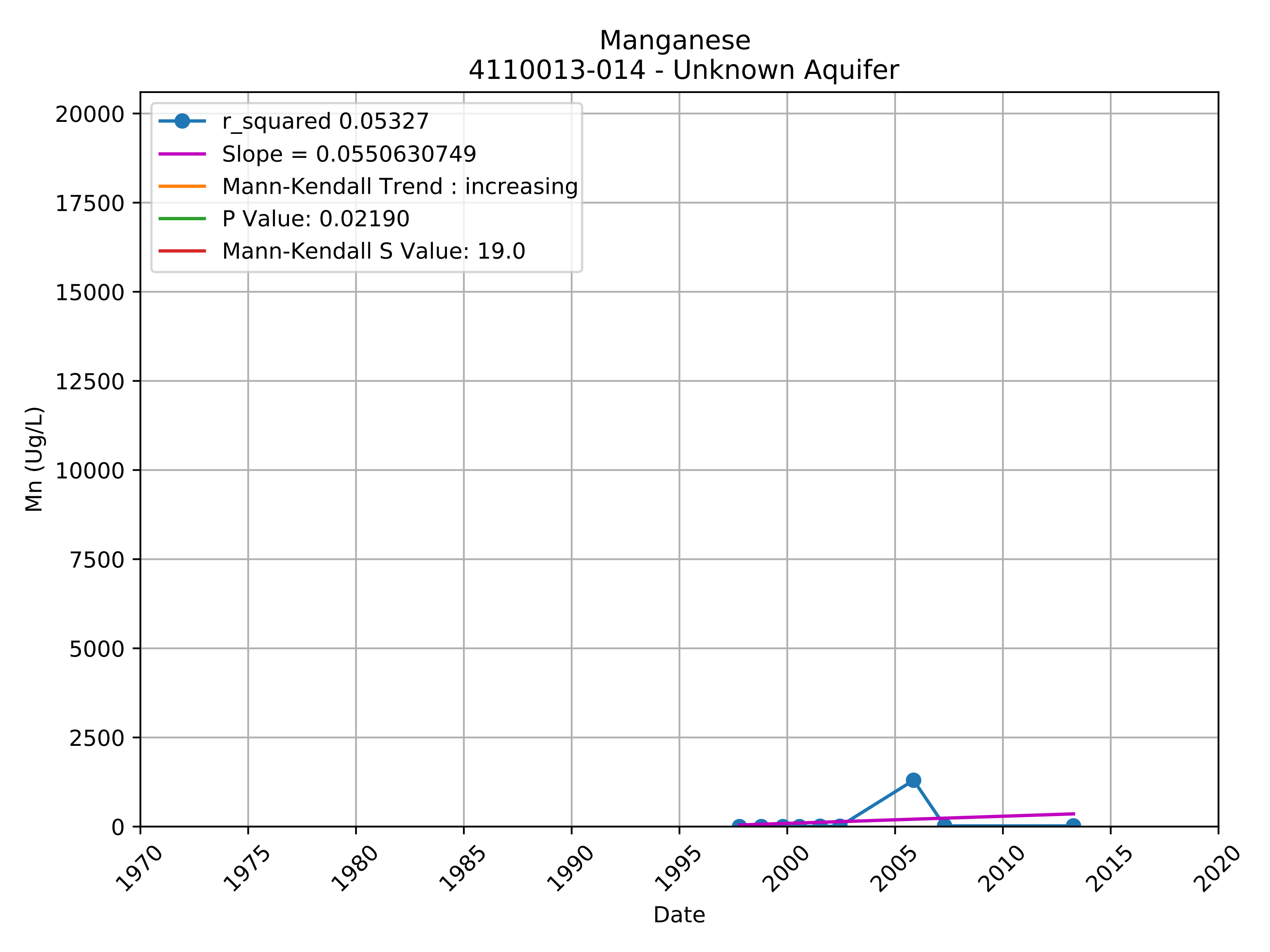
Manganese
3910800-003 - Unknown Aquifer
r_squared 0.58408
Slope = 0.0377264110
Mann-Kendall Trend : no trend
P Value: 0.05532
Mann-Kendall S Value: 98.0
Mn (Ug/L)
20000
17500
15000
12500
10000
7500
5000
2500
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



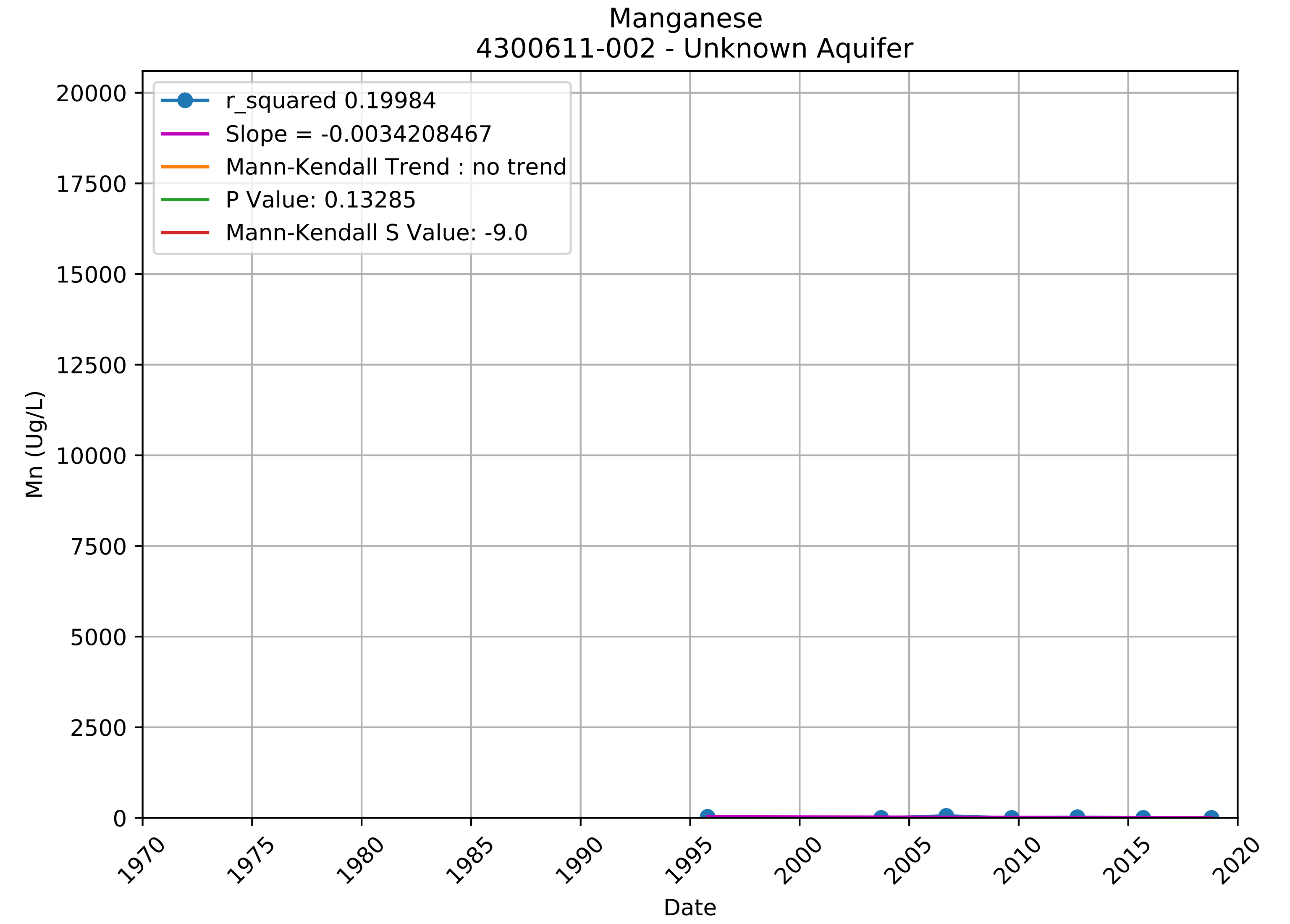
Manganese
3910800-004 - Unknown Aquifer
r_squared 0.10665
Slope = 0.0310876954
Mann-Kendall Trend : no trend
P Value: 0.07737
Mann-Kendall S Value: 147.0
Mn (Ug/L)
Date
0
2500
5000
7500
10000
12500
15000
17500
20000
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



Manganese
3910800-006 - Unknown Aquifer
r_squared 0.11090
Slope = 0.0578893098
Mann-Kendall Trend : increasing
P Value: 0.03403
Mann-Kendall S Value: 114.0
Mn (Ug/L)
0
2500
5000
7500
10000
12500
15000
17500
20000
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



Manganese
4110013-014 - Unknown Aquifer
r_squared 0.05327
Slope = 0.0550630749
Mann-Kendall Trend : increasing
P Value: 0.02190
Mann-Kendall S Value: 19.0
Mn (Ug/L)
Date
0
2500
5000
7500
10000
12500
15000
17500
20000
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

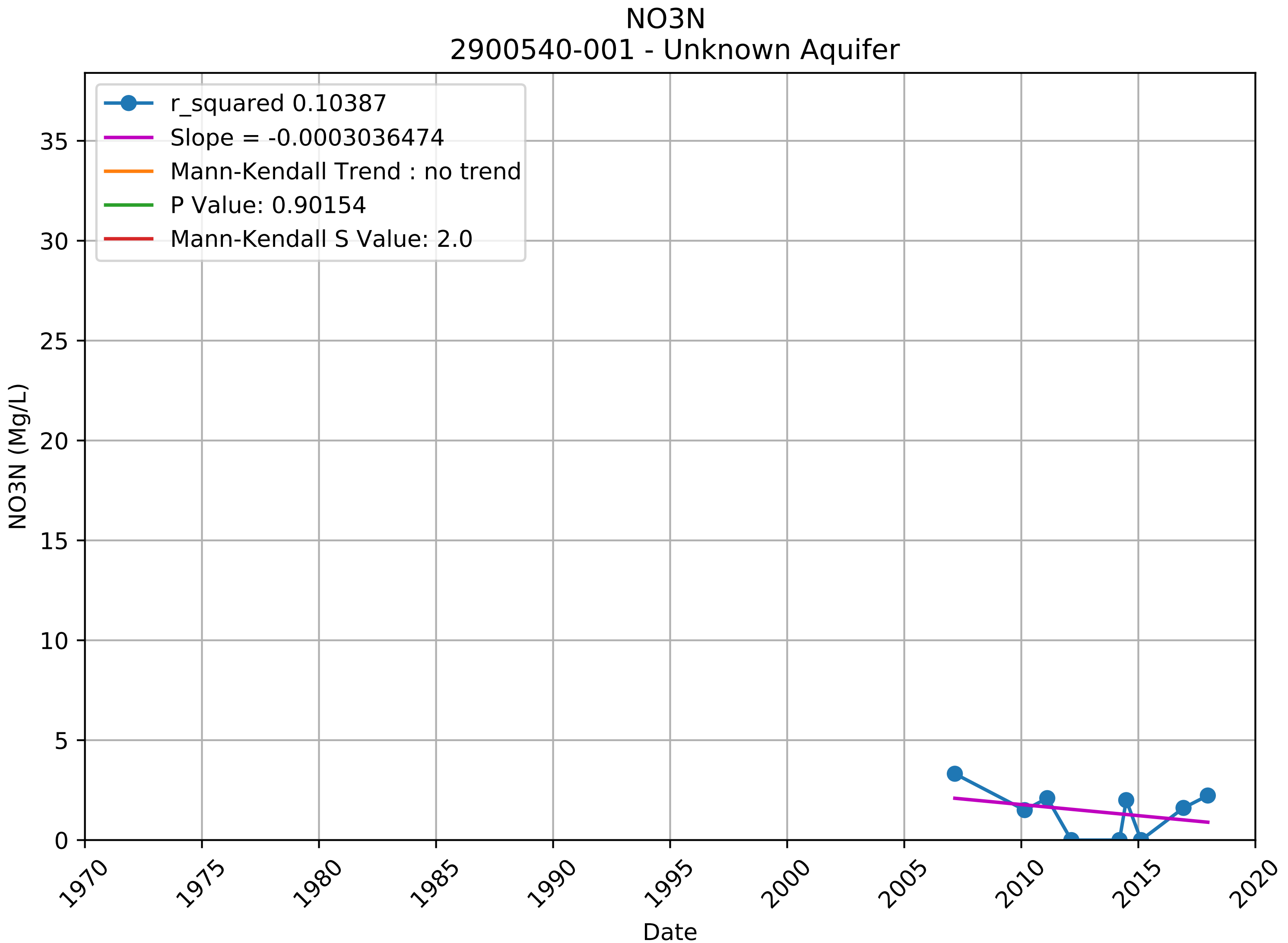


Manganese
4300611-002 - Unknown Aquifer
r_squared 0.19984
Slope = -0.0034208467
Mann-Kendall Trend : no trend
P Value: 0.13285
Mann-Kendall S Value: -9.0
Mn (Ug/L)
Date
0
2500
5000
7500
10000
12500
15000
17500
20000
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

Nitrate as Nitrogen

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
3910011-007	37.714471	-121.426009	NO3N	FALSE	0.533	-9	-0.164	no trend	165	-0.623	Unknown
3910011-010	37.736372	-121.435351	NO3N	FALSE	0.256	36	0.189	no trend	950	1.136	Unknown
3910702-003	37.705557	-121.39764	NO3N	TRUE	0.01	625	0.198	increasing	57930.33	2.593	Unknown
3910701-003	37.85144	-121.2682	NO3N	FALSE	0.462	134	0.062	no trend	32648.67	0.736	Unknown
3910701-001	37.849584	-121.268763	NO3N	TRUE	0.012	-291	-0.247	decreasing	13443.67	-2.501	Unknown
3910011-017	37.738215	-121.419962	NO3N	FALSE	0.074	21	0.467	no trend	125	1.789	Unknown
3910018-001	37.679751	-121.272617	NO3N	FALSE	0.085	-117	-0.209	no trend	4550.333	-1.72	Unknown
3901035-001	37.805066	-121.450392	NO3N	FALSE	0.669	8	0.103	no trend	268.667	0.427	Unknown
3901001-001	37.696111	-121.398611	NO3N	FALSE	0.415	28	0.133	no trend	1096.667	0.815	Unknown
4300611-002	37.994444	-121.499722	NO3N	FALSE	0.809	9	0.043	no trend	1095.667	0.242	Unknown
3901017-001	37.63	-121.39	NO3N	FALSE	0.089	-6	-1	no trend	8.667	-1.698	Unknown
3901015-001	37.805066	-121.450392	NO3N	TRUE	0.008	-62	-0.405	decreasing	523.333	-2.666	Unknown
3901010-001	38.037472	-121.494583	NO3N	FALSE	0.05	51	0.298	no trend	651	1.96	Unknown
3901006-001	37.718897	-121.537176	NO3N	FALSE	0.12	42	0.275	no trend	696	1.554	Unknown
3901011-001	37.695843	-121.434174	NO3N	FALSE	0.581	-18	-0.095	no trend	950	-0.552	Unknown
3901116-001	37.739218	-121.399037	NO3N	FALSE	0.323	-12	-0.267	no trend	124	-0.988	Unknown
3601013-001	37.818722	-121.460778	NO3N	FALSE	0.568	39	0.07	no trend	4417.667	0.572	Unknown
3910015-005	37.816859	-121.266705	NO3N	FALSE	0.978	3	0.005	no trend	5389	0.027	Upper
3910011-003	37.683959	-121.439427	NO3N	FALSE	0.307	73	0.123	no trend	4958.333	1.023	Lower
3910800-002	37.744188	-121.32701	NO3N	FALSE	0.54	32	0.079	no trend	2562.667	0.612	Unknown
3910800-003	37.74545	-121.32897	NO3N	FALSE	0.71	18	0.051	no trend	2082.667	0.373	Unknown
3910800-001	37.744746	-121.327221	NO3N	FALSE	0.063	-18	-0.5	no trend	83.333	-1.862	Unknown
3910800-004	37.74591	-121.336213	NO3N	FALSE	0.113	82	0.202	no trend	2618.667	1.583	Unknown
3100014-001	37.716956	-121.379533	NO3N	TRUE	0.042	-46	-0.338	decreasing	488.667	-2.036	Unknown
3910701-005	37.851301	-121.2673	NO3N	FALSE	0.668	75	0.037	no trend	29786.33	0.429	Unknown
3910011-004	37.682308	-121.436988	NO3N	FALSE	0.851	11	0.027	no trend	2829.667	0.188	Lower
3910011-006	37.686539	-121.443515	NO3N	FALSE	0.107	-105	-0.199	no trend	4164.333	-1.612	Lower
3910011-005	37.683353	-121.443313	NO3N	TRUE	0.003	240	0.341	increasing	6322	3.006	Lower
3910015-006	37.818884	-121.266416	NO3N	FALSE	0.066	104	0.239	no trend	3140.667	1.838	Upper
3910015-007	37.811547	-121.263915	NO3N	FALSE	0.099	-148	-0.18	no trend	7926.667	-1.651	Upper
3910015-008	37.801132	-121.262514	NO3N	TRUE	0.002	181	0.389	increasing	3461.667	3.059	Upper
3910011-018	37.743262	-121.424805	NO3N	FALSE	0.191	-85	-0.161	no trend	4135	-1.306	Lower
3910018-004	37.679705	-121.272761	NO3N	FALSE	0.379	-100	-0.089	no trend	12658.67	-0.88	Unknown
3910701-007	37.851431	-121.265247	NO3N	FALSE	0.707	-21	-0.052	no trend	2841	-0.375	Unknown
3910702-006	37.709972	-121.390802	NO3N	TRUE	0	842	0.32	increasing	42145.33	4.097	Unknown
3910702-005	37.708149	-121.393881	NO3N	TRUE	0.008	547	0.208	increasing	41804.33	2.67	Unknown
4110013-014	37.7	-121.466667	NO3N	TRUE	0.001	729	0.277	increasing	44031.67	3.469	Unknown
3900993-001	37.668527	-121.323805	NO3N	TRUE	0.035	-119	-0.274	decreasing	3141.667	-2.105	Unknown
3901396-001	37.856888	-121.279555	NO3N	FALSE	0.726	-11	-0.064	no trend	815	-0.35	Unknown
3901398-001	37.716956	-121.379533	NO3N	TRUE	0.017	-345	-0.216	decreasing	20852.33	-2.382	Unknown
3400391-001	37.717581	-121.456832	NO3N	FALSE	0.138	37	0.272	no trend	588.333	1.484	Unknown
3900991-001	37.743544	-121.461428	NO3N	FALSE	0.322	176	0.085	no trend	31200	0.991	Unknown
3910011-030	37.740208	-121.439285	NO3N	TRUE	0	-270	-0.481	decreasing	4474.667	-4.021	Lower
3900719-001	37.7685	-121.35325	NO3N	TRUE	0.037	-63	-0.332	decreasing	883.667	-2.086	Unknown
3901348-002	37.702894	-121.406986	NO3N	FALSE	0.634	-29	-0.062	no trend	3461.667	-0.476	Unknown
3901181-001	37.692555	-121.428055	NO3N	TRUE	0.004	229	0.326	increasing	6327	2.866	Unknown
3900589-001	37.783862	-121.305584	NO3N	FALSE	0.433	4	0.4	no trend	14.667	0.783	Unknown
3901327-001	37.69	-121.44	NO3N	FALSE	0.673	17	0.067	no trend	1433.667	0.423	Unknown
3900818-001	37.85	-121.28	NO3N	FALSE	0.133	11	0.524	no trend	44.333	1.502	Unknown
3900556-001	37.78	-121.36	NO3N	FALSE	1	1	0.1	no trend	15.667	0	Unknown
3900557-001	37.79	-121.38	NO3N	FALSE	0.707	3	0.2	no trend	28.333	0.376	Unknown
3900557-002	37.79	-121.4	NO3N	FALSE	0.848	2	0.133	no trend	27.333	0.191	Unknown
3900555-001	37.7685	-121.35325	NO3N	FALSE	0.336	10	0.278	no trend	87.333	0.963	Unknown
3600756-001	38.037472	-121.494583	NO3N	FALSE	0.602	6	0.167	no trend	92	0.521	Unknown
3901409-001	37.709642	-121.426004	NO3N	FALSE	0.202	32	0.235	no trend	589.333	1.277	Unknown
3901342-001	37.980357	-121.487177	NO3N	FALSE	0.592	-16	-0.084	no trend	784	-0.536	Unknown
3901204-001	37.85	-121.27	NO3N	FALSE	0.312	5	0.5	no trend	15.667	1.011	Unknown
3901320-001	37.712722	-121.379138	NO3N	FALSE	0.475	-28	-0.111	no trend	1430.667	-0.714	Unknown
2900540-001	37.709642	-121.426004	NO3N	FALSE	0.902	2	0.071	no trend	65.333	0.124	Unknown
3901305-007	37.741365	-121.399277	NO3N	FALSE	0.621	11	0.105	no trend	408.333	0.495	Unknown
3900713-001	37.84	-121.44	NO3N	FALSE	1	0	0	no trend	0	0	Unknown
3901378-002	37.743671	-121.362772	NO3N	FALSE	0.421	106	0.077	no trend	16995.33	0.805	Unknown
3901172-002	37.636324	-121.399544	NO3N	FALSE	0.753	-42	-0.03	no trend	16995.33	-0.314	Unknown
3901172-003	37.632289	-121.39736	NO3N	FALSE	0.202	-32	-0.235	no trend	589.333	-1.277	Unknown
3900702-001	37.990639	-121.407056	NO3N	FALSE	0.327	29	0.17	no trend	817	0.98	Unknown
3900805-002	37.73886	-121.399853	NO3N	TRUE	0.017	54	0.45	increasing	493.333	2.386	Unknown
3900583-001	37.84	-121.44	NO3N	TRUE	0.024	68	0.324	increasing	882	2.256	Unknown
3900810-001	37.804543	-121.267078	NO3N	FALSE	0.115	24	0.364	no trend	212.667	1.577	Unknown
3901001-002	37.69	-121.39	NO3N	FALSE	0.155	27	0.297	no trend	333.667	1.423	Unknown
3901348-001	37.708679	-121.412023	NO3N	FALSE	0.764	3	0.143	no trend	44.333	0.3	Unknown
3901216-002	37.74753	-121.516649	NO3N	FALSE	0.306	28	0.183	no trend	696	1.023	Unknown
3900559-001	37.79	-121.38	NO3N	FALSE	0.266	28	0.206	no trend	589.333	1.112	Unknown

3901283-001	37.667467	-121.361198	NO3N	FALSE	0.128	122	0.174	no trend	6326	1.521	Unknown
3900558-002	37.79	-121.4	NO3N	TRUE	0.008	68	0.398	increasing	643.333	2.642	Unknown
3901338-001	37.693705	-121.413813	NO3N	FALSE	0.338	-47	-0.134	no trend	2301	-0.959	Unknown
3901299-001	37.753624	-121.372933	NO3N	FALSE	0.592	-14	-0.103	no trend	589.333	-0.536	Unknown
3901383-001	37.955403	-121.424888	NO3N	FALSE	1	-1	-0.028	no trend	63.667	0	Unknown
3900616-002	37.988607	-121.404525	NO3N	FALSE	0.167	37	0.242	no trend	678.333	1.382	Unknown
3900616-001	37.990638	-121.407055	NO3N	FALSE	0.178	30	0.25	no trend	464	1.346	Unknown
3910011-034	37.752802	-121.434603	NO3N	FALSE	0.365	-49	-0.121	no trend	2813	-0.905	Lower
3910011-032	37.754682	-121.465249	NO3N	FALSE	0.404	-41	-0.117	no trend	2301	-0.834	Lower
3901348-003	37.698742	-121.409917	NO3N	TRUE	0.024	76	0.362	increasing	1096.667	2.265	Unknown
3901348-004	37.698147	-121.416153	NO3N	FALSE	0.763	11	0.052	no trend	1095.667	0.302	Unknown
3900974-001	37.742638	-121.366611	NO3N	TRUE	0.02	321	0.216	increasing	18975	2.323	Unknown
3901106-008	37.804969	-121.458072	NO3N	TRUE	0.028	57	0.333	increasing	651	2.195	Unknown
3900810-002	37.808086	-121.271346	NO3N	TRUE	0.024	34	0.515	increasing	212.667	2.263	Unknown
3900807-001	37.936416	-121.432916	NO3N	TRUE	0.002	65	0.542	increasing	427	3.097	Unknown
3900759-003	37.982798	-121.471581	NO3N	TRUE	0.036	41	0.39	increasing	363	2.099	Unknown
3901308-001	37.926727	-121.431152	NO3N	TRUE	0.015	23	0.639	increasing	82.333	2.425	Unknown
3901401-001	37.985559	-121.480458	NO3N	FALSE	0.571	13	0.108	no trend	449	0.566	Unknown
3901406-001	37.766333	-121.474027	NO3N	TRUE	0.005	345	0.271	increasing	15147	2.795	Unknown
3910015-013	37.792108	-121.274608	NO3N	FALSE	0.592	7	0.156	no trend	125	0.537	Unknown
3901301-001	37.927085	-121.425948	NO3N	TRUE	0.002	94	0.407	increasing	922	3.063	Unknown
377427N1213943W002	37.742656	-121.394318	NO3N	FALSE	0.276	23	0.219	no trend	408.333	1.089	Lower
377427N1213943W001	37.742656	-121.394318	NO3N	FALSE	0.92	-3	-0.029	no trend	401	-0.1	Lower
377427N1213943W003	37.742656	-121.394318	NO3N	FALSE	0.68	-9	-0.086	no trend	376.333	-0.412	Lower
377402N1214508W001	37.740187	-121.450762	NO3N	TRUE	0.01	52	0.495	increasing	388.667	2.587	Lower
377143N1214459W002	37.714305	-121.445905	NO3N	FALSE	1	0	0	no trend	407.333	0	Lower
377143N1214459W003	37.714305	-121.445905	NO3N	FALSE	0.166	-29	-0.276	no trend	408.333	-1.386	Lower
377402N1214508W003	37.740187	-121.450762	NO3N	FALSE	0.469	-15	-0.143	no trend	374.333	-0.724	Lower
377402N1214508W002	37.740187	-121.450762	NO3N	TRUE	0.039	-41	-0.39	decreasing	376.333	-2.062	Lower
377143N1214459W001	37.714305	-121.445905	NO3N	FALSE	1	0	0	no trend	363.333	0	Lower
3901310-001	37.740277	-121.403277	NO3N	FALSE	0.368	-7	-0.333	no trend	44.333	-0.901	Unknown
3901309-008	37.694682	-121.411996	NO3N	FALSE	0.692	-9	-0.086	no trend	408.333	-0.396	Unknown
3901397-007	37.759762	-121.508982	NO3N	FALSE	0.166	29	0.276	no trend	408.333	1.386	Unknown
377656N1214199W001	37.765631	-121.41992	NO3N	FALSE	0.134	-22	-0.333	no trend	196	-1.5	Lower
377656N1214199W002	37.765631	-121.41992	NO3N	FALSE	0.564	-7	-0.156	no trend	108.333	-0.576	Lower
377656N1214199W003	37.765631	-121.41992	NO3N	FALSE	0.077	-29	-0.372	no trend	251	-1.767	Lower
377149N1214257W003	37.714872	-121.425674	NO3N	FALSE	0.249	-17	-0.258	no trend	192.333	-1.154	Lower
377149N1214257W002	37.714872	-121.425674	NO3N	FALSE	0.511	-10	-0.152	no trend	187.333	-0.658	Lower
377149N1214257W001	37.714872	-121.425674	NO3N	FALSE	1	-1	-0.018	no trend	139.667	0	Lower
377031N1214485W002	37.703055	-121.448544	NO3N	FALSE	0.481	-12	-0.154	no trend	243.333	-0.705	Lower
377031N1214485W001	37.703055	-121.448544	NO3N	FALSE	0.504	-11	-0.141	no trend	223.667	-0.669	Lower
377031N1214485W003	37.703055	-121.448544	NO3N	FALSE	0.504	-11	-0.141	no trend	223.667	-0.669	Lower
3901336-008	37.7408	-121.401267	NO3N	FALSE	0.853	-8	-0.032	no trend	1428	-0.185	Unknown
3900588-001	37.74	-121.36	NO3N	FALSE	0.502	-12	-0.154	no trend	268.667	-0.671	Unknown
3910005-044	37.782808	-121.300937	NO3N	TRUE	0	21198	0.117	increasing	24300499	4.3	Unknown
3900593-001	37.891215	-121.488002	NO3N	TRUE	0.004	38	0.576	increasing	167.333	2.86	Unknown
3901435-007	37.64166	-121.397886	NO3N	FALSE	0.307	-161	-0.091	no trend	24582.33	-1.02	Unknown
3901449-001	37.891449	-121.512766	NO3N	FALSE	0.241	16	0.291	no trend	164	1.171	Unknown
3901426-007	37.799466	-121.415735	NO3N	FALSE	0.531	9	0.164	no trend	163	0.627	Unknown
3901430-001	37.891449	-121.512766	NO3N	TRUE	0	73	0.608	increasing	418.333	3.52	Unknown
3901107-013	37.695101	-121.39788	NO3N	FALSE	0.502	-12	-0.154	no trend	268.667	-0.671	Unknown
3901405-007	37.631659	-121.289884	NO3N	FALSE	0.228	-23	-0.253	no trend	333.667	-1.204	Unknown
3910800-006	37.744722	-121.329167	NO3N	FALSE	0.535	10	0.152	no trend	210.667	0.62	Unknown
3301280-002	37.712773	-121.37925	NO3N	FALSE	0.613	-3	-0.3	no trend	15.667	-0.505	Unknown
USGS-374046121155402	37.6793611	-121.2650278	NO3N	FALSE	0.575	17	0.099	no trend	812.333	0.561	Upper
USGS-374046121155401	37.6793611	-121.2650278	NO3N	FALSE	0.888	5	0.029	no trend	801.667	0.141	Upper
3901420-001	37.690618	-121.432012	NO3N	FALSE	0.271	-17	-0.258	no trend	211.667	-1.1	Unknown
3901299-007	37.753588	-121.373063	NO3N	FALSE	0.111	-33	-0.314	no trend	403.667	-1.593	Unknown
3901355-001	37.89	-121.48	NO3N	TRUE	0.003	41	0.621	increasing	182.333	2.962	Unknown
3900998-001	37.818722	-121.460777	NO3N	FALSE	0.071	23	0.418	no trend	148.333	1.806	Unknown
3601152-001	37.742639	-121.366611	NO3N	FALSE	0.174	-16	-0.356	no trend	122	-1.358	Unknown
3901338-007	37.693257	-121.414274	NO3N	FALSE	0.128	23	0.348	no trend	209	1.522	Unknown
3901388-007	37.986365	-121.474094	NO3N	FALSE	0.303	-13	-0.236	no trend	135.667	-1.03	Unknown
3910015-016	37.80114	-121.262596	NO3N	FALSE	0.371	11	0.244	no trend	125	0.894	Upper
3901320-008	37.712313	-121.378815	NO3N	FALSE	1	1	0.036	no trend	64.333	0	Unknown
3901116-007	37.739222	-121.399009	NO3N	FALSE	0.059	-17	-0.472	no trend	71.667	-1.89	Unknown
3901336-009	37.740646	-121.401135	NO3N	FALSE	0.386	-8	-0.286	no trend	65.333	-0.866	Unknown
3900805-008	37.737601	-121.398465	NO3N	FALSE	0.266	-10	-0.357	no trend	65.333	-1.113	Unknown
3900731-001	37.85	-121.27	NO3N	FALSE	1	0	0	no trend	16.667	0	Unknown
3901310-007	37.740293	-121.403473	NO3N	FALSE	0.06	11	0.733	no trend	28.333	1.879	Unknown
3901447-007	37.799466	-121.415735	NO3N	FALSE	0.339	6	0.4	no trend	27.333	0.956	Unknown
3901484-001	37.943625	-121.530755	NO3N	FALSE	0.119	9	0.6	no trend	26.333	1.559	Unknown


NO3N
2900540-001 - Unknown Aquifer
r_squared 0.10387
Slope = -0.0003036474
Mann-Kendall Trend : no trend
P Value: 0.90154
Mann-Kendall S Value: 2.0
NO3N (Mg/L)
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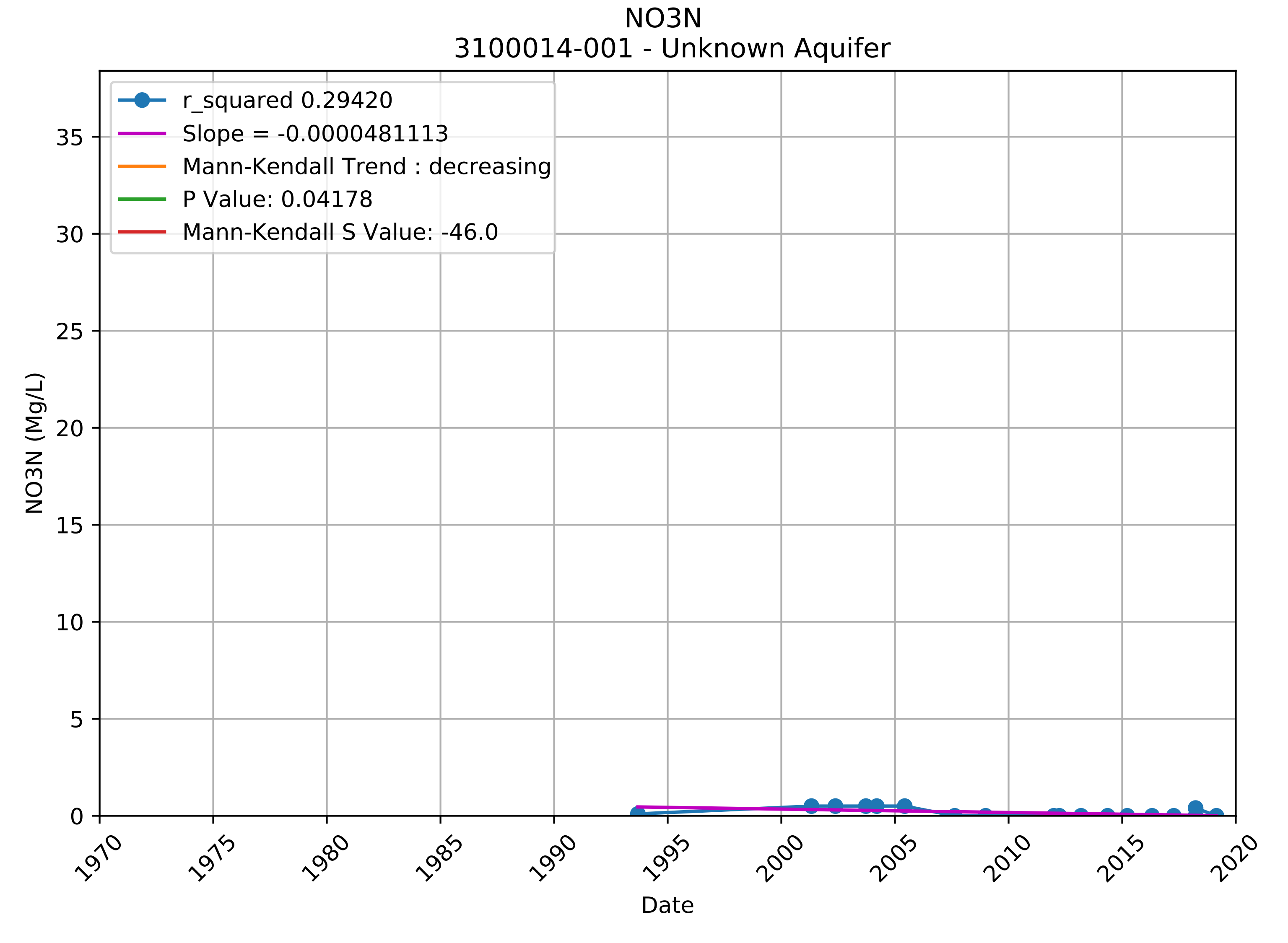

NO3N
3100014-001 - Unknown Aquifer
r_squared 0.29420
Slope = -0.0000481113
Mann-Kendall Trend : decreasing
P Value: 0.04178
Mann-Kendall S Value: -46.0
NO3N (Mg/L)
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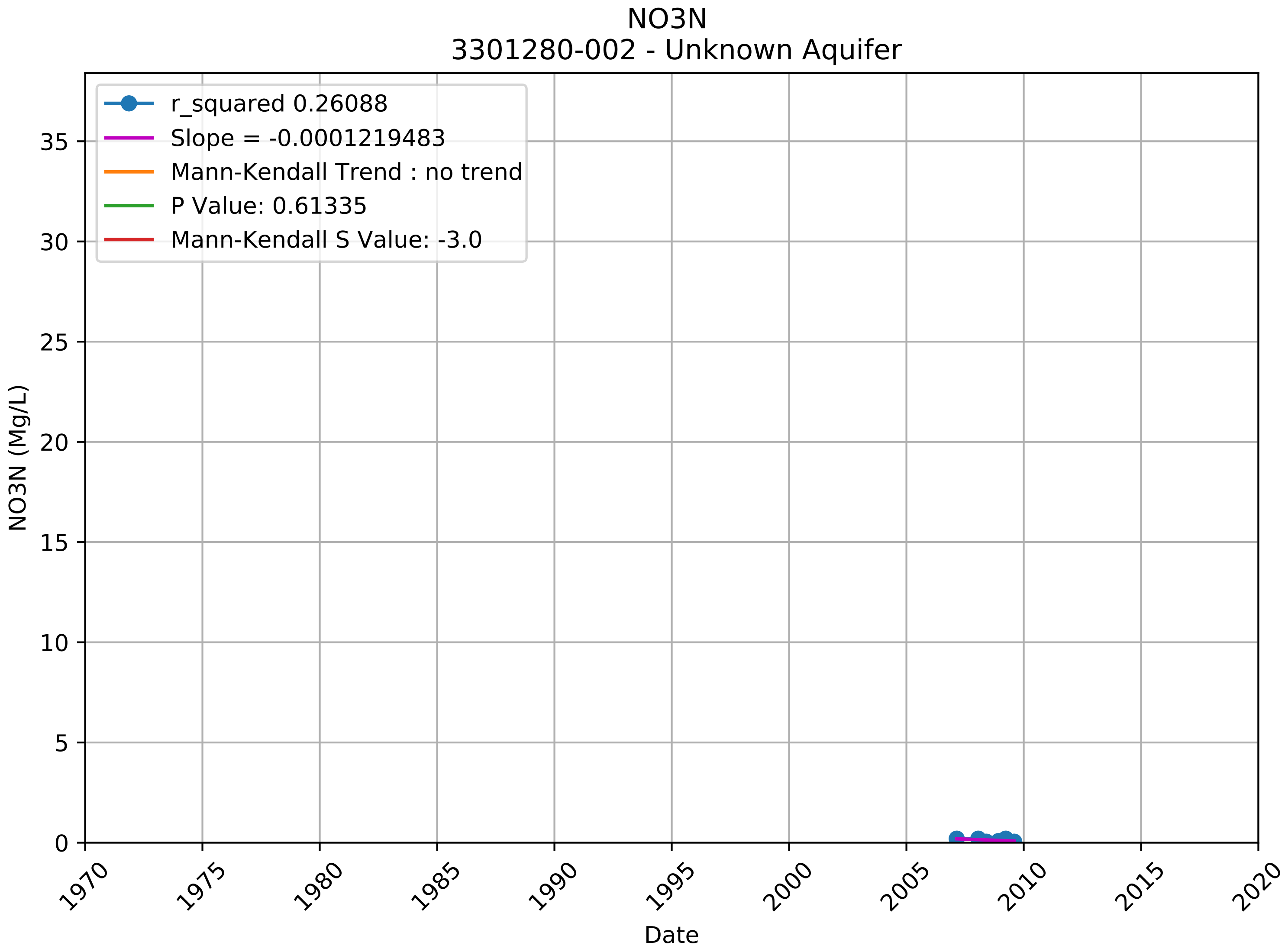

NO3N
3301280-002 - Unknown Aquifer
r_squared 0.26088
Slope = -0.0001219483
Mann-Kendall Trend : no trend
P Value: 0.61335
Mann-Kendall S Value: -3.0
NO3N (Mg/L)
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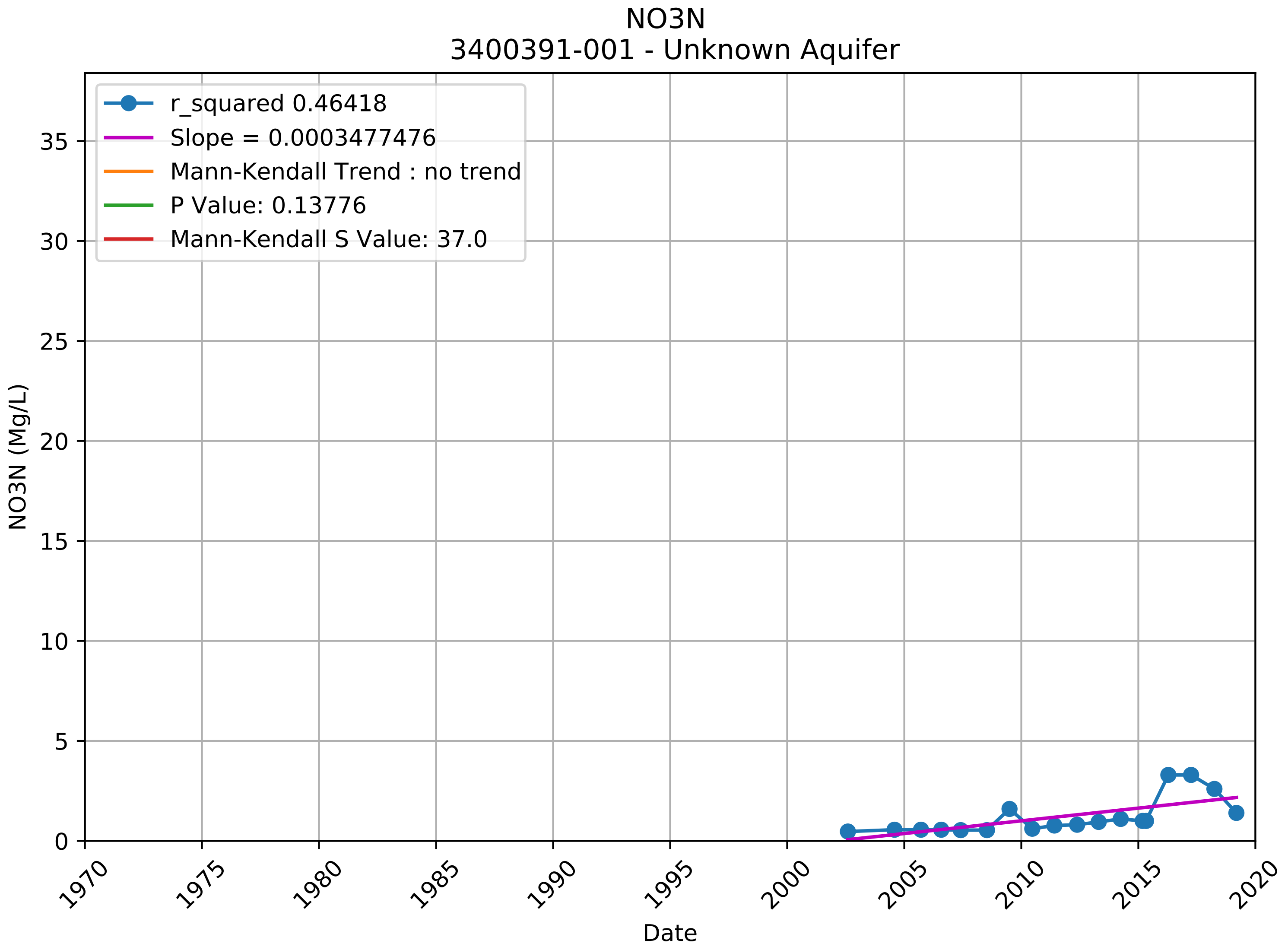
NO3N
3400391-001 - Unknown Aquifer
r_squared 0.46418
Slope = 0.0003477476
Mann-Kendall Trend : no trend
P Value: 0.13776
Mann-Kendall S Value: 37.0
NO3N (Mg/L)
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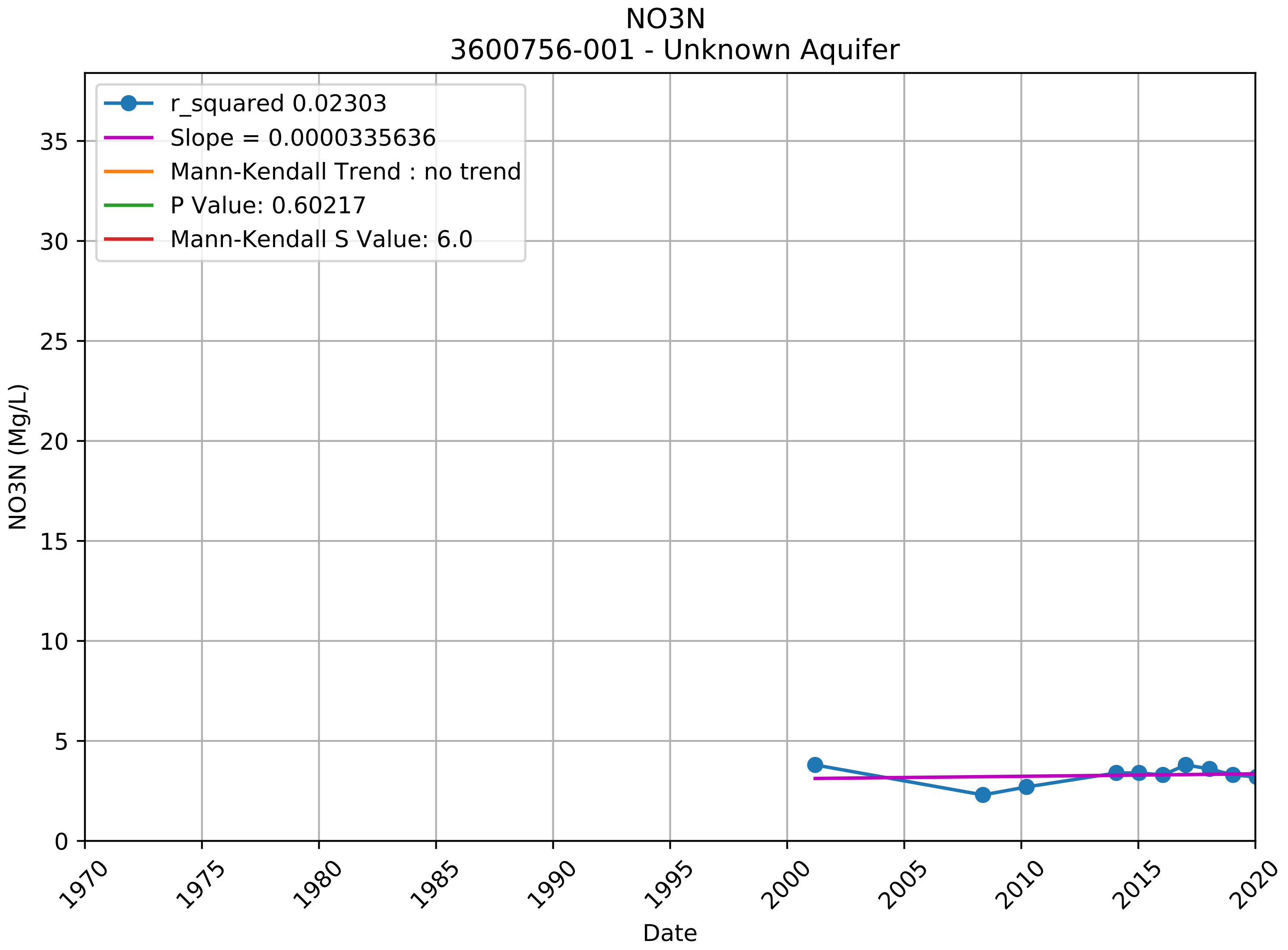
NO3N
3600756-001 - Unknown Aquifer
r_squared 0.02303
Slope = 0.0000335636
Mann-Kendall Trend : no trend
P Value: 0.60217
Mann-Kendall S Value: 6.0
NO3N (Mg/L)
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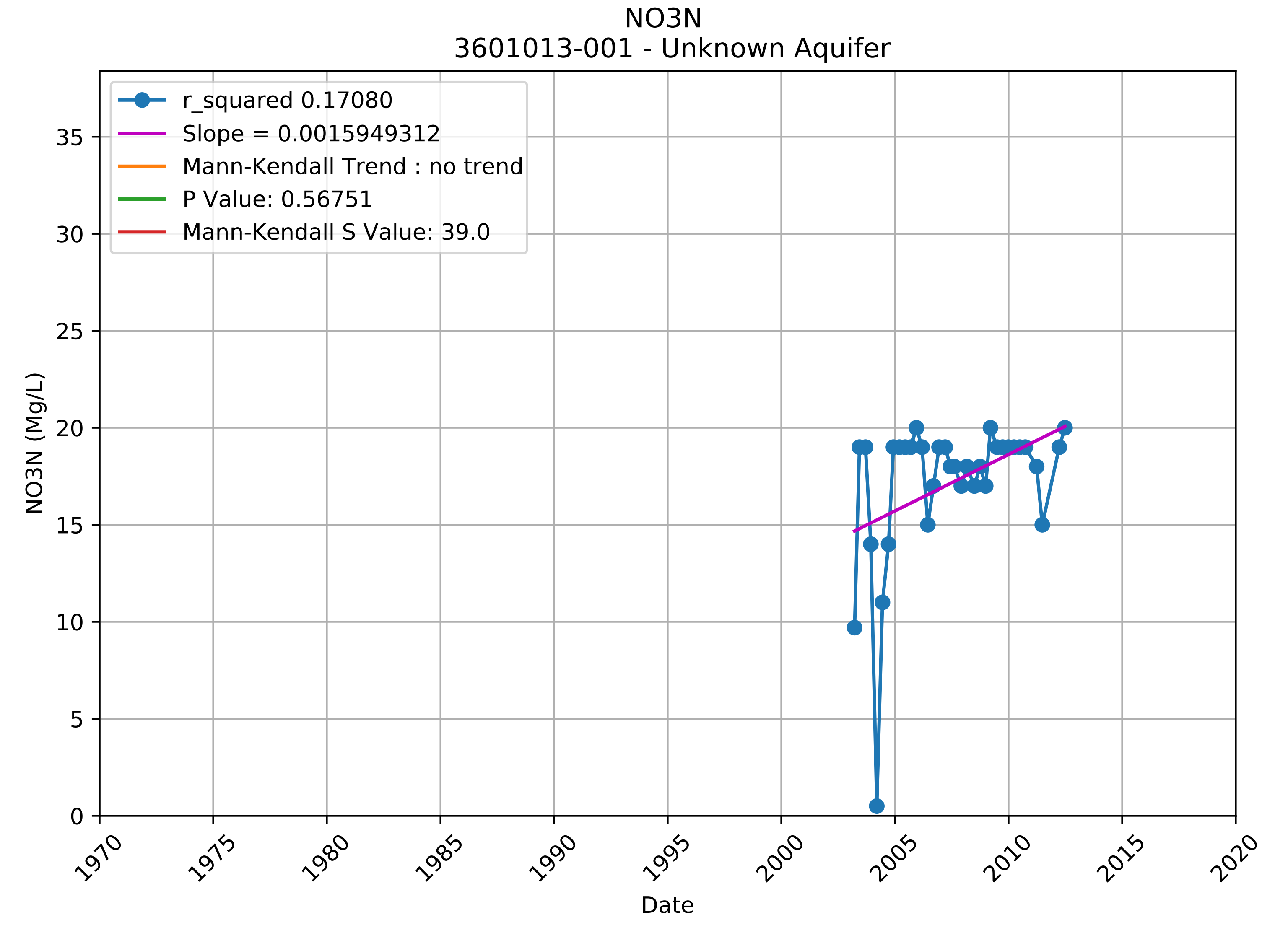
NO3N
3601013-001 - Unknown Aquifer
r_squared 0.17080
Slope = 0.0015949312
Mann-Kendall Trend : no trend
P Value: 0.56751
Mann-Kendall S Value: 39.0
NO3N (Mg/L)
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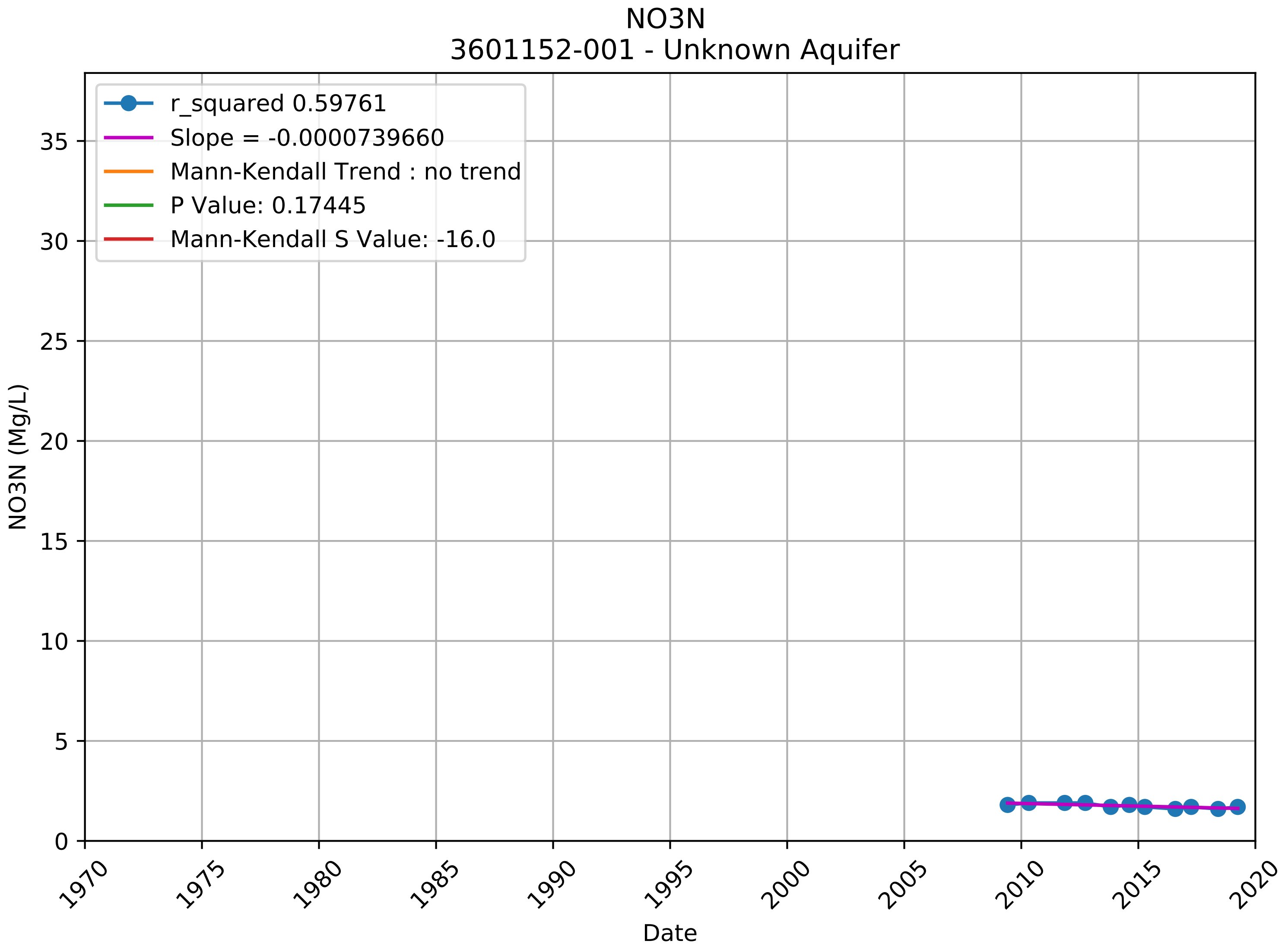

NO3N
3601152-001 - Unknown Aquifer
r_squared 0.59761
Slope = -0.0000739660
Mann-Kendall Trend : no trend
P Value: 0.17445
Mann-Kendall S Value: -16.0
NO3N (Mg/L)
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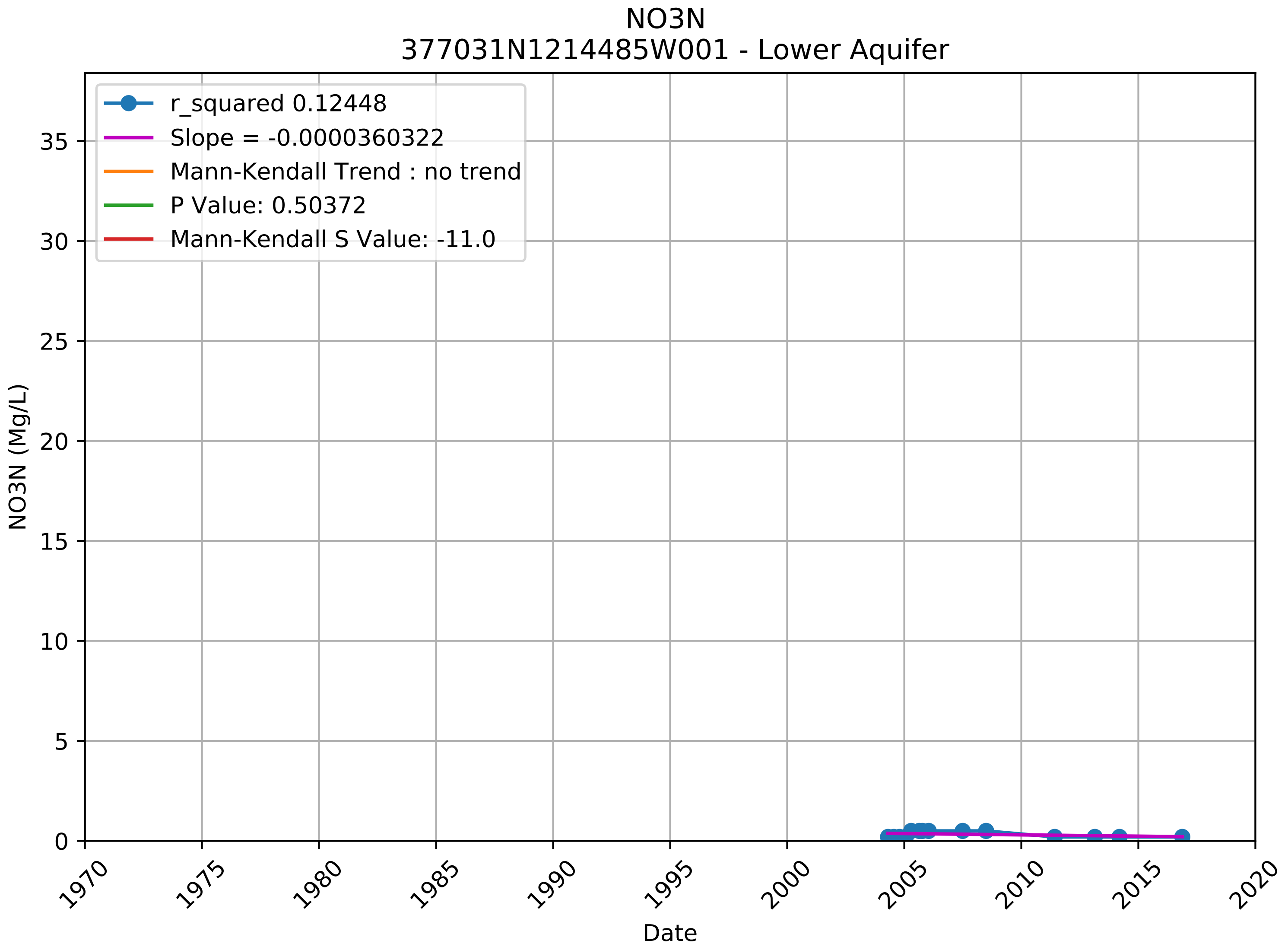

NO3N
377031N1214485W001 - Lower Aquifer
r_squared 0.12448
Slope = -0.0000360322
Mann-Kendall Trend : no trend
P Value: 0.50372
Mann-Kendall S Value: -11.0
NO3N (Mg/L)
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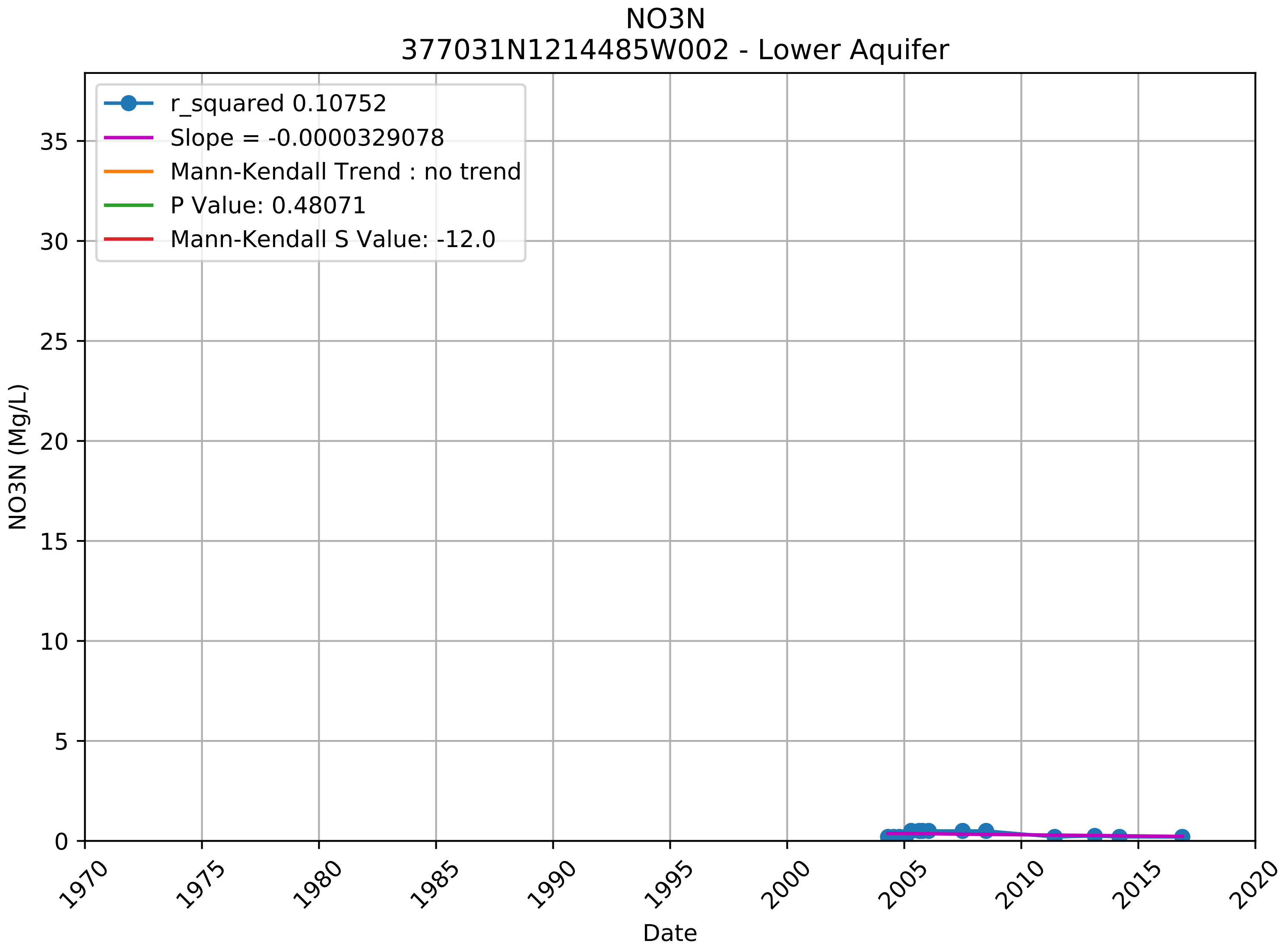

NO3N
377031N1214485W002 - Lower Aquifer
r_squared 0.10752
Slope = -0.0000329078
Mann-Kendall Trend : no trend
P Value: 0.48071
Mann-Kendall S Value: -12.0
NO3N (Mg/L)
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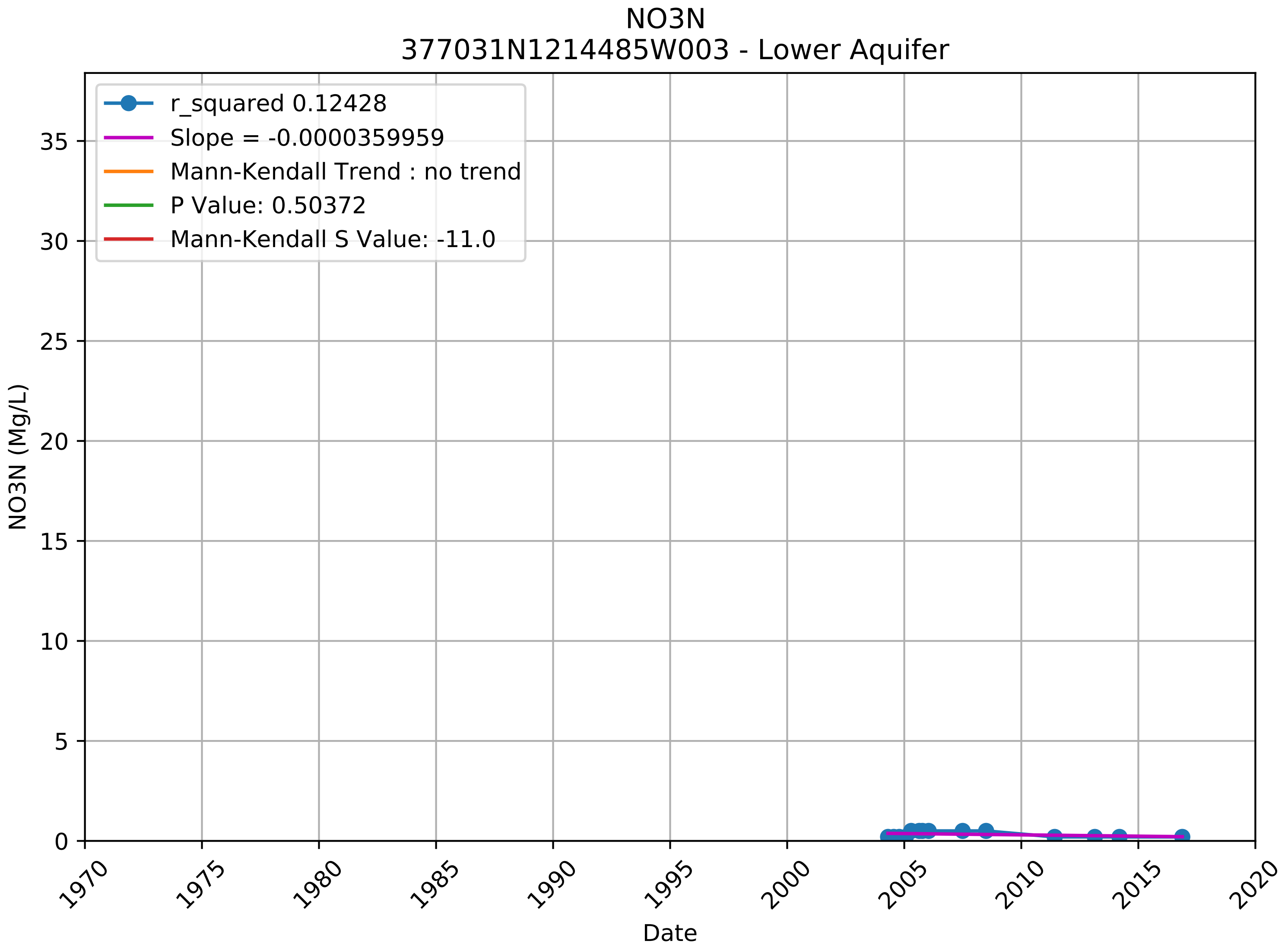

NO3N
377031N1214485W003 - Lower Aquifer
r_squared 0.12428
Slope = -0.0000359959
Mann-Kendall Trend : no trend
P Value: 0.50372
Mann-Kendall S Value: -11.0
NO3N (Mg/L)
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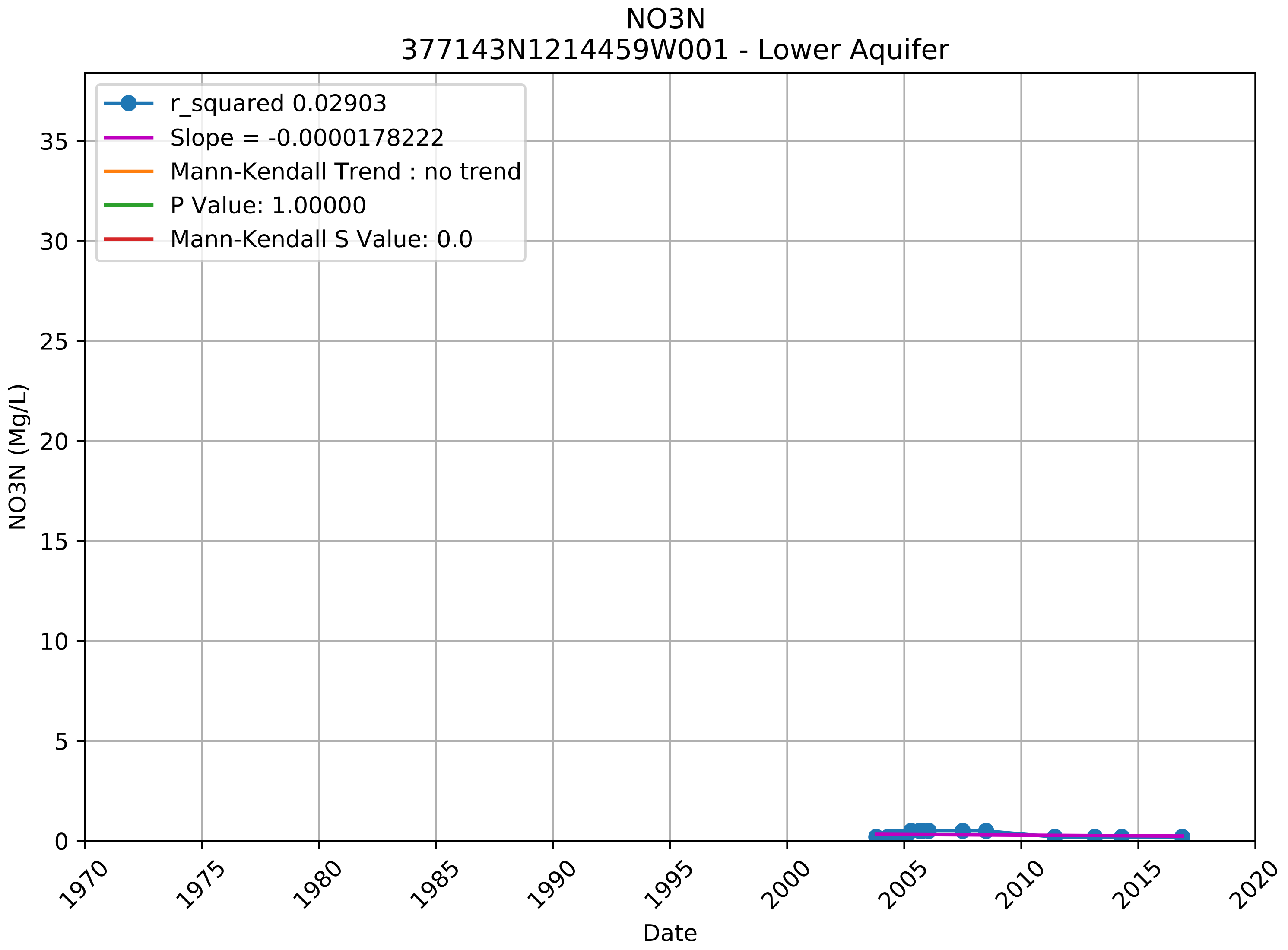

NO3N
377143N1214459W001 - Lower Aquifer
r_squared 0.02903
Slope = -0.0000178222
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
NO3N (Mg/L)
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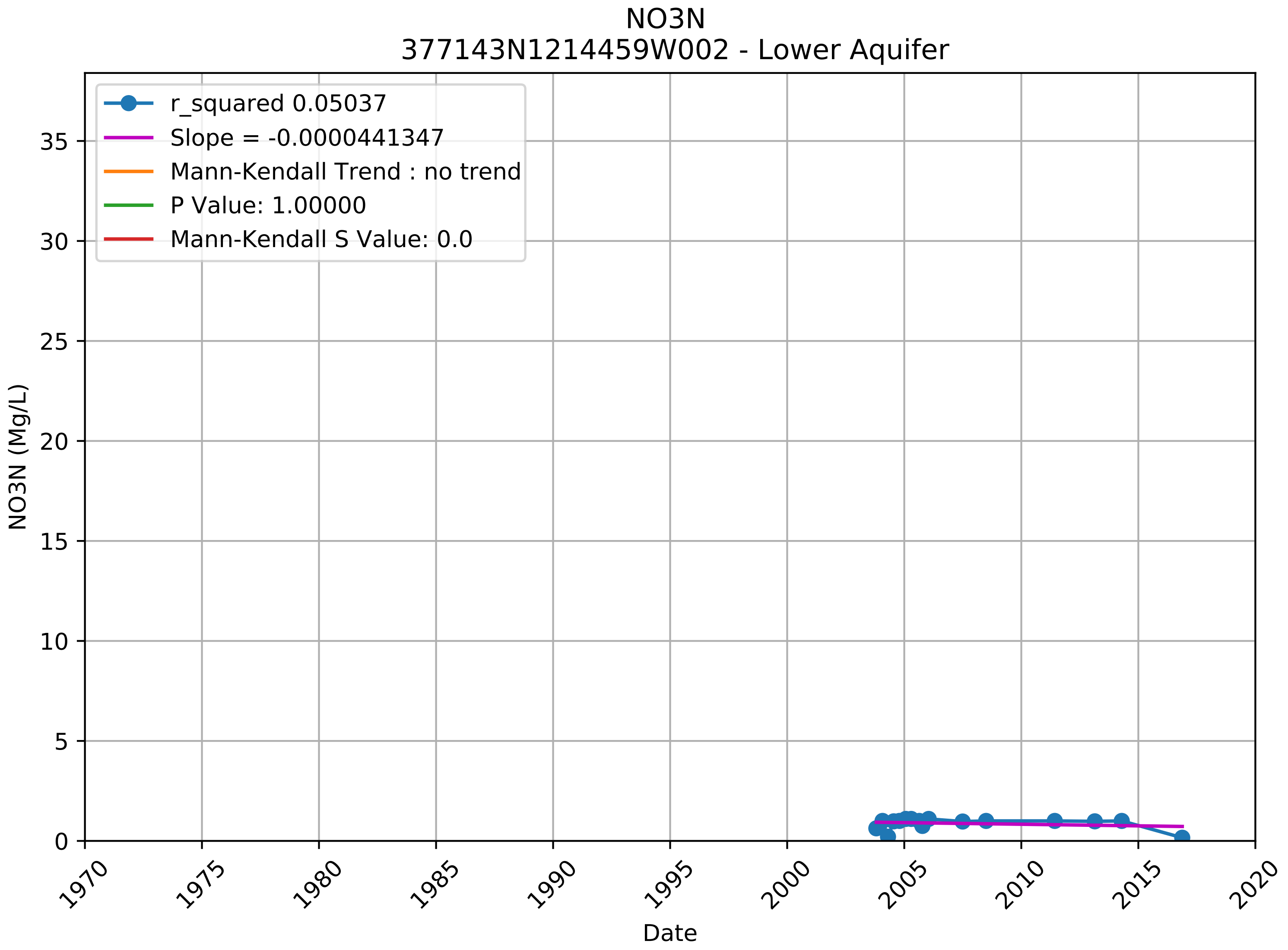

NO3N
377143N1214459W002 - Lower Aquifer
r_squared 0.05037
Slope = -0.0000441347
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
NO3N (Mg/L)
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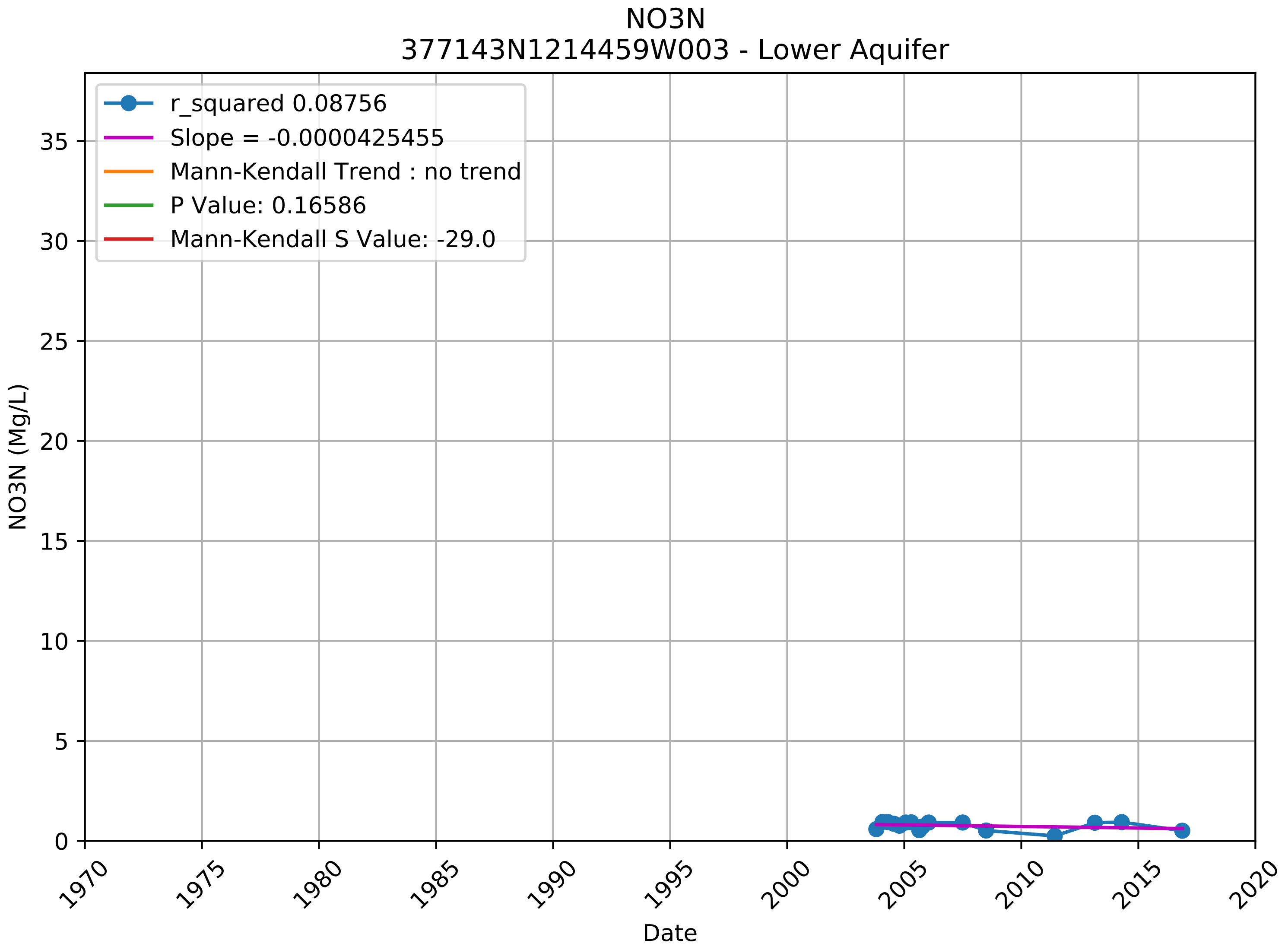
NO3N
377143N1214459W003 - Lower Aquifer
r_squared 0.08756
Slope = -0.0000425455
Mann-Kendall Trend : no trend
P Value: 0.16586
Mann-Kendall S Value: -29.0
NO3N (Mg/L)
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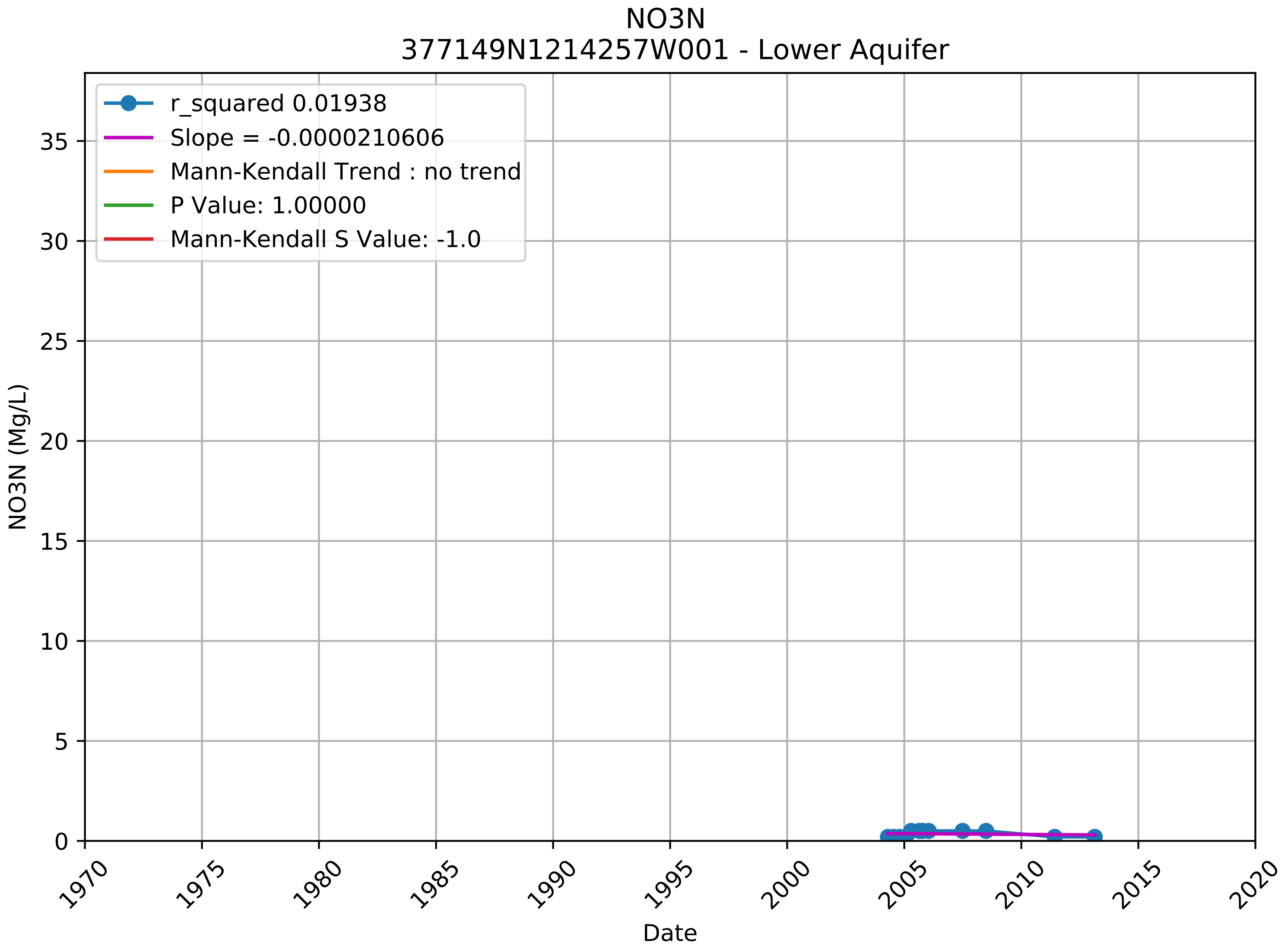

NO3N
377149N1214257W001 - Lower Aquifer
r_squared 0.01938
Slope = -0.0000210606
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
NO3N (Mg/L)
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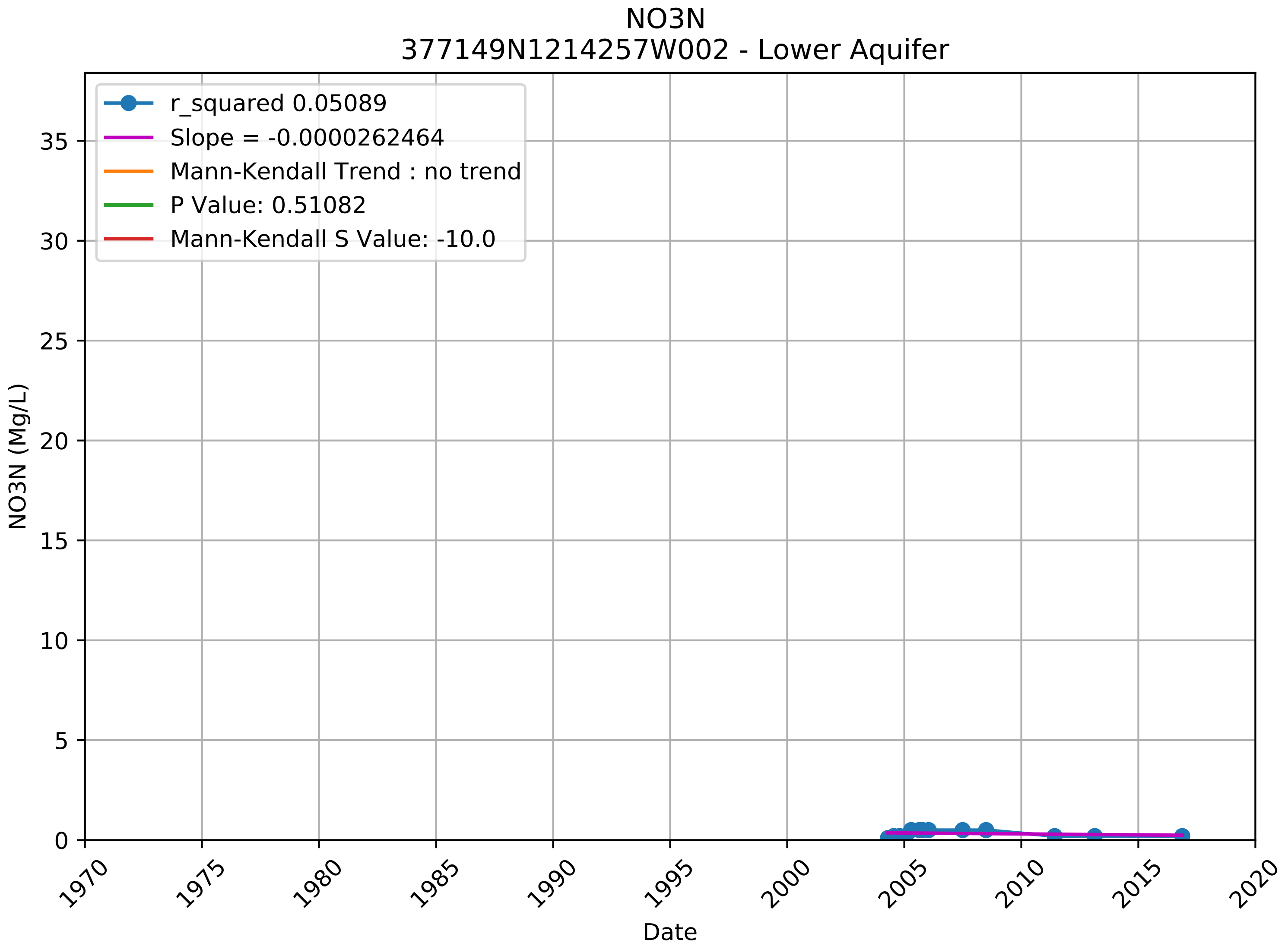
NO3N
377149N1214257W002 - Lower Aquifer
r_squared 0.05089
Slope = -0.0000262464
Mann-Kendall Trend : no trend
P Value: 0.51082
Mann-Kendall S Value: -10.0
NO3N (Mg/L)
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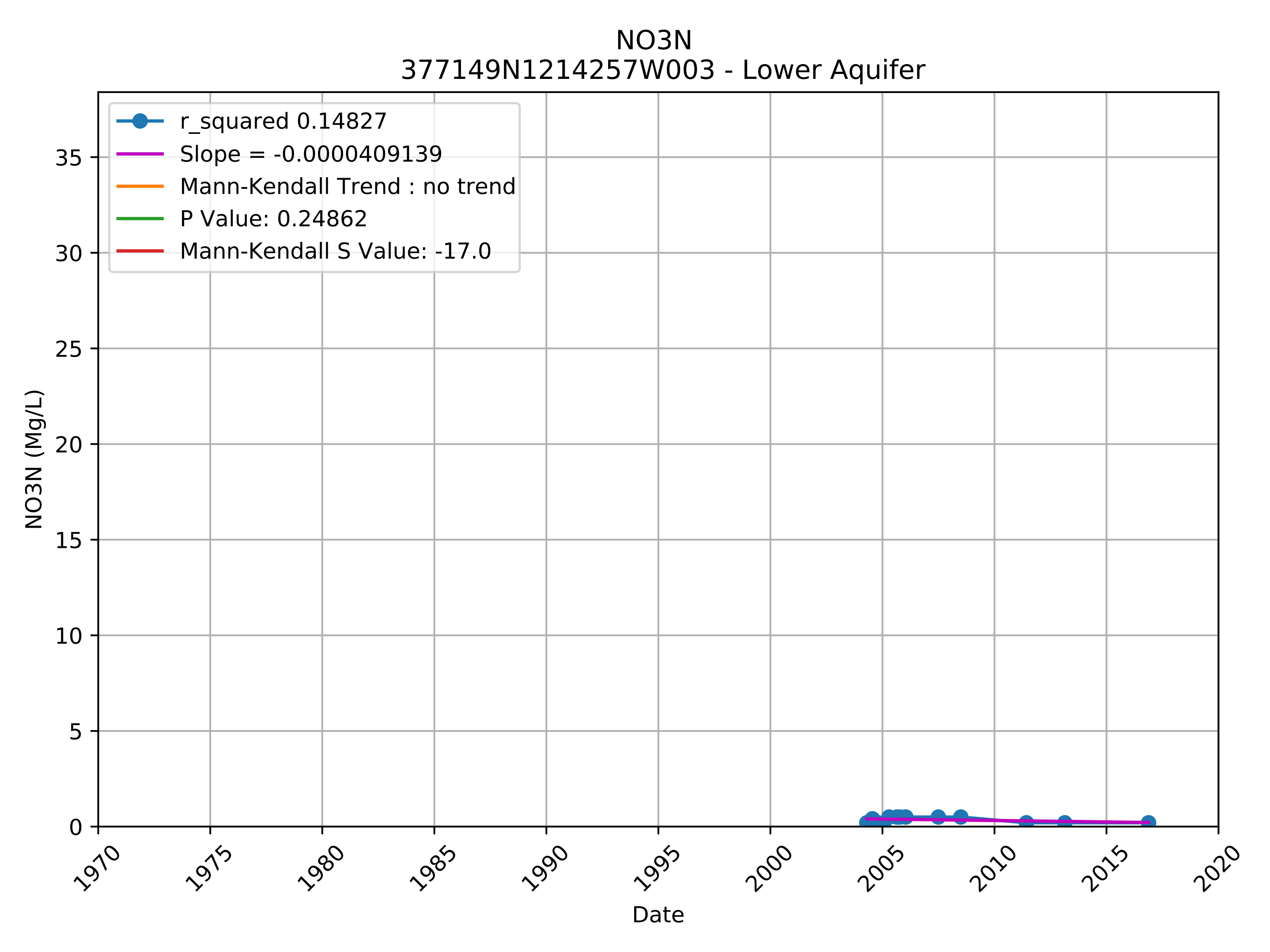

NO3N
377149N1214257W003 - Lower Aquifer
r_squared 0.14827
Slope = -0.0000409139
Mann-Kendall Trend : no trend
P Value: 0.24862
Mann-Kendall S Value: -17.0
NO3N (Mg/L)
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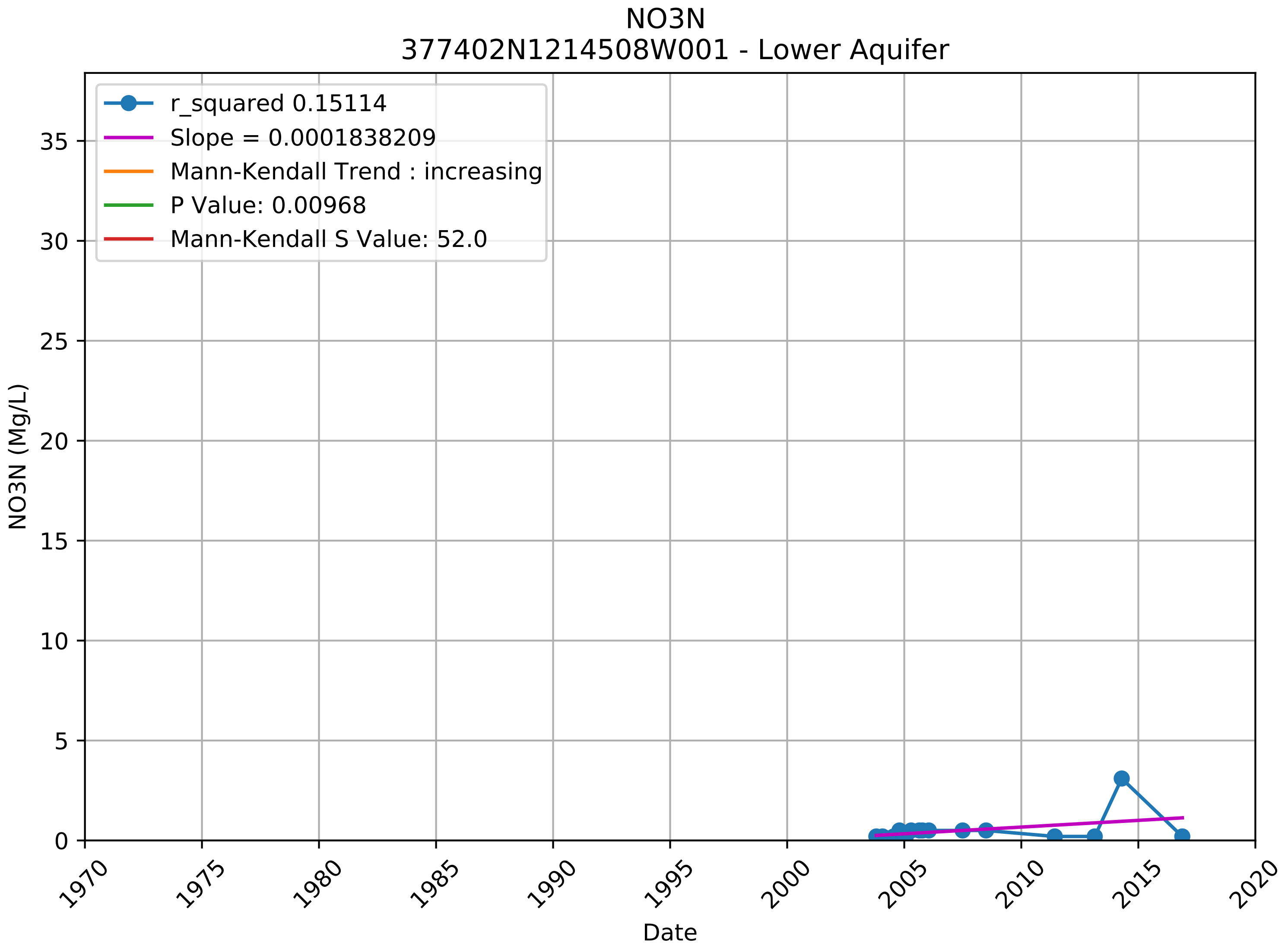

NO3N
377402N1214508W001 - Lower Aquifer
r_squared 0.15114
Slope = 0.0001838209
Mann-Kendall Trend : increasing
P Value: 0.00968
Mann-Kendall S Value: 52.0
NO3N (Mg/L)
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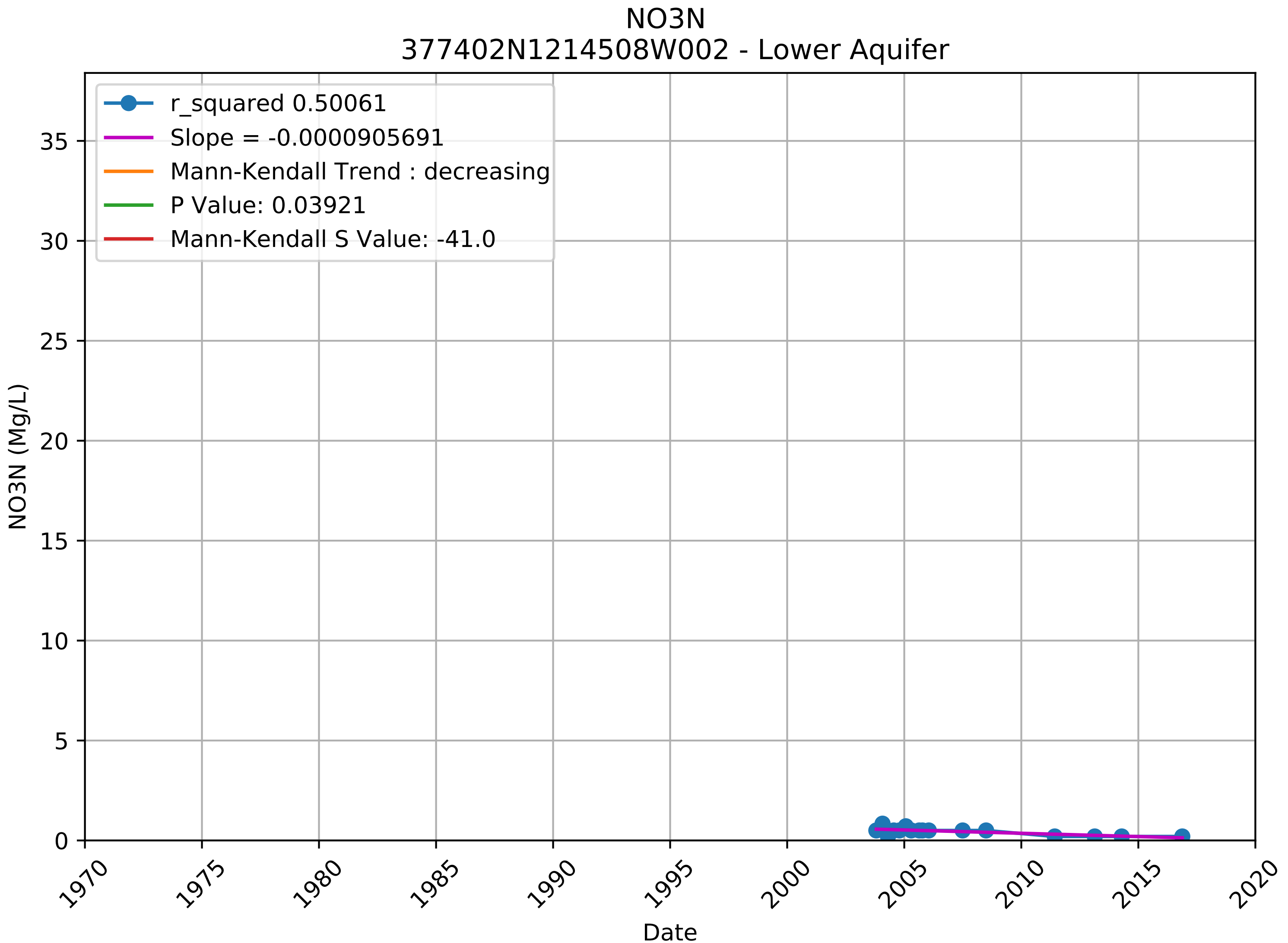

NO3N
377402N1214508W002 - Lower Aquifer
r_squared 0.50061
Slope = -0.0000905691
Mann-Kendall Trend : decreasing
P Value: 0.03921
Mann-Kendall S Value: -41.0
NO3N (Mg/L)
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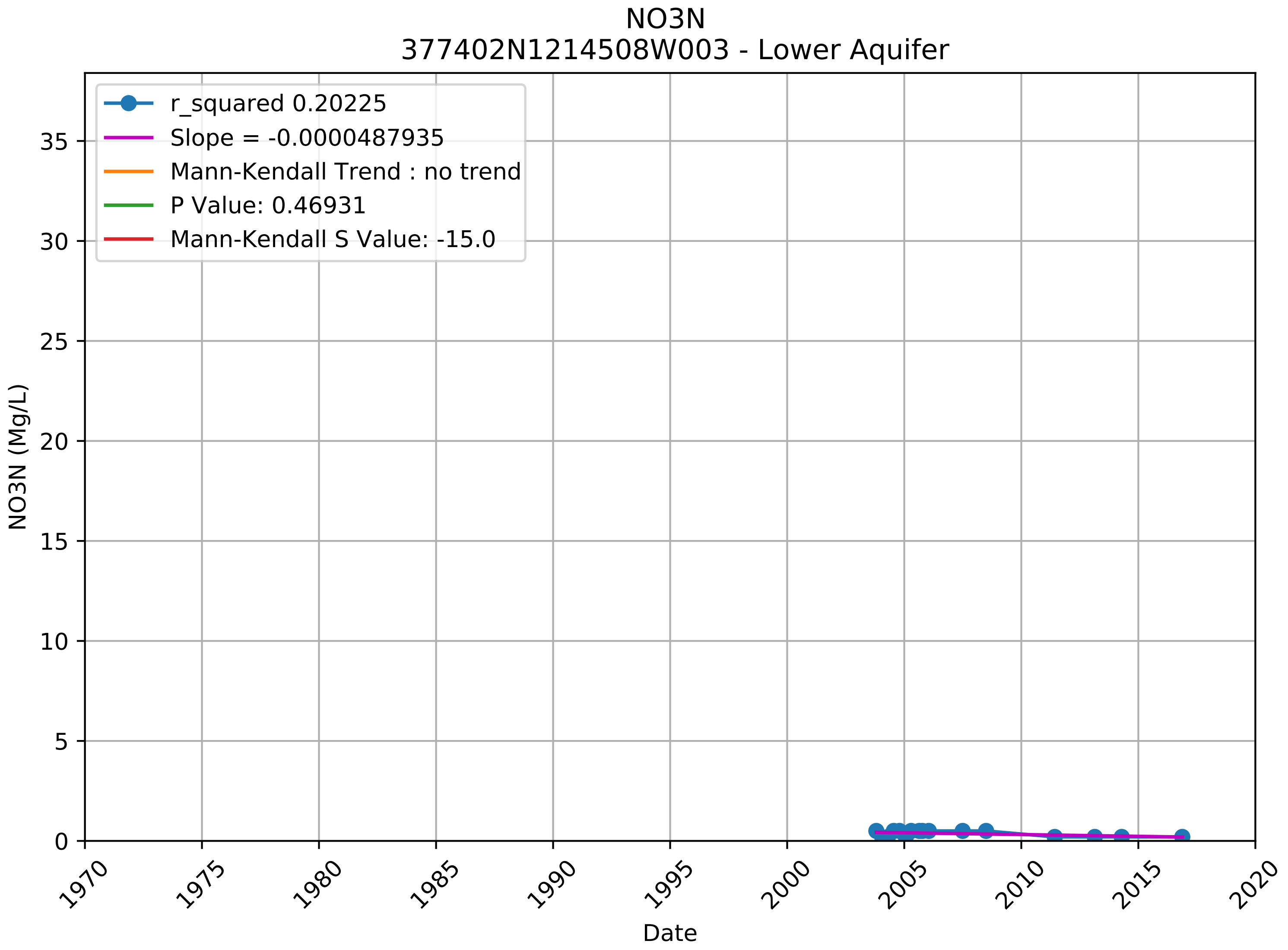

NO3N
377402N1214508W003 - Lower Aquifer
r_squared 0.20225
Slope = -0.0000487935
Mann-Kendall Trend : no trend
P Value: 0.46931
Mann-Kendall S Value: -15.0
NO3N (Mg/L)
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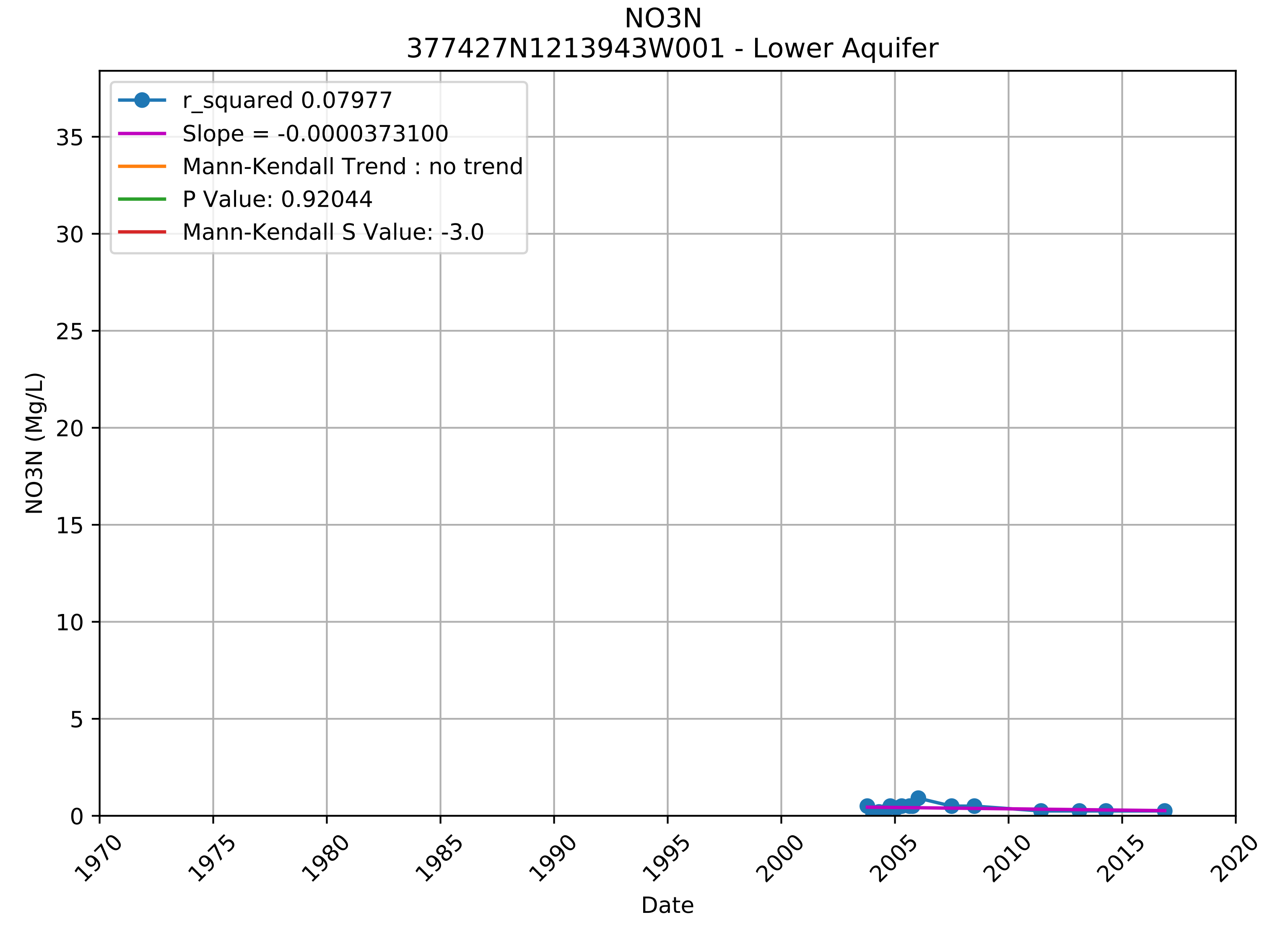

NO3N
377427N1213943W001 - Lower Aquifer
r_squared 0.07977
Slope = -0.0000373100
Mann-Kendall Trend : no trend
P Value: 0.92044
Mann-Kendall S Value: -3.0
NO3N (Mg/L)
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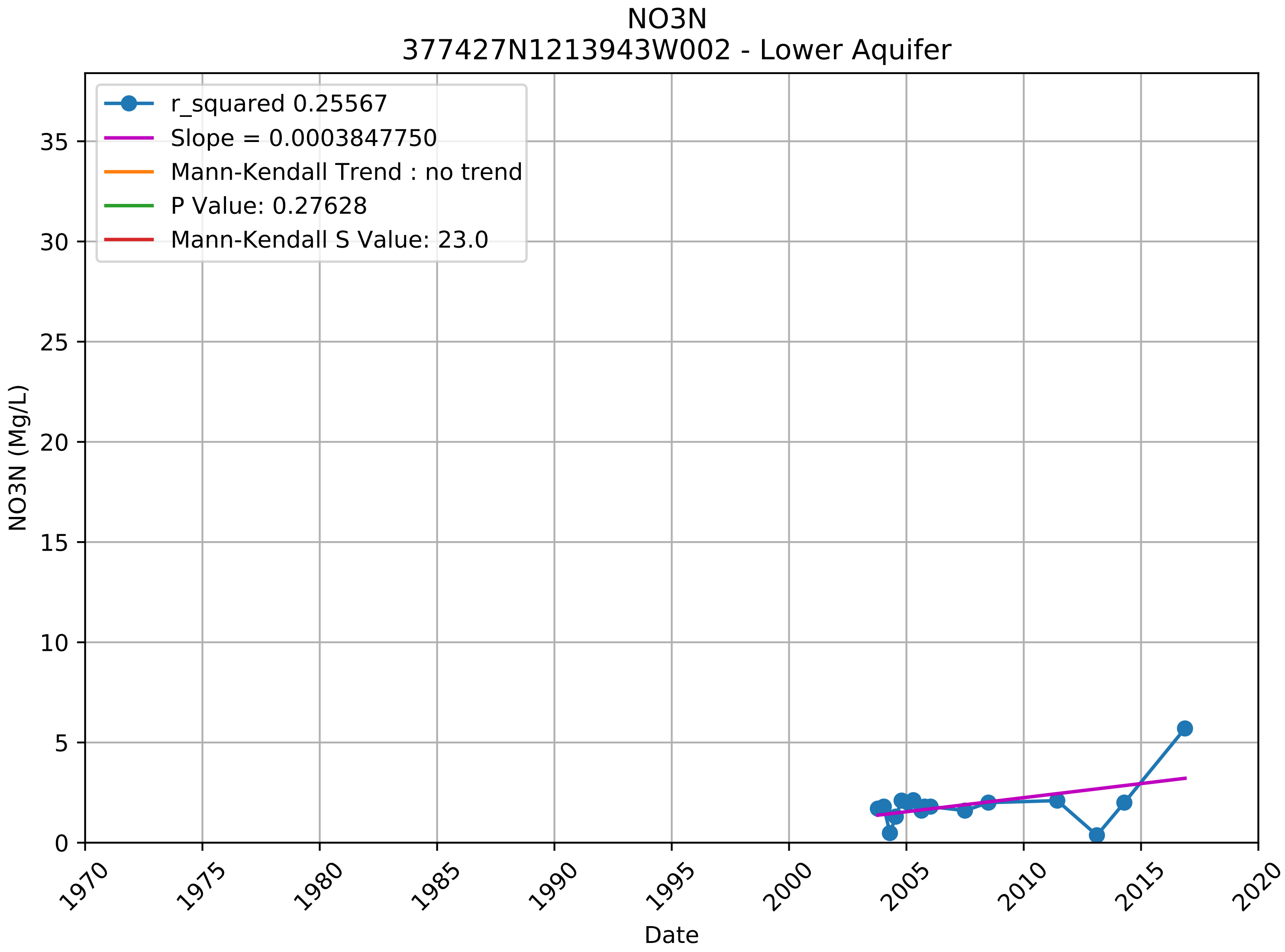
NO3N
377427N1213943W002 - Lower Aquifer
r_squared 0.25567
Slope = 0.0003847750
Mann-Kendall Trend : no trend
P Value: 0.27628
Mann-Kendall S Value: 23.0
NO3N (Mg/L)
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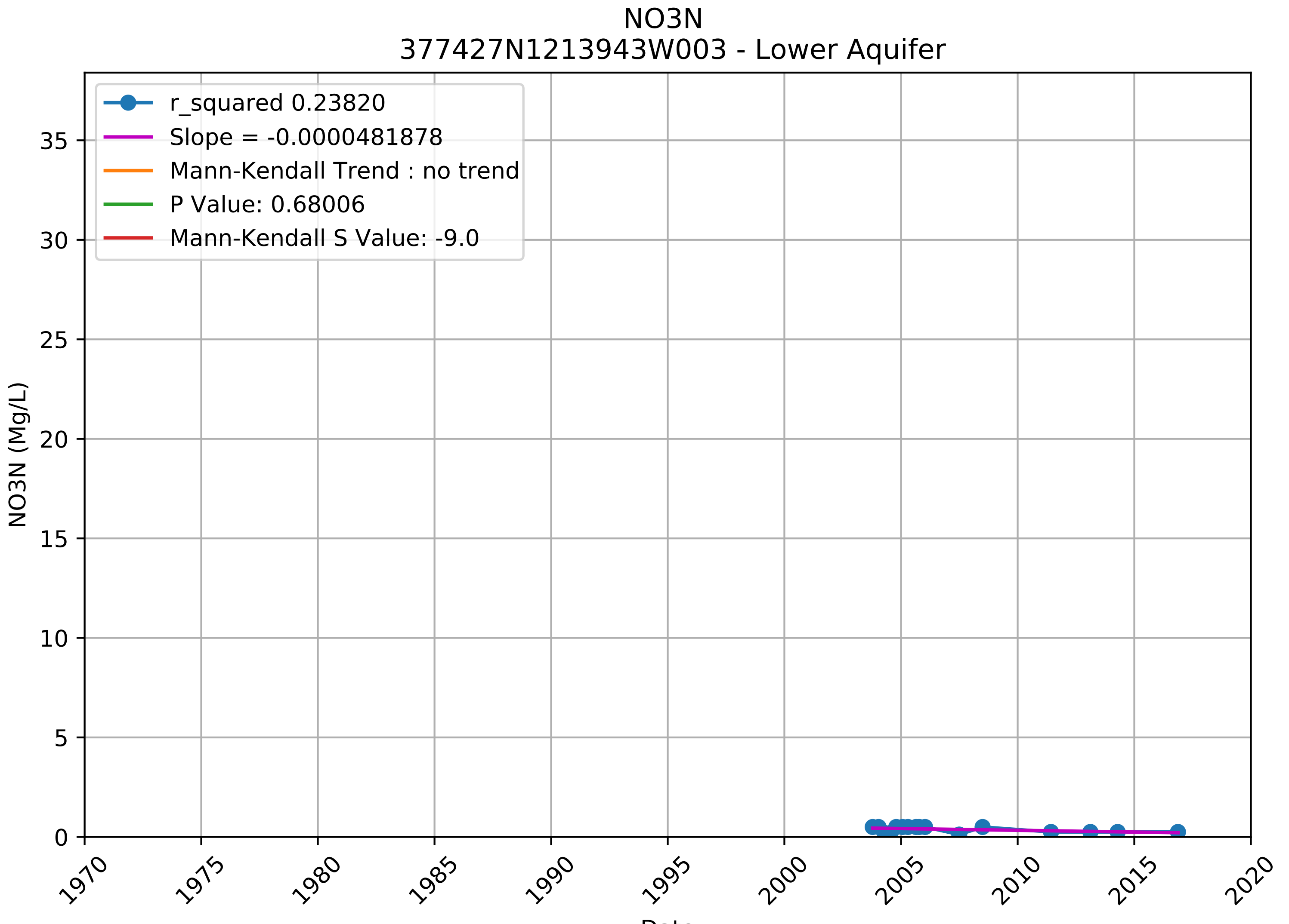

NO3N
377427N1213943W003 - Lower Aquifer
r_squared 0.23820
Slope = -0.0000481878
Mann-Kendall Trend : no trend
P Value: 0.68006
Mann-Kendall S Value: -9.0
NO3N (Mg/L)
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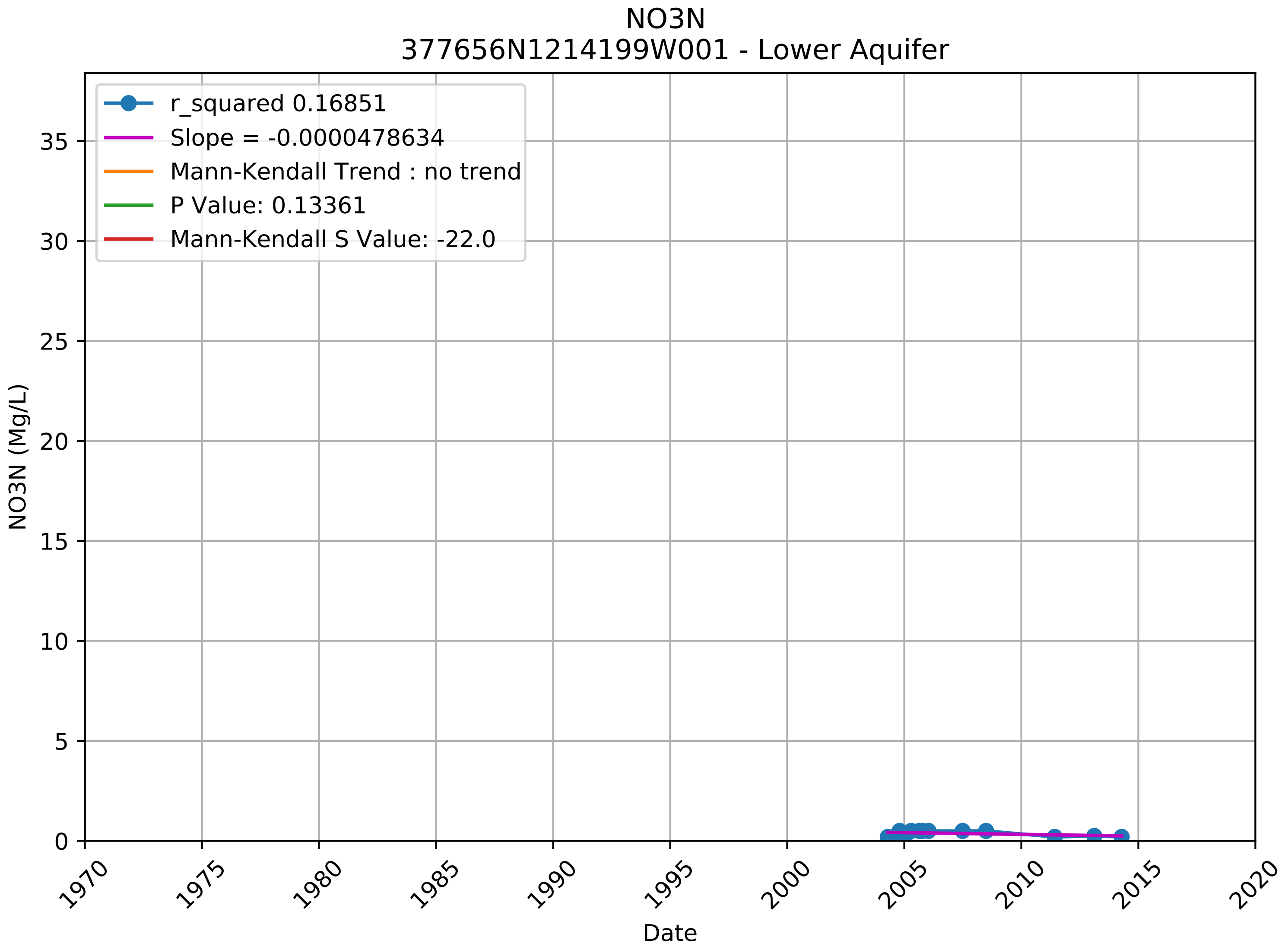

NO3N
377656N1214199W001 - Lower Aquifer
r_squared 0.16851
Slope = -0.0000478634
Mann-Kendall Trend : no trend
P Value: 0.13361
Mann-Kendall S Value: -22.0
NO3N (Mg/L)
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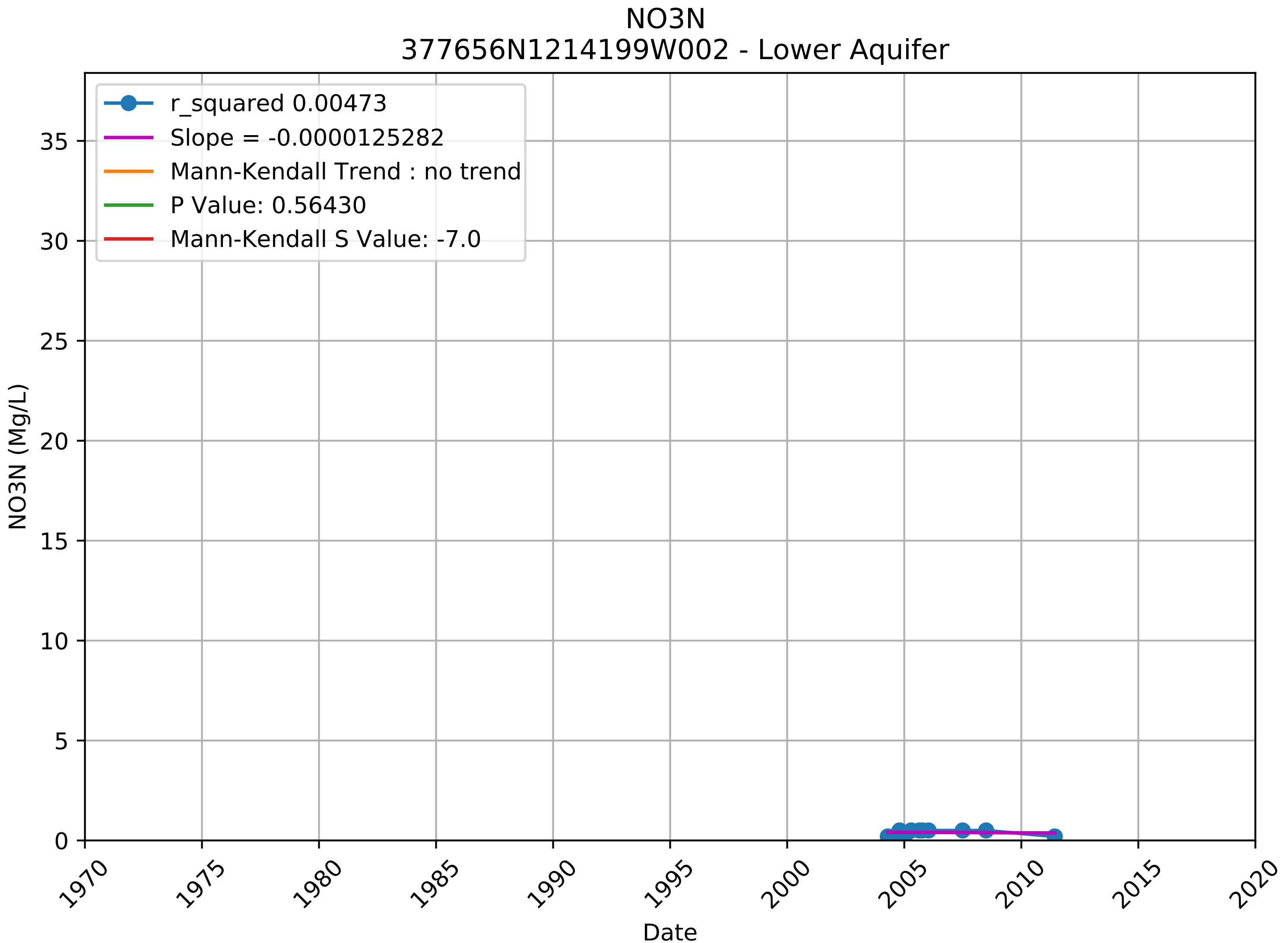
NO3N
377656N1214199W002 - Lower Aquifer
r_squared 0.00473
Slope = -0.0000125282
Mann-Kendall Trend : no trend
P Value: 0.56430
Mann-Kendall S Value: -7.0
NO3N (Mg/L)
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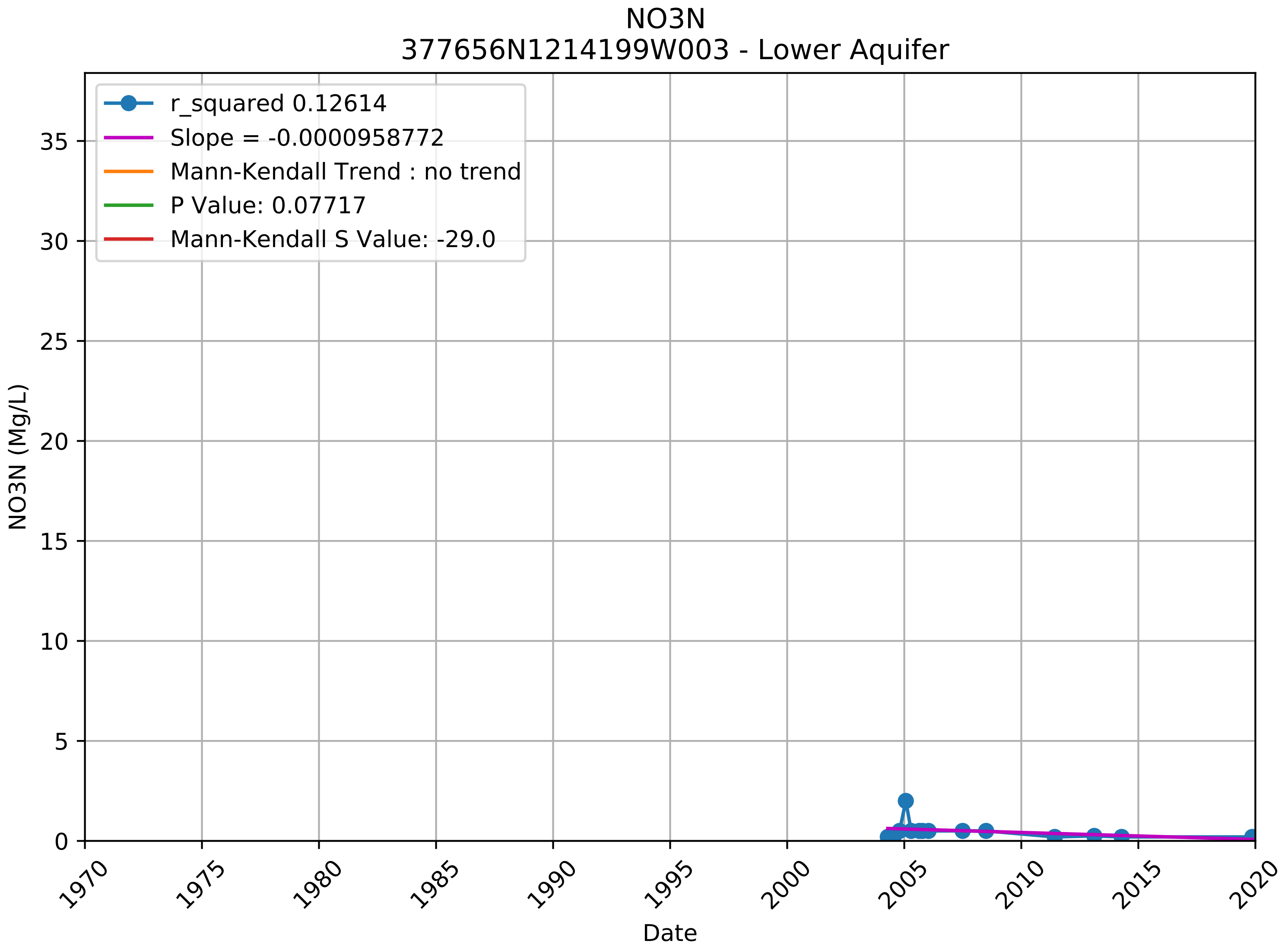

NO3N
377656N1214199W003 - Lower Aquifer
r_squared 0.12614
Slope = -0.0000958772
Mann-Kendall Trend : no trend
P Value: 0.07717
Mann-Kendall S Value: -29.0
NO3N (Mg/L)
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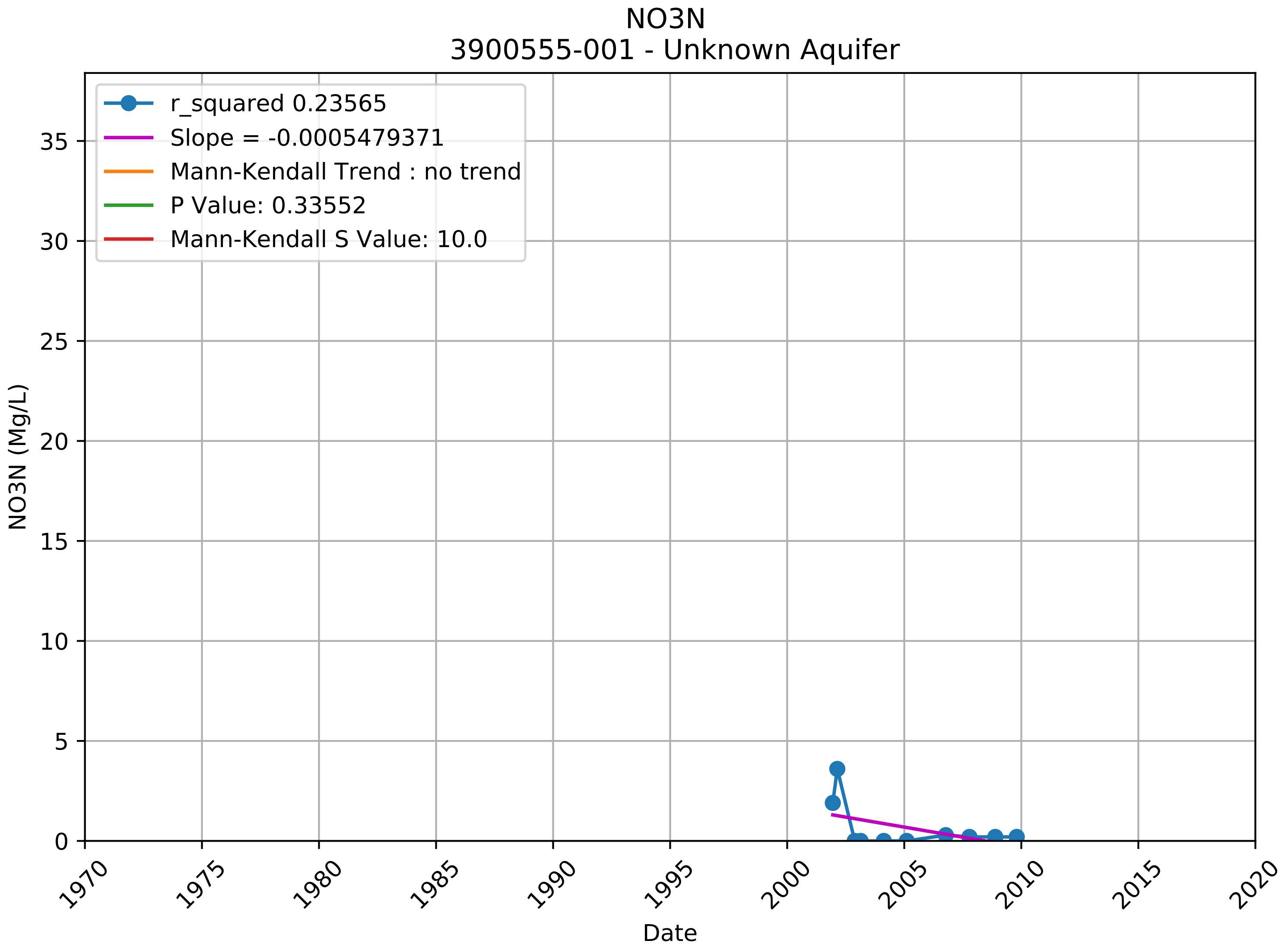
NO3N
3900555-001 - Unknown Aquifer
r_squared 0.23565
Slope = -0.0005479371
Mann-Kendall Trend : no trend
P Value: 0.33552
Mann-Kendall S Value: 10.0
NO3N (Mg/L)
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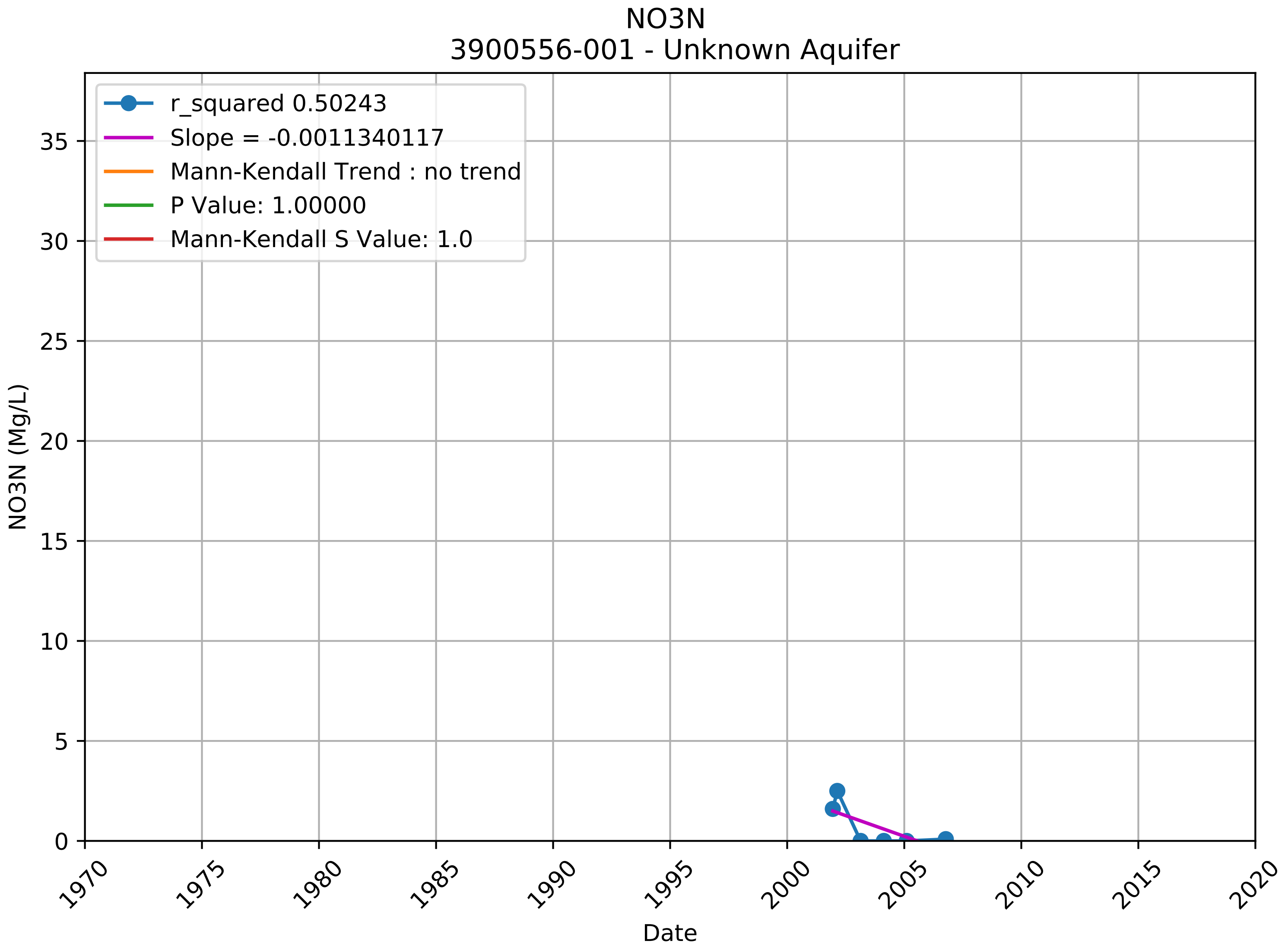

NO3N
3900556-001 - Unknown Aquifer
r_squared 0.50243
Slope = -0.0011340117
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
NO3N (Mg/L)
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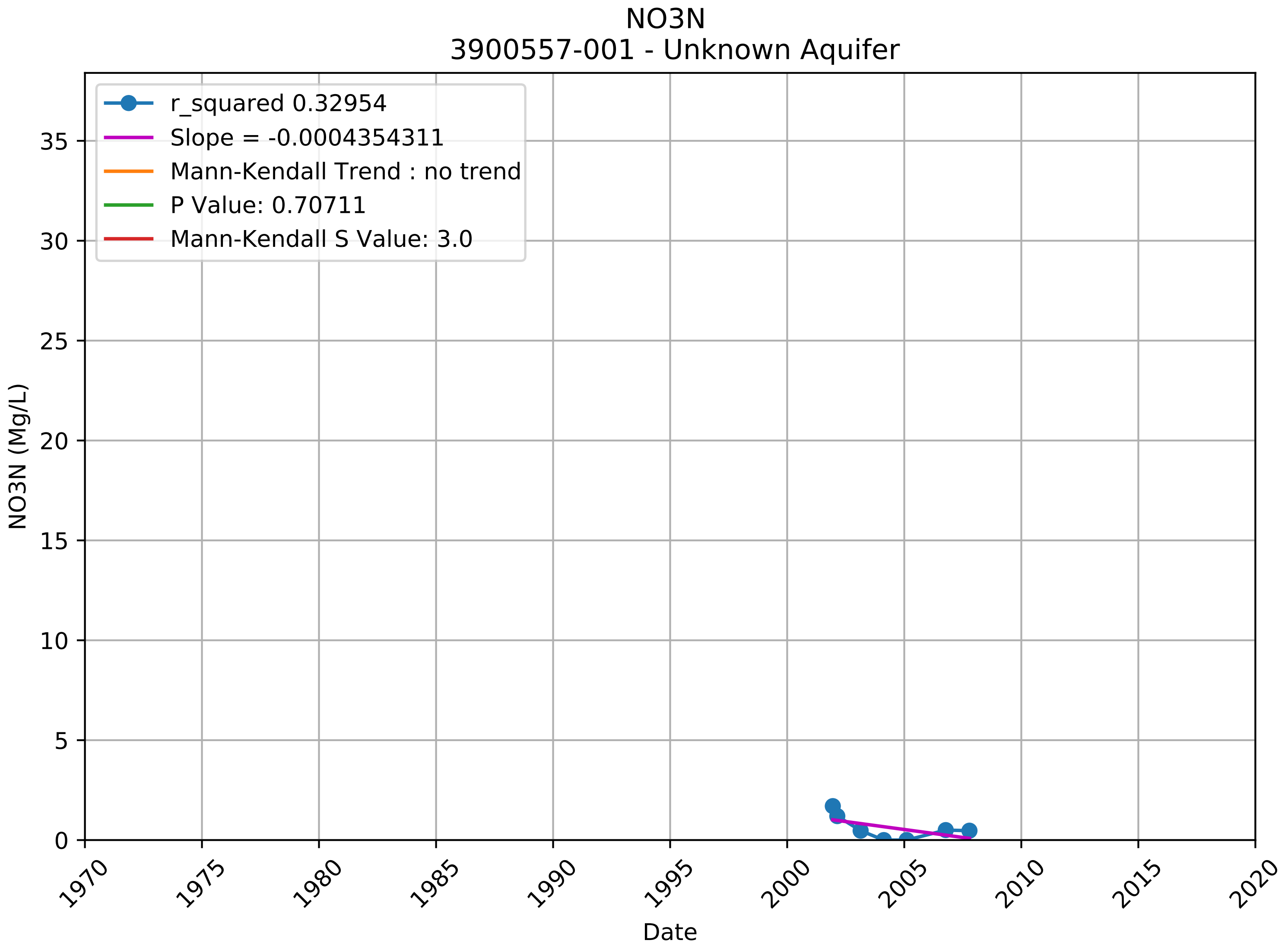
NO3N
3900557-001 - Unknown Aquifer
r_squared 0.32954
Slope = -0.0004354311
Mann-Kendall Trend : no trend
P Value: 0.70711
Mann-Kendall S Value: 3.0
NO3N (Mg/L)
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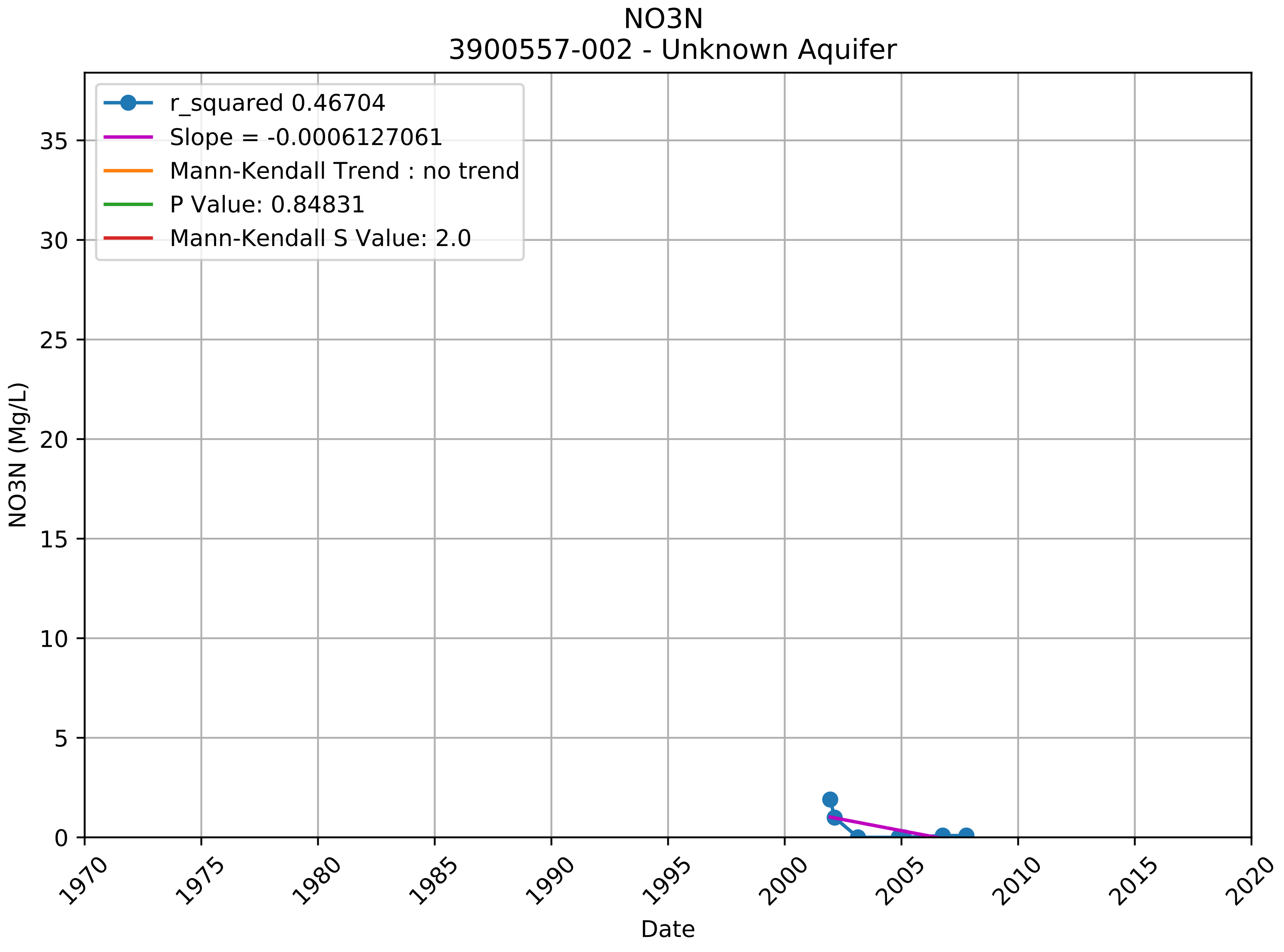

NO3N
3900557-002 - Unknown Aquifer
r_squared 0.46704
Slope = -0.0006127061
Mann-Kendall Trend : no trend
P Value: 0.84831
Mann-Kendall S Value: 2.0
NO3N (Mg/L)
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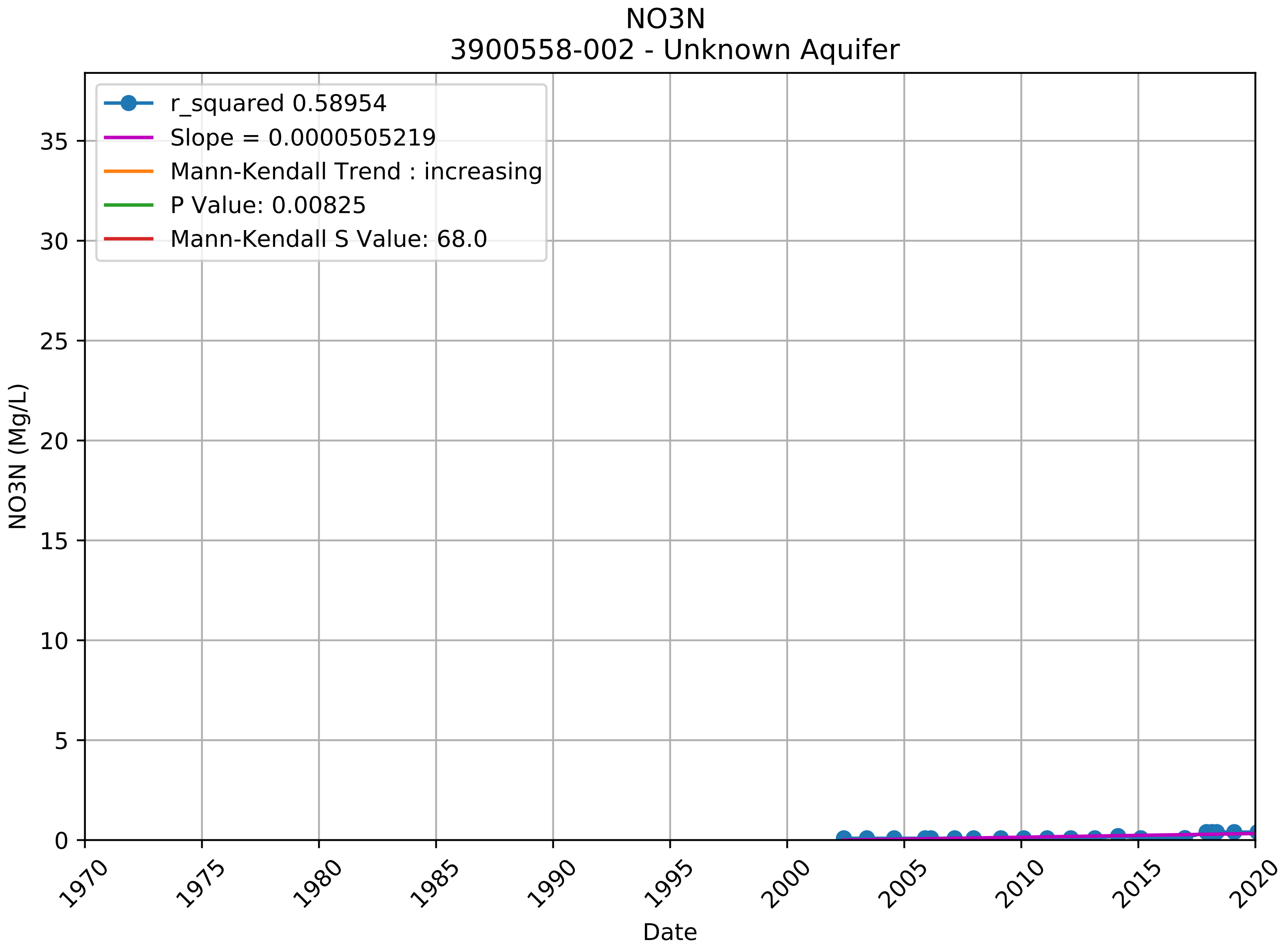
NO3N
3900558-002 - Unknown Aquifer
r_squared 0.58954
Slope = 0.0000505219
Mann-Kendall Trend : increasing
P Value: 0.00825
Mann-Kendall S Value: 68.0
NO3N (Mg/L)
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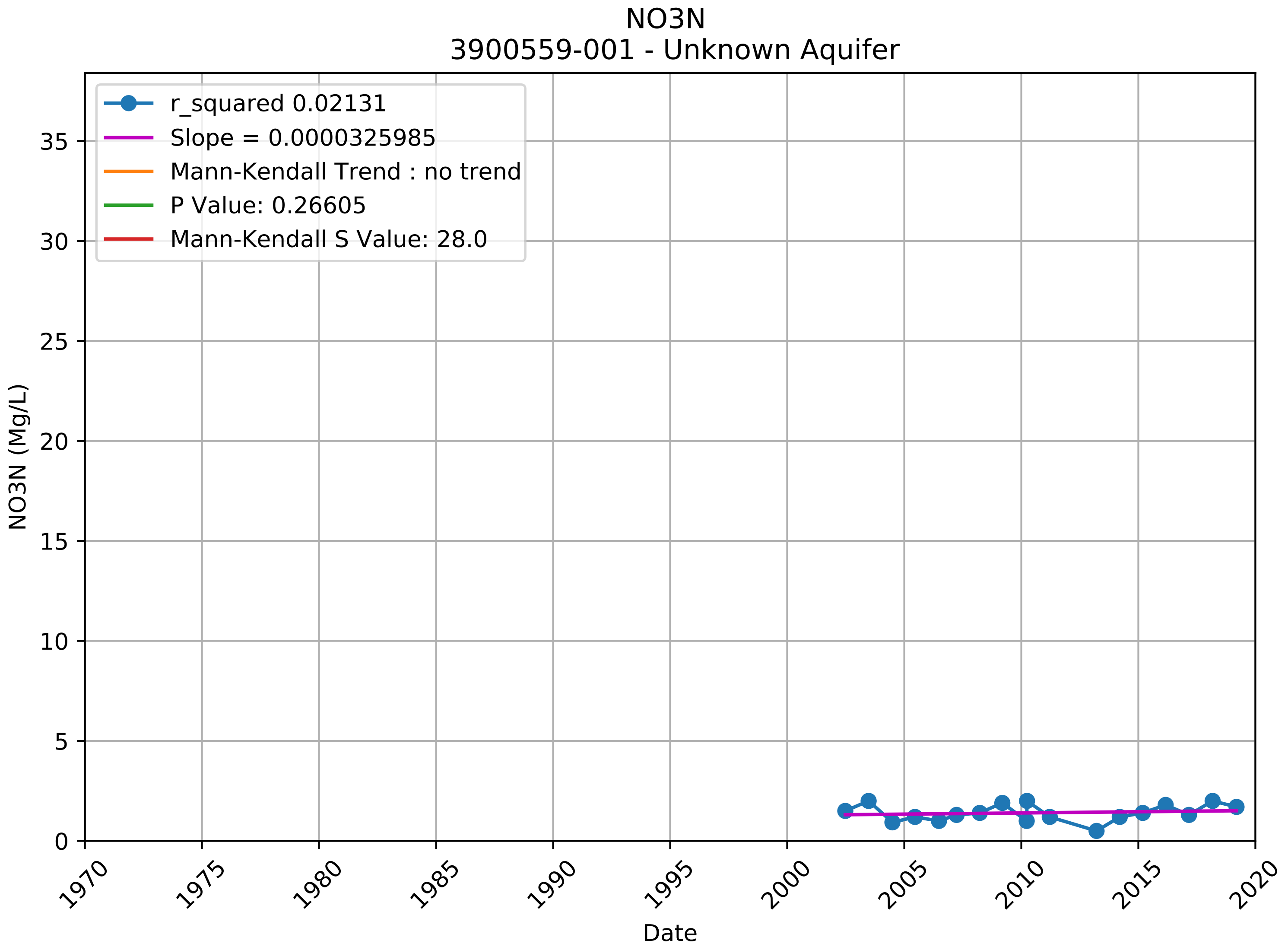

NO3N
3900559-001 - Unknown Aquifer
r_squared 0.02131
Slope = 0.0000325985
Mann-Kendall Trend : no trend
P Value: 0.26605
Mann-Kendall S Value: 28.0
NO3N (Mg/L)
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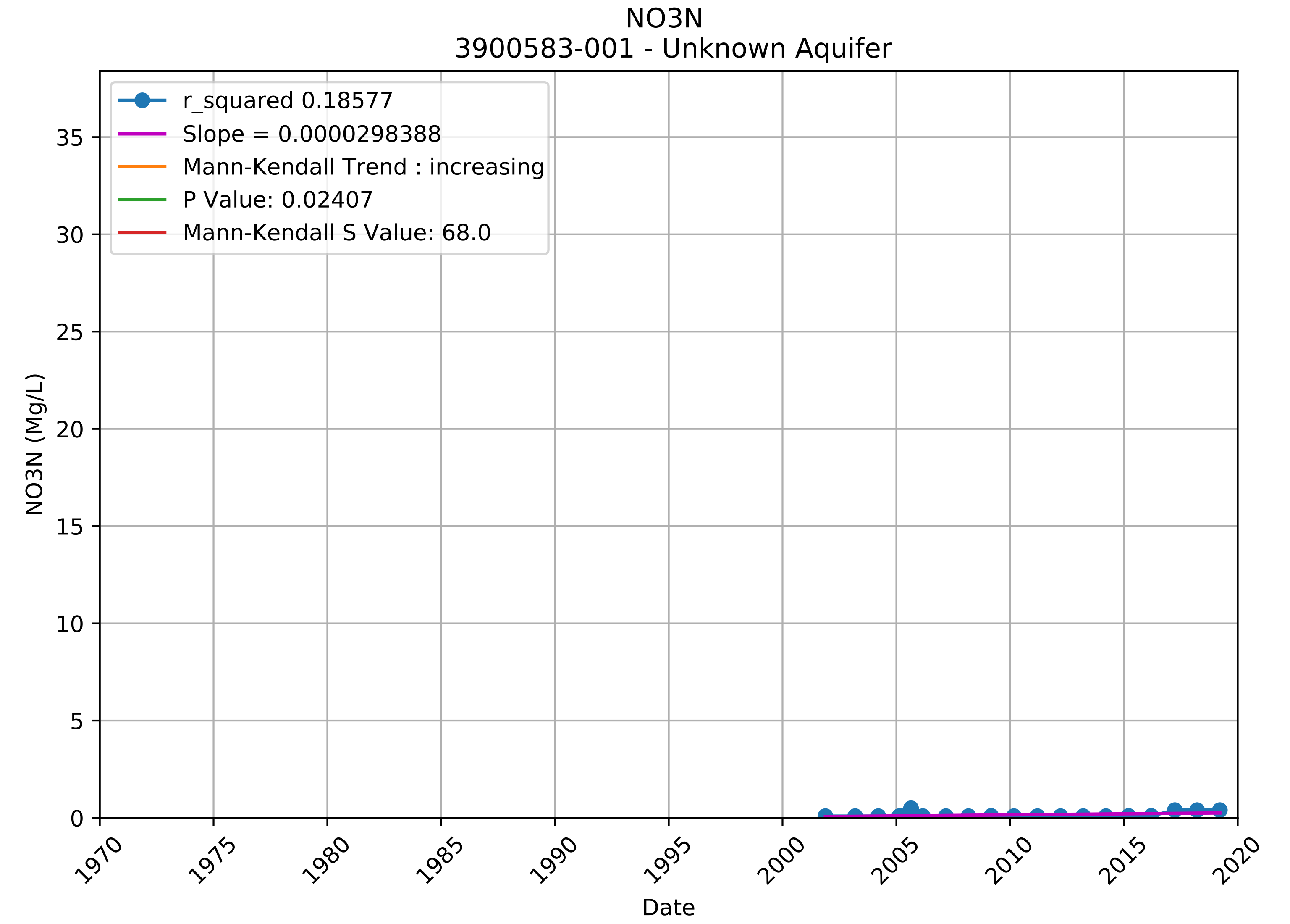

NO3N
3900583-001 - Unknown Aquifer
r_squared 0.18577
Slope = 0.0000298388
Mann-Kendall Trend : increasing
P Value: 0.02407
Mann-Kendall S Value: 68.0
NO3N (Mg/L)
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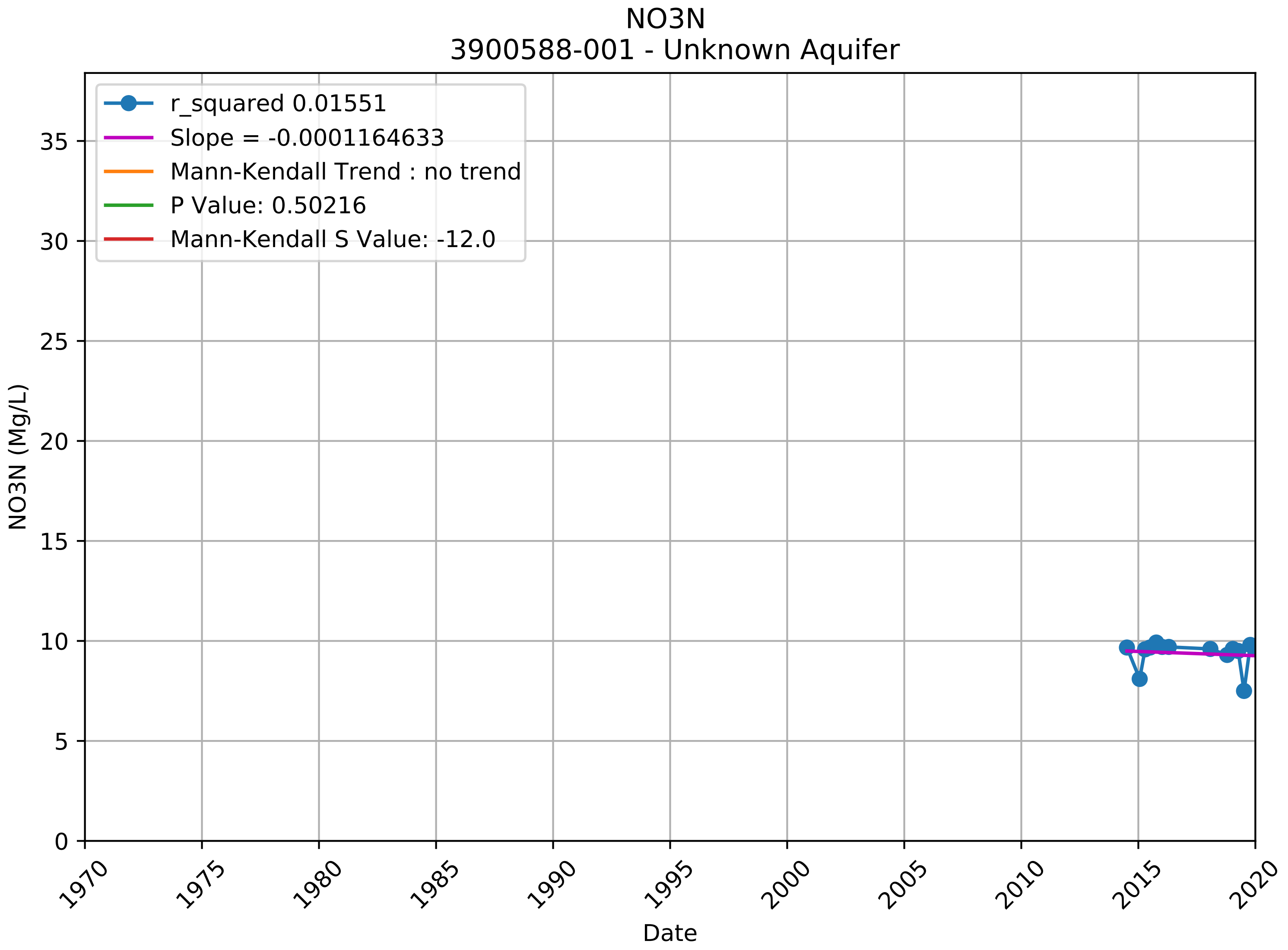

NO3N
3900588-001 - Unknown Aquifer
r_squared 0.01551
Slope = -0.0001164633
Mann-Kendall Trend : no trend
P Value: 0.50216
Mann-Kendall S Value: -12.0
NO3N (Mg/L)
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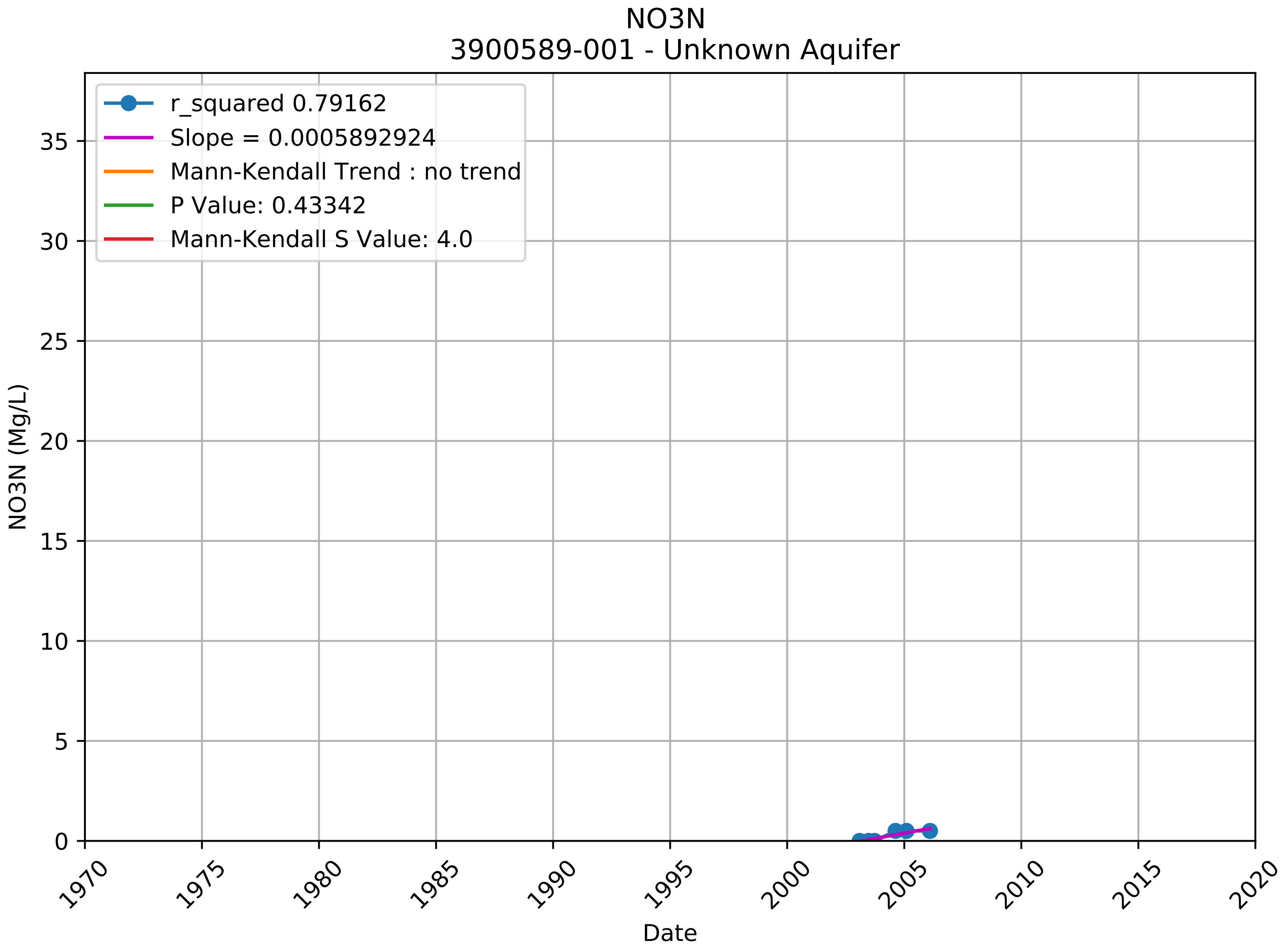
NO3N
3900589-001 - Unknown Aquifer
r_squared 0.79162
Slope = 0.0005892924
Mann-Kendall Trend : no trend
P Value: 0.43342
Mann-Kendall S Value: 4.0
NO3N (Mg/L)
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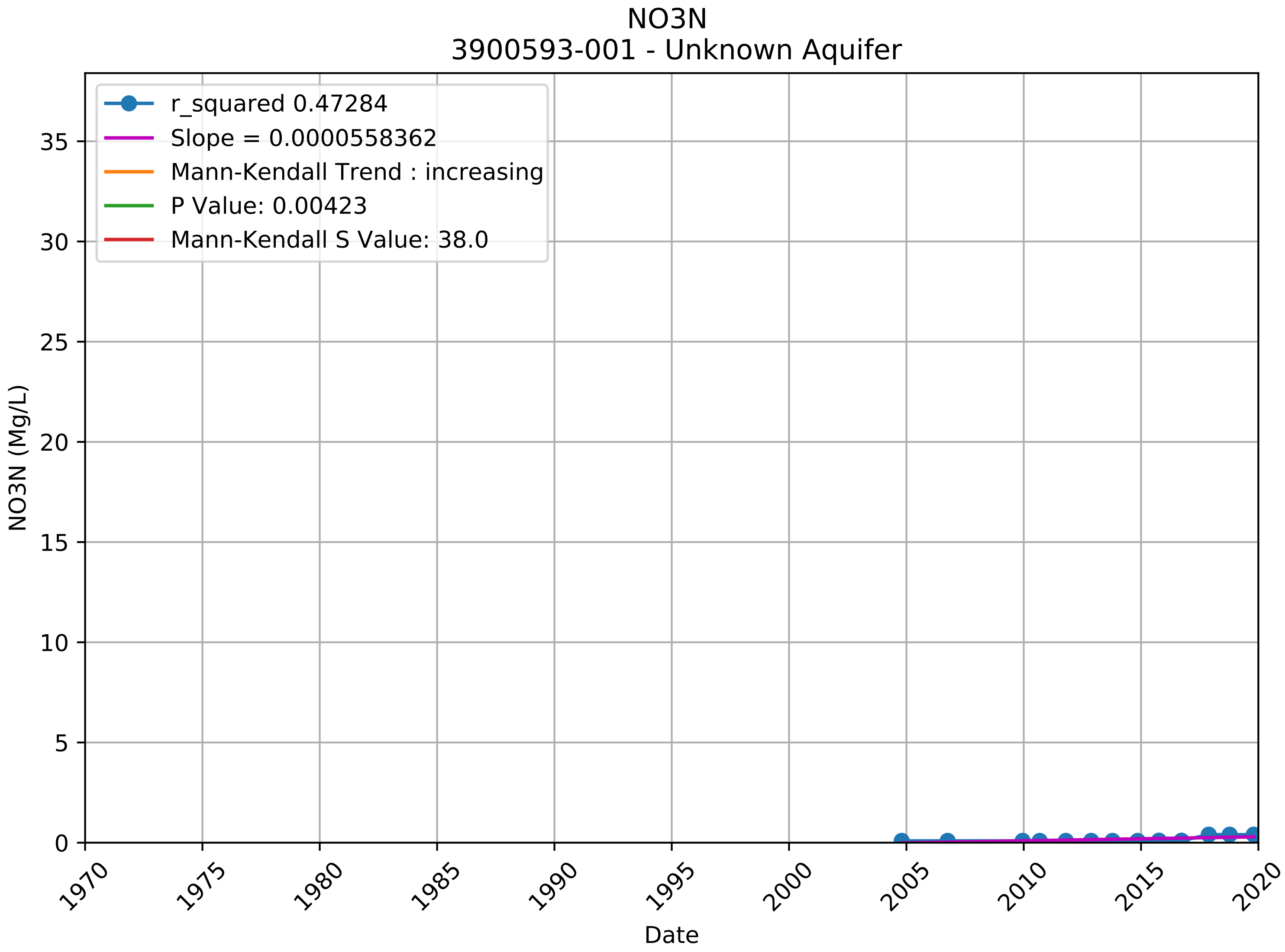

NO3N
3900593-001 - Unknown Aquifer
r_squared 0.47284
Slope = 0.0000558362
Mann-Kendall Trend : increasing
P Value: 0.00423
Mann-Kendall S Value: 38.0
NO3N (Mg/L)
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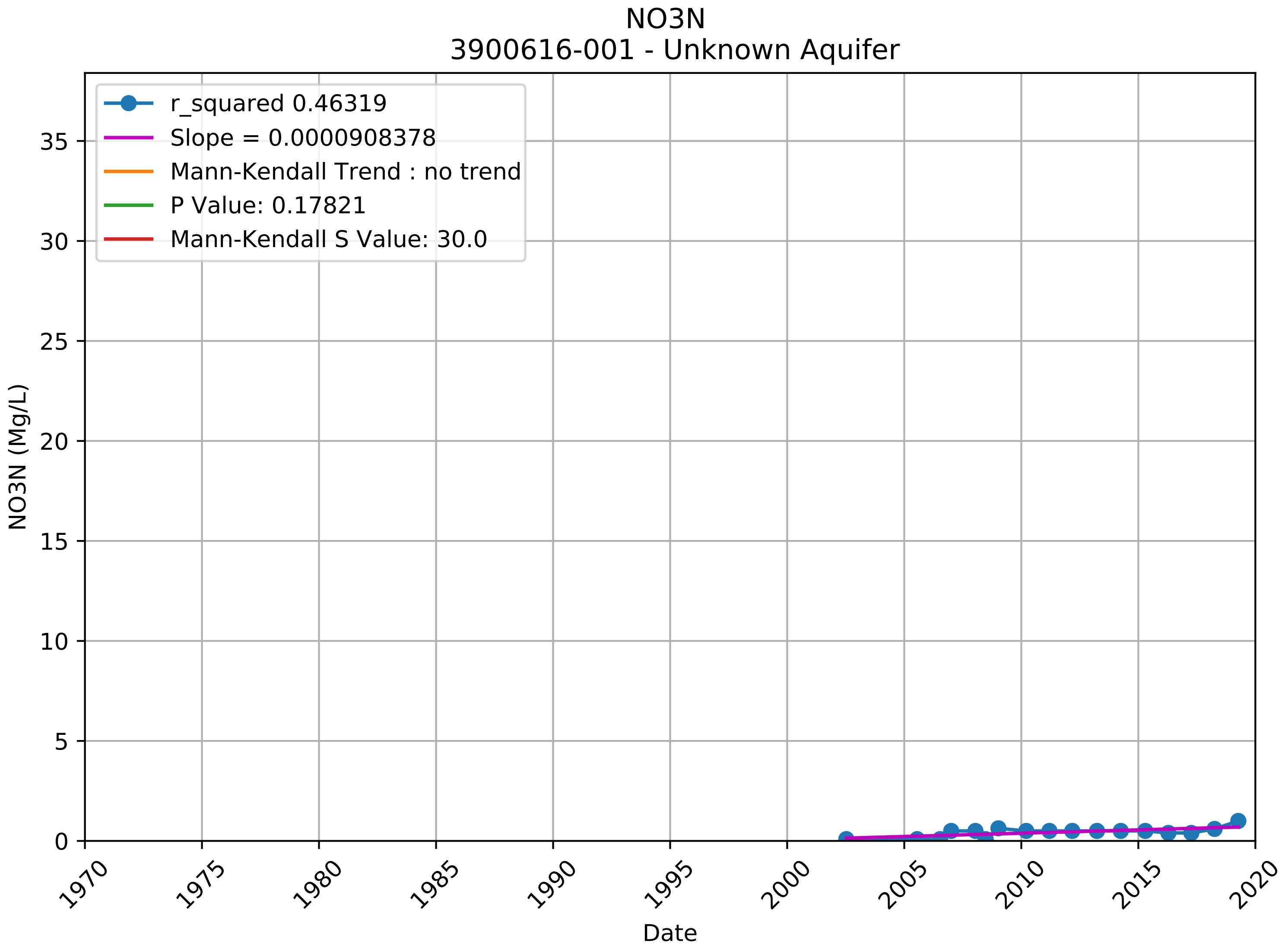
NO3N
3900616-001 - Unknown Aquifer
r_squared 0.46319
Slope = 0.0000908378
Mann-Kendall Trend : no trend
P Value: 0.17821
Mann-Kendall S Value: 30.0
NO3N (Mg/L)
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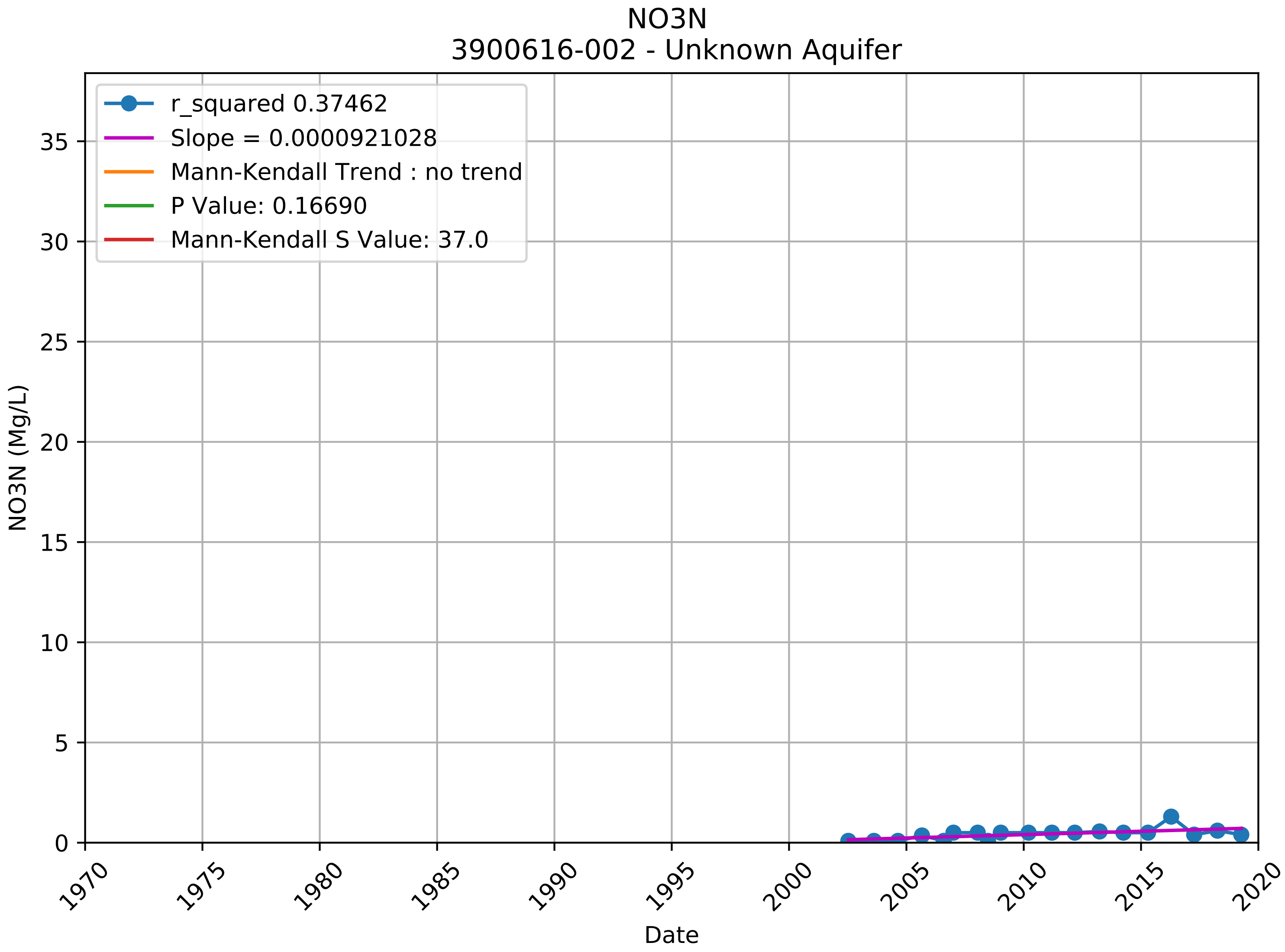
NO3N
3900616-002 - Unknown Aquifer
r_squared 0.37462
Slope = 0.0000921028
Mann-Kendall Trend : no trend
P Value: 0.16690
Mann-Kendall S Value: 37.0
NO3N (Mg/L)
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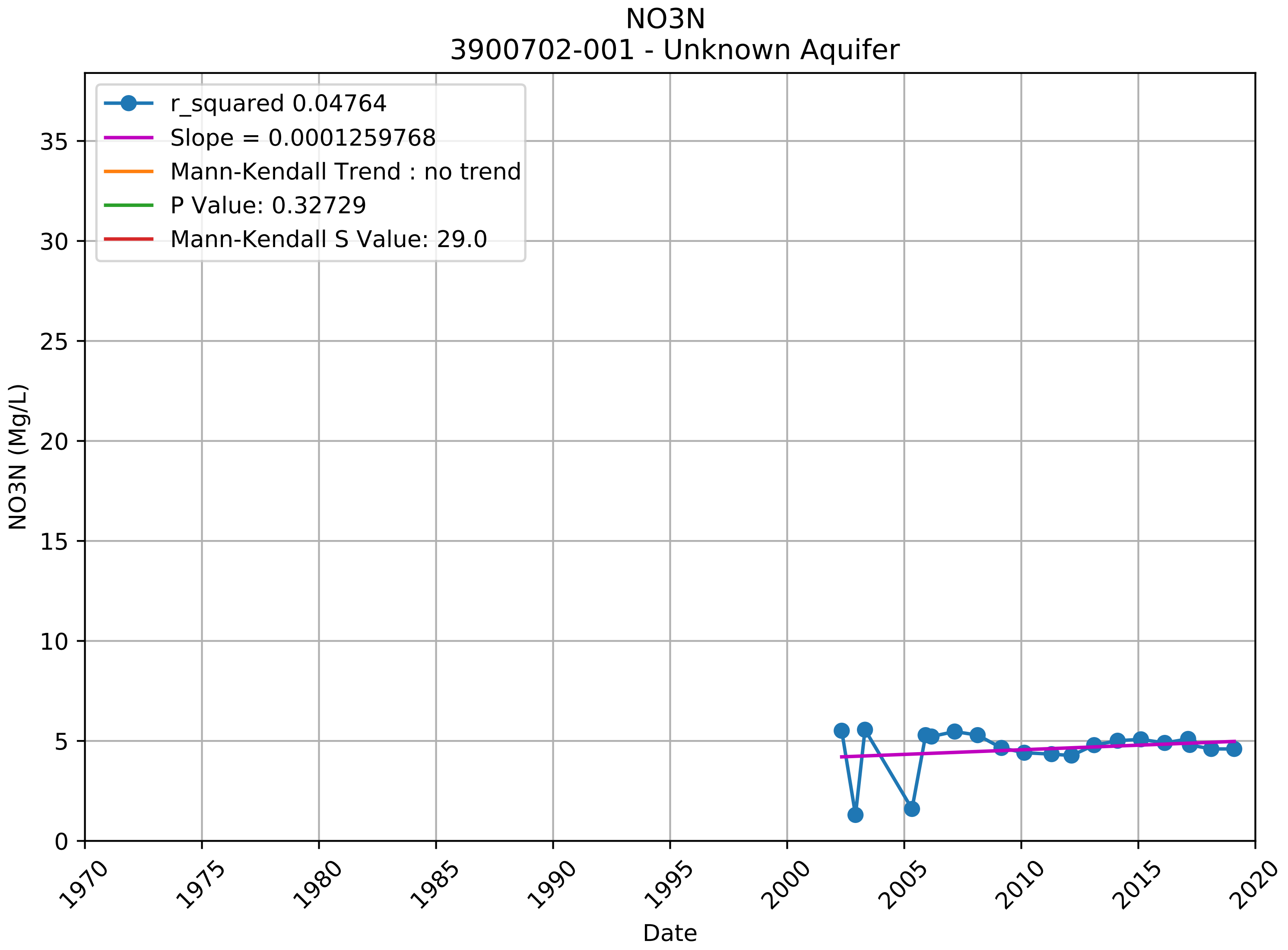
NO3N
3900702-001 - Unknown Aquifer
r_squared 0.04764
Slope = 0.0001259768
Mann-Kendall Trend : no trend
P Value: 0.32729
Mann-Kendall S Value: 29.0
NO3N (Mg/L)
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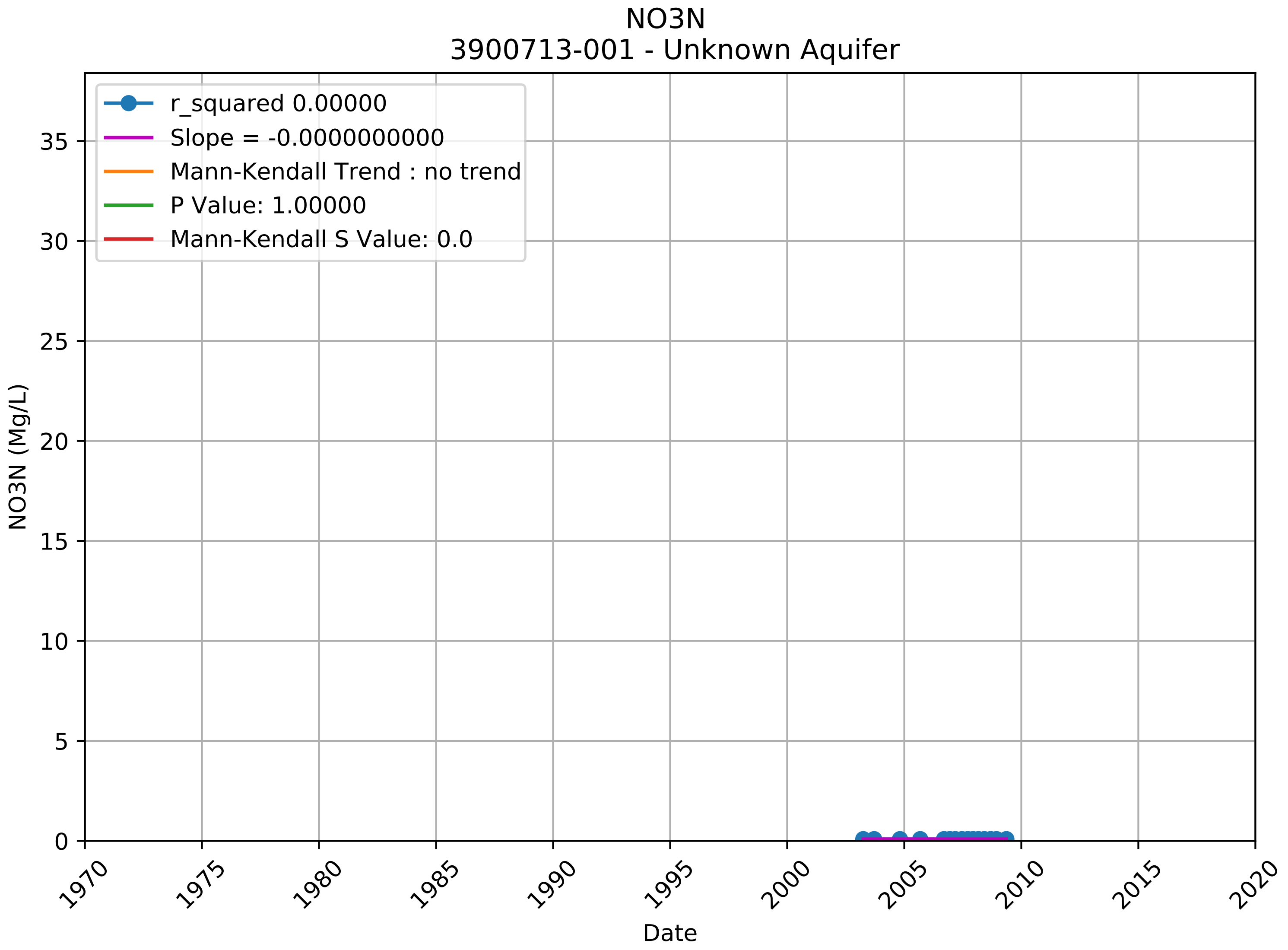

NO3N
3900713-001 - Unknown Aquifer
r_squared 0.00000
Slope = -0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
NO3N (Mg/L)
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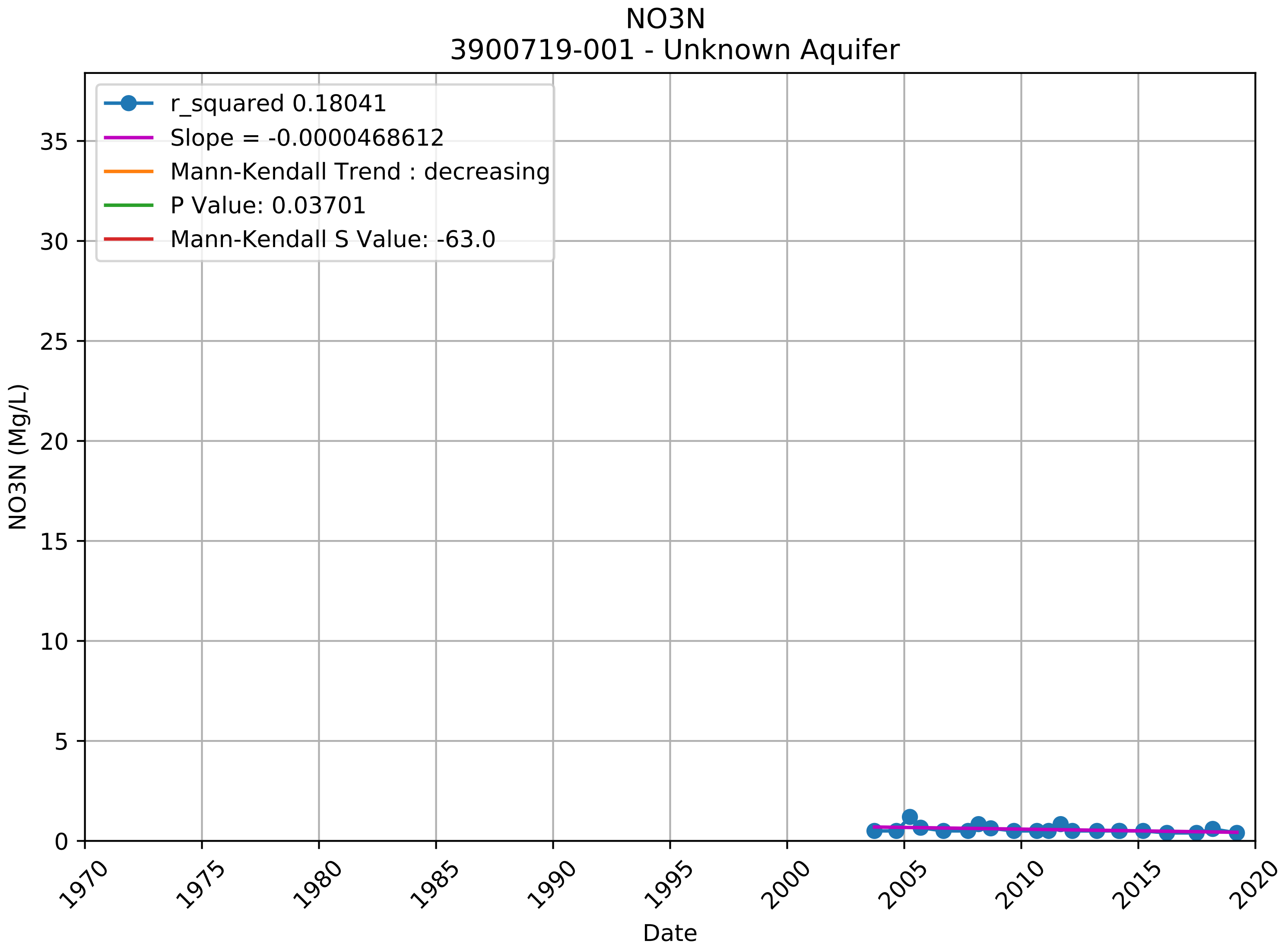

NO3N
3900719-001 - Unknown Aquifer
r_squared 0.18041
Slope = -0.0000468612
Mann-Kendall Trend : decreasing
P Value: 0.03701
Mann-Kendall S Value: -63.0
NO3N (Mg/L)
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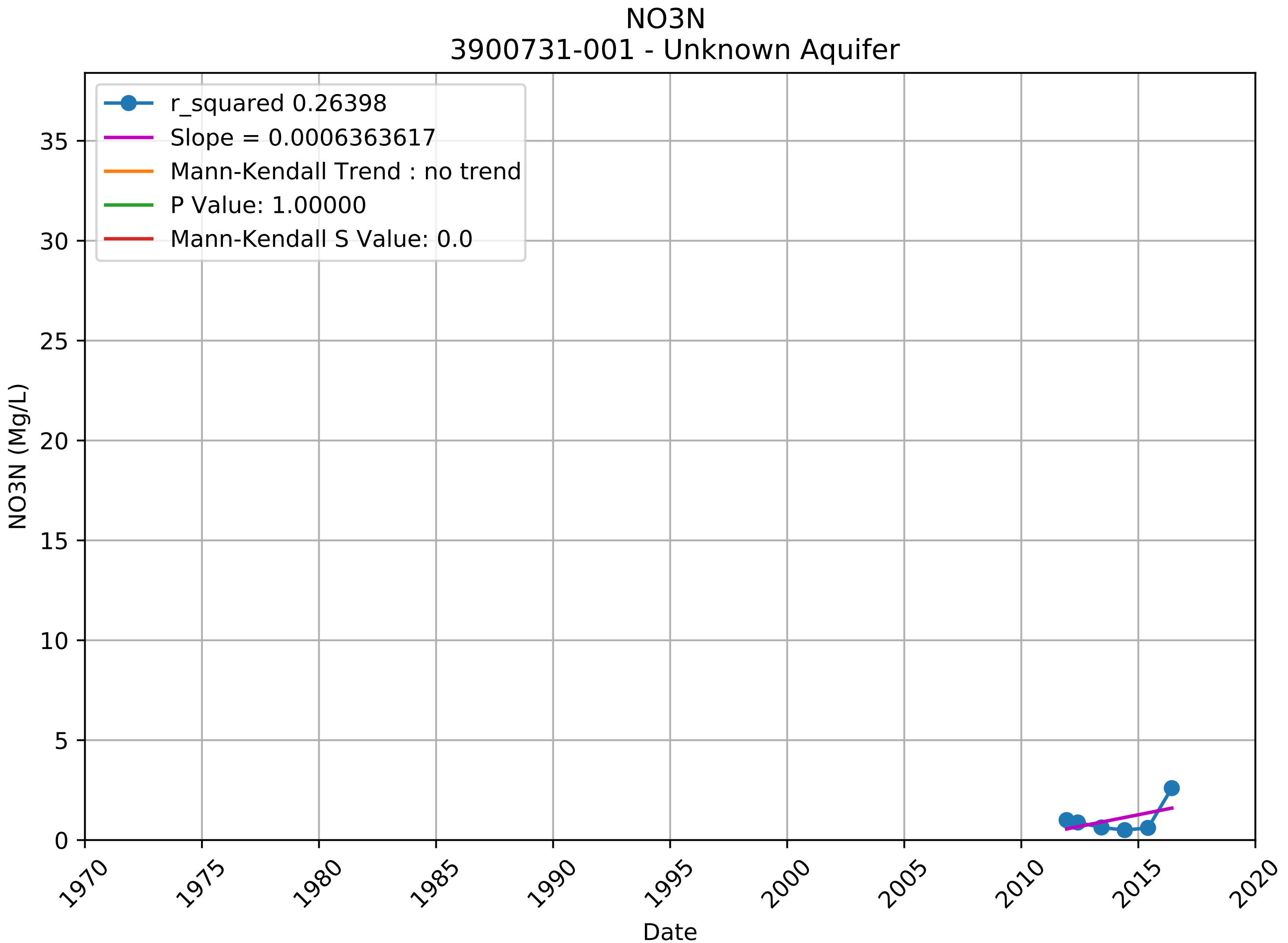

NO3N
3900731-001 - Unknown Aquifer
r_squared 0.26398
Slope = 0.0006363617
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
NO3N (Mg/L)
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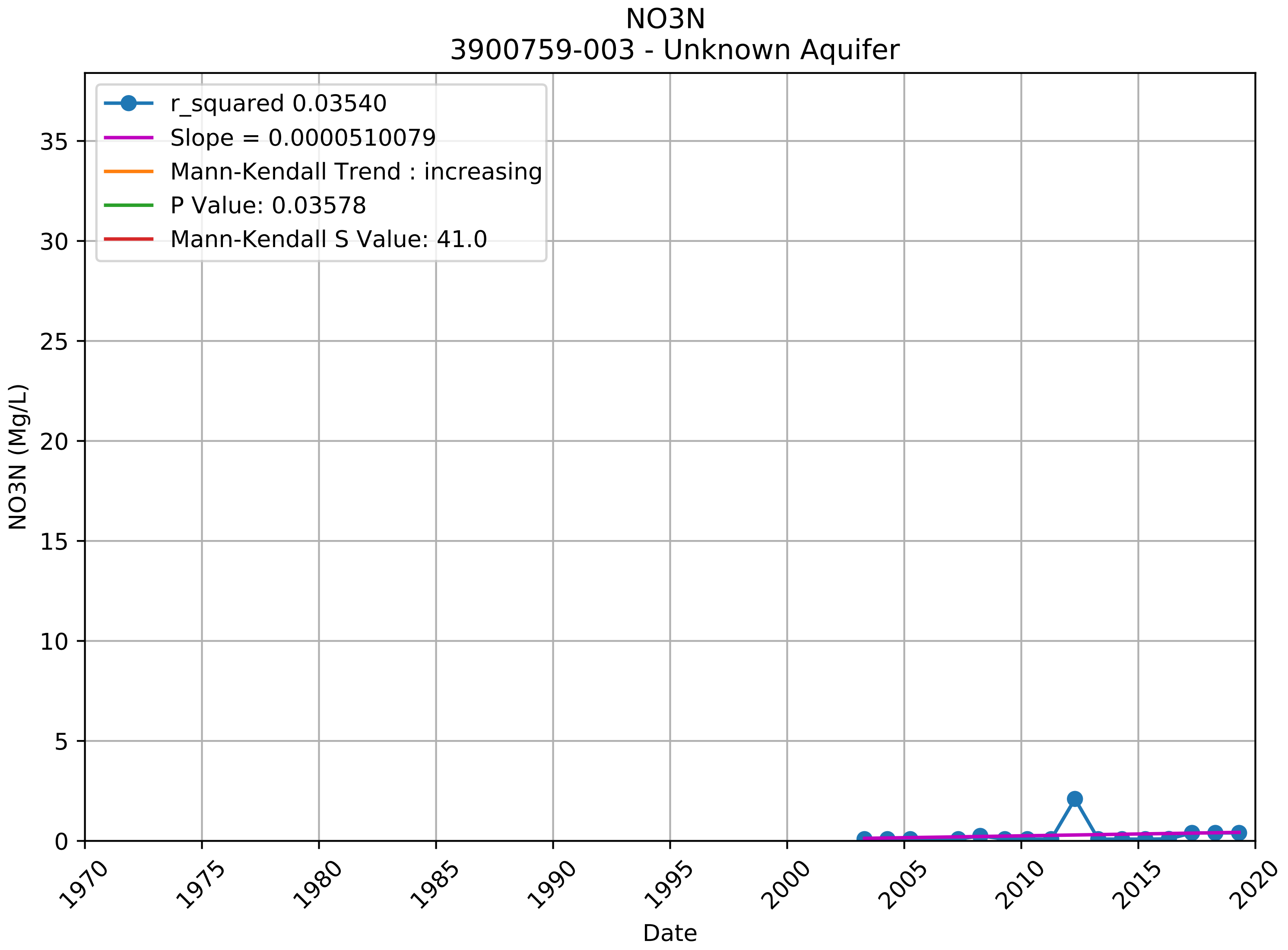
NO3N
3900759-003 - Unknown Aquifer
r_squared 0.03540
Slope = 0.0000510079
Mann-Kendall Trend : increasing
P Value: 0.03578
Mann-Kendall S Value: 41.0
NO3N (Mg/L)
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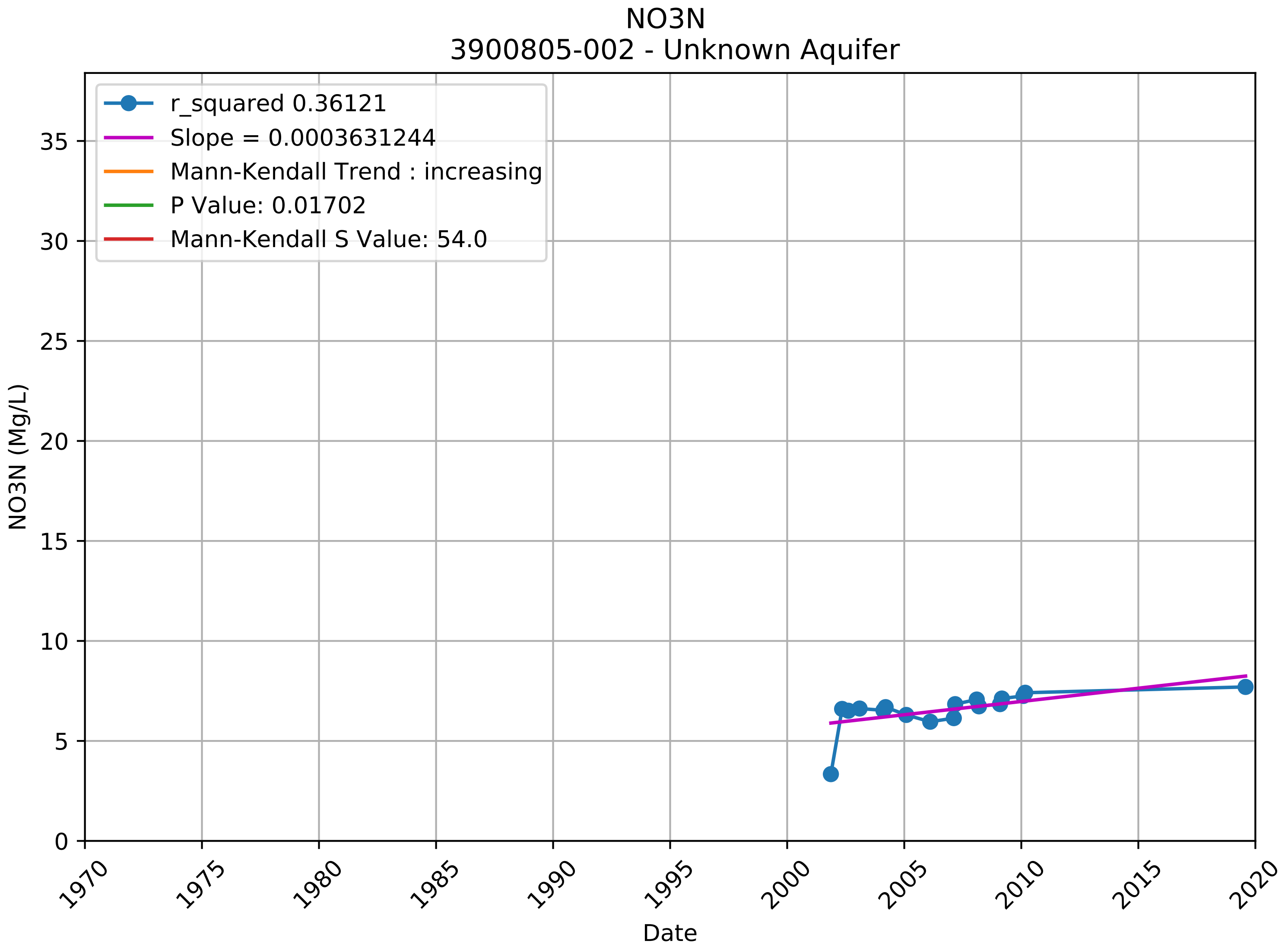

NO3N
3900805-002 - Unknown Aquifer
r_squared 0.36121
Slope = 0.0003631244
Mann-Kendall Trend : increasing
P Value: 0.01702
Mann-Kendall S Value: 54.0
NO3N (Mg/L)
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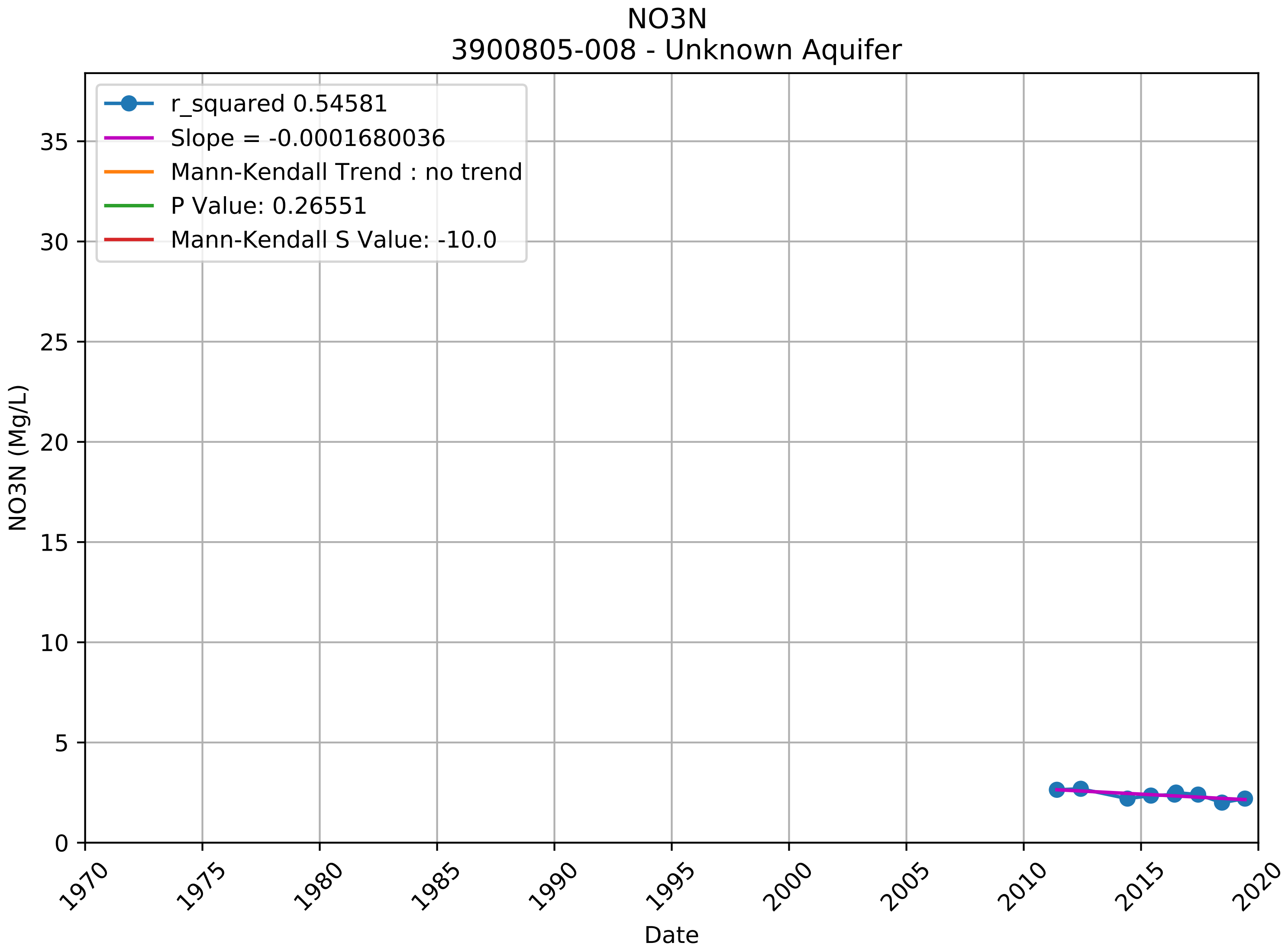
NO3N
3900805-008 - Unknown Aquifer
r_squared 0.54581
Slope = -0.0001680036
Mann-Kendall Trend : no trend
P Value: 0.26551
Mann-Kendall S Value: -10.0
NO3N (Mg/L)
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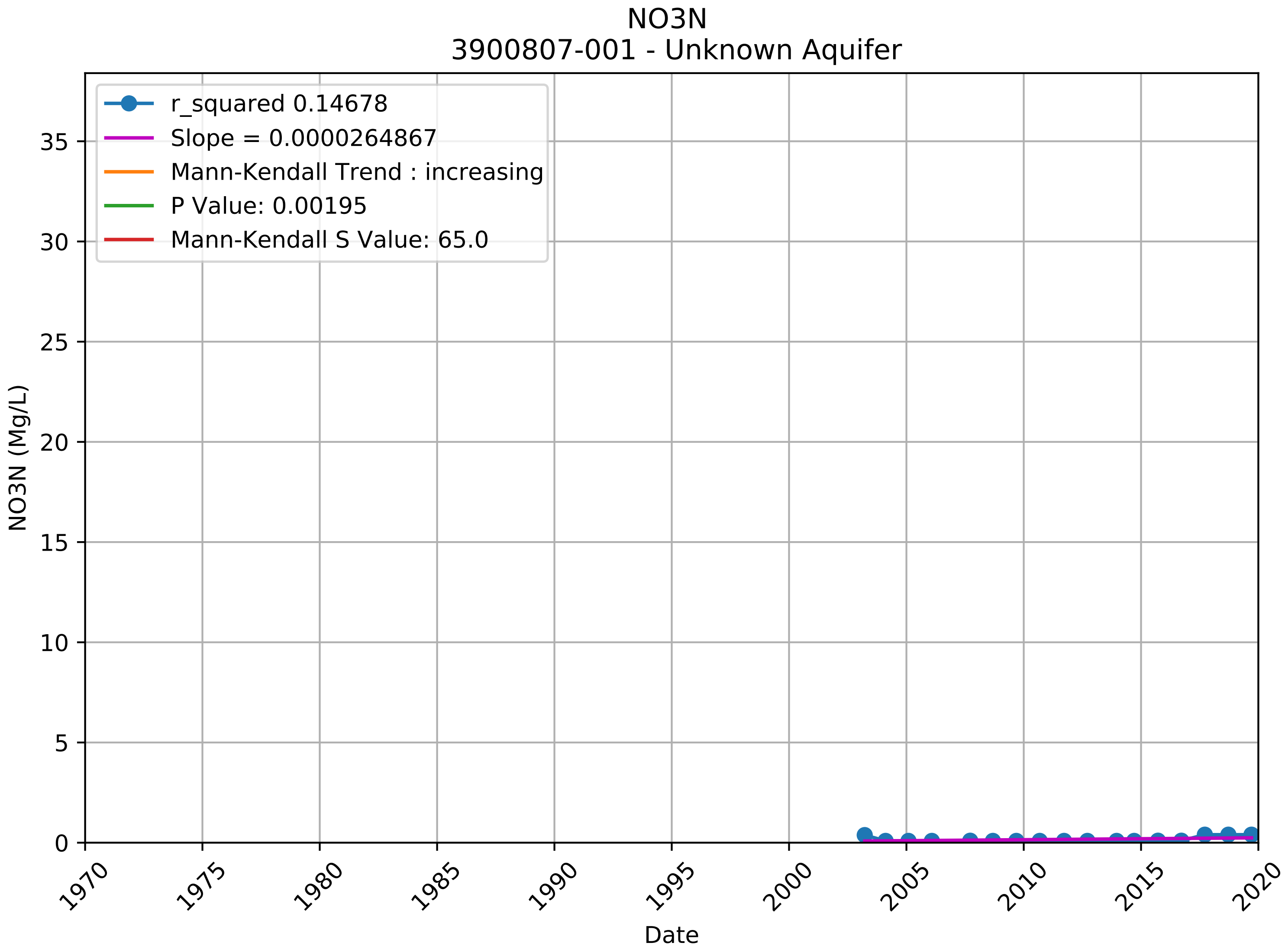

NO3N
3900807-001 - Unknown Aquifer
r_squared 0.14678
Slope = 0.0000264867
Mann-Kendall Trend : increasing
P Value: 0.00195
Mann-Kendall S Value: 65.0
NO3N (Mg/L)
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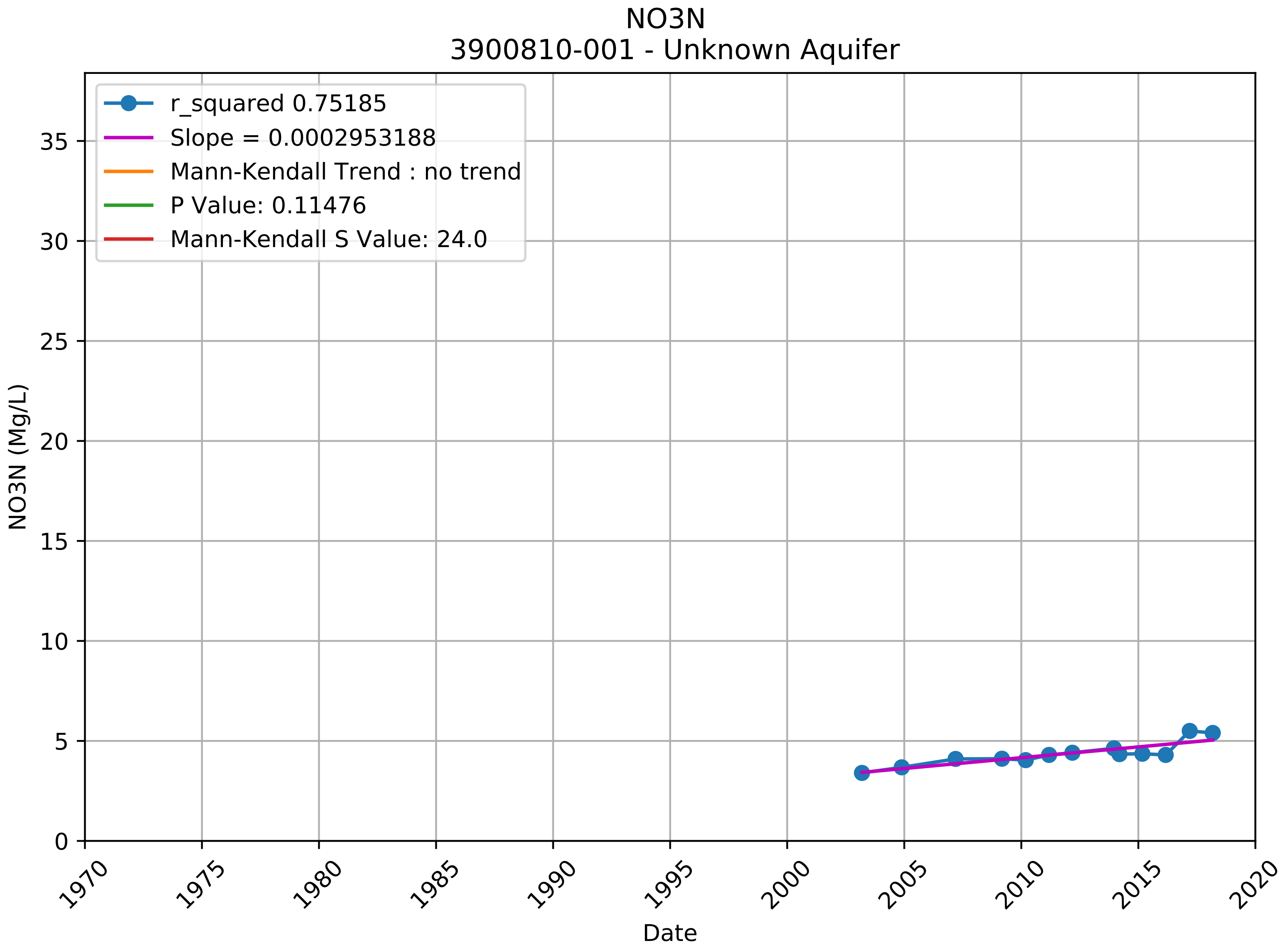

NO3N
3900810-001 - Unknown Aquifer
r_squared 0.75185
Slope = 0.0002953188
Mann-Kendall Trend : no trend
P Value: 0.11476
Mann-Kendall S Value: 24.0
NO3N (Mg/L)
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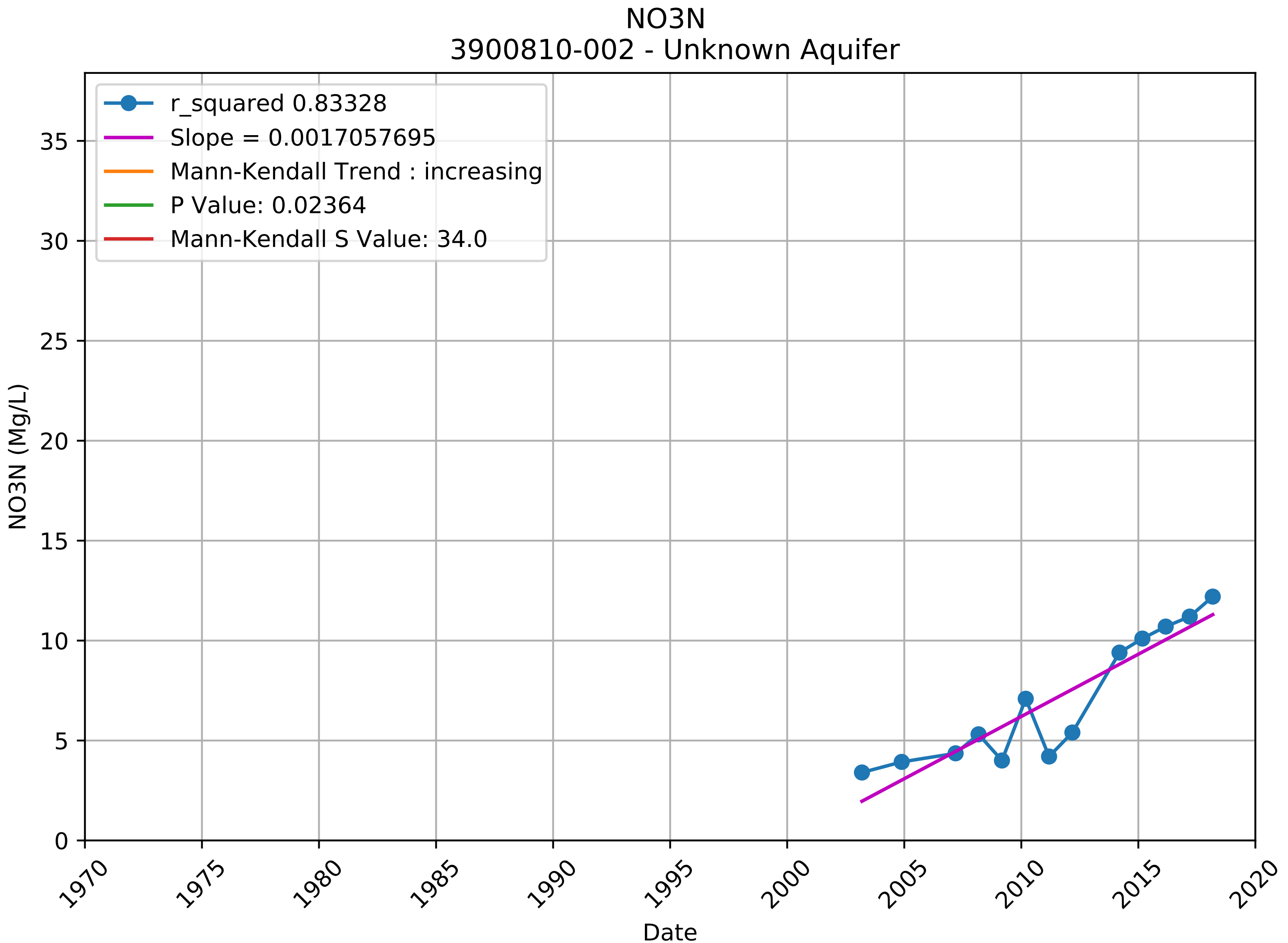
NO3N
3900810-002 - Unknown Aquifer
r_squared 0.83328
Slope = 0.0017057695
Mann-Kendall Trend : increasing
P Value: 0.02364
Mann-Kendall S Value: 34.0
NO3N (Mg/L)
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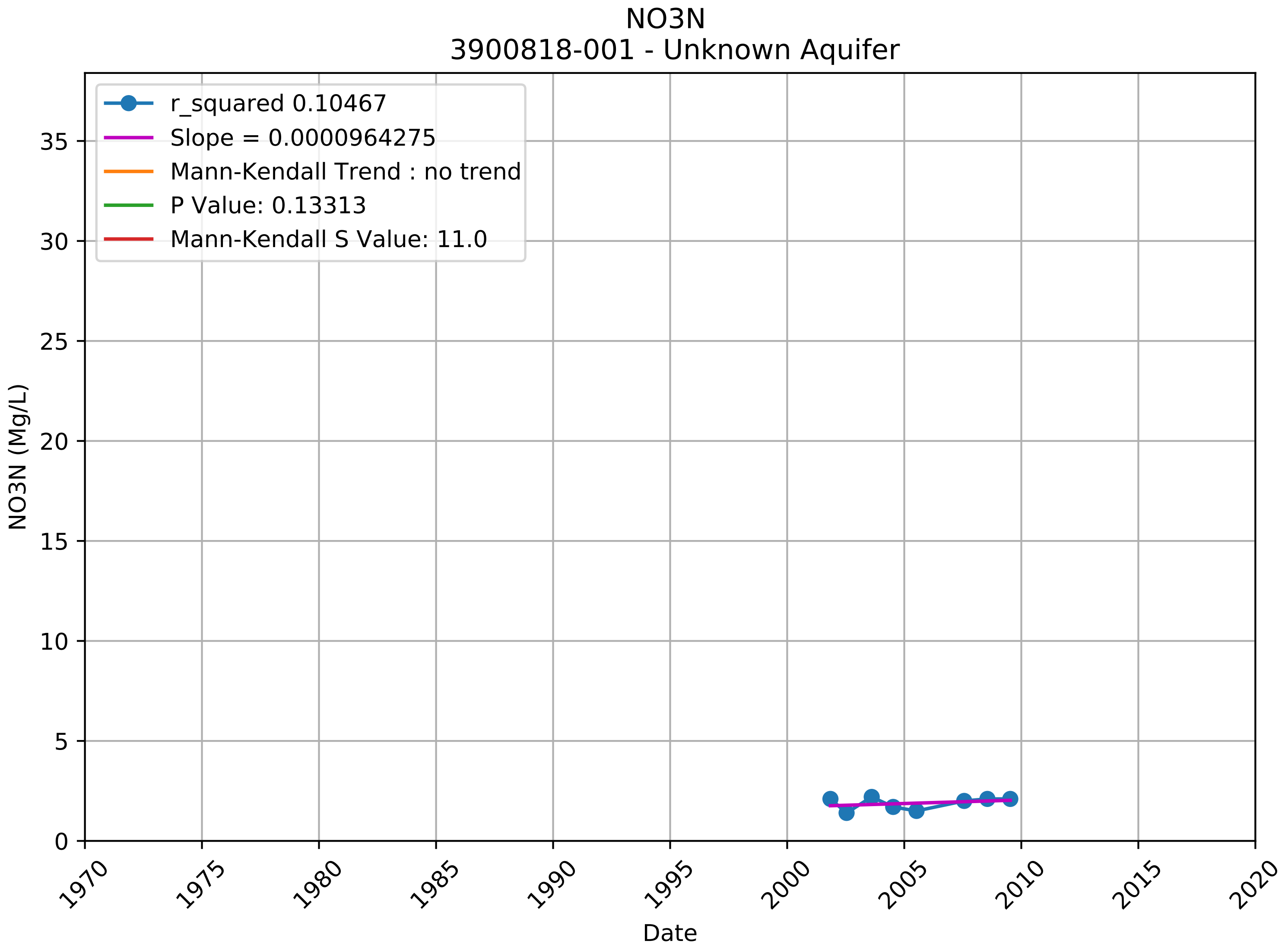

NO3N
3900818-001 - Unknown Aquifer
r_squared 0.10467
Slope = 0.0000964275
Mann-Kendall Trend : no trend
P Value: 0.13313
Mann-Kendall S Value: 11.0
NO3N (Mg/L)
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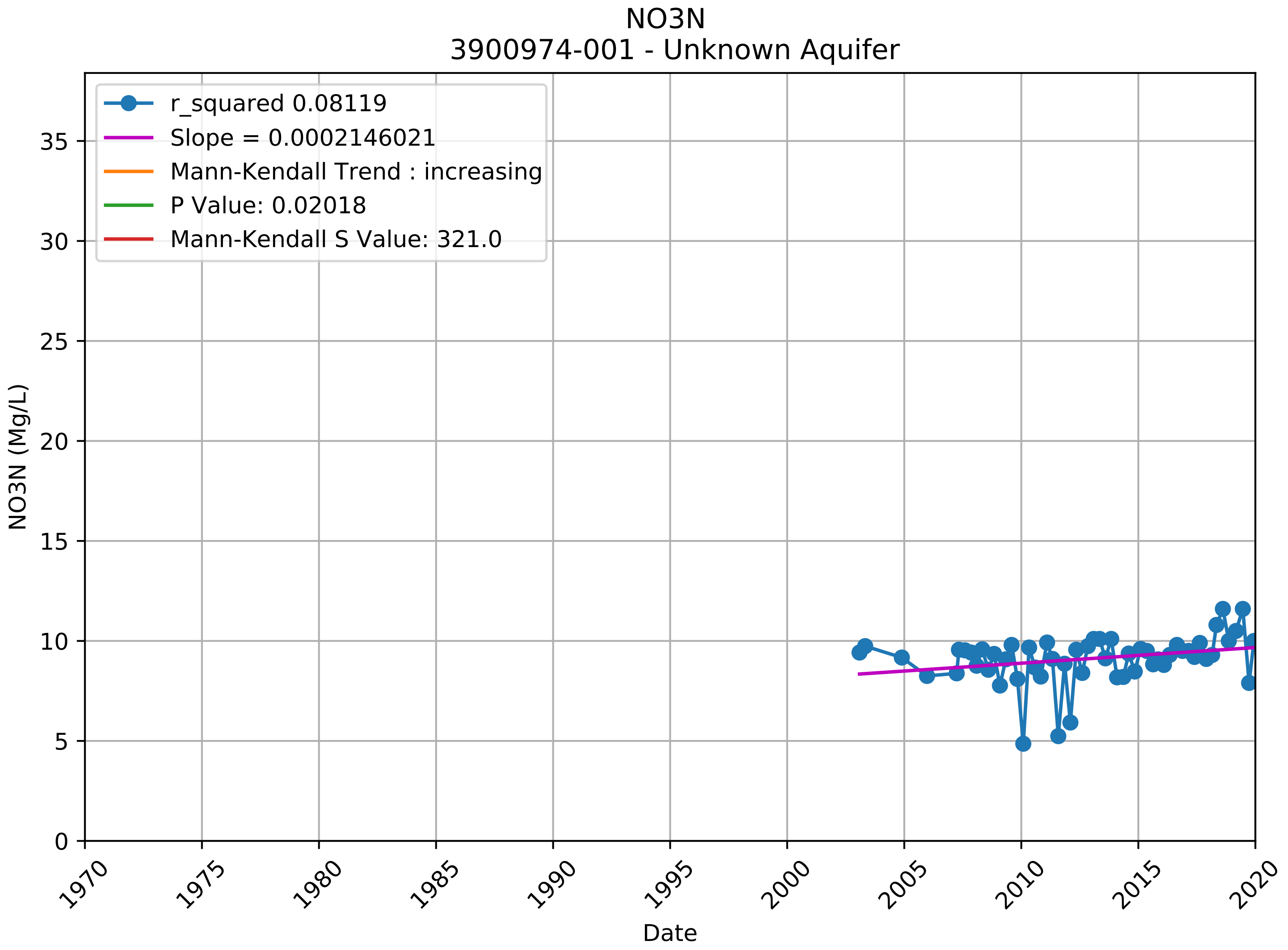
NO3N
3900974-001 - Unknown Aquifer
r_squared 0.08119
Slope = 0.0002146021
Mann-Kendall Trend : increasing
P Value: 0.02018
Mann-Kendall S Value: 321.0
NO3N (Mg/L)
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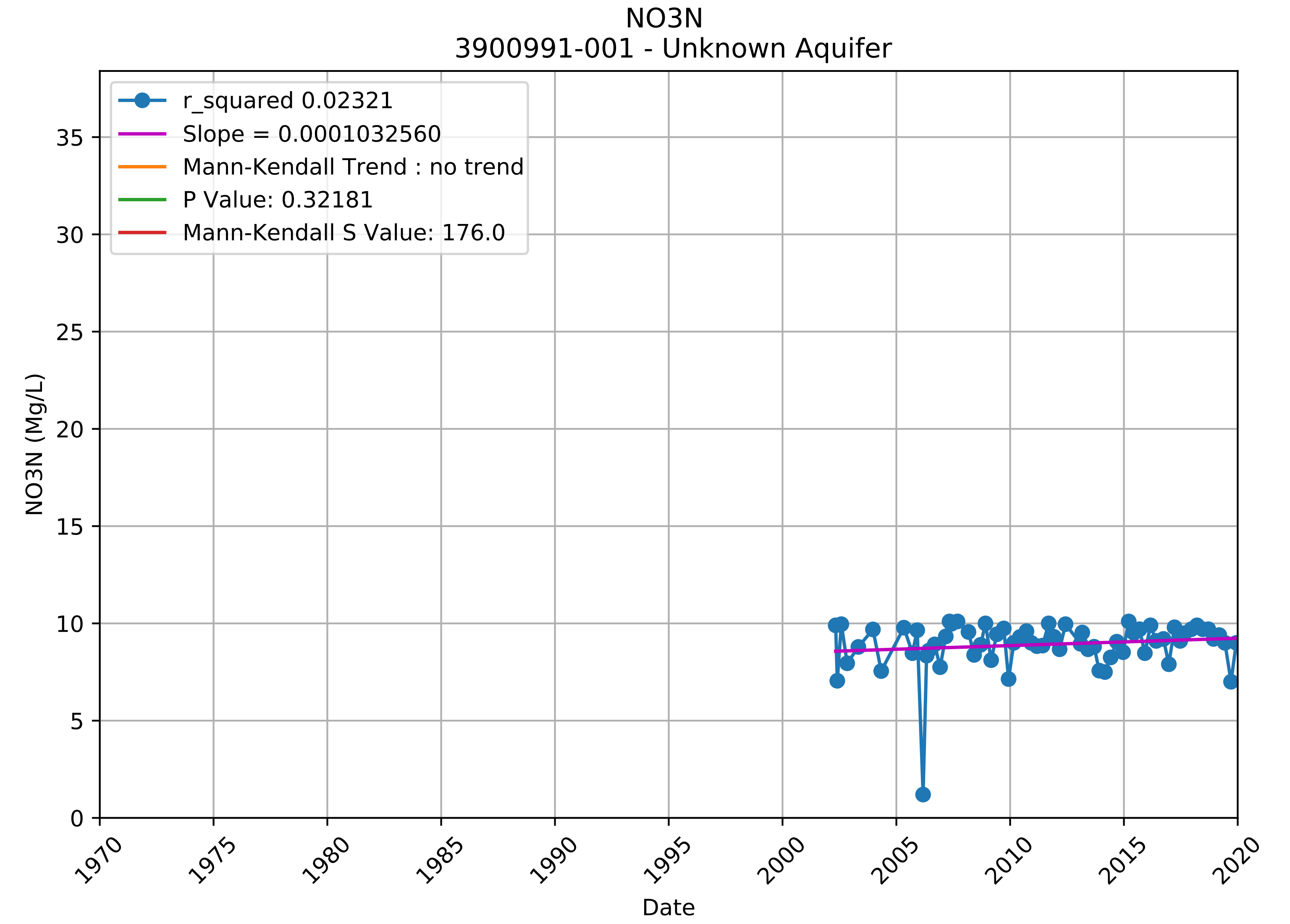
NO3N
3900991-001 - Unknown Aquifer
r_squared 0.02321
Slope = 0.0001032560
Mann-Kendall Trend : no trend
P Value: 0.32181
Mann-Kendall S Value: 176.0
NO3N (Mg/L)
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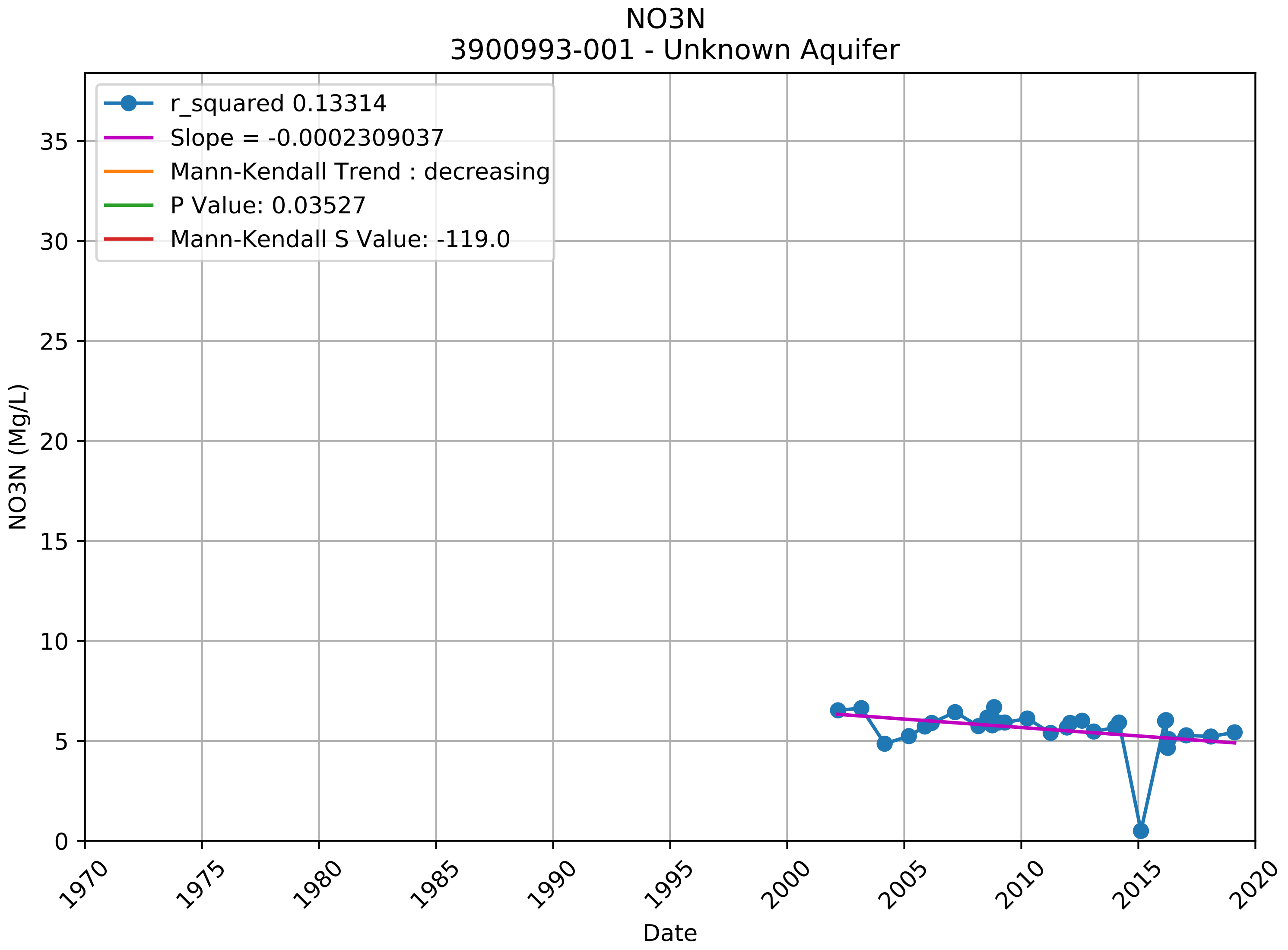

NO3N
3900993-001 - Unknown Aquifer
r_squared 0.13314
Slope = -0.0002309037
Mann-Kendall Trend : decreasing
P Value: 0.03527
Mann-Kendall S Value: -119.0
NO3N (Mg/L)
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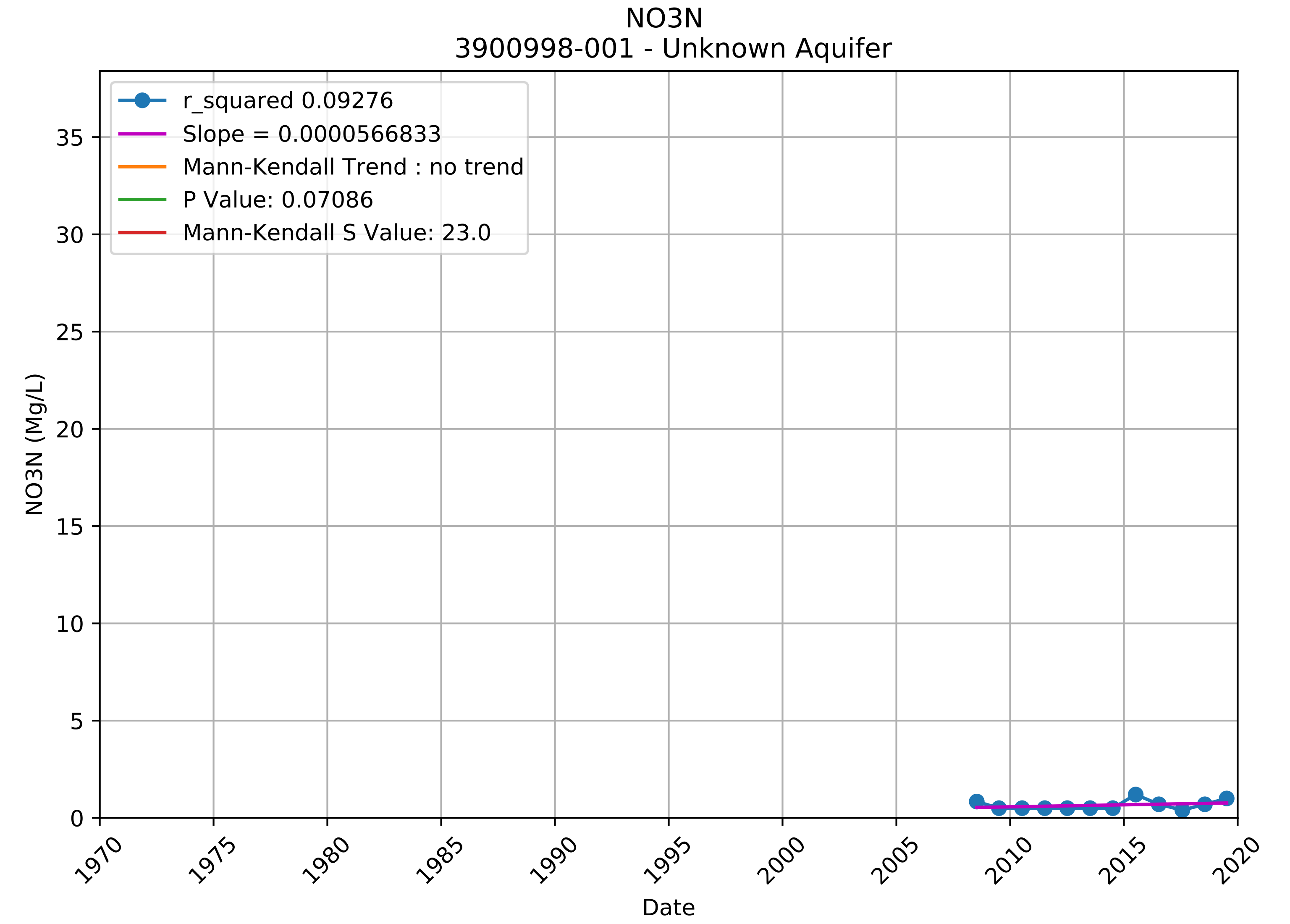

NO3N
3900998-001 - Unknown Aquifer
r_squared 0.09276
Slope = 0.0000566833
Mann-Kendall Trend : no trend
P Value: 0.07086
Mann-Kendall S Value: 23.0
NO3N (Mg/L)
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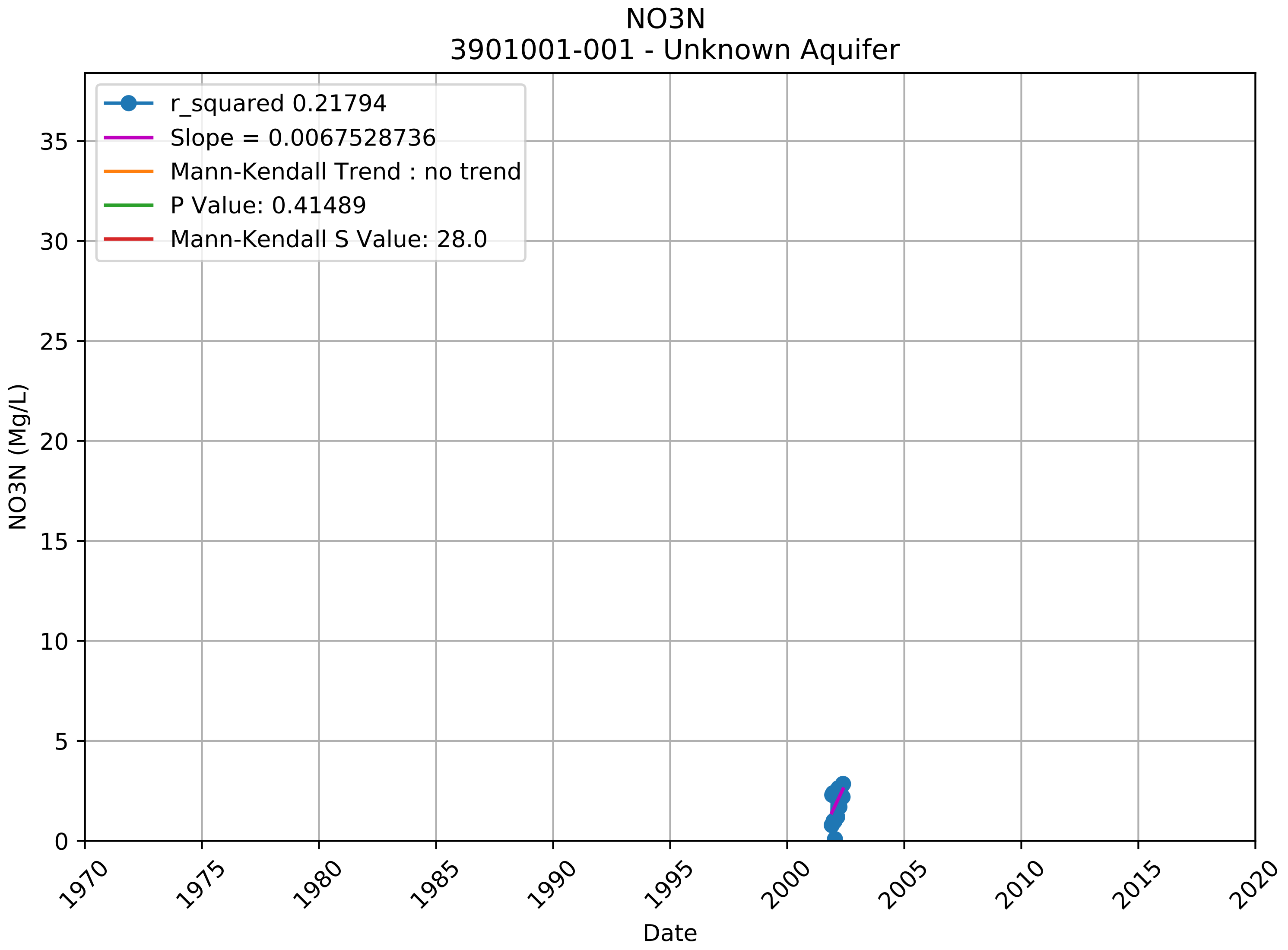

NO3N
3901001-001 - Unknown Aquifer
r_squared 0.21794
Slope = 0.0067528736
Mann-Kendall Trend : no trend
P Value: 0.41489
Mann-Kendall S Value: 28.0
NO3N (Mg/L)
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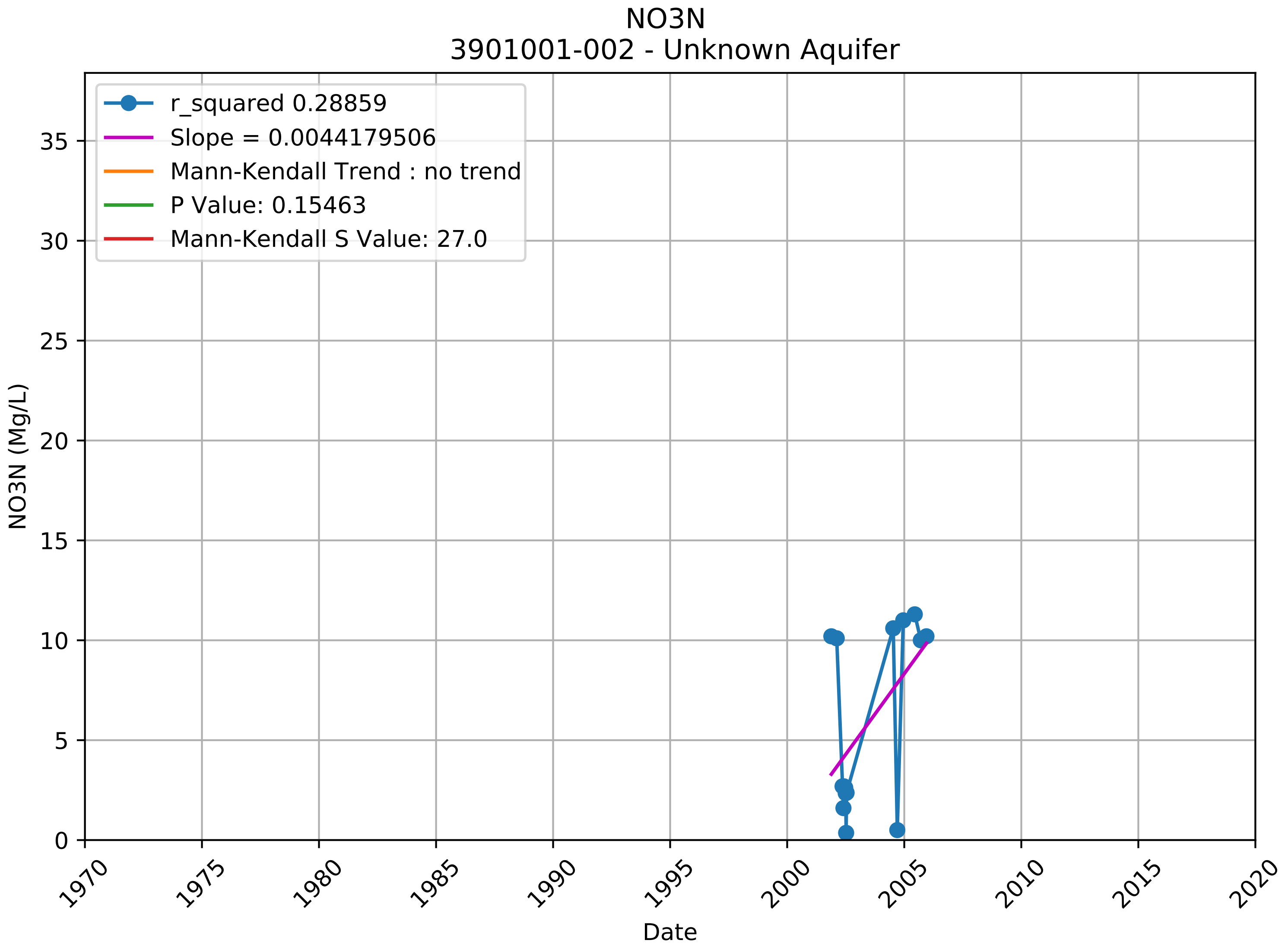
NO3N
3901001-002 - Unknown Aquifer
r_squared 0.28859
Slope = 0.0044179506
Mann-Kendall Trend : no trend
P Value: 0.15463
Mann-Kendall S Value: 27.0
NO3N (Mg/L)
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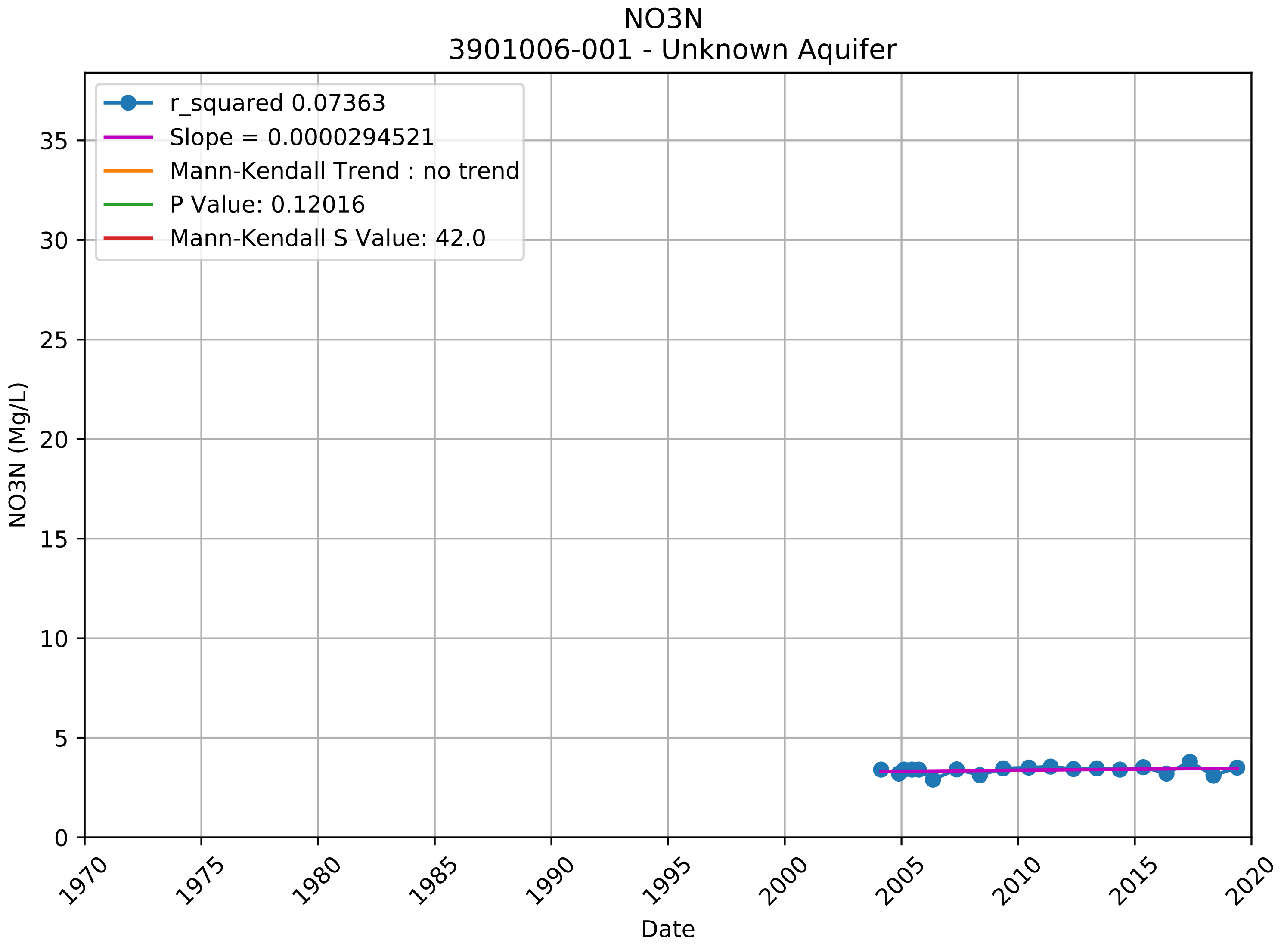
NO3N
3901006-001 - Unknown Aquifer
r_squared 0.07363
Slope = 0.0000294521
Mann-Kendall Trend : no trend
P Value: 0.12016
Mann-Kendall S Value: 42.0
NO3N (Mg/L)
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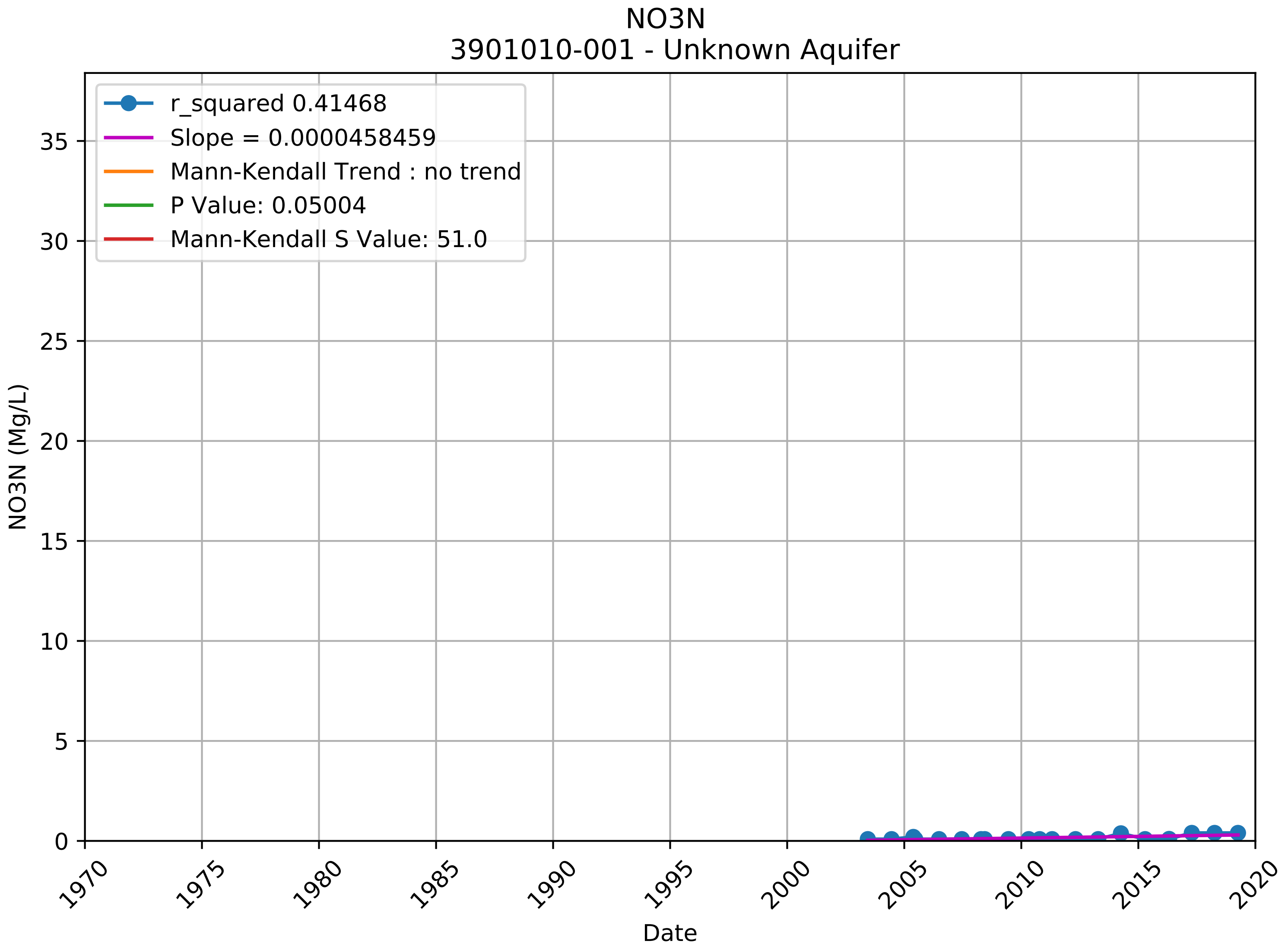
NO3N
3901010-001 - Unknown Aquifer
r_squared 0.41468
Slope = 0.0000458459
Mann-Kendall Trend : no trend
P Value: 0.05004
Mann-Kendall S Value: 51.0
NO3N (Mg/L)
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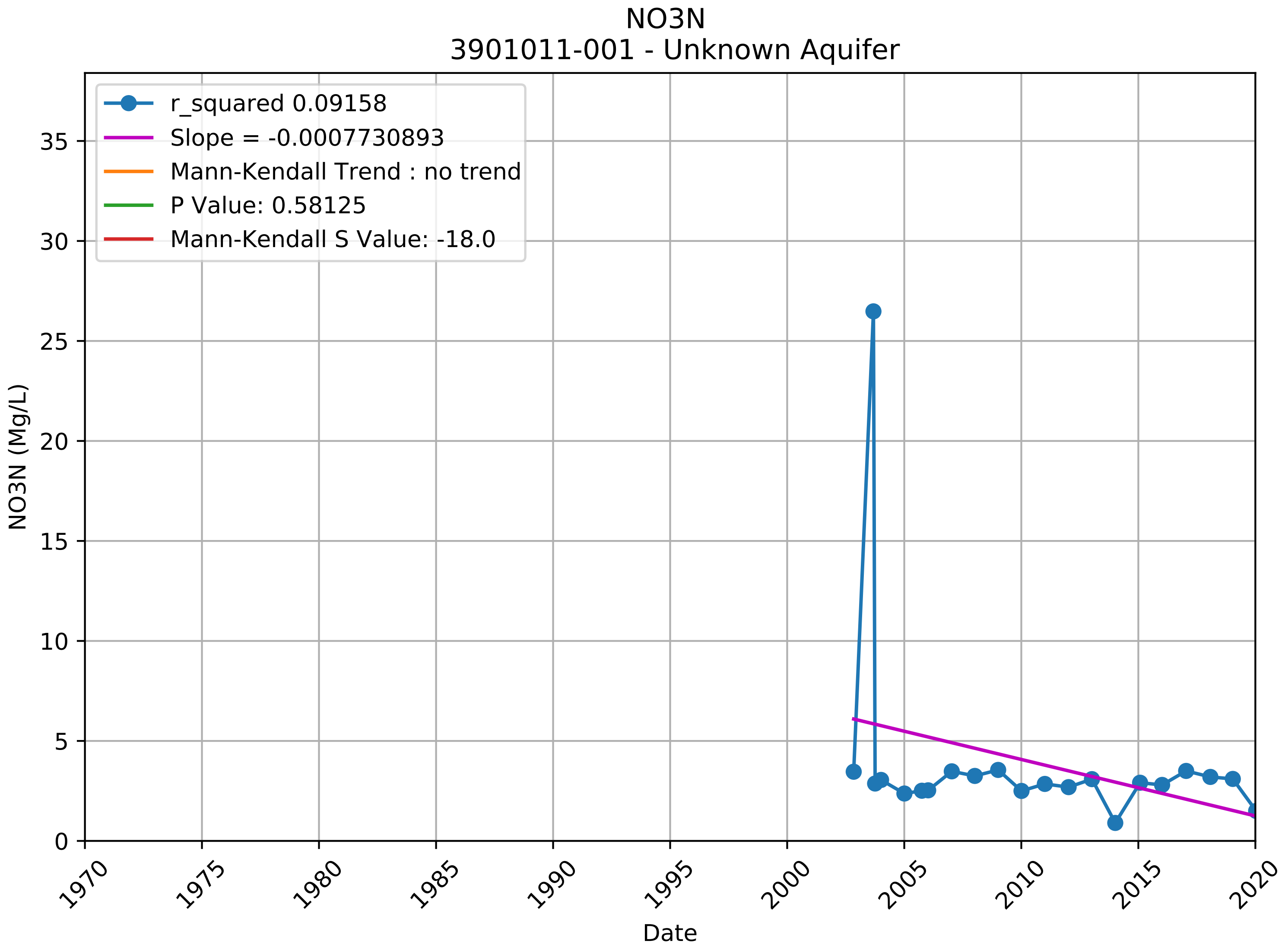
NO3N
3901011-001 - Unknown Aquifer
r_squared 0.09158
Slope = -0.0007730893
Mann-Kendall Trend : no trend
P Value: 0.58125
Mann-Kendall S Value: -18.0
NO3N (Mg/L)
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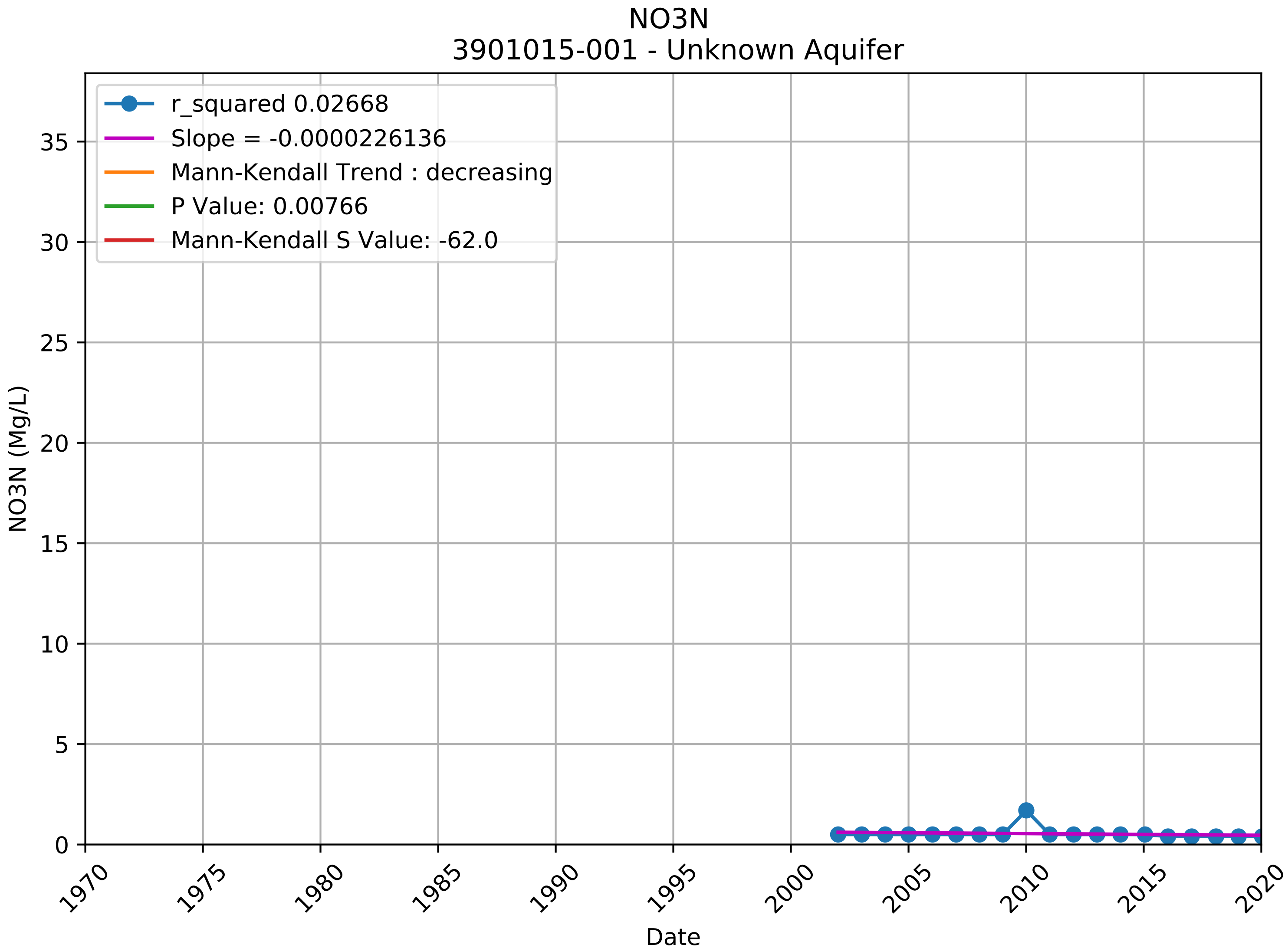

NO3N
3901015-001 - Unknown Aquifer
r_squared 0.02668
Slope = -0.0000226136
Mann-Kendall Trend : decreasing
P Value: 0.00766
Mann-Kendall S Value: -62.0
NO3N (Mg/L)
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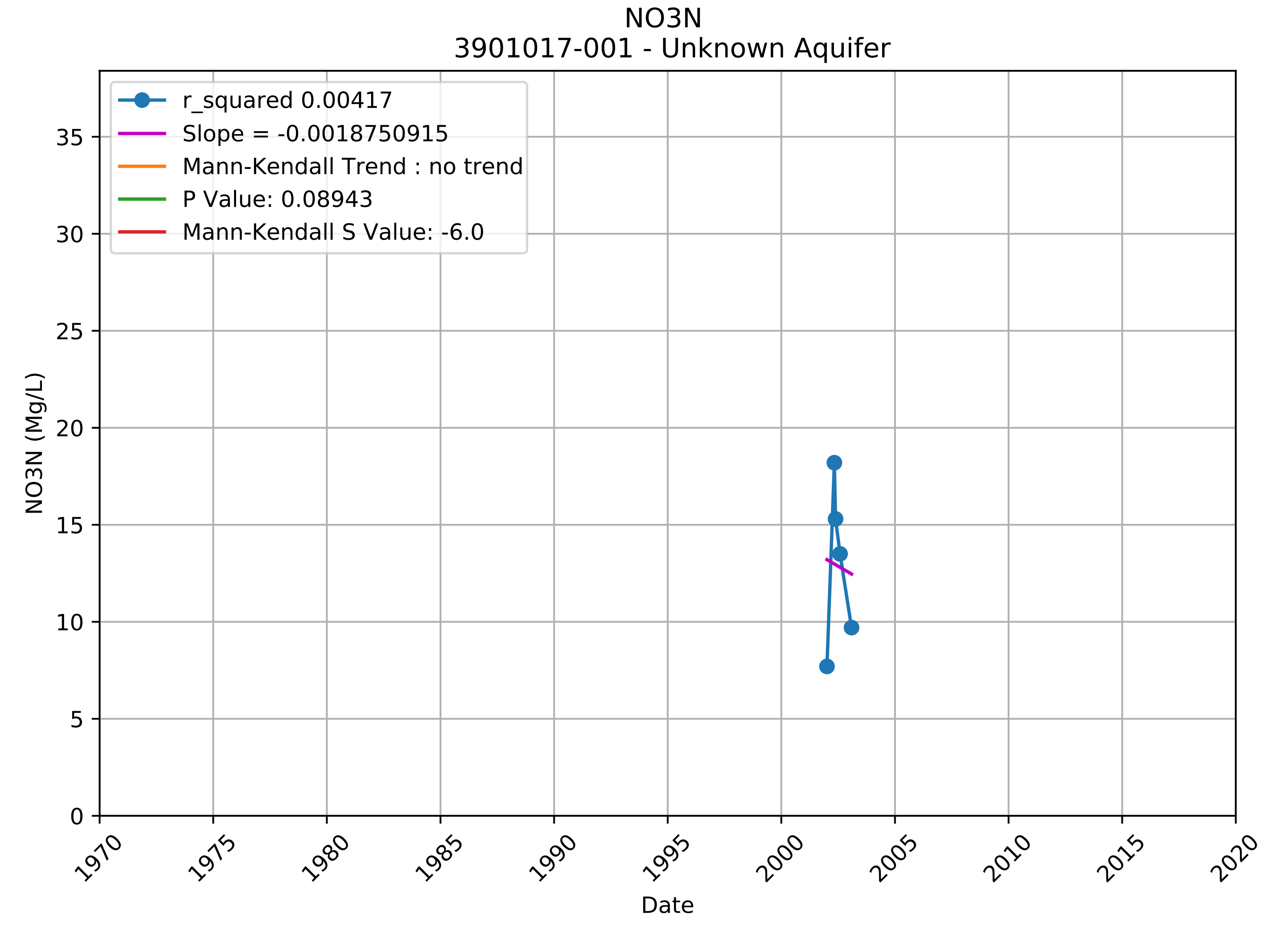
NO3N
3901017-001 - Unknown Aquifer
r_squared 0.00417
Slope = -0.0018750915
Mann-Kendall Trend : no trend
P Value: 0.08943
Mann-Kendall S Value: -6.0
NO3N (Mg/L)
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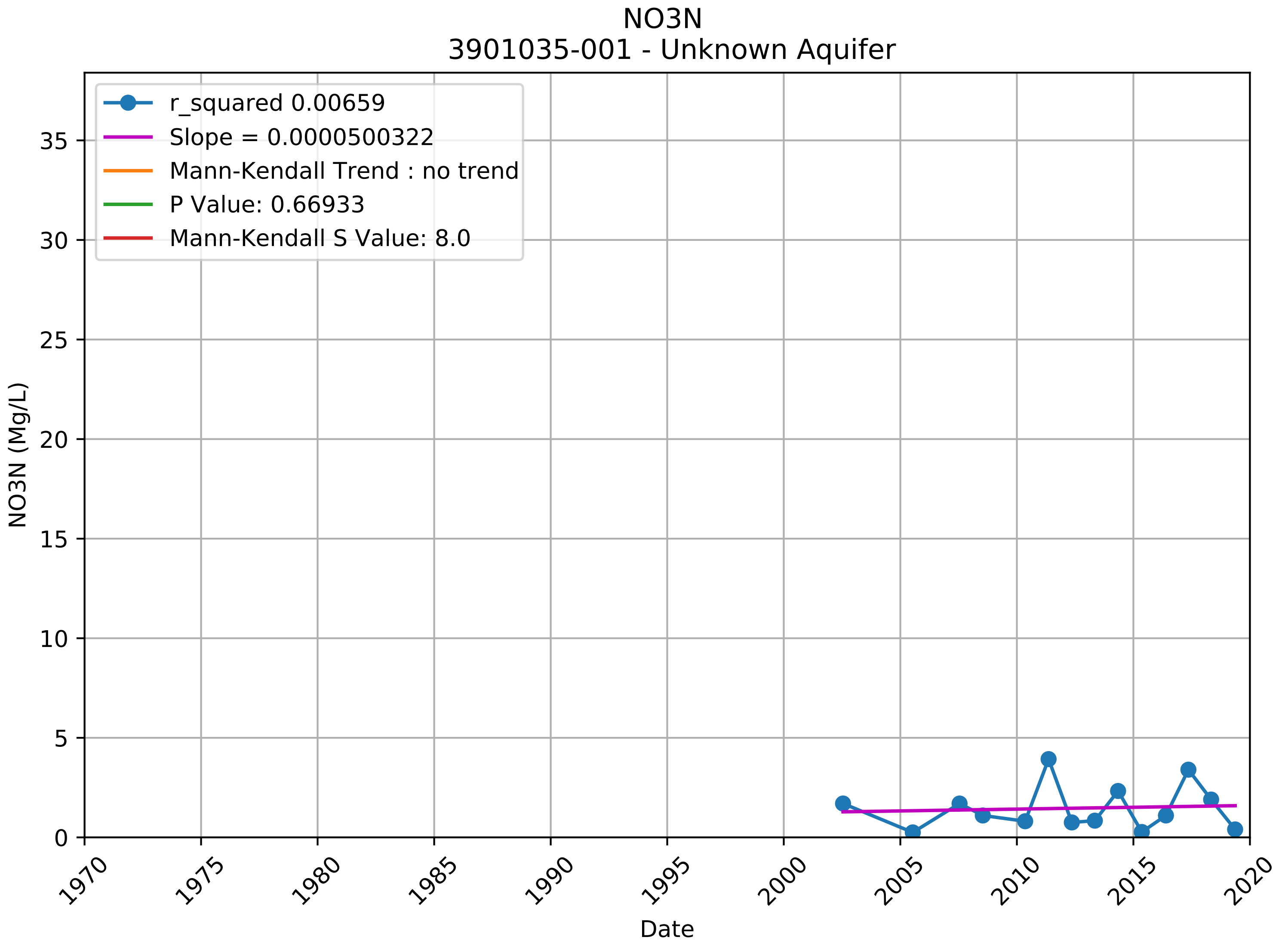

NO3N
3901035-001 - Unknown Aquifer
r_squared 0.00659
Slope = 0.0000500322
Mann-Kendall Trend : no trend
P Value: 0.66933
Mann-Kendall S Value: 8.0
NO3N (Mg/L)
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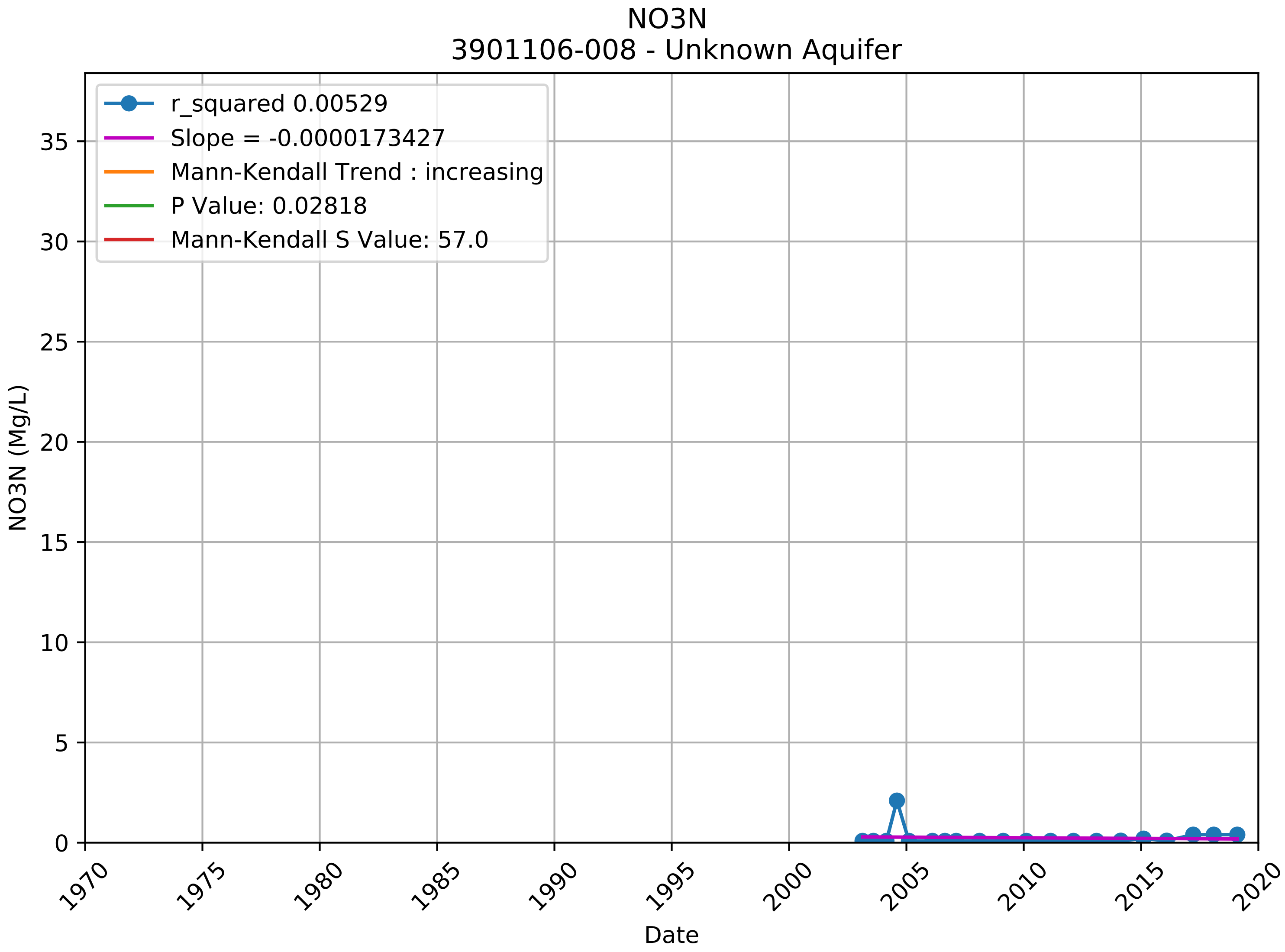

NO3N
3901106-008 - Unknown Aquifer
r_squared 0.00529
Slope = -0.0000173427
Mann-Kendall Trend : increasing
P Value: 0.02818
Mann-Kendall S Value: 57.0
NO3N (Mg/L)
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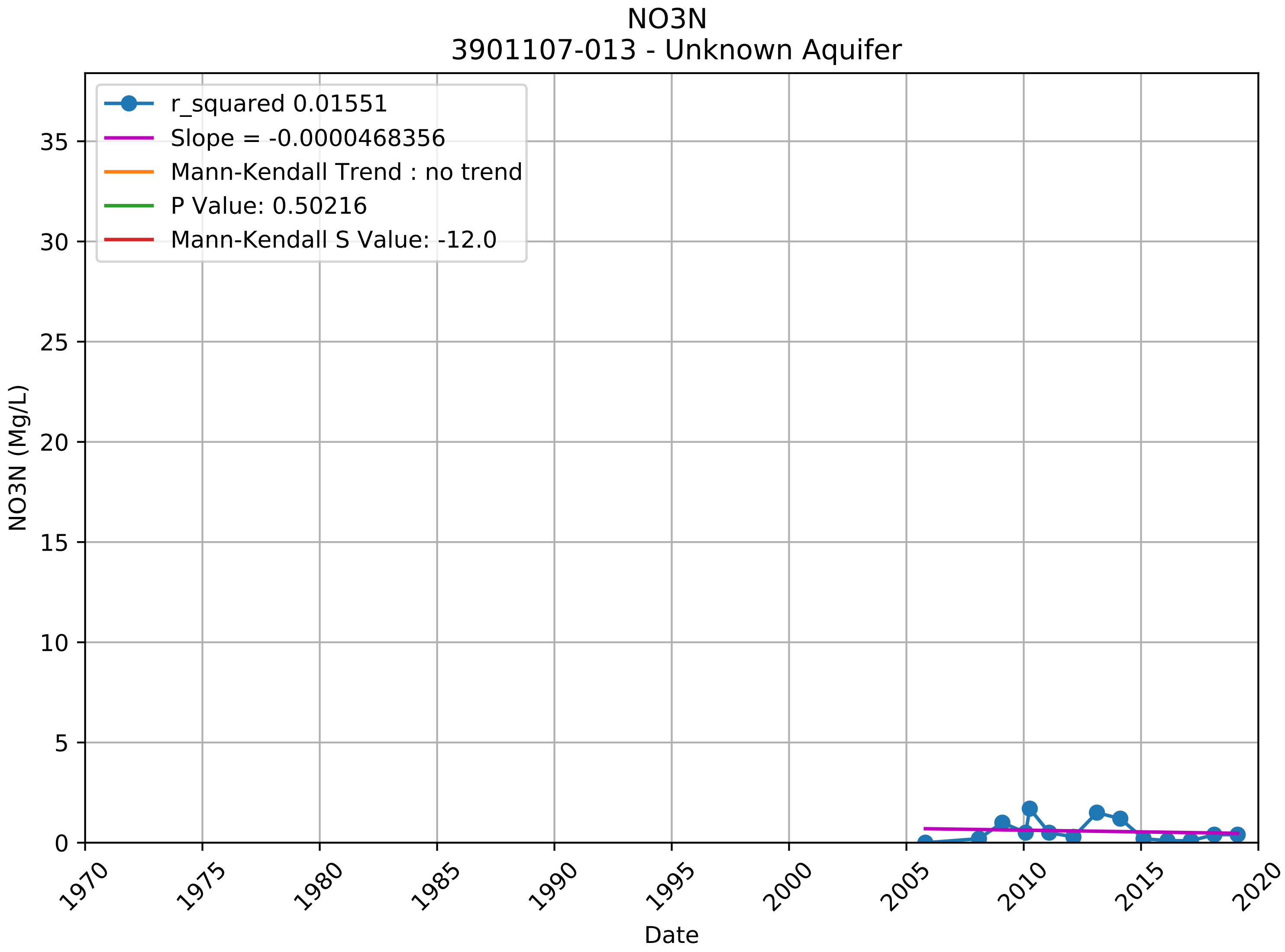
NO3N
3901107-013 - Unknown Aquifer
r_squared 0.01551
Slope = -0.0000468356
Mann-Kendall Trend : no trend
P Value: 0.50216
Mann-Kendall S Value: -12.0
NO3N (Mg/L)
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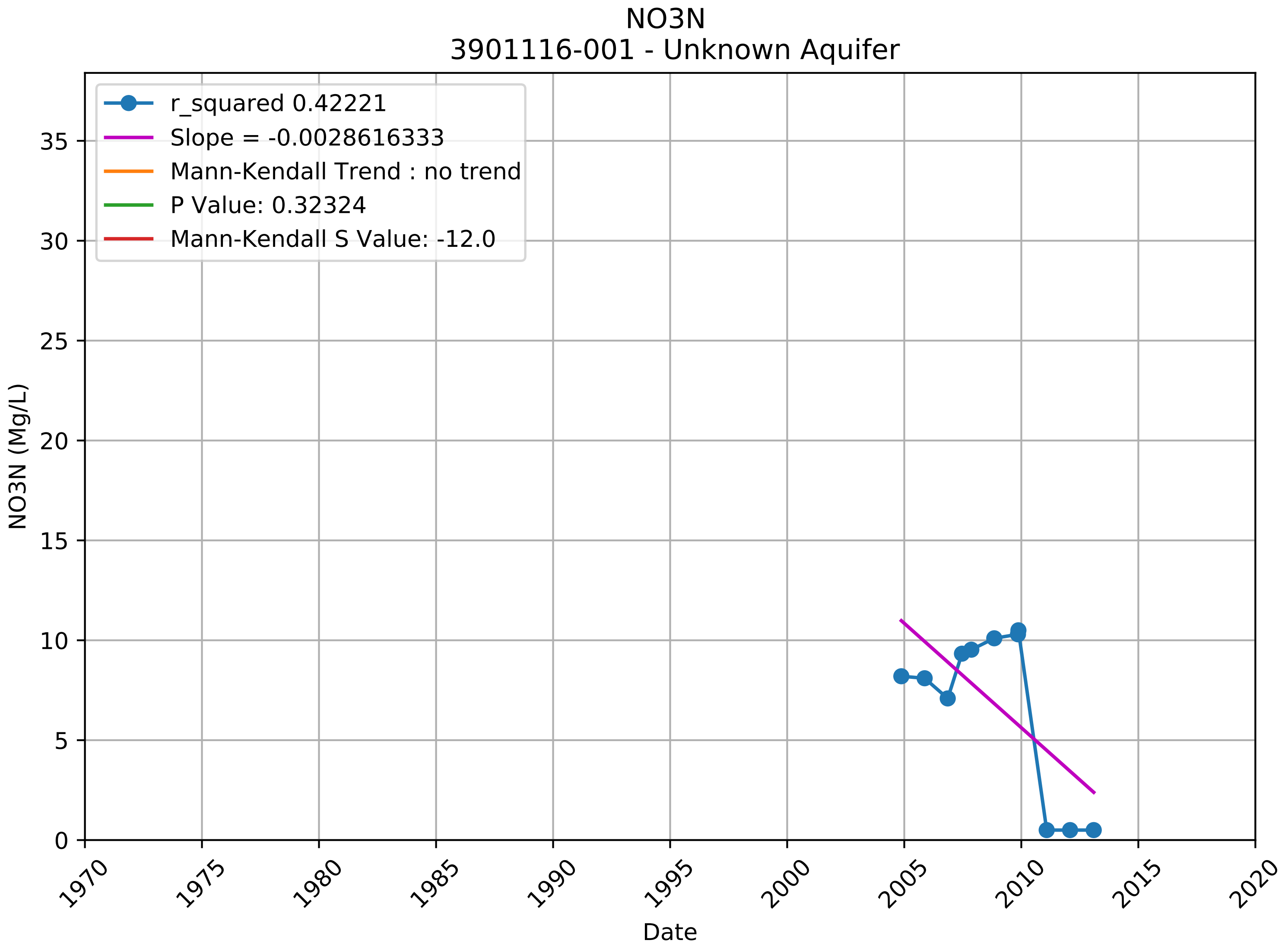

NO3N
3901116-001 - Unknown Aquifer
r_squared 0.42221
Slope = -0.0028616333
Mann-Kendall Trend : no trend
P Value: 0.32324
Mann-Kendall S Value: -12.0
NO3N (Mg/L)
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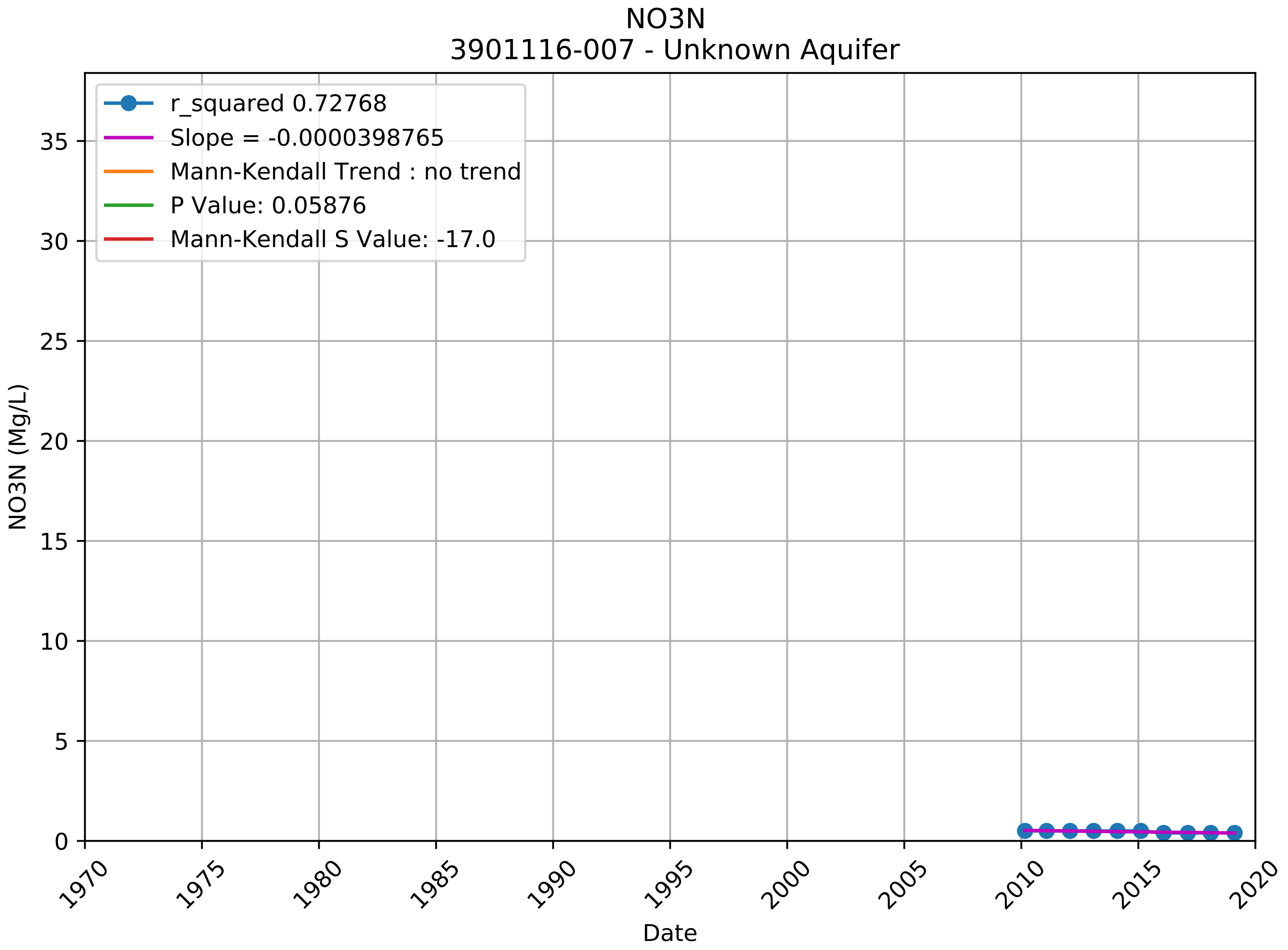

NO3N
3901116-007 - Unknown Aquifer
r_squared 0.72768
Slope = -0.0000398765
Mann-Kendall Trend : no trend
P Value: 0.05876
Mann-Kendall S Value: -17.0
NO3N (Mg/L)
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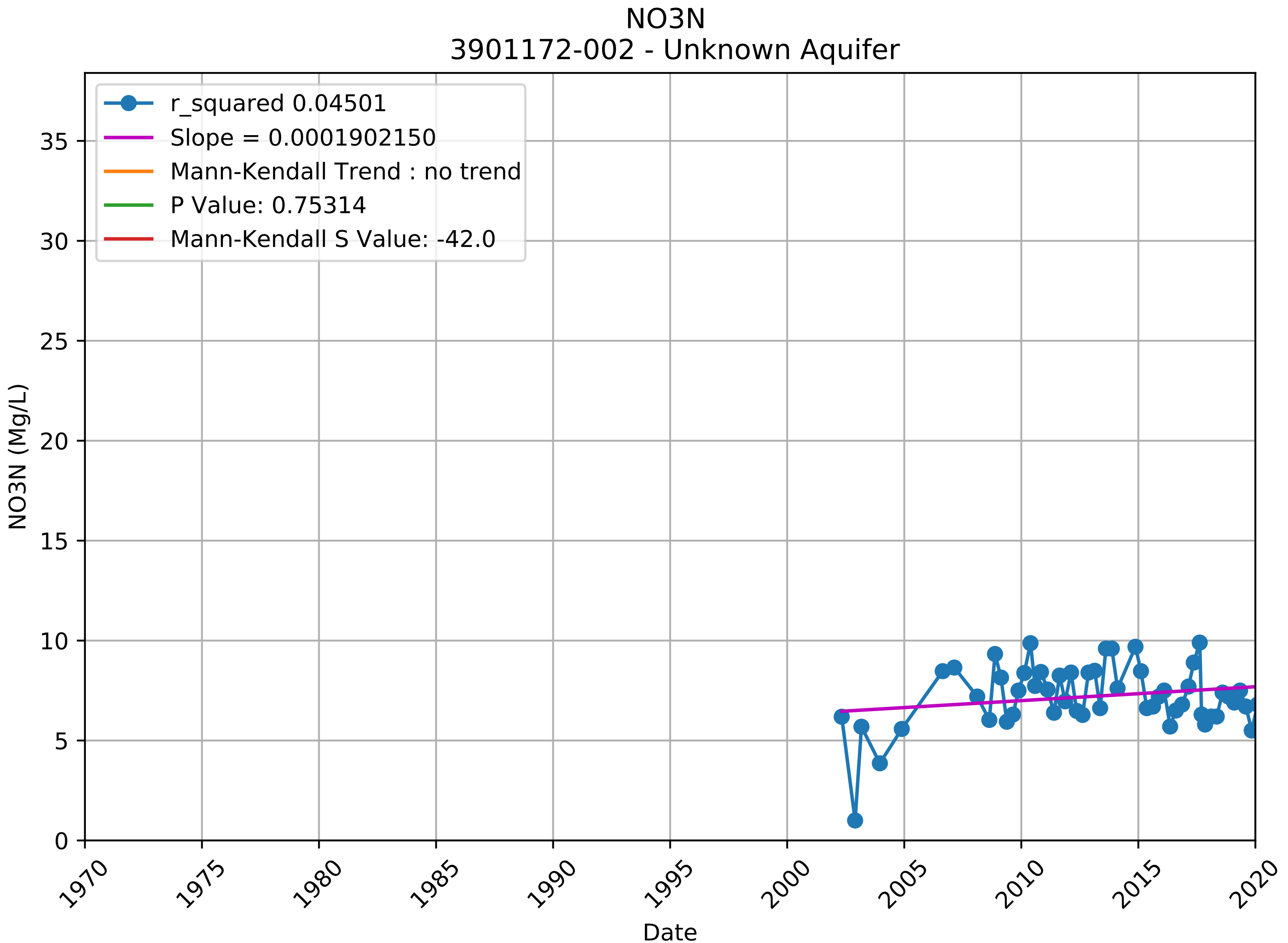
NO3N
3901172-002 - Unknown Aquifer
r_squared 0.04501
Slope = 0.0001902150
Mann-Kendall Trend : no trend
P Value: 0.75314
Mann-Kendall S Value: -42.0
NO3N (Mg/L)
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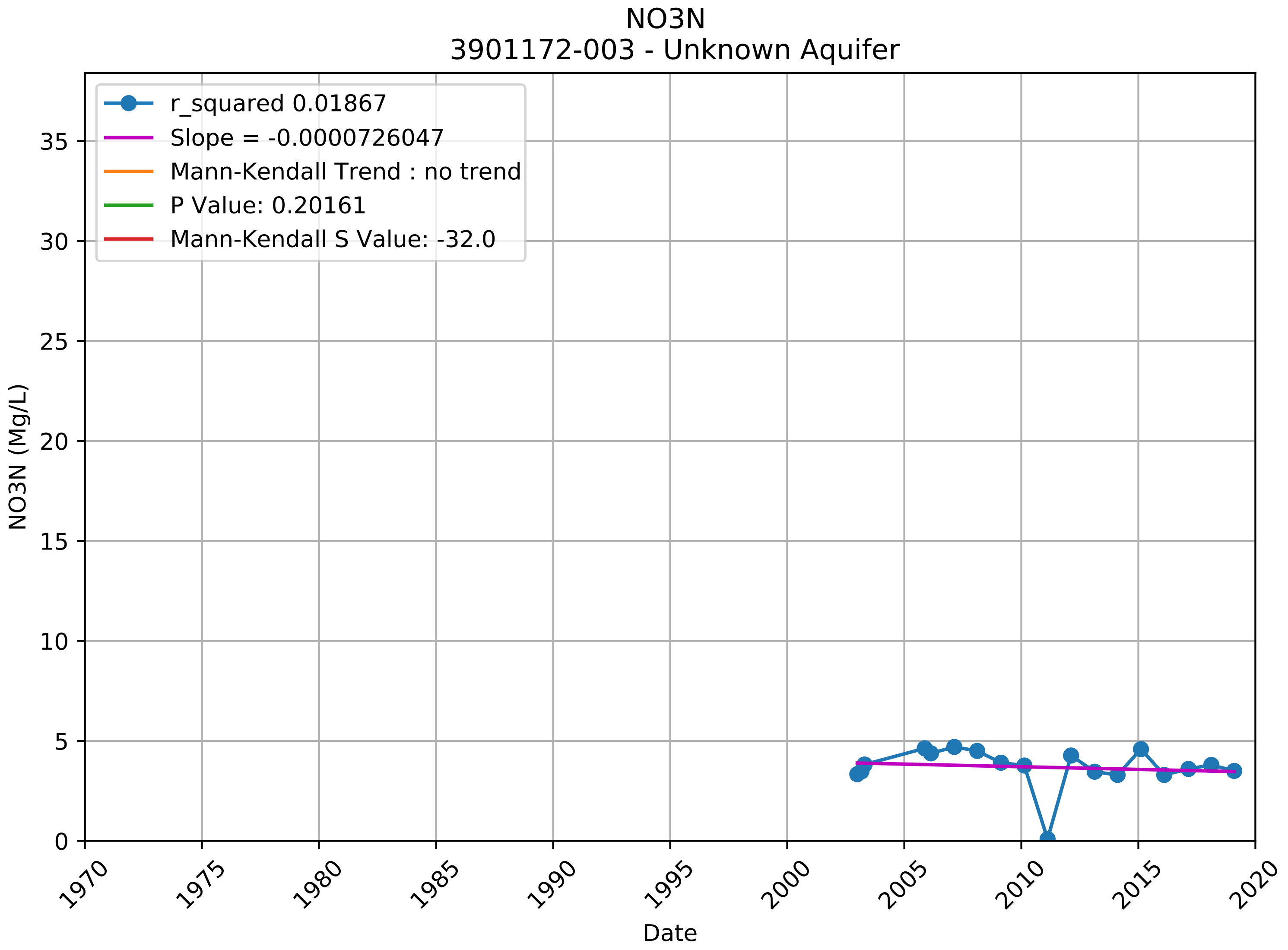

NO3N
3901172-003 - Unknown Aquifer
r_squared 0.01867
Slope = -0.0000726047
Mann-Kendall Trend : no trend
P Value: 0.20161
Mann-Kendall S Value: -32.0
NO3N (Mg/L)
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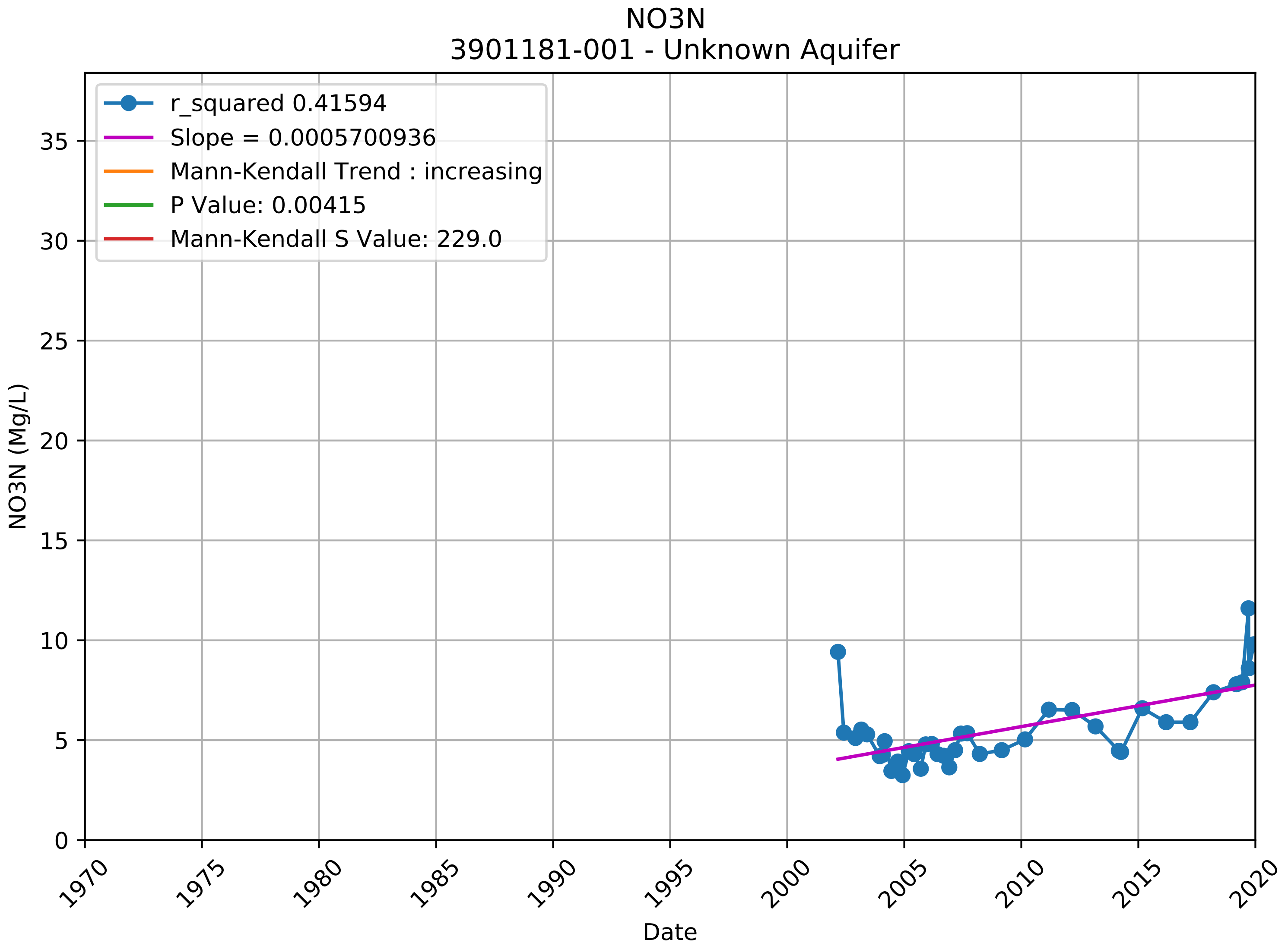
Date


NO3N
3901181-001 - Unknown Aquifer
r_squared 0.41594
Slope = 0.0005700936
Mann-Kendall Trend : increasing
P Value: 0.00415
Mann-Kendall S Value: 229.0
NO3N (Mg/L)
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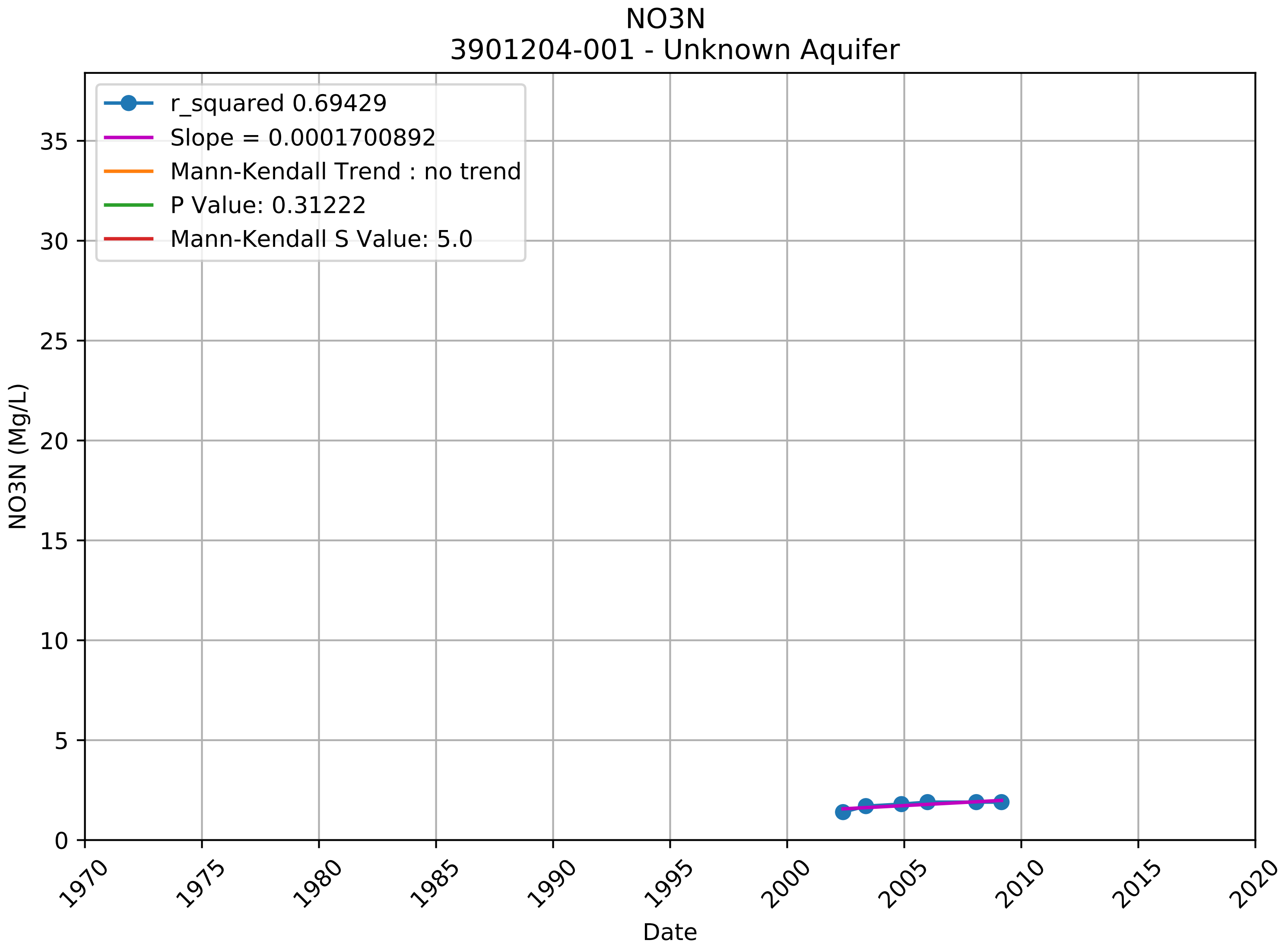

NO3N
3901204-001 - Unknown Aquifer
r_squared 0.69429
Slope = 0.0001700892
Mann-Kendall Trend : no trend
P Value: 0.31222
Mann-Kendall S Value: 5.0
NO3N (Mg/L)
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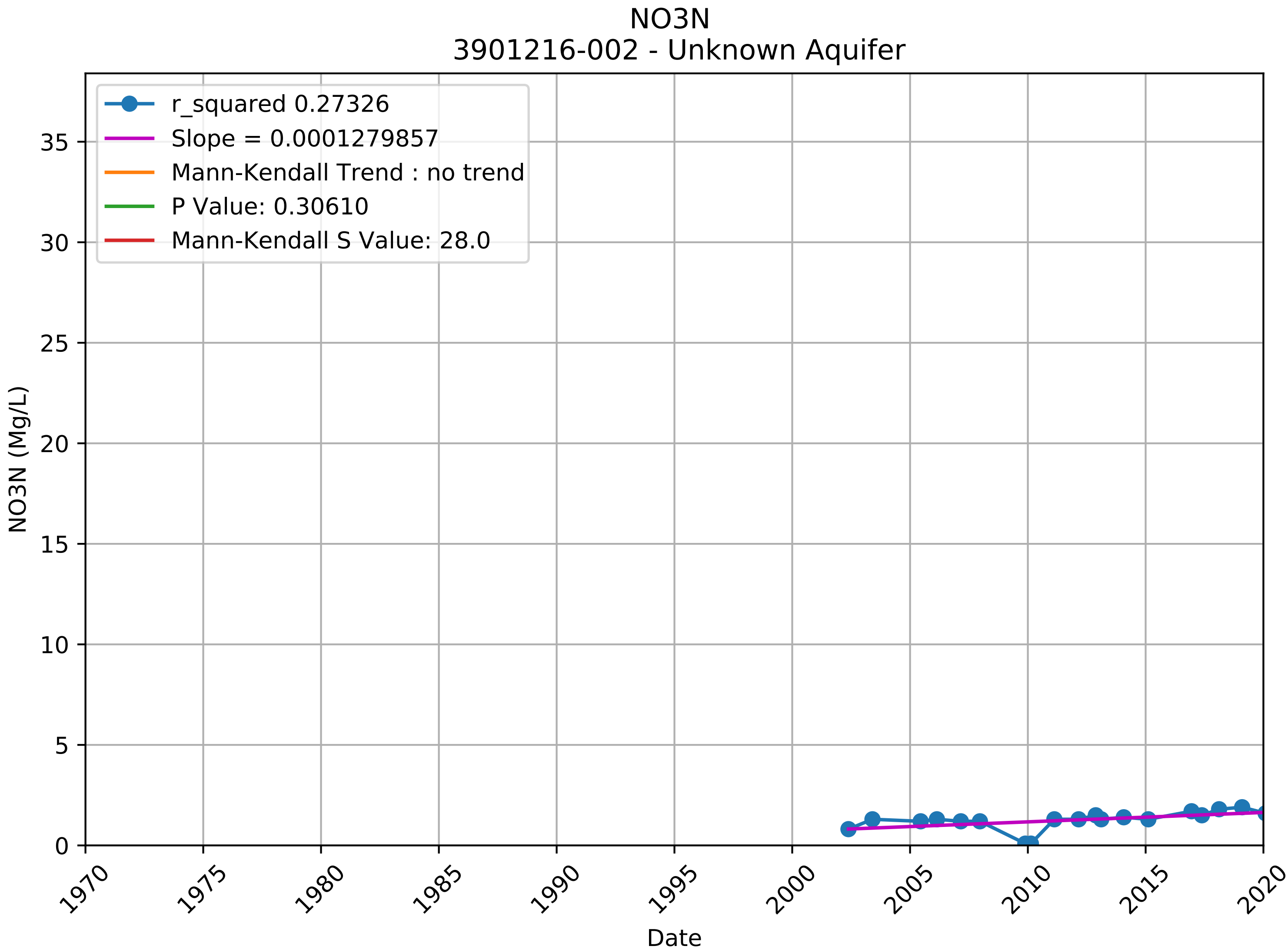
NO3N
3901216-002 - Unknown Aquifer
r_squared 0.27326
Slope = 0.0001279857
Mann-Kendall Trend : no trend
P Value: 0.30610
Mann-Kendall S Value: 28.0
NO3N (Mg/L)
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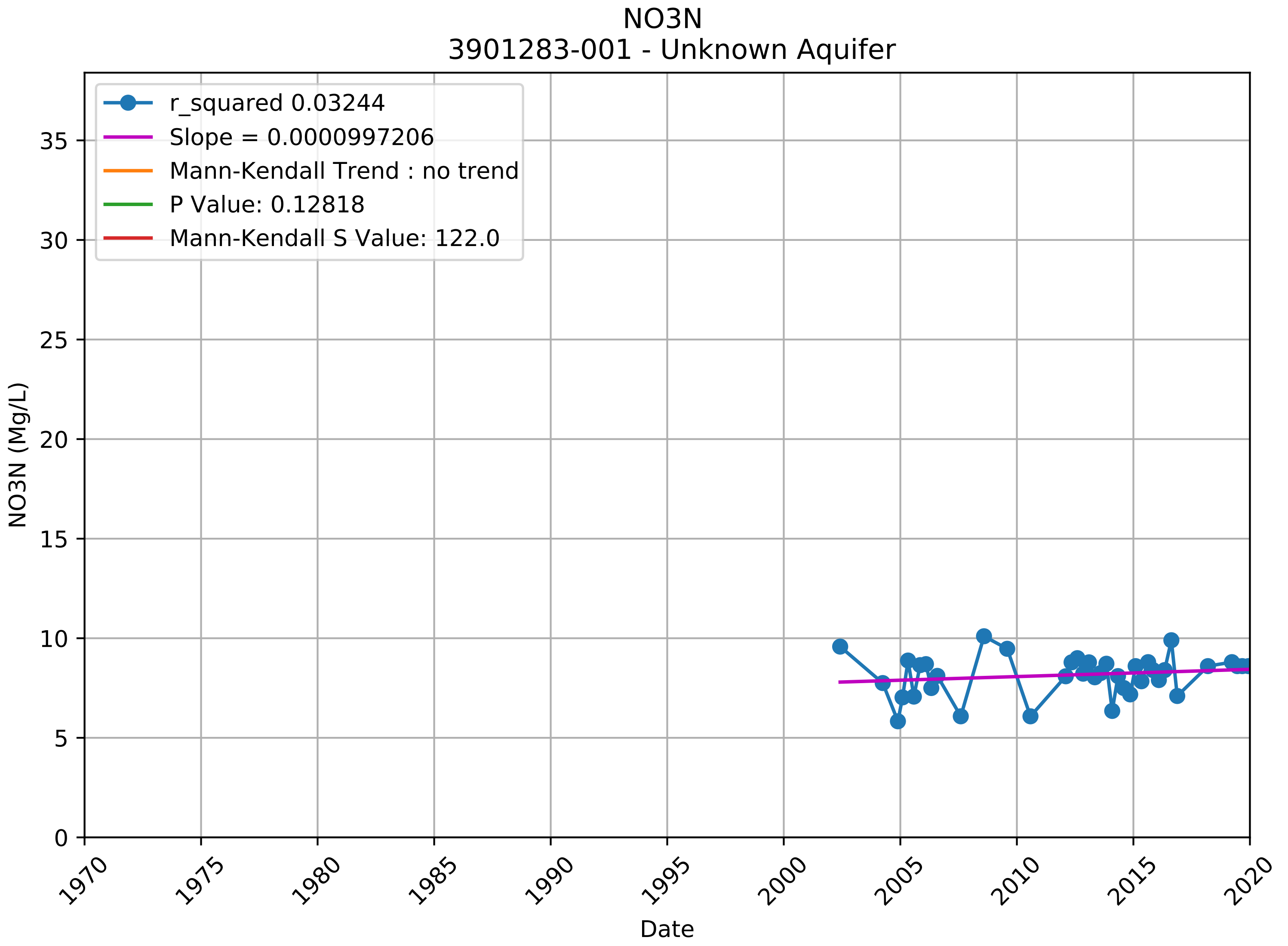
NO3N
3901283-001 - Unknown Aquifer
r_squared 0.03244
Slope = 0.0000997206
Mann-Kendall Trend : no trend
P Value: 0.12818
Mann-Kendall S Value: 122.0
NO3N (Mg/L)
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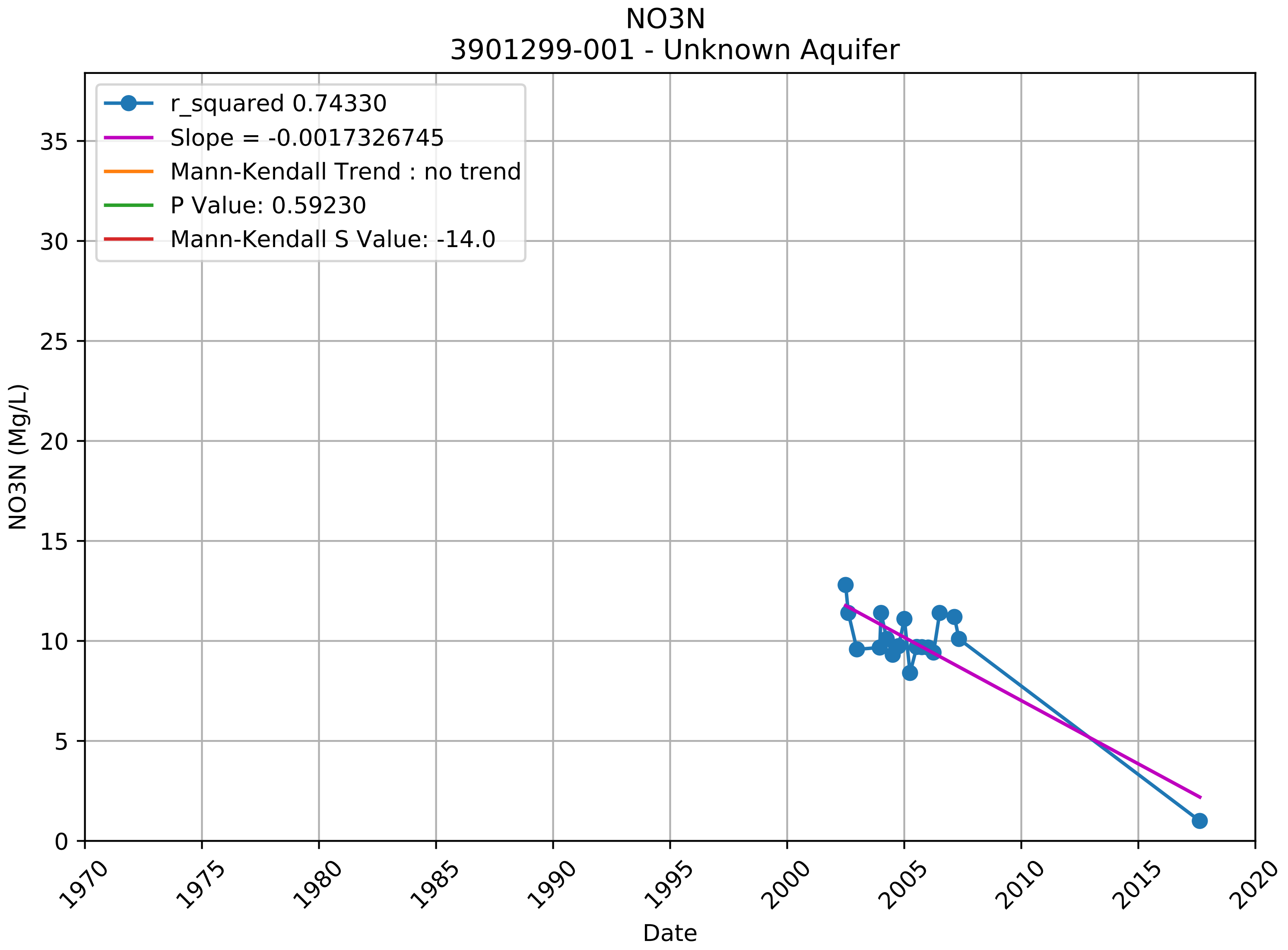
NO3N
3901299-001 - Unknown Aquifer
r_squared 0.74330
Slope = -0.0017326745
Mann-Kendall Trend : no trend
P Value: 0.59230
Mann-Kendall S Value: -14.0
NO3N (Mg/L)
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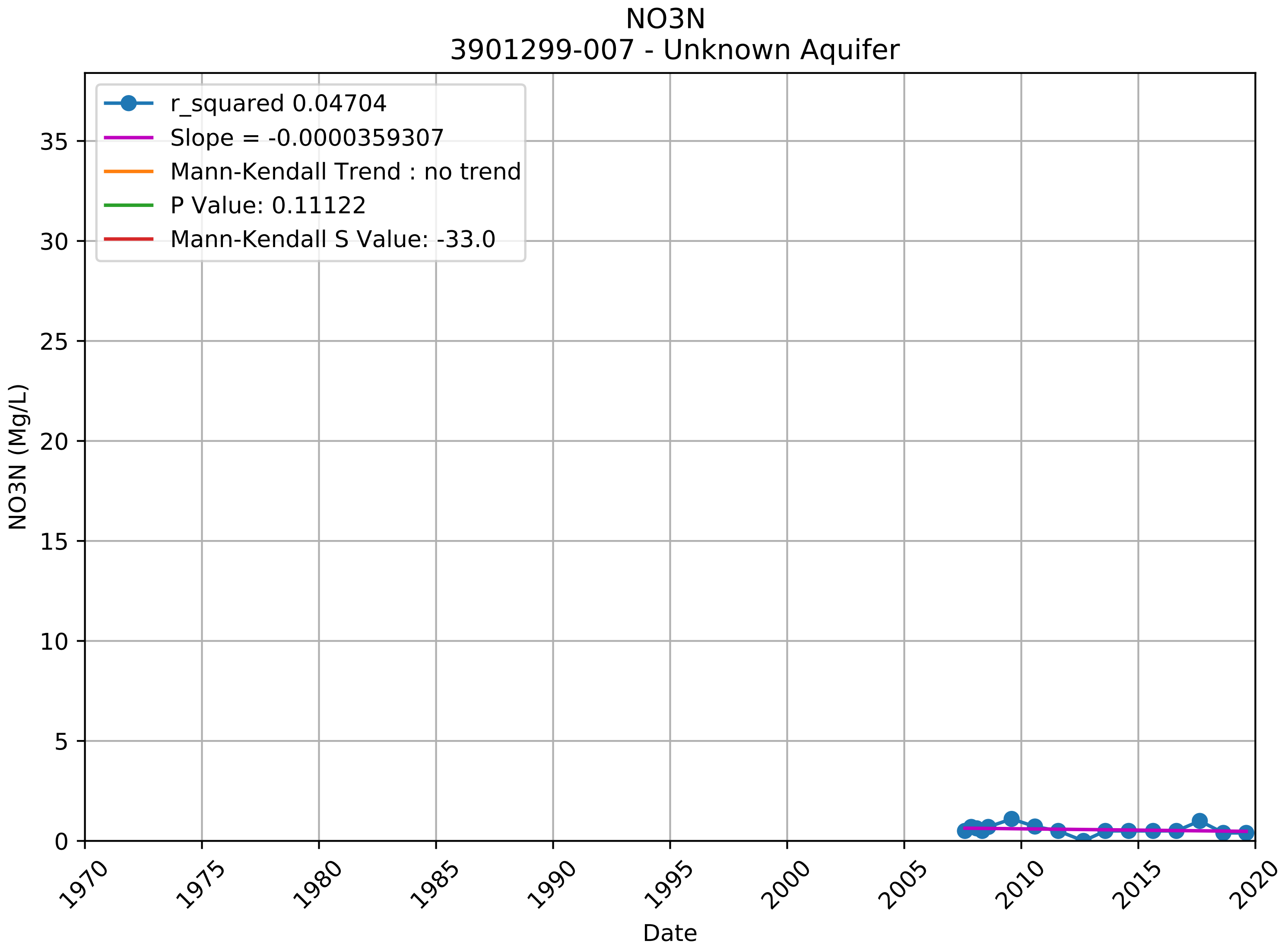
NO3N
3901299-007 - Unknown Aquifer
r_squared 0.04704
Slope = -0.0000359307
Mann-Kendall Trend : no trend
P Value: 0.11122
Mann-Kendall S Value: -33.0
NO3N (Mg/L)
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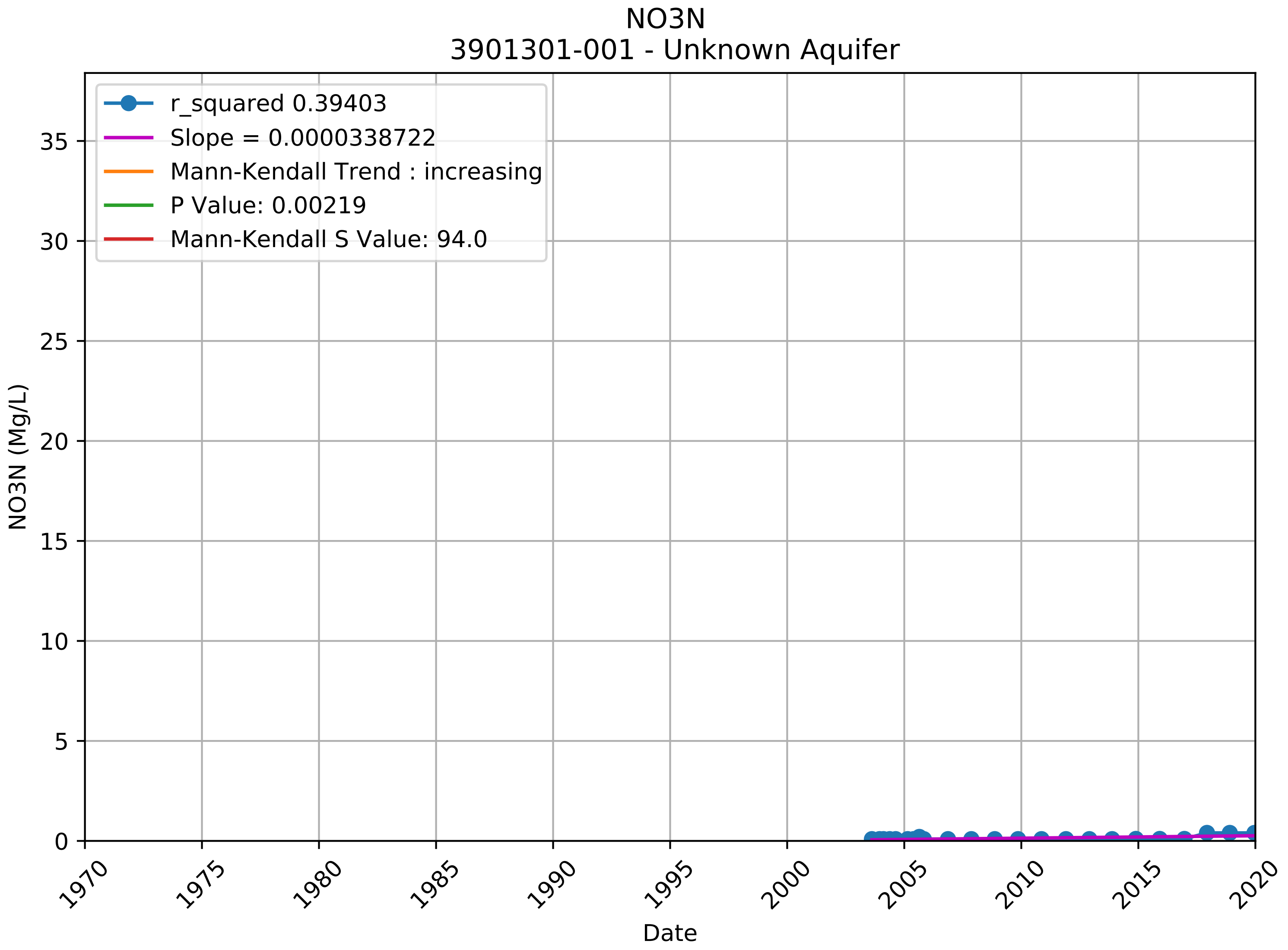
NO3N
3901301-001 - Unknown Aquifer
r_squared 0.39403
Slope = 0.0000338722
Mann-Kendall Trend : increasing
P Value: 0.00219
Mann-Kendall S Value: 94.0
NO3N (Mg/L)
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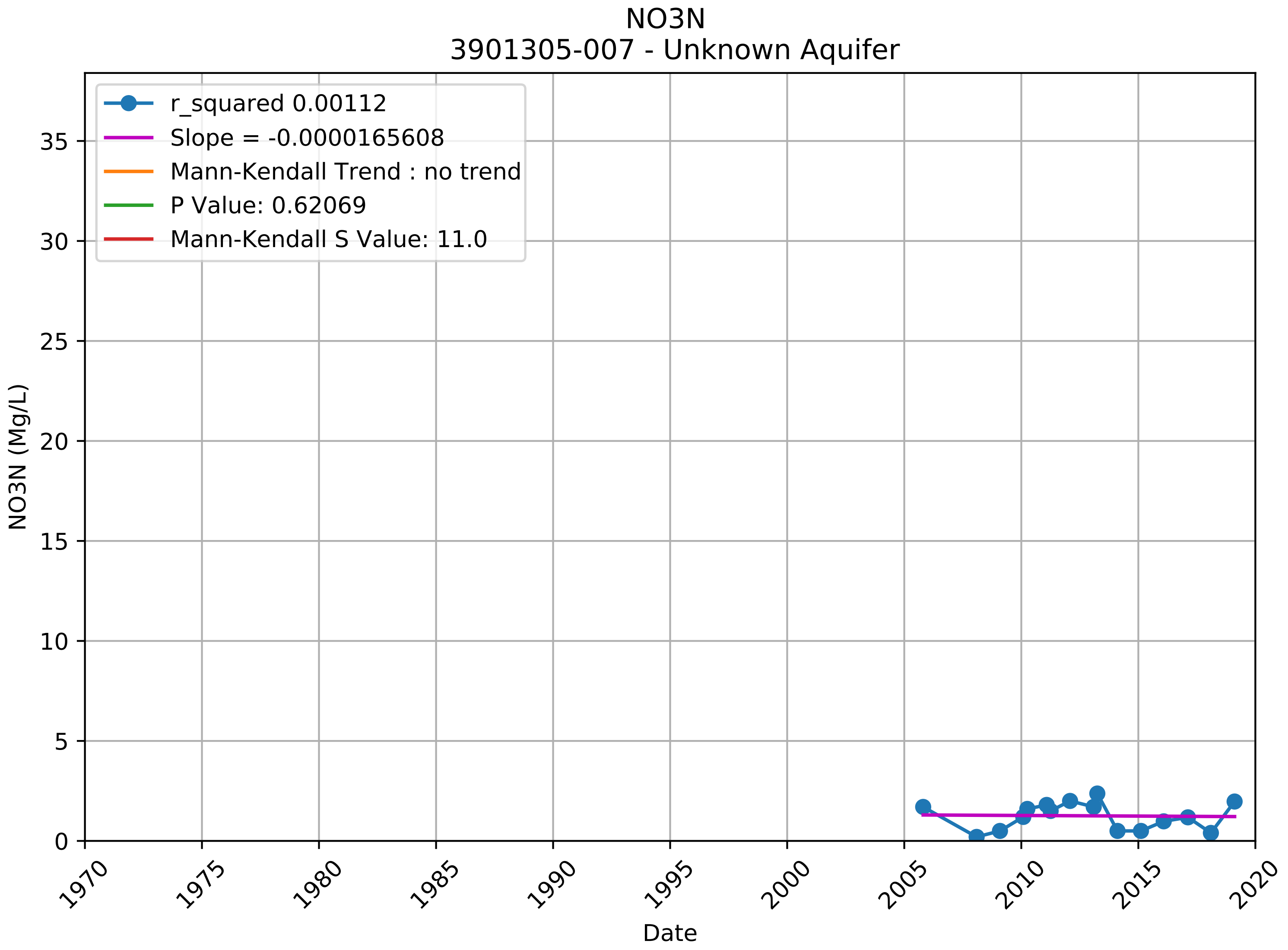
NO3N
3901305-007 - Unknown Aquifer
r_squared 0.00112
Slope = -0.0000165608
Mann-Kendall Trend : no trend
P Value: 0.62069
Mann-Kendall S Value: 11.0
NO3N (Mg/L)
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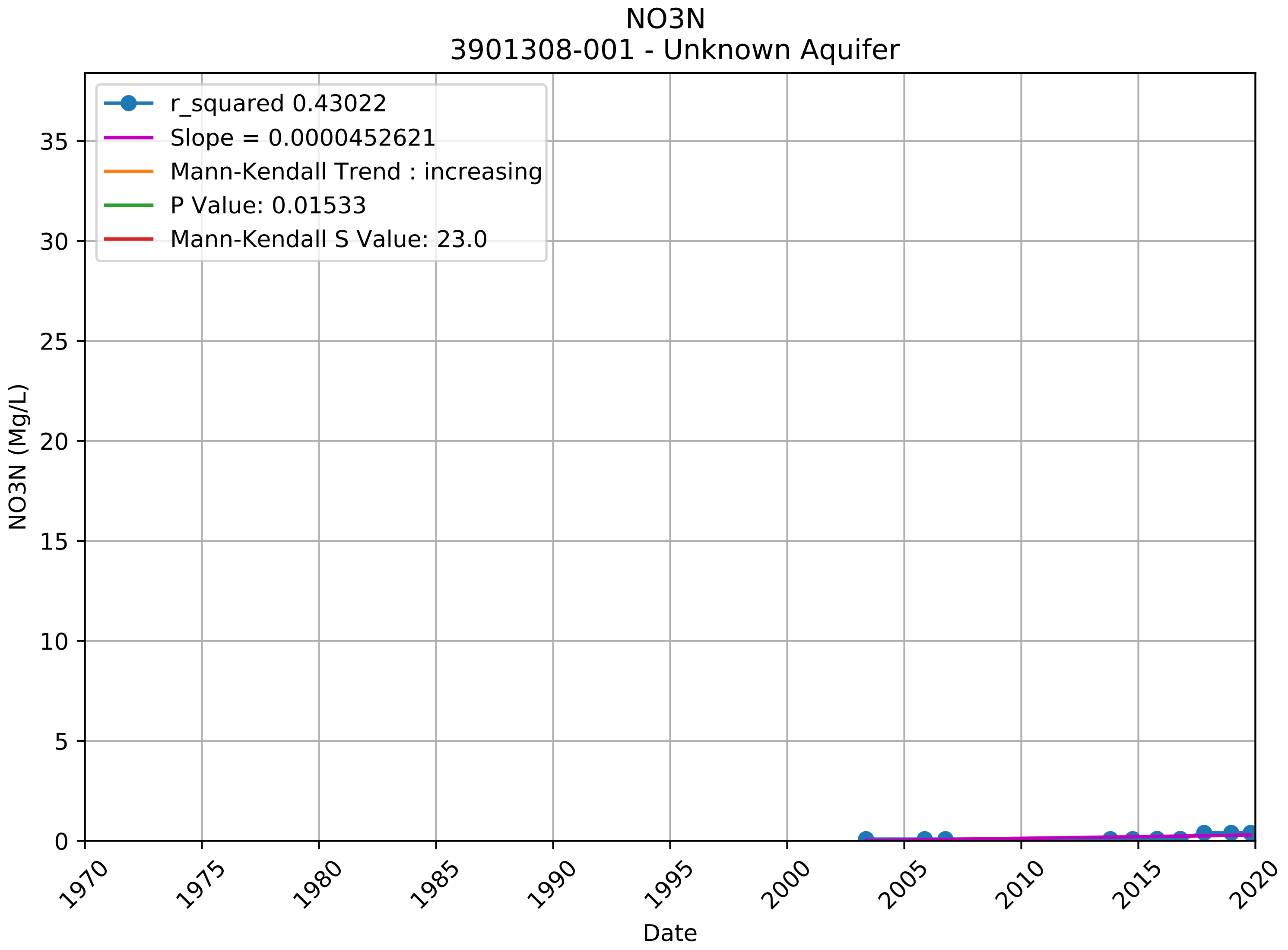
NO3N
3901308-001 - Unknown Aquifer
r_squared 0.43022
Slope = 0.0000452621
Mann-Kendall Trend : increasing
P Value: 0.01533
Mann-Kendall S Value: 23.0
NO3N (Mg/L)
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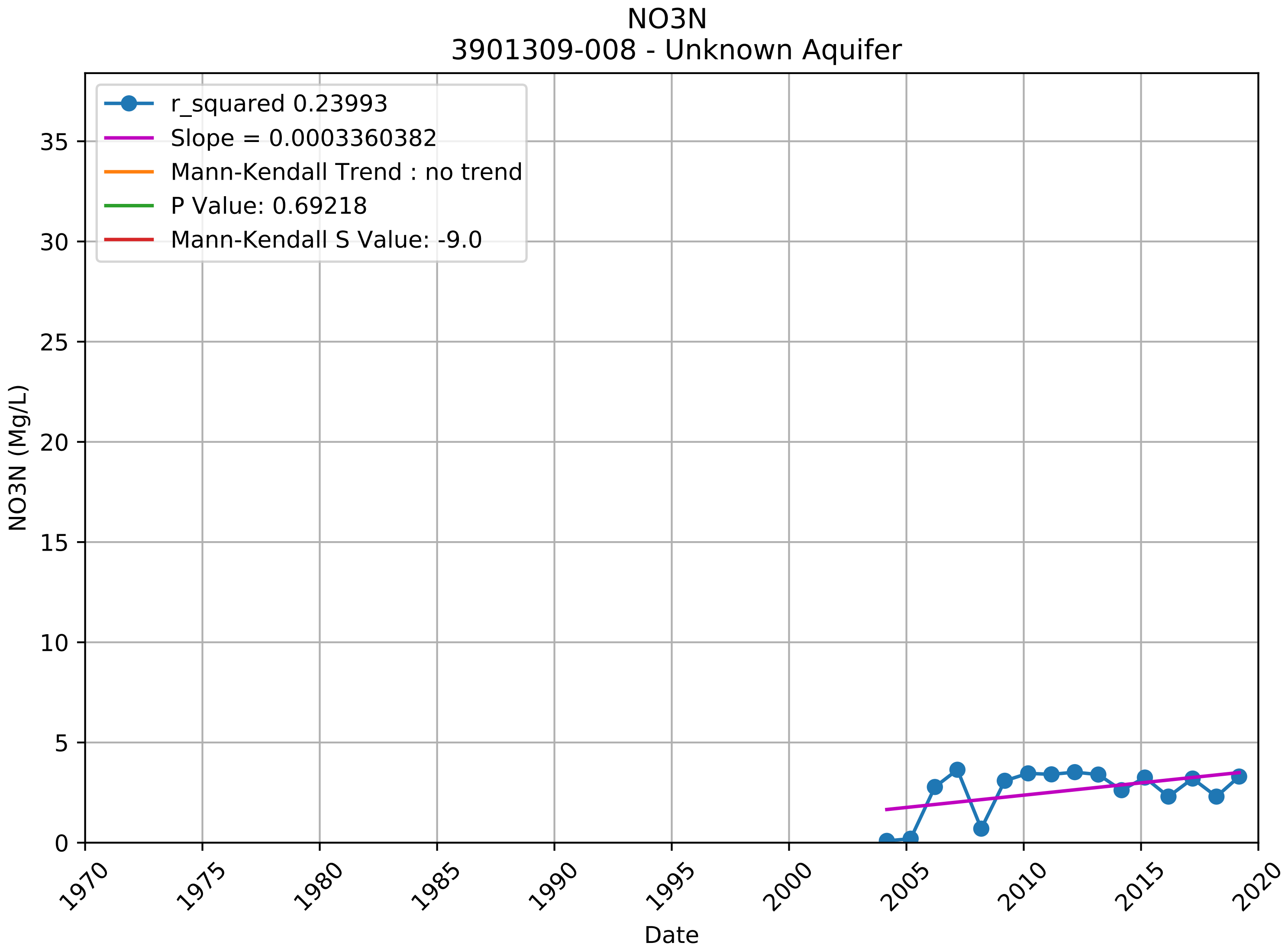

NO3N
3901309-008 - Unknown Aquifer
r_squared 0.23993
Slope = 0.0003360382
Mann-Kendall Trend : no trend
P Value: 0.69218
Mann-Kendall S Value: -9.0
NO3N (Mg/L)
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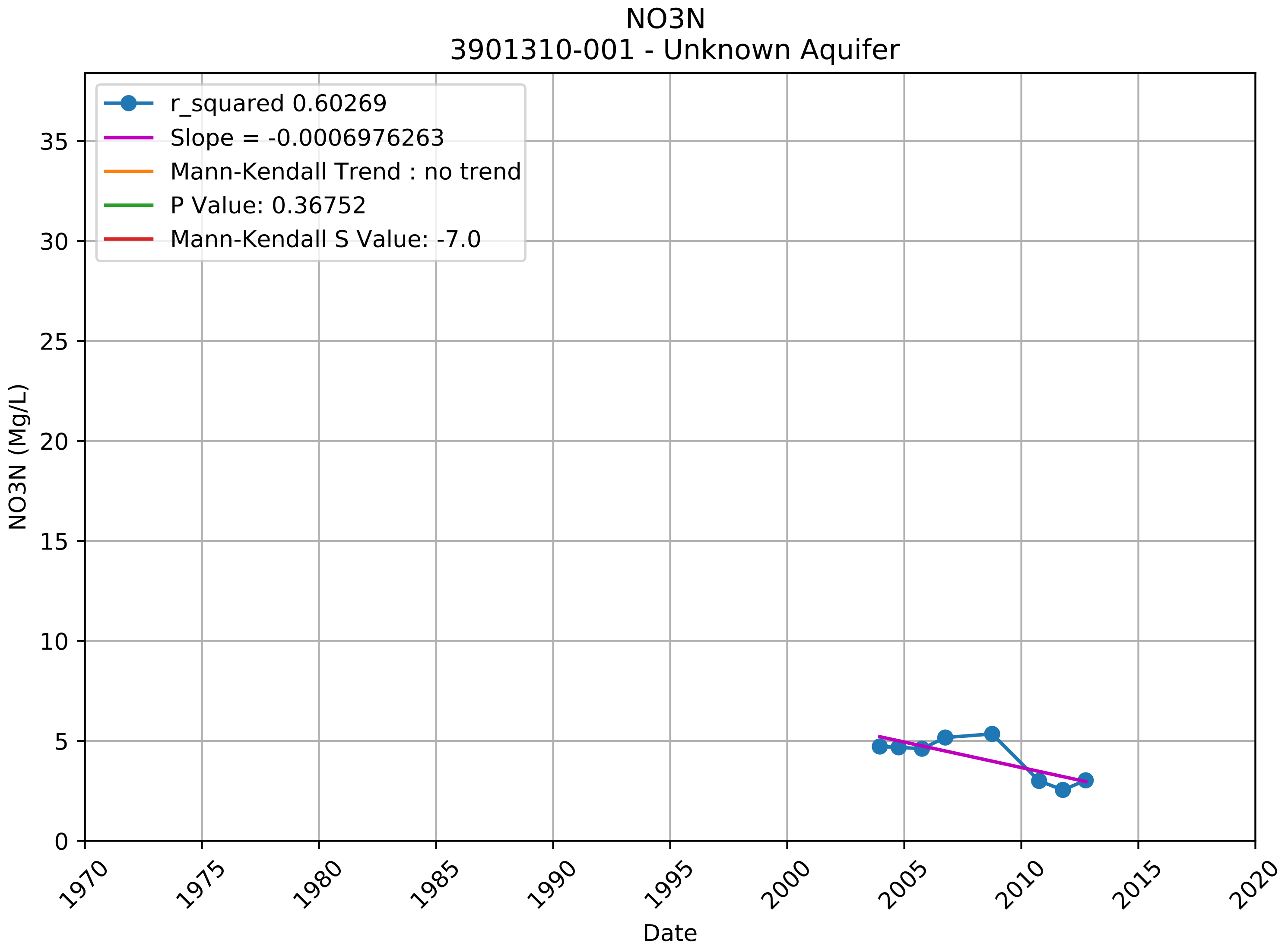
NO3N
3901310-001 - Unknown Aquifer
r_squared 0.60269
Slope = -0.0006976263
Mann-Kendall Trend : no trend
P Value: 0.36752
Mann-Kendall S Value: -7.0
NO3N (Mg/L)
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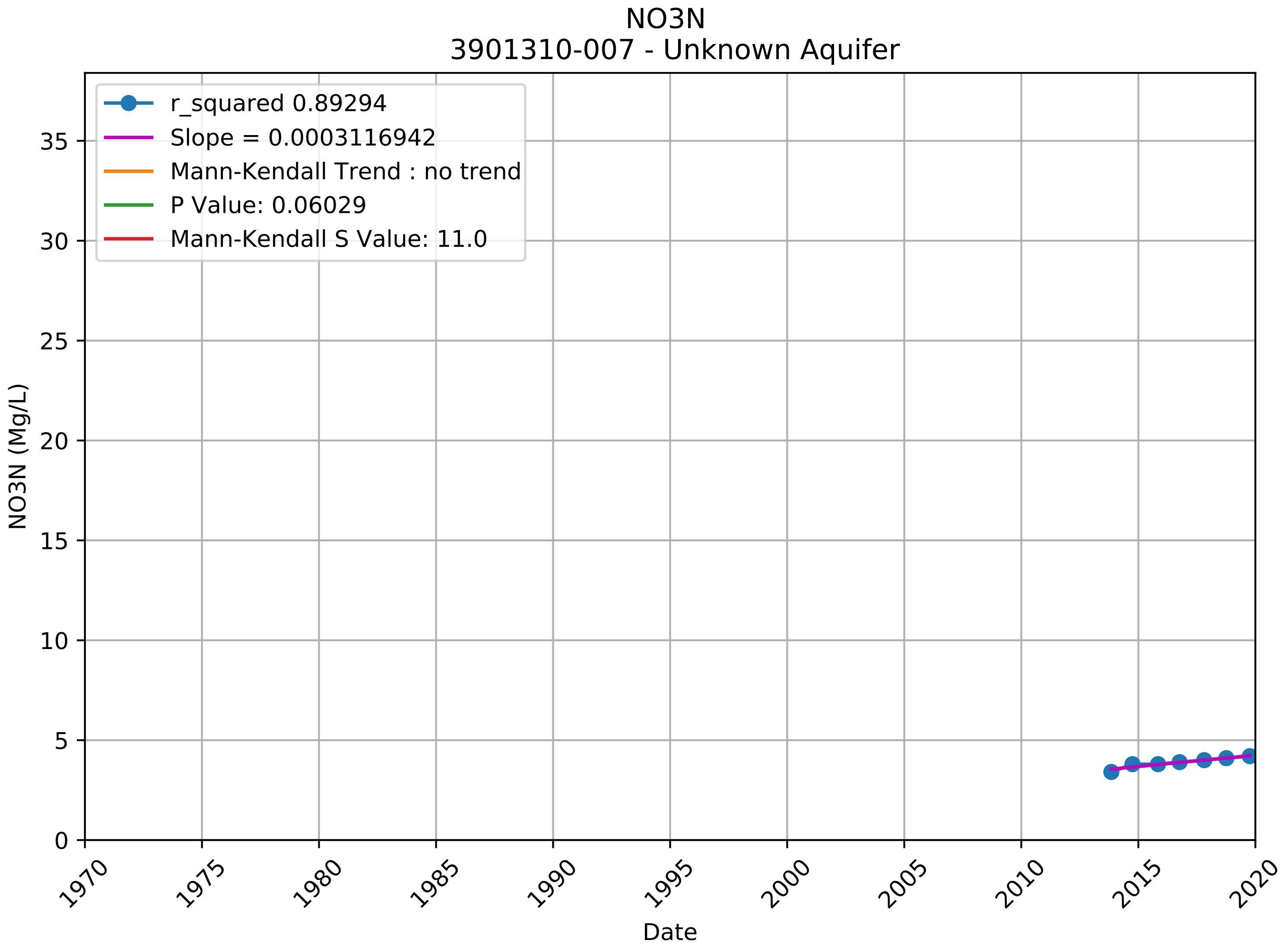
NO3N
3901310-007 - Unknown Aquifer
r_squared 0.89294
Slope = 0.0003116942
Mann-Kendall Trend : no trend
P Value: 0.06029
Mann-Kendall S Value: 11.0
NO3N (Mg/L)
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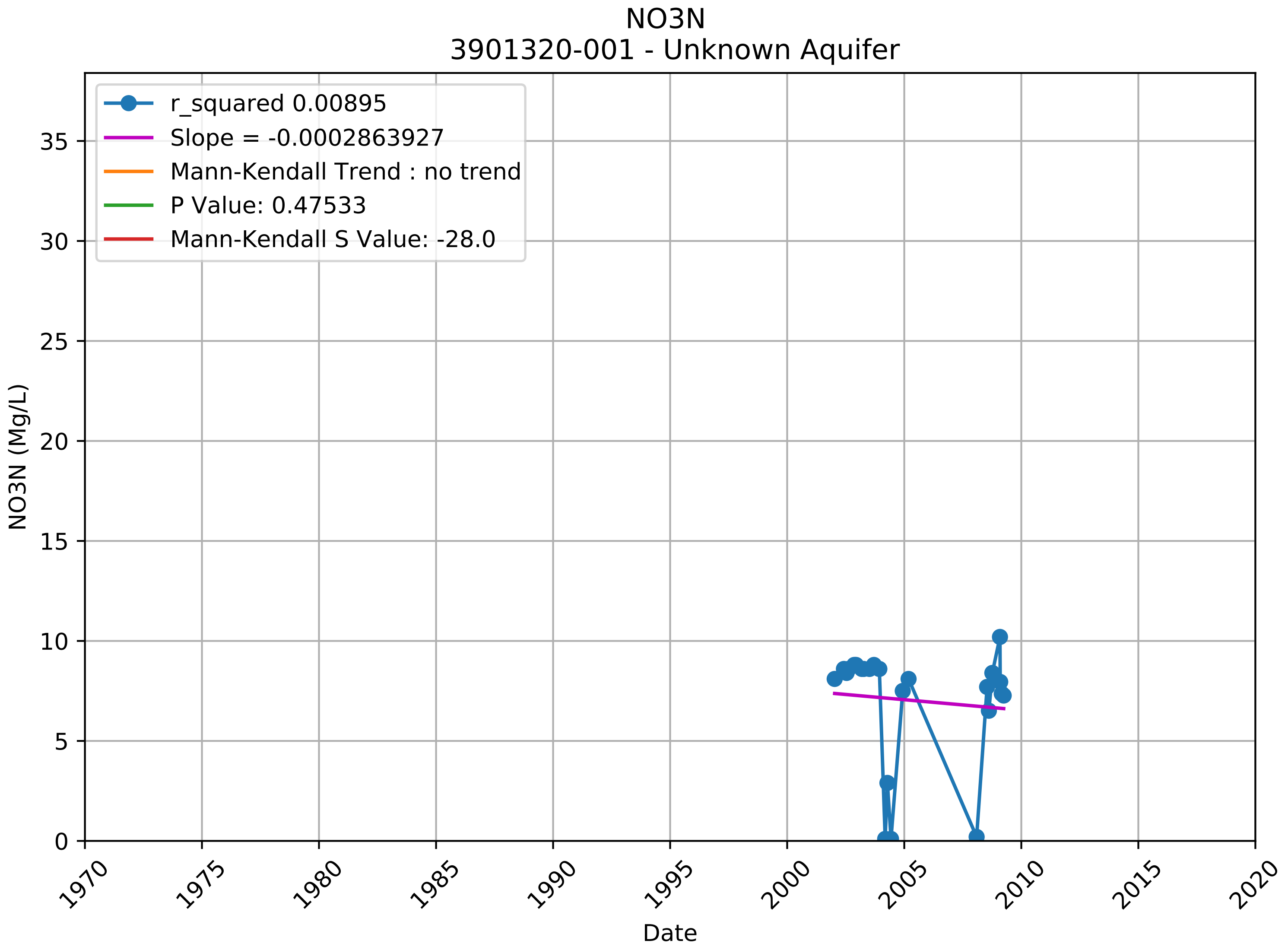
NO3N
3901320-001 - Unknown Aquifer
r_squared 0.00895
Slope = -0.0002863927
Mann-Kendall Trend : no trend
P Value: 0.47533
Mann-Kendall S Value: -28.0
NO3N (Mg/L)
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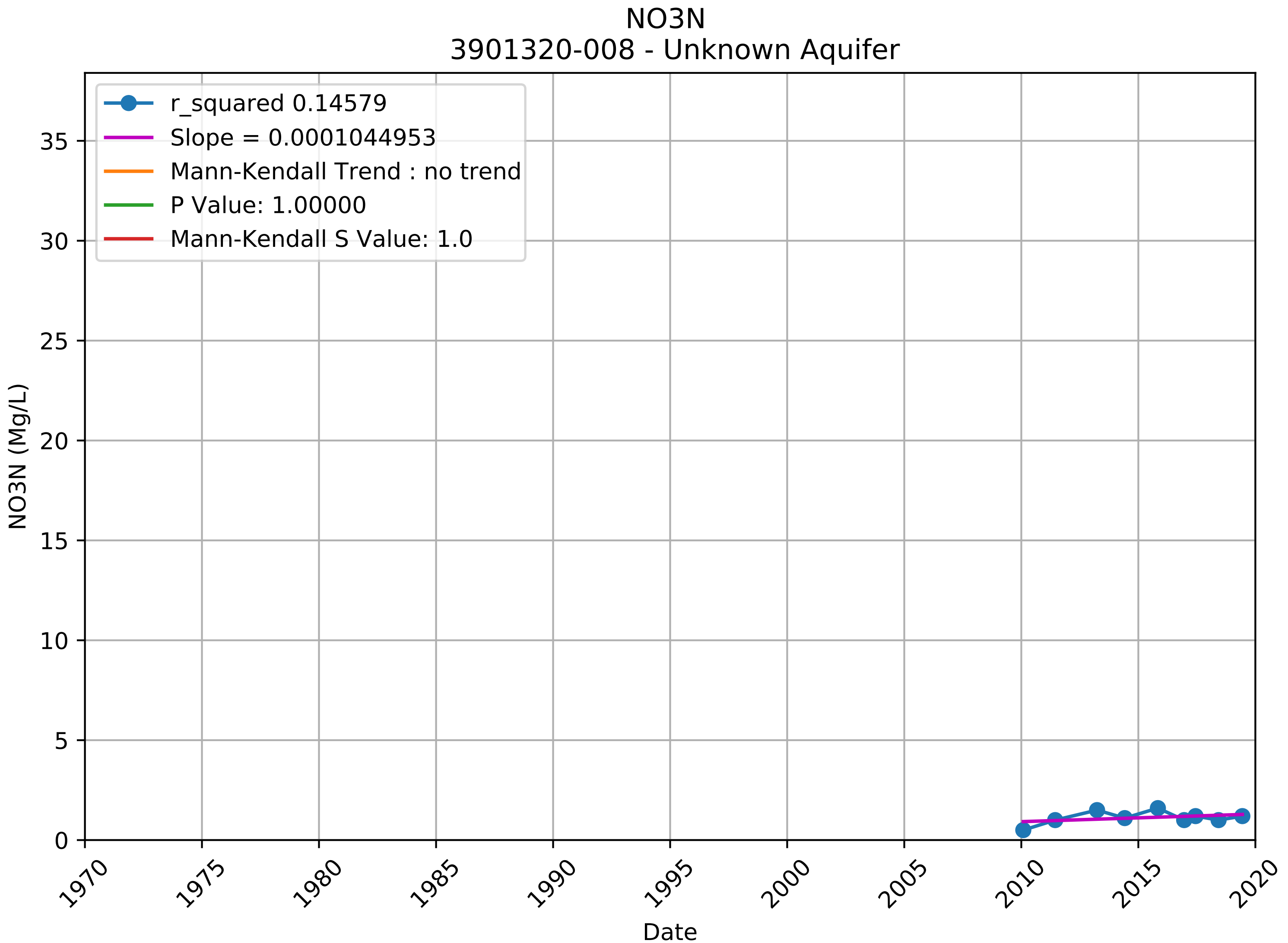
NO3N
3901320-008 - Unknown Aquifer
r_squared 0.14579
Slope = 0.0001044953
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
NO3N (Mg/L)
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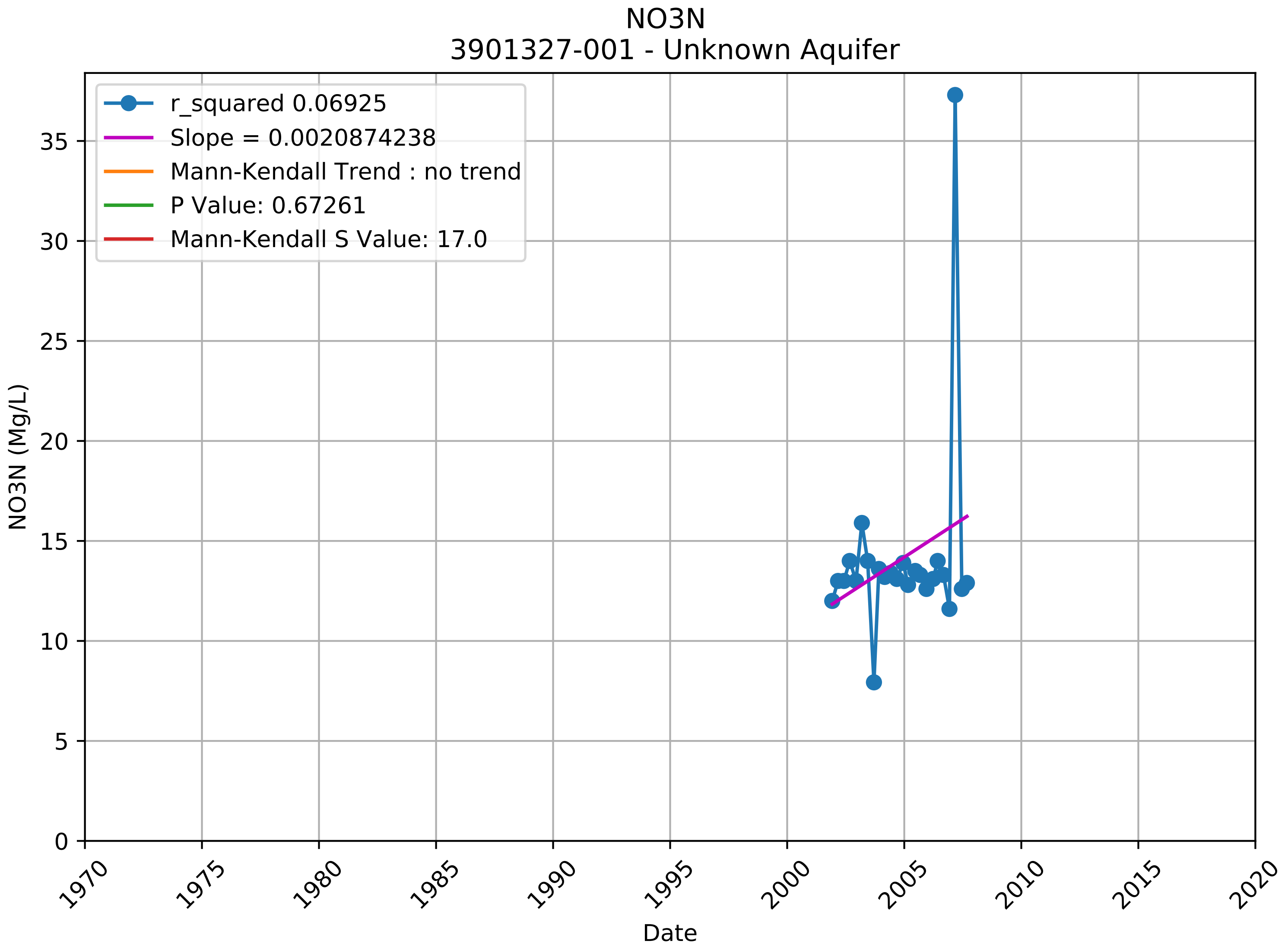
NO3N
3901327-001 - Unknown Aquifer
r_squared 0.06925
Slope = 0.0020874238
Mann-Kendall Trend : no trend
P Value: 0.67261
Mann-Kendall S Value: 17.0
NO3N (Mg/L)
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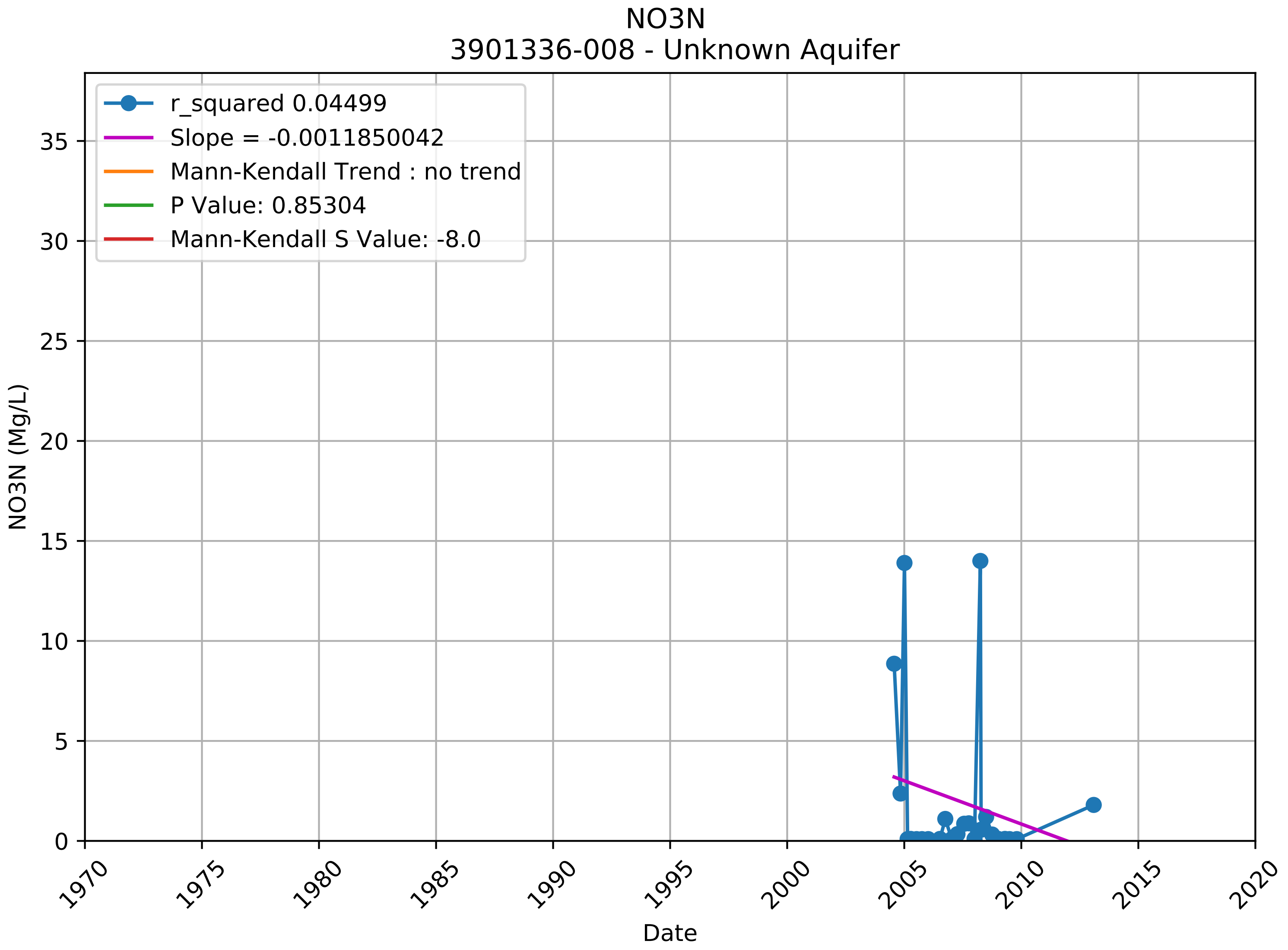

NO3N
3901336-008 - Unknown Aquifer
r_squared 0.04499
Slope = -0.0011850042
Mann-Kendall Trend : no trend
P Value: 0.85304
Mann-Kendall S Value: -8.0
NO3N (Mg/L)
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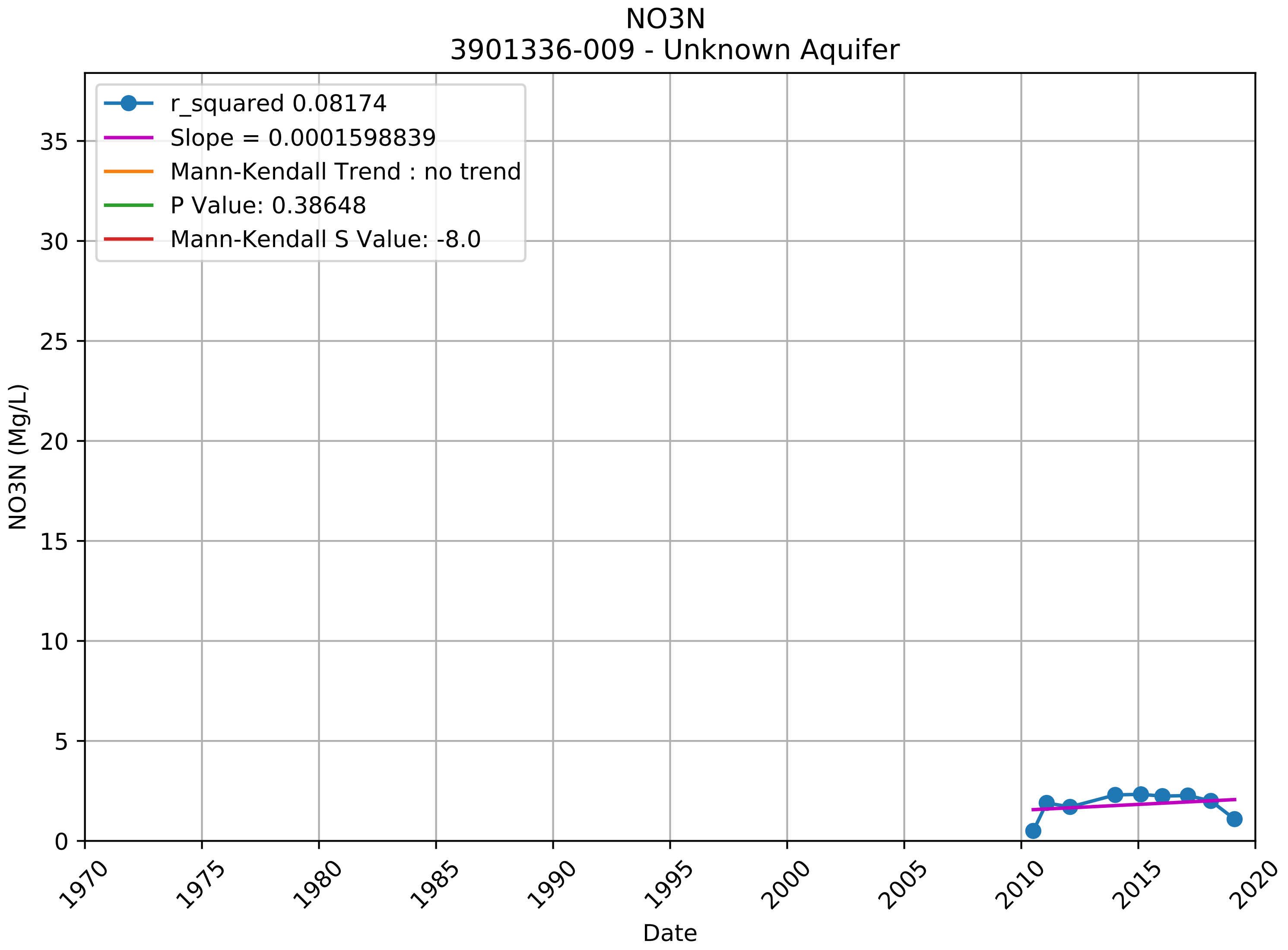
NO3N
3901336-009 - Unknown Aquifer
r_squared 0.08174
Slope = 0.0001598839
Mann-Kendall Trend : no trend
P Value: 0.38648
Mann-Kendall S Value: -8.0
NO3N (Mg/L)
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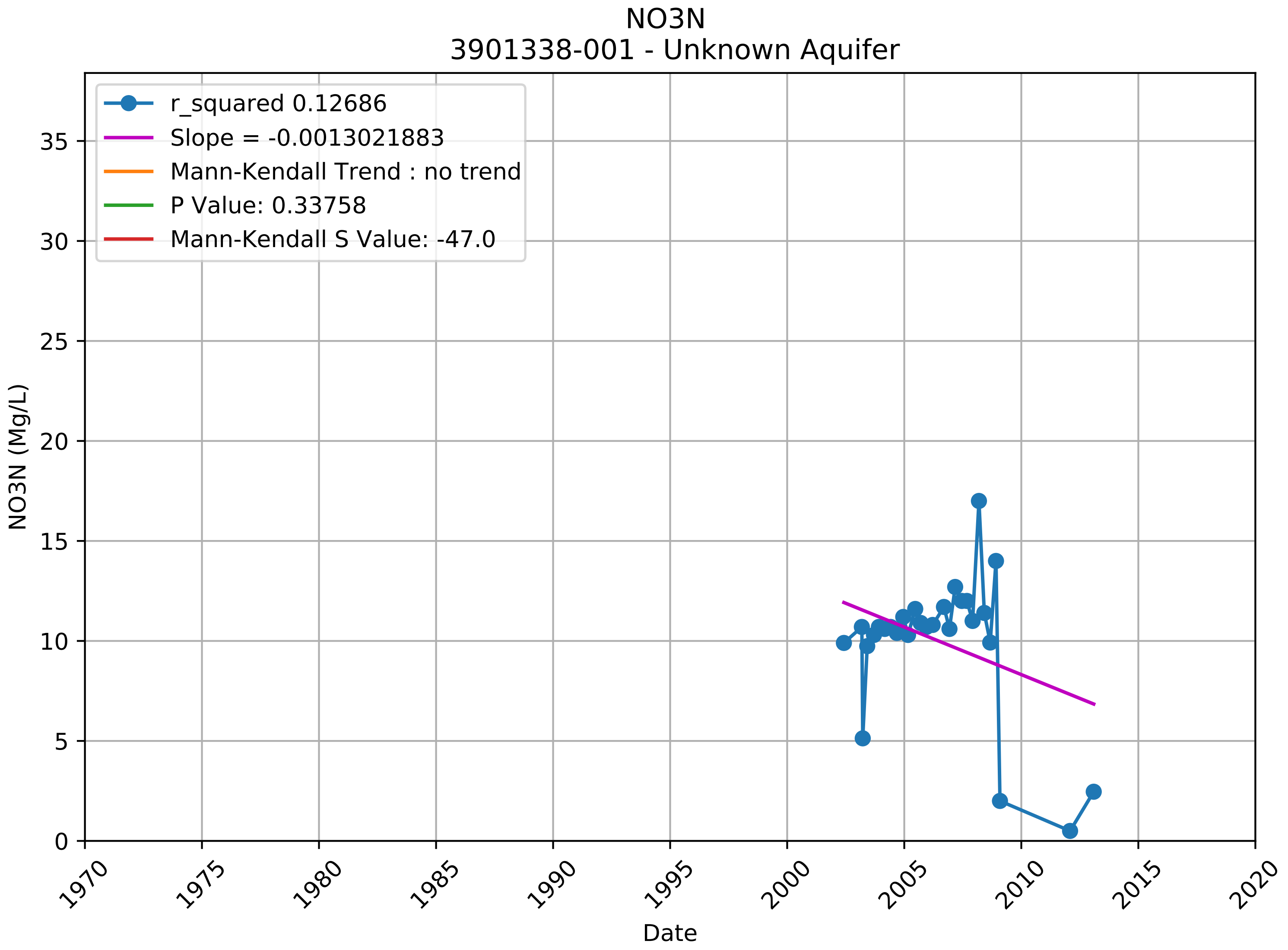
NO3N
3901338-001 - Unknown Aquifer
r_squared 0.12686
Slope = -0.0013021883
Mann-Kendall Trend : no trend
P Value: 0.33758
Mann-Kendall S Value: -47.0
NO3N (Mg/L)
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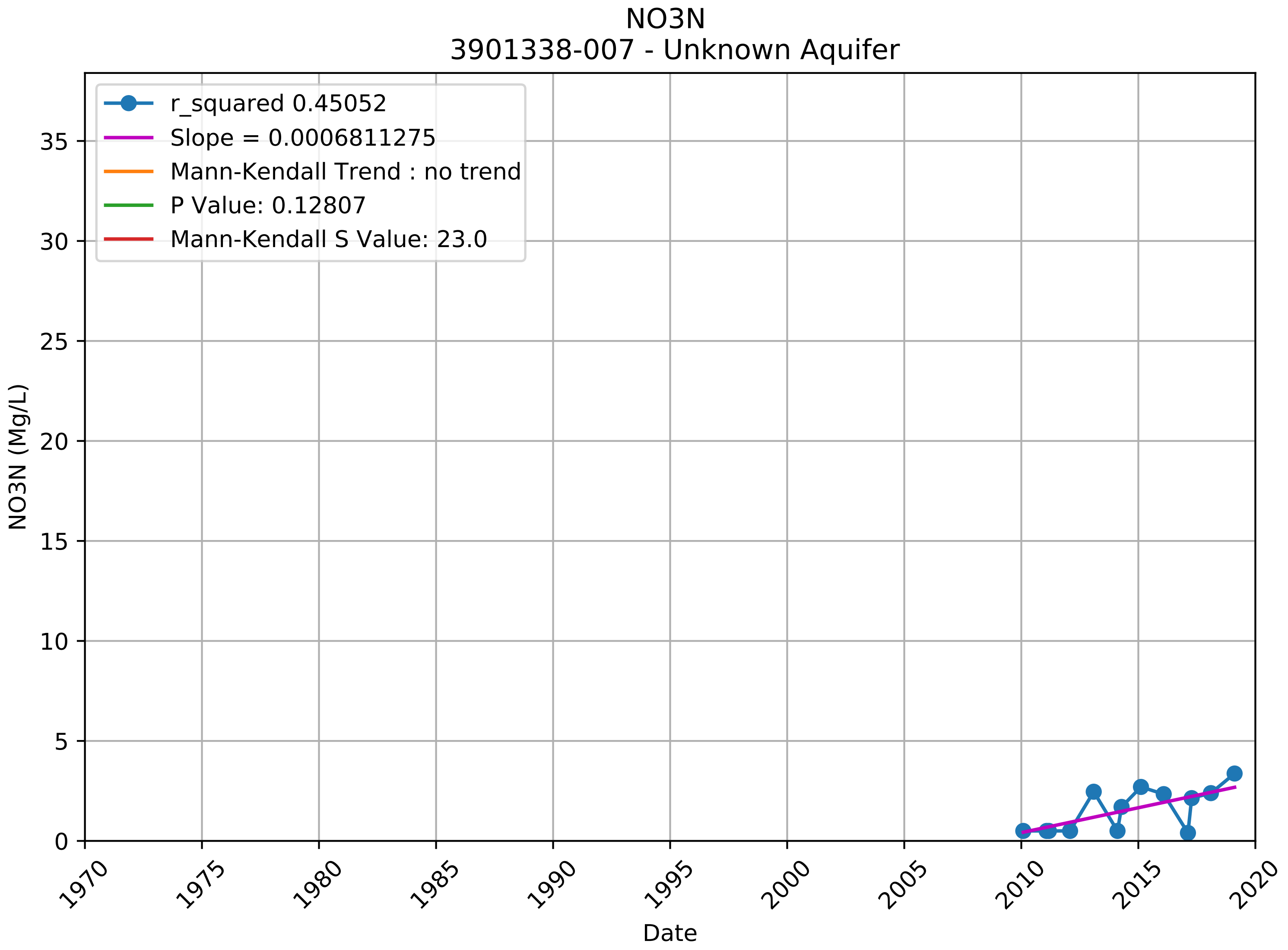

NO3N
3901338-007 - Unknown Aquifer
r_squared 0.45052
Slope = 0.0006811275
Mann-Kendall Trend : no trend
P Value: 0.12807
Mann-Kendall S Value: 23.0
NO3N (Mg/L)
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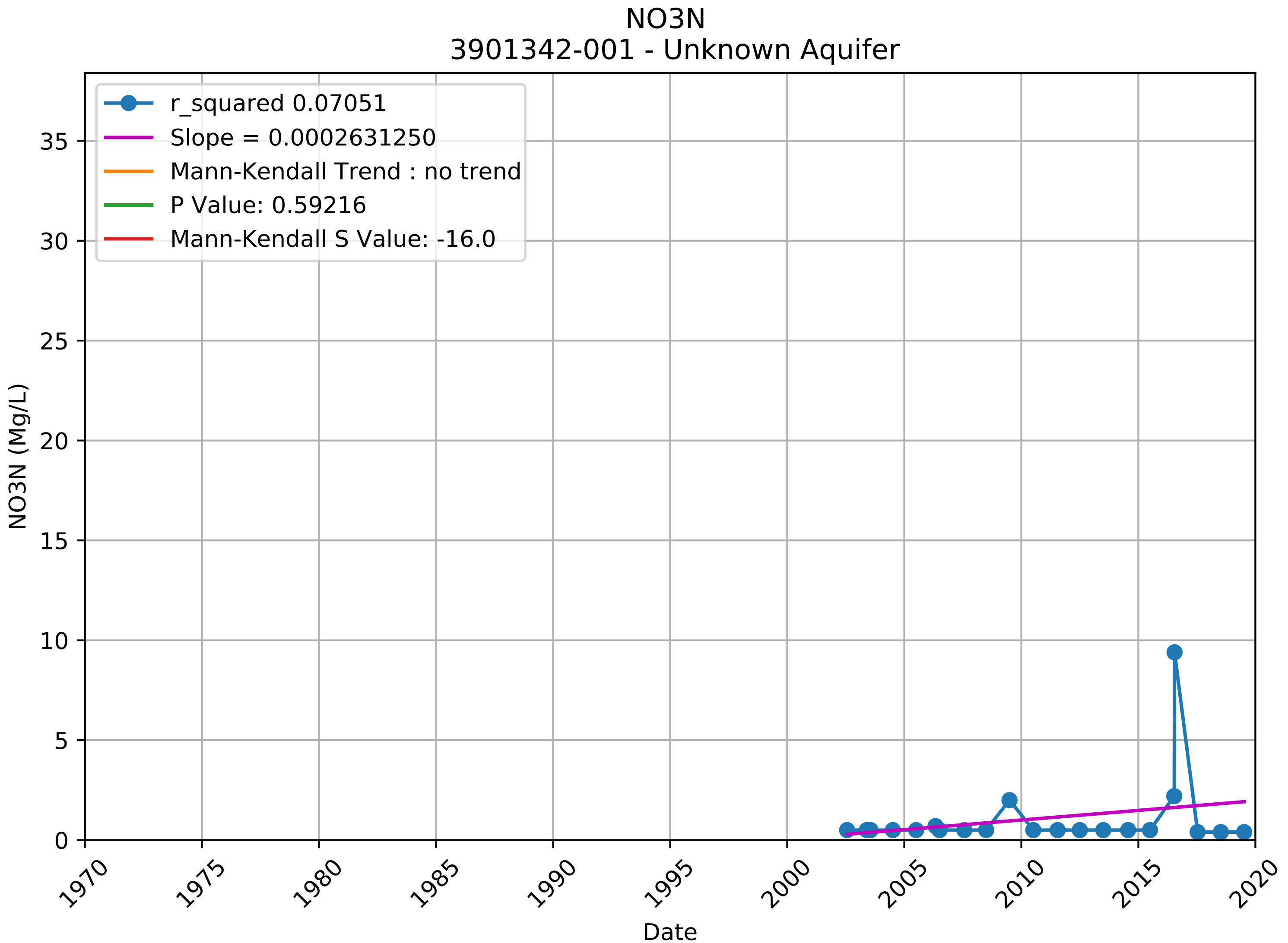
NO3N
3901342-001 - Unknown Aquifer
r_squared 0.07051
Slope = 0.0002631250
Mann-Kendall Trend : no trend
P Value: 0.59216
Mann-Kendall S Value: -16.0
NO3N (Mg/L)
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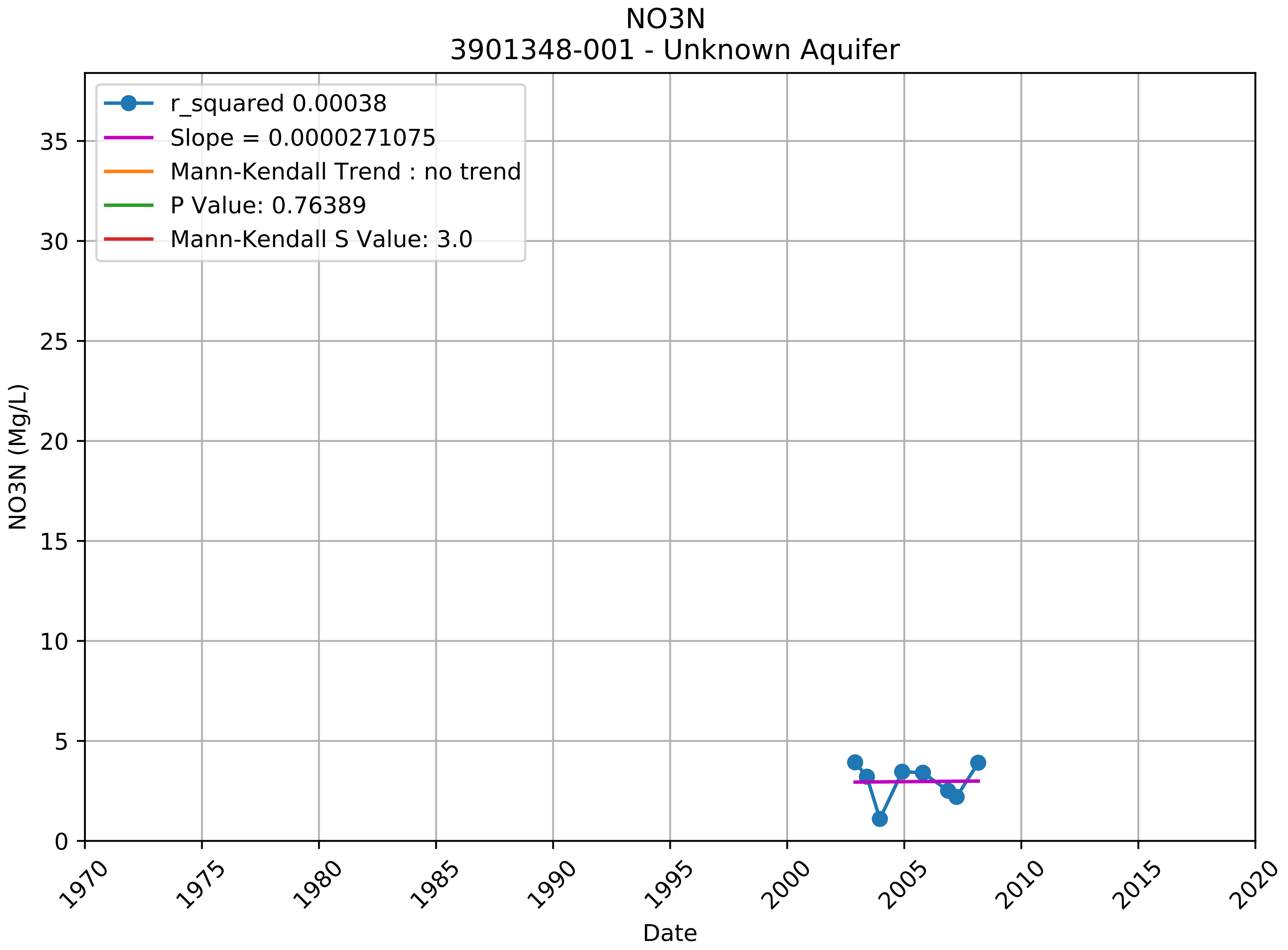

NO3N
3901348-001 - Unknown Aquifer
r_squared 0.00038
Slope = 0.0000271075
Mann-Kendall Trend : no trend
P Value: 0.76389
Mann-Kendall S Value: 3.0
NO3N (Mg/L)
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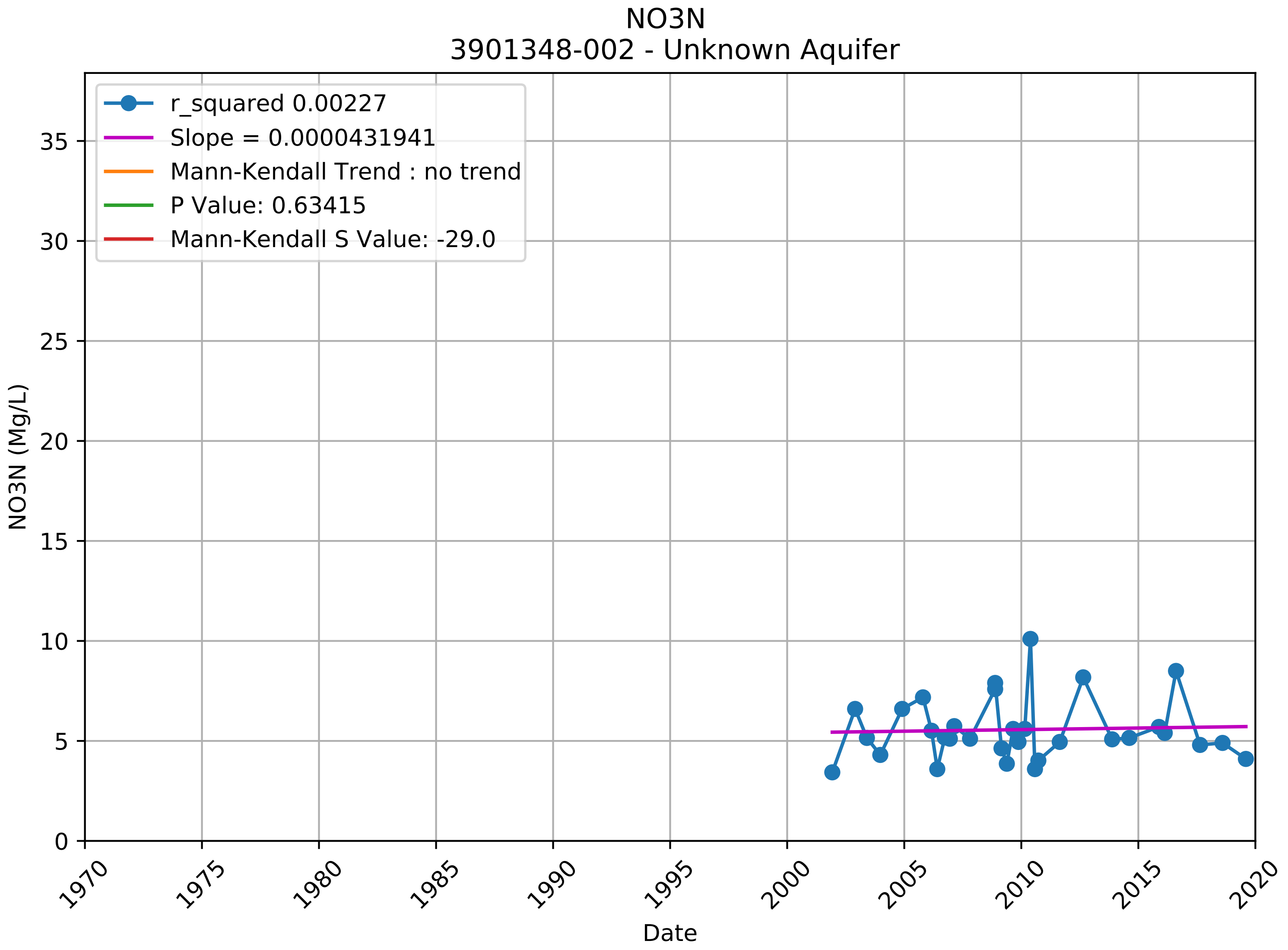

NO3N
3901348-002 - Unknown Aquifer
r_squared 0.00227
Slope = 0.0000431941
Mann-Kendall Trend : no trend
P Value: 0.63415
Mann-Kendall S Value: -29.0
NO3N (Mg/L)
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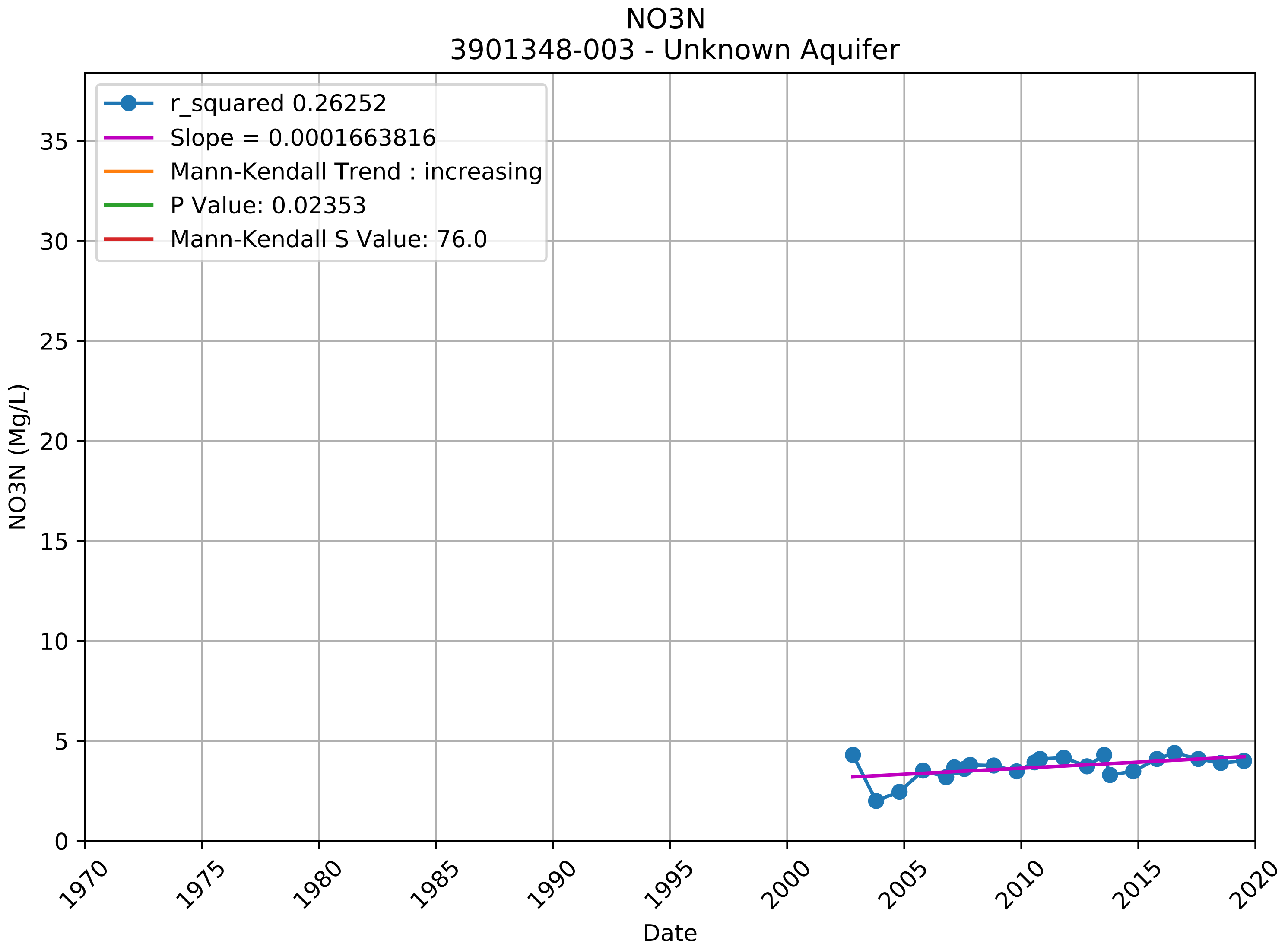
NO3N
3901348-003 - Unknown Aquifer
r_squared 0.26252
Slope = 0.0001663816
Mann-Kendall Trend : increasing
P Value: 0.02353
Mann-Kendall S Value: 76.0
NO3N (Mg/L)
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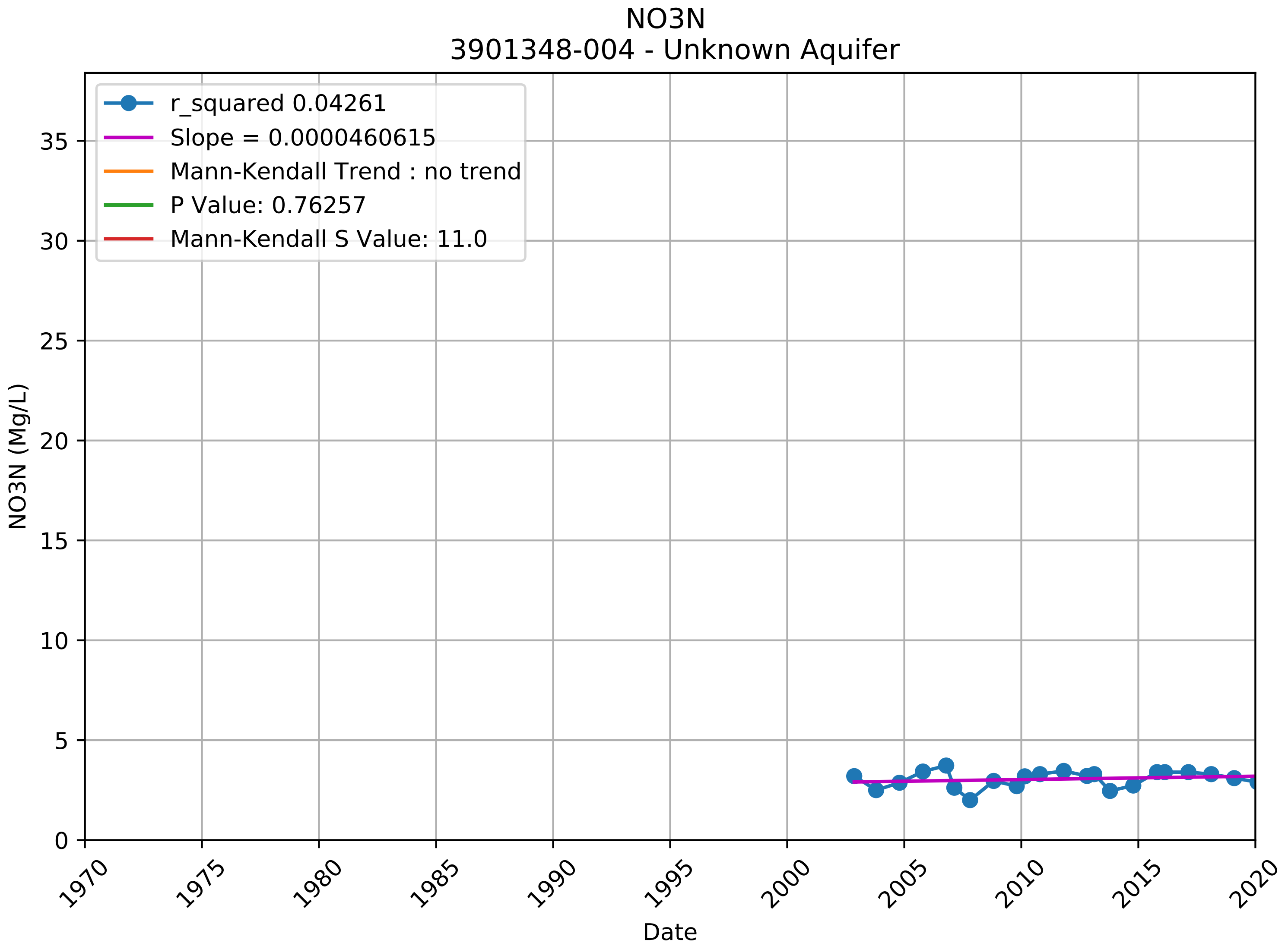

NO3N
3901348-004 - Unknown Aquifer
r_squared 0.04261
Slope = 0.0000460615
Mann-Kendall Trend : no trend
P Value: 0.76257
Mann-Kendall S Value: 11.0
NO3N (Mg/L)
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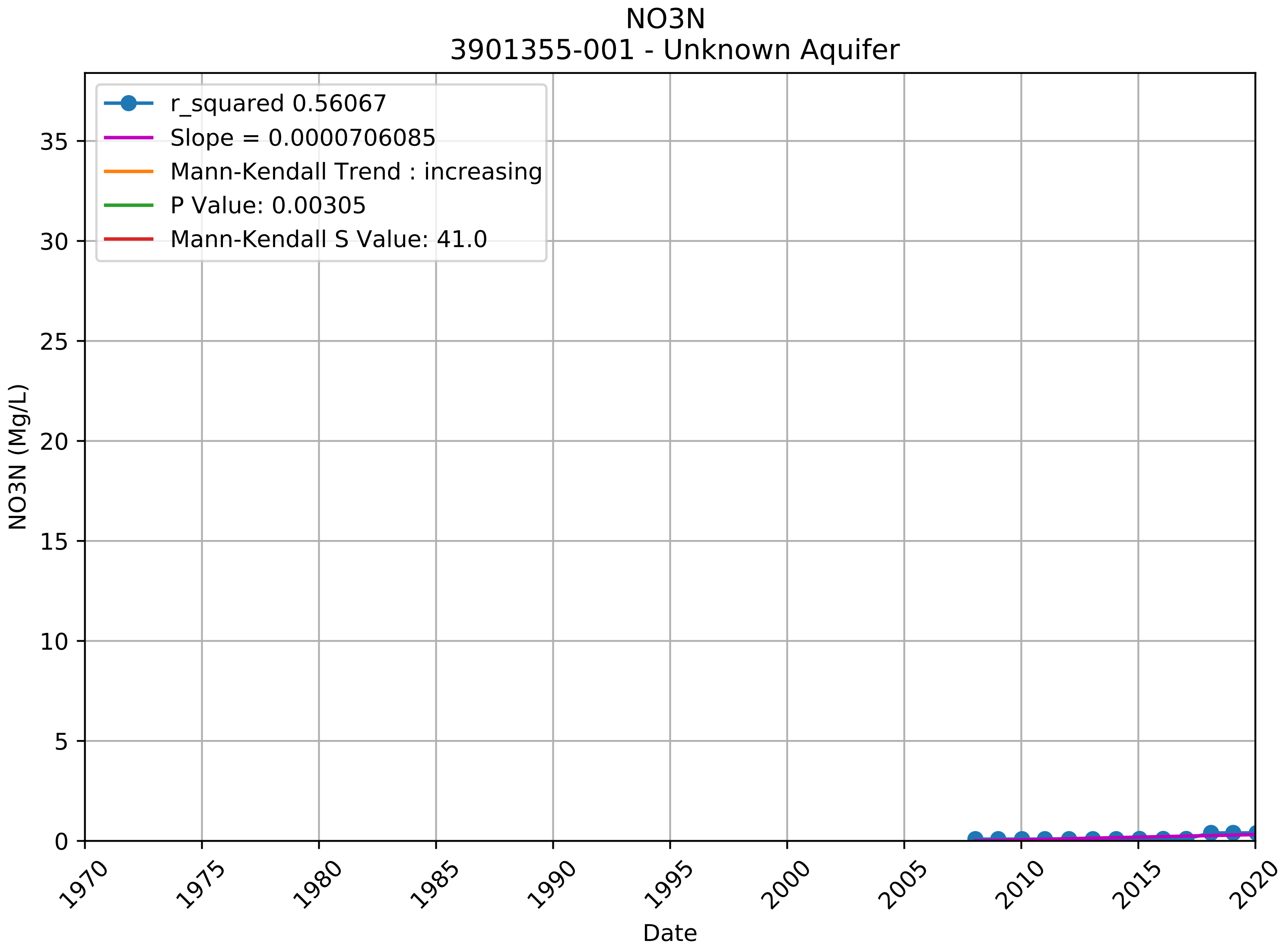

NO3N
3901355-001 - Unknown Aquifer
r_squared 0.56067
Slope = 0.0000706085
Mann-Kendall Trend : increasing
P Value: 0.00305
Mann-Kendall S Value: 41.0
NO3N (Mg/L)
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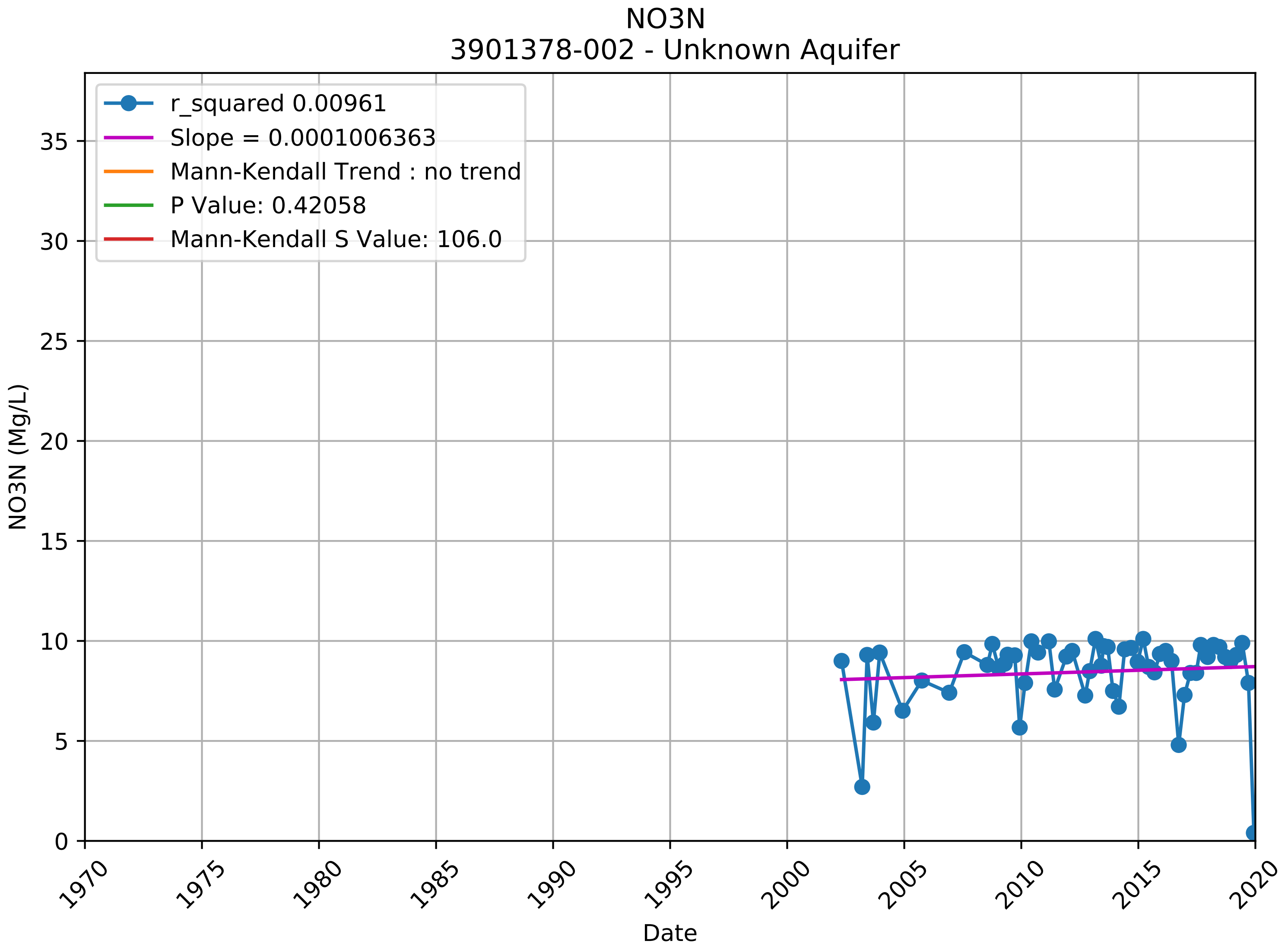

NO3N
3901378-002 - Unknown Aquifer
r_squared 0.00961
Slope = 0.0001006363
Mann-Kendall Trend : no trend
P Value: 0.42058
Mann-Kendall S Value: 106.0
NO3N (Mg/L)
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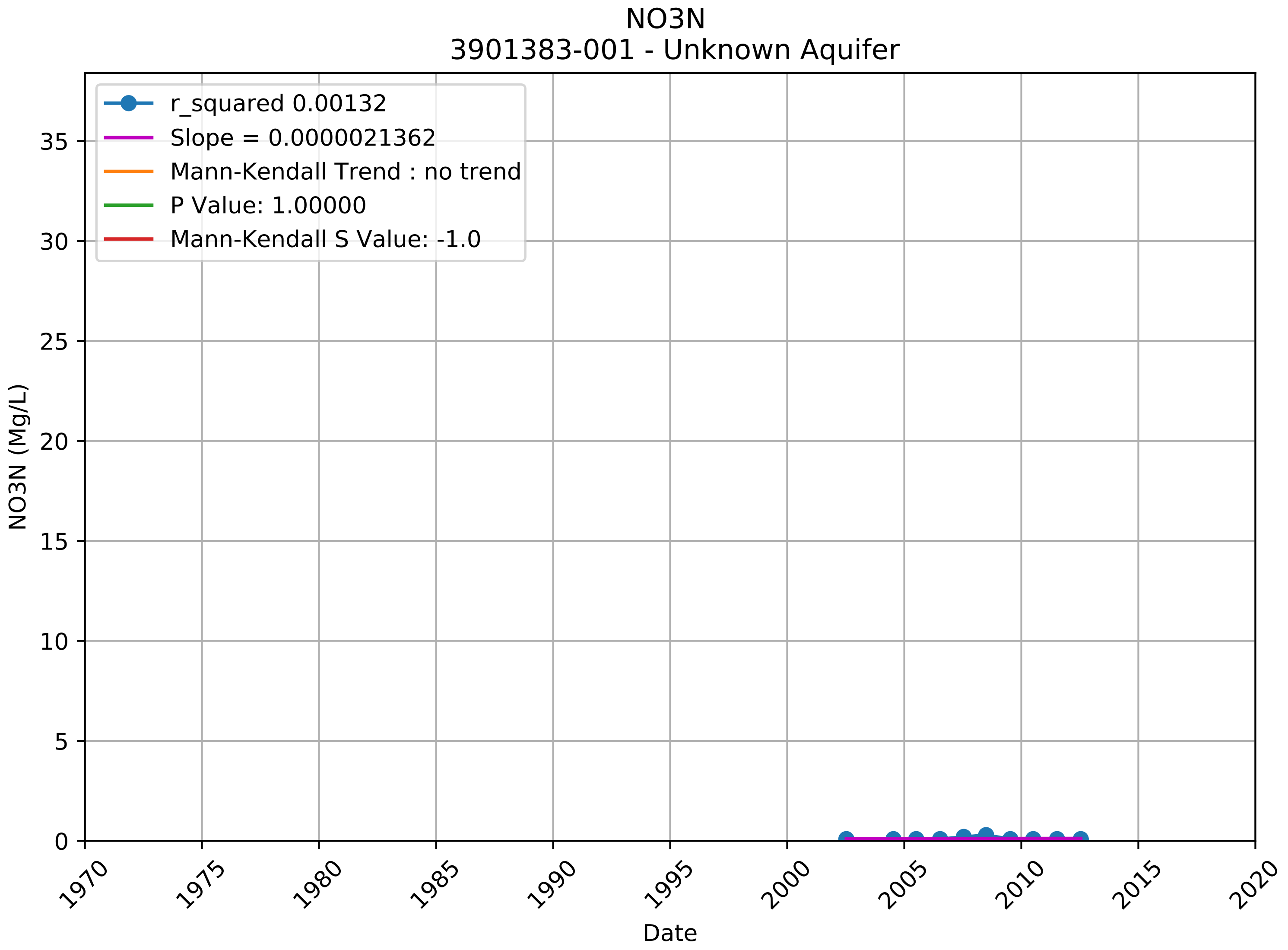

NO3N
3901383-001 - Unknown Aquifer
r_squared 0.00132
Slope = 0.0000021362
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
NO3N (Mg/L)
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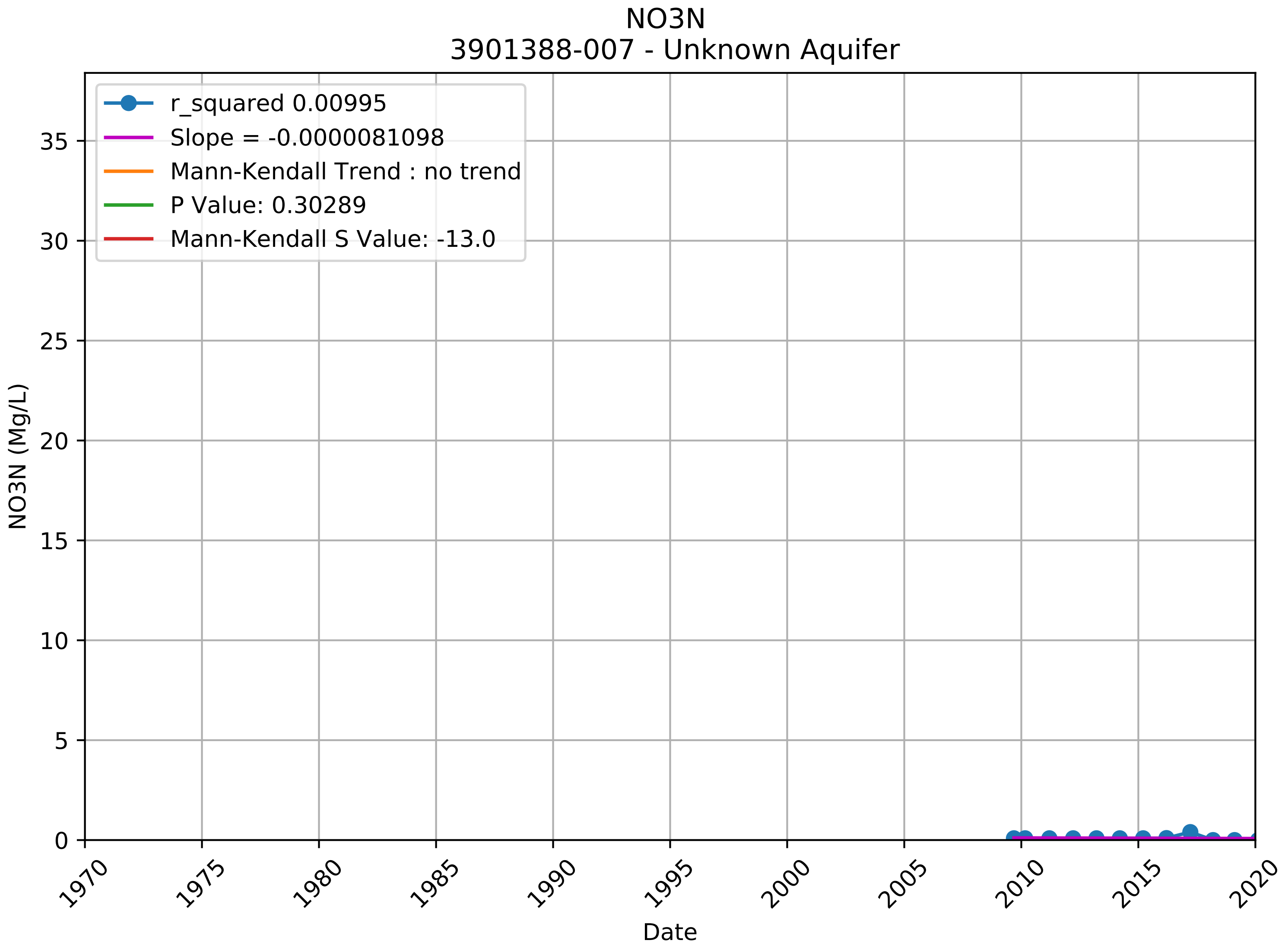

NO3N
3901388-007 - Unknown Aquifer
r_squared 0.00995
Slope = -0.0000081098
Mann-Kendall Trend : no trend
P Value: 0.30289
Mann-Kendall S Value: -13.0
NO3N (Mg/L)
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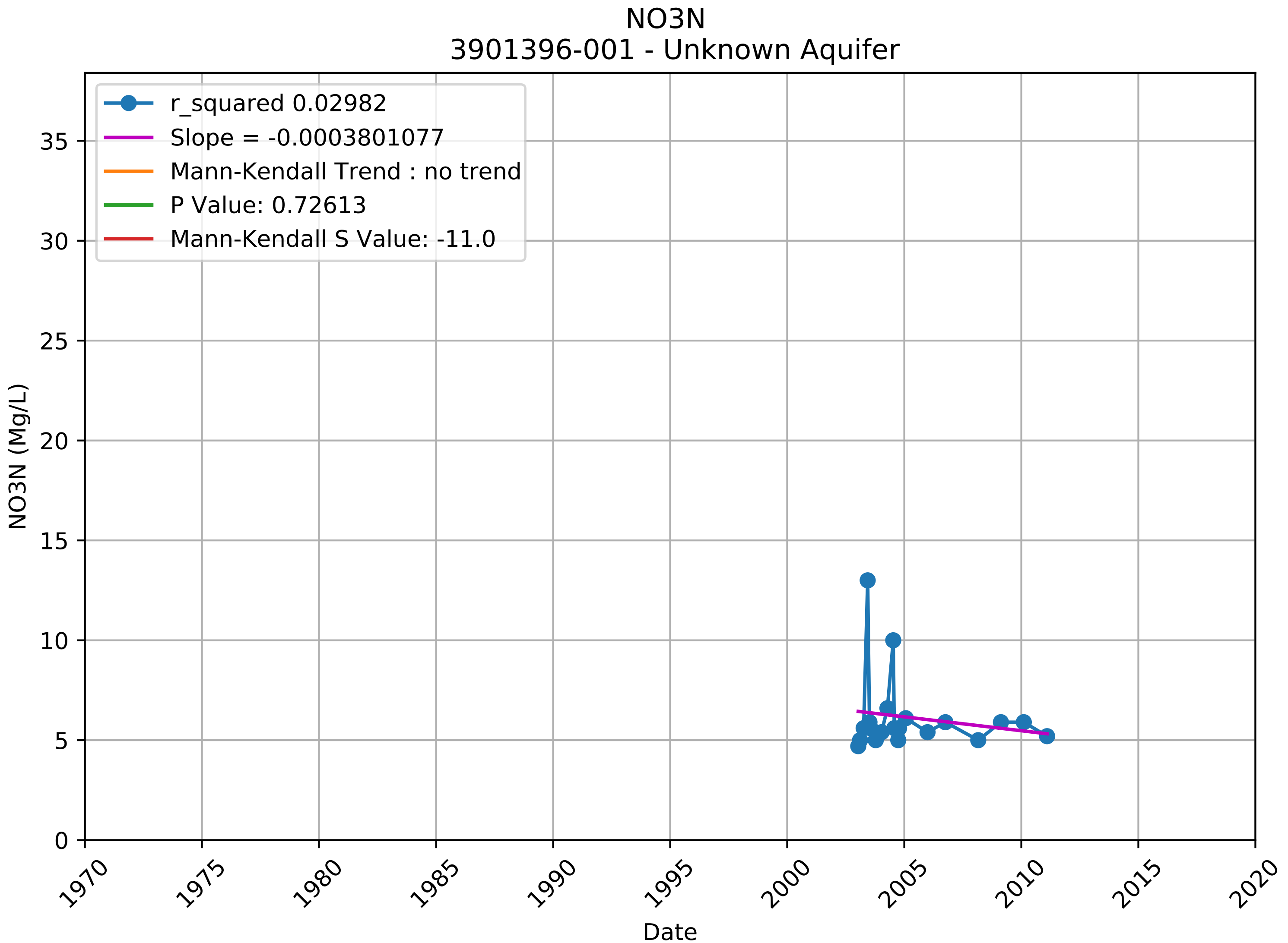
NO3N
3901396-001 - Unknown Aquifer
r_squared 0.02982
Slope = -0.0003801077
Mann-Kendall Trend : no trend
P Value: 0.72613
Mann-Kendall S Value: -11.0
NO3N (Mg/L)
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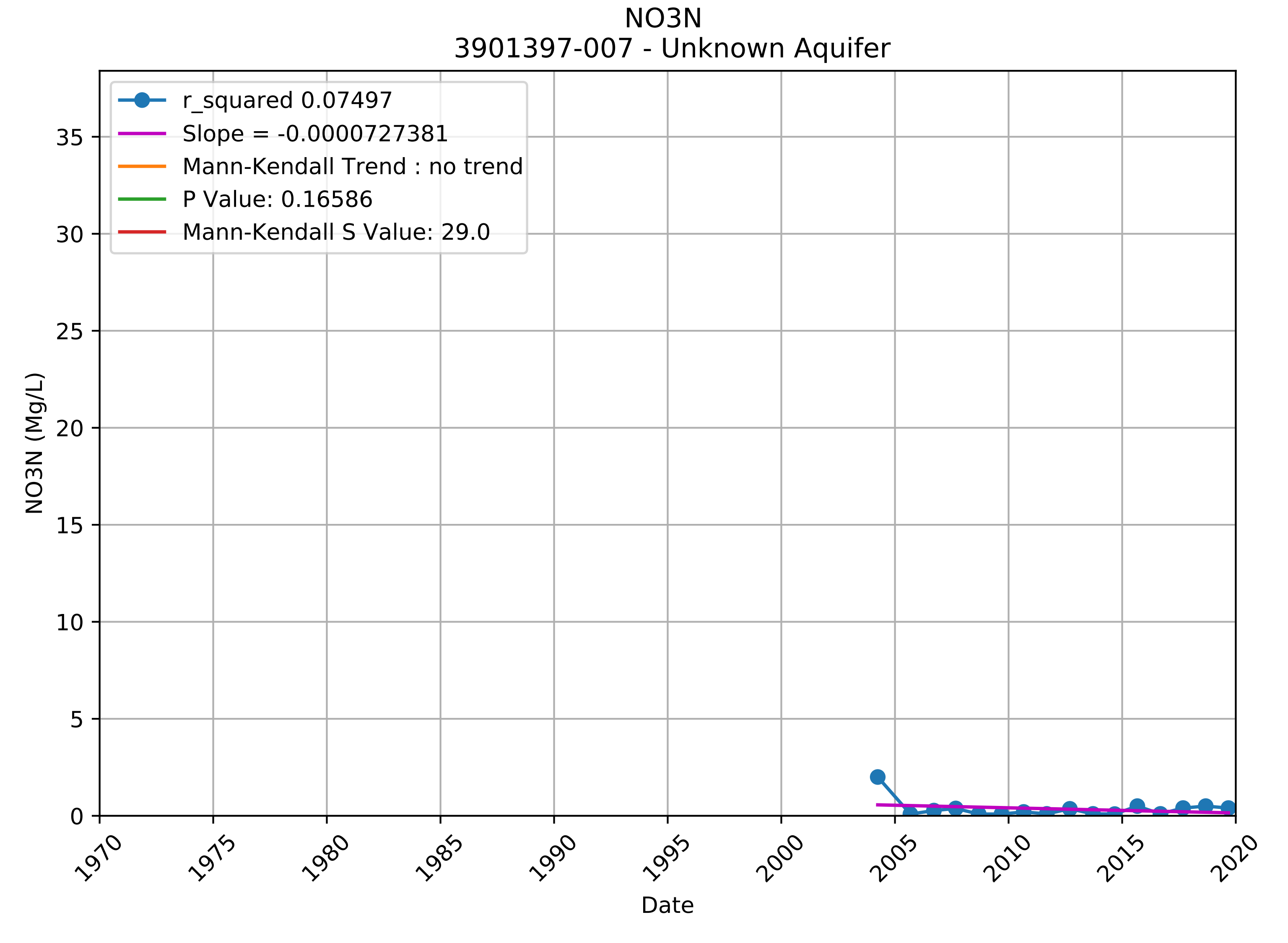
NO3N
3901397-007 - Unknown Aquifer
r_squared 0.07497
Slope = -0.0000727381
Mann-Kendall Trend : no trend
P Value: 0.16586
Mann-Kendall S Value: 29.0
NO3N (Mg/L)
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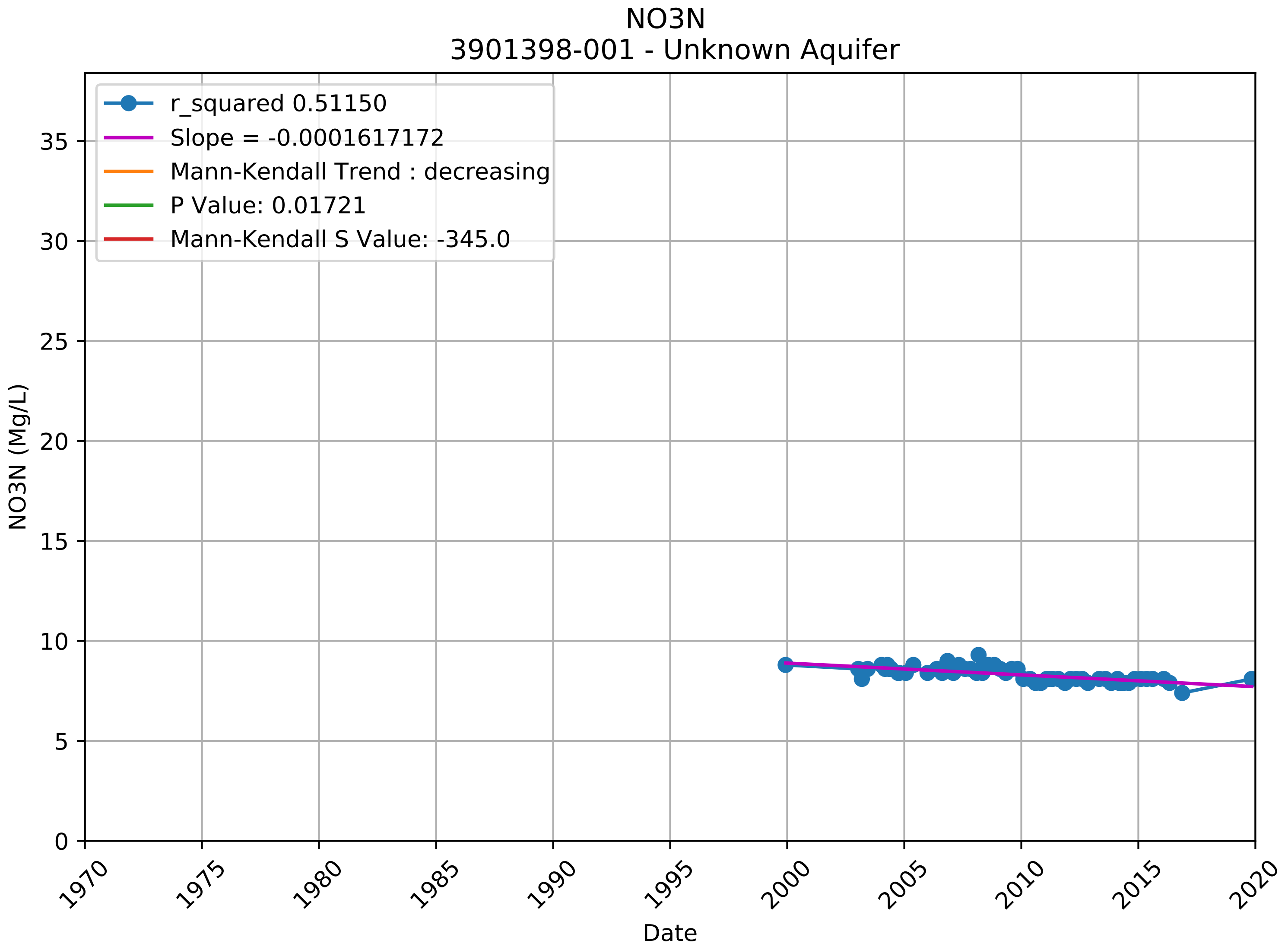
NO3N
3901398-001 - Unknown Aquifer
r_squared 0.51150
Slope = -0.0001617172
Mann-Kendall Trend : decreasing
P Value: 0.01721
Mann-Kendall S Value: -345.0
NO3N (Mg/L)
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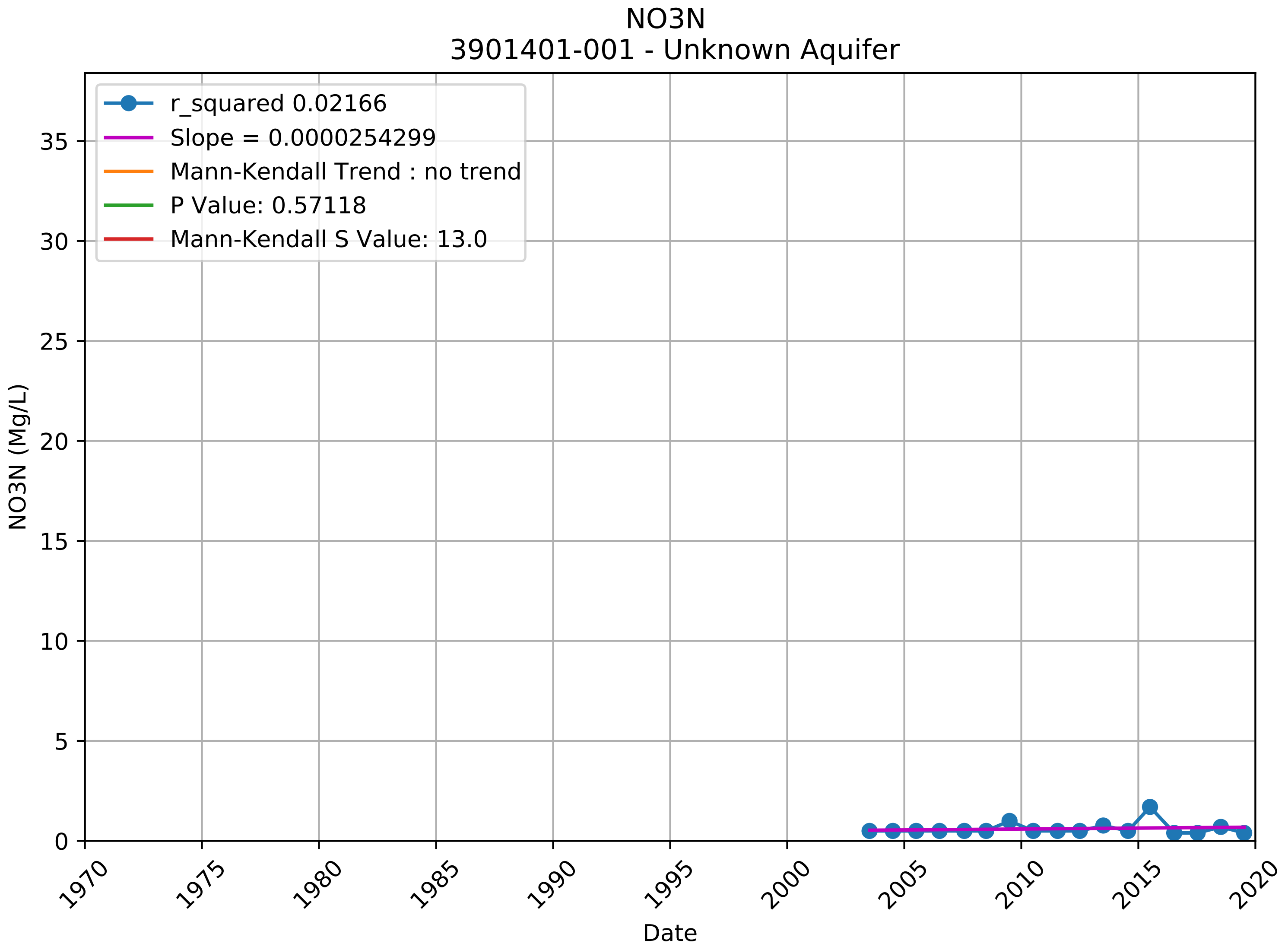

NO3N
3901401-001 - Unknown Aquifer
r_squared 0.02166
Slope = 0.0000254299
Mann-Kendall Trend : no trend
P Value: 0.57118
Mann-Kendall S Value: 13.0
NO3N (Mg/L)
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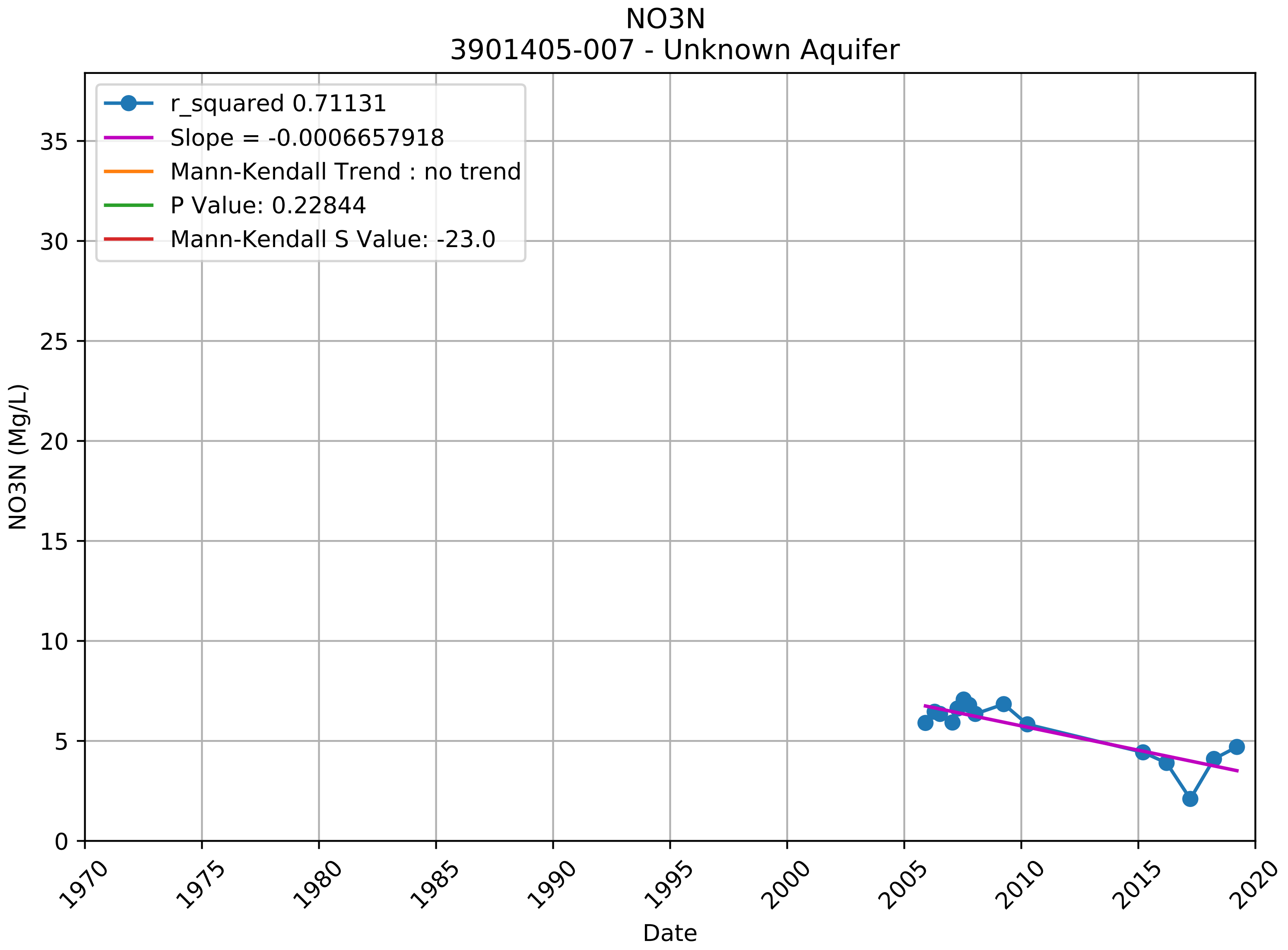
NO3N
3901405-007 - Unknown Aquifer
r_squared 0.71131
Slope = -0.0006657918
Mann-Kendall Trend : no trend
P Value: 0.22844
Mann-Kendall S Value: -23.0
NO3N (Mg/L)
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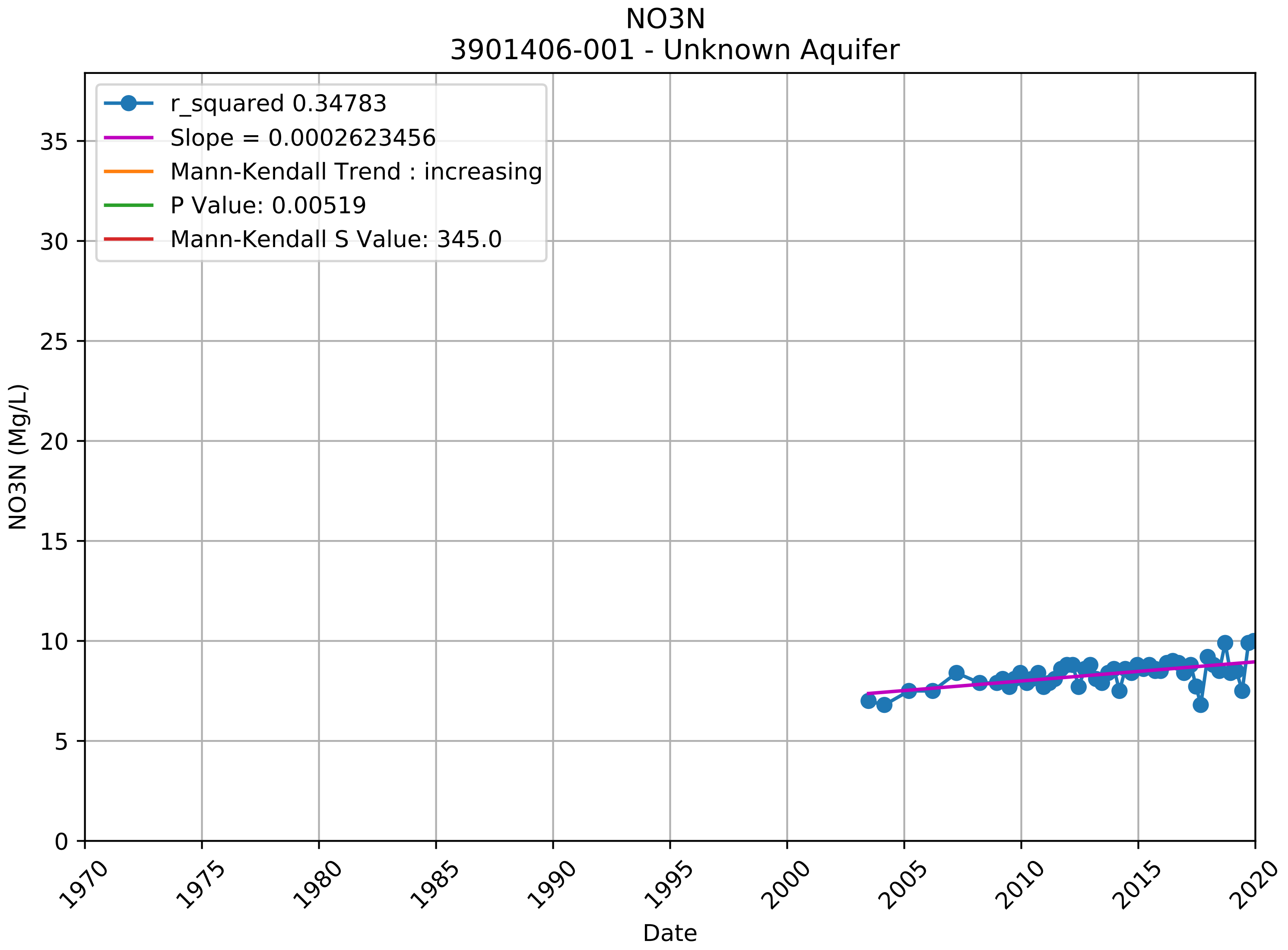

NO3N
3901406-001 - Unknown Aquifer
r_squared 0.34783
Slope = 0.0002623456
Mann-Kendall Trend : increasing
P Value: 0.00519
Mann-Kendall S Value: 345.0
NO3N (Mg/L)
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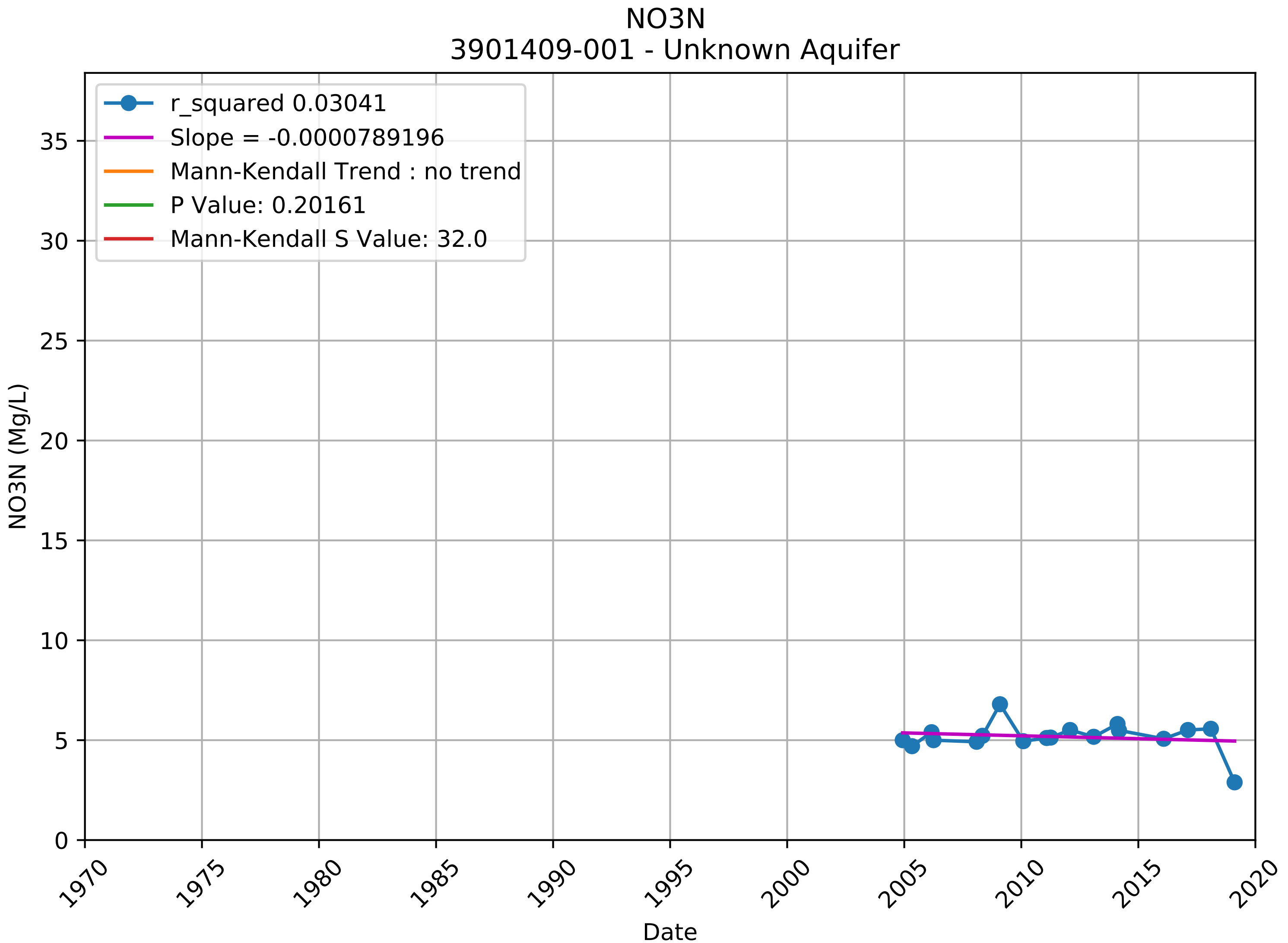

NO3N
3901409-001 - Unknown Aquifer
r_squared 0.03041
Slope = -0.0000789196
Mann-Kendall Trend : no trend
P Value: 0.20161
Mann-Kendall S Value: 32.0
NO3N (Mg/L)
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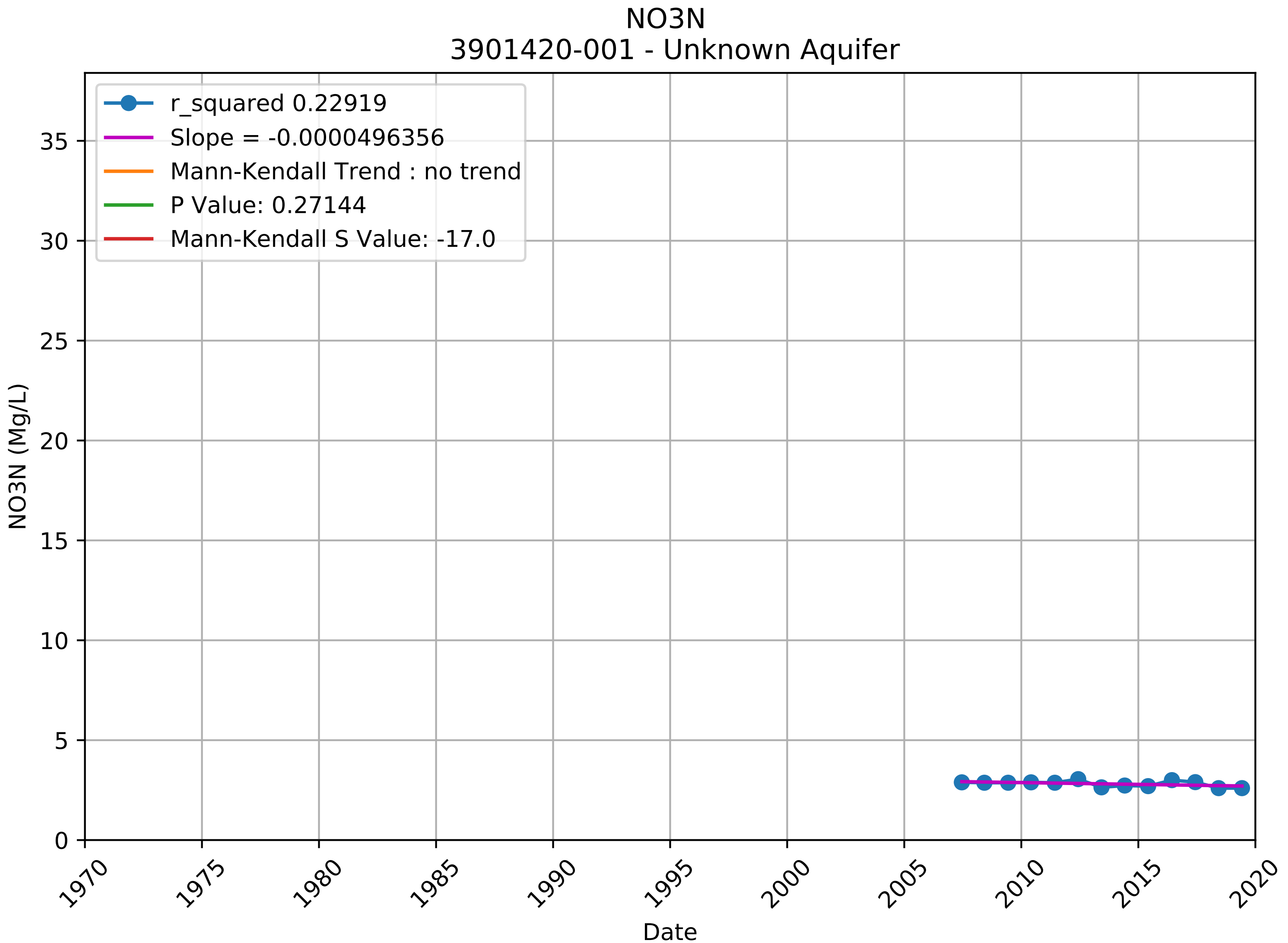

NO3N
3901420-001 - Unknown Aquifer
r_squared 0.22919
Slope = -0.0000496356
Mann-Kendall Trend : no trend
P Value: 0.27144
Mann-Kendall S Value: -17.0
NO3N (Mg/L)
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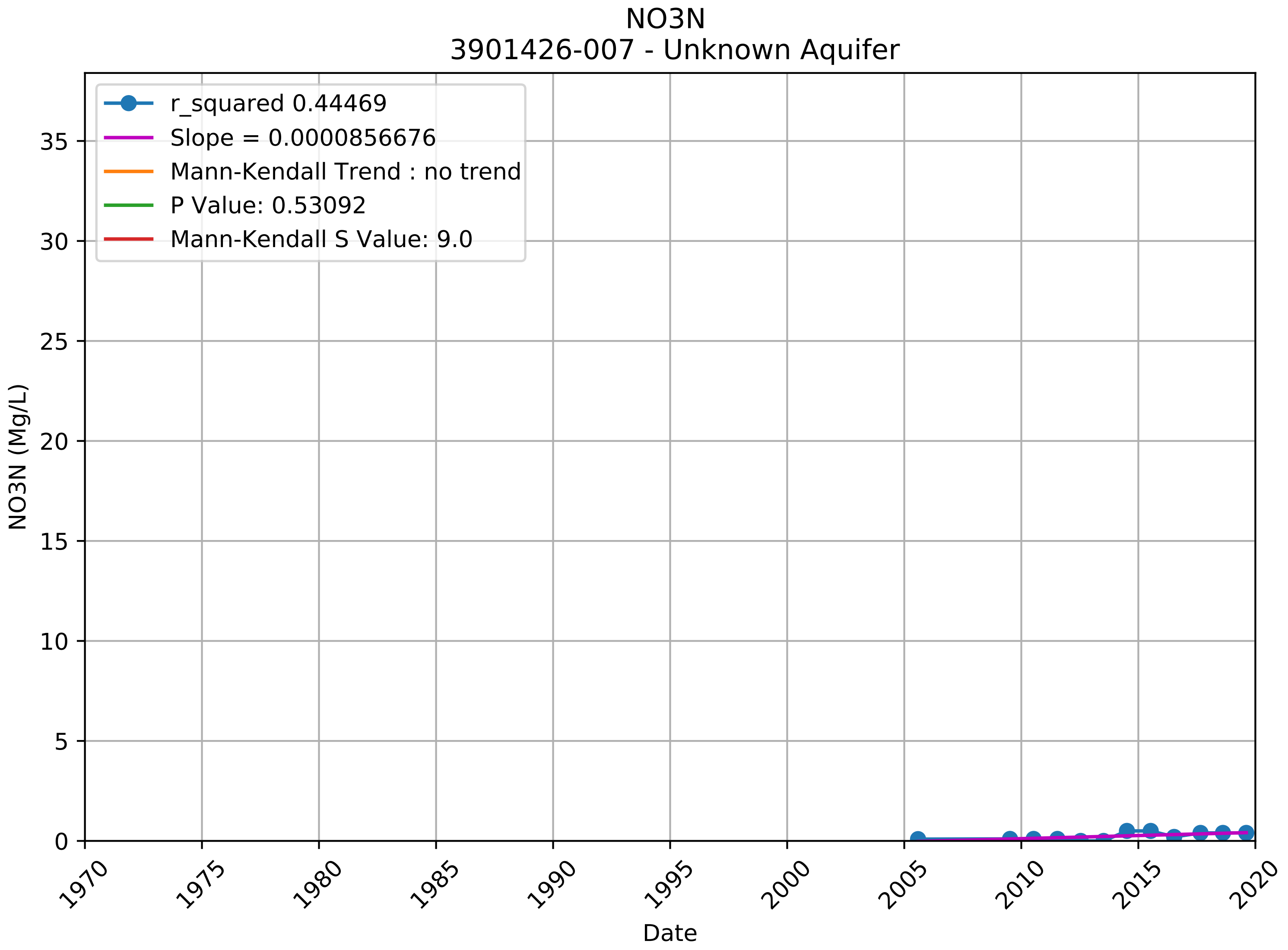

NO3N
3901426-007 - Unknown Aquifer
r_squared 0.44469
Slope = 0.0000856676
Mann-Kendall Trend : no trend
P Value: 0.53092
Mann-Kendall S Value: 9.0
NO3N (Mg/L)
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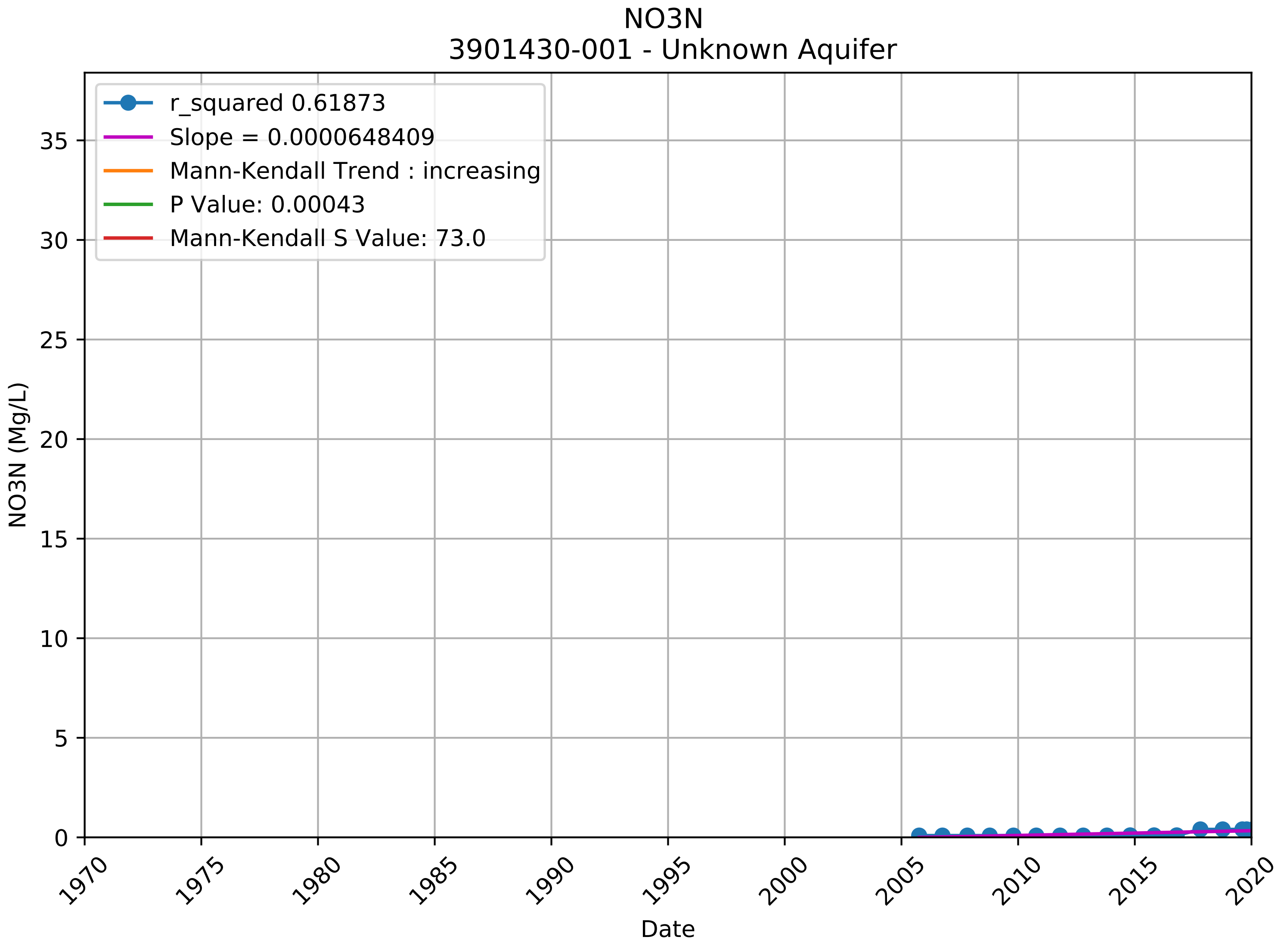
NO3N
3901430-001 - Unknown Aquifer
r_squared 0.61873
Slope = 0.0000648409
Mann-Kendall Trend : increasing
P Value: 0.00043
Mann-Kendall S Value: 73.0
NO3N (Mg/L)
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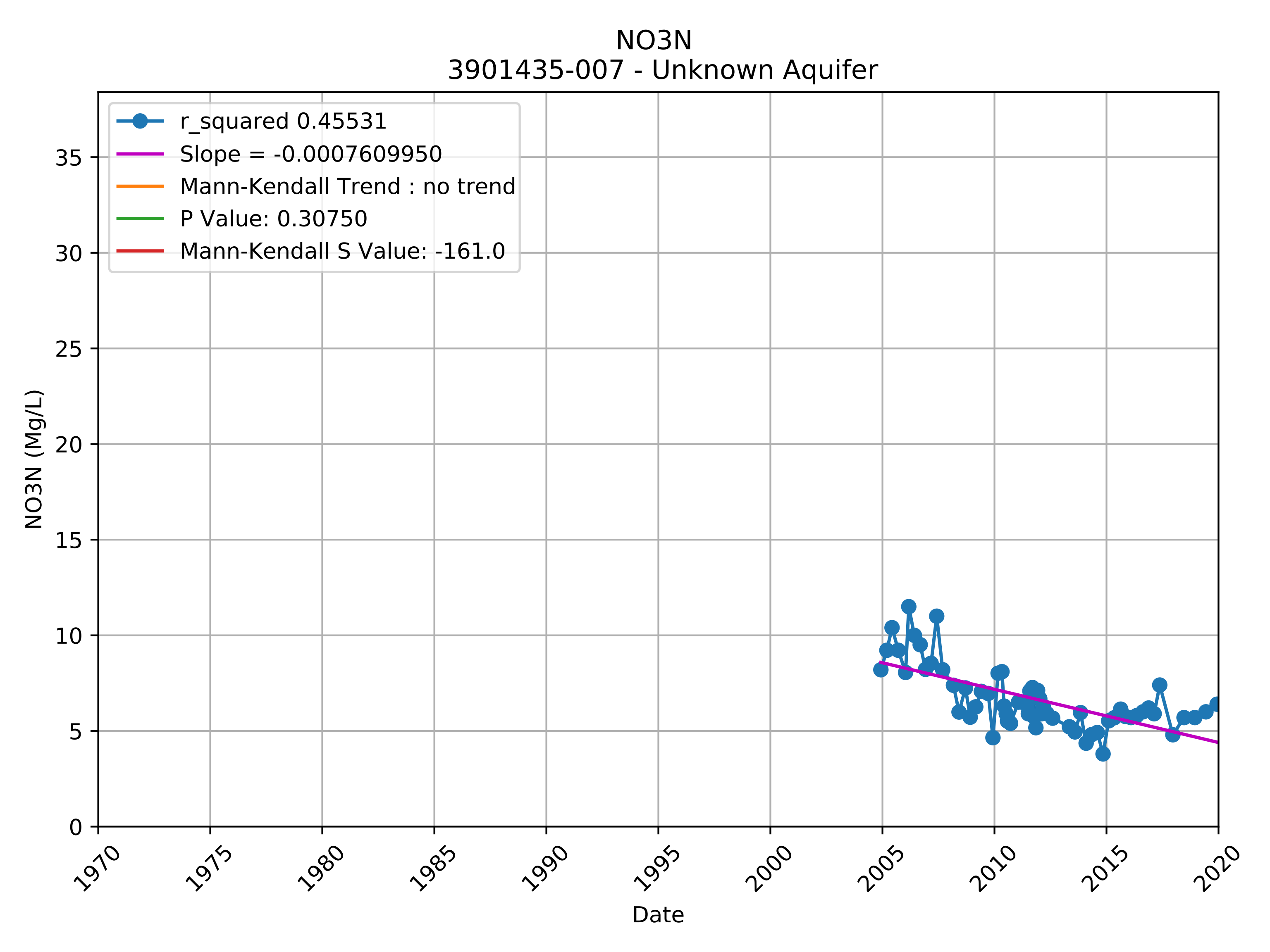

NO3N
3901435-007 - Unknown Aquifer
r_squared 0.45531
Slope = -0.0007609950
Mann-Kendall Trend : no trend
P Value: 0.30750
Mann-Kendall S Value: -161.0
NO3N (Mg/L)
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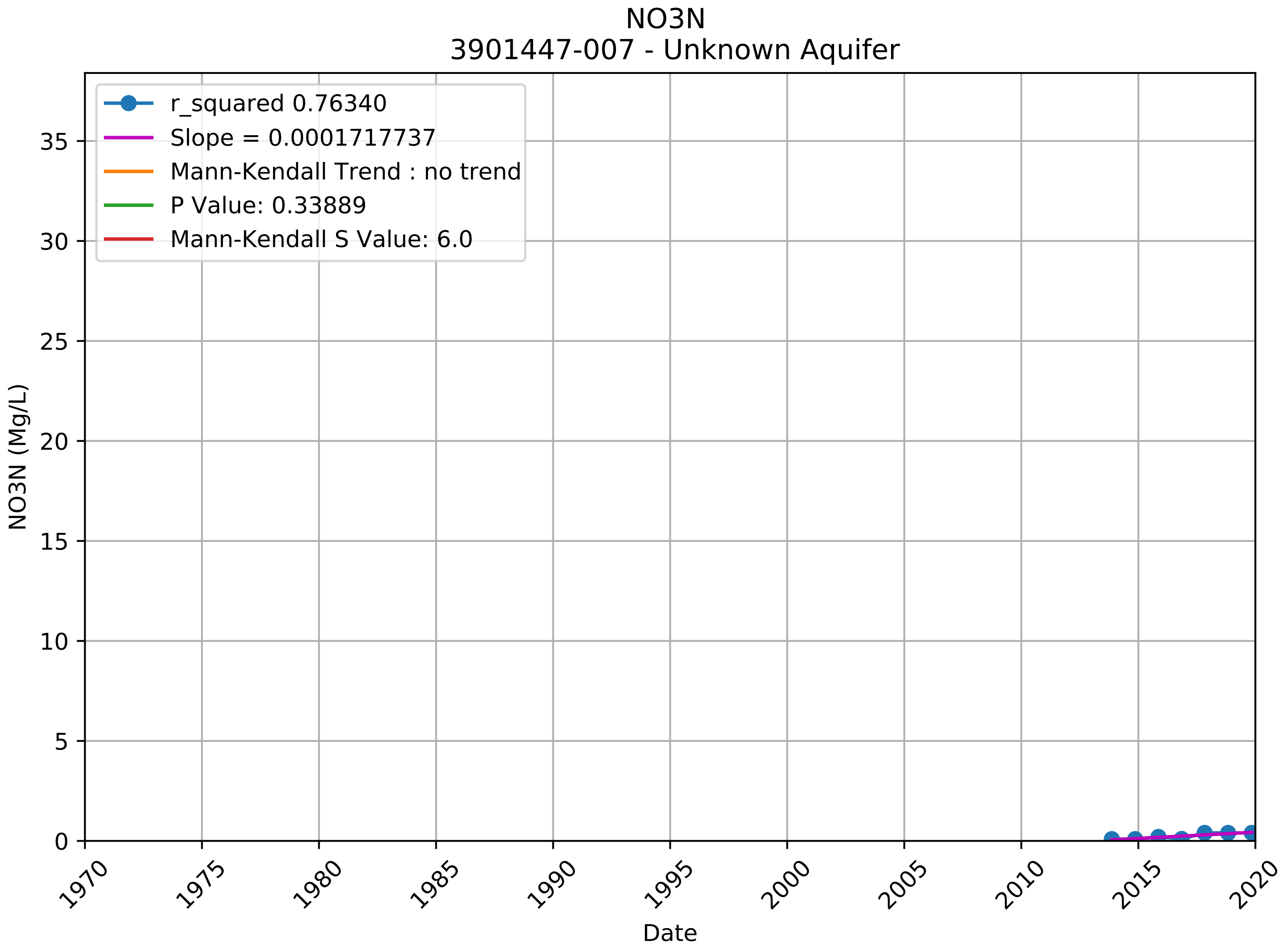

NO3N
3901447-007 - Unknown Aquifer
r_squared 0.76340
Slope = 0.0001717737
Mann-Kendall Trend : no trend
P Value: 0.33889
Mann-Kendall S Value: 6.0
NO3N (Mg/L)
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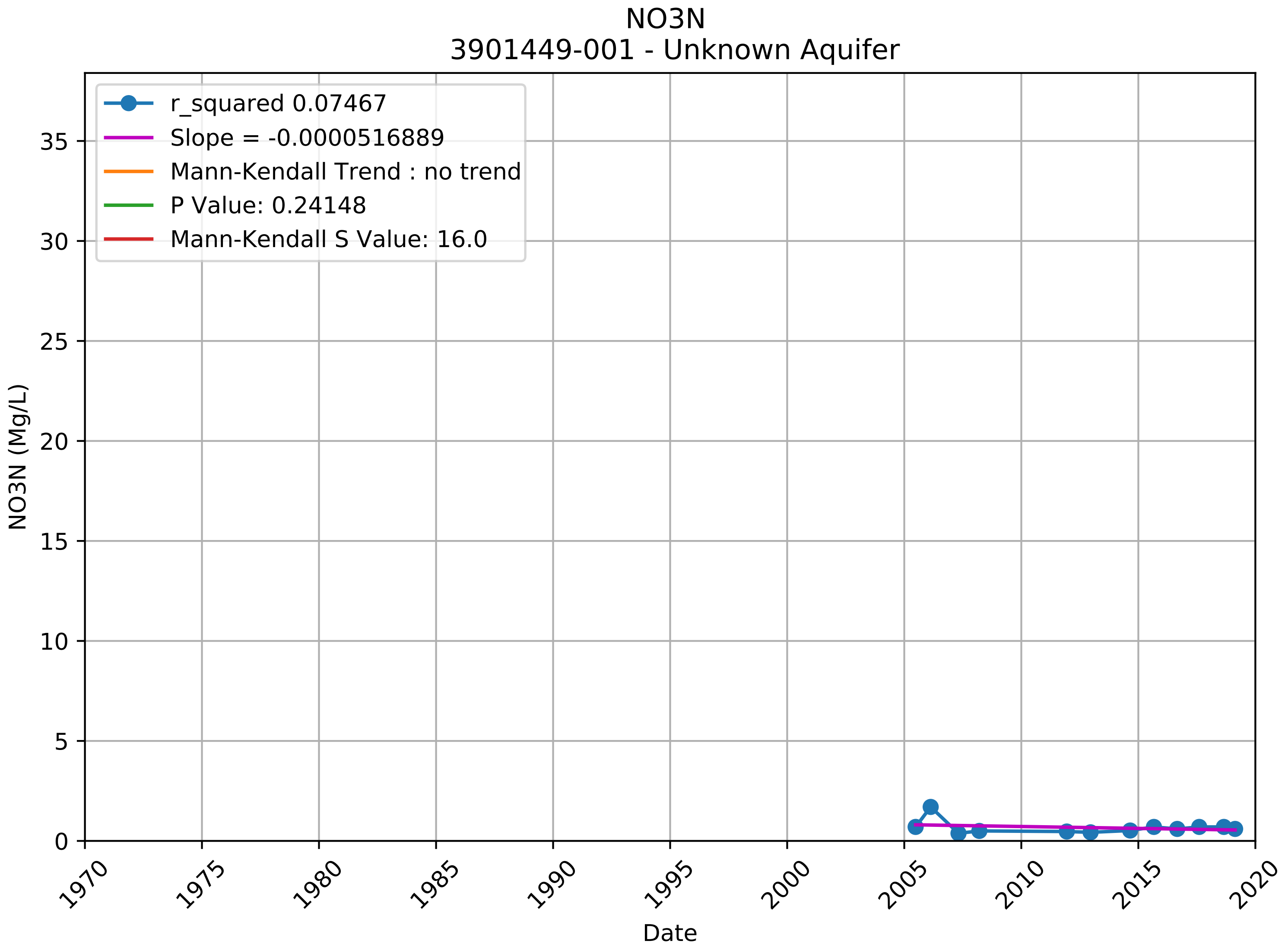
NO3N
3901449-001 - Unknown Aquifer
r_squared 0.07467
Slope = -0.0000516889
Mann-Kendall Trend : no trend
P Value: 0.24148
Mann-Kendall S Value: 16.0
NO3N (Mg/L)
Date
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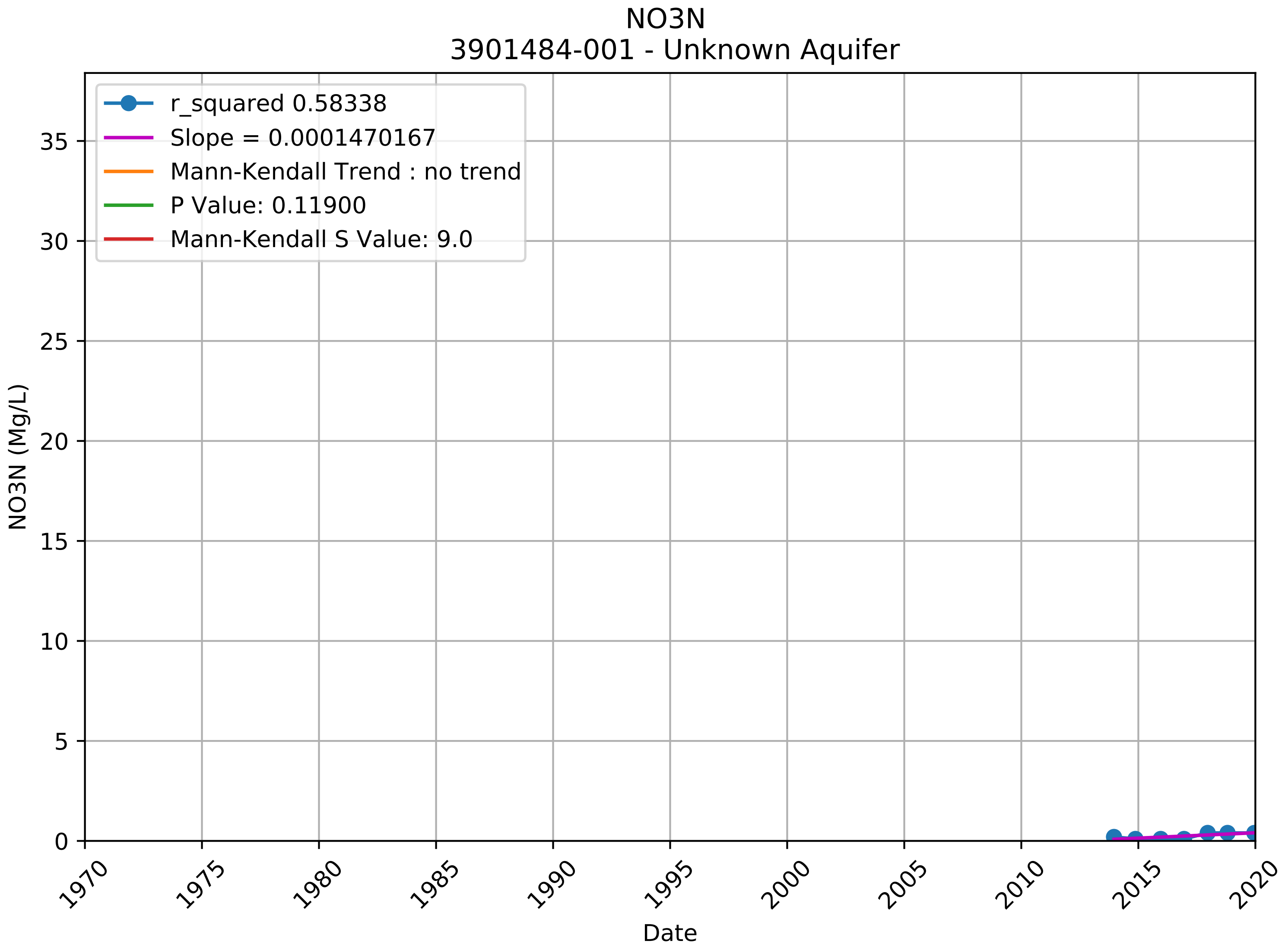
NO3N
3901484-001 - Unknown Aquifer
r_squared 0.58338
Slope = 0.0001470167
Mann-Kendall Trend : no trend
P Value: 0.11900
Mann-Kendall S Value: 9.0
NO3N (Mg/L)
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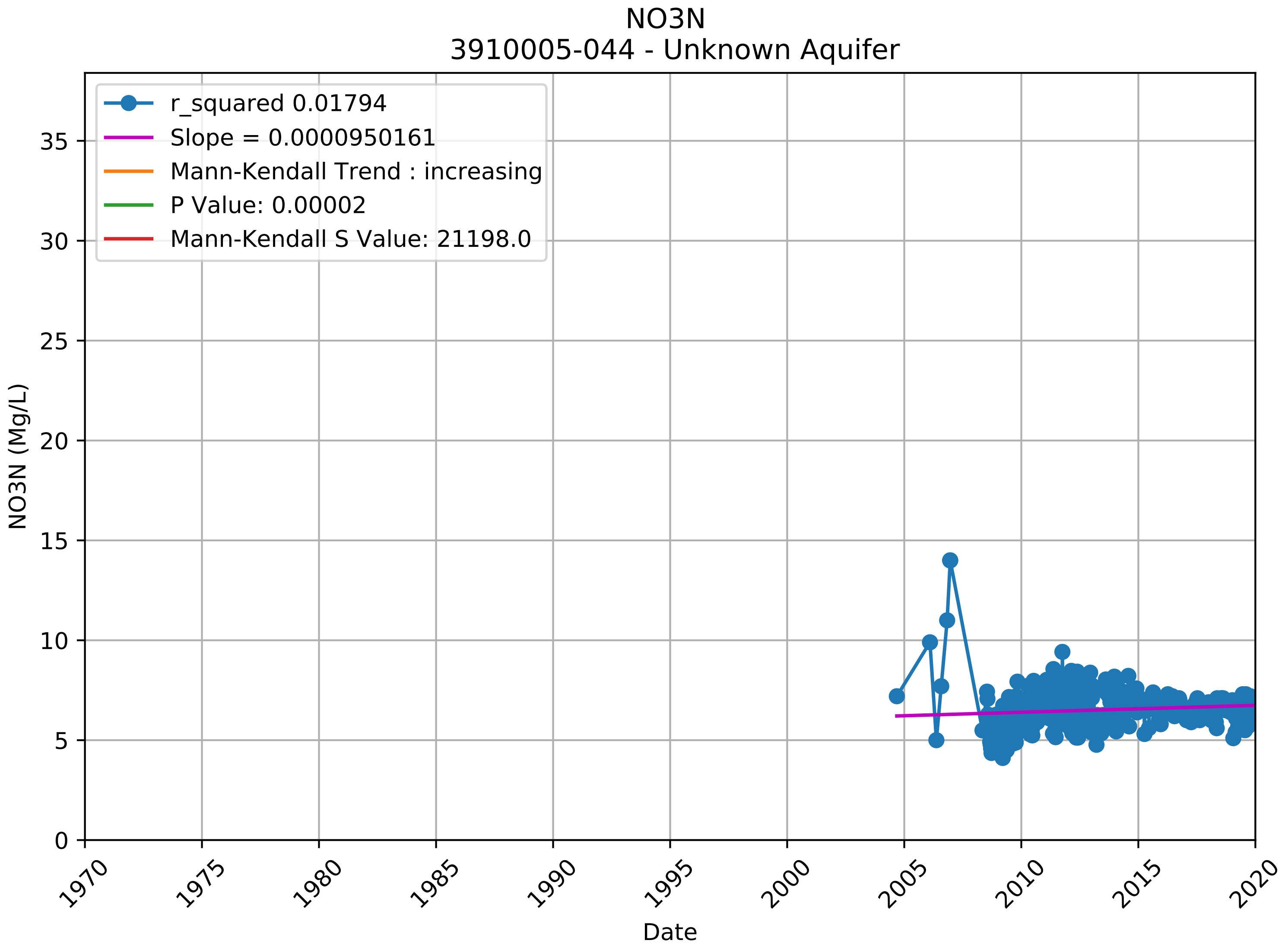
NO3N
3910005-044 - Unknown Aquifer
r_squared 0.01794
Slope = 0.0000950161
Mann-Kendall Trend : increasing
P Value: 0.00002
Mann-Kendall S Value: 21198.0
NO3N (Mg/L)
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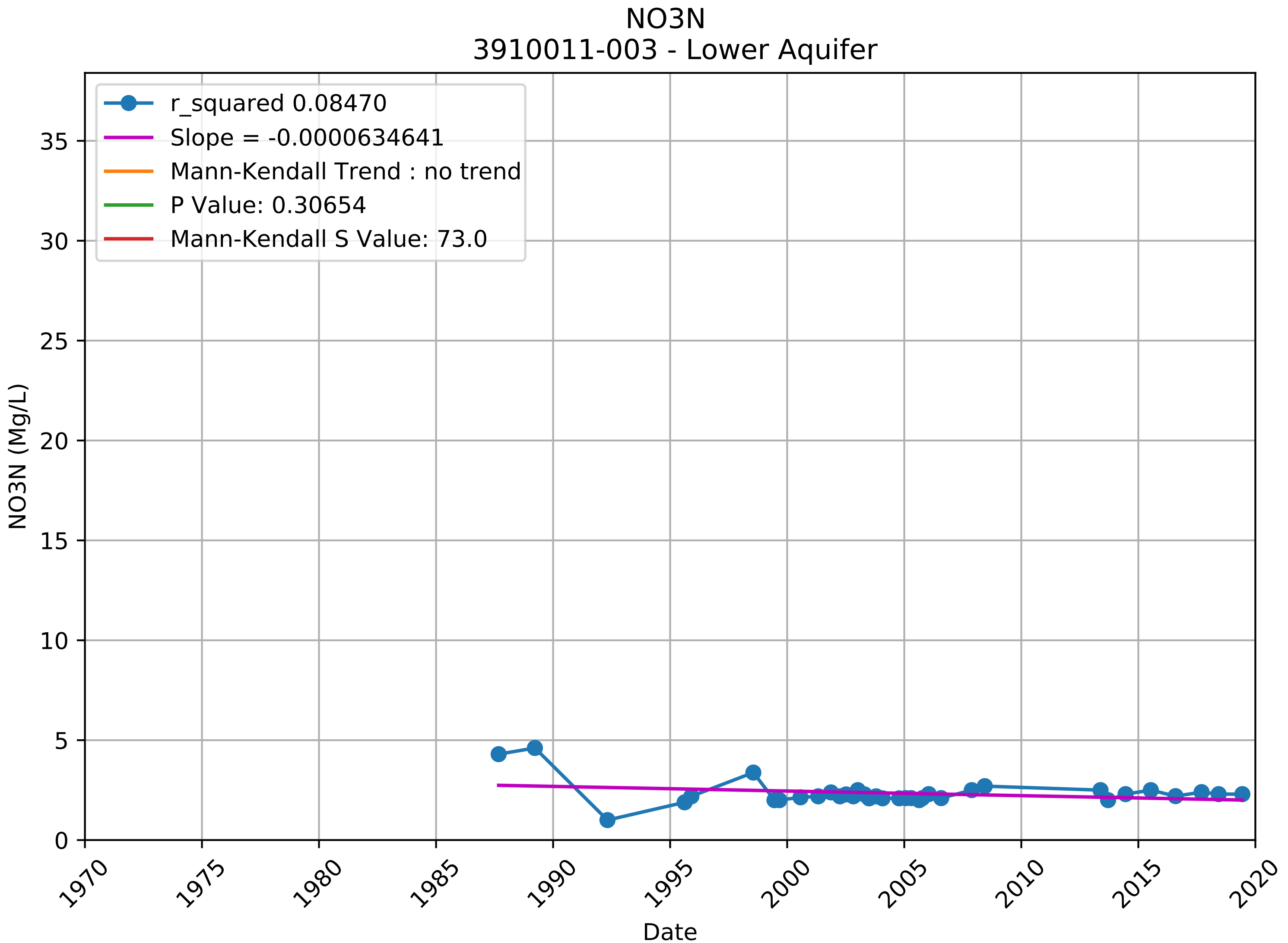

NO3N
3910011-003 - Lower Aquifer
r_squared 0.08470
Slope = -0.0000634641
Mann-Kendall Trend : no trend
P Value: 0.30654
Mann-Kendall S Value: 73.0
NO3N (Mg/L)
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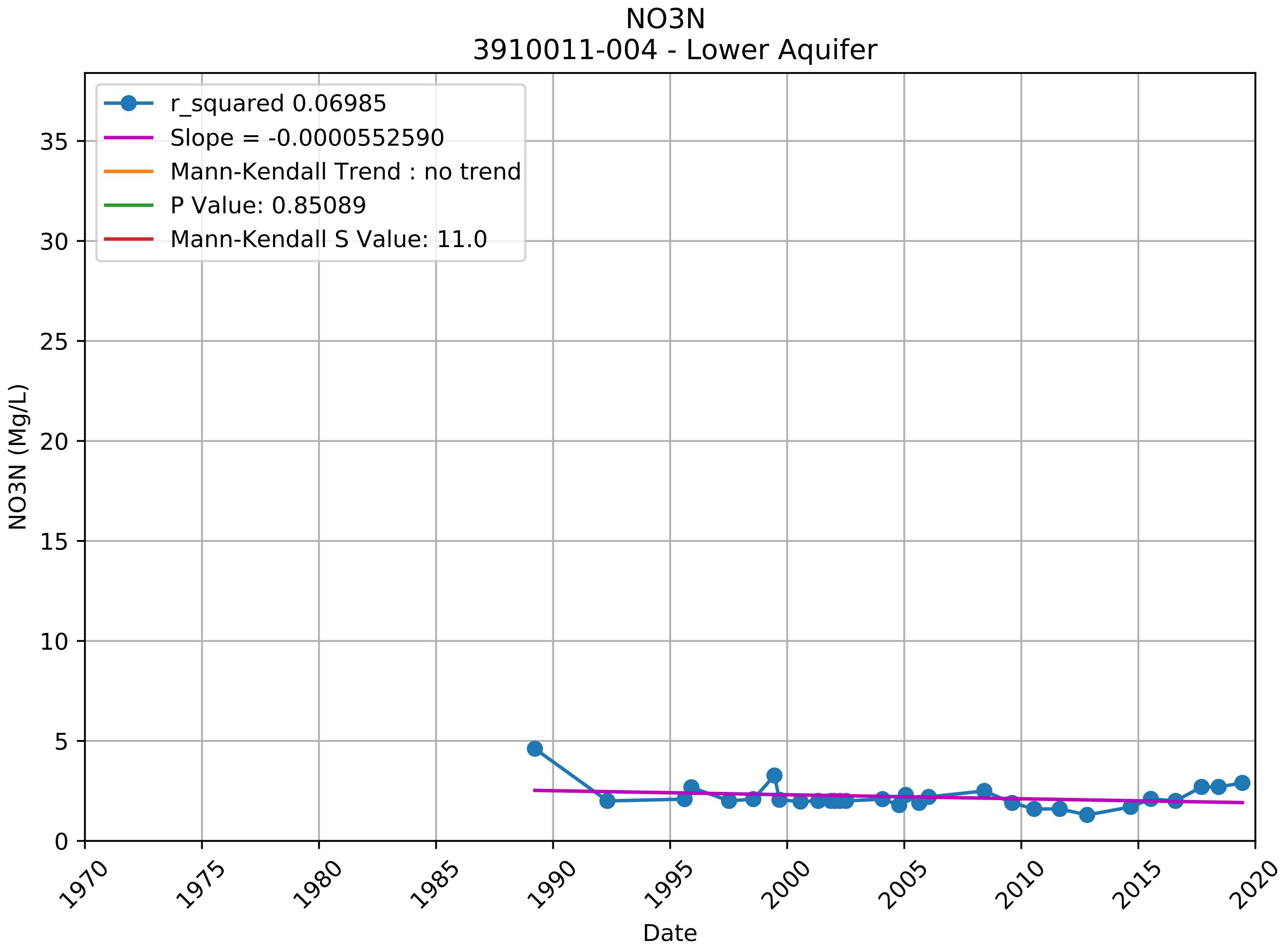
NO3N
3910011-004 - Lower Aquifer
r_squared 0.06985
Slope = -0.0000552590
Mann-Kendall Trend : no trend
P Value: 0.85089
Mann-Kendall S Value: 11.0
NO3N (Mg/L)
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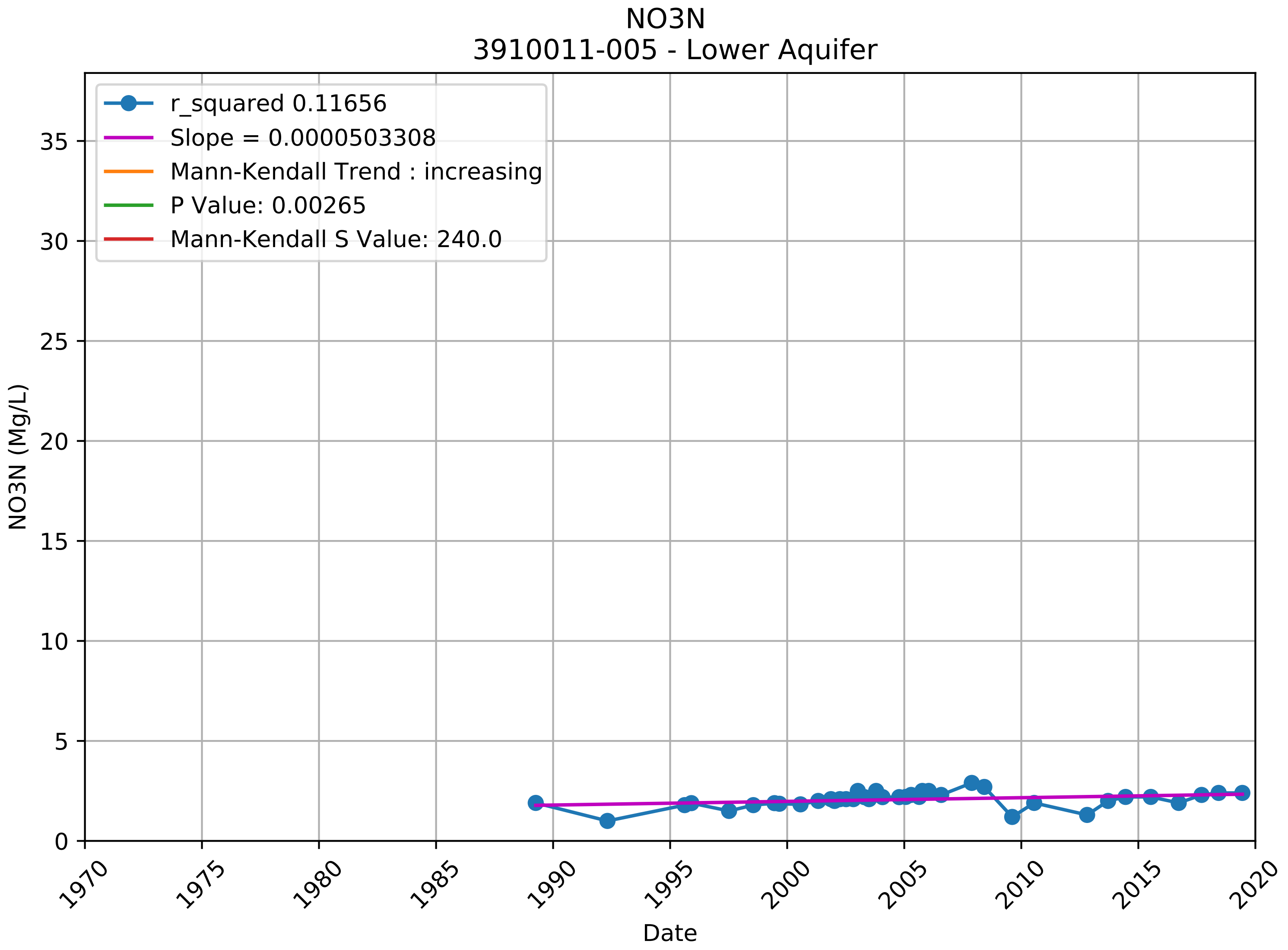
NO3N
3910011-005 - Lower Aquifer
r_squared 0.11656
Slope = 0.0000503308
Mann-Kendall Trend : increasing
P Value: 0.00265
Mann-Kendall S Value: 240.0
NO3N (Mg/L)
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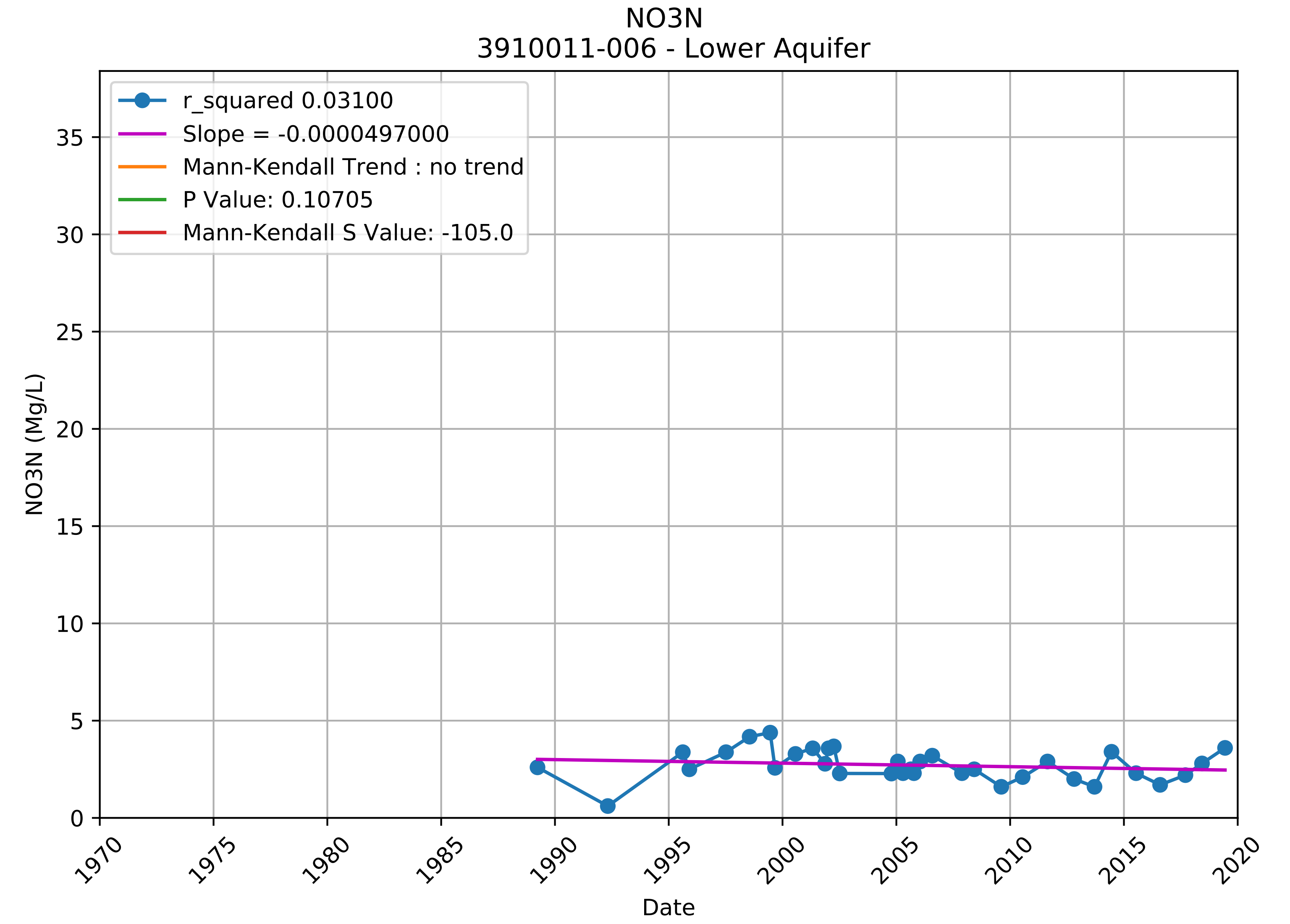

NO3N
3910011-006 - Lower Aquifer
r_squared 0.03100
Slope = -0.0000497000
Mann-Kendall Trend : no trend
P Value: 0.10705
Mann-Kendall S Value: -105.0
NO3N (Mg/L)
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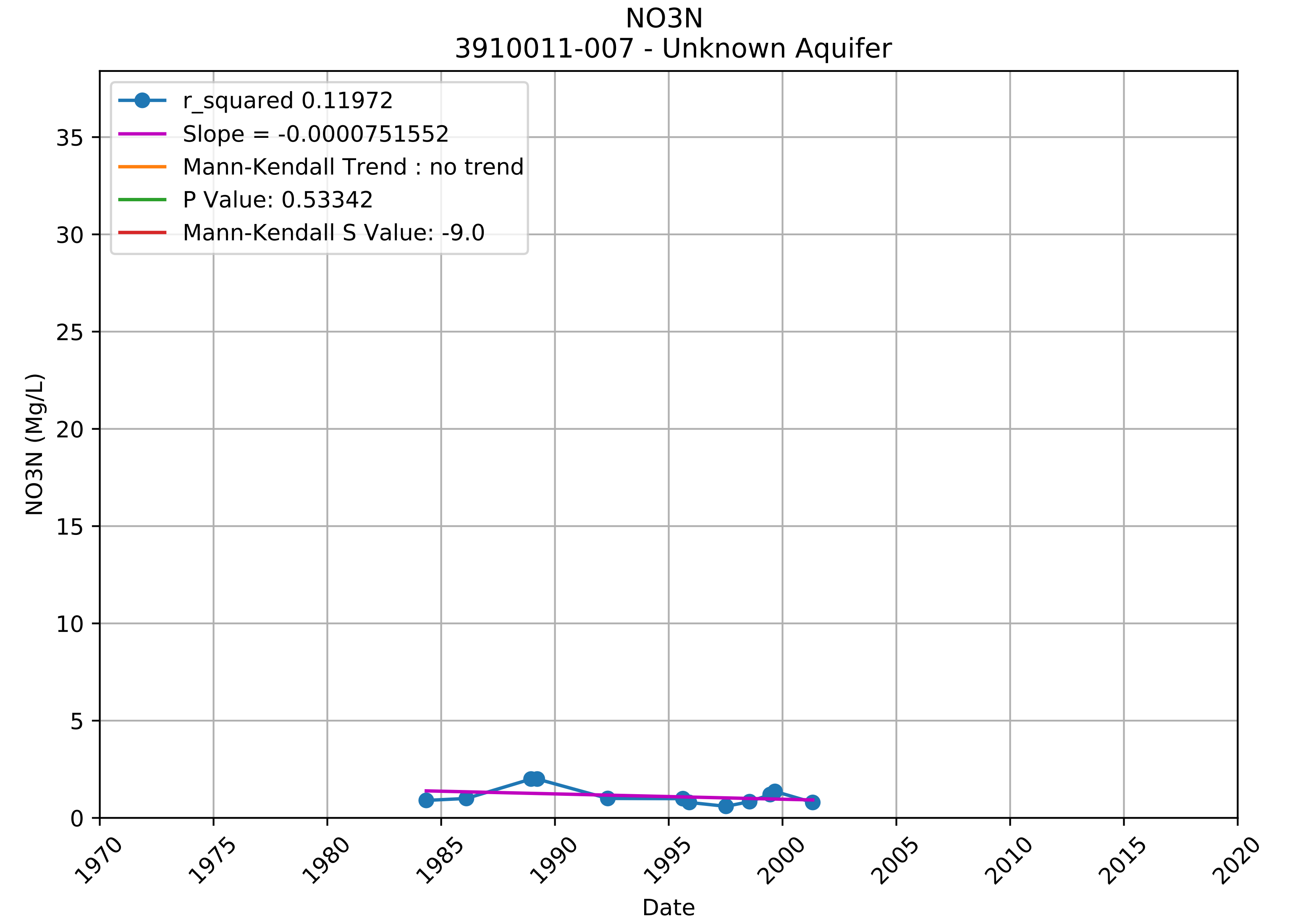

NO3N
3910011-007 - Unknown Aquifer
r_squared 0.11972
Slope = -0.0000751552
Mann-Kendall Trend : no trend
P Value: 0.53342
Mann-Kendall S Value: -9.0
NO3N (Mg/L)
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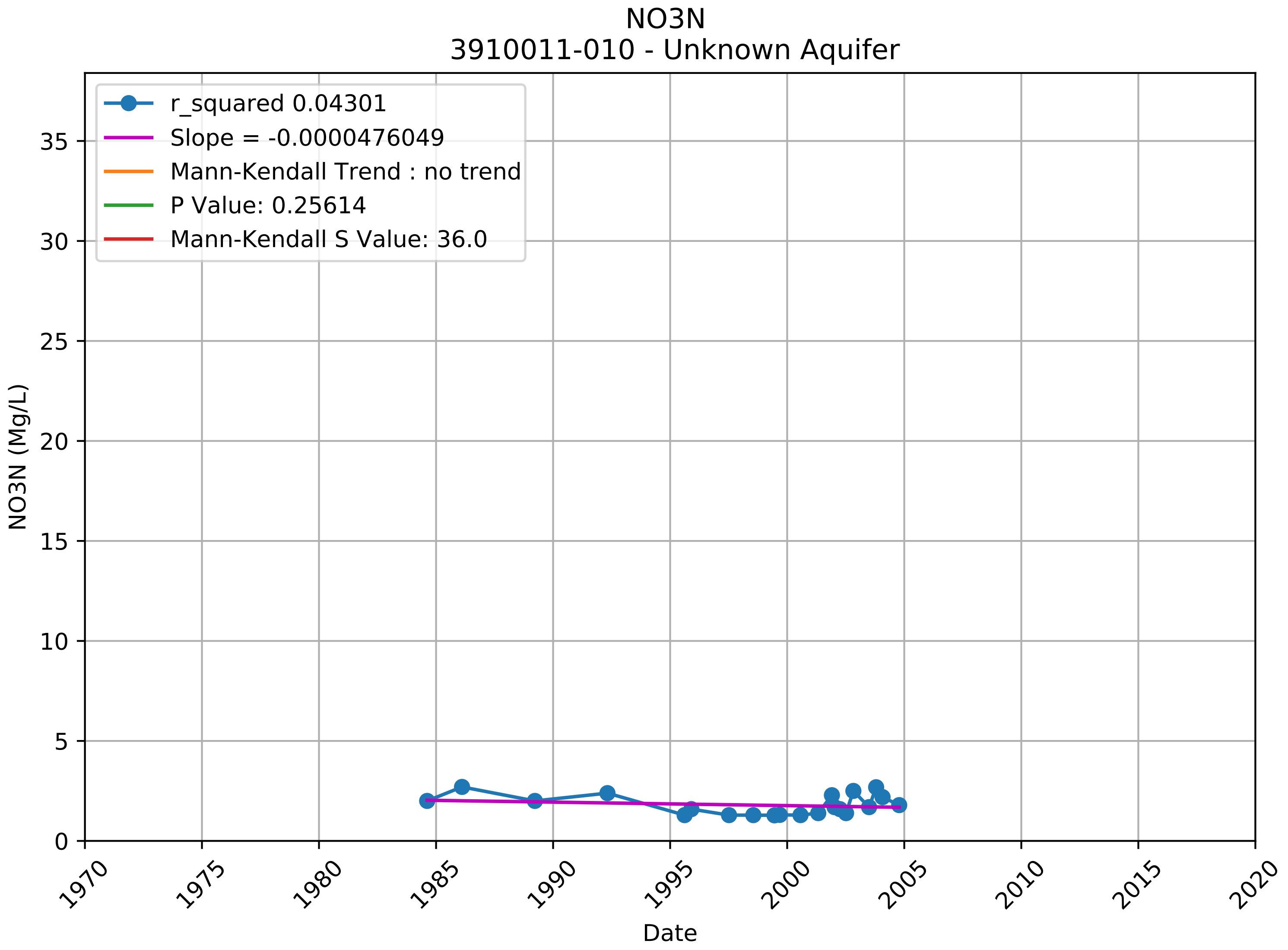
NO3N
3910011-010 - Unknown Aquifer
r_squared 0.04301
Slope = -0.0000476049
Mann-Kendall Trend : no trend
P Value: 0.25614
Mann-Kendall S Value: 36.0
NO3N (Mg/L)
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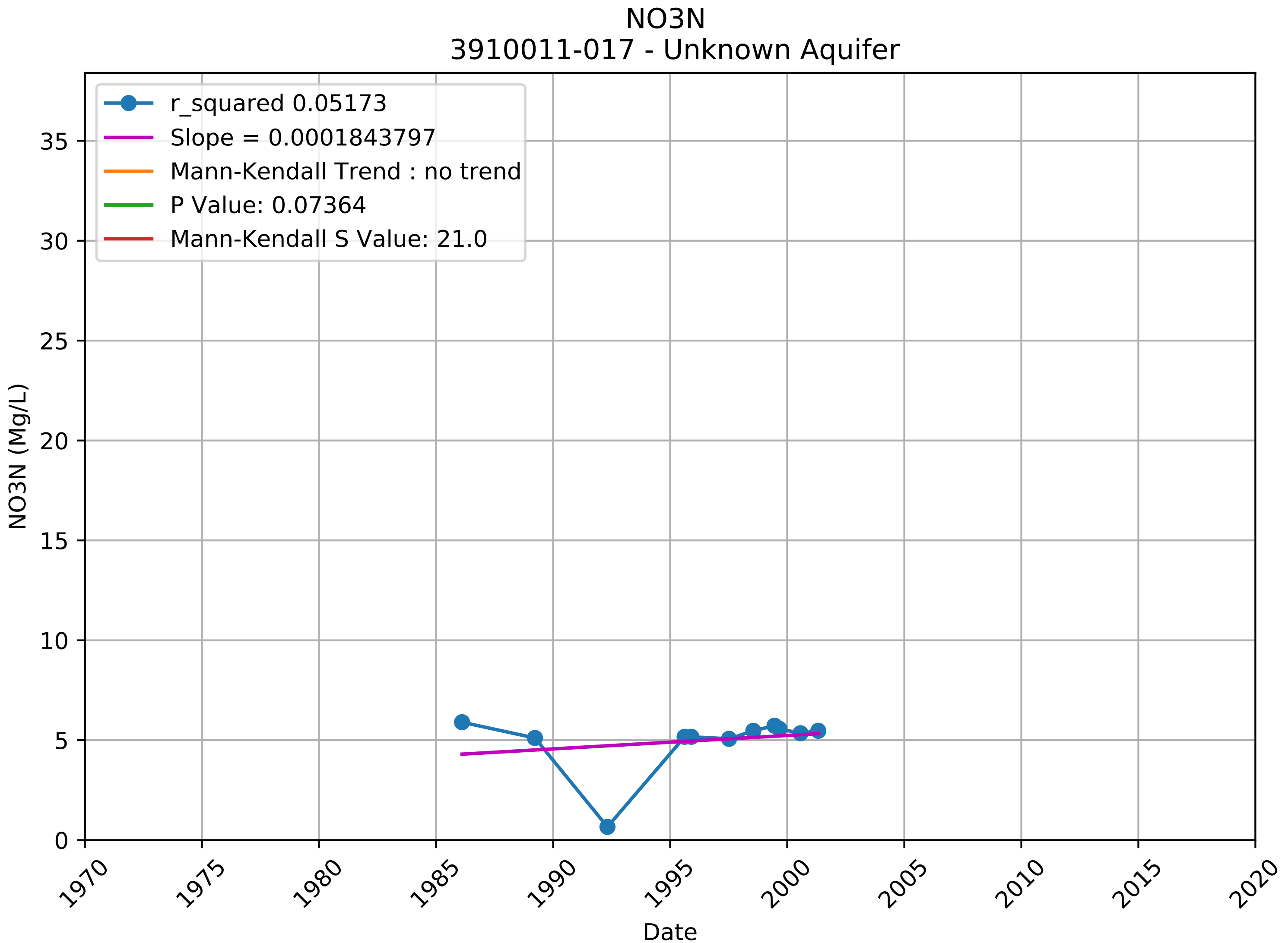

NO3N
3910011-017 - Unknown Aquifer
r_squared 0.05173
Slope = 0.0001843797
Mann-Kendall Trend : no trend
P Value: 0.07364
Mann-Kendall S Value: 21.0
NO3N (Mg/L)
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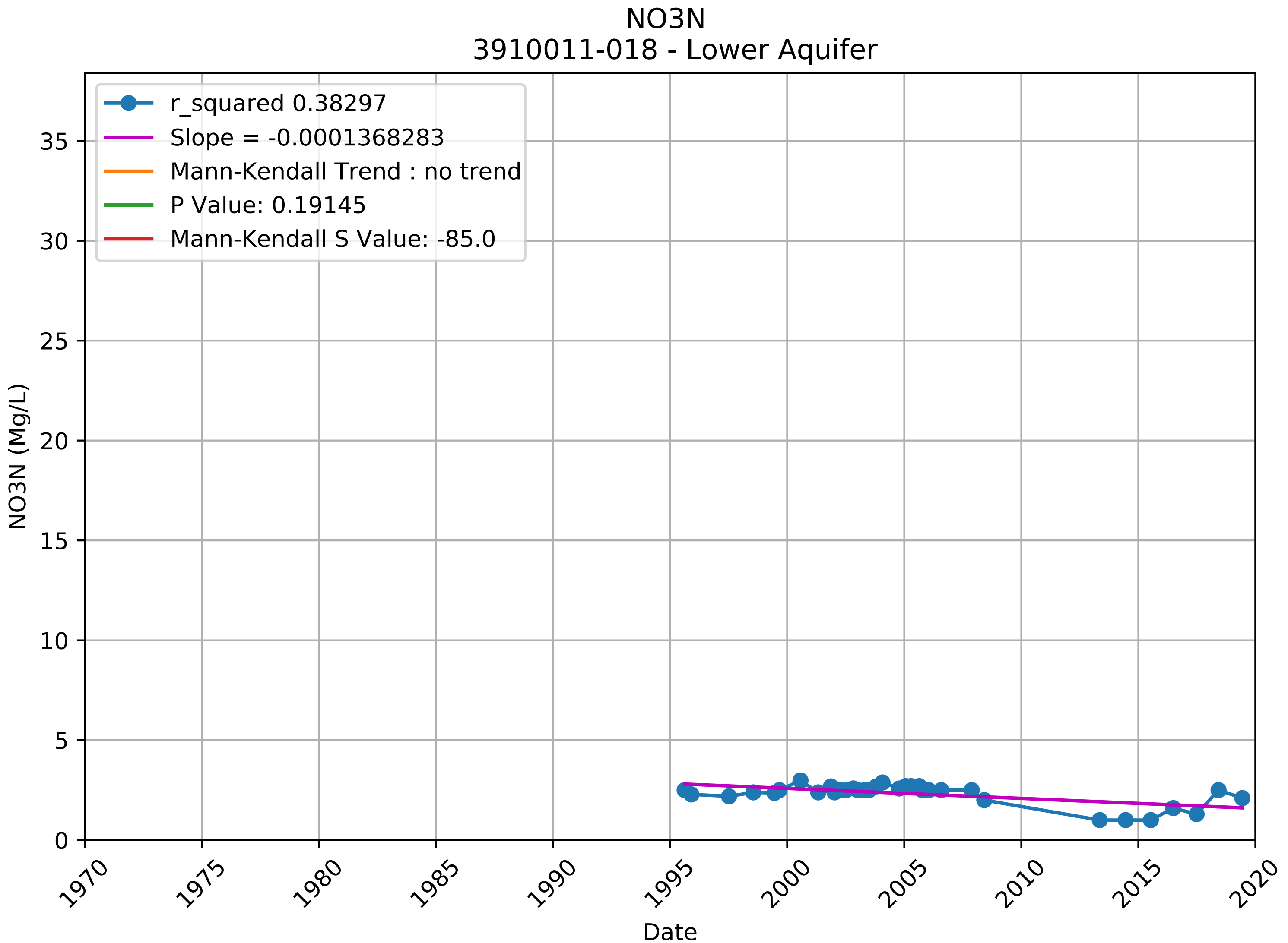

NO3N
3910011-018 - Lower Aquifer
r_squared 0.38297
Slope = -0.0001368283
Mann-Kendall Trend : no trend
P Value: 0.19145
Mann-Kendall S Value: -85.0
NO3N (Mg/L)
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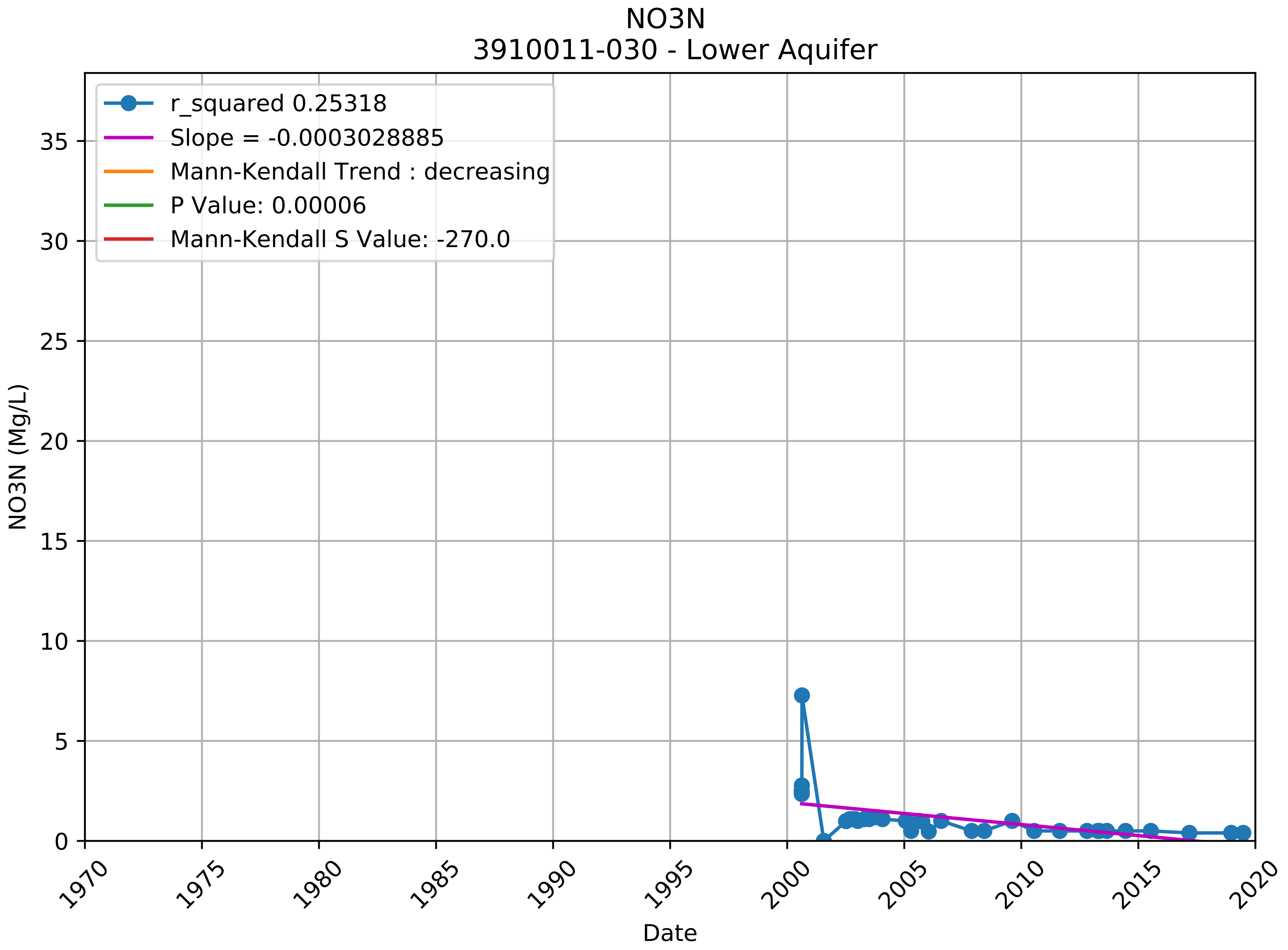

NO3N
3910011-030 - Lower Aquifer
r_squared 0.25318
Slope = -0.0003028885
Mann-Kendall Trend : decreasing
P Value: 0.00006
Mann-Kendall S Value: -270.0
NO3N (Mg/L)
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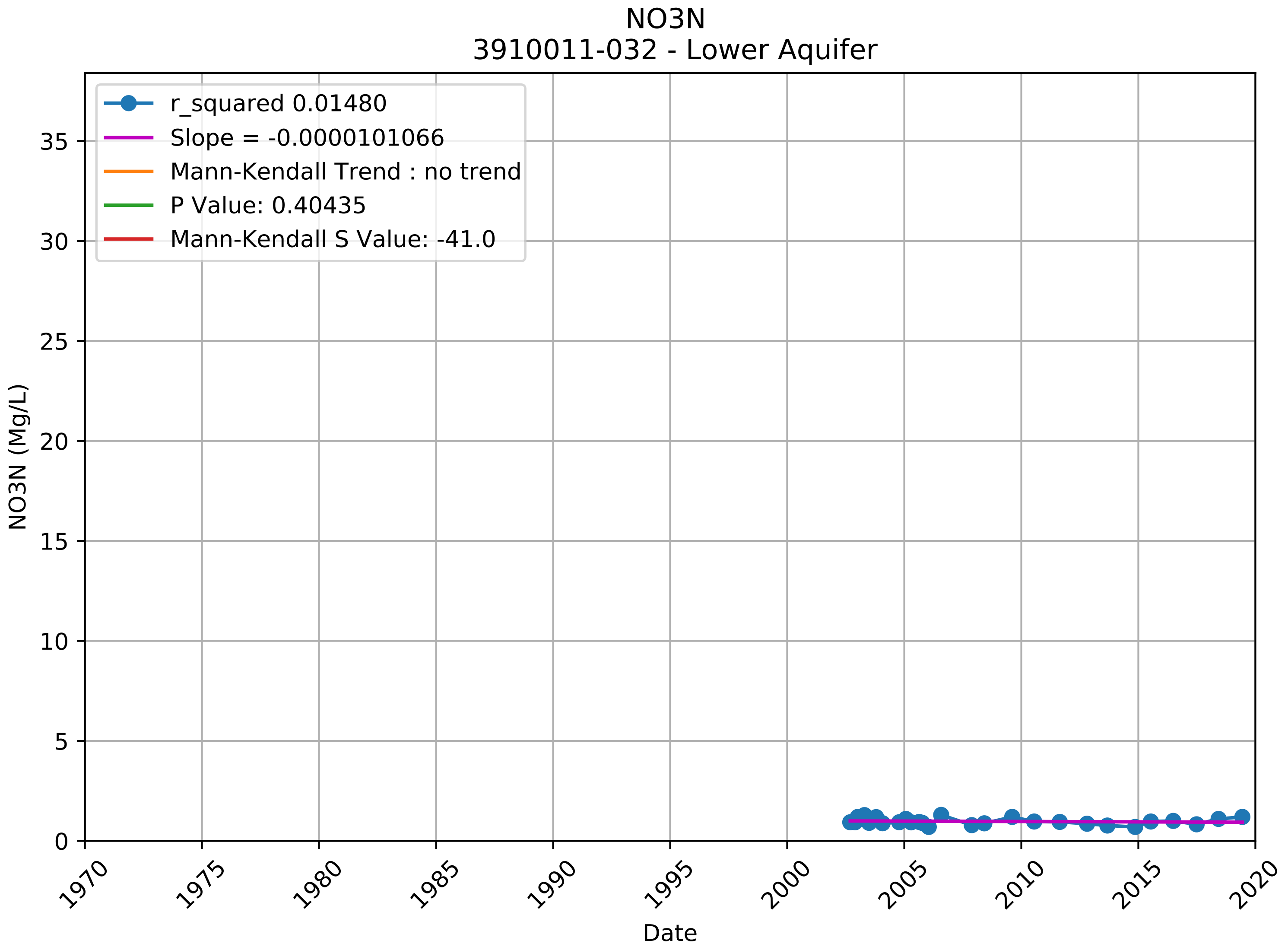

NO3N
3910011-032 - Lower Aquifer
r_squared 0.01480
Slope = -0.0000101066
Mann-Kendall Trend : no trend
P Value: 0.40435
Mann-Kendall S Value: -41.0
NO3N (Mg/L)
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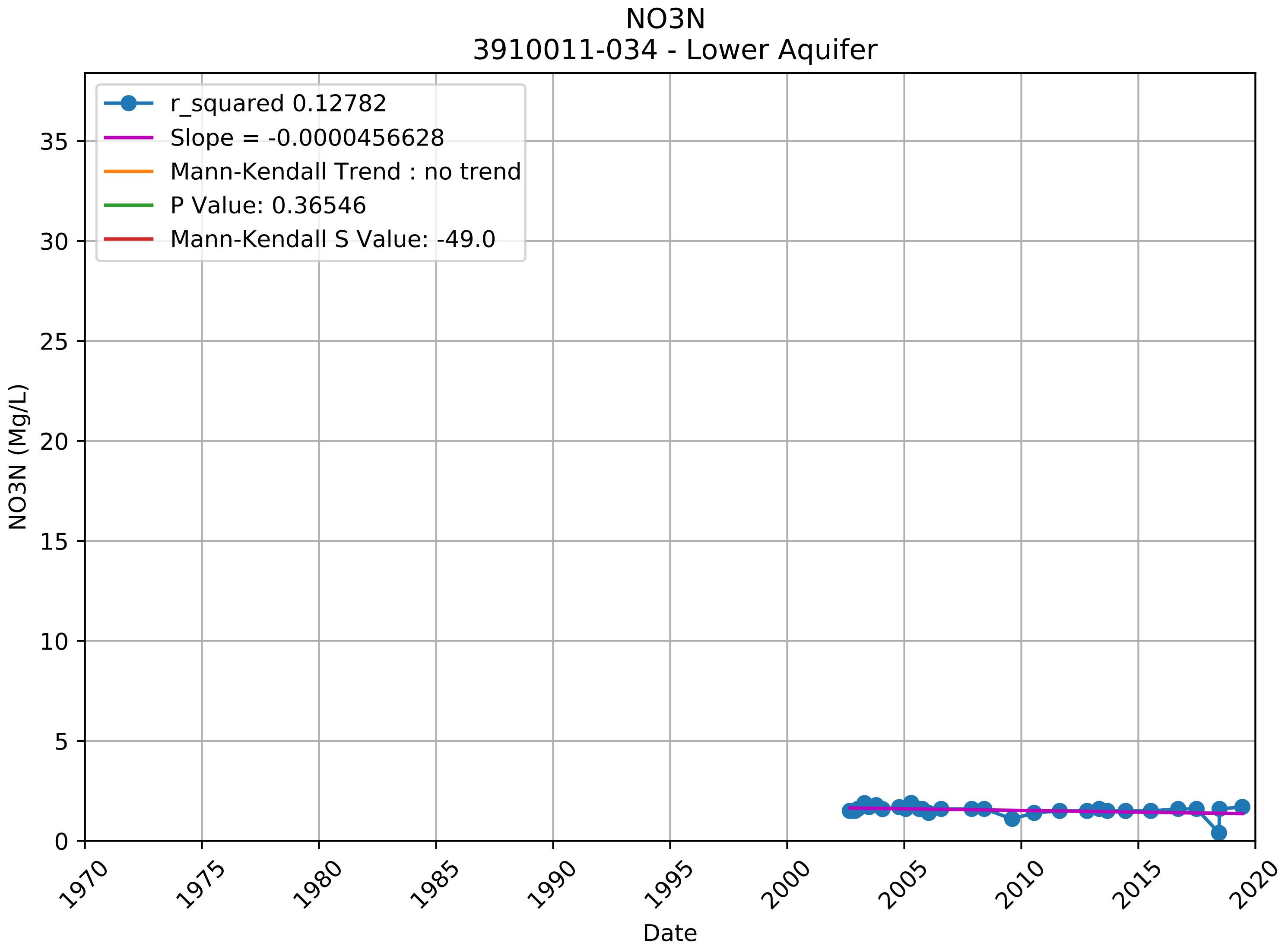
NO3N
3910011-034 - Lower Aquifer
r_squared 0.12782
Slope = -0.0000456628
Mann-Kendall Trend : no trend
P Value: 0.36546
Mann-Kendall S Value: -49.0
NO3N (Mg/L)
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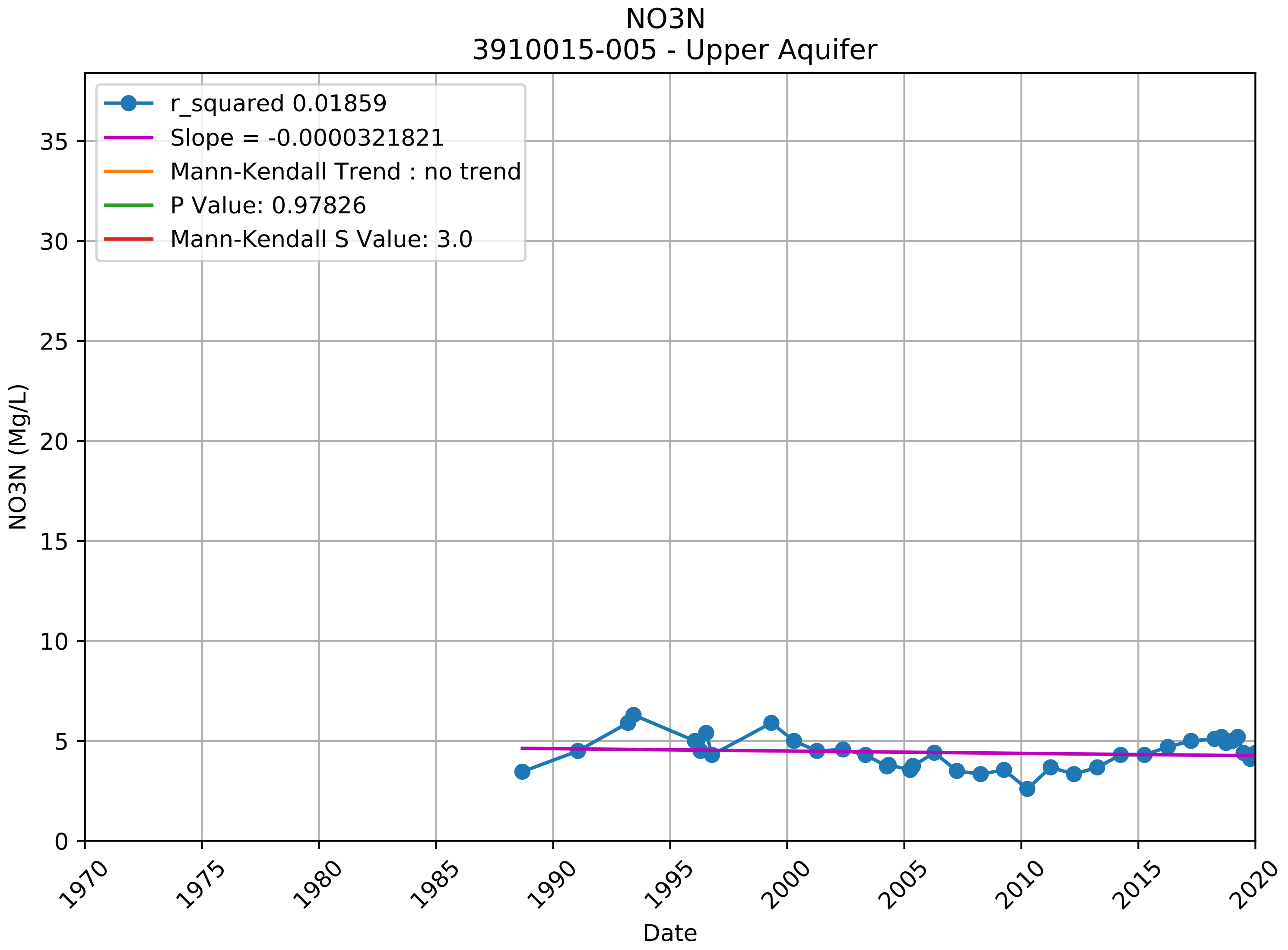

NO3N
3910015-005 - Upper Aquifer
r_squared 0.01859
Slope = -0.0000321821
Mann-Kendall Trend : no trend
P Value: 0.97826
Mann-Kendall S Value: 3.0
NO3N (Mg/L)
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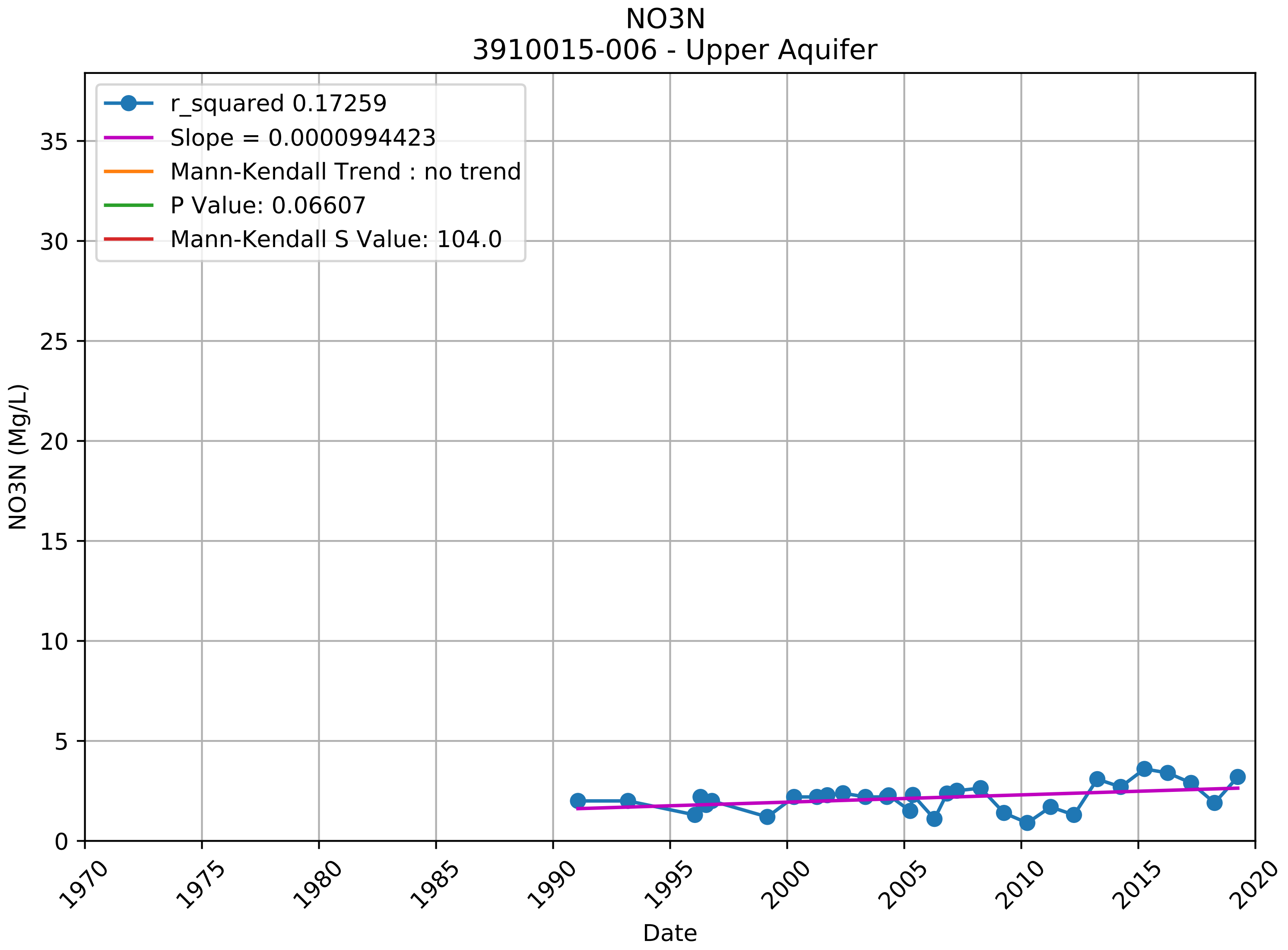

NO3N
3910015-006 - Upper Aquifer
r_squared 0.17259
Slope = 0.0000994423
Mann-Kendall Trend : no trend
P Value: 0.06607
Mann-Kendall S Value: 104.0
NO3N (Mg/L)
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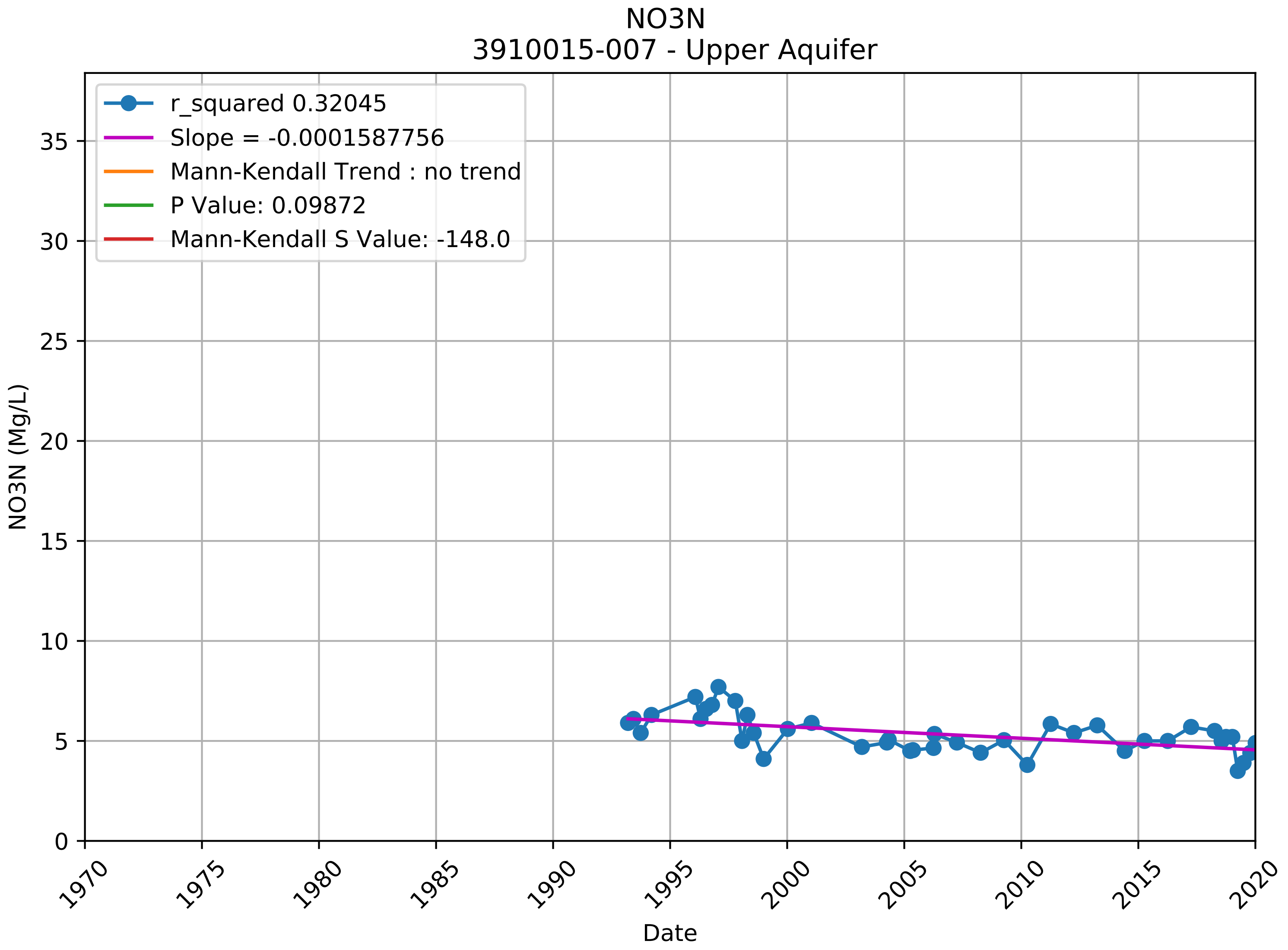
NO3N
3910015-007 - Upper Aquifer
r_squared 0.32045
Slope = -0.0001587756
Mann-Kendall Trend : no trend
P Value: 0.09872
Mann-Kendall S Value: -148.0
NO3N (Mg/L)
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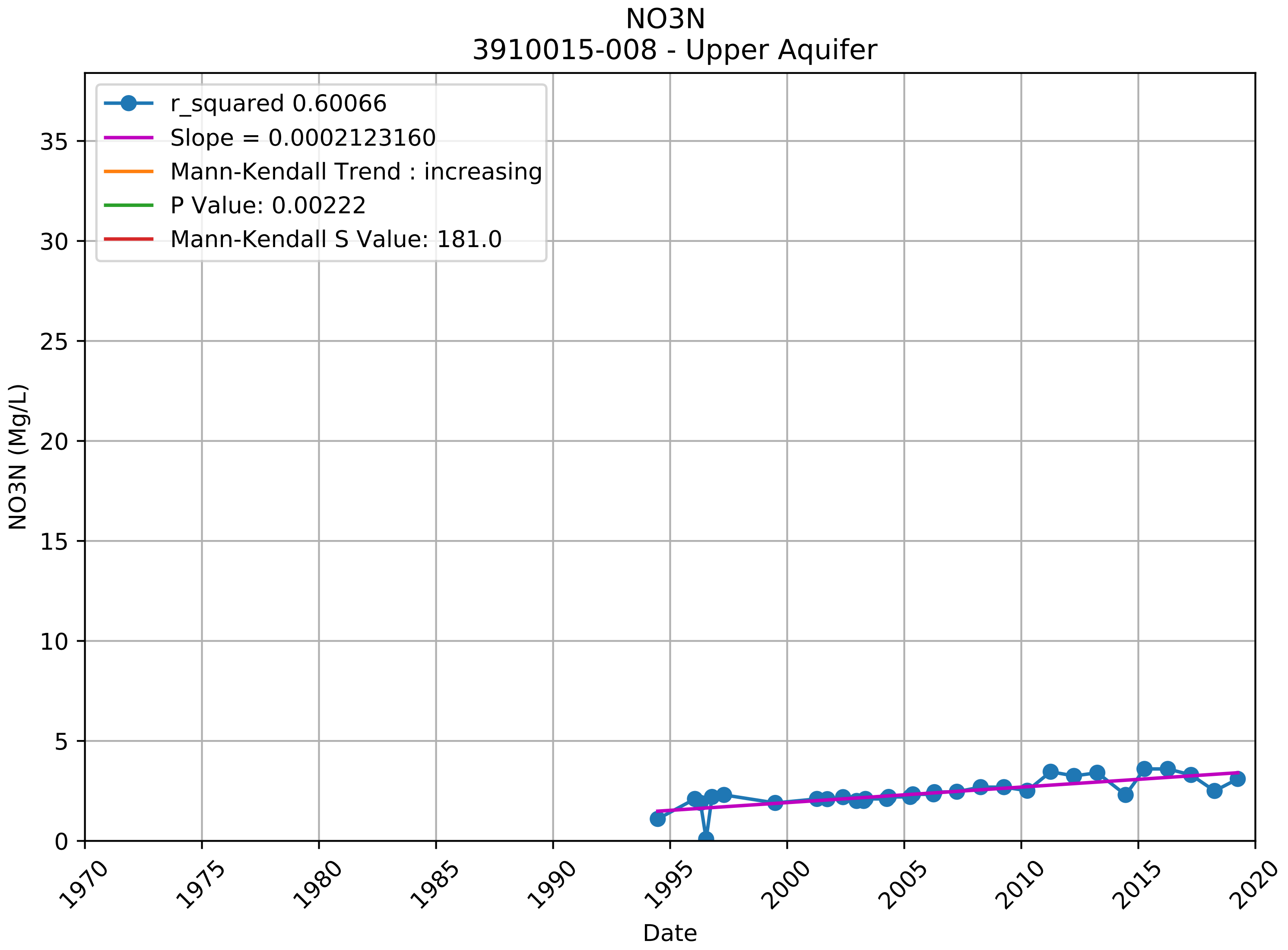
NO3N
3910015-008 - Upper Aquifer
r_squared 0.60066
Slope = 0.0002123160
Mann-Kendall Trend : increasing
P Value: 0.00222
Mann-Kendall S Value: 181.0
NO3N (Mg/L)
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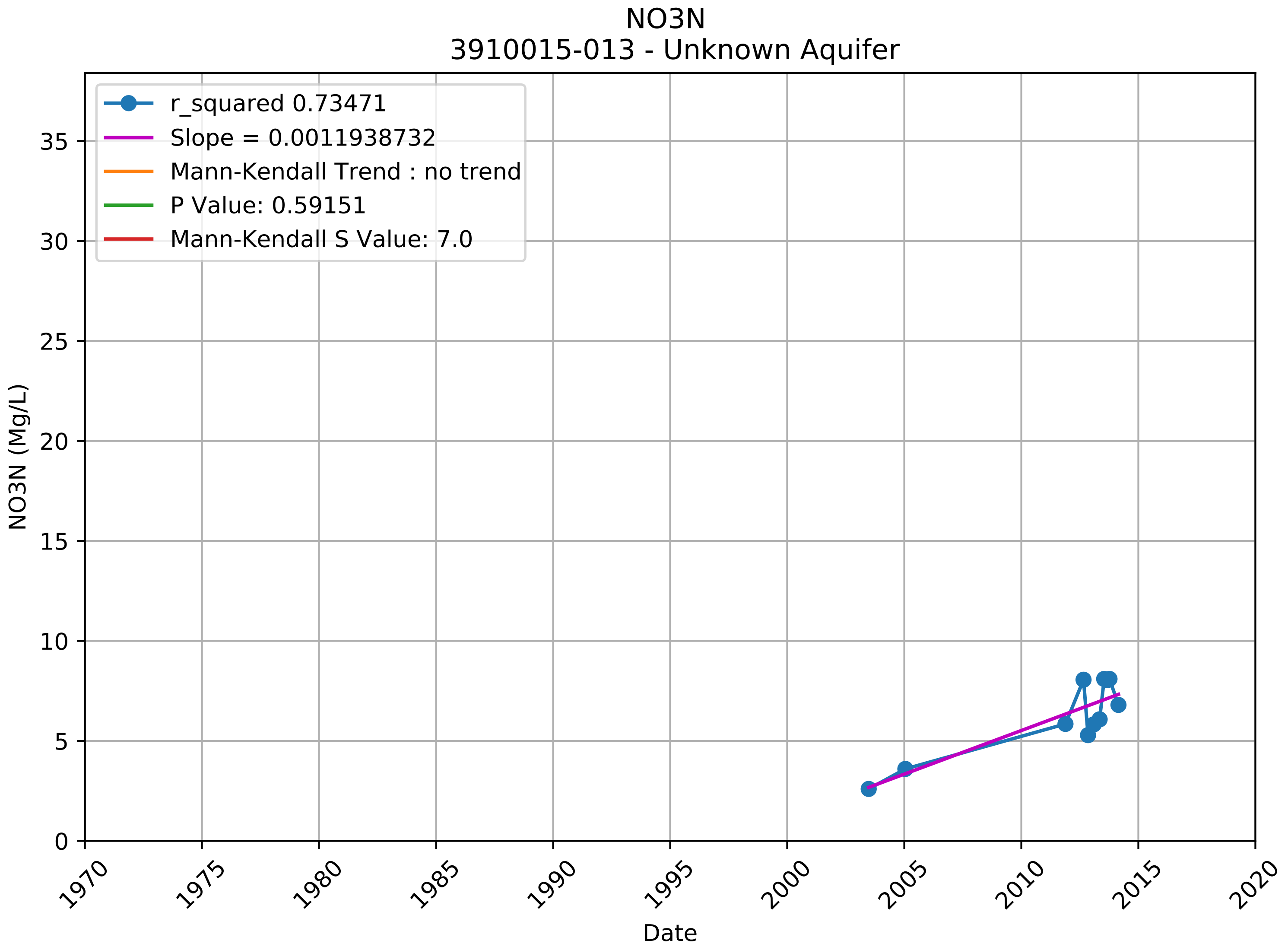

NO3N
3910015-013 - Unknown Aquifer
r_squared 0.73471
Slope = 0.0011938732
Mann-Kendall Trend : no trend
P Value: 0.59151
Mann-Kendall S Value: 7.0
NO3N (Mg/L)
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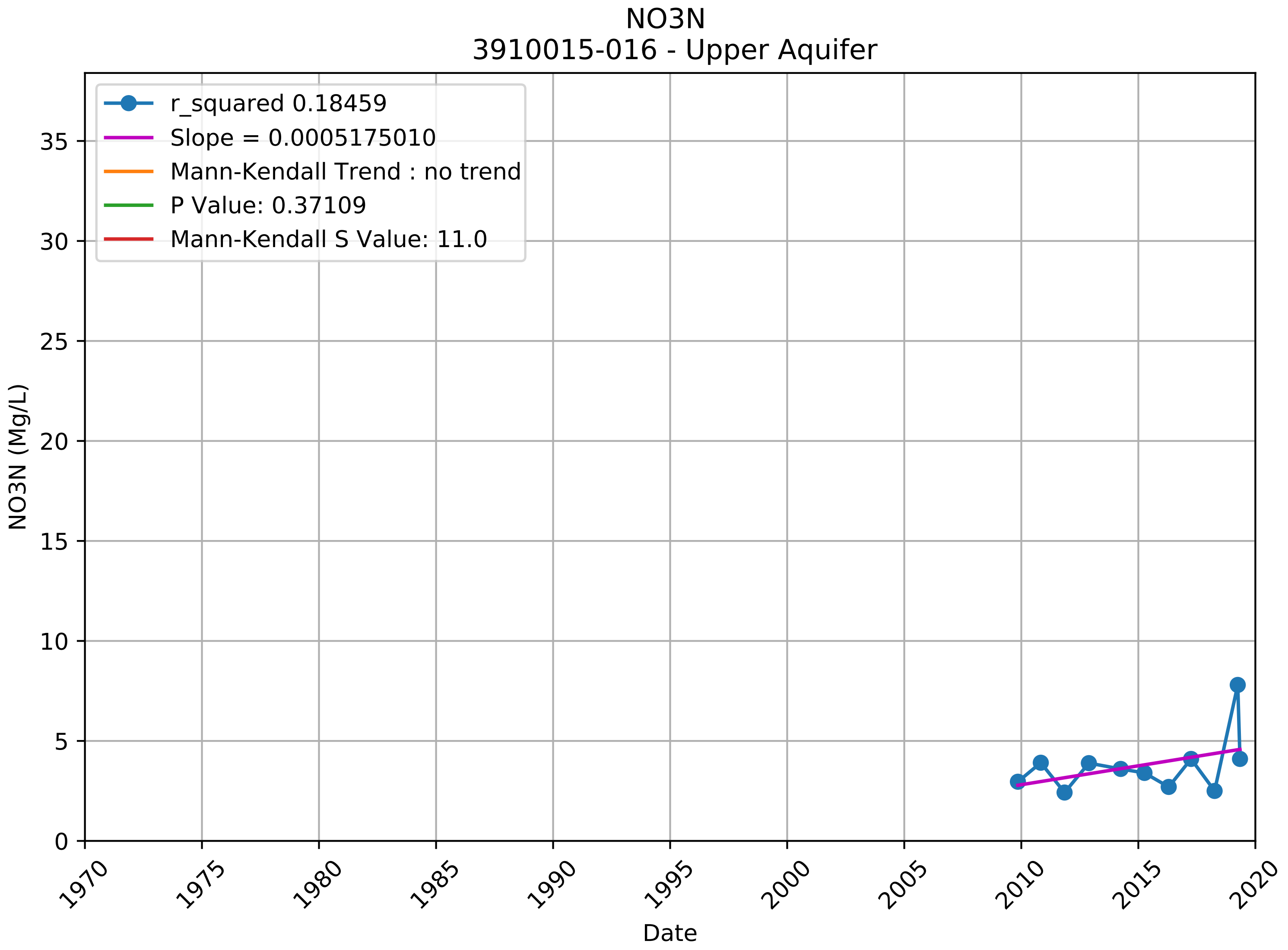

NO3N
3910015-016 - Upper Aquifer
r_squared 0.18459
Slope = 0.0005175010
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: 11.0
NO3N (Mg/L)
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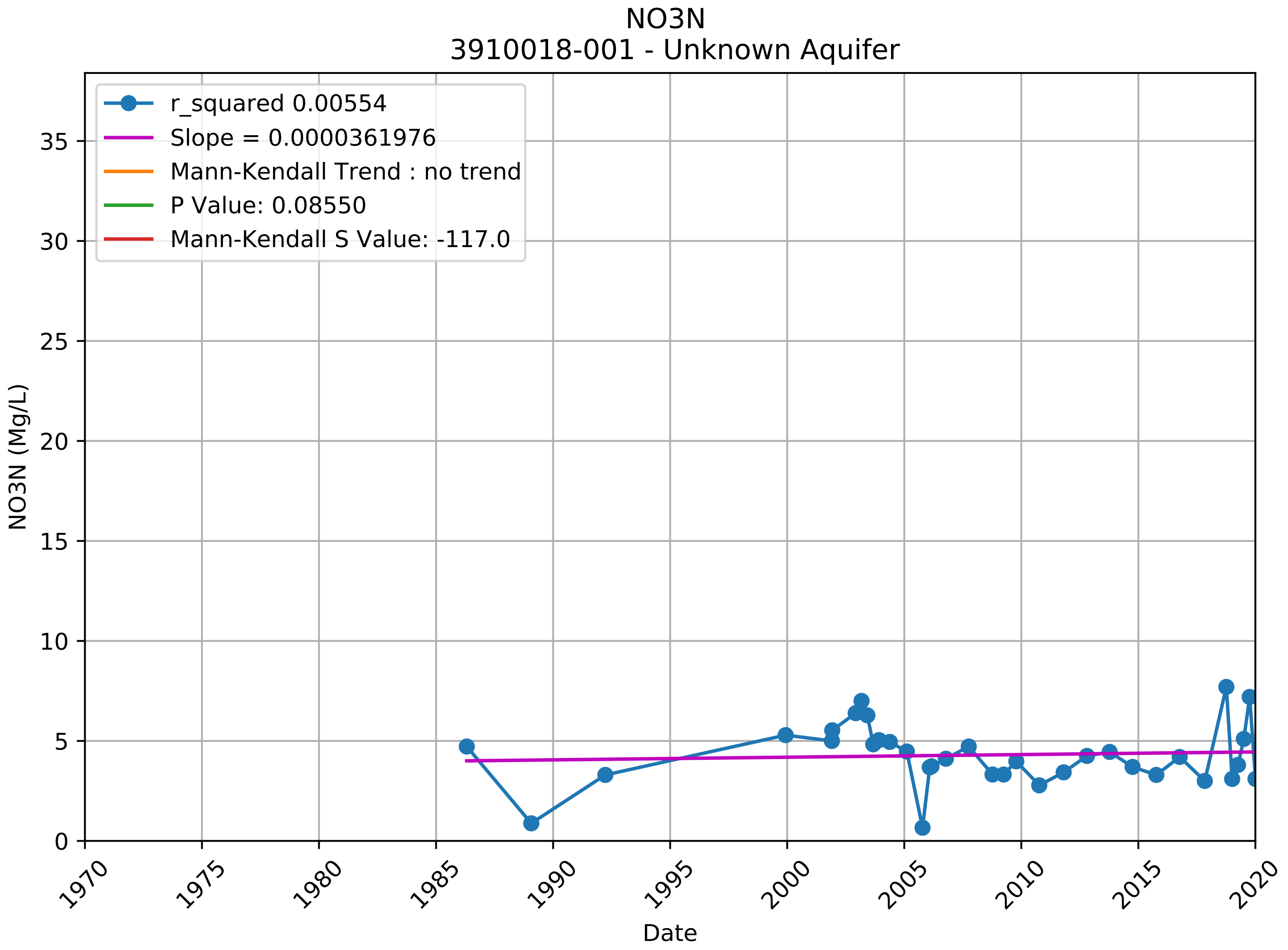

NO3N
3910018-001 - Unknown Aquifer
r_squared 0.00554
Slope = 0.0000361976
Mann-Kendall Trend : no trend
P Value: 0.08550
Mann-Kendall S Value: -117.0
NO3N (Mg/L)
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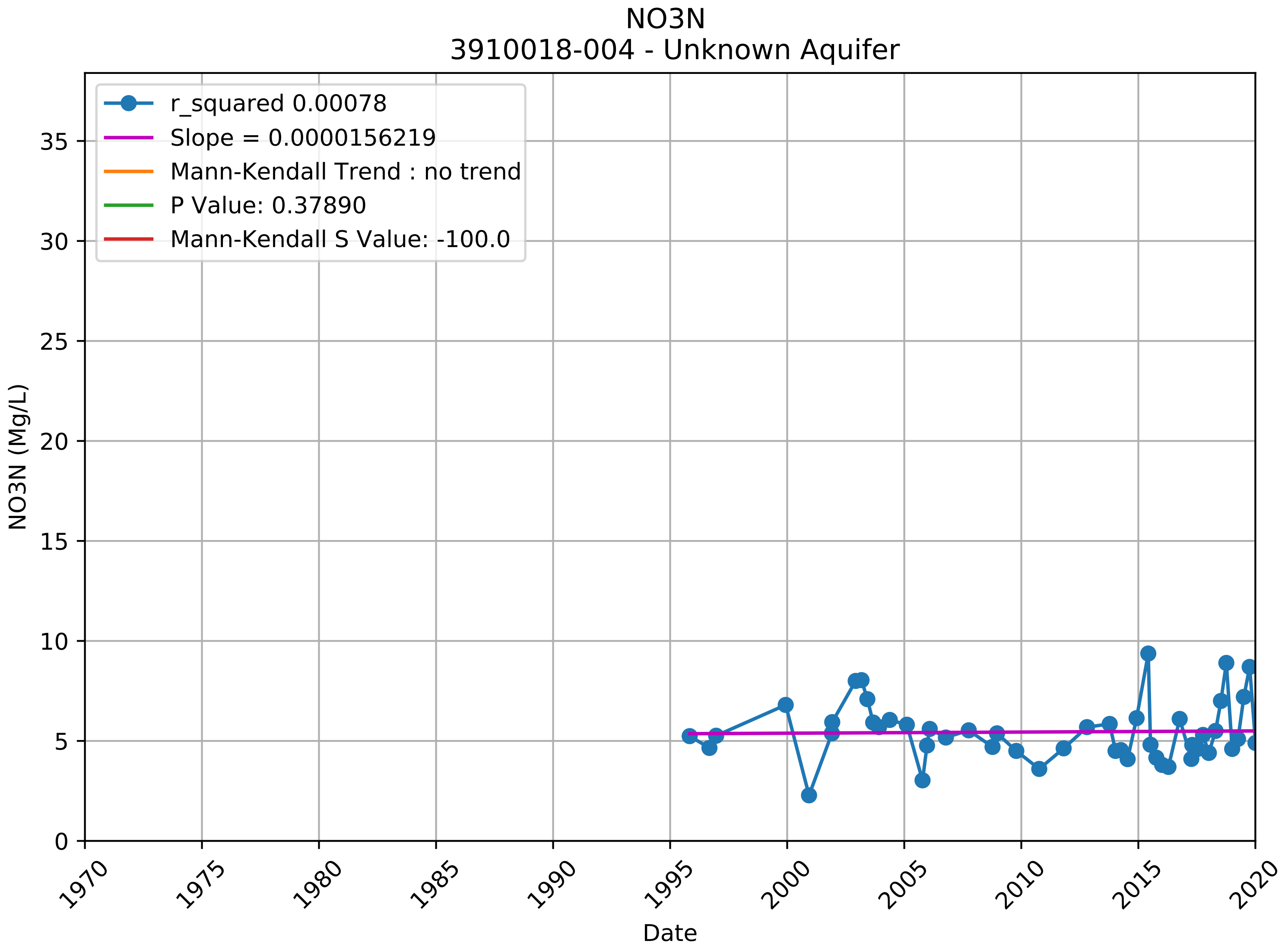

NO3N
3910018-004 - Unknown Aquifer
r_squared 0.00078
Slope = 0.0000156219
Mann-Kendall Trend : no trend
P Value: 0.37890
Mann-Kendall S Value: -100.0
NO3N (Mg/L)
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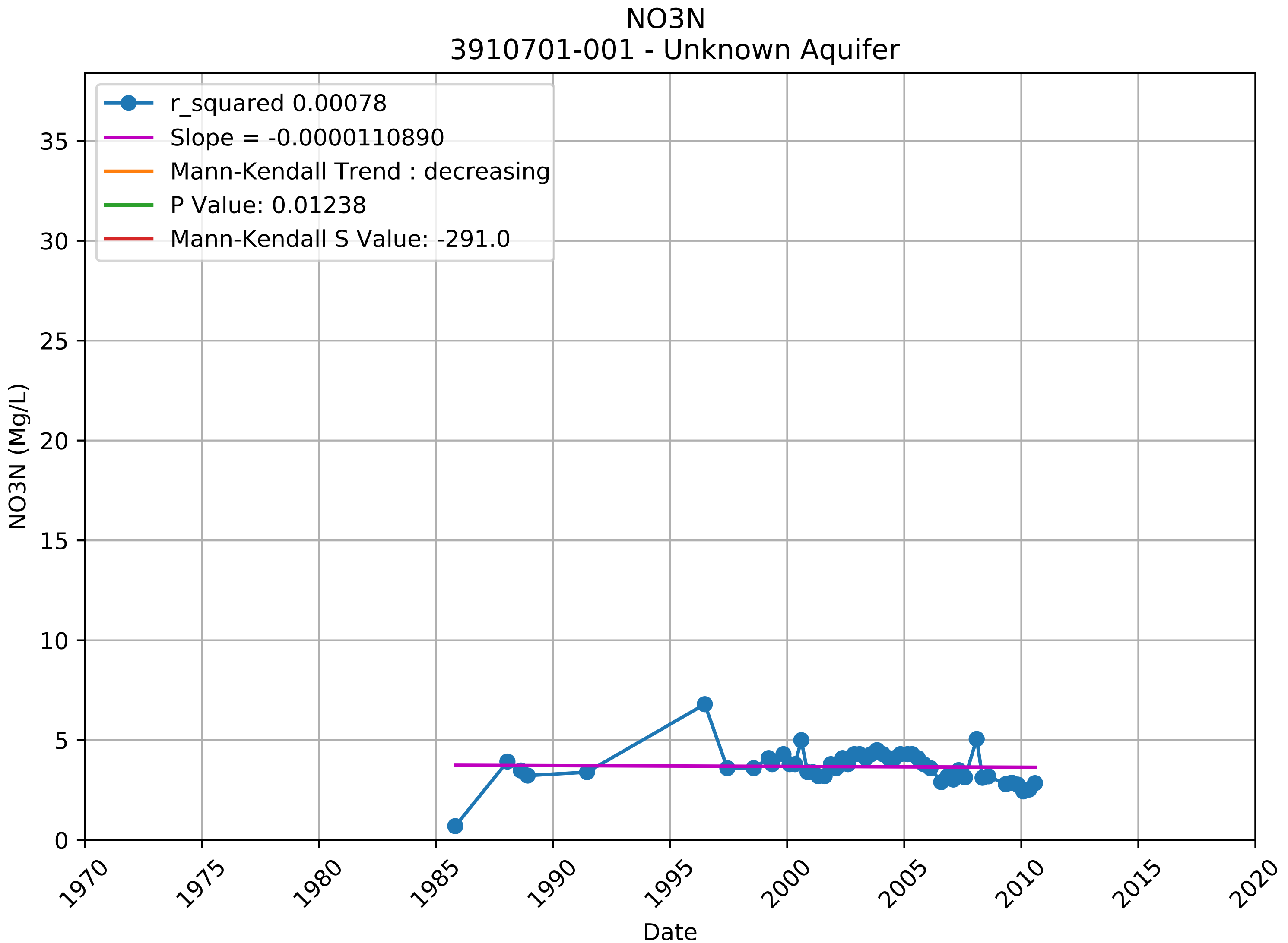

NO3N
3910701-001 - Unknown Aquifer
r_squared 0.00078
Slope = -0.0000110890
Mann-Kendall Trend : decreasing
P Value: 0.01238
Mann-Kendall S Value: -291.0
NO3N (Mg/L)
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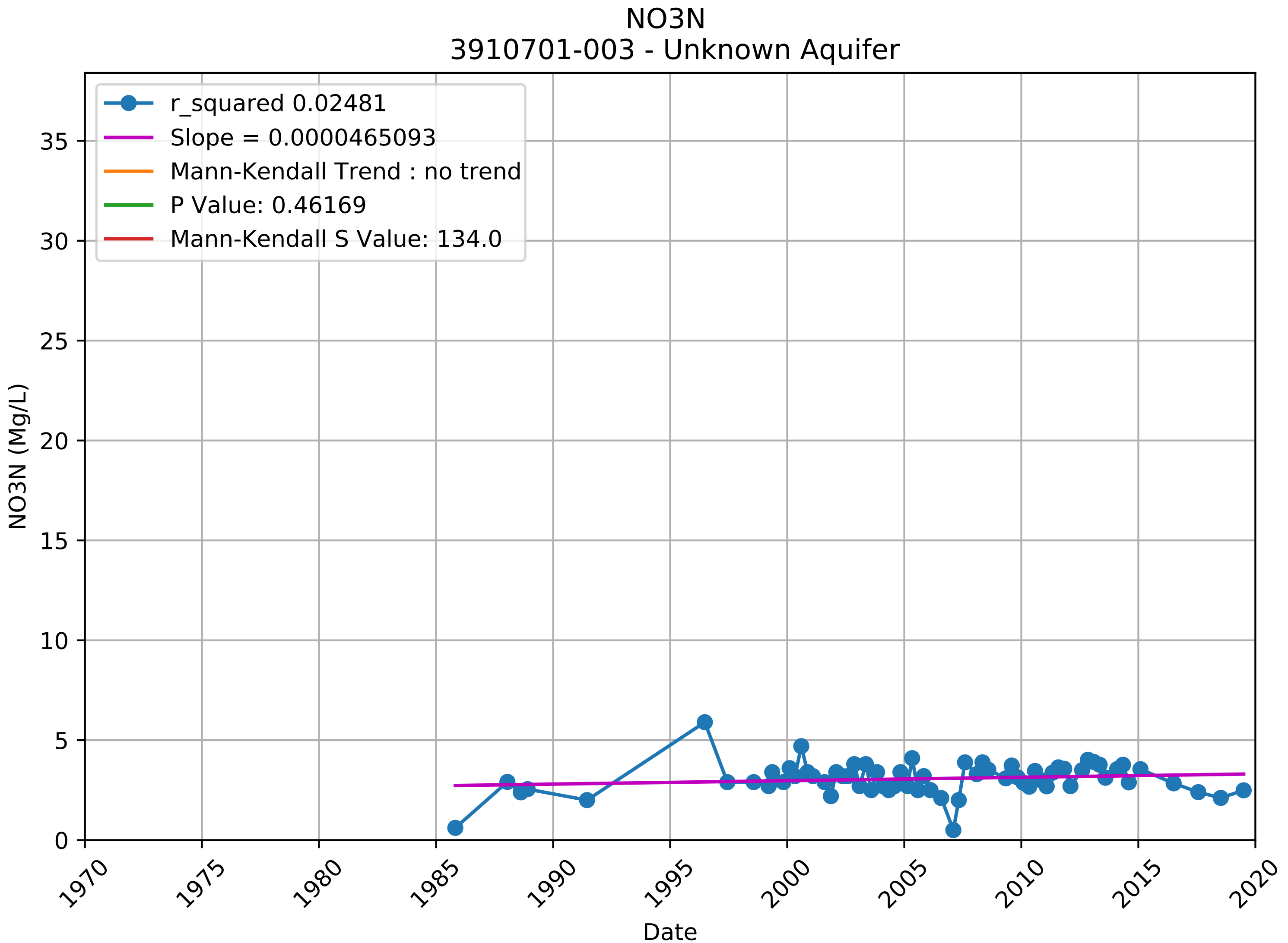
NO3N
3910701-003 - Unknown Aquifer
r_squared 0.02481
Slope = 0.0000465093
Mann-Kendall Trend : no trend
P Value: 0.46169
Mann-Kendall S Value: 134.0
NO3N (Mg/L)
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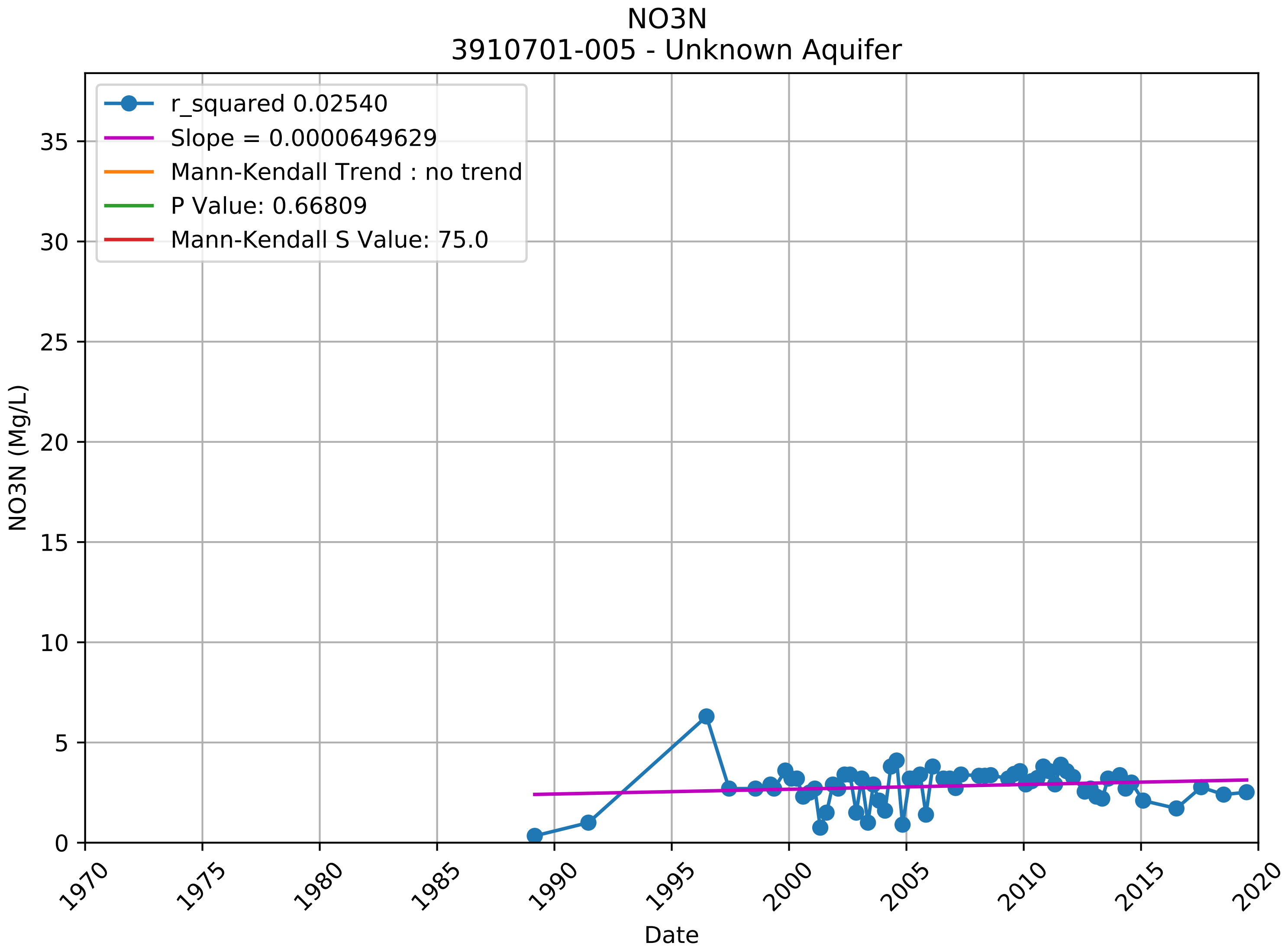

NO3N
3910701-005 - Unknown Aquifer
r_squared 0.02540
Slope = 0.0000649629
Mann-Kendall Trend : no trend
P Value: 0.66809
Mann-Kendall S Value: 75.0
NO3N (Mg/L)
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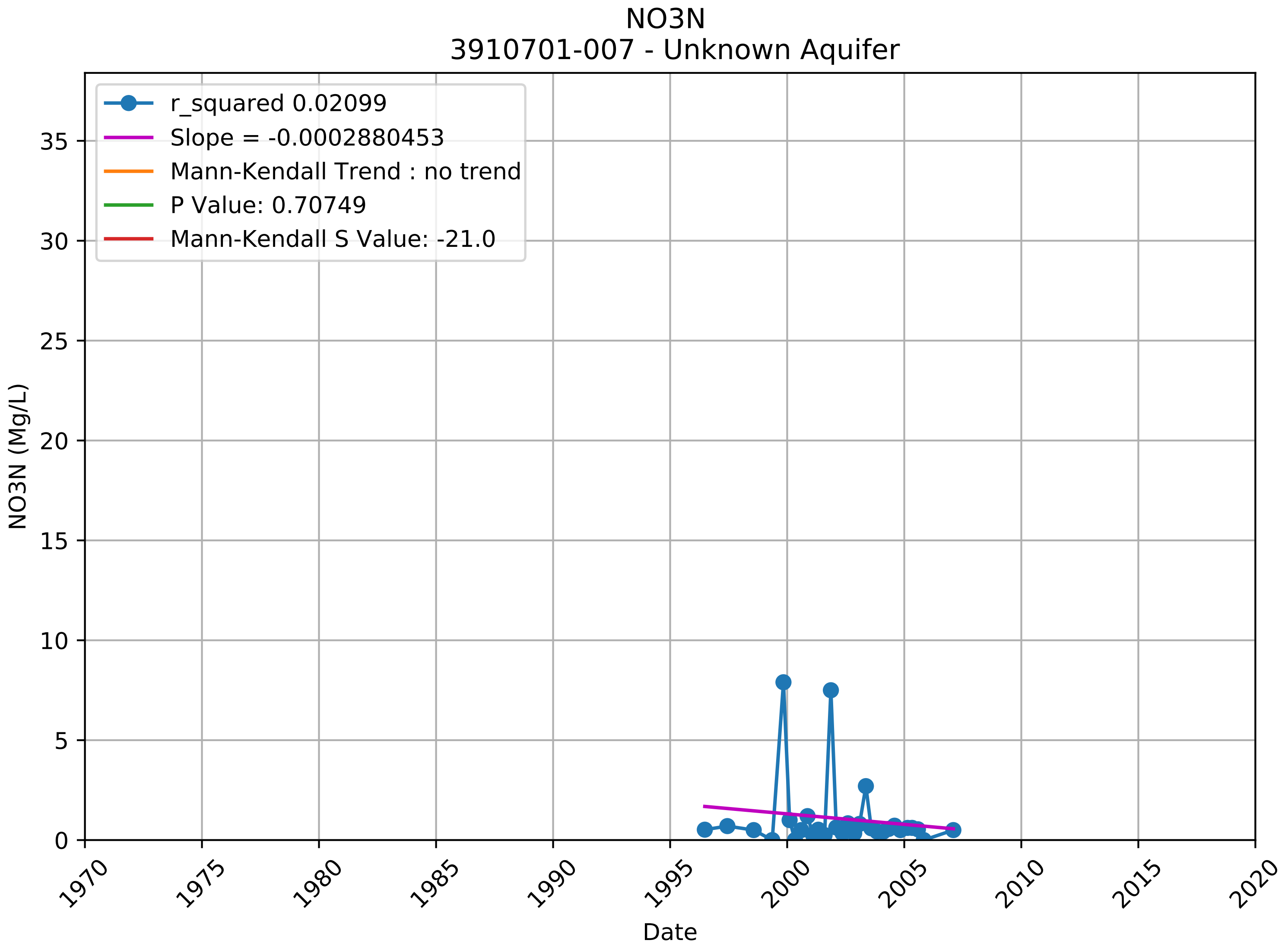

NO3N
3910701-007 - Unknown Aquifer
r_squared 0.02099
Slope = -0.0002880453
Mann-Kendall Trend : no trend
P Value: 0.70749
Mann-Kendall S Value: -21.0
NO3N (Mg/L)
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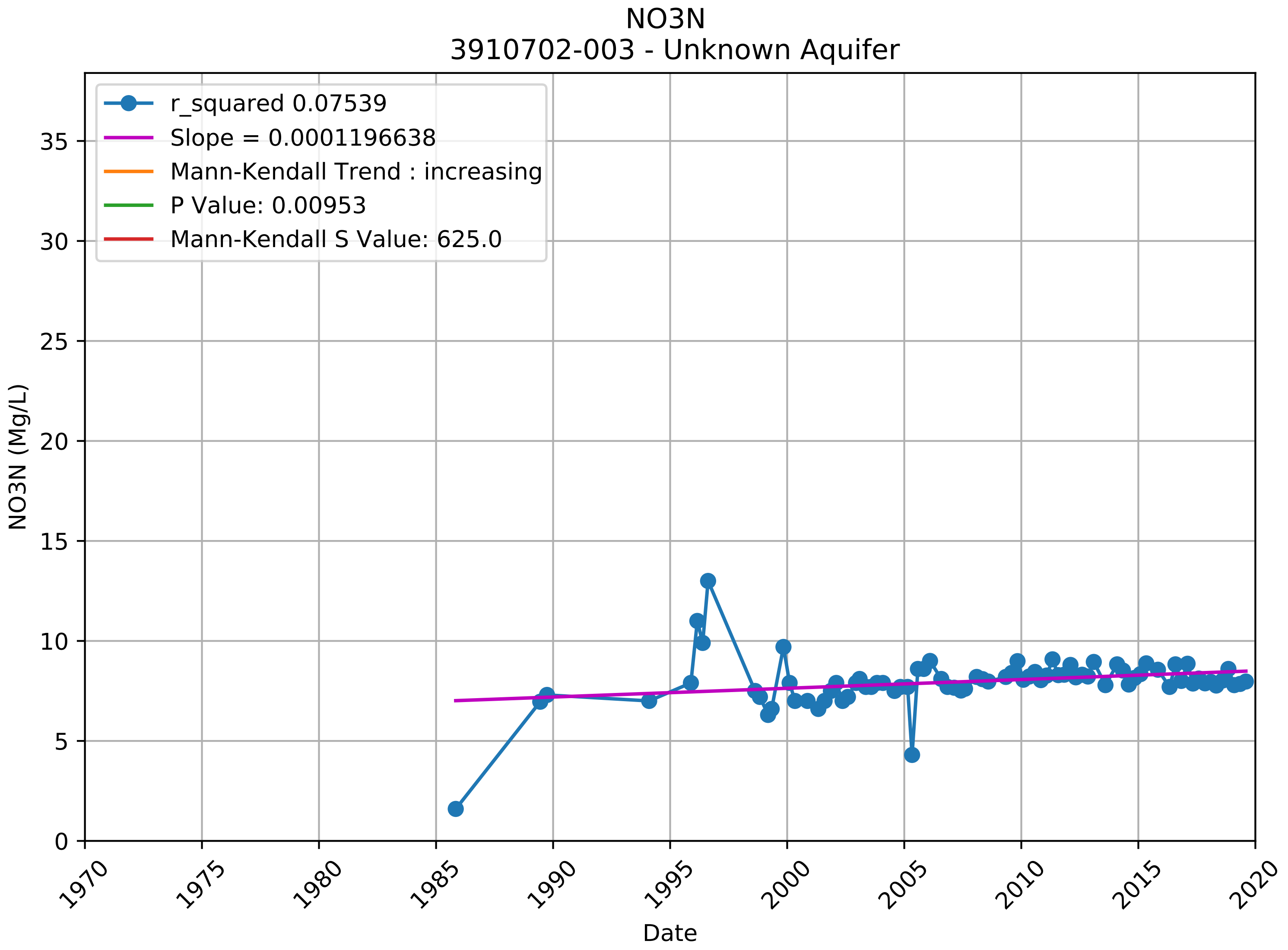

NO3N
3910702-003 - Unknown Aquifer
r_squared 0.07539
Slope = 0.0001196638
Mann-Kendall Trend : increasing
P Value: 0.00953
Mann-Kendall S Value: 625.0
NO3N (Mg/L)
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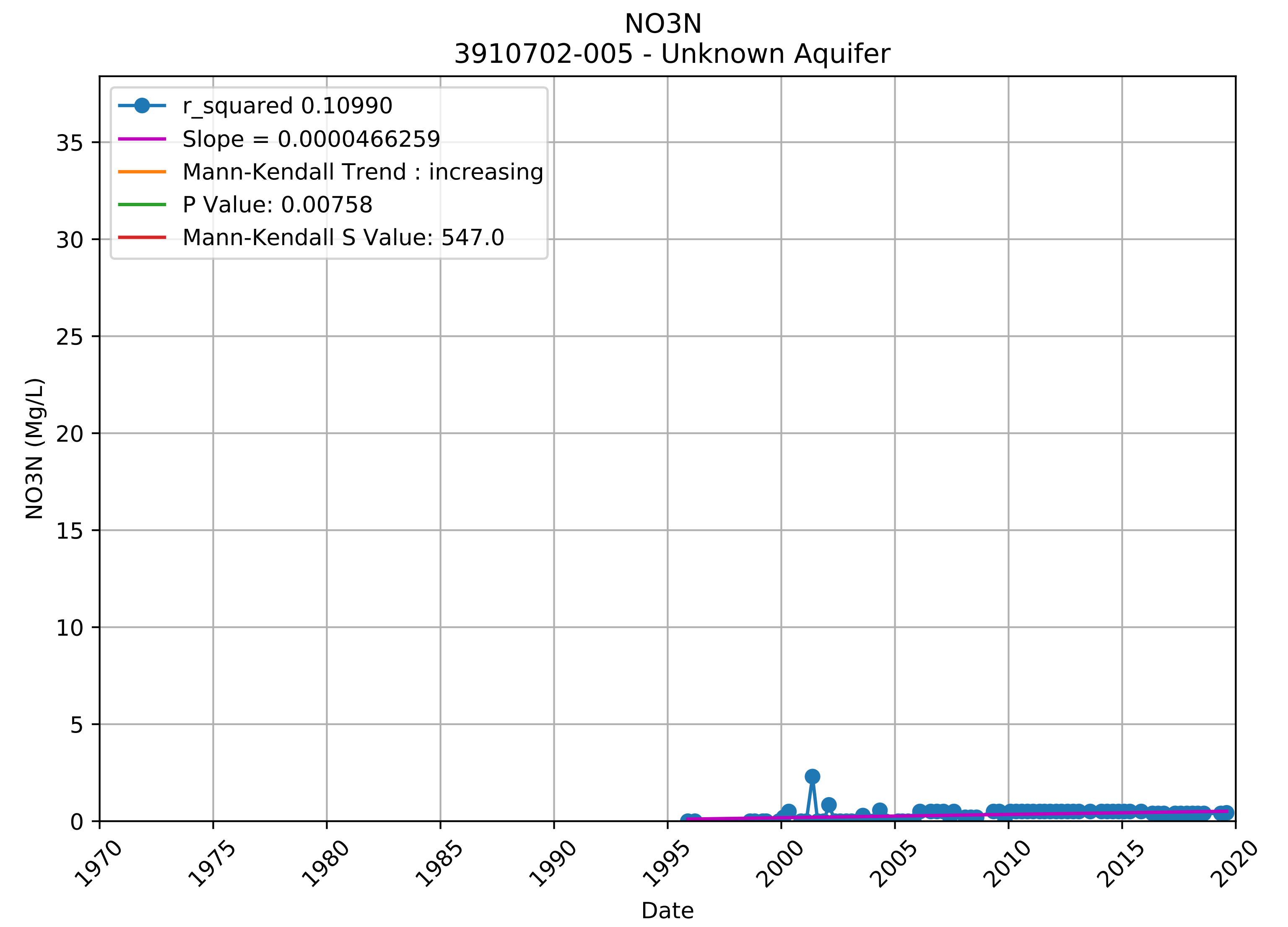
2015
2020
Date


NO3N
3910702-005 - Unknown Aquifer
r_squared 0.10990
Slope = 0.0000466259
Mann-Kendall Trend : increasing
P Value: 0.00758
Mann-Kendall S Value: 547.0
NO3N (Mg/L)
0
5
10
15
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1970
1975
1980
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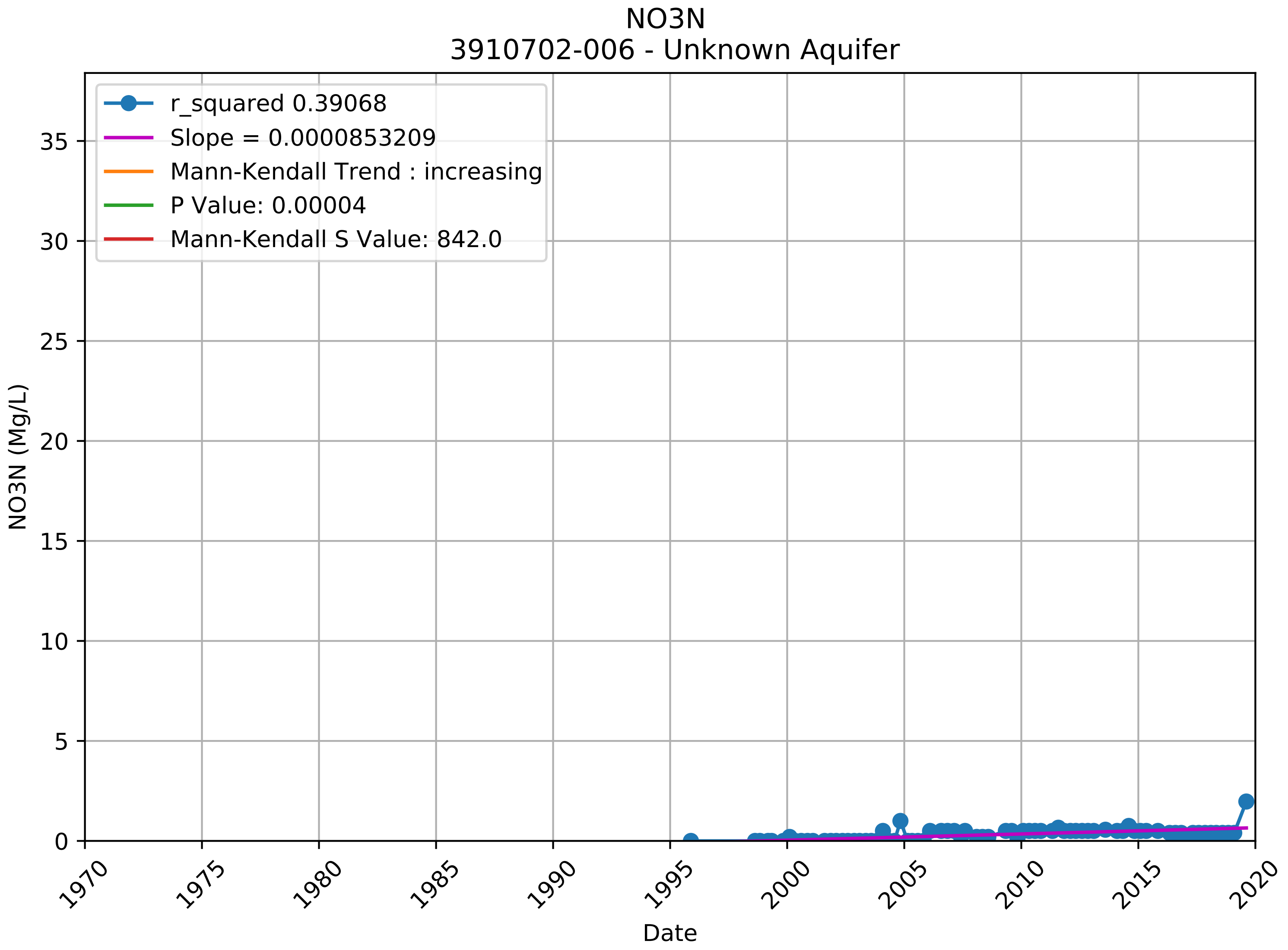
Date



NO3N
3910702-006 - Unknown Aquifer
r_squared 0.39068
Slope = 0.0000853209
Mann-Kendall Trend : increasing
P Value: 0.00004
Mann-Kendall S Value: 842.0
NO3N (Mg/L)
0
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1970
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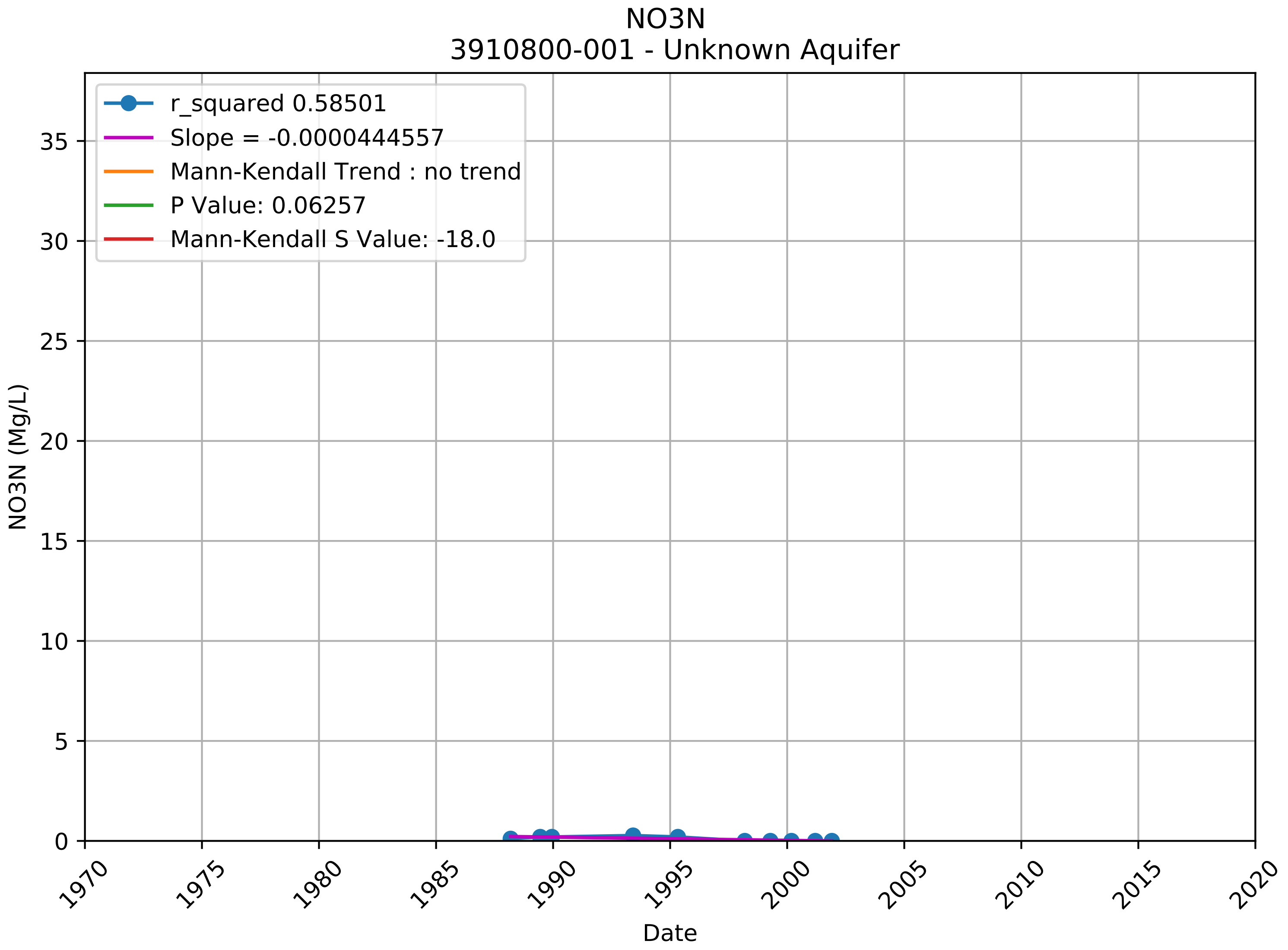
Date



NO3N
3910800-001 - Unknown Aquifer
r_squared 0.58501
Slope = -0.0000444557
Mann-Kendall Trend : no trend
P Value: 0.06257
Mann-Kendall S Value: -18.0
NO3N (Mg/L)
0
5
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1970
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2010
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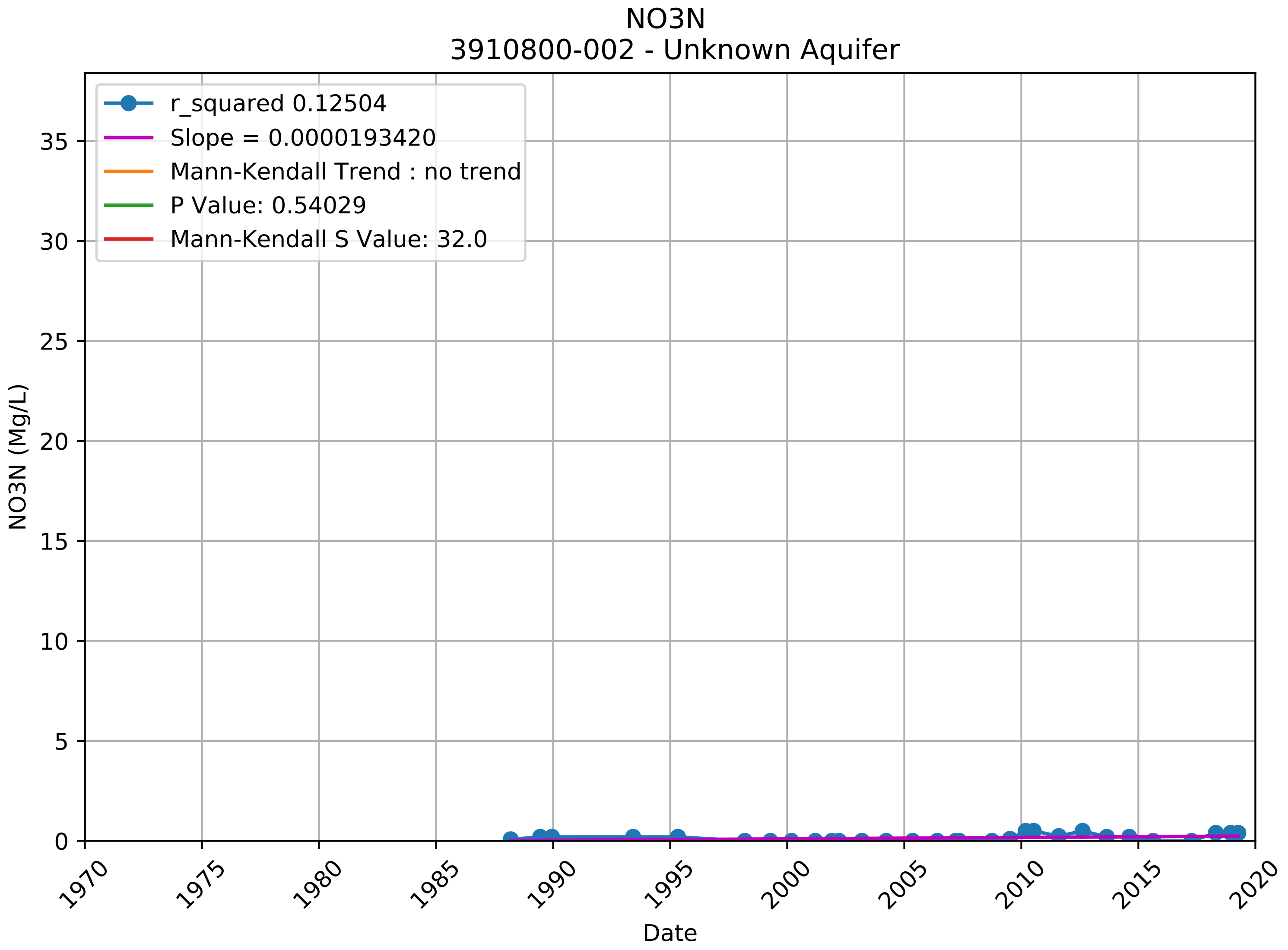
Date



NO3N
3910800-002 - Unknown Aquifer
r_squared 0.12504
Slope = 0.0000193420
Mann-Kendall Trend : no trend
P Value: 0.54029
Mann-Kendall S Value: 32.0
NO3N (Mg/L)
0
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1970
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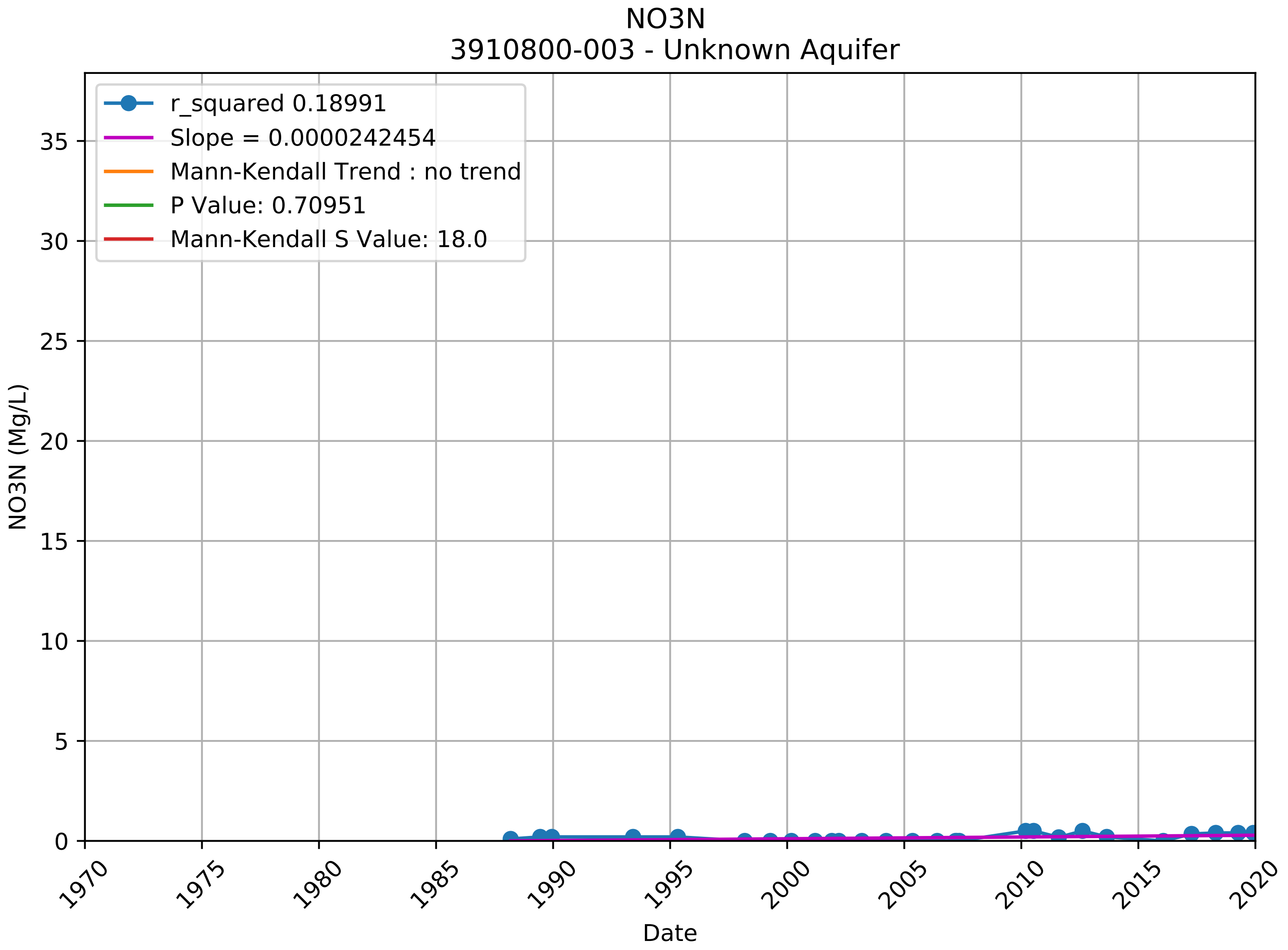
Date



NO3N
3910800-003 - Unknown Aquifer
r_squared 0.18991
Slope = 0.0000242454
Mann-Kendall Trend : no trend
P Value: 0.70951
Mann-Kendall S Value: 18.0
NO3N (Mg/L)
0
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1970
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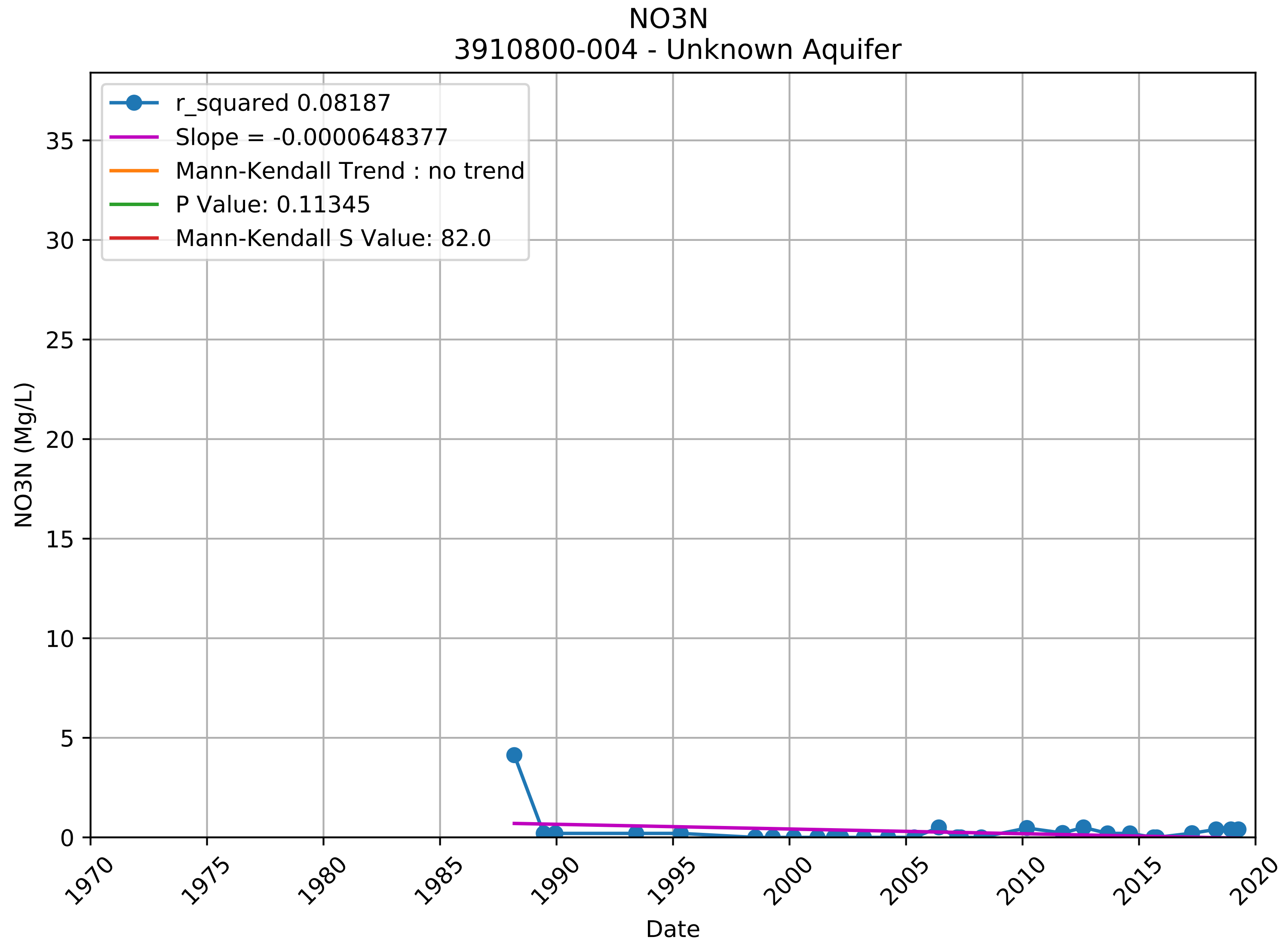
Date


NO3N
3910800-004 - Unknown Aquifer
r_squared 0.08187
Slope = -0.0000648377
Mann-Kendall Trend : no trend
P Value: 0.11345
Mann-Kendall S Value: 82.0
NO3N (Mg/L)
0
5
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1970
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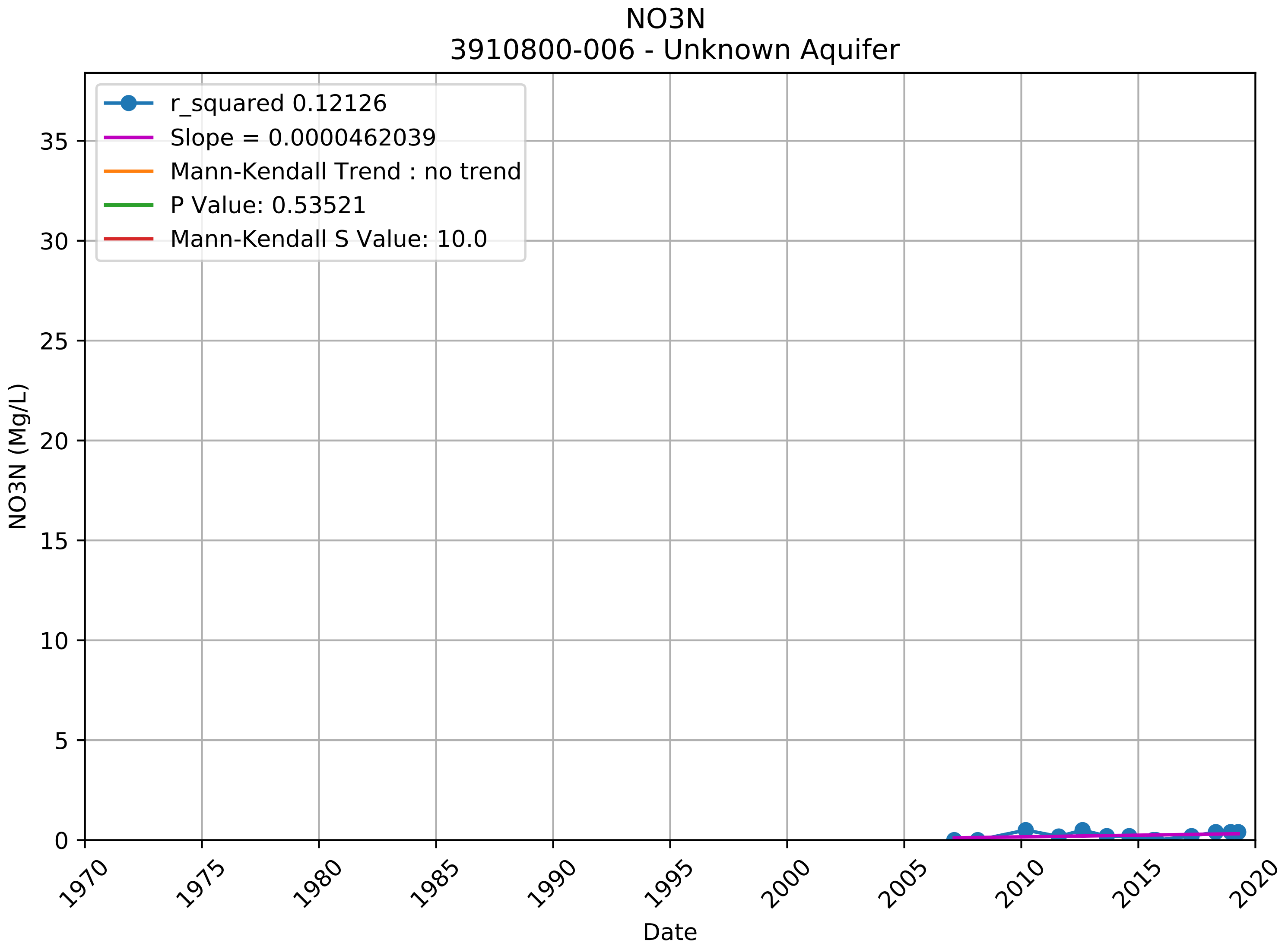
Date


NO3N
3910800-006 - Unknown Aquifer
r_squared 0.12126
Slope = 0.0000462039
Mann-Kendall Trend : no trend
P Value: 0.53521
Mann-Kendall S Value: 10.0
NO3N (Mg/L)
Date
0
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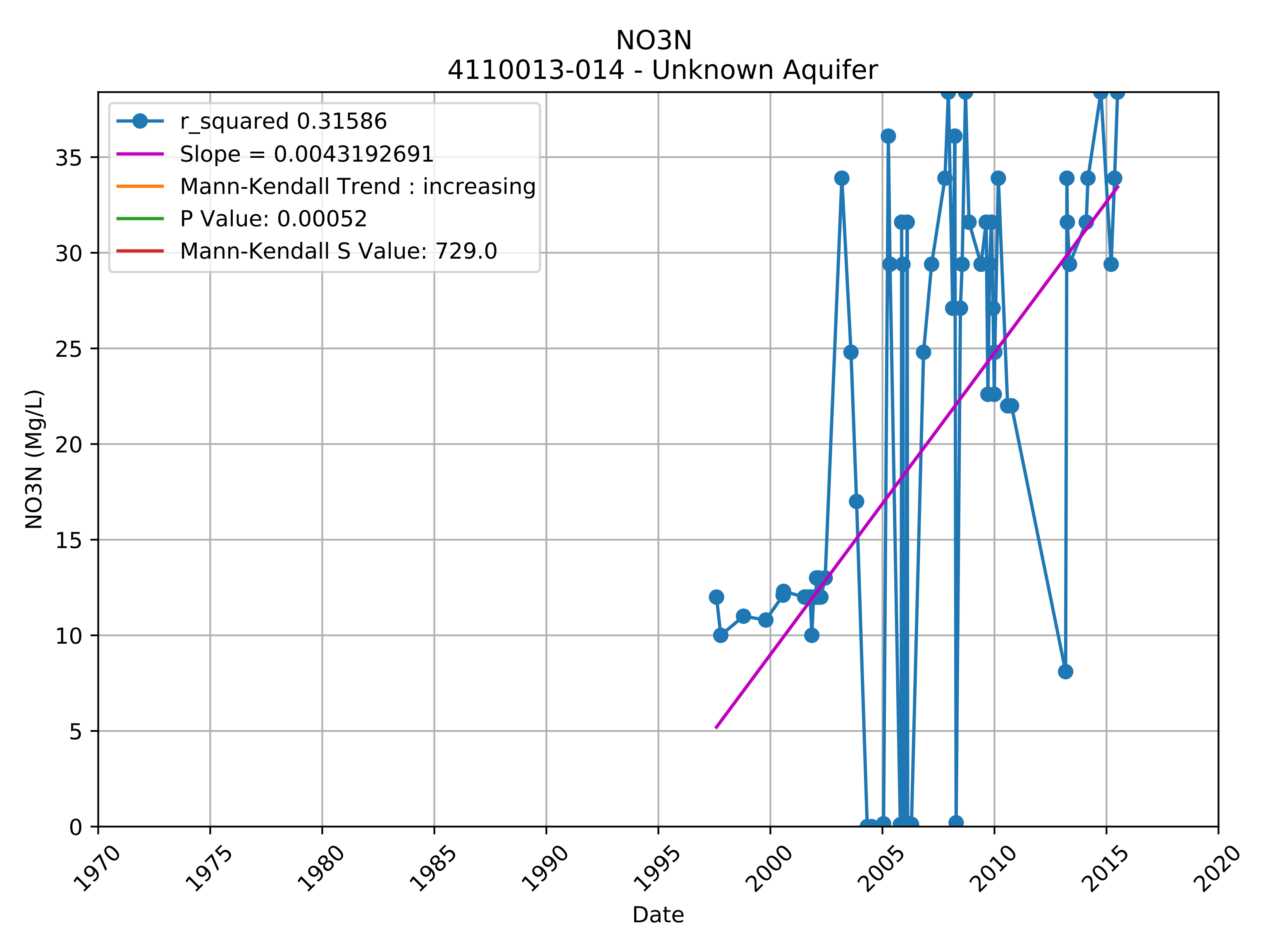

NO3N
4110013-014 - Unknown Aquifer
r_squared 0.31586
Slope = 0.0043192691
Mann-Kendall Trend : increasing
P Value: 0.00052
Mann-Kendall S Value: 729.0
NO3N (Mg/L)
0
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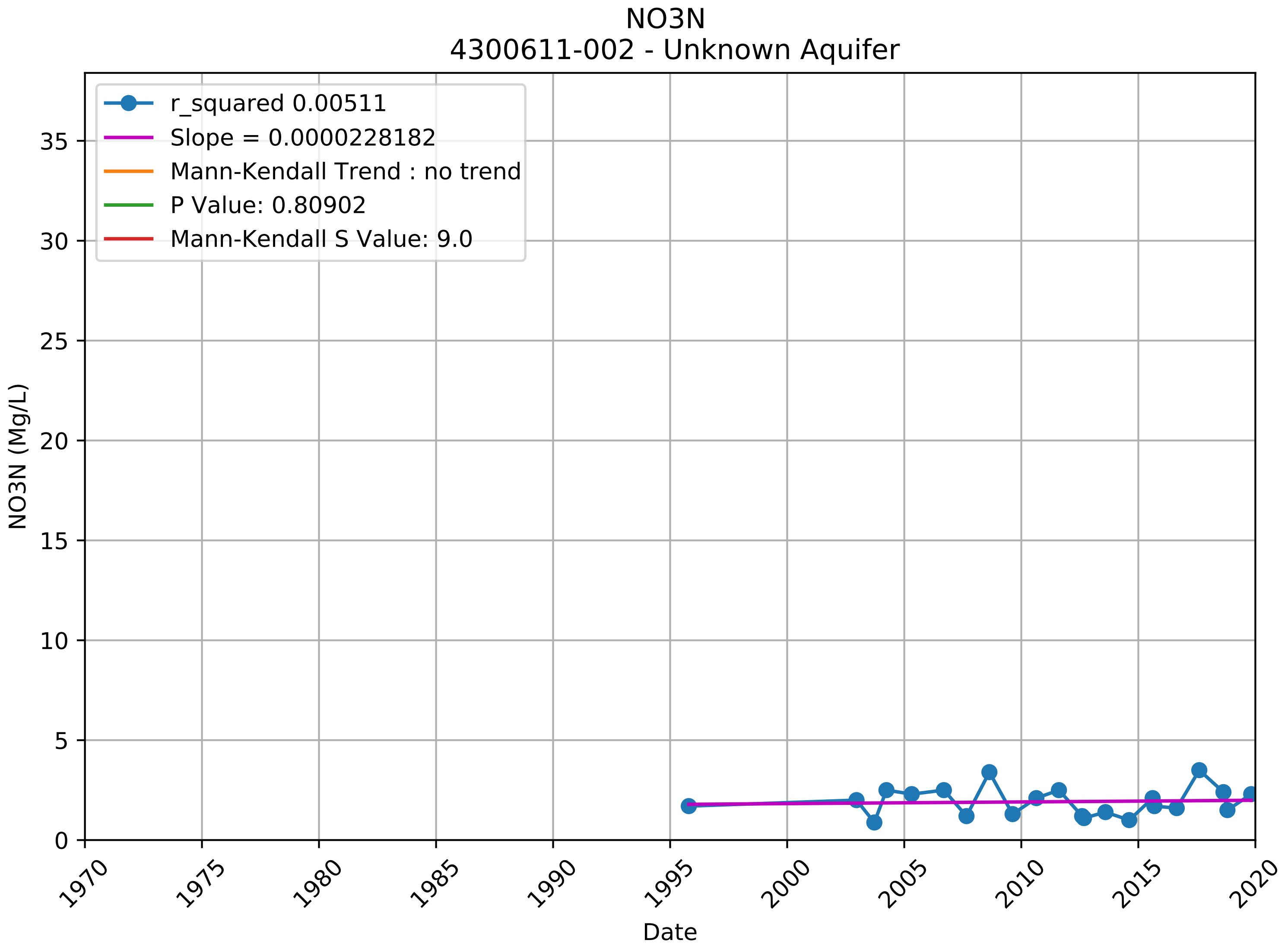
Date



NO3N
4300611-002 - Unknown Aquifer
r_squared 0.00511
Slope = 0.0000228182
Mann-Kendall Trend : no trend
P Value: 0.80902
Mann-Kendall S Value: 9.0
NO3N (Mg/L)
0
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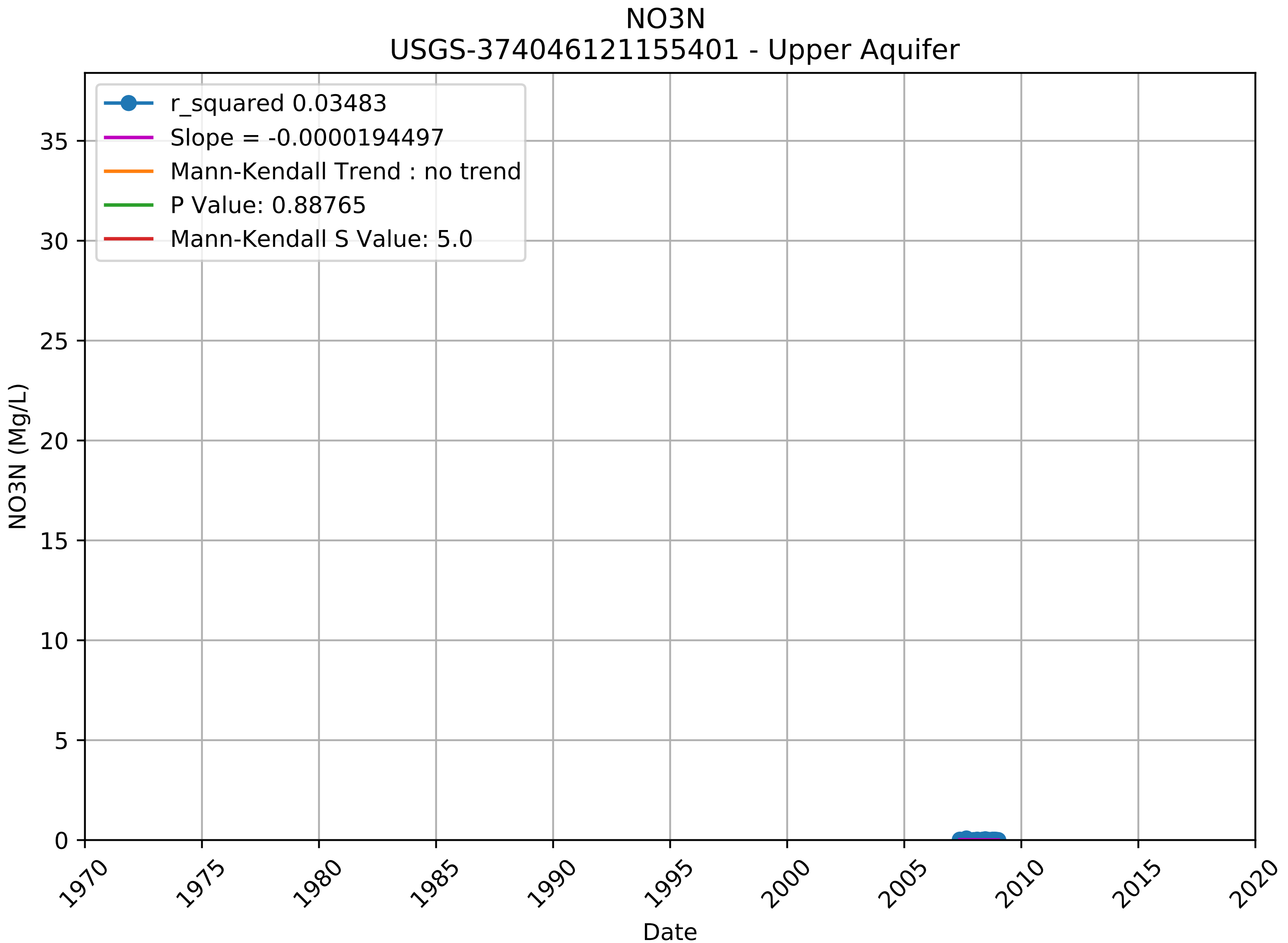
Date



NO3N
USGS-374046121155401 - Upper Aquifer
r_squared 0.03483
Slope = -0.0000194497
Mann-Kendall Trend : no trend
P Value: 0.88765
Mann-Kendall S Value: 5.0
NO3N (Mg/L)
Date
0
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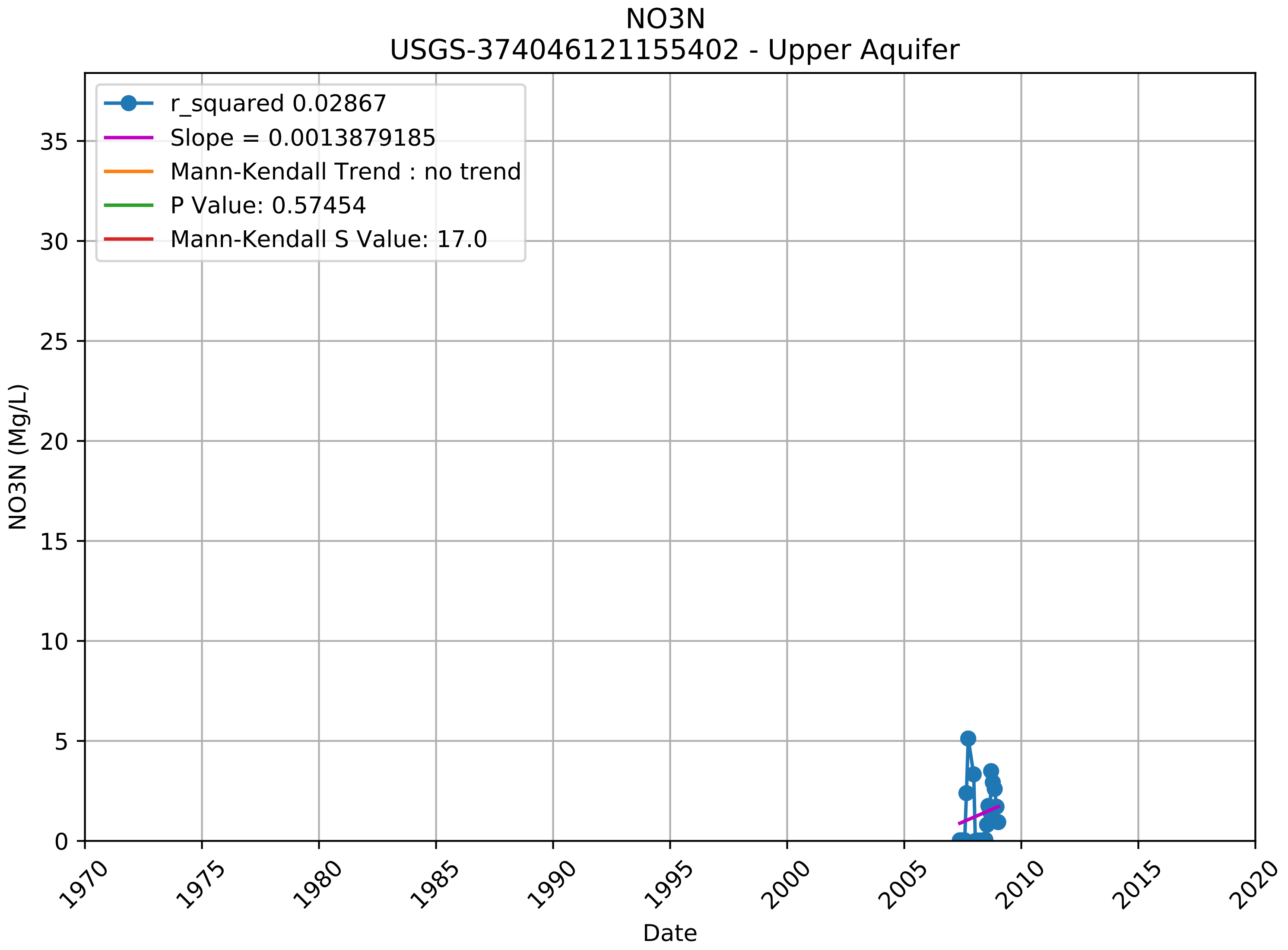

NO3N
USGS-374046121155402 - Upper Aquifer
r_squared 0.02867
Slope = 0.0013879185
Mann-Kendall Trend : no trend
P Value: 0.57454
Mann-Kendall S Value: 17.0
NO3N (Mg/L)
0
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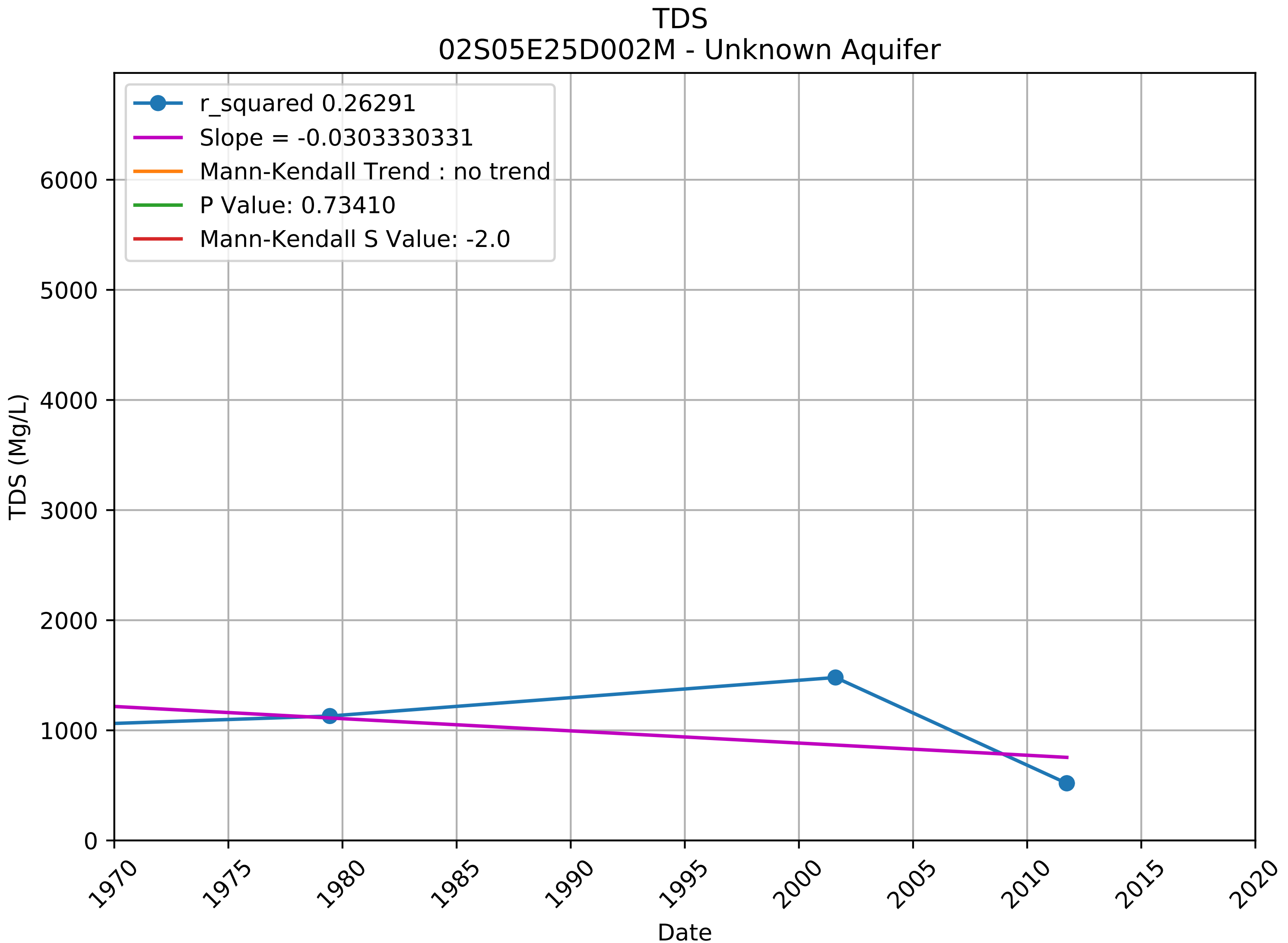
2015
2020
Date

Total Dissolved Solids

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
02S05E25D002M	37.7351	-121.3833	TDS	FALSE	0.734	-2	-0.333	no trend	8.667	-0.34	Unknown
USGS-374223121250601	37.7063185	-121.4193886	TDS	FALSE	0.089	-6	-1	no trend	8.667	-1.698	Upper
3910011-007	37.714471	-121.426009	TDS	TRUE	0.035	-15	-0.714	decreasing	44.333	-2.103	Unknown
3910011-010	37.736372	-121.435351	TDS	FALSE	0.488	-15	-0.143	no trend	408.333	-0.693	Unknown
3910702-003	37.705557	-121.39764	TDS	TRUE	0	1070	0.33	increasing	60120	4.36	Unknown
3910701-003	37.85144	-121.2682	TDS	TRUE	0.012	417	0.221	increasing	27099.67	2.527	Unknown
3910701-001	37.849584	-121.268763	TDS	FALSE	0.37	-105	-0.089	no trend	13436.33	-0.897	Unknown
3910011-017	37.738215	-121.419962	TDS	FALSE	0.462	4	0.4	no trend	16.667	0.735	Unknown
3910018-001	37.679751	-121.272617	TDS	FALSE	0.108	-14	-0.5	no trend	65.333	-1.608	Unknown
4300611-002	37.994444	-121.499722	TDS	FALSE	0.23	-9	-0.429	no trend	44.333	-1.202	Unknown
3910015-005	37.816859	-121.266705	TDS	FALSE	0.127	-26	-0.333	no trend	268.667	-1.525	Upper
3910011-003	37.683959	-121.439427	TDS	TRUE	0.047	107	0.264	increasing	2836.333	1.99	Lower
3910800-002	37.744188	-121.32701	TDS	TRUE	0.003	246	0.332	increasing	6828	2.965	Unknown
3910800-003	37.74545	-121.32897	TDS	TRUE	0	273	0.628	increasing	3141.667	4.853	Unknown
3910800-001	37.744746	-121.327221	TDS	FALSE	0.221	6	0.6	no trend	16.667	1.225	Unknown
3910800-004	37.74591	-121.336213	TDS	TRUE	0.037	193	0.224	increasing	8514.333	2.081	Unknown
3100014-001	37.716956	-121.379533	TDS	FALSE	1	-1	-0.067	no trend	28.333	0	Unknown
3910701-005	37.851301	-121.2673	TDS	TRUE	0.011	402	0.227	increasing	24581.33	2.558	Unknown
3910011-004	37.682308	-121.436988	TDS	FALSE	0.267	-43	-0.17	no trend	1433.667	-1.109	Lower
3910011-006	37.686539	-121.443515	TDS	FALSE	0.643	22	0.068	no trend	2057.333	0.463	Lower
3910011-005	37.683353	-121.443313	TDS	TRUE	0	302	0.649	increasing	3442	5.131	Lower
3910015-006	37.818884	-121.266416	TDS	FALSE	0.891	-3	-0.045	no trend	211.667	-0.137	Upper
3910015-007	37.811547	-121.263915	TDS	FALSE	0.2	-22	-0.282	no trend	268.667	-1.281	Upper
3910015-008	37.801132	-121.262514	TDS	FALSE	0.251	12	0.333	no trend	92	1.147	Upper
3910011-018	37.743262	-121.424805	TDS	FALSE	0.052	-84	-0.28	no trend	1829.333	-1.941	Lower
3910018-004	37.679705	-121.272761	TDS	FALSE	0.133	-11	-0.524	no trend	44.333	-1.502	Unknown
3910701-007	37.851431	-121.265247	TDS	FALSE	0.752	-17	-0.045	no trend	2561	-0.316	Unknown
3910702-006	37.709972	-121.390802	TDS	TRUE	0.019	493	0.188	increasing	44091	2.343	Unknown
3910702-005	37.708149	-121.393881	TDS	FALSE	0.2	-270	-0.103	no trend	44092	-1.281	Unknown
4110013-014	37.7	-121.466667	TDS	TRUE	0.006	68	0.5	increasing	589.333	2.76	Unknown
3900991-001	37.743544	-121.461428	TDS	FALSE	0.089	-6	-1	no trend	8.667	-1.698	Unknown
3910011-030	37.740208	-121.439285	TDS	FALSE	0.052	-89	-0.274	no trend	2058.333	-1.94	Lower
3901348-002	37.702894	-121.406986	TDS	FALSE	0.462	4	0.4	no trend	16.667	0.735	Unknown
3900713-001	37.84	-121.44	TDS	FALSE	0.076	18	0.5	no trend	92	1.772	Unknown
3901172-002	37.636324	-121.399544	TDS	FALSE	0.481	33	0.102	no trend	2058.333	0.705	Unknown
3901172-003	37.632289	-121.39736	TDS	FALSE	1	-1	-0.067	no trend	28.333	0	Unknown
3900702-001	37.990639	-121.407056	TDS	FALSE	0.806	-2	-0.2	no trend	16.667	-0.245	Unknown
3900583-001	37.84	-121.44	TDS	FALSE	0.462	4	0.4	no trend	16.667	0.735	Unknown
3901216-002	37.74753	-121.516649	TDS	FALSE	0.051	105	0.259	no trend	2839	1.952	Unknown
3900559-001	37.79	-121.38	TDS	FALSE	0.308	-4	-0.667	no trend	8.667	-1.019	Unknown
3900558-002	37.79	-121.4	TDS	FALSE	0.462	-4	-0.4	no trend	16.667	-0.735	Unknown
3910011-034	37.752802	-121.434603	TDS	FALSE	0.545	30	0.085	no trend	2300	0.605	Lower
3910011-032	37.754682	-121.465249	TDS	FALSE	0.283	-47	-0.157	no trend	1832.333	-1.075	Lower
3901348-003	37.698742	-121.409917	TDS	FALSE	1	0	0	no trend	92	0	Unknown
3901348-004	37.698147	-121.416153	TDS	FALSE	0.063	-16	-0.571	no trend	65.333	-1.856	Unknown
377427N1213943W002	37.742656	-121.394318	TDS	FALSE	0.96	2	0.019	no trend	407.333	0.05	Lower
377427N1213943W001	37.742656	-121.394318	TDS	FALSE	0.102	-34	-0.324	no trend	407.333	-1.635	Lower
377427N1213943W003	37.742656	-121.394318	TDS	FALSE	0.138	-31	-0.295	no trend	408.333	-1.485	Lower
377402N1214508W001	37.740187	-121.450762	TDS	FALSE	0.083	-36	-0.343	no trend	407.333	-1.734	Lower
377143N1214459W002	37.714305	-121.445905	TDS	FALSE	0.96	-2	-0.019	no trend	407.333	-0.05	Lower
377143N1214459W003	37.714305	-121.445905	TDS	FALSE	0.053	-40	-0.381	no trend	404.667	-1.939	Lower
377402N1214508W003	37.740187	-121.450762	TDS	FALSE	0.092	-35	-0.333	no trend	408.333	-1.683	Lower
377402N1214508W002	37.740187	-121.450762	TDS	TRUE	0.038	-43	-0.41	decreasing	408.333	-2.078	Lower
377143N1214459W001	37.714305	-121.445905	TDS	FALSE	0.15	-30	-0.286	no trend	405.333	-1.44	Lower
377656N1214199W001	37.765631	-121.41992	TDS	TRUE	0.003	-44	-0.667	decreasing	212.667	-2.949	Lower
377656N1214199W002	37.765631	-121.41992	TDS	FALSE	0.721	-5	-0.111	no trend	125	-0.358	Lower
377656N1214199W003	37.765631	-121.41992	TDS	FALSE	0.669	-8	-0.103	no trend	268.667	-0.427	Lower
377149N1214257W003	37.714872	-121.425674	TDS	TRUE	0.024	-34	-0.515	decreasing	212.667	-2.263	Lower
377149N1214257W002	37.714872	-121.425674	TDS	FALSE	0.191	-20	-0.303	no trend	210.667	-1.309	Lower
377149N1214257W001	37.714872	-121.425674	TDS	FALSE	0.054	-29	-0.439	no trend	211.667	-1.925	Lower
377031N1214485W002	37.703055	-121.448544	TDS	FALSE	0.076	30	0.385	no trend	266.667	1.776	Lower
377031N1214485W001	37.703055	-121.448544	TDS	FALSE	0.157	-24	-0.308	no trend	264	-1.416	Lower
377031N1214485W003	37.703055	-121.448544	TDS	FALSE	0.269	-19	-0.244	no trend	265	-1.106	Lower
3910005-044	37.782808	-121.300937	TDS	FALSE	0.371	-3	-0.5	no trend	5	-0.894	Unknown
USGS-374900121160001	37.8168333	-121.2666667	TDS	FALSE	1	0	0	no trend	8.667	0	Unknown
USGS-374100121260001	37.6834167	-121.4433333	TDS	FALSE	0.26	7	0.467	no trend	28.333	1.127	Unknown
3910800-006	37.744722	-121.329167	TDS	TRUE	0.011	150	0.323	increasing	3460.667	2.533	Unknown



TDS
02S05E25D002M - Unknown Aquifer
r_squared 0.26291
Slope = -0.0303330331
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: -2.0
TDS (Mg/L)
0
1000
2000
3000
4000
5000
6000
1970
1975
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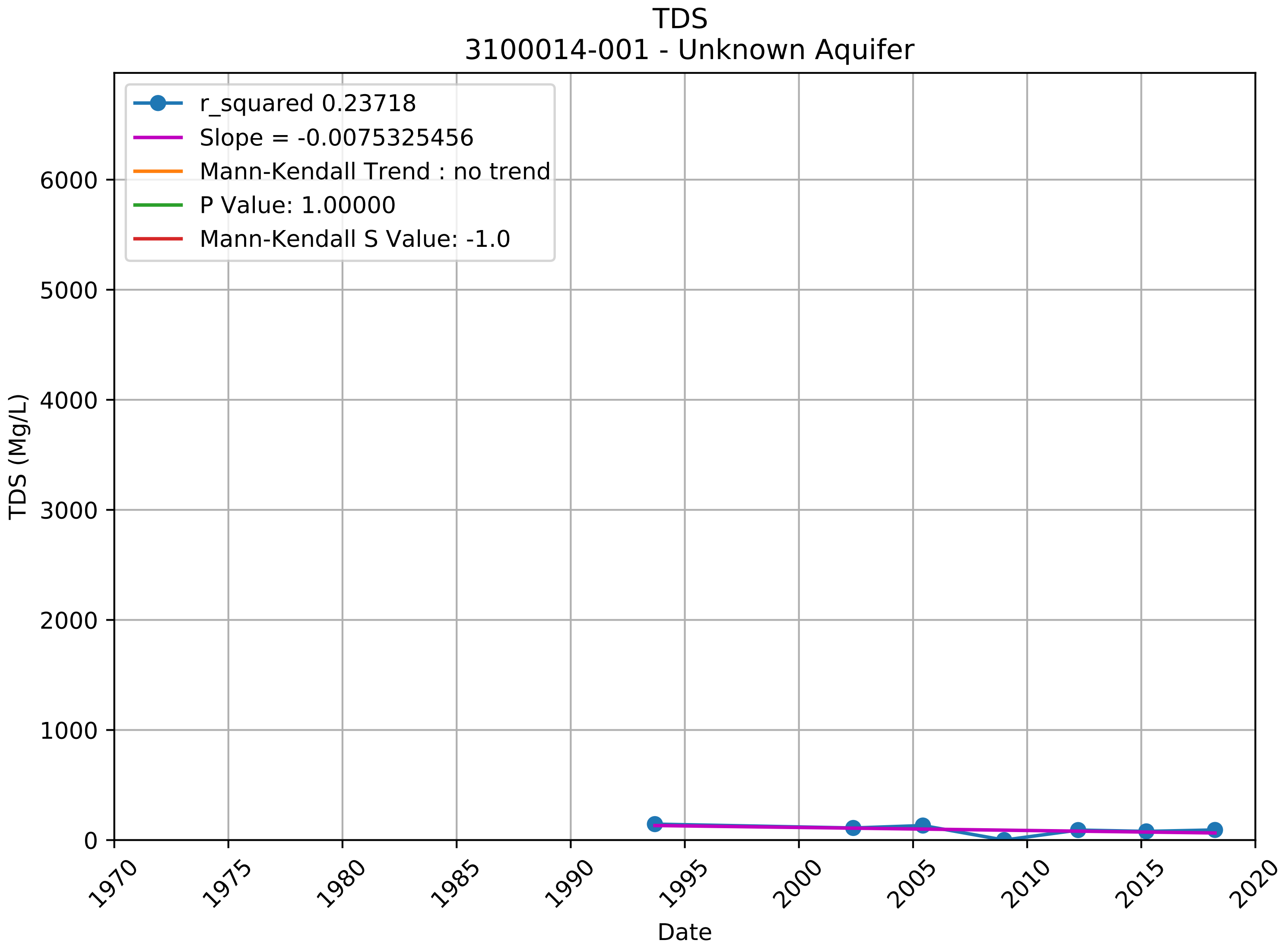
Date


TDS
3100014-001 - Unknown Aquifer
r_squared 0.23718
Slope = -0.0075325456
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
TDS (Mg/L)
0
1000
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3000
4000
5000
6000
1970
1975
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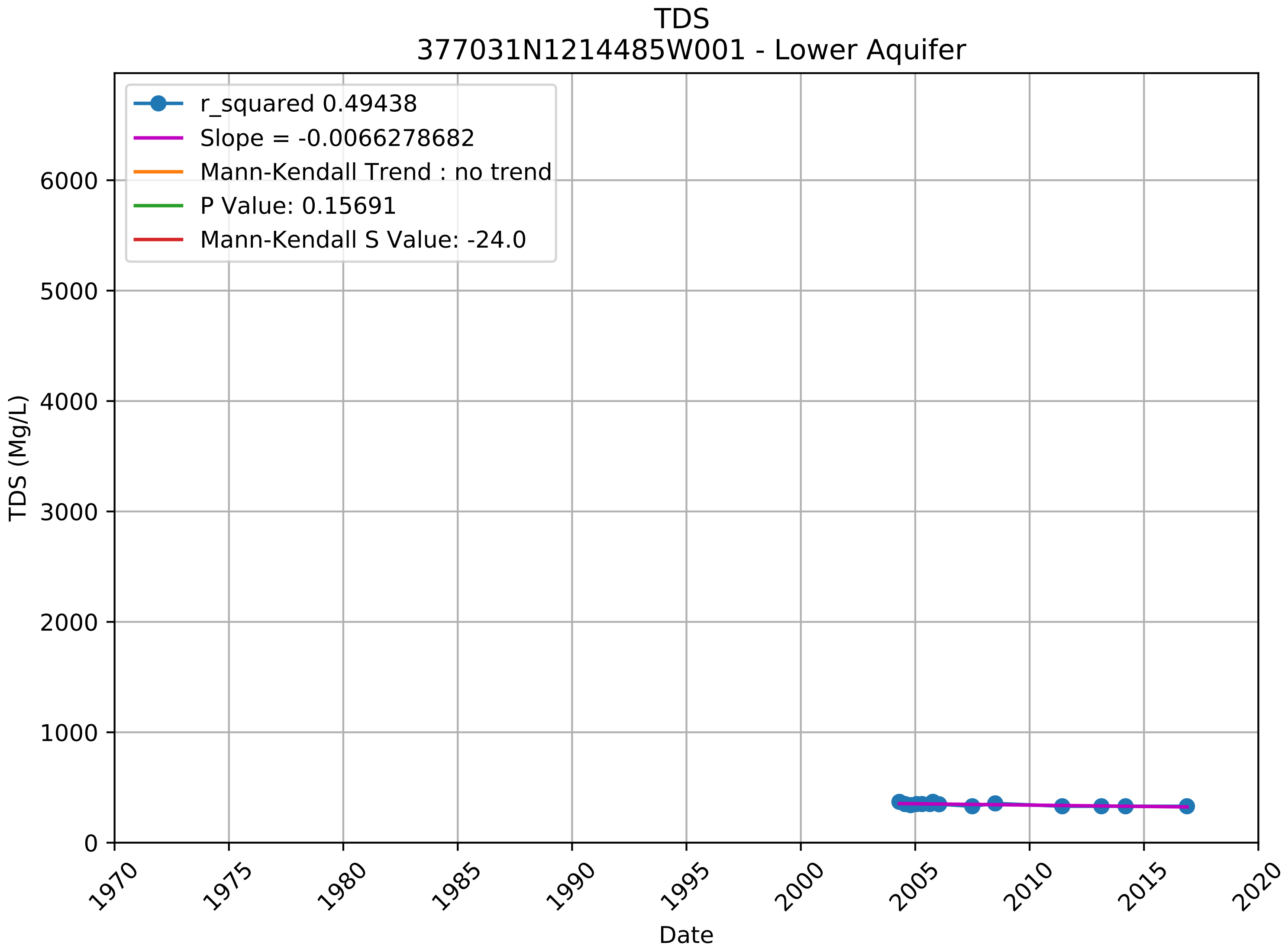
Date



TDS
377031N1214485W001 - Lower Aquifer
r_squared 0.49438
Slope = -0.0066278682
Mann-Kendall Trend : no trend
P Value: 0.15691
Mann-Kendall S Value: -24.0
TDS (Mg/L)
0
1000
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6000
1970
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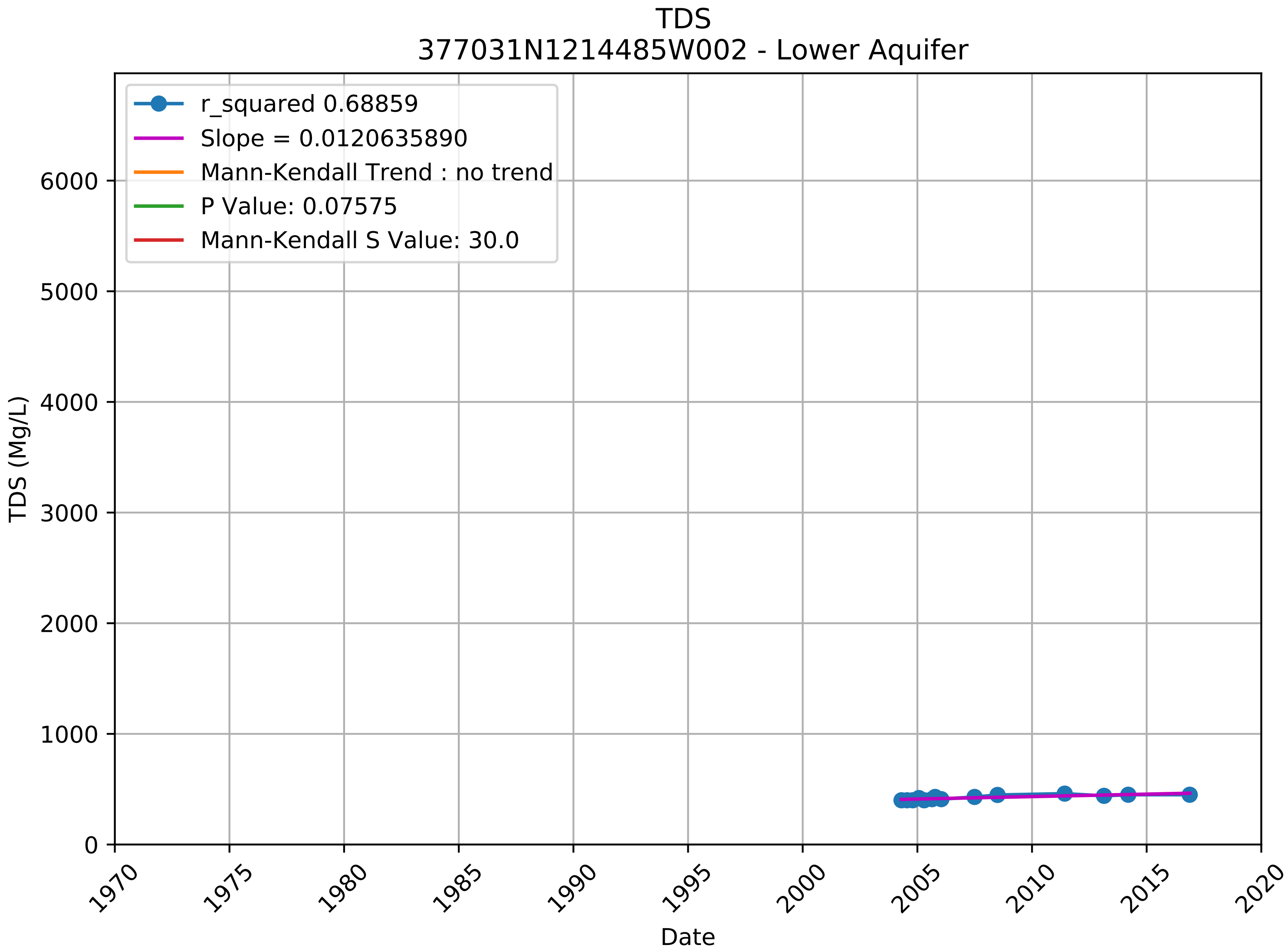
2015
2020
Date



TDS
377031N1214485W002 - Lower Aquifer
r_squared 0.68859
Slope = 0.0120635890
Mann-Kendall Trend : no trend
P Value: 0.07575
Mann-Kendall S Value: 30.0
TDS (Mg/L)
0
1000
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1970
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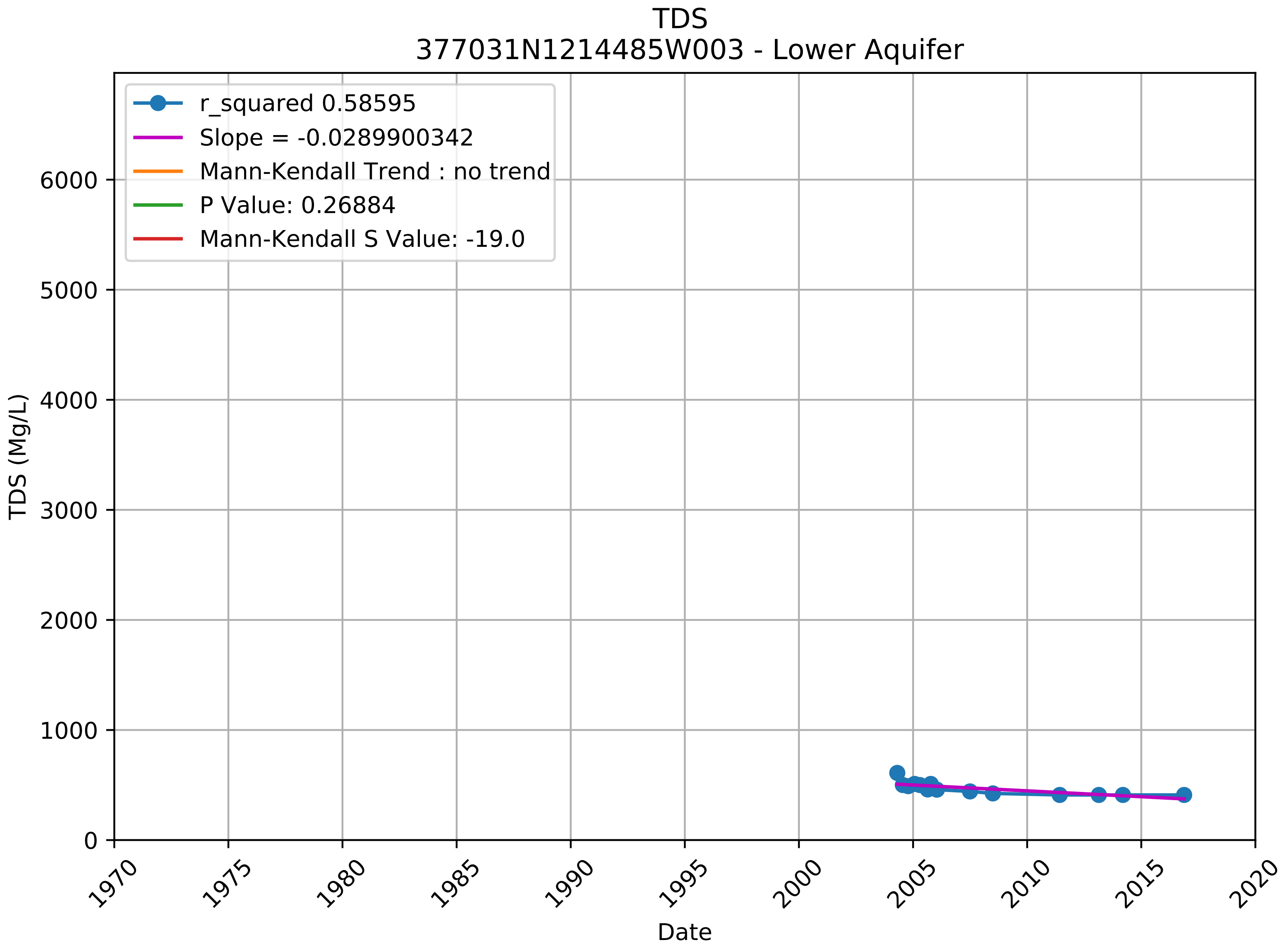
Date



TDS
377031N1214485W003 - Lower Aquifer
r_squared 0.58595
Slope = -0.0289900342
Mann-Kendall Trend : no trend
P Value: 0.26884
Mann-Kendall S Value: -19.0
TDS (Mg/L)
0
1000
2000
3000
4000
5000
6000
1970
1975
1980
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1995
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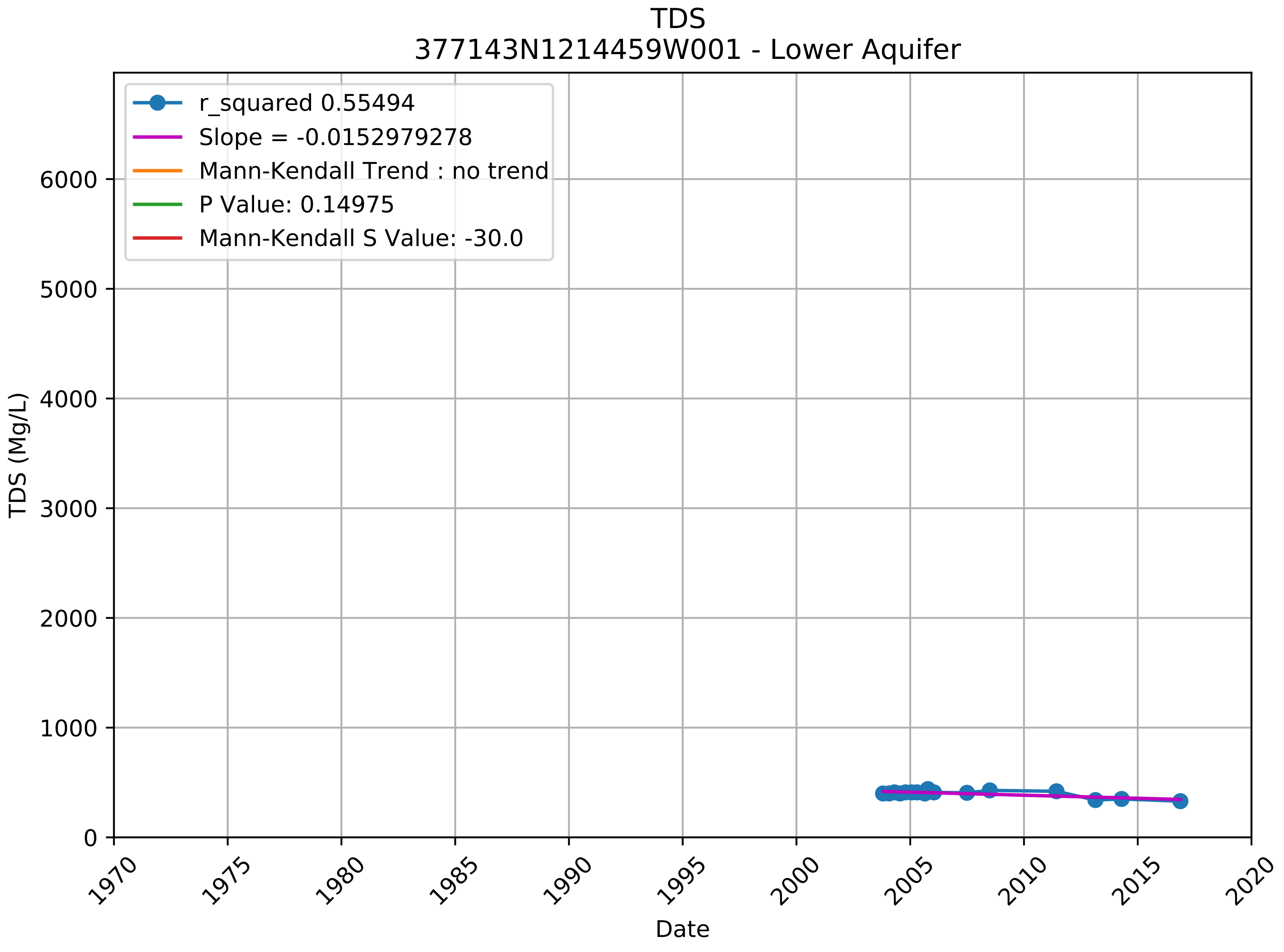
2010
2015
2020
Date



TDS
377143N1214459W001 - Lower Aquifer
r_squared 0.55494
Slope = -0.0152979278
Mann-Kendall Trend : no trend
P Value: 0.14975
Mann-Kendall S Value: -30.0
TDS (Mg/L)
0
1000
2000
3000
4000
5000
6000
1970
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2015
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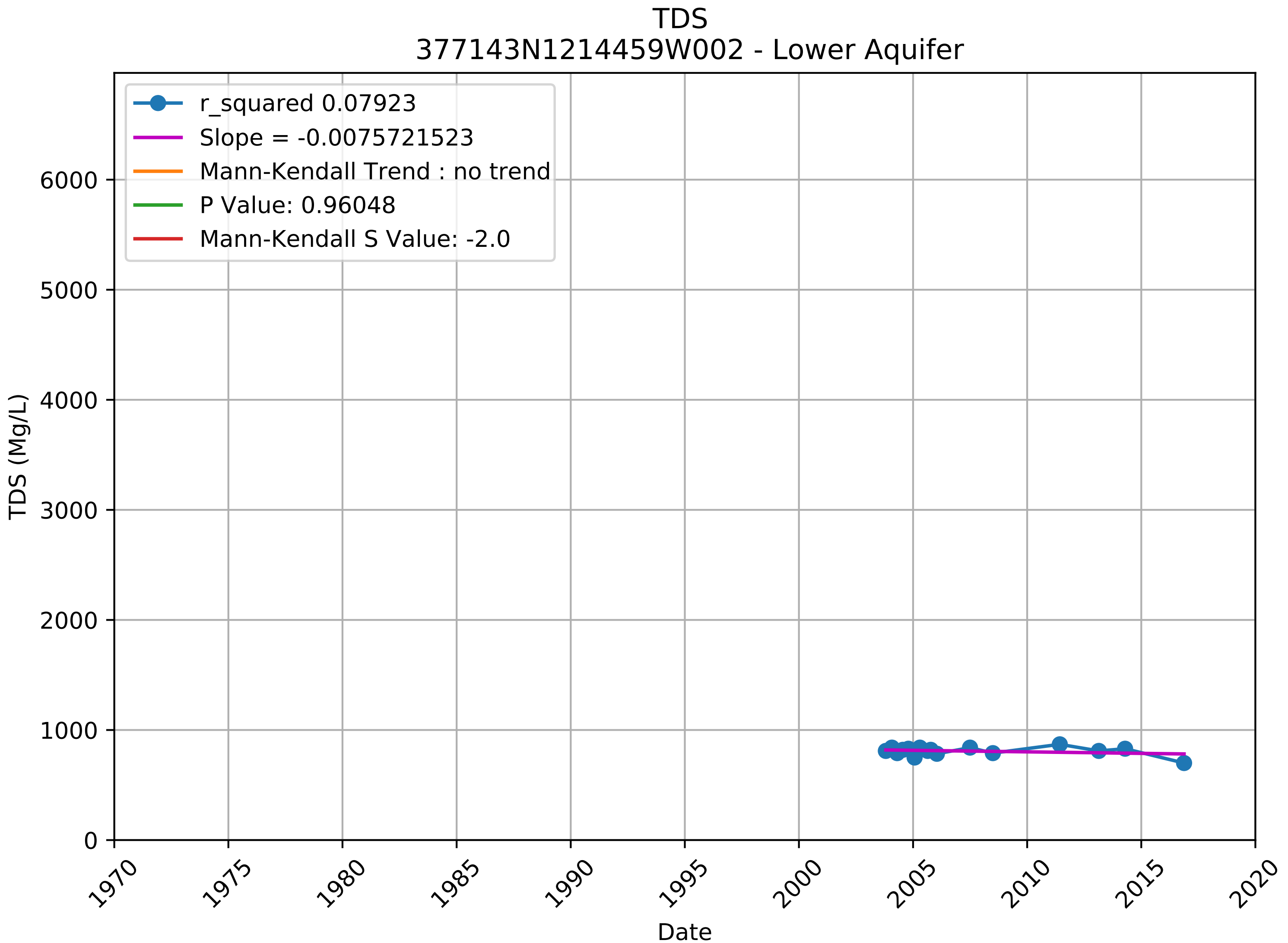
Date


TDS
377143N1214459W002 - Lower Aquifer
r_squared 0.07923
Slope = -0.0075721523
Mann-Kendall Trend : no trend
P Value: 0.96048
Mann-Kendall S Value: -2.0
TDS (Mg/L)
0
1000
2000
3000
4000
5000
6000
1970
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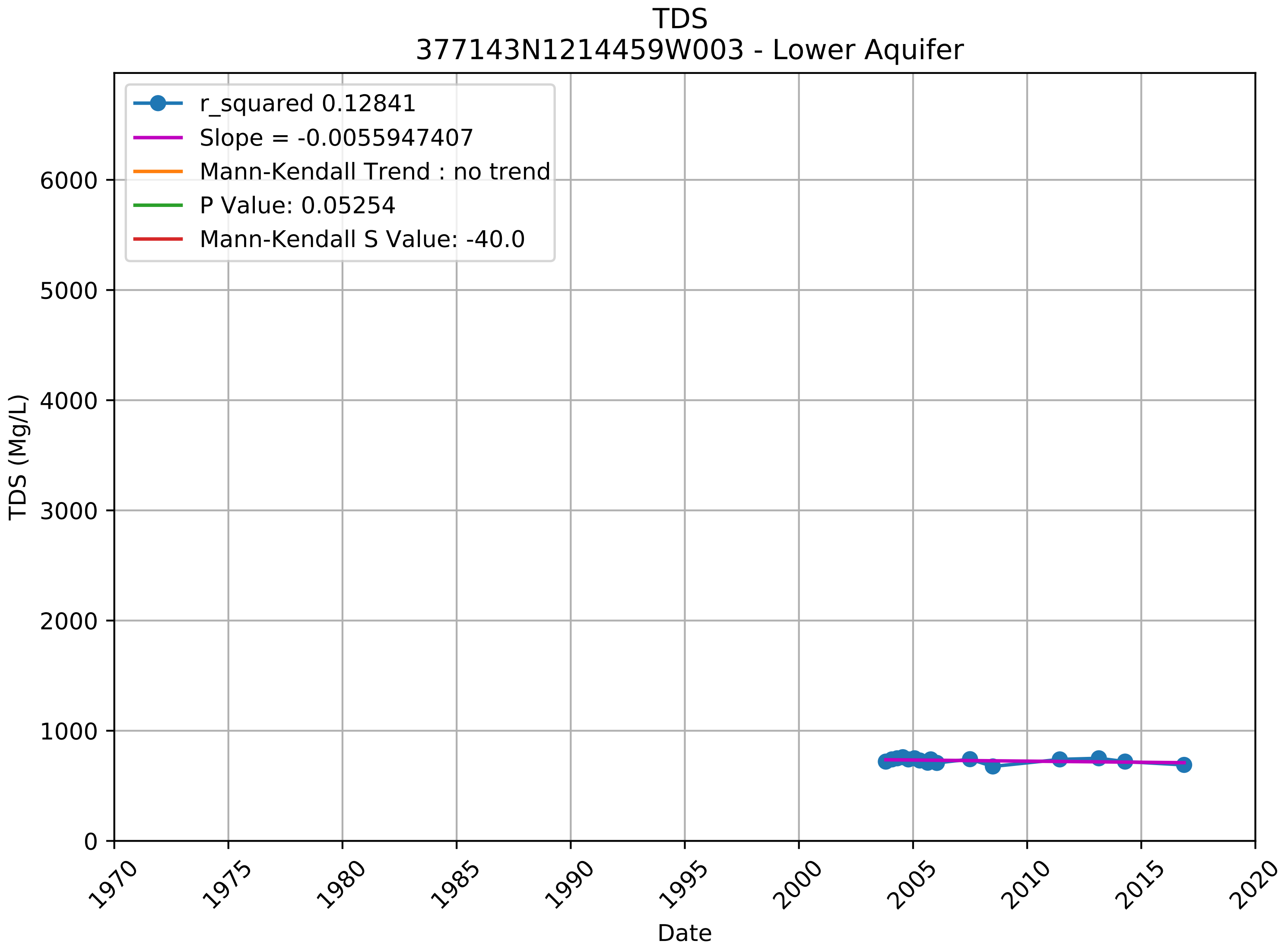
Date


TDS
377143N1214459W003 - Lower Aquifer
r_squared 0.12841
Slope = -0.0055947407
Mann-Kendall Trend : no trend
P Value: 0.05254
Mann-Kendall S Value: -40.0
TDS (Mg/L)
0
1000
2000
3000
4000
5000
6000
1970
1975
1980
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1995
2000
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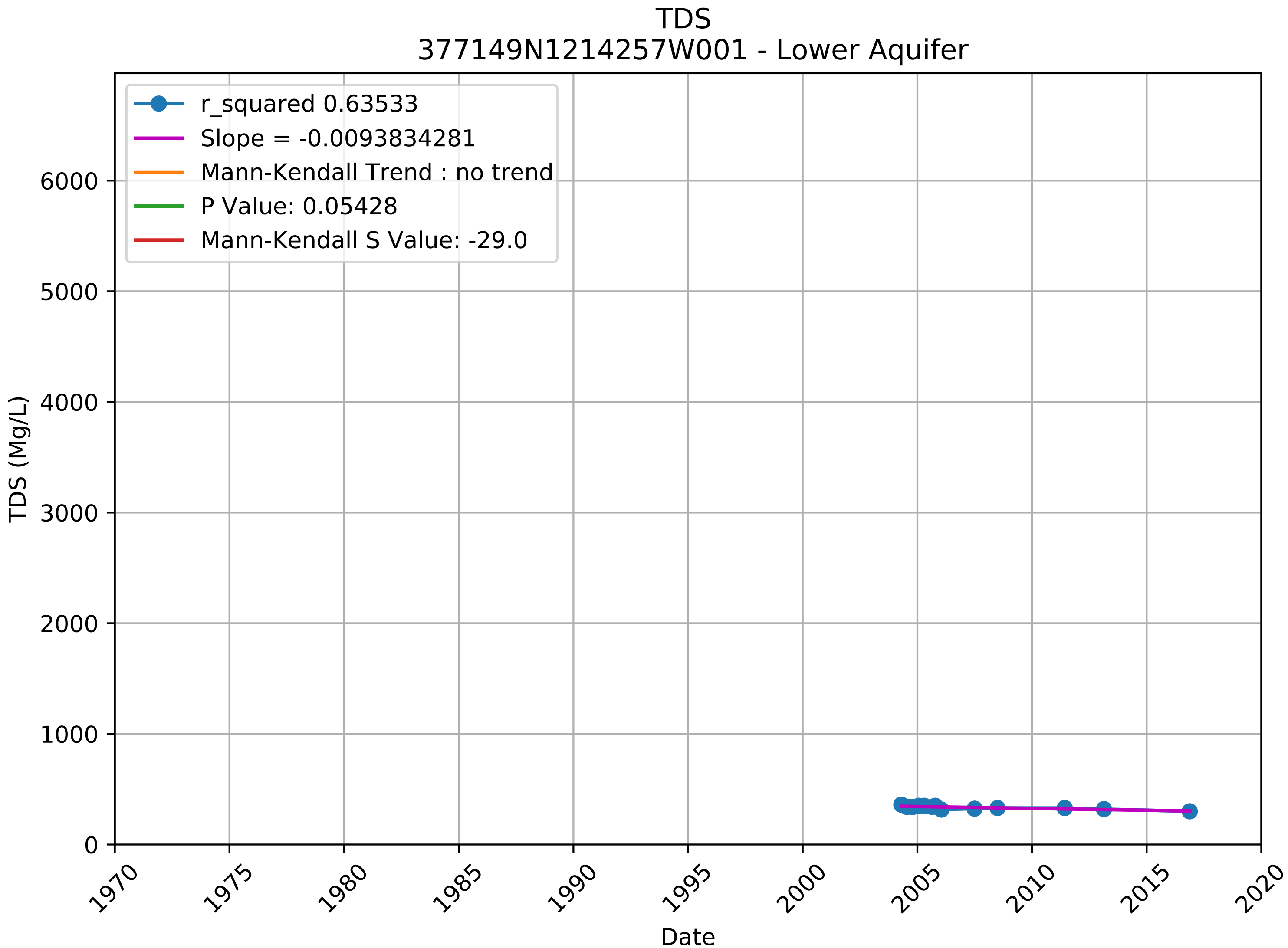
2010
2015
2020
Date


TDS
377149N1214257W001 - Lower Aquifer
r_squared 0.63533
Slope = -0.0093834281
Mann-Kendall Trend : no trend
P Value: 0.05428
Mann-Kendall S Value: -29.0
TDS (Mg/L)
0
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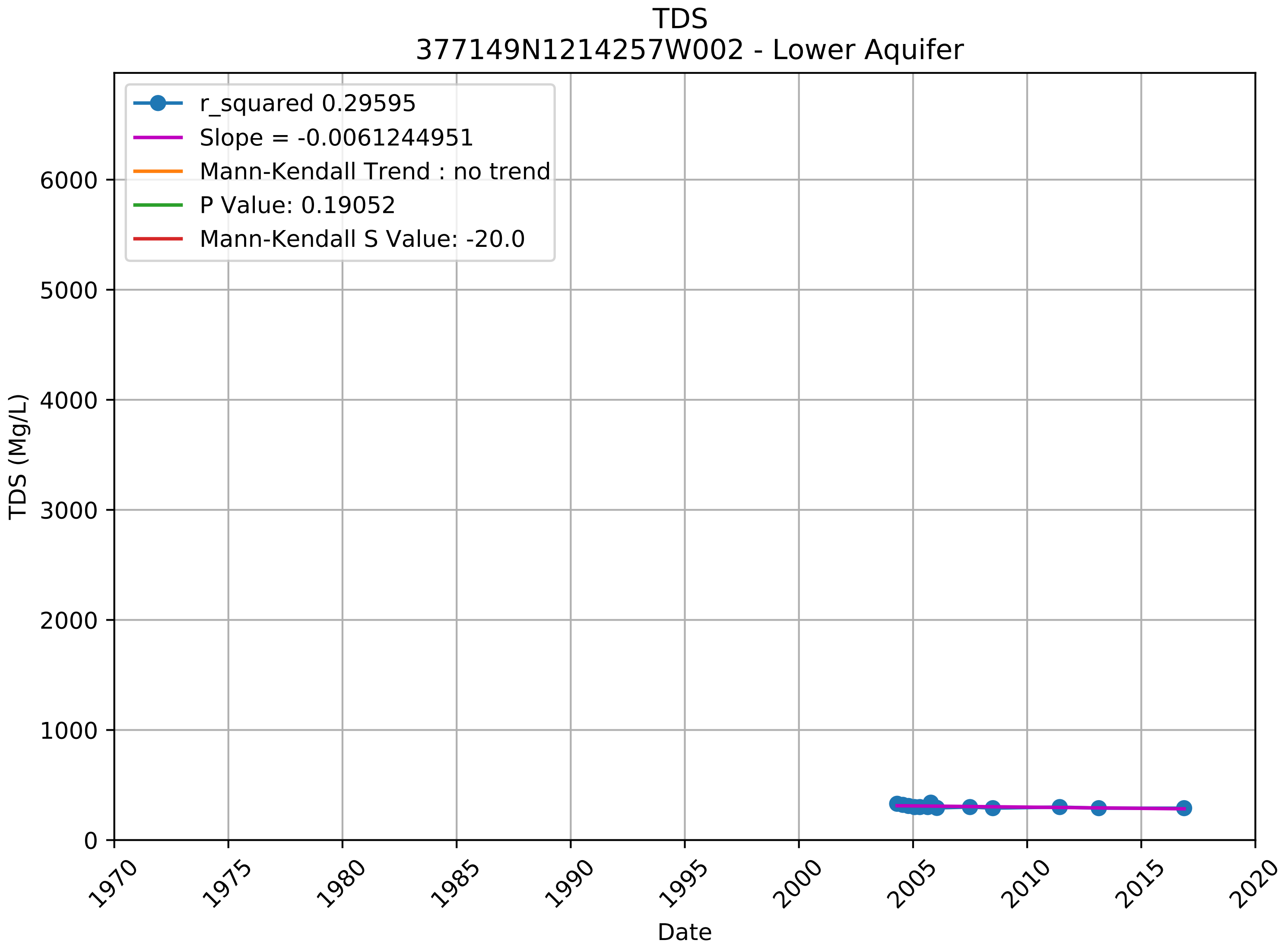
Date


TDS
377149N1214257W002 - Lower Aquifer
r_squared 0.29595
Slope = -0.0061244951
Mann-Kendall Trend : no trend
P Value: 0.19052
Mann-Kendall S Value: -20.0
TDS (Mg/L)
6000
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4000
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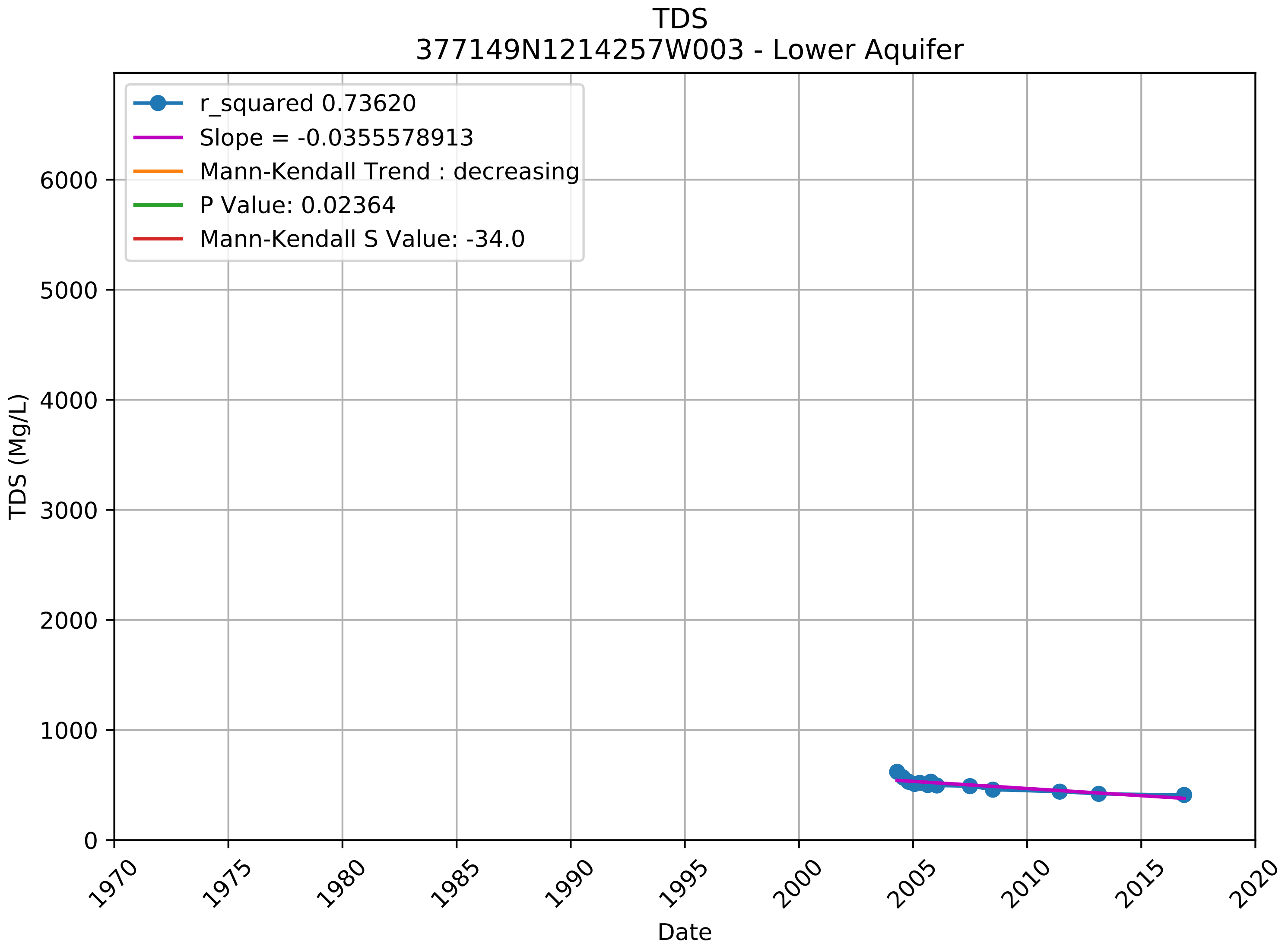
Date


TDS
377149N1214257W003 - Lower Aquifer
r_squared 0.73620
Slope = -0.0355578913
Mann-Kendall Trend : decreasing
P Value: 0.02364
Mann-Kendall S Value: -34.0
TDS (Mg/L)
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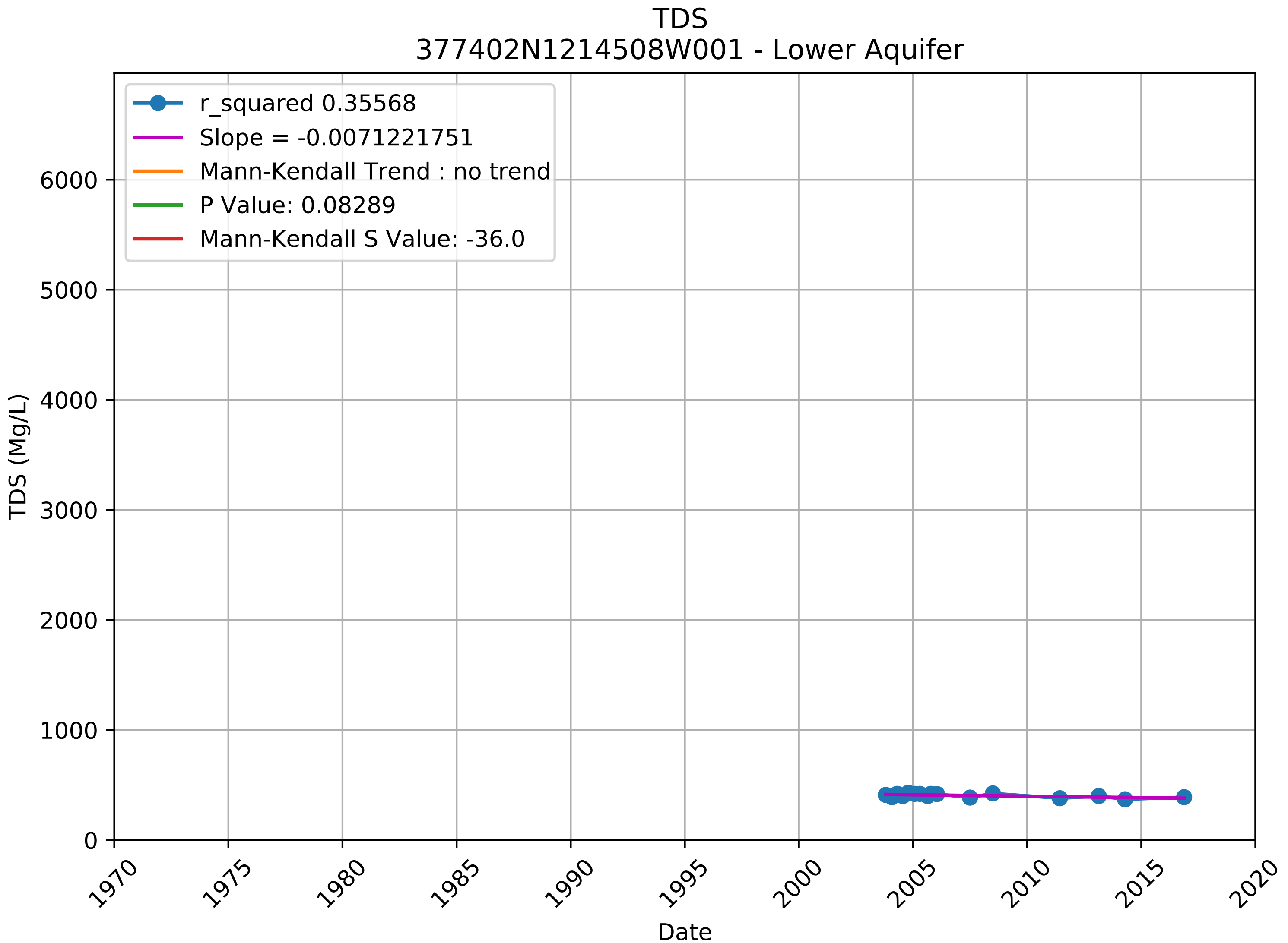
Date


TDS
377402N1214508W001 - Lower Aquifer
r_squared 0.35568
Slope = -0.0071221751
Mann-Kendall Trend : no trend
P Value: 0.08289
Mann-Kendall S Value: -36.0
TDS (Mg/L)
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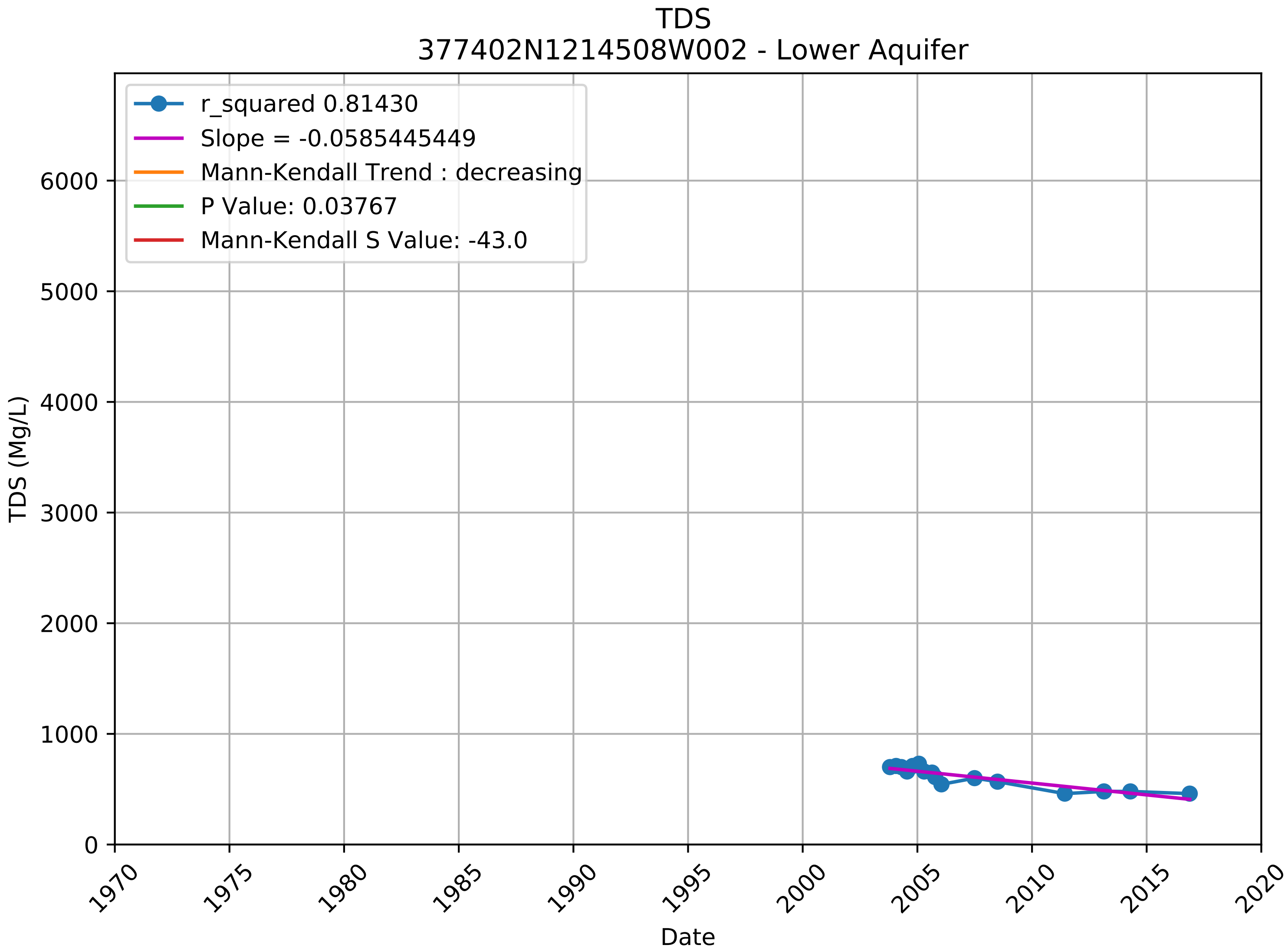

TDS
377402N1214508W002 - Lower Aquifer
r_squared 0.81430
Slope = -0.0585445449
Mann-Kendall Trend : decreasing
P Value: 0.03767
Mann-Kendall S Value: -43.0
TDS (Mg/L)
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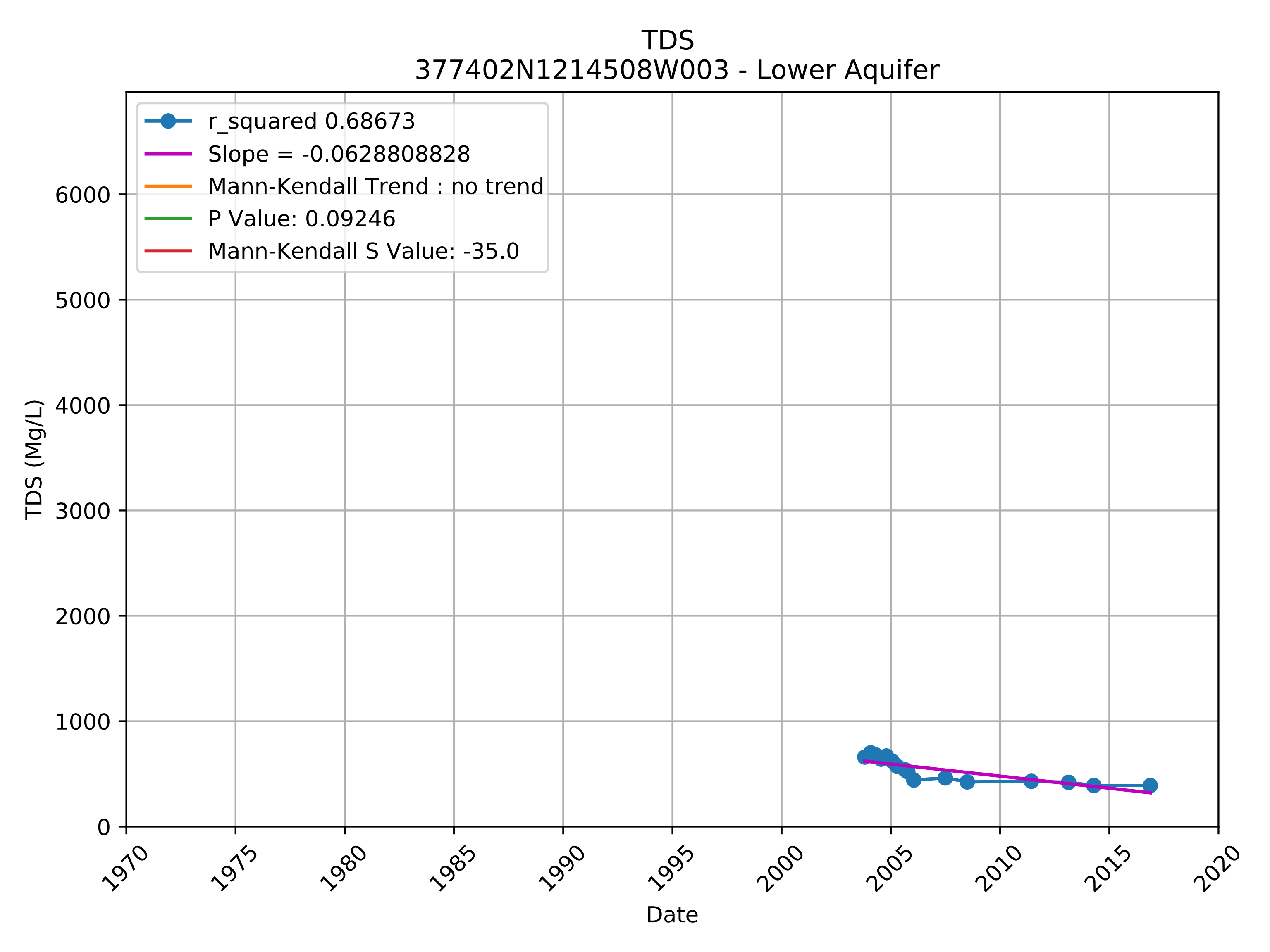
Date


TDS
377402N1214508W003 - Lower Aquifer
r_squared 0.68673
Slope = -0.0628808828
Mann-Kendall Trend : no trend
P Value: 0.09246
Mann-Kendall S Value: -35.0
TDS (Mg/L)
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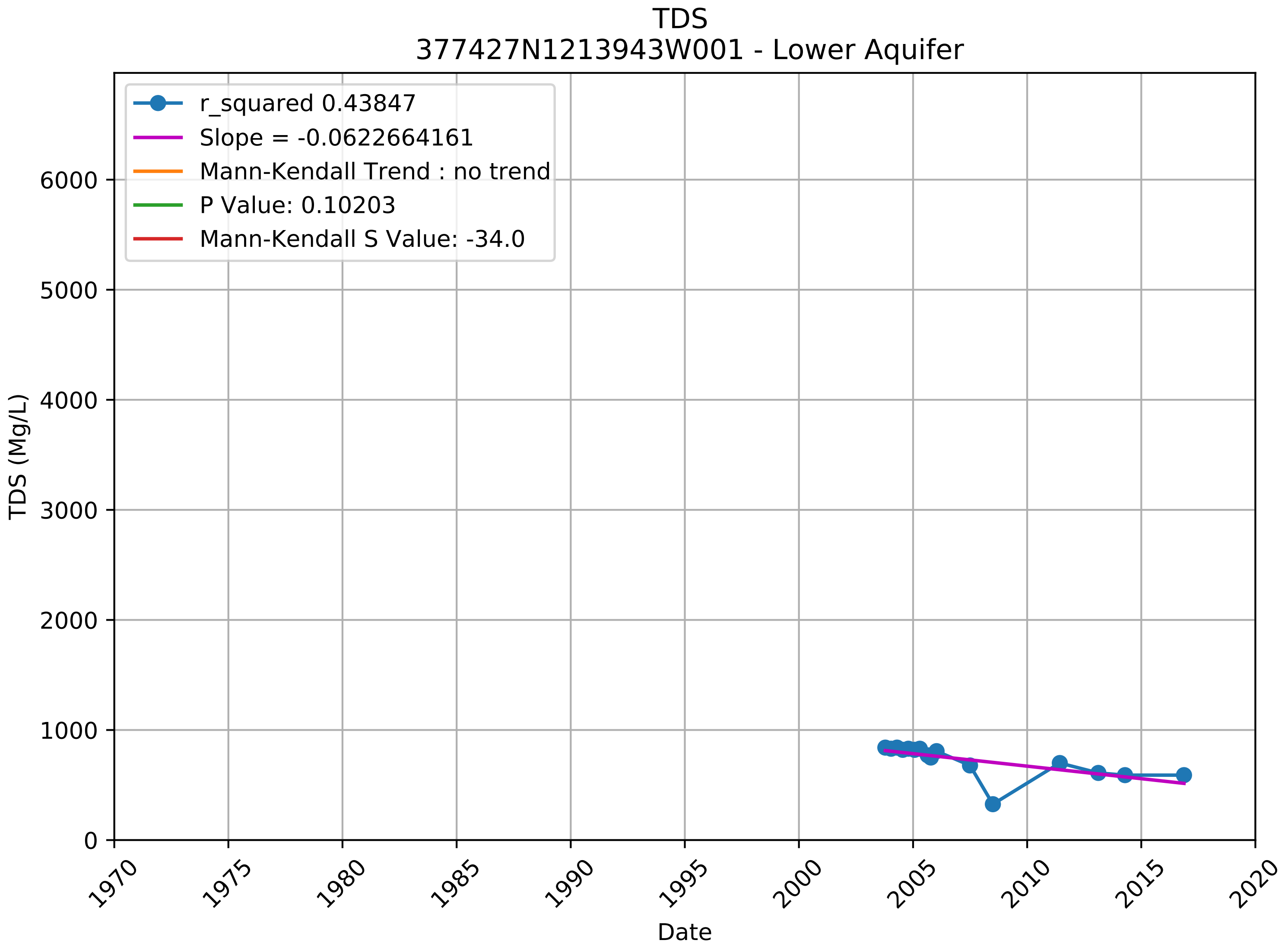
Date



TDS
377427N1213943W001 - Lower Aquifer
r_squared 0.43847
Slope = -0.0622664161
Mann-Kendall Trend : no trend
P Value: 0.10203
Mann-Kendall S Value: -34.0
TDS (Mg/L)
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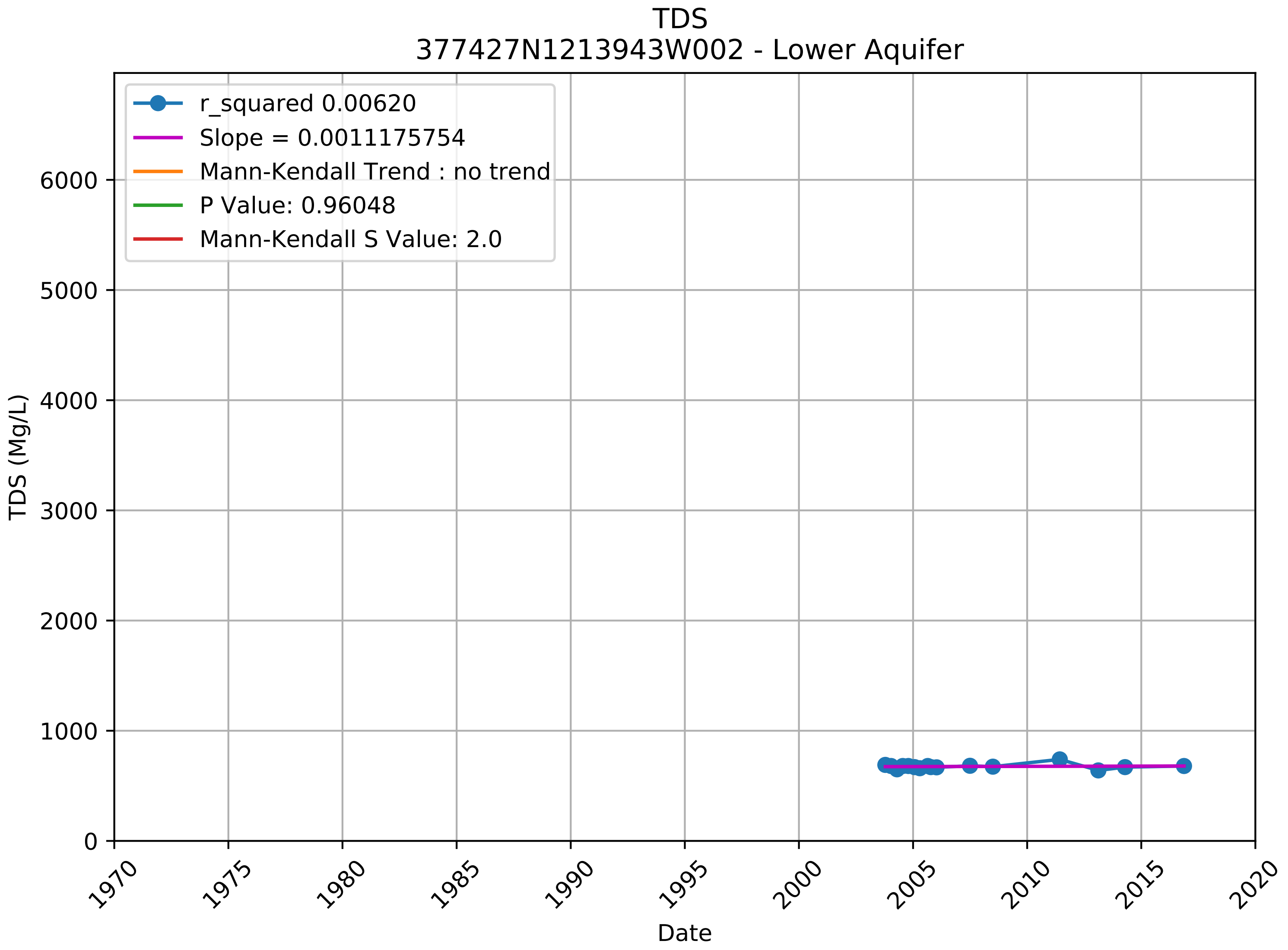
Date



TDS
377427N1213943W002 - Lower Aquifer
r_squared 0.00620
Slope = 0.0011175754
Mann-Kendall Trend : no trend
P Value: 0.96048
Mann-Kendall S Value: 2.0
TDS (Mg/L)
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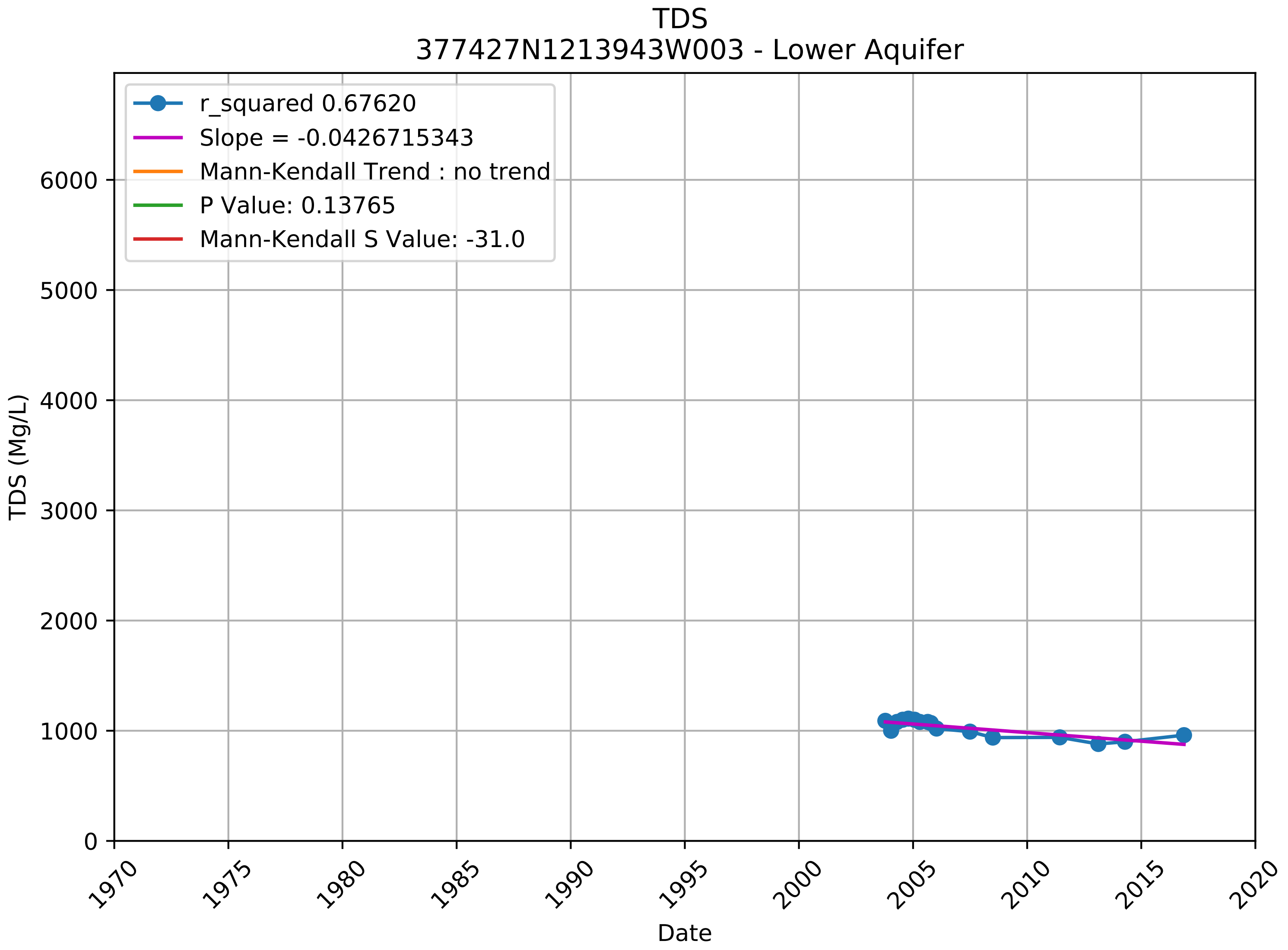

TDS
377427N1213943W003 - Lower Aquifer
r_squared 0.67620
Slope = -0.0426715343
Mann-Kendall Trend : no trend
P Value: 0.13765
Mann-Kendall S Value: -31.0
TDS (Mg/L)
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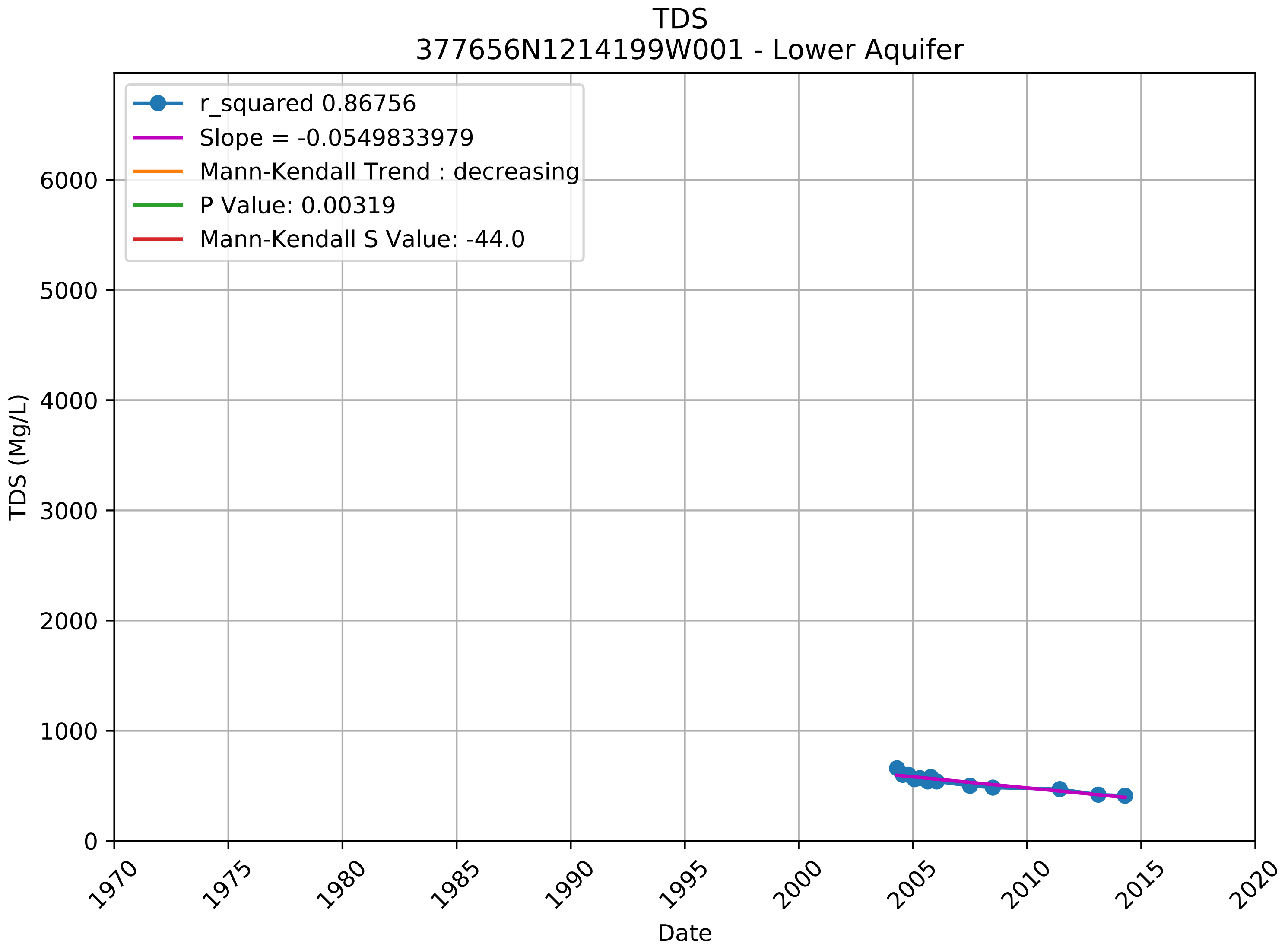

TDS
377656N1214199W001 - Lower Aquifer
r_squared 0.86756
Slope = -0.0549833979
Mann-Kendall Trend : decreasing
P Value: 0.00319
Mann-Kendall S Value: -44.0
TDS (Mg/L)
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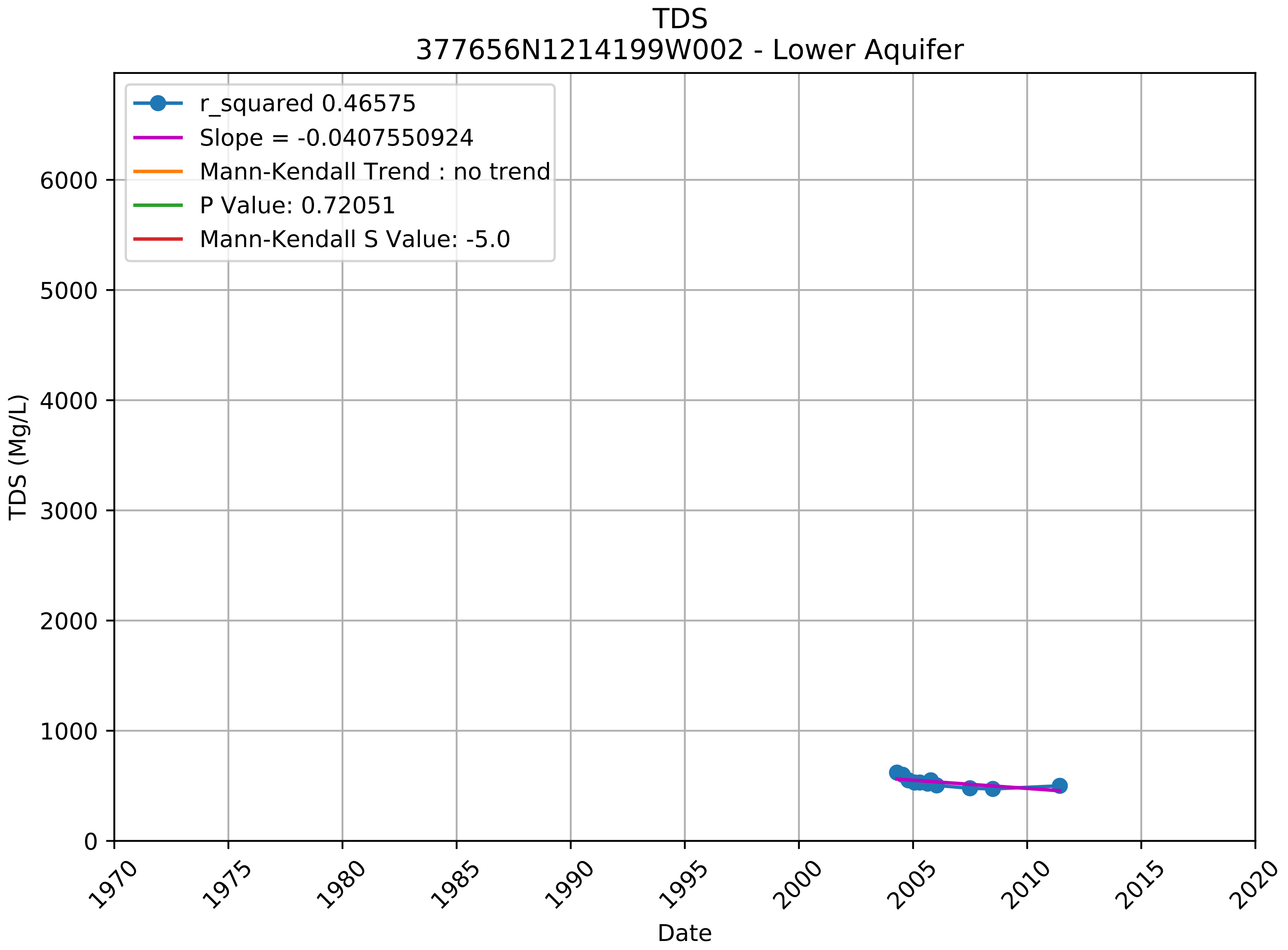
TDS
377656N1214199W002 - Lower Aquifer
r_squared 0.46575
Slope = -0.0407550924
Mann-Kendall Trend : no trend
P Value: 0.72051
Mann-Kendall S Value: -5.0
TDS (Mg/L)
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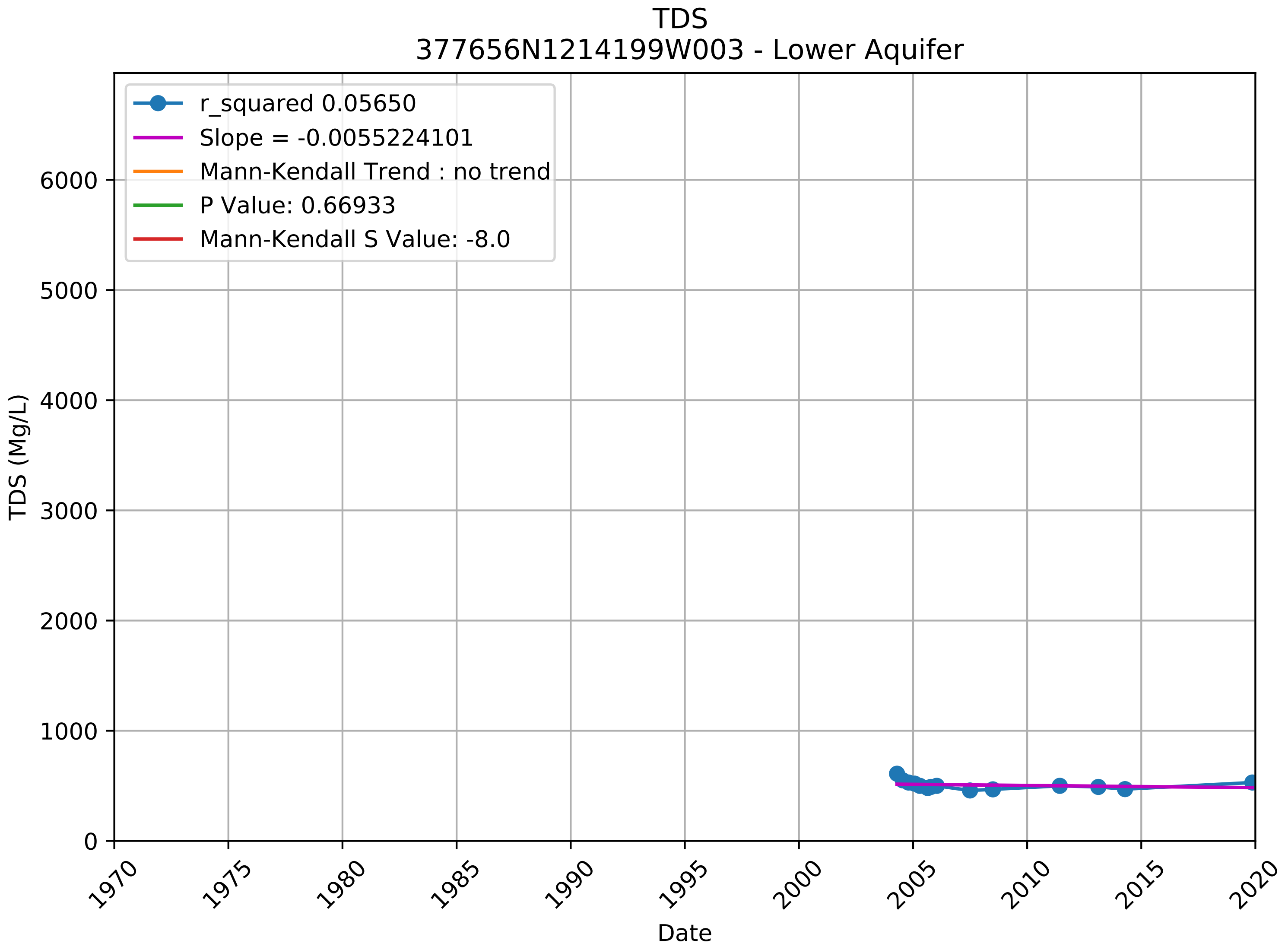
TDS
377656N1214199W003 - Lower Aquifer
r_squared 0.05650
Slope = -0.0055224101
Mann-Kendall Trend : no trend
P Value: 0.66933
Mann-Kendall S Value: -8.0
TDS (Mg/L)
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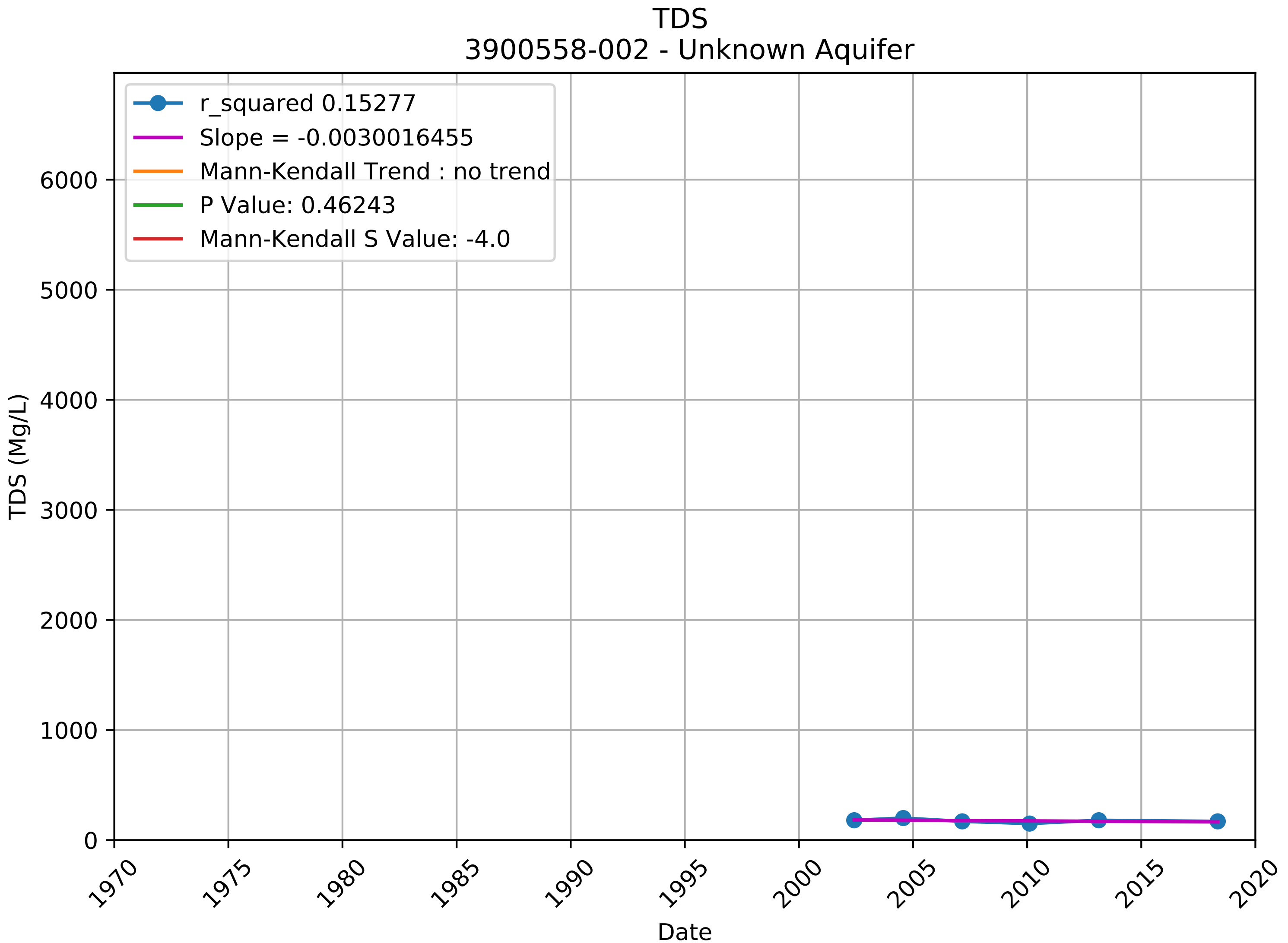
TDS
3900558-002 - Unknown Aquifer
r_squared 0.15277
Slope = -0.0030016455
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: -4.0
TDS (Mg/L)
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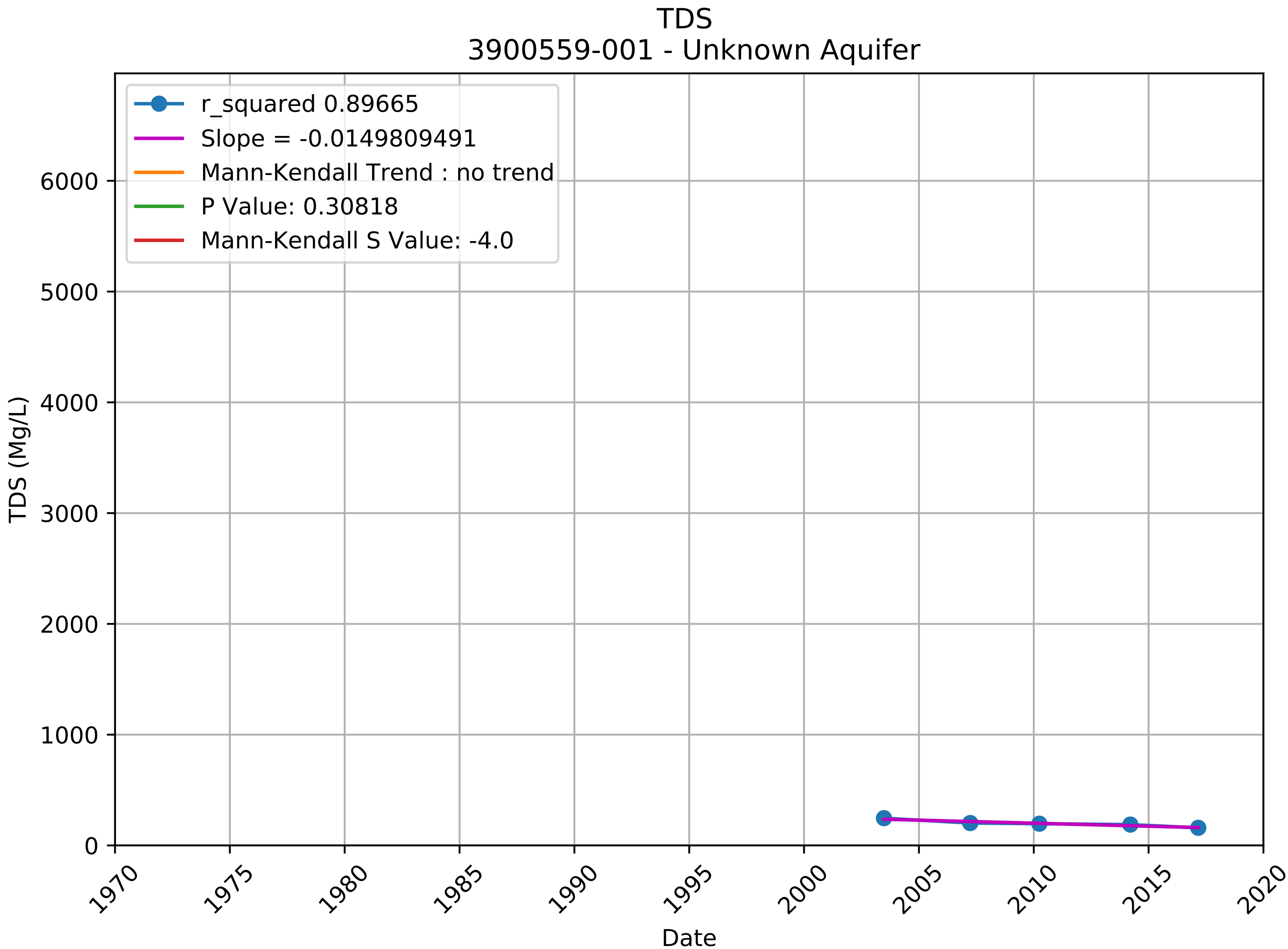

TDS
3900559-001 - Unknown Aquifer
r_squared 0.89665
Slope = -0.0149809491
Mann-Kendall Trend : no trend
P Value: 0.30818
Mann-Kendall S Value: -4.0
TDS (Mg/L)
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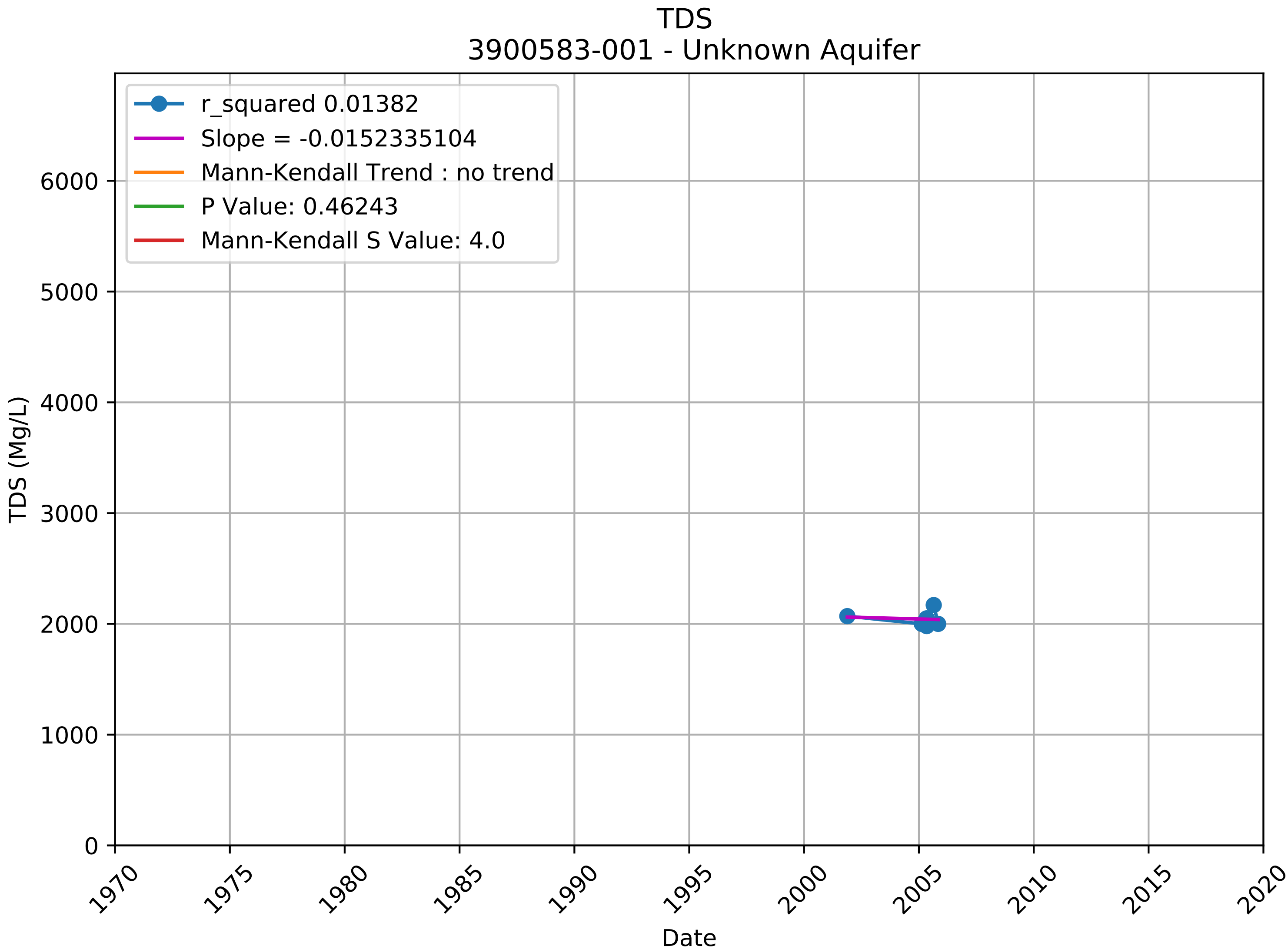

TDS
3900583-001 - Unknown Aquifer
r_squared 0.01382
Slope = -0.0152335104
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: 4.0
TDS (Mg/L)
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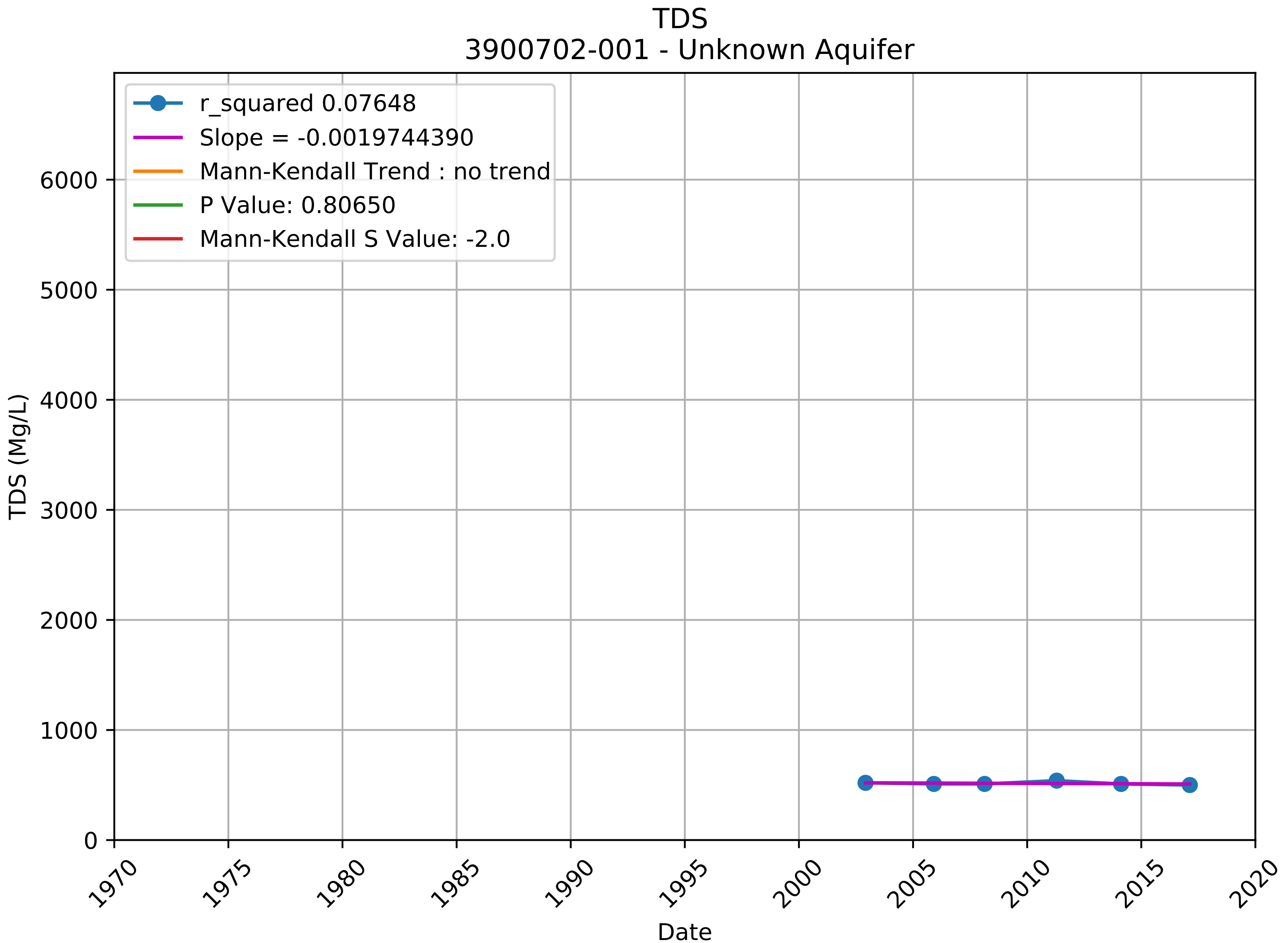
TDS
3900702-001 - Unknown Aquifer
r_squared 0.07648
Slope = -0.0019744390
Mann-Kendall Trend : no trend
P Value: 0.80650
Mann-Kendall S Value: -2.0
TDS (Mg/L)
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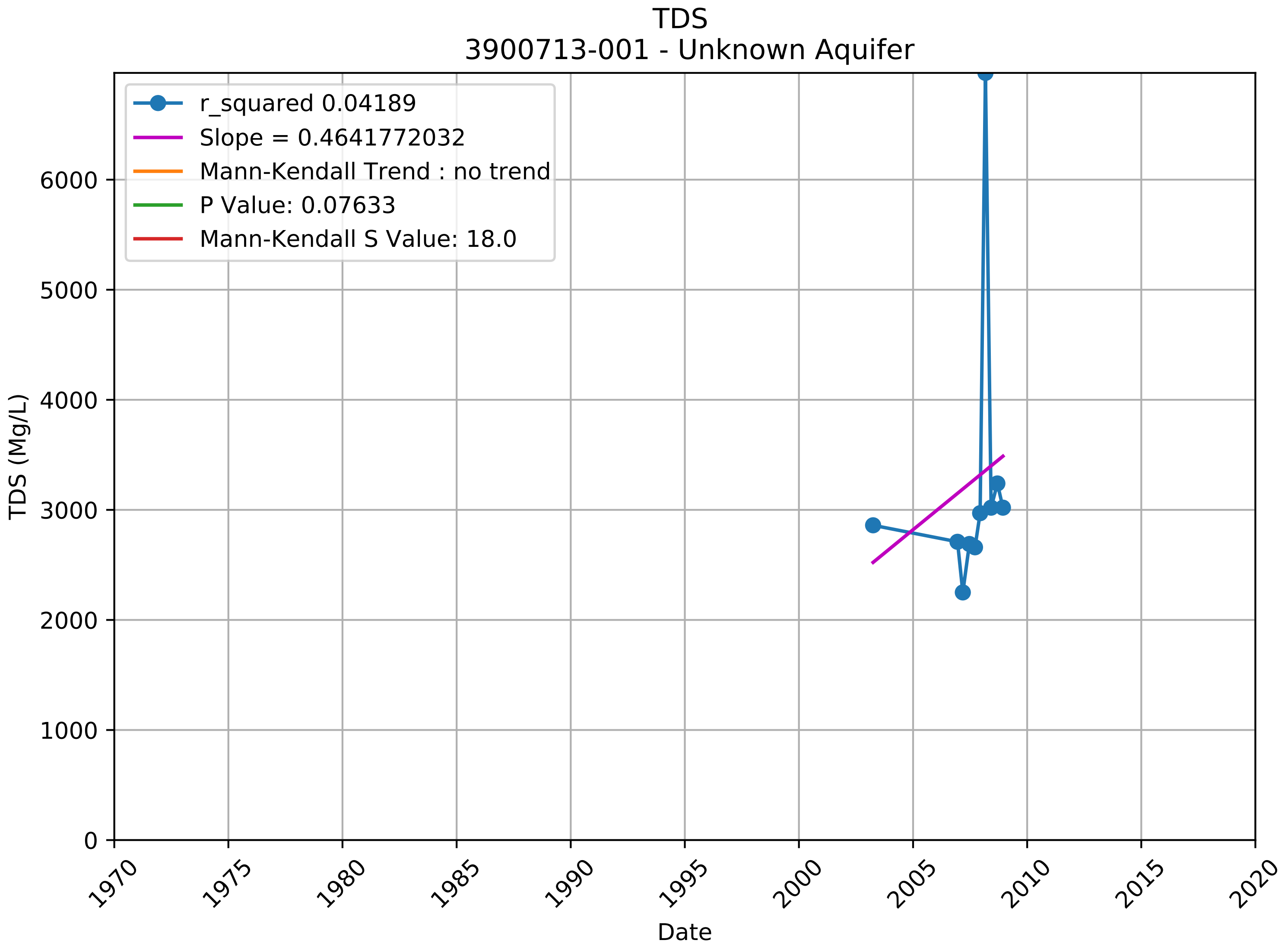
Date



TDS
3900713-001 - Unknown Aquifer
r_squared 0.04189
Slope = 0.4641772032
Mann-Kendall Trend : no trend
P Value: 0.07633
Mann-Kendall S Value: 18.0
TDS (Mg/L)
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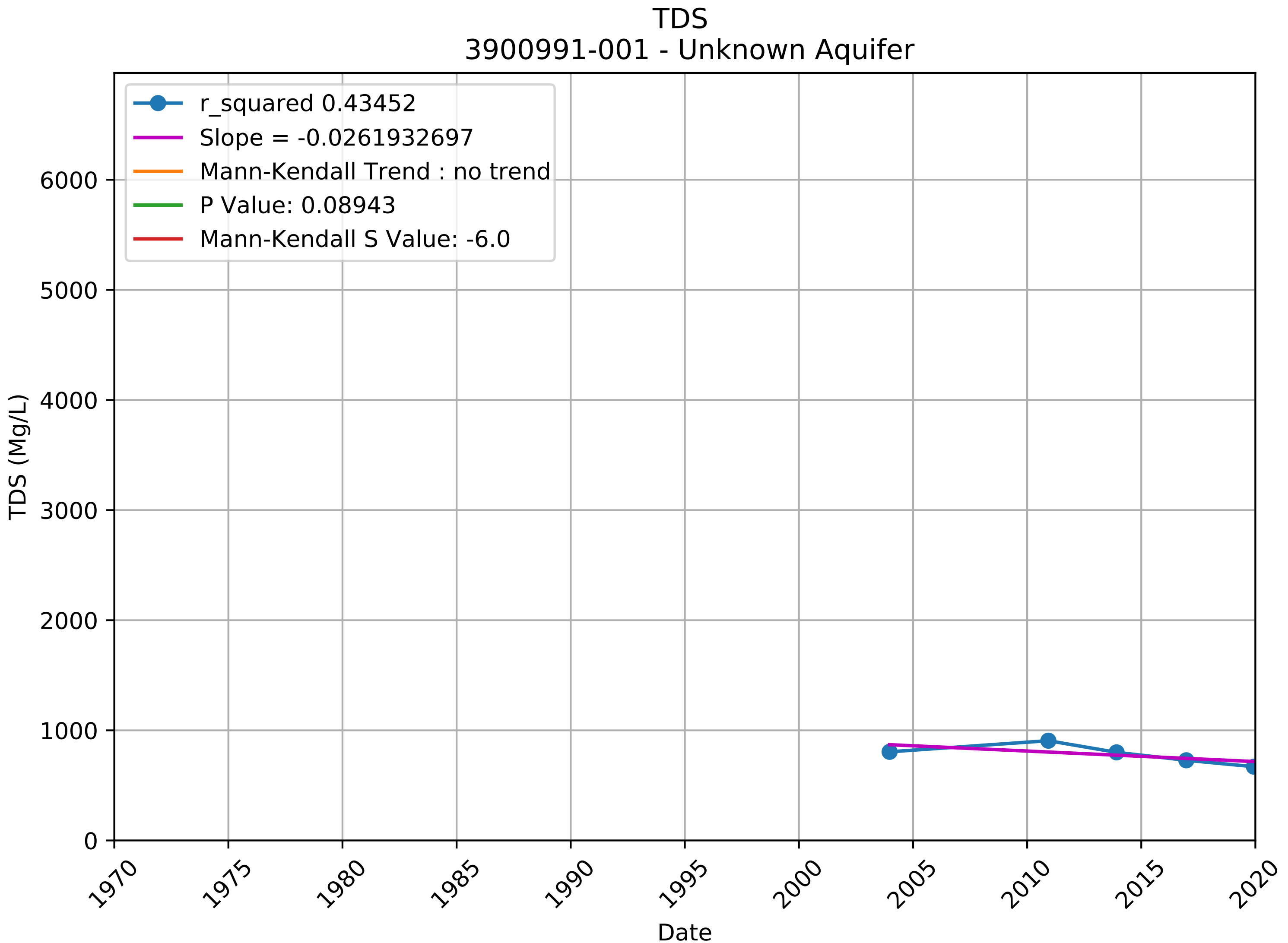

TDS
3900991-001 - Unknown Aquifer
r_squared 0.43452
Slope = -0.0261932697
Mann-Kendall Trend : no trend
P Value: 0.08943
Mann-Kendall S Value: -6.0
TDS (Mg/L)
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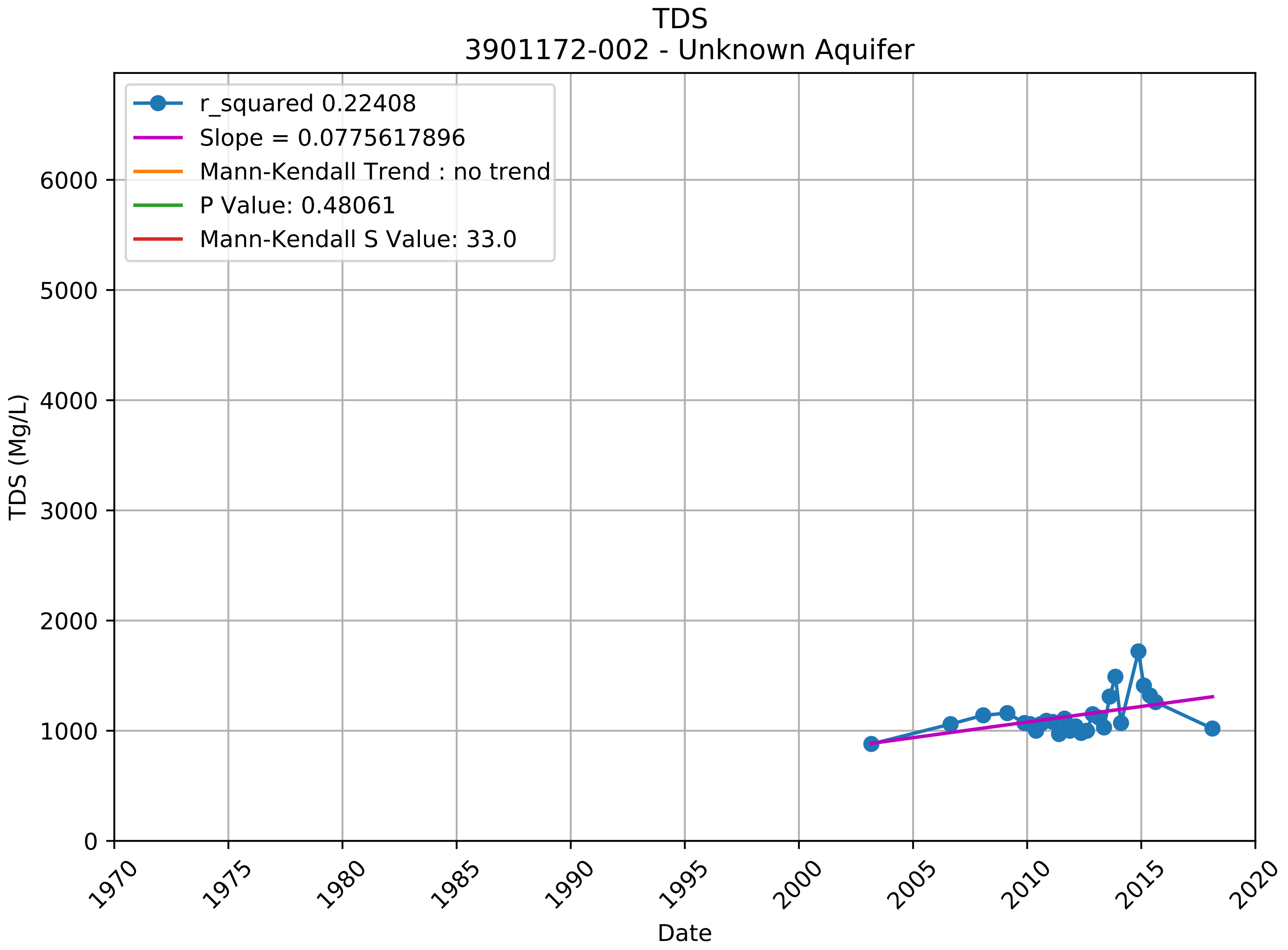
TDS
3901172-002 - Unknown Aquifer
r_squared 0.22408
Slope = 0.0775617896
Mann-Kendall Trend : no trend
P Value: 0.48061
Mann-Kendall S Value: 33.0
TDS (Mg/L)
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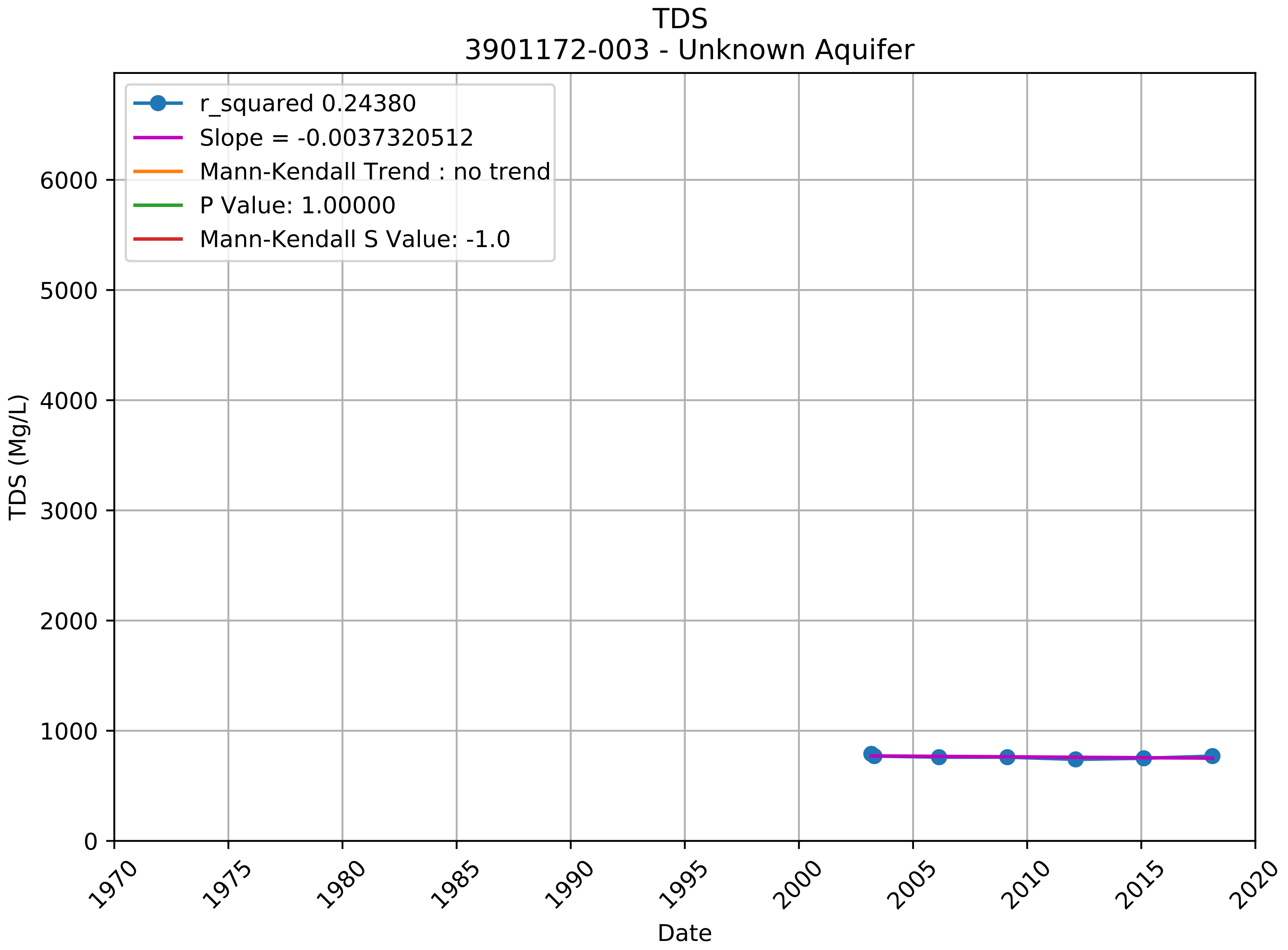

TDS
3901172-003 - Unknown Aquifer
r_squared 0.24380
Slope = -0.0037320512
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
TDS (Mg/L)
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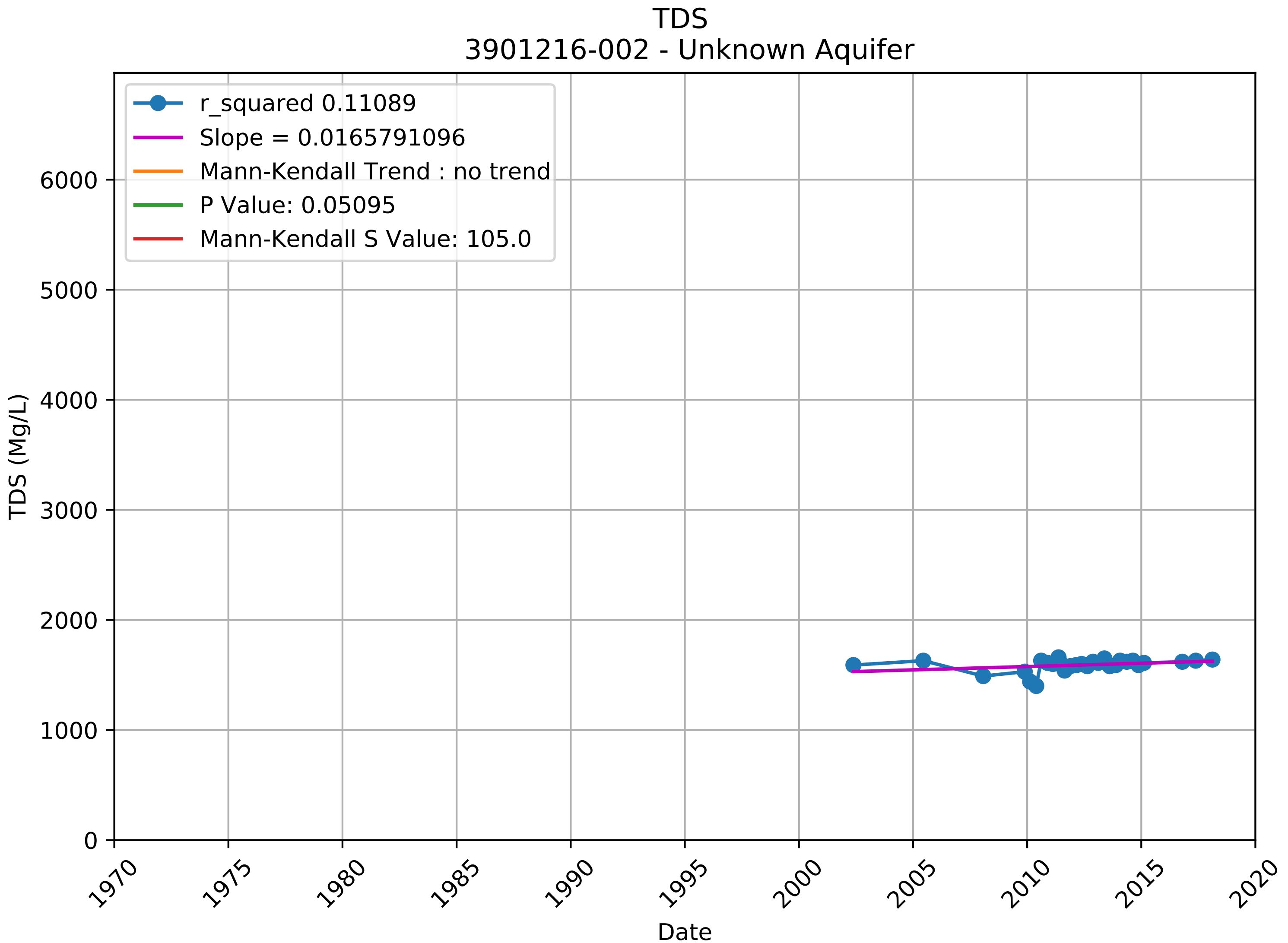
TDS
3901216-002 - Unknown Aquifer
r_squared 0.11089
Slope = 0.0165791096
Mann-Kendall Trend : no trend
P Value: 0.05095
Mann-Kendall S Value: 105.0
TDS (Mg/L)
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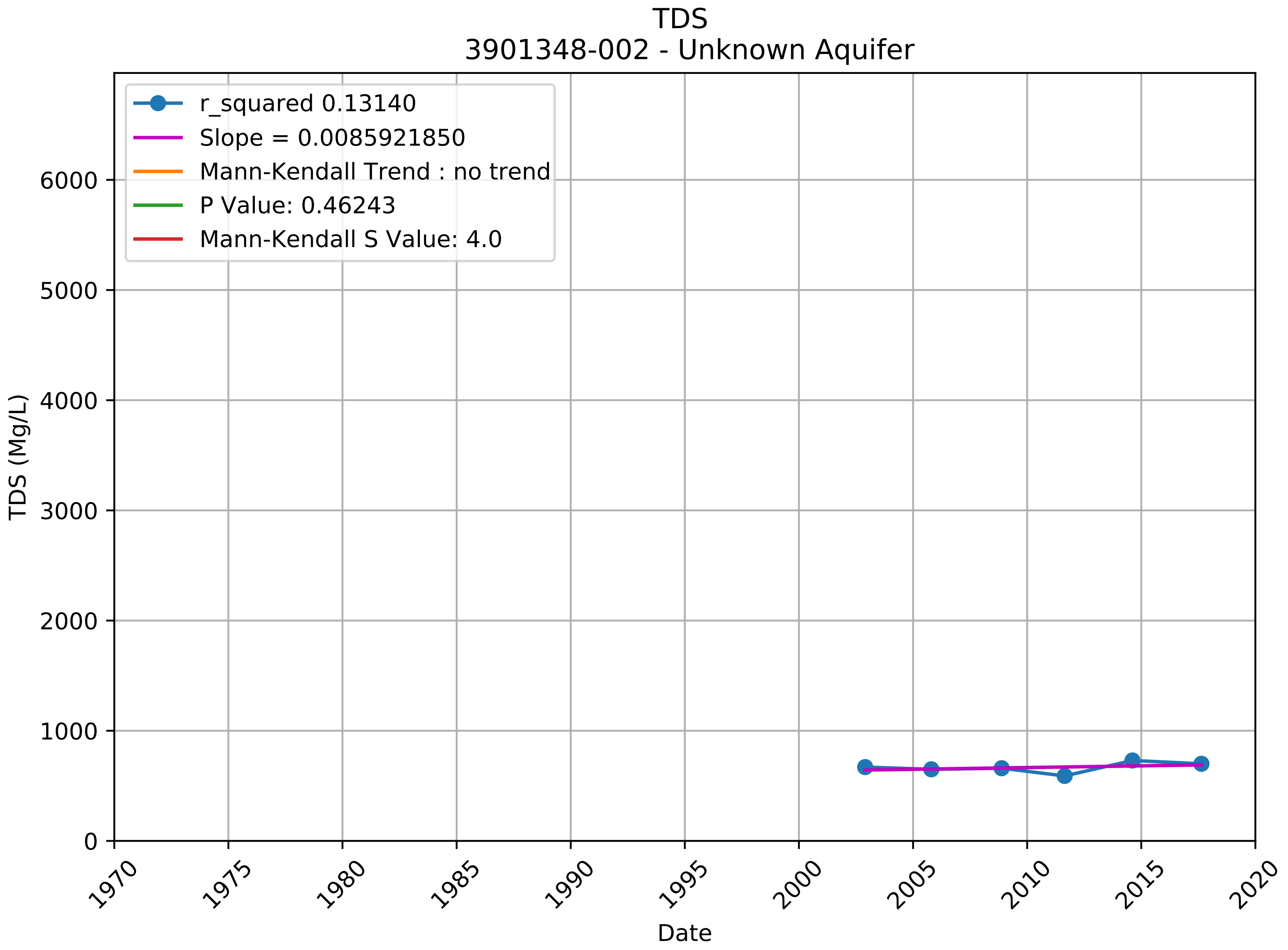
TDS
3901348-002 - Unknown Aquifer
r_squared 0.13140
Slope = 0.0085921850
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: 4.0
TDS (Mg/L)
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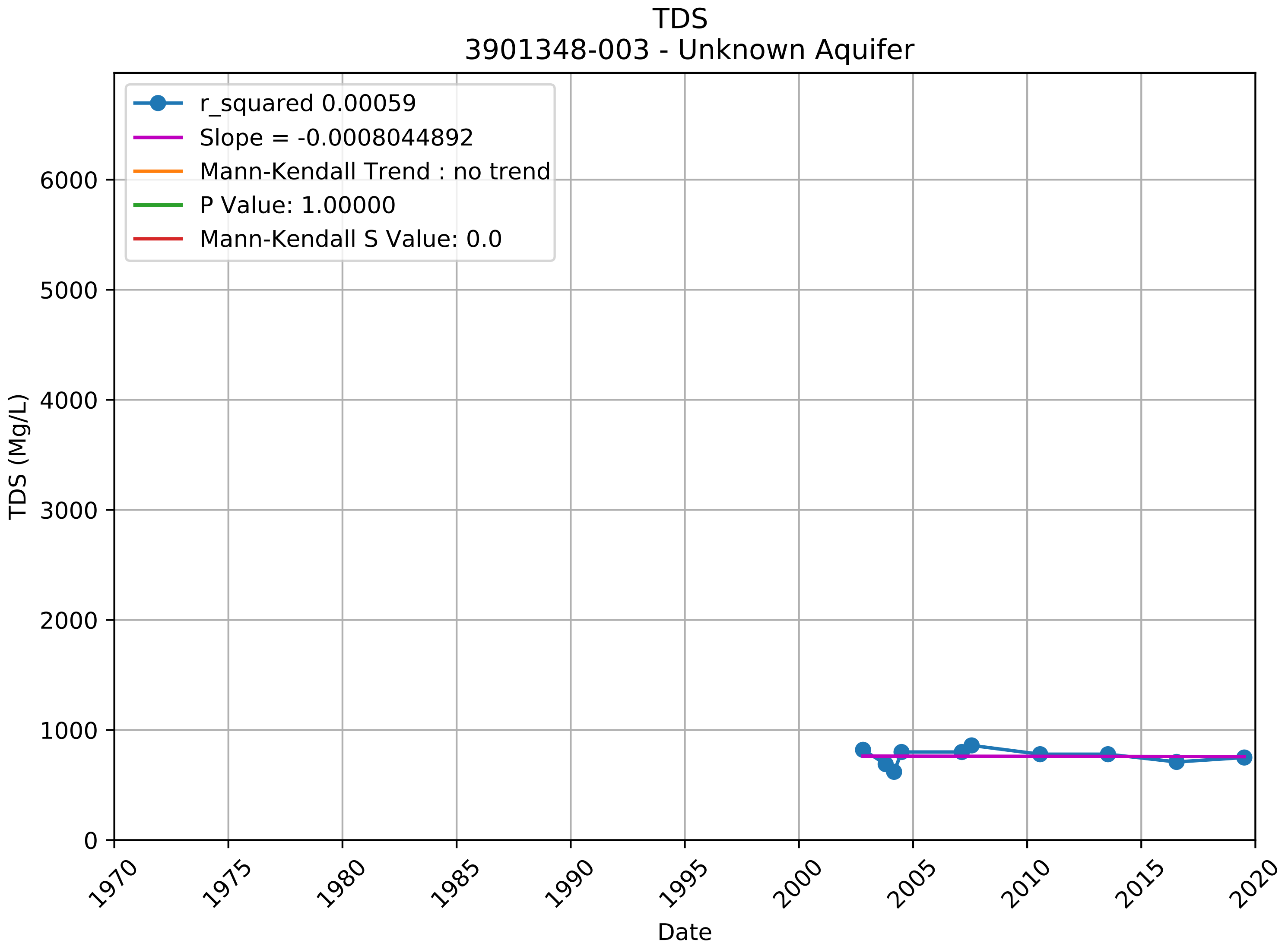

TDS
3901348-003 - Unknown Aquifer
r_squared 0.00059
Slope = -0.0008044892
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
TDS (Mg/L)
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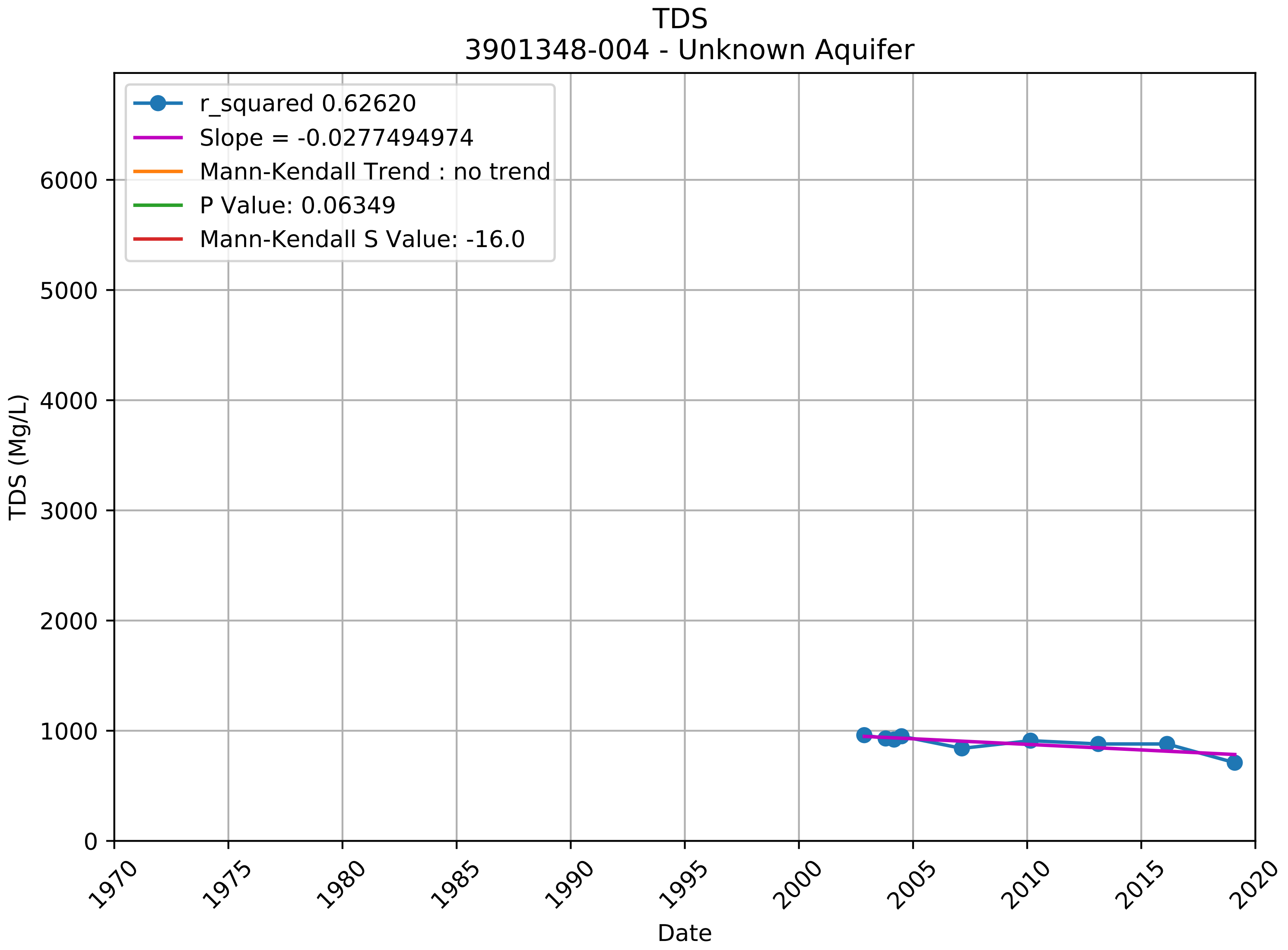

TDS
3901348-004 - Unknown Aquifer
r_squared 0.62620
Slope = -0.0277494974
Mann-Kendall Trend : no trend
P Value: 0.06349
Mann-Kendall S Value: -16.0
TDS (Mg/L)
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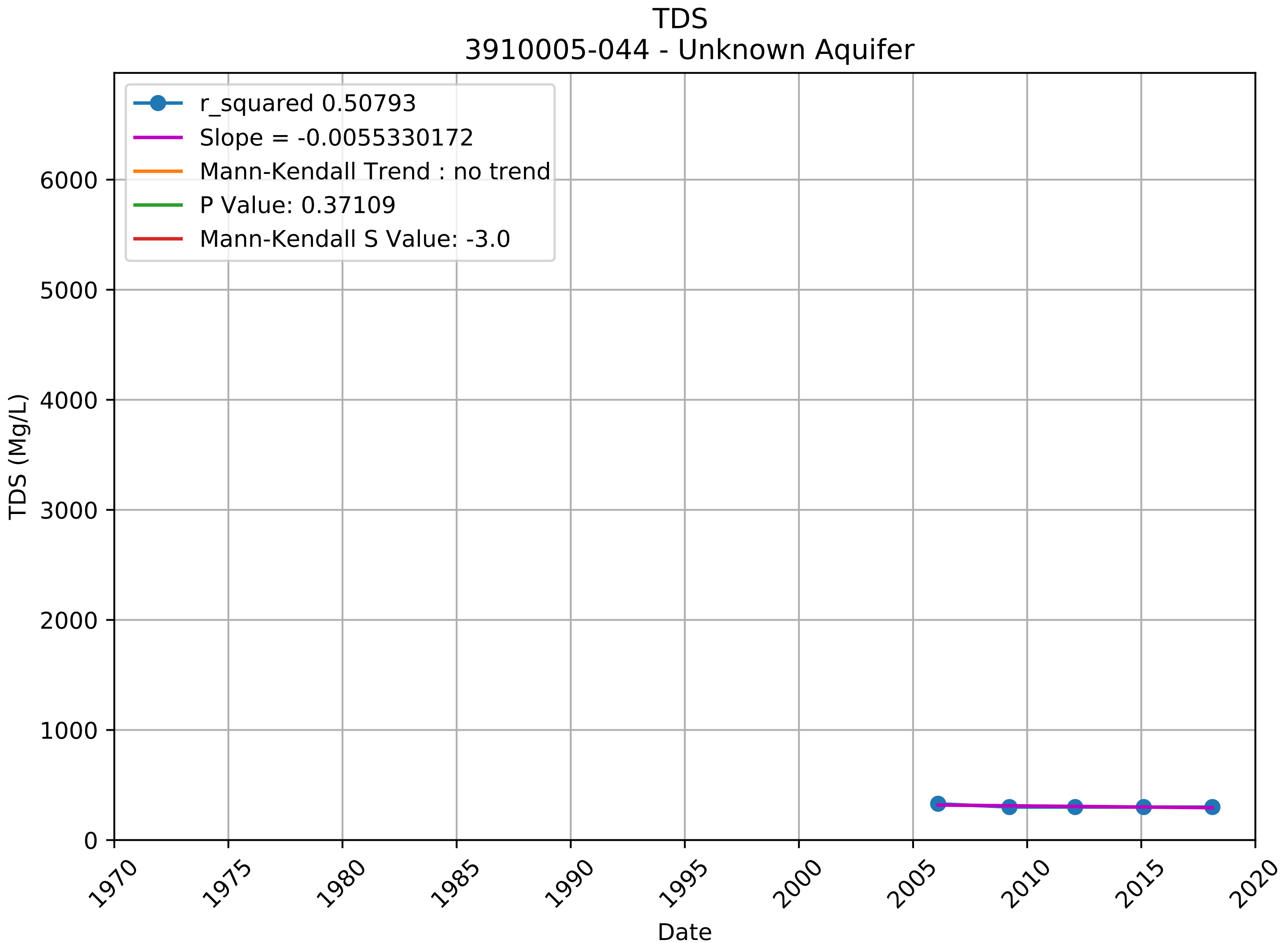
TDS
3910005-044 - Unknown Aquifer
r_squared 0.50793
Slope = -0.0055330172
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: -3.0
TDS (Mg/L)
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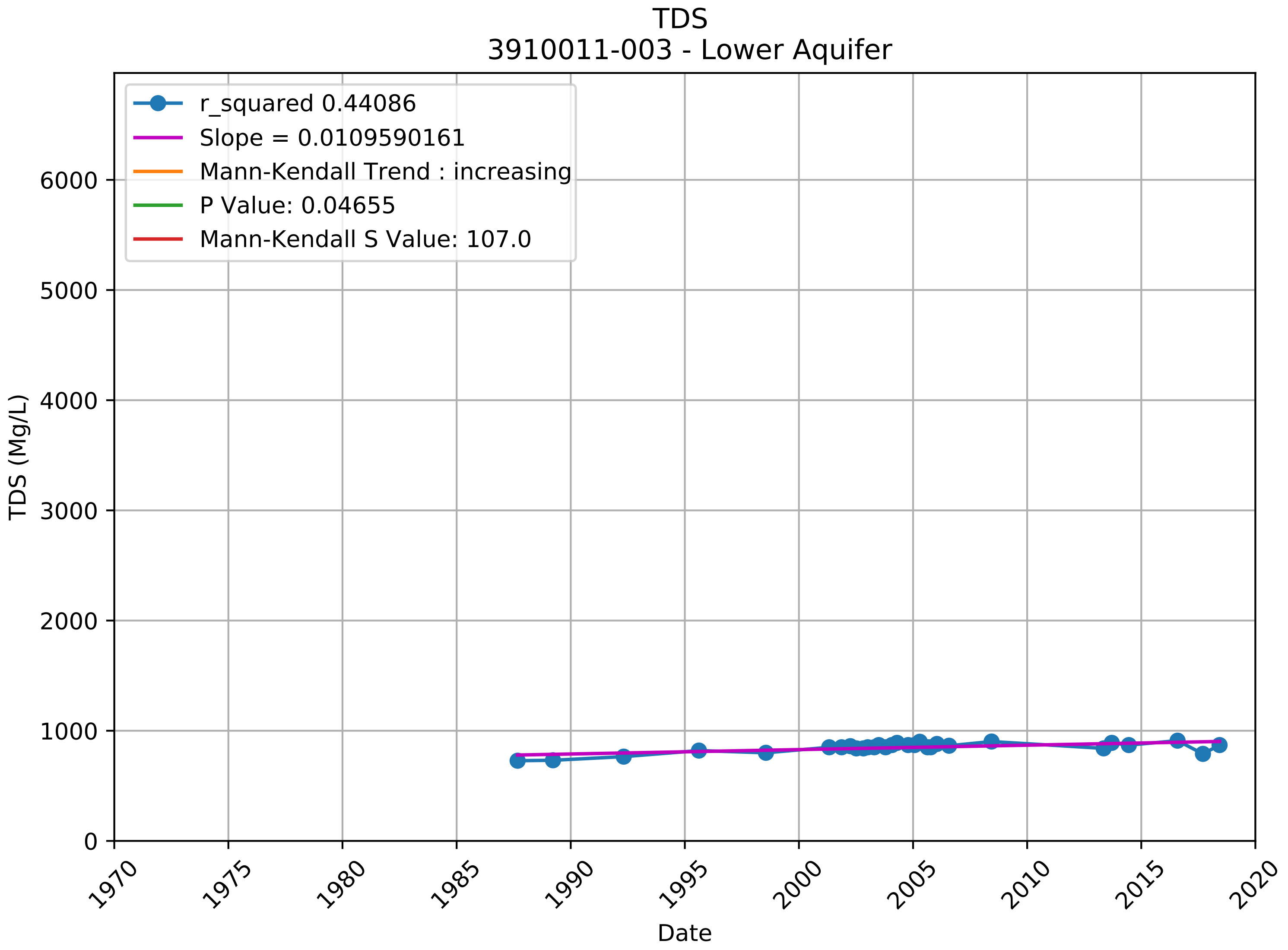

TDS
3910011-003 - Lower Aquifer
r_squared 0.44086
Slope = 0.0109590161
Mann-Kendall Trend : increasing
P Value: 0.04655
Mann-Kendall S Value: 107.0
TDS (Mg/L)
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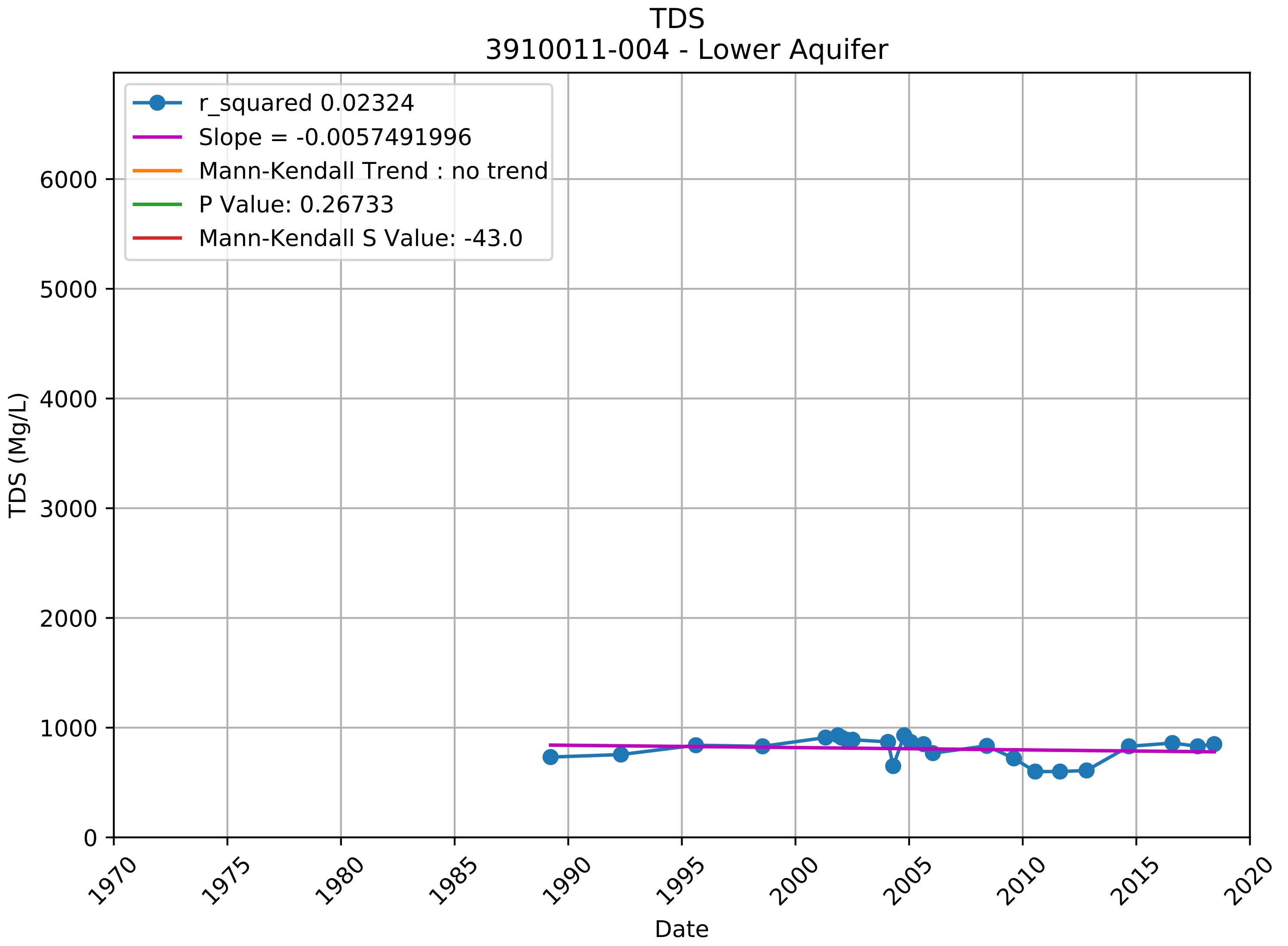

TDS
3910011-004 - Lower Aquifer
r_squared 0.02324
Slope = -0.0057491996
Mann-Kendall Trend : no trend
P Value: 0.26733
Mann-Kendall S Value: -43.0
TDS (Mg/L)
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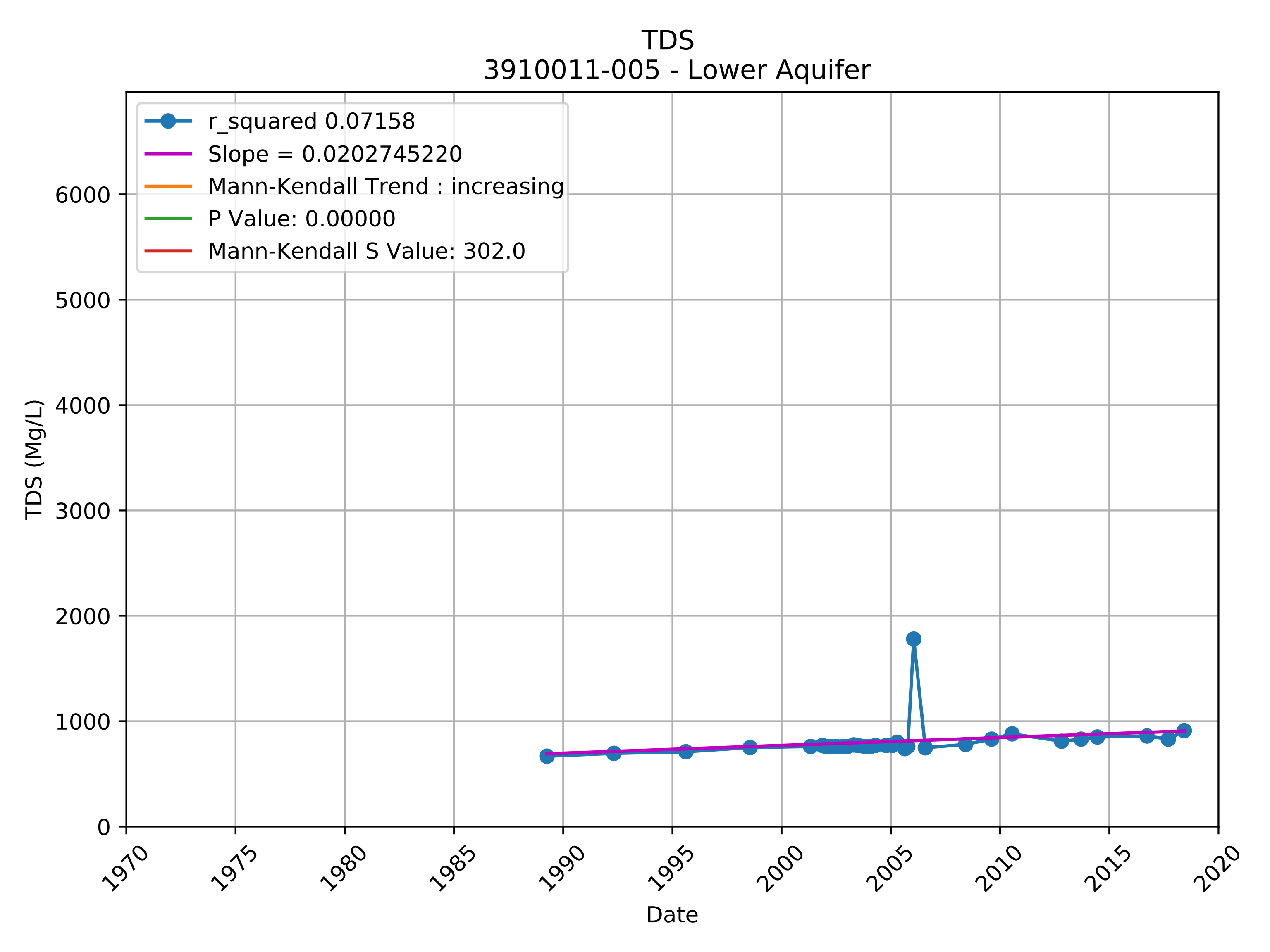

TDS
3910011-005 - Lower Aquifer
r_squared 0.07158
Slope = 0.0202745220
Mann-Kendall Trend : increasing
P Value: 0.00000
Mann-Kendall S Value: 302.0
TDS (Mg/L)
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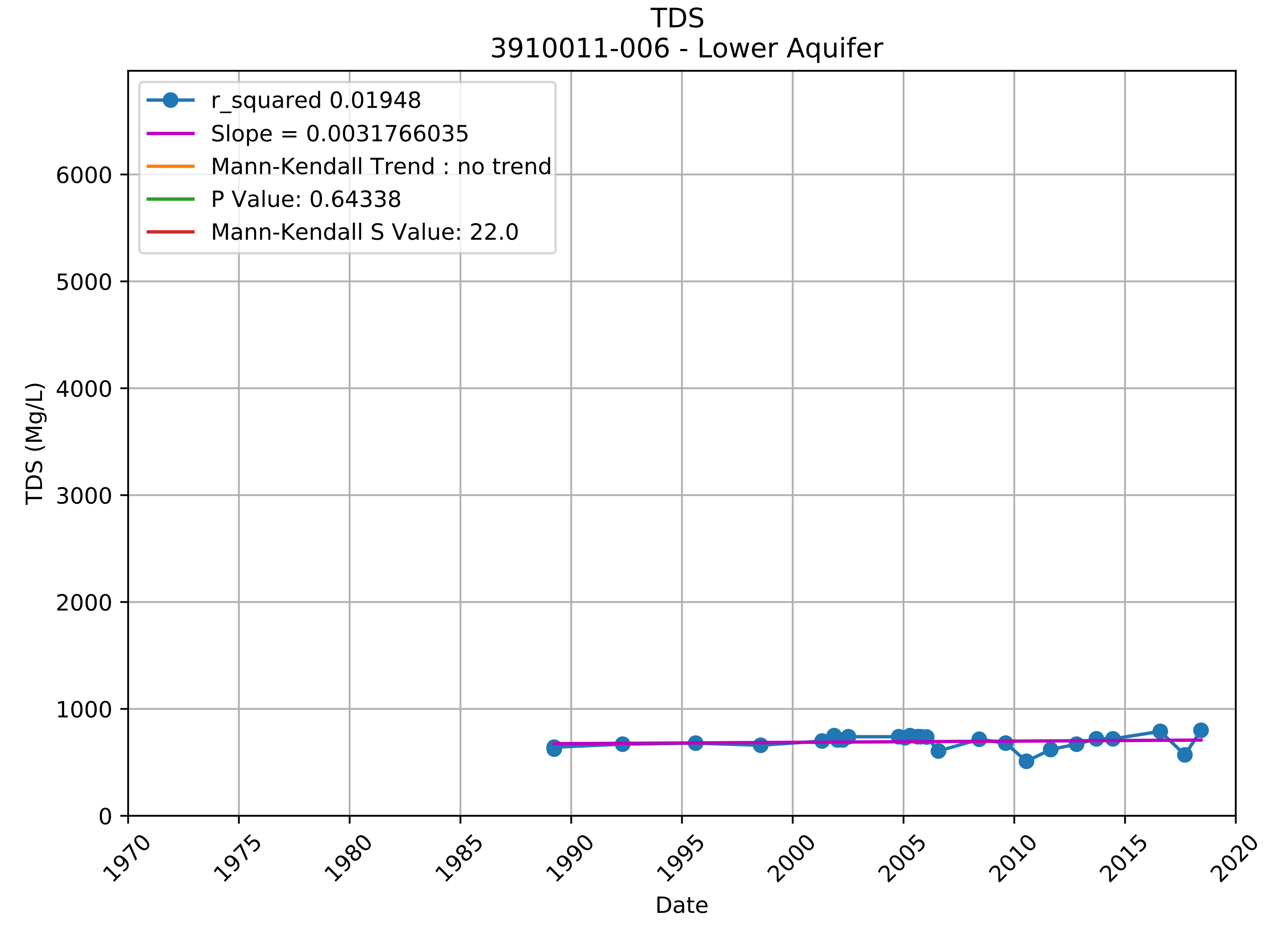
Date


TDS
3910011-006 - Lower Aquifer
r_squared 0.01948
Slope = 0.0031766035
Mann-Kendall Trend : no trend
P Value: 0.64338
Mann-Kendall S Value: 22.0
TDS (Mg/L)
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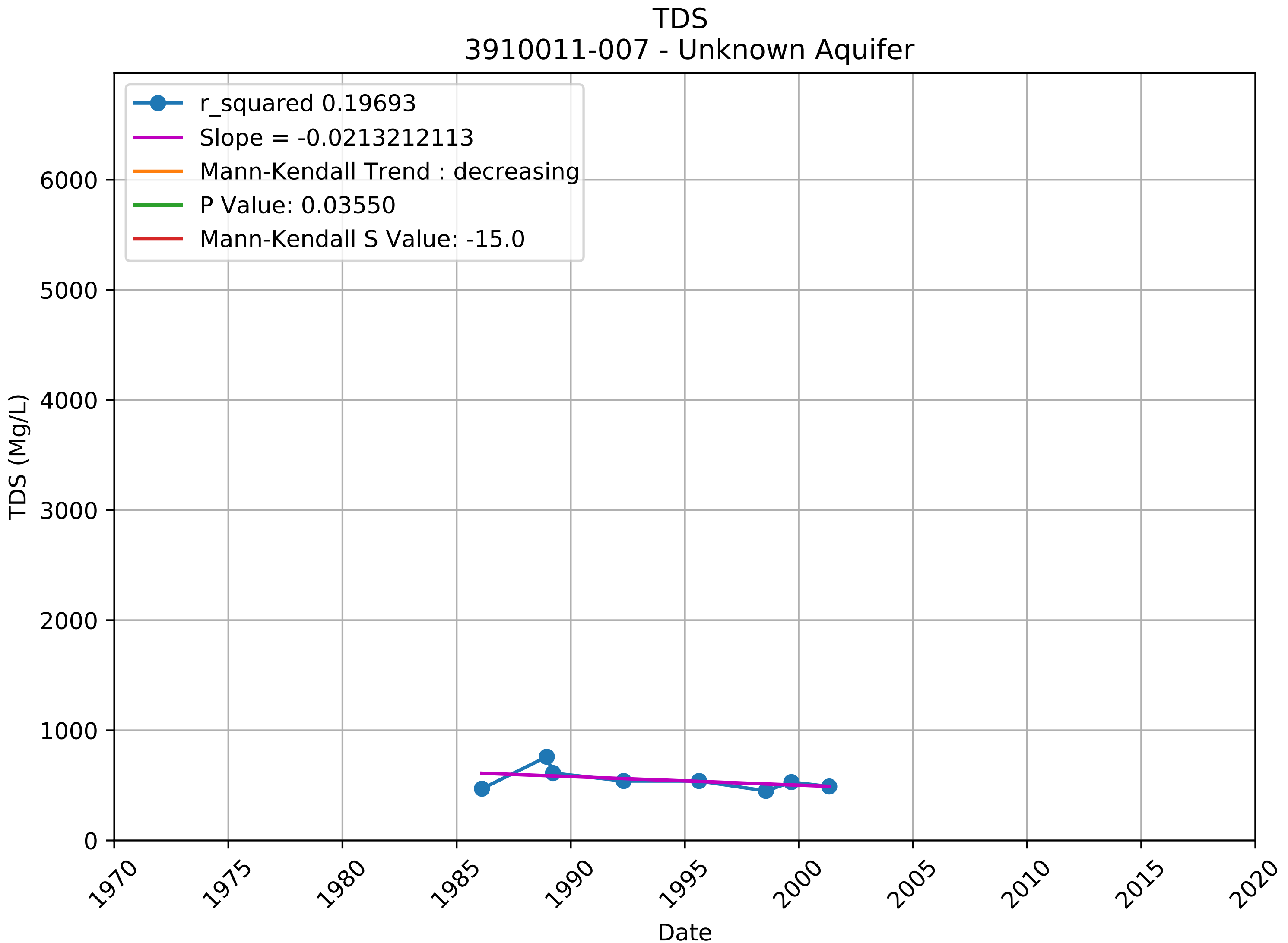
TDS
3910011-007 - Unknown Aquifer
r_squared 0.19693
Slope = -0.0213212113
Mann-Kendall Trend : decreasing
P Value: 0.03550
Mann-Kendall S Value: -15.0
TDS (Mg/L)
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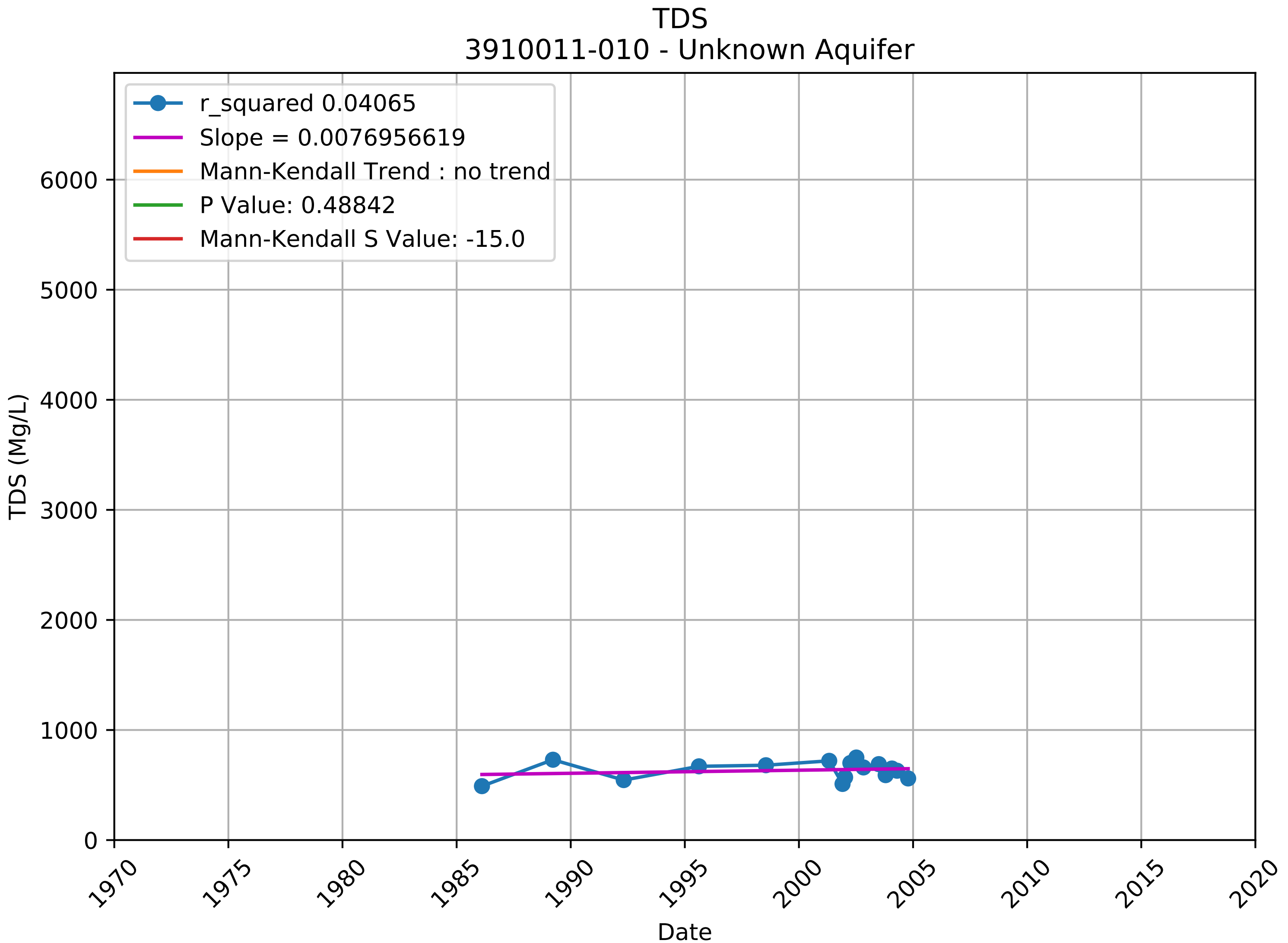

TDS
3910011-010 - Unknown Aquifer
r_squared 0.04065
Slope = 0.0076956619
Mann-Kendall Trend : no trend
P Value: 0.48842
Mann-Kendall S Value: -15.0
TDS (Mg/L)
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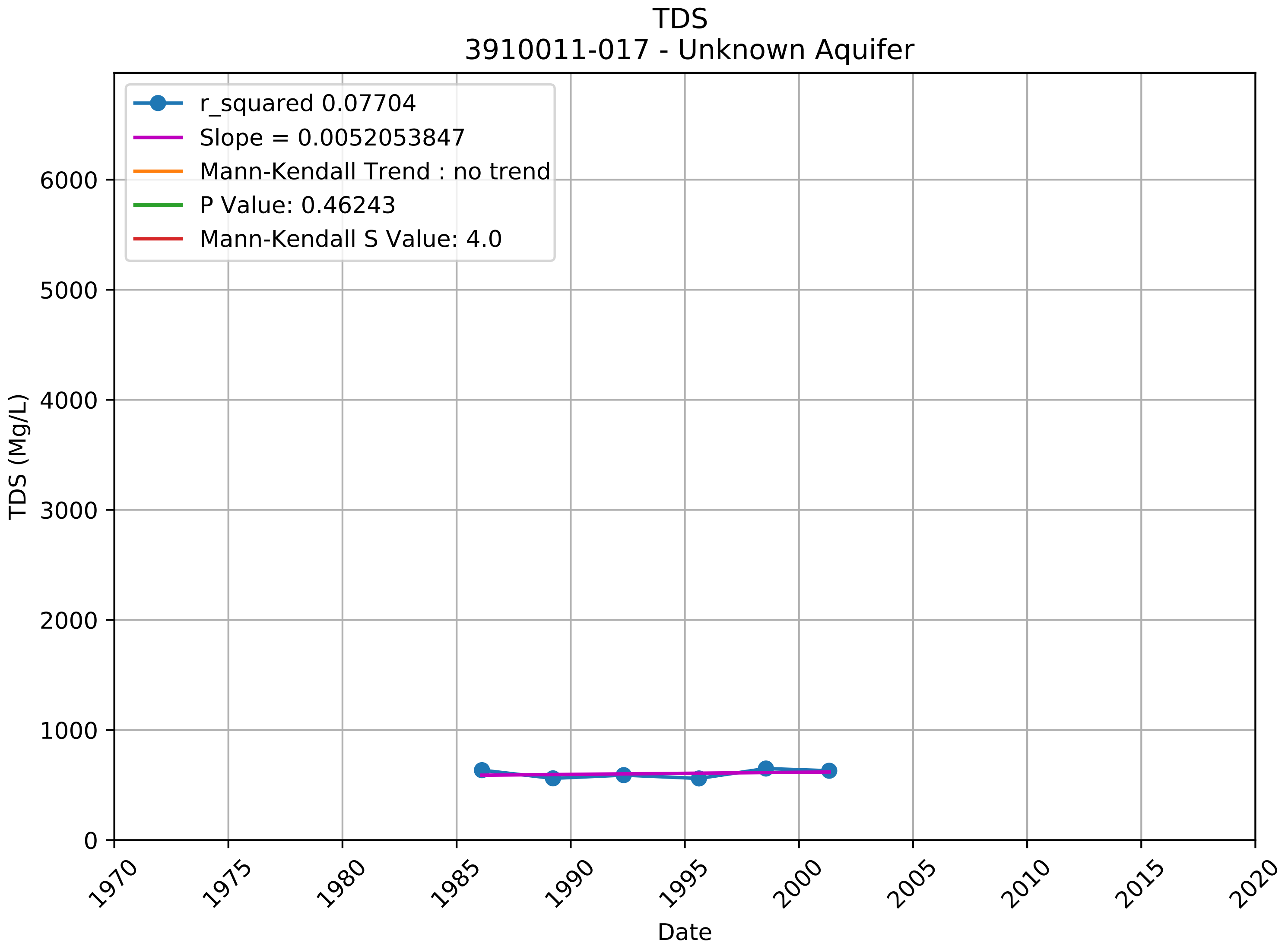
Date


TDS
3910011-017 - Unknown Aquifer
r_squared 0.07704
Slope = 0.0052053847
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: 4.0
TDS (Mg/L)
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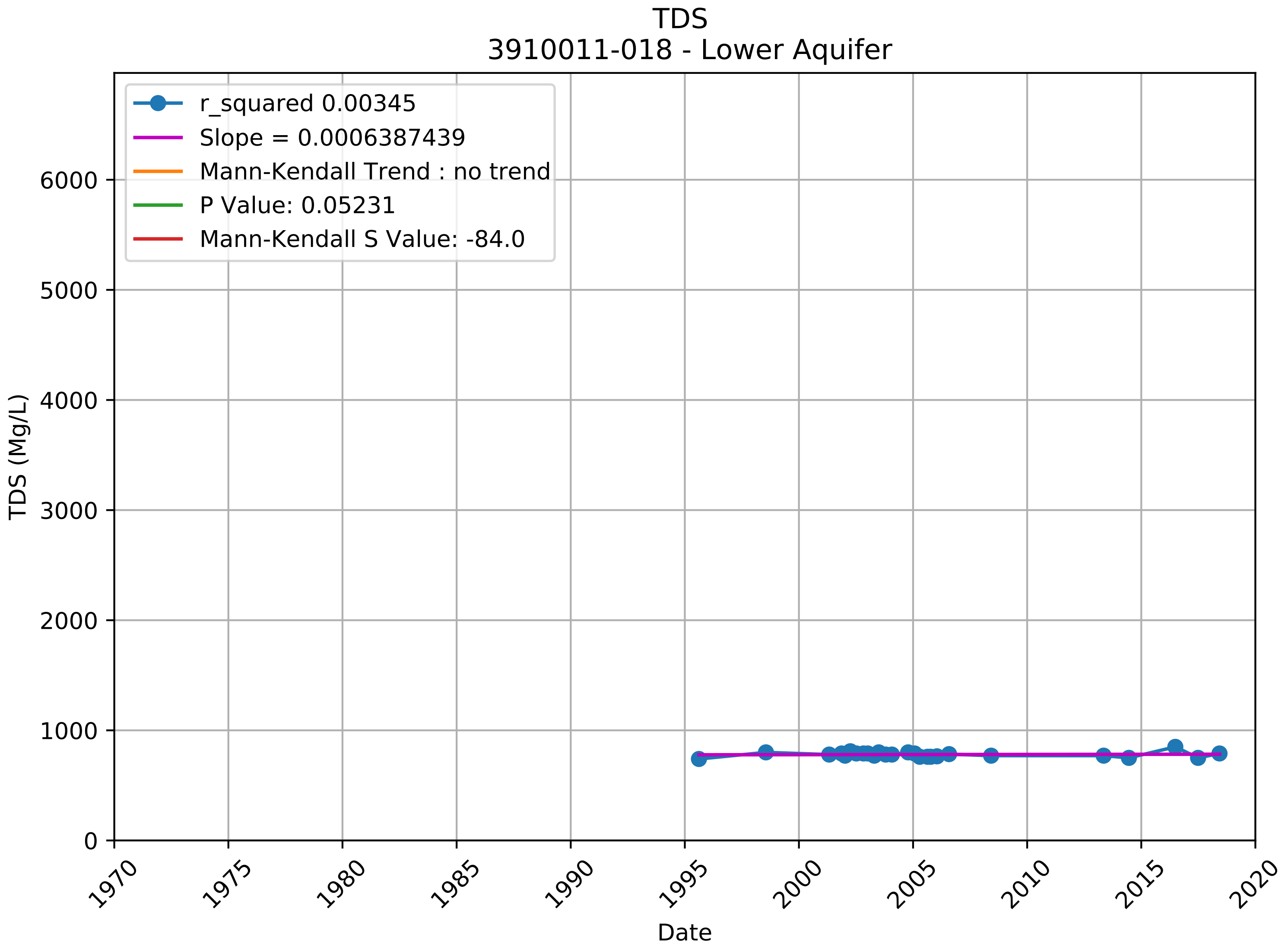

TDS
3910011-018 - Lower Aquifer
r_squared 0.00345
Slope = 0.0006387439
Mann-Kendall Trend : no trend
P Value: 0.05231
Mann-Kendall S Value: -84.0
TDS (Mg/L)
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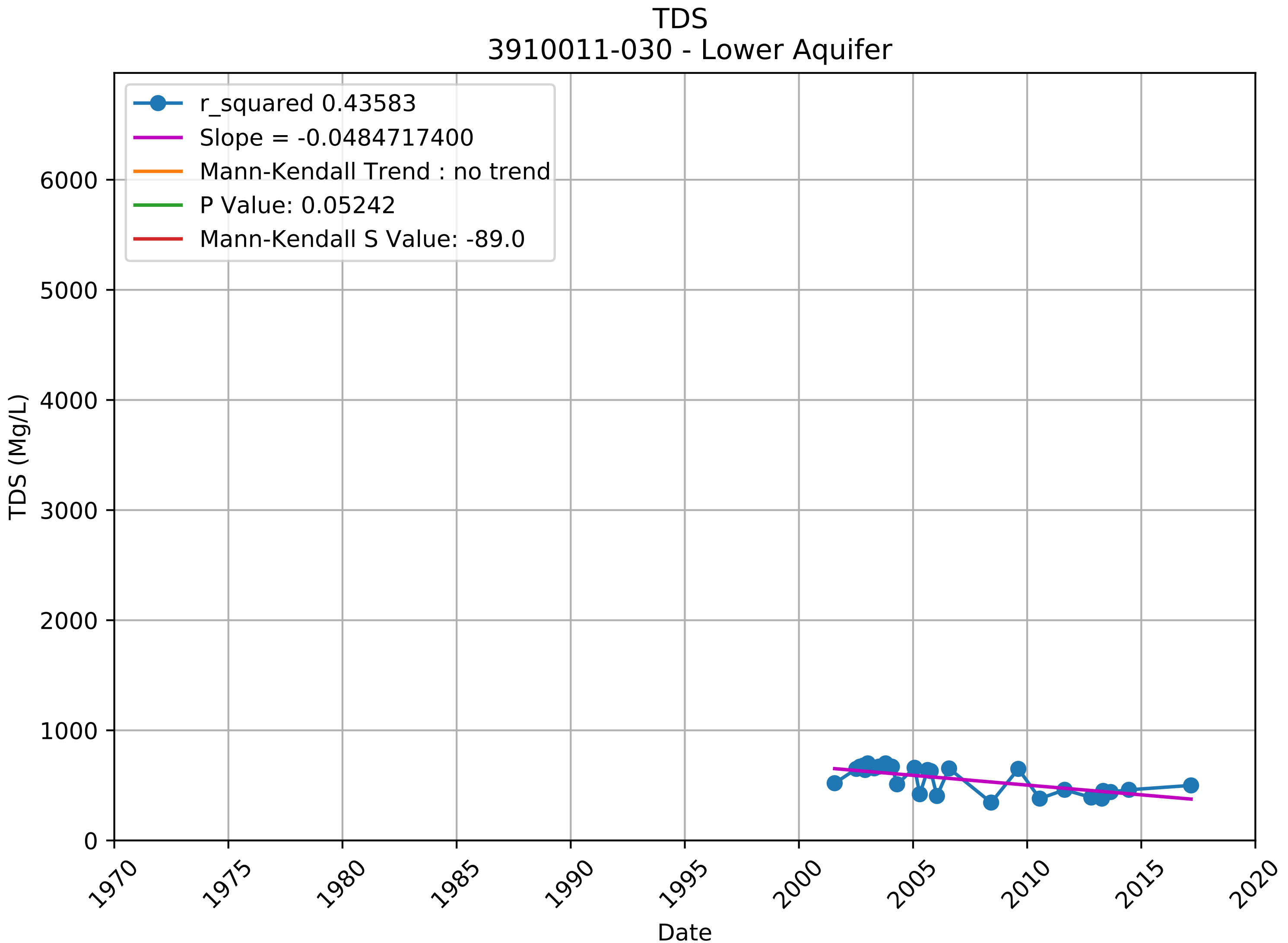
Date


TDS
3910011-030 - Lower Aquifer
r_squared 0.43583
Slope = -0.0484717400
Mann-Kendall Trend : no trend
P Value: 0.05242
Mann-Kendall S Value: -89.0
TDS (Mg/L)
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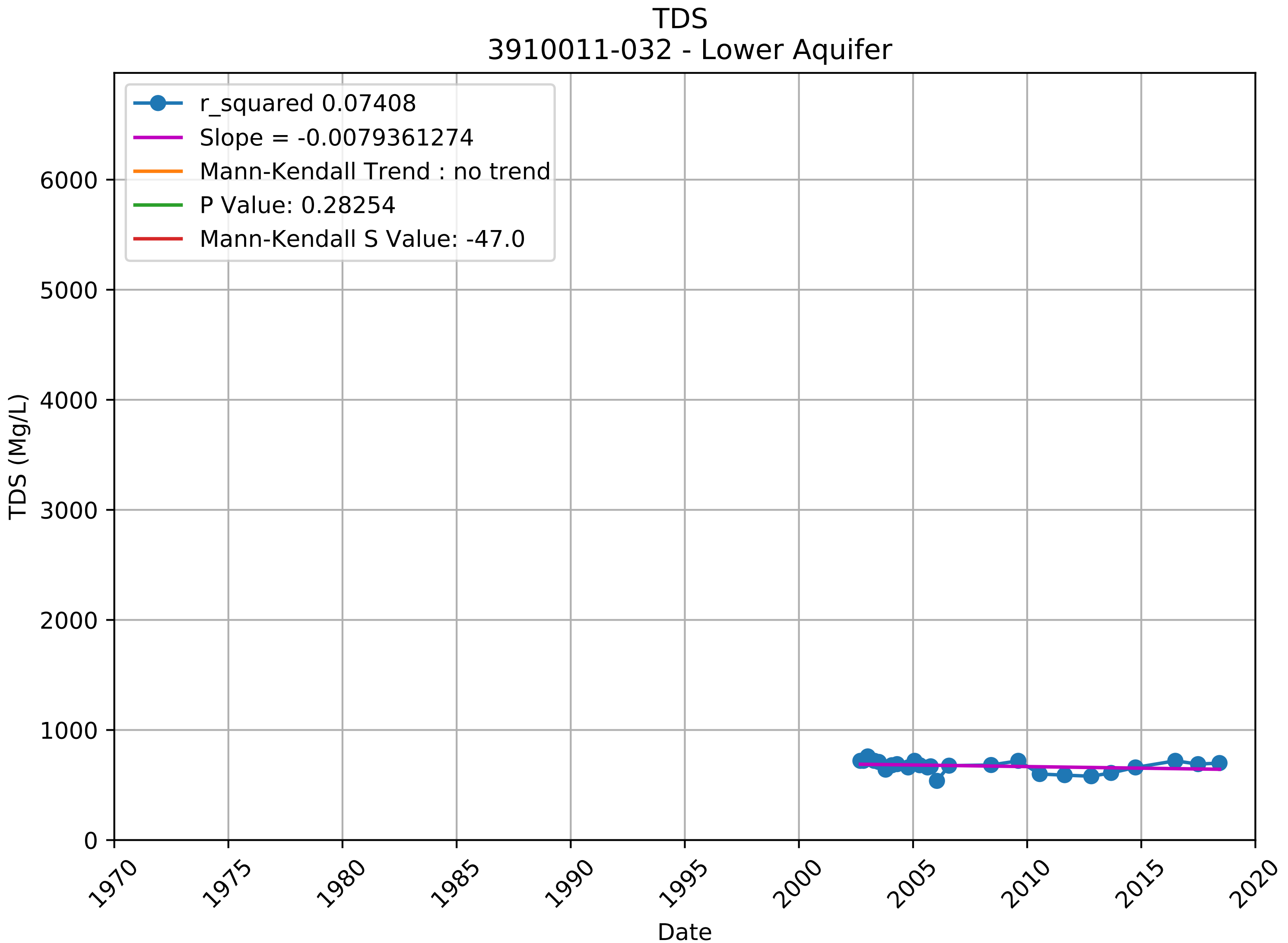
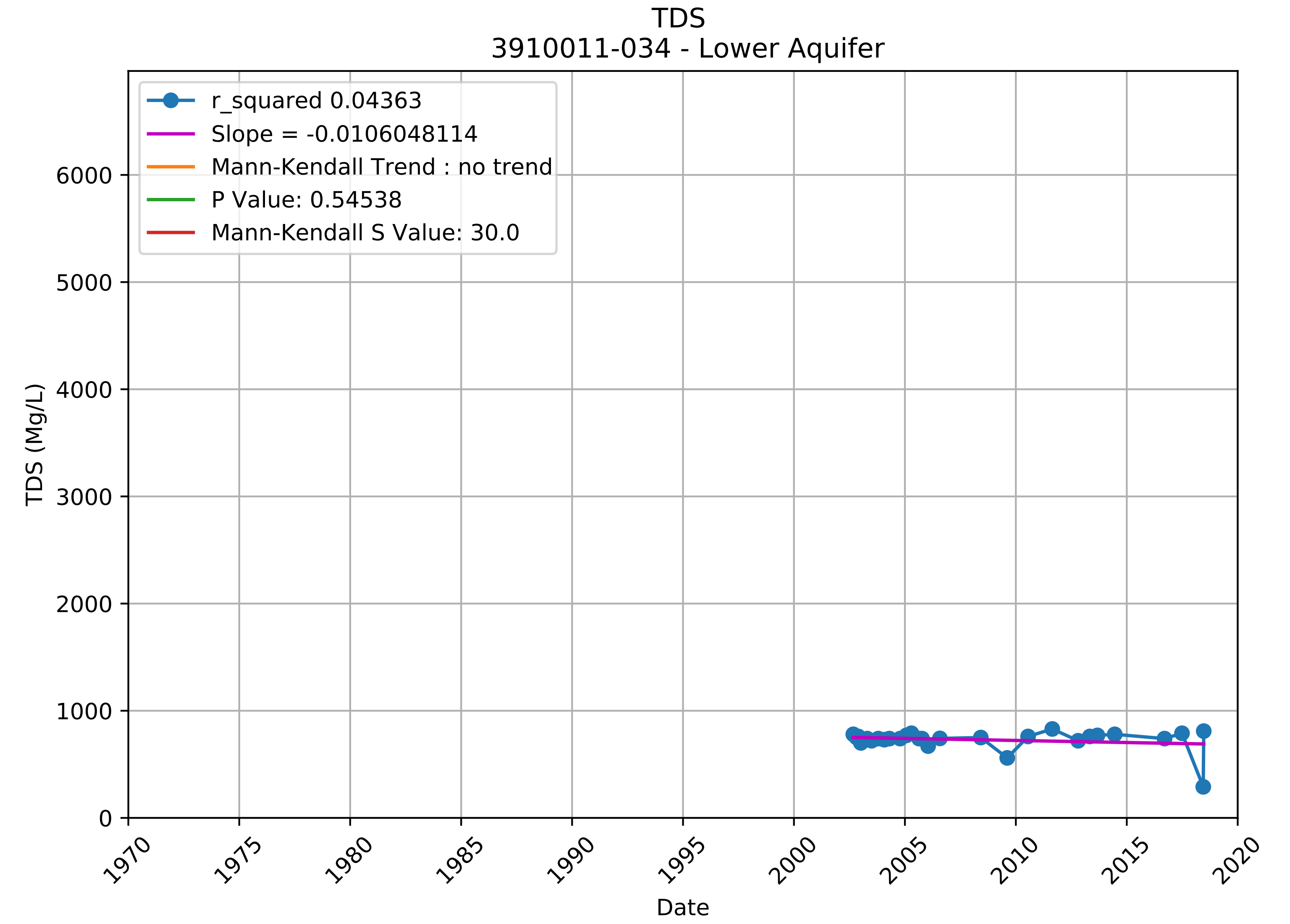

TDS
3910011-032 - Lower Aquifer
r_squared 0.07408
Slope = -0.0079361274
Mann-Kendall Trend : no trend
P Value: 0.28254
Mann-Kendall S Value: -47.0
TDS (Mg/L)
0
1000
2000
3000
4000
5000
6000
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


TDS
3910011-034 - Lower Aquifer
r_squared 0.04363
Slope = -0.0106048114
Mann-Kendall Trend : no trend
P Value: 0.54538
Mann-Kendall S Value: 30.0
TDS (Mg/L)
0
1000
2000
3000
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1970
1975
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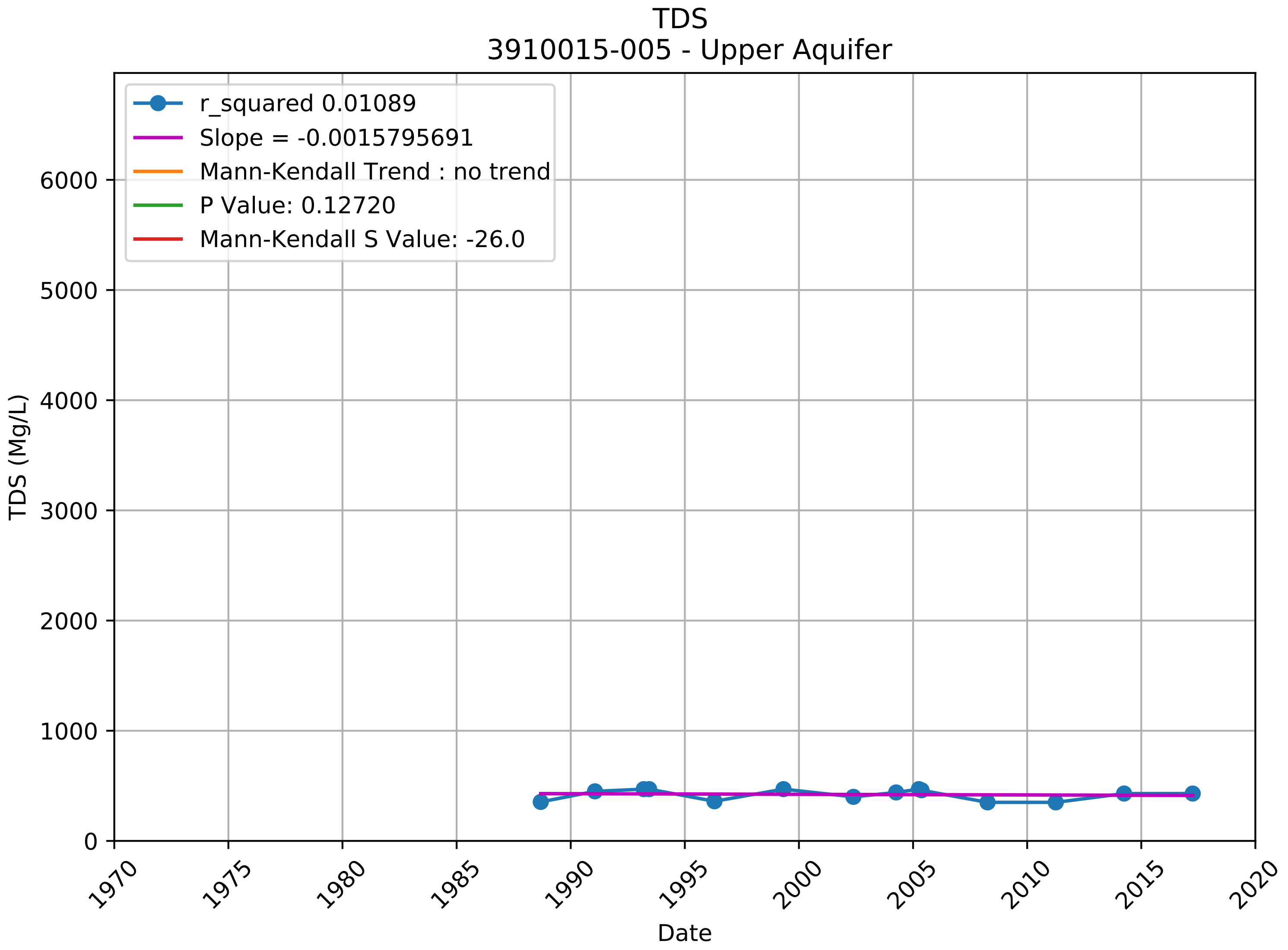
Date


TDS
3910015-005 - Upper Aquifer
r_squared 0.01089
Slope = -0.0015795691
Mann-Kendall Trend : no trend
P Value: 0.12720
Mann-Kendall S Value: -26.0
TDS (Mg/L)
0
1000
2000
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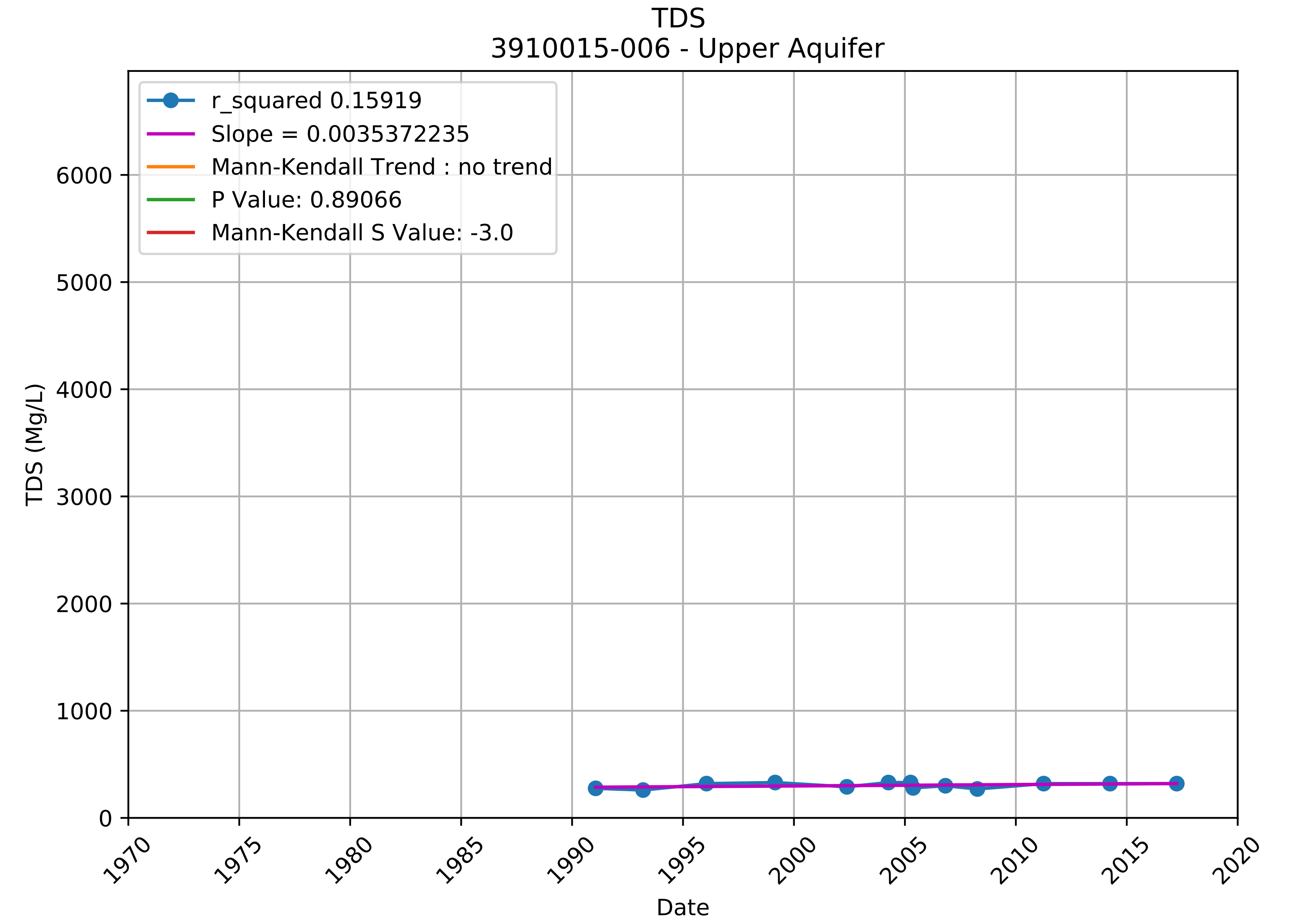
Date



TDS
3910015-006 - Upper Aquifer
r_squared 0.15919
Slope = 0.0035372235
Mann-Kendall Trend : no trend
P Value: 0.89066
Mann-Kendall S Value: -3.0
TDS (Mg/L)
0
1000
2000
3000
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1970
1975
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2015
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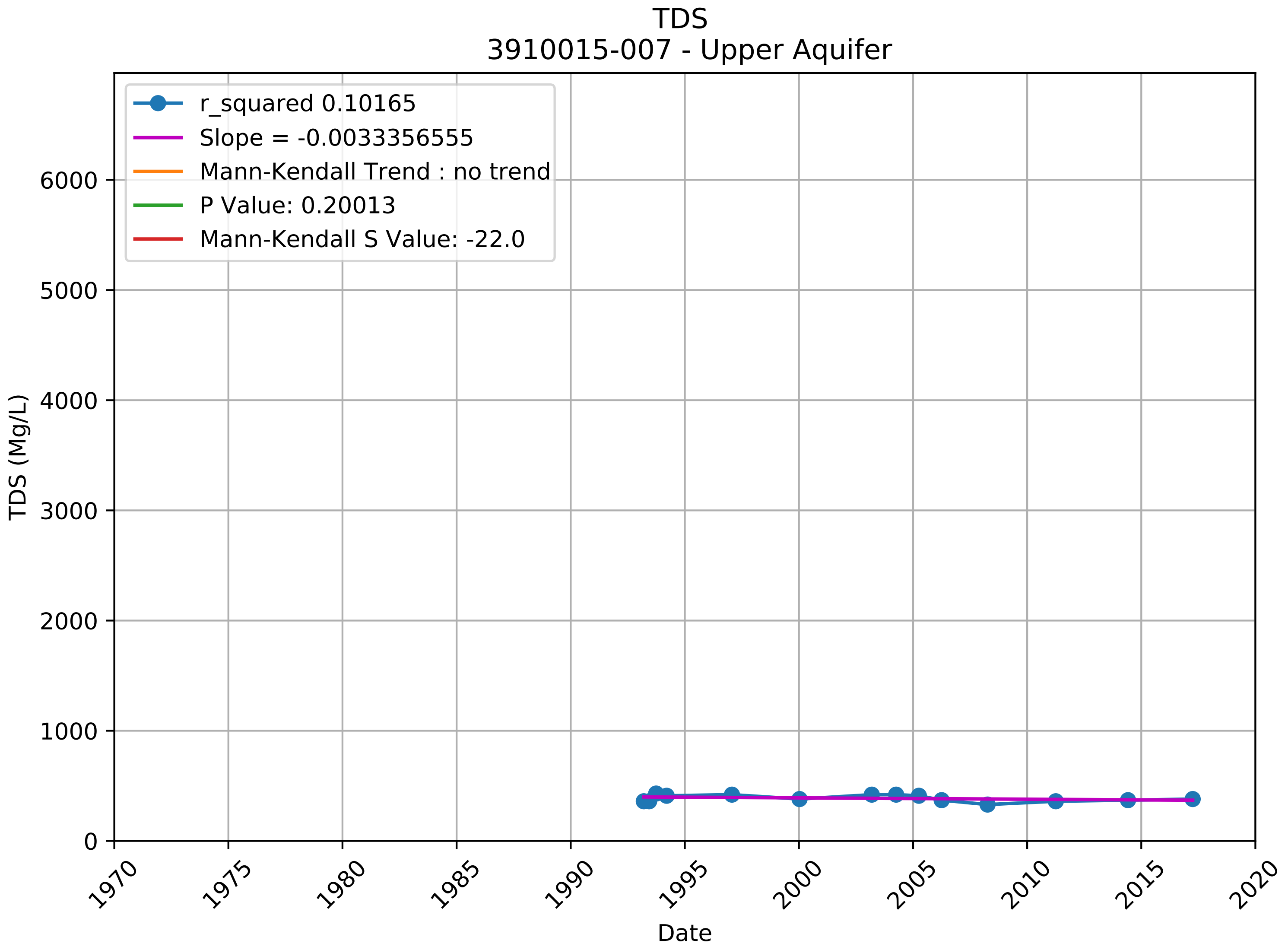
Date


TDS
3910015-007 - Upper Aquifer
r_squared 0.10165
Slope = -0.0033356555
Mann-Kendall Trend : no trend
P Value: 0.20013
Mann-Kendall S Value: -22.0
TDS (Mg/L)
0
1000
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1970
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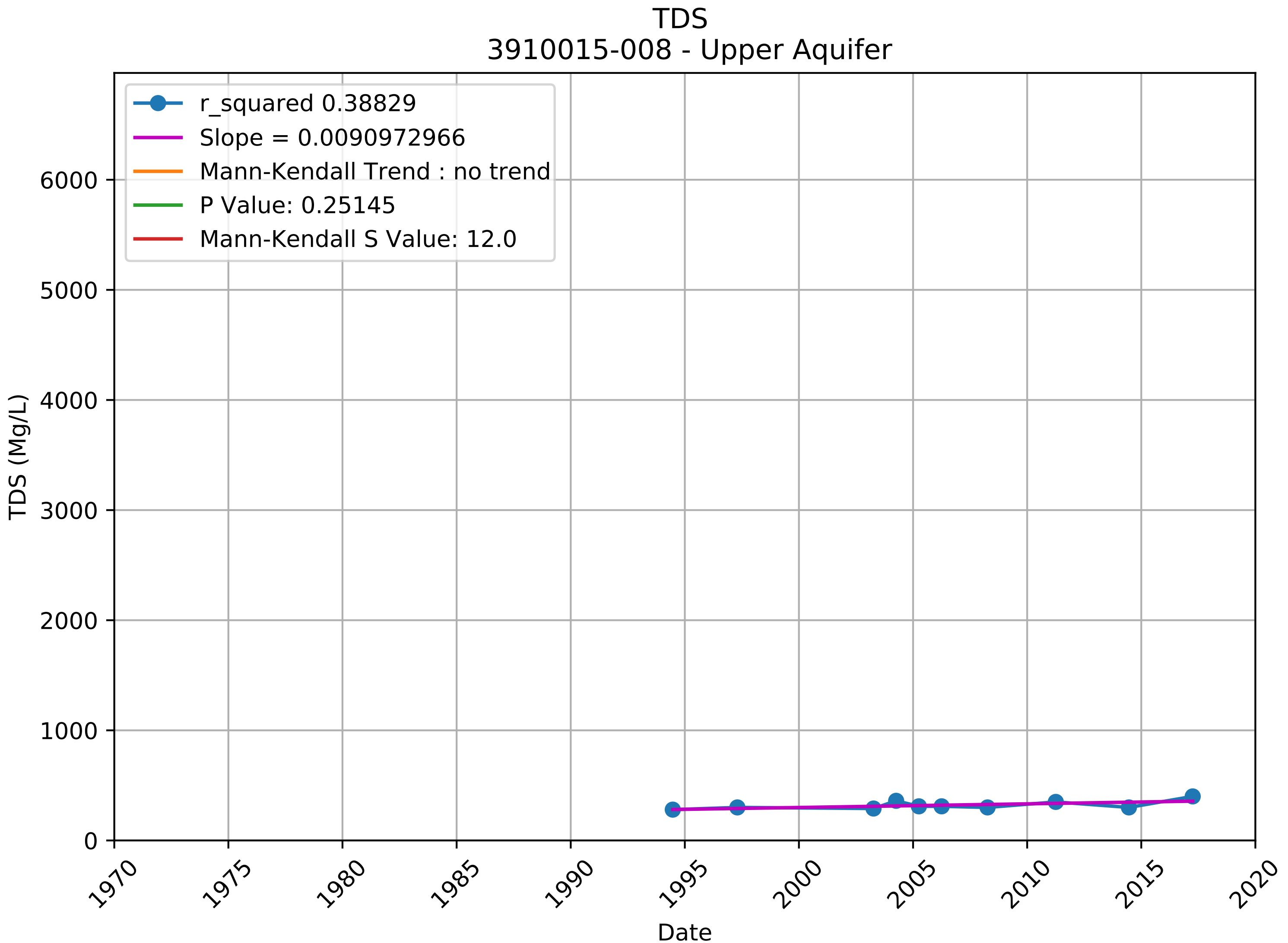
Date



TDS
3910015-008 - Upper Aquifer
r_squared 0.38829
Slope = 0.0090972966
Mann-Kendall Trend : no trend
P Value: 0.25145
Mann-Kendall S Value: 12.0
TDS (Mg/L)
0
1000
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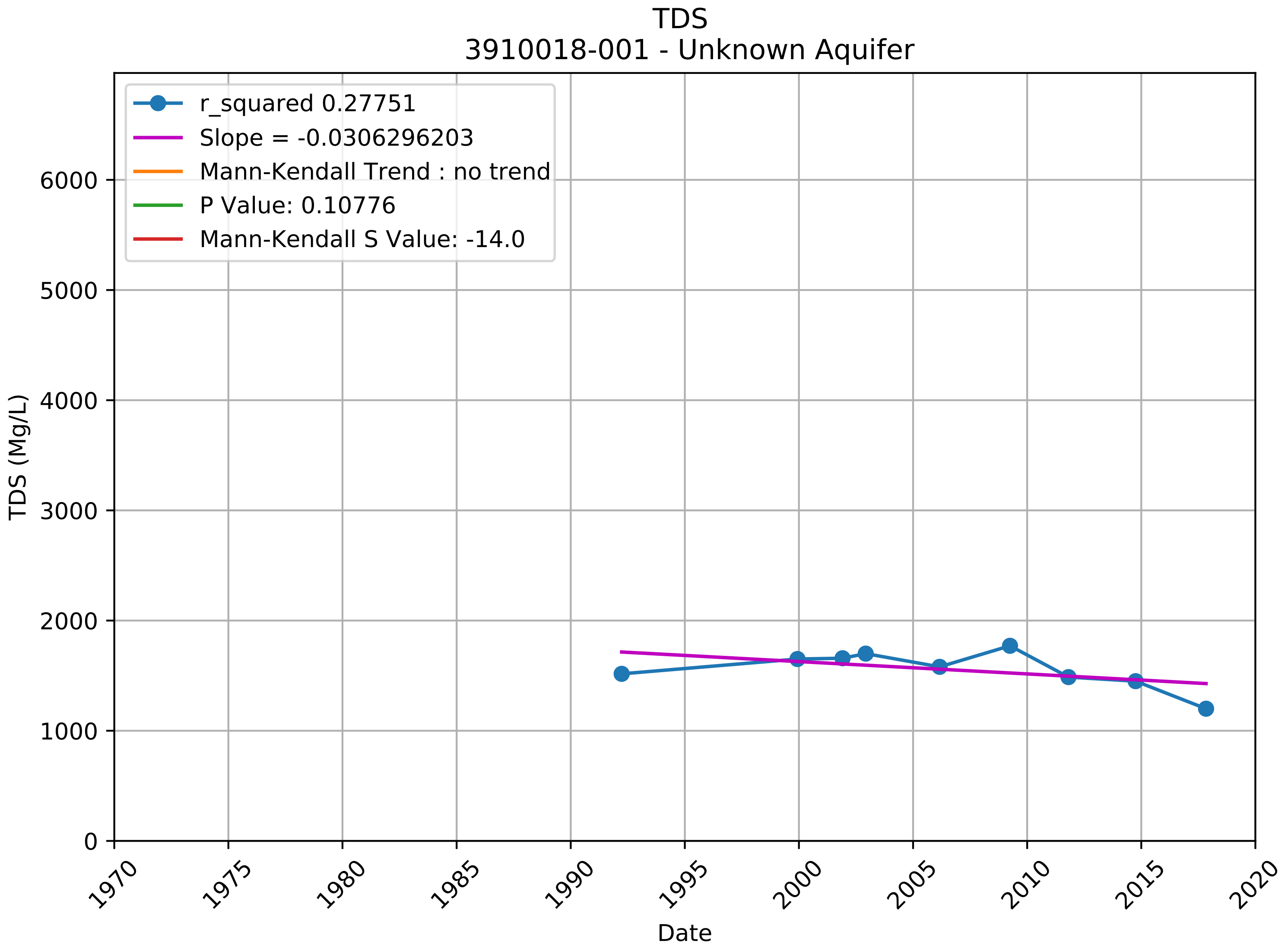
Date



TDS
3910018-001 - Unknown Aquifer
r_squared 0.27751
Slope = -0.0306296203
Mann-Kendall Trend : no trend
P Value: 0.10776
Mann-Kendall S Value: -14.0
TDS (Mg/L)
0
1000
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1970
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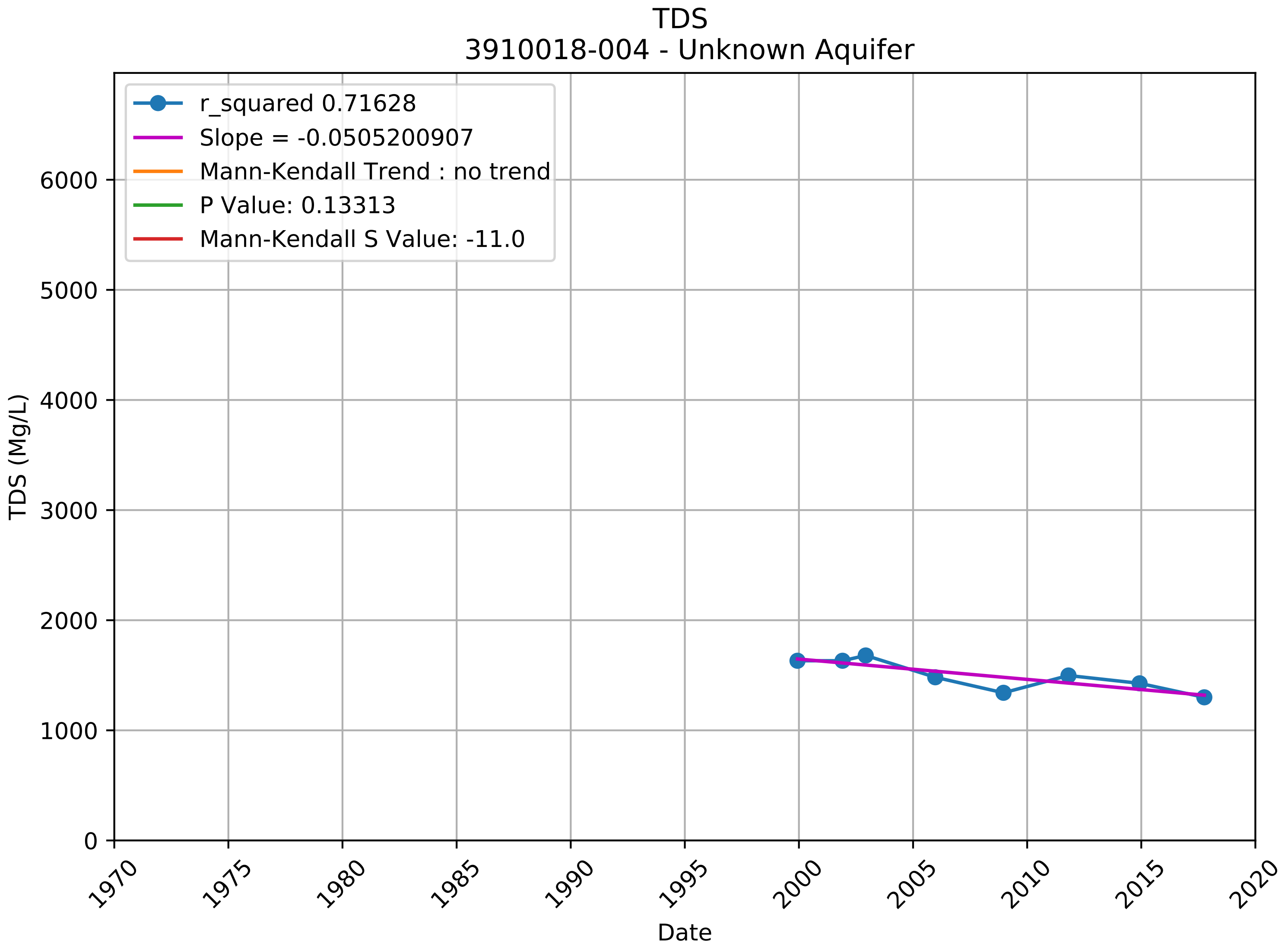
Date



TDS
3910018-004 - Unknown Aquifer
r_squared 0.71628
Slope = -0.0505200907
Mann-Kendall Trend : no trend
P Value: 0.13313
Mann-Kendall S Value: -11.0
TDS (Mg/L)
0
1000
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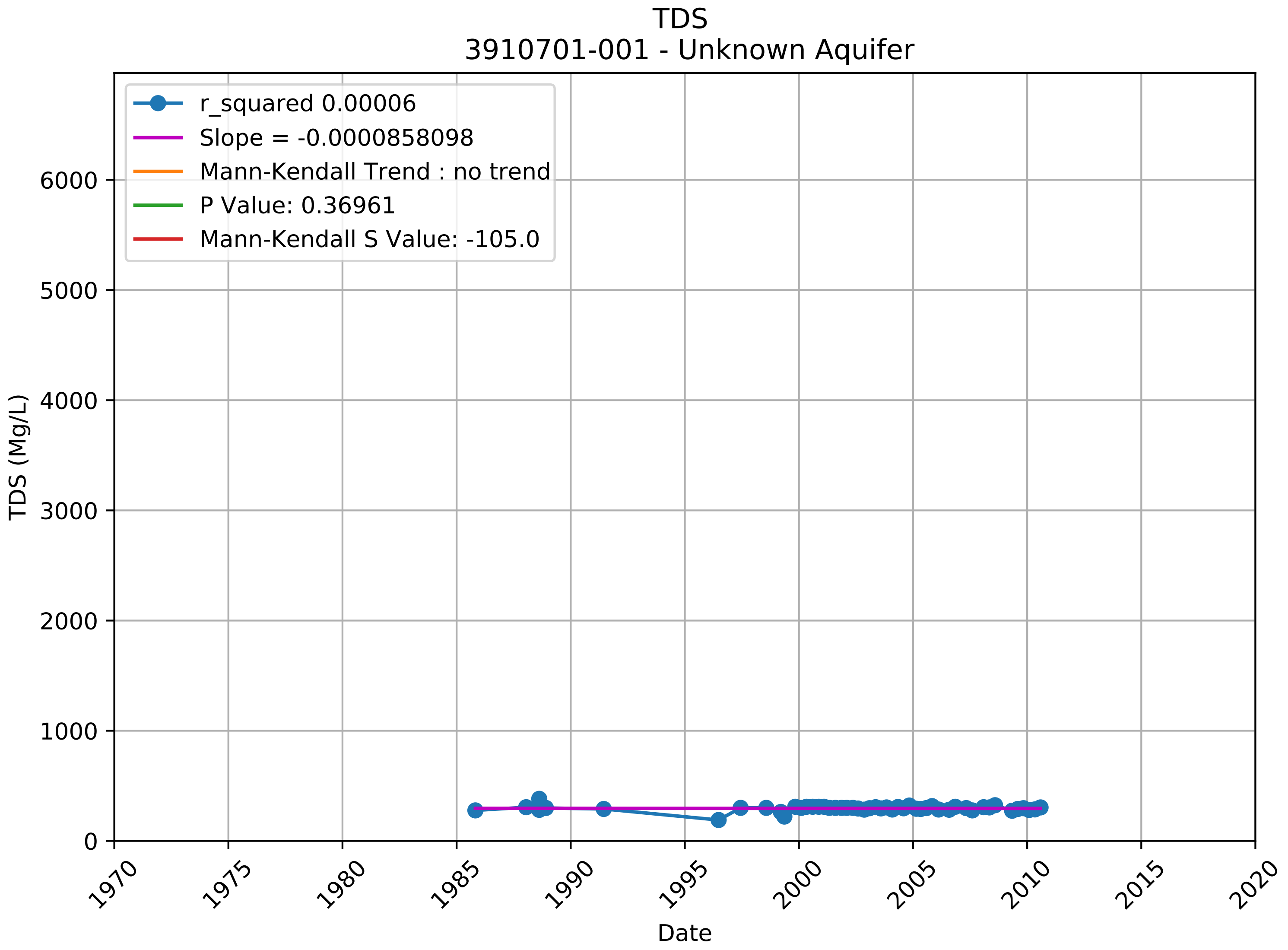
Date



TDS
3910701-001 - Unknown Aquifer
r_squared 0.00006
Slope = -0.0000858098
Mann-Kendall Trend : no trend
P Value: 0.36961
Mann-Kendall S Value: -105.0
TDS (Mg/L)
Date
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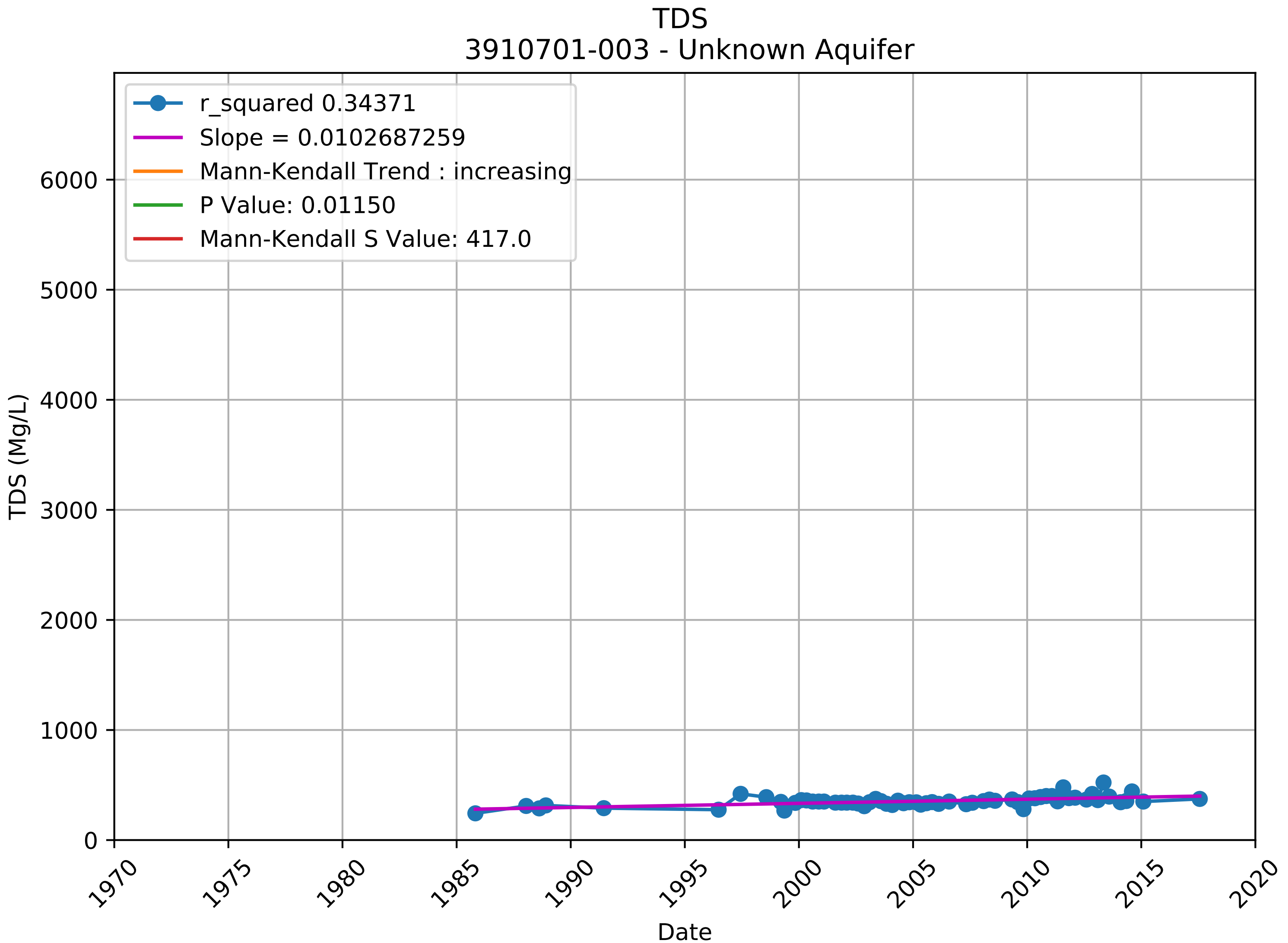

TDS
3910701-003 - Unknown Aquifer
r_squared 0.34371
Slope = 0.0102687259
Mann-Kendall Trend : increasing
P Value: 0.01150
Mann-Kendall S Value: 417.0
TDS (Mg/L)
Date
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1000
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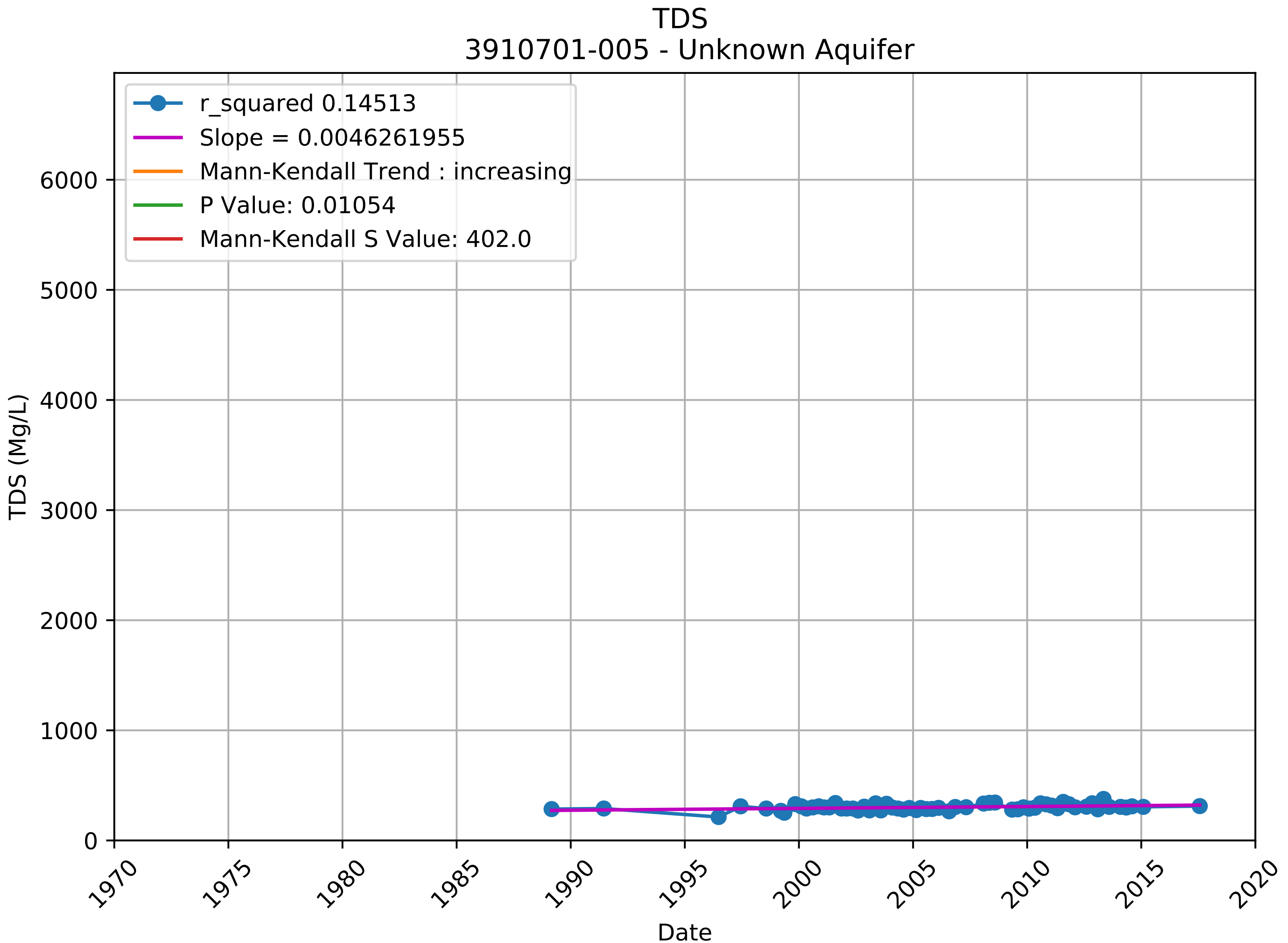

TDS
3910701-005 - Unknown Aquifer
r_squared 0.14513
Slope = 0.0046261955
Mann-Kendall Trend : increasing
P Value: 0.01054
Mann-Kendall S Value: 402.0
TDS (Mg/L)
0
1000
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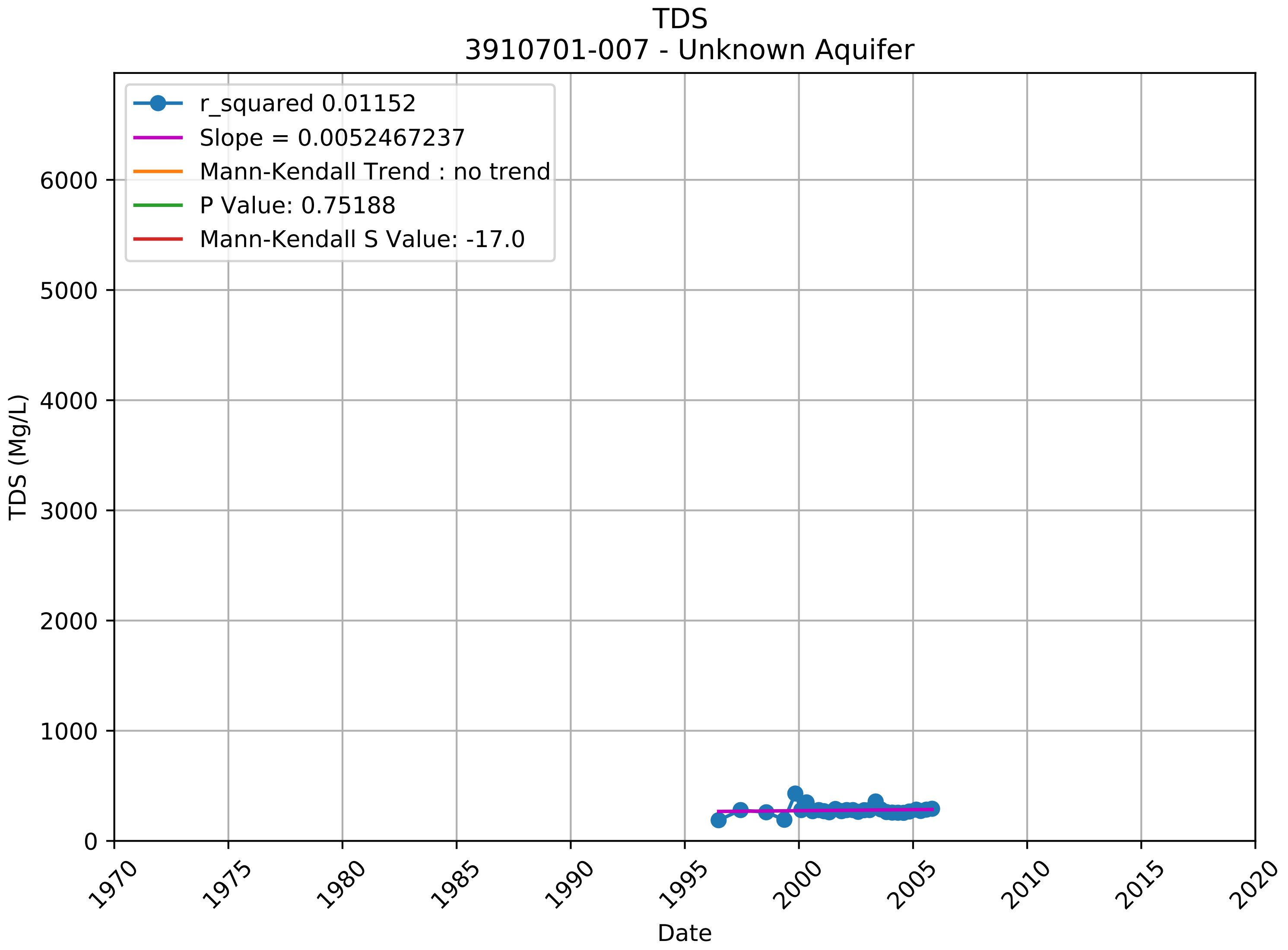
Date



TDS
3910701-007 - Unknown Aquifer
r_squared 0.01152
Slope = 0.0052467237
Mann-Kendall Trend : no trend
P Value: 0.75188
Mann-Kendall S Value: -17.0
TDS (Mg/L)
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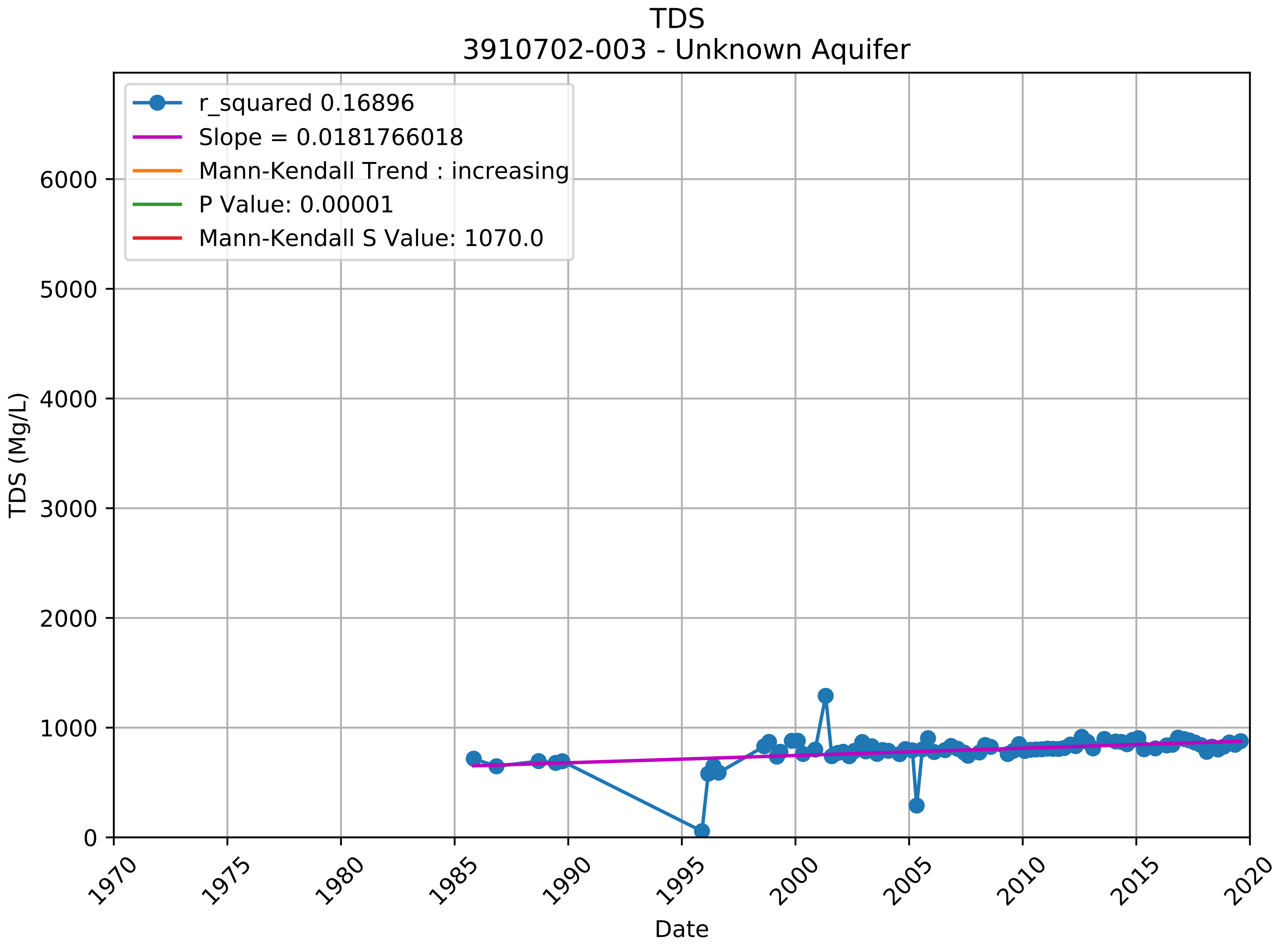
Date



TDS
3910702-003 - Unknown Aquifer
r_squared 0.16896
Slope = 0.0181766018
Mann-Kendall Trend : increasing
P Value: 0.00001
Mann-Kendall S Value: 1070.0
TDS (Mg/L)
Date
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1000
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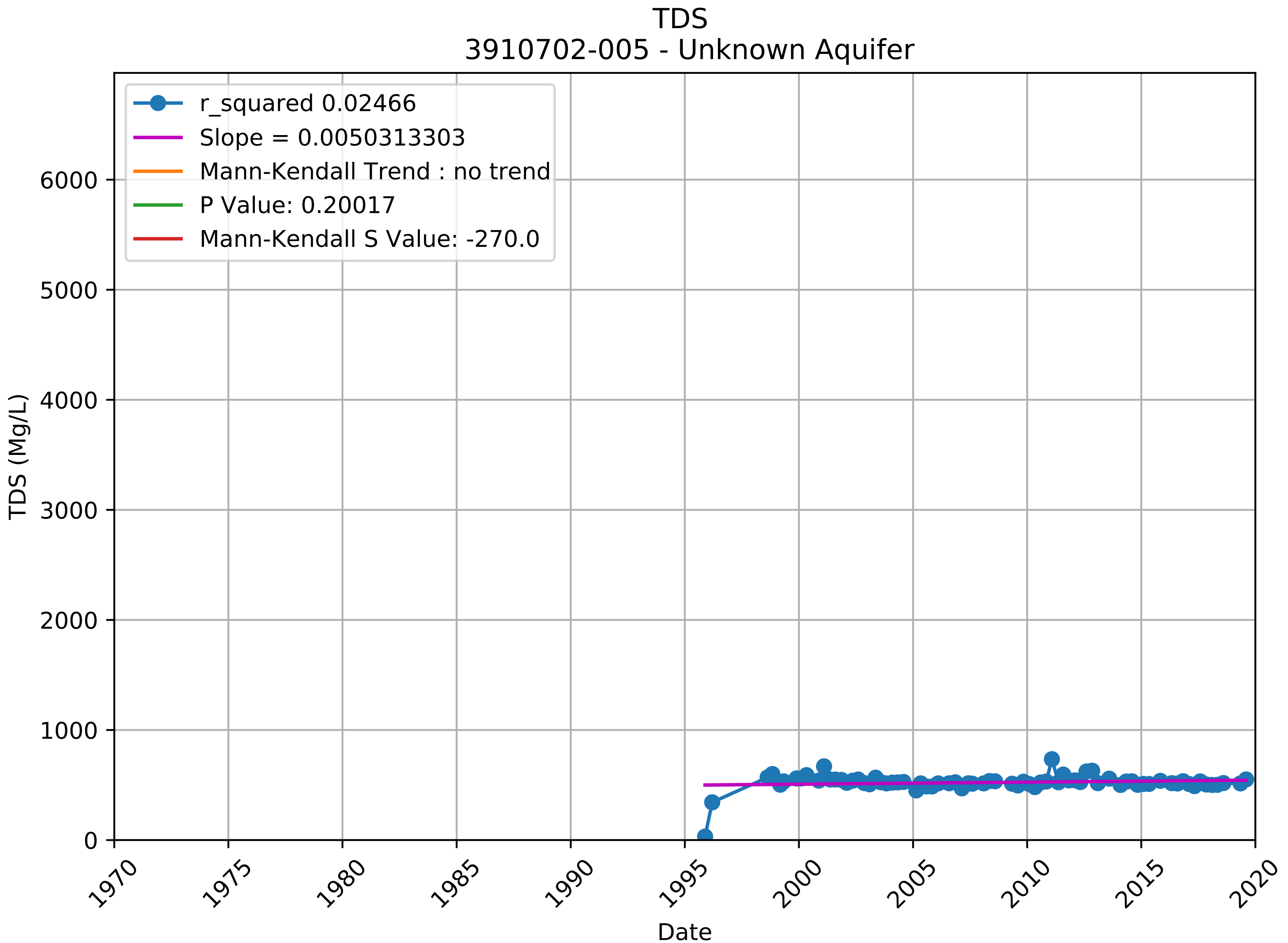
TDS
3910702-005 - Unknown Aquifer
r_squared 0.02466
Slope = 0.0050313303
Mann-Kendall Trend : no trend
P Value: 0.20017
Mann-Kendall S Value: -270.0
TDS (Mg/L)
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1000
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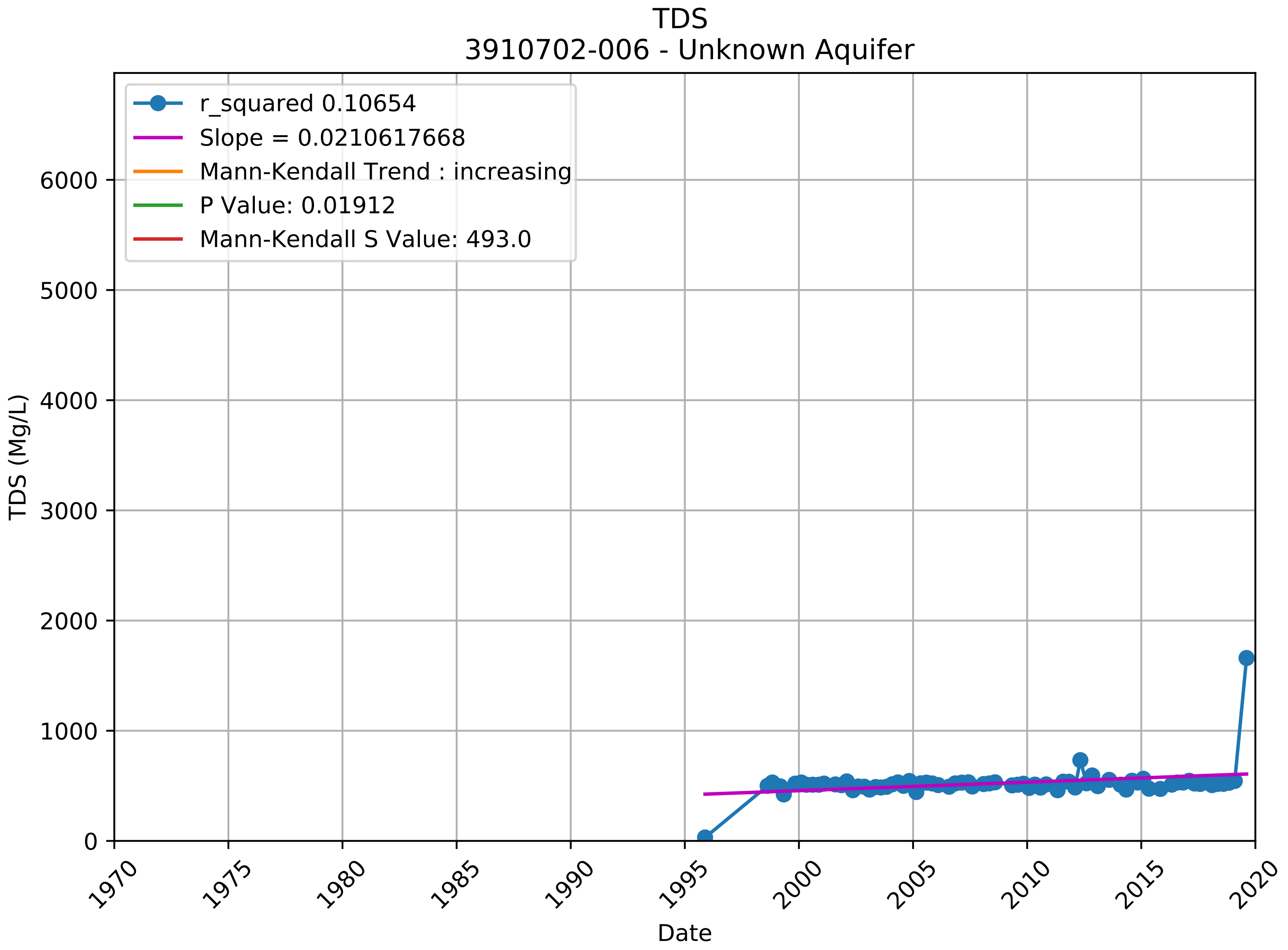
Date



TDS
3910702-006 - Unknown Aquifer
r_squared 0.10654
Slope = 0.0210617668
Mann-Kendall Trend : increasing
P Value: 0.01912
Mann-Kendall S Value: 493.0
TDS (Mg/L)
0
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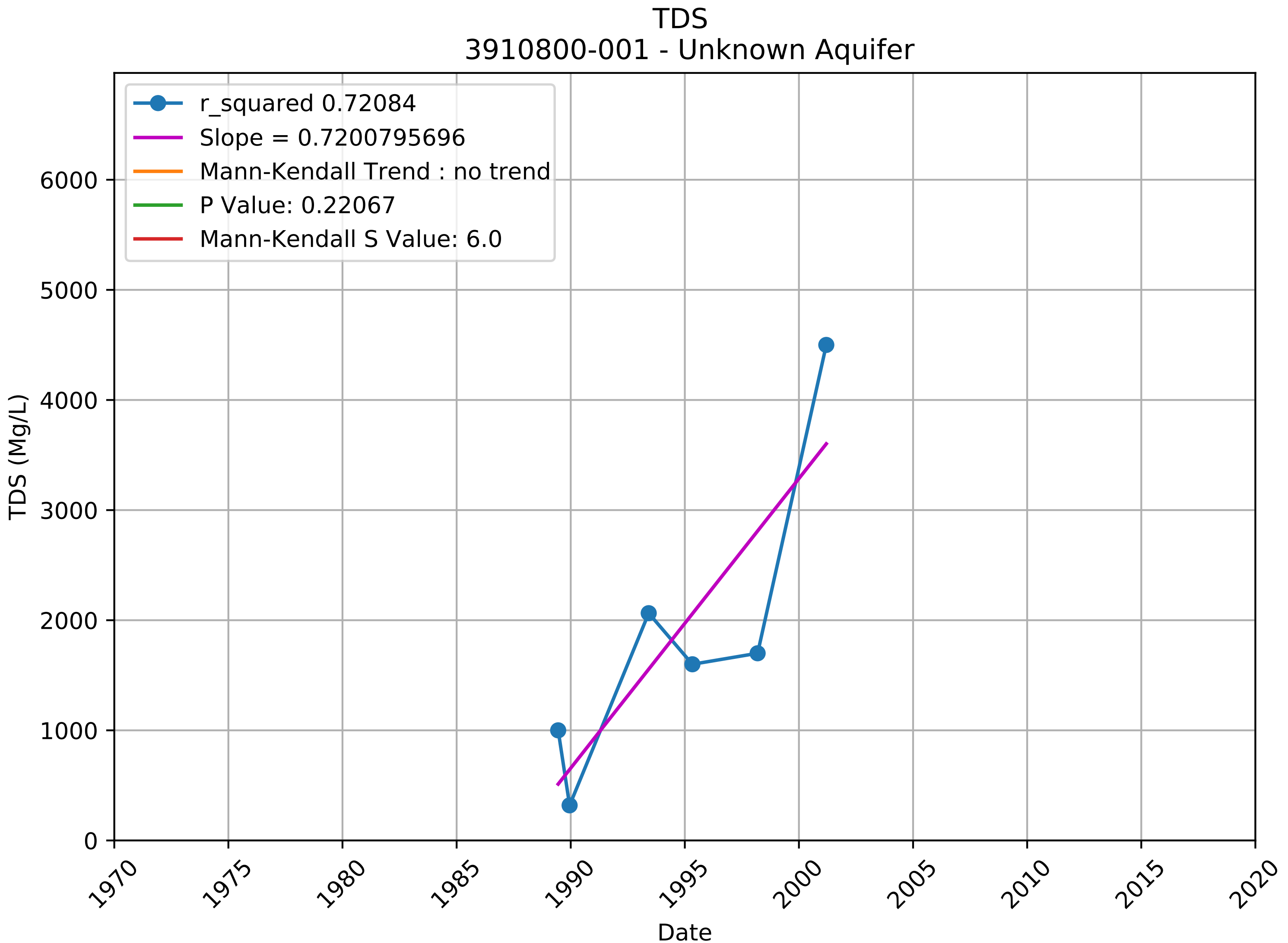
Date


TDS
3910800-001 - Unknown Aquifer
r_squared 0.72084
Slope = 0.7200795696
Mann-Kendall Trend : no trend
P Value: 0.22067
Mann-Kendall S Value: 6.0
TDS (Mg/L)
0
1000
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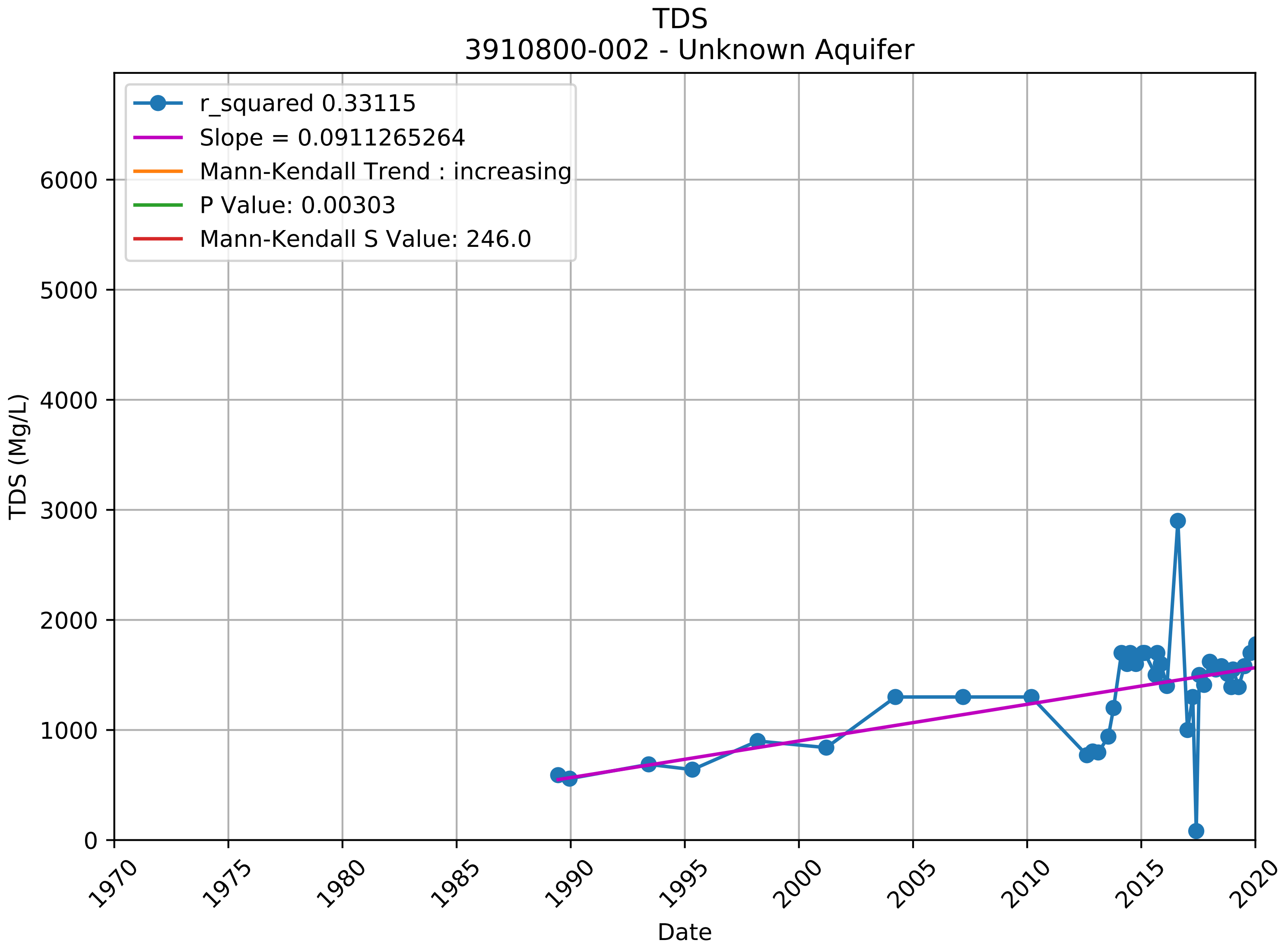
Date


TDS
3910800-002 - Unknown Aquifer
r_squared 0.33115
Slope = 0.0911265264
Mann-Kendall Trend : increasing
P Value: 0.00303
Mann-Kendall S Value: 246.0
TDS (Mg/L)
Date
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1000
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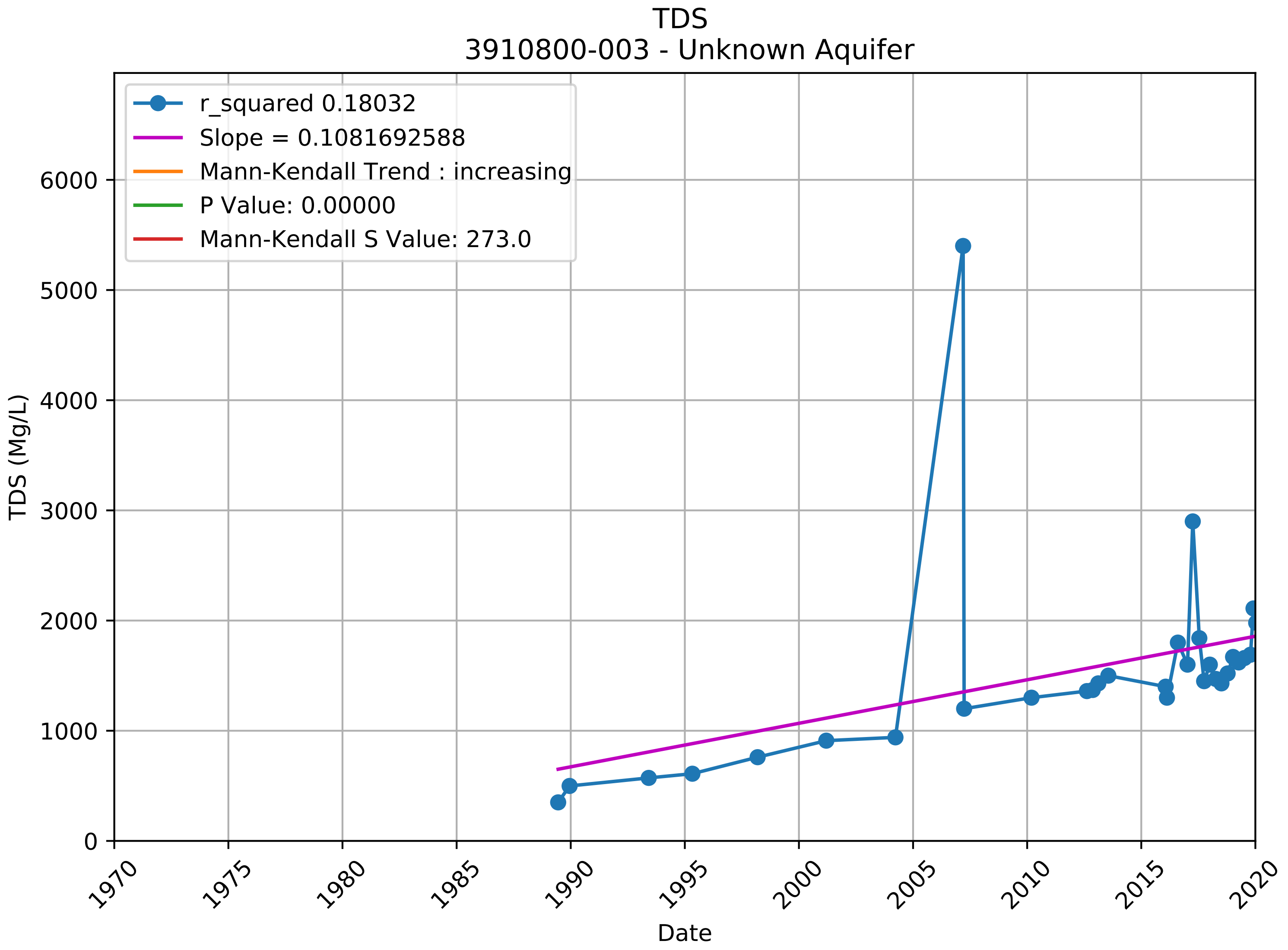

TDS
3910800-003 - Unknown Aquifer
r_squared 0.18032
Slope = 0.1081692588
Mann-Kendall Trend : increasing
P Value: 0.00000
Mann-Kendall S Value: 273.0
TDS (Mg/L)
0
1000
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Date
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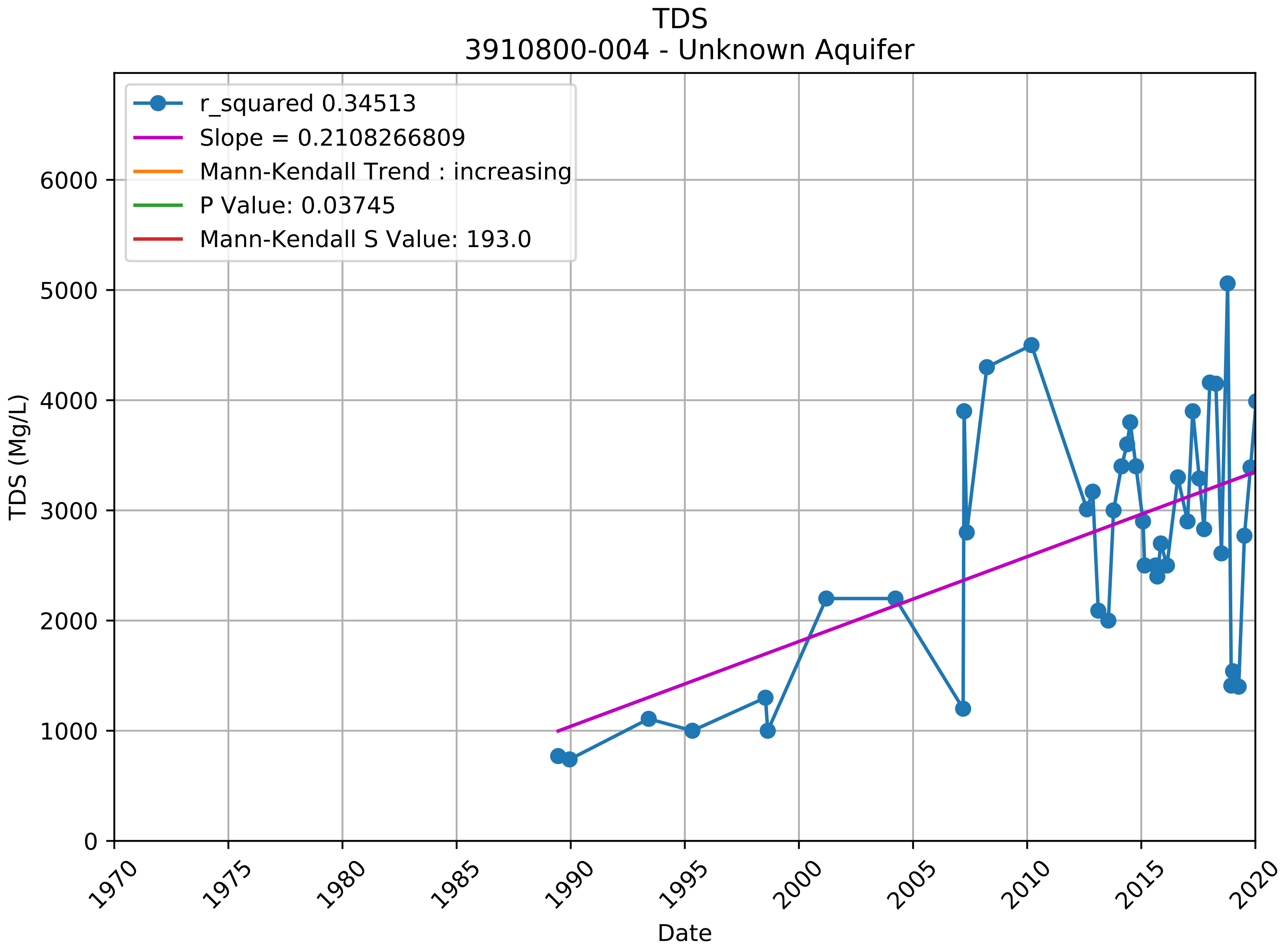

TDS
3910800-004 - Unknown Aquifer
r_squared 0.34513
Slope = 0.2108266809
Mann-Kendall Trend : increasing
P Value: 0.03745
Mann-Kendall S Value: 193.0
TDS (Mg/L)
0
1000
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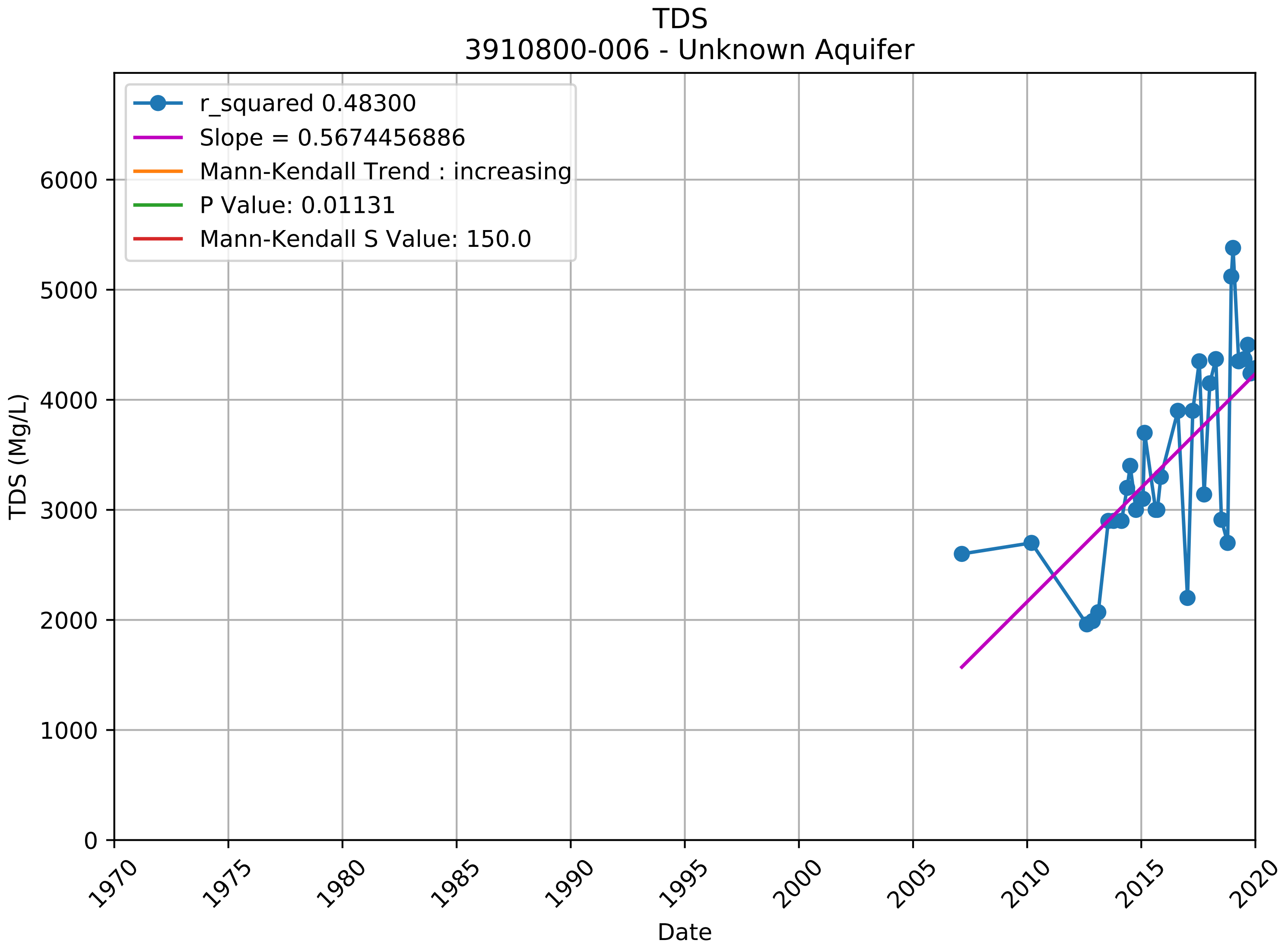
Date


TDS
3910800-006 - Unknown Aquifer
r_squared 0.48300
Slope = 0.5674456886
Mann-Kendall Trend : increasing
P Value: 0.01131
Mann-Kendall S Value: 150.0
TDS (Mg/L)
0
1000
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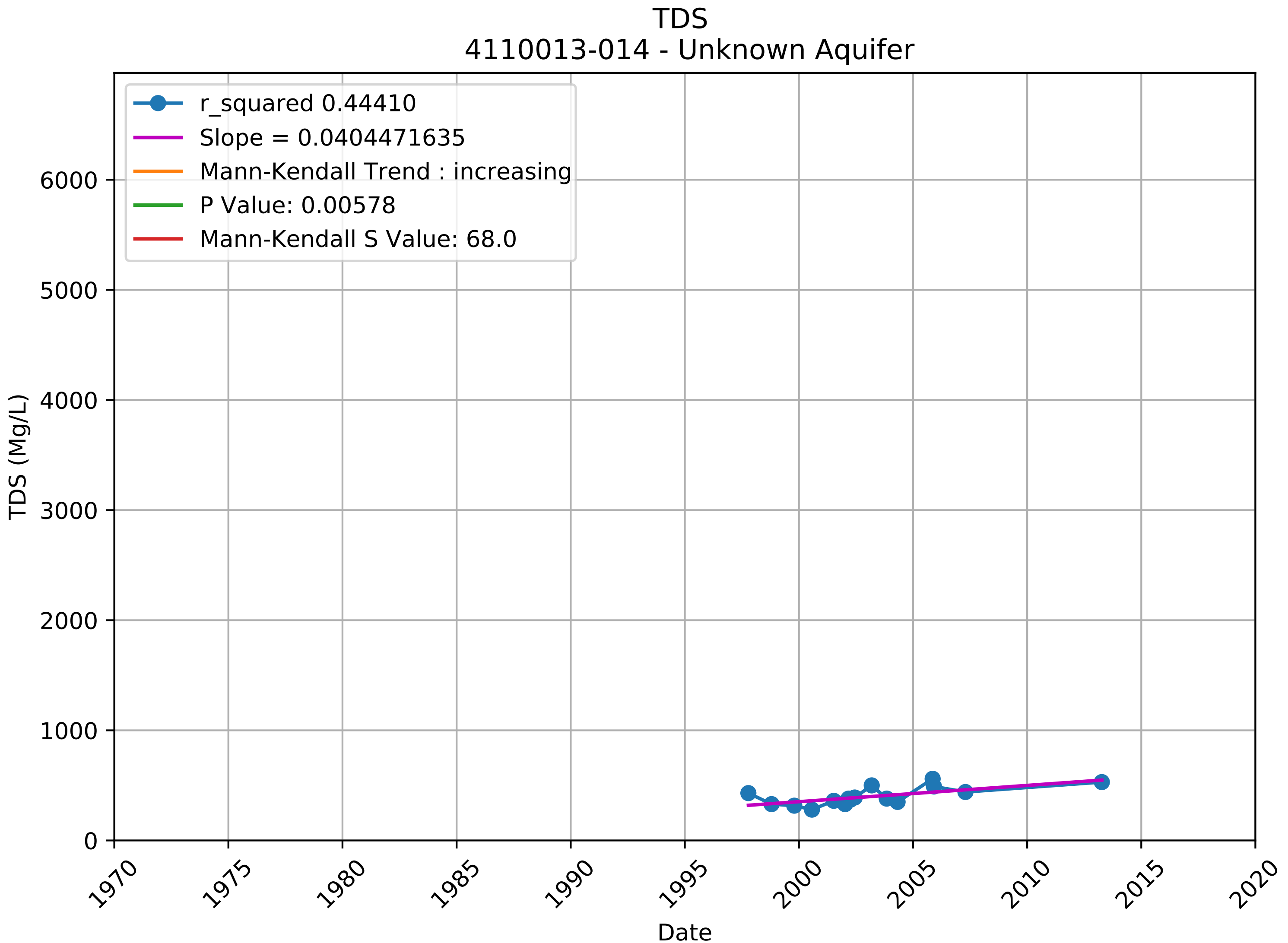
Date


TDS
4110013-014 - Unknown Aquifer
r_squared 0.44410
Slope = 0.0404471635
Mann-Kendall Trend : increasing
P Value: 0.00578
Mann-Kendall S Value: 68.0
TDS (Mg/L)
Date
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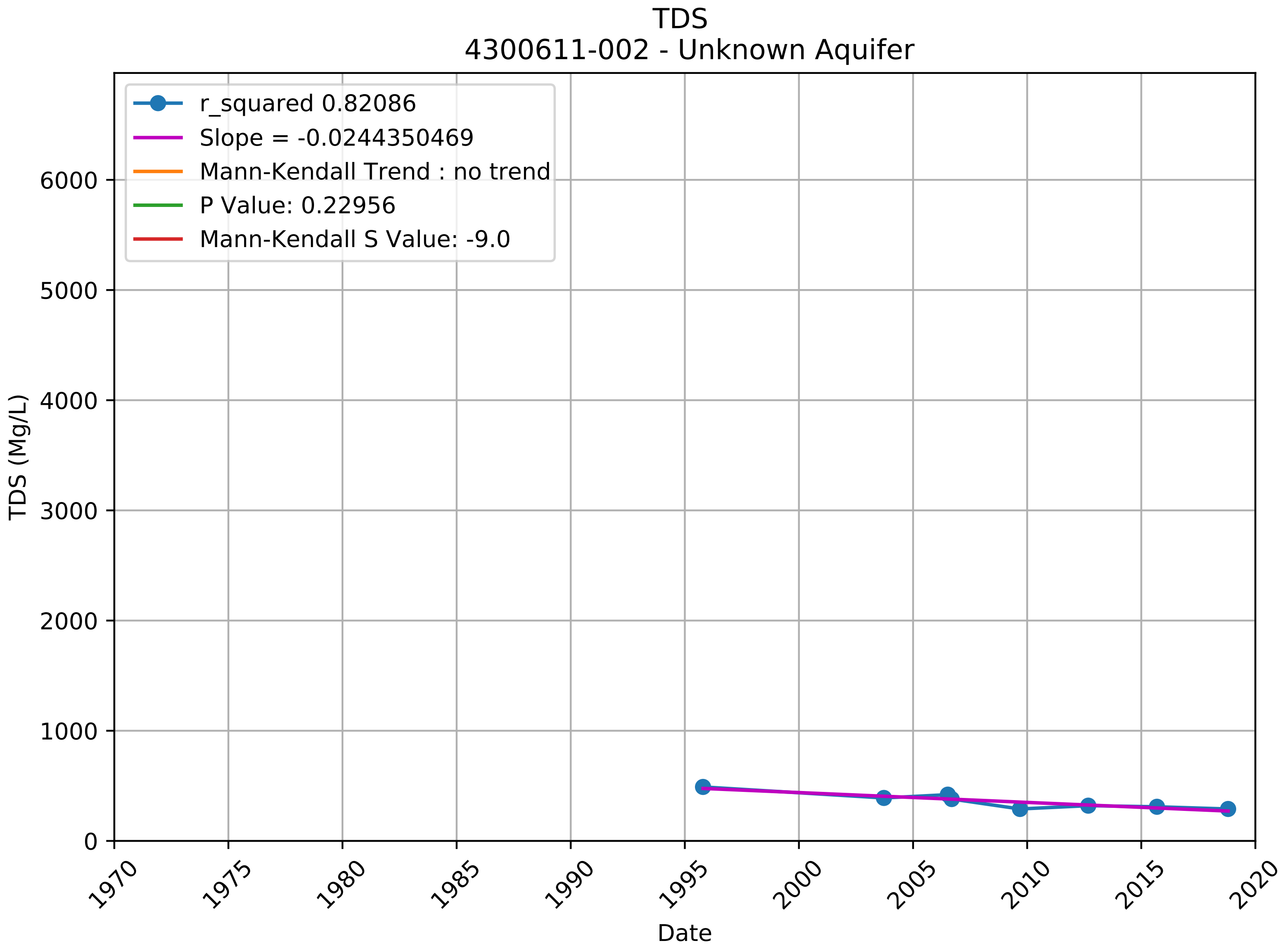
TDS
4300611-002 - Unknown Aquifer
r_squared 0.82086
Slope = -0.0244350469
Mann-Kendall Trend : no trend
P Value: 0.22956
Mann-Kendall S Value: -9.0
TDS (Mg/L)
0
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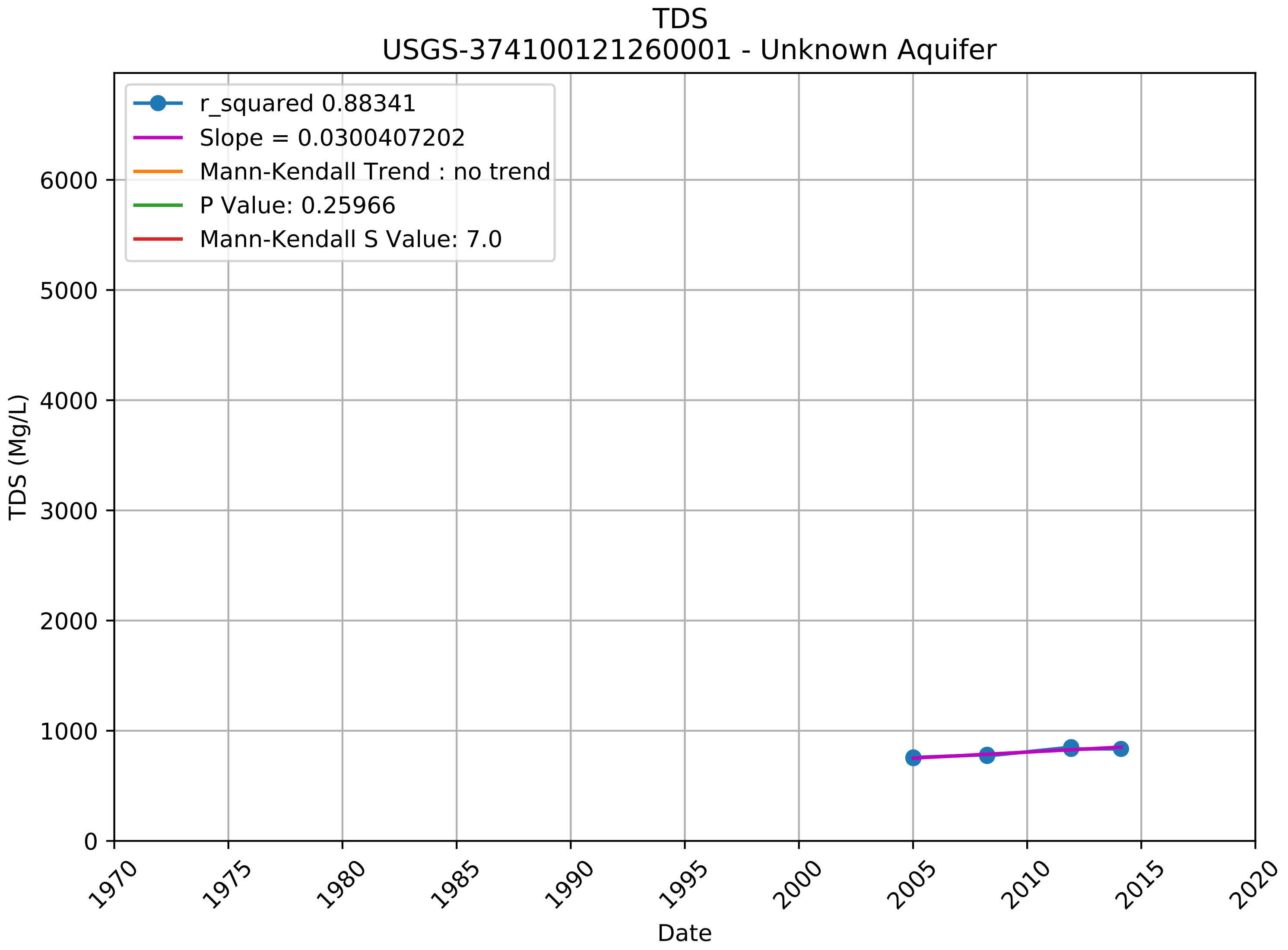
Date


TDS
USGS-374100121260001 - Unknown Aquifer
r_squared 0.88341
Slope = 0.0300407202
Mann-Kendall Trend : no trend
P Value: 0.25966
Mann-Kendall S Value: 7.0
TDS (Mg/L)
0
1000
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1970
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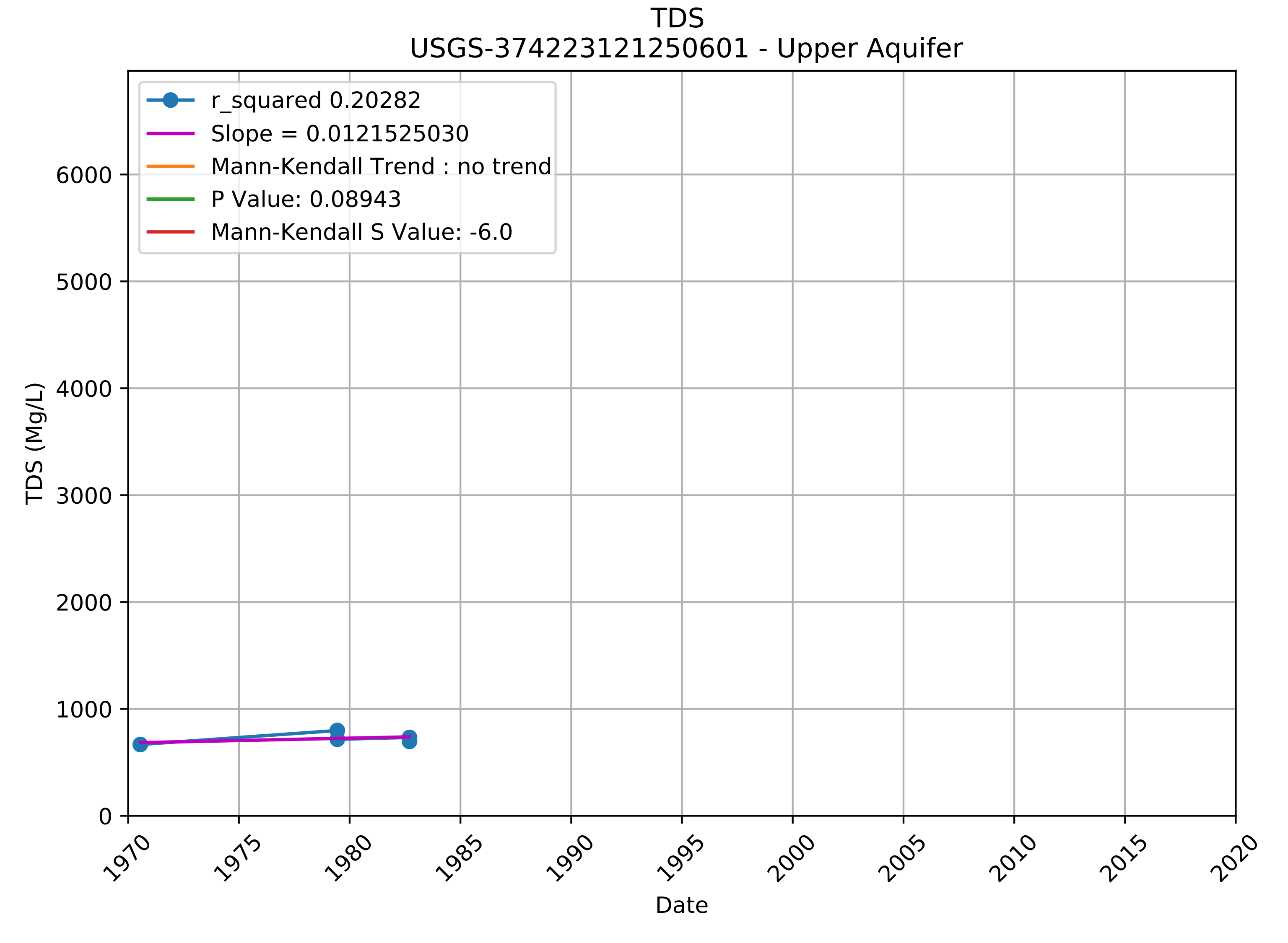
Date


TDS
USGS-374223121250601 - Upper Aquifer
r_squared 0.20282
Slope = 0.0121525030
Mann-Kendall Trend : no trend
P Value: 0.08943
Mann-Kendall S Value: -6.0
TDS (Mg/L)
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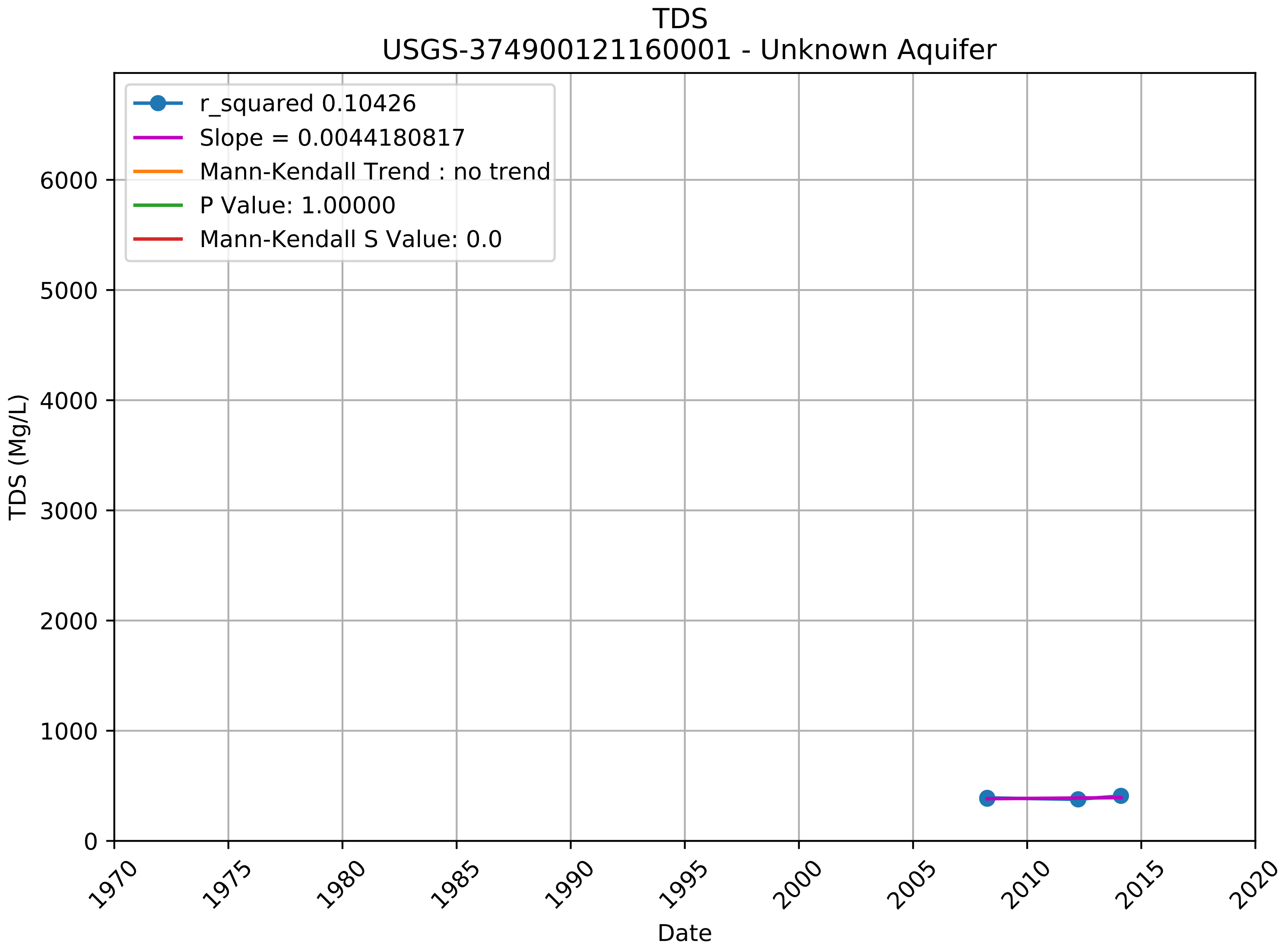
Date


TDS
USGS-374900121160001 - Unknown Aquifer
r_squared 0.10426
Slope = 0.0044180817
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
TDS (Mg/L)
Date
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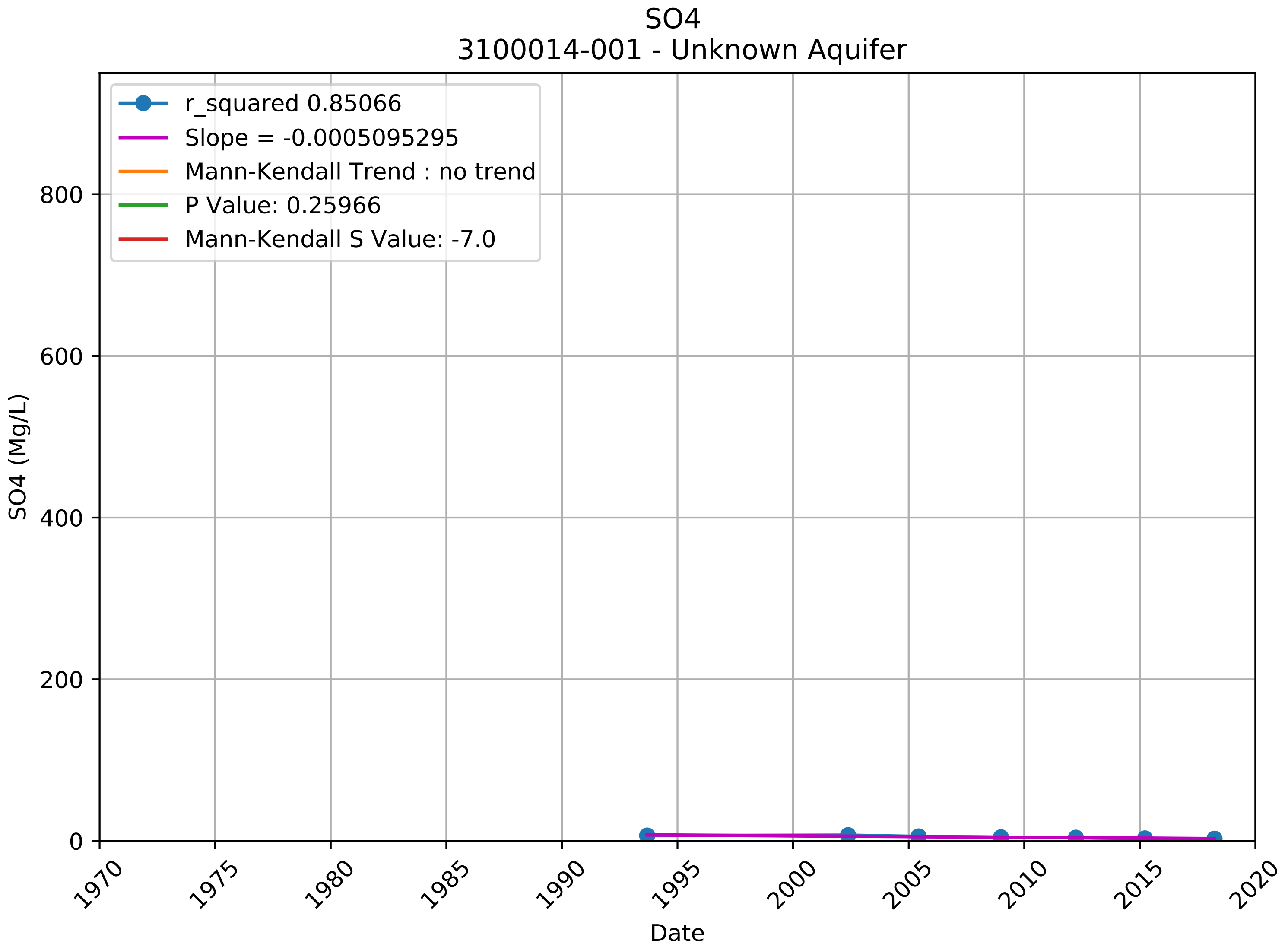
2020

Sulfate

WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
USGS-374223121250601	37.7063185	-121.4193886	SO4	FALSE	1	0	0	no trend	8.667	0	Upper
3910011-007	37.714471	-121.426009	SO4	FALSE	0.386	-8	-0.286	no trend	65.333	-0.866	Unknown
3910011-010	37.736372	-121.435351	SO4	FALSE	0.499	-16	-0.133	no trend	493.333	-0.675	Unknown
3910702-003	37.705557	-121.39764	SO4	TRUE	0	1197	0.369	increasing	60117	4.878	Unknown
3910701-003	37.85144	-121.2682	SO4	TRUE	0.004	490	0.251	increasing	28414	2.901	Unknown
3910701-001	37.849584	-121.268763	SO4	TRUE	0.011	296	0.252	increasing	13447.33	2.544	Unknown
3910011-017	37.738215	-121.419962	SO4	FALSE	0.221	-6	-0.6	no trend	16.667	-1.225	Unknown
3910018-001	37.679751	-121.272617	SO4	FALSE	0.119	-21	-0.382	no trend	165	-1.557	Unknown
4300611-002	37.994444	-121.499722	SO4	FALSE	1	-1	-0.067	no trend	28.333	0	Unknown
3910015-005	37.816859	-121.266705	SO4	FALSE	0.428	14	0.179	no trend	268.667	0.793	Upper
3910011-003	37.683959	-121.439427	SO4	FALSE	0.157	76	0.187	no trend	2808	1.415	Lower
3910800-002	37.744188	-121.32701	SO4	FALSE	0.161	-19	-0.345	no trend	165	-1.401	Unknown
3910800-003	37.74545	-121.32897	SO4	FALSE	0.193	-20	-0.303	no trend	212.667	-1.303	Unknown
3910800-001	37.744746	-121.327221	SO4	FALSE	0.613	3	0.3	no trend	15.667	0.505	Unknown
3910800-004	37.74591	-121.336213	SO4	TRUE	0.042	-42	-0.4	decreasing	407.333	-2.031	Unknown
3100014-001	37.716956	-121.379533	SO4	FALSE	0.26	-7	-0.467	no trend	28.333	-1.127	Unknown
3910701-005	37.851301	-121.2673	SO4	TRUE	0	612	0.334	increasing	25816.67	3.803	Unknown
3910011-004	37.682308	-121.436988	SO4	FALSE	0.107	-62	-0.245	no trend	1430	-1.613	Lower
3910011-006	37.686539	-121.443515	SO4	FALSE	0.44	34	0.113	no trend	1829.333	0.772	Lower
3910011-005	37.683353	-121.443313	SO4	FALSE	0.116	93	0.2	no trend	3427.667	1.571	Lower
3910015-006	37.818884	-121.266416	SO4	FALSE	0.271	17	0.258	no trend	211.667	1.1	Upper
3910015-007	37.811547	-121.263915	SO4	FALSE	0.428	-14	-0.179	no trend	268.667	-0.793	Upper
3910015-008	37.801132	-121.262514	SO4	FALSE	0.246	12	0.333	no trend	90	1.16	Upper
3910011-018	37.743262	-121.424805	SO4	FALSE	0.14	-64	-0.213	no trend	1824	-1.475	Lower
3910018-004	37.679705	-121.272761	SO4	FALSE	0.368	-7	-0.333	no trend	44.333	-0.901	Unknown
3910701-007	37.851431	-121.265247	SO4	FALSE	0.302	56	0.138	no trend	2840	1.032	Unknown
3910702-006	37.709972	-121.390802	SO4	TRUE	0.004	610	0.232	increasing	44092	2.9	Unknown
3910702-005	37.708149	-121.393881	SO4	FALSE	0.386	183	0.07	no trend	44091	0.867	Unknown
4110013-014	37.7	-121.466667	SO4	TRUE	0.021	43	0.473	increasing	333.667	2.299	Unknown
3900991-001	37.743544	-121.461428	SO4	FALSE	0.089	6	1	no trend	8.667	1.698	Unknown
3910011-030	37.740208	-121.439285	SO4	FALSE	0.507	-40	-0.086	no trend	3456.667	-0.663	Lower
3901348-002	37.702894	-121.406986	SO4	FALSE	0.462	4	0.4	no trend	16.667	0.735	Unknown
3900713-001	37.84	-121.44	SO4	FALSE	0.175	14	0.389	no trend	92	1.355	Unknown
3901172-002	37.636324	-121.399544	SO4	FALSE	1	0	0	no trend	16.667	0	Unknown
3901172-003	37.632289	-121.39736	SO4	FALSE	0.707	3	0.2	no trend	28.333	0.376	Unknown
3900702-001	37.990639	-121.407056	SO4	FALSE	0.806	-2	-0.2	no trend	16.667	-0.245	Unknown
3900583-001	37.84	-121.44	SO4	FALSE	0.734	2	0.333	no trend	8.667	0.34	Unknown
3901216-002	37.74753	-121.516649	SO4	FALSE	0.133	-9	-0.6	no trend	28.333	-1.503	Unknown
3900559-001	37.79	-121.38	SO4	FALSE	0.734	-2	-0.333	no trend	8.667	-0.34	Unknown
3900558-002	37.79	-121.4	SO4	FALSE	0.312	5	0.5	no trend	15.667	1.011	Unknown
3910011-034	37.752802	-121.434603	SO4	FALSE	0.095	81	0.231	no trend	2289.667	1.672	Lower
3910011-032	37.754682	-121.465249	SO4	FALSE	0.252	-50	-0.167	no trend	1828.667	-1.146	Lower
3901348-003	37.698742	-121.409917	SO4	FALSE	0.448	6	0.286	no trend	43.333	0.76	Unknown
3901348-004	37.698147	-121.416153	SO4	FALSE	0.452	5	0.333	no trend	28.333	0.751	Unknown
377427N1213943W002	37.742656	-121.394318	SO4	FALSE	0.653	-10	-0.095	no trend	400.667	-0.45	Lower
377427N1213943W001	37.742656	-121.394318	SO4	TRUE	0.013	-51	-0.486	decreasing	408.333	-2.474	Lower
377427N1213943W003	37.742656	-121.394318	SO4	FALSE	0.232	-25	-0.238	no trend	403.667	-1.195	Lower
377402N1214508W001	37.740187	-121.450762	SO4	TRUE	0.042	-42	-0.4	decreasing	407.333	-2.031	Lower
377143N1214459W002	37.714305	-121.445905	SO4	FALSE	0.803	-6	-0.057	no trend	403.333	-0.249	Lower
377143N1214459W003	37.714305	-121.445905	SO4	FALSE	0.517	-14	-0.133	no trend	403.333	-0.647	Lower
377402N1214508W003	37.740187	-121.450762	SO4	TRUE	0.012	-52	-0.495	decreasing	407.333	-2.527	Lower
377402N1214508W002	37.740187	-121.450762	SO4	TRUE	0.023	-47	-0.448	decreasing	408.333	-2.276	Lower
377143N1214459W001	37.714305	-121.445905	SO4	FALSE	0.087	-35	-0.333	no trend	395.667	-1.709	Lower
377656N1214199W001	37.765631	-121.41992	SO4	FALSE	0.115	-24	-0.364	no trend	212.667	-1.577	Lower
377656N1214199W002	37.765631	-121.41992	SO4	FALSE	0.152	-17	-0.378	no trend	125	-1.431	Lower
377656N1214199W003	37.765631	-121.41992	SO4	FALSE	0.2	-22	-0.282	no trend	268.667	-1.281	Lower
377149N1214257W003	37.714872	-121.425674	SO4	TRUE	0.024	-34	-0.515	decreasing	212.667	-2.263	Lower
377149N1214257W002	37.714872	-121.425674	SO4	TRUE	0.016	-36	-0.545	decreasing	212.667	-2.4	Lower
377149N1214257W001	37.714872	-121.425674	SO4	TRUE	0.007	-40	-0.606	decreasing	212.667	-2.674	Lower
377031N1214485W002	37.703055	-121.448544	SO4	TRUE	0.033	36	0.462	increasing	268.667	2.135	Lower
377031N1214485W001	37.703055	-121.448544	SO4	TRUE	0.025	-37	-0.474	decreasing	256.333	-2.249	Lower
377031N1214485W003	37.703055	-121.448544	SO4	TRUE	0.024	-38	-0.487	decreasing	268.667	-2.257	Lower
3910005-044	37.782808	-121.300937	SO4	FALSE	0.089	6	1	no trend	8.667	1.698	Unknown
3910800-006	37.744722	-121.329167	SO4	FALSE	0.462	-4	-0.4	no trend	16.667	-0.735	Unknown
USGS-374046121155402	37.6793611	-121.2650278	SO4	FALSE	0.124	45	0.263	no trend	817	1.539	Upper
USGS-374046121155401	37.6793611	-121.2650278	SO4	FALSE	0.171	40	0.234	no trend	813.333	1.368	Upper


SO4
3100014-001 - Unknown Aquifer
r_squared 0.85066
Slope = -0.0005095295
Mann-Kendall Trend : no trend
P Value: 0.25966
Mann-Kendall S Value: -7.0
SO4 (Mg/L)
0
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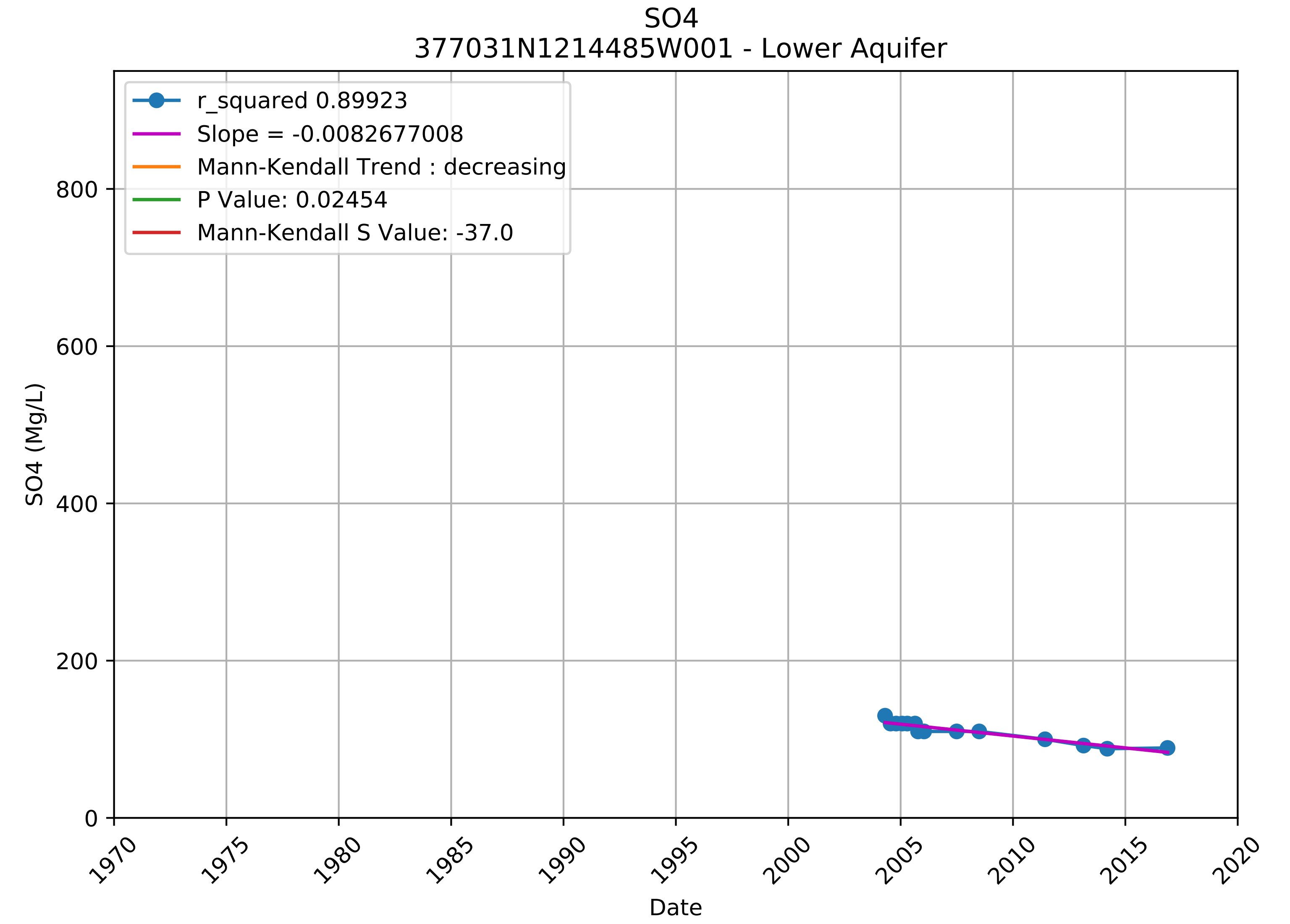
Date



SO4
377031N1214485W001 - Lower Aquifer
r_squared 0.89923
Slope = -0.0082677008
Mann-Kendall Trend : decreasing
P Value: 0.02454
Mann-Kendall S Value: -37.0
SO4 (Mg/L)
0
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1970
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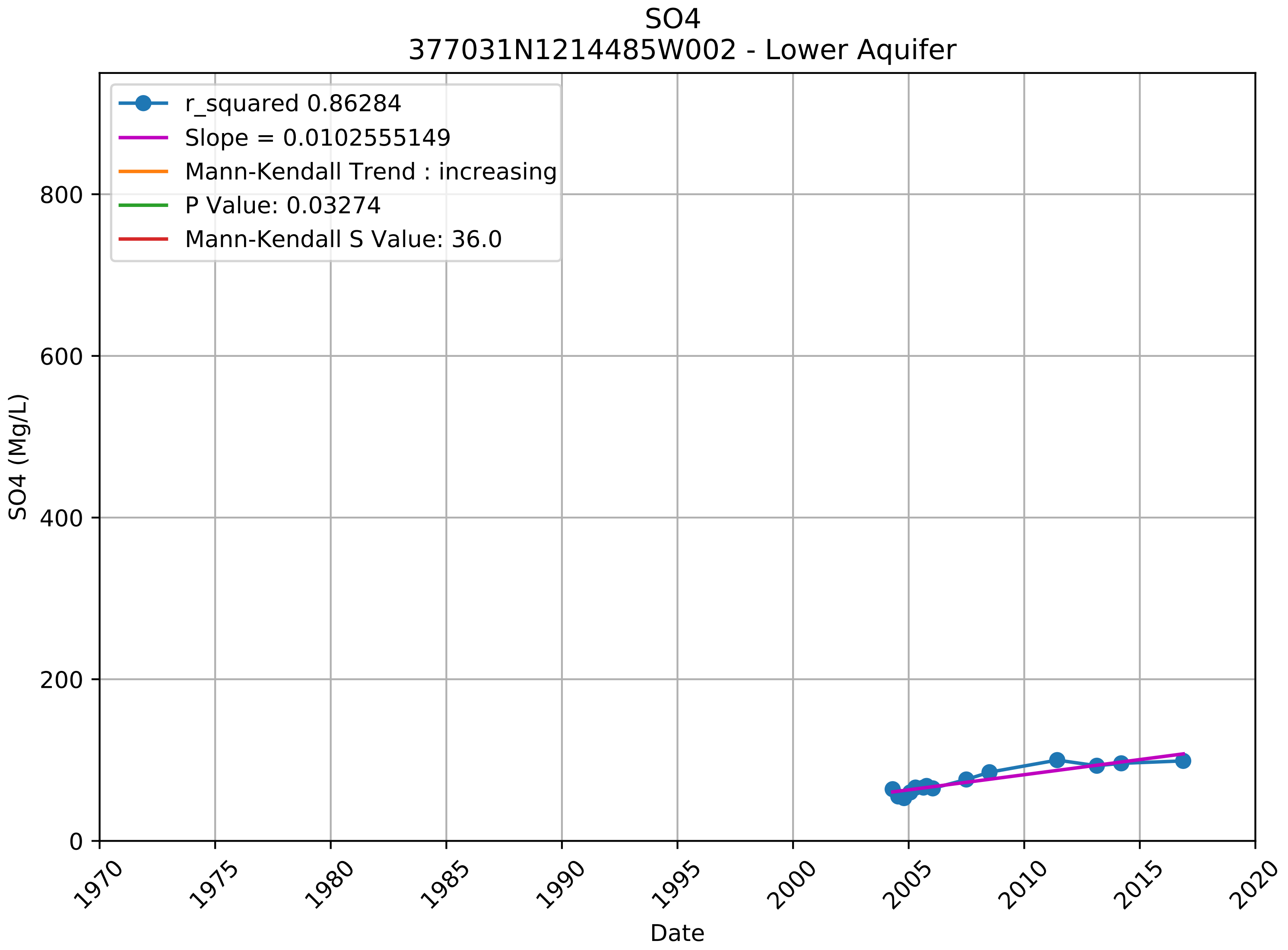
Date



SO4
377031N1214485W002 - Lower Aquifer
r_squared 0.86284
Slope = 0.0102555149
Mann-Kendall Trend : increasing
P Value: 0.03274
Mann-Kendall S Value: 36.0
SO4 (Mg/L)
0
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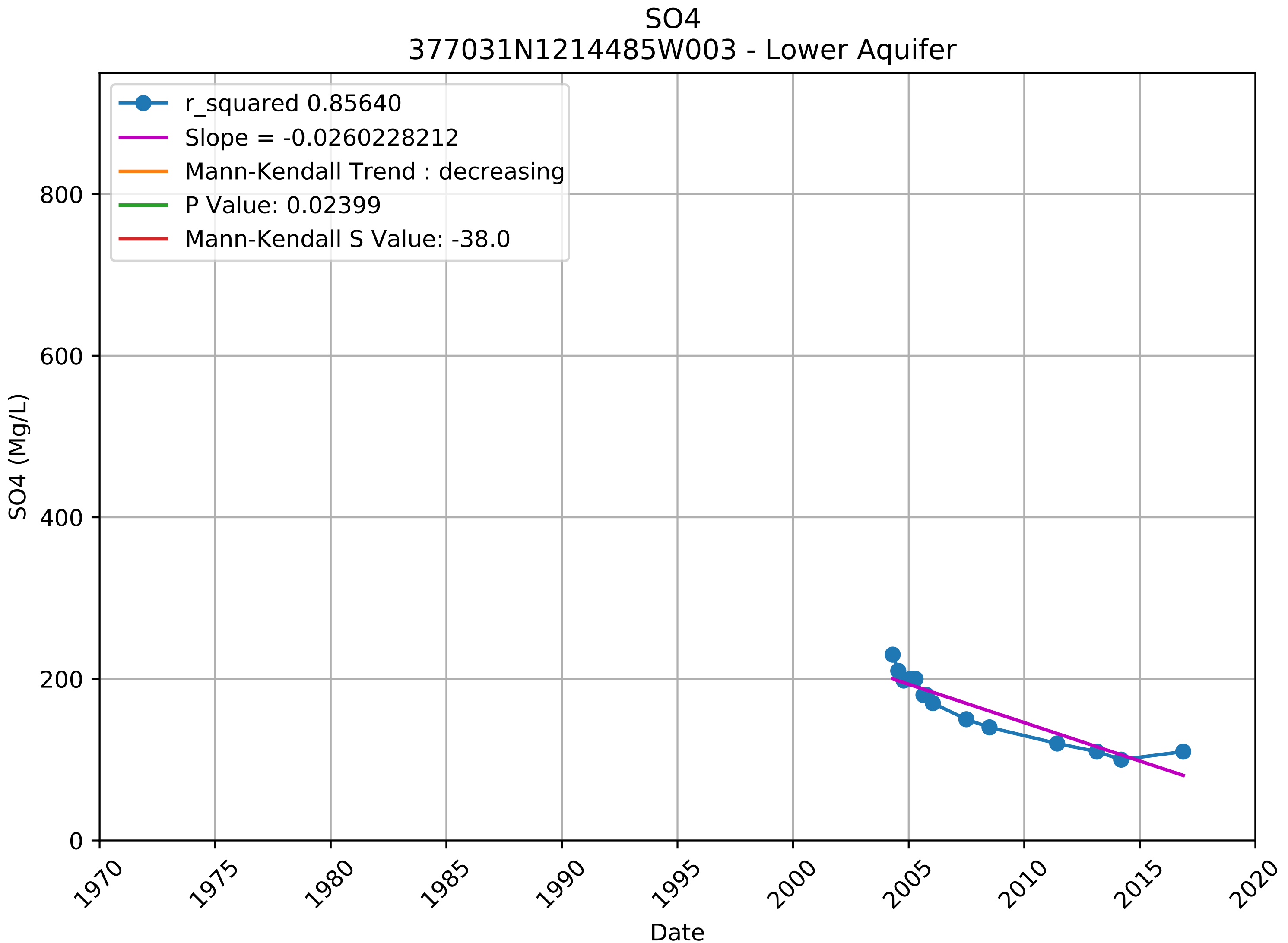
Date



SO4
377031N1214485W003 - Lower Aquifer
r_squared 0.85640
Slope = -0.0260228212
Mann-Kendall Trend : decreasing
P Value: 0.02399
Mann-Kendall S Value: -38.0
SO4 (Mg/L)
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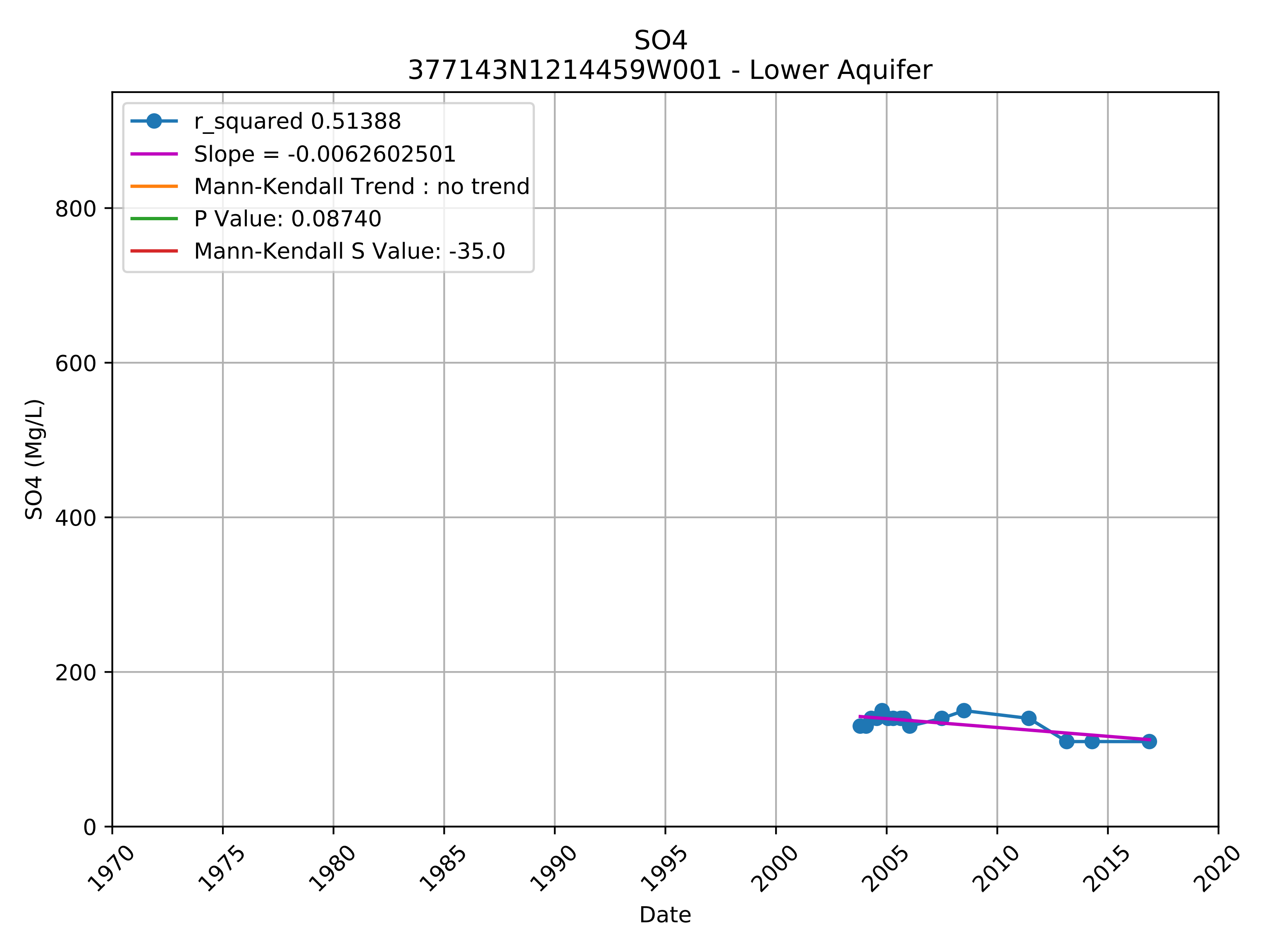
Date



SO4
377143N1214459W001 - Lower Aquifer
r_squared 0.51388
Slope = -0.0062602501
Mann-Kendall Trend : no trend
P Value: 0.08740
Mann-Kendall S Value: -35.0
SO4 (Mg/L)
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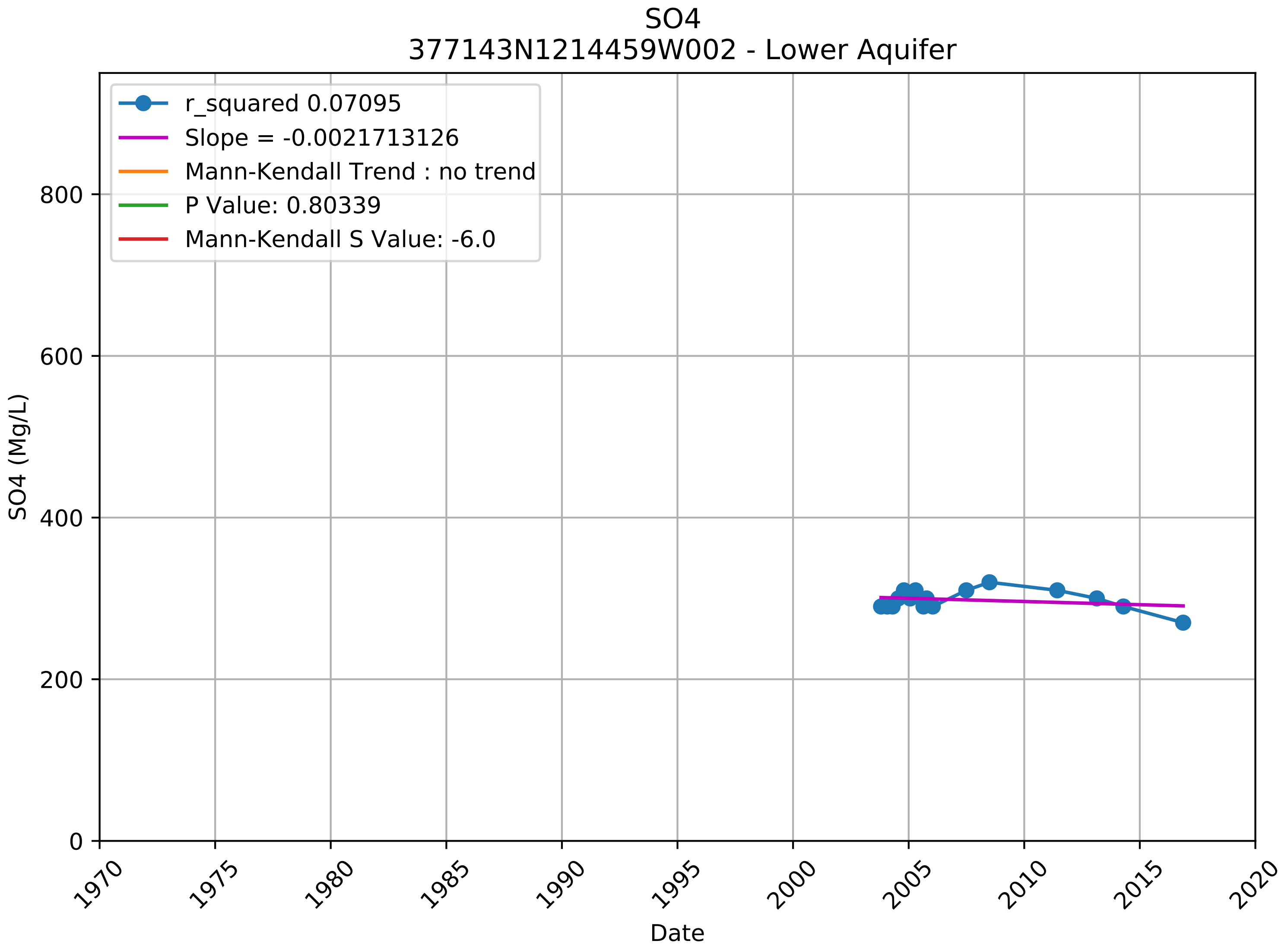
Date



SO4
377143N1214459W002 - Lower Aquifer
r_squared 0.07095
Slope = -0.0021713126
Mann-Kendall Trend : no trend
P Value: 0.80339
Mann-Kendall S Value: -6.0
SO4 (Mg/L)
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200
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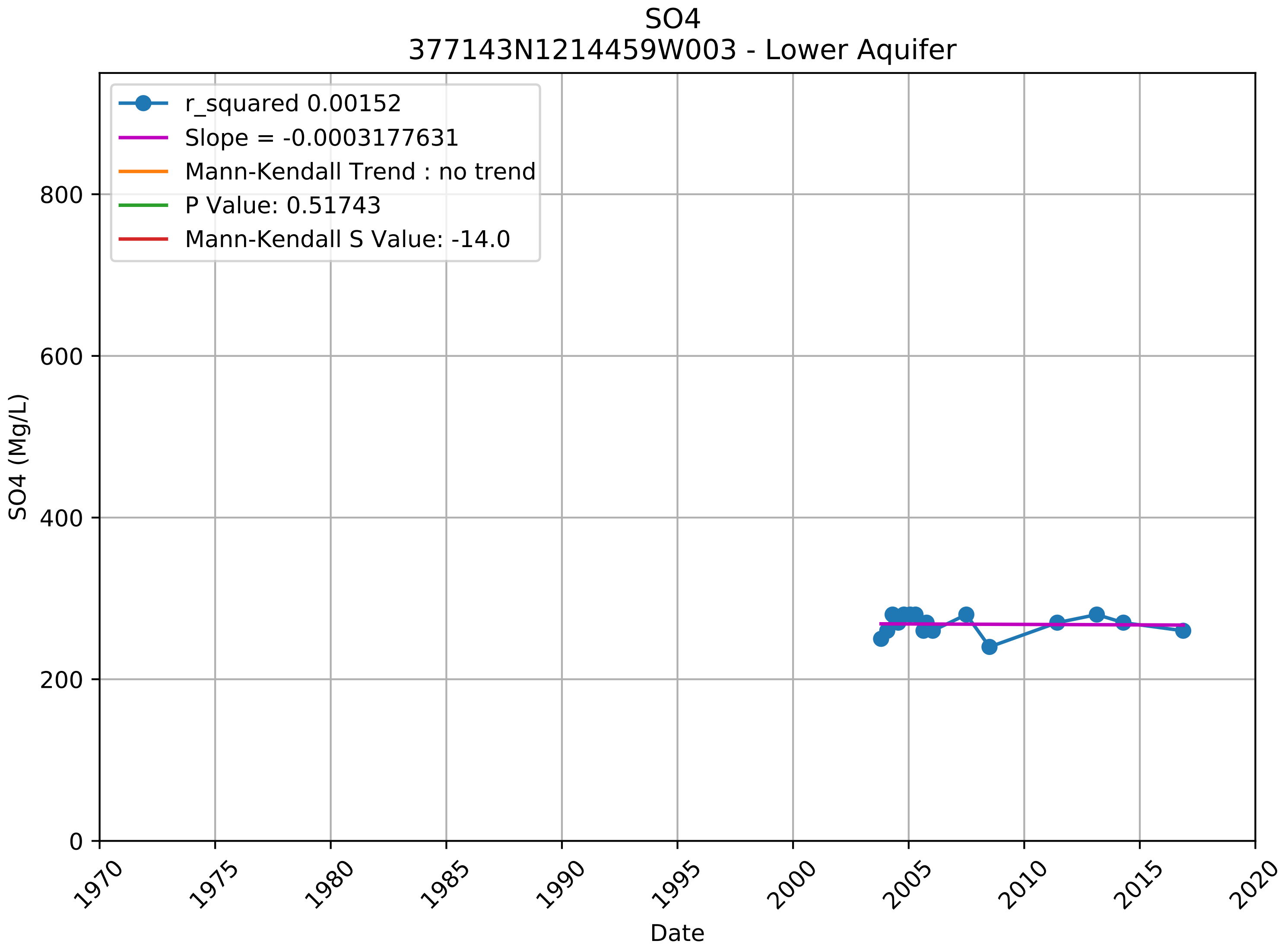
Date



SO4
377143N1214459W003 - Lower Aquifer
r_squared 0.00152
Slope = -0.0003177631
Mann-Kendall Trend : no trend
P Value: 0.51743
Mann-Kendall S Value: -14.0
SO4 (Mg/L)
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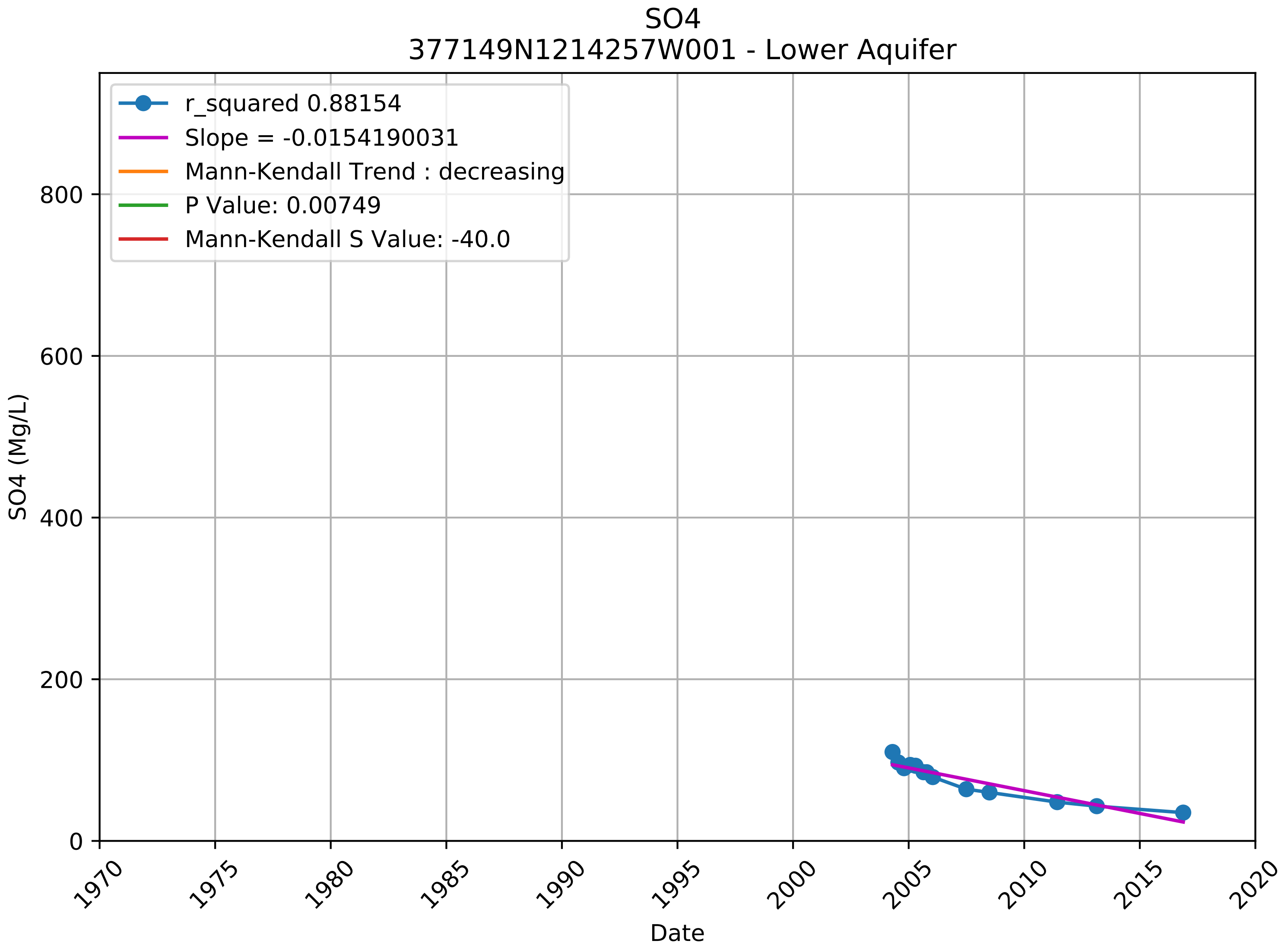
Date


SO4
377149N1214257W001 - Lower Aquifer
r_squared 0.88154
Slope = -0.0154190031
Mann-Kendall Trend : decreasing
P Value: 0.00749
Mann-Kendall S Value: -40.0
SO4 (Mg/L)
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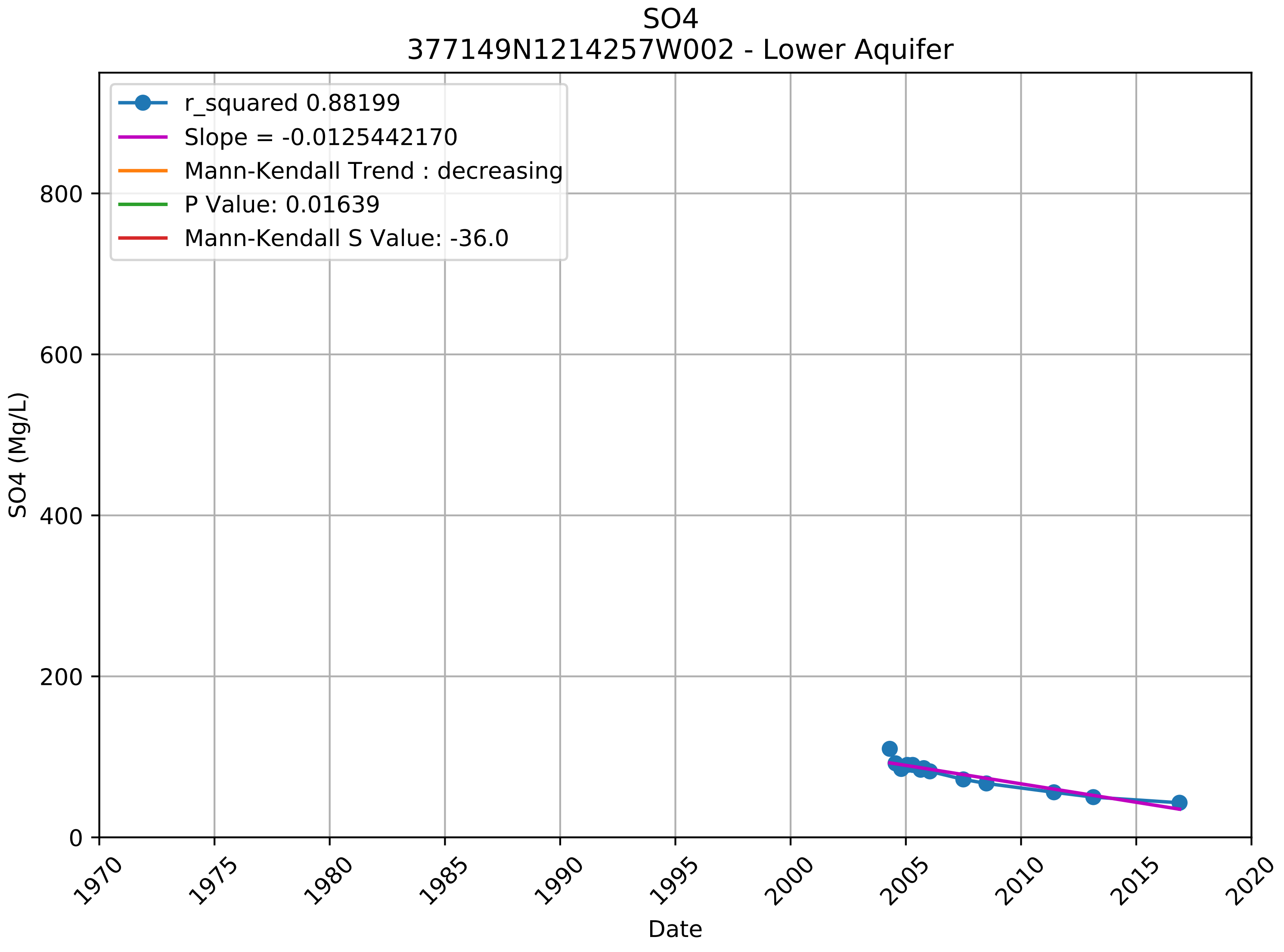
Date


SO4
377149N1214257W002 - Lower Aquifer
r_squared 0.88199
Slope = -0.0125442170
Mann-Kendall Trend : decreasing
P Value: 0.01639
Mann-Kendall S Value: -36.0
SO4 (Mg/L)
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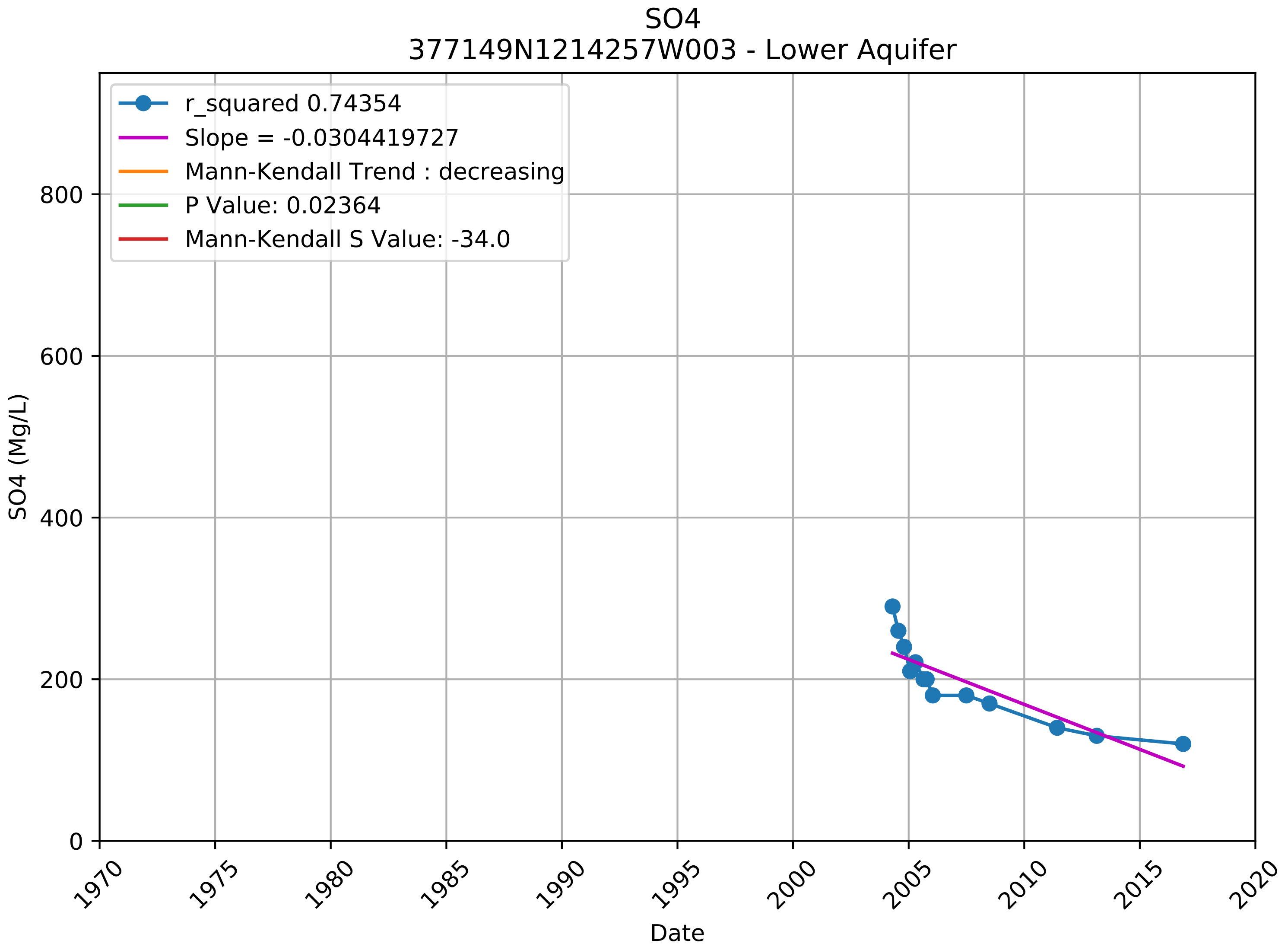
Date



SO4
377149N1214257W003 - Lower Aquifer
r_squared 0.74354
Slope = -0.0304419727
Mann-Kendall Trend : decreasing
P Value: 0.02364
Mann-Kendall S Value: -34.0
SO4 (Mg/L)
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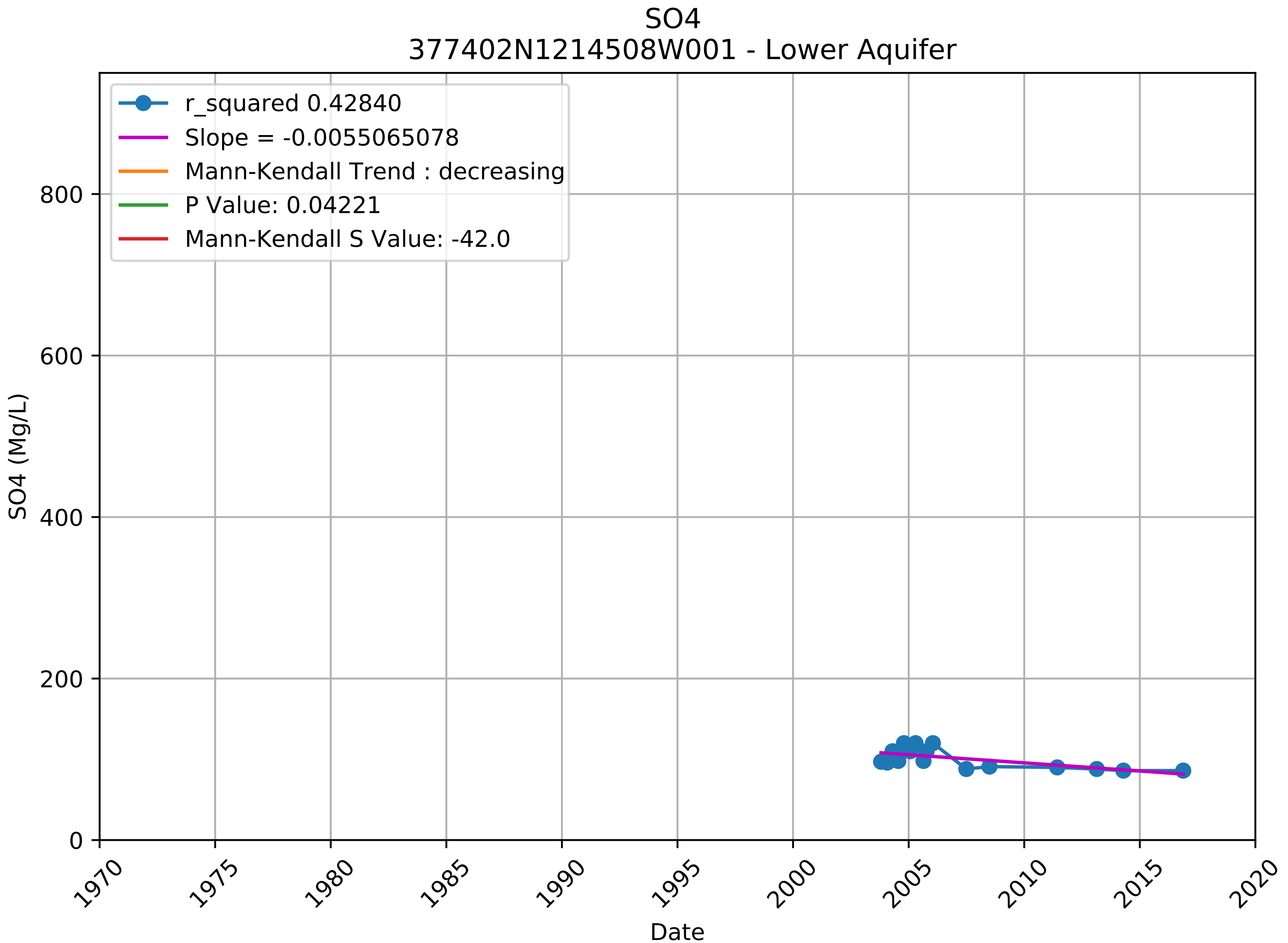
Date



SO4
377402N1214508W001 - Lower Aquifer
r_squared 0.42840
Slope = -0.0055065078
Mann-Kendall Trend : decreasing
P Value: 0.04221
Mann-Kendall S Value: -42.0
SO4 (Mg/L)
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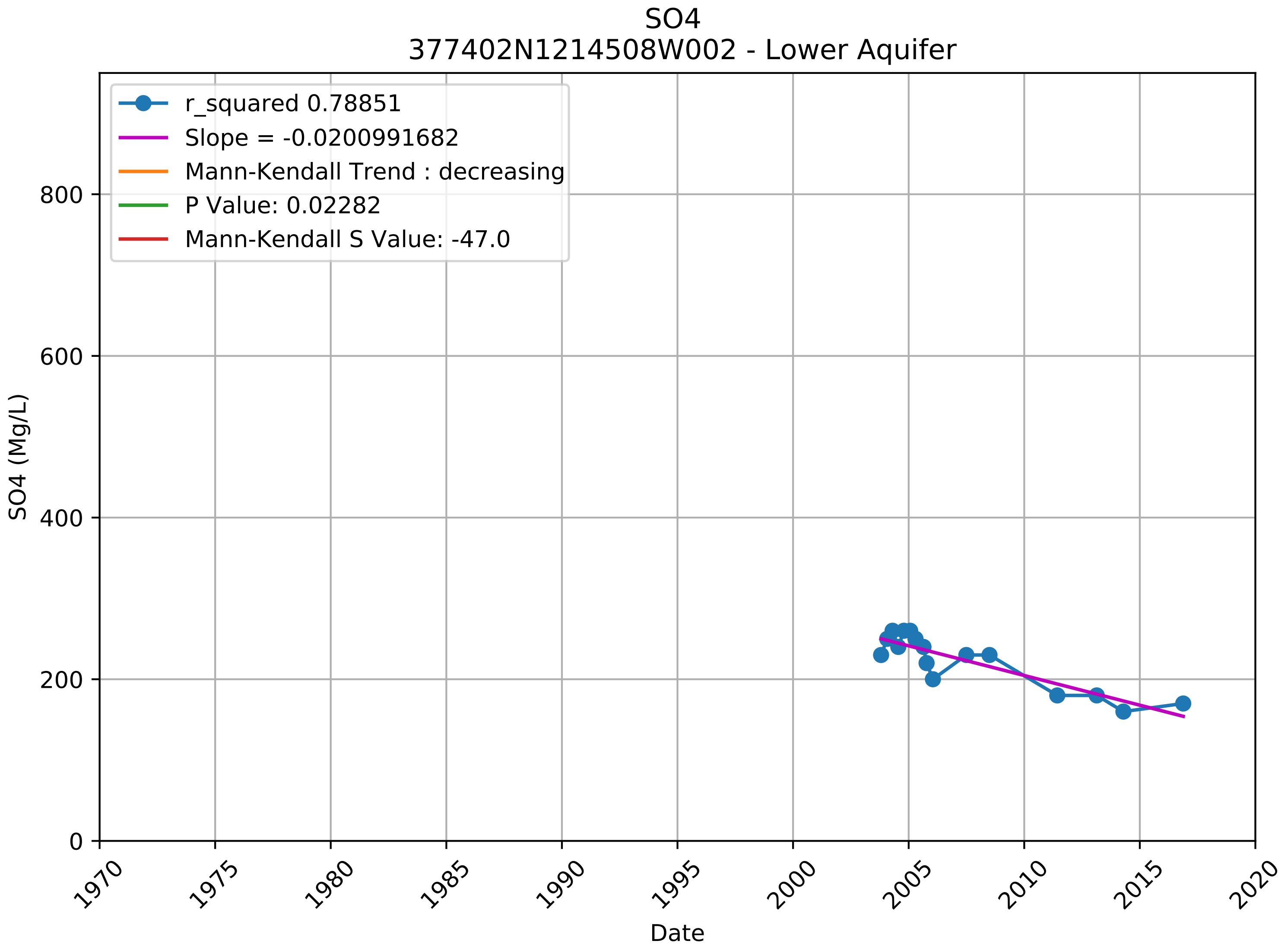
Date



SO4
377402N1214508W002 - Lower Aquifer
r_squared 0.78851
Slope = -0.0200991682
Mann-Kendall Trend : decreasing
P Value: 0.02282
Mann-Kendall S Value: -47.0
SO4 (Mg/L)
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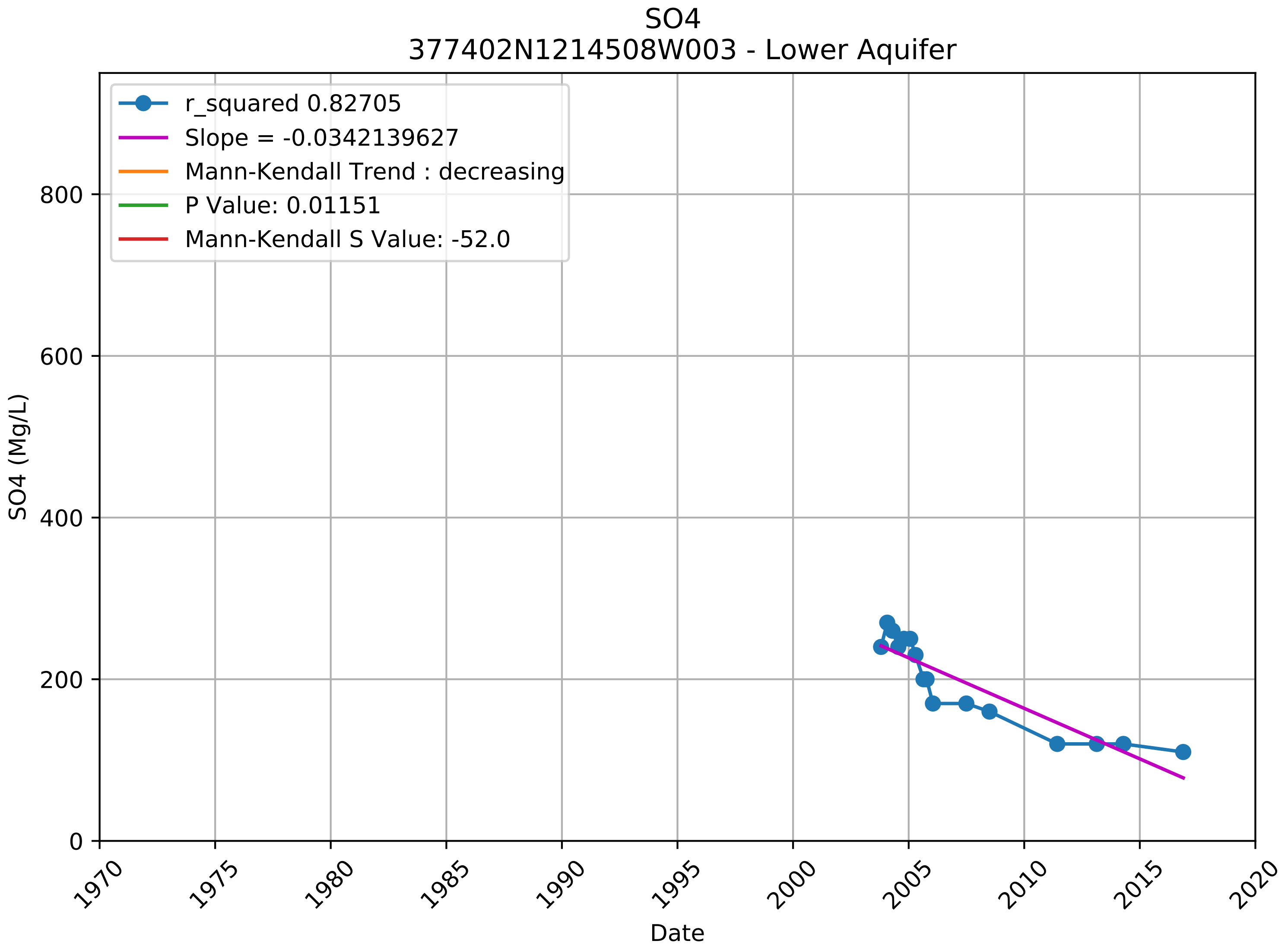
SO4
377402N1214508W003 - Lower Aquifer
r_squared 0.82705
Slope = -0.0342139627
Mann-Kendall Trend : decreasing
P Value: 0.01151
Mann-Kendall S Value: -52.0
SO4 (Mg/L)
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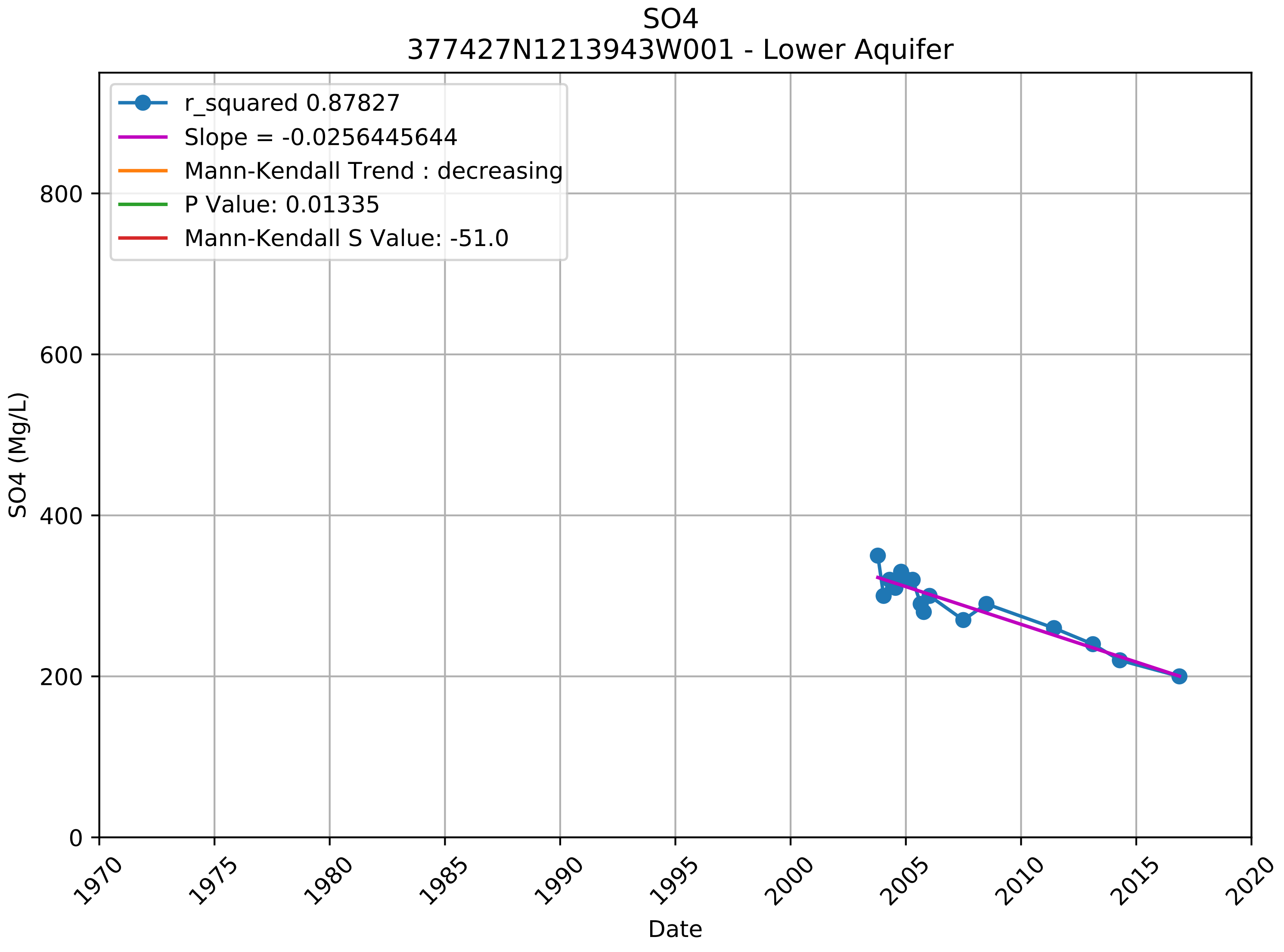

SO4
377427N1213943W001 - Lower Aquifer
r_squared 0.87827
Slope = -0.0256445644
Mann-Kendall Trend : decreasing
P Value: 0.01335
Mann-Kendall S Value: -51.0
SO4 (Mg/L)
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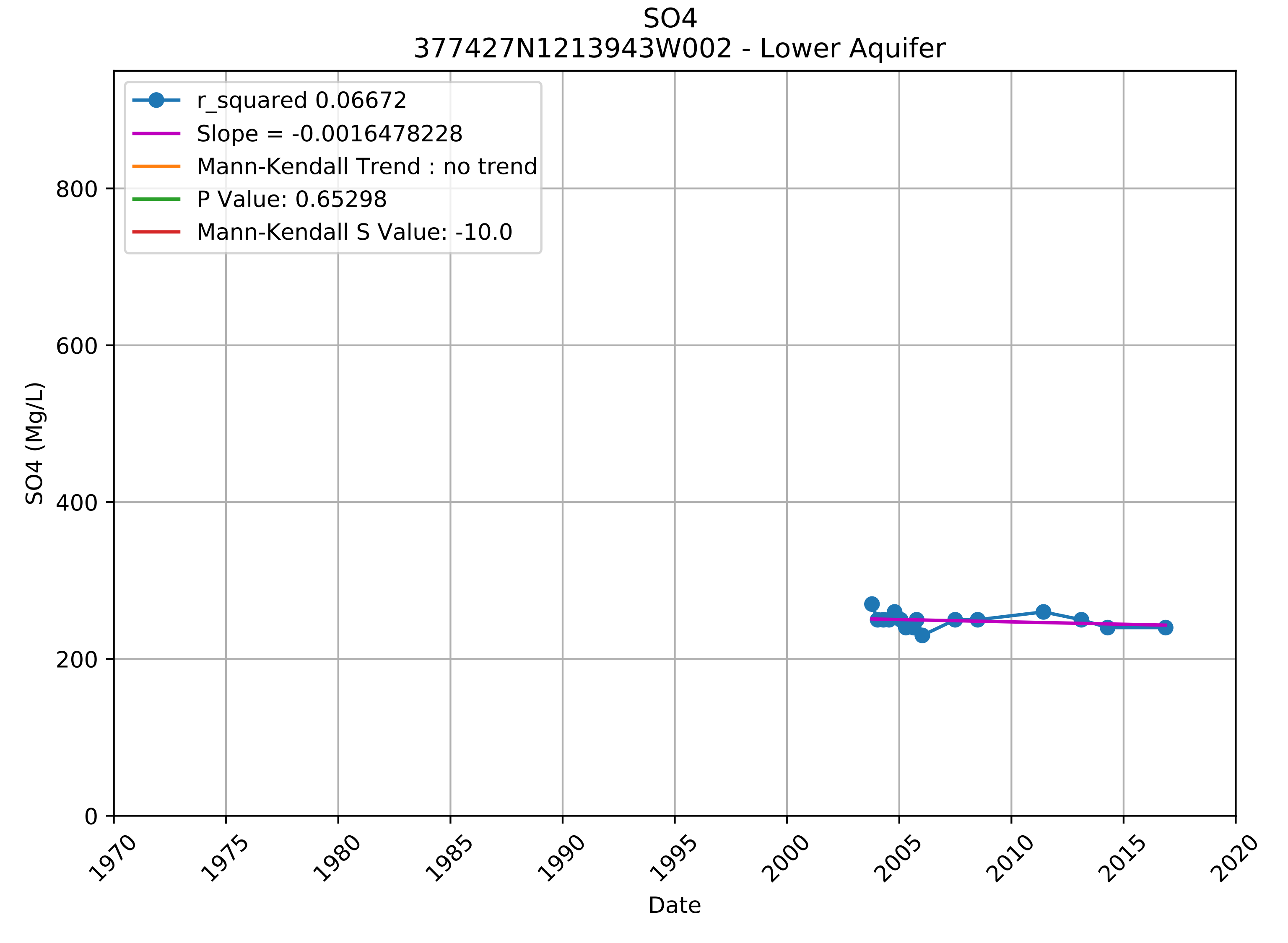
SO4
377427N1213943W002 - Lower Aquifer
r_squared 0.06672
Slope = -0.0016478228
Mann-Kendall Trend : no trend
P Value: 0.65298
Mann-Kendall S Value: -10.0
SO4 (Mg/L)
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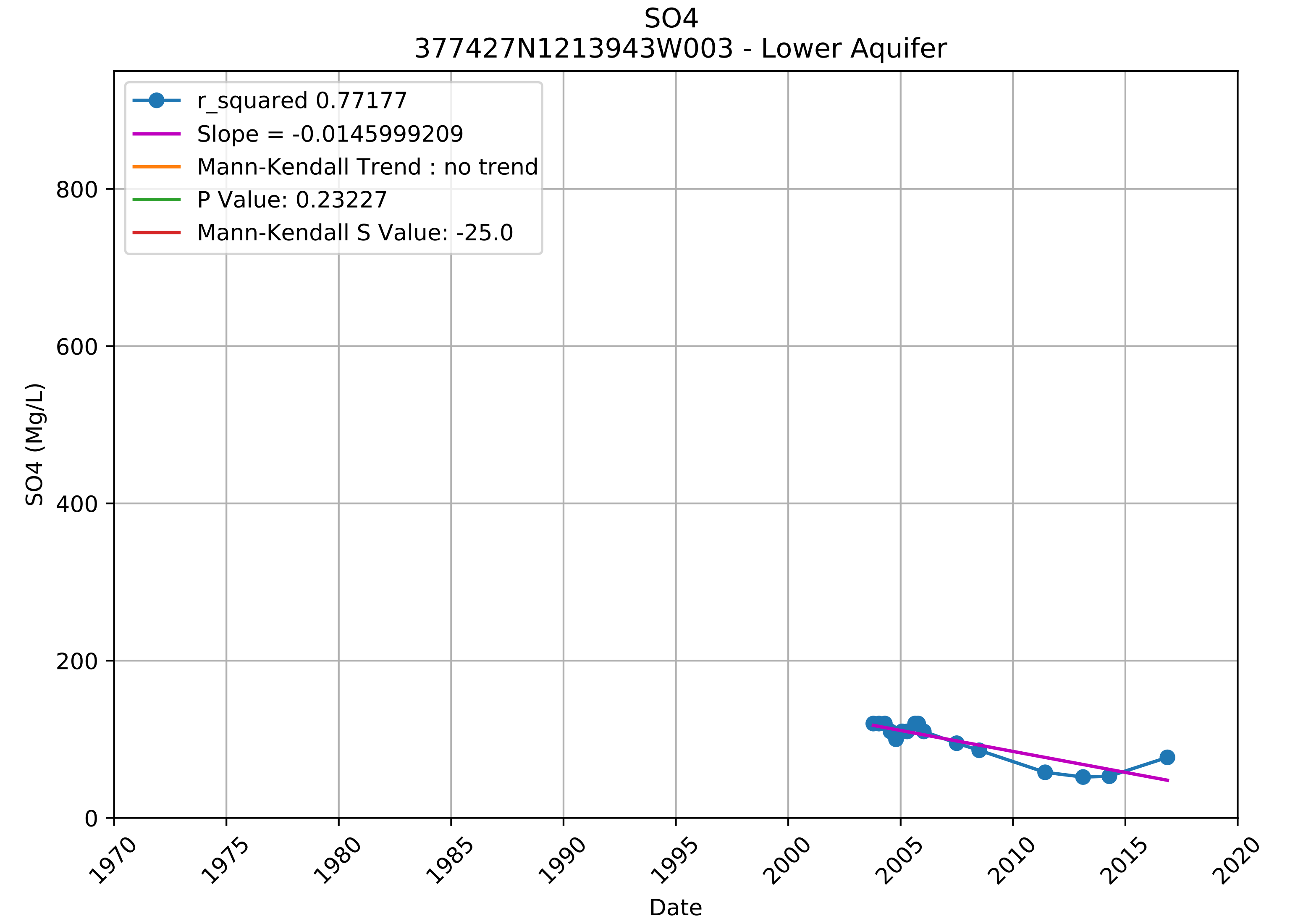
Date


SO4
377427N1213943W003 - Lower Aquifer
r_squared 0.77177
Slope = -0.0145999209
Mann-Kendall Trend : no trend
P Value: 0.23227
Mann-Kendall S Value: -25.0
SO4 (Mg/L)
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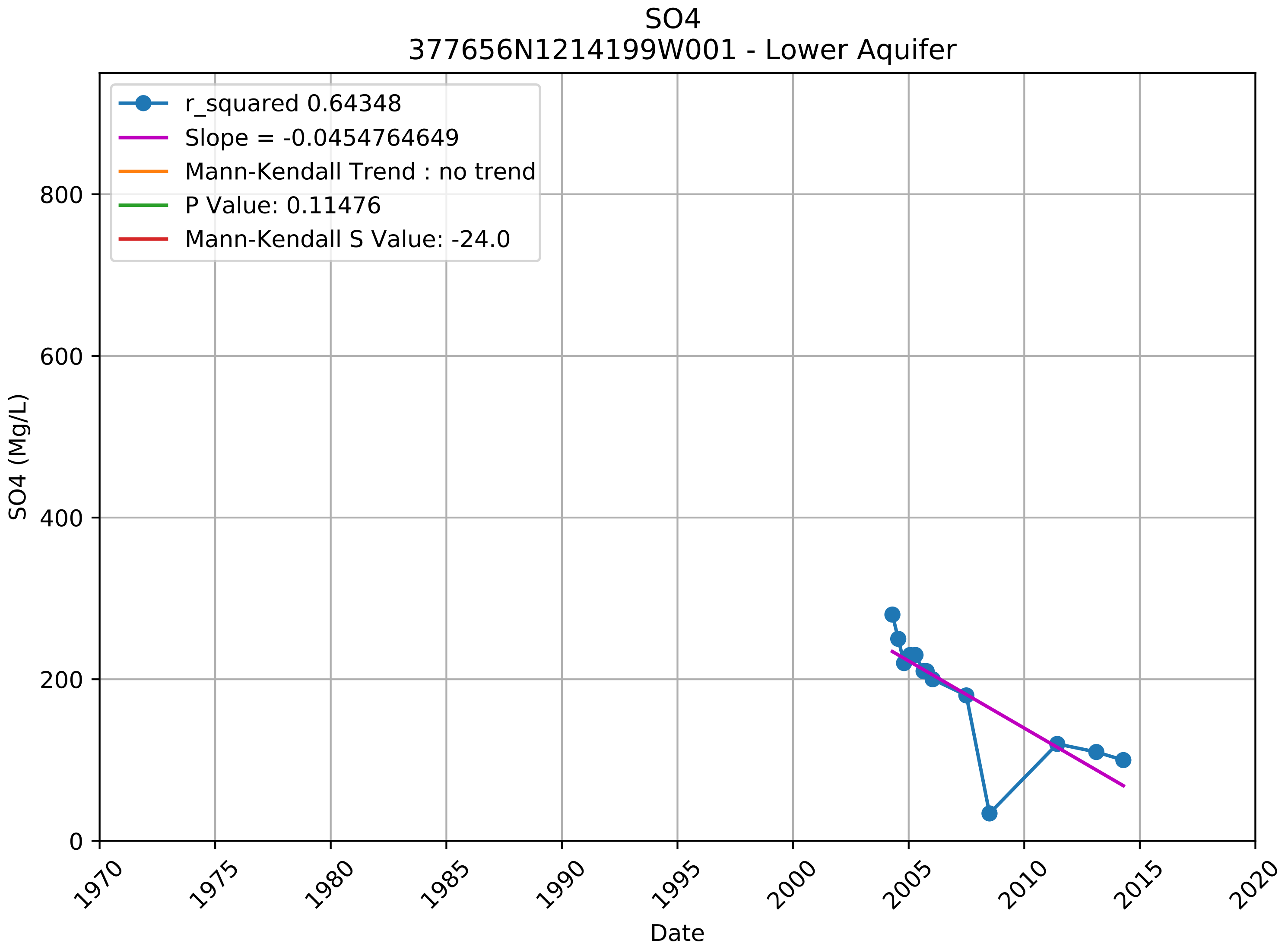
SO4
377656N1214199W001 - Lower Aquifer
r_squared 0.64348
Slope = -0.0454764649
Mann-Kendall Trend : no trend
P Value: 0.11476
Mann-Kendall S Value: -24.0
SO4 (Mg/L)
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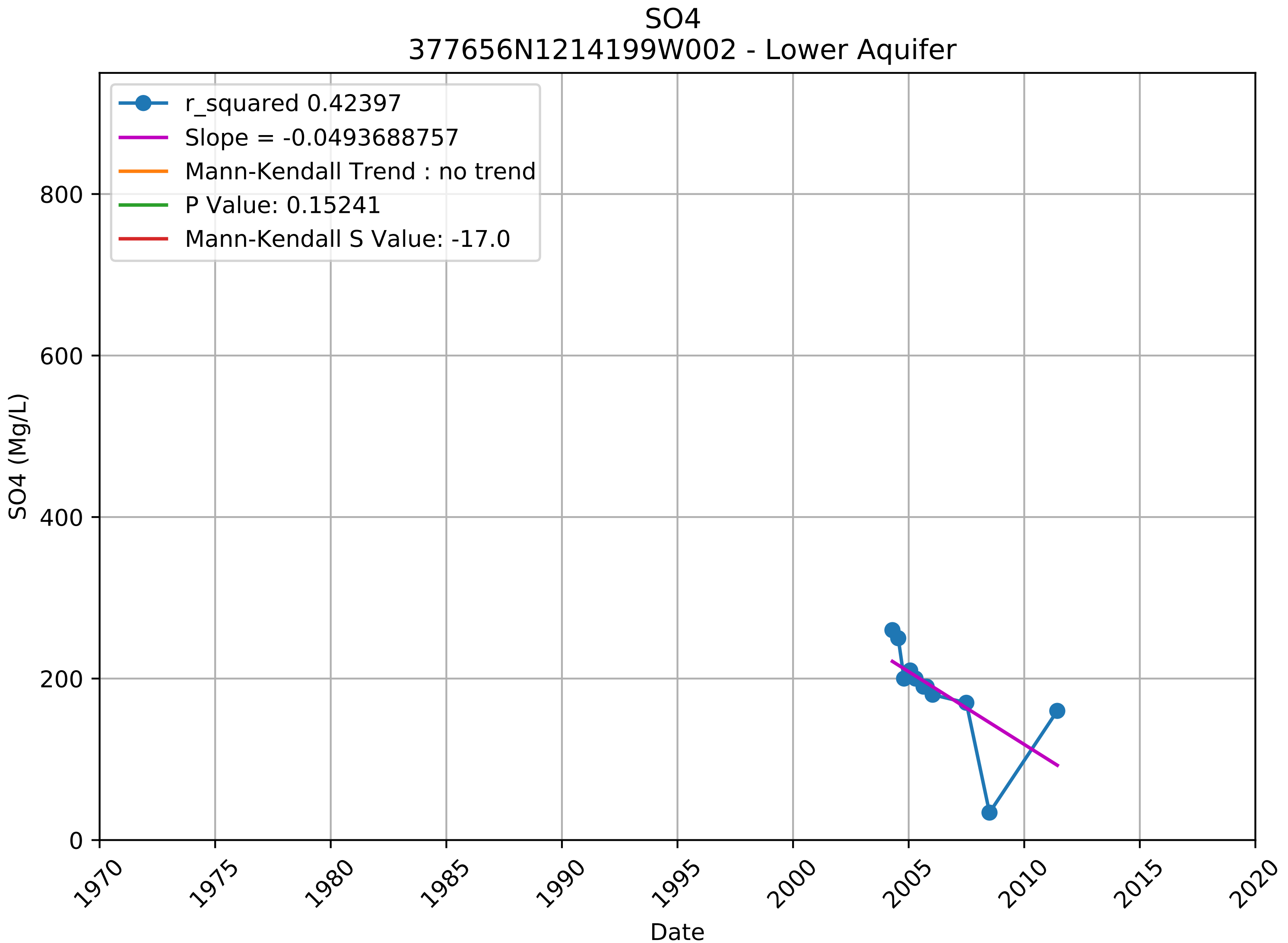
Date



SO4
377656N1214199W002 - Lower Aquifer
r_squared 0.42397
Slope = -0.0493688757
Mann-Kendall Trend : no trend
P Value: 0.15241
Mann-Kendall S Value: -17.0
SO4 (Mg/L)
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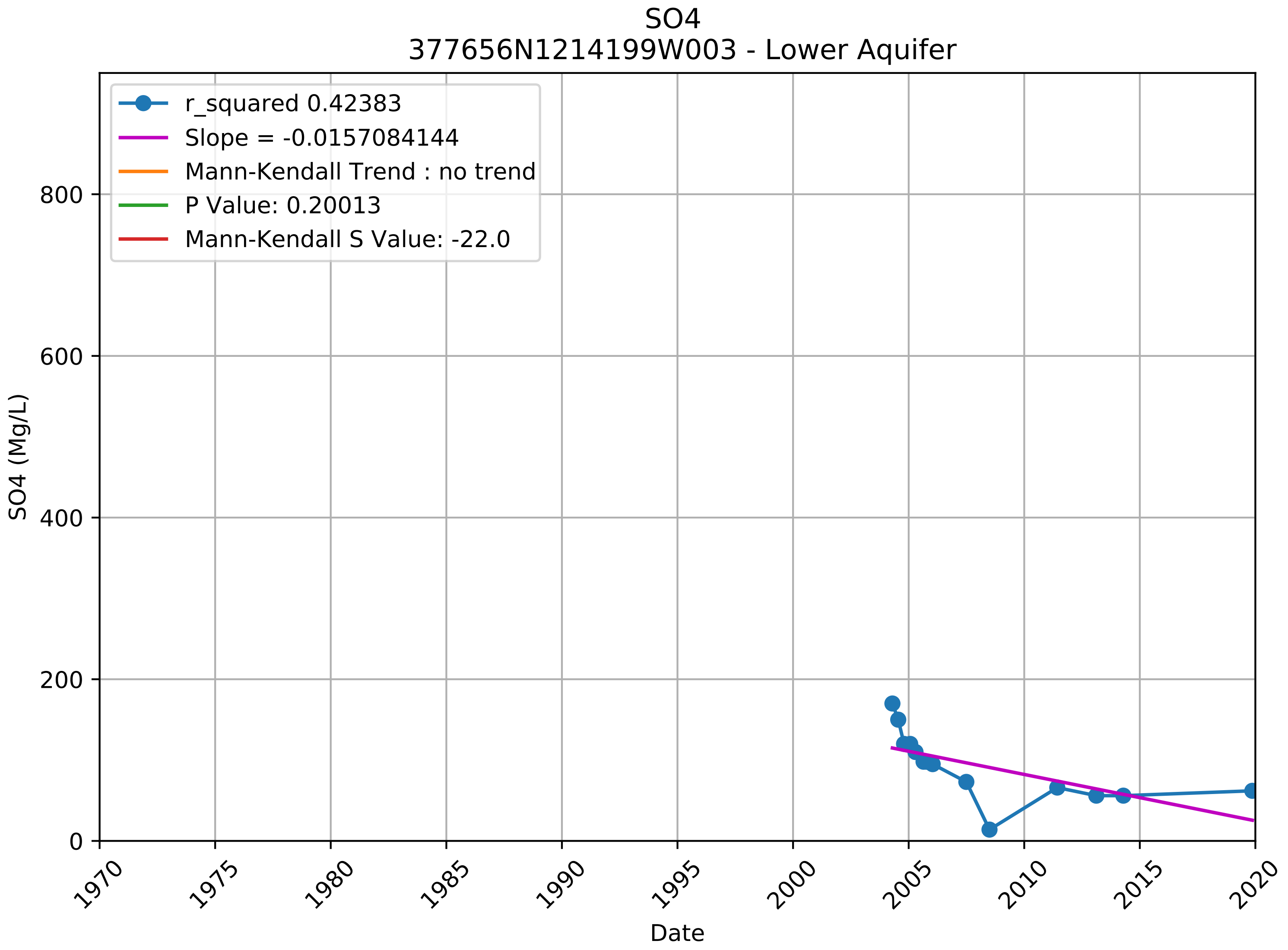
Date


SO4
377656N1214199W003 - Lower Aquifer
r_squared 0.42383
Slope = -0.0157084144
Mann-Kendall Trend : no trend
P Value: 0.20013
Mann-Kendall S Value: -22.0
SO4 (Mg/L)
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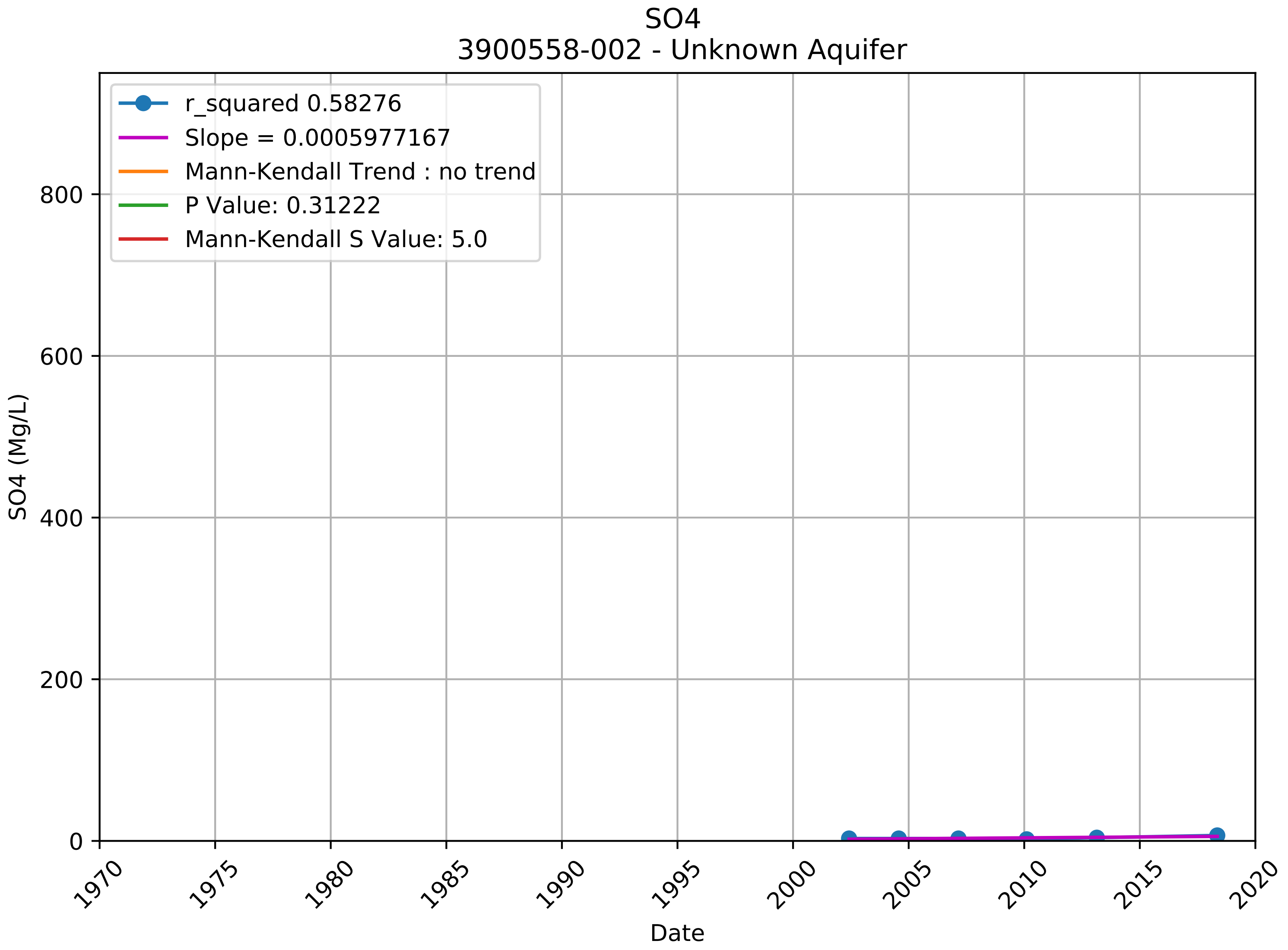
Date



SO4
3900558-002 - Unknown Aquifer
r_squared 0.58276
Slope = 0.0005977167
Mann-Kendall Trend : no trend
P Value: 0.31222
Mann-Kendall S Value: 5.0
SO4 (Mg/L)
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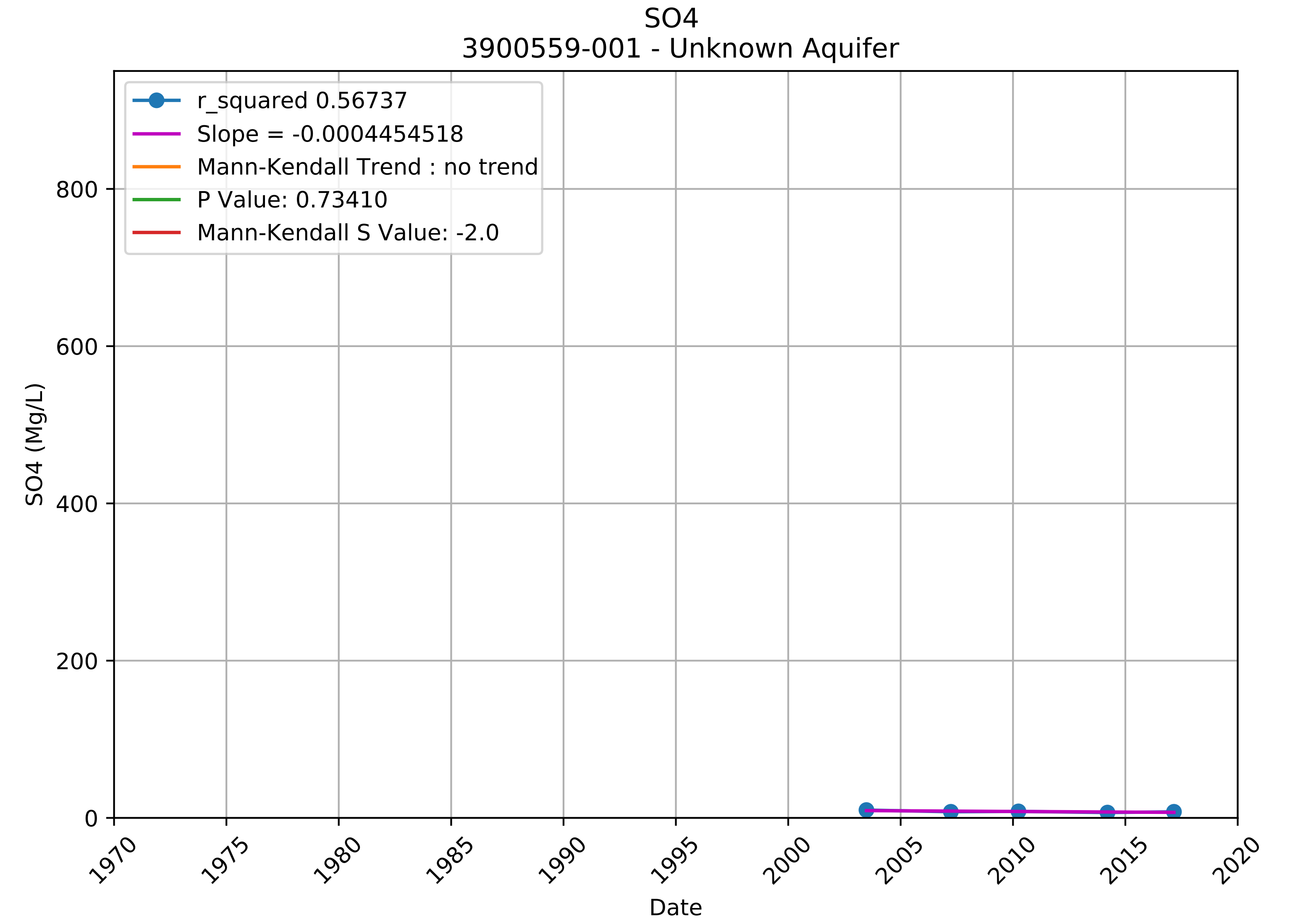
Date



SO4
3900559-001 - Unknown Aquifer
r_squared 0.56737
Slope = -0.0004454518
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: -2.0
SO4 (Mg/L)
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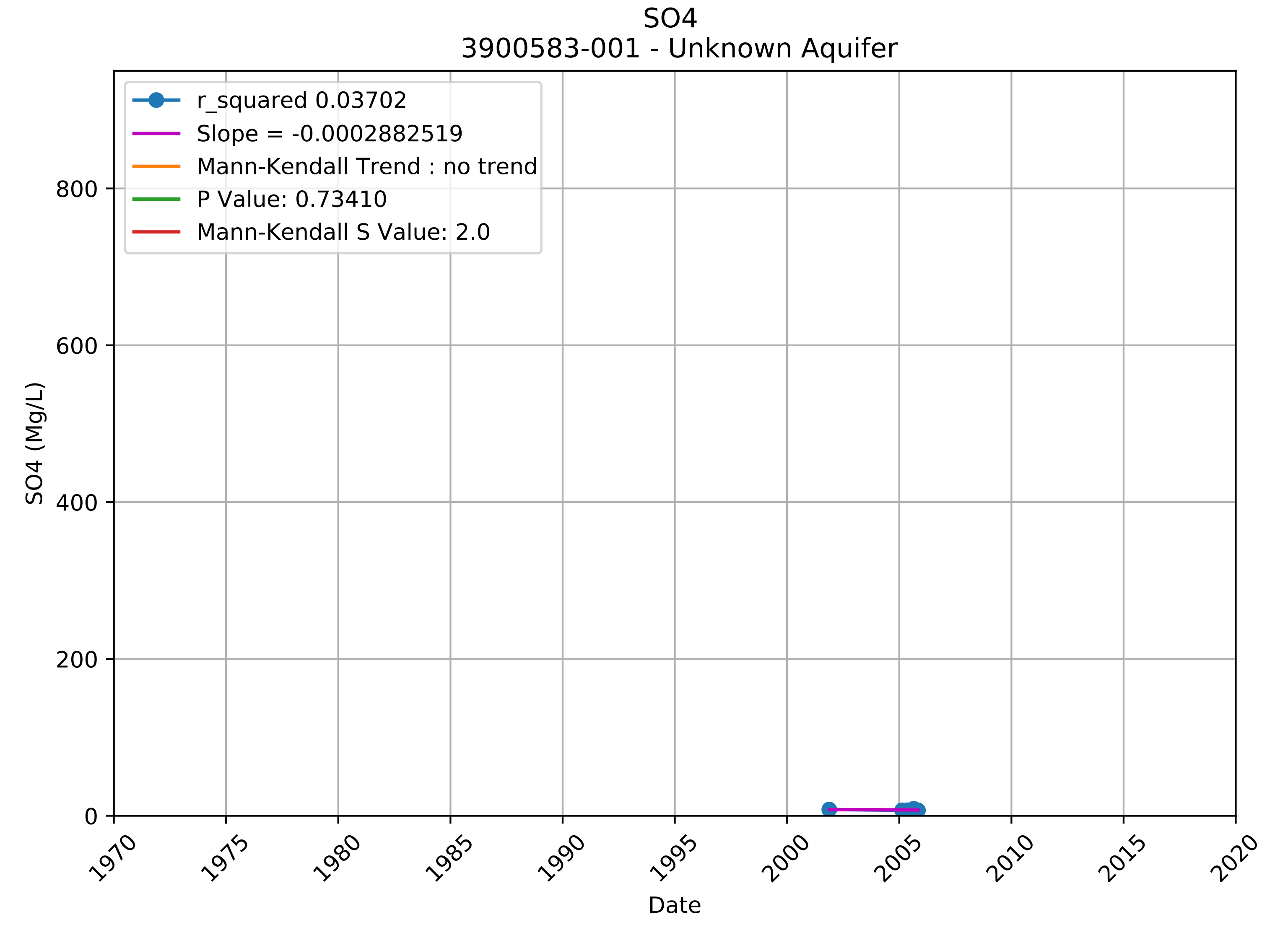
Date



SO4
3900583-001 - Unknown Aquifer
r_squared 0.03702
Slope = -0.0002882519
Mann-Kendall Trend : no trend
P Value: 0.73410
Mann-Kendall S Value: 2.0
SO4 (Mg/L)
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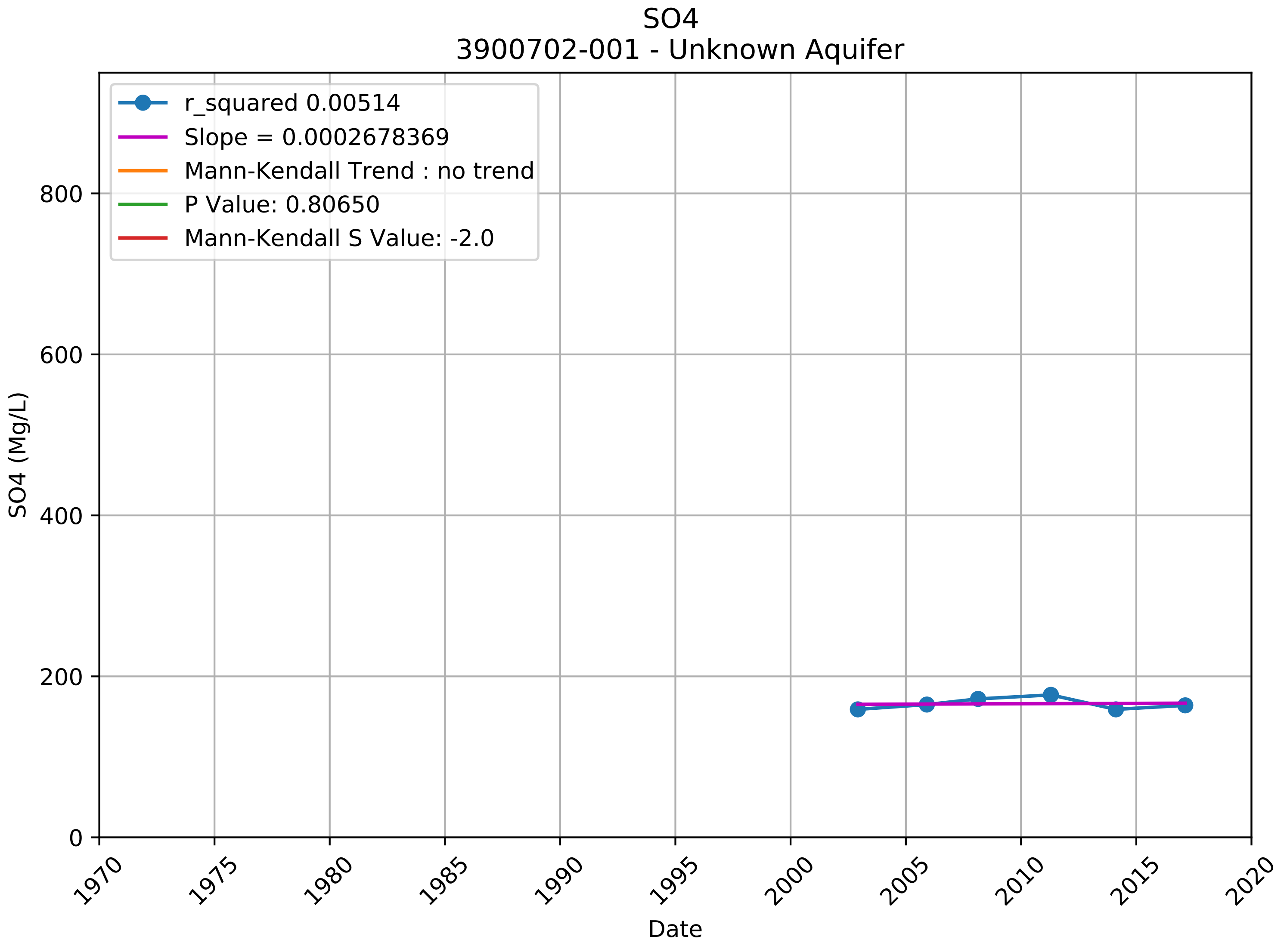
SO4
3900702-001 - Unknown Aquifer
r_squared 0.00514
Slope = 0.0002678369
Mann-Kendall Trend : no trend
P Value: 0.80650
Mann-Kendall S Value: -2.0
SO4 (Mg/L)
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200
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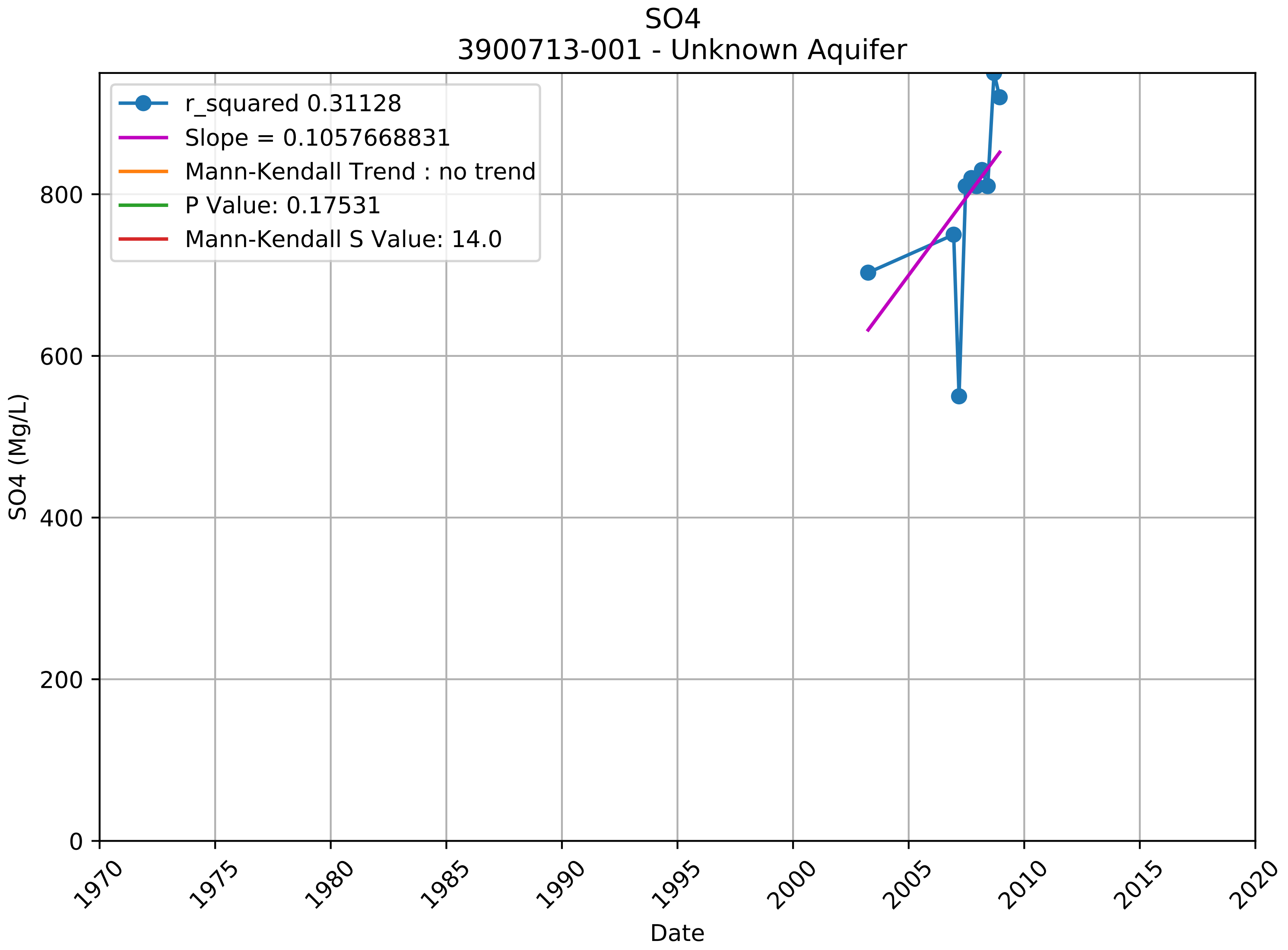
Date


SO4
3900713-001 - Unknown Aquifer
r_squared 0.31128
Slope = 0.1057668831
Mann-Kendall Trend : no trend
P Value: 0.17531
Mann-Kendall S Value: 14.0
SO4 (Mg/L)
0
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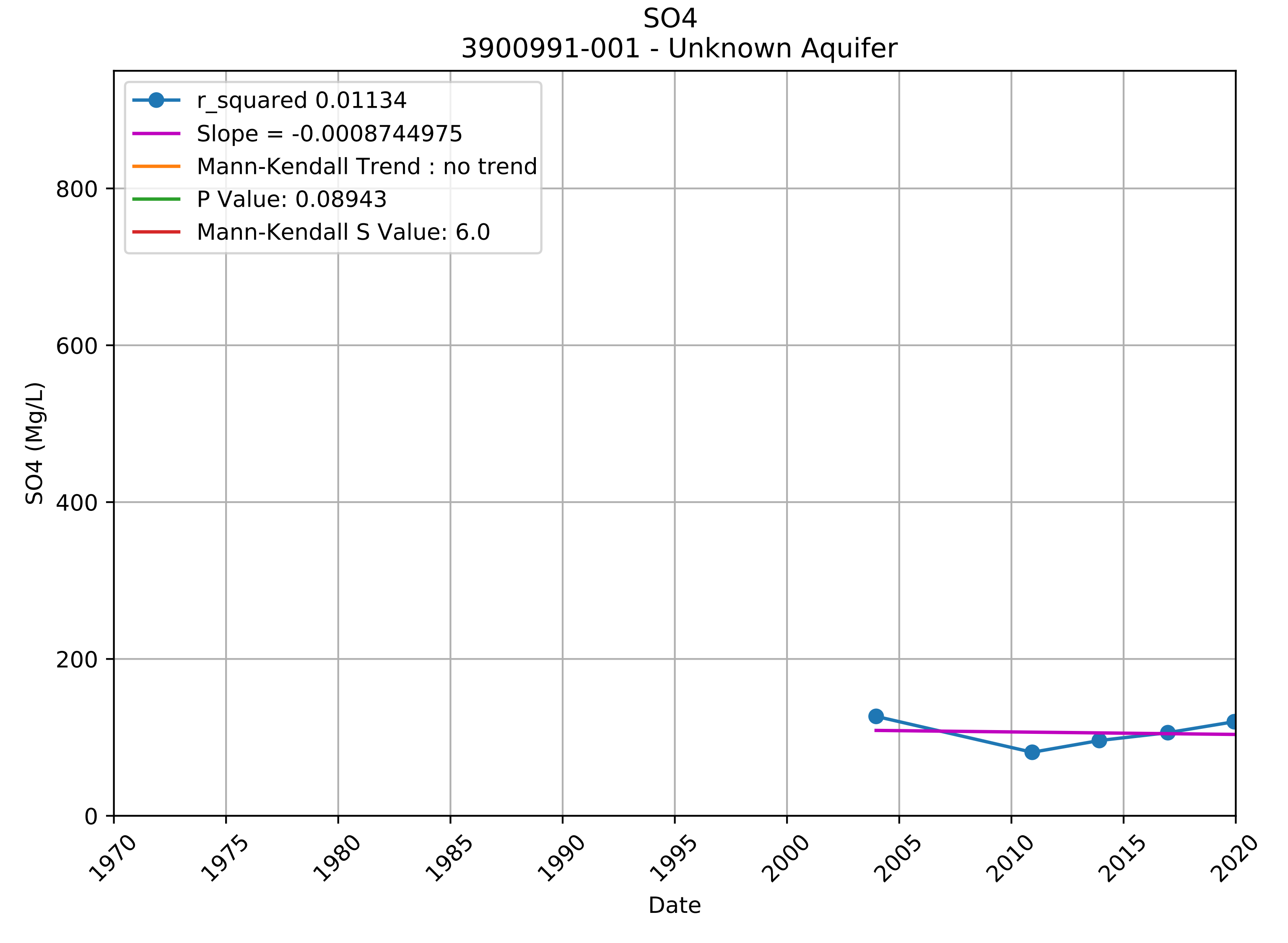
Date


SO4
3900991-001 - Unknown Aquifer
r_squared 0.01134
Slope = -0.0008744975
Mann-Kendall Trend : no trend
P Value: 0.08943
Mann-Kendall S Value: 6.0
SO4 (Mg/L)
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1970
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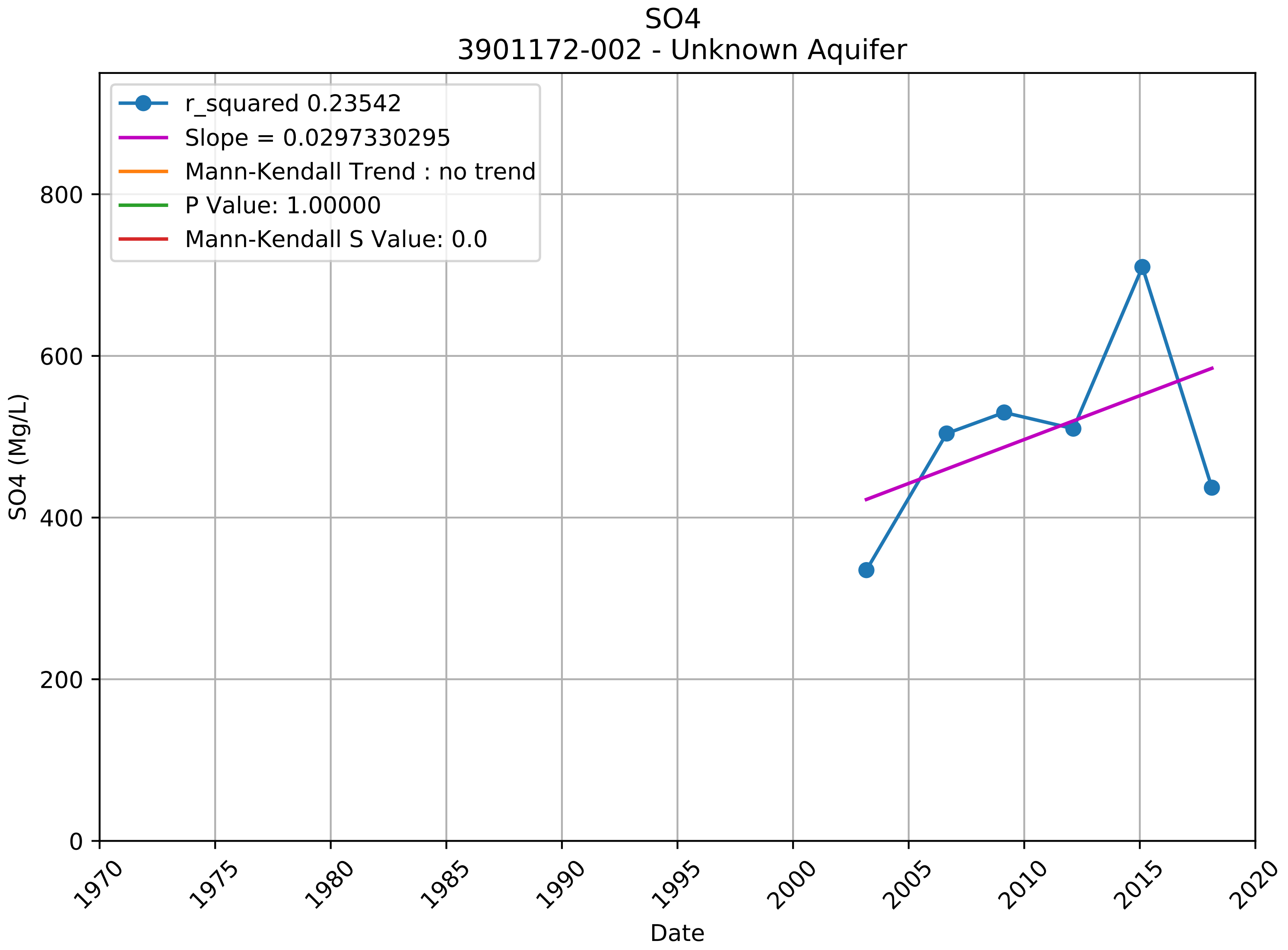
Date



SO4
3901172-002 - Unknown Aquifer
r_squared 0.23542
Slope = 0.0297330295
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
SO4 (Mg/L)
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200
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1970
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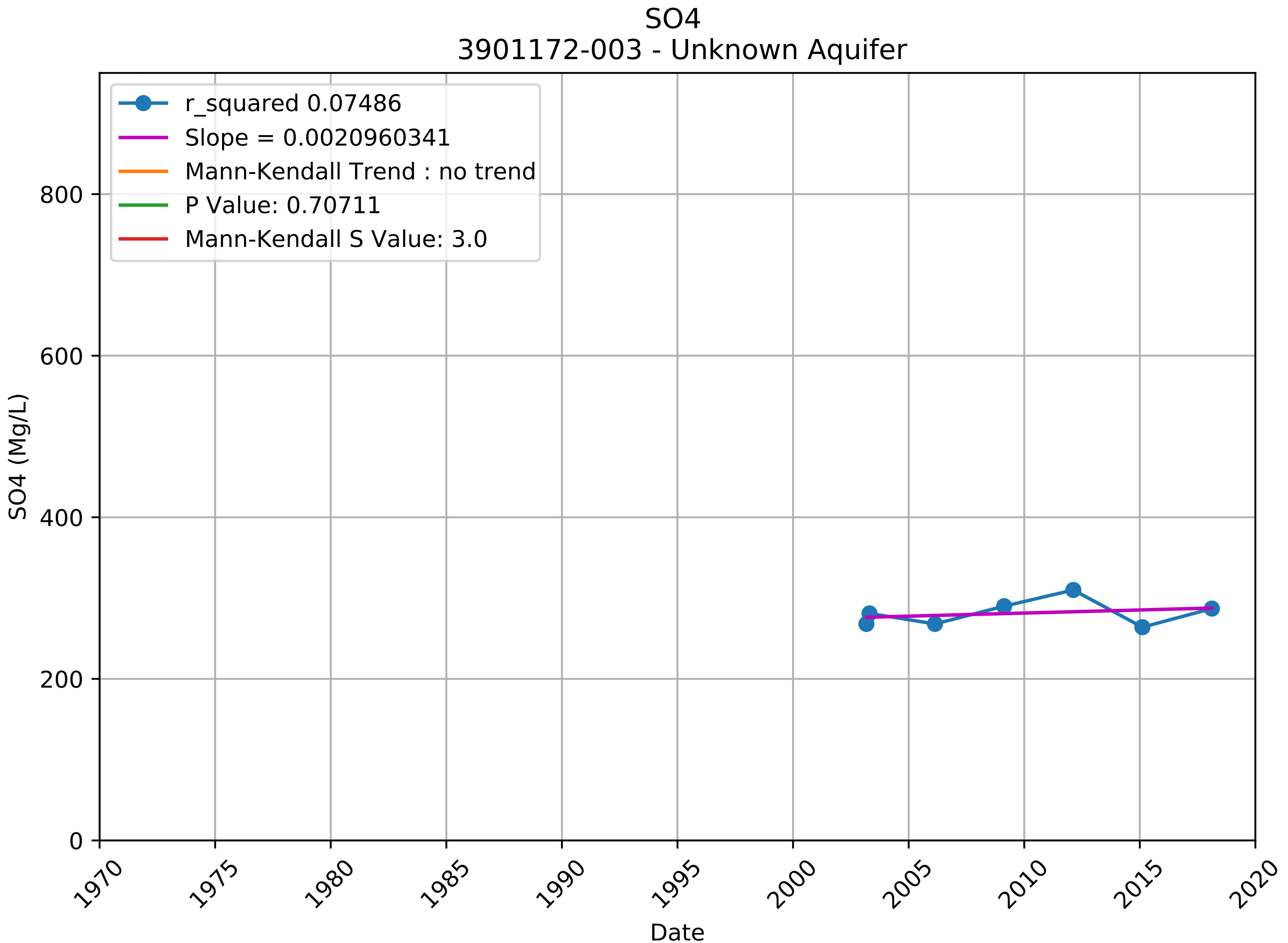
Date



SO4
3901172-003 - Unknown Aquifer
r_squared 0.07486
Slope = 0.0020960341
Mann-Kendall Trend : no trend
P Value: 0.70711
Mann-Kendall S Value: 3.0
SO4 (Mg/L)
0
200
400
600
800
1970
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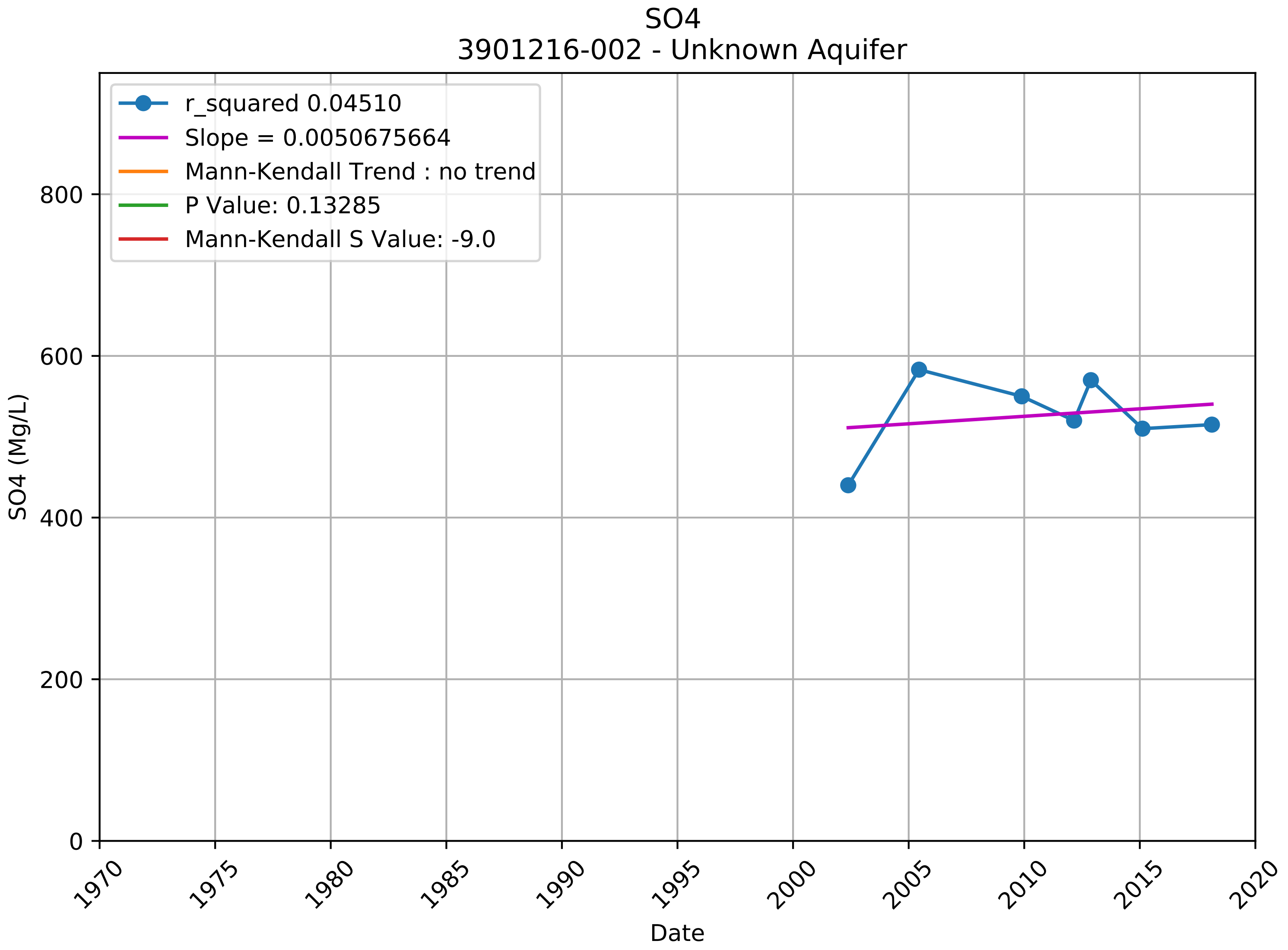
Date


SO4
3901216-002 - Unknown Aquifer
r_squared 0.04510
Slope = 0.0050675664
Mann-Kendall Trend : no trend
P Value: 0.13285
Mann-Kendall S Value: -9.0
SO4 (Mg/L)
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200
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1970
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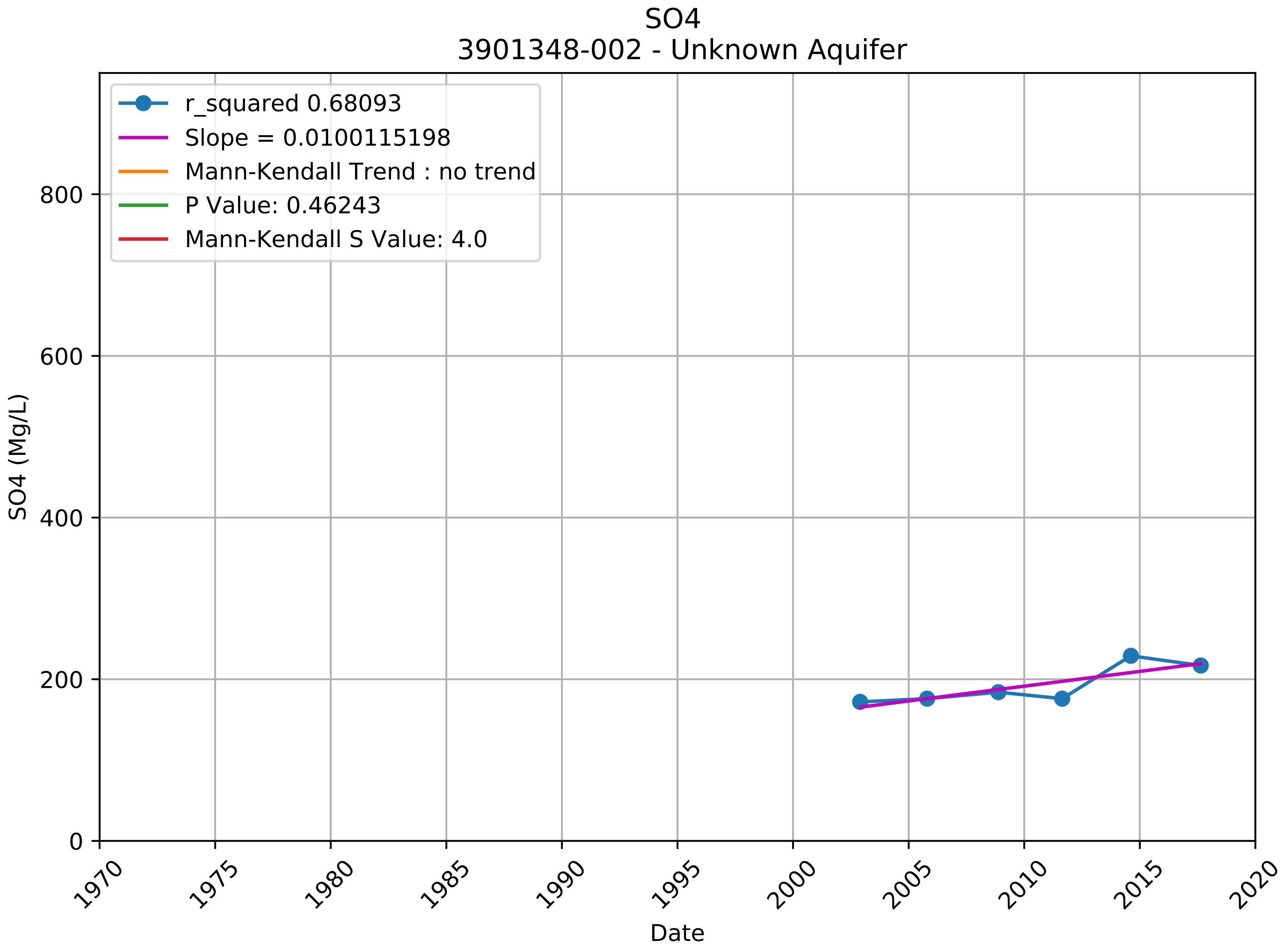
Date


SO4
3901348-002 - Unknown Aquifer
r_squared 0.68093
Slope = 0.0100115198
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: 4.0
SO4 (Mg/L)
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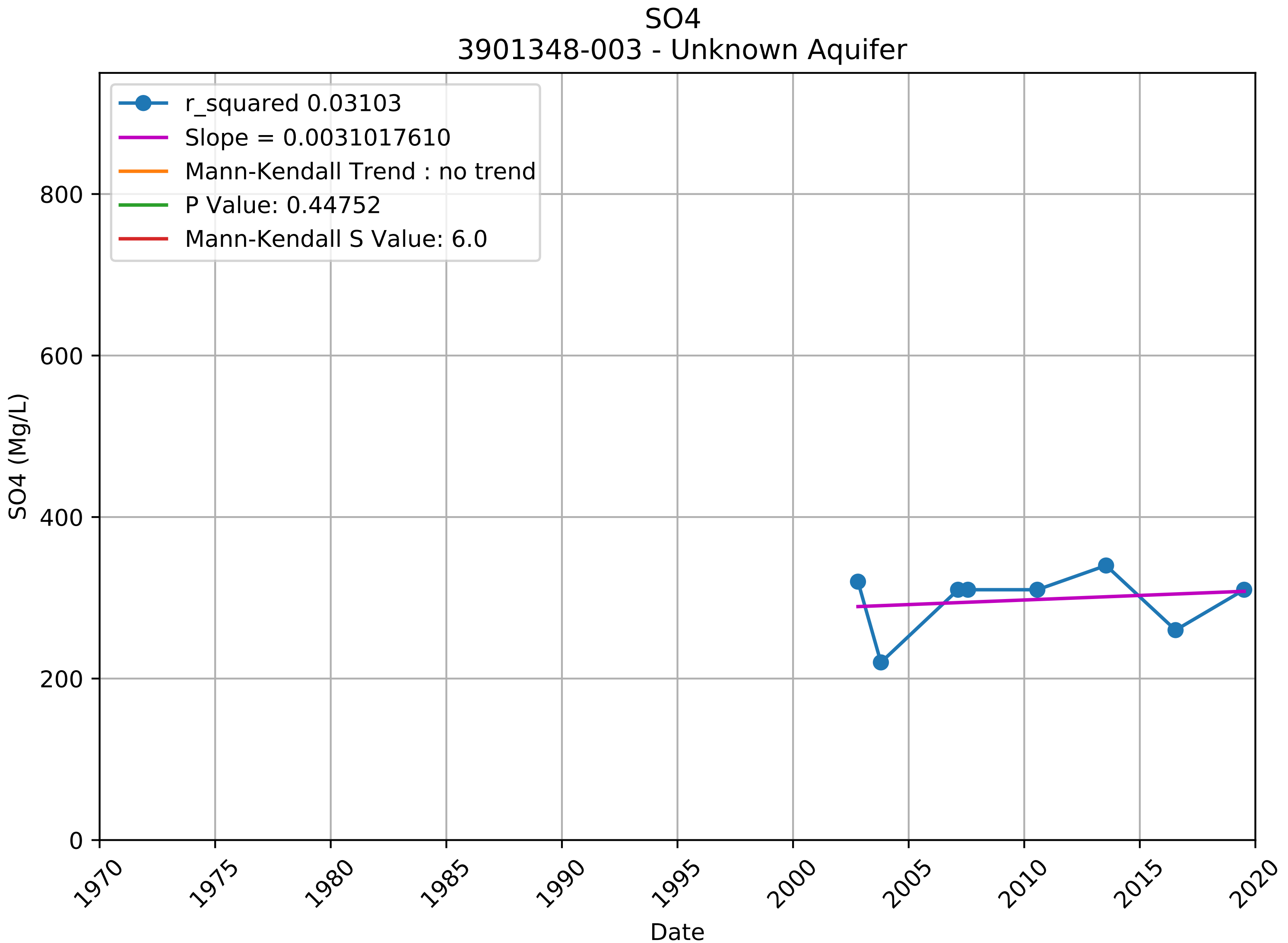
Date



SO4
3901348-003 - Unknown Aquifer
r_squared 0.03103
Slope = 0.0031017610
Mann-Kendall Trend : no trend
P Value: 0.44752
Mann-Kendall S Value: 6.0
SO4 (Mg/L)
800
600
400
200
0
1970
1975
1980
1985
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1995
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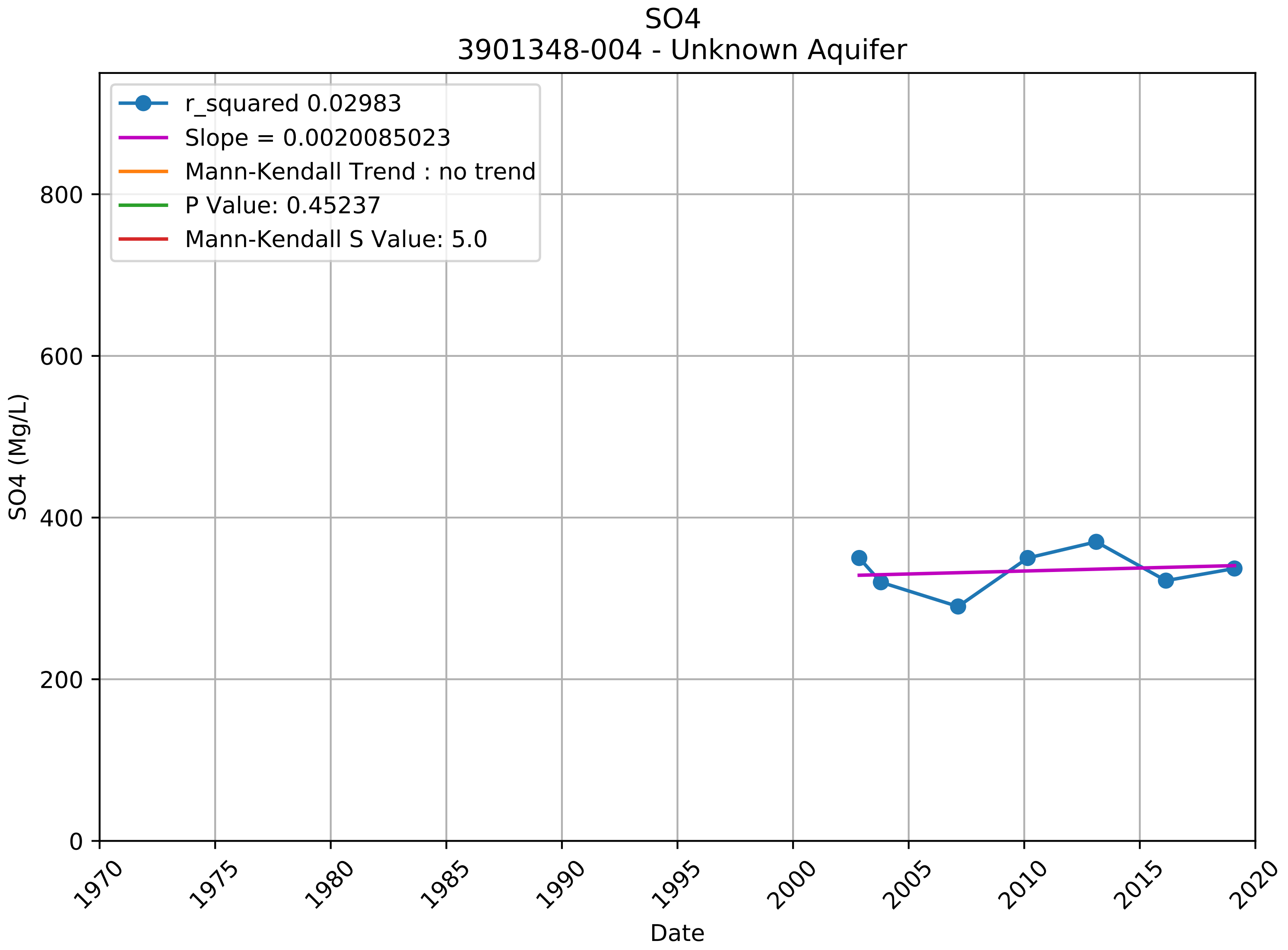
2020
Date



SO4
3901348-004 - Unknown Aquifer
r_squared 0.02983
Slope = 0.0020085023
Mann-Kendall Trend : no trend
P Value: 0.45237
Mann-Kendall S Value: 5.0
SO4 (Mg/L)
0
200
400
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1970
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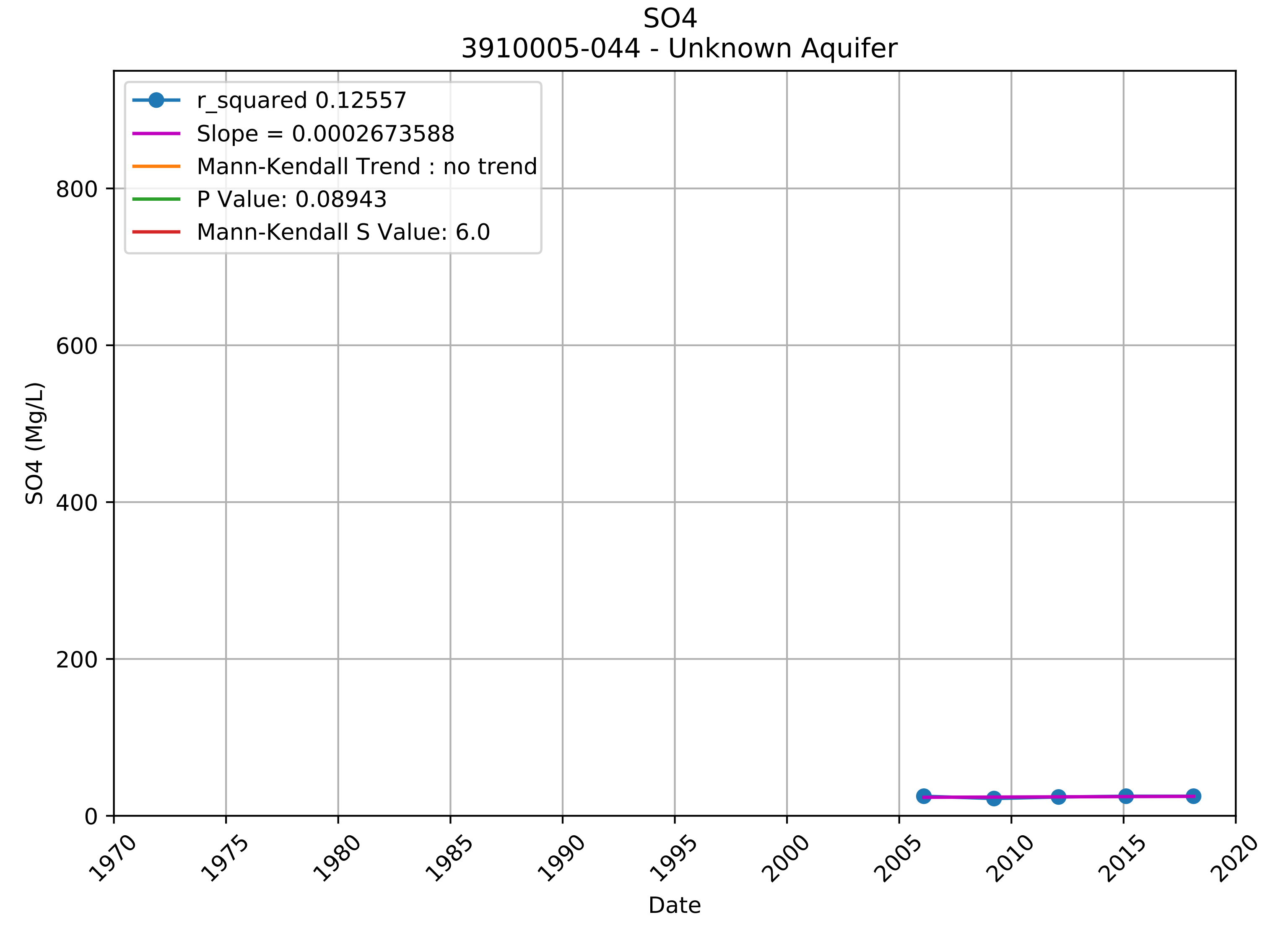
2020
Date



SO4
3910005-044 - Unknown Aquifer
r_squared 0.12557
Slope = 0.0002673588
Mann-Kendall Trend : no trend
P Value: 0.08943
Mann-Kendall S Value: 6.0
SO4 (Mg/L)
0
200
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1970
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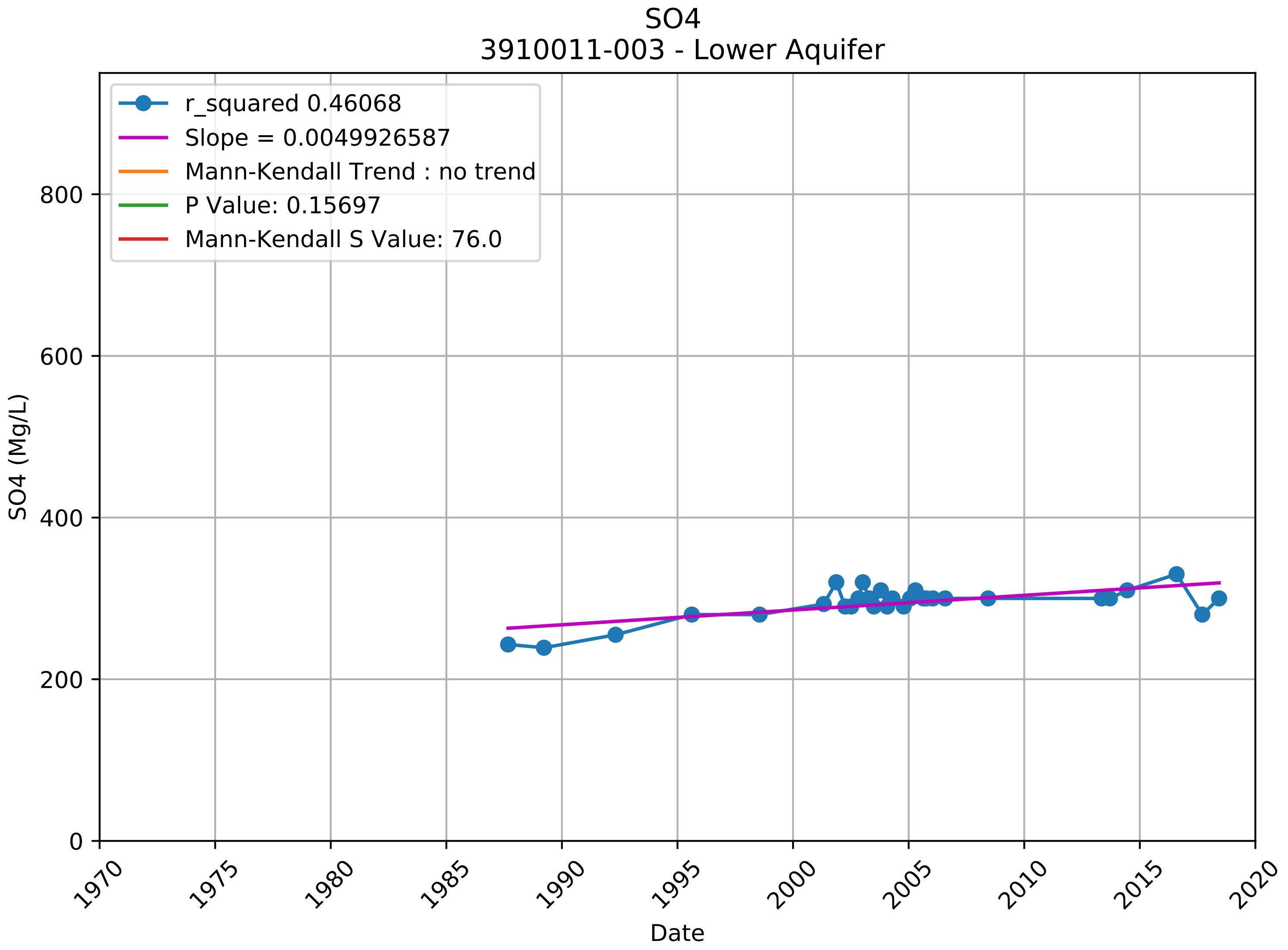
2020
Date


SO4
3910011-003 - Lower Aquifer
r_squared 0.46068
Slope = 0.0049926587
Mann-Kendall Trend : no trend
P Value: 0.15697
Mann-Kendall S Value: 76.0
SO4 (Mg/L)
0
200
400
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1970
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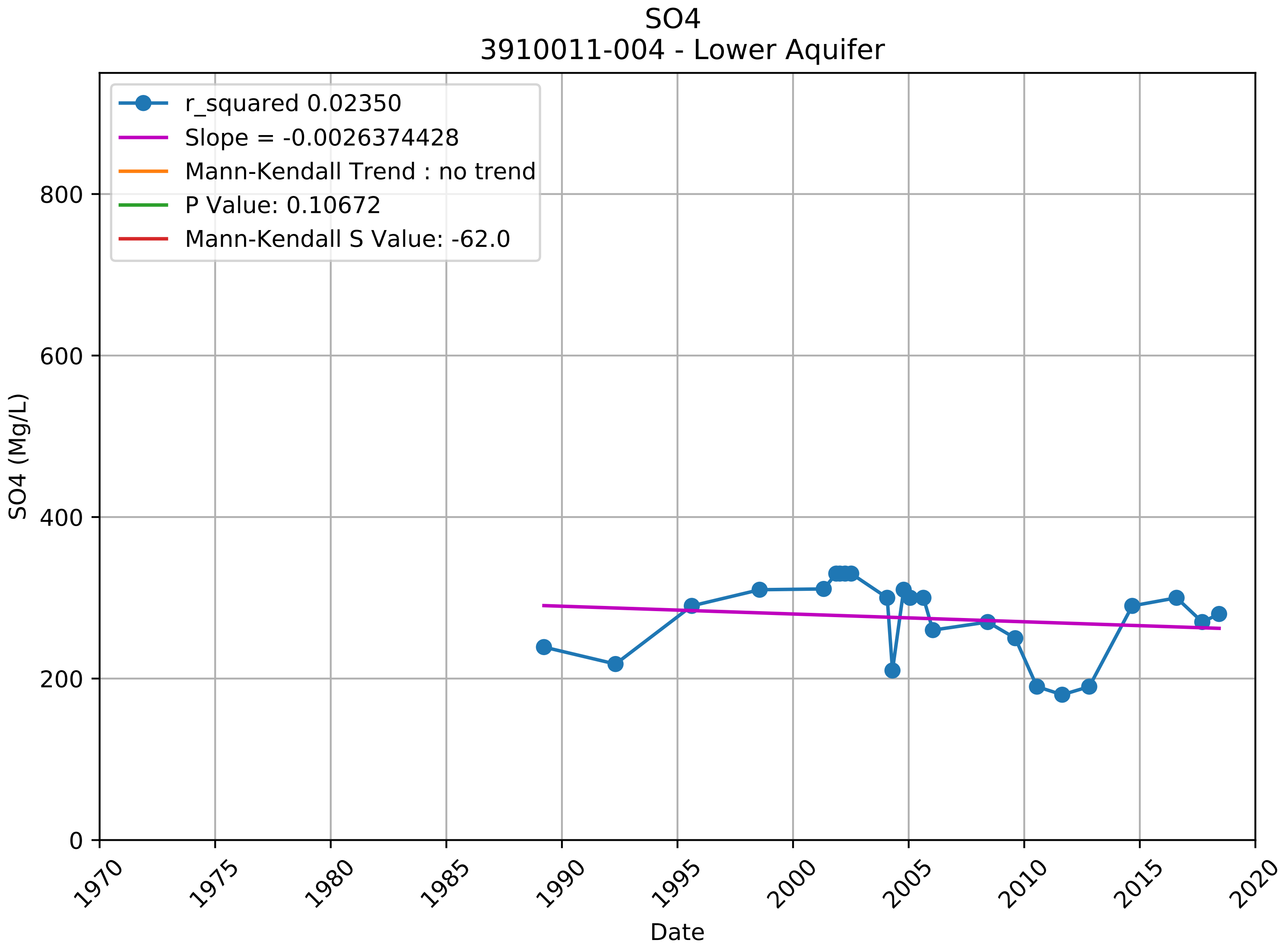
2020
Date



SO4
3910011-004 - Lower Aquifer
r_squared 0.02350
Slope = -0.0026374428
Mann-Kendall Trend : no trend
P Value: 0.10672
Mann-Kendall S Value: -62.0
SO4 (Mg/L)
0
200
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1970
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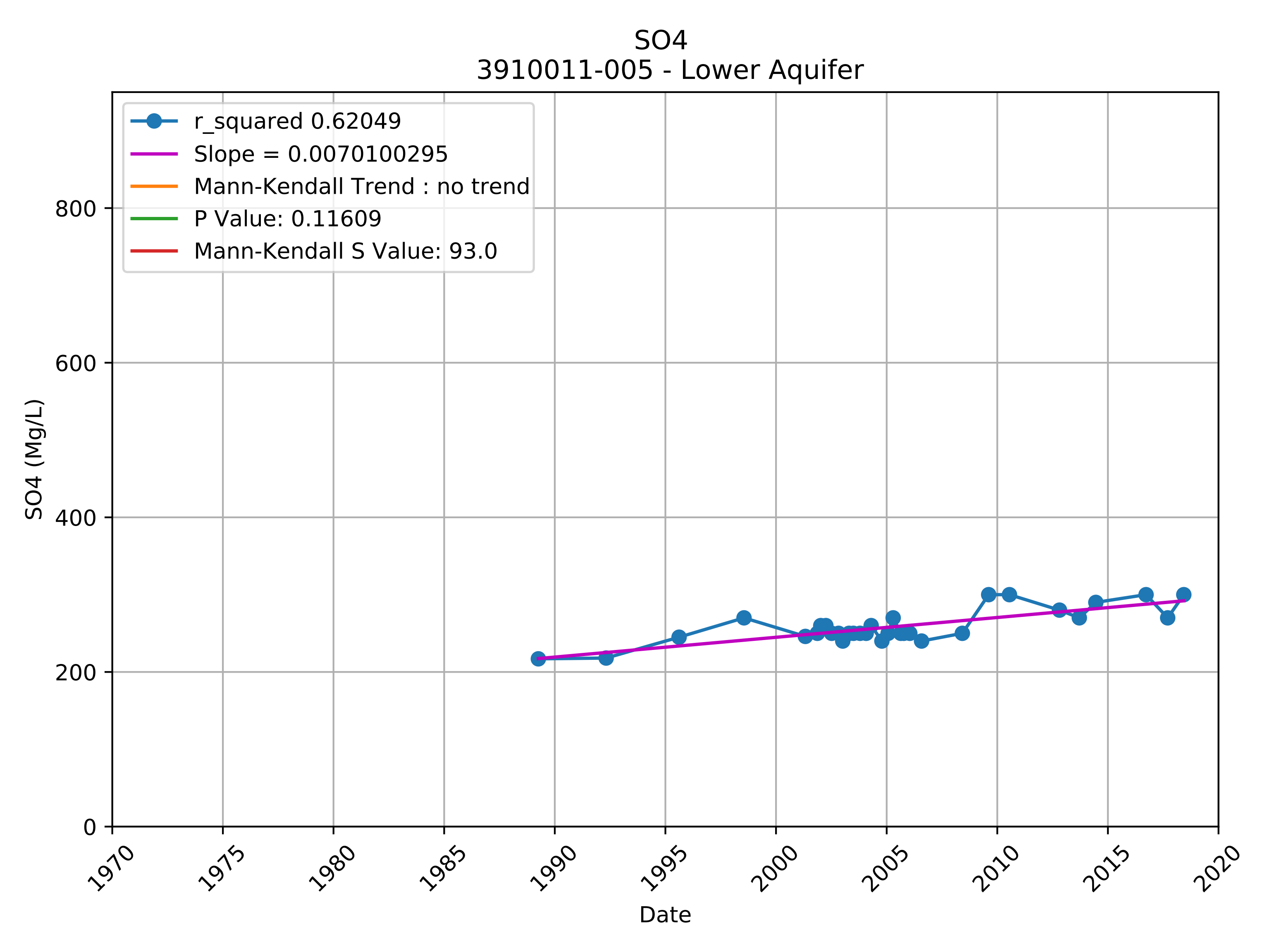
Date



SO4
3910011-005 - Lower Aquifer
r_squared 0.62049
Slope = 0.0070100295
Mann-Kendall Trend : no trend
P Value: 0.11609
Mann-Kendall S Value: 93.0
SO4 (Mg/L)
0
200
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1970
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2020
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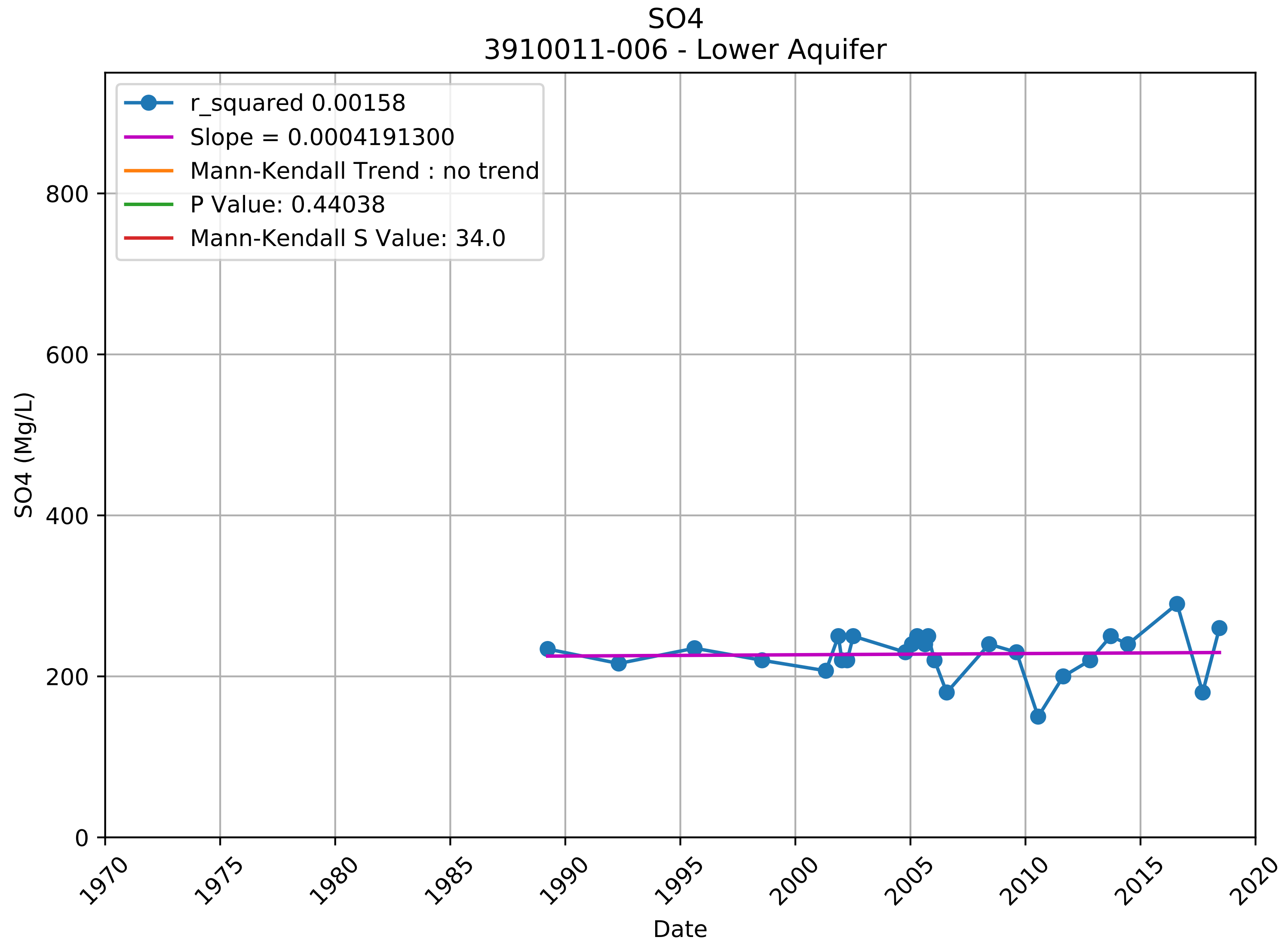

SO4
3910011-006 - Lower Aquifer
r_squared 0.00158
Slope = 0.0004191300
Mann-Kendall Trend : no trend
P Value: 0.44038
Mann-Kendall S Value: 34.0
SO4 (Mg/L)
0
200
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1970
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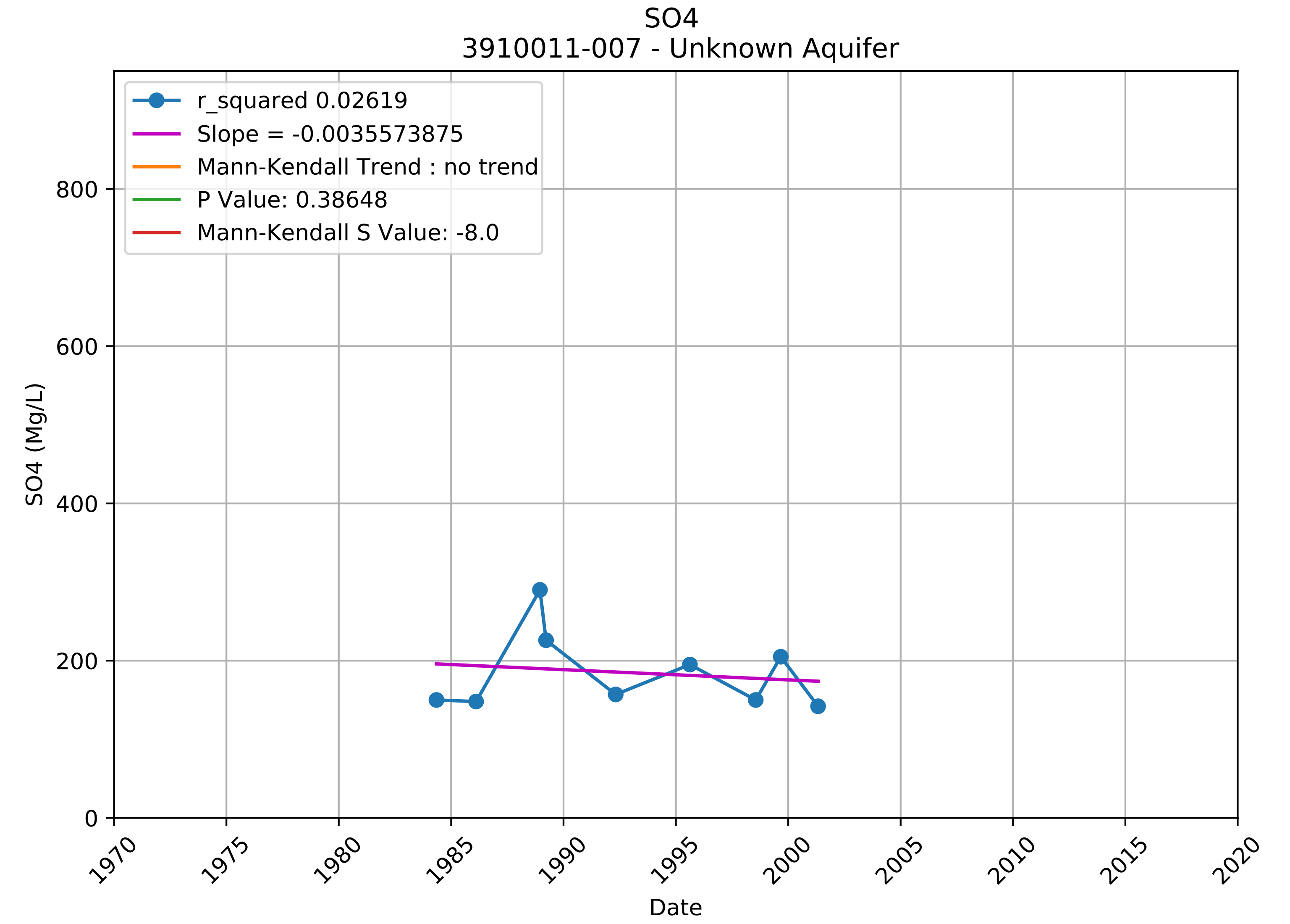
2020
Date


SO4
3910011-007 - Unknown Aquifer
r_squared 0.02619
Slope = -0.0035573875
Mann-Kendall Trend : no trend
P Value: 0.38648
Mann-Kendall S Value: -8.0
SO4 (Mg/L)
0
200
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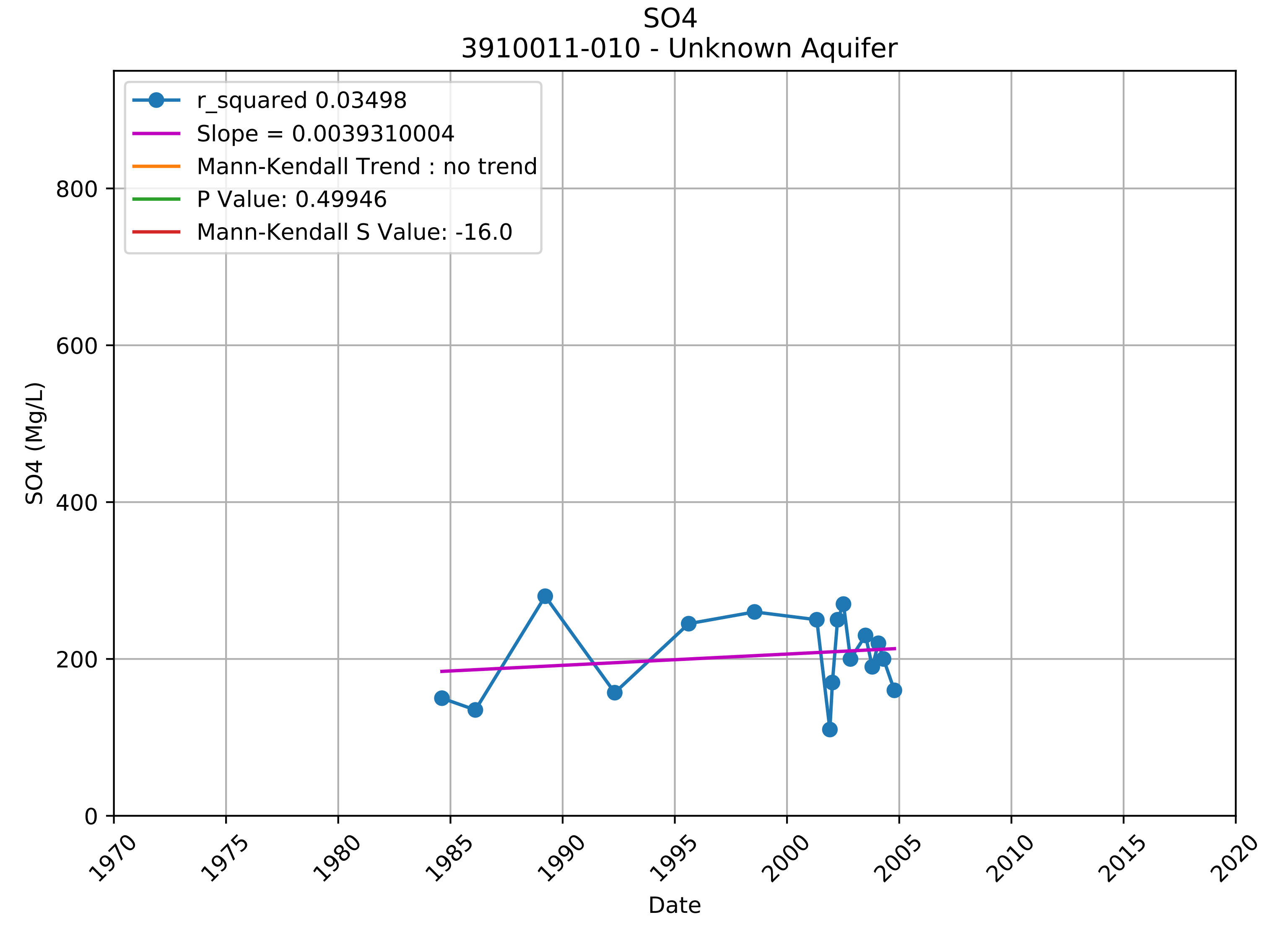
Date


SO4
3910011-010 - Unknown Aquifer
r_squared 0.03498
Slope = 0.0039310004
Mann-Kendall Trend : no trend
P Value: 0.49946
Mann-Kendall S Value: -16.0
SO4 (Mg/L)
0
200
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1970
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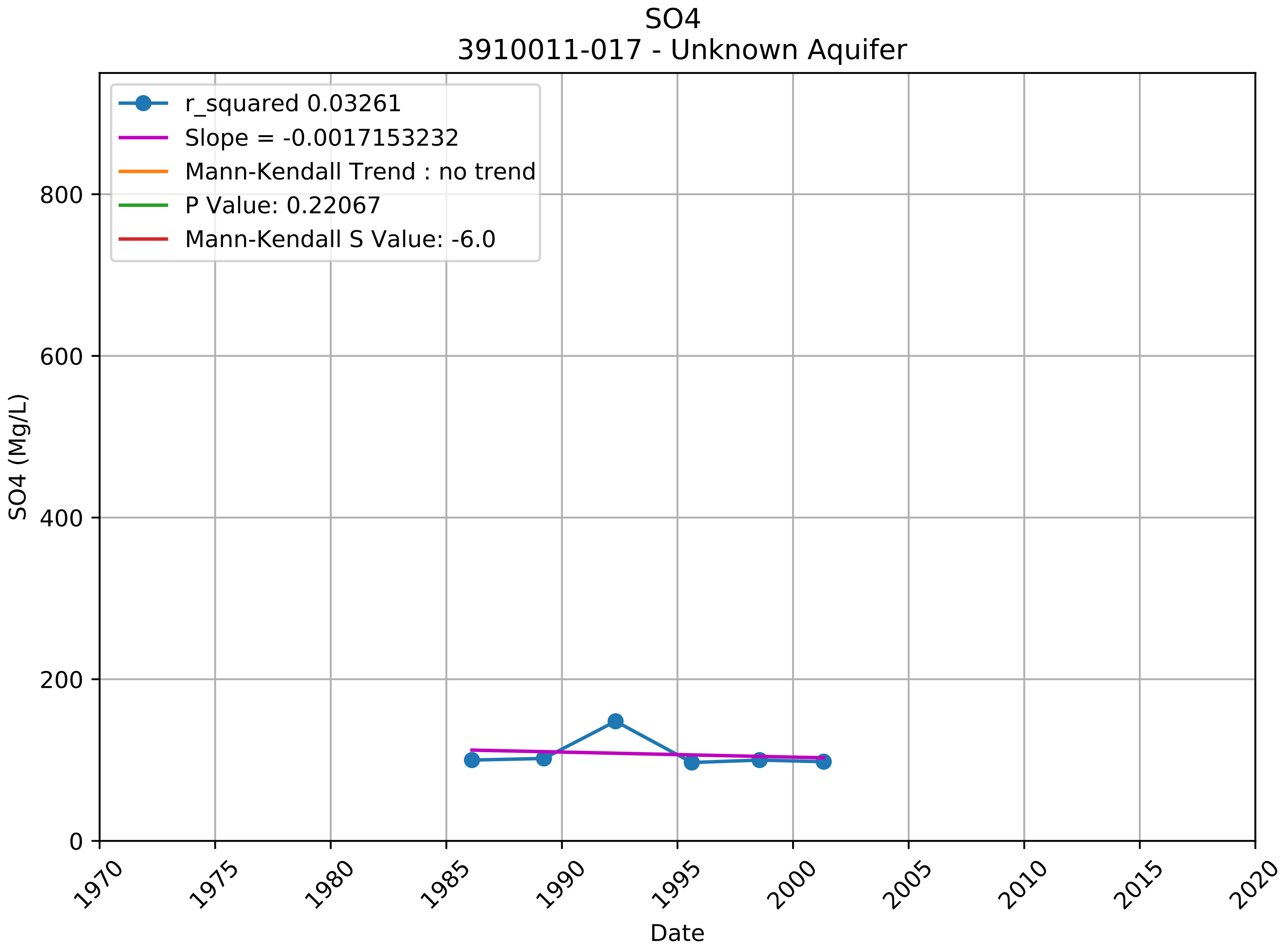
Date


SO4
3910011-017 - Unknown Aquifer
r_squared 0.03261
Slope = -0.0017153232
Mann-Kendall Trend : no trend
P Value: 0.22067
Mann-Kendall S Value: -6.0
SO4 (Mg/L)
Date
0
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1970
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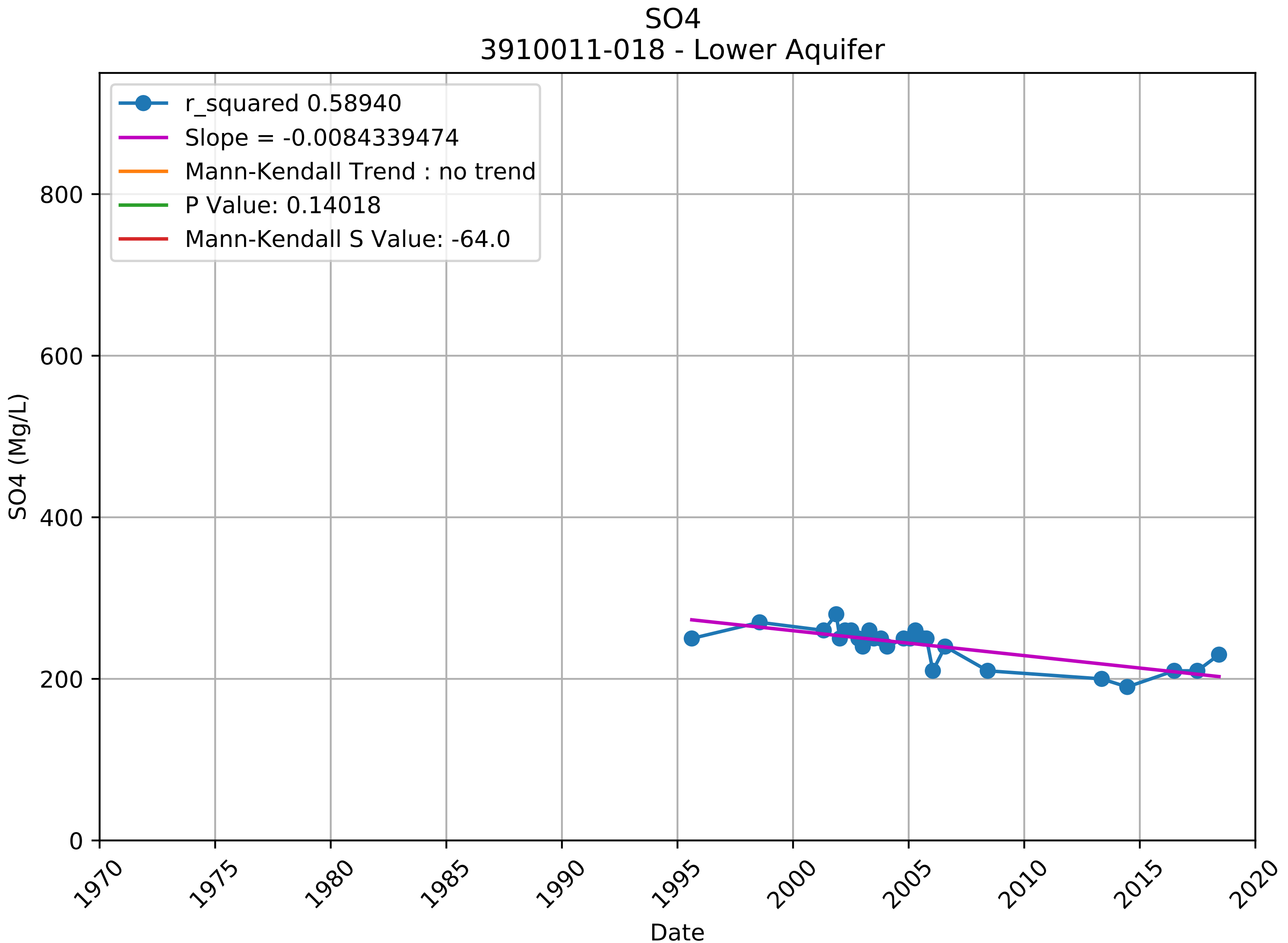
2020


SO4
3910011-018 - Lower Aquifer
r_squared 0.58940
Slope = -0.0084339474
Mann-Kendall Trend : no trend
P Value: 0.14018
Mann-Kendall S Value: -64.0
SO4 (Mg/L)
0
200
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1970
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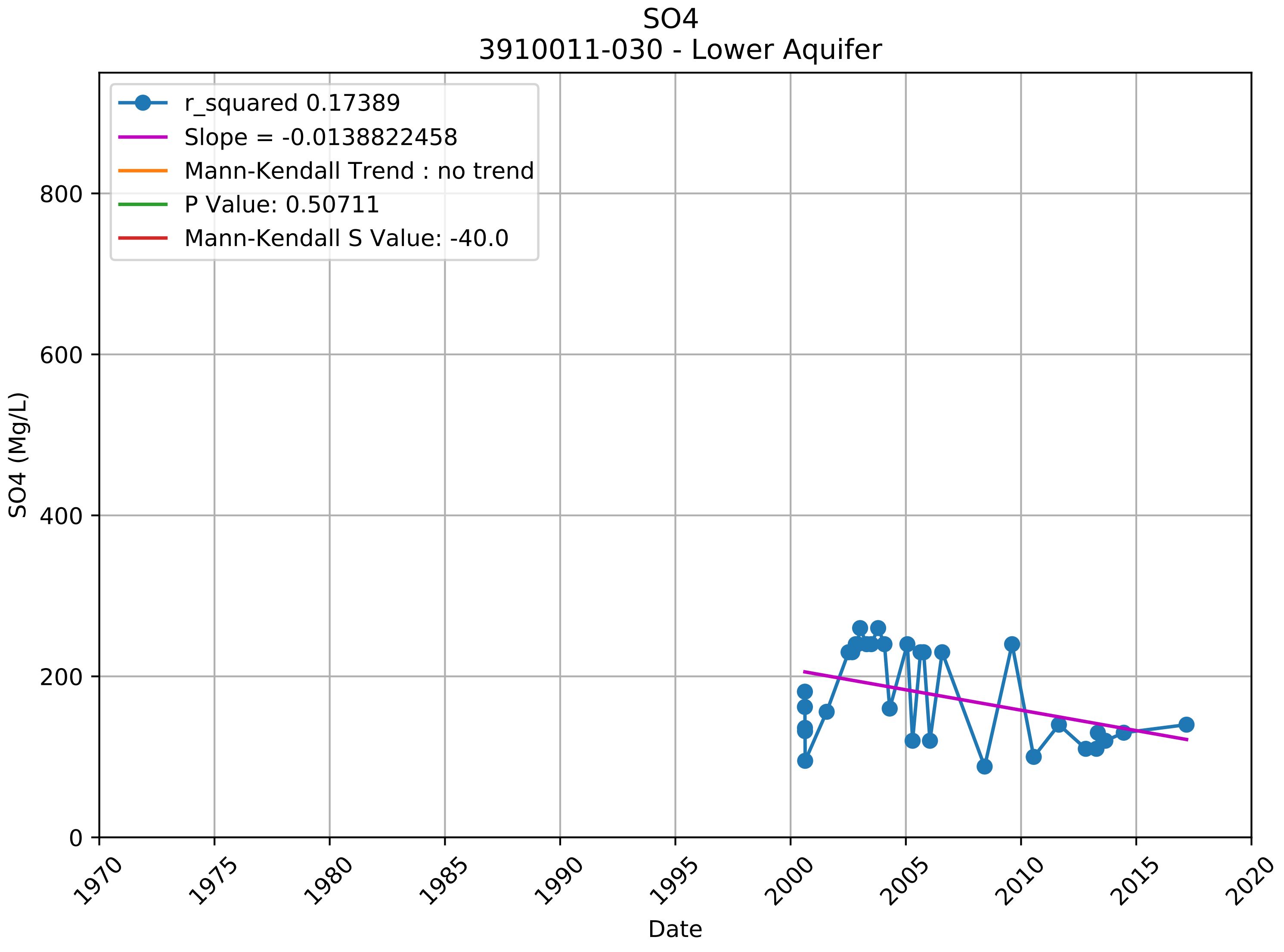
2015
2020
Date


SO4
3910011-030 - Lower Aquifer
r_squared 0.17389
Slope = -0.0138822458
Mann-Kendall Trend : no trend
P Value: 0.50711
Mann-Kendall S Value: -40.0
SO4 (Mg/L)
0
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1970
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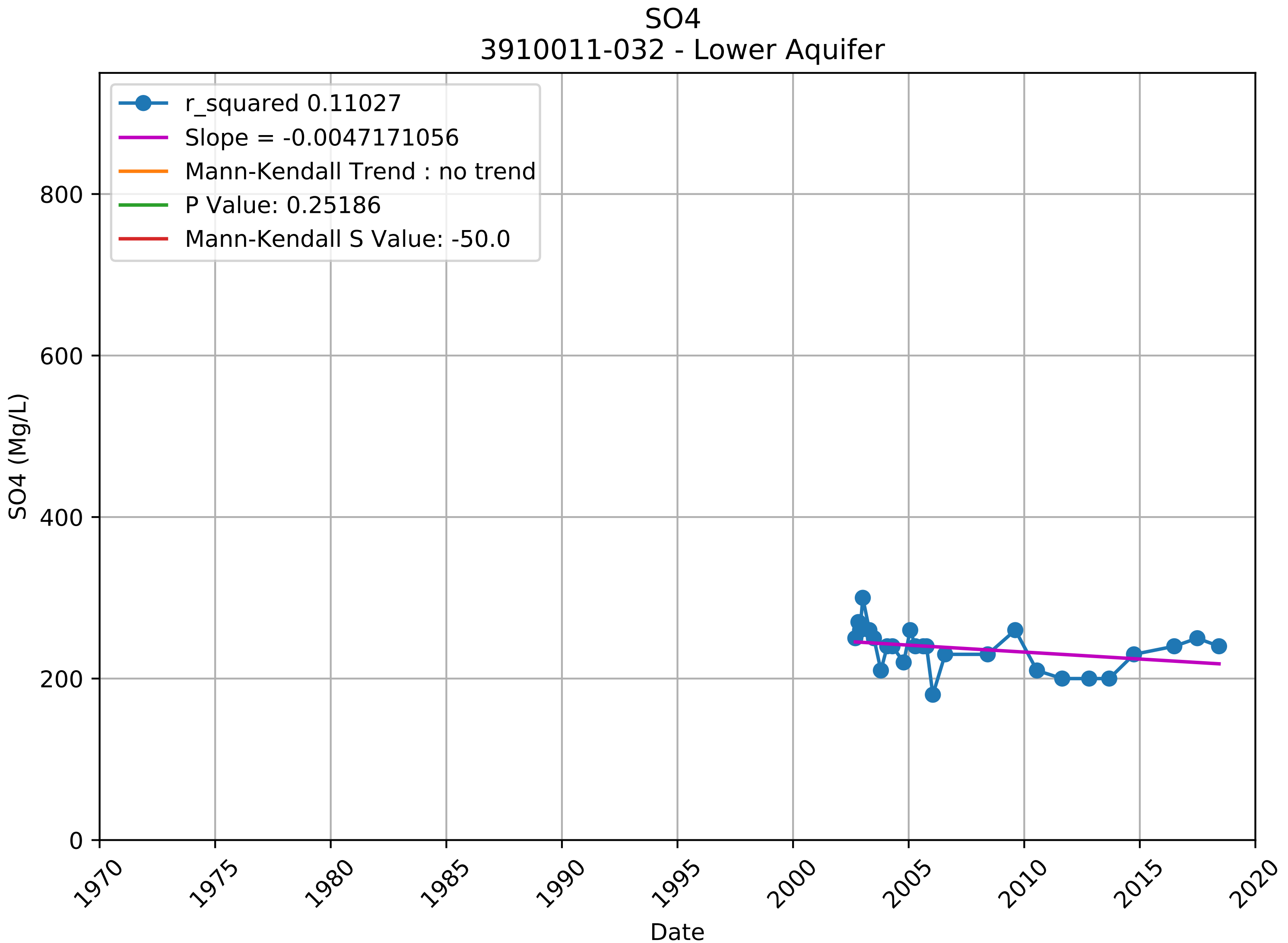
2015
2020
Date



SO4
3910011-032 - Lower Aquifer
r_squared 0.11027
Slope = -0.0047171056
Mann-Kendall Trend : no trend
P Value: 0.25186
Mann-Kendall S Value: -50.0
SO4 (Mg/L)
0
200
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1970
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2015
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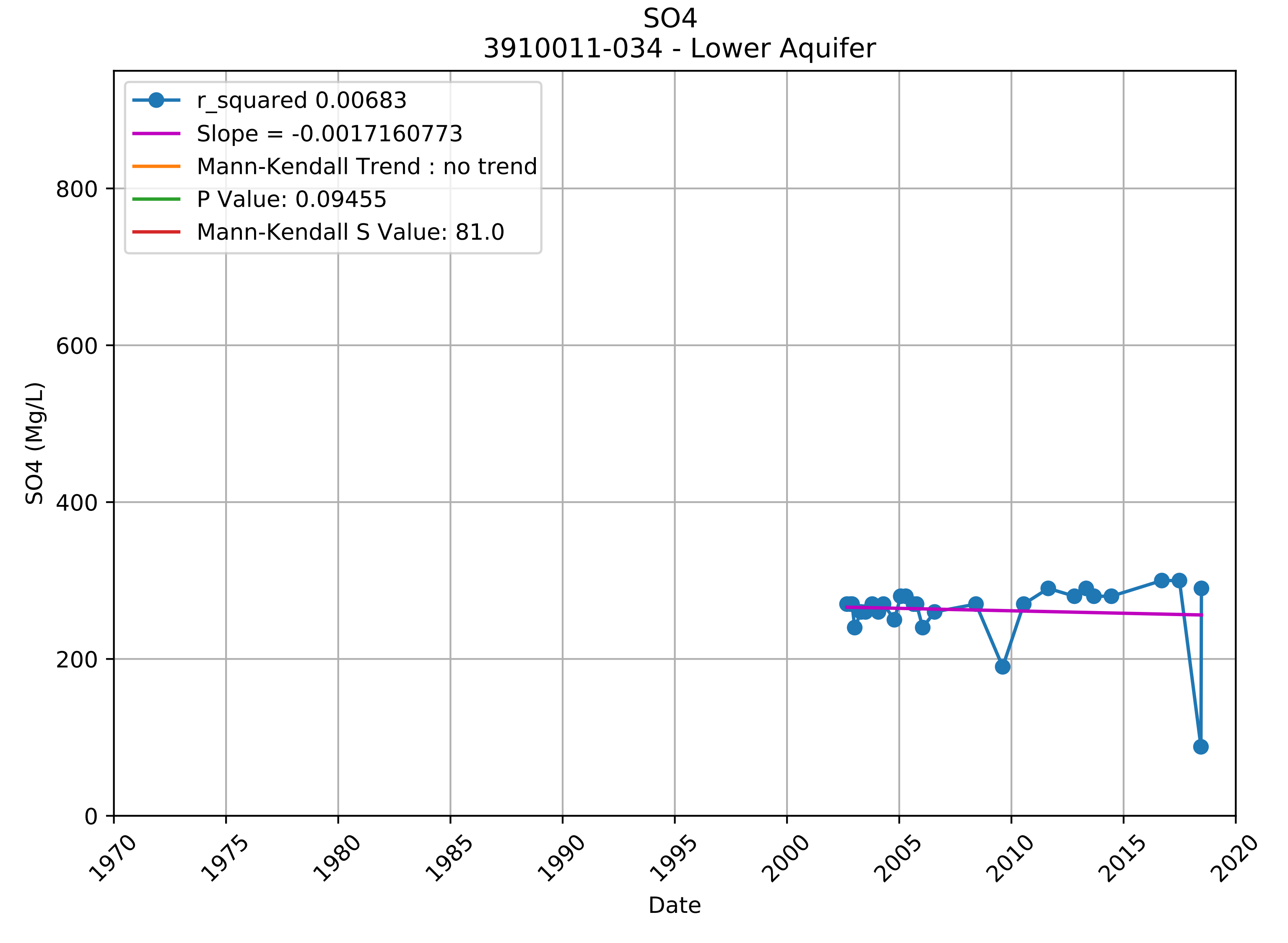
Date



SO4
3910011-034 - Lower Aquifer
r_squared 0.00683
Slope = -0.0017160773
Mann-Kendall Trend : no trend
P Value: 0.09455
Mann-Kendall S Value: 81.0
SO4 (Mg/L)
0
200
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1970
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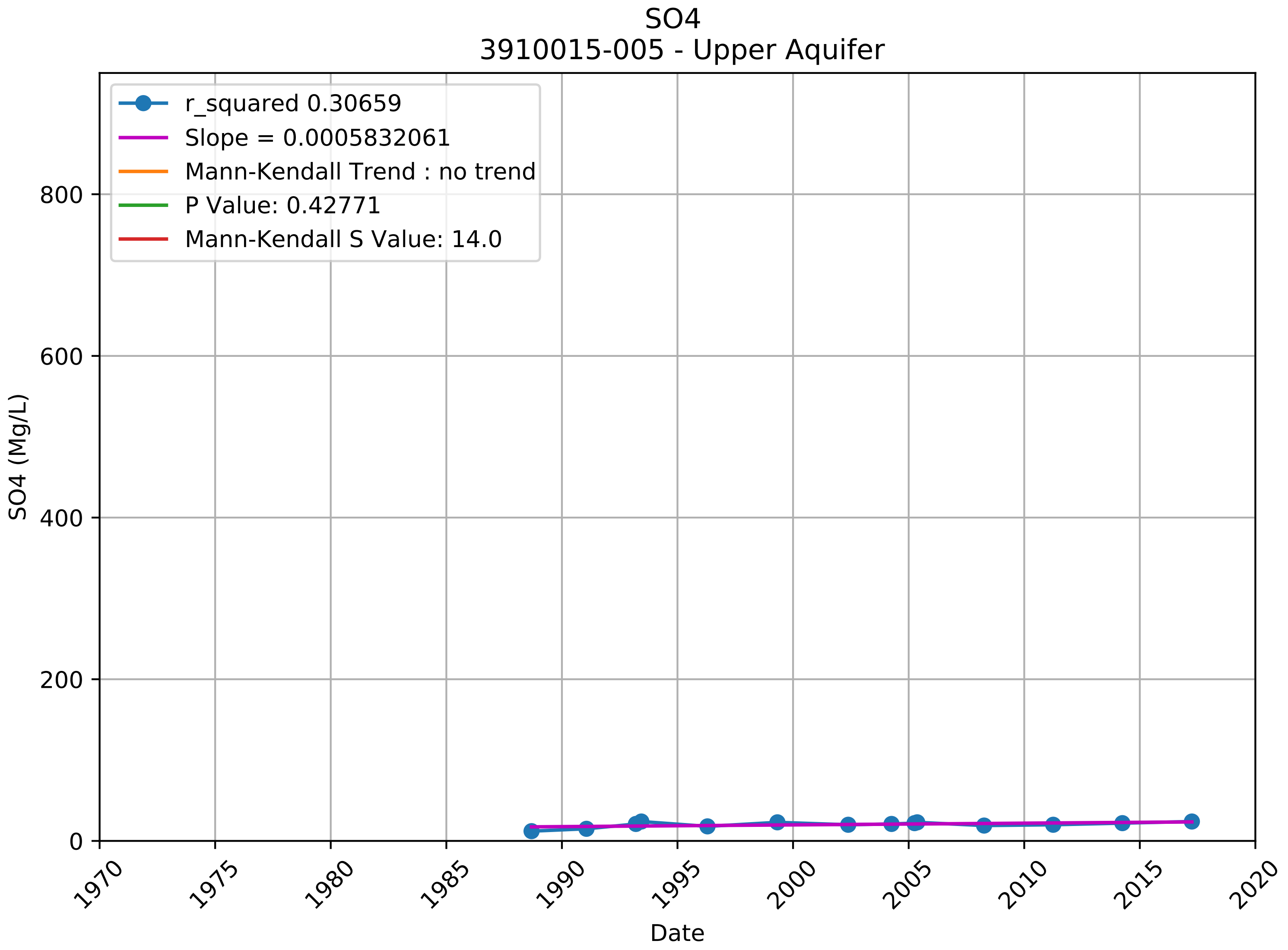
2010
2015
2020
Date



SO4
3910015-005 - Upper Aquifer
r_squared 0.30659
Slope = 0.0005832061
Mann-Kendall Trend : no trend
P Value: 0.42771
Mann-Kendall S Value: 14.0
SO4 (Mg/L)
0
200
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1970
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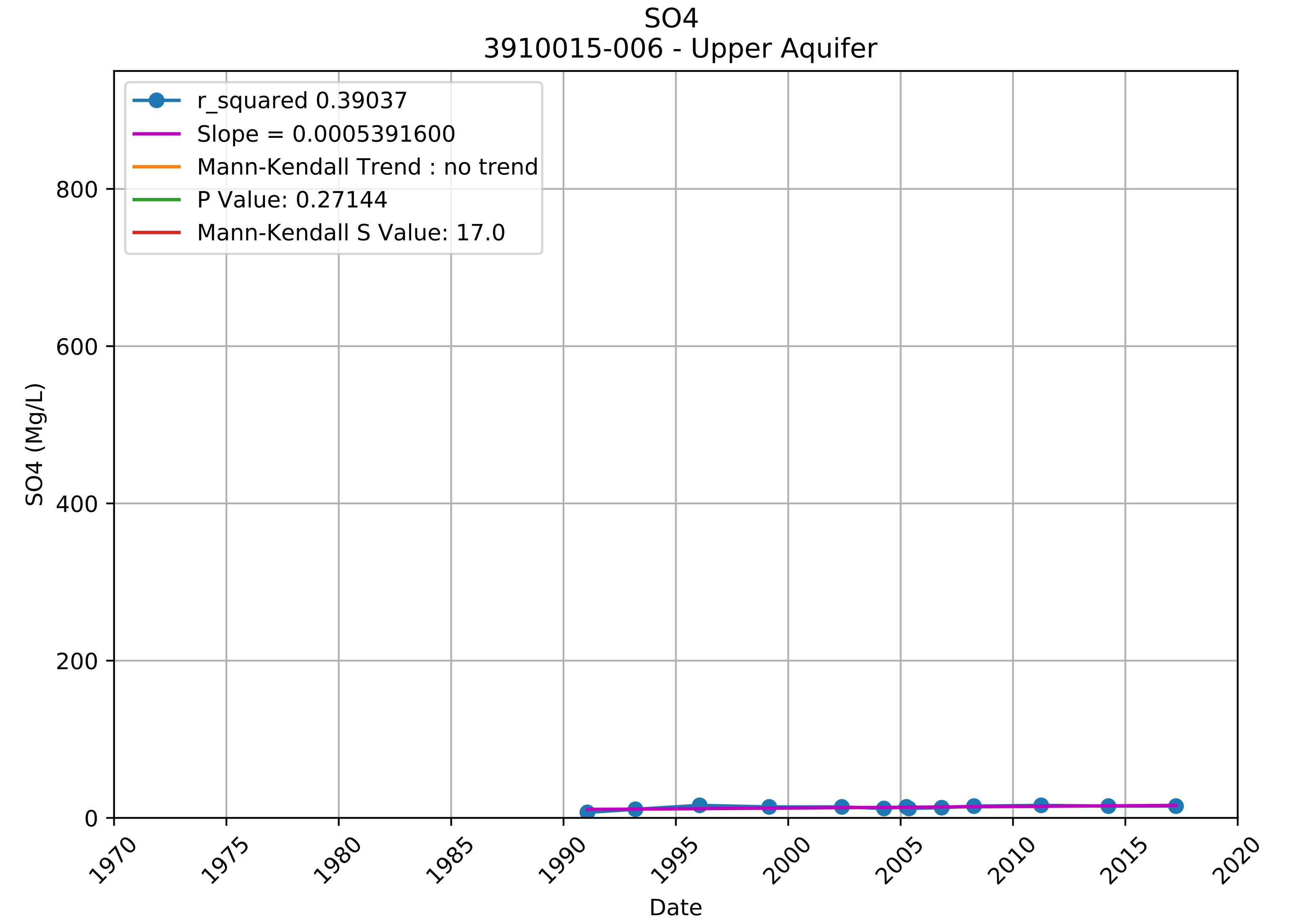
2020
Date


SO4
3910015-006 - Upper Aquifer
r_squared 0.39037
Slope = 0.0005391600
Mann-Kendall Trend : no trend
P Value: 0.27144
Mann-Kendall S Value: 17.0
SO4 (Mg/L)
Date
0
200
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1970
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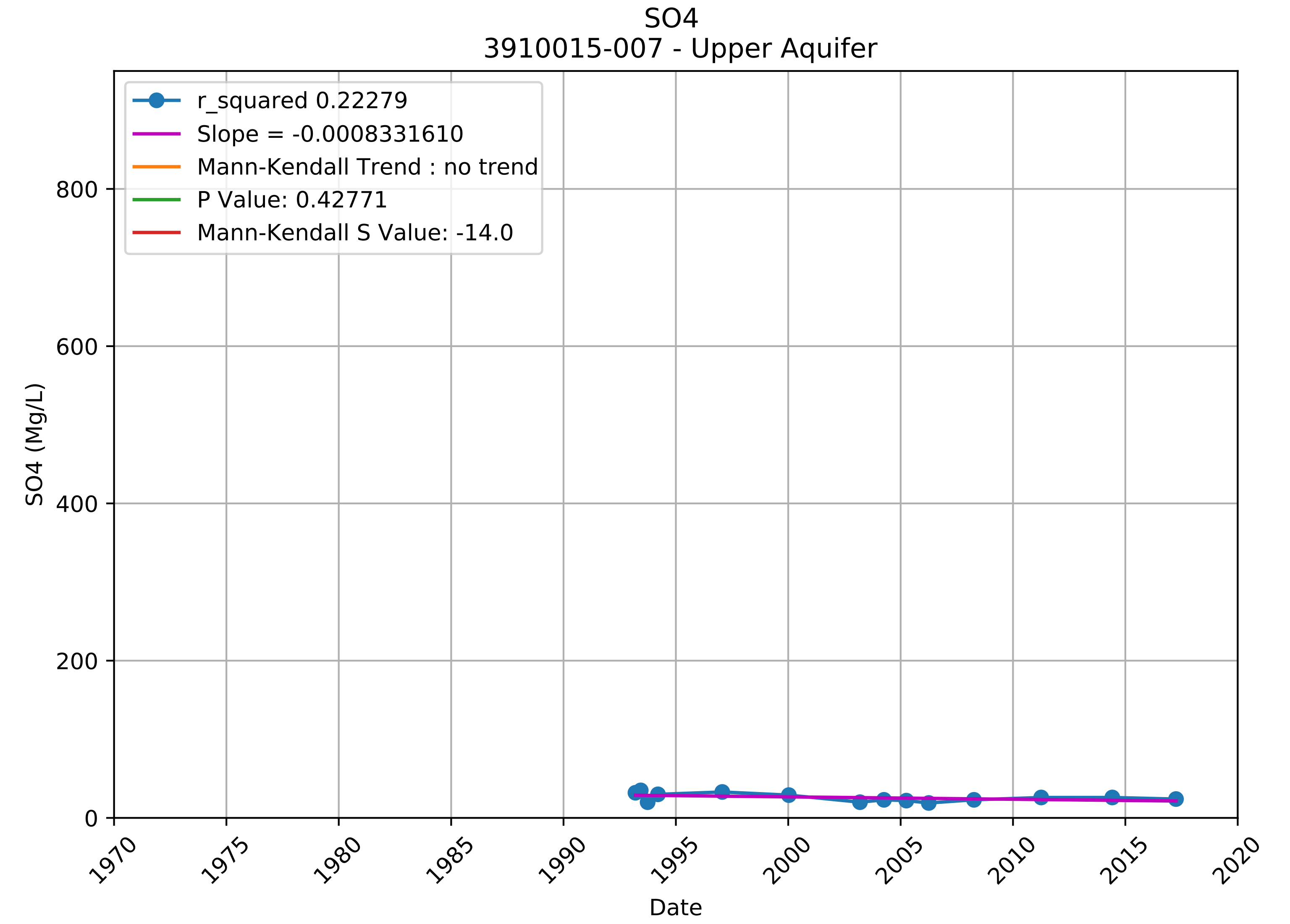
2020


SO4
3910015-007 - Upper Aquifer
r_squared 0.22279
Slope = -0.0008331610
Mann-Kendall Trend : no trend
P Value: 0.42771
Mann-Kendall S Value: -14.0
SO4 (Mg/L)
0
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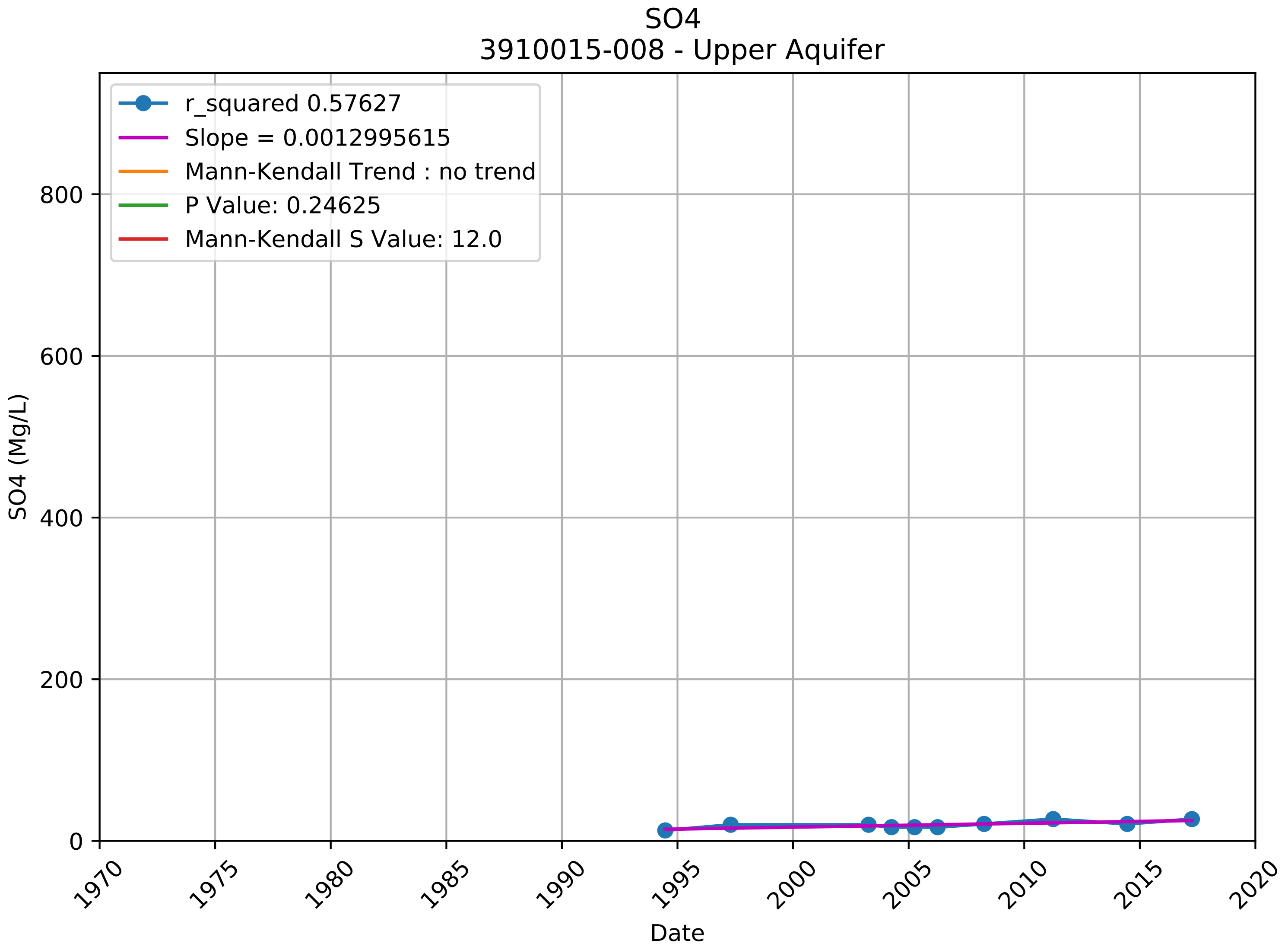
Date



SO4
3910015-008 - Upper Aquifer
r_squared 0.57627
Slope = 0.0012995615
Mann-Kendall Trend : no trend
P Value: 0.24625
Mann-Kendall S Value: 12.0
SO4 (Mg/L)
0
200
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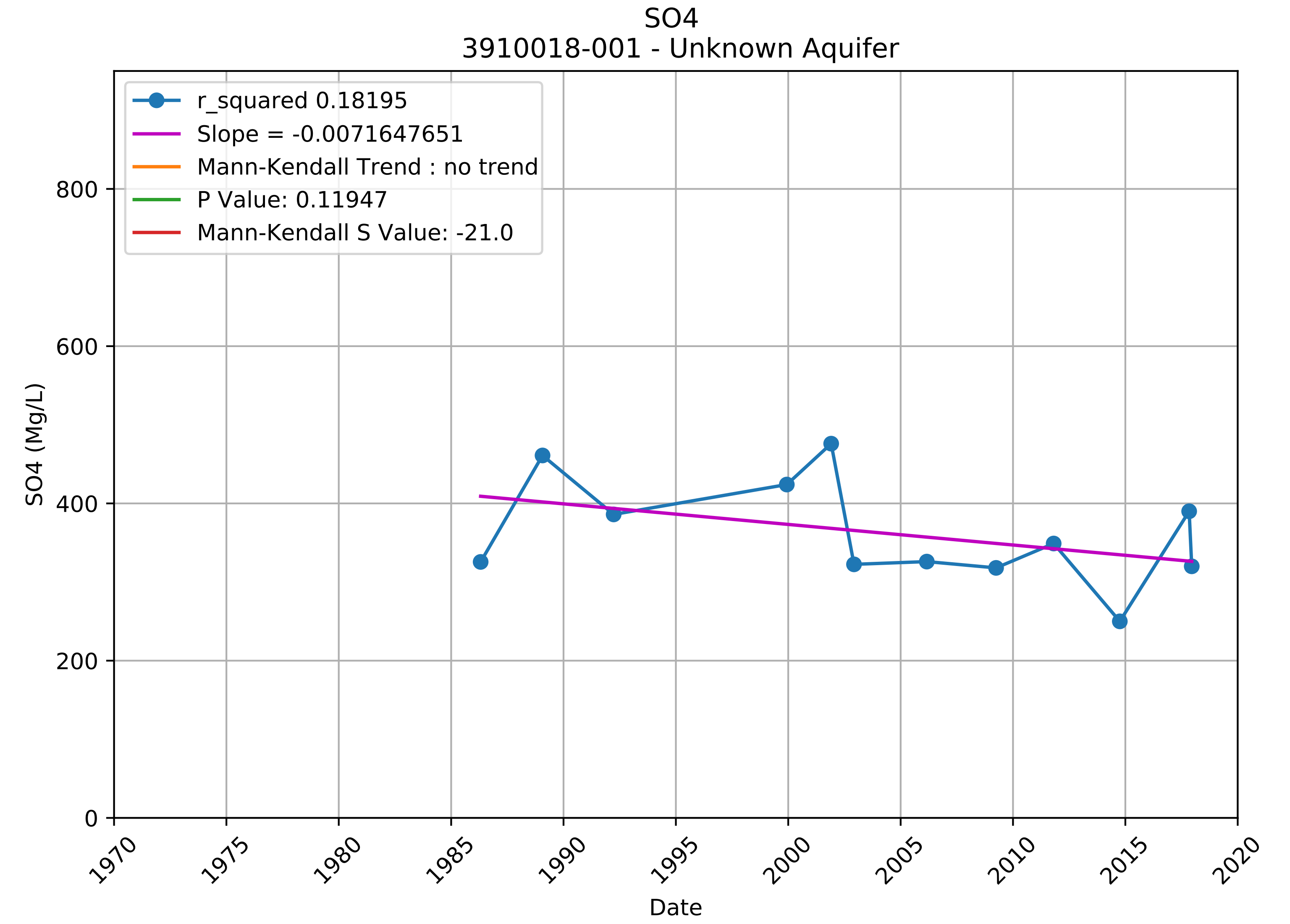
Date



SO4
3910018-001 - Unknown Aquifer
r_squared 0.18195
Slope = -0.0071647651
Mann-Kendall Trend : no trend
P Value: 0.11947
Mann-Kendall S Value: -21.0
SO4 (Mg/L)
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200
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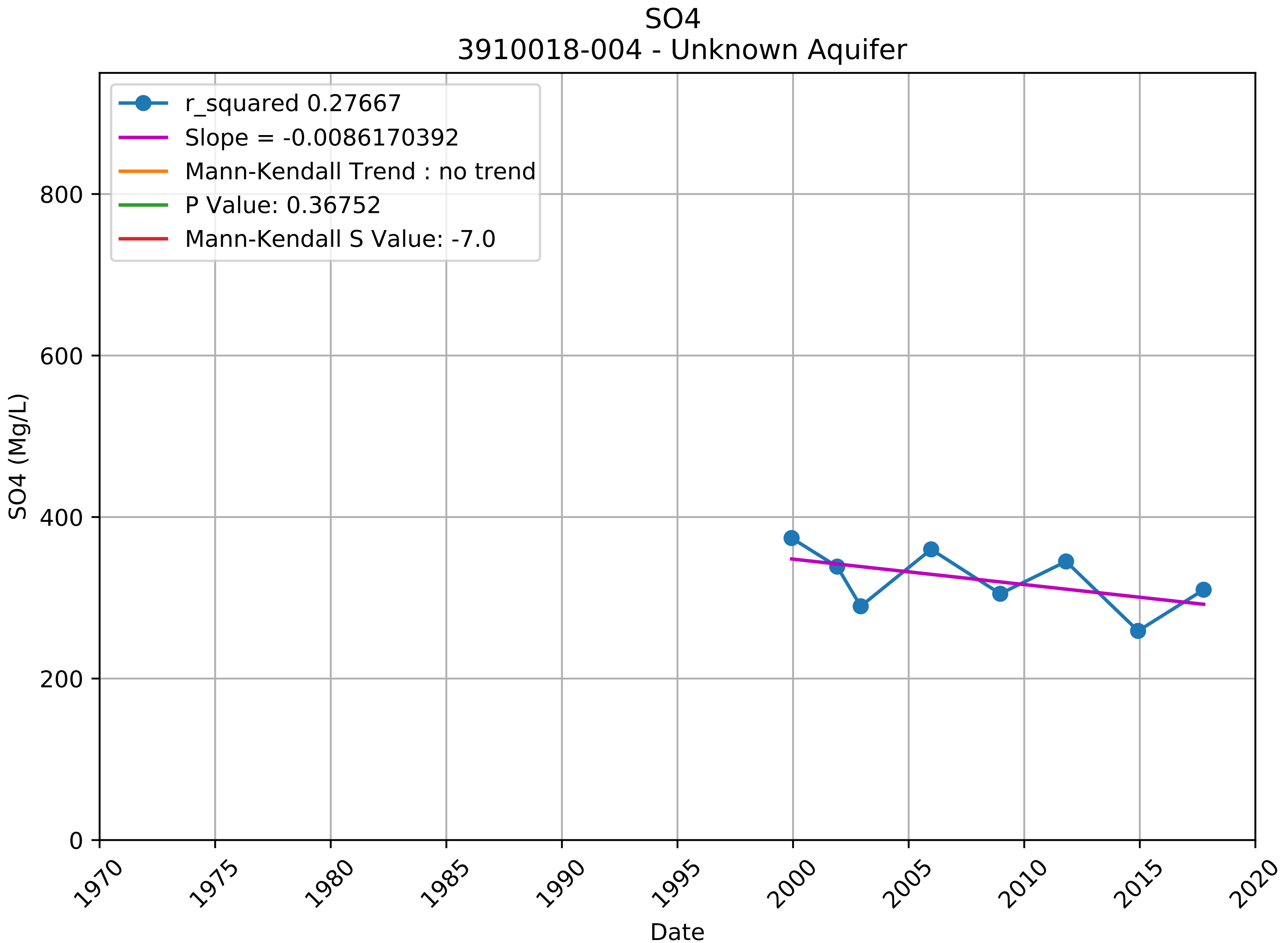
Date



SO4
3910018-004 - Unknown Aquifer
r_squared 0.27667
Slope = -0.0086170392
Mann-Kendall Trend : no trend
P Value: 0.36752
Mann-Kendall S Value: -7.0
SO4 (Mg/L)
0
200
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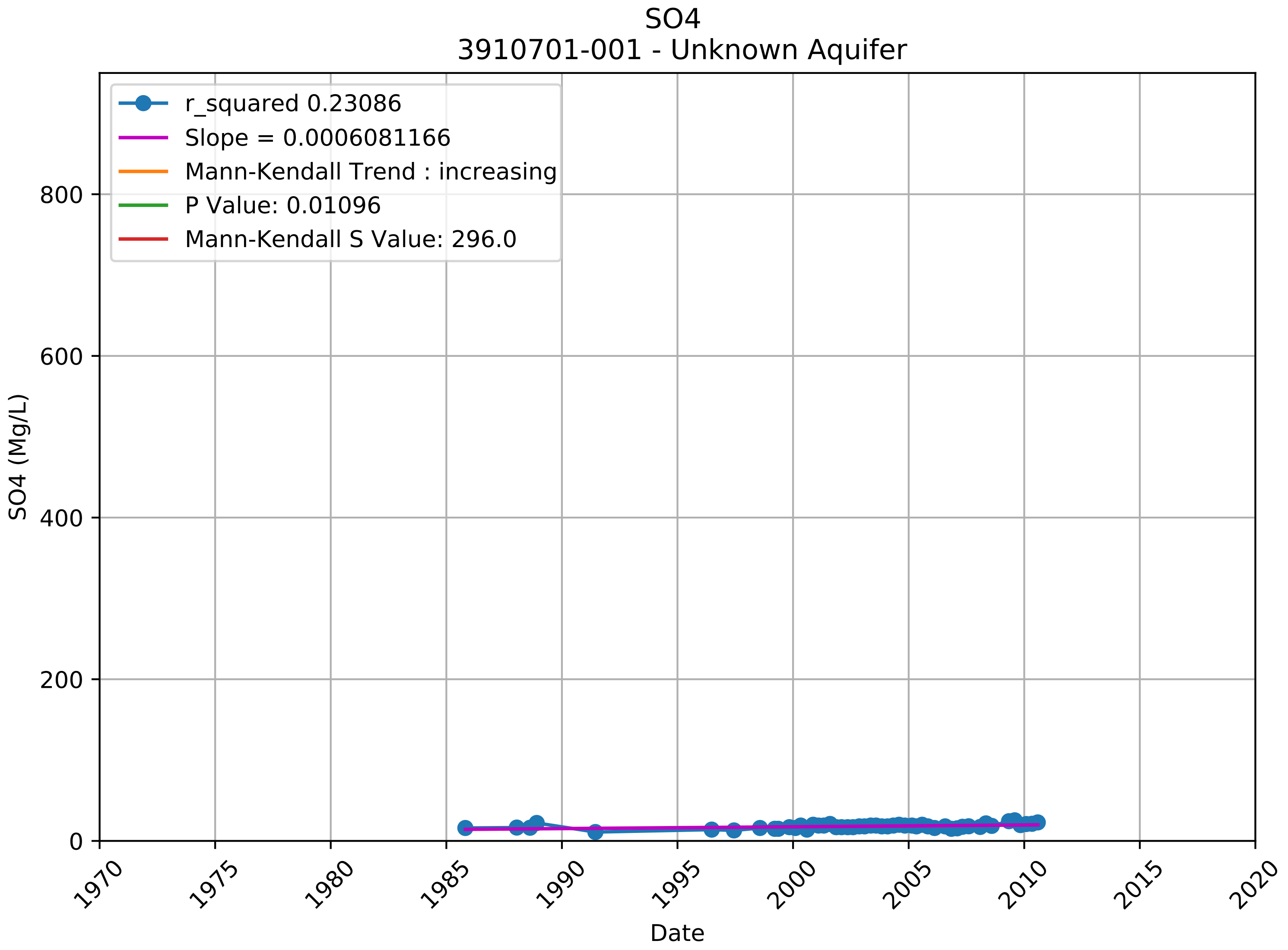
Date



SO4
3910701-001 - Unknown Aquifer
r_squared 0.23086
Slope = 0.0006081166
Mann-Kendall Trend : increasing
P Value: 0.01096
Mann-Kendall S Value: 296.0
SO4 (Mg/L)
0
200
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Date
1970
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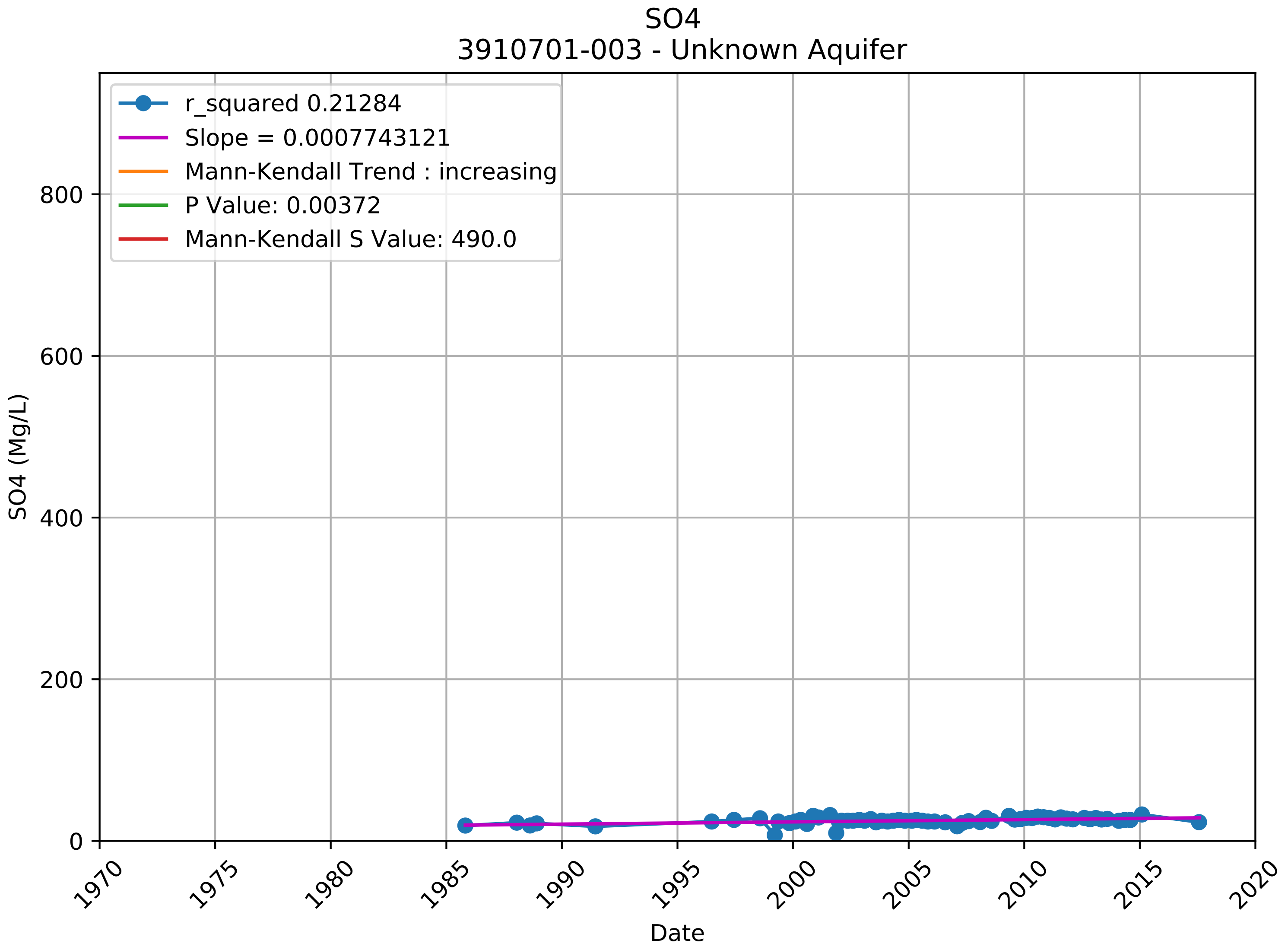
2020



SO4
3910701-003 - Unknown Aquifer
r_squared 0.21284
Slope = 0.0007743121
Mann-Kendall Trend : increasing
P Value: 0.00372
Mann-Kendall S Value: 490.0
SO4 (Mg/L)
0
200
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1970
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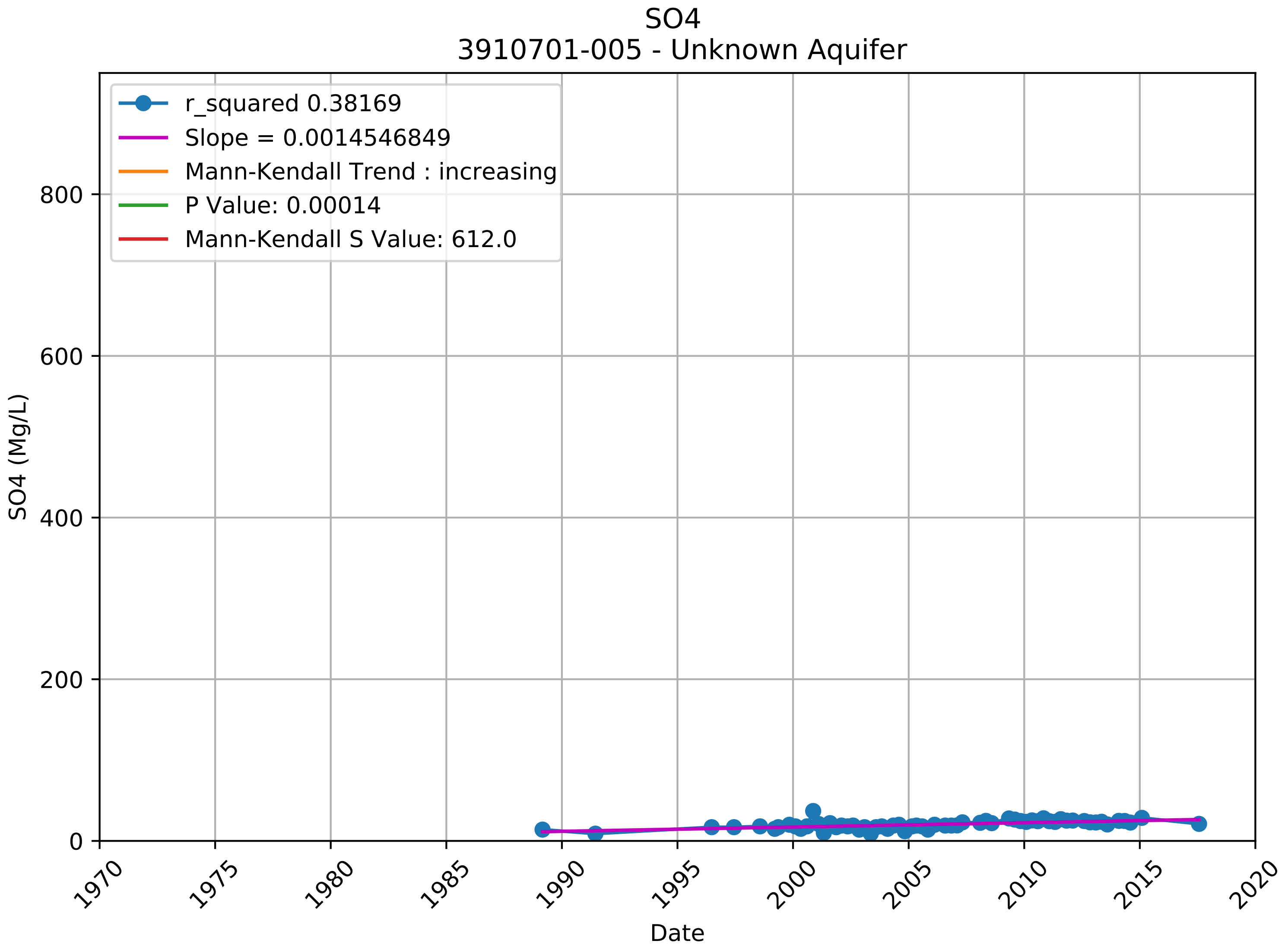
Date


SO4
3910701-005 - Unknown Aquifer
r_squared 0.38169
Slope = 0.0014546849
Mann-Kendall Trend : increasing
P Value: 0.00014
Mann-Kendall S Value: 612.0
SO4 (Mg/L)
0
200
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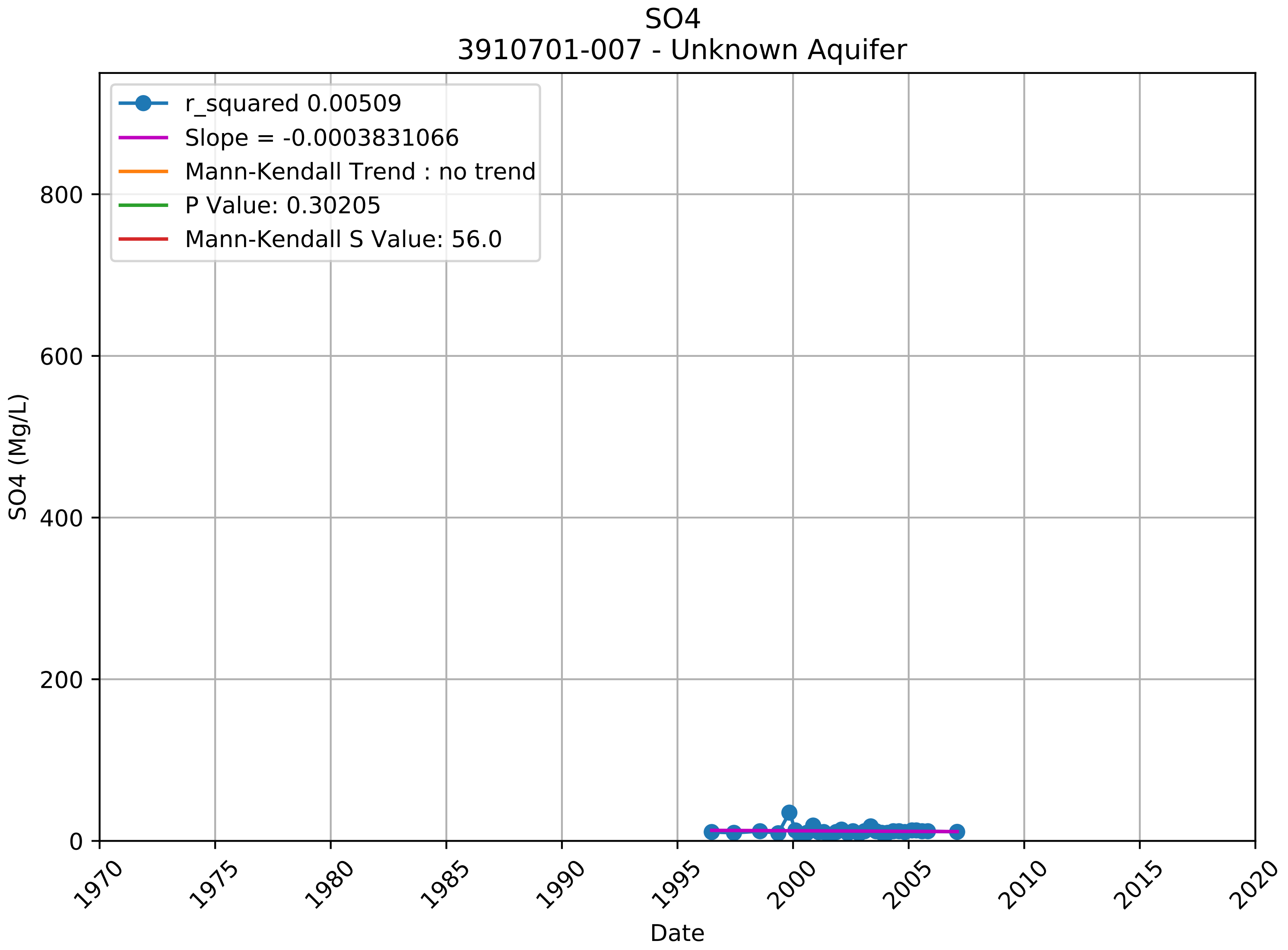
Date


SO4
3910701-007 - Unknown Aquifer
r_squared 0.00509
Slope = -0.0003831066
Mann-Kendall Trend : no trend
P Value: 0.30205
Mann-Kendall S Value: 56.0
SO4 (Mg/L)
0
200
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1970
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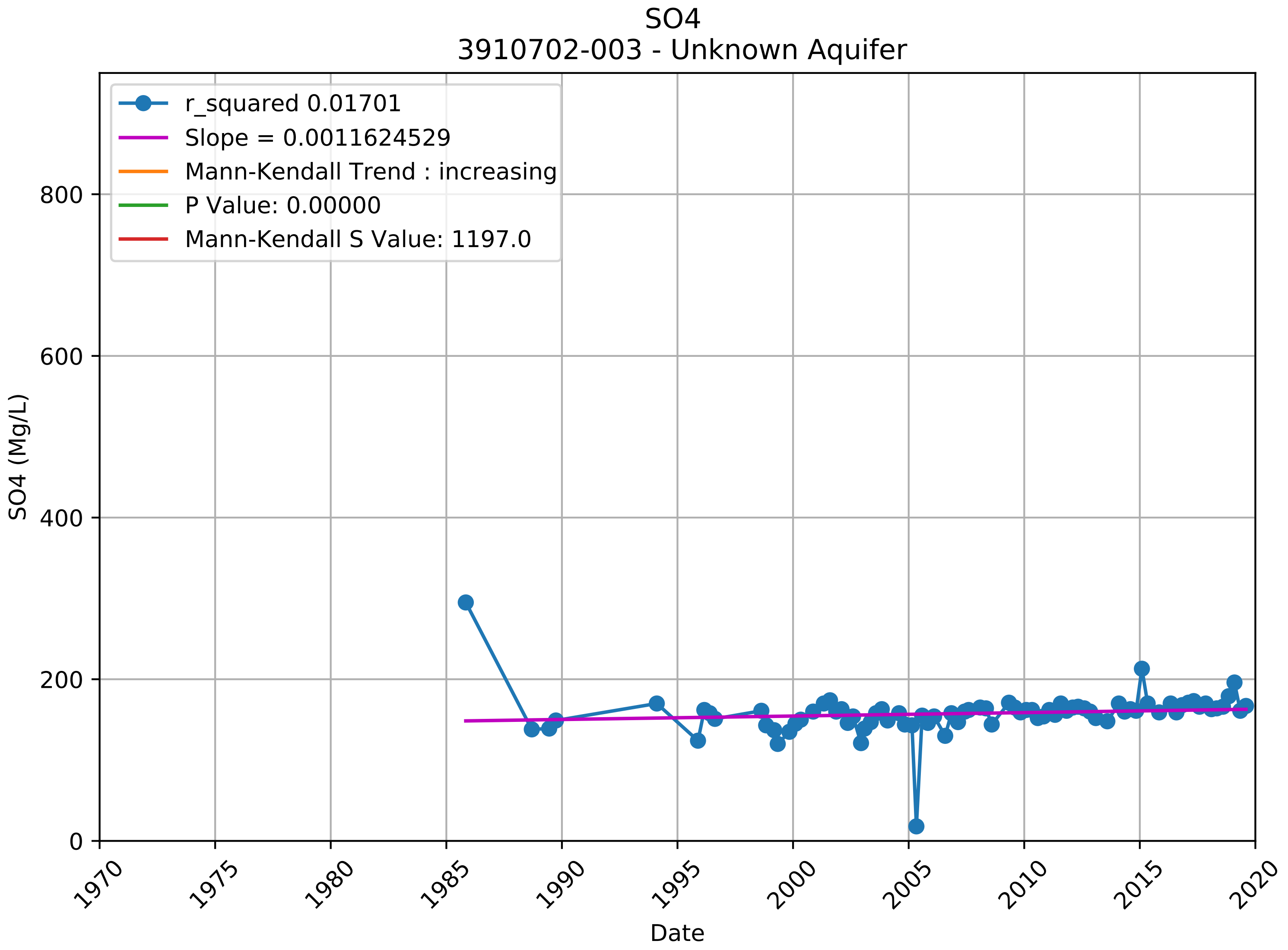
Date



SO4
3910702-003 - Unknown Aquifer
r_squared 0.01701
Slope = 0.0011624529
Mann-Kendall Trend : increasing
P Value: 0.00000
Mann-Kendall S Value: 1197.0
SO4 (Mg/L)
0
200
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1970
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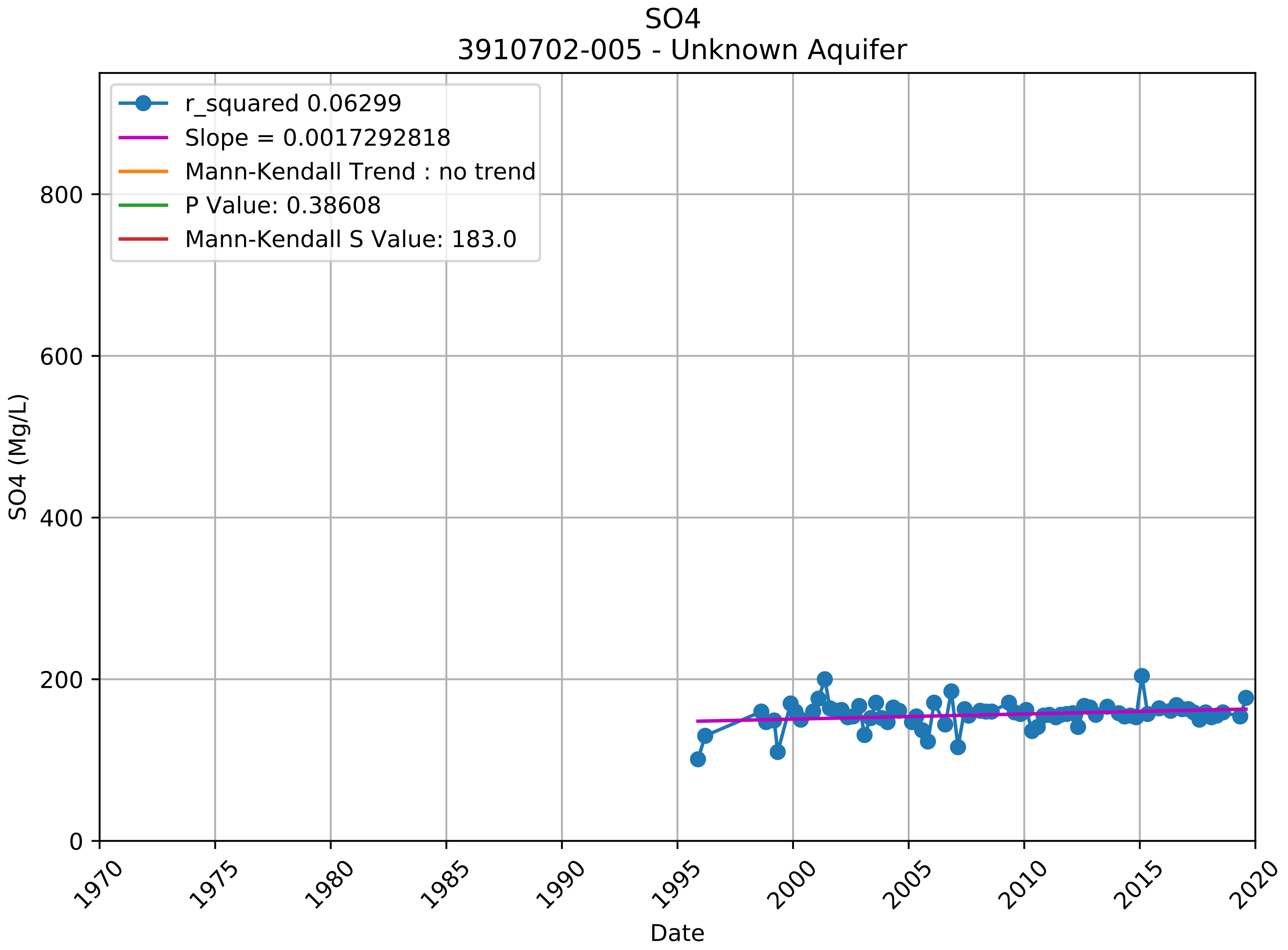
Date



SO4
3910702-005 - Unknown Aquifer
r_squared 0.06299
Slope = 0.0017292818
Mann-Kendall Trend : no trend
P Value: 0.38608
Mann-Kendall S Value: 183.0
SO4 (Mg/L)
0
200
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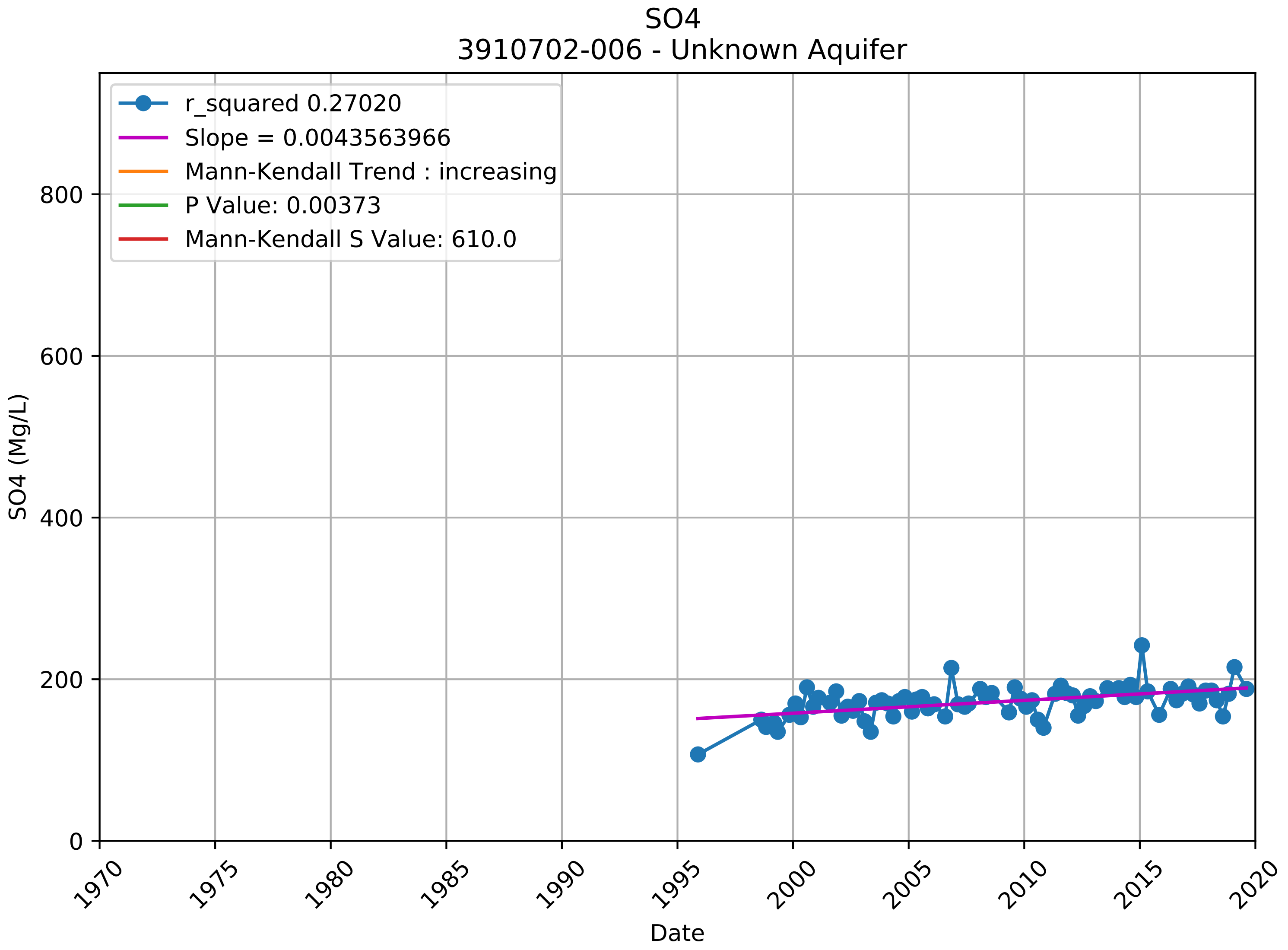
Date


SO4
3910702-006 - Unknown Aquifer
r_squared 0.27020
Slope = 0.0043563966
Mann-Kendall Trend : increasing
P Value: 0.00373
Mann-Kendall S Value: 610.0
SO4 (Mg/L)
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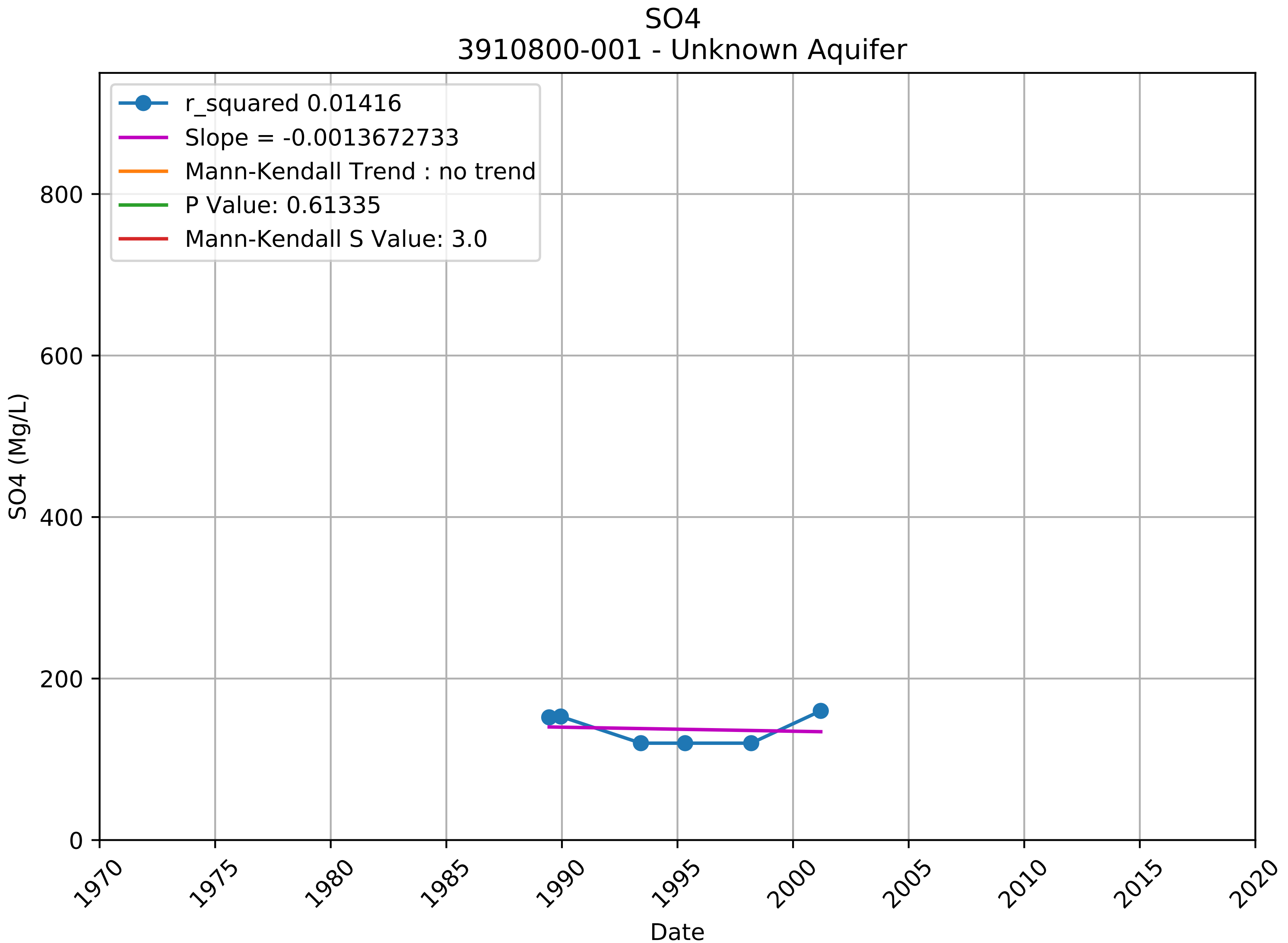
Date



SO4
3910800-001 - Unknown Aquifer
r_squared 0.01416
Slope = -0.0013672733
Mann-Kendall Trend : no trend
P Value: 0.61335
Mann-Kendall S Value: 3.0
SO4 (Mg/L)
0
200
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1970
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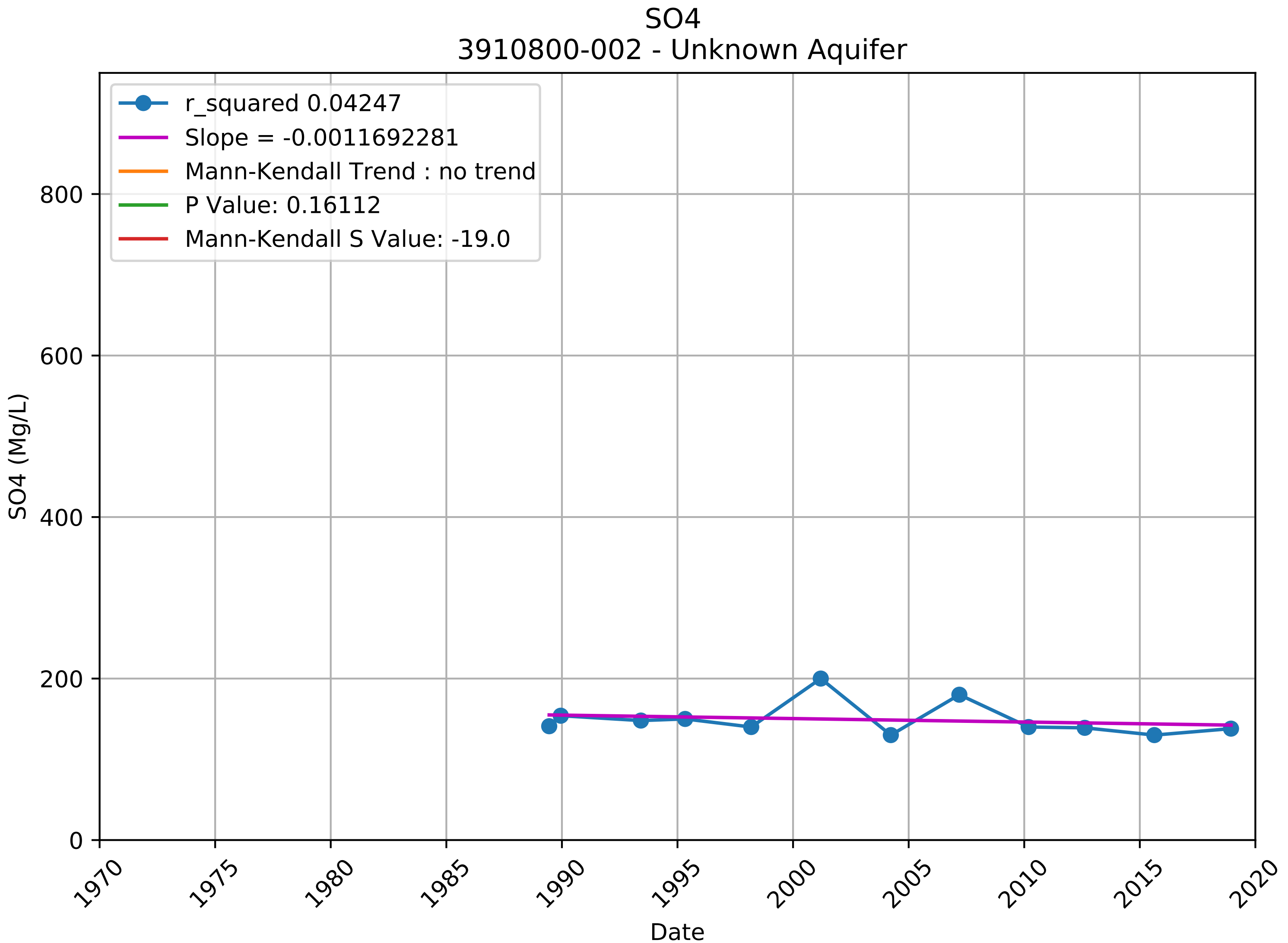
Date



SO4
3910800-002 - Unknown Aquifer
r_squared 0.04247
Slope = -0.0011692281
Mann-Kendall Trend : no trend
P Value: 0.16112
Mann-Kendall S Value: -19.0
SO4 (Mg/L)
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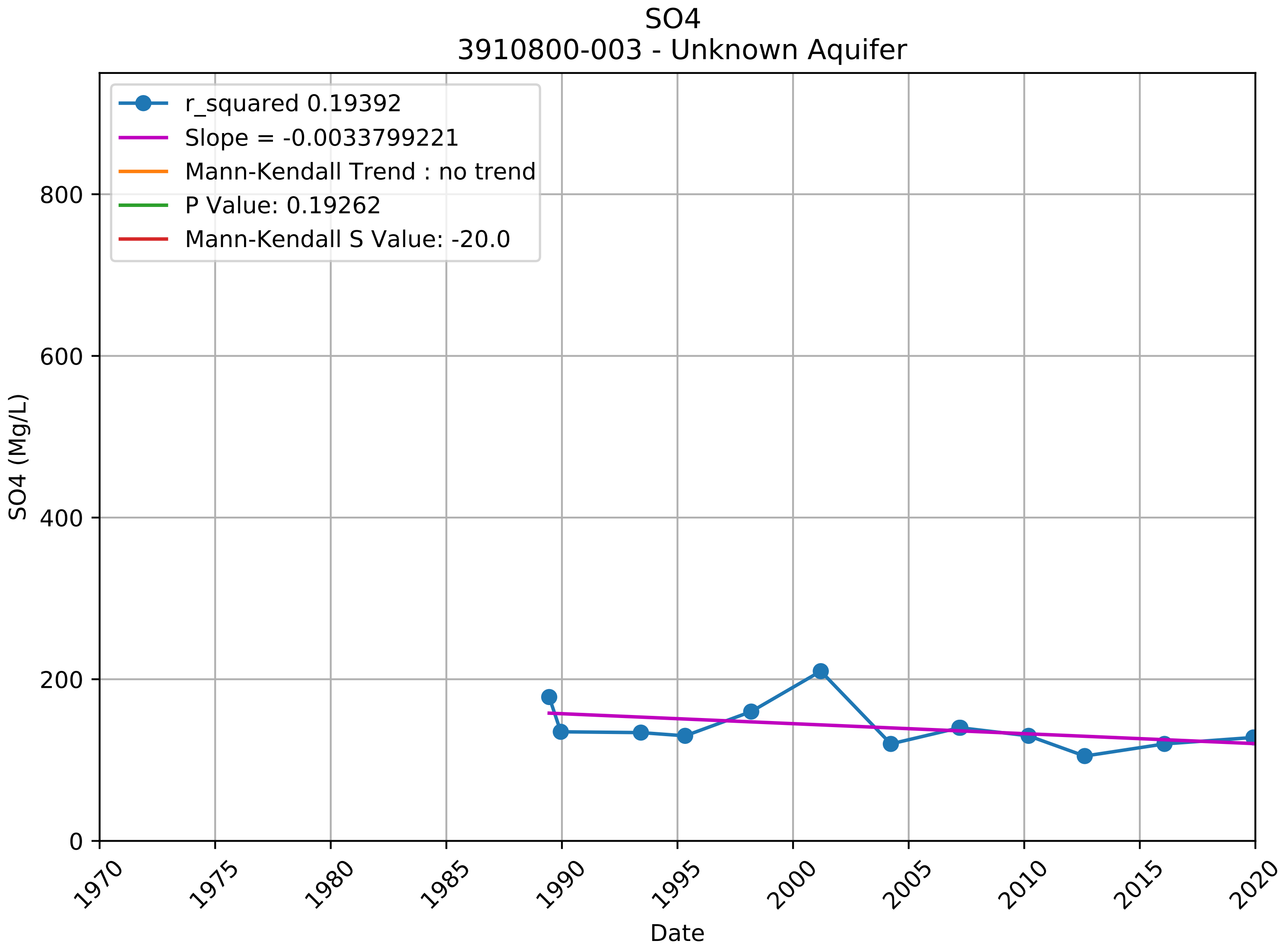
Date


SO4
3910800-003 - Unknown Aquifer
r_squared 0.19392
Slope = -0.0033799221
Mann-Kendall Trend : no trend
P Value: 0.19262
Mann-Kendall S Value: -20.0
SO4 (Mg/L)
Date
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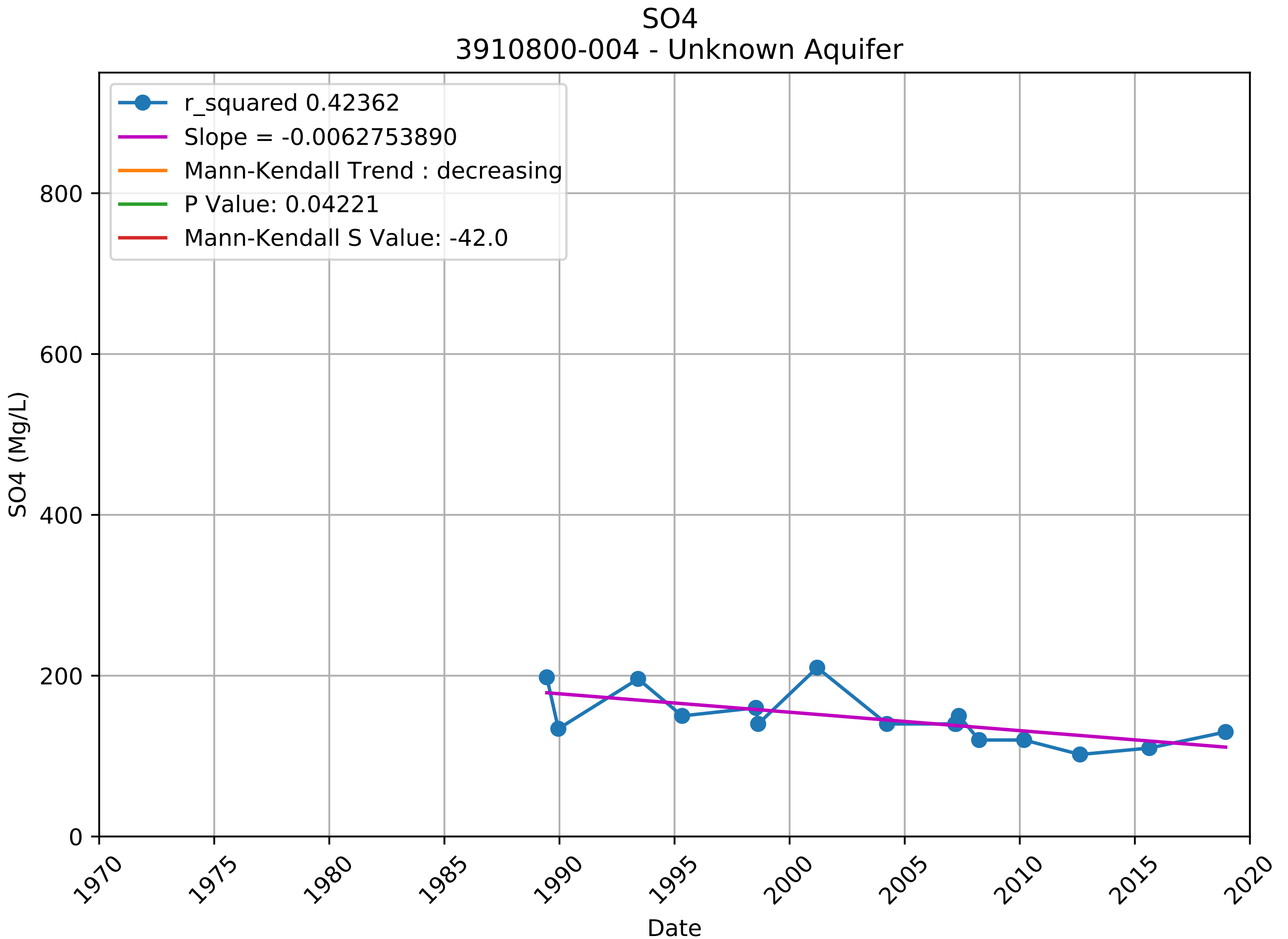

SO4
3910800-004 - Unknown Aquifer
r_squared 0.42362
Slope = -0.0062753890
Mann-Kendall Trend : decreasing
P Value: 0.04221
Mann-Kendall S Value: -42.0
SO4 (Mg/L)
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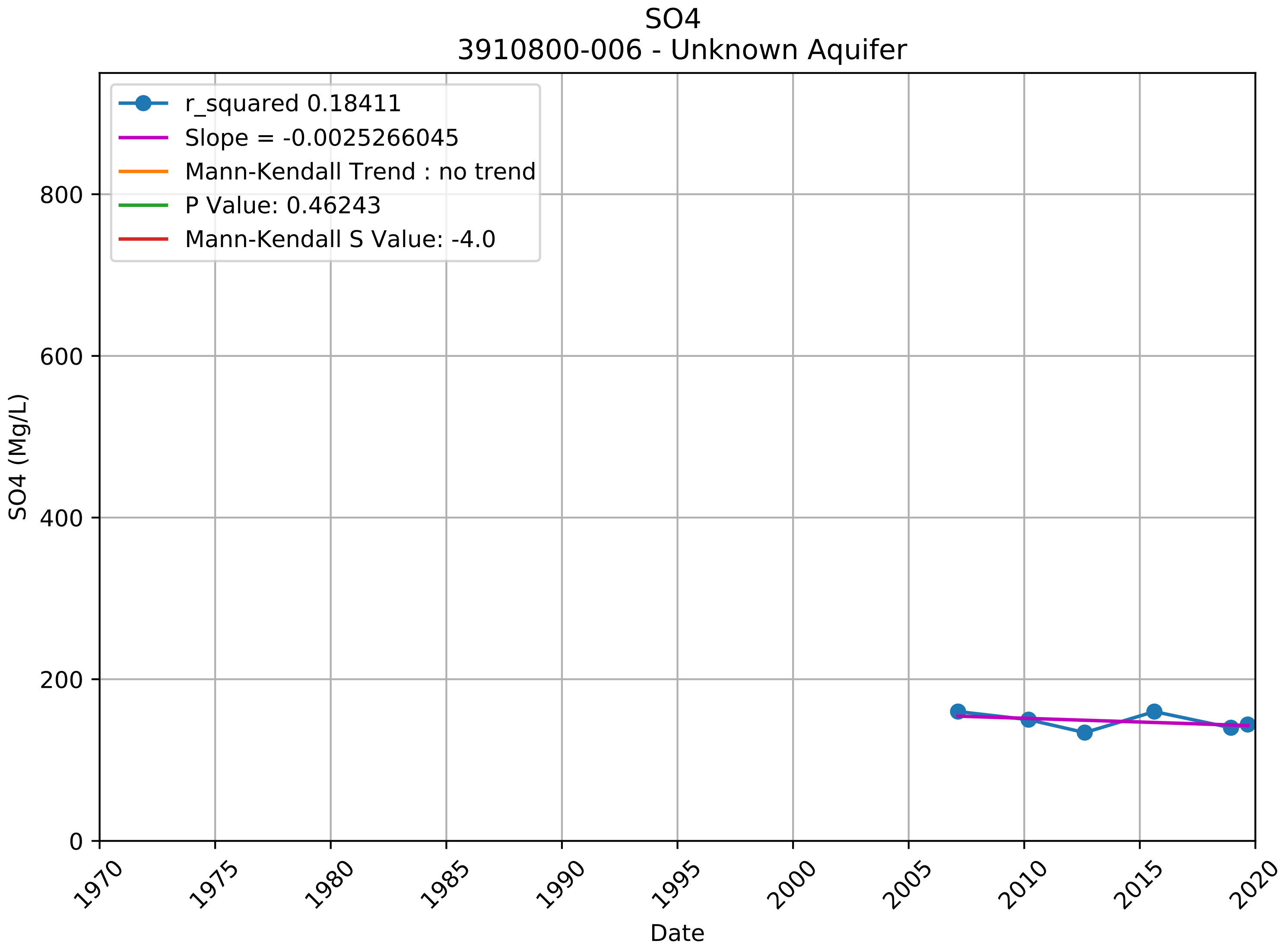
Date



SO4
3910800-006 - Unknown Aquifer
r_squared 0.18411
Slope = -0.0025266045
Mann-Kendall Trend : no trend
P Value: 0.46243
Mann-Kendall S Value: -4.0
SO4 (Mg/L)
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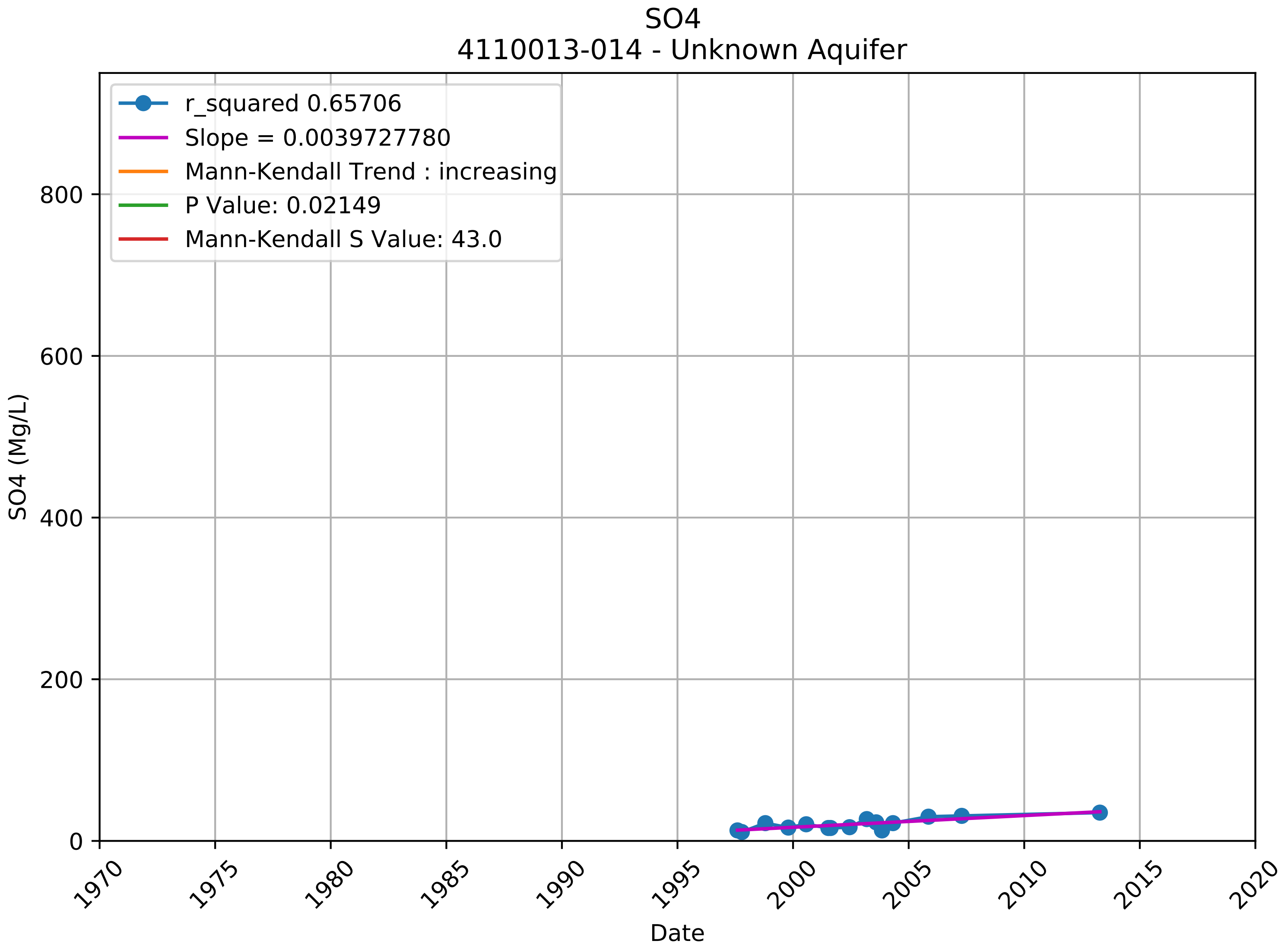
Date



SO4
4110013-014 - Unknown Aquifer
r_squared 0.65706
Slope = 0.0039727780
Mann-Kendall Trend : increasing
P Value: 0.02149
Mann-Kendall S Value: 43.0
SO4 (Mg/L)
0
200
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1970
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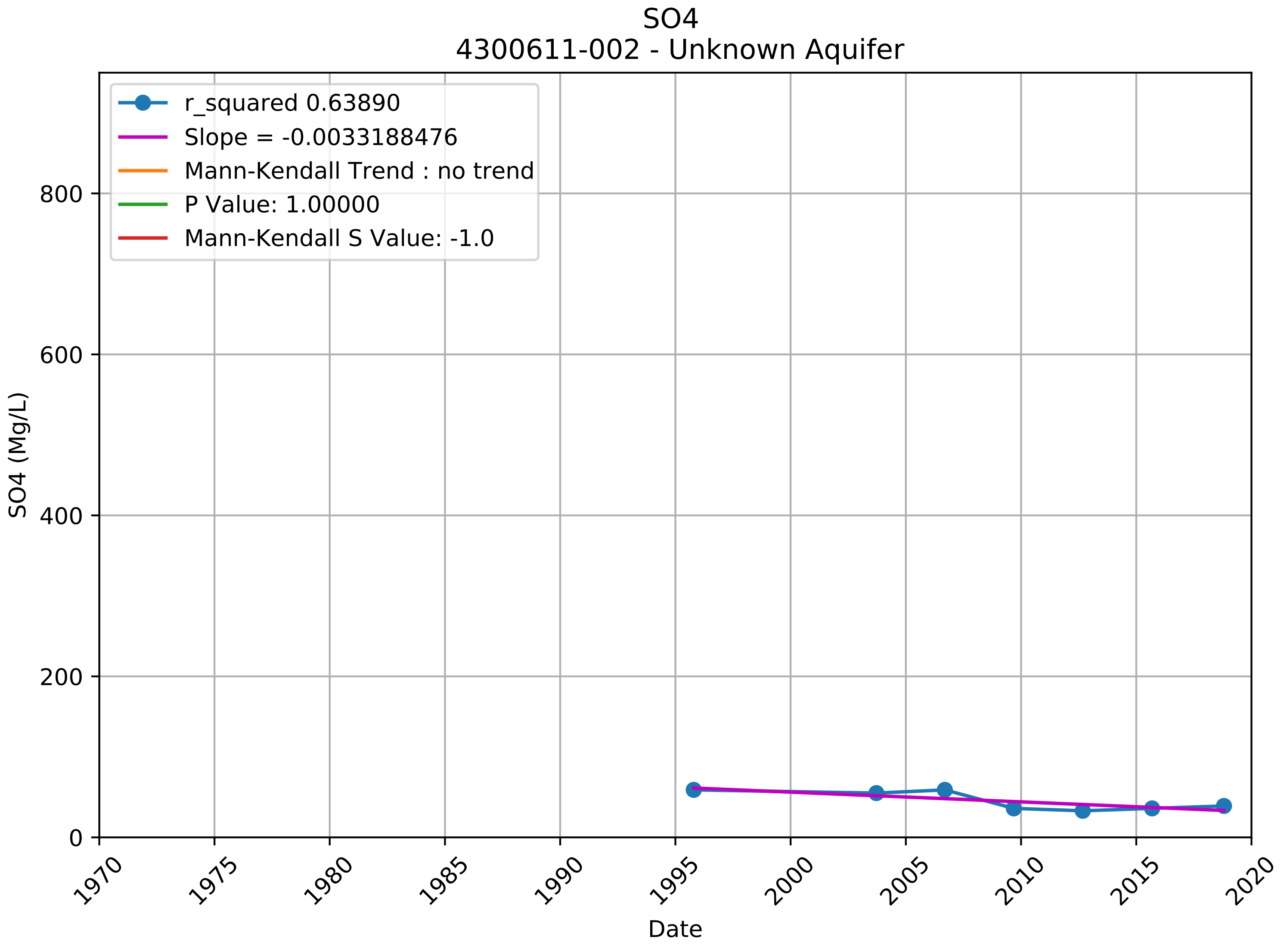
2015
2020
Date



SO4
4300611-002 - Unknown Aquifer
r_squared 0.63890
Slope = -0.0033188476
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
SO4 (Mg/L)
0
200
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1970
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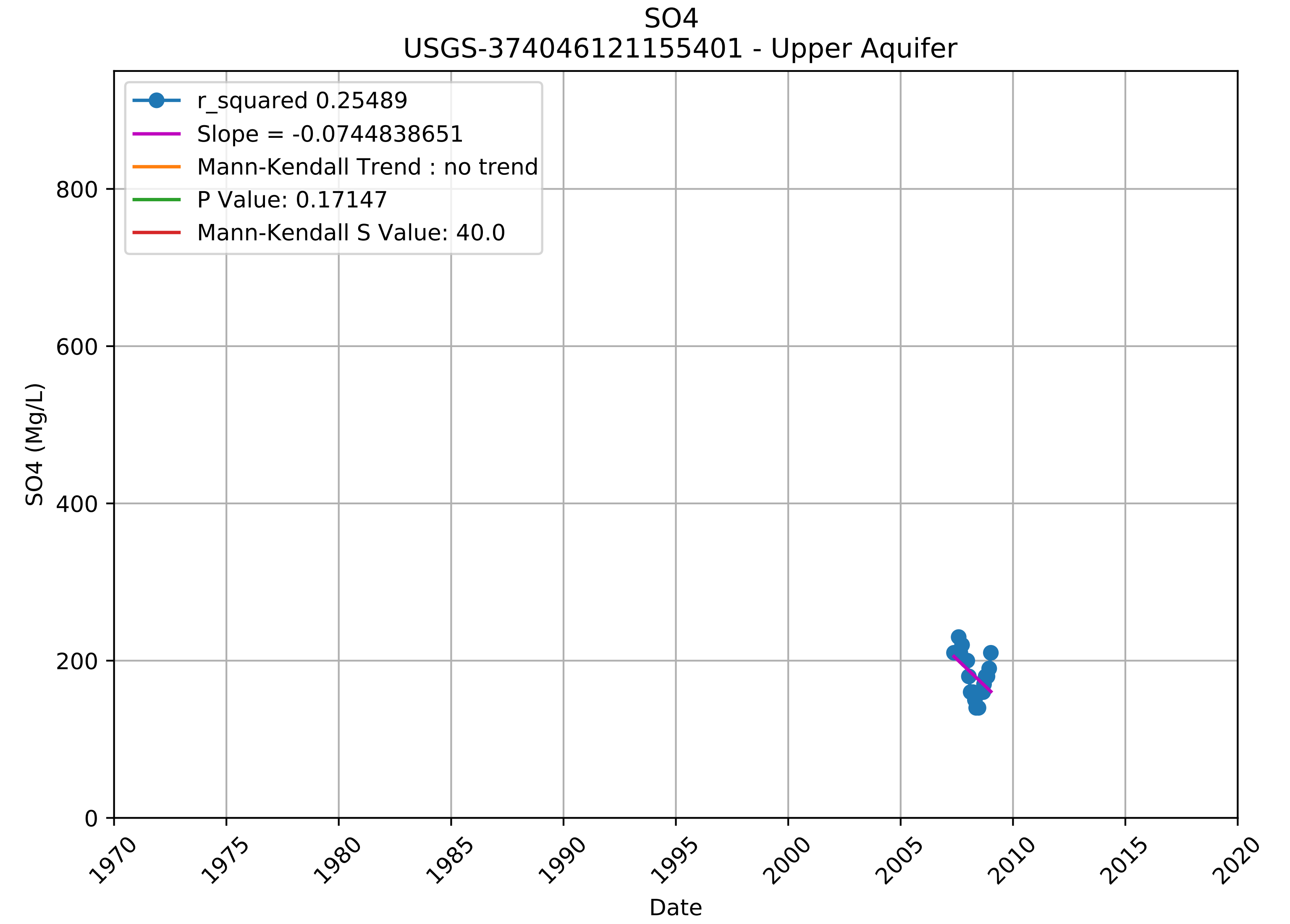
Date



SO4
USGS-374046121155401 - Upper Aquifer
r_squared 0.25489
Slope = -0.0744838651
Mann-Kendall Trend : no trend
P Value: 0.17147
Mann-Kendall S Value: 40.0
SO4 (Mg/L)
0
200
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1970
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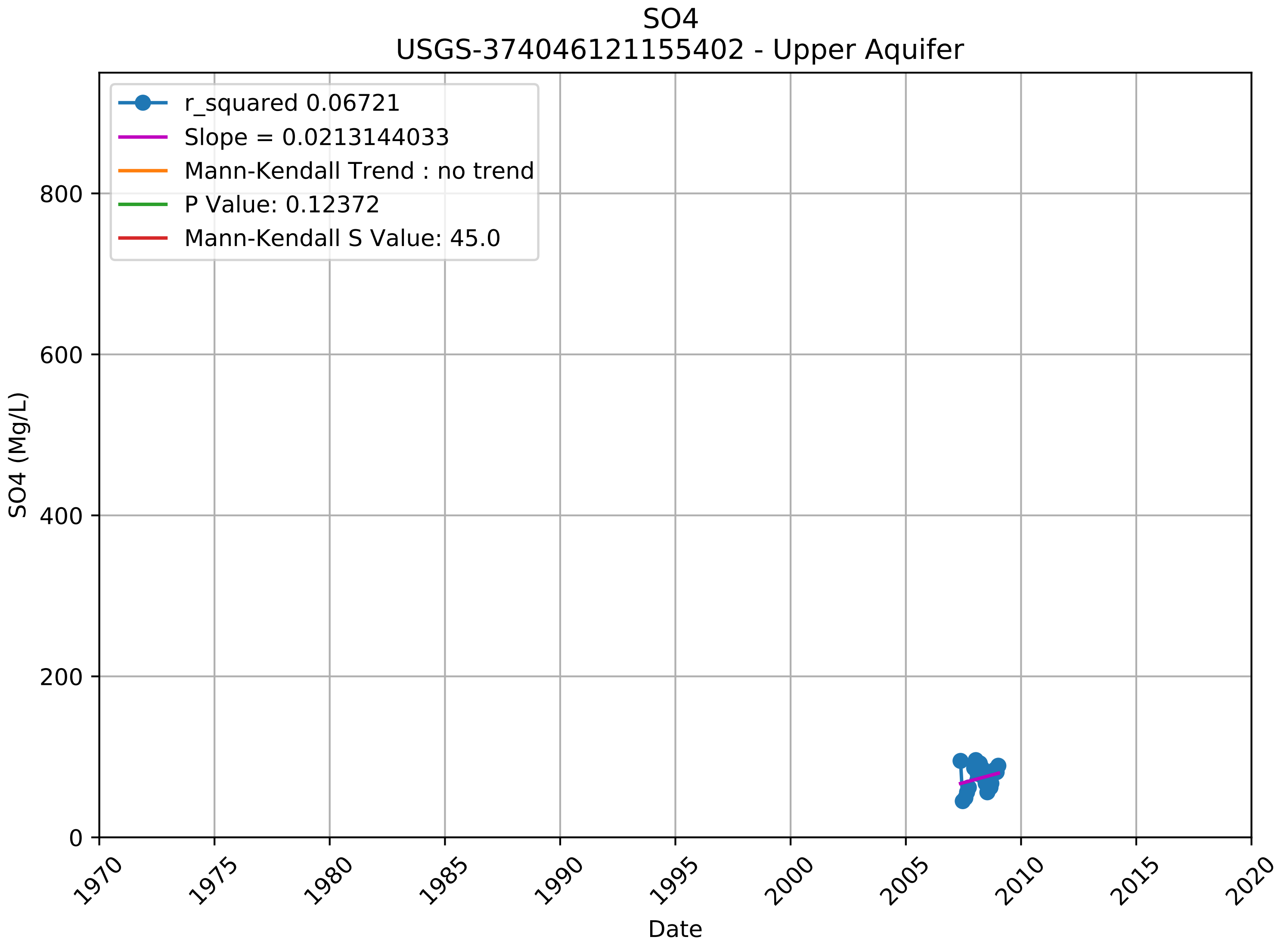
Date



SO4
USGS-374046121155402 - Upper Aquifer
r_squared 0.06721
Slope = 0.0213144033
Mann-Kendall Trend : no trend
P Value: 0.12372
Mann-Kendall S Value: 45.0
SO4 (Mg/L)
0
200
400
600
800
Date
1970
1975
1980
1985
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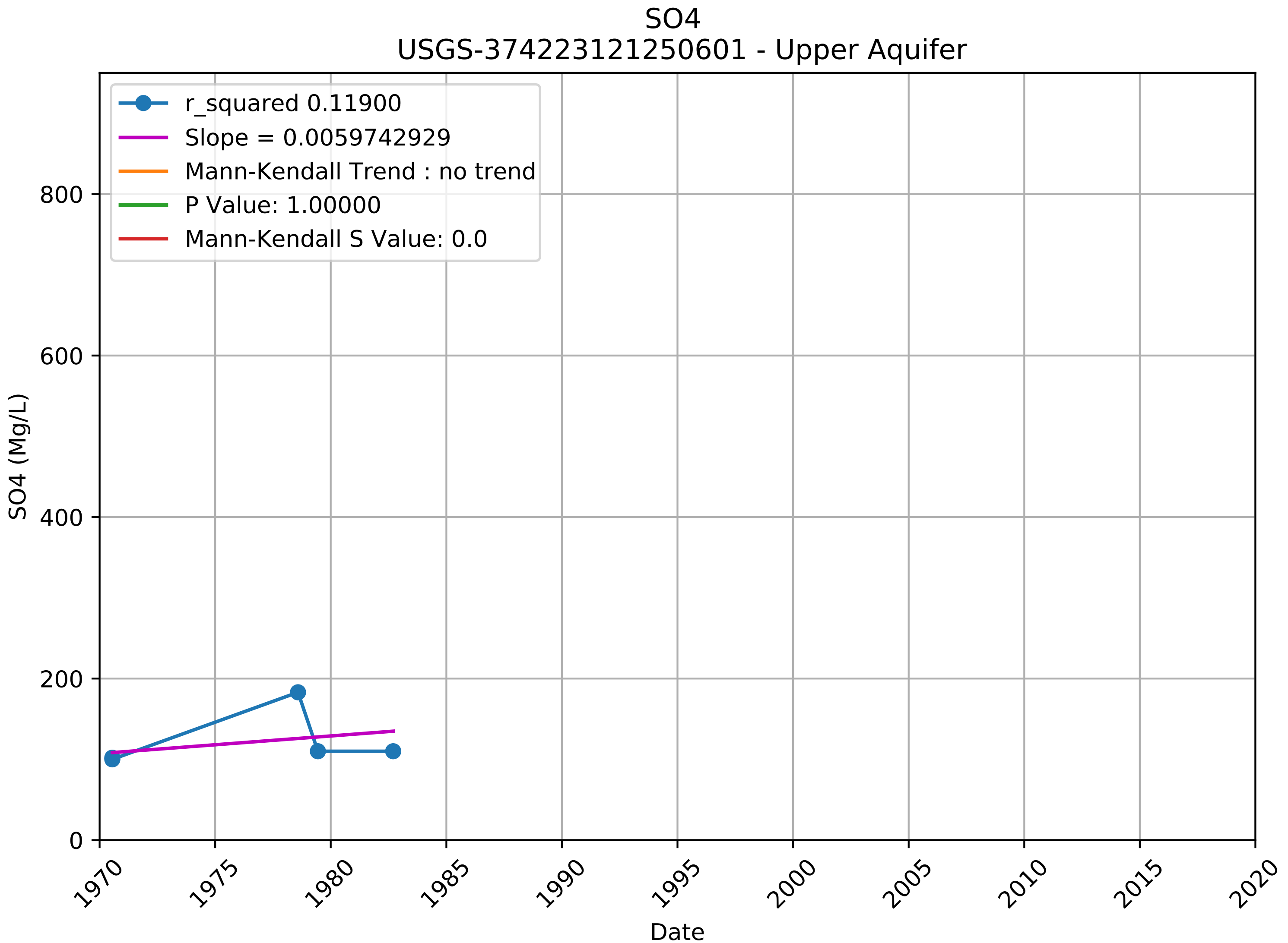
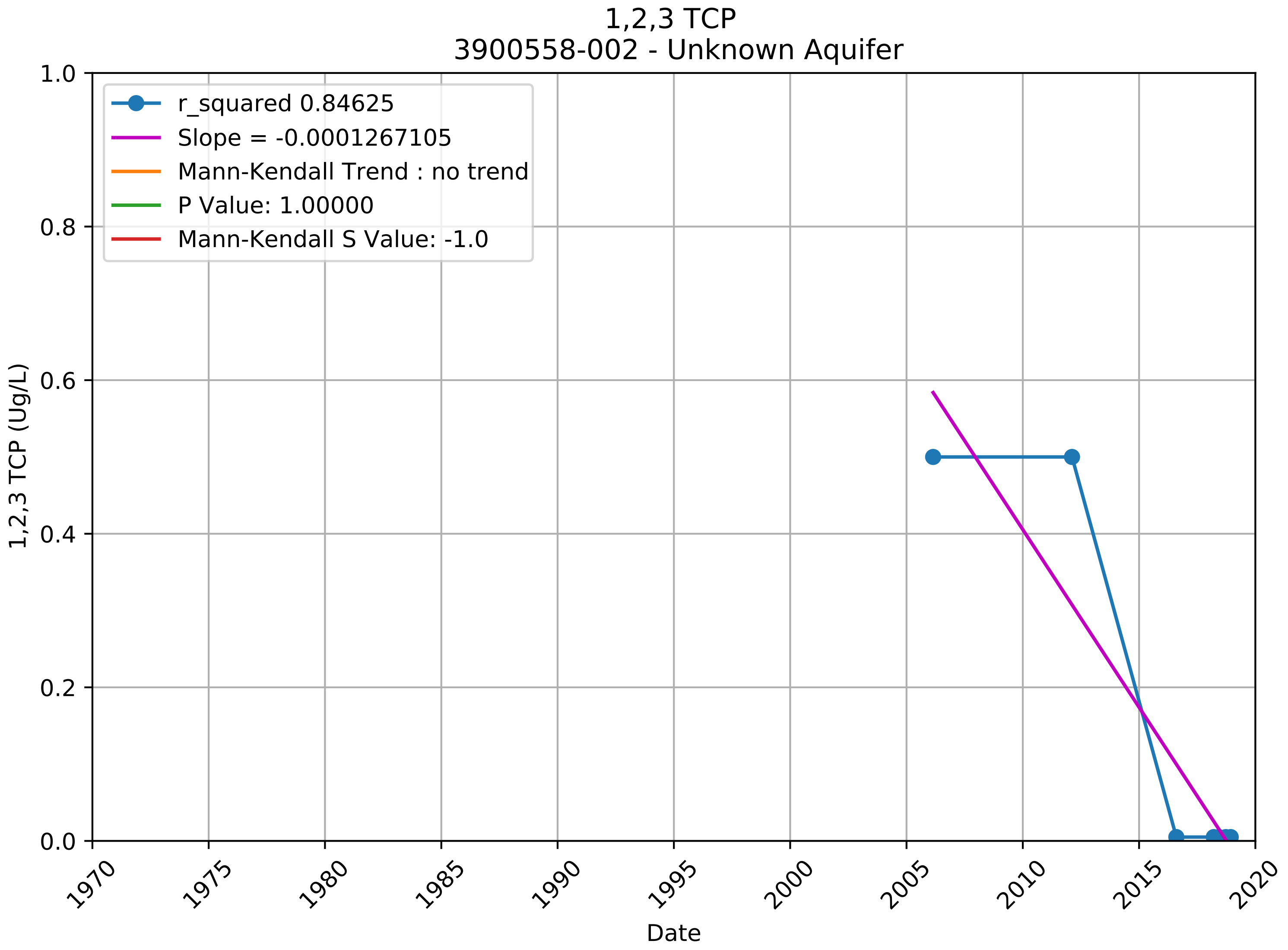
1995
2000
2005
2010
2015
2020

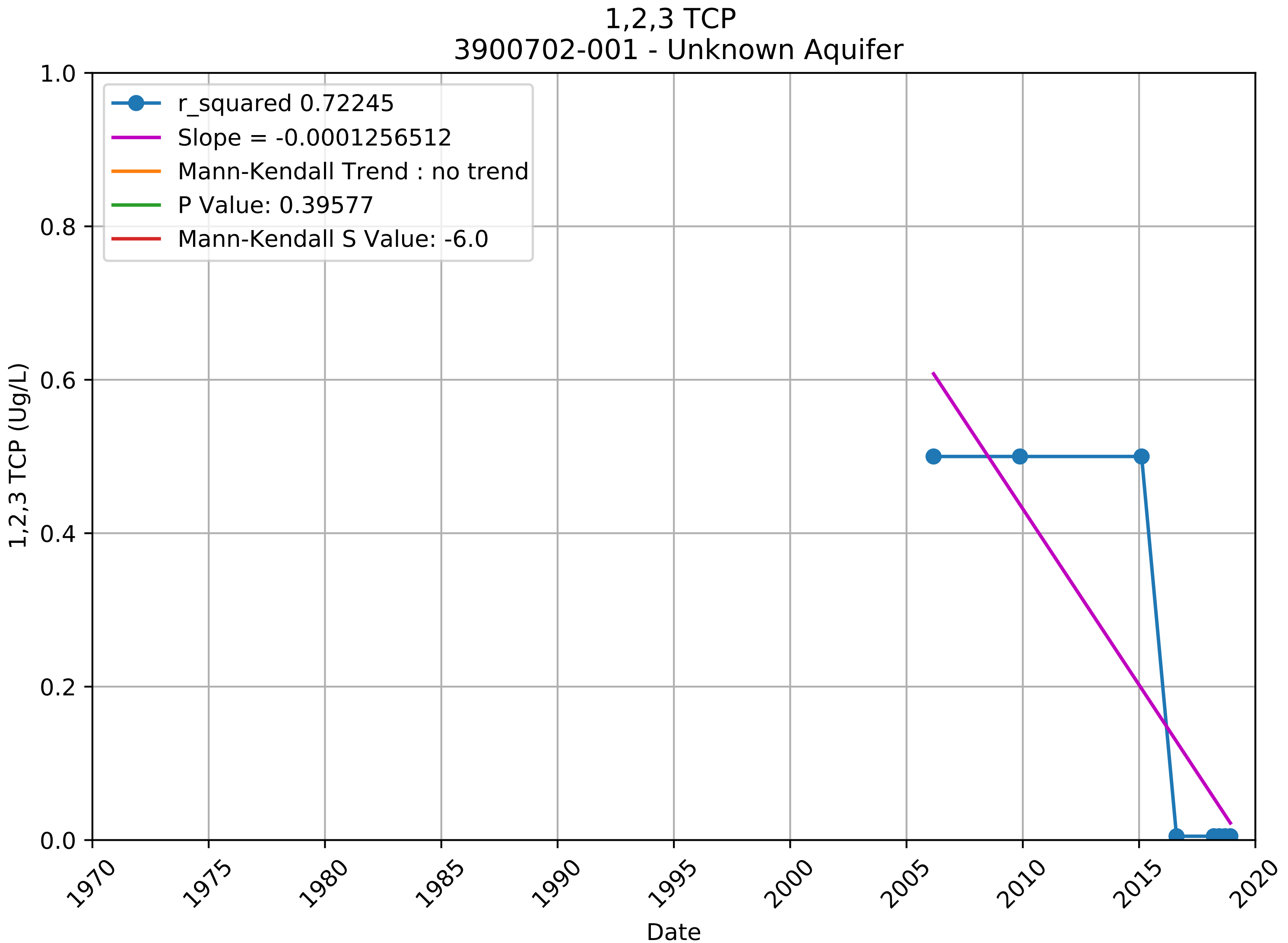

SO4
USGS-374223121250601 - Upper Aquifer
r_squared 0.11900
Slope = 0.0059742929
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
SO4 (Mg/L)
0
200
400
600
800
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

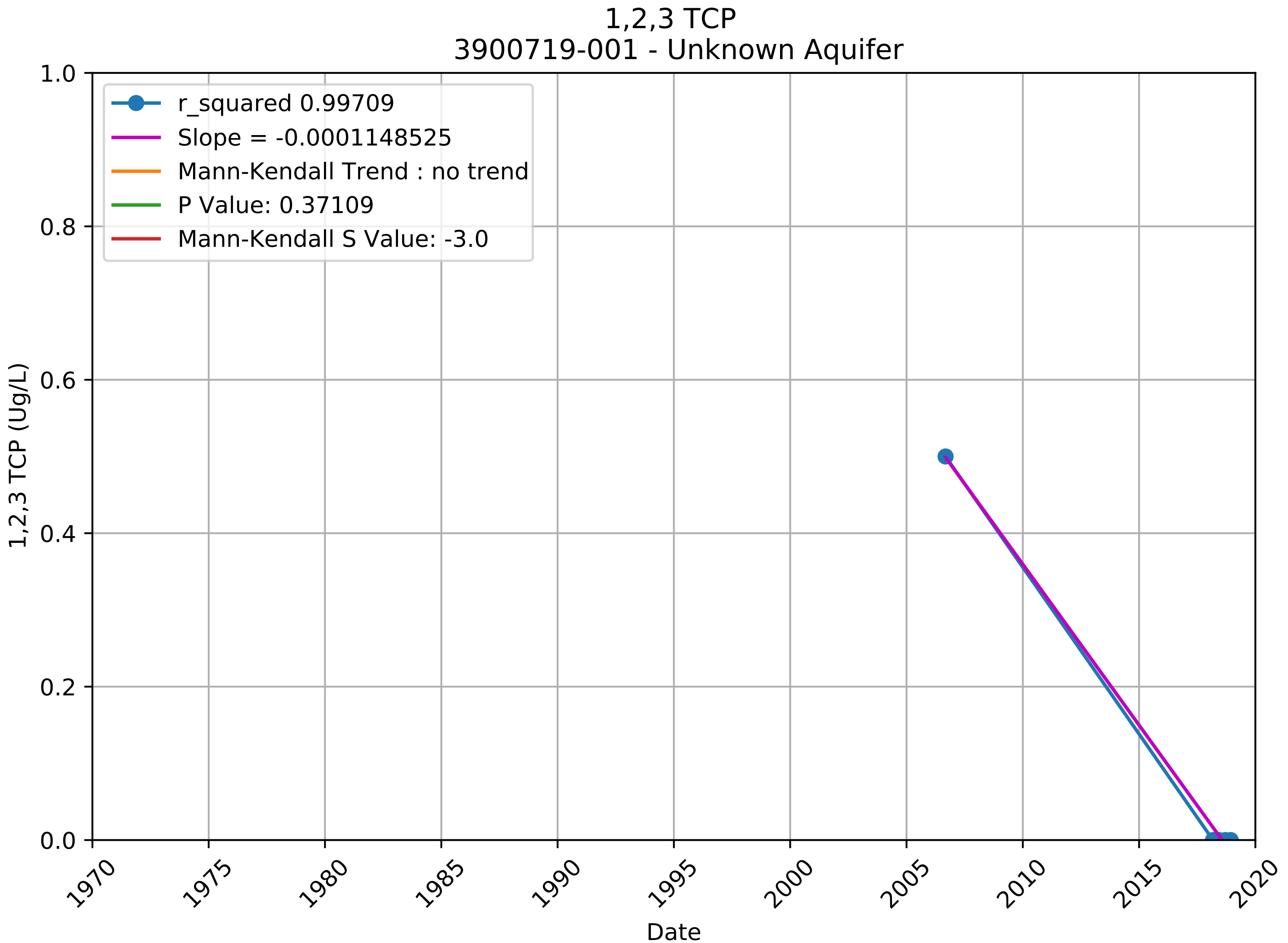
1,2,3-Trichloropropane

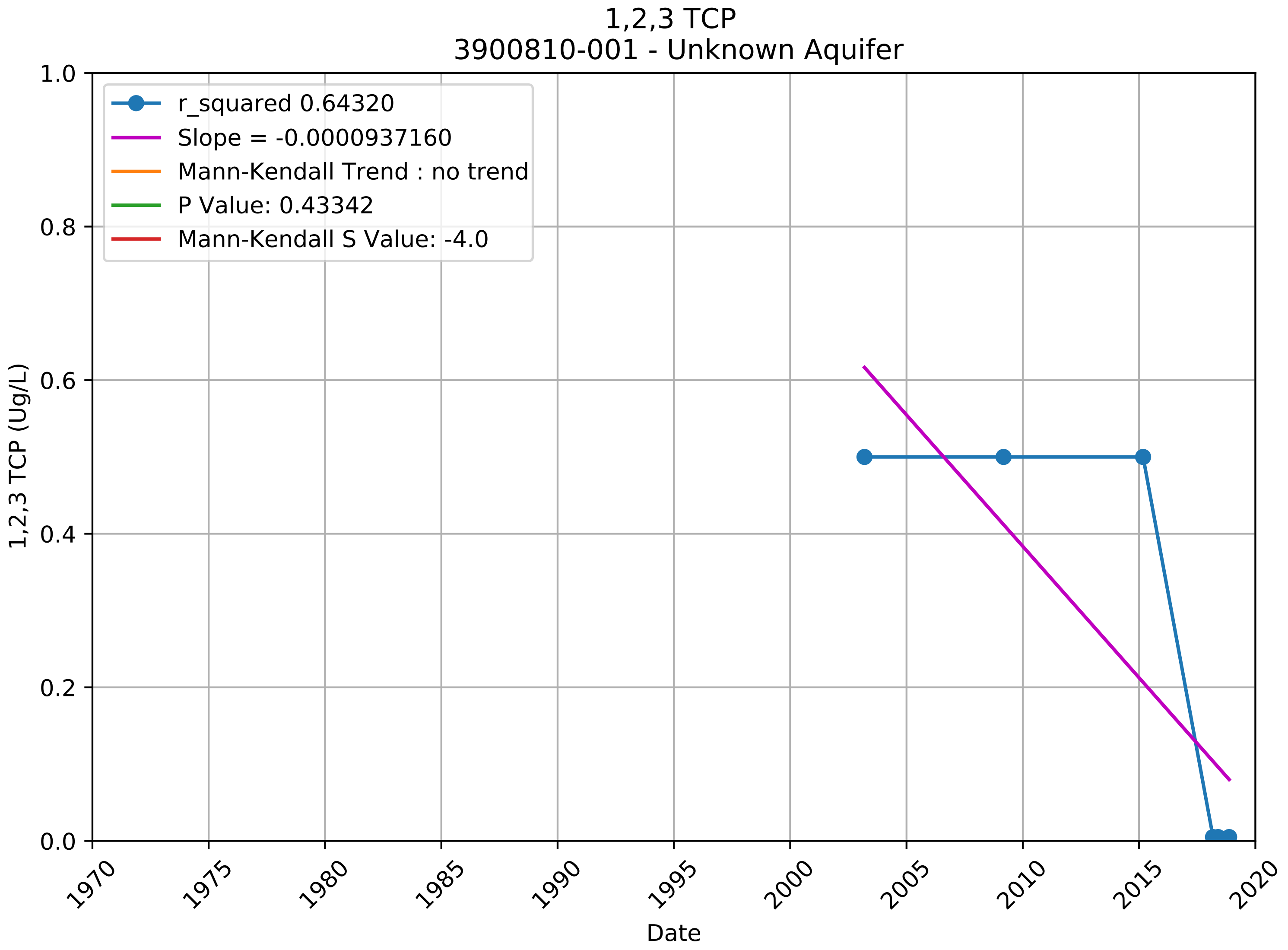
WellName	Latitude_NAD83	Longitude_NAD83	chemical	h	p	s	tau	trend	var_s	z	PRINCIPAL_AQUIFER
3910011-007	37.714471	-121.426009	TCPR123	FALSE	1	0	0	no trend	92	0	Unknown
3910011-010	37.736372	-121.435351	TCPR123	FALSE	1	0	0	no trend	165	0	Unknown
3910702-003	37.705557	-121.39764	TCPR123	FALSE	0.789	3	0.107	no trend	55.667	0.268	Unknown
3910018-002	37.683333	-121.266667	TCPR123	FALSE	0.289	-4	-0.4	no trend	8	-1.061	Unknown
3910701-003	37.85144	-121.2682	TCPR123	TRUE	0.003	54	0.45	increasing	324.667	2.941	Unknown
3910701-001	37.849584	-121.268763	TCPR123	FALSE	0.129	15	0.125	no trend	85	1.519	Unknown
3910011-017	37.738215	-121.419962	TCPR123	FALSE	1	0	0	no trend	44.333	0	Unknown
3910018-001	37.679751	-121.272617	TCPR123	FALSE	0.522	7	0.106	no trend	87.667	0.641	Unknown
3901035-001	37.805066	-121.450392	TCPR123	FALSE	0.25	-22	-0.242	no trend	332.667	-1.151	Unknown
4300611-002	37.994444	-121.499722	TCPR123	FALSE	0.096	-7	-0.7	no trend	13	-1.664	Unknown
3910015-005	37.816859	-121.266705	TCPR123	FALSE	0.665	12	0.078	no trend	647.333	0.432	Upper
3910011-003	37.683959	-121.439427	TCPR123	TRUE	0.012	37	0.407	increasing	205	2.514	Lower
3910800-002	37.744188	-121.32701	TCPR123	FALSE	0.313	16	0.205	no trend	220.667	1.01	Unknown
3910800-003	37.74545	-121.32897	TCPR123	FALSE	0.313	16	0.205	no trend	220.667	1.01	Unknown
3910800-001	37.744746	-121.327221	TCPR123	FALSE	1	0	0	no trend	16.667	0	Unknown
3910800-004	37.74591	-121.336213	TCPR123	FALSE	0.313	16	0.205	no trend	220.667	1.01	Unknown
3910701-005	37.851301	-121.2673	TCPR123	TRUE	0.002	64	0.418	increasing	424.667	3.057	Unknown
3910011-004	37.682308	-121.436988	TCPR123	TRUE	0.012	37	0.407	increasing	205	2.514	Lower
3910011-006	37.686539	-121.443515	TCPR123	TRUE	0.015	33	0.423	increasing	173	2.433	Lower
3910011-005	37.683353	-121.443313	TCPR123	FALSE	0.212	19	0.209	no trend	207.667	1.249	Lower
3910015-006	37.818884	-121.266416	TCPR123	FALSE	0.091	-47	-0.275	no trend	742.333	-1.688	Upper
3910015-007	37.811547	-121.263915	TCPR123	FALSE	0.699	-10	-0.074	no trend	540.667	-0.387	Upper
3910015-008	37.801132	-121.262514	TCPR123	FALSE	0.455	20	0.131	no trend	647.333	0.747	Upper
3910011-018	37.743262	-121.424805	TCPR123	FALSE	0.099	13	0.464	no trend	53	1.648	Lower
3910018-004	37.679705	-121.272761	TCPR123	FALSE	0.503	-5	-0.238	no trend	35.667	-0.67	Unknown
3910701-007	37.851431	-121.265247	TCPR123	FALSE	0.289	4	0.4	no trend	8	1.061	Unknown
3910702-006	37.709972	-121.390802	TCPR123	FALSE	0.071	-9	-0.6	no trend	19.667	-1.804	Unknown
3910702-005	37.708149	-121.393881	TCPR123	FALSE	0.371	-3	-0.5	no trend	5	-0.894	Unknown
4110013-014	37.7	-121.466667	TCPR123	FALSE	1	-1	-0.1	no trend	15.667	0	Unknown
3900993-001	37.668527	-121.323805	TCPR123	FALSE	1	1	0.067	no trend	19.667	0	Unknown
3900991-001	37.743544	-121.461428	TCPR123	FALSE	0.096	-7	-0.7	no trend	13	-1.664	Unknown
3910011-030	37.740208	-121.439285	TCPR123	FALSE	1	1	0.048	no trend	39.667	0	Lower
3900719-001	37.7685	-121.35325	TCPR123	FALSE	0.371	-3	-0.5	no trend	5	-0.894	Unknown
3901348-002	37.702894	-121.406986	TCPR123	FALSE	0.083	-16	-0.444	no trend	74.667	-1.736	Unknown
3901181-001	37.692555	-121.428055	TCPR123	FALSE	1	0	0	no trend	16.667	0	Unknown
3901409-001	37.709642	-121.426004	TCPR123	FALSE	0.289	4	0.4	no trend	8	1.061	Unknown
3901305-007	37.741365	-121.399277	TCPR123	FALSE	1	0	0	no trend	8.667	0	Unknown
3901378-002	37.743671	-121.362772	TCPR123	FALSE	0.371	-3	-0.5	no trend	5	-0.894	Unknown
3901172-002	37.636324	-121.399544	TCPR123	FALSE	1	-1	-0.067	no trend	19.667	0	Unknown
3901172-003	37.632289	-121.39736	TCPR123	FALSE	1	-1	-0.067	no trend	19.667	0	Unknown
3900702-001	37.990639	-121.407056	TCPR123	FALSE	0.396	-6	-0.286	no trend	34.667	-0.849	Unknown
3900810-001	37.804543	-121.267078	TCPR123	FALSE	0.433	-4	-0.4	no trend	14.667	-0.783	Unknown
3901216-002	37.74753	-121.516649	TCPR123	FALSE	1	-1	-0.067	no trend	19.667	0	Unknown
3900559-001	37.79	-121.38	TCPR123	FALSE	1	0	0	no trend	8.667	0	Unknown
3900558-002	37.79	-121.4	TCPR123	FALSE	1	-1	-0.067	no trend	19.667	0	Unknown
3910011-034	37.752802	-121.434603	TCPR123	FALSE	1	1	0.048	no trend	39.667	0	Lower
3910011-032	37.754682	-121.465249	TCPR123	FALSE	1	1	0.048	no trend	39.667	0	Lower
3901348-003	37.698742	-121.409917	TCPR123	FALSE	0.3	-12	-0.267	no trend	112.667	-1.036	Unknown
3901348-004	37.698147	-121.416153	TCPR123	FALSE	0.508	-7	-0.194	no trend	82.333	-0.661	Unknown
3900810-002	37.808086	-121.271346	TCPR123	FALSE	1	-1	-0.067	no trend	19.667	0	Unknown
3901309-008	37.694682	-121.411996	TCPR123	FALSE	1	-1	-0.1	no trend	13	0	Unknown
3910005-044	37.782808	-121.300937	TCPR123	FALSE	0.133	-98	-0.186	no trend	4158.667	-1.504	Unknown
ESJ-01	37.81683333	-121.2666667	TCPR123	FALSE	0.806	2	0.2	no trend	16.667	0.245	Unknown
TRCY-03	37.68341667	-121.4433333	TCPR123	FALSE	1	-1	-0.067	no trend	28.333	0	Unknown
3901405-007	37.631659	-121.289884	TCPR123	FALSE	0.289	-4	-0.4	no trend	8	-1.061	Unknown
3910800-006	37.744722	-121.329167	TCPR123	FALSE	0.371	3	0.5	no trend	5	0.894	Unknown
3901420-001	37.690618	-121.432012	TCPR123	FALSE	1	-1	-0.1	no trend	13	0	Unknown
3901338-007	37.693257	-121.414274	TCPR123	FALSE	1	0	0	no trend	8.667	0	Unknown
3910015-016	37.80114	-121.262596	TCPR123	FALSE	0.071	-19	-0.422	no trend	99.667	-1.803	Upper
3901320-008	37.712313	-121.378815	TCPR123	FALSE	0.371	3	0.5	no trend	5	0.894	Unknown
3901116-007	37.739222	-121.399009	TCPR123	FALSE	1	0	0	no trend	8.667	0	Unknown
3901336-009	37.740646	-121.401135	TCPR123	FALSE	1	0	0	no trend	8.667	0	Unknown

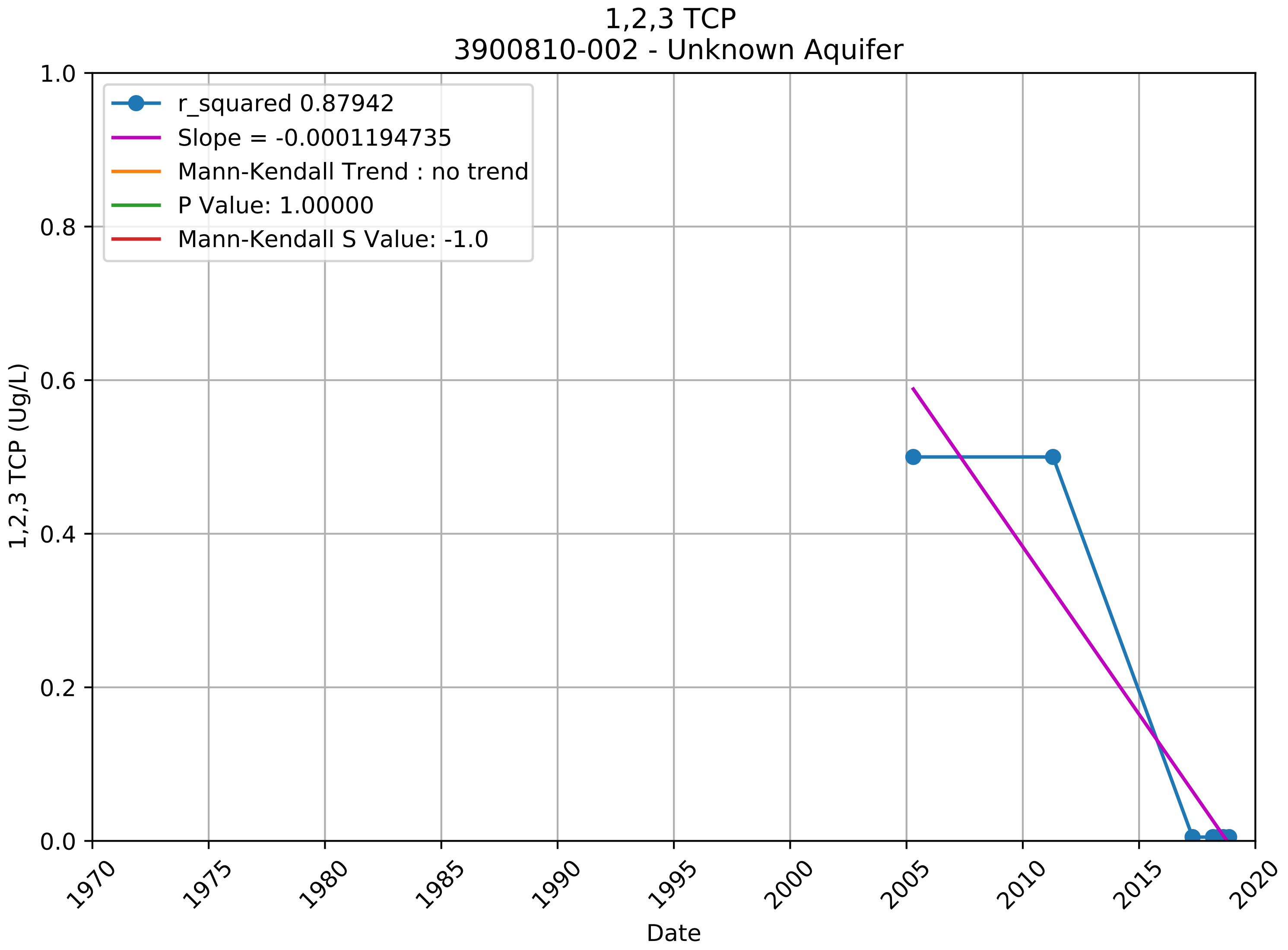

1,2,3 TCP
3900558-002 - Unknown Aquifer
r_squared 0.84625
Slope = -0.0001267105
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
Date
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

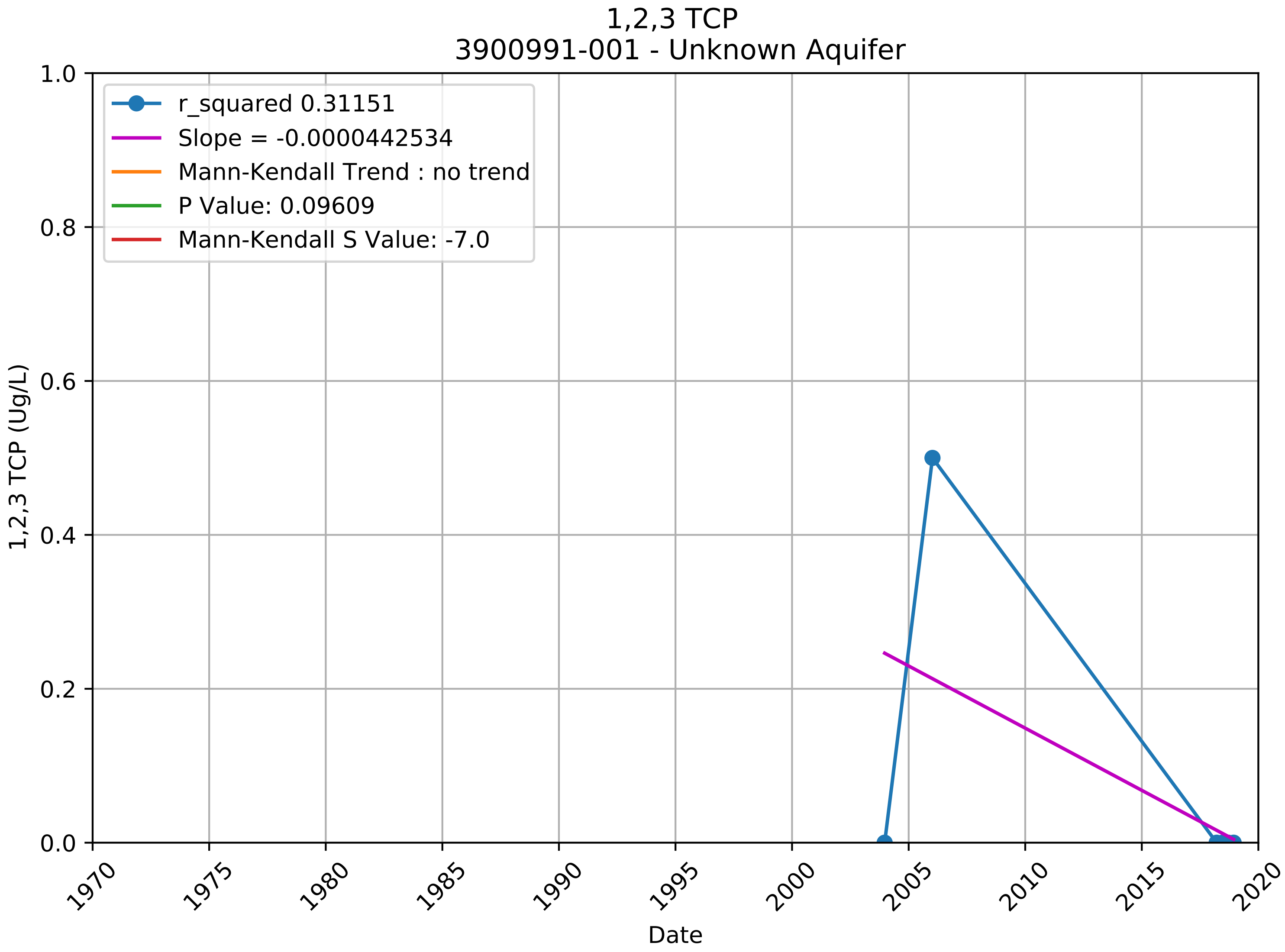

1,2,3 TCP
3900559-001 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

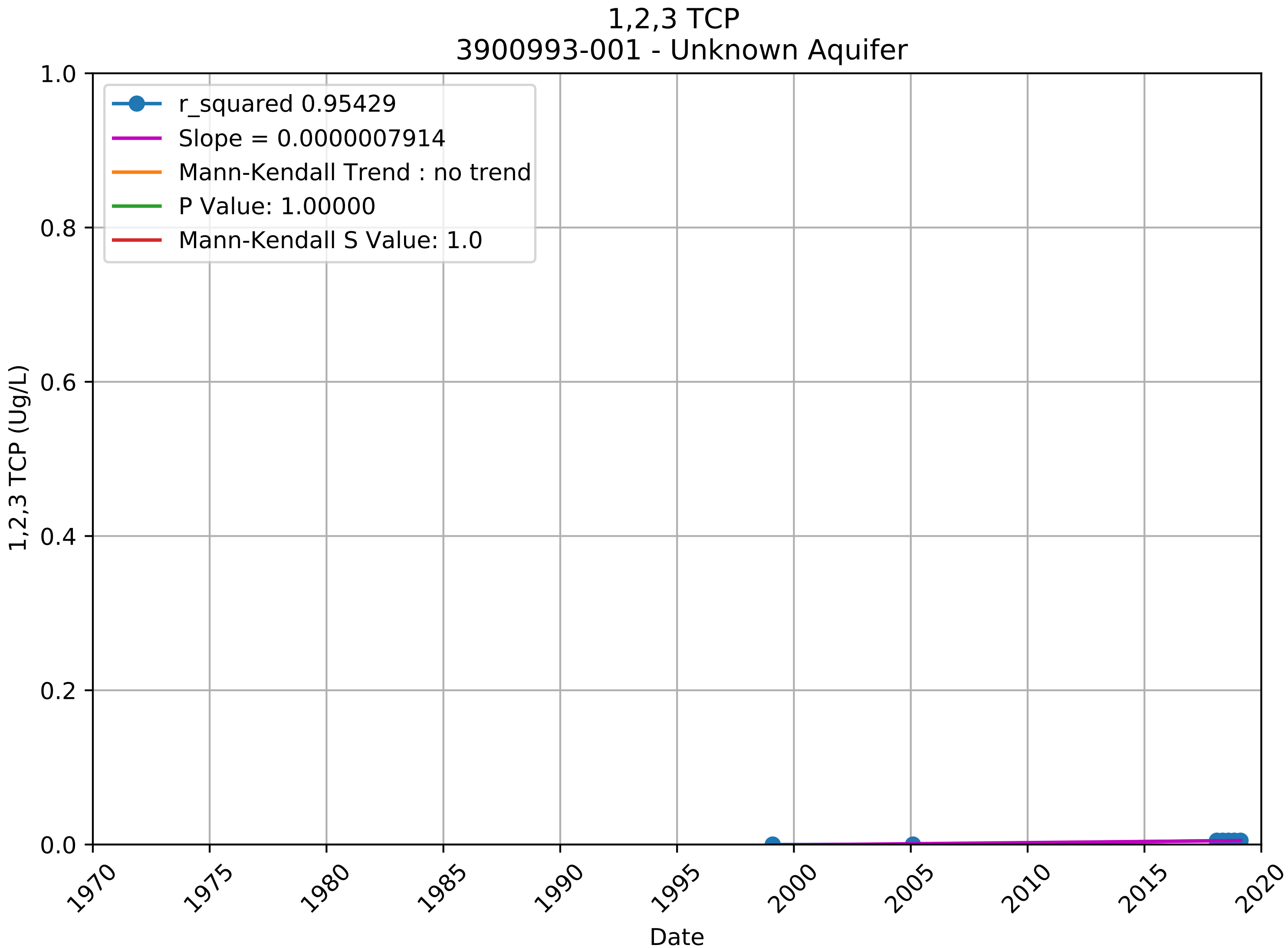

1,2,3 TCP
3900702-001 - Unknown Aquifer
r_squared 0.72245
Slope = -0.0001256512
Mann-Kendall Trend : no trend
P Value: 0.39577
Mann-Kendall S Value: -6.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


1,2,3 TCP
3900719-001 - Unknown Aquifer
r_squared 0.99709
Slope = -0.0001148525
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: -3.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

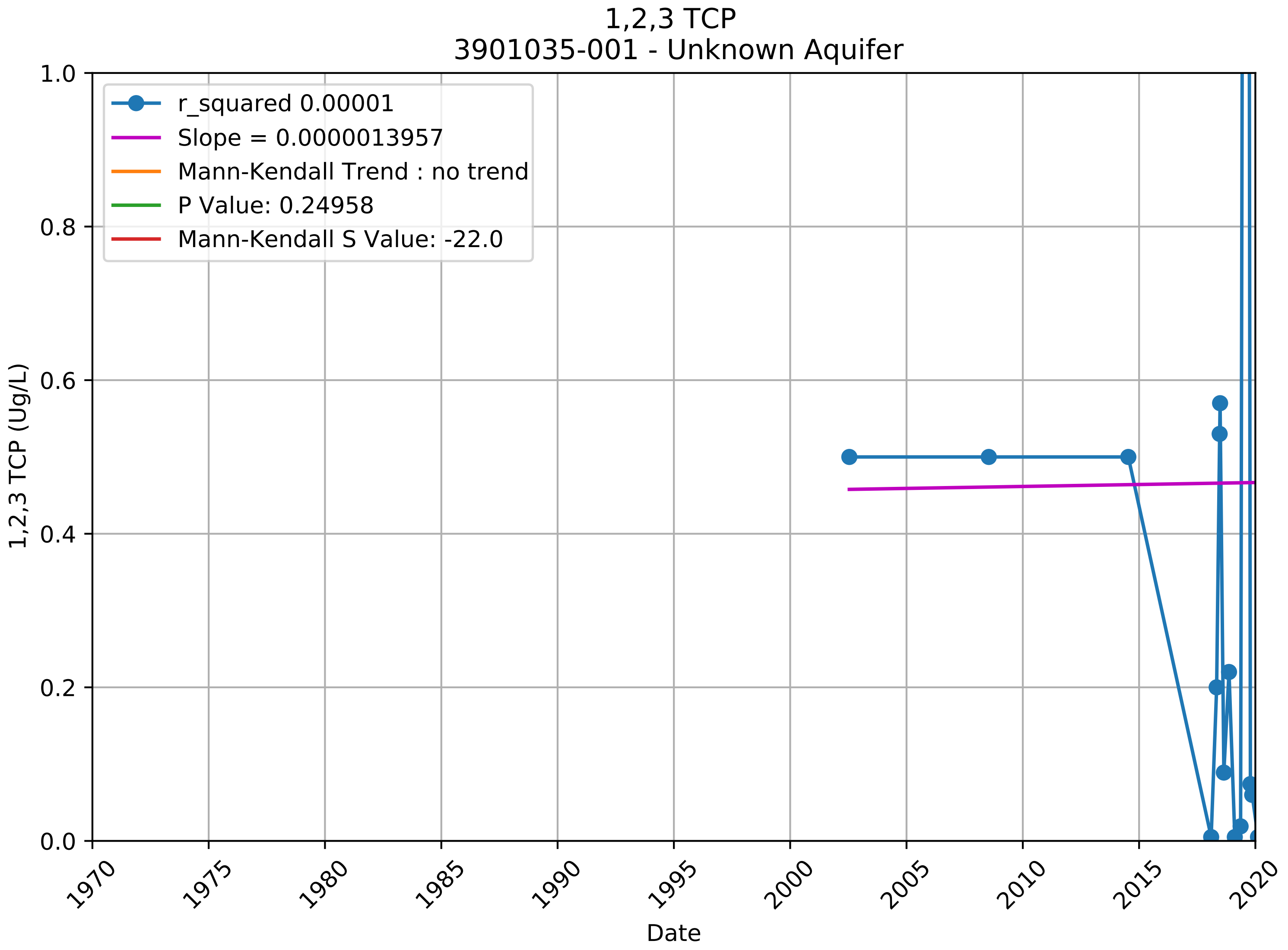

1,2,3 TCP
3900810-001 - Unknown Aquifer
r_squared 0.64320
Slope = -0.0000937160
Mann-Kendall Trend : no trend
P Value: 0.43342
Mann-Kendall S Value: -4.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3900810-002 - Unknown Aquifer
r_squared 0.87942
Slope = -0.0001194735
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

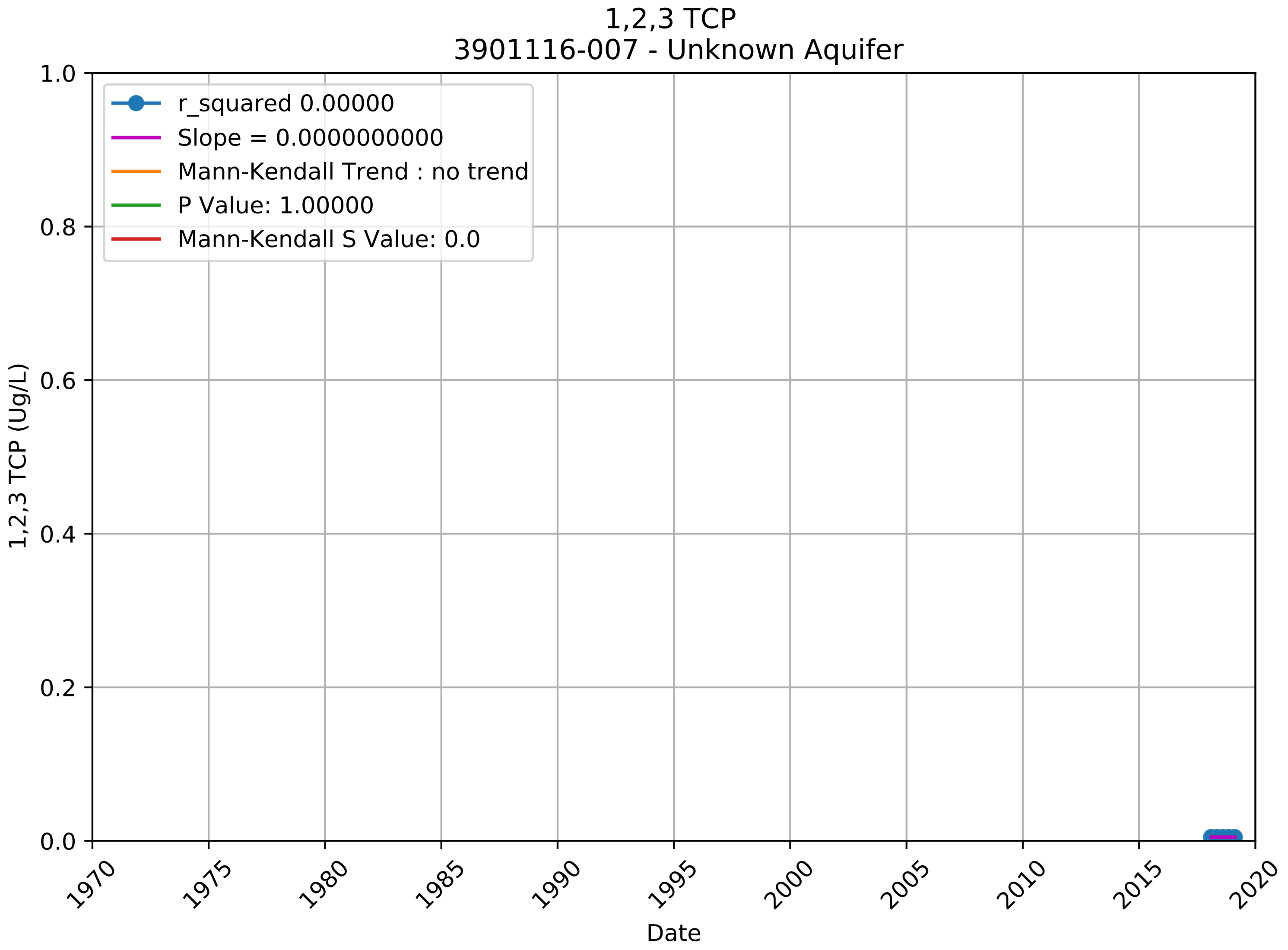

1,2,3 TCP
3900991-001 - Unknown Aquifer
r_squared 0.31151
Slope = -0.0000442534
Mann-Kendall Trend : no trend
P Value: 0.09609
Mann-Kendall S Value: -7.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

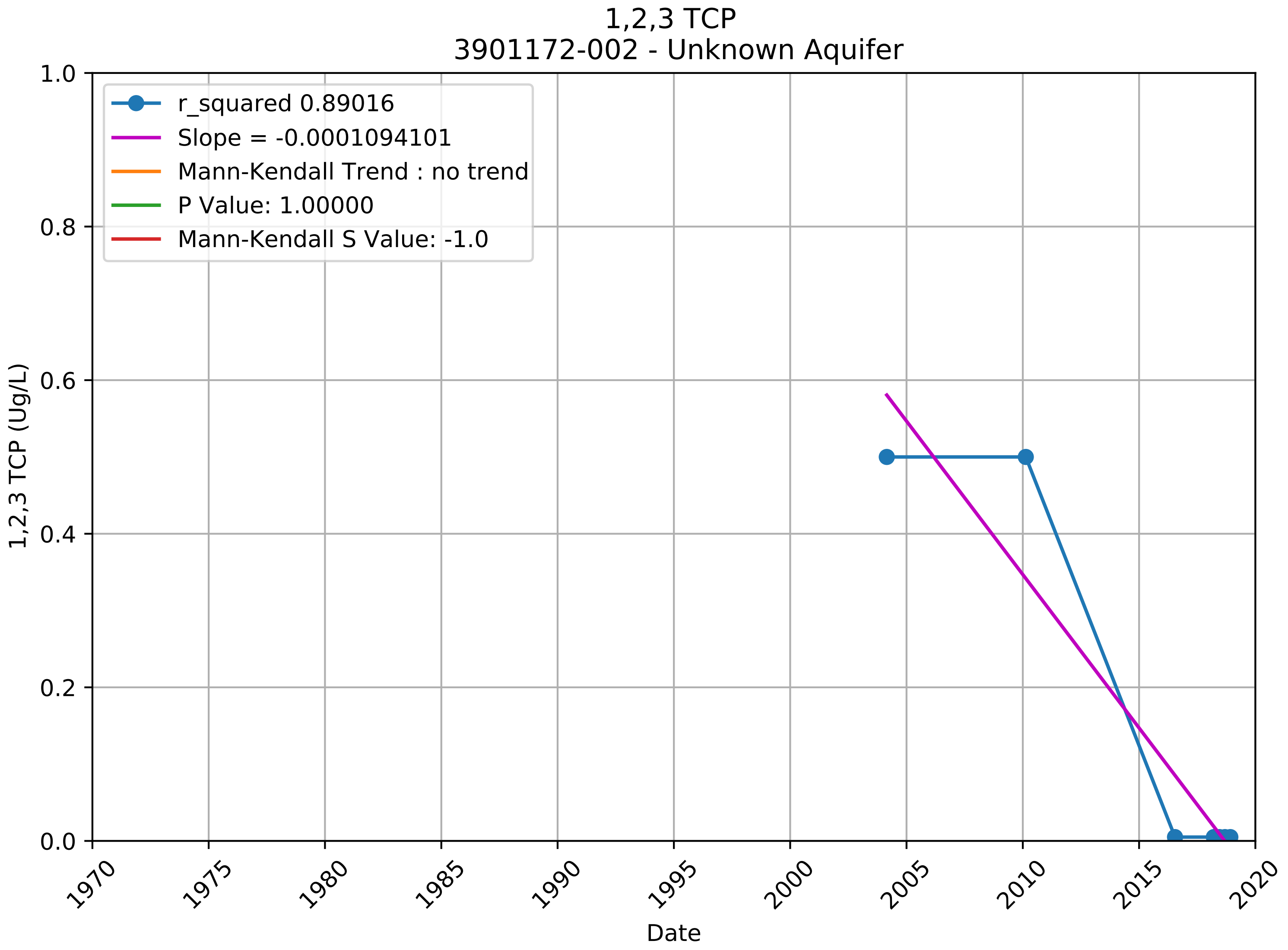


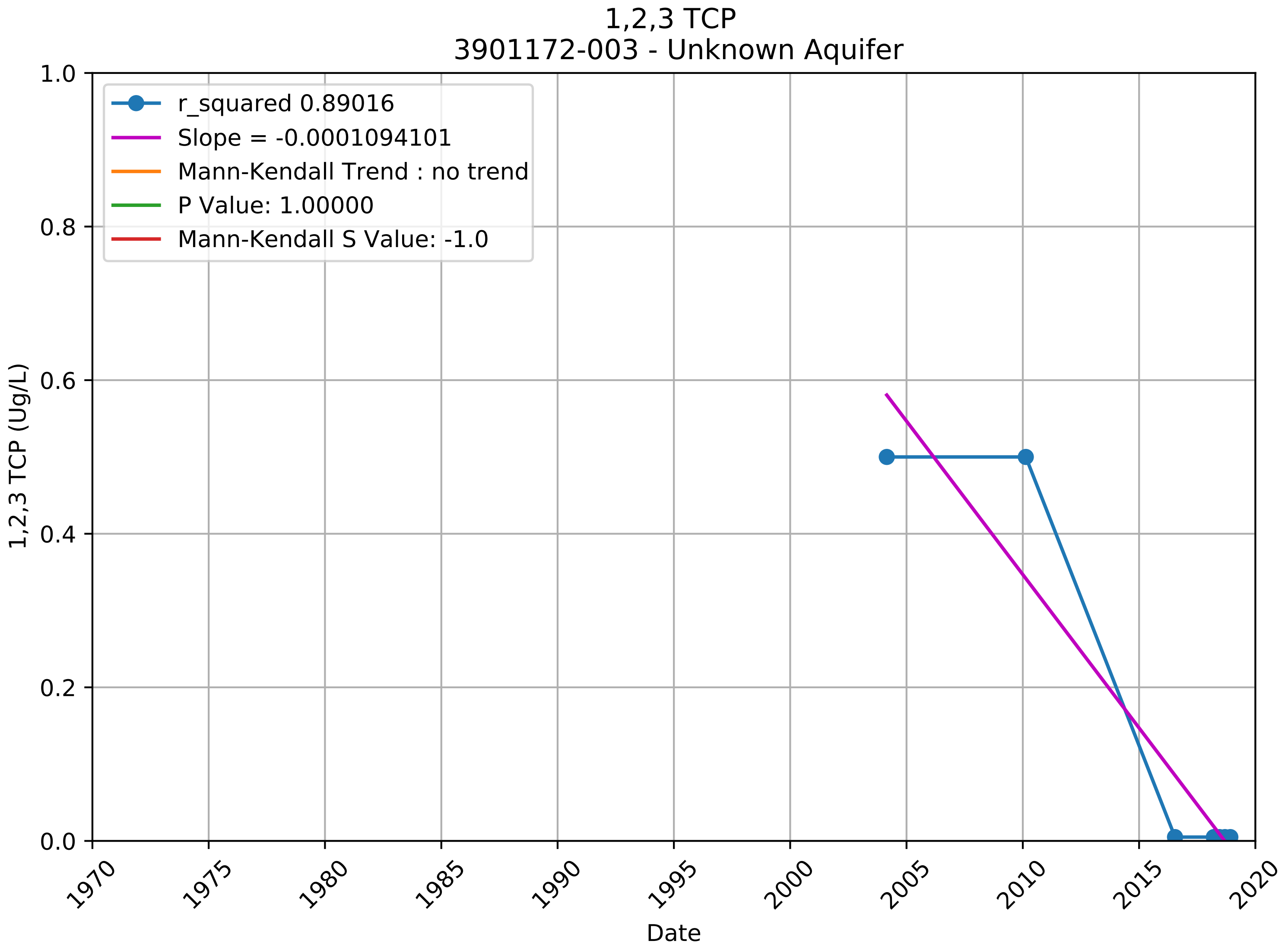
1,2,3 TCP
3900993-001 - Unknown Aquifer
r_squared 0.95429
Slope = 0.0000007914
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

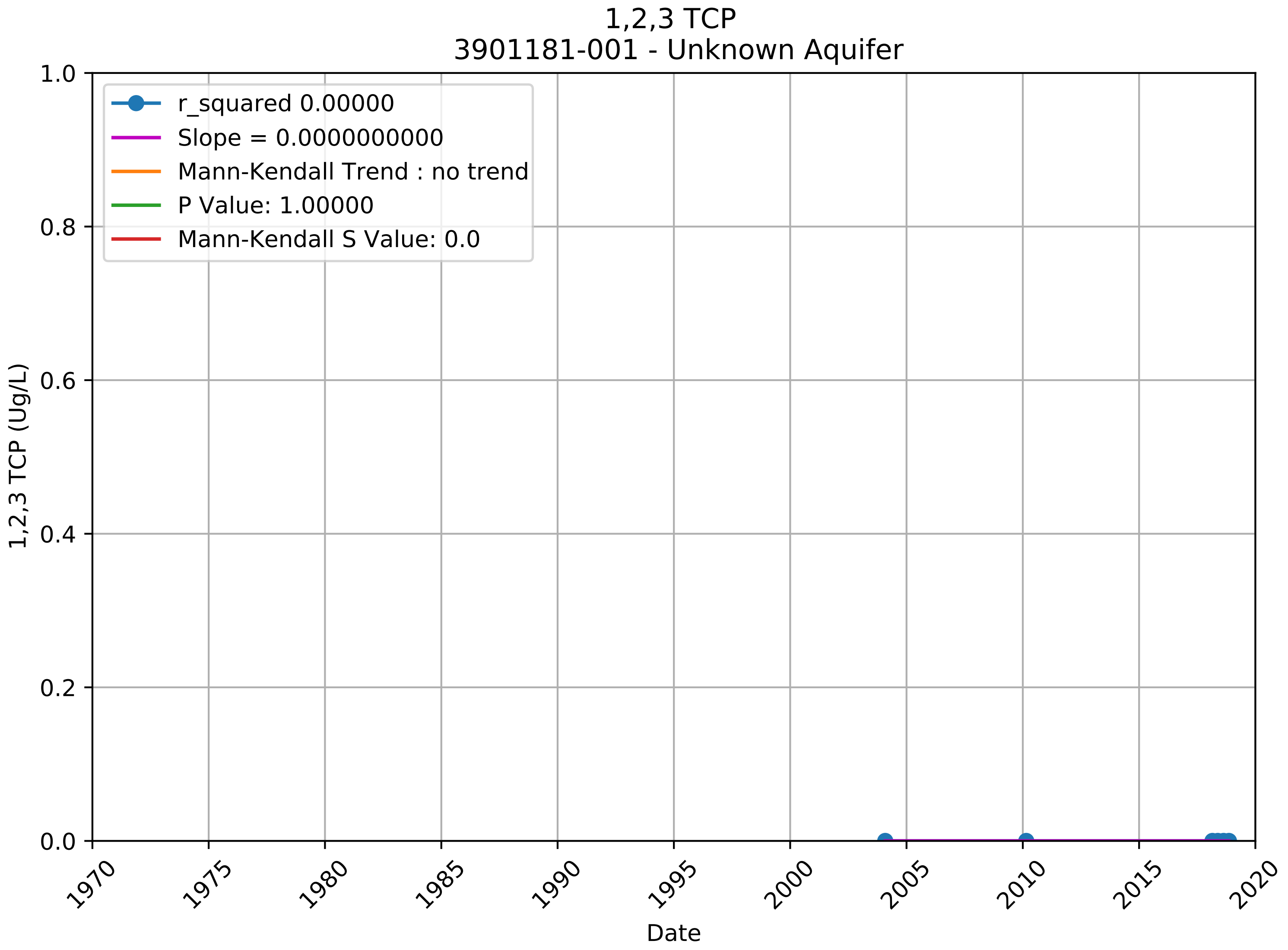


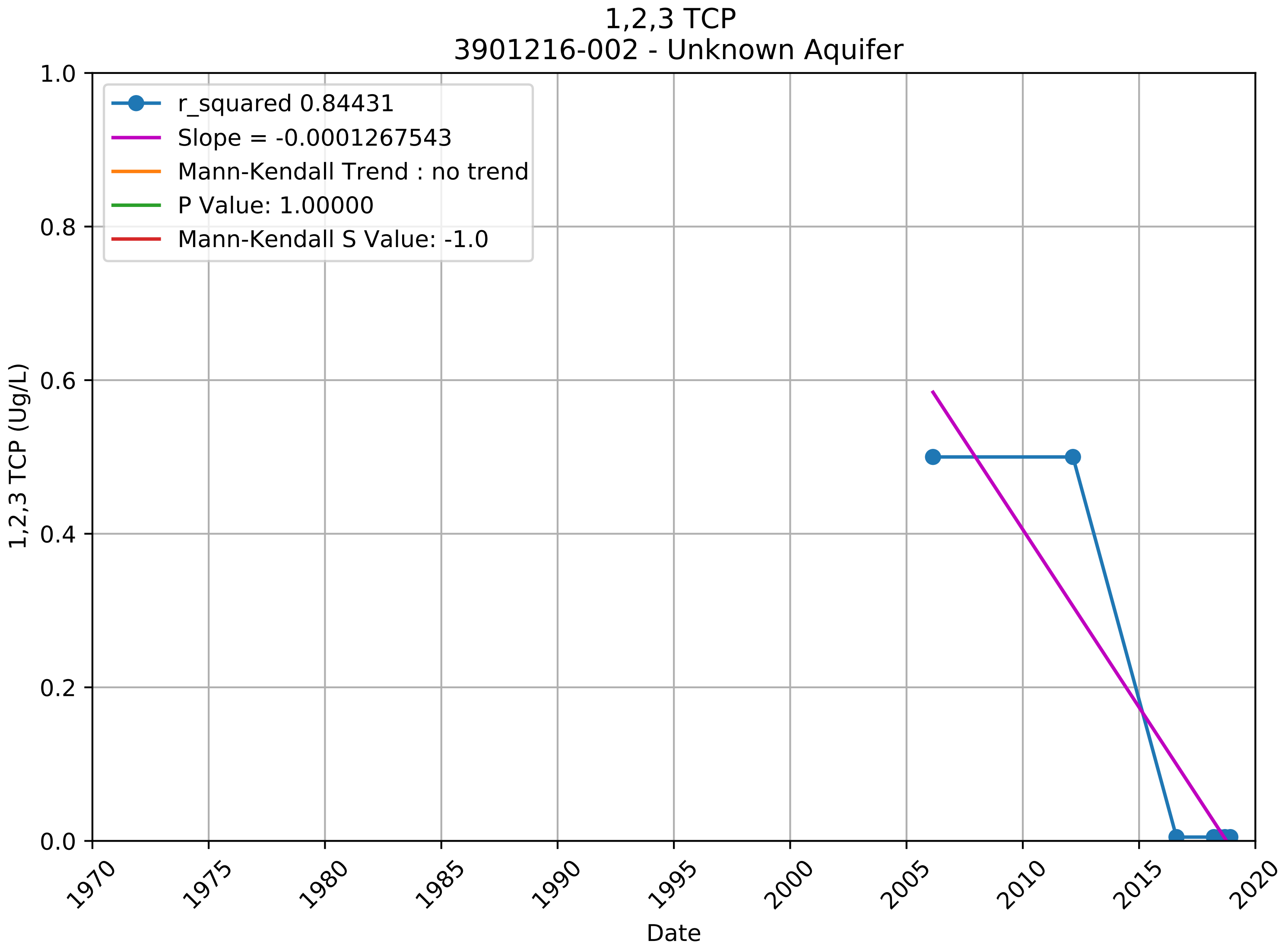
1,2,3 TCP
3901035-001 - Unknown Aquifer
r_squared 0.00001
Slope = 0.0000013957
Mann-Kendall Trend : no trend
P Value: 0.24958
Mann-Kendall S Value: -22.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

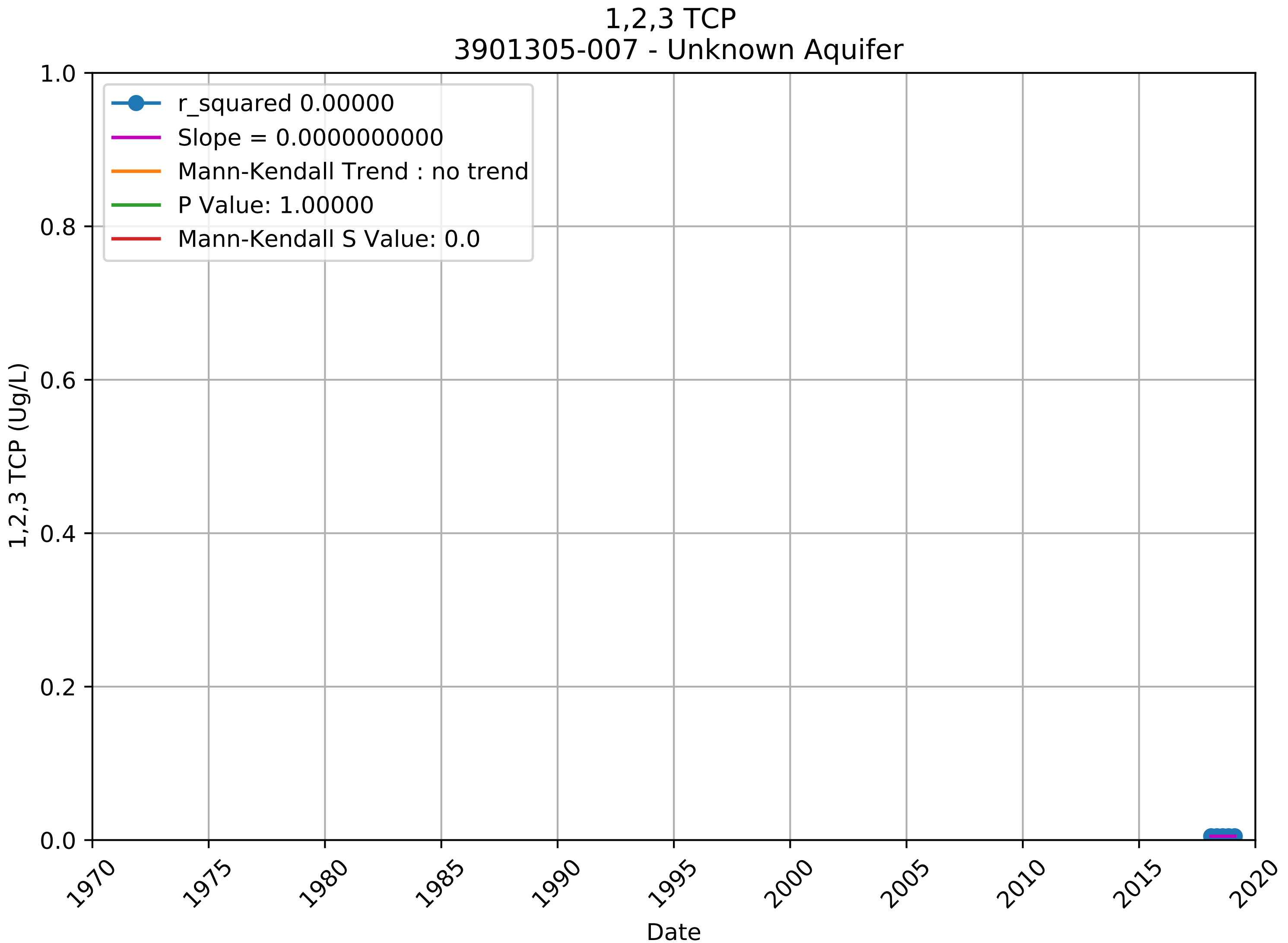

1,2,3 TCP
3901116-007 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3901172-002 - Unknown Aquifer
r_squared 0.89016
Slope = -0.0001094101
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

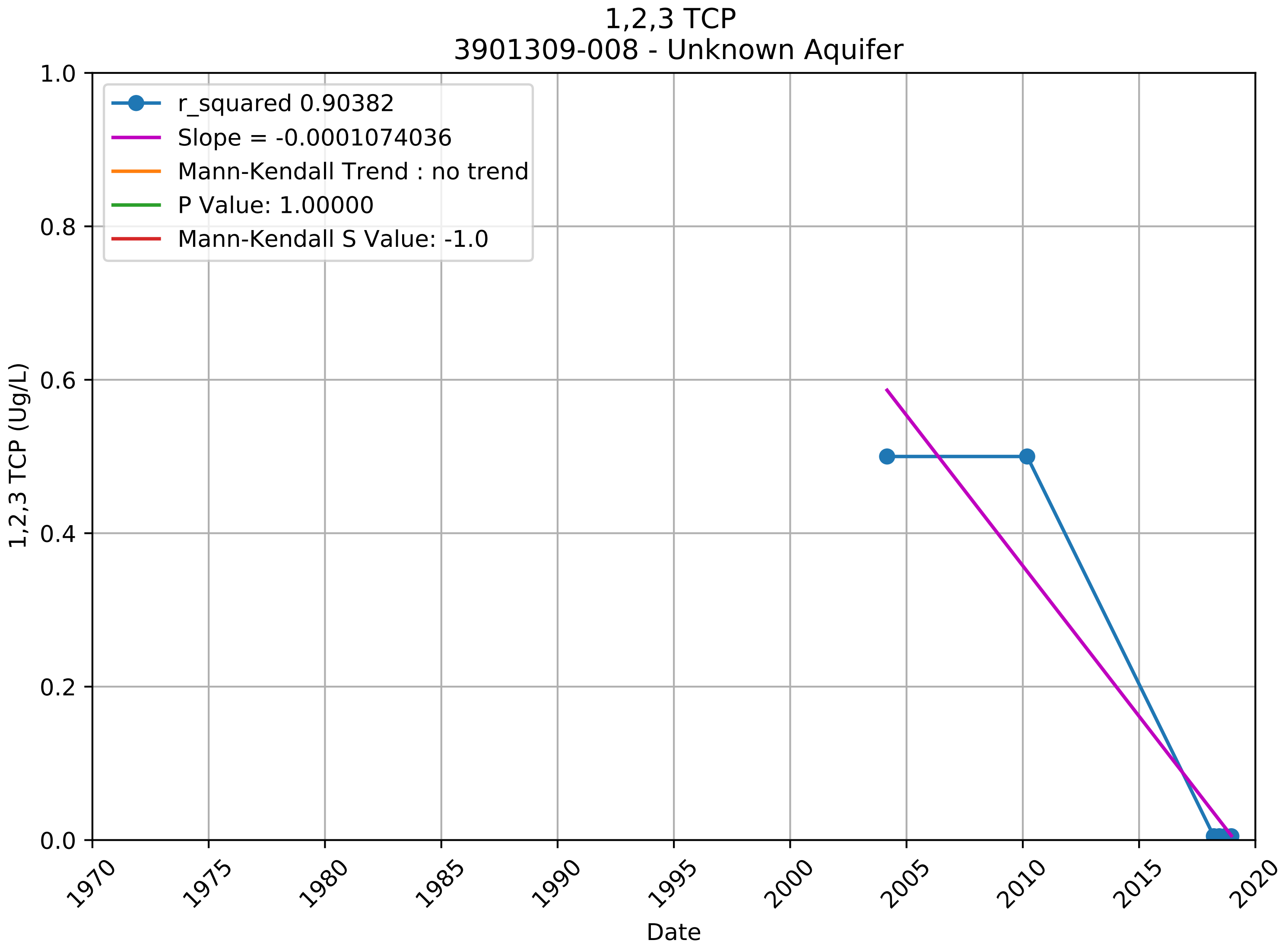

1,2,3 TCP
3901172-003 - Unknown Aquifer
r_squared 0.89016
Slope = -0.0001094101
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3901181-001 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

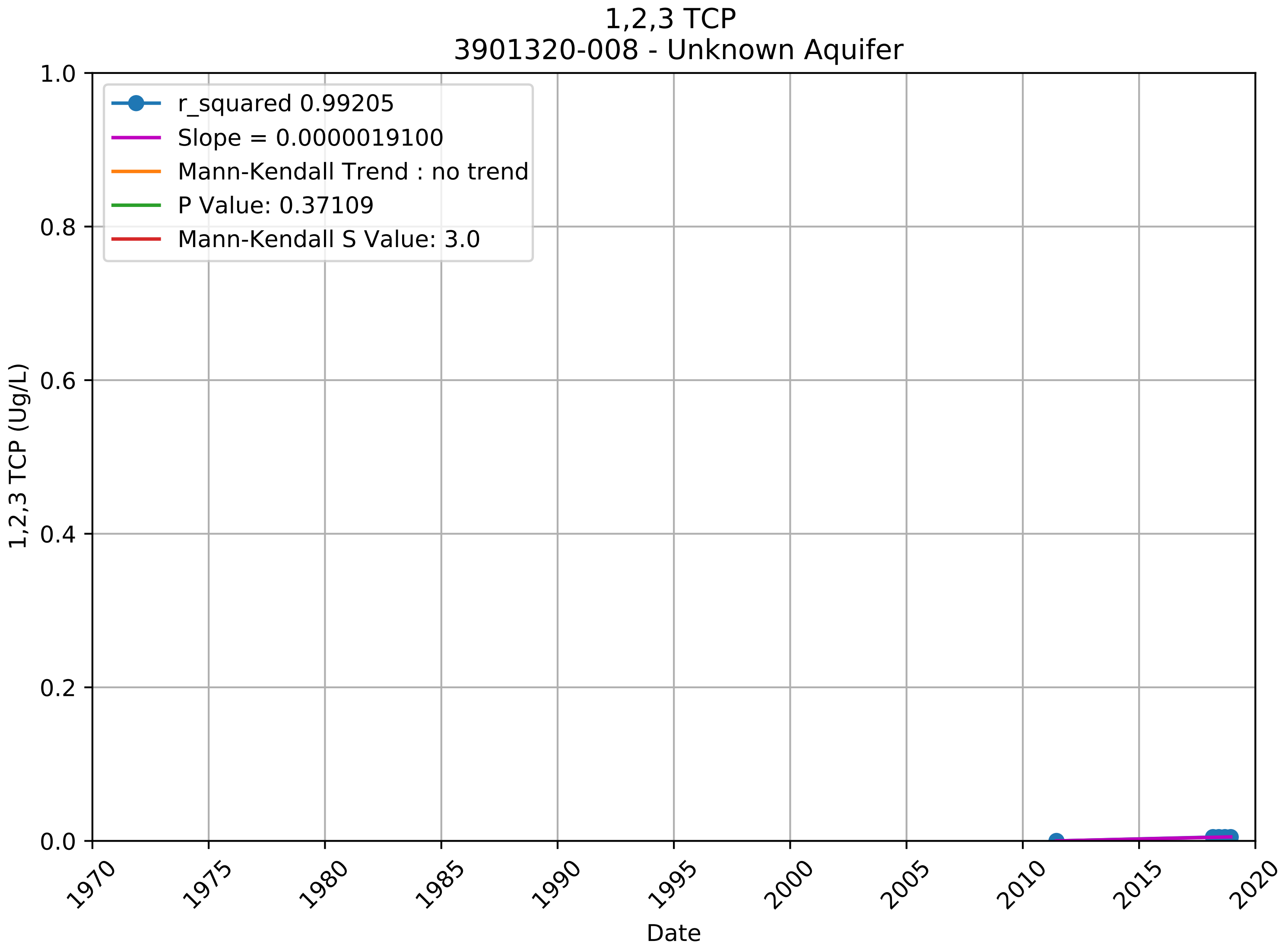

1,2,3 TCP
3901216-002 - Unknown Aquifer
r_squared 0.84431
Slope = -0.0001267543
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



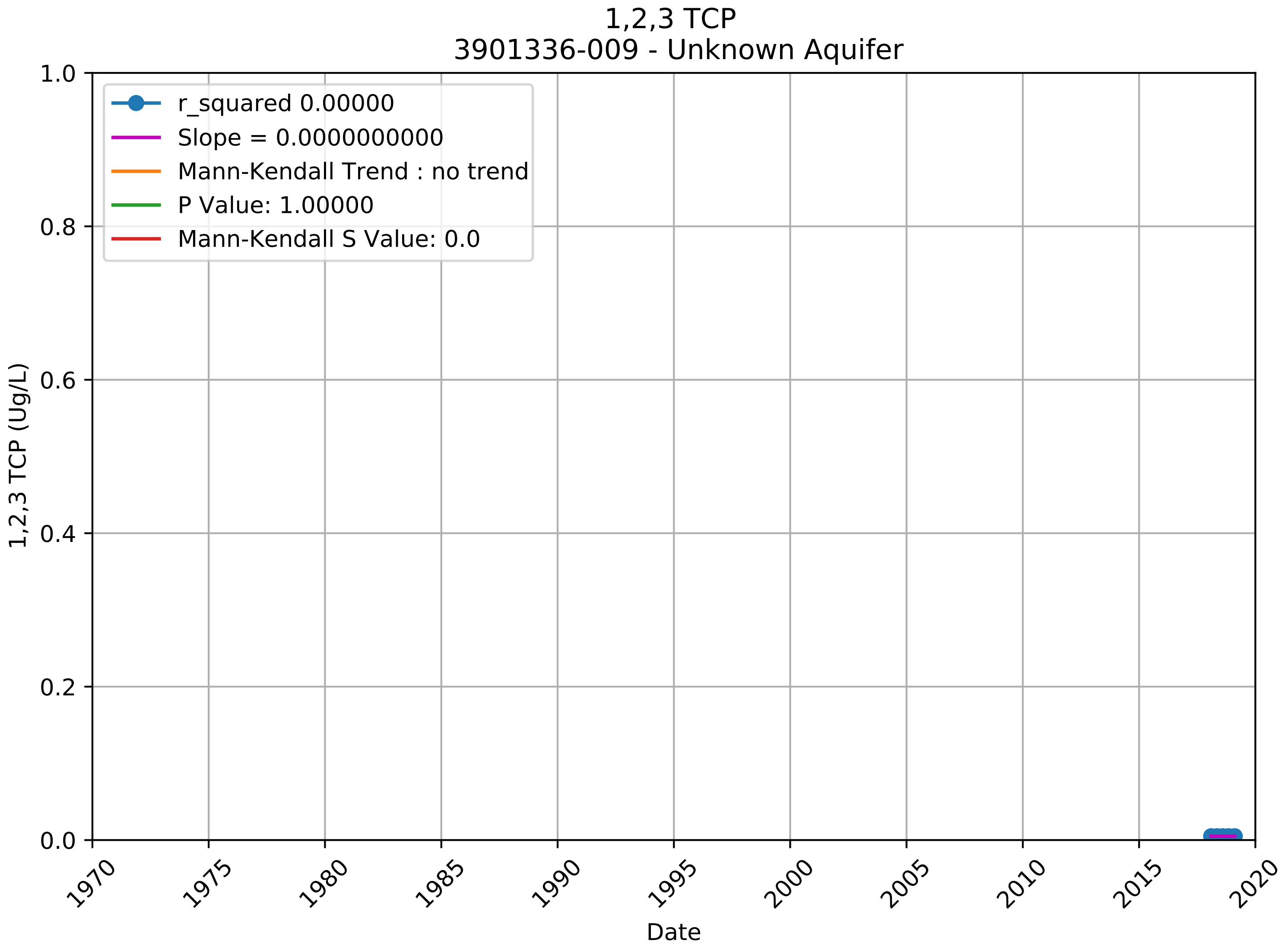
1,2,3 TCP
3901305-007 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
Date
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



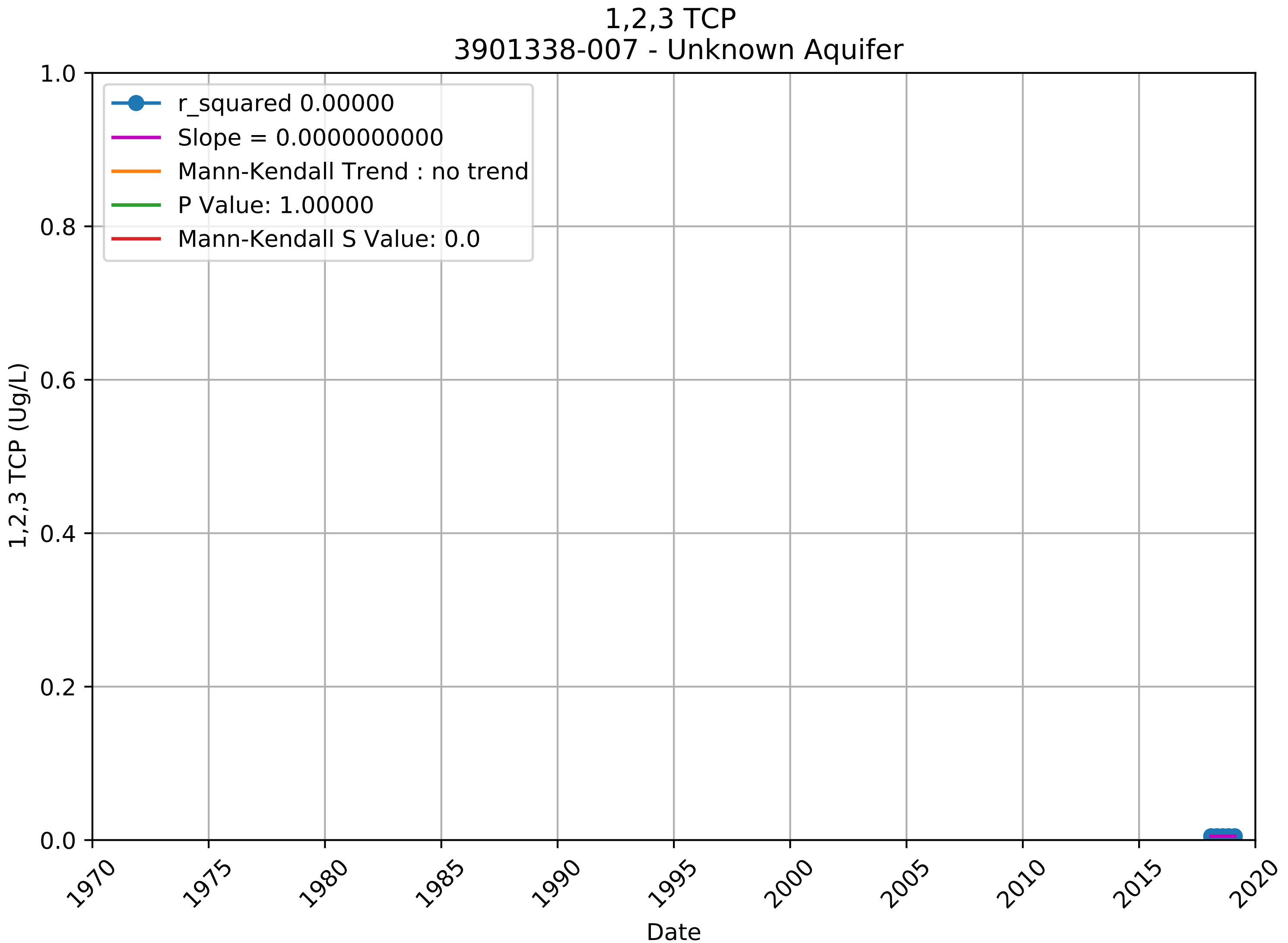
1,2,3 TCP
3901309-008 - Unknown Aquifer
r_squared 0.90382
Slope = -0.0001074036
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



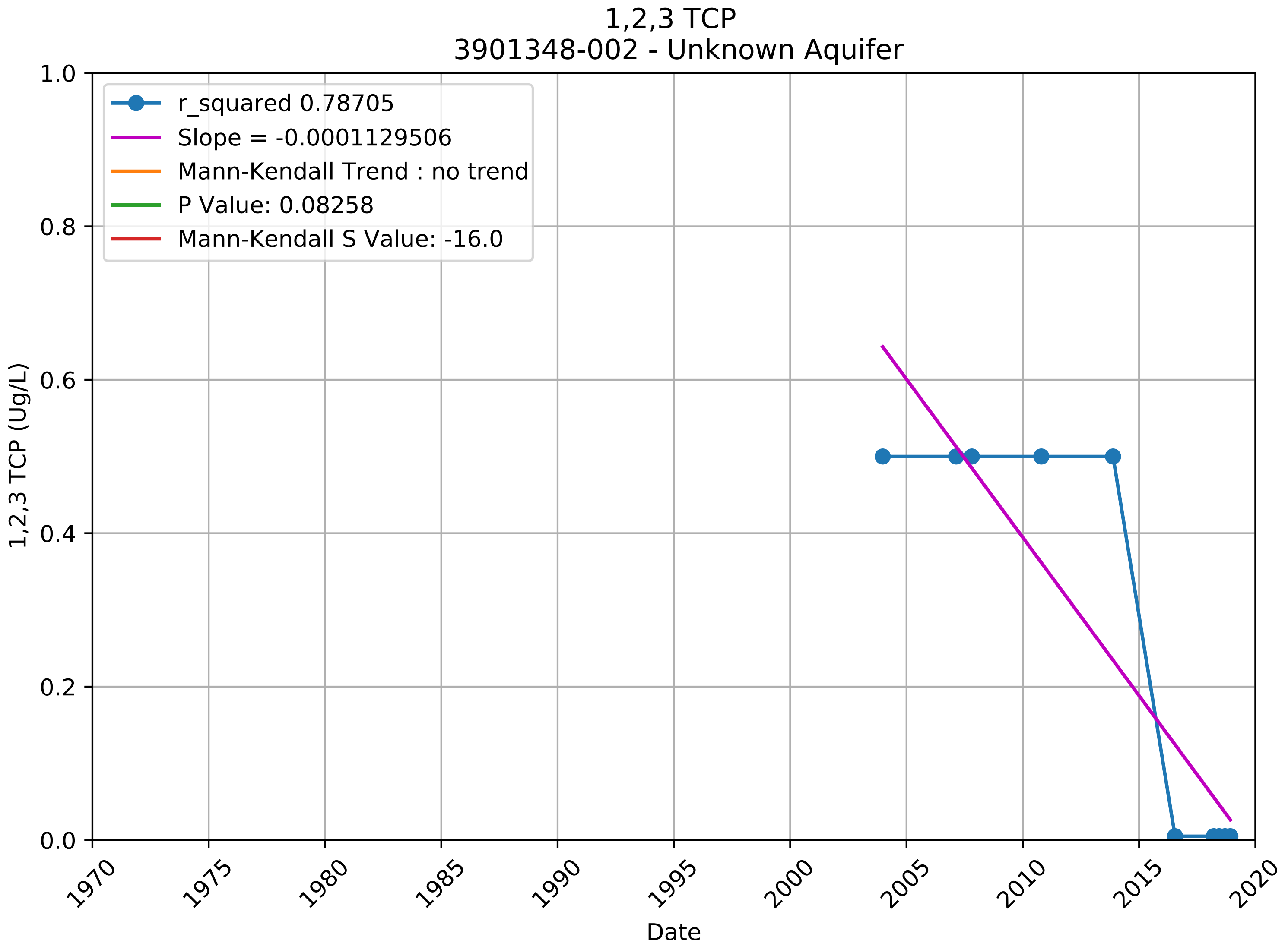
1,2,3 TCP
3901320-008 - Unknown Aquifer
r_squared 0.99205
Slope = 0.0000019100
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: 3.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



1,2,3 TCP
3901336-009 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



1,2,3 TCP
3901338-007 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3901348-002 - Unknown Aquifer
r_squared 0.78705
Slope = -0.0001129506
Mann-Kendall Trend : no trend
P Value: 0.08258
Mann-Kendall S Value: -16.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
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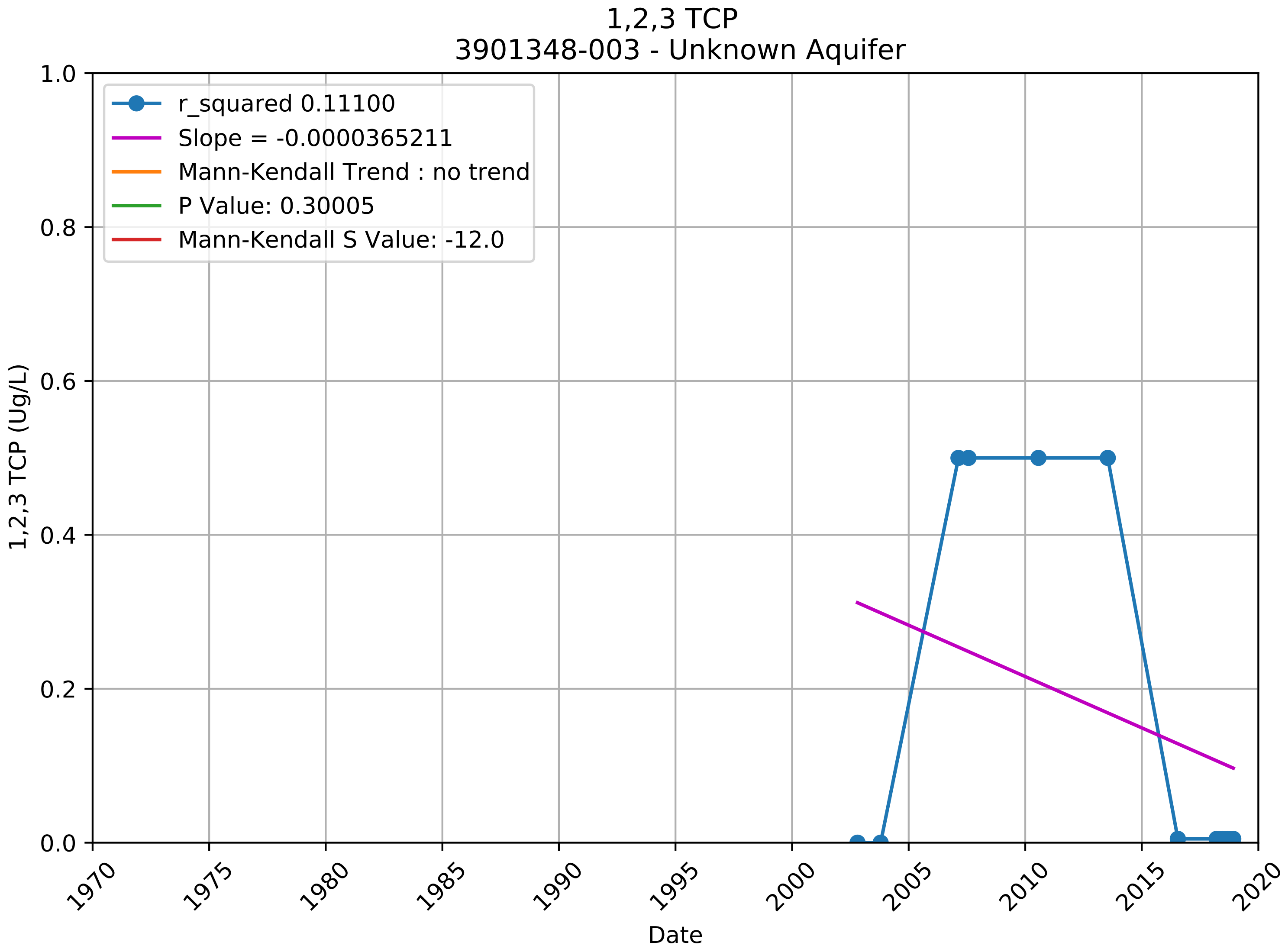
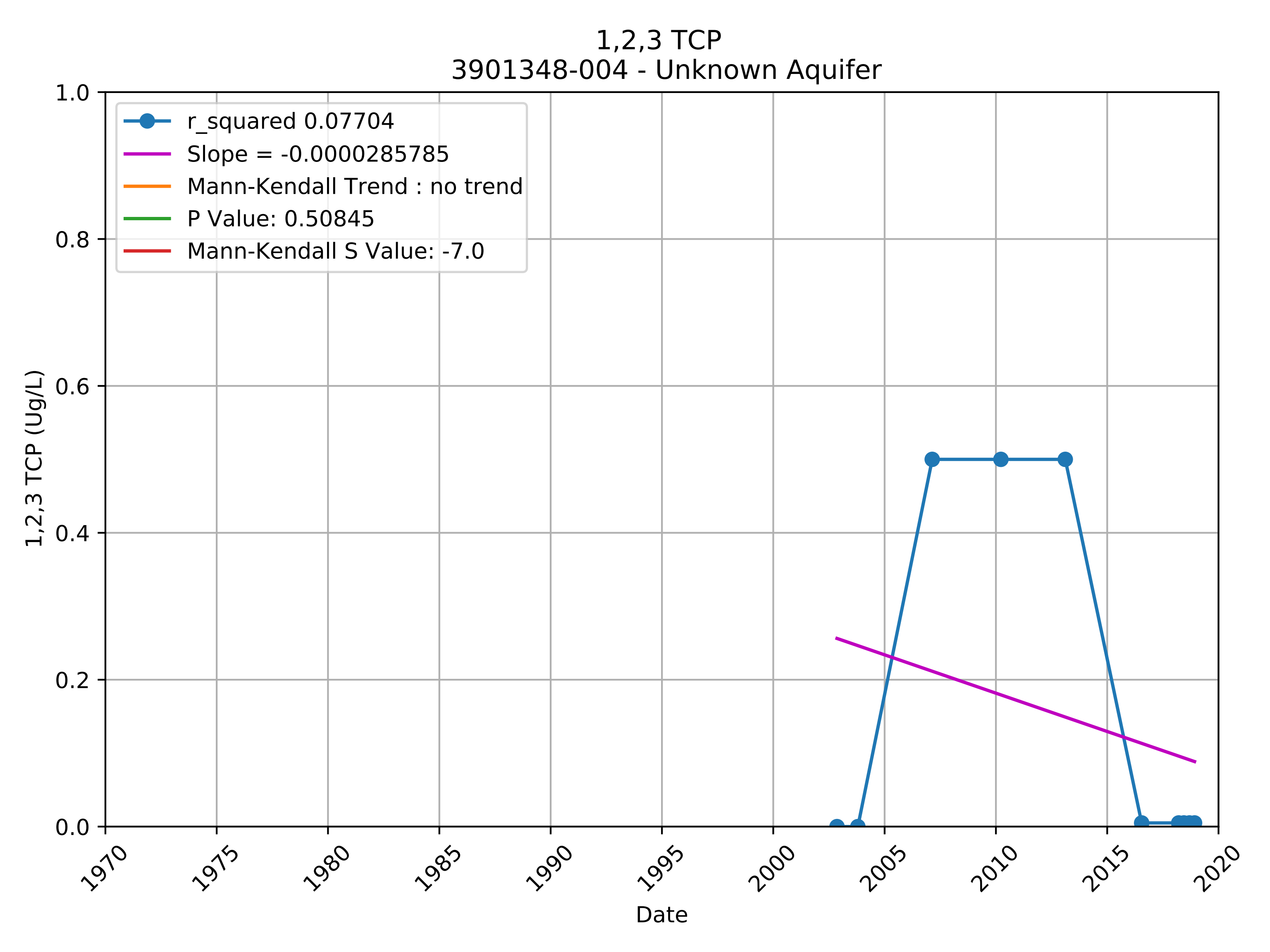
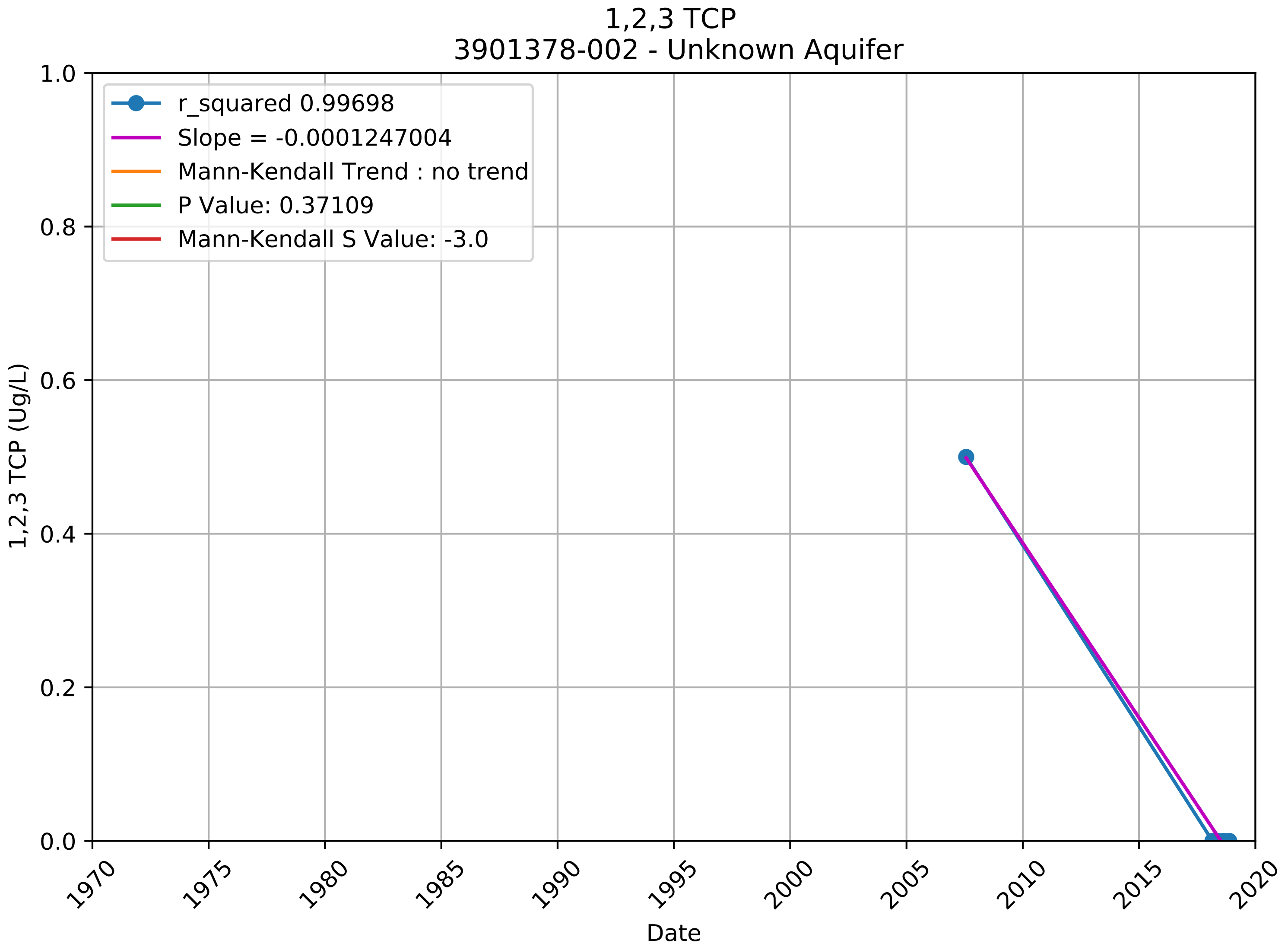
2005
2010
2015
2020



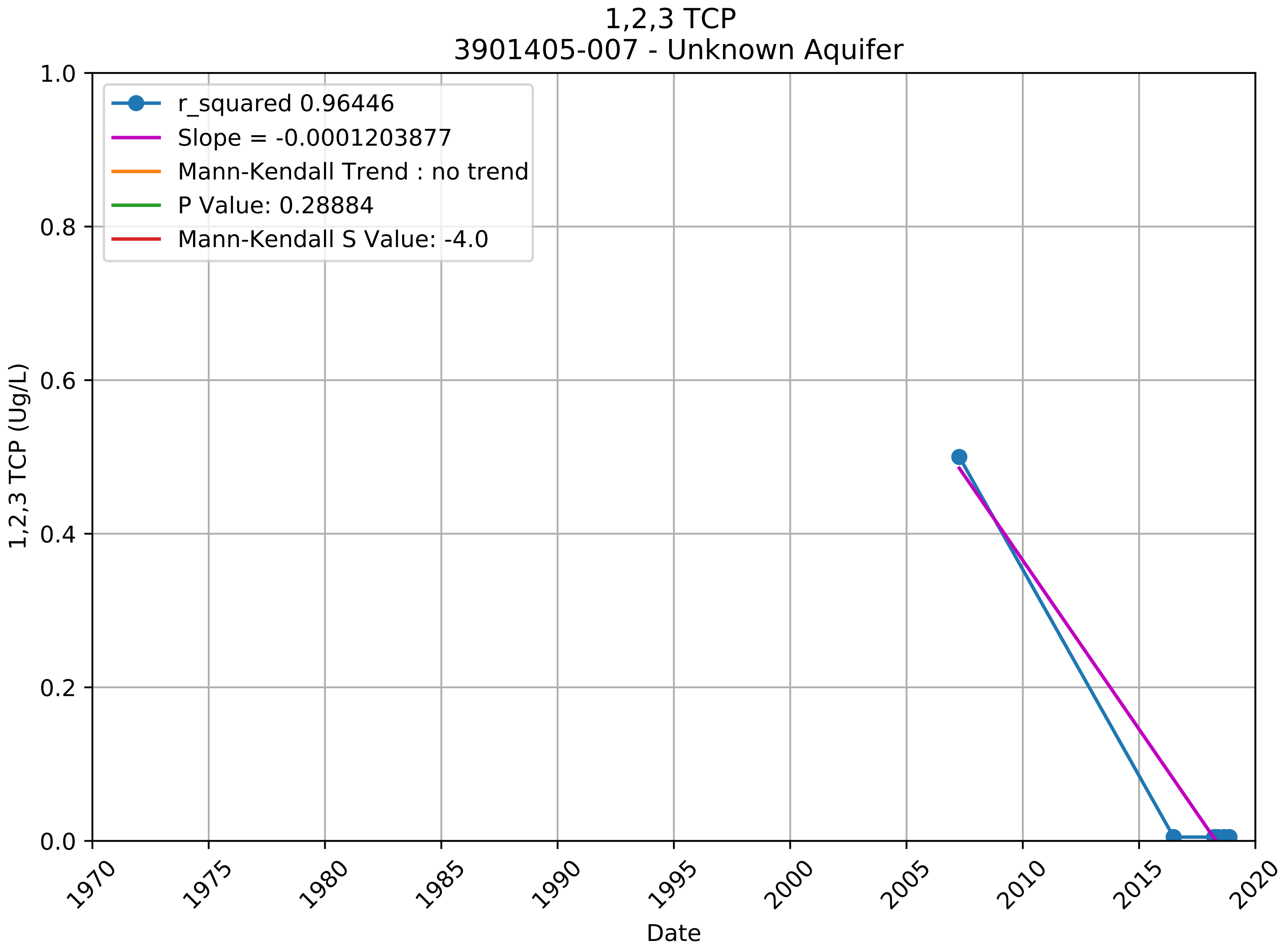
1,2,3 TCP
3901348-003 - Unknown Aquifer
r_squared 0.11100
Slope = -0.0000365211
Mann-Kendall Trend : no trend
P Value: 0.30005
Mann-Kendall S Value: -12.0
1,2,3 TCP (Ug/L)
Date
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

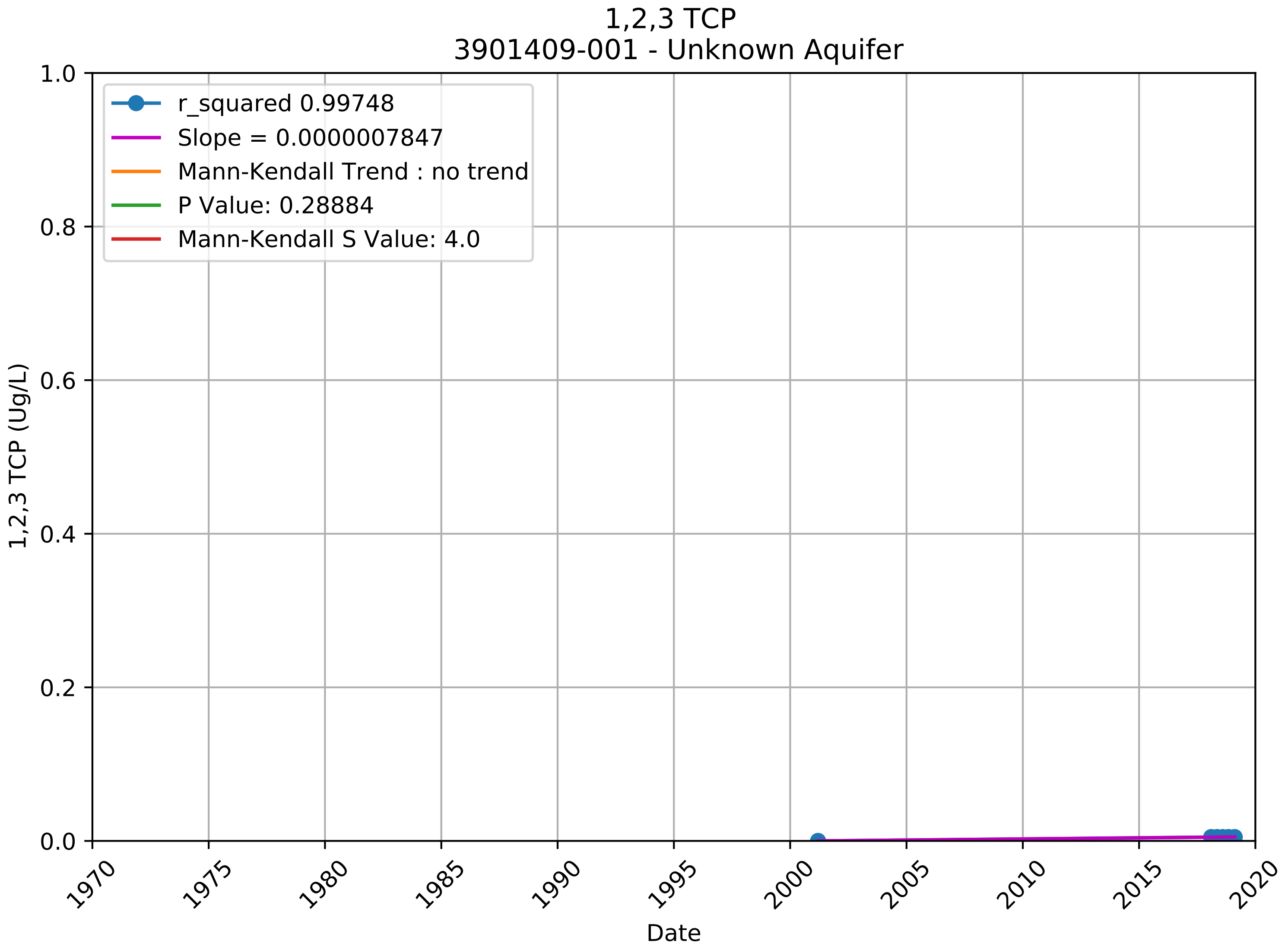


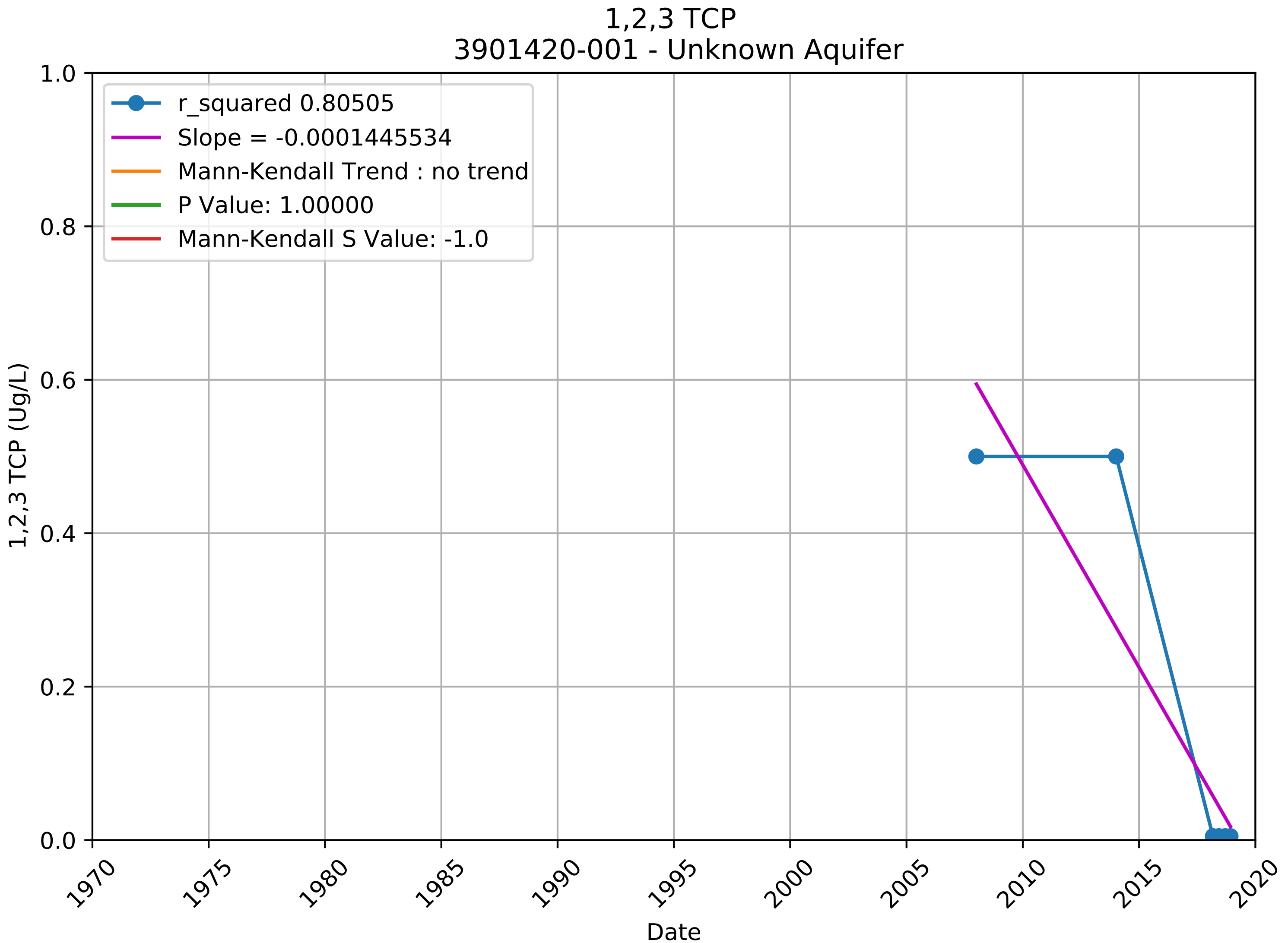
1,2,3 TCP
3901348-004 - Unknown Aquifer
r_squared 0.07704
Slope = -0.0000285785
Mann-Kendall Trend : no trend
P Value: 0.50845
Mann-Kendall S Value: -7.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

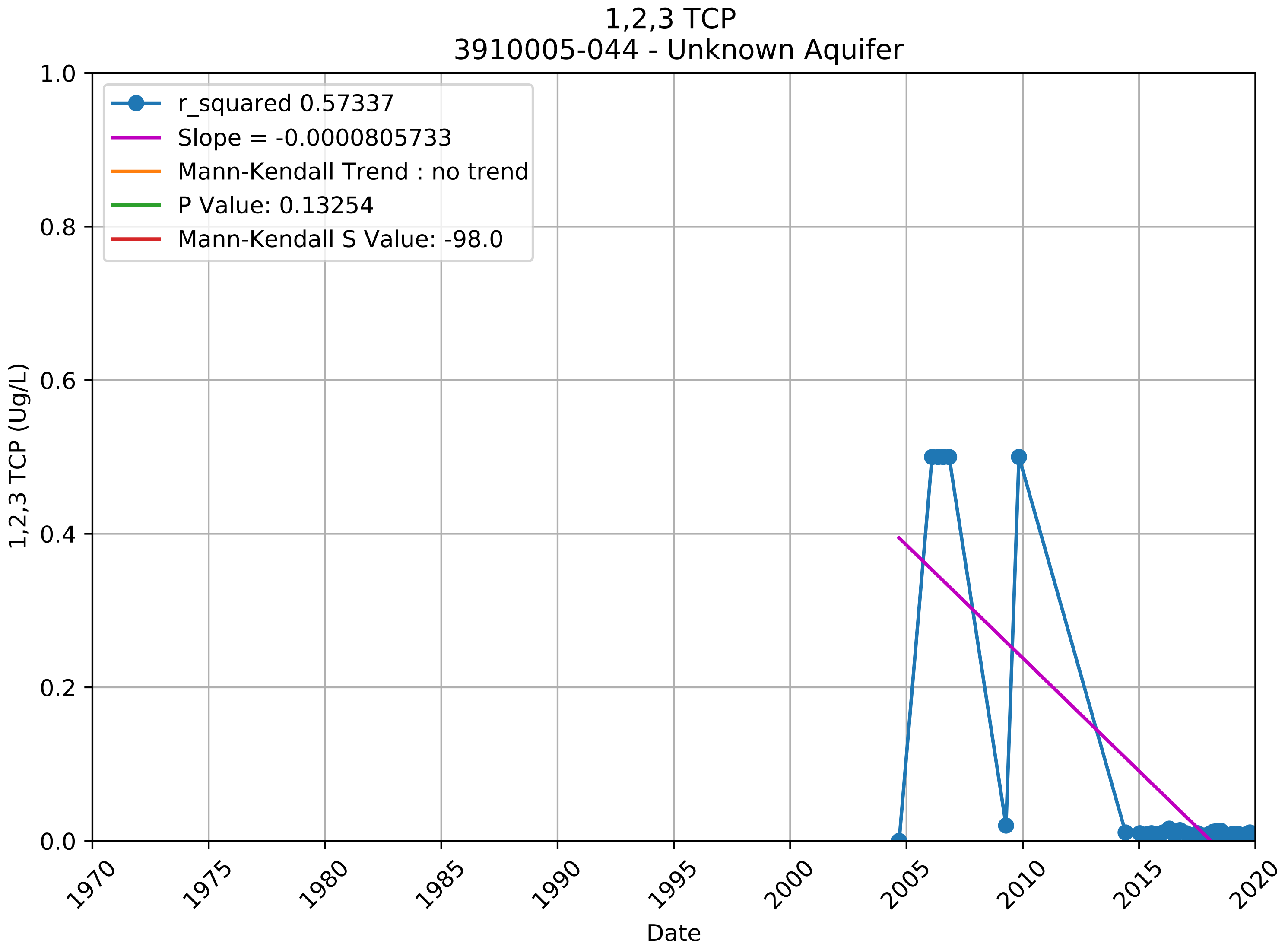


1,2,3 TCP
3901378-002 - Unknown Aquifer
r_squared 0.99698
Slope = -0.0001247004
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: -3.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

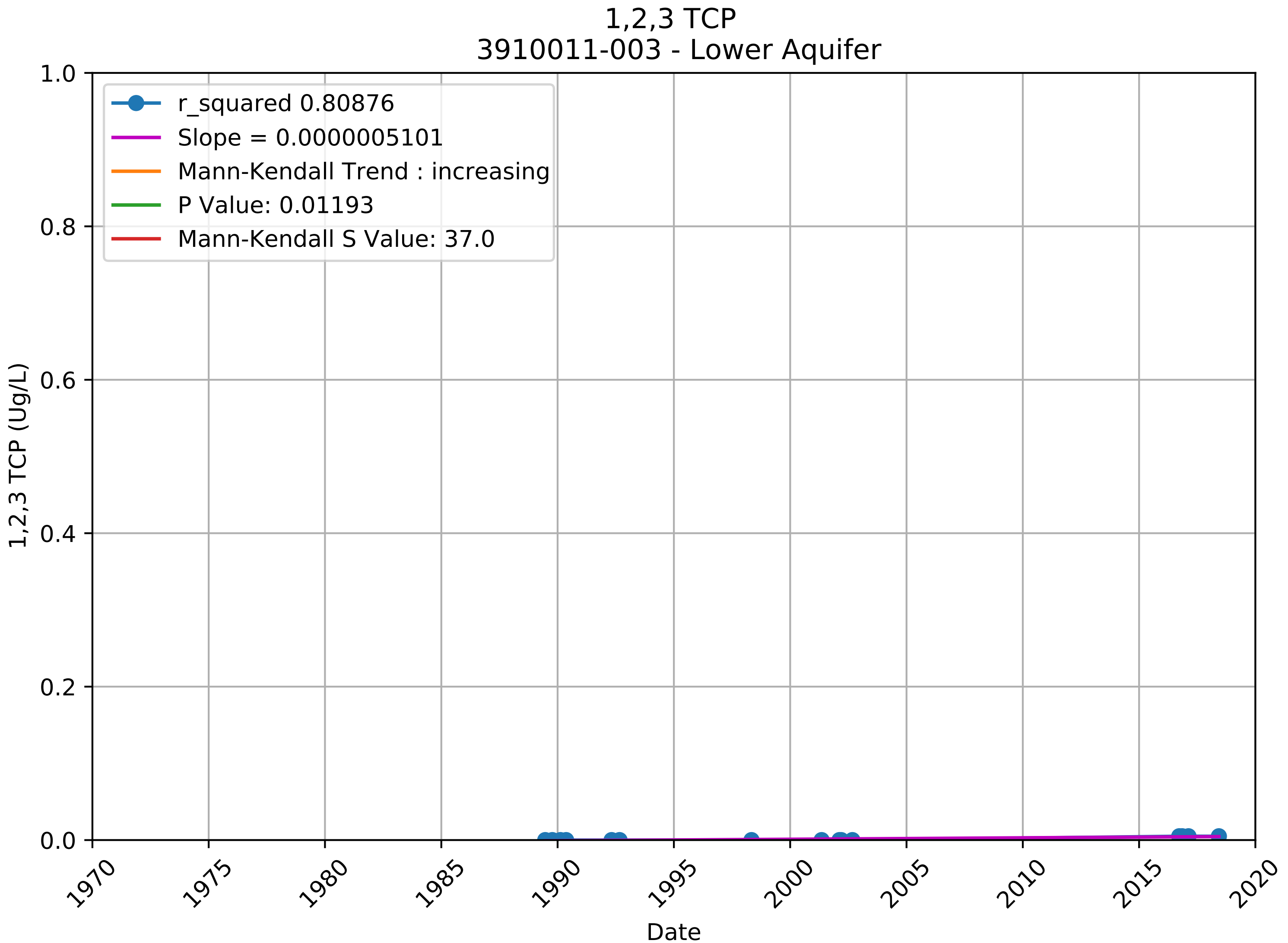

1,2,3 TCP
3901405-007 - Unknown Aquifer
r_squared 0.96446
Slope = -0.0001203877
Mann-Kendall Trend : no trend
P Value: 0.28884
Mann-Kendall S Value: -4.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3901409-001 - Unknown Aquifer
r_squared 0.99748
Slope = 0.0000007847
Mann-Kendall Trend : no trend
P Value: 0.28884
Mann-Kendall S Value: 4.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

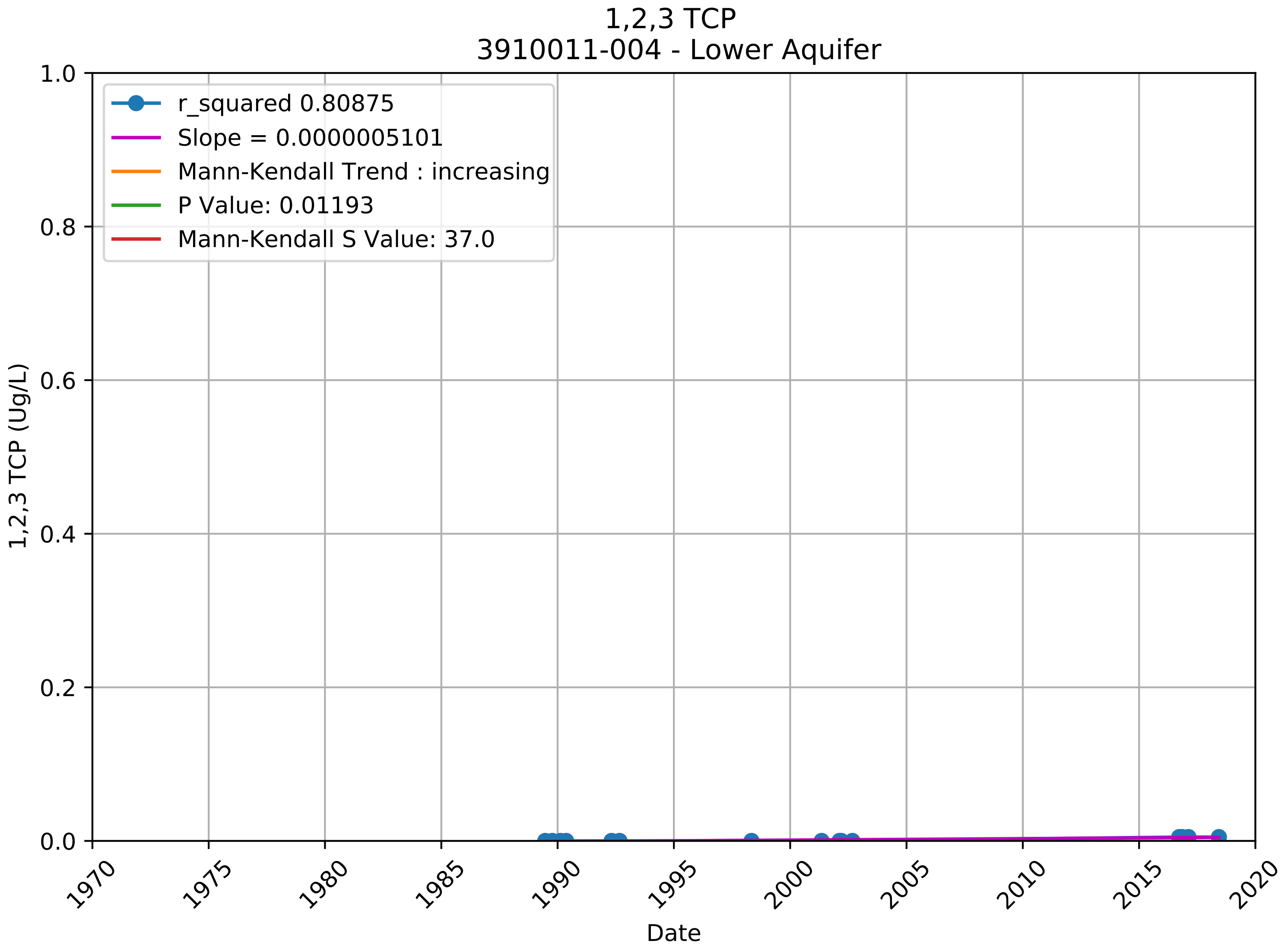

1,2,3 TCP
3901420-001 - Unknown Aquifer
r_squared 0.80505
Slope = -0.0001445534
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



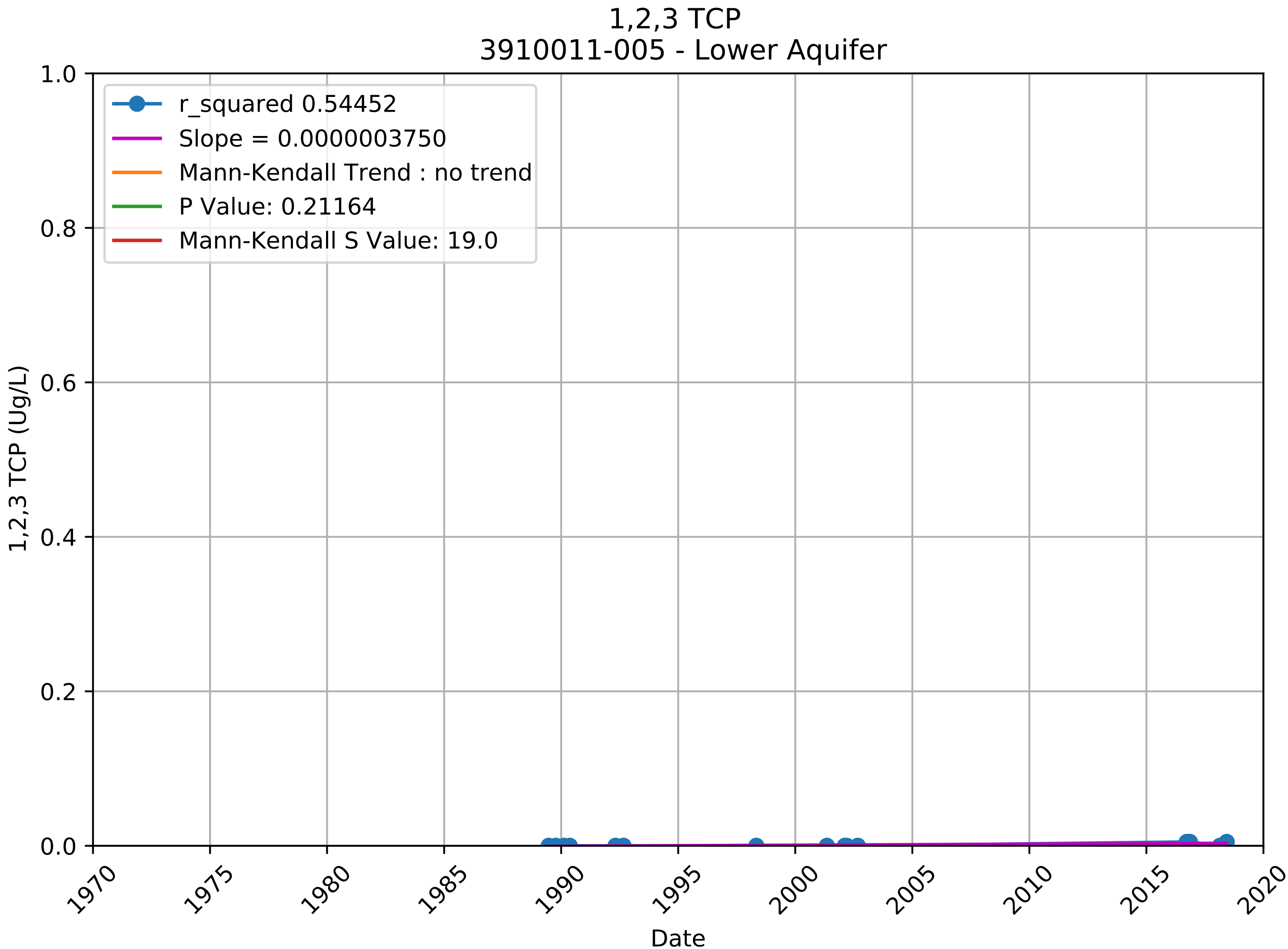
1,2,3 TCP
3910005-044 - Unknown Aquifer
r_squared 0.57337
Slope = -0.0000805733
Mann-Kendall Trend : no trend
P Value: 0.13254
Mann-Kendall S Value: -98.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



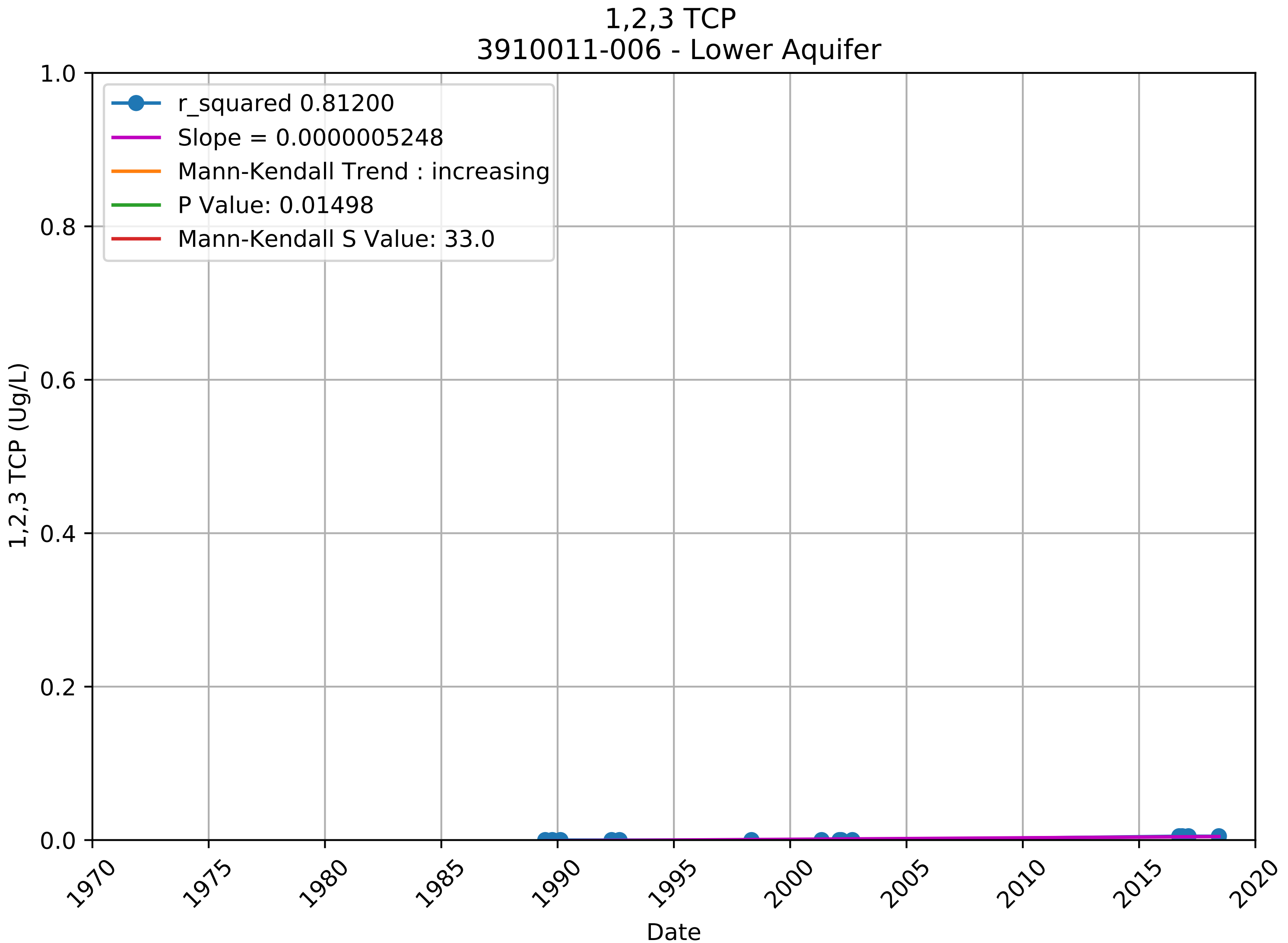
1,2,3 TCP
3910011-003 - Lower Aquifer
r_squared 0.80876
Slope = 0.0000005101
Mann-Kendall Trend : increasing
P Value: 0.01193
Mann-Kendall S Value: 37.0
1,2,3 TCP (Ug/L)
Date
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



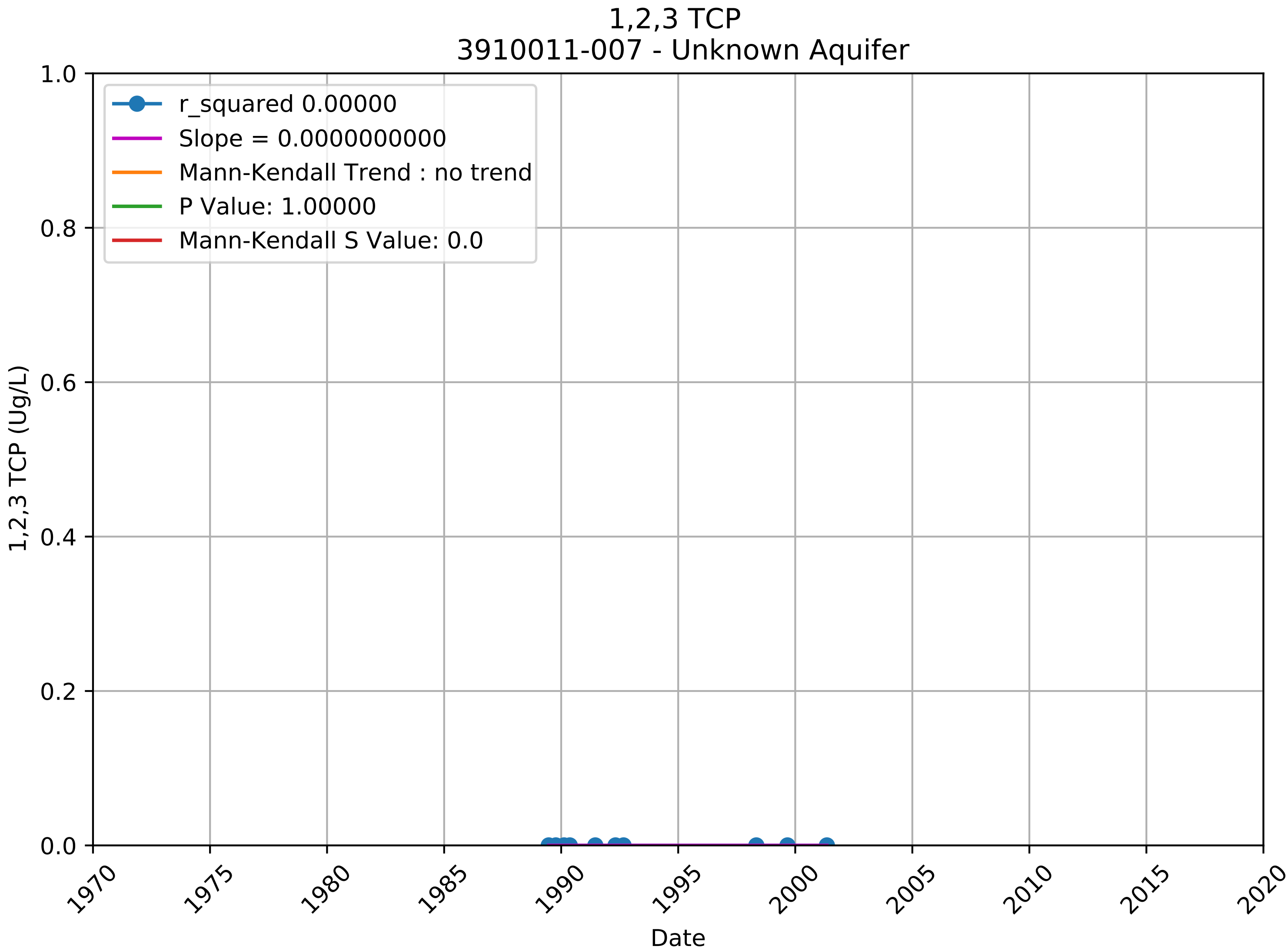
1,2,3 TCP
3910011-004 - Lower Aquifer
r_squared 0.80875
Slope = 0.0000005101
Mann-Kendall Trend : increasing
P Value: 0.01193
Mann-Kendall S Value: 37.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



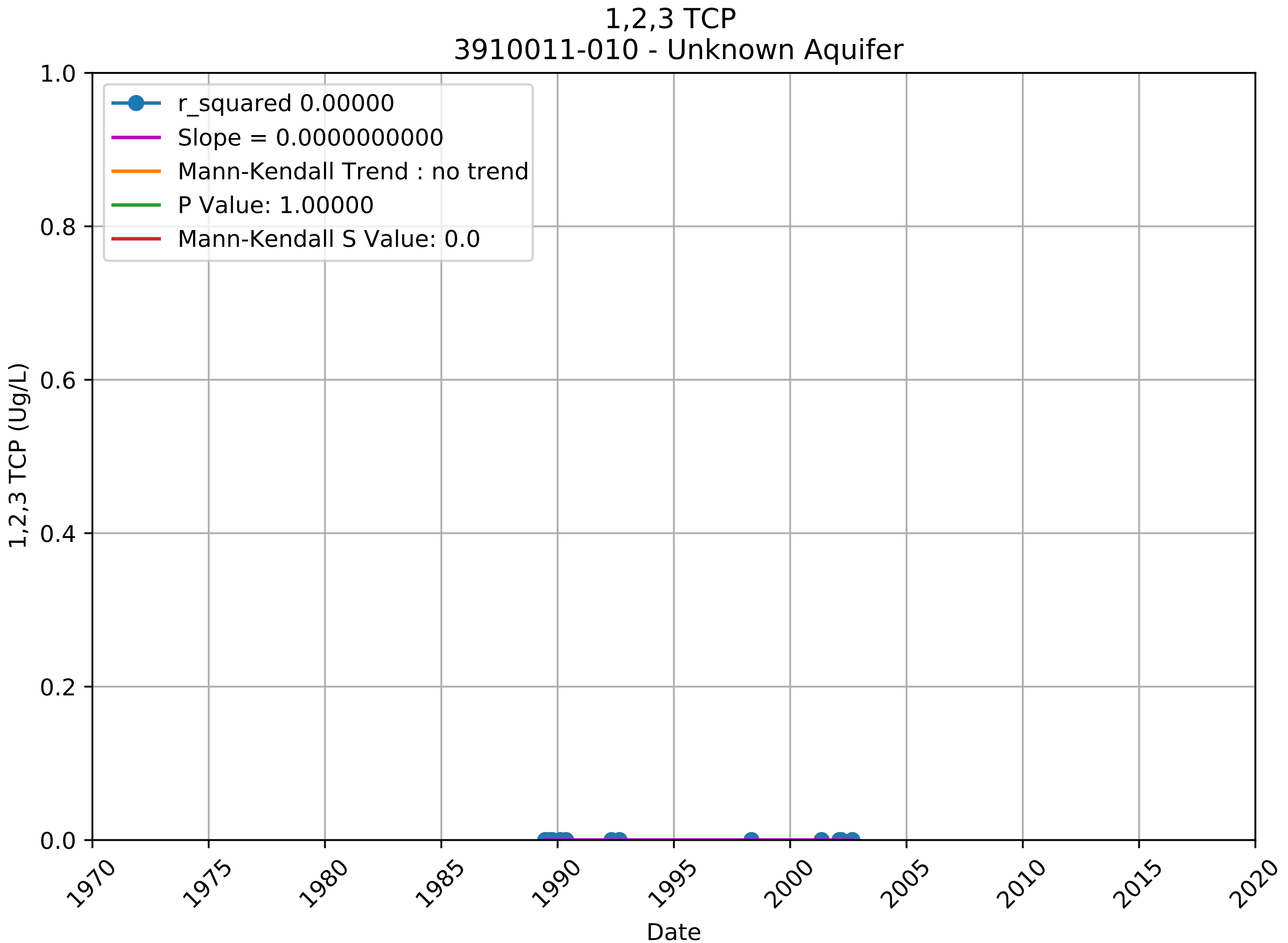
1,2,3 TCP
3910011-005 - Lower Aquifer
r_squared 0.54452
Slope = 0.0000003750
Mann-Kendall Trend : no trend
P Value: 0.21164
Mann-Kendall S Value: 19.0
1,2,3 TCP (Ug/L)
Date
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



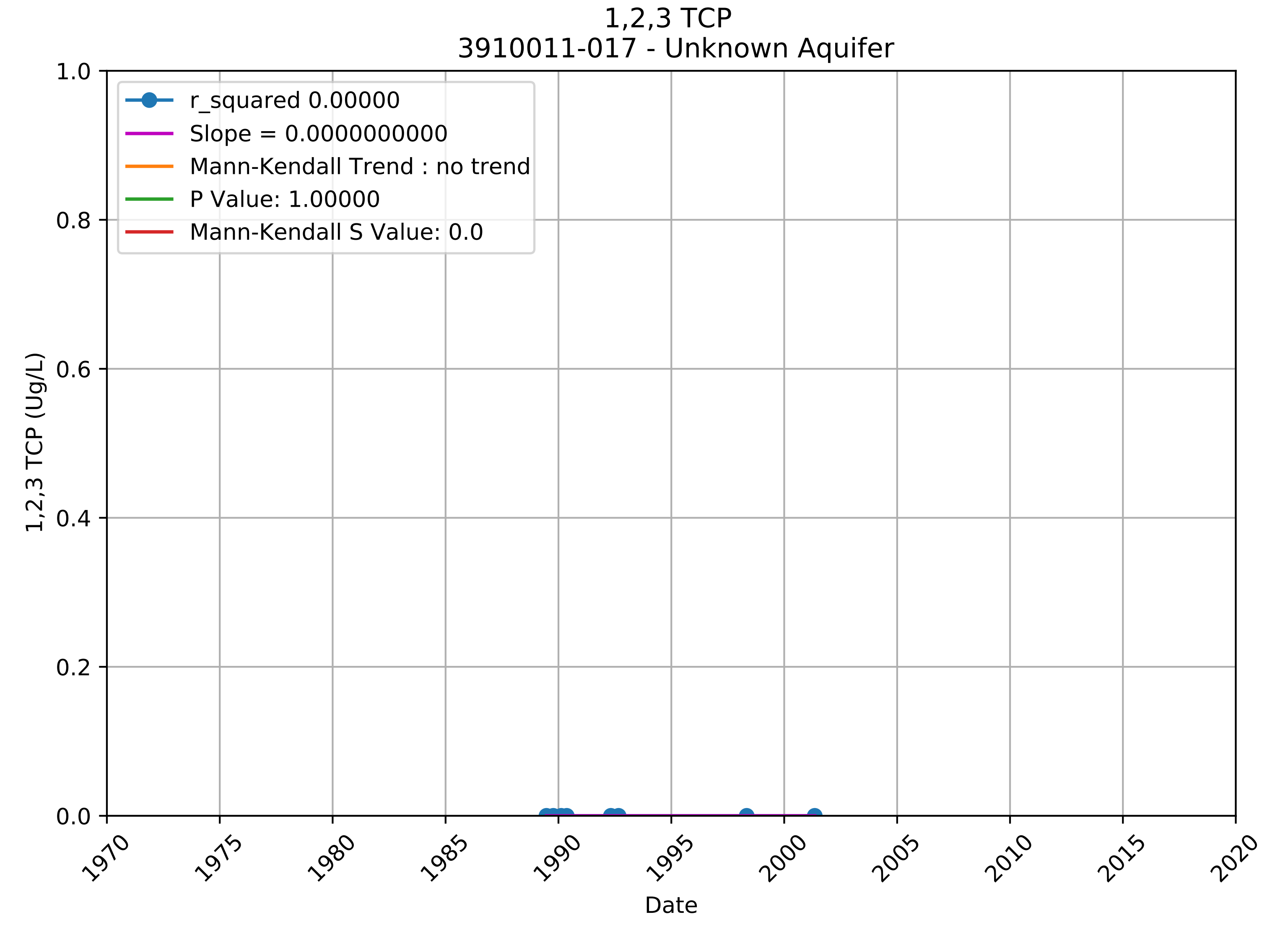
1,2,3 TCP
3910011-006 - Lower Aquifer
r_squared 0.81200
Slope = 0.0000005248
Mann-Kendall Trend : increasing
P Value: 0.01498
Mann-Kendall S Value: 33.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

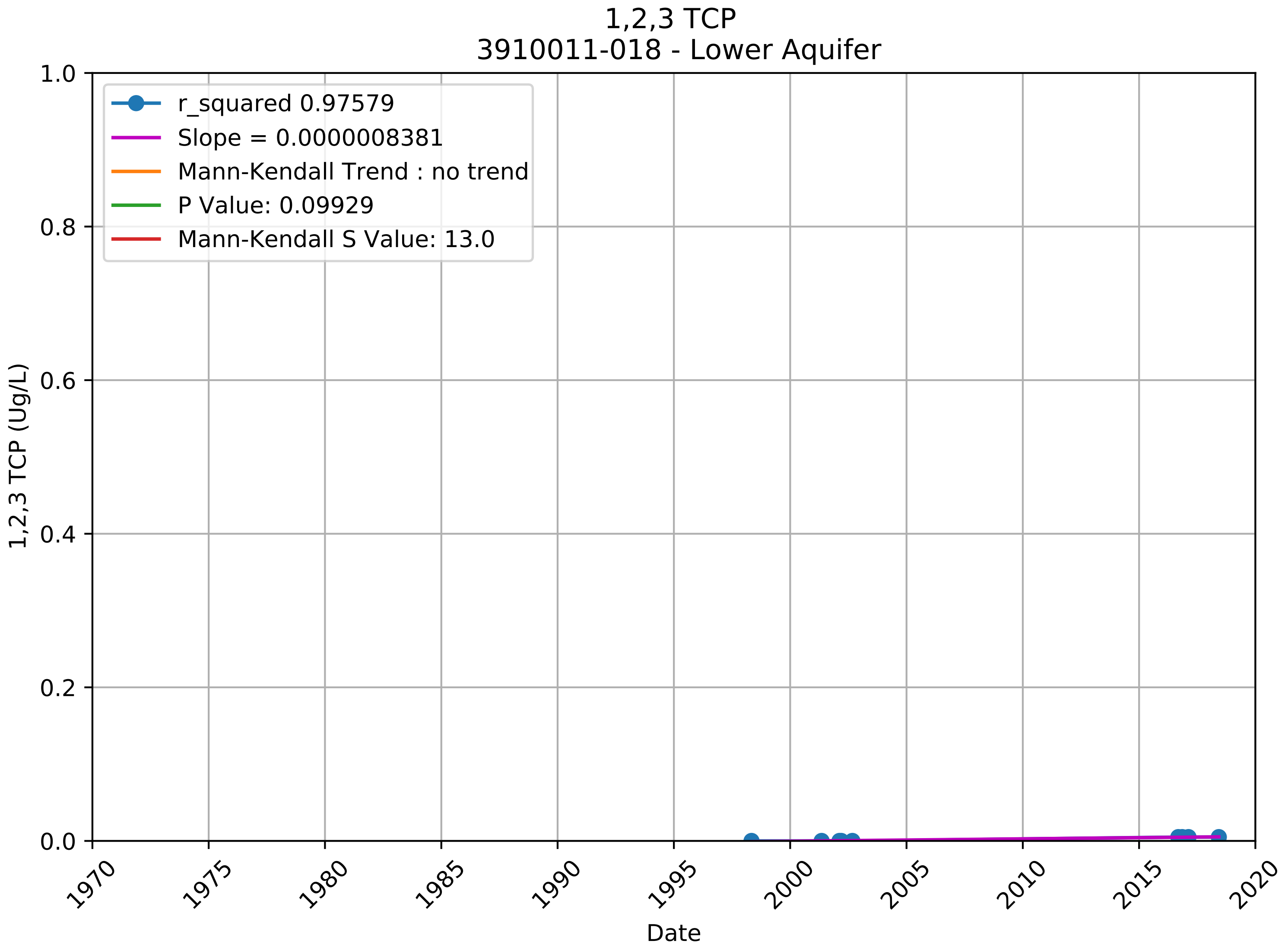


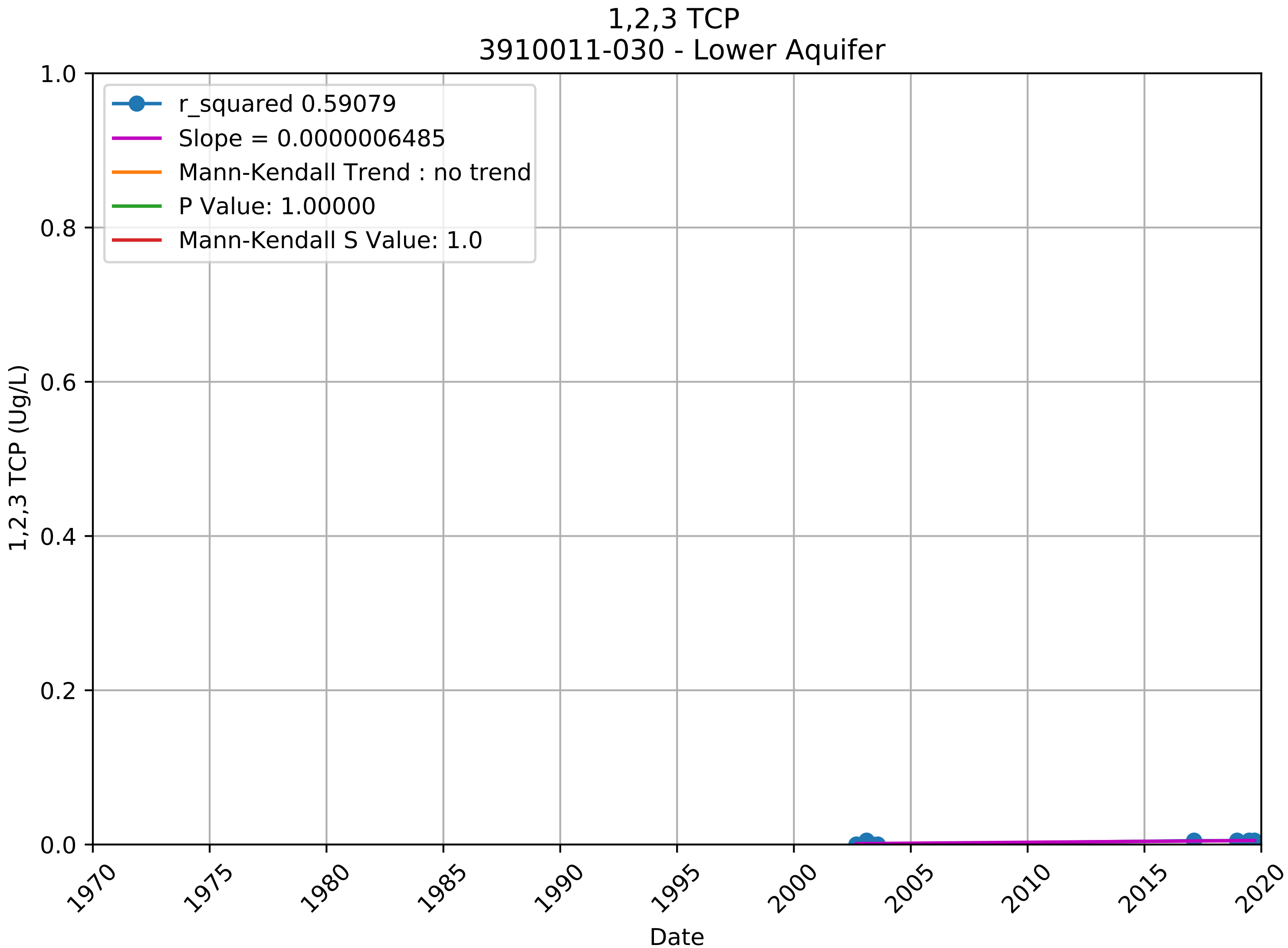
1,2,3 TCP
3910011-007 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



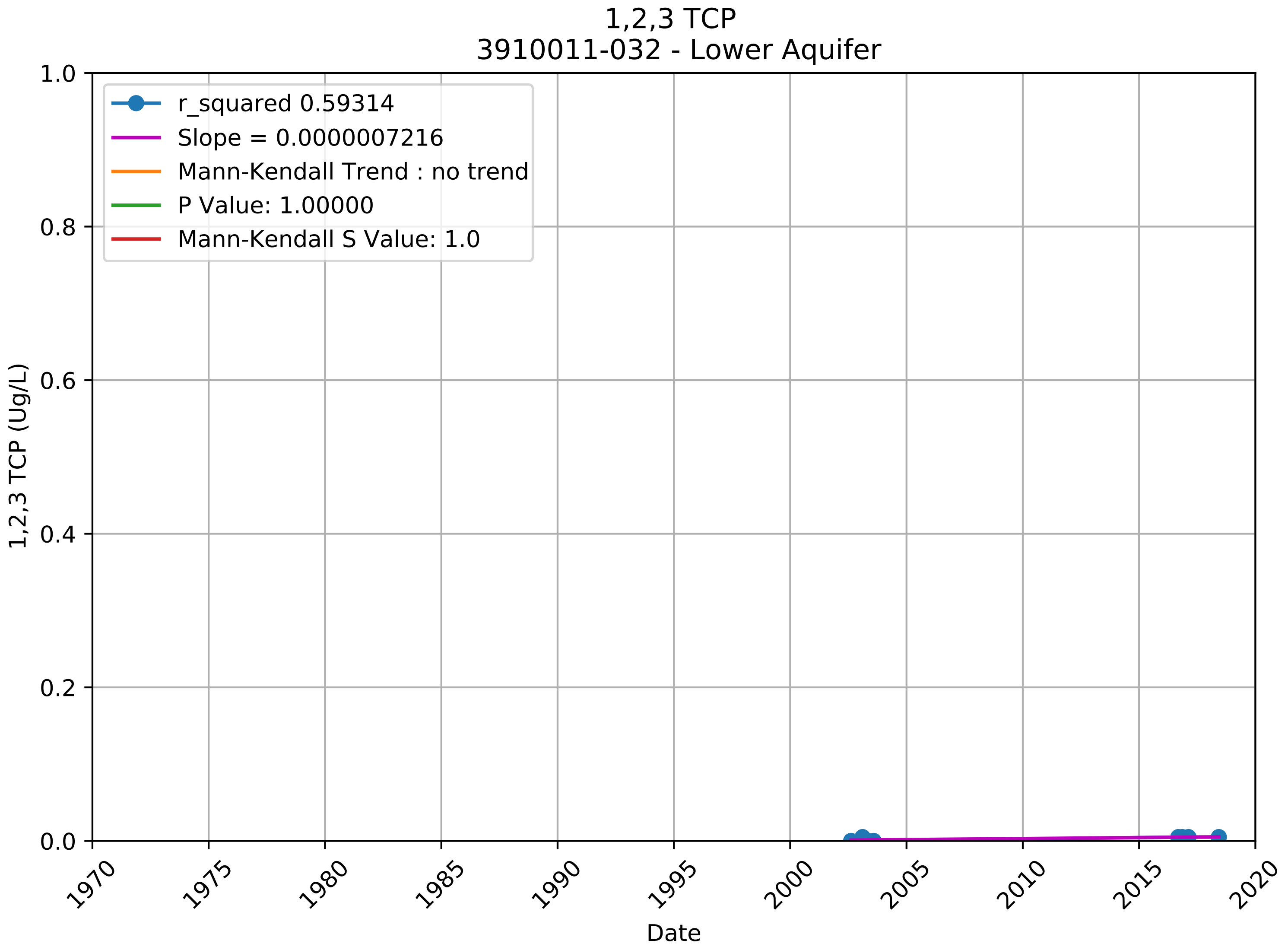
1,2,3 TCP
3910011-010 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020


1,2,3 TCP
3910011-017 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

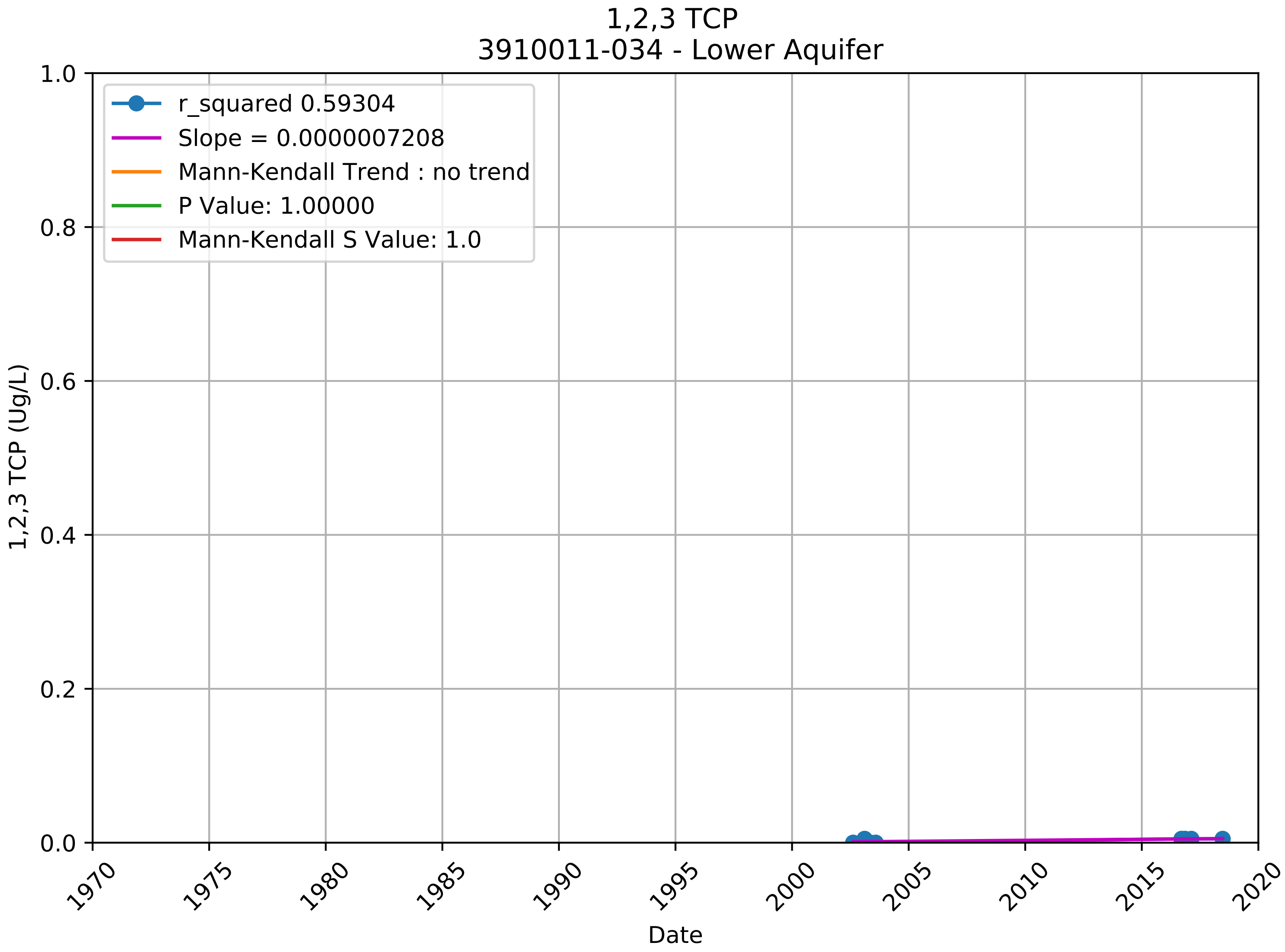

1,2,3 TCP
3910011-018 - Lower Aquifer
r_squared 0.97579
Slope = 0.0000008381
Mann-Kendall Trend : no trend
P Value: 0.09929
Mann-Kendall S Value: 13.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

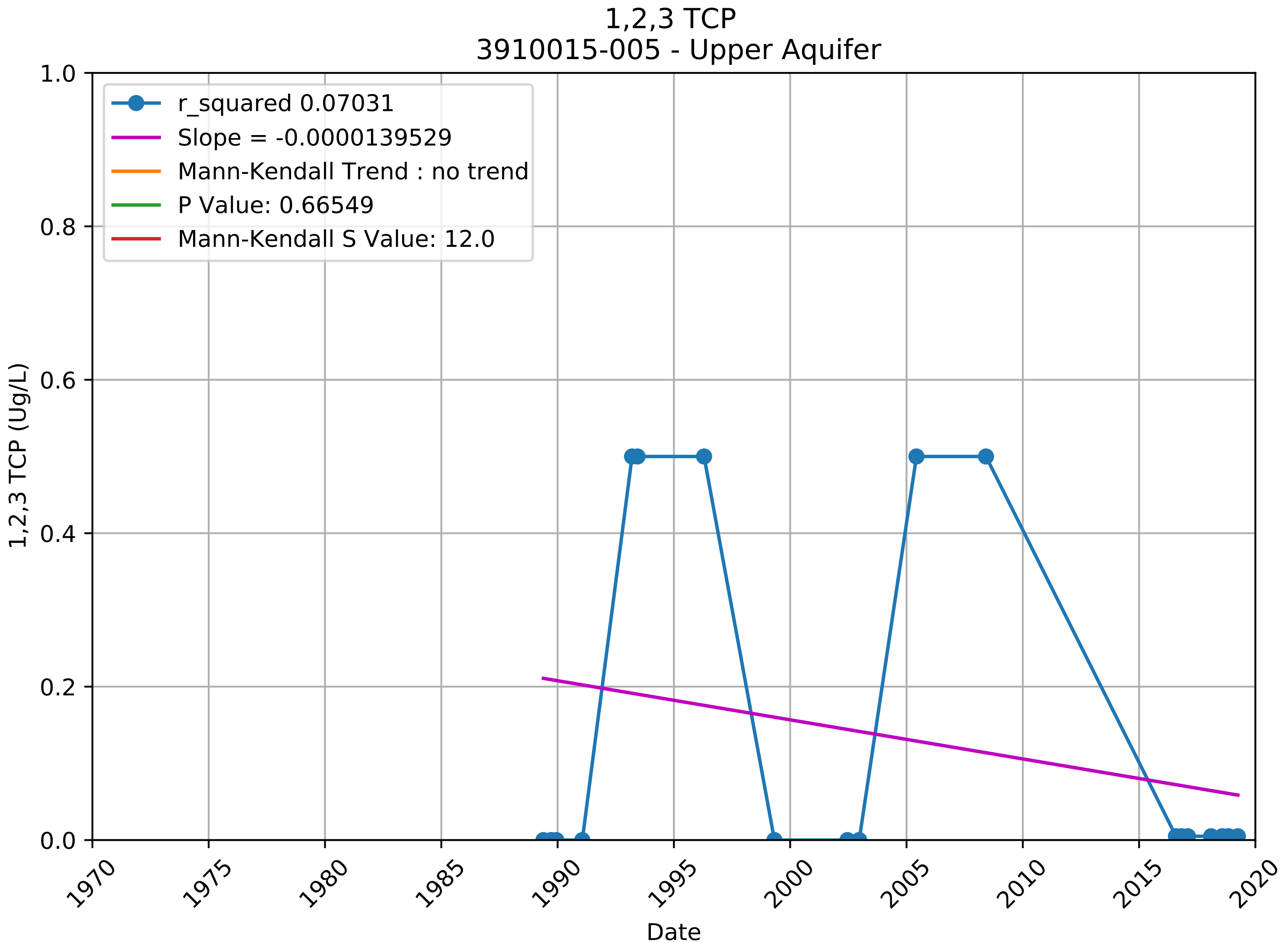


1,2,3 TCP
3910011-030 - Lower Aquifer
r_squared 0.59079
Slope = 0.0000006485
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

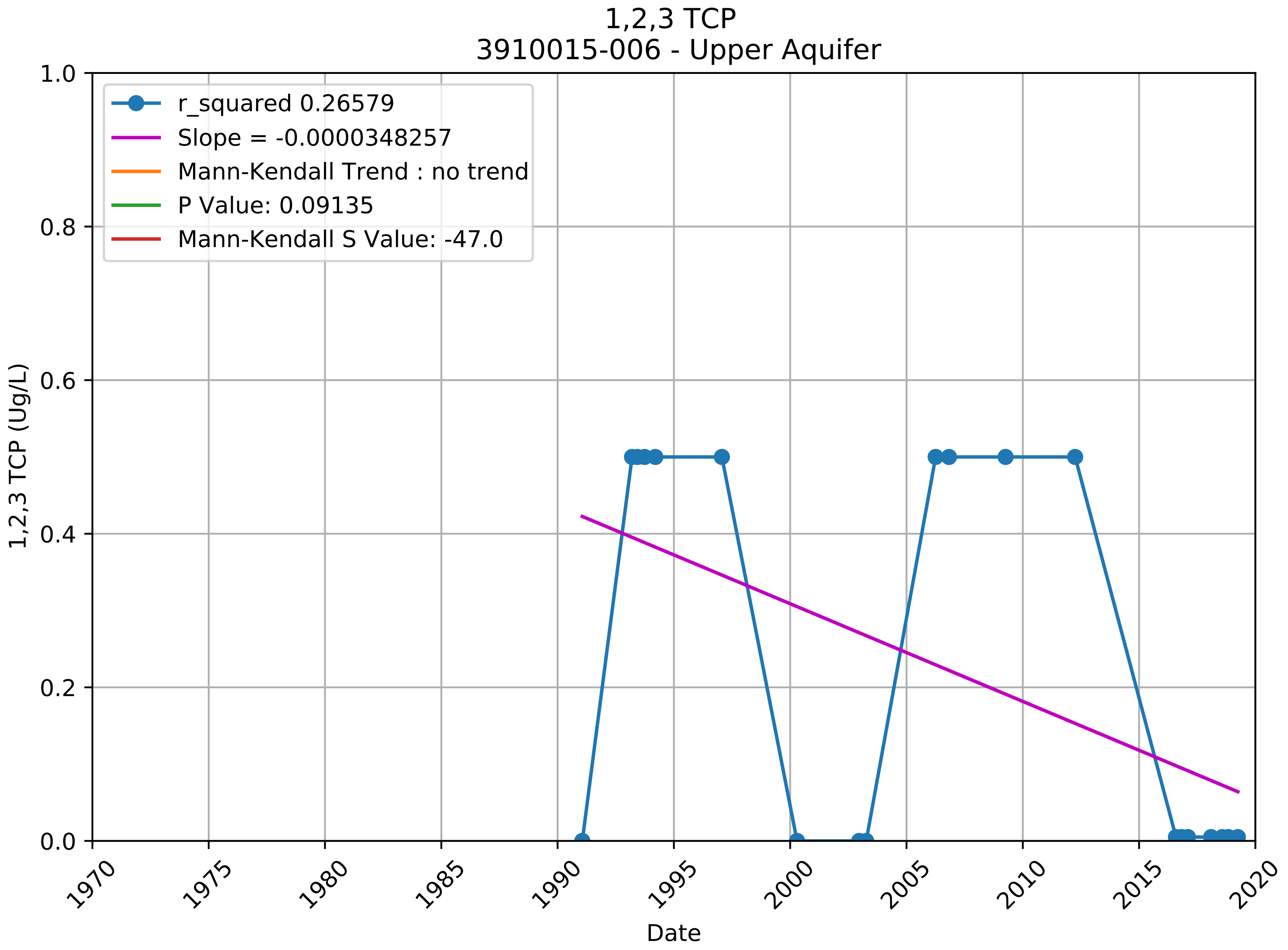


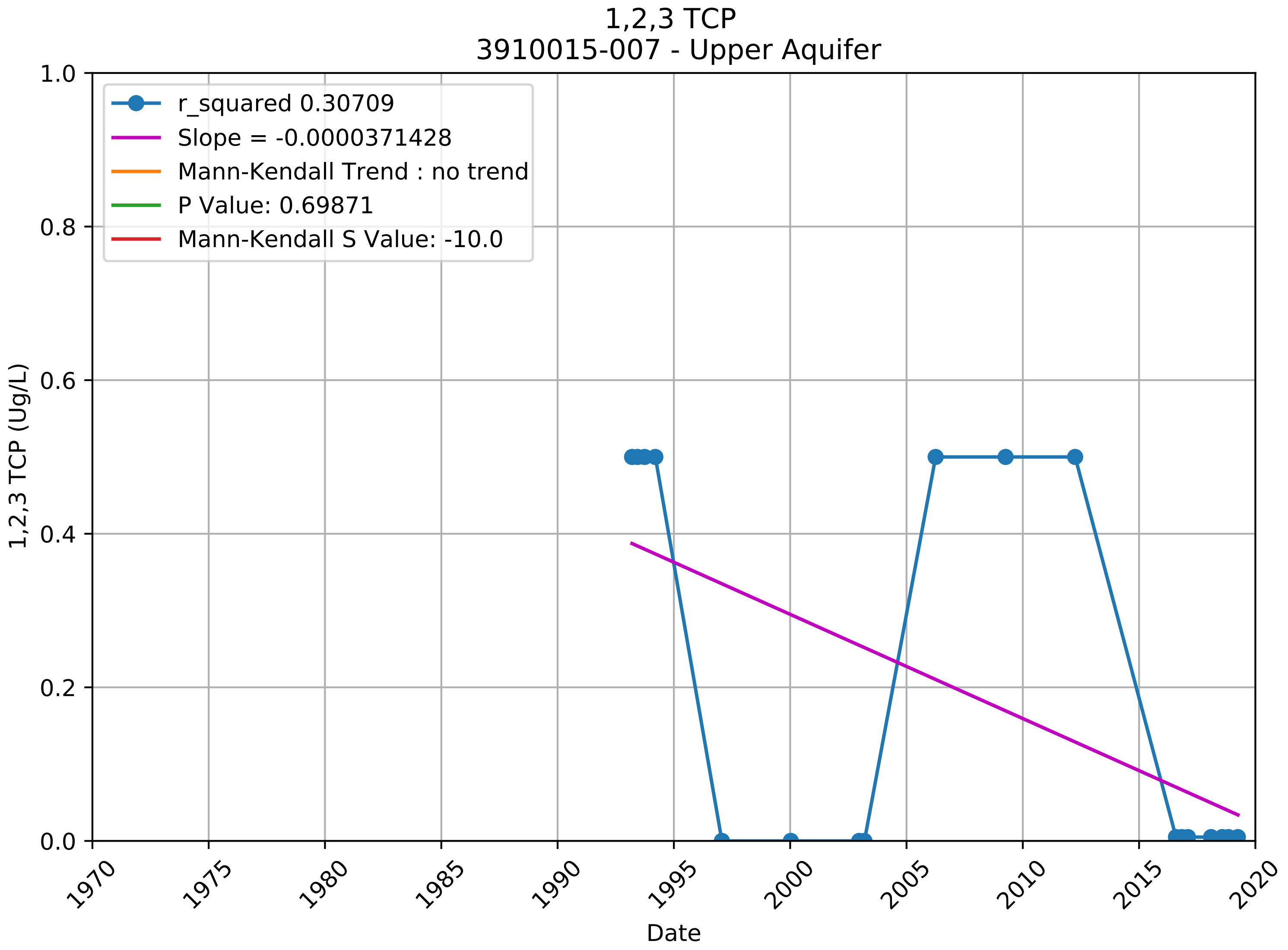
1,2,3 TCP
3910011-032 - Lower Aquifer
r_squared 0.59314
Slope = 0.0000007216
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

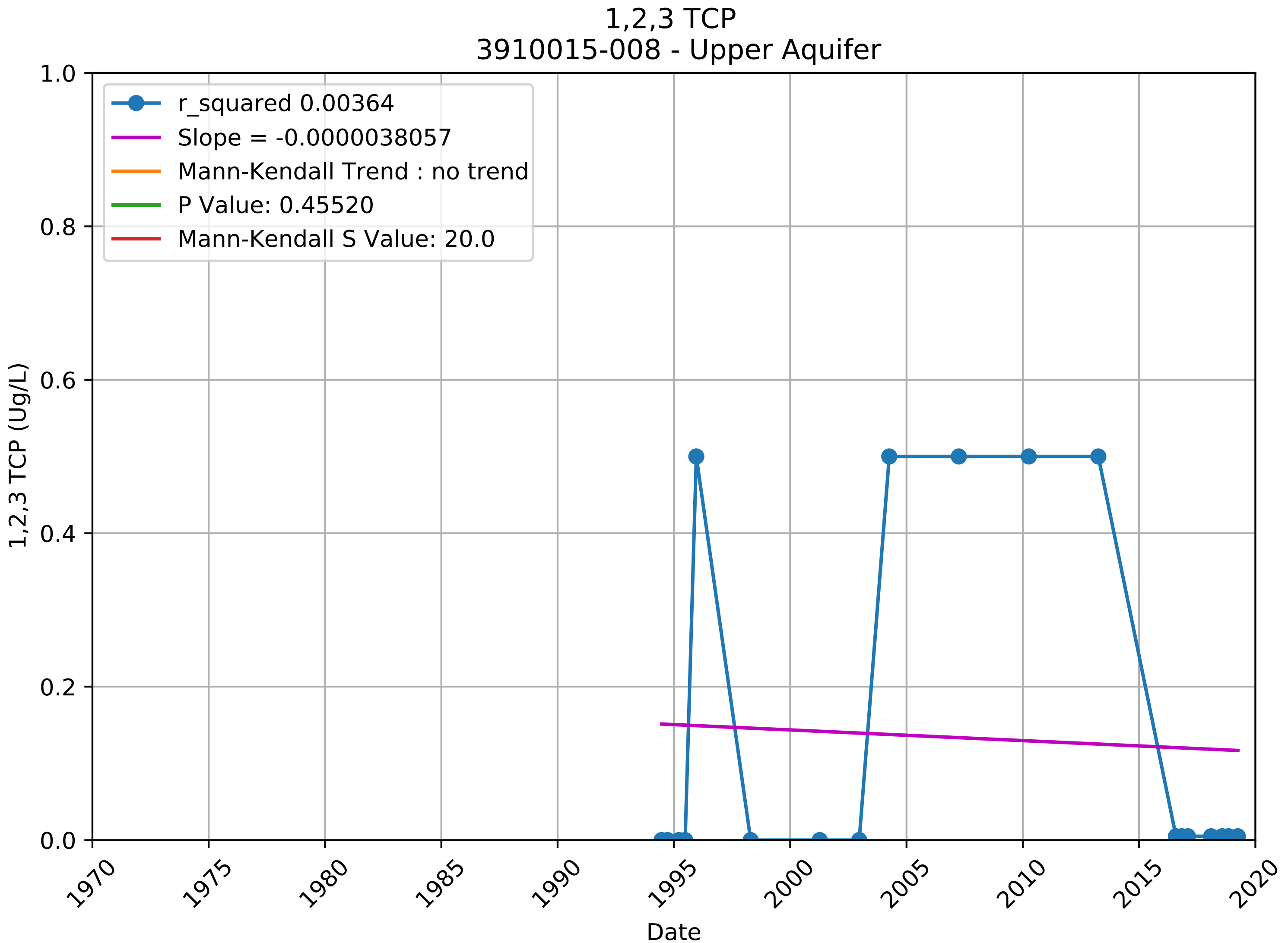

1,2,3 TCP
3910011-034 - Lower Aquifer
r_squared 0.59304
Slope = 0.0000007208
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 1.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

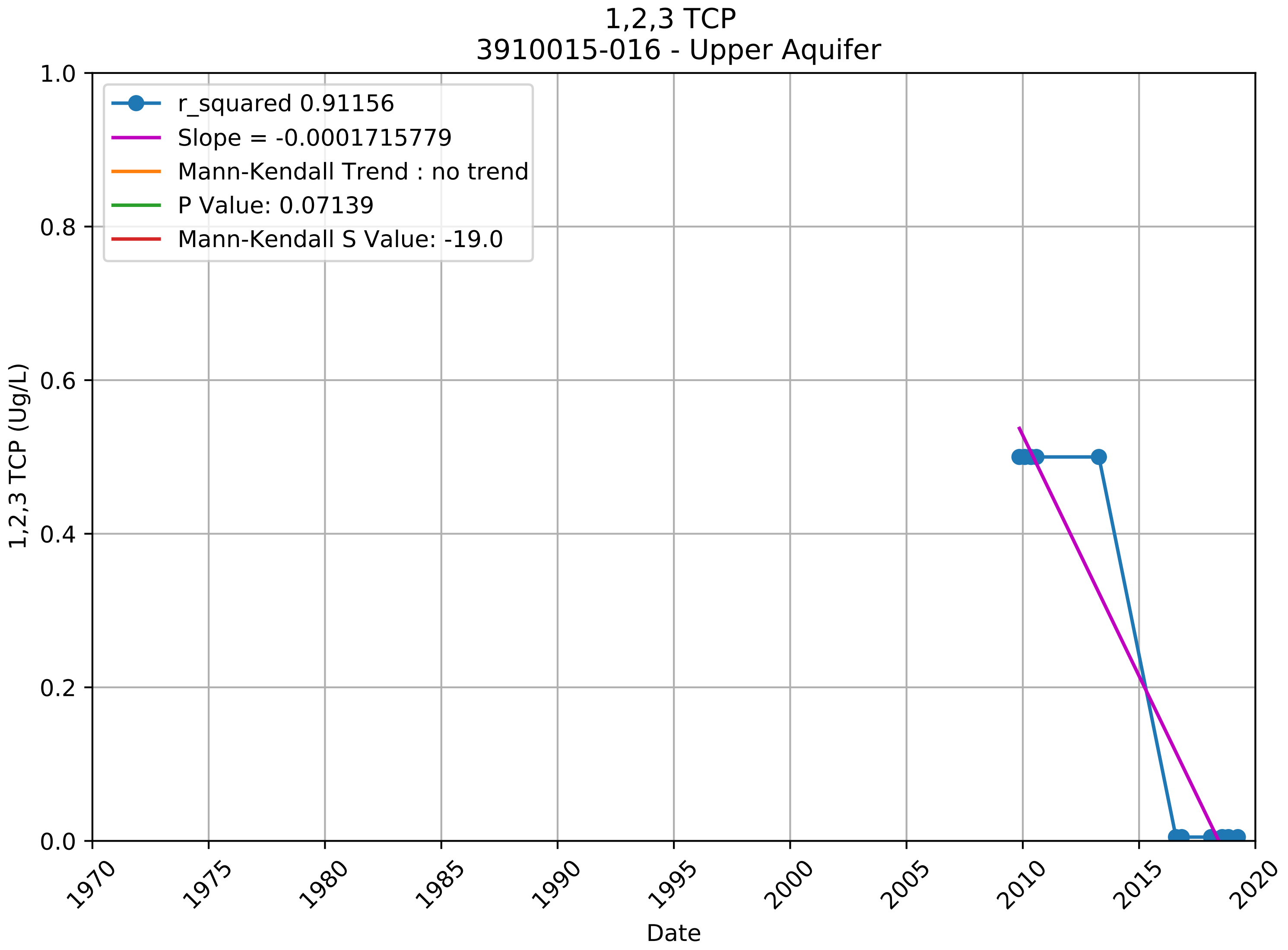


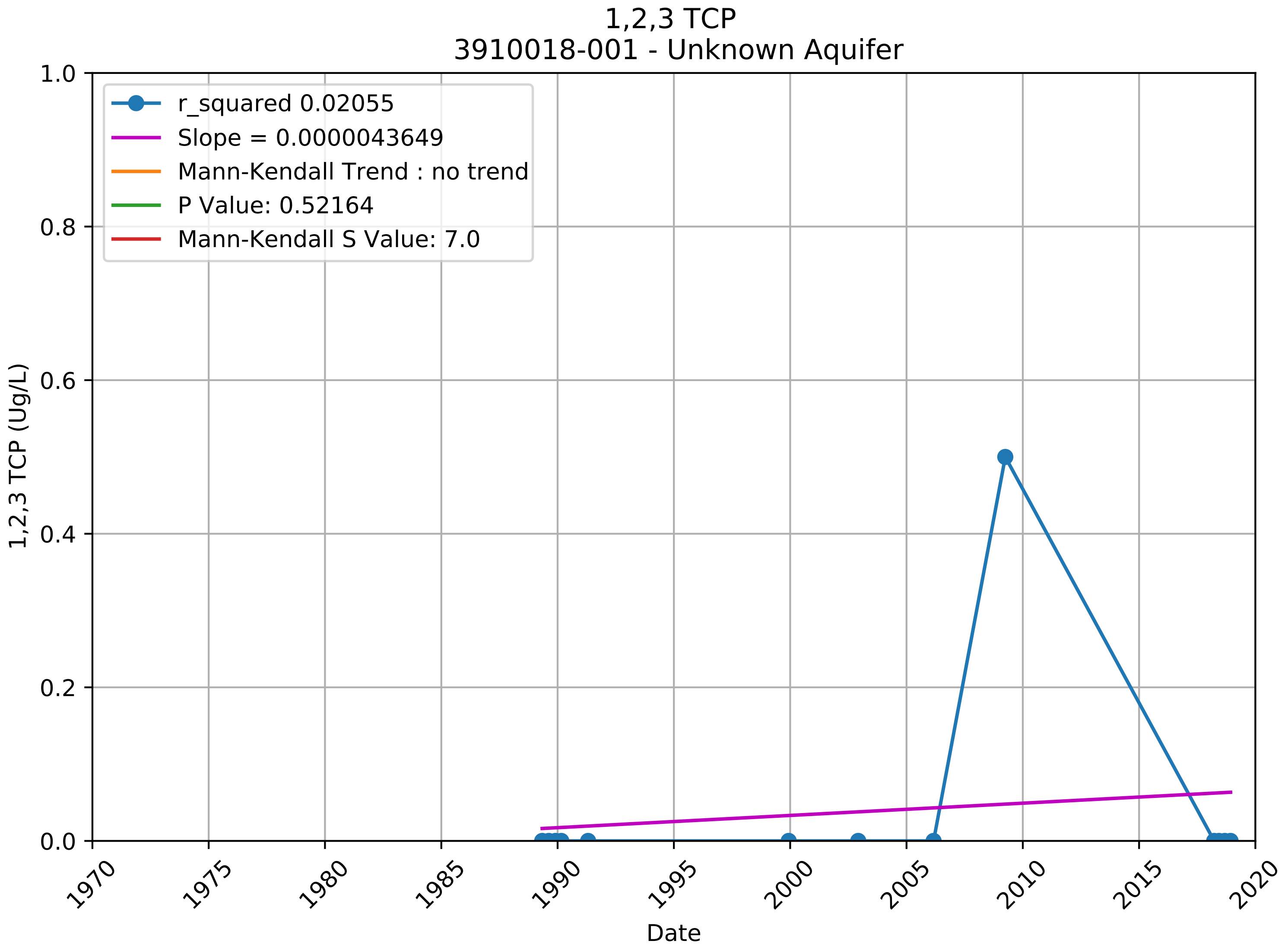
1,2,3 TCP
3910015-005 - Upper Aquifer
r_squared 0.07031
Slope = -0.0000139529
Mann-Kendall Trend : no trend
P Value: 0.66549
Mann-Kendall S Value: 12.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

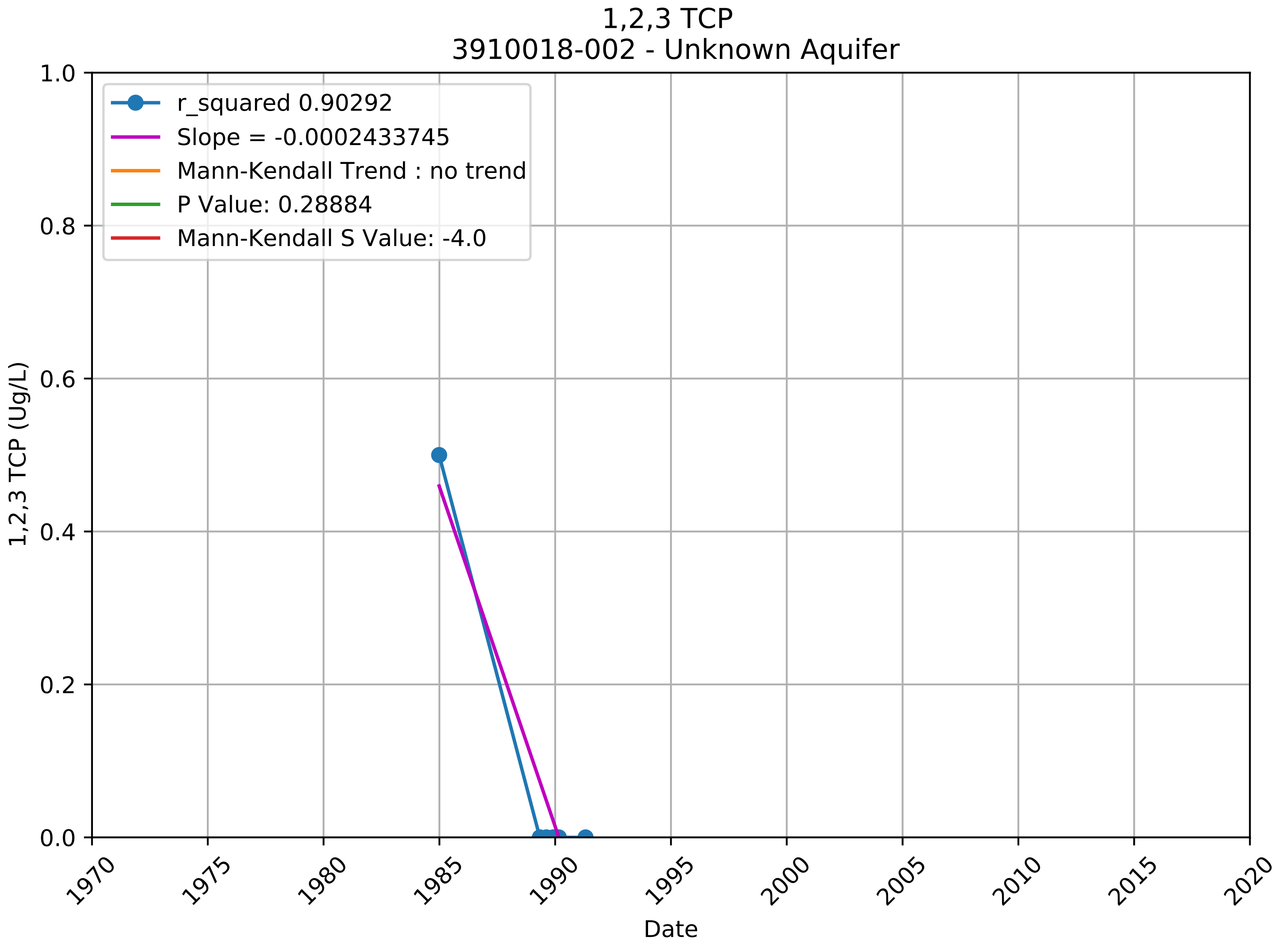

1,2,3 TCP
3910015-006 - Upper Aquifer
r_squared 0.26579
Slope = -0.0000348257
Mann-Kendall Trend : no trend
P Value: 0.09135
Mann-Kendall S Value: -47.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

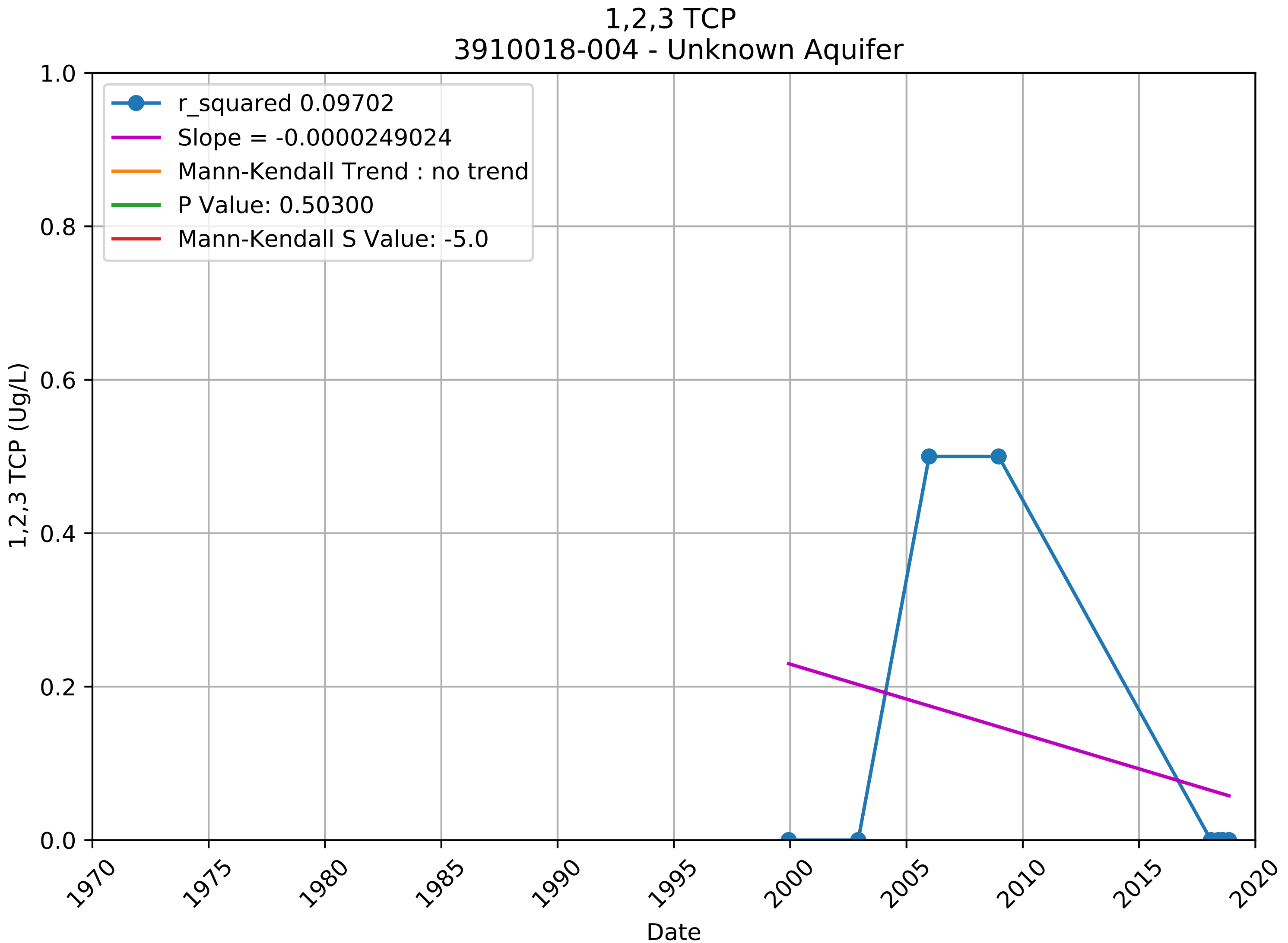

1,2,3 TCP
3910015-007 - Upper Aquifer
r_squared 0.30709
Slope = -0.0000371428
Mann-Kendall Trend : no trend
P Value: 0.69871
Mann-Kendall S Value: -10.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

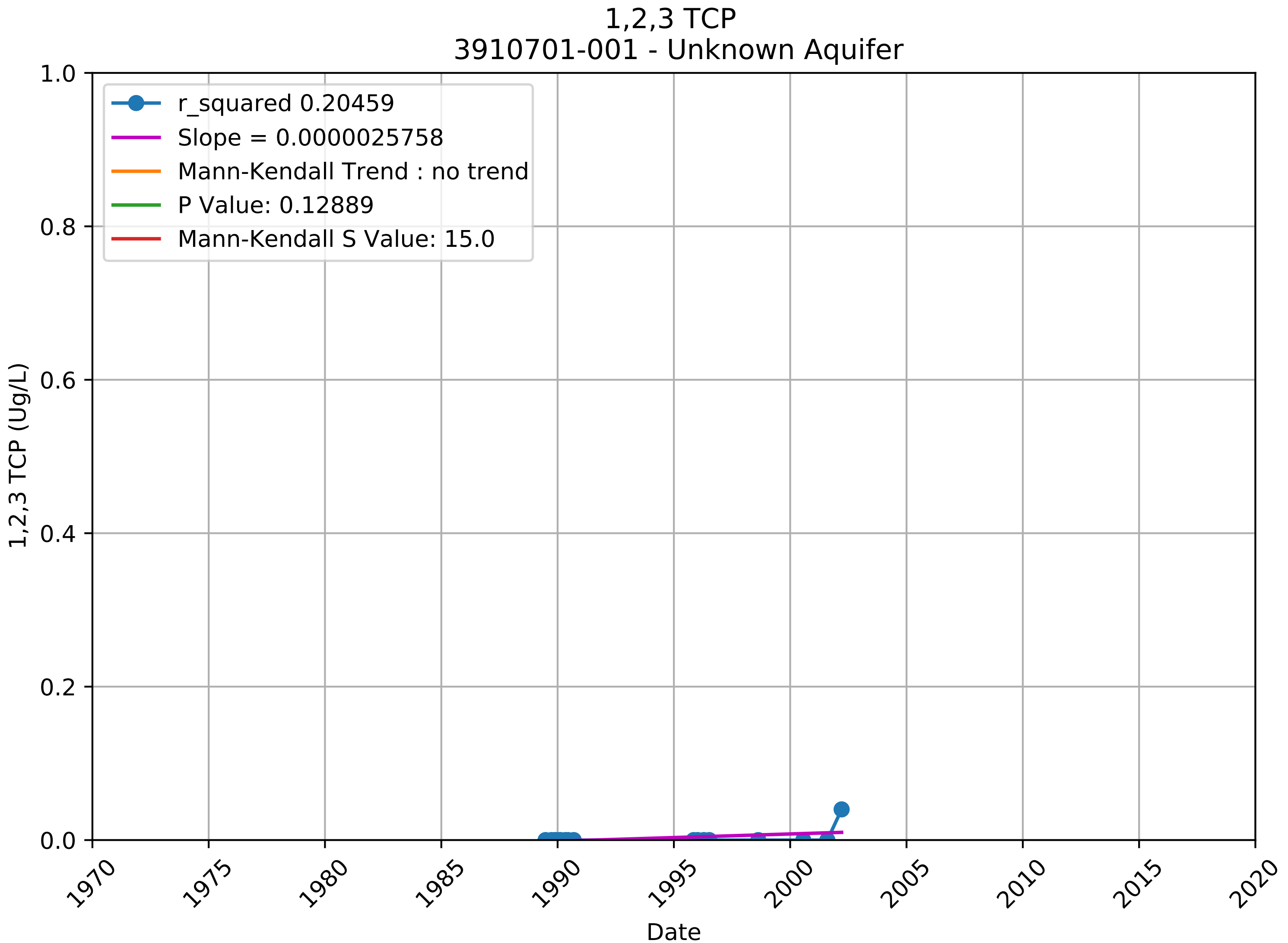

1,2,3 TCP
3910015-008 - Upper Aquifer
r_squared 0.00364
Slope = -0.0000038057
Mann-Kendall Trend : no trend
P Value: 0.45520
Mann-Kendall S Value: 20.0
1.0
0.8
0.6
0.4
0.2
0.0
1,2,3 TCP (Ug/L)
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3910015-016 - Upper Aquifer
r_squared 0.91156
Slope = -0.0001715779
Mann-Kendall Trend : no trend
P Value: 0.07139
Mann-Kendall S Value: -19.0
1,2,3 TCP (Ug/L)
Date
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

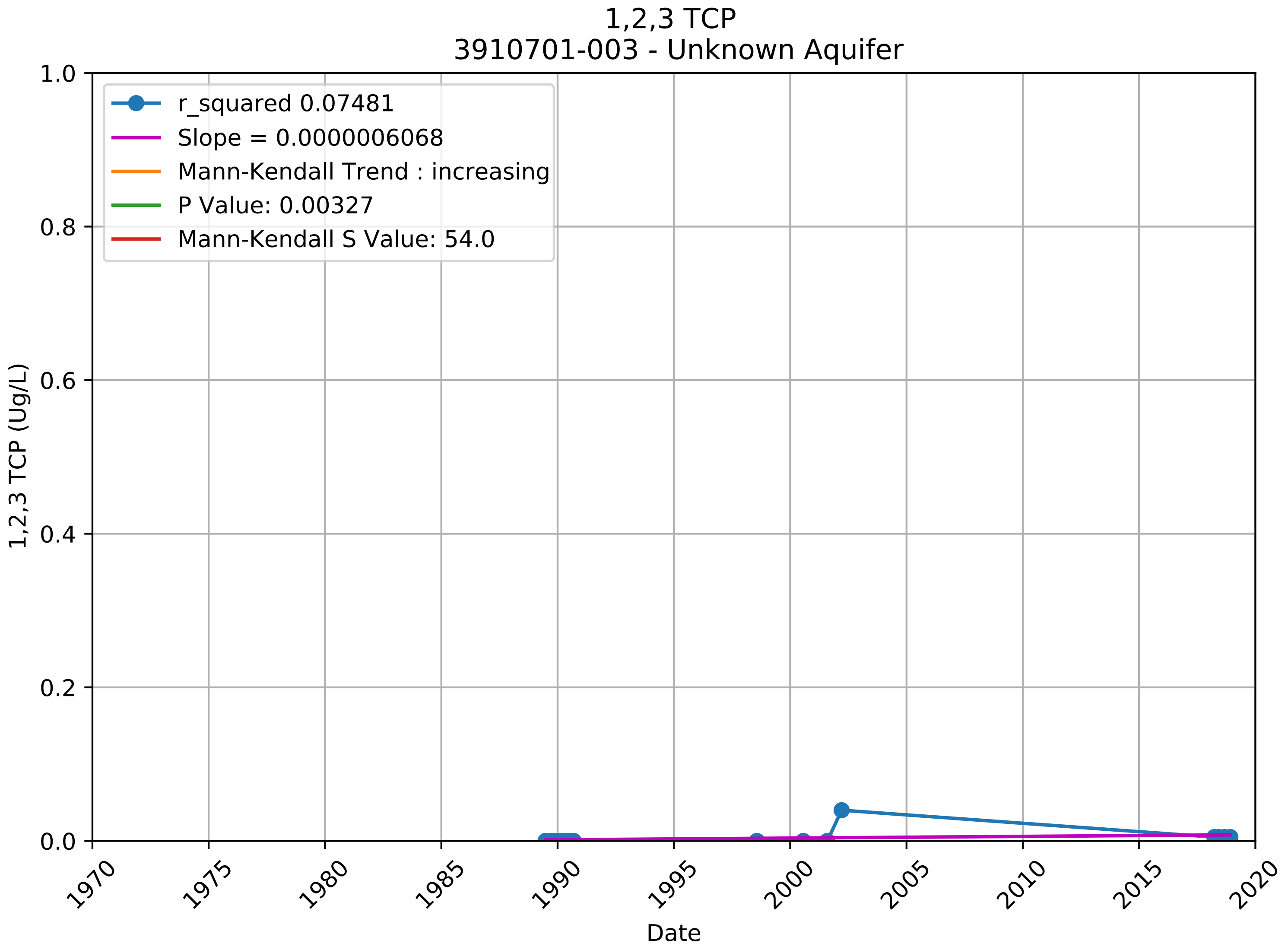

1,2,3 TCP
3910018-001 - Unknown Aquifer
r_squared 0.02055
Slope = 0.0000043649
Mann-Kendall Trend : no trend
P Value: 0.52164
Mann-Kendall S Value: 7.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

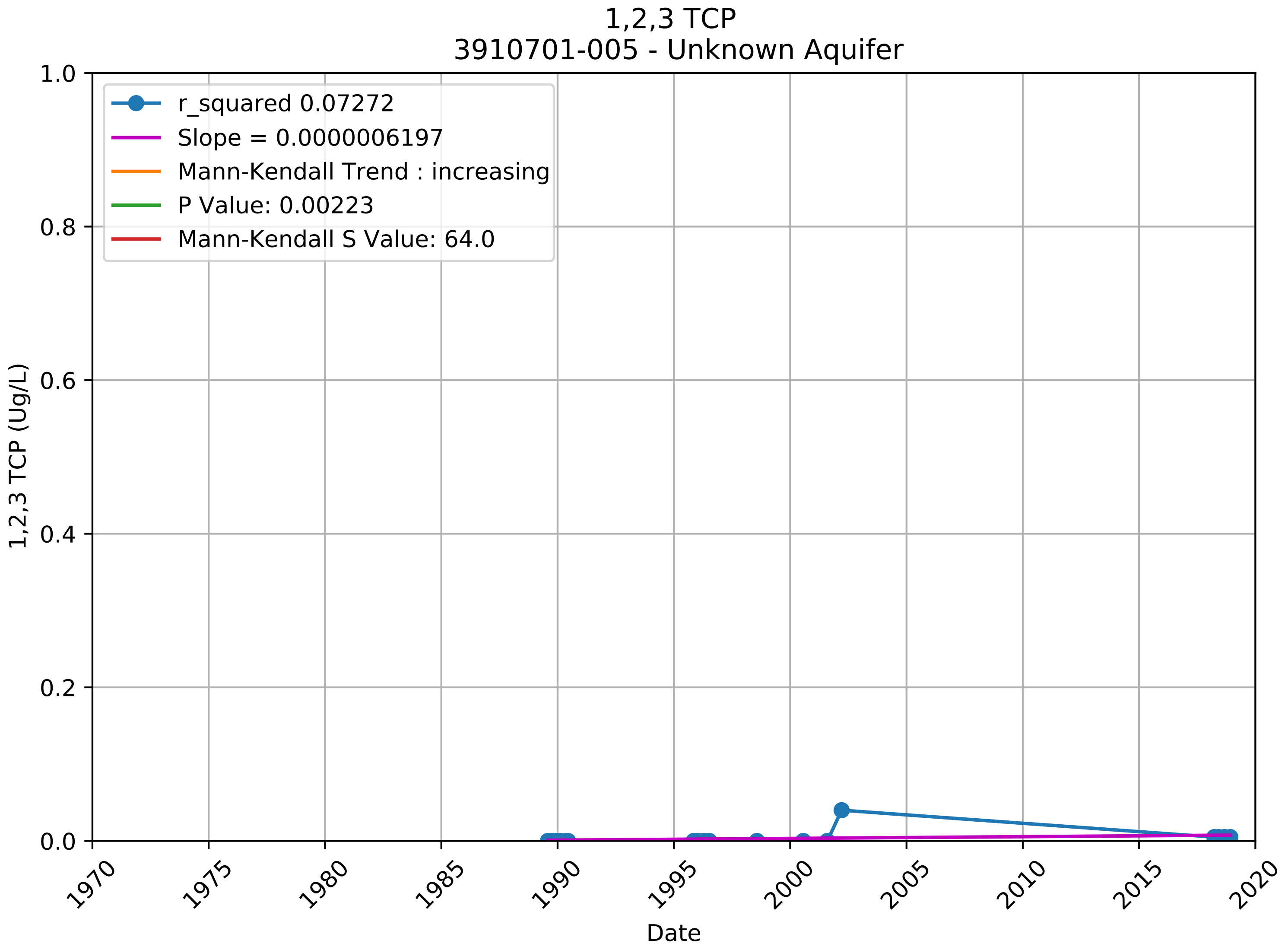

1,2,3 TCP
3910018-002 - Unknown Aquifer
r_squared 0.90292
Slope = -0.0002433745
Mann-Kendall Trend : no trend
P Value: 0.28884
Mann-Kendall S Value: -4.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

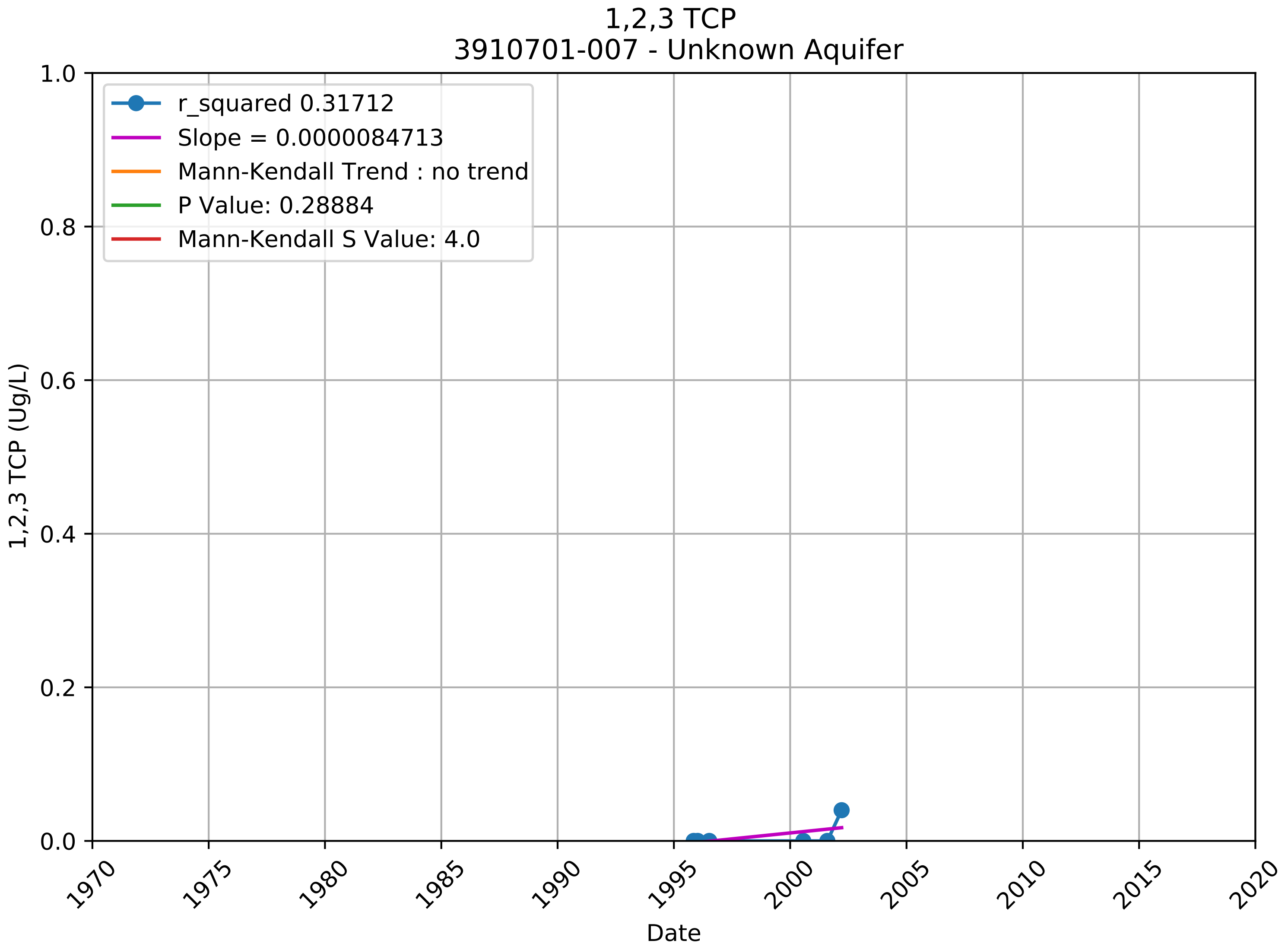

1,2,3 TCP
3910018-004 - Unknown Aquifer
r_squared 0.09702
Slope = -0.0000249024
Mann-Kendall Trend : no trend
P Value: 0.50300
Mann-Kendall S Value: -5.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



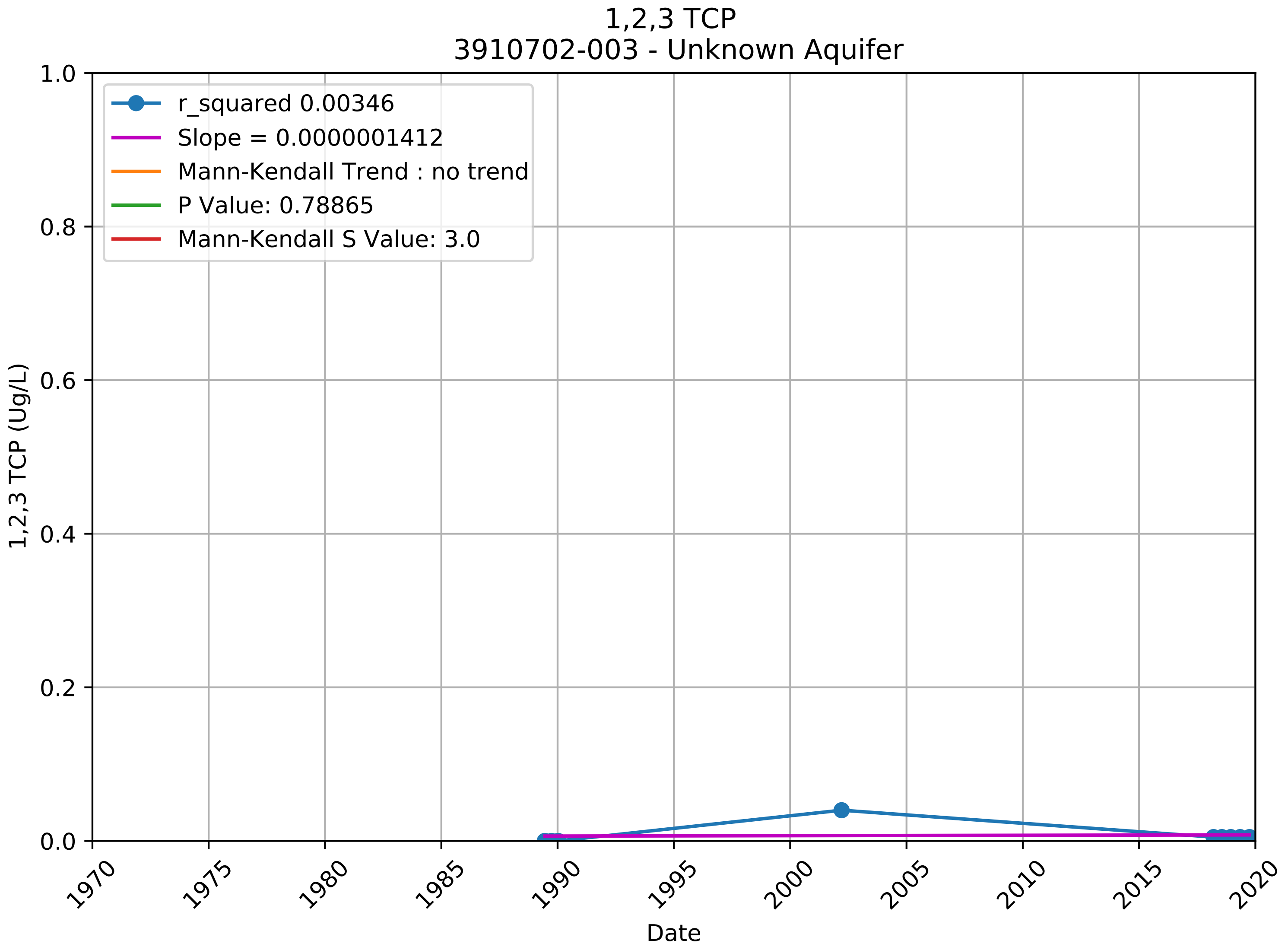
1,2,3 TCP
3910701-001 - Unknown Aquifer
r_squared 0.20459
Slope = 0.0000025758
Mann-Kendall Trend : no trend
P Value: 0.12889
Mann-Kendall S Value: 15.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

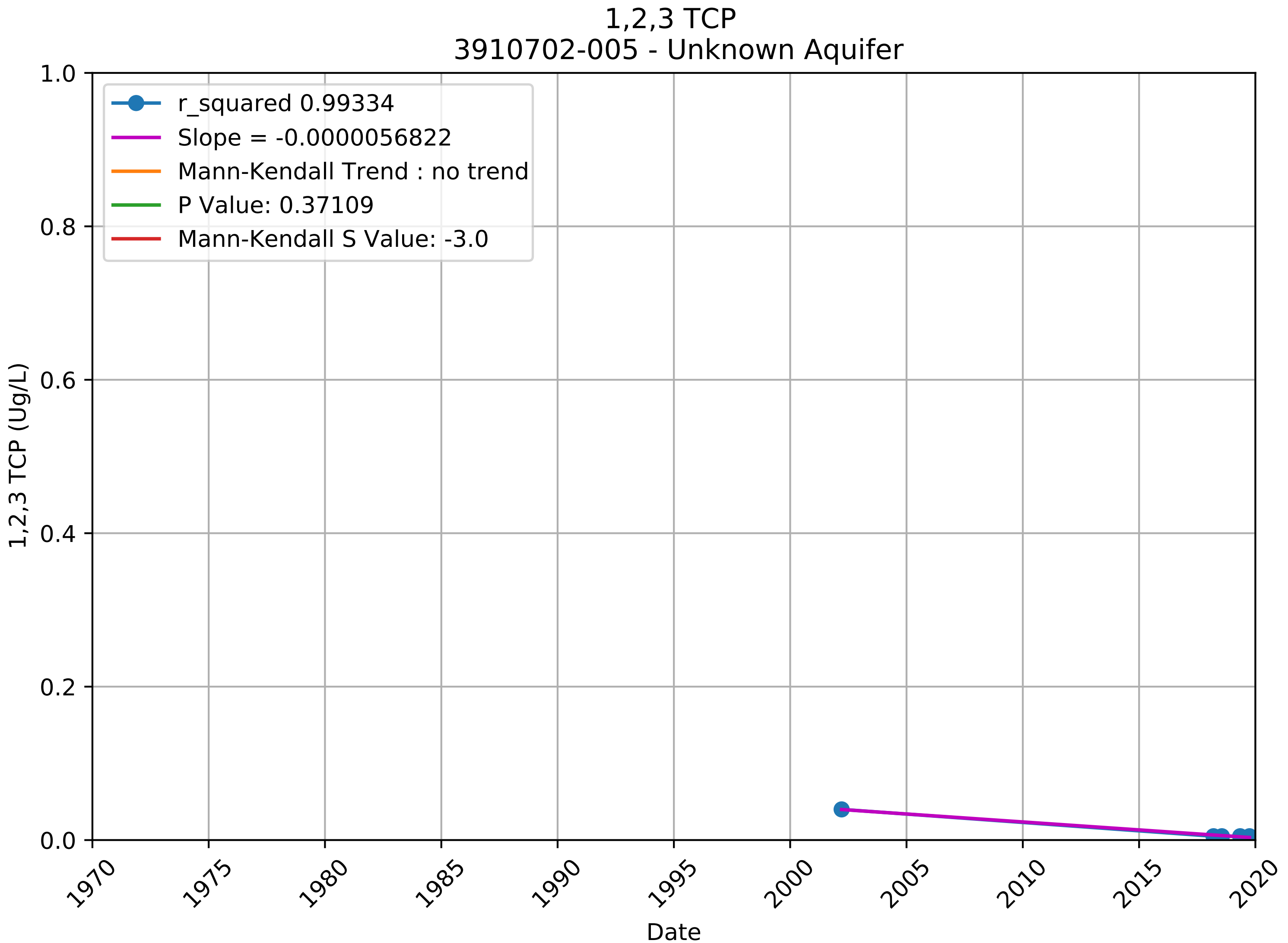

1,2,3 TCP
3910701-003 - Unknown Aquifer
r_squared 0.07481
Slope = 0.0000006068
Mann-Kendall Trend : increasing
P Value: 0.00327
Mann-Kendall S Value: 54.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

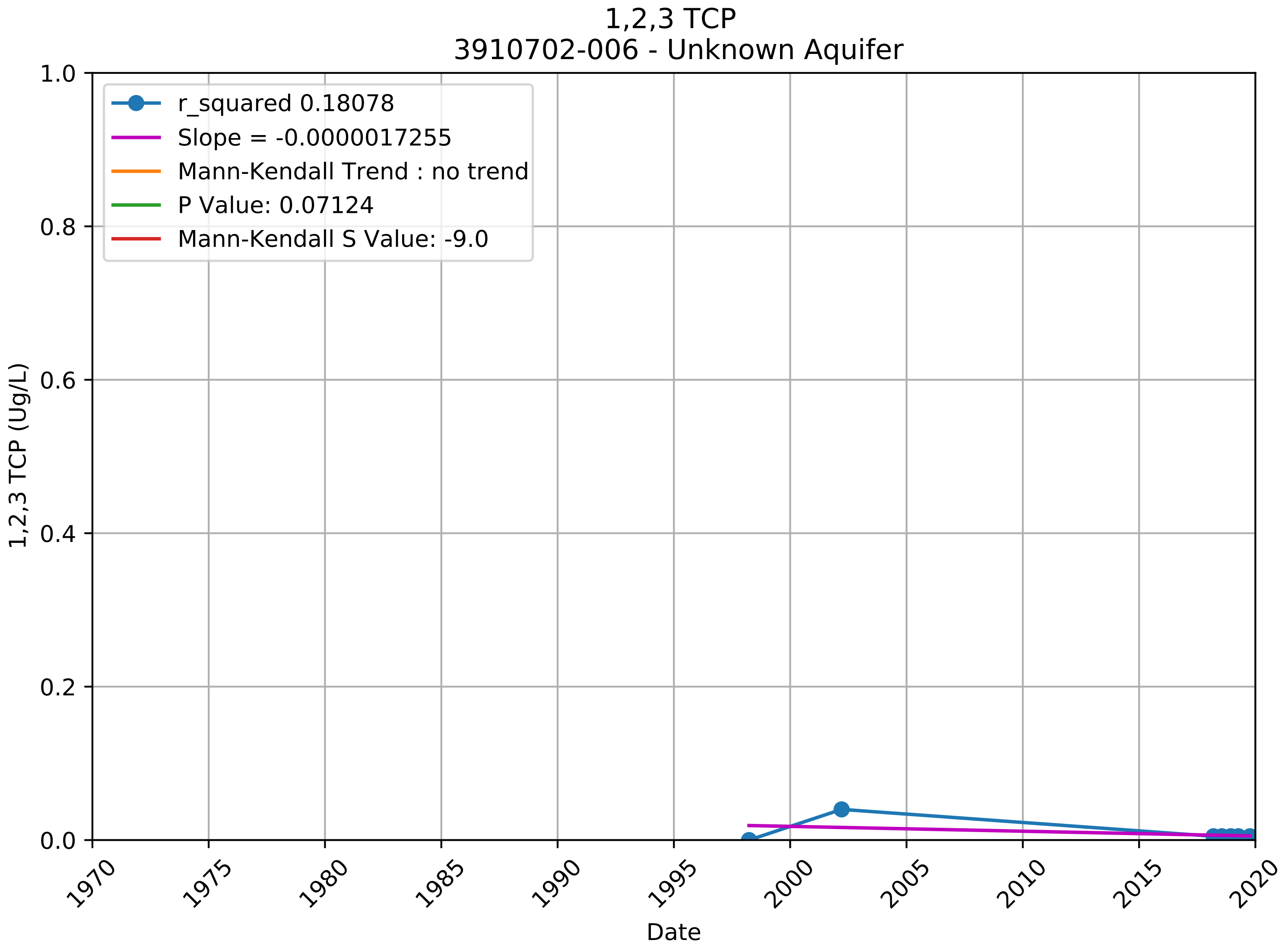

1,2,3 TCP
3910701-005 - Unknown Aquifer
r_squared 0.07272
Slope = 0.0000006197
Mann-Kendall Trend : increasing
P Value: 0.00223
Mann-Kendall S Value: 64.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

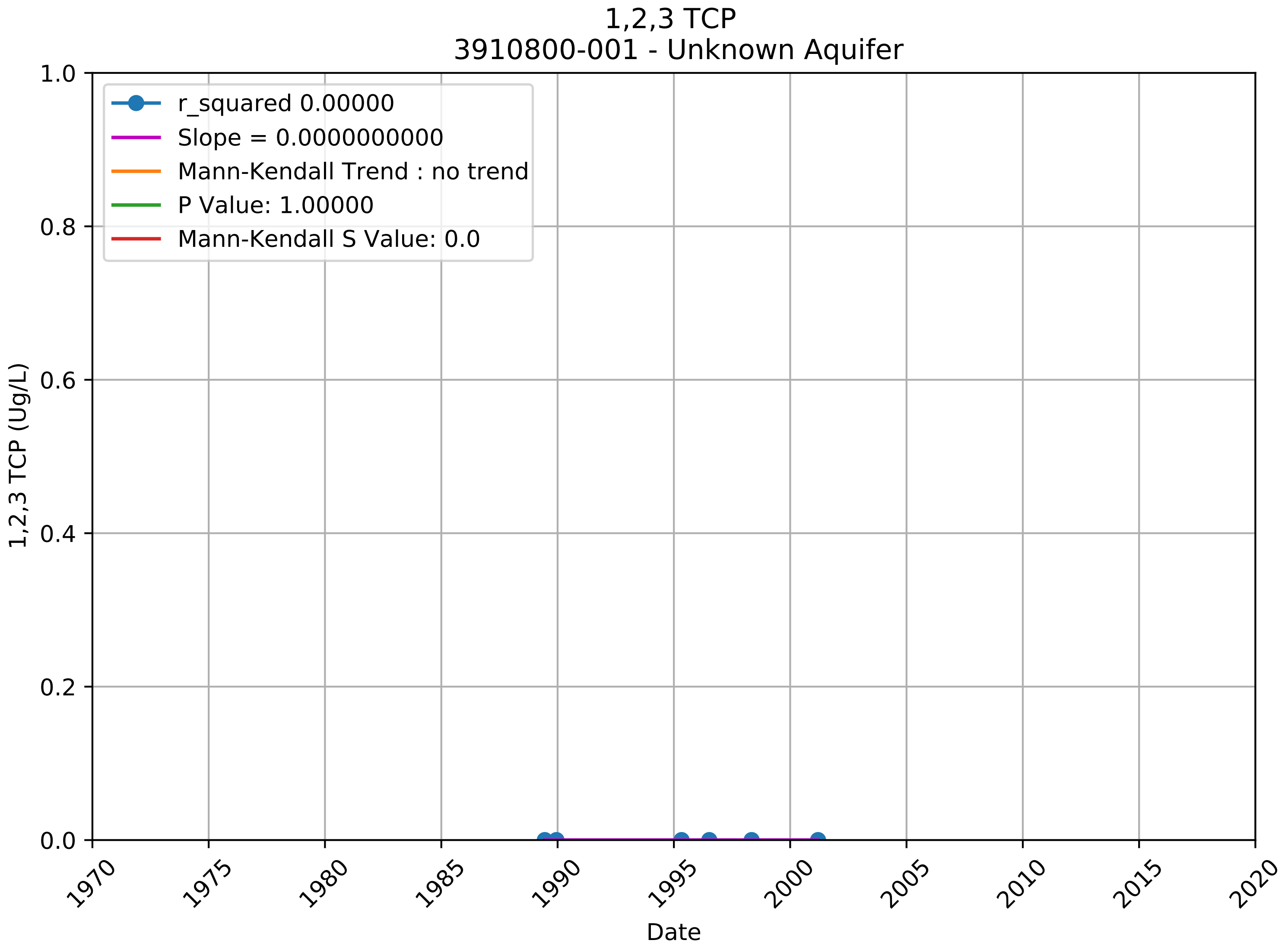


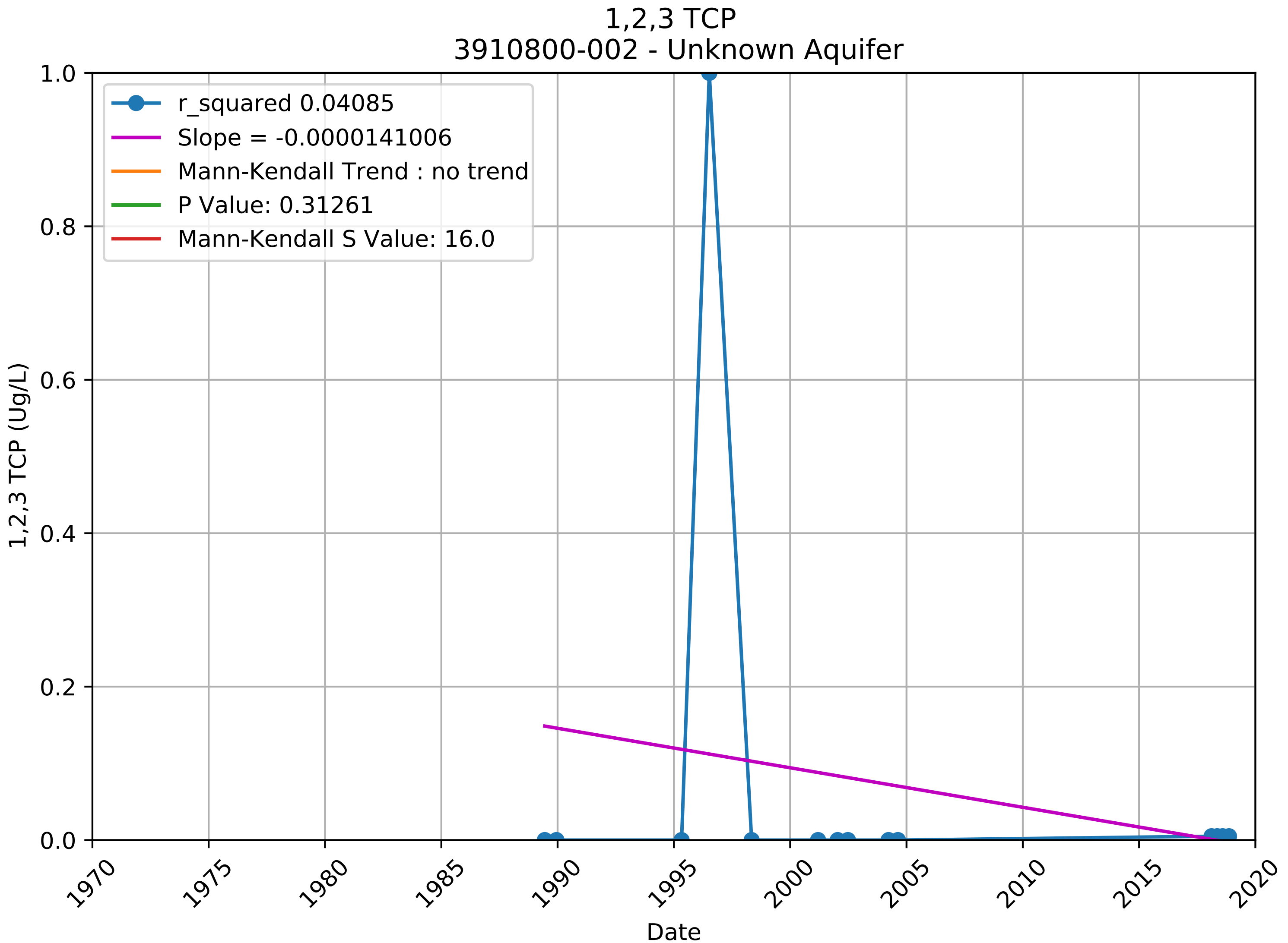
1,2,3 TCP
3910701-007 - Unknown Aquifer
r_squared 0.31712
Slope = 0.0000084713
Mann-Kendall Trend : no trend
P Value: 0.28884
Mann-Kendall S Value: 4.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

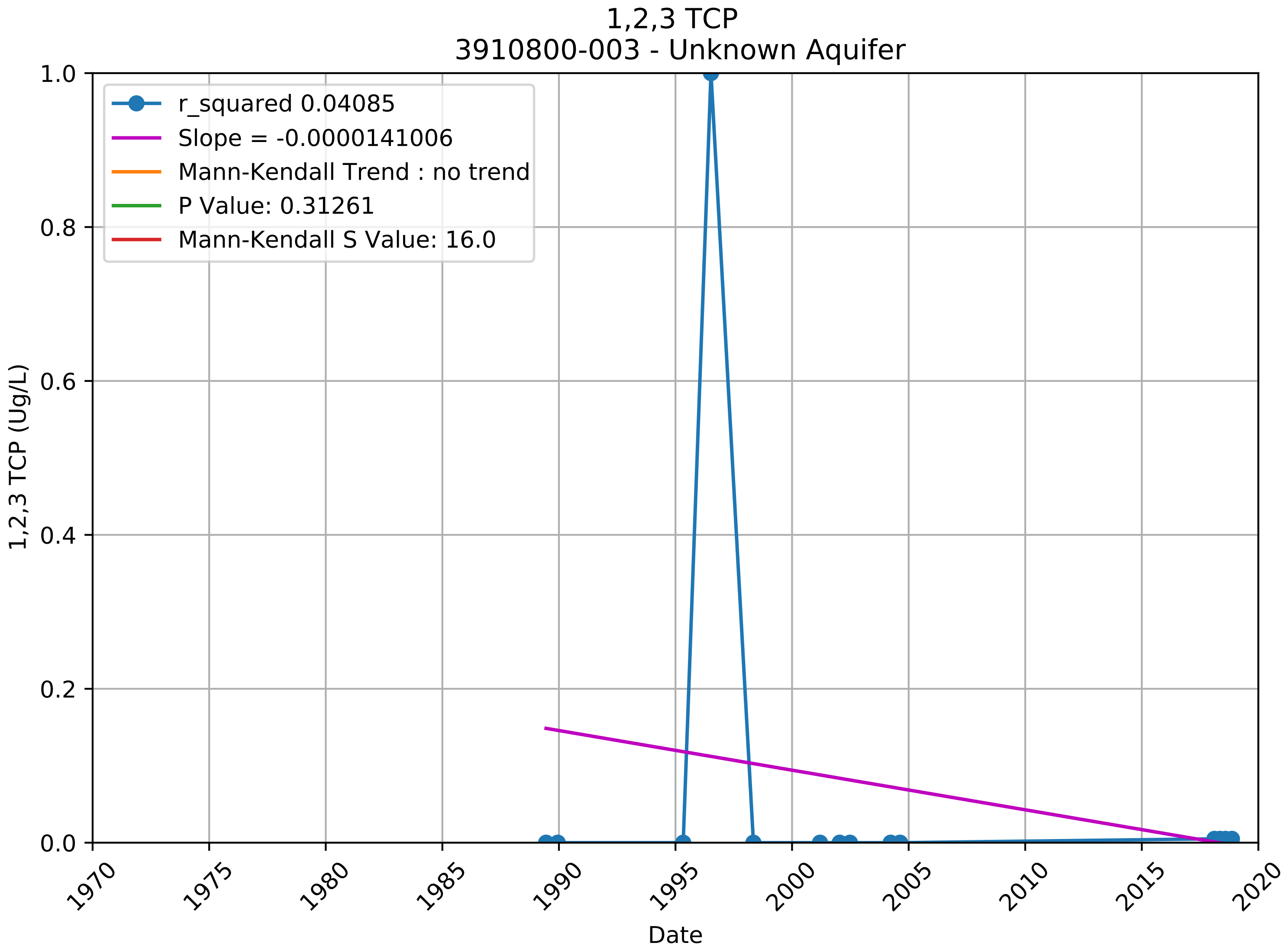

1,2,3 TCP
3910702-003 - Unknown Aquifer
r_squared 0.00346
Slope = 0.0000001412
Mann-Kendall Trend : no trend
P Value: 0.78865
Mann-Kendall S Value: 3.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3910702-005 - Unknown Aquifer
r_squared 0.99334
Slope = -0.0000056822
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: -3.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

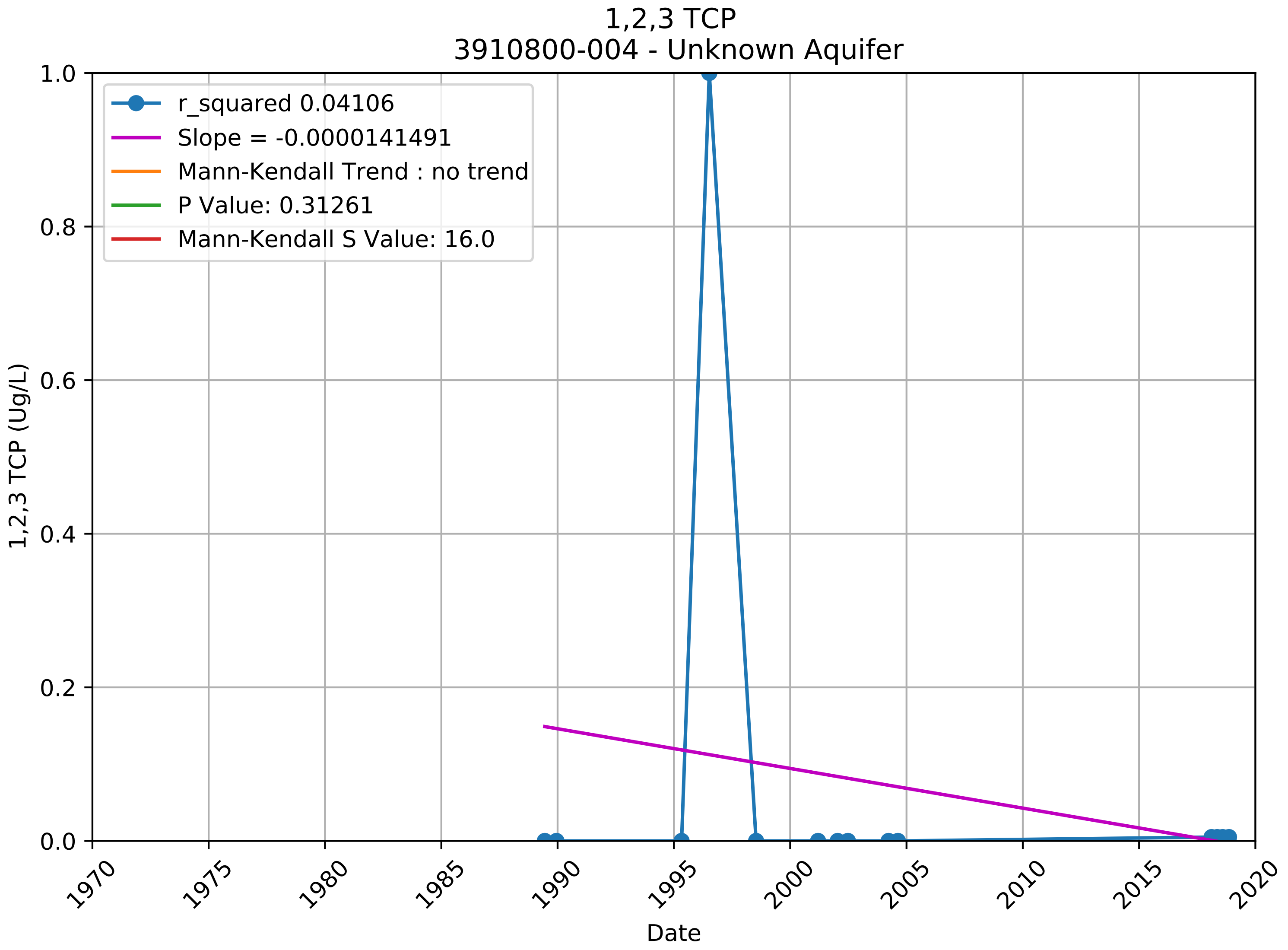

1,2,3 TCP
3910702-006 - Unknown Aquifer
r_squared 0.18078
Slope = -0.0000017255
Mann-Kendall Trend : no trend
P Value: 0.07124
Mann-Kendall S Value: -9.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date


1,2,3 TCP
3910800-001 - Unknown Aquifer
r_squared 0.00000
Slope = 0.0000000000
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: 0.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

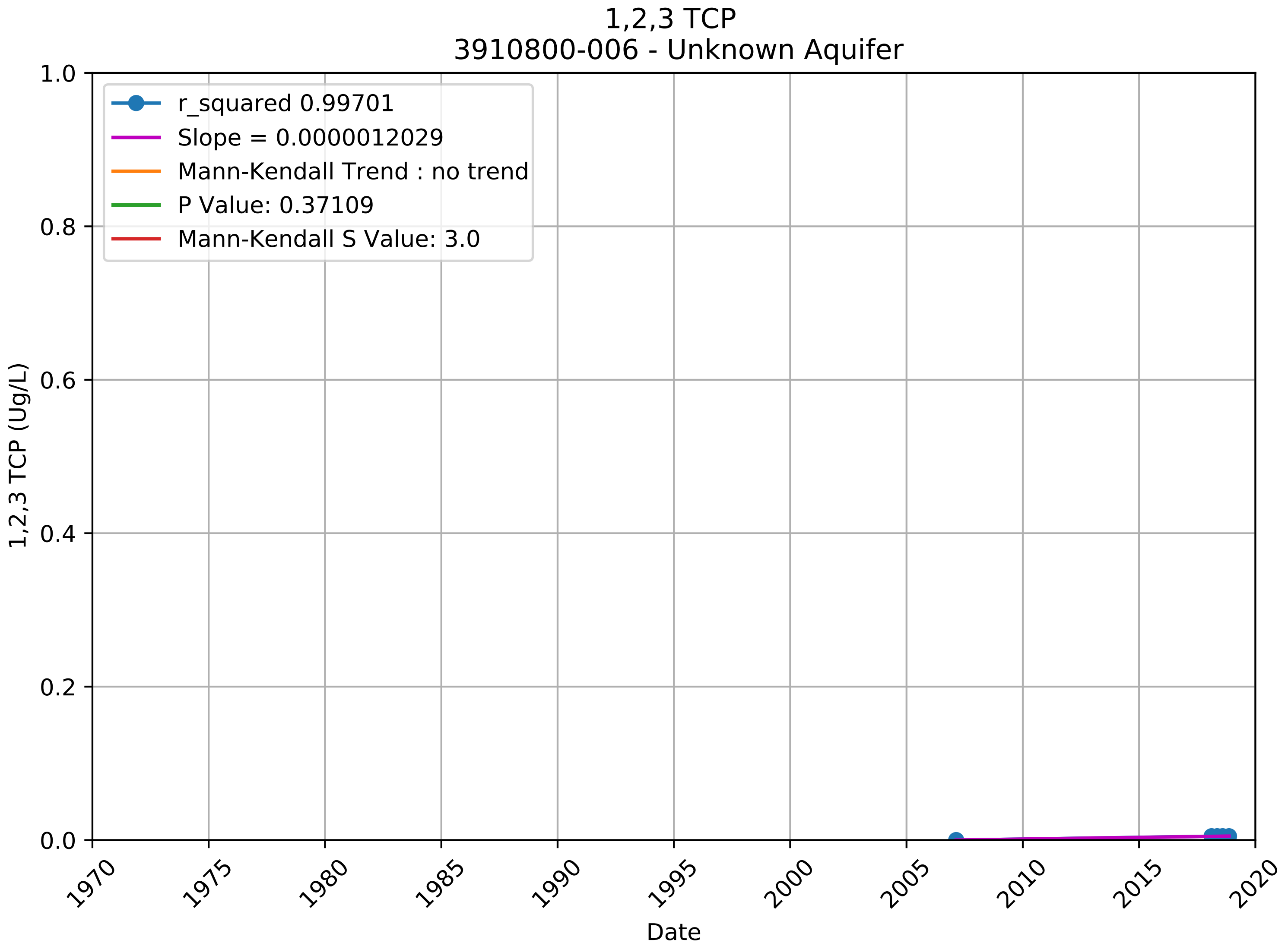

1,2,3 TCP
3910800-002 - Unknown Aquifer
r_squared 0.04085
Slope = -0.0000141006
Mann-Kendall Trend : no trend
P Value: 0.31261
Mann-Kendall S Value: 16.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

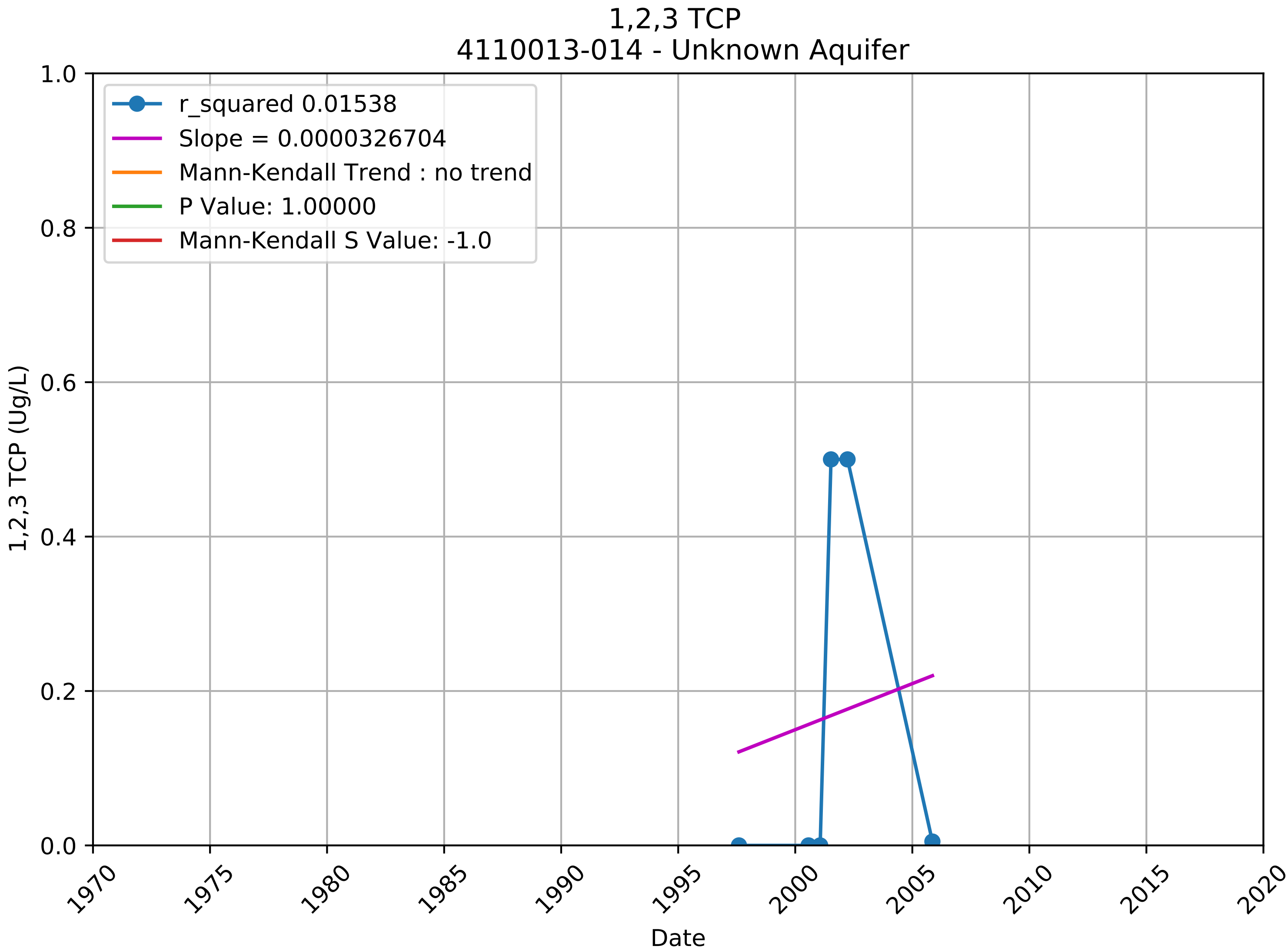


1,2,3 TCP
3910800-003 - Unknown Aquifer
r_squared 0.04085
Slope = -0.0000141006
Mann-Kendall Trend : no trend
P Value: 0.31261
Mann-Kendall S Value: 16.0
1,2,3 TCP (Ug/L)
1.0
0.8
0.6
0.4
0.2
0.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

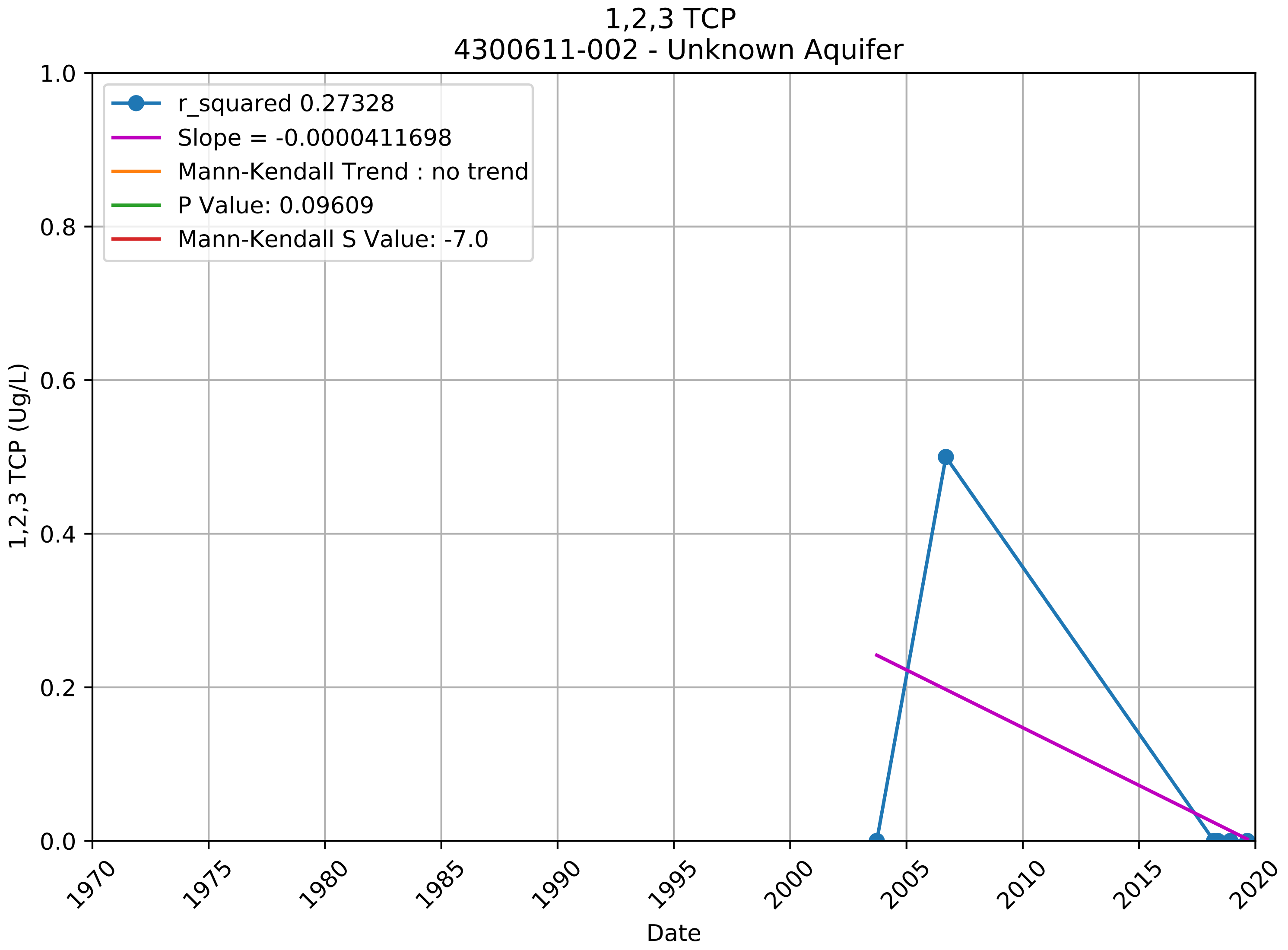


1,2,3 TCP
3910800-004 - Unknown Aquifer
r_squared 0.04106
Slope = -0.0000141491
Mann-Kendall Trend : no trend
P Value: 0.31261
Mann-Kendall S Value: 16.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date

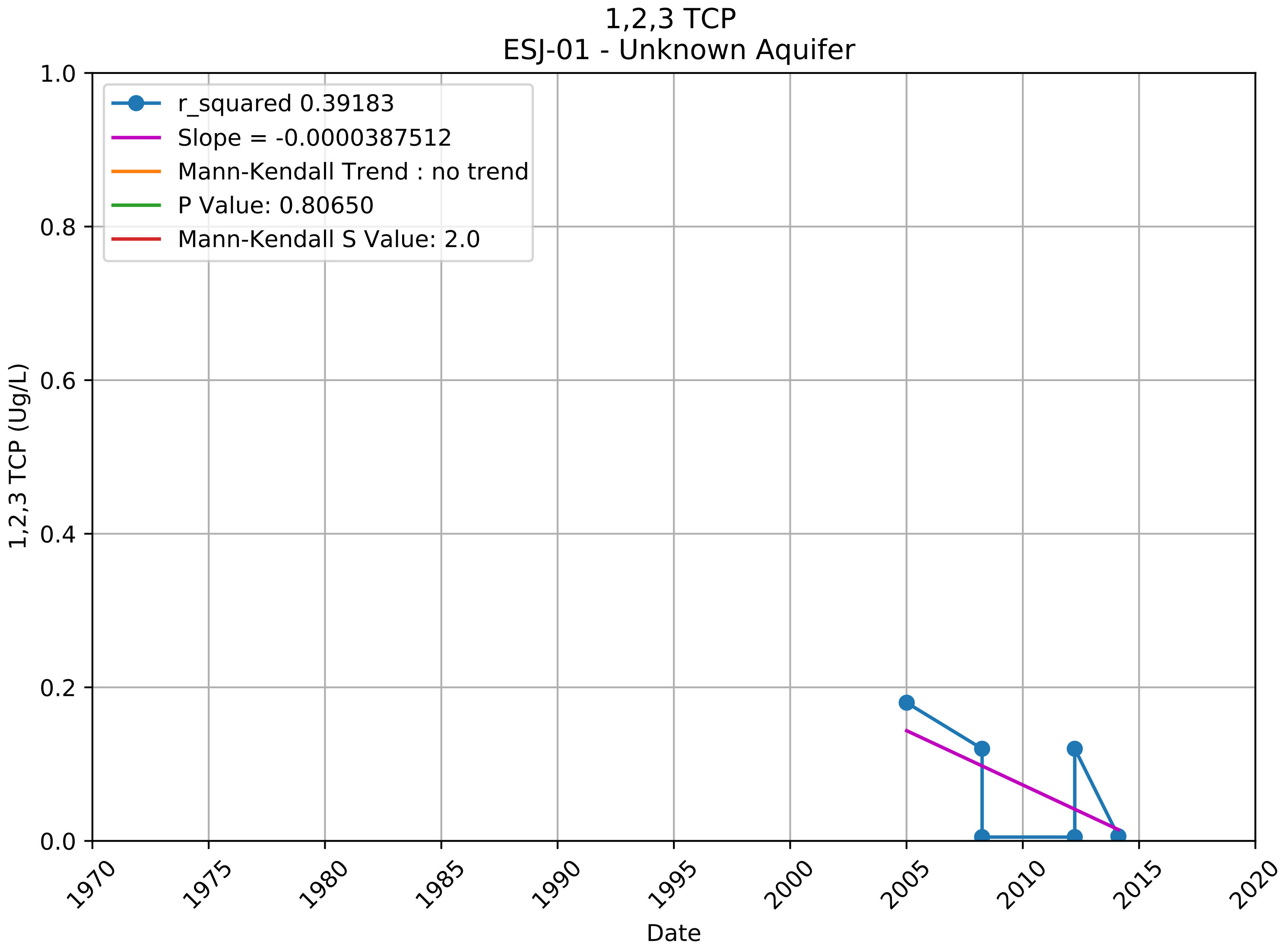

1,2,3 TCP
3910800-006 - Unknown Aquifer
r_squared 0.99701
Slope = 0.0000012029
Mann-Kendall Trend : no trend
P Value: 0.37109
Mann-Kendall S Value: 3.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020



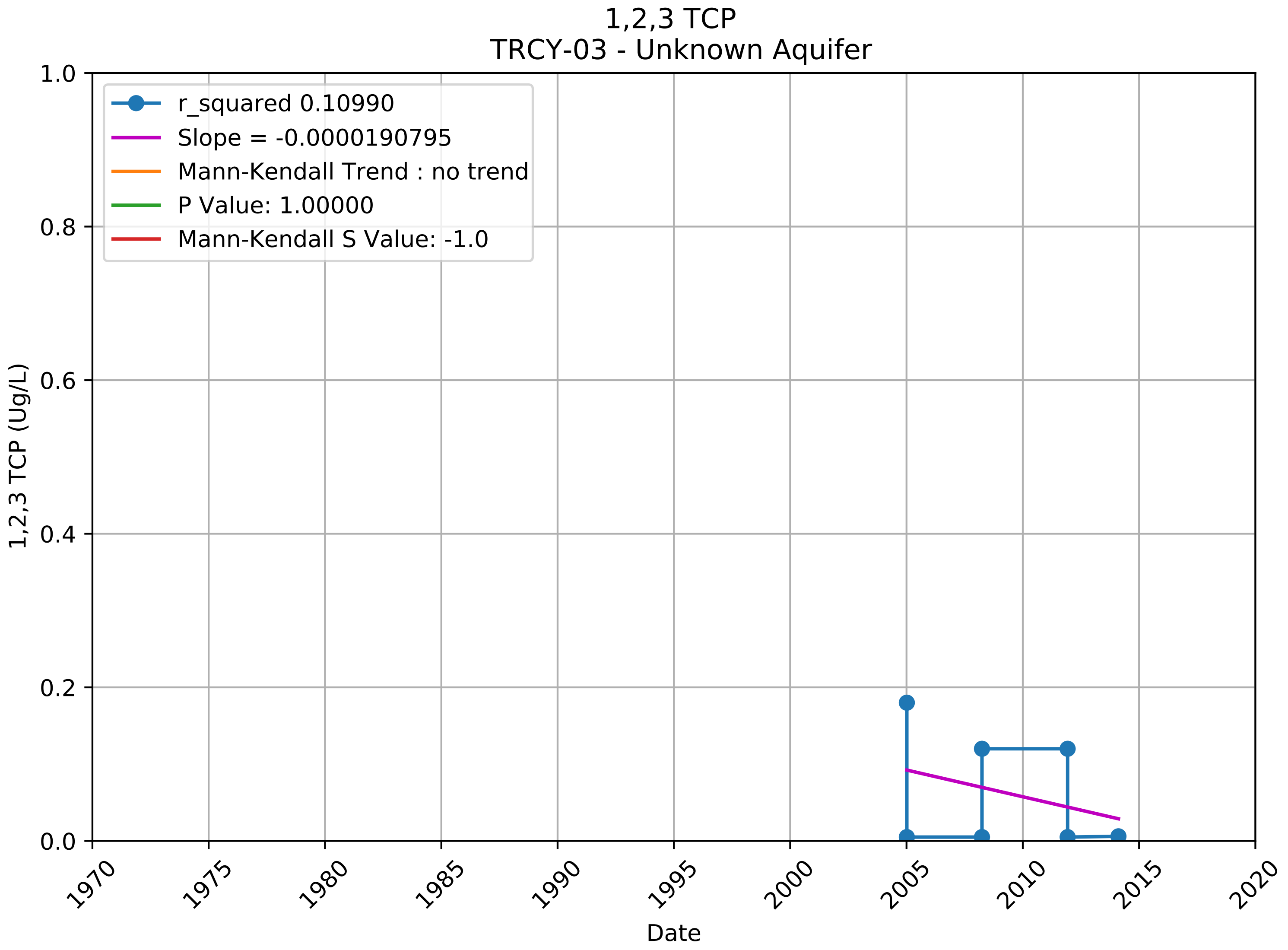
1,2,3 TCP
4110013-014 - Unknown Aquifer
r_squared 0.01538
Slope = 0.0000326704
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



1,2,3 TCP
4300611-002 - Unknown Aquifer
r_squared 0.27328
Slope = -0.0000411698
Mann-Kendall Trend : no trend
P Value: 0.09609
Mann-Kendall S Value: -7.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



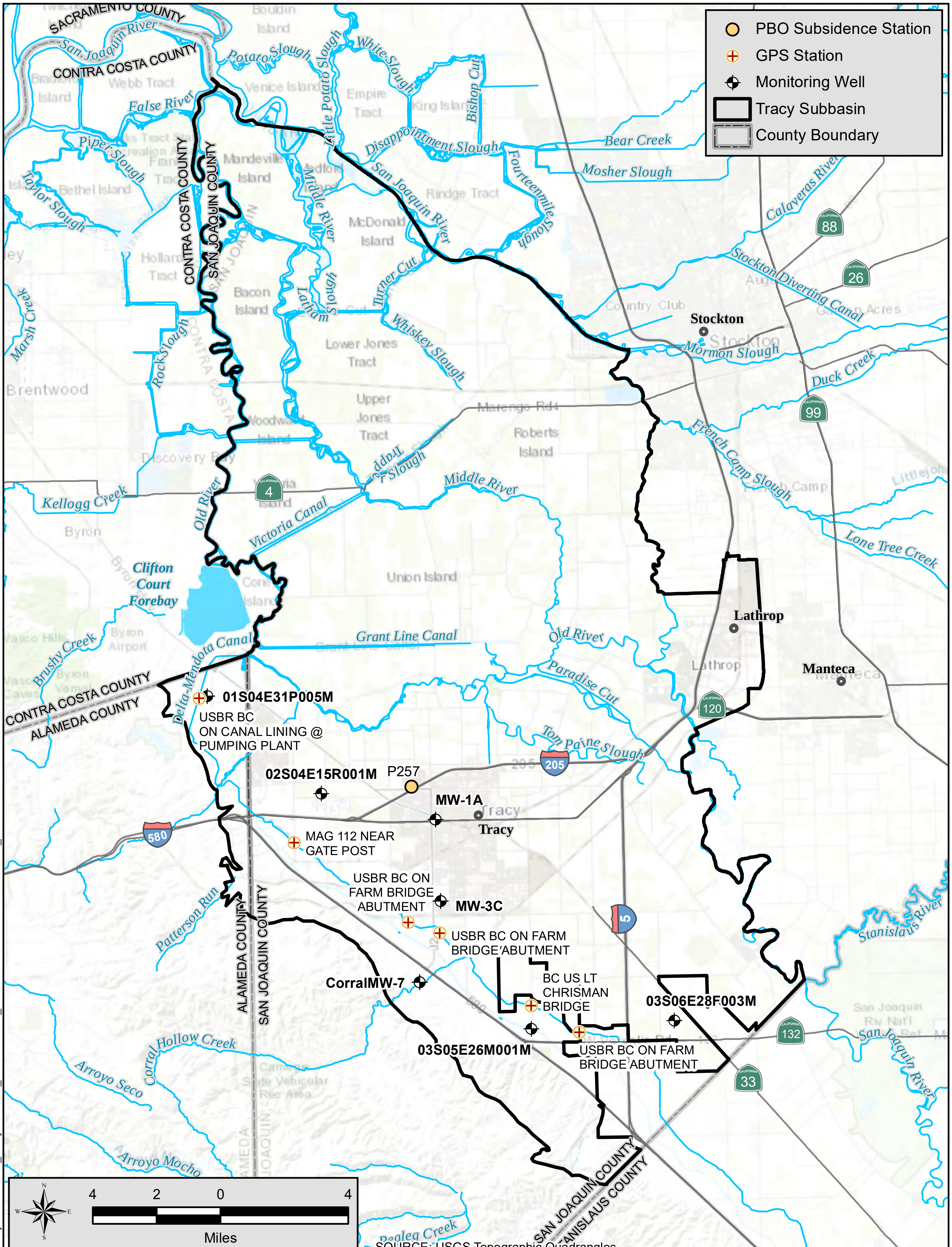
1,2,3 TCP
ESJ-01 - Unknown Aquifer
r_squared 0.39183
Slope = -0.0000387512
Mann-Kendall Trend : no trend
P Value: 0.80650
Mann-Kendall S Value: 2.0
1,2,3 TCP (Ug/L)
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Date



1,2,3 TCP
TRCY-03 - Unknown Aquifer
r_squared 0.10990
Slope = -0.0000190795
Mann-Kendall Trend : no trend
P Value: 1.00000
Mann-Kendall S Value: -1.0
1,2,3 TCP (Ug/L)
Date
0.0
0.2
0.4
0.6
0.8
1.0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020

APPENDIX J

SUBSIDENCE



Z:\Projects\1905394_TracySubbasin_GSP\GSP029_SubsidenceBenchmarkDifferences_20200701.mxd RS

07-Jul-2020

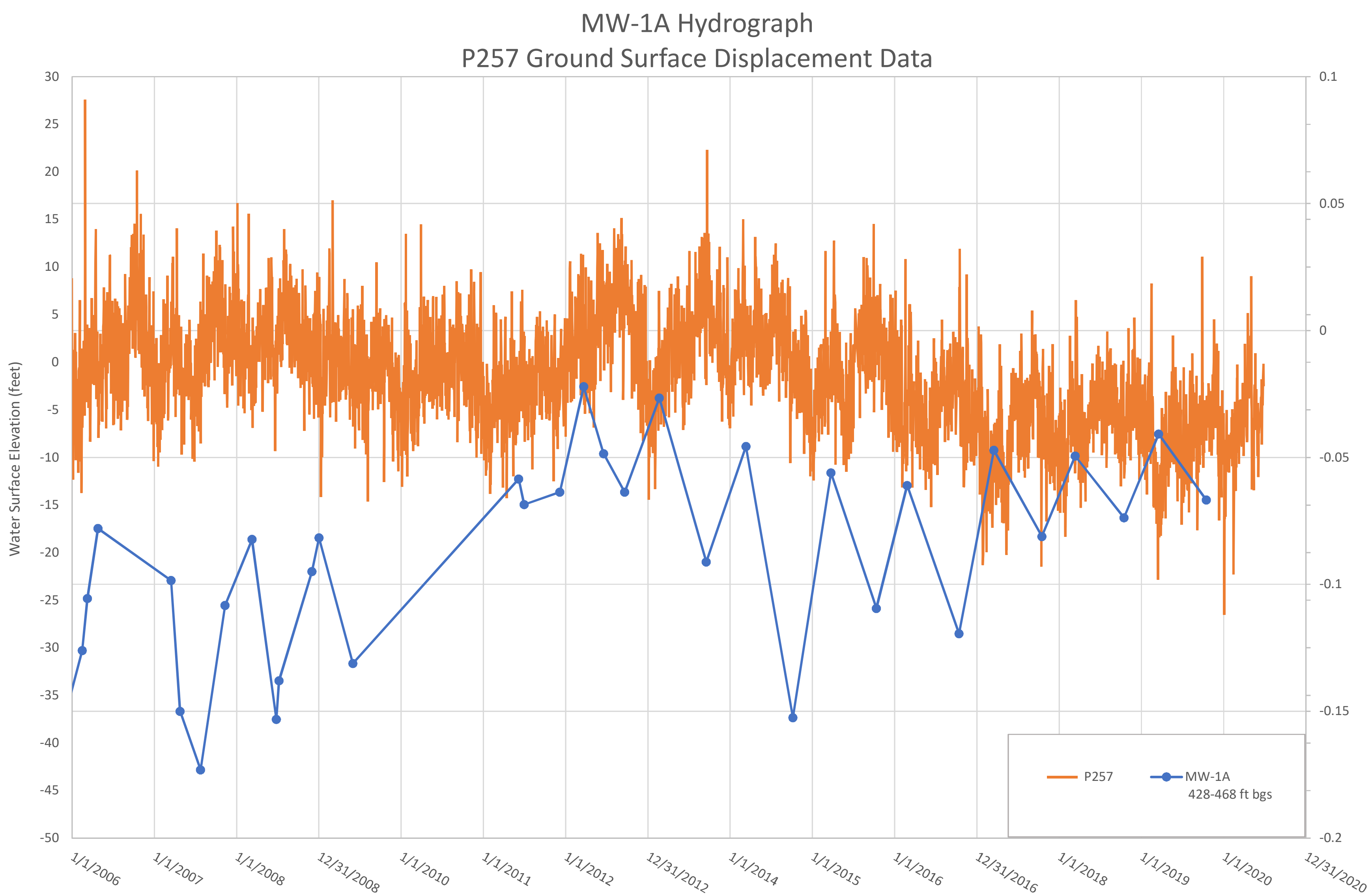
Tracy Subbasin
San Joaquin and Alameda Counties

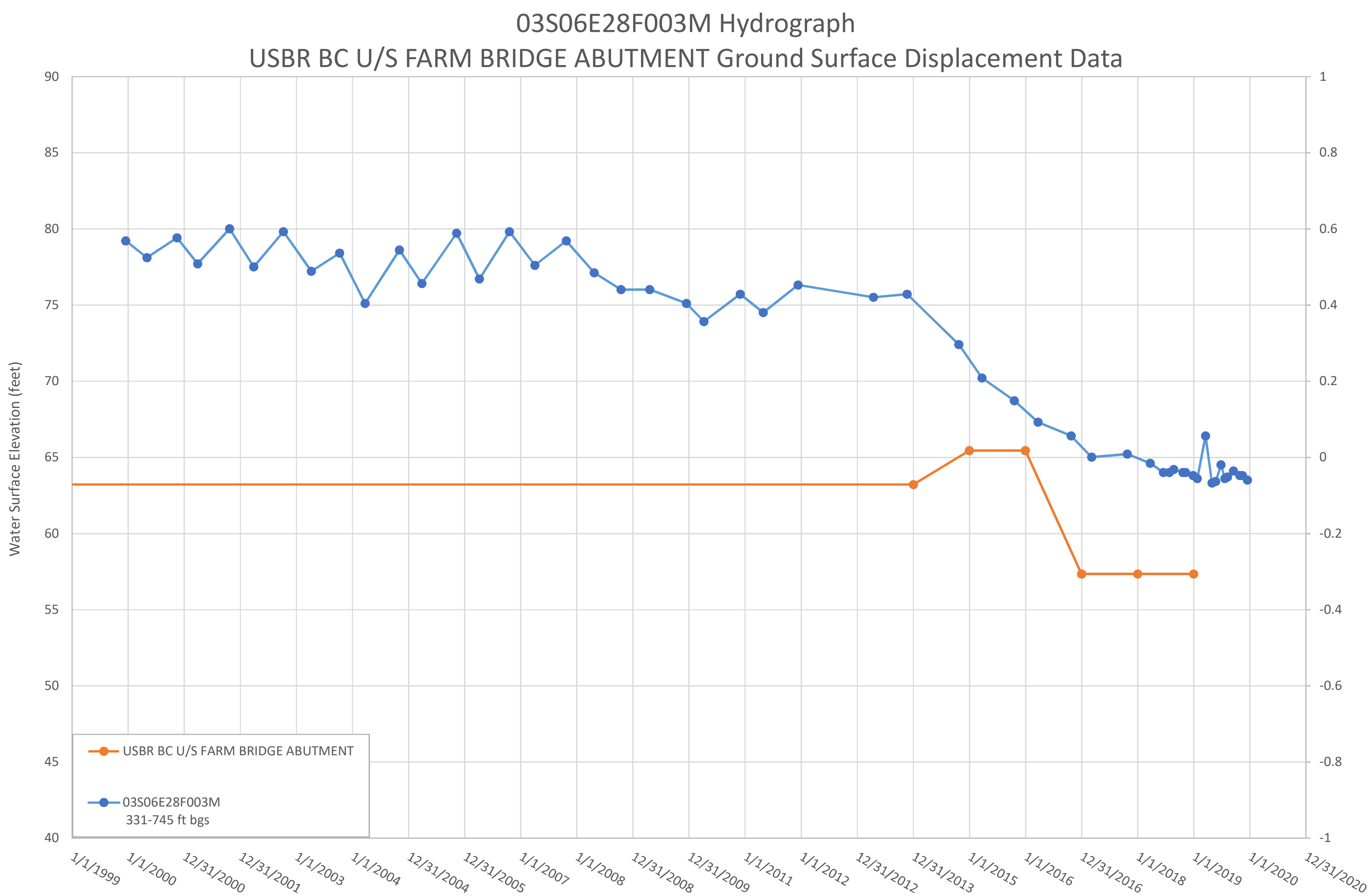
Subsidence Benchmarks with Hydrographs

Tracy Subbasin

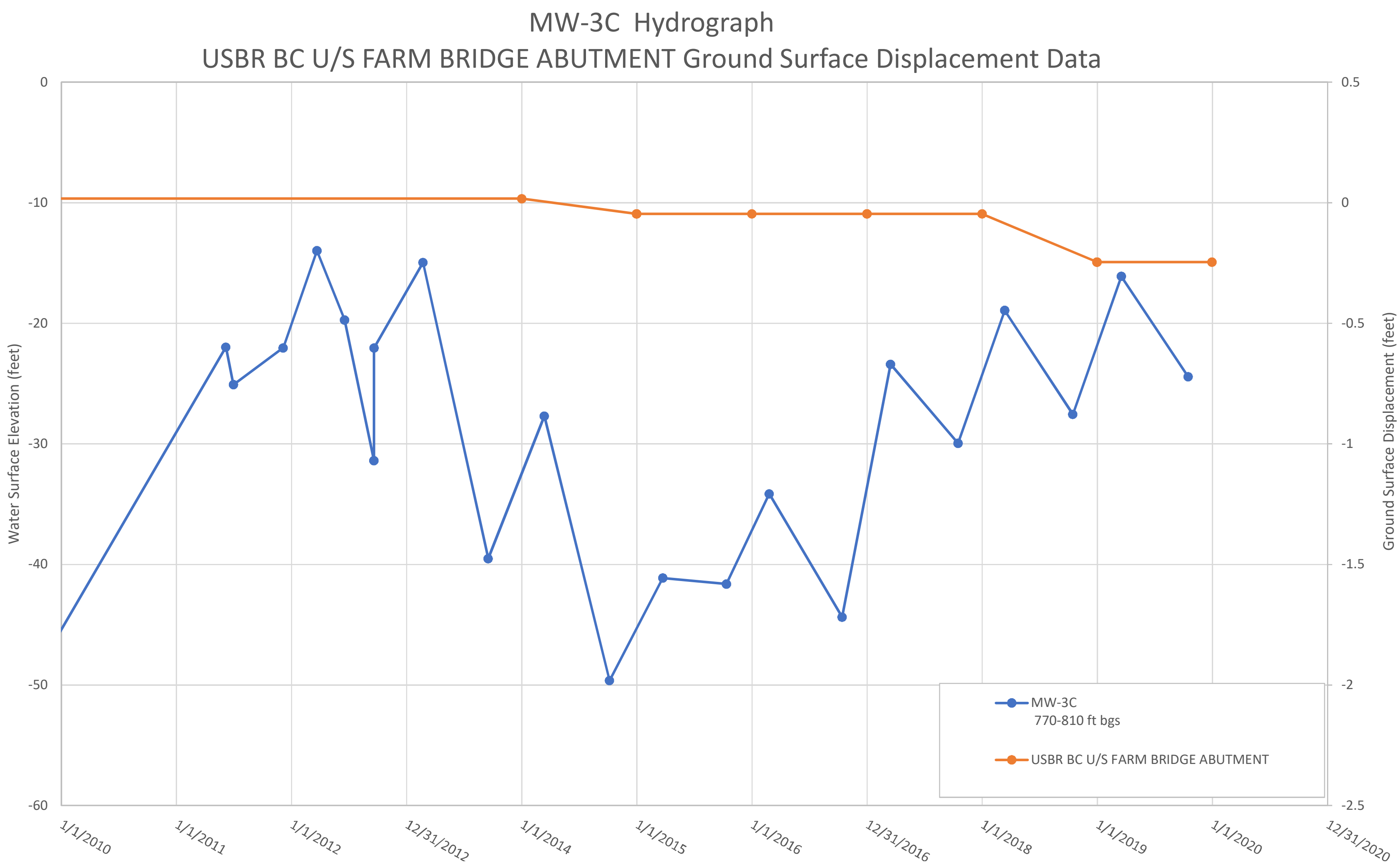
GEI Consultants

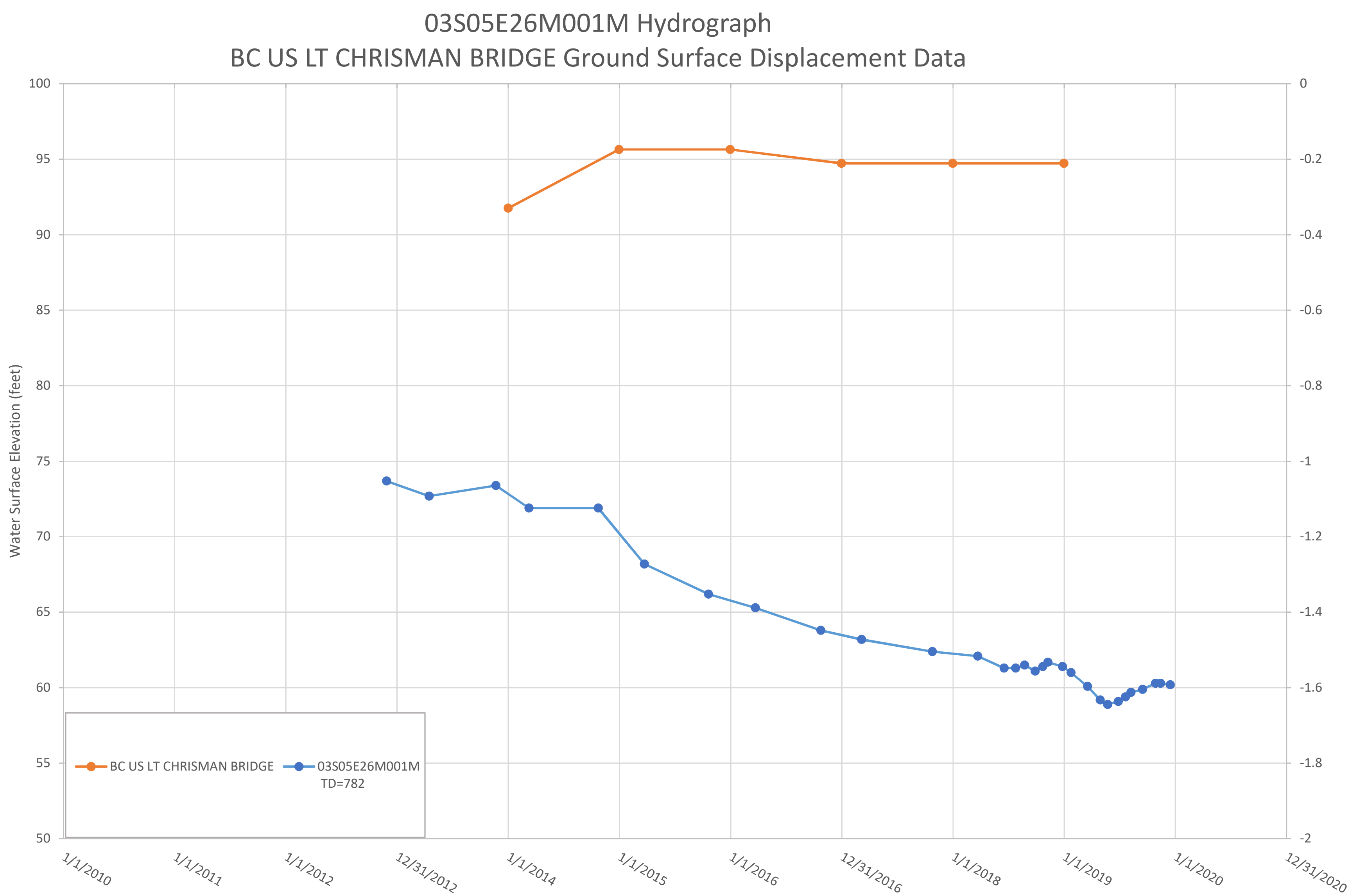
JULY 2020


MW-1A Hydrograph
P257 Ground Surface Displacement Data
Water Surface Elevation (feet)
Ground Surface Displacement (feet)
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
1/1/2006
1/1/2007
1/1/2008
12/31/2008
1/1/2010
1/1/2011
1/1/2012
12/31/2012
1/1/2014
1/1/2015
1/1/2016
12/31/2016
1/1/2018
1/1/2019
1/1/2020
12/31/2020
P257
MW-1A
428-468 ft bgs

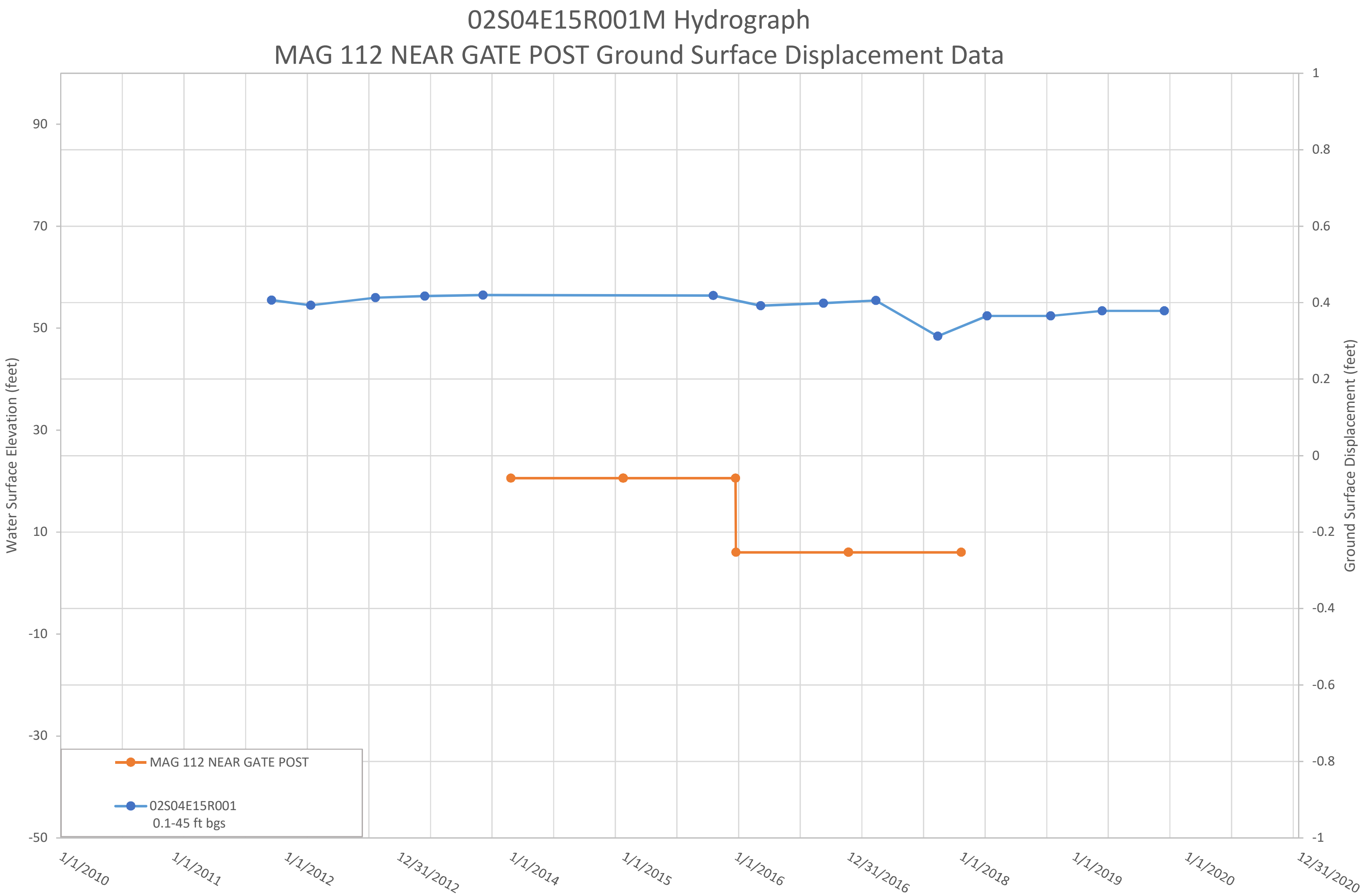


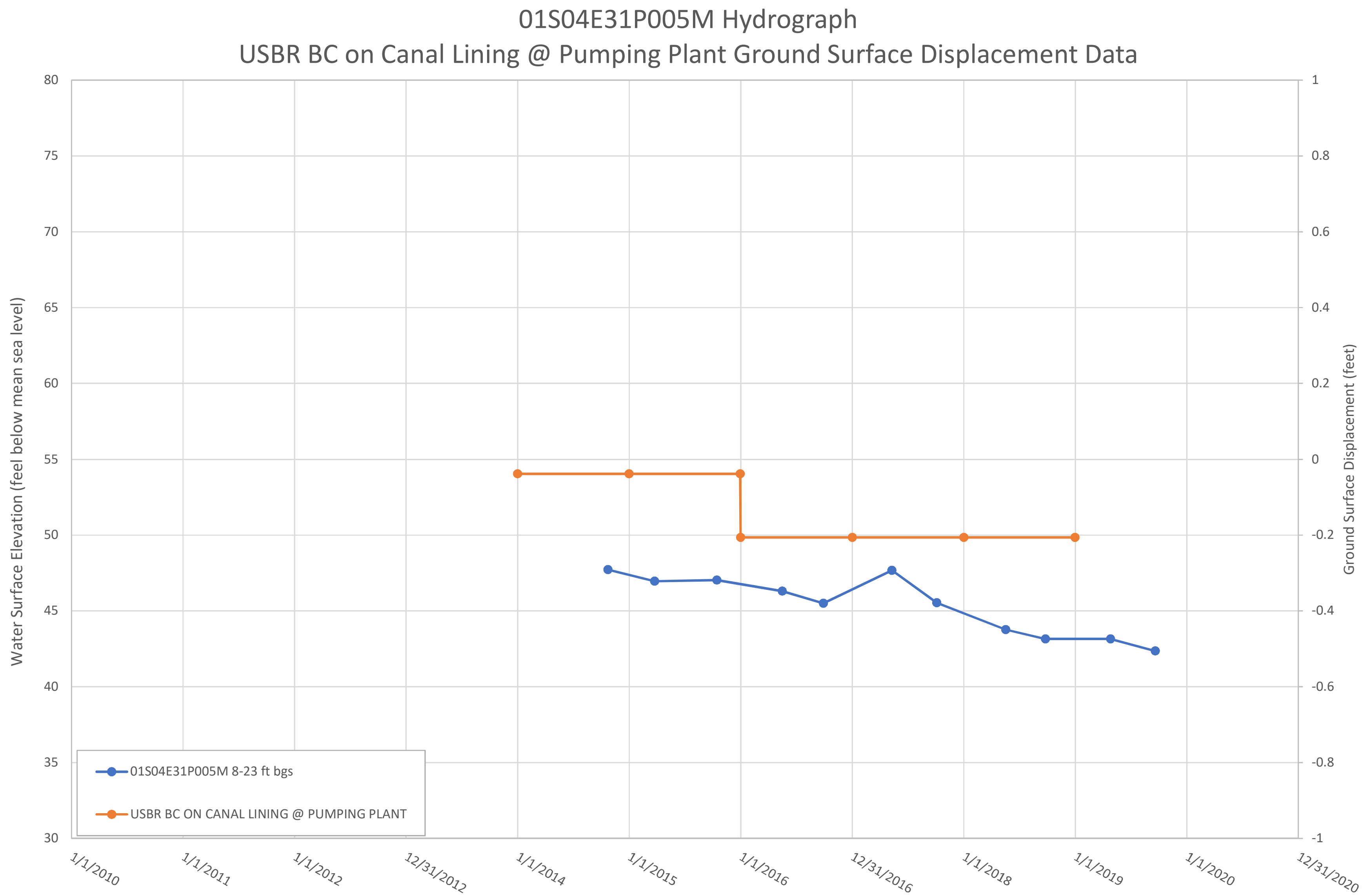
03S06E28F003M Hydrograph
USBR BC U/S FARM BRIDGE ABUTMENT Ground Surface Displacement Data
Water Surface Elevation (feet)
Ground Surface Displacement (feet)
90
85
80
75
70
65
60
55
50
45
40
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1/1/1999
1/1/2000
12/31/2000
12/31/2001
1/1/2003
1/1/2004
12/31/2004
12/31/2005
1/1/2007
1/1/2008
12/31/2008
12/31/2009
1/1/2011
1/1/2012
12/31/2012
12/31/2013
1/1/2015
1/1/2016
12/31/2016
1/1/2018
1/1/2019
1/1/2020
12/31/2020
USBR BC U/S FARM BRIDGE ABUTMENT
03S06E28F003M
331-745 ft bgs


MW-3C Hydrograph
USBR BC U/S FARM BRIDGE ABUTMENT Ground Surface Displacement Data
Water Surface Elevation (feet)
Ground Surface Displacement (feet)
0
-10
-20
-30
-40
-50
-60
0.5
0
-0.5
-1
-1.5
-2
-2.5
1/1/2010
1/1/2011
1/1/2012
12/31/2012
1/1/2014
1/1/2015
1/1/2016
12/31/2016
1/1/2018
1/1/2019
1/1/2020
12/31/2020
MW-3C
770-810 ft bgs
USBR BC U/S FARM BRIDGE ABUTMENT

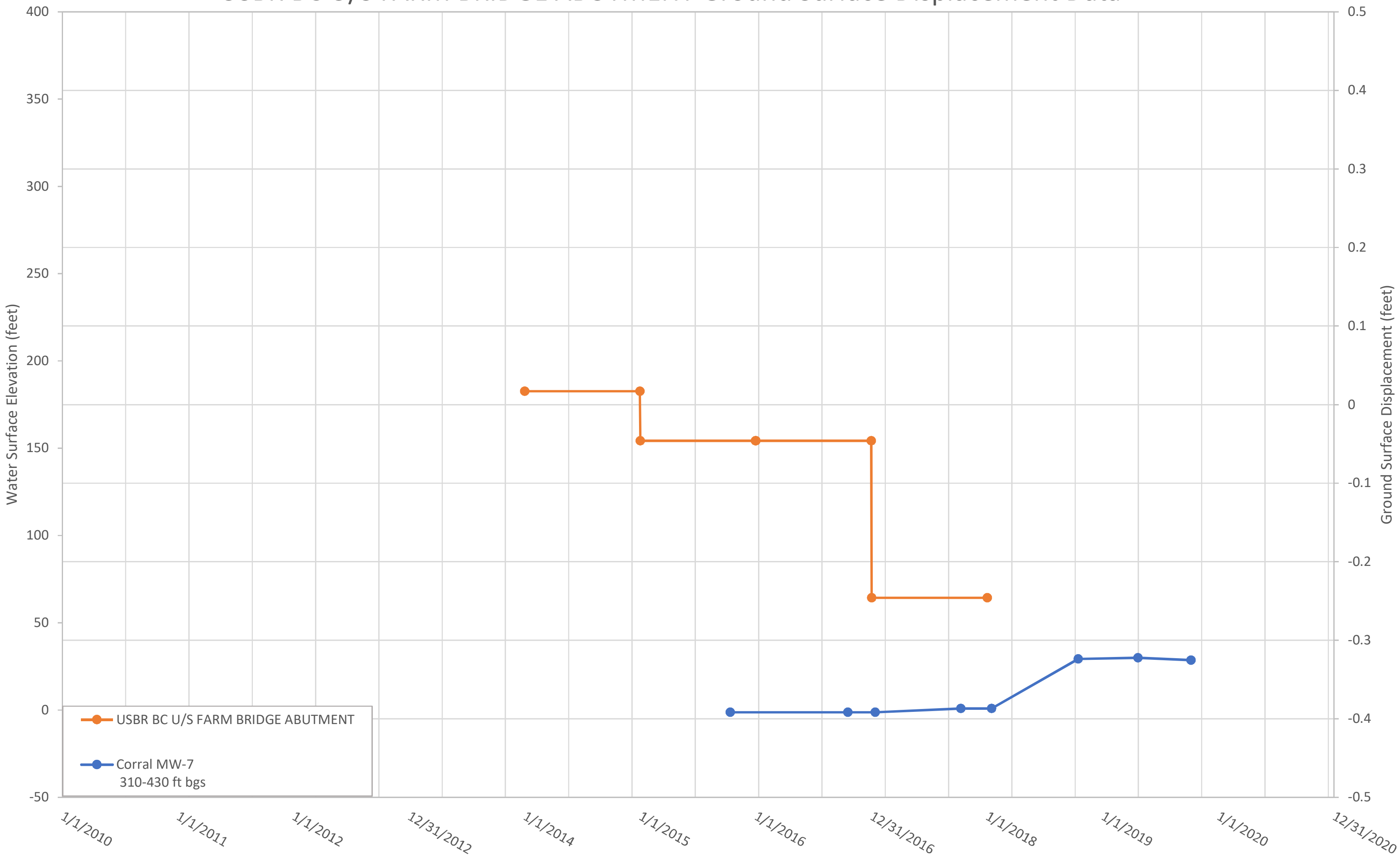


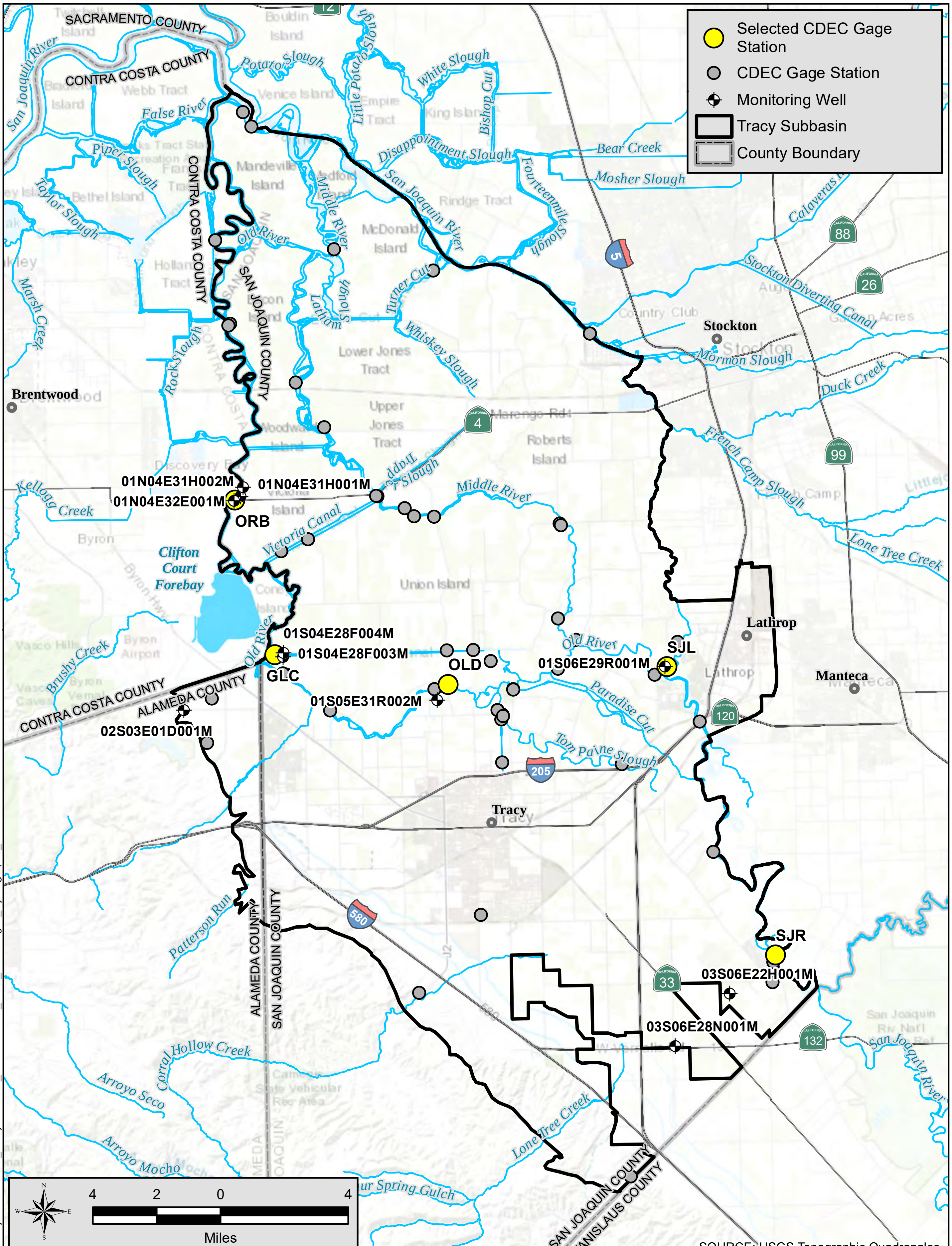
03S05E26M001M Hydrograph
BC US LT CHRISMAN BRIDGE Ground Surface Displacement Data
Water Surface Elevation (feet)
Ground Surface Displacement (feet)
100
95
90
85
80
75
70
65
60
55
50
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
1/1/2010
1/1/2011
1/1/2012
12/31/2012
1/1/2014
1/1/2015
1/1/2016
12/31/2016
1/1/2018
1/1/2019
1/1/2020
12/31/2020
BC US LT CHRISMAN BRIDGE
03S05E26M001M TD=782


02S04E15R001M Hydrograph
MAG 112 NEAR GATE POST Ground Surface Displacement Data
Water Surface Elevation (feet)
Ground Surface Displacement (feet)
90
70
50
30
10
-10
-30
-50
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1/1/2010
1/1/2011
1/1/2012
12/31/2012
1/1/2014
1/1/2015
1/1/2016
12/31/2016
1/1/2018
1/1/2019
1/1/2020
12/31/2020
MAG 112 NEAR GATE POST
02S04E15R001
0.1-45 ft bgs


01S04E31P005M Hydrograph
USBR BC on Canal Lining @ Pumping Plant Ground Surface Displacement Data
Water Surface Elevation (feel below mean sea level)
Ground Surface Displacement (feet)
80
75
70
65
60
55
50
45
40
35
30
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1/1/2010
1/1/2011
1/1/2012
12/31/2012
1/1/2014
1/1/2015
1/1/2016
12/31/2016
1/1/2018
1/1/2019
1/1/2020
12/31/2020
01S04E31P005M 8-23 ft bgs
USBR BC ON CANAL LINING @ PUMPING PLANT

Corral MW-7 Hydrograph
USBR BC U/S FARM BRIDGE ABUTMENT Ground Surface Displacement Data





Z:\Projects\1905394_TracySubbasin_GSP\GSP071_GWL_RiverGages_Hydrographs_20200622.mxd RS/PAE

04-Aug-2020

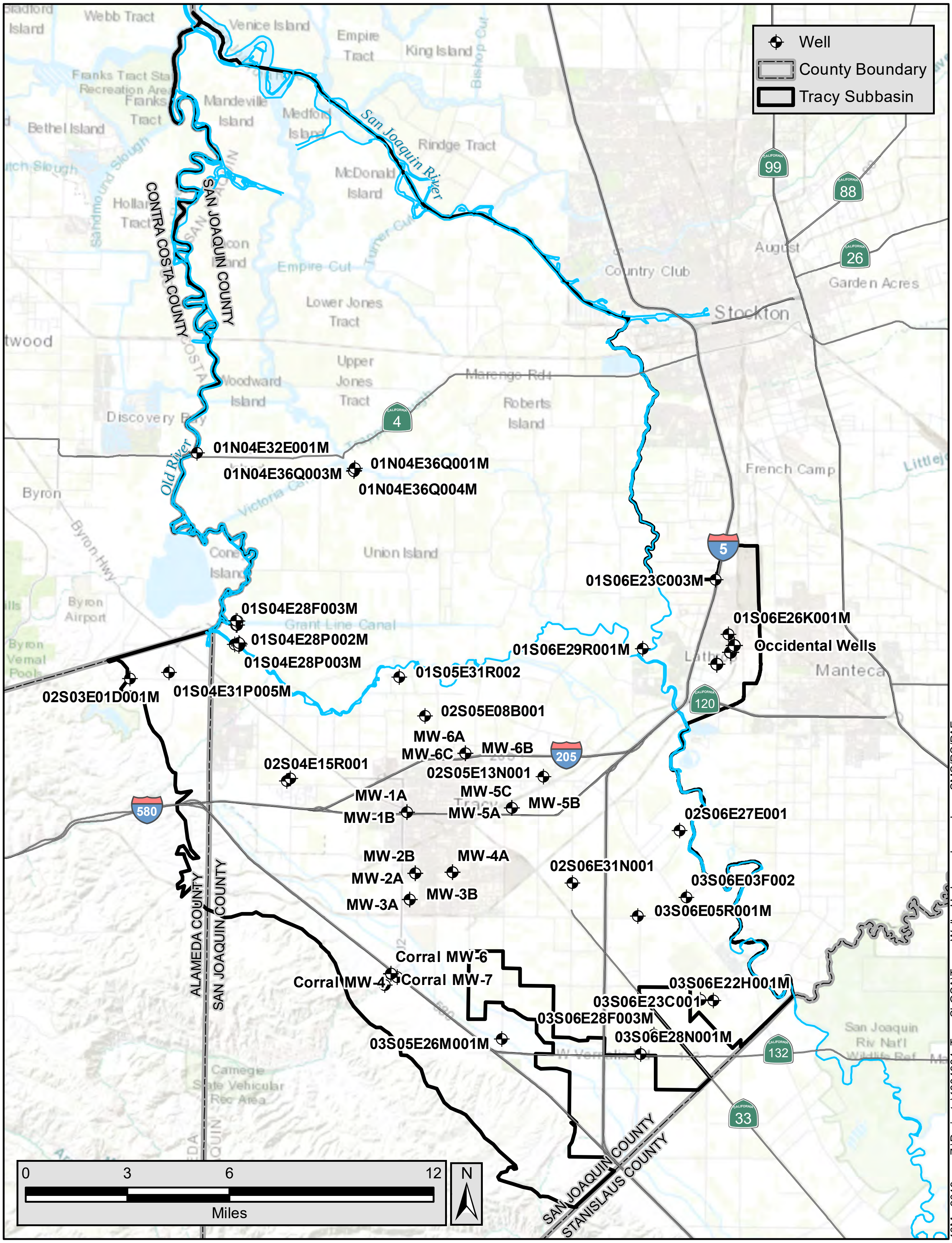
Tracy Subbasin
San Joaquin and Alameda Counties

Tracy Subbasin

GEI Consultants

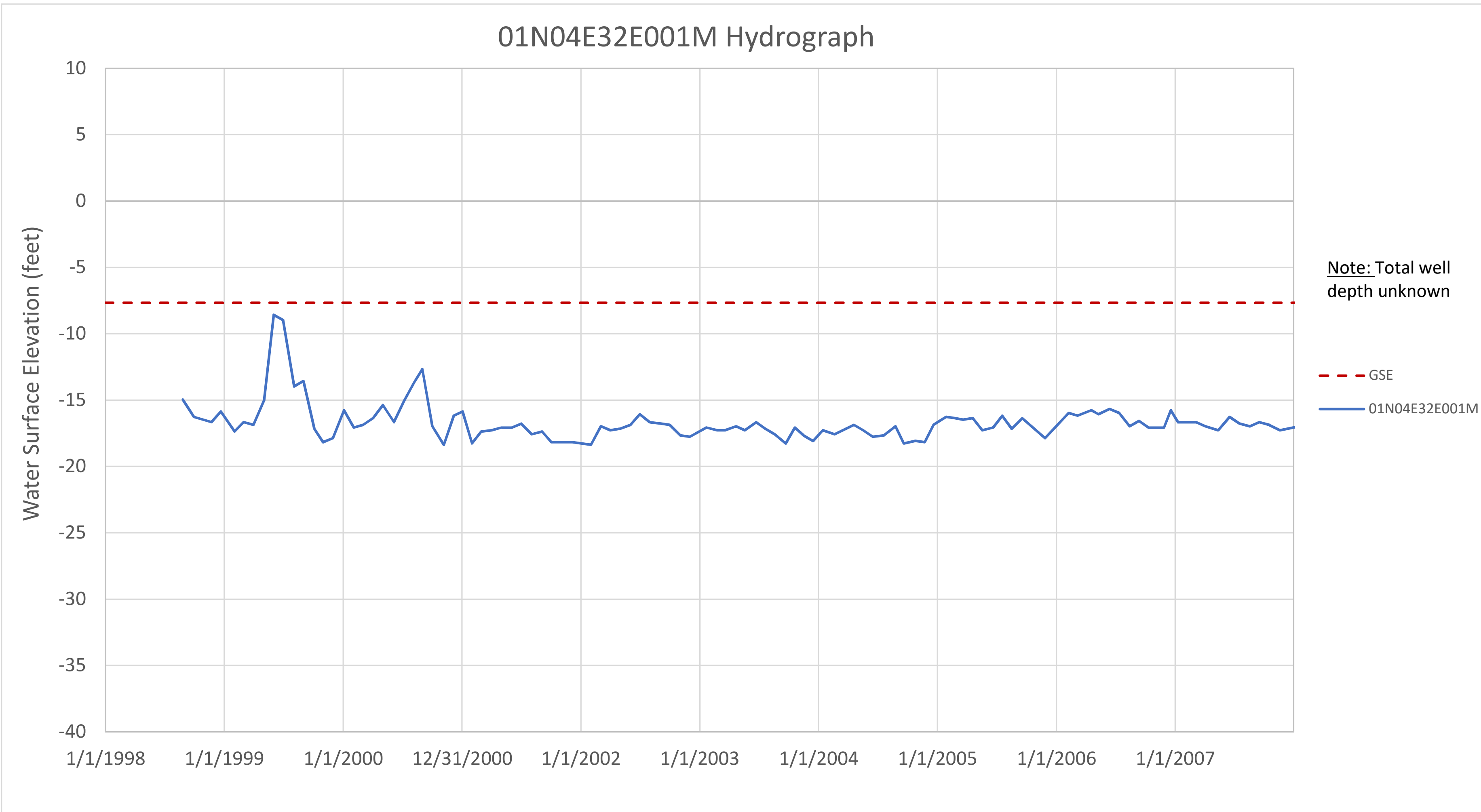
Surface Water/Groundwater Monitoring Locations

JUNE 2020

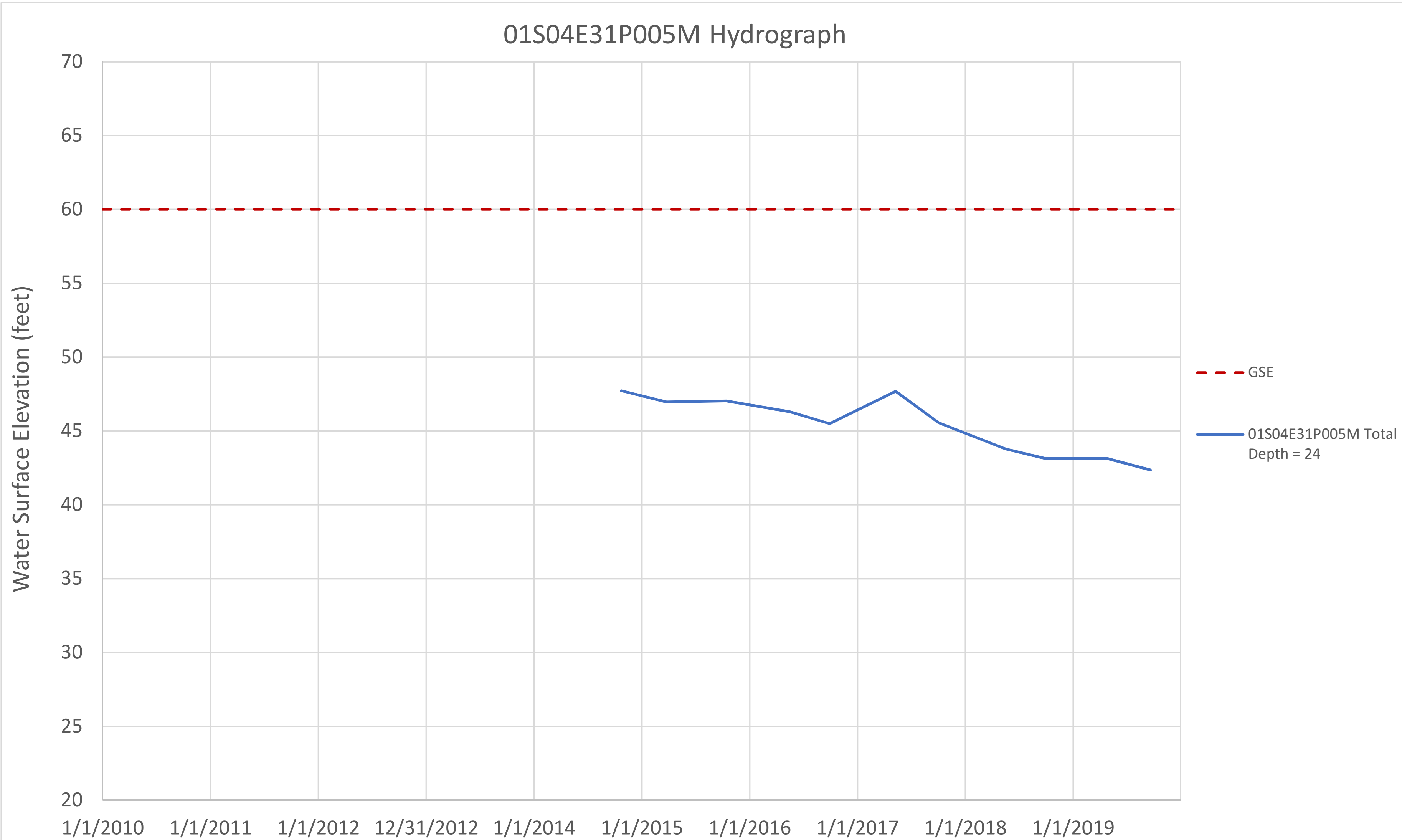


Z:\Projects\1804984_TracySbGSA\Tracy_Wells_Hydrographs.mxd 13Mar2019 SMS/RS/PAE

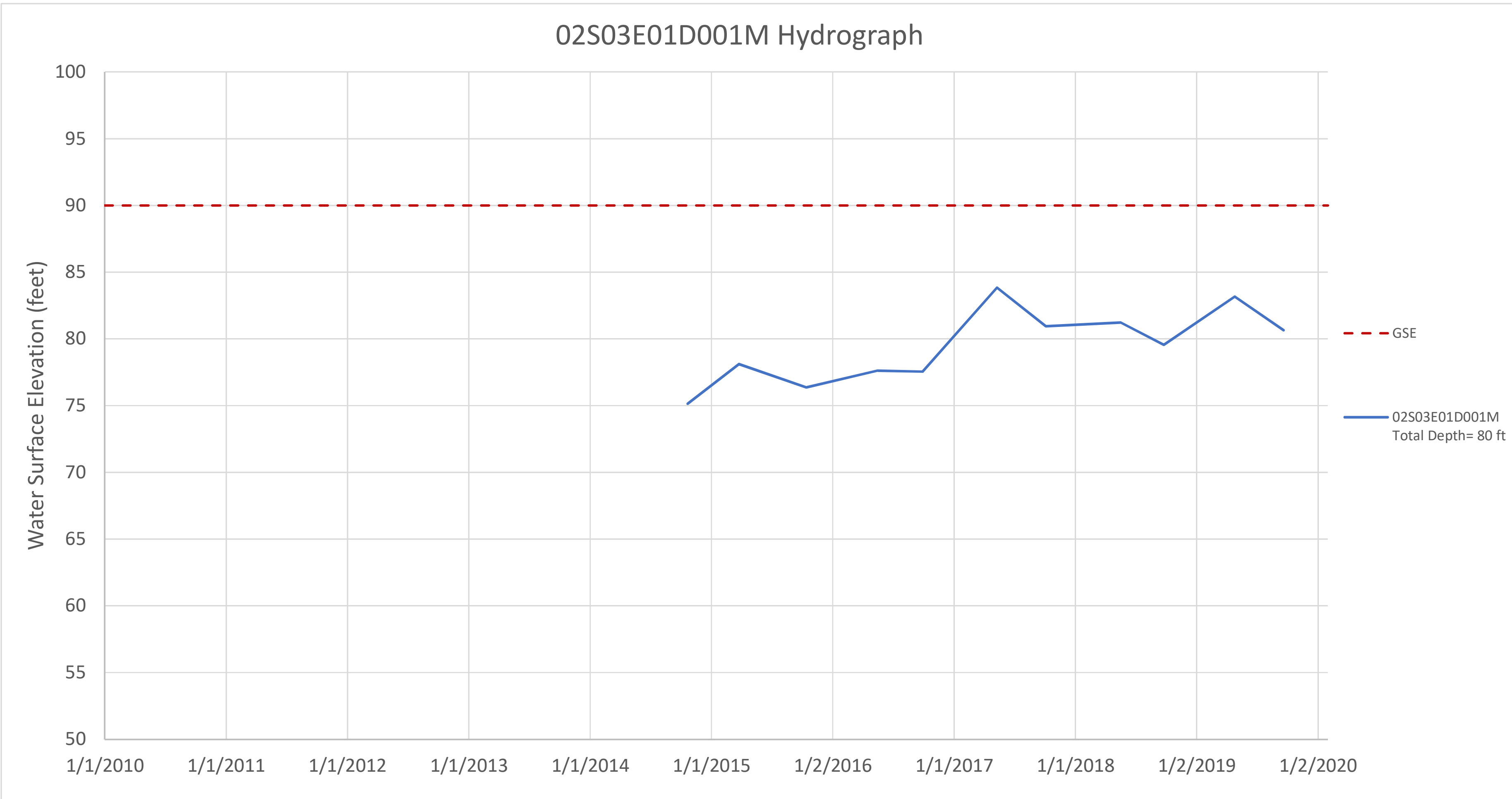
Tracy Subbasin San Joaquin County, CA	GEI Consultants	Wells with Hydrographs
Tracy Subbasin GSAs		JUNE 2020



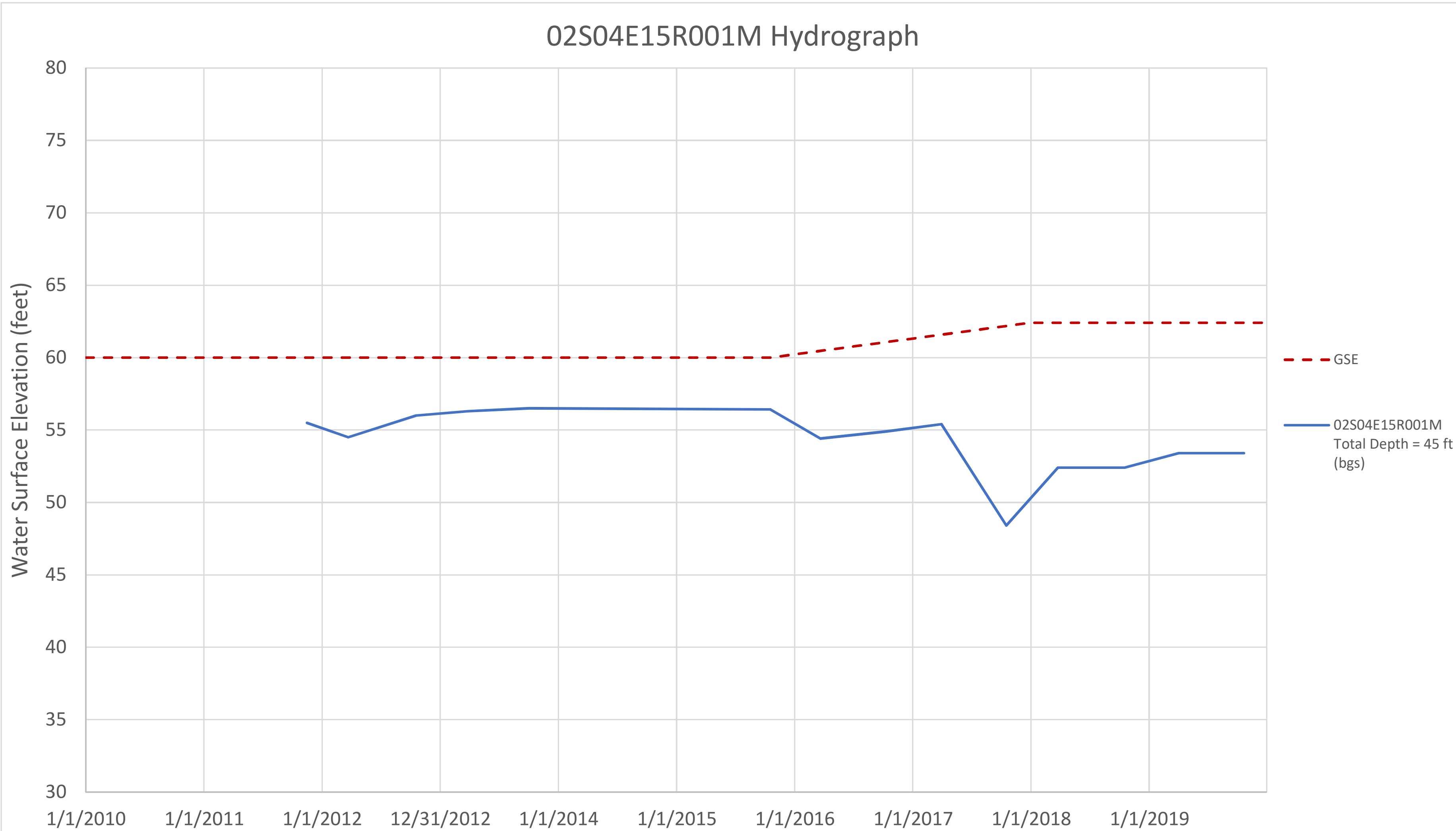
01N04E32E001M Hydrograph
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
Water Surface Elevation (feet)
1/1/1998
1/1/1999
1/1/2000
12/31/2000
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007
Note: Total well depth unknown
GSE
01N04E32E001M



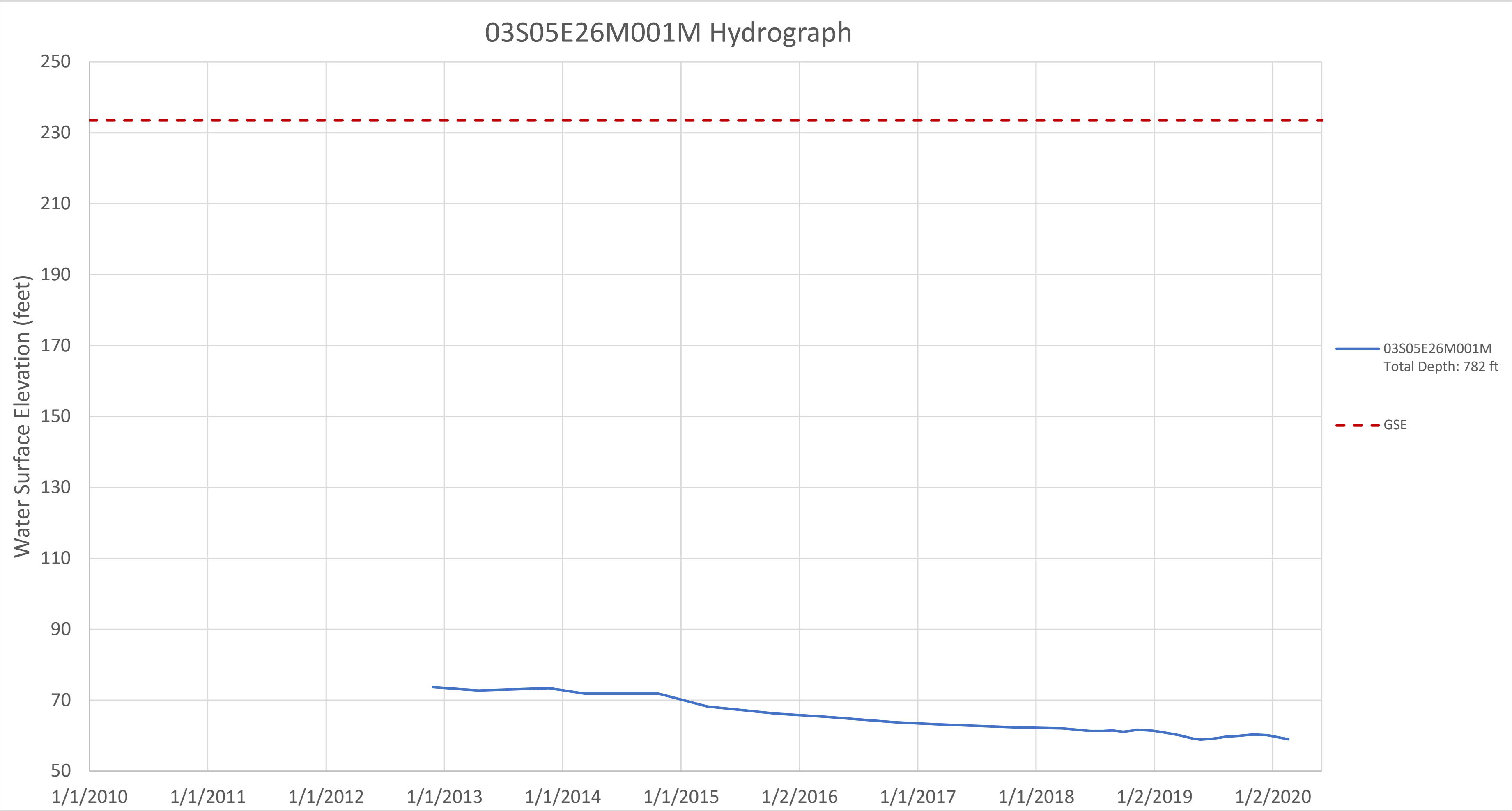
01S04E31P005M Hydrograph
Water Surface Elevation (feet)
70
65
60
55
50
45
40
35
30
25
20
1/1/2010
1/1/2011
1/1/2012
12/31/2012
1/1/2014
1/1/2015
1/1/2016
1/1/2017
1/1/2018
1/1/2019
GSE
01S04E31P005M Total Depth = 24



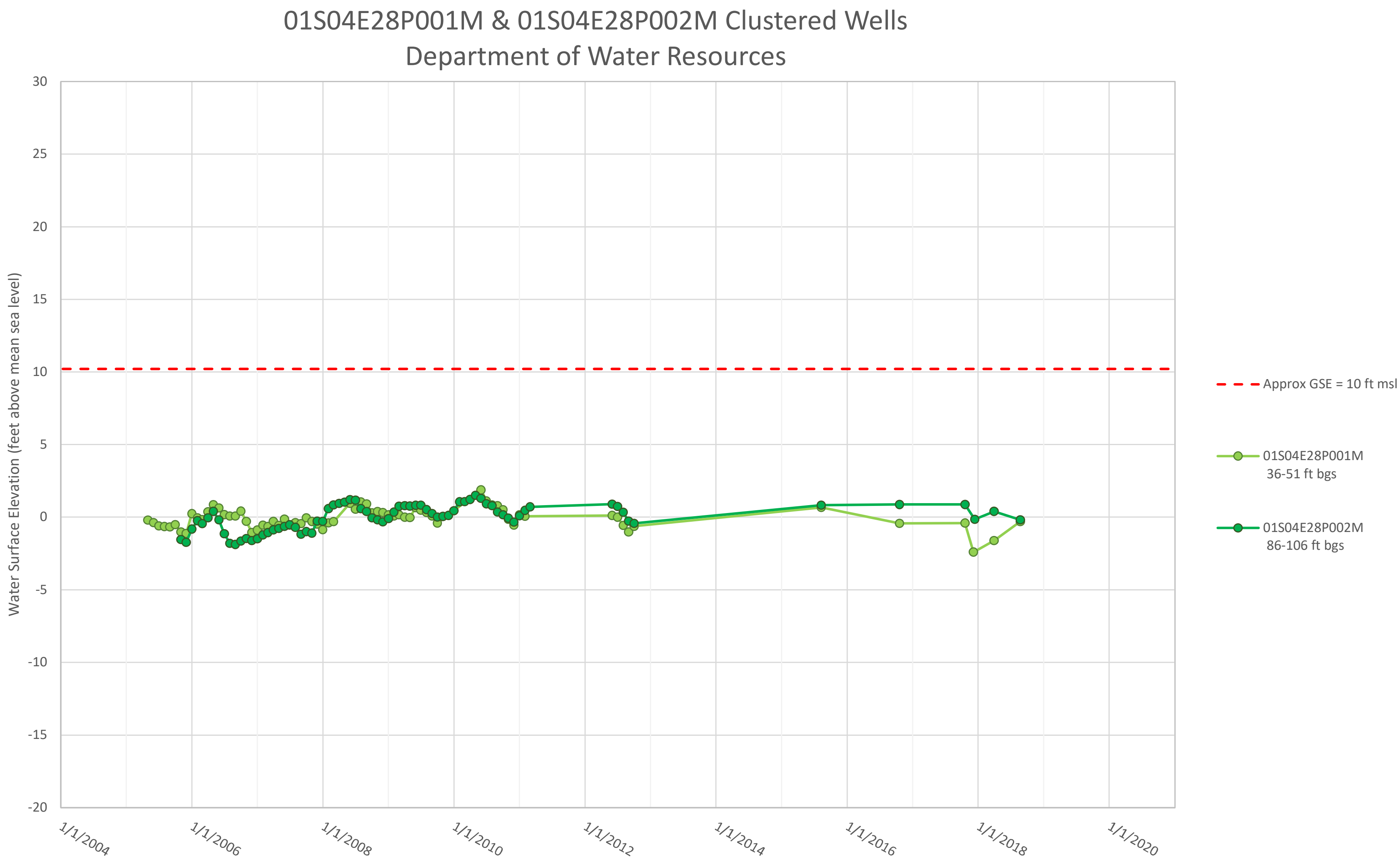
02S03E01D001M Hydrograph
Water Surface Elevation (feet)
100
95
90
85
80
75
70
65
60
55
50
1/1/2010
1/1/2011
1/1/2012
1/1/2013
1/1/2014
1/1/2015
1/2/2016
1/1/2017
1/1/2018
1/2/2019
1/2/2020
GSE
02S03E01D001M
Total Depth= 80 ft

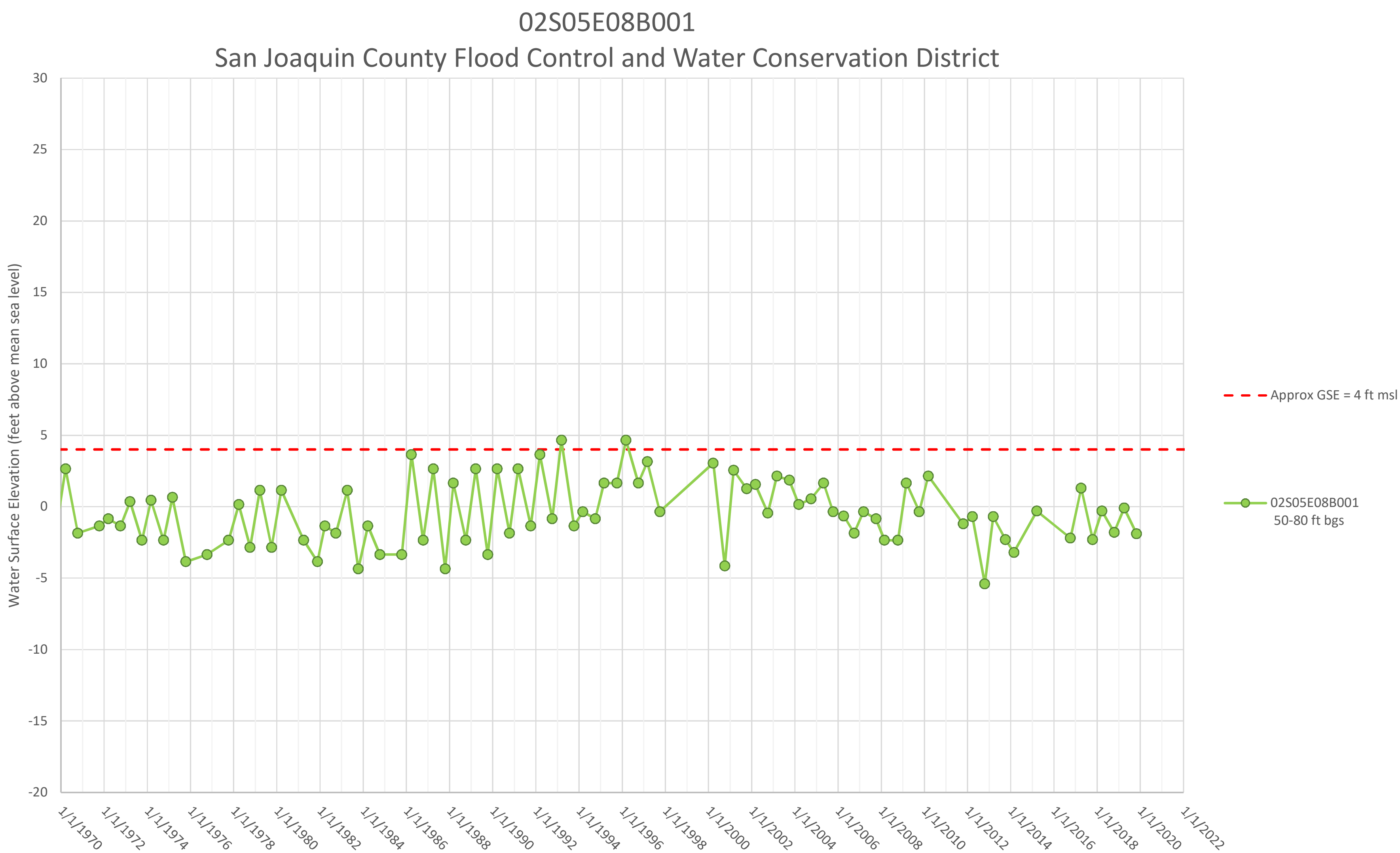


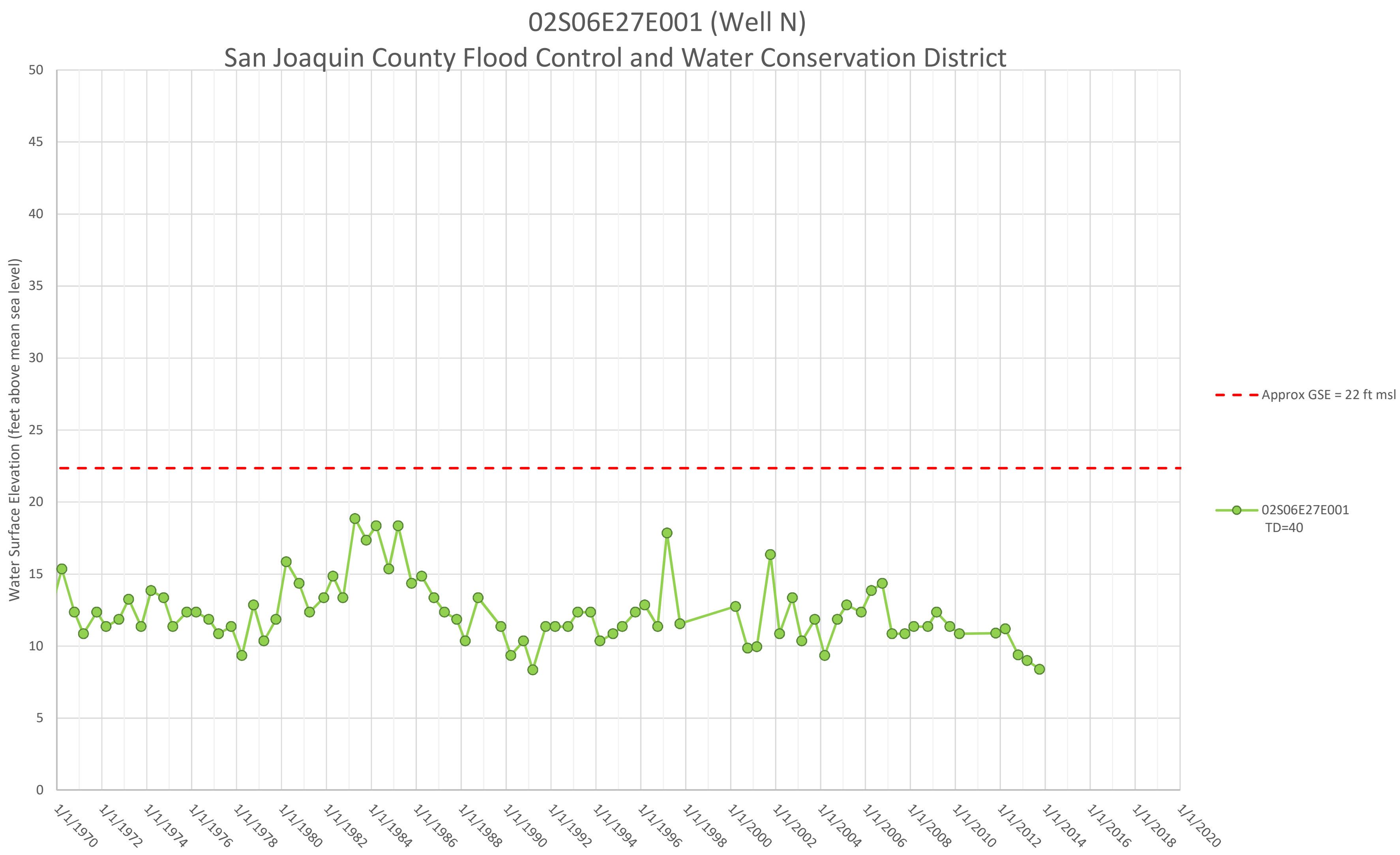
02S04E15R001M Hydrograph
Water Surface Elevation (feet)
80
75
70
65
60
55
50
45
40
35
30
1/1/2010
1/1/2011
1/1/2012
12/31/2012
1/1/2014
1/1/2015
1/1/2016
1/1/2017
1/1/2018
1/1/2019
GSE
02S04E15R001M
Total Depth = 45 ft
(bgs)

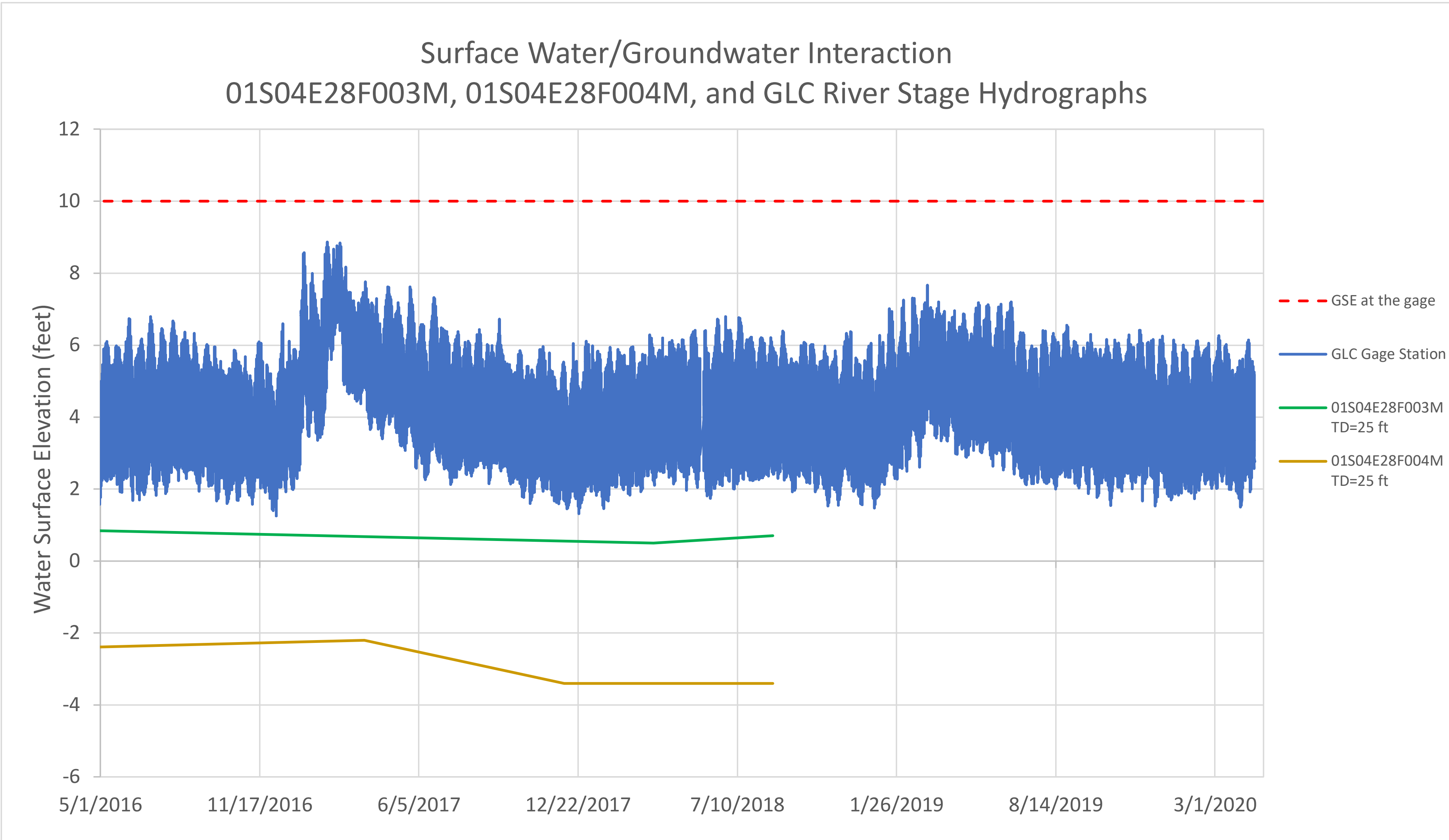


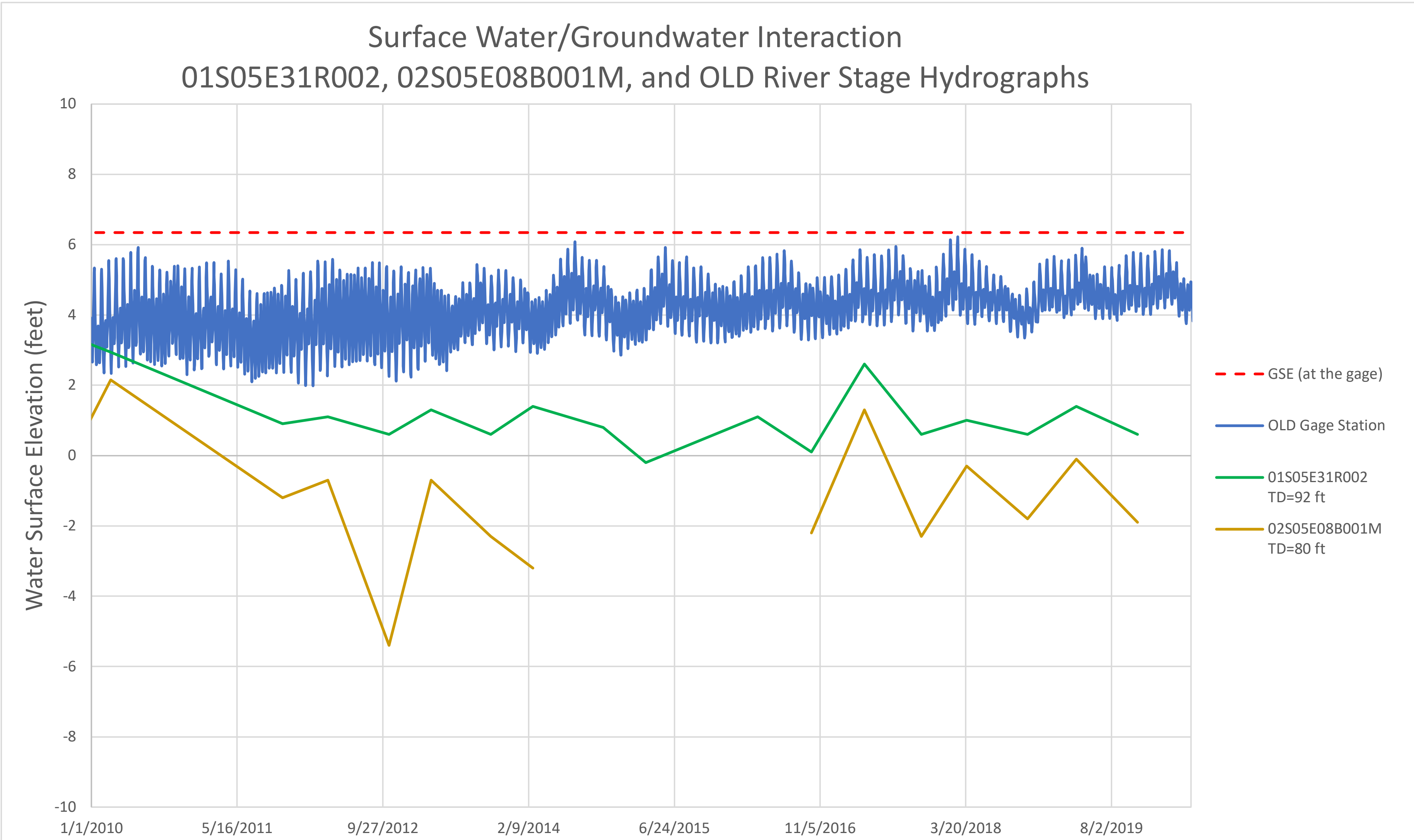
03S05E26M001M Hydrograph
Water Surface Elevation (feet)
250
230
210
190
170
150
130
110
90
70
50
1/1/2010
1/1/2011
1/1/2012
1/1/2013
1/1/2014
1/1/2015
1/2/2016
1/1/2017
1/1/2018
1/2/2019
1/2/2020
03S05E26M001M
Total Depth: 782 ft
GSE


01S04E28P001M & 01S04E28P002M Clustered Wells
Department of Water Resources
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 10 ft msl
01S04E28P001M
36-51 ft bgs
01S04E28P002M
86-106 ft bgs

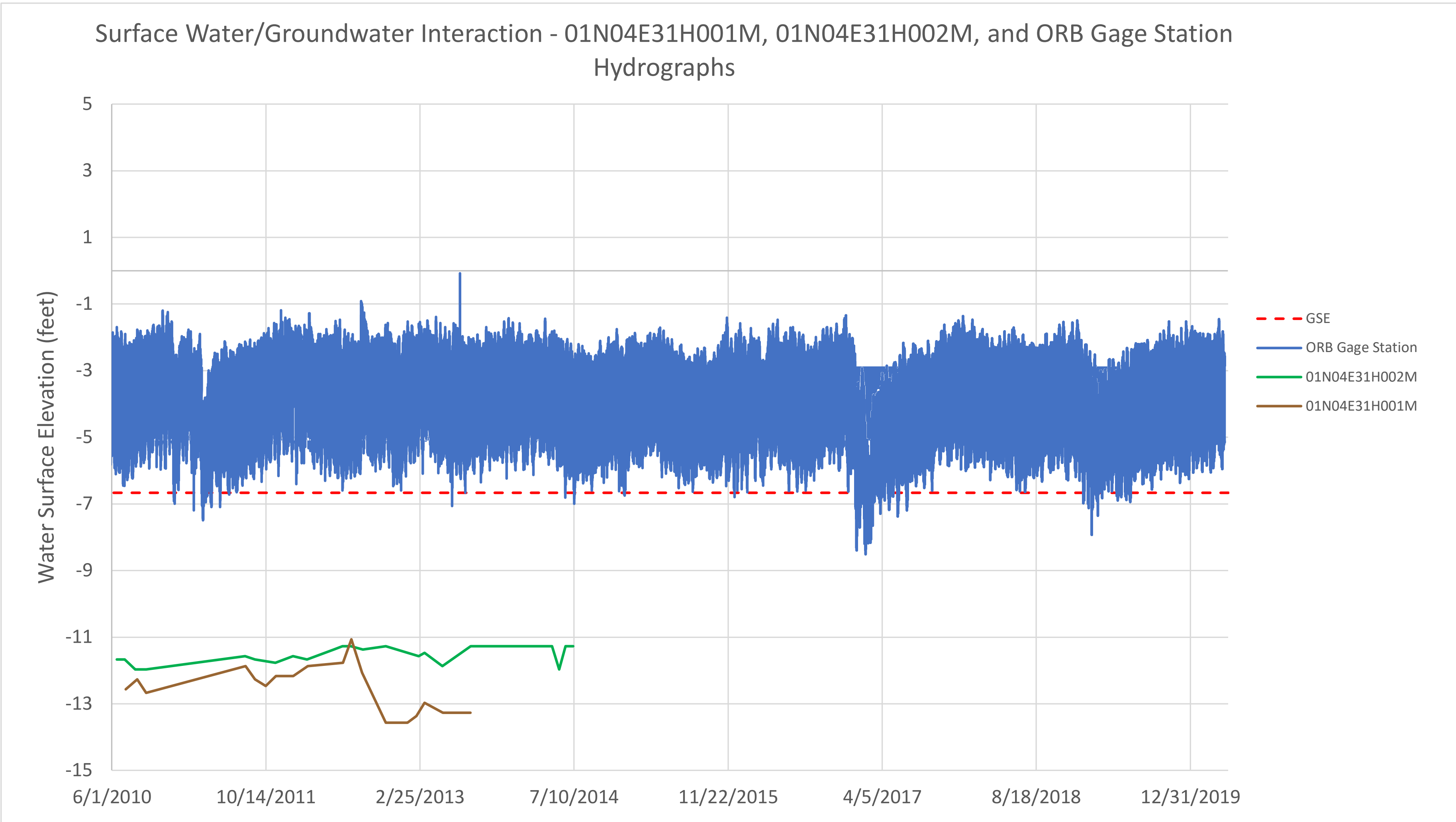

02S05E08B001
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
-15
-20
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
1/1/2022
Approx GSE = 4 ft msl
02S05E08B001
50-80 ft bgs


02S06E27E001 (Well N)
San Joaquin County Flood Control and Water Conservation District
Water Surface Elevation (feet above mean sea level)
50
45
40
35
30
25
20
15
10
5
0
1/1/1970
1/1/1972
1/1/1974
1/1/1976
1/1/1978
1/1/1980
1/1/1982
1/1/1984
1/1/1986
1/1/1988
1/1/1990
1/1/1992
1/1/1994
1/1/1996
1/1/1998
1/1/2000
1/1/2002
1/1/2004
1/1/2006
1/1/2008
1/1/2010
1/1/2012
1/1/2014
1/1/2016
1/1/2018
1/1/2020
Approx GSE = 22 ft msl
02S06E27E001
TD=40

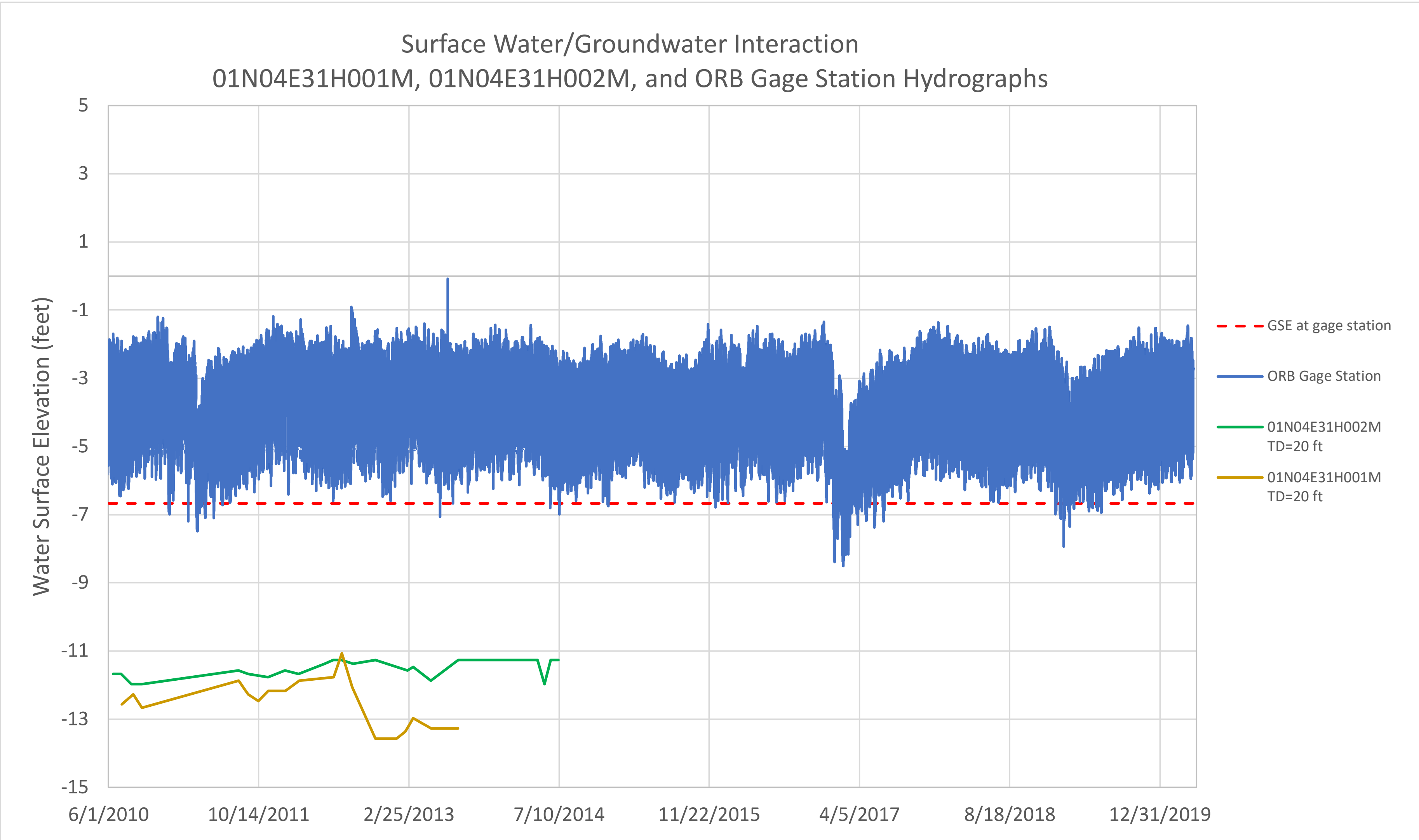

Surface Water/Groundwater Interaction
01S04E28F003M, 01S04E28F004M, and GLC River Stage Hydrographs
Water Surface Elevation (feet)
12
10
8
6
4
2
0
-2
-4
-6
5/1/2016
11/17/2016
6/5/2017
12/22/2017
7/10/2018
1/26/2019
8/14/2019
3/1/2020
GSE at the gage
GLC Gage Station
01S04E28F003M TD=25 ft
01S04E28F004M TD=25 ft

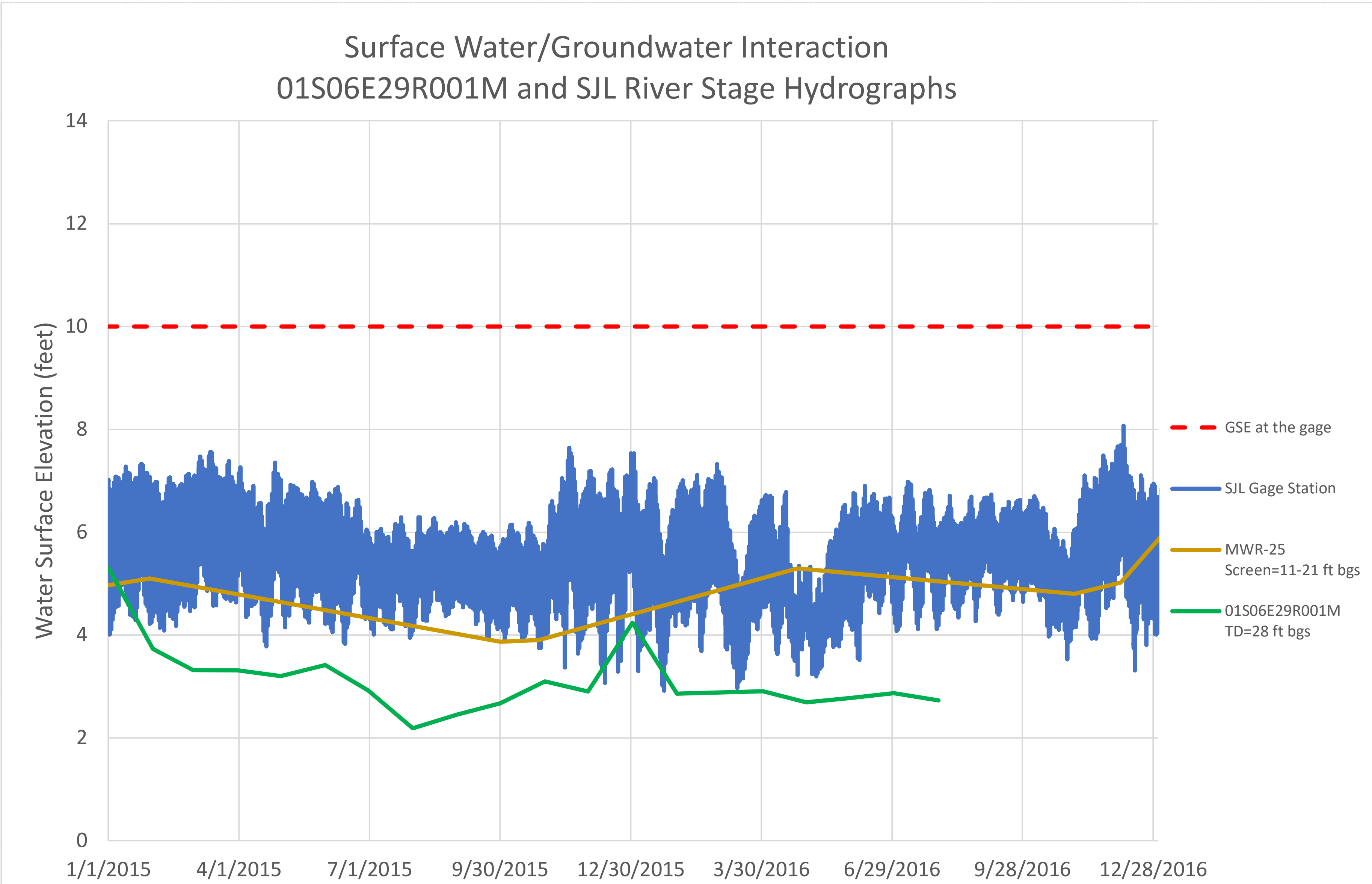


Surface Water/Groundwater Interaction
01S05E31R002, 02S05E08B001M, and OLD River Stage Hydrographs
Water Surface Elevation (feet)
10
8
6
4
2
0
-2
-4
-6
-8
-10
1/1/2010
5/16/2011
9/27/2012
2/9/2014
6/24/2015
11/5/2016
3/20/2018
8/2/2019
GSE (at the gage)
OLD Gage Station
01S05E31R002 TD=92 ft
02S05E08B001M TD=80 ft

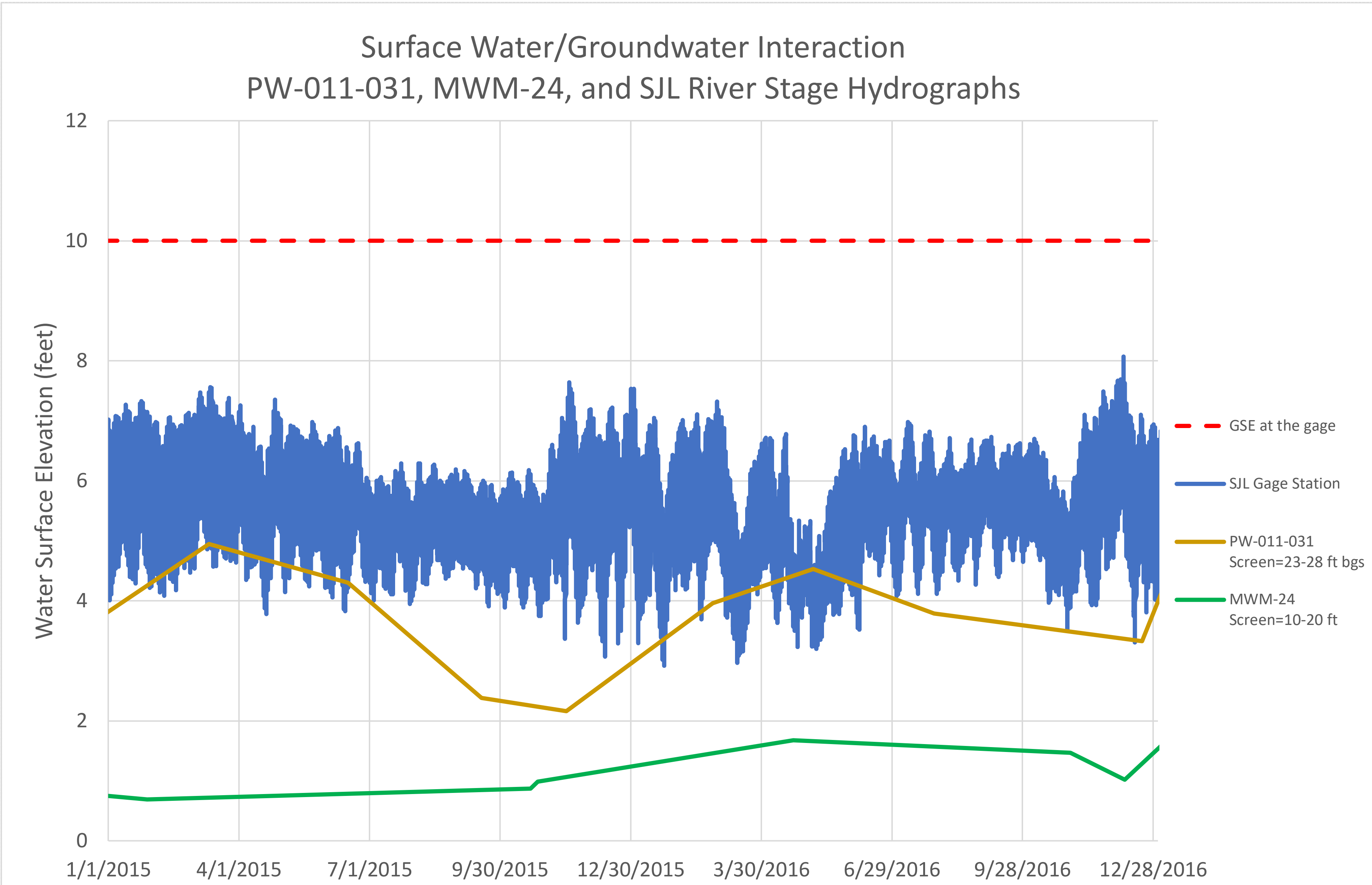


Surface Water/Groundwater Interaction - 01N04E31H001M, 01N04E31H002M, and ORB Gage Station Hydrographs
Water Surface Elevation (feet)
5
3
1
-1
-3
-5
-7
-9
-11
-13
-15
6/1/2010
10/14/2011
2/25/2013
7/10/2014
11/22/2015
4/5/2017
8/18/2018
12/31/2019
GSE
ORB Gage Station
01N04E31H002M
01N04E31H001M


Surface Water/Groundwater Interaction
01N04E31H001M, 01N04E31H002M, and ORB Gage Station Hydrographs
Water Surface Elevation (feet)
5
3
1
-1
-3
-5
-7
-9
-11
-13
-15
6/1/2010
10/14/2011
2/25/2013
7/10/2014
11/22/2015
4/5/2017
8/18/2018
12/31/2019
GSE at gage station
ORB Gage Station
01N04E31H002M TD=20 ft
01N04E31H001M TD=20 ft



Surface Water/Groundwater Interaction
01S06E29R001M and SJL River Stage Hydrographs
Water Surface Elevation (feet)
14
12
10
8
6
4
2
0
1/1/2015
4/1/2015
7/1/2015
9/30/2015
12/30/2015
3/30/2016
6/29/2016
9/28/2016
12/28/2016
GSE at the gage
SJL Gage Station
MWR-25
Screen=11-21 ft bgs
01S06E29R001M
TD=28 ft bgs


Surface Water/Groundwater Interaction
PW-011-031, MWM-24, and SJL River Stage Hydrographs
Water Surface Elevation (feet)
12
10
8
6
4
2
0
1/1/2015
4/1/2015
7/1/2015
9/30/2015
12/30/2015
3/30/2016
6/29/2016
9/28/2016
12/28/2016
GSE at the gage
SJL Gage Station
PW-011-031
Screen=23-28 ft bgs
MWM-24
Screen=10-20 ft

APPENDIX L

POTENTIAL GDE SPECIES

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Bouldin Island (3812115) OR Terminous (3812114) OR Woodward Island (3712185) OR Holt (3712184) OR Stockton West (3712183) OR Union Island (3712174) OR Lathrop (3712173) OR Clifton Court Forebay (3712175) OR Midway (3712165) OR Spalding Tract (4012067) OR Tracy (3712164) OR Vernalis (3712163) OR Ripon (3712162) OR Lone Tree Creek (3712154) OR Solyo (3712153))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Accipiter gentilis northern goshawk	ABNKC12060	None	None	G5	S3	SSC
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G2G3	S1S2	SSC
Alkali Meadow Alkali Meadow	CTT45310CA	None	None	G3	S2.1	
Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	WL
Amsinckia grandiflora large-flowered fiddleneck	PDBOR01050	Endangered	Endangered	G1	S1	1B.1
Anniella pulchra northern California legless lizard	ARACC01020	None	None	G3	S3	SSC
Anthicus sacramento Sacramento anthicid beetle	IICOL49010	None	None	G1	S1	
Antigone canadensis tabida greater sandhill crane	ABNMK01014	None	Threatened	G5T4	S2	FP
Antrozous pallidus pallid bat	AMACC10010	None	None	G5	S3	SSC
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Ardea herodias great blue heron	ABNGA04010	None	None	G5	S4	
Arizona elegans occidentalis California glossy snake	ARADB01017	None	None	G5T2	S2	SSC
Asio flammeus short-eared owl	ABNSB13040	None	None	G5	S3	SSC
Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1	None	None	G2T1	S1	1B.2
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Atriplex cordulata var. cordulata heartscale	PDCHE040B0	None	None	G3T2	S2	1B.2
Atriplex minuscula lesser saltscale	PDCHE042M0	None	None	G2	S2	1B.1
Blepharizonia plumosa big tarplant	PDAST1C011	None	None	G1G2	S1S2	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Bombus crotchii Crotch bumble bee	IIHYM24480	None	Candidate Endangered	G3G4	S1S2	
Bombus occidentalis western bumble bee	IIHYM24250	None	Candidate Endangered	G2G3	S1	
Branchinecta conservatio Conservancy fairy shrimp	ICBRA03010	Endangered	None	G2	S2	
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Branchinecta mesovallensis midvalley fairy shrimp	ICBRA03150	None	None	G2	S2S3	
Branta hutchinsii leucopareia cackling (=Aleutian Canada) goose	ABNJB05035	Delisted	None	G5T3	S3	WL
Brasenia schreberi watershield	PDCAB01010	None	None	G5	S3	2B.3
Buteo regalis ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
Campanula exigua chaparral harebell	PDCAM020A0	None	None	G2	S2	1B.2
Carex comosa bristly sedge	PMCYP032Y0	None	None	G5	S2	2B.1
Carex petasata Liddon's sedge	PMCYP03AE0	None	None	G5	S3	2B.3
Caulanthus lemmonii Lemmon's jewelflower	PDBRA0M0E0	None	None	G3	S3	1B.2
Chloropyron palmatum palmate-bracted bird's-beak	PDSCR0J0J0	Endangered	Endangered	G1	S1	1B.1
Circus hudsonius northern harrier	ABNKC11011	None	None	G5	S3	SSC
Cirsium crassicaule slough thistle	PDAST2E0U0	None	None	G1	S1	1B.1
Coastal and Valley Freshwater Marsh Coastal and Valley Freshwater Marsh	CTT52410CA	None	None	G3	S2.1	
Coccyzus americanus occidentalis western yellow-billed cuckoo	ABNRB02022	Threatened	Endangered	G5T2T3	S1	
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	None	G3G4	S2	SSC
Delphinium californicum ssp. interius Hospital Canyon larkspur	PDRAN0B0A2	None	None	G3T3	S3	1B.2
Delphinium recurvatum recurved larkspur	PDRAN0B1J0	None	None	G2?	S2?	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S2	
Diplacus pygmaeus Egg Lake monkeyflower	PDSCR1B2C0	None	None	G4	S3	4.2
Eagle Lake Eagle Lake	CALC1320CA	None	None	GNR	SNR	
Elanus leucurus white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
Elderberry Savanna Elderberry Savanna	CTT63440CA	None	None	G2	S2.1	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eremophila alpestris actia California horned lark	ABPAT02011	None	None	G5T4Q	S4	WL
Erethizon dorsatum North American porcupine	AMAFJ01010	None	None	G5	S3	
Eriastrum tracyi Tracy's eriastrum	PDPLM030C0	None	Rare	G3Q	S3	3.2
Eryngium racemosum Delta button-celery	PDAPI0Z0S0	None	Endangered	G1	S1	1B.1
Eryngium spinosepalum spiny-sepaled button-celery	PDAPI0Z0Y0	None	None	G2	S2	1B.2
Erythranthe inflatula ephemeral monkeyflower	PDSCR1B370	None	None	G3	S2	1B.2
Eschscholzia rhombipetala diamond-petaled California poppy	PDPAP0A0D0	None	None	G1	S1	1B.1
Eucerceris ruficeps redheaded sphecid wasp	IIHYM18010	None	None	G1G3	S1S2	
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G5T4	S3S4	SSC
Extriplex joaquinana San Joaquin spearscale	PDCHE041F3	None	None	G2	S2	1B.2
Falco columbarius merlin	ABNKD06030	None	None	G5	S3S4	WL
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Great Valley Mixed Riparian Forest Great Valley Mixed Riparian Forest	CTT61420CA	None	None	G2	S2.2	
Great Valley Valley Oak Riparian Forest Great Valley Valley Oak Riparian Forest	CTT61430CA	None	None	G1	S1.1	
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S3	FP

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Helisoma newberryi Great Basin rams-horn	IMGASM6020	None	None	G1	S1S2	
Hesperolinon breweri Brewer's western flax	PDLIN01030	None	None	G2	S2	1B.2
Hibiscus lasiocarpos var. occidentalis woolly rose-mallow	PDMAL0H0R3	None	None	G5T3	S3	1B.2
Hygrotus curvipes curved-foot hygrotus diving beetle	IICOL38030	None	None	G1	S1	
Hypomesus transpacificus Delta smelt	AFCHB01040	Threatened	Endangered	G1	S1	
Lanius ludovicianus loggerhead shrike	ABPBR01030	None	None	G4	S4	SSC
Larus californicus California gull	ABNNM03110	None	None	G5	S4	WL
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G5	S3S4	
Lasiurus cinereus hoary bat	AMACC05030	None	None	G5	S4	
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Lathyrus jepsonii var. jepsonii Delta tule pea	PDFAB250D2	None	None	G5T2	S2	1B.2
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Leptosyne hamiltonii Mt. Hamilton coreopsis	PDAST2L0C0	None	None	G2	S2	1B.2
Lilaeopsis masonii Mason's lilaeopsis	PDAPI19030	None	Rare	G2	S2	1B.1
Limosella australis Delta mudwort	PDSCR10030	None	None	G4G5	S2	2B.1
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Lytta moesta moestan blister beetle	IICOL4C020	None	None	G2	S2	
Madia radiata showy golden madia	PDAST650E0	None	None	G3	S3	1B.1
Malacothamnus hallii Hall's bush-mallow	PDMAL0Q0F0	None	None	G2	S2	1B.2
Masticophis flagellum ruddocki San Joaquin coachwhip	ARADB21021	None	None	G5T2T3	S2?	SSC
Masticophis lateralis euryxanthus Alameda whipsnake	ARADB21031	Threatened	Threatened	G4T2	S2	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Melospiza melodia song sparrow ("Modesto" population)	ABPBXA3010	None	None	G5	S3?	SSC
Mylopharodon conocephalus hardhead	AFCJB25010	None	None	G3	S3	SSC
Myotis evotis long-eared myotis	AMACC01070	None	None	G5	S3	
Myotis thysanodes fringed myotis	AMACC01090	None	None	G4	S3	
Myotis volans long-legged myotis	AMACC01110	None	None	G5	S3	
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
Navarretia nigelliformis ssp. radians shining navarretia	PDPLM0C0J2	None	None	G4T2	S2	1B.2
Neotoma fuscipes riparia riparian (=San Joaquin Valley) woodrat	AMAFF08081	Endangered	None	G5T1Q	S1	SSC
Northern Claypan Vernal Pool Northern Claypan Vernal Pool	CTT44120CA	None	None	G1	S1.1	
Oncorhynchus mykiss aquilarum Eagle Lake rainbow trout	AFCHA02091	None	None	G5T1Q	S1	SSC
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Pandion haliaetus osprey	ABNKC01010	None	None	G5	S4	WL
Pekania pennanti fisher - West Coast DPS	AMAJF01021	None	Threatened	G5T2T3Q	S2S3	SSC
Perognathus inornatus San Joaquin Pocket Mouse	AMAFD01060	None	None	G2G3	S2S3	
Phacelia inundata playa phacelia	PDHYD0C2E0	None	None	G2	S2	1B.3
Phacelia phacelioides Mt. Diablo phacelia	PDHYD0C3Q0	None	None	G2	S2	1B.2
Phalacrocorax auritus double-crested cormorant	ABNFD01020	None	None	G5	S4	WL
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Pine Creek Tributary To Eagle Lake Pine Creek Tributary To Eagle Lake	CARC2333CA	None	None	GNR	SNR	
Pisidium ultramontanum montane peaclam	IMBIV51220	None	None	G1	S1	
Potamogeton zosteriformis eel-grass pondweed	PMPOT03160	None	None	G5	S3	2B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Puccinellia simplex California alkali grass	PMPOA53110	None	None	G3	S2	1B.2
Rana boylii foothill yellow-legged frog	AAABH01050	None	Endangered	G3	S3	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Rumex venosus winged dock	PDPGN0P1K0	None	None	G5?	S3	2B.3
Sagittaria sanfordii Sanford's arrowhead	PMALI040Q0	None	None	G3	S3	1B.2
Scutellaria galericulata marsh skullcap	PDLAM1U0J0	None	None	G5	S2	2B.2
Scutellaria lateriflora side-flowering skullcap	PDLAM1U0Q0	None	None	G5	S2	2B.2
Senecio aphanactis chaparral ragwort	PDAST8H060	None	None	G3	S2	2B.2
Siphateles bicolor ssp. 1 Eagle Lake tui chub	AFCJB1303L	None	None	G4T1T2	S1S2	SSC
Spea hammondii western spadefoot	AAABF02020	None	None	G3	S3	SSC
Spergularia macrotheca var. longistyla long-styled sand-spurrey	PDCAR0W062	None	None	G5T2	S2	1B.2
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	
Stenotus lanuginosus var. lanuginosus woolly stenotus	PDASTCX012	None	None	G5T5	S3	2B.2
Sylvilagus bachmani riparius riparian brush rabbit	AMAEB01021	Endangered	Endangered	G5T1	S1	
Symphyotrichum lentum Suisun Marsh aster	PDASTE8470	None	None	G2	S2	1B.2
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Thaleichthys pacificus eulachon	AFCHB04010	Threatened	None	G5	S3	
Thamnophis gigas giant gartersnake	ARADB36150	Threatened	Threatened	G2	S2	
Thelypodium howellii ssp. howellii Howell's thelypodium	PDBRA2N051	None	None	G1T1	S1	1B.2
Trichocoronis wrightii var. wrightii Wright's trichocoronis	PDAST9F031	None	None	G4T3	S1	2B.1
Trifolium hydrophilum saline clover	PDFAB400R5	None	None	G2	S2	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Tropidocarpum capparideum caper-fruited tropidocarpum	PDBRA2R010	None	None	G1	S1	1B.1
Valley Sink Scrub Valley Sink Scrub	CTT36210CA	None	None	G1	S1.1	
Vireo bellii pusillus least Bell's vireo	ABPBW01114	Endangered	Endangered	G5T2	S2	
Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2	S2	
Xanthocephalus xanthocephalus yellow-headed blackbird	ABPBXB3010	None	None	G5	S3	SSC

Record Count: 128

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

49 matches found. *Click on scientific name for details*

Search Criteria

Found in Quads 3812115, 3812114, 3712185, 3712184, 3712183, 3712174, 3712173, 3712175, 3712165, 3712164, 3712163, 3712162 3712154 and 3712153;

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

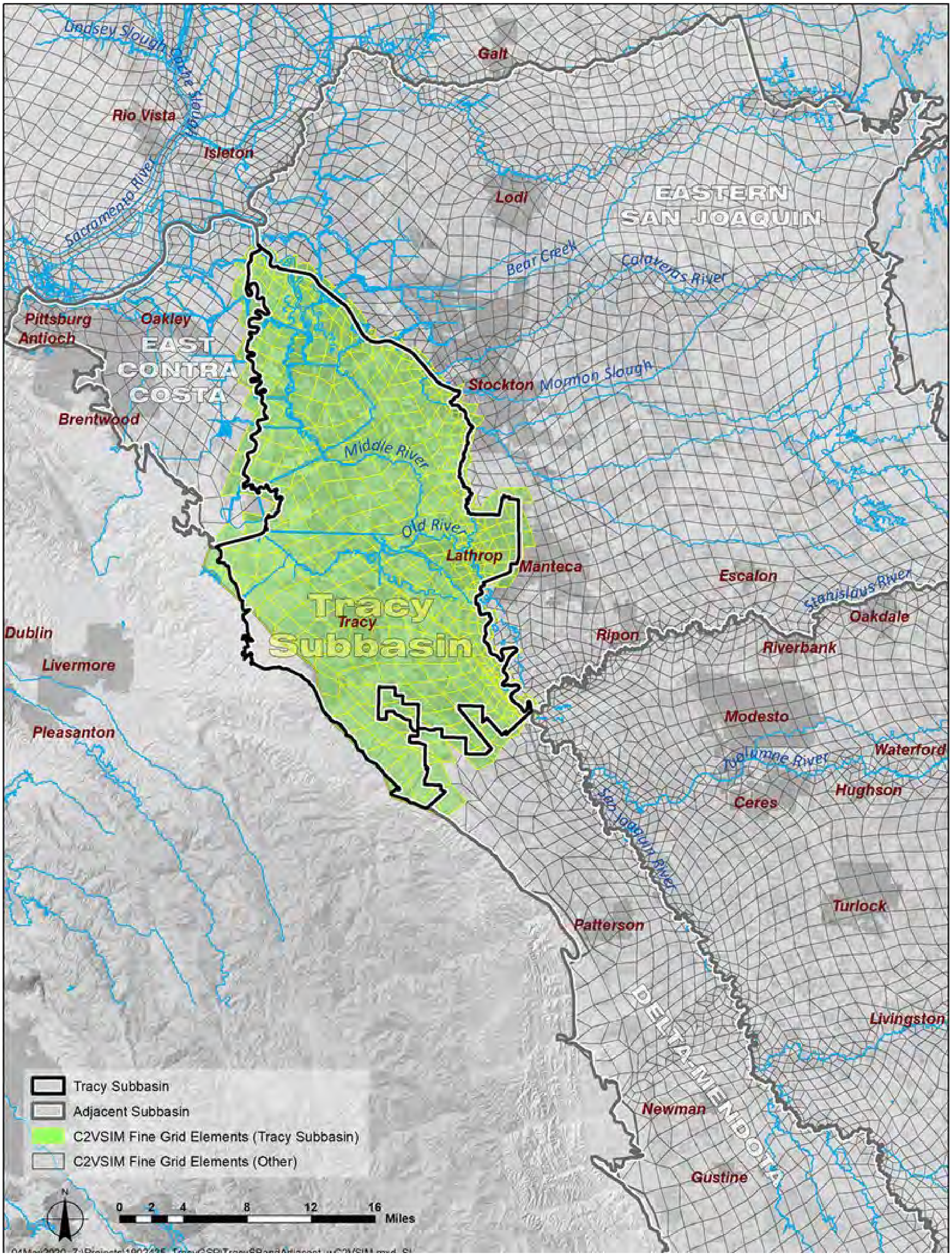
Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Listing Status	Federal Listing Status
Acanthomintha lanceolata	Santa Clara thorn-mint	Lamiaceae	annual herb	Mar-Jun	4.2		
Amsinckia grandiflora	large-flowered fiddleneck	Boraginaceae	annual herb	(Mar)Apr-May	1B.1	CE	FE
Androsace elongata ssp. acuta	California androsace	Primulaceae	annual herb	Mar-Jun	4.2		
Astragalus tener var. tener	alkali milk-vetch	Fabaceae	annual herb	Mar-Jun	1B.2		
Atriplex cordulata var. cordulata	heartscale	Chenopodiaceae	annual herb	Apr-Oct	1B.2		
Atriplex coronata var. coronata	crownscale	Chenopodiaceae	annual herb	Mar-Oct	4.2		
Atriplex coronata var. vallicola	Lost Hills crownscale	Chenopodiaceae	annual herb	Apr-Sep	1B.2		
Atriplex depressa	brittlescale	Chenopodiaceae	annual herb	Apr-Oct	1B.2		
Atriplex minuscula	lesser saltscale	Chenopodiaceae	annual herb	May-Oct	1B.1		
Blepharizonia plumosa	big tarplant	Asteraceae	annual herb	Jul-Oct	1B.1		
Brasenia schreberi	watershield	Cabombaceae	perennial rhizomatous herb (aquatic)	Jun-Sep	2B.3		
Campanula exigua	chaparral harebell	Campanulaceae	annual herb	May-Jun	1B.2		
Carex comosa	bristly sedge	Cyperaceae	perennial rhizomatous herb	May-Sep	2B.1		
Caulanthus lemmonii	Lemmon's jewelflower	Brassicaceae	annual herb	Feb-May	1B.2		
Centromadia parryi ssp. rudis	Parry's rough tarplant	Asteraceae	annual herb	May-Oct	4.2		
Chloropyron palmatum	palmate-bracted bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	May-Oct	1B.1	CE	FE
Cirsium crassicaule	slough thistle	Asteraceae	annual / perennial herb	May-Aug	1B.1		
Clarkia breweri	Brewer's clarkia	Onagraceae	annual herb	Apr-Jun	4.2		
Convolvulus simulans	small-flowered morning-glory	Convolvulaceae	annual herb	Mar-Jul	4.2		
Delphinium californicum ssp. interius	Hospital Canyon larkspur	Ranunculaceae	perennial herb	Apr-Jun	1B.2		
Delphinium recurvatum	recurved larkspur	Ranunculaceae	perennial herb	Mar-Jun	1B.2		
Eriastrum tracyi	Tracy's eriastrum	Polemoniaceae	annual herb	May-Jul	3.2	CR	
Eryngium racemosum	Delta button-celery	Apiaceae	annual / perennial herb	Jun-Oct	1B.1	CE	
Eryngium spinosepalum	spiny-sepaled button-celery	Apiaceae	annual / perennial herb	Apr-Jun	1B.2		
Eschscholzia rhombipetala	diamond-petaled California poppy	Papaveraceae	annual herb	Mar-Apr	1B.1		
Extriplex joaquinana	San Joaquin spearscale	Chenopodiaceae	annual herb	Apr-Oct	1B.2		
Hesperolinon breweri	Brewer's western flax	Linaceae	annual herb	May-Jul	1B.2		
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Malvaceae	perennial rhizomatous herb (emergent)	Jun-Sep	1B.2		
Lasthenia ferrisiae	Ferris' goldfields	Asteraceae	annual herb	Feb-May	4.2		
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	May-Jul(Aug-Sep)	1B.2		
Leptosyne hamiltonii	Mt. Hamilton coreopsis	Asteraceae	annual herb	Mar-May	1B.2		
Lilaeopsis masonii	Mason's lilaeopsis	Apiaceae	perennial rhizomatous herb	Apr-Nov	1B.1	CR	
Limosella australis	Delta mudwort	Scrophulariaceae	perennial stoloniferous herb	May-Aug	2B.1		
Madia radiata	showy golden madia	Asteraceae	annual herb	Mar-May	1B.1		

Malacothamnus hallii	Hall's bush-mallow	Malvaceae	perennial evergreen shrub	(Apr)May-Sep(Oct)	1B.2
Myosurus minimus ssp. apus	little mousetail	Ranunculaceae	annual herb	Mar-Jun	3.1
Navarretia nigelliformis ssp. radians	shining navarretia	Polemoniaceae	annual herb	(Mar)Apr-Jul	1B.2
Phacelia phacelioides	Mt. Diablo phacelia	Hydrophyllaceae	annual herb	Apr-May	1B.2
Potamogeton zosteriformis	eel-grass pondweed	Potamogetonaceae	annual herb (aquatic)	Jun-Jul	2B.2
Puccinellia simplex	California alkali grass	Poaceae	annual herb	Mar-May	1B.2
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb (emergent)	May-Oct(Nov)	1B.2
Scutellaria galericulata	marsh skullcap	Lamiaceae	perennial rhizomatous herb	Jun-Sep	2B.2
Scutellaria lateriflora	side-flowering skullcap	Lamiaceae	perennial rhizomatous herb	Jul-Sep	2B.2
Senecio aphanactis	chaparral ragwort	Asteraceae	annual herb	Jan-Apr(May)	2B.2
Spergularia macrotheca var. longistyla	long-styled sand-spurrey	Caryophyllaceae	perennial herb	Feb-May(Jun)	1B.2
Symphyotrichum lentum	Suisun Marsh aster	Asteraceae	perennial rhizomatous herb	(Apr)May-Nov	1B.2
Trichocoronis wrightii var. wrightii	Wright's trichocoronis	Asteraceae	annual herb	May-Sep	2B.1
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	Apr-Jun	1B.2
Tropidocarpum capparideum	caper-fruited tropidocarpum	Brassicaceae	annual herb	Mar-Apr	1B.1

Suggested Citation

California Native Plant Society, Rare Plant Program. 2020. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 26 June 2020].

APPENDIX M
GROUNDWATER MODELING
SUPPLEMENTAL INFORMATION


Lindsey Slough
Cache Slough
Galt
Rio Vista
Isleton
Sacramento River
Lodi
EASTERN SAN JOAQUIN
Bear Creek
Calaveras River
Pittsburg
Antioch
Oakley
EAST CONTRA COSTA
Stockton
Mormon Slough
Brentwood
Middle River
Old River
Lathrop
Manteca
Escalon
Stanislaus River
Tracy Subbasin
Tracy
Oakdale
Dublin
Ripon
Riverbank
Livermore
Modesto
Pleasanton
Tuolumne River
Waterford
Ceres
Hughson
San Joaquin River
Turlock
Patterson
DELTA-MENDOTA
Livingston
Newman
Gustine
Tracy Subbasin
Adjacent Subbasin
C2VSIM Fine Grid Elements (Tracy Subbasin)
C2VSIM Fine Grid Elements (Other)
N
0 2 4 8 12 16
Miles

Tracy Subbasin C2VSIM Results - Historical

	Inflow (AF)										Outflow (AF)								
AVERAGES	**40,183**	**175,107**	**6,423**	**62,035**		**19,053**	**24,419**	**56,457**	**678**	**384,151**	**103,997**	**167,378**	**11,355**	**64,337**	**33,603**	**574**	**381,243**		
Water Year	*Streams In*	*Deep Percolation*	*Small Watersheds In*	*Diversion Recharge*	Subsidence (inflow-outflow)	*Subsurface East Contra Costa*	*Subsurface Eastern San Joaquin*	*Subsurface Delta Mendota*	*Subsurface Other*	***TOTAL IN***	*Streams Out*	*Pumping*	*Subsurface East Contra Costa*	*Subsurface Eastern San Joaquin*	*Subsurface Delta Mendota*	*Subsurface Other*	***TOTAL OUT***	*Change in Storage (AC-FT)*	*Cumulative Change in Storage (AC-FT)*
1974	62,548	204,911	22,811	58,233	14,225	18,192	29,790	45,289	201	**456,200**	76,302	156,780	7,830	46,183	39,800	2,369	**329,265**	126,935	126,935
1975	54,725	181,956	1,602	58,294	2,886	12,956	27,602	48,056	399	**388,476**	81,032	155,876	7,267	49,140	39,767	872	**333,954**	54,522	181,457
1976	36,084	122,012	689	65,989	4,574	15,223	26,839	53,785	578	**325,773**	102,811	147,114	9,871	54,904	37,217	854	**352,772**	-26,999	154,459
1977	27,850	140,543	580	48,164	10,844	17,695	24,951	54,196	495	**325,318**	106,652	192,187	9,298	63,097	35,180	436	**406,849**	-81,530	72,929
1978	64,988	195,097	2,860	55,149	2,101	16,424	23,063	50,399	520	**410,601**	81,306	142,712	8,529	63,373	31,640	267	**327,826**	82,775	155,703
1979	43,407	166,824	2,532	56,698	1,327	15,542	24,244	51,752	440	**362,766**	102,514	155,177	9,502	63,260	29,533	335	**360,321**	2,445	158,148
1980	54,382	188,331	14,362	53,143	328	14,059	23,992	53,341	283	**402,220**	89,611	139,134	10,731	59,763	27,701	326	**327,266**	74,954	233,102
1981	31,543	140,890	2,127	59,435	1,117	14,978	26,282	55,711	297	**332,379**	117,066	163,607	12,107	60,040	28,159	377	**381,355**	-48,977	184,126
1982	50,635	216,428	11,522	49,967	-37	14,829	24,696	54,667	301	**423,007**	90,853	126,923	12,530	56,127	27,463	272	**314,168**	108,840	292,966
1983	34,747	241,927	51,371	50,755	-168	19,395	26,618	54,802	491	**479,938**	112,260	115,414	11,273	55,515	25,605	268	**320,335**	159,604	452,569
1984	20,390	160,875	7,936	57,577	82	19,629	34,534	57,195	445	**358,661**	147,781	169,745	12,318	59,254	28,275	272	**417,645**	-58,984	393,585
1985	26,990	152,892	2,003	59,410	25	19,108	32,509	59,488	485	**352,910**	130,325	158,696	13,091	59,591	30,044	296	**392,044**	-39,134	354,451
1986	39,895	193,362	8,999	54,015	-74	17,830	29,792	60,366	465	**404,649**	113,104	140,314	13,167	57,594	29,730	282	**354,191**	50,458	404,910
1987	23,021	135,243	2,508	59,488	70	18,622	30,028	61,730	691	**331,400**	134,247	150,646	12,793	60,257	30,604	177	**388,725**	-57,324	347,585
1988	25,440	134,756	1,639	58,774	211	23,136	27,559	64,720	1,069	**337,305**	120,262	190,392	13,918	61,764	32,834	160	**419,331**	-82,027	265,559
1989	30,305	141,711	1,468	58,680	606	24,365	24,305	61,616	1,166	**344,223**	108,656	159,541	10,763	68,690	31,342	175	**379,167**	-34,944	230,615
1990	29,105	140,480	1,321	56,322	1,398	22,788	23,394	57,619	1,045	**333,473**	108,713	152,404	10,092	74,267	30,719	209	**376,404**	-42,931	187,683
1991	40,872	146,984	1,333	43,015	3,781	23,512	25,311	51,118	1,388	**337,314**	120,997	173,739	13,973	77,881	29,950	137	**416,678**	-79,364	108,320
1992	39,752	157,811	1,505	41,693	2,785	22,654	23,696	45,845	1,147	**336,888**	106,094	163,521	10,940	73,864	26,938	64	**381,421**	-44,533	63,787
1993	53,480	220,183	14,442	58,662	2,183	21,190	23,095	44,597	925	**438,757**	90,560	167,281	12,742	78,088	25,434	285	**374,391**	64,366	128,153
1994	32,098	171,207	2,597	59,773	4,754	21,719	23,364	45,853	1,013	**362,379**	105,091	207,721	15,299	78,484	26,268	155	**433,018**	-70,639	57,514
1995	63,271	234,320	21,004	64,517	433	21,382	22,007	44,666	1,064	**472,665**	83,627	130,279	18,118	77,364	24,611	322	**334,321**	138,344	195,857
1996	37,238	189,587	21,591	61,726	-31	22,461	24,497	50,616	1,156	**408,842**	118,612	151,994	16,524	71,051	25,746	367	**384,292**	24,550	220,407
1997	44,788	193,053	2,763	59,392	-13	22,032	25,466	51,218	1,072	**399,770**	119,711	150,819	15,350	71,087	25,840	284	**383,090**	16,680	237,086
1998	50,499	223,738	33,087	48,695	-111	21,425	24,445	50,430	1,076	**453,283**	97,190	156,293	13,360	65,271	24,264	309	**356,688**	96,596	333,682
1999	28,850	166,461	6,096	53,852	48	19,626	26,798	51,986	980	**354,697**	121,813	179,778	12,007	64,447	26,177	313	**404,536**	-49,839	283,843
2000	36,720	166,321	5,590	61,260	22	18,498	27,265	53,800	766	**370,241**	111,831	177,579	11,264	60,988	29,206	495	**391,362**	-21,121	262,723
2001	34,316	147,584	3,490	61,255	51	17,059	25,432	54,959	653	**344,798**	105,883	179,482	10,763	60,827	30,679	592	**388,226**	-43,427	219,295
2002	30,626	147,827	1,999	67,629	64	17,254	23,166	57,839	597	**347,001**	103,767	170,795	10,147	65,184	33,028	721	**383,641**	-36,640	182,655
2003	38,683	163,923	2,136	95,638	-21	15,865	21,931	63,930	465	**402,549**	96,267	150,058	9,506	66,648	37,947	1,063	**361,489**	41,059	223,715
2004	38,344	171,871	1,825	73,271	9	14,483	21,519	70,745	428	**392,494**	99,987	148,698	10,488	70,738	40,431	1,178	**371,520**	20,974	244,688
2005	54,766	206,514	2,058	55,664	-51	13,831	20,639	62,837	516	**416,773**	84,094	160,150	10,079	71,208	34,873	683	**361,086**	55,687	300,375
2006	52,900	185,563	1,648	56,531	-22	14,455	21,511	60,981	631	**394,197**	88,902	188,258	8,737	66,698	35,058	681	**388,333**	5,864	306,239
2007	29,336	148,033	1,260	54,941	701	16,746	22,613	56,535	871	**331,036**	105,313	251,670	9,454	65,926	34,767	494	**467,623**	-136,588	169,651
2008	39,908	156,818	1,218	48,964	398	18,996	21,253	50,071	811	**338,438**	99,097	176,484	10,411	67,934	33,251	305	**387,482**	-49,044	120,607
2009	36,551	137,440	1,084	47,591	558	21,692	20,236	44,026	768	**309,945**	94,167	155,826	9,745	64,679	31,342	250	**356,008**	-46,063	74,544
2010	48,209	212,545	1,047	169,713	-25	20,284	18,825	74,259	495	**545,352**	93,138	124,571	10,986	68,292	57,372	2,293	**356,652**	188,699	263,243
2011	64,064	253,079	2,037	152,911	-196	18,383	19,346	92,569	227	**602,420**	74,637	158,258	11,472	68,342	64,017	2,537	**379,263**	223,157	486,401
2012	27,025	169,885	1,121	69,275	122	20,874	23,711	79,232	420	**391,665**	119,767	250,230	10,943	61,777	52,733	1,323	**496,774**	-105,109	381,292
2013	36,049	161,181	941	47,815	36	22,652	21,184	64,118	587	**354,564**	108,352	196,893	10,610	58,298	43,920	580	**418,652**	-64,088	317,204
2014	37,034	145,440	725	42,462	969	24,027	19,261	55,604	541	**326,063**	90,183	231,511	9,412	55,002	42,411	370	**428,888**	-102,825	214,379
2015	36,254	152,933	856	49,114	1,400	24,353	18,843	48,648	522	**332,923**	105,309	211,321	9,492	59,257	39,449	341	**425,169**	-92,246	122,133

Tracy Subbasin C2VSIM Results - Projected

	Inflow (AF)										*Outflow (AF)*								
AVERAGES	**58,633**	**180,334**	**6,458**	**74,015**	**608**	**23,075**	**23,427**	**60,303**	**486**	**427,338**	**93,446**	**199,549**	**10,158**	**74,157**	**44,251**	**971**	**422,532**		
Water Year	*Streams In*	*Deep Percolation*	*Small Watersheds In*	*Diversion Recharge*	Subsidence (inflow-outflow)	*Subsurface East Contra Costa*	*Subsurface Eastern San Joaquin*	*Subsurface Delta Mendota*	*Subsurface Other*	***TOTAL IN***	*Streams Out*	*Pumping*	*Subsurface East Contra Costa*	*Subsurface Eastern San Joaquin*	*Subsurface Delta Mendota*	*Subsurface Other*	***TOTAL OUT***	*Change in Storage (AF)*	*Cumulative Change in Storage (AF)*
2016	61,079	157,770	22,350	56,705	8,243	24,006	20,186	55,585	590	**406,515**	87,837	233,761	7,585	61,108	49,424	864	**440,580**	-34,065	-34,065
2017	50,897	162,393	649	55,340	2,739	23,351	20,806	54,864	572	**371,610**	84,761	185,697	7,938	63,759	46,541	646	**389,341**	-17,730	-51,795
2018	89,709	208,168	4,977	49,110	1,116	20,294	25,556	46,207	588	**445,725**	73,320	176,468	9,844	69,479	39,399	406	**368,915**	76,810	25,015
2019	41,984	145,116	1,721	47,734	1,645	21,142	21,953	42,415	576	**324,285**	100,481	192,824	10,086	66,267	35,234	349	**405,242**	-80,957	-55,942
2020	75,035	255,111	13,465	169,562	197	19,809	25,201	70,826	248	**629,455**	87,129	160,841	11,451	71,010	59,270	2,528	**392,229**	237,227	181,285
2021	43,143	163,757	1,700	152,760	1,007	23,334	23,345	91,834	113	**500,992**	104,712	234,421	10,530	67,946	66,604	2,712	**486,926**	14,066	195,351
2022	46,438	143,402	1,128	68,867	2,302	25,913	22,293	81,663	307	**392,314**	95,280	233,036	8,763	69,261	56,074	1,447	**463,862**	-71,548	123,803
2023	50,353	147,026	951	47,391	2,731	26,453	21,963	66,310	498	**363,677**	89,781	211,886	7,958	71,222	47,098	691	**428,636**	-64,959	58,844
2024	79,350	169,984	1,086	42,722	1,273	23,888	23,158	55,145	476	**397,082**	74,535	210,807	7,908	75,209	43,655	415	**412,528**	-15,446	43,398
2025	79,930	197,984	2,041	49,302	5	20,544	23,651	47,945	424	**421,826**	77,996	177,028	9,817	79,326	39,504	378	**384,049**	37,777	81,175
2026	39,862	145,694	1,487	55,806	1,620	22,352	21,484	50,470	486	**339,261**	104,296	254,054	8,251	73,896	37,927	720	**479,144**	-139,883	-58,708
2027	84,412	187,762	1,870	55,373	38	20,659	24,357	46,652	584	**421,707**	76,082	177,568	9,711	76,106	33,622	605	**373,693**	48,013	-10,695
2028	53,353	165,045	1,470	49,212	337	20,616	22,675	41,782	597	**355,088**	101,202	185,311	10,858	73,333	30,832	378	**401,913**	-46,825	-57,520
2029	87,557	202,705	1,394	47,727	849	19,590	24,654	36,949	612	**422,037**	69,328	184,657	11,030	73,931	28,075	303	**367,324**	54,713	-2,807
2030	37,735	162,429	1,153	168,849	386	21,861	23,441	67,546	305	**483,705**	109,097	217,579	10,866	67,467	53,956	2,456	**461,422**	22,283	19,476
2031	87,099	228,853	15,410	153,221	-192	20,957	26,642	89,172	149	**621,311**	75,667	178,570	10,903	76,235	60,503	2,625	**404,503**	216,808	236,284
2032	51,344	169,868	2,717	69,534	30	21,419	25,247	79,107	337	**419,602**	104,135	211,585	10,784	73,056	51,170	1,362	**452,092**	-32,490	203,794
2033	54,873	168,298	2,922	48,113	4	22,574	24,096	64,071	497	**385,448**	101,148	188,619	10,051	71,884	42,720	623	**415,045**	-29,596	174,198
2034	55,710	136,608	1,383	42,848	112	23,701	21,578	54,567	503	**337,009**	83,136	232,693	8,637	70,801	41,535	358	**437,159**	-100,150	74,048
2035	74,912	201,388	2,151	49,384	87	21,861	24,062	47,461	486	**421,791**	81,922	193,790	9,187	77,864	38,848	299	**401,910**	19,880	93,928
2036	56,901	179,023	2,413	56,733	10	22,685	23,188	48,704	579	**390,236**	95,567	224,299	8,239	75,174	36,362	608	**440,249**	-50,013	43,915
2037	69,111	168,096	3,440	55,359	-20	22,454	23,608	46,614	655	**389,317**	83,940	188,892	9,217	71,694	32,953	531	**387,226**	2,091	46,006
2038	43,331	137,684	1,380	49,186	89	23,906	21,513	43,305	710	**321,104**	102,707	209,001	9,805	69,760	31,136	326	**422,735**	-101,631	-55,625
2039	47,049	123,392	1,143	44,465	5,380	27,117	20,656	39,695	716	**309,613**	91,217	243,312	8,566	69,953	29,636	279	**442,962**	-133,349	-188,974
2040	88,281	209,414	3,361	169,585	511	23,543	25,159	68,429	373	**588,658**	69,378	176,558	8,925	74,195	53,807	2,436	**385,299**	203,359	14,385
2041	61,258	190,575	2,976	153,307	-20	22,933	24,672	89,609	188	**545,497**	93,414	211,075	10,071	77,186	61,708	2,602	**456,056**	89,440	103,826
2042	83,064	205,695	14,763	69,377	-132	21,249	25,293	79,580	348	**499,236**	70,908	171,551	10,389	81,232	50,223	1,367	**385,670**	113,567	217,393
2043	50,971	153,136	2,474	48,239	70	21,876	23,151	65,289	516	**365,720**	96,969	215,722	10,186	76,648	43,353	626	**443,503**	-77,783	139,610
2044	74,447	236,041	11,828	42,547	-141	20,827	25,365	54,303	491	**465,708**	80,547	156,021	11,666	77,675	39,219	342	**365,470**	100,238	239,848
2045	53,265	264,823	51,644	49,238	-129	23,414	23,300	47,329	510	**513,395**	99,364	148,961	12,501	78,950	34,773	264	**374,813**	138,582	378,430
2046	32,446	161,761	8,177	56,881	136	25,812	24,552	51,701	594	**362,059**	130,174	259,917	10,563	70,457	37,222	639	**508,972**	-146,912	231,518
2047	46,918	155,204	2,217	55,519	28	25,893	21,501	51,064	716	**359,059**	102,566	194,729	10,187	69,074	36,694	504	**413,754**	-54,695	176,823
2048	69,884	219,921	9,189	49,054	-97	23,678	24,797	45,428	732	**442,585**	90,261	165,536	12,387	74,520	33,279	299	**376,282**	66,303	243,125
2049	33,676	146,756	2,676	47,789	126	24,247	23,767	41,965	733	**321,735**	121,302	209,158	12,144	69,411	32,114	248	**444,378**	-122,643	120,483
2050	42,504	168,932	1,788	169,710	12	26,049	22,044	73,026	375	**504,440**	102,253	209,891	10,950	69,323	58,768	2,348	**453,531**	50,909	171,391
2051	46,856	165,141	1,600	153,251	-17	26,468	22,249	93,279	201	**509,029**	95,135	200,649	10,472	75,821	65,528	2,613	**450,218**	58,810	230,202
2052	46,444	159,961	1,438	69,399	50	26,212	22,473	82,302	379	**408,659**	95,173	202,418	9,783	80,830	54,445	1,387	**444,036**	-35,377	194,825
2053	59,528	158,913	1,437	48,099	81	26,527	23,604	67,054	550	**385,793**	103,976	204,086	8,954	84,366	46,011	646	**448,039**	-62,246	132,579
2054	57,642	169,622	1,597	42,706	68	24,964	22,379	56,634	517	**376,129**	88,590	199,318	8,963	82,869	42,948	383	**423,070**	-46,941	85,638
2055	79,990	223,527	14,523	49,285	-51	22,114	23,443	51,017	490	**464,339**	69,026	185,546	9,377	88,715	39,283	343	**392,290**	72,048	157,686
2056	36,831	147,069	2,670	56,761	95	23,298	21,779	52,821	551	**341,875**	106,102	238,681	7,941	80,917	38,423	679	**472,743**	-130,868	26,818
2057	90,793	224,264	21,068	55,295	-154	21,845	24,441	49,035	646	**487,234**	65,973	165,661	9,938	84,360	33,920	577	**360,429**	126,805	153,623
2058	52,753	210,261	21,648	49,157	-47	20,902	25,177	45,760	693	**426,304**	102,872	186,965	11,560	76,032	31,398	360	**409,186**	17,118	170,741
2059	55,493	185,645	2,813	47,799	50	22,262	24,592	41,024	692	**380,371**	112,582	210,579	11,744	71,655	30,711	267	**437,537**	-57,167	113,575
2060	71,446	259,435	33,131	169,412	-245	22,779	24,984	74,440	368	**655,750**	86,852	151,751	12,930	71,886	55,905	2,401	**381,724**	274,026	387,600
2061	38,171	192,124	6,136	153,248	-20	22,452	24,908	97,179	183	**534,381**	124,456	191,285	13,642	72,390	65,940	2,627	**470,339**	64,042	451,643
2062	49,169	176,245	5,625	69,457	2	23,208	24,790	85,199	350	**434,044**	112,752	189,086	12,264	73,724	55,947	1,376	**445,149**	-11,105	440,537
2063	42,471	158,888	3,521	48,138	64	23,553	23,415	69,670	505	**370,226**	107,455	202,548	11,330	73,554	48,046	631	**443,563**	-73,337	367,200
2064	48,718	165,099	2,027	42,827	99	24,128	21,994	59,678	499	**365,069**	95,867	215,598	10,575	75,626	46,570	355	**444,592**	-79,523	287,677
2065	57,479	180,703	2,160	49,382	67	23,008	22,187	53,423	491	**388,900**	93,069	207,440	10,494	80,706	44,227	327	**436,262**	-47,362	240,315

Tracy Subbasin C2VSIM Results - Projected w/ Climate Change

	Inflow (AF)										Outflow (AF)								
AVERAGES	**65,375**	**176,342**	**6,458**	**73,972**	**1,552**	**23,707**	**24,599**	**58,720**	**516**	**431,242**	**85,610**	**221,393**	**9,381**	**69,507**	**43,400**	**963**	**430,254**		
Water Year	*Streams In*	*Deep Percolation*	*Small Watersheds In*	*Diversion Recharge*	Subsidence (inflow-outflow)	*Subsurface East Contra Costa*	*Subsurface Eastern San Joaquin*	*Subsurface Delta Mendota*	*Subsurface Other*	***TOTAL IN***	*Streams Out*	*Pumping*	*Subsurface East Contra Costa*	*Subsurface Eastern San Joaquin*	*Subsurface Delta Mendota*	*Subsurface Other*	***TOTAL OUT***	*Change in Storage (AF)*	*Cumulative Change in Storage (AF)*
2016	61,659	155,637	22,350	56,794	11,363	24,313	20,366	55,437	600	**408,519**	87,128	254,112	7,349	60,470	49,831	865	**459,755**	-51,235	-51,235
2017	52,441	156,413	649	55,429	5,069	24,272	20,990	54,644	602	**370,508**	82,741	210,235	7,537	62,137	46,977	645	**410,271**	-39,763	-90,998
2018	93,284	198,326	4,977	49,202	2,224	21,268	25,868	45,883	616	**441,646**	70,196	187,441	9,084	67,643	39,818	413	**374,594**	67,053	-23,946
2019	44,748	141,457	1,721	47,827	3,928	22,309	22,245	42,061	621	**326,917**	96,139	215,946	9,085	63,742	35,792	352	**421,056**	-94,139	-118,085
2020	79,818	245,921	13,460	169,654	497	20,898	25,984	69,856	276	**626,364**	82,395	182,100	10,790	68,016	59,521	2,529	**405,352**	221,012	102,927
2021	46,738	162,220	1,698	152,372	1,990	24,399	24,075	90,266	141	**503,898**	99,220	255,733	9,783	64,623	66,598	2,698	**498,657**	5,241	108,169
2022	50,548	140,700	1,129	68,413	6,265	26,979	23,248	80,545	343	**398,171**	89,094	259,601	8,053	66,100	56,107	1,452	**480,407**	-82,236	25,933
2023	54,901	141,651	951	46,936	7,937	27,526	22,866	65,180	527	**368,473**	83,540	234,254	7,263	68,141	47,032	696	**440,927**	-72,454	-46,521
2024	85,560	164,914	1,086	42,810	3,696	25,095	24,252	54,273	520	**402,206**	68,764	234,783	7,266	71,461	43,554	412	**426,240**	-24,034	-70,555
2025	87,434	192,914	2,041	49,396	2,329	21,529	24,684	47,200	474	**428,001**	71,736	200,477	8,675	75,462	39,205	370	**395,926**	32,076	-38,480
2026	44,537	143,776	1,488	55,190	5,069	23,623	22,374	49,626	533	**346,215**	96,469	282,721	7,389	69,567	37,593	713	**494,451**	-148,236	-186,716
2027	92,760	179,472	1,871	55,469	531	21,604	25,679	45,553	612	**423,551**	70,323	194,067	8,418	72,106	33,343	600	**378,858**	44,693	-142,023
2028	60,006	163,340	1,471	49,098	1,817	21,748	23,736	40,950	638	**362,804**	93,027	214,806	9,802	68,647	30,637	395	**417,314**	-54,509	-196,533
2029	96,660	196,153	1,395	47,825	2,506	20,344	25,982	35,767	647	**427,277**	62,564	205,236	10,153	70,127	27,707	324	**376,111**	51,166	-145,367
2030	42,990	158,393	1,153	168,044	944	22,803	24,541	65,522	315	**484,706**	100,000	240,325	10,070	63,089	53,260	2,452	**469,196**	15,510	-129,856
2031	96,326	220,492	15,396	153,307	-158	21,932	28,422	87,346	182	**623,244**	68,237	202,810	9,763	71,803	59,870	2,656	**415,138**	208,106	78,250
2032	57,881	170,638	2,713	69,620	30	21,994	26,546	77,725	350	**427,497**	95,506	232,162	9,826	68,704	50,559	1,369	**458,126**	-30,629	47,621
2033	60,868	165,545	2,914	48,210	6	23,026	25,369	62,749	513	**389,200**	92,759	207,819	9,109	67,701	42,136	622	**420,145**	-30,945	16,676
2034	62,579	132,768	1,382	42,933	406	24,185	23,035	53,288	534	**341,111**	75,217	251,849	8,028	66,433	40,873	348	**442,748**	-101,637	-84,961
2035	83,850	196,780	2,148	49,466	1,395	22,420	25,650	46,102	528	**428,339**	74,725	217,861	8,482	72,325	37,825	293	**411,511**	16,828	-68,133
2036	63,653	178,982	2,411	56,824	22	23,304	24,485	47,336	602	**397,619**	87,363	248,211	7,902	70,240	35,324	601	**449,642**	-52,024	-120,157
2037	76,301	163,057	3,433	55,447	-29	22,853	24,979	44,981	681	**391,703**	77,220	204,072	8,731	66,971	31,997	523	**389,515**	2,188	-117,969
2038	49,407	131,348	1,379	48,818	450	24,825	22,744	41,888	745	**321,605**	93,590	230,937	9,013	64,465	30,262	315	**428,583**	-106,977	-224,946
2039	52,093	119,617	1,142	42,733	16,594	28,170	22,079	38,026	736	**321,191**	81,069	283,373	7,781	64,369	28,663	277	**465,532**	-144,341	-369,287
2040	98,754	199,848	3,360	169,673	2,246	24,963	27,167	66,424	409	**592,843**	62,533	201,081	8,142	68,552	52,630	2,400	**395,338**	197,505	-171,782
2041	69,604	186,002	2,977	153,395	-13	23,626	26,364	87,554	237	**549,743**	85,002	231,194	9,327	71,224	60,695	2,635	**460,077**	89,666	-82,115
2042	92,611	203,158	14,759	69,466	-140	21,666	27,027	77,726	361	**506,636**	63,387	188,625	9,766	75,342	49,269	1,361	**387,751**	118,885	36,770
2043	57,629	153,641	2,475	48,328	79	22,382	24,399	63,546	534	**373,013**	88,047	238,598	9,272	71,375	42,368	613	**450,273**	-77,260	-40,490
2044	84,682	232,846	11,845	42,633	-140	21,181	26,923	53,010	519	**473,498**	71,250	175,132	10,993	72,726	38,270	328	**368,698**	104,800	64,309
2045	60,877	271,840	51,654	49,324	-142	23,777	24,825	45,718	540	**528,412**	89,838	167,655	11,902	75,566	33,786	251	**378,998**	149,414	213,723
2046	37,054	158,328	8,182	56,967	148	26,164	25,572	49,923	638	**362,977**	120,940	286,119	10,055	65,813	36,068	626	**519,621**	-156,644	57,079
2047	52,580	148,463	2,217	55,610	24	26,006	22,599	49,114	725	**357,338**	94,346	210,995	9,466	64,102	35,337	493	**414,738**	-57,400	-321
2048	79,057	210,740	9,174	49,138	-94	24,114	26,268	43,571	767	**442,734**	81,018	185,011	12,009	68,990	31,961	289	**379,277**	63,457	63,135
2049	38,892	145,600	2,675	47,876	132	24,732	24,744	40,143	766	**325,561**	111,925	232,563	11,359	64,121	30,823	242	**451,033**	-125,472	-62,337
2050	49,004	161,268	1,788	169,842	19	26,633	23,329	70,380	411	**502,674**	93,243	231,619	10,203	64,137	57,212	2,341	**458,754**	43,920	-18,417
2051	53,699	160,655	1,600	153,380	-14	27,028	23,435	90,565	246	**510,595**	86,431	221,813	9,401	70,268	64,075	2,563	**454,550**	56,046	37,629
2052	54,188	155,339	1,438	69,543	84	26,770	23,589	80,472	406	**411,828**	85,346	226,212	8,617	74,986	53,172	1,361	**449,694**	-37,865	-236
2053	68,295	156,561	1,437	47,069	210	27,172	24,763	65,227	588	**391,322**	94,217	236,084	7,918	78,443	44,676	626	**461,964**	-70,642	-70,878
2054	66,260	164,734	1,596	42,790	135	25,914	23,645	54,872	564	**380,511**	79,429	223,565	7,698	76,183	41,577	363	**428,815**	-48,305	-119,183
2055	90,977	220,524	14,525	49,374	231	22,586	24,840	49,596	541	**473,194**	59,785	207,396	8,458	82,193	37,991	320	**396,143**	77,051	-42,132
2056	43,123	145,817	2,668	56,854	127	23,892	22,895	50,980	590	**346,947**	96,765	259,378	7,225	75,029	36,962	658	**476,017**	-129,070	-171,202
2057	102,647	217,851	21,081	55,381	-154	22,013	25,931	46,841	664	**492,255**	57,657	182,189	9,123	79,176	32,357	562	**361,063**	131,193	-40,009
2058	59,676	212,128	21,638	49,252	-46	21,189	26,432	43,516	730	**434,514**	93,846	206,799	11,090	70,986	29,986	346	**413,054**	21,460	-18,549
2059	62,637	182,592	2,813	47,887	39	22,741	25,947	39,059	736	**384,451**	102,813	227,419	11,390	66,863	29,375	253	**438,113**	-53,662	-72,212
2060	80,766	254,240	33,135	169,504	-246	23,119	26,375	71,670	383	**658,947**	77,115	170,323	12,622	67,026	54,295	2,399	**383,781**	275,166	202,955
2061	43,453	190,546	6,143	153,344	-23	22,384	25,885	94,421	207	**536,361**	114,727	210,308	12,893	66,909	64,186	2,597	**471,620**	64,741	267,695
2062	55,729	173,240	5,649	69,552	10	23,274	25,891	82,731	354	**436,429**	102,911	212,495	11,239	67,969	54,331	1,361	**450,305**	-13,877	253,819
2063	48,224	156,568	3,526	48,222	66	23,509	24,395	67,441	513	**372,466**	98,047	222,613	10,430	67,789	46,355	619	**445,853**	-73,387	180,431
2064	55,484	160,242	2,028	42,917	112	24,145	23,193	57,891	522	**366,533**	86,720	238,089	9,554	70,167	45,017	341	**449,889**	-83,356	97,076
2065	65,827	173,812	2,161	49,480	59	22,970	23,319	51,407	527	**389,561**	84,139	225,422	9,564	75,053	42,722	307	**437,207**	-47,646	49,430

APPENDIX N

GROUNDWATER LEVELS MINIMUM THRESHOLDS AND MEASURABLE OBJECTIVES

APPENDIX N

WATER YEAR LEGEND

SAN JOAQUIN VALLEY RIVER INDEX

LEGEND:

Water Year Type

Wet

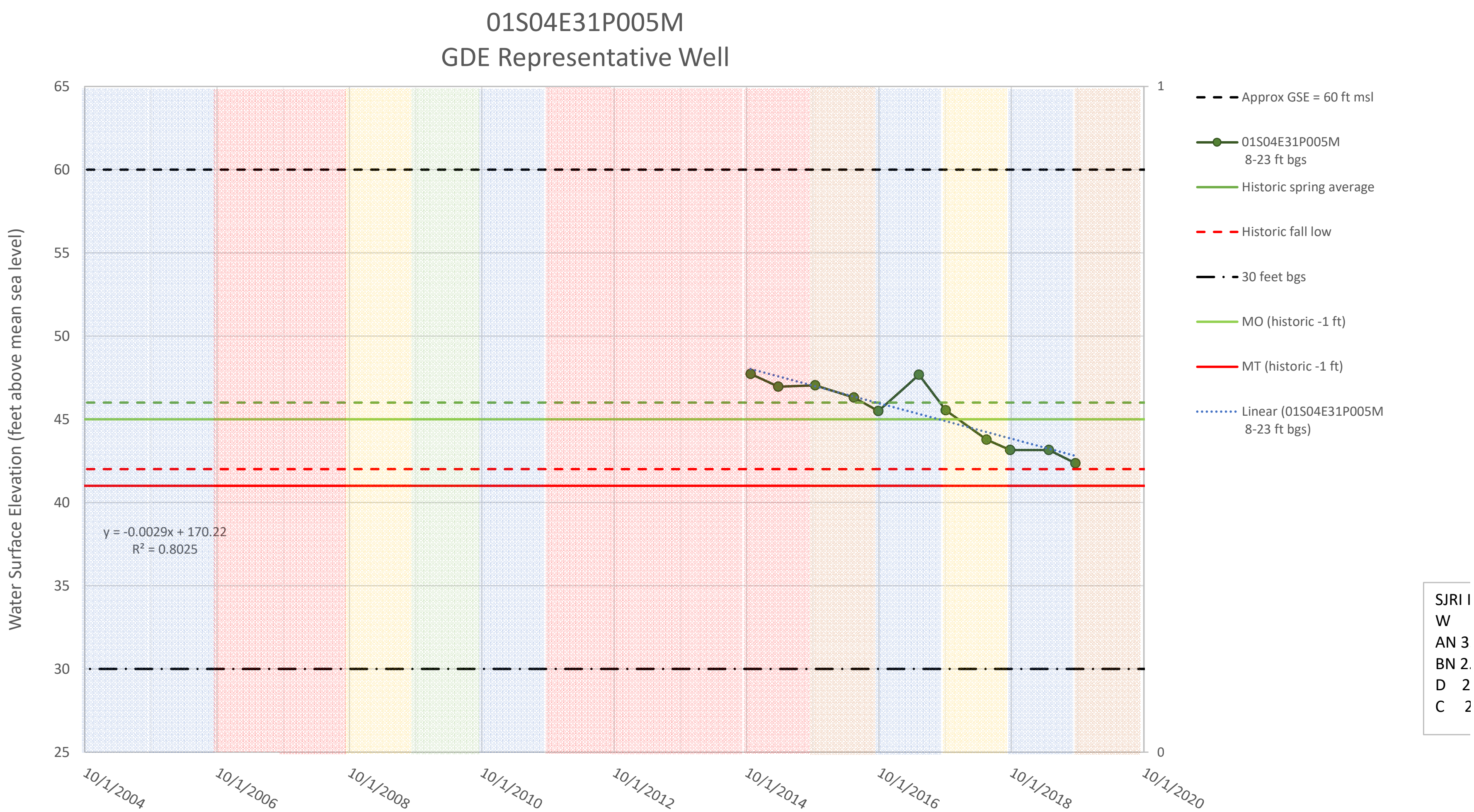
Above normal

Below Normal

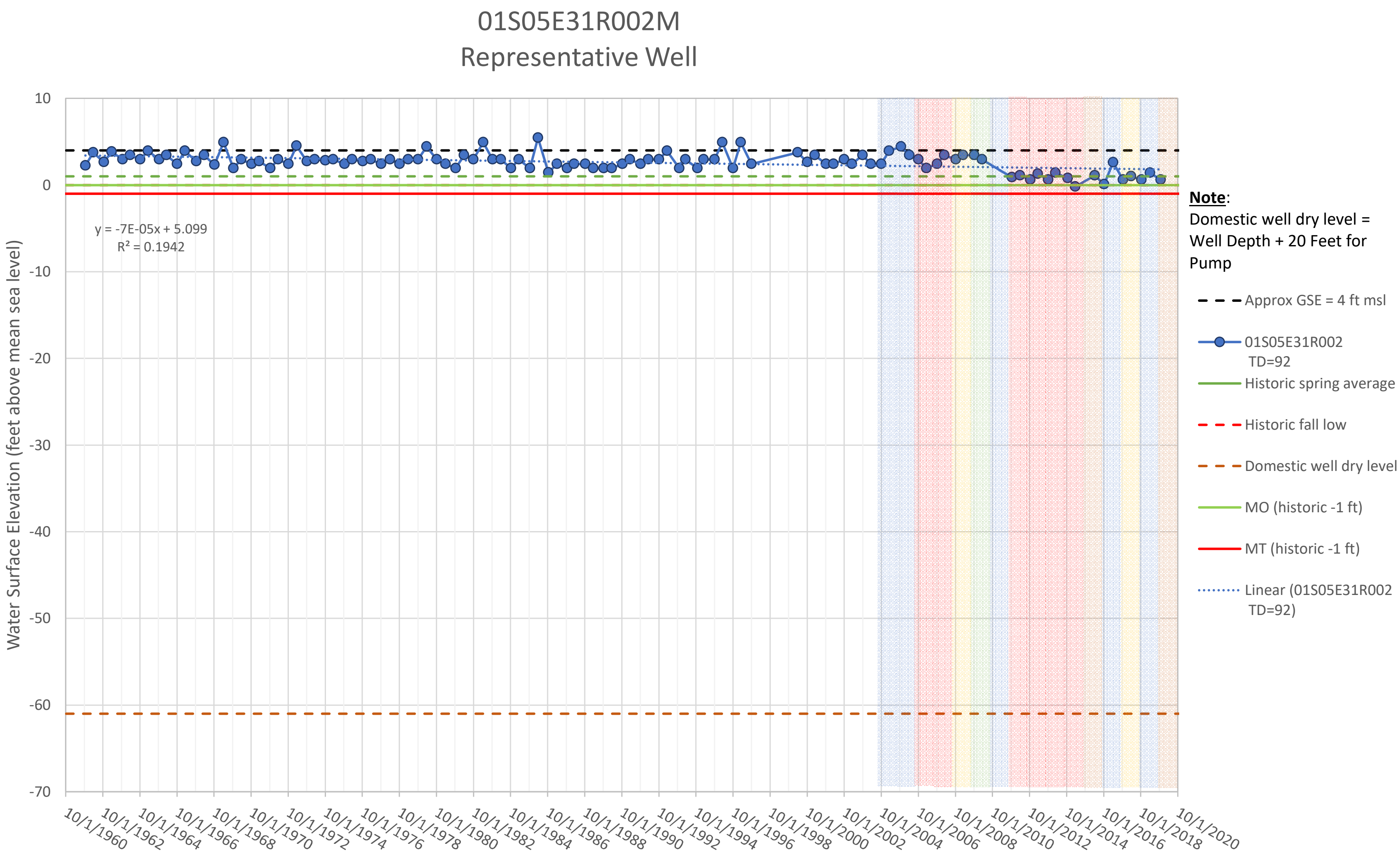
Dry

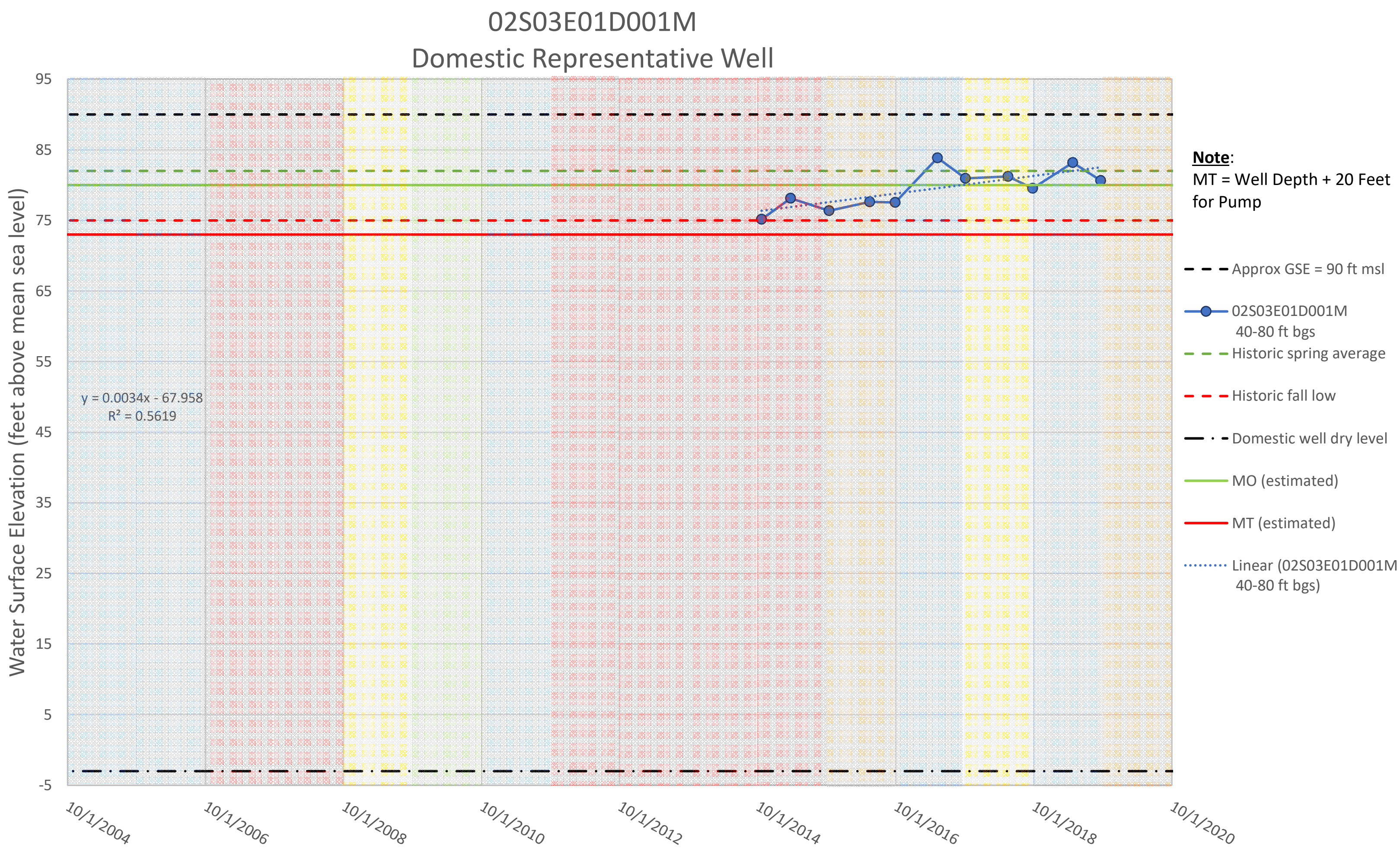
Critical

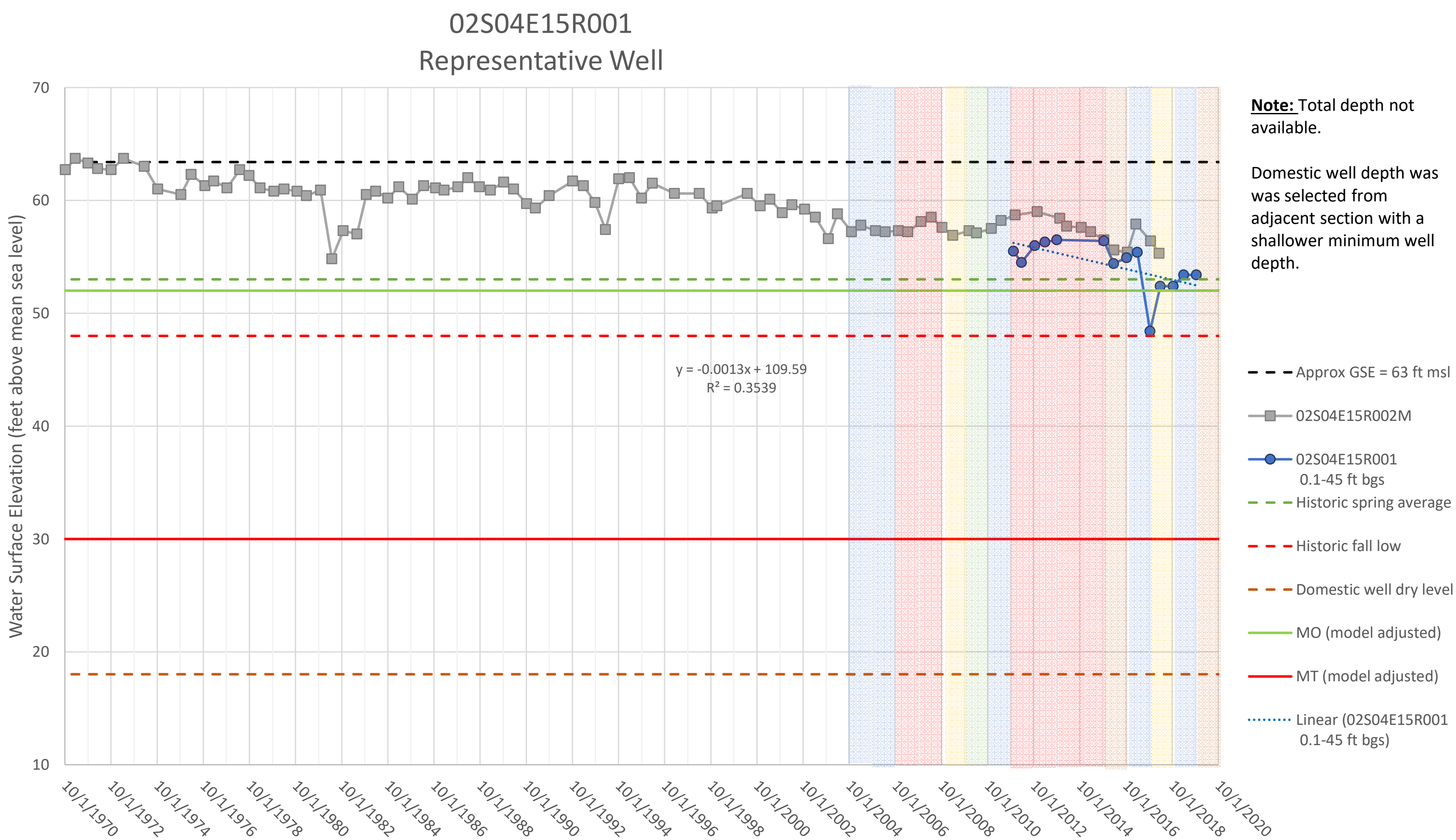
Source: https://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST



01S04E31P005M
GDE Representative Well
Water Surface Elevation (feet above mean sea level)
65
60
55
50
45
40
35
30
25
1
0
y = -0.0029x + 170.22
R² = 0.8025
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 60 ft msl
01S04E31P005M
8-23 ft bgs
Historic spring average
Historic fall low
30 feet bgs
MO (historic -1 ft)
MT (historic -1 ft)
Linear (01S04E31P005M
8-23 ft bgs)
SJRI I
W
AN 3
BN 2.
D 2
C 2

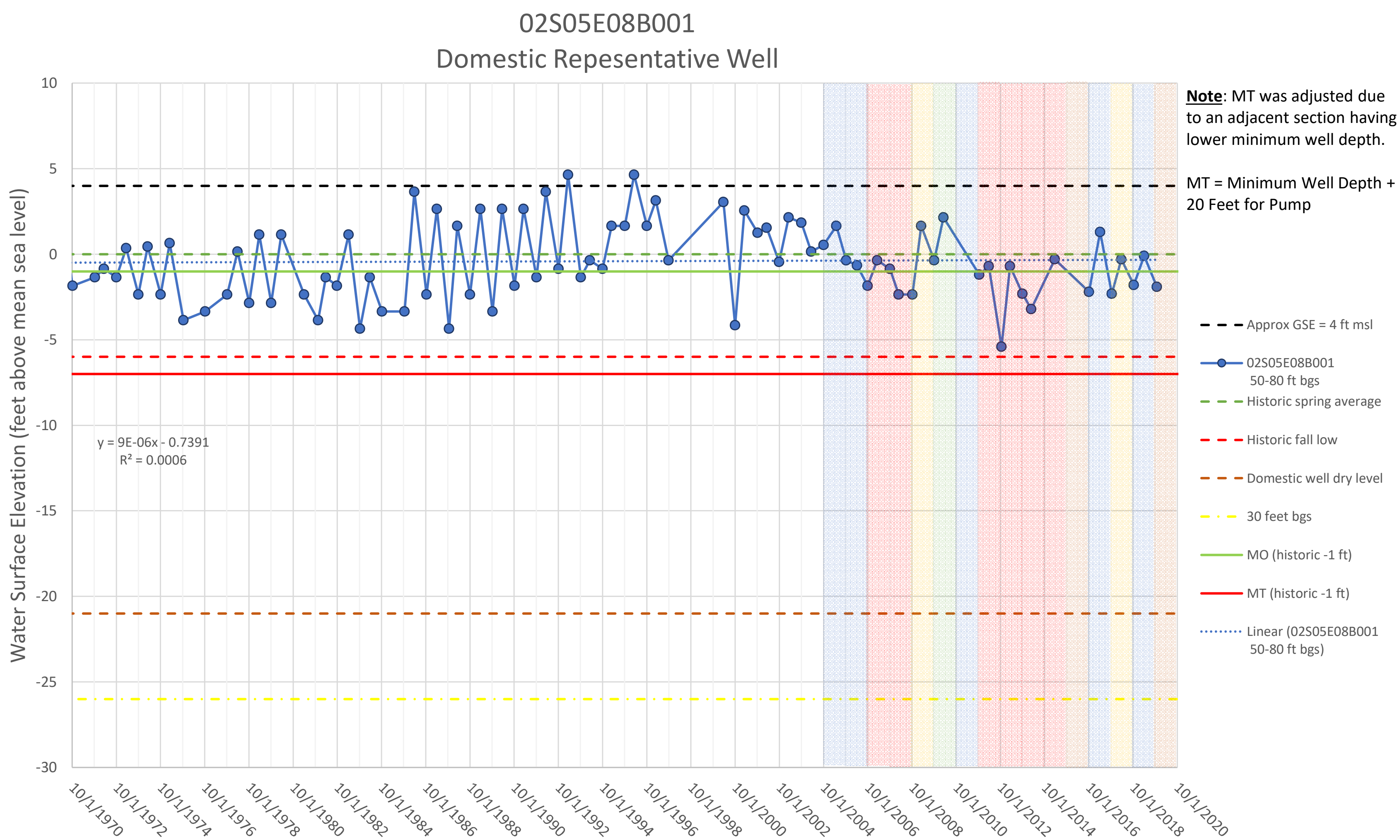

01S05E31R002M
Representative Well
Water Surface Elevation (feet above mean sea level)
10
0
-10
-20
-30
-40
-50
-60
-70
y = -7E-05x + 5.099
R^2 = 0.1942
10/1/1960
10/1/1962
10/1/1964
10/1/1966
10/1/1968
10/1/1970
10/1/1972
10/1/1974
10/1/1976
10/1/1978
10/1/1980
10/1/1982
10/1/1984
10/1/1986
10/1/1988
10/1/1990
10/1/1992
10/1/1994
10/1/1996
10/1/1998
10/1/2000
10/1/2002
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Note:
Domestic well dry level = Well Depth + 20 Feet for Pump
Approx GSE = 4 ft msl
01S05E31R002 TD=92
Historic spring average
Historic fall low
Domestic well dry level
MO (historic -1 ft)
MT (historic -1 ft)
Linear (01S05E31R002 TD=92)

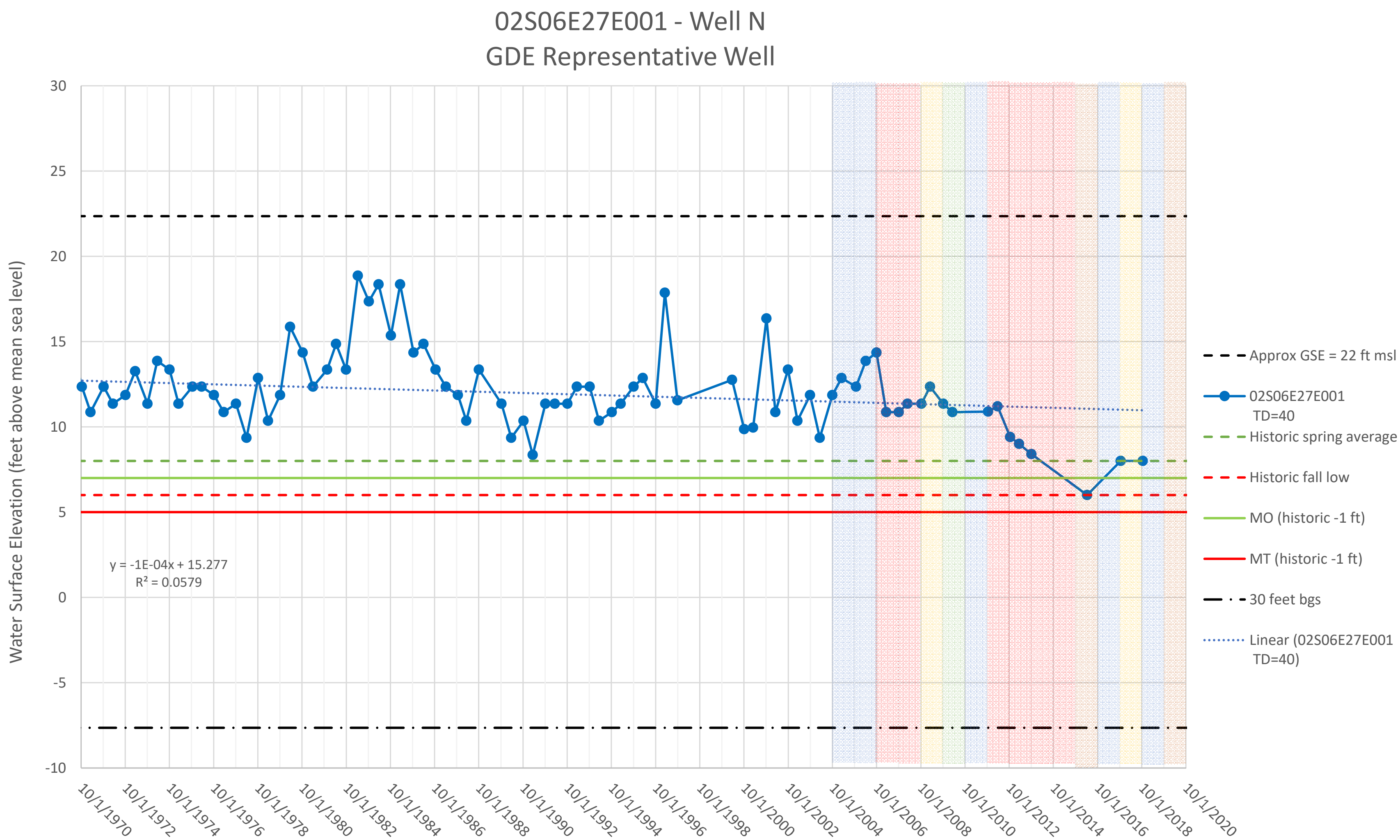

02S03E01D001M
Domestic Representative Well
Water Surface Elevation (feet above mean sea level)
95
85
75
65
55
45
35
25
15
5
-5
y = 0.0034x - 67.958
R² = 0.5619
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Note:
MT = Well Depth + 20 Feet for Pump
Approx GSE = 90 ft msl
02S03E01D001M 40-80 ft bgs
Historic spring average
Historic fall low
Domestic well dry level
MO (estimated)
MT (estimated)
Linear (02S03E01D001M 40-80 ft bgs)



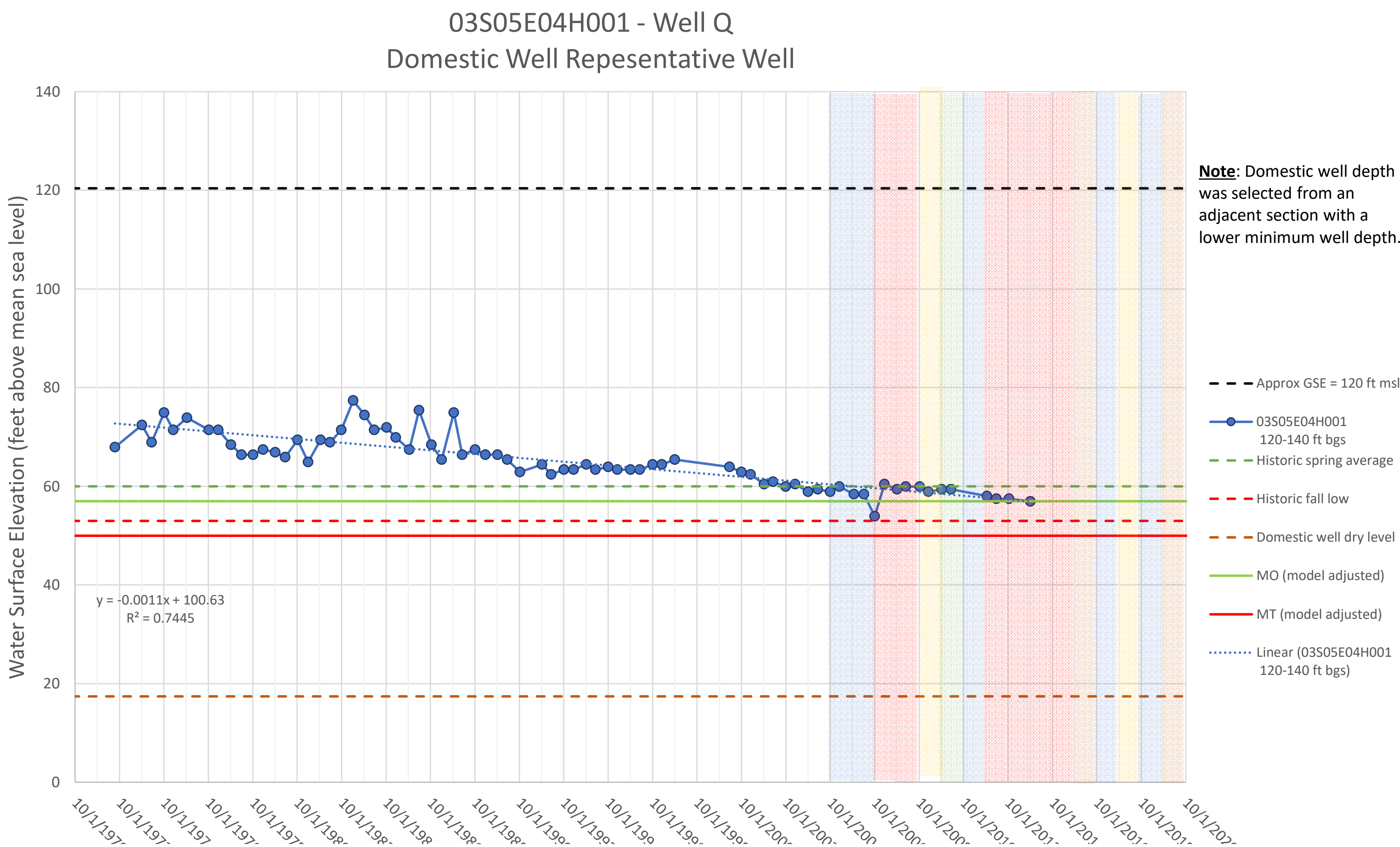
Note: Total depth not available.

Domestic well depth was was selected from adjacent section with a shallower minimum well depth.

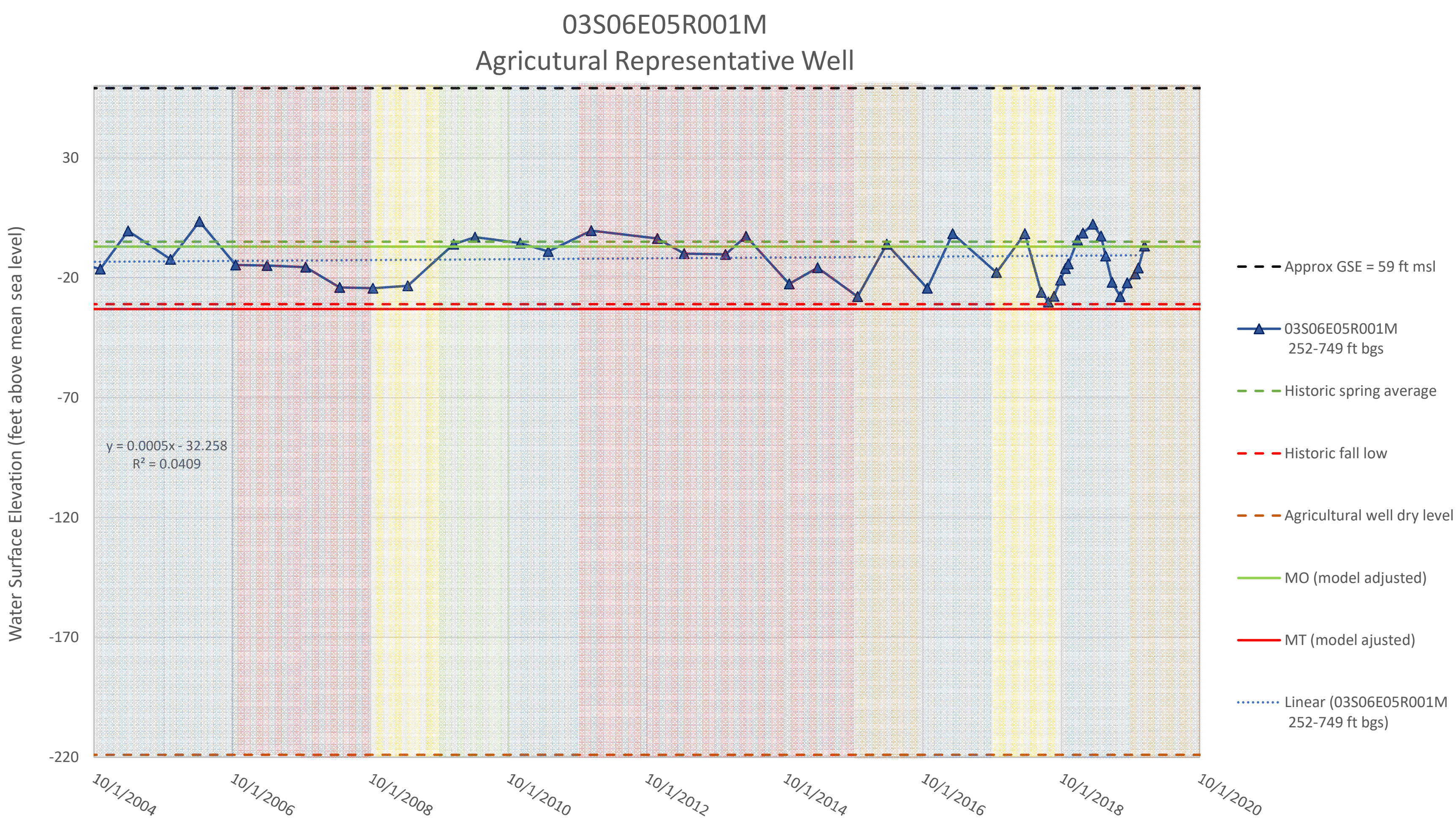

02S05E08B001
Domestic Repesentative Well
Water Surface Elevation (feet above mean sea level)
10
5
0
-5
-10
-15
-20
-25
-30
y = 9E-06x - 0.7391
R² = 0.0006
10/1/1970
10/1/1972
10/1/1974
10/1/1976
10/1/1978
10/1/1980
10/1/1982
10/1/1984
10/1/1986
10/1/1988
10/1/1990
10/1/1992
10/1/1994
10/1/1996
10/1/1998
10/1/2000
10/1/2002
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Note: MT was adjusted due to an adjacent section having lower minimum well depth.
MT = Minimum Well Depth + 20 Feet for Pump
Approx GSE = 4 ft msl
02S05E08B001 50-80 ft bgs
Historic spring average
Historic fall low
Domestic well dry level
30 feet bgs
MO (historic -1 ft)
MT (historic -1 ft)
Linear (02S05E08B001 50-80 ft bgs)



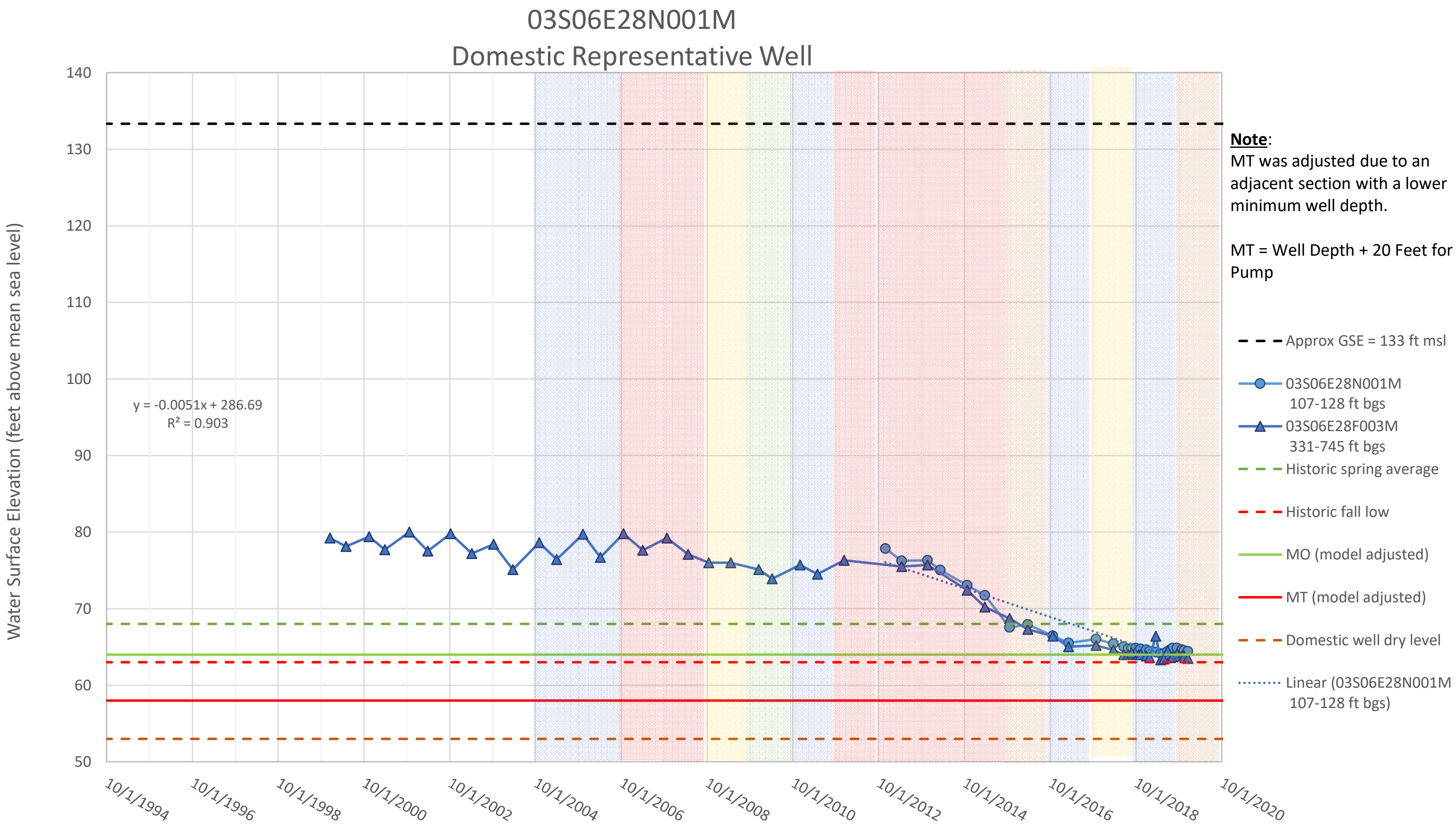
02S06E27E001 - Well N
GDE Representative Well
Water Surface Elevation (feet above mean sea level)
30
25
20
15
10
5
0
-5
-10
y = -1E-04x + 15.277
R² = 0.0579
10/1/1970
10/1/1972
10/1/1974
10/1/1976
10/1/1978
10/1/1980
10/1/1982
10/1/1984
10/1/1986
10/1/1988
10/1/1990
10/1/1992
10/1/1994
10/1/1996
10/1/1998
10/1/2000
10/1/2002
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 22 ft msl
02S06E27E001 TD=40
Historic spring average
Historic fall low
MO (historic -1 ft)
MT (historic -1 ft)
30 feet bgs
Linear (02S06E27E001 TD=40)

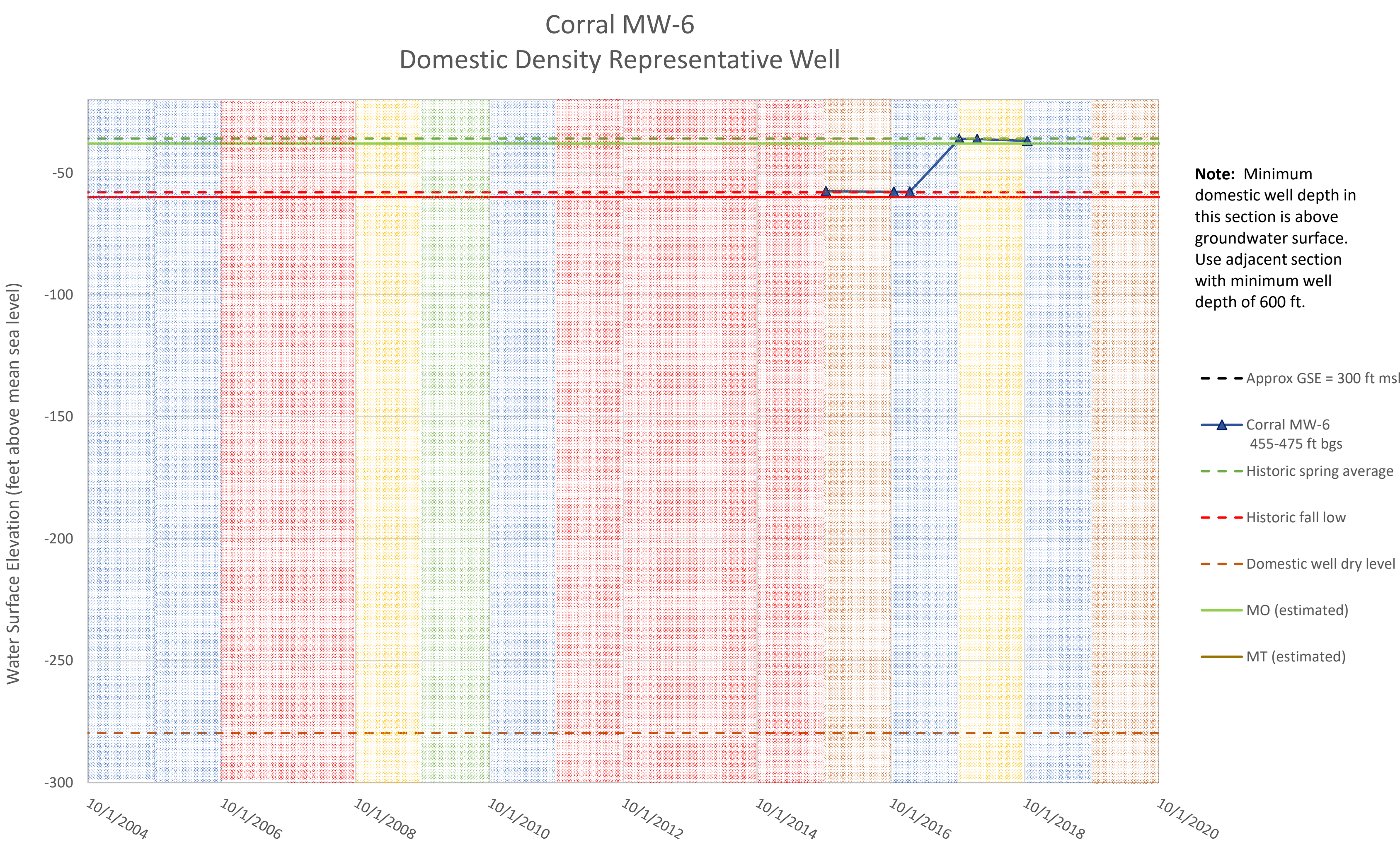


03S05E04H001 - Well Q
Domestic Well Repesentative Well
Water Surface Elevation (feet above mean sea level)
140
120
100
80
60
40
20
0
y = -0.0011x + 100.63
R^2 = 0.7445
Note: Domestic well depth was selected from an adjacent section with a lower minimum well depth.
Approx GSE = 120 ft msl
03S05E04H001 120-140 ft bgs
Historic spring average
Historic fall low
Domestic well dry level
MO (model adjusted)
MT (model adjusted)
Linear (03S05E04H001 120-140 ft bgs)

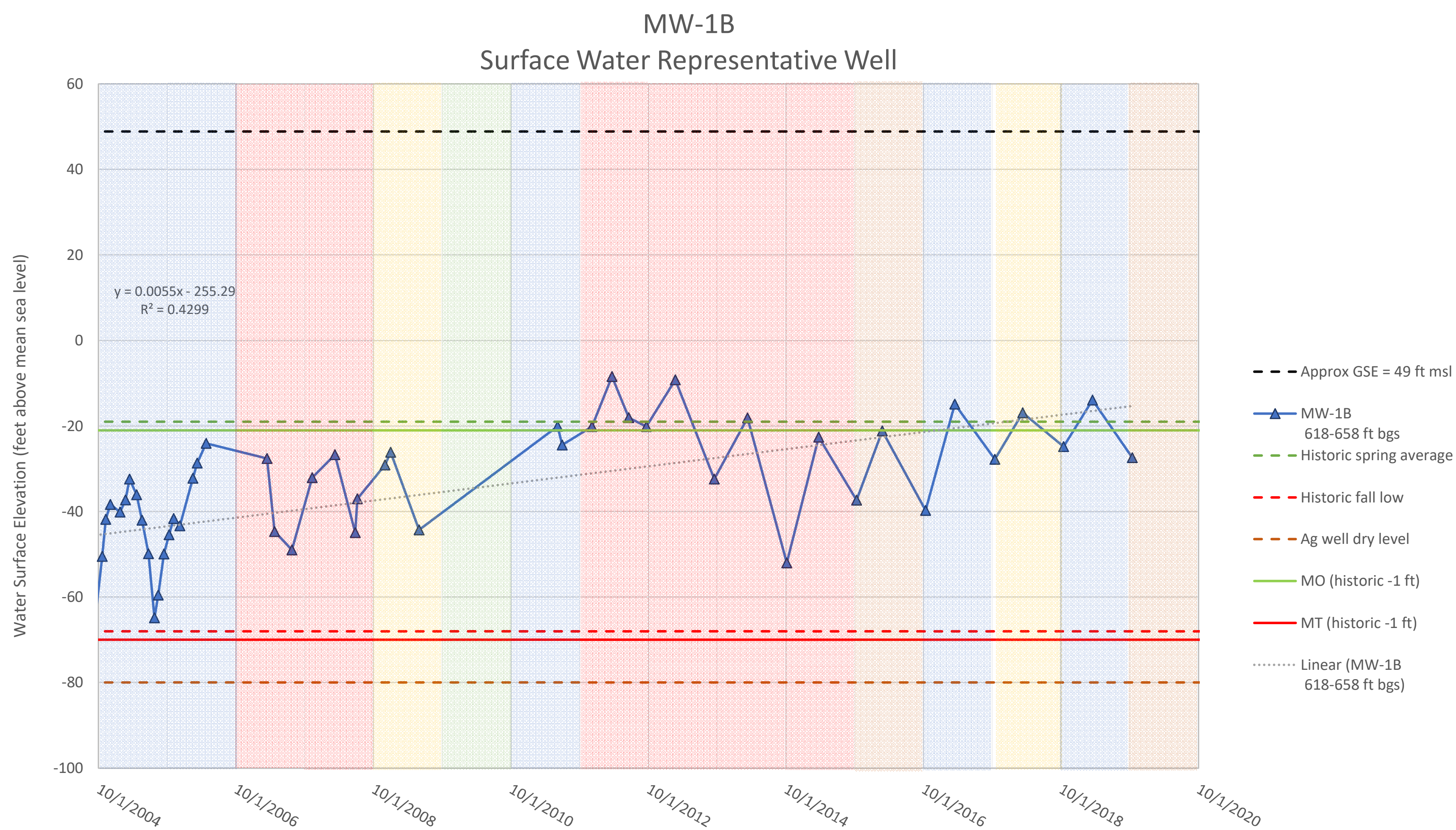


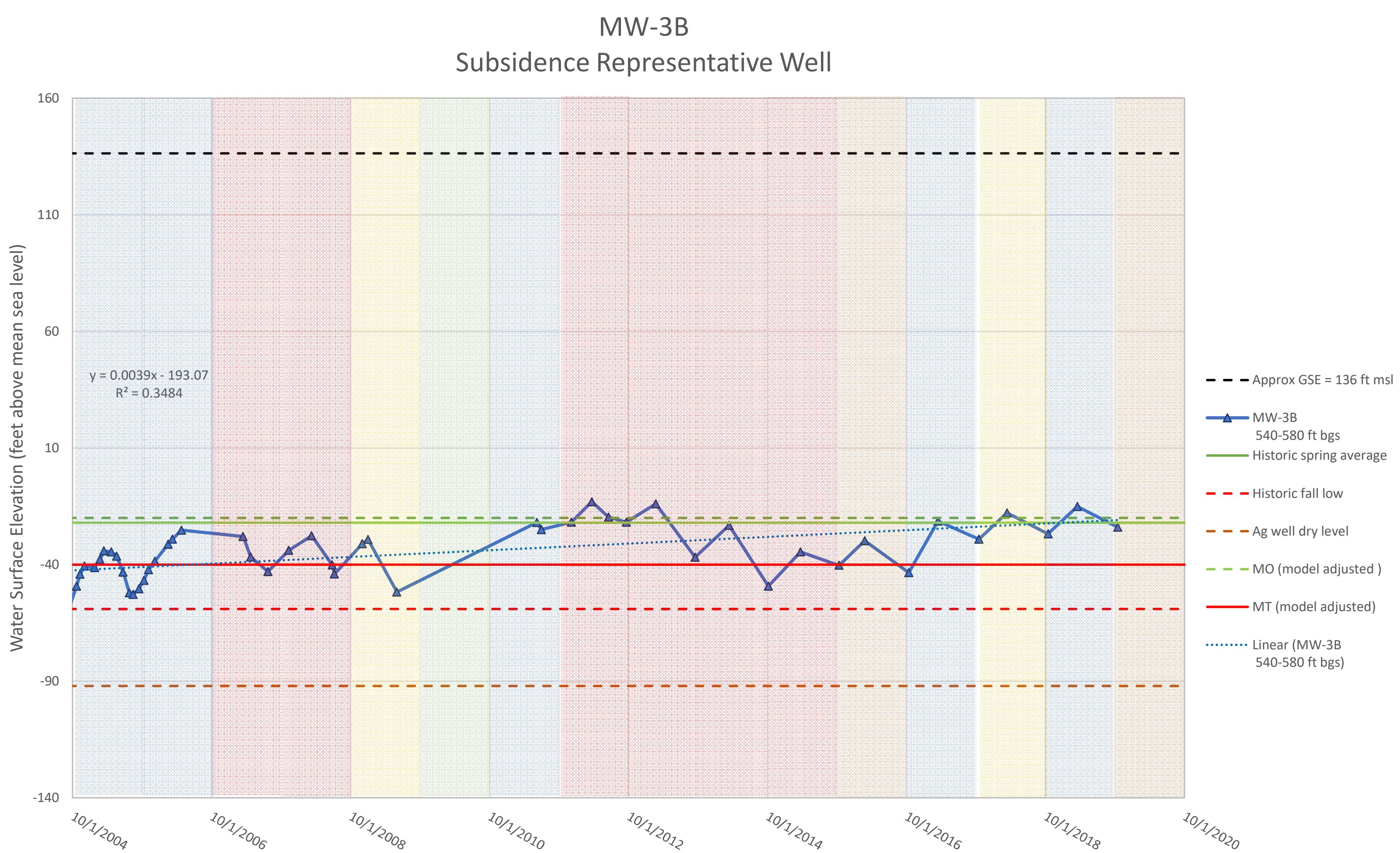
03S06E05R001M
Agricutural Representative Well
Water Surface Elevation (feet above mean sea level)
30
-20
-70
-120
-170
-220
y = 0.0005x - 32.258
R² = 0.0409
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 59 ft msl
03S06E05R001M 252-749 ft bgs
Historic spring average
Historic fall low
Agricultural well dry level
MO (model adjusted)
MT (model ajusted)
Linear (03S06E05R001M 252-749 ft bgs)


03S06E28N001M
Domestic Representative Well
Water Surface Elevation (feet above mean sea level)
140
130
120
110
100
90
80
70
60
50
y = -0.0051x + 286.69
R² = 0.903
10/1/1994
10/1/1996
10/1/1998
10/1/2000
10/1/2002
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Note:
MT was adjusted due to an adjacent section with a lower minimum well depth.
MT = Well Depth + 20 Feet for Pump
Approx GSE = 133 ft msl
03S06E28N001M 107-128 ft bgs
03S06E28F003M 331-745 ft bgs
Historic spring average
Historic fall low
MO (model adjusted)
MT (model adjusted)
Domestic well dry level
Linear (03S06E28N001M 107-128 ft bgs)

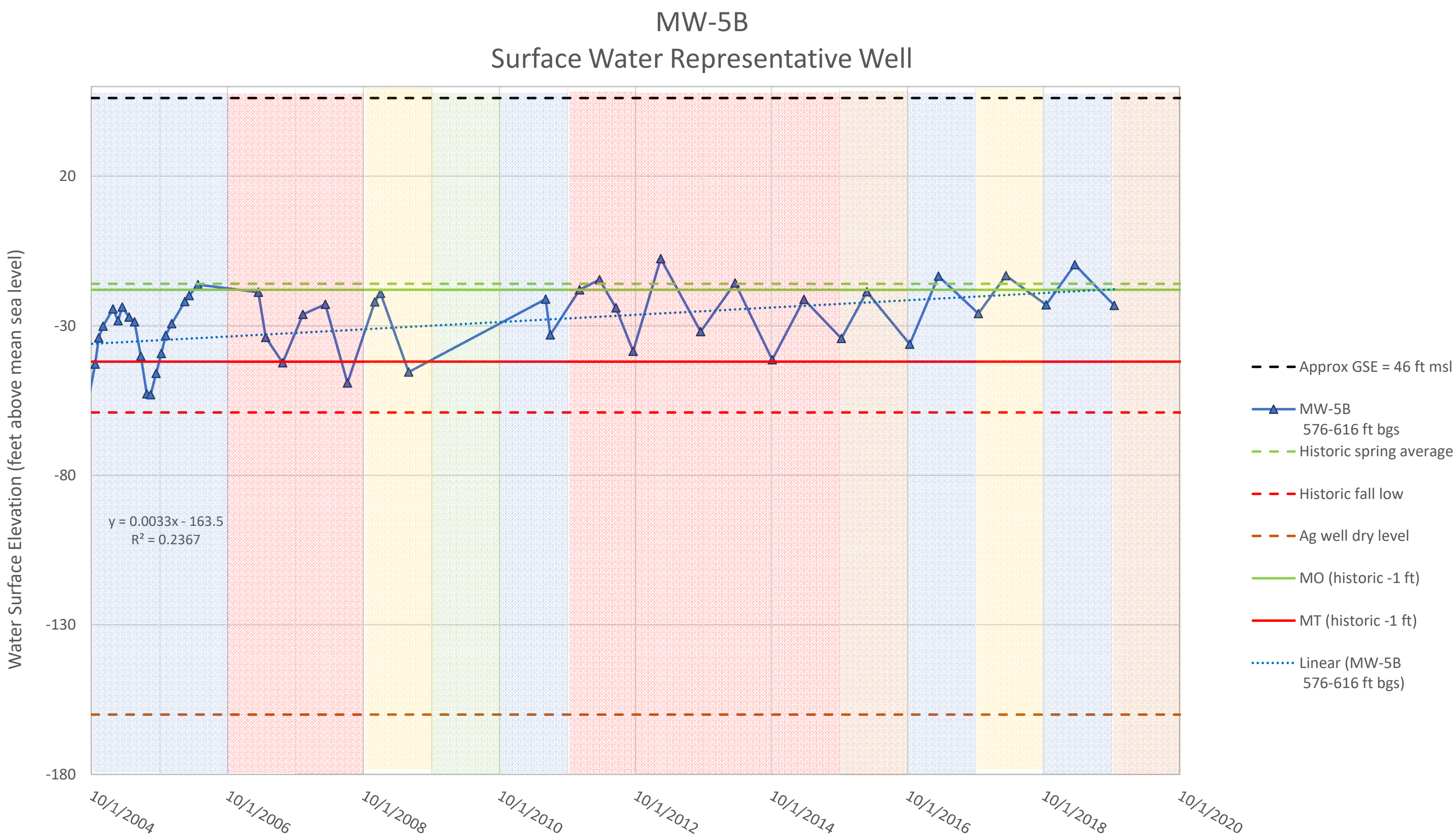


Corral MW-6
Domestic Density Representative Well
Water Surface Elevation (feet above mean sea level)
-50
-100
-150
-200
-250
-300
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Note: Minimum domestic well depth in this section is above groundwater surface. Use adjacent section with minimum well depth of 600 ft.
Approx GSE = 300 ft msl
Corral MW-6
455-475 ft bgs
Historic spring average
Historic fall low
Domestic well dry level
MO (estimated)
MT (estimated)

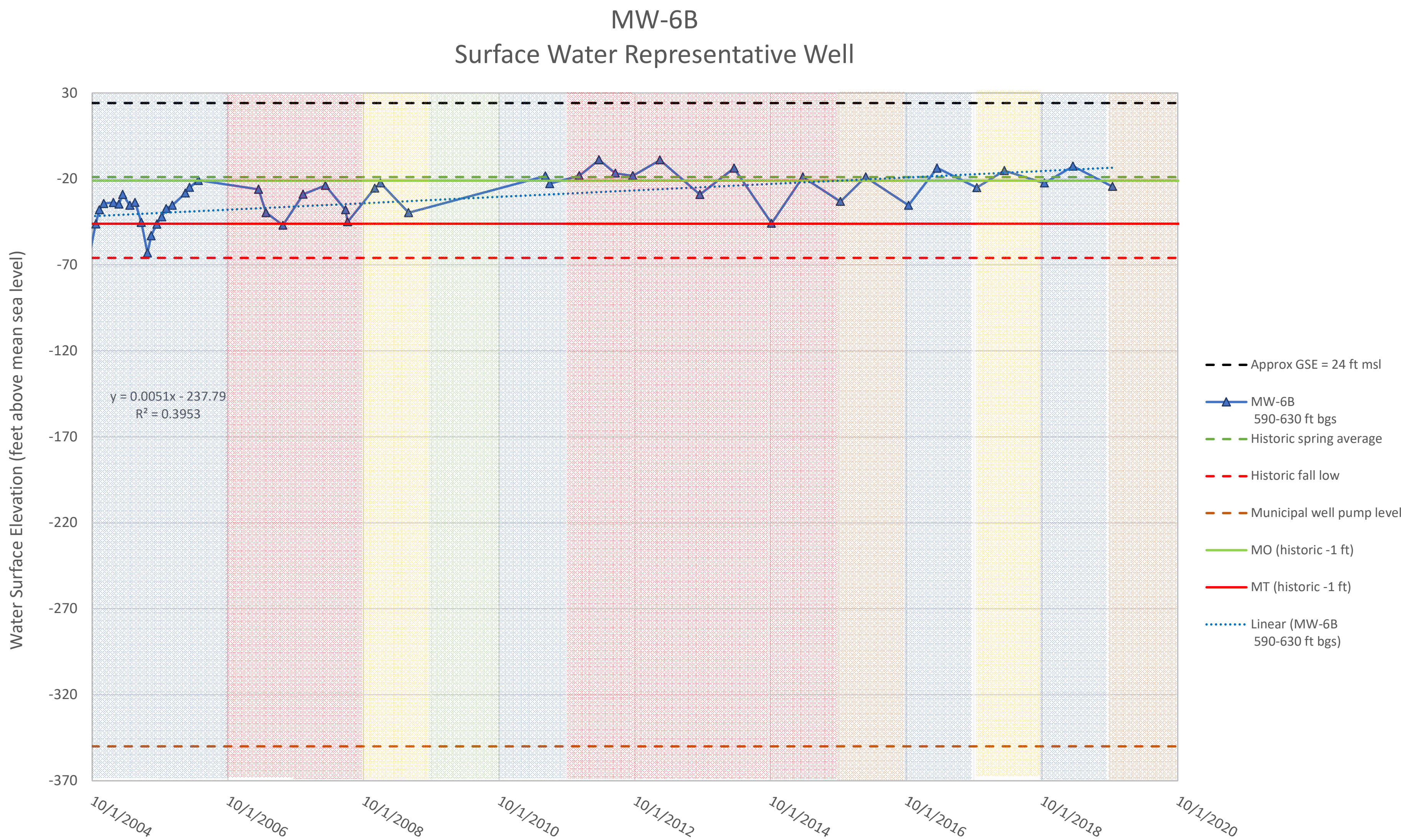

MW-1B
Surface Water Representative Well
Water Surface Elevation (feet above mean sea level)
60
40
20
0
-20
-40
-60
-80
-100
y = 0.0055x - 255.29
R² = 0.4299
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 49 ft msl
MW-1B
618-658 ft bgs
Historic spring average
Historic fall low
Ag well dry level
MO (historic -1 ft)
MT (historic -1 ft)
Linear (MW-1B
618-658 ft bgs)

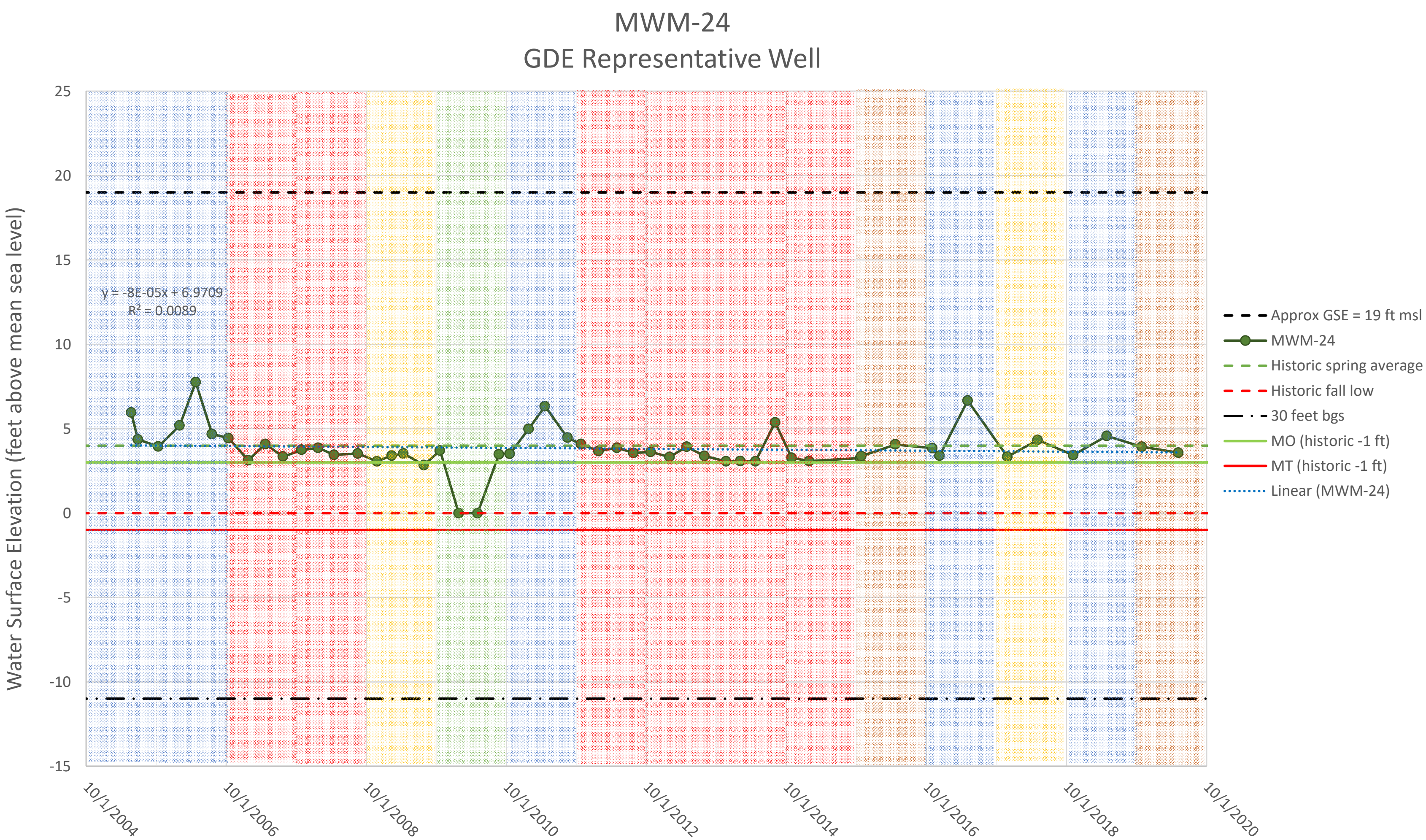


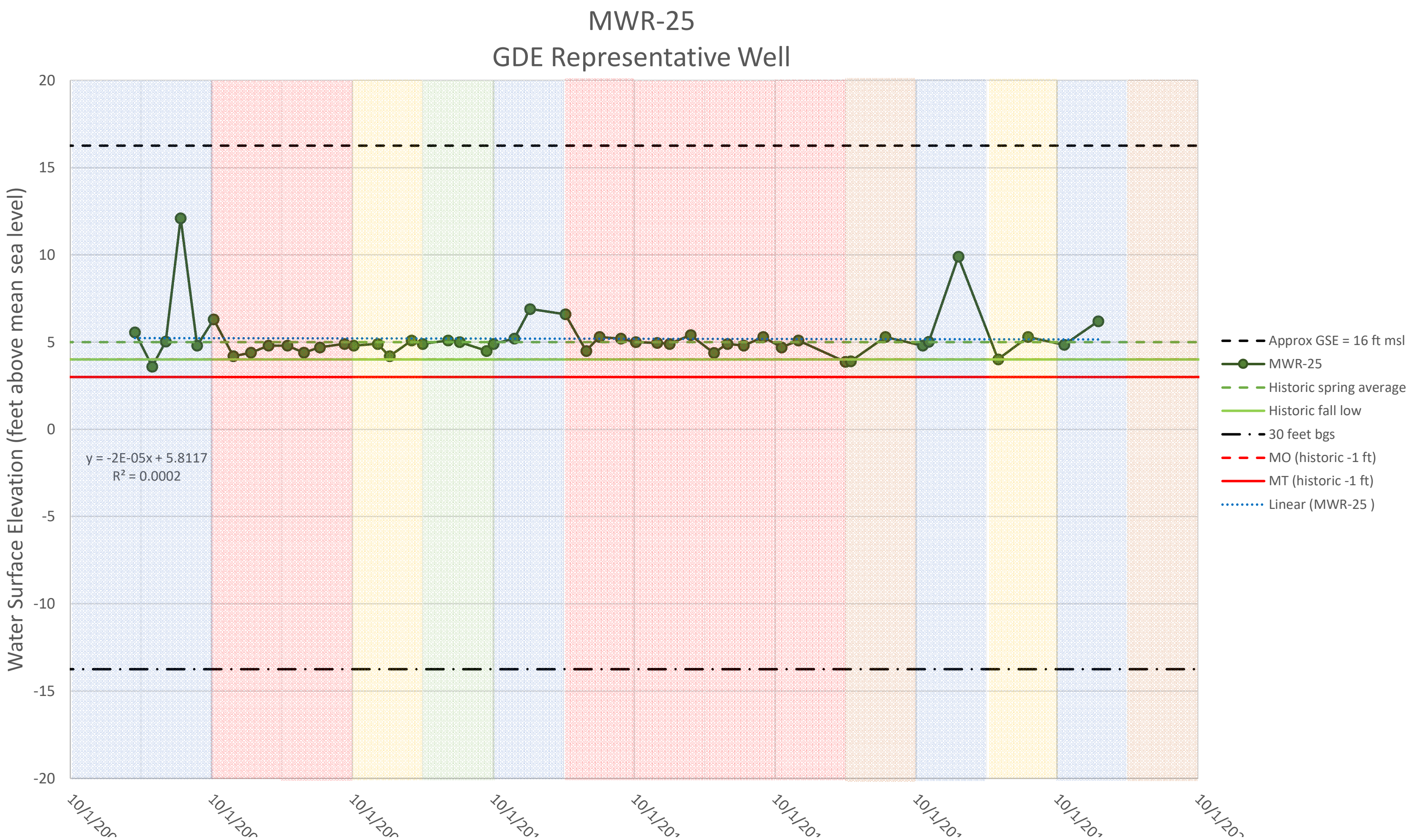
MW-3B
Subsidence Representative Well
Water Surface Elevation (feet above mean sea level)
160
110
60
10
-40
-90
-140
y = 0.0039x - 193.07
R² = 0.3484
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 136 ft msl
MW-3B
540-580 ft bgs
Historic spring average
Historic fall low
Ag well dry level
MO (model adjusted)
MT (model adjusted)
Linear (MW-3B
540-580 ft bgs)



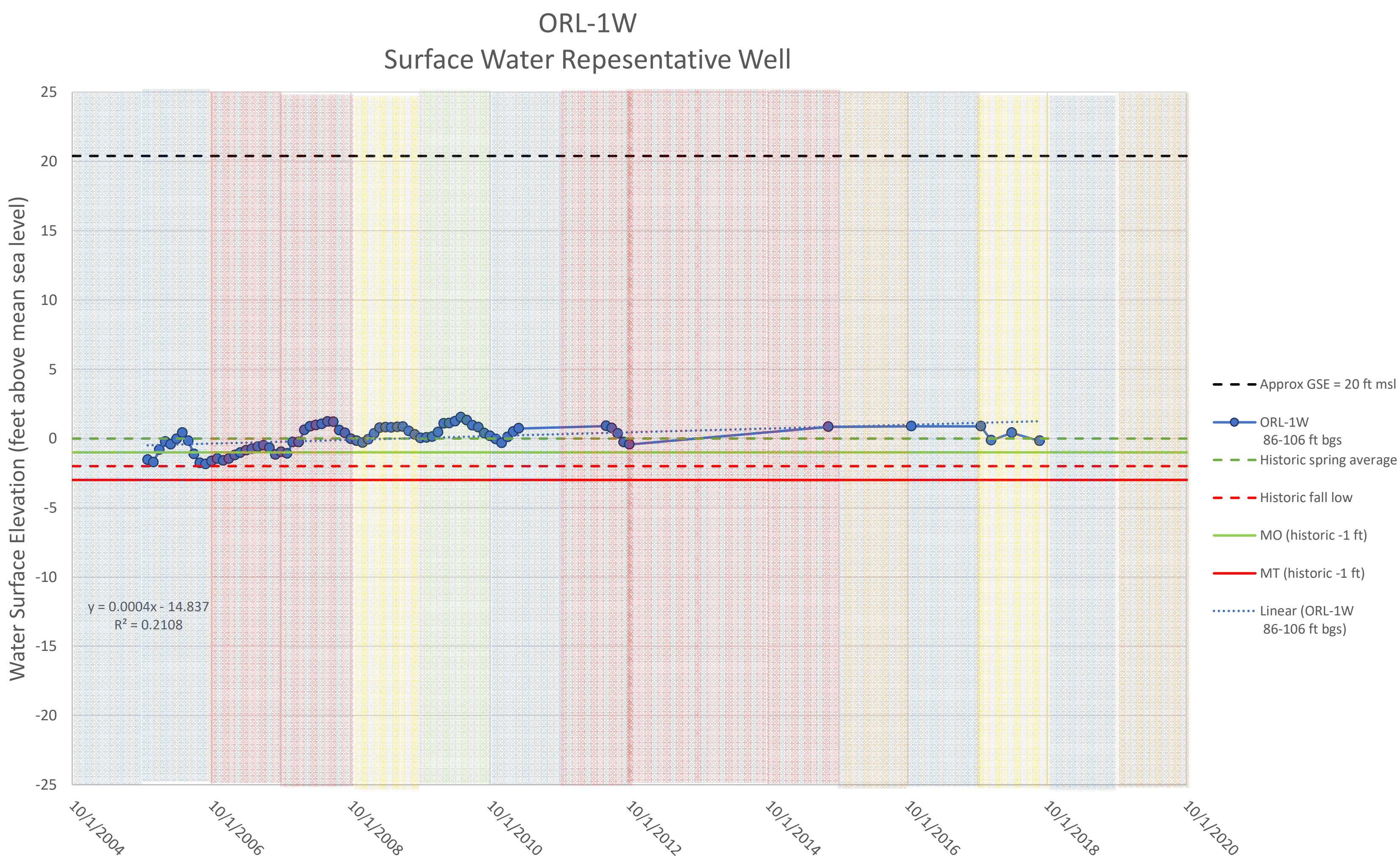
MW-5B
Surface Water Representative Well
Water Surface Elevation (feet above mean sea level)
20
-30
-80
-130
-180
y = 0.0033x - 163.5
R² = 0.2367
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 46 ft msl
MW-5B
576-616 ft bgs
Historic spring average
Historic fall low
Ag well dry level
MO (historic -1 ft)
MT (historic -1 ft)
Linear (MW-5B
576-616 ft bgs)

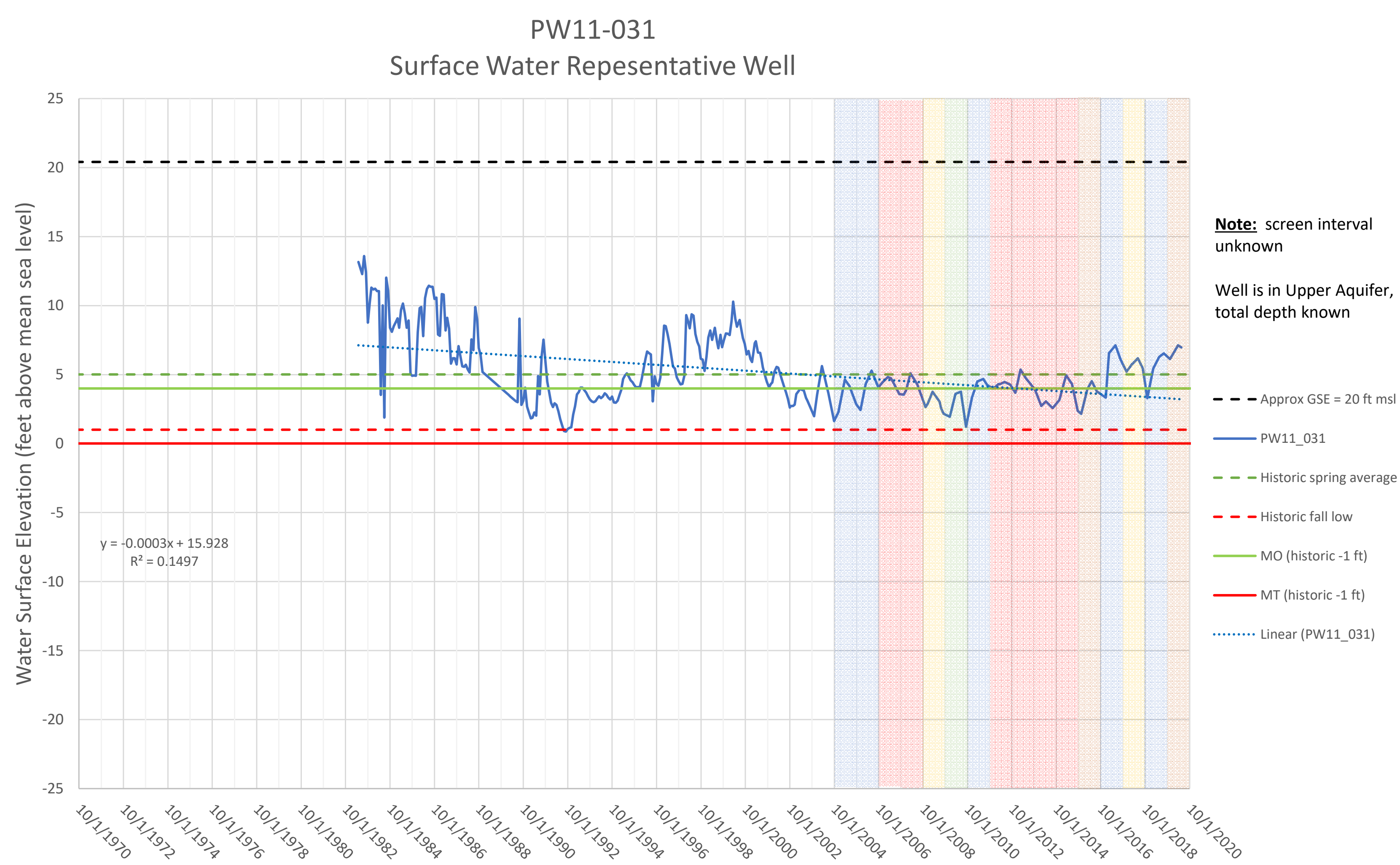

MW-6B
Surface Water Representative Well
Water Surface Elevation (feet above mean sea level)
30
-20
-70
-120
-170
-220
-270
-320
-370
y = 0.0051x - 237.79
R² = 0.3953
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 24 ft msl
MW-6B
590-630 ft bgs
Historic spring average
Historic fall low
Municipal well pump level
MO (historic -1 ft)
MT (historic -1 ft)
Linear (MW-6B
590-630 ft bgs)


MWM-24
GDE Representative Well
Water Surface Elevation (feet above mean sea level)
25
20
15
10
5
0
-5
-10
-15
y = -8E-05x + 6.9709
R² = 0.0089
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 19 ft msl
MWM-24
Historic spring average
Historic fall low
30 feet bgs
MO (historic -1 ft)
MT (historic -1 ft)
Linear (MWM-24)

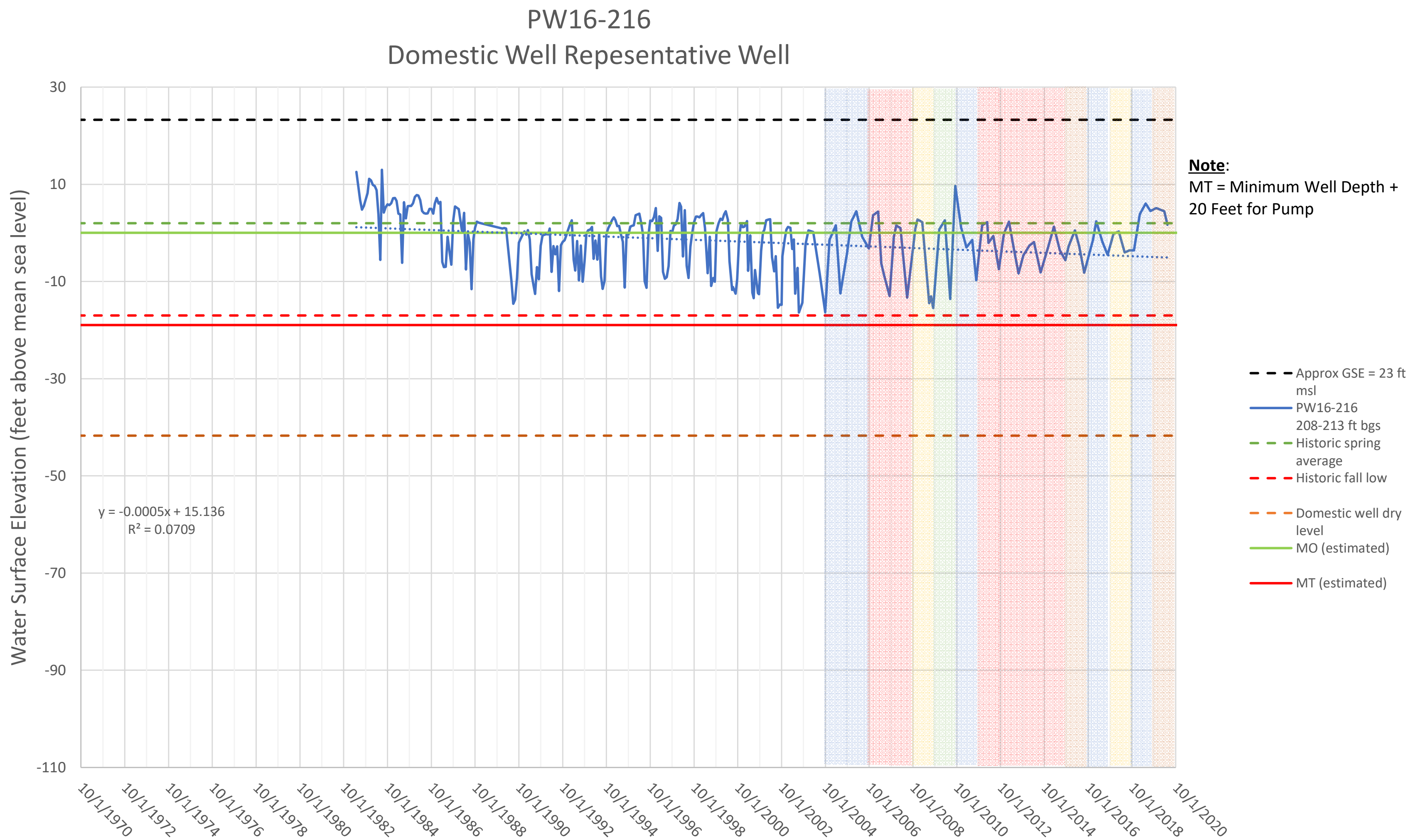


MWR-25
GDE Representative Well
Water Surface Elevation (feet above mean sea level)
20
15
10
5
0
-5
-10
-15
-20
y = -2E-05x + 5.8117
R² = 0.0002
Approx GSE = 16 ft msl
MWR-25
Historic spring average
Historic fall low
30 feet bgs
MO (historic -1 ft)
MT (historic -1 ft)
Linear (MWR-25)

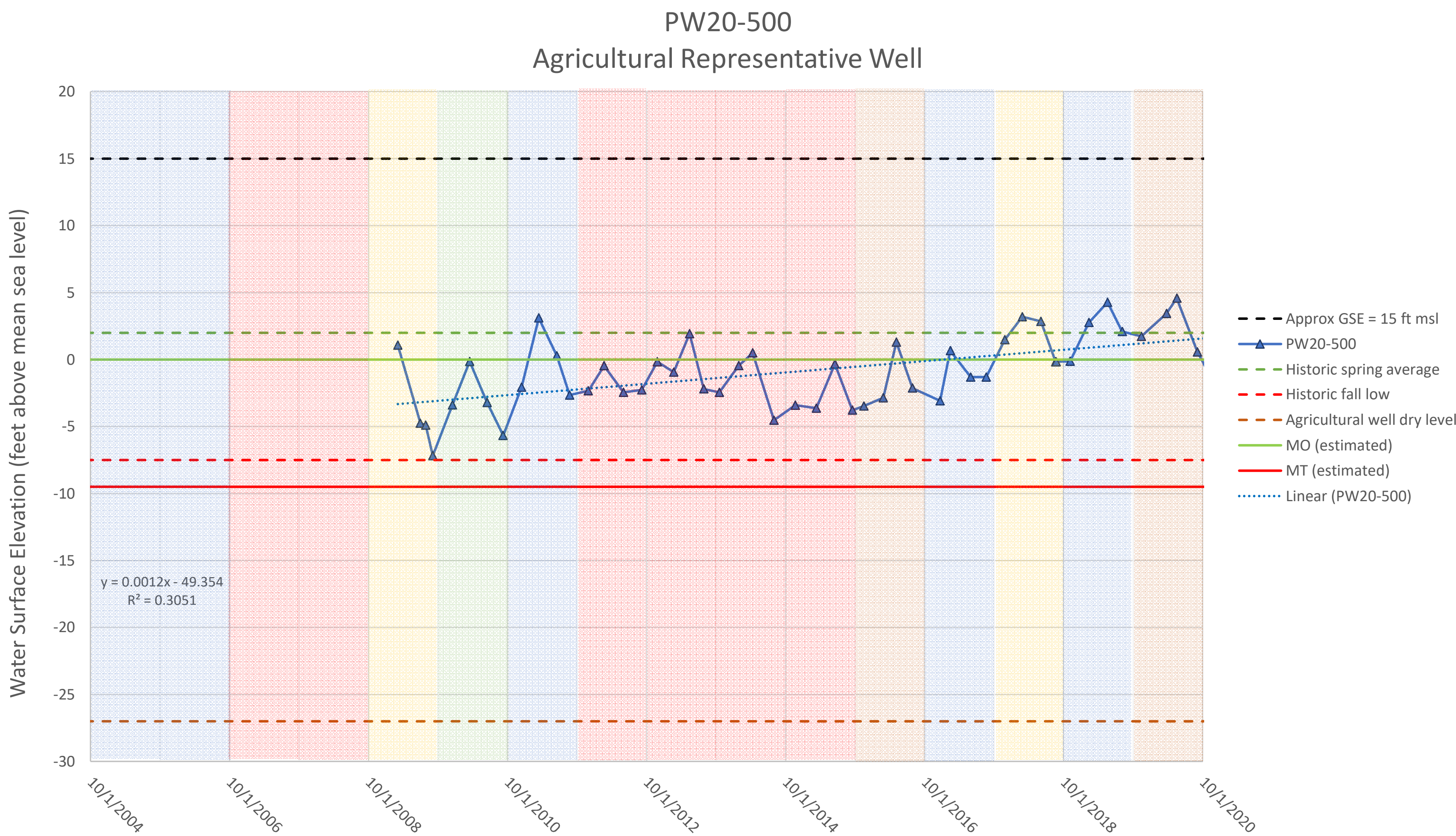

ORL-1W
Surface Water Repesentative Well
Water Surface Elevation (feet above mean sea level)
25
20
15
10
5
0
-5
-10
-15
-20
-25
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
y = 0.0004x - 14.837
R² = 0.2108
Approx GSE = 20 ft msl
ORL-1W
86-106 ft bgs
Historic spring average
Historic fall low
MO (historic -1 ft)
MT (historic -1 ft)
Linear (ORL-1W
86-106 ft bgs)



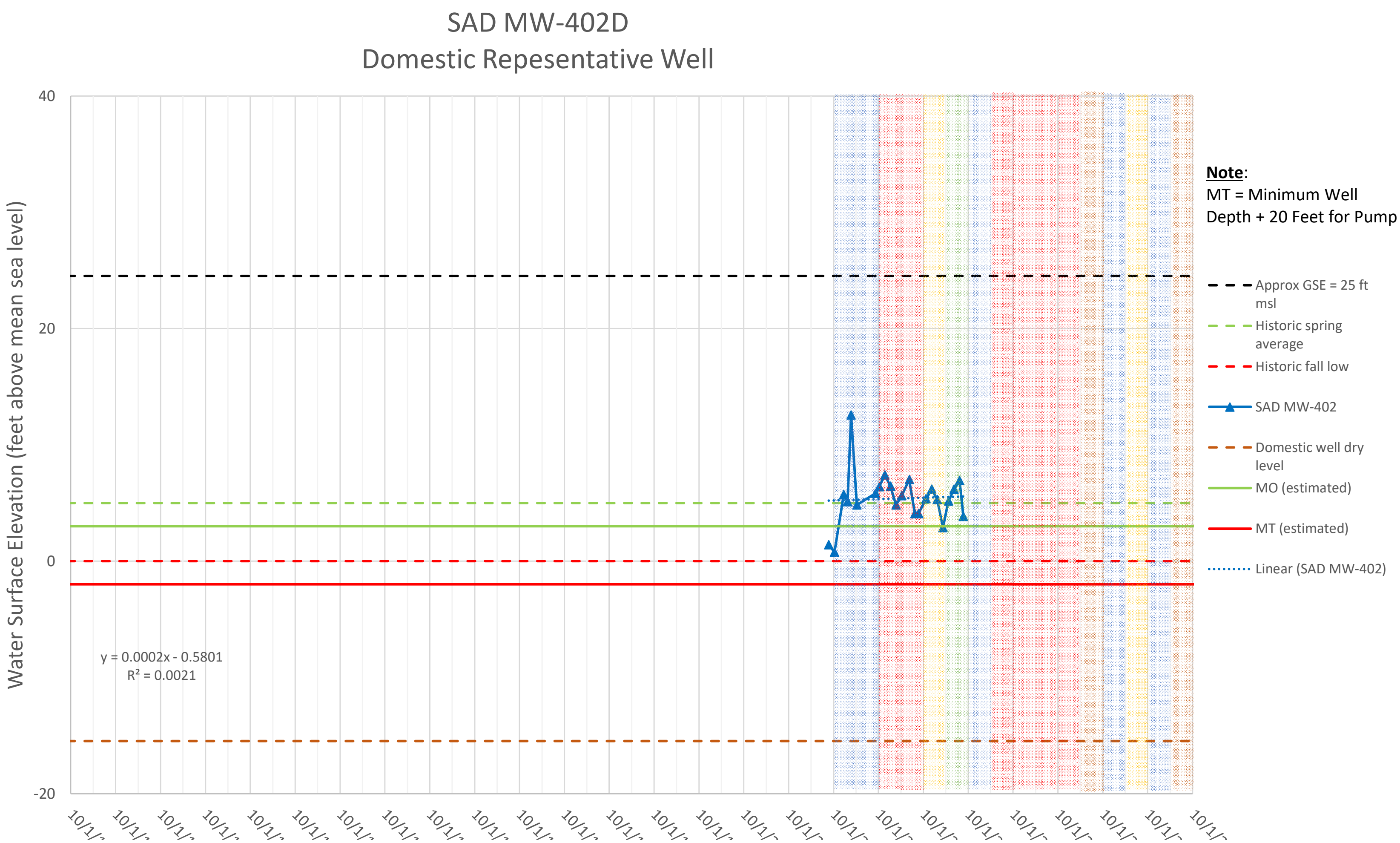
PW11-031
Surface Water Repesentative Well
Water Surface Elevation (feet above mean sea level)
25
20
15
10
5
0
-5
-10
-15
-20
-25
y = -0.0003x + 15.928
R² = 0.1497
10/1/1970
10/1/1972
10/1/1974
10/1/1976
10/1/1978
10/1/1980
10/1/1982
10/1/1984
10/1/1986
10/1/1988
10/1/1990
10/1/1992
10/1/1994
10/1/1996
10/1/1998
10/1/2000
10/1/2002
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Note: screen interval unknown
Well is in Upper Aquifer, total depth known
Approx GSE = 20 ft msl
PW11_031
Historic spring average
Historic fall low
MO (historic -1 ft)
MT (historic -1 ft)
Linear (PW11_031)



PW16-216
Domestic Well Repesentative Well
Water Surface Elevation (feet above mean sea level)
30
10
-10
-30
-50
-70
-90
-110
y = -0.0005x + 15.136
R² = 0.0709
10/1/1970
10/1/1972
10/1/1974
10/1/1976
10/1/1978
10/1/1980
10/1/1982
10/1/1984
10/1/1986
10/1/1988
10/1/1990
10/1/1992
10/1/1994
10/1/1996
10/1/1998
10/1/2000
10/1/2002
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Note:
MT = Minimum Well Depth + 20 Feet for Pump
Approx GSE = 23 ft msl
PW16-216 208-213 ft bgs
Historic spring average
Historic fall low
Domestic well dry level
MO (estimated)
MT (estimated)



PW20-500
Agricultural Representative Well
Water Surface Elevation (feet above mean sea level)
20
15
10
5
0
-5
-10
-15
-20
-25
-30
y = 0.0012x - 49.354
R² = 0.3051
10/1/2004
10/1/2006
10/1/2008
10/1/2010
10/1/2012
10/1/2014
10/1/2016
10/1/2018
10/1/2020
Approx GSE = 15 ft msl
PW20-500
Historic spring average
Historic fall low
Agricultural well dry level
MO (estimated)
MT (estimated)
Linear (PW20-500)

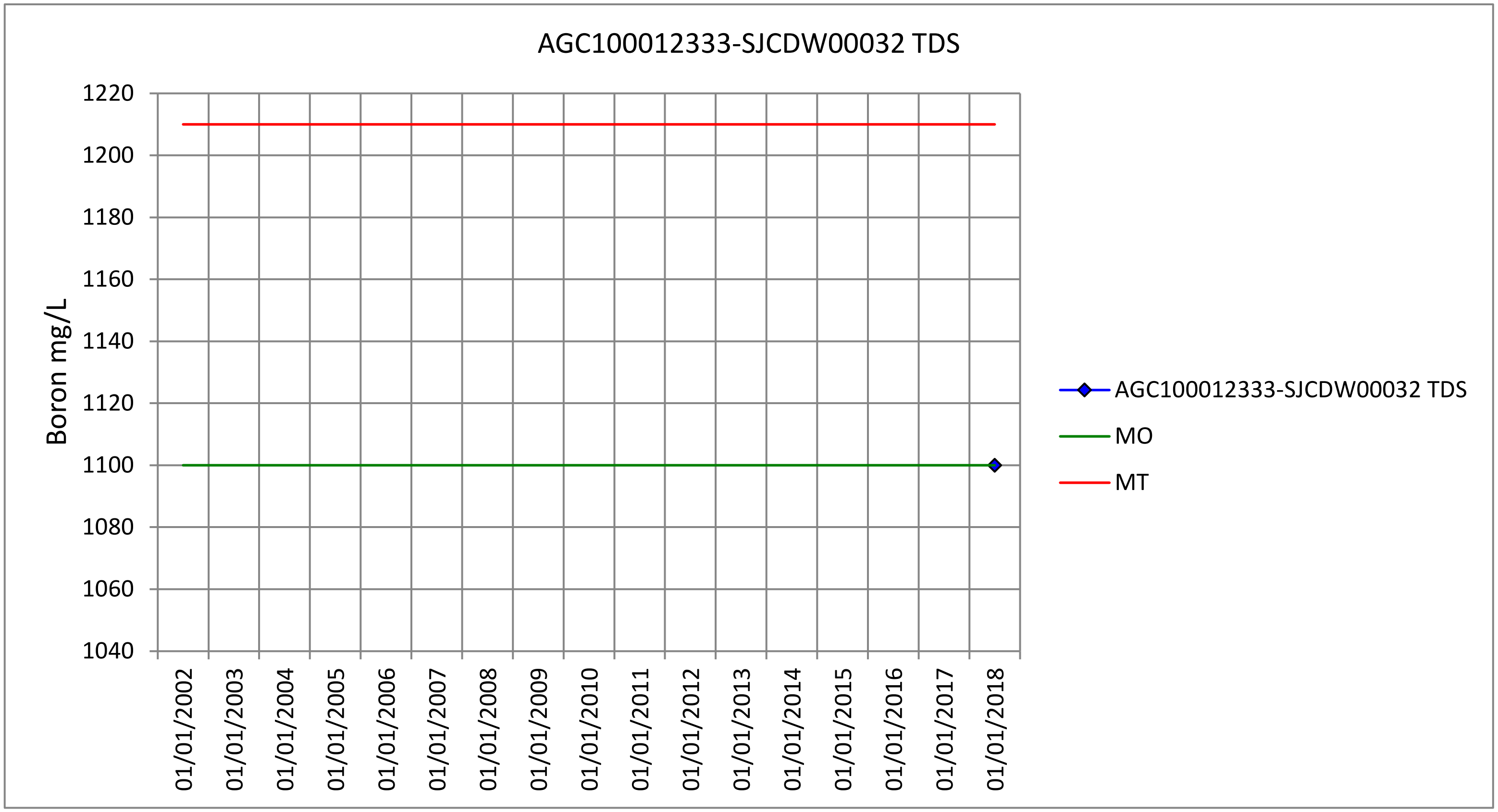


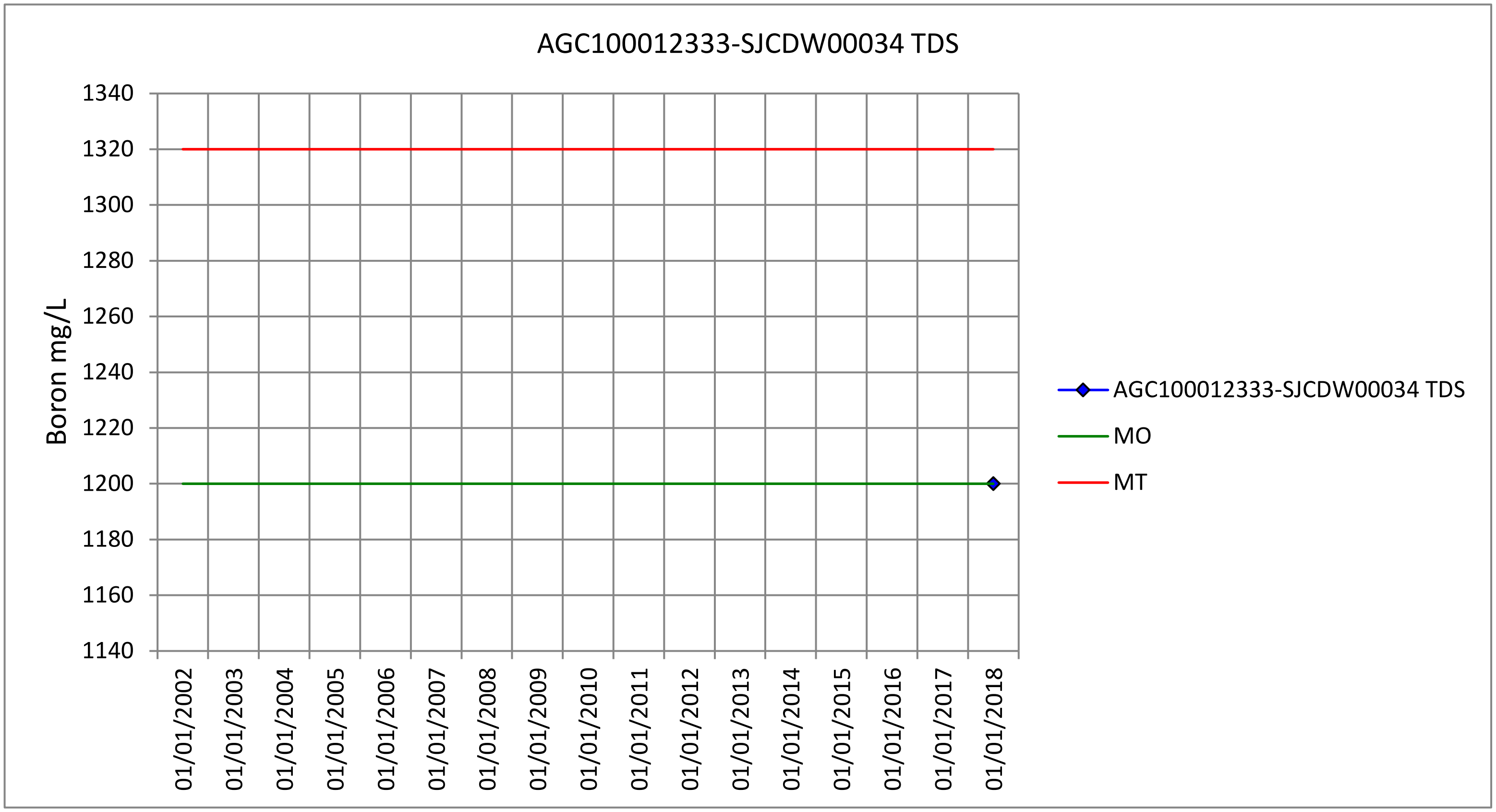
SAD MW-402D
Domestic Repesentative Well
Water Surface Elevation (feet above mean sea level)
40
20
0
-20
y = 0.0002x - 0.5801
R² = 0.0021
Note:
MT = Minimum Well Depth + 20 Feet for Pump
Approx GSE = 25 ft msl
Historic spring average
Historic fall low
SAD MW-402
Domestic well dry level
MO (estimated)
MT (estimated)
Linear (SAD MW-402)

APPENDIX O

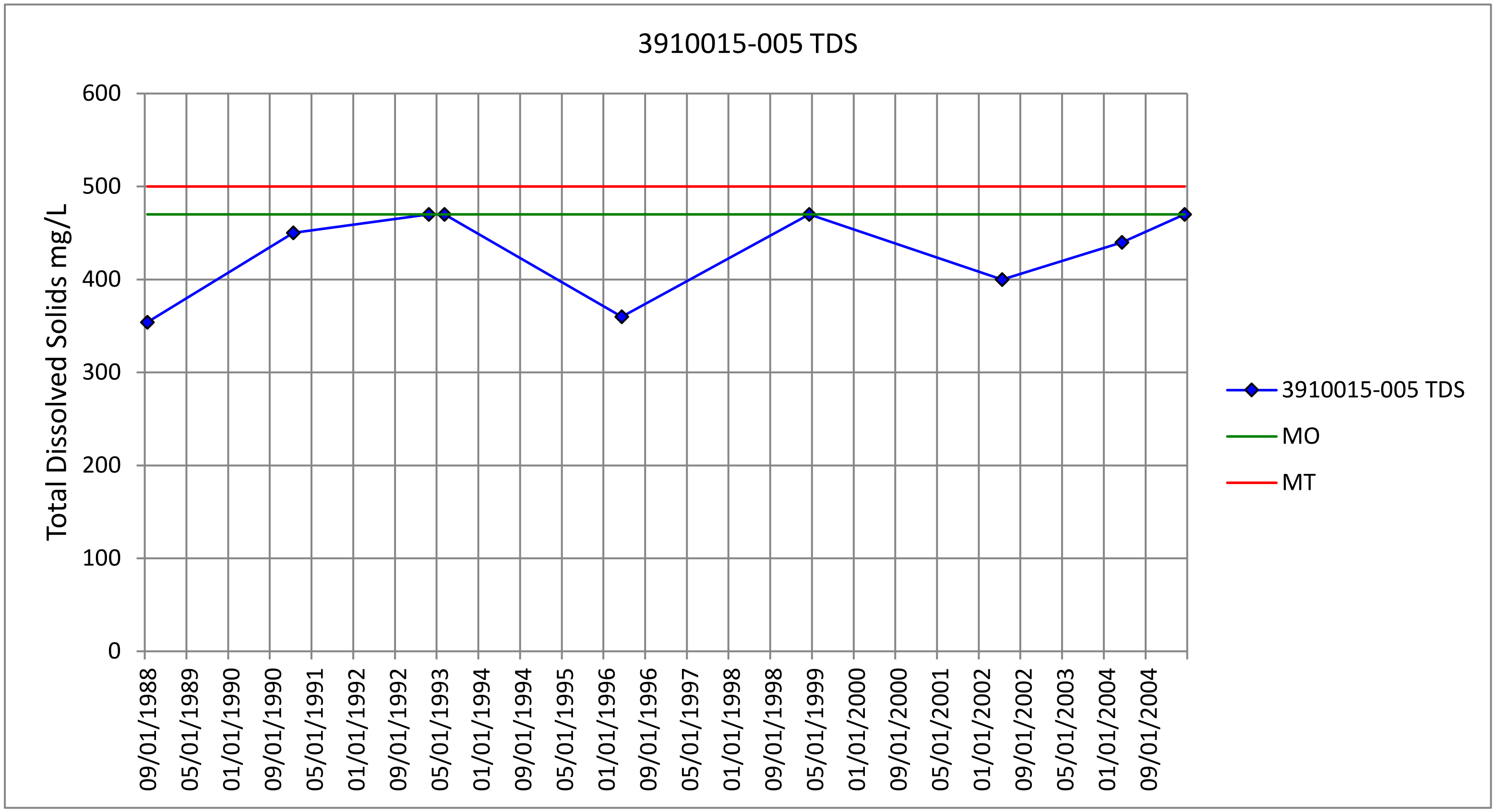
WATER QUALITY
MINIMUM THRESHOLDS AND
MEASURABLE OBJECTIVES

Total Dissolved Solids

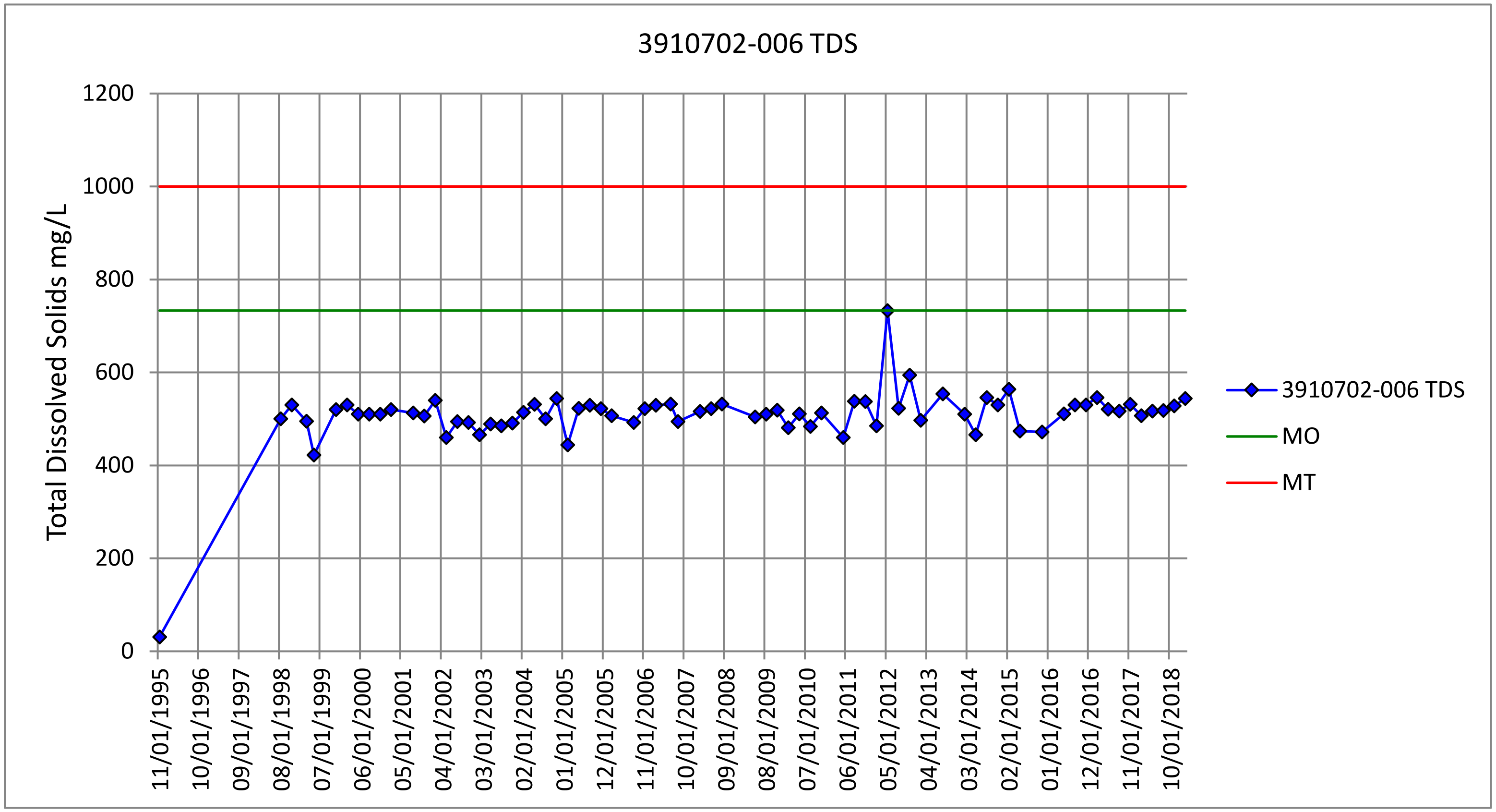

AGC100012333-SJCDW00032 TDS
Boron mg/L
1220
1200
1180
1160
1140
1120
1100
1080
1060
1040
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
AGC100012333-SJCDW00032 TDS
MO
MT

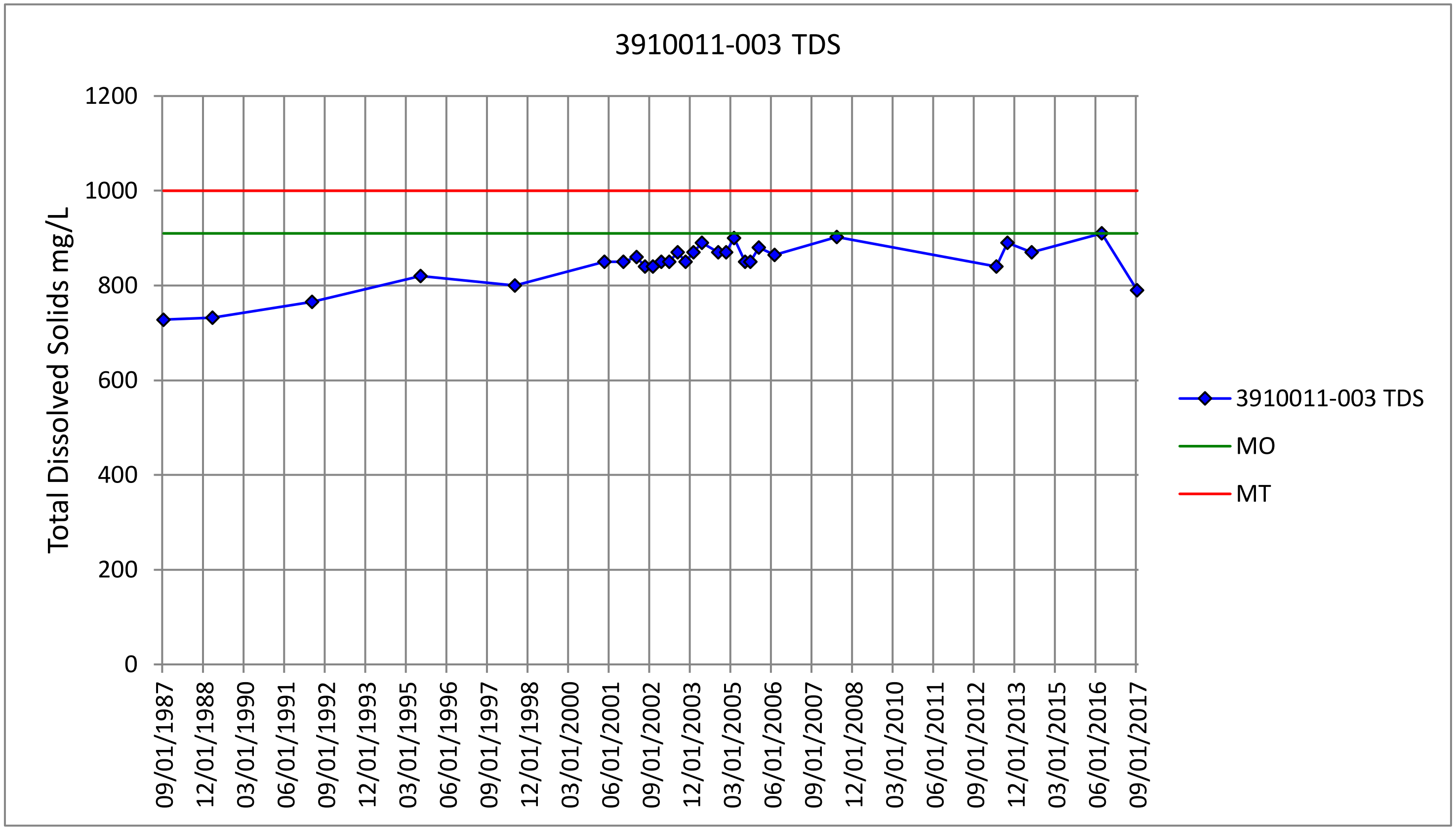


AGC100012333-SJCDW00034 TDS
Boron mg/L
1340
1320
1300
1280
1260
1240
1220
1200
1180
1160
1140
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
AGC100012333-SJCDW00034 TDS
MO
MT

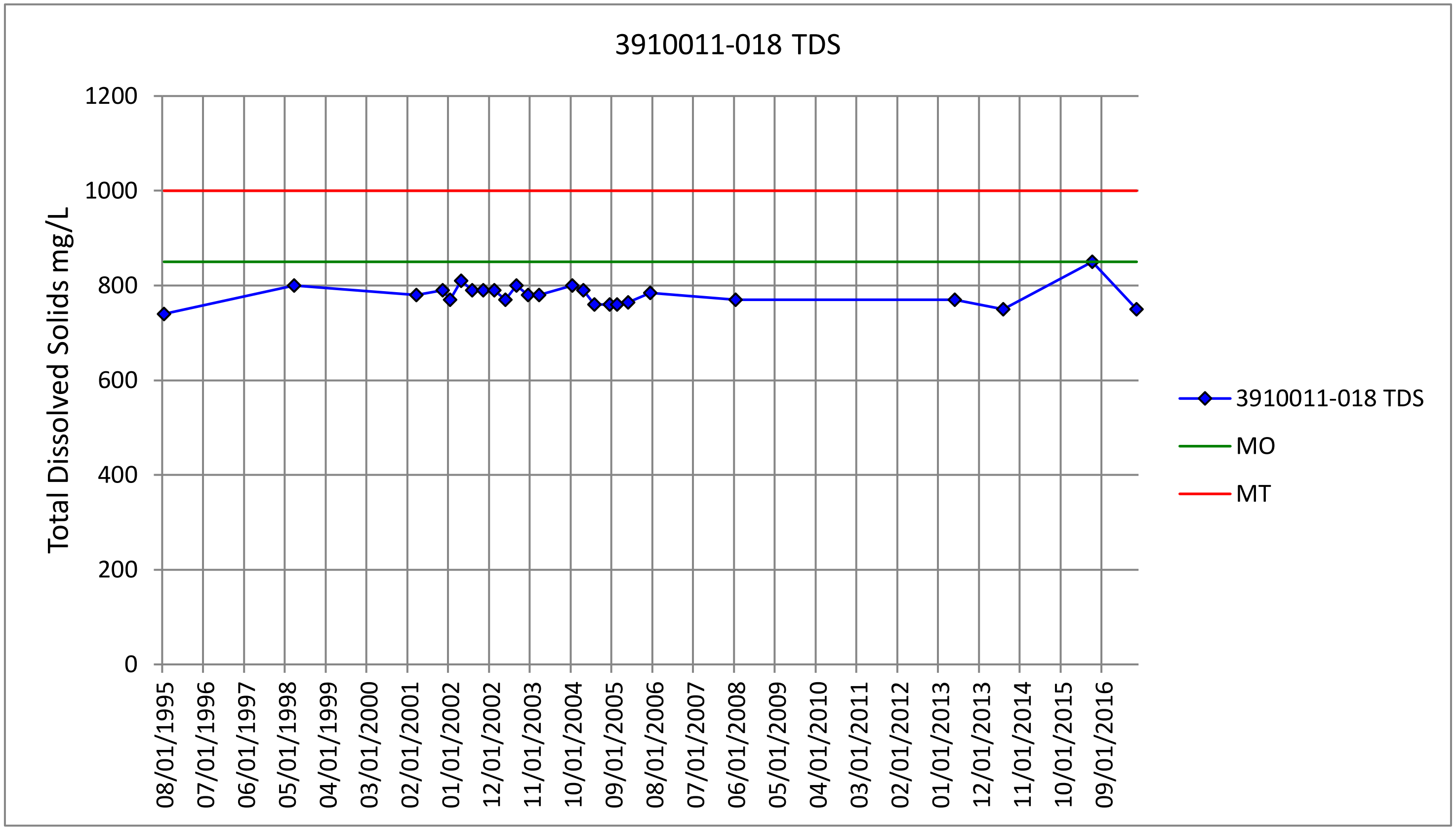


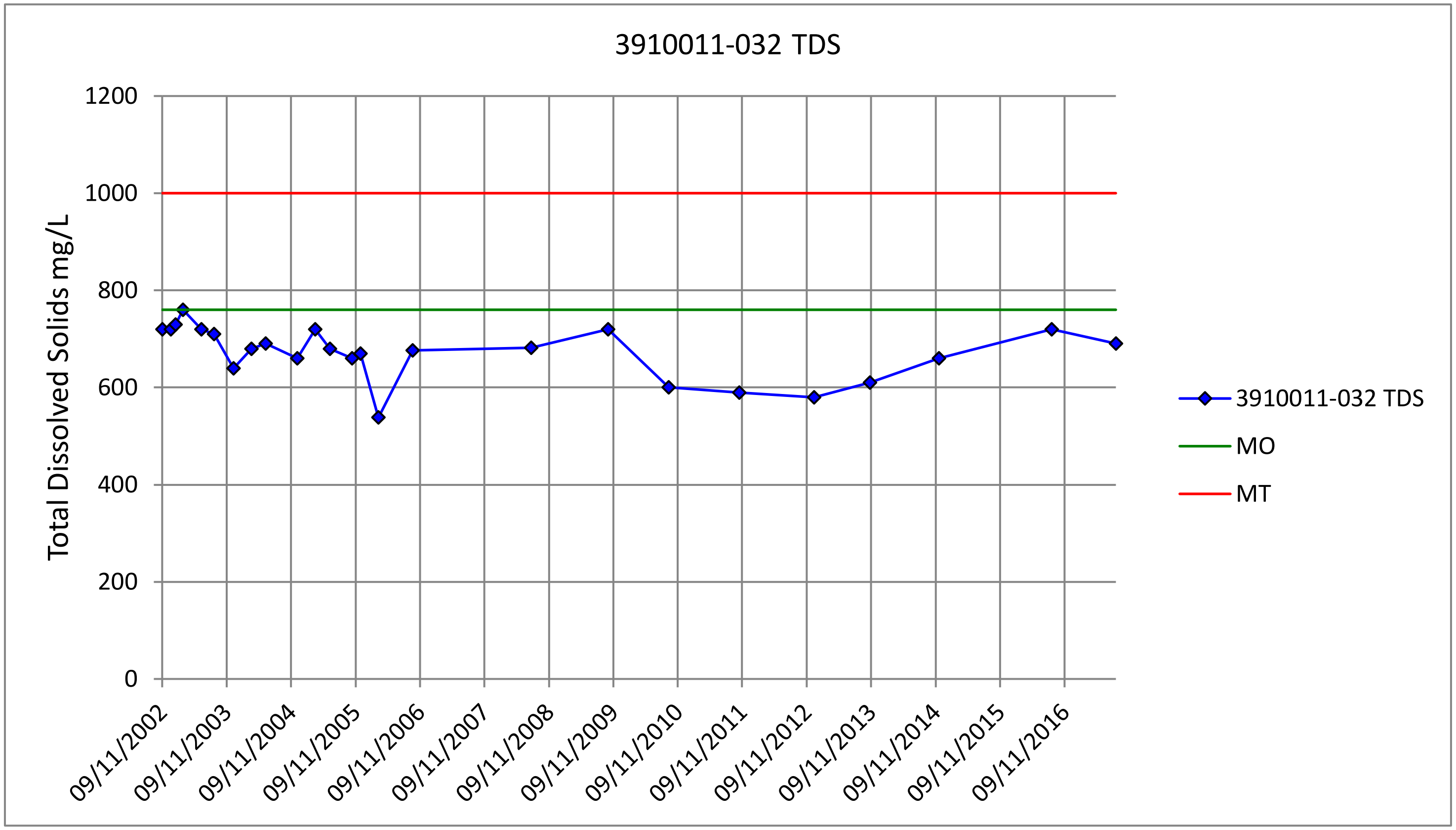
3910015-005 TDS
Total Dissolved Solids mg/L
600
500
400
300
200
100
0
09/01/1988
05/01/1989
01/01/1990
09/01/1990
05/01/1991
01/01/1992
09/01/1992
05/01/1993
01/01/1994
09/01/1994
05/01/1995
01/01/1996
09/01/1996
05/01/1997
01/01/1998
09/01/1998
05/01/1999
01/01/2000
09/01/2000
05/01/2001
01/01/2002
09/01/2002
05/01/2003
01/01/2004
09/01/2004
3910015-005 TDS
MO
MT

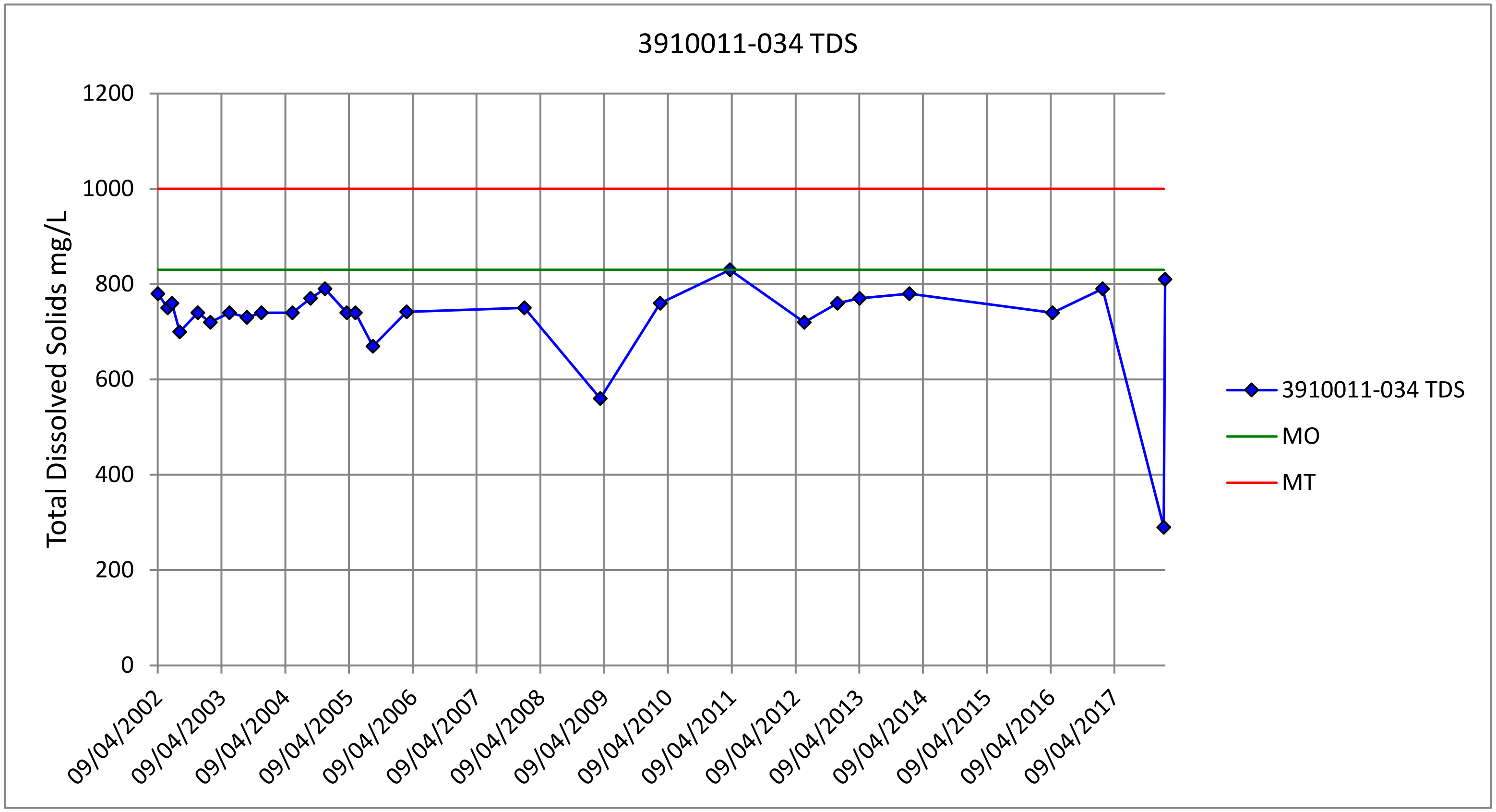

3910702-006 TDS
Total Dissolved Solids mg/L
1200
1000
800
600
400
200
0
11/01/1995
10/01/1996
09/01/1997
08/01/1998
07/01/1999
06/01/2000
05/01/2001
04/01/2002
03/01/2003
02/01/2004
01/01/2005
12/01/2005
11/01/2006
10/01/2007
09/01/2008
08/01/2009
07/01/2010
06/01/2011
05/01/2012
04/01/2013
03/01/2014
02/01/2015
01/01/2016
12/01/2016
11/01/2017
10/01/2018
3910702-006 TDS
MO
MT



3910011-003 TDS
Total Dissolved Solids mg/L
1200
1000
800
600
400
200
0
09/01/1987
12/01/1988
03/01/1990
06/01/1991
09/01/1992
12/01/1993
03/01/1995
06/01/1996
09/01/1997
12/01/1998
03/01/2000
06/01/2001
09/01/2002
12/01/2003
03/01/2005
06/01/2006
09/01/2007
12/01/2008
03/01/2010
06/01/2011
09/01/2012
12/01/2013
03/01/2015
06/01/2016
09/01/2017
3910011-003 TDS
MO
MT

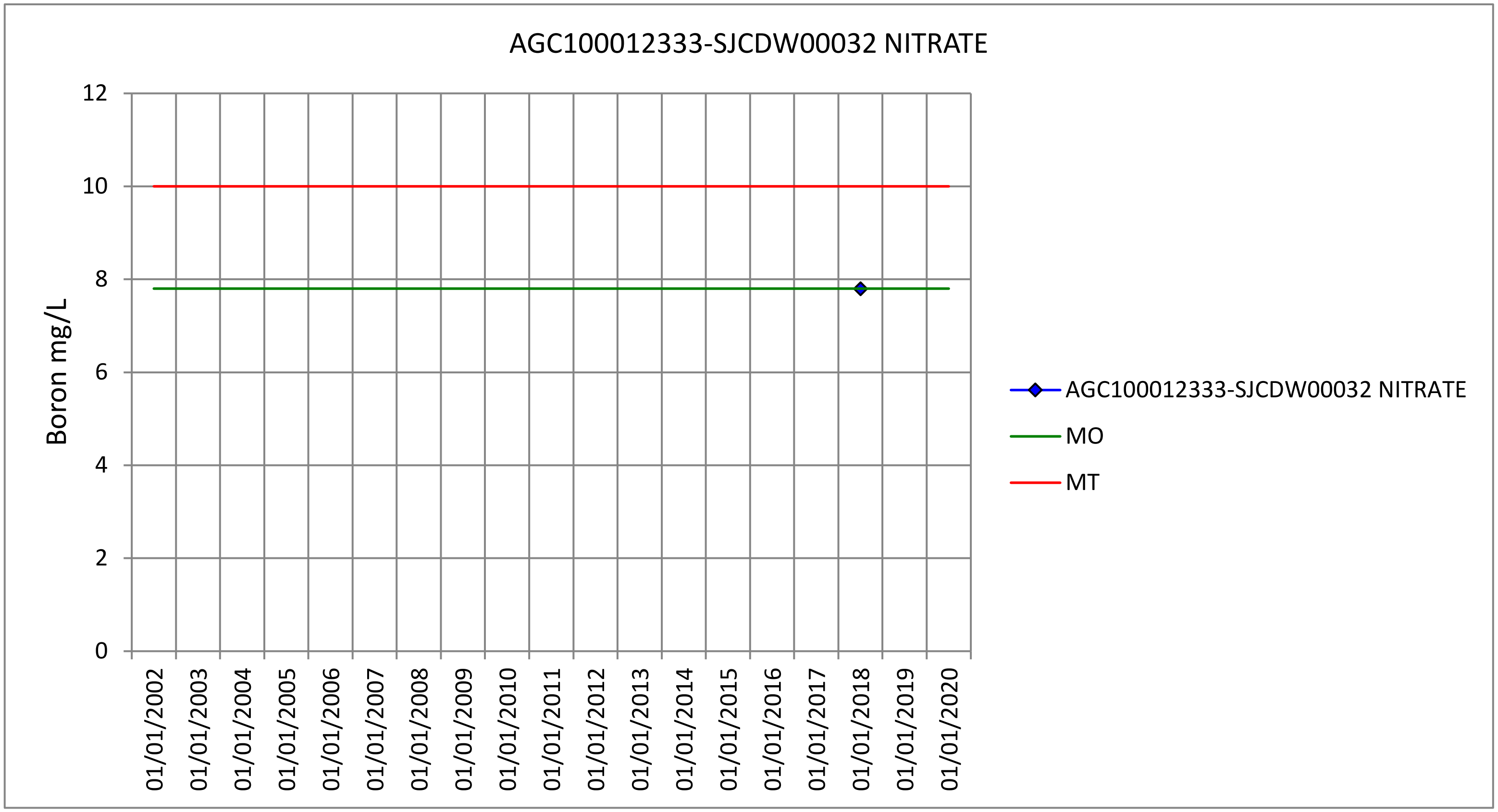

3910011-018 TDS
Total Dissolved Solids mg/L
1200
1000
800
600
400
200
0
08/01/1995
07/01/1996
06/01/1997
05/01/1998
04/01/1999
03/01/2000
02/01/2001
01/01/2002
12/01/2002
11/01/2003
10/01/2004
09/01/2005
08/01/2006
07/01/2007
06/01/2008
05/01/2009
04/01/2010
03/01/2011
02/01/2012
01/01/2013
12/01/2013
11/01/2014
10/01/2015
09/01/2016
3910011-018 TDS
MO
MT

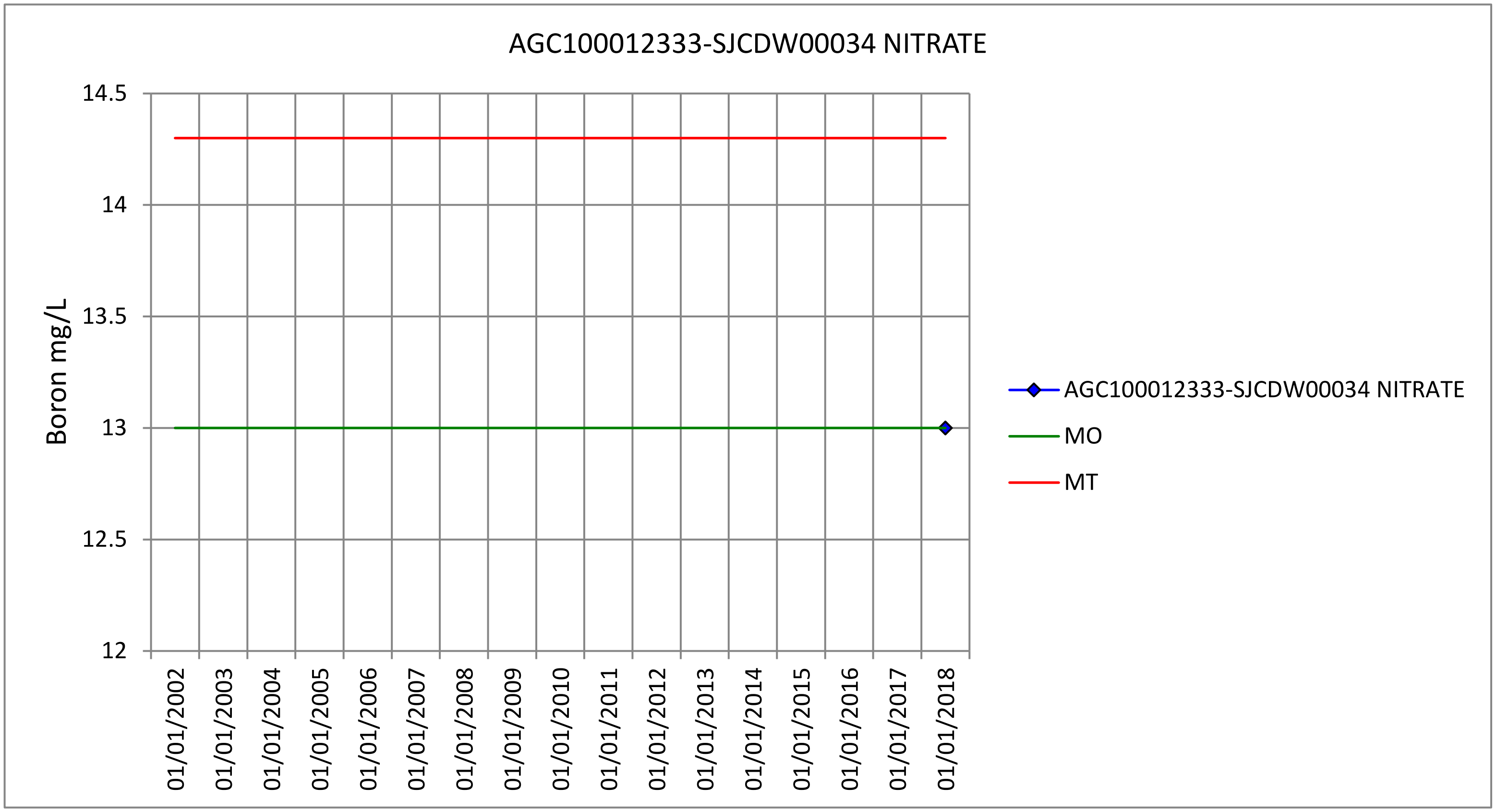

3910011-032 TDS
Total Dissolved Solids mg/L
1200
1000
800
600
400
200
0
09/11/2002
09/11/2003
09/11/2004
09/11/2005
09/11/2006
09/11/2007
09/11/2008
09/11/2009
09/11/2010
09/11/2011
09/11/2012
09/11/2013
09/11/2014
09/11/2015
09/11/2016
3910011-032 TDS
MO
MT



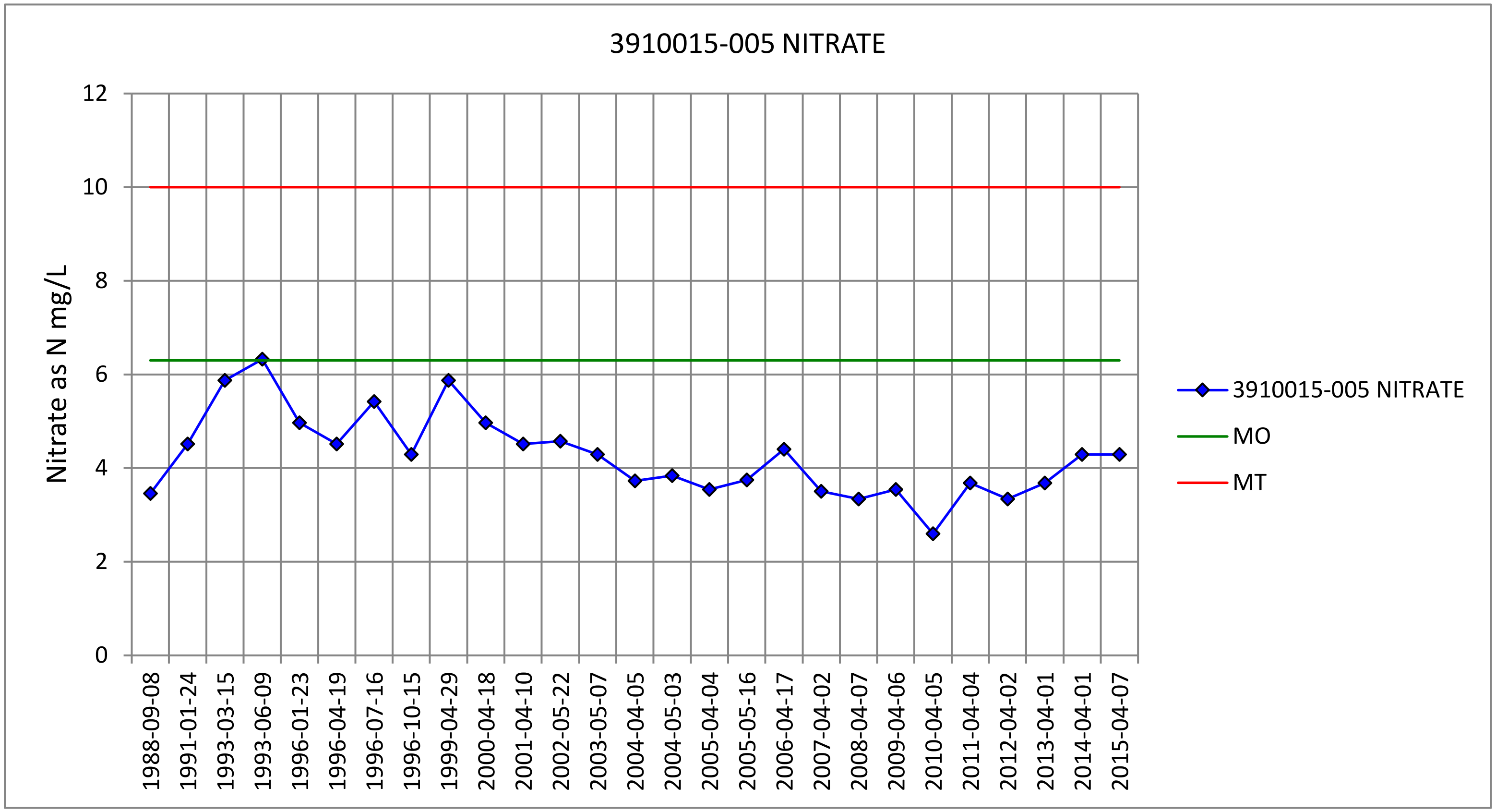
3910011-034 TDS
Total Dissolved Solids mg/L
1200
1000
800
600
400
200
0
09/04/2002
09/04/2003
09/04/2004
09/04/2005
09/04/2006
09/04/2007
09/04/2008
09/04/2009
09/04/2010
09/04/2011
09/04/2012
09/04/2013
09/04/2014
09/04/2015
09/04/2016
09/04/2017
3910011-034 TDS
MO
MT

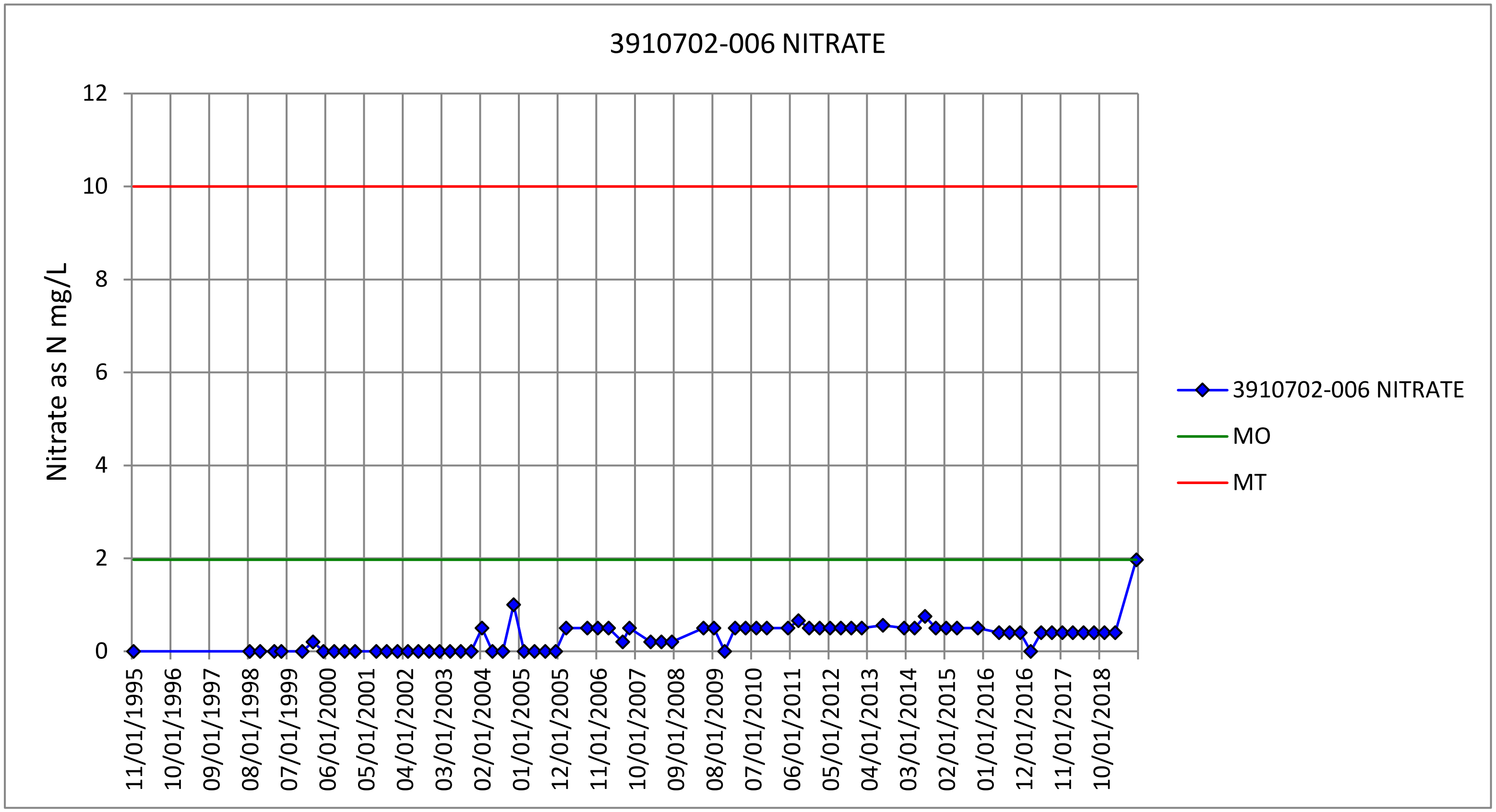
Nitrate


AGC100012333-SJCDW00032 NITRATE
Boron mg/L
0
2
4
6
8
10
12
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
AGC100012333-SJCDW00032 NITRATE
MO
MT



AGC100012333-SJCDW00034 NITRATE
Boron mg/L
14.5
14
13.5
13
12.5
12
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
AGC100012333-SJCDW00034 NITRATE
MO
MT


3910015-005 NITRATE
Nitrate as N mg/L
12
10
8
6
4
2
0
1988-09-08
1991-01-24
1993-03-15
1993-06-09
1996-01-23
1996-04-19
1996-07-16
1996-10-15
1999-04-29
2000-04-18
2001-04-10
2002-05-22
2003-05-07
2004-04-05
2004-05-03
2005-04-04
2005-05-16
2006-04-17
2007-04-02
2008-04-07
2009-04-06
2010-04-05
2011-04-04
2012-04-02
2013-04-01
2014-04-01
2015-04-07
3910015-005 NITRATE
MO
MT


3910702-006 NITRATE
Nitrate as N mg/L
12
10
8
6
4
2
0
11/01/1995
10/01/1996
09/01/1997
08/01/1998
07/01/1999
06/01/2000
05/01/2001
04/01/2002
03/01/2003
02/01/2004
01/01/2005
12/01/2005
11/01/2006
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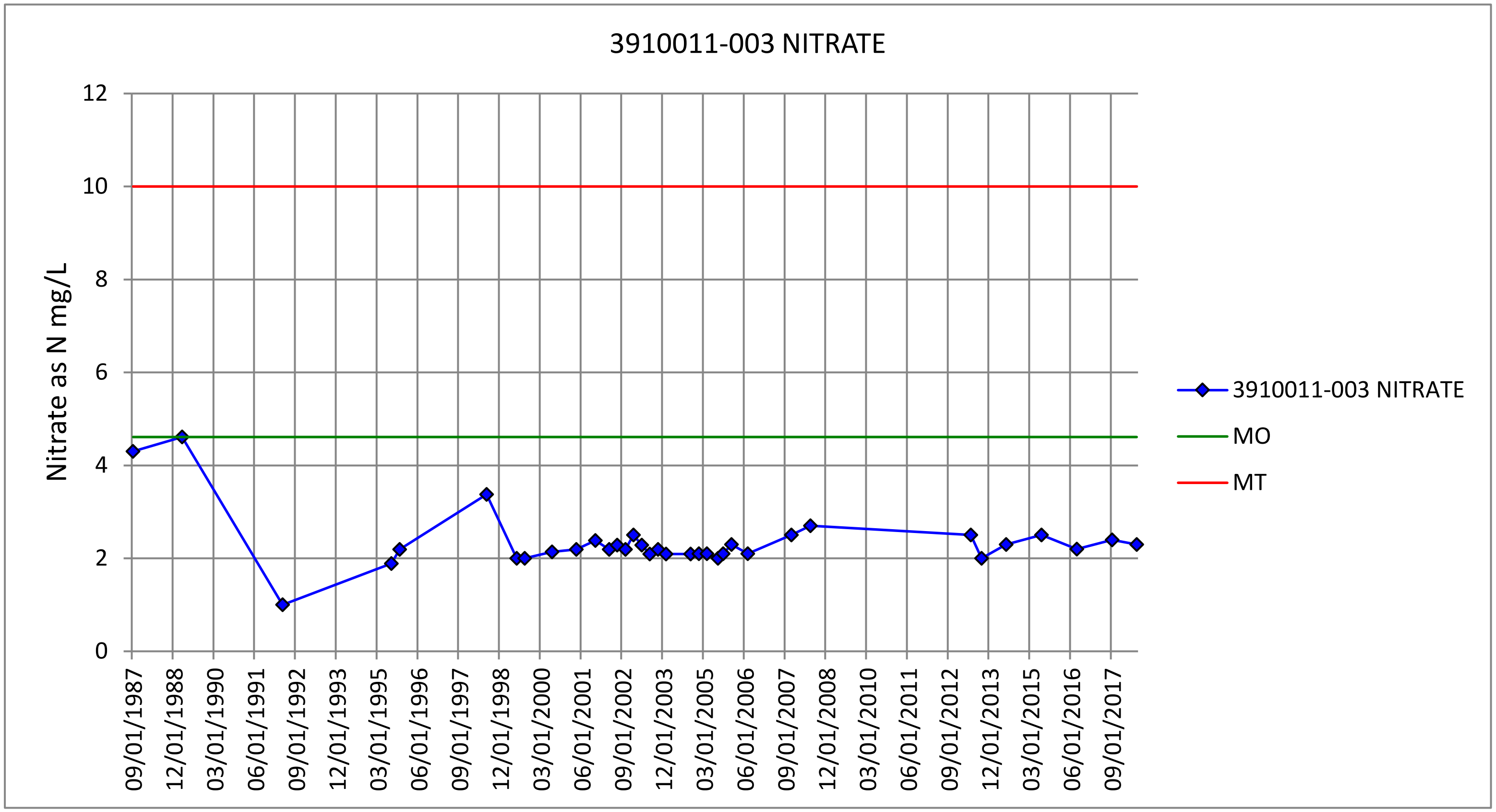

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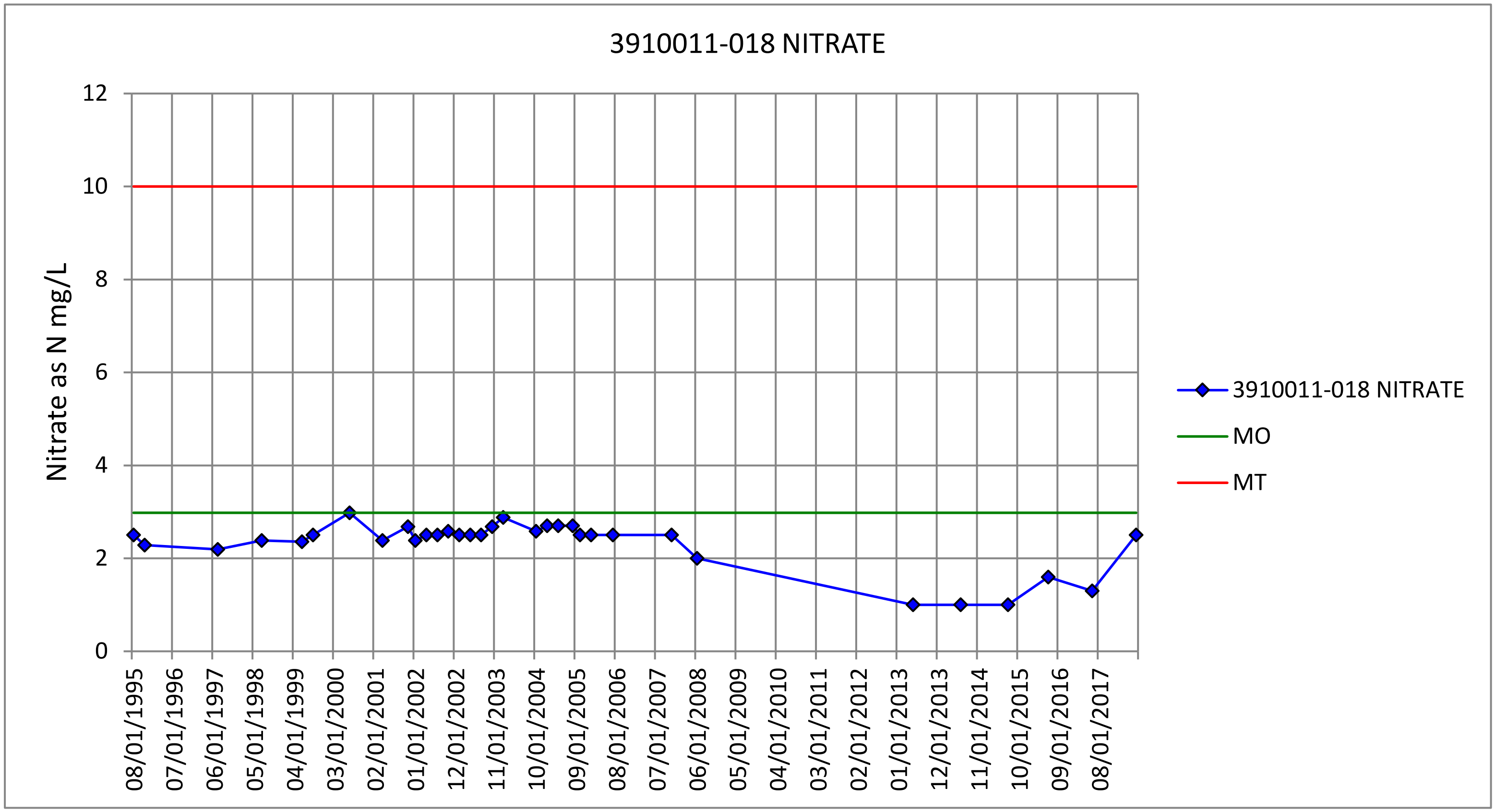
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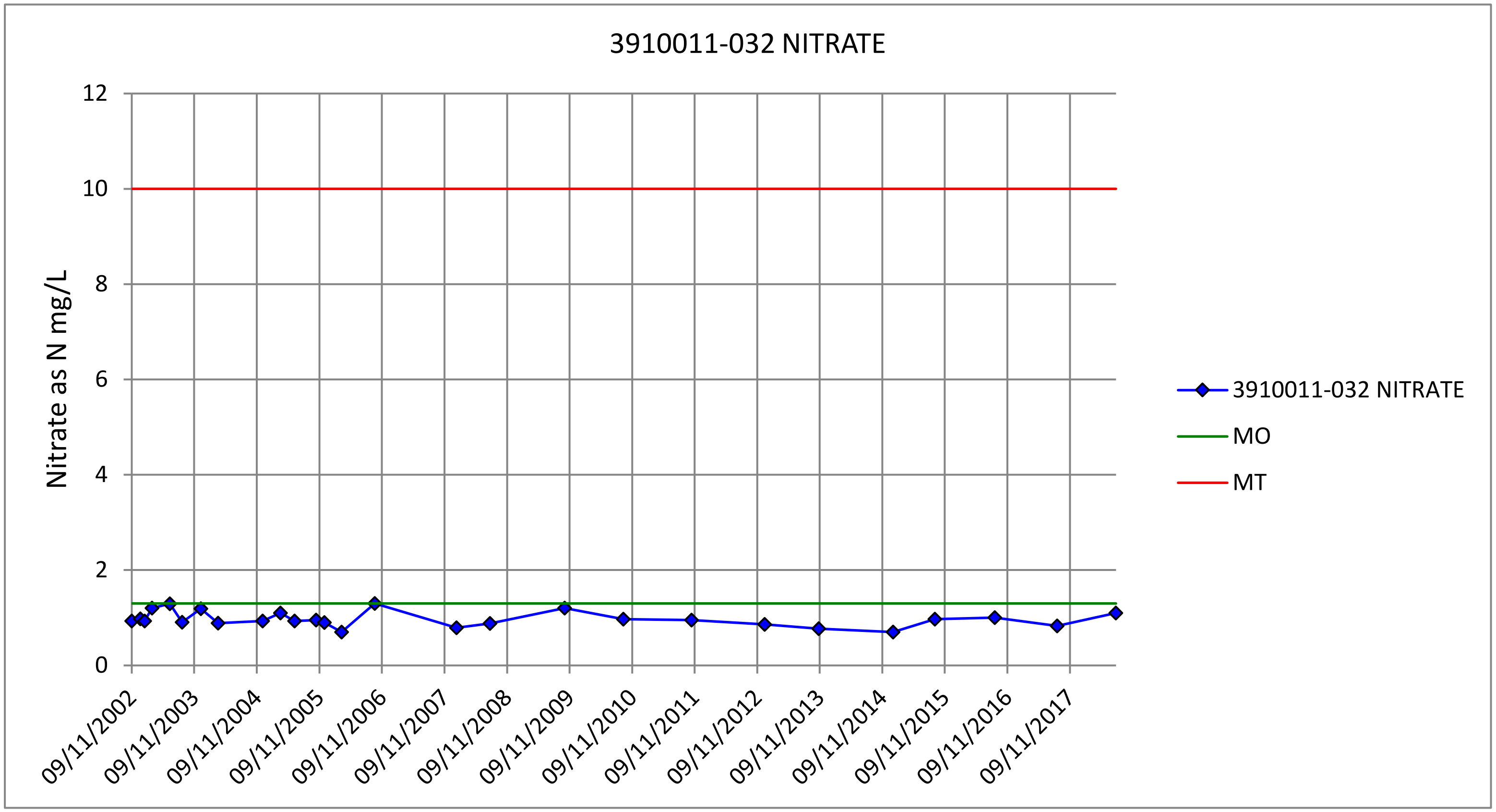

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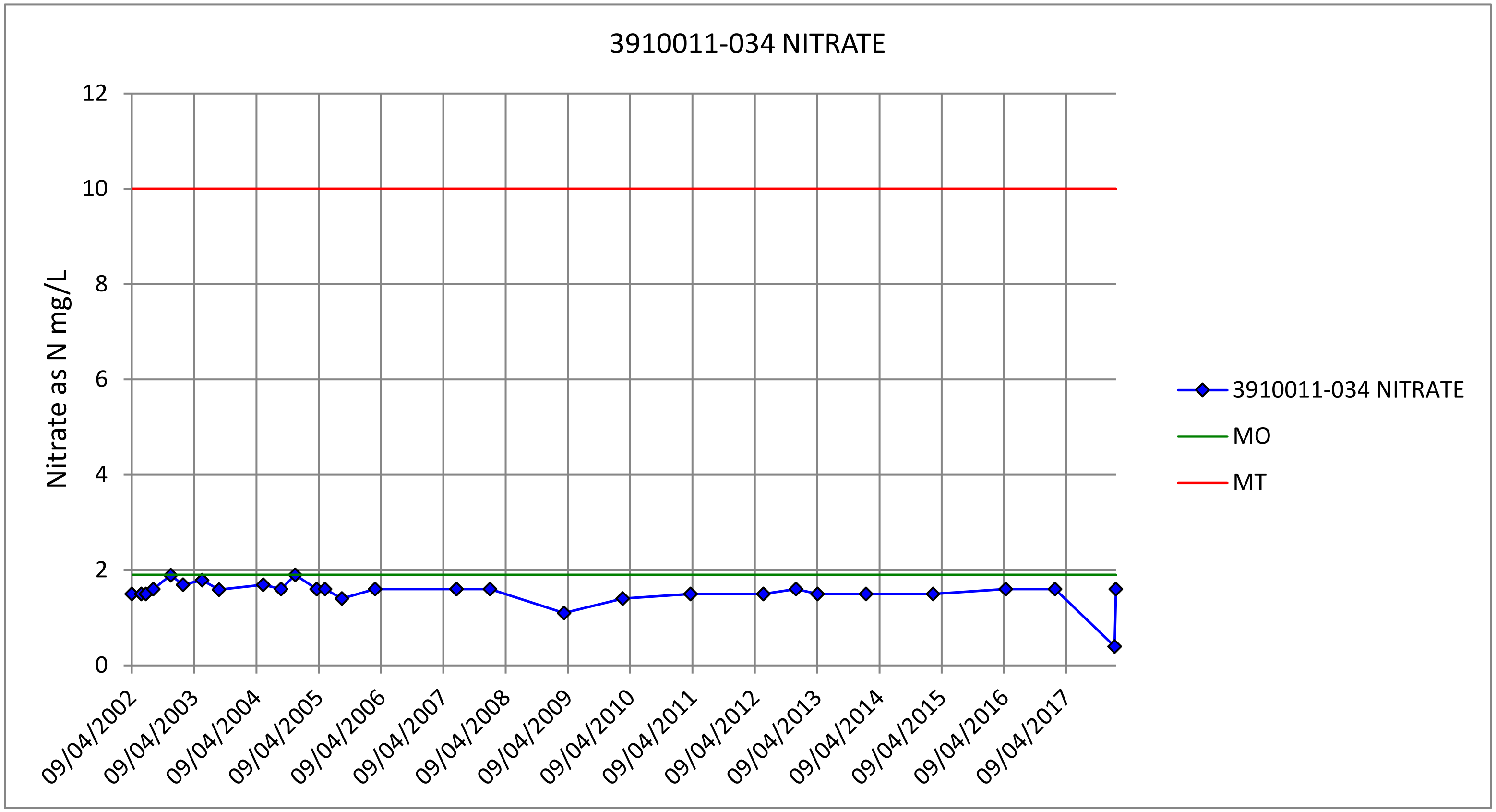
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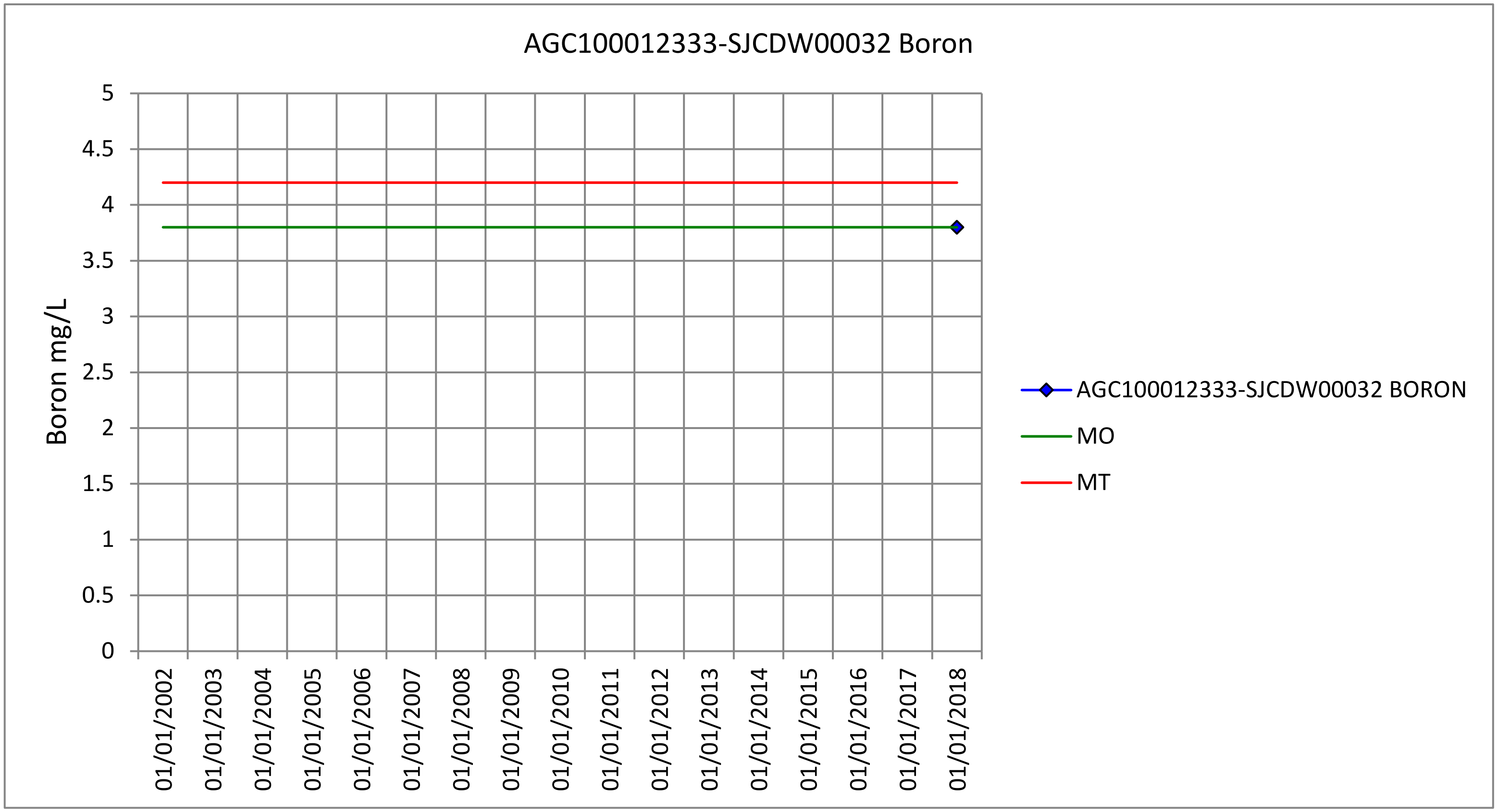
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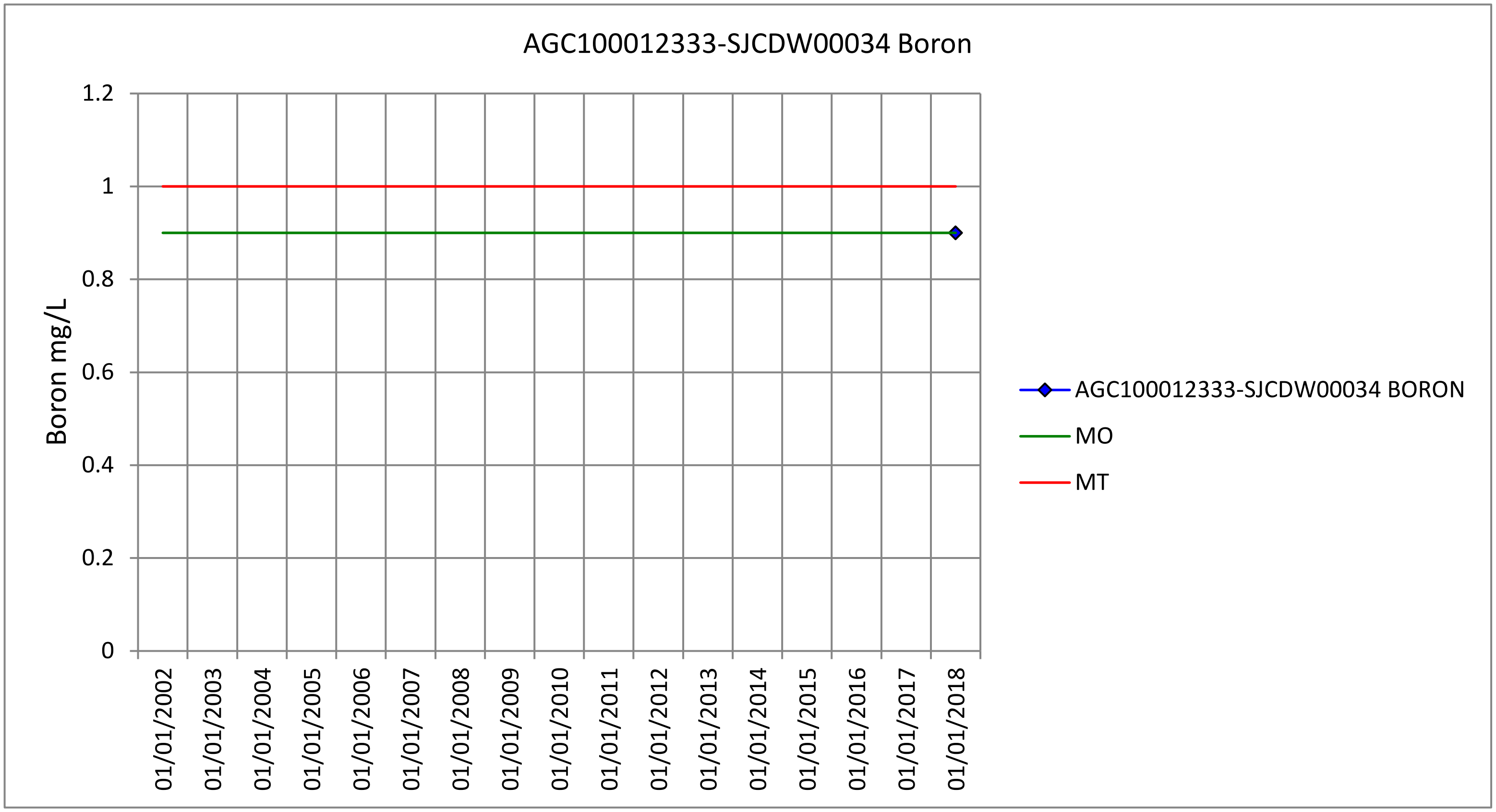
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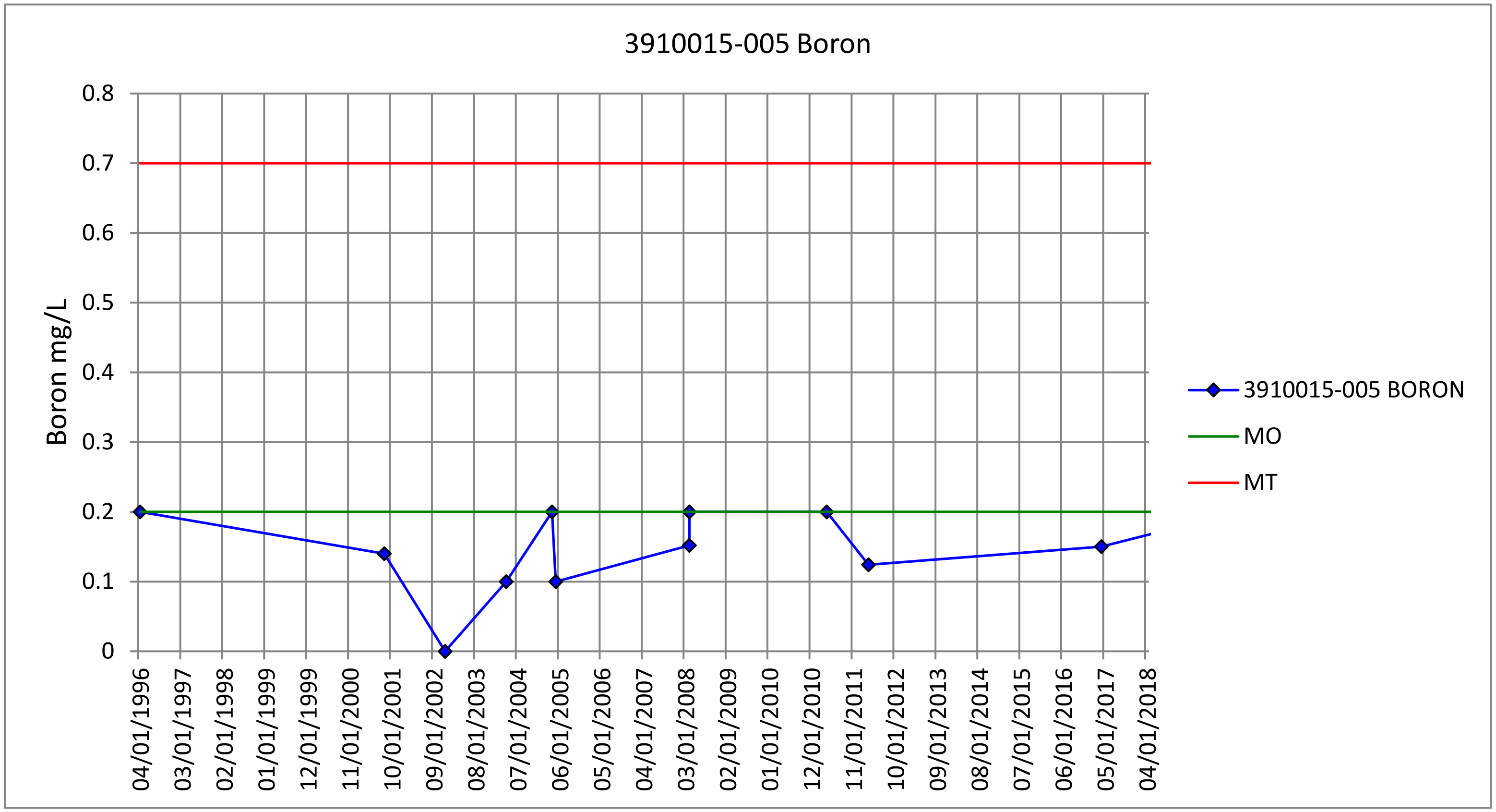

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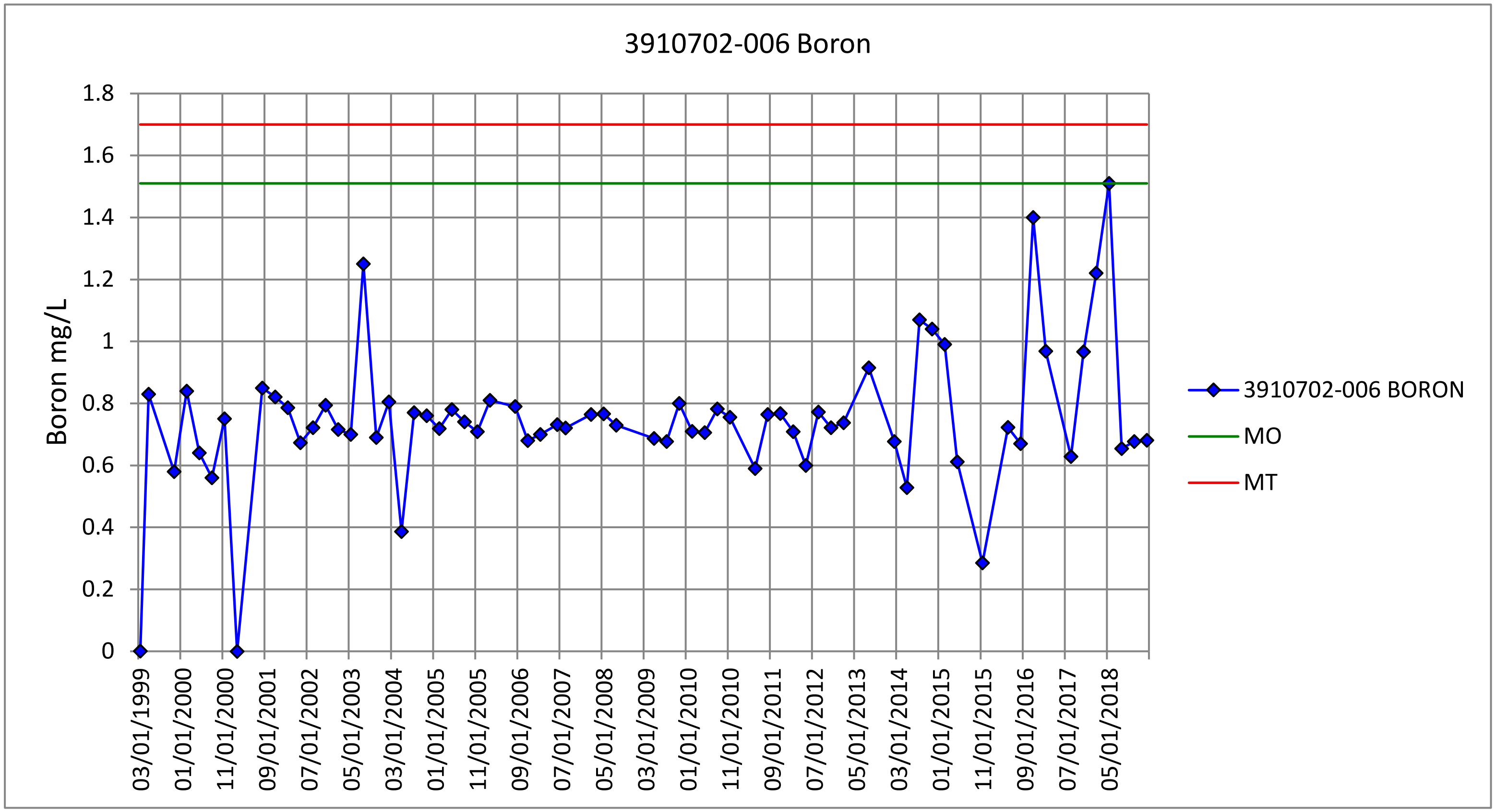

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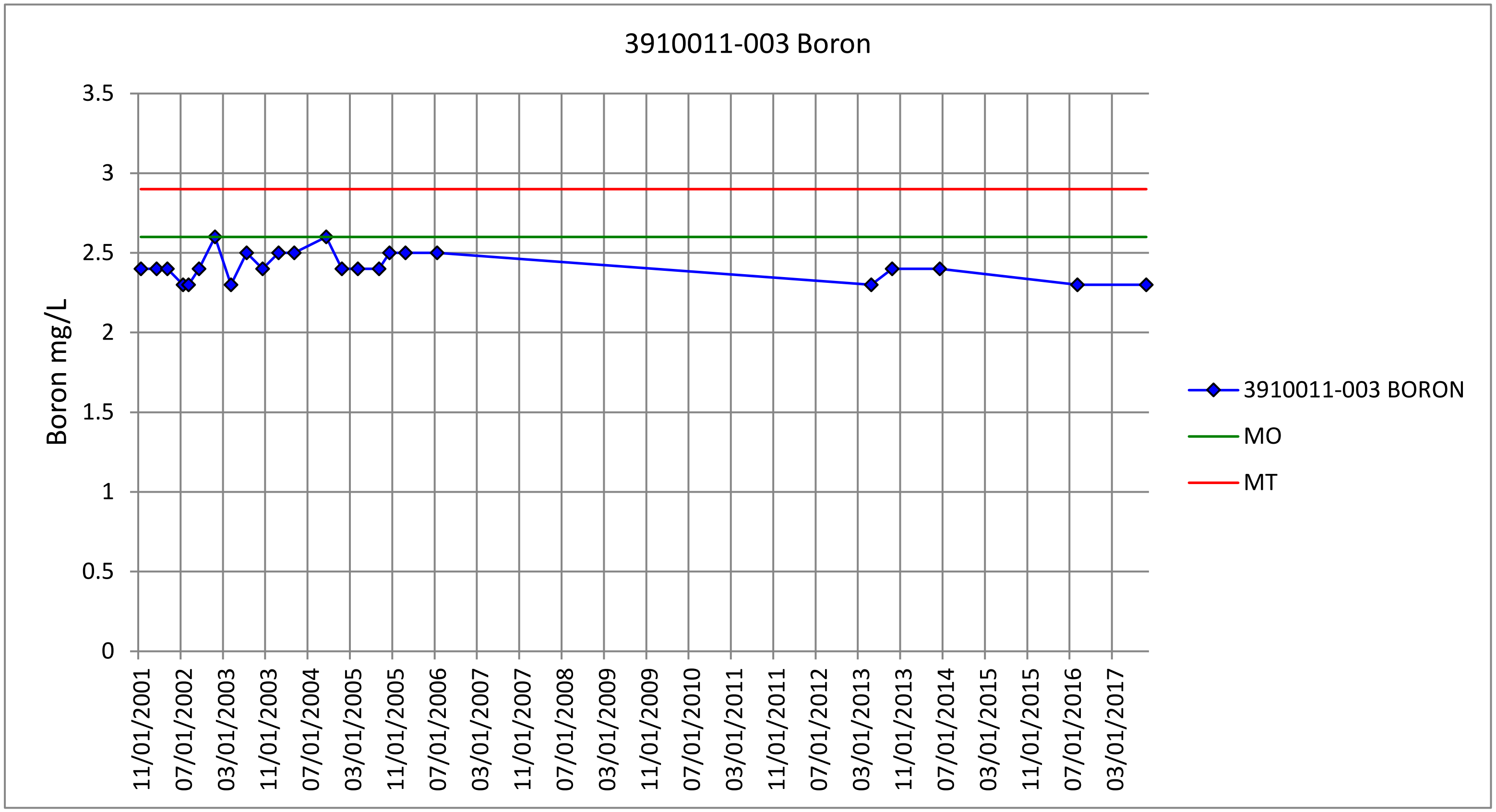
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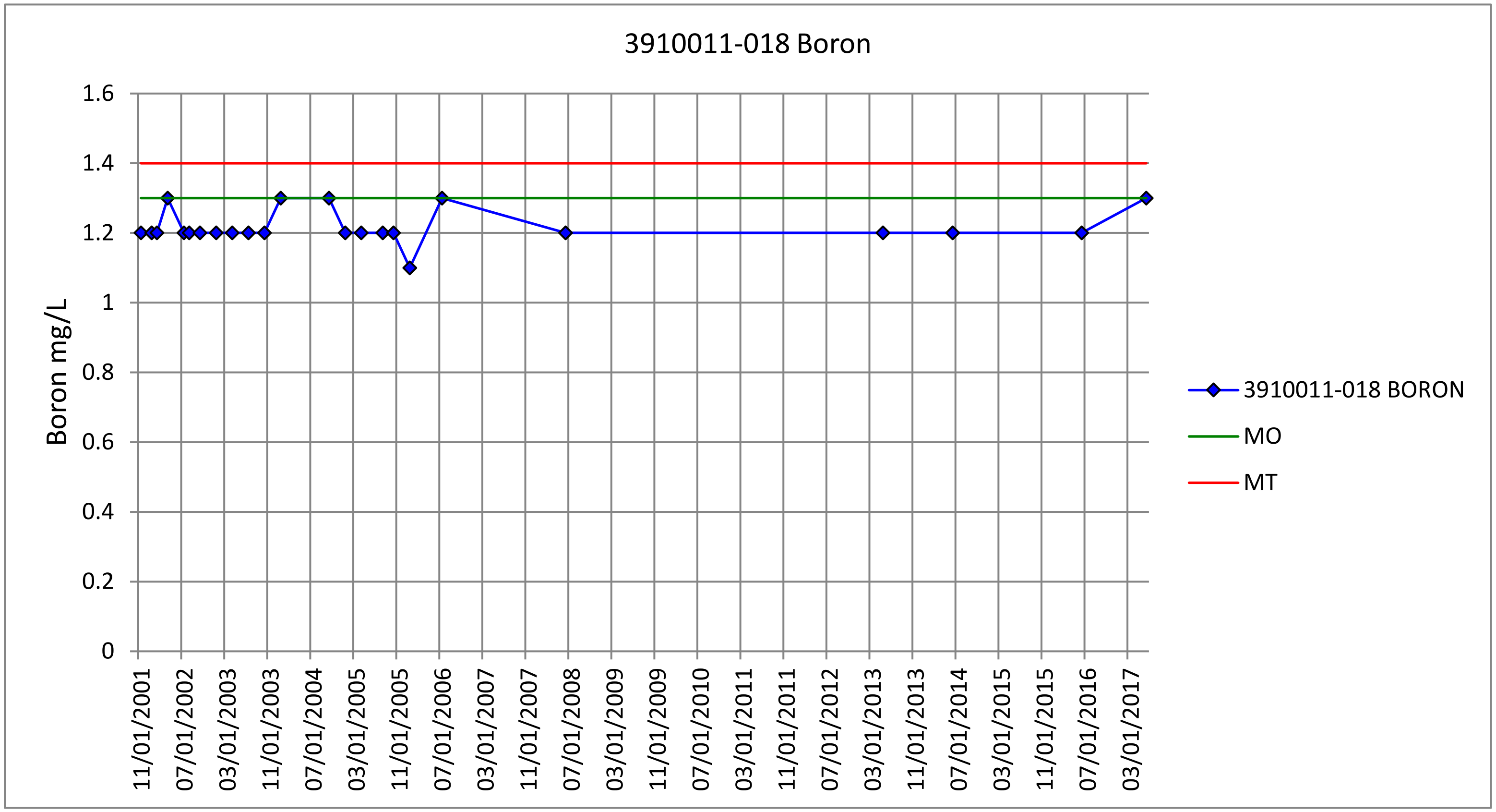
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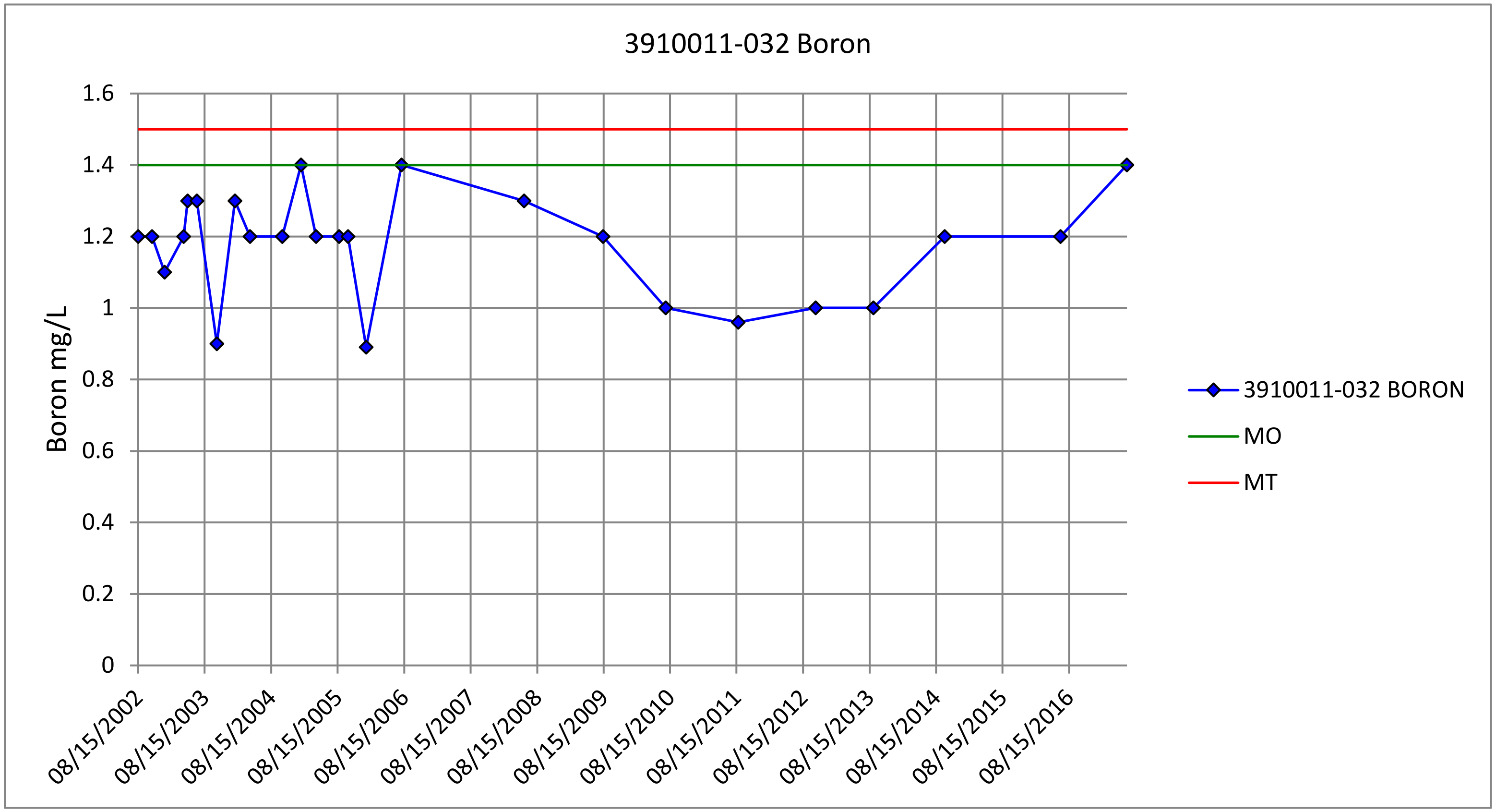
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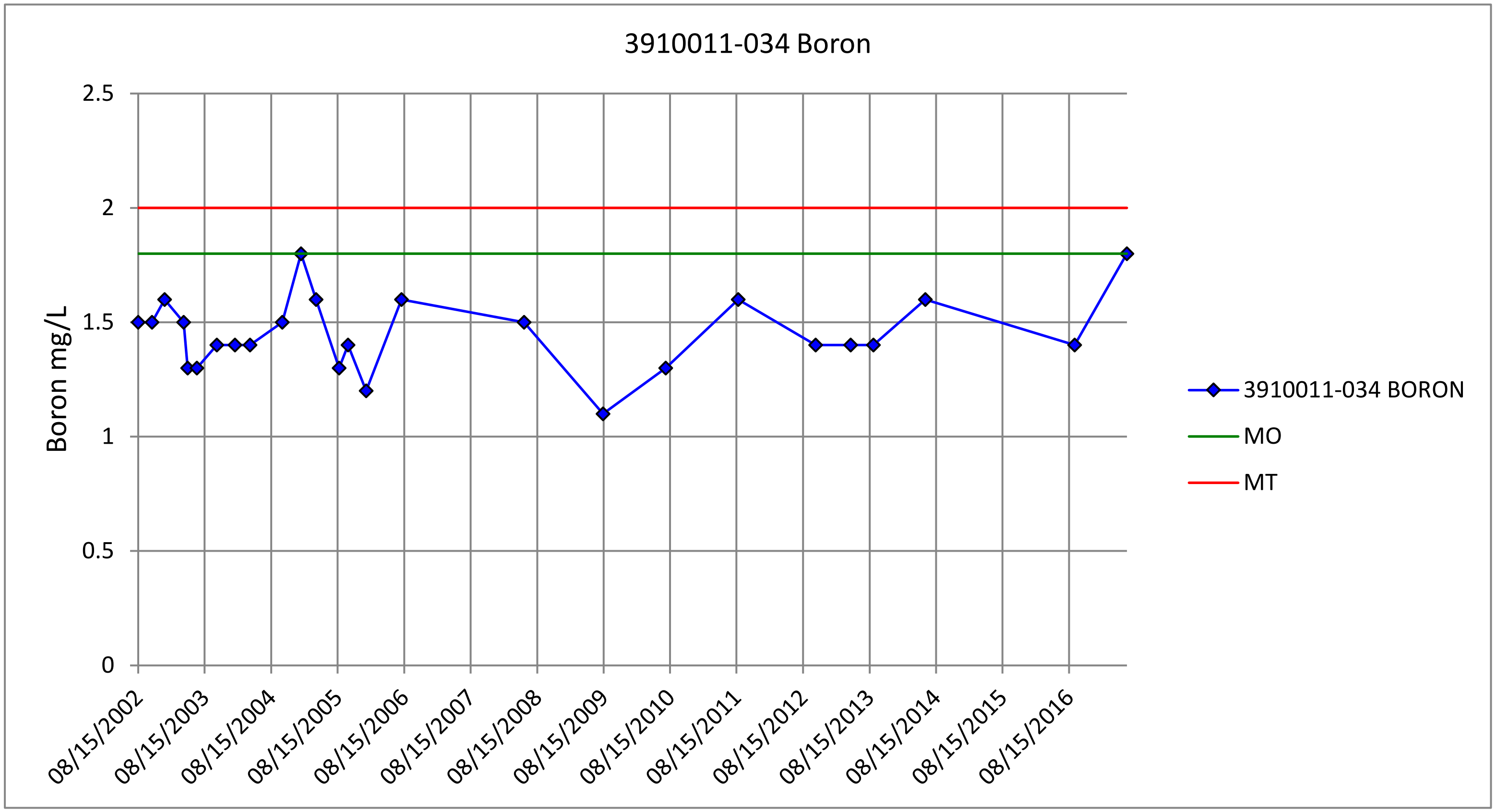
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08/15/2012
08/15/2013
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APPENDIX P
PUBLIC OUTREACH

Communications and Engagement Plan

Tracy Subbasin

Communication and Engagement Plan for the Groundwater Sustainability Plan

June 2019

1.0 INTRODUCTION

1.1 SGMA OVERVIEW

The Sustainable Groundwater Management Act (SGMA) is a combination of three bills signed by California Governor Jerry Brown in 2014: Assembly Bill (AB) 1739, Senate Bill (SB) 1168, and SB 1319. SGMA provides local agencies with the framework to manage groundwater basins in a sustainable manner. The legislation recognizes that groundwater is most effectively managed at the local level, and local agencies will need to achieve groundwater sustainability by 2040.

In SGMA, sustainable groundwater management is defined as management of groundwater supplies in a manner that can be maintained in planning and implementation phases without causing undesirable results. Undesirable results include significant and unreasonable chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and interconnected surface waters.

1.2 DESCRIPTION OF TRACY SUBBASIN

The Tracy Subbasin (DWR Bulletin 118, 5-22.15) is a medium-priority subbasin within the larger San Joaquin Valley Groundwater Basin. Several agencies submitted Basin Boundary Modification requests in 2018 to the California Department of Water Resources (DWR) to modify the boundaries of the Eastern San Joaquin (ESJ) Subbasin, the Tracy Subbasin (Subbasin) and the Delta-Mendota Subbasin in order to better facilitate jurisdictional issues. DWR approved the modifications in February 2019. The new basin boundaries are shown on **Exhibit 1**.

The Subbasin covers portions of two counties: San Joaquin and Alameda. The northern boundary (from west to east) of the Subbasin follows the San Joaquin River west until its convergence with the Mokelumne River by Webb Tract. The eastern boundary (from north to south) follows the San Joaquin River south until the San Joaquin-Stanislaus County line other than for a small area which extends east along the City of Lathrop service area. The southeastern boundary (from east to west) is irregular with some portions following the San Joaquin-Stanislaus County line before jogging north again along the foothills to the Alameda and Contra Costa County line. The western boundary (from south to north) the Alameda and Contra Costa County line and then along the San Joaquin and Contra Costa County line. Adjacent subbasins include the Eastern San Joaquin Subbasin on the east, the Delta-Mendota Subbasin to the south, and the East Contra Costa Subbasin on the west; all of which are also part of the larger San Joaquin Valley Groundwater Basin; as well as the Solano Subbasin of the Sacramento Groundwater Basin to the north.

The Subbasin is drained by the San Joaquin River and one of its major westside tributaries; Corral Hollow Creek. The San Joaquin River flows northward into the Sacramento and San Joaquin Delta and discharges into the San Francisco Bay.

1.3 DESCRIPTION OF THE TRACY SUBBASIN GSAs

Sustainable management of the Tracy Subbasin will be performed cooperatively by seven Groundwater Sustainability Agencies (GSAs) in the Tracy Subbasin: Banta-Carbona Irrigation District, Byron-Bethany Irrigation District, City of Lathrop, City of Tracy, San Joaquin County, Stewart Tract, and West Side Irrigation District (hereafter known as GSA agencies). San Joaquin County was elected by the agencies to be the lead agency during the development of a single Groundwater Sustainability Plan (GSP) for the Tracy Subbasin.

San Joaquin County was authorized by the Subbasin GSAs to submit the GSP Initial Notification to DWR. The Initial Notification was filed for the entire Tracy Subbasin prior to the basin boundary modification and was amended in July 2019.

1.4 DECISION-MAKING PROCESS

Representatives from San Joaquin County or individual GSAs have no authority of their own. All actions agreed upon by the GSA representatives must be voted on by each member agency at a public meeting (e.g. County Board of Supervisors, City Councils, and/or water agency Board of Directors meetings). Stakeholders and interested parties will be notified prior to public meetings involving decisions regarding the GSA or GSP. Throughout development and implementation of the GSP, the seven GSAs will solicit feedback from stakeholders and interested parties, particularly at key decision points. Any proposed implementation measures for the GSP must then be voted on by each GSA's member agencies at a public meeting.

1.5 COMMUNICATION AND ENGAGEMENT PLAN

As required by SGMA, each GSA must consider the interests of all beneficial uses and users of groundwater and include them in the GSP development process. This Communication and Engagement Plan (Plan) is intended to provide a high-level overview of how stakeholders within the coverage area will be engaged through outreach, education, and opportunities for input during the development and implementation of the GSP.

2.0 GOALS AND DESIRED OUTCOMES

2.1 GOALS OF GSP DEVELOPMENT

The goals of the GSA agencies are to establish and execute a GSP that will sustain and manage groundwater within the Subbasin in a way that is cost-effective, avoids undesirable results, and is beneficial, with minimal negative impacts, to the beneficial uses and users.

2.2 COMMUNICATION OBJECTIVES

The objectives of this Plan are to provide stakeholders and interested parties clear, consistent, and unified information and opportunities to engage and provide input throughout the GSP process.

2.3 COMMUNICATION AND PUBLIC PARTICIPATION GOALS

The specific communication and public participation goals are to:

- Provide the public with comprehensive, clear, balanced, and objective information to assist in understanding the GSP effort and associated alternatives, opportunities, and/or solutions.
- Utilize effective communication methods and tools.
- Provide information in sufficient frequency so that stakeholders feel adequately engaged and informed of material in a timely manner.
- Solicit public feedback throughout development and implementation of the GSP, particularly at key decision points.
- Ensure public concerns and interests are understood and considered.

- Provide methods for the public to be involved in the GSP development and implementation stages.
- Document and provide access to information, presentations, and comments received to provide clarity regarding the decision-making process.

2.4 OVERRIDING CONCERNS AND CHALLENGES

Through preliminary discussions and stakeholder engagement efforts, one major concern identified is the potential impact to the agricultural industry in the Subbasin. Most of the groundwater usage within the Subbasin is by agriculture.

3.0 STAKEHOLDER IDENTIFICATION

3.1 PRIMARY STAKEHOLDERS

Primary stakeholder groups are the GSA members: the local land use and water authorities that will be making decisions about groundwater management and whose participation is mandatory for the GSP process to occur. Those entities include Banta-Carbona Irrigation District, Byron-Bethany Irrigation District, City of Lathrop, City of Tracy, San Joaquin County, Stewart Tract, and West Side Irrigation District.

3.2 SECONDARY STAKEHOLDERS

The GSA member entities have the responsibility, as identified in SGMA, Section 10723.2, for the “Consideration of All Beneficial Uses and Users of Groundwater”. These users include organizations, agencies, or individuals that have an interest in groundwater; such as the agriculture community, well owners, military, tribes, state and federal agencies, and environmental groups and agencies. Although the law clearly states that these interests are to be considered, the extent of engagement with the stakeholders is left to the GSAs to determine. San Joaquin County will maintain and periodically review the list of secondary stakeholders specific to its management area to ensure that other interested persons or groups are identified and added to the list as needed. Each GSA in the Subbasin will also maintain a list specific to its stakeholders and regularly share the list with the other GSAs.

3.3 INTERESTED PERSONS LIST

Establishment and ongoing maintenance of an interested party list is required by SGMA during GSA formation and GSP development and implementation. Chaptered in Water Code §10723.4, this section states that any person may request, in writing, to be placed on a list to receive notices regarding plan preparation, meeting announcements, and availability of draft plans, maps, and other relevant documents. To comply with this section, the San Joaquin County GSA has established and maintains an email notification database. The public is regularly informed through engagement activities how they can request to be placed on the list (e.g. through the Tracy Subbasin website, emails, and at public meetings, etc.). In addition, a Tracy Subbasin website will be developed that will also provide a means for the public to request and receive notifications related to GSP development.

3.3 ON-GOING

As an ongoing practice, the GSAs will routinely assess stakeholder involvement and update public participation practices to meet the needs of those interested in the Subbasin and its development of the GSP.

4.0 VENUES FOR ENGAGING

To effectively inform, educate, and engage audiences regarding milestones, meeting dates and times, and other pertinent information about the development of the GSP, the GSAs will conduct the following activities to notify the public of engagement opportunities.

4.1 NOTIFICATIONS

The GSAs will use a multi-layered approach to effectively inform interested parties of upcoming opportunities to engage in the GSP including:

- **Email blast** using an established interested party email list. Maintain a list of interested stakeholder email database updated frequently based on interest and sign-ups on the Subbasin websites, at board meetings, and other venues.
- **Website postings** with agendas, meeting minutes, and presentations.

4.2 ENGAGEMENT METHODS

The GSAs will use a variety of methods and venues to engage stakeholders throughout GSP development. The public will be given an opportunity to provide comments on draft versions of the GSP.

- **Website:** Use tracysubbasin.org as an information hub associated with development of the basin-wide GSP. The Subbasin website will be updated and managed by San Joaquin County on behalf of the GSAs. The website will provide meeting agendas and minutes, presentations, white papers, FAQs, and GSA contact information. Draft GSP chapters will also be posted on the Subbasin website and comments will be collected via an online form. Those interested can also sign up directly to receive updates by email. Additionally, the website will be used as a clearing house to document comments received, responses, and decision-making.
- **Public board meetings:** Conduct public GSA meetings, as needed, to encourage input on items associated with the development of the GSP and to garner general feedback for consideration. Each meeting will include a set agenda with opportunities to comment on agenda items as well as a public comment period for items not on the agenda. **Attachment A** contains a list of these meetings.
- **Board**, **neighborhood, or other community meetings**: Attend partner agency meetings (council meetings, commission meetings, neighborhood/community meetings/ag commission) to give updates on the progression of the GSP. Meetings with primary stakeholders will be held periodically, and during key decision points, at the agencies' regularly scheduled meeting times. Members of the public and partners from other local agencies are encouraged to attend these meetings to voice their thoughts and concerns throughout the GSP development, public review, and implementation phases. Meeting notices and agendas are routinely distributed to the Interested Parties List and are posted on the GSA website.

4.3 PRESENTATION MATERIALS

To the extent possible the GSAs will use common presentations and FAQ sheets at their various meetings. Some of the key messaging points are provided in **Attachment B**.

5.0 IMPLEMENTATION TIMELINE

SGMA statute and regulations define key phases in which stakeholder engagement is required. The timelines for implementing this Plan are broken down by phase; however, this timeline is tentative and subject to change with the progression of GSP development, public review, and implementation phases.

5.1 PHASE 1: GSA FORMATION AND COORDINATION – 2015 THROUGH 2018

Prior to filing of the Initial Notification to become a GSA, all of the GSAs held public meetings to discuss their intent to become GSAs. A list of stakeholders was developed during this period. In conjunction with what is now the East Contra Costa Subbasin, facilitation services were obtained through DWR to perform public outreach and develop a Communications Plan for both the Tracy and East Contra Costa Subbasin. In addition to these outreach activities, during the Basin Boundary Modification process San Joaquin County also reached out to stakeholders to gain their approval. This stakeholder list is being reused to begin Phase 2.

5.2 PHASE 2: GSP PREPARATION AND SUBMISSION – 2019 THROUGH 2022

This document outlines Phase 2 activities. SGMA requires and/or encourages stakeholder input during specific activities in this phase (listed below).

- GSP Initial Notification: San Joaquin County filed the required Initial Notification to DWR in July 2019. The GSAs will inform the public via:
    - Public Meetings: The GSA will use their Board meeting to updates member agencies, informing them of the key information from the Initial Notification such as the process for developing the GSP and how interested parties can be involved.
    - Notifications: The public will receive a notification containing the same information via the Notification methods described above.
- GSP Preparation: The GSAs will encourage active involvement through the methods described above, and beneficial uses and users will be considered as the GSP is developed and public input will be considered.
- GSP Public Notice and Adoption: SGMA Section 10728.4 requires 90-day public notice prior to adoption of a GSP. Noticing will occur using the paper of record that comprises each GSA service area.
- GSP Submittal: SGMA regulations Section 354.10 requires a summary of communications including description of beneficial users, list of public meetings, and comments/responses received will be provided as part of the GSP submittal. The website will maintain an administrative record of all communication actions and will use that for submission purposes.

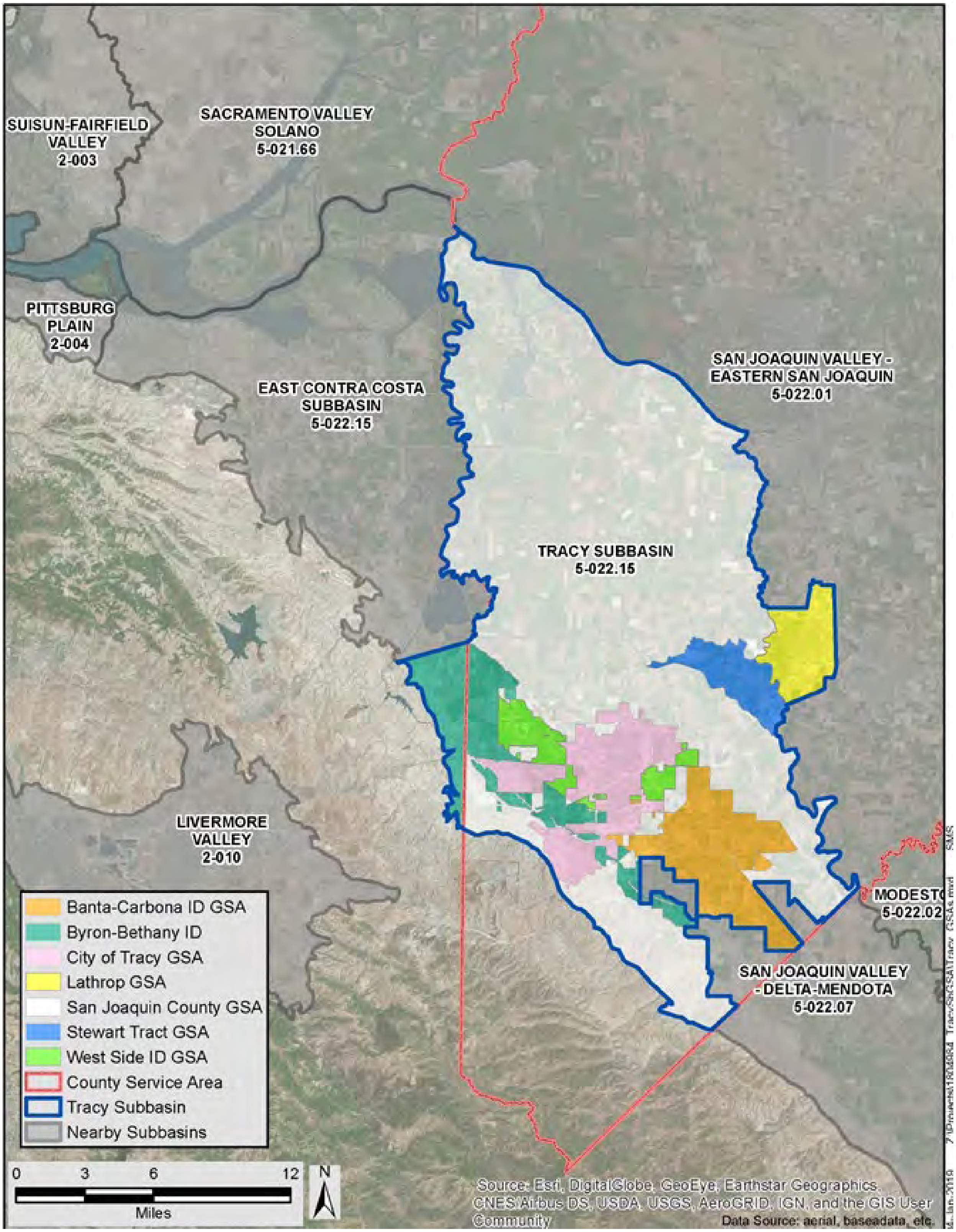
5.3 FUTURE PHASES

As mentioned, this Plan identifies the communication and engagement efforts planned for Phase 2 of GSP Preparation and Submission (2019-2022). This Plan may be updated and used during future GSP phases including the GSP Implementation, during the annual reports and the 5-year update and revisions to the original GSP.

###

EXHIBITS AND ATTACHMENTS

EXHIBIT 1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SAN JOAQUIN VALLEY - EASTERN SAN JOAQUIN 5-022.01
TRACY SUBBASIN 5-022.15
LIVERMORE VALLEY 2-010
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Byron-Bethany ID
City of Tracy GSA
Lathrop GSA
San Joaquin County GSA
Stewart Tract GSA
West Side ID GSA
County Service Area
Tracy Subbasin
Nearby Subbasins
0 3 6 12
Miles
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Data Source: aerial, baseadata, etc.

ATTACHMENT A – Public Meetings and Briefings

Byron-Bethany Irrigation District

Board of Directors Board meetings (third Tuesday of each month)

Banta-Carbona Irrigation District

Board of Directors Board meetings (first Wednesday after the 10^{th} of each month)

City of Lathrop

Council meetings (second Monday of each month)

City of Tracy

Council meetings and workshops (first and third Tuesdays of each month)

San Joaquin County

Board of Supervisor meetings (second and fourth Tuesday of each month)

Stewart Tract

RD 2000 Board of Directors Board meetings (no regular meetings)

SGMA MANDATED AGENCIES AND GROUPS BRIEFINGS

Tribal: Wilton Rancheria Tribe, Bay Miwok Tribe

Federal: U.S. Army (Tracy Army Depot), U.S. Bureau of Reclamation, US Fish and Wildlife

State: Department of Water Resources, Duell Vocational Institute

Local: Community Water Systems, Reclamation Districts, Domestic Well Owners, Disadvantaged Communities served by wells, Environmental Users of Groundwater

Potential Other Venues:

Farm Bureau

Chamber of Commerce

Trade Groups

ATTACHMENT B – Key Messages

What is SGMA

The Sustainable Groundwater Management Act, signed into law in 2014, provides a framework for long-term sustainable groundwater management across California. It requires that local and regional authorities in the medium- and high-priority groundwater basins form a locally-controlled and governed Groundwater Sustainability Agency (GSA) and prepare and implement a Groundwater Sustainability Plan (GSP).

What is a GSP

A GSP is a plan required by SGMA and developed by a GSA that outlines how the GSA will implement, manage and measure specific actions for the health and viability of the subbasin. Specifically, groundwater must be managed with the goal to reduce or avoid "undesirable results" including, but not limited to, lowering of groundwater levels, water quality degradation, and depletion of surface water. The GSP for the Subbasin must be submitted by January 31, 2022.

De minimis Users

Domestic well users generally fall within the SGMA definition of a de minimis extractor. SGMA defines a de minimis extractor as "a person who extracts, for domestic purposes, two acre-feet or less (of groundwater) per year." Most private users of domestic wells use less than two acre-feet of water per year.

Local Control

SGMA provides for the management of groundwater supplies by local authorities. In fact, it specifically limits state intervention provided that local agencies develop and implement GSPs as required by the legislation. Only under a limited set of circumstances, can the State Water Board step in to help protect local groundwater resources if local efforts to form a GSA or prepare a viable GSP are not successful.

Stakeholder Participation

Under the requirements of SGMA, GSAs must "consider interests of all beneficial uses and users of groundwater". GSP regulations require that during GSP preparation, GSAs must provide opportunities for the public to be engaged and actively involved throughout the process and document in the GSP how they accomplished that. Stakeholders can be involved by visiting the Tracy Subbasin website, subscribing to receive notifications, providing comments, and attending public workshops.

Overall health of the basin

Data collected over many years indicates the Tracy groundwater subbasin is generally in good condition. The GSP development will include several SGMA required technical groundwater studies and models. The results of these studies will be shared at public workshops and meetings and the public will be able to review and provide comments.

Support for Agriculture

The large majority of groundwater usage comes from agriculture. The GSAs have and will continue to engage the agricultural community throughout the GSP process and is committed to ensuring continued existence of a robust agricultural community.

Tracy Subbasin
Workshop #1 Summary

Date: Tuesday, July 21, 2020
Time: 5:30 p.m. – 7:00 p.m.
Location: Virtual (Webinar)

Attendees	
Name	**Agency**
Ryan Alameda	Stewart Tract*
Debbie Cannon	Luhdorff & Scalmanini Consulting Engineers
Alicia Connelly	San Joaquin County*
Pete Dennehy	N/A
Ryan Dupuis	N/A
Mary Elizabeth	N/A
Greg Gibson	City of Lathrop*
Nick Janes	Byron-Bethany Irrigation District* & West Side Irrigation District*
Rosemary Martinez	City of Lathrop*
Bruce McLaughlin	N/A
Glenn Prasad	San Joaquin County*
Daryll Quaresma	N/A
Michael Quartaroli	N/A
Keith Robertson	N/A
Lemar Saffi	City of Tracy*
Catherine Smith	N/A
Chelsea Spier	California Department of Water Resources
Roy Valadez	San Joaquin County*
David Weisenberger	Banta-Carbona Irrigation District*
Matt Zidar	San Joaquin County*
Staff and Presenters	
Name	**Agency**
Michael Callahan	San Joaquin County*
Khandriale Clark	Stantec
Kirsten Pringle	Stantec
Richard Shatz	GEI

*indicates that the agency is one of the Tracy Subbasin Groundwater Sustainability Agencies

Purpose

The Tracy Subbasin Groundwater Sustainability Agencies (Tracy Subbasin GSAs) held a coordinated, virtual public workshop from 5:30 p.m. to 7:00 p.m. on Tuesday, July 21, 2020. This was the first in a series of public workshops aimed at educating and soliciting input from members of the public about key topics related to the development of the Groundwater Sustainability Plan (GSP) for the Tracy Subbasin. The purpose of the workshop was to inform stakeholders and other interested parties within the Tracy Subbasin about SGMA and the GSP development process and identify opportunities for public input in this process.

Summary

The workshop was held virtually through GoToWebinar, an online meeting platform. A total of 29 individuals registered for the workshop and 20 individuals attended. Attendees were notified that the workshop was being recorded for preparation of this summary and to post a video of the workshop for follow-on viewing by attendees, the public, and other interested parties.

The Tracy Subbasin GSAs advertised the workshop via postings on the Tracy Subbasin and GSAs' websites; emails to the Tracy Subbasin Interested Parties Database; and direct invitations to individual stakeholders and stakeholder organizations, including the San Joaquin Farm Bureau Federation, Mountain House Community Services District, and Stockton East Water District. The workshop flyer was made available in both English and Spanish.

The workshop included a series of short presentations from GSA representatives and consultant staff. Speakers included Michael Callahan, San Joaquin County; Richard Shatz, GEI; and Kirsten Pringle, Stantec. Workshop topics included: SGMA, the Tracy Subbasin, the GSP development process, content of the draft GSP chapters 1 - 3, and methods for interested parties to stay informed and engaged in development of the draft GSP.

The presenters held three designated question and answer segments. The attendees submitted questions using the webinar platform or by text message to Ms. Pringle. The attendees were given the option of having their microphone unmuted and reading their question out loud themselves; however, no attendee chose to do so.

A link to the recording of the workshop and copies of the workshop materials in English and Spanish are available on the Tracy Subbasin website.

Audience Feedback

Catherine Smith, workshop participant, asked the following questions:

- It appears on the map that the homes along W Grant Line Road are no longer in the Byron-Bethany Irrigation District. Is that correct? If they are no longer in Byron-Bethany Irrigation District, what does that mean?
- Are you planning to place meters on private residential wells? If so, what is the timeline?

Tracy Subbasin
Workshop #2 Summary

Date: Thursday, January 21, 2021
Time: 5:30 p.m. – 6:30 p.m.
Location: Virtual (Zoom)

Attendees	
Name	**Agency**
Sarah Bai	N/A (Participant)
John Brodie	San Luis & Delta-Mendota Water Authority
Stephen Chen	N/A (Participant)
Jose Coronado	N/A (Participant)
Greg Gibson	City of Lathrop*
Claire Howard	San Luis & Delta-Mendota Water Authority
Lemar Saffi	City of Tracy*
Sean Storey	GEI
Greg Young	Byron-Bethany Irrigation District* and Westside Irrigation District*
Staff and Presenters	
Name	**Agency**
Stephen Pang	Stantec
Kirsten Pringle	Stantec
Richard Shatz	GEI
Matt Zidar	San Joaquin County*

*indicates that the agency is one of the Tracy Subbasin Groundwater Sustainability Agencies

Purpose

The Tracy Subbasin Groundwater Sustainability Agencies (GSAs) held a coordinated, virtual public workshop from 5:30 p.m. to 6:30 p.m. on Thursday, January 21, 2021. This was the second in a series of public workshops aimed at educating and soliciting input from members of the public about key topics related to the development of the Groundwater Sustainability Plan (GSP) for the Tracy Subbasin. The purpose of the workshop was to receive input from stakeholders and other interested parties within the Tracy Subbasin about the draft Sustainable Management Criteria (SMC).

Summary

The workshop was held virtually through Zoom, a video conferencing and online meeting platform. A total of 13 individuals attended, including technical staff and GSA representatives.

The Tracy Subbasin GSAs advertised the workshop via postings on the Tracy Subbasin and GSAs' websites and social media accounts and emails to the Tracy Subbasin Interested Parties Database. The workshop flyer is included as **Attachment A** to this summary. Direct invitations were also sent via email to stakeholder and local community organizations, including the Mountain House Community Services District, San Joaquin Farm Bureau Federation, San Joaquin River Club, Sikhs of Tracy, and Reclamation Districts with jurisdiction within the basin boundaries. In addition, the GSAs notified representatives of adjacent basins.

Prior to the workshop, participants were encouraged to view a short, informative presentation on SMC created by the GSAs. The purpose of the video was to explain key concepts related to SMC (e.g., sustainability goal, minimum thresholds, measurable objectives) in order to prepare interested parties for participation in the workshop and monthly GSP Coordination and Technical Committee Meetings.

The workshop started with opening remarks from Matt Zidar, County of San Joaquin GSA representative, followed by an informational presentation on SMC provided by Richard Shatz, GEI (technical consultant for the subbasin). The workshop participants then discussed and provided input on the draft SMC for the Tracy Subbasin. The discussion was guided by a Participant Guide which asked questions related to the draft SMC and GSP. The guide was also used to collect information about the participants, including their role as it relates to groundwater, familiarity with SGMA, and whether they own or operate a well. A copy of the Participant Guide is provided as **Attachment B** to this summary.

Using the Participant Guide, the workshop facilitator led a guided discussion on the draft SMC. Discussion topics included groundwater levels, groundwater quality, subsidence, and groundwater dependent ecosystems. Participant feedback was recorded in the meeting notes and is summarized below. Participants and GSA representatives were also provided the option to send their Participant Guide to the facilitator up to a week after the workshop. Feedback provided at the workshop was summarized at the Tracy Subbasin GSP Coordination meeting held on February 18, 2021 and used to inform the content of the draft GSP.

Participant Feedback

Sarah Bai, local resident, provided the following comments:

- Consider concerns about potential rate increases resulting from GSP implementation.
- Apply criteria for groundwater quality impacts to livestock production in addition to crop production.
- Examine how climate change may impact groundwater pumping costs.
- Consider consequences if groundwater quality becomes harmful to its users.
- Determine how the development of a nature preserve in the city of Tracy might impact groundwater resources.

Greg Gibson, City of Lathrop GSA representative, asked the following questions:

- Clarify why groundwater quality is included in the criteria for groundwater levels.
- Provide a detailed discussion of how soil composition impacts subsidence within the Tracy Subbasin.
- Add peat subsidence as a criterion when examining subsidence in the Delta region of the subbasin.

Help plan for the future of your community’s groundwater resources

Local agencies are developing a plan to continue the sustainability of the region’s groundwater supplies for the next 20 years. The plan will be used to protect groundwater users in the region. *If you use groundwater for your home, farm, or business this may impact you.*

Lend your voice to this important planning process at our upcoming virtual workshop:

Thursday, January 21, 2021

5:30 PM – 6:30 PM

Click here to register

Interested in learning more? Watch our informative video series on the Tracy Subbasin website.

For questions, contact Kirsten Pringle at kirsten.pringle@stantec.com or 916-418-8243.

Stewart Tract

For more information, visit: tracysubbasin.org

Tracy Subbasin Sustainable Management Criteria
Participant Guide

BACKGROUND

Local Groundwater Sustainability Agencies are preparing a plan to manage the region's groundwater. As part of this process, these agencies are interested in the input of those that live, work, and use groundwater in the region. You can help us by providing responses to the questions identified in this Participant Guide. Your responses will be combined with those of others and shared to with the Groundwater Sustainability Agencies to help inform and guide the content of the Groundwater Sustainability Plan.

For more information about the Groundwater Sustainability Plan and Tracy Subbasin, visit our website at tracysubbasin.org/.

INSTRUCTIONS

This Participant Guide is intended to support discussions during the January 21, 2021 public workshop on Sustainable Management Criteria for the Tracy Subbasin. You may provide your input verbally during the designated discussion time and/or in this document. Completion and submission of this Participant Guide is encouraged, but not required to participate in the workshop.

This Participant Guide is divided into three parts. **Parts 1 and 2 are optional.** Part 1 asks some basic questions about you. Part 2 asks about how you use groundwater and your familiarity with the Sustainable Groundwater Management Act. You may fill-out these sections anytime during or after the workshop.

Part 3 asks you to provide input on how the Groundwater Sustainability Plan should define 'sustainability' of the region's groundwater resources. **The workshop facilitator will lead you and the other participants through this section.**

When you have completed the Participant Guide, please **email a copy to Kirsten Pringle at kirsten.pringle@stantec.com. Worksheets will be accepted until 5 PM, Friday, January 29.**

Your responses provided in this Participant Guide and verbally during the workshop will be combined with the responses of others and summarized at the February Groundwater Sustainability Plan Coordination Meeting. Note that individual responses will not be shared, but the summary may include a list of participating individuals.

For questions or concerns, contact Kirsten Pringle at kirsten.pringle@stantec.com or (916) 418-8243.

PART 1 (Optional)

1. Name

2. Organization/Affiliation

3. City

4. Email or Contact Information

5. Would you like to be added to our mailing list? You will receive notices about upcoming public events and releases of public documents.

☐ Yes
☐ No

PART 2 (Optional)

1. How would you characterize your role as it relates to groundwater? (Check all that apply)

- ☐ Use groundwater for growing/livestock
- ☐ Use groundwater for my home or business
- ☐ Use groundwater or works for an agency that uses groundwater for environmental purposes
- ☐ Live in a city or community that uses groundwater
- ☐ Own land with a groundwater well
- ☐ Work for a reclamation district or municipal or public water system
- ☐ Work for a land use planning agency
- ☐ Work for a state or federal agency
- ☐ Concerned member of the public
- ☐ Other (please describe):

2. Before this workshop, were you familiar with Sustainable Groundwater Management Act?
   - ☐ Yes
   - ☐ No

3. Do you know which Groundwater Sustainability Agency represents you or your community?
   - ☐ Yes
   - ☐ No

If yes, which Groundwater Sustainability Agency represents you? ______

4. Do you own or operate a well?
   - ☐ Yes
   - ☐ No

5. If you answered yes to #4, has your well ever gone dry?
   - ☐ Yes
   - ☐ No

If yes, what is the depth of your well? ______

6. Have you heard of any else's well going dry during the last 10 years?
   - ☐ Yes
   - ☐ No

If yes, where was the well located (approximately)? ☐

PART 3

The Sustainable Groundwater Management Act identifies six “undesirable results” that may negatively impact a groundwater basin:

- Chronic lowering of groundwater levels
- Reduction of groundwater storage
- Degraded water quality
- Land subsidence (sinking)
- Surface water depletion

The sixth undesirable result is seawater intrusion, which does not occur in our region. To be considered an undesirable result these effects must be defined as “significant and unreasonable.” The Sustainable Groundwater Management Act allows local agencies to determine what is considered “significant and unreasonable” for each undesirable result. *This is where we need your help*.

During the workshop, we will be collectively discussing the questions below to get your input on how to define “significant and unreasonable” for the undesirable results listed above. Your input will help the Groundwater Sustainability Agencies develop the sustainable management criteria for the Tracy Subbasin.

1. How would you describe ‘sustainability’ in terms of the region’s groundwater resources? What would make the region’s groundwater resources ‘unsustainable’?

2. The Groundwater Sustainability Agencies have identified the following draft criteria to define how low **groundwater levels** could drop before they become significant and unreasonable:
    - Domestic and irrigation wells go dry
    - Increased costs to pump groundwater
    - Surface water is depleted such that creeks go dry
    - Groundwater supported vegetation die or cannot repopulate
    - Groundwater quality is degraded by increasing the salt content
    - Groundwater quality declines to the point of being unusable

Are the impacts listed above good indicators of the sustainability of the region's groundwater resources? Why or why not?

Are there other impacts related to the reliability of the region's groundwater resources that the Groundwater Sustainability Agencies should consider?

3. The Groundwater Sustainability Agencies have identified the following draft criteria to define what would make the **quality of groundwater** significant and unreasonable:
   - Migration of large-scale groundwater contamination
   - Contaminant concentrations in public supply wells above legal limits
   - Degraded water quality that leads to reduced crop production
   - Increased groundwater salinity requiring treatment
   - Implementation of projects and management actions that increase concentrations of elements that make the groundwater unusable

Are the impacts listed above good indicators of the **quality** of the region's groundwater resources? Why or why not?

Are there other impacts related to the quality of the region's groundwater supplies that the Groundwater Sustainability Agencies should consider?

4. What type of impacts caused by land subsidence (sinking) could occur before the subsidence becomes significant and unreasonable (e.g. damage to infrastructure, increased flooding)?

5. To what extent are issues of surface water depletion a concern to you and your community? To your knowledge, are there areas within the region that rely on groundwater to support the overlying environment? If yes, where are these areas located?

6. What other impacts caused by or related to groundwater use should the Groundwater Sustainability Agencies consider when defining sustainability for the basin's groundwater resources?

Tracy Subbasin
Workshop #3 Summary

Date: Tuesday, August 10, 2021
Time: 5:30 p.m. – 6:30 p.m.
Location: Virtual (Zoom)

Attendees	
Name	**Agency**
David Weisenberger	Banta-Carbona Irrigation District*
Chelsea Spier	California Department of Water Resources
Jackson Cook	California Department of Water Resources
Greg Gibson	City of Lathrop*
Lea Emmons	City of Tracy*
Nacho Mendoza	Diablo Water District
Daniel Golman	Member of the public
George Hartmann	Member of the public
Jim Boyle	Member of the public
L. Sipich	Member of the public
Mary Mitracos	Member of the public
Ralph	Member of the public
Nader Shareghi	Mountain House Community Services District
Eric Thorburn	Oakdale Irrigation District
Claire Howard	San Luis & Delta-Mendota Water Authority
John Brodie	San Luis & Delta-Mendota Water Authority
Jose Coronado	San Joaquin County*
Scott Tyrell	San Joaquin County*
Staff and Presenters	
Name	**Agency**
Sergio Morales	Focus Interpreting (Spanish interpreter)
Elizabeth Simon	Stantec
Kirsten Pringle	Stantec
Richard Shatz	GEI
Matt Zidar	San Joaquin County*

*indicates that the agency is one of the Tracy Subbasin Groundwater Sustainability Agencies

Purpose

The Tracy Subbasin Groundwater Sustainability Agencies (GSAs) held a coordinated, virtual public workshop from 5:30 p.m. to 6:30 p.m. on Tuesday, January 10, 2021. This was the third and final in a series of public workshops aimed at educating and soliciting input from members of the public about key topics related to the development of the Groundwater Sustainability Plan (GSP) for the Subbasin. The workshop was held during the beginning of the 30-day public comment period for the draft GSP. The purpose of the workshop was to prepare beneficial users of groundwater and other stakeholders to provide comment on the plan. Discussion topics included the content of the draft GSP, public comment process, water budgets, projects and management actions, and groundwater monitoring network.

Summary

The workshop was held virtually through Zoom, a video conferencing and online meeting platform. A total of 23 individuals attended, including technical staff and GSA representatives. Live Spanish interpretation was provided.

The Tracy Subbasin GSAs advertised the workshop via postings on the Tracy Subbasin and GSAs' websites and social media accounts and emails to the Interested Parties Database. The workshop flyer is included as **Attachment A** to this summary. Email invitations were also sent directly to individuals representing beneficial users of groundwater, stakeholder organizations, and adjacent basins. This included targeted invitations to local Reclamation Districts, public water agencies, community services districts, individual well owners, and organizations representing environmental uses of groundwater in the basin.

The workshop started with opening remarks from Matt Zidar, San Joaquin County GSA representative. Richard Shatz, GEI (technical consultant) provided an informational presentation on the content of the draft GSP. This was followed by an overview of the draft GSP public comment process and next steps provided by Kirsten Pringle, Stantec (outreach consultant). Workshop participants then voted on which GSP topics they would like to discuss. Based on the results of the poll, Mr. Shatz provided additional information on the water budget, projects and management actions, and groundwater monitoring network.

Participants were encouraged to ask questions throughout the workshop. Staff also utilized live polling to gather information on the participants' existing level of knowledge about the GSP, interest in groundwater, and goals for attending the workshop. The workshop content was adapted based on the poll results.

Participant Questions

A workshop participant asked what the typical capacity of an aquifer storage and recovery (ASR) well is and how many ASR wells the City of Tracy has. Mr. Shatz responded that, in general, the amount of water that can be recharged into a basin is about half about what can be pumped out of it. He stated that the City of Tracy currently has one ASR well and plans to expand to eight ASR wells.

A workshop participant asked why inflows into the Subbasin are projected to increase from historic and current conditions. Mr. Shatz responded that inflows into the Subbasin are projected to increase due to changes in land use patterns and climate change. Mr. Zidar added that the model used to develop the water budget has some discrepancies and that the water budget will be updated over the next five years as the model is refined.

A workshop participant asked which groundwater quality parameters the GSAs will be monitoring for. Mr. Shatz responded that the GSAs will be monitoring for total dissolved solids, nitrate, and boron. He stated that the GSAs set the thresholds for groundwater quality using drinking water quality standards (maximum contaminant levels). He noted that some wells are already exceeding these standards. In those cases, the threshold will be set to maintain the constituent at a similar concentration.

August 6, 2021

Via email and U.S. mail

Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: *Notice of Intent to Adopt a Groundwater Sustainability Plan*

The Groundwater Sustainability Agencies (GSAs) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSAs), pursuant to California Water Code Section 10728.4, hereby give notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that they intend to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

The undersigned GSAs specifically provide notice to the City of Lathrop, City of Tracy, Alameda County, and San Joaquin County of the GSAs' intent to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below.

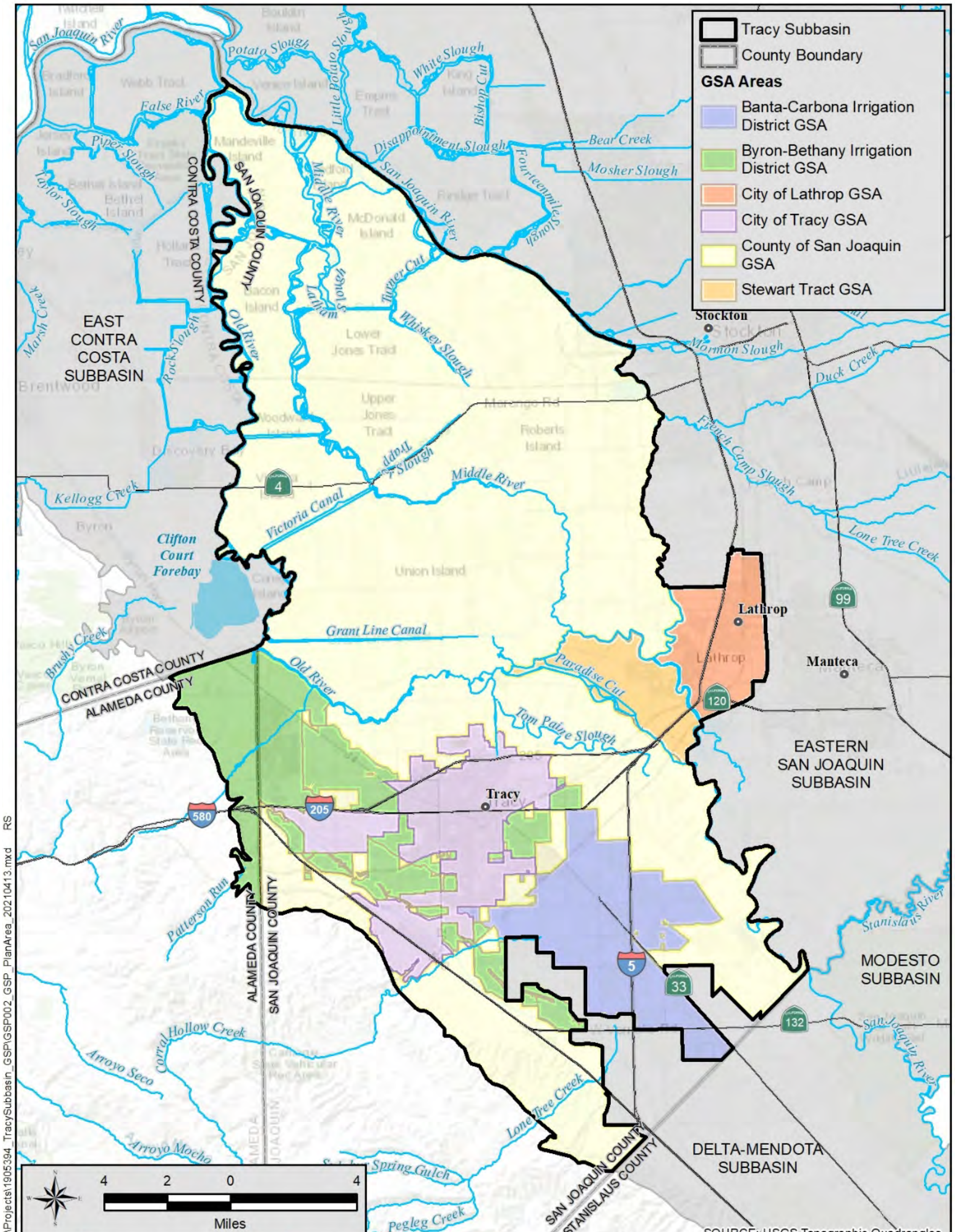
Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460.

Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit www.tracysubbasin.org/meetings.

The GSAs look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative.

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA



Tracy Subbasin
San Joaquin and Alameda Counties

Tracy Subbasin

GEI Consultants

GSP Plan Area and GSAs

APRIL 2021

FIGURE 2-1

13-Apr-2021 Z:\Projects\1905394_TracySubbasin_GSP\GSP002_GSP_PlanArea_20210413.mxd RS

RESOLUTION 2021-16
RESOLUTION AUTHORIZING A NOTICE OF INTENT
TO ADOPT
THE TRACY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d));

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727);

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15);

WHEREAS, in order to exercise the authority granted by SGMA, a local agency may decide to become a GSA;

WHEREAS, the Byron-Bethany Irrigation District (BBID or District) is a local agency as defined by SGMA;

WHEREAS, on March 21, 2017, the District Board of Directors adopted Resolution No. 2017-5, thereby deciding to become the GSA for the areas of the Tracy Subbasin (Subbasin No. 5-22.15) within the District boundaries in Contra Costa and San Joaquin Counties, and both within and outside the District boundaries in Alameda County;

WHEREAS, the District subsequently transmitted notice of its intent to become a GSA consistent with Resolution No. 2017-5 to DWR, and following the required notice, became the GSA for the areas of the Tracy Subbasin within the District boundaries in Contra Costa and San Joaquin Counties, and both within and outside the District boundaries in Alameda County;

WHEREAS, on February 11, 2019, DWR released the final basin boundary modification for the Tracy Subbasin, and thereby divided the Tracy Subbasin into the East Contra Costa and Tracy Subbasins;

WHEREAS, BBID has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 *et seq.*); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, BBID is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP;

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4).

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors hereby approves and authorizes the filing of the Notice of Intent, attached as Exhibit "A", to adopt the Final Tracy Subbasin GSP.

PASSED AND ADOPTED at a Rescheduled Meeting of the Board of Directors of Byron-Bethany Irrigation District on 29 June 2021 by the following vote:

AYES: ALVAREZ, KAGEHIRO, M.MAGGIORE, T.MAGGIORE, PEREIRA, TUSO
NOES:
ABSENT: ENOS
ABSTAIN:

/s/ Russell Kagehiro
Mr. Russell Kagehiro, President

****

Secretary's Certification

I, Kelley Geyer, Deputy Secretary of the Board of Directors of Byron-Bethany Irrigation District, do hereby certify that the foregoing Resolution is a true and correct copy entered into the Minutes of the Rescheduled Meeting of 29 June, 2021, at which time a quorum was present, and no motion to amend or rescind the above resolution was made.

/s/ Kelley Geyer
Kelley Geyer, Deputy Secretary

RESOLUTION NO. 2021-02

RESOLUTION OF THE BANTA CARBONA IRRIGATION DISTRICT AUTHORIZING ISSUANCE OF NOTICE OF INTENT TO ADOPT A GROUNDWATER SUSTAINABILITY PLAN

A. WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("**SGMA**") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

B. WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("**GSPs**"), which can be a single plan developed by one or more groundwater sustainability agency ("**GSA**") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

C. WHEREAS, SGMA requires a GSA to manage groundwater in all basins designated by the Department of Water Resources ("**DWR**") as a medium or high priority, including the Tracy Subbasin; and

D. WHEREAS, the Banta-Carbona Irrigation District ("**BCID**") formed a GSA for the purposes of sustainably managing groundwater in the Tracy Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

E. WHEREAS, BCID has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 *et seq.*); and

F. WHEREAS, BCID has joined with other GSAs to develop a single GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6 (i)); and

G. WHEREAS, the GSAs preparing the GSP for the Tracy Subbasin are finalizing the GSP for the Tracy Subbasin; and

H. WHEREAS, the GSAs must release a Notice of Intent to Adopt the GSP pursuant to Water Code section 10728.4.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of Banta-Carbona Irrigation District as follows:

1. BCID hereby approves and authorizes issuance of a Notice of Intent to Adopt a Groundwater Sustainability Plan for the Tracy Subbasin as required by Water Code Section 10728.4.

2. BCID authorizes its consultant, Stantec, to issue the Notice of Intent on its behalf.

PASSED, APPROVED, AND ADOPTED this 14th day of July, 2021 by the following vote:

AYES: Directors James M. Thoming, Glenn Robertson, Mark Cardoza and Annette Elissagaray
NAYS: None
ABSTAIN: None
ABSENT: Director Keith Robertson

James M. Thoming

President

Attest:

Margaret Howe

Margaret Howe, Secretary

Date: 8/5/2021

ITEM 5.1

CITY MANAGER'S REPORT
JULY 12, 2021 CITY COUNCIL REGULAR MEETING

ITEM: **AUTHORIZE NOTICE OF INTENT TO ADOPT THE GROUNDWATER SUSTAINABILITY PLAN FOR THE TRACY SUBBASIN**

RECOMMENDATION: **Adopt a Resolution Authorizing a Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin**

SUMMARY:

On August 29, 2014, the California Legislature passed the comprehensive groundwater legislation Sustainable Groundwater Management Act (SGMA). SGMA provides a framework for sustainable groundwater management in California, and can be found in Senate Bills 1168 and 1319 and Assembly Bill 1739.

The City of Lathrop is one of six Groundwater Sustainability Agencies (GSAs) that form the Tracy Subbasin. Under SGMA, the GSAs must complete a Groundwater Sustainability Plan (GSP) and submit such plan to the Department of Water Resources (DWR) by January 31, 2022. Under a Memorandum of Agreement (MOA) executed on September 24, 2019, the City of Lathrop and the other five local agencies have been collaborating to develop a single GSP for the Tracy Subbasin.

The final GSP for the Tracy Subbasin will be presented to Council for adoption consideration in October or November of 2021. At least 90-days prior to the adoption hearing, the GSAs in the Tracy Subbasin are required by SGMA to send a Notice of Intent to adopt the GSP (Notice of Intent) to the cities and counties within the GSP area.

Staff recommends that Council, as the governing body of the City of Lathrop Groundwater Sustainability Agency (GSA), adopt the attached Resolution authorizing release of Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin.

BACKGROUND:

On August 29, 2014, the California Legislature passed comprehensive groundwater legislation contained in Senate Bills 1168 and 1319 and Assembly Bill 1739, which are collectively referred to as the Sustainable Groundwater Management Act (SGMA). SGMA provides a framework for sustainable groundwater management in California.

SGMA requires government and water agencies in groundwater basins designated as medium or high priority by the California Department of Water Resources (DWR) to meet certain requirements:

- Form new Groundwater Sustainability Agencies (GSA) by June 30, 2017.
- Complete and submit a Groundwater Sustainability Plan (GSP) to DWR by January 31, 2020 for critically over drafted basins and by January 31, 2022 for non-critically over drafted basins.
- Update the GSP every five years.
- Achieve basin sustainability within 20 years of submitting the GSP.

The City of Lathrop overlies the Tracy Subbasin, which is designated by the State as a medium-priority, non-critically over drafted basin. Pursuant to the requirements of SGMA, the City of Lathrop originally formed as a GSA on October 3, 2016, for the portion of the City located east of the San Joaquin River and within the Eastern San Joaquin Subbasin. In 2018, the DWR approved a Basin Boundary Modification such that the City of Lathrop was located entirely within the Tracy Subbasin. Five other GSAs located in the Tracy Subbasin include the Banta-Carbona Irrigation District GSA, Byron-Bethany Irrigation District GSA, City of Tracy GSA, San Joaquin County GSA, and Stewart Tract GSA (herein collectively referred to as the "Tracy Subbasin GSAs").

On September 24, 2019, the Tracy Subbasin GSAs executed a Memorandum of Agreement to coordinate groundwater management and develop a single GSP for the Tracy Subbasin, which is due to the State no later than January 31, 2022. Local agencies have collaboratively managed groundwater resources in the Tracy Subbasin for decades. As a result of these efforts, groundwater resources in the basin are already sustainable. The GSP will provide a roadmap to continue to the sustainability of the region's groundwater supplies.

The GSP is being collaboratively developed with input from the six GSAs, as well as input from members of the public provided through monthly meetings, public workshops, and public comment periods. The Draft GSP is anticipated to be released for public comment and review in August 2021.

SGMA requires GSAs to adopt the final GSP at a public hearing. At least 90-days prior to the hearing, the GSA must send a notice to cities and counties within the plan area notifying them of the proposed GSP. This requirement is identified in Section 10728.4 of the California Water Code, which states that:

A groundwater sustainability agency may adopt or amend a groundwater sustainability plan after a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan or amendment. The groundwater sustainability agency shall review and consider comments from any city or county that receives notice pursuant to this section and shall consult with a city or county that requests consultation within 30 days of receipt of the notice. Nothing in this section is intended to preclude an agency and a city or county from otherwise consulting or commenting regarding the adoption or amendment of a plan.

The final GSP for the Tracy Subbasin will be presented to Council for consideration to adopt at a regular public hearing held in October or November of 2021. At least 90-days prior to the adoption hearing, the GSAs in the basin will send a Notice of Intent to Adopt the GSP (Notice of Intent) to cities and counties within the GSP area. A copy of this Notice of Intent is provided as Attachment B.

REASON FOR RECOMMENDATION:

Pursuant to SGMA requirements, staff recommends Council to adopt a resolution authorizing a Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin.

FISCAL IMPACT:

There is no fiscal impact at this time for releasing the Notice of Intent to Adopt the Tracy Subbasin Groundwater Sustainability Plan.

ATTACHMENTS:

A. Resolution Authorizing Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin

B. Notice of Intent to Adopt the Tracy Subbasin Groundwater Sustainability Plan

APPROVALS:

Greg Gibson Senior Civil Engineer	6/28/2021 Date
Michael King Director of Public Works	6/23/2021 Date
Cari James Director of Finance	6/23/2021 Date
Glenn Gebhardt City Engineer	6/28/21 Date
Salvador Navarrete City Attorney	6-24-2021 Date
Stephen J. Salvatore City Manager	6·30·21 Date

RESOLUTION 21 -____

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LATHROP AUTHORIZING A NOTICE OF INTENT TO ADOPT THE GROUNDWATER SUSTAINABILITY PLAN FOR THE TRACY SUBBASIN

WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15); and

WHEREAS, the City of Lathrop GSA was formed as a GSA on October 3, 2016, for the purposes of sustainably managing groundwater in the Eastern San Joaquin Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

WHEREAS, in October 2018, the DWR approved a jurisdictional Basin Boundary Modification such that the City of Lathrop was located entirely within the Tracy Subbasin; and

WHEREAS, the City of Lathrop GSA has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 et seq.); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, the GSAs submitted an Initial Notification to DWR to jointly develop a GSP for the Tracy Subbasin on February 12, 2018; and

WHEREAS, the City of Lathrop GSA is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP; and

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4).

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Lathrop, as the governing body of the City of Lathrop Groundwater Sustainability Agency, hereby approves the Notice of Intent (Attachment B to the City Managers Report) to adopt the final Tracy Subbasin Groundwater Sustainability Plan.

The foregoing resolution was passed and adopted this 12th day of July, 2021, by the following vote of the City Council, to wit:

AYES:

NOES:

ABSTAIN:

ABSENT:

Sonny Dhaliwal, Mayor

ATTEST:

Teresa Vargas, City Clerk

APPROVED AS TO FORM:

Salvador Navarrete, City Attorney

Attachment B

[Date]

Via email and U.S. mail

Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: *Notice of Intent to Adopt a Groundwater Sustainability Plan*

The Groundwater Sustainability Agencies (GSAs) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSAs), pursuant to California Water Code Section 10728.4, hereby give notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that they intend to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

The undersigned GSAs specifically provide notice to the City of Lathrop, City of Tracy, Alameda County, and San Joaquin County of the GSAs' intent to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below.

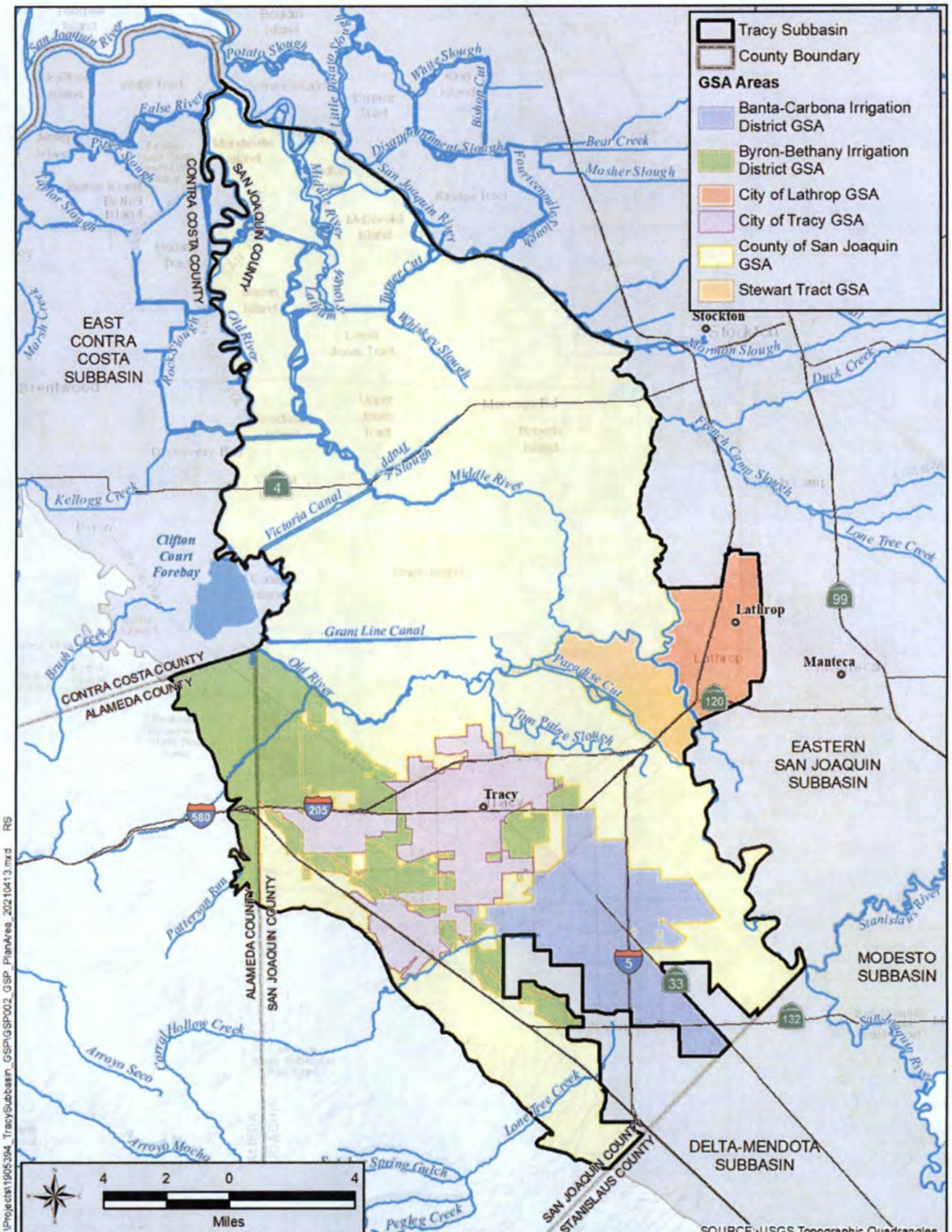
Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460.

Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit www.tracysubbasin.org/meetings.

The GSAs look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative.

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA



Tracy Subbasin San Joaquin and Alameda Counties	GEI Consultants	GSP Plan Area and GSAs
Tracy Subbasin		APRIL 2021 FIGURE 2-1

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1.

SAN JOAQUIN COUNTY
FLOOD CONTROL & WATER CONSERVATION DISTRICT
P. O. BOX 1810
1810 EAST HAZELTON AVENUE
STOCKTON, CALIFORNIA 95201
TELEPHONE (209) 468-3000
FAX NO. (209) 468-2999

KRIS BALAJI
DIRECTOR OF PUBLIC WORKS
FLOOD CONTROL ENGINEER

July 22, 2021

Via email and U.S. mail
Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: Notice of Intent to Adopt a Groundwater Sustainability Plan

The San Joaquin County (SJC) Groundwater Sustainability Agency (GSA) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSA), pursuant to California Water Code Section 10728.4, hereby gives notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that it intends to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

Notice is hereby provided to the City of Lathrop, the City of Tracy, and Alameda County of its intention to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below:

Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460

Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit:

www.tracysubbasin.org/meetings

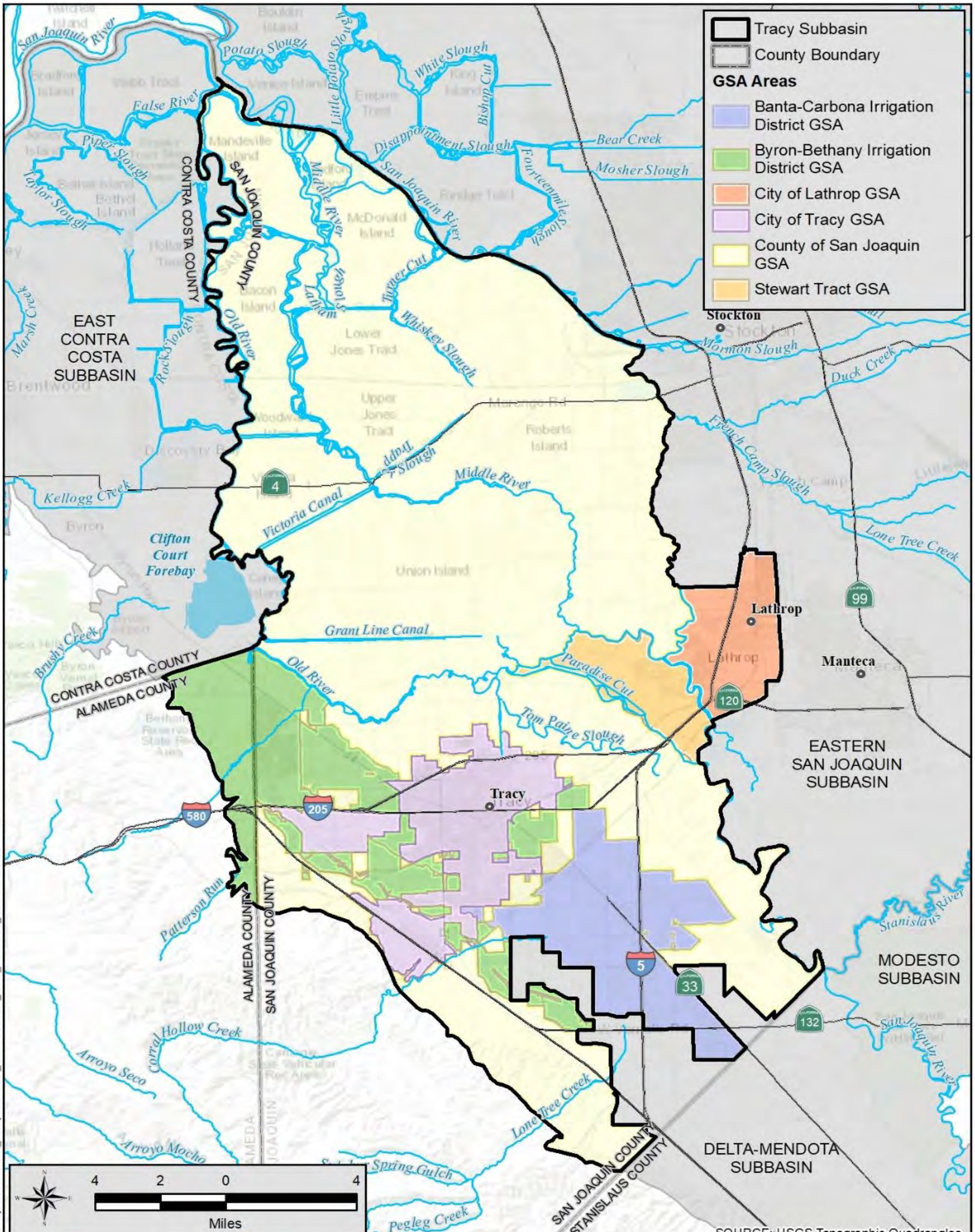
The GSAs of the Tracy Subbasin look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative. The Tracy Subbasin GSAs are as follows:

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA

By:____

Matt Zidar
GSP Coordinator, San Joaquin County GSA



Tracy Subbasin San Joaquin and Alameda Counties	GEI Consultants	GSP Plan Area and GSAs
Tracy Subbasin		APRIL 2021 — FIGURE 2-1

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13-Apr-2021

STEWART TRACT GROUNDWATER SUSTAINABILTY AGENCY

RESOLUTION NO. 21-1

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE STEWART TRACT GROUNDWATER SUSTAINABILITY AGENCY AUTHORIZING A NOTICE OF INTENT TO ADOPT THE TRACY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15); and

WHEREAS, Stewart Tract GSA was formed as a GSA on June 13, 2017 for the purposes of sustainably managing groundwater in the Tracy Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

WHEREAS, Stewart Tract GSA has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 et seq.); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, the GSAs submitted an Initial Notification to DWR to jointly develop a GSP for the Tracy Subbasin on February 12, 2018; and

WHEREAS, the Stewart Tract GSA is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP; and

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4).

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Stewart

Tract GSA finds as follows:

Section 1. Incorporation of Recitals. The Recitals are hereby incorporated in full as set forth above.

Section 2. Approval of Notice of Intent. Stewart Tract GSA hereby approves the notice of intent, attached in Exhibit A, to adopt the final Tracy Subbasin GSP .

Section 3. Official Actions. The President is authorized to transmit a conformed copy of this Resolution to the other member GSA's of the Tracy Sub-Basin as evidence of the Stewart Tract GSA's formal action.

Section 4. Effective Date. This Resolution shall take effect immediately upon its adoption by the Board of Directors.

* * * * * * *

PASSED, APPROVED AND ADOPTED this 4th day of August 2021.

By: ______________________
President,
Stewart Tract Groundwater Sustainability Agency

ATTEST:

By: ______________________
Director,
Stewart Tract Groundwater Sustainability Agency

I, Ramon Batista, Director of the Stewart Tract Groundwater Sustainability Agency, do hereby certify that the following resolution was duly passed and adopted by the Board of Directors of Stewart Tract Groundwater Sustainability Agency, at a special meeting thereof held on the 4th day of August 2021.

AYES: Director:

NOES: Director:

ABSENT: Director:

ABSTAINED: Director:

By: ______________________
Director,
Stewart Tract Groundwater Sustainability Agency

Stewart
Tract

TRACY

[Date]

Via email and U.S. mail

Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: *Notice of Intent to Adopt a Groundwater Sustainability Plan*

The Groundwater Sustainability Agencies (GSAs) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSAs), pursuant to California Water Code Section 10728.4, hereby give notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that they intend to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

The undersigned GSAs specifically provide notice to the City of Lathrop, City of Tracy, Alameda County, and San Joaquin County of the GSAs' intent to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below.

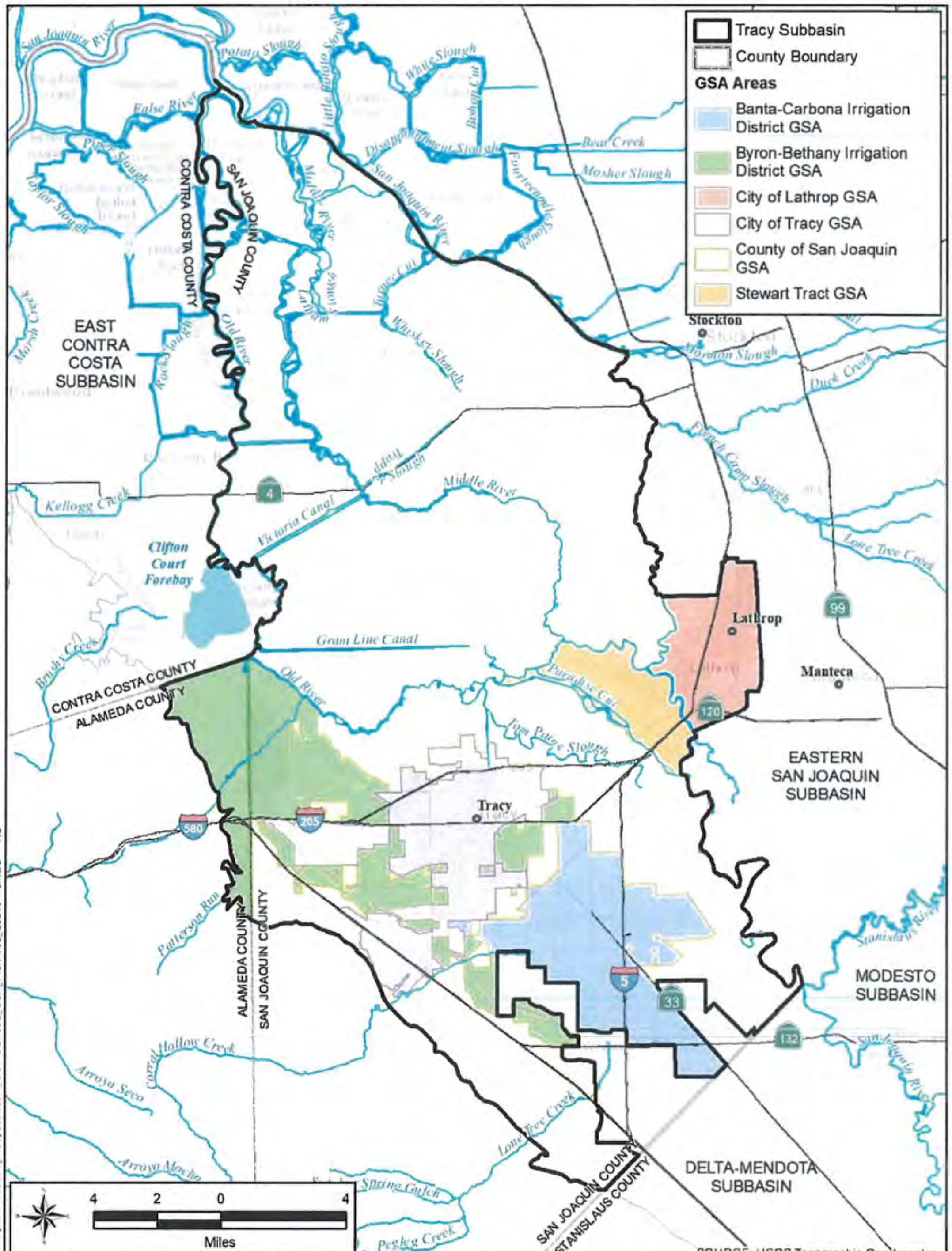
Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460.

Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit www.tracysubbasin.org/meetings.

The GSAs look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative.

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA



Tracy Subbasin San Joaquin and Alameda Counties	GEI Consultants	GSP Plan Area and GSAs
Tracy Subbasin		APRIL 2021 — FIGURE 2-1

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RESOLUTION 2021-092

APPROVING NOTICE OF INTENT TO ADOPT THE TRACY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15); and

WHEREAS, City of Tracy was formed as a GSA on February 2, 2016, by City Council per Resolution 2016-026, for the purposes of sustainably managing groundwater in the Tracy Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

WHEREAS, City of Tracy has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 *et seq.*); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, the GSAs submitted an Initial Notification to DWR to jointly develop a GSP for the Tracy Subbasin on February 12, 2018; and

WHEREAS, the City of Tracy is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP; and

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4);

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Tracy hereby approves the Notice of Intent to adopt the final Tracy Subbasin GSP at least 90 days from the issuance of this notice.

* *

The foregoing Resolution 2021-092 was adopted by the Tracy City Council on the 20th day of July, 2021, by the following vote:

AYES: COUNCIL MEMBERS: ARRIOLA, BEDOLLA, DAVIS, YOUNG

NOES: COUNCIL MEMBERS: NONE

ABSENT: COUNCIL MEMBERS: VARGAS

ABSTAIN: COUNCIL MEMBERS: NONE

MAYOR

ATTEST

CITY CLERK

APPENDIX Q
PUBLIC COMMENTS

Responses to Public Comments to Draft GSP

Comment No.	Name	Comment	Response to Comment/Changes to the GSP
1	Various agencies[1]	Provide the size of the population in each DAC.	Comment noted. Not required by GSP regulations.
2	Various agencies[1]	The identification of Interconnected Surface Waters (ISWs) is insufficient. (p.5-72 of GSP): [Perennial stream flows year round, text in GSP is contradictory.]	Language was changed to intermittent.
3	Various agencies[1]	The GSP cites Appendix K (Surface Water/Groundwater Interaction Hydrographs) as evidence that when depth to water is less than 20 feet, the surface water can be inferred to be interconnected to the upper aquifer. This appendix, however, is missing.	Comment noted. Appendix K was present.
4	Various agencies[1]	Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled with stream name and interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP.	Figure 5-11 has been replaced using information from https://icons.codefornature.org/. Tributaries have been named.
5	Various agencies[1]	Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.	Language added. Figure 5-11 shows spring 2019 depth to water. It does not correct for ground surface elevations. Section 5.11 Data Gaps expanded to include this approach for the 5-year GSP update.
6	Various agencies[1]	Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs.	Language changed Section 5.11 Data Gaps expanded to include this approach for the 5-year GSP update. Seasonal data over multiple water year types is provided in Appendix K and as shown on Figure 5-11.
7	Various agencies[1]	Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP. Data gaps are discussed in general terms on p. 5-78, but very little detail is provided.	Language added to Table 8-4 . See Figure 8-11, showing the representative monitoring well network shows ISW monitoring network s is sufficient other than near the SJR gage where MW-102 is proposed to fill a data gap, as described in Section 8.7.4.
8	Various agencies[1]	Overlay GDE locations with depth-to-groundwater contour maps. For these contour maps, note the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape.	Comment noted. Data Gap, Section 5.11 row 2445 states; "The areas (NCCAG dataset) identified as GDEs have not been validated. Evaluation of GDEs through a detailed depth to water evaluation should be performed. " In Section 2.4 GDE evaluation has been included in the fiscal budget.
9	Various agencies[1]	Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.	Comment noted, see response to Comment 6.

Comment No.	Name	Comment	Response to Comment/Changes to the GSP
10	Various agencies[1]	The GSP should be improved by including a separate Communication and Engagement Plan that describes outreach to DACs and environmental stakeholders during the GSP implementation phase, in addition to the GSP development phase. Include a robust Communication and Engagement Plan.	Comment noted. The Tracy Subbasin Communication and Public Outreach Plan (developed in June 2019) is included in Appendix P to the GSP. The Plan guided activities during GSP implementation and will be updated to include outreach activities during GSP implementation. Chapter 11 of the GSP describes how beneficial users, including DACs and environmental stakeholders, were consulted in development of the GSP.
11	Various agencies[1]	Describe efforts to engage with stakeholders during the GSP implementation phase in the Communication and Engagement Plan. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.	Comment noted. Section 11.7 of the Draft GSP identified how stakeholders will be consulted during the GSP implementation phased. The Communication and Public Outreach Plan will be updated to include outreach activities during GSP implementation.
12	Various agencies[1]	Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the subbasin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.	Comment noted. Section 9.3.3 Describes the criteria used to establish minimum thresholds, appendix N provides hydrographs showing the relationship between MTs to domestic wells. All domestic Well Owners regardless of whether they are DAC or not were considered in developing of the MTs. As shown in Appendix N, the MTs selected are not indicating domestic wells will go dry. It is not anticipated MTs will be exceeded, and therefor speculation of impacts for exceeding the MT is not required.
13	Various agencies[1]	For undesirable results, the Plan states that "the level when there would be significant undesirable results will be when 25 percent or more of the representative monitoring wells record groundwater levels that exceed the minimum thresholds for more than 2 consecutive years excluding drought periods." Include and consider periods of drought when defining undesirable results for the basin.	Language changed. Section 9.3.2, fifth paragraph.
14	Various agencies[1]	Describe direct and indirect impacts on DACs when defining undesirable results for degraded water quality. For specific guidance on how to consider domestic water users, refer to “Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act.”	Comment noted. All domestic Well Owners regardless of whether they are DAC or not were considered in developing of the undesirable results. State drinking water standards were applied uniformly.
15	Various agencies[1]	Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and drinking water users.	Comment noted. All domestic Well Owners regardless of whether they are DAC or not were considered in developing of the MTs. State drinking water standards were applied uniformly.

Comment No.	Name	Comment	Response to Comment/Changes to the GSP
16	Various agencies[1]	Set minimum thresholds at the MCL for TDS, nitrate, and boron, instead of 10% higher than the MCL at some wells.	Comment noted. Boron does not have an MCL but has a Notification Level. As illustrated in Table 9-3, MTs were established at the MCLs for most wells. At some wells the concentrations already exceed the primary and Recommended secondary MCLs prior to the start of SGMA. The GSP is using the Upper secondary MCL for TDS in most cases. The wells were the 10% had to be used are wells that are being sampled as part of the ILRP and only one sample had been acquired to date. The GSP consider using "short-term MCL" for TDS level of 1500 mg/L rather than 10% but this would allow for an increase of 25%. We acknowlege the RWQCB Basin Plan as the mechanism to project designated benefical uses and users. The GSP will seek to mitigate for any contribution to undesirable results from projects and management actions.
17	Various agencies[1]	Set minimum thresholds for the additional COCs: sulfate, 1,2,3-TCP, and arsenic. Ensure they align with drinking water standards.	Comment noted. As described in the text sulfate is a naturally occurring element and as shown on Figure 5-22 is present above the Recommended SMCL, in both the upper and lower aquifers and was present prior to SGMA. Management of the basin cannot prevent the occurrence of sulfate. Arsenic is present above the MCL just in the Lathrop area. 123 TCP is a chemical that is associated with manmade contamination. Its inclusion in pesticides was discontinued in 1984, prior to SGMA. RWQCB should fund regional sampling conistent with their legistative manadate and pursuant to the Basin Plan. The GSAs do not believe these are COCs and therefore are not including them for establishment of MTs.
18	Various agencies[1]	When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds can be determined.	Comment noted. GDEs were considered in the development of undesirable results and potential impacts. Figure 8-6 shows the location of GDEs near representative wells along with a new proposed monitoring well (MW-102). Potential impacts to environmental users by establishing MTs, as shown in Table 9-1, groundwater level MTs were selected based on the most sensitive beneficial user, which in shallow groundwater areas was surface water depletion, which in all cases were higher than the average 30-foot maximum of California preatophytes and within one foot of historic conditions. Therefore, potential impacts to environmental users were considered and biological responses would be minimal with changes less than 1-foot. Language added to more clearly reflect the potential changes and impacts to environmental users.

Comment No.	Name	Comment	Response to Comment/Changes to the GSP
19	Various agencies[1]	For the interconnected surface water SMC, the undesirable results should include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the subbasin. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.	Language added to Section 9.8.2 to more clearly reflect the potential changes and impacts to environmental users. Potential impacts to aquatic species users by establishing MTs, as shown in Table 9-1, groundwater level MTs were selected based on the most sensitive beneficial user, which in shallow groundwater areas was surface water depletion, which in all cases were higher than the 30-foot maximum rooting depth of Valley Oaks and within one foot of historic conditions. Therefore, potential impacts to environmental users were considered and biological responses would be minimal with changes less than 1-foot.
20	Various agencies[1]	Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.	Comment noted. Section 7.8 describes improvements needed to the groundwater model. After improvements are made, additional modelling runs may be considered at the time of the GSP 5-year update.
21	Various agencies[1]	Incorporate surface water flow inputs that are adjusted for climate change to the projected water budget.	Comment noted. See response to Comment 20.
22	Various agencies[1]	Calculate sustainable yield based on the projected water budget with climate change incorporated.	Comment noted. See response to Comment 20.
23	Various agencies[1]	Incorporate climate change scenarios into projects and management actions.	Comment noted. See response to Comment 20.
24	Various agencies[1]	Provide maps that overlay monitoring well locations with the locations of DACs and GDEs to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) across the subbasin for all groundwater condition indicators.	Comment noted. Figure 8-3 shows the representative monitoring wells with respect to DACs. Figure 8-6 shows the representative monitoring wells with respect to potential GDEs. Section 8.2.5 describes additional monitoring wells to be RMSs.
25	Various agencies[1]	Reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.	Language modified Section 8.7.4. Table 8-4 modified.
26	Various agencies[1]	Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.	Language modified Section 8.2.5 to include in future refinements to the GSP.
27	Various agencies[1]	Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”	Comment noted. No recharge ponds, reservoirs and facilities for managed stormwater are proposed for Projects.

Comment No.	Name	Comment	Response to Comment/Changes to the GSP
28	Various agencies[1]	For all beneficial users, provide public notice and engagement before consideration and implementation of the management actions and projects identified.	Comment noted. As stated in Section 11.7 of the GSP, interested parties will be kept informed about the status of projects and managmenet actions through emails distributed to the interested parties database and discussions held during quarterly public meetings and annual workshops. GSAs may also conduct additional public outreach for projects in their GSA area.
29	Various agencies[1]	For DACs and domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.	Comment noted. Due to minimal increase in the depth to water established by the MT versus historic groundwater levels as shown in Table 9-1 a well mitigation program is not necessary.
30	Various agencies[1]	For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.	Language modified, Section 10.2.1, to include potential impacts of the selected project to water quality.
31	Various agencies[1]	Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.	Comment noted.
32	Jenny	Thank you for this opportunity to comment on this draft GSP. First I want to commend all those who worked on it. It is a comprehensive and incisive document and it is obvious that a lot of research and collaboration went into it. I appreciate the attention to the ecosystem through monitoring surface water to ensure we don't deplete that and concern for vegetation in the environment, not just agricultural or human use. My comment comes with the growing threat of climate change and the understanding that we must do all we can to mitigate its effects. While I appreciate that climate change was considered in the Water Budget portion of the report, I don't think the full impact of it can possibly be predicted or accounted for and so I hope to begin a conversation about the use of greywater in home gardens, and other ecologically sustainable practices, as a way to reduce the demand for surface and groundwater. I would like to suggest that some of the projects or management actions be around encouraging or even incentivizing residents to create greywater systems to water their landscapes. This could be through easing restrictions in the permitting process, creating incentives through the City of Tracy utility, and developing ways to educate the public about the use of greywater and how to make systems for themselves. These things are already being implemented in other communities in California and proving to reduce the use of city water and groundwater. I am attaching a study by Greywater Action in collaboration with the City of Santa Rosa and Ecology Action of Santa Cruz about Residential Greywater Irrigation Systems in California that provides some great information on this subject. Other ideas to increase the recharge of the upper aquifer would be to use heavy mulch in public areas and using permeable concrete in new developments in the city in order to retain rainwater, allowing it to sink into the ground rather than being washed into the sewers. These methods not only help recharge the upper aquifer, they also reduce the need and energy used for treating sewer water to create recycled water and improve the soil in order to retain more water in the long-run. Tracy is a fast growing city with many developments planned in the future. It is critical that we plan these developments with our ecosystem and water system in mind. Thank you again for your consideration and I hope that we as a community can start to plan for the future using environmentally sustainable practices, along with the great projects you are already working on. If it is too late to include these in this iteration of the GSP, I would ask that you consider them in future 5-year updates.	Comment noted.

Comment No.	Name	Comment	Response to Comment/Changes to the GSP
33	Northern and Central Delta-Mendota Region GSA Management Committees	Use of NCDM GSP implementation data to close the gap in water level Measurable Objectives and Minimum Thresholds for representative monitoring network wells located along the subbasin boundary.	Language added to new Section 12 - Interagency Agreements and agreeing to share information.
34	Northern and Central Delta-Mendota Region GSA Management Committees	Jointly analyze data on subsurface groundwater exchanges rather than rely on modeling to better inform assumptions within the Tracy GSP draft on Water Budget (Section 7.7), Chronic Lowering of Groundwater Levels (Section 9.3.1), and Degraded Water Quality (Section 9.6.5) as they relate to the Delta-Mendota Subbasin.	Language added to new Section 12 - Interagency Agreements and agreeing to share information.
35	Northern and Central Delta-Mendota Region GSA Management Committees	Table 8.4 - Data Gap Monitoring Wells highlights several proposed monitoring wells that are of interest to the Management Committees due to their location near the subbasin boundary (also depicted in Figures 8-1 and 8-2). Knowledge of these sites' water levels and quality will aid the NCDM GSP's understanding of subsurface boundary flows and regional water quality. Sharing available data from well construction and monitoring will support shared efforts between the Tracy GSP and NCDM GSP.	Language added to new Section 12 - Interagency Agreements and agreeing to share information.
36	Northern and Central Delta-Mendota Region GSA Management Committees	We feel that there is a general perception that actions in neighboring subbasins have a greater influence on some general conditions and sustainable management criteria in the Tracy Subbasin than activities within the Tracy Subbasin itself, admittedly without conclusive data to substantiate those inferences. We disagree with that perception.	Language added to new Section 12 - Interagency Agreements and agreeing to share information.
37	Northern and Central Delta-Mendota Region GSA Management Committees	The Management Committees are interested in sharing information regarding future development along the subbasin boundary that may affect groundwater levels, quality, and access in the NCDM GSP area. Members are interested in ongoing communication regarding development and well permitting activity and seek ongoing awareness of activities that may affect the NCDM GSP's successful implementation.	Language added to new Section 12 - Interagency Agreements and agreeing to share information.

Notes:

[1] = The Nature Conservancy, Audubon, Local Government Commission, Union of Concerned Scientists, Clean Water Action/Clean Water Fund

Comments Letters

September 9, 2021

Tracy Subbasin Groundwater Sustainability Agencies
c/o San Joaquin County
1810 E. Hazelton Avenue
Stockton, CA 95201

Submitted via email: mzidar@sjgov.org

Re: Public Comment Letter for Tracy Subbasin Draft GSP

Dear Matt Zidar,

On behalf of the above-listed organizations, we appreciate the opportunity to comment on the Draft Groundwater Sustainability Plan (GSP) for the Tracy Subbasin being prepared under the Sustainable Groundwater Management Act (SGMA). Our organizations are deeply engaged in and committed to the successful implementation of SGMA because we understand that groundwater is critical for the resilience of California's water portfolio, particularly in light of changing climate. Under the requirements of SGMA, Groundwater Sustainability Agencies (GSAs) must consider the interests of all beneficial uses and users of groundwater, such as domestic well owners, environmental users, surface water users, federal government, California Native American tribes and disadvantaged communities (Water Code 10723.2).

As stakeholder representatives for beneficial users of groundwater, our GSP review focuses on how well disadvantaged communities, tribes, climate change, and the environment were addressed in the GSP. While we appreciate that some basins have consulted us directly via focus groups, workshops, and working groups, we are providing public comment letters to all GSAs as a means to engage in the development of 2022 GSPs across the state. Recognizing that GSPs are complicated and resource intensive to develop, the intention of this letter is to provide constructive stakeholder feedback that can improve the GSP prior to submission to the State.

Based on our review, we have significant concerns regarding the treatment of key beneficial users in the Draft GSP and consider the GSP to be **insufficient** under SGMA. We highlight the following findings:

1. Beneficial uses and users **are not sufficiently** considered in GSP development.
    a. Human Right to Water considerations **are not sufficiently** incorporated.
    b. Public trust resources **are not sufficiently** considered.
    c. Impacts of Minimum Thresholds, Measurable Objectives and Undesirable Results on beneficial uses and users **are not sufficiently** analyzed.
2. Climate change **is not sufficiently** considered.
3. Data gaps **are not sufficiently** identified and the GSP **does not have a plan** to eliminate them.

4. Projects and Management Actions **do not sufficiently consider** potential impacts or benefits to beneficial uses and users.

Our specific comments related to the deficiencies of the Tracy Subbasin Draft GSP along with recommendations on how to reconcile them, are provided in detail in **Attachment A.**

Please refer to the enclosed list of attachments for additional technical recommendations:

Attachment A	GSP Specific Comments
Attachment B	SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users
Attachment C	Freshwater species located in the subbasin
Attachment D	The Nature Conservancy's "Identifying GDEs under SGMA: Best Practices for using the NC Dataset"

Thank you for fully considering our comments as you finalize your GSP.

Best Regards,

Ngodoo Atume
Water Policy Analyst
Clean Water Action/Clean Water Fund

J. Pablo Ortiz-Partida, Ph.D.
Western States Climate and Water Scientist
Union of Concerned Scientists

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

E.J. Remson
Senior Project Director, California Water Program
The Nature Conservancy

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Tracy Subbasin Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes, groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities and Drinking Water Users
The identification of Disadvantaged Communities (DACs) and drinking water users is **incomplete**, based on lack of identification of the population size of DACs in the subbasin.

The GSP provides a map of DAC and SDAC locations (Figure 3-17) and identifies DACs by census tracts (Table 11-1). The GSP also provides adequate mapping of the location of all domestic wells by location and by depth (Figure 3-14) and the density of domestic wells in the subbasin (Figure 3-13). The GSP identifies the sources of water for DACs and what percentage is supplied by groundwater. However, the missing population size element is required for the GSA to fully understand the specific interests and water demands of these beneficial users, to support the development of water budgets using the best available information, and to support the development of sustainable management criteria and projects and management actions that are protective of these users.

RECOMMENDATIONS
• Provide the size of the population in each DAC.

Interconnected Surface Waters
The identification of Interconnected Surface Waters (ISWs) is **insufficient**. The GSP states (p. 5-72): “The creeks in these areas [the lands south of the Old River and Tom Paine Slough] are perennial, not flowing year-round, and therefore the surface water in this area is not considered to be interconnected to groundwater.” There are two problems with this sentence. First, a perennial stream is one that does flow year round. Second, this sentence contradicts the the first sentence of the ISW section on p. 5-72, which states: “Interconnected surface water refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted (CCR 2014).” The phrase “at any point” has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water.

Figure 5-40 shows the locations of monitoring wells and their hydrographs used to verify the ISW analysis, however the stream reaches are not labeled on this figure, nor is any analysis provided in the text. Furthermore, no backup analysis is provided for the use of the 20-ft criteria provided in the text. The GSP cites Appendix K (Surface Water/Groundwater Interaction Hydrographs) as evidence that when depth to water is less than 20 feet, the surface water can be inferred to be interconnected to the upper aquifer. This appendix, however, is missing.

Because potential ISWs have not been identified, they cannot be adequately managed in the GSP. Until a disconnection can be proven, include all potential ISWs in the GSP. This is necessary to assess whether surface water depletions caused by groundwater use are having an adverse impact on environmental beneficial users of surface water.

RECOMMENDATIONS
• Provide a map showing all the stream reaches in the subbasin, with reaches clearly labeled with stream name and interconnected or disconnected. Consider any segments with data gaps as potential ISWs and clearly mark them as such on maps provided in the GSP. • Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth to groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found. • Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. • Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP. Data gaps are discussed in general terms on p. 5-78, but very little detail is provided.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**, due to a lack of comprehensive, systematic analysis of the subbasin's GDEs. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). We commend the GSA for retaining all of the NC dataset polygons in the subbasin as potential GDEs. However, the GSP did not verify the NC dataset with the use of groundwater data from the underlying principal aquifer. Without an analysis of groundwater data to verify the NC dataset polygons, it will be difficult or impossible to adequately monitor and manage the GDEs throughout GSP implementation.

RECOMMENDATIONS

- Overlay GDE locations with depth-to-groundwater contour maps. For these contour maps, note the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth to groundwater contours across the landscape.

- Use depth to groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required[1,2] to be included into the water budget. The integration of these ecosystems into the water budget is **sufficient**. We commend the GSA for including and showing the groundwater demands of these ecosystems in the historical, current and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement during GSP development

Stakeholder engagement during GSP development is **incomplete**. SGMA's requirement for public notice and engagement of stakeholders[3] is not fully met by the description in the GSP. The GSP references Appendix P for the Tracy Subbasin Communication and Engagement Plan, however only a placeholder for Appendix P is included in the Draft GSP. While the main text describes how DACs and environmental stakeholders were given opportunities to engage in the GSP development process, the GSP should be improved by including a separate Communication and Engagement Plan that describes outreach to DACs and environmental stakeholders during the GSP *implementation* phase, in addition to the GSP development phase.

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[1] "'Water use sector' refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation." [23 CCR §351(al)]

[2] "The water budget shall quantify the following, either through direct measurements or estimates based on data: (3) Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow." [23 CCR §354.18]

[3] "A communication section of the Plan shall include a requirement that the GSP identify how it encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin." [23 CCR §354.10(d)(3)]

RECOMMENDATIONS
• Include a robust Communication and Engagement Plan. • Describe efforts to engage with stakeholders during the GSP *implementation* phase in the Communication and Engagement Plan. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process.

C. Considering Beneficial Uses and Users When Establishing Sustainable Management Criteria and Analyzing Impacts on Beneficial Uses and Users

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the subbasin are required when defining undesirable results[4] and establishing minimum thresholds.[5,6]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs or domestic drinking water wells when defining undesirable results. The GSP does not sufficiently describe how the existing minimum threshold groundwater levels are consistent with avoiding undesirable results in the subbasin. For undesirable results, the plan states that "[t]he level when there would be a significant undesirable result will be when 25 percent or more of the representative monitoring wells record groundwater levels that exceed the minimum thresholds for more than 2 consecutive years excluding drought periods." The GSP failed to include periods of drought.

For degraded water quality, SMCs were developed for three of the constituents of concern (COCs) in the subbasin: TDS, nitrate, and boron. SMCs were not developed for the other stated COCs (sulfate, 1,2,3-TCP, and arsenic). Where concentrations are above the maximum contaminant level (MCL) or agricultural water quality objective, minimum thresholds were established at 10% higher than the maximum concentrations historically found at representative monitoring wells. The increase of 10% above the historical levels was developed based on uncertainty in concentrations and due to concentrations in some wells having upward trends (p. 9-18). This method of establishing minimum thresholds is not protective of DACs or drinking water users.

[4] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results." [23 CCR §354.26(b)(3)]
[5] "The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[6] "The description of minimum thresholds shall include [...] how state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the agency shall explain the nature of and the basis for the difference." [23 CCR §354.28(b)(5)]

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on DACs and drinking water users within the subbasin. Further describe the impact of passing the minimum threshold for drinking water users. For example, provide the number of domestic wells that would be de-watered at the minimum threshold.

- Include and consider periods of drought when defining undesirable results for the basin.

Degraded Water Quality

- Describe direct and indirect impacts on DACs when defining undesirable results for degraded water quality. For specific guidance on how to consider domestic water users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[7]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds on DACs and drinking water users.

- Set minimum thresholds at the MCL for TDS, nitrate, and boron, instead of 10% higher than the MCL at some wells.

- Set minimum thresholds for the additional COCs: sulfate, 1,2,3-TCP, and arsenic. Ensure they align with drinking water standards[8].

Groundwater Dependent Ecosystems and Interconnected Surface Waters

The GSP uses historic low groundwater levels (typically those that occurred during the 2012-2016 drought) as a proxy to establish minimum thresholds for the depletions of interconnected surface water. The GSP assumes that historical conditions are protective of beneficial uses related to interconnected surface water. However, the true impacts to ecosystems under this scenario are not discussed. If minimum thresholds are set to historic low groundwater levels and the subbasin is allowed to operate just above or close to those levels over many years, there is a risk of causing catastrophic damage to ecosystems that is more adverse than what was occurring during the 2012-2016 drought. This is because California ecosystems, which are adapted to our Mediterranean climate, have some drought strategies that they can utilize to deal with short-term water stress. If the drought conditions are prolonged however, the ecosystem can collapse. While ecosystems may have been only water stressed during the recent drought, they could be inadvertently destroyed if groundwater conditions are maintained at or just above those levels in the long-term, since the subbasin would be permitted to sustain extreme dry conditions over multiple seasons and years.

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[7] Guide to Protecting Water Quality under the Sustainable Groundwater Management Act https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858.

[8] "Degraded Water Quality [...] collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues." [23 CCR §354.34(c)(4)]

RECOMMENDATIONS

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable' effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results[9] in the subbasin. Defining undesirable results is the crucial first step before the minimum thresholds[10] can be determined.

- For the interconnected surface water SMC, the undesirable results should include a description of potential impacts on instream habitats within ISWs when defining minimum thresholds in the subbasin[11]. The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts to environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law[6,12].

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations[13] require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.

The integration of climate change into the projected water budget is **insufficient**. The GSP does incorporate climate change into the projected water budget using DWR change factors for 2070. However, the GSP did not consider multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) in the projected water budget. The GSP should clearly and transparently incorporate the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for their basins. While these extreme scenarios may have a lower

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[9] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]

[10] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]

[11] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]

[12] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf

[13] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]

likelihood of occurring, their consequences could be significant, therefore they should be included in groundwater planning.

The GSP includes climate change into precipitation and evapotranspiration terms of the projected water budget. Surface water deliveries, however, were not adjusted for climate change. Furthermore, the GSP does not calculate a sustainable yield based on the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios, and sustainable yield is not calculated based on climate change projections, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems and DACs.

RECOMMENDATIONS

- Integrate climate change, including extremely wet and dry scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions.
- Incorporate surface water flow inputs that are adjusted for climate change to the projected water budget.
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**. The representative monitoring sites (RMSs) do not adequately represent water quality conditions or groundwater elevation conditions in the northern DAC communities of the Tracy subbasin. Only one new monitoring well is proposed to supplement the GDE analysis, despite the lack of existing shallow wells to monitor GDEs.

The RMSs for surface water depletion monitoring are located only in the southern half of the subbasin (Figure 8-11). The GSP states (p. 8-25): “Monitoring wells along tributaries were not selected as the tributaries only flow for short periods after rain events and are not connected by a continuous saturated interval with the principal aquifers.” As discussed above in the ISW section, this shows a disregard for potential ISWs in the subbasin.

The lack of shallow monitoring wells and the lack of plans for future monitoring threatens GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Potential GDEs are located in areas of the subbasin where no shallow groundwater monitoring currently exists or is proposed, leaving data gaps unfilled. Potential ISWs have been dismissed in the GSP, without proposed recommendations to improve ISW identification, mapping, and estimates of depletions. Appropriate monitoring is necessary so that groundwater conditions are characterized and surface-shallow groundwater interactions are fully integrated into the GSP.

RECOMMENDATIONS

- Provide maps that overlay monitoring well locations with the locations of DACs and GDEs to clearly identify potentially impacted areas. Increase the number of representative monitoring sites (RMSs) across the subbasin for all groundwater condition indicators.

- Reconcile data gaps in the monitoring network by evaluating how the gathered data will be used to identify and map GDEs and ISWs, and identify DACs and shallow domestic well users that are vulnerable to undesirable results.

- Determine what ecological monitoring can be used to assess the potential for significant and unreasonable impacts to GDEs or ISWs due to groundwater conditions in the subbasin.

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions in the GSP is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users.

RECOMMENDATIONS

- Recharge ponds, reservoirs and facilities for managed stormwater recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the “Multi-Benefit Recharge Project Methodology Guidance Document”[14].

- For all beneficial users, provide public notice and engagement before consideration and implementation of the management actions and projects identified.

- For DACs and domestic well owners, include discussion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

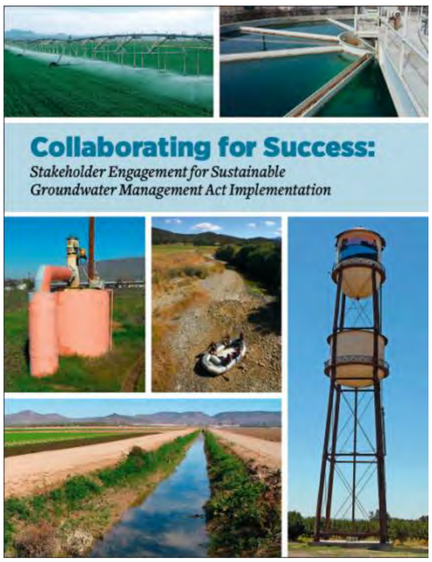
[14] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSA plans to mitigate such impacts.
- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

Attachment B

SGMA Tools to address DAC, drinking water, and environmental beneficial uses and users

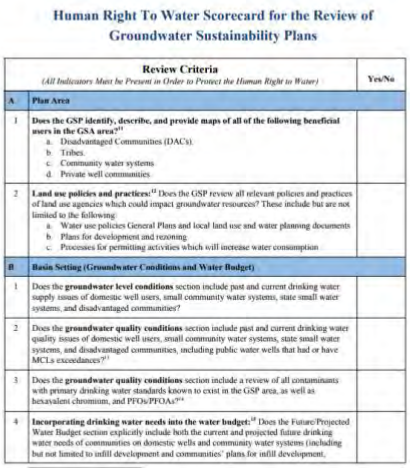
Stakeholder Engagement and Outreach



Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement during Groundwater Sustainability Plan (GSP) development and implementation. Conducting a targeted outreach involves:

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.
- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.
- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

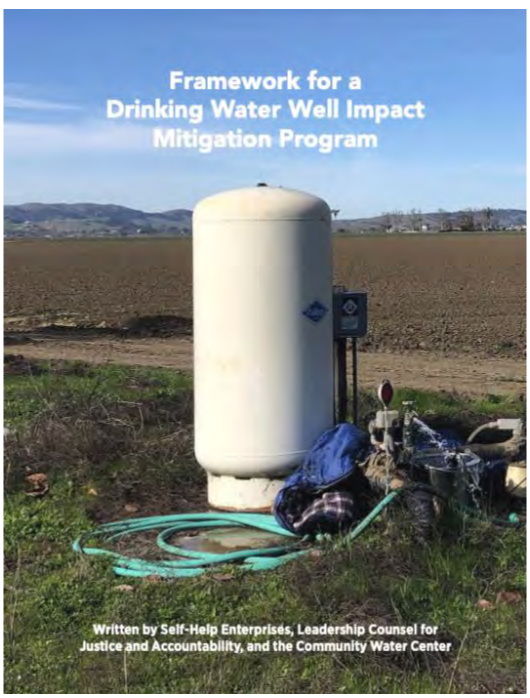


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

	Review Criteria *(All Indicators Must be Present in Order to Protect the Human Right to Water)*	Yes/No
A	**Plan Area**	
1	**Does the GSP identify, describe, and provide maps of all of the following beneficial users in the GSA area?**[11] a. Disadvantaged Communities (DACs). b. Tribes. c. Community water systems d. Private well communities	
2	**Land use policies and practices:**[12] Does the GSP review all relevant policies and practices of land use agencies which could impact groundwater resources? These include but are not limited to the following: a. Water use policies General Plans and local land use and water planning documents b. Plans for development and rezoning c. Processes for permitting activities which will increase water consumption	
B	**Basin Setting (Groundwater Conditions and Water Budget)**	
1	Does the **groundwater level conditions** section include past and current drinking water supply issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities?	
2	Does the **groundwater quality conditions** section include past and current drinking water quality issues of domestic well users, small community water systems, state small water systems, and disadvantaged communities, including public water wells that had or have MCLs exceedances?[13]	
3	Does the **groundwater quality conditions** section include a review of all contaminants with primary drinking water standards known to exist in the GSP area, as well as hexavalent chromium, and PFOs/PFOAs?[14]	
4	**Incorporating drinking water needs into the water budget:**[15] Does the Future/Projected Water Budget section explicitly include both the current and projected future drinking water needs of communities on domestic wells and community water systems (including but not limited to infill development and communities' plans for infill development,	

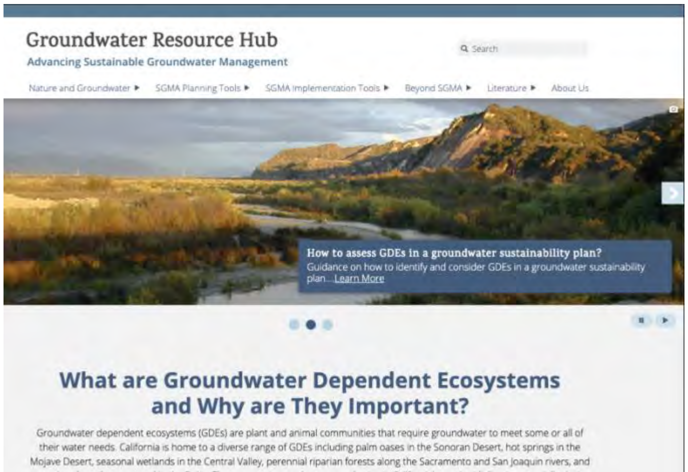
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in GSPs to adequately protect the Human Right to Drinking water.

Drinking Water Well Impact Mitigation Framework



The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure its data gathering, monitoring network and management actions to proactively monitor and protect drinking water wells and mitigate impacts should they occur.

Groundwater Resource Hub



The Nature Conservancy has developed a suite of tools based on best available science to help GSAs, consultants, and stakeholders efficiently incorporate nature into GSPs. These tools and resources are available online at GroundwaterResourceHub.org. The Nature Conservancy's tools and resources are intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Rooting Depth Database

The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

The Plant Rooting Depth Database is an Excel workbook composed of four worksheets:

1. California phreatophyte rooting depth data (included in the NC Dataset)
2. Global phreatophyte rooting depth data
3. Metadata
4. References

How the database was compiled

The Plant Rooting Depth Database is a compilation of rooting depth information for the groundwater-dependent plant species identified in the NC Dataset. Rooting depth data were compiled from published scientific literature and expert opinion through a crowdsourcing campaign. As more information becomes available, the database of rooting depths will be updated. Please Contact Us if you have additional rooting depth data for California phreatophytes.

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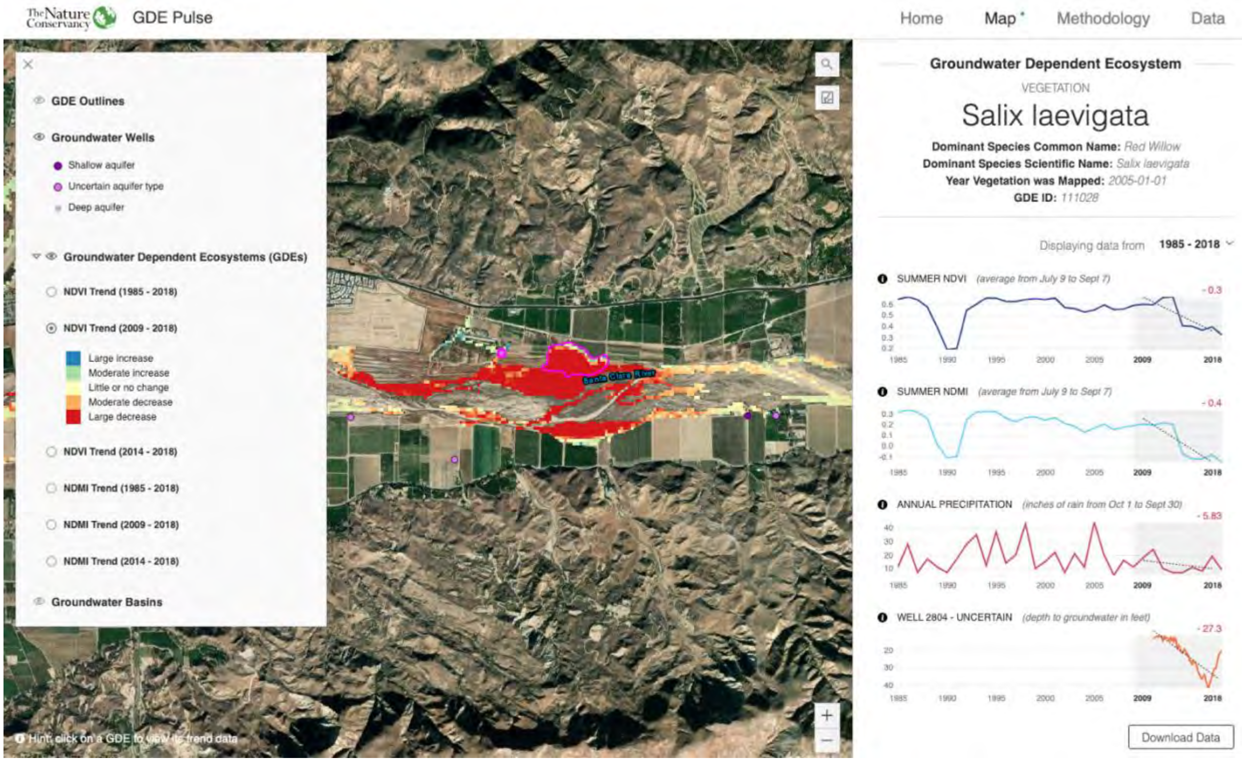
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



[GDE Pulse](#) is a free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data. Remote sensing data from satellites has been used to monitor the health of vegetation all over the planet. GDE pulse has compiled 35 years of satellite imagery from NASA's Landsat mission for every polygon in the Natural Communities Commonly Associated with Groundwater Dataset. The following datasets are available for downloading:

Normalized Difference Vegetation Index (NDVI) is a satellite-derived index that represents the greenness of vegetation. Healthy green vegetation tends to have a higher NDVI, while dead leaves have a lower NDVI. We calculated the average NDVI during the driest part of the year (July - Sept) to estimate vegetation health when the plants are most likely dependent on groundwater.

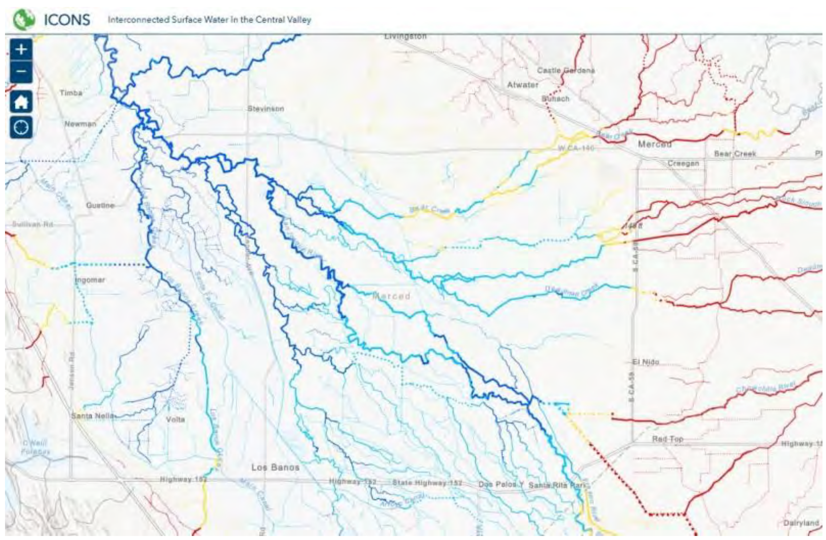
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water stressed tends to have lower NDMI. We calculated the average NDVI during the driest part of the year (July–September) to estimate vegetation health when the plants are most likely dependent on groundwater.

Annual Precipitation is the total precipitation for the water year (October 1st – September 30th) from the PRISM dataset. The amount of local precipitation can affect vegetation with more precipitation generally leading to higher NDVI and NDMI.

Depth to Groundwater measurements provide an indication of the groundwater levels and changes over time for the surrounding area. We used groundwater well measurements from nearby (<1km) wells to estimate the depth to groundwater below the GDE based on the average elevation of the GDE (using a digital elevation model) minus the measured groundwater surface elevation.

ICONOS Mapper

Interconnected Surface Water in the Central Valley



[ICONS](#) maps the likely presence of interconnected surface water (ISW) in the Central Valley using depth to groundwater data. Using data from 2011-2018, the ISW dataset represents the likely connection between surface water and groundwater for rivers and streams in California's Central Valley. It includes information on the mean, maximum, and minimum depth to groundwater for each stream segment over the years with available data, as well as the likely presence of ISW based on the minimum depth to groundwater. The Nature Conservancy developed this database, with guidance and input from expert academics, consultants, and state agencies.

We developed this dataset using groundwater elevation data available online from the California Department of Water Resources (DWR). DWR only provides this data for the Central Valley. For GSAs outside of the valley, who have groundwater well measurements, we recommend following our methods to determine likely ISW in your region. The Nature Conservancy's ISW dataset should be used as a first step in reviewing ISW and should be supplemented with local or more recent groundwater depth data.

Attachment C

Freshwater Species Located in the Tracy Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Tracy Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
Laterallus jamaicensis coturniculus	California Black Rail	Bird of Conservation Concern	Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas discors	Blue-winged Teal			
Anas platyrhynchos	Mallard			
Anas strepera	Gadwall			
Anser albifrons	Greater White-fronted Goose			
Ardea alba	Great Egret			
Ardea herodias	Great Blue Heron			

[1] Howard, J.K. et al. 2015. Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoSONE, 11(7). Available at: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0130710

[2] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS

[3] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

Aythya affinis	Lesser Scaup			
Aythya americana	Redhead		Special Concern	BSSC - Third priority
Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Empidonax traillii	Willow Flycatcher	Bird of Conservation Concern	Endangered	
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Geothlypis trichas trichas	Common Yellowthroat			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Histrionicus histrionicus	Harlequin Duck		Special Concern	BSSC - Second priority
Icteria virens	Yellow-breasted Chat		Special Concern	BSSC - Third priority
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			

Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Mergus serrator	Red-breasted Merganser			
Numenius americanus	Long-billed Curlew			
Numenius phaeopus	Whimbrel			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			
Phalaropus tricolor	Wilson's Phalarope			
Piranga rubra	Summer Tanager		Special Concern	BSSC - First priority
Plegadis chihi	White-faced Ibis		Watch list	
Pluvialis squatarola	Black-bellied Plover			
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Riparia riparia	Bank Swallow		Threatened	
Rynchops niger	Black Skimmer			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Tringa solitaria	Solitary Sandpiper			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Branchinecta lynchi	Vernal Pool Fairy Shrimp	Threatened	Special	IUCN - Vulnerable
Branchinecta mesovallensis	Midvalley Fairy Shrimp		Special	
Linderiella occidentalis	California Fairy Shrimp		Special	IUCN - Near Threatened

Hyalella spp.	Hyalella spp.			
FISH				
Oncorhynchus mykiss irideus	Coastal rainbow trout			Least Concern - Moyle 2013
Oncorhynchus tshawytscha - CV winter	Central Valley winter Chinook salmon	Endangered	Endangered	Vulnerable - Moyle 2013
Spirinchus thaleichthys	Longfin smelt	Candidate	Threatened	Vulnerable - Moyle 2013
Acipenser medirostris ssp. 1	Southern green sturgeon	Threatened	Special Concern	Endangered - Moyle 2013
Oncorhynchus mykiss - CV	Central Valley steelhead	Threatened	Special	Vulnerable - Moyle 2013
Oncorhynchus tshawytscha - CV spring	Central Valley spring Chinook salmon	Threatened	Threatened	Vulnerable - Moyle 2013
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Ambystoma californiense californiense	California Tiger Salamander	Threatened	Threatened	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Rana boylii	Foothill Yellow-legged Frog	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Rana draytonii	California Red-legged Frog	Threatened	Special Concern	ARSSC
Spea hammondii	Western Spadefoot	Under Review in the Candidate or Petition Process	Special Concern	ARSSC
Thamnophis gigas	Giant Gartersnake	Threatened	Threatened	
Thamnophis sirtalis sirtalis	Common Gartersnake			
Anaxyrus boreas halophilus	California Toad			ARSSC
Pseudacris regilla	Northern Pacific Chorus Frog			
INSECTS & OTHER INVERTS				
Hygrotus curvipes	Curved-foot Hygrotus Diving Beetle		Special	
Ablabesmyia spp.	Ablabesmyia spp.			
Apedilum spp.	Apedilum spp.			
Baetis tricaudatus	A Mayfly			
Chironomus spp.	Chironomus spp.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			

Dicrotendipes spp.	Dicrotendipes spp.			
Enallagma carunculatum	Tule Bluet			
Enallagma civile	Familiar Bluet			
Hydroptila spp.	Hydroptila spp.			
Ischnura cervula	Pacific Forktail			
Libellula luctuosa	Widow Skimmer			
Oxyethira spp.	Oxyethira spp.			
Paratanytarsus spp.	Paratanytarsus spp.			
Phaenopsectra spp.	Phaenopsectra spp.			
Procladius spp.	Procladius spp.			
Simulium spp.	Simulium spp.			
Sympetrum corruptum	Variegated Meadowhawk			
Tanytarsus spp.	Tanytarsus spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists
Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Anodonta californiensis	California Floater		Special	
Fluminicola seminalis	Nugget Pebblesnail		Special	T
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Helisoma spp.	Helisoma spp.			
Margaritifera falcata	Western Pearlshell		Special	
Physa spp.	Physa spp.			
Planorbella trivolvis	Marsh Rams-horn			CS
PLANTS				
Carex comosa	Bristly Sedge		Special	CRPR - 2B.1
Eryngium racemosum	Delta Coyote-thistle		Endangered	CRPR - 1B.1
Hibiscus lasiocarpos occidentalis			Special	CRPR - 1B.2
Lasthenia conjugens	Contra Costa Goldfields	Endangered	Special	CRPR - 1B.1
Lilaeopsis masonii	Mason's Lilaeopsis		Special	CRPR - 1B.1

Limosella australis	NA		Special	CRPR - 2B.1
Puccinellia simplex	Little Alkali Grass			
Symphyotrichum lentum	Suisun Marsh Aster		Special	CRPR - 1B.2
Alisma triviale	Northern Water-plantain			
Alnus rhombifolia	White Alder			
Alopecurus saccatus	Pacific Foxtail			
Ammannia coccinea	Scarlet Ammannia			
Anemopsis californica	Yerba Mansa			
Arundo donax	NA			
Azolla microphylla	Mexican mosquito fern		Special	CRPR - 4.3
Baccharis glutinosa	NA			Not on any status lists
Bidens laevis	Smooth Bur-marigold			
Bolboschoenus maritimus paludosus	NA			Not on any status lists
Callitriche longipedunculata	Longstock Water-starwort			
Callitriche marginata	Winged Water-starwort			
Carex aquatilis dives	Sitka Sedge			
Carex nebrascensis	Nebraska Sedge			
Carex obnupta	Slough Sedge			
Carex vulpinoidea	NA			
Cephalanthus occidentalis	Common Buttonbush			
Ceratophyllum demersum	Common Hornwort			
Cicuta douglasii	Western Water-hemlock			
Cicuta maculata bolanderi	Bolander's Water-hemlock		Special	CRPR - 2B.1
Cirsium hydrophilum hydrophilum	Suisun Thistle	Endangered	Special	CRPR - 1B.1
Cotula coronopifolia	NA			
Crassula aquatica	Water Pygmyweed			
Crassula solieri	NA			Not on any status lists
Crypsis vaginiflora	NA			
Cyperus erythrorhizos	Red-root Flatsedge			

Downingia insignis	Parti-color Downingia			
Elatine californica	California Waterwort			
Eleocharis macrostachya	Creeping Spikerush			
Eleocharis parvula	Small Spikerush		Special	CRPR - 4.3
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium cleistogamum	Cleistogamous Spike-primrose			
Eragrostis hypnoides	Teal Lovegrass			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium spinosepalum	Spiny Sepaled Coyote-thistle		Special	CRPR - 1B.2
Eryngium vaseyi vaseyi	Vasey's Coyote-thistle			Not on any status lists
Euthamia occidentalis	Western Fragrant Goldenrod			
Galium trifidum	Small Bedstraw			
Glyceria leptostachya	Slim-head Mannagrass			
Helenium bigelovii	Bigelow's Sneezeweed			
Helenium puberulum	Rosilla			
Hydrocotyle ranunculoides	Floating Marsh-pennywort			
Hydrocotyle umbellata	Many-flower Marsh-pennywort			
Hydrocotyle verticillata verticillata	Whorled Marsh-pennywort			
Isoetes howellii	NA			
Isoetes orcuttii	NA			
Isolepis cernua	Low Bulrush			
Juncus acuminatus	Sharp-fruit Rush			
Juncus articulatus articulatus				Not on any status lists
Juncus effusus effusus	NA			
Juncus effusus pacificus				
Juncus lescurii				Not on any status lists

Juncus phaeocephalus phaeocephalus	Brown-head Rush			
Lasthenia ferrisiae	Ferris' Goldfields		Special	CRPR - 4.2
Lasthenia fremontii	Fremont's Goldfields			
Leersia oryzoides	Rice Cutgrass			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Lepidium oxycarpum	Sharp-pod Pepper-grass			
Limnanthes douglasii nivea	Douglas' Meadowfoam			
Limnanthes douglasii rosea	Douglas' Meadowfoam			
Limosella acaulis	Southern Mudwort			
Ludwigia peploides peploides	NA			Not on any status lists
Lycopus americanus	American Bugleweed			
Lythrum californicum	California Loosestrife			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus guttatus	Common Large Monkeyflower			
Mimulus latidens	Broad-tooth Monkeyflower			
Myosurus minimus	NA			
Myosurus sessilis	Sessile Mousetail			
Najas guadalupensis guadalupensis	Southern Naiad			
Navarretia cotulifolia	Cotula Navarretia			
Navarretia heterandra	Tehama Navarretia			
Oenanthe sarmentosa	Water-parsley			
Panicum acuminatum acuminatum				Not on any status lists
Paspalum distichum	Joint Paspalum			
Persicaria hydropiper	NA			Not on any status lists
Persicaria hydropiperoides				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists

Persicaria punctata	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phragmites australis australis	Common Reed			
Pilularia americana	NA			
Plagiobothrys acanthocarpus	Adobe Popcorn-flower			
Plagiobothrys greenei	Greene's Popcorn-flower			
Plagiobothrys humistratus	Dwarf Popcorn-flower			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Plantago elongata elongata	Slender Plantain			
Platanus racemosa	California Sycamore			
Pluchea odorata odorata	Scented Conyza			
Pogogyne zizyphoroides				Not on any status lists
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton illinoensis	Illinois Pondweed			
Potamogeton nodosus	Longleaf Pondweed			
Potamogeton zosteriformis	Flatstem Pondweed		Special	CRPR - 2B.2
Potentilla anserina pacifica				Not on any status lists
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			
Psilocarphus oregonus	Oregon Woolly-heads			
Rorippa curvisiliqua curvisiliqua	Curve-pod Yellowcress			
Rorippa palustris palustris	Bog Yellowcress			
Rumex crassus				Not on any status lists
Rumex occidentalis				Not on any status lists
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix babylonica	NA			
Salix exigua exigua	Narrowleaf Willow			

Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Goodding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lasiolepis lasiolepis	Arroyo Willow			
Samolus parviflorus	NA			Not on any status lists
Schoenoplectus acutus acutus	NA			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Schoenoplectus americanus	Three-square Bulrush			
Schoenoplectus californicus	California Bulrush			
Senecio hydrophilus	Great Swamp Ragwort			
Sinapis alba	NA			
Sium suave	Hemlock Water-parsnip			
Sparganium eurycarpum eurycarpum				
Stachys albens	White-stem Hedge-nettle			
Triglochin maritima	Common Bog Arrow-grass			
Triglochin striata	Three-ribbed Arrow-grass			
Typha latifolia	Broadleaf Cattail			

Scientific Name	Common Name	Legal Protected Status		
		Federal	State	Other
BIRDS				
FISH				
HERPS				
INSECTS & OTHER INVERTS				

MAMMALS				
MOLLUSKS				
PLANTS				

Attachment D

July 2019

IDENTIFYING GDEs UNDER SGMA
Best Practices for using the NC Dataset

The Sustainable Groundwater Management Act (SGMA) requires that groundwater dependent ecosystems (GDEs) be identified in Groundwater Sustainability Plans (GSPs). As a starting point, the Department of Water Resources (DWR) is providing the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online[1] to help Groundwater Sustainability Agencies (GSAs), consultants, and stakeholders identify GDEs within individual groundwater basins. To apply information from the NC Dataset to local areas, GSAs should combine it with the best available science on local hydrology, geology, and groundwater levels to verify whether polygons in the NC dataset are likely supported by groundwater in an aquifer (Figure 1)[2]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.

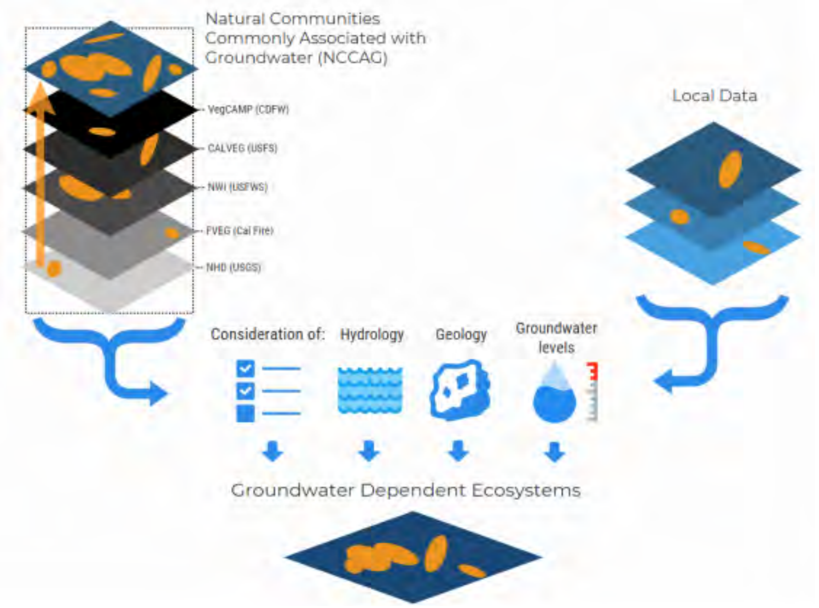


Figure 1. Considerations for GDE identification.
Source: DWR[2]

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/
[2] California Department of Water Resources (DWR). 2018. Summary of the "Natural Communities Commonly Associated with Groundwater" Dataset and Online Web Viewer. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Data-and-Tools/Files/Statewide-Reports/Natural-Communities-Dataset-Summary-Document.pdf

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

Groundwater basins can be comprised of one continuous aquifer (Figure 2a) or multiple aquifers stacked on top of each other (Figure 2b). In unconfined aquifers (Figure 2a), using the depth-to-groundwater and the rooting depth of the vegetation is a reasonable method to infer groundwater dependence for GDEs. If groundwater is well below the rooting (and capillary) zone of the plants and any wetland features, the ecosystem is considered disconnected and groundwater management is not likely to affect the ecosystem (Figure 2d). However, it is important to consider local conditions (e.g., soil type, groundwater flow gradients, and aquifer parameters) and to review groundwater depth data from multiple seasons and water year types (wet and dry) because intermittent periods of high groundwater levels can replenish perched clay lenses that serve as the water source for GDEs (Figure 2c). Maintaining these natural groundwater fluctuations are important to sustaining GDE health.

Basins with a stacked series of aquifers (Figure 2b) may have varying levels of pumping across aquifers in the basin, depending on the production capacity or water quality associated with each aquifer. If pumping is concentrated in deeper aquifers, SGMA still requires GSAs to sustainably manage groundwater resources in shallow aquifers, such as perched aquifers, that support springs, surface water, domestic wells, and GDEs (Figure 2). This is because vertical groundwater gradients across aquifers may result in pumping from deeper aquifers to cause adverse impacts onto beneficial users reliant on shallow aquifers or interconnected surface water. The goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits. While groundwater pumping may not be currently occurring in a shallower aquifer, use of this water may become more appealing and economically viable in future years as pumping restrictions are placed on the deeper production aquifers in the basin to meet the sustainable yield and criteria. Thus, identifying GDEs in the basin should done irrespective to the amount of current pumping occurring in a particular aquifer, so that future impacts on GDEs due to new production can be avoided. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

[3] For more details on the mapping methods, refer to: Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems in California: Methods Report. San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/iGDE_data_paper_20180423.pdf
[4] "Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans" is available at: https://groundwaterresourcehub.org/gde-tools/gsp-guidance-document/
[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

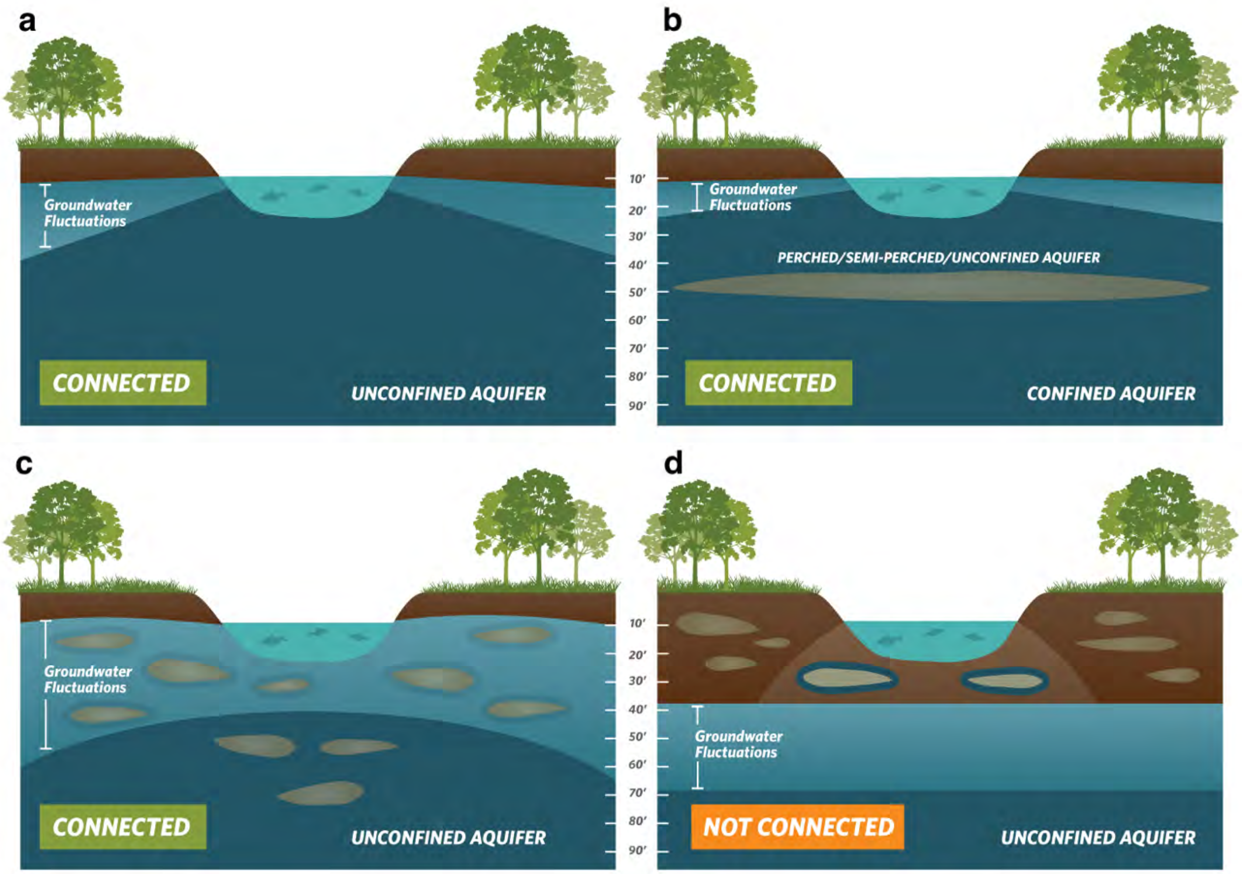


Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. (b) Depth-to-groundwater in the shallow aquifer is connected to overlying ecosystem. Pumping predominately occurs in the confined aquifer, but pumping is possible in the shallow aquifer. Bottom: (c) Depth-to-groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. (d) Groundwater is disconnected from surface water, and any water in the vadose (unsaturated) zone is due to direct recharge from precipitation and indirect recharge under the surface water feature. These areas are not connected to groundwater and typically support species that do not require access to groundwater to survive.

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

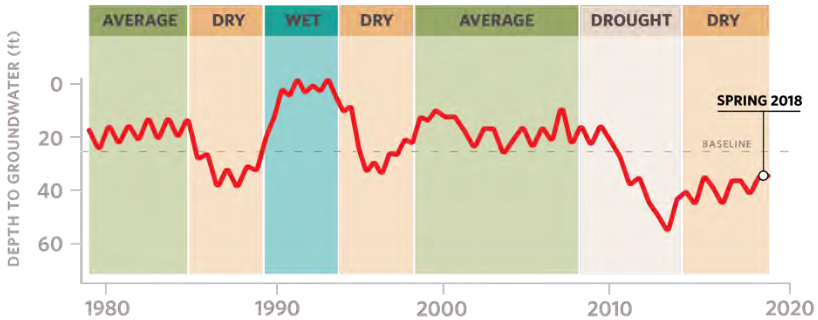


Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time. Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future so adverse impacts are avoided.

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[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

[7] Baseline is defined under the GSP regulations as "historic information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin." [23 CCR §351(e)]

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

[9] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

BEST PRACTICE #3. Ecosystems Often Rely on Both Groundwater and Surface Water

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

GSAs are only responsible for impacts to GDEs resulting from groundwater conditions in the basin, so if adverse impacts to GDEs result from the diversion of applied water, treated wastewater, or irrigation return flow away from the GDE, then those impacts will be evaluated by other permitting requirements (e.g., CEQA) and may not be the responsibility of the GSA. However, if adverse impacts occur to the GDE due to changing groundwater conditions resulting from pumping or groundwater management activities, then the GSA would be responsible (Figure 4).

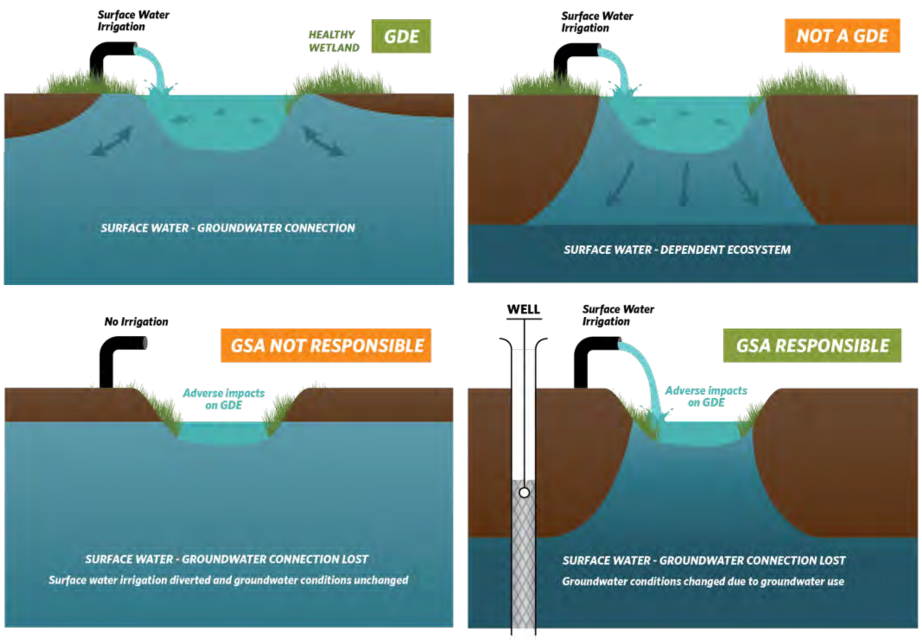

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. (Right) Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. Bottom: (Left) An ecosystem that was once dependent on an interconnected surface water, but loses access to groundwater solely due to surface water diversions may not be the GSA's responsibility. (Right) Groundwater dependent ecosystems once dependent on an interconnected surface water system, but loses that access due to groundwater pumping is the GSA's responsibility.

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[10] For a list of environmental beneficial users of surface water by basin, visit: https://groundwaterresourcehub.org/gde-tools/environmental-surface-water-beneficiaries/

BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin requires that groundwater conditions are characterized to confirm whether polygons in the NC dataset are supported by the underlying aquifer. To do this, proximate groundwater wells should be identified to characterize groundwater conditions (Figure 5). When selecting representative wells, it is particularly important to consider the subsurface heterogeneity around NC polygons, especially near surface water features where groundwater and surface water interactions occur around heterogeneous stratigraphic units or aquitards formed by fluvial deposits. The following selection criteria can help ensure groundwater levels are representative of conditions within the GDE area:

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

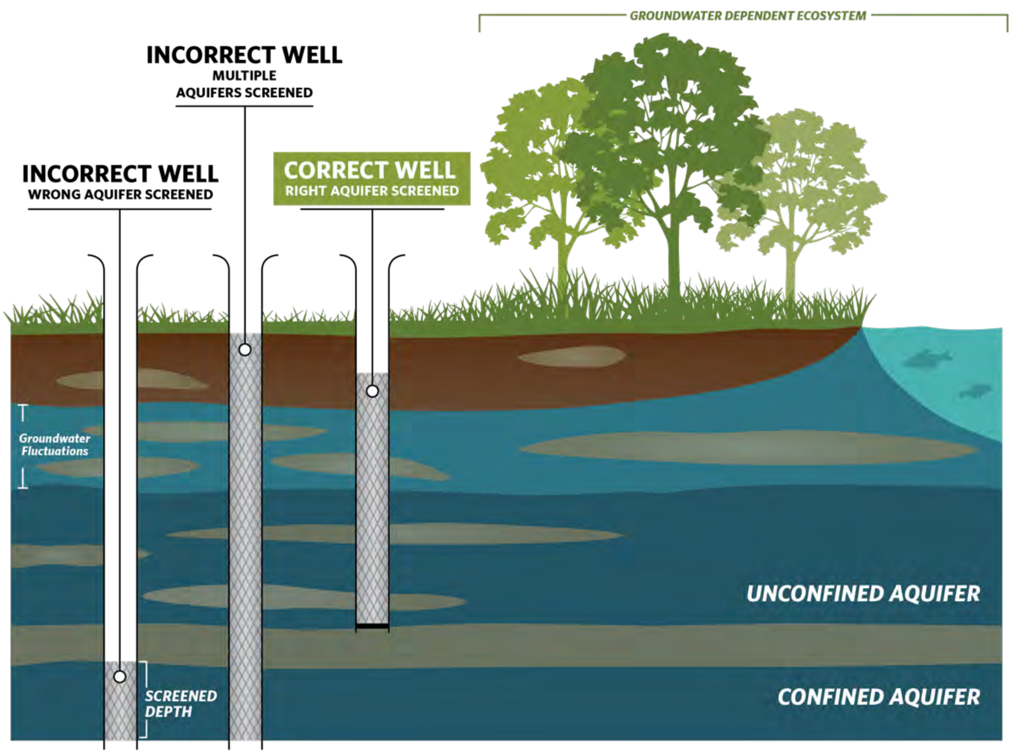

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

The common practice to contour depth-to-groundwater over a large area by interpolating measurements at monitoring wells is unsuitable for assessing whether an ecosystem is supported by groundwater. This practice causes errors when the land surface contains features like stream and wetland depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6a). A more accurate approach is to interpolate groundwater elevations at monitoring wells to get groundwater elevation contours across the landscape. This layer can then be subtracted from land surface elevations from a Digital Elevation Model (DEM)[11] to estimate depth-to-groundwater contours across the landscape (Figure b; Figure 7). This will provide a much more accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.

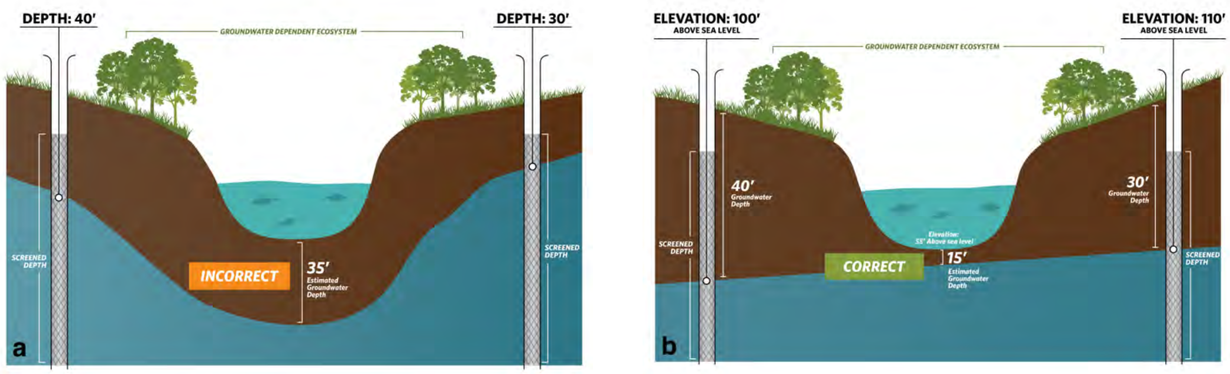

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. (b) Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

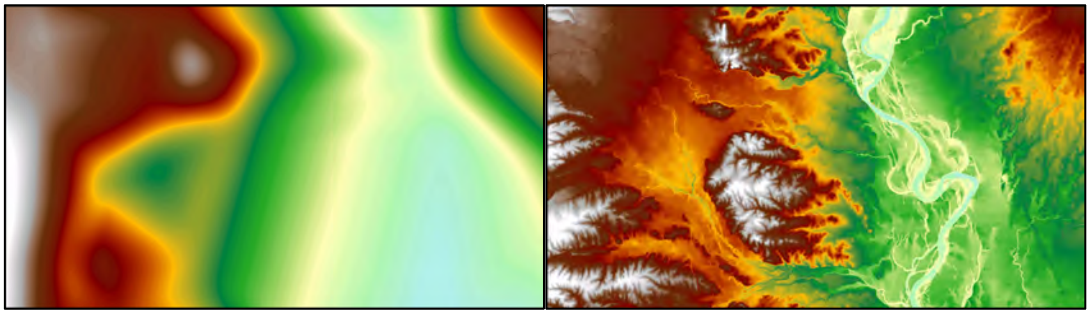

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. (Right) Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation from DEM spatial data to generate depth-to-groundwater contours. The image on the right shows a more accurate depth-to-groundwater estimate because it takes the local topography and elevation changes into account.

[11] USGS Digital Elevation Model data products are described at: https://www.usgs.gov/core-science-systems/ngp/3dep/about-3dep-products-services and can be downloaded at: https://iewer.nationalmap.gov/basic/

BEST PRACTICE #6. Best Available Science

Adaptive management is embedded within SGMA and provides a process to work toward sustainability over time by beginning with the best available information to make initial decisions, monitoring the results of those decisions, and using the data collected through monitoring programs to revise decisions in the future. In many situations, the hydrologic connection of NC dataset polygons will not initially be clearly understood if site-specific groundwater monitoring data are not available. If sufficient data are not available in time for the 2020/2022 plan, The Nature Conservancy strongly advises that questionable polygons from the NC dataset be included in the GSP until data gaps are reconciled in the monitoring network. Erring on the side of caution will help minimize inadvertent impacts to GDEs as a result of groundwater use and management actions during SGMA implementation.

KEY DEFINITIONS

Groundwater basin is an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom. *23 CCR §341(g)(1)*

Groundwater dependent ecosystem (GDE) are ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. *23 CCR §351(m)*

Interconnected surface water (ISW) surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted. *23 CCR §351(o)*

Principal aquifers are aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems. *23 CCR §351(aa)*

ABOUT US

The Nature Conservancy is a science-based nonprofit organization whose mission is *to conserve the lands and waters on which all life depends*. To support successful SGMA implementation that meets the future needs of people, the economy, and the environment, TNC has developed tools and resources (www.groundwaterresourcehub.org) intended to reduce costs, shorten timelines, and increase benefits for both people and nature.

Residential Greywater Irrigation Systems in California:

An Evaluation of Soil and Water Quality, User Satisfaction, and Installation Costs

Greywater Action

in collaboration with
City of Santa Rosa and Ecology Action of Santa Cruz

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November, 2012, revised September 2013

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Acknowledgments

We thank the following people for their technical support, time, and expertise on this study including, Rachel Abramson (City of Santa Rosa), Nik Bertulis (DIG Cooperative), Christina Bertea (Greywater Action), Zachary Burt (UC Berkeley), the Ecology Center, Mike Galloway (Soil Control Laboratory), Richard Harris (EBMUD), Tara Hui (Greywater Action), Natalie Kilmer, Cliff Low (Perry Laboratory), Kara Nelson (UC Berkeley), Walter Norosky (City of Santa Rosa), Ann Northrup (Merritt College Horticulture Department), Stephen Norwick (Sonoma State University), Sharada Prasad (UC Berkeley), Peter Ralph (UC Davis), Isha Ray (UC Berkeley), Kristine Tjung (UC Berkeley), and Gwendolyn von Klan (UC Berkeley). We also thank all the greywater system owners for participating in the study.

All errors are our own.

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Appendices

Introduction

As water shortages become increasingly common, new and innovative ways to conserve and reuse water are critically important. Widespread reuse of household greywater has the potential to contribute significant water savings, up to 40% of residential consumption (Cohen, 2009), although how much water is actually saved depends on how people design and maintain their systems. Lack of scientific data on how greywater affects soils and plants has been a barrier for widespread implementation of greywater systems for residents and public agencies alike. Lack of data regarding the costs of installation, permitting and maintenance for greywater systems also present barriers for households that are considering greywater reuse. We seek to collect this data through a multi-faceted study of residential greywater systems in Central California.

In 2009 California rewrote its greywater code, making low-tech greywater systems legal for the first time, and excluding clothes washer systems from permit requirements (CBSC, 2010). The legalization of greywater reuse in California has stimulated many local governments and water utilities to invest in public education and incentive programs. The increase in public interest and installation of greywater systems has also generated concerns from some water districts, public agencies, and states about potential environmental problems resulting from using greywater. Despite these concerns, greywater systems have been legal and widely implemented in states like Arizona and New Mexico for many years with no reports of health or environmental problems.[2]

Few U.S. greywater studies have investigated residential greywater systems *in situ*, and those that have typically only evaluated a handful of systems (City of LA, 1992; Bennet et al., 1999; Little et al., 2000). Field studies of greywater systems in other countries have provided some information, however the results do not account for differences in local conditions, such as soaps used, water use patterns, soils, or types of plants grown (Al-Hamaiedeh and Bino 2010, Gross et al. 2005). This comprehensive study of 66 households, comprising a total of 83 residential greywater irrigation systems, seeks to fill critical scientific data gaps by evaluating indicators of soil and greywater irrigation water quality, plant health assessment, water consumption data, user satisfaction, and greywater system installation and permitting costs.

Background

Definition of Greywater

"Greywater", as we use the term, refers to water discharged from washing machines, showers, baths, and sinks. Greywater does not include water from toilets or wash water with fecal material (eg. soiled diapers). Kitchen sink water is often classified as "dark greywater", though currently some states in the United States, including California, classify it as "blackwater" and prohibit on-site reuse.

Reuse of greywater has many potential benefits; it can reduce overall potable water consumption, thus decreasing the demand for surface and groundwater. Greywater reuse can reduce energy consumption, as it offsets the need to treat water to potable quality for irrigation, and can protect water quality by reducing

2 Allen, L. Personal communication with Charles Graf (ADEQ) and Val Little (Water CASA) on 7/2/09 and 7/16/09

flows on over-loaded septic systems.

However, greywater may contain pathogens due to fecal contamination or food handling. Greywater system design and safe management should prevent direct contact with greywater other than when performing system maintenance or repairs. Many systems distribute greywater subsurface, thus eliminating direct contact. Other systems deliver the water at the ground surface, where it quickly soaks in, thereby limiting opportunities for direct contact. Systems that allow for untreated greywater to pond or pool on the soil surface create a potential for direct contact with greywater.

Previous Greywater Studies

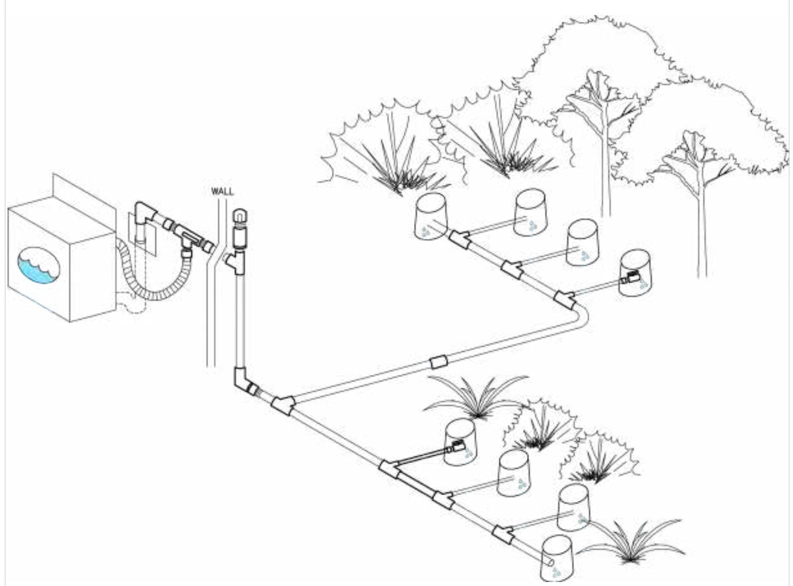
In an effort to understand the benefits and risks of greywater use, researchers have investigated the chemical and biological characteristics of greywater, the public health risks posed by different sources of water and different types of greywater systems, and the effect of different sources and distribution methods on soils and plants (Al-Hamaiedeh and Bino, 2010; Ottosson and Stenstrom, 2003; Pinto et al., 2009; Travis et al., 2010). A growing literature from Australia, the Middle East, and Europe documents the costs, water savings, maintenance requirements, effects on soil and plants, and social aspects of residential greywater systems.

A variety of studies look at the public health risks of greywater. Many have found fecal indicator bacteria present, (Casanova et al., 2001a; Ottoson and Stenstrom, 2003a; Friedler, 2004), demonstrating the potential for greywater to contain faecal transmitted pathogens. Nevertheless, few studies have found specific pathogens. Neither the City of Los Angeles nor the Water CASA study found disease causing organisms when they tested for salmonella, shigella, and entamoeba histolytica (City of LA, 1992) or *Cryptosporidium spp.* and *Giardia spp.* (Little, et al., 2000). However, *Cryptosporidium spp.* and *Giardia spp.* have been detected in greywater from other studies (Casanova et al., 2001b; Birks et al., 2004), as well as skin pathogens such as *Staphylcoccus aureus* (Kim, et. al 2008). Furthermore, there have been no documented cases of illness from greywater (Sheikh, 2010; Ludwig, 2009; Winward et al., 2007). In contrast, there are an estimated 3.5 million documented cases of illnesses in the United States each year caused by recreational contact with surface waters contaminated by sewage (American Rivers). Regardless, due to greywater's non-potable quality, care should be taken to avoid direct contact and irrigation of root vegetables should be avoided to prevent accidental ingestion of greywater.

In the United States a major focus of greywater educators is the use of “plant friendly” household products, those without salts and boron. Studies conducted internationally in places without availability of “plant-friendly” products found that, though it did not harm the soil or plants, the irrigation quality of greywater was lower than other sources of water. For instance, a study in Jordan found that the salinity and sodium adsorption ratio (SAR) of the soil increased over the one year study period, (Al-Hamaiedeh and Bino 2010) but that chemical properties of the crops were not changed. In another project study in Israel, researchers compared and analyzed soil and water quality on crops irrigated with freshwater, freshwater mixed with fertilizer (fertigation), and untreated greywater on crops over a three year period. They found that while water quality properties of the greywater can be lower than other sources of water with regard to contaminants of boron, surfactants, and SAR, the soil salinity in the greywater irrigated plot was similar to a site irrigated with fertilized water, and below concentrations harmful to plants (Gross et al. 2005). An Australian study on tomato plants irrigated with laundry greywater found that though the water was more saline, the tomato plants grew significantly more biomass than plants irrigated with tap water. The greywater irrigated tomato plants also contained significantly more nutrients than the plants irrigated with tapwater. The researchers concluded that “laundry greywater has a promising potential for reuse as irrigation water to grow tomatoes” (Misra et al., 2010).

Description of the Types of Greywater Systems in this Study

Greywater systems can be classified as those designed for outdoor irrigation and those for indoor non-potable use. In general, residential systems for outdoor irrigation are simpler and easier to maintain, while larger, mechanized systems for indoor non-potable use, such as toilet flushing, are more complicated. The systems surveyed in this study are residential systems, predominantly "laundry to landscape" and "branched drain" systems. These systems do not have tanks, pumps or filters, and irrigate landscape plants directly, though a few systems we studied did incorporate pumps. Figure 4 shows the breakdown of the types of systems studied.



igure 1: Laundry to landscape system. Credit: Cleanwater Components

In the "laundry to landscape" system, shown in figure 1, the washing machine pump sends greywater from the drain hose of the machine directly to the landscape (usually gravity based). The system does not alter the existing plumbing of the house and does not require a permit in the state of California or several other states, like Arizona, New Mexico, and Montana, if basic guidelines are followed.

The "branched drain" greywater system (not shown) uses gravity to distribute greywater from showers, sinks, and baths. "Branched drain" systems typically divert greywater through the drainage plumbing of the house, which is then distributed to plants via a series of branching drainage-type pipes.

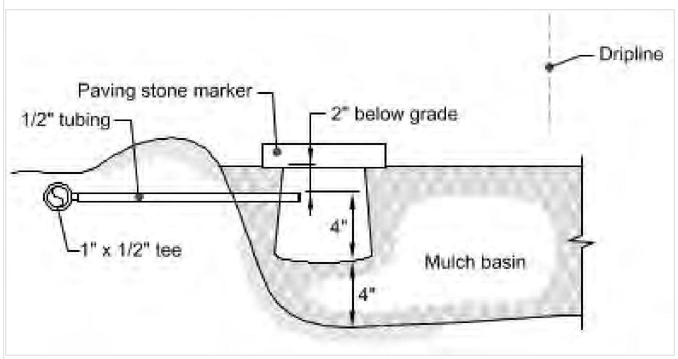
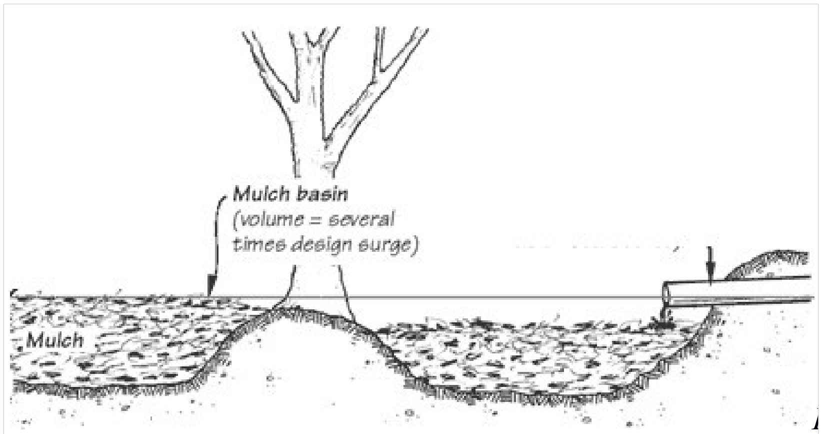


Figure 2: Subsurface irrigation. Credit: SFPUC

Both types of systems discharge greywater into "mulch basins", which are excavated trenches in the ground, usually 6 to 20 inches deep, 1 to 2 feet wide and 3 to 10 feet long, and filled with wood chips or other woody organic material (see figures 2 and 3). These basins require periodic maintenance to replace mulch and remove decomposed material. The frequency of maintenance depends on several factors, including the particle size of the mulch, the size of the mulch basin, soil texture type, and the quantity and source of greywater entering the basins. The experience of greywater installers and Greywater Action members is that basins need maintenance about once a year, although kitchen sink systems may need more frequent maintenance due to build up of organic matter and grease. Neglecting this maintenance can lead to slower infiltration, pooling, or runoff of greywater.

The two types of pumped systems in the study, “pump no filter,” and “pump with filter,” both have a small surge tank to temporarily collect greywater. Inside the tank is a pump, which send the water to the landscape. The “pump no filter” system sends unfiltered greywater to the landscape, typically using 1” pipe or tubing, whereas the “pump with filter” first filters the greywater and sends it out through smaller tubing, typically 3/4” mainline with 1/2” irrigation lines with ¼” emitters.



igure 3: Mulch basin Credit: Oasis Design

Study Group

The study group consisted of 66 households with one or more greywater systems located in the San Francisco Bay Area (Albany, Berkeley, El Cerrito, Oakland, Piedmont, Richmond, San Francisco, San Leandro, and San Pablo), the Monterey Bay area (Aptos, Monterey, Pacific Grove, Santa Cruz, Seaside, and Watsonville), and the Santa Rosa area (Cotati, Petaluma and Santa Rosa).

The San Francisco Bay Area is home to 1.6 million people, the Monterey Bay area to 732,708, and the Santa Rosa area to 234,000 people (US Census, 2010). Annual rainfall in the East Bay is approximately 24" and San Francisco 21”. Average annual rainfall in the Santa Rosa area is approximately 31”. Average annual rainfall in the Monterey Bay Area ranges from 42.8” in the Santa Cruz Mountains to 20” on the Monterey Peninsula The climate is “Mediterranean”, with mild, wet winters, and warm, dry summers. Average summertime high temperatures range from 66 to 83 , and winter lows from 37 to 47 degrees Fahrenheit. (The Western Regional Climate Center, 1919-2005, 1931-2005)

The participants for this survey were identified through the networks of the investigators (“snowball” sampling method). Greywater systems had been installed by homeowners, by independent professional installers, or through training programs led by local governments and NGOs.[3]

Methods

Structured Interview of Greywater System Users

We conducted a one-hour structured interview at each of the 66 households, representing a total of 83 greywater systems. Following the interview, w e collected greywater and soil samples and recorded qualitative plant health metrics for greywater-irrigated plants at each site. Interviews were conducted between May and July of 2012 by the principal investigators and trained enumerators.

Interview questions elicited demographic information, details about the greywater system(s) and other water

3 Greywater Action, Ecology Action of Santa Cruz, or the City of Santa Rosa

conservation practices (e.g rainwater harvesting), laundry and soap products used, and irrigation methods and frequencies. The interviews were recorded on a hand- held Android device using the program ODK (opendatakit.org) for data collection. See appendix IV for the survey questionnaire.

We interviewed the principal caretakers of the greywater system at each site. On sites where multiple people maintained the system we interviewed whoever was available at the time of the interview.

Greywater Testing

One sample of greywater was collected per system. For the “laundry to landscape” systems, we asked household members to wash a load of dirty laundry following their usual practice, then collected greywater at an accessible outlet in the landscape. The samples passed through the system before collection, and represent the typical irrigation water that plants receive. Shower, sink, and bath greywater from “branched drain” systems was either collected though a similar method (plugging the tub for a shower and collecting greywater from an outlet in the yard), or, in a few cases, were collected in the house by mixing a small quantity of products typically used in the system. Because this method of collection used less water than would be generated in typical usage, the concentration of constituents in greywater in the shower/sink samples may be higher than would be present in the actual greywater generated from these fixtures, and also did not pass through the greywater distribution pipes.

Greywater samples were tested on site for pH. Collected samples were refrigerated and sent to a laboratory [4] where they were tested for conductivity (an indicator of salt content), TDS (total dissolved solids), and boron. A subset of 57 samples were also tested for irrigation suitability at Soil Control Laboratory,including pH, total dissolved solids, conductivity, alkalinity (Carbonate and Bicarbonate reported as CO3 & HCO3), chloride, phosphate, boron, sodium, iron, potassium, nitrate (NO3), phosphate (o-PO4), sulfate (SO4) and secondary nutrients (Calcium (Ca), Magnesium (Mg)).

The laboratories analyzed greywater samples following standard methods for examining irrigation water. Samples from the Santa Rosa area were tested in the city's water quality laboratory (ci.santa-rosa.ca.us) following standard methods.

Categorization of Greywater Quality and Soil Test Results

To summarize the results of the greywater and soil testing we categorized samples into “generally safe”, “slight to moderate”, and “severe” risk levels for soil and irrigation, following guidelines in “Abiodic Disorders of Landscape Plants” and “Water Quality for Agriculture”, based on the work of Pettygrove and Asano (1985). Long-term irrigation with water containing levels in the “generally safe” range should have no negative effects on most plants regardless of soil type. Levels in the “slight to moderate” risk may cause harm to sensitive plants and may be more problematic in clay or slow draining soils. Depending on the plant species, and other factors, long term irrigation with the level “slight to moderate” may have no negative affect, or it may reduce plant growth and productivity. Long term irrigation with water containing levels in the “severe” risk category will most likely cause plant growth problems, and reduce yields in most, but not all, plants.

4 Perry Laboratory, Watsonville, CA or Soil Control Laboratory, Watsonville, CA

Soil Quality and Texture

At the time of the site visit two soil samples were collected per greywater system. One sample was collected from soil underneath the greywater outlets, the area directly beneath where greywater entered the soil from the irrigation system. The other sample was collected from soil in the same area of the landscape that had no contact with greywater. Both samples were collected following standard soil sampling procedures. Investigators also conducted on-site soil texture tests following the soil ribbon and soil worm procedures (see Appendix III).

Soil samples were air dried and sent to the soil laboratory at the University of Massachusetts for standardized testing. Samples were tested for soluble salts, pH, extractable nutrients (P, K, Ca, Mg, Fe, Mn, Zn, Cu, B), extractable aluminum and cation exchange capacity. To test for an effect of greywater irrigation on these variables, at each site we subtracted the value for the non-greywater irrigated soil sample from the value for the greywater irrigated soil sample and tested whether the resulting differences were significantly positive (or negative). A positive difference would imply that greywater irrigated soil sample constituents were consistently larger than the non-greywater irrigated samples from the same site.

Plant Health Assessment

At each site several plants irrigated by greywater were visually analyzed for qualitative indicators of health. We observed 127 plants in detail, and briefly observed more than 1,000 greywater irrigated plants at the sites. Any plant that was identified by the respondent as having problems, or any plant that the investigator noticed as being unhealthy was observed in detail (one of the 127). We looked for leaf chlorosis, leaf necrosis, insect presence, other diseases (e.g. mildews, leaf curl, etc.) and abnormal growth. We rated each plant for the variables listed above with a numeric value (1,2, or 3). For example plants were rated for chlorosis by a "1"- signifying no sign of chlorosis, almost all leaves appear healthy, "2"- signifying some signs of chlorosis, multiple leaves show symptoms, or "3"- signifying severe chlorosis, most of the leaves show symptoms. We then categorized them as "fully healthy" (plant showed no symptoms, or one minor symptom, ie. minor insect presence), "mostly healthy" (plant showed two minor symptoms ie. minor insect presence and some chlorosis), or "unhealthy" (plant showed multiple symptoms or one severe symptom ie. disease, and severe chlorosis), depending on their symptoms.

Calculating Water Savings

We used two methods for calculating water savings. First, we looked at water consumption data for 34 sites (52% of study population) provided by one of the water utilities, East Bay Municipal Utility (EBMUD) and compared consumption before installation of the greywater system to consumption after installation. All water data ended in May of 2012. We analyzed average savings, as well as savings per subgroup. We classified study households into subgroups based on survey questions that explored other steps taken in the home that would influence water consumption, such as whether they made other water saving changes (eg. low-flow fixtures or rainwater harvesting systems) and whether they planted new plants at the time they installed the greywater system or irrigated existing plants.

Second, we estimated how much water would be required to irrigate the area at each site that is currently irrigated by greywater using local climate data and standard irrigation requirements. This method attempts to address the challenge of estimating savings for households that added additional plants to measure how much potable water their system potentially offset. Since we do not have information on whether the presence of greywater as an irrigation source affected a households decisions on what type of plants to grow (i.e. high water need plants vs. low water need plants), this estimate will not capture those variables.

Evaluation of Greywater System Costs

We conducted a separate survey of 20 professional greywater installers, mainly landscaping or plumbing contractors, to evaluate costs of greywater installation materials, labor and permitting. These greywater installers owned businesses in the San Francisco Bay area, Monterey Bay area, Sonoma and Marin counties, and Los Angeles county. Collectively, these installers reported that they had installed 259 greywater systems since 2009. 94% of these greywater systems were the same irrigation system types included in our general analysis (see figure 9). Interviews with greywater system installers were conducted over the phone and or using a web form between July and September 2012. See appendix V for the greywater installer survey questionnaire.

Statistical Methods

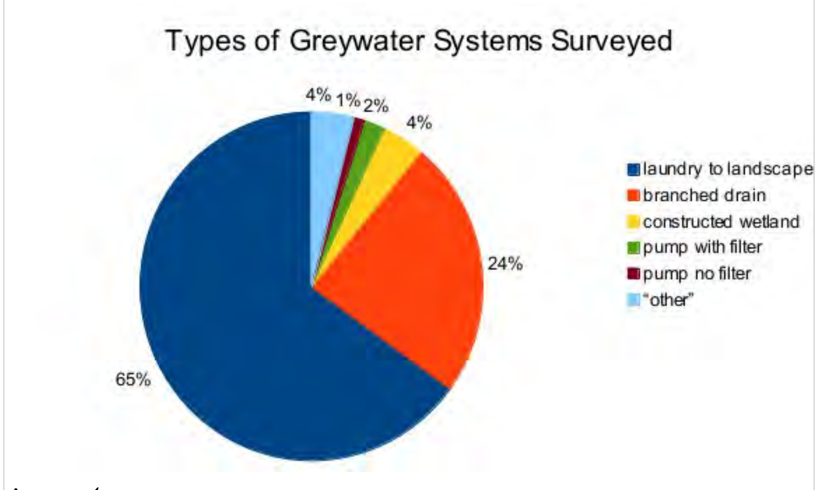
For the soil and greywater test results, many of the variables measured contained a few extreme outliers. To remove their influence and summarize typical values we use medians instead of means and discuss the outliers in detail in the Results.

In the water savings section, however, we used averages rather than medians because data was not influenced by large outliers. The average saving we found, therefore, reflects actual water savings a water district would see if more of their customers with similar water usage patterns as those in our study installed greywater systems.

Statistical analyses and plots were produced in R 2.7 (rproject.org).

Results

Here we report aspects of user experience, the results of the soil and water tests, plant health, water savings, and system costs.



igure 4

Greywater Users

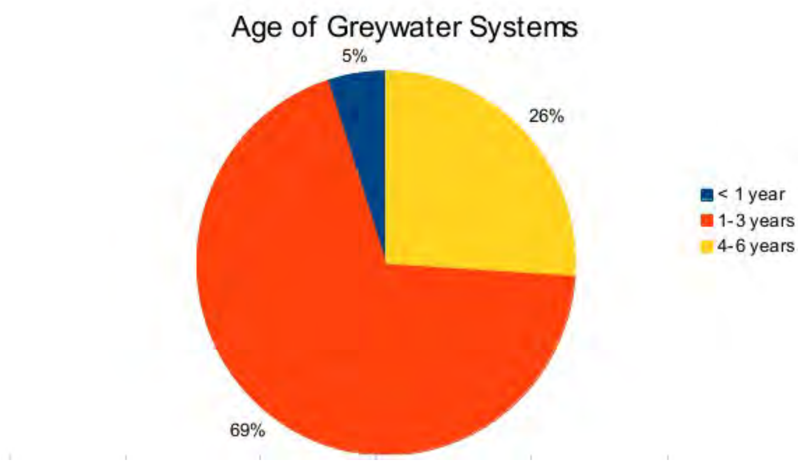
The vast majority, (95%), of participants were homeowners, the remainder rented their homes.

Participants in our study produced an estimated average of 11 gallons/person/day from shower/baths and 7 gallons/person/day from washing machines, (compared to the California code estimate of 25 gallon/person/day for showers/baths and 15 gallons/person/day for washing machines). These numbers were based upon testing the flow of the shower head nozzle, the make and model of washing machine, and reported usage of fixtures from the structured interview.

User Experience

We surveyed these aspects of the user experience:

- how people learned about greywater
- reactions to their system from the larger community
- motivations for installing a system
- perceived benefits
- problems
- user satisfaction
- maintenance and repair needs
- opinions on health risks



igure 5

Overall, respondents reported positive experiences with their greywater systems. Most people felt they had benefited from their systems, were satisfied with how the system worked.

We found that participants first learned about greywater reuse from multiple sources. The most common source was friends or colleagues, classes or workshops, and/or the media (eg. article or news coverage). 71% of respondents reported installing their system within three years of learning about greywater, with 35% of people installing the system within one.

We asked what kinds of comments people recalled hearing when they talked to friends, neighbors, and relatives about their greywater system. All respondents reported hearing positive comments of some sort, including “good idea”, “excited”, “want to do it too”, and “interested”. Only 6% of respondents heard some type of negative comment in addition to positive comments. 33% of respondents reported that a friend or family member installed a greywater system after learning about theirs.

Where People First Learned about Greywater*	
Friend or colleague	34%
Media	24%
Workshop	23%
Book	12%
Other	35%
*Multiple responses were recorded	

able 1

Respondents were mainly motivated to install the system by a workshop, or a concern for saving and reusing water. Most households received no incentives or rebates for installations. Participants had a variety of goals for their greywater system, most commonly to save water or a general desire to make their home more ecologically sound . Most people, (68%), felt their system saved water, and almost half felt their plants benefited. People also reported their systems made them feel good about having a more ecological option for their greywater other than sending it down the drain with the rest of the sewage.

User Satisfaction Findings

Overall, greywater users felt overwhelmingly positively about their greywater systems. All respondents but one were either “very satisfied” or “satisfied” ; only one felt “neutral” about their greywater system. They also felt positively about their system's reliability or need for maintenance: 92% reported they were either “very satisfied” or “satisfied”. People felt slightly less satisfied regarding how well their greywater systems waters the plants, with 90% of users reported they felt either “very satisfied” or “satisfied”.

User Satisfaction with Greywater System					
	% Very satisfied	**% Satisfied**	% Neutral	% Dissatisfied	% Very dissatisfied
Overall satisfaction	**75**	**24**	1	0	0
Reliability (need for maintenance)	**69**	**23**	7	1	0
Irrigation performance	**55**	**40**	5	0	0

able 2

86% of system users said they would recommend their systems to others, and 13% said they would recommend the system with modifications. Only one person said they were “not sure” if they would recommend their system, and no one said they would not recommend it.

Maintenance, Repairs, and System Use

The majority of households reported no operations problems with their systems. 12% reported clogging problems, mostly at the greywater outlet (see figure 2), and for most it was a single occurrence that they fixed themselves. The single household that had the most frequent clogging issues had a pump with filter system and reported that the filter clogged every 1-2 months. 8% reported that the system was not irrigating properly, due to a clog, or a valve that had come detached. Pests occasionally disturbed the systems. At one site, slugs congregated inside of the greywater outlets, while at another gophers dug up the mulch basins.

84% of households reported no broken parts up to the date of the interviews with their greywater systems. Of the eleven households that reported a broken part, the tubing caused a problem for nine, one the filter, and one a valve. The typical reason for the tubing to break was through damage during gardening, for example, by accidentally putting a shovel through it. Though not technically part of the greywater system, the “mulch shield” which protects the greywater outlet from root intrusion, was often damaged when it had been made out of a plastic polyethylene nursery pot (instead of using a rigid irrigation valve box or hard plastic container).

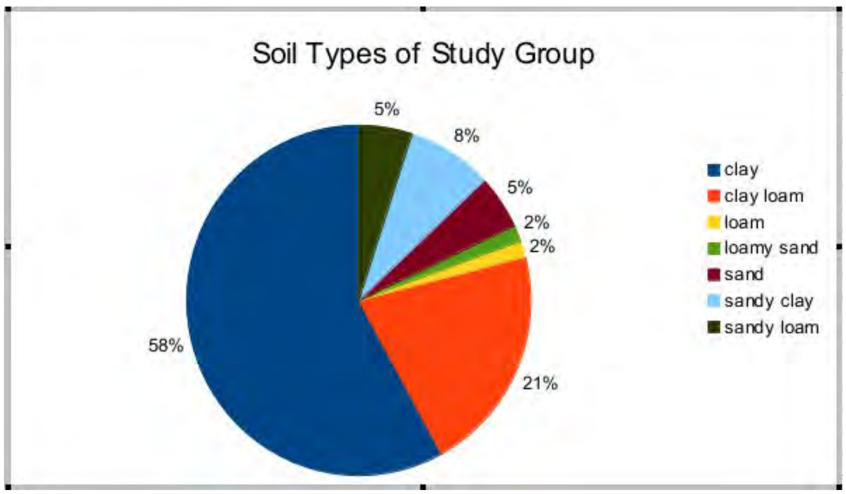
Most households did very little general maintenance on their systems. Of the 89% of households with mulch basins, about half had done nothing to the basin, and the other half had dug out the area under the outlet and replaced the mulch. Through most respondents indicated they did not notice greywater pooling or running off the soil surface, continued lack of maintenance could lead to this problem. Participants did not believe that system clogs had exposed residents to pooled greywater (97%). Only two participants reported that possible direct contact with greywater had occurred (not including maintenance), both incidents were from greywater runoff onto a path. Though most respondents in the survey were not public health professionals, we asked about their perception on safety, specifically if they thought anyone could get sick from their greywater system. From their personal experience no one believed their system could cause illness.

Even though few people reported pooling or runoff, investigators noticed several additional sites that had some pooling when water was run through the system, indicating these people were not checking the outlets frequently enough to notice the problem. In fact, 25% of people reported they never checked the outlets. After the interview several participants asked questions about maintenance, indicating there was not a good understanding of maintenance needs, even though most people reported they had a good understanding of how the system functioned in general.

Soil Testing Results

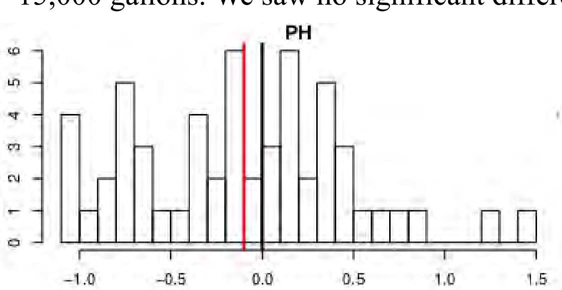
Our soil test results suggest that irrigation with greywater did not affect soil salinity, boron, or other nutrient levels. We can be quite confident that if there is an effect it is quite small, since we compared soils irrigated with greywater to soils not irrigated with greywater at each site, thus controlling for most other sources of variation.

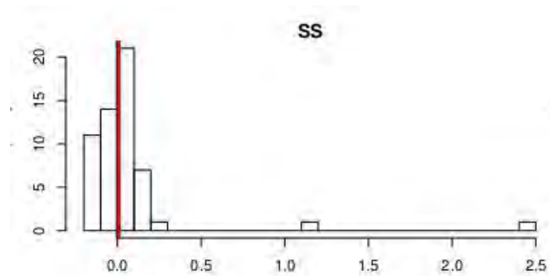
We compared the difference between greywater and non-greywater irrigated soils for the variables of soil pH, soluble salts, boron, as well as other nutrients (P, K, Mg, Ca, S) and micronutrients (Zn, Mn, Cu, Fe, Cd, Pb, Al, Cr, Ni). We analyzed the differences between variables at each site (See figure 7). We also compared differences by soil type to see if some soils could be more impacted by greywater irrigation, since heavy clay soils are known to be more susceptible to accumulation of salts and other ions, whereas sandy soils are more easily leached. However, we saw no significant differences between greywater and non-greywater irrigated soils for any of the soil types (Wilcoxon signed-rank tests). Most of our sites were in clay, clay loam, or sandy clay soils, so these results are more informative than the soil types of loam, loamy sand, sand, and sandy loam that had few samples.



igure 6

Additionally, we looked for correlations between the age of the system and the difference between greywater and non-greywater irrigated soils, as well as quantity of greywater produced, since older systems might have had more time to accumulate salts or boron. Systems were grouped into less than 1 year old, 1-3 years old, 4-6 years, and more than 6 years. The only variable we found to be significantly different (Wilcoxon signed-rank test) between age categories was a lower pH (relative to the paired non-greywater irrigated soil sample from the same site) in systems older than four years. Since the greywater samples in our study were typically more acidic than the average pH of the municipal water, the reduction of pH could be due to the long term irrigation of a more acidic water. (Note that the pH range of the soils was still with in the safe range for soil pH). Systems were also grouped according to how much estimated greywater had been discharged: less than 5,000 gallons, 5,000 -10,000 gallons, 10,000 -15,000 gallons; or greater than 15,000 gallons. We saw no significant difference for any variable between these groupings.





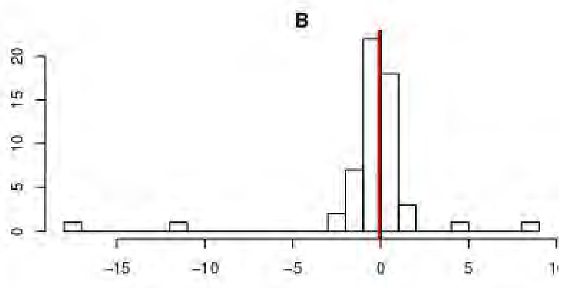


Figure 7

Difference between GW and non-GW

soil tests for pH, suspended salts (SS),

and boron (B) at the same site. Gray

Salts and boron are two constituents commonly found in greywater of most concern for plant health. We found no significant difference between the greywater irrigated soils, and the non-greywater irrigated soils in their level of salts (the EC), or boron levels. Additionally, the difference between greywater and non-greywater soil variables (soluble salts and boron) wasn't correlated with the amount of the salts or boron found in the greywater samples from the same site (EC, B, Na, and Cl).

Guidelines for Interpreting Soil Test Results

	Generally safe	Slight to moderate risk	Severe risk
Soluble salts (EC) mmhos/cm	0.5-2.0	2.0-4.0	>4.0
Boron (ppm)	0.1-0.5	1 – 5	>5

able 3

We found large variation in the non-greywater irrigated soil samples for the variables we tested, much larger than the typical differences between greywater and non-greywater irrigated soils due to variability in original soils, imported soils, use of fertilizers, etc. Table 4 below illustrates these variations for soluble salts, pH, and boron.

We found the median pH of the greywater irrigated soils to be 6.5 with a range of 5.3 to 7.5, whereas the non-greywater irrigated soils also had a median of 6.5 , with a range of 5.2 to 7.6. The median pH difference between greywater irrigated and non-greywater irrigated soils was -0.1. These results indicate that the greywater irrigated soils were slightly more acidic than the non-greywater irrigated soils, although the difference is not statistically significant and much smaller than the natural range of variation. Range in pH common for arid region mineral soils are 6.5-9. Range in pH common for humid region soils is 5-7 (Brady, Weil, 1999).

The median soluble salts in the greywater irrigated soil was 0.17 mmhos/cm (dS/m), with a range of 0.05 mmhos/cm to 2.6 mmhos/cm. The median for non-greywater irrigated soils was 0.16 mmhos/cm with a range of 0.05 mmhos/cm to 1.85 mmhos/cm. The median difference between greywater and non-greywater irrigated soils was 0.01. All but two of the greywater irrigated samples were in the "generally safe" range, and 3% were in the "slight to moderate" risk range for soluble salts, whereas 100% of non-greywater irrigated samples were in the "generally safe" range.

Greywater and Non-greywater Irrigated Soil Testing Results								
		Median	Min	Max	Samples in **"generally safe"** range	Samples in **"slight to medium"** risk range	Samples in **"severe"** risk range	median difference btw. GW and non-GW samples
Soluble salts (mmhos/cm) or dS/m	greywater	0.17	0.05	2.6	97%	3%	0%	0.01
	non-GW	0.16	0.05	1.85	100%	0%	0%	
pH	greywater	6.5	5.3	7.5				-0.1
	non-GW	6.5	5.2	7.6				
Boron (ppm)	greywater	1	0.2	9.3	55%	42%	3%	0
	non-GW	0.8	0.2	19.3	65%	32%	3%	

able 4

The two greywater soil samples with salt levels outside of the "generally safe" range (2.03 and 2.6 mmhos/cm) did not have high salt levels in the greywater we tested. Greywater from the first site tested low in salts (EC 0.31 mmhos/cm and TDS 198 ppm) and greywater from the second site had salt levels slightly above the "generally safe" range. (EC of 0.78 mmhos/cm, TDS of 504 ppm, and SAR of 5.4). Soap used at this second site listed no sodium products in its ingredients list, and other sites that used the same detergent did not have levels of salts out of the "generally safe" range. Since this was a one time sampling, it is possible the higher level of salts could have come from the clothing, or residue from other detergents. This site also reported that manure had been added within the month, possibly another source of salts to the soil since manures have been found to have salts ranging from 12.0 to 23.0 mmhos/cm (Costello et. al 2003). We did not see any problems with plants at either site.

The median level of boron in the greywater irrigated soils was 1.0 ppm, with a range of 0.2 to 9.3 ppm; while the median for non-greywater irrigated soils was 0.8 with a range of 0.2 to 19.3. The greywater from the site with the highest levels of boron in the greywater irrigated soil (9.3 ppm) had very low levels of boron in the greywater, 0.18 ppm, indicating the source of boron in the soil was from elsewhere. Even though the greywater irrigated soils had a higher median boron level, the difference is not attributed to greywater. The median difference between boron levels in greywater and non-greywater irrigated soil samples from the same site was 0.00 and the distribution was not significantly positive (wilcoxon signed-rank test).

Guidelines for Interpreting Greywater Test Results			
	Generally safe	**Slight to moderate risk**	**Severe risk**
EC (mmhos/cm)	<0.7	0.7-3.0	>3.0
TDS (ppm)	<450	450-2,000	>2,000
SAR	<3	3 – 9	>9
Boron (ppm)	<0.5	0.5-1.0	>1.0
Chloride (ppm)	<140	140-300	>300
Sodium (ppm)	<70	70-200	>200

Table 5

Greywater Testing Results

In this section, we report our findings for each variable we tested for, where we found most samples to be in the generally safe range for irrigation water, and provide details on outlier samples. Only one site used powdered detergent and was the source for many of the outliers results. A few sites occasionally used powdered cleaning products.

Municipal water contains some amounts of salts and bo ron, Table 6 s hows ranges found in tap water from the municipalities of the study area. Note that the reported maximum levels of salts (EC, TDS, Na, and Cl) found in tap water from some municipalities in our study area are in the "slight to moderate" risk category for irrigation, hence, results from those districts will most likely have higher salt content than from municipalities with lower salt content in the tap water. Although we lack data on the specific salt levels of tap water in our greywater samples, we suspect some of our samples were influenced by this, particularly the samples that tested on the low-end of the "slight to moderate" risk category for EC, TDS, SAR, chloride, and sodium, came from sites using products that tested "generally safe" at other sites, and did not contain any salt compounds in their ingredients.

See appendix I for information about each variable and its effect on soils and plants and table 5 (above) for the ranges for each category of "generally safe", "slight to moderate", and "severe" risk for long term irrigation.

The median pH was 6.5, with a range of 5.5 to 9.7[5].

The median EC was 0.31mmhos/cm, with a range of 0.07 to 4.82 mmhos/cm. 85% were in the "generally safe" range for irrigation water, 14% were on the low end of the "slight to moderate risk" (0.704, 0.74, 0.78, 0.79, 0.91, 0.92, 1.15, 1.21, 1.3, 1.35 mmhos/cm), and one sample was in the "severe" risk range- 4.82 mmhos/cm. This site used powdered laundry detergent.

We found the median TDS to be 198 ppm, with a range of 47 to 3133 ppm. 84% were in the "generally safe" range, 15% in the "slight to moderate" risk range, and only one in the "severe" risk range. This site used powdered laundry detergent.

The median sodium absorption ratio (SAR) (adjusted Rna) level was 1.8 with a range of 0.35 to 64. 80% of the samples had a SAR rating in the "generally safe" range, 18% in the low range of the "slight to moderate" risk, and two samples in the "severe" risk category (SAR 14 and SAR 64). The sample with the highest SAR rating, SAR 64, used powdered laundry detergent, and the sample with the second highest rating, SAR 14, used many different commercial brands (like Suave).

We found the median boron level to be 0.05 ppm, with a range of 0.003 to 4.55 ppm. 92% of the samples were in the "generally safe" range, 5% were in the "slight to moderate risk" range, and two samples were in the "severe" risk range, with levels of 2.81 and 4.55 ppm. The site with the highest boron levels in the water used a detergent that lists itself as "greywater safe", though boron is an ingredient (7th Generation). The second site used Arm and Hammer Oxy Clean Power Gel, which does not list all ingredients.

We evaluated the boron levels in the soil at the sites with high boron levels in the greywater. It was not obvious that boron levels were increasing, though they could over more time. The soil from the two sites with highest levels of boron in the greywater did have more boron in the greywater irrigated soil than in the non-greywater irrigated soil. However, soil from the three greywater samples that showed a "slight to moderate" risk had only one site with an increase in boron levels and two sites with no increase compared to the non-greywater irrigated soil sample. Since most of the greywater samples did not contain elevated levels of boron, we do not have many sites that could experience a build up of

5 There was some discrepancy between the on-site pH tests and the laboratory, we used the average between the two results.

boron.

The median chloride level was 24 ppm, with a range of 4 to 210 ppm. 94% of samples had levels in the "generally safe" range, with most samples lower than 50ppm. Six percent of samples had levels in the "slight to moderate" risk range. No sites had chloride levels in the severe risk range.

The median sodium level was 32 ppm, with a range of 7 to 1024ppm. 85% of samples were in the "generally safe" range, 13% were in the "slight to moderate" risk range. One sample was in the "severe" risk range, with a level of 1024 ppm. This site used powdered detergent.

Greywater Testing Results

		Median	Min	Max	Samples in "generally safe" range	Samples in "slight to medium" risk range	Samples in "severe" risk range
EC (mmhos/cm)	greywater	0.31	0.07	4.82	85%	14%[2]	1%
	municipal water[1]	0.38	0.04	1.64			
TDS (ppm)	greywater	193	47	3133	84%	15%[2]	1%
	municipal water[1]	240	29	846			
SAR[3]	greywater	1.8	0.35	64	80%	18%[2]	2%
	municipal water[1]	no data available					
pH	greywater	6.5	5.5	9.7			
	municipal water[1]	8.3	6.7	9.7			
Boron (ppm)	greywater	0.04	0.003	4.55	92%	5%[2]	3%
	municipal water[1]	0.31	ND	0.88			
Chlorine (ppm)	greywater	24	4	210	94%	6%[2]	0%
	municipal water[1]	24	3	394			
Sodium (ppm)	greywater	32	7	1024	85%	13%[2]	2%
	municipal water[1]	23	3	140			

1- We averaged the quality of municipal water for the seven water districts of the study area. Since there was not an even distribution of sites in each water district, the averages show above do not reflect an accurate estimate of constituents preexisting in the water, rather they shows levels that can be found in municipal water.

2- Most samples were at the low end of range. see results section for details

3- SAR- We used the adjusted Rna calculation

able 6

Plant Health Results

Our detailed observations of greywater irrigated plants found 95% to be fully healthy. We found seven cases of disease, none of which appeared to be attributed to greywater. Of the plants identified as unhealthy, half had been identified by the household as unhealthy prior to greywater irrigation, while the remaining unhealthy plants showed

Health of Greywater Irrigated Plants

	No signs	Some signs	Severe signs
Leaf necrosis	95%	5%	0%
Leaf chlorosis	94%	5%	1%
	Fully healthy	**Mostly healthy**	**Unhealthy[1]**
Overall health	95%	2%	3%

1- Of the unhealthy plants, half were identified to be unhealthy before greywater irrigation began.

able 7

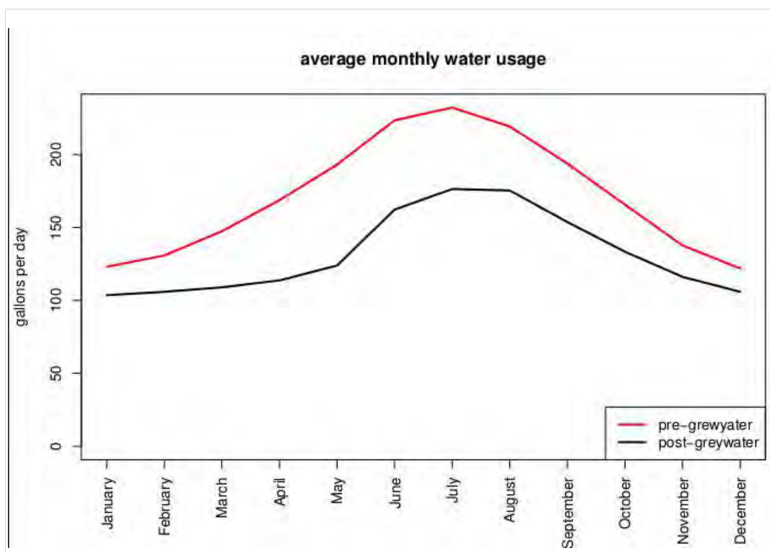
symptoms of common diseases that did not appear to be directly related to greywater (such as peach leaf curl).

Leaf chlorosis and necrosis are common symptoms of salt and boron toxicity, but can also indicate nutrient limitations and other stresses. 95% of the plants observed showed no signs of necrosis, 5% of plants showed minimal signs of necrosis, and no plants showed severe signs of necrosis. 94% of plants showed no signs of chlorosis, 5% showed minimal signs of chlorosis, and two plants showed extreme signs of chlorosis. Of the two plants with severe chlorosis, one was grossly over-watered (all greywater was being directed to one tree) with poor drainage, and the other was a lemon tree, which often suffer from chlorosis due to nutrient deficiencies.

We observed plants in good health under a large range of irrigation regimes. For each household, we estimated weekly greywater production and plant water requirements. We found that some plants were being under-watered, some appropriately watered, and some over-watered. This demonstrates that the common landscape plants included in this study can tolerate and thrive under many different soil moisture conditions.

Water Savings Results

In this section we provide results for estimating water savings, as well as water consumption findings for various subgroups of households, for example, separating results from households that planted new plants with their greywater system vs. those that did not.



igure 8

From the water consumption data we found an average water savings of 17 gallons per person per day after installation of the greywater system and people used 48 gpd (down from 65 gpd before greywater system installation).

Average annual household water savings was 14,565 gallons each year after installation of the system. Average savings varied by season, with higher savings in spring and summer, (nearly 10,000 gallons), and lower in fall and winter, (close to 5,000 gallons). Since these systems were used for outdoor irrigation we would expect to see higher savings during the irrigation season.

Average Water Usage and Savings Pre and Post Greywater System				
Month	**Pre-greywater gpd**	**Post-greywater gpd**	**Daily savings**	**Monthly savings**
January	123	104	19	589
February	131	106	25	700
March	147	109	38	1178
April	169	114	55	1650
May	193	124	69	2139
June	223	162	61	1830
July	232	176	56	1736
August	219	175	44	1364
September	194	154	40	1200
October	166	133	33	1023
November	138	116	22	660
December	122	106	16	496
		Annual average household savings (gal)=		**14 565**

able 8

Though the average per capita daily savings was 17 gallons per day (gpcd), (68 gallon/day for a family of four), some households actually used more water after installing greywater, (up to 32 gallons/day), while others saved much more than this (up to 122 gallons/day). For households that reported they had adopted other water-saving practices in addition to their greywater system the average savings was 23 gpcd. Of the households that did not make any water saving changes, those that planted new plants when they installed their greywater system used an average of 4 more gallons per person per day, while households that did not plant new plants saved an average of 11gpcd. Some households had a change in the number of people living in the house before and after installing the greywater system. We will discuss the implications of this and affects on our results in the Discussion.

Per Capita Savings Per Category (GPCD)			
	Average	Minimum	Maximum
Per capita	**17**	-32	122
GW + other water saving changes in home	**23**	-18	81
Planted new plants with GW, no other changes	**-4**	-19	8
No new plants, no other changes	**11**	-32	122

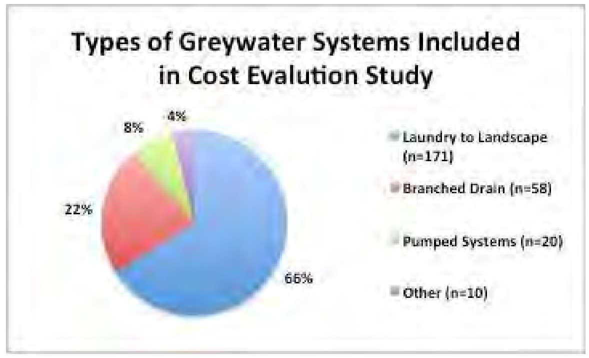
able 9

To account for the amount of water potentially offset by a greywater system that was installed with new landscaping, we looked at the total area irrigated with greywater at each site and then estimated how much irrigation water it would require during an eight month irrigation season. We found that on average 325 square feet was irrigated with greywater at each study site, offsetting an estimated 5,200 gallons of potable water a year per site. Landscaped areas irrigated with greywater ranged from 36 to

1,380 square feet, offsetting an estimated 576 to 22,080 gallons a year. These calculation assume that all new landscape area irrigated by greywater would have been irrigated with municipal water [6]. The estimated savings found with this method were significantly lower than the actual savings we observed from water consumption data, suggesting that actual savings associated with greywater systems may be influenced by factors other than just landscape irrigation needs.

Greywater System Cost Results

Results show that homeowners that hire a professional plumber or landscaper to install a greywater irrigation system can expect to pay a range of costs depending on the system type, size and complexity of the system installed. Table 10 documents the low, average, and high range of system costs including materials, labor, and permitting fees for systems installed by the 20 professional installers in the study group. Table 11 reports the low, average, and high range of costs for homeowners who install their own greywater systems.



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Professional-Installed Greywater System Cost Range

MATERIALS + LABOR + PERMIT	L2L (no permit)	Branched Drain	Pumped Systems
Low	$350.00	$500.00	$1,800.00
Average	$750.00	$1,740.00	$3,790.00
High	$2,000.00	$4,250.00	$5,750.00

Table 10

Homeowner Installed Greywater System Cost Range

MATERIALS + PERMIT ONLY	L2L (no permit)	Branched Drain	Pumped Systems
Low	$100.00	$250.00	$800.00
Average	$250.00	$715.00	$1,790.00
High	$500.00	$1,750.00	$2,750.00

Table 11

Materials Costs

Laundry-to Landscape

58% of laundry to landscape systems had material costs between $0-$250. 42% these installations had material costs between $250-$500.

6 We used the estimate of 0.5 gallons/square foot of planted area per week for irrigation need

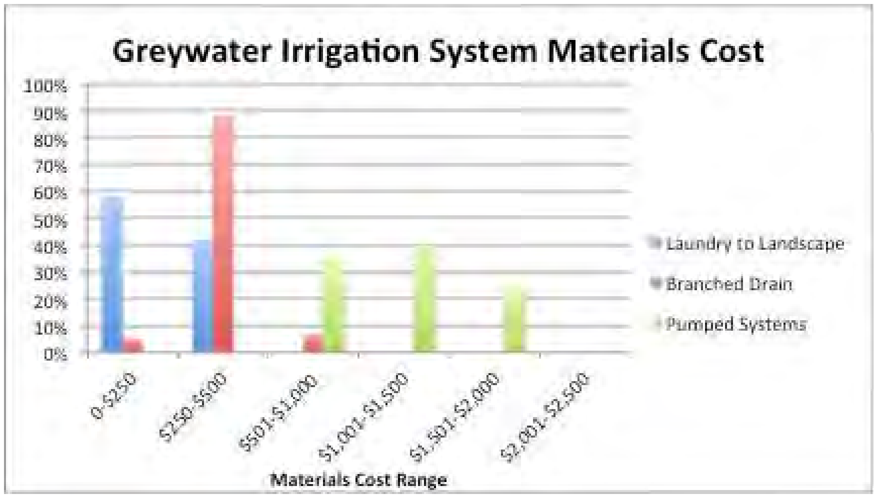
Branched Drain
88% of branched drain systems had material costs between $250-$500.

Pumped Systems
Contractors reported the widest range of costs for pumped systems, with a total of 75% of installations costing between $500 and $1,500.

<u>**Labor Costs**</u>

Laundry-to Landscape
56% of laundry to landscape systems had installation labor costs between $250-$500. Another 40% of these systems had labor costs in the $501-$1,000 range.

Branched Drain
41% of branched drain systems had installation labor costs between $501-$1,000. 34% of these systems had labor cost between $1001-$1,500. 10% of systems had lower labor costs in the range of $250-$500, while 14% of systems had labor costs over $1,501.



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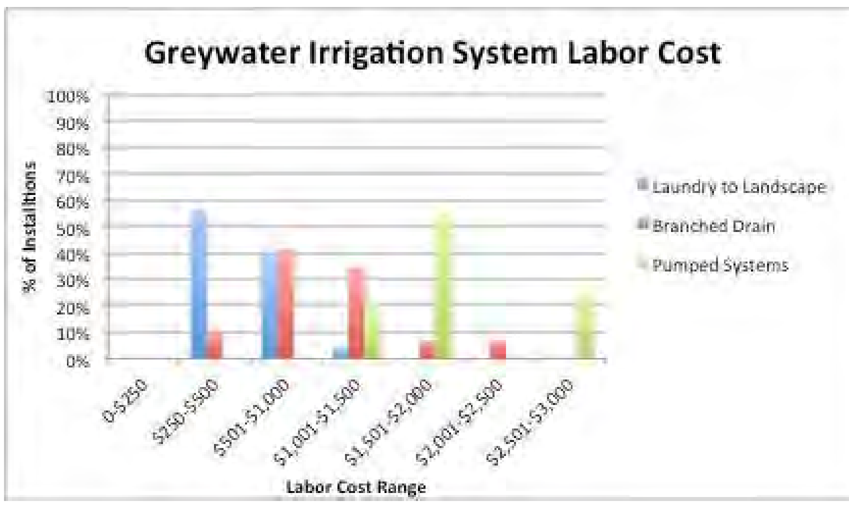


igure 11

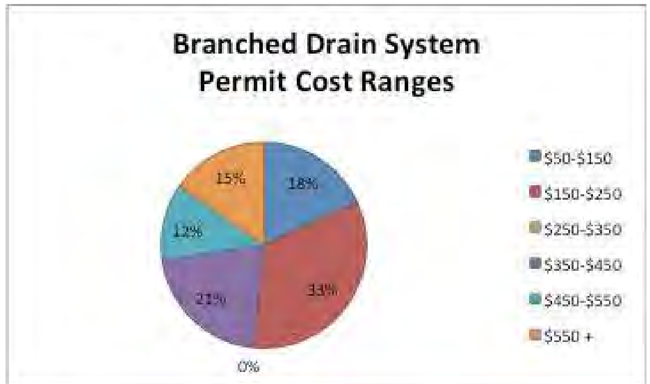
Pumped Systems
A total of 75% of pumped system had labor costs between $1,001-$2,000. The remaining 25% of installations had labor costs in the range of $2,501-$3,000. Pumped systems often combine flows from more than one greywater fixture. Higher labor costs reflect the increased complexity of designing pumped systems, which involves sizing, selecting, and siting an appropriate pump, preparing more complex permit applications and drawings, as well as installing additional electrical outlets and other site specific overflow requirements.

<u>**Permitting Costs**</u>
Installers who reported the lowest permit fees ($50-$150 range) were from the Monterey Peninsula and the San Francisco Bay area. Higher permit fees were defined as >$550. Installers from the Los Angeles area reported the highest permit fees of the study group.

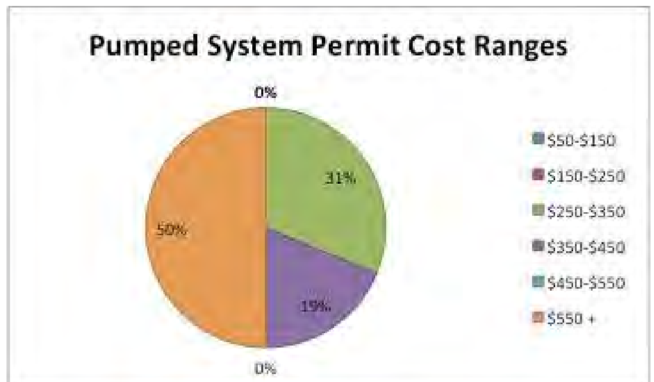
The average permit fee for a branched drain system was $340, although the most common permit fee reported (33% of systems) was between $150-$250.

The average permit fee for a pumped system was $540, although the most common permit fee reported (50% of systems) was greater than $550.

When installed by a professional installer, average greywater system permitting costs were 20% and 14% of the total installation cost for branched drain and pumped systems respectively. Homeowners who have the training and skills necessary to install their own greywater irrigation systems will experience lower overall average costs because they are contributing their own labor: $250 for a laundry-to landscape system, $715 for a branched drain system, and $1790 for a pumped system. For homeowners who act as their own contractors, average permitting costs are 48% and 30% of the total installation cost for branched drain and pumped systems respectively.



igure 12



igure 13

<u>Total Average Costs for Three Most Common Types of Greywater Irrigation Systems</u>

igure 14

igure 15

Average materials and labor costs were lowest for laundry to landscape systems. Pumped system had the highest average materials, labor, and permitting costs.

igure 16

Discussion

Overall, the greywater systems in our study saved water and had few problems. Key findings include:

- Per capita water consumption decreased by an average of 17 gallons per day after greywater system installation, at least half of which is directly attributable to water savings from greywater reuse.
- Greywater did not negatively affect soil or plant health.
- Quality of greywater was typically suitable for long-term irrigation of plants, so long as households used products without sodium or boron compounds.
- System users were overwhelmingly satisfied with their systems.
- Though people did very little maintenance on their system, no major problems developed. However, more education and a few changes in design can improve greywater systems to avoid potential problems.

Relationship to Other Studies

Other studies have found the quality of greywater for irrigation to be much lower than ours (Al-Hamaidedeh and Bino, 2010; Alifya, et al., 2012; Misra and Sivongxay 2009). We believe this difference is due to the fact that most of the households in our study changed their products after installing their greywater system, or were already using plant friendly soaps and detergents prior to irrigation with greywater. For example, an Australian a study found the average EC value three times higher than our results, SAR seven times higher, sodium five times higher, and pH 2.7 units higher (Howard, et al., 2005).

It is clear that we cannot form conclusions about the quality of greywater as a source of irrigation without considering the types of products used in the systems, since the quality of greywater is dependent upon what products are used in the home. For example, many people and organizations (Greenplumbers, Duttle for New Mexico State University) report that greywater is alkaline or basic, when, as seen in our study, greywater can actually be acidic depending on what products are used.

Water Savings

Overall water usage decreased after households installed greywater systems by an average of 17 gallons per capita per day (gpcd), which represents an average reduction of 26% (48 gpcd down from 65 gpcd). It is interesting to note that the average reduction of 26% that we found is higher than the target reduction of 20% in the 2020 plan for the state of California.

The range in water savings was large, with maximum savings reaching 122 gpcd. Measuring water savings is not as straight forward as simply looking at water consumption data. Increased water use associated with new landscaping or young children in the home are important considerations when assessing actual savings from a greywater system. Also, behavior factors, such as continued irrigation of plants that are also irrigated with greywater, can negatively affect potential water savings. In our study group most homes (27 households) decreased their total usage. Ten of our study sites increased, with four of the increases explained by an increase in landscaped area, and two by an increase in water use associated with a new baby in the home. We observed some additional trends with water savings:

- Households that used more water to begin with were more likely to see reductions than households that used less water to start with.
- Many households implemented additional water saving techniques after installing their greywater system; these homes saved more water than those that reported they made no other changes in water use, 23 gpcd vs. 11 gpcd.
- There was a wide range of savings, as some households saw reductions seven times higher than the average, and in contrast, some used more water after installing their system then before.

These trends suggest that while greywater systems can save water on their own, they can be effectively incorporated into a wider suite of water saving techniques.

Cost of Greywater Systems

The installation and maintenance of greywater irrigation systems has the potential to create quality green jobs in the water sector. Early adopters of greywater reuse (such as those included in this study) reported investing in a greywater system because of a general concern for saving and reusing water. However, many consumers may be genuinely interested in greywater reuse but will be motivated to actually install a system if there are economic savings over a reasonable period of time.

Our evaluation of average system costs and corresponding payback period under a range of residential water rate scenarios shows that for professionally-installed systems, the payback period for the greywater irrigation system may exceed the period of time the homeowner actually owns the home. As conservation water rates increase, the return on investment of a greywater system becomes more attractive. The calculation does not include other potential benefits of the greywater system that are more difficult to quantify economically, such as “drought insurance” for landscapes during water restrictions, extending the life of septic systems, delaying the need to drill deeper wells, time savings on watering, or increasing a home’s resale value.

Average permitting fees that amount to between 20-48% of the total cost of the system may negatively impact a homeowner’s decision to move forward with a greywater irrigation system installation. Regions with higher permit fees and/or time-consuming permit processes may experience an increase in unpermitted installations by uneducated homeowners and unlicensed contractors. Regions who use inexpensive, over-the-counter permits and streamlined inspections for simple greywater systems will have more opportunities to educate residents about best practices at the permit counter.

To overcome these types of financial barriers, the energy efficiency industry employs a multitude of federal, state, and local financing mechanisms and rebates to incentivize residential energy efficiency and alternative energy installations and upgrades (DOE, Database of State Incentives for Renewables & Efficiency, 2012). Expedited permits or reduced permit fees, state and municipal utility rebate programs, tax credits, PACE programs[7], and other low interest financing should all play an important role in lowering economic barriers to investing in greywater systems for the average consumer. Public agency-sponsored hands-on installation workshops for lower cost laundry to landscape systems are an important strategy for increasing adoption of greywater systems, especially in disadvantaged and lower income communities. Increasing water rates throughout the state, combined with financial incentives and peer-to-peer sharing of greywater system satisfaction will help to drive market demand for greywater irrigation systems in the future.

Use and Maintenance

A large number of our respondents did not maintain their greywater systems adequately. Maintenance for the majority of systems in our study would only require annual replacing of decomposed mulch. This is a simple task, in most situations should take approximately one hour or less. This leads us to conclude that greywater promoters, educators and installers should do more to educate people about how to maintain their systems, and installers should create maintenance contracts with their clients who are unwilling or unable to do this work**.**

Furthermore, we believe that a strong emphasis on appropriate choice of soaps, detergents, and cleaning products is important to improve the quality irrigation water from greywater systems. Most people in our study group used products with little or no salts or boron, resulting in a better quality irrigation water. The few samples that were not safe for irrigation came from households that used either powdered detergents, known to be high in salts, or commercial brands not typically considered "greywater friendly" nor listed all ingredients.

System Performance and Design Recommendations

We observed a few minor problems that could be avoided by better design or more frequent maintenance. A few sites had pooling or runoff of greywater, and a few others experienced uneven distribution of greywater to plants. Locating greywater outlets away from pathways can prevent any pooling that results from lack of maintenance or other causes, from creating a route of exposure to the public. In systems where greywater outlets are located near hardscape, such as the cement paths of the two sites with runoff in our study, any of three simple design changes would have prevented runoff and subsequent potential for public exposure:

- Ensure sufficiently large basin sizes.

7 PACE: Property Assessed Clean Energy, formerly known as Special Energy Financing District

- Move the basin farther from the path.
- Create a mound of soil (a "berm") next to the path to prevent greywater from overflowing onto the path.

Irrigation problems are another potential problem related to system design. We observed two system designs resulting in over-irrigation.

- One system had shut-off valves on all greywater outlets. Someone shut off all but one valve, so all greywater was directed to one tree, resulting in massive over-watering. Poor soil drainage and excess water caused the tree to exhibit signs of stress, so the homeowner watered it more, unaware that the problem was too much water.

- One site had an existing irrigation system that the homeowner did not disconnect or turn off, so the plants were being irrigated twice (greywater and drip system). In this situation there was good drainage and the plants were not harmed, but the system design did not result in water savings.

For the most part, plants grew healthily with greywater with no obvious changes from when they received freshwater irrigation. Several sites reported plants that had been unhealthy becoming healthy after greywater irrigation. One bougainvillea vine didn't flower much until it received greywater, a fig tree began to "thrive", and a lime tree that the homeowner thought was going to die began to flower and produce fruit.

Conclusion and Policy Recommendations

Greywater irrigation is an important component of reducing total residential water consumption. Residential greywater systems can work synergistically with other water conservation strategies, such as lawn removal, conversion of non-greywater irrigated landscapes to xeriscaping or native plantings, rainwater harvesting and rain gardens, and installation of water-efficient fixtures and appliances. In preparation for drought-related water shortages and mandates for reduced water withdrawals to help restore our aquatic ecosystems, water districts can encourage deep savings by promoting a suite of options to reduce water demand by increasing incentives to the homeowner as they incorporate all the strategies.

Our findings suggest five policy approaches that can help agencies and other organizations realize residential greywater systems' water savings potential at scale:

- Simple laundry-to-landscape and branched drain systems should be promoted, as these types of systems are more economical, have few problems, and result in high user satisfaction.
- Education programs should also include support for implementation, since most people installed their systems within a year of learning about greywater. For example, installation workshops, subsidized installations, or referrals to local installers could enable people to follow through with their ideas for a home greywater systems.
- Use of plant-friendly products (without salt and boron) should be emphasized, to ensure good

quality greywater for irrigation.

- To increase water savings, greywater systems should be designed to replace other irrigation methods. Drip irrigation should be removed from greywater-irrigated areas, and supplemental hand watering should be discouraged.
- Thoughtful integration of greywater irrigation with rainwater harvesting, rain gardens, and climate-adapted plantings can maximize outdoor water savings by replacing municipal water as an irrigation water source. Such landscapes will be resilient in the face of future water shortages, and should be promoted as a strategy to increase resilience to droughts and adapt to climate change.

Our study should allay concerns about long-term effects on soils and plants, so long as greywater system owners have proper education about the importance of “plant friendly” products, but key questions about the mechanisms to maximize water savings and economic barriers to widespread adoption and sustained use of greywater irrigation systems remain. Most of our respondents are classic “early adopters”, who were motivated by environmental concerns and desires for a more “eco-friendly” landscape, and who invested a few hundred or thousands of dollars in their greywater systems. Understanding how to recruit other potential adopters is a key area for future research.

We found significant average water savings in households that installed greywater irrigation systems (17 gpcd), but there was significant variation between households, given that many concurrently adopted other water saving practices, while others increased the amount of landscaped area, and others had changes in household size or composition. (Despite these confounding factors, we estimated that at least half of the 17 gpcd was due directly to greywater.) The adoption of multiple conservation measures is encouraging for scale up, but the variability in water savings suggests that how people use systems, and behavioral practices related to irrigation, are also important.

Follow-up studies can be designed to evaluate the long-term effect (more then 3 years) of greywater irrigation on soil and plant health over the growing season. Such a study conducted in a phased matter (over irrigation seasons, e.g. Spring, Summer and Fall), especially in productive urban gardens, along with documentation of plant species irrigated, yields obtained over the growing season, and detergents used will strengthen the evidence for greywater reuse in residential irrigation. Such studies will also make a case for productivity of greywater irrigation, strengthening the socio economic angle for greywater reuse.

Finally, follow-up studies should be conducted to investigate the lifetime and long-term maintenance needs of these systems. These studies should assess the lifetime of system components, the effects of different maintenance regimes, whether new owners and residents understand and choose to maintain the systems, and how systems fare when new residents undertake major changes to the landscape.

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NORTHERN &
CENTRAL
DELTA-
MENDOTA

September 9, 2021

Matt Zidar
San Joaquin County
1810 E. Hazelton Avenue
Stockton, CA 95201

Re: Northern and Central Delta-Mendota Groundwater Sustainability Agency (GSA) Management Committees Comments on the Draft Tracy Subbasin Groundwater Sustainability Plan

Dear Mr. Zidar,

Representatives from the Northern and Central Delta-Mendota Region GSA Management Committees (Management Committees) have coordinated in preparing this comment letter on the draft Tracy Subbasin Groundwater Sustainability Plan (Tracy GSP). Members of the Management Committees collaborated to develop and submit the Northern & Central Delta-Mendota Region GSP (NCDM GSP), which was submitted as a separate GSP, but in coordination with five additional GSPs in the Delta-Mendota Subbasin in January 2020. The NCDM GSP Region borders the southern portion of the Tracy Subbasin, so groundwater management activities in both the Delta-Mendota and Tracy subbasins are critical to successful long-term management and sustainability.

Representatives from GSAs and consultant staff for both the Delta-Mendota and Tracy subbasins, along with staff from the San Luis & Delta-Mendota Water Authority (SLDMWA) representing NCDM GSP, have participated in public workshops and reviewed the Tracy GSP and meeting materials.

Additionally, representatives from both GSPs have previously met to discuss monitoring networks along the shared subbasin boundary. Building on past coordination and in anticipation of ongoing shared interest in long-term groundwater sustainability, representatives from the Management Committees have reviewed content in the Tracy GSP that references the NCDM GSP or other Delta-Mendota Subbasin activities.

The following areas were identified needing additional coordination and cooperation between our subbasins to further our shared interest in regional groundwater sustainability:

- Use of NCDM GSP implementation data to close the gap in water level Measurable Objectives and Minimum Thresholds for representative monitoring network wells located along the subbasin boundary.
- Jointly analyze data on subsurface groundwater exchanges rather than rely on modeling to better inform assumptions within the Tracy GSP draft on Water Budget (Section 7.7), Chronic

Lowering of Groundwater Levels (Section 9.3.1), and Degraded Water Quality (Section 9.6.5) as they relate to the Delta-Mendota Subbasin.

- Table 8.4 – Data Gap Monitoring Wells highlights several proposed monitoring wells that are of interest to the Management Committees due to their location near the subbasin boundary (also depicted in Figures 8-1 and 8-2). Knowledge of these sites' water levels and quality will aid the NCDM GSP's understanding of subsurface boundary flows and regional water quality. Sharing available data from well construction and monitoring will support shared efforts between the Tracy GSP and NCDM GSP.
- We feel that there is a general perception that actions in neighboring subbasins have a greater influence on some general conditions and sustainable management criteria in the Tracy Subbasin than activities within the Tracy Subbasin itself, admittedly without conclusive data to substantiate those inferences. We disagree with that perception.
- The Management Committees are interested in sharing information regarding future development along the subbasin boundary that may affect groundwater levels, quality, and access in the NCDM GSP area. Members are interested in ongoing communication regarding development and well permitting activity and seek ongoing awareness of activities that may affect the NCDM GSP's successful implementation.

We look forward to working with the GSAs in the Tracy Subbasin to further our shared interest in regional groundwater sustainability.

Sincerely,

Bobby Pierce
Northern Management Committee Chairperson

Aaron Barcellos
Central Management Committee Chairperson

APPENDIX R
RESOLUTIONS TO ADOPT GSP

Notice of Intent to Adopt GSP

Stewart Tract

TRACY

August 6, 2021

Via email and U.S. mail

Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: *Notice of Intent to Adopt a Groundwater Sustainability Plan*

The Groundwater Sustainability Agencies (GSAs) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSAs), pursuant to California Water Code Section 10728.4, hereby give notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that they intend to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

The undersigned GSAs specifically provide notice to the City of Lathrop, City of Tracy, Alameda County, and San Joaquin County of the GSAs' intent to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below.

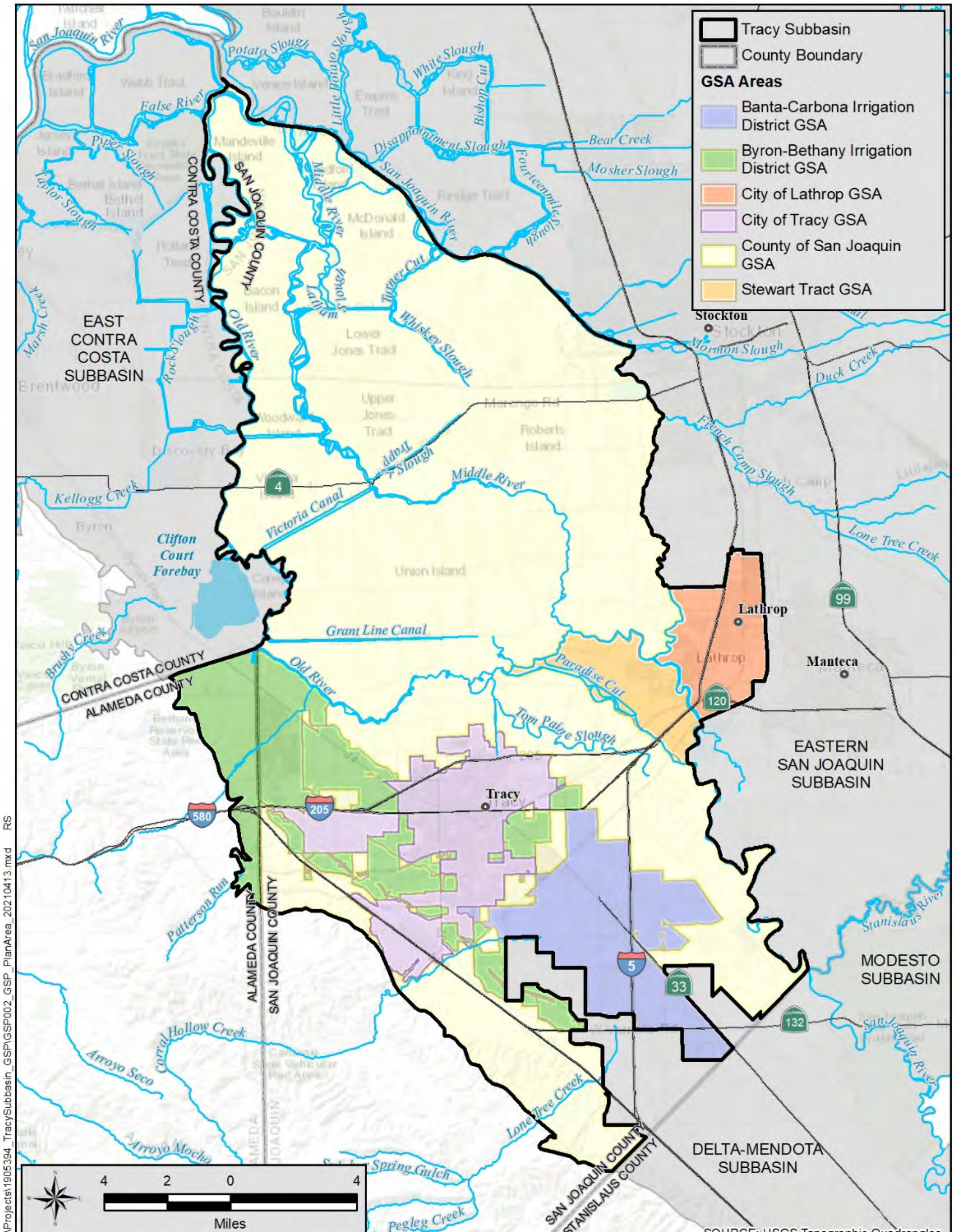
Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460.

Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit www.tracysubbasin.org/meetings.

The GSAs look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative.

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA



Tracy Subbasin San Joaquin and Alameda Counties	GEI Consultants	GSP Plan Area and GSAs
Tracy Subbasin		APRIL 2021 FIGURE 2-1

13-Apr-2021 Z:\Projects\1905394_TracySubbasin_GSP\GSP002_GSP_PlanArea_20210413.mxd RS

RESOLUTION 2021-16
RESOLUTION AUTHORIZING A NOTICE OF INTENT
TO ADOPT
THE TRACY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

WHEREAS**,** in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d));

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727);

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15);

WHEREAS, in order to exercise the authority granted by SGMA, a local agency may decide to become a GSA;

WHEREAS, the Byron-Bethany Irrigation District (BBID or District) is a local agency as defined by SGMA;

WHEREAS, on March 21, 2017, the District Board of Directors adopted Resolution No. 2017-5, thereby deciding to become the GSA for the areas of the Tracy Subbasin (Subbasin No. 5-22.15) within the District boundaries in Contra Costa and San Joaquin Counties, and both within and outside the District boundaries in Alameda County;

WHEREAS, the District subsequently transmitted notice of its intent to become a GSA consistent with Resolution No. 2017-5 to DWR, and following the required notice, became the GSA for the areas of the Tracy Subbasin within the District boundaries in Contra Costa and San Joaquin Counties, and both within and outside the District boundaries in Alameda County;

WHEREAS, on February 11, 2019, DWR released the final basin boundary modification for the Tracy Subbasin, and thereby divided the Tracy Subbasin into the East Contra Costa and Tracy Subbasins;

WHEREAS, BBID has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 *et seq*.); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, BBID is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP;

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4).

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors hereby approves and authorizes the filing of the Notice of Intent, attached as Exhibit "A", to adopt the Final Tracy Subbasin GSP.

PASSED AND ADOPTED at a Rescheduled Meeting of the Board of Directors of Byron-Bethany Irrigation District on 29 June 2021 by the following vote:

AYES: ALVAREZ, KAGEHIRO, M.MAGGIORE, T.MAGGIORE, PEREIRA, TUSO
NOES:
ABSENT: ENOS
ABSTAIN:

/s/ Russell Kagehiro
Mr. Russell Kagehiro, President

****

Secretary's Certification

I, Kelley Geyer, Deputy Secretary of the Board of Directors of Byron-Bethany Irrigation District, do hereby certify that the foregoing Resolution is a true and correct copy entered into the Minutes of the Rescheduled Meeting of 29 June, 2021, at which time a quorum was present, and no motion to amend or rescind the above resolution was made.

/s/ Kelley Geyer
Kelley Geyer, Deputy Secretary

RESOLUTION NO. 2021-02

RESOLUTION OF THE BANTA CARBONA IRRIGATION DISTRICT AUTHORIZING ISSUANCE OF NOTICE OF INTENT TO ADOPT A GROUNDWATER SUSTAINABILITY PLAN

A. WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("**SGMA**") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

B. WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("**GSPs**"), which can be a single plan developed by one or more groundwater sustainability agency ("**GSA**") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

C. WHEREAS, SGMA requires a GSA to manage groundwater in all basins designated by the Department of Water Resources ("**DWR**") as a medium or high priority, including the Tracy Subbasin; and

D. WHEREAS, the Banta-Carbona Irrigation District ("**BCID**") formed a GSA for the purposes of sustainably managing groundwater in the Tracy Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

E. WHEREAS, BCID has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 *et seq.*); and

F. WHEREAS, BCID has joined with other GSAs to develop a single GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6 (i)); and

G. WHEREAS, the GSAs preparing the GSP for the Tracy Subbasin are finalizing the GSP for the Tracy Subbasin; and

H. WHEREAS, the GSAs must release a Notice of Intent to Adopt the GSP pursuant to Water Code section 10728.4.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of Banta-Carbona Irrigation District as follows:

1. BCID hereby approves and authorizes issuance of a Notice of Intent to Adopt a Groundwater Sustainability Plan for the Tracy Subbasin as required by Water Code Section 10728.4.

2. BCID authorizes its consultant, Stantec, to issue the Notice of Intent on its behalf.

PASSED, APPROVED, AND ADOPTED this 14th day of July, 2021 by the following vote:

AYES: Directors James M. Thoming, Glenn Robertson, Mark Cardoza and Annette Elissagaray
NAYS: None
ABSTAIN: None
ABSENT: Director Keith Robertson

President

Attest:

Margaret Howe, Secretary

Date: 8/5/2021

ITEM 5.1

CITY MANAGER'S REPORT
JULY 12, 2021 CITY COUNCIL REGULAR MEETING

ITEM: **AUTHORIZE NOTICE OF INTENT TO ADOPT THE GROUNDWATER SUSTAINABILITY PLAN FOR THE TRACY SUBBASIN**

RECOMMENDATION: **Adopt a Resolution Authorizing a Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin**

SUMMARY:

On August 29, 2014, the California Legislature passed the comprehensive groundwater legislation Sustainable Groundwater Management Act (SGMA). SGMA provides a framework for sustainable groundwater management in California, and can be found in Senate Bills 1168 and 1319 and Assembly Bill 1739.

The City of Lathrop is one of six Groundwater Sustainability Agencies (GSAs) that form the Tracy Subbasin. Under SGMA, the GSAs must complete a Groundwater Sustainability Plan (GSP) and submit such plan to the Department of Water Resources (DWR) by January 31, 2022. Under a Memorandum of Agreement (MOA) executed on September 24, 2019, the City of Lathrop and the other five local agencies have been collaborating to develop a single GSP for the Tracy Subbasin.

The final GSP for the Tracy Subbasin will be presented to Council for adoption consideration in October or November of 2021. At least 90-days prior to the adoption hearing, the GSAs in the Tracy Subbasin are required by SGMA to send a Notice of Intent to adopt the GSP (Notice of Intent) to the cities and counties within the GSP area.

Staff recommends that Council, as the governing body of the City of Lathrop Groundwater Sustainability Agency (GSA), adopt the attached Resolution authorizing release of Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin.

BACKGROUND:

On August 29, 2014, the California Legislature passed comprehensive groundwater legislation contained in Senate Bills 1168 and 1319 and Assembly Bill 1739, which are collectively referred to as the Sustainable Groundwater Management Act (SGMA). SGMA provides a framework for sustainable groundwater management in California.

SGMA requires government and water agencies in groundwater basins designated as medium or high priority by the California Department of Water Resources (DWR) to meet certain requirements:

- Form new Groundwater Sustainability Agencies (GSA) by June 30, 2017.
- Complete and submit a Groundwater Sustainability Plan (GSP) to DWR by January 31, 2020 for critically over drafted basins and by January 31, 2022 for non-critically over drafted basins.
- Update the GSP every five years.
- Achieve basin sustainability within 20 years of submitting the GSP.

The City of Lathrop overlies the Tracy Subbasin, which is designated by the State as a medium-priority, non-critically over drafted basin. Pursuant to the requirements of SGMA, the City of Lathrop originally formed as a GSA on October 3, 2016, for the portion of the City located east of the San Joaquin River and within the Eastern San Joaquin Subbasin. In 2018, the DWR approved a Basin Boundary Modification such that the City of Lathrop was located entirely within the Tracy Subbasin. Five other GSAs located in the Tracy Subbasin include the Banta-Carbona Irrigation District GSA, Byron-Bethany Irrigation District GSA, City of Tracy GSA, San Joaquin County GSA, and Stewart Tract GSA (herein collectively referred to as the "Tracy Subbasin GSAs").

On September 24, 2019, the Tracy Subbasin GSAs executed a Memorandum of Agreement to coordinate groundwater management and develop a single GSP for the Tracy Subbasin, which is due to the State no later than January 31, 2022. Local agencies have collaboratively managed groundwater resources in the Tracy Subbasin for decades. As a result of these efforts, groundwater resources in the basin are already sustainable. The GSP will provide a roadmap to continue to the sustainability of the region's groundwater supplies.

The GSP is being collaboratively developed with input from the six GSAs, as well as input from members of the public provided through monthly meetings, public workshops, and public comment periods. The Draft GSP is anticipated to be released for public comment and review in August 2021.

SGMA requires GSAs to adopt the final GSP at a public hearing. At least 90-days prior to the hearing, the GSA must send a notice to cities and counties within the plan area notifying them of the proposed GSP. This requirement is identified in Section 10728.4 of the California Water Code, which states that:

A groundwater sustainability agency may adopt or amend a groundwater sustainability plan after a public hearing, held at least 90 days after providing notice to a city or county within the area of the proposed plan or amendment. The groundwater sustainability agency shall review and consider comments from any city or county that receives notice pursuant to this section and shall consult with a city or county that requests consultation within 30 days of receipt of the notice. Nothing in this section is intended to preclude an agency and a city or county from otherwise consulting or commenting regarding the adoption or amendment of a plan.

The final GSP for the Tracy Subbasin will be presented to Council for consideration to adopt at a regular public hearing held in October or November of 2021. At least 90-days prior to the adoption hearing, the GSAs in the basin will send a Notice of Intent to Adopt the GSP (Notice of Intent) to cities and counties within the GSP area. A copy of this Notice of Intent is provided as Attachment B.

REASON FOR RECOMMENDATION:

Pursuant to SGMA requirements, staff recommends Council to adopt a resolution authorizing a Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin.

FISCAL IMPACT:

There is no fiscal impact at this time for releasing the Notice of Intent to Adopt the Tracy Subbasin Groundwater Sustainability Plan.

ATTACHMENTS:

A. Resolution Authorizing Notice of Intent to Adopt the Groundwater Sustainability Plan for the Tracy Subbasin

B. Notice of Intent to Adopt the Tracy Subbasin Groundwater Sustainability Plan

APPROVALS:

Greg Gibson Senior Civil Engineer	6/28/2021 Date
Michael King Director of Public Works	6/23/2021 Date
Cari James Director of Finance	6/23/2021 Date
Glenn Gebhardt City Engineer	6/28/21 Date
Salvador Navarrete City Attorney	6-24-2021 Date
Stephen J. Salvatore City Manager	6-30-21 Date

RESOLUTION 21 -____

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF LATHROP AUTHORIZING A NOTICE OF INTENT TO ADOPT THE GROUNDWATER SUSTAINABILITY PLAN FOR THE TRACY SUBBASIN

WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15); and

WHEREAS, the City of Lathrop GSA was formed as a GSA on October 3, 2016, for the purposes of sustainably managing groundwater in the Eastern San Joaquin Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

WHEREAS, in October 2018, the DWR approved a jurisdictional Basin Boundary Modification such that the City of Lathrop was located entirely within the Tracy Subbasin; and

WHEREAS, the City of Lathrop GSA has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 et seq.); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, the GSAs submitted an Initial Notification to DWR to jointly develop a GSP for the Tracy Subbasin on February 12, 2018; and

WHEREAS, the City of Lathrop GSA is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP; and

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4).

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Lathrop, as the governing body of the City of Lathrop Groundwater Sustainability Agency, hereby approves the Notice of Intent (Attachment B to the City Managers Report) to adopt the final Tracy Subbasin Groundwater Sustainability Plan.

The foregoing resolution was passed and adopted this 12th day of July, 2021, by the following vote of the City Council, to wit:

AYES:

NOES:

ABSTAIN:

ABSENT:

____

Sonny Dhaliwal, Mayor

ATTEST:

____

Teresa Vargas, City Clerk

APPROVED AS TO FORM:

____

Salvador Navarrete, City Attorney

Stewart Tract

TRACY

Attachment B

[Date]

Via email and U.S. mail

Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: *Notice of Intent to Adopt a Groundwater Sustainability Plan*

The Groundwater Sustainability Agencies (GSAs) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSAs), pursuant to California Water Code Section 10728.4, hereby give notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that they intend to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

The undersigned GSAs specifically provide notice to the City of Lathrop, City of Tracy, Alameda County, and San Joaquin County of the GSAs' intent to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below.

Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460.

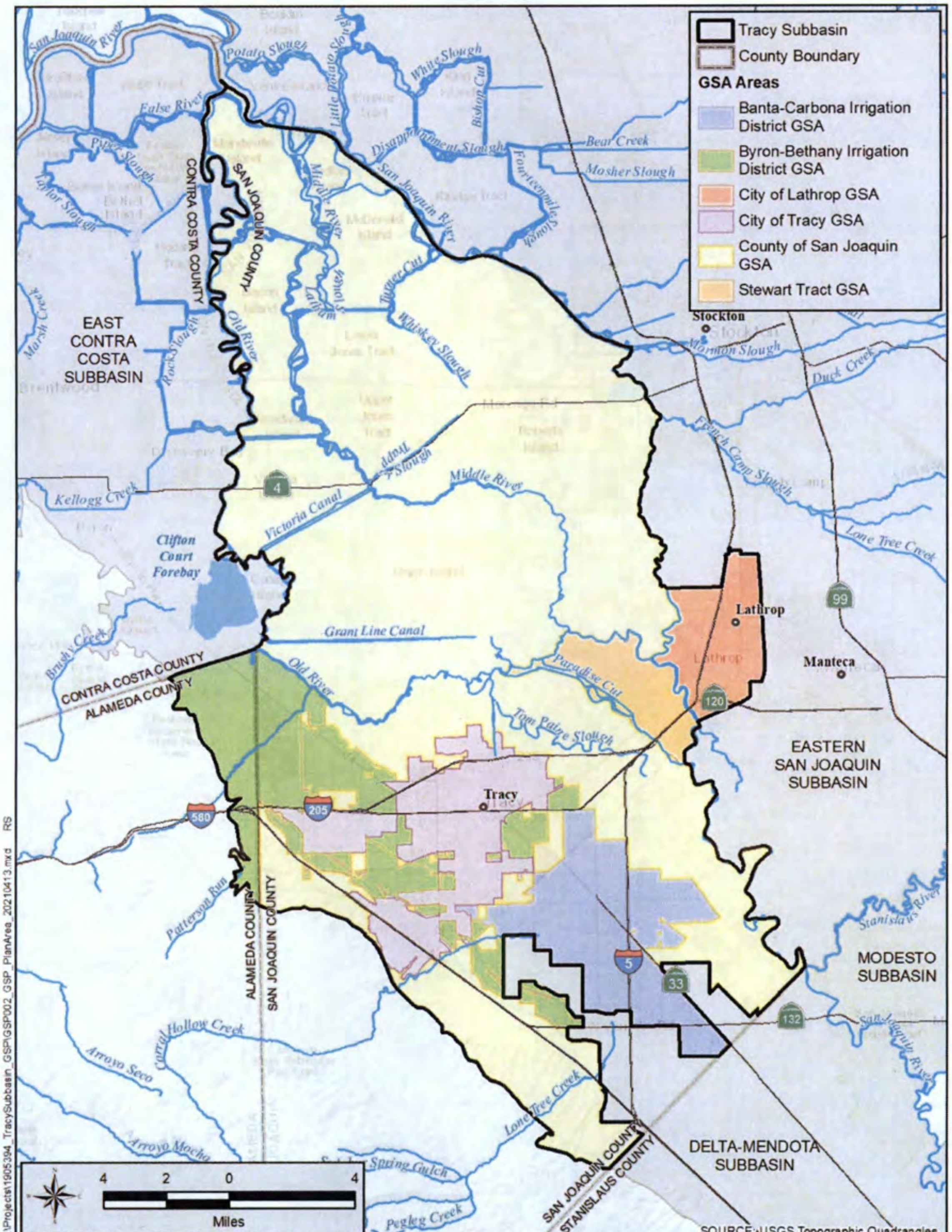
Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit www.tracysubbasin.org/meetings.

The GSAs look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative.

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA

Stewart Tract



Tracy Subbasin San Joaquin and Alameda Counties	GEI Consultants	GSP Plan Area and GSAs
Tracy Subbasin		APRIL 2021 — FIGURE 2-1

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RESOLUTION 2021-092

APPROVING NOTICE OF INTENT TO ADOPT THE TRACY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15); and

WHEREAS, City of Tracy was formed as a GSA on February 2, 2016, by City Council per Resolution 2016-026, for the purposes of sustainably managing groundwater in the Tracy Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

WHEREAS, City of Tracy has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 *et seq.*); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, the GSAs submitted an Initial Notification to DWR to jointly develop a GSP for the Tracy Subbasin on February 12, 2018; and

WHEREAS, the City of Tracy is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP; and

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4);

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Tracy hereby approves the Notice of Intent to adopt the final Tracy Subbasin GSP at least 90 days from the issuance of this notice.

* *

The foregoing Resolution 2021-092 was adopted by the Tracy City Council on the 20th day of July, 2021, by the following vote:

AYES: COUNCIL MEMBERS: ARRIOLA, BEDOLLA, DAVIS, YOUNG

NOES: COUNCIL MEMBERS: NONE

ABSENT: COUNCIL MEMBERS: VARGAS

ABSTAIN: COUNCIL MEMBERS: NONE

MAYOR

ATTEST

CITY CLERK

1.

SAN JOAQUIN COUNTY
FLOOD CONTROL & WATER CONSERVATION DISTRICT
P. O. BOX 1810
1810 EAST HAZELTON AVENUE
STOCKTON, CALIFORNIA 95201
TELEPHONE (209) 468-3000
FAX NO. (209) 468-2999

KRIS BALAJI
DIRECTOR OF PUBLIC WORKS
FLOOD CONTROL ENGINEER

July 22, 2021

Via email and U.S. mail
Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: Notice of Intent to Adopt a Groundwater Sustainability Plan

The San Joaquin County (SJC) Groundwater Sustainability Agency (GSA) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSA), pursuant to California Water Code Section 10728.4, hereby gives notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that it intends to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

Notice is hereby provided to the City of Lathrop, the City of Tracy, and Alameda County of its intention to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below:

Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460

Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit:

www.tracysubbasin.org/meetings

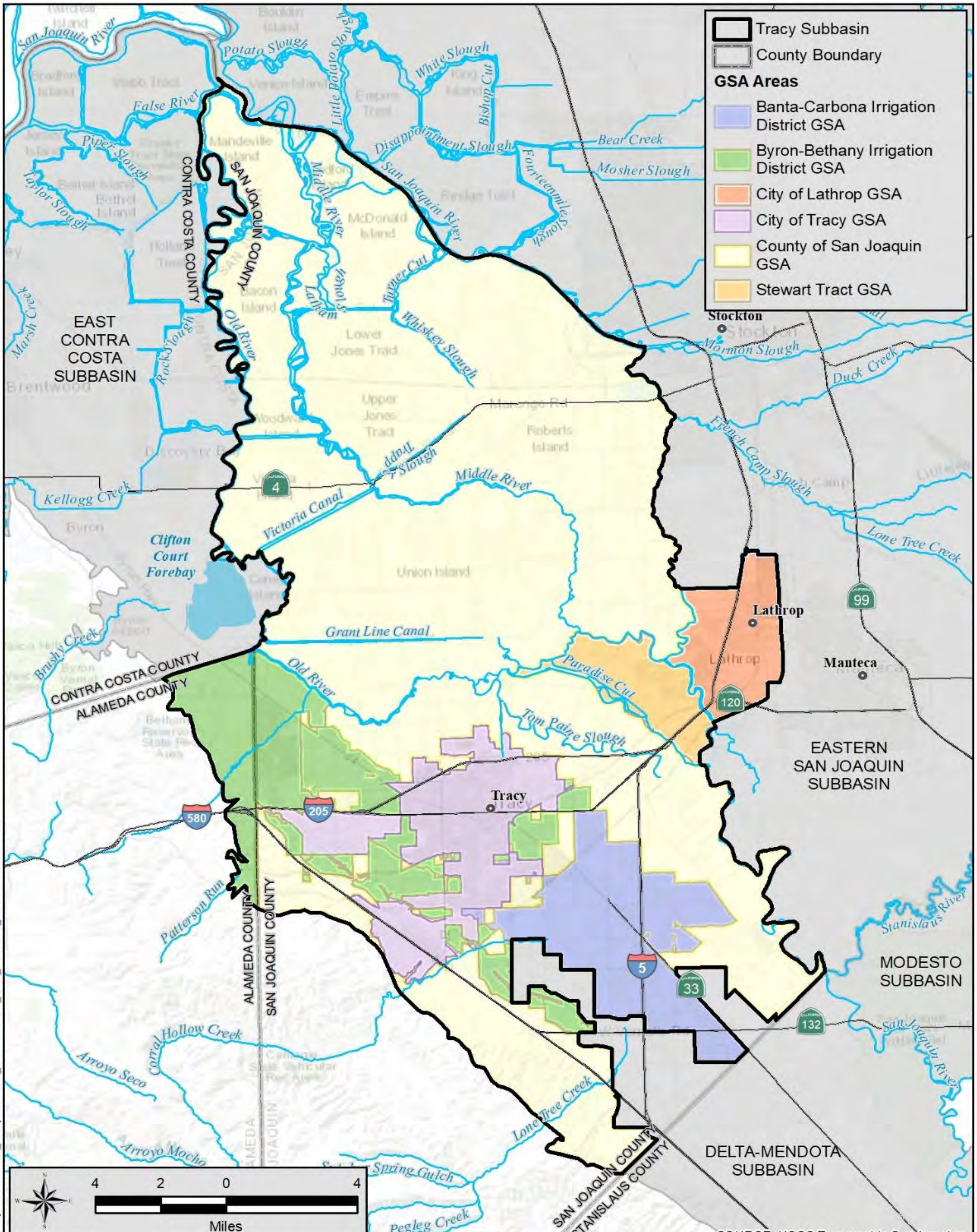
The GSAs of the Tracy Subbasin look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative. The Tracy Subbasin GSAs are as follows:

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA

By:____

Matt Zidar
GSP Coordinator, San Joaquin County GSA



Tracy Subbasin San Joaquin and Alameda Counties	GEI Consultants	GSP Plan Area and GSAs
Tracy Subbasin		APRIL 2021 FIGURE 2-1

13-Apr-2021 Z:\Projects\1905394_TracySubbasin_GSP\GSP002_GSP_PlanArea_20210413.mxd RS

STEWART TRACT GROUNDWATER SUSTAINABILTY AGENCY

RESOLUTION NO. 21-1

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE STEWART TRACT GROUNDWATER SUSTAINABILITY AGENCY AUTHORIZING A NOTICE OF INTENT TO ADOPT THE TRACY SUBBASIN GROUNDWATER SUSTAINABILITY PLAN

WHEREAS, in August 2014, the California Legislature passed, and in September 2014 the Governor signed, legislation creating the Sustainable Groundwater Management Act ("SGMA") "to provide local groundwater sustainability agencies with the authority and technical and financial assistance necessary to sustainably manage groundwater" (Wat. Code, § 10720, (d)); and

WHEREAS, SGMA requires sustainable management through the development of groundwater sustainability plans ("GSPs"), which can be a single plan developed by one or more groundwater sustainability agency ("GSA") or multiple coordinate plans within a basin or subbasin (Wat. Code, § 10727); and

WHEREAS, SGMA requires a GSA manage groundwater in all basins designated by the Department of Water Resources ("DWR") as a medium or high priority, including the Tracy Subbasin (designated basin number 5-22.15); and

WHEREAS, Stewart Tract GSA was formed as a GSA on June 13, 2017 for the purposes of sustainably managing groundwater in the Tracy Subbasin, within its jurisdictional boundaries, pursuant to the requirements of SGMA; and

WHEREAS, Stewart Tract GSA has the authority to draft, adopt, and implement a GSP (Wat. Code, § 10725 et seq.); and

WHEREAS, on September 24, 2019, the GSAs executed a Memorandum of Agreement for the purpose of developing a GSP and coordinating sustainable groundwater management in the Tracy Subbasin (Wat. Code, § 10723.6(i)); and

WHEREAS, the GSAs submitted an Initial Notification to DWR to jointly develop a GSP for the Tracy Subbasin on February 12, 2018; and

WHEREAS, the Stewart Tract GSA is coordinating with the other GSAs in the Tracy Subbasin to draft a single GSP; and

WHEREAS, SGMA requires a GSA to adopt a GSP at a public hearing at least 90 days after providing notice to a city or county within the area of the proposed plan (Wat. Code, § 10728.4).

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Stewart

Tract GSA finds as follows:

Section 1. Incorporation of Recitals. The Recitals are hereby incorporated in full as set forth above.

Section 2. Approval of Notice of Intent. Stewart Tract GSA hereby approves the notice of intent, attached in Exhibit A, to adopt the final Tracy Subbasin GSP .

Section 3. Official Actions. The President is authorized to transmit a conformed copy of this Resolution to the other member GSA's of the Tracy Sub-Basin as evidence of the Stewart Tract GSA's formal action.

Section 4. Effective Date. This Resolution shall take effect immediately upon its adoption by the Board of Directors.

* * * * * * *

PASSED, APPROVED AND ADOPTED this 4th day of August 2021.

By: ______________________________
President,
Stewart Tract Groundwater Sustainability Agency

ATTEST:

By: ______________________________
Director,
Stewart Tract Groundwater Sustainability Agency

I, Ramon Batista, Director of the Stewart Tract Groundwater Sustainability Agency, do hereby certify that the following resolution was duly passed and adopted by the Board of Directors of Stewart Tract Groundwater Sustainability Agency, at a special meeting thereof held on the 4th day of August 2021.

AYES: Director:

NOES: Director:

ABSENT: Director:

ABSTAINED: Director:

By: ______________________________
Director,
Stewart Tract Groundwater Sustainability Agency

Stewart Tract

TRACY

[Date]

Via email and U.S. mail

Alameda County
City of Lathrop
City of Tracy
San Joaquin County

RE: *Notice of Intent to Adopt a Groundwater Sustainability Plan*

The Groundwater Sustainability Agencies (GSAs) of the Tracy Subbasin (referred to herein as the Tracy Subbasin GSAs), pursuant to California Water Code Section 10728.4, hereby give notice to the legislative body of any city, county, or Public Utilities Commission-regulated company within the geographic area covered by the pending Tracy Subbasin Groundwater Sustainability Plan (GSP) that they intend to adopt a GSP for the Tracy Subbasin (Basin No. 5-022.15). A map of the GSP area is included herein.

The undersigned GSAs specifically provide notice to the City of Lathrop, City of Tracy, Alameda County, and San Joaquin County of the GSAs' intent to adopt the Tracy Subbasin GSP no earlier than 90-days upon your receipt of this notice. Considerations to adopt this joint document shall occur as part of the public hearings to be held individually by the undersigned GSAs.

Cities or counties that receive this notice may request to consult on the Tracy Subbasin GSP. These requests must be received within 30 calendar days upon receipt of this notice. Written requests to consult with one or more of the GSAs intended to adopt the Tracy Subbasin GSP shall be delivered to the GSP coordinator identified below.

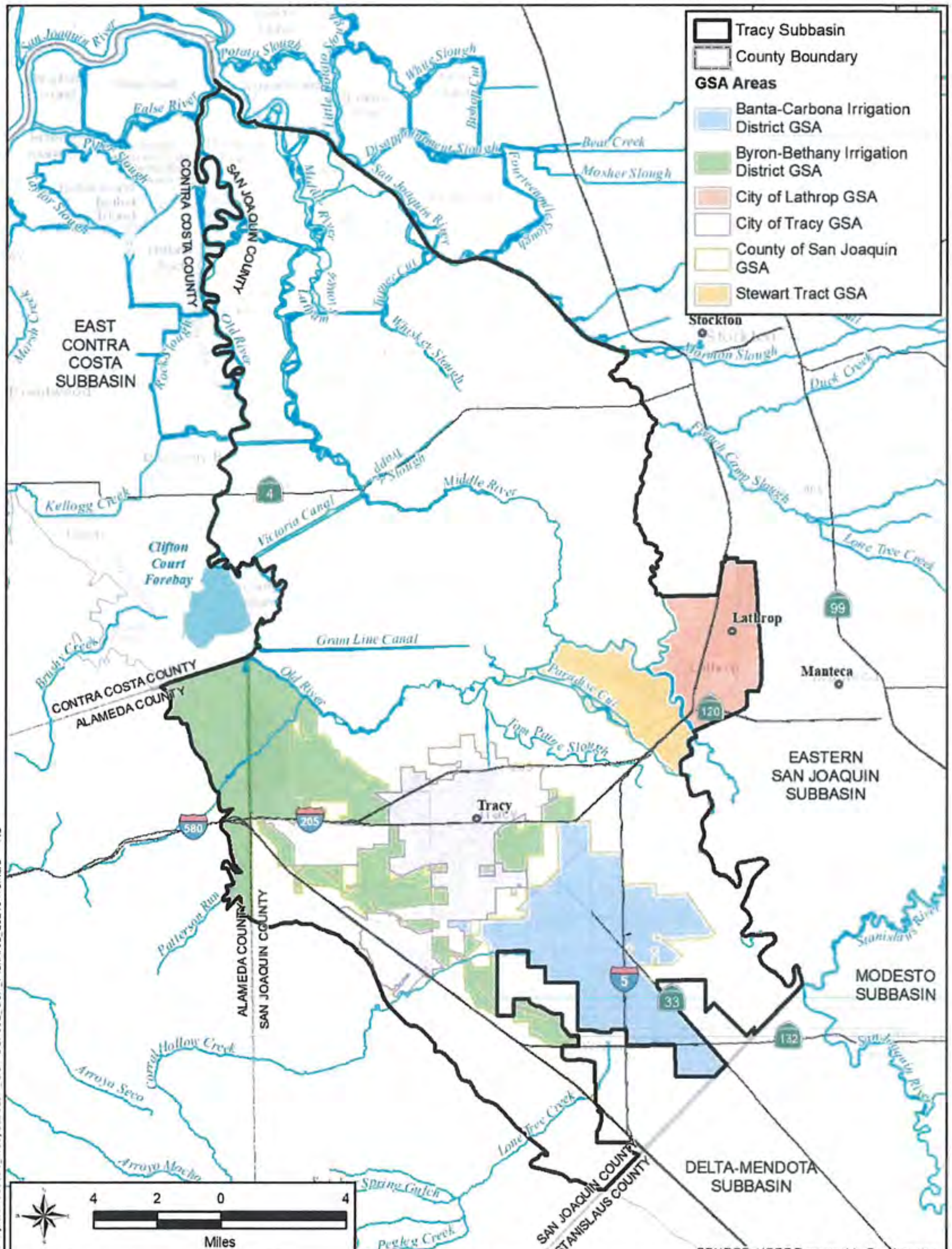
Matt Zidar, San Joaquin County
mzidar@sjgov.org or by phone at (209) 953 -7460.

Interested parties may provide comments on the Public Draft GSP during the scheduled public comment period, August 9 through September 9, 2021. Information regarding the Draft GSP has been posted on the Tracy Subbasin website at tracysubbasin.org. The Draft GSP can be viewed on the website homepage. To review the list of GSA public hearings schedule for adoption proceedings of the Tracy Subbasin, visit www.tracysubbasin.org/meetings.

The GSAs look forward to adopting a GSP for the Tracy Subbasin. Should you have any questions about this notice, please contact your local GSA representative.

GSAs:

- Banta-Carbona Irrigation District GSA
- Byron-Bethany Irrigation District GSA
- City of Lathrop GSA
- City of Tracy GSA
- San Joaquin County GSA
- Stewart Tract GSA



Tracy Subbasin San Joaquin and Alameda Counties	GEI Consultants	GSP Plan Area and GSAs
Tracy Subbasin		APRIL 2021 FIGURE 2-1

13-Apr-2021 Z:\Projects\1905394_TracySubbasin_GSP\GSP002_GSP_PlanArea_20210413.mxd RS

Groundwater Sustainability Agencies
GSP Adoption Resolutions