Ventura County
Watershed Protection District

FEMA Levee Certification

Ventura County, California

Santa Clara River Levee (SCR-1)
Highway 101 to Saticoy

Evaluation Report

February 13, 2009

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

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Prepared for:

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Watershed Protection District

Prepared by:

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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 Santa Clara River Levee (SCR-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 SCR-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.

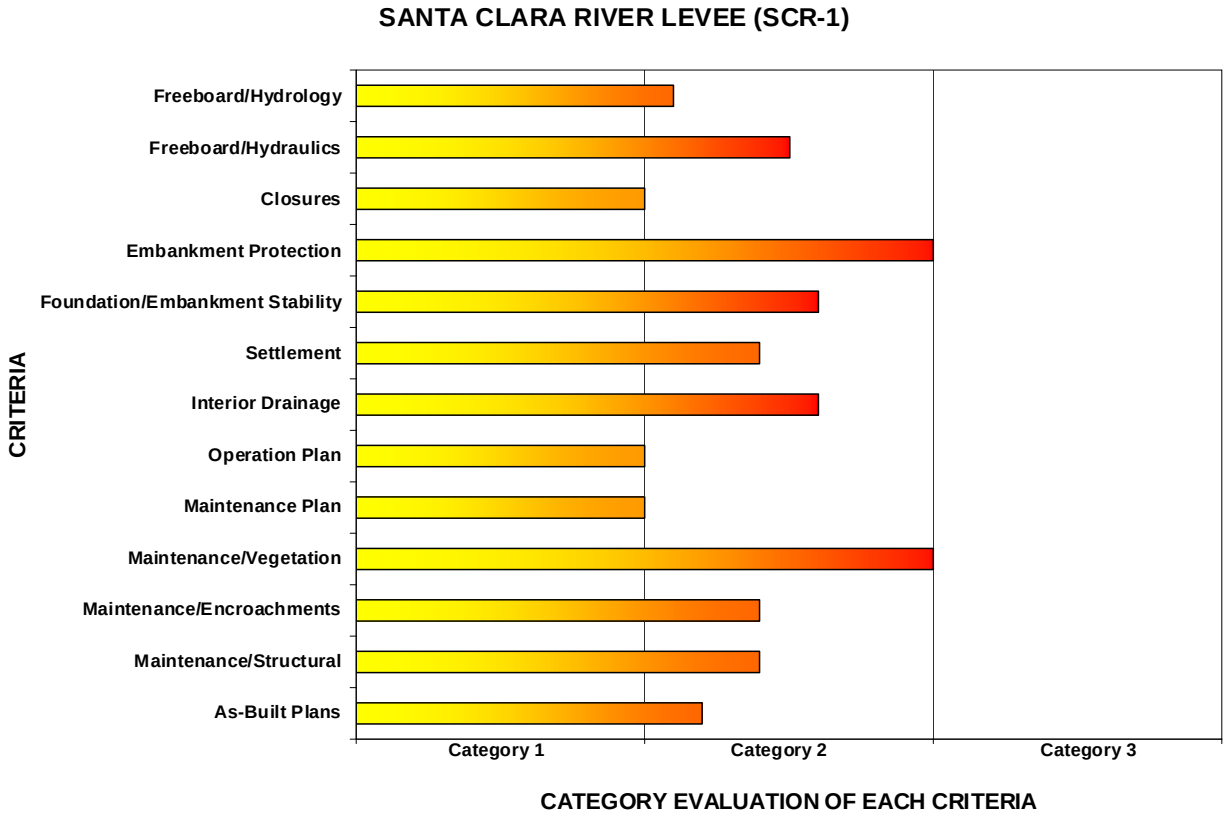
Data collection efforts have been performed to determine what information is available in support of levee certification. Existing information collected and reviewed at the time of preparation of this report includes the following:

- 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 SCR-1 levee system be classified as a Category 2 Levee. The suggested critical path to achieve levee certification for the SCR-1 levee system is outlined in Section F Recommendation.

FEMA Levee Certification

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Highway 101 to Saticoy

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A) Introduction

The Santa Clara River Levee (VCWPD ID No: SCR-1) is located in the City of Oxnard in Ventura County. The location of the levee system is from the Highway 101 to Saticoy and is shown on Figure 1. The SCR-1 levee system is located along the left side of the Santa Clara River. The levee system consists of embankment levee with loose rock revetment, rock groins, and side drainage penetrations. The protective works of the Santa Clara 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 commercial, industrial, agricultural, and potentially developable property in low lying areas within the base flood floodplain of the Santa Clara River Watershed.

The levee system begins at Highway 101 in Ventura County and continues upstream to South Mountain. The length of the levee along the Santa Clara River is approximately 4.73 miles, with an embankment height varying between 2 feet to 15 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 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 river 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.

The discharge frequency values presented in the December 2006 Ventura County Watershed Protection District report (VCWPD) entitled "Santa Clara River 2006 Hydrology Update, Phase I, From Ocean to County Line" are directly usable for Santa Clara River and Sespe

Figure 1 – Location Map

Creek levee certification purposes. This report was developed through a collaborative effort among hydrologic engineering staff at VCWPD, Corps of Engineers (Los Angeles District), and Los Angeles County Department of Public Works. The study results are current in that flow data through water year 2005 was used in the hydrologic analysis, and there have been no flood events in the interim that are large enough to significantly alter the discharge frequency values in the report. Water Resource Council Bulletin #17B discharge frequency procedures were applied as prescribed by FEMA guidelines as the basis for the hydrologic analysis.

An issue has been raised regarding the use of a discharge frequency value transfer function on the Santa Clara River between the Montalvo gage and the SCR-1 levee. Proposed revisions would result in a lower discharge than what has currently been published by FEMA. The recommendation for the levee evaluation is to use the higher discharge. If the criteria are met for the higher discharge they would be met for the lower discharge. If the criteria are not met with the higher discharge this issue would be revisited during the analysis process.

There will be a need to generate baseflood hydrographs for geotechnical evaluation of levee stability considering seepage therefore a volume duration frequency analysis will need to be performed. Baseflood hydrographs would be generated using a "balanced hydrograph" approach in which the baseflood hydrograph would be consistent with respect to volume duration frequency relationships for the Santa Clara River levee. A pattern hydrograph based on either a hypothetical flood event such as Standard Project Flood or a large historical flood event would be used to shape the baseflood hydrographs.

The current FEMA FIS hydraulic model for the Santa Clara River is available. The current FEMA FIS hydraulic model will be useful as a base model to develop the freeboard analysis. In addition, the existing topographic information may need to be verified with a survey due to vegetation that may have created inaccuracies in the LiDAR data.

In addition 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 at Stroube Drain that acts as a closure. The stop log structure includes aluminum beams that are stored at the Districts maintenance yard (SOY) for installation during flooding conditions.

Documentation of this structure is required as part of the certification.

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.

Data needed to perform this analysis includes results from the hydraulic analysis, scour analysis, as-built plans, and field verification of the existing embankment protection. The hydraulic analysis and scour analysis would be developed as part of the freeboard assessment. 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.

Field investigations have identified several locations where the levee embankment has been impacted and requires restoration/mitigation. The existing rock revetment is of several different types (sandstone/igneous/conglomerate) of rock and a lot of it is desiccated and broken down into smaller pieces along the entire length of the levee. The ability of this rock revetment to provide the appropriate level of protection is questionable and will be determined in this analysis.

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 and boring logs from the original levee design are available for review. These include a total of about 32 exploration points with laboratory testing. Available data includes Standard Penetration Test (SPT) blow counts, in-situ moisture contents, and the results of soil classification testing. Several Corps reports are available for review. A Corps report dated November 1958 provides basic soil engineering properties for compacted fill and foundation material. The report also provides gradation requirements for revetment stone and groin stone. However, no information regarding the original geotechnical design, such as seepage or slope stability evaluations, is available.

The rip-rap over a significant portion of the levee riverside was observed to be either missing or buried under soil and/or construction debris. In addition, a large portion of the rip-rap material did not appear to meet the requirements for rip-rap with regard to rock size and soundness.

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.

The referenced geotechnical information did not address settlement of the levee. As of January 22, 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 8 storm drain penetrations through the levee. All storm drains have flap gates with the exception of two locations at Side Drain 1A and a 12" metal pipe commercial drain (possibly abandoned). 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 Oxnard, 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 and debris removal, power pole relocation, buried groin exposure, inoperable storm drain flap gates due to sediment deposition, sloughing embankment protection, and levee erosion due to runoff, pedestrian and vehicle traffic.

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 analysis and certification process. A list of the as-built plans and their status for this project is presented in Exhibit 3.

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.

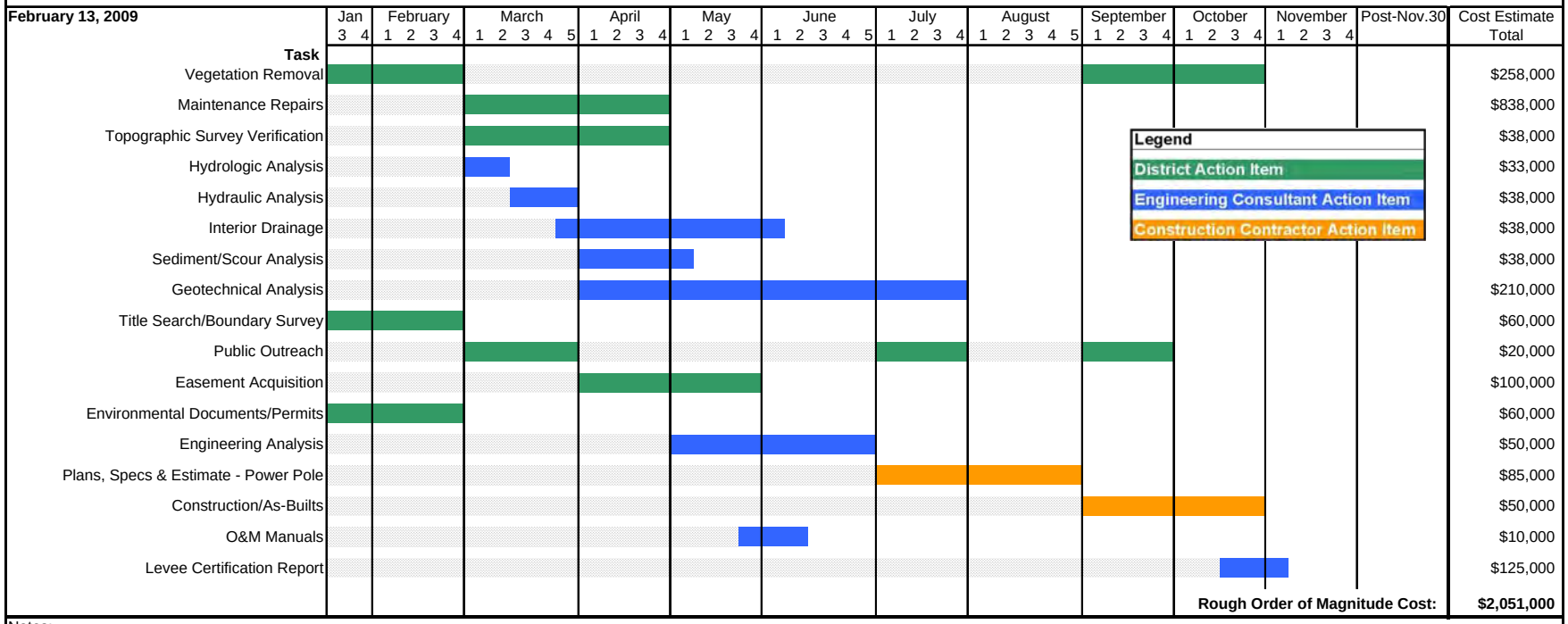
F) Recommendation

The field investigation identified several critical issues that must be resolved prior to certification. The most significant issues are unwanted vegetation along the landward side levee toe, possible power pole relocation, exposure of buried groins due to river erosion, inoperable storm drain flap gates due to sediment deposition, and levee erosion due to runoff, pedestrian, and vehicle traffic. Other issues that require major attention are debris removal throughout the levee and sloughing embankment protection. Engineering analyses will also need to be performed to verify that this levee meets the NFIP Section 65.10 requirements. Based on the review of existing data and observations from the field investigation, it is recommended that the SCR-1 levee system be classified as a Category 2 Levee.

The suggested critical path to achieve levee certification for the SCR-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 SCR-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. *Santa Clara River Levee (SCR-1) Highway 101 to Saticoy, Field Investigation Report.* Prepared for the Ventura County Watershed Protection District, Ventura, California.

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).*

Ventura County Watershed Protection District. 2006. *Santa Clara River 2006 Hydrology Update, Phase I, From Ocean to County Line.*

Ventura County Watershed Protection District. 2007. *Santa Clara River Levee, Highway 101 to Saticoy, Operation and Maintenance Manual*.

Exhibit 1

Field Investigation Report

Ventura County
Watershed Protection District

FEMA Levee Certification

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Introduction

Santa Clara River Levee (VCWPD ID No: SCR-1) is located between Highway 101 and Saticoy in the City of Oxnard, Ventura County. The location of the levee system is shown on Figure 1.

As part of the FEMA levee certification process, field investigations of the Santa Clara River Levee (SCR-1) were conducted on December 8-10, 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 Santa Clara River. The levee system consists of embankment levees and side drainage penetrations.
- The protective works of the Santa Clara 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 Hwy 101 Bridge and extends 4.73 miles upstream of the Santa Clara River.
- The FIRM dated October 31, 1985 shows containment of Zone A.
- The levee system is intended to protect existing residential, commercial, industrial, or potentially developable property in low lying areas within the base flood floodplain of the Santa Clara River Watershed.
- The levee's earthen berm is protected by ungrouted riprap and the access road that runs along the top is approximately 18 feet wide.
- The height of the embankment ranges from 4 feet to 13 feet above the existing ground surface.

General Field Observations

a) Riverward side of Levee:

1. Removal of sediment that has accumulated in most pipe penetrations/ structures is required to allow drainage and proper operation of the closure devices (flap gates).
2. Restoration of top and embankment is required in certain locations due to unauthorized vehicle ramps, off-road vehicle rutting, rock revetment sloughing, and runoff erosion.
3. Rock revetment is of several different types (sandstone/igneous/ conglomerate) of rock and a lot of it is desiccated and broken down into smaller pieces along entire length of the levee. The ability of this rock revetment to provide the appropriate level of protection is questionable.
4. Restoration of top and embankment is required in extensive stretches of the levee due to unauthorized dumping/washing out of concrete trucks obscuring any observation of rip-rap.
5. Restoration of top and embankment is required due to unauthorized dumping of large quantity of material on the levee adjacent to the concrete plant obscuring any observation of rip-rap.
6. Downstream buried groins near Hwy 101 have been exposed and are actively washing away. This erosion is within 200 feet of the levee embankment. Some

of the river erosion has a 20-25 ft deep cut that is tending towards the levee embankment.

7. Removal of one tree within 15 feet of levee toe is required at downstream end near Hwy 101. Also mowing of the other vegetation within the 15 feet of the levee toe to a height less then 12-inches is required. (Approximately 900 lf).

b) Landward side of Levee:

1. The stop logs for the Stroube Drain outlet are not on-site. County personnel stated that the stop logs are at the Saticoy maintenance yard and are transported to the site during events that require their installation. The stop logs and their installation procedures need to be verified.
2. There has been a lot of dumped stone, debris and random soil along the toe and beyond along the levee. In some locations the toe goes right up to the fence leaving no room for maintenance.
3. Restoration of top and embankment is required in certain locations due to unauthorized vehicle ramps, off-road vehicle rutting, and runoff erosion.
4. Restoration of top and embankment is required due to unauthorized dumping of large quantity of material on the levee adjacent to the concrete plant.
5. Removal and relocation of a utility pole and guy-wire anchors within the levee embankment prism must be relocated.
6. Removal of vegetation (trees and shrubs) within 15 feet of levee toe is required between Central Ave Drain and concrete plant (approximately 75-100 large trees).
7. The quarry pits along the levee are quite deep and will require geotechnical consideration for seepage and deep stability.
8. Removal of vegetation (trees and shrubs) within 15 feet of levee toe is required between the Nursery and South Mountain (approximately 25 large trees).
9. Multiple animal burrows were observed in the field.

Levee Penetrations

Levee closure of the Santa Clara River Levee (SCR-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 Stroube Drain stop log structure includes aluminum beams located at the Saticoy maintenance yard 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		
Santa Clara River Levee (SCR-1)				
491+45	N34.28293	W119.12251	P1	Side Drain 1-A, 4' x 4' x 23.5' R.C.B located at upstream end of levee
480+00	N34.28128	W119.12649	P2	Side Drain No. 1, 42" RCP and flap gate (on landward side)
442+00	N34.27578	W119.13717	P3	Side Drain No. 2, 48" RCP and flap gate (on landward side) located just U/S of Los Angeles Ave.
422+25	NA	NA		Commercial drain from asphalt plant (not found in December 9, 2008 field inspection)
410+60	N34.27117	W119.14602	P4	Side Drain No. 3, 48" RCP and flap gate (on landward side)
385+77	N34.26742	W119.15291	P5	12" metal pipe commercial drain from process plant
351+50 (+/-)	N34.26138	W119.16201	P6	Central Avenue Drain, 2-72" RCP with flap gates
316+60	N34.25530	W119.17042	P7	Side Drain No. 4, 48" RCP and flap gate (on landward side)
282+00	N34.24892	W119.17903	P8	Side Drain No. 6, 48" RCP and flap gate (on landward side)
246+20	N34.24340	W119.18577	P9, P10	Stroube Drain – Unit I, Stop Log Structure & 10'W x 8'H RCB

* 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 Santa Clara River Levee (SCR-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			
Santa Clara River Levee (SCR-1)				
N34.28292	W119.12323	M1, M2	Damaged concrete on Side Drain 1A headwall with rebar exposed (riverward side)	Repair the concrete headwall of outlet structure
N34.28300	W119.12337	M3	Sediment spoils (riverward side)	Remove spoils from levee
N34.28128	W119.12649	M4, M5	Sediment deposition in Side Drain No. 1, 42” RCP inlet and outlet. Flap gate is stuck open by debris and sediment	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)
N34.27899	W119.13102	M6, M7	Wood debris (riverward side)	Remove debris from the levee
N34.27848	W119.13181	M8, M9	Broken stone revetment (riverward side)	Stone revetment may need to be repaired, additional engineering analysis is recommended
N34.27828	W119.13232	M10	Animal burrows at levee toe (riverward side)	Fill voids with impervious material and firmly compact
N34.27513	W119.13823	M11, M12	Levee embankment erosion (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.27498	W119.13871	M13	Concrete debris has been spread over levee embankment (riverward side)	Remove unauthorized concrete cover from levee embankment
N34.27418	W119.14011	M14	A low point along top of levee causing concentrated flow and surface erosion on levee embankment (riverward side)	Regrade top of levee to meet design profile of top of levee. Fill embankment voids with impervious material and firmly compact
N34.27306	W119.14247	M15, M16, M17	Levee embankment erosion (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.27202	W119.14444	M18	Levee embankment erosion caused by vehicles (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.27188	W119.14478	M19	Broken stone revetment (riverward side)	Stone revetment may need to be repaired, additional engineering analysis is recommended
N34.27117	W119.14602	M20	Sediment deposition in Side Drain No. 3, 48” RCP outlet (riverward side)	Remove sediment and establish a clear passage from pipe to channel

GPS		*Photo No.	Description	Action Required
Lat	Long			
Santa Clara River Levee (SCR-1)				
N34.27086	W119.14668	M21	Broken stone revetment (riverward side)	Additional engineering analysis is recommended
N34.26952	W119.14963	M22, M23	Erosion on top of levee caused by vehicular traffic (landward side)	Reestablish top of levee to meet design elevations
N34.26663	W119.15408	M24	Levee embankment erosion caused by vehicular traffic (riverward side)	Reestablish levee revetment with design specifications. Fill voids with impervious material and firmly compact
N34.26585	W119.15552	M25	Broken stone revetment (riverward side)	Additional engineering analysis is recommended
N34.26352	W119.15907	M26	Broken concrete pipe debris along levee toe (riverward side)	Remove unauthorized concrete pipe debris from levee embankment
N34.25950	W119.16435	M27	Unauthorized ramp on levee (riverward side)	Remove unauthorized earthen ramp
N34.25604	W119.16931	M28	Debris stock piles along levee toe (riverward side)	Remove unauthorized debris stockpiles from levee toe
N34.25530	W119.17042	M29	Sediment deposition in Side Drain No. 6, 48” RCP outlet (riverward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)
N34.25059	W119.17676	M30	Unauthorized ramp on levee	Remove unauthorized debris stockpiles from levee toe
N34.24912	W119.17862	M31	Sloughing levee embankment protection (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.24892	W119.17903	M32	Sediment deposition in Side Drain No. 4, 48” RCP outlet (riverward side)	Remove sediment and establish a clear passage from pipe to channel (riverward & landward sides)
N34.24664	W119.18184	M33, M34	Tip of buried groin is exposed and sink holes are present in soil covering groins (riverward side)	Repair sinkholes and fill voids with impervious material and firmly compact. (Safety Hazard) Additional engineering analysis is recommended for exposed groins
N34.24605	W119.18254	M35, M36	Tip of buried groin is exposed and sink holes are present in soil covering groins (riverward side)	Repair sinkholes and fill voids with impervious material and firmly compact. (Safety Hazard) Additional engineering analysis is recommended for exposed groins

GPS		*Photo No.	Description	Action Required
Lat	Long			
Santa Clara River Levee (SCR-1)				
N34.24565	W119.18301	M37	Tip of buried groin is exposed (riverward side)	Additional engineering analysis is recommended for exposed groins
N34.24565	W119.18301	M38	Unauthorized ramp with missing levee embankment protection (riverward side)	Remove unauthorized earthen ramp and reestablish levee embankment and embankment protection
N34.24491	W119.18396	M39	Concrete washout poured over rock protection down to Highway 101 (riverward side)	Remove unauthorized concrete cover from levee embankment
N34.24425	W119.18471	M40	Dumped concrete debris, unauthorized PVC pipe in levee embankment (riverward side)	Remove unauthorized debris and PVC pipe
N34.24297	W119.18643	M41	Vegetation and irrigation lines within 15-feet of levee toe (riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact. Remove Irrigation lines.
N34.24326	W119.18564	M42	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.24414	W119.18459	M43	PVC pipe protruding from top of levee (landward side)	Remove unauthorized PVC pipe and fill voids with impervious material and firmly compact
N34.24687	W119.18124	M44	Erosion on top of levee exposing fence posts (landward side)	Reestablish top of levee and fill voids with impervious material and firmly compact
N34.24687	W119.18124	M45	Stone debris approximately 500-feet along levee toe (landward side)	Remove unauthorized stone debris from levee toe
N34.24735	W119.18062	M46	Erosion on top of levee (landward side)	Reestablish top of levee and fill voids with impervious material and firmly compact
N34.24851	W119.17918	M47, M48	Dumped stone and debris approximately 100-feet along the levee (landward side)	Remove unauthorized stone debris from levee toe
N34.24878	W119.17883	M49, M50	Sediment deposition in Side Drain No. 4, 48” RCP inlet structure (landward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)
N34.25935	W119.16430	M51, M52	Erosion on levee embankment (landward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.26012	W119.16325	M53	Animal burrows near top of levee (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact

GPS		*Photo No.	Description	Action Required
Lat	Long			
Santa Clara River Levee (SCR-1)				
N34.26130	W119.16144	M54	Tree within 15' of levee toe (landward side)	Remove tree and root ball, fill voids with impervious material and firmly compact.
N34.26134	W119.16139	M55, M56	Trees within 15' along levee toe (landward side)	Remove trees and root ball, fill voids with impervious material and firmly compact.
N34.26134	W119.16139	M57, M58	Power poles within 15' of levee toe (landward side)	Relocation not required.
N34.26303	W119.15904	M59	Tree within 15' of levee toe (landward side)	Remove trees and root ball, fill voids with impervious material and firmly compact.
N34.26435	W119.15715	M60	Trees, stumps within 15' of levee toe approximately 1,000' along levee toe (landward side)	Remove trees and root ball, fill voids with impervious material and firmly compact
N34.26498	W119.15623	M62	Utility pole and guy wires anchored into embankment (landward side)	Utility poles within levee embankment prism must be relocated.
N34.26498	W119.15623	M61, M63, M64	Fallen trees on levee embankment (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.26918	W119.14969	M65	Trees and fallen trees within 15' along levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.26929	W119.14954	M66	Erosion on top of levee caused by vehicles (landward side)	Reestablish top of levee and fill voids with impervious material and firmly compact
N34.26933	W119.14939	M67	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.27027 to N34.27071	W119.14750 to W119.14673	M68	Vegetation within 15-feet of levee toe approximately 150-feet along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.27071 to N34.27100	W119.14673 to W119.14609	M69	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.27100	W119.14609	M70	Animal burrow on top of levee (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact

GPS		*Photo No.	Description	Action Required
Lat	Long			
Santa Clara River Levee (SCR-1)				
N34.27111	W119.14593	M71	Sediment deposition and metal debris Side Drain No. 3 in 48" RCP inlet (landward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)
N34.27286	W119.14245	M72	Erosion on levee embankment (landward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.27448	W119.13939	M73	Erosion on levee embankment (landward side	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.27545	W119.13752	M74	Erosion caused by vehicles under Los Angeles bridge crossing (landward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact
N34.27564	W119.13711	M75, M76	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.27638	W119.13571	M77	Erosion at top of levee with miscellaneous debris at toe (landward side)	Repair erosion and remove miscellaneous debris
N34.27671	W119.13503	M78	Animal burrows at top of levee (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact
N34.27997 to N34.28052	W119.12884 to W119.12786	M79	Trees within 15-feet of levee toe, approximately 200-feet along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.28123	W119.12643	M80	Sediment deposition and debris in Side Drain No. 1, 42" RCP inlet invert (landward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)
N34.28123 to N34.28155	W119.12643 to W119.12585	M81	Vegetation within 15-feet of toe, approximately 1,200-feet along levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.28220 to N34.28283	W119.12463 to W119.12341	M82	Vegetation within 15-feet of toe, approximately 400-feet along levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.28246	W119.12401	M83	Animal burrow at toe of levee	Remove animal burrow, fill voids with impervious material and firmly compact

Appendix A

Levee Inspection Log

Levee Inspection Log

Facility Name/ID:	SCR-1	Date:	December 8-10, 2008
Watercourse:	Santa Clara River	By:	Ike Pace, Michael Chung (Tt),
Reach:	Hwy 101 to South Mountain		Doug Dahncke, Bijan
			Farahani (AMEC), & Bill
			DuFrain (VCWPD)

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.	Re-establishment of top of levee is required at depression in access road near sta. 398+35. Fill depression with suitable material and firmly compact.
					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.	
			X		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.	Restoration of top and embankments is required in various locations along the entire length of levee due to unauthorized vehicle ramps, off-road vehicle rutting, rock revetment sloughing, and runoff erosion.
					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.	
		X			M	Minor superficial sliding that with deferred repairs will not pose an immediate threat to FCW integrity.	
					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	X				A	No slides present.	
					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. .	
					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.	There has been extensive dumping of stone, debris and random soil along the landward side toe and beyond along the levee.
					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.	Rock revetment is of several different types. Some of the rock revetment is broken down into smaller pieces along entire length of the levee. Additional engineering analyses are recommended. Observation of extensive stretches of the levee was obscured due to unauthorized dumping/ debris/ washing out of concrete trucks.
					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.	The stop logs for the Stroube Drain outlet are not on-site.
			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 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.	
					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 Santa Clara River Levee (SCR-1)

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Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P1 – Side drain 1-A, 4' x 4' R.C.B located at upstream end of levee (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P3) – Side Drain No. 2, 48" RCP located just U/S of L.A. Ave. (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P2) – Side Drain No. 1, 42" RCP (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P4) – Side Drain No. 3, 48" RCP (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P5) – 12" metal pipe, commercial drain from process plant (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy. (*Photo No. P7) – Side Drain No. 4, 48" RCP (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P6) – Central Avenue Drain, 2-72" RCP with flap gates (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P8) – Side Drain No. 6, 48" RCP

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P9) – Stroube Drain – Unit I, Stop Log Structure looking downstream

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. F1) – 20’ -25’ high erosion cut eroding towards levee, looking d/s (riverward)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. P10) – Stroube Drain – Unit I, 10’Wx8’H RCB looking upstream

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. F2) – 20’ -25’ high erosion cut eroding towards levee, looking u/s (riverward)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. F3) – Erosion cut eroding towards levee exposing groins, looking d/s (riverward)

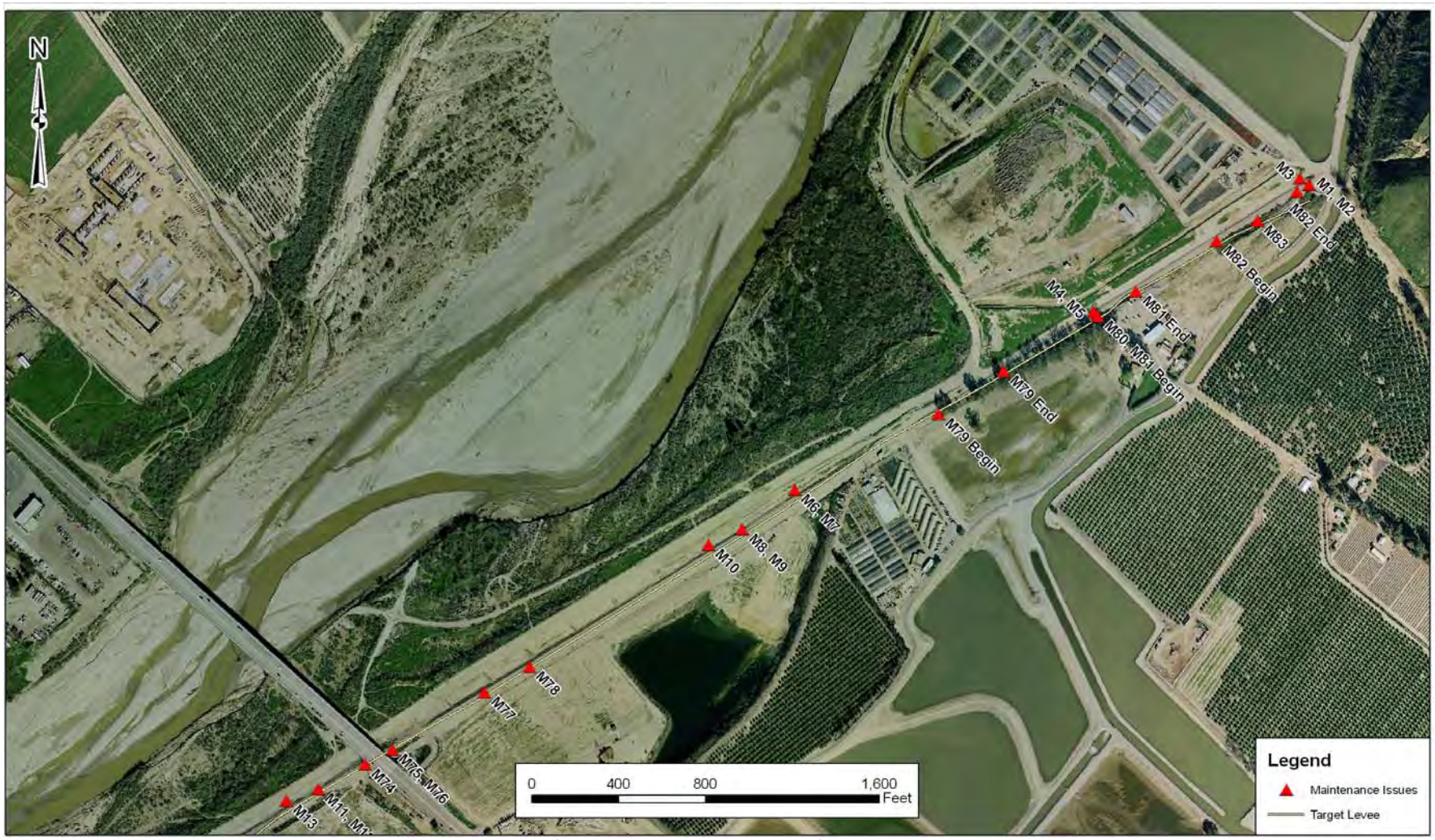
Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. F5) – Levee bank stone protection, two different types of stone (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. F4) – Erosion cut eroding towards levee exposing groins, looking u/s (riverward)

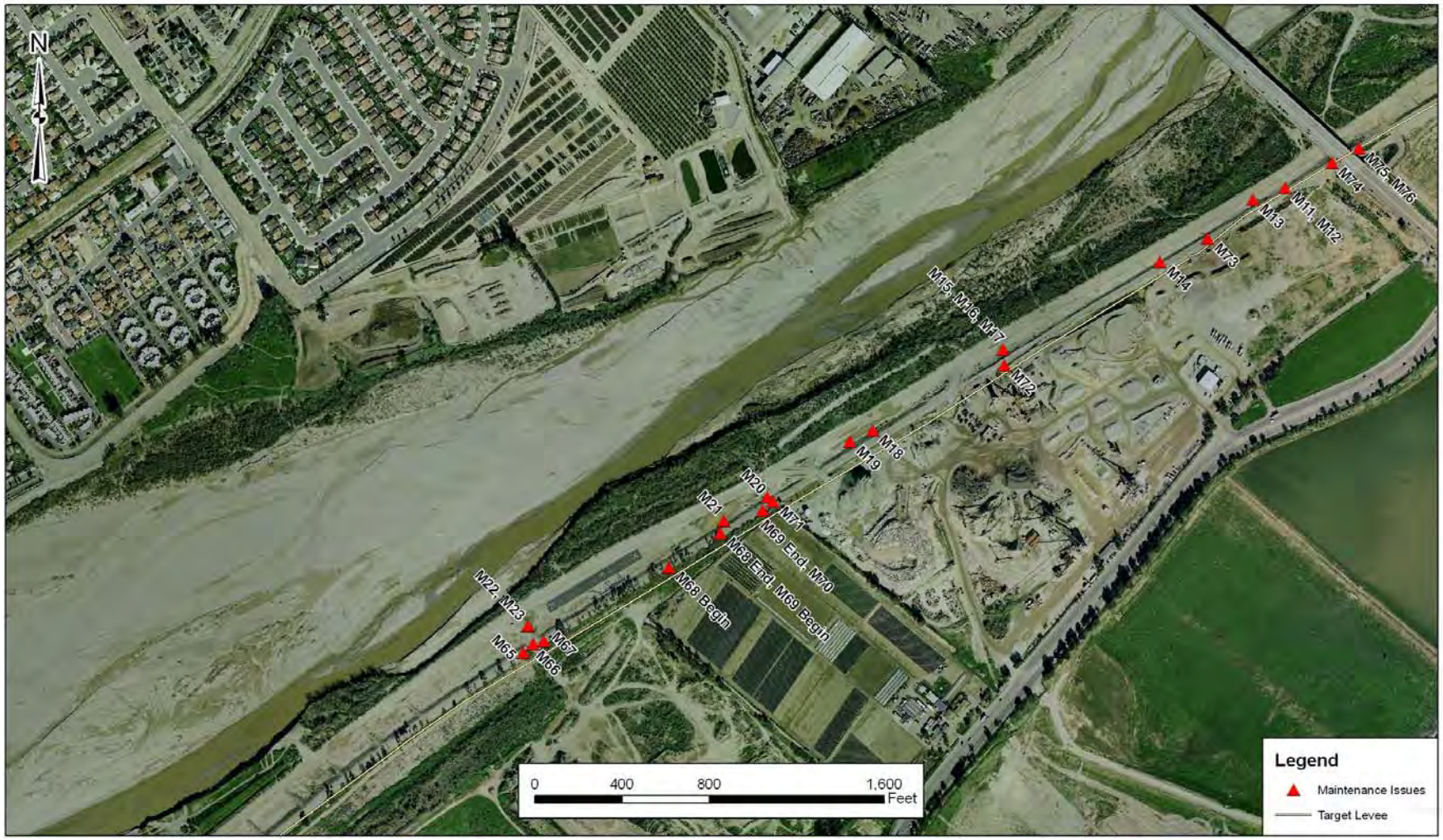
Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. F6) – Groin and levee embankment, looking downstream (riverward side)

Appendix C

Photos for Maintenance Required Locations



Appendix C – Locations of Photos at the Maintenance-Required Sites for Santa Clara River Levee (SCR-1)



Appendix C – Locations of Photos at the Maintenance-Required Sites for Santa Clara River Levee (SCR-1)

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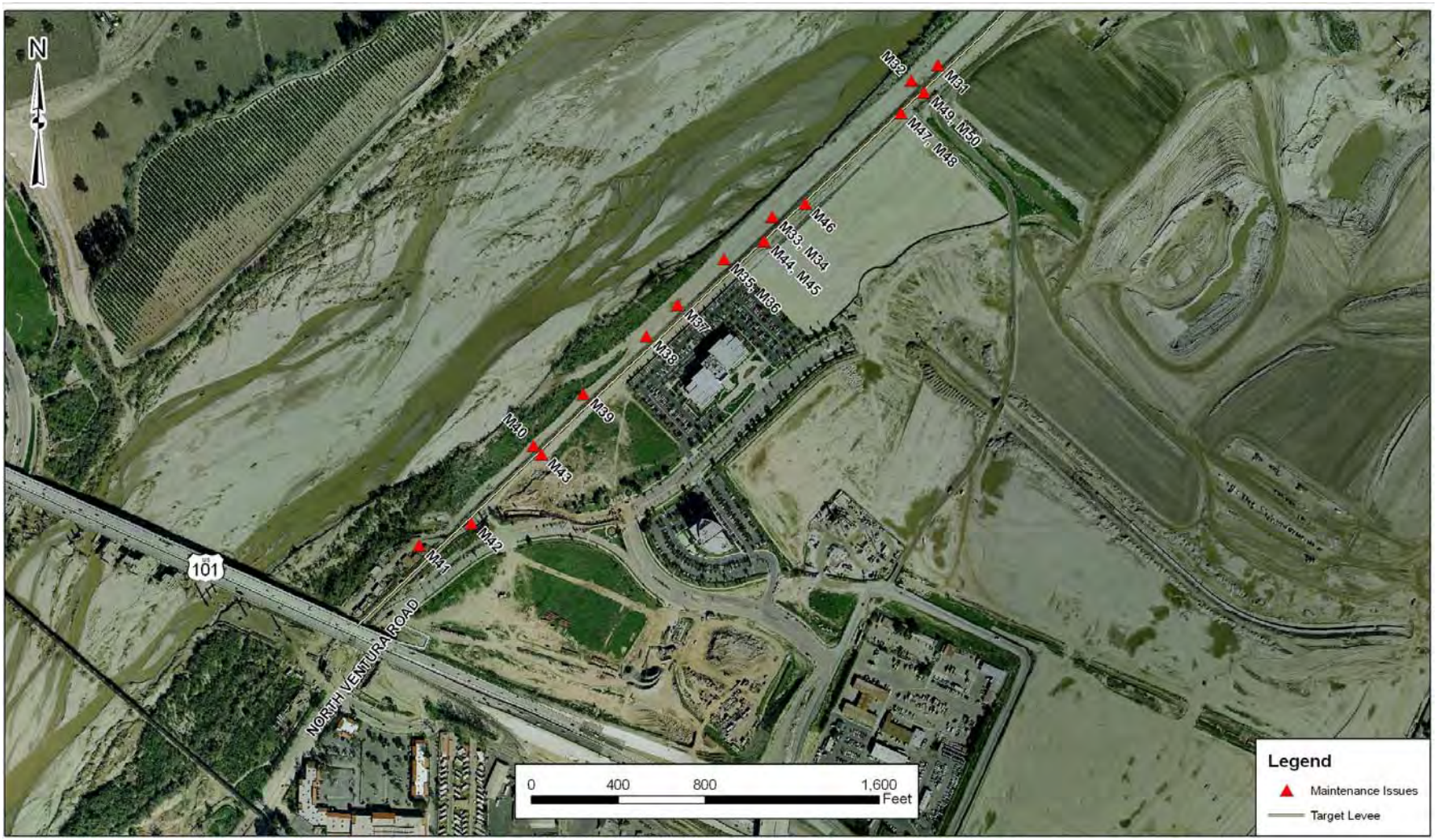


Appendix C – Locations of Photos at the Maintenance-Required Sites for Santa Clara River Levee (SCR-1)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M1) – Damaged concrete on Side Drain 1A headwall with rebar exposed

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M3) – Sediment spoils, upstream end of levee (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M2) – Detail of damaged concrete headwall & exposed rebar (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M4) – Sediment deposition in Side Drain No. 1, 42" RCP outlet (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M5) – Sediment deposition in Side Drain No. 1, 42" RCP inlet (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M7) – Wood debris adjacent to nursery looking upstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M6) – Wood debris adjacent to nursery looking upstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M8) – Broken stone revetment (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M9) – Broken stone revetment (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M11) – Erosion of levee embankment (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M10) – Animal burrows at levee toe (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M12) – Erosion of levee embankment just downstream of L.A. Ave.(riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M13) – Concrete spread over levee embankment, looking d/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M15) – Erosion of levee embankment, looking upstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M14) – Erosion on levee embankment, looking d/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M16) – Erosion of levee embankment, adjacent to asphalt plant (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M17) – Erosion of levee embankment, adjacent to asphalt plant (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M19) – Broken stone revetment (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M18) – Levee embankment erosion caused by vehicles (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M20) – Sediment deposition in Side Drain No. 3, 48” RCP outlet (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M21) – Broken stone revetment (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M23) – Erosion on top of levee caused by vehicles, looking d/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M22) – Erosion on top of levee caused by vehicles (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M24) – Levee embankment erosion caused by vehicles (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*. (Photo No. M25) – Broken stone revetment (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*. (Photo No. M27) – Unauthorized ramp on levee (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*. (Photo No. M26) – Concrete pipe debris along levee toe, looking d/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*. (Photo No. M28) – Debris along levee toe, looking downstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M29) – Sediment deposition in Side Drain No. 6, 48" RCP outlet (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M31) – Sloughing levee embankment protection (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M30) – Unauthorized ramp on levee (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M32) – Sediment deposition in Side Drain No. 4, 48" RCP outlet (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M33) – Exposure of tip of buried groin looking downstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M35) – Exposure of tip of buried groin looking downstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M34) – Sink hole in soil covering buried groins looking down/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M36) – Sink hole in soil covering buried groins (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M37) – Exposure of tip of buried groin, looking upstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M39) – Concrete washout poured over rock protection, looking d/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M38) – Unauthorized ramp with missing levee embankment protection (riverward)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M40) – Dumped concrete debris at levee toe (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M41) – Vegetation within 15' levee toe, looking d/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M43) – PVC pipe protruding from levee (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy.* (Photo No. M42) – Vegetation within 15-feet of levee toe looking d/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M44) – Erosion on top of levee exposing fence posts, looking d/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M45) – Stone debris approx. 500' along levee toe, looking u/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Satico,.* (Photo No. M47) – Debris approx. 100' along levee, looking u/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M46) – Erosion on top of levee, looking downstream (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M48) – Debris approx. 100' along levee, looking u/s (riverward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M49) – Sediment deposition in Side Drain No. 4, 48" RCP invert (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M51) – Erosion on levee embankment, looking upstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M50) – Looking down at sediment in SD No. 4, inlet structure (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M52) – Erosion on levee embankment, looking downstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M53) – Animal burrows at top of levee (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M55) – Trees within 15' of levee toe, looking downstream (landward side)

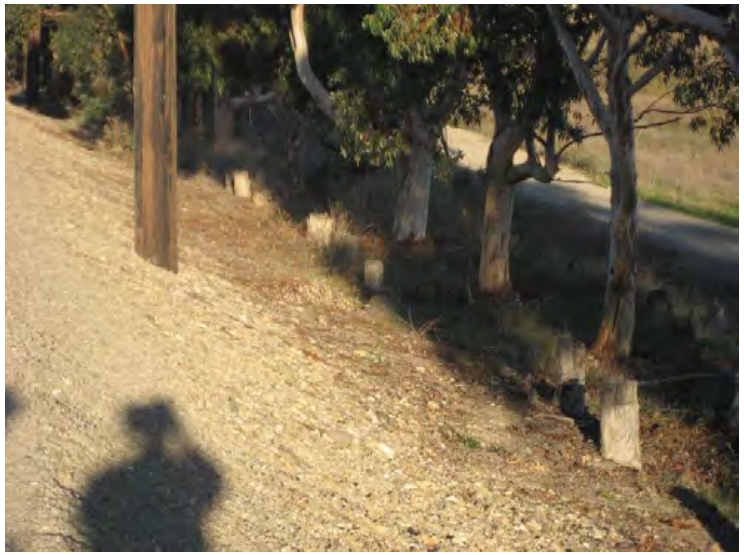
Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M54) – Tree within 15' of levee toe, looking downstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M56) – Trees within 15' of levee toe, looking upstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M57) – Power poles within 15' of levee toe, looking upstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M59) – Trees within 15' of levee toe, looking u/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M58) – Power poles within 15' of levee toe, looking upstream (landward side)



Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M60) – Trees, power poles & stumps within 15' of toe, looking u/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M61) – Power poles on levee embankment, looking upstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M63) – Power poles guy wires anchored in levee bank, looking d/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M62) – Power poles on levee embankment, looking upstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M64) – Fallen trees and vegetation on levee bank, looking u/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M65) – Trees and fallen trees within 15' of levee toe, looking u/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M67) – Vegetation within 15-feet of levee toe, looking downstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M66) – Erosion on top of levee caused by vehicles, looking S/E (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M68) – Vegetation within 15-feet of levee toe, looking d/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M69) – Vegetation within 15-feet of levee toe, looking u/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M71) – Sediment & metal debris in Side Drain No. 3 inlet (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M70) – Animal burrow on top of levee (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy*, (Photo No. M72) – Erosion on levee embankment, looking downstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M73) – Erosion on levee embankment, looking upstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M75) – Vegetation within 15-feet of levee toe, looking downstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M74) – Erosion caused by vehicles under L.A. Ave. Bridge (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M76) – Vegetation within 15-feet of levee toe, looking downstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M77) – Erosion at top of levee with debris at toe, looking d/s (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M79) – Trees within 15-feet of levee toe, looking downstream (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M78) – Animal burrows at top of levee (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M80) – Sediment and debris in Side Drain No.1, 42” RCP inlet (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M81) – Vegetation within 15-feet of levee toe, looking upstream (landward side)

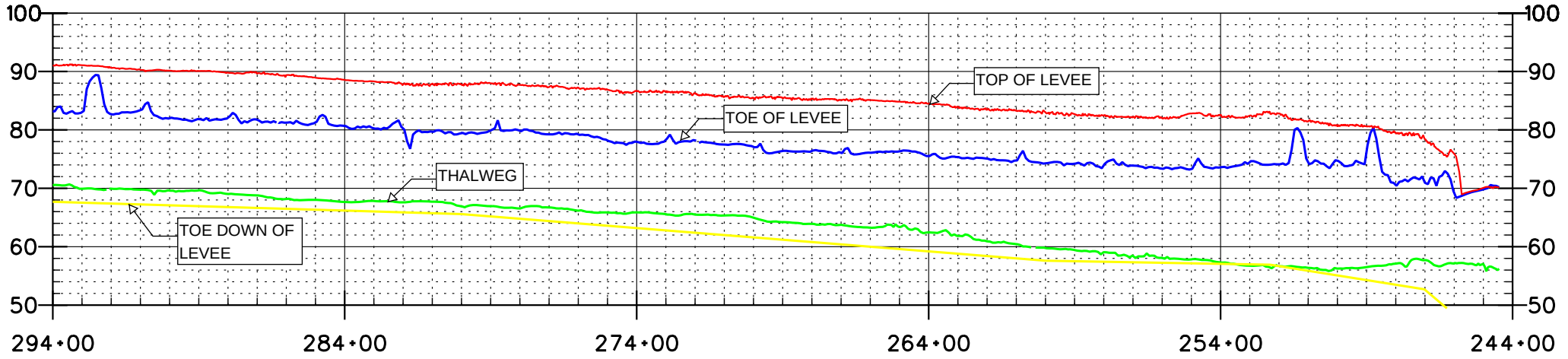
Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M83) – Animal burrows at levee toe (landward side)

Santa Clara River Levee, *From Hwy 101 to Saticoy,* (Photo No. M82) – Vegetation within 15-feet of levee toe, looking downstream (landward side)

Exhibit 2

Preliminary Evaluation of Levee System Profiles

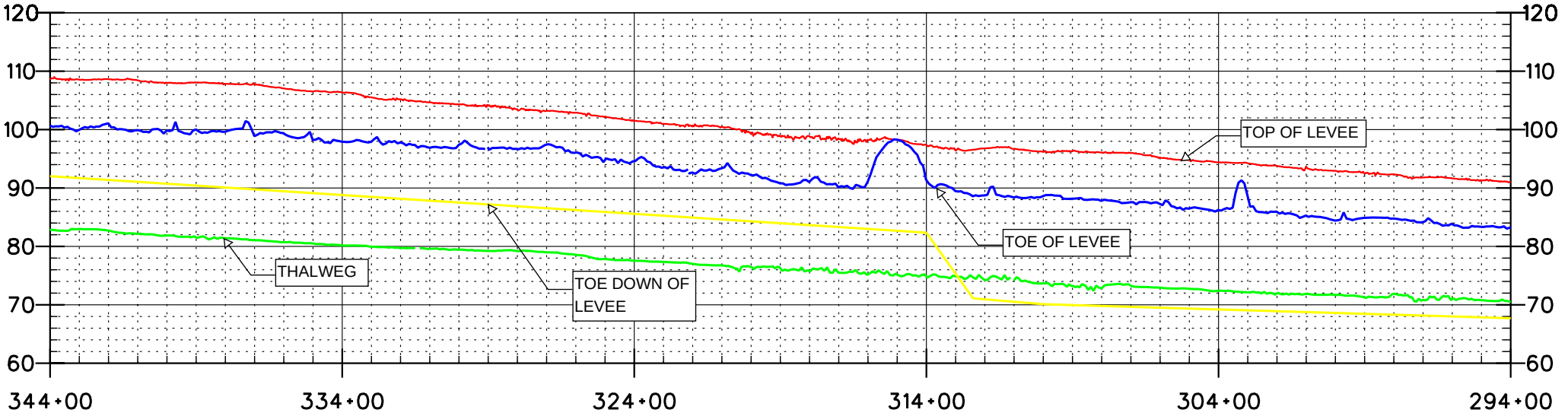
SANTA CLARA RIVER (SCR-1)
STATION 244+46 TO 294+00



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

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

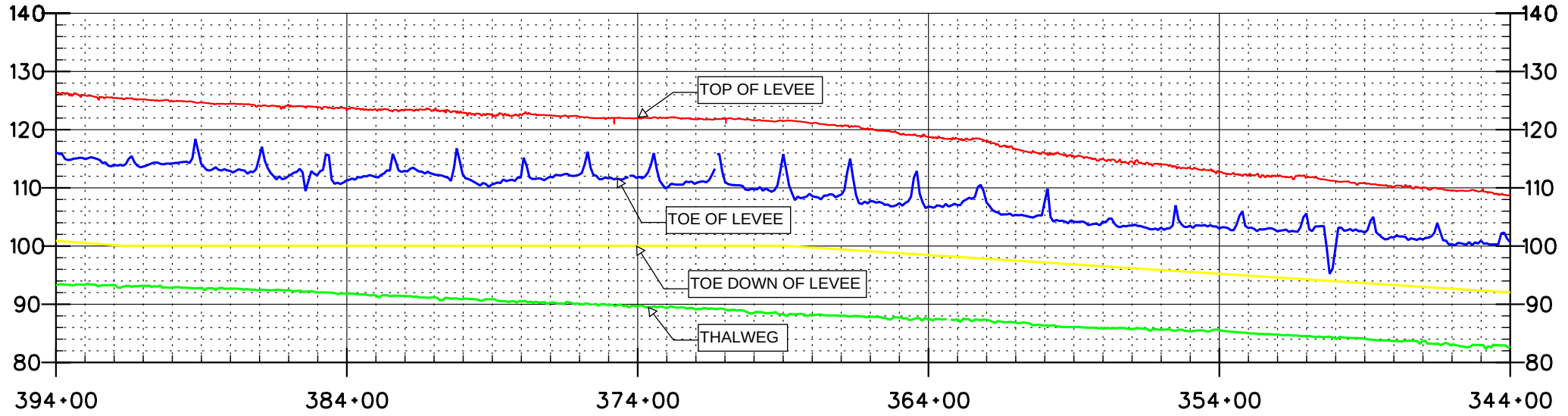
SANTA CLARA RIVER (SCR-1)
STATION 294+00 TO 344+00



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

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

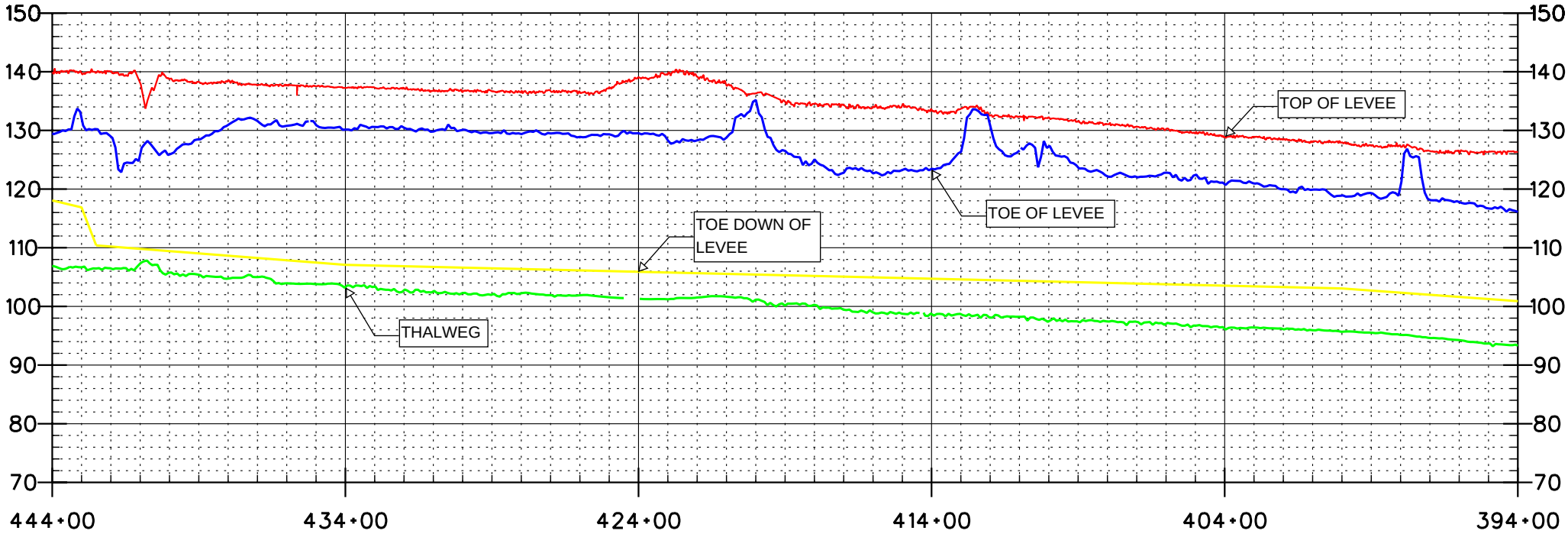
SANTA CLARA RIVER (SCR-1)
STATION 344+00 TO 394+00



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

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

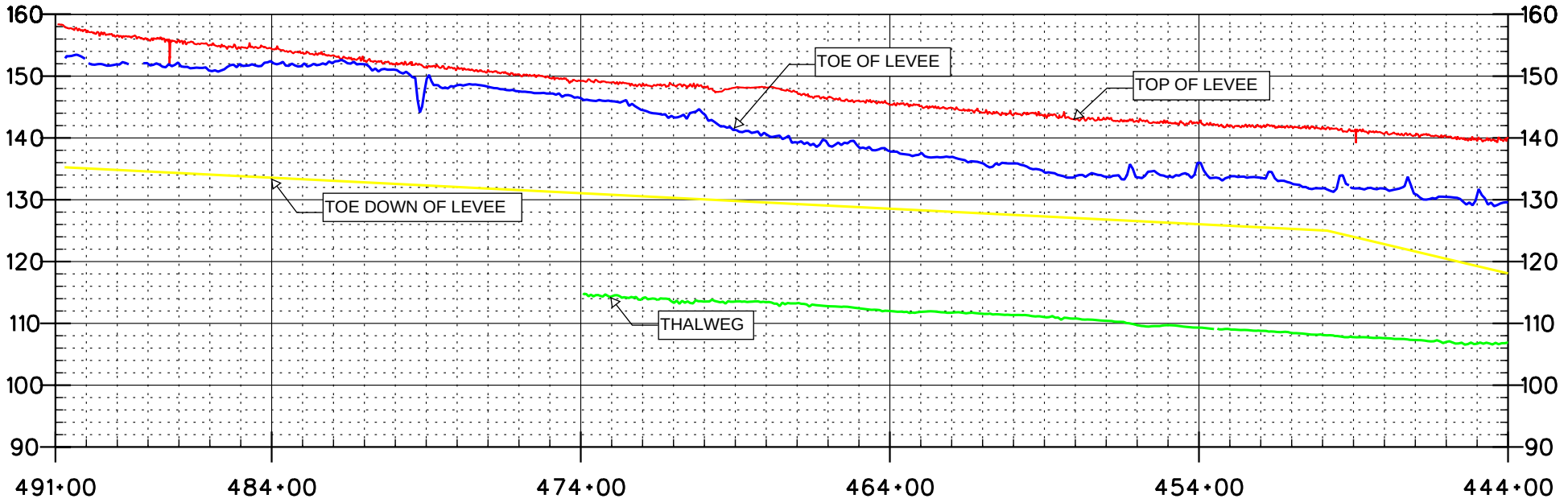
SANTA CLARA RIVER (SCR-1)
STATION 394+00 TO 444+00



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

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

SANTA CLARA RIVER (SCR-1)
STATION 444+00 TO 491+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

Santa Clara River Levee (SCR-1) - Hwy 101 to Saticoy

Bridge Crossings (U/S to D/S)	**As-Builts Provided to Consultant by County**	**County or USACE Dwg. No.**	**Date***	**Sta. (relative to 1961 Dwgs)**	**Action**
Los Angeles Ave.	No				Request from County.
Hwy 101	No				Request from Caltrans.
Railroad Crossing (D/S Hwy 101)	No				Request from SPRR.
Victoria Ave.	No				Request from County.
Harbor Blvd.	No				Request from County.
Levee System (U/S to D/S)					
Santa Clara River Levee	Yes	187/31 to 51	1961		
Levee and Channel Restoration	Yes	187/161 to 208	1971		
Modification of Canal Structures	Yes	Y-2-142	1959		
Santa Clara River Groin Repair	Yes	Y-2-1829 to 1832	1985		
Penetrations (U/S to D/S)					
Side Drain 1-A, 4’ x 4’ x 23.5’ RCB	No	Y-2-336 to 338	1965	491+45	We have dwgs, but they're not stamped as "Record Dwgs." Request from County.
Side Drain No. 1, 42" RCP	Yes	187/38, 49 & 50	1961	480+00	
Side Drain No. 2, 48" RCP	Yes	187/38, 49 & 50	1961	442+00	
Commercial drain from asphalt plant	Yes	187/39	1961	422+25	
Side Drain No. 3, 48" RCP	Yes	187/39, 49 & 50	1961	410+60	
12” metal pipe commercial drain from plant	Yes	187/39	1961	385+77	
Central Avenue Drain, 2-72” RCP w/ flap gates	Yes	Y-2-2399 to 2410	1997	351+50	
Side Drain No. 6, 48" RCP	Yes	187/40, 49 & 50	1961	316+60	
Side Drain No. 4, 48” RCP w/ flap gate	Yes	187/41, 49 & 50	1961	282+00	
10’W x 8’H RCB (Stroube Drain-Unit I)	Yes	Y-2-2011 to 2023	1989	246+20	

*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
Santa Clara River Levee (SCR-1), Category 2								
M1, M2	Spalled concrete on Side Drain 1A headwall with rebar exposed (riverward side)	Repair the concrete headwall of outlet structure	**C1**	E1	Concrete repair during dry season, use BMPs		Does this need a flap gate?	No the inlet to Side Drain 1A is a reinforced concrete channel with wall heights extending to the top of the levee, thus flow from the Santa Clara River would not cause interior flooding.
M3	Sediment spoils (riverward side)	Remove spoils from levee	**C1**	E1	Removal of spoil pile		Why are the spoils an issue?	In this particular case, the unauthorized spoils are precluding a riverward side view of the levee which is required for routine maintenance and inspection.
M4, M5	Sediment deposition in Side Drain No. 1, 42" RCP inlet and outlet. Flap gate is stuck open by debris and sediment	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)	**C1** - to clean drain, **C5** drainage stopped by other property	E1	Removal of debris and dirt		How much removal is required? Water will not drain unless drainage is extended. Is this an issue?	In this particular case, it seems the inlet (landward side) is lower than the outlet (riverward side). Recommend determining how the property behind levee drains to see if this penetration is even valid. If this penetration is no longer required it could be sealed. If it is still required the operation of the flap gate must be restored to prevent interior flooding.
M6, M7	Wood debris (riverward side)	Remove debris from the levee	**C1**	E1	Removal of wood ok, what about hole?			
M8, M9	Broken stone revetment (riverward side)	Stone revetment may need to be repaired, additional engineering analysis is recommended	**C2**	E2	In kind repair, exc. & place new rock	X	Are the broken rocks still an issue?	Determination of the revetment protection will require hydraulic and rock sizing analyses. These analyses will be performed during the next phase of work.
M10	Animal burrows at levee toe (riverward side)	Fill voids with impervious material and firmly compact	**C1**	E2	Excavate & recompact existing levee, add IPM		Definition of impervious material	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 with in-kind materials. 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 discussed below. 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.
M11, M12	Levee embankment erosion (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C1/C4,** or **C5** - fencing needed, redesign needed?, How do we stop the vehicle issue?	E2	Excavate & recompact existing levee, in kind		Definition of impervious material	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. Additionally, revetment protection evaluation including rock sizing analysis should be incorporated in repair of revetment material.
M13	Concrete debris has been spread over levee embankment (riverward side)	Remove unauthorized concrete cover from levee embankment	**C1/C4**, or **C5** - fencing needed, redesign needed?, How do we stop the vehicle issue?	E2	In kind repair ok, what is needed?			
M14	A low point along top of levee causing concentrated flow and surface erosion on levee embankment (riverward side)	Regrade top of levee to meet design profile of top of levee. Fill embankment voids with impervious material and firmly compact	**C1/C4**, or **C5** - fencing needed, redesign needed?, How do we stop the vehicle issue?	E2	Regrade levee top, in kind repair			
M15, M16, M17	Levee embankment erosion (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C1/C4**, or **C5** - fencing needed, redesign needed?, How do we stop the vehicle issue?	E2	Redress levee slope in kind repair			
M18	Levee embankment erosion caused by vehicles (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C1/C4**, or **C5** - fencing needed, redesign needed?, How do we stop the vehicle issue?	E2	Redress levee slope in kind repair		How do we mitigate these vehicles? What about items repaired and then immediately ruined again?	Facility could be made more secure to prevent vehicles. Anytime damages occur they must be repaired.

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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
Santa Clara River Levee (SCR-1), Category 2								
M19	Broken stone revetment (riverward side)	Stone revetment may need to be repaired, additional engineering analysis is recommended	**C2**	E2	In kind repair, exc. & replace rock		Are the broken rocks still an issue?	Determination of the revetment protection will require hydraulic and rock sizing analyses. These analyses will be performed during the next phase of work.
M20	Sediment deposition in Side Drain No. 3, 48" RCP outlet (riverward side)	Remove sediment and establish a clear passage from pipe to channel	**C1/C4**	E1	Removal of debris and dirt ok			
M21	Broken stone revetment (riverward side)	Additional engineering analysis is recommended	**C2**	E2	In kind repair, exc. & replace rock	X	Are the broken rocks still an issue?	Determination of the revetment protection will require hydraulic and rock sizing analyses. These analyses will be performed during the next phase of work.
M22, M23	Erosion on top of levee caused by vehicular traffic (landward side)	Reestablish top of levee to meet design elevations	**C1/C4**, or **C5** - fencing needed, redesign needed?, How do we stop the vehicle issue?	E1	Regrade levee top, in kind repair			
M24	Levee embankment erosion caused by vehicular traffic (riverward side)	Reestablish levee revetment with design specifications. Fill voids with impervious material and firmly compact	**C1/C4**, or **C5** - fencing needed, redesign needed?, How do we stop the vehicle issue?	E2	Redress levee slope in kind repair			
M25	Broken stone revetment (riverward side)	Additional engineering analysis is recommended	**C2**	E2	In kind repair, exc. & replace rock		Are the broken rocks still an issue?	Determination of the revetment protection will require hydraulic and rock sizing analyses. These analyses will be performed during the next phase of work.
M26	Broken concrete pipe debris along levee toe (riverward side)	Remove unauthorized concrete pipe debris from levee embankment	**C1**	E1	Remove debris			
M27	Unauthorized ramp on levee (riverward side)	Remove unauthorized earthen ramp	**C1/C4**	E2	Redress levee slope in kind repair			
M28	Debris stock piles along levee toe (riverward side)	Remove unauthorized debris stockpiles from levee toe	**C1**	E1	Remove debris			
M29	Sediment deposition in Side Drain No. 6, 48" RCP outlet (riverward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)	**C1**	E1	Remove sediment			
M30	Unauthorized ramp on levee	Remove unauthorized debris stockpiles from levee toe	**C1/C4**	E2	Remove ramp, in kind repair			
M31	Sloughing levee embankment protection (riverward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C1/C4**	E2	Redress levee slope in kind repair			
M32	Sediment deposition in Side Drain No. 4, 48" RCP outlet (riverward side)	Remove sediment and establish a clear passage from pipe to channel (riverward & landward sides)	**C1/C4**	E2	Excavate sediment to drain properly			
M33, M34	Tip of buried groin is exposed and sink holes are present in soil covering groins (riverward side)	Repair sinkholes and fill voids with impervious material and firmly compact. (Safety Hazard) Additional engineering analysis is recommended for exposed groins	**C5** - D&C to rebuild groin	E3	Excavate/repair groin may need fish permit			
M35, M36	Tip of buried groin is exposed and sink holes are present in soil covering groins (riverward side)	Repair sinkholes and fill voids with impervious material and firmly compact. (Safety Hazard) Additional engineering analysis is recommended for exposed groins	**C5** - D&C to rebuild groin	E2	Likely do in concert with M33, M34			
M37	Tip of buried groin is exposed (riverward side)	Additional engineering analysis is recommended for exposed groins	**C5** - D&C to rebuild groin	E3	Excavate/repair groin may need fish permit			
M38	Unauthorized ramp with missing levee embankment protection (riverward side)	Remove unauthorized earthen ramp and reestablish levee embankment and embankment protection	**C1/C4**	E2	Remove ramp, in kind repair			

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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
Santa Clara River Levee (SCR-1), Category 2								
M39	Concrete washout poured over rock protection down to Highway 101 (riverward side)	Remove unauthorized concrete cover from levee embankment	**C1/C4**	E2	Remove concrete, repair in kind			
M40	Dumped concrete debris, unauthorized PVC pipe in levee embankment (riverward side)	Remove unauthorized debris and PVC pipe	**C1/C4**	E1	Debris removal			
M41	Vegetation and irrigation lines within 15-feet of levee toe (riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact. Remove Irrigation lines.	**C1/C4**	E1	Upland veg ok to remove			
M42	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5**, PR issue with Developer and City of Oxnard	E1	Landward veg removal not regulated	X		
M43	PVC pipe protruding from top of levee (landward side)	Remove unauthorized PVC pipe and fill voids with impervious material and firmly compact	**C1/C4**	E1	Excavate & repair in kind			
M44	Erosion on top of levee exposing fence posts (landward side)	Reestablish top of levee and fill voids with impervious material and firmly compact	**C1/C4**	E1	Repair, redress in kind			
M45	Stone debris approximately 500-feet along levee toe (landward side)	Remove unauthorized stone debris from levee toe	**C1/C4**	E1	Remove debris			
M46	Erosion on top of levee (landward side)	Reestablish top of levee and fill voids with impervious material and firmly compact	**C1/C4**	E1	Regrade levee top & bank, in kind repair			
M47, M48	Dumped stone and debris approximately 100-feet along the levee (landward side)	Remove unauthorized stone debris from levee toe	**C1/C4**	E1	Remove debris			
M49, M50	Sediment deposition in Side Drain No. 4, 48" RCP inlet structure (landward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)	**C1/C4**	E1	Remove sediment & debris			
M51, M52	Erosion on levee embankment (landward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C1/C4**	E1	Redress levee slope in kind repair			
M53	Animal burrows near top of levee (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact	**C1**	E1	Excavate & recompact existing levee, add IPM			
M54	Tree within 15' of levee toe (landward side)	Remove tree and root ball, fill voids with impervious material and firmly compact.	**C1/C4**	E1	Landward veg removal not regulated	X	Where does the toe start?	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)
M55, M56	Trees within 15' along levee toe (landward side)	Remove trees and root ball, fill voids with impervious material and firmly compact.	**C1/C4**	E1	Landward veg removal not regulated	X	Where does the toe start?	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)
M57, M58	Power poles within 15' of levee toe (landward side)	May require relocation	**C5** - Planning to coordinate removal of poles with SCE	E1	Unless major reconstruction, no permits	X	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.
M59	Tree within 15' of levee toe (landward side)	Remove trees and root ball, fill voids with impervious material and firmly compact.	**C1/C4**	E1	Landward veg removal not regulated	X	Where does the toe start?	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)
M60	Trees, stumps, power poles within 15' of levee toe approximately 1,000' along levee toe (landward side)	Remove trees and root ball, fill voids with impervious material and firmly compact	**C1** - for tree removal, **C5** - Planning to coordinate removal of poles with SCE	E1	Landward veg removal not regulated, power poles may be issue	X	Are all static poles a problem? Where does the toe start?	Utility poles within the embankment prism (only 1 on SCR-1) must be relocated. This pole does not require relocation.
M61, M62, M63, M64	Power pole and fallen trees on levee embankment, guy wires anchored into embankment (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1** - for tree removal, **C5** - Planning to coordinate removal of poles with SCE	E1	Landward veg removal not regulated, power poles may be issue	X		Utility poles within the embankment prism (only 1 on SCR-1) must be relocated. This pole requires relocation.

*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
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
Santa Clara River Levee (SCR-1), Category 2								
M65	Trees and fallen trees within 15' along levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1/C4**	E1	Landward veg removal not regulated			
M66	Erosion on top of levee caused by vehicles (landward side)	Reestablish top of levee and fill voids with impervious material and firmly compact	**C1/C4**	E1	Redress levee slope in kind repair			
M67	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5** - Planning to assess property issues	E1	Landward veg removal not regulated	X		
M68	Vegetation within 15-feet of levee toe approximately 150-feet along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5** - Planning to assess property issues	E1	Landward veg removal not regulated	X		
M69	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5** - Planning to assess property issues	E1	Landward veg removal not regulated	X		
M70	Animal burrow on top of levee (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact	**C1**	E1	Excavate & recompact existing levee, add IPM			
M71	Sediment deposition and metal debris Side Drain No. 3 in 48" RCP inlet (landward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)	**C1/C4**	E1	Landward veg removal not regulated		Does this need a flap gate?	This penetration does have a flap gate. This penetration must be cleaned and the flap gate restored to working order.
M72	Erosion on levee embankment (landward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C1/C4**	E1	Redress levee slope in kind repair			
M73	Erosion on levee embankment (landward side	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C1/C4**	E1	Redress levee slope in kind repair			
M74	Erosion caused by vehicles under Los Angeles bridge crossing (landward side)	Reestablish levee embankment and fill voids with impervious material and firmly compact	**C5**, Cal-Trans issue	E1	Remove sediment, repair slopes, in kind repair	X	This could be a Cal-Trans issue?	Repair is required
M75, M76	Vegetation within 15-feet of levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1/C4**	E1	Landward veg removal not regulated			
M77	Erosion at top of levee with miscellaneous debris at toe (landward side)	Repair erosion and remove miscellaneous debris	**C1/C4**	E1	Redress levee slope in kind repair			
M78	Animal burrows at top of levee (landward side)	Remove animal burrows, fill voids with impervious material and firmly compact	**C1**	E1	Excavate & recompact existing levee, add IPM			
M79	Trees within 15-feet of levee toe, approximately 200-feet along levee (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C2**	E1	Landward veg removal not regulated	X	Where does the toe start?	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)
M80	Sediment deposition and debris in Side Drain No. 1, 42" RCP inlet invert (landward side)	Remove sediment and debris and establish a clear passage from pipe to channel (riverward & landward sides)	**C1/C4**	E1	Remove debris and sediment			
M81	Vegetation within 15-feet of toe, approximately 1,200-feet along levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C2**	E1	Landward veg removal not regulated	X	Where does the toe start?	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)
M82	Vegetation within 15-feet of toe, approximately 400-feet along levee toe (landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C2**	E1	Landward veg removal not regulated	X	Where does the toe start?	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)
M83	Animal burrow at toe of levee	Remove animal burrow, fill voids with impervious material and firmly compact	**C1**	E1	Excavate & recompact existing 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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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.**

*Indicates comment made by more than one reviewer.

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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.

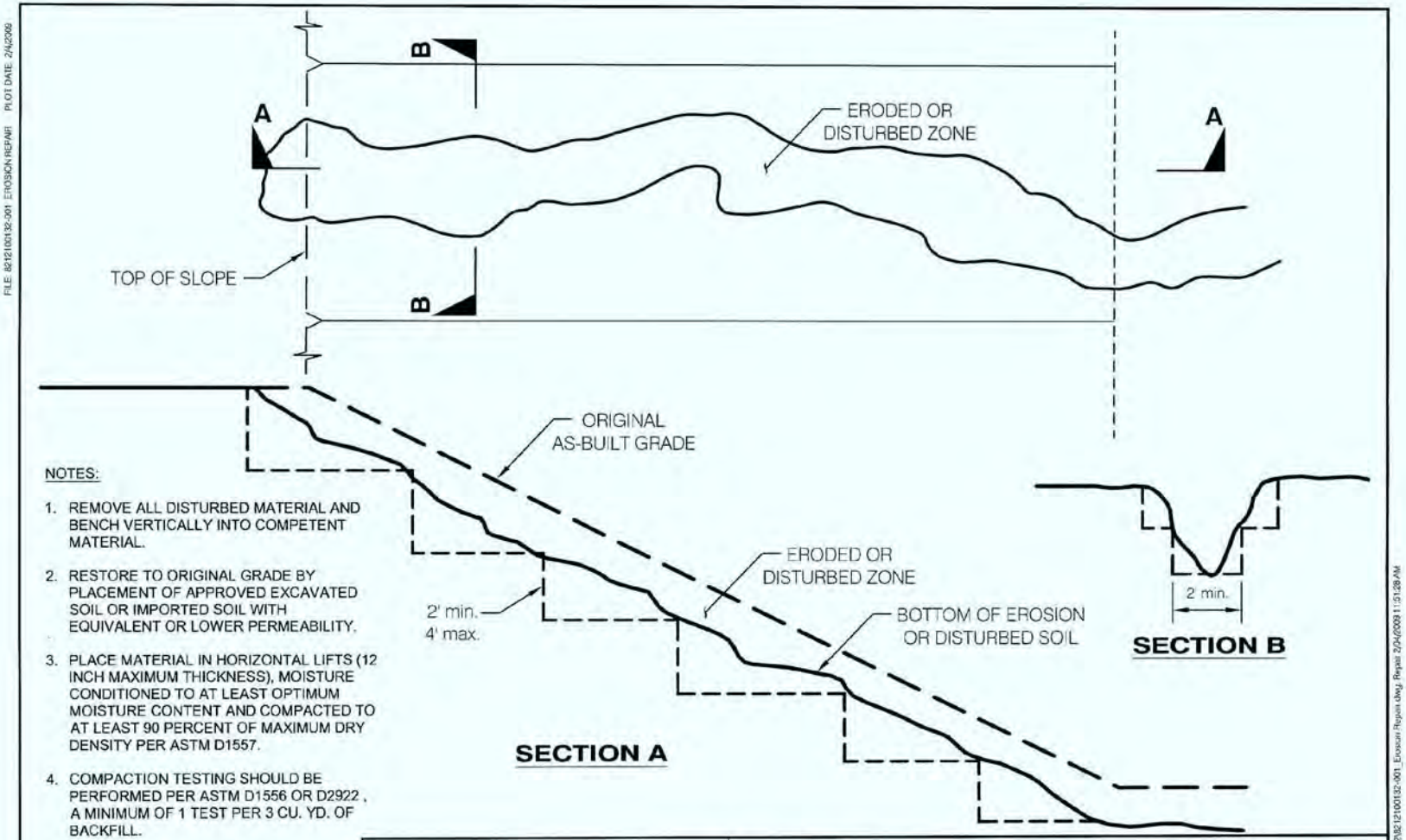
VCWPD OPERATION & MAINTENANCE DIVISION RFI

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

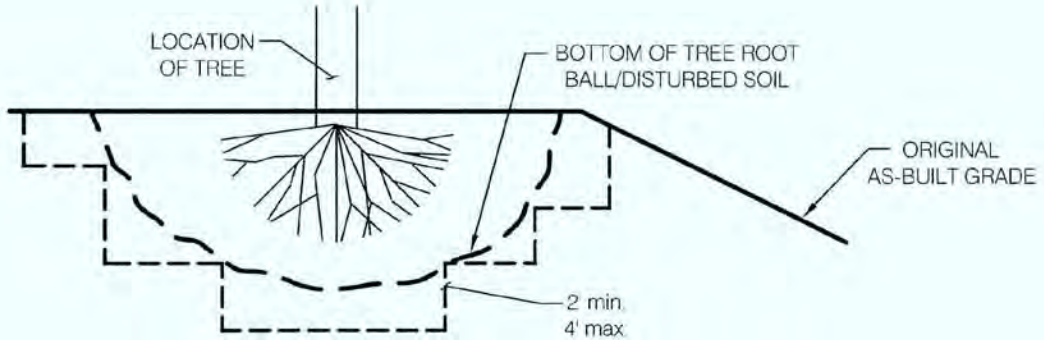
LEVEE CERTIFICATION PROJECT
VENTURA COUNTY, CALIFORNIA

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

FILE: 8212100132-001 EROSION REPAIR PLOT DATE: 2/4/2009
ANAHEIM R:\Drawings\2008\Dept \8212100132\8212100132-001_Erosion Repair.dwg, Repair 2/24/2009 11:51:28 AM

FILE: 8212100132-001_EROSION REPAIR PLOT DATE: 2/4/2009



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
www.amec.com/earthandenvironmental

DWN BY:	DATE:	PROJECT NO:
JBD	February 2009	8212100132
CHK'D BY:	SCALE:	FIGURE No.
DRB	Not To Scale	FIGURE 2

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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.