Ventura County
Watershed Protection District

FEMA Levee Certification

Ventura County, California

Ventura River Levee (VR-1)
Pacific Ocean to Canada de San Joaquin

Evaluation Report

February 20, 2009

TETRA TECH, INC.
17770 Cartwright Road, Suite 500
Irvine, California 92614

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Prepared for:

Ventura County
Watershed Protection District

Prepared by:

Tetra Tech, Inc.
17770 Cartwright Road, Suite 500
Irvine, California 92614
(949) 250-6788

and

AMEC
1290 North Hancock Street, Suite 102
Anaheim, California 92807
(714) 779-2591

Executive Summary

As nation-wide efforts to certify all the existing flood control levees, FEMA has identified existing levee facilities within Ventura County. As part of this effort FEMA has requested the Ventura County Watershed Protection District (District) to evaluate the Ventura River Levee (VR-1) and prepare documents for the certification process based on FEMA's regulatory requirements as identified in Title 44 of the Code of Federal Regulations (CFR), Section 65.10 (44 CFR 65.10).

Certification Criteria are as follows:

- Design criteria (freeboard, closures, embankment protection, embankment and foundation stability, settlement, and interior drainage)
- Operation plans and criteria (for closures and interior drainage)
- Maintenance plans and criteria
- Actual certification requirements (i.e. as-builts, forms, documentation, and data)

As part of the Phase 1 process, Tetra Tech was contracted by the District to evaluate the VR-1 levee system and to recommend a levee categorization to facilitate the levee certification.

Levee Categorizations are as follows:

- Category 1 – Levees meet 44 CFR 65.10 requirements and all data or complete documentation is available
- Category 2 – Levees may meet 44 CFR 65.10, but additional data or documentation is needed
- Category 3 – Levees do not currently meet 44 CFR 65.10
- Not a Levee – Based on physical conditions, low WSEL, no SFHA, and/or not providing flood protection

A levee that is assigned a Category 1 or 2 ratings will be further evaluated in the Phase 2 or 3 processes, respectively, in order to finalize its certification status. A levee that is assigned a Category 3 rating will require a Pre-Design Study in the Phase 4 process and implementation of the required improvements to achieve certification status.

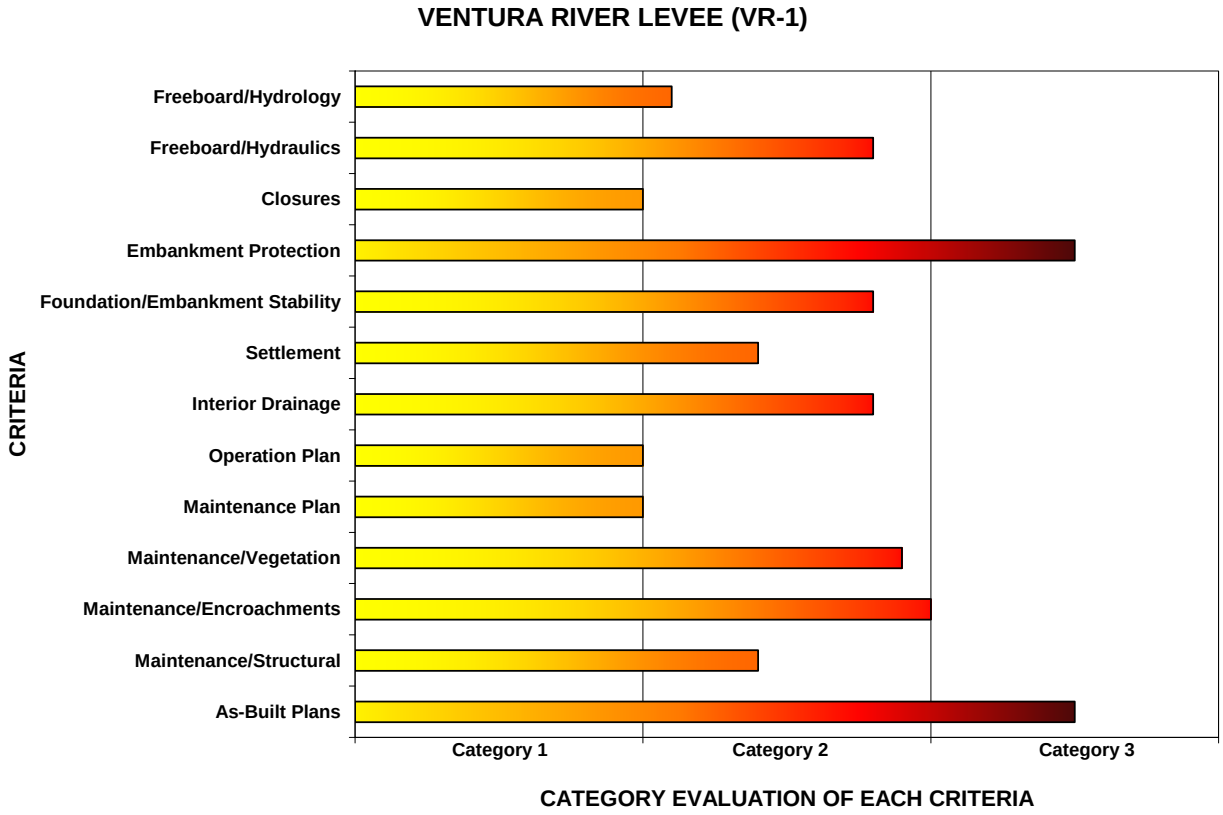
Data collection efforts have been performed to determine what information is available in support of levee certification. Existing information collected and reviewed at the time of preparation of this report includes the following:

- Hydrologic Analysis
- LiDAR Topographic data
- As-built Plans
- Operation and Maintenance Manual
- Inspection/Maintenance Records

A field investigation conducted in early December identified several maintenance issues that will need to be addressed prior to levee certification. Additional field investigations to obtain

geotechnical data and additional engineering analyses to support certification requirements will be required to complete levee certification. The specifics of the work required are discussed in this report.

The graphic presented below identifies the extent of work to be accomplished related to each criterion for levee certification. The longer the task bar the more work required to complete certification. This is a subjective analysis that can be best used to compare the relative amount of work required for all the levees being considered as part of the Levee Certification program within Ventura County. The extent of work required can also be used to categorize the levee. The longest task bar determines the recommended categorization of the levee.



Based on the review of existing data and observations from the field investigation, it is recommended that the VR-1 levee system be classified as a Category 3 Levee. The suggested critical path to achieve levee certification for the VR-1 levee system is outlined in Section F Recommendation.

FEMA Levee Certification

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A) Introduction

The Ventura River Levee (VCWPD ID No: VR-1) is located in the city of San Buenaventura in Ventura County. The location of the levee system is from the Pacific Ocean to Canada de San Joaquin and is shown on Figure 1. The VR-1 levee system is located along the left side of the Ventura River. The levee system consists of embankment levees, side drainage penetrations, and a stop-log structure in the levee at a bike trail crossing. The protective works of the Ventura River levee were designed to provide protection from the 1-percent-annual-chance discharge (base flood) in conformance with FEMA required freeboard and other regulations. The levee system is intended to protect existing residential, commercial, industrial, and potentially developable property in low lying areas within the base flood floodplain of the Ventura River Watershed.

The levee system begins at the Pacific Ocean in Ventura County and continues upstream to the confluence of Canada de San Joaquin. The length of the levee along the Ventura River is approximately 2.65 miles, with an embankment height up to 10 feet above natural ground on the landward side. The levee's earthen berm is protected by loose riprap and grouted riprap with an access road that runs along the top which is approximately 18 to 26 feet wide.

For purposes of the NFIP, FEMA will only recognize in its flood hazard and risk mapping effort those levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with the level of protection sought through the comprehensive floodplain management criteria established by Section 60.3 of the NFIP regulations. Section 65.10 of the NFIP regulations describes the types of information FEMA needs to recognize, on NFIP maps, that a levee system provides protection from the flood that has a 1-percent chance of being equaled or exceeded in any given year (base flood). This information must be supplied to FEMA by the community or other party seeking recognition of a levee system at the time a study or restudy is conducted, when a map revision under the provisions of Part 65 of the NFIP regulations is sought based on a levee system, and upon request by the Administrator during the review of previously recognized structures. The FEMA review is for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and does not constitute a determination by FEMA as to how a structure or system will perform in a flood event. (FEMA, 2007a)

B) Design Criteria

For the purposes of the NFIP, FEMA has established levee design criteria for freeboard, closures, embankment protection, embankment and foundation stability, settlement, interior drainage, and other design criteria. These criteria are summarized in subsections below.

B.1) Freeboard

Section 65.10(b)(1) of the NFIP regulations identifies a minimum freeboard requirement of 3 feet along riverine levees with an additional 0.5 feet required at the upstream limit of the levee and an additional 1.0 foot on both sides of structures (such as bridges). Freeboard is determined by comparing the 100-year water surface elevation with the top of levee elevation. The water surface elevation is derived from hydrologic and hydraulic analyses.

Hydrologic analyses based on stream gage records were performed by the Bureau of Reclamation and presented in Appendix D of the "Matilija Dam Ecosystem Restoration Feasibility Report", prepared by the U.S. Army Corps of Engineers, dated September 2004.

Figure 1 – Location Map

These analyses are appropriate for use in levee certification for the Ventura River and provide a 100-year flow that can be used in the hydraulic analysis. The hydrologic analysis did not develop a hydrograph and this work would need to be completed to support the geotechnical seepage analysis.

No recent FEMA reviewed and approved hydraulic analysis is available for the Ventura River. The Bureau of Reclamation prepared Hydrology, Hydraulics and Sediment Studies for the Matilija Dam Ecosystem Restoration project, dated November 2006. In their report they determined a discrepancy in datum with the LIDAR data. Apparently the datum from the Ocean to river mile 4 was in a vertical datum of NGVD29 as opposed to the vertical datum of NAVD88 which covered the remainder of the river. The existing hydraulic model from the Bureau of Reclamation will be useful as a reference, however, the LIDAR data from the Ocean to river mile 4 will need to be re-created in NAVD88 per FEMA Procedural Memorandum No. 41.

The County has corrected the inaccuracies in the LiDAR data and has appropriate topographic information in the vertical datum of NAVD88. This topographic information is appropriate for preparing a hydraulic analysis to support the freeboard analysis.

The existing sediment study from the Bureau of Reclamation will be useful as a reference, however, additional sedimentation and scour analyses will need to be performed to support the freeboard analysis and embankment stability analysis.

B.2) Closures

Section 65.10(b)(2) of the NFIP regulations requires that all openings be provided with closure devices that are structural parts of the system.

Review of the as-built plans and results from the field investigation (Field Investigation Report included as Exhibit 1) indicate that the system includes a stop log system that acts as a closure. The stop log structure includes 12 aluminum beams at the site for installation during flooding conditions.

Documentation of this structure is required as part of the certification. Work will also include an assessment of the impacts of the cracks in the structure observed during the field investigation and any corrective actions that may be required.

B.3) Embankment Protection

Section 65.10(b)(3) of the NFIP regulations requires that engineering analyses be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the 100-year flood.

Field investigations have identified several locations where the levee embankment has been impacted and requires restoration/mitigation. The District is aware of and working on a design improvement for the location where the maintenance road is failing near levee Station 121+00.

As-built plans are available and field verification has been completed. A preliminary evaluation of the levee system’s current top, toe, toedown and river thalweg has been

prepared and is presented in Exhibit 2. The 1949 as-built plans show 8-feet of toedown was provided when the levee was initially constructed. Over the last 60 years the Ventura River has degraded along the VR-1 levee to a point where currently, there is minimal to no toedown protection.

To better understand the factors leading to this erosion, Tetra Tech became familiar with the report titled "Hydrology, Hydraulics, and Sediment Studies for the Matilija Dam Ecosystem Restoration Project, Ventura, CA – DRAFT Report", developed by the Bureau of Reclamation, dated November 2006. The following information is based on an examination of that report.

Structures have been built within the Ventura River Watershed that impact sediment transport. These manmade features include:

- Matilija Dam, built 1947
- Casitas Dam, built 1958
- Robles Diversion Dam, built 1958
- McDonald Detention Basin
- San Antonio Creek Debris Basin
- Stewart Canyon Debris Basin
- Dent Debris Basin

The review of historical data and sediment transport modeling performed as part of the Bureau study indicates that erosion experienced in Reach 2 (which includes the VR-1 levee) is not largely attributed to the manmade features. The significant sediment supply available throughout the watershed and not impeded by the manmade features diminishes the impact of the manmade features on sediment transport through the VR-1 reach.

The Bureau report identifies the largest contributor to the erosion in reaches well downstream of the dams as being a shift from a relatively dry period to a wet period. The gage record shows a shift from a dry period to a wet period beginning in 1969.

The Bureau report indicates degradation of the river along the VR-1 levee, however the data analyzed was limited to between 1970 and 2001. The impact of the change in regime could be further investigated if historical data were available to compare thalweg changes from pre-1969 to those of post-1969. Based on data presented in the Bureau report it cannot be determined if the Ventura River along the VR-1 levee has been degrading for a long period of time (pre-1969) or if the rate of degradation has accelerated during the years post-1969.

While the Bureau report points to a change to a wet period as being the largest factor for the overall degradation of the river system as a whole, other factors such as the manmade features within the watershed are also likely to have contributed to some degree.

B.4) Embankment and Foundation Stability

Section 65.10(b)(4) of the NFIP regulations requires that engineering analyses be submitted that evaluate the levee embankment stability. Borings of the levee are required to support this analysis.

Test pit logs from the original levee design are available for review. These included 19 test pits with minimal laboratory testing. The test pits were shallow in depth and laboratory testing was limited to moisture density tests and some gradation analyses. However, no information regarding the original geotechnical design, such as seepage or slope stability evaluations, is available.

From about levee Station 119+00 to 124+00 the river channel has eroded in close proximity to the levee structure. A potential exists for undermining of the levee at this location. From Station 39+80 to 46+24 modifications to the levee landside slope, such as undercutting and construction of retaining structures, have been performed which are considered to have a negative potential impact to the stability of the slope. At Station 35+33 the adjacent landside slope has been subject to heavy erosion. Areas of the slope have non-grouted rip-rip which could not be observed either because the rip-rip could be missing or was buried with soil/debris.

Further analysis and evaluations would include the following:

- Geotechnical borings for determining existing geologic conditions, obtaining geologic samples, and performing in-situ permeability testing.
- Test pits for evaluation of rip-rap conditions.
- Laboratory testing consisting of soil classification, shear strength and permeability,
- Seepage analyses.
- Slope stability analyses.

B.5) Settlement

Section 65.10(b)(5) of the NFIP regulations requires that engineering analyses be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement.

As of February 13, 2009, no geotechnical design or construction information regarding settlement potential has been made available for review.

During field inspections, no obvious evidence of adverse settlement was observed.

Further analysis and evaluations would include the following:

- Geotechnical borings for determining existing geologic conditions, obtaining geologic samples, and performing in-situ permeability testing.
- Laboratory testing to evaluate consolidation potential.
- Analyses of potential long term settlement and seismic deformation.

B.6) Interior Drainage

Section 65.10(b)(6) of the NFIP regulations requires that an analysis be submitted that indentifies the sources, extent, and depth of interior flooding.

Interior drainage analyses would be required at all storm drain penetrations. Based on the field investigation and review of the as-built plans, there are 13 storm drain penetrations through the levee. All storm drains have flap gates with the exception of one location at

Stanley Drain which is currently being repaired. GPS locations and descriptions for each are included in Table 1 of the field investigation report included as Exhibit 1. Photographs of the outlets are also included in the report. For storm drains that continue underground into the City of San Buenaventura, additional documents will be required including the master plan of drainage to develop the interior drainage analyses.

C) Operation Plans and Criteria

Section 65.10(c) of the NFIP regulations requires submittal of appropriate documentation of the operation of the system.

An operation plan exists that is in use for this levee. For certification this operation plan will need to be updated to meet the NFIP requirements including the attachment of the County's Flood Warning System and Emergency Response Plan. The operation plan will need to include the procedures for operating the entire system including the stop log structure as well as the interior drainage system.

D) Maintenance Plans and Criteria

Section 65.10(d) of the NFIP regulations requires submittal of appropriate documentation for the maintenance of the system.

A maintenance plan exists that is in use for this levee. For certification this maintenance plan will need to be updated to meet the NFIP requirements.

The field investigation report included as Exhibit 1 documents maintenance issues that were identified during the field investigation. Those issues are summarized in Table 2 of that report. The District has been unable to implement certain maintenance improvements due to permitting and environmental constraints. However, these locations need to be repaired or remediated in order for the levee system to meet the levee certification criteria set by USACE and FEMA and to be fully operational. Table 2 also provides possible repair or remediation actions for the locations along with the GPS points. Photos taken at the maintenance required locations are included in Appendix C of the report. Major maintenance issues are related to vegetation removal, encroachments into the landward side levee embankment, scour/bank stability near Hwy 33 crossing (levee Station 121+00) and embankment erosion due to runoff, pedestrian traffic, and resident activities.

E) Certification Requirements

Section 65.10(e) of the NFIP regulations requires that in addition to the above-described analyses, certified as-built plans of the levee must be submitted.

Most as-built plans obtained through data collection efforts have appropriate approvals to be used for certification, however, there are some outstanding as-built documents that still need to be obtained to complete the analyses and certification process. A list of the as-built plans and their status for this project is presented in Exhibit 3. New as-built documents will need to be prepared for all construction improvements required.

A complete system and structural evaluation should be performed as part of the certification. This analysis will address some concerns identified in the field investigation including spalling at concrete structures.

Additional work to complete this task includes preparation of a Levee Certification Report that includes all analyses to meet the Section 65.10 NFIP requirements as well as the FEMA MT-2 application package.

F) Recommendation

The field investigation identified several critical issues that must be resolved prior to certification. The most significant issues are deficient toedown protection and the encroachments into the landward side embankment upstream of the ocean outlet and upstream of Main Street. Other issues that require major attention are vegetation removal. Engineering analyses will also need to be performed to verify that this levee meets the NFIP Section 65.10 requirements.

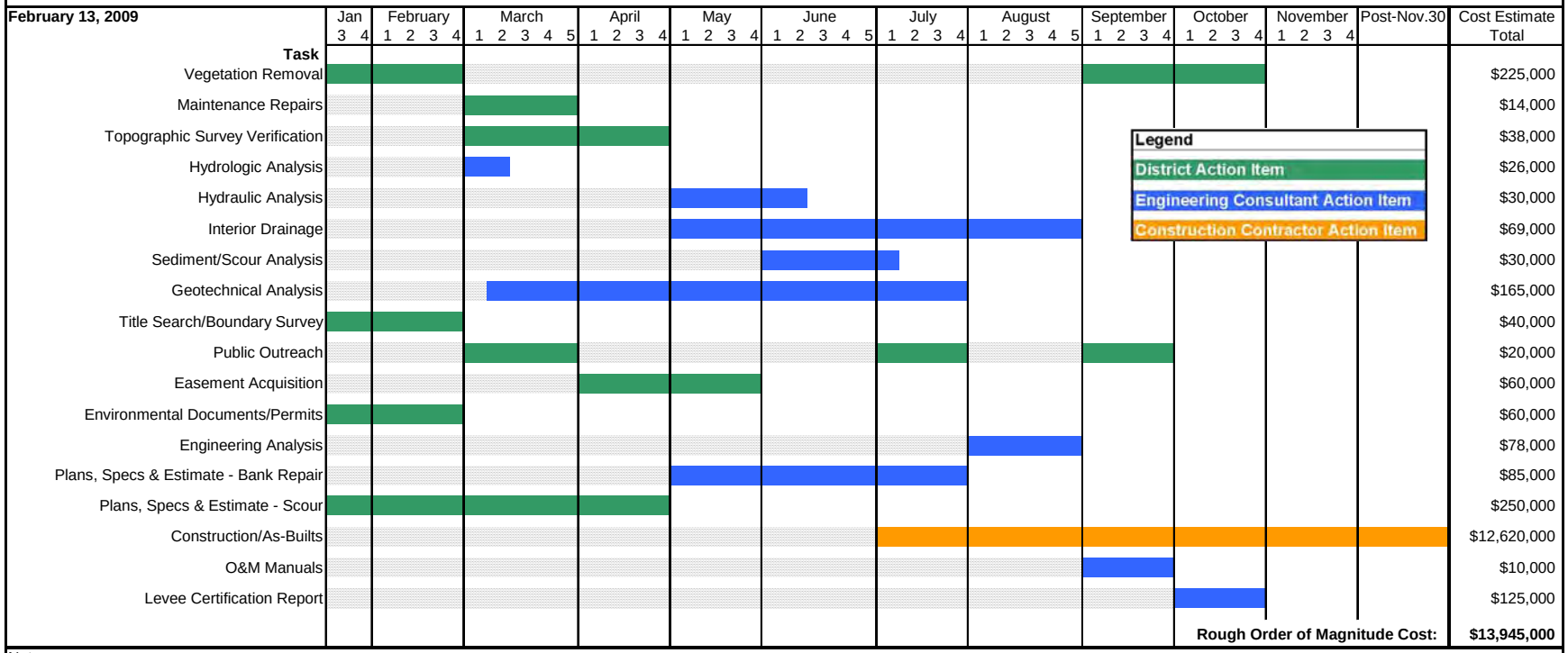
Presented in Exhibit 2 are the profiles of the existing thalweg and the levee toedown along the entire 2.65-mile levee system. It reveals that approximately 1.4 miles of the Ventura River thalweg, from Station 64+00 to Station 138+50, is either below or very close to the existing levee toedown. There are no geological features, such as bedrock, or manmade feature, such as rock groins, that would prevent the thalweg of the river from migrating toward the levee and undermining the toedown. Thus, the existing levee has a reasonable failure potential due to toedown undermining during major flood events and cannot be certified in its current condition.

Based on the review and comparison of existing data and observations from the field investigation, it is recommended that the VR-1 levee system be classified as a Category 3 Levee.

The suggested critical path to achieve levee certification for the VR-1 levee system is outlined below and a tentative schedule of actions is shown on Figure 2.

- Vegetation Removal
- Maintenance Repairs
- Topographic Survey
- H&H Analyses/Interior Drainage
- Sediment/Scour Analyses
- Geotechnical Field Investigation and Analyses
- Title Search and Boundary Survey -
- Public Outreach/Workshop
- Easement Acquisition (if needed)
- Environmental Documents/Permits
- Engineering Analysis and Design
- Plans, Specifications and Estimate
- Construction/As-builts
- Operation and Maintenance Manuals
- Levee Certification Report

LEVEE CERTIFICATION ACTION PLAN TASK TIMELINE AND COST ESTIMATES FOR VR-1



Notes:
1) Costs in this table are Rough Order of Magnitude and are based on the best available information as of the date listed in the upper left.
2) Costs for major rehabilitation requirements due to deficiencies found in future work are not included in this table.

Figure 2 – Tentative Schedule of Actions

G) References

FEMA. 2005a. *Title 44 of the Code of Federal Regulations (CFR), Section 65.10 (44 CFR 65.10),* Federal Emergency Management Agency.

FEMA. 2005b. *Procedural Memorandum 34 – Interim Guidance for Studies Including Levees,* Federal Emergency Management Agency.

FEMA. 2007a. *Fact Sheet Requirements of 44 CFR, Section 65.10 Mapping of Areas Protected by Levee Systems,* Federal Emergency Management Agency.

FEMA. 2007b. *Revised Procedural Memorandum 43 – Guidelines for Identifying Provisionally Accredited Levees,* Federal Emergency Management Agency.

Tetra Tech. 2008. *Ventura River Levee (VR-1) Pacific Ocean to Canada de San Joaquin, Field Investigation Report.* Prepared for the Ventura County Watershed Protection District, Ventura, California.

U.S. Army Corps of Engineers. 2004. *Matilija Dam Ecosystem Restoration Feasibility Report, Appendix D.*

U.S. Army Corps of Engineers. 2006. *Levee Owner's Manual for Non-Federal Flood Control Works*. Prepared for the Rehabilitation and Inspection Program, Public Law 84-99.

U.S. Army Corps of Engineers. 2008. *EC 1110-2-6067 - Certification of Levee Systems for the National Flood Insurance Program (NFIP).*

U.S. Department of the Interior, Bureau of Reclamation. 2006. *Hydrology, Hydraulics and Sediment Studies for the Matilija Dam Ecosystem Restoration Project*.

Ventura County Watershed Protection District. 2007. *Ventura River Ocean to Canada de San Joaquin Operation and Maintenance Manual*.

Exhibit 1

Field Investigation Report

Ventura County
Watershed Protection District

FEMA Levee Certification

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Field Investigation Report

Introduction

Ventura River Levee (VCWPD ID No: VR-1) is located in the city of San Buenaventura in Ventura County. The location of the levee system is from the Pacific Ocean to Canada de San Joaquin and is shown on Figure 1.

As part of the FEMA levee certification process, field investigations of the Ventura River Levee (VR-1) were conducted on December 10-11, 2008. The team included representatives from the Ventura County Watershed Protection District (District), Tetra Tech, and AMEC. The investigation was conducted by walking the entire length of the levee system while visually assessing the existing conditions of the flood protection elements. The visual assessment included thirteen (13) different evaluation items such as unwanted vegetation growth, signs of depression/rutting and erosion/bank caving, slope stabilities, penetration, etc. The description of these 13 items can be found in the Levee Inspection Log (Appendix A). Separate inspection logs were completed by Tetra Tech and AMEC at the end of the field visit. The log in Appendix A is a team log that comprises the assessments from the individual inspection logs.

Any notable findings and existing conditions of the levee during the walk were documented with photos and their geo-referenced locations were recorded with a GPS unit. Photos taken during the field investigation along with maps showing their location are presented in Appendix B and Appendix C.

Figure 1 – Location Map

General Descriptions

- The levee system is located along the left side of the Ventura River. The levee system consists of embankment levees, side drainage penetrations, and a stop-log structure in the levee at a bike trail crossing.
- The protective works of the Ventura River levee were designed to provide protection from the 1-percent-annual-chance discharge (base flood) in conformance with FEMA required freeboard and other regulations.
- The levee system begins at the Pacific Ocean in Ventura County and continues upstream to the confluence of Canada de San Joaquin.
- The length of the levee along the Ventura River is approximately 2.65 miles, with an embankment height varying between 3 feet to 25 feet above natural ground.
- The FIRM dated September 29, 1986 shows containment of Zone A.
- The levee system is intended to protect existing residential, commercial, industrial, and potentially developable property in low lying areas within the base flood floodplain of the Ventura River Watershed.
- The levee's earthen berm is protected by loose riprap and grouted riprap with an access road that runs along the top which is approximately 18 to 26 feet wide.
- A right-of-way chain link fence runs along most of the levee.

General Field Observations

a) Riverward side of Levee:

1. Removal of vegetation (trees and shrubs) within 15 feet of levee toe is required between the stop log structure and Fwy 33 (approximately 3 large trees).
2. Multiple cracks were observed on the downstream stop log concrete structure.
3. Restoration of levee top is required in certain locations due to runoff erosion.
4. At the downstream side of Fwy 33 there is a turnout. The maintenance road along the toe of the levee at this point is actively eroding and sloughing away. The river erosion in this area is within 30 feet of the levee embankment and is approximately 17-20 ft deep. This erosion is tending towards the levee embankment.
5. Stanley Drain outlet is missing its closure device (flap gate). County personnel stated that it was being repaired. Closure devices are necessary to avoid flooding behind the levee caused by the backup of the channel flow.
6. The Romona Drain concrete outlet structure is spalling and has exposed rebar. The concrete outlet structure should be repaired.

7. The Simpson Drain concrete outlet structure is spalling and has exposed rebar. The concrete outlet structure should be repaired. Also the flap gate is stuck open due to sediment debris. Removal of sediment that has accumulated in is required to allow drainage and proper operation of the flapgate.
8. Broken up concrete and debris have been dumped over the levee bank near the Main Street gate obscuring any observation of the rip-rap.
9. Multiple animal burrows were observed in the field. They are located near the toe of the slope.
10. Removal of heavy vegetation (trees, shrubs, willows) within 15 feet of levee toe is required between the (3) 48" drainage outlet from the CalTrans yard and the end of the levee.

b) Landward side of Levee:

1. Removal of vegetation (trees, shrubs, willows) within 15 feet of levee toe is required between 150-ft upstream of the stop log structure and Fwy 33 (approximately 12 large trees).
2. Multiple cracks were observed on the downstream stop log concrete structure.
3. Restoration of top and embankment is required in certain locations due to unauthorized pedestrian traffic and runoff erosion.
4. Removal of street signs within the levee embankment may be required.
5. Removal of vegetation (trees, shrubs, willows) within 15 feet of levee toe is required at the Fwy 33 Main St off ramp (approximately 12 large trees).
6. There has been a lot of disturbance along the toe and beyond along the levee between the Fwy 33 Main St off ramp and Main St crossing. In some locations the fence is at the toe or at the top of the levee leaving no room for maintenance.
7. Restoration of the embankment toe is required near the Fwy 33 Main St off ramp. A tin building is encroaching into the toe of the levee. The building needs to be removed and the toe restored.
8. Removal of vegetation (trees, shrubs, willows) within 15 feet of levee toe is required between the tin building and the high pressure gas cage entrance (approximately 70 large trees).
9. Restoration of the embankment toe is required between the high pressure gas cage entrance and Main St crossing. Several private owners have cut into the toe of the levee and constructed keystone blocks and retaining walls.
10. Removal of vegetation (trees, shrubs, willows) within 15 feet of levee toe is required between the high pressure gas cage entrance and Main St crossing (one large tree at the levee entrance gate).
11. Removal of vegetation (trees, shrubs, willows) within 15 feet of levee toe is required between Main St crossing and Rail Road crossing (approximately 13 medium trees).

12. Removal of vegetation (trees, shrubs, willows) within 15 feet of levee toe is required between Rail Road crossing and end of levee (approximately 16 large palms and 5 medium trees).
13. Restoration of the embankment toe is required between Rail Road crossing and end of levee. Toe has been undercut and k-rails placed along toe with debris dumped on the bank. The debris and k-rails need to be removed and the toe restored.

Levee Penetrations

Levee closure of the Ventura River Levee (VR-1) system during storm events must consider the existing storm drain outlets and the existing stop log structure. The storm drain outlets should include closure devices at the end of each storm drain penetration. The stop log structure includes 12 aluminum beams at the site for installation during flooding conditions. A summary of levee system penetrations is presented in Table 1.

Table 1 – Summary of Levee Penetration

River Station	GPS		*Photo No.	Description
	Lat	Long		
Ventura River Levee (VR-1)				
140+53.13	N34.30752	W119.29767	P1, P2	12 beam stop log system at bicycle path crossing
131+21 (+/-)	N34.30577	W119.29945	P3	12” CMP, drains turn out area adjacent to Hwy 33 (not shown on as-builts)
124+89 (+/-)	N34.30430	W119.30057	P4	90” RCP with flap gate ,New Dent Drain (not shown on 1949 as-builts)
117+00	N34.30235	W119.30165	P5	24” CMP & 42” CMP (Old Dent Drain)
111+26.9 (+/-)	N34.30088	W119.30233	P6	48” RCP with missing flap gate, currently being repaired on 12/10/08 (Stanley Drain)
105+90 (+/-)	N34.29954	W119.30315	P7	36” pipe flap gate, FWY #4 Drain (not shown on as-builts)
76+38 (+/-)	N34.29198	W119.30662	P8	36” pipe with flap gate, Vince Drain (not shown on as-builts)
72+50	N34.29097	W119.30708	P9	24” CMP with flap gate, FWY #3 Drain
69+40	N34.29004	W119.30727	P10	48”CMP with flap gate, FWY #2 Drain
67+46 (+/-)	N34.28953	W119.30733	P11	72” RCP with flap Gate, Ramona Drain (not shown on as-builts)
65+19 (+/-)	N34.28892	W119.30706	P12	24” RCP with flap gate, FWY #1 Drain (not shown on as-builts)
60+23 (+/-)	N34.28646	W119.30661	P13	48” pipe with flap gate, Simpson Drain (not shown on as-builts)

River Station	GPS		*Photo No.	Description
	Lat	Long		
49+50	N34.28467	W119.30652	P14	48” CMP with flap gate, Harrison Drain
41+13	N34.28238	W119.30673	P15	24” CMP with flap gate, Peking Drain
22+20	N34.27725	W119.30705	P16	3-48” CMP with flap gates

* Photos can be found in Appendix B.

Maintenance Required Locations

During the field inspection, locations where maintenance is required were documented and are summarized in Table 2. The District has been unable to implement certain maintenance improvements due to permitting and environmental constraints. However, these locations need to be repaired or remediated in order for the levee system to meet the levee certification criteria set by USACE and FEMA and to be fully operational. Table 2 also provides possible repair or remediation actions for the locations along with the GPS points. Photos taken at the maintenance required locations are included in Appendix C.

Inspection Conclusion

Once maintenance at the locations identified in Table 2 are complete, the field inspection of the levee system indicates that the Ventura River Levee (VR-1) system may be certified as providing base flood protection if all other criteria are satisfied. Some maintenance improvements may require additional engineering analyses, design, construction and preparation of as-constructed documents.

Table 2 – Summary of Maintenance Required Locations

GPS		*Photo No.	Description	Action Required
Lat	Long			
Ventura River Levee (VR-1)				
N34.30771	W119.29797	M1	Vegetation within 15' of levee toe (riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.28953	W119.30733	M2, M3	Damaged concrete on 72" RCP Ramona Drain headwall with rebar exposed (riverward side)	Repair the concrete headwall portion of outlet structure
N34.28646	W119.30661	M4, M5	Damaged concrete on 48" Simpson Drain headwall with rebar exposed, flap gate stuck open with sediment (riverward side)	Repair concrete. Remove sediment from pipe opening and ensure complete seal around flap gate
N34.27725 to N34.27552	W119.30705 to W119.30687	M6, M7	Vegetation within 15' of levee toe, approximately 500' along levee (riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.30764 to N34.30745	W119.29728 to W119.29767	M8	Vegetation within 15' of levee toe, approximately 123' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.30758 N34.30762	W119.29775 to W119.29822	M9	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.30106	W119.30201	M10	Erosion on levee top and embankment (landward side)	Fill voids with impervious material, firmly compact, and restore design slope
N34.28545 to N34.28470	W119.30629 to W119.30625	M11	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.28442	W119.30630	M12, M13	Tin storage shed and miscellaneous debris at levee toe (landward side)	Remove tin storage shed and miscellaneous debris
N34.28414 to N34.28325	W119.30637 to W119.30642	M14	Vegetation within 15' of levee toe, approximately 150' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.28325 to N34.28199	W119.30642 to W119.30661	M15, M16	Vegetation and debris within 15' of levee toe, approximately 300' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact. Remove debris (within the 15'-zone as appropriate)
N34.28325 to N34.28199	W119.3064 to W119.30661	M17	Levee toe has been undercut (landward side)	Re-establish 2:1 toe of levee embankment. Additional engineering analyses are recommended.

GPS		*Photo No.	Description	Action Required
Lat	Long			
Ventura River Levee (VR-1)				
N34.28199	W119.29797	M18	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.28199	W119.29797	M18	Retaining wall at property line on landward side is not stable and embankment is damaged	Re-establish 2:1 toe of levee embankment. Additional engineering analyses are recommended.
N34.28056 to N34.28037	W119.3064 to W119.30653	M19, M20	Vegetation within 15' of levee toe, approximately 100' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.27882	W119.30671	M21	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.27614 to N34.27485	W119.30684 to W119.30687	M22	Vegetation within 15' of levee toe, approximately 500' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.27614 to N34.27485	W119.30684 to W119.30687	M23	Debris and K-rails along toe of levee (landward side)	Remove debris and K-rails (within the 15'-zone as appropriate)
N34.29193	W119.30647	M24	Freeway sign installed in levee embankment (landward side)	Relocation of signs not required
N34.28809	W119.30675	M25	Freeway sign installed in levee embankment (landward side)	Relocation of signs not required
N34.28645	W119.30646	M26	Utility poles within 15' of levee toe	Relocation of utility poles not required
N34.28199 to N34.28181	W119.30670 to W119.30664	M27	Dumped debris over levee embankment (riverward side)	Remove debris (within the 15'-zone as appropriate)
N34.28199 to N34.28181	W119.30670 to W119.30664	M28	Erosion along levee toe (landward side)	Fill voids with impervious material, firmly compact, and restore design slope
N34.3061	W119.2992	M29, M30	Approximately 12 sink holes and piping at the top of grouted levee embankment (riverward side)	Repair sink holes. Fill voids with impervious material and firmly compact.
N/A	N/A	M31, M32	Animal burrows at levee toe (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact

Appendix A

Levee Inspection Log

Levee Inspection Log

Facility Name/ID:	VR-1	Date:	December 10-11, 2008
Watercourse:	Ventura River	By:	Ike Pace, Michael Chung (Tt), Doug Dahncke, Bijan Farahani (AMEC), & Bill DuFrain (VCWPD)
Reach:	Pacific Ocean to Canada de San Joaquin		

RATED ITEM	A	M	U	N/A		EVALUATION	LOCATIONS / REMARKS / RECOMMENDATIONS
1. Unwanted Vegetation Growth					A	The levee has a good grass cover with little or no unwanted vegetation (trees, bushes, or undesirable weeds) and has been recently mowed. Except in those cases where a vegetation variance has been granted by the Corps, a 15' zone, free from all woody vegetation, is maintained adjacent to the landward/riverside toe of the FCW for maintenance and flood-fighting activities. Additionally, a 3' root free zone is maintained to protect the external limits of the levee cross section. Reference EM 110-2-301 and/or local Corps policy.	Removal of vegetation (trees and shrubs) on levee embankment and within 15 feet of the toes is required in various locations. Remove vegetation and root ball, fill voids with impervious material and firmly compact.
					M	Minimal number of trees (2" diameter or smaller) and /or brush present on the levee or within the 15' zone, that will not threaten the integrity of the project but which need to be removed.	
			X		U	Tree, weed, and brush cover exists in the FCW requiring removal to reestablish or ascertain FCW integrity. (Note: if significant growth on levees exists, prohibiting the inspection of animal burrows or other inspection items, then the levee inspection should be ended until this item is corrected.)	
2. Depressions /Rutting					A	There are no ruts, pot holes, or other depressions on the levee. No evidence of levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.	
		X			M	Some minor depressions in the levee crown, embankment, or access roads that will not pond water and do not threaten the integrity of the levee.	
					U	There are depressions greater than 6 inches deep that will pond water, endangering the integrity of the levee.	
3. Erosion / Bank Caving					A	No active erosion, undermining, or bank caving due to riverbed degradation or flow impingement, observed on the landward or on the riverward side of the levee.	The maintenance road along the toe of the levee is actively eroding and sloughing away. The river erosion in this area is within 30 feet of the levee embankment and is approximately 17-20 ft deep. Additional engineering analyses are recommended.
					M	There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
			X		U	Erosion, undermining, or caving is occurring or has occurred along the toes that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
4. Surficial Slope Stability					A	No slides present.	There is an approx. 30-ft wide slope failure on the landward side along the 33 fwy near sta. 111+90. There is an over steeped slope to a drainage ditch just downstream of park and ride.
					M	Minor superficial sliding that with deferred repairs will not pose an immediate threat to FCW integrity.	
			X		U	Surficial instabilities that will require more than typical or periodic repair and that threatens FCW integrity. Repairs are required to reestablish FCW integrity.	
5. Deep Seated Slope Stability					A	No slides present.	See item 3.
					M	Signs of deep seated instability can not be determined from site assessment or evidence may or may not be an indicator of deep seated stability. .	
			X		U	Evidence of deep seated sliding that threatens FCW integrity. Repairs are required to reestablish FCW integrity.	
6. Cracking	X				A	No cracking observed on the levee greater than 6 inches deep.	
					M	Longitudinal and/or transverse cracking greater than 6 inches deep. No evidence of vertical movement along the crack.	
					U	Longitudinal and/or transverse cracking present and exhibits signs of vertical movement.	
7. Animal Burrows					A	No animal burrows present on the levees.	Multiple animal burrows were observed in the field. Fill voids
					M	Several animal burrows present which may lead to seepage or slope stability problems, and they require immediate attention.	

RATED ITEM	A	M	U	N/A		EVALUATION	LOCATIONS / REMARKS / RECOMMENDATIONS
			X		U	Significant maintenance is required to fill existing burrows, and the levee will not provide reliable flood protection until this maintenance is complete.	with suitable material and firmly compact.
8. Encroachments					A	No trash, debris, excavations, structures, adverse sediment accumulation, or other obstructions present within the project easement area.	From the 33 Fwy Main St off ramp to the Main St crossing there are numerous encroachments into the landward side toe including metal buildings, landscaping, keystones, retaining walls and vegetation. Additional engineering analyses are recommended.
					M	Trash, debris, excavations, structures, adverse sediment accumulation, or other obstructions present, or inappropriate activities that will not inhibit project operations and maintenance or emergency operations.	
			X		U	Trash, debris, excavations, structures, adverse sediment accumulation, or other obstructions present, or inappropriate activities that will inhibit project operations and maintenance or emergency operations.	
9. Revetments & Banks					A	Existing revetment protection is properly maintained and is undamaged. Revetment protection clearly visible and revetment materials are of sound quality.	Unauthorized dumping of debris, concrete, asphalt and heavy vegetation near Main St crossing obscuring observation of revetment.
					M	No revetment displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow. Unwanted vegetation must be cleared and sprayed with an appropriate herbicide.	
			X		U	Dense brush, trees, or grasses hide the revetment protection or meandering and/or scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling.	
					N/A	There is no revetment protecting the levee.	
10. Closure Structures (Stop Log, Earthen Closures, or Gates)					A	Closure structure in good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components of closure clearly marked and installation instructions/procedures readily available.	Missing closure device on Stanley Drain.
			X		U	Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within normal warning time.	
					N/A	There are no closure structures along the levee.	
11. Underseepage Relief Wells / Toe Drainage Systems					A	Toe drainage systems and pressure relief wells necessary for maintaining FCW stability during flood events functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). No signs of adverse seepage conditions adjacent to or within the levees. Nothing is observed which would indicate that the system won't function properly during the next flood.	
					M	Toe drainage systems or pressure relief wells are damaged and may become clogged if they are not repaired. Signs of adverse seepage such as sand boils, spring lines, vegetation change or other seepage indicators are present but do not directly affect the stability of the levee.	
					U	Toe drainage systems or pressure relief wells necessary for maintaining FCW stability during flood events have fallen into disrepair or have become clogged. Signs of adverse seepage such as sand boils, spring lines, vegetation change or other seepage indicators are present and directly affect the stability of the levee.	
				X	N/A	There are no relief wells/toe drainage systems along the levee.	
12 Maintenance and Emergency Access					A	Maintenance/emergency accesses are clear of obstructions and in good condition.	For certain stretches of the landward side toe the fence is located at the top or toe leaving no room for maintenance along the toe.
		X			M	Minor obstructions and/or damages to the maintenance/emergency access are present, but would not directly affect the accessibility of the levee..	
					U	Numerous obstructions and/or damages to the maintenance/emergency access are present that would directly affect the accessibility of the levee.	
13. Deviation from As-Built Plans					A	There are no deviations from the as-built plans.	Unauthorized alterations to the levees landward side embankment
					M	There are minor deviations from the as-built plans that would not affect the functionality of the levee.	
			X		U	There are major deviations from the as-built plans that could affect the functionality of the levee. Additional engineering analyses are recommended.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. RODI =Requires Operation during Inspection.

Appendix B

Photos of Penetrations and Typical Levee Features

Appendix B – Locations of Levee Photos for Ventura River Levee (VR-1)

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Appendix B – Locations of Levee Photos for Ventura River Levee (VR-1)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P1) - 12 beam stop log system at bicycle path crossing (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P3) - 12" CMP, drains turn out area adjacent to Hwy 33 (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P2) - 12 beams for stop log system located on top of levee

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P4) - 90" RCP with flap gate, New Dent Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P5) - 24" & 42" CMP with flap gates, Old Dent Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P7) - 36" Flap Gate, FWY #4 Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P6) - 48" RCP with missing flap gate being repaired on 12/10/08, Stanley Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P8) - 36" Flap Gate, Vince Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P9) - 24" CMP with flap gate, FWY #3 Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P11) - 72" RCP with flap Gate ,Ramona Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P10) - 48" CMP with flap gate, FWY #2 Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P12) - 24" RCP with flap gate, FWY #1 Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P13) - 48" pipe with flap gate, Simpson Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P15) - 24" CMP with flap Gate, Peking Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P14) - 48" CMP with flap gate, Harrison Drain (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. P16) - 3-48" CMP with flap gates (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F1) – Top of levee looking downstream at grouted levee bank (riverward)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F3) – Looking d/s at low flow erosion (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F2) – At toe of levee looking downstream (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F4) – Looking d/s at ungrouted levee bank protection (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F5) –Looking downstream at levee embankment & toe (landward side)

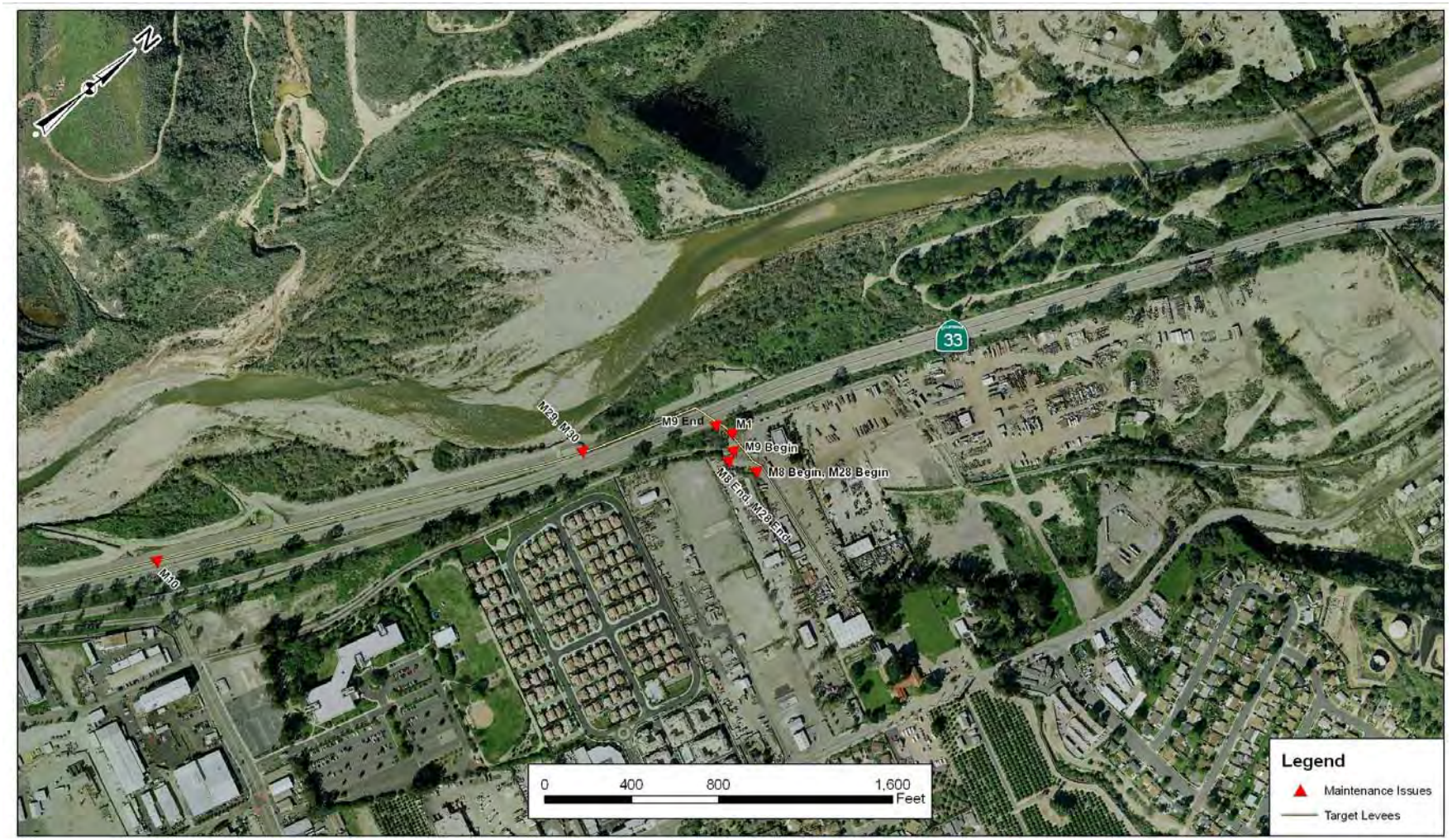
Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F7) – Looking u/s at bike path on top of levee (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F6) – Gas line crossing (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. F8) – Looking d/s at bike path and flood wall on top of levee

Appendix C

Photos for Maintenance Required Locations



Appendix C – Locations of Photos at the Maintenance-Required Sites for Ventura River Levee (VR-1)

Appendix C – Locations of Photos at the Maintenance-Required Sites for Ventura River Levee (VR-1)

Appendix C – Locations of Photos at the Maintenance-Required Sites for Ventura River Levee (VR-1)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M1) - Vegetation within 15' of levee toe (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M3) - Damaged concrete on headwall with rebar exposed (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M2) - Damaged concrete on 72" RCP headwall (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M4) - Damaged concrete on headwall with flap gate stuck open (riverward)

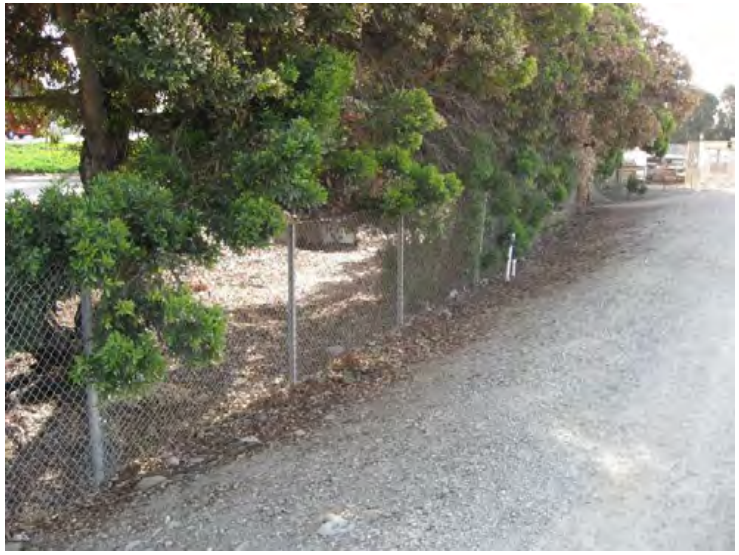
Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M5) - Damaged concrete on headwall with rebar exposed (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M7) - Vegetation within 15’ of levee toe, looking u/s (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M6) - Vegetation within 15’ of levee toe, looking d/s (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M8) - Vegetation within 15’ of levee toe, looking d/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M9) - Vegetation within 15’ of levee toe, looking d/s (landward side)



Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M11) - Vegetation within 15’ of levee toe, looking d/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M10) - Erosion on levee top and embankment (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M12) - Tin storage shed and miscellaneous debris at levee toe (landward)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M13) - Tin storage shed at levee toe (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M15) - Vegetation within 15' of levee toe (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M14) - Vegetation within 15' of levee toe, looking d/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M16) - Vegetation within 15' of levee toe, looking u/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M17) – Levee toe has been undercut (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M19) - Vegetation within 15’ of levee toe (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M18) - Vegetation within 15’ of levee toe, looking d/s (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M20) - Vegetation within 15’ of levee toe, looking u/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M21) – Vegetation within 15' of levee toe, looking u/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M23) – K-rails and debris along levee toe, looking d/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M22) - Vegetation within 15' of levee toe, looking d/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M24) – Freeway sign installed in levee bank looking u/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M25) – Freeway sign installed in levee bank, looking u/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M27) – Dumped debris over levee embankment (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M26) – Power poles within 15’ of levee toe, looking d/s (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M28) – Erosion along levee toe (landward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M29) – Fence piping on top of levee bank, looking u/s (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M31) – Animal burrows along levee toe (landward side)

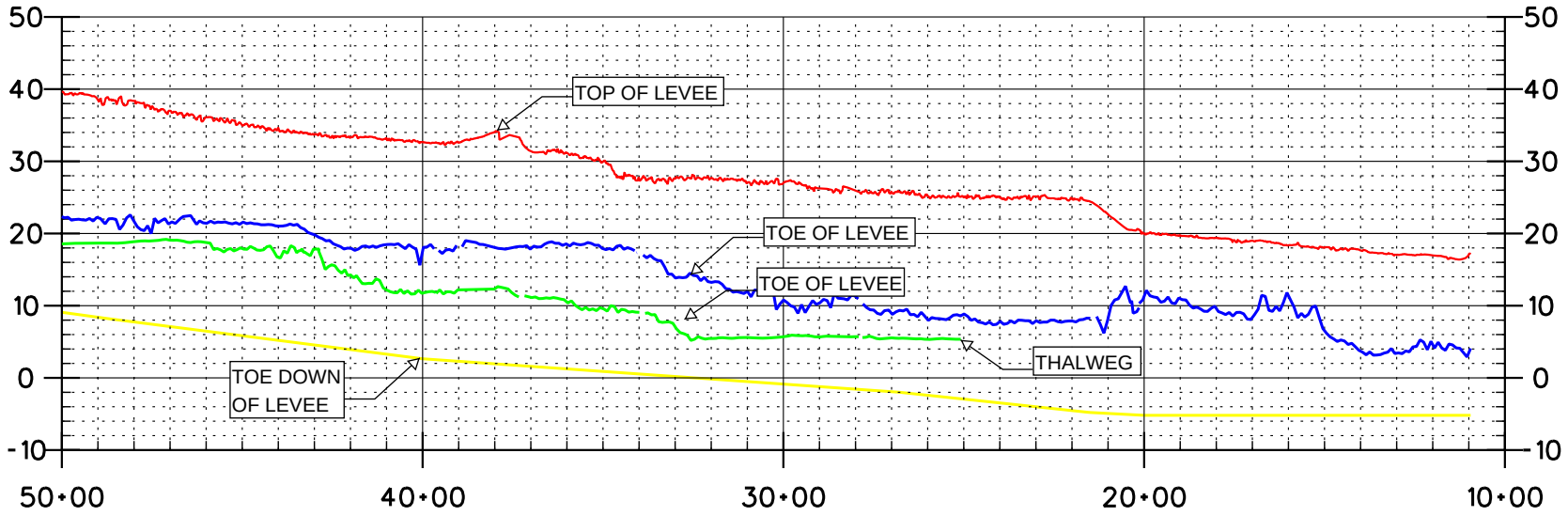
Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M30) – Sink holes on top of levee embankment (riverward side)

Ventura River Levee, *From Ocean to Canada de San Joaquin. (*Photo No. M30) – Animal burrows along levee toe (landward side)

Exhibit 2

Preliminary Evaluation of Levee System Profiles

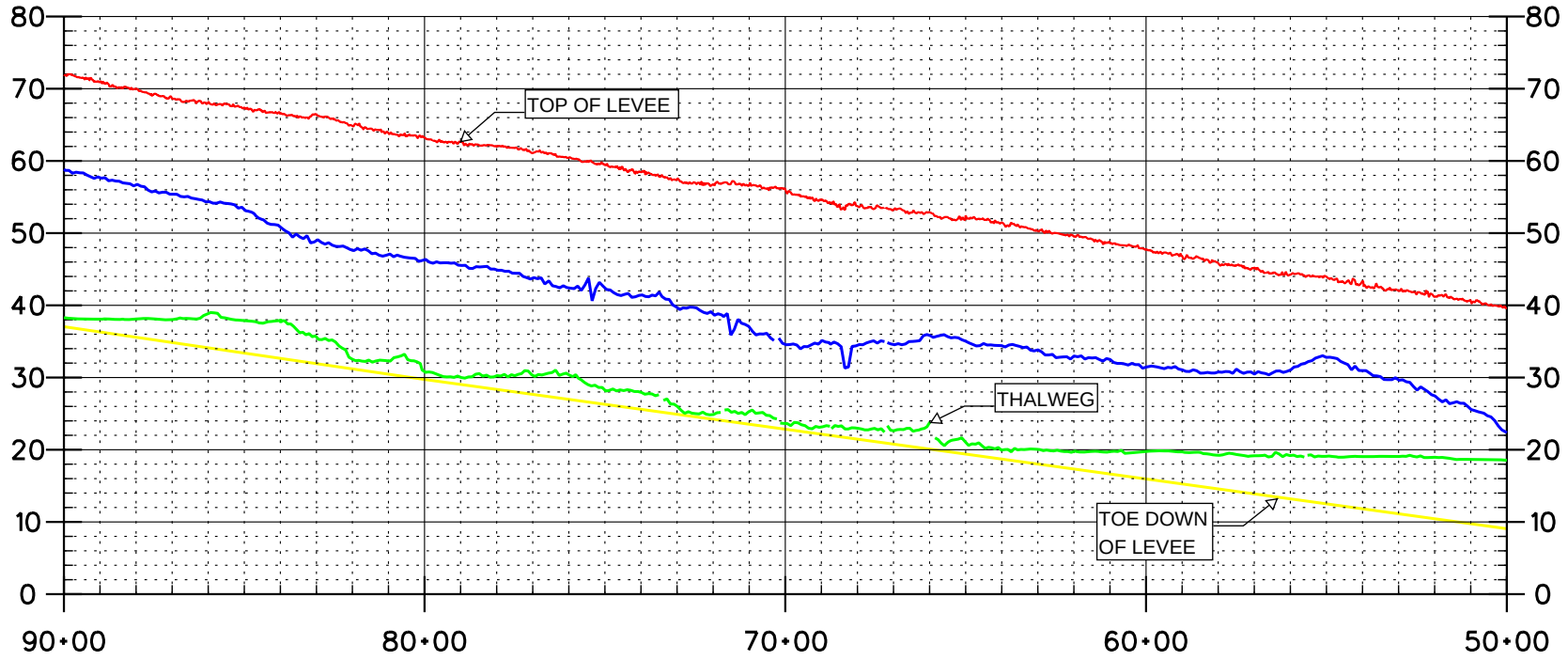
VENTURA RIVER (VR-1)
STATION 10+00 TO 50+00



LEGEND:
- TOP OF LEVEE
- TOE OF LEVEE
- THALWEG
- TOE DOWN OF LEVEE

SCALE:
HORIZONTAL:1"=500'
VERTICAL:1"=25'

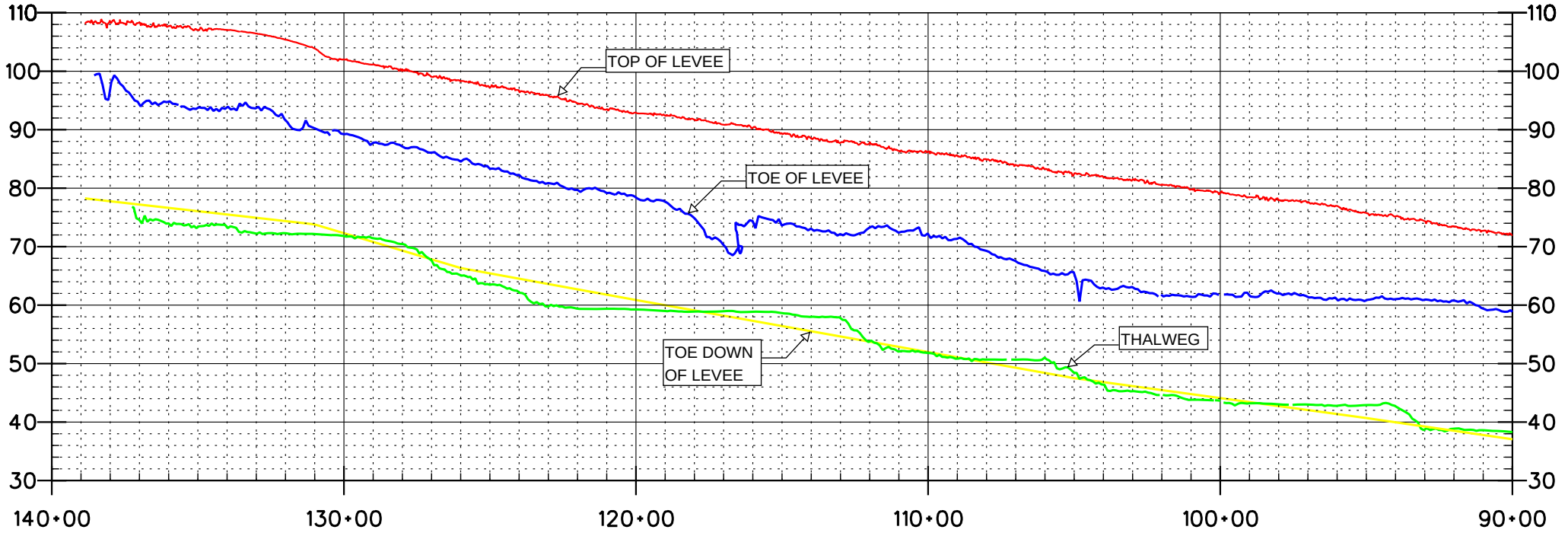
VENTURA RIVER (VR-1)
STATION 50+00 TO 90+00



LEGEND:
- TOP OF LEVEE
- TOE OF LEVEE
- THALWEG
- TOE DOWN OF LEVEE

SCALE:
HORIZONTAL:1"=500'
VERTICAL:1"=25'

VENTURA RIVER (VR-1)
STATION 90+00 TO 140+00



LEGEND:
- TOP OF LEVEE
- TOE OF LEVEE
- THALWEG
- TOE DOWN OF LEVEE

SCALE:
HORIZONTAL:1"=500'
VERTICAL:1"=25'

Exhibit 3

As-Built Plans Status List

Ventura River Levee (VR-1) - Pacific Ocean to Canada de San Joaquin

Bridge Crossings (U/S to D/S)	**As-Builts Provided to Consultant by County**	**County Dwg. No.**	**Date***	**Sheet No.(s)**	**Sta. (relative to Y-1-132 Dwgs)**	**Action**
Hwy 33 (at levee crossing near OST)	No					Request from Caltrans.
W. Main St.	No					Request from County.
Hwy 101	No					Request from Caltrans.
Railroad Crossing (d/s of Hwy 101)	No					Request from County.
Levee System (U/S to D/S)						
Ventura River Levee (Left Bank)	Yes	Y-1-132	1949	1 to 18		
Stop log system @ bike path X-ing	Yes	Y-1-132	1949	15	140+59	
Future Repairs						
Maintenance road repairs			Fall 2009			To be constructed.
Encroachment repair			Fall 2009			To be constructed.
Penetrations (U/S to D/S)						
90" RCP (New Dent Drain)	Yes	Y-1-433 to 438	1985	1 to 6	124+92	
24" CMP & 42" CMP w/ Flap Gates	Yes	Y-1-132	1949	7, 16 & 17	117+00	
48" RCP w/ Flap Gate (Stanley Drain)	Yes	Y-1-132	1949	7, 16 & 17	111+26.9	
36" Flap Gate (FWY Drain #4)	No					Request from County.
36" Flap Gate (Vince Drain)	No					Request from County.
24" CMP w/ Flap Gate (FWY Drain #3)	Yes	Y-1-132	1949	6, 16 & 17	72+50	
48" CMP w/ Flap Gate (FWY Drain #2)	Yes	Y-1-132	1949	6, 16 & 17	69+40	
72" Flap Gate (Ramona Drain)	No					Request from County.
24" Flap Gate (FWY Drain #1)	No					Request from County.
48" Flap Gate (Simpson Drain)	No					Request from County.
48" CMP w/ Flap Gate (Harrison Drain)	Yes	Y-1-132	1949	6, 16 & 17	49+50	
24" CMP w/ Flap Gate (Peking Drain)	Yes	Y-1-132	1949	6, 16 & 17	41+13	
3-48"CMP	Yes	Y-1-132	1949	6 & 12	22+20	
30" CMP	Yes	Y-1-132	1949	6, 16 & 17	14+02	

*Date indicates as-built date. Design plan dates were used if the plans were available, but were not stamped and/or signed as-built.

Exhibit 4

Responses to Comments on Draft Evaluation Report

FEMA Levee Certification -VCWPD
Project Team Comments on Tetra Tech's Draft Evaluation Reports
January 2009

Maint. Defect	Description	Recommended Action by Tetra-Tech	Recommended Response by O&M Division	Environ. Permit Codes	Environmental Services Section Comments	R.O.W. Issue*	Levee Certification Project Team's Comments to Draft Evaluation Reports	Tetra Tech's Response
Ventura River Levee (VR-1), Category 2								
M1	Vegetation within 15' of levee toe (riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5 -** D&C redesign of entire area	E1	Not riverward, veg ok to clear w/o permits		Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, & shall be evaluated by the lab.
M2, M3	Spalled concrete on 72" RCP Ramona Drain headwall with rebar exposed (riverward side)	Repair the concrete headwall portion of outlet structure	**C1**	E1	Fix concrete and excavate channel to drain properly		Excavator damage, not spalling	"Spalled" will be changed to "Damaged" in report
M4, M5	Spalled concrete on 48" Simpson Drain headwall with rebar exposed, flap gate stuck open with sediment (riverward side)	Repair concrete. Remove sediment from pipe opening and ensure complete seal around flap gate	**C1**	E1	Fix concrete and excavate channel to drain properly		Excavator damage, not spalling	"Spalled" will be changed to "Damaged" in report
M6, M7	Vegetation within 15' of levee toe, approximately 500' along levee (riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C4 -** bird issue, needs to be worked prior to March 1 or after Sept 1	E3	Endangered species issues		Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, & shall be evaluated by the lab.
M8	Vegetation within 15' of levee toe, approximately 123' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C4 -** bird issue, needs to be worked prior to March 1 or after Sept 1	E1	Landward veg removal not regulated		Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, & shall be evaluated by the lab.

*Right of Way column reflects the Operation and Maintenance Division's preliminary opinion based on their field inspections. That opinion will be vetted through the Real Estate Services Division of the Public Works Agency.

FEMA Levee Certification -VCWPD
Project Team Comments on Tetra Tech's Draft Evaluation Reports
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Maint. Defect	Description	Recommended Action by Tetra-Tech	Recommended Response by O&M Division	Environ. Permit Codes	Environmental Services Section Comments	R.O.W. Issue*	Levee Certification Project Team's Comments to Draft Evaluation Reports	Tetra Tech's Response
Ventura River Levee (VR-1), Category 2								
M9	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C2** & Cal-Trans (survey needed)	E1	Landward veg no permits	X	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, & shall be evaluated by the lab.
M10	Erosion on levee top and embankment (landward side)	Fill voids with impervious material, firmly compact, and restore design slope	**C1 -** bank and road repair	E1	No permits needed		What is the criteria for inspection and testing?	Erosion should be repaired as indicated with in-kind material and documented. Documentation of the removal and replacement/re-compaction of the impacted material shall be conducted by a certified testing and materials lab that the District is familiar with. The documentation shall include a report provided by the testing and materials lab. AMEC will periodically observe these locations and will require a copy of the report for documentation and review. In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, and shall be evaluated by the testing and materials lab. compaction requirements are detailed on the attached Figure 1. Major repair examples include any erosion feature that is deeper than 1 foot or that is greater than 2 feet wide. Additionally, revetment protection evaluation including rock sizing analysis should be incorporated in repair of revetment material.
M11	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5** - Planning, Survey needed, Letters to homeowners	E1	Landward veg removal not regulated	X		
M12, M13	Tin storage shed and miscellaneous debris at levee toe (landward side)	Remove tin storage shed and miscellaneous debris	**C5** - Planning	E1	No permits needed	X		
M14	Vegetation within 15' of levee toe, approximately 150' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5** - Planning	E1	Landward veg removal not regulated	X		
M15, M16	Vegetation and debris within 15' of levee toe, approximately 300' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact. Remove debris (within the 15'-zone as appropriate)	**C5** - Planning	E1	Landward veg removal not regulated	X		
M17	Levee toe has been undercut (landward side)	Re-establish 2:1 toe of levee embankment. Additional engineering analyses are recommended.	**C5** - Planning	E1	Landward repair no permits	X	Who is responsible for the analysis?	District to determine whether this work is to be completed by in-house staff or engineering consultant. Certified As-builts drawings need to be prepared.
M18	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C2** - survey needed	E1	Landward veg removal not regulated	X		
M18	Retaining wall at property line on landward side is not stable and embankment is damaged	Re-establish 2:1 toe of levee embankment. Additional engineering analyses are recommended.	**C5** - D&C	E2	Depends on repair	X		This repair will likely require design and engineering to construct the grade control structure. Certified As-builts drawings need to be prepared.
M19, M20	Vegetation within 15' of levee toe, approximately 100' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C2** - survey needed	E1	Landward veg removal not regulated	X	Floodwall or levee? Location of levee toe? Definition of toe for this levee location, trees are 20' back from wall (banks are higher than top of levee)	The fifteen (15) foot vegetation line is measured from the visual toe of slope to the center line of the trunk (tree), the closest trunk to the toe (multiple trunk trees/plants) or the stock/stem protruding through the soil (large plant connected to a root system). Since there is high ground on the landward side of the levee the fifteen (15) feet is from the top landward side of the levee embankment.

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FEMA Levee Certification -VCWPD
Project Team Comments on Tetra Tech's Draft Evaluation Reports
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Maint. Defect	Description	Recommended Action by Tetra-Tech	Recommended Response by O&M Division	Environ. Permit Codes	Environmental Services Section Comments	R.O.W. Issue*	Levee Certification Project Team's Comments to Draft Evaluation Reports	Tetra Tech's Response
Ventura River Levee (VR-1), Category 2								
M21	Vegetation within 15' of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C2** - survey needed	E1	Landward veg removal not regulated	X	Definition of toe for this levee location, trees are on opposite embankment (Cal-Trans embankment)	The fifteen (15) foot vegetation line is measured from the visual toe of slope to the center line of the trunk (tree), the closest trunk to the toe (multiple trunk trees/plants) or the stock/stem protruding through the soil (large plant connected to a root system)
M22	Vegetation within 15' of levee toe, approximately 500' along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5 -** palm trees relocated, public relations issue (PR), City of Ventura Fairgrounds	E1	Landward veg removal not regulated	X	No problem with Edison pole?	Utility poles within the embankment prism (only 1 on SCR-1) must be relocated. This pole does not require relocation.
M23	Debris and K-rails along toe of levee (landward side)	Remove debris and K-rails (within the 15'-zone as appropriate)	**C5 -** PR issue (City of Ventura Fairgrounds)	E1	No permits needed, use BMPs	X		
M24	Freeway sign installed in levee embankment (landward side)	Relocation of signs may be required	**C5**, Cal-Trans	E1	No permits needed, use BMPs	X		
M25	Freeway sign installed in levee embankment (landward side)	Relocation of signs may be required	**C5**, Cal-Trans	E1	No permits needed, use BMPs	X		
M26	Power poles within 15' of levee toe	Relocation of utility poles may be required	**C5** - Planning to coordinate removal of poles with SCE	E1	No permits needed, use BMPs		Are all static poles a problem?	Utility poles within the embankment prism (only 1 on SCR-1) must be relocated. These poles do not require relocation.
M27	Dumped debris over levee embankment (riverward side)	Remove debris (within the 15'-zone as appropriate)	**C1**	E2	Remove debris, repair slope as needed			
M28	Erosion along levee toe (landward side)	Fill voids with impervious material, firmly compact, and restore design slope	**C1**	E1	Repair erosion, remove vegetation			
M29, M30	Approximately 12 sink holes and piping at the top of grouted levee embankment (riverward side)	Repair sink holes. Fill voids with impervious material and firmly compact.	**C1**	E2	Excavate and repair in kind			
M31, M32	Animal burrows at levee toe (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact	**C1**	E1	Excavate & recompact levee, add IPM			

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Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
VR-3	**Zia**	i	Change 'for' to 'in'. Data collection efforts have been performed to determine what information is available for support of levee certification.	**Change made.**
		i	Under LiDAR Topographic data, reviewer requests addition of 1. Compare the river bed vertical elevation and cross section changes by topo & survey. 2. There are some areas always need repair by records. Point out the areas need re-study.	**This entire levee was severely damaged in the 2005 flood. This levee is being re-designed by the Corps of Engineers from Santa Ana Blvd to the Live Oaks Diversion. Tetra Tech would need to review the Corps design to see if new topographic data was used.**
		1	Change 'give year' to 'given year'. "… or exceeded in any give year (base flood).	**Change made.**
		3*	Change 'addition' to 'additional'. "…however addition sedimentation and scour analyses…"	**Change made.**
		3	Change 'the' to 'that'. "…NFIP regulations requires the engineering analyses…"	**Change made.**
		4	Question: Are interior flooding and interior drainage the same? Please clarify the use of these terms. Are they to be used interchangeably?	**Interior flooding is caused from impeded interior drainage.**
		4	To the Levee Penetration portion, add: 1. Is the flap gate work fine? 2. Sediment deposition in the gate area? 3. Describe existing condition and pictures.	**The flap gate is in working order unless it is listed in Table 2 where its condition is described and associated photos are referenced in Appendix C.**
	Jaques	**General Comment**	The middle section of this reach is not a levee. Does it make sense to split this into two separate levees? 1. Near Santa Ana Blvd and 2. Live Oak Creek Diversion to where the levee terminates?	**A determination of segmenting this levee system would have to be made during the hydraulic analysis which is the next phase of work.**
		ii	Why is as-built plan show as Category 3?	**The construction of the Corps' proposed design is not expected to happen with in the PAL time schedule (Nov.30,2009) therefore as-builts would not be prepared.**
		3	Why is a hydrograph needed for levee certification?	**For geotechnical seepage analyses which requires the baseflood stage duration.**
		3	See the Bureau of Reclamation report "Hydrology, Hydraulics, and Sediment Studies for the Meiners Oaks and Live Oak Levees-Draft Report (July 2007) for the information on scour analysis, toe down and rock size requirements.	**Noted, Tetra Tech has obtained this document and will be used during the next phase of work.**
		4	Check with Corps of Engineers on geotechnical available for the levees.	**Noted, all available Corps of Engineers' design work will be obtained for use in the next phase of work.**
		6	Since the levee and floodwall up to Live Oak Creek Diversion will be improved by the Corps with the Matilija project, should we pursue improvements required on the Diversion portion in anticipation of the Corps certifying this entire levee once their work is complete?	**This work needs to be done to certify the entire system however the schedule of this Category 3 levee is to be determined.**
		6	Should we ask Tetra Tech to review Corps construction documents as part of their contract?	**Yes we will need to review design for certification.**
		4	Check with the Corps of Engineers on geotechnical information available for the levees.	**Noted, all available Corps of Engineers' design work will be obtained for use in the next phase of work.**
		6	Table 2-Summary of Maintenance Required, add the River Stations to the table.	**There are many different as-built drawings with different stationing. It was determined the best way to convey the location of the required maintenance was with a Lat. Long. GPS point.**

*Indicates comment made by more than one reviewer.

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Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
VR-1	**Jaques**	3*	Change 'addition' to 'additional'. "…however addition sedimentation and scour analyses…"	**Change made.**
		field investigation report, page 3	Remove "Show desktop.scf"	**Change made.**
		Appendix B, photos of penetrations	P6 (Stanley Drain) missing from map. Please include.	**P6 is shown on pages B-1 and B-2.**
		B-4	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	**Noted this will be evaluated in the structural analysis.**
		Exhibit 2, Preliminary Evaluation of levee system profiles	Station 90+00 to 140+00, is there an additional toe down for green and yellow lines between 140+ and 130+?	**We do not have any additional available information showing additional toe down.**
SC-1	**Jaques**	3	Add 'to' between 'used' and 'shape'. "…flood even would be used shape the base flood…"	**Change made.**
		4	Remove 'it'. Their findings are that only 5% of the rock is breaking down and they do not anticipate it the break down to continue at …"	**Change made.**
		field investigation report, page 1	Insert 'County' between Ventura and Watershed. "The team included representatives from the Ventura Watershed Protection District…"	**Change made.**
		B-2	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	**Noted, this will be evaluated in the structural analysis.**
AS-6	**Jaques**	3	Insert commas as follows: "reference, however, additional sedimentation and scour…" "…dated February 2004 will be useful as a reference however addition sedimentation and scour analyses…"	**Change made.**
		Field investigation report page 3	Change "borrows" to "burrows" throughout.	**Change made.**
		Levee Inspection Log, A-1	Change "borrows" to "burrows" throughout.	**Change made.**
		B-5	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	**Noted, this will be evaluated in the structural analysis.**
		Appendix C, Photos of Maintenance Required Locations	M22R Photo Caption, revise borrow to read "burrow"	**Change made.**
	Joe Lampara	General Comment	Similar to AS-7, this levee system is identified as extending along Arroyo Simi from 1st. Street to Erringer Road. In actuality this reach is a combination of a series of levees, including a floodwall located immediately upstream of 1st Street, and levees located in the immediately vicinity of the channel drop structures, and along one reach of low land at the upstream end adjacent to the channel. Between these locations there are reaches of incised channel which do not meet the definition of a levee or levee system.	**Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.**

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Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
AS-7	**Jaques**	General Comment	A LOMR was accepted FEMA on March 4, 2003.	**All Current LOMRs have been requested from FEMA, if the County has a copy Tetra Tech would like to obtain a copy.**
		6	Application of 44 CFR65.10 criteria should be applied only to the reaches of the channel between 1st and Erringer that meet the definition of a levee.	**Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.**
		field investigation report, page 1	Insert 'County' between Ventura and Watershed. "The team included representatives from the Ventura Watershed Protection District…"	**Change made.**
		field investigation report, page 4	Table 1-Summary of Penetrations. River Station 120+72 and 125+66.1, reviewer indicates the WSL is below the existing ground.	**Noted**
CC-3	**Jaques**	**General Comment**	If this levee is 2' above adjacent ground (page 1) and FEMA requires 3' minimum levee height above the 100 yr flood, how is this a levee? It looks like this should be re-categorized as Not a Levee.	**The 2' height is based on a visual inspection. Determination of the levee situation will require a hydraulic analysis to compare the 100-yr WS to adjacent ground. This analysis will be performed during the next phase of work. If the analysis shows the 100-yr WS is below adjacent ground then de-listing this stretch of channel as a levee will be pursued.**
		Field Investigation Report, 1	Has the Kasraie Report and Draft D-Firm maps been reviewed? I believe that they show breakout to the east in this reach of Calleguas Creek.	**They have not been reviewed. Tetra Tech has requested all current D-Firm analyses and Appeals from FEMA. If the County has a copy Tetra Tech would like a copy.**
	Joe Lampara	**General Comment**	The efforts under Phase 1 involve the categorization of the nine Provisionally Accredited Levees in Ventura County. Levee categories include: Category 1 – levee meets 44CFR65.10 requirements and all data or complete documentation is available, Category 2 – levee may meet 44CFR65.10 criteria , but additional data or documentation is needed, Category 3 – levee does not currently meet 44CFR65.10 criteria, Not a levee – Based on physical conditions, low WSEL, no SFHA, and/or not providing flood protection. This levee system, which extends along Calleguas Creek from Pleasant Valley Road to Hwy 101, may not be a levee in the sense as a levee is defined. Phase 1 efforts must include this determination prior to the final categorizing of this "levee system." Determination under Phase 3 efforts that Phase 1 efforts were incomplete.	**The 2' height is based on a visual inspection. Determination of the levee situation will require a hydraulic analysis to compare the 100-yr WS to adjacent ground. This analysis will be performed during the next phase of work. If the analysis shows the 100-yr WS is below adjacent ground then de-listing this stretch of channel as a levee will be pursued.**
CC-2	**Joe Lampara**	**General Comment** The reach between Mission Oaks and this point no longer meet the definition of a levee.	This levee system is identified as extending along Calleguas Creek from Mission Oaks Blvd. upstream to Adolfo Road. It includes the reach of Somis Drain from Calleguas Creek up to The reach upstream of Somis Drain along Calleguas Creek to Adolfo Road is not a levee in that the surface of the ground landward of the Calleguas Creek Channel is higher than the streambank protection placed along the channel bank. As originally constructed the levee did extend from Mission Oaks Blvd to Somis Drain. Subsequent to the completion of construction of this levee developers were granted permits to fill in portions of the land behind the levee to allow for industrial development. As a result there is a reach of the original levee extending from Mission Oaks Blvd. upstream for approximately 1500 feet that no longer meets the definition of a levee. The surface of the ground landward of the levee now exceeds base flood elevation in the channel, or is at or above the top of levee elevation. Suggest revising the downstream terminus of CC-2 from Mission Oaks Blvd. to the point upstream where the permitted fill placed behind the original levee alignment ends.	**Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis and verification of the higher adjacent ground due to recent improvements. This analysis will be performed during the next phase of work.**

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Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
ASR-2	**Jaques**	Field investigation report, A-2	Number 8, Encroachments, remarks are included, but no rating is given. Please add an A, M or a U.	**Change made to reflect a U.**
		B-2	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	**Noted, this will be evaluated in the structural analysis.**
		Exhibit 2, Preliminary Evaluation of levee system profiles	Station 120+00 and 130+00, is there an additional toe down for green and yellow lines between 129+ and 128+?	**We do not have any additional available information showing additional toe down.**
All Levee Reports	**Tony Chen**	**General Comment**		
			Please extend the tree removal to a flexible limit. For some trees, the 15' buffer belt is not enough. We need to remove the vegetation and trees within 15' buffer belt. As I learned from FMA classes. I understand some of the special kinds of the tree roots can extend and penetrate the levee. These trees shall be cleaned within a certain distance. I suggest to ask the Environmental Section set up a list of trees need to install an underground buffer wall or remove the special trees within a defined distance.	**The Corps guidelines in EM 1110-2-301 are the current standard for vegetation on levees.**
			There are power poles in the defined levee area. Do we need to relocate them?	**Utility poles within the embankment prism (only 1 on SCR-1) must be relocated.**
			A new aero-photo map is necessary to get for study, planning, design and construction purposes. Please put some budget for survey purposes.	**Noted**
			How to get rid of small animals like gofers.	**According to O&M the WPD currently has a plan to control burrowing animals**
			A levee Certification Work Team is necessary. It could be consisted by Advanced Planning, O&M, Design and Construction, Environmental Section, and Real Estate Section.	**Noted**
			There are many small lateral storm drain pipes, how to prevent the backup water?	**An interior drainage analysis will be performed on each drain to determine if a flap gate is required.**
			There are some developed areas behind the levee. How to get the required land from the land owners?	**This is a County Real Estate issue.**
			The flood control annually budget is limited. How to get the required money to finish the work?	**This is a County Budget issue.**

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Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
All Levee Reports	**Joe Lampara**	**General Comment**		
		All levees categorized as Category 2	Include in the work to be done as noted in Figure 2 for each levee a Right of Way survey to establish in the field the actual limits of County owned property and easements.	**This is part of the Title Search/Boundary Survey task.**
		CC-2, AS-6, SCR 1, VR-1, ASR-2, CC-3	Figure 2 of each report contains a list of work that needs to be completed for levee certification to be done for each levee. One of the items is Topographic Survey Verification. For selected levees, VR-1 being one, there is a time interval indicated for this work. For the majority of the remaining levees no verification is required. Recommend that topographic survey verification being included the levees noted with this comment. The reasoning for including it with VR-1 can be applied to the others, i.e. ASR-1 – concerns exists regarding the elevation of the channel, including the stabilizer, relative to the footing of the floodwall. Without a survey it may not be possible to discern the relationship of these two items. For CC 3, if this levee is not categorized as "not-a-levee" in Phase 1, verification of the topography is required under Phase 3 in order to finalize whether or not CC-3 is a levee.	**Tetra Tech will provide the District with a standard specification sheet and survey topo exhibit describing minimum survey requirements for levee certification requirements for all levees, and additional levee-specific survey requirements and locations of additional topo required.**
All Levee Reports	**Zia**	**General Comment**	What is the plan for soil testing?	**A scope of work detailing the subsurface exploration, laboratory testing and geotechnical assessment is being prepared for the next Phase of work.**
			Why is the consultant requesting consolidation tests?	**The purpose for the consolidation testing is three-fold. The first reason is to determine the existing conditions of the alluvium and levee material and evaluate if any material may experience consolidation with future loads that could be detrimental to the levee. The second, and in this case more critical, is to determine if any consolidation as a result of the original levee construction is anticipated. Secondary compression or consolidation in fine grained soils is dependant on the time needed for the excess pore pressures created by imposed loads to dissipate allowing the soil to consolidate. Typically the finer grained a soil and the thicker the soil deposit, the longer amount of time is needed for consolidation to take place. By running time based consolidation tests on samples collected, we can anticipate the amount of settlement that is to occur, as well as the time needed, as a result of implied loads on the soil. If we have a condition, say, that just meets the 3 feet of freeboard and we are anticipating another 6 inches of settlement in the foreseeable future, something will need to be done to ensure that the levee can maintain that 3 feet of freeboard. The third reason is to evaluate the potential for hydro-collapse. If soils are rapidly deposited and are buried quickly by subsequent depositional events, the soil structure may develop such that they have not been allowed to consolidate fully. Additionally, mineral accumulation, such as salts or caliche, may also develop giving the soil added strength. When these soils are subsequently saturated during a future event, the potential for consolidation of the loose soils or dissolution of the mineral content, collectively know as hydro-collapse, exists. In some cases this collapse can be significant and has caused failure of structures built over the collapsible soils. The testing for this potential is similar to consolidation testing, although slightly less time consuming, and will be conducted if the field investigation reveals the potential.**
			Could the consultant please be more specific when commenting on areas of concern? Please quantify problems, instead of making general comments.	**Tetra Tech would be happy to answer any specific questions, however for most items specific data is not required and with the accelerated schedule detailing and quantifying each problem is not feasible.**

*Indicates comment made by more than one reviewer.

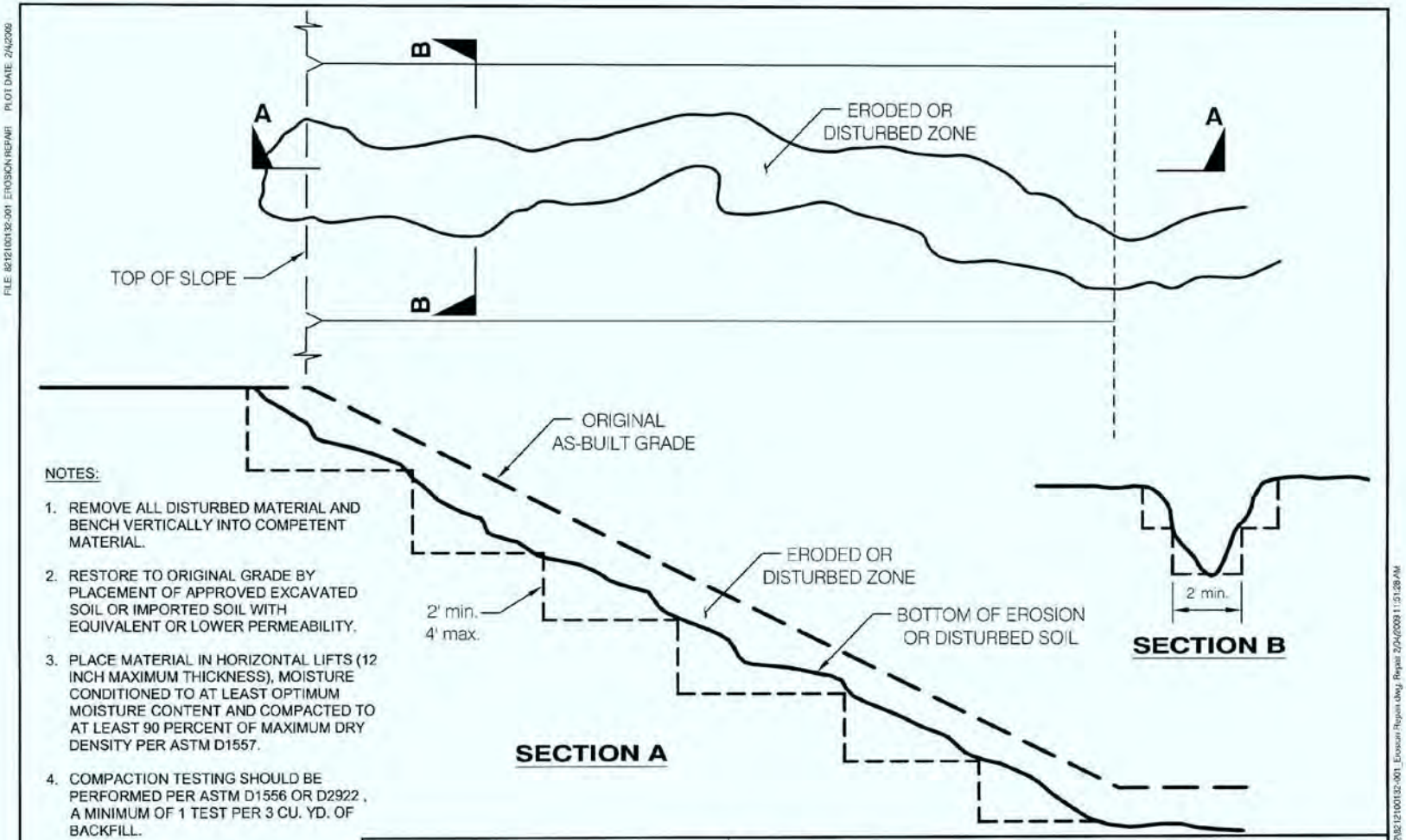
VCWPD OPERATION & MAINTENANCE DIVISION RFI

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
1. Animal burrow/hole repair procedures. Please confirm acceptable methods. Also confirm acceptable documentation method.	For small isolated burrows, infilling of the burrow with grout is sufficient. The grout should be relatively free flowing to permeate the burrows. A typical grout specification would be similar to CalTrans Specifications Section 41-1. A copy of this section is attached but should be modified to suit the conditions. For areas where a large number of interconnected burrows exist or the amount of burrows present has caused surficial instability, removal and replacement/re-compaction of the impacted material is needed. The attached Figure 1 presents a typical detail and backfilling requirements. Documentation for the singular burrows shall consist of a documentation of the location, size, volume of grout placed, and other pertinent details. Documentation of the removal and replacement/re-compaction of the impacted material shall be conducted by a certified testing and materials lab that the District is familiar with. The documentation shall include a report provided by the testing and materials lab. AMEC will periodically observe these locations and will require a copy of the report for documentation and review.
2. Please describe methods for vegetation and rootball removal.	4" DIAMETER TRUNK OR GREATER: Cut the woody vegetation approximately two (2) feet above ground level leaving a prominent stump for use in the rootball extraction process. Remove the stump and rootball by pulling or extracting with a backhoe or similar equipment. Clean the rootball cavity of all loose soil and remaining root system (roots greater than 1/2" diameter). Prepare the cavity by excavating per FIGURE 2. Backfill with excavated soil or imported soil with equivalent or lower permeability. Place material in horizontal lifts no greater than twelve (12) inches. Moisture conditioned to at least optimum moisture content and compacted to at least ninety (90) percent of the maximum dry density of the fill soil per ASTM D1557. Compaction typically requires the use of manually operated compaction equipment or compaction attachment to a backhoe. Compaction testing should be performed per ASTM D1556 or D2922. A minimum of one (1) test per three (3) cubic yards of backfill. 2"-4" DIAMETER TRUNK: Cut the woody vegetation stump flush with the ground. Treat the stump with a protective coating similar to polyurethane to prolong the decay process.

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
	2" DIAMETER TRUNK OR LESS: Cut the woody vegetation to twelve (12) inches of height above the ground level. For all vegetation removal under 4” trunk diameter, no documentation is necessary. For larger rootball removal in which excavation and compaction is required, documentation of the impacted material shall be conducted by a certified testing and materials lab that the District is familiar with. The documentation shall include a report provided by the testing and materials lab. AMEC will periodically observe these locations and will require a copy of the report for documentation and review.
3. Where is 15’ buffer from toe measured from (buried portion or at ground level)?	The fifteen (15) foot vegetation line is measured from the visual toe of slope to the center line of the trunk (tree), the closest trunk to the toe (multiple trunk trees/plants) or the stock/stem protruding through the soil (large plant connected to a root system)
4. Can Tetra Tech provide specs for compaction and grading requirements? Discuss major and minor repair examples.	Compaction requirements are detailed on the attached Figures 1 and 2. Major repair examples include any erosion feature that is deeper than 1 foot or that is greater than 2 feet wide. Major and minor animal burrows are discussed in item 1.
5. Can in-kind materials be used for backfill?	In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, and shall be evaluated by the testing and materials lab.
6. Discuss documentation/inspection requirements for verification of grading.	The requirements for verification of grading are discussed above.

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
7. Can Tetra Tech provide weekly inspection of work completed to date?	Future work can be observed by AMEC. It is suggested that scheduling field time be conducted to maximize the efficiencies of the site visits. AMEC will provide a site visit to each levee during repair work preferably before backfill commences. Additional site visits would likely incur additional costs.
8. Please provide a procedure for concrete patching.	All repairs should extend at least three (3) inches beyond the area of delaminated or broken concrete and should be chipped out to at least 3/4 inch below any exposed reinforcing. Concrete patch edges should be sawcut without damaging embedded reinforcing bars. Sandblast clean all exposed concrete and steel surfaces in repair opening and paint any exposed reinforcing bars and tensioning posts with a protective anti-corrosive coating. After coating cure, recast the repair opening using concrete patching material. In the case of minor chipping of concrete surface – no deep concrete cracks or steel exposure – a high performance urethane polymer or industrial bonding epoxy may be used to restore the concrete surface. The documentation shall include a report documenting the statement of work, list of materials used and photos. Tetra Tech will make a final inspection of the completed work.
9. Is a headwall needed for flap gate attachment?	No. Different styles of heavy-duty flap gates can be attached directly to an exposed corrugated pipe. If the pipe already ends directly at a headwall or culvert, then it is recommended the flap gate be attached to the concrete surface. In either application the flap gate needs to remain operational and achieve the goal of backflow prevention. The documentation shall include a report documenting the statement of work, list of materials used and photos. Tetra Tech will make a final inspection of the completed work.
10. Are rock or soil piles (or ramps) a problem for certification?	Any trash, debris or other obstructions that inhibit operations and maintenance performance and visual inspection of a levee will affect the completion of certification. Unauthorized levee debris that causes obstruction from routine levee inspection and management, obstruction to flood-fighting zones, and debris flow/breeching during storm events must be removed.

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
11. AS-7, M4R: Is this a levee? Is veg removal required within only 8’ of the foundation of the wall?	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work. A levee is an earthen embankment, floodwall, or structure along a water course whose purpose is flood risk reduction or water conveyance. In the case of a floodwall, the root-free zone is the greater of either eight (8) feet from toe of the floodwall foundation or fifteen (15) feet from face of floodwall. If there is a drainage system at the toe, then the eight (8) feet is measured from the outside of the drainage system. All vegetation growing over the floodwall’s foundation heel/toe as well as the eight (8) feet root-free zone must be removed.
12. AS-7, M4L: Is seepage a problem for certification?	Further analysis is required to make that determination. Provided that the wall and channel bottom have been designed to accommodate this condition and that existing and anticipated future groundwater conditions are within the anticipated ranges utilized in design, certification may proceed.
13. AS-7, M8L: What is considered the top of the levee? Is there a floodwall?	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.
14. AS-6, M13L: Does not appear to be a levee.	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.
15. AS-6, M23R: Does not appear to be a levee.	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.



NOTES:

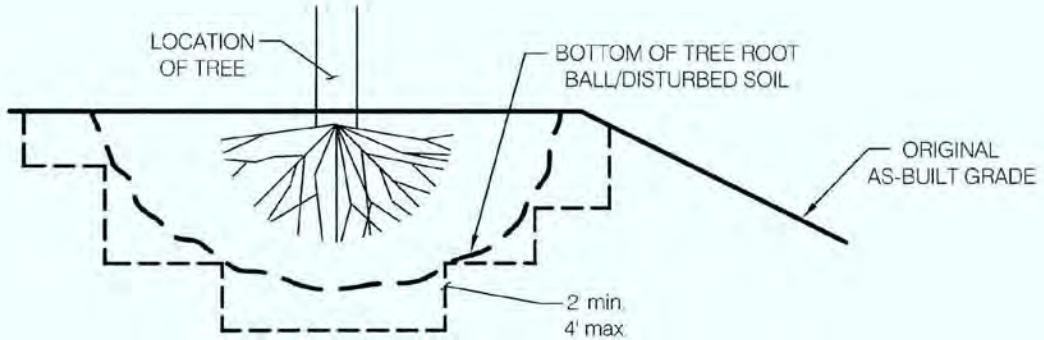
1. REMOVE ALL DISTURBED MATERIAL AND BENCH VERTICALLY INTO COMPETENT MATERIAL.
2. RESTORE TO ORIGINAL GRADE BY PLACEMENT OF APPROVED EXCAVATED SOIL OR IMPORTED SOIL WITH EQUIVALENT OR LOWER PERMEABILITY.
3. PLACE MATERIAL IN HORIZONTAL LIFTS (12 INCH MAXIMUM THICKNESS), MOISTURE CONDITIONED TO AT LEAST OPTIMUM MOISTURE CONTENT AND COMPACTED TO AT LEAST 90 PERCENT OF MAXIMUM DRY DENSITY PER ASTM D1557.
4. COMPACTION TESTING SHOULD BE PERFORMED PER ASTM D1556 OR D2922 , A MINIMUM OF 1 TEST PER 3 CU. YD. OF BACKFILL.

TYPICAL EROSION OR SURFICIAL SLOPE INSTABILITY REPAIR

LEVEE CERTIFICATION PROJECT
VENTURA COUNTY, CALIFORNIA

AMEC Earth & Environmental
1290 N. HANCOCK STREET, SUITE 102
ANAHEIM, CA 92807-1924
www.amec.com/earthandenvironmental

DWN BY:	DATE:	PROJECT NO:
JBD	February 2009	8212100132
CHKD BY:	SCALE:	FIGURE No.
DRB	Not To Scale	FIGURE 1



NOTES:

1. REMOVE ALL DISTURBED MATERIAL AND BENCH VERTICALLY INTO COMPETENT MATERIAL.
2. RESTORE TO ORIGINAL GRADE BY PLACEMENT OF APPROVED EXCAVATED SOIL OR IMPORTED SOIL WITH EQUIVALENT OR LOWER PERMEABILITY.
3. PLACE MATERIAL IN HORIZONTAL LIFTS (12 INCH MAXIMUM THICKNESS), MOISTURE CONDITIONED TO AT LEAST OPTIMUM MOISTURE CONTENT AND COMPACTED TO AT LEAST 90 PERCENT OF MAXIMUM DRY DENSITY PER ASTM D1557.
4. COMPACTION TESTING SHOULD BE PERFORMED PER ASTM D1556 OR D2922 , A MINIMUM OF 1 TEST PER 3 CU. YD. OF BACKFILL.

TYPICAL VEGETATION REMOVAL REPAIR

LEVEE CERTIFICATION PROJECT
VENTURA COUNTY, CALIFORNIA

AMEC Earth & Environmental
1290 N. HANCOCK STREET, SUITE 102
ANAHEIM, CA 92807-1924
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DWN BY:	DATE:	PROJECT NO:
JBD	February 2009	8212100132
CHK'D BY:	SCALE:	FIGURE No.
DRB	Not To Scale	FIGURE 2

SECTION 41: PAVEMENT SUBSEALING AND JACKING

41-1 PAVEMENT SUBSEALING

41-1.01 DESCRIPTION

This work shall consist of filling voids beneath existing portland cement concrete pavement, at the locations shown on the plans, by drilling holes through the existing pavement, injecting grout through the holes and filling the drilled holes with mortar or concrete.

41-1.02 MATERIALS

Grout for filling the voids beneath the existing pavement shall be composed of portland cement, fly ash and water. Portland cement and fly ash shall be proportioned by weight at the rate of one part portland cement to 2.4 to 2.7 parts fly ash. Water shall be added in an amount to provide a grout efflux time of 10 to 16 seconds as determined by California Test 541, Part D.

Portland cement for the grout shall be Type II Modified conforming to the provisions in Section 90-2.01, "Cement."

Fly ash shall conform to the requirements in ASTM Designation: C 618 for either Class C or Class F fly ash, except that the loss on ignition shall not exceed 4 percent. The brand of fly ash used in the work shall conform to the provisions for approval of admixture brands in Section 90-4.03, "Admixture Approval."

When fly ash, cement, or fly ash and cement are delivered in packages, each package shall be marked plainly with the class, type, name and brand of producer, and the weight of material contained therein. Similar information shall be provided in the shipping invoices accompanying the shipment of packaged or bulk fly ash and cement.

Chemical admixtures and calcium chloride conforming to the provisions in Section 90-4, "Admixtures," may be used in the grout mixture, subject to the Engineer's written approval.

In advance of grouting operations, the Contractor shall submit a proposal for the materials to be used in the work accompanied with independent laboratory test data that indicates the initial set time and the one-day, 3-day, and 7-day compressive strengths of the grout at 10-second, 12-second and 14-second efflux times using specimen molds and curing conditions specified in ASTM Designation: C 109.

Grout having a 7-day compressive strength of less than 750 psi at a 12-second efflux time as determined by the independent laboratory tests will not be acceptable.

No change in the grout materials shall be made unless a resubmittal of the above information and requirements is furnished to the Engineer.

Mortar for filling the holes in the concrete pavement shall be composed of one part portland cement to 3 parts fine aggregate, by volume, and only enough water to permit placing and packing of the mortar in the holes. A commercial quality premixed rapid set mortar or concrete may be used to fill the holes.

41-1.03 CONSTRUCTION

Holes shall be drilled through the pavement and underlying base to a depth of 15 inches to 18 inches below the pavement surface. The holes shall be drilled to the diameter necessary to accommodate the equipment used for injecting the grout. Care shall be taken to protect the pavement surrounding each hole from damage.

The location of the holes shall conform to the configuration shown on the plans unless otherwise directed or permitted by the Engineer. Before beginning grouting operations, and continuing thereafter to the end of each run or work shift, the holes in at least 2 consecutive slabs requiring subsealing shall be drilled ahead of the grouting operations.

Open drilled holes shall not remain ungrouted for more than 2 working days.

The side of the injection hole shall be washed with a minimum water gage pressure of 40 psi just prior to grout injection. The washing device shall be constructed such that a minimum of 4 jets shall direct water horizontally at the slab-base interface.

The grout plant shall consist of a positive displacement cement injection pump and a high-speed colloidal mixer. The colloidal mixer shall operate between a minimum speed of 800 RPM and a maximum speed of 2,000 RPM. The injection pump shall be capable of sustaining a gage pressure of 150 psi when pumping a grout mixed to a 12-second flow time. A pressure gage shall be located immediately adjacent to the grout hose supply valve and shall be positioned so it can be easily monitored by the Engineer.

Dry cement and fly ash shall be accurately measured by weight, if in bulk, or shall be packaged in containers of uniform weight.

Water shall be introduced into the mixing process through a meter or scale.

Grout not used in the work within one hour after mixing shall be disposed of as directed by the Engineer.

Grout shall be pressure injected through the holes until all voids under the pavement slab are filled. No portion of the slab shall be moved or raised more than 0.050-inch as a result of pressure grouting. The Engineer will furnish and utilize suitable devices to monitor slab movement during pressure grouting.

The injection nozzle shall prevent leakage during injection and shall not protrude below the concrete slab. Grout shall be injected into only one hole at a time on any slab. When grout appears at any longitudinal or transverse joint, crack, or adjacent hole, or when monitoring devices indicate slab movement in excess of 0.050-inch, pressure injection of grout shall cease at that hole.

In the event that grout flow does not occur after 7 seconds of sustained 150 psi injection pump gage pressure and if there is no indication of slab movement, continued injection at that hole shall cease.

Immediately after the nozzle is removed, the hole shall be temporarily plugged with a round, tapered wooden plug. The plug shall remain in place until pressure grouting at adjacent holes progresses to the point where grout will not be forced up through previously grouted holes.

In the event the Engineer determines that continued grouting at a location is no longer advantageous, the Engineer may direct the Contractor to cease subsealing operations at that location.

. Grouting shall not be performed when the atmospheric or subgrade temperature is below 40° F, or during inclement weather. When standing rainwater is present in the holes, grouting shall not be performed unless permitted by the Engineer.

. The Contractor shall take necessary precautions to prevent grout from being injected into any drainage facility or other open structure.

. Cracks in the pavement which occur during the injection of grout will be considered as damage to the pavement due to the Contractor's operations. The damage shall be repaired by the Contractor at the Contractor's expense and as directed by the Engineer.

. Upon completion of the grouting operation, grout shall be removed from the drilled holes to a depth of not less than 4 inches below the pavement surface. The holes shall be cleaned and then filled with mortar or premixed, rapid set concrete and finished flush with the concrete pavement surface.

. At the end of each work shift, the work area shall be left in a clean, swept and neat condition.

41-1.04 MEASUREMENT

. The quantity of drilled holes will be measured as units determined by actual count. Any hole drilled that is not shown on the plans or ordered by the Engineer will not be measured nor paid for.

. The quantities of dry cement and fly ash used in the grout mix will be measured by the ton and will be paid for as grout (subsealing). Quantities of grout not used in the work and grout that is wasted by leaking through to the pavement surface because of not taking preventative measures to avoid wasting of grout, will not be paid for. The quantity of grout wasted or disposed of will be determined by the Engineer. Quantities of grout, cement or fly ash remaining on hand after completion of the work will not be paid for.

41-1.05 PAYMENT

. Items of work, measured as specified in Section 41-1.04, "Measurement," will be paid for at the contract unit price for drill hole (subsealing) and the contract price per ton for grout (subsealing).

. The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in subsealing existing portland cement concrete pavement as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.

. Full compensation for furnishing and placing mortar or concrete for filling the drilled holes shall be considered as included in the contract unit price paid for drill hole (subsealing) and no additional compensation will be allowed therefor.

41-2 PAVEMENT JACKING

41-2.01 DESCRIPTION

. This work shall consist of raising existing portland cement concrete pavement to grade, at the locations shown on the plans, by drilling holes through the existing

pavement, injecting grout through the holes to fill voids beneath the pavement and raise the pavement to grade, and filling the drilled holes with mortar or concrete.

41-2.02 MATERIALS

. The grout for pavement jacking and mortar or concrete for filling the drilled holes shall conform to the provisions for grout and mortar or concrete for pavement subsealing in Section 41-1.02, "Materials," except that the grout for pavement jacking shall contain water in an amount to provide a grout efflux time of 16 seconds to 26 seconds. Additional water may be added to reduce the grout efflux time to not less than 10 seconds to initiate the pressure injection of the grout.

41-2.03 CONSTRUCTION

. Pavement jacking shall conform to the provisions for pavement subsealing in Section 41-1.03, "Construction," except for the following:

The positive displacement grout injection pump shall be capable of providing a sustained gage pressure of 200 psi. Gage pressures exceeding 200 psi, but not exceeding 600 psi, may be used for brief periods of time to start the movement of the slab.

Slabs shall be raised uniformly to grade. The Contractor shall furnish and utilize stringlines to monitor the movement of the pavement.

The final elevation of the surface of the concrete pavement shall not vary at any point more than 0.01-foot above or below the grade established by the Engineer. If the surface of the pavement at any point is higher than 0.01-foot above the grade established by the Engineer, the surface shall be ground to meet the above specified tolerance; however, the entire slab shall be removed and replaced with new concrete pavement if the surface at any point is higher than 0.10-foot above the grade established by the Engineer. Grinding of the concrete pavement or removal and replacement of the pavement, if necessary, shall conform to the provisions in Section 42-2, "Grinding," except for payment.

Adjacent slabs, not requiring adjustment in grade, shall not be moved. Corrections to grade of adjacent slabs, if necessary, and as determined by the Engineer, shall be made in the same manner that is required for pavement that is raised to grade.

41-2.04 MEASUREMENT

. The quantity of drilled holes will be measured as units determined by actual count. Any hole drilled that is not shown on the plans or ordered by the Engineer will not be measured nor paid for.

. The quantities of dry cement and fly ash used in the grout mix will be measured by the ton and will be paid for as grout (jacking). Quantities of grout not used in the work and grout that is wasted by leaking through to the pavement surface because of not taking preventative measures to avoid wasting of grout, will not be paid for. The quantity of grout wasted or disposed of will be determined by the Engineer. Quantities of grout, cement or fly ash remaining on hand after completion of the work will not be paid for.