NAPA RIVER LEFT BANK TULOCAY TO IMOLA LEVEE SYSTEM

NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
NAPA, CALIFORNIA
NLD SYSTEM ID NO. 5305000100; SEGMENT ID NO. 5304000090

PERIODIC INSPECTION REPORT NO. 1
SEPTEMBER 2020

**US Army Corps
of Engineers ®**
San Francisco District

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QUALITY CONTROL CERTIFICATION

COMPLETION OF QUALITY CONTROL ACTIVITIES

The Walla Walla District has completed the Periodic Inspection Report No. 1 for the Napa River Left Bank Tulocay to Imola Levee System in Napa, California for San Francisco District. Notice is hereby given that the DQC Review has been conducted in accordance with District policy. During this review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified.

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Table of Contents

ACRONYMS AND ABBREVIATIONS.. v

PART 1 - EXECUTIVE SUMMARY.. 1
1.1 SCOPE AND PURPOSE OF PERIODIC INSPECTION 1
1.2 SYSTEM SUMMARY 1
1.3 SUMMARY OF MAJOR DEFICIENCIES 1
1.4 OVERALL RATING 2
PART 2 - INSPECTION TEAM AND DATE OF INSPECTION.. 4
2.1 INSPECTION TEAM... 4
2.2 DATE OF INSPECTION 4
2.3 WEATHER DURING INSPECTION 4
2.4 RIVER GAUGE OR ELEVATION READINGS DURING INSPECTION 4
PART 3 - SYSTEM BACKGROUND INFORMATION 5
3.1 PROJECT DESCRIPTION... 5
3.1.1 Project Type 5
3.1.2 Authority 5
3.1.3 Cost.. 5
3.1.4 Completion Date... 5
3.1.5 Public Sponsor... 6
3.1.6 Location 6
3.1.7 Potential Consequences.. 6
3.1.8 Investigations Prior to Construction 6
3.1.9 History of Remedial Measures.. 6
3.2 DESCRIPTION OF PERTINENT FEATURES 8
3.2.1 Imola Levee.. 8
3.2.2 NSD Levee 9
3.3 TOPOGRAPHY, GEOLOGY, SEISMICITY, AND GROUNDWATER.................................. 10
3.3.1 Regional Geologic Setting, Site Specific Geology, and Topography.................... 10
3.3.2 Seismicity.. 11
3.3.3 Groundwater Conditions... 11
3.3.4 Subsurface Investigation and Foundation Conditions.................................... 11
3.4 HYDROLOGIC/HYDRAULIC 11
3.4.1 Past Project Performance... 11
3.4.2 Flood Insurance Study... 11
3.5 REFERENCES 12
PART 4 - DESIGN CRITERIA REVIEW 14
4.1 GEOTECHNICAL... 14
4.1.1 Soil Investigations.. 14
4.1.2 Slope Stability 14
4.1.3 Seepage... 15
4.1.4 Settlement.. 15
4.1.5 Seismic Evaluation and Liquefaction 16
4.2 HYDROLOGIC/HYDRAULIC 16
4.2.1 Design Capacity... 16

4.2.2 Hydraulic Analysis.. 17
4.2.3 Adequacy of Erosion Protection 17
4.3 MAINTENANCE ACCESS ROADS... 18
4.4 SURVEY DATUM 18
4.5 DESIGN CRITERIAL REVIEW CONCLUSIONS 18
PART 5 - INSPECTION FINDINGS AND EVALUATIONS.. 19
5.1 INSPECTION SUMMARY.. 19
5.2 GENERAL ITEMS FOR ALL FLOOD DAMAGE REDUCTION SEGMENTS/SYSTEMS 19
5.2.1 Operation and Maintenance Manuals.. 19
5.2.2 Emergency Supplies and Equipment... 19
5.2.3 Flood Preparedness and Training... 19
5.3 LEVEE EMBANKMENTS... 21
5.3.1 Non-Compliant Vegetation Growth.. 21
5.3.2 Encroachments... 21
5.3.3 Slope Stability 21
5.3.4 Erosion/Bank Caving 21
5.3.5 Settlement.. 21
5.3.6 Depressions and Rutting... 22
5.3.7 Cracking... 22
5.3.8 Animal Control... 23
5.3.9 Seepage.. 23
5.4 INTERIOR DRAINAGE SYSTEM 23
5.4.1 Vegetation and Obstructions.. 23
5.4.2 Encroachments... 23
5.4.3 Concrete Surfaces 24
5.4.4 Tilting, Sliding or Settlement of Concrete Structure....................................... 24
5.4.5 Foundation of Concrete Structures.. 24
5.4.6 Culverts/Discharge Pipes.. 24
5.4.7 Sluice/Slide Gates.. 24
5.4.8 Flap Gates/Flap Valves/Pinch Valves.. 25
PART 6 - CONCLUSIONS AND RECOMMENDATIONS 26
6.1 RECOMMENDATIONS.. 26
6.1.1 General Items for All Flood Damage Reduction Segments/Systems............... 26
6.1.2 Levee Embankment.. 26
6.1.3 Interior Drainage System.. 27
6.2 RATING.. 27
6.3 FUTURE PERIODIC INSPECTION 27

Tables

Table 3-1: NCFCWCD Points of Contact...6
Table 4-1: Slope Stability Summary..15
Table 5-1: List of Key Inspection Staff..19
Table 5-2: PI Rated Summary..20
Table 6-1: Levee Embankment Deficiencies and Recommended Actions.................26

Figures

Figure 1-1: Location Map of the Napa River Left Tulocay to Imola Levee System..................... 3
Figure 3-1: Napa Levee Safety System Map.. 7
Figure 3-2: Typical Levee Cross Section Imola Levee Section.. 8
Figure 3-3: Typical Cross Section of the Duden-NSD Levee... 10
Figure 4-1: Table 9 Memorandum for Record (USACE, 2010)... 17
Figure 5-1: Inspection Point NLT3_2020_0012: Fence along the levee toe............................. 21
Figure 5-2: Inspection Point NLT3_2020_a_0011: Rutting along the levee slope..................... 22
Figure 5-3: Inspection Point NLT3_2020_a_0020: Cracking observed in asphalt.................... 23
Figure 5-4: Inspection Point NLT3_2015_a_0020: Animal burrows on the downstream slope of the levee... 24
Figure 5-5: Inspection Point NLT3_2015_a_0008: Headwall structure and flap gate on the Caltrans Drainage Structure... 25

Appendices

Appendix A Pertinent Plates and Drawings
Appendix B Flood Damage Reduction Segment/System Inspection Report
Appendix C 2005 Geotechnical Design Documentation Report
Appendix D Napa River H&H 2010 Memorandums for Record
Appendix E District Quality Control and Independent Technical Review

ACRONYMS AND ABBREVIATIONS

A	Acceptable
ASTM	American Society for Testing and Materials
cfs	cubic feet per second
CGS	California Geological Survey
DDR	Design Documentation Report
EM	Engineering Manual
ER	Engineering Regulation
ETL	Engineering Technical Letter
FEMA	Federal Emergency Management Agency
FWHA	Federal Highway Administration
FESWMS	Finite-Element Surface-Water Modeling System
FIRM	Flood Insurance Rate Map
FOUO	For Official Use Only
ft	foot or feet
gpm	gallons per minute
GPS	Global Positioning System
H:V	Horizontal:Vertical
in.	inch or inches
ITR	Independent Technical Review
lb	Pounds
LIS	Levee Inspection System
LSO	Levee Safety Officer
M	Minimally Acceptable
MLLW	Mean Lower Low Water
MSL	Mean Sea Level
n	Coefficient of Roughness
NA	Not Applicable
NAVD88	North American Vertical Datum of 1988
NCFCWCD	Napa County Flood Control and Water Conservation District

NGS	National Geodetic Survey
NSD	Napa Sanitation District
NLD	National Levee Database
NWW	Walla Walla District
O&M	Operations & Maintenance
Project	Napa River/Napa Creek Flood Protection Project
pcf	pounds per cubic foot
PGA	Peak Ground Acceleration
PI	Periodic Inspection
PL	Public Law
psf	pounds per square foot
psi	pounds per square inch
ROW	Right-Of-Way
SGDM	Supplemental General Design Memorandum
SPN	San Francisco District
U	Unacceptable
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

PART 1 - EXECUTIVE SUMMARY

This Executive Summary provides the scope and purpose of the periodic inspection (PI), an overview of the Napa River Left Bank Tulocay to Imola Levee Segment, a summary of the major findings of the PI, and the overall levee segment rating.

1.1 Scope and Purpose of Periodic Inspection

The purpose of the Napa River Left Tulocay to Imola Levee PI is to identify deficiencies that pose hazards to human life or property, and to determine design adequacy relative to present day criteria. The inspection is intended to identify the issues in order to facilitate future studies and associated repairs, as appropriate.

This assessment of the general condition of the Napa River Left Tulocay to Imola Levee is based on available data and visual inspections. Detailed investigation and analysis involving hydrologic design, topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of this PI.

1.2 System Summary

The Napa River/Napa Creek Flood Protection Project is a federally authorized, multiphase urban project that was designed to provide 100-year level of flood protection and also referred to as the 1% annual chance of exceedance (ACE) flood event to the city of Napa, California. Herein, this overall flood protection project will be simply be referred to as the “Project”. The Project spans almost 7 miles of the Napa River from Trancas Street to the Highway 29 crossing. A levee system of the Project is the Tulocay to Imola Levee, which is located on the left bank of the Napa River, in the vicinity of Imola Avenue. The Tulocay to Imola Levee segment consists of the Imola Levee which is 1,467 feet long and runs parallel to and just south of Imola Avenue. The second half of the segment was referred to in design documentation as the Napa Sanitation District (NSD) Levee. The NSD Levee goes from the end of the Imola Levee across the Napa Sanitation District property to the left bank of Tulocay Creek. The levee is 2,446 feet long. Herein the two levees will be referred to as the Tulocay to Imola Levee or as the Levee. A general location map is shown in Figure 1-1.

The local sponsor is the Napa County Flood Control and Water Conservation District (NCFCWCD). The U.S. Army Corps of Engineers (USACE) Sacramento District recently transferred the Tulocay to Imola Levee to NCFCWCD for long-term operation and maintenance. A final inspection or PI is required for the transfer of all levee/floodwall segments.

The Project was authorized by the Flood Control Act of 1965 (Public Law 89-298). Recreation features were included as an allied purpose in the authorizing document, House Document 222, 89th Congress, 1st Session, and are also an authorized purpose for the Project. The recreational elements within the Tulocay to Imola Levee include a recreation and maintenance trail along to top of the levee.

1.3 Summary of Major Deficiencies

There were no major deficiencies that were observed by the inspection team or issues rated as “unacceptable” for this PI.

1.4 Overall Rating

The overall rating of the Napa River East Tulocay to Imola Levee System is “minimally acceptable” based on USACE Levee Safety Program rating criteria and the results of this periodic inspection. The levee system appears to have the ability to continue safe operation as a flood reduction system and function as authorized. See Appendix B, Flood Damage Reduction Segment/System Inspection Report, and Part 5 of this report for more information.

Figure 1-1: Location Map of the Napa River Left Tulocay to Imola Levee System

PART 2 - INSPECTION TEAM AND DATE OF INSPECTION

The following section contains a summary of general information pertaining to the inspection team and conditions during the PI of the Napa River Left Tulocay to Imola Levee System. The information presented below was obtained through readily available data sources and is accurate and complete to the best of our knowledge at the time of preparation of this report.

2.1 Inspection Team

The inspection team consisted of one representative from NCFCWCD and three representatives from USACE. Mr. Jeremy Sarrow represented NCFCWCD and is their designated lead point of contact for the Project. Mr. John Conway represented USACE San Francisco District and is the Levee Safety Program Manager. Mr. Michael Franssen, USACE Walla Walla District served as the inspection team lead, and has a background in Civil Engineering. Mr. Nathan DeLannoy, USACE Walla Walla District, served as the inspection recorder and has a background as a Civil Engineering Technician.

2.2 Date of Inspection

The PI was conducted on 22 July 2020

2.3 Weather During Inspection

The weather on the day of the PI was partly cloudy, with light winds and temperatures in the mid to high 70s (degrees Fahrenheit).

2.4 River Gauge or Elevation Readings During Inspection

The closest stream gage to the Napa Left Tulocay to Imola Levee, as discussed in further detail in Section 3.3.1, recorded a gage height of approximately 1.97 feet (ft) during the PI, which results in no apparent discharge on the Napa River.

PART 3 - SYSTEM BACKGROUND INFORMATION

The following section contains detailed information pertaining to the Tulocay to Imola Levee System relating to design and expected project performance. Additional information, including as-built drawings, is in the appendices of this inspection report.

3.1 Project Description

The Project is designed to provide protection for the 100-year flood event, which has a 1% chance of occurrence in any given year. The 100-year flood is also referred to as the 1% ACE flood event. The Tulocay to Imola Levee segment consists of two levee segments. The first was referred to as the Napa Sanitation District (NSD) Levee during design and construction and the second is referred to as the Imola Levee.

The NSD Levee goes from the left bank of New Tulocay Creek across the NSD properties extending south beyond Imola Avenue an additional 500 feet to Old Tulocay Creek where it connects with the pedestrian bridge. The levee is 2,446 feet long with a design height above the landside toe of 1 to 5 feet. The upstream (north) end of the levee ties into the levee on the left bank of the New Tulocay Creek.

The Imola Levee runs parallel to and just south of Imola Avenue. This levee protects Imola Avenue from flooding by the Old Tulocay Creek. The levee is 1,467 feet long and is 4 to 9 feet tall. The downstream end ties into an existing railroad embankment. The upstream end of the levee ties into high ground west of Soscol Avenue, however a gap was constructed in the levee at levee stations 9+60 and 12+25 to allow drainage from the upstream shopping center. The levee does not provide the intended level of protection due to this gap. This feature is discussed further in the description of pertinent features.

3.1.1 Project Type

The Project is a federally authorized urban flood protection project. The Project will be locally operated and maintained after transfer to the local sponsor.

3.1.2 Authority

Construction of the local flood protection measures along the Napa River from Edgerly Island to Trancas Street was authorized by the Flood Control Act of 1965 (Public Law 89-298). Recreation features were included as an allied purpose in the authorizing document, House Document 222, 89th Congress, 1st Session, and are also an authorized purpose for the Project. Napa Creek was added to the Project authorization by the Flood Control Act of 1976 (Public Law 94-587).

3.1.3 Cost

The Operations, Maintenance, Repair, Replacement and Rehabilitation Manual for the Napa River / Napa Creek Flood Protection Project (USACE 2018) indicates that the overall cost of the Duden Levee Contract, which includes both the Imola and the levee along the north bank of the New Tulocay Creek, was $3,949,608 and the NSD Levee Contract was $2,855,149. Herein, the manual will simply be referred to as the “OMRR&R Manual”.

3.1.4 Completion Date

The Imola Levee contract was started in July 2004 and completed in September 2005. The NSD levee contract was started in June 2005 and completed in October 2006.

3.1.5 Public Sponsor

NCFCWCD is the public sponsor and will operate and maintain the Levee. The point-of-contacts for NCFCWCD are referenced in Table 3-1.

Table 3-1: NCFCWCD Points of Contact

Name	Address	Phone	Email
Jeremy Sarrow (Primary Point of Contact)	804 First Street Napa, California 94559-2623	(707) 259-8204	Jeremy.Sarrow@CountyofNapa.org
Andrew Butler	804 First Street Napa, California 94559-2623	(707) 259-8671	Andrew.Butler@CountyofNapa.org
Richard Thomasser	804 First Street Napa, California 94559-2623	(707) 259-0407	Richard.Thomasser@CountyofNapa.org

3.1.6 Location

The Project is located in Napa County, California, with the majority of the work occurring within the city of Napa. The limits of the Project start at the State Highway 29 Bridge over the Napa River and extends approximately 6.9 miles upriver (north) to Trancas Street. The Project also includes approximately two-thirds of a mile of Napa Creek starting at its confluence with the Napa River and extending upstream to Jefferson Street. This PI report only covers the Tulocay to Imola Levee System part of the Project as shown in Figure 3-1 below.

3.1.7 Potential Consequences

The *Supplemental General Design Memorandum* (USACE 1998) identified average annual flood damages of $247,704,000 for the “largest floodplain” (1430 to 500-year) and $163,834,000 for the “medium floodplain (65 to 50-year), in October 1997 dollars, for the Project. Herein, the *Supplemental General Design Memorandum* will simply be referred to as the “*SGDM*”. Average annual flood damages specific to the Tulocay to Imola Levees are not given in the *SGDM*.

3.1.8 Investigations Prior to Construction

A summary of geotechnical investigations is included in the *SGDM* and the *Napa River Contract 2 East Geotechnical Design Document Report* (February 2014). Herein, the *Contract 2 East Geotechnical Design Document Report* will be referred to as the “*2 East GDR*”.

3.1.9 History of Remedial Measures

A contract to repair rodent holes in the Imola Levee was completed in October 2010 with a total construction cost of $134,412. No other repairs have been noted.

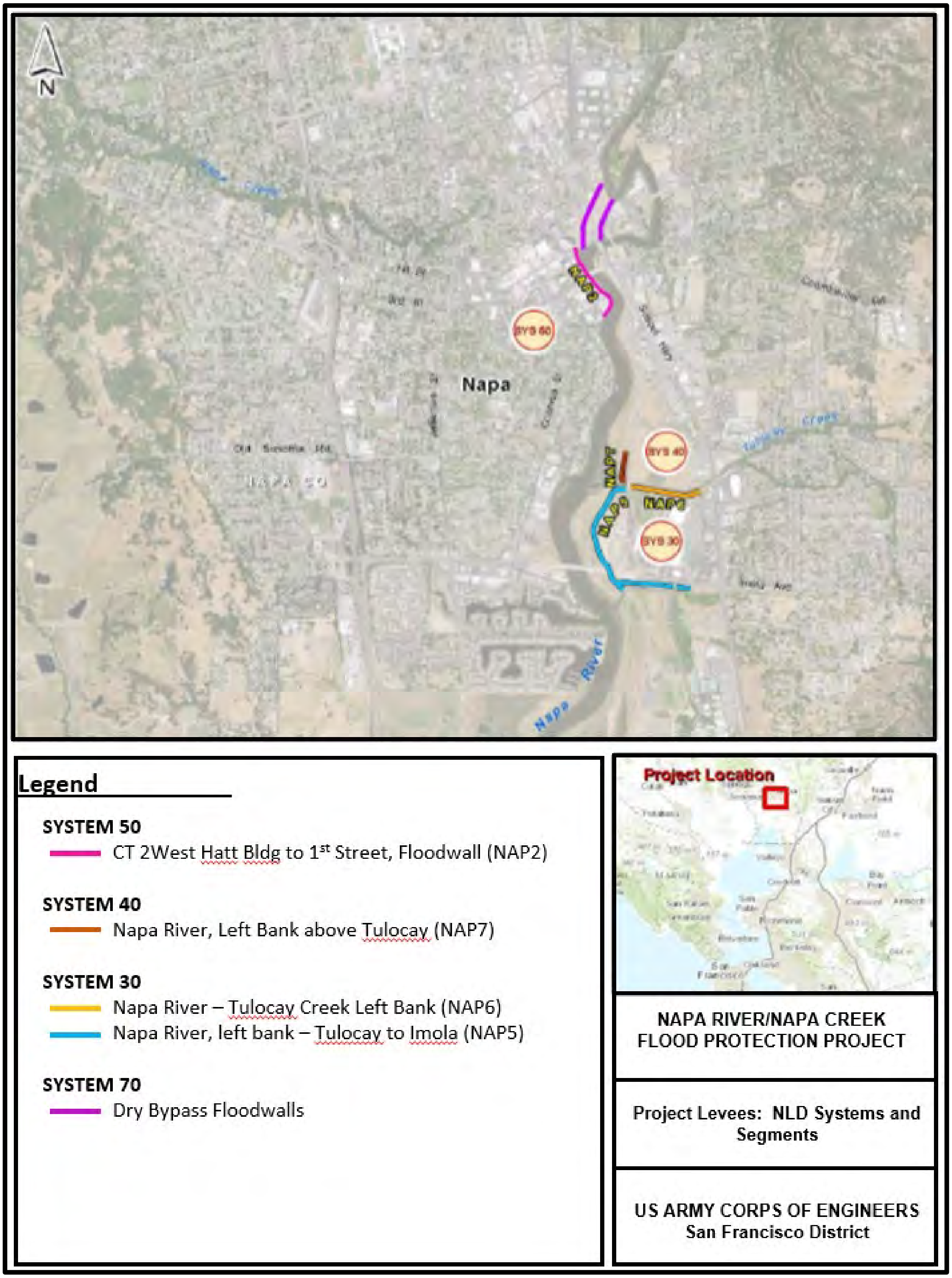

Figure 3-1: Napa Levee Safety System Map

3.2 Description of Pertinent Features

3.2.1 Imola Levee

The Imola Levee runs parallel to and just south of Imola Avenue. The levee is 1,467 feet long and is 4 to 9 feet tall. The upstream end of the levee ties into high ground west of Soscol Avenue. The downstream end ties into an existing railroad embankment.

3.2.1.1 Embankment

The levee crest is 15 feet wide and consists of 6 inches of aggregate base course. Embankment slopes were constructed to 3H:1V and are covered with grass. The levee was constructed with a 12-foot-wide inspection trench with 1H:1V sideslopes centered on the levee centerline.

A typical levee cross section from the as-built drawings (USACE 2004 Sheet C-316) is shown in Figure 3-2.

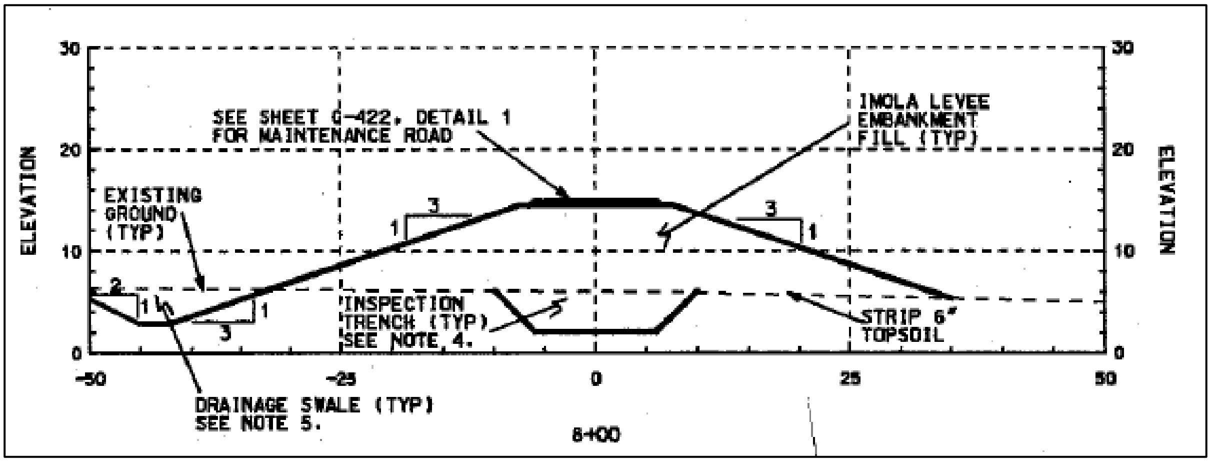

Figure 3-2: Typical Levee Cross Section Imola Levee Section

Specifications required the levee fill to consist of lean clay, silt, sandy clay, sandy silt, sandy gravel or clayey gravel materials free from particles greater than 2 inches in size. The materials were to contain no less than 15 percent of the particles finer than the No. 200 sieve. The liquid limet was required to be a maximum of 45, and the plasticity index between 7 and 25. Fill material was to be placed in layers not more than 8 inches in uncompacted thickness and compacted to a minimum of 95 percent of the maximum dry density.

The early design called for one gravity drainage pipe going through the Imola levee near its upstream end. Runoff from a shopping center on the north side of Imola Avenue is collected and conveyed under the road by a culvert. The culvert empties on the south side of Imola Avenue, where a small channel conveys the drainage into Old Tulocay Creek. With the levee in place, the drainage culvert would have to continue to the south through the levee and outlet on the waterside of the levee.

In the pre-project condition, the Napa River would overtop in the oxbow bend upstream of the Contract 2 East area. That floodwater flowed from north to south and flowed into both Old and New Tulocay Creeks. Hydraulic analysis showed that building the Imola drainage structure prior to building the upstream floodwalls would reduce the ability of surface drainage water to enter Old

Tulocay Creek and would increase the depth of this water relative to the pre-project condition, effectively inducing flooding. Temporarily inducing flooding in a developed urban area is not acceptable practice, so the decision was made to not construct the gravity drainage structure until after the upstream floodwalls were constructed. A “hole” was left in the Imola levee between levee stations 9+60 and 12+25 for future construction of this drainage structure and is still present as of this inspection.

3.2.1.2 Caltrans Drainage Structure

The City of Napa was replacing the Imola Avenue bridge across the Napa River at the same time as the Imola levee was being constructed. During construction it became apparent that the fill for the approach to the new bridge would be closer to the Imola levee than what was assumed during levee design. After discussions between all the impacted parties, the decision was made to construct an additional gravity drainage structure through the Imola levee near its downstream end, approximately 150 feet east of the existing railroad track. This structure was designed by the bridge contractor and reviewed/approved by the Corps of Engineers. The design is a standard gravity drainage through a levee with a 48-inch concrete culvert through the levee, a flapgate at the waterside outlet, and a concrete riser structure with a metal sluice gate in the levee crest near the waterside hinge. This structure was built by the bridge contractor with construction oversite by Corps construction personnel

3.2.2 NSD Levee

The Napa Sanitation District (NSD) Levee goes from the right (north) bank of the Old Tulocay Creek across the NSD properties to the left (south) bank of the New Tulocay Creek. The levee is 2,446 feet long with a design height above the landside toe of 1 to 5 feet. The upstream (north) end of the levee ties into the levee on the left bank of the New Tulocay Creek. The NSD levee extends past (south) Imola Avenue an additional 500 feet to Old Tulocay Creek and connects with the pedestrian bridge.

3.2.2.1 Embankment

The levee crest is 15 feet wide and is covered with an asphalt surface. Embankment slopes were constructed to 3H:1V and are covered with grass. The levee was constructed with a 12-foot-wide inspection trench with 1H:1V sideslopes centered on the levee centerline. Levee fill materials were the same as those required for the Imola Levee. A typical levee cross section from the as-built drawings (USACE 2005 Sheet C-344) is shown in Figure 3-2.

The levee alignment cut across a pile of dredged material at the upstream end. The top of levee is lower than the top of the dredge material pile. Explorations of the dredge material indicate it is unsuitable for levee construction (less than 5 percent nonplastic fines), and it was not compacted during placement. Therefore, the dredged material pile was removed prior to levee construction, and the dredge material used to construct a ring dike around a new dredge material disposal area on the landside of the NSD levee.

During construction, some soil excavated from the marsh plain and floodplain terraces was placed on the landside of the NSD levee between Imola Avenue and the dredge disposal dike. In this area, the top of the landside fill is equal to or higher than the levee crest elevation.

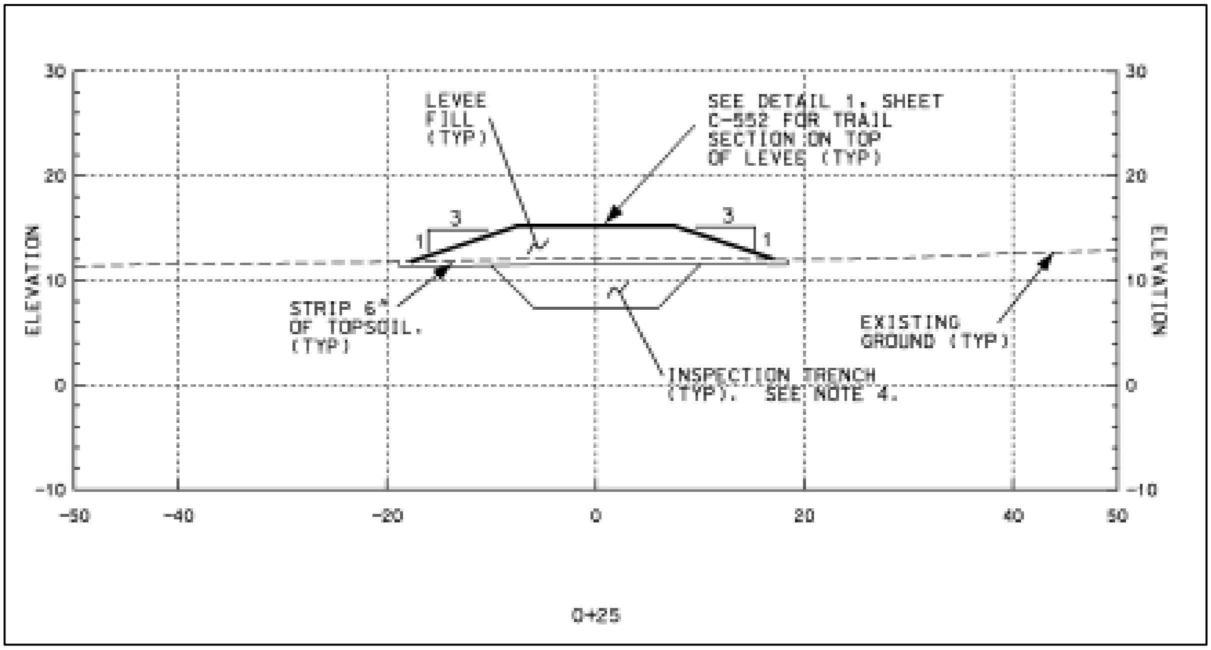

Figure 3-3: Typical Cross Section of the Duden-NSD Levee

3.2.2.2 Drainage structures

Contract drawings indicate one drainage structure was constructed through the NSD levee. It is located at the far upstream end and used to drain the dredge disposal area. The structure is a 25-inch-High Density Polyethylene pipe with a flap gate.

3.3 Topography, Geology, Seismicity, and Groundwater

The topographic, geologic, and foundation conditions for the Napa River Left Tulocay to Imola Levee System are characterized in the *SGDM*, the *2 East GDDR* and the as-built drawings (USACE 2004 and 2005). They are summarized below. Seismic analysis was not discussed in the *2E GDDR*, however it is discussed in the Napa Dry Bypass DDR (USACE 2011) and some of the information from that report is included in the following.

3.3.1 Regional Geologic Setting, Site Specific Geology, and Topography

The Project is located in the Coast Ranges Physiographic Province, which is composed of the Southern Coast Ranges and Northern Coast Ranges, extend to the Great Valley Province to the east, the Pacific Ocean to the west, the Klamath Mountains Province to the north, and Transverse Ranges in the south. The Northern Coast Ranges Physiographic Province typically trend parallel to the California coastline with north-to-south trending mountain ranges and valleys, including the Napa Valley. The Northern Coast Ranges are dominated by extensive hills with landside characteristics from the Franciscan Complex. In several areas, Franciscan rocks are overlain by volcanic cones and flows of the Quian Sabe, Sonoma, and Clear Lake volcanic fields (California Geological Survey [CGS] 2002).

The Napa Valley is a northwest-trending with the Napa River flowing south through the Napa Valley and into San Francisco Bay. The valley is bounded to the west by sedimentary rocks of the Late Jurassic/Early Cretaceous Franciscan Formation and Late Jurassic to Cretaceous Great Valley Formation. To the north and east, the valley by overlying Pliocene and early Miocene volcanic rocks (United States Geological Survey [USGS], 2006). The valley floor is covered by alluvium and older alluvium composed of sediment derived from both sides of the valley.

3.3.2 Seismicity

According to the *Napa Dry Bypass DDR*, an estimated peak ground acceleration of 0.27g was estimated for a 100-year event (estimated magnitude 6.7) from the 2008 Probabilistic Seismic Hazard Analysis (PSHA) USGS model. This peak ground acceleration was used for the seismic evaluation of the Dry Bypass and is appropriate for the other Napa River Flood Protection Project features.

On August 24, 2014, the Main Street USGS Station N016 measured a 6.0 magnitude earthquake, 9.1 miles from the epicenter, with a peak ground acceleration of 0.61g. This monitoring station is within 1 mile of the Tulocay to Imola Levee System. (Strong-Motion Center 2016).

3.3.3 Groundwater Conditions

The various exploratory programs performed for the Project indicate that the groundwater elevation for the Tulocay to Imola Levees varied between -8 ft and 3 ft NAVD88. Based on the review of existing logs and *2 East GDDR* (USACE 2014), the typical groundwater elevation was estimated near -3 ft NAVD88 and varied due to seasonal and tidal influences.

3.3.4 Subsurface Investigation and Foundation Conditions

Within the Tulocay to Imola Levee area, multiple subsurface investigations were conducted between 1998 and 2001 which included soil borings, test pit excavations, and cone penetrometer soundings. Several of the borings extended more than 70 ft below the ground surface while most boring depths are 50 ft or less. Locations of subsurface investigations are shown in the as-built drawings (USACE 2004 and 2005). Laboratory testing included index testing to determine moisture, plasticity, and grain size, and triaxial shear test modes including unconsolidated-undrained, consolidated-undrained, and consolidated-drained, and direct shear test. A summary of the site conditions is documented in the *2 East GDDR*.

The majority of borings encountered clayey soils to the bottom of the hole which ranged from 20 to 80 ft from the ground surface. A few holes encountered clayey sand and clayey gravel approximately 30 feet below the surface which was followed by deeper layers of clay.

3.4 Hydrologic/Hydraulic

The Napa River Basin lies in California’s Central Coast Mountain Range, draining 426 square miles in Napa and Solano County. The headwaters of the basin are on the southeast slope of Mount Saint Helena. The basin is approximately 50 miles long and 10 miles wide (USACE 1998).

3.4.1 Past Project Performance

The construction of the Tulocay to Imola Levee system was completed in 2005. Therefore, this section will only refer to flows on the Napa River that occurred between 2005 and the date of this PI. The closest stream gage to the area is USGS Stream Gage 11458000, located on the Napa River near Oak Knoll Avenue, approximately 5 miles upstream of the levee system. The largest flow at the gage was on December 31, 2005 with a recorded flow of 29,600 cfs and a gage height of 29.85 feet. There is no record of poor performance or whether the levees experienced flooding.

3.4.2 Flood Insurance Study

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM)

06055C0516F and 06055C0517F covers the Levee system. Both FEMA FIRMs indicate that area behind the Levee System are classified in the Zone AE and Zone X floodplains. The Zone AE floodplain is defined by FEMA as areas subjected to inundation by the 1% annual chance (100-year) flood event. The Zone X floodplain is defined by FEMA as areas subject to inundation by the 0.2% annual chance (500-year) flood event. However, the map was last updated in September 2010, prior to construction of the Dry Bypass. It is anticipated that if this levee were to be certificated a revision of the maps would indicate the area behind to levee as only Zone X.

3.5 References

Below is a list of references that are used in this report. Note: these do not include the USACE design references (such engineering manuals and engineering regulations) that are included at the end of Part 4 of this report.

- American Society of Testing and Materials (ASTM), 2012. *D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)), ASTM International, West Conshohocken, PA.*
- California Geologic Survey (CGS). 2002. *Note 26 California Geomorphic Provinces, by the California Department of Conservation, revised December 2002*.
- California Geologic Survey (CGS). 2004. *Geologic Map of the Napa 7.5' Quadrangle, Napa County, California: a Database Version 1.0 By Kevin B. Clahan, David L. Wagner, George J. Saucedo, Carolyn E. Randolph-Loar, and Janet M. Sowers. Digital Database by: Carlos I.*
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- U.S. Army Corps of Engineers (USACE), 2004. *Napa River/Napa Creek Flood Protection Project, Contract 2 East Duden (Between Old Tulocay Creek & Imola Ave)*

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PART 4 - DESIGN CRITERIA REVIEW

Design for the features in the Imola to Tulocay Levee began in 2004 and was complete in 2005. Geotechnical and Civil Design was performed by the US Army Corps of Engineers, Sacramento District. The inspection team reviewed the documentation referenced in the Introduction section and evaluated the levee system's documented design criteria against current design criteria. The purpose of the evaluation is to assess the ability of each feature and overall system to function as authorized and identify potential needs to update system design. The results of the design criteria review for each feature are described in the following sections.

4.1 Geotechnical

4.1.1 Soil Investigations

The subsurface investigation and laboratory testing program supporting the project basis of design is summarized in Part 3. Explorations near the Imola levee alignment consisted of five borings and one Cone Penetrometer Test (CPT). The typical boring depth was less than 50 ft. Except for boring 2F-00-38, the soils consist of lean clays, fat clays, and sandy clays to a minimum of 22 feet below ground surface, underlain by clayey sand and gravel layers with a fines content between 10 and 44 percent. Boring 2F-00-38 has a 1.5-foot thick clayey gravel with sand layer at the ground surface. This boring was drilled through a pre-project unpaved access road.

Explorations conducted along and near the NSD Levee alignment consisted of 9 borings and one CPT. The explorations show the in-situ soils (not the dredged material) consist of a blanket layer of lean and fat clays and sandy clays between 8.5 and 42 feet thick, overlying clayey sand and gravel layers with 5 to 45 percent fines. At locations where the blanket layer is less than 20 feet thick, the fines content of the pervious (or semi-pervious) layer is greater than 30 percent.

EM 1110-2-1913, Design and Construction of Levees states that Phase 1 spacing for borings usually varies from 200 to 1,000 ft. In Phase 2, additional locations of borings are selected based on Phase 1 results. *EM 1110-2-1913* also states that borings should be drilled to depths at least equal to the height of the proposed levee at its highest points but not less than 10 ft. The level of investigation is compliant with a Phase 2 exploration and testing parameters described in *EM 1110-2-1913*.

4.1.2 Slope Stability

During design a slope stability analysis was conducted at Imola Levee station 9+00. This station was chosen because the levee is at the maximum height of 9 feet. The subsurface soil profile was based on soil boring 2F-99-07 and consists of alternating layers of lean and fat clay to elevation -11 feet (16 feet below ground surface). End of construction, steady state seepage, and rapid drawdown analyses were conducted using material properties developed during design.

Per *EM 1110-2-1902, Slope Stability*, minimum acceptable factors of safety are 1.3 for the end of construction and multistage loading and 1.5 for steady state conditions. *EM 1110-2-1913* recommends a minimum acceptable factor of safety for rapid drawdown between 1.0 to 1.2 in cases where rapid drawdown represents an infrequent loading condition. *EM 1110-2-1913* also references that earthquake loading is not normally considered in analyzing the stability of levees because of the low probability of an earthquake coinciding with periods of high water, hence there is no minimum factor of safety.

A comparison between calculated and minimum factor of safety requirements are summarized in

Table 4-1 below.

Table 4-1: Slope Stability Summary

Condition	Calculated Factor of Safety	Minimum Requirement
End of Construction	4.7	1.3
Long Term – Steady State	1.71	1.4
Rapid Drawdown	1.58	1.0 to 1.2

4.1.3 Seepage

EM 1110-2-1913 requires an evaluation of seepage control if unsafe seepage forces are present. No underseepage analysis was conducted for either of the levees during design. According to the *2 East GDDR* the semi-pervious subsurface layers under the Imola Levee are at least 22 feet below ground surface, and the maximum levee height is 9 feet. Since the blanket layer thickness is more than twice the levee height, underseepage was not considered be a problem during design. The clayey gravel with sand layer at the surface of Boring 2F-00-38 is a gravel access road. The gravel access road was removed during construction, and any remaining semi-pervious material cut off by the levee inspection trench. Underseepage analysis was done as part of the *2 East GDDR* using blanket theory with the water surface at the levee crest at levee station 12+00 resulted in an exit gradient of 0.01, confirming that underseepage is not a problem for the Imola levee.

No underseepage analysis was conducted for the NSD Levee during design. Most of the soil boring indicated the presence of a very thick blanket layer, and locations with the thinnest blanket layer have a semi-pervious layer (fines content greater than 30 percent) instead of a pervious layer under the blanket indication exit gradients are likely to be low. In addition, this is a short levee in design height (1-5 feet) and the placement of landside fill against the levee has make the landside elevation equal to or higher than the levee crest elevation over much of the levee alignment. Additionally, the analysis for the Imola Levee, which has a taller cross section indicates underseepage is not a problem.

The analysis performed in the *2 East GDDR* meets current seepage analysis requirements.

4.1.4 Settlement

EM 1110-2-1913, requires the final levee grade of the levee to be based on deterministic risk-based analysis to account for settlement. Settlement analysis was conducted in accordance with *EM 1110-2-1904, Settlement Analysis*. As stated in the *SGDM*, the insitu clay soils at Napa are overconsolidated. The added surcharge from the levee results in soil pressures less than the preconsolidation pressure (σp'), so the coefficient of recompression Cr (average slope of the recompression line) instead of the coefficient of consolidation Cc (average slope of the virgin consolidation curve) is used to calculate consolidation settlement. Consolidation data for the Contract 2 East area is given on Plate 66 of the Geotechnical Appendix to the *SGDM*. Consolidation calculations were done for levee heights of 6 feet and 9 feet. A clay thickness of 30 feet was used, with the ground water table at 10 feet depth. Foundation consolidation settlement was calculated as 0.07 inch for a 6-foot tall levee and 0.11 inch for a 9-foot tall levee. Secondary compression could not be calculated as time-rate histories were not provided for the consolidation tests. The Perloff Approximation was used to calculate immediate settlement. Immediate settlement was calculated as 1.5 inches for a 6-foot tall levee and 2.86 inches for a 9-foot tall levee. The analysis performed in the SGDM meets current settlement requirements.

4.1.5 Seismic Evaluation and Liquefaction

ER 1110-2-1806, Earthquake Design and Evaluation for Civil Works Projects indicates an evaluation shall be performed on embankments, slopes and/or foundation that are susceptible to liquefaction or excessive deformation for all projects located in high seismic hazard regions. In addition, *EM 1110-2-1913* indicates that earthquake loadings are not normally considered in analyzing the stability of levees because of the low probability of earthquake coinciding with periods of high water. Levee constructed of loose cohesionless materials or founded on loose cohesionless material are particularly susceptible to failure due to liquefaction during earthquakes. The *SGDM* performed a comprehensive analysis and review of the data and concluded that the levees did not need a liquefaction analysis per *EM 1110-2-1913*.

Liquefaction was reviewed for the Dry Bypass portion of the project located approximately 1 mile upstream of the levees. The *Dry Bypass DDR* briefly summarized conclusions from liquefaction analyses performed by USACE which concluded little potential for liquefaction or surface rupture using a peak ground acceleration of 0.27. Soil conditions at the Dry Bypass generally include clay soil overlying medium dense to dense clayey gravel. The liquefaction evaluation found that these soils are generally not susceptible to potential liquefaction at the accelerations considered for this project, because of the amount of clay present and plasticity of the soil.

The soils in the foundation below both the NSD and Imola Levees are the same type of clays and clayey gravel and the ground motions at this location would be very similar to those expected at the Dry Bypass. Additionally, the levees are short with a maximum height of 9 feet and are constructed of well compacted fine-grained soils. The assessment detailed in the *Dry Bypass DDR* is compliant with *EM 1110-2-1913*.

4.2 Hydrologic/Hydraulic

4.2.1 Design Capacity

The Project, which includes the Napa River Left Tulocay to Imola Levee System, is designed to provide protection to the city of Napa for the 1% annual chance of exceedance flood event. The current design-flood peak discharge for the Projects is based on the Project-Specific National Economic Development plan, as specified in ER 1105-2-100.

The most recent hydrologic analysis is presented in Table 9 of the Memorandum for Record (USACE, 2010), Napa River Hydrology, Computed Probability Flows (USACE, 2010). The computed Napa River summary of discharges along the levees are shown in Figure 4-1 below. The levee is designed for the 1% ACE floodevent discharge.

According to the *Field Manual 2018 O&M Manual*, Sites 1A, 1B and 2E all increase conveyance and excavating channel banks to form flood conveyance terraces. Dikes constructed in Sites 1A and 1B match pre-project dike elevations and do not provide additional flood protection.

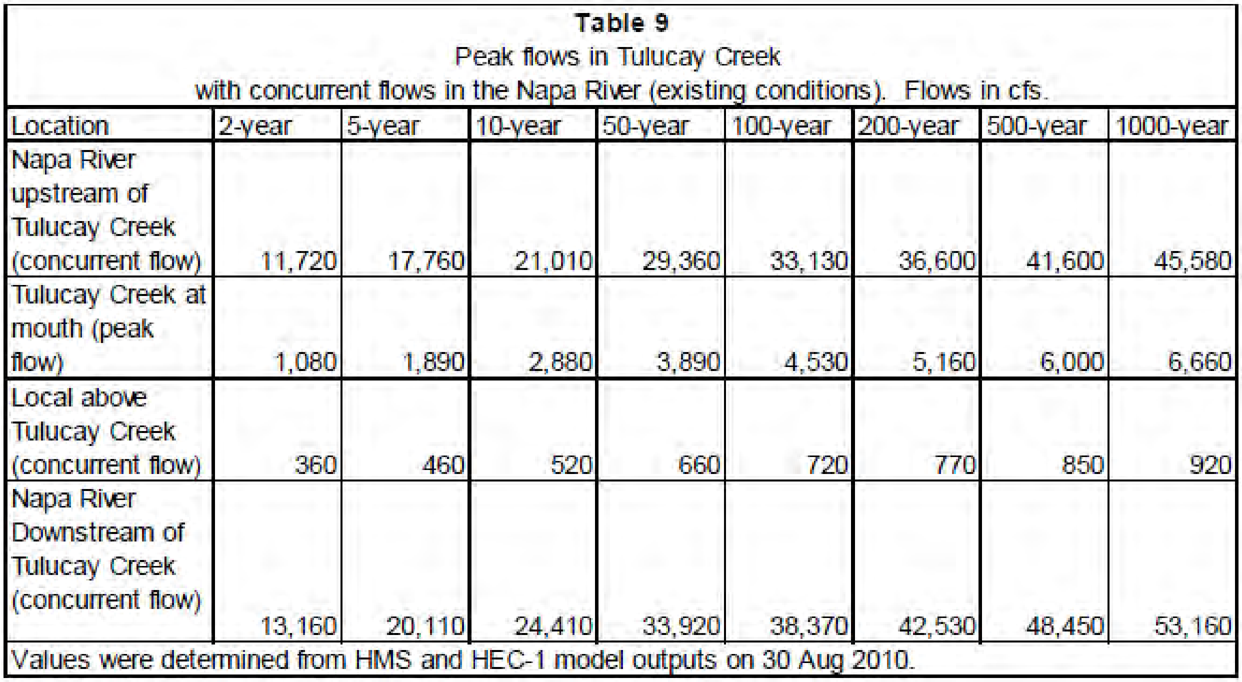

Table 9
Peak flows in Tulucay Creek
with concurrent flows in the Napa River (existing conditions). Flows in cfs.

Location	2-year	5-year	10-year	50-year	100-year	200-year	500-year	1000-year
Napa River upstream of Tulucay Creek (concurrent flow)	11,720	17,760	21,010	29,360	33,130	36,600	41,600	45,580
Tulucay Creek at mouth (peak flow)	1,080	1,890	2,880	3,890	4,530	5,160	6,000	6,660
Local above Tulucay Creek (concurrent flow)	360	460	520	660	720	770	850	920
Napa River Downstream of Tulucay Creek (concurrent flow)	13,160	20,110	24,410	33,920	38,370	42,530	48,450	53,160

Values were determined from HMS and HEC-1 model outputs on 30 Aug 2010.

Figure 4-1: Table 9 Memorandum for Record (USACE, 2010)

4.2.2 Hydraulic Analysis

Flood protection on the Napa River extends from about one-half mile below Trancas Street to Imola Avenue. The Napa Project includes floodplain restoration, terraced bank excavation, and a raised bed oxbow cutoff channel to increase the conveyance of the existing river corridor and reduce water surface elevations.

Hydraulic design of the Napa Project was performed using both one and two-dimensional numerical hydraulic models. RMA-2, a two-dimensional finite element hydrodynamic model, was selected to model the restoration of the historic floodplain south of the Imola Avenue Bridge. For the reach extending from the downstream Project limit (station 550+00) upstream to station 685+00, RMA-2 model results were used for hydraulic design.

The crest of the training dike in the Contract 1B area was set to match the elevation of the pre-Project dike formerly located along the riverbank. The pre-Project riverbank dike was removed and replaced with the training dike, which is set back at least 300 feet from the riverbank. This allows water to spread out over a larger area downstream of Imola Avenue during floods in order to lower the flood water elevation upstream of Imola Avenue. The existing west bank river development downstream of Imola Avenue is set at or above the 100-year storm peak stage. Design profile distance heights were selected through town to provide consistent flood water containment levels for both levees and floodwalls.

4.2.3 Adequacy of Erosion Protection

Erosion protection for the levees is provided by vegetation. Flows are expected to be low against the levee embankment and vegetated slopes are adequate.

4.3 Maintenance Access Roads

EM 1110-2-1913 requires that vehicular access to the levee should be provided at reasonably close intervals for maintenance access. Per the details on the as-built drawings, a maintenance access road had been provided along the top of the levees and at either ends. The width of the maintenance access roads varies from 8 to 12 ft and are sufficient to provide access to maintenance vehicles.

4.4 Survey Datum

The levees were surveyed during construction for measurement and payment purposes and that survey is reflected in the as-built drawings. The NGVD 29 vertical datum was used for the design and construction of this segment. A survey to determine the conversion between NGVD29 and NAVD88 datums for the Imola to Tulocay Levee has not been completed as required in *ER 1110-2-8160 Policies for Referencing Project Evaluation Grades to Nationwide Vertical Datums*

4.5 Design Criterial Review Conclusions

Based on the findings of the design criteria review, each feature and the overall system appear to be able to function as originally authorized

PART 5 - INSPECTION FINDINGS AND EVALUATIONS

The PI was conducted on 22 July 2020. Table 5-1 shows the key team members and the role each assumed during the PI. The inspection team lead was Mr. Michael Franssen.

Table 5-1: List of Key Inspection Staff

Title	Name
Local Sponsor Representative (NCFCWCD)	Jeremy Sarrow
Civil/Team Lead (USACE Walla Walla District)	Michael Franssen, PE
Geotechnical/LSPM (USACE San Francisco District)	John Conway, PG
Civil Technician (USACE Walla Walla District)	Nathan DeLannoy

5.1 Inspection Summary

An overall summary of the PI ratings is shown in Table 5-2. Specific detailed related to acceptable, minimally acceptable, and unacceptable rated items are discussed in the subsequent sections.

5.2 General Items for All Flood Damage Reduction Segments/Systems

A summary of the rated items contained in the checklist titled “General Items for All Flood Damage Reduction Segments/Systems” is shown in Table 5-2. The following subsections provide additional detail on these items.

5.2.1 Operation and Maintenance Manuals

The operation and maintenance (O&M) manual for the Napa River / Napa Creek Flood Protection Project was made final in April 2018 by USACE Sacramento District and provided to NCFCWCD. The Dry Bypass is a component of the Project.

5.2.2 Emergency Supplies and Equipment

NCFCWCD maintains a supply of empty sand bags, stockpile sand, chain saws, various hand tools, and other emergency supplies at the maintenance yard located on 933 Water Street in Napa, CA. The majority of sand that would be used for sands bags is stored at 770 Jackson Street in Napa, CA. Both of these locations are within 1.5 miles of the Levees. NCFCWCD has emergency contracts with general contractors when emergency services are needed. NCFCWCD informed the inspection team that the location on 933 Water Street may be bought out or leased to an external organization in the near future.

5.2.3 Flood Preparedness and Training

NCFCWCD has developed a flood emergency operation plan. Annual flood fight training program is conducted by the California Department of Water Resources at the Napa Sheriff’s Department each fall. NCFCWCD has previously attended the USACE San Francisco District's Levee Owner Workshop in Sausalito, CA.

Table 5-2: PI Rated Summary

Category	Rated Item	Rating[1]
General Items for All Flood Damage Reduction Segments/Systems	1. Operation and Maintenance Manuals	A
	2. Emergency Supplies and Equipment	A
	3. Flood Preparedness and Training	A
Levee Embankments	1. Non-Compliant Vegetation Growth	A
	2. Sod Cover	NA
	3. Encroachments	A
	4. Closure Structures	NA
	5. Slope Stability	A
	6. Erosion Bank Caving	A
	7. Settlement	A
	8. Depressions/Rutting	M
	9. Cracking	M
	10. Animal Control	M
	11. Culverts/Discharge Pipes	NA
	12. Riprap Revetments & Bank Protection	NA
	13. Revetments other than Riprap	NA
	14. Underseepage Relief Wells/Toe Drainage Systems	NA
	15. Seepage	A
Interior Drainage System	1. Vegetation and Obstructions	A
	2. Encroachments	A
	3. Ponding Areas	NA
	4. Fencing and Gates	NA
	5. Concrete Surfaces	A
	6. Tilting, Sliding or Settlement of Concrete and Sheet Pile Structures	A
	7. Foundation of Concrete Structures	A
	8. Monolith Joints	NA
	9. Culvert/Discharge Pipes	A
	10. Sluice/Slide Gates	A
	11. Flap Gates/Flap Valves/Pinch Valves	A
	12. Trash Racks	NA
	13. Other Metallic Items	NA
	14. Riprap Revetments of Inlet/Discharge Areas	NA
	15. Revetments other than Riprap	NA

[1] Note: Acceptable (A), Minimally Acceptable (M), Unacceptable (U), Not Applicable (NA)

5.3 Levee Embankments

A summary of the rated items contained in the checklist titled “Levee Embankments” is shown in Table 5-2. The following subsections provide additional detail on these items.

5.3.1 Non-Compliant Vegetation Growth

This item was rated “acceptable”. The levee is maintained very well with no large vegetation observed during the inspection.

5.3.2 Encroachments

This item was rated “acceptable”. A fence along the levee toe was noted along with some gates. Access through the gates is maintained and these items were rated acceptable.

Figure 5-1: Inspection Point NLT3_2020_0012: Fence along the levee toe.

5.3.3 Slope Stability

This item was rated “acceptable”. No indications of slope instability were observed during the inspection.

5.3.4 Erosion/Bank Caving

This item was rated “acceptable”. No erosion or bank caving was noted along the embankments.

5.3.5 Settlement

This item was rated “acceptable”. No settlement was observed during the inspection.

5.3.6 Depressions and Rutting

This item was rated “minimally acceptable”. Several footpaths have been established on the levee slopes. These should be filled and compacted to reestablish the levee cross section.

Figure 5-2: Inspection Point NLT3_2020_a_0011: Rutting along the levee slope

5.3.7 Cracking

This item was rated “minimally acceptable”. Longitudinal cracks were observed in asphalt along the NSD Levee crest between station 16+00 and 18+00 in the general area where additional fill material was placed on the landside of the levee. These may be from drying of the embankment or may be from the fill material adding stress to the embankment. However, the cracks may be just in the asphalt pavement and not in the levee embankment. The area should be monitored for additional cracking or moving of the embankment.

Figure 5-3: Inspection Point NLT3_2020_a_0020: Cracking observed in asphalt

5.3.8 Animal Control

This item was rated “minimally acceptable”. Animal burrows that had not been filled with grout were observed along both levees. Sponsor has been active in conducting control measures and should continue by filling the burrows as soon as possible.

5.3.9 Seepage

This item was rated “acceptable”. There was no evidence of seepage observed by the inspection team.

5.4 Interior Drainage System

A summary of the rated items contained in the checklist titled “Interior Drainage System” is shown in Table 5-2. The following subsections provide additional detail on these items.

5.4.1 Vegetation and Obstructions

This item was rated “acceptable”. There was no vegetation or other obstructions blocking the interior drainage system culverts.

5.4.2 Encroachments

This item was rated “acceptable”.

Figure 5-4: Inspection Point NLT3_2015_a_0020: Animal burrows on the downstream slope of the levee.

5.4.3 Concrete Surfaces

This item was rated "acceptable". The concrete headwall is in good condition. No spalling, scaling or cracking was observed. See Figure 5.5 below

5.4.4 Tilting, Sliding or Settlement of Concrete Structure

This item was rated "acceptable". Concrete headwalls were all noted to be in good condition and no tilting or settlement was observed during the inspection.

5.4.5 Foundation of Concrete Structures

This item was rated "acceptable". No foundation concerns were noted during the inspection.

5.4.6 Culverts/Discharge Pipes

This item was rated "acceptable". No deficiencies were observed. The Caltrans culvert could not be inspected during the inspection. It is due for the 5-year inspection in 2021. Other small concrete culverts passing through the access ramps were noted and no breaks, holes or cracks were observed.

5.4.7 Sluice/Slide Gates

This item was rated "acceptable". Slide gate is in good condition and functional and exercised annually.

5.4.8 Flap Gates/Flap Valves/Pinch Valves

This item was rated “acceptable”. The only flap gate noted is on the Caltrans culvert through the Imola Levee near the downstream end. The gate is in good condition and exercised annually.

Figure 5-5: Inspection Point NLT3_2015_a_0008: Headwall structure and flap gate on the Caltrans Drainage Structure

PART 6 - CONCLUSIONS AND RECOMMENDATIONS

This section summarizes items that received either "minimally acceptable" or "unacceptable" ratings for each feature of the Napa River Left Tulocay to Imola Levee System, and it includes the recommended actions for each of these items. A discussion of levee safety issues and a summary of the needs related to the design criteria review follow the inspection recommendations.

6.1 Recommendations

6.1.1 General Items for All Flood Damage Reduction Segments/Systems

All of the General Items for All Flood Damage Reduction Segments/Systems items received an "acceptable" rating.

6.1.2 Levee Embankment

Recommendations for Levee Embankment items are summarized in Table 6-1.

Table 6-1: Levee Embankment Deficiencies and Recommended Actions

Rated Item	Rating[1]	Recommended Action
1. Non-Compliant Vegetation Growth	A	No recommended actions
2. Sod Cover	NA	NA
3. Encroachments	A	No recommended actions.
4. Closure Structures	NA	
5. Slope Stability	A	No recommended actions
6. Erosion/Bank Caving	A	No recommended actions
7. Settlement	NA	
7. Depressions/Rutting	M	These should be filled and compacted to reestablish the levee cross section.
9. Cracking	M	The area should be monitored for additional cracking or moving of the embankment.
10. Animal Control	M	Sponsor has been active in conducting control measures. This should be continued as needed
11. Culverts Discharge Pipes	NA	NA
12. Riprap Revetments & Bank Protection	NA	NA
13. Revetments other than Riprap	NA	NA
14. Underseepage Relief Wells/Toe Drain Systems	NA	NA
15. Seepage	A	No recommended actions.

[1] Note: Acceptable (A), Minimally Acceptable (M), Unacceptable (U), Not Applicable (NA)

6.1.3 Interior Drainage System

All of the Interior Drainage items received an “acceptable” or “not applicable” rating.

6.2 Rating

The overall rating of the Napa River Left Tulocay to Imola Levee System is “minimally acceptable”.

6.3 Future Periodic Inspection

The next PI of the Napa River Left Tulocay to Imola Levee System should be at 5 years from the levee screening to take place in 2021.

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Appendix A

Pertinent Plates and Drawings

US Army Corps
of Engineers
Sacramento District

NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT CONTRACT 2 EAST DUDEN (BETWEEN OLD TULOCAY CREEK & IMOLA AVE)

NAPA

CALIFORNIA

NRB 3
NRB 4

RECORD DRAWING:
THIS DRAWING IS THE LATEST RECORD AVAILABLE AS OF MARCH 30, 2005. IT PRESENTS DESIGN INFORMATION ONLY AND MAY NOT REFLECT AS-BUILT CONDITIONS. FIELD VERIFY BEFORE USE.

This project was designed by the Sacramento District of the U. S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear on these project documents within the scope of their employment as required by ER 1110-1-8152

Approved Functional Adequacy
/s/RONALD F. MULLER 06/01/2004
Chief, Civil Design Br Date:

Prepared by
SACRAMENTO DISTRICT
CIVIL DESIGN BRANCH

/s/PETER VALENTINE 06/01/2004
Chief, Civil Design Sec & Date:

Drawing Code:

Designed by
WMH

Drawn by
JMA

Spec No.
1395

Design File No:
NA-04-026

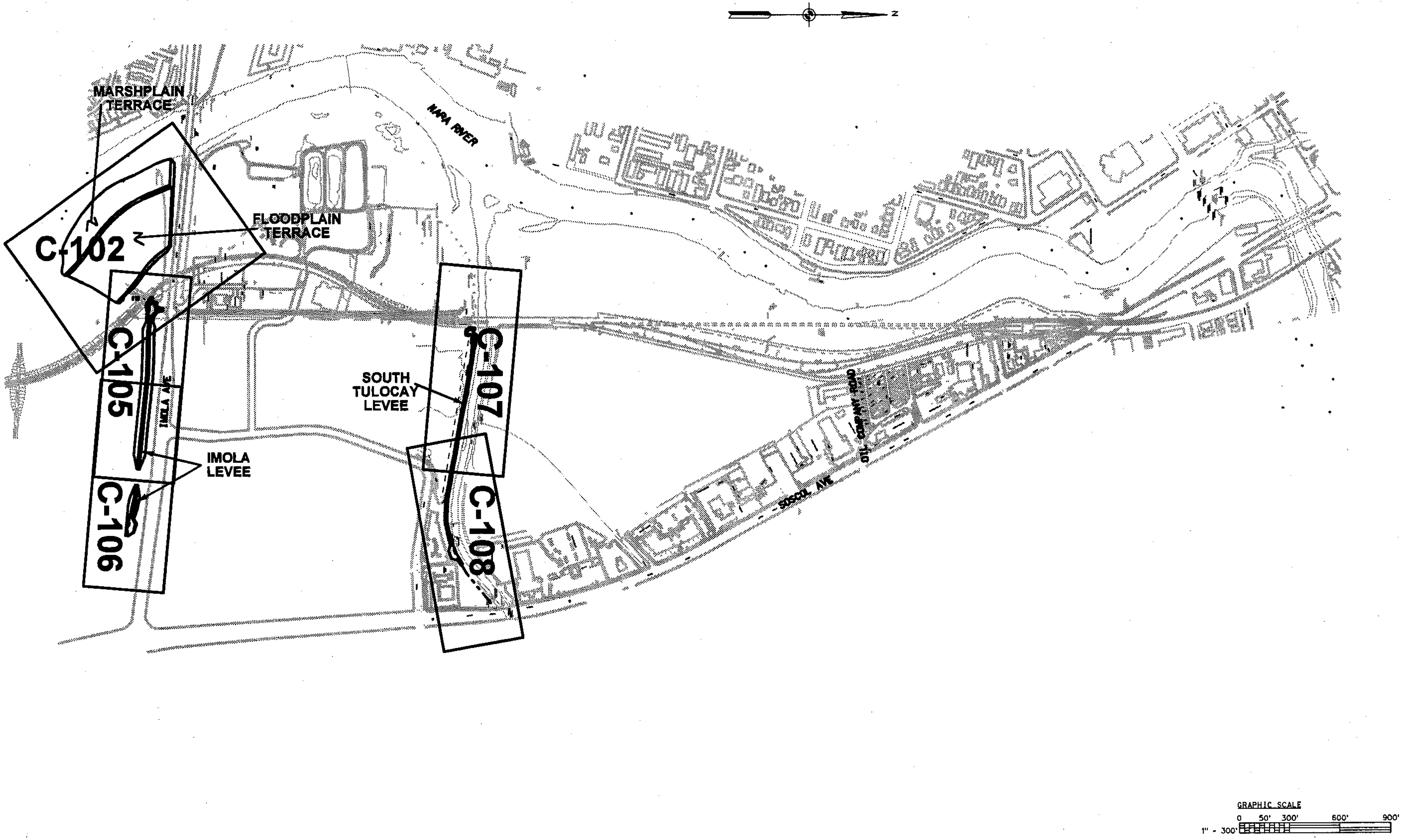
Approved
/s/THOMAS E. TRAINER 06/01/2004
Chief, Engineering Division Date:

Prepared Under the Direction of
MICHAEL J. CONRAD, JR.
Col. Corps of Engineers District Engineer

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
TITLE SHEET

Sheet reference number:
G-001
Sheet 1 of 39

PLOT DATE: 28-MAY-2004 PLOT TIME: 11:17 \\gold\civcad\napar\cn2a_duden\CADD\SheetFiles\NA-04-026G-001xxx.dgn



PLOT DATE: 28-MAY-2004

PLOT TIME: 11:37

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US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Date: 06/01/2004
Rev. REV.0
Design file no: NA-04-026
Drawing Code:
File name:
Plot date:
Plot scale: 300

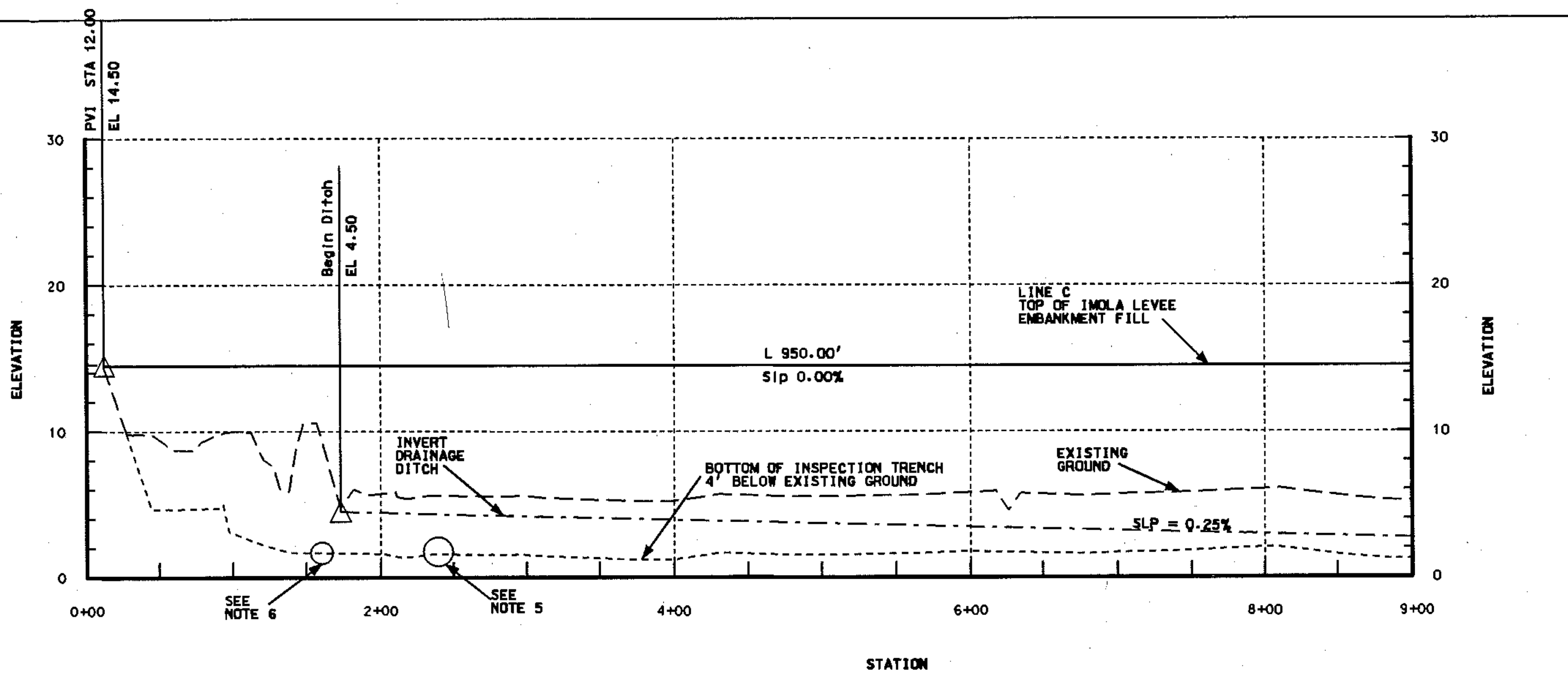
Designed by:
Dwn by: JMA
Spec No.: 1385
Reviewed by: T. CATARELLA
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A

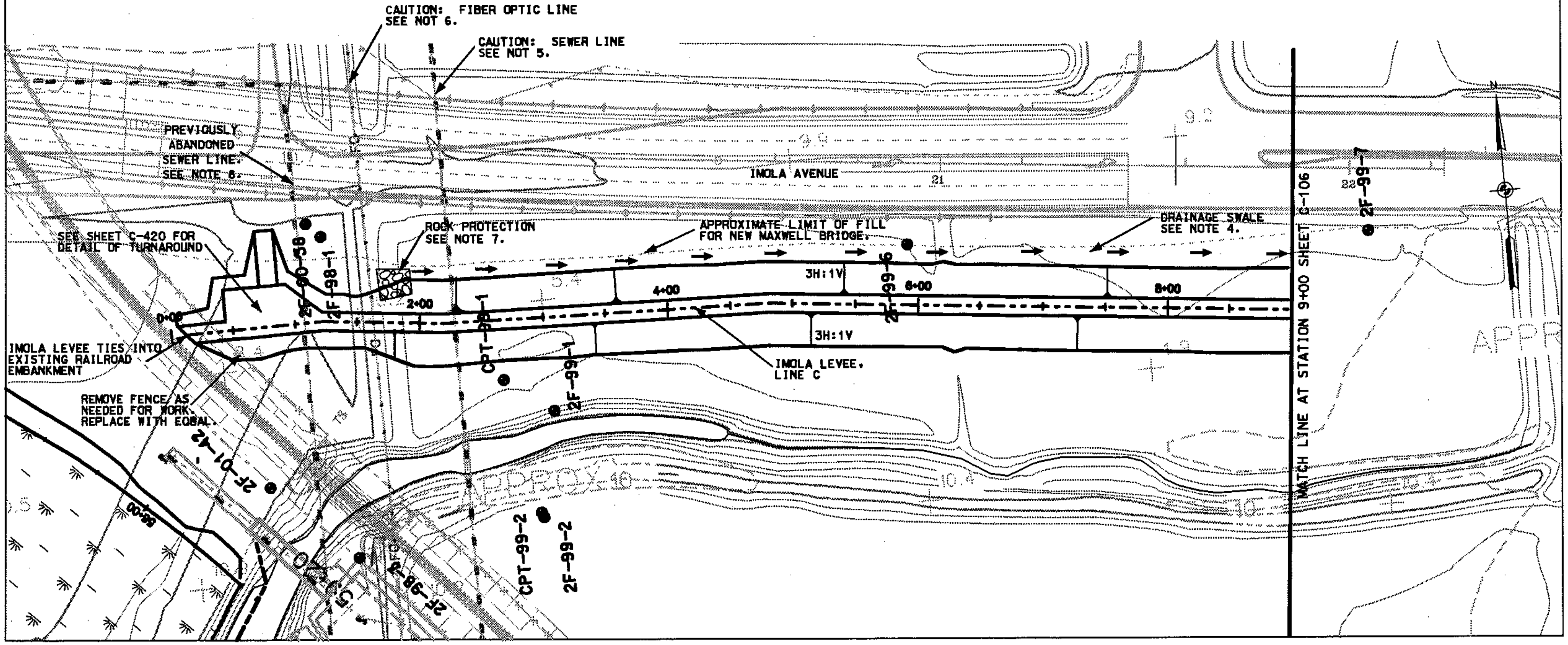
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
SHEET LAYOUT
FLOODPLAIN/MARSHPLAIN TERRACE

Sheet
reference
number:
C-101
Sheet 18 of 39





LEGEND:

▨ ROCK PROTECTION

NOTES:

1. SEE SHEET C-110 FOR ALIGNMENT OF IMOLA LEVEE, LINE C.

2. SEE SHEET C-316 FOR CROSS SECTIONS OF IMOLA LEVEE.

3. PROFILE GRADE IS TOP OF IMOLA LEVEE EMBANKMENT FILL. AGGREGATE BASE ROAD SURFACE IS ABOVE THIS ELEVATION. SEE SHEET C-422, DETAIL 1.

4. CONSTRUCT A DRAINAGE SWALE AT THE MID-POINT BETWEEN THE TOE OF IMOLA LEVEE AND THE TOE OF IMOLA AVENUE FILL SECTIONS WITH A BASE OF 3', VARYING DEPTHS, AND FLOW LINE ELEVATIONS ESTABLISHED BY VERTICAL PROFILE. TYPICAL SIDE SLOPES NOTED ON SHEET C-316.
BEGINNING INVERT
ELEVATION = 4.5'
END INVERT
ELEVATION = 2.2'

5. APPROXIMATE LOCATION OF SEWER LINE, DEPTH UNKNOWN. THE CONTRACTOR SHALL CONTACT THE OWNER & U.S.A. PRIOR TO DISTURBING THE AREA.
OWNER: NAPA SANITATION DISTRICT
CONTACT NUMBER: 707-258-6000

6. APPROXIMATE LOCATION OF FIBER OPTIC LINE, DEPTH UNKNOWN. THE CONTRACTOR SHALL CONTACT THE OWNER & U.S.A. PRIOR TO DISTURBING THE AREA.
OWNER: QWEST
CONTACT NUMBER: 916-788-1042
303-445-7021

7. PLACE ROCK PROTECTION AT CULVERT OUTLET.
SEE DETAIL SHEET C-422.

8. LOCATE AND REMOVE ABANDONED SEWER LINE WITHIN FOOTPRINT OF LEVEE. CAP ABANDONED LINE WITH CONCRETE ON EACH END.

9. FILL FOR LEVEE SHALL COME FROM TERRACE EXCAVATION.

GRAPHIC SCALE
0 10' 25' 50' 100' 150'
1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol | Description | Date | Approved

Designed by: NNN
Dwn by: JAA
Spec No.: 1386
Reviewed by: T. CATANELLA
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A
Date: 06/01/2004
Rev. REV_0
Design file no: NA-04-026
Drawing Code:
File name:
Plot date:
Plot scale: 50

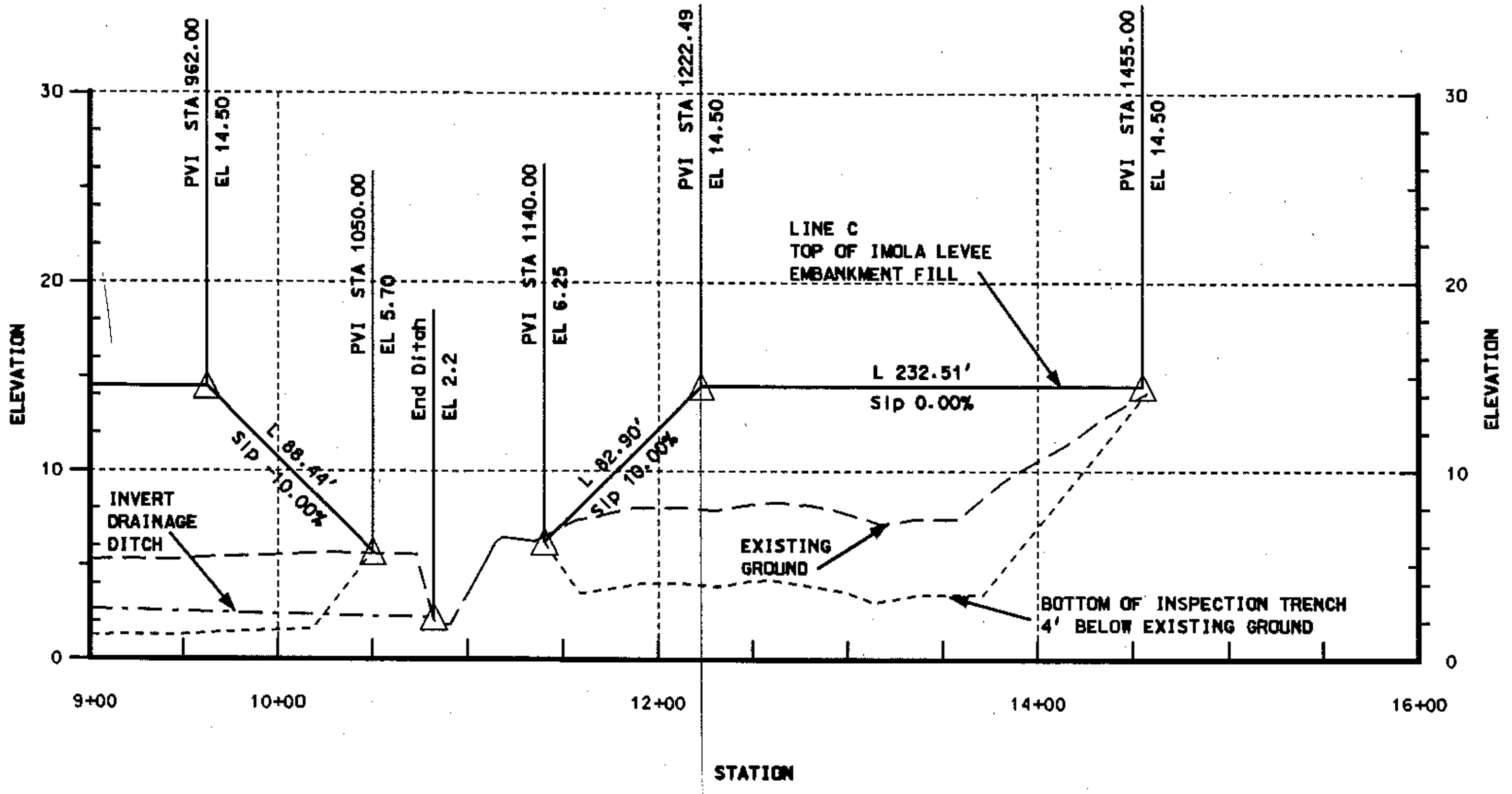
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

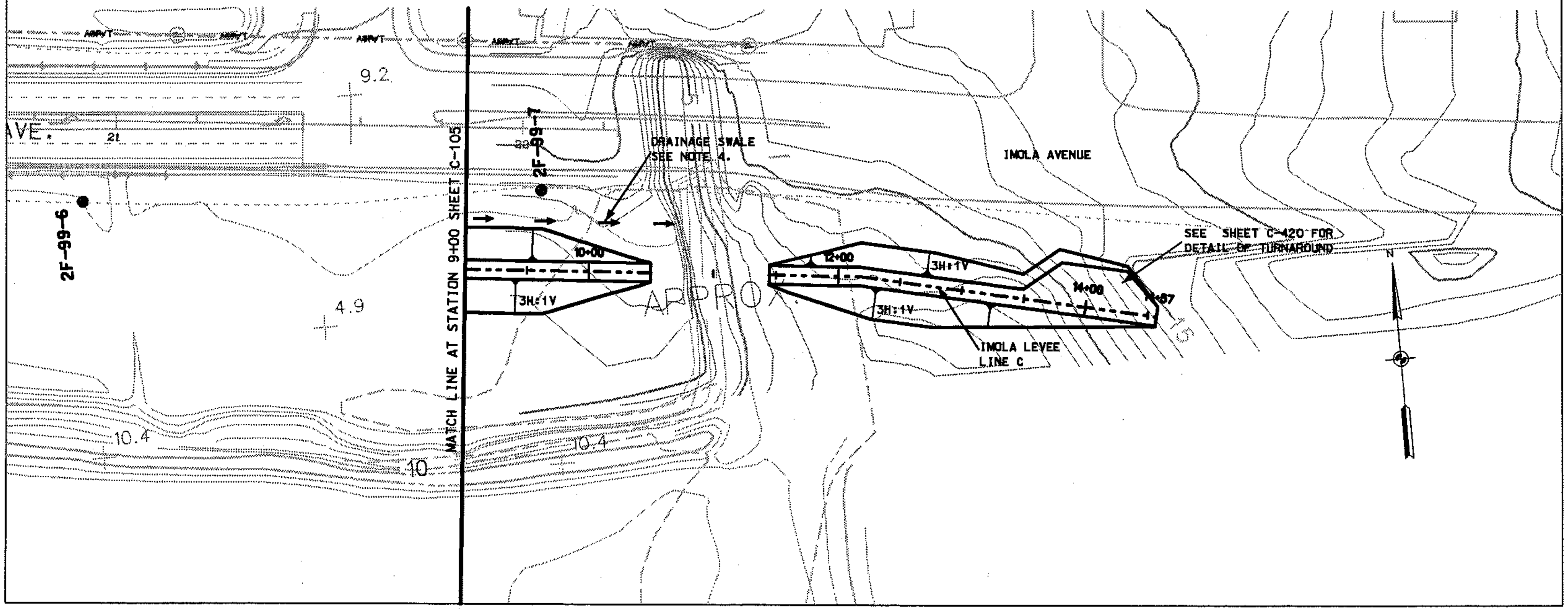
SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 "J" STREET
SACRAMENTO, CA 95814-2922

NAPA
CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
PLAN AND PROFILE
IMOLA LEVEE

Sheet
reference
number:
C-105
Sheet 22 of 39

PLOT DATE: 28-MAY-2004 PLOT TIME: 11:39 \\gold\civcad\napar\cn2a_duden\cadd\SheetFiles\NA-04-026C-105xxx.dgn





NOTES:

1. SEE SHEET C-110 FOR ALIGNMENT OF IMOLA LEVEE, LINE C.

2. SEE SHEET C-316 FOR CROSS SECTIONS OF IMOLA LEVEE.

3. PROFILE GRADE IS TOP OF IMOLA LEVEE EMBANKMENT FILL. AGGREGATE BASE ROAD SURFACE IS ABOVE THIS ELEVATION. SEE SHEET C-422, DETAIL 1.

4. CONSTRUCT A DRAINAGE SWALE AT THE MID-POINT BETWEEN THE TOE OF IMOLA LEVEE AND THE TOE OF IMOLA AVENUE FILL SECTIONS, WITH A BASE OF 3', VARYING DEPTHS, AND FLOW LINE ELEVATIONS ESTABLISHED BY VERTICAL PROFILE. TYPICAL SIDE SLOPES NOTED ON SHEET C-316.
BEGINNING INVERT
ELEVATION = 4.5'
END INVERT
ELEVATION = 2.2'

GRAPHIC SCALE
0 10' 25' 50' 100' 150'
1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

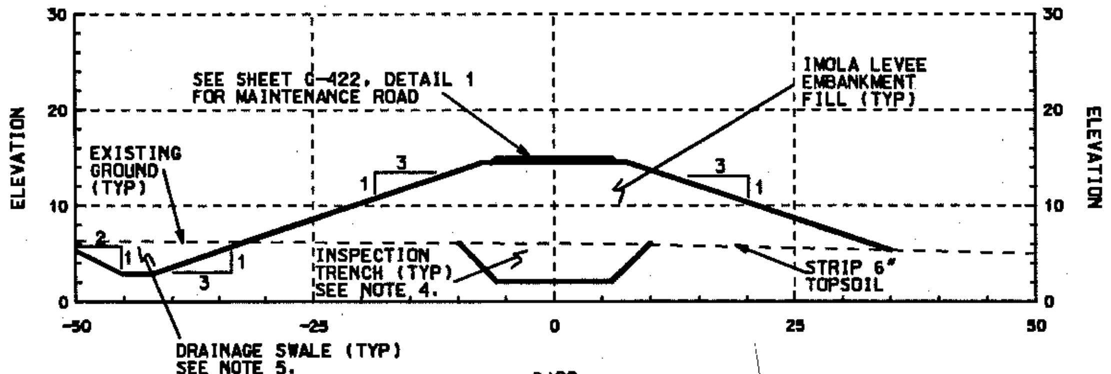
Designed by: WH
Dwn by: JMA
Spec No.: 1385
Reviewed by: T. CATARELLA
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A
Date: 06/01/2004
Rev. REV_0
Design file no: NA-04-026
Drawing Code:
File name:
Plot date:
Plot scale:50

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA
CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
PLAN AND PROFILE
IMOLA LEVEE

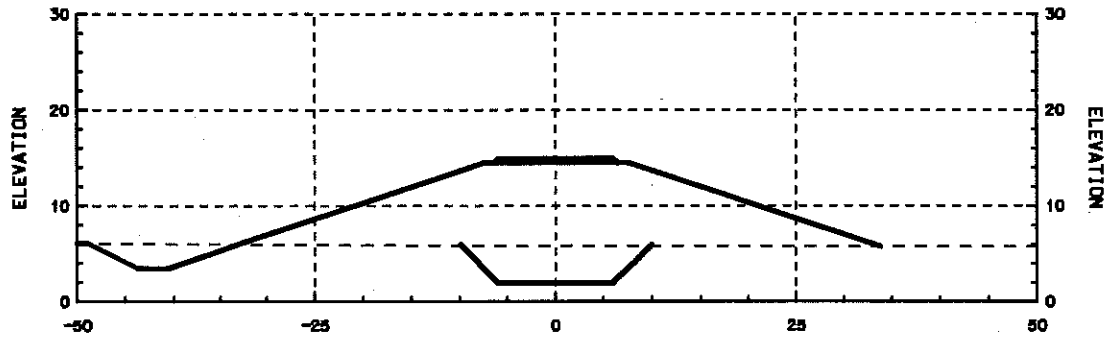
Sheet
reference
number:
C-106
Sheet 23 of 39



8+00

NOTES:

1. ALL SECTIONS LOOKING TOWARDS INCREASING STATIONS.
2. SEE SHEET C-105 AND C-106 FOR PROFILE OF IMOLA LEVEE.
3. SEE SHEET C-110 FOR ALIGNMENT OF IMOLA LEVEE.
4. INSPECTION TRENCH SHALL BE 4' DEPTH, 12' WIDE, WITH 1H:1V SLOPES.
5. SEE SHEET C-105 AND C-106 FOR ALIGNMENT AND PROFILE OF DRAINAGE SWALE.



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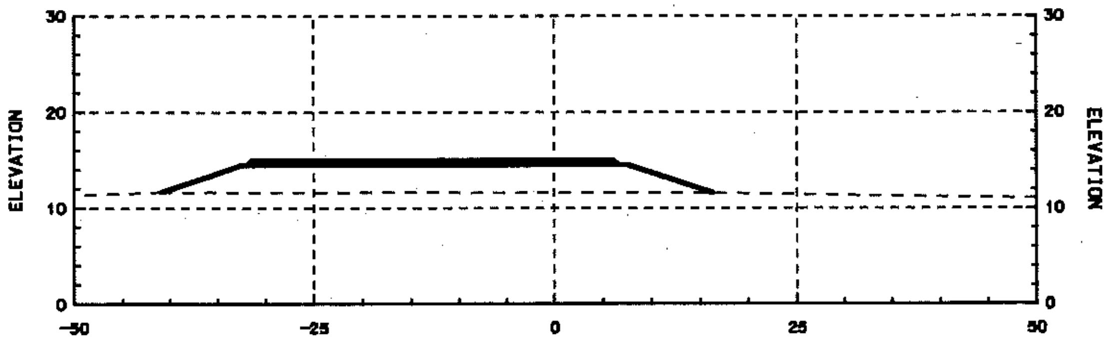

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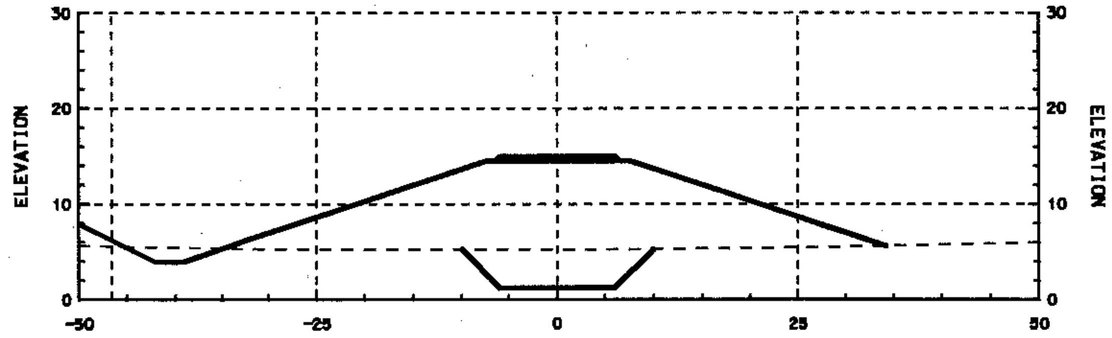

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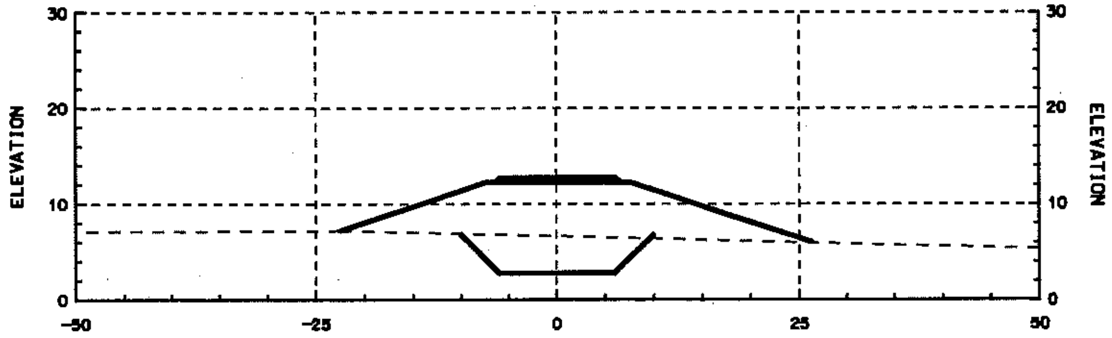

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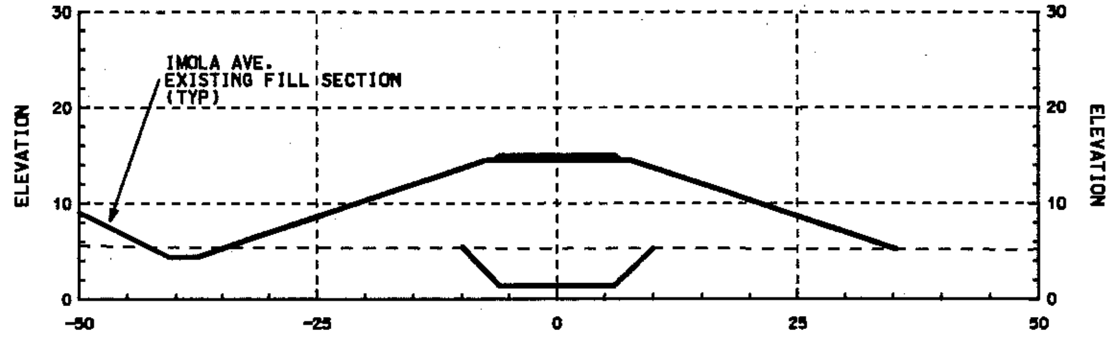

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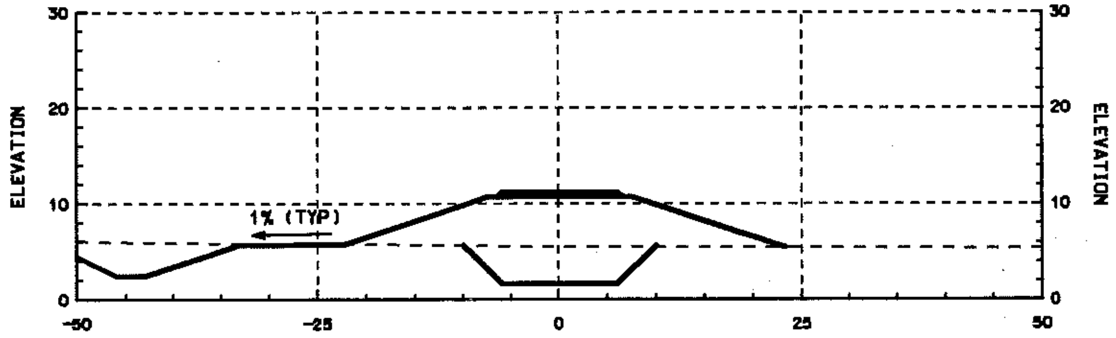


10+00

US Army Corps of Engineers
Sacramento District

Description
Date
Approved
Symbol

Date: 06/01/2004
Rev. REV_#
Design file no: NA-04-026
Drawing Code:
File name:
Plot date:
Plot scale:10

Designed by:
Dwn by: JMA
Spec No.: 1385
Reviewed by: T. CATANELLA
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
CROSS SECTIONS IMOLA LEVEE
STA. 2+00 TO STA. 14+00

Sheet reference number:
C-316
Sheet 33 of 39

US Army Corps
of Engineers
Sacramento District

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST NSD
(IMOLA AVENUE TO TULOCAY CREEK)

NAPA

CALIFORNIA

RECORD DRAWING:
THIS DRAWING IS THE LATEST RECORD AVAILABLE AS OF JUNE 30, 2005. IT PRESENTS DESIGN INFORMATION ONLY AND MAY NOT REFLECT AS-BUILT CONDITIONS. FIELD VERIFY BEFORE USE.

This project was designed by the Sacramento District of the U. S. Army Corps of Engineers. The initials or signatures and registration designations of individuals appear on these project documents within the scope of their employment as required by ER 1110-1-8152.

/S/THOMAS E. TRAINOR 04/25/2005
COL. RONALD N. LIGHT

JMA
NA 04 027

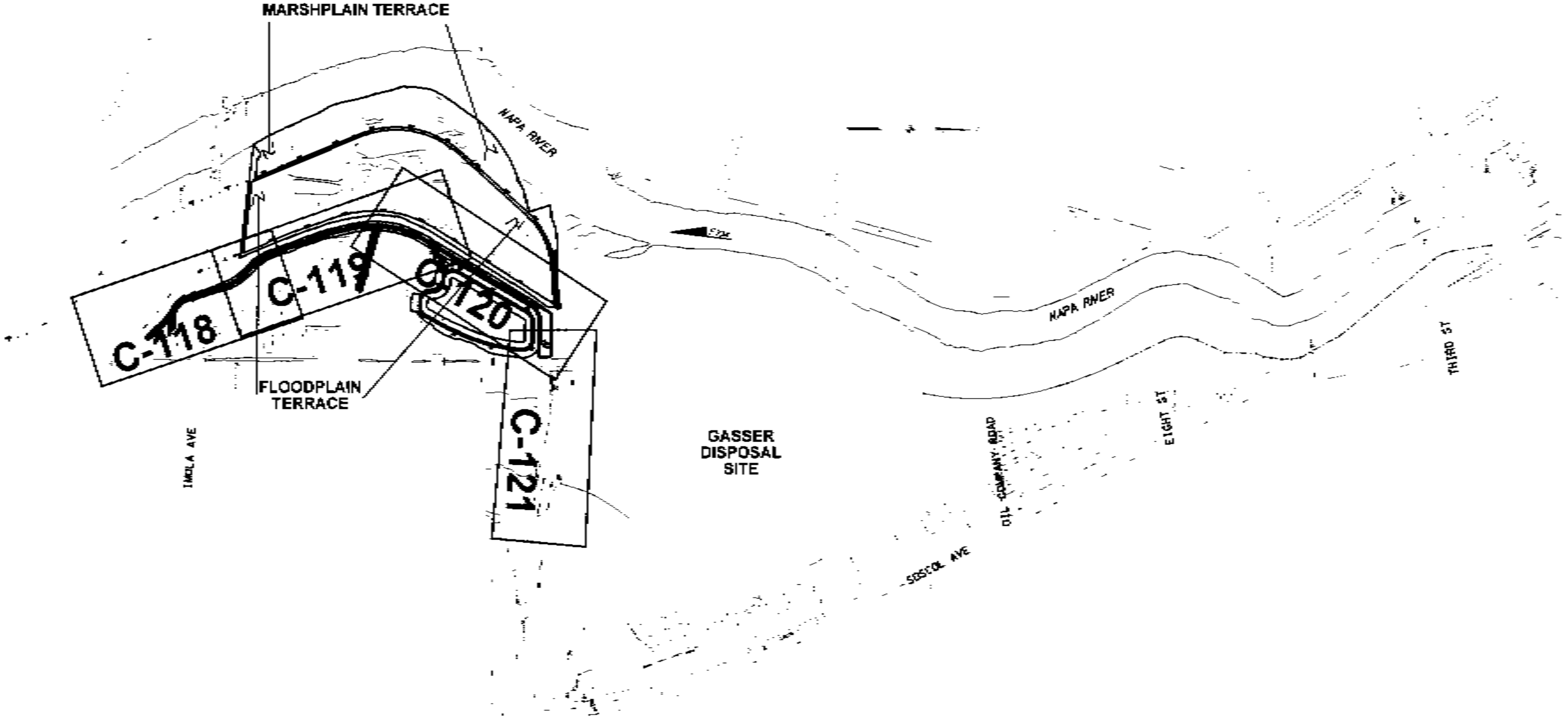
WMH
1.5SG

/S/RONALD L. MILLER 04/25/2005
SACRAMENTO DISTRICT
CIVIL DESIGN BRANCH
/S/[illegible] VALENTINI 04/25/2005

NAPA
CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST NSD
(IMOLA TO NEW TULOCAY CK.)
TITLE SHEET

Sheet
reference
number:
G-001
Sheet 1 of [illegible]

PLOT DATE: 26-APR-2005 PLOT TIME: 13:35 MASTER DESIGN FILE: [illegible]



US Army Corps
of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
[illegible]
SACRAMENTO, CA 95814-2922

04/27/2005

/S/ PETER VALENTINE

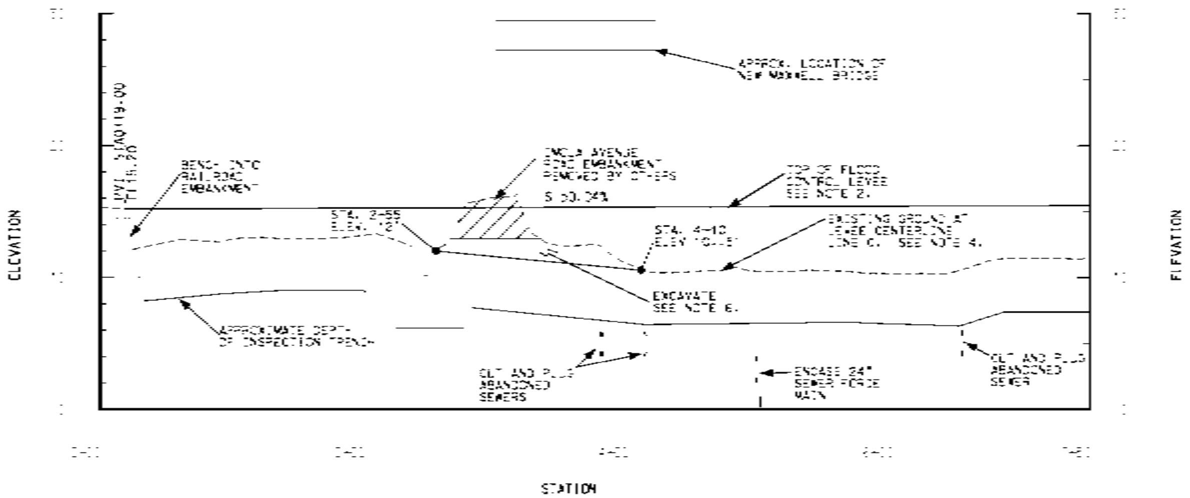
NAPA CALIFORNIA

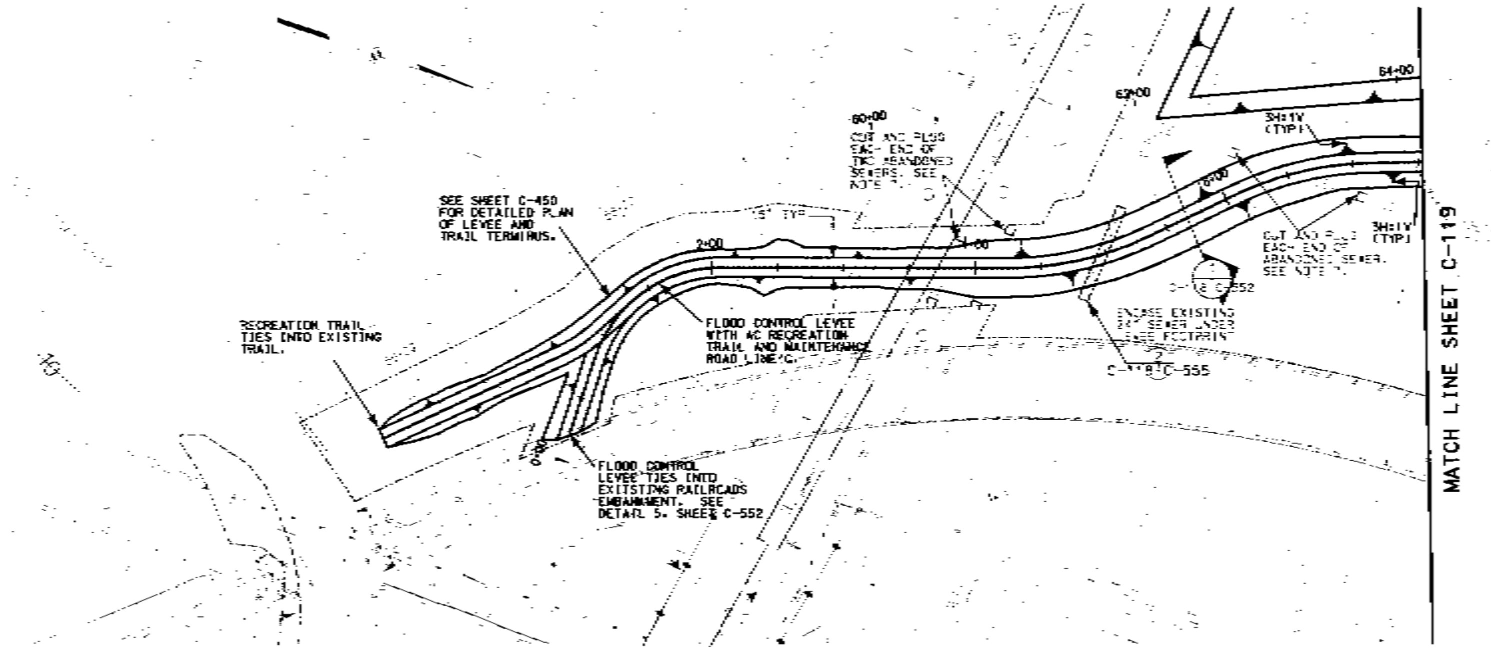
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 [illegible]
(IMOLA TO NEW TULOCAY CK)

SHEET LAYOUT
PLAN & PROFILE

Sheet
reference
number:
C-117

PLOT DATE: 26-APR-2005 PLOT TIME: 13:43





NOTES:

1. SEE SHEETS [illegible] TO [illegible] FOR LEVEE SECTIONS.

2. TOP OF LEVEE IN PROFILE [illegible] LEVEE EMBANKMENT FILL. [illegible] ON TOP OF THIS ELEVATION.

3. SEE SHEET [illegible] FOR HORIZONTAL ALIGNMENT OF LEVEE.

4. STRIP [illegible] OF TOPSOIL FROM LEVEE EMBANKMENT FOOTPRINT PRIOR TO PLACEMENT OF LEVEE EMBANKMENT FILL.

5. INSPECTION TRENCH SHALL BE [illegible] SEE SHEETS [illegible] TO [illegible].

6. EXCAVATE TO LINE SHOWN PRIOR TO INSPECTION OF FLOOD CONTROL LEVEE [illegible] LEVEE FOOTPRINT.

7. COMPLETELY REMOVE ABANDONED [illegible] LEVEE FOOTPRINT [illegible] LEVEE.

US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

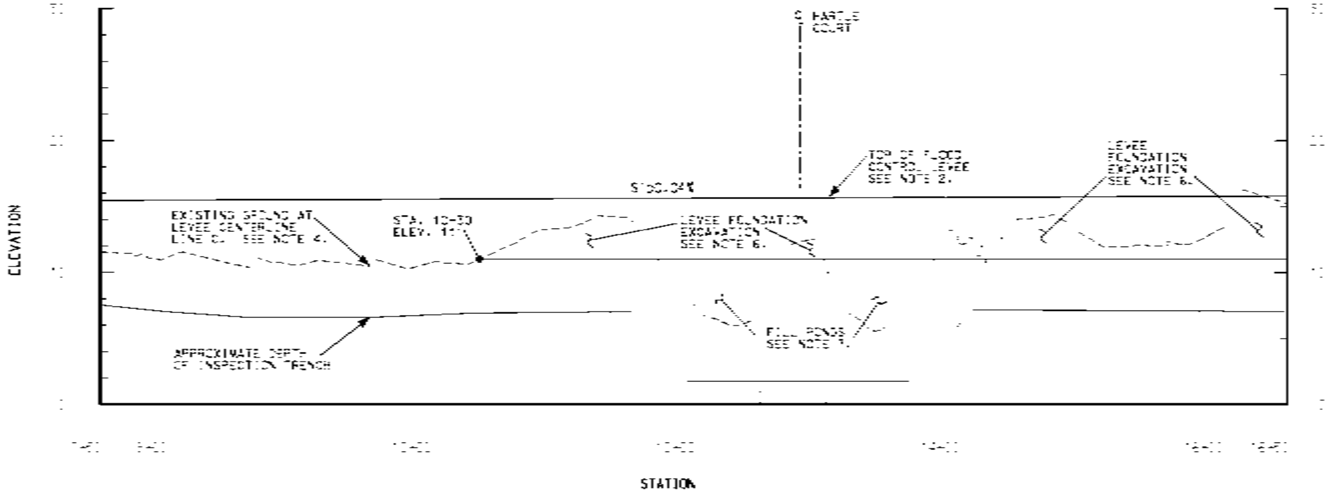
SACRAMENTO DISTRICT
IN HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814-2922

JMA
J. BUCKLAND
/S/ PETER VALENTINE
04/29/2005
NA-04-007

NAPA
CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 1 (ALL NSD)
(IMOLA TO NEW TULOCAY CK.)
PLAN & PROFILE
NSD LEVEE

Sheet reference number:
C-118
Sheet 38 of 73

PLOT DATE 26-APR-2005 PLOT TIME 13:45



NOTES:

1. SEE SHEETS C-[illegible] TO C-[illegible] FOR LEVEE SECTIONS.

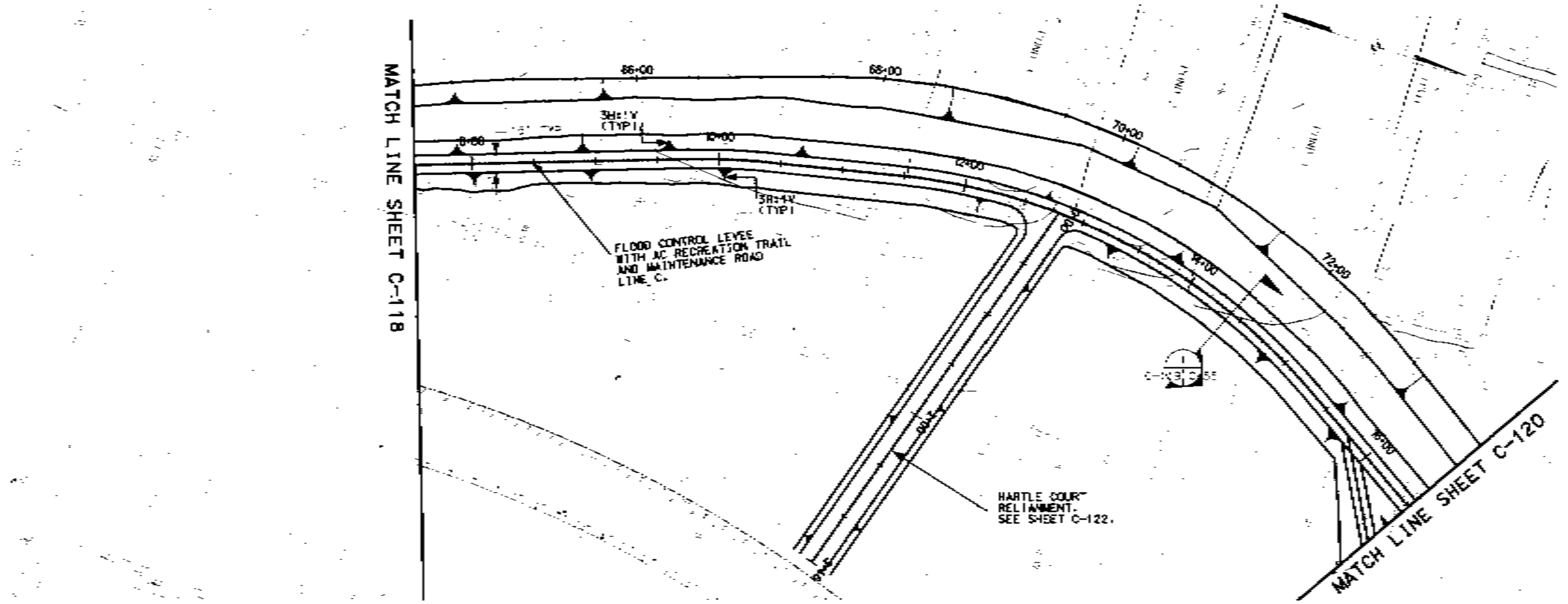
2. TOP OF LEVEE IN PROFILE [illegible] INDICATES THE TOP OF LEVEE EMBANKMENT [illegible] AC AND [illegible] SHALL BE PLACED ON TOP OF THIS ELEVATION.

3. SEE SHEET C-[illegible] FOR HORIZONTAL ALIGNMENT OF LEVEE. [illegible] LEVEE EMBANKMENT FOOTPRINT PRIOR TO PLACEMENT OF LEVEE EMBANKMENT FILL.

5. INSPECTION TRENCH SHALL BE [illegible] PRIOR TO PLACEMENT OF LEVEE. SEE SHEETS C-[illegible] TO C-[illegible].

6. [illegible] FLOOD CONTROL LEVEE.

7. FILL PONDS TO ELEVATION [illegible] FLOOD CONTROL LEVEE. FILL SHALL BE PLACED TO SAME REQUIREMENTS OF FLOOD CONTROL LEVEE.



US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

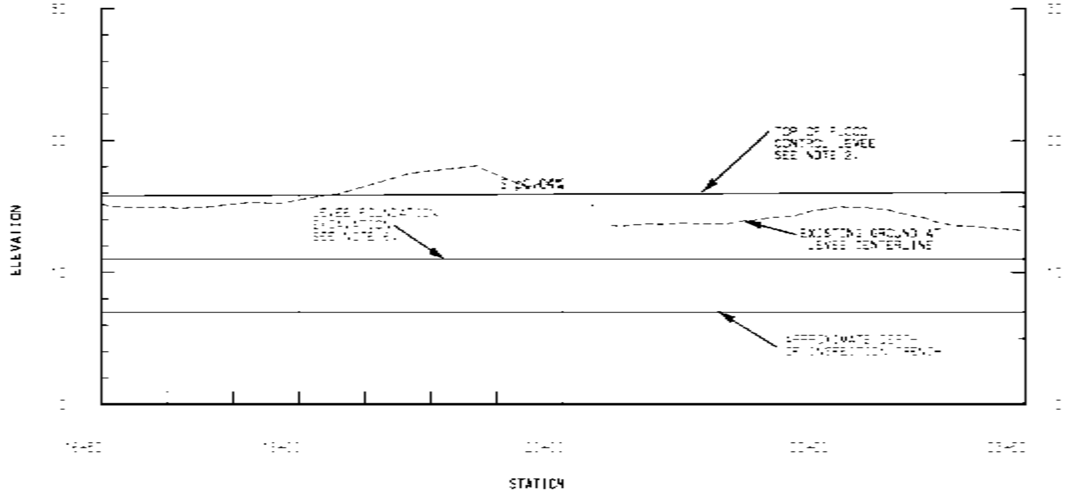
SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO, CA 95814-2922

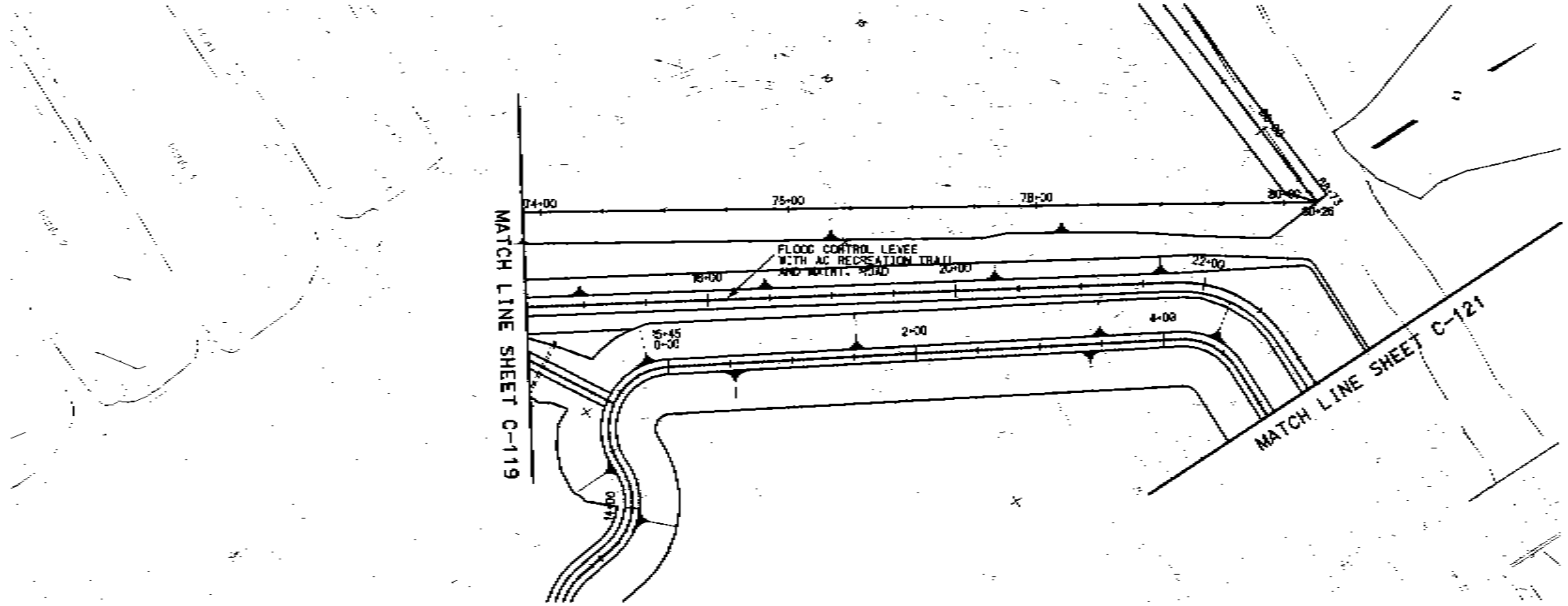
04/27/2005

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 (ALL NSD)
(IMOLA TO NEW TULOCAY CK)
PLAN & PROFILE
NSD LEVEE

NAPA CALIFORNIA

Sheet reference number:
C-119
Sheet 37 of 72





NOTES:

1. SEE SHEETS C-344 TO C-348 FOR LEVEE SECTIONS.

2. TOP OF LEVEE IN PROFILE WINDOW INDICATES THE TOP OF LEVEE EMBANKMENT FILL. AB [illegible] SHALL BE PLACED ON TOP OF THIS ELEVATION.

3. SEE SHEET C-[illegible] FOR HORIZONTAL ALIGNMENT OF LEVEE.

4. STRIP [illegible] OF TOPSOIL FROM LEVEE EMBANKMENT FOOTPRINT PRIOR TO PLACEMENT OF LEVEE EMBANKMENT FILL.

5. INSPECTION TRENCH SHALL BE EXCAVATED PRIOR TO PLACEMENT OF LEVEE. SEE SHEET C-344 TO C-348.

6. EXCAVATE TO ELEVATION [illegible] FEET PRIOR TO CONSTRUCTION OF FLOOD CONTROL LEVEE.

US Army Corps of Engineers
Sacramento District

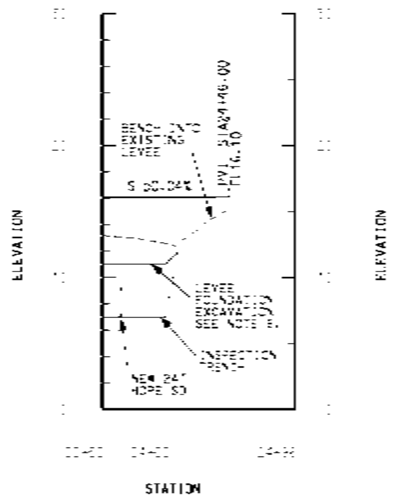
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

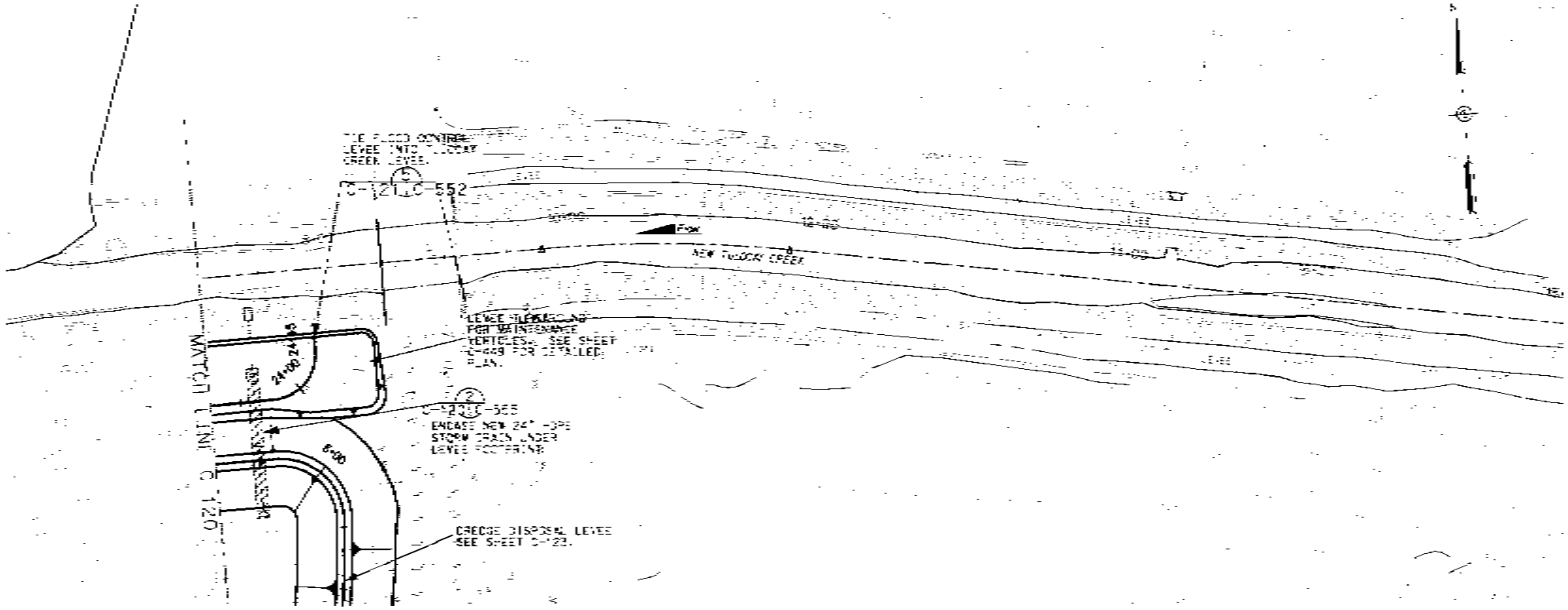
SACRAMENTO DISTRICT
ENGINEERING DIVISION
1325 J STREET
SACRAMENTO, CA 95814-2922

04/??/2005
JHA
J. DUKLAND
/S/ PETER VALENTINE

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 [illegible]
[illegible] TO NEW TULOCAY CK.
PLAN & PROFILE
NSD LEVEE

Sheet reference number:
C-120
Sheet 38 of 75





NOTES:

1. SEE SHEETS C-344 TO C-346 FOR LEVEE SECTIONS.

2. TOP OF LEVEE IN PROFILE WINDOW INDICATES THE TOP OF LEVEE EMBANKMENT FILL. AB AND AC LAYERS SHALL BE PLACED ON TOP OF THIS ELEVATION.

3. SEE SHEET C-132 FOR HORIZONTAL ALIGNMENT OF LEVEE.

4. STRIP 6" OF TOPSOIL FROM LEVEE EMBANKMENT FOOTPRINT, PRIOR TO PLACEMENT OF LEVEE EMBANKMENT FILL.

5. INSPECTION TRENCH SHALL BE EXCAVATED PRIOR TO PLACEMENT OF LEVEE. SEE SHEETS C-344 TO C-346.

6. EXCAVATE TO ELEVATION 11.0 FEET PRIOR TO CONSTRUCTION OF FLOOD CONTROL LEVEE.

GRAPHIC SCALE

0 10 25 50 100 150

1" = 50'

US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
ENGINEERING DIVISION
1325 J STREET
SACRAMENTO, CA 95814-2922

JMA
J. RAGLAND
/S/ PETER VALENTINE
04/27/2005
NA-04-027

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 (EAST NSD)
(IMOLA TO NEW TULOCAY CK)
PLAN & PROFILE
NSD LEVEE

Sheet reference number:
C-121
Sheet 39 of 73

PLOT DATE: 25-APR-2005 PLOT TIME: 13:44

Appendix B

Flood Damage Reduction Segment/System Inspection Report

&

Inspection Map

US Army Corps
of Engineers®

Flood Damage Reduction Segment / System Inspection Report

Name of Segment / System: Napa River, left bank - Tulocay to Imola

Public Sponsor(s): Napa County Flood Control and Water Conservation District

Public Sponsor Representative: Jeremy Sarrow

Sponsor Phone: 707-259-8204

Sponsor Email: jeremy.sarrow@countyofnapa.org

Corps of Engineers Inspector: Micheal Franssen PE and Nathan DeLannoy

Inspection Start Date: 07/22/20

Inspection End Date: 07/22/20

Inspection Report Prepared By: Nathan DeLannoy

Date Report Prepared: 08/05/20

Internal Technical Review (for Periodic Inspections) By:

Date of ITR:

Final Approved By: Marcus Palmer, PE, Levee Safety Officer

Date Approved:

Type of Inspection:

- ☐ **Initial Eligibility Inspection**
- ☐ **Continuing Eligibility Inspection (Routine)**
- ☒ **Continuing Eligibility Inspection (Periodic)**

Overall Segment / System Rating:

- ☐ **Acceptable**
- ☒ **Minimally Acceptable**
- ☐ **Unacceptable**

Contents of Report:

- ☒ **Instructions**
- ☐ **Initial Eligibility Inspection**
- ☒ **General Items for All Flood Control Works**
- ☒ **Levee Embankment**
- ☐ **Concrete Floodwalls**
- ☐ **Sheet Pile and Concrete I-walls**
- ☒ **Interior Drainage System**
- ☐ **Pump Stations**
- ☐ **FDR System Channels**

Note: In addition to the report contents indicated here, a plan view drawing of the system, with stationing, should be included with this report to reference locations of items rated less than acceptable. Photos of general system condition and any noted deficiencies should also be attached.

Note: This inspection rating represents the Corps evaluation of operations and maintenance of the flood damage reduction system and may be used in conjunction with other information for a levee certification determination for National Flood Insurance Program (NFIP) purposes if applicable. An Acceptable Corps inspection rating, alone, does not equate to a certifiable levee for the NFIP. It is recommended for levee systems currently accredited by the Federal Emergency Management Agency (FEMA) for NFIP purposes receiving a Corps Minimally Acceptable or Unacceptable rating, be evaluated by the levee owner to determine the potential impacts to the certification for FEMA.

US Army Corps
of Engineers®

Flood Damage Reduction Segment / System
Public Sponsor Pre-Inspection Form

The following information is to be provided by the levee district sponsor prior to an inspection. This information will be used to help evaluate the organizational capability of the levee district to manage the levee segment / system maintenance program.

1. Levee segment / system and district: (name of the segment / system and levee district)

Napa River, left bank - Tulocay to Imola for CESPN

2. Reporting period: (month/day/year to month/day/year)

3. Summary of maintenance required by last inspection report:

None

4. Summary of maintenance performed this reporting period:

Vegetation maintenance and animal control

5. Summary of maintenance planned next reporting period:

Vegetation maintenance and animal control

6. Summary of changes to segment / system since last inspection:

None

7. Problems/ issues requiring the assistance of the US Army Corps of Engineers:

None

Public Sponsor Pre-Inspection Report

The following information is to be provided by the levee district sponsor prior to an inspection

8. Levee district organization: (elected or appointed levee district officials and key employees)

Name	Position	Mailing Address	Phone Number	Email Address
Jeremy Sorrow	Resources Specialist	804 First Street, Napa, CA 94559	707-259-8204	jeremy.sarrow@countyofnapa.org

General Instructions for the Inspection of Flood Damage Reduction Segments / Systems

A. **Purpose of USACE Inspections:**

The primary purpose of these inspections is to prevent loss of life and catastrophic damages; preserve the value of Federal investments, and to encourage non-Federal sponsors to bear responsibility for their own protection. Inspections should assure that Flood Damage Reduction structures and facilities are continually maintained and operated as necessary to obtain the maximum benefits. Inspections are also conducted to determine eligibility for Rehabilitation Assistance under authority of PL 84-99 for Federal and non-Federal systems. (ER 1130-2-530, ER 500-1-1)

B. **Types of Inspections:**
The Corps conducts several types of inspections of Flood Damage Reduction systems, as outlined below:

Initial Eligibility Inspections	Continuing Eligibility Inspections	
	Routine Inspections	Periodic Inspections
IEIs are conducted to determine whether a non-Federally constructed Flood Damage Reduction system meets the minimum criteria and standards set forth by the Corps for initial inclusion into the Rehabilitation and Inspection Program.	RIs are intended to verify proper maintenance, owner preparedness, and component operation.	PIs are intended to verify proper maintenance and component operation and to evaluate operational adequacy, structural stability, and safety of the system. Periodic Inspections evaluate the system's original design criteria vs. current design criteria to determine potential performance impacts, evaluate the current conditions, and compare the design loads and design analysis used against current design standards. This is to be done to identify components and features for the sponsor that need to be monitored more closely over time or corrected as needed. (Periodic Inspections are used as the basis of risk assessments.)

C. **Inspection Boundaries:**
Inspections should be conducted so as to rate each Flood Damage Reduction "Segment" of the system. The overall system rating will be the lowest segment rating in the system.

Project	System	Segment
A flood damage reduction project is made up of one or more flood damage reduction systems which were under the same authorization.	A flood damage reduction system is made up of one or more flood damage reduction segments which collectively provide flood damage reduction to a defined area. Failure of one segment within a system constitutes failure of the entire system. Failure of one system does not affect another system.	A flood damage reduction segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A flood damage reduction segment can be made up of one or more features (levee, floodwall, pump stations, etc).

D. **Land Use Definitions:**
The following three definitions are intended for use in determining minimum required inspection intervals and initial requirements for inclusion into the Rehabilitation and Inspection Program. Inspections should be considered for all systems that would result in significant environmental or economic impact upon failure regardless of specific land use.

Agricultural	Rural	Urban
Protected population in the range of zero to 5 households per square mile protected.	Protected population in the range of 6 to 20 households per square mile protected.	Greater than 20 households per square mile; major industrial areas with significant infrastructure investment. Some protected urban areas have no permanent population but may be industrial areas with high value infrastructure with no overnight population.

E. Use of the Inspection Report Template:

The report template is intended for use in all Army Corps of Engineers inspections of levee and floodwall systems and flood damage reduction channels. The section of the template labeled “Initial Eligibility" only needs to be completed during Initial Eligibility Inspections of Non-Federally constructed Flood Damage Reduction Systems. The section labeled "General Items" needs to be completed with every inspection, along with all other sections that correspond to features in the system. The section labeled "Public Sponsor Pre-Inspection Report" is intended for completion before the inspection, if possible.

F. Individual Item / Component Ratings:

Assessment of individual components rated during the inspection should be based on the criteria provided in the inspection report template, though inspectors may incorporate additional items into the report based on the characteristics of the system. The assessment of individual components should be based on the following definitions.

Acceptable Item	Minimally Acceptable Item	Unacceptable Item
The inspected item is in satisfactory condition, with no deficiencies, and will function as intended during the next flood event.	The inspected item has one or more minor deficiencies that need to be corrected. The minor deficiency or deficiencies will not seriously impair the functioning of the item as intended during the next flood event.	The inspected item has one or more serious deficiencies that need to be corrected. The serious deficiency or deficiencies will seriously impair the functioning of the item as intended during the next flood event.

G. Overall Segment / System Ratings:

Determination of the overall system rating is based on the definitions below. Note that an Unacceptable System Rating may be either based on an engineering determination that concluded that noted deficiencies would prevent the system from functioning as intended during the next flood event, or based on the sponsor's demonstrated lack of commitment or inability to correct serious deficiencies in a timely manner.

Acceptable System	Minimally Acceptable System	Unacceptable System
All items or components are rated as Acceptable.	One or more items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable items would not prevent the segment / system from performing as intended during the next flood event.	One or more items are rated as Unacceptable and would prevent the segment / system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

H. Eligibility for PL84-99 Rehabilitation Assistance:

Inspected systems that are not operated and maintained by the Federal government may be Active in the Corps' Rehabilitation and Inspection Program (RIP) and eligible for rehabilitation assistance from the Corps as defined below:

If the Overall System Rating is Acceptable	If the Overall System Rating is Minimally Acceptable	If the Overall System Rating is Unacceptable
The system is active in the RIP and eligible for PL84-99 rehabilitation assistance.	The system is Active in the RIP during the time that it takes to make needed corrections. Active systems are eligible for rehabilitation assistance. However, if the sponsor does not present USACE with proof that serious deficiencies (which had previously resulted in a minimally acceptable system rating) were corrected within the established timeframe, then the system will become Inactive in the RIP.	The system is Inactive in the RIP, and the status will remain Inactive until the sponsor presents USACE with proof that all items rated Unacceptable have been corrected. Inactive systems are ineligible for rehabilitation assistance.

I. Reporting:

After the inspection, the Corps is responsible for assembling an inspection report (or a summary report if it was a Periodic Inspection) including the following information:

a. All sections of the report template used during the inspection, including the cover and pre-inspection materials. (Supplemental data collected, and any sections of the template that weren't used during the inspection do not need to be included with the report.)

b. Photos of the general system condition and noted deficiencies.

c. A plan view drawing of the system, with stationing, to reference locations of items rated less than acceptable.

d. The relative importance of the identified maintenance issues should be specified in the transmittal letter.

e. If the Overall System Rating is Minimally Acceptable, the report needs to establish a timeframe for correction of serious deficiencies noted (not to exceed two years) and indicate that if these items are not corrected within the required timeframe, the system will be rated as Unacceptable and made Inactive in the Rehabilitation Inspection Program.

J. Notification:

Reports are to be disseminated as follows within 30 days of the inspection date.

If the Overall System Rating is Acceptable	If the Overall System Rating is Minimally Acceptable	If the Overall System Rating is Unacceptable
Reports need to be provided to the local sponsor and the county emergency management agency.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, and to the FEMA region.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, FEMA region, and to the Congressional delegation within 30 days of the inspection.

General Items for All Flood Damage Reduction Segments / Systems

For use during all inspections of all Flood Damage Reduction Segments / Systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Operations and Maintenance Manuals	**A**	**A**	Levee Owner's Manual, O&M Manuals, and/or manufacturer's operating instructions are present.	Our current Operations and Maintenance Manual is kept in sponsor's office along with a digit copy kept on their server.
		M	Sponsor manuals are lost or missing or out of date; however, sponsor will obtain manuals prior to next scheduled inspection.	
		U	Sponsor has not obtained lost or missing manuals identified during previous inspection.	
2. Emergency Supplies and Equipment (A or M only)	**A**	**A**	The sponsor maintains a stockpile of sandbags, shovels, and other flood fight supplies which will adequately supply all needs for the initial days of a flood fight. Sponsor determines required quantity of supplies after consulting with inspector.	The District's Emergency Supplies and Equipment are located at 933 Water St. Supplies consist of sand bags, shovels, sand for the sand bags, chain saws, flash lights, barriers, a grip hoist, and other various flood fighting supplies.
		M	The sponsor does not maintain an adequate supply of flood fighting materials as part of their preparedness activities.	
3. Flood Preparedness and Training (A or M only)	**A**	**A**	Sponsor has a written system-specific flood response plan and a solid understanding of how to operate, maintain, and staff the FDR system during a flood. Sponsor maintains a list of emergency contact information for appropriate personnel and other emergency response agencies.	Annual flood fighting training program conducted by the CA Department of Water Resources at the Napa Sheriff's Department each fall.
		M	The sponsor maintains a good working knowledge of flood response activities, but documentation of system-specific emergency procedures and emergency contact personnel is insufficient or out of date.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Unwanted Vegetation Growth[1]	**A**	**A**	The levee has little or no unwanted vegetation (trees, bush, or undesirable weeds), except for vegetation that is properly contained and/or situated on overbuilt sections, such that the mandatory 3-foot root-free zone is preserved around the levee profile. The levee has been recently mowed. The vegetation-free zone extends 15 feet from both the landside and riverside toes of the levee to the centerline of the tree. If the levee access easement doesn't extend to the described limits, then the vegetation-free zone must be maintained to the easement limits. Reference EM 1110-2-301 or Corps policy for regional vegetation variance.	The levee is maintained very well with no large vegetation obscuring the PI.
		M	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the levee.	
		U	Significant vegetation growth (brush, weeds, or any trees greater than 2 inches in diameter) is present within the zones described above and must to be removed to reestablish or ascertain levee integrity.	
2. Sod Cover	**NA**	**A**	There is good coverage of sod over the levee.	
		M	Approximately 25% of the sod cover is missing or damaged over a significant portion or over significant portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
		U	Over 50% of the sod cover is missing or damaged over a significant portion or portions of the levee embankment.	
		N/A	Surface protection is provided by other means.	
3. Encroachments	**A**	**A**	No trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the levee.	NLT3_2020_a_0001: Station_1 NA: Upstream end of levee segment.: No action required at this time. (A) NLT3_2020_a_0003: Station_1 NA: Access ramp with gate.: No action required at this time. (A) NLT3_2020_a_0006: Station_1 NA: Station_2 NA: Homeless encampment within 15 feet of landside toe.: No action required at this time. (M) NLT3_2020_a_0012: Station_1 NA: Fence and gate across levee slope and crown.: Ensure access is obtained and maintained for flood fighting, maintenance and inspection activities. (A) NLT3_2020_a_0013: Station_1 NA: Station_2 NA: Fenceline within 15 feet of landside slope.: Ensure access is obtained and maintained for flood fighting, maintenance and inspection activities. (A) NLT3_2020_a_0016: Station_1 NA: Access road on landside slope.: No action required at this time. (A) NLT3_2020_a_0018: Station_1 NA: Access ramp observed
		M	Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
		U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the levee.	

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Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
				on landside slope.: No action required at this time. (A) NLT3_2020_a_0022: Station_1 NA: Downstream end of levee segment.: No action required at this time. (A)
4. Closure Structures (Stop Log, Earthen Closures, Gates, or Sandbag Closures) (A or U only)	**NA**	**A**	Closure structure in good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions/ procedures readily available. Trial erections have been accomplished in accordance with the O&M Manual.	
		U	Any of the following issues is cause for this rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection. Components of closure are not clearly marked and installation instructions/ procedures are not readily available. Trial erections have not been accomplished in accordance with the O&M Manual.	
		N/A	There are no closure structures along this component of the FDR segment / system.	
5. Slope Stability	**A**	**A**	No slides, sloughs, tension cracking, slope depressions, or bulges are present.	No slides, bulges or cracking observed during the PI.
		M	Minor slope stability problems that do not pose an immediate threat to the levee embankment.	
		U	Major slope stability problems (ex. deep seated sliding) identified that must be repaired to reestablish the integrity of the levee embankment.	
6. Erosion/ Bank Caving	**A**	**A**	No erosion or bank caving is observed on the landward or riverward sides of the levee that might endanger its stability.	NLT3_2020_a_0005: Station_1 NA: Foot path on landside slope of levee.: Fill and compact to reestablish levee cross section. (M) NLT3_2020_a_0011: Station_1 NA: Foot path observed on riverside slope.: Fill and compact to reestablish levee cross section. (M)
		M	There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
		U	Erosion or caving is occurring or has occurred 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.	
7. Settlement[2]	**A**	**A**	No observed depressions in crown. Records exist and indicate no unexplained historical changes.	No settlements were observed during the PI.
		M	Minor irregularities that do not threaten integrity of levee. Records are incomplete or inclusive.	
		U	Obvious variations in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.	
8. Depressions/ Rutting	**M**	**A**	There are scattered, shallow ruts, pot holes, or other depressions on the levee that are unrelated to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.	NLT3_2020_a_0014: Station_1 NA: Footpath observed on landside slope.: Fill and compact to reestablish levee cross section. (M) NLT3_2020_a_0017: Station_1 NA: Foot path observed on riverside slope.: Fill and compact to reestablish levee cross
		M	There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment, or access roads that will pond water.	

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Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
		U	There are depressions greater than 6 inches deep that will pond water.	section. (M) NLT3_2020_a_0021: Station_1 NA: Foot path observed on landside slope.: Fill and compact to reestablish levee cross section. (M)
9. Cracking	**M**	**A**	Minor longitudinal, transverse, or desiccation cracks with no vertical movement along the crack. No cracks extend continuously through the levee crest.	NLT3_2020_a_0020: Station_1 NA: Station_2 NA: Cracking observed in asphalt along this section.: Repair as needed. (M)
		M	Longitudinal and/or transverse cracks up to 6 inches in depth with no vertical movement along the crack. No cracks extend continuously through the levee crest. Longitudinal cracks are no longer than the height of the levee.	
		U	Cracks exceed 6 inches in depth. Longitudinal cracks are longer than the height of the levee and/or exhibit vertical movement along the crack. Transverse cracks extend through the entire levee width.	
10. Animal Control	**M**	**A**	Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.	NLT3_2020_a_0002: Station_1 NA: Station_2 NA: Animal burrows where observed. Sponsor provided photos of animal control measure conducted.: Continue animal control measures (M) NLT3_2020_a_0015: Station_1 NA: Animal burrows observed on riverside slope: Monitor the activity and implement animal control measures as necessary. (M)
		M	The existing animal burrow control program needs to be improved. Several burrows are present which may lead to seepage or slope stability problems, and they require immediate attention.	
		U	Animal burrow control program is not effective or is nonexistent. Significant maintenance is required to fill existing burrows, and the levee will not provide reliable flood protection until this maintenance is complete.	
11. Culverts/ Discharge Pipes[3] (This item includes both concrete and corrugated metal pipes.)	**NA**	**A**	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		M	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	

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Levee Embankments

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
		U	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
		N/A	There are no discharge pipes/ culverts.	
12. Riprap Revetments & Bank Protection	**NA**	**A**	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	
		M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		U	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		N/A	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	
13. Revetments other than Riprap	**NA**	**A**	Existing revetment protection is properly maintained, undamaged, and clearly visible.	
		M	Minor revetment displacement or deterioration that does not pose an immediate threat to the integrity of the levee. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		U	Significant revetment displacement, deterioration, or exposure of bedding observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Revetment protection is hidden by dense brush and trees.	
		N/A	There are no such revetments protecting this feature of the segment / system.	
14. Underseepage Relief Wells/ Toe Drainage Systems	**NA**	**A**	Toe drainage systems and pressure relief wells necessary for maintaining FDR segment / system stability during high water functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). Nothing is observed which would indicate that the drainage systems won't function properly during the next flood, and maintenance records indicate regular cleaning. Wells have been pumped tested within the past 5 years and documentation is provided.	
		M	Toe drainage systems or pressure relief wells are damaged and may become clogged if they are not repaired. Maintenance records are incomplete or indicate irregular cleaning and pump testing.	

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Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
		U	Toe drainage systems or pressure relief wells necessary for maintaining FDR segment / system stability during flood events have fallen into disrepair or have become clogged. No maintenance records. No documentation of the required pump testing.	
		N/A	There are no relief wells/ toe drainage systems along this component of the FDR segment / system.	
15. Seepage	**M**	**A**	No evidence or history of unrepaired seepage, saturated areas, or boils.	No observations of seepage, boils or saturated areas were observed during the PI.
		M	Evidence or history of minor unrepaired seepage or small saturated areas at or beyond the landside toe but not on the landward slope of levee. No evidence of soil transport.	
		U	Evidence or history of active seepage, extensive saturated areas, or boils.	

[1] If there is significant growth on the levee that inhibits the inspection of animal burrows or other items, the inspection should be ended until this item is corrected.

[2] Detailed survey elevations are normally required during Periodic Inspections, and whenever there are obvious visual settlements.

[3] The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

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Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

	**Inspect ID:** NLT3_2020_a_0001 **Title:** USACE_CESPN_NLT3_2020_a_0001_1.jpg **Rated Item:** 3. Encroachments **Caption:** Rating: Acceptable; Remarks: Upstream end of levee segment.; Action: No action required at this time.
	**Inspect ID:** NLT3_2020_a_0006 **Title:** USACE_CESPN_NLT3_2020_a_0006_1.jpg **Rated Item:** 3. Encroachments **Caption:** Rating: Minimally Acceptable; Remarks: Homeless encampment within 15 feet of landside toe.; Action: No action required at this time.

Inspect ID: NLT3_2020_a_0012 **Title:** USACE_CESPN_NLT3_2020_a_0012_1.jpg
Rated Item: 3. Encroachments **Caption:** Rating: Acceptable; Remarks: Fence and gate across levee slope and crown.; Action: Ensure access is obtained and maintained for flood fighting, maintenance and inspection activities.

Inspect ID: NLT3_2020_a_0013 **Title:** USACE_CESPN_NLT3_2020_a_0013_1.jpg
Rated Item: 3. Encroachments **Caption:** Rating: Acceptable; Remarks: Fenceline within 15 feet of landside slope.; Action: Ensure access is obtained and maintained for flood fighting, maintenance and inspection activities.

Inspect ID: NLT3_2020_a_0016 **Title:** USACE_CESPN_NLT3_2020_a_0016_1.jpg
Rated Item: 3. Encroachments **Caption:** Rating: Acceptable; Remarks: Access road on landside slope.; Action: No action required at this time.

Inspect ID: NLT3_2020_a_0018 **Title:** USACE_CESPN_NLT3_2020_a_0018_1.jpg
Rated Item: 3. Encroachments **Caption:** Rating: Acceptable; Remarks: Access ramp observed on landside slope.; Action: No action required at this time.

Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Inspect ID: NLT3_2020_a_0022 **Title:** USACE_CESPN_NLT3_2020_a_0022_1.jpg **Rated Item:** 3. Encroachments **Caption:** Rating: Acceptable; Remarks: Downstream end of levee segment.; Action: No action required at this time.

Inspect ID: NLT3_2020_a_0005 **Title:** USACE_CESPN_NLT3_2020_a_0005_1.jpg **Rated Item:** 6. Erosion/ Bank Caving **Caption:** Rating: Minimally Acceptable; Remarks: Foot path on landside slope of levee.; Action: Fill and compact to reestablish levee cross section.

 2020/07/22 07:54	**Inspect ID:** NLT3_2020_a_0011 **Title:** USACE_CESPN_NLT3_2020_a_0011_1.jpg **Rated Item:** 6. Erosion/ Bank Caving **Caption:** Rating: Minimally Acceptable; Remarks: Foot path observed on riverside slope.; Action: Fill and compact to reestablish levee cross section.
 2020/07/22 08:07	**Inspect ID:** NLT3_2020_a_0014 **Title:** USACE_CESPN_NLT3_2020_a_0014_1.jpg **Rated Item:** 8. Depressions/ Rutting **Caption:** Rating: Acceptable; Remarks: Footpath observed on landside slope.; Action: Fill and compact to reestablish levee cross section.

Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

2020/07/22 08:19

Inspect ID: NLT3_2020_a_0017 **Title:** USACE_CESPN_NLT3_2020_a_0017_1.jpg
Rated Item: 8. Depressions/ Rutting **Caption:** Rating: Minimally Acceptable; Remarks: Foot path observed on riverside slope.; Action: Fill and compact to reestablish levee cross section.

2020/07/22 08:31

Inspect ID: NLT3_2020_a_0021 **Title:** USACE_CESPN_NLT3_2020_a_0021_1.jpg
Rated Item: 8. Depressions/ Rutting **Caption:** Rating: Minimally Acceptable; Remarks: Foot path observed on landside slope.; Action: Fill and compact to reestablish levee cross section.

2020/07/22 08:25

Inspect ID: NLT3_2020_a_0020 **Title:** USACE_CESPN_NLT3_2020_a_0020_1.jpg **Rated Item:** 9. Cracking **Caption:** Rating: Minimally Acceptable; Remarks: Cracking observed in asphalt along this section.; Action: Repair as needed.

2020/07/22 08:26

Inspect ID: NLT3_2020_a_0020 **Title:** USACE_CESPN_NLT3_2020_a_0020_2.jpg **Rated Item:** 9. Cracking **Caption:** Rating: Minimally Acceptable; Remarks: Cracking observed in asphalt along this section.; Action: Repair as needed.

Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

	**Inspect ID:** NLT3_2020_a_0020 **Title:** USACE_CESPN_NLT3_2020_a_0020_3.jpg **Rated Item:** 9. Cracking **Caption:** Rating: Minimally Acceptable; Remarks: Cracking observed in asphalt along this section.; Action: Repair as needed.
	**Inspect ID:** NLT3_2020_a_0002 **Title:** USACE_CESPN_NLT3_2020_a_0002_1.jpg **Rated Item:** 10. Animal Control **Caption:** Rating: Minimally Acceptable; Remarks: Animal burrows where observed. Sponsor provided photos of animal control measure conducted. ; Action: Continue animal control measures; ; ; ;

 2020/07/22 07:55	**Inspect ID:** NLT3_2020_a_0002 **Title:** USACE_CESPN_NLT3_2020_a_0002_2.jpg **Rated Item:** 10. Animal Control **Caption:** Rating: Minimally Acceptable; Remarks: Animal burrows where observed. Sponsor provided photos of animal control measure conducted. ; Action: Continue animal control measures; ; ; ;
 2020/07/22 08:13	**Inspect ID:** NLT3_2020_a_0015 **Title:** USACE_CESPN_NLT3_2020_a_0015_1.jpg **Rated Item:** 10. Animal Control **Caption:** Rating: Minimally Acceptable; Remarks: Animal burrows observed on riverside slope; Action: Monitor the activity and implement animal control measures as necessary.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Vegetation and Obstructions	**A**	**A**	No obstructions, vegetation, debris, or sediment accumulation noted within interior drainage channels or blocking the culverts, inlets, or discharge areas. Concrete joints and weep holes are free of grass and weeds.	Vegetation was not blocking any of the IDS culvert.
		M	Obstructions, vegetation, debris, or sediment are minor and have not impaired channel flow capacity or blocked more than 10% of any culvert openings, but should be removed. A limited volume of grass and weeds may be present in concrete channel joints and weep holes.	
		U	Obstructions, vegetation, debris, or sediment have impaired the channel flow capacity or blocked more than 10% of a culvert opening. Sediment and debris removal required to re-establish flow capacity.	
2. Encroachments	**A**	**A**	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the interior drainage system.	No encroachments affect the IDS culverts.
		M	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
		U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of this component of the interior drainage system.	
3. Ponding Areas	**NA**	**A**	No trash, debris, structures, or other obstructions present within the ponding areas. Sediment deposits do not exceed 10% of capacity.	
		M	Trash, debris, excavations, structures, or other obstructions present, or inappropriate activities that will not inhibit operations and maintenance. Sediment deposits do not exceed 30% of capacity.	
		U	Trash, debris, excavations, structures, or other obstructions, or other encroachments or activities noted that will inhibit operations, maintenance, or emergency work. Sediment deposits exceeds 30% of capacity.	
		N/A	There are no ponding areas associated with the interior drainage system.	
4. Fencing and Gates[1]	**NA**	**A**	Fencing is in good condition and provides protection against falling or unauthorized access. Gates open and close freely, locks are in place, and there is little corrosion on metal parts.	
		M	Fencing or gates are damaged or corroded but appear to be maintainable. Locks may be missing or damaged.	
		U	Fencing and gates are damaged or corroded to the point that replacement is required, or potentially dangerous features are not secured.	
		N/A	There are no features noted that require safety fencing.	
5. Concrete Surfaces (Such as gate	**A**	**A**	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	NLT3_2020_a_0009: Station_1 NA: Concrete headwall in good condition.: No action required at this time. (A)

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Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
wells, outfalls, intakes, or culverts)		**M**	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
		U	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
		N/A	There are no concrete items in the interior drainage system.	
6. Tilting, Sliding or Settlement of Concrete and Sheet Pile Structures[2] (Such as gate wells, outfalls, intakes, or culverts)	**A**	**A**	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	No tilting, sliding or settlement of concrete floodwall was observed during PI.
		M	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
		U	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
		N/A	There are no concrete items in the interior drainage system.	
7. Foundation of Concrete Structures[3] (Such as culverts, inlet and discharge structures, or gatewells.)	**A**	**A**	No active erosion, scouring, or bank caving that might endanger the structure's stability.	No foundation concerns were observed during PI.
		M	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. The rate of erosion is such that the structure is expected to remain stabile until the next inspection.	
		U	Erosion or bank caving observed that may lead to structural instabilities before the next inspection.	
		N/A	There are no concrete items in the interior drainage system.	
8. Monolith Joints	**NA**	**A**	The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
		M	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
		U	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
		N/A	There are no monolith joints in the interior drainage system.	
9. Culverts/ Discharge Pipes[4]	**A**	**A**	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	NLT3_2020_a_0004: Station_1 NA: Station_2 NA: Concrete culvert through access ramp: No action required at this time. (A) NLT3_2020_a_0007: Station_1 NA: Station_2 NA: Culvert is in good condition. Slide gate is exercised annually.: Culvert is due for 5-year inspection by inspection season 2021. (A) NLT3_2020_a_0019: Station_1 NA: Station_2 NA: Concrete culvert passing through access ramp.: Monitor. (A)
		M	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		U	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
		N/A	There are no discharge pipes/ culverts.	
10. Sluice / Slide Gates[5]	**A**	**A**	Gates open and close freely to a tight seal or minor leakage. Gate operators are in good working condition and are properly maintained. Sill is free of sediment and other obstructions. Gates and lifters have been maintained and are free of corrosion. Documentation provided during the inspection.	NLT3_2020_a_0010: Station_1 NA: Slide gate is in good condition and functional. Sponsor exercises gate annually.: No action required at this time. (A)
		M	Gates and/or operators have been damaged or have minor corrosion, and open and close with resistance or binding. Leakage quantity is controllable, but maintenance is required. Sill is free of sediment and other obstructions.	
		U	Gates do not open or close and/or operators do not function. Gate, stem, lifter and/or guides may be damaged or have major corrosion.	
		N/A	There are no sluice/ slide gates.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
11. Flap Gates/ Flap Valves/ Pinch Valves[1]	**A**	**A**	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	NLT3_2020_a_0008: Station_1 NA: Flap gate is functional and in good condition, exercised annually.: No action required at this time. (A)
		M	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
		U	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
		N/A	There are no flap gates.	
12. Trash Racks (non-mechanical)	**NA**	**A**	Trash racks are fastened in place and properly maintained.	
		M	Trash racks are in place but are unfastened or have bent bars that allow debris to enter into the pipe or pump station, bars are corroded to the point that up to 10% of the sectional area may be lost. Repair or replacement is required.	
		U	Trash racks are missing or damaged to the extent that they are no longer functional and must be replaced. (For example, more than 10% of the sectional area may be lost.)	
		N/A	There are no trash racks, or they are covered in the pump stations section of the report.	
13. Other Metallic Items	**NA**	**A**	All metal parts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.	
		M	Corrosion seen on metallic parts appears to be maintainable.	
		U	Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.	
		N/A	There are no other significant metallic items.	
14. Riprap Revetments of Inlet/ Discharge Areas	**NA**	**A**	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	
		M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		U	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		N/A	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	
15. Revetments other than Riprap	**NA**	**A**	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
		M	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		U	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		N/A	There are no such revetments protecting this feature of the segment / system.	

[1] Proper operation of this item must be demonstrated during the inspection.

[2] The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

[3] Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

[4] The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

[5] Proper operation of the gates (full open and closed) must be demonstrated during the inspection if no documentation is available. Be aware of both manual and electrical operators.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems


2020/07/22 07:52

Inspect ID: NLT3_2020_a_0009 **Title:** USACE_CESPN_NLT3_2020_a_0009_1.jpg
Rated Item: 5. Concrete Surfaces (Such as gate wells, outfalls, intakes, or culverts)
Caption: Rating: Acceptable; Remarks: Concrete headwall in good condition.; Action: No action required at this time.


2020/07/22 07:40

Inspect ID: NLT3_2020_a_0004 **Title:** USACE_CESPN_NLT3_2020_a_0004_1.jpg
Rated Item: 9. Culverts/ Discharge Pipes **Caption:** Rating: Acceptable; Remarks: Concrete culvert through access ramp; Action: No action required at this time.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

	**Inspect ID:** NLT3_2020_a_0007 **Title:** USACE_CESPN_NLT3_2020_a_0007_1.jpg **Rated Item:** 9. Culverts/ Discharge Pipes **Caption:** Rating: Acceptable; Remarks: Culvert is in good condition. Slide gate is exercised annually.; Action: Culvert is due for 5-year inspection by inspection season 2021.
	**Inspect ID:** NLT3_2020_a_0019 **Title:** USACE_CESPN_NLT3_2020_a_0019_1.jpg **Rated Item:** 9. Culverts/ Discharge Pipes **Caption:** Rating: Acceptable; Remarks: Concrete culvert passing through access ramp.; Action: Monitor.

Interior Drainage System

For use during Initial and Continuing Eligibility Inspections of interior drainage systems

Inspect ID: NLT3_2020_a_0010 **Title:** USACE_CESPN_NLT3_2020_a_0010_1.jpg **Rated Item:** 10. Sluice/ Slide Gates **Caption:** Rating: Acceptable; Remarks: Slide gate is in good condition and functional. Sponsor exercises gate annually.; Action: No action required at this time.

Inspect ID: NLT3_2020_a_0008 **Title:** USACE_CESPN_NLT3_2020_a_0008_1.jpg **Rated Item:** 11. Flap Gates/ Flap Valves/ Pinch Valves **Caption:** Rating: Acceptable; Remarks: Flap gate is functional and in good condition, exercised annually.; Action: No action required at this time.

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

2020 Levee Inspection

Napa River
Tulocay to Imola, California
Pg. 1 of 3
Bank: Left

Legend

Point Features

Rating:

- 🔴 Unacceptable
- 🟡 Minimally Acceptable
- 🟢 Acceptable
- 🔵 N/A

Line Features

Rating:

- 🟥 Unacceptable
- 🟨 Minimally Acceptable
- 🟩 Acceptable
- 🟪 Centerline

0 55 110 220 330 440 Feet

N

US Army Corps of Engineers
Walla Walla District

CREATED BY: Nathan DeLannoy
LAST UPDATED BY: g4ecdnld
MAP ID: MXD_NLT3_DDP.mxd
DATE: 09/02/20
COORDINATE SYSTEM: GCS North American 1983
Datum: North American 1983

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2020 Levee Inspection

Napa River
Tulocay to Imola, California
Pg. 2 of 3
Bank: Left

Legend

Point Features

Rating:

- 🔴 Unacceptable
- 🟡 Minimally Acceptable
- 🟢 Acceptable
- 🔵 N/A

Line Features

Rating:

- 🟥 Unacceptable
- 🟨 Minimally Acceptable
- 🟩 Acceptable
- 🟪 Centerline

0 30 60 120 180 240 Feet

N

US Army Corps of Engineers
Walla Walla District

CREATED BY: Nathan DeLannoy
LAST UPDATED BY: g4ecdnld
MAP ID: MXD_NLT3_DDP.mxd
DATE: 09/02/20
COORDINATE SYSTEM: GCS North American 1983
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

2020 Levee Inspection

Napa River
Tulocay to Imola, California
Pg. 3 of 3
Bank: Left

Legend

Point Features

Rating:

- 🔴 Unacceptable
- 🟡 Minimally Acceptable
- 🟢 Acceptable
- 🔵 N/A

Line Features

Rating:

- 🟥 Unacceptable
- 🟨 Minimally Acceptable
- 🟩 Acceptable
- 🟪 Centerline

0 30 60 120 180 240 Feet

N

US Army Corps of Engineers
Walla Walla District

CREATED BY: Nathan DeLannoy
LAST UPDATED BY: g4ecdnld
MAP ID: MXD_NLT3_DDP.mxd
DATE: 09/02/20
COORDINATE SYSTEM: GCS North American 1983
Datum: North American 1983

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Appendix C

2005 Geotechnical Design Documentation Report

Napa River/Napa Creek Flood Protection Project

Napa, California

Contract 2 East

Geotechnical Design Document Report

Submitted by:

U.S. Army Corps of Engineers

Sacramento District

Updated February 2014

TABLE OF CONTENTS

1. Introduction…………………………………………………………………….1
2. Project Features…………………………………………………………………1
3. Vertical Datum…………………………………………………………………..2
4. Floodplain and Marshplain Terrace Excavation…………………………………..2
5. New Levee Construction…………………………………………………………..2
    5.1. Imola Levee………………………………………………………………2
    5.2. Duden/NSD Levee…………………………………………………………..4
    5.3. Old Nord Vineyard Levee…………………………………………………..5
6. Drainage Structures Through the Imola Levee……………………………………6
    6.1. Imola Drainage Structure…………………………………………………..6
    6.2. Caltrans Drainage Structure………………………………………………..6
7. Dredge Disposal Dike……………………………………………………………7
8. New Tulocay Creek Levee Raising………………………………………………..8
    8.1. South Levee………………………………………………………………8
    8.2. North Levee……………………………………………………………….10
9. Freeboard Berm…………………………………………………………………..10
10. Floodwall Construction…………………………………………………………10
    10.1. Explorations/Soil Conditions…………………………………………….11
    10.2. Slope Stability……………………………………………………………11
    10.3 Seepage…………………………………………………………………11
    10.4 Other Analyses…………………………………………………………11
11. Drainage Structures Through the Floodwall…………………………………….11
12. Pedestrian Bridge Across New Tulocay Creek…………………………………..11
13. Recreation/Maintenance Trail…………………………………………………12
14. References………………………………………………………………………..12

LIST OF TABLES

Table 1. Slope Stability Material Properties, Imola Levee
Table 2. Results of Slope Stability Analysis - Imola Levee
Table 3. Slope Stability Material Properties, Dredge Disposal Dike
Table 4. Results of Slope Stability Analysis - Dredge Disposal Dike
Table 5. Slope Stability Material Properties, New Tulocay Creek South Levee
Table 6. Results of Slope Stability Analysis – New Tulocay Creek South Levee

LIST OF FIGURES

Figure 1. General Map of Contract 2 East
Figure 2. Contract 2 East Areas
Figure 3. Project Features, Duden and NSD Areas
Figure 4. Project Features, NSD, Old Nord Vineyard, and HTRW Cleanup Areas
Figure 5. Project Features, HTRW Cleanup and Northern Areas

LIST OF ENCLOSURES

Enclosure 1. Imola Levee Plan, Soil Boring Logs, and Slope Stability Models
Enclosure 2. Duden-NSD Levee Plan and Soil Boring Logs
Enclosure 3. Old Nord Vineyard Levee Plan and Soil Boring Logs
Enclosure 4. Dredge Disposal Dike Plan, Soil Boring Logs, and Slope Stability Models
Enclosure 5. New Tulocay Creek Levee Plan, Soil Boring Logs, and Slope Stability Models
Enclosure 6. Freeboard Berm Plan
Enclosure 7. Floodwall (Unconstructed) Layout and Soil Boring Logs

NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
NAPA, CALIFORNIA

GEOTECHNICAL DESIGN DOCUMENT REPORT
CONTRACT 2 EAST

1. Introduction. The Napa River/Napa Creek Flood Protection Project is a multi-year, multi-phase project to provide 100-year flood protection to the city of Napa. The downstream (south of Imola Avenue) project phases (Contracts 1A and 1B) will not provide FEMA 100-year certification. The upstream (north of Imola Avenue) phases (Contracts 2 East, 2 West, 3, and 4) are intended to provide FEMA 100-year certification. This document outlines the geotechnical considerations for the design of the Contract 2 East project features.

2. Project Features. The Contract 2 east area is on the left (east) side of the Napa River and extends from Old Tulocay Creek on the south (downstream) to Third Street on the north (upstream) (Figure 1). From downstream to upstream the contract area may be subdivided into the Duden area (Old Tulocay Creek to Imola Ave.), the NSD area (Imola Avenue to New Tulocay Creek), the old Nord vineyard (New Tulocay Creek upstream approximately 700 feet), the HTRW cleanup area (up to the former Sixth Street), and the northern area (Sixth Street to Third Street); see Figure 2. The project features consist of:

a. Excavation of floodplain and marshplain terraces (entire Contract 2 east area)
b. New levee construction (Duden, NSD, and Nord Vineyard areas)
c. Levee raising (New Tulocay Creek levees)
d. Dredge material disposal dike (NSD area)
e. Freeboard berm (northern area)
f. Drainage structures for interior drainage under the levee (Duden area)
g. Recreation/maintenance trail construction (entire Contract 2 East area)
h. Floodwall construction (Nord Vineyard, HTRW cleanup, and northern areas)
i. Drainage structures for interior drainage under the floodwall (HTRW cleanup area)
j. Pedestrian bridge over New Tulocay Creek

Not all of the Contract 2 East area features have been constructed as of this document update. The constructed and unconstructed project features are shown on Figures 3 through 5. Items a through e above are complete. Only one of the two planned drainage structures in item f above has been constructed; the other structure cannot be built until the upstream floodwalls have been built to prevent negative impacts to interior drainage. The recreation/maintenance trail (item g) has been constructed on most of the levee crests in the contract area. Items h through j have not been constructed.

3. Vertical Datum. All elevations referenced in this report are in the NGVD 29 vertical datum. The Contract 2 East features were designed and constructed before the project was converted to the NAVD 88 vertical datum.

4. Floodplain and Marshplain Terrace Excavation. The marshplain and floodplain terraces are areas on the waterside of the project levees and (unconstructed) floodwalls where the ground surface has been excavated (lowered) from the pre-project natural ground surface. These features are intended to increase the river flow capacity to reduce the water level in more heavily developed upstream portions of the city. These areas also provide habitat for plants and animals. Depending on location, the marshplain terrace is between elevation 0 and 1 foot NGVD and between 150 and 500 feet wide. The marshplain terrace is inundated during high tides and exposed during low tides. The floodplain terrace elevation is between 5 and 6 feet NGVD and the width is between 100 and 350 feet, depending on location. The floodplain terrace is only inundated during flood events. The transition slopes between the marshplain and the floodplain terraces and between the floodplain terrace and natural ground are 3H:1V. The slope from natural ground down to the floodplain terrace is generally 20 feet from the waterside toe of the project levees and (unconstructed) floodwalls. Terrace excavation in the HTRW cleanup area and most of the old Nord Vineyard area was completed by the HTRW cleanup contractor, Montgomery Watson Harza (MWH), in 2002-2003. The remaining terrace excavation was completed by the Contract 2 East construction contractors in 2004-2005. The 3H:1V marshplain to floodplain terrace slope excavation completed by MWH eroded to a near vertical slope less than a year after construction due to wavewash from passing boats and a delay in awarding of a separate erosion control planting contract. To prevent this erosion at other parts of the Contract 2 East area, rock riprap was placed on the lower half of this slope upstream of Sixth Street. In the NSD and Duden areas, the slope was reduced to 4H:1V.

5. New Levee Construction. The new levees will have 15-foot wide crests and 3H:1V sideslopes. The levee heights are given in the individual levee discussions. Fill material for the levees will come from the project floodplain terrace excavation. Inspection trenches will be excavated prior to levee construction. The inspection trenches will be 12 feet wide, have 1H:1V sideslopes, and will center on the centerline of the levee. For levees less than 6 feet high, the depth of the inspection trench will be the height of the levee. For levees greater than 6 feet high, the inspection trench will be 6 feet deep. The purpose of the inspection trench is to remove any near-surface debris (including old abandoned utilities) and to document near-surface foundation conditions over the entire levee alignment.

5.1. Imola Levee. This levee runs parallel to and just south of Imola Avenue. This levee will protect Imola Avenue from flooding by Old Tulocay Creek. The levee is 1,467 feet long and is 4 to 9 feet tall. The upstream (east) end of this levee ties into high ground west of Soscol Avenue. The downstream (west) end of this levee ties into an existing railroad embankment. The levee plan, soil boring logs, and slope stability models are in Enclosure 1.

5.1.1. Explorations/Soil Conditions. Explorations along and near the levee alignment are (from downstream to upstream) 2F-00-38, 2F-98-1, CPT-99-1, 2F-99-1, 2F-99-6, and 2F-99-7. With the exception of boring 2F-00-38, the soils consist of lean clays, fat clays, and sandy clays to a minimum of 22 feet below ground surface, underlain by clayey sand and gravel layers with a fines content between 10 and 44 percent. Boring 2F-00-38 has a 1.5-foot thick clayey gravel with sand layer at the ground surface. This boring was drilled through a pre-project unpaved access road.

5.1.2. Slope Stability. During design a slope stability analysis was conducted at levee station 9+00. This station was chosen because the levee is at the maximum height of 9 feet. The subsurface soil profile was based on soil boring 2F-99-07 and consists of alternating layers of lean and fat clay to elevation -11 feet (16 feet below ground surface). End of construction, steady state seepage, and rapid drawdown analyses were conducted using the material properties listed in Table 1. The analysis results are shown in Table2. The factors of safety meet the minimum Corps criteria.

Table 1. Slope Stability Material Properties, Imola Levee

Soil Type	**Unit Weight (pcf)**	**Q-Strength C (psf)**	**Q-Strength Phi (deg)**	**C' (psf)**	**Phi' (deg)**	**C (psf)**	**Phi (deg)**
New Levee Fill	125	1400	0	100	31	300	15
CL Foundation	120	1200	0	50	30	300	15
CH Foundation	115	600	0	25	27	250	10

Table 2. Results of Slope Stability Analysis – Imola Levee

Analysis	**Computed F.S.**	**Corps Minimum F.S.**
End of Construction	4.723	1.3
Steady State	1.710	1.4
Rapid Drawdown	1.582	1.0 to 1.2

5.1.3. Seepage. No underseepage analysis was conducted for this levee during design. The (semi-)pervious subsurface layers are at least 22 feet below ground surface, and the maximum levee height is 9 feet. Since the blanket layer thickness is more than twice the levee height, underseepage was not considered be a problem during design. The clayey gravel with sand layer at the surface of Boring 2F-00-38 is a gravel access road. The gravel access road will be removed during construction, and any remaining semi-pervious material will be cut off by the levee inspection trench. Underseepage analysis was done for the LRR using blanket theory with the water surface at the levee crest at levee station 12+00 resulted in an exit gradient of 0.01, confirming that underseepage is not a problem for this levee.

5.1.4. Settlement. Settlement analysis was conducted in accordance with EM 1110-2-1904, Settlement Analysis. As stated in the SGDM, the insitu clay soils at Napa are overconsolidated. The added surcharge from the levee results in soil pressures less than the preconsolidation pressure (σ_p'), so the coefficient of recompression C_r (average slope of the recompression line) instead of the coefficient of consolidation C_c (average slope of the virgin consolidation curve) is used to calculate consolidation settlement. Consolidation data for the Contract 2 East area is given on Plate 66 of the Geotechnical Appendix to the SGDM. Figure 6 of Chapter 4 of NAVFAC 7.01, Soil Mechanics, was used to determine the stress increase at depth for the consolidation calculation. Calculations were done for levee heights of 6 feet and 9 feet. A clay thickness of 30 feet was used, with the ground water table at 10 feet depth. Foundation consolidation settlement was calculated as 0.07 inch for a 6-foot tall levee and 0.11 inch for a 9-foot tall levee. Secondary compression could not be calculated as time-rate histories were not provided for the consolidation tests. The Perloff Approximation was used to calculate immediate settlement. Immediate settlement was calculated as 1.5 inches for a 6-foot tall levee and 2.86 inches for a 9-foot tall levee.

5.1.5. Drainage swale. A drainage swale will be excavated 8 feet from the landside toe of the levee. The swale will be a maximum of 3 feet deep. Surface runoff from the north side of Imola Avenue is directed under Imola through a culvert in the vicinity of the Animal Shelter access road. The swale will convey this water as well as surface runoff between the Imola Levee and Imola Avenue. Drainage swales and ditches are generally not recommended near the landside toes of levees because they reduce the thickness of the impervious blanket layer, increasing the likelihood of underseepage related distress occurring during flood events. In this case, explorations show the only (semi-)pervious sand and gravel layers are a minimum of 22 feet below ground surface, and the levee is only 4-9 feet tall. Given that the blanket layer thickness is more than 2 times the maximum height of the levee, this drainage swale will not negatively impact the levee.

5.2. Duden-NSD Levee. This levee goes from the right (north) bank of Old Tulocay Creek across the Duden and NSD properties to the left (south) bank of New Tulocay Creek. The levee is 2,446 feet long with a design height above the landside toe of 1 to 5 feet. The upstream (north) end of this levee ties into the levee on the left (south) bank of New Tulocay Creek. The downstream (south) end of this levee ties into an existing railroad embankment. The levee plan and soil boring logs are in Enclosure 2.

The levee alignment cut across a pile of dredged material at it’s upstream end. The top of levee is lower than the top of the dredge material pile. Explorations of the dredge material indicate it is unsuitable for levee construction (less than 5 percent nonplastic fines), and it was not compacted during placement. Therefore the dredged material pile will be removed prior to levee construction, and the dredge material will be used to construct a ring dike around a new dredge material disposal area on the landside of the NSD levee.

During construction, some soil excavated from the marshplain and floodplain terraces was placed on the landside of the NSD levee between Imola Avenue and the dredge disposal dike. In this area, the top of the landside fill is equal to or higher than the levee crest elevation.

5.2.1. Explorations/Soil Conditions. Explorations were conducted along and near the levee alignment (from downstream to upstream) 2F-01-42, 4B-01-22, CPT-97-1, 2F-00-11 through 2F-00-13, 4B-01-20, 2F-00-14, 2F-94-11, and 2F-00-15. The explorations show the in-situ soils (not the dredged material) consist of a blanket layer of lean and fat clays and sandy clays between 8.5 and 42 feet thick, overlying clayey sand and gravel layers with 5 to 45 percent fines. At locations where the blanket layer is less than 20 feet thick, the fines content of the pervious (or semi-pervious) layer is greater than 30 percent.

5.2.2. Slope Stability. Limited slope stability analysis (end of construction, long-term with no flood, and rapid drawdown) was conducted for the SGDM. No slope stability analysis was conducted during design due to the short (in height) embankment and the similarity of the crest width, sideslopes, and subsurface conditions to the Imola Levee. No slope stability analysis was conducted for the LRR because the levee is less than 5 feet tall.

5.2.3. Seepage. No underseepage analysis was conducted for this levee during design. Most of the soil borings indicate the presence of a very thick blanket layer, and locations with the thinnest blanket layer have a semi-pervious layer (fines content greater than 30 percent) instead of a pervious layer under the blanket, indicating exit gradients are likely to be low. In addition, this is a short levee in design height (1-5 feet), and the placement of landside fill against the levee has made the landside elevation equal to or higher than the levee crest elevation over much of the levee alignment. No underseepage analysis was conducted for this levee for the LRR due to the levee geometry and soil conditions.

5.2.4. Settlement. See settlement for the Imola Levee, paragraph 4.1.4.

5.3. Old Nord Vineyard Levee. This levee goes from the right (north) bank of New Tulocay Creek partly across the Old Nord Vineyard property, where it will transition into a floodwall at it's upstream (north) end. The downstream (south) end ties into the levee on the right (north) bank of New Tulocay Creek. The levee is 727 feet long and 4 to 6 feet tall. The levee plan and soil boring logs are in Enclosure 3.

5.3.1. Explorations/Soil Conditions. Explorations were conducted along and near the levee alignment (from downstream to upstream) 2F-00-16, 2F-94-12, 2F-00-18, and BH-2. Explorations show the foundation soils to a minimum depth of 20 feet consist mostly of lean clay and sandy lean clay, with occasional zones of fat clay and silty or clayey sand (24-42 percent fines).

5.3.2. Slope Stability. Limited slope stability analysis (end of construction, long-term with no flood, and rapid drawdown) was conducted for the SGDM. No slope stability analysis was conducted during design due to the short levee height and the similarity of the crest width, sideslopes, and subsurface conditions to the Imola Levee. No slope stability analysis was conducted for the LRR because the levee is less than 5 feet tall over most of it's length.

5.3.3. Seepage. No underseepage analysis was conducted for this levee during design. Explorations showed no pervious foundation soils. A semi-pervious zone of clayey sand (28 percent fines) exists in boring 2F-00-18 between 2.5 and 4.5 feet below ground surface. This zone will be cut off by the inspection trench underneath the levee. No underseepage analysis was conducted during the LRR due to the short height of the levee and the lack of pervious soils in the foundation.

5.3.4. Settlement. See settlement for the Imola Levee, paragraph 4.1.4.

6. Drainage Structures Through the Imola Levee.

6.1. Imola Drainage Structure. The early design called for one gravity drainage pipe going through the Imola levee near it's upstream end. Runoff from a shopping center on the north side of Imola Avenue is collected and conveyed under the road by a culvert. The culvert empties on the south side of Imola Avenue, where a small channel conveys the drainage into Old Tulocay Creek. With the levee in place, the drainage culvert would have to continue to the south through the levee and outlet on the waterside of the levee.

In the pre-project condition, the Napa River would overtop in the oxbow bend upstream of the Contract 2 East area. That floodwater flowed from north to south and flowed into both Old and New Tulocay Creeks. Hydraulic analysis showed that building the Imola drainage structure prior to building the upstream floodwalls would reduce the ability of surface drainage water to enter Old Tulocay Creek and would increase the depth of this water relative to the pre-project condition, effectively inducing flooding. Temporarily inducing flooding in a developed urban area is not acceptable practice, so the decision was made to not construct the gravity drainage structure until after the upstream floodwalls were constructed. A “hole” was left in the Imola levee between levee stations 9+60 and 12+25 for future construction of this drainage structure.

6.2. Caltrans Drainage Structure. The City of Napa was replacing the Imola Avenue bridge across the Napa River at the same time as the Imola levee was being constructed. During construction it became apparent that the fill for the approach to the new bridge would be closer to the Imola levee than what was assumed during levee design. After discussions between all the impacted parties, the decision was made to construct an additional gravity drainage structure through the Imola levee near it's downstream end, just east of the existing railroad track. This structure was designed by the bridge contractor and reviewed/approved by the Corps of Engineers. The design is a standard gravity drainage through a levee with a 48-inch concrete culvert through the levee, a flapgate at the waterside outlet, and a concrete riser structure with a metal sluice gate in the levee crest near the waterside hinge. This structure was built by the bridge contractor with construction oversight by Corps construction personnel.

7. Dredge Disposal Dike. The Napa River up to Third Street is periodically dredged by the Corps of Engineers, San Francisco District. In the past, dredge tailings were deposited at a location between Hartle Court and New Tulocay Creek. Over the years, some of the dredge tailings have been removed and used as fill for local construction projects. In 2001, three test pits were excavated into the tailings as part of a borrow site evaluation. Laboratory testing indicated the dredge tailings are not suitable for flood control levee construction because they contain less than 5 percent nonplastic fines. The NSD levee cuts across the pre-project dredge material disposal facility. As part of the 2 East NSD contract, the remaining dredge tailings will be excavated. Some of the excavated material will be used to construct a ring dike to enclose future dredge tailings (called the dredge disposal dike) on the landside of the NSD levee just south of New Tulocay Creek. The remaining excavated material will be placed in the Ghisletta disposal site on the opposite side of the Napa River. The dredge disposal dike will be filled in over time with future dredge tailings. The dredge disposal dike will be a maximum of 16 feet tall on the inside and 12 feet tall on the outside, with a crest width of 12 feet. The inside slope will be 2H:1V and the outside slope will be 2.5H:1V. The dike plan, soil boring logs, and slope stability models are in Enclosure 4.

7.1. Seepage. No seepage analysis was conducted for this dike because it is not a flood protection feature.

7.2. Slope Stability. End of construction and long term slope stability analyses were conducted on the taller, steeper inside slope. A long-term slope stability analysis assuming the dike had been partially filled with dredge tailings with a high water content was conducted on the outside slope. These analyses were conducted at dike station 4+00 because that is the location of the maximum dike height (both inside and outside). The subsurface soil profile was developed from boring 2F-00-14 and consists of lean clay to elevation -1 foot overlying 8 feet of clayey sand. Material properties used in the analysis are listed in Table 3. Factors of Safety compared to Corps minimum criteria for levees are listed in Table 4. The dike meets applicable Corps levee criteria.

Table 3. Slope Stability Material Properties, Dredge Disposal Dike

Soil Type	Unit Weight (pcf)	Q-Strength C (psf)	Q-Strength Phi (deg)	C’ (psf)	Phi’ (deg)
Dike Fill	125	0	34	0	34
CL Foundation	120	1200	0	50	30
SC Foundation	120	250	20	25	29

Table 4. Results of Slope Stability Analysis - Dredge Disposal Dike

Condition	F.S. (Calculated)	F.S. (Minimum)
End of Construction, Inside Slope	1.521	1.3*
Long Term, Inside Slope	1.521	None listed
Partly Filled, Outside Slope	1.462	1.4*

*Levee Criteria

7.3. Settlement. No settlement analysis was conducted because this dike is not a flood control feature and eventually it will be filled in with dredge tailings, so minor variations in dike height are not critical.

8. New Tulocay Creek Levee Raising. The existing levees along New Tulocay Creek were constructed by the Soil Conservation Service (now Natural Resources Conservation Service or NRCS) in the 1950's. The levees will be raised a maximum of one foot for the flood protection project. The raise will be carried out upstream of a proposed pedestrian bridge to be constructed just downstream of the existing Napa Valley Wine Train bridge. In the late 1990's, the NRCS extensively planted both levees with trees and bushes as mitigation for one of their projects. By the time of Contract 2 East construction, the vegetation was well established. Fill material for the raise will come from the project floodplain terrace excavation. Levee plans and soil boring logs for both levees and slope stability models for the south levee are in Enclosure 5.

8.1. South Levee. The south levee is about1,500 lineal feet long and has a crest width of 14 to 20 feet, waterside slope between 1.7H:1V and 2.2H:1V, landside slope between 1.6H:1V and 2H:1V, and a height between 1 and 8 feet above the landside toe. In general, the levee height increases, the crest width increases, and the sideslopes get steeper moving downstream. There is no waterside bench or landside toe drainage ditch. The creek bottom is about 10 to 14 feet below the levee crest. Because the levee raise is only 1 foot maximum and the crest width is 14 to 20 feet and New Tulocay Creek is a minor tributary, the raise was conducted by simply adding material to the existing levee crest. Slope stability analysis was conducted for that situation (see subsequent paragraphs). The vegetation above the landside toe elevation was cleared and grubbed during construction; however, trees have grown back in the levee since construction.

8.1.1. Explorations/Soil Conditions. SPT borings (2F-00-15, 2F-00-19 to –22) to a depth of 30 feet below the crest were drilled every 350 to 550 feet along the levee. The levee soils consist mostly of lean clay and sandy lean clay, except at the location boring 2F-00-20 (located at levee station 7+50), where the levee consists of clayey sand and gravel with 34 percent fines. The foundation soils consist mostly of clays except at the location of boring 2F-00-21 (levee station 10+90), where the foundation soils consist of an 8 foot thick blanket of lean clay and silt overlying 10 feet of clayey sand and gravel with a fines content of 15-20 percent.

8.1.2. Seepage. No seepage analysis was conducted for this levee raise. The only pervious or semi-pervious foundation soils are clayey sands and gravel in boring 2F-00-21 with 15-20 percent fines. This boring was drilled in the upstream portion of the levee, where the levee is only 3 feet above the landside toe. Even with a 1 foot raise, the differential head across the levee at the design water surface (2 feet below the raised crest) will only be 2 feet, and the blanket layer is 8 feet thick at this location. Seepage is not expected to be a problem for the raised levee.

8.1.3. Slope Stability. Slope stability analysis was conducted for the south levee at the location of boring 2F-00-20 (levee station 7+50). This location was chosen because the pre-project levee height above the landside toe (7 feet) is close to the maximum height of 8 feet and the existing levee soils consist of clayey sands and gravels, which is unusual for the Napa project. The end-of-construction case was not analyzed. The new loading imposed by the raise, a maximum of 125 pcf, is not sufficient to develop the undrained shear strengths of the levee and foundation soils. Steady state seepage and rapid drawdown analyses were conducted using the shear strengths shown in Table 5. Slope stability results are shown on Table 6. Factors of safety are above Corps minimum criteria.

Table 5. Slope Stability Material Properties, New Tulocay Creek South Levee

Soil Type	**Unit Weight (pcf)**	**C' (psf)**	**Phi' (deg)**	**C (psf)**	**Phi (deg)**
New Levee Fill	125	100	31	300	15
GC/SC Levee Fill	120	25	29	250	13
CL Foundation	120	50	30	300	15

Table 6. Results of Slope Stability Analysis – New Tulocay Creek South Levee

Analysis	**Computed F.S.**	**Corps Minimum F.S.**
Steady State	1.454	1.4
Rapid Drawdown	1.288	1.0 to 1.2

8.1.4. Settlement. A settlement analysis was not conducted for this levee raise. The levee is only being raised a maximum of 1 foot, the levee was originally built in the 1950's or 1960's so the foundation has already consolidated under the original levee loading, and the insitu clay soils in the Napa project area are overconsolidated. With the small additional loading, settlement will be negligible.

8.2. North Levee. The north levee is about 1,500 lineal feet long and has a crest width of 12 to 18 feet, waterside slope between 1.5H:1V and 3H:1V, landside slope between 2H:1V and 3H:1V, and a height between 1 and 7 feet above the landside toe. In general, the levee height increases, the crest width decreases, and the sideslopes get steeper moving downstream. There is no waterside bench or landside toe drainage ditch. The creek bottom is about 10 to 14 feet below the levee crest. During large storms, the east side of the Napa River first overtops at the oxbow bend, which is located upstream of the Contract 2 East area. Overtopped floodwater, as well as excess interior drainage water, flows to the south. Some of this water flows into New Tulocay Creek through a "hole" in the north levee, approximately 75 lineal feet long. The authorized flood protection project includes an interior drainage structure and pump station at the location of the "hole" through this levee to drain this area. However, the interior drainage structure and pump station cannot be built until the floodwalls within the Contract 2 East area and along the oxbow bend are constructed to avoid inducing flooding.

8.2.1. Explorations/Soil Conditions. Explorations 2F-00-16, 2F-00-26, 2F-00-25, 2F-00-24, and 2F-00-23, from downstream to upstream, were drilled to a depth of 30 feet through the levee crest. These explorations show the levee is primarily lean clay and sandy lean clay, although there is a thin clayey gravel with sand layer in boring 2F-00-24. The foundation soils consist primarily of lean and fat clays, although there are clayey sand and gravel layers with fines contents between 15 and 45 percent in three of the explorations.

8.2.2. Design. The raise of this levee has not been designed or constructed. This levee was not included in the LRR.

9. Freeboard Berm. A freeboard berm was constructed immediately south (downstream) of Third Street. This berm will only have a differential head across it during floods in excess of the project design flood. The freeboard berm varies from 0.5 to 2.6 feet tall and is approximately 480 feet long. The freeboard berm is triangular shaped with a width of 90 feet at the upstream end, decreasing to <1 foot wide at the downstream end. The sideslopes are 3H:1V. The freeboard berm is surrounded by Third Street on the north (upstream) side, Soscol Avenue on the east side, and the Napa River on the west side. A plan of the freeboard berm is in Enclosure 6. No seepage, slope stability, or settlement analysis was conducted for the freeboard berm due to it's low height. The upstream end of the Contract 2 East floodwall will tie into the downstream end of the freeboard berm. The City of Napa has constructed a small park on top of the freeboard berm. Park features were mostly constructed on the eastern half of the freeboard berm, away from the Napa River bank, to allow for future inspection of the freeboard berm near the Napa River.

10. Floodwall Construction. A floodwall will extend from the upstream end of the Old Nord Vineyard Levee on the south (downstream) to the freeboard berm south of Third Street at the north (upstream) end. The floodwall will be about 4,000 lineal feet long and between 2 and 7 feet tall above ground surface. It is expected that the floodwall will be a T-type concrete floodwall with a shallow footing. The floodwall layout and soil boring logs are in Enclosure 7. The floodwall layout is expected to be along the existing haul road shown on the plan sheets. The haul road was constructed by the HTRW cleanup contractor.

10.1. Explorations/Subsurface Conditions. Explorations along and near the floodwall alignment are, from downstream to upstream, BH-2, BH-1, 2F-00-27, 2F-00-28, 2F-00-29, 2F-00-30, 2F-00-32, 2F-00-33, and 2F-00-34. These borings show lean and fat clays, sandy clays, and sandy silts at least 16 feet thick, overlying clayey sands and silty sands with 14-42 percent fines, except for boring 2F-00-27, which shows almost entirely clayey sands and gravels with 14-50 percent fines.

10.2. Slope Stability. The floodwalls in the Contract 2 East area have not been designed and constructed. Limited slope stability analysis (end of construction, long-term with no flood, and rapid drawdown) was conducted for the SGDM; because the flood protection feature is a floodwall and not a levee, the slope stability analysis was looking at the slope down from natural ground to the floodplain terrace, located on the waterside of the floodwall, and not the floodwall itself. No sections were analyzed for slope stability during the LRR because the flood protection feature is a floodwall and not a levee.

10.3. Seepage. Two seepage analyses were conducted for the floodwall during the LRR; Napa River station 750+00 and Napa River station 764+25. The exit gradient at station 750+00 at the design water surface was 0.07. Geotechnical explorations near station 764+25 indicate the presence of gravelly fill, resulting in a high exit gradient at the landside floodwall toe despite the short floodwall height of 4 feet at this location. Remediation alternatives proposed in the LRR are a 10-15 foot deep cutoff wall, excavation and replacement of the gravel fill, and a several-feet-deep key below the landside floodwall toe. Remediation options for the portion of the floodwall between Napa River stations 762+20 and 782+50 should be evaluated during the design of the floodwall.

10.4. Other Analyses. Settlement, bearing capacity, sliding stability, and overturning stability analysis of the proposed floodwall should be conducted during design.

11. Drainage Structures Through the Floodwall. There are several existing storm drains that cross the alignment of the floodwall and empty into the Napa River. When the floodwall is constructed those storm drains will be modified to meet Corps criteria, including having flapgates and the outlets and riser structures with sluice gates along the floodwall alignment. These project features have not been designed or constructed.

12. Pedestrian Bridge Across New Tulocay Creek. This project feature will likely be designed and constructed by the project sponsor under an encroachment permit reviewed and approved by the Corps of Engineers, San Francisco District.

13. Recreation/Maintenance Trail. The recreation/maintenance trail is a 12-foot wide, asphalt-paved trail on the levee crests and on the landside of the floodwall. Because the only vehicular traffic on the trail will be occasional pickup trucks for inspection and maintenance, the asphalt is 2 inches thick and the underlying aggregate base course is four inches thick. The trail has been constructed over most of the Duden/NSD levees; the upstream end of the NSD levee was left unpaved because the plan during design was that the pedestrian bridge across New Tulocay Creek would be built within a couple of years, and the design team did not want to spend money on pavement that would be ripped up by construction in a few years. The Old Nord Vineyard Levee was also left unpaved because it was believed during design that both the upstream and downstream ends of that levee would be disturbed in a few years by construction of the floodwall and the pedestrian bridge over New Tulocay Creek respectively. The Imola levee is not part of the recreation trail and that levee is covered by aggregate surface course.

14. References.

Naval Facilities Engineering Command (NAVFAC), Design Manual 7.01, Soil Mechanics, 1 September 1986.

U.S. Army Corps of Engineers, Headquarters. EM 1110-1-1904, Settlement Analysis, 30 September 1990

U.S. Army Corps of Engineers, Headquarters. EM 1110-2-1913, Design and Construction of Levees, 30 April 2000.

U.S. Army Corps of Engineers, Sacramento District. Napa River/Napa Creek Flood Protection Project, Final Supplemental General Design Memorandum (SGDM), October 1998.

U.S. Army Corps of Engineers, Sacramento District. Napa River/Napa Creek Flood Protection Project, Limited Reevaluation Report (LRR), Geotechnical Appendix, 26 April 2011.

FIGURES

Figure 1. General Map of Contract 2 East

Figure 2. Contract 2 East Areas

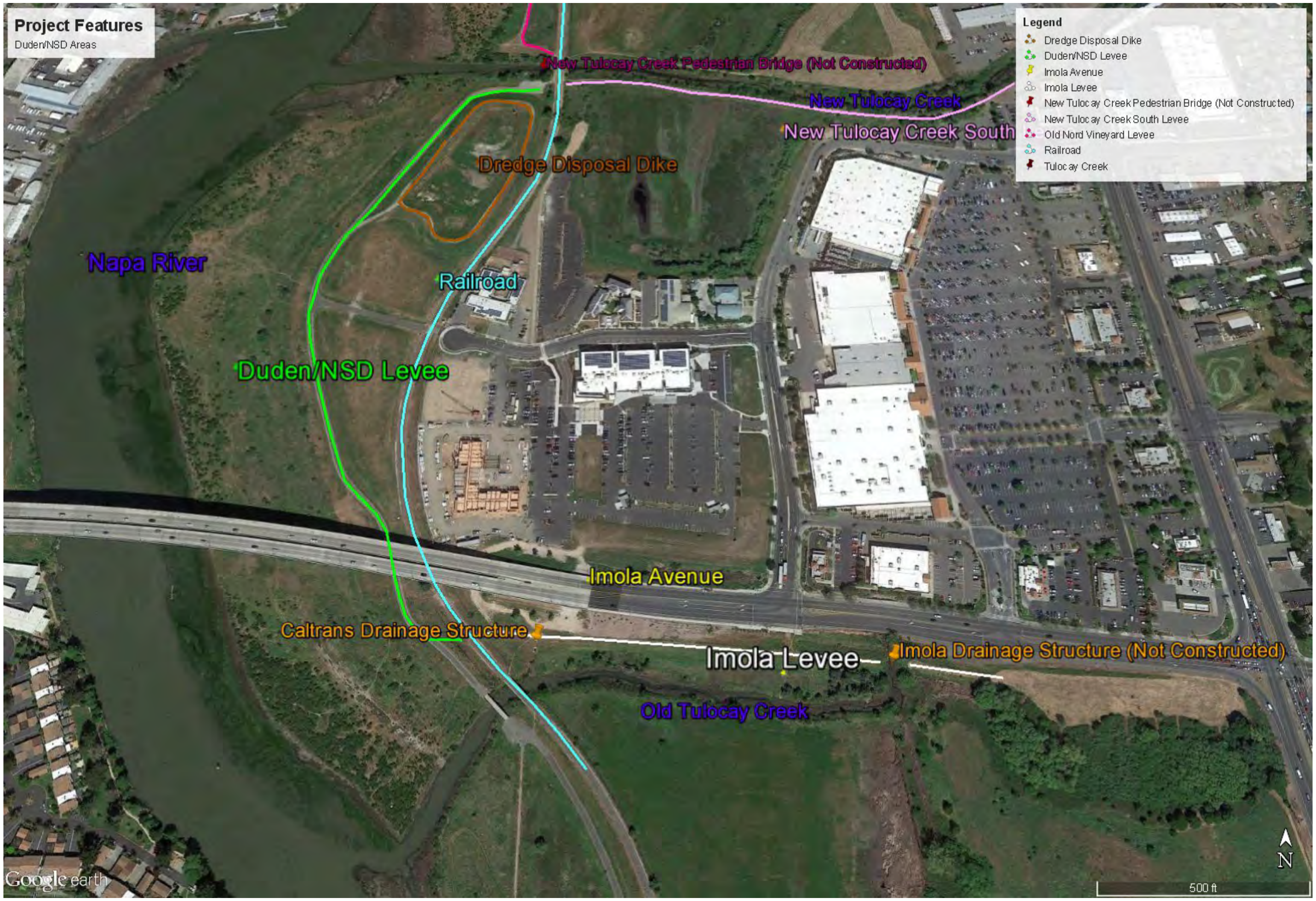


Figure 3. Project Features, Duden and NSD Areas

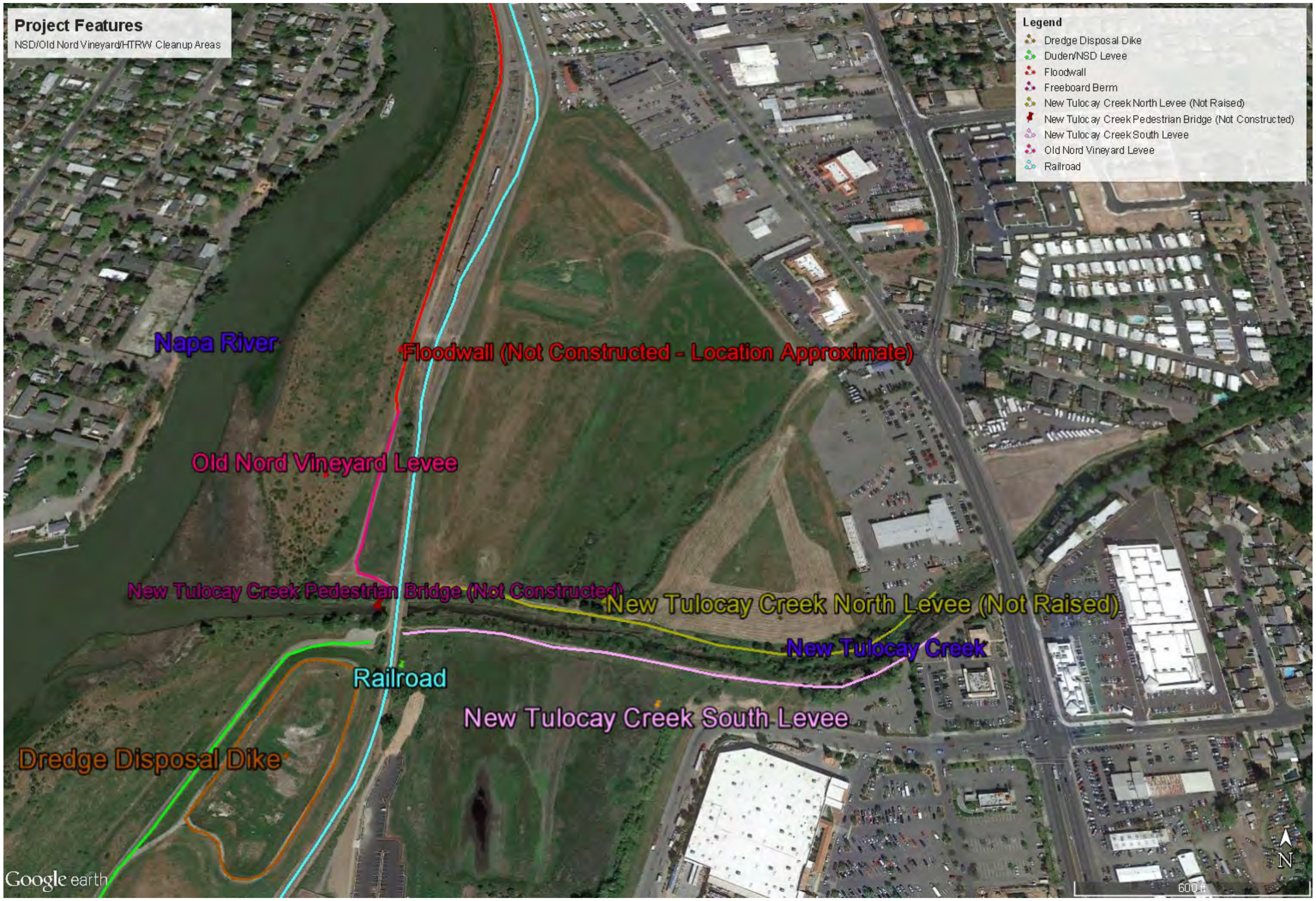
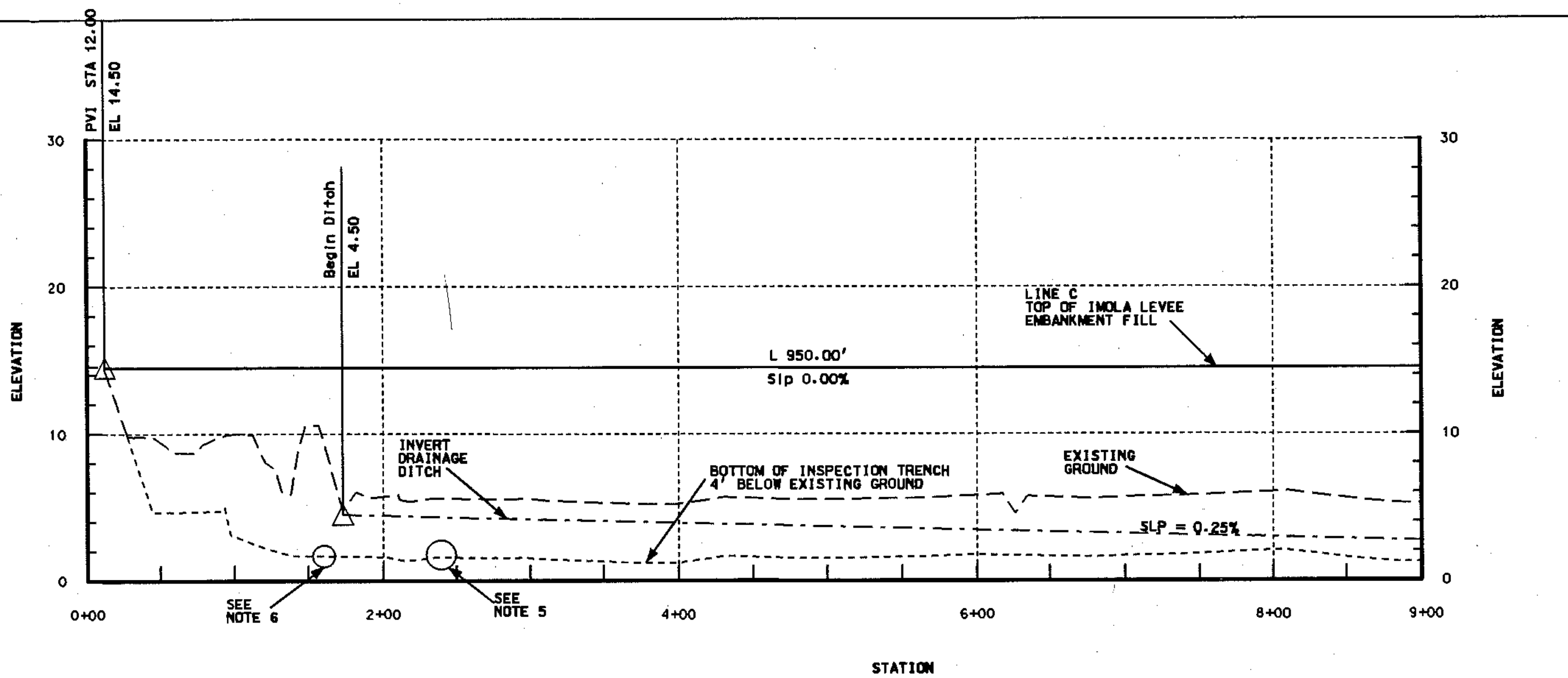


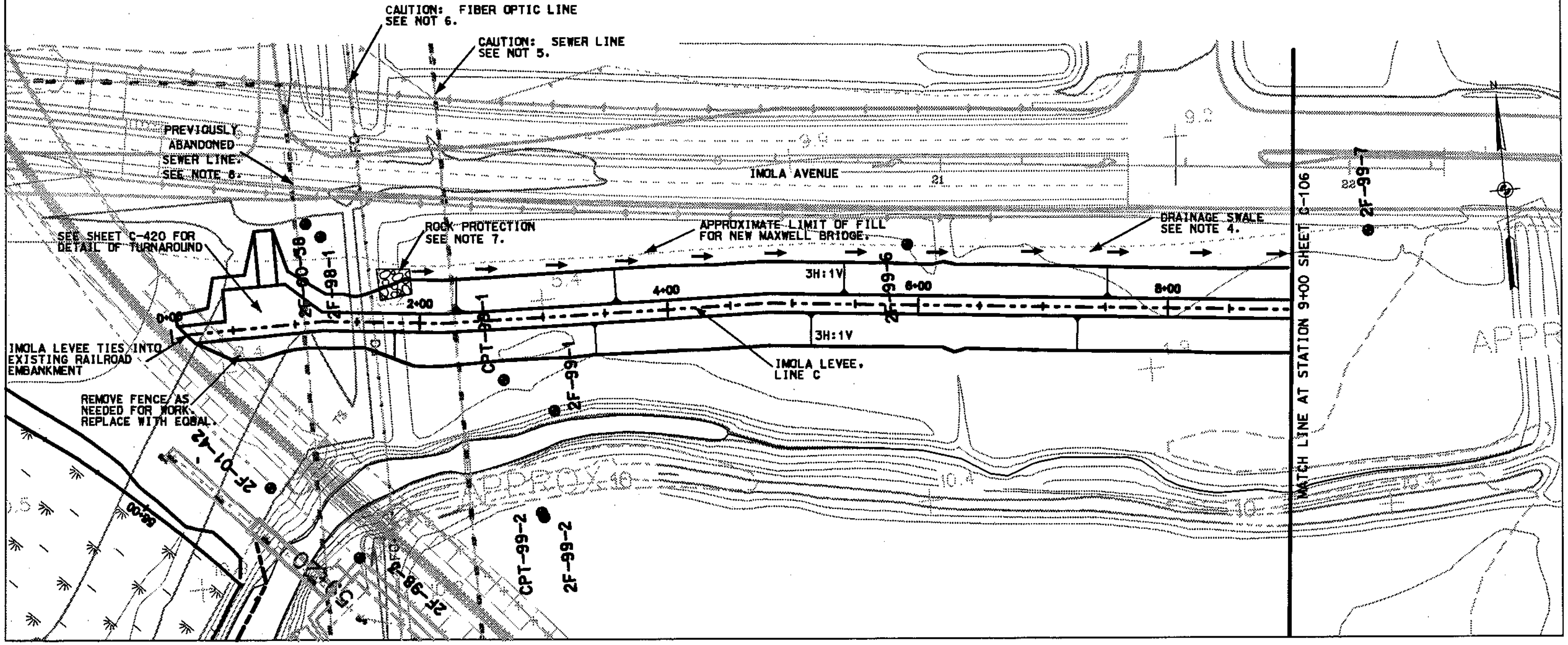
Figure 4. Project Features, NSD, Old Nord Vineyard, and HTRW Cleanup Areas

Figure 5. Project Features, HTRW Cleanup and Northern Areas

ENCLOSURE 1

Imola Levee Plan, Soil Boring Logs, and Slope Stability Models





LEGEND:

▨ ROCK PROTECTION

NOTES:

1. SEE SHEET C-110 FOR ALIGNMENT OF IMOLA LEVEE, LINE C.

2. SEE SHEET C-316 FOR CROSS SECTIONS OF IMOLA LEVEE.

3. PROFILE GRADE IS TOP OF IMOLA LEVEE EMBANKMENT FILL. AGGREGATE BASE ROAD SURFACE IS ABOVE THIS ELEVATION. SEE SHEET C-422, DETAIL 1.

4. CONSTRUCT A DRAINAGE SWALE AT THE MID-POINT BETWEEN THE TOE OF IMOLA LEVEE AND THE TOE OF IMOLA AVENUE FILL SECTIONS WITH A BASE OF 3', VARYING DEPTHS, AND FLOW LINE ELEVATIONS ESTABLISHED BY VERTICAL PROFILE. TYPICAL SIDE SLOPES NOTED ON SHEET C-316.
BEGINNING INVERT
ELEVATION = 4.5'
END INVERT
ELEVATION = 2.2'

5. APPROXIMATE LOCATION OF SEWER LINE, DEPTH UNKNOWN. THE CONTRACTOR SHALL CONTACT THE OWNER & U.S.A. PRIOR TO DISTURBING THE AREA.
OWNER: NAPA SANITATION DISTRICT
CONTACT NUMBER: 707-258-6000

6. APPROXIMATE LOCATION OF FIBER OPTIC LINE, DEPTH UNKNOWN. THE CONTRACTOR SHALL CONTACT THE OWNER & U.S.A. PRIOR TO DISTURBING THE AREA.
OWNER: QWEST
CONTACT NUMBER: 916-788-1042
303-445-7021

7. PLACE ROCK PROTECTION AT CULVERT OUTLET.
SEE DETAIL SHEET C-422.

8. LOCATE AND REMOVE ABANDONED SEWER LINE WITHIN FOOTPRINT OF LEVEE. CAP ABANDONED LINE WITH CONCRETE ON EACH END.

9. FILL FOR LEVEE SHALL COME FROM TERRACE EXCAVATION.

GRAPHIC SCALE
0 10' 25' 50' 100' 150'
1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: NMN
Dwn by: JMA
Spec No.: 1386
Reviewed by: T. CATANELLA
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A
Date: 06/01/2004
Design file no: NA-04-026
Drawing Code:
File name:
Plot date:
Plot scale:50
Rev. REV_0

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA
CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)

PLAN AND PROFILE
IMOLA LEVEE

Sheet
reference
number:
C-105
Sheet 22 of 39

PLOT DATE: 28-MAY-2004
PLOT TIME: 11:39
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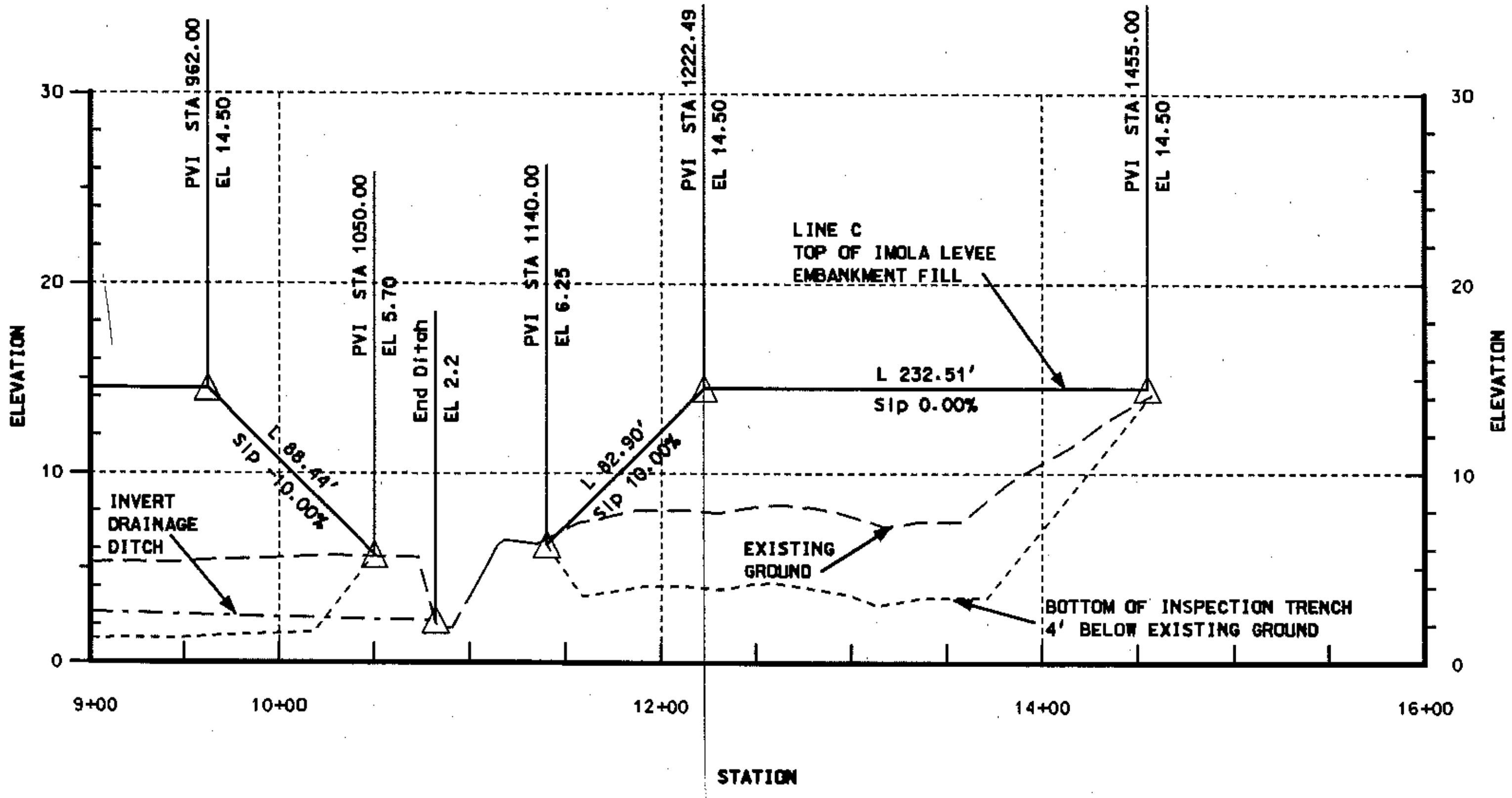

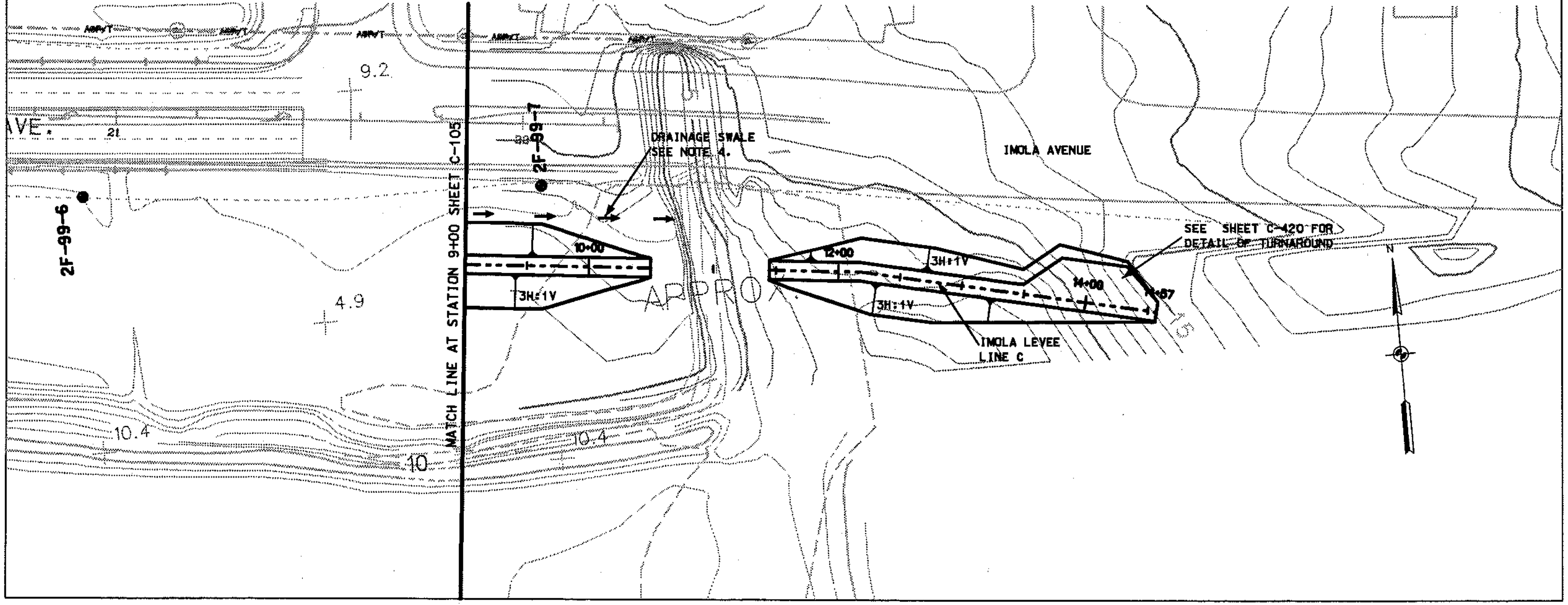

NOTES:

1. SEE SHEET C-110 FOR ALIGNMENT OF IMOLA LEVEE, LINE C.

2. SEE SHEET C-316 FOR CROSS SECTIONS OF IMOLA LEVEE.

3. PROFILE GRADE IS TOP OF IMOLA LEVEE EMBANKMENT FILL. AGGREGATE BASE ROAD SURFACE IS ABOVE THIS ELEVATION. SEE SHEET C-422, DETAIL 1.

4. CONSTRUCT A DRAINAGE SWALE AT THE MID-POINT BETWEEN THE TOE OF IMOLA LEVEE AND THE TOE OF IMOLA AVENUE FILL SECTIONS, WITH A BASE OF 3', VARYING DEPTHS, AND FLOW LINE ELEVATIONS ESTABLISHED BY VERTICAL PROFILE. TYPICAL SIDE SLOPES NOTED ON SHEET C-316.
BEGINNING INVERT
ELEVATION = 4.5'
END INVERT
ELEVATION = 2.2'

GRAPHIC SCALE
0 10' 25' 50' 100' 150'
1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: WH
Dwn by: JMA
Spec No.: 1385
Reviewed by: T. CATARELLA
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A
Date: 06/01/2004
Rev. REV_#
Design file no: NA-04-026
Drawing Code:
File name:
Plot date:
Plot scale:50

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
PLAN AND PROFILE
IMOLA LEVEE

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number:
C-106
Sheet 23 of 39

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N ±1,864,005; E ±6,480,366

DEPTH		N	GR	SA	FI	LL	PI	MC	
El. 12.6'± = 0	(CL)	15 22 A	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Stiff; moist; dark brown; about 80% medium plasticity fines; about 20% fine, with a trace of coarse sand; no reaction to HCl At 3.0' as above with trace of fine gravel and debris (wood) From 4.5' to 5.0' very rough drilling From 4.7' to 4.9' wood At 5.0' remnants of concrete fill At 6.0' able to break through concrete
7.0'		11	–	–	–	–	–	–	LEAN CLAY, (CL): Stiff; moist; dark brown; about 90% medium plasticity fines; about 10% fine sand; no reaction to HCl
9.0'	(CL/ CH)	15	–	–	–	–	–	–	LEAN TO FAT CLAY, (CL/CH): Stiff; moist; olive-brown; about 95% medium to high plasticity fines; about 5% fine sand; no reaction to HCl
11.0' ▽ 12.0'	SC	9	0	52	48	28	12	25	CLAYEY SAND, SC: (Field: loose; wet; olive-brown); fine to medium sand; low plasticity fines; (Field: No reaction to HCl)
13.0'	CL		0	49	51	34	17	33	SANDY LEAN CLAY, CL: (Field: wet; olive-brown); medium plasticity fines; fine to medium sand; (Field: No reaction to HCl)
15.5'	▨		–	–	–	–	–	–	NO RECOVERY FROM SAMPLER
17.0'	(CH)		–	–	–	–	–	–	FAT CLAY, (CH): Wet; olive-brown; about 95% high plasticity fines; about 5% fine sand; no reaction to HCl
20.0'	SC		0	51	49	36	15	39	CLAYEY SAND, SC: (Field: Wet; dark gray); fine to medium sand; medium plasticity fines; (Field: No reaction to HCl)
21.5'		22 17	–	–	–	–	–	–	CLAYEY SAND, (SC): Firm to very firm; wet; dark gray; about 70% hard, subangular to subrounded sand; about 25% low to medium plasticity fines; about 5% hard, subangular to subrounded gravel; no reaction to HCl From 25.0' heaving sands
28.0'		29	–	–	–	–	–	–	CLAYEY SAND, (SC): Very firm; wet; dark brown; about 80% hard, fine to coarse, subangular to subrounded sand; about 20% low to medium plasticity fines; no reaction to HCl
33.0'	(SC)	40 23 32	–	–	–	–	–	–	CLAYEY SAND, (SC): Very firm to dense; wet; about 75% fine to coarse, subangular to subrounded sand; about 20% low to medium plasticity fines; about 5% hard, fine gravel; no reaction to HCl From 35.0' to 41.0' heaving sands
45.0'	B.O.H.								(27 OCT 94)

2 F - 9 8 - 1

N ±1,864,250; E ±6,481,009

DEPTH		N	GR	SA	FI	LL	PI	MC	
El. 8.0'± = 0	(CL)	28 15	–	–	–	–	–	–	LEAN CLAY WITH GRAVEL, (CL): Stiff to very stiff; dry; grayish-brown; 60% medium plasticity fines; 40% hard, subrounded to rounded gravel to 1 inch; 10% fine sand; abundant organic material (grasses)
4.0'		9 8 12	–	–	–	–	–	–	LEAN CLAY, (CL): Firm to stiff; moist; dark brown; 90% medium plasticity fines; 10% fine sand; iron oxide staining; trace of charcoal At 8.0' mottled dark brown and dark gray
10.0'	CH	11	0	13	87	56	38	–	FAT CLAY, CH: (Field: Stiff; moist (increasing moisture content); mottled dark brown and dark gray); high plasticity fines; fine (with scattered medium) sand; (Field: Small amount of iron oxide staining; trace of charcoal)
12.5'	(CL)	11	–	–	–	–	–	–	LEAN CLAY, (CL): Stiff; moist; mottled dark brown and dark gray; 90% medium plasticity fines; 10% fine sand; small amount of iron oxide staining; trace of charcoal
14.0'		10	–	–	–	–	–	–	LEAN CLAY WITH GRAVEL, (CL): Stiff; very moist; mottled dark brown and dark gray; 75% medium plasticity fines; 15% hard, subrounded gravel to 3/4 inch; 10% fine to coarse, subangular to subrounded sand; small amount of iron oxide staining
▽ 16.0'	CL	5	9	26	65	43	25	30	At 16.0' water level SANDY LEAN CLAY, CL: (Field: Firm; wet; mottled dark brown and dark gray); medium plasticity fines; fine to coarse, (Field: Subangular to subrounded) sand; gravel to 3/4 inch (Field: Hard, subrounded); (Field: Small amount of iron oxide staining; trace of bricks)
17.5'	(CL)	5	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Firm; wet; mottled dark brown and dark gray; 75% medium plasticity fines; 20% fine to coarse, subangular to subrounded sand; 5% hard, subrounded gravel to 3/4 inch; trace of iron oxide staining
20.0'	CL	9	0	33	67	44	23	38	SANDY LEAN CLAY, CL: (Field: Stiff; very moist to almost wet; very dark grayish-brown); medium plasticity fines; fine to medium sand; γd = 82.9 PCF; (Field: Organic odor)
22.5'	SC	4	1 –	55 –	44 –	45 –	25 –	43 –	CLAYEY SAND, SC: (Field: Very loose; very moist to almost wet; very dark grayish-brown); fine to coarse (mostly fine) sand; medium plasticity fines; gravel to 3/8 inch; (Field: Organic odor)
24.3'	SC*	14	19 –	65 –	16 –	– –	– –	32 –	CLAYEY SAND WITH GRAVEL, SC*: (Field: Firm; wet; very dark grayish-brown); fine to coarse, (Field: Subangular to subsubrounded) sand; gravel to 3/4 inch (Field: Moderately soft to hard, subrounded to rounded, volcanic); (Field: Medium plasticity fines)
27.0'	(GC)	23	–	–	–	–	–	–	CLAYEY GRAVEL WITH SAND, (GC): Very loose to very firm; wet; very dark grayish-brown; 50% moderately soft to hard, subrounded to rounded, volcanic gravel; 25% fine to coarse, subangular to subrounded sand; 20% medium plasticity fines At 28.5' contact to core axis is approximately 30°
28.8'	(CL/ CH)	4	–	–	–	–	–	–	LEAN TO FAT CLAY WITH SAND, (CL/CH): Soft; moist; mottled very dark gray and very dark grayish-brown; 85% medium to high plasticity fines; 15% fine sand; slight organic odor
29.25'	(CL)		–	–	–	–	–	–	LEAN CLAY, (CL): Soft; moist; dark olive-gray; 90% medium plasticity fines; 10% fine sand
30.0'	CL	8	0	36	64	46	21	34	SANDY LEAN CLAY, CL: (Field: Firm; moist; very dark grayish-brown); medium plasticity fines; fine to medium sand; γd = 86.0 PCF
32.5'	(CL)	8 10 10	–	–	–	–	–	–	LEAN CLAY, (CL): Firm to stiff; moist; dark olive-gray; 90% medium plasticity fines; 10% fine sand
38.5'	(GC)	52	–	–	–	–	–	–	CLAYEY GRAVEL WITH SAND, (GC): Very dense; wet; dark olive-gray; 60% moderately soft to moderately hard, subrounded volcanic gravel; 25% fine to coarse sand; 15% medium plasticity fines
40.0'	B.O.H.								(27 AUG 98)

VERTICAL SCALE: 1"=3'

GRAPHIC SCALE

1"=3' 3' 2' 1' 0 3' 6' 9' 12'

NOTES:

1. Legend and Notes are shown on Sheet No. B-301.
2. Logs of Explorations are shown on Sheet Nos. B-301 through B-313.
3. Locations of Explorations are shown on Sheet Nos. C-102 through C-109.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
△			
△			
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△			
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△			

Designed by: Nicola Holmes/Jane Ballon		Date:
Dwn by: N.B./R.L.T.	Spec No.: 1395	Design file no: NA-04-026
Reviewed by: J. Sciandrone		Drawing Code:
Submitted by: /s/ Ben Gompers Chief, Soil Design Section		File name: NA-04-02BB302XXX.dwg Plot date: Dwg scale: AS_NOTED

Rev.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CR & IMOLA)
LOG OF EXPLORATIONS
2F-94-6 AND 2F-98-1

Sheet
reference
number:
B-303
Sheet 7 of 39

Soil Design Section Sheet No. 3 of 13

Reference: Exploration Log File No. NA-01-028

2 F – 9 9 – 1

N ±1,864,093; E ±6,481,184

DEPTH		N	GR	SA	FI	LL	PI	MC	
El. 4.0'± = 0	(CL)	7	–	–	–	–	–	13	LEAN CLAY WITH SAND, (CL): Firm; moist; dark grayish-brown; 60% medium plasticity fines; 30% fine to medium sand; 10% subrounded gravel to 3/4 inch; abundant organic material (roots); easy drilling
2.0'	CL	7	0	6	94	47	23	20	LEAN CLAY, CL: (Field: Firm; moist; very dark grayish-brown); medium plasticity fines; fine (with scattered medium to coarse) sand; (Field: Trace of organic material (roots); easy drilling)
4.0'	CL	5	0	2	98	39	17	27	LEAN CLAY, CL: (Field: Firm; moist; very dark grayish-brown); medium plasticity fines; fine sand; (Field: Small amount of iron oxide staining; trace of organic material (roots); easy drilling)
6.0'	(CL)	7	–	–	–	–	–	33	LEAN CLAY, (CL): Firm; moist; very dark grayish-brown; 90% medium plasticity fines; 10% fine sand; small amount of iron oxide staining; trace of organic material (roots); easy drilling)
7.5'	(CL)	7	–	–	–	–	–	–	LEAN CLAY, (CL): Firm; moist; dark brown; 95% medium plasticity fines; 5% fine sand; small amount of iron oxide staining; easy drilling
9.0'	CH	SHELBY TUBE	0	3	97	55	29	30	FAT CLAY, CH: High plasticity fines; fine sand; γd = 90.5 pcf (avg.); (Field: Shelby tube was easy to push entire length of sample)
∇ 11.5'	(CL)	7	–	–	–	–	–	30	At 11.5' water level LEAN CLAY, (CL): Firm; moist; dark brown; 90% medium plasticity fines; 10% fine sand; trace of iron oxide staining; trace of charcoal; easy drilling
13.0'	(CL)	6	–	–	–	–	–	30	At 13.0' increased water content
	(CL)	5	–	–	–	–	–	29	
17.0'	CL	6	0	12	88	40	19	28	LEAN CLAY, CL: (Field: Firm; wet; dark brown); medium plasticity fines; fine sand; (Field: Trace of iron oxide staining; trace of charcoal; easy drilling)
19.0'	(CL)	5	–	–	–	–	–	–	LEAN CLAY, (CL): Firm; moist; dark brown; 90% medium plasticity fines; 10% fine sand; moderate amount of iron oxide staining; trace of charcoal; easy drilling
21.0'	(CL)	4	–	–	–	–	–	–	LEAN CLAY, (CL): Soft; wet; dark brown; 90% medium plasticity fines; 10% fine to medium sand; moderate amount of iron oxide staining; easy drilling; sampler sank under weight of hammer
22.5'	CL	2	0	11	89	43	21	33	LEAN CLAY, CL: (Field: Soft; wet; dark brown); medium plasticity fines; fine sand; (Field: Moderate amount of iron oxide staining; easy drilling; sampler sank under weight of hammer)
24.0'	CL	SHELBY TUBE	0	11	89	40	17	33	LEAN CLAY, CL: Medium plasticity fines; fine sand; γd = 87.2 pcf (avg.); (Field: Shelby tube was easy to push entire length of sample)
26.5'	(CL)	3 3	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Soft; wet; dark brown; 85% medium plasticity fines; 15% fine to medium sand; moderate amount of iron oxide staining; easy drilling
30.0'	ML	2	0	15	85	39	10	39	SILT WITH SAND, ML: (Field: Soft; wet; dark brown); medium plasticity fines; fine sand; (Field: Easy drilling; sampler sank under weight of hammer)
32.0'	(CL)	5	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Firm; wet; dark grayish-brown; 85% medium plasticity fines; 15% fine to medium sand; easy drilling
34.0'	(CL)	5	–	–	–	–	–	–	LEAN CLAY, (CL): Firm; wet; dark brown; 90% medium plasticity fines; 10% fine sand; easy drilling
35.0'	(CL)		–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Firm; wet; dark grayish-brown; 85% medium plasticity fines; 15% fine to medium sand; easy drilling; sampler sank under weight of hammer
36.5'	SC	16	36	50	14	35	13	17	CLAYEY SAND WITH GRAVEL, SC: (Field: Firm; wet; dark brown); fine to coarse, (Field: Hard, subrounded) sand; medium plasticity fines; (Field: Hard, subrounded) gravel to 1-1/2 inches; (Field: Easy drilling; sampler sank under weight of hammer)
37.5' 38.0'	SC*	47	42 –	45 –	13 –	– –	– –	– –	CLAYEY SAND WITH GRAVEL, SC*: (Field: Very dense; wet; dark brown); fine to coarse (mostly coarse), (Field: Hard, subangular to subrounded) sand; (Field: Hard, subangular) gravel to 1-1/2 inches; (Field: Medium plasticity fines)
40.5'	(CL)	9	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Stiff; moist; yellowish-brown; 85% medium plasticity fines; 15% hard, fine to coarse, subrounded sand; easy drilling
41.5'	(CL)	SHELBY TUBE	–	–	–	–	–	–	From 41.5' to 44.0' Shelby tube sample was not tested
44.0'	(CL)	17	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Very stiff; moist; yellowish-brown; 85% medium plasticity fines; 15% hard, fine to coarse, subrounded sand; trace of hard, subangular gravel to 1-3/8 inches; easy drilling
46.0'	(GC)	19 28	–	–	–	–	–	–	CLAYEY GRAVEL WITH SAND, (GC): Firm to very firm; wet; yellowish-brown; 55% hard, subangular to subrounded gravel to 1-3/8 inches; 30% hard, fine to coarse, subangular to subrounded sand; 15% medium plasticity fines; slightly hard drilling
50.0'									

(Continued in Next Column)

2 F – 9 9 – 1

(Continued from Previous Column)

DEPTH		N	GR	SA	FI	LL	PI	MC	
50.0'	(CL)	20	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Very stiff; moist; light olive-brown; 85% medium plasticity fines; 15% fine sand; moderate iron oxide staining; moderate manganese oxide staining; slightly hard drilling
52.0'	CL	17	0	8	92	46	20	25	LEAN CLAY, CL: (Field: Very stiff; moist; light olive-brown); medium plasticity fines; fine (with scattered medium to coarse) sand; (Field: Moderate amount of iron oxide staining; abundant manganese oxide staining; slightly hard drilling)
54.0'	(CL)	23 15 15 12	–	–	–	–	–	–	LEAN CLAY, (CL): Stiff to very stiff; moist; light olive-brown; 90% medium plasticity fines; 10% fine to medium (with scattered coarse) sand; moderate amount of iron oxide staining; abundant manganese oxide staining; slightly hard drilling At 56.0' easy drilling At 60.0' small amount of iron oxide staining; small amount of manganese oxide staining
61.0'	(CL)	13	–	–	–	–	–	–	LEAN CLAY, (CL): Stiff; moist; light olive-brown; 90% medium plasticity fines; 10% fine to medium sand; moderate amount of iron oxide staining; moderate amount of manganese oxide staining; trace of charcoal; easy drilling
62.5'	(CL)	SHELBY TUBE	–	–	–	–	–	–	From 62.5' to 65.0' Shelby tube sample was not tested
65.0'	(CL)	15 16 22 9 12 12 21 16	–	–	–	–	–	–	LEAN CLAY, (CL): Stiff to very stiff; moist; light olive-brown; 90% medium plasticity fines; 10% fine to medium sand; moderate amount of iron oxide staining; moderate amount of manganese oxide staining; trace of charcoal; easy drilling
80.0' B.O.H.									(11-12 JUN 99)

VERTICAL SCALE: 1"=3'

NOTES:

1. Legend and Notes are shown on Sheet No. B-301.
2. Logs of Explorations are shown on Sheet Nos. B-301 through B-313.
3. Locations of Explorations are shown on Sheet Nos. C-102 through C-109.

GRAPHIC SCALE

1"=3' 3' 2' 1' 0 3' 6' 9' 12'

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Designed by: Nicola Holmes/Jane Ballon
Dwn by: N.B./R.L.T.
Spec No.: 1395
Reviewed by: J. Sciandrone
Submitted by: /s/ Ben Gompers
Chief, Soil Design Section
Date:
Rev.
Design file no: NA-04-026
Drawing Code:
File name: NA-04-026B306XXX.dwg
Plot date:
Dwg scale: AS_NOTED

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST OUDEN (BETWEEN
OLD TULDCAY CR & IMOLA)
LOG OF EXPLORATIONS
2 F – 9 9 – 1

Sheet reference number:
B-306
Sheet 10 of 39

Soil Design Section Sheet No. 6 of 13

Reference: Exploration Log File No. NA-01-028

Border Revised 01/07/02, C0ESHT02.DWG

2 F – 9 9 – 6

N ±1,864,198; E ±6,481,503

DEPTH		N	GR	SA	FI	LL	PI	MC
El. 6.0'± = 0	(CL)	9	–	–	–	–	–	–
2.0'		7	–	–	–	–	–	–
4.0'	CH	SHELBY TUBE	0	1	99	61	32	32
6.5'	(CL)	10	–	–	–	–	–	–
▽ 8.0'	CH	SHELBY TUBE	0	3	97	52	28	32
10.5'	(CL)	11	–	–	–	–	–	35
12.0'	CH	5	0	6	94	55	26	35
14.0'	(CH)	5	–	–	–	–	–	35
16.0'	(CL)	8	–	–	–	–	–	33
18.0'		9	–	–	–	–	–	–
20.0'		11	–	–	–	–	–	–
22.0'	CL	6	0	25	75	48	21	42
24.0'	(CL)	6	–	–	–	–	–	–
25.4'								
26.0'	(SC)	14	–	–	–	–	–	–
28.5'	(GC)	16	–	–	–	–	–	–
30.0'	B.O.H.							

LEAN CLAY WITH SAND, (CL): Stiff; moist; dark grayish–brown; 85% medium plasticity fines; 15% fine sand; small amount of organic material (roots)

LEAN CLAY, (CL): Firm; moist; very dark grayish–brown; 90% medium plasticity fines; 10% fine sand; trace to small amount of organic material (roots)

FAT CLAY, CH: (Field: Moist; very dark grayish–brown); high plasticity fines; fine sand; γd = 88.6 pcf; (Field: Trace to small amount of organic material (roots))

LEAN CLAY, (CL): Stiff; moist; brown; 95% medium plasticity fines; 5% fine sand; iron oxide staining; trace of organic material (roots); trace of charcoal throughout sample

At 8.0' water level

FAT CLAY, CH: (Field: Moist; brown); high plasticity fines; fine sand; γd = 87.7 pcf; (Field: Iron oxide staining; trace of organic material (roots); small amount of charcoal throughout sample)

LEAN CLAY, (CL): Firm to stiff; moist to very moist; very dark grayish–brown; 90% to 95% medium plasticity fines; 5% to 10% fine sand; iron oxide staining; trace of organic material

FAT CLAY, CH: (Field: Firm; moist; very dark grayish–brown); high plasticity fines; fine sand; (Field: Iron oxide staining; trace of organic material)

SANDY FAT CLAY, (CH)*: Firm; very moist; very dark grayish–brown; 70% medium plasticity fines; 25% hard, fine to coarse, subangular to subrounded sand; 5% hard, subangular gravel; small amount of iron oxide staining; trace of organic material

LEAN CLAY WITH SAND, (CL): Firm; very moist to almost wet; very dark grayish–brown; 80% medium plasticity fines; 15% hard, fine to coarse, subangular to subrounded sand; 5% hard gravel to 3/4 inch; trace of iron oxide staining; trace of organic material

LEAN CLAY, (CL): Stiff; very moist; dark olive–gray; 90% medium plasticity fines; 10% fine sand; iron oxide staining; trace of organic material

LEAN CLAY, (CL): Stiff; moist to very moist; dark olive–gray; 90% medium plasticity fines; 10% fine to medium sand; iron oxide staining; trace of organic material

LEAN CLAY WITH SAND, CL: (Field: Firm; very moist; dark olive–gray); medium plasticity fines; fine sand; (Field: Trace of iron oxide staining; trace of organic material)

SANDY LEAN CLAY, (CL): Firm; very moist to almost wet; dark olive–gray; 60% medium plasticity fines; 40% fine to medium (with a trace of hard, coarse, subrounded) sand

From 24.2' to 24.8' moderate iron oxide staining

At 24.8' very dark grayish–brown.

Grades into following description.

CLAYEY SAND, (SC): 80% hard, fine to coarse, subrounded sand; 20% medium plasticity fines

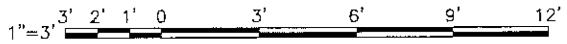
CLAYEY SAND, (SC): Firm; wet; very dark grayish–brown; 75% hard, fine to coarse, subrounded sand; 25% medium plasticity fines; trace of iron oxide staining

CLAYEY GRAVEL WITH SAND, (GC): Firm; wet; very dark grayish–brown; 55% hard, subrounded gravel to 3/4 inch; 30% hard, fine to coarse, subrounded sand; 15% medium plasticity fines

(12 JAN 99)

VERTICAL SCALE: 1"=3'

GRAPHIC SCALE



NOTES:

1. Legend and Notes are shown on Sheet No. B–301.
2. Logs of Explorations are shown on Sheet Nos. B–301 through B–313.
3. Locations of Explorations are shown on Sheet Nos. C–102 through C–109.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: Nicola Holmes/Jane Bolton		Date:	Rev.
Dwn by: N.B./R.L.T.	Spec No.: 1395	Design file no: NA–04–026	
Reviewed by: J. Sciandrone		Drawing Code:	
Submitted by: /s/ Ben Gompers Chief, Soil Design Section		File name: NA–04–026B307XXX.dwg Plot date: Dwg scale: AS_NOTED	

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN–HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814–2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CR & IMOLA)
LOG OF EXPLORATIONS
2 F – 9 9 – 6

Sheet
reference
number:
B–307
Sheet 11 of 39

Soil Design Section Sheet No. 7 of 13

Reference: Exploration Log File No. NA–01–028

2 F - 9 9 - 7

N ±1,864,162; E ±6,481,883

DEPTH			N	GR	SA	FI	LL	PI	MC	
El. 7.7'± = 0	(CL)		8	–	–	–	–	–	18	GRAVELLY LEAN CLAY WITH SAND, (CL): Firm; moist; dark brown; 55% medium plasticity fines; 30% hard, subrounded gravel to 1 inch; 15% hard, fine to coarse, subrounded sand; moderate iron oxide staining; trace of organic material (roots)
2.0'			7	–	–	–	–	–	30	LEAN CLAY, (CL): Firm; very moist; black; 90% medium plasticity fines; 10% fine (with a trace of medium and hard, coarse, subrounded) sand; trace of iron oxide staining; trace of organic material (roots)
∇ 4.0'			7	–	–	–	–	–	37	At 4.0' water level LEAN CLAY, (CL): Firm; very moist to wet; black; 90% medium plasticity fines; 10% fine sand; trace of iron oxide staining; trace or organic material (roots)
5.5'	CH	SHELBY TUBE		0	1	99	65	36	38	FAT CLAY, CH: (Field: Firm; very moist to wet; black); high plasticity fines; fine sand; γd = 81.2 pcf; (Field: Trace of iron oxide staining; trace or organic material (roots))
8.0'	(CL)		8	–	–	–	–	–	35	LEAN CLAY WITH SAND, (CL): Firm; moist; black; 85% medium plasticity fines; 15% hard, fine to coarse, subrounded sand; trace of iron oxide staining; trace of organic material (roots)
10.0'	CH		6	0	2	98	60	31	41	FAT CLAY, CH: (Field: Firm; very moist to wet; very dark grayish-brown); high plasticity fines; fine sand; (Field: Iron oxide staining; trace of organic material (roots))
12.0'	(CL)		6	–	–	–	–	–	41	LEAN CLAY WITH SAND, (CL): Firm; very moist to wet; very dark grayish-brown; 85% medium plasticity fines; 15% fine sand; iron oxide staining; trace of organic material (roots)
14.0'			7	–	–	–	–	–	38	LEAN CLAY, (CL): Firm; very moist to wet; very dark grayish-brown; 90% medium plasticity fines; 10% fine sand; iron oxide staining; trace of organic material
16.0'			8	–	–	–	–	–	45	LEAN CLAY WITH SAND, (CL): Firm; very moist to wet; very dark grayish-brown; 85% medium plasticity fines; 15% hard, coarse, subrounded sand; trace of organic material
17.5'	ML	SHELBY TUBE		2	11	86	41	14	34	SILT, ML: (Field: Firm; very moist to wet; very dark grayish-brown); medium plasticity fines; fine to coarse, (Field: Hard, subrounded) sand; gravel to 3/4 inch; γd = 85.5 pcf; (Field: Trace of organic material)
20.0'	(CL)		10	–	–	–	–	–	41	SANDY LEAN CLAY, (CL): Stiff; wet; verk dark grayish-brown; 60% medium plasticity fines; 40% hard, fine to coarse, subrounded sand; trace of iron oxide staining
22.0'	(SC)		17	–	–	–	–	–	19	CLAYEY SAND, (SC): Firm; wet; verk dark grayish-brown; 55% hard, subrounded gravel to 1 inch; 30% hard, fine to coarse, subrounded sand; 15% medium plasticity fines
24.0'			26	–	–	–	–	–	14	CLAYEY SAND WITH GRAVEL, (SC): Very firm; wet; dark yellowish-brown; 60% hard, subrounded gravel to 1-3/8 inches; 30% hard, fine to coarse, subrounded sand; 10% medium plasticity fines
26.0'	(GP)		15	–	–	–	–	–	–	POORLY GRADED GRAVEL, (GP): Firm; wet; dark yellowish-brown; 80% hard, subrounded gravel to 1-3/8 inches; 15% hard, fine to coarse, subrounded sand; 5% fines
28.5'	(CL)		14	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Stiff; very moist; olive-brown; 75% medium plasticity fines; 25% fine to medium sand; iron oxide staining
30.0'	B.O.H.									(12 JAN 99)

VERTICAL SCALE: 1"=3'

GRAPHIC SCALE

1"=3' 3' 2' 1' 0 3' 6' 9' 12'

NOTES:

1. Legend and Notes are shown on Sheet No. B-301.
2. Logs of Explorations are shown on Sheet Nos. B-301 through B-313.
3. Locations of Explorations are shown on Sheet Nos. C-102 through C-109.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
△			
△			
△			
△			
△			
△			
△			
△			

Designed by: Nicola Holmes/Jane Bolton

Date:

Rev.

Dwn by: N.B./R.L.T.

Spec No.: 1395

Design file no: NA-04-026

Reviewed by: J. Sciandrone

Drawing Code:

Submitted by: /s/ Ben Gompers
Chief, Soil Design Section

File name: NA-04-026B308XXX.dwg
Plot date:
Dwg scale: AS_NOTED

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Soil Design Section Sheet No. 8 of 13

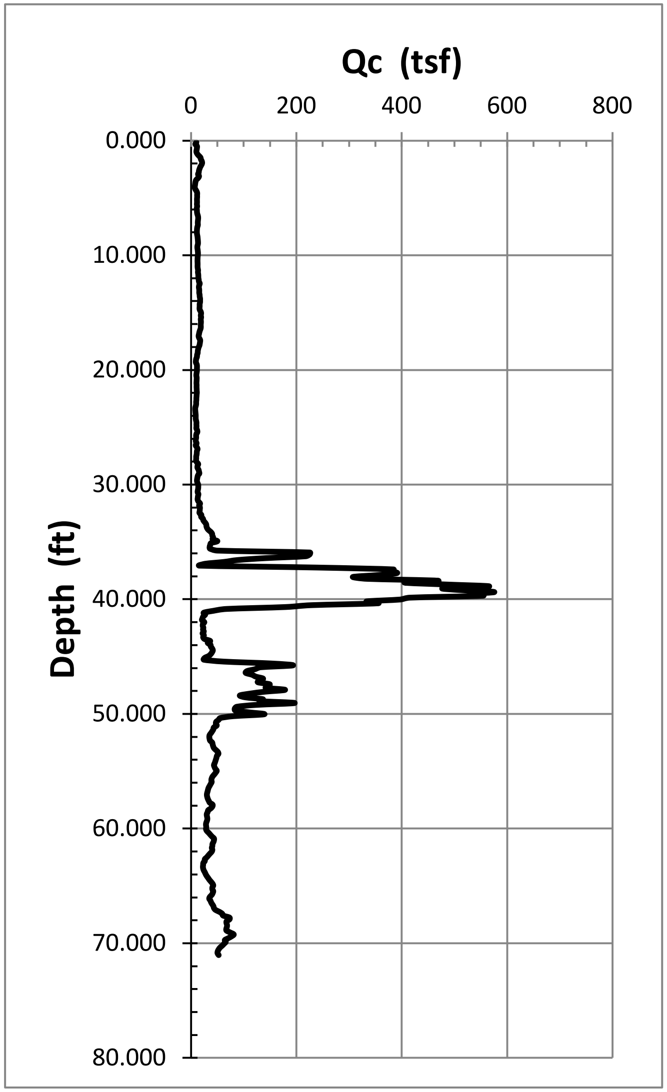
NAPA CALIFORNIA

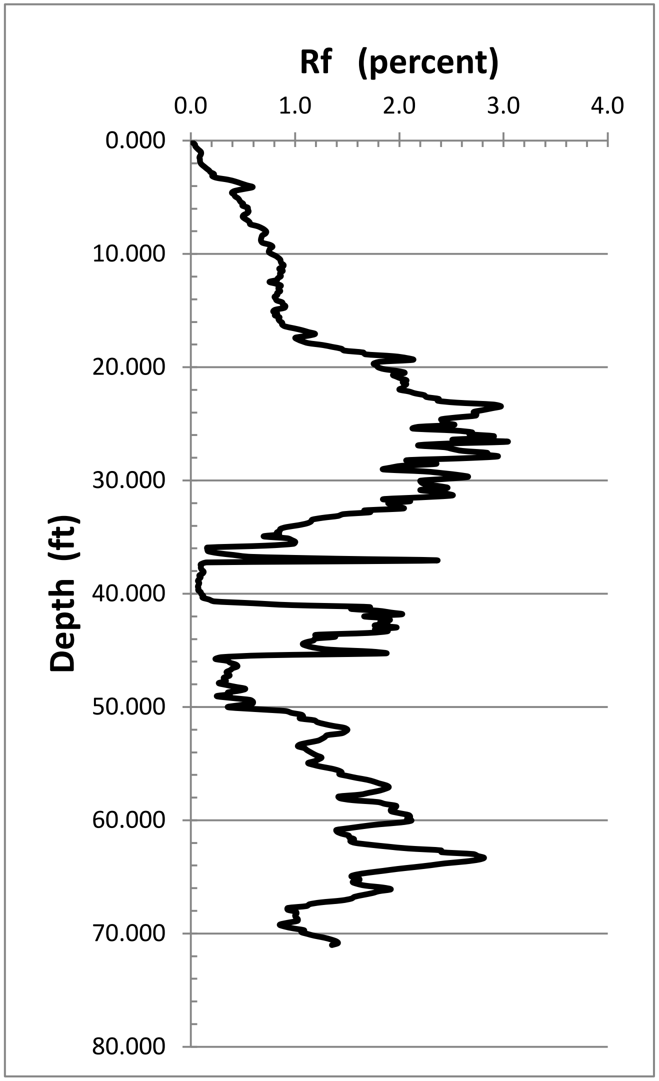
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CR & IMOLA)
LOG OF EXPLORATIONS
2 F - 9 9 - 7

Sheet
reference
number:
B-308
Sheet 12 of 39

Reference: Exploration Log File No. NA-01-028

CPT-99-1


Qc (tsf)
0
200
400
600
800
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
Depth (ft)


Rf (percent)
0.0
1.0
2.0
3.0
4.0
0.000
10.000
20.000
30.000
40.000
50.000
60.000
70.000
80.000
Depth (ft)

NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
CONTRACT 2 EAST
IMOLA LEVEE

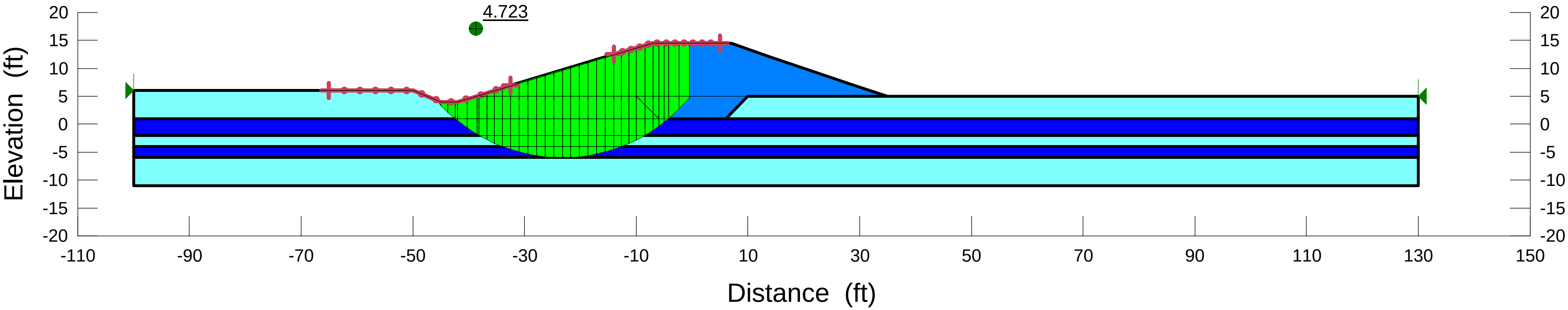
End of Construction

Levee Crest Elev = 14.5 ft
Landside Ground Elev = 6 ft
Drainage Swale Elev = 4 ft

Levee Fill: Unit wt = 125 pcf, c = 1400 psf, phi = 0
CL Foundation: Unit wt = 120 pcf, c = 1200 pcf, phi = 0
CH Foundation: Unit wt = 115 pcf, c = 600 psf, phi = 0

Filename: c:Documents\Napa\Cont2east\DDR\GeoStudio\Imola_EOC

F.S. = 4.723



NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
CONTRACT 2 EAST
IMOLA LEVEE

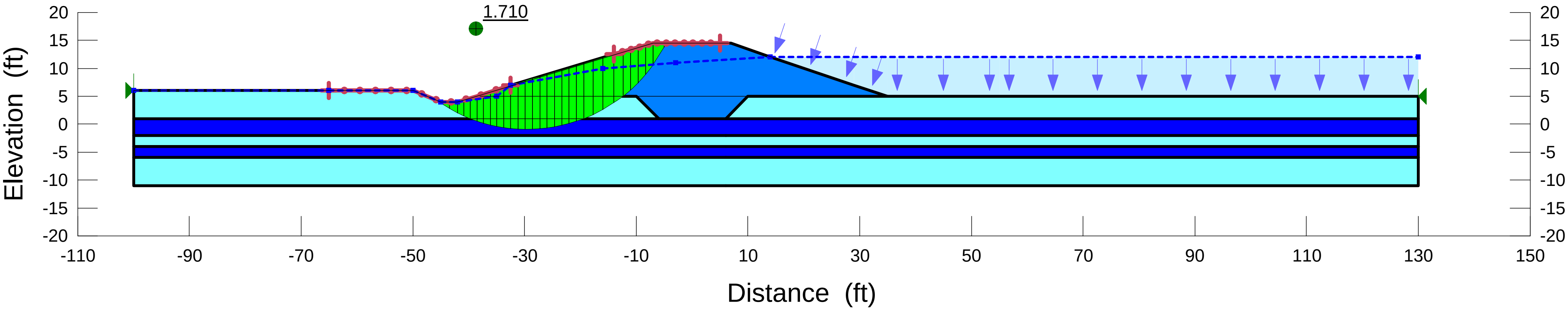
Steady State Seepage

Levee Crest Elev = 14.5 ft
Landside Ground Elev = 6 ft
Drainage Swale Elev = 4 ft
WSEL = 12 ft

Levee Fill: Unit wt = 125 pcf, c' = 100 psf, phi' = 31
CL Foundation: Unit wt = 120 pcf, c' = 50 pcf, phi' = 30
CH Foundation: Unit wt = 115 pcf, c' = 25 psf, phi' = 27

Filename: c:Documents\Napa\Cont2east\DDR\GeoStudio\Imola_SS.gsz

F.S. = 1.710



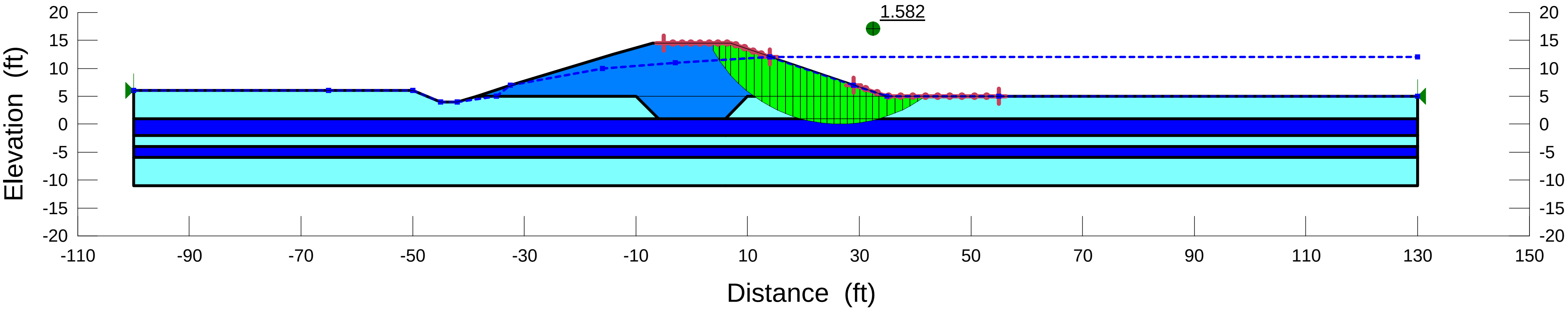
NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
CONTRACT 2 EAST
IMOLA LEVEE

Rapid Drawdown

Levee Crest Elev = 14.5 ft	Levee Fill: Unit wt = 125 pcf, c' = 100 psf, phi' = 31, c = 300 psf, phi = 15 deg
Landside Ground Elev = 6 ft	CL Foundation: Unit wt = 120 pcf, c' = 50 pcf, phi' = 30, c = 300 psf, phi = 15 deg
Drainage Swale Elev = 4 ft	CH Foundation: Unit wt = 115 pcf, c' = 25 psf, phi' = 27, c = 250 psf, phi = 10 deg
WSEL = 12 ft	

Filename: c:Documents\Napa\Cont2east\DDR\GeoStudio\Imola_RD.gsz

F.S. = 1.582



ENCLOSURE 2

Duden-NSD Levee Plan and Soil Boring Logs

RECREATION TRAIL TIES INTO EXISTING PEDESTRIAN BRIDGE AND TRAIL.

FLOOD CONTROL LEVEE, WITH AC REC TRAIL AND MAINTENANCE ROAD. LINE C

FLOOD CONTROL LEVEE AND MAINTENANCE ROAD TIES INTO EXISTING RAILROAD EMBANKMENT. SEE NOTE 6.

FLOOD CONTROL LEVEE PASSES UNDER NEW MAXWELL BRIDGE UNDER CONSTRUCTION. SEE NOTE 4.

LEGEND

RIGHT-OF-WAY

CENTERLINE OF LEVEE [illegible]

NOTES:

[illegible]

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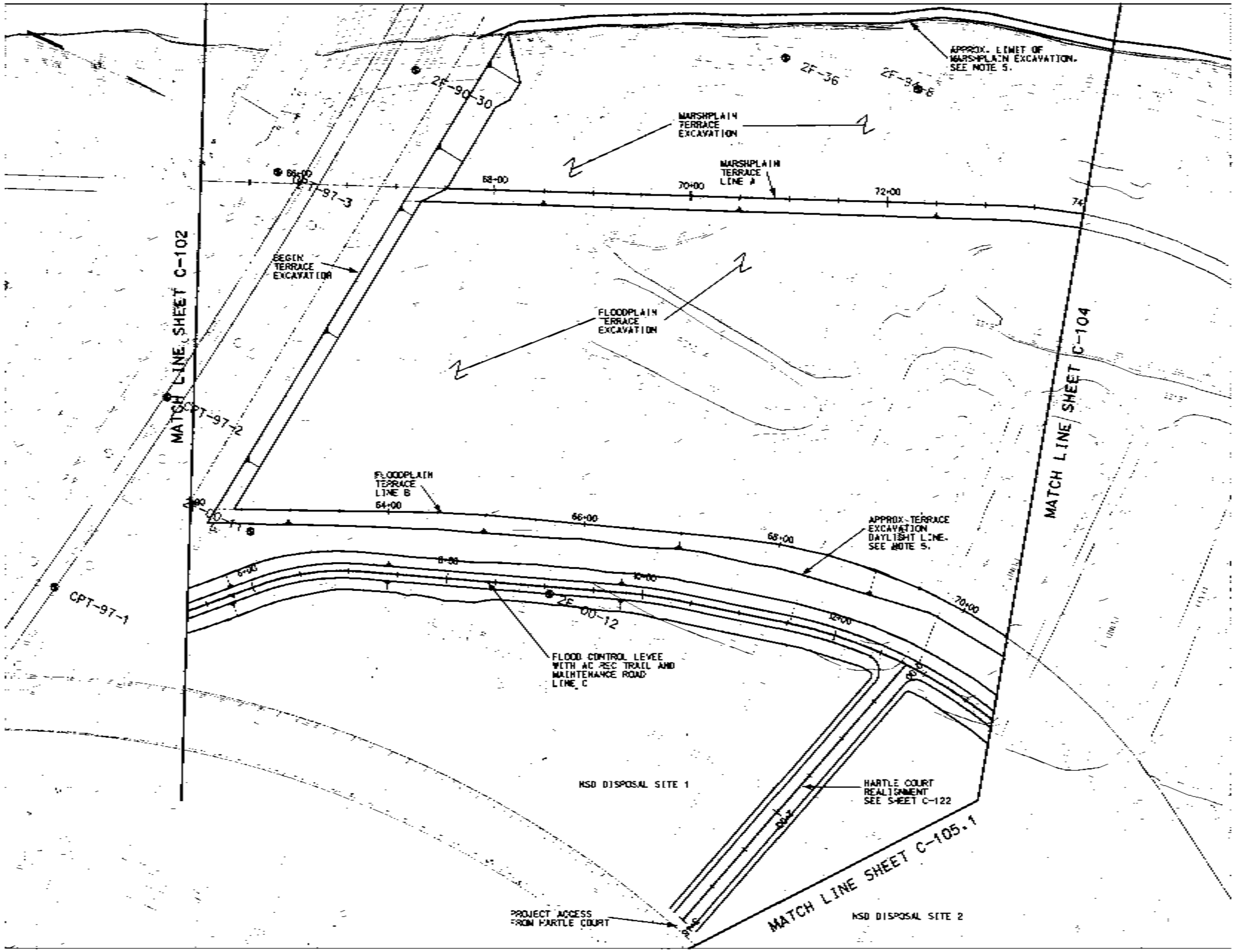
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
GENERAL PLAN, RIGHT-OF-WAY,
PROJECT ACCESS AND
LOCATION OF EXPLORATIONS
FLOODPLAIN/MARSHPLAIN TERRACE

Sheet reference number:
C-102

PLOT DATE 26-APR-2005 PLOT TIME 13:27



LEGEND

RIGHT-OF-WAY

TURBIDITY CURTAIN

CENTERLINE OF LEVEE [illegible]

FLOODPLAIN TERRACE

MARSHPLAIN TERRACE

NOTES:

[illegible]

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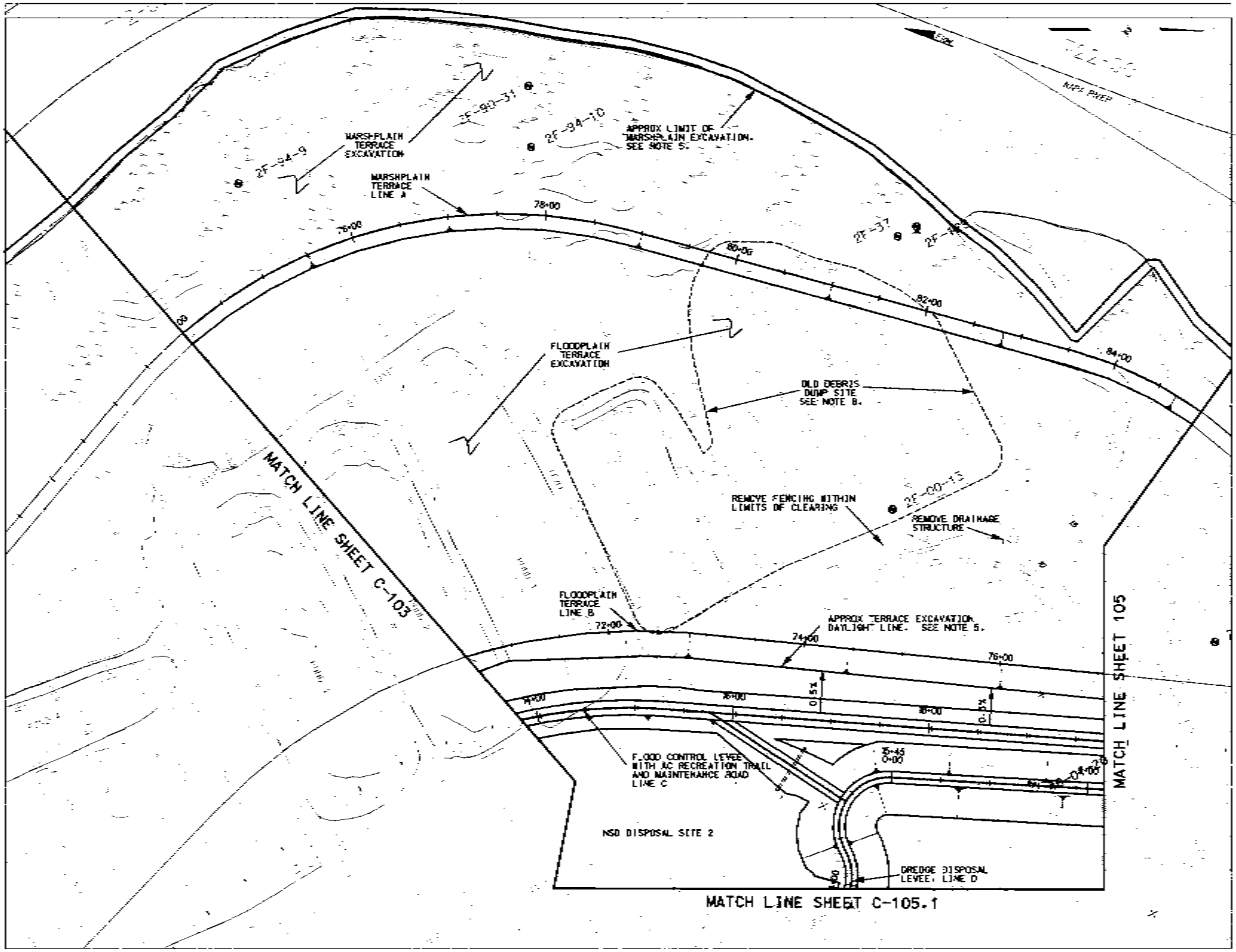
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT

NAPA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CALIFORNIA
GENERAL PLAN, RIGHT-OF-WAY,
PROJECT ACCESS AND
LOCATION OF EXPLORATIONS
FLOODPLAIN/MARSPLAIN TERRACE

Sheet reference number:
C-103

PLOT DATE 26-APR-2005
PLOT TIME 13:37



LEGEND

RIGHT-OF-WAY

TURBIDITY CURTAIN

CENTERLINE OF LEVEE, [illegible] AND MAINT. ROAD

FLOODPLAIN TERRACE

MARSHPLAIN TERRACE

NOTES:

1. SEE SHEETS [illegible] FOR LEVEE PLAN AND PROFILES.

2. SEE SHEETS [illegible] FOR TERRACE GRADING PLAN.

3. SEE SHEETS [illegible] FOR [illegible] ALIGNMENTS.

4. EXISTING TREES AND SHRUBS [illegible]

5. APPROXIMATE LIMITS OF EXCAVATION AND FILL ARE SHOWN [illegible] SECTIONS.

6. [illegible]

7. [illegible]

8. [illegible] WHEN EXCAVATING THIS AREA.

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SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
[illegible]
SACRAMENTO, CA 95814-2922

NAPA

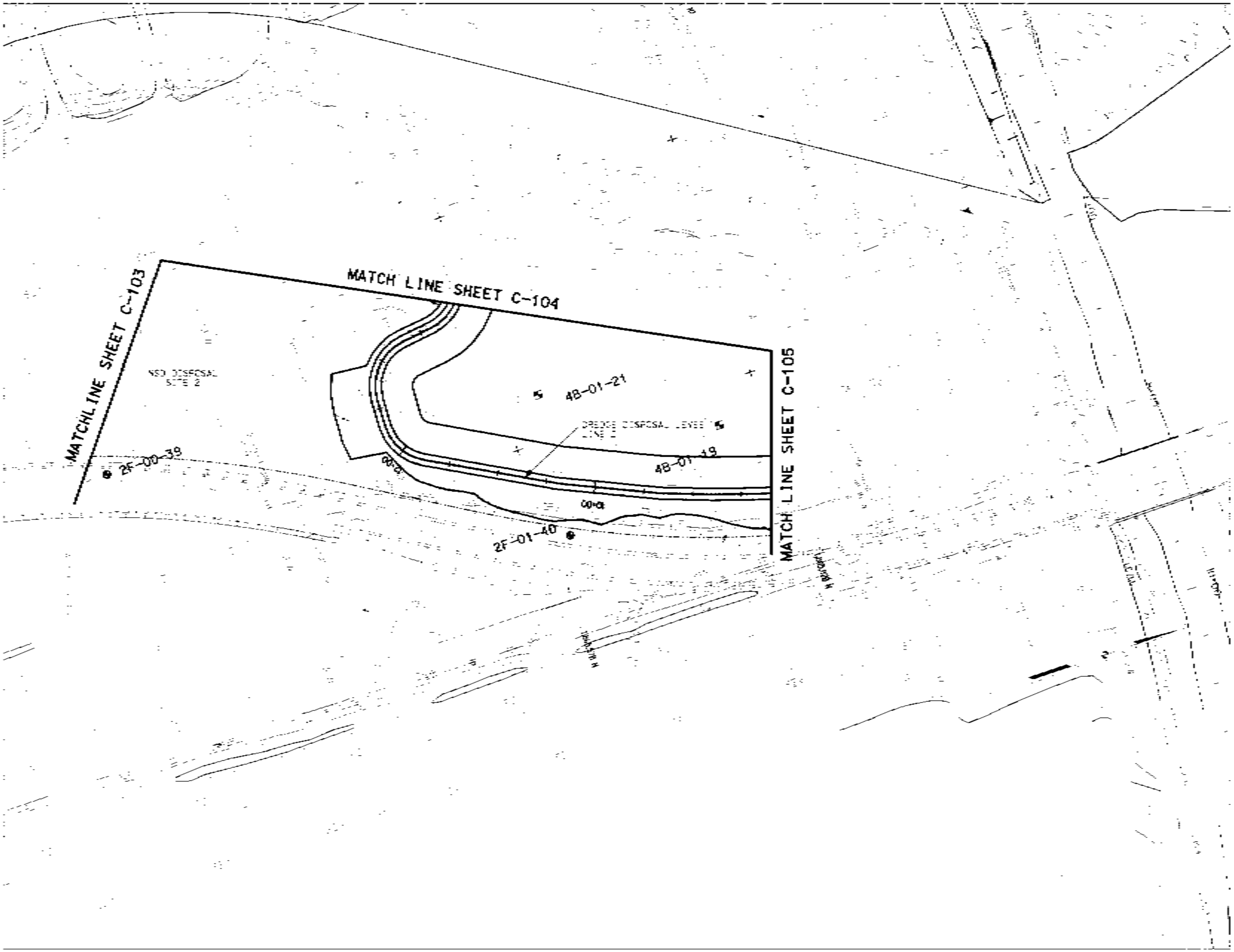
CALIFORNIA

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST NSD
IMOLA TO NEW TULOCAY CK.
GENERAL PLAN, RIGHT-OF-WAY,
PROJECT ACCESS AND
LOCATION OF EXPLORATIONS
FLOODPLAIN/MARSHPLAIN TERRACE

Sheet reference number:

C-104

Sheet 21 of 7?



LEGEND

RIGHT-OF-WAY
TURBIDITY CURTAIN
CENTERLINE OF LEVEE AND FLOODWALL
> > HAUL ROUTE
FLOODPLAIN TERRACE
MARSHPLAIN TERRACE

NOTES:

1. SEE SHEETS [illegible] TO [illegible] FOR LEVEE PLAN AND PROFILE.

2. SEE SHEETS [illegible] TO [illegible] FOR TERRACE GRADING PLAN.

3. SEE SHEETS [illegible] TO [illegible] FOR [illegible] ALIGNMENTS.

4. EXISTING TREES AND SHRUBS ARE NOT SPECIFICALLY IDENTIFIED BY LOCATION AND SIZE. [illegible]

5. APPROXIMATE LIMITS OF EXCAVATION AND FILL ARE SHOWN IN DRAWINGS. [illegible]

6. [illegible]

7. CONTRACTOR SHALL PROVIDE [illegible]

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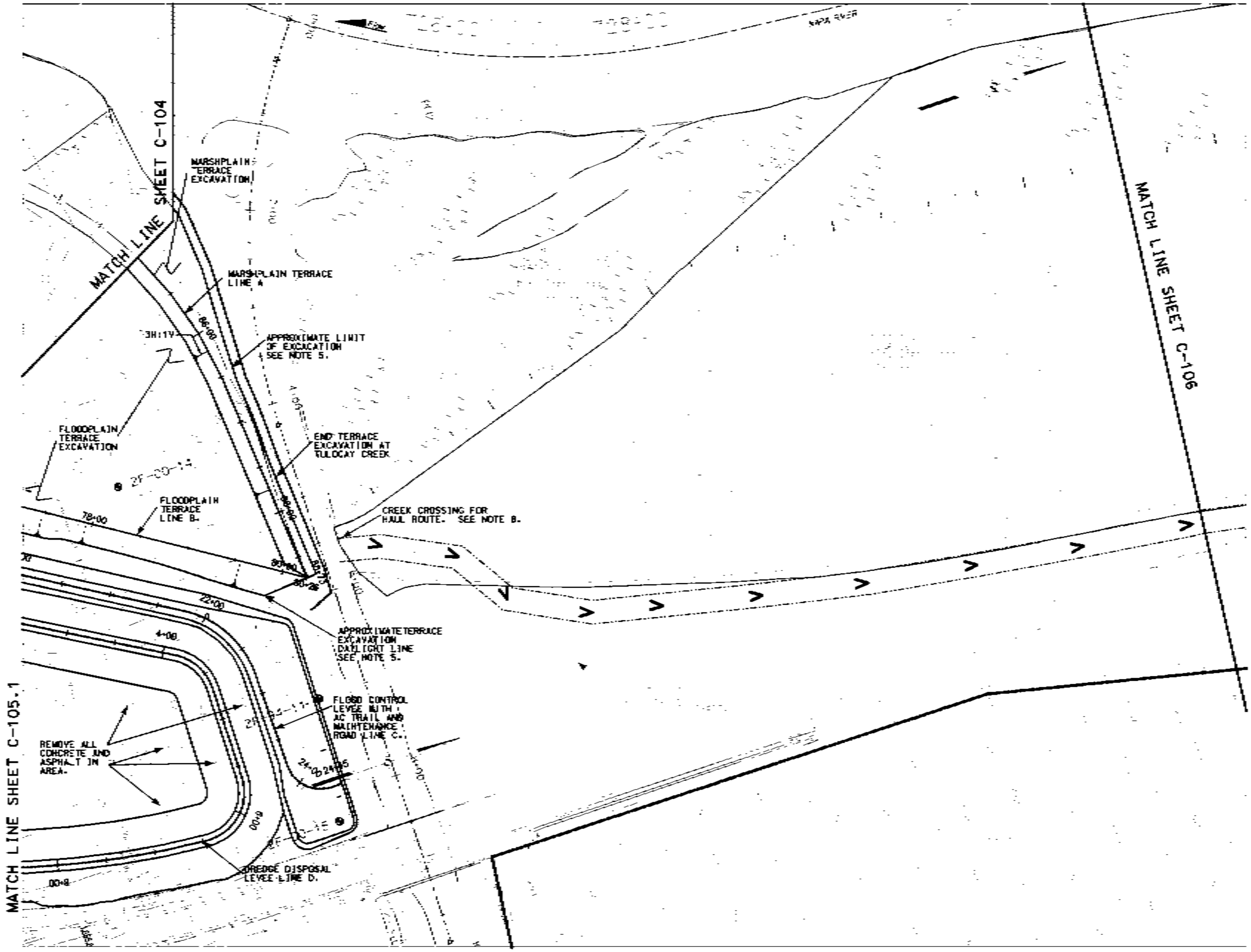
SACRAMENTO DISTRICT

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
IMOLA TO NEW TULOCAY CK.
GENERAL PLAN, RIGHT OF WAY,
PROJECT ACCESS AND
LOCATION OF EXPLORATIONS
FLOODPLAIN/MARSHPLAIN TERRACE

Sheet reference number:
C-105.1
Sheet 25 of [illegible]

PLOT DATE 26-APR-2005 PLOT TIME 13:39



LEGEND

RIGHT-OF-WAY

TURBIDITY CURTAIN

CENTERLINE OF LEVEE AND FLOODWALL

> > HAUL ROUTE

FLOODPLAIN TERRACE

MARSHPLAIN TERRACE

NOTES:

1. SEE SHEETS [illegible] FOR LEVEE PLAN AND PROFILE.

2. SEE SHEETS [illegible] FOR TERRACE GRADING PLAN.

3. SEE SHEETS [illegible] FOR [illegible] ALIGNMENTS.

4. EXISTING TREES AND SHRUBS [illegible]

5. APPROXIMATE LIMITS OF EXCAVATION [illegible]

6. [illegible]

7. CONTRACTOR SHALL PROVIDE [illegible]

8. CONTRACTOR MAY [illegible]

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SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
[illegible]
1325 J STREET
SACRAMENTO, CA 95814-2922

04/??/2005

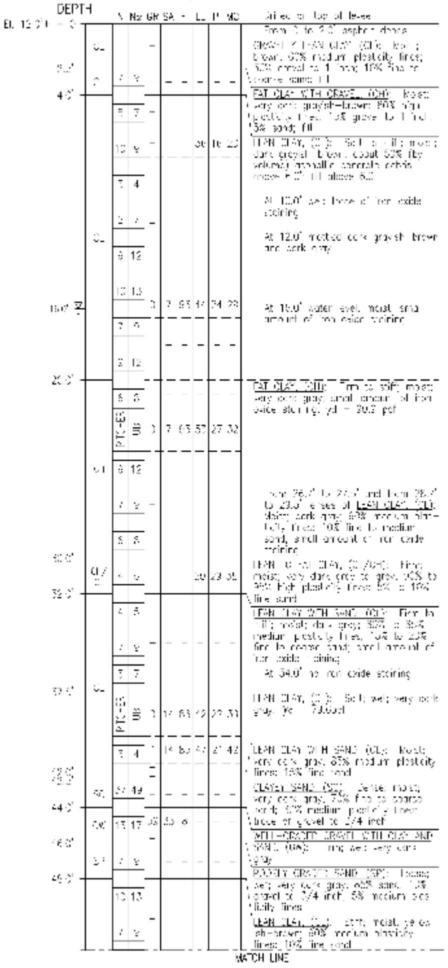
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
[illegible]
LINCOLN TO NEW TULOCAY CK
GENERAL PLAN, RIGHT OF WAY,
PROJECT ACCESS AND
LOCATION OF EXPLORATIONS
FLOODPLAIN/MARSHPLAIN TERRACE

Sheet reference number:
C-105
Sheet 22 of 72

PLOT DATE 26-APR-2005 PLOT TIME 13:36

2F-01-42

N 1,864,051.12; E 6,480,949.75



Drilled on top of levee

From 0 to 2.0' asphalt debris

GRAVELLY LEAN CLAY (CL): Moist; brown; 60% medium plasticity fines; 30% gravel to 1 inch; 10% fine to coarse sand; fill

FAT CLAY WITH GRAVEL (CH): Moist; very dark grayish-brown; 80% high plasticity fines; 15% gravel to 1 inch; 5% sand; fill

LEAN CLAY, (CL): Soft to stiff; moist; dark grayish brown; about 50% (by volume) asphaltic concrete debris above 6.0'; fill above 6.0

At 10.0' very trace of iron oxide staining

At 12.0' mottled dark grayish brown and dark gray

At 15.0' water level; moist; small amount of iron oxide staining

FAT CLAY, (CH): Firm to stiff; moist; very dark gray; small amount of iron oxide staining; γd = 90.2 pcf

From 26.7' to 27.0' and from 28.7' to 29.0' lenses of LEAN CLAY, (CL): Moist; dark gray; 90% medium plasticity fines; 10% fine to medium sand; small amount of iron oxide staining

LEAN TO FAT CLAY, (CL/CH): Firm; moist; very dark gray to gray; 90% to 95% high plasticity fines; 5% to 10% fine sand

LEAN CLAY WITH SAND, (CL): Firm to stiff; moist; dark gray; 80% to 85% medium plasticity fines; 15% to 20% fine to coarse sand; small amount of iron oxide staining

At 34.0' no iron oxide staining

LEAN CLAY, (CL): Soft; wet; very dark gray; γd = 79.6pcf

LEAN CLAY WITH SAND (CL): Moist; very dark gray; 85% medium plasticity fines; 15% fine sand

CLAYEY SAND (SC): Dense; moist; very dark gray; 70% fine to coarse sand; 30% medium plasticity fines; trace of gravel to 3/4 inch

WELL-GRADED GRAVEL WITH CLAY AND SAND (GW): Firm; wet; very dark gray

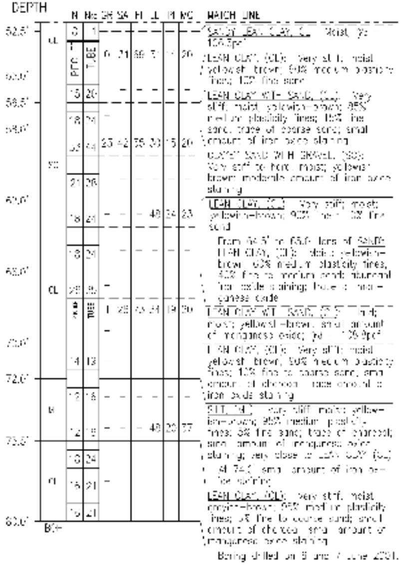
POORLY GRADED SAND (SP): Loose; wet; very dark gray; 85% sand; 10% gravel to 3/4 inch; 5% medium plasticity fines

LEAN CLAY, (CL): Stiff; moist; yellowish-brown; 90% medium plasticity fines; 10% fine sand

VERTICAL SCALE: 1" = 3'

2F-01-42

(Continued)



SANDY LEAN CLAY, CL: Moist; γd = 105.3pcf

LEAN CLAY, (CL): Very stiff; moist; yellowish brown; 90% medium plasticity fines; 10% fine sand

LEAN CLAY WITH SAND, (CL): Very stiff; moist; yellowish-brown; 85% medium plasticity fines; 15% fine sand; trace of coarse sand; small amount of iron oxide staining

CLAYEY SAND WITH GRAVEL (SC): Very stiff to hard; moist; yellowish brown; moderate amount of iron oxide staining

LEAN CLAY, (CL): Very stiff; moist; yellowish-brown; 90% fines; 10% fine sand

From 64.5' to 65.0' lens of SANDY LEAN CLAY, (CL): Moist; yellowish-brown; 60% medium plasticity fines; 40% fine to medium sand; abundant iron oxide staining; trace of manganese oxide

LEAN CLAY WITH SAND, (CL): Firm; moist; yellowish-brown; small amount of manganese oxide; γd = 105.9pcf

LEAN CLAY, (CL): Very stiff; moist; yellowish brown; 90% medium plasticity fines; 10% fine to coarse sand; small amount of charcoal; trace amount of iron oxide staining

SILT, (ML): Very stiff; moist; yellowish-brown; 95% medium plasticity fines; 5% fine sand; trace of charcoal; small amount of manganese oxide staining; very close to LEAN CLAY (CL)

At 74.0' small amount of iron oxide staining

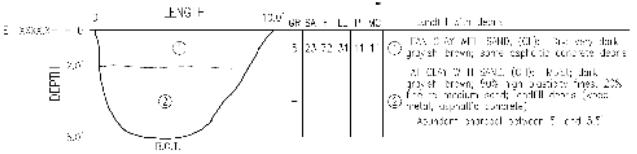
LEAN CLAY, (CL): Very stiff; moist; grayish-brown; 95% medium plasticity fines; 5% fine to coarse sand; small amount of charcoal; small amount of manganese oxide staining

Boring drilled on 6 and 7 June 2001.

4B-01-22

N 1,864,140; E 6,480,222

N 65° W



Landfill with debris

① LEAN CLAY WITH SAND, (CL): Dry; very dark grayish brown; some asphaltic concrete debris

② FAT CLAY WITH SAND (CH): Moist; dark grayish brown; 80% high plasticity fines; 20% fine to medium sand; landfill debris (wood, metal, asphaltic concrete)

Abundant charcoal between 5' and 5.5'

SCALE: 1" = 3'

NOTES:

1. Locations of borings/Cone are shown on Sheet Nos. C-103 through C-105 and C-125.
2. Legend and Notes are shown on Sheet No. B-301.
3. Other Logs of Explorations are shown on Sheet Nos. B-303 through B-312.

GRAPHIC SCALE

1" = 3' 3' 2' 1' 0 3' 6' 9' 12'

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SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST SIDE
(IMOLA TO NEW TULOCAY CK)

LOG OF EXPLORATIONS 2F-01-42,
4B-01-22, 4B-01-23 AND 2F-00-28

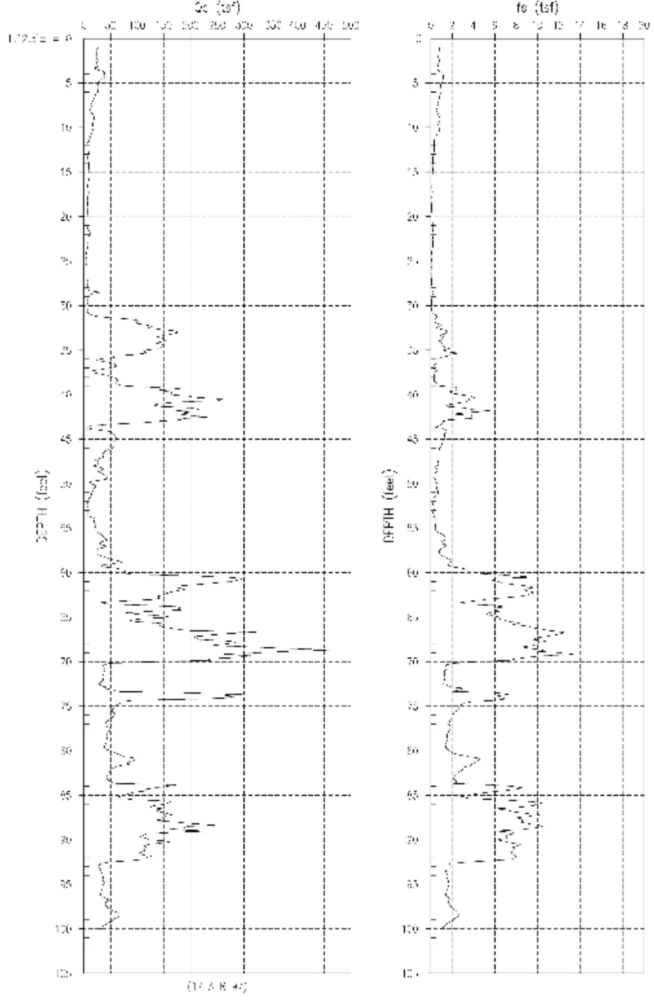
Sheet reference number:
B-302

Reference - Exploration Log file No.: NA-01-029

Soil Design Section Sheet No.: 2 of 12

C P T - 9 7 - 1

N 1,864,410; E 6,460,616



Horizontal Scale: 1" = 100 tsf

Horizontal Scale: 1" = 5 tsf

Vertical Scale: 1" = 8'

N O T E S :

1. Locations of explorations are shown on Sheet Nos. C-102 through C-105 and C-125.
2. Legend and Notes are shown on Sheet No. B-301.
3. Other Logs of Explorations are shown on Sheet Nos. B-302, B-303, and B-305 through B-312.

G R A P H I C   S C A L E S

1" = 6'

1" = 5 tsf

1" = 100 TSF

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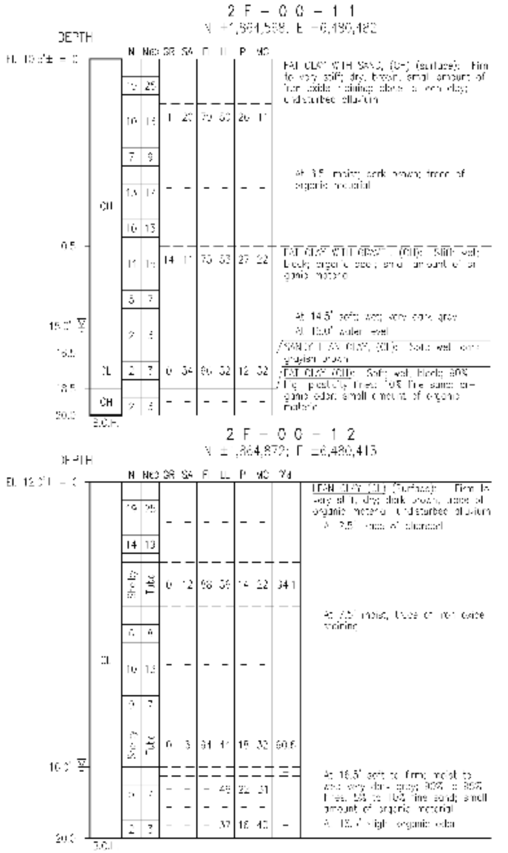
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST RED
UNION TO NEW TULOCAY
LOG OF EXPLORATION
CPT-97-1

Sheet reference number:

B-304

Reference - Exploration Log file No.: 95-01-C29

Soil Design Sheets Sheet No.: 4 of 12



2F-00-11

N ±1,864,598; E ±6,480,482

N	Nc	GR	SA	FI	LL	PI	WC
15	25						
16	15	1	20	79	60	26	11
7	9						
13	17	–	–	–	–	–	–
16	13						
11	15	14	11	75	53	27	22
5	7						
2	3						
2	7	0	34	66	32	12	32
2	3	–	–	–	–	–	–

FAT CLAY WITH SAND, (CH) (surface): Firm to very stiff; dry; brown; small amount of iron oxide staining; clods of lean clay; undisturbed alluvium

At 3.5' moist; dark brown; trace of organic material

FAT CLAY WITH GRAVEL (CH): Stiff; wet; black; organic odor; small amount of organic material

At 14.5' soft; wet; very dark gray

At 15.0' water level

SANDY LEAN CLAY, (CL): Soft; wet; dark grayish brown

FAT CLAY (CH): Soft; wet; black; 90% high plasticity fines; 10% fine sand; organic odor; small amount of organic material

2F-00-12

N ±1,864,872; E ±6,480,413

N	Nc	GR	SA	FI	LL	PI	WC	Yd
19	25	–	–	–	–	–	–	
14	13							
Shelby	Tube	0	12	88	36	14	22	94.1
6	6							
10	13	–	–	–	–	–	–	
9	7							
Shelby	Tube	0	3	91	41	19	32	90.6
5	7	–	–	–	49	22	31	
		–	–	–	–	–	–	
2	3	–	–	–	37	18	40	–

LEAN CLAY (CL) (surface): Firm to very stiff; dry; dark brown; trace of organic material. Undisturbed alluvium

At 2.5' trace of charcoal

At 7.5' moist; trace of iron oxide staining

At 16.5' soft to firm; moist to wet; very dark gray; 90% to 95% fines; 5% to 10% fine sand; small amount of organic material

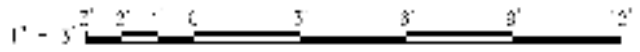
At 18.0' slight organic odor

VERTICAL SCALE: 1" = 3'

NOTES:

1. Locations of explorations are shown on Sheet Nos. C-103 through C-105 and C-125.
2. Legend and notes are shown on Sheet No. B-301.
3. Other Logs of Explorations are shown on Sheet Nos. B-302 through B-308 and B-310 through B-312.

GRAPHIC SCALE



US Army Corps of Engineers
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SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
ENGINEERING DIVISION

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST BED
UNION TO NEW TULOCAY 2B

LOG OF EXPLORATIONS
2F-37, 2F-129, 2F-00-11 AND 2F-00-12

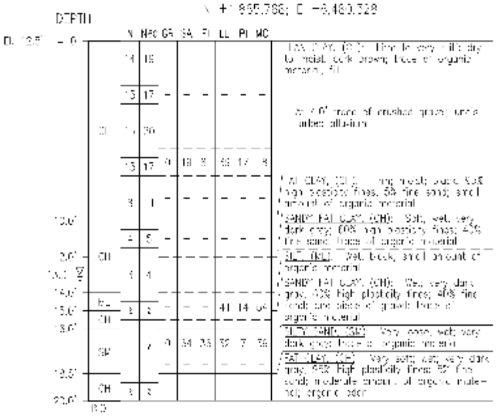
Sheet reference number:
B-309
Sheet 14 of 72

Reference – Exploration Log file no.: NA-01-C29

Soil Design Section Sheet No.: 8 of 12

2F-00-13

N +1,865,786; E -6,480,328



LEAN CLAY, (CL): Firm to very stiff; dry to moist; dark brown; trace of organic material; fill

At 4.0' trace of crushed gravel; undisturbed alluvium

FAT CLAY, (CH): Firm; moist; black; 95% high plasticity fines; 5% fine sand; small amount of organic material

SANDY FAT CLAY, (CH): Soft; wet; very dark gray; 60% high plasticity fines; 40% fine sand; trace of organic material

SILT, (ML): Wet; black; small amount of organic material

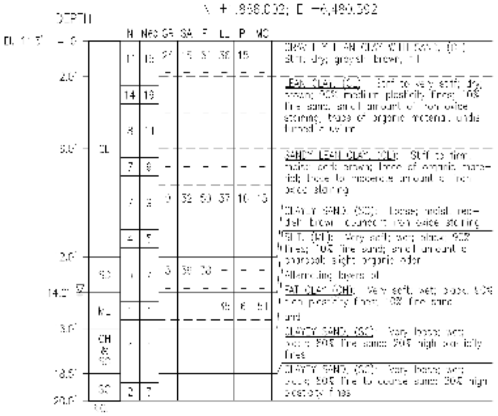
SANDY FAT CLAY, (CH): Wet; very dark gray; 60% high plasticity fines; 40% fine sand; one piece of gravel; trace of organic material

SILTY SAND, (SM): Very loose; wet; very dark gray; trace of organic material

FAT CLAY, (CH): Very soft; wet; very dark gray; 95% high plasticity fines; 5% fine sand; moderate amount of organic material; organic odor

2F-00-14

N +1,868,002; E -6,480,302



GRAVELLY LEAN CLAY WITH SAND, (CL): Stiff; dry; grayish brown; fill

LEAN CLAY, (CL): Soft to very stiff; dry; brown; 90% medium plasticity fines; 10% fine sand; small amount of iron oxide staining; trace of organic material; undisturbed alluvium

SANDY LEAN CLAY, (CL): Stiff to firm; moist; dark brown; trace of organic material; trace to moderate amount of iron oxide staining

CLAYEY SAND, (SC): Loose; moist; reddish brown; abundant iron oxide staining

SILT, (ML): Very soft; wet; black; 90% fines; 10% fine sand; small amount of charcoal; slight organic odor

Alternating layers of

FAT CLAY, (CH): Very soft; wet; black; 90% high plasticity fines; 10% fine sand

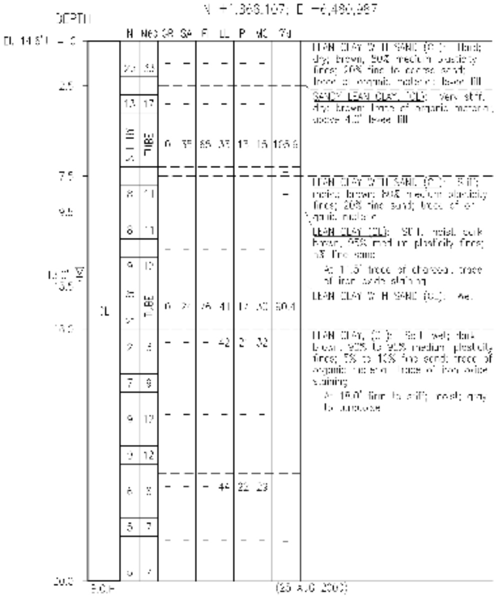
and

CLAYEY SAND, (SC): Very loose; wet; black; 80% fine sand; 20% high plasticity fines

CLAYEY SAND, (SC): Very loose; wet; black; 80% fine to coarse sand; 20% high plasticity fines

2F-00-15

N +1,868,107; E -6,480,987



LEAN CLAY WITH SAND (CL): Hard; dry; brown; 80% medium plasticity fines; 20% fine to coarse sand; trace of organic material; levee fill

SANDY LEAN CLAY, (CL): Very stiff; dry; brown; trace of organic material; above 4.0' levee fill

LEAN CLAY WITH SAND (CL): Stiff; moist; brown; 80% medium plasticity fines; 20% fine sand; trace of organic material

LEAN CLAY (CL): Soft; moist; dark brown; 95% medium plasticity fines; 5% fine sand

At 11.5' trace of charcoal; trace of iron oxide staining

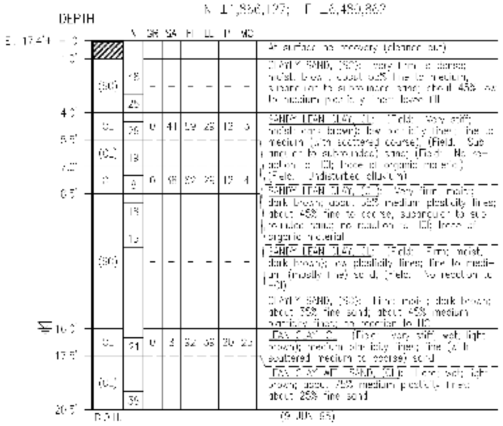
LEAN CLAY WITH SAND (CL): Wet

LEAN CLAY, (CL): Soft; wet; dark brown; 90% to 95% medium plasticity fines; 5% to 10% fine sand; trace of organic material; trace of iron oxide staining

At 16.0' firm to stiff; moist; gray to turquoise

2F-94-11

N 1,866,127; E 6,480,862



At surface no recovery (cleaned out)

CLAYEY SAND, (SC): Very firm to dense; moist; brown; about 55% fine to medium, subangular to subrounded sand; about 45% low to medium plasticity fines; levee fill

SANDY LEAN CLAY, (CL): (Field) Very stiff; moist; dark brown; low plasticity fines; fine to medium (with scattered coarse), (Field) Subangular to subrounded sand; (Field) No reaction to HCl; trace of organic material (Field) Undisturbed alluvium

SANDY LEAN CLAY, (CL): Very firm; moist; dark brown; about 55% medium plasticity fines; about 45% fine to coarse, subangular to subrounded sand; no reaction to HCl; trace of organic material

SANDY LEAN CLAY, (CL): (Field) Firm; moist; dark brown; low plasticity fines; fine to medium (mostly fine) sand; (Field) No reaction to HCl

CLAYEY SAND, (SC): Firm; moist; dark brown; about 55% fine sand; about 45% medium plasticity fines; no reaction to HCl

LEAN CLAY, (CL): (Field) Very stiff; wet; light brown; medium plasticity fines; fine (with scattered medium to coarse) sand

LEAN CLAY WITH SAND, (CL): Firm; wet; light brown; about 75% medium plasticity fines; about 25% fine sand

NOTES:

1. Locations of borings/Cone are shown on Sheet Nos. C-102 through C-105 and C-123.
2. Legend and Notes are shown on Sheet No. B-301.
3. Other Logs of Explorations are shown on Sheet Nos. B-303 through B-309, B-311 and B-312.

GRAPHIC SCALE

1" = 3'

VERTICAL SCALE: 1" = 3'

US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST HED
UNION TO NEW TULOCAY SKI

LOG OF EXPLORATIONS 2F-00-13,
2F-00-14, 2F-00-15 AND 2F-94-11

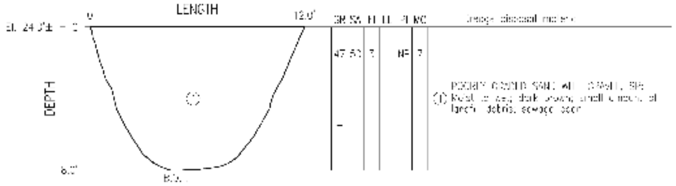
Sheet reference number:
B-310

Reference – Exploration Log file No.: 95-01-029

50% Design Review Sheet No.: 10 of 12

4B-01-20

N 1,866,770; E 6,480,836

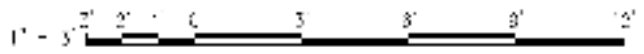


SCALE: 1" = 3'

NOTES:

1. Locations of explorations are shown on Sheet Nos. C-102 through C-105 and C-125.
2. Legend and notes are shown on Sheet No. B-301.
3. Other Logs of Explorations are shown on Sheet Nos. B-202 through B-310 and B-312.

GRAPHIC SCALE



US Army Corps
of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN HOUSE DESIGN
1325 J STREET
[illegible]

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST BID
(UNCLA TO NEW TULOCAY CK)
LOG OF EXPLORATIONS 2F-01-40,
4B-01-19, 4B-01-20 AND 4B-01-21

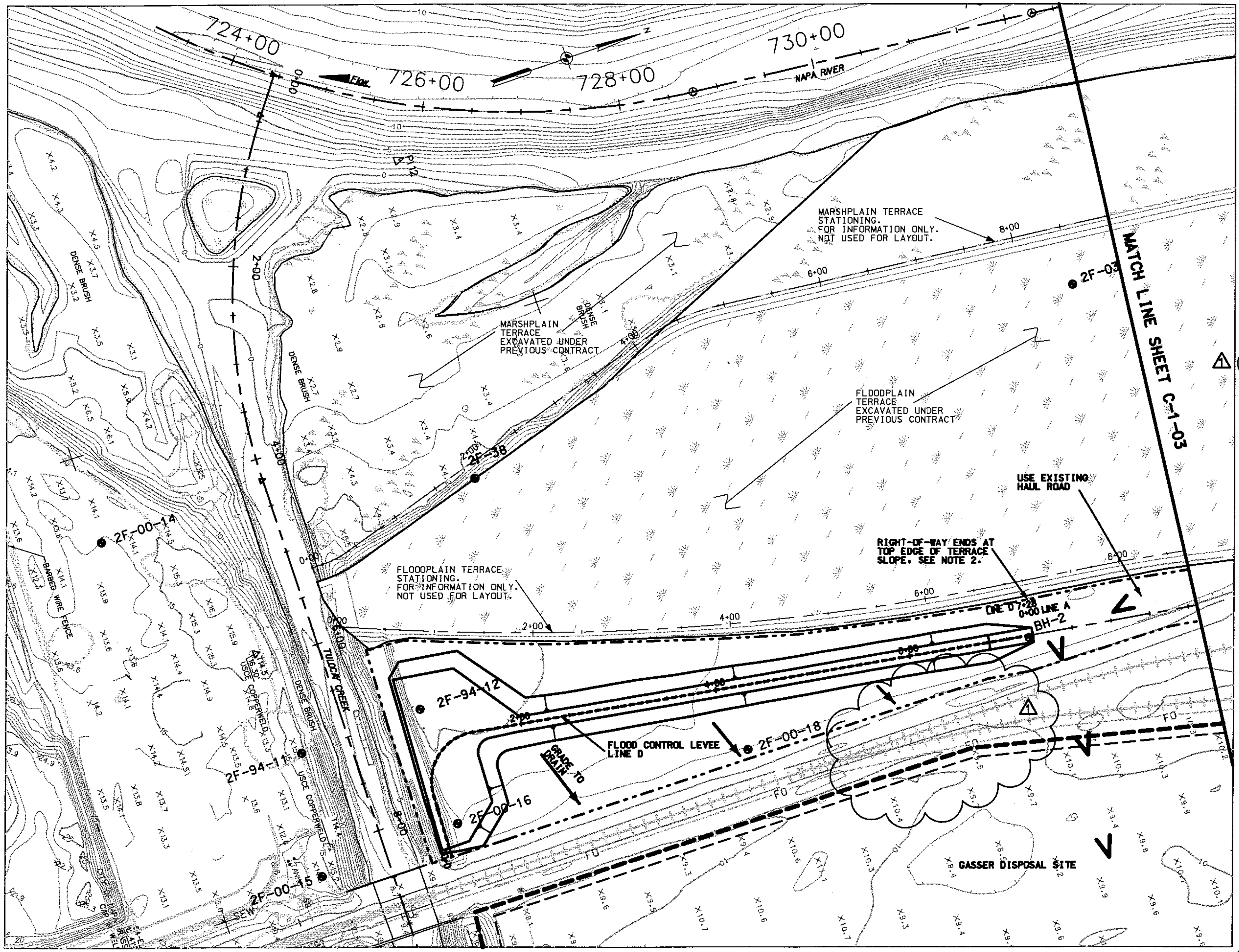
Sheet
reference
number:
B-311

Reference - Exploration Log file no.: NA-01-029

Soil Design Section Sheet No. 11 of 12

ENCLOSURE 3

Old Nord Vineyard Levee Plan and Soil Boring Logs



LEGEND

- - - - RIGHT-OF-WAY
< < HAUL ROUTE
▨ FLOODPLAIN TERRACE
▨ MARSHPLAIN TERRACE
▬ ▬ GASSER DISPOSAL SITE
– – – – ENVIRONMENTALLY SENSITIVE AREA

NOTES:

1. SEE SHEET C-1-09 FOR LEVEE DESIGN.
2. CONTRACTOR SHALL NOT ENTER FLOODPLAIN TERRACE, UNLESS APPROVED BY CONTRACTING OFFICER.
3. DELETED
4. LOGS OF EXPLORATION ARE SHOWN ON SHEETS B-3-01 TO B-3-19.
5. CONTRACTOR SHALL PROVIDE FENCING, BARRICADES, SAFETY SIGNS, ETC. AS REQUIRED TO RESTRICT PUBLIC ACCESS TO CONSTRUCTION AREAS AND HAUL ROADS.
6. SEE SHEET C-3-19 FOR LEVEE CROSS-SECTION.
7. CONTRACTOR SHALL PROVIDE TEMPORARY SAFETY FENCING ALONG RIGHT-OF-WAY LINE BETWEEN RAILROAD AND PROJECT SITE. FENCING SHALL RUN NORTH ALL THE WAY TO END OF LINE A.

GRAPHIC SCALE
0 10' 25' 50' 100' 150'
1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
1	SHEET NOTES DELETED	6/18/04	PV/RM

Designed by: [illegible]	Date: 05/06/2004	Rev. REV.1
Dwn by: JMA	Spec No.: 1298	Design file no: NA-04-018
Reviewed by: TMC		Drawing Code:
Submitted by: /s/PETER VALENTINE CHIEF, CIVIL DESIGN SEC A		File name: Plot date: Plot scale:60

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH ST TO THIRD ST)

GENERAL PLAN, RIGHT-OF-WAY, STAGING AREAS, PROJECT ACCESS AND LOCATION OF EXPLORATIONS

Sheet reference number:
C-1-02
Sheet 26 of 52

PLOT DATE 22-JUN-2004 PLOT TIME 07:57 MASTER DESIGN FILE \\gold\civcad\napar\cn2a\cadd\SheetFiles\Mods\NA-04-015C-102am1.dgn

AM-001

2F-94-12

N ±1,866,256; E ±6,480,858

DEPTH		N	GR	SA	FI	LL	PI	MC
El. 9.7'± = 0	(CL)	14	–	–	–	–	–	–
		12						
4.0'	CL	9	0	37	63	35	13	13
5.5'	(CL)	7	–	–	–	–	–	–
7.0'	(CH)	4	–	–	–	–	–	–
8.5'	CL	4	1	29	70	35	16	30
10.0'	(CH)	3						
		2	–	–	–	–	–	–
▽ 16.0'								
16.5'	SM	2	0	76	24	–	NP	31
17.5'	(SC)	2	–	–	–	–	–	–
20.5'	B.O.H.							

LEAN CLAY, (CL): Stiff; moist; dark brown; about 90% medium plasticity fines; about 10% fine to medium sand; no reaction to HCl

SANDY LEAN CLAY, CL: (Field: Stiff; moist; dark brown); medium plasticity fines; (Field: Fine to medium sand; no reaction to HCl)

LEAN CLAY WITH SAND, (CL): Firm; moist; olive-brown; about 85% medium plasticity fines; about 15% fine to medium sand; no reaction to HCl

FAT CLAY, (CH): Soft; mottled olive-brown to dark gray; about 95% high plasticity fines; about 5% fine sand; no reaction to HCl

SANDY LEAN CLAY, CL: (Field: Soft; mottled olive-brown to dark gray); medium plasticity fines; (Field: Fine sand); gravel; (Field: No reaction to HCl)

FAT CLAY, (CH): Soft; mottled olive-brown to dark gray; about 95% high plasticity fines; about 5% fine sand; no reaction to HCl; very easy drilling

At 10.5' gray

At 16.0' wet

At 16.2' wood debris

At 16.4' rounded rock

SILTY SAND, SM: (Field: Very loose; wet; dark brown; fine to medium (with scattered coarse), subangular to subrounded sand); nonplastic fines; (Field: No reaction to HCl)

CLAYEY SAND, (SC): Very loose; wet; dark brown; about 70% fine to medium (with a trace of coarse), subangular to subrounded sand; about 30% low to medium plasticity fines; no reaction to HCl

(25 OCT 94)

2F-00-16

N ±1,866,254; E ±6,480,981

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	γd
El. 11.4'± = 0	CL	12	16	–	–	–	–	–	–	–
2.5'		4	5	–	–	–	–	–	–	–
4.0'		Shelby	Tube	0	48	52	27	9	17	98.7
5.5'	CL-ML			0	50	50	25	6	16	106.4
6.0'	CL			0	24	76	35	15	21	106.9
		9	12							
		7	9	–	–	–	–	–	–	–
11.5' ▽		5	7							
		Shelby	Tube	0	10	90	46	21	28	–
		7	9	–	–	–	–	–	–	–
		11	15	–	–	–	–	–	–	–
		7	9							
22.0'		5	7	0	19	81	42	20	–	–
		3	4							
		2	3	–	–	–	–	–	–	–
		2	3							
30.0'	B.O.H.									

LEAN CLAY, (CL): Very stiff; dry; brown; 90% medium plasticity fines; 10% fine sand; trace of organic material

LEAN CLAY WITH SAND, (CL): Firm; moist; dark brown; trace of organic material

SANDY LEAN CLAY, (CL):

SANDY SILTY CLAY, (CL-ML):

LEAN CLAY, (CL): Firm to stiff; moist; dark brown to dark gray; trace of organic matter; trace of charcoal

At 11.5' no charcoal, trace of iron oxide staining

From 16.0' to 18.0' 3% gravel

LEAN CLAY WITH SAND, (CL): Soft; moist; dark brown to dark gray; trace of organic material; moderate iron oxide staining

(26 JULY 2000)

2F-00-18

N ±1,866,558; E ±6,481,003

DEPTH		N	N60	GR	SA	FI	LL	PI	MC
El. 9.0'± = 0	CL	6	8	–	–	–	–	–	–
2.5'	SC	6	8	2	70	28	32	14	24
4.5'	CL	4	5	–	–	–	–	–	–
		14	19						
8.5'		6	8	–	–	–	–	–	–
		7	9	0	36	64	40	19	25
		6	8	–	–	–	–	–	–
14.5'		8	11						
16.0' ▽				–	–	–	–	–	–
		7	9						
18.5'	SC	2	3	1	57	42	34	15	27
20.0'	B.O.H.								

GRAVELLY LEAN CLAY, (CL): Firm; moist; dark brown to brown

CLAYEY SAND, (SC): Firm; moist; dark brown to brown

LEAN CLAY, (CL): Firm to very stiff; moist; dark brown; trace of organic material

SANDY LEAN CLAY, (CL): Firm to stiff; moist; dark brown; weak iron oxide staining

LEAN CLAY, (CL): Stiff; moist to wet; gray; moderate iron oxide staining

CLAYEY SAND, (SC): Very loose; wet; brown; moderate iron oxide staining

(26 JULY 2000)

VERTICAL SCALE: 1" = 3'

N O T E S :

1. Legend and Notes are shown on Sheet No. B-3-01.
2. Logs of Explorations are shown on Sheet Nos. B-3-01 through B-3-19.
3. Location of Explorations are shown on Sheet Nos. C-1-02 through C-1-08 and C-1-10.

GRAPHIC SCALE

1" = 3' 3' 2' 1' 0 3' 6' 9' 12'

US Army Corps of Engineers Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Design file no: NA-04-15

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STREET)

LOG OF EXPLORATIONS
2F-15, 2F-94-6 AND 2F-00-38

Sheet reference number: B-3-02

Sheet 7 of 52

Reference: Exploration Log File No. NA-01-17

Soil Design Section Sheet No. 2 of 15

BH2

N. 1,866,864.99, E. 6,480,986.40

DEPTH		N	GR	SA	FI	LL	PI	MC	
Elev. 13.48'=0			-	-	-	-	-	-	
0.3'	ML-GM		-	-	-	-	-	-	GRAVELY SILT, ML-GM: Gravel to 2" size; (FILL)
	ML	33	-	-	-	42	20	14	CLAYEY SILT, ML: Hard; moist (humid); moderate brown; medium plasticity fines; trace of medium to coarse grained, subrounded sand; (FILL)
		34	-	-	-	-	-	-	From 2.3' to 4.5' depth, as above except low plasticity fines At 2.9' depth, sand content increasing to approximately 5%
4.5'		20	-	-	-	-	-	-	CLAYEY SILT, ML: Very stiff; moist; moderate brown, with come darker brown sub-horizontal laminations; low plasticity fines; trace of medium to coarse grained sand; fine gravel to 3/8" size; (FILL)
6.6'		10							SILTY CLAY, CL: Stiff; moist; moderate brown; medium plasticity fines; trace of coarse gravel to 1" size
		12	-	-	-	-	-	-	At 8.7' depth, some vertical root fibers
		13							At 10.7' depth, decreasing root fibers
13.0'	CL	8							SILTY CLAY, CL: Firm to stiff; moist; moderate brown; medium plasticity fines; some very thin, fine, wet sand seams; trace of subrounded gravel
		9	-	-	-	-	-	-	From 14.5 to 16.5' depth, as above except mottled orangish-brown and grayish-brown; contains some very thin, silty, wet, fine sand seams
16.5'		9	-	-	-	-	-	-	SILTY CLAY, CL: Stiff; moist to wet; mottled moderate brown and grayish-brown; medium plasticity fines; some fine to medium grained sand
		10	0	33	67	34	18	25	SANDY LEAN CLAY, CL: Stiff; moist to wet; mottled moderate brown and grayish-brown; medium plasticity fines; fine to medium grained sand

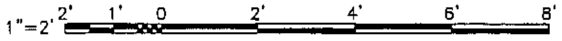
A — MATCH LINE — A

A — MATCH LINE — A

20.5'			-	-	-	-	-	-	
		10							SANDY CLAY, CL: Stiff; wet; mottled moderate brown and grayish-brown; medium plasticity fines; 10% fine to medium grained (black) sand
		8	-	-	-	-	-	-	At 20.8' depth, 1" thick clayey sand layer At 22.8' depth, firm; sand content decreases to 5% At 22.9' depth, very thin fine to medium grained sand seam At 24.5' depth, sand content increases to 25%
		6							At 25.0' depth, very thin fine to medium grained sand seam
26.5'	CL-SC	6	-	-	-	-	-	-	SANDY CLAY, CL-SC: Firm; wet; mottled moderate brown and grayish-brown; medium plasticity fines; 30% fine to medium grained sand
28.5'		6	-	-	-	-	-	-	SILTY CLAY, CL: Firm; wet; mottled moderate brown and grayish-brown; medium plasticity fines; 5% fine to medium grained sand
	CL	7	0	20	80	38	20	36	LEAN CLAY WITH SAND, CL: Firm; wet; mottled moderate brown and grayish-brown; medium plasticity fines; fine to medium grained sand
			-	-	-	-	-	-	
32.5'		6							
		9	-	-	-	-	-	-	SILTY CLAY, CL: Firm to stiff; moist; mottled moderate brown and grayish-brown; medium plasticity fines; trace fine to medium grained sand
		7							
38.2'	SC	42	-	-	-	-	-	-	CLAYEY SAND, SC: Dense; wet; moderate brown; 50% fine to medium grained sand; 40% clay/silt; 10% fine gravel
40.0'	BOH								(8 JULY 2003)

VERTICAL SCALE: 1" = 2'

GRAPHIC SCALE



NOTES:

1. Legend and Notes are shown on Sheet No. B-3-01.
2. Logs of Explorations are shown on Sheet Nos. B-3-01 through B-3-19.
3. Location of Explorations are shown on Sheet Nos. C-1-02 through C-1-06 and C-1-10.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
△			
△			
△			
△			
△			
△			
△			
△			

Designed by: Nicole Holmes/Jane Bolton
Date: 05/06/2004
Rev.
Dwn by: N.L.B./R.L.T.
Spec No.: 1299
Design file no: NA-04-15
Reviewed by: Joe Sciandrone
Drawing Code:
Submitted by: /s/ Ben Gamparo
Chief, Soil Design Section
File name: NA-01-01 [illegible]
Plot date: 05/06/2004
Dwg scale: AS_NOTED

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA
CALIFORNIA

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STEET)

LOG OF EXPLORATION
BH-2

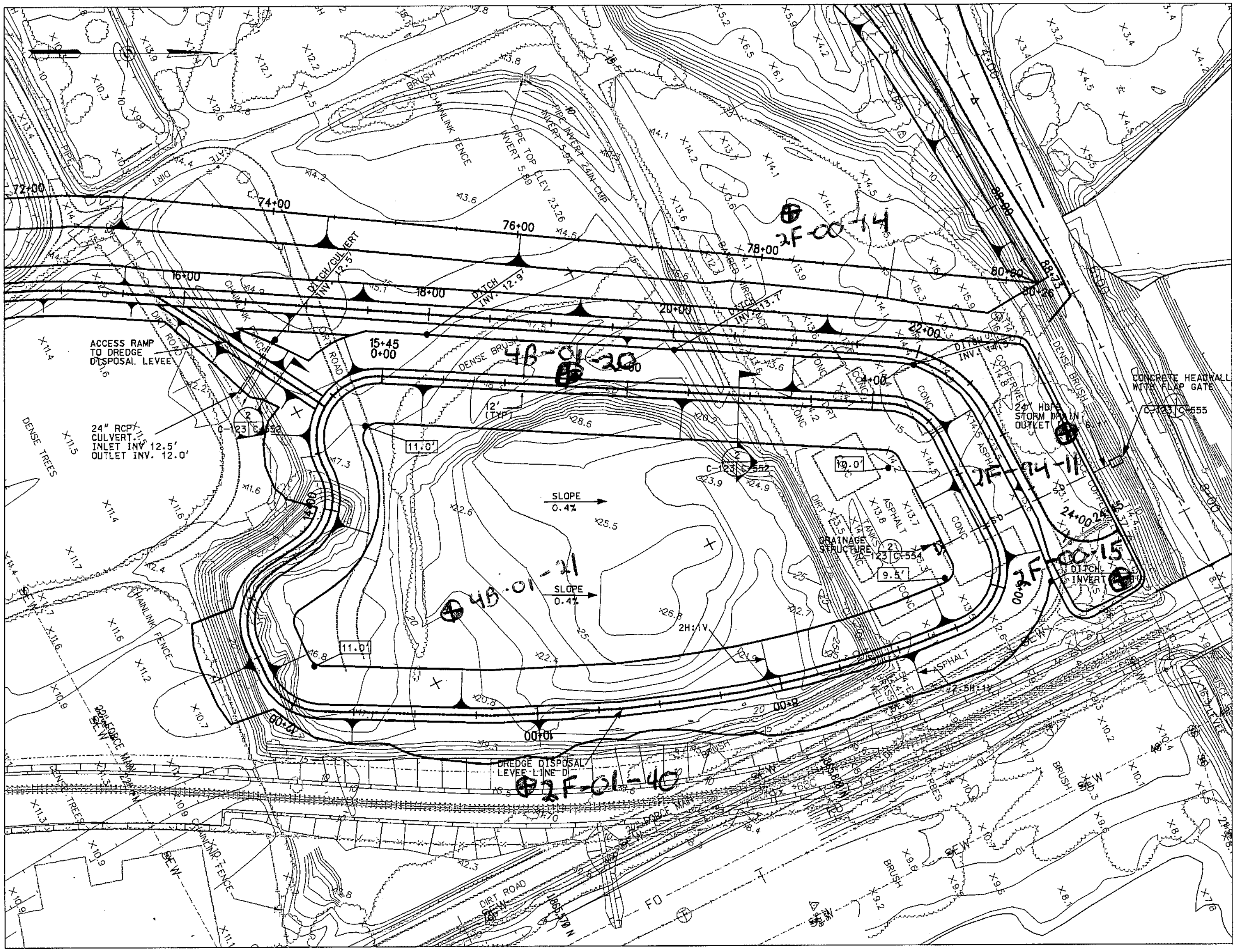
Sheet reference number:
B-3-06
Sheet 11 of 52

Soil Design Section Sheet No. 6 of 19

Reference: Exploration Log File No. NA-01-17

ENCLOSURE 4

Dredge Disposal Dike Plan, Soil Boring Logs, and Slope Stability Models



GRAPHIC SCALE
0 20' 40' 80' 120'
1" = 40'

NOTES:

1. SEE SHEET C-134 FOR LINE D ALIGNMENT.

2. SEE SHEET C-237 FOR PROFILE OF DREDGE DISPOSAL LEVEE.

3. SEE SHEET C-348 FOR CROSS-SECTIONS OF DREDGE DISPOSAL LEVEE.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: NWI
Dwn by: JMA
Spec No.: 1396
Reviewed by: J. BERKLAND
Submitted by: /S/ PETER VALENTINE
CHIEF, CIV ENG&G DES SEC A
Date: 04/25/2005
Rev.: REV_#
Design file no: NA-04-027
Drawing Code:
File name:
Plot date:
Plot scale: 40

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

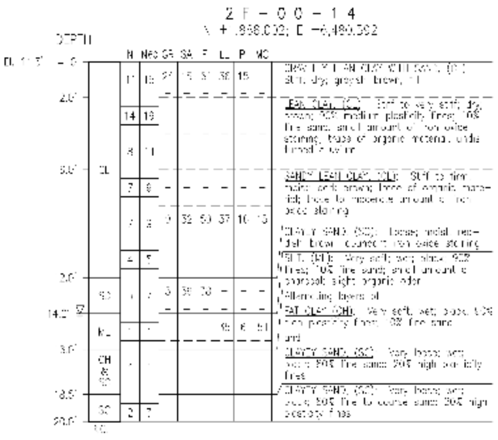
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST NSD
(IMOLA TO NEW TULOCAY CK)
DREDGE DISPOSAL
LEVEE PLAN

Sheet reference number:
C-123
Sheet 41 of 72

PLOT DATE: 26-APR-2005 PLOT TIME: 13:45 MASTER DESIGN FILE: Z:\NapaR\Cn2a_nsd\CADD\SheetFiles\na-04-027c-123xxx.dgn

2F-00-14

N +1,868,002; E -6,480,392



GRAVELLY LEAN CLAY WITH SAND (CL): Stiff; dry; grayish brown; fill

LEAN CLAY (CL): Stiff to very stiff; dry; brown; 90% medium plasticity fines; 10% fine sand; small amount of iron oxide staining; trace of organic material; undisturbed alluvium

SANDY LEAN CLAY (CL): Stiff to firm; moist; dark brown; trace of organic material; trace to moderate amount of iron oxide staining

CLAYEY SAND (SC): Loose; moist; reddish brown; abundant iron oxide staining

SILT (ML): Very soft; wet; black; 90% fines; 10% fine sand; small amount of charcoal; slight organic odor

Alternating layers of

FAT CLAY (CH): Very soft; wet; black; 90% high plasticity fines; 10% fine sand

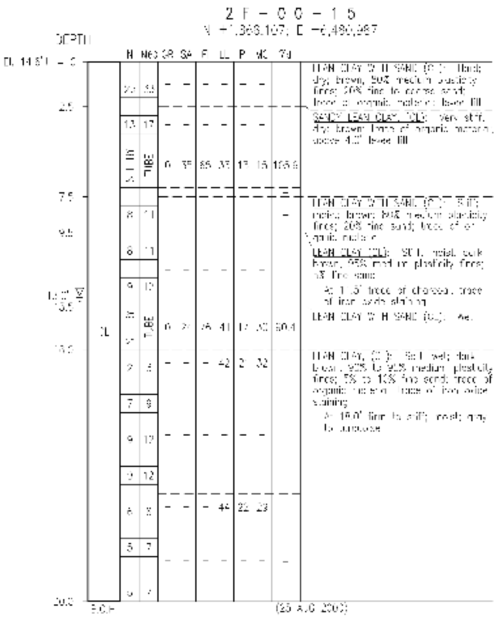
and

CLAYEY SAND (SC): Very loose; wet; black; 80% fine sand; 20% high plasticity fines

CLAYEY SAND (SC): Very loose; wet; black; 80% fine to coarse sand; 20% high plasticity fines

2F-00-15

N +1,868,107; E -6,480,987



LEAN CLAY WITH SAND (CL): Hard; dry; brown; 80% medium plasticity fines; 20% fine to coarse sand; trace of organic material; levee fill

SANDY LEAN CLAY (CL): Very stiff; dry; brown; trace of organic material; above 4.0' levee fill

LEAN CLAY WITH SAND (CL): Stiff; moist; brown; 80% medium plasticity fines; 20% fine sand; trace of organic material

LEAN CLAY (CL): Stiff; moist; dark brown; 95% medium plasticity fines; 5% fine sand

At 11.5' trace of charcoal; trace of iron oxide staining

LEAN CLAY WITH SAND (CL): Wet

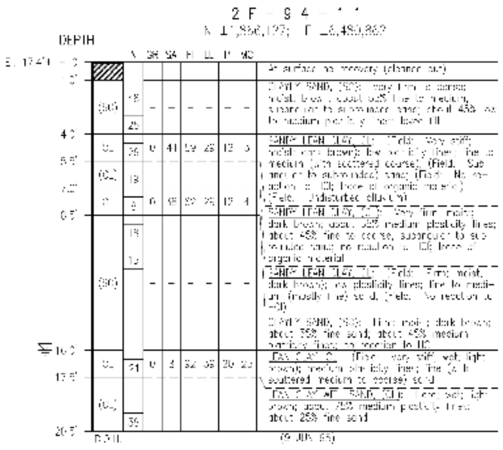
LEAN CLAY (CL): Soft; wet; dark brown; 90% to 95% medium plasticity fines; 5% to 10% fine sand; trace of organic material; trace of iron oxide staining

At 16.0' firm to stiff; moist; gray to [illegible]

(25 AUG 2000)

2F-94-11

N 1,866,127; E 6,480,862



At surface no recovery (cleaned out)

CLAYEY SAND (SC): Very firm to dense; moist; brown; about 55% fine to medium, subangular to subrounded sand; about 45% low to medium plasticity fines; levee fill

SANDY LEAN CLAY (CL): (Field) Very stiff; moist; dark brown; low plasticity fines; fine to medium (with scattered coarse), (Field) Subangular to subrounded sand; (Field) No reaction to HCl; trace of organic material; (Field) Undisturbed alluvium

SANDY LEAN CLAY (CL): Very firm; moist; dark brown; about 55% medium plasticity fines; about 45% fine to coarse, subangular to subrounded sand; no reaction to HCl; trace of organic material

SANDY LEAN CLAY (CL): (Field) Firm; moist; dark brown; low plasticity fines; fine to medium (mostly fine) sand; (Field) No reaction to HCl

CLAYEY SAND (SC): Firm; moist; dark brown; about 55% fine sand; about 45% medium plasticity fines; no reaction to HCl

LEAN CLAY (CL): (Field) Very stiff; wet; light brown; medium plasticity fines; fine (with scattered medium to coarse) sand

LEAN CLAY WITH SAND (CL): Firm; wet; light brown; about 75% medium plasticity fines; about 25% fine sand

(9 JUN 95)

NOTES:

1. Locations of Explorations are shown on Sheet Nos. C-102 through C-105 and C-125.
2. Legend and Notes are shown on Sheet No. B-301.
3. Other Logs of Explorations are shown on Sheet Nos. B-302 through B-309, B-311 and B-312.

GRAPHIC SCALE

1" = 3'
3' 2' 1' 0 3' 6' 9' 12'

VERTICAL SCALE: 1" = 3'

US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
[illegible]

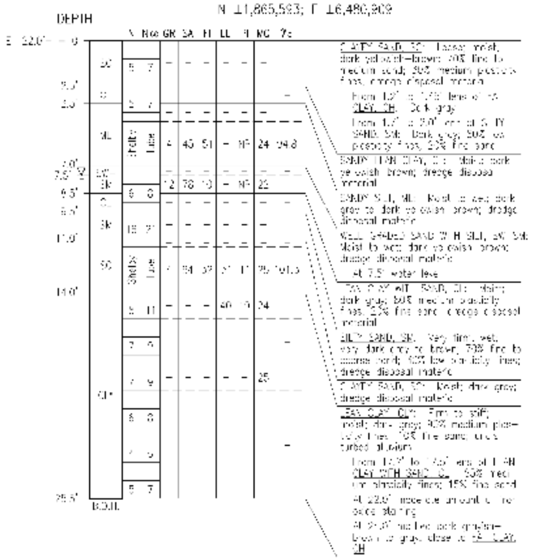
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST [illegible]
[illegible] TO NEW TULOCAY [illegible]

LOG OF EXPLORATIONS 2F-00-14,
2F-00-15 AND 2F-94-11

Sheet reference number:
B-310

Reference – Exploration Log file No.: 94-0[illegible]-C29
Soil Design Section Sheet No.: 10 of 12

2F-01-40
N 11,865,593; E 16,480,909



CLAYEY SAND, SC: Loose; moist; dark yellowish-brown; 70% fine to medium sand; 30% medium plastic fines; dredge disposal material

From 1.0' to 1.5' lens of FAT CLAY, CH: Dark gray

From 1.5' to 2.0' lens of SILTY SAND, SM: Dark gray; 50% low plasticity fines; 50% fine sand

SANDY LEAN CLAY, CL: Moist; dark yellowish brown; dredge disposal material

SANDY SILT, ML: Moist to wet; dark gray to dark yellowish brown; dredge disposal material

WELL GRADED SAND WITH SILT, SW-SM: Moist to wet; dark yellowish brown; dredge disposal material

At 7.5' water level

LEAN CLAY WITH SAND, CL: Moist; dark gray; 85% medium plasticity fines; 15% fine sand; dredge disposal material

SILTY SAND, SM: Very firm; wet; very dark gray to brown; 70% fine to coarse sand; 30% low plasticity fines; dredge disposal material

CLAYEY SAND, SC: Moist; dark gray; dredge disposal material

LEAN CLAY, CL*: Firm to stiff; moist; dark gray; 90% medium plasticity fines; 10% fine sand; undisturbed alluvium

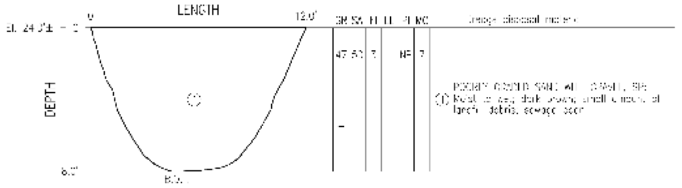
From 17.0' to 17.5' lens of LEAN CLAY WITH SAND, CL: 85% medium plasticity fines; 15% fine sand

At 22.0' moderate amount of iron oxide staining

At 24.0' mottled dark gray/brown to gray; close to FAT CLAY, CH

VERTICAL SCALE: 1" = 3'

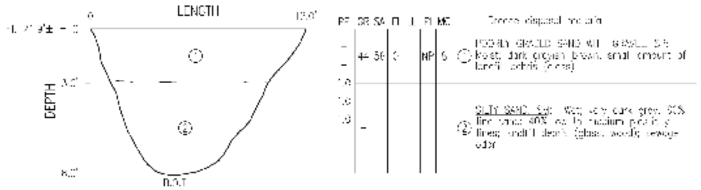
4B-01-20
N 1,865,770; E 6,480,838



Dredge disposal material

① POORLY GRADED SAND WITH GRAVEL, SP: Moist to wet; dark brown; small amount of landfill debris; sewage odor

4B-01-21
N 1,865,608; E 6,480,750



Dredge disposal material

① POORLY GRADED SAND WITH GRAVEL, SP: Moist; dark grayish brown; small amount of landfill debris (glass)

② SILTY SAND, SM: Wet; very dark gray; 60% fine sand; 40% low to medium plasticity fines; landfill debris (glass, wood); sewage odor

SCALE: 1" = 3'

NOTES:

1. Locations of explorations are shown on Sheet Nos. C-102 through C-105 and C-123.
2. Legend and notes are shown on Sheet No. B-301.
3. Other Logs of Explorations are shown on Sheet Nos. B-302 through B-310 and B-312.

GRAPHIC SCALE

1" = 3' 3' 2' 1' 0 3' 6' 9' 12'

US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT

NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST NBS
IMOLA TO NEW TULOCAY
LOG OF EXPLORATIONS 2F-01-40,
4B-01-19, 4B-01-20 AND 4B-01-21

Sheet reference number:
B-311

Reference — Exploration Log file No.: NA-01-029

NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
CONTRACT 2 EAST
DREDGE DISPOSAL DIKE

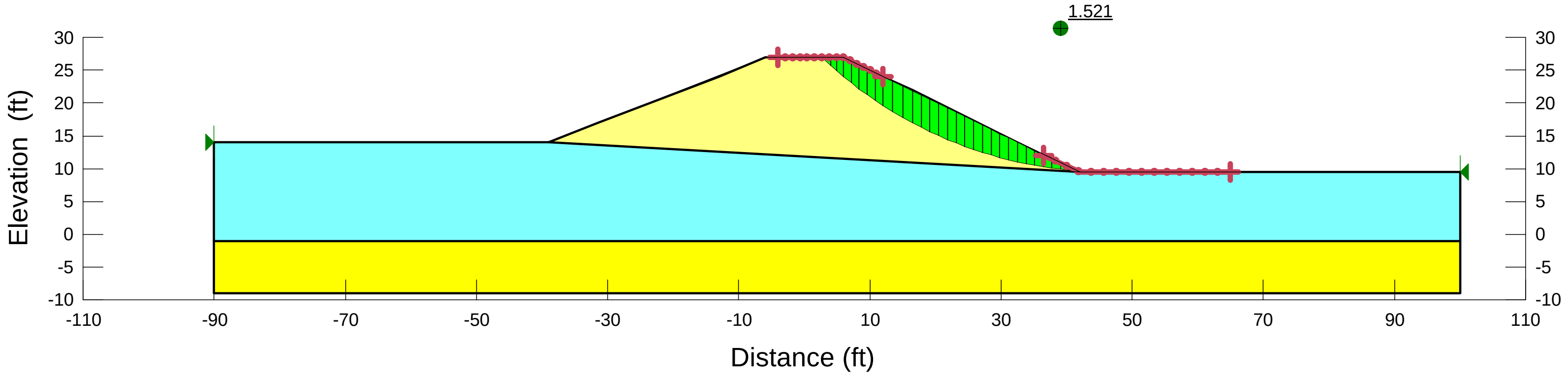
End of Construction

Dike Crest Elev = 27 ft
Inside Toe Elev = 9.5 ft
Outside Toe Elev = 14 ft

Dike Fill: Unit wt = 125 pcf, c = 0, phi = 34 deg
CL Foundaiton: Unit wt = 120 pcf, c = 1200 psf, phi = 0
SC Foundation: Unit wt = 120 pcf, c = 250 psf, phi = 20 deg

Filename: C:Documents\NapaR\Cont2east\DDR\GeoStudio\Dredge_EOC.gsz

F.S. = 1.521



NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
CONTRACT 2 EAST
DREDGE DISPOSAL DIKE

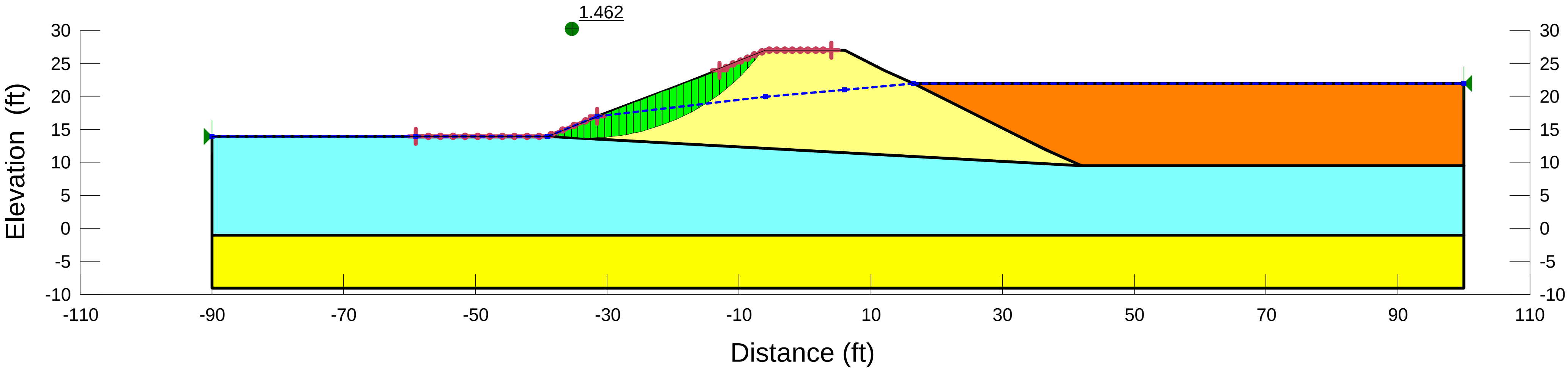
Long Term, Partly Filled

Dike Crest Elev = 27 ft
Inside Toe Elev = 9.5 ft
Outside Toe Elev = 14 ft
Tailings Elev = 22 ft

Dike Fill: Unit wt = 125 pcf, c = 0, phi = 34 deg
CL Foundation: Unit wt = 120 pcf, c' = 50 psf, phi' = 30
SC Foundation: Unit wt = 120 pcf, c' = 25 psf, phi' = 29 deg
Dredge Spoils: Unit wt = 120 pcf, c = 0, phi = 29 deg

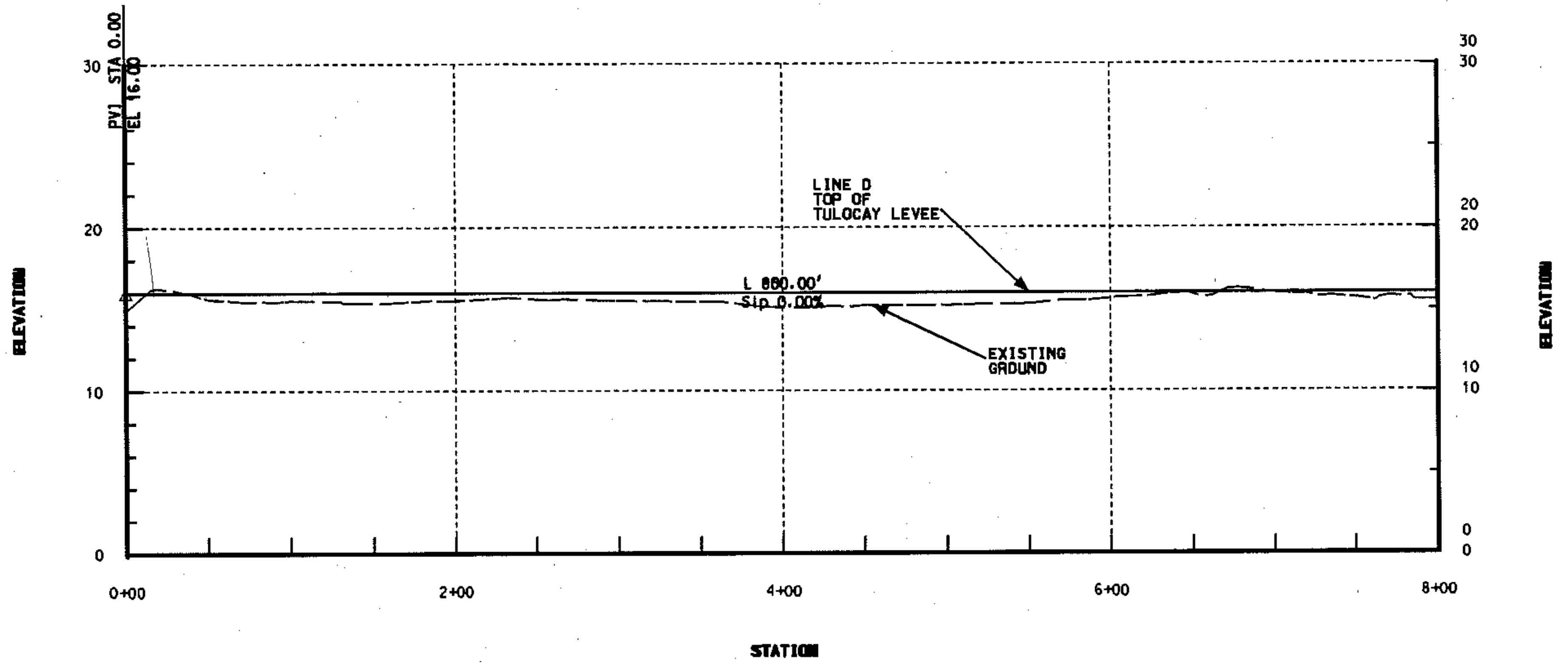
Filename: C:Documents\NapaR\Cont2east\DDR\GeoStudio\Dredge_LT_partlyfilled.gsz

F.S. = 1.462



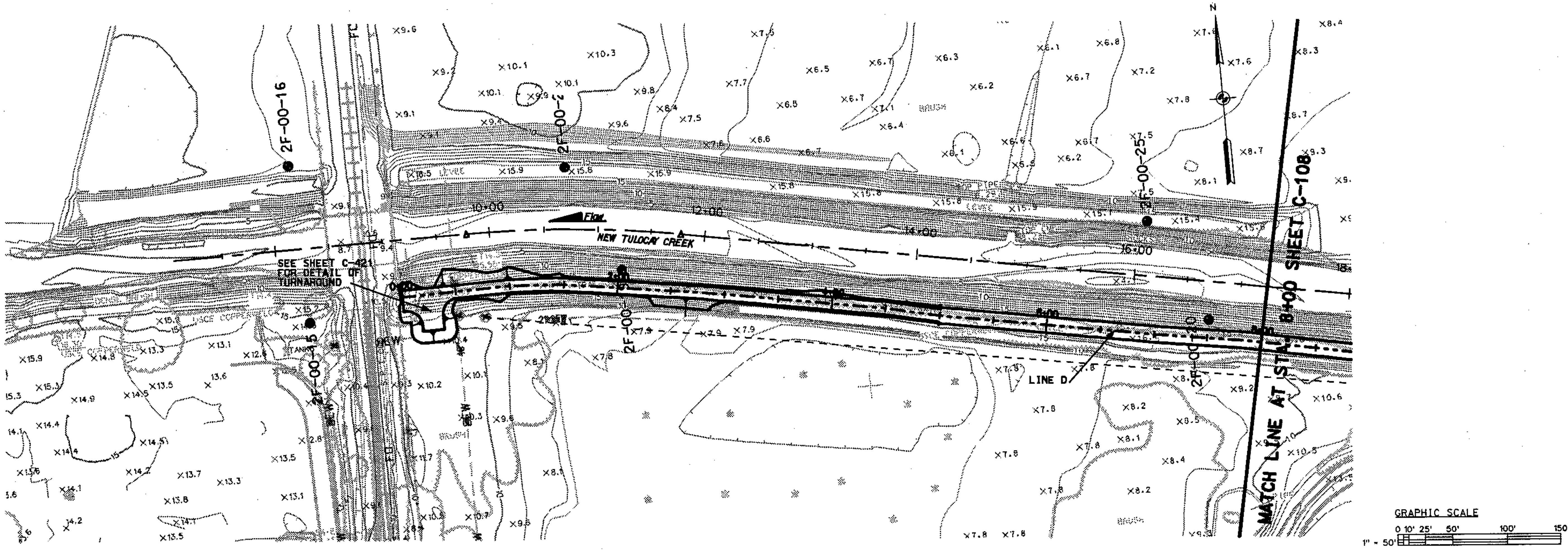
ENCLOSURE 5

New Tulocay Creek Levee Plan, Soil Boring Logs, and Slope Stability Models



NOTES:

1. SEE SHEET C-113 FOR ALIGNMENT OF TULOCAY LEVEE. LINE D.
2. SEE SHEETS C-317 AND C-318 FOR CROSS SECTIONS OF TULOCAY LEVEE.
3. PROFILE GRADE IS TOP OF TULOCAY LEVEE EMBANKMENT FILL. AGGREGATE BASE ROAD SURFACE IS ABOVE THIS ELEVATION. SEE SHEET C-422. DETAILS 1 AND 2.
4. EXISTING GROUND WILL BE EXCAVATED WHEN HIGHER THAN LEVEE VERTICAL PROFILE



US Army Corps of Engineers
Sacramento District

Symbol | Description | Date | Approved

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 "J" STREET
SACRAMENTO, CA 95814-2922

Designed by: [illegible]
Dwn by: JMA
Spec No.: 1388
Reviewed by: T. CATANELLA
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A

Date: 06/01/2004
Rev. REV_#
Design file no: NA-04-026
Drawing Code:
File name: n[illegible]
Plot date:
Plot scale:

NAPA
CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
PLAN & PROFILE
TULOCAY LEVEE

Sheet reference number:
C-107
Sheet 24 of 39

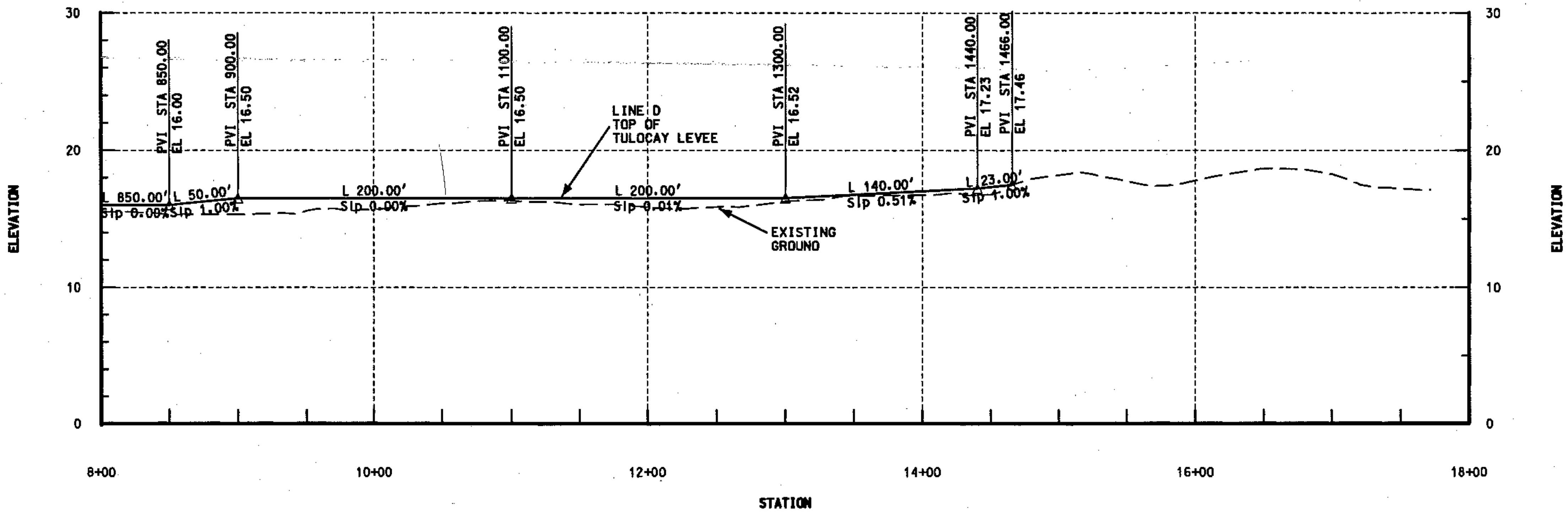
PLOT DATE: 28-MAY-2004
PLOT TIME: 11:40
\\gold\civcad\napar\cn2a_duden\CADD\SheetFiles\NA-04-026C-107xxx.dgn

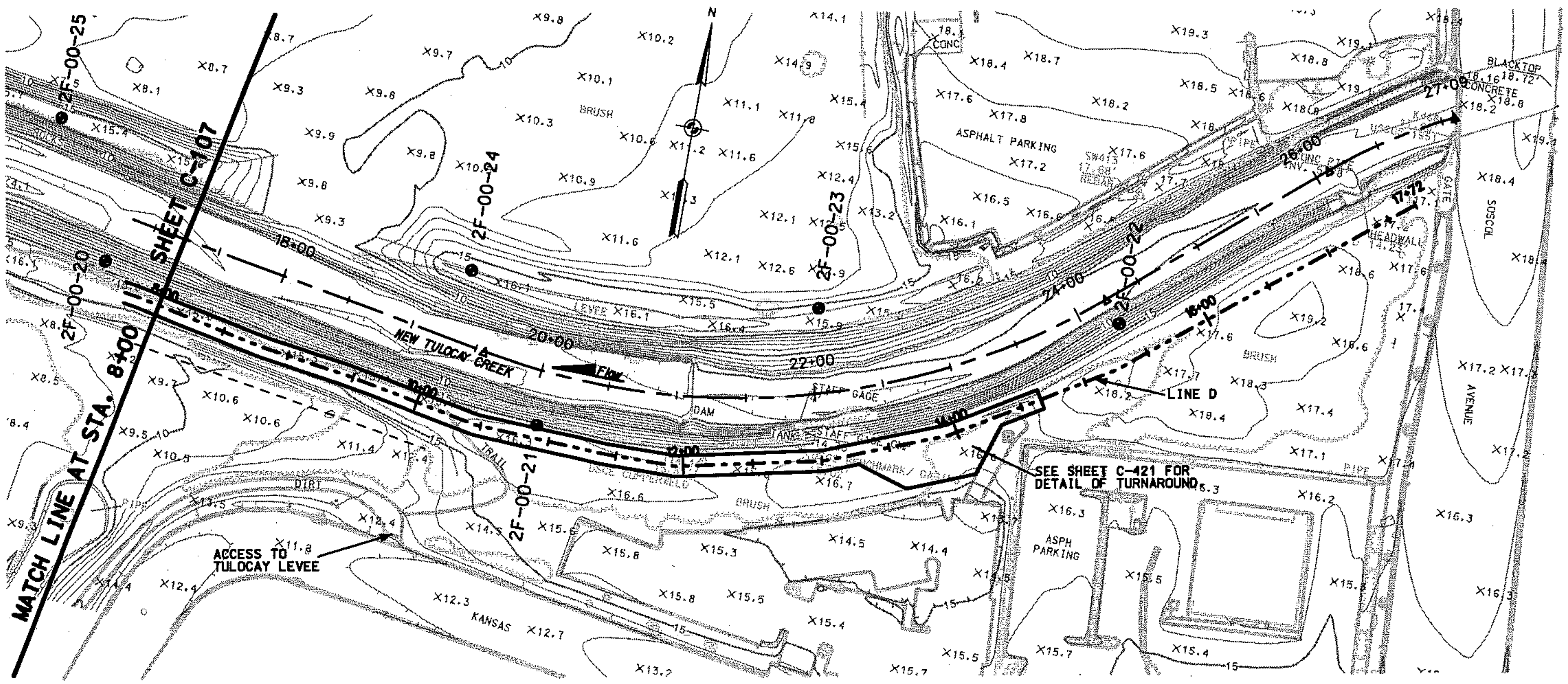
NOTES:

1. SEE SHEET C-113 FOR ALIGNMENT OF TULOCAY LEVEE, LINE D.

2. SEE SHEETS C-317 AND C-318 FOR CROSS SECTIONS OF TULOCAY LEVEE.

3. PROFILE GRADE IS TOP OF TULOCAY LEVEE EMBANKMENT FILL. AGGREGATE BASE ROAD SURFACE IS ABOVE THIS ELEVATION. SEE SHEET C-422, DETAIL 1.





GRAPHIC SCALE
0 10' 25' 50' 100' 150'
1" = 50'

PLOT DATE: 30-JUN-2004 PLOT TIME: 10:14

\\Gold\civcad\NapaR\Cn2a_duden\CADD\SheetFiles\NA-04-026C-108xxx.dgn

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by:	Date: 08/01/2004	Rev. REV_0
Dwn by: JMA	Spec No.: 1306	Design file no: NA-04-026
Reviewed by: T. CATANELLA		Drawing Code:
Submitted by: /s/PETER VALENTINE CHIEF, CIVIL DESIGN SEC A		File name: Plot date: Plot scale: 50

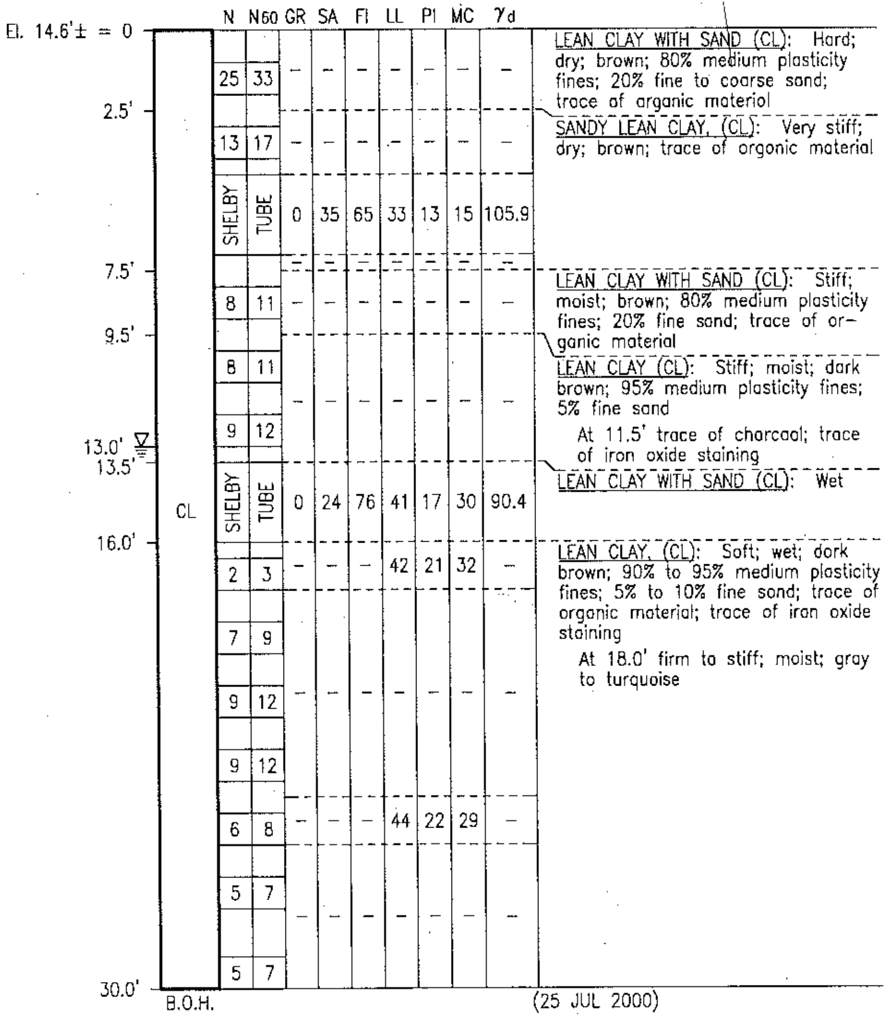
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CK & IMOLA)
PLAN & PROFILE
TULOCAY LEVEE

Sheet reference number:
C-108
Sheet 25 of 39

2F-00-15
N ±1,866,107; E ±6,480,987



DEPTH		N	N60	GR	SA	FI	LL	PI	MC	γd
El. 14.6'± = 0										
		25	33	–	–	–	–	–	–	–
2.5'										
		13	17	–	–	–	–	–	–	–
		SHELBY	TUBE	0	35	65	33	13	15	105.9
7.5'				–	–	–	–	–	–	–
		8	11	–	–	–	–	–	–	–
9.5'										
		8	11							
				–	–	–	–	–	–	–
		9	12							
13.0' ∇ 13.5'										
	CL	SHELBY	TUBE	0	24	76	41	17	30	90.4
16.0'										
		2	3	–	–	–	42	21	32	–
		7	9							
		9	12	–	–	–	–	–	–	–
		9	12							
		6	8	–	–	–	44	22	29	–
		5	7							
				–	–	–	–	–	–	–
		5	7							
30.0'	B.O.H.									

LEAN CLAY WITH SAND (CL): Hard; dry; brown; 80% medium plasticity fines; 20% fine to coarse sand; trace of organic material

SANDY LEAN CLAY, (CL): Very stiff; dry; brown; trace of organic material

LEAN CLAY WITH SAND (CL): Stiff; moist; brown; 80% medium plasticity fines; 20% fine sand; trace of organic material

LEAN CLAY (CL): Stiff; moist; dark brown; 95% medium plasticity fines; 5% fine sand

At 11.5' trace of charcoal; trace of iron oxide staining

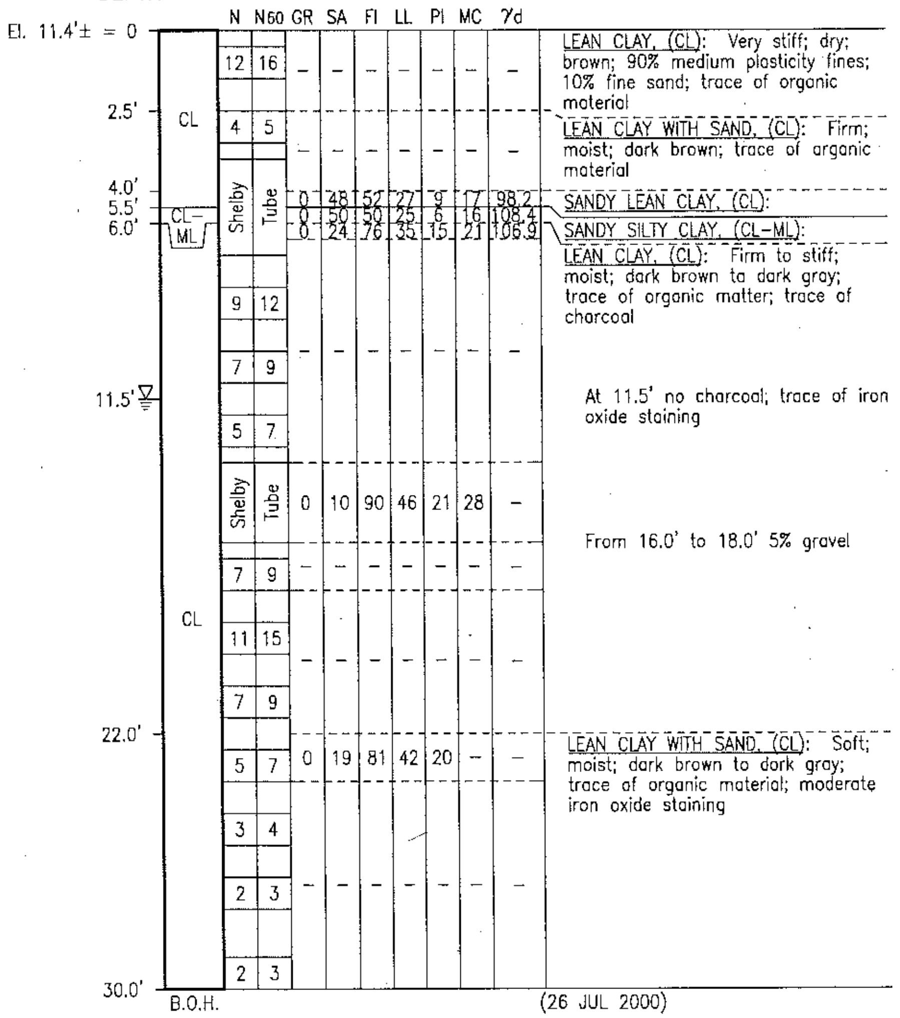
LEAN CLAY WITH SAND (CL): Wet

LEAN CLAY, (CL): Soft; wet; dark brown; 90% to 95% medium plasticity fines; 5% to 10% fine sand; trace of organic material; trace of iron oxide staining

At 18.0' firm to stiff; moist; gray to turquoise

(25 JUL 2000)

2F-00-16
N ±1,866,254; E ±6,480,981



DEPTH		N	N60	GR	SA	FI	LL	PI	MC	γd
El. 11.4'± = 0										
		12	16	–	–	–	–	–	–	–
2.5'	CL									
		4	5							
				–	–	–	–	–	–	–
4.0'		Shelby	Tube	0	48	52	27	9	17	98.2
5.5'				0	50	50	25	6	16	108.4
6.0'	CL–ML			0	24	76	35	15	21	106.9
		9	12							
				–	–	–	–	–	–	–
		7	9							
11.5' ∇										
		5	7							
		Shelby	Tube	0	10	90	46	21	28	–
		7	9	–	–	–	–	–	–	–
	CL	11	15							
				–	–	–	–	–	–	–
		7	9							
22.0'										
		5	7	0	19	81	42	20	–	–
		3	4							
				–	–	–	–	–	–	–
		2	3							
		2	3							
30.0'	B.O.H.									

LEAN CLAY, (CL): Very stiff; dry; brown; 90% medium plasticity fines; 10% fine sand; trace of organic material

LEAN CLAY WITH SAND, (CL): Firm; moist; dark brown; trace of organic material

SANDY LEAN CLAY, (CL):

SANDY SILTY CLAY, (CL–ML):

LEAN CLAY, (CL): Firm to stiff; moist; dark brown to dark gray; trace of organic matter; trace of charcoal

At 11.5' no charcoal; trace of iron oxide staining

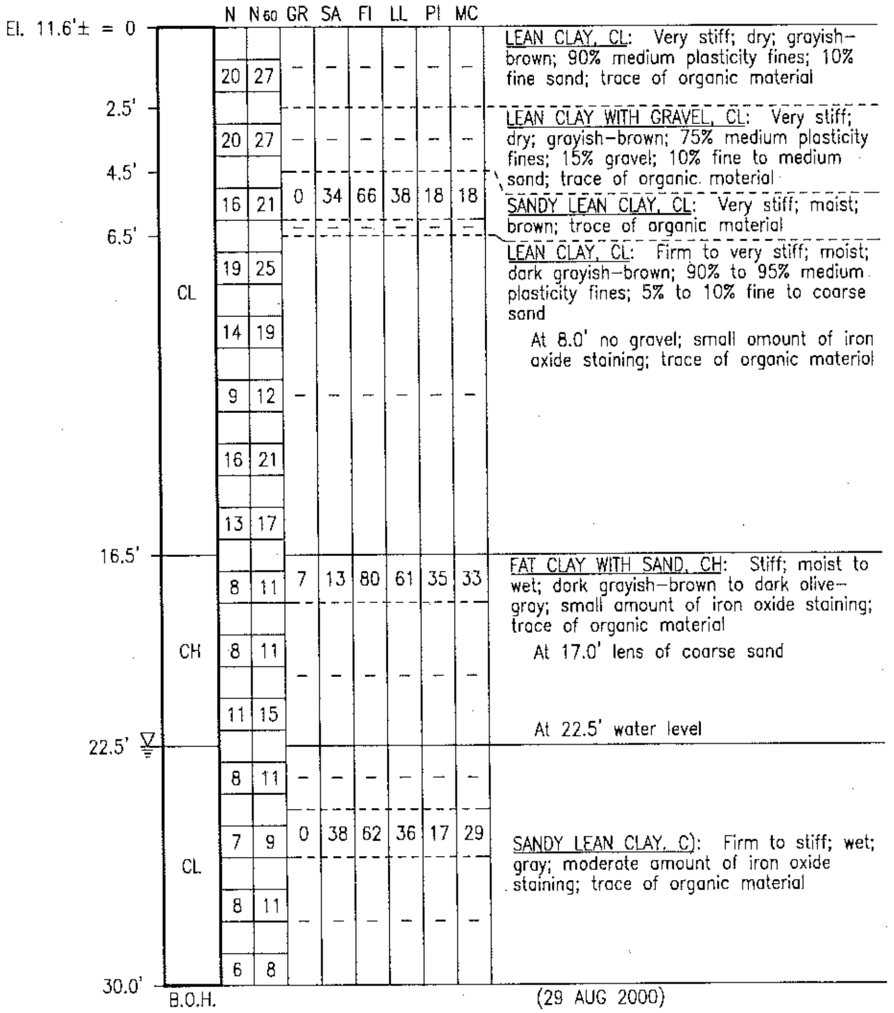
From 16.0' to 18.0' 5% gravel

LEAN CLAY WITH SAND, (CL): Soft; moist; dark brown to dark gray; trace of organic material; moderate iron oxide staining

(26 JUL 2000)

VERTICAL SCALE: 1"=3'

2F-00-19
N ±1,866,130; E ±6,481,280



DEPTH		N	N60	GR	SA	FI	LL	PI	MC
El. 11.6'± = 0									
		20	27	–	–	–	–	–	–
2.5'									
		20	27	–	–	–	–	–	–
4.5'									
		16	21	0	34	66	38	18	18
				–	–	–	–	–	–
6.5'									
		19	25						
	CL								
		14	19						
		9	12	–	–	–	–	–	–
		16	21						
		13	17						
16.5'									
		8	11	7	13	80	61	35	33
	CH	8	11						
				–	–	–	–	–	–
		11	15						
22.5' ∇									
		8	11	–	–	–	–	–	–
		7	9	0	38	62	36	17	29
	CL								
		8	11	–	–	–	–	–	–
		6	8						
30.0'	B.O.H.								

LEAN CLAY, CL: Very stiff; dry; grayish–brown; 90% medium plasticity fines; 10% fine sand; trace of organic material

LEAN CLAY WITH GRAVEL, CL: Very stiff; dry; grayish–brown; 75% medium plasticity fines; 15% gravel; 10% fine to medium sand; trace of organic material

SANDY LEAN CLAY, CL: Very stiff; moist; brown; trace of organic material

LEAN CLAY, CL: Firm to very stiff; moist; dark grayish–brown; 90% to 95% medium plasticity fines; 5% to 10% fine to coarse sand

At 8.0' no gravel; small amount of iron oxide staining; trace of organic material

FAT CLAY WITH SAND, CH: Stiff; moist to wet; dark grayish–brown to dark olive–gray; small amount of iron oxide staining; trace of organic material

At 17.0' lens of coarse sand

At 22.5' water level

SANDY LEAN CLAY, C): Firm to stiff; wet; gray; moderate amount of iron oxide staining; trace of organic material

(29 AUG 2000)

GRAPHIC SCALE

1"=3' 3' 2' 1' 0 3' 6' 9' 12'

NOTES:

1. Legend and Notes are shown on Sheet No. B–301.
2. Logs of Explorations are shown on Sheet Nos. B–301 through B–313.
3. Locations of Explorations are shown on Sheet Nos. C–102 through C–109.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: Nicola Holmes/Jane Bolton	Date:
Dwn by: N.B./R.L.T.	Spec No.: 1395
Design file no: NA–04–026	Rev.
Reviewed by: J. Sciandrone	Drawing Code:
Submitted by: /s/ Ben Gompers Chief, Soil Design Section	File name: NA–04–026B310XXX.dwg Plot date: Dwg scale: AS_NOTED

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN–HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814–2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CR & IMOLA)
LOG OF EXPLORATIONS
2F–00–15, 2F–00–16 AND 2F–00–19

Sheet
reference
number:
B–310
Sheet 14 of 39

Soil Design Section Sheet No. 10 of 13

Reference: Exploration Log File No. NA–01–028

2F-00-20
N ±1,866,031; E ±6,481,819

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	γ_d	
El. 12.2'± = 0	GC	10	13	–	–	–	–	–	–	–	CLAYEY GRAVEL WITH SAND, GC: Firm to very firm; dry; very dark grayish-brown; trace of organic material
		16	21								
4.5'	SC	SHELBY	TUBE	29	37	34	41	18	11	113.4	CLAYEY SAND WITH GRAVEL, SC: Firm to very firm; dry; very dark grayish-brown; trace of organic material
7.0'	CL	8	11	–	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Firm to stiff; moist; dark brown; 80% medium plasticity fines; 20% fine to coarse sand; trace of organic material; trace of iron oxide staining
		5	7								
10.0'		8	11	–	–	–	–	–	–	–	LEAN CLAY, CL: Stiff; moist; very dark gray; 90% medium plasticity fines; 10% fine sand; trace of organic material
11.5'		7	9	–	–	–	–	–	–	–	SANDY LEAN CLAY, CL: Stiff; moist; dark brown
13.5'	ML	SHELBY	TUBE	4	35	61	34	9	26	98.4	SANDY SILT, ML: Moist; dark brown At 16.0' water level
16.0' ▽		9	12	–	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Stiff; moist; dark brown; 85% medium plasticity fines; 15% fine to coarse sand; trace of iron oxide staining
		8	11								
20.0'		15	20	–	–	–	–	–	–	–	LEAN CLAY, CL: Very stiff; moist; very dark grayish-brown; 90% medium plasticity fines; 10% fine sand; trace of organic material; trace of iron oxide staining
22.5'	CL	9	12	–	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Stiff to hard; moist; dark gray; abundant iron oxide staining
		8	11	0	28	72	42	23	31	–	
		8	11	–	–	–	–	–	–	–	
29.5'		34	45	–	–	–	–	–	–	–	GRAVELLY LEAN CLAY, CL: 60% medium plasticity fines; 30% gravel; 10% fine to coarse sand
30.0'	B.O.H.										(29 AUG 2000)

2F-00-21
N ±1,865,969; E ±6,482,150

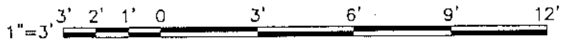
DEPTH		N	N60	GR	SA	FI	LL	PI	MC	
El. 15.3'± = 0	CL	15	20	–	–	–	–	–	–	LEAN CLAY, CL: Very stiff; dry; dark grayish-brown; 90% medium plasticity fines; 10% fine to coarse sand; trace of organic material
2.5'	SC	13	17	23	36	40	38	16	–	CLAYEY SAND WITH GRAVEL, SC: Firm; dry; dark grayish-brown
4.5'	CL	25	33	–	–	–	–	–	–	GRAVELLY LEAN CLAY, CL: Hard; dry; dark grayish-brown; 60% medium plasticity fines; 25% gravel; 15% fine to coarse sand
6.5'	ML	7	9	1	19	80	39	12	23	SILT WITH SAND, ML: Stiff; moist; very dark brown; trace of organic material
		11	15	–	–	–	–	–	–	At 10.0' a few obsidian fragments
		11	15							At 12.5' water level
12.5' ▽	SC	22	29							CLAYEY SAND, SC: Loose to dense; wet; brown; 70% to 80% fine to coarse sand; 15% medium plasticity fines; 5% to 15% gravel
		25	33	–	–	–	–	–	–	
		6	8							
18.5'		2	3	22	58	20	32	10	19	CLAYEY SAND WITH GRAVEL, (SC): Very loose; wet; brown
20.5'	GC	22	29	–	–	–	–	–	–	CLAYEY GRAVEL WITH SAND, (GC): Very firm; wet; grayish-brown; 60% gravel; 25% fine to coarse sand; 15% medium plasticity fines
22.5'	CL	6	8	–	–	–	–	–	–	LEAN CLAY WITH SAND, (CL): Firm; wet; dark gray; 85% medium plasticity fines; 15% fine to coarse sand; trace of organic material At 24.5' 5% gravel
		6	8							
26.5'		14	19	–	–	–	–	–	–	LEAN CLAY, (CL): Firm to very stiff; moist; dark gray; 90% medium plasticity fines; 10% fine sand; abundant iron oxide staining
		6	8							
30.0'	B.O.H.									(31 AUG 2000)

VERTICAL SCALE: 1"=3'

2F-00-22
N ±1,866,115; E ±6,482,553

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	γ_d	
El. 12.2'± = 0	SC	28	37	–	–	–	–	–	–	–	CLAYEY SAND, SC: Dense; dry; pale brown; 85% fine to coarse sand; 15% medium plasticity fines
2.5'	CL	25	33	–	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Hard; dry; dark grayish-brown
4.5'	SC	SHELBY	TUBE	16	64	20	33	12	17	112.0	CLAYEY SAND WITH GRAVEL, SC: Hard; dry; dark grayish-brown
5.5'	SM			8	80	12	–	NP	8	111.2	SILTY SAND, SM: Hard; dry; dark grayish-brown
7.0'	CL	20	27	–	–	–	–	–	–	–	SANDY LEAN CLAY, CL: Very stiff; moist; dark yellowish-brown; 55% medium plasticity fines; 40% fine to coarse sand; 5% fine gravel
8.5'		10	13	–	–	–	–	–	–	–	CLAYEY SAND, SC: Firm; moist; dark yellowish-brown; 60% fine to coarse sand; 30% medium plasticity fines; 10% gravel
10.0'		18	24								CLAYEY SAND WITH GRAVEL, SC: Firm to very dense; moist to wet; dark yellowish-brown to yellowish-brown At 11.5' water level
11.5' ▽		54	72	–	–	–	–	–	–	–	
		12	16								
		49	65								
	SC	40	53	40	47	13	27	8	–	–	
		45	60								
		35	47	–	–	–	–	–	–	–	
		20	27								
		16	21								
28.5'		20	27	–	–	–	–	–	–	–	CLAYEY SAND, SC: Very firm; wet; yellowish-brown; 75% fine to coarse sand; 15% medium plasticity fines; 10% gravel
30.0'	B.O.H.										(31 AUG 2000)

GRAPHIC SCALE



NOTES:

1. Legend and Notes are shown on Sheet No. B-301.
2. Logs of Explorations are shown on Sheet Nos. B-301 through B-313.
3. Locations of Explorations are shown on Sheet Nos. C-102 through C-109.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: Nicola Holmes/Jane Bolton
Dwn by: N.B./R.L.T.
Spec No.: 1395
Reviewed by: J. Sciandrone
Submitted by: /s/ Ben Gompers
Chief, Soil Design Section
Date:
Rev.
Design file no: NA-04-026
Drawing Code:
File name: NA-04-026B311XXX.dwg
Plot date:
Dwg scale: AS_NOTED

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CR & IMOLA)
LOG OF EXPLORATIONS
2F-00-20, 2F-00-21 AND 2F-00-22

Sheet
reference
number:
B-311
Sheet 15 of 39

Soil Design Section Sheet No. 11 of 13

Reference: Exploration Log File No. NA-01-028

2F-00-23
N ±1,866,088; E ±6,482,336

DEPTH		N	N60	GR	SA	FI	LL	PI	MC
El. 15.5'± = 0	CL	25	33	–	–	–	–	–	–
		29	39	9	35	56	44	23	12
		23	31						
		13	17	–	–	–	–	–	–
		19	25						
10.5'		9	12	–	–	–	–	–	–
		5	7						
14.5' ▽	SC	11	15	2	53	45	35	15	29
				–	–	–	–	–	–
16.5'	GC	10	13	–	–	–	–	–	–
18.5'	CL	11	15	–	–	–	–	–	–
		10	13						
		8	11	–	–	–	49	24	41
		11	15	–	–	–	–	–	–
		10	13						
28.5'	SC	19	25	–	–	–	–	–	–
30.0'	B.O.H.								

SANDY LEAN CLAY, CL: Stiff to hard; dry to moist; very dark grayish-brown to dark brown; trace of organic material

At 8.5' trace of iron oxide staining

LEAN CLAY WITH SAND, CL: Firm to stiff; moist; brown; trace of organic material

CLAYEY SAND, SC: Firm; wet; dark brown; trace of organic material

CLAYEY GRAVEL WITH SAND, GC: Firm; wet; dark brown; 60% gravel; 25% fine to coarse sand; 15% medium plasticity fines

LEAN CLAY, CL: Stiff; moist; very dark grayish-brown to very dark gray; 90% fines; 10% fine to coarse sand

At 20.5' trace of organic material

At 22.5' small amount of iron oxide staining

CLAYEY SAND, SC: Very firm; wet; dark grayish-brown; 60% fine to coarse sand; 40% medium plasticity fines; small amount of iron oxide staining

(28 AUG 2000)

2F-00-24
N ±1,866,071; E ±6,482,084

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	γ_d
El. 15.9'± = 0	CL	9	12	–	–	–	–	–	–	–
2.5'	GC	27	36	–	–	–	–	–	–	–
4.5'	CH	SHELBY	TUBE	0	13	87	53	25	25	96.5
7.0'	CL	8	11	–	–	–	–	–	–	–
9.0'		11	15	–	–	–	–	–	–	–
		16	21							
11.5'		16	21	–	–	–	–	–	–	–
13.5'		SHELBY	TUBE	–	–	–	–	–	–	–
14.3'				0	11	89	33	10	29	91.2
14.8' (15.0' ▽)				2	36	62	36	13	25	95.6
15.3'				0	9	91	34	11	29	91.6
15.8'		8	11							
		16	21	–	–	–	–	–	–	–
		9	12							
		10	13							
		7	9	–	–	–	43	23	37	–
				–	–	–	–	–	–	–
26.0'		10	13	–	–	–	–	–	–	–
28.5'		17	23	–	–	–	–	–	–	–
30.0'	B.O.H.									

LEAN CLAY WITH SAND, CL: Stiff; moist; dark grayish-brown; 75% medium plasticity fines; 15% fine to coarse sand; 10% gravel; trace of organic material; trace of iron oxide staining

CLAYEY GRAVEL WITH SAND, GC: Dense; moist; dark grayish-brown; 60% gravel; 25% fine to coarse sand; 15% medium plasticity fines; trace of organic material

FAT CLAY, CL: Stiff; moist; dark grayish-brown

SANDY LEAN CLAY, CL: Stiff; moist; dark grayish-brown; 60% medium plasticity fines; 40% fine to coarse sand

LEAN CLAY, CL: Stiff to very stiff; moist; very dark brown to very dark gray; 90% medium plasticity fines; 10% fine to coarse sand; small amount of organic material

LEAN CLAY WITH GRAVEL, CL: Very stiff; moist; brown; 75% medium plasticity fines; 15% gravel; 10% fine to coarse sand

LEAN CLAY, CL: Stiff to very stiff; wet to moist; dark grayish-brown to dark gray; small amount of iron oxide staining; trace of organic material; trace of charcoal

SANDY LEAN CLAY, CL: As from 13.5' to 14.8'

At 15.0' water level

LEAN CLAY, CL: As from 13.5' to 14.8'

At 18.5' no charcoal

LEAN CLAY WITH SAND, CL: Stiff; moist; dark gray; 85% medium plasticity fines; 15% fine sand; moderate amount of iron oxide staining

SANDY LEAN CLAY, CL: Very stiff; wet; dark gray; 65% medium plasticity fines; 35% fine to coarse sand

(28 AUG 2000)

2F-00-25
N ±1,866,129; E ±6,481,770

DEPTH		N	N60	GR	SA	FI	LL	PI	MC
El. 15.7'± = 0	CL	20	27	–	–	–	–	–	–
2.5'		22	29	–	–	–	–	–	–
		17	23						
6.5'	CH	11	15	0	27	73	52	29	26
		6	8	–	–	–	–	–	–
10.5'		8	11	–	–	–	63	35	34
				–	–	–	–	–	–
12.5'	SC	10	13	27	42	31	–	–	–
				–	–	–	–	–	–
14.5' ▽	CL	6	8	–	–	–	–	–	–
16.5'		8	11	–	–	–	–	–	–
		12	16						
20.5'	CH	8	11	–	–	–	–	–	–
23.0'	CL	8	11	–	–	–	–	–	–
24.5'		9	12	–	–	–	–	–	–
		18	24						
28.5'	SC	8	11	4	66	30	–	–	–
30.0'	B.O.H.								

LEAN CLAY, CL: Very stiff; dry; very dark grayish-brown; 90% medium plasticity fines; 10% fine sand; small amount of man-made debris

SANDY LEAN CLAY WITH GRAVEL, CL: Very stiff; dry; very dark grayish-brown; 70% medium plasticity fines; 20% gravel; 10% fine to coarse sand

FAT CLAY WITH SAND, CH: Firm to stiff; moist; dark grayish-brown to very dark gray; trace of iron oxide staining

FAT CLAY, CH: Stiff; moist; black; 95% fines; 5% fine sand; trace of organic material; small amount of iron oxide staining

CLAYEY SAND WITH GRAVEL, SC: Stiff; moist; dark grayish-brown

At 14.5' water level

SANDY LEAN CLAY WITH GRAVEL, CL: Firm; wet; dark brown; 55% medium plasticity fines; 35% fine to coarse sand; 10% gravel

LEAN CLAY WITH SAND, CL: Stiff to very stiff; wet to moist; dark grayish-brown to dark gray; 85% medium plasticity fines; 15% fine to coarse sand; trace of iron oxide staining

FAT CLAY, CH: Stiff; moist; very dark gray; 95% high plasticity fines; 5% fine to medium sand (primarily in a lens at 20.7')

LEAN CLAY, CL: Stiff; moist; gray; 90% medium plasticity fines; 10% fine to medium sand; moderate amount of iron oxide staining

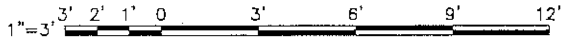
LEAN CLAY WITH SAND, CL: Stiff to very stiff; moist; gray; 85% medium plasticity fines; 10% fine to medium sand; 5% gravel; moderate amount of iron oxide staining

CLAYEY SAND, SC: Firm; wet; dark gray

(24 AUG 2000)

VERTICAL SCALE: 1"=3'

GRAPHIC SCALE



NOTES:

1. Legend and Notes are shown on Sheet No. B-301.
2. Logs of Explorations are shown on Sheet Nos. B-301 through B-313.
3. Locations of Explorations are shown on Sheet Nos. C-102 through C-109.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: Nicola Holmes/Jane Bolton	Date:	Rev.
Dwn by: N.B./R.L.T.	Spec No.: 1395	Design file no: NA-04-026
Reviewed by: J. Sciandrone		Drawing Code:
Submitted by: /s/ Ben Gampers Chief, Soil Design Section		File name: NA-04-026B312XXX.dwg Plot date: Dwg scale: AS_NOTED

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Soil Design Section Sheet No. 12 of 13

NAPA CALIFORNIA

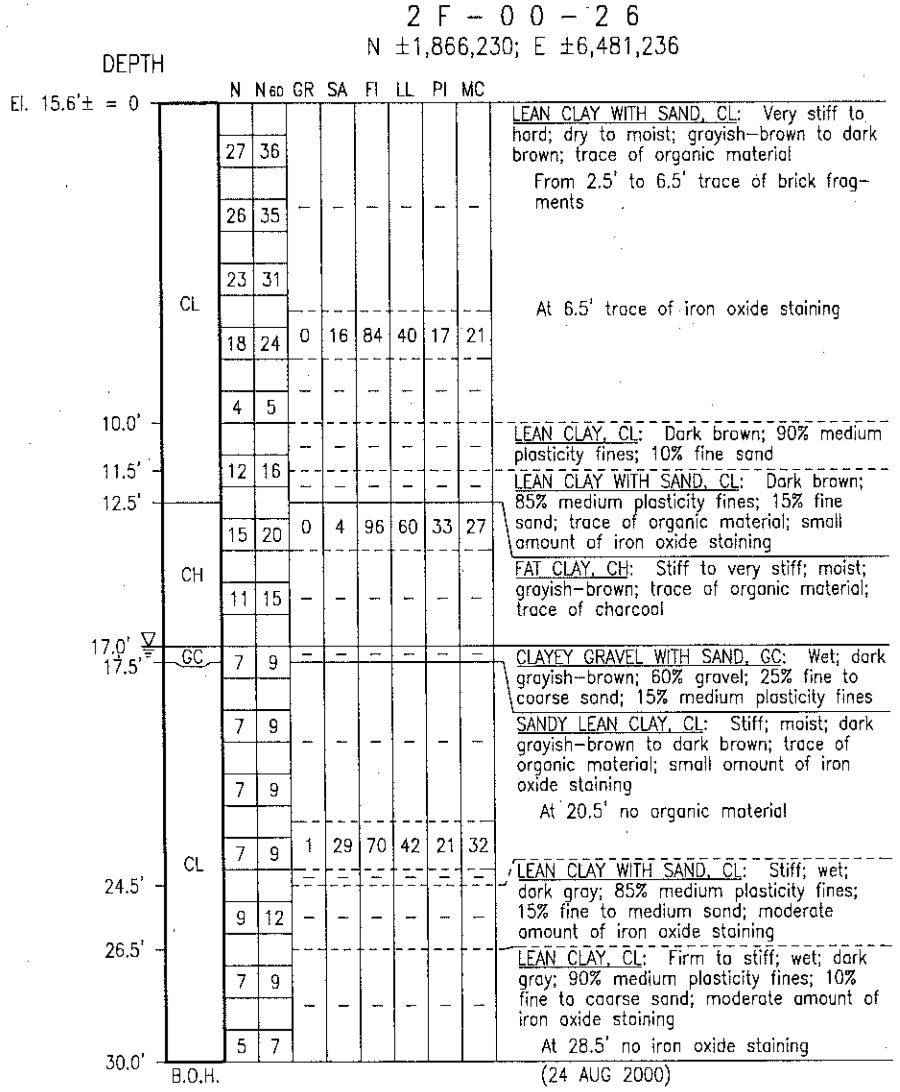
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CR & IMOLA)
LOG OF EXPLORATIONS
2F-00-23, 2F-00-24 AND 2F-00-25

Sheet
reference
number:
B-312
Sheet 16 of 39

Reference: Exploration Log File No. NA-01-028

2F-00-26

N ±1,866,230; E ±6,481,236



N	N60	GR	SA	FI	LL	PI	MC
27	36						
26	35	–	–	–	–	–	–
23	31						
18	24	0	16	84	40	17	21
		–	–	–	–	–	–
4	5						
		–	–	–	–	–	–
12	16	–	–	–	–	–	–
15	20	0	4	96	60	33	27
11	15	–	–	–	–	–	–
7	9	–	–	–	–	–	–
7	9	–	–	–	–	–	–
7	9						
7	9	1	29	70	42	21	32
		–	–	–	–	–	–
9	12	–	–	–	–	–	–
7	9	–	–	–	–	–	–
5	7						

LEAN CLAY WITH SAND, CL: Very stiff to hard; dry to moist; grayish-brown to dark brown; trace of organic material

From 2.5' to 6.5' trace of brick fragments

At 6.5' trace of iron oxide staining

LEAN CLAY, CL: Dark brown; 90% medium plasticity fines; 10% fine sand

LEAN CLAY WITH SAND, CL: Dark brown; 85% medium plasticity fines; 15% fine sand; trace of organic material; small amount of iron oxide staining

FAT CLAY, CH: Stiff to very stiff; moist; grayish-brown; trace of organic material; trace of charcoal

CLAYEY GRAVEL WITH SAND, GC: Wet; dark grayish-brown; 60% gravel; 25% fine to coarse sand; 15% medium plasticity fines

SANDY LEAN CLAY, CL: Stiff; moist; dark grayish-brown to dark brown; trace of organic material; small amount of iron oxide staining

At 20.5' no organic material

LEAN CLAY WITH SAND, CL: Stiff; wet; dark gray; 85% medium plasticity fines; 15% fine to medium sand; moderate amount of iron oxide staining

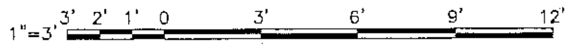
LEAN CLAY, CL: Firm to stiff; wet; dark gray; 90% medium plasticity fines; 10% fine to coarse sand; moderate amount of iron oxide staining

At 28.5' no iron oxide staining

(24 AUG 2000)

VERTICAL SCALE: 1"=3'

GRAPHIC SCALE



NOTES:

1. Legend and Notes are shown on Sheet No. B-301.
2. Logs of Explorations are shown on Sheet Nos. B-301 through B-313.
3. Locations of Explorations are shown on Sheet Nos. C-102 through C-109.

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
△			
△			
△			
△			
△			
△			
△			
△			

Designed by: Nicola Holmes/Jane Bolton
Date:
Rev.
Dwn by: N.B./R.L.T.
Spec No.: 1395
Design file no: NA-04-026
Reviewed by: J. Sciandrone
Drawing Code:
Submitted by: /s/ Ben Gompers
Chief, Soil Design Section
File name: NA-04-026B313XXX.dwg
Plot date:
Dwg scale: AS_NOTED

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST DUDEN (BETWEEN
OLD TULOCAY CR & IMOLA)
LOG OF EXPLORATIONS
2F-00-26

Sheet reference number:
B-313
Sheet 17 of 39

Reference: Exploration Log File No. NA-01-028

Soil Design Section Sheet No. 13 of 13

Border Revised 01/07/02, COESHT02.DWG

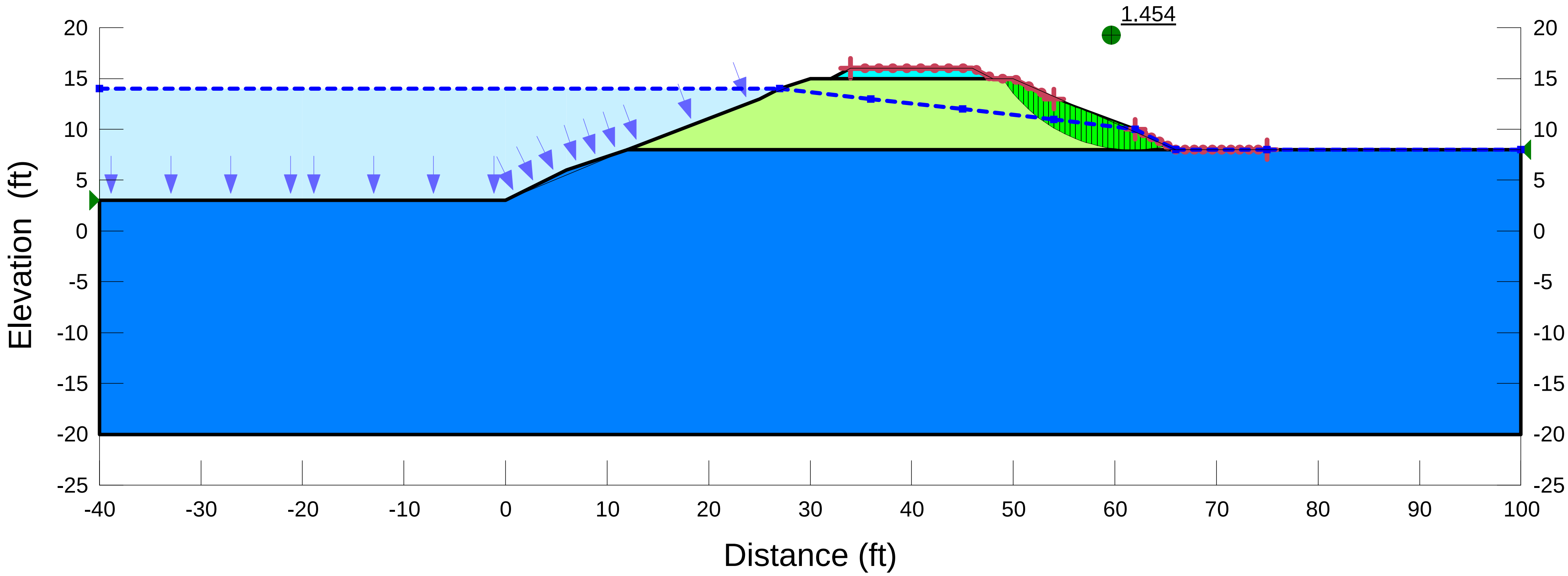
NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
New Tulocay Creek South Levee, Station 7+90
Steady State Seepage

Levee Crest Elev = 16 ft
Landside Toe Elev = 8 ft
Creek Bottom Elev = 3 ft
WSEL = 14 ft

New Levee Fill: Unit wt = 125 pcf, c' = 100 psf, phi' = 31 deg
GC/SC Levee Fill: Unit wt = 120 pcf, c' = 25 psf, phi' = 29 deg
CL Foundation: Unit wt = 120 pcf, c' = 50 psf, phi' = 30 deg

Filename: c:Napa\Cont2east\DDR\GeoStudio\NewTulocay_SS.gsz

Factor of Safety = 1.454



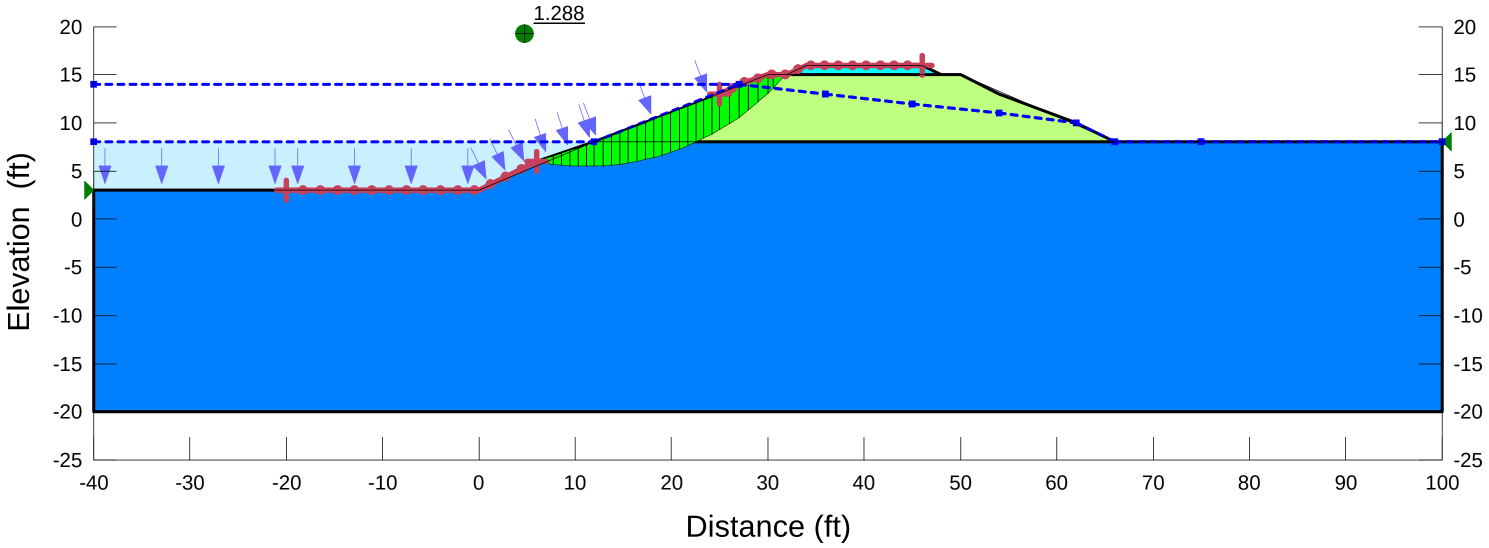
NAPA RIVER/NAPA CREEK FLOOD PROTECTION PROJECT
New Tulocay Creek South Levee, Station 7+90
Rapid Drawdown

Levee Crest Elev = 16 ft
Landside Toe Elev = 8 ft
Creek Bottom Elev = 3 ft
WSEL Before Drawdown = 14 ft
WSEL After Drawdown = 8 ft

New Levee Fill: Unit wt = 125 pcf, c' = 100 psf, phi' = 31 deg, c = 300 psf, phi = 15 deg
GC/SC Levee Fill: Unit wt = 120 pcf, c' = 25 psf, phi' = 29 deg, c = 250 psf , phi = 13 deg
CL Foundation: Unit wt = 120 pcf, c' = 50 psf, phi' = 30 deg, c = 300 psf, phi = 15 deg

Filename: c:Napa\Cont2east\DDR\GeoStudio\NewTulocay_RD.gsz

Factor of Safety = 1.288

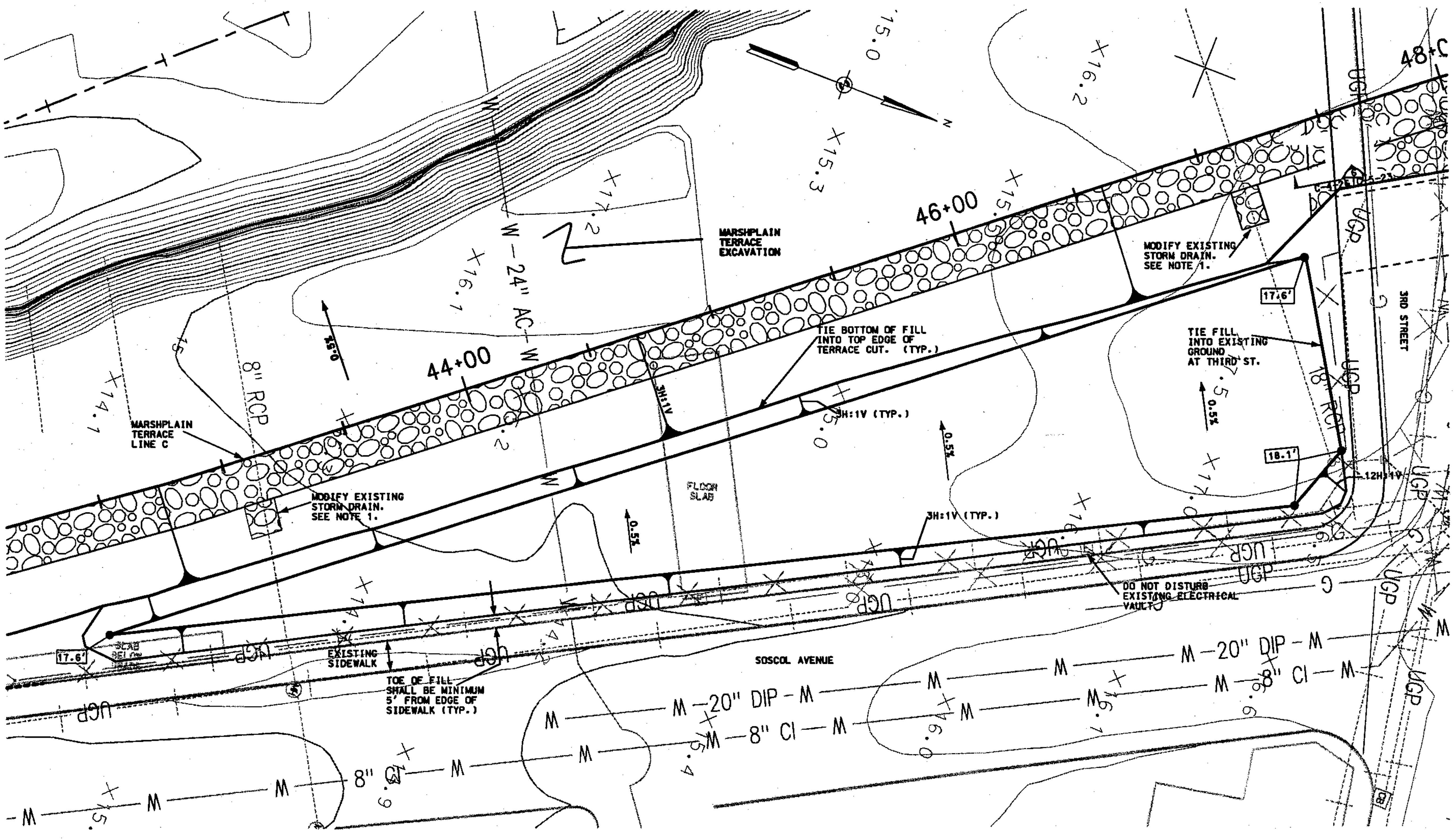


ENCLOSURE 6

Freeboard Berm Plan

NOTES:

1. EXISTING STORM DRAINS ARE 18" AND 8" RCP. CUT DRAIN LINES BACK TO WHERE THEY DAYLIGHT NEW TERRACE SLOPE. CONSTRUCT NEW FLAP GATES AND CONCRETE HEADWALL STRUCTURES AS SHOWN ON SHEET C-5-23.1. INSTALL STONE PROTECTION FROM BOTTOM OF HEADWALL STRUCTURES TO MARSHPLAIN STONE PROTECTION.



GRAPHIC SCALE
0 5' 10' 15' 20' 40' 60'
1" = 20'

US Army Corps of Engineers
Sacramento District

Symbol | Description | Date | Approved

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 "J" STREET
SACRAMENTO, CA 95814-2922

Designed by: [illegible]
Dwn by: JMA
Spec No.: 1396
Date: [illegible]
Rev. REV.0
Design file no: NA-04-015
Reviewed by: TMG
Drawing Code:
Submitted by: /s/PETER VALENTINE CHIEF, CIVIL DESIGN SEC A
File name:
Plot date:
Plot scale: 20

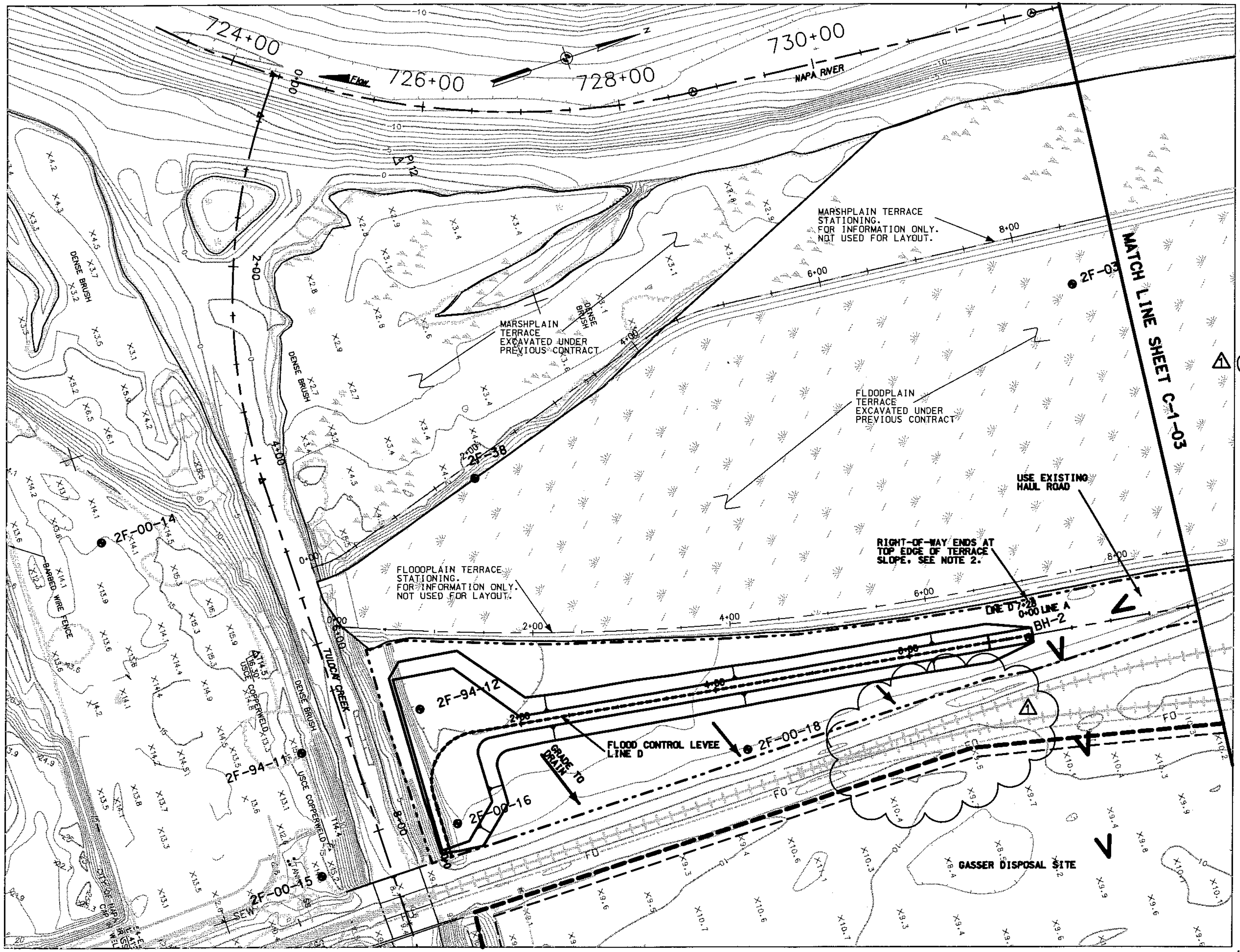
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH ST TO THIRD ST)
LARGE SCALE PLAN
FILL AT 3RD STREET

Sheet reference number:
C-4-26
Sheet 52 of 52

PLOT DATE 18-MAY-2004 PLOT TIME 09:54 MASTER DESIGN FILE \\gold\civcad\napar\cn2a\cadd\SheetFiles\NA-04-015C-426xx.dgn

ENCLOSURE 7

Floodwall (Unconstructed) Layout and Soil Boring Logs



LEGEND

- – – – RIGHT-OF-WAY
- < < HAUL ROUTE
- ▨ FLOODPLAIN TERRACE
- ▨ MARSHPLAIN TERRACE
- ▬ ▬ GASSER DISPOSAL SITE
- – – – – ENVIRONMENTALLY SENSITIVE AREA

NOTES:

1. SEE SHEET C-1-09 FOR LEVEE DESIGN.

2. CONTRACTOR SHALL NOT ENTER FLOODPLAIN TERRACE, UNLESS APPROVED BY CONTRACTING OFFICER.

△1 3. DELETED

4. LOGS OF EXPLORATION ARE SHOWN ON SHEETS B-3-01 TO B-3-19.

5. CONTRACTOR SHALL PROVIDE FENCING, BARRICADES, SAFETY SIGNS, ETC. AS REQUIRED TO RESTRICT PUBLIC ACCESS TO CONSTRUCTION AREAS AND HAUL ROADS.

6. SEE SHEET C-3-19 FOR LEVEE CROSS-SECTION.

7. CONTRACTOR SHALL PROVIDE TEMPORARY SAFETY FENCING ALONG RIGHT-OF-WAY LINE BETWEEN RAILROAD AND PROJECT SITE. FENCING SHALL RUN NORTH ALL THE WAY TO END OF LINE A.

GRAPHIC SCALE
0 10' 25' 50' 100' 150'
1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
△1	SHEET NOTES DELETED	6/18/04	PV/RM

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Designed by: [illegible]
Dwn by: JMA
Spec No.: 1298
Reviewed by: TMC
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A
Date: 05/06/2004
Rev. REV_#
Design file no: NA-04-015
Drawing Code:
File name:
Plot date:
Plot scale: 50

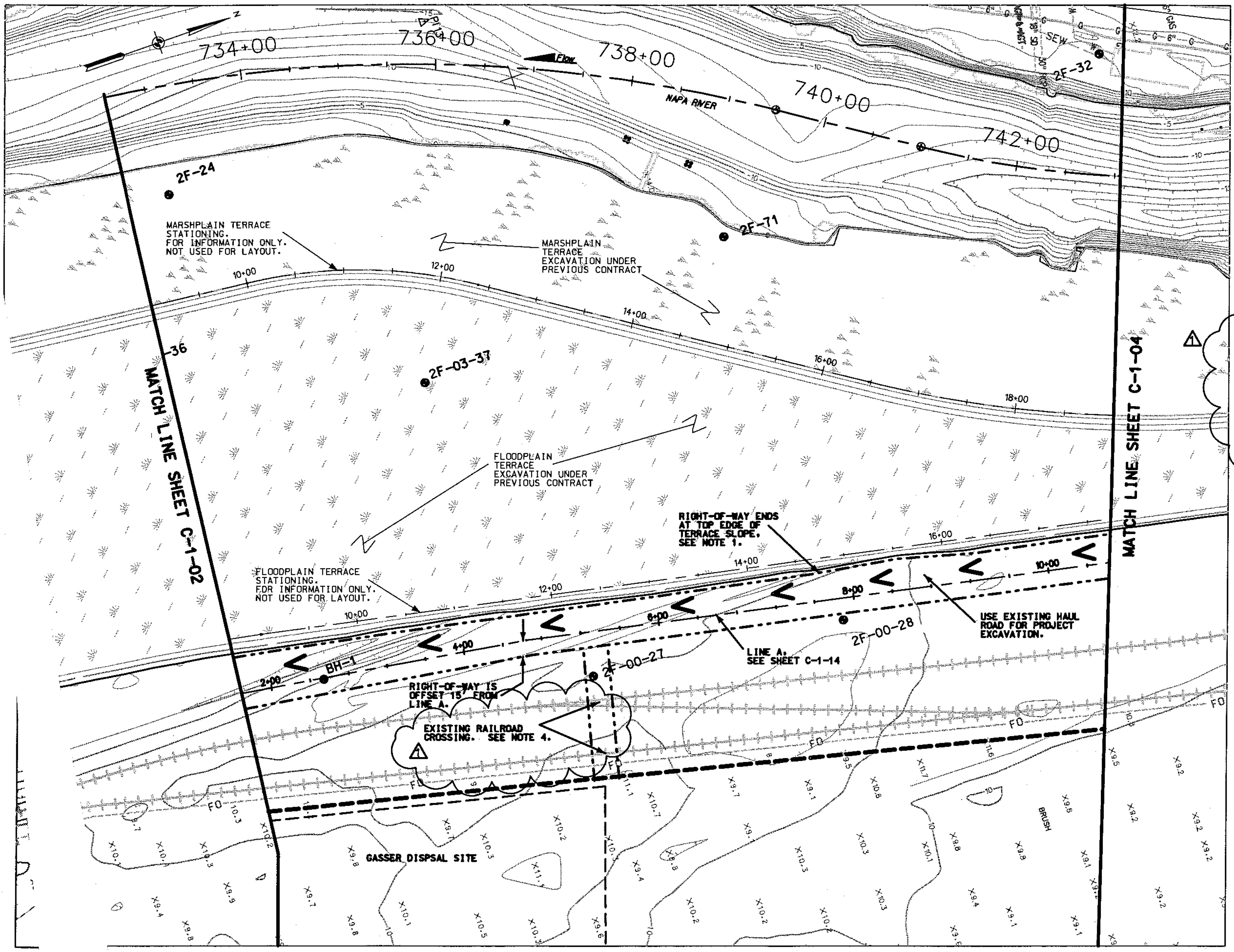
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH ST TO THIRD ST)

GENERAL PLAN, RIGHT-OF-WAY,
STAGING AREAS, PROJECT ACCESS
AND LOCATION OF EXPLORATIONS

Sheet
reference
number:
C-1-02
Sheet 26 of 52

PLOT DATE 22-JUN-2004 PLOT TIME 07:57 MASTER DESIGN FILE \\gold\civcad\napar\cn2a\cadd\SheetFiles\Mods\NA-04-015C-102am1.dgn

AM-001



LEGEND

- - - - RIGHT-OF-WAY

< < HAUL ROUTE

▨ FLOODPLAIN TERRACE

▨ MARSHPLAIN TERRACE

NOTES:

1. CONTRACTOR SHALL NOT ENTER FLOODPLAIN TERRACE, UNLESS APPROVED BY CONTRACTING OFFICER.

2. LOGS OF EXPLORATION ARE SHOWN ON SHEETS B-3-01 TO B-3-19.

3. CONTRACTOR SHALL PROVIDE FENCING, BARRICADES, SAFETY SIGNS, ETC. AS REQUIRED TO RESTRICT PUBLIC ACCESS TO CONSTRUCTION AREAS AND HAUL ROADS.

4. CONTRACTOR SHALL USE EXISTING GASSER DISPOSAL SITE. CONTRACTOR SHALL NOT CROSS RAILROAD TRACKS OR ENTER RAILROAD RIGHT-OF-WAY IN ANY OTHER LOCATIONS. SEE SPECIFICATIONS FOR REQUIREMENTS FOR RAILROAD INSURANCE. STEEL PLATING SHALL BE INSTALLED AT TRACK CROSSING WITH DIRECTION FROM NAPA VALLEY WINE TRAIN (THROUGH CONTRACTING OFFICER).

1

GRAPHIC SCALE

0 10' 25' 50' 100' 150'

1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
1	NEW SHEET NOTES	6/18/04	PV/RM

Designed by: [illegible]
Dwn by: JMA
Spec No.: 1200
Reviewed by: TMC
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A
Date: 05/06/2004
Rev.: REV.#
Design file no: NA-04-015
Drawing Code:
File name:
Plot date:
Plot scale: 50

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

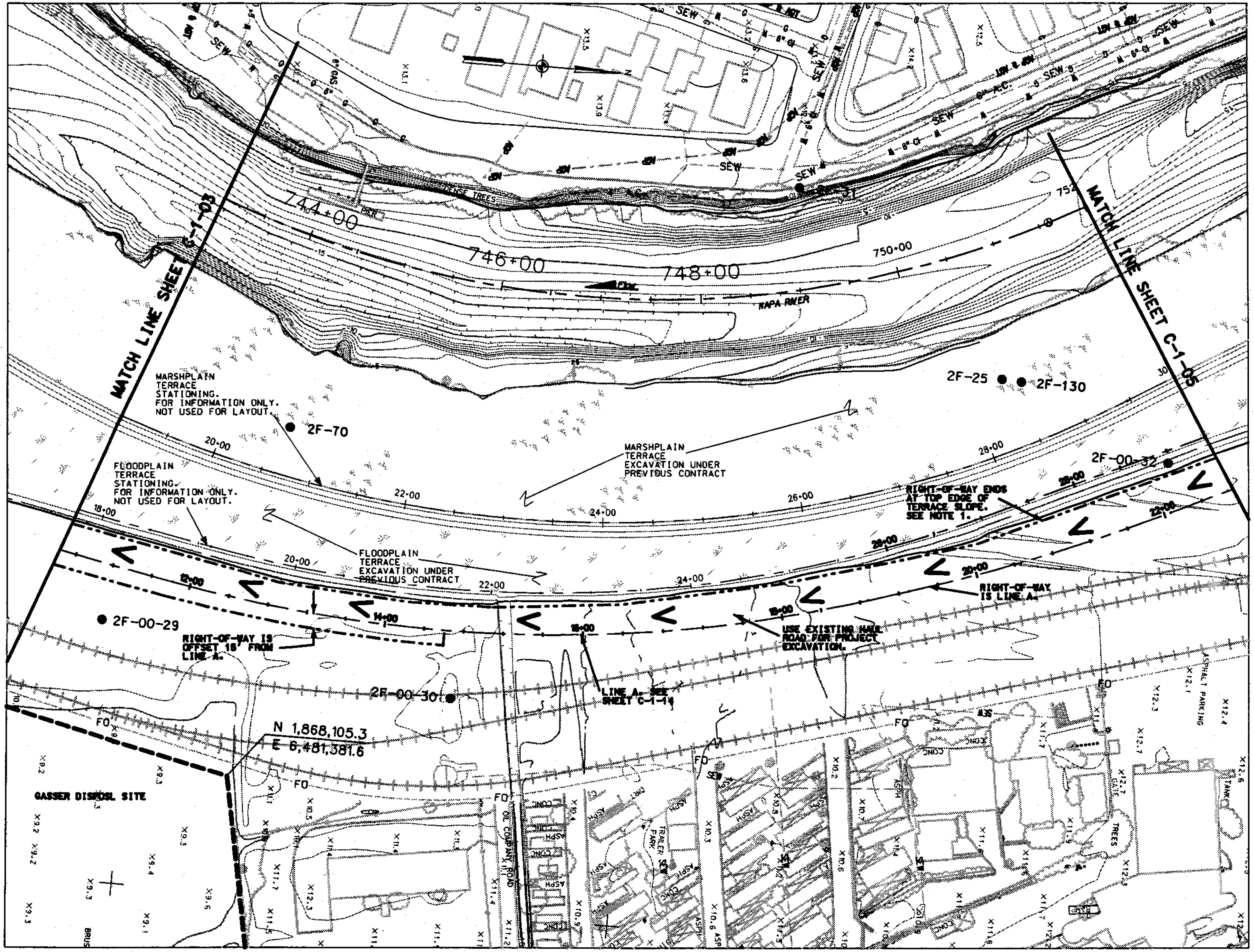
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH ST TO THIRD ST)

GENERAL PLAN, RIGHT-OF-WAY,
STAGING AREAS, PROJECT ACCESS
AND LOCATION OF EXPLORATIONS

Sheet
reference
number:
C-1-03
Sheet 27 of 52

PLOT DATE 16-JUN-2004 PLOT TIME 08:27 MASTER DESIGN FILE \\gold\civcad\napar\cn2a\cadd\SheetFiles\Mods\NA-04-015C-103am1.dgn

AM-001



LEGEND

- - - - RIGHT-OF-WAY

< < HAUL ROUTE

FLOODPLAIN TERRACE

MARSHPLAIN TERRACE

NOTES:

1. CONTRACTOR SHALL NOT ENTER FLOODPLAIN TERRACE, UNLESS APPROVED BY CONTRACTING OFFICER.

2. LOGS OF EXPLORATION ARE SHOWN ON SHEETS B-3-01 TO B-3-19.

3. CONTRACTOR SHALL PROVIDE FENCING, BARRICADES, SAFETY SIGNS, ETC. AS REQUIRED TO RESTRICT PUBLIC ACCESS TO CONSTRUCTION AREAS AND HAUL ROADS.

GRAPHIC SCALE

0 10' 25' 50' 100' 150'

1" = 50'

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by:
Dwn by: JWA
Spec No.: 1238
Reviewed by: TMC
Submitted by: CHIEF, CIVIL DESIGN SEC A
Date: 05/06/2004
Rev.
Design file no: NA-04-018
Drawing Code:
File name:
Plot date:
Plot scale:

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

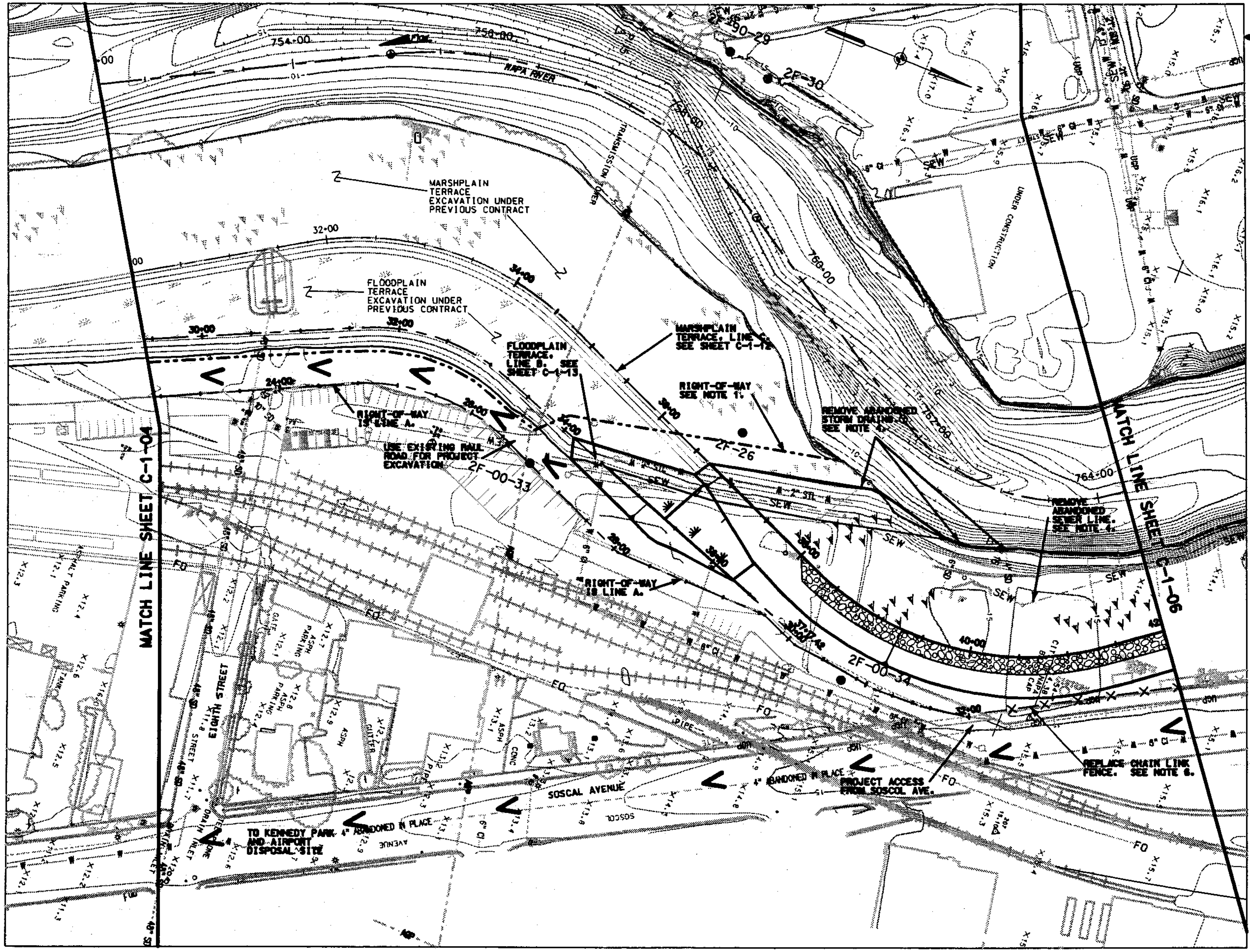
SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH ST TO THIRD ST)

GENERAL PLAN, RIGHT-OF-WAY, STAGING AREAS, PROJECT ACCESS AND LOCATION OF EXPLORATIONS

Sheet reference number:
C-1-04
Sheet 28 of 52

PLOT DATE 18-MAY-2004 PLOT TIME 09:18 MASTER DESIGN FILE \\gold\civcad\napar\cn2a\cadd\SheetFiles\NA-04-015C-104xxx.dgn



LEGEND

- - - - RIGHT-OF-WAY
- < < HAUL ROUTE
- FLOODPLAIN TERRACE
- MARSHPLAIN TERRACE
- STONE PROTECTION

NOTES:

1. CONTRACTOR'S RIGHT-OF-WAY IS 15 FEET OUTSIDE LIMITS OF EXCAVATION.
2. LOGS OF EXPLORATION ARE SHOWN ON SHEETS B-3-01 TO B-3-19.
3. CONTRACTOR SHALL PROVIDE FENCING, BARRICADES, SAFETY SIGNS, ETC. AS REQUIRED TO RESTRICT PUBLIC ACCESS TO CONSTRUCTION AREAS AND HAUL ROADS.
4. REMOVE ABANDONED UTILITY LINES AS NECESSARY FOR PROJECT EXCAVATION. VERIFY WITH APPROPRIATE UTILITY OWNER THAT LINES HAVE BEEN PROPERLY ABANDONED PRIOR TO WORK.
5. CONTRACTOR SHALL ADD FABRIC OR PLASTIC STRIP INSERTS TO FENCING ALONG SOSCOL AVENUE TO SCREEN WORK FROM VIEW.
6. REPLACE EXISTING CHAIN LINK FENCE FROM 3RD TO 6TH STREET.

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved

Designed by: | Spec No.: | Dwn by: JAA | Reviewed by: TMS | Submitted by: PETER VALENTINE, CHIEF, CIVIL DESIGN SEC A
Date: 05/04/2004 | Rev. | Design file no: NA-04-018 | Drawing Code: | File name: | Plot date: | Plot scale:

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 "J" STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH ST TO THIRD ST)

GENERAL PLAN, RIGHT-OF-WAY, STAGING AREAS, PROJECT ACCESS AND LOCATION OF EXPLORATIONS

Sheet reference number:
C-1-05
Sheet 29 of 52

PLOT DATE 18-MAY-2004 PLOT TIME 09:18 MASTER DESIGN FILE \\gold\civcad\napar\cn2a\cadd\SheetFiles\NA-04-015C-105xxx.dgn

LEGEND

- - - - RIGHT-OF-WAY

<< HAUL ROUTE

▨ FLOODPLAIN TERRACE

▨ MARSHPLAIN TERRACE

▨ STONE PROTECTION

NOTES:

1. RIGHT-OF-WAY BEGINS AT EDGE OF SIDEWALK. IF SIDEWALK IS REQUIRED FOR TEMPORARY WORK AREA, CONTACT CITY OF NAPA FOR PERMIT AND REQUIREMENTS.

2. THIS ACCESS SHALL NOT BE USED AS A HAUL ROUTE. CONTRACTOR MAY CONSTRUCT A TEMPORARY ENTRANCE AT THIS LOCATION, IF REQUIRED. PROTECT EXISTING SIDEWALK. ANY DAMAGE TO SIDEWALK, VEGETATION, ETC. SHALL BE REPAIRED BY CONTRACTOR. RESTORE TO PRIOR CONDITION. CONTRACTOR SHALL NOT BLOCK ACCESS TO REAR OF BORREO BUILDING.

3. PRIOR TO TERRACE EXCAVATION, HEIGHT RESTRICTIONS RANGE FROM 8' TO 12'. CONTRACTOR SHALL TAKE EXTREME CARE NOT TO DAMAGE BRIDGE STRUCTURE DURING WORK.

4. RIGHT-OF-WAY ENDS AT LIMITS OF EXCAVATION FOR MARSHPLAIN, PLUS THE MINIMUM AREA NEEDED TO INSTALL TURBIDITY CURTAIN AND REMOVE EXISTING BANK PROTECTION AND OTHER RUBBLE TO ELEVATION -2.7".

5. REMOVE ABANDONED UTILITY LINES AS NECESSARY FOR PROJECT EXCAVATION. VERIFY WITH APPROPRIATE UTILITY OWNER THAT LINES HAVE BEEN PROPERLY ABANDONED PRIOR TO WORK.

6. LOGS OF EXPLORATION ARE SHOWN ON SHEETS B-3-01 TO B-3-19.

7. CONTRACTOR SHALL PROVIDE FENCING, BARRICADES, SAFETY SIGNS, ETC. AS REQUIRED TO RESTRICT PUBLIC ACCESS TO CONSTRUCTION AREAS AND HAUL ROADS.

8. REFERENCE SPEC SECTION 02301 FOR DESCRIPTION OF CONCRETE FINISH WORK REQUIRED ON BRIDGE PIERS.

9. CONTRACTOR SHALL ADD FABRIC OR PLASTIC STRIP INSERTS TO FENCING ALONG SOSCOL AVENUE TO SCREEN WORK FROM VIEW.

10. REMOVE EXISTING CHAIN LINK FENCE BELOW THIRD STREET BRIDGE WITHIN FOOTPRINT OF TERRACE EXCAVATION (APPROX. 600 FEET).

11. INSTALL CHAIN LINK FENCE 20' BACK FROM EDGE OF TERRACE EXCAVATION.

12. REPLACE EXISTING CHAIN LINK FENCING FROM 3RD TO 6TH STREET.

GRAPHIC SCALE

0 10' 25' 50' 100' 150'

1" = 50'

US Army Corps
of Engineers
Sacramento District

Symbol	Description	Date	Approved
⚠1	ADD SHEET NOTE TO DEMOLISH SLAB	6/15/04	PV/RM

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Designed by:
Dwn by: JMA
Spec No.: 1209
Reviewed by: TMC
Submitted by: /s/PETER VALENTINE
CHIEF, CIVIL DESIGN SEC A
Date: 06/08/2004
Rev. REV_#
Design file no: NA-04-015
Drawing Code:
File name:
Plot date:
Plot scale: 50

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH ST TO THIRD ST)

GENERAL PLAN, RIGHT-OF-WAY,
STAGING AREAS, PROJECT ACCESS
AND LOCATION OF EXPLORATIONS

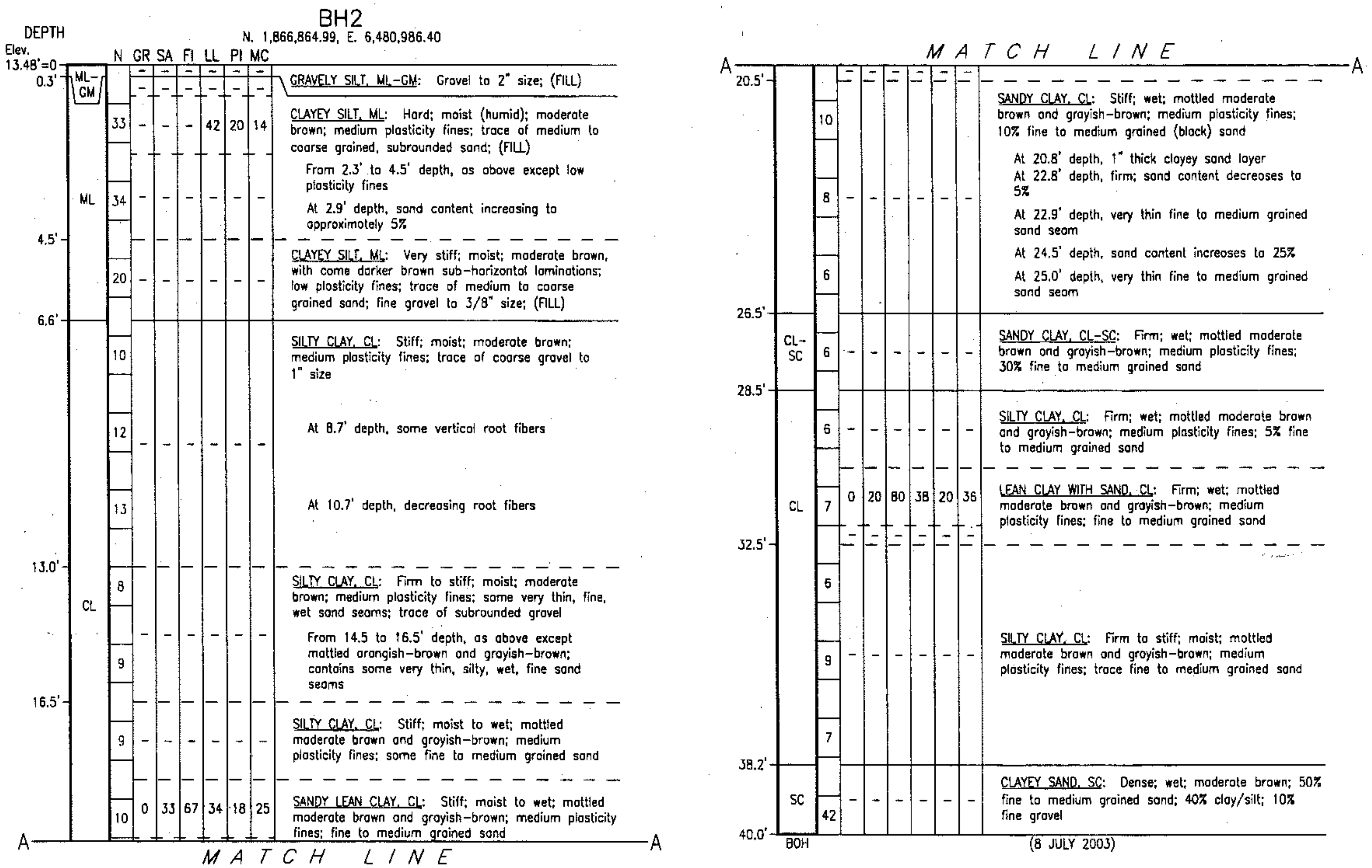
Sheet reference number:
C-1-06
Sheet 30 of 52

PLOT DATE 16-JUN-2004 PLOT TIME 08:22 MASTER DESIGN FILE \\gold\civcad\napar\cn2a\cadd\SheetFiles\Mods\NA-04-015C-106am1.dgn

AM-001

BH2

N. 1,866,864.99, E. 6,480,986.40



GRAVELY SILT, ML–GM: Gravel to 2" size; (FILL)

CLAYEY SILT, ML: Hard; moist (humid); moderate brown; medium plasticity fines; trace of medium to coarse grained, subrounded sand; (FILL)

From 2.3' to 4.5' depth, as above except low plasticity fines

At 2.9' depth, sand content increasing to approximately 5%

CLAYEY SILT, ML: Very stiff; moist; moderate brown, with come darker brown sub–horizontal laminations; low plasticity fines; trace of medium to coarse grained sand; fine gravel to 3/8" size; (FILL)

SILTY CLAY, CL: Stiff; moist; moderate brown; medium plasticity fines; trace of coarse gravel to 1" size

At 8.7' depth, some vertical root fibers

At 10.7' depth, decreasing root fibers

SILTY CLAY, CL: Firm to stiff; moist; moderate brown; medium plasticity fines; some very thin, fine, wet sand seams; trace of subrounded gravel

From 14.5 to 16.5' depth, as above except mattled orangish–brown and grayish–brown; contains some very thin, silty, wet, fine sand seams

SILTY CLAY, CL: Stiff; moist to wet; mottled moderate brown and grayish–brown; medium plasticity fines; some fine to medium grained sand

SANDY LEAN CLAY, CL: Stiff; moist to wet; mottled moderate brown and grayish–brown; medium plasticity fines; fine to medium grained sand

SANDY CLAY, CL: Stiff; wet; mottled moderate brown and grayish–brown; medium plasticity fines; 10% fine to medium grained (black) sand

At 20.8' depth, 1" thick clayey sand layer

At 22.8' depth, firm; sand content decreases to 5%

At 22.9' depth, very thin fine to medium grained sand seam

At 24.5' depth, sand content increases to 25%

At 25.0' depth, very thin fine to medium grained sand seam

SANDY CLAY, CL–SC: Firm; wet; mottled moderate brown and grayish–brown; medium plasticity fines; 30% fine to medium grained sand

SILTY CLAY, CL: Firm; wet; mottled moderate brown and grayish–brown; medium plasticity fines; 5% fine to medium grained sand

LEAN CLAY WITH SAND, CL: Firm; wet; mottled moderate brown and grayish–brown; medium plasticity fines; fine to medium grained sand

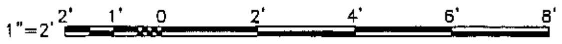
SILTY CLAY, CL: Firm to stiff; moist; mottled moderate brown and grayish–brown; medium plasticity fines; trace fine to medium grained sand

CLAYEY SAND, SC: Dense; wet; moderate brown; 50% fine to medium grained sand; 40% clay/silt; 10% fine gravel

(8 JULY 2003)

VERTICAL SCALE: 1" = 2'

GRAPHIC SCALE



NOTES:

1. Legend and Notes are shown on Sheet No. B–3–01.
2. Logs of Explorations are shown on Sheet Nos. B–3–01 through B–3–19.
3. Location of Explorations are shown on Sheet Nos. C–1–02 through C–1–06 and C–1–10.

US Army Corps of Engineers
Sacramento District

Symbol | Description | Date | Approved

Designed by: Nicole Holmes/Jane Bolton
Dwn by: N.L.B./R.L.T.
Spec No.: 1299
Reviewed by: Joe Sciandrone
Submitted by: /s/ Ben Gampers, Chief, Soil Design Section
Date: 05/06/2004
Design file no: NA–04–15
Drawing Code:
File name: NA–01–01SB106XX.dwg
Plot date: 05/06/2004
Dwg scale: AS_NOTED
Rev.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN–HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814–2922

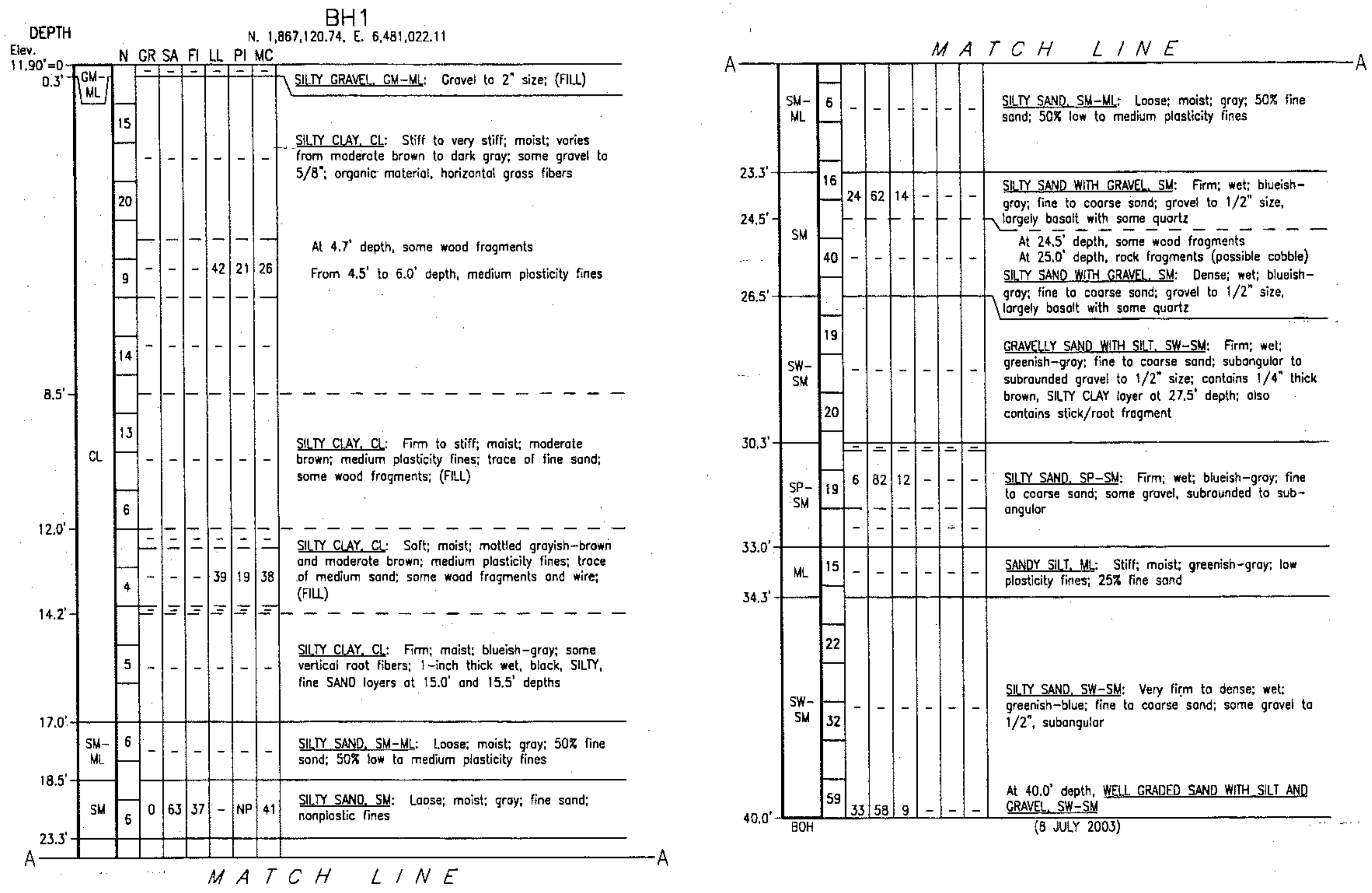
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STEET)

LOG OF EXPLORATION
BH–2

Sheet reference number:
B–3–06
Sheet 11 of 52

Soil Design Section Sheet No. 6 of 19

Reference: Exploration Log File No. NA–01–17



BH1

N. 1,867,120.74, E. 6,481,022.11

DEPTH		N	GR	SA	FI	LL	PI	MC	
Elev. 11.90'=0 – 0.3'	GM-ML		–	–	–	–	–	–	SILTY GRAVEL, GM-ML: Gravel to 2" size; (FILL)
0.3' – 8.5'	CL	15 20 9 14	– – –	– – –	– – –	– 42 –	– 21 –	– 26 –	SILTY CLAY, CL: Stiff to very stiff; moist; varies from moderate brown to dark gray; some gravel to 5/8"; organic material, horizontal grass fibers At 4.7' depth, some wood fragments From 4.5' to 6.0' depth, medium plasticity fines
8.5' – 12.0'		13 6	–	–	–	–	–	–	SILTY CLAY, CL: Firm to stiff; moist; moderate brown; medium plasticity fines; trace of fine sand; some wood fragments; (FILL)
12.0' – 14.2'		4	–	–	–	39	19	38	SILTY CLAY, CL: Soft; moist; mottled grayish-brown and moderate brown; medium plasticity fines; trace of medium sand; some wood fragments and wire; (FILL)
14.2' – 17.0'		5	–	–	–	–	–	–	SILTY CLAY, CL: Firm; moist; blueish-gray; some vertical root fibers; 1-inch thick wet, black, SILTY, fine SAND layers at 15.0' and 15.5' depths
17.0' – 18.5'	SM-ML	6	–	–	–	–	–	–	SILTY SAND, SM-ML: Loose; moist; gray; 50% fine sand; 50% low to medium plasticity fines
18.5' – 23.3'	SM	6	0	63	37	–	NP	41	SILTY SAND, SM: Loose; moist; gray; fine sand; nonplastic fines

A — MATCH LINE — A

DEPTH		N	GR	SA	FI	LL	PI	MC	
– 23.3'	SM-ML	6	–	–	–	–	–	–	SILTY SAND, SM-ML: Loose; moist; gray; 50% fine sand; 50% low to medium plasticity fines
23.3' – 24.5'	SM	16	24	62	14	–	–	–	SILTY SAND WITH GRAVEL, SM: Firm; wet; blueish-gray; fine to coarse sand; gravel to 1/2" size, largely basalt with some quartz
24.5' – 26.5'		40	–	–	–	–	–	–	At 24.5' depth, some wood fragments At 25.0' depth, rock fragments (possible cobble) SILTY SAND WITH GRAVEL, SM: Dense; wet; blueish-gray; fine to coarse sand; gravel to 1/2" size, largely basalt with some quartz
26.5' – 30.3'	SW-SM	19 20	–	–	–	–	–	–	GRAVELLY SAND WITH SILT, SW-SM: Firm; wet; greenish-gray; fine to coarse sand; subangular to subrounded gravel to 1/2" size; contains 1/4" thick brown, SILTY CLAY layer at 27.5' depth; also contains stick/root fragment
30.3' – 33.0'	SP-SM	19	6 –	82 –	12 –	– –	– –	– –	SILTY SAND, SP-SM: Firm; wet; blueish-gray; fine to coarse sand; some gravel, subrounded to subangular
33.0' – 34.3'	ML	15	–	–	–	–	–	–	SANDY SILT, ML: Stiff; moist; greenish-gray; low plasticity fines; 25% fine sand
34.3' – 40.0'	SW-SM	22 32 59	– 33	– 58	– 9	– –	– –	– –	SILTY SAND, SW-SM: Very firm to dense; wet; greenish-blue; fine to coarse sand; some gravel to 1/2", subangular At 40.0' depth, WELL GRADED SAND WITH SILT AND GRAVEL, SW-SM
BOH									(8 JULY 2003)

VERTICAL SCALE: 1" = 2'

GRAPHIC SCALE

NOTES:

1. Legend and Notes are shown on Sheet No. B-3-01.
2. Logs of Explorations are shown on Sheet Nos. B-3-01 through B-3-19.
3. Location of Explorations are shown on Sheet Nos. C-1-02 through C-1-06 and C-1-10.

US Army Corps
of Engineers
Sacramento District

Symbol	Descriptions	Date	Approved

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Designed by: Nicole Holmes/Jane Bolton
Date: 05/06/2004
Rev.
Dwn by: N.L.B./R.L.T.
Spec No.: 1299
Design file no: NA-04-15
Reviewed by: Joe Sciandrone
Drawing Code:
Submitted by: /s/ Ben Gompers
Chief, Soil Design Section
File name: NA-01-0158305XXX.dwg
Plot date: 05/06/2004
Dwg scale: AS_NOTED

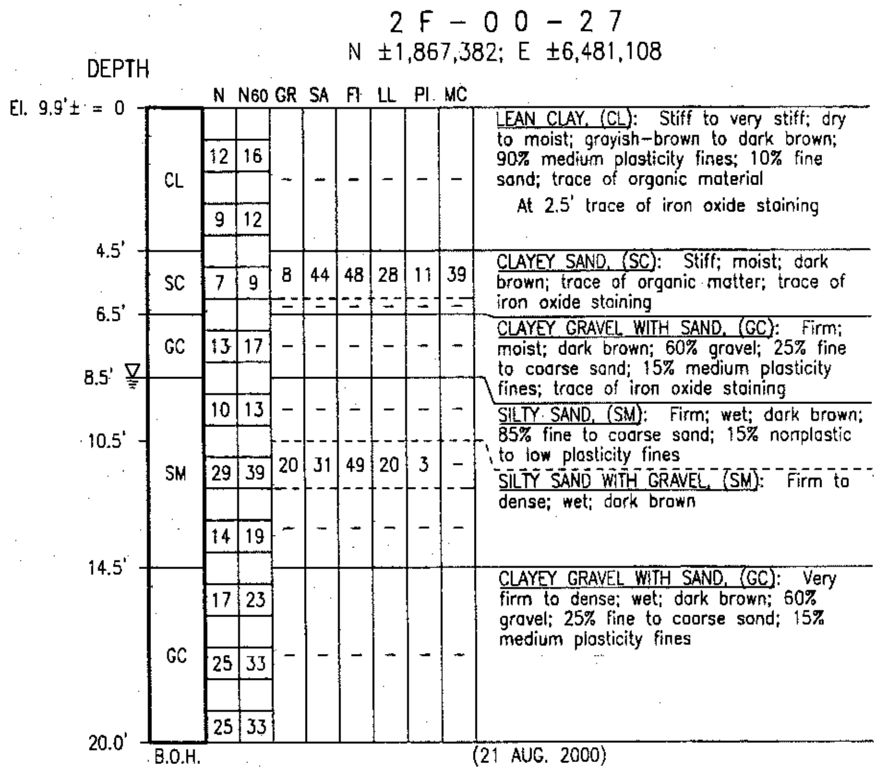
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STEET)

LOG OF EXPLORATION
BH-1

Sheet reference number:
B-3-05
Sheet 10 of 52

Soil Design Section Sheet No. 5 of 19

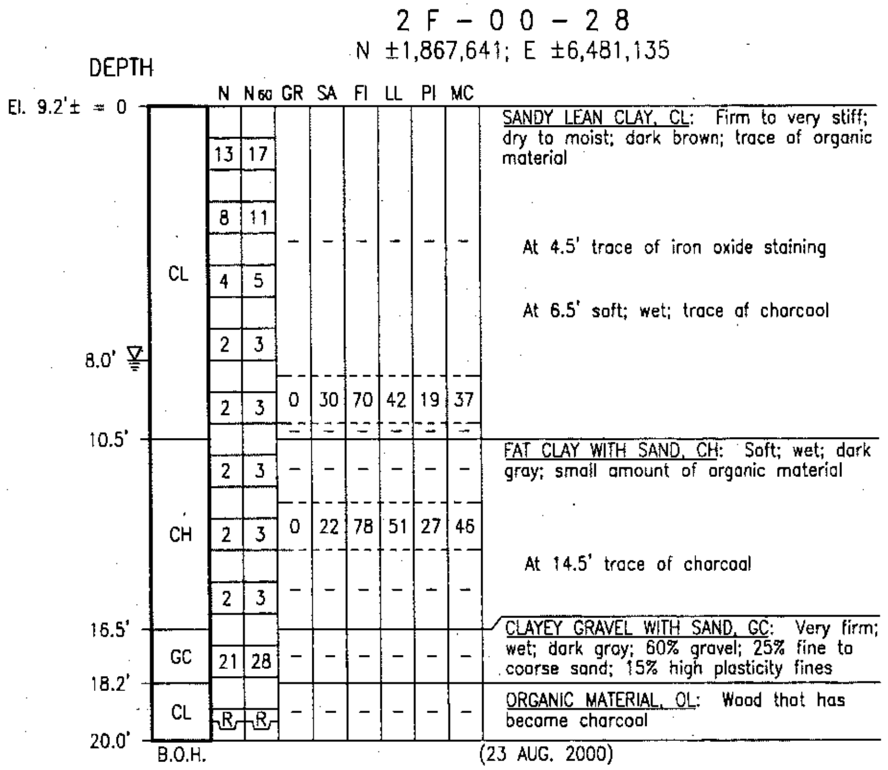
Reference: Exploration Log File No. NA-01-17



2F-00-27

N ±1,867,382; E ±6,481,108

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	
El. 9.9'± = 0	CL	12 9	16 12	-	-	-	-	-	-	LEAN CLAY, (CL): Stiff to very stiff; dry to moist; grayish-brown to dark brown; 90% medium plasticity fines; 10% fine sand; trace of organic material At 2.5' trace of iron oxide staining
4.5'	SC	7	9	8	44	48	28	11	39	CLAYEY SAND, (SC): Stiff; moist; dark brown; trace of organic matter; trace of iron oxide staining
6.5'	GC	13	17	-	-	-	-	-	-	CLAYEY GRAVEL WITH SAND, (GC): Firm; moist; dark brown; 60% gravel; 25% fine to coarse sand; 15% medium plasticity fines; trace of iron oxide staining
8.5' ▽	SM	10 29 14	13 39 19	- 20 -	- 31 -	- 49 -	- 20 -	- 3 -	- - -	SILTY SAND, (SM): Firm; wet; dark brown; 85% fine to coarse sand; 15% nonplastic to low plasticity fines SILTY SAND WITH GRAVEL, (SM): Firm to dense; wet; dark brown
10.5'										
14.5'	GC	17 25 25	23 33 33	-	-	-	-	-	-	CLAYEY GRAVEL WITH SAND, (GC): Very firm to dense; wet; dark brown; 60% gravel; 25% fine to coarse sand; 15% medium plasticity fines
20.0'	B.O.H.									(21 AUG. 2000)

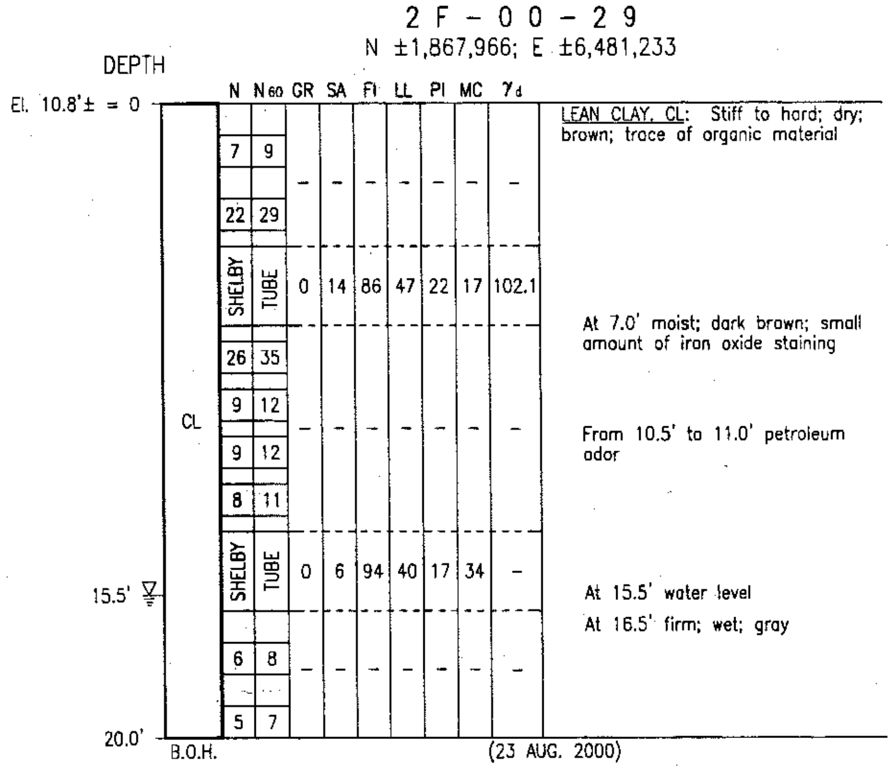


2F-00-28

N ±1,867,641; E ±6,481,135

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	
El. 9.2'± = 0 8.0' ▽	CL	13 8 4 2 2	17 11 5 3 3	- 0	- 30	- 70	- 42	- 19	- 37	SANDY LEAN CLAY, CL: Firm to very stiff; dry to moist; dark brown; trace of organic material At 4.5' trace of iron oxide staining At 6.5' soft; wet; trace of charcoal
10.5'	CH	2 2 2	3 3 3	- 0 -	- 22 -	- 78 -	- 51 -	- 27 -	- 46 -	FAT CLAY WITH SAND, CH: Soft; wet; dark gray; small amount of organic material At 14.5' trace of charcoal
16.5'	GC	21	28	-	-	-	-	-	-	CLAYEY GRAVEL WITH SAND, GC: Very firm; wet; dark gray; 60% gravel; 25% fine to coarse sand; 15% high plasticity fines
18.2'	CL	R	R	-	-	-	-	-	-	ORGANIC MATERIAL, OL: Wood that has become charcoal
20.0'	B.O.H.									(23 AUG. 2000)

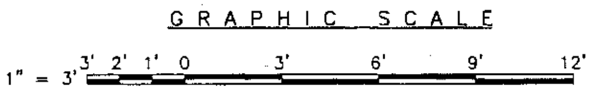
VERTICAL SCALE: 1" = 3'



2F-00-29

N ±1,867,966; E ±6,481,233

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	γd	
El. 10.8'± = 0	CL	7 22	9 29	-	-	-	-	-	-	-	LEAN CLAY, CL: Stiff to hard; dry; brown; trace of organic material
		SHELBY	TUBE	0	14	86	47	22	17	102.1	At 7.0' moist; dark brown; small amount of iron oxide staining
		26 9 9 8	35 12 12 11	-	-	-	-	-	-	-	From 10.5' to 11.0' petroleum odor
15.5' ▽		SHELBY	TUBE	0	6	94	40	17	34	-	At 15.5' water level At 16.5' firm; wet; gray
		6 5	8 7	-	-	-	-	-	-	-	
20.0'	B.O.H.										(23 AUG. 2000)



GRAPHIC SCALE

NOTES:

1. Legend and Notes are shown on Sheet No. B-3-01.
2. Logs of Explorations are shown on Sheet Nos. B-3-01 through B-3-19.
3. Location of Explorations are shown on Sheet Nos. C-1-02 through C-1-06 and C-1-10.

US Army Corps of Engineers
Sacramento District

Symbol	Description	Date	Approved

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

Designed by: Nicole Holmes/Jane Belton
Date: 05/06/2004
Rev.
Dwn by: R.L.B. / R.L.T.
Spec No.: 1299
Design file no: NA-04-15
Reviewed by: Joe Sciandrone
Drawing Code:
Submitted by: /s/ Ban Campers, Chief, Soil Design Section
File name: NA-01-0158300027.dwg
Plot date: 05/06/2004
Dwg scale: AS_NOTED

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STEET)

LOG OF EXPLORATIONS
2F-00-27, -28 AND -29

Sheet reference number:
B-3-09
Sheet 14 of 52

Soil Design Section Sheet No. 9 of 19

Reference: Exploration Log File No. NA-01-17

2F-00-30

N ±1,868,323; E ±6,481,284

DEPTH		N	N60	GR	SA	FI	LL	PI	MC	
El. 10.9'± = 0	SC	26	35	–	–	–	–	–	–	CLAYEY SAND, SC: Dense; dry; pale brown; 60% fine to coarse sand; 40% medium plasticity fines
2.5'	CL	16	21	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Stiff to hard; dry; brown to dark brown; trace of organic material
		31	41							
		22	29	0	17	83	41	21	26	At 6.5' moist; trace of iron oxide staining
		11	15	–	–	–	–	–	–	
10.5'		11	15							LEAN CLAY, CL: Stiff to very stiff; moist; 95% medium plasticity fines; 5% fine sand; trace of organic material; trace of iron oxide staining
		12	16	–	–	–	–	–	–	At 14.5' gray
		10	13							At 16.5' firm; wet
		5	7							
18.5' ▽	SC	2	3	0	58	42	27	7	27	CLAYEY SAND, SC: Very loose; wet; gray; small amount of iron oxide staining
20.0'	B.O.H.									(22 AUG 2000)

NOTES:

1. Legend and Notes are shown on Sheet No. B-3-01.
2. Logs of Explorations are shown on Sheet Nos. B-3-01 through B-3-19.
3. Location of Explorations are shown on Sheet Nos. C-1-02 through C-1-06 and C-1-10.

GRAPHIC SCALE

1" = 3' 3' 2' 1' 0 3' 6' 9' 12'

VERTICAL SCALE: 1" = 3'

US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 "J" STREET
SACRAMENTO, CA 95814-2922

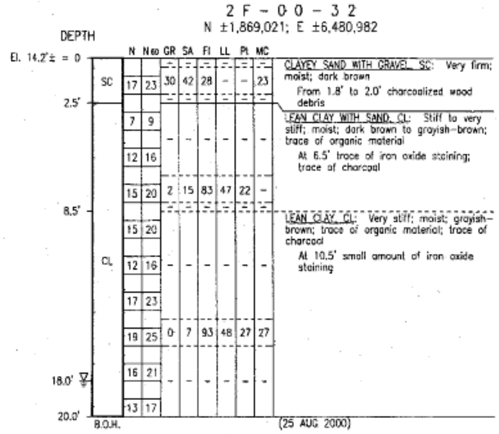
NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STREET)

LOG OF EXPLORATIONS
2F-00-16, -18 AND -27

Sheet reference number:
B-3-11
Sheet 16 of 52

Reference: Exploration Log File No. NA-01-17 | Soil Design Section Sheet No. 11 of 18

2 F - 0 0 - 3 2
N ±1,869,021; E ±6,480,982



N	N60	GR	SA	FI	LL	PI	MC
17	23	30	42	28	–	–	23
7	9	–	–	–	–	–	–
12	16						
15	20	2	15	83	47	22	–
15	20						
12	16	–	–	–	–	–	–
17	23						
19	25	0	7	93	48	27	27
16	21	–	–	–	–	–	–
13	17						

CLAYEY SAND WITH GRAVEL, SC: Very firm; moist; dark brown

From 1.8' to 2.0' charcoalized wood debris

LEAN CLAY WITH SAND, CL: Stiff to very stiff; moist; dark brown to grayish-brown; trace of organic material

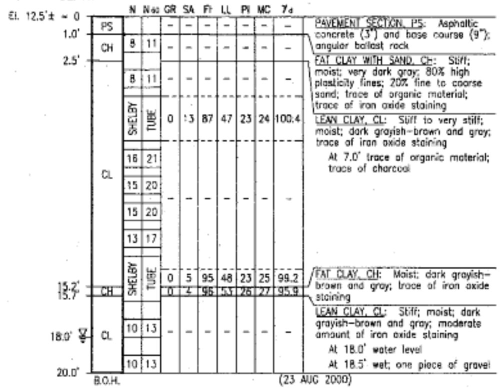
At 6.5' trace of iron oxide staining; trace of charcoal

LEAN CLAY, CL: Very stiff; moist; grayish-brown; trace of organic material; trace of charcoal

At 10.5' small amount of iron oxide staining

(25 AUG 2000)

2 F - 0 0 - 3 3
N ±1,869,465; E ±6,480,925



N	N60	GR	SA	FI	LL	PI	MC	γd
		–	–	–	–	–	–	–
8	11	–	–	–	–	–	–	–
8	11	–	–	–	–	–	–	–
SHELBY	TUBE	0	13	87	47	23	24	100.4
16	21							
15	20	–	–	–	–	–	–	–
15	20							
13	17							
SHELBY	TUBE	0	5	95	48	23	25	99.2
		0	4	96	53	26	27	95.9
10	13	–	–	–	–	–	–	–
10	13							

PAVEMENT SECTION, PS: Asphaltic concrete (3") and base course (9"); angular ballast rock

FAT CLAY WITH SAND, CH: Stiff; moist; very dark gray; 80% high plasticity fines; 20% fine to coarse sand; trace of organic material; trace of iron oxide staining

LEAN CLAY, CL: Stiff to very stiff; moist; dark grayish-brown and gray; trace of iron oxide staining

At 7.0' trace of organic material; trace of charcoal

FAT CLAY, CH: Moist; dark grayish-brown and gray; trace of iron oxide staining

LEAN CLAY, CL: Stiff; moist; dark grayish-brown and gray; moderate amount of iron oxide staining

At 18.0' water level

At 18.5' wet; one piece of gravel

(23 AUG 2000)

GRAPHIC SCALE

1" = 3' 3' 2' 1' 0 3' 6' 9' 12'

VERTICAL SCALE: 1" = 3'

US Army Corps of Engineers
Sacramento District

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STREET)

LOG OF EXPLORATION
2F-00-32, -33 AND 2F-26

Sheet reference number:
B-3-12
Sheet 17 of 52

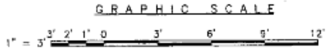
Reference: Exploration Log File No. NA-01-17

Soil Design Section Sheet No. 12 of 19

2F-00-34

N ±1,869,837; E ±6,481,016

DEPTH		N	Nss	GR	SA	FI	LL	PI	MC	
El. 14.5'± = 0	PS			–	–	–	–	–	–	PAVEMENT SECTION, PS: Asphaltic concrete (3") and base course (4"); angular ballast rock
2.0'	CL	4	5	–	–	–	–	–	–	LEAN CLAY WITH SAND, CL: Firm; moist; dark brown; 75% medium plasticity fines; 20% fine to coarse sand; 5% gravel; trace of organic material
4.0'		14	19	–	–	–	–	–	–	LEAN CLAY, CL: Very stiff; moist; dark brown; trace of organic material; trace of iron oxide staining; trace of charcoal
		14	19							
8.0'	CH	12	16	0	7	93	50	26	27	FAT CLAY, CH: Very stiff; moist; brown; trace of organic material; trace of iron oxide staining; trace of charcoal
9.5'	CL	12	16							LEAN CLAY, CL: Very stiff; moist; brown; trace of organic material; trace of iron oxide staining; trace of charcoal
		19	25	–	–	–	–	–	–	At 14.0' mottled brown
		18	24							At 16.0' no organic material or charcoal
		12	16							At 18.5' water level
18.5' ∇	SC	12	16	15	48	37	36	18	21	CLAYEY SAND WITH GRAVEL, SC: Firm; wet; brown; small amount of iron oxide staining
20.0'	B.O.H.									(22 AUG 2000)



VERTICAL SCALE: 1" = 3'

US Army Corps of Engineers
Sacramento District

Designed by:
Dwn by:
Reviewed by:
Submitted by:
Date: 05/08/2004
Drawing Code:

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

SACRAMENTO DISTRICT
IN-HOUSE DESIGN
1325 'J' STREET
SACRAMENTO, CA 95814-2922

NAPA CALIFORNIA
NAPA RIVER/NAPA CREEK
FLOOD PROTECTION PROJECT
CONTRACT 2 EAST (SIXTH STREET TO THIRD STREET)

LOG OF EXPLORATIONS
2F-00-34 AND 2F-27

Sheet reference number:
B-3-13
Sheet 18 of 52

Reference: Exploration Log File No. NA-03-17
Soil Design Section Sheet No. 13 of 19

Appendix D

Napa River H&H Memorandums for Record – 2010

CESPK-ED-D August 31, 2010

MEMORANDUM FOR RECORD

SUBJECT: Napa River Hydrology, Computed Probability Flows

1. Scope

Expected probability flows for the Napa River near Napa gage (USGS # 11458000) and locations downstream are contained in the "Napa River /Napa Creek Flood Protection Project Final Supplemental General Design Memorandum, Appendix H, Napa River Basin Hydrology for the Supplemental General Design Memorandum, "dated October 1998. The Napa River at Napa gage has a drainage area of 218 square miles and is located 5 miles north of Napa at Oak Knoll Avenue. The original hydrology was done using expected probability. This memorandum provides a full range of computed probability flows for the Napa River near Napa gage derived from the median flow frequency curve. These frequencies are 50, 20, 10, 5, 2, 1, 0.5, 0.2, and 0.1 percent. These results will be used for FDA analysis and FEMA certification. This analysis updates the flow frequency curves at the Napa River at Napa gage and select downstream locations. Locations upstream of Oak Knoll Avenue are not included in this study. Figure 1 shows the location of the relevant gages and index points. Future condition floods were not simulated because rural land use and urbanization in the Napa River Basin are not expected to change dramatically (USACE, 1998).

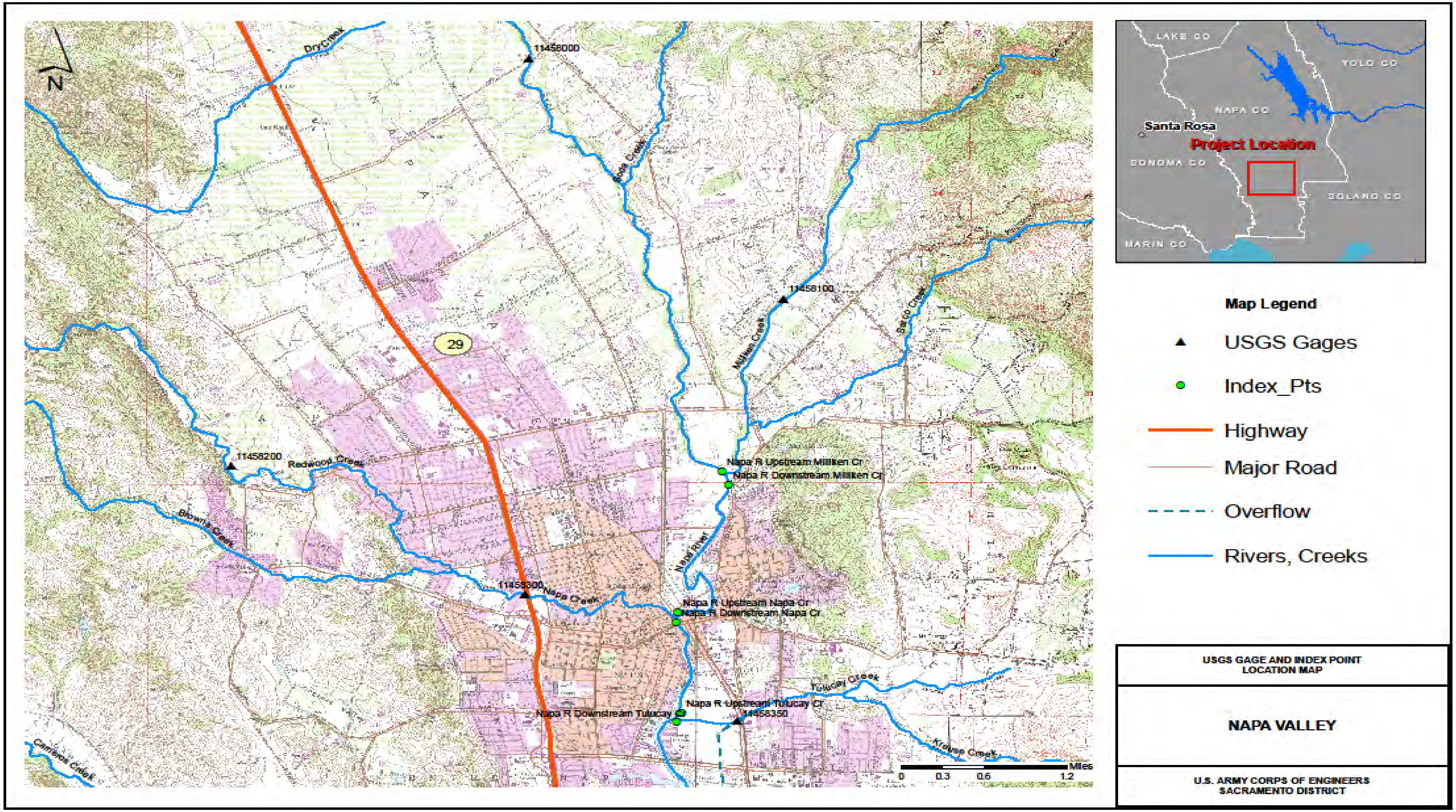


Figure 1 Study area location map showing important gages and index locations (USGS 1980).

2. Hydrologic Analysis

An unregulated peak flow frequency curve was constructed from unregulated peak flow data from USGS 11458000 Napa River near Napa (Oak Knoll) gage using the procedures in Bulletin 17B. As of Water Year 1997, 38 years (WY 1960-1997) of recorded data were available at USGS 11458000 and Conn Dam is the primary regulating influence on the flows at the Oak Knoll gage. The unregulated peak flows were obtained by routing and adding Conn Dam change in storage to the recorded flows at the Napa River near Napa gage (USACE, 1998). HEC-FFA was used to identify low outliers and the identified low outlier is from WY 1977. The period of record was extended from 38 years to 72 years by examining historical floods in the Napa River Basin and adjacent basins and by correlation with an upstream gage, Napa River at St Helena (USGS # 1145600), which has a 58 year period of record (WY 1940-1997) and a drainage area of 79 square miles. The adopted log statistics for the unregulated curve are: mean 3.989, standard deviation 0.329, and adopted skew of -0.8. HEC-REGFRQ (Regional Frequency Computation) was used in the correlation analysis.

A graphical curve was constructed for the regulated flows by fitting the curve through the regulated historical points. The present conditions curve is a combination of the regulated and unregulated curves. The unregulated and regulated curves for the Napa River near Napa (Oak Knoll) gage are shown in Figure 2 and the final present conditions curve is shown in Figure 3. The data used for the present study are from the 1998 GDM and are shown in Table 1 below.

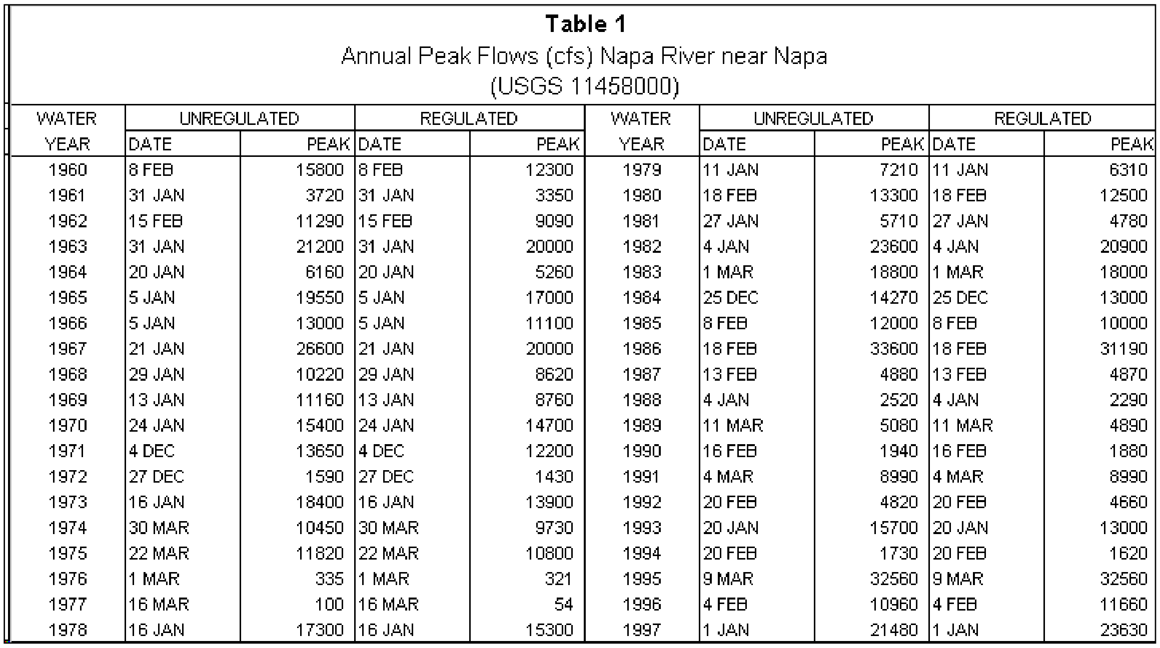


Table 1

Annual Peak Flows (cfs) Napa River near Napa

(USGS 11458000)

WATER YEAR	UNREGULATED		REGULATED		WATER YEAR	UNREGULATED		REGULATED	
	DATE	PEAK	DATE	PEAK		DATE	PEAK	DATE	PEAK
1960	8 FEB	15800	8 FEB	12300	1979	11 JAN	7210	11 JAN	6310
1961	31 JAN	3720	31 JAN	3350	1980	18 FEB	13300	18 FEB	12500
1962	15 FEB	11290	15 FEB	9090	1981	27 JAN	5710	27 JAN	4780
1963	31 JAN	21200	31 JAN	20000	1982	4 JAN	23600	4 JAN	20900
1964	20 JAN	6160	20 JAN	5260	1983	1 MAR	18800	1 MAR	18000
1965	5 JAN	19550	5 JAN	17000	1984	25 DEC	14270	25 DEC	13000
1966	5 JAN	13000	5 JAN	11100	1985	8 FEB	12000	8 FEB	10000
1967	21 JAN	26600	21 JAN	20000	1986	18 FEB	33600	18 FEB	31190
1968	29 JAN	10220	29 JAN	8620	1987	13 FEB	4880	13 FEB	4870
1969	13 JAN	11160	13 JAN	8760	1988	4 JAN	2520	4 JAN	2290
1970	24 JAN	15400	24 JAN	14700	1989	11 MAR	5080	11 MAR	4890
1971	4 DEC	13650	4 DEC	12200	1990	16 FEB	1940	16 FEB	1880
1972	27 DEC	1590	27 DEC	1430	1991	4 MAR	8990	4 MAR	8990
1973	16 JAN	18400	16 JAN	13900	1992	20 FEB	4820	20 FEB	4660
1974	30 MAR	10450	30 MAR	9730	1993	20 JAN	15700	20 JAN	13000
1975	22 MAR	11820	22 MAR	10800	1994	20 FEB	1730	20 FEB	1620
1976	1 MAR	335	1 MAR	321	1995	9 MAR	32560	9 MAR	32560
1977	16 MAR	100	16 MAR	54	1996	4 FEB	10960	4 FEB	11660
1978	16 JAN	17300	16 JAN	15300	1997	1 JAN	21480	1 JAN	23630

Flows with exceedance frequencies greater than 1 % chance exceedance are from the regulated curve. At about 1 % chance exceedance, the upstream regulation ceases to have an effect on the flows. Thus the flows at frequencies less than or equal to 1% chance exceedance are from the unregulated curve. None of the measured flows at the

Napa River near Napa gage reached the threshold value of 36,500 cfs (1%) where regulated flows equal unregulated flows. As a result all recorded gage data are considered to be regulated flows. Flows for all exceedance intervals are shown in Table 2 below.

Table 2
Napa River near Napa
USGS 11458000

Exceedance Frequency per 100 Years	Flows (cfs)
80	5,000
50	9,900
20	17,200
10	22,200
5.0	26,800
2.0	32,600
1.0	36,500
0.5	39,600
0.2	43,200
0.1	45,600

The Napa River flood hydrographs for each exceedance interval were computed by multiplying the existing Standard Project Flood (SPF) hydrographs by ratios determined from the Napa River frequency curves (USACE 1975, USACE 1998). The ratios were determined by dividing the given exceedance peak flow by the peak of the SPF. For example, the 1% chance exceedance flow is 36,500 cfs, which is 0.802 times the SPF of 45,500 cfs. The adopted Napa River 50-, 20-, 10-, 2-, 1-, 0.5-, 0.2-, and 0.1-percent chance exceedance ratios are: 0.218, 0.378, 0.488, 0.716, 0.802, 0.870, 0.949 and 1.002 respectively. The drainage areas of Soda, Milliken, Napa and Tulucay Creeks are: 15.5, 17.3, 14.9 and 12.6 sqare miles respectively. The flood hydrographs for the local creeks through the project area below Oak Knoll were obtained by ratios derived from the Napa Creek frequency curve. The adopted Napa Creek 50-, 20-, 10-, 2-, 1-, 0.5-, 0.2-, and 0.1-percent chance exceedance ratios are: 0.380, 0.492, 0.562, 0.713, 0.775, 0.832, 0.922, 0.995, respectively. The frequency curve for Napa Creek at Napa River is shown in Figure 4. The original curve was constructed using data from the Napa Creek at Napa gage (USGS# 11458300) and values estimated by correlation with Redwood Creek near Napa gage (USGS# 11458200). This frequency curve was extended from the original graphical curve in the 1998 GDM using regression and graphical methods. Linear regression was used on the upper end of the data to get an approximate trend then the curve is extended graphically. The Napa Creek ratios were used for local concurrent flows from Soda Creek, Milliken Creek and the local flow into the Napa River. An HMS model of Tulucay Creek was used to determine peak flows in that basin (see Sept 1 Addendum).

Two HEC-1 models are used in this study: a rainfall runoff model for Soda, Milliken and Napa Creeks and a routing model for the main stem of the Napa River. The rainfall runoff model uses Kinematic wave unit hydrographs with a 0.75-inch initial loss and a constant loss rate of 0.1 inches per hour. The precipitation pattern is that of the Standard Project Flood (SPF). The SPF for the Napa River Valley is the December 1964 storm over Laytonville, California, artificially centered over the Napa River Basin with wet ground conditions (initial loss of 0.2 inches and final loss rate of 0.1 inches per hour) as was done in USACE 1998 and USACE 1975. The routing model uses the Modified Puls method and routing parameters are the same as in the 1998 GDM (USACE 1998 and USACE 1975).

3. Recent Data

Peak flow data from the Napa River near Napa gage from water years 1998 through 2006 are shown in Table 3, below. The data appear to be randomly distributed. There is not enough evidence at this time to justify revising the flow frequency curves at the Napa River near Napa gage.

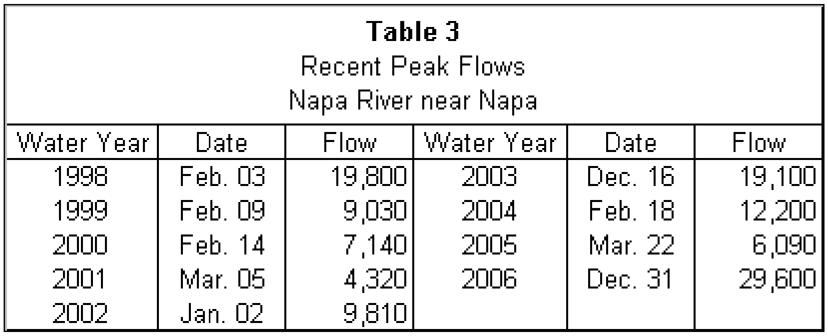


Table 3
Recent Peak Flows
Napa River near Napa

Water Year	Date	Flow	Water Year	Date	Flow
1998	Feb. 03	19,800	2003	Dec. 16	19,100
1999	Feb. 09	9,030	2004	Feb. 18	12,200
2000	Feb. 14	7,140	2005	Mar. 22	6,090
2001	Mar. 05	4,320	2006	Dec. 31	29,600
2002	Jan. 02	9,810			

4. Results

Peak flows in the Napa River with concurrent flows in Milliken, Napa and Tulucay Creeks are shown in Tables 4, 5 and 6. Tables 7, 8 and 9 show the peak flows in Milliken, Napa and Tulucay Creeks with the concurrent flows in the Napa River. Soda Creek is not included in this analysis. These tables follow the same format as the 1998 GDM and can be used to estimate concurrent Napa River flow for nonuniform storms over the Napa River Basin. For example, if a 10 year flood strikes the Napa River Basin and a 100 year flood strikes the Napa Creek Basin, then the concurrent flow downstream of Napa Creek is estimated to be 23,710 cfs (19,430 + 4,280 = 23,710). The tables are for the 50-, 20-, 10-, 2-, 1-, 0.5-, 0,2- and 0.1-percent chance exceedance floods and reflect existing conditions. For example, Table 4 shows that the 1% chance exceedance floods in the Napa River upstream of Milliken Creek is 37,500 cfs and the concurrent flows in Milliken Creek and in the Napa River downstream of Milliken Creek at the time of the peak upstream are 1,570 cfs and 39,400 cfs, respectively.

For the Napa River upstream of Napa Creek shown in Table 5, the 1% chance exceedance flow is 40,100 cfs and the concurrent flows in Napa Creek and in Napa River downstream of Napa Creek (at the time of the peak upstream) are 2,600 cfs and 42,700 cfs, respectively.

In the Napa River above Tulucay Creek, shown in Table 6, the 1% chance exceedance flow is 42,400 cfs, while the concurrent flows in Tulucay Creek and in Napa River below Tulucay Creek are 1660 cfs and 44,400 cfs, respectively

Peak flows in Milliken, Napa, and Tulucay Creek are shown in Tables 7, 8, and 9. These tables follow the same format as in the 1998 GDM. For example, in Table 7, Milliken Creek at the Napa River, the 1% chance exceedance peak flow is 4,900 cfs and the concurrent flows in the Napa River upstream and downstream of Milliken Creek are 27,000 cfs and 32,700 cfs, respectively.

In Napa Creek, at the Napa River, shown in Table 8, the 1% chance exceedance peak flow is 4,280 cfs and the concurrent flows in the Napa River upstream and downstream are 31,700 cfs and 36,000 cfs, respectively.

In Tulucay Creek at the Napa River, shown in Table 9, the 1% chance exceedance peak flow is 4530 cfs and the concurrent flows in the Napa River upstream and downstream are 33,100 cfs and 38,400 cfs, respectively. The index location “Local above Tulucay Creek” refers to a small creek that enters the Napa River approximately ½ mile upstream from the mouth of Tulucay Creek. Figure 5 contains peak flow frequency curves for the Napa River upstream of Milliken, Napa and Tulucay Creeks.

Table 4

Peak Flows in the Napa River Upstream of Milliken Creek
with Concurrent Flows in Milliken Creek (Existing Conditions). Flows in cfs..

Location	2-year	5-year	10-year	50-year	100-year	200-year	500-year	1000-year	SPF
Napa River upstream of Milliken Creek (peak flow)	10,420	17,640	22,750	33,430	37,470	40,730	44,540	47,160	47,080
Milliken Creek at Mouth (concurrent flow)	730	690	840	1,300	1,570	1,800	2,390	2,880	2,920
Local above Milliken Creek (concurrent flow)	170	200	220	270	300	320	360	390	390
Napa River downstream of Milliken Creek (concurrent flow)	11,320	18,520	23,810	35,010	39,350	42,850	47,300	50,430	50,400

Values were determined from HEC-1 ouput on 02 Nov 2007.

Table 5

Peak Flows in the Napa River Upstream of Napa Creek
with Concurrent Flows in Napa Creek (Existing Conditions). Flows in cfs.

Location	2-year	5-year	10-year	50-year	100-year	200-year	500-year	1000-year	SPF
Napa River upstream of Napa Creek (peak flow)	11,630	18,810	24,040	35,600	40,100	43,620	48,300	51,810	51,800
Napa Creek at mouth (concurrent flow)	1,310	1,670	1,770	2,410	2,620	2,690	2,960	3,330	3,360
Napa River downstream of Napa Creek (concurrent flow)	12,940	20,480	25,810	38,010	42,720	46,310	51,260	55,140	55,160

Values were determined from HEC-1 model output on 02 Nov 2007.

Table 6

Peak flows in the Napa River, upstream of Tulucay Creek
with concurrent flows in Tulucay Creek (existing conditions). Flows in cfs.

Location	2-year	5-year	10-year	50-year	100-year	200-year	500-year	1000-year
Napa River upstream of Tulucay Creek (peak flow)	12,900	20,270	25,650	37,610	42,410	46,110	51,060	54,770
Tulucay Creek at mouth (concurrent flow)	510	710	970	1,300	1,660	1,890	2,180	2,400
Local above Tulucay Creek (concurrent flow)	170	190	210	260	300	320	350	380
Napa River Downstream of Tulucay Creek (concurrent flow)	13,580	21,170	26,830	39,170	44,370	48,310	53,590	57,550

Values were determined from HMS and HEC-1 model outputs on 30 Aug 2010.

Table 7

Peak Flows in Milliken Creek
with Concurrent Flows in the Napa River (Existing Conditions). Flows in cfs.

Location	2-year	5-year	10-year	50-year	100-year	200-year	500-year	1000-year	SPF
Napa River upstream of Milliken Creek (concurrent flow)	8,190	13,070	16,200	23,710	26,950	29,370	32,470	34,660	34,630
Milliken Creek at Mouth (peak flow)	1,730	2,390	2,890	4,220	4,910	5,610	7,010	8,390	8,490
Local above Milliken Creek (concurrent flow)	430	550	630	800	870	930	1,030	1,110	1,110
Napa River downstream of Milliken Creek (concurrent flow)	10,360	16,000	19,730	28,730	32,730	35,910	40,510	44,160	44,230

Values were determined from HEC-1 output on 02 Nov 2007.

Table 8

Peak flows in Napa Creek
with concurrent flows in Napa River (existing conditions). Flows in cfs.

Location	2-year	5-year	10-year	50-year	100-year	200-year	500-year	1000-year	SPF
Napa River upstream of Napa Creek (concurrent flow)	10,280	15,910	19,430	28,170	31,660	34,960	39,610	42,780	42,850
Napa Creek at mouth (peak flow)	2,120	2,720	3,110	3,950	4,280	4,580	5,090	5,500	5,530
Napa River downstream of Napa Creek (concurrent flow)	12,400	18,630	22,540	32,110	35,950	39,540	44,700	48,280	48,370

Values were determined from HEC-1 model output on 6 Nov 2007.

Table 9
Peak flows in Tulucay Creek
with concurrent flows in the Napa River (existing conditions). Flows in cfs.

Location	2-year	5-year	10-year	50-year	100-year	200-year	500-year	1000-year
Napa River upstream of Tulucay Creek (concurrent flow)	11,720	17,760	21,010	29,360	33,130	36,600	41,600	45,580
Tulucay Creek at mouth (peak flow)	1,080	1,890	2,880	3,890	4,530	5,160	6,000	6,660
Local above Tulucay Creek (concurrent flow)	360	460	520	660	720	770	850	920
Napa River Downstream of Tulucay Creek (concurrent flow)	13,160	20,110	24,410	33,920	38,370	42,530	48,450	53,160

Values were determined from HMS and HEC-1 model outputs on 30 Aug 2010.

5. Conclusions

A full range of computed probability flows has been developed for the Napa River near Napa (Oak Knoll) gage. Flow hydrographs at the Napa River near Napa Gage were routed from Oak Knoll Avenue (location of Napa River near Napa gage) to Soda, Milliken, Napa and Tulucay Creeks using HEC-1. Flows in Soda, Milliken and Napa Creeks were routed to the Napa River using the HEC-1 rainfall runoff model. There is not enough evidence at this time to justify revising the flow frequency curves at the Oak Knoll gage. The routed flow hydrographs can be used for flood damage analysis (FDA) and risk-based analysis (RBA) for FEMA certification.

6. References:

1. U.S. Army Corps of Engineers, Sacramento District, “Napa River/Napa Creek Flood Protection Project, Final Supplemental General Design Memorandum Volume II Appendix H: Napa River Basin Hydrology for the Supplemental General Design Memorandum,” October 1998.

2. U.S. Army Corps of Engineers, the Hydrologic Engineering Center, HEC-FFA Flood Frequency Analysis, version 3.1, February 1995.

3. U.S. Army Corps of Engineers, the Hydrologic Engineering Center, HEC-REGFRQ Regional Frequency Computation, version dated September 8, 1989.

4. U.S. Geological Survey, http://waterdata.usgs.gov/ca/nwis, National Water Information System Web Interface, Daily Streamflow for California (accessed September 24, 2007).

5. U.S. Army Corps of Engineers, San Francisco District, “Final General Design Memorandum and Environmental Impact Statement,“ Napa River Flood Control Project, Napa County, California, September 1975.

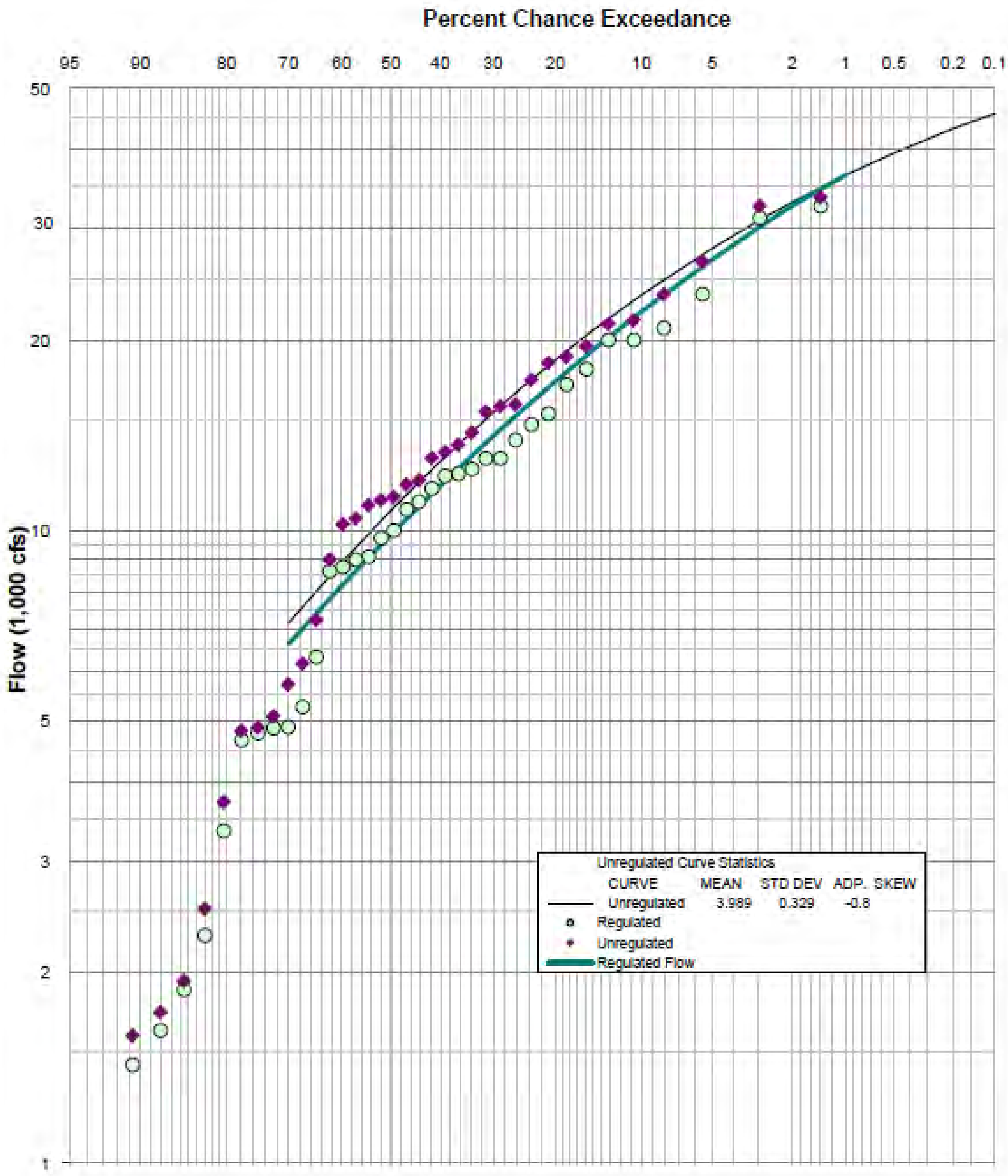
6. U.S. Army Corps of Engineers, the Hydrologic Engineering Center, HEC-1 Flood Hydrograph Package, version 4.1, September 1990.

7. U.S. Army Corps of Engineers, Sacramento District, Memorandum for Record: Napa Creek Hydrologic and Hydraulic Analysis of Historic Events, September 8, 2006.

8. U.S. Geological Survey, “Guidelines for Determining Flood Flow Frequency: Bulletin 17 B of the Hydrologic Subcommittee,” revised September 1981.

9. U.S. Geological Survey and State of California Department of Water Resources, Napa 7.5 Minute Topographic Quadrangle: 1:24,000, dated 1951, photorevised 1980.

William Curry
Hydrologist
CESPK-ED-DW



NOTES:

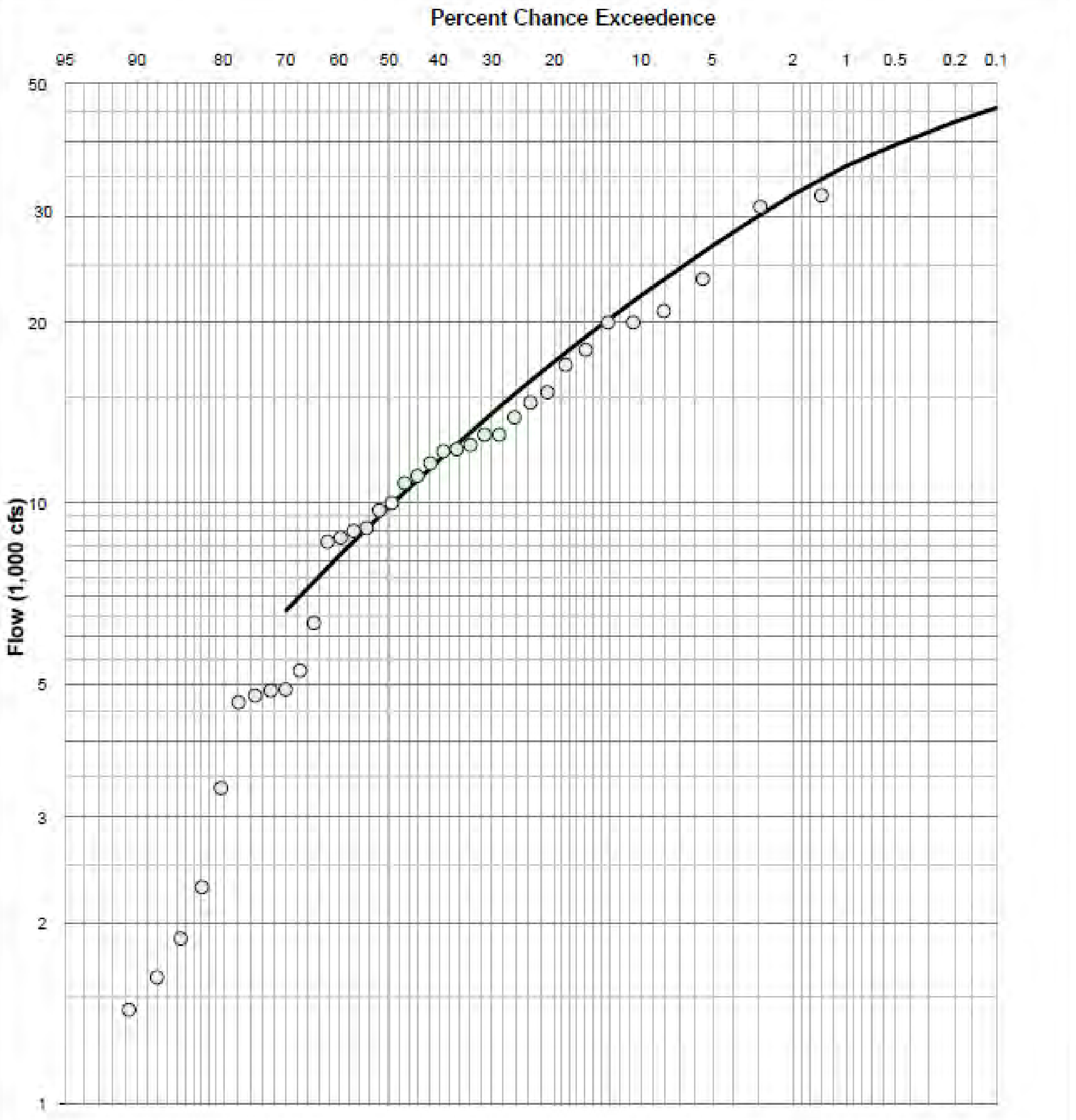
1. The unregulated curve is a Log Pearson Type III curve based on 72 years of record with median plotting postions.
2. The systematic record of 38 years has been extended to 72 years by examination of historical floods in the region and by correlation with the Napa River near St Helena gage.
3. The mean and standard deviation are adjusted to the longer record of the Napa River near St Helena gage.
4. The regulated curve is a graphical curve which was drawn through the regulated peak flows and extended using the unregulated curve.
5. Drainage area: 218 Sq Mi
6. Data are from the 1998 General Design Memorandum.

NAPA RIVER FLOOD PROTECTION PROJECT
NAPA RIVER BASIN, CALIFORNIA

**REGULATED AND UNREGULATED
PEAK FLOW FREQUENCY CURVES
PRESENT CONDITIONS
NAPA RIVER NEAR NAPA
(SAME AS NAPA RIVER AT OAK KNOLL)**

U.S ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Figure 2. Unregulated and Regulated Flow Frequency Curves for the Napa River near Napa (Oak Knoll) Gage (USGS 11458000) present conditions.



NOTES:

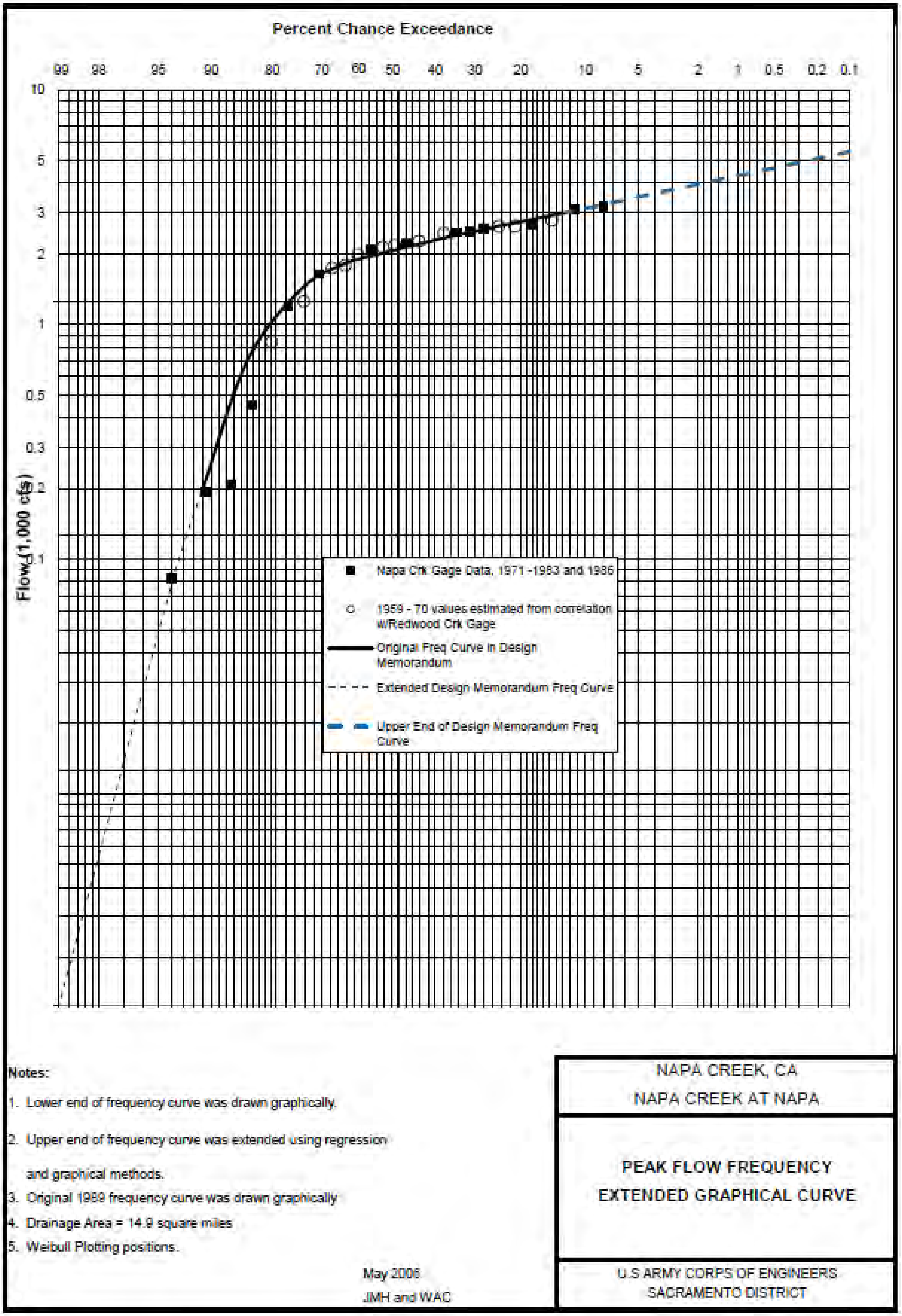
1. The regulated curve is a graphical curve which was drawn through the regulated peak flows and extended using the unregulated curve.
2. Data are from the 1998 General Design Memorandum.
3. Drainage area: 218 Sq Mi.

NAPA RIVER FLOOD PROTECTION PROJECT
NAPA RIVER BASIN, CALIFORNIA

PRESENT CONDITIONS
REGULATED
PEAK FLOW FREQUENCY CURVE
NAPA RIVER NEAR NAPA

U.S ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Figure 3. Present Conditions Regulated Peak Flow Frequency Curve for the Napa River near Napa Gage.

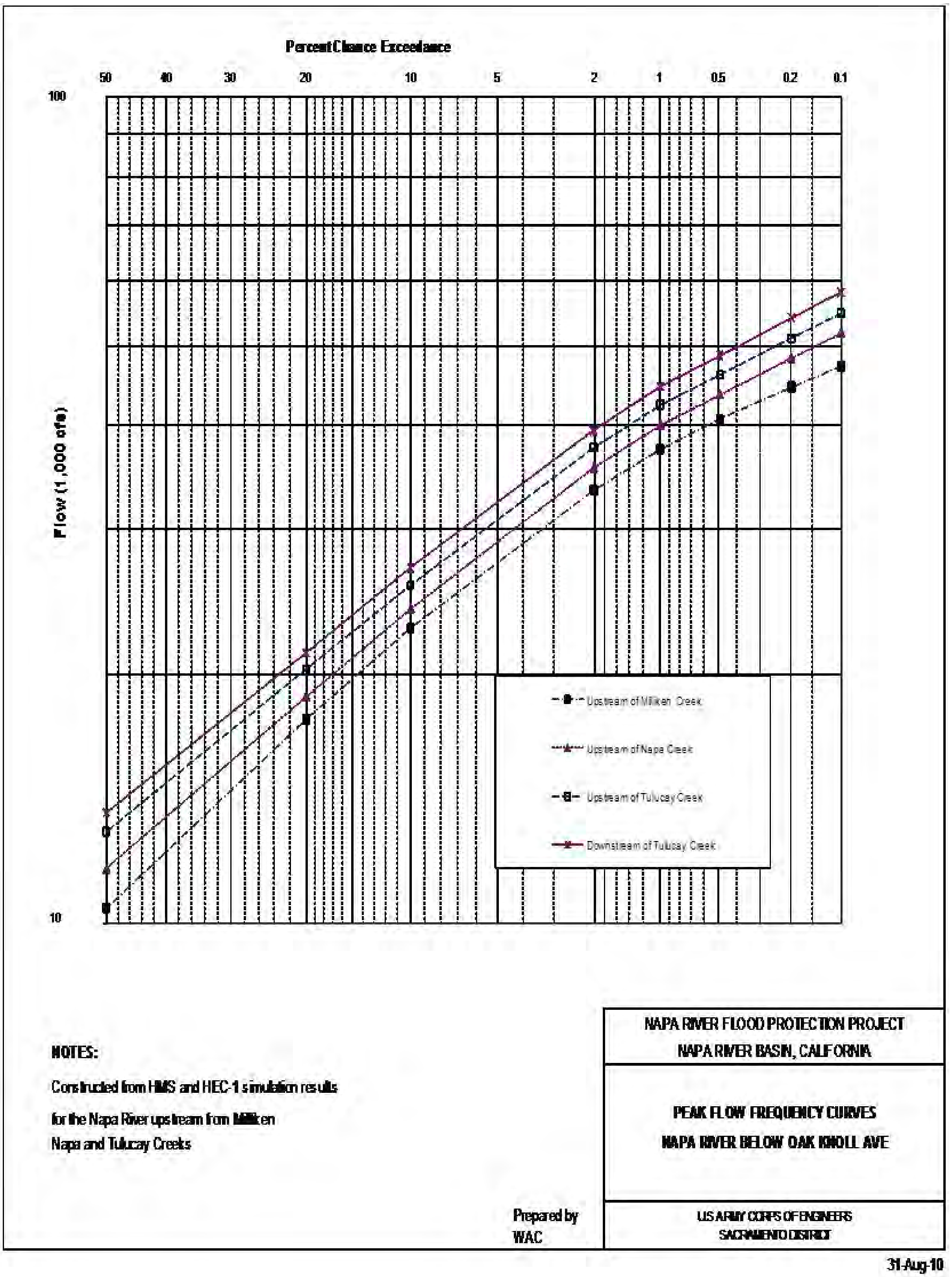


Notes:

1. Lower end of frequency curve was drawn graphically.
2. Upper end of frequency curve was extended using regression and graphical methods.
3. Original 1989 frequency curve was drawn graphically
4. Drainage Area = 14.9 square miles
5. Weibull Plotting positions.

May 2006
JMH and WAC

Figure 4. Napa Creek at Napa River Peak Flow Frequency Curve adapted from the "Napa River/Napa Creek Final Supplemental General Design Memorandum, Appendix H, Hydrology Office Report" (This curve was determined by graphical methods.) (USACE 1998)



NOTES:

Constructed from HMS and HEC-1 simulation results
for the Napa River upstream from Milliken
Napa and Tulucay Creeks

NAPA RIVER FLOOD PROTECTION PROJECT
NAPA RIVER BASIN, CALIFORNIA

PEAK FLOW FREQUENCY CURVES
NAPA RIVER BELOW OAK KNOLL AVE

Prepared by
WAC

US ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

31-Aug-10

Figure 5. Frequency Curves for the Napa River Upstream of Milliken, Napa and Tulucay Creeks

January 12, 2010 Addendum

Scope of Addendum
Additional work was requested by the Hydraulic Design Section in FY 2009 to prepare the Economic Evaluation of the Project and the Limited Reevaluation Report. These requests included 1) verification of the methods for computing the flow frequency curves and description of the lower end of the curves from 60% to 99.99% probability; and 2) obtaining flows at different frequencies for Risk Based Analysis. This addendum to the November 2007 Napa River Hydrology, Computed Probability Flows Memorandum for Record, was completed in January 12, 2010. The methods for computing the mean flow frequency curves were checked and verified. Additional work was done to describe the lower end of the curves for flows from 0.999 to 0.600 exceedance probabilities for use in the risk analysis for the project's economic evaluation. In addition, flows were needed at different frequencies for greater definition of the frequency curves used for the risk analysis. These flows were estimated by extending the frequency curves, graphically based on the heavily regulated flows of the Napa River near Napa gage and interpolating between the flow frequency values in this report. A brief write-up and the present conditions Flow frequency Curves are added as an addendum to this memo.

Frequency Data Check and Tables Expanded.
Flows used in previous reports cited used expected probability and computed probably frequency curves. The scope of the first request was to make sure the flows used in the new risk based analysis reflected mean flows and computed frequencies at their required exceedance probability at each of the five locations sited in the request. The locations are: upstream of Milliken, Napa and Tulucay Creeks and downstream of Milliken and Tulucay Creeks. It was determined that the flow and exceedance values found in the Napa River Hydrology, Computed Probability Flows Memorandum, dated November 21, 2007 were the correct values to use for Risk Analysis.

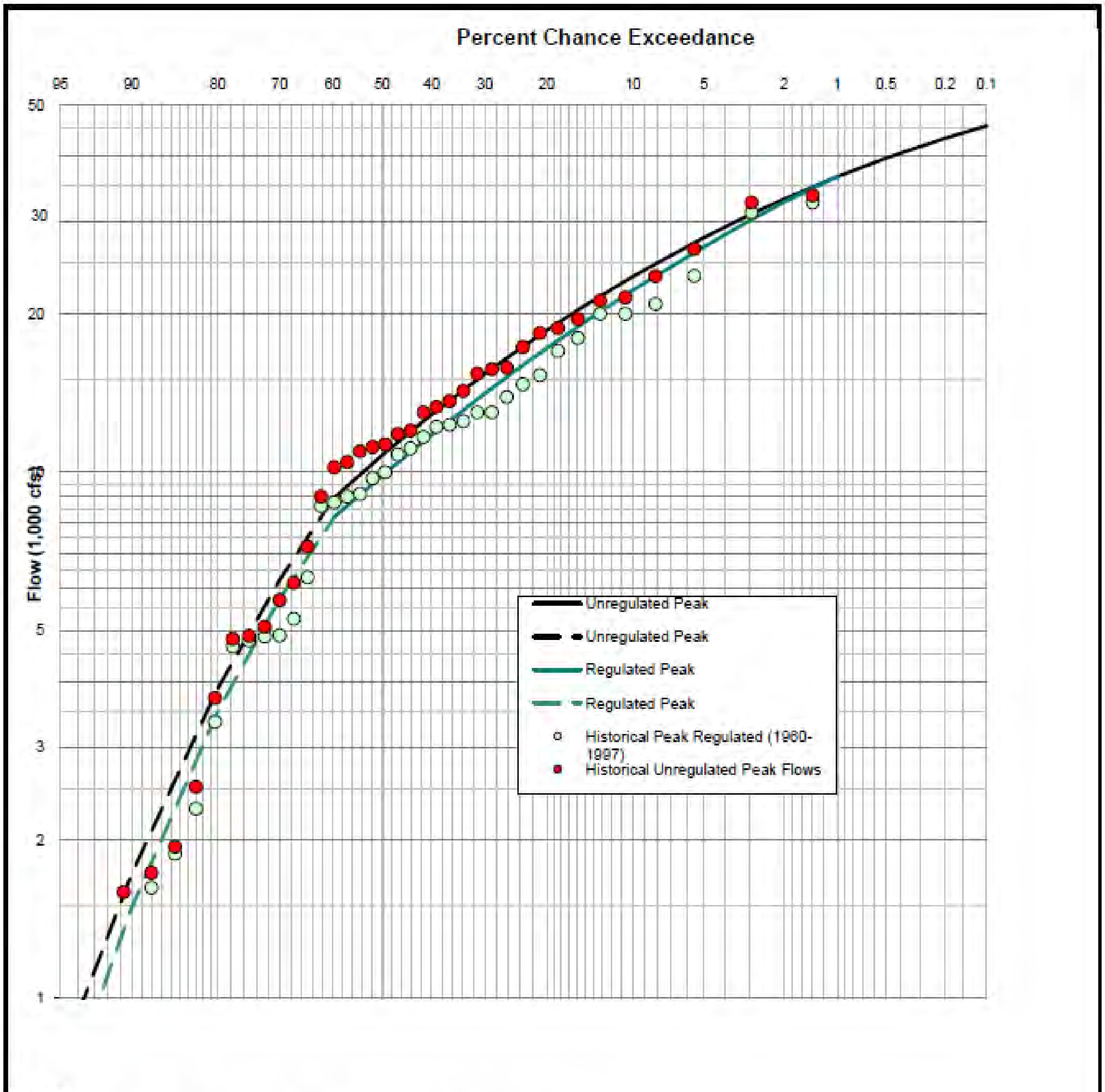
Additional work was done to describe the lower end of the curves for flows from 0.999 to 0.600 exceedance probabilities for use in the risk analysis for the project's economic evaluation. In addition to this, additional flows were needed at different frequencies for greater definition of the frequency curves used for the risk analysis. These flows were estimated by extending the frequency curves, graphically based the heavily regulated flows of Napa River near Napa gage and interpolating between this report's flow frequency values.

Table 10 lists the unregulated computed probability curve, and the regulated graphical frequency curve and their probabilities as plotted in Figure 6.

Table 10
Napa River near Napa
USGS 11458000

Exceedance Probability	Unregulated Flow (cfs)	Regulated Flow (cfs)
0.990	112	75
0.980	257	188
0.950	763	618
0.900	1,720	1,480
0.800	3,870	3,500
0.700	6,240	5,740
0.600	8,900	8,130
0.500	10,800	9,860
0.400	12,900	11,800
0.300	15,400	14,100
0.250	16,900	15,500
0.200	18,600	17,200
0.150	20,700	19,300
0.100	23,600	22,200
0.050	27,900	26,800
0.030	30,900	30,100
0.020	33,100	32,600
0.010	36,500	36,500
0.005	39,600	39,600
0.004	40,500	40,500
0.002	43,200	43,200
0.001	45,900	45,600

Notes:
1. Unregulated flow reflects the removal of Conn Dam (Hennessey Reservoir) the only reservoir that would significantly reduce peak flow in the Napa River at Napa.
2. It was assumed that antecedent conditions would fill and cause Conn Dam to be spilling for events equal to or greater than the 1% flood.
3. Curves plotted in Figure 6 of this addendum.



NOTES:

1. Notes 2-5 only apply to the portion of the curve extending from 60 percent chance exceendance to 0.1 percent chance exceedance
2. The unregulated curve is a Log Pearson Type III curve based on 72 years of record with median plotting postions
3. The systematic record of 38 years has been extended to 72 years by examination of historical floods in the region and by correlation with the Napa River near St Helena gage.
4. The mean and standard deviation are adjusted to the longer record of the Napa River near St Helena gage
5. The regulated curve is a graphical curve which was drawn through the regulated peak flows and extended using the unregulated curve.
6. Booth Curves were extended graphicaly fron 60 to 99 percent chance exceedence using regulated Peak Flow.
7. Data are from the 1998 General Design Memorandum

NAPA RIVER
NAPA RIVER BASIN, CALIFORNIA

REGULATED AND UNREGULATED
PEAK FLOW FREQUENCY CURVES
NAPA RIVER AT OAK KNOLL AVENUE
(SAME AS NAPA RIVER AT NAPA)
USGS # 11458000

U.S ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

RFC 1/4/2010

Figure 6. Re-plotted Figure2 frequency curves for the unregulated and regulated flow for the Napa River near Napa (Oak Knoll) Gage (USGS 11458000) extending the curves from 0.60 to 0.99 exceedance frequency. The LPIII analysis and extension of the period of record pertain only to the portion of the unregulated curve extending from 60 to 0.1 percent chance exceedance.

The second request was to compute additional flood flows for risk analysis based on the shaded flows and probabilities found in Table 11. Shaded data came from the 2007 Memorandum. Curves requested were not ordered in any particular manner so that data is also annotated by station name and location based on tables in the 2007 memo and the hydraulic design section’s station numbering system. The frequency curves were drawn and plotted in Figures 6 and 7. Estimated flow values were obtained for frequencies of 0.3, 0.4, 0.005, and 0.004 exceedance probabilities and added to Table 10. Exceedance probability of 0.005 was added because of California's new mandate to know the 0.5% flood peak (200 year) flood.

The legends in those figures name the curves in their plotting order. Figure 7 is Figure 5 replotted, Frequency Curves for the Napa River Upstream of Milliken, Napa and Tulucay Creeks, downstream of Milliken Creek and downstream of Tulucay Creek. Figure 8 is the same as Figure 7 which includes all locations found in Figure 5 and expands the Exceedance Probability axis scale from 0.99 to 0.001 probabilities.

Table 11
Exceedance Probabilities For Napa River Below Napa River at Oak Knoll Avenue
(Napa River at Napa, California)

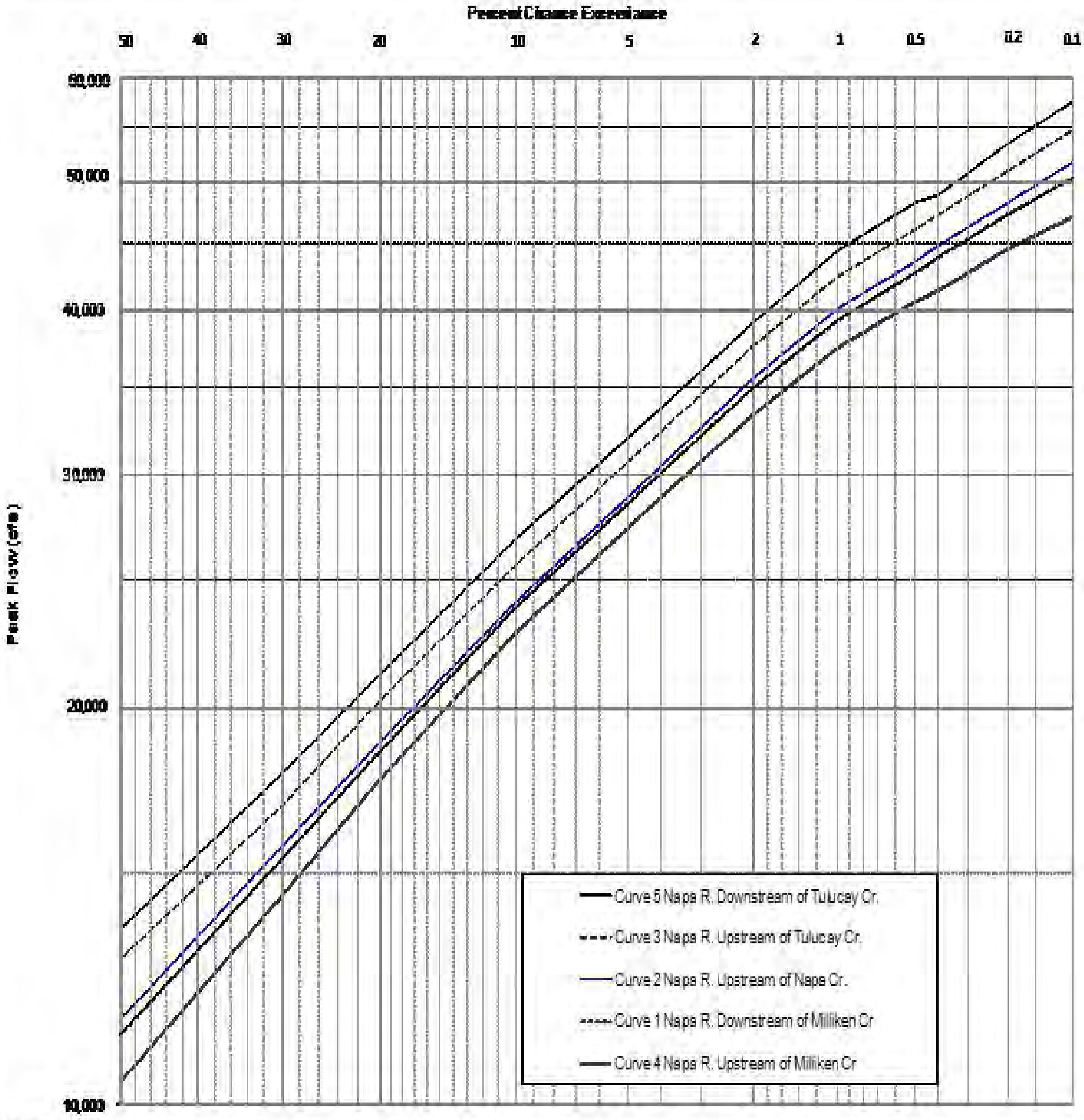
Exceedance Probability	Discharge (cfs)				
	Curve 4 Napa River upstream of Milliken Cr. Table 4	Curve1 Napa River Downstream of Milliken Cr.	Curve 2 Napa River upstream of Napa Cr Table 5	Curve 3 Napa River Upstream of Tulucay Cr	Curve 5 Napa River downstream of Tulucay Cr Table 6
0.999	70	80	85	90	110
0.990	98	107	111	127	144
0.950	714	783	810	930	1029
0.900	1,660	1,819	1,880	2,162	2366
0.800	3,840	4,210	4,360	5,010	5411
0.700	6,290	6,900	7,140	8,200	8811
0.650	7,610	8,340	8,630	9,910	10663
0.600	9,100	9,830	10,180	11,250	11990
0.500	10,420	11,300	11,600	12,900	13580
0.300	14,400	15,380	15,700	16,870	17828
0.200	17640	18,520	18,810	20,270	21170
0.100	22750	23,810	24,040	25,650	26830
0.040	28,850	30,100	30,500	32,370	33741
0.020	33430	35,010	35,600	37,610	39170
0.010	37470	39,350	40,100	42,410	44370
0.005	40,640	42,700	43,600	46,100	48310
0.004	41,400	43,900	44,800	47,300	48891
0.002	44540	47,300	48,300	51,060	53590
0.001	47160	50,430	51,810	54,770	57550
Index Point Station	1L 88034.00	2R 85379.00	3R 83769.00	5L 79160.00	7R 72095.00
Index Point Station			4L 82453.00	6L 72621.00	8R 70411.00

Note:

1. Curve numbers, shaded flows and probabilities, index points, and station locations were provided by the hydraulic Design Section.

2. Locations and Table numbers at the head of the flow columns indicate source Tables in the November 21, 2007 Memorandum for record above this addendum.

3. Flows and probabilities can be found in the same Tables.



NOTES:

1. Based on median plotting positions (ales Computed)

2. Flow data for Napa River are based on 72 years of record.

3. Plotted curves are plotted as ordered, top to bottom in the legend located in the graphic box.

Curve No.	Index Point	Station	Index Point	Station
Curve 1	1L	88034.00	---	---
Curve 2	2R	86379.00	---	---
Curve 3	3R	83769.00	4L	82463.00
Curve 4	5L	79160.00	6L	72621.00
Curve 5	7R	72095.00	8R	70411.00

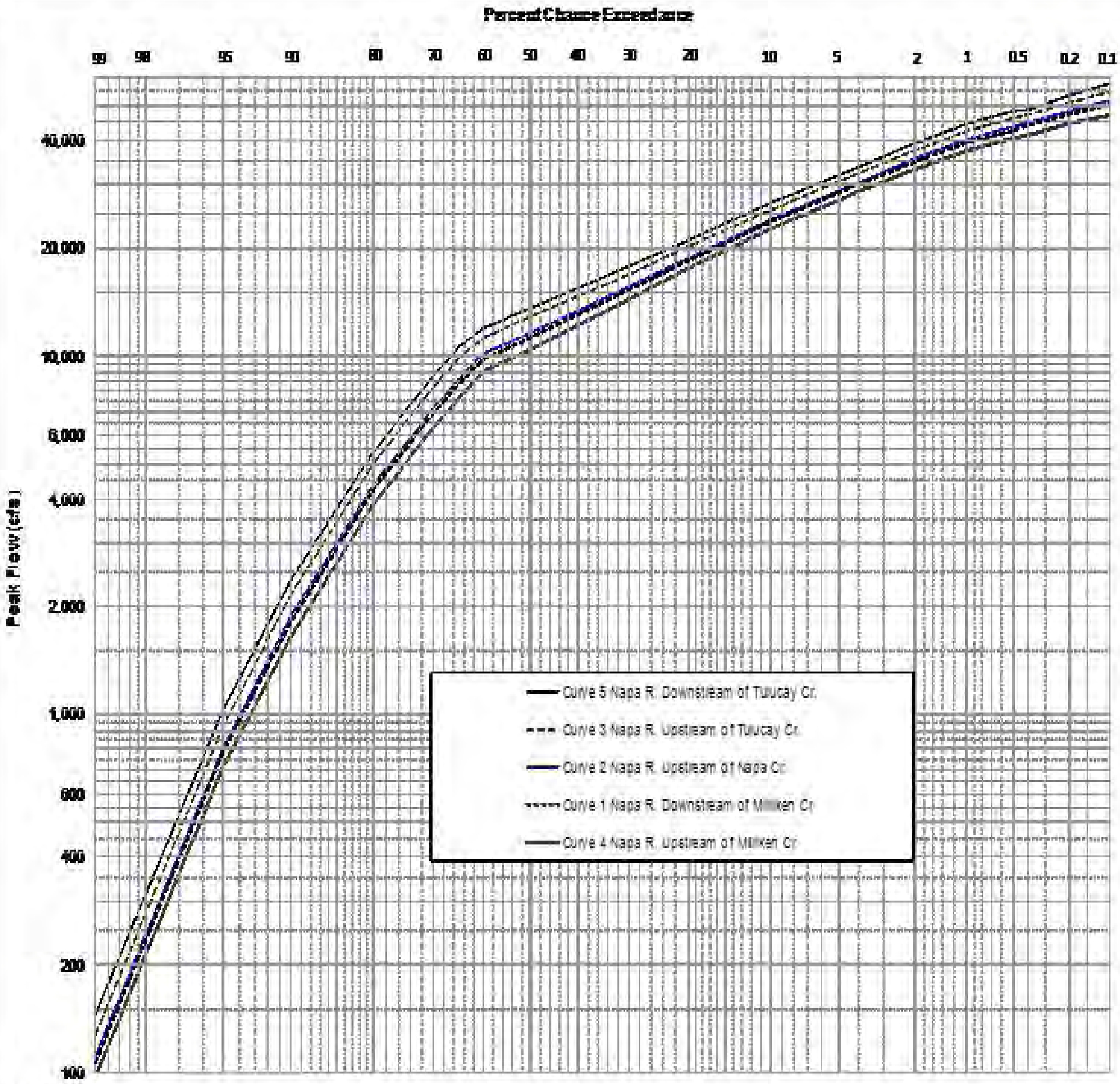
NAPA RIVER BASIN
NAPA RIVER AT 5 LOCATIONS THROUGH NAPA

REGULATED PEAK FLOW FREQUENCY
CURVES FOR NAPA RIVER BELOW
OAK KNOLL AVENUE, NAPA, CALIFORNIA

US ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Prepared by: RFC 11-Jan-2010

Figure 7: Figure 5 re-plotted, Frequency Curves for the Napa River Upstream of Milliken, Napa and Tulucay Creeks and downstream of Tulucay and Milliken Creeks.



NOTES:

1. Based on median plotting positions (ales Computed)

2. Flow data for Napa River are based on 72 years of record.

3. Plotted curves are plotted as ordered, top to bottom in the legend located in the graphic box.

Curve No.	Index Point	Station	Index Point	Station
Curve 1	1L	88034.00	---	---
Curve 2	2R	86379.00	---	---
Curve 3	3R	83769.00	4L	82453.00
Curve 4	5L	79160.00	6L	72521.00
Curve 5	7R	72095.00	8R	70411.00

NAPA RIVER BASIN
NAPA RIVER AT 5 LOCATIONS THROUGH NAPA

REGULATED PEAK FLOW FREQUENCY
CURVES FOR NAPA RIVER BELOW
OAK KNOLL AVENUE, NAPA, CALIFORNIA

US ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Figure 8 Figure 5 re-plotted Frequency Curves for the Napa River Upstream of Milliken, Napa and Tulucay Creeks and downstream of Tulucay and Milliken Creeks with the Exceedance probability axis scaled from 0.99 to 0.001 probabilities.

September 1, 2010 Addendum

In 2007 an HMS model of Tulucay Creek was obtained from the Napa County Resource Conservation District. This model produced a 100 year (1% probability) peak flow of 4,530 cfs and was adopted by the CORPS for use with Tulucay Creek. The model uses SCS Unit Hydrograph as the transform method and the SCS Curve number (typically in the 70s) as loss method on all sub-basins. The outlet point of the model is Soscal Avenue Bridge which is near the USGS gage (#11458350) at Tulucay Creek and about 0.4 miles east of the Napa River. Maximum n- year 24 hour precipitation values were obtained using the Gumbel Extrapolation method from NOAA Atlas 2 for the 20-, 0.5-, 0.2-, and 0.1-% probability events. The precipitation values are as follows: 4.17, 7.39, 8.17 and 8.76 inches for the 20-, 0.5-, 0.2-, and 0.1-% probability storms. The 50 -, 20-, 10-, 2-, 1-, 0.5-, 0.2-, and 0.1-% probability peak flows produced by the HMS model are as follows: 1,080, 1,890, 2,880, 3,890, 4,530, 5,160, 6,000, and 6,660 cfs. Ratios were calculated by dividing the newly created peak flows for Tulucay Creek by the peaks flows for Tulucay Creek produced by the HEC-1 model used for the GDM and original Memorandum. The ratios for the 50 -, 20-, 10-, 2-, 1-, 0.5-, 0.2-, and 0.1-% probability peak flows are 3.20 , 3.34, 3.82, 3.05, 2.94, 2.86, 2.61 and 2.41 respectively. The hydrographs from the original HEC-1 model for Tulucay Creek were multiplied by the ratios above and were added to the local flows above Tulucay Creek, generated by taking the difference between the original Tulucay Creek (HEC-1) flows and the original Tulucay+Locals (HEC-1) flows. The new flood series, Tulucay+Locals, was then read into the downstream routing model where it was used in the creation of the hydrographs for the Napa River below Tulucay Creek. Tables 6 and 9 were reproduced and replaced in the text and appropriate changes were made to the text itself. The 1% chance peak flow in the Napa River upstream of Tulucay Creek is 42,410 cfs and the concurrent flow downstream of Tulucay Creek is 44,370 cfs. At the time of the 1 % probability peak flow of 4,530 cfs in Tulucay Creek, the concurrent flow in the Napa River is 38,370 cfs (see Tables 6 and 9).

Additional References

1. U.S. Army Corps of Engineers, The Hydrologic Engineering Center, HEC-HMS Hydrologic Modeling System, Version 3.1.0 Build 1206, dated December 2006.
2. U.S. Army Corps of Engineers, Sacramento District, Memorandum for Record: Tulucay Creek – Hydrology Review, July 6, 2006.
3. National Atmospheric and Oceanic Administration, Hydrometeorological Design Center, NOAA Atlas 2, Precipitation Frequency Atlas of the Western United States: Volume XI-California dated 1973.

Appendix E

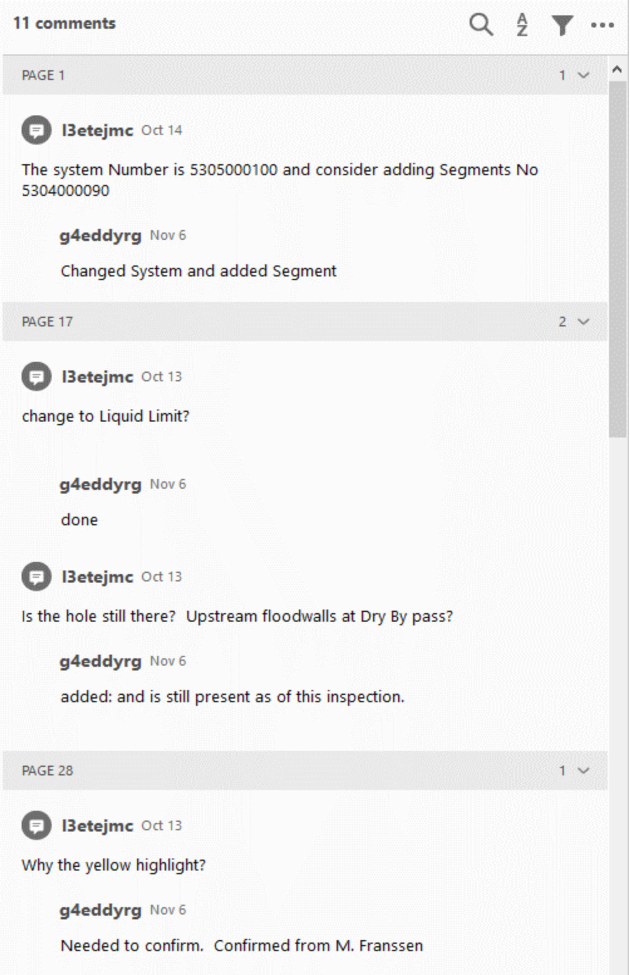
District Quality Control and ITR

Napa River, Left bank Tulocay to Imola Periodic Inspection Report No. 1 - District Quality Control

Reviewer:	Michael Franssen, PE
Designer:	Yvonne Palmer, PE

Cmt No.	Section	Comment	Review Date	Response	Backcheck Date
1	Quality Control Cert.	Updated text to reflect correct project.	9/29/2020	Concur	9/29/2020
2	2.1	Added "." after Mr in paragragh.	9/29/2020	Concur	9/29/2020
3	2.3	Changed 70's to 70s.	9/29/2020	Concur	9/29/2020
4	Part 3 title	Typo, changed to read "System".	9/29/2020	Concur	9/29/2020
5	3.2.2	Spelled out Napa Sanitation District.	9/29/2020	Concur	9/29/2020
6	4.1.1	Changed sentence to be more concise.	9/29/2020	Concur	9/29/2020
7	Table 5-2	Updated table format.	9/29/2020	Concur	9/29/2020
8	Figure 5-4	Added "w" to burro making it burrows.	9/29/2020	Concur	9/29/2020
9	5.4.6	Typo, changed "observerd" to "observed."	9/29/2020	Concur	9/29/2020
10	Table 6-1	Updated table format.	9/29/2020	Concur	9/29/2020
11	6.3	Added, "..., but is expected to be in the 2025."	9/29/2020	Concur	9/29/2020

John Conway Comments



11 comments

PAGE 1

l3etejmc Oct 14

The system Number is 5305000100 and consider adding Segments No 5304000090

g4eddyrg Nov 6

Changed System and added Segment

PAGE 17

l3etejmc Oct 13

change to Liquid Limit?

g4eddyrg Nov 6

done

l3etejmc Oct 13

Is the hole still there? Upstream floodwalls at Dry By pass?

g4eddyrg Nov 6

added: and is still present as of this inspection.

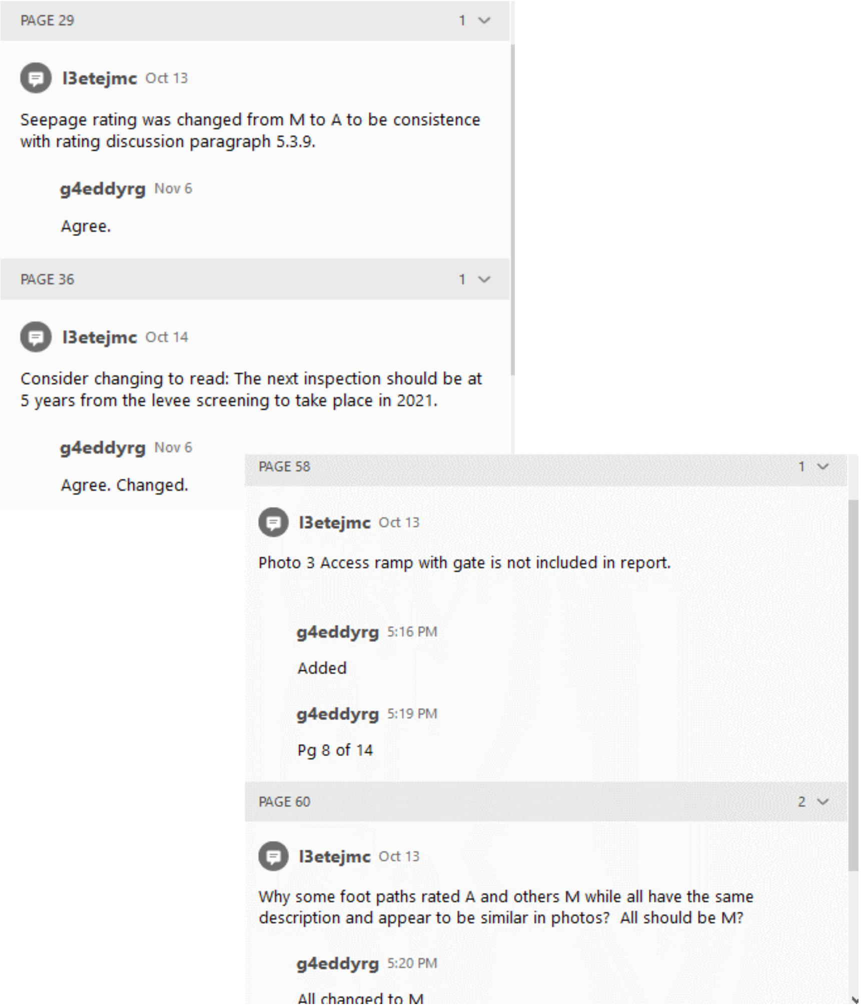
PAGE 28

l3etejmc Oct 13

Why the yellow highlight?

g4eddyrg Nov 6

Needed to confirm. Confirmed from M. Franssen



PAGE 29

l3etejmc Oct 13

Seepage rating was changed from M to A to be consistence with rating discussion paragraph 5.3.9.

g4eddyrg Nov 6

Agree.

PAGE 36

l3etejmc Oct 14

Consider changing to read: The next inspection should be at 5 years from the levee screening to take place in 2021.

g4eddyrg Nov 6

Agree. Changed.

PAGE 58

l3etejmc Oct 13

Photo 3 Access ramp with gate is not included in report.

g4eddyrg 5:16 PM

Added

g4eddyrg 5:19 PM

Pg 8 of 14

PAGE 60

l3etejmc Oct 13

Why some foot paths rated A and others M while all have the same description and appear to be similar in photos? All should be M?

g4eddyrg 5:20 PM

All changed to M

From: Butler, Andrew <Andrew.Butler@countyofnapa.org>
Sent: Wednesday, December 16, 2020 3:07 PM
To: Sarrow, Jeremy <Jeremy.Sarrow@countyofnapa.org>; Franssen, Michael J CIV USARMY CENWW (USA) <Michael.J.Franssen@usace.army.mil>
Cc: Conway, John M CIV USARMY CESPN (US) <John.M.Conway@usace.army.mil>; Palmer, Yvonne R CIV USARMY CENWW (USA) <Yvonne.R.Palmer@usace.army.mil>; Schneidmiller, Kevan H CIV USARMY CENWW (USA) <Kevan.H.Schneidmiller@usace.army.mil>; DeLannoy, Nathaniel L CIV USARMY CENWW (USA) <Nathaniel.L.Delannoy@usace.army.mil>; Thomasser, Richard <Richard.Thomasser@countyofnapa.org>
Subject: [Non-DoD Source] RE: Napa PI - Sponsor Review for Left Bank, Tulocay Creek (5305000100) - (2 of 2 emails)

Our comments on the PIs are below. If you have any questions on these, just let me know. Thank you.

Napa River Left Bank Tulocay to Imola

1. Page 5, 3.1 – Last paragraph should state that there is a gap in the Imola levee due to the closure structure that was never constructed. Therefore the levee doesn't currently provide any protection. Added sentence to the paragraph
2. Page 7 - Some text on Figure 3-1 unreadable. Possible to get a higher resolution version inserted? Modified
3. Page 12 First Paragraph – Was the last sentence meant to say "It is anticipated that a revision to the map would indicate the area be only within Zone X." instead of "Zone AE? The maps have been updated post-bypass, LOMR 16-09-1316P effective 1/22/2019. The changes can be seen on FEMA's map service center viewer. Changed to reflect Zone X and comments from H&H reviewer.
4. Page 18, 4.4 – As stated on sheet G-003 of the Duden plan set, this feature was designed and constructed using NGVD 29. Corrected.
5. Page 22 – My understanding is that the "Cracking" item in the PI checklist is referring to cracks in the levee embankment itself. However, the report only describes cracks in the asphalt road on top of the levee. I have not observed any cracks in the levee embankment. Added that this may only be asphalt cracking
6. Page 26, Item 10 – The inspection gave a rating of M on the Animal Control item, but then states that we should continue our current animal control program. Please describe what changes we need to make to get to an "Acceptable" rating on this item. Added to the paragraph.

Napa River Left Bank Tulocay Creek

1. Page 10, 3.4.2 - Was the last sentence meant to say "It is anticipated that a revision to the map would indicate the area be only within Zone X." instead of "Zone AE? The maps have been updated post-bypass, LOMR 16-09-1316P effective 1/22/2019. The changes can be seen on FEMA's map service center viewer. The area is still shown as being in the floodplain because the levee was not completed during the Duden contract and does not provide 100 year protection to the area as stated in the Executive Summary. Changed to reflect Zone X and comments from H&H reviewer
2. Page 15, Last paragraph of 4.2.2 – This doesn't seem relevant here. Agree. Removed
3. Page 15, 4.4 – As stated on sheet G-003 of the Duden plan set, this feature was designed and constructed using NGVD 29. Changed.

Andrew Butler, PE
Senior Engineer
Napa County Flood Control and Water Conservation District
707-259-8671