



RECLAMATION DISTRICT No. 1000

SYSTEM-WIDE IMPROVEMENT

FRAMEWORK

Submitted by

RECLAMATION DISTRICT No. 1000

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*RECLAMATION DISTRICT NO. 1000
SYSTEM-WIDE IMPROVEMENT FRAMEWORK*

INTRODUCTION

Reclamation District No. 1000 (RD 1000; District) has prepared this System-Wide Improvement Framework (SWIF) to support continued eligibility in the Public Law (PL) 84-99 Rehabilitation Program (RP) for the RD 1000–Natomas levee system (Natomas levee system).

The U.S. Army Corps of Engineers (USACE) Sacramento District issued a Periodic Inspection Report (PIR) in September 2010. Of significant relevance to this SWIF, is the active construction on the Natomas levee system that began in 2007 and continues today. More information about this construction is provided in later chapters, but it is important to understand that since the inspection was performed, nearly 23 miles of levee have been substantially improved to address design deficiencies. As a result of these improvements, many of the items identified in the PIR were and continue to be addressed. Additionally, the majority of the levee system is now subject to an approved vegetation variance (2010), as a result vegetation listed in the PIR is no longer unacceptable.

The Natomas levee system is currently active in the RP (Letter of Intent (LOI) approved May 2013); however, there are a number of unacceptable items that need to be addressed over a longer period as part of a “worst-first” plan. These items are the subject of this SWIF. A draft SWIF was submitted to the Central Valley Flood Protection Board (CVFPB) and USACE Sacramento District in 2016. This revised SWIF was prepared at the request of the USACE Sacramento District and includes updates to the resolution of unacceptable items and schedule milestones.

1. LEVEE SYSTEM AND SEGMENT IDENTIFICATION AND DESCRIPTION

This SWIF applies to the Natomas levee system (National Levee Database [NLD] System ID: 5205000923). This system is comprised of five segments as described in **Table 1** below. The Sacramento Area Flood Control Agency (SAFCA) and CVFPB are the non-Federal sponsors for this system; RD 1000 is the local maintaining agency (LMA). Figure 1.1 presents the location of the segments and the system.

Table 1. Levee System and Segment Identification

| Levee System Name and ID Number | National Levee Database (NLD) Segment Name | NLD Segment ID Number |
|---|--|-----------------------|
| RD 1000–Natomas NLD System ID: 5205000923 | RD 1000–Natomas – Unit 1, Sacramento River | 5204000911 |
| | RD 1000–Natomas – Unit 2, American River | 5204000912 |
| | RD 1000–Natomas – Unit 3 South, Natomas East Main Drainage Canal | 5204000913 |
| | RD 1000–Natomas – Unit 3 North, Cross Canal Inflow* | 5204000914 |
| | RD 1000–Natomas – Unit 4, Natomas Cross Canal | 5204000915 |

*The Cross Canal Inflow is commonly and herein referred to as the Pleasant Grove Creek Canal.

The Natomas levee system is located within Sacramento and Sutter counties, and partly within the City of Sacramento, California. **Table 2** presents a basic description of the individual segments comprising the Natomas levee system.

Table 2. Description of Segments in the RD 1000–Natomas Levee System

| O&M Unit | River/Channel | Location | Levee Miles |
|---------------|--|---|---------------|
| Unit 1 | Sacramento River | Located on the east (left) bank of the Sacramento River, beginning at the Natomas Cross Canal and extending south to the confluence of the American River | 0.00 to 18.49 |
| Unit 2 | American River | Located on the north (right) bank of the American River | 0.00 to 1.90 |
| Unit 3, South | Natomas East Main Drainage Canal (NEMDC) | Located on the west (right) bank of NEMDC | 0.00 to 12.62 |
| Unit 3, North | Pleasant Grove Creek Canal (PGCC) | Located on the west (left) bank of PGCC | 0.00 to 4.35 |
| Unit 4 | Natomas Cross Canal | Located on the south (left) bank of the Natomas Cross Canal | 0.00 to 4.34 |

The overall segment ratings are provided in **Table 3** by inspection item. Items not applicable have not been included (e.g., Item 4, closure structures).

Table 3. Periodic Inspection Segment Ratings by Levee Embankment Item

| Item | Affects PL 84-99 Eligibility | Unit 1. SREL | Unit 2. ARNL | Unit 3 South. NEMDC | Unit 3 North. PGCC | Unit 4. NCC |
|-----------------------------|------------------------------|--------------|--------------|---------------------|--------------------|-------------|
| Item 1, Vegetation Growth | No | U | U | U | U | U |
| Item 2, Sod Cover | No | A | A | A | A | A |
| Item 3, Encroachments | Yes | U | U | U | U | U |
| Item 5, Slope Stability | Yes | M | A | M | A | M |
| Item 6, Erosion/Bank Caving | Yes | M | M | M | M | M |
| Item 7, Settlement | No | M | A | A | A | A |
| Item 8, Depressions/Rutting | No | A | A | M | M | A |
| Item 9, Cracking | No | M | A | M | A | A |

| Item | Affects PL 84-99 Eligibility | Unit 1. SREL | Unit 2. ARNL | Unit 3 South. NEMDC | Unit 3 North. PGCC | Unit 4. NCC |
|--|------------------------------|--------------|--------------|---------------------|--------------------|-------------|
| Item 10, Animal Control | Yes | M | A | M | M | M |
| Item 12, Riprap Revetments and Bank Protection | No | M | NA | M | M | A |
| Item 15, Seepage | Yes | A | A | A | A | A |

Note: A = Acceptable; M = Minimally Acceptable; U = Unacceptable; N/A = Not Applicable;

1.1 Historical and Regional Context

The Sacramento River Flood Control Project (SRFCP) is one of the oldest federally authorized flood control projects in the nation. Its long history and location in the Central Valley present unique and complex challenges for those responsible for operation and maintenance (O&M) of the SRFCP.

In response to the frequent and damaging floods that occurred in the Sacramento River watershed, Congress authorized the SRFCP in 1917. Many of the SRFCP levees were constructed in the 1800s or early 1900s by local reclamation districts to protect their lands from flooding. The project was designed to self-scour, thus flushing hydraulic mining debris through the system while providing modest flood protection to adjacent lands. The primary river levees, set close together, were constructed with material dredged from the channel and nearby lands. While the design and construction of the system served the needs at the time, the levees have since proven problematic during rare flood events, particularly in regard to seepage.

Starting in the 1940s, several years after congressional authorization, the USACE and the State began to undertake significant levee improvement efforts. Despite these efforts, the 1986 and 1997 flood events demonstrated that the methods and technologies employed at the time of the SRFCP design and construction resulted in significant residual risk of flooding.

The environmental compliance requirements for LMAs to routinely operate and maintain their levee system(s) have increasingly become more rigorous due to current state and federal regulations. This has been compounded by passage of the Endangered Species Act, which often conflicts with the operation and maintenance needs for the system. RD 1000 will continue to ensure all O&M work performed is reported and shall comply with all the applicable environmental measures set forth under state and federal law. O&M activities that affect endangered species shall be addressed through the proper consultation processes with the pertinent federal and state regulatory agencies.

The Central Valley provides habitat for more than 500 species of native plants and wildlife, some of which are threatened or endangered. However, with settlement of the Central Valley, the geographic extent, quality, and connectivity of native habitat along Central Valley rivers and streams has drastically declined. Only a very small percentage of the historical riparian forest that once lined these watercourses continues to exist, and much of these remaining forests exist on or near the levees. In addition, other non-riparian

forests and native grasslands existing on or near levees provide habitat for other listed species. Because these forests and grasslands provide habitat for State and federally protected species, activities along levees are subject to environmental laws and regulations which significantly affect the timing and manner in which LMAs are able to operate and maintain levee systems. In essence, LMAs are now responsible not only for operating and maintaining levees, but also for acting as conservators of the natural habitat and species found along the levees.

2. DESCRIPTION OF UNACCEPTABLE ITEMS, DESIGN DEFICIENCIES, & CORRECTIVE ACTION

The USACE identified over 1,000 items in its January 2010 inspection. RD 1000 corrected all “unacceptable items that could adversely affect levee performance in the next flood event”, i.e., “critical items”, following the PIR publication.

Additionally, as described above, substantial construction has and is occurring to the Natomas levee system and improvements have significantly affected the condition of the levee system. SAFCA, of which RD 1000 is a member agency, in cooperation with the State of California improved the Natomas Cross Canal levee (Unit 4) from 2007 to 2009. From 2009 to 2012, SAFCA improved 12 miles of the Sacramento River east levee (Unit 1). This work was completed under the Natomas Levee Improvement Project (NLIP). Concurrent with this construction effort, SAFCA, the State, and USACE were planning and designing the Natomas Basin Common Features project (Natomas Project). This project broke ground in 2019 and as of April 2021, 23 of 42 miles of the Natomas Basin levee system have been improved.

Despite correction of critical items, and more than half a billion dollars of capital expenditures, there remains unacceptable items that are of a lower risk to levee performance and/or impede operation, maintenance, and the ability to flood fight. The overwhelming majority of these items are located along the Sacramento River where waterside urban development is present. **Table 4** provides a description of the outstanding unacceptable items of which all are an encroachment type.

Table 4. Outstanding Unacceptable Items

| Item Type | Quantity | Description |
|--|------------|---|
| Encroachment – Dwelling | 131 | Garden Hwy is a county road located on the levee crown in portions of the SREL (Unit 1) and ARNL (Unit 2). There are many residences located on the waterside of the levee along Garden Hwy. |
| Encroachments – Above Ground Utilities | 35 | Several utility and communication lines are strung along poles parallel and across the levees. Due to the significant levee construction efforts, these items have either been modified, relocated, or removed. |
| Encroachments – Underground Utilities | 33 | Several pump stations and associated facilities (pipe penetrations) associated with water supply and interior drainage are present within the levee system. There are also a few underground utilities (conduit) present. |
| Encroachment - Other | 58 | Other encroachments include drainage inlet/outlets, fences, residential features, driveways and roads, etc. |
| Total | 257 | |

SWIFs are intended to provide for a “worst-first” approach in addressing flood risk reduction system deficiencies. SAFCA and RD 1000 have established three (3) categories of risk for the purposes of this SWIF: **(1) Levee Design Standard Deficiencies** that threaten the performance of the levee (highest risk); **(2) Encroachments on the Levee** that present an unacceptable threat to levee integrity and operation and maintenance (high, moderate, and low risk), and; **(3) Administrative Deficiencies** (lowest risk) that pertain to encroachments lacking proper documentation, or where the encroachment is otherwise not in compliance with the permit conditions, but do not pose a threat to levee integrity or operation and maintenance.

2.1 Levee Design Standard Deficiencies

USACE, DWR, and SAFCA have undertaken significant efforts to compare the existing condition and design of the levee to current standards for levee systems. These efforts have identified several deficiencies in meeting current levee design standards, including through-seepage, underseepage, embankment instability, and susceptibility to erosion and scour. These deficiencies present the highest risk to the levee system and are described in the 2010 USACE *American River Common Features Project, Natomas Post-Authorization Change Report*.

From 2007 to 2012, SAFCA and the State began addressing these deficiencies under the NLIP. Despite significant expenditure made by SAFCA and the State as part of the NLIP, the Natomas Basin remains severely vulnerable to flood threats. These threats continue to be reduced through the USACE Natomas Project. A description and status of the measures proposed as part of the Natomas Project are provided in **Table 5**.

Table 5. Levee Standard Deficiency Remediation by the Natomas Project

| Reach & Length | Reach Description | Proposed Improvements | Status |
|--------------------------|--|---|---|
| Unit 1, Sacramento River | | | |
| A 3.8 miles | Sacramento River east levee from Interstate Highway 5 at the American River north levee to San Juan Road | Widening existing levee through construction of an adjacent levee and remediation of geotechnical deficiencies (e.g., landside berms and cutoff walls). | Construction scheduled for 2022. |
| B 9.5 miles | Sacramento River east levee from San Juan Road to Elverta Road | Widening existing levee through construction of an adjacent levee and remediation of geotechnical deficiencies (e.g., landside berms and cutoff walls). | A significant portion of this work was completed as part of the NLIP. USACE construction began in 2020 with anticipated completion in 2021. |
| C 5 miles | Sacramento River east levee from Elverta Road to Sankey Road at the downstream end of the south levee of the NCC | Widening existing levee through construction of an adjacent levee and remediation of geotechnical deficiencies (e.g., landside berms and cutoff walls). | Most of this work was completed as part of the NLIP. Pumping plant work outstanding and currently unscheduled. |
| Unit 2, American River | | | |
| I 1.8 miles | American River north levee from Northgate Boulevard to Interstate Highway 5 | Fix-in-place construction and remediation of geotechnical deficiencies (e.g., landside flattening and cutoff walls). | USACE construction began in 2019; completed in 2020. |
| Unit 3 South, NEMDC | | | |
| H 4.5 miles | NEMDC west levee from the NEMDC stormwater pumping station to Northgate Boulevard | Fix-in-place construction and remediation of geotechnical deficiencies (e.g., landside flattening and cutoff walls). | USACE construction began in 2019; completed in 2020. |
| G 3.6 miles | NEMDC west levee from Elverta Road to the NEMDC stormwater pumping station | Fix-in-place construction and remediation of geotechnical deficiencies (e.g., landside flattening and cutoff walls). | Construction scheduled for 2022. |

| | | | |
|---|--|---|---|
| F 4.7 miles | NEMDC west levee from Sankey Road to Elverta Road | Widening the existing levee by fix-in-place construction and remediation of geotechnical deficiencies (e.g., landside flattening and cutoff walls). | Construction scheduled for 2022. |
| Unit 3 North, Cross Canal Inflow (PGCC) | | | |
| E 3.3 miles | PGCC west levee from Howsley Road (at PGCC) to Sankey Road (at PGCC) | Widening the existing levee by fix-in-place construction and remediation of geotechnical deficiencies (e.g., landside flattening and cutoff walls). | Construction scheduled for 2022. |
| Unit 4, Natomas Cross Canal | | | |
| D 5.5 miles | NCC south levee from Sankey Road (at SREL) to Howsley Road (at PGCC) | Widening the existing levee by fix-in-place construction and remediation of geotechnical deficiencies (e.g., landside flattening and cutoff walls). | Levee work completed as part of the NLIP. USACE construction in 2019. Completion of pump plant 4 anticipated in 2021. |

2.2 Encroachments on the Levee

Upon completion of the Natomas Project, the greatest risk to levee integrity and functionality is presented by encroachments on the levee. Encroachments can present varying threats to levee integrity and operation and maintenance (e.g., levee inspection and monitoring and flood response). Levee integrity concerns associated with encroachments have been reduced over the past several years due to the improvements constructed as part of the NLIP and increased coordination by the RD with residents. However, encroachments can not only have an adverse impact on levee integrity, but can significantly impede the ability of levee personnel to safely and adequately conduct inspection, operation, maintenance, and flood fighting activities along the levee. One of the main impediments to levee inspection and flood fighting is safe and adequate access. Adequate visual inspections cannot always be accomplished from the levee crown and access is needed to the levee slopes. Access impediments typically include fences, gates, inadequate walking paths due to landscaping or hardscaping, and inadequate and/or infrequent parking alcoves. The second type of impediment to levee inspections is visual obstructions. Inspectors must be able to view the levee slope from the crown to properly inspect, monitor and assess the levee condition, particularly during high-water events. Because encroachments significantly affect access and visibility and thus the ability of levee personnel to perform necessary operation and maintenance activities, their modification or removal may be necessary.

As described previously, SAFCA, RD 1000, and/or USACE are addressing landside encroachments through construction of the Natomas Project; therefore, these topics are not discussed further except in generalities. However, unique to this area is the significant waterside development present along the Sacramento River east levee. Typical structures and features that are common to private residences and

commercial buildings (e.g., homes, offices, restaurants, sheds, hardscaping, retaining walls, landscaping) are present on the waterside slope. In some cases, these encroachments are located waterward of the theoretical levee prism, due to construction of an adjacent levee as part of NLIP, or future adjacent levee as part of the Natomas Project, and in some cases, this is the waterside levee slope. For both new and existing encroachments, existing rules, standards, and regulations are being applied; however, due to the presence of an adjacent levee in some locations, there may be some flexibility provided to the landowners as long as the encroachments are not presenting an unacceptable threat to levee integrity, or operation, through restriction or impediment of access and visibility.

In 2019, RD 1000 conducted a property-by-property survey along the Garden Highway (i.e. SREL) to identify the severity of encroachments that could impact inspections, operations and maintenance. Existing encroachments presenting an unacceptable threat to levee integrity and/or operation and maintenance, primarily access and/or visibility, were assessed for each property. RD 1000 is using the assessments to develop a plan to facilitate the necessary corrective actions that each affected landowner shall undertake in the remediation and/or removal process for the non-compliant encroachments. RD 1000 will prioritize the correction of unacceptable items and develop a schedule for correction for each identified property. Properties with high-risk items will be prioritized for correction. Moderate and low risk items will be addressed over time. In all cases, correction timelines will be subject to the cooperation of property owners. If a landowner refuses to remove or modify their non-compliant encroachment, RD 1000 will request enforcement assistance from the CVFPB. Enforcement proceedings, which are subject to mandated notifications and notification periods, require a significant amount of time and resources to execute.

Additionally, RD 1000 in cooperation with CVFPB, Sacramento and Sutter Counties and the City of Sacramento, will reestablish access to both the waterside levee slope within the scope of RD 1000's easements, and the easement area and city and counties road rights-of-way under the control of the state and/or RD 1000. These areas currently have physical obstructions needing to be modified or removed to allow access for visual inspection. Obstructions include, but are not limited to, walls, fences, and gates that restrict the ability to conduct inspections of the waterside slope and adjacent areas of the Garden Highway levee from the roadway.

2.3 Administrative Deficiencies Associated with Encroachments

Following the property-by-property survey and identification of the items presenting an unacceptable threat to levee integrity and/or access and visibility, there are anticipated to be several hundred additional encroachments, that are identified as lacking proper permit documentation and not presenting an unacceptable threat to levee integrity or operation and maintenance. RD 1000 and the CVFPB will conduct an exhaustive research effort to locate the documentation required for these items and where documentation cannot be located, affected encroachment owners will be required to apply for all necessary permits from the USACE, RD 1000, CVFPB, and/or the City of Sacramento, County of Sacramento or County of Sutter, or remove the encroachment. These items present the lowest risk to the system.

Per 33 *Code of Federal Regulations* (CFR) 208.10, any action over, under, or through a flood control work requires review and concurrence that the action meets USACE levee standards prior to that action being

taken. Additionally, in the California Central Valley, issuance of a permit is the responsibility of the CVFPB, as the non-Federal sponsor, to ensure the action is in compliance with Title 23 of the California Code of Regulations, along with permitting approval (letter of permission) under 33 *United States Code* (USC) Section 408 by the USACE Sacramento District. Therefore, for each encroachment, there should be an encroachment permit from the CVFPB and a letter of permission (previously called a “no objection letter”) from the USACE. In some cases, the encroachments predated 33 CFR 208.10 so documentation is typically limited to a note in the project’s as-built drawings.

There are hundreds of levee encroachments in the Natomas levee system that fall into one of the following categories:

- Permitted by the CVFPB, accompanied by a no-objection letter from the USACE, and in compliance with the conditions of the permit (results in an acceptable rating).
- Permitted by the CVFPB, accompanied by a no-objection letter from the USACE, and not in compliance with the conditions of the permit (results in an unacceptable rating).
- Permitted by the CVFPB, lacking a no-objection letter from the USACE, and in compliance with the conditions of the permit (results in an unacceptable rating).
- Permitted by the CVFPB but lacking documentation of the permit, either lacking or accompanied by a no-objection letter from the USACE, and in or out of compliance with the conditions of the permit (results in an unacceptable rating).
- Not permitted by the CVFPB, lacking a no-objection letter from the USACE, and documented in the project as-builts (typically results in an acceptable rating).
- Not permitted by the CVFPB, lacking a no-objection letter from the USACE, and not documented in the project as-builts (results in an unacceptable rating).
- Unintended encroachments (e.g. trash, debris, obstructions) and inappropriate activities (e.g. temporary storage, excavations) that can be immediately corrected but do not inhibit operations and maintenance or emergency operations would generally result in a minimally acceptable rating.

Irrespective of any threat assessment towards levee safety, all encroachments, fall into one or more of the above categories. Therefore, an encroachment that does not present an unacceptable threat to levee integrity or operation and maintenance may be rated as marginally acceptable regardless of its permit status; however, an encroachment that is neither in compliance with the permit nor meets current design standards may be rated as unacceptable. To this end, proper documentation is required to demonstrate that each encroachment has been reviewed and approved by USACE and CVFPB.

RD 1000 and the CVFPB will conduct an exhaustive research effort to locate the documentation required for these items and where documentation cannot be located, affected encroachment owners will be required to apply for all necessary permits from the USACE, RD 1000, CVFPB, and/or the City of Sacramento, County of Sacramento or County of Sutter, or remove the encroachment.

3. INTERAGENCY COORDINATION & CONSULTATION

3.1 USACE Natomas Project

Efforts related to the Natomas PACR have been based on the coordinated, collaborative efforts of the SAFCA, RD 1000, CVFPB, DWR, USACE, U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Environmental Protection Agency (EPA), State Historic Preservation Officer (SHPO), California Department of Fish and Wildlife (CDFW), and Central Valley Regional Water Quality Control Board (CVRWQCB). The primary purpose of this coordination has been in the form of consultation to obtain the necessary permits to construction the project. Continued coordination with these agencies will occur until completion of the Natomas Basin Project.

3.2 Encroachments

The Natomas levee system protects a highly urbanized area, and development along the waterside of the SREL (Unit 1) and ARNL (Unit 2) is present. These facts present unique challenges to RD 1000.

Modification, removal, and/or permitting of encroachments will require significant coordination between RD 1000, CVFPB, and USACE Sacramento District. Extensive research and documentation and outreach to landowners and encroachment owners will be required to resolve unacceptable items. In cases where the property owners are uncooperative, collaboration will be required to enforce compliance.

The Central Valley is home to hundreds of species of wildlife and plant life, including several State and federally threatened and endangered species. Removal or modification of encroachments may impact one or more of these species, although formal consultations with the applicable environmental regulatory agencies are not expected. Encroachment removal or modification may also involve actions such as alterations in the streambed or disturbance to Waters of the United States, and as such could require consultation with the applicable state and federal agencies. It is expected that the landowner would implement most encroachment removals or modifications.

3.3 Administrative Actions

Encroachment permitting, including development of the administrative record, will require significant coordination among RD 1000, CVFPB, USACE Sacramento District, individual encroachment owners, and landowners. The files of all three agencies will need to be researched to determine what the permitting needs are for each individual encroachment. This will require research into actual permits as well as as-builts because in many cases, encroachments predate the establishment of the SRFCP. In cases where there are no objections to the encroachment but there is no record, RD 1000 will work with the CVFPB and USACE to retroactively processing permits. In cases where there are objections, RD 1000 will work with landowners to modify or remove the encroachments. In cases where the landowner or encroachment owner is uncooperative, enforcement proceeding will be required. The CVFPB is responsible for enforcing encroachment permit terms and conditions and has a process in place for such enforcement. The process includes research of permit and as-built records, informal coordination with easement owners and landowners, noticing, and potentially public hearings. This process can take significant time and can become litigious.

4. AGREEMENTS

There are no specific agreements required to support implementation of this SWIF. O&M requirements are documented in relevant O&M Manuals published by USACE, including the forthcoming revision to the Unit 124 O&M Manual which incorporates specific access and visibility standards for the SREL. In addition, RD 1000 has and continues to seek supplemental funding from the State under its Flood Maintenance Assistance Program ("FMAP") which could expedite resolution of some items.

5. INTERIM RISK REDUCTION MEASURES PLAN

Implementation of the Natomas Project, restoration of access and visibility, and development of the administrative record are long-term solutions that will not be complete for several years. Therefore, an Interim Risk Reduction Measures (IRRM) plan has been developed to reduce the likelihood and consequences associated with inundation risk to the levee area while these long-term solutions are being implemented. This IRRM plan includes both structural and non-structural measures to reduce risk.

5.1 Potential Levee Failure Scenarios

USACE requires that the IRRM consider four potential levee failure modes:

a. Levee Breach Prior to Overtopping

A levee breach prior to overtopping would provide less warning time than an overtopping scenario. Levee breaches may provide warning signs, such as sand boils and surface erosion, but failure can also occur without warning in the form of foundation failure. Reduced warning times provides less time for mitigating responses to potential levee failure. A breach prior to overtopping would initially provide a smaller initial inundation due to breaching when compared to a levee overtopping with breach scenario, however the ultimate inundation is directly proportional to external (waterside of levee) water elevations and by the minimum levee crest elevation.

The risk of a levee breach prior to overtopping for the Natomas levee system is low due to the multi-phased levee improvement efforts implemented by SAFCA and USACE which include increased slope stability, improved through- and underseepage mitigation measures, and reduction in freeboard deficiencies for the 200-year event.

b. Levee Overtopping with Breach

The overtopping with levee breach scenario starts as an overtopping event and followed by a breach caused by the overtopping. A levee overtopping event with a subsequent breach would produce the maximum initial flood wave; however, it also provides the greatest warning time, prior to breach, when compared to the breach prior to overtopping scenario. The locations of anticipated levee overtopping, based on the minimum levee crest elevation, will be monitored for warning signs and preventive

measures would be implemented in the event of an impending overtopping scenario, e.g. sandbagging along levee crest. The ultimate maximum water elevation is directly proportional to the external water elevation and the minimum levee crest elevation.

Similar to the scenario of a breach prior to overtopping, the risk of a levee breach is low for the Natomas levee system due to the flood reduction measures implemented by SAFCA and USACE for the 200-year event.

c. Malfunction of the Levee System Components

Malfunctioning of the levee system components, assuming no levee overtopping, would likely result in the least severe consequences of the four potential failure modes. Within the levee system, the components likely to fail/malfunction are flap gates or other closure devices on through pipes, gravity pipes, and other pipes; railroad or road crossing closure gates; relief wells; flood walls; and pump stations designed to pump interior drainage to the external water sources.

Generally, malfunction of levee system components results in localized flooding and provides opportunity for immediate mitigating actions, such as pumping, and additional levee armoring on the landside to prevent an escalation of consequences. In the event of a flap gate failure, flooding would be localized and mitigating actions, such as pumping and additional levee armoring on the landside, could prevent escalating consequences. However, the localized flooding on the landside toe could weaken the levee and increase the likelihood of failure. A failure of railroad, road crossing, or manual closure gates could result in more severe localized flooding and lower the minimum levee crest elevation significantly resulting in overtopping. Depending on the type of gate, the severity of the gate failure, and the invert elevation of the gate, the failure could result in minor consequences similar to a failed flap gate to a full levee breach.

d. Levee Overtopping Without Breach

Generally, the interior inundation levels due to a levee overtopping scenario without a breach, are lower than both an overtopping scenario with a subsequent breach and a breach prior to overtopping, and the amount of flooding is related to the amount of time of the overtopped levee flow. The locations of overtopping can be anticipated based on the lowest levee crest elevations and preparations for reinforcement can be planned beforehand and rapidly mobilized. The overtopping will also produce relatively localized inundations and therefore provide more opportunity for mitigating actions during a flood event.

Similar to the above scenarios, the risk of a levee breach is low for the Natomas levee system due to the flood reduction measures implemented by SAFCA and USACE for the 200-year event.

5.2 Interim Maintenance Standards & Risk Reduction Measures

No additional or new maintenance standards are being proposed during implementation of this SWIF, although interim risk reduction measures will be implemented. Implementation of the below measures will continue to reduce risk to the Natomas Basin:

- Access and visibility conditions have been assessed and ranked for degrees of severity for all privately-owned waterside properties on the Garden Highway. RD 1000 will initially reach out to landowners to address encroachments that severely impact access and/or visibility.
- Sacramento County, Sutter County and the State of California provide annual pre-season flood awareness information to the public through mailers, ads, and social media.
- RD 1000 has a comprehensive public outreach campaign to make the community aware of its flood control responsibility and authorities. This includes an active website and Facebook page to increase and improve communications with residents in the basin, particularly during flood season.
- RD 1000 participates in community meetings and informational events hosted by the City and Counties to provide information to the public about emergency planning and evacuation procedures.
- RD 1000 has also been coordinating with City and County emergency managers to improve communication, flood event response and evacuation planning.
- RD 1000 is a signatory to the Sacramento County Public Works Mutual Aid Agreement, and has executed a similar agreement with the City of Sacramento to ensure adequate resources are available to monitor the system and respond to a flood emergency.
- When river waters are forecast to rise to above trigger levels, RD 1000 provides increased patrols and monitoring. Areas of known seepage or geotechnical concerns are closely monitored for any signs of distress.
- RD 1000 works closely with DWR and USACE to flood fight any signs of distress.

5.3 Risk Communication

To address residual flood risk, SAFCA, RD 1000, and the State have a multi-pronged public outreach campaign aimed at informing residents in the Natomas basin of their flood risk. Available information that is provided to the public includes: the annual flood risk notification to residents by the State; annual notification to waterside residents by RD 1000; annual assessment notifications; and informal and formal outreach functions with and among the agencies. Additionally, RD 1000 conducts targeted outreach efforts, primarily through face-to-face interactions with landowner's associations, public meetings, and website/social media, to make the community aware of the district's flood control responsibilities and to provide contact information and locations for the public to get pertinent information before and during every flood season. Further, RD 1000 conducts separate and focused outreach efforts with property owners adjacent to the levees, particularly the waterside property owners along the Sacramento River, which is the area of greatest concern for encroachments. In recent years, there has been significant improvement in addressing encroachments from landowners in response to RD 1000's notices and communications.

RD 1000's Emergency Action Plan includes roles and responsibilities, operations, response actions, and coordination procedures in the event of a flood emergency. Communication and coordination with other jurisdictions shall occur during a flood response on a daily basis at a minimum.

More information can be found on RD 1000's website at www.rd1000.org and Facebook page at <https://www.facebook.com/ReclamationDistrict1000/>.

6. MILESTONE SCHEDULE

Table 6 below presents the major milestones being implemented as part of this SWIF. As stated previously, work towards meeting milestones will occur concurrently despite a difference in risk level, especially as some tasks will support multiple milestones and objectives.

Table 6. SWIF Milestone Implementation Schedule

| Action | Start | Completion |
|---|---------|------------|
| USACE Natomas Project | | |
| Execute PPA | | 2016 |
| Construction | Ongoing | 2024 |
| Encroachments – Highest Risk | | |
| Garden Highway Property-by-Property Access and Visibility Survey | 2019 | 2020 |
| Owner Outreach for Access and Visibility Action (Highest Risk first) | 2020 | 2021 |
| Owner Modifications and Removal | 2020 | 2024 |
| Enforcement Actions (as needed) and Subsequent Owner Modification and Removal | 2020 | 2030 |
| Encroachments – Moderate to Low Risk | | |
| Owner Outreach for Access and Visibility Action | 2021 | 2023 |
| Owner Modifications and Removal | 2022 | 2025 |
| Enforcement Actions (as needed) and Subsequent Owner Modification and Removal | 2025 | 2030 |
| Administrative Actions | | |
| Encroachment Documentation Research and Compliance Determination | 2023 | 2027 |
| Owner Outreach for Encroachment Modification or Permitting | 2024 | 2028 |
| Owner Modifications, Removal, and/or Permitting | 2025 | 2030 |
| Enforcement Actions (as needed) and Subsequent Owner Modification and Removal | 2026 | 2035 |

For actions shown in Table 6 that span over multiple years, the current plan is to remediate all identified encroachments by its respective completion year. Highest risk encroachments will be the top priority for the initial remediation effort and its progress will have a bearing on the timeline for the necessary actions required for encroachments that are moderate to low risk. RD 1000 anticipates that the above schedule may change based on the success rate of the initial remediation efforts.

6.1 Progress Reporting

The most significant reduction in flood control risk will come from implementation of the Natomas Project. This project is federally led by the USACE Sacramento District. To this end, RD1000 may not report on its progress; however, the project will address encroachments impacted by construction.

Progress reporting for correction of unacceptable encroachments will primarily include the number of parcels surveyed, number of parcels undergoing active, voluntary compliance, number of parcels referred to the CVFPB for enforcement, and number of parcels in compliance through resolution.

Updates to the administrative record will occur, in part, inherently with correction of unacceptable encroachments as it is RD 1000's intent to address unacceptable items by property thereby identifying all

access, visibility, and administrative deficiencies at once. The remainder will occur independent and following correction of higher risk items. Progress for these activities will be reported through the number of items/parcels for which permits exist, number of items /parcels for which permits have been determined to not exist or require amendment; number of items'/parcels referred to the CVFPB for enforcement, and number of items/parcels in compliance.

Finally, RD 1000 is utilizing a spreadsheet to track correction of the unacceptable items and will summarize the data as part of its annual progress report. See **Appendix A** for the listing of parcels along the Garden Highway and the visibility and access assessment for each parcel.

7. COORDINATION WITH FEMA

RD 1000, SAFCA, the City, and counties, continue close coordination with FEMA. This has been especially true in recent years as actions taken by RD 1000, SAFCA, and the State have resulted in a new FEMA mapping designation for the Natomas Basin. In June 2015, the Natomas Basin was mapped as an A99 Zone, which recognizes the improvements made to date but still requires residents and businesses with federally-backed mortgages and loans to carry flood insurance. This coordination is expected to continue during construction of the Natomas Project.

8. CONCLUSION

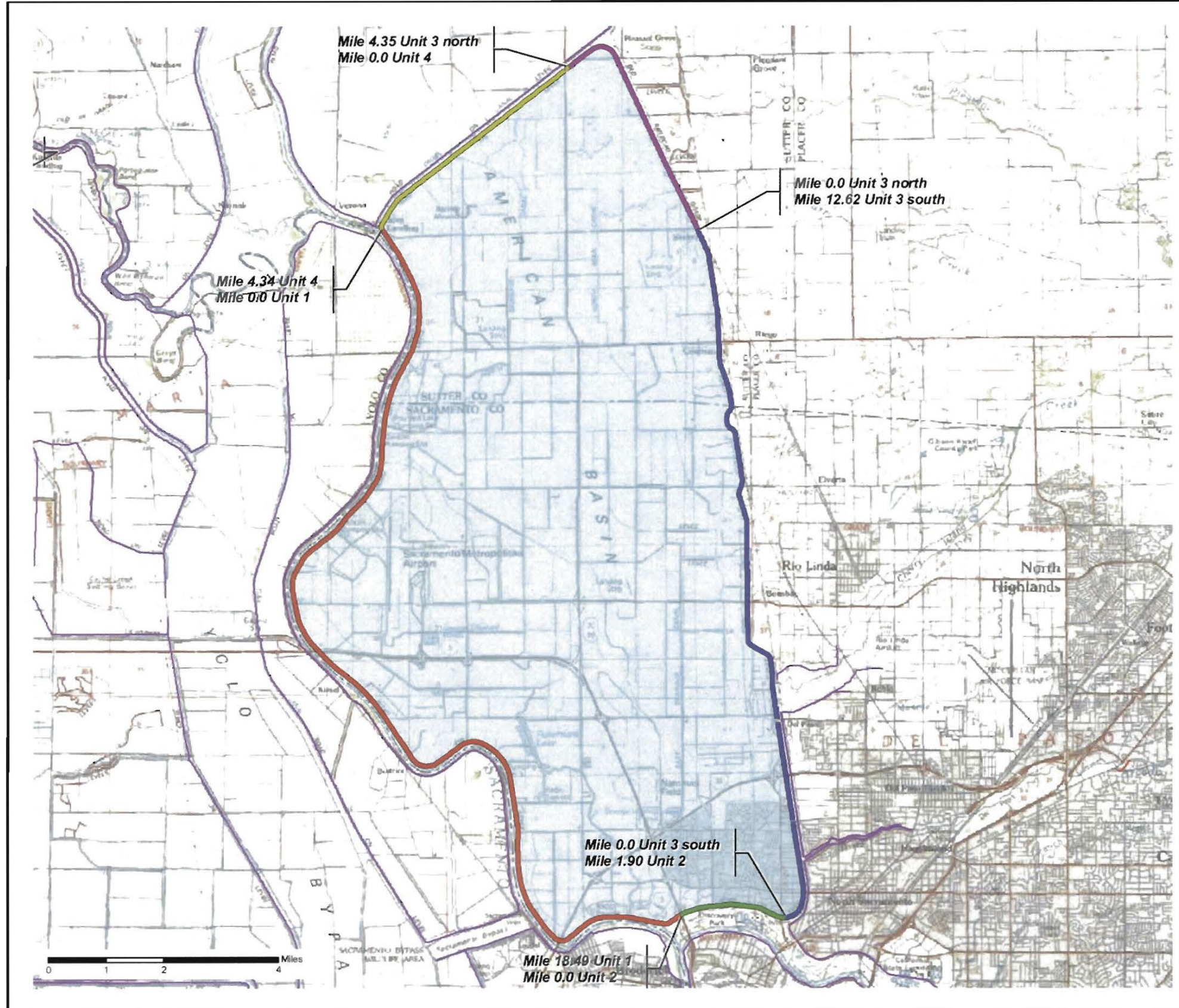
Implementation of this SWIF will address unacceptable items identified by USACE in 2010, levee design standard deficiencies, unacceptable threats to levee integrity and operation and maintenance, and rebuild the administrative record. Correction of levee design standard deficiencies through implementation of the Natomas Project is well underway and completion is expected within five years. Identification of threats to levee safety presented by encroachments and notification to their owners is also expected to be completed within five years, as is correction of many of these items. RD 1000 is committed to engaging landowners in a respectful, professional, and patient manner appropriately scaled to the threat presented by unacceptable items. However, some landowners may be reluctant and/or resistant to cooperation with RD 1000. As a result, RD 1000 anticipates enforcement action will be necessary. Enforcement proceeding are subject to legal timelines and court orders and take several years to complete. As required by the SWIF policy, RD 1000 will provide annual updates on its status in implementing this SWIF.

REFERENCES

Documentation supporting this SWIF:

1. USACE, 2013. Letter Accompanying Revised Levee Inspection Report Card and Revised Unacceptable Deficiency List for RD 1000- Natomas Levee System. July 1, 2013.

2. USACE, 2010. RD 1000 Natomas/California Periodic Inspection. Sacramento and Sutter Counties, California. September 2010.
3. USACE, 2010. American River Common Features Project, Natomas Post-Authorization Change Report. July 2010.
4. SAFCA and CVFPB, 2010. Vegetation Variance Request, Natomas Levee Improvement Program (Additional Information Provided May 27). April 2, 2010.
5. USACE, 2010. Memorandum CVFPB Vegetation Variance Request for the American River Watershed, California, Common Features (Natomas Basin) Project, Post-Authorization Change Report.
6. USACE. Unit No. 124 North Levee of American River from Natomas East Canal to the Sacramento River and East Levee of the Sacramento River from Natomas Cross Canal to American River. Supplement to Standard Operation and Maintenance Manual Sacramento River Flood Control Project.
7. USACE. Unit No. 125 Back Levee of Reclamation District No. 1000 Supplement to Standard Operation and Maintenance Manual Sacramento River Flood Control Project.
8. Reclamation District No. 1000. Emergency Action Plan. Approved by RD 1000 Board of Trustees October 14, 2016.



Map Legend

Project Levees NLD SYSTEM and SEGMENTS
(LIS Code and Segment Length Miles)

- Unit 1, Sacramento River (NAT1 - 18.49)
- Unit 2, American River (NAT2 - 1.90)
- Unit 3 north, Cross Canal inflow (NAT3 - 4.35)
- Unit 3 south, NMDEC (NATC - 12.62)
- Unit 4, Natomas Cross Canal (NAT4 - 4.34)

- Federal Levee
- Non-Federal Levee (PL84-99)
- Protection Area

USGS Quadrangles (100k)
SACRAMENTO, 1982

| |
|---|
| FEDERAL LEVEE PROJECTS SYSTEMS MAP |
| RD 1000 - NATOMAS |
| U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT |

APPENDIX A

Garden Highway Waterside Visibility and Access Inventory