



**RIVER ISLANDS AT LATHROP
PHASE 1 AREA**

**REPORT OF ADEQUATE PROGRESS
TOWARDS AN URBAN LEVEL OF FLOOD
PROTECTION**

FEBRUARY 2017

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INTRODUCTION

In 2007, the California Legislature passed Senate Bill (SB) 5, which requires all cities and counties within the Sacramento-San Joaquin Valley to make findings related to an urban level of flood protection for lands within a flood hazard zone. The bill defined "urban level of flood protection" as the level of flood protection necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources (DWR). Furthermore, the SB 5 legislation required a city or county, prior to making any number of land use decisions beginning in July 2016, to demonstrate that there is an urban level of flood protection, impose conditions that will achieve the urban level of flood protection, or demonstrate adequate progress toward providing an urban level of flood protection. In November 2013, DWR released guidelines for implementing the legislation titled, *Urban Level of Flood Protection Criteria* (ULOP Criteria).

The River Islands at Lathrop (River Islands) project is a master planned community located within the limits of the City of Lathrop on Stewart Tract. Stewart Tract is an island in the Sacramento-San Joaquin Delta and is surrounded by federally authorized "Project" levees with Island Reclamation District 2062 (RD 2062) comprising the area north of the Union Pacific Railroad (UPRR) and Reclamation District 2017 (RD 2107) comprising the southern portion. The River Islands project area is coincident with the jurisdictional boundary of RD 2062 which serves as both the local maintaining agency for levees and the local flood management agency as defined by State law for the River Islands project area.

The River Islands project area can be delineated into the Phase 1 and Phase 2 Areas. The Phase 1 area is further delineated into the Stage 1 Area, Stage 2A Area, and the Stage 2B Area which are collectively bounded by the existing Stage 1 Levee System comprised of the Perimeter Levee, Interior Levee, and Cross Levee; the existing Stage 2A Levee; and future Stage 2B Levee (Plate 1).

The Stage 1 Area was subject to an Adequate Progress Finding (APF) made by the City of Lathrop in 2016. At that time, the intent was to certify that the Stage 1 Levee System would provide an urban level of flood protection upon completion of outstanding procedural actions. However, shortly after the APF, River Islands began and completed construction of the Stage 2A Levee and is currently in the design phase for the Stage 2B Levee, which is scheduled for construction in 2017. Therefore, the City of Lathrop is planning to make an APF, encompassing the entire Phase 1 Area, in March 2017. The APF will heavily rely on the completed 2016 Stage 1 Area APF.

The Phase 2 Area is planned for future development, but plans for the flood protection facilities protecting the Phase 2 Area are still under development. Flood protection for the Phase 1 Area has occurred in stages. With each stage, the previous stage is modified to result in a larger, combined protected area. Implementation of the Phase 2 project will follow the same pattern. Upon completion, the Phase 1 and Phase 2 Areas will be joined, surrounded by a single primary line of flood defense. However, both the Phase 1 APF and the substantial evidence record have been developed blind to the Phase 2 project. Consequently, regardless of the Phase 2 project implementation schedule, the actions required for the Phase 1 levees to meet Urban Levee Design Criteria (ULDC), and thus, for the Phase 1 Area to have an urban level of flood protection, have been clearly identified and scheduled.

- ⌋ The city or county has not been responsible for a significant delay in the completion of the system.
- ⌋ The local flood management agency shall provide the DWR and the CVFPB with the information sufficient to determine substantial completion of the required flood protection. The local flood management agency shall annually report to the CVFPB on the efforts in working toward completion of the flood protection system.

This report addresses each of these items in subsequent chapters.

SCOPE

The ULOP Criteria requires a scope of work for completion of the flood protection system. The specific structural actions necessary for the Phase 1 Area levees to meet ULDC and the procedural actions to demonstrate this compliance are presented in the *Engineer's Report*. Whereas the *Engineer's Report* identifies the specific actions required for each levee, this report presents the efforts underway and planned that will accomplish these actions. Additionally, there are procedural actions required to meet ULOP Criteria beyond what is presented in the *Engineer's Report*.

RIVER ISLANDS STAGE 2B LEVEE PROJECT

The Stage 2B project consists of the design and construction of a new levee, approximately 16,000 feet in length that will provide protection from the 200-year flood event. The levee will be a northwest extension of the Stage 2A Levee. Beginning at approximately Station 77+13 of the Stage 2A Levee, the new Stage 2B Levee will run northwest approximately 5,000 feet, before turning north and then east, running adjacent, but interior, to the Old River levee, until it meets the Stage 2A Levee again at Station 106+64 (Plate 2). With construction of the Stage 2B Levee, the portion of the Stage 2A Levee between the Stage 2B Levee tie-ins (i.e., Stage 2A Levee Station 77+13 to 106+64) will no longer be required to provide an urban level of protection, as the Stage 2B Levee will provide this protection upon completion.

The Stage 2B Levee is currently in the advanced design stage. Construction is planned for summer 2017. Design and construction will follow the same methods used for the Stage 2A Levee and Stage 1, Interior Levee. Many of the products associated with this effort are part of the substantial evidence record and are discussed in more detail below in the "Development of the Substantial Evidence Record" section. This effort is focused on delivery of the actual levee embankment.

SCOUR PREVENTION PROJECTS

As part of the IPE review of the Stage 1 substantial evidence record, the IPE requested that River Islands evaluate the potential for erosion and scour failure of the Stage 1 Interior Levee caused by failure of the Old River Levee. After conferring with the IPE, it became evident that this concern was present for the (then future) Stage 2A Levee and Stage 2B Levee. Furthermore, a similar, but separate concern is present for the Cross Levee, due to its proximity to the UPRR embankment. Evaluations of these concerns are ongoing in close coordination with the IPE. Preliminary alternatives for resolving these concerns have

been identified and include stockpiling of dirt and/or rock, construction of cross dykes, and replacement of drainage facilities, but at this time, a final solution has not been selected or concurred upon by the IPE. In any case, it is expected that resolution of the scour concern related to an Old River levee failure will require approval by the USACE since the Old River Levee is a Federal levee. Resolution of the UPRR embankment failure concern will require coordination with Union Pacific, which owns the railroad embankment. The scour prevention projects will be implemented by River Islands and RD 2062, in conjunction with other agencies.

RD 2062 O&M MODERNIZATION

The ULDC provides requirements to support a modern levee program. This includes ensuring robust operations and maintenance (O&M) practices and procedures are in place for urban levees. To this end, RD 2062 will review its current O&M practices and procedures, and will revise its manual to reflect a modern levee program. This will include new and improved practices and procedures for inspecting encroachments and penetrations, mitigating burrowing rodent damage, managing vegetation, and implementing a security plan. It will also include a review of existing flood safety plans to ensure any plans in place meet ULDC.

This effort was already significantly underway as part of certification efforts for Stage 1; therefore, the work done for Stage 1 will be expanded to the Stage 2A Levee and the Stage 2B Levee. Expected deliverables are:

- } Rodent Control and Abatement Program
- } Encroachment and Penetrations Inspection Logs
- } Erosion Inspection Log
- } Flood Relief Cut Plan
- } Security Plan
- } Flood Safety Plan

RD 2062 RIGHT-OF-WAY ACQUISITION

The ULDC requires fee title or an easement for the entire levee prism extending to a minimum of 20 feet beyond the landside toe of the flood protection system for access and inspection. Furthermore, waterward of the levee prism, where there is sufficient area to do so without resulting in the loss of sensitive riparian habitat, ULDC encourages a 15-foot-wide zone.

River Islands has already transferred maintenance rights to RD 2062 for the Stage 1 Levee system. However, these rights do not meet ULDC; therefore, an exception is required. For the Stage 2A Levee and the Stage 2B Levee, River Islands will transfer rights to RD 2062 for the entire embankment, 20 feet landward of the landside toes, and 15 feet waterward of the waterside toes. Expected deliverables are:

- } Justification for exception to ULDC for right-of-way for Stage 1 Levee System
- } Recorded deeds for all right transfers

DEVELOPMENT OF THE SUBSTANTIAL EVIDENCE RECORD

Although the Phase 1 levees will meet ULDC, there is a considerable amount of effort involved in developing the substantial evidence record needed to demonstrate this fact. The substantial evidence record for the Stage 1 Levee System is virtually complete, but there are a few outstanding items that require completion or transition to a record that will support the Stage 2A Levee and 2B Levee. Most of the evaluations concerning the Stage 2A Levee are complete, but these evaluations still require documentation. Currently, the Stage 2B Levee evaluations are underway. Given the status of the Stage 2B Levee, most of the evaluations for the Stage 2A Levee and Stage 2B Levee will be jointly documented.

As individual memoranda, reports, and other documents are prepared, they will be compiled to form the foundation of the substantial evidence record. RD 2062 will then prepare an *Engineer's Report*, which summarizes the compliance of the Phase 1 levees with the ULDC. The substantial evidence record, including the *Engineer's Report*, will then be reviewed by the IPE. The IPE's review will be documented in a report, and subsequently, added to the substantial evidence record. Lastly, the certifying engineer will prepare a response to the IPE's review.

Expected deliverables are:

- } Stage 1, Stage 2A, and Stage 2B – Exception to Emergency Actions
- } Stage 1, Stage 2A, and Stage 2B –UPRR scour evaluation memorandum
- } Stage 1 - Exception to ULDC for Right-of-Way
- } Stage 2A and Stage 2B - Water surface elevations technical memorandum
- } Stage 2A and Stage 2B - Minimum top of levee evaluation memorandum
- } Stage 2A and Stage 2B - Geotechnical evaluation report
- } Stage 2A and Stage 2B - Levee Loading evaluation memorandum
- } Stage 2A and Stage 2B - Old River scour evaluation memorandum
- } Stage 2A - Wind setup and wave runup evaluation report
- } Stage 2B - Wind setup and wave runup evaluation report
- } Stage 2A and Stage 2B - real estate deeds
- } RD 2062 Updated O&M Manual (i.e., O&M Modernization documents)
- } Phase 1 Urban Level of Flood Protection Engineer's Report
- } Phase 1 Urban Level of Flood Protection IPE's report

ULOP CRITERIA PROCEDURAL ACTIONS

Finally, in addition to the structural and procedural actions required to meet ULDC and described above, there also remains several procedural actions required to support a future ULOP Finding:

- } RD 2062 adoption of the ULDC certification package comprised of:
 - a. Engineer's Certification
 - b. Engineer's Report
 - c. IPE report
 - d. Engineer's Response
- } RD 2062 transmittal of the ULDC certification package to the City of Lathrop
- } City of Lathrop preparation of the ULOP Finding

City of Lathrop adoption of ULOP Finding

SCHEDULE

The required actions identified in the Engineer’s Reports, which are being accomplished through the aforementioned efforts, will take several years to complete. Some of the efforts will be conducted concurrently, while other efforts will be staggered. It is possible that these efforts could be complete as soon as 2023, as shown in **Table 1**. However, it is also possible that some or all of the actions and efforts identified may be postponed or eliminated, due to the future Phase 2 project, which would make portions of the Interior Levee, Stage 2A Levee, and Stage 2B Levee, no longer necessary for 200-year protection. Regardless, the schedule below does not take this fact into consideration; the schedule assumes that the City of Lathrop will make a ULOP finding for the Phase 1 Area prior to completion of the Phase 2 Project.

Table 1. Project Schedule

ACTION	ESTIMATED START	ESTIMATED COMPLETION
Stage 2B Levee Project - Design	Underway	2017
Stage 2B Levee Project - Construction	2017	2018
Scour Prevention Project - Old River – Design and Permitting	2018	2020
Scour Prevention Project - Old River - Construction	2020	2020
Scour Prevention Project - UPRR – Design and Permitting	2018	2020
Scour Prevention Project – UPRR - Construction	2020	2020
RD 2062 O&M Modernization	Underway	2018
RD 2062 Transfer of Real Estate Rights for Stage 2A Levee and Stage 2B Levee	2018	2021
Development of the Substantial Evidence Record	Underway	2021
ULOP Criteria Procedural Actions	2021	2023

Table 2 presents the status of compliance for each criterion, by levee. Both **Table 1** and **Table 2** will be updated annually as part of the annual report.

Table 2. Status of Compliance With ULDC

ULDC	CURRENT STATUS ¹ & ESTIMATED COMPLETION DATE ²					ESTIMATED COMPLETION DATE FOR PHASE 1 ³
	STAGE 1 PERIMETER LEVEE	STAGE 1 INTERIOR LEVEE	STAGE 1 CROSS LEVEE	STAGE 2A LEVEE	STAGE 2B LEVEE	
7.1 DESIGN WATER SURFACE	○	○	○	◐	◑	2019
				2018	2018	
7.2 MINIMUM TOP OF LEVEE	○	○	○	◑	◑	2020
				2018	2018	
7.3 SOIL SAMPLING, TESTING, AND LOGGING	○	○	○	◑	◑	2020
				2018	2018	
7.4 SLOPE STABILITY	○	○	○	◑	◑	2020
				2018	2018	
7.5 UNDERSEEPAGE	○	○	○	◑	◑	2020
				2018	2018	
7.6 LEVEE LOADING	○	○	○	◑	◑	2019
				2018	2018	
7.7 SEISMIC VULNERABILITY	○	○	○	◑	◑	2020
				2018	2018	
7.8 LEVEE GEOMETRY	○	○	○	◑	◑	2020
				2018	2018	
7.9 INTERFACES AND TRANSITIONS	○	○	○	◑	◑	2020
				2018	2018	
7.10 EROSION	◐	◑	◑	◑	◑	2020
	2018	2018	2018	2018	2018	
7.11 RIGHT-OF-WAY	◑	◑	◑	◑	◑	2021
	2017	2018	2017	2019	2019	
7.12 ENCROACHMENTS	○	○	○	◑	◑	2020
				2018	2018	
7.13 PENETRATIONS	○	○	○	◑	◑	2020
				2018	2018	
7.14 FLOODWALLS, RETAINING WALLS, AND CLOSURE STRUCTURES	○	○	○	◑	◑	2020
				2018	2018	
7.15 ANIMAL BURROWS	◑	◑	◑	◑	◑	2018
	2017	2017	2017	2017	2017	
7.16 LEVEE VEGETATION	○	○	○	◑	◑	2020
				2018	2018	
7.17 WIND SETUP AND WAVE RUNUP	○	○	○	◐	◑	2020
				2018	2018	
7.18 SECURITY	○	○	○	◑	◑	2020
				2018	2018	
7.19 SEA LEVEL RISE	○	○	○	◐	◑	2019
				2018	2018	
7.20 EMERGENCY ACTIONS	○	◑	◑	◑	◑	2020
		2018	2018	2018	2018	

- Action Required (Not used in table.)
- ◑ In-Progress. Evaluations underway and construction required.
- ◑ In-Progress. Development of the substantial evidence record underway.
- ◐ In-Progress. IPE Review remaining.
- No Action Required

Notes:

- ¹ Current status at the time of the annual report.
- ² Estimated completion date for the specific action (e.g., IPE Review).
- ³ Estimated date all actions required to meet ULDC will be complete.
- ⁴ Estimated complete date for the specific action has been adjusted. See Expanded Table Notes. (Applicable to future versions of this table).

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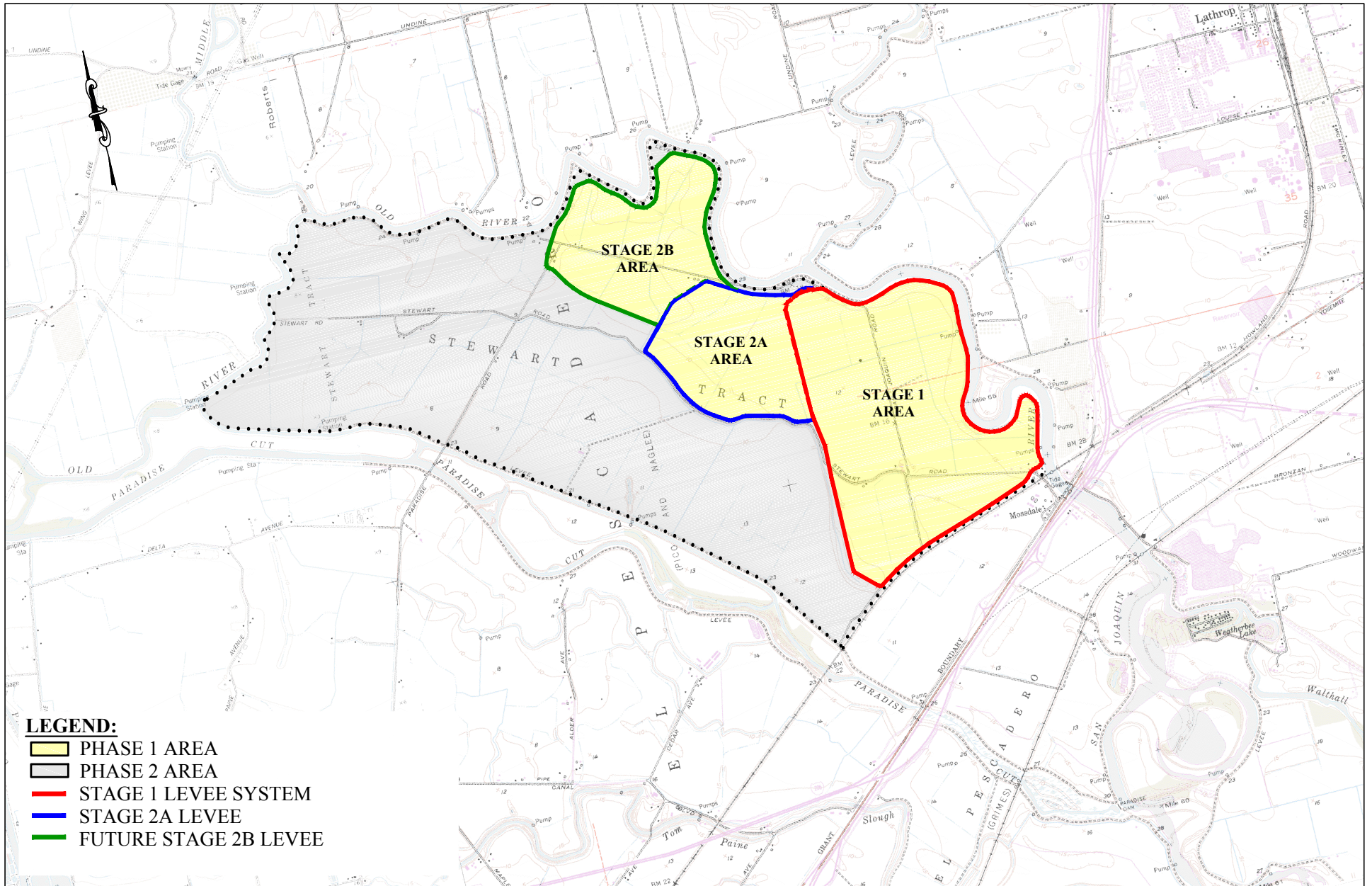
As required by ULOP Criteria, RD 2062 will report on its progress in providing an urban level of flood protection on an annual basis to the CVFPB. The progress reports will include an update to the scope of work, schedule, and the cost and revenues.

PLATES

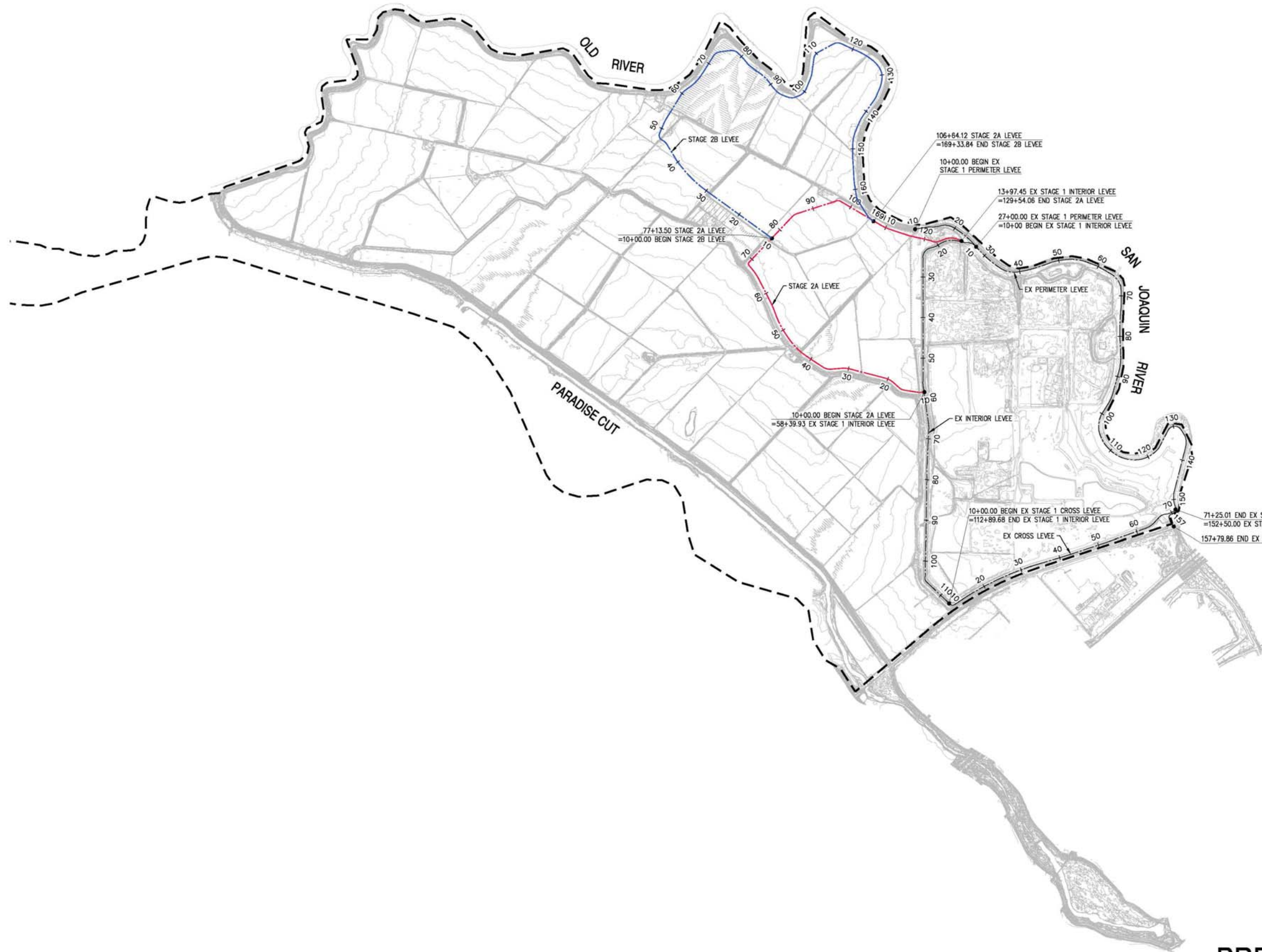


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River Islands Phases and Stages



- LEGEND**
- RIVER ISLANDS BOUNDARY
 - STAGE 1 LEVEE
 - STAGE 2A LEVEE
 - STAGE 2B LEVEE

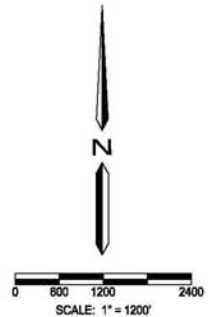


PLATE 2

**PRELIMINARY
LEVEE ALIGNMENT EXHIBIT
RIVER ISLANDS**

CITY OF LATHROP SAN JOAQUIN COUNTY CALIFORNIA
DATE: OCTOBER 24, 2016



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Pleasanton, CA 94588
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APPENDICES

Appendix A	Engineer's Certification
Appendix B	Engineer's Response
Appendix C	Report by the Independent Panel of Experts
Appendix D	Engineer's Report

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APPENDIX A. ENGINEER'S CERTIFICATION



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Water Resources ♦ Flood Control ♦ Water Rights

GILBERT COSIO, JR., P.E.
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 GARY KIENLEN, P.E.
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 NATHAN HERSHEY, P.E., P.L.S.
 LEE G. BERGFELD, P.E.
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ANGUS NORMAN MURRAY
 1913-1985

CONSULTANTS:
 JOSEPH I. BURNS, P.E.
 DONALD E. KIENLEN, P.E.

CERTIFICATION

This certification is provided to the City of Lathrop, River Islands at Lathrop, and Reclamation District (RD) 2062 for the sole purpose of supporting an Adequate Progress Finding (APF). This certification is made in accordance with the requirements, definitions, and descriptions in the State of California Department of Water Resources' (DWR) *Urban Level of Flood Protection Criteria* (November 2013), Section 2, Subsection *EVD-3* and *Urban Levee Design Criteria* (ULDC) (May 2012), Section 7.0 *Urban Levee Design Criteria*.

All information, calculations, definitions, descriptions, restrictions, limitations, or other pertinent data contained or referenced in this document form the basis of this certification. This certification does not constitute a warranty or guarantee of performance, expressed or implied. This certification is made with respect to the River Islands at Lathrop Stage 2A and 2B Levees (Levees), as described in the *Reclamation District 2062, River Islands at Lathrop Stage 2A and 2B Levees, Adequate Progress Towards an Urban Level of Flood Protection Engineer's Report, January 2017* (Engineer's Report).

Limits and Conditions of This Certification

This certification shall expire or become invalid at the earliest time any of the following conditions are met:

- ⌋ A certification of an urban level of flood protection for the Levees.
- ⌋ Integrity of the Levees has degraded to the point that the identified actions will not be adequate to provide an urban level of flood protection, as determined by me, or a duly qualified designated successor.
- ⌋ Discovery of any substantive defect in the condition of any component of the Levees that was not known at the time this certification was made, and which materially affects the Levees' ability to provide protection relative to the 0.5 percent annual flood, as determined by me, or a duly qualified designated successor.

Certification Statement

At the request of RD 2062, as supported by the information contained and referenced within the Engineer's Report, this is to certify the following:

- ⌋ *Certification of Data and Information* – The data and information presented in this report are accurate to the best of my knowledge.
- ⌋ *Certification of Analysis* – To the best of my knowledge, the analyses conducted were performed in accordance with DWR's ULDC and/or sound engineering practices, in a manner consistent with the degree of skill and care ordinarily exercised by members of the civil engineering profession currently practicing in the same locality under similar conditions.

I, Richard Reinhardt, PE, a professional registered civil engineer in the State of California, certify that the aforementioned levee system, as described in the *Reclamation District 2062, River Islands at Lathrop, Stage 2A and 2B Levees, Adequate Progress Towards an Urban Level of Flood Protection Engineer's Report, January 2017* will provide an urban level of flood protection upon completion of the substantial evidence record.



Signed: January 6, 2017

APPENDIX B. ENGINEER'S RESPONSE



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ENGINEER'S RESPONSE TO

**INDEPENDENT PANEL OF EXPERTS REPORT ON THE REVIEW OF
*RIVER ISLANDS AT LATHROP, STAGE 2A AND 2B LEVEES,
ADEQUATE PROGRESS TOWARDS AN URBAN LEVEL OF FLOOD
PROTECTION, ENGINEER'S REPORT, DATED JANUARY 2017,
PREPARED BY RECLAMATION DISTRICT 2062***

PREPARED BY: RICHARD G. REINHARDT, P.E.

JANUARY 30, 2017

Reclamation District 2062 issued its final *River Islands at Lathrop, Stage 2A and 2B Levees, Adequate Progress Towards an Urban Level of Flood Protection, Engineer's Report* (Engineer's Report) in January 2017. Subsequently, the RD 2062 Urban Level of Flood Protection Independent Panel of Experts (IPE) reviewed the Engineer's Report and issued its own report (Letter, Subject: *River Islands at Lathrop, Stage 2A and 2B Levee System, Adequate Progress Towards an Urban Level of Flood Protection, Independent Panel of Experts' Review of Engineer's Report*) on their review on January 28, 2017. State of California, Department of Water Resources' Urban Level of Flood Protection Criteria requires a response by the Engineer to the IPE's report.

After review of the IPE's report, I concur with the IPE's opinion indicating the Engineer's Report documents the criteria, evaluations, and construction that will be implemented to provide an urban level of flood protection and does not provide substantial evidence that an urban level of flood protection currently exists. The IPE also reviewed a previous draft of the Engineer's Report dated November 2016. The IPE provided non-substantive, but valuable comments on the draft and these were considered and incorporated as appropriate. The IPE had no additional comments on the January 2017 Engineer's Report. In support of the APF, there are no outstanding or unresolved comments from the IPE.

Signed,



Ric Reinhardt, PE
MBK Engineers

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APPENDIX C. IPE REPORT



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January 28, 2017

Ms. Susan Dell'Osso, President
Reclamation District 2062
73 West Stewart Road
Lathrop, CA 95330

**Subject: River Islands at Lathrop, Stages 2A and 2B Levee System
Adequate Progress towards an Urban Level of Flood Protection
Independent Panel of Experts' Review of Engineer's Report**

Dear Ms. Dell'Osso:

Introduction

This letter serves as the Independent Panel of Experts' (IPE) report on the review of the Reclamation District (RD) 2062, *River Islands at Lathrop Stage 2A and 2B Levee System, Adequate Progress Towards an Urban Level of Flood Protection Engineer's Report, January 2017* (Engineer's Report) for levees protecting the Phase 1 development area of River Islands on Stewart Tract. The Engineer's Report was prepared by MBK Engineers.

Stages 2A and 2B are additional ring levee cells within the interior of Stewart Tract that are adjacent to and abut the Stage 1 ring levee previously constructed in Stewart Tract. Together, Stages 1, 2A, and 2B comprise the Phase 1 development area of Stewart Tract. Stewart Tract is part of the Sacramento-San Joaquin Delta and part of the City of Lathrop in San Joaquin County, California.

The intent of the Engineer's Report is to demonstrate by substantial evidence in the record that a 200-year Urban Level of Flood Protection (ULOP) will exist within the Phase 1 development area if all of the actions outlined in the Engineer's Report are completed. Specifically, the purpose of the Engineer's Report is to document the work done to date and what additional work needs to be completed to assure that the 200-year ULOP will exist no later than 2025. The Stages 1 and 2A levee systems have been constructed, while the Stage 2B levee system has not yet been built. The Engineer's Report will be used to support an Adequate Progress Finding (APF) to be made by the City of Lathrop that the Stages 2A and 2B levee systems are making adequate progress towards a 200-year ULOP. The City of Lathrop previously completed an APF for the Stage 1 portion of the Phase 1 development area in June 2016.

A review of the Engineer's Report by the IPE is required in order to complete the APF. The IPE previously reviewed the Engineer's Report and other supporting documents for the Stage 1

portion of the Phase 1 development area and documented its conclusions in a June 9, 2016 report. The IPE concurred at that time that there was substantial evidence in the record demonstrating that the Stage 1 levee system will provide a 200-year ULOP for the Stage 1 protected area upon completion of all of the actions outlined in that Engineer's Report.

The IPE has reviewed the current Engineer's Report for the Stages 2A and 2B levee systems. However, no specific documentation regarding the engineering analyses, evaluations, or construction documentation have yet been provided for the Stages 2A or 2B levee systems for IPE review. Instead, the Engineer's Report has been developed to simply document the criteria, evaluations, and construction that will be implemented to support a 200-year ULOP once the work for the Stages 2A and 2B have been completed.

The IPE concurs that a 200-year ULOP will exist in all of the Phase 1 development area if all of the actions outlined in the current Engineer's Report for Stages 2A and 2B are implemented. However, the IPE wishes to stress that the current Engineer's Report for Stages 2A and 2B is an outline of the criteria needed for meeting the substantial evidence in the record documentation requirements, and not yet the substantial evidence itself. The IPE is willing to provide this concurrence because of the close coordination between the IPE and the River Islands Design Team and the work done in reviewing the evaluations and construction completed to date for the Stage 1 levee systems. It should also be noted that the 200-year ULOP for the Phase 1 development area also depends upon the documentation and work still needed in the Stage 1 levee system to meet a 200-year ULOP.

Background

The Phase 1 River Island levee system is located entirely within RD 2062 and is composed of the following levee segments:

- **Stage 1 Levee System** – The Stage 1 Levee System is comprised of the following three levee reaches:
 - Perimeter Levee – The Perimeter Levee is part of the San Joaquin River left bank levee between the northwestern branch of the Union Pacific Railroad (UPRR) and the junction with Old River. It is approximately 12,500 feet long. The Perimeter Levee was greatly enlarged (widened) in recent years by constructing competent levee fill adjacent to and landward of the existing levee. This configuration resulted in levee crowns much wider than common levee sections. Levee crowns along the Perimeter Levee range from a minimum width of about 70 feet to over 300 feet in width, as compared to a nominal 20-foot-width generally required for levees meeting the ULOP.
 - Cross Levee – The Cross Levee is the segment of the Stage 1 ring levee that parallels the northwestern UPRR embankment. It is approximately 6,000 feet long and has a minimum levee crown width of about 50 feet. It is normally a dry-land levee that provides flood protection only if certain portions of the San Joaquin River, Old River, or Paradise Cut levees fail and flood Stewart Tract.

- **Interior Levee** – The Interior Levee is the segment of the Stage 1 ring levee on the west side of the Stage 1 project area and runs between the Cross Levee and the Perimeter Levee. The Interior Levee joins the Perimeter Levee near the junction of the San Joaquin River with Old River. It is approximately 10,000 feet long and has a minimum levee crown width of about 40 feet. It is also a normally dry-land levee that provides flood protection only if certain portions of either the San Joaquin River, Old River, or Paradise Cut levees fail and flood Stewart Tract.
- **Stage 2A Levee System** – The Stage 2A Levee System was constructed in the summer of 2016 and is approximately 12,000 feet long. It is a dry-land levee interior to the State-federal levee system surrounding Stewart Tract. It is adjacent to the previously constructed Stage 1 levee system. It should be noted that a portion of the existing Stage 1 Interior levee will eventually be removed as part of the future site development, and that Stages 1 and 2A will be connected into a singular flood protected basin.
- **Stage 2B Levee System** – The Stage 2B Levee System has not yet been constructed. It is planned to be approximately 16,000 feet long. It too is a dry-land levee interior to the State-federal levee system surrounding Stewart Tract. It will be adjacent to the previously constructed Stage 2A levee system. It should be noted that a portion of the existing Stage 2A levee will eventually be removed as part of the future site development and that Stages 1, 2A, and 2B will be connected into a singular flood protected basin.

The River Islands Phase 1 and Phase 2 development areas on Stewart Tract are illustrated in Figure 1 below:

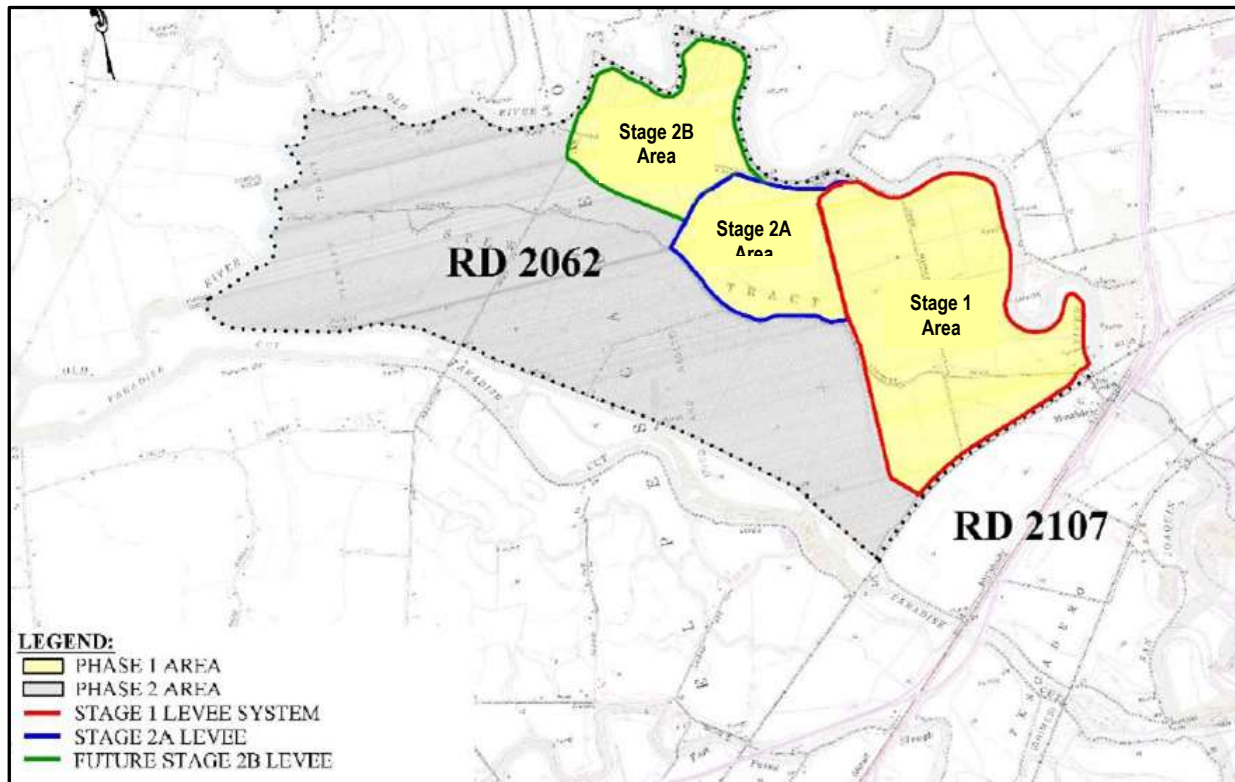


Figure 1: River Islands at Lathrop - Phase 1 Project (adapted from MBK, 2017)

Senate Bill 5, enacted in 2007, requires cities and counties within the Sacramento-San Joaquin Valley to make a finding related to the Urban Level of Flood Protection criteria before approving certain land-use decisions within a flood basin. The finding can be either a finding that the levee system **provides** an Urban Level of Flood Protection, or a finding that **adequate progress** is being made towards providing an Urban Level of Flood Protection. In this case, the IPE is being asked to review an Engineer's Report for the River Islands Stages 2A and 2B levee systems in support of an APF in fulfillment of this requirement. The technical criteria associated with an Urban Level of Flood Protection and what is required for substantial evidence in the record to support an APF are contained in the following two documents:

1. Urban Levee Design Criteria (ULDC) – published by the Department of Water Resources (DWR) in May 2012, this document provides the engineering criteria and guidance for the design, evaluation, operation, and maintenance of levees and floodwalls that provide a 200-year Urban Level of Flood Protection. It outlines 20 technical areas associated with levee integrity and the evaluations needed to assure an Urban Level of Flood Protection:

- ❖ Section 7.1 - Design Water Surface Elevation
- ❖ Section 7.2 - Minimum Top of Levee
- ❖ Section 7.3 - Soil Sampling, Testing, and Logging
- ❖ Section 7.4 - Slope Stability for Intermittently Loaded Levees
- ❖ Section 7.5 - Underseepage for Intermittently Loaded Levees
- ❖ Section 7.6 - Frequently Loaded Levees
- ❖ Section 7.7 - Seismic Vulnerability
- ❖ Section 7.8 - Levee Geometry
- ❖ Section 7.9 - Interfaces and Transitions
- ❖ Section 7.10 - Erosion
- ❖ Section 7.11 - Right-of-Way
- ❖ Section 7.12 - Encroachments
- ❖ Section 7.13 - Penetrations
- ❖ Section 7.14 - Floodwalls, Retaining Walls, and Closure Structures
- ❖ Section 7.15 - Animal Burrows
- ❖ Section 7.16 - Levee Vegetation
- ❖ Section 7.17 - Wind Setup and Wave Runup
- ❖ Section 7.18 - Security
- ❖ Section 7.19 - Sea Level Rise
- ❖ Section 7.20 - Emergency Actions

2. Urban Level of Flood Protection (ULOP) Criteria – published in November 2013 by DWR, this document describes the procedures for making findings, including the processes for having substantial evidence in the record to make an APF.

To support an APF, the ULOP Criteria includes the following requirements:

“EVD-3: Substantial evidence in the record to support a finding related to an urban level of flood protection based on adequate progress on the construction of a flood protection system shall include the following, at a minimum:

- *A report prepared by a Professional Civil Engineer registered in California to document the data and analyses for demonstrating the property, development project, or subdivision will have an urban level of flood protection at the time when the flood protection system is completed.*
- *A report by an Independent Panel of Experts on the review of the report prepared by the Professional Civil Engineer.*
- *A response by the Professional Civil Engineer to the comments from the Independent Panel of Experts.”*

The ULOP EVD-3 Criteria has other requirements as well, but the subject of this report by the IPE pertains to the second bullet outlined above. Under Section 3.0, Other Considerations, the ULOP Criteria also states:

“The report prepared by a Professional Civil Engineer registered in California should provide the following information as evidence that an urban level of flood protection exists or will exist for the area under consideration:

- *A list of the flood management facilities utilized in providing an urban level of flood protection, including, but not limited to, SPFC facilities.*
- *The location of the flood management facilities utilized in providing an urban level of flood protection.*
- *The entities that operate and maintain the flood management facilities utilized in providing an urban level of flood protection.*
- *A list of, and consideration of, reports, evaluations, inspections, and performance history of the flood management facilities utilized in providing an urban level of flood protection since the previous finding, if any, was made.*
- *The response to the Independent Panel of Experts.”*

Also under Section 3.0, Other Considerations, the ULOP Criteria states:

“The report by an Independent Panel of Experts should consider the assertions made in the Professional Civil Engineer’s report and determine whether:

- *An urban level of flood protection from the identified sources of flooding exists or will exist for the area under consideration, or*
- *The subject flood management facilities meet the Urban Levee Design Criteria (DWR, 2012).*

If the panel does not concur with the assertions made in the Professional Civil Engineer’s report, the report by the Independent Panel of Experts should state the reason(s) for not concurring.”

Engineer's Report for Stages 2A and 2B Prepared by MBK Engineers

The IPE has reviewed two versions of the Engineer's Report prepared by MBK Engineers for the Stages 2A and 2B levee systems. The first version reviewed by the IPE was a draft version dated November 2016. The IPE had several comments on the draft, mostly minor in nature that were related to typographical errors and clarity. MBK Engineers then revised the report to address IPE comments and submitted a final version dated January 2017. The current IPE report and review reflects our reviews of the final versions.

Composition of the IPE

The ULOP Criteria requires an IPE review of the Engineer's Report when flood management facilities and procedures are relied upon to provide an Urban Level of Flood Protection. As described in ULOP Criteria EVD-5, the ULOP Criteria requires a panel of at least three experts with different expertise, including at least one with expertise in hydrology and hydraulics, and at least two with expertise in design and construction of flood management facilities relevant to those under review, in this case, levee systems protecting urbanized areas. This IPE is comprised of Mr. Raymond Costa and Dr. Leslie F. Harder, both of whom have expertise in the design and construction of levees and other flood management facilities, and Dr. David T. Williams who has expertise in hydrology and hydraulics. Copies of the resumes for the IPE members are attached to IPE's June 9, 2016 letter of concurrence for the Stage 1 levee system.

June 9, 2016 IPE Review of the Previous Engineer's Report for the Stage 1 Levee System

The previous June 9, 2016 IPE review of the Stage 1 levee system resulted in the following status of documentation to support a 200-year ULOP using DWR's ULDC criteria:

ULDC Criterion No.	Subject	IPE Conclusion/Status for Stage 1 levee system
7.1	Design Water Surface Elevation	Fully addressed, partially documented, EXCEPTION REQUIRED
7.2	Minimum Top of Levee	Fully addressed and documented
7.3	Soil Sampling, Test and Logging	Fully addressed and documented
7.4	Slope Stability for Interm. Levee	Partially addressed, partially documented
7.5	Underseepage	Partially addressed, partially documented
7.6	Frequently Loaded Levees	Fully addressed and documented
7.7	Seismic Vulnerability	Fully addressed and documented
7.8	Levee Geometry	Fully addressed and documented
7.9	Interfaces and Transitions	Fully addressed and documented
7.10	Erosion	Partially addressed, partially documented
7.11	Right-of-Way	Fully addressed, partially documented, EXCEPTION REQUIRED
7.12	Encroachments	Fully addressed and documented
7.13	Penetrations	Fully addressed and documented
7.14	Floodwalls, Ret. Walls, Closures	Fully addressed and documented
7.15	Animal Burrows	Fully addressed, partially documented
7.16	Vegetation Evaluation	Fully addressed and documented
7.17	Wind Setup and Wave Runup	Fully addressed and documented
7.18	Security	Fully addressed, partially documented
7.19	Sea Level Rise	Fully addressed, partially documented
7.20	Emerg. Actions & Flood Safety Plans	Fully addressed, partially documented

In its review of the Engineer's Report for the Stage 1 levee system, the IPE found that the vast majority of the DWR ULDC criteria had been fully addressed and either partially or fully documented by MBK Engineers. For this reason and because the Engineer's Report provided a full understanding of the additional efforts needed to address the outstanding issues, the IPE concurred with the Engineer's Report for an APF. The major exceptions to fully addressing the criteria involved the following issues:

- Seepage and slope stability of large interior manmade lakes near some levee reaches
- Potential scour erosion of interior ring levee (Cross Levee) due to possible future failure of the adjacent UPRR embankment
- Potential scour erosion of interior ring levee (Interior Levee) due to possible future failure of the nearby Old River Levee

These issues remain outstanding and have not yet been fully addressed and documented for the Stage 1 area. In addition, these same issues will need to be addressed for the Stages 2A and 2B levee systems as interior lakes are also planned for these areas, and because portions of these levees will also be near the existing Old River Levee and susceptible to potential scour erosion if that levee fails. It is also important to note that issues for the Stage 1 levee system would also impact the Stages 2A and 2B development areas if portions of the Stage 1 Interior Levee were removed following construction of the Stages 2A and 2B levees, as is the apparent plan by the River Islands development team. This is because the Stages 2A and 2B development area would then be part of a common basin with the Stage 1 development area.

IPE Review of the Engineer's Report for the Stages 2A and 2B Levee Systems

The IPE reviewed an initial draft of the Engineer's Report for the Stages 2A and 2B Levee Systems dated November 2016 and provided comments to MBK Engineers who prepared the report. MBK Engineers then revised the report and submitted the revised document, dated January 2017, to the IPE for further review. The IPE makes the following observations with regard to the *January, 2017* version of the Engineer's Report in meeting the requirements for an APF for an Urban Level of Flood Protection:

1. The Engineer's Report has been prepared under the direction of a licensed Civil Engineer in the State of California, Mr. Richard G. Reinhardt, who has provided a Certification Statement stating that the Stages 2A and 2B levees will provide an Urban Level of Flood Protection upon completion of the actions identified in the Engineer's Report. Mr. Reinhardt has signed and stamped the Certification Statement (see Attachment 1).
2. The Engineer's Report has prepared a complete list of the flood management facilities, namely the Stage 2A and Stage 2B levee systems.
3. The Engineer's Report identifies in text and in plates the locations of the flood protection facilities as well as levee stationing.
4. The Engineer's Report identifies the local maintaining agencies that operate and maintain the flood management facilities that will be utilized in providing an Urban Level of Flood Protection, namely Reclamation District 2062.

5. The Engineer's Report demonstrates a clear understanding of the requirements of DWR's ULDC and what is needed for the Stages 2A and 2B levee systems to meet them.

In addition, MBK Engineers and other members of the River Islands Team have previously provided substantial evidence in the record indicating that they fully understand the requirements of DWR's ULDC in addressing the APF for the Stage 1 levee system.

It is important to note again that, other than the current Engineer's Report, no specific documentation regarding the engineering analyses, evaluations, or construction documentation have yet been provided for the Stages 2A or 2B levee systems for IPE review. The Engineer's Report simply documents the criteria, evaluations, and construction that have been and *will be implemented* to support a 200-year ULOP. The Engineer's Report concludes that *none* of the ULDC are currently met for either the Stage 2A or Stage 2B levee systems, in part because none of the engineering analyses, evaluations, and related documentation has been reviewed by the IPE. Thus, there remains a significant amount of work, analyses, construction, and documentation to be done before a full finding that a 200-year ULOP exists can be made. Nevertheless, the IPE believes that the Engineer's Report satisfies the requirements for an ULOP APF.

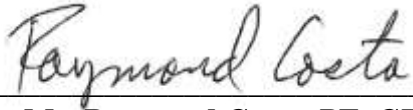
The IPE also wishes to note that while the Stage 2A levee system has already been constructed, additional structural actions may need to be made to this levee system if it is found that the constructed features cannot be fully documented and shown to meet ULDC. Changes to the currently proposed elements of the Stage 2B levee system may also need to be made once the designs for these levees have been reviewed by the IPE. The IPE will also review the Stages 2A and 2B levee systems once construction has been completed.

Conclusion of the IPE

The IPE has reviewed the *January 2017 Engineer's Report* and the Engineer's Certification and concurs that there is substantial evidence in the record demonstrating that the River Islands Stages 2A and 2B levee systems will provide an Urban Level of Flood Protection upon the end of construction and upon completion of the evaluations and documentation that will be added as substantial evidence to the record as identified in the Engineer's Report.

Respectfully submitted,


RIVER ISLANDS IPE TEAM MEMBERS



Mr. Raymond Costa, PE, GE



Dr. Leslie F. Harder, Jr., PE, GE



Dr. David T. Williams, PE, PH, CFM, DWRE

Attachments:

- 1) Certification Statement from Richard Reinhardt, MBK Engineers, dated January 6, 2017

APPENDIX D. ENGINEER'S REPORT



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**RIVER ISLANDS AT LATHROP
STAGE 2A AND 2B LEVEES**

**ADEQUATE PROGRESS TOWARDS AN URBAN
LEVEL OF FLOOD PROTECTION**

ENGINEER'S REPORT

JANUARY 2017

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ACRONYMS AND ABBREVIATIONS

APF	Adequate Progress Finding
DWR	California Department of Water Resources
DWSE	Design Water Surface Elevation
ETL	Engineering Technical Letter
FEMA	Federal Emergency Management Agency
H:V	horizontal-to-vertical ratio
HTOL	Hydraulic Top of Levee
IPE	Independent Panel of Experts
LSJR Model	Lower San Joaquin River HEC-RAS Model
MBK	MBK Engineers
MTOL	Minimum Top of Levee
O&M	operation and maintenance
pcf	pounds per cubic foot
RD	Reclamation District
SB	Senate Bill
SOP	Standard Operating Procedure
SPFC	State Plan of Flood Control
SPK	Sacramento District (USACE)
ULDC	Urban Levee Design Criteria
ULOP Finding	Urban Level of Flood Protection Finding
ULOP Criteria	Urban Level of Flood Protection Criteria
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
WSE	water surface elevation

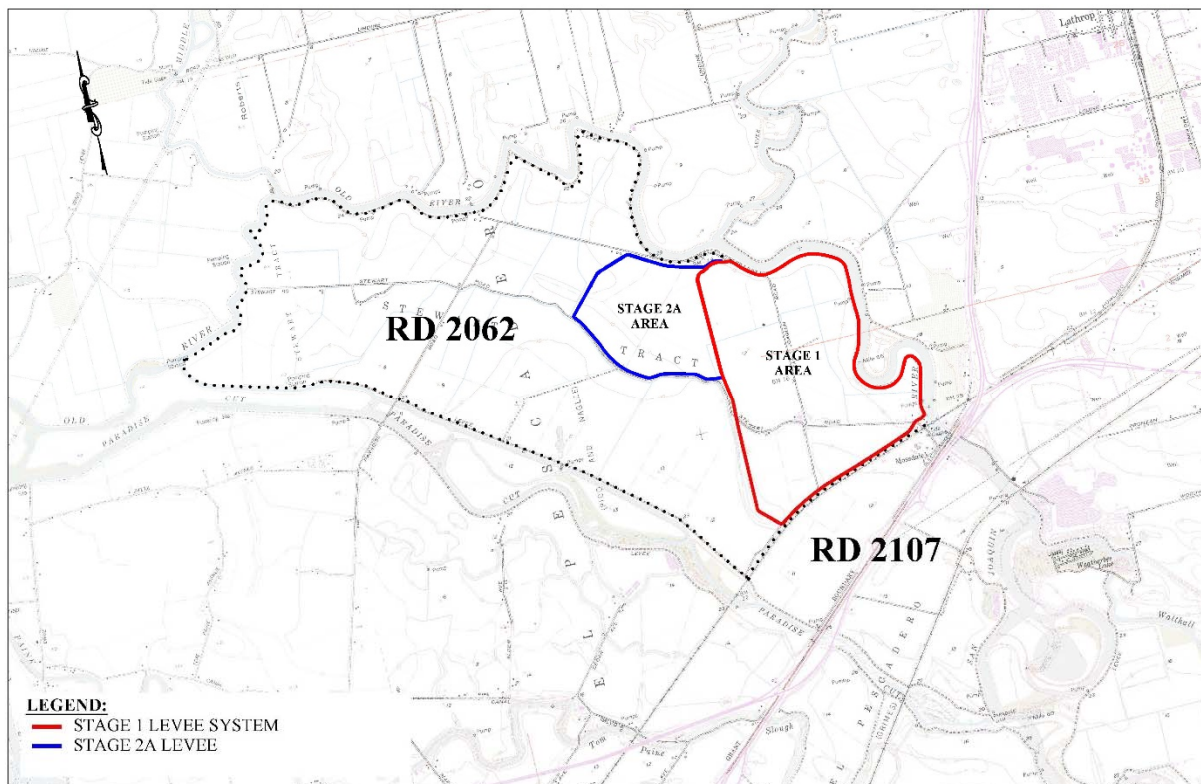
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1.0 INTRODUCTION

In 2007, the California State Legislature passed Senate Bill (SB) 5, which requires all cities and counties within the Sacramento-San Joaquin Valley, to make findings related to an urban level of flood protection for urban and urbanizing lands within a flood hazard zone. The bill defined an "urban level of flood protection" as the level of flood protection necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year, using criteria consistent with, or developed by, the California Department of Water Resources (DWR). The Urban Level of Flood Protection Criteria (ULOP Criteria) implementation guidance, issued by the State of California in November 2013, requires that these findings be based on substantial evidence in the record.

In June 2016, the City of Lathrop (City) made an Adequate Progress Finding (APF) for the River Islands at Lathrop Stage 1 Area (Figure 1) based on certification by Reclamation District (RD) 2062 that the Stage 1 Levee System would provide an urban level of flood protection upon completion of the procedural requirements in the ULOP Criteria. Concurrent with that effort, River Islands constructed a new levee, the Stage 2A Levee in the summer of 2016, which was designed to protect against the 200-year event (Figure 1). The Stage 2A Levee essentially extended the Stage 1 Interior Levee to the west by creating a loop, similar to a backwards "P", thereby expanding the protected area. Additionally, River Islands is currently in the process of designing the Stage 2B Levee, which will further extend the Stage 2A levee (Figure 2) to the west and be a further expansion of the protected area. The Stage 1, 2A, and 2B areas collectively make-up the "Phase 1 Area" (Figure 2).

Figure 1. Existing Phase 1 Levees



RD 2062 has prepared this Engineer's Report to provide substantial evidence that the Phase 1 Levee System (i.e., Stage 1, 2A, and 2B levees) will be able to withstand flooding from a 1-in-200-year flood event upon completion of structural and procedural requirements, in accordance with the State of California's Urban Levee Design Criteria (ULDC), issued in May 2012. This Engineer's Report evaluates the structural flood control facilities, and their associated non-structural components (e.g., security plan, encroachment remediation plan). This document does not evaluate protection from the 1-in-100-year flood event for purposes of accreditation by the Federal Emergency Management Agency (FEMA).

RD 2062 has prepared a separate report, titled River Islands at Lathrop, Phase 1 Area, Report of Adequate Progress Towards an Urban Level of Flood Protection, commonly referred to as the "Adequate Progress Finding Report" or "APF Report", that identifies the scope, schedule, and costs for demonstrating an urban level of flood protection.

REPORT PURPOSE AND ORGANIZATION

The purpose of this report is to present the required information listed above, and to describe the current status of the levee system's compliance with the ULDC. Because the City is amending the Stage 1 Area APF, this report only discusses the Stage 2A and 2B Levees. This report relies on several other documents, reports, analyses, and evaluations to comprise the substantial evidence record in support of an APF. In particular, this report relies heavily, and hereby incorporates by reference, the substantial evidence record presented in the River Islands at Lathrop Stage 1 Engineer's Report (Reclamation District 2062, 2016).

REVIEW BY AN INDEPENDENT PANEL OF EXPERTS

The ULOP Criteria (Section Substantial Evidence, Subsection EVD-5), requires a review by an Independent Panel of Experts (IPE) when flood management facilities are relied upon to provide an urban level of flood protection. The River Islands at Lathrop IPE is comprised of Dr. Les Harder and Mr. Ray Costa, both of whom have expertise in the design and construction of levees and other flood management facilities, and Dr. David Williams who has expertise in hydrology and hydraulics.

The IPE has been heavily engaged in the River Islands at Lathrop project since before 2014. Their engagement has focused on ensuring that levees designed and constructed by River Islands not only meet ULDC, but provide a robust and resilient system. The IPE's review of the Stage 1 Levee System is documented in a report (Costa, Harder, & Williams, 2016), which supports the Stage 1 APF. The IPE's report demonstrates that the IPE has reviewed and concurred with the methods and assumptions used to evaluate the Stage 1 Levee System. As applicable and appropriate, these same methods and assumptions have been, and continue to be, used to evaluate the Stage 2A and 2B Levees.

Following the IPE's review of this Engineer's Report, the IPE will prepare its own report, and the Engineer will prepare a response to the IPE's report. The IPE's report and the Engineer's Response are separate documents that will support the APF.

2.0 DESCRIPTION OF FLOOD MANAGEMENT FACILITIES

As described in the substantial evidence record for Stage 1, the River Islands at Lathrop project is a master planned community located within the limits of the City of Lathrop on Stewart Tract. The island can be divided into two sections, delineated by the Union Pacific Railroad (UPRR) embankment located west of Interstate 5, which coincides with the jurisdictional boundary between Reclamation District (RD) 2062 and RD 2107 (Figure 1). RD 2062 can be further delineated into the Phase 1 and Phase 2 Areas of the River Islands at Lathrop development (Figure 2). The Phase 1 area is bounded by the existing Stage 1 Levees (i.e., Perimeter Levee, Interior Levee, and Cross Levee), existing Stage 2A Levee, and future Stage 2B Levee. The Phase 2 Area is planned for development, but plans for the flood protection facilities protecting the Phase 2 Area are still under development. Therefore, this report and the City's Phase 1 APF, will only address the Phase 1 Area. All of Phase 1 levees are and/or will be maintained by RD 2062.

The Stage 1 substantial evidence record, which is incorporated by reference into this document, describes the Stage 1 levee system. Changes to the Stage 1 levees are planned as described below.

STAGE 2A LEVEE

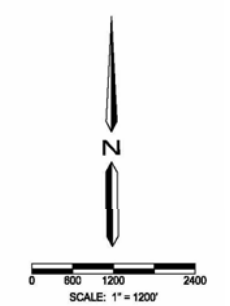
The Stage 2A Levee is a non-Federal levee and is not a SPFC facility; it is approximately 12,000 feet, or 2.2 miles, long. It is a dry-land levee in that it is interior to the federally authorized levees surrounding Stewart Tract. The Stage 2A Levee essentially extended the Stage 1 Interior Levee to the west by creating a loop (Figure 3). Beginning at approximately Station 58+40 of the Interior Levee, the Stage 2A Levee runs northwest for approximately 7,000 feet before turning north, then east, at Old River where it continues adjacent, but interior, to the Old River Levee until it meets the Interior Levee again at Station 13+97. Construction of the Stage 2A Levee meant the portion of the Interior Levee between the Stage 2A Levee tie-ins (i.e., Interior Levee Station 13+97 to 58+40) was no longer required to provide an urban level of flood protection, as the Stage 2A Levee provides this protection. River Islands plans on modifying the Interior Levee between the tie-ins in 2017 for development purposes, since this portion of the Interior Levee no longer serves as a flood protection feature. Specifically, this portion of the Interior Levee is planned for removal; doing so will combine the Stage 1 and Stage 2A Areas.

Construction of the Stage 2A Levee began in April 2016 with removal of existing irrigation infrastructure; excavation of the inspection trench (which is centered on the waterside hinge point for the entire levee extent); and excavation of Lakes 10 and 11, both located within the Stage 2A area. Fill generated through excavation of the inspection trench and Lakes 10 and 11 was used to construct the levee and backfill the inspection trench. Based on observation of the inspection trench and analyses performed between the existing and new levees, no adverse impacts to the Federal levee are expected. The material used for construction met current U.S. Army Corps of Engineers (USACE) and ULDC geotechnical requirements and construction was overseen by geotechnical engineers to ensure conformance with plans and specifications, through visual inspection, and field and laboratory testing. Specifically, material compliance testing performed during levee construction consisted of Atterberg Limits and grain size distribution tests, sampled approximately every 1,000 cubic yards. All soil types were compacted to at least 90 percent relative compaction at a minimum of 3 percentage points over the optimum moisture content (ASTM D-

1557). Levee fill consisted of soil material with a Plasticity Index of 8 or more, a Liquid Limit of less than 50 percent, 20 percent or more passing the No. 200 sieve, and a maximum particle size of 3 inches. Construction was completed in November 2016.

The levee will be maintained by RD 2062. Additional details about the Stage 2A Levee are found in Chapter 3.

Figure 3. Phase 1 Levee Alignments



Source: O'Dell 2016.

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STAGE 2B LEVEE

The planned Stage 2B Levee is a non-Federal levee and not within the SPFC; it is approximately 16,000 feet, or 3.0 miles, long. It is a dry-land levee in that it is interior to the federally authorized levees surrounding Stewart Tract. The Stage 2B Levee will be an extension of the Stage 2A Levee (Figure 3). Beginning at approximately Station 77+13 of the Stage 2A Levee, the levee will run northwest approximately 5,000 feet, before turning north and then east, running adjacent, but interior, to the Old River levee, until it meets the Stage 2A levee again at Station 106+64. With construction of the Stage 2B Levee, the portion of the Stage 2A Levee between the Stage 2B Levee tie-ins (i.e., Stage 2A Levee Station 77+13 to 106+64) will no longer be required to provide an urban level of protection, as the Stage 2B Levee will provide this protection upon completion.

The Stage 2B Levee is currently in the advance design stage. Design and construction will follow the same methods used for the Stage 2A Levee and Stage 1, Interior Levee. Construction is planned for summer 2017. River Islands intends on modifying the Stage 2A Levee between the Stage 2B Levee tie-ins in 2018 for development purposes since this portion of the Stage 2A Levee will no longer serve as a flood protection feature. Specifically, a portion of the Stage 2A Levee is planned for removal, while the remainder is planned for lowering; doing so will join the already combined Stage 1 and Stage 2 Area with the Stage 2B Area. In other words, the Phase 1 Area will be protected by a single ring levee without individually protected sub-areas.

The Stage 2B Levee will be maintained by RD 2062. Additional details about the Stage 2B Levee are found in Chapter 3.

PAST PERFORMANCE

The Stage 2A Levee is a new levee constructed in 2016; as such, there is no past performance history for the levee. Since the Stage 2B Levee has yet to be constructed, there is not a past performance history of the levee.

3.0 ULDC EVALUATION OF THE STAGE 2A AND 2B LEVEES

The Stage 1 Levees were evaluated previously and these evaluations are documented in the substantial evidence record incorporated by reference in Chapter 1. To support an APF for the Phase 1 Area, an evaluation of the Stage 2A and 2B Levees was performed to determine their compliance with ULDC. The evaluation of each levee for each criterion is provided below.

ULDC 7.1: DESIGN WATER SURFACE ELEVATION

The Design Water Surface Elevation (DWSE) is the 200-year WSE used to design and evaluate levees and floodwalls for the purposes of providing an urban level of flood protection. The ULDC offers two options for determination of the DWSE: the FEMA approach and the USACE approach. The median 200-year Water Surface Elevations (WSE) is the unadjusted DWSE. With consideration and adjustments for debris loading, superelevation, climate change, updated hydrology, updated hydraulic models, and sea level rise, the median 200-year WSE becomes the DWSE.

An additional water surface elevation required by the ULDC is the Hydraulic Top of Levee (HTOL), which is defined as the lower of the DWSE plus 3 feet or the median 500-year water surface elevation. The HTOL is used to evaluate slope stability and seepage.

STAGE 2A LEVEE

River Islands has computed the DWSE for the Stage 2A Levee using the same methods and assumptions as those used for the Stage 1 Levee System, which was based on the FEMA approach using the MBK Lower San Joaquin River HEC-RAS model (LSJR Model). Similar to the Stage 1, Interior Levee, the DWSE for the Stage 2A Levee relies on a flood relief cut and therefore the DWSE cannot be lower than the crown elevation of the cut levee (i.e., Paradise Cut) which is 20.5 feet NAVD88. The flood relief cut being relied upon requires an exception, as discussed under ULDC 7.20. While the Stage 2A Levee appears to meet ULDC 7.1, and development of the DWSE has been documented, the document has not undergone review by the IPE; therefore, the Stage 2A Levee **does not meet** ULDC 7.1.

STAGE 2B LEVEE

The DWSE for the Stage 2B Levee has not yet been developed; however, the same methods as those used for the Stage 1, Interior Levee will be used for the Stage 2B Levee. The Stage 2B Levee will rely on the same flood relief cut assumed for the Stage 1, Interior Levee and Stage 2A Levee. The flood relief cut being relied upon requires an exception, as discussed under ULDC 7.20. Therefore, Stage 2B Levee **does not meet** ULDC 7.1.

ULDC 7.2: MINIMUM TOP OF LEVEE

The Minimum Top of Levee (MTOL) is the required minimum elevation for the physical top of levee to provide reasonable assurance of containing the DWSE. The MTOL is defined as the higher of the DWSE plus 3 feet or the DWSE plus wind setup and wave runup.

STAGE 2A LEVEE

River Islands has computed the MTOL for the Stage 2A Levee using the same methods as those used for the Stage 1, Interior Levee, including incorporation of wind setup and wave runup, which have also been computed and are discussed under ULDC 7.17. The computed MTOL is provided in Table 1. The Stage 2A Levee appears to meet ULDC 7.2 for MTOL based on a topographic survey performed by River Islands after construction of the levee which indicates that the levee was constructed between 0.8 to 1.5 feet higher than the MTOL. However, because this evaluation has not undergone review by the IPE, the Stage 2A Levee **does not meet** ULDC 7.2.

Table 1. Stage 2A DWSE and MTOL

Evaluation Site	Stage 2a Levee Station	DWSE (feet NAVD88)	Wind Setup and Wave Runup (feet)	MTOL ¹ (feet NAVD88)
1	10+00	20.5	4.2	24.7
2	20+00	20.5	4.1	24.6
3	30+00	20.5	3.9	24.4
4	40+00	20.5	3.9	24.4
5	50+00	20.5	4.0	24.5
6	60+00	20.5	4.4	24.9
7	70+00	20.5	4.6	25.1
8	80+00	20.5	4.7	25.2
9	90+00	20.5	4.7	25.2
10	97+00	20.5	4.7	25.2

¹ DWSE plus greater of 3 feet or wind setup and wave runup.

STAGE 2B LEVEE

The MTOL will be developed as part of the design for the Stage 2B Levee. The same methods and assumptions used for the Stage 1 Levee will be used for the Stage 2B Levee. Because the MTOL has not been developed or reviewed, and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.2.

ULDC 7.3: SOIL SAMPLING, TESTING, AND LOGGING

ULDC 7.3 requires soil sampling, testing, and logging, per standard procedures prescribed in guidance documents, including USACE Sacramento District's *Geotechnical Levee Practice Standard Operating*

Procedures and DWR's Division of Flood Management Soil and Rock Logging, Classification, Description and Presentation Manual (2009) (SOP).

STAGE 2A LEVEE

In general, River Islands has obtained approximately four geotechnical explorations every one thousand feet along the levee alignment. Explorations are located generally at the levee centerline, waterside and landside toe, and approximately 250 feet landward from the landside toe. The Stage 2A Levee construction was observed by the geotechnical engineer of record, and the as-built plans and field and laboratory testing indicate that the entire levee was constructed of levee-specification fill.

During construction, an inspection trench was excavated below the landside toe of the levee prism. The trench was excavated to a minimum depth of 6 feet, with a minimum bottom width of approximately 25 feet. The purpose of the inspection trench was both to create an engineered fill key at the base of the levee, and to identify potential seepage paths below the levee. Two representatives from ENGEO observed the trench during excavation and backfill to identify near surface sand layers or other potentially detrimental seepage paths, or to extend the depth of the trench where appropriate.

The Stage 2A Levee appears to meet ULDC 7.3, however, geotechnical data reports have not yet been reviewed by the IPE; therefore, the Stage 2A **does not meet** ULDC 7.3.

STAGE 2B LEVEE

In general, River Islands has obtained approximately four geotechnical explorations every one thousand feet along the levee alignment. Explorations are located generally at the levee centerline, waterside and landside toe, and approximately 250 feet landward from the landside toe. Prior to the construction of the Stage 2B levee, an inspection trench similar to the trench performed for the Stage 1, Interior Levee and Stage 2A Levee is planned to be excavated and logged to identify potentially adverse underseepage conditions.

The Stage 2B Levee appears to meet ULDC 7.3, however, geotechnical data reports have not yet been prepared nor have they been reviewed by the IPE; therefore, the Stage 2B **does not meet** ULDC 7.3.

ULDC 7.4: SLOPE STABILITY FOR INTERMITTENTLY LOADED LEVEES

ULDC 7.4.1 requires a minimum factor of safety of 1.4 landside slope stability during steady-state seepage conditions, based on the DWSE, for failure surfaces that intersect the levee crown and are greater than a few feet deep in the levee slope. It also requires a minimum factor of safety of 1.2, based on the HTOL, for failure surfaces that intersect the levee crown and are greater than a few feet deep in the levee slope. ULDC 7.4.2 requires a minimum safety factor of 1.0 to 1.2 for waterside slope stability during rapid drawdown conditions from the DWSE depending how long the embankment is saturated with the higher factor of safety used for longer duration events.

The ULDC also provides guidance for the presence of wide (crown width over 20 feet) and extremely wide (crown width over 50 feet) levees with respect to levee stability. A slope may have a factor of safety less than the specified criteria, provided that the minimum levee dimensions are contained within the existing levee prism, and that the minimum levee geometry meets the minimum slope stability and seepage criteria. Based on crown widths of 40 feet, both the Stage 2A and 2B Levees can be considered wide levees.

Though the ULDC does not directly address through seepage analyses, it does consider the potential for erosion when addressing the integrity of the levee. Specifically, the ULDC states that if the "phreatic surface emerges onto a landside levee slope consisting of erodible materials, remediation will be required to prevent unraveling and progressive slope failure that may lead to a levee breach." However, based on the material specifications for the Stage 2A and Stage 2B levee fill, the embankments, through which seepage is exiting, does not consist of erodible material.

STAGE 2A LEVEE

Slope stability and through seepage were evaluated for the Stage 2A Levee using the same methods as those used for the Stage 1, Interior Levee. Although the Stage 2A Levee appears to meet for ULDC 7.4, the analyses and results have not yet been documented or reviewed by the IPE; therefore, the Stage 2A Levee **does not meet** ULDC 7.4.

STAGE 2B LEVEE

Slope stability and through seepage analyses will be evaluated as part of design of the Stage 2B Levee. The same methods and assumptions used for the Stage 1, Interior Levee and Stage 2A Levees will be used for the Stage 2B Levee. Because slope stability and through seepage have not been evaluated and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.4.

ULDC 7.5: UNDERSEEPAGE FOR INTERMITTENTLY LOADED LEVEES

ULDC 7.5 provides levee underseepage criteria for intermittently loaded levees. Based on USACE Engineering Manual 1110-2-1913 (as modified by Engineering Technical Letter 1110-2-569) and the ULDC, the current guidance for acceptable exit gradients through soils with a minimum saturated unit weight of 112 pounds per cubic foot at the toe of the levee (average exit gradient) should be no greater than 0.5 and no greater than 0.8 within a distance of 150 feet from the levee toe for the DWSE. In addition, the minimum criteria for any location between the levee toe and 150 feet from the toe should be linearly interpolated between 0.5 and 0.8 for the DWSE. When modeling a scenario that incorporates the HTOL, the allowable exit gradient is no greater than 0.6 at the levee toe.

STAGE 2A LEVEE

Underseepage was evaluated for the Stage 2A Levee using the same methods as used for the Stage 1, Interior Levee, including consideration of three-dimensional effects, simultaneous flood stage conditions due to flooding within the RD 2062 basin and flood stage in Old River, and the presence of landside lakes. Although the Stage 2A Levee appears to meet for ULDC 7.4, the evaluation and results have not yet been documented or reviewed by the IPE; therefore, the Stage 2A Levee **does not meet** ULDC 7.5.

STAGE 2B LEVEE

Underseepage will be evaluated as part of design of the Stage 2B Levee. The same methods used for the Stage 1, Interior Levee and Stage 2A Levee will be used for the Stage 2B Levee. Underseepage has not been evaluated and the levee has not been constructed, therefore, the Stage 2B Levee **does not meet** ULDC 7.5.

ULDC 7.6: FREQUENTLY LOADED LEVEES

ULDC 7.6 clarifies that frequently loaded levees are subject to more stringent requirements. Frequently loaded levees are those levees that experience a water surface elevation of 1 foot or higher above the elevation of the landside levee toe at least once a day for more than 36 days per year on average.

STAGE 2A LEVEE

The Stage 2A Levee is a dry-land levee and does not meet the definition of a frequently loaded levee. Therefore, more stringent requirements do not apply. However, this conclusion requires documentation by River Islands and review by the IPE, therefore the Stage 2A Levee **does not meet** ULDC 7.6.

STAGE 2B LEVEE

The Stage 2B Levee is a dry-land levee and does not meet the definition of a frequently loaded levee. Therefore, more stringent requirements do not apply. However, this conclusion requires documentation by River Islands and review by the IPE, therefore the Stage 2B Levee **does not meet** ULDC 7.6.

ULDC 7.7: SEISMIC VULNERABILITY

ULDC 7.7 requires an analysis of seismic vulnerability of the levee system for the 200-year return period ground motions. ULDC 7.7.1 indicates that if seismic damage from the 200-year return period ground motion is expected, a post-earthquake remediation plan is required as part of a flood safety plan developed in coordination with pertinent local, State, and Federal agencies.

STAGE 2A LEVEE

Seismic vulnerability was evaluated for the Stage 2A Levee using the same methods as used for the Stage 1, Interior Levee. Although the Stage 2A Levee appears to meet for ULDC 7.7, the evaluation and results have not yet been documented or reviewed by the IPE, therefore the Stage 2A Levee **does not meet** ULDC 7.7.

STAGE 2B LEVEE

Seismic vulnerability will be evaluated as part of design of the Stage 2B Levee. The same methods used for the Stage 1, Interior Levee and Stage 2A Levee will be used for the Stage 2B Levee. Because seismic vulnerability has not been evaluated and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.7.

ULDC 7.8: LEVEE GEOMETRY

ULDC 7.8 requires that for new levees or levees with extensive reconstruction situated along major waterways, a minimum 20-foot-wide crown width and 3:1 horizontal-to-vertical ratio (H:V) waterside and landside slopes are required.

ULDC 7.8.1 allows levees wider than the minimum requirement to have steeper slopes if the minimum required dimensions would fit entirely within the actual levee, and if seepage and slope stability criteria are met (for both deep and shallow failure surfaces). Furthermore, for extremely wide levees, seepage and slope stability criteria do not need to be met for the outer levee slopes as long as certain criteria are met.

ULDC 7.8.2 requires a patrol road along the crown of the levee for inspection, maintenance, and flood-fighting. The patrol road must be designed, constructed, and maintained to provide "all-weather" support of maintenance and patrolling vehicles.

STAGE 2A LEVEE

The Stage 2A Levee embankment is considered a wide levee with a 40 foot crown width and 3:1 landside and waterside slopes. A patrol road is present along the crown. Access ramps are present on the landside every approximate 0.25 mile. There are four waterside access ramps, located approximately every half to one mile. Gates along the patrol road and at access points are anticipated, but are not currently present. The Stage 2A Levee appears to meet ULDC 7.8 for geometry. However, because this evaluation has not undergone review by the IPE, the Stage 2A Levee **does not meet** ULDC 7.8.

STAGE 2B LEVEE

The Stage 2B Levee embankment will be designed to the same dimensions as the Stage1, Interior Levee and the Stage 2A Levee with a 40 foot crown width and 3:1 landside and waterside slopes and a patrol road on the crown. Because the design is not complete, and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.8.

ULDC 7.9: INTERFACES AND TRANSITIONS

ULDC 7.9 highlights the need to ensure that the levee system functions holistically, such that no levee reach is more susceptible to problems than an adjacent reach due to gaps in features, loading/demand concentrations, or other three-dimensional effects when designing interfaces, transitions, and connections that commonly occur at the ends of seepage berms, seepage cutoff walls, revetments, and floodwalls.

STAGE 2A LEVEE

Interfaces and transitions were evaluated for the Stage 2A Levee using the same methods as used for the Stage 1, Interior Levee. Construction of the Stage 2A Levee was performed in one continuous project to avoid potential changes in soil characteristics or construction methods during construction. The only locations where transitions occurred with the levee construction are at the start and end of the Stage 2A Levee, where the levee ties into the existing Stage 1, Interior Levee. The Stage 2A Levee fill was benched into the existing Stage 1 levee with a maximum bench height of 2 feet, and the same material specification was used for both levees. There are no other interfaces or transitions present. Although the Stage 2A Levee appears to meet for ULDC 7.9, the analyses and results have not yet been documented or reviewed by the IPE, therefore the Stage 2A Levee **does not meet** ULDC 7.9.

STAGE 2B LEVEE

Interfaces and transitions will be evaluated as part of design of the Stage 2B Levee. The same methods used for the Stage 1, Interior Levee and Stage 2A Levee will be used for the Stage 2B Levee. Because Interfaces and transitions have not been evaluated and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.9.

ULDC 7.10: EROSION

Levees that pose an immediate erosional breaching hazard during either a flood or normal flow condition need to be repaired to meet ULDC. Similarly, levees that are likely to be significantly damaged during either a flood or normal flow condition should be protected with appropriate slope treatments. Erosion hazards are evaluated for the following conditions: 1) high-velocity flows coupled with erosive levee materials and/or poor hydraulic conditions; 2) large waves developed by wind over large, open bodies of water; and 3) boat wakes.

STAGE 2A LEVEE

Erosion was evaluated for the Stage 2A Levee using the same methods as used for the Stage 1, Interior Levee. Because the Stage 2A Levee is a dry-land levee, there is no potential for erosion damage due to high-velocity flows and erosive materials or boat wakes, although there is a potential for wind-generated waves. Additionally, there is potential for erosion caused by failure of the Old River Levee. This erosion potential is currently being evaluated and a structural action to remediate this concern is anticipated,

although this has not been fully evaluated. Because erosion has not been fully evaluated, the Stage 2A Levee **does not meet** ULDC 7.10.

STAGE 2B LEVEE

Erosion will be evaluated as part of design of the Stage 2B Levee. The same methods used for the Stage 1, Interior Levee and Stage 2A Levee will be used for the Stage 2B Levee. Similar to the Stage 2A Levee, there is potential for erosion caused by failure of the Old River Levee and this potential will be evaluated and remediated as necessary. Because erosion has not been evaluated and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.10.

ULDC 7.11: RIGHT-OF-WAY

Per ULDC, right-of-way criteria for levees and floodwalls in urban and urbanizing areas need to allow adequate room for maintenance, inspection, patrolling during high water, and flood-fighting; allow additional room to expand facilities in the future; and prohibit excavations and land modifications that would endanger the integrity of the levee or floodwall. Specifically, the ULDC requires fee title or an easement for the entire levee prism extending to a minimum of 20 feet beyond the landside toe of the flood protection system for access and inspection. Furthermore, waterward of the levee prism, where there is sufficient area to do so without resulting in the loss of sensitive riparian habitat, consideration should be given to acquiring a 15-foot-wide zone. In addition to the minimums required by the ULDC for access and inspection, the ULDC recommends acquiring right-of-way that has a width equal to at least four times the levee height or 50 feet, whichever is greater, on the landside of the 20-foot clear zone for longer-term flood protection. Lastly, the ULDC recommends that the city or county adopt restrictions on excavations within 200 to 400 feet depending on the levee height.

In 2016, the City of Lathrop adopted a grading ordinance that restricts any excavation within 500 feet of the physical waterside hinge point of a levee within River Islands.

STAGE 2A LEVEE

The Stage 2A Levee embankment and lands under the embankment are all owned by River Islands and no rights have been transferred to RD 2062, although RD 2062 does maintain the levee. River Islands intends on transferring title and/or easements to the levee embankment, 20 feet landward of the landside toe, and the lands waterward of the waterside toe to RD 2062. Because these lands have not yet been transferred, the Stage 2A Levee **does not meet** ULDC 7.11.

STAGE 2B LEVEE

The lands upon which the Stage 2B Levee will be constructed are owned by River Islands. River Islands intends on transferring title and/or easements to the levee embankment, 20 feet landward of the landside toe, and the lands waterward of the waterside toe to RD 2062. Because the levee has not been constructed and rights have not been transferred to RD 2062, the Stage 2B Levee **does not meet** ULDC 7.7.

ULDC 7.12: ENCROACHMENTS

ULDC 7.12 requires a hazard assessment of each existing encroachment, permitted or not, to determine the encroachment's impact on the reliability of levee performance. The evaluation of encroachments considers the following: age, type, condition, performance history, impacts on the levee structural integrity, impacts on the hydraulic effect of the channel, and impacts on the Operation & Maintenance (O&M) of the levee. If encroachments are considered high-hazard, additional evaluation and action is required.

STAGE 2A LEVEE

There are no encroachments along the Stage 2A Levee; therefore, the Stage 2A Levee appears to meet ULDC 7.12. However, this conclusion has not been reviewed by the IPE therefore the Stage 2A Levee **does not meet** ULDC 7.12. Future encroachments related to recreation and for security purposes are planned and will meet ULDC requirements.

STAGE 2B LEVEE

Encroachments along the Stage 2B Levee are not planned as part of levee construction. However, encroachments related to recreation and security are planned in the future after construction of the Stage 2B Levee. These encroachments will meet ULDC requirements; however, because the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.12.

ULDC 7.13: PENETRATIONS

ULDC 7.13 requires a hazard assessment of each existing penetration, permitted or not, to determine the penetration's impact on the reliability of levee performance. If penetrations are considered high-hazard, additional evaluation and action are required. For other existing penetrations that are not considered to be high-hazard, but have not been permitted, the city or county is required to have a remediation plan in place, or reference such a plan, for the entire length of levee that the finding is to cover.

STAGE 2A LEVEE

There are no penetrations along the Stage 2A Levee; therefore, the Stage 2A Levee appears to meet ULDC 7.13. However, this conclusion has not been reviewed by the IPE therefore the Stage 2A Levee **does not meet** ULDC 7.13.

STAGE 2B LEVEE

Penetrations associated with RD 2062's pumping plant are being planned as part of the design and construction of the Stage 2B Levee. These penetrations will be designed to meet ULDC requirements; however, because the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.13.

ULDC 7.14: FLOODWALLS, RETAINING WALLS, AND CLOSURE STRUCTURES

ULDC 7.14 presents requirements for design of special features such as floodwalls, retaining walls, and closure structures.

STAGE 2A LEVEE

There are no floodwalls, retaining walls, or closure structures along the Stage 2A Levee; therefore, the Stage 2A Levee appears to meet ULDC 7.14. However, this conclusion has not been reviewed by the IPE therefore the Stage 2A Levee **does not meet** ULDC 7.14.

STAGE 2B LEVEE

Floodwalls, retaining walls, and closure structures are not planned for the Stage 2B Levee. This criteria will be met when the levee is constructed. However, because the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.14.

ULDC 7.15: ANIMAL BURROWS

Burrowing animals can present a significant threat to levee integrity and therefore proactive animal control and damage repair are required levee maintenance practices.

RD 2062 has an annual rodent control and abatement program. The program uses two primary modes to control rodent populations and one primary method to repair rodent holes and burrows. The District uses bait stations to administer chemicals at active rodent areas to control populations, as well as traps at areas where excessive rodent activity is present. The District also administers a grouting program to backfill rodent holes identified within the levee; the grouting is performed on the waterside and landside of the levee, as necessary.

STAGE 2A LEVEE

RD 2062's rodent control and abatement program has not undergone review by the IPE, therefore the Stage 2A Levee **does not meet** ULDC 7.15.

STAGE 2B LEVEE

RD 2062's rodent control and abatement program has not undergone review and the levee has not been constructed; therefore, the Stage 2B Levee **does not meet** ULDC 7.15.

ULDC 7.16: VEGETATION EVALUATION

ULDC 7.16.1 requires an engineering inspection and evaluation to identify trees and other woody vegetation on the levee and within 15 feet of the levee toe that pose an unacceptable threat to the integrity of the levee. Those posing an unacceptable threat are to be removed; those not posing an unacceptable threat need not be removed. Non-hazardous vegetation allowed to remain because they do not pose an unacceptable threat must be trimmed and thinned for access and visibility. RD 2062 will follow an annual maintenance schedule to control annual grasses and woody vegetation.

STAGE 2A LEVEE

There are no trees or other woody vegetation on or adjacent to the Stage 2A Levee. The levee was hydroseeded following construction in November 2016. The Stage 2A Levee appears to meet ULDC 7.16; however, this conclusion has not been reviewed by the IPE, therefore the Stage 2A Levee **does not meet** ULDC 7.16.

STAGE 2B LEVEE

Vegetation, other than grasses, is not planned for the Stage 2B Levee. This criteria will be met when the levee is constructed. However, because the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.16.

ULDC 7.17: WIND SETUP AND WAVE RUNUP

ULDC 7.17 requires a wind-wave analysis. The wind setup and wave runup distances must be computed and added to the median 200-year still WSE to determine the required elevation of the MTOL. Wind setup and wave runup may also be considered when evaluating erosion. The formation and magnitude of wind-generated waves against shoreline structures is controlled by the physical conditions present on and near the shore such as slope and roughness of the structure, wind speed, and distance over which wind blows (fetch length).

STAGE 2A LEVEE

Wind setup and wave runup were evaluated for the Stage 2A Levee using the same methods as used for the Stage 1, Interior Levee. The evaluation and results have been documented in a memorandum, and while the Stage 2A Levee appears to meet for ULDC 7.17, the evaluation and results have not yet been reviewed by the IPE. The wind setup and wave runup are presented in Table 1. Therefore, the Stage 2A Levee **does not meet** ULDC 7.17.

STAGE 2B LEVEE

Wind setup and wave runup will be evaluated as part of design of the Stage 2B Levee. The same methods used for the Stage 1, Interior Levee and Stage 2A Levee will be used for the Stage 2B Levee. Because wind

setup and wave runup have not been evaluated and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.17.

ULDC 7.18: SECURITY

ULDC criterion 7.18 requires a security plan to protect urban and urbanizing area levee systems from acts of terrorism and other malicious or negligent acts. The security plan is to identify security personnel, responsibilities, resources, and measures. In developing the security plan, the agency/agencies responsible for levee maintenance must consider and prioritize vulnerabilities and employ an array of security measures from four basic categories to address vulnerabilities: networked detection (criterion 7.18.1); deterrence (criterion 7.18.2); physical security (criterion 7.18.3); and intrusion interdiction (criterion 7.18.4) during high-threat periods.

STAGE 2A LEVEE

A security plan for the Stage 2A Levee does not currently exist and therefore, this levee **does not meet** ULDC 7.18. RD 2062 has developed a Security Plan for the Stage 1 Levee System that will be modified for the Stage 2A Levee.

STAGE 2B LEVEE

A security plan for the Stage 2B Levee does not currently exist and therefore, this levee **does not meet** ULDC 7.18. RD 2062 has developed a Security Plan for the Stage 1 Levee System that will be modified for the Stage 2B Levee.

ULDC 7.19: SEA LEVEL RISE

ULDC 7.19 requires that the effects of sea level rise be estimated and addressed for the duration during which a ULOP Finding may be valid. Guidance for sea level rise is available through the State of California Ocean Protection Council, *State of California Sea-Level Rise Guidance Document* dated March 2013. The guidance provides sea level rise projection ranges for durations of 30 years, 50 years, and 100 years, using the year 2000 as the baseline.

The effects of the sea level rise were considered and incorporated by increasing the stages at the hydraulic model downstream boundaries, which are located far enough into the Delta to be primarily tidally driven, by the sea level rise projection.

STAGE 2A LEVEE

Sea level rise was considered for the Stage 2A Levee using the same methods as used for the Stage 1, Interior Levee. Consideration and incorporation of sea level rise has been documented in a technical

memorandum, and while the Stage 2A Levee appears to meet for ULDC 7.19, the evaluation and results have not yet been reviewed by the IPE. Therefore, the Stage 2A Levee **does not meet** ULDC 7.19.

STAGE 2B LEVEE

Sea level rise will be considered as part of design of the Stage 2B Levee. The same methods used for the Stage 1, Interior Levee and Stage 2A Levee will be used for the Stage 2B Levee. Because sea level rise has not been considered and the levee has not been constructed, the Stage 2B Levee **does not meet** ULDC 7.19.

ULDC 7.20: EMERGENCY ACTIONS AND FLOOD SAFETY PLANS

ULDC 7.20 includes requirements for preparing flood safety plans, as it is important for local maintaining agencies and communities to understand the responsibilities of flood risk management within their jurisdictions. Specifically, the ULDC requires each public agency with the responsibility for public safety for residents protected by levees and floodwalls to have a plan for flood events and other natural or man-made flood-related incidents that could result in human casualties, property destruction, and economic losses.

STAGE 2A LEVEE

While there are several emergency planning documents related to flood safety, many of which include the required information to meet ULDC 7.20, these plans will require modification to incorporate the Stage 2A Levee. Additionally, the DWSE for the Stage 2A relies on a flood relief cut which is an emergency action. Because RD 2062 is relying on floodwaters to expand the flood relief cut, an exception is required. Because the plans require modification, and development and IPE concurrence of an exception has not been completed, the Stage 2A Levee **does not meet** ULDC 7.20.

STAGE 2B LEVEE

While there are several emergency planning documents related to flood safety, many of which include the required information to meet ULDC 7.20, these plans will require modification to incorporate the Stage 2B Levee. Additionally, the DWSE for the Stage 2B Levee relies on a flood relief cut which is an emergency action. Because RD 2062 is relying on floodwaters to expand the flood relief cut, an exception is required. Because the plans require modification, and development and IPE concurrence of an exception has not been completed, the Stage 2B Levee **does not meet** ULDC 7.20.

4.0 ACTIONS REQUIRED TO PROVIDE AN URBAN LEVEL OF FLOOD PROTECTION

ULOP Criteria requires a complete plan to provide an urban level of flood protection by 2025 for an APF. This plan is provided as a separate document titled *River Islands at Lathrop, Phase 1, Report of Adequate Progress Towards an Urban Level of Flood Protection*, prepared in conjunction with this report by RD 2062. This chapter describes the specific structural actions necessary for the Phase 2A and 2B Levees to meet ULDC and the procedural actions to demonstrate this compliance. Table 2 and Table 3 present a summary of the required actions by criterion for each levee.

STRUCTURAL ACTIONS

Structural actions are those actions requiring modification to the flood protection facilities. These actions may include embankment construction or modification; placement of rock slope protection; removal, replacement, or modification of encroachments, penetrations, and/or vegetation.

STAGE 2A LEVEE

Since the Stage 2A Levee is already constructed, the required structural actions for the levee to meet ULDC are limited to resolving potential erosion caused by a failure of the Old River Levee. However, because the substantial evidence record for providing 200-year protection is still under development and has not yet been reviewed by the IPE, it is possible that additional structural actions may be taken.

STAGE 2B LEVEE

The required structural action for the Stage 2B Levee to meet ULDC is its construction, including addressing the potential erosion caused by a failure of the old River Levee.

PROCEDURAL ACTIONS

Procedural actions are those actions that support certification of the levees in meeting ULDC. These actions may include technical evaluations; development of technical memoranda, reports, or other documents; development of protocols and/or procedures; and/or policy or legal actions. IPE Review of the substantial evidence record, including the future Engineer's Report, is required by the ULOP Criteria, and given the technical nature of this review, is included here as an action required for ULDC compliance. The remaining procedural actions required to meet ULOP Criteria are discussed in the APF Report.

STAGE 2A LEVEE

Since the Stage 2A Levee is already constructed, the remaining required actions are primarily procedural actions. Actions required are:

- Conduct evaluations for erosion (ULDC 7.10) and security (ULDC 7.18).

- } Transfer right-of-way (ULDC 7.11).
- } Development of technical memoranda, reports, or other documentation for minimum top of levee (ULDC 7.2), geotechnical evaluations (ULDC 7.3, 7.4, 7.5, 7.7, 7.9), levee loading (ULDC 7.6), levee geometry (ULDC 7.8), erosion (ULDC 7.10), right-of-way (ULDC 7.11), encroachments (ULDC 7.12), penetrations (ULDC 7.13), animal burrows (ULDC 7.15), levee vegetation (ULDC 7.16), security (ULDC 7.18), and emergency actions (ULDC 7.20).
- } IPE review of all evaluations and documentation supporting these evaluations (ULDC 7.1 – 7.20), and subsequent revision of evaluations and documentation as appropriate.
- } IPE review and concurrence of exception for Flood Relief Cuts (ULDC 7.20).

STAGE 2B LEVEE

Since the Stage 2B Levee is currently in the design phase and has yet to be constructed, there are a considerable amount of procedural actions to be completed. Actions required are:

- } Conduct evaluations for the DWSE and HTOL (ULDC 7.1), minimum top of levee (ULDC 7.2), geotechnical evaluations (ULDC 7.4, 7.5, 7.7, 7.9), levee geometry (ULDC 7.8), erosion (ULDC 7.10), penetrations (ULDC 7.13), security (ULDC 7.18), and sea level rise (ULDC 7.19).
- } Transfer right-of-way (ULDC 7.11).
- } Development of technical memoranda, reports, or other documentation for all evaluations (ULDC 7.1 – 7.20).
- } IPE review of all evaluations and documentation supporting these evaluations (ULDC 7.1 – 7.20), and subsequent revision of evaluations and documentation as appropriate.
- } IPE review and concurrence of exception for Flood Relief Cuts (ULDC 7.20).

Table 2. Required Actions for Stage 2A Levee

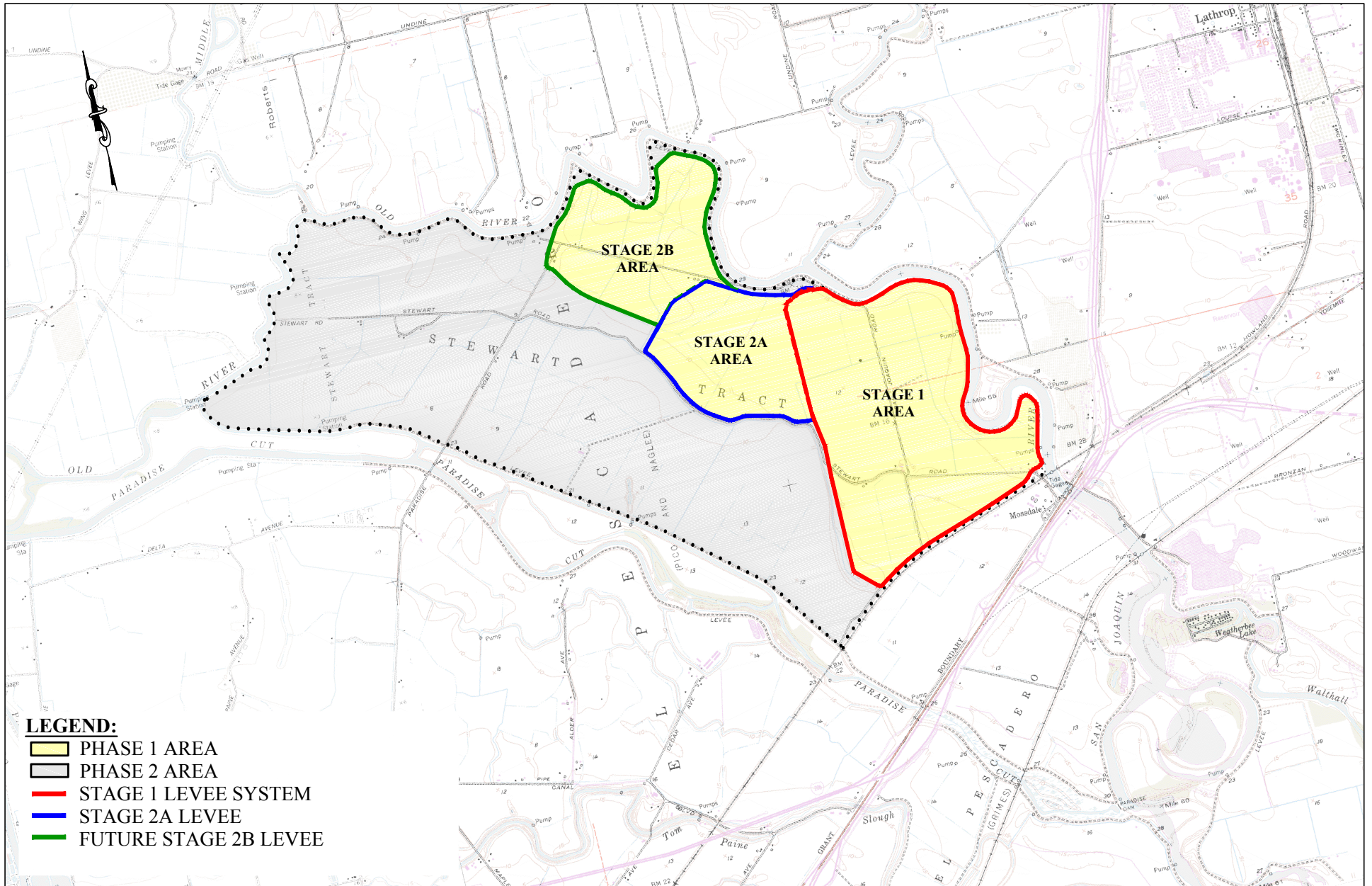
ULDC	STAGE 2A LEVEE		
	DEVELOP SUBSTANTIAL EVIDENCE RECORD	STRUCTURAL ACTION	IPE REVIEW
7.1 DESIGN WATER SURFACE	○	○	●
7.2 MINIMUM TOP OF LEVEE	⊙	○	●
7.3 SOIL SAMPLING, TESTING, AND LOGGING	⊙	○	●
7.4 SLOPE STABILITY	⊙	○	●
7.5 UNDERSEEPAGE	⊙	○	●
7.6 LEVEE LOADING	⊙	○	●
7.7 SEISMIC VULNERABILITY	⊙	○	●
7.8 LEVEE GEOMETRY	⊙	○	●
7.9 INTERFACES AND TRANSITIONS	⊙	○	●
7.10 EROSION	⊙	●	●
7.11 RIGHT-OF-WAY	●	○	●
7.12 ENCROACHMENTS	⊙	○	●
7.13 PENETRATIONS	⊙	○	●
7.14 FLOODWALLS, RETAINING WALLS, AND CLOSURE STRUCTURES	⊙	○	●
7.15 ANIMAL BURROWS	⊙	○	●
7.16 LEVEE VEGETATION	⊙	○	●
7.17 WIND SETUP AND WAVE RUNUP	○	○	●
7.18 SECURITY	●	○	●
7.19 SEA LEVEL RISE	○	○	●
7.20 EMERGENCY ACTIONS	⊙	○	●
KEY	○ No Action Required. ⊙ Action In-Progress. ● Action Required.		

Table 3. Required Actions for Stage 2B Levee

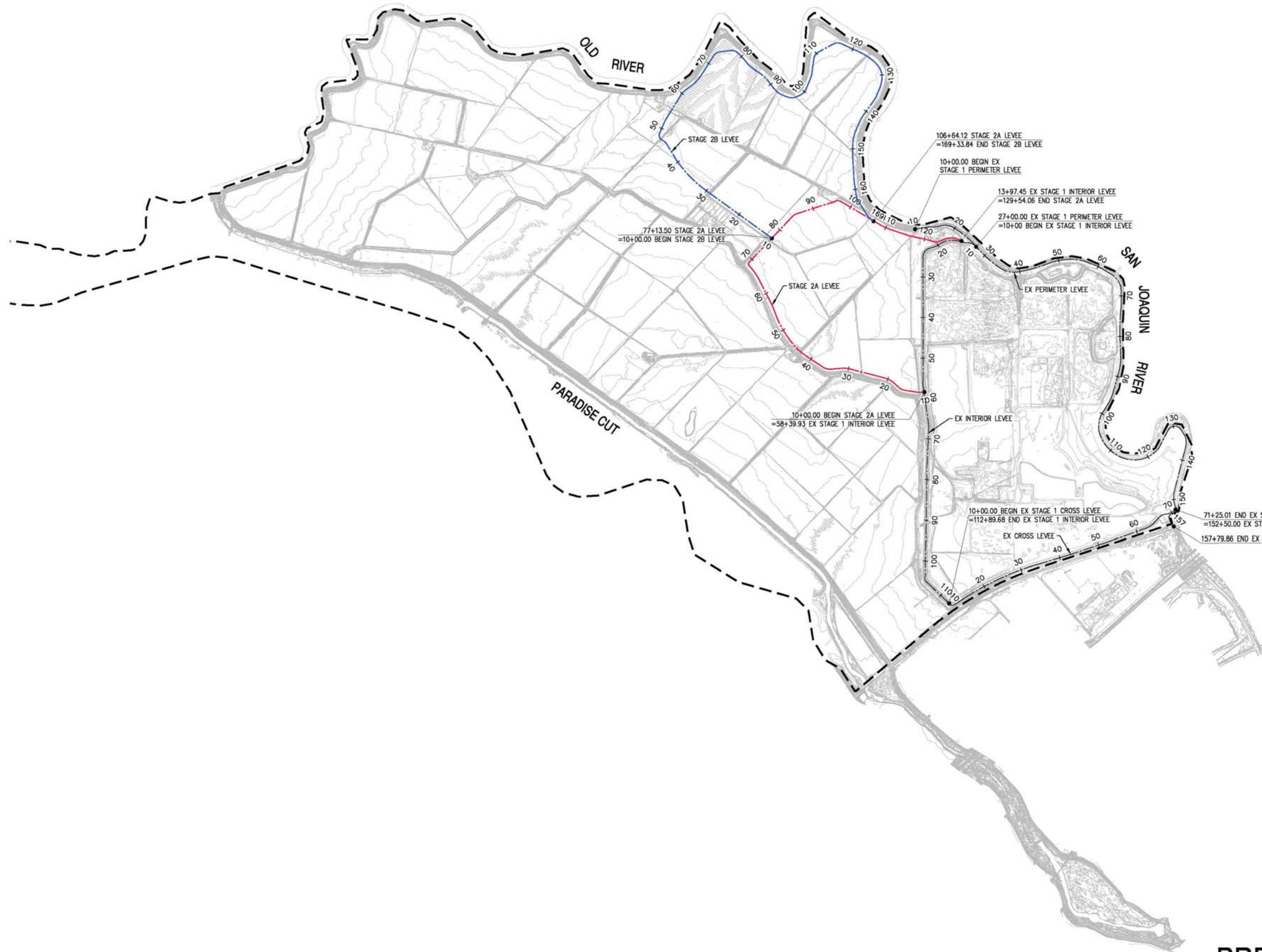
ULDC	STAGE 2B LEVEL		
	DEVELOP SUBSTANTIAL EVIDENCE RECORD	STRUCTURAL ACTION	IPE REVIEW
7.1 DESIGN WATER SURFACE	⊙	○	●
7.2 MINIMUM TOP OF LEVEE	⊙	●	●
7.3 SOIL SAMPLING, TESTING, AND LOGGING	⊙	○	●
7.4 SLOPE STABILITY	⊙	●	●
7.5 UNDERSEEPAGE	⊙	●	●
7.6 LEVEE LOADING	⊙	○	●
7.7 SEISMIC VULNERABILITY	⊙	●	●
7.8 LEVEE GEOMETRY	⊙	●	●
7.9 INTERFACES AND TRANSITIONS	⊙	●	●
7.10 EROSION	⊙	●	●
7.11 RIGHT-OF-WAY	⊙	●	●
7.12 ENCROACHMENTS	⊙	○	●
7.13 PENETRATIONS	⊙	●	●
7.14 FLOODWALLS, RETAINING WALLS, AND CLOSURE STRUCTURES	⊙	○	●
7.15 ANIMAL BURROWS	⊙	○	●
7.16 LEVEE VEGETATION	⊙	○	●
7.17 WIND SETUP AND WAVE RUNUP	⊙	○	●
7.18 SECURITY	⊙	●	●
7.19 SEA LEVEL RISE	⊙	○	●
7.20 EMERGENCY ACTIONS	⊙	○	●
KEY	○ No Action Required. ⊙ Action In-Progress. ● Action Required.		

5.0 REPORT REFERENCES

- Costa, R., Harder, L., & Williams, D. (2016). *River Islands at Lathrop, Stage 1 Levee System, Adequete Progress Towards an Urban Level of Flood Protection, Independent Panel of Experts Review of Engineer's Report.*
- Reclamation District 2062. (2016). *River Islands at Lathrop Stage 1 Levee System, Adequate Progress Towards and Urban Level of Flood Protection, Engineer's Report, Final.*



River Islands Phases and Stages



- LEGEND**
- RIVER ISLANDS BOUNDARY
 - STAGE 1 LEVEE
 - STAGE 2A LEVEE
 - STAGE 2B LEVEE

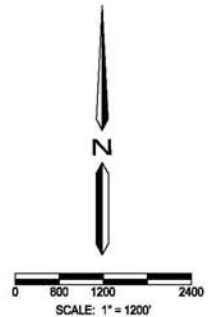


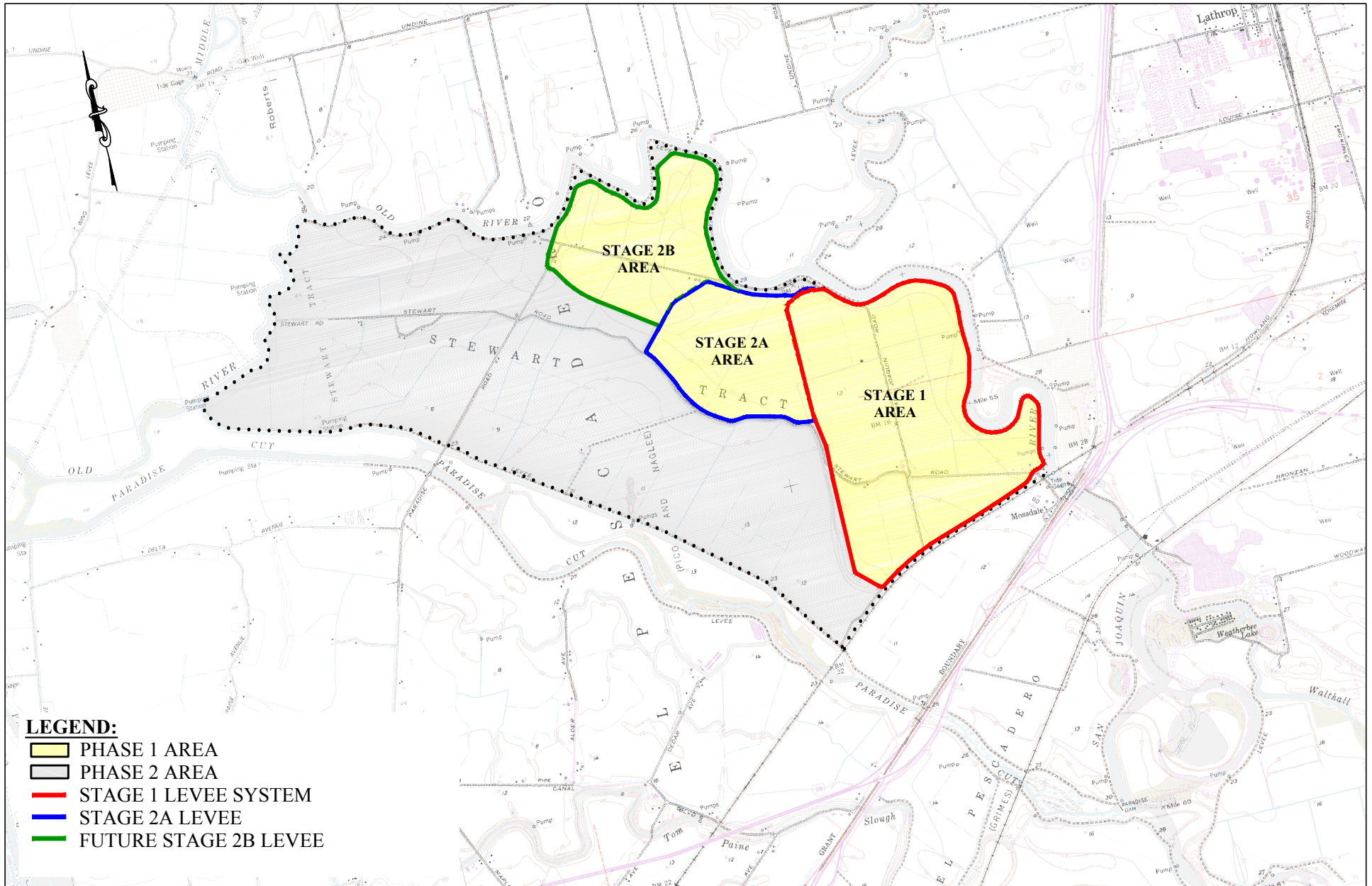
PLATE 2

**PRELIMINARY
LEVEE ALIGNMENT EXHIBIT
RIVER ISLANDS**

CITY OF LATHROP SAN JOAQUIN COUNTY CALIFORNIA
DATE: OCTOBER 24, 2016



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River Islands Phases and Stages