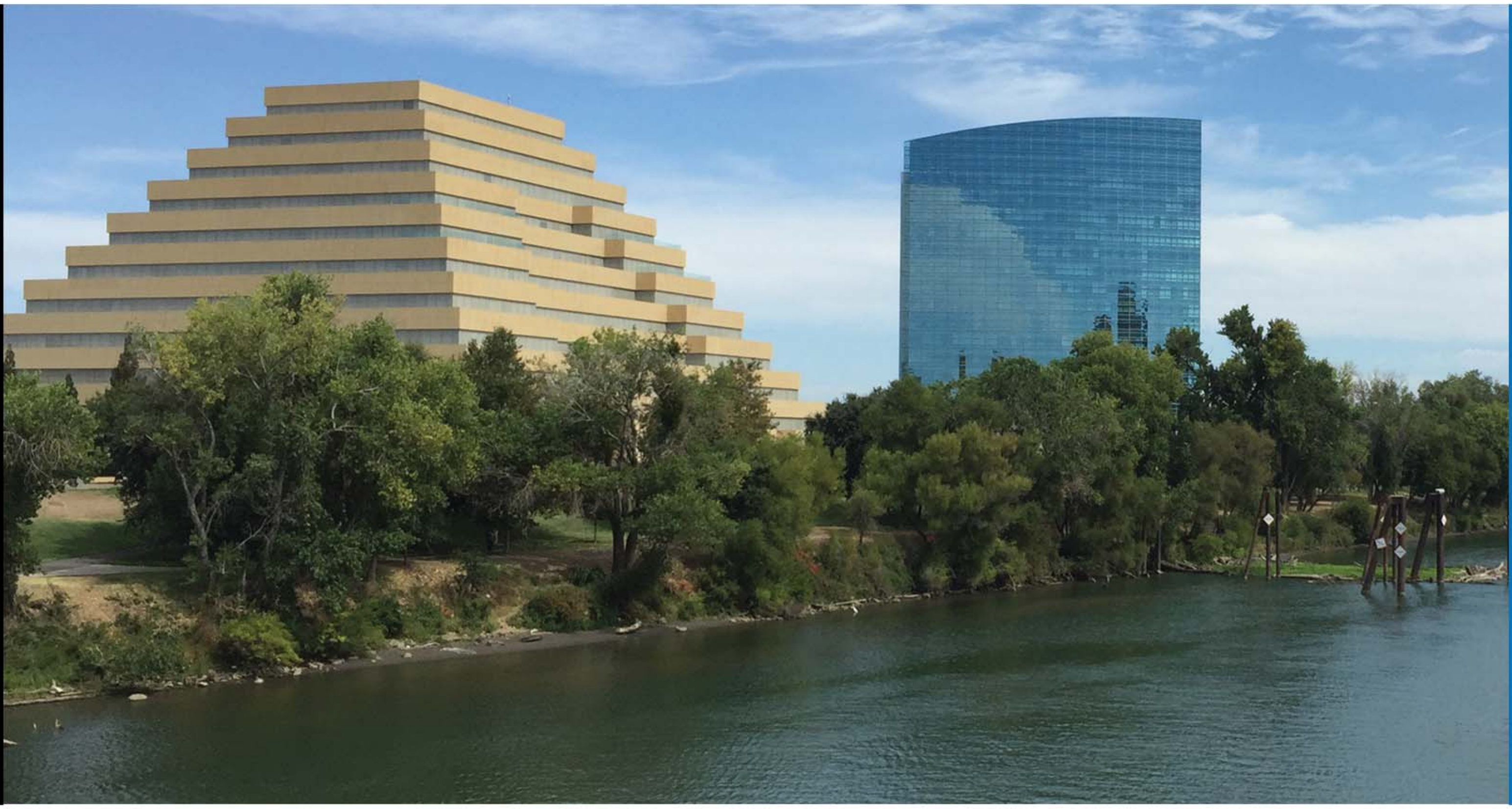
WSAFCA
West Sacramento Area Flood Control Agency

City of West Sacramento
Flood Engineering Services

Alternatives Analysis Report



June 2016

WOOD RODGERS

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June 1, 2016

Mr.Greg Fabun
Flood Protection Manager
City of West Sacramento
1110 West Capitol Avenue, 2nd Floor
West Sacramento, California 95691

Dear Mr. Fabun,

Subject: City of West Sacramento – Flood Program Services – Final Alternatives Analysis Report

Enclosed is the Alternatives Analysis Report that was prepared by Wood Rodgers, Inc. for the subject project. Comments from the City of West Sacramento and the Independent Panel of Experts on the draft version of this report (dated March 2016) have been incorporated as appropriate. A comment and response register is included as Attachment D of the enclosed Alternatives Analysis Report.

If you have any questions regarding the report, please call Jonathan Kors at 916-326-5264 or Jesse Patchett at 916-341-7712.

Sincerely,

Jonathan L. Kors, P.E. Principal in Charge	Jesse J. Patchett, P.E., CFM Project Manager

REGISTERED PROFESSIONAL ENGINEER
JESSE J. PATCHETT
No. 79448
Exp. 3/31/18
CIVIL
STATE OF CALIFORNIA

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I. INTRODUCTION

The City of West Sacramento (City) and the West Sacramento Area Flood Control Agency (WSAFCA) are in the process of advancing the West Sacramento Levee Improvement Program (WSLIP). The WSLIP is a comprehensive flood risk reduction program with the goal of providing the City with a minimum of 200-year flood protection. A 200-year flood is a flood that has a 1-in-200 (0.5%) chance of occurring in any given year.

As shown on **Figure 1** (attached), the City is protected on the west by levees along the Yolo Bypass, on the north by levees along the Sacramento Bypass, on the east by levees along the Sacramento River, and on the south by the South Cross Levee. The City is also bifurcated by the Sacramento River Deep Water Ship Channel (DWSC) and Barge Canal, which have levees and areas of high ground on both sides.

In 2007, several bills were passed that amended the California Water Code and Government Code to improve flood protection and align land use decisions with statewide flood planning objectives. Senate Bill 5 (2007), as amended by Senate Bill 1278 (2012) and Assembly Bill 1259 (2013), requires cities and counties within the Sacramento and San Joaquin Valleys to make findings before allowing development in flood hazard zones (DWR, 2010; DWR, 2013; DWR, 2014b). "Flood hazard zones" include floodplains within a Federal Emergency Management Agency (FEMA) designated special flood hazard area (a 100-year floodplain) or a FEMA-designated moderate flood hazard area (a 500-year floodplain) (GC §65007(d)).

To support the advancement of the WSLIP, Wood Rodgers, Inc. (Wood Rodgers) prepared a Problem Identification Report (PIR) for the City and WSAFCA in June 2016 (Wood Rodgers' 2016 PIR) outlining, at a high level, the deficiencies remaining to be addressed to support 200-year protection.

This Alternatives Analysis Report (AAR) is a follow-on document that identifies alternatives and estimated costs for mitigating the deficiencies identified in the PIR. Both the Wood Rodgers' 2016 PIR and this AAR will be referenced by the City of West Sacramento Adequate Progress Report that is currently being prepared to meet the requirements of Senate Bill 5 in July of 2016.

II. SUMMARY OF IDENTIFIED SYSTEM DEFICIENCIES

Wood Rodgers' 2016 PIR identified seepage, stability, freeboard, geometry, erosion, vegetation, and encroachment/penetration deficiencies in many of the levees that protect the City. The only areas that did not have significant deficiencies were those areas where WSLIP Early Implementation Projects (EIPs) and levee improvements performed by the USACE have been constructed. A graphical depiction of the overall deficiencies identified in Wood Rodgers' 2016 PIR is shown on **Figure 2** (attached). Tabular results of identified deficiencies are included in **Table 1** (attached). Brief descriptions of the deficiencies identified for each levee segment are included below. The geotechnical deficiencies considered existing conditions and did not consider future improvements such as levee raises for freeboard deficiencies. The geotechnical deficiencies further assumed that any landside development would require additional analysis to determine potential impacts to the levee system as well as to the proposed development.

A. Sacramento River West North Levee

In general, the Sacramento River West North Levee evaluation indicates that there is a potential for through seepage north (upstream) of Station 136+00. The exception is between Stations 71+50 and 101+00, where The Rivers EIP Project addressed known issues. Due to the relatively wide levee in this area, it is possible that the concern for identified through seepage issues upstream of Station 136+00 may be eliminated with additional monitoring and reporting during high water events. The freeboard and geometry issues in this reach are generally intermittent and minor (between six and eight inches). Erosion was identified as a concern from Stations 0+00 to 43+00 in this segment.

Between Stations 136+00 and 215+30, through seepage, steady-state underseepage and landside slope stability, and waterside rapid drawdown slope stability deficiencies were identified. The freeboard and geometry issues in this segment are generally intermittent and minor (between six and eight inches). Erosion was identified as a concern in this segment for the area located between Stations 161+00 and 215+30. Additional analysis may confirm that recent improvements between Stations 194+60 and 199+60 for the I Street Bridge EIP project sufficiently addressed the identified geotechnical deficiencies.

Neither through seepage issues nor underseepage issues were identified downstream of the Tower Bridge (i.e.: Station 215+30) due primarily to the levee measuring several hundred feet in width. This segment does contain areas with relatively steep waterside slopes which would traditionally result in waterside slope instabilities. Waterside slopes steeper than 2H:1V exist within several portions of this levee segment. For levee segments considered high ground and/or wide levees, identification of a waterside rapid drawdown slope stability deficiency is dependent on the location of the assumed theoretical levee template. For example, if the waterside slope levee template is located within approximately five feet of the existing waterside slope, a rapid drawdown slope stability deficiency would be identified and the slopes would require slope flattening. If the template is located further inland, Blackburn Consulting (BCI) would recommend that the waterslide slopes be maintained during and after high water events to maintain the existing waterside slope location.

Therefore, two alternatives to address waterside instability could be considered within these levee stretches where waterside slopes are steeper than 2H:1V. The first alternative would be to flatten the waterside slopes to 2H:1V, removing the instability. The second alternative would be to consider the risk to existing infrastructure due to the potential slope failure. Where infrastructure or existing improvements are not likely to be impacted by a slope failure, the waterside instabilities can be considered a maintenance issue to be repaired by the Local Maintaining Agency if a failure occurs. This AAR assumes that the slopes will be flattened as needed to address the instability as a capital improvement. Future iterations of the AAR may reconsider this approach and defer them to long-term maintenance items.

Freeboard deficiencies downstream of the Tower Bridge generally measure between eight and fourteen inches. Erosion was identified as a concern in this segment between Stations 215+30 and 301+57. Even though this area is considered high-ground, erosion is a concern since prolonged scour along the toe will ultimately result in steeper slopes and landward retreat, threatening existing infrastructure and structures.

In addition to these deficiencies, routine inspections conducted by the California Department of Water Resources (DWR) and the US Army Corps of Engineers (USACE) identified issues with vegetation, encroachments, and penetrations. A total of 78 high-hazard encroachments, 27 high-hazard penetrations, and 26 unacceptable vegetation issues were identified within the Sacramento River West North Levee. Reference is made to Wood Rodgers' 2016 PIR for an explanation of how the hazard assessment ratings for penetrations and encroachments were developed. These issues will need to be addressed as part of the Flood Program since they are believed to pose an unacceptable threat to levee integrity, maintenance, and/or flood-fighting operations. Low and moderate hazard encroachments and penetrations will also be reviewed against potential remediation measures in each reach in order to determine which penetrations and encroachments are most likely to be modified or removed as part of a future remediation project (i.e.: cutoff wall), and which ones can be addressed as part of a long-term remediation plan.

B. Barge Canal Bulkhead Closure Structure

The bulkhead structure (Bulkhead) at the east end of the W.G. Stone Lock is another component of the City's flood protection system. The Bulkhead separates the Sacramento River from the Deep Water Ship Channel (DWSC) and, in a flood event, prevents flood waters in the Sacramento River from entering the DWSC. These facilities were constructed by USACE in conjunction with the construction of the DWSC. In 2006 these facilities were congressionally de-authorized and the responsibility for them was turned over to the City of West Sacramento. Unfortunately, the facilities that are needed to operate and maintain the removable bulkhead structure are not currently operational. A failure at the Bulkhead could cause severe flooding in the Port of West Sacramento and in the City since the water surface elevation in the Sacramento River is approximately 17 feet higher than it is in the DWSC.

The Bulkhead structure has more than three feet of freeboard above the 200-year flood event. However, the concrete abutments and land beyond the abutments only provide approximately 2.5 to 3.0 feet of freeboard. Therefore, minor freeboard improvements are needed at the abutments and adjacent lands.

The assessment also indicated that the Bulkhead is not structurally capable of withstanding the height of water in the Sacramento River during a 200-year flood event. The assessment indicates that the Bulkhead is only capable of withstanding about 13 feet of water differential, whereas a 200-year flood event is expected to create more than a 17-foot differential. In order to make the Bulkhead structurally capable of providing 200-year protection, the Bulkhead would need to be retrofitted by welding steel plates across the Sacramento River and Deep Water Ship Channel sides of each of the twelve plate girder assemblies that make up the Bulkhead. The concrete abutments were determined to be capable of supporting the Bulkhead during a 200-year flood event.

In addition, it was determined that the Bulkhead is not currently seated properly due to debris at the base of the Bulkhead. The sediment and debris prevented large segments of the base of the Bulkhead from being observed, so the condition of the base of the Bulkhead is not known. It is assumed that, if the sediment and debris were removed, water flowing under the Bulkhead would be significantly reduced.

C. Sacramento River West South Levee

The Sacramento River West South Levee has identified deficiencies with underseepage, slope stability, and geometry from Station 0+00 to Station 295+00. From Station 295+00 to Station 332+70, recent levee improvements constructed as part of the USACE, Sacramento River Bank Protection Project, Sacramento River Erosion Repair Site River Mile (RM) 57.2 remediated previously identified deficiencies. There are intermittent, localized areas where freeboard is also insufficient. The Southport EIP Project, which is slated to begin construction in 2016/2017, proposes to address identified underseepage and slope stability deficiencies between Stations 0+00 and 295+00. Therefore, once this project is complete, the only remaining deficiencies will be intermittent freeboard deficiencies between Stations 315+00 and 332+70. The freeboard deficiency is generally less than six inches.

In addition to these deficiencies, routine inspections conducted by DWR and USACE indicate that there are issues with vegetation, encroachments, and penetrations. Only issues between Stations 295+00 and 332+70 are shown since penetrations, encroachments, and vegetation issues between Stations 0+00 and 295+00 will be addressed with the Southport EIP project.

Upstream of Station 295+00, the Sacramento River West South Levee is generally in good condition. Only one high-hazard encroachment was identified between Stations 295+00 and 332+70. This was identified as a pair of wooden posts and a highway marker on the landside slope. The USACE inspections also indicate that there are issues with trees along the waterside slope between Stations 315+00 and 332+70. These items will need to be addressed as part of the Flood Program.

D. Sacramento Bypass South Levee

USACE Levee Reconstruction Contract B and the recent California Highway Patrol (CHP) Academy EIP project addressed many of the historical deficiencies related to through seepage, underseepage, slope stability and erosion. The results of this evaluation indicate that the Sacramento Bypass South Levee mostly meets seepage, stability, freeboard, and erosion criteria. The only remaining deficiencies include a through and/or underseepage issue in the easternmost 285 feet of the levee (i.e.: Station 61+75 to Station 64+60) since the CHP EIP construction did not extend into this levee segment. A geometry deficiency was also identified throughout this levee since a theoretical Urban Levee Design Criteria (ULDC) bypass levee prism with 4H:1V waterside and 3H:1V landside slopes does not fit within the existing embankment. However, although a ULDC geometry deficiency was identified in this reach, it is assumed that this segment will qualify for an exception from the geometry requirements specified in Title 23 § 120.a.25 because the USACE, Central Valley Flood Protection Board (CVFPB), and DWR provided their concurrence with the CHP Academy EIP Project design. This project also included an Independent External Peer Review, also known as a Safety Assurance Review.

In addition to these deficiencies, routine inspections conducted by DWR and USACE revealed issues with vegetation, encroachments, and penetrations. A total of two high-hazard encroachments (unpermitted monitoring wells) and three high-hazard penetrations (fiber optic line, drainage pipe, and unknown 4-inch-diameter pipe) were identified in this levee. The USACE inspections also found four vegetation issues along the landside and waterside slopes. These high-hazard items will need to be addressed as part of the Flood Program. Low and moderate hazard encroachments and penetrations will also be reviewed against potential remediation measures in each reach in order to determine which penetrations and encroachments are likely to be modified or removed as part of a future remediation project (i.e.: cutoff wall), and which ones can be addressed as part of a long-term remediation plan.

E. Training Berm

The Training Berm directs water from the Sacramento Bypass into the main channel of the Yolo Bypass. When the Sacramento and Yolo Bypasses flood, water exists on both sides of this berm and, therefore, there is no seepage gradient. However, the berm appears to be important for hydraulic reasons, and determining its susceptibility to erosion is important. The results of Wood Rodgers' 2016 PIR indicated that slope stability and erosion are concerns for this entire berm segment. Penetrations, encroachments, and vegetation issues were not identified in this berm.

F. Yolo Bypass East Levee

Between the Port North Levee and Interstate 80 (I-80), the evaluation of the Yolo Bypass East Levee identified relatively few geotechnical deficiencies. Steady-state underseepage and landside slope stability deficiencies were identified between Stations 27+52 and 51+63, and waterside slope stability concerns were generally identified between Stations 51+63 and 70+00.

The levee segment between I-80 and the Union Pacific Railroad (UPRR) crossing (Stations 82+82 to 136+00) has had numerous slope stability failures since completion of the USACE West Sacramento Project Contract A Improvements in 1998. Therefore, landside and waterside slope instability was identified as the primary geotechnical concern in this segment. An underseepage issue was also identified immediately north of the UPRR crossing. This deficiency exists because the existing ditch adjacent to the landside levee toe cannot reasonably be expected to contain water during high water stages in the Yolo Bypass.

Because it is a bypass levee, the Yolo Bypass East Levee was originally designed to have six feet of freeboard on its design water surface (i.e.: the 1957 profile). A wind/wave evaluation performed as part of the General Re-evaluation Report (GRR) indicated that wave runup heights along this levee can be as high as 11 feet, although the risk of landside slope erosion due to overtopping was found to be low in the *Wave Runup and Erosion Analysis for the West Sacramento Levee System General Reevaluation Report* conducted by Northwest Hydraulic Consultants in March 2012 (Reference 14). The GRR also found that placement of waterside rock slope protection (RSP) would address waterside erosion issues and reduce wave runup to less than six feet. Six feet of freeboard is also considered sufficient in the ULDC, except in unusual circumstances. Therefore, six feet of freeboard was determined to be the appropriate threshold criteria for the freeboard evaluation. The entire Yolo Bypass East Levee has less than six feet of freeboard; therefore, a freeboard deficiency was identified for the segment.

The Wood Rodgers Draft 2016 PIR also noted that the Yolo Bypass East Levee does not meet the geometry requirements specified in the ULDC because the waterside slope is steeper than 4H:1V (slopes are generally 2.75H:1V to 3H:1V). Correcting geometry issues along the Yolo Bypass East Levee would require a significant amount of additional right-of-way on the landside of the levee (through industrial portions of West Sacramento, including existing drainage infrastructure) which may not be practical. For these reasons, where the slopes are otherwise stable, it is assumed that an exception could be obtained from the CVFPB to allow the existing Yolo Bypass East Levee geometry to remain. Erosion deficiencies were intermittently identified for the entire Yolo Bypass East Levee.

In addition to these deficiencies, routine inspections conducted by DWR and USACE indicate that there are issues with vegetation, encroachments, and penetrations. A total of seven high-hazard encroachments and sixteen high-hazard penetrations were identified in this levee. The USACE inspections also indicate that there are issues with trees along the landside and waterside levee slopes. These high-hazard items will need to be addressed as part of the Flood Program since they are believed to pose an unacceptable threat to levee integrity, maintenance, and/or flood fight operations. Low and moderate hazard encroachments and penetrations will also be reviewed against potential remediation measures in each reach in order to determine which penetrations and encroachments are likely to be modified or removed as part of a future remediation project (i.e.: cutoff wall), and which ones can be addressed as part of a long-term remediation plan.

G. South Cross Levee

The South Cross Levee is a dryland levee across the southern end of the City. This levee is only expected to provide flood protection to the City in the event of a failure of the Sacramento River West South Levee or the DWSC East Levee downstream of the South Cross Levee. Underseepage, landside slope stability, geometry, and freeboard deficiencies were found throughout the South Cross Levee. The average freeboard deficiency was approximately 4.5 feet based on a breach of the Sacramento River West South Levee just south of the South Cross Levee during a 200-year storm event.

In addition to these deficiencies, routine inspections conducted by DWR and USACE indicate that there are issues with vegetation, encroachments, and penetrations. A total of four high-hazard penetrations were identified in this levee. The USACE inspections revealed issues with approximately 57 vegetation items along this levee. These items will need to be addressed as part of the Flood Program. Low and moderate hazard encroachments and penetrations will also be reviewed against potential remediation measures in each reach in order to determine which penetrations and encroachments are likely to be modified or removed as part of a future remediation project (i.e.: cutoff wall), and which ones can be addressed as part of a long-term remediation plan.

H. DWSC West Levee

The DWSC West Levee (a.k.a. Navigation Levee) serves as the east levee of the Yolo Bypass. As described in the Wood Rodgers' 2016 PIR, a breach at any point in this

19-mile-long levee would allow water from the Yolo Bypass to enter the DWSC, and the resulting backwater could flood the Port and significant portions of the City.

The DWSC West Levee is an over-widened embankment (more than 600 feet wide in some areas) that was constructed using dredged material excavated during construction of the DWSC. This material mitigates some through seepage and underseepage issues. Without considering the presence of this "berm", through seepage and underseepage deficiencies will exist along portions of the DWSC West Levee.

Previous evaluations have indicated that removal of dredging spoils material along the DWSC West Levee's channel-side slope would lead to high exit gradients. Furthermore, existing explorations suggest that removal of material within the DWSC West Levee embankment could also cause unacceptable through seepage in some locations. The extent of allowable material removal was not studied in detail as part of the Wood Rodgers 2016 PIR, but the Urban Levee Evaluation (ULE) performed by DWR in 2012 (Reference 5) indicated that limiting material removal in the DWSC West Levee provided protection against underseepage. Therefore, borrow restrictions are associated with many of the remediation measures proposed in this levee.

Additionally, due to the levee having relatively flat waterside and landside slopes, geometry issues were not identified for this levee. Only one segment, from Station 202+00 to Station 290+00, has a potential stability issue, which is located on the channel side. Since this levee was constructed as a navigation levee associated with the DWSC, the increased freeboard criteria associated with the Yolo Bypass were not considered during the original design. Therefore, freeboard deficiencies were identified along the entire length of this levee. Erosion was identified as a concern throughout the DWSC West Levee.

In addition to these deficiencies, routine inspections conducted by DWR and USACE indicate issues with vegetation, encroachments, and penetrations. Only one moderate hazard encroachment was identified in this levee (a gas line running parallel to the landside levee toe). Since this is not considered to be a high hazard, it does not need to be modified immediately. This gas line will be reviewed against potential remediation measures in order to determine if it will likely be modified or removed as part of a future remediation project, or if it can be addressed in a long-term plan. Finally, the USACE inspections revealed issues with approximately 22 vegetation items along this levee. These items will need to be addressed as part of the Flood Program.

I. DWSC East Levee

Before the DWSC was constructed, the DWSC East Levee served as the east levee of the Yolo Bypass. With the construction of the DWSC West Levee (aka, Navigation Levee), the DWSC East Levee is now subject to the water surface elevation of the DWSC, which is significantly lower than that of the Yolo Bypass. Underseepage deficiencies identified for the DWSC East Levee are generally a result of the presence of a landside ditch. The identified landside and waterside stability deficiencies are primarily located at existing pump stations where slopes have been steepened. Erosion was only identified as a concern at a few localized areas on this levee.

In addition to these deficiencies, routine inspections conducted by DWR and USACE revealed issues with vegetation, encroachments, and penetrations. A total of fourteen high-hazard encroachments and three high-hazard penetrations were identified in this levee. The USACE inspections revealed issues with five vegetation items along this levee. These items will need to be addressed as part of the Flood Program since they are believed to pose an unacceptable threat to levee integrity, maintenance, and flood-fight operations. Low and moderate hazard encroachments and penetrations will also be reviewed against potential remediation measures in each reach in order to determine which penetrations and encroachments are likely to be modified as part of a future remediation project (i.e.: cutoff wall), and which ones could be addressed as part of a long-term remediation plan.

J. Port North Levee

The results of this investigation indicate that the Port North Levee has only one area between Stations 26+00 and 35+50 where waterside slope stability and localized, intermittent erosion potential are a concern. Additionally, a potential for underseepage deficiency was identified from Stations 120+00 to 142+50. However, there are no explorations after Station 135+00; therefore, additional explorations are recommended to evaluate subsurface soil conditions. Furthermore, nearly the entire segment is freeboard deficient, with some areas lower than the design water surface elevation (DWSE). This is due to the fact that a noticeable levee embankment only exists from Station 0+00 to Station 125+00. Beyond Station 125+00, Industrial Boulevard essentially serves as the “levee” because the area that is waterward of Industrial Boulevard has many low spots to accommodate infrastructure associated with the Port of West Sacramento. Additional explorations and geotechnical analysis should be conducted to confirm that no additional geotechnical deficiencies will result from future freeboard mitigation measures, especially from Stations 8+00 to 26+00, Stations 35+00 to 120+00, and Stations 142+50 to 236+00.

In addition to these deficiencies, routine inspections conducted by DWR and USACE revealed issues with vegetation, encroachments, and penetrations. Only two low-hazard and moderate-hazard penetrations were identified in this levee. Since they are not high hazard, these penetrations do not need to be modified immediately. These penetrations will be reviewed against potential remediation measures in each reach in order to determine which ones are likely to be modified or removed as part of a future remediation project, and which ones could be addressed in a long-term plan. Vegetation issues were not identified for the Port North Levee.

K. Port South Levee

The Port South Levee evaluation indicates that, generally, there is a potential for underseepage between Stations 23+00 and 123+50 and through seepage from Stations 143+00 to 186+93. Steep waterside slopes along the eastern end of this levee may result in in waterside slope instability associated with rapid draw-down from Station 138+00 to Station 158+00. Finally, this segment has freeboard deficiencies along its entire length. Additional explorations and geotechnical analysis should be conducted to confirm that no additional geotechnical deficiencies will result from future freeboard mitigation measures. Erosion was not identified as a concern in this levee. The Port South Levee was the only levee in the study area that was not included in the USACE and DWR Periodic Inspections. A site-specific review of this levee should be performed in future iterations of Wood Rodgers' 2016 PIR before any improvements are made to this levee.

III. ALTERNATIVES CONSIDERED

The deficiencies presented in the previous section include seepage, stability, freeboard, geometry, erosion, vegetation, and penetrations/encroachments. This section discusses the measures that are typically used to address each of these types of deficiencies.

A. Seepage and Stability Mitigation Measures

1. Cutoff Walls

Cutoff walls reduce levee underseepage and through seepage by providing a barrier of low permeability material through the levee and levee foundation where sandy or gravelly soils of higher permeability can transmit seepage during high water stages. Cutoff walls are installed to the depth determined by geotechnical analysis to reduce underseepage and through seepage at the DWSE to gradients that satisfy seepage criteria specified by the ULDC.

Based on previous cutoff wall projects in northern California, the cutoff wall alternatives presented in this AAR target a soil-bentonite wall (described in more detail below) with a levee degrade equal to one-half of the existing levee height as measured from the landside levee toe. While some projects in California's Central Valley have reduced this degrade to one-third of the levee height, a one-half levee degrade is assumed for the purposes of this initial Flood Program analysis. The degrade limits will be reviewed in greater detail during the design phase. The greater degrade amount reduces a number of risks by placing the wall deeper within the levee prism: 1) susceptibility to burrowing rodents; 2) the potential for hydraulic fracture during wall construction; and 3) potential for the wall to fail in the event of a circular slip-type failure at the levee waterside face. For very wide levees (widths in excess of 100 feet), the amount of degrade was reduced as needed to provide a minimum 30-foot-wide cutoff wall working platform. Each of the various cutoff wall types, construction methods, and costs are described below. A summary of this information is also included as **Table 2** (attached).

a. Types of Cutoff Walls

Cutoff walls can be constructed using a number of different methods to suit site conditions and required cutoff wall depth. Traditional types of cutoff wall construction include soil-cement-bentonite (SCB) cutoff walls, soil-bentonite (SB) cutoff walls, and cement-bentonite (CB) cutoff walls. The type of wall chosen depends on the desired properties of the finished wall. Each of these wall types is described below.

<u>SCB Cutoff Walls</u> – SCB cutoff walls are constructed by degrading the existing levee by one-half (or an amount to provide at least a 30-foot-wide working

platform) followed by the excavation of a minimum 36-inch-wide trench down the levee centerline using a hydraulic long-reach excavator. A bentonite slurry is then pumped into the excavated trench in order to maintain sidewall stability while a mix of bentonite slurry, select native material (or a combination of native and import material), and cement is processed and placed into the trench. For levee cutoff walls, the mixture is designed to produce a wall with a permeability of typically 5x10-7 cm/sec at 28 days and a compressive strength ranging from 40 to 300 psi at 28 days (design permeability is 1x10-6 cm/sec; however, to assure that this is reached by the completed wall, the specifications target 5x10-7 cm/sec). SCB cutoff walls constructed by the traditional, long-reach excavator method are typically feasible up to approximately 85 feet. Constructing a SCB cutoff wall deeper than 85 feet typically requires adding a hydraulic clamshell to excavate to the required depth. The costs for constructing a typical SCB cutoff wall to conventional depths range from $8-$18 per square foot, depending upon depth, width, and quality control requirements. Typical mobilization costs for conventional SCB installation are $75,000-$125,000. Due to increased costs of SCB walls with respect to SB walls, shallow SCB walls were not proposed as part of this analysis. Where deep wall are proposed, SCB wall constructed with the Deep Soil Mixing (DSM) method are recommended in this Report.

<u>SB Cutoff Walls</u> – SB cutoff walls are constructed similar to SCB cutoff walls and have the same depth limitations; however, cement is not included in the slurry mix. SB cutoff walls, if not protected sufficiently, can be susceptible to subsidence and damage by equipment loads on the levee surface.

Since the permeability of SB cutoff walls is relatively predictable compared to SCB walls, construction is able to move forward without first completing a testing program to select a mix design. This predictability also allows cutoff wall field permeability to target the design permeability, which is normally 1x10-6 cm/sec, verses a lower permeability of 5x10-7 for SCB walls.

Typically, there are limitations on the materials comprising SB backfill. To achieve good mixing of the materials, SB backfill soils must contain fines (materials passing the No. 200 Sieve) in the range of 20-40 percent. If the existing material is higher than 40 percent passing the No. 200 Sieve, this could require importing and mixing SB backfill materials.

Typical costs for SB walls range from $7.50-$12.00 per square foot depending upon the effort required to meet the materials specification. Typical mobilization costs for conventional SB installation are $75,000-$125,000.

CB Cutoff Walls – CB cutoff walls contain cement and bentonite only. A trench for the wall is constructed and the excavated material is hauled off-site or incorporated into earthwork portions of the project (such as levee raising or slope flattening). CB walls require a smaller construction footprint (as small as 20 feet wide). Therefore, CB walls are good options where one-half degrade or wider working platforms are not feasible. CB walls are typically constructed in alternating panels, with the intermediate panels constructed once the first panel sections have had several days to cure. Alternatively, the CB wall can be constructed using the continuous trench method; however, this requires trimming and disposing of a portion of the previous day's work if the work is discontinuous overnight. CB walls begin to set within hours, and backfill over the trench can proceed after a short period of curing. If desired permeability is 1x10-6, CB walls can be in the general cost range of SCB and SB walls; however, target permeabilities lower than 1x10-6 cm/sec require specialized slag cement mixtures that significantly add to the cost. Basic CB walls typically range in cost from $20 to $30 per square foot. Typical mobilization costs for conventional CB installation are $75,000 to $125,000.

b. Cutoff Wall Construction Methods

Each of the walls described in the previous section can be constructed using convention methods (i.e.: with a long-stick excavator). The maximum depth of conventional construction methods is approximately 85 feet. Where deeper walls are required, alternative equipment methods can be employed such as deep soil mixing (DSM), trench cutting and remixing (TRD), cutter-soil mixing (CSM) and jet grouting. Each of these equipment types and methods are described below.

DSM – Deep Soil Mixing (DSM) is a second method for installing SCB or SB cutoff walls at greater depths (80 feet to 200 feet) is using DSM. DSM produces a wall of similar permeability and strength characteristics as a conventional cutoff wall, but can be constructed to greater depths. DSM is accomplished with specially-designed drilling equipment that drills into the subsurface soils, injects cement and bentonite slurry, and mixes the materials in place to form a column of low permeability material. A series of overlapping columns are constructed to form a continuous wall. DSM can be performed to create a SB cutoff wall, but this method has a limited history in California and, where it has been used, has experienced anomalous results. DSM is more expensive than conventional cutoff walls ($20-$30 per square foot for SCB). Typical mobilization costs for DSM walls are $100,000-$150,000.

TRD – The Trench Remixing, Deep (TRD) method, also referred to as the "Chainsaw Method," utilizes a continuous vertical chain bucket excavator to cut a trench along the alignment of the proposed cutoff wall. While excavating, the TRD equipment dispenses a cement-bentonite slurry into the soil and mixes the slurry with the cement-bentonite to achieve the required cutoff wall strength and permeability. A TRD machine can achieve a cutoff wall depth of up to 200 feet. Similar to DSM, the TRD method does not become economical until the cutoff wall depth exceeds the limit of conventional equipment. Sharp turns in levee alignment can also slow production rates. Typical costs for TRD wall construction, through a straight levee alignment with favorable subsurface conditions, is $20-$30 per square foot. Typical mobilization costs for TRD walls are $150,000 to $200,000.

CSM – The Cutter Soil Method (CSM) - CSM uses two counter-rotating cutting heads at the end of a long shaft to break up subsurface materials, inject slurry, and mix the components into a homogenous mass. This method of cutoff wall construction works particularly well where hard or rocky subsurface conditions are present. A drawback of this wall is the minimal overlap provided between panels of completed wall, which are typically four inches, and can be reduced if the stem of the auger is not maintained vertically during driving. Similar to the other hydromill methods, the CSM method requires that a drill rig pre-drill along the wall alignment and classify the subsurface soils in advance of the CSM machine. Degrade of the levee to provide a minimum working platform of 30 feet is desirable for this equipment

Dewind One-Pass Trencher Method – The Dewind One-Pass Trencher is a proprietary cutoff wall construction machine that has completed many cutoff walls through the United States (mainly for dewatering applications). It is similar to the TRD equipment in the mixing method, but its mixing boom is situated on a large excavator chassis. This equipment arrangement has cost efficiencies and production advantages that may be well suited for levee rehabilitation work in California. However, it has not yet been used in California, and has not (in Wood Rodgers knowledge) been used on a federally-owned levee. Wood Rodgers understands that the Sacramento Area Flood Control Agency (SAFCA) may be set to use this equipment on a North Area Streams project in the near future. If the equipment is used and performs well, it may be considered further in upcoming phases of the City's Flood Program.

Jet Grouting – Jet grouting is a general term used to describe construction techniques where high-pressure fluids or binders are injected into the soil at high velocities (800 to 1,000 feet per second). Depending upon the depth of grouting required and the subsurface material encountered, the injected fluid may be comprised of grout; grout and air; or grout, air, and water. Jet grouting breaks up the soil structure and mixes the soil particles in-situ, with a binder to create a homogeneous mass. In time, this mass solidifies to form a prism of low permeability material. Jet grouting is particularly useful where obstructions along the path of the wall do not allow the use of other methods. As noted, jet grouting can entail a number of construction techniques and equipment variants that add significant uncertainty to the cost. For the purposes of budgeting, a cost of between $75 and $150 per square foot is appropriate. Typical mobilization costs for jet grout walls are $250,000-$500,000.

c. Cutoff Wall Location

Cutoff walls are typically constructed either near the levee centerline or at the levee waterside toe. Constructing the wall at the levee waterside toe decreases the quantity of cutoff wall square footage; however, a blanket of low permeability material is required at the waterside slope face. Existing levee excavation and reconstruction quantities vary in relation to a typical degrade, depending on the degrade height used. A typical section for a cutoff wall at the levee centerline is presented on **Figure 3** (attached). A typical section for a cutoff wall at the waterside levee toe is presented on **Figure 4** (attached).

2. Seepage Berms

Seepage berms provide mitigation for levee underseepage by extending the seepage path away from the landside levee toe, and adding weight to counteract upward seepage forces. The ULDC provides guidance that seepage berms should be at least four times the minimum top-of-levee (MTOL) height with a maximum width of 300 feet. Seepage berms also provide protection against the landside slope slumping at the levee toe. There are different types of seepage berms including impervious, semi-pervious, sand, and free-draining. The preferred configuration, similar to a free-draining seepage berm, incorporates a soil mass, a drainage layer, and a filter layer to control the flow of seepage through the levee. Collection systems are not typically designed to accompany drained seepage berms because it is assumed that seepage flow emanating from the seepage berm would not increase over existing conditions. A typical seepage berm configuration is presented on **Figure 5** (attached).

3. Stability Berms

Stability berms provide protection against through seepage and landside levee slope failure by buttressing the levee slope and draining levee through seepage. Stability berms have been identified as an option only where through seepage (and not underseepage) is of concern, and a stability berm is not already present. A typical stability berm configuration is presented on **Figure 6** (attached).

4. Slope Flattening/Reconstruction

Slope flattening and reconstruction help improve the stability of waterside slopes. Along the Yolo Bypass, slope stability issues will be addressed using details from recent USACE repair work completed as part of Contract C, Contract D, and slump repairs completed in 2002. Typical sections for these repairs are shown in **Figures 7**, **8**, and **9** (attached), respectively.

5. Relief Wells

Relief wells provide protection against levee underseepage by providing a path for underseepage pressures to exit to the landside ground surface without piping levee foundation materials. Relief wells are only an option in areas where continuous sand and gravel layers and a continuous, low-permeability, fine-grained clayey blanket have been identified by the geotechnical analysis. Wells are typically constructed with six-inch to eight-inch stainless steel screens and casings, and they discharge into a concrete-lined ditch running parallel to the landside levee toe. Seepage in the collection ditch is then routed either to an existing drainage system or pumped back over the levee. Relief well discharge requires water quality permitting. Piezometers are also installed within the relief well field to monitor relief well performance. A typical relief well and piezometer detail are presented on **Figure 10** and **Figure 11** (attached), respectively.

Due to the water quality permitting, increased operation and maintenance, and vandalism concerns, relief wells are only considered as a seepage remediation measure in limited circumstances where cutoff walls and berms are impractical.

6. Typical Treatment at Transitions

Where different seepage mitigation measures are installed in adjacent reaches, overlapping the treatments is required to transition from one measure to another. For example, if a cutoff wall is constructed for Reach A, and a seepage berm is installed for Reach B, then the cutoff wall of Reach A would need to extend into Reach B and the seepage berm may need to extend into Reach A. **Figure 12** (attached) shows a typical detail for the transition overlap between a cutoff wall and a seepage berm. Reaches with a seepage mitigation measure to be constructed adjacent to a reach with no new seepage mitigation measure would be extended to overlap into the untreated area.

B. Freeboard Mitigation Measures

1. Levee Raising

Levee raising increases the height of a levee by adding additional embankment material to the existing crown and landside slope in order to create a taller levee. The levee crown would be raised to the height needed to contain the DWSE plus freeboard (typically three feet). Raised levees generally become five to six feet wider for every one foot they get taller since both the waterside and landside slopes of new and/or improved levees is 2H or 3H:1V. Typically, levee raises occur by projecting a 3:1 theoretical waterside slope to the top of the new levee crest (beginning at the waterside toe), and then incorporating a 20-foot crown width. In this way, a levee raise is built landward of the existing levee prism. Therefore, land acquisition at the landside levee toe is typically necessary in order to accommodate the wider levee footprint. Where hydraulic and environmental analysis allow, extending the levee footprint waterward may be considered. Finally, where the freeboard deficiencies are very minor (i.e.: less than six inches), alternative measures of achieving the required height such as constructing a cap on the crown, or using steeper side slopes to minimize the disturbance of the entire levee footprint may be considered during future phases of the Flood Program. A typical levee raise is presented on **Figure 13** (attached).

2. Floodwalls

A floodwall is essentially a concrete retaining wall that provides flood protection by creating a vertical barrier between high water and the area it protects. Where floodwalls are used, they usually are designed to meet the same height and freeboard criteria as levees. Construction of floodwalls is generally more expensive than constructing a new levee. For this reason, floodwall applications are typically implemented only in areas where the available right-of-way is limited. For this AAR, floodwalls were not considered as a preferred freeboard mitigation measure on any levee except the Port North Levee. A typical floodwall is presented on **Figure 14** (attached).

C. Geometry Mitigation Measures

Where seepage berms, stability berms, and/or levee raising are proposed, these measures may also address geometry issues. Where these measures do not add sufficient material to the existing levee to contain a theoretical ULDC prism within the embankment, the levee prism is expanded landward of the existing levee prism as needed so that the theoretical geometry prism exists within the new levee.

D. Erosion Mitigation Measures

Erosion mitigation measures will be needed to repair identified erosion and to protect against erosion in areas where the levee bank will be exposed by new construction. Erosion protection solutions will be designed primarily to address mechanisms that cause erosion, including but not limited to:

- wave wash during high water;
- boat and wind waves;
- toe erosion due to outer bank scour;
- geotechnical failure;
- scour by currents;
- local scour due to a constriction or other features.

Secondarily, erosion protection designs will need to be compatible with bank conditions resulting from other anticipated levee repairs.

There are various means of providing erosion protection, ranging from concrete revetment to seeding and planting. Rock slope protection (RSP) is commonly used to provide flexible, durable, resistive protection in the wave wash zone, to protect against scour, and to provide slope stability. Seeding and planting is a less expensive "greener" alternative that should be considered where conditions allow. Recent experience suggests that regulating agencies may require inclusion of earth fill and vegetation in RSP designs for habitat enhancement purposes, where it is appropriate.

Repair of existing erosion sites should be completed according to a prioritization system that is based on the severity of the deficiencies.

The priority classification should be based on the following criteria:

- erosion mechanism,
- erosion severity,
- channel morphology,
- proximity to infrastructure,
- presence of previously placed slope protection,
- toe condition,
- levee classification and
- spot repairs.

Using this system, observed and potential erosion sites may be roughly classified (e.g., severe, medium and low risk). Erosion sites with highest priority (most severe) should be repaired, while medium and low priority sites should be monitored, unless their repair is justified by other concerns. In the PIR, observed erosion sites on the Sacramento West South Levee were classified according to the three categories above. In all other levee reaches, two classes of erosion – "minimally acceptable" and "unacceptable" – were documented for existing erosion sites by HDR, Inc. (HDR). This alternatives analysis recommends repair of “high priority” erosion sites on the Sacramento West South Levee and “unacceptable” erosion sites on all other levees, with one exception. Repair of minimally acceptable erosion sites on the DWSC West Levee is recommended because the erosion mechanism of concern (wind waves) is similar for all portions of this levee, so over time it is anticipated that the minimally acceptable sites will become unacceptable and will need similar repairs. Newly exposed soils in areas being constructed or repaired for other reasons will require soil stabilization by seeding, at a minimum, and may require more robust treatment depending on circumstances.

Erosion repair concepts recommended by this Report are discussed below.

1. Riprap or Rock Slope Protection

   Rock slope protection is one measure considered in this Report to address areas where erosion is a concern. RSP can be used as a standalone measure, included in a wave rock bench, or used in combination with vegetation. Each of these measures is described in more detail below.

   a. Wave rock benches are included as an alternative to resist wave erosion, and are typically located just below average annual high water. Depending on the site location on the river and bank condition, the repair might include rock coverage down to the bank toe. Wave rock bench designs typically include soil fill and installed vegetation on the bench and on the bank landward of the bench.

   b. Rock slope protection is also presented as a singular bank protection alternative that comprises riprap placed from the toe to the crown of the levee where waves and currents are the mechanisms of concern. Typical details for singular RSP installations can be found on Figure 9 (attached).

   c. Vegetated riprap is presented as an alternative for sites where it will be helpful to match existing conditions and satisfy anticipated permitting needs. Vegetated riprap designs include planting willow cuttings (poles) through the riprap blanket. The willows are intended to slow flows near the bank, help anchor rock and stabilize slopes and to provide habitat. Please refer to **Figure 15** (attached) for a typical detail of this measure.

E. Penetration and Encroachment Mitigation Measures

Penetrations typically include pipe or conduit crossings through the levee embankment and its foundation. Penetrations are a concern to levee integrity since they have the potential to produce rapid breaching via preferential seepage paths or an open conveyance for floodwaters if they penetrate the levee below the DWSE.

Encroachments typically include utility poles, fences, gates, ramps, or other structures that are within the levee prism, within the channel, or are located within 20 feet of the landside toe. Encroachments are a concern to levee integrity since they can interfere with channel hydraulics, levee operation, maintenance, inspection, or flood fight capability. In some cases they can present a preferential path for seepage or interrupt confining layers that would otherwise minimize seepage gradients.

Penetrations and encroachments were evaluated in Wood Rodgers' 2016 PIR to determine if they presented a low, moderate, or high hazard to levee integrity. Mitigation measures for the different hazard levels are presented below.

1. Low Hazard Penetrations and Encroachments

   These penetrations and encroachments represent a low hazard to levee integrity and have minimal impacts to operations, maintenance, and flood fight capability. For penetrations and encroachments that were identified as having a low hazard potential and are permitted, no action is necessary. A plan to permit currently unpermitted penetrations and encroachments identified as a low hazard potential should be developed in future phases of the Flood Program. Whether permitted or not, if low hazard penetrations and encroachments require removal/modification incidental to a proposed seepage, stability, erosion, geometry, or freeboard remediation project, they will need to be relocated/modified as part of the larger project. Alternatively, these penetrations and encroachments can be addressed through a long-term plan.

2. Moderate Hazard Penetrations and Encroachments

   These penetrations and encroachments represent a moderate hazard to levee integrity and may have moderate impacts to operations, maintenance, and flood fight capability. Permitted and unpermitted penetrations and encroachments that were identified as having a moderate hazard potential should be developed in future phases of the Flood Program. If moderate hazard penetrations and encroachments require removal/modification incidental to a proposed seepage, stability, erosion, geometry, or freeboard remediation project, they will need to be relocated/modified as part of the larger project. Alternatively, these encroachments can be addressed through a long-term plan.

3. High Hazard Penetrations and Encroachments

   These penetrations and encroachments represent a high hazard to levee integrity and/or operations, maintenance, and flood fight capability. For penetrations and encroachments identified as having a high hazard potential, the City should either: 1) perform a full engineering evaluation of high hazard penetrations and encroachments to demonstrate that the hazard is acceptable; or, 2) remove or modify the penetration/encroachment. If high hazard penetrations and encroachments require removal/modification incidental to a proposed seepage, stability, erosion, geometry, or freeboard remediation project, they will need to be relocated/modified as part of the larger project. A typical detail for a penetration modification including the installation of a positive closure device is shown in **Figure 16** (attached).

F. Vegetation Mitigation Measures

The ULDC provides guidance for vegetation management that incorporates levee integrity; visibility; and accessibility for inspections, maintenance, and flood-fight operations, while protecting critical environmental resources and habitat offered by existing vegetation.

For existing vegetation that does not pose an unacceptable hazard threat to levee integrity, the ULDC recommends adopting a Life-Cycle Management (LCM) approach. This policy is aimed at limiting the financial costs associated with extensive vegetation removal and potentially significant loss of habitat along levees. Under the LCM approach, levees containing legacy trees along the landside or waterside slopes will be managed to allow vegetation and trees to live out their normal life cycles except where they pose a threat, while gradually progressing (over several decades) toward the current USACE policy of eliminating woody vegetation from the Vegetation Management Zone (VMZ). The LCM approach protects and improves riparian habitat as long as the vegetation does not impair visibility and accessibility. The levee crown must be kept free of all vegetation since it serves as a patrol road for levee maintenance. **Figure 17** (attached) depicts the VMZ and associated criteria for vegetation on existing levees.

For this AAR, vegetation will be removed within the VMZ as needed to accommodate a seepage, erosion, or freeboard improvement project. Existing vegetation within the VMZ that does not need to be removed to accommodate a remediation project will be allowed to remain. Since most levees considered in this AAR require some form of improvement that impacts the waterside slope (e.g., freeboard raising, cutoff wall, etc.), it is expected that many of the existing vegetation issues will be addressed concurrently with a repair/remediation project. Future phases of the Flood Program may conduct engineering assessments to determine if vegetation that is allowed to remain poses an unacceptable risk to levee integrity.

G. Right-of-Way

Based on discussions with the project team, existing right-of-way is assumed to extend 10 feet landward of the landside toe to 15 feet waterward of the waterside toe for most levees considered in this AAR. Therefore, it is assumed that the minimum ULDC criteria are met for most levees. The notable exceptions are the Port North, Port South, and DWSC West Levees where the Port is assumed to own all of the land in these areas. Right-of-way is assumed to be needed for all improvements in these levees. Outside of the Port North, Port South, and DWSC West Levees, land acquisition needs have been estimated where seepage and stability berms are proposed and are included in the respective cost estimates.

Land acquisition estimates also consider a 20-foot future needs area landward of proposed improvements (where land appears to be available). A 20-foot future needs area is included waterward of proposed improvements where it is not expected to impact sensitive riverine or aquatic habitat areas (this was generally limited to the Port levees).

IV. BASIS OF COSTS

To estimate preliminary project costs, unit prices were developed and material quantities were calculated for the project features. Geotechnical remediation measures were based on information provided in **Attachment A** (attached). Estimated quantities for each alternative in each reach were developed using specific cross sections taken at locations where the existing levee geometry was representative of a “typical” section in that reach. Cross sections that were used to estimate quantities for the alternatives considered in each reach are included in **Attachment B** (attached). Unit prices for typical levee construction (e.g.: site clearing, borrow excavation and hauling, levee embankment fill, rock slope protection, riparian corridor construction, and roadway construction) were determined based upon recent contractor bid summaries for similar levee improvement projects in Northern California. Where recent bid tabulations were not available, cost-determination publications, such as RS Means’ *Heavy Construction Cost Data*, were used to develop costs.

For purposes of this AAR, levee degrade material is assumed to be stockpiled and replaced. It was assumed that 80 percent of the degrade material could be reused, and 20 percent would have to be hauled off and disposed. Since the DWSC West Levee consists of an over-widened embankment, the unsuitable material was assumed to be disposed of along this levee, which eliminated hauling and disposal costs for this levee. Clay cap material placed on top of proposed cutoff walls and levee embankment material in order to address freeboard/geometry deficiencies is assumed to come from borrow sites. Seepage berm fill is also assumed to come from project excavations and borrow sites. Although specific borrow sites have not been identified, this AAR assumes that borrow material will come from within City. The most likely sources for borrow material are located in the southern part of the City, south of Port South. This assumption limits most hauling distances to a maximum of 10 miles (one-way). For embankment material in the DWSC West Levee, material is assumed to come from within the DWSC or the Yolo Bypass. Borrow material shrinkage is assumed to be 30 percent, and borrow acreages were estimated assuming a borrow depth of five feet.

The cost estimates include a contingency amount of 30 percent for all items, except land acquisition costs, where a 15 percent contingency was used due to less uncertainty associated with these items. Due to the increased uncertainty of possible impacts to buildings and utilities in Port North, a 50-percent contingency was applied in many reaches within that levee. Planning, engineering, and design were included at seven percent. Environmental mitigation and planning/permitting costs were developed for each levee reach by Ascent Environmental, Inc. based on a review of proposed improvements and the project footprint. Right-of-way costs were developed by Bender Rosenthal, Inc. and were informed by recent land sales of agricultural, residential, and commercial/industrial properties in the vicinity of the project.

Cost estimates reflect 2015 costs, escalated to 2019 costs at a rate of 2.5 percent per year. This escalation rate was determined from a review of the Engineering News Record (ENR) Historical Cost Index for the years of 2012 through 2015. Unit costs used for this Report are presented in **Table 3** (attached). Detailed cost estimates for each levee system are included in **Attachment C** (attached).

V. BASIS OF ANALYSIS

The potential alternatives were evaluated with respect to the following criteria: cost, constructability, effectiveness, operation and maintenance requirements, and flexibility. This section presents the considerations associated with each of these evaluation criteria.

A. Cost

Given the quantity of levee improvement work that is needed to address the identified deficiencies and the limited resources available to fund improvements, cost is often an overriding consideration in selecting the recommended alternative. Thus, cost is the focus of the comparative evaluations and tables included in this Report. Cost is also the only objective comparison measure used as a basis for analysis of alternatives.

Typically, if land is available landward of the levee toe and borrow material can be acquired at a reasonable cost, seepage berms are often the least cost alternative. Where subsurface conditions require a wider berm (greater than four times the levee height), or where environmentally-sensitive areas or existing infrastructure are located landward of the levee, costs for seepage berms can increase significantly or become prohibitive.

Most existing erosion protection consists of RSP, and costs considered herein are for repair of existing revetment or addition of protection to existing unprotected erosion sites. Initial costs for levee erosion protection generally reflect the erosion resistance of the protection measure (i.e. concrete is more costly than riprap, which is more expensive than revegetation).

Vegetated benches were generally selected for new erosion protection structures as this is a proven alternative with attractive features with respect to environmental impacts. The vegetated bench design for toe protection may cost more due to the expanded rock prism that is required to construct it, but it is a design we anticipate needing in order to meet permitting requirements. In areas where RSP was recommended, it was viewed as the most economical solution from the standpoint of reducing future maintenance. The repair alternatives provided are based on our experience with similar requirements on local projects. Although detailed cost comparison analysis was not completed, qualitative assessment and professional judgment indicated that these are cost-effective strategies.

B. Constructability

Constructability considerations include construction impacts that may affect overall project costs but that may not be directly accounted for in a construction cost estimate. Such impacts include air quality (for large earthwork and earthwork hauling operations), staging area needs, level of construction quality assurance (QA) monitoring required, and impacts to surrounding infrastructure (such as traffic delays on local roadways and potential use fees or replacement costs to address hauling damage).

Cutoff walls typically are the easiest to construct as they are located within the existing levee footprint and require minimal hauling or impacts to local traffic.

Seepage berms can have a significant impact in that they require large volumes of material to be hauled from an off-site source. As a result, such impacts can have detrimental effects on air quality, traffic, and existing roadway infrastructure.

Similarly, construction of erosion mitigation measures can have constructability considerations. Repairs require hauling and staging of large amounts of material (principally earth and stone). Construction may require heavy equipment and staging from the waterside that can potentially affect recreational use of waterways. Erosion repairs can also present regulatory issues such as habitat degradation, as in-water work and vegetation clearing are often required, so biological and water quality monitors may be required, and waterside construction may be limited to strict seasonal windows.

Constructability was considered qualitatively for alternatives analyzed in this Report, and where constructability was deemed a substantial concern for a given alternative, it was screened out.

C. Effectiveness

In general, if installed correctly and maintained properly, all seepage mitigation measures under consideration in this AAR are effective in reducing through and underseepage gradients to within ULDC criteria. Likewise, erosion mitigation measures are effective when constructed and maintained property.

D. Operation and Maintenance Requirements

Cutoff walls require no operation and maintenance (O&M) effort and, therefore, are highly desirable by maintaining agencies. Seepage berms, because they periodically require mowing and some inspection, would require an increased level of O&M. However, because this level of increased maintenance is generally minor, it is not enough to screen out a seepage berm alternative.

Erosion protection measures involving vegetation require more frequent inspection and maintenance, especially during the period of establishment. Irrigation may be required, as well as control of the beaver population or invasive plant species. Erosion solutions that present the potential for ongoing O&M were considered here in light of their ability to meet the above criteria and the potentially restrictive cost of alternatives.

O&M is used as a subjective consideration for selecting a preferred alternative. O&M cost estimates for each alternative were not included.

E. Flexibility

Given the dynamic nature of the levee design, construction, and maintenance criteria, flexibility to build upon current improvements in the future is an important consideration. With respect to changing underseepage criteria, seepage berms offer the most flexibility because additional material can be placed on the seepage berm to increase its capabilities. Cutoff walls offer little flexibility in response to changing criteria and industry practices.

With respect to future levee widening, raising, and landside slope flattening, both seepage berms and cutoff walls offer sufficient flexibility to increase the levee geometry without affecting completed seepage improvements. Similarly, erosion protection and repairs are typically compatible with future levee improvements because they are located on the waterside of the levee, and improvements typically affect the interior of the embankment (cutoff walls) or landside (berms). Erosion protection and repairs are easily modified by adding more material (fill, gravel, stone, plants, geotextile). Flexibility was considered qualitatively for alternatives analyzed in this AAR.

VI. ALTERNATIVES ANALYSIS

Alternatives to address deficiencies identified in Wood Rodgers' 2016 PIR were developed by Blackburn Consulting (BCI), CBEC, Inc. (CBEC), and Wood Rodgers. Each levee segment was divided into reaches of similar deficiencies and recommended remediation measures. **Table 4** (attached) presents the alternatives considered in each reach. Table 3 also includes the minimum seepage and stability remediation measures that might be supported if additional exploration and evaluation is conducted. This is discussed in more detail in Section VIII.

A description of the alternatives developed to address identified deficiencies for each reach are included below.

A. Sacramento River West North Levee

1. Reach 1 (Station 0+00 to Station 71+50)

a. Alternative 1 –Levee Raising with Shallow CB Cutoff Wall

A minimum 36-inch-wide, 45-foot-deep cutoff wall could be constructed (to elevation zero) to address through seepage issues in Reach 1. Between Stations 0+00 and 30+00, North Harbor Boulevard is situated on the levee crest. Since this is the only access road in this area, a CB wall is the preferred cutoff wall type due to a slightly smaller construction footprint (20 feet). This would allow traffic to be routed around the construction staging area with the use of flaggers. In the vicinity of the Bryte Bend Maintenance Yard, the cutoff wall would traverse the pavement in the parking areas, since the area outside of this facility along the waterside and landside hinges is not large enough to construct a cutoff wall.

The Reach would also need to be raised as much as six inches between Stations 54+58 and 56+43 and up to eight inches between Stations 58+19 to 61+19. All of the 11 utility penetrations within this segment would need to be modified due to the installation of the cutoff wall. There are approximately 18 high-hazard encroachments that also need to be modified and/or relocated in this Reach. This alternative would not require additional right-of-way since the levee footprint is not expected to change significantly.

The estimated cost for this alternative is approximately $23.4 million. This may be reduced with future maintenance if landside slope slumping due to through seepage is observed during and after prolonged high water events, as discussed in Section VIII of this Report.

b. Alternative 2 – Minor Levee Raising and a Drained Stability Berm

A 10-foot-wide stability berm is another alternative that could address through seepage issues in Reach 1. Due to the presence of the UPRR tracks immediately adjacent to North Harbor Boulevard from Stations 0+00 to 30+00, and the proximity of Riverbank Road between Stations 30+00 and 50+00, implementation of this remediation measure would involve costly rail and roadway relocations. For these reasons, the stability berm alternative was considered infeasible and, therefore, screened out.

2. Reach 2 (Station 71+50 to Station 101+00)

The Rivers EIP Project addressed known deficiencies in this Reach. The USACE inspections identified several utilities that were installed as part of The Rivers EIP project as being unacceptable. For purposes of this AAR, these utilities are assumed to have been constructed in compliance with USACE and DWR requirements and, therefore, do not require modification as part of the Flood Program. Future iterations of Wood Rodgers' 2016 PIR may conduct additional exploration/ evaluation of these utilities in order to assemble the documentation necessary for USACE inspections to reflect these items as "acceptable".

3. Reach 3 (Station 101+00 to Station 136+00)

a. Alternative 1 – Shallow Cutoff Wall

A minimum 36-inch-wide, 40-foot-deep cutoff wall is an alternative that could be constructed (to elevation zero) to address through seepage issues in Reach 3. River Crest Drive is the approximate levee centerline, and eleven homes exist atop the wide levee crest in this Reach. These existing improvements would pose a challenge to construction of a cutoff wall in this Reach. For this reason, the cutoff wall alternative was determined to be infeasible in this Reach.

b. Alternative 2 – Drained Stability Berm

A 10-foot-wide drained stability berm is another alternative that could be constructed to address through seepage issues in Reach 3. The stability berm would be constructed along the existing landside toe of the levee. The area where the berm would be constructed appears to be open space along Fountain Drive, but the seepage berm at the northern end of this Reach may require acquisition of right-of-way on two residential parcels. For conservative cost estimating purposes, it is assumed that these two properties would need to be acquired.

The USACE inspections identified five encroachments in this Reach as being unacceptable since they pose a high hazard to levee integrity. One of the encroachments is a building at the southern end of the Reach near Station 132+00. This appears to have been constructed at the same time as the acceptably-rated (and permitted) houses along River Crest Drive near Station 102+00. It is assumed that this building could be permitted in future phases of the Flood Program by providing the necessary information to USACE to give this encroachment an acceptable rating. Two other unacceptable encroachments are newly installed waterlines that the USACE inspection requested additional information on so that these could be permitted. Future iterations of Wood Rodgers' 2016 PIR may conduct additional exploration/ evaluation of these encroachments in order to assemble the documentation necessary for USACE inspections to reflect these items as acceptable. Therefore, these encroachments are not considered as needing modification with the stability berm alternative in this Reach.

The remaining unacceptable encroachments include a monitoring well and an existing fence at the landside toe. These encroachments would be removed, relocated or modified incidental to the construction of the stability berm.

In addition to acquisition of the two homes near Station 102+00, a new right-of-way would need to be acquired along the landside toe of the levee to accommodate the new seepage berm. This alternative would require a total of approximately 5.5 acres of new land acquisition to accommodate the berm.

The estimated cost for this alternative is approximately $5.2 million. This may be reduced with future maintenance if landside slope slumping due to through seepage is observed during and after prolonged high water events, as discussed in Section VIII of this Report.

4. Reach 4 (Station 136+00 to Station 152+00)

   a. Alternative 1 – Minor Levee Raise with Deep Cutoff Wall

A minimum 36-inch-wide, 100-foot-deep cutoff wall could be constructed (to elevation -55) to address steady-state underseepage and slope stability issues in Reach 4. The levee would also need to be raised as much as six inches between Stations 148+58 and 152+00. There is only one penetration in this Reach according to the USACE inspections (a three-inch PVC waterline) that would need to be modified due to installation of the cutoff wall. There are no other known penetrations in this Reach.

The USACE inspections also identified five encroachments in this Reach as being unacceptable since they pose a high hazard to levee integrity. One of the encroachments is the Regatta residential development. It is assumed that this complex could be permitted in future phases of the Flood Program by providing the necessary information to USACE to give this encroachment an acceptable rating. Therefore, this encroachment is not considered to need modification with the cutoff wall alternative in this Reach.

The remaining unacceptable encroachments include utility poles, concrete rubble, and fences along the levee. These encroachments would be relocated or modified incidental to the construction of the cutoff wall. This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly. The estimated cost for this alternative is approximately $7.7 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Minor Levee Raise with a Seepage Berm

A 150-foot-wide seepage berm is another alternative that could address seepage issues in Reach 4. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment where a berm slightly wider than the minimum berm width may be required. However, due to the existing Regatta residential development located immediately adjacent to the landside toe of the levee approximately from Stations 140+00 to 148+00, this alternative was not considered feasible and was therefore not considered in this study.

5. Reach 5 (Station 152+00 to Station 161+00)

a. Alternative 1 – Waterside Slope Flattening with a Deep Cutoff Wall

A minimum 36-inch-wide, 125-foot-deep cutoff wall could be constructed (to elevation -85) in order to address steady-state underseepage issues in Reach 5. The waterside slope would be flattened and armored with RSP to address rapid drawdown slope stability and erosion issues. A moderate-hazard pipeline associated with a water treatment facility will need to be modified due to installation of the cutoff wall. There are no other known penetrations in this Reach.

The USACE inspections also identified four encroachments in this Reach as being unacceptable since they pose a high hazard to levee integrity. Three of these are utility poles, concrete rubble, and fences. The fourth unacceptable encroachment is an irrigation system for the plantings along Lighthouse Drive at the landside toe of the levee near Station 160+00. All of these encroachments will be removed, relocated, or modified in conjunction with the cutoff wall project.

This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly.

The estimated cost for this alternative is approximately $6.9 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Waterside Slope Flattening with a Seepage Berm

A 150-foot-wide seepage berm is another alternative that could address seepage and stability issues in Reach 5. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment, where a berm slightly wider than the minimum berm width may be required. However, due to the proximity of Lighthouse Road to the existing landside levee toe in this Reach, this alternative was not considered feasible and was therefore not considered in this study.

6. Reach 6 (Station 161+00 to Station 194+60)

a. Alternative 1 – Levee Raise and Deep Cutoff Wall

A minimum 36-inch-wide, 115-foot-deep cutoff wall could be constructed (to elevation -75) in order to address both through seepage and steady-state underseepage issues in Reach 6. The levee would also need to be raised as much as eleven inches from Stations 173+58 to 194+60. Erosion issues in this Reach would be addressed by placing RSP along the waterside slope between Stations 165+00 and 195+00. All seven moderate-hazard and three high-hazard penetrations identified in the USACE inspections would need to be modified due to installation of the cutoff wall alternative in this Reach.

The USACE inspections also identified nine encroachments in this Reach as being unacceptable since they pose a high hazard to levee integrity. Two of the high hazard encroachments in the USACE inspections – a River Walk tower/sign and an apartment complex – will likely need to have an engineering assessment performed during future phases of the Flood Program in order to determine if they pose a threat to levee integrity, since it would be very expensive to remove these encroachments. The costs needed to remove/modify these encroachments are not included in this Report.

Other unacceptable, high-hazard encroachments in this Reach include utility poles, fences, and an access ramp that encroaches into the levee prism. These encroachments would be relocated or modified incidental to the construction of the cutoff wall.

This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly.

The estimated cost for this alternative is approximately $22.9 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Levee Raise with a Seepage Berm

A 150-foot-wide seepage berm is another alternative that could address seepage and stability issues in Reach 6. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment, where a berm slightly wider than the minimum berm width may be required. However, due to the proximity of existing residential and municipal improvements to the existing landside levee toe in this Reach, this alternative was not considered feasible and was therefore not considered in this study.

7. Reach 7 (Station 194+60 to Station 199+60)

The I Street EIP Project is assumed to have addressed known deficiencies in this Reach. Additional geotechnical explorations and evaluations are needed to support this assumption.

8. Reach 8 (Station 199+60 to Station 215+30)

a. Alternative 1 – Deep Cutoff Wall

A minimum 36-inch-wide, 115-foot-deep cutoff wall could be constructed (to elevation -75) in order to address through seepage and underseepage issues in Reach 8. In order to address erosion issues, RSP would be installed along the waterside toe in this Reach. All three of the moderate hazard penetrations within this segment would need to be modified due to installation of the cutoff wall. There are no other known penetrations in this Reach.

The USACE inspections also identified one high-hazard fire hydrant encroachment in this Reach. This Report considers the cost to relocate this fire hydrant, but since it is permitted by the CVFPB, it may be possible to provide information to USACE to give this encroachment an acceptable rating.

This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly.

The estimated cost for this alternative is approximately $10.3 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Seepage Berm

A 150-foot-wide seepage berm is another alternative that could address through seepage and underseepage issues in Reach 8. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment where a berm slightly wider than the minimum berm width may be required. However, due to the proximity of existing commercial improvements to the existing landside levee toe in this Reach, this alternative was not considered feasible and was, therefore, not considered in this study.

9. Reach 9 (Station 215+30 to Station 301+57)

Downstream of the Tower Bridge (Station 215+30), the Sacramento River West North "Levee" is more than 800 feet wide (this area is technically considered high ground by Wood Rodgers, even though it is treated by regulatory agencies as a levee). Between Stations 222+19 and 274+32, freeboard deficiencies range from six to sixteen inches. However, since the risk of levee failure due to overtopping is very low in this Reach, no freeboard improvements are proposed. Future analysis may eliminate identified freeboard deficiencies in this Reach. The only remaining deficiency is a waterside slope stability deficiency. To address this issue, the waterside slopes will be flattened to 2H:1V.

The USACE inspections identified 12 high-hazard penetrations and 15 high-hazard encroachments in this Reach. The USACE inspection requested additional information on these items so that these could be permitted. Future iterations of the Wood Rodgers 2016 Draft PIR may conduct additional exploration/evaluation of these penetrations and encroachments in order to assemble the documentation necessary for USACE inspections to reflect these items as acceptable. Therefore, physical modifications to these penetrations and encroachments is not expected to be needed as part of the Flood Program.

The estimated cost for this alternative is approximately $10.8 million. If the oversteepened waterside slopes are allowed to remain and are addressed as maintenance items, these costs may be reduced.

B. Barge Canal Bulkhead Closure Structure

The concrete abutments adjacent to the Bulkhead would need to be raised approximately six inches in order to address freeboard deficiencies. Beyond the concrete abutments, a small embankment raise of six to twelve inches in height and twenty feet in width would be constructed away from the abutments for 200 to 300 feet until the new levee in this area ties into existing high ground. Alternatively, a concrete curb could be constructed.

In order to address the structural deficiencies, the individual plate girder assemblies will need to be retrofitted with a continuous 5/8-inch-thick steel plate. This new plate would be welded to the flanges on the Sacramento River side of the individual plate girder assemblies, and would overlap the existing continuous plate. The new plates would need to be 62 feet long and be centered on the individual plate girder assemblies. Due to the presence of the existing continuous tie plate, shim plates will be required for the addition of the 5/8-inch plate. All welds should be continuous between the plates. The existing plate girder assemblies will need to be removed to allow retrofit work to be completed out of the water in order to avoid issues that could arise from welding the old steel to new steel while the Bulkhead is under a load. As long as the retrofit work is completed in this manner, issues with welding old steel to new steel are not anticipated.

Finally, is recommended that the silt and debris at the base of the Bulkhead be removed in order to achieve the best seal possible along the base of the structure. With the Bulkhead properly seated, it is anticipated that the Bulkhead will seal much better; however a minor amount of water may still flow around the sides. Wood Rodgers feels that the seal between the Bulkhead and the abutments would improve with increased water levels since the weight of the water would "push" the Bulkhead firmly against the DWSC side of the abutment. These measures are not expected to make the Bulkhead watertight, but the minor leaking past the Bulkhead during a high water event is not expected to pose a hazard to the City.

The estimated costs of these improvements is approximately $2.5 million. Due to uncertainty associated with these estimated costs, a 100-percent contingency was used.

C. Sacramento River West South Levee

1. Reach 1 (Station 0+00 to Station 295+00)

   The Southport EIP Project currently in design will address known deficiencies in this Reach.

2. Reach 2 (Station 295+00 to Station 315+00)

   Recent levee mitigation remediated deficiencies previously noted in this area. No improvements are necessary.

3. Reach 3 (Station 315+00 to Station 332+70)

    a. Alternative 1 – Minor Levee Raising

    This Reach was found to have two localized areas with minor freeboard deficiencies. To address this deficiency, the levee would need to be raised approximately six inches between Stations 328+83 and 332+70. No other deficiencies were identified in this Reach. Due to the minor freeboard deficiency (and no other identified deficiencies), construction of an access road along the levee crown should address issues in this Reach.

    This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly. There are no known penetrations or encroachments in this Reach.

    The estimated cost for this alternative is approximately $3.4 million, which is primarily due to estimated land acquisition costs.

D. Sacramento Bypass South Levee

1. Reach 1 (Station 0+00 to Station 61+75)

    The CHP Academy EIP project and levee improvements constructed under the USACE Contract B addressed many of the known deficiencies in this Reach. Although a ULDC geometry deficiency was identified in this Reach, it is assumed that this segment will quality for an exception due to the extensive review by DWR and USACE that occurred as part of the CHP Academy EIP Project.

    The USACE inspections identified two high-hazard encroachments in this Reach. These were a pair of monitoring wells that were not shown in the CHP Academy EIP Record Drawings. The other encroachment was a toe cut on the west end of this Reach. A field visit was performed on February 24, 2016, and these encroachments could not be located. Therefore, physical modifications to these penetrations and encroachments is not expected to be needed as part of the Flood Program.

2. Reach 2 (Station 61+75 to Station 64+60)

    a. Alternative 1 –Deep Cutoff Wall with Waterside Slope Flattening

    A minimum 36-inch-wide, 140-foot-deep cutoff wall could be constructed (to elevation -100) in order to address both through seepage and steady-state underseepage issues in Reach 2. The depth of the CHP Academy EIP cutoff wall at Station 61+75 is only elevation 5. Therefore, the new deep cutoff wall would have to overlap the existing cutoff wall by approximately 200 feet (or more depending on future analyses) in order to mitigate end-around effects.

Additionally, although a ULDC geometry deficiency was identified in this Reach, it is assumed that this segment will qualify for an exception due to the extensive design review by USACE and DWR that occurred as part of the CHP Academy EIP Project. Therefore, geometry improvements are not proposed for this Reach. The existing waterside slope will be flattened and armored with concrete in order to address slope stability concerns in this Reach between Stations 61+75 and 63+50.

The USACE inspections identified three high-hazard and two moderate-hazard penetrations in this Reach. All five of these penetrations will need to be modified due to installation of the cutoff wall. There are no other known penetrations in this Reach. The USACE inspections also identified three moderate-hazard and six low-hazard encroachments in this Reach. These include monitoring wells, gates, and power poles. These will also be relocated or modified with construction of the cutoff wall in this Reach.

This alternative would require about 0.10 acre of additional right-of-way from the CHP Academy to accommodate the levee alignment shift due to the waterside slope flattening. This would also require the removal and replacement of the fence along the northern boundary of the CHP Academy.

The estimated cost for this alternative is approximately $4.9 million. This alternative is considerably higher than Alternative 2, so it was not selected as the preferred mitigation measure in this Reach.

b. Alternative 2 – Seepage Berm with Waterside Slope Flattening

A 100-foot-wide seepage berm is another alternative that could address underseepage and stability issues in Reach 2. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment, where a berm slightly wider than the minimum berm width may be required. This seepage berm would overlap the existing CHP Academy cutoff wall by approximately 200 feet in order to mitigate end-around effects. The existing waterside slope would be flattened to 3H:1V and armored with concrete in order to address slope stability concerns in this Reach.

The USACE inspections identified three unacceptable penetrations since they may pose a high-hazard to levee integrity in this Reach. The USACE inspection requested additional information on these items so that these could be permitted. Future iterations of the Wood Rodgers 2016 Draft PIR may conduct additional exploration/evaluation of these encroachments in order to assemble the documentation necessary for USACE inspections to reflect these items as acceptable. Therefore, these encroachments are not considered to need modification with the seepage berm alternative in this Reach.

The USACE inspections also identified three moderate-hazard and six low-hazard encroachments in this Reach. These include monitoring wells, gates, and power poles. These will also be relocated or modified with construction of the seepage berm in this Reach.

This alternative requires approximately 0.8 acre of land to be acquired from the CHP Academy for the seepage berm footprint. The existing fence, utilities, and patrol road associated with the CHP Academy would also need to be removed and relocated to accommodate a seepage berm in this Reach.

The estimated cost for this alternative is approximately $3.1 million. Due to the reduced costs, the seepage berm is the preferred remediation measure for this Reach. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

E. Training Berm

As previously discussed, although the Training Berm does not directly provide flood protection to the City, it appears to be important to direct flows from the Sacramento Bypass into the main channel of the Yolo Bypass, thereby protecting the Yolo Bypass East Levee south of the Sacramento Bypass. To address erosion and slope stability concerns with this berm, the slopes will be armored with RSP and flattened as needed (using RSP) to achieve a 3H:1V slope. Since the footprint is expected to change significantly, and adjacent land is within the Yolo and Sacramento Bypasses, land acquisition is not assumed to be needed for this berm. The estimated construction cost for this Reach is approximately $9.7 million.

F. Yolo Bypass East Levee

1. Reach 1 (Station 0+00 to Station 27+52)

a. Alternative 1 – Minor Levee Raise

To address minor freeboard deficiencies, the levee would need to be raised as much as six inches in this Reach. The waterside toe would be armored with RSP in order to address erosion concerns in this Reach. There is an acceptable/low-hazard penetration and two moderate hazard encroachments identified in this

Reach. Future iterations of the Wood Rodgers 2016 Draft PIR may conduct additional exploration/evaluation of these encroachments in order to assemble the documentation necessary for USACE inspections to reflect the moderate hazard items as “acceptable”. No other deficiencies were identified in this Reach. This alternative requires approximately 1.3 acres of land acquisition to accommodate a 20-foot future needs area along the landside toe of the levee. It appears an access road exists along the landside levee toe, so the required land acquisition may be reduced in future phases of the Flood Program.

The estimated cost for this alternative is approximately $2.8 million.

2. Reach 2 (Station 27+52 to Station 51+63)

a. Alternative 1 – Minor Levee Raise with Shallow Cutoff Wall

A minimum 36-inch-wide, 50-foot-deep cutoff wall could be constructed (to elevation -10) in order to address steady-state underseepage and landside slope stability issues in Reach 2. The levee would also need to be raised as much as six inches in this Reach. The waterside toe would be armored with RSP in order to address erosion concerns in this Reach.

The USACE inspections identified seven encroachments in this Reach, five of which included utility poles, fences, and debris on the levee slopes. These encroachments would be relocated or modified incidental to the construction of the cutoff wall. None of these encroachments were rated a high hazard. The other encroachments were access roads that did not encroach into the prism, so no modifications are proposed with this alternative. No penetrations were identified in this Reach.

This alternative requires approximately 1.4 acres of land acquisition to accommodate a 20-foot future needs area along the landside toe of the levee. It appears that an access road exists along the landside levee toe, so the required land acquisition may be reduced in future phases of the Flood Program.

The estimated cost for this alternative is approximately $4 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Minor Levee Raise with Seepage Berm

An 80-foot-wide seepage berm is another alternative that could be constructed to address underseepage and landside slope stability issues in this Reach. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment, where a minimum berm width seemed appropriate. However, due to the proximity of existing industrial buildings/ improvements at the existing landside levee toe in this Reach, this alternative was not considered feasible and was therefore not considered in this study.

3. Reach 3 (Station 51+63 to Station 70+00)

    a. Alternative 1 – Minor Levee Raise with Waterside Slope Reconstruction and Stability Berm

Reconstructing the waterside slope of the levee (similar to the USACE repair completed in 2009 as part of Contract C) from Stations 70+00 to 86+00 would address waterside slope stability issues in this Reach. The levee would also need to be raised as much as six inches and the waterside slope would be armored with RSP in order to address erosion concerns in this Reach.

The USACE inspections identified two high-hazard encroachments in this Reach, which include a drainage ditch and a storage area surrounded by barbed wire. These encroachments would be relocated or modified incidental to the construction of the improvements. No penetrations were identified in this Reach.

This alternative requires approximately 0.8 acre of land acquisition to accommodate a 20-foot future needs area along the landside toe of the levee. It appears that an access road exists along the landside levee toe, so the required land acquisition may be reduced in future phases of the Flood Program.

The estimated cost for this alternative is approximately $7.2 million.

4. Reach 4 (Station 70+00 to Station 82+82)

    a. Alternative 1 – Minor Levee Raise

To address minor freeboard deficiencies, the levee would need to be raised as much as eight inches in this Reach (average raise is approximately four inches). The waterside toe would be armored with RSP in order to address erosion concerns.

The USACE inspections identified seven penetrations as being unacceptable since they pose a high hazard to levee integrity in this Reach. These items appear to be gas lines, or are associated with the existing pump station located just south of I-80. These penetrations do not appear to have positive closures.

All of these penetrations will need to be modified as part of the levee raising in this Reach.

This alternative requires approximately 0.6 acre of land acquisition to accommodate a 20-foot future needs area along the landside toe of the levee. It appears that an access road exists along the landside levee toe, so the required land acquisition may be reduced in future phases of the Flood Program.

The estimated cost for this alternative is approximately $4.6 million.

5. Reach 5 (Station 82+82 to Station 95+50)

    a. Alternative 1 – Minor Levee Raise with Waterside and Landside Slope Reconstruction

The waterside and landside slopes of the Yolo Bypass East Levee need to be reconstructed in order to address slope stability issues in this Reach. Landside slope repairs should be similar to the landside slope repairs completed in 2011 by USACE as part of Contract D. Waterside reconstruction should be similar to the 2002 USACE Slump Repairs. The levee would also need to be raised as much as nine inches in this Reach (average raise is approximately four inches). The existing RSP would be extended to the new waterside hinge in order to match existing RSP extents.

One high-hazard penetration (30-inch steel pipeline) was identified in this Reach that will need to be modified to be above the 200-year water surface elevation. A positive closure device will also be added to this pipeline. Three high-hazard encroachments were also identified in this Reach. These encroachments include metal standpipes on the levee and utility poles. These will be relocated or modified incidental to the construction of the improvements in this Reach.

This alternative would require 6.4 acres of land acquisition along the landside toe to accommodate the drained toe berm, which extends approximately 30-feet beyond the existing landside toe in this Reach. The estimated cost for this alternative is approximately $10.6 million.

6. Reach 6 (Station 95+50 to Station 114+50)

    a. Alternative 1 – Minor Levee Raise with Waterside Slope Reconstruction

The waterside slope of the Yolo Bypass East Levee needs to be reconstructed in order to address slope stability issues in this Reach. Waterside reconstruction should be similar to the 2002 USACE slump repairs. The levee would also need to be raised as much as eight inches in this Reach (average raise is approximately four inches). The existing RSP would be extended to the new waterside hinge in order to match existing RSP extents.

There were no high-hazard penetrations or encroachments identified in this Reach. One moderate-hazard encroachment (a sign) will be modified as part of the levee raising. The other moderate hazard encroachments (relief wells and monitoring wells) do not appear to be impacted by proposed improvements in this Reach and will therefore not be modified.

This alternative would require 0.9 acre of land acquisition along the landside toe to accommodate a future needs area.

The estimated cost for this alternative is approximately $7.7 million.

7. Reach 7 (Station 114+50 to Station 130+00)

a. Alternative 1 – Minor Levee Raise with Landside Slope Reconstruction

The landside slope of the Yolo Bypass East Levee needs to be reconstructed in order to address slope stability issues in this Reach. Landside slope repairs should be similar to the landside slope repairs completed in 2011 by USACE as part of Contract D. The levee would also need to be raised as much as nine inches in this Reach (average raise is approximately four inches). Rock slope protection would be continued to the proposed waterside hinge in order to match existing extents.

The USACE inspections identified one penetration as being unacceptable since it may pose a high hazard to levee integrity in this Reach. This penetration is associated with the existing pump station located just south of the UPRR tracks. This penetration does not appear to have positive closure devices. This penetration will need to be modified as part of the improvements in this Reach.

An existing fiber-optic line was found to be an unacceptable encroachment in this Reach. This line is located along the landside toe of the levee, so it will need to be modified as part of the landside slope reconstruction project.

This alternative would likely require 0.8 acres of additional right-of-way along the landside toe to accommodate the drained toe berm, which extends approximately 30 feet beyond the existing landside toe in this Reach.

The estimated cost for this alternative is approximately $9.4 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

8. Reach 8 (Station 130+00 to Station 136+00)

   a. Alternative 1 – Minor Levee Raise with Waterside and Landside Slope Reconstruction

The waterside and landside slopes of the Yolo Bypass East Levee need to be reconstructed in order to address slope stability issues in this Reach. Landside slope repairs should be similar to the landside slope repairs completed in 2011 by USACE as part of Contract D. Waterside reconstruction should be similar to the 2002 USACE slump repairs. The levee would also need to be raised as much as nine inches in this Reach (average raise is approximately seven inches). Rock slope protection would be continued to the proposed waterside hinge in order to match existing extents.

The USACE inspections identified two encroachments in this Reach, which included an existing telephone cable conduit and a levee access ramp. These encroachments would be relocated or modified incidental to the construction of the improvements in this Reach. None of these encroachments were rated as high hazard. No penetrations were identified in this Reach.

This alternative would likely require additional right-of-way along the landside toe to accommodate the drained toe berm, which extends approximately 30 feet beyond the existing landside toe in this Reach. This alternative would also require the relocation of the existing drainage canal at the landside toe. A total of approximately one acre of land acquisition is needed to accommodate the improvements in this Reach.

The estimated cost for this alternative is approximately $2.7 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

9. Reach 9 (Station 136+00 to Station 155+00)

   a. Alternative 1 – Levee Raise with Deep Cutoff Wall

A minimum 36-inch-wide, 95-foot-deep cutoff wall could be constructed (to elevation -55) in order to address steady-state underseepage issues in Reach 9. The levee would also need to be raised between 12 and 18 inches in this Reach.

Rock slope protection would be continued to the proposed waterside hinge in order to match existing extents.

The USACE inspections identified three penetrations in this Reach, all of which were identified as being unacceptable since they may pose a high hazard to levee integrity in this Reach. These penetrations will need to be modified due to construction of a cutoff wall in this Reach. There were no encroachments identified in this Reach.

This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly. It is also assumed that RD 900 has access along the landside toe since the RD 900 drainage canal is located along the landside toe.

The estimated cost for this alternative is approximately $10.6 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Levee Raise with Seepage Berm

An 80-foot-wide seepage berm is another alternative that could be constructed to address underseepage issues in this Reach. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment, where a minimum berm width appeared appropriate. However, due to the proximity of an existing drainage canal to the existing landside levee toe in this Reach, the seepage berm may not address the gradient calculated at this ditch. For this reason, this alternative was not considered feasible and was therefore not considered in this study.

10. Reach 10 (Station 155+00 to Station 197+55)

a. Alternative 1 – Levee Raise

To address freeboard deficiencies, the levee would need to be raised between 12 and 18 inches in this Reach. Rock slope protection would be continued to the proposed waterside crown hinge in order to match existing extents.

There is one high-hazard fiber optic penetration identified in this Reach. No other information is available on this penetration. It is assumed that this penetration will need to be modified in this Reach. The USACE inspections also identified two monitoring wells as being high-hazard encroachments since abandonment/decommissioning was unknown. It is assumed that these will need to be abandoned as part of the levee raising in this Reach. No other deficiencies were identified in this Reach.

This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly. It is also assumed RD 900 has access along the landside toe since the RD 900 drainage canal is located along the landside toe.

The estimated cost for this alternative is approximately $1.7 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

G. South Cross Levee

1. Reach 1 (Station 0+00 to Station 65+00)

a. Alternative 1 – Levee Raise with a Shallow Cutoff Wall

A minimum 36-inch-wide, 65-foot-deep cutoff wall could be constructed (to elevation -35) to address steady-state underseepage and landside slope stability issues in the South Cross Levee. Most of this levee would also need to be raised by an average of approximately 4.5 feet to provide adequate freeboard. Landside slope flattening would be accomplished by the levee raising. All four of the penetrations and seven encroachments within this segment would need to be modified due to installation of the cutoff wall. Finally, this alternative would require approximately 4.4 acres of residential and agriculture land to accommodate the increased levee footprint associated with the levee raising and a 20-foot future needs area.

The estimated cost for this alternative is approximately $14.2 million. Despite being more expensive than Alternative 2, this alternative was selected as the preferred remediation measure in this Reach due to sensitivities associated with landside seepage berm improvements. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Levee Raise with a Seepage Berm

An 80-foot-wide seepage berm could also be constructed to address underseepage and landside slope stability issues in the South Cross Levee. The seepage berm width was based on a limited review of the existing explorations and evaluations in this levee segment, where a minimum berm width appeared appropriate. Most of this levee would also need to be raised by an average of

4.5 feet to provide adequate freeboard. Landside slope flattening would be accomplished by the levee raising. All four of the penetrations and seven encroachments within this segment would need to be modified due to installation of the cutoff wall. This alternative would require approximately 17 acres of land acquisition in order to accommodate the seepage berm (including acquisition within residential parcels). Some existing improvements (pole barn) located on the western end of this Reach may need to be removed/relocated. One home located within the footprint of the seepage berm would need to be acquired.

The estimated cost for this alternative is approximately $9.2 million. Due to sensitivities associated with improvements on the landside of the levee, this alternative was not selected as the preferred remediation measure in this Reach.

H. DWSC West Levee

1. Reach 1 (Station 0+00 to Station 35+00)

a. Alternative 1 –Levee Raise with Deep Cutoff Wall

A minimum 36-inch-wide, 100-foot-deep cutoff wall could be constructed (to elevation -60) in order to address both through seepage and steady-state underseepage issues in this Reach. The levee would also need to be raised by approximately 2.5 to 4 feet in this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising will increase the footprint of the “top” of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $22.1 million. This may be reduced with channel-side borrow restrictions and additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

2. Reach 2 (Station 35+00 to Station 60+00)

    a. Alternative 1 – Levee Raise

To address freeboard deficiencies, the levee would need to be raised between 3.5 and 4 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. No other deficiencies were identified in this Reach.

Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

A moderate hazard gas line along the landside toe was identified in this Reach. Since it is not a high hazard, modifications to this gas line will be addressed in a long-term plan in future phases of the Flood Program.

The estimated cost for this alternative is approximately $4.5 million.

3. Reach 3 (Station 60+00 to Station 111+00)

    a. Alternative 1 – Levee Raise with Deep Cutoff Wall

A minimum 36-inch-wide, 95-foot-deep cutoff wall could be constructed (to elevation -60) in order to address underseepage issues in this Reach. The levee would also need to be raised by approximately 3.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $28.8 million. This may be reduced with channel-side borrow restrictions and additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

4. Reach 4 (Station 111+00 to Station 145+00)

    a. Alternative 1 – Levee Raise

    To address freeboard deficiencies, the levee would need to be raised by approximately 3.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. No other deficiencies were identified in this Reach.

    Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

    The estimated cost for this alternative is approximately $5.1 million.

5. Reach 5 (Station 145+00 to Station 165+00)

    a. Alternative 1 – Levee Raise with Shallow Cutoff Wall

    A minimum 36-inch-wide, 65-foot-deep cutoff wall could be constructed (to elevation -30) in order to address underseepage issues in this Reach. The levee would also need to be raised by approximately 2.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

    Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

    The estimated cost for this alternative is approximately $5.7 million. This may be reduced with channel-side borrow restrictions and additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

6. Reach 6 (Station 165+00 to Station 202+00)

    a. Alternative 1 – Levee Raise

    To address freeboard deficiencies, the levee would need to be raised by approximately three feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. No other deficiencies were identified in this Reach.

    Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

    The estimated cost for this alternative is approximately $6 million.

7. Reach 7 (Station 202+00 to Station 290+00)

    a. Alternative 1 – Levee Raise with Embankment Reconstruction

    Reconstructing the existing silty sand levee embankment using low permeability material is an alternative that could be constructed in order to address through seepage issues in this Reach with channel-side borrow restrictions to address underseepage issues. The levee would also need to be raised by approximately 2.5 to 3.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

    Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

    The estimated cost for this alternative is approximately $15.9 million. Due to the increased costs with respect to Alternative 2, this was not selected as the preferred remediation measure in this Reach.

b. Alternative 2 – Levee Raise with Drained Stability Berm

A 10-foot-wide drained stability berm could be constructed in order to address through seepage and landside slope stability issues in this Reach. Channel-side borrow restrictions would also be required with this alternative to address steady-state underseepage deficiencies. The levee would also need to be raised by approximately 2.5 to 3.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising and stability berm will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $15.6 million. This was selected as the preferred remediation measure in this Reach. However, the estimated costs may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

c. Alternative 3 – Levee Raise with a Deep Cutoff Wall

A minimum 36-inch-wide, 90-foot-deep cutoff wall could also be constructed (to elevation -55) in order to address through seepage, underseepage, and landside slope stability issues in this Reach. The levee would also need to be raised by approximately 2.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $47.6 million. Due to the increased costs with respect to Alternative 2, this was not selected as the preferred remediation measure in this Reach.

8. Reach 8 (Station 290+00 to Station 486+00)

   a. Alternative 1 – Levee Raise

   To address freeboard deficiencies, the levee would need to be raised by approximately three to six feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. No other deficiencies were identified in this Reach.

   Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

   The estimated cost for this alternative is approximately $36.9 million.

9. Reach 9 (Station 486+00 to Station 521+00)

   a. Alternative 1 – Levee Raise with Deep Cutoff Wall

   A minimum 36-inch-wide, 95-foot-deep cutoff wall could be constructed (to elevation -60) in order to address steady-state underseepage issues in this Reach. The levee would also need to be raised by approximately three to four feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

   Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $19.7 million. This may be reduced with channel-side borrow restrictions and additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

10. Reach 10 (Station 521+00 to Station 681+00)

a. Alternative 1 – Levee Raise with Deep Cutoff Wall

A minimum 36-inch-wide, 110-foot-deep cutoff wall could be constructed (to elevation -80) in order to address possible through seepage issues and steady-state underseepage issues in this Reach. The levee would also need to be raised by approximately 2.5 to 3.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $102.7 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

11. Reach 11 (Station 681+00 to Station 705+00)

a. Alternative 1 – Levee Raise with Shallow Cutoff Wall

A minimum 36-inch-wide, 25-foot-deep cutoff wall could be constructed (to elevation 5) in order to address through seepage issues in this Reach. The levee would also need to be raised by approximately one to two feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $4.9 million. Despite having increased costs with respect to Alternative 2, this was chosen as the preferred mitigation measure in this reach in order to maintain continuity with the cutoff walls in Reaches 10 and 12. The estimated costs may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Levee Raise with Landside Drained Stability Berm

A 10-foot-wide drained stability berm could be constructed in order to address through seepage issues in this Reach. Landside borrow restrictions would also be required with this alternative to prevent steady-state underseepage deficiencies. The levee would also need to be raised by approximately one to two feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising and stability berm will increase the footprint of the “top” of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $4.1 million. As discussed above, this was not selected as the preferred remediation measure in this Reach.

12. Reach 12 (Station 705+00 to Station 720+00)

a. Alternative 1 – Levee Raise with Shallow Cutoff Wall

A minimum 36-inch-wide, 40-foot-deep cutoff wall could be constructed (to elevation -10) in order to address through seepage issues in this Reach. Channel-side borrow restrictions would also be required with this alternative to address steady-state underseepage deficiencies. The levee would also need to be raised by up to one foot throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. There were no penetrations or encroachments identified in this Reach.

Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $3.9 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

13. Reach 13 (Station 720+00 to Station 1001+00)

a. Alternative 1 – Levee Raise

To address freeboard deficiencies, the levee would need to be raised by approximately 1.5 to 2.5 feet throughout this Reach. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe. No other deficiencies were identified in this Reach.

Although the levee raising will increase the footprint of the "top" of the DWSC West Levee, the proposed improvements will be contained within the overall footprint of the DWSC West Levee. Therefore, additional right-of-way is not expected to be needed to accommodate the proposed levee raising.

The estimated cost for this alternative is approximately $41.5 million.

I. DWSC East Levee

1. Reach 1 (Station 0+00 to Station 8+00)

There were no freeboard, seepage, or erosion issues identified in this Reach. However, the USACE identified five high-hazard encroachments that need to be addressed. These encroachments were identified as being access ramps, a drainage ditch, and excavation near the landside toe of the levee which extends to the crown. To address these items, minor fill and slope reconstruction may be necessary. No additional right-of-way is needed to accommodate these repairs. Also, due to an existing RD 900 drainage canal located along the landside toe, and the DWSC along the waterside toe, no acquisition is expected to be needed for this Reach.

The estimated cost for this Reach is approximately $85,000.

2. Reach 2 (Station 8+00 to Station 15+00)

a. Alternative 1 – Deep Cutoff Wall with Waterside Slope Flattening

A minimum 36-inch-wide, 90-foot-deep cutoff wall could be constructed (to elevation -60) in order to address steady-state underseepage.in this Reach. Waterside slope stability issues were also identified in this Reach due to steep slopes associated with the pump station. Due to existing improvements at this location, slope flattening may not be feasible. Future phases of the Flood Program may include specific explorations and a geotechnical evaluation in the vicinity of the pump station to ensure slopes are stable as constructed.

Between Stations 13+72 and 14+72, RSP would be placed on the waterside slope to address erosion concerns.

The USACE inspections identified two penetrations in this Reach, one of which was rated as unacceptable since it may pose a high hazard to levee integrity. The other penetration appears to be related to the existing pump station near Station 12+50. Both of these penetrations will need to be modified to include positive closure devices with the construction of the cutoff wall.

Three high-hazard encroachments were also identified in this Reach. These pertained to the existing pump Station (i.e.: drainage basin, concrete walls, and fences). These items would either be inspected as part of the cutoff wall improvements and permitted with USACE, or modified if they were found to be a threat to the levee. Eight other encroachments were identified in this Reach that were a moderate hazard. These included access ramps, fences, gates, and signs. All of these encroachments would be modified as part of the cutoff wall improvements.

This alternative would not likely require additional right-of-way since the levee footprint is not expected to change significantly.

The estimated cost for this alternative is approximately $3.6 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Seepage Berm with Waterside Slope Flattening

An 80-foot-wide seepage berm with waterside slope flattening is another alternative that could be constructed to address steady-state underseepage and waterside rapid drawdown slope stability issues in this Reach. However, due to the proximity of an existing drainage canal to the existing landside levee toe in this Reach, this alternative is not considered feasible and was therefore not considered in this study.

3. Reach 3 (Station 15+00 to Station 85+55)

    a. Alternative 1 – Deep Cutoff Wall

A minimum 36-inch-wide, 140-foot-deep cutoff wall could be constructed (to elevation -110) in order to address steady-state underseepage seepage issues in this Reach. Also, due to an existing RD 900 drainage canal located along the landside toe, and the DWSE along the waterside toe, no acquisition is expected to be needed for this Reach.

The USACE inspections identified three high-hazard encroachments in this Reach. These were all access ramps that cut into the levee prism. These ramps would be reconstructed to be outside of the levee prism with the construction of the cutoff wall.

Three high-hazard encroachments were also identified in this Reach. These pertained to the exiting pump station (i.e.: drainage basin, concrete walls, and fences). These items would either be inspected as part of the cutoff wall improvements and permitted with USACE, or modified if they were found to be a threat to the levee. Ten other encroachments were identified in this Reach that were a moderate hazard. These included access ramps, fences, gates, and signs. All of these encroachments would be modified as part of the cutoff wall improvements. There were no penetrations identified in this Reach.

The estimated cost for this alternative is approximately $45.3 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

    b. Alternative 2 – Seepage Berm

An 80-foot-wide seepage berm is another alternative that could be constructed to address steady-state underseepage issues in this Reach. However, due to the proximity of an existing drainage canal and existing homes to the existing landside levee toe in this Reach, this alternative was not considered feasible and was therefore not considered in this study.

4. Reach 4 (Station 85+55 to Station 102+00)

    a. Alternative 1 – Shallow Cutoff Wall

A minimum 36-inch-wide, 60-foot-deep cutoff wall could be constructed (to elevation -30) in order to address steady-state underseepage issues in this Reach. Also, due to an existing RD 900 drainage canal located along the landside toe, and the Yolo Bypass along the waterside toe, no acquisition is expected to be needed for this Reach.

One high-hazard encroachment was found in this Reach: debris on the levee slope. The debris would be removed as part of the cutoff wall project. There were also seven moderate-hazard encroachments in this Reach that included access ramps, signs, and posts within the levee prism. These would be modified due to the construction of the cutoff wall in order to reduce the threat to levee integrity posed by these items.

The estimated cost for this alternative is approximately $2.8 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

    b. Alternative 2 – Seepage Berm

An 80-foot-wide seepage berm is another alternative that could be constructed to address steady-state underseepage issues in this Reach. However, due to the proximity of an existing drainage canal to the existing landside levee toe in this Reach, this alternative is not considered feasible and was therefore not considered in this study.

5. Reach 5 (Station 102+00 to Station 106+00)

    a. Alternative 1 – Shallow Cutoff Wall

A minimum 36-inch-wide, 60-foot-deep cutoff wall could be constructed (to elevation -30) in order to address steady-state underseepage issues in this Reach. Both waterside and landside slope stability issues were also identified in this Reach due to steep slopes associated with the pump station. Due to existing improvements at this location, slope flattening may not be feasible. Future phases of the Flood Program may include specific explorations in the vicinity of the pump station to ensure slopes are stable as constructed. Also, due to an existing RD 900 drainage canal located along the landside toe, and the Yolo Bypass along the waterside toe, no acquisition is expected to be needed for this Reach.

The USACE inspections identified three unacceptable penetrations in this Reach since it may pose a high hazard to levee integrity. One moderate-hazard penetration was also identified. These were related to the pump station penetrations located near Station 104+00. The pump station penetrations will be modified to include positive closure devices and the pipelines will be raised above the DWSE as part of the cutoff wall improvements. The pump station structure was also identified as a high-hazard encroachment in this Reach. Modifications to the pump station facility are not anticipated with construction of the cutoff wall. Future phases of the Flood Program may conduct an inspection of this facility to demonstrate it does not pose an unacceptable risk to levee integrity since relocation/reconstruction of the pump station would significantly increase remediation costs.

The estimated cost for this alternative is approximately $3.8 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Seepage Berm with Waterside Slope Flattening

An 80-foot-wide seepage berm with waterside slope flattening is another alternative that could be constructed to address steady-state underseepage, landside slope stability, and waterside rapid drawdown stability issues in this Reach. However, due to the proximity of an existing drainage canal and existing improvements at the existing landside levee toe in this Reach, this alternative was not considered feasible and was therefore not considered in this study.

6. Reach 6 (Station 106+00 to Station 145+00)

a. Alternative 1 – Shallow Cutoff Wall

A minimum 36-inch-wide, 60-foot-deep cutoff wall could be constructed (to elevation -30) in order to address steady-state underseepage issues in this Reach. Also, due to an existing RD 900 drainage canal located along the landside toe, and the Yolo Bypass along the waterside toe, no acquisition is expected to be needed for this Reach.

Two high-hazard fence encroachments were identified in this Reach. One is a residence located near Station 130+00, and the other is a barbed wire fence near Station 138+00. There were no penetrations identified in this Reach.

The estimated cost for this alternative is approximately $9.5 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

b. Alternative 2 – Seepage Berm

An 80-foot-wide seepage berm is another alternative that could be constructed to address steady-state underseepage issues in this Reach. However, due to proximity of an existing drainage canal to the existing landside levee toe in this Reach, this alternative was not considered feasible and was therefore not considered in this study.

J. Port North Levee

The Port North area is heavily developed with industrial and maritime-related improvements. These improvements pose a significant challenge to developing a preferred flood control alignment without significantly impacting Port operations. The alignment used in this AAR was developed to eliminate "splitting" of the Port, leaving facilities waterward of the levee protection. Since a clear alignment could not be developed along the turning basin and the Port from Stations 135+00 to 235+00, the proposed alignment generally follows the USACE alignment along Industrial Boulevard. This would result in most of the existing facilities in the Port being waterward of the levee alignment. Furthermore, the alternatives proposed for this levee segment would likely require extensive utility research/investigation as well as coordination with existing property and business owners in order to determine the feasibility of implementing the alternatives presented in this section.

The City is pursuing an alternative to construct a closure structure across the Deep Water Ship Channel south of the Port, primarily due to these concerns. This is discussed in more detail in Section VIII of this AAR.

1. Reach 1 (Station 0+00 to Station 8+00)

There were no freeboard, seepage, stability or erosion issues identified in this Reach. No remediation is necessary.

2. Reach 2 (Station 8+00 to Station 26+00)

a. Alternative 1 – Minor Levee Raise with Shallow Cutoff Wall

A minimum 36-inch-wide, 25-foot-deep cutoff wall could be constructed (to elevation zero) in order to address possible nuisance seepage issues in this Reach. The identified potential "nuisance" seepage may result in ongoing maintenance during and following high water events. To address freeboard deficiencies, the levee would need to be raised an average of approximately six inches.

The levee raising will increase the levee footprint width to the landside by five feet or less. There do not appear to be any buildings or structures that would be impacted by widening (an existing paved parking area is approximately 50 feet from the current landside toe), although an additional 2.7 acres of right-of-way would need to be secured to accommodate the increased width and a future needs area along the landside and waterside slopes.

The estimated cost for this alternative is approximately $2.1 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

3. Reach 3 (Station 26+00 to Station 35+50)

a. Alternative 1 – Levee Raise with Waterside Slope Flattening

To address freeboard deficiencies, the levee would need to be raised an average of approximately one foot throughout this Reach. The waterside slope would be flattened to 3H:1V to address waterside rapid drawdown slope stability issues in this Reach.

The levee raising will increase the levee footprint width by approximately six feet. Agrium US, Inc. (Agrium) is a fertilizer production company located in this Reach, and raising the levee through the Agrium property would require modification of ramps and structures that span across the levee. A paved parking area would also be impacted. It is likely that Agrium business operations would be severely impacted by the improvements. Due to the many unknown impacts, an increased contingency of 50 percent was used in this Reach. An approximately 0.6 acre of land acquisition is needed for these improvements.

The estimated cost for this alternative is approximately $1.7 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

4. Reach 4 (Station 35+50 to Station 45+00)

a. Alternative 1 – Levee Raise with Shallow Cutoff Wall

A minimum 36-inch-wide, 25-foot-deep cutoff wall could be constructed (to elevation zero) in order to address possible nuisance seepage issues in this Reach. The identified potential “nuisance” seepage may result in ongoing maintenance during and following high water events. To address freeboard deficiencies, the levee would need to be raised an average of approximately one foot throughout this Reach.

The levee raising will increase the levee footprint width by approximately six feet. There do not appear to be any buildings or structures that would be impacted by widening, although 1.1 acres of land acquisition is needed from the Port for these improvements plus an additional 20 feet along the landside slope for a future needs area.

The estimated cost for this alternative is approximately $1.1 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

5. Reach 5 (Station 45+00 to Station 54+00)

    a. Alternative 1 – Minor Levee Raise with Shallow Cutoff Wall

A minimum 36-inch-wide, 25-foot-deep cutoff wall could be constructed (to elevation zero) in order to address possible nuisance seepage issues in this Reach. The identified potential "nuisance" seepage may result in ongoing maintenance during and following high water events. To address freeboard deficiencies, the levee would need to be raised an average of approximately six inches. The levee raise would extend waterward of existing industrial improvements, which are built up to the existing levee crown.

An existing industrial development with a paved parking and storage area would be impacted by the proposed levee raising and cutoff wall, and approximately 1.2 acres of land would need to be acquired from the property owner and/or the Port to accommodate the proposed improvements and future needs area. Due to increased coordination with the adjacent industrial development, an increased contingency of 50 percent was applied in this Reach.

The estimated cost for this alternative is approximately $1.4 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

6. Reach 6 (Station 54+00 to Station 163+00)

    a. Alternative 1 – Levee Raise with Shallow Cutoff Wall

A minimum 36-inch-wide, 25-foot-deep cutoff wall could be constructed (to elevation zero) in order to address possible nuisance seepage issues in this Reach. The identified potential "nuisance" seepage may result in ongoing maintenance during and following high water events. To address freeboard deficiencies, the levee would need to be raised an average of approximately three feet.

The levee raising will increase the levee footprint width by approximately 15 feet. A Cemex plant is located between Stations 70+00 and 82+00 in this Reach. Raising the levee in this Reach would require close coordination with Cemex to minimize impacts to Cemex's operations. Additionally, the levee would be constructed of fill placed along existing railroad tracks between Stations 125+00 and 134+00. This fill would be on the waterside of the existing levee due to construction conflicts with the existing railroad and Industrial Boulevard. Although the waterside has the potential to introduce hydraulic impacts, as the turning basin is not a conveyance facility, it is likely that the hydraulic impacts are minimal and acceptable. A closure structure would be installed across Boathouse Road near Station 155+70. This alternative would require approximately 25 acres of land acquisition from the Port to accommodate the improvements. Due to the many unknown impacts, an increased contingency of 50 percent was used in this Reach.

Due to the varying geometry of the proposed improvements, a cross section was not created for this Reach. Estimated quantities were developed by estimating the amount of fill needed to construct a new levee with an average height of three feet above existing grade. The working platform for the shallow cutoff wall was assumed to be the existing ground elevation.

The estimated cost for this alternative is approximately $21.2 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

7. Reach 7 (Station 163+00 to Station 236+00)

    a. Alternative 1 – Floodwall with Shallow Cutoff Wall

A minimum 36-inch-wide, 25-foot-deep cutoff wall could be constructed (to elevation zero) in order to address nuisance seepage issues in this Reach. The identified potential for "nuisance" seepage may result in ongoing maintenance during and following high water events, and may detrimentally impact the levee with successive seepage immediately under the levee and exiting at or near the levee toe. To address freeboard deficiencies, a floodwall with an average height of approximately three feet above existing grade would be constructed in this Reach.

The alignment for this alternative follows the USACE GRR alignment along Industrial Boulevard. However, it is noted that different alignments are not expected to significantly change the estimated costs.

This alternative may require demolition of buildings owned/operated by SSA Marine between Stations 165+00 and 175+00. Demolition of these and other buildings near the alignment are included in the cost estimates for this alternative.

Closure structures would be constructed at Harbor Boulevard and Terminal Street. A closure would be also be required across existing railroad tracks. East of Industrial Boulevard, the floodwall and cutoff wall would be constructed waterward of the existing railroad tracks.

Reach 7 is the most challenging Reach for constructing improvements in the Port North area. This alternative would require approximately 6.7 acres of land acquisition from the Port to accommodate the improvements. Due to the many unknown impacts, an increased contingency of 50 percent was used in this Reach.

Due to the varying geometry of the proposed improvements, a cross section was not created for this Reach. Estimated quantities were developed by estimating the concrete and reinforcing steel in a typical floodwall, using the dimensions shown on Figure 14. Asphalt removal and replacement was estimated using aerial imagery. The working platform for the shallow cutoff wall was assumed to be the existing ground elevation.

The estimated cost for this alternative is approximately $20.9 million. This may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

8. Reach 8 (Station 236+00 to Station 244+00)

There were no freeboard, seepage, stability, or erosion issues identified in this Reach. No remediation measures are needed in this Reach.

K. Port South Levee

1. Reach 1 (Station 0+00 to Station 23+00)

a. Alternative 1 – Levee Raise

To address freeboard deficiencies, the levee would need to be raised an average of approximately 18 inches throughout this Reach. No other deficiencies were identified in this Reach.

The levee raising will increase the levee footprint width by approximately 10 feet. There do not appear to be any buildings or structures that would be impacted by widening (existing structures are more than 100 feet from the landside toe), although an additional 6.9 acres of right-of-way would need to be secured to accommodate the increased width and future needs areas.

The estimated cost for this alternative is approximately $1.7 million.

2. Reach 2 (Station 23+00 to Station 116+00)

a. Alternative 1 – Levee Raise with Deep Cutoff Wall

A minimum 36-inch-wide, 120-foot-deep cutoff wall could be constructed (to elevation -95) in order to address steady-state underseepage issues in this Reach. This wall would have to extend 200 feet beyond the ends of this Reach to address end-around effects. For freeboard deficiencies, the levee would need to be raised an average of approximately 18 inches. No other deficiencies were identified in this Reach.

The levee raising will increase the levee footprint width by approximately 10 feet. There is an existing storage tank near Station 26+50 that is approximately 25 feet from the landside levee toe. The fence around this tank is approximately 13 feet from the levee toe and may need to be relocated to accommodate the levee widening. However, it may be possible to address freeboard deficiencies in this area by shifting the levee alignment slightly waterward in order to avoid conflict these facilities. Other than this structure, there do not appear to be any buildings or structures that would be impacted by the widening, although an additional 28.9 acres of right-of-way would need to be secured to accommodate the increased width and a future needs area along the landside and waterside slopes.

The estimated cost for this alternative is approximately $53.5 million. Due to the increased costs with respect to Alternative 2, this was not selected as the preferred remediation measure in this Reach.

b. Alternative 2 – Levee Raise with a Seepage Berm

A 45-foot-wide seepage berm is another option that could be constructed in order to address steady-state underseepage issues in this Reach. This berm would have to extend 200 feet beyond the ends of this Reach to address end-around effects. To address freeboard deficiencies, the levee would need to be raised an average of approximately 18 inches. No other deficiencies were identified in this Reach.

The seepage berm would impact an existing storage tank near Station 26+50 that is approximately 25 feet from the landside levee toe. Other than this structure, there do not appear to be any buildings or structures that would be impacted by the seepage berm, although an additional 40.3 acres of right-of-way would need to be secured to accommodate the increased width and a future needs area along the landside and waterside slopes.

The estimated cost for this alternative is approximately $29.1 million. This was selected as the preferred remediation measure in this Reach. However, the estimated costs may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

3. Reach 3 (Station 116+00 to Station 118+00)

a. Alternative 1 – Levee Raise

To address freeboard deficiencies, the levee would need to be raised an average of approximately 18 inches throughout this Reach. No other deficiencies were identified in this Reach. Due to the relatively short length, underseepage mitigation measures in Reaches 2 and 4 will extend significantly into this Reach.

The estimated cost for this alternative is approximately $732,000.

4. Reach 4 (Station 118+00 to Station 123+50)

a. Alternative 1 – Levee Raise with a Shallow Cutoff Wall

A minimum 36-inch-wide, 45-foot-deep cutoff wall could be constructed (to elevation -20) in order to address steady-state underseepage issues in this Reach. To address freeboard deficiencies, the levee would need to be raised an average of approximately one foot. No other deficiencies were identified in this Reach.

The levee raising will increase the levee footprint width by approximately six feet. There do not appear to be any buildings or structures that would be impacted by the widening, although an additional 2.3 acres of right-of-way would need to be secured to accommodate the increased width and a future needs area along the landside and waterside slopes.

The estimated cost for this alternative is approximately $940,000. Although this alternative is less expensive than Alternative 2, it was not chosen as the preferred remediation measure since it breaks continuity with the seepage berm from Reach 2 (which spans much of Reach 3 due to its small length).

b. Alternative 2 – Levee Raise with a Seepage Berm

A 50-foot-wide seepage berm is another option that could be constructed in order to address steady-state underseepage issues in this Reach. To address freeboard deficiencies, the levee would need to be raised an average of approximately one foot. No other deficiencies were identified in this Reach.

There do not appear to be any buildings or structures that would be impacted by the seepage berm, although an additional 3.4 acres of right-of-way would need to be secured to accommodate the increased width and a future needs area along the landside and waterside slopes.

The estimated cost for this alternative is approximately $2.2 million. Although this is more expensive than Alternative 1, this is the preferred remediation measure for this Reach since it allows continuity with the seepage berm from Reach 2 (which spans Reach 3 due to its small length). These costs may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

5. Reach 5 (Station 123+50 to Station 138+00)

a. Alternative 1 – Levee Raise

To address freeboard deficiencies, the levee would need to be raised an average of approximately 18 inches throughout this Reach, although the maximum raising is nearly five feet. No other deficiencies were identified in this Reach.

The levee raising will increase the levee footprint width by approximately 10 feet. There do not appear to be any buildings or structures that would be impacted by with widening (existing structures are more than 100 feet from the landside toe), although an additional 4.8 acres of right-of-way would need to be secured to accommodate the increased width and a future needs area along the landside and waterside slopes.

The estimated cost for this Reach is approximately $2 million.

6. Reach 6 (Station 138+00 to Station 143+00)

   a. Alternative 1 – Levee Raise with Waterside Slope Flattening

To address freeboard deficiencies, the levee would need to be raised an average of approximately one foot throughout this Reach. The waterside slope would also need to be flattened to 3H:1V in order to address waterside rapid drawdown slope stability issues.

The levee raising will increase the levee footprint width by approximately six feet. There do not appear to be any buildings or structures that would be impacted by the widening, although an additional 1.1 acres of right-of-way would need to be secured for the increased width and landside future needs area.

The estimated cost for this Reach is approximately $585,000. These costs may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

7. Reach 7 (Station 143+00 to Station 186+93)

   a. Alternative 1 – Levee Raise with a Shallow Cutoff Wall

A minimum 36-inch-wide, 25-foot-deep cutoff wall could be constructed (to elevation zero) in order to address nuisance seepage issues in this Reach. The identified potential "nuisance" seepage may result in ongoing maintenance during and following high water events. Additionally, the waterside slope would also be flattened to 3H:1V in order to address waterside rapid drawdown slope stability issues though Station 158+00. To address freeboard deficiencies, the levee would need to be raised by more than four feet. No other deficiencies were identified in this Reach.

The levee raising will increase the levee footprint width by approximately 25 feet. There do not appear to be any buildings or structures that would be impacted by the widening, although an additional 8.2 acres of right-of-way would need to be secured to accommodate the increased width and a future needs area along the landside and waterside slopes.

The estimated cost for this alternative is approximately $6.2 million. These costs may be reduced with additional geotechnical exploration and evaluation, as discussed in Section VIII of this Report.

VII. DESCRIPTION OF THE PREFERRED PLAN

The preferred remediation measure for each Reach is highlighted in bold on Table 4. **Table 5** (attached) presents the estimated costs of the recommended remediation measures in each reach against costs for remediation measures included in previous evaluation efforts. The recommended remediation measures are also shown graphically on **Figure 18** (attached). The preferred remediation measures would require approximately 2.3 million cubic yards of borrow material, as shown in **Table 6** (attached).

The Sacramento River West North Levee would be improved with a combination of shallow and deep cutoff walls, slope flattening, and stability berms. The levee would be raised in localized areas where freeboard was found to be deficient. Rock slope protection would be placed on the waterside slope downstream of the confluence with the American River down to the Tower Bridge.

The Sacramento River West South Levee was found to have a small segment of freeboard deficiency along the Barge Canal. This segment would be raised up to six inches. The Southport EIP project will address other known deficiencies in this levee.

The Sacramento Bypass South Levee would be improved with a seepage berm and waterside slope flattening just downstream of the Sacramento Weir, and rock slope protection would be placed on both sides of the Training Berm to address erosion potential.

The Yolo Bypass East Levee would be raised by up to 18 inches between the Sacramento Bypass and the UPRR tracks. Downstream of the UPRR tracks, the Yolo Bypass East Levee needs to be raised up to six inches. Other improvements in this levee include deep and shallow cutoff walls, waterside and landside slope flattening, and stability berms. Rock slope protection would be placed along this entire levee segment.

The South Cross Levee would be raised several feet, and a shallow cutoff wall would be constructed in order to address identified deficiencies in this levee.

The DWSC West Levee would be improved with deep and shallow cutoff walls and stability berms. The levee would also generally be raised between 2.0 and 3.5 feet. In order to address erosion potential, the upper 30 feet of the waterside slope would be armored with RSP, the lower slope would be seeded (with soil fill added for localized depressions), and a 50-foot-wide riparian corridor would be constructed waterward of the waterside toe of the entire levee. These improvements would be coupled with channel-side borrow restrictions.

The DWSC East Levee would be improved with deep and shallow cutoff walls. Rock slope protection would be placed just south of the Port to address erosion issues identified in this Reach.

The Port North Levee improvements would consist of levee raising, floodwalls, shallow cutoff walls (due to seepage issue resulting from levee raises). The Port South would be improved with raised levees, seepage berms, and waterside slope flattening.

The total estimated cost to plan, permit, design, and construct these improvements is approximately $635 million. Table 3 also presents the costs of “minimum remediation measures” where these may be supported by additional exploration, evaluation, and/or using updated data. Opportunities to reduce the extent of some of the recommended mitigation measures is discussed in the following section.

VIII. POTENTIAL ACTIONS TO REDUCE SELECTED PLAN COSTS

Wood Rodgers’ 2016 PIR was developed using information developed by and contained in previous studies. Where information was incomplete or uncertainties existed, conservative assumptions were made in order to identify deficiencies and recommend mitigation measures. Performing additional geotechnical explorations and analysis or using updated hydrologic data in order to establish a lower DWSE has the potential to reduce estimated Flood Program costs. Furthermore, although construction of a closure structure across the DWSC may increase remediation measures for the DWSC East Levee, this project could also eliminate significant remediation measures required at the Port North, Port South, and DWSC West Levees. The potential remediation measure reductions associated with this potential action are discussed in this section.

A. DWSE Reductions

Freeboard deficiencies were identified using a DWSE that incorporated the USACE Comprehensive Study (Comp Study) hydrology. Over the past several years, DWR and USACE have developed updated hydrology as part of the Central Valley Hydrology Study (CVHS). Although a detailed comparison of the DWSE using Comp Study hydrology vs. CHVS hydrology was not performed for this AAR, qualitative assessments by Wood Rodgers and others suggest that design water surfaces computed using the updated CVHS hydrology are generally lower than those developed using earlier Comp Study hydrology.

If the DWSE was developed using the CVHS hydrology, it is likely that the DWSE could be lowered by as much as one foot in many of the waterways around the City. Although this reduction is not expected to reduce recommended geotechnical remediation measures, it does have the potential to reduce the extent of freeboard improvements, particularly in areas where minor levee raises (i.e., raises less than six inches) are needed.

B. Additional Subsurface Explorations and Geotechnical Evaluation

The geotechnical deficiencies identified were based on a review of available information. If additional geotechnical explorations and analyses are conducted, it may be possible to reduce the estimated remediation costs, as shown in Table 3.

C. DWSC Closure Structure Option

The City is in the process of evaluating the feasibility of constructing a closure structure across the DWSC. The preliminary array of closure structure alternatives includes permanent closures (i.e., earthen levee across the DWSC) and operable closures (i.e., sector gates, lift gates, barge gates and others). The closure structure evaluation is ongoing, but preliminary cost estimates range from approximately $76 million dollars for an earthen levee closure to approximately $365 million for an operable sector gate closure.

A closure across the DWSC could eliminate the need to improve the Port North and Port South levees. It would also greatly reduce the extent of improvements needed to the DWSC West Levee south of the closure. The total length of levees that could potentially be eliminated by constructing a closure structure is approximately 27 miles, or approximately 56 percent of the WSLIP levee system. However, this option would require additional improvements to the DWSC East Levee in order to provide 200-year flood protection based on the DWSE in the Yolo Bypass.

IX. CONCLUSIONS AND RECOMMENDATIONS

This AAR presents the recommended alternatives to mitigate the deficiencies identified in the Wood Rodgers Draft 2016 PIR. These improvements represent the baseline improvements that are needed in order to provide 200-year flood protection to the City. The total estimated cost to plan, permit, design, and construct these improvements is approximately $635 million.

As noted in the previous section, conducting additional explorations or using the latest hydrologic models has the potential to reduce the estimated cost of the baseline improvements to approximately $338 million.

It is recommended that the analysis and preliminary cost estimates developed within this AAR document be used for development of the City's official Flood Program Baseline Program Cost Estimate for a finding of adequate progress in 2016 with respect to ULOP Criteria. It is also recommended that the City consider pursuing additional explorations, evaluation, and the use of updated hydrologic and hydraulic data in order to reduce the estimated Baseline Flood Program Costs.

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XI. ACRONYMS

AAR	Alternatives Analysis Report
BCI	Blackburn Consulting
CB	Cement-Bentonite
CBEC	CBEC, Inc.
CHP	California Highway Patrol
CSM	cutter-soil mixing
CVHS	Central Valley Hydrology Study
CVFPB	Central Valley Flood Protection Board
DSM	deep soil mixing
DWR	California Department of Water Resources
DWSC	Sacramento River Deep Water Ship Channel
DWSE	Design Water Surface Elevation
EIP	Early Implementation Projects (Program)
ENR	Engineering News Record
FEMA	Federal Emergency Management Agency
GRR	General Reevaluation Report
HDR	HDR, Inc.
I-80	Interstate 80
LCM	Life-Cycle Management
MBK	MBK Engineers, Inc.
MHM	MHM, Inc.
MTOL	minimum top-of-levee
NHC	Northwest Hydraulic Consultants

O&M	Operation and Maintenance
PIR	Problem Identification Report
QA	Quality Assurance
RM	River Mile
RSP	rock slope protection
SAFCA	Sacramento Area Flood Control Agency
SB	soil-bentonite
SCB	soil-cement-bentonite
TRD	trench cutting and remixing
ULDC	Urban Levee Design Criteria
ULE	Urban Levee Evaluation
ULOP	Urban Level of Flood Protection
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
VMZ	Vegetation Management Zone
WSAFCA	West Sacramento Area Flood Control Agency
WSLIP	West Sacramento Levee Improvement Program

TABLES

Table 1 – Summary of Identified Deficiencies

Table 2 – Summary of Cutoff Wall Types, Construction Methods, and Costs

Table 3 – Summary of Unit Costs

Table 4 – Remediation Measure Alternatives

Table 5 – Summary of Preferred Remediation Measure Costs, "Minimum Remediation Measures Costs", and Estimated Costs from Previous Studies

Table 6 – Summary of Estimated Earthwork Quantities

FIGURES

Figure 1 – PIR Levee Alignments

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Table 1 – Summary of Identified Deficiencies

Reach	Approximate Station	Seepage		Slope Stability		Erosion	Geometry	Freeboard	Seismic Vulnerability	Penetrations			Encroachments		
		Under-Seepage	Through Seepage	Waterside	Landslide					L	M	H	L	M	H
Sacramento River West North Levee															
Reach 1	0+00 to 43+00		X?			X			n/a	0	5	6	7	24	18
	43+00 to 60+00		X?			X	X	X	n/a	0	1	4	9	1	11
	60+00 to 71+50		X?			X	X		n/a	0	0	1	8	10	10
Reach 2	71+50 to 101+00	The Rivers EIP Project Addressed Identified Deficiencies							n/a	1	0	0	11	1	0
Reach 3	101+00 to 136+00		X?						n/a	0	1	0	7	6	5
Reach 4	136+00 to 152+00	X			X	X	X	X	n/a	0	0	1	1	7	5
Reach 5	152+00 to 161+00	X		X?		X	X	X	n/a	0	1	0	0	2	4
Reach 6	161+00 to 194+60	X	X			X	X	X	n/a	0	7	3	5	12	9
Reach 7	194+60 to 199+60	X?	Need additional geotechnical exploration and evaluation to confirm deficiencies were addressed with the I Street EIP Project						n/a	5	0	0	1	1	0
Reach 8	199+60 to 215+30	X	X			X			n/a	0	3	0	1	4	1
Reach 9	215+30 to 301+57					X	X	X	n/a	0	7	12	4	10	15
Sacramento River West South Levee															
Reach 1	0+00 to 295+00	Deficiencies in this reach are being addressed with the Southport EIP Project.							n/a	-	-	-	-	-	-
Reach 2	295+00 to 315+00	No Deficiencies Identified							n/a	0	0	0	3	4	1
Reach 3	315+00 to 332+70							X	n/a	0	0	0	0	0	0
Sacramento Bypass South Levee															
Reach 1	0+00 to 61+75	The USACE West Sacramento Contract B and the CHP Academy EIP Project Addressed Identified Deficiencies								2	2	0	5	2	2
Reach 2	61+75 to 64+60	X	X				X (to 63+50)		n/a	0	2	3	6	3	0
Training Berm															
Reach	0+00 to 29+10					X			n/a						
Yolo Bypass East Levee															
Reach 1	0+00 to 27+52					X		X	n/a	1	0	0	0	2	0
Reach 2	27+52 to 51+63	X			X	X		X	n/a	0	0	0	1	6	0
Reach 3	51+63 to 70+00			X				X	n/a	0	0	0	1	0	2
Reach 4	70+00 to 82+82							X	n/a	0	3	7	0	4	0
Reach 5	82+82 to 95+50			X	X	X		X	n/a	1	1	1	5	4	3
Reach 6	95+50 to 114+50			X		X		X	n/a	0	0	0	2	6	0
Reach 7	114+50 to 130+00				X			X	n/a	0	0	1	1	0	1
Reach 8	130+00 to 136+00			X	X			X	n/a	0	0	0	0	2	0
Reach 9	136+00 to 155+00	X				X		X	n/a	1	0	2	0	0	0
Reach 10	155+00 to 197+55							X	n/a	0	0	1	3	2	1
South Cross Levee															
Reach 1	0+00 to 5+00	X?			X?		X	X	n/a	0	0	0	0	1	0
	5+00 to 55+00	X			X		X	X	n/a	0	0	3	0	5	0
	55+00 to 65+00	X?			X?				n/a	0	0	1	0	1	0
DSWC West Levee															
Reach 1	0+00 to 35+00	X	X					X	n/a	0	0	0	0	0	0
Reach 2	35+00 to 60+00							X	n/a	0	0	0	0	1	0
Reach 3	60+00 to 111+00	X				X		X	n/a	0	0	0	0	1	0
Reach 4	111+00 to 145+00							X	n/a	0	0	0	0	0	0
Reach 5	145+00 to 165+00	X						X	n/a	0	0	0	0	1	0
Reach 6	165+00 to 202+00					X		X	n/a	-	-	-	-	-	-
Reach 7	202+00 to 290+00	X	X		X?	X		X	n/a	-	-	-	-	-	-
Reach 8	290+00 to 486+00					X		X	n/a	-	-	-	-	-	-
Reach 9	486+00 to 521+00	X				X		X	n/a	-	-	-	-	-	-
Reach 10	521+00 to 681+00	X	X?			X		X	n/a	-	-	-	-	-	-
Reach 11	681+00 to 705+00		X			X		X	n/a	-	-	-	-	-	-
Reach 12	705+00 to 720+00	X	X			X		X	n/a	-	-	-	-	-	-
Reach 13	720+00 to 1001+00					X		X	n/a	-	-	-	-	-	-
DSWC East Levee															
Reach 1	0+00 to 8+00	No Deficiencies Identified							n/a	0	0	0	1	3	4
Reach 2	8+00 to 15+00	X		X (pump station)		X			n/a	0	1	1	1	8	3
Reach 3	15+00 to 85+55	X							n/a	0	0	0	1	10	3
Reach 4	85+55 to 102+00	X				X			n/a	0	0	0	0	7	1
Reach 5	102+00 to 106+00	X		X (pump station)	X? (pump station)	X			n/a	0	1	3	0	2	1
Reach 6	106+00 to 145+00	X (ditches only)				X			n/a	0	0	0	0	8	2
Port North															
Reach 1	0+00 to 8+00	No Deficiencies Identified								0	0	0	0	0	0
Reach 2	8+00 to 26+00							X	n/a	0	0	0	0	0	0
Reach 3	26+00 to 35+50			X		X		X	n/a	0	0	0	0	0	0
Reach 4	35+50 to 45+00							X	n/a	0	1	0	0	0	0
Reach 5	45+00 to 54+00							X	n/a	0	1	0	0	0	0
Reach 6	54+00 to 163+00	X? (from 120+00 to 142+50)						X	n/a	0	1	0	0	0	0
Reach 7	163+00 to 236+00							X	n/a	0	1	0	0	0	0
Reach 8	236+00 to 242+79							X	n/a	0	1	0	0	0	0
Port South															
Reach 1	0+00 to 23+00							X	n/a	0	0	0	0	0	0
Reach 2	23+00 to 116+00	X?						X	n/a	0	0	0	0	0	0
Reach 3	116+00 to 118+00							X	n/a	0	0	0	0	0	0
Reach 4	118+00 to 123+50	X						X	n/a	0	0	0	0	0	0
Reach 5	123+50 to 138+00							X	n/a	0	0	0	0	0	0
Reach 6	138+00 to 143+00			X				X	n/a	0	0	0	0	0	0
Reach 7	143+00 to 186+93		X	X (to 158+00)				X	n/a	0	0	0	0	0	0

X = deficiency identified
X? = deficiency possible, recommend monitoring and/or additional subsurface explorations and/or evaluations
Blank cell = no deficiency identified

TABLE 2 - SUMMARY OF CUTOFF WALL TYPES, CONSTRUCTION METHODS, AND COSTS					
Type of Wall	**Construction Method**	**Max Depth (ft)**	**Working Platform Width (ft)**	**General Range of Unit Cost ($/sf)**	**Typical Mobilization Cost**
SCB	Conventional	85'	30'[1]	$8.00 to $18.00	$75,000 to $125,000
	DSM	200'	50'	$20.00 to $30.00	$100,000 to $150,000
	TRD	180'	50'	$20.00 to $30.00	$150,000 to $200,000
	CSM	110'	30'	$20.00 to $40.00	$150,000 to $200,000
	One Pass Trench (Dewind)	85'	25'	$8.00 to $18.00	$75,000 to $125,000
	Jet Grout	200'+	25'	$75.00 to $150.00	$250,000 to $500,000
SB	Conventional	85'	30'[1]	$7.50 to $12.00	$75,000 to $125,000
	DSM	200'	50'	n/a[3]	$100,000 to $150,000
	TRD	180'	50'	n/a[3]	$150,000 to $200,000
	CSM	110'	30'	n/a[3]	$150,000 to $200,000
	One Pass Trench (Dewind)	85'	25'	$7.00 to $12.00	$75,000 to $125,000
	Jet Grout	200'+	25'	$75.00 to $150.00	$250,000 to $500,000
CB	Conventional	85'	20'[2]	$20.00 to $30.00	$75,000 to $125,000

NOTE: Other site-specific conditions and specification requirements can have a significant influence on costs

1. For Conventional Construction the levee must be degraded at least 1/3 of the height due to geotechnical stability issues.
2. Conventional Construciton of CB Cutoff Wall does not require a 1/3 degrade. The strength of the Cement-Bentonite fill mitigates stability concerns.
3. Limited or missing data

TABLE 3 - SUMMARY OF UNIT COSTS				
Item #	**Description**	**Unit**	**Unit Price**	**Comments**
1	**Lands**			
	Agricultural	AC	$25,000.00	BRI Cost
	Improved Mixed Industrial	AC	$260,000.00	BRI Cost
	Improved Residential	AC	$90,000.00	BRI Cost
	River Mixed Use	AC	$260,000.00	BRI Cost
	Vacant Heavy Industrial	AC	$90,000.00	BRI Cost
	Vacant Public/Quasi Public	AC	$120,000.00	BRI Cost
	Vacant Water Related Ind	AC	$260,000.00	BRI Cost
	Water Related Commercial	AC	$200,000.00	BRI Cost
	Water Related Industrial	AC	$260,000.00	BRI Cost
	Land Acquisition Soft Costs	Parcel	$12,500.00	BRI Cost
	Borrow Site Royalties	AC	$20,000.00	
2	**Mitigation**			
	Upland	AC	$22,000.00	Ascent Cost
	Water	AC	$200,000.00	Ascent Cost
	Riparian	AC	$38,500.00	Ascent Cost
3	**Relocations**			
	Utility Pole Relocation	EA	$30,000.00	
	Irrigation/Drainage Canal Relocation	LF	$110.00	
	Culvert Crossing Relocation	EA	$150,000.00	
	Disharge Pipe Crossing Relocation	EA	$100,000.00	
	Remove and Salvage Ex. Agg. Surfacing	LF	$10.00	
	Class 2 Aggregate Surfacing	TON	$35.00	
	Asphalt Concrete (3.5")	TON	$90.00	
	Concrete Removal and Replacement	SF	$12.00	
	Catch Basin	EA	$2,000.00	
	<2" Pipe Modification	EA	$65,000.00	
	Fence/Gate Modification	EA	$5,000.00	
	2"-5" Pipe Modification	EA	$90,000.00	
	6" Pipe Modification	EA	$125,000.00	
	8" Pipe Modification	EA	$140,000.00	
	10" Pipe Modification	EA	$145,000.00	
	12" Pipe Modification	EA	$150,000.00	
	16" Pipe Modification	EA	$165,000.00	
	18" Pipe Modification	EA	$175,000.00	
	24" Pipe Modification	EA	$225,000.00	
	30" Pipe Modification	EA	$235,000.00	
	36" Pipe Modification	EA	$250,000.00	
	42" Pipe Modification	EA	$250,000.00	
	54" Pipe Modification	EA	$250,000.00	
	72" Pipe Modification	EA	$300,000.00	
	Sign Relocation	EA	$2,500.00	
	Misc Port Facility Modifications/Relocations	EA	$100,000.00	
	Misc Railroad Modification	EA	$250,000.00	
	Misc Building Demolition	EA	$500,000.00	
	12" Fiber Optic	EA	$150,000.00	
	CHP Academy Fence Reloation	LF	$125.00	
	Abandon 36" Bore Casing	EA	$10,000.00	
	Abandon 30" Sewer	EA	$10,000.00	
	Remove Abandoned 4" Gas Line Along Levee	LF	$35.00	
	Misc Relocations	EA	$50,000.00	

TABLE 3 - SUMMARY OF UNIT COSTS				
Item #	**Description**	**Unit**	**Unit Price**	**Comments**
4	**Roads**			
	Mobilization/Demobilization	%	5%	
	Traffic Control	%	3%	
	AC Paving Removal	SY	$20.00	
	AC Paving Replacement	SY	$65.00	
	Aggregate Base, Class 2 (6")	TON	$40.00	
	Striping	LF	$1.00	
5	**Flood Control Features**			
	Mobilization/Demobilization	%	5%	
	Clearing and Grubbing (Levee)	AC	$5,500.00	
	Stripping (Levee)	AC	$6,500.00	
	Erosion Control Seeding (Levee)	AC	$4,000.00	
	Levee Degrading/ Excavation	CY	$8.50	
	Inspection Trench Excavation	CY	$8.50	
	Seepage Berm Fill (Soil Type 2)	CY	$6.00	
	Levee Embankment Fill (Soil Type 2)	CY	$6.00	
	Clay Cap Fill (Soil Type 1)	CY	$6.00	
	Cutoff Wall <75' (Soil Bentonite)	SF	$10.00	
	Cutoff Wall <75' (Cement Bentonite)	SF	$30.00	
	Cutoff Wall >75' (SCB by DSM)	SF	$25.00	
	Drain Rock	TON	$45.00	
	Sand Filter Layer	TON	$45.00	
	Filter Fabric	SY	$3.00	
	Haul and Dispose of Unsuitable Material	CY	$15.00	
	Excavation (Borrow Site)	CY	$5.00	
	Clearing and Grubbing (Borrow Site)	AC	$5,500.00	
	Stripping (Borrow Site)	AC	$6,500.00	
	Erosion Control Seeding (Borrow Site)	AC	$4,000.00	
	Hauling Level 1 (< 5 miles)	CY	$4.35	
	Hauling Level 2 (5 miles - 10 miles)	CY	$7.50	
	Hauling Level 3 (> 10 miles)	CY	$14.00	
	Rock Slope Protection	TON	$95.25	
6	**Other Project Costs**			
	Land Acquisition Contingency	%	15%	
	Contingency	%	30%	
	Contingency (High)	%	50%	
	Flood Control Features Contingency	%	30%	
	Planning, Engineering, & Design	%	7%	
	Construction Management	%	5%	

TABLE 4 - REMEDIATION MEASURE ALTERNATIVES

Levee	Reach	Start STA	End STA	Alternative	Stability Berm	Seepage Berm	Shallow Cutoff Wall	Deep Cutoff Wall	Levee Raise	Geometry Repair / Slope Flattening	Rock Slope Protection	Riparian Corridor at the Waterside Toe	Estimated Cost	Notes
Sacramento River West North Levee	Reach 1	0+00	71+50	Alternative 1			X		X				**$23,373,000**	
				~~Alternative 2~~	X				X				--	Existing improvements (UPRR tracks and Riverbank Road) along the landside of the levee preclude construction of a stability berm in this Reach. Therefore, this measure has been screened out.
				Minimum Remediation*					X				$5,330,000	Minimum Remediation* alternative would eliminate the need for seepage mitigation measures in this reach. Residual O&M concerns may still exist on WS slopes. Additional monitoring is needed to support this alternative.
	Reach 2	71+50	101+00		No Improvement Needed.								**$0**	Remediation was completed as part of The Rivers EIP Project
	Reach 3	101+00	136+00	~~Alternative 1~~			X						--	New homes along River Crest Drive could make constructability of the cutoff wall difficult in this Reach. For this reason, the cutoff wall alternative was screened out.
				Alternative 2	X								**$5,172,000**	
				Minimum Remediation*									$57,000	Minimum Remediation* alternative would eliminate the need for seepage mitigation measures in this reach. Residual O&M concerns may still exist on WS slopes. Additional monitoring is needed to support this alternative.
	Reach 4	136+00	152+00	Alternative 1				X	X				**$7,694,000**	
				~~Alternative 2~~		X			X				--	The Regatta apartments are located immediately adjacent to the landside toe of the levee. This makes implementation of a seepage berm infeasible. Therefore, this alternative was screened out.
				Minimum Remediation*			X		X				$748,000	Minimum Remediation* reduces cutoff wall to elevation 0. Additional explorations and evaluations are needed to support this alternative.
	Reach 5	152+00	161+00	Alternative 1				X		X	X		**$6,922,000**	
				~~Alternative 2~~		X				X	X		--	The proximity of Lighthouse Road to the landside toe of the levee makes implementation of a seepage berm difficult. Therefore, this alternative was screened out.
				Minimum Remediation*			X			X	X		$2,216,000	Minimum Remediation* reduces cutoff wall to elevation 0. Additional explorations and evaluations are needed to support this alternative.
	Reach 6	161+00	194+60	Alternative 1				X	X		X		**$22,923,000**	
				~~Alternative 2~~		X			X		X		--	Seepage berm screened out due to proximity of existing residential and municipal improvements to the landside levee toe.
				Minimum Remediation*			X		X		X		$9,331,000	Minimum Remediation* reduces cutoff wall to elevation 0. Additional explorations and evaluations are needed to support this alternative.
	Reach 7	194+60	199+60					X					**$0**	Additional Analysis is needed to confirm I Street Bridge EIP Project addressed known deficiencies.
	Reach 8	199+60	215+30	Alternative 1				X			X		**$10,273,000**	
				~~Alternative 2~~		X					X		--	Seepage berm screened out due to proximity of existing commercial properties to the landside levee toe.
				Minimum Remediation*			X				X		$3,956,000	Minimum Remediation* reduces cutoff wall to elevation 0. Additional explorations and evaluations are needed to support this alternative.
	Reach 9	215+30	301+57	Alternative 1						X			**$10,759,000**	
				Minimum Remediation*									$7,260,000	Minimum Remediation* defers slope flattening as a maintenance item.

*NOTES: 1) Minimum Remediation requires additional geotechnical exploration and evaluation in order to support

2) All slopes and disturbed areas that are not armored with RSP will be seeded, and localized depressions will be filled with soil as needed

X = Remediation Measure Considered

X = Remediation Measure Screened Out as Being Infeasible

$$$$ = Preferred Remediation Measure

$$$$ = Remediation Measure Not Selected

TABLE 4 - REMEDIATION MEASURE ALTERNATIVES

Levee	Reach	Start STA	End STA	Alternative	Stability Berm	Seepage Berm	Shallow Cutoff Wall	Deep Cutoff Wall	Levee Raise	Geometry Repair / Slope Flattening	Rock Slope Protection	Riparian Corridor at the Waterside Toe	Estimated Cost	Notes
Sacramento River West South Levee	Reach 1	0+00	295+00		No Improvement Needed.								**$0**	Southport EIP Project will address known deficiencies.
	Reach 2	295+00	315+00		No Improvement Needed.								**$0**	No deficiencies found in this reach
	Reach 3	315+00	329+34	Alternative 1					X				**$3,442,000**	Levee Raise is only about 6". May be eliminated if future DWSEs are lower.
Sacramento Bypass South Levee	Reach 1	0+00	61+75		No Improvement Needed.								**$0**	
	Reach 2	61+75	64+60	Alternative 1				X		X			$4,922,000	
				Alternative 2		X				X			**$3,091,000**	
				Minimum Remediation*			X			X			$2,545,000	Minimum Remediation* reduces cutoff wall to elevation 5. Additional explorations and evaluations are needed to support this alternative.
Training Berm	Reach 1	0+00	End	Alternative 1							X		**$9,654,000**	
Yolo Bypass East Levee	Reach 1	0+00	27+52	Alternative 1					X		X		**$2,756,000**	
	Reach 2	27+52	51+63	Alternative 1			X		X		X		**$3,964,000**	
				~~Alternative 2~~		X			X		X		--	Seepage berm screened out due to the proximity of existing industrial building to the landside levee toe.
				Minimum Remediation*					X		X		$2,407,000	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 3	51+63	70+00	Alternative 1	X				X	X	X		**$7,150,000**	
	Reach 4	70+00	82+82	Alternative 1					X		X		**$4,586,000**	
	Reach 5	82+82	95+50	Alternative 1					X	X	X		**$10,619,000**	
	Reach 6	95+50	114+50	Alternative 1					X	X	X		**$7,717,000**	
	Reach 7	114+50	130+00	Alternative 1					X	X	X		**$9,365,000**	
				Minimum Remediation*					X		X		$2,002,000	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 8	130+00	136+00	Alternative 1					X	X	X		**$2,683,000**	
				Minimum Remediation*					X		X		$617,000	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 9	136+00	155+00	Alternative 1				X	X		X		**$10,580,000**	
				~~Alternative 2~~		X			X		X		--	Seepage berm screened out since it would require filling the existing drainage ditch along the landside of the levee.
				Minimum Remediation*					X		X		$2,067,000	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 10	155+00	197+55						X		X		**$1,658,000**	
South Cross Levee	Reach 1	0+00	65+00	Alternative 1			X		X	X			**$14,216,000**	Cutoff wall alternative chosen as the preferred remediation measure due to landside land acquisition sensitivities
				Alternative 2		X			X	X			$9,156,000	
				Minimum Remediation*					X	X			$6,673,000	Minimum Remediation* reduces seepage remediation to none, or landside slope flattening. Additional explorations and evaluations are needed to support this alternative.

*NOTES: 1) Minimum Remediation requires additional geotechnical exploration and evaluation in order to support

2) All slopes and disturbed areas that are not armored with RSP will be seeded, and localized depressions will be filled with soil as needed

X = Remediation Measure Considered

X = Remediation Measure Screened Out as Being Infeasible

$$$$ = Preferred Remediation Measure

$$$$ = Remediation Measure Not Selected

TABLE 4 - REMEDIATION MEASURE ALTERNATIVES

Levee	Reach	Start STA	End STA	Alternative	Stability Berm	Seepage Berm	Shallow Cutoff Wall	Deep Cutoff Wall	Levee Raise	Geometry Repair / Slope Flattening	Rock Slope Protection	Riparian Corridor at the Waterside Toe	Estimated Cost	Notes
DWSC West Levee	Reach 1	0+00	35+00	Alternative 1				X	X		X	X	**$22,147,000**	
				Minimum Remediation*					X		X	X	$7,963,000	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 2	35+00	60+00	Alternative 1					X		X	X	**$4,461,000**	Confirm that seepage mitigation is not required with additional explorations and evaluation
	Reach 3	60+00	111+00	Alternative 1				X	X		X	X	**$28,816,000**	
				Minimum Remediation*					X		X	X	$6,535,000	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 4	111+00	145+00	Alternative 1					X		X	X	**$5,051,000**	Confirm that seepage mitigation is not required with additional explorations
	Reach 5	145+00	165+00	Alternative 1			X		X		X	X	**$5,745,000**	
				Minimum Remediation*					X		X	X	$3,378,000	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 6	165+00	202+00	Alternative 1					X		X	X	**$6,016,000**	Confirm that seepage mitigation is not required with additional explorations and evaluation
	Reach 7	202+00	290+00	Alternative 1					X		X	X	$15,902,000	If levee raising is done with low permeability material, through seepage and stability deficiencies may be addressed.
				Alternative 2	X				X		X	X	**$15,624,000**	If levee raising is done with low permeability material, through seepage and stability deficiencies may be addressed.
				Alternative 3				X	X		X	X	$47,604,000	If levee raising is done with low permeability material, seepage issues may be addressed.
				Minimum Remediation*					X		X	X	$14,489,000	Minimum Remediation* reduces seepage remediation to reconstructing the existing embankment with low permeability material with waterside borrow restrictions and replacement of sand in levee with select low permeability material. Additional explorations and evaluations are needed to support this alternative.
	Reach 8	290+00	486+00	Alternative 1					X		X	X	**$36,939,000**	Confirm that seepage mitigation is not required with additional explorations
	Reach 9	486+00	521+00	Alternative 1				X	X		X	X	**$19,702,000**	
				Minimum Remediation*					X		X	X	$6,383,000	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 10	521+00	681+00	Alternative 1				X	X		X	X	**$102,699,000**	
				Minimum Remediation*					X		X	X	$29,029,000	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 11	681+00	705+00	Alternative 1			X		X		X	X	**$4,933,000**	Waterside borrow restrictions are also required
				Alternative 2	X				X		X	X	$4,072,000	
				Minimum Remediation*					X		X	X	$3,636,000	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 12	705+00	720+00	Alternative 1			X		X		X	X	**$3,922,000**	Waterside borrow restrictions are also required
				Minimum Remediation*					X		X	X	$2,733,000	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 13	720+00	1001+00	Alternative 1					X		X	X	**$41,522,000**	

*NOTES: 1) Minimum Remediation requires additional geotechnical exploration and evaluation in order to support

2) All slopes and disturbed areas that are not armored with RSP will be seeded, and localized depressions will be filled with soil as needed

X = Remediation Measure Considered

X = Remediation Measure Screened Out as Being Infeasible

$$$$ = Preferred Remediation Measure

$$$$ = Remediation Measure Not Selected

TABLE 4 - REMEDIATION MEASURE ALTERNATIVES

Levee	Reach	Start STA	End STA	Alternative	Stability Berm	Seepage Berm	Shallow Cutoff Wall	Deep Cutoff Wall	Levee Raise	Geometry Repair / Slope Flattening	Rock Slope Protection	Riparian Corridor at the Waterside Toe	Estimated Cost	Notes
DWSC East Levee	Reach 1	0+00	8+00	No Improvement Needed.									**$85,000**	Cost includes encroachment modifications.
	Reach 2	8+00	15+00	Alternative 1				X		X	X		**$3,591,000**	
				~~Alternative 2~~		X				X	X		--	Seepage berm screened out since it would require filling the existing drainage ditch along the landside of the levee.
	Reach 3	15+00	85+55	Alternative 1				X					**$45,283,000**	
				~~Alternative 2~~		X							--	Seepage berm screened out since it would require filling the existing drainage ditch along the landside of the levee.
				Minimum Remediation*									$0	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 4	85+55	102+00	Alternative 1			X						**$2,775,000**	
				~~Alternative 2~~		X							--	Seepage berm screened out since it would require filling the existing drainage ditch along the landside of the levee.
				Minimum Remediation*									$0	Minimum Remediation* reduces seepage remediation to none with waterside borrow restrictions. Additional explorations and evaluations are needed to support this alternative.
	Reach 5	102+00	106+00	Alternative 1			X						**$3,777,000**	Slope flattening not included since it is not possible in this Reach due to presence of the pump station
				~~Alternative 2~~		X							--	Slope flattening not included since it is not possible in this Reach due to presence of the pump station
	Reach 6	106+00	145+00	Alternative 1			X						**$9,544,000**	
				~~Alternative 2~~		X							--	
				Minimum Remediation*									$0	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
Port North Levee	Reach 1	0+00	8+00	No Improvement Needed										
	Reach 2	8+00	26+00	Alternative 1			X		X				**$2,141,000**	
				Minimum Remediation*					X				$1,320,000	If no seepage measures are implemented, nuisance seepage may result.
	Reach 3	26+00	35+50	Alternative 1					X	X			**$1,681,000**	
				Minimum Remediation*					X				$1,628,000	Minimum Remediation* reduces stability remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 4	35+50	45+00	Alternative 1			X		X				**$1,082,000**	
				Minimum Remediation*					X				$709,000	If no seepage measures are implemented, nuisance seepage may result.
	Reach 5	45+00	54+00	Alternative 1			X		X				**$1,399,000**	
				Minimum Remediation*					X				$903,000	If no seepage measures are implemented, nuisance seepage may result.
	Reach 6	54+00	163+00	Alternative 1			X		X				**$21,185,000**	
				Minimum Remediation*					X				$15,498,000	If no seepage measures are implemented, nuisance seepage may result.
	Reach 7	163+00	236+00	Alternative 1			X		X				**$20,937,000**	
				Minimum Remediation*					X				$17,141,000	If no seepage measures are implemented, nuisance seepage may result.
	Reach 8	236+00	244+00	No Improvement Needed									**$0**	
Port South Levee	Reach 1	0+00	23+00	Alternative 1					X				**$1,683,000**	
	Reach 2	23+00	116+00	Alternative 1				X	X				$53,540,000	
				Alternative 2		X			X				**$29,058,000**	
				Minimum Remediation*					X				$20,152,000	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 3	116+00	118+00	Alternative 1					X				**$732,000**	
	Reach 4	118+00	123+50	Alternative 1			X		X				$940,000	
				Alternative 2		X			X				**$2,244,000**	
				Minimum Remediation*					X				$865,000	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.
	Reach 5	123+50	138+00	Alternative 1					X				**$1,967,000**	
	Reach 6	138+00	143+00	Alternative 1					X	X			**$585,000**	
	Reach 7	143+00	186+93	Alternative 1			X		X				**$6,229,000**	
				Minimum Remediation*			X		X				$3,990,000	Minimum Remediation* reduces seepage remediation to none. Additional explorations and evaluations are needed to support this alternative.

*NOTES: 1) Minimum Remediation requires additional geotechnical exploration and evaluation in order to support
2) All slopes and disturbed areas that are not armored with RSP will be seeded, and localized depressions will be filled with soil as needed

X = Remediation Measure Considered

X = Remediation Measure Screened Out as Being Infeasible

$$$$ = Preferred Remediation Measure

$$$$ = Remediation Measure Not Selected

Table 5 - Summary of Preferred Mitigation Measure Costs, "Minimum Remediation Measure Costs" and Estimated Costs from Previous Studies								
		Wood Rodgers 2016 Draft AAR				DWR GER	USACE GRR	2008 PIR
Levee	Reach	Reach Start STA	Reach End STA	Preferred Plan Costs	Preferred Plan w/ Minimum Measures	Cost	Cost	Cost
Sac River South Levee	Reach 1	0+00	295+00	-	-			
	Reach 2	295+00	315+00	$0	$0			
	Reach 3	315+00	332+70	$3,442,000	$3,442,000	$5,013,000		
	Total Sac River West South Levee			$3,442,000	$3,442,000	$5,013,000	$0	$0
Sac River North Levee	Reach 1	0+00	71+50	$23,373,000	$5,330,000	$8,622,000		
	Reach 2	71+50	101+00	$0	$0	$0		
	Reach 3	101+00	136+00	$5,172,000	$57,000	$4,963,000		
	Reach 4	136+00	152+00	$7,694,000	$748,000	$5,377,000		
	Reach 5	152+00	161+00	$6,922,000	$2,216,000		$278,289,000	$77,702,200
	Reach 6	161+00	194+60	$22,923,000	$9,331,000			
	Reach 7	194+60	199+60	$0	$0	$32,466,000		
	Reach 8	199+60	215+30	$10,273,000	$3,956,000			
	Reach 9	215+30	301+57	$10,759,000	$7,260,000	$10,024,000		
	Total Sac River West North Levee			$87,116,000	$28,898,000	$61,452,000	$278,289,000	$77,702,200
South Cross Levee		0+00	65+00	$14,216,000	$6,673,000	$11,160,000	$29,215,000	$11,684,000
	Total South Cross Levee			$14,216,000	$6,673,000	$11,160,000	$29,215,000	$11,684,000
Sac Bypass South	Reach 2	61+75	64+60	$3,091,000	$2,545,000	$16,165,000	$0	$9,347,600
	Total Sacramento Bypass South			$3,091,000	$2,545,000	$16,165,000	$0	$9,347,600
Training Berm		0+00	29+10	$9,654,000	$9,654,000	$12,992,000	$7,868,000	0
	Total Training Berm			$9,654,000	$9,654,000	$12,992,000	$7,868,000	$0
Yolo Bypass East Levee	Reach 1	0+00	27+52	$2,756,000	$2,756,000	$3,376,000		
	Reach 2	27+52	51+63	$3,964,000	$2,407,000	$7,078,000		
	Reach 3	51+63	70+00	$7,150,000	$7,150,000	$7,129,000		
	Reach 4	70+00	82+82	$4,586,000	$4,586,000	$5,864,000		
	Reach 5	82+82	95+50	$10,619,000	$10,619,000		$28,745,000	$51,530,600
	Reach 6	95+50	114+50	$7,717,000	$7,717,000	$31,493,000		
	Reach 7	114+50	130+00	$9,365,000	$2,002,000			
	Reach 8	130+00	136+00	$2,683,000	$617,000			
	Reach 9	136+00	155+00	$10,580,000	$2,067,000	$2,287,000		
	Reach 10	155+00	197+55	$1,658,000	$1,658,000	$4,465,000		
	Total Yolo Bypass East Levee			$61,078,000	$41,579,000	$61,692,000	$28,745,000	$51,530,600
Deep Water Ship Channel E.	Reach 1	0+00	8+00	$85,000	$85,000			
	Reach 2	8+00	15+00	$3,591,000	$3,591,000			
	Reach 3	15+00	85+55	$45,283,000	$0	$2,740,000	$123,467,000	$6,140,800
	Reach 4	85+55	102+00	$2,775,000	$0			
	Reach 5	102+00	106+00	$3,777,000	$3,777,000			
	Reach 6	106+00	145+00	$9,544,000	$0			
	Total DWSC East Levee			$65,055,000	$7,453,000	$2,740,000	$123,467,000	$6,140,800

Table 5 - Summary of Preferred Mitigation Measure Costs, "Minimum Remediation Measure Costs" and Estimated Costs from Previous Studies								
		Wood Rodgers 2016 Draft AAR				DWR GER	USACE GRR	2008 PIR
Levee	Reach	Reach Start STA	Reach End STA	Preferred Plan Costs	Preferred Plan w/ Minimum Measures	Cost	Cost	Cost
Deep Water Ship Channel W.	Reach 1	0+00	35+00	$22,147,000	$7,963,000	$97,780,000	$311,234,000	$144,813,800
	Reach 2	35+00	60+00	$4,461,000	$4,461,000			
	Reach 3	60+00	111+00	$28,816,000	$6,535,000			
	Reach 4	111+00	145+00	$5,051,000	$5,051,000			
	Reach 5	145+00	165+00	$5,745,000	$3,378,000			
	Reach 6	165+00	202+00	$6,016,000	$6,016,000			
	Reach 7	202+00	290+00	$15,624,000	$14,489,000			
	Reach 8	290+00	486+00	$36,939,000	$36,939,000			
	Reach 9	486+00	521+00	$19,702,000	$6,383,000			
	Reach 10	521+00	681+00	$102,699,000	$29,029,000			
	Reach 11	681+00	705+00	$4,933,000	$3,636,000			
	Reach 12	705+00	720+00	$3,922,000	$2,733,000			
	Reach 13	720+00	1001+11	$41,522,000	$41,522,000			
			Total DWSC West Levee	**$297,577,000**	**$168,135,000**	**$97,780,000**	**$311,234,000**	**$144,813,800**
Port South	Reach 1	0+00	23+00	$1,683,000	$1,683,000	$3,719,000	$8,222,000	$9,048,500
	Reach 2	23+00	116+00	$29,058,000	$20,152,000			
	Reach 3	116+00	118+00	$732,000	$732,000			
	Reach 4	118+00	123+50	$2,244,000	$865,000			
	Reach 5	123+50	138+00	$1,967,000	$1,967,000			
	Reach 6	138+00	143+00	$585,000	$585,000			
	Reach 7	143+00	186+93	$6,229,000	$3,990,000			
			Total Port South Levee	**$42,498,000**	**$29,974,000**	**$3,719,000**	**$8,222,000**	**$9,048,500**
Port North	Reach 1	0+00	8+00	$0	$0	$7,800,000	$0	$37,649,800
	Reach 2	8+00	26+00	$2,141,000	$1,320,000			
	Reach 3	26+00	35+50	$1,681,000	$1,628,000			
	Reach 4	35+50	45+00	$1,082,000	$709,000			
	Reach 5	45+00	54+00	$1,399,000	$903,000			
	Reach 6	54+00	163+00	$21,185,000	$15,498,000			
	Reach 7	163+00	236+00	$20,937,000	$17,141,000			
	Reach 8	236+00	242+79	$0	$0			
			Total Port North Levee	**$48,425,000**	**$37,199,000**	**$7,800,000**	**$0**	**$37,649,800**
Stone Lock Structure	-	-	-	$2,500,000	$2,500,000	$0	$31,463,000	$0
			Total	**$634,652,000**	**$338,052,000**	**$280,513,000**	**$818,503,000**	**$347,917,300**

Table 6 - Summary of Estimated Earthwork Quantities									
Levee					Estimated Earthwork Quantities for the Preferred Alternative				
	Reach	Reach Start STA	Reach End STA	Preferred Alternative	Berm Fill (CY)	Levee Embankment Fill (CY)	Clay Cap Fill (CY)	Hauling and Disposal of Unsuitable Material (CY)	Borrow Site Excavation (CY)
Sac River South Levee	Reach 1	0+00	295+00	N/A	0	0	0	0	0
	Reach 2	295+00	315+00	N/A	0	0	0	0	0
	Reach 3	315+00	332+70	Alt 1	0	636	0	53	909
	Total Sac River West South Levee				**0**	**636**	**0**	**53**	**909**
Sac River North Levee	Reach 1	0+00	71+50	Alt 1	0	4,887	0	4,315	6,982
	Reach 2	71+50	101+00	None	N/A	N/A	N/A	N/A	N/A
	Reach 3	101+00	136+00	Alt 2?	20,702	5,334	0	5,334	37,194
	Reach 4	136+00	152+00	Alt 1	0	2,282	6,050	7,298	11,903
	Reach 5	152+00	161+00	Alt 1	0	6,946	2,930	9,543	14,108
	Reach 6	161+00	194+60	Alt 1	0	7,557	9,147	10,476	23,862
	Reach 7	194+60	199+60	N/A	0	0	0	0	0
	Reach 8	199+60	215+30	Alt 1	0	2,091	4,559	6,068	9,499
	Reach 9	215+30	301+57	Alt 1	0	0	0	12,781	0
	Total Sac River West North Levee				**20,702**	**29,097**	**22,686**	**55,815**	**103,549**
South Cross Levee		0+00	65+00	Alt 1	0	77,000	21,330	19,582	140,471
	Total South Cross Levee				**0**	**77,000**	**21,330**	**19,582**	**140,471**
Sac Bypass South	Reach 2	61+75	64+60	Alt 2	6,370	4,410	0	2,183	15,399
	Total Sacramento Bypass South				**6,370**	**4,410**	**0**	**2,183**	**15,399**
Training Berm		0+00	29+10	Alt 1	0	12,804	0	7,092	18,291
	Total Training Berm				**0**	**12,804**	**0**	**7,092**	**18,291**
Yolo Bypass East Levee	Reach 1	0+00	27+52	Alt 1	0	11,614	0	4,184	16,592
	Reach 2	27+52	51+63	Alt 1	0	2,913	5,005	7,025	11,311
	Reach 3	51+63	70+00	Alt 1	17,254	57,484	0	55,000	106,770
	Reach 4	70+00	82+82	Alt 1	0	6,116	0	1,842	8,737
	Reach 5	82+82	95+50	Alt 1	0	117,000	0	90,000	117,000
	Reach 6	95+50	114+50	Alt 1	0	110,000	0	84,000	110,000
	Reach 7	114+50	130+00	Alt 1	0	85,000	0	65,000	85,000
	Reach 8	130+00	136+00	Alt 1	0	15,595	0	15,180	22,279
	Reach 9	136+00	155+00	Alt 1	0	12,146	10,239	18,909	31,978
	Reach 10	155+00	197+55	Alt 1	0	12,458	0	3,711	17,797
	Total Yolo Bypass East Levee				**17,254**	**430,326**	**15,243**	**344,850**	**527,463**
Deep Water Ship Channel E.	Reach 1	0+00	8+00	N/A	0	0	0	0	0
	Reach 2	8+00	15+00	Alt 1	0	607	1,973	2,144	3,685
	Reach 3	15+00	85+55	Alt 1	0	16,422	32,322	44,825	69,635
	Reach 4	85+55	102+00	Alt 1	0	2,195	7,165	8,629	13,372
	Reach 5	102+00	106+00	Alt 1	0	83	1,333	1,120	2,023
	Reach 6	106+00	145+00	Alt 1	0	5,449	15,716	19,720	30,235
	Total DWSC East Levee				**0**	**24,757**	**58,509**	**76,439**	**118,951**

Table 6 - Summary of Estimated Earthwork Quantities									
					Estimated Earthwork Quantities for the Preferred Alternative				
Levee	Reach	Reach Start STA	Reach End STA	Preferred Alternative	Berm Fill (CY)	Levee Embankment Fill (CY)	Clay Cap Fill (CY)	Hauling and Disposal of Unsuitable Material (CY)	Borrow Site Excavation (CY)
Deep Water Ship Channel W.	Reach 1	0+00	35+00	Alt 1	0	60,471	12,289	0	103,943
	Reach 2	35+00	60+00	Alt 1	0	20,194	0	0	28,849
	Reach 3	60+00	111+00	Alt 1	0	28,599	17,756	0	66,220
	Reach 4	111+00	145+00	Alt 1	0	3,022	0	0	4,317
	Reach 5	145+00	165+00	Alt 1	0	8,497	6,363	0	21,229
	Reach 6	165+00	202+00	Alt 1	0	18,849	0	0	26,928
	Reach 7	202+00	290+00	Alt 2	1,108	50,176	0	0	73,263
	Reach 8	290+00	486+00	Alt 1	0	192,697	0	0	275,281
	Reach 9	486+00	521+00	Alt 1	0	25,389	10,876	0	51,807
	Reach 10	521+00	681+00	Alt 1	0	115,268	50,370	0	236,626
	Reach 11	681+00	705+00	Alt 1	0	3,468	6,364	0	14,046
	Reach 12	705+00	720+00	Alt 1	0	12,413	3,961	0	23,391
	Reach 13	720+00	1001+11	Alt 1	0	36,179	0	0	51,684
	Total DWSC West Levee				**1,108**	**575,223**	**107,979**	**0**	**977,587**
Port South	Reach 1	0+00	23+00	Alt 1	0	9,541	0	1,763	13,630
	Reach 2	23+00	116+00	Alt 2	64,703	40,984	0	21,753	150,980
	Reach 3	116+00	118+00	Alt 1	0	4,953	0	4,634	7,076
	Reach 4	118+00	123+50	Alt 2	5,308	2,974	0	1,847	11,833
	Reach 5	123+50	138+00	Alt 1	0	3,539	0	709	5,056
	Reach 6	138+00	143+00	Alt 1	0	1,508	0	542	2,155
	Reach 7	143+00	186+93	Alt 1	0	7,318	11,074	6,554	26,274
	Total Port South Levee				**70,011**	**70,817**	**11,074**	**37,803**	**217,003**
Port North	Reach 1	0+00	8+00	N/A	N/A	N/A	N/A	N/A	N/A
	Reach 2	8+00	26+00	Alt1	0	1,405	3,467	2,798	6,960
	Reach 3	26+00	35+50	Alt 1	0	3,575	0	2,538	5,107
	Reach 4	35+50	45+00	Alt 1	0	999	1,970	1,614	4,241
	Reach 5	45+00	54+00	Alt 1	0	817	1,757	1,770	3,677
	Reach 6	54+00	163+00	Alt 1	0	46,103	22,607	28,340	98,158
	Reach 7	163+00	236+00	Alt 1	0	0	15,141	12,436	15,141
	Reach 8	236+00	242+79	N/A	0	0	0	0	0
	Total Port North Levee				**0**	**52,898**	**44,942**	**49,497**	**133,283**
Total					**115,445**	**1,277,969**	**281,763**	**593,313**	**2,252,907**

FIGURES

Figure 1 – PIR Levee Alignments

Figure 2 – Overall Identified Deficiencies

Figure 3 – Typical Cutoff Wall at Levee Centerline

Figure 4 – Typical Cutoff Wall at Waterside Toe

Figure 5 – Typical Seepage Berm

Figure 6 – Typical Stability Berm

Figure 7 – Typical Waterside Slope Reconstruction (USACE Contract C)

Figure 8 – Typical Landside Slope Reconstruction (USACE Contract D)

Figure 9 – Typical Waterside Slope Reconstruction (2002 USACE Slump Repair)

Figure 10 – Typical Relief Well Section

Figure 11 – Typical Piezometer Detail

Figure 12 – Typical Seepage Berm and Cutoff Wall Transition

Figure 13 – Typical Levee Raise

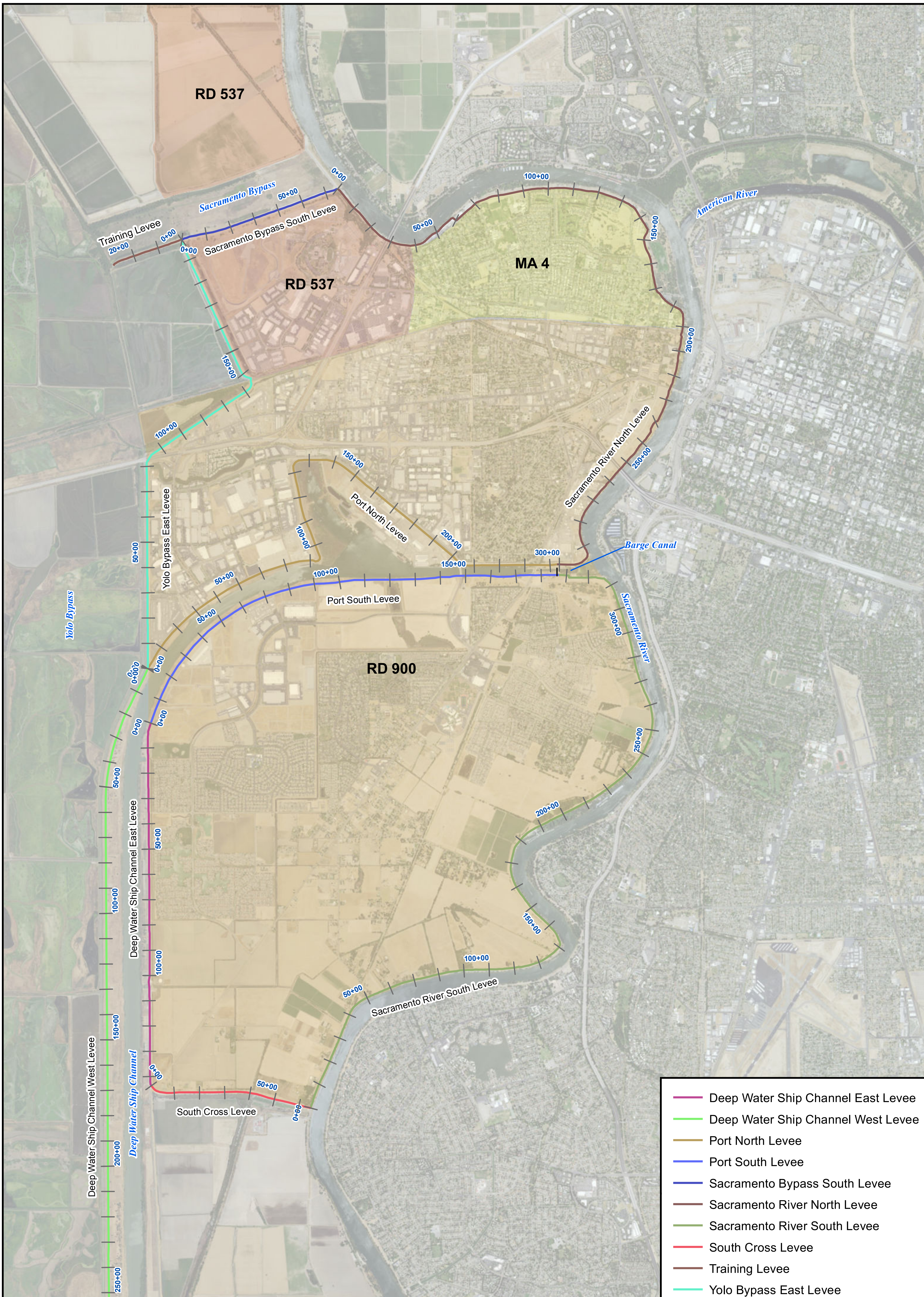
Figure 14 – Typical Floodwall

Figure 15 – Vegetated Rock Slope Protection

Figure 16 – Typical Pipe Modification

Figure 17 – Typical Vegetation Management Zone Detail

Figure 18 – Overall Recommended Remediation Measures



CITY OF WEST SACRAMENTO FLOOD PROGRAM

PIR LEVEE ALIGNMENTS

MAY, 2016

PRELIMINARY

WOOD RODGERS

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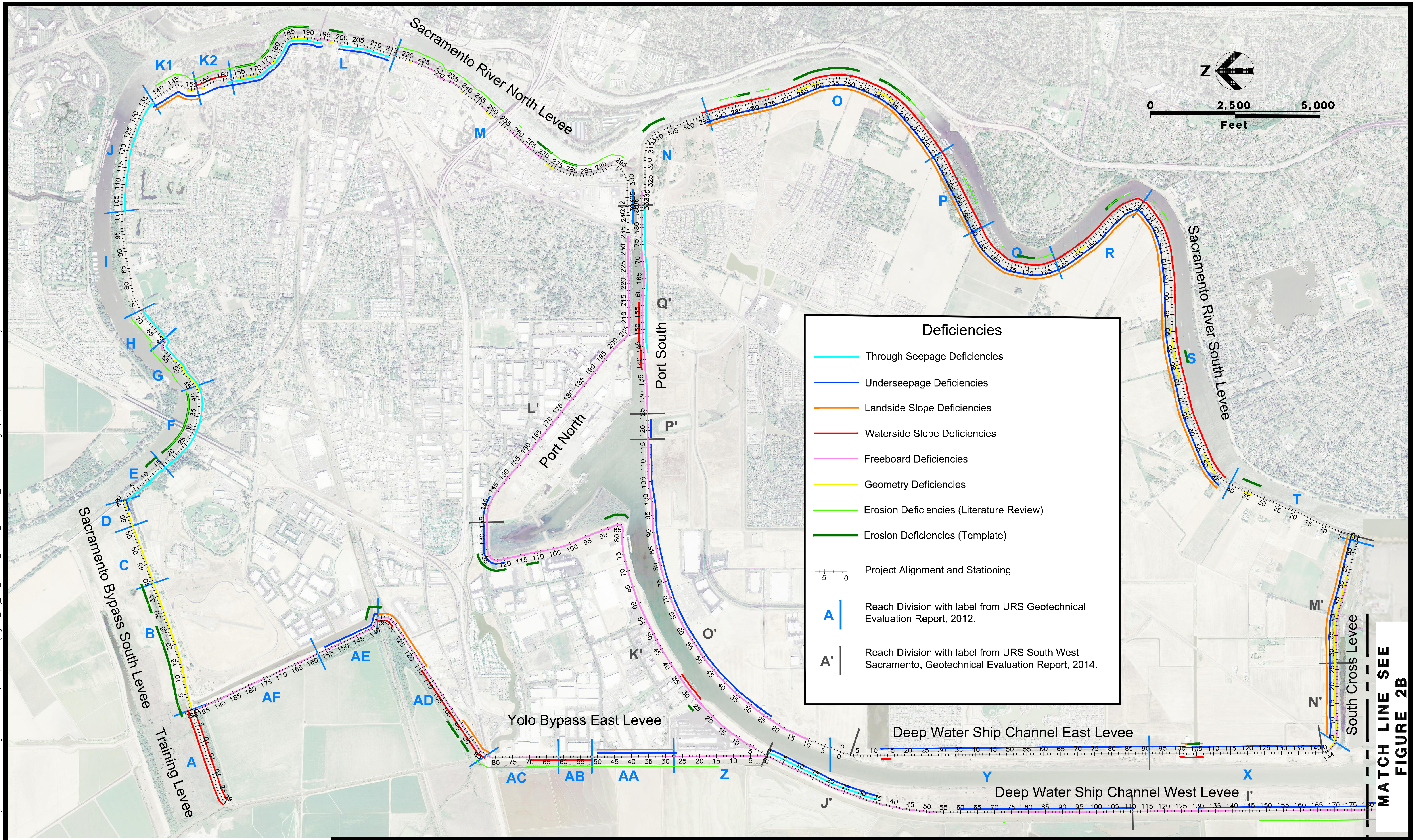
FIGURE 1



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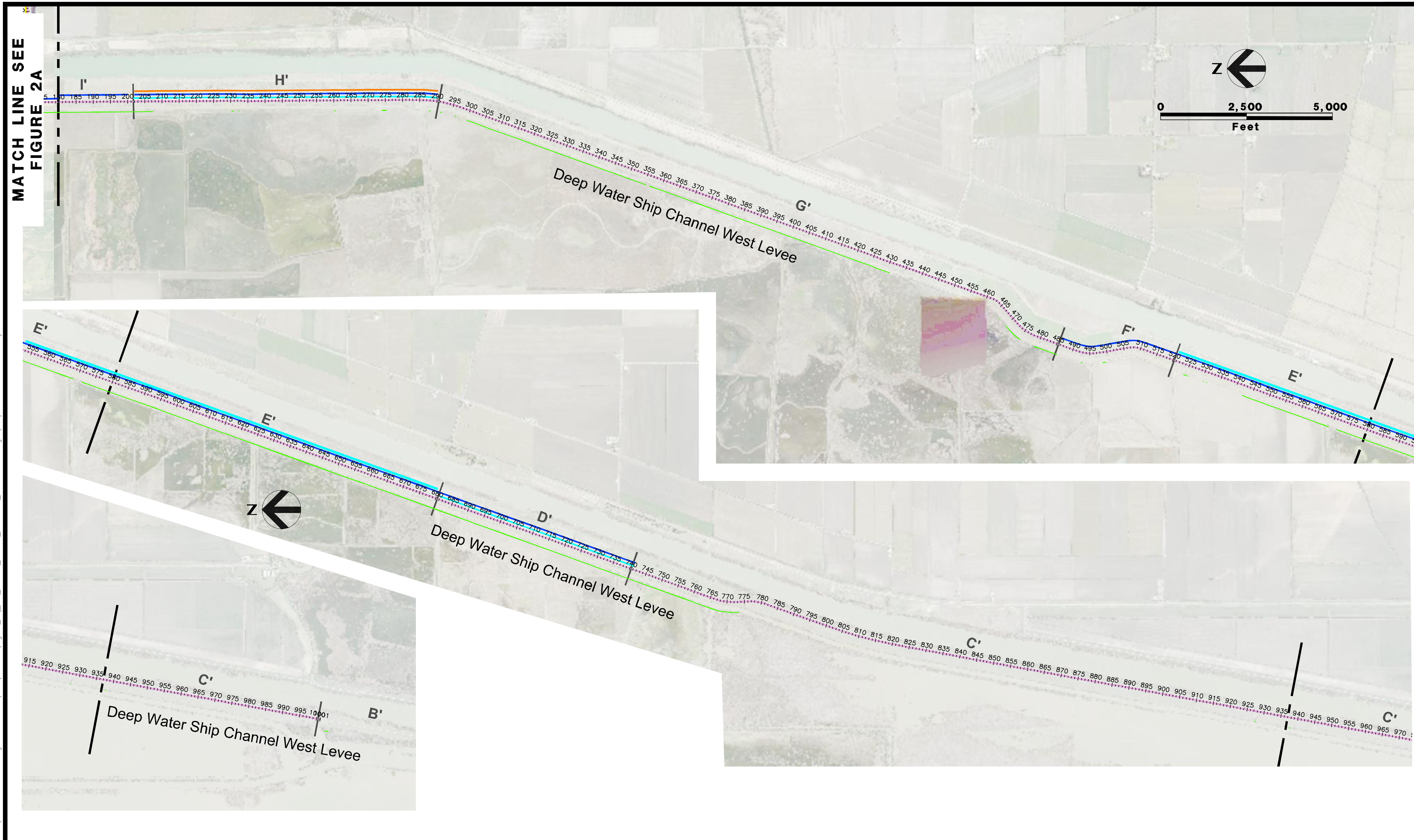
Fax 916.341.7767

blackburn consulting
2491 Boatman Avenue
West Sacramento, CA 95691
Tel 916.375.8706
Fax 916.375.8709
File No. 2916.1

OVERALL IDENTIFIED DEFICIENCIES

City of West Sacramento Flood Program
Draft Alternatives Analysis Report

Figure 2A



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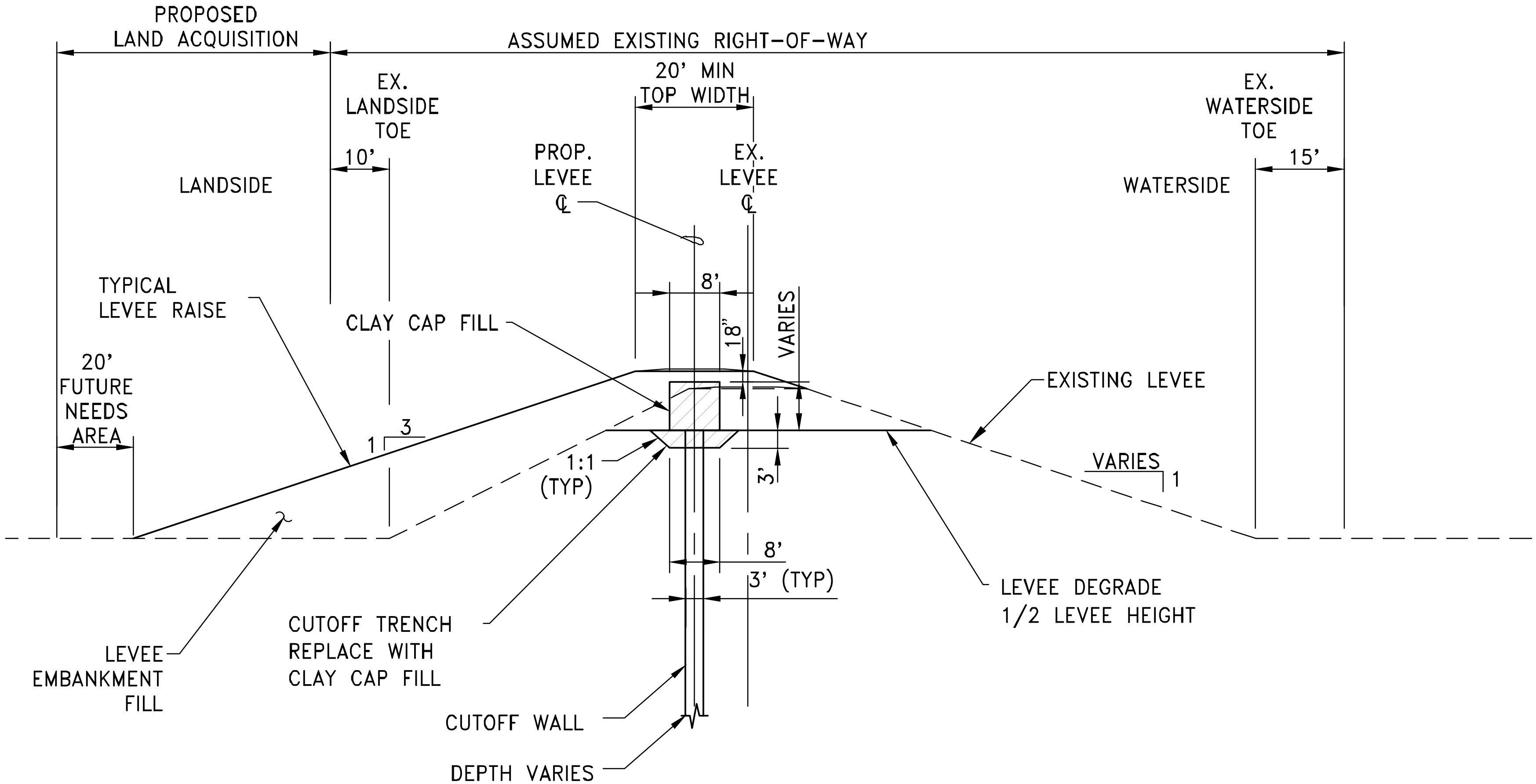
OVERALL IDENTIFIED DEFICIENCIES
City of West Sacramento Flood Program
Draft Alternatives Analysis Report

Figure
2B

CUTOFF WALL AT LEVEE CENTERLINE



NOTES

- DEGRADE LEVEE AS NEEDED TO ALLOW A 30-FOOT WIDE WORKING PLATFORM
- DEGRADE MATERIAL TO BE STOCKPILED AND REPLACED
- EXISTING AB TO BE SALVAGED & REUSED ON NEW LEVEE CROWN
- NO EXISTING RIGHT-OF-WAY ASSUMED FOR PORT LEVEES

NOT TO SCALE

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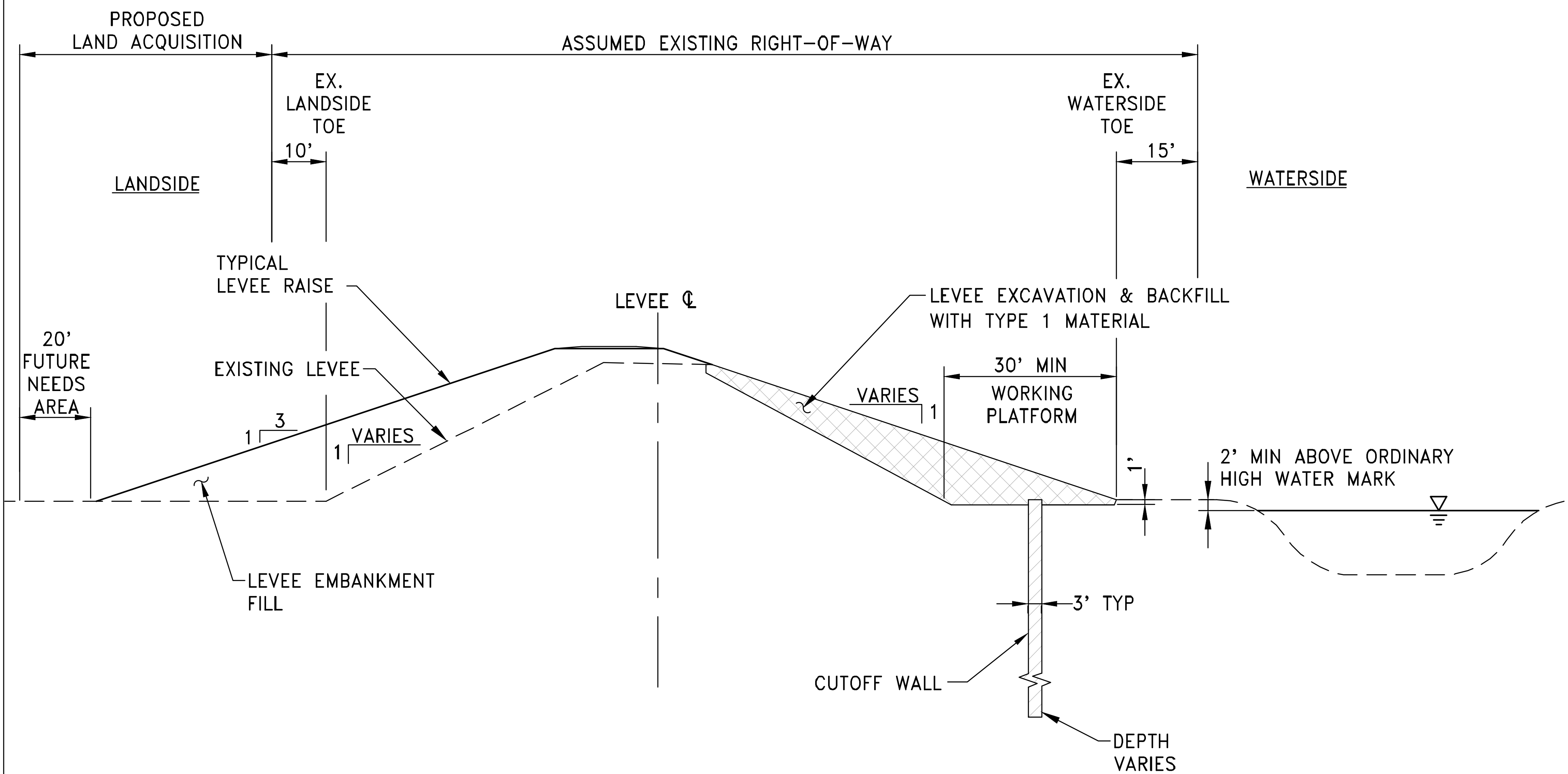
FIGURE 3

CUTOFF WALL AT WATERSIDE TOE



NOT TO SCALE

NOTES

-NO EXISTING RIGHT-OF-WAY ASSUMED FOR PORT LEVEES

FIGURE 4

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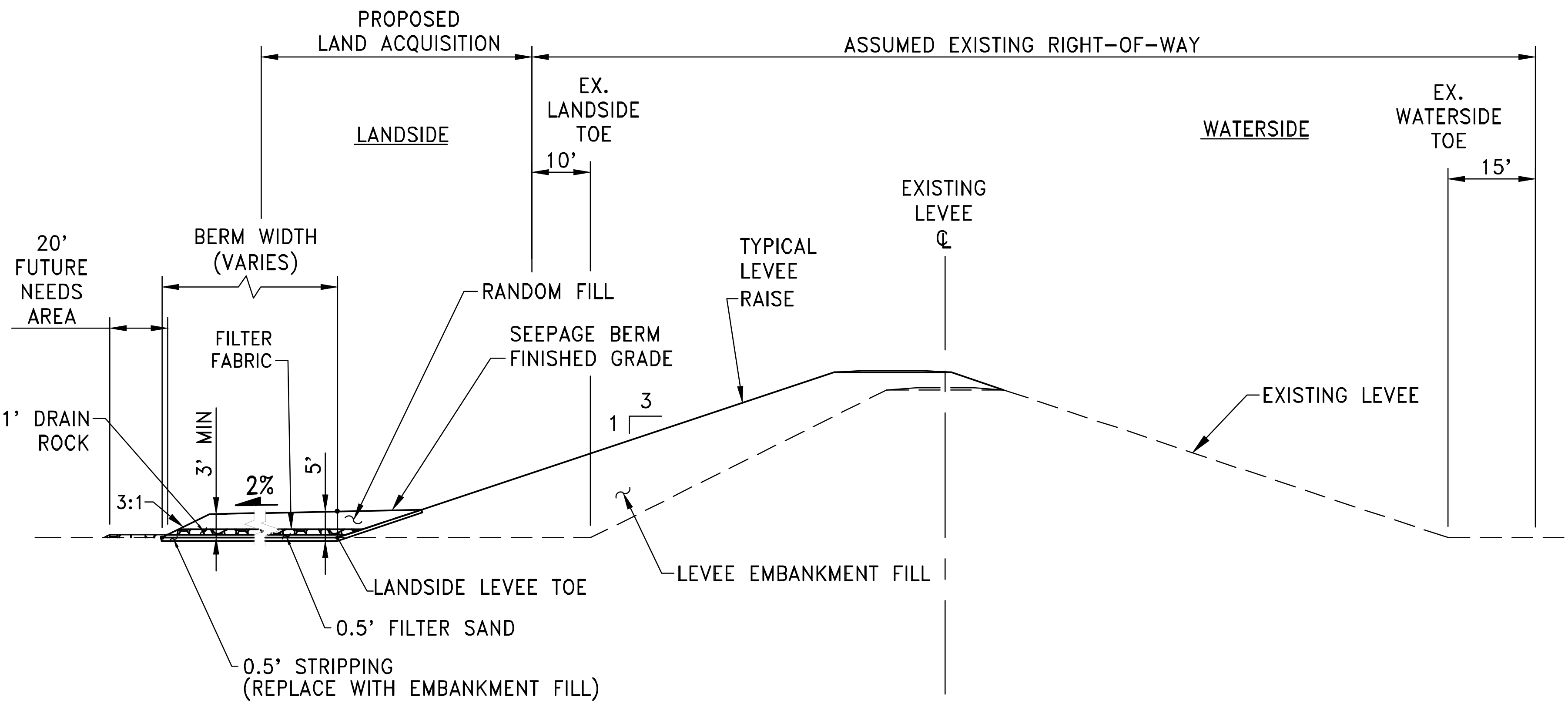
SEEPAGE BERM



NOT TO SCALE

NOTES

-NO EXISTING RIGHT-OF-WAY ASSUMED FOR PORT LEVEES

FIGURE 5

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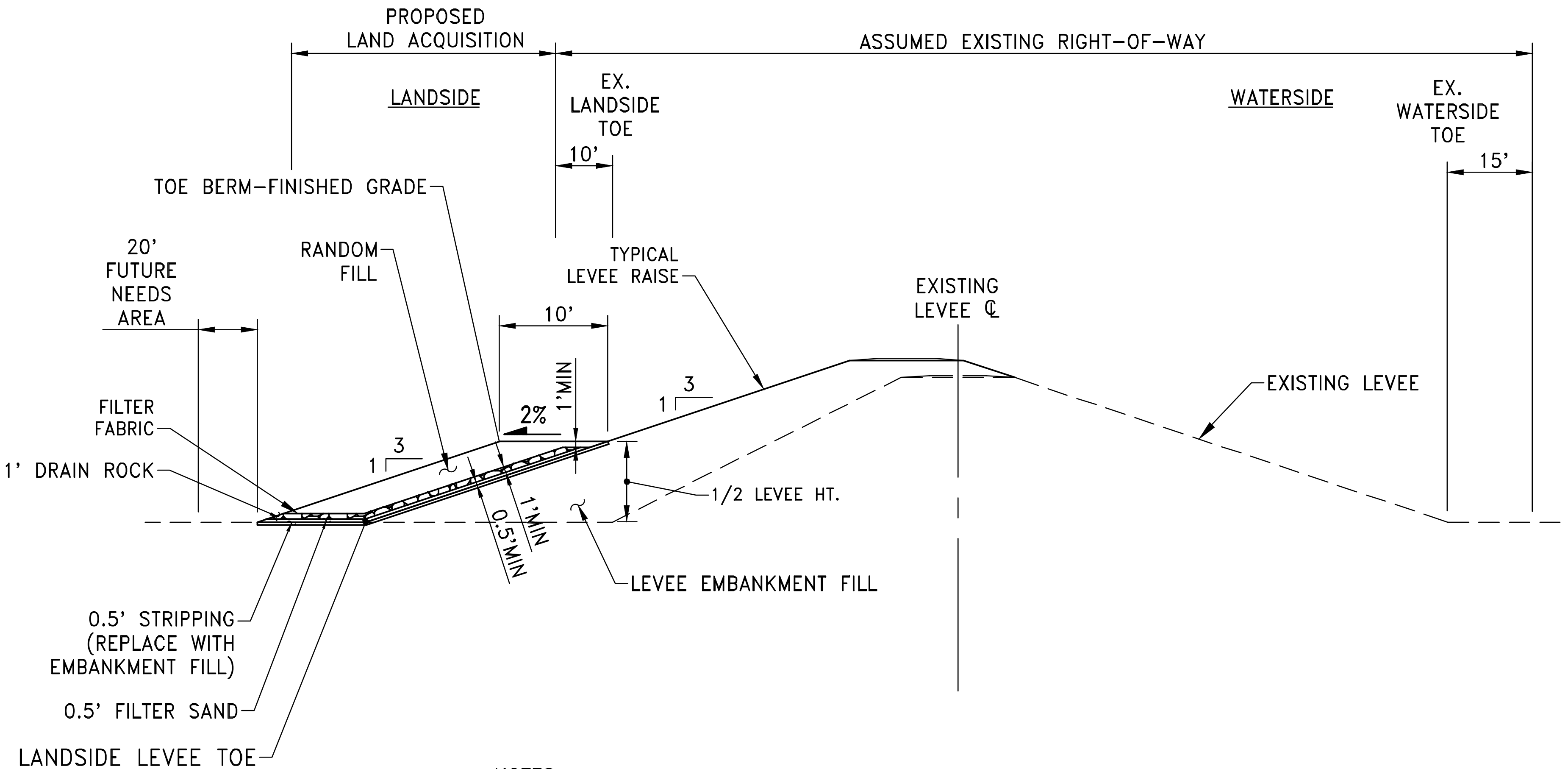
DRAINED STABILITY BERM



NOTES

-NO EXISTING RIGHT-OF-WAY ASSUMED FOR PORT LEVEES

NOT TO SCALE

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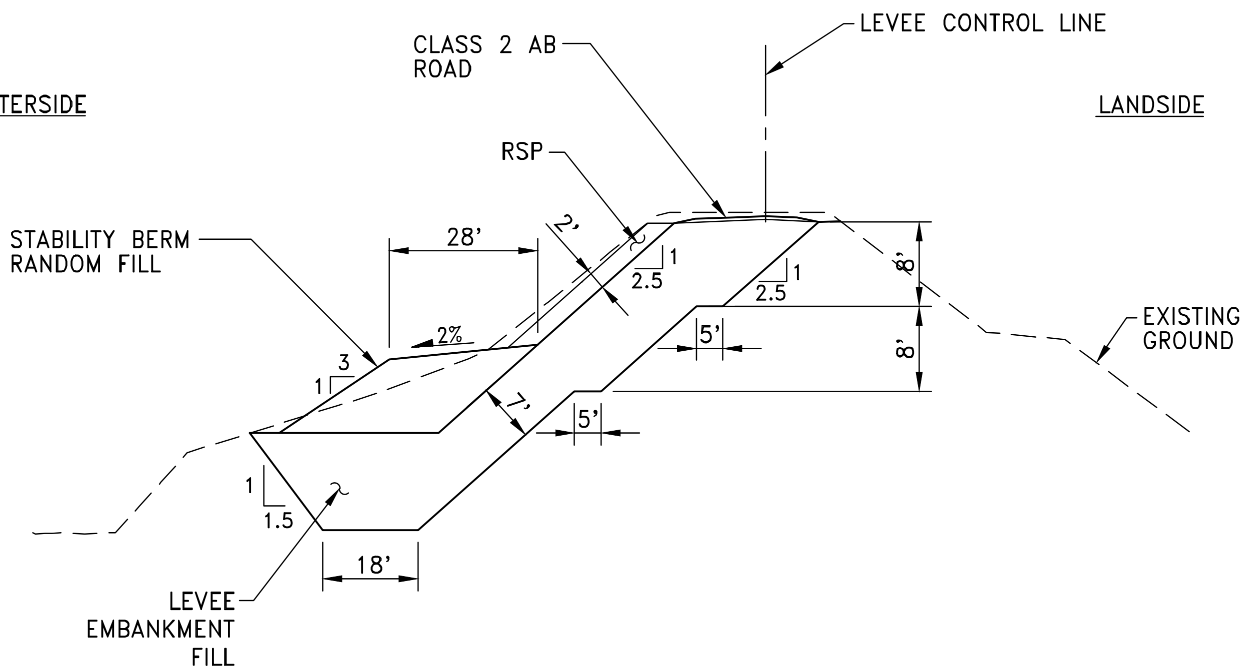
FIGURE 6

TYPICAL CROSS SECTION
WATERSIDE SLOPE RECONSTRUCTION WITH KEYWAY AND STABILITY BERM (SIMILAR TO USACE CONTRACT C REPAIR)



TYPICAL CROSS SECTION–LEVEE REPAIR
(NOT TO SCALE)

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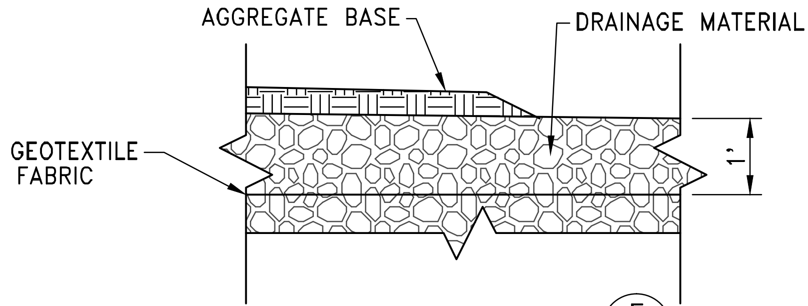
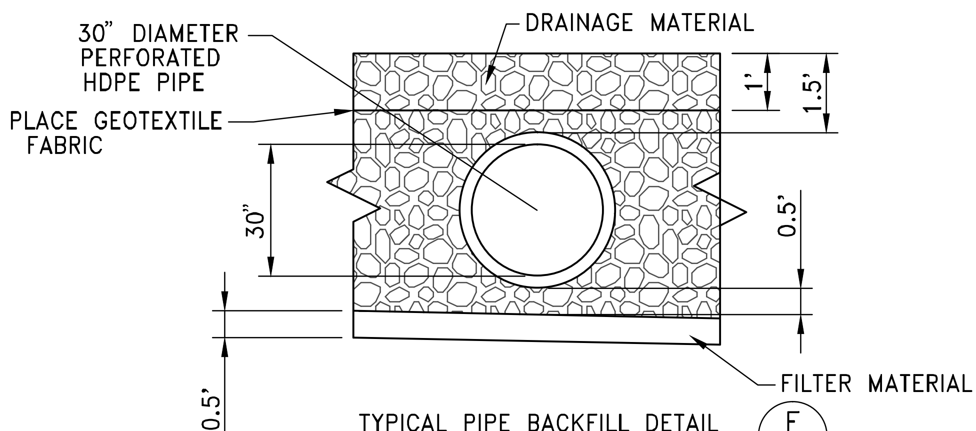
FIGURE 7

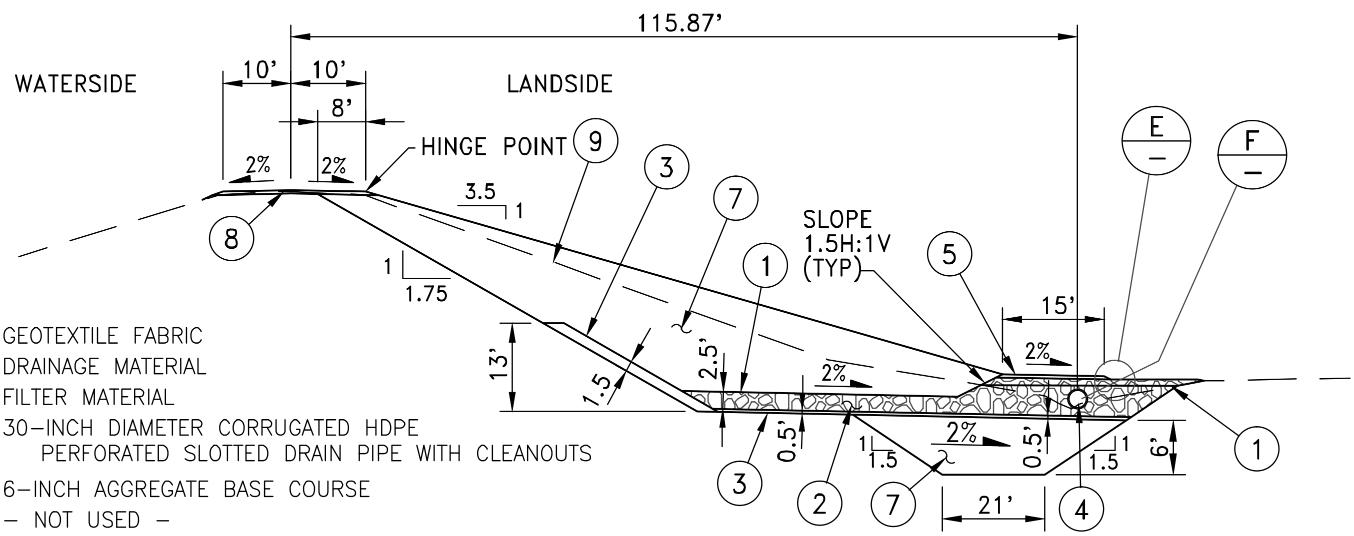
TYPICAL CROSS SECTION
LANDSIDE SLOPE RECONSTRUCTION WITH INTERNAL DRAIN
(SIMILAR TO USACE CONTRACT D REPAIR)



GEOTEXTILE DETAIL (NOT TO SCALE) E –



TYPICAL PIPE BACKFILL DETAIL (NOT TO SCALE) F –



1. GEOTEXTILE FABRIC
2. DRAINAGE MATERIAL
3. FILTER MATERIAL
4. 30-INCH DIAMETER CORRUGATED HDPE PERFORATED SLOTTED DRAIN PIPE WITH CLEANOUTS
5. 6-INCH AGGREGATE BASE COURSE
6. – NOT USED –
7. IMPORTED FILL
8. 4-INCH AGGREGATE BASE COURSE
9. EXISTING LEVEE SLOPE

TYPICAL CROSS SECTION–LEVEE REPAIR (NOT TO SCALE)

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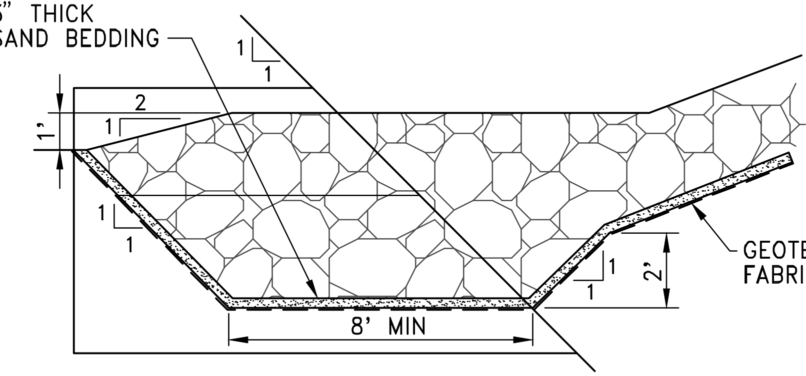
FIGURE 8

TYPICAL CROSS SECTION
WATERSIDE RECONSTRUCTION
(SIMILAR TO 2002 USACE SLUMP REPAIR)



RIPRAP ANCHOR DETAIL
(NOT TO SCALE)
B
–

WATERSIDE (NORTH WEST)

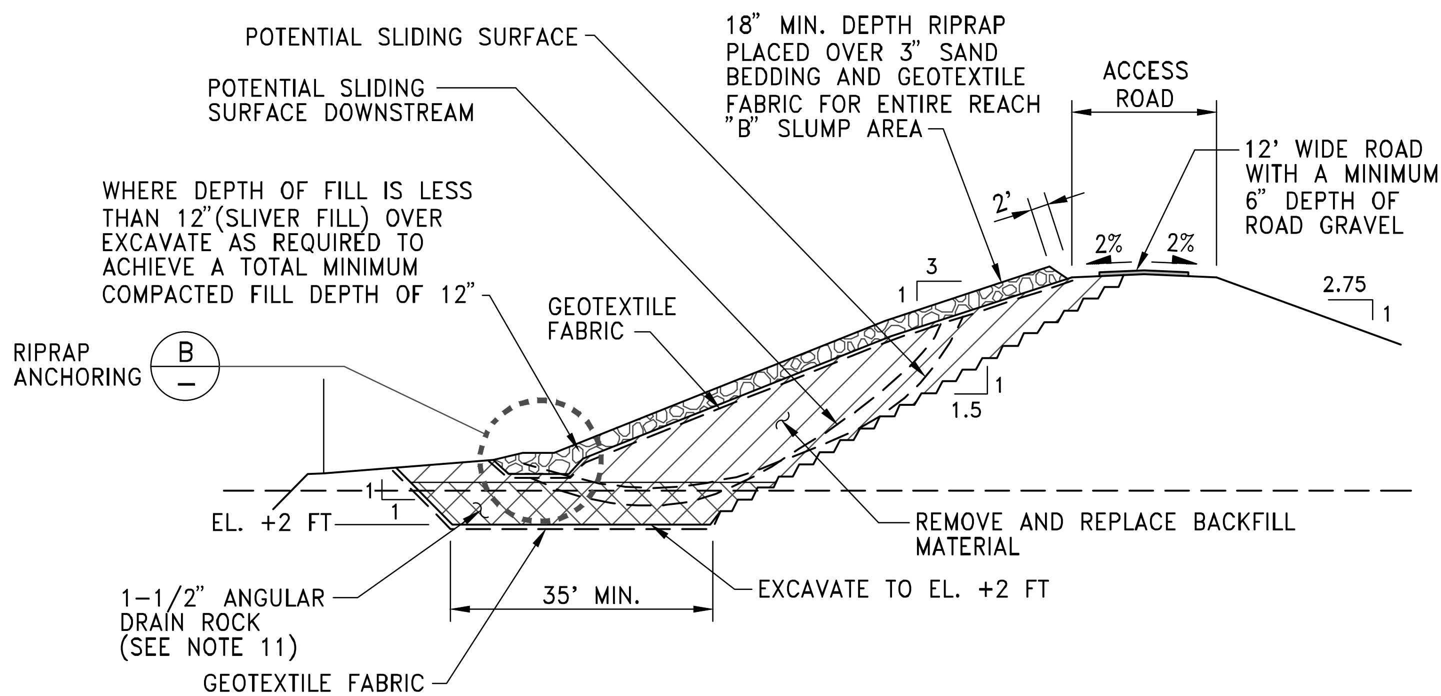


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FIGURE 9

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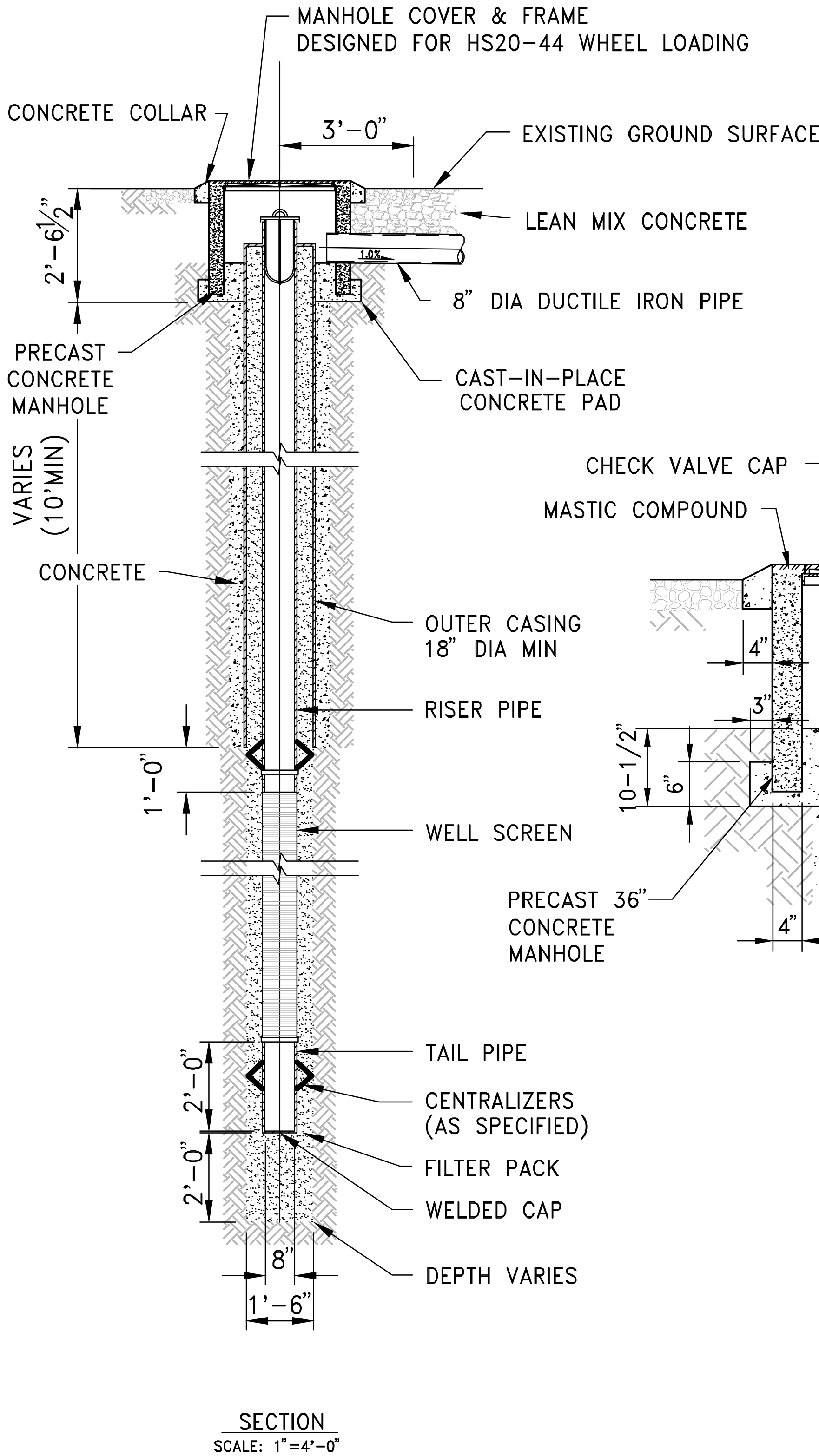
TYPICAL RELIEF WELL SECTION AND DETAIL



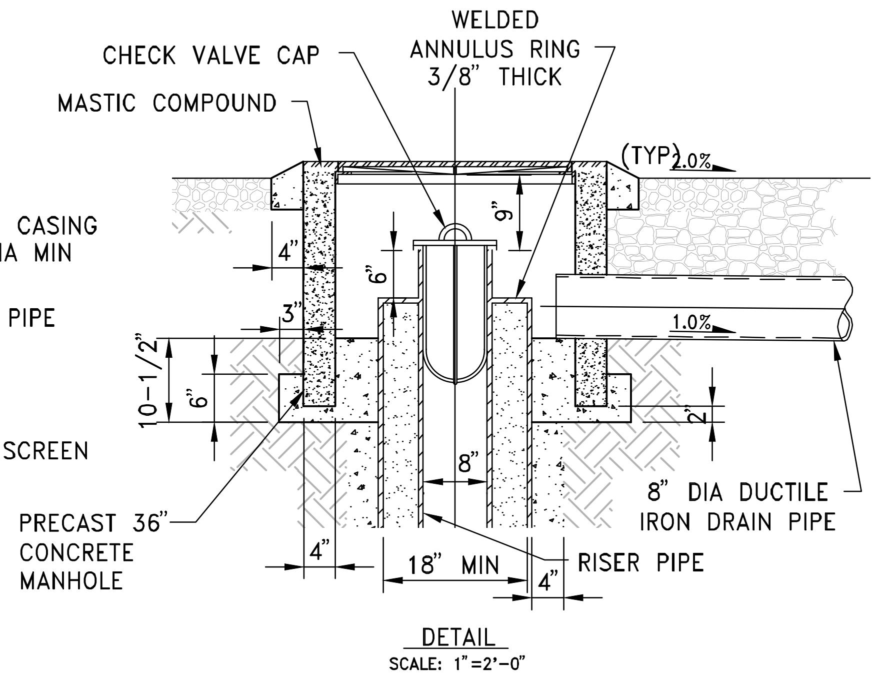


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FIGURE 10

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PIEZOMETER FOR MONITORING RELIEF WELL PERFORMANCE

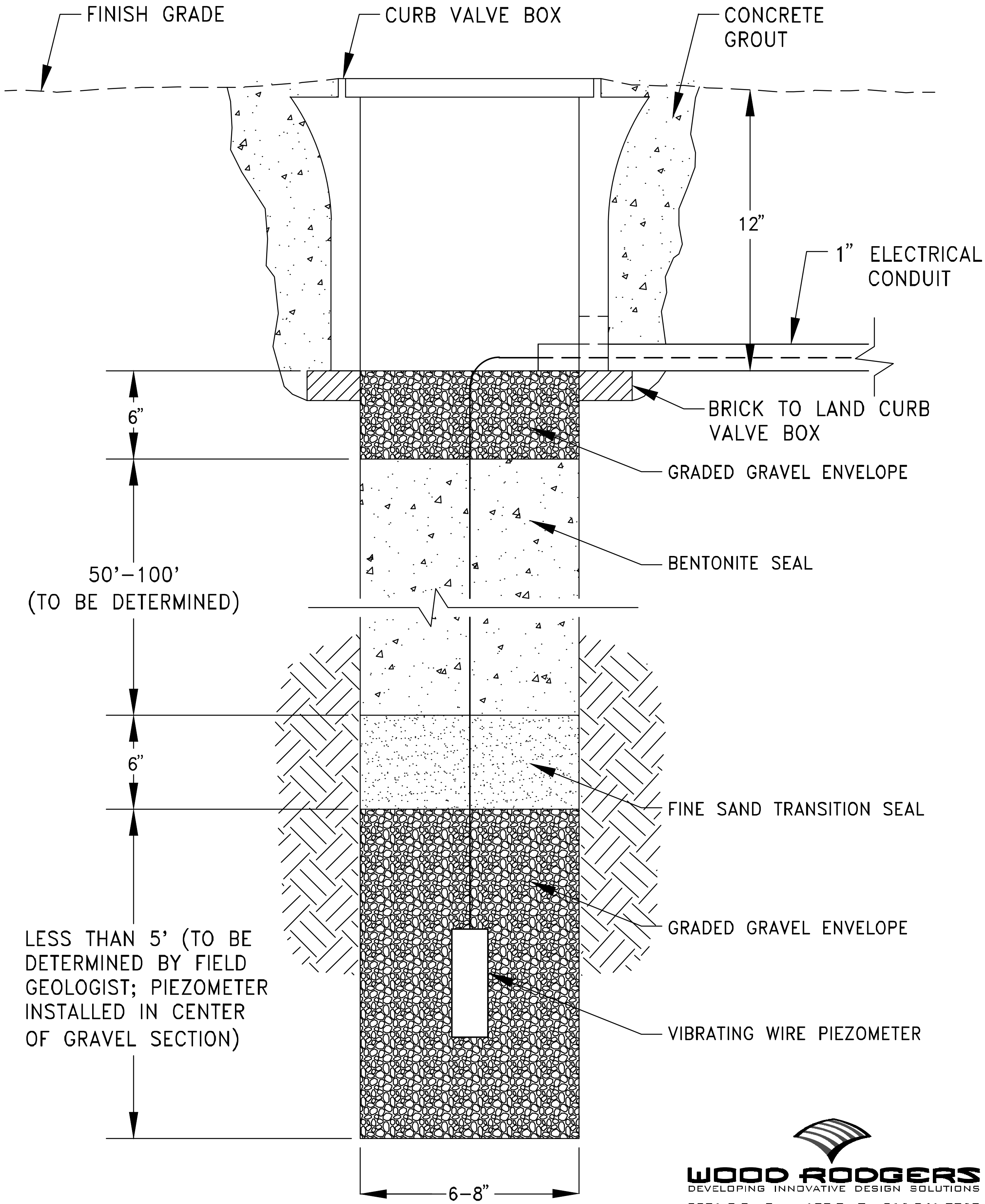

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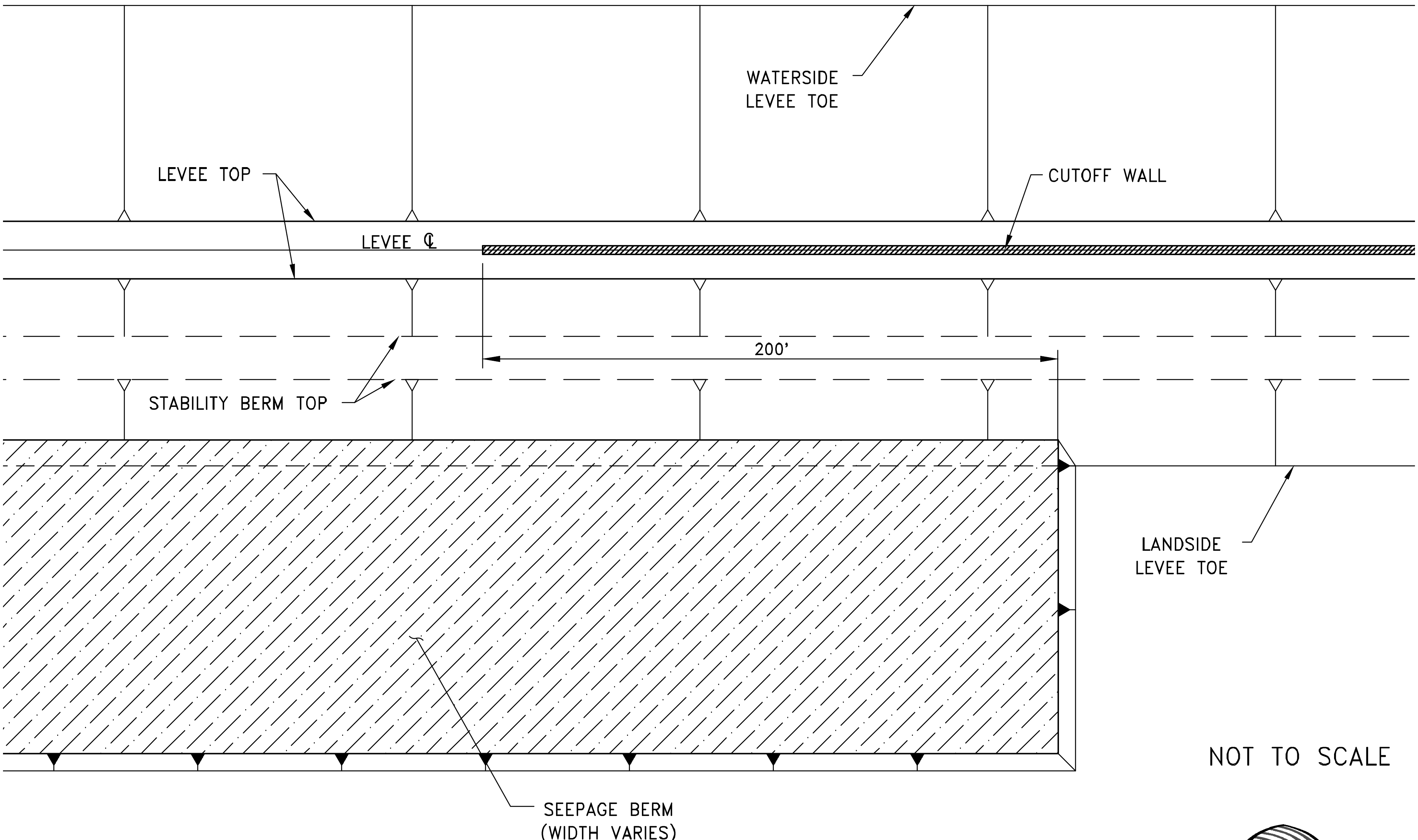
FIGURE 11

SEEPAGE BERM CUTOFF WALL TRANSITION



NOT TO SCALE

NOTES

-OVERLAP DISTANCE MAY VARY BASED ON EXISTING CONDITIONS

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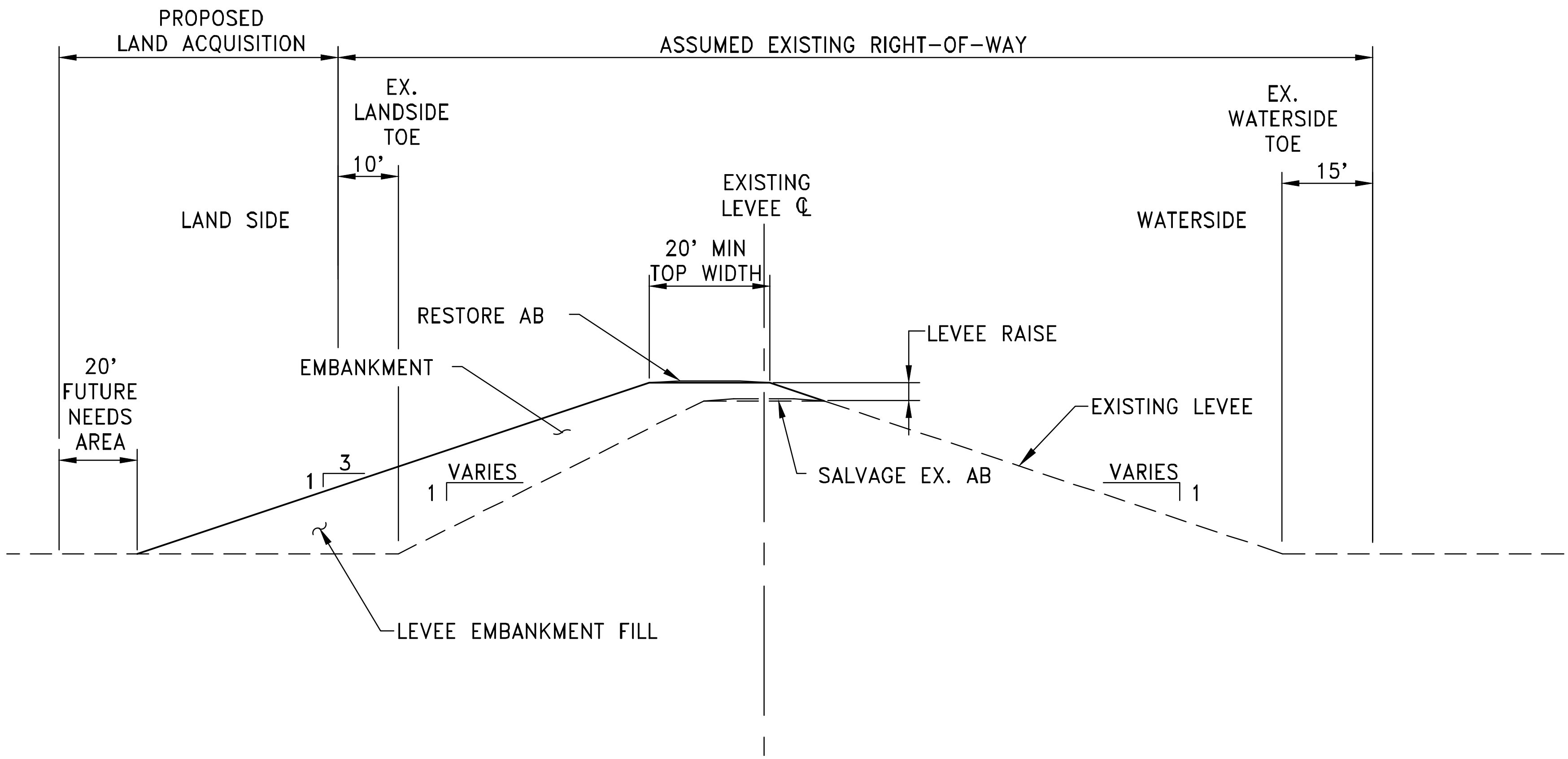
FIGURE 12

TYPICAL LEVEE RAISE



NOTES

-NO EXISTING RIGHT-OF-WAY ASSUMED FOR PORT LEVEES

NOT TO SCALE

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FIGURE 13

FLOODWALL SECTION

DESIGN ASSUMPTIONS

1. ALLOWABLE BEARING PRESSURE = 1500 PSF
2. PASSIVE PRESSURE = 150 PSF
3. COEFFICIENT OF FRICTION = 0.35 x 0.5 = 0.175
4. CONCRETE COMPRESSIVE STRENGTH, f'c = 4000 PSI
5. ACTIVE PRESSURE / HYDRAULIC PRESSURE = 63 PCF

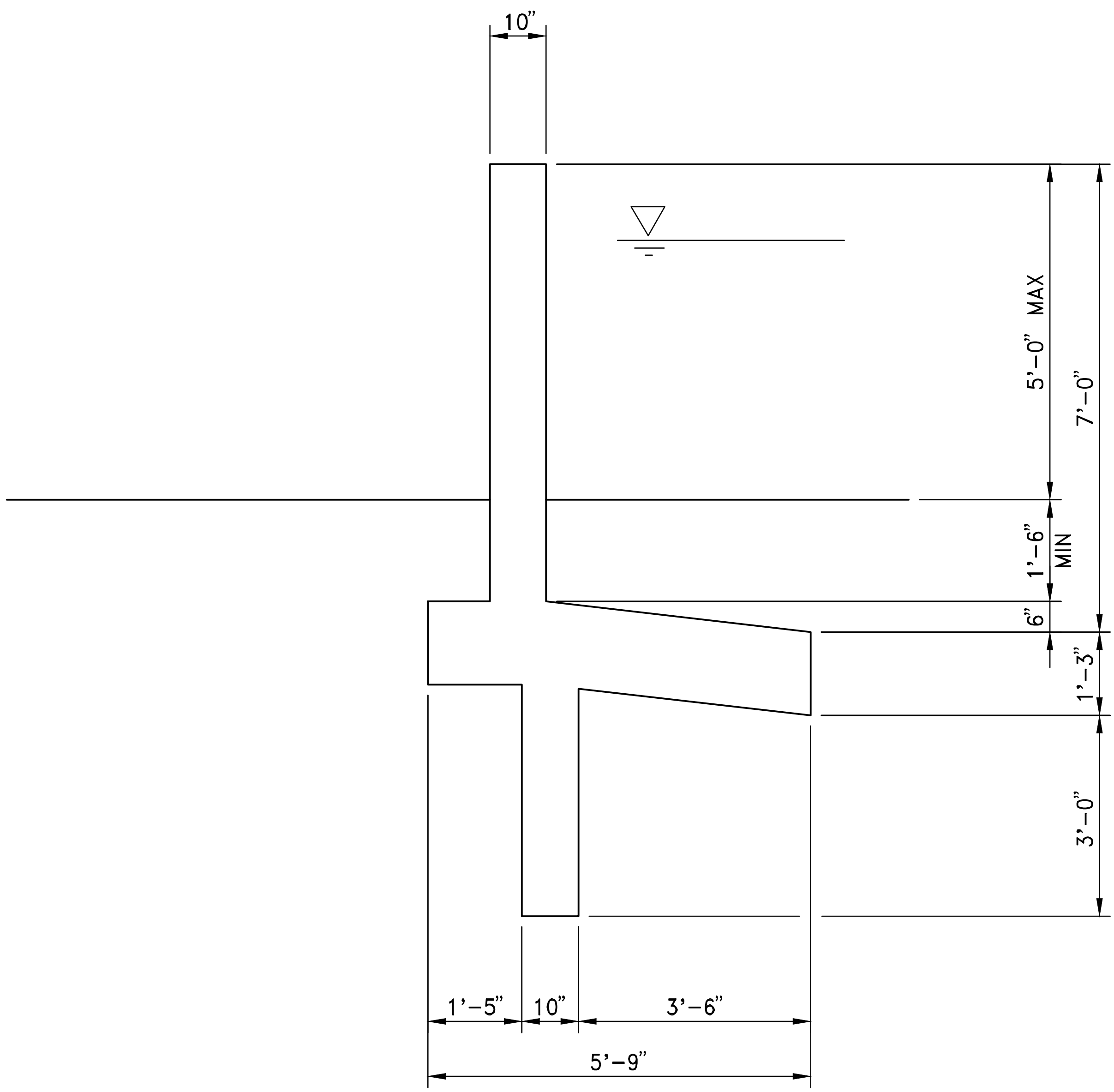

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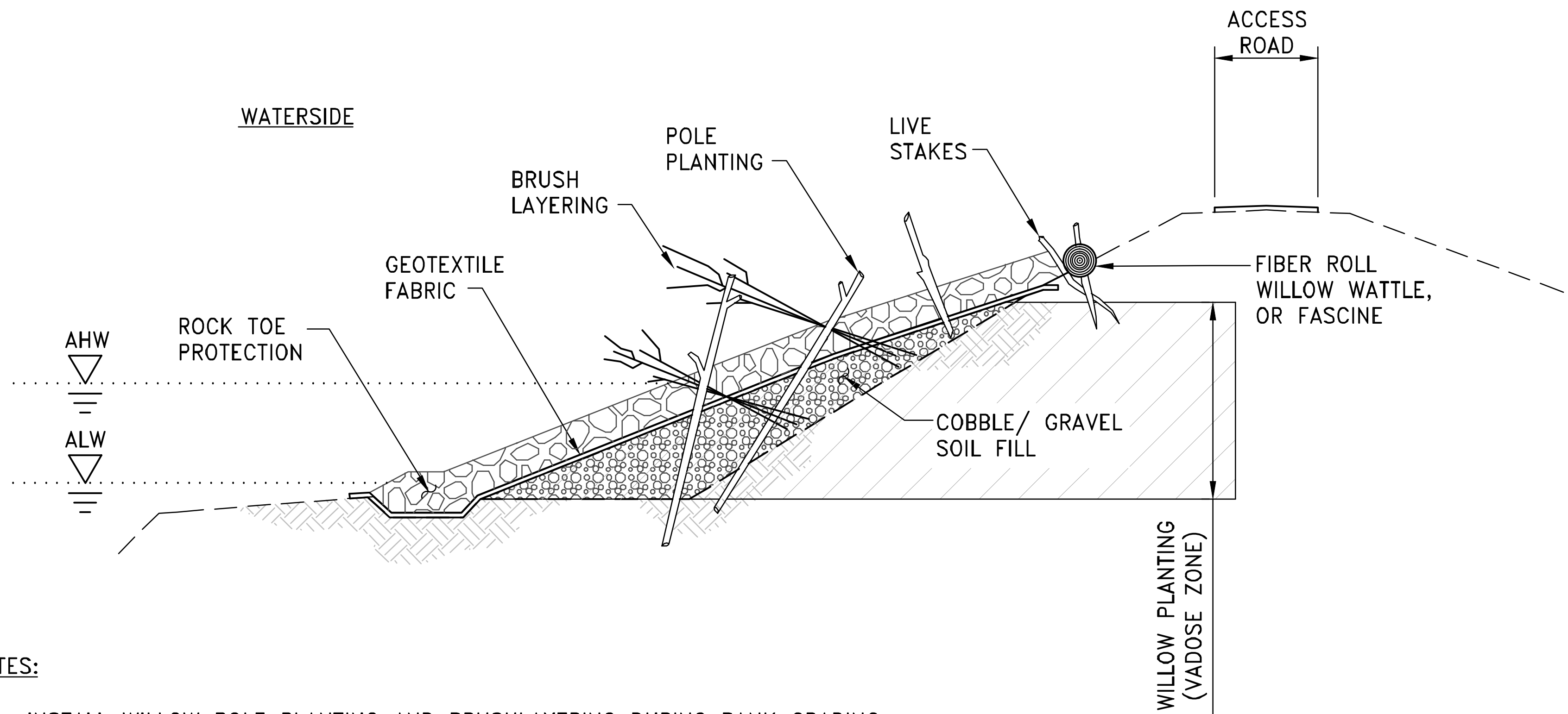
FIGURE 14

VEGETATED RIPRAP WITH BRUSHLAYERING AND POLE PLANTING



NOTES:

1. INSTALL WILLOW POLE PLANTING AND BRUSHLAYERING DURING BANK GRADING AND RIPRAP PLACEMENT TO ENSURE GOOD CONTACT WITH 'NATIVE GROUND AND/OR SOIL FILL.

2. WILLOW POLES AND BRUSH LAYERS SHOULD EXTEND DOWN INTO EXPECTED SOIL MOISTURE ZONES (VADOSE).

3. CUT SMALL HOLES OR SLITS IN FILTER FABRIC AS NECESSARY.

4. PLACE SOIL FILL (COBBLES, GRAVEL, SOIL) AROUND CUTTINGS. PLACE RIPRAP CAREFULLY, DO NOT END DUMP. SOME DAMAGE TO BRUSH LAYERS AND WILLOW POLES IS UNAVOIDABLE AND ACCEPTABLE. DEEPLY PLANTED WILLOW MATERIAL WILL REGENERATE.

FIGURE 15

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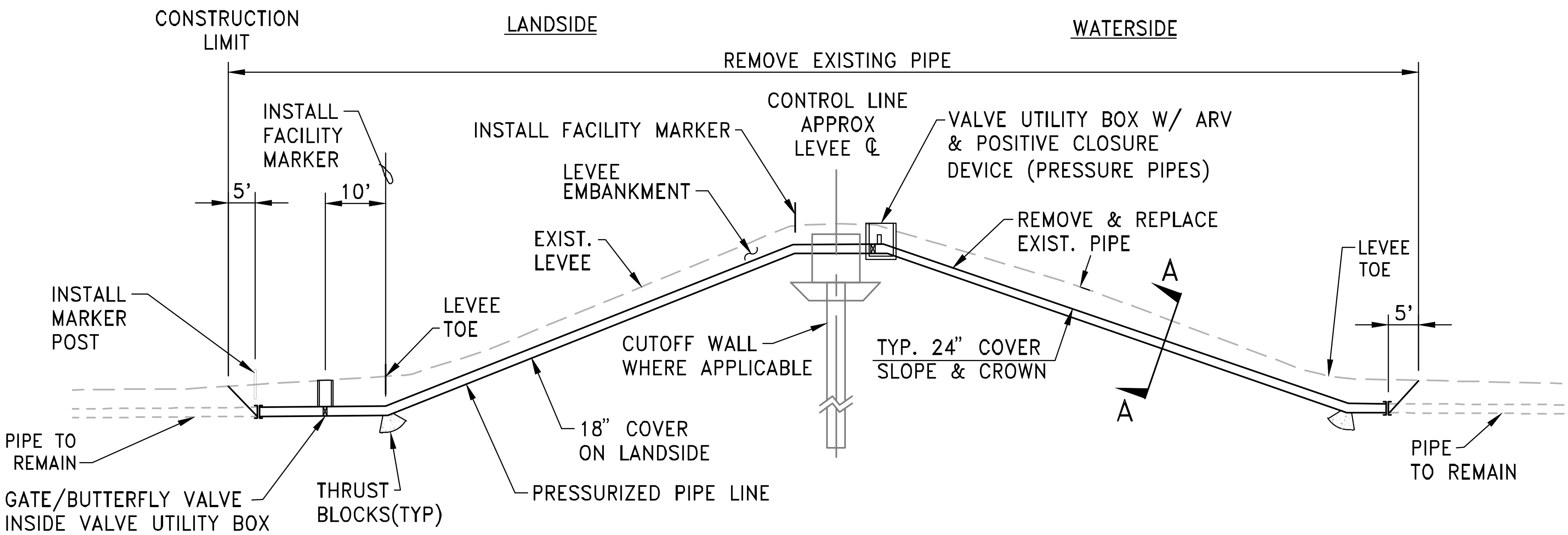
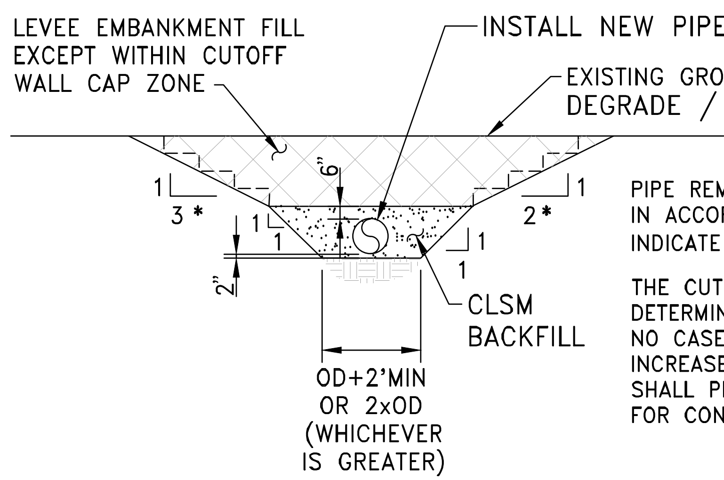
TYPICAL PIPE MODIFICATION





SECTION A-A
N.T.S.

PIPE REMOVAL EXCAVATION LIMIT, (EMBANKMENT SHALL BE PLACE IN LIFTS IN ACCORDANCE WITH CONTRACT DOCUMENTS. BENCHING SHOWN TO INDICATE REQUIREMENT TO PLACE EMBANKMENT IN LIFTS)

THE CUT SLOPE IS SHOWN 2H:1V. THE CUT SLOPE CAN BE INCREASED IF DETERMINED TO BE STABLE AND ALL OSHA STANDARD ARE ME, BUT IN NO CASE SHALL THE CUT SLOPE BE STEEPER THAN 1H:1V. APPROVAL TO INCREASE SLOPE SHALL BE PROVIDED BY CONTRACTOR. CONTRACTOR SHALL PROVIDE STAMPED DOCUMENTATION FROM PROFESSIONAL ENGINEER FOR CONSIDERATION BY AGENCY.

NOT TO SCALE

FIGURE 16

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VEGETATION MANAGEMENT FOR EXISTING LEVEES WITH A LONG WATERSIDE SLOPE

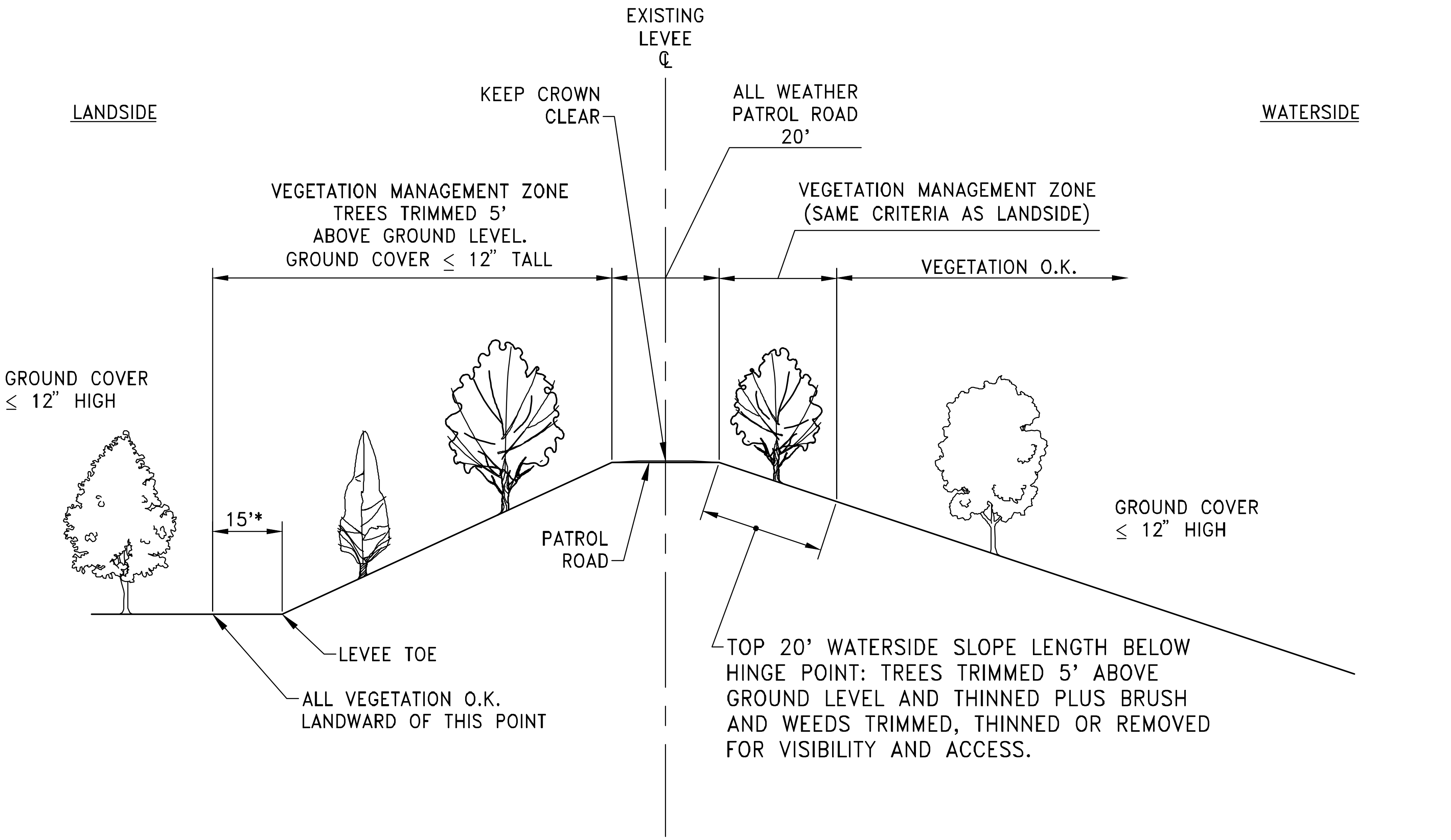

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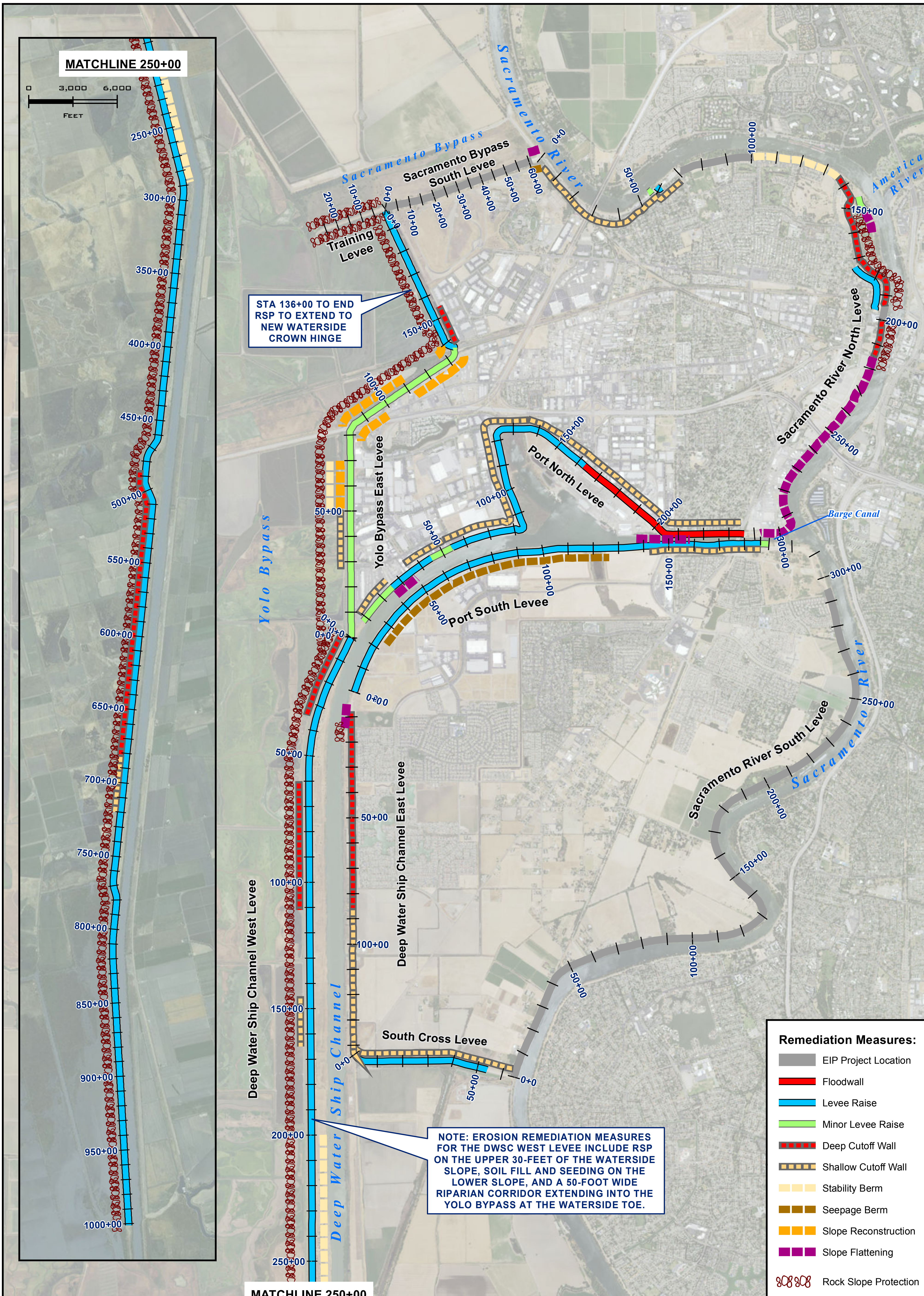
FIGURE 17



CITY OF WEST SACRAMENTO
FLOOD PROGRAM
OVERALL RECOMMENDED
REMEDIATION MEASURES

MAY, 2016

PRELIMINARY

WOOD RODGERS

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FIGURE 18

ATTACHMENTS

Attachment A – Geotechnical Alternatives Analysis Report

Attachment B – Cross Sections

Attachment C – Cost Estimates

Attachment D – Comment and Response Register

ATTACHMENT A

Geotechnical Alternatives Analysis Report

CITY OF WEST SACRAMENTO
FLOOD PROGRAM ENGINEERING SERVICES
GEOTECHNICAL ALTERNATIVES ANALYSIS REPORT

West Sacramento, California

Prepared by:

BLACKBURN CONSULTING
2491 Boatman Avenue
West Sacramento, CA 95691

May 2016

Prepared for:

Wood Rodgers, Inc.
3301 C Street, Bldg. 100-B
Sacramento, CA 95816

West Sacramento Office:
2491 Boatman Ave. ▪ West Sacramento, CA 95691
(916) 375-8706 ▪ Fax (916) 375-8709

blackburn consulting

Main Auburn Office: (530) 887-1494
Fresno Office: (559) 438-8411
Modesto Office: (209) 522-6273

Geotechnical ▪ Geo-Environmental ▪ Construction Services ▪ Forensics

BCI File No. 2916.1
May 27, 2016

Mr. Jonathan Kors
Wood Rodgers, Inc.
3301 C Street, Bldg. 100-B
Sacramento, CA 95816

Subject: **City of West Sacramento Flood Program Engineering Services**
Geotechnical Alternatives Analysis Report
West Sacramento, California

Dear Mr. Kors,

Blackburn Consulting (BCI) is pleased to submit this Geotechnical Alternatives Analysis Report (GAAR) for the City of West Sacramento Flood Program Engineering Services. This GAAR provides a summary of geotechnical alternatives for the levee system surrounding West Sacramento based on the identified geotechnical deficiencies as summarized in BCI's Geotechnical Problem Identification Report.

Thank you for including BCI on your team for this important project. Please call if you have questions or require additional information.

Sincerely,

BLACKBURN CONSULTING

REGISTERED PROFESSIONAL ENGINEER
ROBERT B. LOKTEFF
No. 2589
Exp. 12/31/17
GEOTECHNICAL
STATE OF CALIFORNIA

Robert B. Lokteff, P.E., G.E.
Principal

Nicole C. Hart, P.E.
Project Manager

Juliana T. Fisher, P.E.
Sr. Engineer

CITY OF WEST SACRAMENTO
FLOOD PROGRAM ENGINEERING SERVICES
GEOTECHNICAL ALTERNATIVES ANALYSIS REPORT

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Table 7 - BCI Alternatives, South Cross Levee
Table 8 - BCI Alternatives, Port North Levee
Table 9 - BCI Alternatives, Port South Levee

FIGURES

Figure 1 - Vicinity Map
Figure 2 - Levee Segment Map
Figure 3 - BCI Geotechnical Deficiencies

1. PURPOSE

Blackburn Consulting (BCI) prepared this Geotechnical Alternatives Analysis Report (GAAR) report for Wood Rodgers, Inc. (WR) as part of their overall alternatives analysis evaluation of the West Sacramento flood control system.

2. SCOPE OF SERVICES

BCI performed the following to prepare this GAAR:

- Reviewed existing available geotechnical alternatives analyses performed by others for the West Sacramento levee system. Section 4 of this report contains a list of the documents reviewed.
- Reviewed recent West Sacramento levee improvement design reports and plans.
- Considered the BCI May 2016 Geotechnical Problem Identification Report (GPIR) prepared for the West Sacramento Levee System.
- Evaluated:
    - Relevant West Sacramento geology, geomorphology, historical levee construction methods and failures discussed in the existing levee deficiency evaluations.
    - Subsurface profiles, number and spacing of subsurface explorations, design water surfaces, geotechnical parameters, electromagnetic imaging, levee geometry (provided by WR) and results from the cross-sections previously analyzed in the existing levee deficiency evaluations.
    - Topographic mapping and associated cross-sections as provided by WR. The topographic mapping was obtained from the DWR Central Valley Floodplain Evaluation and Delineation Program Light Detection and Ranging Data and did not include bathymetry data.
    - Concurrences and discrepancies in the analysis results and recommendations from the existing alternatives analyses.
- Determined geotechnical alternatives analyses based on our evaluation described above.

3. PROJECT DESCRIPTION

The City of West Sacramento (City) is protected from flooding by levees surrounding the entire City; on the west by levees along the Yolo Bypass, Deep Water Ship Channel (DWSC); on the north by the Sacramento Bypass South Levee; on the north and east by the Sacramento River West North and South Levees (SRWNL and SRWSL); and on the south by the South Cross Levee. The City is also bifurcated by the Sacramento River DWSC and Barge Canal, which have levees on both sides. Figures 1 and 2a/2b present a Vicinity Map and Levee Segment Maps, respectively.

The City and West Sacramento Area Flood Control Agency (WSAFCA) are in the process of developing a baseline 200-year Flood Program (Flood Program) in order to comply with state-mandated Urban Level of Flood Protection (ULOP) requirements by 2025. When completed, the Flood Program will provide the City with protection from a 200-year flood event. The first step toward developing the Flood Program is to identify the locations of levee segments that do not meet Urban Levee Design Criteria (ULDC) requirements.

This GAAR provides a summary of the BCI GPIR and presents alternatives to address the identified geotechnical levee deficiencies for the levee system surrounding West Sacramento. These geotechnical alternatives address steady-state through seepage, underseepage, and landside slope stability, and waterside rapid drawdown slope stability deficiencies.

4. RELEVANT EVALUATIONS BY OTHERS

The levees that protect the City have been studied in detail as part of several different efforts. Previous studies by Kleinfelder and HDR for the City of West Sacramento on behalf of the West Sacramento Area Flood Control Agency (WSAFCA), the United States Army Corps of Engineers (USACE), and URS for the Department of Water Resources (DWR) provide a geotechnical assessment of the existing levee system with respect to steady-state through seepage, underseepage, landside slope stability, waterside rapid drawdown slope stability. These studies identify and provide methods to address geotechnical deficiencies within the levee system.

BCI reviewed the following documents as part of the current problem identification evaluation for the City of West Sacramento Flood Program Engineering Services:

- West Sacramento Levee System, Problem Identification and Alternatives Analysis, Volume 1 - Geotechnical Problem Identification (Kleinfelder PIR/AA), Kleinfelder 2007,
- Preliminary Seismic Evaluation, West Sacramento Levee Assessment, Sacramento River, Reach 1 (Sacramento River Right Bank Levee), Reclamation District 900, Yolo County, Kleinfelder 2007,
- West Sacramento Levee Evaluation Project, Draft Problem Identification Report (HDR PIR), HDR 2008,
- West Sacramento Area Flood Control Agency, Levee Improvement Program, Alternatives Analysis (HDR AA), HDR 2009,
- Phase 1 Geotechnical Data Report, West Sacramento Study Area (URS P1GDR), URS 2008,
- Draft Supplemental Geotechnical Data Report, West Sacramento Study Area (URS SGDR), URS 2009,
- Guidance Document for Geotechnical Analysis, Urban Levee Geotechnical Evaluations Program Report, (URS Guidance Document) prepared for the State of California Department of Water Resources (DWR), 2011,

- Geotechnical Evaluation Report, Volume 1, Existing Conditions, West Sacramento Study Area (URS GER), URS 2012,
- Geotechnical Evaluation Report, Volume 2, Remedial Measures, West Sacramento Study Area (URS RM), URS 2012, prepared for DWR Urban Levee Geotechnical Evaluation (ULE) program,
- Supplemental Geotechnical Data Report, South West Sacramento Study Area (URS SWS SGDR), URS 2013, prepared for DWR Urban Levee Geotechnical Evaluation (ULE) program,
- Geotechnical Evaluation Report, Volume 1, Existing Conditions, South West Sacramento Study Area (URS SWS GER), URS 2014, prepared for DWR Urban Levee Geotechnical Evaluation (ULE) program,
- Geotechnical Evaluation Report, Volume 2, Remedial Alternatives, South West Sacramento Study Area (URS SWS RA), URS 2015, prepared for DWR Urban Levee Geotechnical Evaluation (ULE) program,
- Geotechnical Levee Practice, REFP10L0, USACE, 2008,
- West Sacramento Project General Reevaluation Report, Geotechnical Appendix, October 2015, (USACE GRR GA), prepared by the USACE, and
- Periodic Inspection Report No. 1, West Sacramento - Sac Yolo South (USACE PI), 2015, prepared by HDR/Fugro, WLA for USACE.

BCI also reviewed the following design and construction documents prepared by the USACE, BCI, and HDR for West Sacramento levee improvements that have recently been completed or scheduled for construction in in the near future:

- Emergency Levee Repairs, East Yolo Bypass - RD 900, As-Built, USACE 1983
- West Sacramento / Mitigation Area Site Preparation, General Plan and Index of Drawings Wahler Associates 1990,
- PL84-99 - Emergency Levee Repair East Levee Yolo Bypass (Various Locations) and Scott Creek USACE 1995,
- West Sacramento Project Levee Reconstruction Contract A, (USACE Contract A) USACE 1998,
- West Sacramento Project Levee Reconstruction Contract B, (USACE Contract B) USACE 1999
- West Sacramento Project Drainage Ditch and Levee Slump Repair Remaining Work USACE FY 2002,
- West Sacramento Project Levee Slump Repair 2 USACE FY 2004,
- West Sacramento Project Levee Reconstruction Contract C, (USACE Contract C) USACE FY 2009,
- West Sacramento Levee Improvement Program, Early Implementation Project, I Street Bridge, As-Builts, HDR 2009 (HDR I Street),

- Sacramento River Bank Protection Project, Sacramento River Erosion Repair Site, Rivermile 57.2R, West Sacramento, CA USACE 2010,
- West Sacramento Project Levee Reconstruction Contract “D” - North Repair Site, (USACE Contract D) USACE 2011,
- West Sacramento Levee Improvement Program, Early Implementation Project, The Rivers Phase 1 Site, As-Built, HDR 2012 (HDR The Rivers),
- West Sacramento Levee Improvement Program, Early Implementation Project, C.H.P. Academy Site - Sacramento Bypass, As-Built, HDR 2012 (HDR CHP Academy)
- Draft Geotechnical Basis of Design Report, Southport Early Implementation Project - Up to 90% Design, BCI, 2015 (BCI Southport EIP).

A brief description of the main documents BCI reviewed for this current study follows.

4.1 West Sacramento Area Flood Control Agency Levee Improvement Program Alternatives Analysis Report

HDR prepared the HDR AA, with consideration to the Draft HDR PIR. The HDR AA presents findings to upgrade the West Sacramento levee system to a level that provides protection from a 200-yr flood event. The HDR AA presents the mitigation selection process, the recommended mitigation alternatives, and a graphical summary of the alternatives considered in the study to mitigate identified deficiencies.

4.2 Geotechnical Evaluation Report, Volume 2, Remedial Measures, West Sacramento Study Area

The 2012 URS RM develops conceptual remediation for the levees identified as having deficiencies in the URS GER (Volume 1). The URS RM presents the levee reaches requiring remediation, the associated deficiency, and the evaluation and confirmation of remediation. In general, URS developed two applicable remedial alternatives for a levee reach considering geomorphology, construction history, past performance data and numerical modeling. Based on practicality, URS then selected one alternative to verify by evaluations and/or analyses.

4.3 Geotechnical Evaluation Report, Volume 2, Remedial Alternatives, South West Sacramento Study Area

The 2014 URS SWS RM presents analysis, evaluation results and associated cost estimates for selecting conceptual remedial alternatives for levees not meeting ULE criteria within the South West Sacramento Study Area as identified in Volume 1, URS SWS GER. Similar to the URS RM, this URS SWS RM presents the levee reaches requiring remediation with the associated deficiency, and the evaluated and confirmed remediation. In general, URS developed two applicable remedial alternatives for a levee reach considering geomorphology, construction history, past performance data and numerical modeling. Based on practicality, URS then selected one alternative to verify by evaluations and/or analyses.

4.4 USACE West Sacramento Project, General Reevaluation Report

The USACE prepared the USACE GRR GA to the General Reevaluation Report for the West Sacramento Project. The USACE GRR GA presents findings from the USACE's geotechnical evaluation and recommendations to address levee deficiencies within the West Sacramento GRR study area. The USACE GRR GA tabulated recommendations to address the identified deficiencies, with additional consideration to existing available subsurface information for cutoff wall depth determination.

5. SUMMARY OF REMEDIAL ALTERNATIVES

The GPIR presents a summary of the levee reaches with identified deficiencies. To address each deficiency, BCI presents one or more recommended remedial alternatives. BCI provides below a general description of each of the alternatives and the deficiencies these alternatives address:

- Drained Stability Berm: designed to address steady-state through seepage and landside slope stability deficiencies.
- Shallow Cutoff Wall: designed to address steady-state through seepage and landside slope stability deficiencies and shallow, uncontrolled nuisance seepage through near-surface silty sand and poorly-graded sand with silt layers, and crevasse splay deposits.
- Deep Cutoff Wall: designed to address steady-state through seepage, underseepage and landside slope stability deficiencies.
- Seepage Berm: designed to address steady-state underseepage and landside slope stability deficiencies.
- Waterside Slope Flattening: designed to address rapid drawdown slope stability deficiencies.
- Waterside Slope Repair with Keyway: designed to address waterside slope slumping during or following high water events.
- Landside Slope Repair with Keyway: designed to address landside slope slumping during or following high water events.
- No Action, Monitor During High Water Events: designed to document landside slope conditions during high water events with respect to potential through seepage and/or landside slope slumping.
- Landside Restrictions: designed to require specific landside restrictions to address steady-state underseepage deficiencies. Restrictions include maintaining a specified water level in landside ditches or restricting landside borrow.
- Relief Wells: designed to address underseepage deficiencies. Due to the water quality permitting needs, increased operation and maintenance responsibilities, and potential impacts to pump stations and internal drainage facilities, relief wells were not identified as a preferred seepage remediation measure.

6. BCI GEOTECHNICAL PROBLEM IDENFICIATION REPORT FINDINGS

BCI prepared the GPIR as part of the overall problem identification evaluation of the West Sacramento flood control system. To prepare the GPIR, BCI reviewed existing available geotechnical evaluations, data and design reports and plans. BCI then performed geotechnical problem identification of each levee segment for steady-state though seepage, underseepage and landside slope stability and waterside rapid drawdown slope stability. Figure 3 presents BCI's identified deficiencies for each levee segment, presented as Figure 11 in the BCI GPIR.

7. GEOTECHNICAL ALTERNATIVES ANALYSIS

BCI evaluated several mitigation alternatives to address the identified deficiencies presented in the BCI GPIR. To conduct this evaluation, BCI:

- Considered mitigation alternatives provided in the USACE, URS and HDR documents, including information presented in the following:
  - Tables 13-1 through 13-10 of the July 2015 USACE GRR.
  - Appendix B, Individual Reach Analysis, contained in the 2012 URS RM,
  - Appendix B, Remediated Conditions Analyses and Cost Estimates, contained in the 2015 URS SWS RA,
  - Figures 13 through 35 of the 2009 HDR AA 2009,
- Considered the specific subsurface conditions within each levee stretch as provided in the USACE, URS and HDR documents,
- Considered relevant information contained in the evaluations performed by others as well as design and construction documents prepared by the USACE, BCI and HDR, all of which are referenced in Section 4.0, and
- Considered topographic surveys and associated cross-sections within each levee segment as provided by WR.

Tables 1 through 9 include BCI's identified geotechnical deficiencies and the respective alternatives to address these deficiencies. Where applicable, BCI presents several alternatives to address a deficiency. Most of the recommendations require confirmation with additional geotechnical subsurface explorations and/or geotechnical seepage and stability evaluations.

Tables 1 through 9 also present the USACE, URS, and HDR identified geotechnical deficiencies and the respective mitigation recommendations presented in each report.

The following sections contain a brief description of the subsurface conditions, identified geotechnical deficiencies, recent improvements, and mitigation recommendations for each levee segment. BCI determined these alternatives based on available explorations and evaluations. Additional geotechnical explorations and evaluations may either reduce or possibly eliminate some of these alternatives.

7.1 Sacramento River West North Levee (SRWNL)

The SRWNL extends for approximately 5.8 miles along the west bank of the Sacramento River from the Sacramento Bypass South Levee to the Port North Levee (i.e. Barge Canal). The levee embankment consists predominantly of poorly-graded sand to poorly-graded sand with silt. The near-surface layer immediately underlying the levee and extending landside and waterside (commonly referred to as the "blanket") consists of silt and clay and varies in thickness from 8 feet to 40 feet, with interbedded layers of silty sand. The relatively permeable soil underlying the blanket (the "aquifer") generally consists of pervious poorly-graded sand with silt and poorly-graded gravel.

Many stretches of levee within this segment are considered high ground and/or wide levees. BCI developed the alternatives considering the existing landside topography and assumed that any landside development would require analysis to determine potential detrimental impacts to the levee, and future development.

BCI and others have generally identified steady-state through seepage deficiencies throughout this levee segment, with isolated areas of steady-state underseepage and landside slope stability deficiencies and waterside rapid drawdown slope stability deficiencies. As discussed in the BCI GPIR, two areas have recently been improved as part of two Early Implementation Projects; "The Rivers EIP" project extending from Station 71+50 to Station 101+00 and "I Street Bridge EIP" project extending from Station 194+50 to Station 199+60.

BCI presents three alternatives to address steady-state through seepage deficiencies, where present, in this levee segment. Alternative 1 consists of no action with monitoring during high water events; this may result in future maintenance if landside slope slumping occurs during or following high water events. Alternative 2, a shallow cutoff wall to Elev. 0 feet, or Alternative 3, a drained stability berm along the landside levee slope, would mitigate the steady-state through seepage deficiency.

Two alternatives are presented to address steady-state underseepage and landside slope stability deficiencies, where present, in this levee segment. Alternative 1 consists of a deep cutoff wall with termination depths ranging from Elev. -55 feet to Elev. -85 feet. The cutoff wall will be designed to cut off the pervious sand and gravel aquifer underlying the levee and loaded by the Sacramento River. Additional explorations will be required to confirm the cutoff wall depth. Alternative 2 consists of a 100- to 150-foot-wide seepage berm, which is wider than a calculated minimum berm width. BCI anticipate that the wider berm will be required due to the thick aquifer and the proximity of the Sacramento River to the levee. Additional analyses will be required to confirm the required seepage berm width.

Waterside slopes steeper than 2H:1V exist within several stretches of this levee segment. For levee stretches considered high ground and/or wide levees, identification of a waterside rapid drawdown slope stability deficiency is dependent on the assumed embedded levee template. Two alternatives are considered within these levee stretches with waterside slopes steeper than 2H:1V. The first alternative consists of flattening the waterside slopes to 2H:1V. The second alternative considers this a maintenance issue, which requires waterside slope repair, as necessary, to maintain the identified levee template waterside slope.

In multiple areas, BCI recommends additional explorations and geotechnical analyses to confirm the identified deficiencies. These explorations and analyses may reduce or eliminate the need for remediation in isolated levee stretches.

Table 1 presents a summary of our recommended alternatives.

7.2 Sacramento River West South Levee (SRWSL)

The SRWSL extends for approximately 6.3 miles along the west bank of the Sacramento River from the Port South Levee (i.e. Barge Canal) to the South Cross Levee. The levee embankment consists predominantly of poorly-graded sand to poorly-graded sand with silt. The blanket consists of silt and clay and varies in thickness from 8 feet to 40 feet, with interbedded layers of silty sand. The aquifer generally consists of pervious poorly-graded sand with silt and poorly-graded gravel.

Previous studies identified geotechnical deficiencies throughout this levee segment; however, the USACE performed recent levee improvements in the northern section of the levee segment and the Southport EIP project will address identified deficiencies for the remaining levee segment. No additional analyses will be required for this levee segment as part of this current study due to these improvements. Table 2 presents a summary of our recommended alternatives.

7.3 Sacramento Bypass South Levee & Training Berm

The Sacramento Bypass South Levee extends for approximately 1.2 miles along the south side of the Sacramento Bypass between the Sacramento River to the Yolo Bypass East Levee. The Training Berm is the segment of the Sacramento Bypass South Levee that extends approximately 0.5 miles past the Yolo Bypass East Levee into the Yolo Bypass. The Training Berm directs water from the Sacramento Bypass into the main channel of the Yolo Bypass. Properties in the City do not directly depend on the Training Berm for flood protection.

Recent levee improvements occurred along the Sacramento Bypass South Levee from Station 0+00 to Station 61+75 to address identified geotechnical deficiencies. These improvements were constructed under the West Sacramento Project Levee Reconstruction Contract B under USACE, and the CHP Academy EIP under the West Sacramento Levee Improvement Program (WSLIP) and included slope flattening, levee raises, and slurry cutoff walls.

The levee embankment along the entirety of the Training Berm consists predominantly of silt and clay. The westernmost portion of the Sacramento Bypass South Levee (from Station 0+00 to approximate Station 35+00) also consists predominantly of silt and clay. East of Station 35+00, the original material levee embankment transitions to sand to silty sand. The CHP Academy EIP as-builts indicate that the levee improvement reconstructed cap consists of Type 1 levee material. Type 1 levee material is defined as lean clay, silt or clayey silt in the Final Design

Documentation Report prepared by HDR. The blanket consists of silt and clay and varies in thickness from 10 to 50 feet, with interbedded layers of silty sand. The aquifer generally consists of pervious poorly-graded sand with silt and poorly-graded gravel.

With consideration of the levee improvements recently performed on the Sacramento Bypass Levee, BCI presents two alternatives from Station 61+75 to Station 64+99 (the east end of the levee segment) to address steady-state through seepage and underseepage deficiencies. Alternative 1 consists of waterside slope flattening and a deep cutoff wall with a termination depth of Elev. -100 feet. The cutoff wall will be designed to cut off the pervious sand and gravel aquifer underlying the levee which may be loaded by the Sacramento River. Additional explorations will be required to confirm the cutoff wall depth and potential influence of the Sacramento River. Alternative 2 consists of waterside slope flattening and a minimum 100-foot-wide seepage berm. Additional analysis will be required to confirm the design width. Additional geotechnical analyses may reduce the alternative to a shallow cutoff wall with a termination depth to Elev. -5 feet.

Although BCI does not recommend any alternatives from Station 40+00 to Station 61+75, we do recommend evaluating piezometer readings and visual inspections during high water events to confirm that the recent levee improvements are performing as designed. In addition, BCI agrees with previous studies to flatten the slopes of the Training Berm to 3H:1V to address slope stability deficiencies.

Table 3 presents a summary of our recommended alternatives.

7.4 Yolo Bypass East Levee

The Yolo Bypass East Levee extends for approximately 3.7 miles along the east side of the Yolo Bypass from the Sacramento Bypass South Levee to the Port North / DWSC West Levees. The levee embankment consists predominantly of lean and fat clay and loose silt. The blanket consists of silt and clay and varies in thickness from 5 to 20 feet, with some areas of interbedded layers of silty sand. The aquifer generally consists of pervious poorly-graded sand with silt, poorly-graded sand and silty sand of varying thickness.

BCI and others have identified steady-state through seepage, underseepage, landside slope stability and waterside rapid drawdown slope stability deficiencies generally throughout the levee segment. The USACE has performed numerous reconstruction projects throughout this levee segment, several as emergency repairs to levee slope failures on both the waterside and landside slopes. Up to eight different plan sets document repairs conducted along this levee stretch.

BCI and others identified steady-state underseepage and landside slope stability deficiencies from Station 25+00 to Station 51+63. To address these deficiencies, BCI presents two alternatives. Alternative 1 includes a deep cutoff wall to Elev. -10 feet, with additional explorations required to confirm the cutoff layer. Alternative 2 includes a minimum 80-foot-wide seepage berm with additional analyses required to confirm the berm width.

From Station 51+63 to Station 70+00 and from Station 82+82 to Station 136+00, BCI recommends alternatives consisting of landside and/or waterside slope mitigation measures with a reinforced levee toe and keyway for those areas that have not been improved during recent levee repairs. BCI recommends additional trench explorations to confirm the existing subsurface soil conditions.

From Station 136+00 to Station 155+00, BCI recommends two alternatives to address steady-state underseepage deficiencies. Alternative 1 includes a deep cutoff wall to Elev. -55 feet with additional explorations needed to confirm the cutoff layer. Alternative 2 includes a minimum 80-foot-wide seepage berm with additional evaluations to confirm the berm width. Additional explorations and analyses may reduce the alternatives analyses to no mitigation in this area.

Beyond Station 155+00, the recent mitigation measures implemented by the USACE should be sufficient. Table 4 presents a summary of our recommended alternatives.

7.5 Deep Water Ship Channel West Levee (DWSC WL)

The DWSC West Levee (a.k.a. Navigation Levee) extends for approximately 19 miles along the west bank of the DWSC from the Yolo Bypass East Levee/Port North Levee to Miner Slough. The levee embankment consists predominantly of lean to fat clay with lenses of silty sand and clayey sand. The blanket consists of silt and clay and varies in thickness from 5 to 25 feet with lenses of silty sand and clayey sand. The aquifer generally consists of silty sand and pervious poorly-graded sand with silt, poorly-graded sand, poorly-graded gravel and poorly-graded gravel with silt of varying thickness. At the downstream end of the segment, the aquifer consists of thin lenses of silty sand and poorly-graded sand with silt.

Previous studies identified steady-state through seepage, underseepage, and landside slope stability deficiencies in some reaches along this levee. However, these analyses considered cross-sections based on limited subsurface explorations and some assumed future landside borrow, which impacts seepage and landside stability.

We recommend two primary alternatives along this levee. The first is no mitigation, with the requirement of channel-side borrow restrictions. Currently, the spoils of dredged material from the channel, which have been placed on the ship channel side of the levee, act as a seepage and stability berm. If removal of the spoils is restricted, seepage and stability deficiencies are prevented. Further geotechnical evaluation will be required to determine the required boundaries for removal. Our second primary alternative is a deep cutoff wall with varying termination elevations based on the anticipated depth to a cutoff layer. In most cases, the deep cutoff wall would eliminate the need for borrow restrictions beyond the levee template.
In two stretches, Station 202+00 to 209+00 and 681+00 to 705+00, BCI provides additional alternatives to address the sandy material noted within the levee.

Table 5 presents a summary of our recommended alternatives.

7.6 Deep Water Ship Channel East Levee (DWSC EL)

The evaluated portion of the DWSC East Levee extends for approximately 2.6 miles south along the east side of the DWSC from the Port South Levee to the South Cross Levee. The levee embankment consists predominantly of lean and fat clay. The blanket consists of silt and clay and varies in thickness from 10 to 20 feet with lenses of silty sand. The aquifer generally consists of silty sand and pervious poorly-graded sand with silt and poorly-graded sand of varying thickness up to Station 91+00. Beyond Station 91+00, the aquifer consists of thin lenses of silty sand and poorly-graded sand with silt.

Previous studies identified steady-state through seepage, underseepage, and landside slope stability, and waterside rapid drawdown deficiencies in this levee segment. However, these analyses considered cross-sections based on limited subsurface explorations. In addition, the underseepage deficiency is identified at the landside ditch, not at the levee toe.

BCI presents two alternatives to address these deficiencies. Alternative 1 consists of a deep cutoff wall of varying depths. Additional explorations will be required to confirm the cutoff layer. Alternative 2 consists of an 80-foot-wide seepage berm. Additional geotechnical evaluations will be required to confirm the seepage berm width. In addition, BCI recommends waterside slope flattening near both pump stations, and landside slope flattening near the Main Drain Pump Station.

Additional explorations and evaluations may reduce these alternatives. Table 6 presents a summary of our recommended alternatives.

7.7 South Cross Levee

The South Cross Levee extends for approximately 1.2 miles between the SRWSL and the DWSC East Levee. The levee embankment consists predominantly of lean and fat clay. The blanket consists of silt and clay and varies in thickness from 15 to 40 feet. The aquifer generally consists of silty sand and pervious poorly-graded sand with silt and poorly-graded sand of varying thickness.

BCI and others identified steady-state underseepage and landside slope stability, and waterside rapid drawdown slope stability deficiencies generally throughout this levee segment. BCI presents two alternatives to address these deficiencies. Alternative 1 consists of landside slope flattening and a cutoff wall to Elevation -35 feet. Additional explorations will be required to confirm the cutoff layer. Alternative 2 consists of a minimum 80-foot-wide seepage berm. Additional analyses will be required to confirm the berm width.

The analyses performed by others assumed connectivity between the existing waterside borrow trench and landside aquifer, which may be overly conservative. Therefore, additional explorations and evaluations may reduce the recommended alternatives to either no mitigation or only landside slope flattening. Table 7 presents a summary of our recommended alternatives.

7.8 Port North Levee

The Port North Levee extends for approximately 4.6 miles along the north bank of the DWSC between the Yolo Bypass East Levee / DWSC West Levee and the SRWNL/Barge Canal. There are many structures along the levee associated with the Port of West Sacramento. This includes the lock structure associated with the Barge Canal at the eastern end. In general, the Port North Levee serves as high ground for industrial development. Due to the nature of the Port of West Sacramento, there are many low points in the Port North Levee that are used to access the water. The levee embankment consists predominantly of lean and fat clay. The blanket consists of silt and clay and varies in thickness from 10 to 20 feet. The aquifer generally consists of silty sand and pervious poorly-graded sand with silt and poorly-graded sand of varying thickness.

Previous studies did not identify any geotechnical deficiencies in this levee segment. However, the existing number of explorations does not meet USACE criteria, the levee is partially deficient in freeboard, and one over-steep stretch has not been previously evaluated for rapid drawdown risk.

From Stations 8+00 to 26+00 and 35+50 to 236+00, two alternatives are presented. Alternative 1 is no mitigation with potential nuisance (shallow foundation) seepage and resulting landside maintenance concerns, and Alternative 2 is a shallow cutoff wall, which would prevent any nuisance seepage.

From Station 26+00 to 35+50, waterside slope flattening is recommended, as the steep slope presents a rapid drawdown concern. However, additional explorations and a geotechnical evaluation may eliminate the need for this mitigation.

Table 8 presents a summary of our recommended alternatives.

7.9 Port South Levee

The Port South Levee extends for approximately 3.7 miles along the southern bank of the DWSC between the DWSC East Levee and the Sacramento River/Barge Canal. The levee embankment consists predominantly of lean and fat clay, with some sand on the eastern leg of the levee. The blanket consists of silt and clay and varies in thickness from 10 to 40 feet. The aquifer generally consists of silty sand and pervious poorly-graded sand with silt and poorly-graded sand of varying thickness.

Previous studies identified a steady-state underseepage deficiency in one portion of this levee. In addition to this deficiency, BCI identified an area of waterside rapid drawdown slope stability risk, and an area subject to through seepage and nuisance seepage.

From Stations 23+00 to 116+00 and 118+00 to 123+50, we present two alternatives to address underseepage. Alternative 1 is a deep cutoff wall, and Alternative 2 is a 45- to 50-foot-wide seepage berm. From Station 138+00 to 158+00, we recommend waterside slope flattening to mitigate rapid drawdown slope instability. Partially overlapping this segment, from Station 143+00 to 186+93, we recommend consideration of a shallow cutoff wall to mitigate through seepage and potential nuisance seepage. Since existing explorations and geotechnical evaluations along this levee are limited, it is possible that any of these alternatives may be determined to be unnecessary with further explorations and subsequent evaluations.

Table 9 presents a summary of our recommended alternatives.

8. LIMITATIONS

BCI prepared this GAA for Wood Rogers and the West Sacramento Area Flood Control Agency for the West Sacramento Flood Engineering Services Problem Identification Report. This GAA should not be used by others or for other projects without BCI's written permission.

This study was limited to the evaluation of work performed by others. Additional subsurface exploration, laboratory testing, and analysis recommended in this report will be necessary to provide a sufficient evaluation of geotechnical deficiencies in some levee segments.

BCI performed services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. We do not warranty our services.

Our scope did not include evaluation of on-site hazardous material or biological pollutants. Please contact BCI if you would like an evaluation of these items.

CITY OF WEST SACRAMENTO
FLOOD PROGRAM ENGINEERING SERVICES
GEOTECHNICAL PROBLEM IDENTIFICATION REPORT

West Sacramento, California

TABLES

Table 1 - BCI Alternatives, Sacramento River West North Levee

Table 2 - BCI Alternatives, Sacramento River West South Levee

Table 3 - BCI Alternatives, Sacramento Bypass South Levee and Training Levee

Table 4 - BCI Alternatives, Yolo Bypass East Levee

Table 5 - BCI Alternatives, DWSC West Levee

Table 6 - BCI Alternatives, DWSC East Levee

Table 7 - BCI Alternatives, South Cross Levee

Table 8 - BCI Alternatives, Port North Levee

Table 9 - BCI Alternatives, Port South Levee

Table 1: BCI Alternatives, Sacramento River West North Levee

Levee Station Interval From	Levee Station Interval To	URS Reach	Geotechnical Deficiencies Identified by USACE, URS, HDR*: Under-seepage / Waterside (RD) Slope Stability	Geotechnical Deficiencies Identified by USACE, URS, HDR*: Through Seepage / Landside (SS) Slope Stability	USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*: Under-seepage / Waterside (RD) Slope Stability	Geotechnical Deficiencies Identified by BCI*: Through Seepage / Landside (SS) Slope Stability	BCI Geotechnical Mitigation Recommendations
0+00	16+00	E		X[1,2,3]	Cutoff Wall to Elev. 0 ft	Monitor	Shallow cutoff wall and LS slope flattening		X?	**Alternative 1: No mitigation with potential future maintenance concerns if landside slope slumping is observed after prolonged high water events.** **Alternative 2: Shallow cutoff wall to Elev. 0 ft and no anticipated future maintenance.** **Alternative 3: Drained stability berm and no anticipated future maintenance.**
16+00	43+00	F		X[1,2,3]	Cutoff Wall to Elev. 0 ft	Drained Stability Berm	Shallow cutoff wall and LS slope flattening		X?	**Alternative 1: No mitigation with potential future maintenance concerns if landside slope slumping is observed after prolonged high water events.** **Alternative 2: Shallow cutoff wall to Elev. 0 ft with no anticipated future maintenance.** **Alternative 3: Drained stability berm with no anticipated future maintenance.**
43+00	60+00	G		X[1,2,3]	Cutoff Wall to Elev. 0 ft	Monitor	Shallow cutoff wall, LS slope flattening, levee raise from Sta 56+00		X?	
60+00	71+50	H (71+00)		X[1,2]	Cutoff Wall to Elev. 0 ft	Monitor	LS slope flattening, levee raise to Sta 70+50		X?	
				X[2]						
71+50	101+00	I	X[2,3]	X[2,3]	None	DSM Cutoff Wall to ~102+00	LS slope flattening, shallow cutoff wall (Sta 75+00-90+00)			**No mitigation.** *"The Rivers EIP"*, levee improvements mitigated geotechnical deficiencies
				X[2,3]						
101+00	136+00	J		X[1,2]	Cutoff Wall to Elev. 0 ft	Monitor	LS slope flattening, and deep cutoff wall beginning Sta 130+00		X?	**Alternative 1: No mitigation with potential future maintenance concerns if landside slope slumping is observed after prolonged high water events.** **Alternative 2: Shallow cutoff wall to Elev. 0 ft with no anticipated future maintenance.** **Alternative 3: Drained stability berm with no anticipated future maintenance.**
				X[3]						
136+00	140+30	K1	X[2,3]	X[1,3]	Cutoff Wall to Elev. 0 ft	DSM Wall >70 ft deep	LS slope flattening, and deep cutoff wall	X		**Alternative 1: Cutoff wall to Elev. -55 ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: 100- to 150-foot-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to a shallow cutoff wall to Elev. 0 feet.
				X[2,3]					X	
140+30	152+00	K1	X[2,3]	X[3]	Cutoff Wall to Elev. -50 ft	DSM Wall >70 ft deep	LS slope flattening, deep cutoff wall, and levee raise from Sta 146+00	X		**Alternative 1: Cutoff wall to Elev. -55 ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: 100- to 150-foot-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to a shallow cutoff wall to Elev. 0 feet.
				X[1,2,3]					X	
152+00	155+00	K2	X[3]	X[3]	Cutoff Wall to Elev. -50 ft	Waterside Slope Flattening	LS slope flattening, deep cutoff wall, and levee raise	X		**Alternative 1: Cutoff wall to Elev. -85 ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: 100- to 150-foot-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to a shallow cutoff wall to Elev. 0 feet. Consider waterside slope flattening for each alternative.
			X[2]	X[1,3]				X?		
155+00	161+00	K2 (163+00)	X[3]	X[3]	Cutoff Wall to Elev. -80 ft	Waterside Slope Flattening	LS slope flattening, deep cutoff wall, and levee raise	X		
			X[2]	X[1,3]				X?		
161+00	194+60	L	X[2,3]	X[2,3]	Cutoff Wall to Elev. -80 ft	DSM Wall >70 ft	LS slope flattening, deep cutoff wall, and levee raise to Sta 191+00	X	X	**Alternative 1: Cutoff wall to Elev. -75 ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: 100- to 150-foot-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to a shallow cutoff wall to Elev. 0 feet.
				X[1,3]						
194+60	199+60	L	X[2,3]	X[1,2,3]	Cutoff Wall to Elev. -5 ft	DSM Wall >70 ft	None	X?		*"I Street Bridge EIP"* improvements mitigated geotechnical deficiencies **No mitigation.**
199+60	215+30	L (216+00)	X[2,3]	X[2,3]	Cutoff Wall to Elev. -80 ft	DSM Wall >70 ft	LS slope flattening, deep cutoff wall, and levee raise	X	X	**Alternative 1: Cutoff wall to Elev. -75 ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: 100- to 150-foot-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to a shallow cutoff wall to Elev. 0 feet.
				X[1]						
215+30	301+57	M			None	Monitor	LS slope flattening and deep cutoff wall to Sta 220+00, then None			**No mitigation.** Consider waterside slope flattening minimum 2(H):1(V).
			X[2]							

* An X indicates an identified deficiency; an X? indicates a likely deficiency. [1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015;* [2] URS, *Geotechnical Evaluation Report, Volume 1, Existing Conditions, West Sacramento Study Area, Urban Levee Geotechnical Evaluations Program, Contract 4600007418, May 2012.* [3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009.*

Table 2: BCI Alternatives, Sacramento River West South Levee

Levee Station Interval		URS Reach	Geotechnical Deficiencies Identified by USACE, URS, HDR*		USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Preferred Alternative)	Geotechnical Deficiencies Identified by BCI*		BCI Geotechnical Mitigation Recommendations
			Under-seepage	Through Seepage				Under-seepage	Through Seepage	
From	To		Waterside (RD) Slope Stability	Landside (SS) Slope Stability				Waterside (RD) Slope Stability	Landside (SS) Slope Stability	
0+00	43+00	T (40+87)	X[1]	X[1]	Adjacent Levee, Cutoff Wall to Elev. -5 ft	Flatten slopes	Flatten slopes			**No mitigation for this study.** Southport EIP improvements will mitigate deficiencies. Construction completion anticipated by 2017-2018.
			X[3]							
43+00	65+00	S	X[1,2,3]	X[1]	Adjacent Levee, Cutoff Wall to Elev. -5 ft and 70' Wide Seepage Berm	Flatten slopes and DSM Wall or Seepage Berm	Relief wells and flatten slopes	X		
			X[2,3]	X[2,3]				X	X	
65+00	129+87	S	X[1,2,3]	X[1]	Setback or Adjacent Levee, Cutoff Wall to Elev. -5 ft and 80' wide Seepage Berm	Flatten slopes and DSM Wall or Seepage Berm	Flatten slopes (to Sta 95+00), Relief wells, Setback levee (from Sta 95+00)	X		
			X[2,3]	X[2,3]				X	X	
129+00	167+00	R (161+64)	X[1,2,3]	X[1]	Setback or Adjacent Levee, Cutoff Wall to Elev. -5 ft and 80' wide Seepage Berm	Flatten slopes and DSM Wall or Seepage Berm	Relief wells and setback levee	X		
			X[3]	X[2,3]				X	X	
167+00	189+77	Q	X[1,2,3]	X[1]	Setback or Adjacent Levee, Cutoff Wall to Elev. 0 ft and 100' wide Seepage Berm	Flatten slopes and DSM Wall or Seepage Berm	Relief wells and setback levee	X		
			X[3]	X[2,3]				X	X	
189+77	196+00	P	X[1,2,3]	X[1]	Setback or Adjacent Levee, Cutoff Wall to Elev. 0 ft and 100' wide Seepage Berm	Conventional SB Slurry Wall	Relief wells and setback levee	X		
			X[3]	X[3]				X	X	
196+00	214+87	P	X[1,2,3]	X[1]	Setback or Adjacent Levee, Cutoff Wall to Elev. 0 ft and 100' wide Seepage Berm	Conventional SB Slurry Wall	Relief wells and setback levee	X		
			X[3]	X[3]				X	X	
214+87	275+00	O	X[1,2,3]	X[1]	Setback or Adjacent Levee, Cutoff Wall to Elev. 0 ft and 100' wide Seepage Berm	Flatten slopes and DSM Wall or Seepage Berm	Relief wells and setback levee	X		
			X[3]	X[3]				X	X	
275+00	295+00	O (293+65)	X[1,2,3]	X[1]	Adjacent Levee, Cutoff Wall to Elev. -70 ft	Flatten slopes and DSM Wall or Seepage Berm	Flatten slopes and Relief wells	X		
			X[3]	X[1,3]				X	X	
295+00	315+00	N		X[2]	None	Replacement Levee	Flatten slopes, relief wells, adjacent levee (~Sta 308+00)			**No mitigation.** New setback levee and slurry wall has mitigated deficiencies.
			X[2,3]	X[3]						
315+00	332+70	N		X[2]	None	Replacement Levee	Flatten slopes and levee raise			
			X[2]							

* An X indicates an identified deficiency; an X? indicates a likely deficiency.
[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*
[2] URS, *Geotechnical Evaluation Report, Volume 1, Existing Conditions, West Sacramento Study Area, Urban Levee Geotechnical Evaluations Program, Contract 4600007418, May 2012*
[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009*

Table 3: BCI Alternatives, Sacramento Bypass South Levee

Levee Station Interval From	Levee Station Interval To	URS Reach	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Under-seepage / Waterside (RD) Slope Stability	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Through Seepage / Landside (SS) Slope Stability	USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*: Under-seepage / Waterside (RD) Slope Stability	Geotechnical Deficiencies Identified by BCI*: Through Seepage / Landside (SS) Slope Stability	BCI Geotechnical Mitigation Recommendations
Training Levee		A				Flatten slopes and place riprap				**Flatten both slopes to 3(H):1(V).**
			X[2]					X		
0+00	3+00	B	X[2]		None	Conventional SB Cutoff Wall, Armor crest and LS slope for erosion from overtopping to meet 200-yr+6 ft	None			**No mitigation.**
			X[2]							
3+00	18+00	B	X[2]		None	Conventional SB Cutoff Wall, Armor crest and LS slope for erosion from overtopping to meet 200-yr+6 ft	None			
			X[2]							
18+00	40+00	B (39+00)	X[1,2]		Cutoff wall to Elev. -40 ft	Conventional SB Cutoff Wall, Armor crest and LS slope for erosion from overtopping to meet 200-yr+6 ft	None to ~ Sta 21+00, then cutoff wall			
			X[2]							
40+00	53+00	C	X[2,3]	X[3]	Cutoff wall to Elev. 5 ft	Conventional SB Cutoff Wall, Armor crest and LS slope for erosion from overtopping to meet 200-yr+6 ft	Cutoff wall			**No mitigation.** Evaluate piezometer readings and perform visual inspections during high water events.
				X[1,3]						
53+00	57+00	C	X[2,3]	X[3]	Cutoff wall to Elev. 5 ft	Conventional SB Cutoff Wall, Armor crest and LS slope for erosion from overtopping to meet 200-yr+6 ft	Cutoff wall			
				X[1,3]						
57+00	61+75	D		X[2,3]	Cutoff wall to Elev. 5ft	Conventional SB Cutoff Wall, Armor crest and LS slope for erosion from overtopping to meet 200-yr+6 ft	Cutoff wall			
				X[1,3]						
61+75	64+60	D		X[2,3]	Cutoff wall to Elev. 5 ft to Sta 64+50. None Sta 64+50 to 64+80.	Conventional SB Cutoff Wall, Armor crest and LS slope for erosion from overtopping to meet 200-yr+6 ft	Cutoff wall	X	X	**Alternative 1: Waterside slope flattening (to Sta 63+50) and deep cutoff wall to Elev. -100 feet. Additional explorations may be required to confirm cutoff wall depth. Alternative 2: Waterside slope flattening to 63+50 and minimum 100-foot-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to waterside slope flattening (to Sta 63+50) and cutoff wall to Elev. 5 ft.
				X[1,3]						

* An X indicates an identified deficiency; an X? indicates a likely deficiency.
[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*
[2] URS, *Geotechnical Evaluation Report, Volume 1, Existing Conditions, West Sacramento Study Area, Urban Levee Geotechnical Evaluations Program, Contract 4600007418, May 2012*
[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009*

Table 4: BCI Alternatives, Yolo Bypass East Levee

Levee Station Interval		URS Reach	Geotechnical Deficiencies Identified by USACE, URS, HDR*		USACE Recommendations	URS Recommendations	HDR Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*		BCI Geotechnical Mitigation Recommendations
			Under-seepage	Through Seepage				Under-seepage	Through Seepage	
From	To		Waterside (RD) Slope Stability	Landside (SS) Slope Stability				Waterside (RD) Slope Stability	Landside (SS) Slope Stability	
0+00	25+00	Z (-2+00)			None	Armor, and monitor WS slope	Landside stability berm			**No mitigation**. Monitor waterside slope during and after high water events. If waterside slope failure is observed, waterside slope reconstruction will be required.
				X[3]						
25+00	27+52	Z	X[1]		Cutoff Wall to Elev. -10ft (40 ft Deep)	Armor, and monitor WS slope	Landside stability berm			
				X[3]						
27+52	50+00	AA	X[1,2,3]	X[3]	Cutoff Wall to Elev. -10ft (40 ft Deep)	Armor, and conventional soil-bentonite slurry cutoff wall 70 ft deep	Landside stability berm and cutoff wall after ~Sta 32+00	X		**Alternative 1: Cutoff wall to Elev. -10ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: Minimum 80-ft-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to no mitigation in some areas.
				X[2,3]					X	
50+00	51+63	AA	X[2,3]	X[3]	None	Armor, and conventional soil-bentonite slurry cutoff wall 70 ft deep	Landside stability berm and cutoff wall	X?		**Alternative 1: Cutoff wall to Elev. -10ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: Minimum 80-ft-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to no mitigation.
				X[2,3]					X?	
51+63	61+58	AB		X[3]	None	Armor, WS slope reconstruction w/reinforcement key	Landside stability berm and cutoff wall			**Waterside slope reconstruction with keyway and stability berm as performed under Contract C from Sta 70+00 to 85+00.**
			X[2]	X[3]				X		
61+58	70+00	AC		X[3]	None	Armor, WS slope reconstruction w/reinforcement key	Landside stability berm and cutoff wall			
			X[2]	X[3]				X		
70+00	82+82	AC		X[3]	None	Armor, WS slope reconstruction w/reinforcement key	Landside stability berm and cutoff wall			**No mitigation.**
			X[2]	X[3]						
82+82	95+50	AD	X[3]	X[3]	None	Armor, LS and WS slope reconstruction with internal drain	Landside stability berm and cutoff wall			**Waterside and landside slope reconstruction with keyway and internal drain, similar to landside construction under Contract D in 2011 (Sta 95+50 to 114+50) and WS construction under Levee Slump Repair Work in 2002 (Sta 117+00 to 124+00).** Additional trench explorations to confirm.
			X[2]	X[2,3]				X	X	
95+50	114+50	AD	X[3]	X[3]	None	Armor, LS and WS slope reconstruction with internal drain	Landside stability berm and cutoff wall			**Waterside slope reconstruction with reinforced keyway and placement of geotextile and drain rock on waterside slope similar to WS construction under Levee Slump Repair Work in 2002 (Sta 117+00 to 124+00).** Additional trench explorations to confirm.
			X[2]	X[2,3]				X		
114+50	130+00	AD	X[3]	X[3]	None	Armor, LS and WS slope reconstruction with internal drain	Landside stability berm and cutoff wall			**Landside slope reconstruction with keyway and internal drain, similar to LS construction under Contract D in 2011 (Sta 95+50 to 114+50).** Determine location of emergency levee repair around pump station in 1983 to evaluate sufficiency of landside levee repair which may result in no mitigation in this area.
			X[2]	X[2,3]					X	
130+00	136+00	AD (136+11)	X[3]	X[3]	None	Armor, LS and WS slope reconstruction with internal drain	Landside stability berm and cutoff wall			**Waterside and landside slope reconstruction with keyway and internal drain, similar to landside construction under Contract D in 2011 (Sta 95+50 to 114+50) and waterside construction under Levee Slump Repair Work in 2002 (Sta 117+00 to 124+00).** Determine location of emergency levee repair around pump station in 1983 to evaluate sufficiency of landside levee repair which may result in no mitigation in this area.
			X[2]	X[2,3]				X	X	
136+00	155+00	AE	X[1,2]	X[3]	Cutoff Wall to Elev. -70ft	Armor, and maintain full ditch condition	None	X		**Alternative 1: Cutoff wall to Elev -55ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: Minimum 80-ft-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to no mitigation.
				X[3]						
155+00	157+55	AE	X[2]	X[3]	None	Armor, and maintain full ditch condition	None			**No mitigation.**
				X[3]						
157+55	197+55	AF (198+00)		X[3]	None	Armor Only	None			
				X[3]						

* An X indicates an identified deficiency; an X? indicates a likely deficiency.
[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*
[2] URS, *Geotechnical Evaluation Report, Volume 1, Existing Conditions, West Sacramento Study Area, Urban Levee Geotechnical Evaluations Program, Contract 4600007418, May 2012*
[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009*

Table 5: BCI Alternatives, Deep Water Ship Channel West Levee

Levee Station Interval From	Levee Station Interval To	URS Reach	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Under-seepage Waterside (RD) Slope Stability	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Through Seepage Landside (SS) Slope Stability	USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*: Under-seepage Waterside (RD) Slope Stability	Geotechnical Deficiencies Identified by BCI*: Through Seepage Landside (SS) Slope Stability	BCI Geotechnical Mitigation Recommendations
0+00	35+00	J	X[1,2,3]	X[2,3]	Cutoff Wall to Elev. -60 ft	Levee raise, geometry improvements, waterside cutoff trench, and specified future borrow limitations.	Cutoff wall, levee raise, and riprap. (Contract C constructed prior)	X	X	**Alternative 1: No mitigation with channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** **Alternative 2: Cutoff wall to Elev. -60 ft. Perform additional explorations to confirm depth of cutoff layer.**
35+00	40+00	J	X[2,3]	X[2,3]	None	Levee raise, geometry improvements, waterside cutoff trench, and specified future borrow limitations.	Cutoff wall, levee raise, and riprap.			**No mitigation. Confirm with additional geotechnical evaluation, including additional explorations.**
40+00	60+00	J	X[2]	X[2]	None	Levee raise, geometry improvements, waterside cutoff trench, and specified future borrow limitations.	Levee raise and riprap.			
60+00	111+00	J	X[1,2]	X[2]	Cutoff Wall to Elev. -60 ft	Levee raise, geometry improvements, waterside cutoff trench, and specified future borrow limitations.	Levee raise and riprap.	X		**Alternative 1: No mitigation with channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** **Alternative 2: Cutoff wall to Elev. -60 ft. Perform additional explorations to confirm depth of cutoff layer.**
111+00	115+00	I	X[1,2]		Cutoff Wall to Elev. -60 ft	Levee raise and specified future borrow limitations.	Levee raise and riprap.			**No mitigation. Confirm with additional geotechnical evaluation, including additional explorations.**
115+00	130+00	I	X[2]		None	Levee raise and specified future borrow limitations.	Levee raise and riprap.			
130+00	145+00	I	X[1,2]		Cutoff Wall to Elev. -30 ft	Levee raise and specified future borrow limitations.	Levee raise and riprap.			
145+00	165+00	I	X[1,2]		Cutoff Wall to Elev. -30 ft	Levee raise and specified future borrow limitations.	Levee raise and riprap.	X		**Alternative 1: No mitigation with channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** **Alternative 2: Cutoff wall to Elev. -30 ft. Perform additional explorations to confirm depth of cutoff layer.**
165+00	200+00	I	X[1,2]		Cutoff Wall to Elev. -30 ft	Levee raise and specified future borrow limitations.	Levee raise and riprap.			**No mitigation. Confirm with additional geotechnical evaluation, including additional explorations.**
200+00	202+00	I	X[1,2]		Cutoff Wall to Elev. -55 ft	Levee raise and specified future borrow limitations.	Levee raise and riprap.			
202+00	290+00	H (291)	X[1,2]	X[2] X[2]	Cutoff Wall to Elev. -55 ft	Levee raise and specified future borrow limitations. Remove and replace SM embankment with a select low permeability fill.	Levee raise and riprap.	X	X X?	**Alternative 1: Strengthen-in-place[4] with channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** **Alternative 2: Landside stability berm and channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** **Alternative 3: Strengthen-in-place[4] and cutoff wall to Elev. -55 ft. Perform additional explorations to confirm depth of cutoff layer.**
290+00	486+00	G			None	Levee raise, geometry improvements, and specified future borrow limitations.	Levee raise and riprap.			**No mitigation. Confirm with additional explorations and evaluation.**
486+00	521+00	F	X[2]	X[2]	None	Levee raise, geometry improvements, waterside cutoff trench, and specified future borrow limitations.	Levee raise and riprap.	X		**Alternative 1: No mitigation with channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** **Alternative 2: Cutoff wall to Elev. -60 ft. Perform additional explorations to confirm depth of cutoff layer.** In some areas, additional explorations and evaluation may result recommendation of a shallow cutoff wall to Elev. -10 ft, to address through seepage and nuisance seepage, instead of the deeper wall.

Table 5 (continued): BCI Alternatives, Deep Water Ship Channel West Levee

Levee Station Interval		URS Reach	Geotech Deficiencies Identified Issues by USACE, URS, HDR*		USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*		BCI Geotechnical Mitigation Recommendations
From	To		Under-seepage / Waterside (RD) Slope Stability	Through Seepage / Landside (SS) Slope Stability				Under-seepage / Waterside (RD) Slope Stability	Through Seepage / Landside (SS) Slope Stability	
521+00	681+00	E	X[2]		None	Levee raise, geometry improvements, and specified future borrow limitations.	Levee raise and riprap.	X	X?	**Alternative 1: No mitigation with channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** **Alternative 2: Cutoff wall to Elev. -80 ft. Perform additional explorations to confirm depth of cutoff layer.** In some areas, additional explorations and evaluation may result in a recommendation for a shallow cutoff wall to Elev. -10 ft, to address through seepage and nuisance seepage, instead of the deeper wall.
681+00	705+00	D	X[2]	X[2]	None	Levee raise, geometry improvements, and specified future borrow limitations. Decision was made to not mitigate for through seepage because heads are lower in this reach.	Levee raise and riprap.		X	**Alternative 1: Cutoff wall to Elev. 5 ft. Perform additional explorations and evaluation to confirm depth of cutoff layer and determine necessary restrictions.** **Alternative 2: Landside stability berm and/or channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** Additional explorations and evaluation may reduce the recommended remedial measure.
705+00	720+00	D	X[2]	X[2]	None	Levee raise, geometry improvements, and specified future borrow limitations. Decision was made to not mitigate for through seepage because heads are lower in this reach.	Levee raise and riprap.	X	X	**Cutoff wall to Elev. -10 ft and channel-side borrow restrictions. Perform additional explorations and evaluation to determine necessary restrictions.** Additional explorations and evaluation may reduce the recommended remedial measure to only channel-side borrow restrictions.
720+00	741+00	D	X[2]	X[2]	None	Levee raise, geometry improvements, and specified future borrow limitations. Decision was made to not mitigate for through seepage because heads are lower in this reach.	Levee raise and riprap.			**No mitigation.**
741+00	1001+00	C			None	Levee raise and geometry improvements.	Levee raise and riprap. (Ends at Station 1000+00)			
1001+00	1133+00	B			None	Intended to allow for overtopping	None			**No mitigation.**
1133+00	1195+00	A			None	Intended to allow for overtopping	None			

* An X indicates an identified deficiency; an X? indicates a likely deficiency.
[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*
[2] URS, *Geotechnical Evaluation Report, Volume 2, Remedial Alternatives, South West Sacramento Study Area, Urban Levee Evaluations Project, Contract 4600008101, January 2015*
[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009*
[4] Remove silty sand in the embankment and replace with select low permeability fill.

Table 6: BCI Alternatives, Deep Water Ship Channel East Levee

Levee Station Interval From	Levee Station Interval To	URS Reach	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Under-seepage / Waterside (RD) Slope Stability	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Through Seepage / Landside (SS) Slope Stability	USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*: Under-seepage / Waterside (RD) Slope Stability	Geotechnical Deficiencies Identified by BCI*: Through Seepage / Landside (SS) Slope Stability	BCI Geotechnical Mitigation Recommendations
0+00	2+00	Y	X[1]		Cutoff Wall to Elev. -60 ft to -100 ft	None	None			**No mitigation.**
2+00	8+00	Y	X[1,3]	X[3]	Cutoff Wall to Elev. -60 ft to -100 ft	None	None			
			X[3]	X[3]						
8+00	15+00	Y	X[1,2,3]	X[3]	Cutoff Wall to Elev. -60 ft to -100 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	Slope flattening, cutoff wall, and riprap at pump station	X		**Alternative 1: Cutoff wall to Elev. -60 ft and waterside slope flattening to 3H:1V. Perform additional explorations to confirm depth of cutoff layer.** **Alternative 2: 80-ft-wide minimum seepage berm and waterside slope flattening to 3H:1V. Perform additional analysis to confirm width of berm.** Additional explorations and evaluation may reduce the recommended remedial measures to either no mitigation, only a cutoff wall or berm, or only waterside flattening. Determination of the possibility of rapid drawdown in the Deep Water Ship Channel may eliminate the recommendation for waterside slope flattening.
			X[3]	X[3]				X (at Pump Station only)		
15+00	85+55	Y	X[1,2]		Cutoff Wall to Elev. -110 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	None	X		**Alternative 1: Cutoff wall to Elev. -110 ft. Perform additional explorations to confirm depth of cutoff layer.** **Alternative 2: 80-ft-wide minimum seepage berm. Perform additional analysis to confirm width of berm.** Additional explorations and evaluation may reduce the recommended remedial measures to no mitigation.
				X[1]						
85+55	91+00	Y	X[1,2]		Cutoff Wall to Elev. -30 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	None	X		**Alternative 1: Cutoff wall to Elev. -30 ft. Perform additional explorations to confirm depth of cutoff layer.** **Alternative 2: 80-ft-wide minimum seepage berm. Perform additional analysis to confirm width of berm.** A sensitivity evaluation with respect to water in the landside ditch may reduce the recommended remedial measures to no mitigation.
91+00	96+50	X	X[1,2]		Cutoff Wall to Elev. -30 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	None	X		
96+50	102+00	X	X[1,2,3]		Cutoff Wall to Elev. -30 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	Slope flattening, cutoff wall, and riprap at pump station	X		
			X[3]	X[3]						
102+00	105+50	X	X[1,2,3]		Cutoff Wall to Elev. -30 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	Slope flattening, cutoff wall, and riprap at pump station	X		**Alternative 1: Cutoff wall to Elev. -30 ft**, and **waterside and landside slope flattening to 3H:1V. Perform additional explorations to confirm depth of cutoff layer.** **Alternative 2: 80-ft-wide minimum seepage and berm and waterside slope flattening to 3H:1V. Perform additional analysis to confirm width of berm.** Additional explorations and evaluation may reduce the recommended remedial measures to either no mitigation, only a cutoff wall or berm, or only waterside flattening. Determination of the possibility of rapid drawdown in the Deep Water Ship Channel may eliminate the recommendation for waterside slope flattening.
			X[3]	X[3]				X (at Pump Station only)	X? (at Pump Station only)	
105+50	106+00	X	X[1,2]		Cutoff Wall to Elev. -30 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	None	X		
								X (at Pump Station only)	X? (at Pump Station only)	
105+50	145+00	X	X[1,2]		Cutoff Wall to Elev. -30 ft	Maintain Ditch-full condition during flood events or fill the ditch with soil (would require an alternative drainage system)	None	X (at ditches)		**Alternative 1: Cutoff wall to Elev. -30 ft. Perform additional explorations to confirm depth of cutoff layer.** **Alternative 2: 80-ft-wide minimum seepage berm. Perform additional analysis to confirm width of berm.** A sensitivity evaluation with respect to water in the landside ditch may reduce the recommended remedial measures to no mitigation.

* An X indicates an identified deficiency; an X? indicates a likely deficiency.
[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*
[2] URS, *Geotechnical Evaluation Report, Volume 1, Existing Conditions, West Sacramento Study Area, Urban Levee Geotechnical Evaluations Program, Contract 4600007418, May 2012*
[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009*

Table 7: BCI Alternatives, South Cross Levee

Levee Station Interval		URS Reach	Geotechnical Deficiencies Identified by USACE, URS, HDR*		USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*		BCI Geotechnical Mitigation Recommendations
			Under-seepage	Through Seepage				Under-seepage	Through Seepage	
From	To		Waterside (RD) Slope Stability	Landside (SS) Slope Stability				Waterside (RD) Slope Stability	Landside (SS) Slope Stability	
0+00	5+00	N	X[2]	X[3]	Landside drained stability berm	Adjacent levee raise with landside slope strengthening and keyway and cutoff wall to Elev. -35 ft	Internal drain, adjacent levee raise and slope flattening	X?		**Alternative 1: Landside slope flattening with cutoff wall to Elev. -35 ft. Perform additional explorations to confirm cutoff layer.** **Alternative 2: Minimum 80-foot-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce recommended remedial measures to either no mitigation or landside slope flattening only.
			X[3]	X[1,2,3]					X?	
5+00	25+00	N	X[1,2,3]	X[3]	Relief wells spaced at 50 feet	Adjacent levee raise with landside slope strengthening and keyway and cutoff wall to Elev. -35 ft	Levee raise, cutoff wall and slope flattening	X		
			X[3]	X[1,2,3]					X	
25+00	35+00	M	X[1]	X[3]	Relief wells spaced at 50 feet	Adjacent levee raise with landside slope strengthening and keyway	Internal drain, adjacent levee raise and slope flattening	X		
			X[3]	X[1,3]					X	
35+00	55+00	M	X[1]	X[3]	Relief wells spaced at 50 feet	Adjacent levee raise with landside slope strengthening and keyway	Internal drain, adjacent levee raise and slope flattening	X		
			X[3]	X[1,3]					X	
55+00	65+00	M		X[3]	Landside drained stability berm	Adjacent levee raise with landside slope strengthening and keyway	Internal drain, adjacent levee raise and slope flattening	X?		
			X[3]	X[1,3]					X?	

* An X indicates an identified deficiency; an X? indicates a likely deficiency.
[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*
[2] URS, *Geotechnical Evaluation Report, Volume 2, Remedial Alternatives, South West Sacramento Study Area, Urban Levee Evaluations Project, Contract 4600008101, January 2015*
[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009(at 100-year event only)*

Table 8: BCI Alternatives, Port North Levee

Levee Station Interval From	Levee Station Interval To	URS Reach	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Under-seepage	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Through Seepage	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Waterside (RD) Slope Stability	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Landside (SS) Slope Stability	USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*: Under-seepage	Geotechnical Deficiencies Identified by BCI*: Through Seepage	Geotechnical Deficiencies Identified by BCI*: Waterside (RD) Slope Stability	Geotechnical Deficiencies Identified by BCI*: Landside (SS) Slope Stability	BCI Geotechnical Mitigation Recommendations
0+00	8+00	K					None	None	None					**No mitigation.**
8+00	26+00	K					None	None	Floodwall (some gaps between Stations 10+00 and 25+00)					**Alternative 1: No mitigation with potential nuisance seepage and resulting landside maintenance concerns.** **Alternative 2: Cutoff wall to Elev. 0 ft to address possible nuisance seepage. Confirm with additional explorations and evaluation.**
26+00	35+50	K					None	None	Floodwall			X		**Waterside slope flattening to 3H:1V.** Additional explorations and evaluation may reduce the recommended remedial measure to no mitigation.
35+50	120+00	K					None	Raise crown by up to 1.9 ft (starting at Station 109+00)	Floodwall					**Alternative 1: No mitigation with potential nuisance seepage and resulting landside maintenance concerns.** **Alternative 2: Cutoff wall to Elev. 0 ft to address possible nuisance seepage. Confirm with additional explorations and evaluations.**
120+00	135+50	K					Raise and fix geometry	Raise crown by up to 1.9 ft	Floodwall	X?				
135+50	142+50	L					Raise and fix geometry	Raise crown by up to 5.6 ft	Floodwall	X?				
142+50	172+00	L					None	Raise crown by up to 5.6 ft	Floodwall (gap from about Station 150+00 to 161+00)					
172+00	174+00	L					None	None	Floodwall					
174+00	186+00	L					Floodwalls: Station 174+00 to 176+00 and 179+00 to 185+16 Stop Log at RR: Station 185+16 to 186+00.	None	Floodwall					
186+00	194+00	L					Raise and fix geometry (end at Station 194+00)	None	Floodwall					
194+00	202+00	L					None	Raise crown by up to 5.6 ft (starting at Station 195+00)	Floodwall					
202+00	214+00	L					Floodwall	Raise crown by up to 5.6 ft	Floodwall					
214+00	236+00	L					Raise and fix geometry (Station 228+40 to 231+60)	Raise crown by up to 5.6 ft	Floodwall (ends at about Station 240+00)					
236+00	244+00	L						Raise crown by up to 5.6 ft	Floodwall (ends at about Station 240+00)					**No mitigation.**

* An X indicates an identified deficiency; an X? indicates a likely deficiency.
[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*
[2] URS, *Geotechnical Evaluation Report, Volume 2, Remedial Alternatives, South West Sacramento Study Area, Urban Levee Evaluations Project, Contract 4600008101, January 2015*
[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009*

Table 9: BCI Alternatives, Port South Levee

Levee Station Interval From	Levee Station Interval To	URS Reach	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Under-seepage	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Through Seepage	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Waterside (RD) Slope Stability	Geotech Deficiencies Identified Issues by USACE, URS, HDR*: Landside (SS) Slope Stability	USACE Mitigation Recommendations	URS Mitigation Recommendations	HDR Mitigation Recommendations (Recommended Alternative)	Geotechnical Deficiencies Identified by BCI*: Under-seepage	Geotechnical Deficiencies Identified by BCI*: Through Seepage	Geotechnical Deficiencies Identified by BCI*: Waterside (RD) Slope Stability	Geotechnical Deficiencies Identified by BCI*: Landside (SS) Slope Stability	BCI Geotechnical Mitigation Recommendations
00+00	23+00	O					None	Raise levee up to 2.6 ft	Station 0+00 to 5+00: None Station 5+00 to 23+00: Slope Flattening and Levee Raise					**No mitigation.**
23+00	116+00	O					None	Raise levee up to 2.6 ft	Slope Flattening and Levee Raise	X?				**Alternative 1: Deep cutoff wall to Elev. -95 ft. Perform additional explorations to confirm depth of cutoff layer.** **Alternative 2: 45-ft-wide minimum seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce the recommended remediation measures to no mitigation.
116+00	118+00	P	X[2]				None	Raise levee up to 2.6 ft, Geometry improvement, Undrained LS berm	Slope Flattening and Levee Raise					**No mitigation.**
118+00	123+50	P	X[1,2,3]				Cutoff Wall to Elev. -55 ft (about Station 120+00 to 130+00)	Raise levee up to 2.6 ft, Geometry improvement, Undrained LS berm	Cutoff Wall (starting at Station 119+50), Slope Flattening and Levee Raise	X				**Alternative 1: Deep cutoff wall to Elev. -20 ft. Perform additional explorations to confirm depth of cutoff layer.** **Alternative 2: 50-ft-wide seepage berm. Perform additional analysis to confirm width.** Additional explorations and evaluations may reduce the recommended remediation measures to no mitigation.
123+50	125+00	P	X[2]				Cutoff Wall to Elev. -55 ft (about Station 120+00 to 130+00)	Raise levee up to 2.6 ft, Geometry improvement, Undrained LS berm	Cutoff Wall, Slope Flattening and Levee Raise					**No mitigation. Confirm with additional explorations and evaluation.**
125+00	128+00	Q					Cutoff Wall to Elev. -55 ft (about Station 120+00 to 130+00)	Raise levee up to 4.2 ft	Cutoff Wall (ending at Station 128+50), Slope Flattening and Levee Raise					**No mitigation. Confirm with additional explorations and evaluation.**
128+00	138+00	Q					None	Raise levee up to 4.2 ft	Slope Flattening and Levee Raise					**No mitigation.**
138+00	143+00	Q					None	Raise levee up to 4.2 ft	Slope Flattening and Levee Raise			X		Station 138+00 to 158+00 **Waterside slope flattening to 3H:1V.** Additional explorations and evaluation may reduce the recommended remedial measures to no mitigation. Station 143+00 to 186+93 **No mitigation.** Consider including a shallow cutoff wall to Elev. 0 ft to mitigate potential nuisance seepage.
143+00	153+00	Q					None	Raise levee up to 4.2 ft	Slope Flattening and Levee Raise		X	X		
153+00	186+93	Q					None	Raise levee up to 4.2 ft (end at Station 176+00)	Slope Flattening and Levee Raise		X	X (to 158+00)		

* An X indicates an identified deficiency; an X? indicates a likely deficiency.

[1] USACE, *West Sacramento Project, General Reevaluation Report Geotechnical Appendix, October 2015*

[2] URS, *Geotechnical Evaluation Report, Volume 2, Remedial Alternatives, South West Sacramento Study Area, Urban Levee Evaluations Project, Contract 4600008101, January 2015*

[3] HDR, *Alternatives Analysis, West Sacramento Area Flood Control Agency, Levee Improvement Program, November 13, 2009*

CITY OF WEST SACRAMENTO
FLOOD PROGRAM ENGINEERING SERVICES
GEOTECHNICAL ALTERNATIVES ANALYSIS REPORT
West Sacramento, California

FIGURES

Figure 1 - Vicinity Map
Figure 2 - Levee Segment Map
Figure 3 - BCI Geotechnical Deficiencies

N

NO SCALE

5/9/2016 2916.x Fig1 WSAFCA GAAR Vicinity Map.dwg

blackburn consulting

2491 Boatman Avenue
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Phone: (916) 375-8706
Fax: (916) 375-8709
www.blackburnconsulting.com

VICINITY MAP

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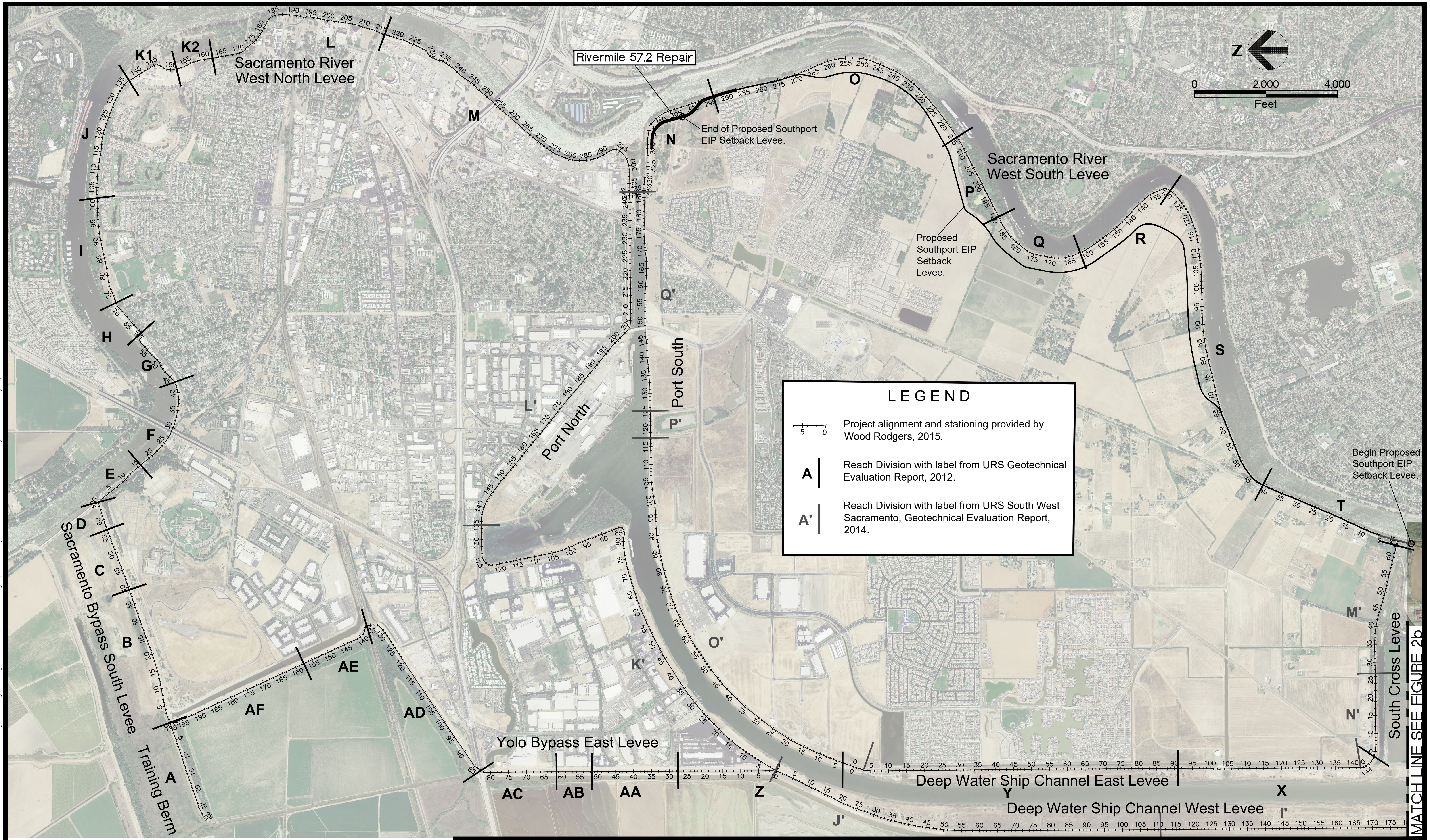
Flood Engineering Program Services
Geotechnical Alternatives Analysis Report

File No. 2916.1

May 2016

Figure 1



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LEVEE SEGMENT MAP

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Figure 2a

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LEVEE SEGMENT MAP

City of West Sacramento Flood Engineering Program Services
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Figure
2b

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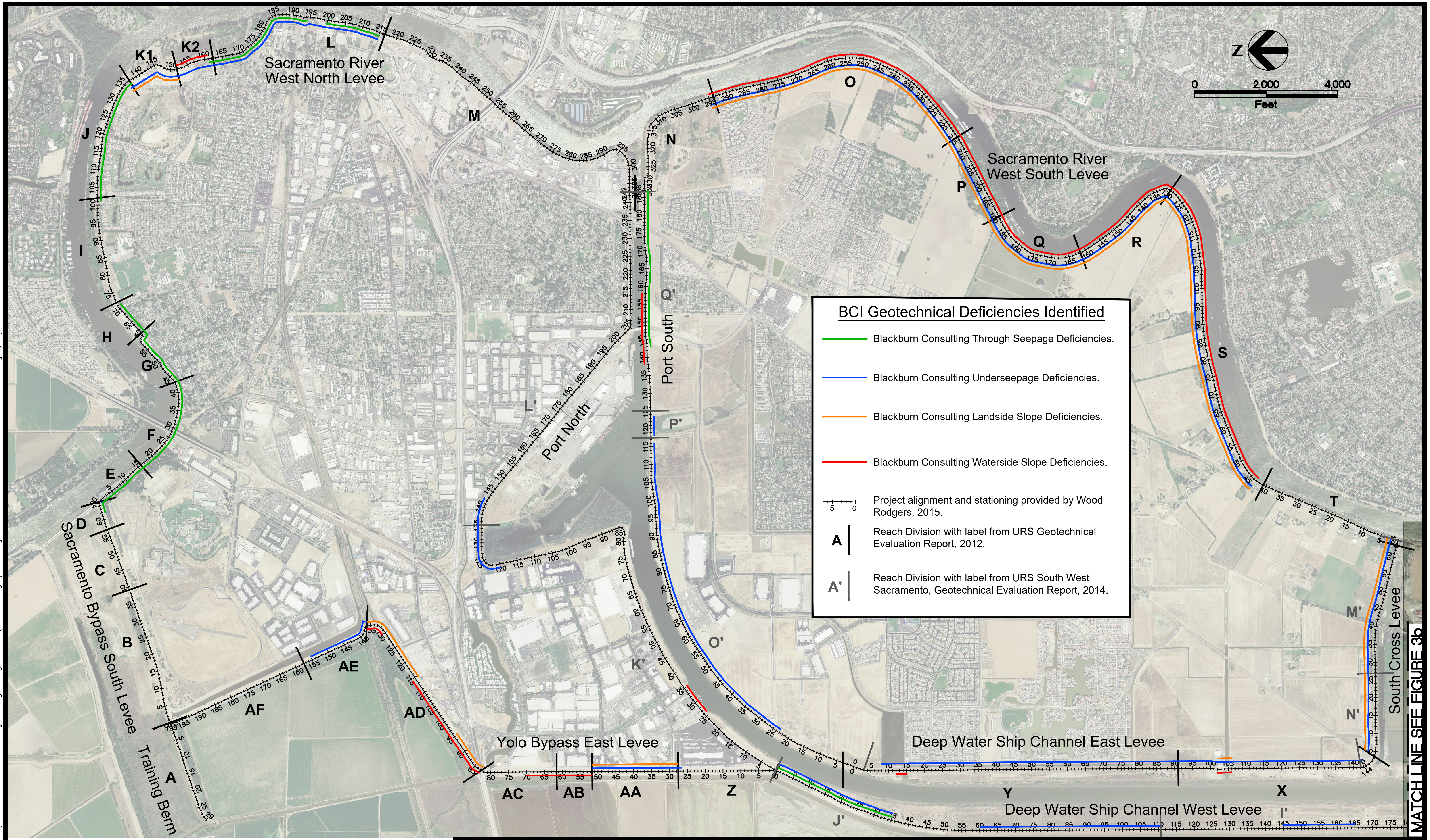

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BCI GEOTECHNICAL DEFICIENCIES

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Figure 3a

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BCI GEOTECHNICAL DEFICIENCIES
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Geotechnical Alternatives Analysis Report

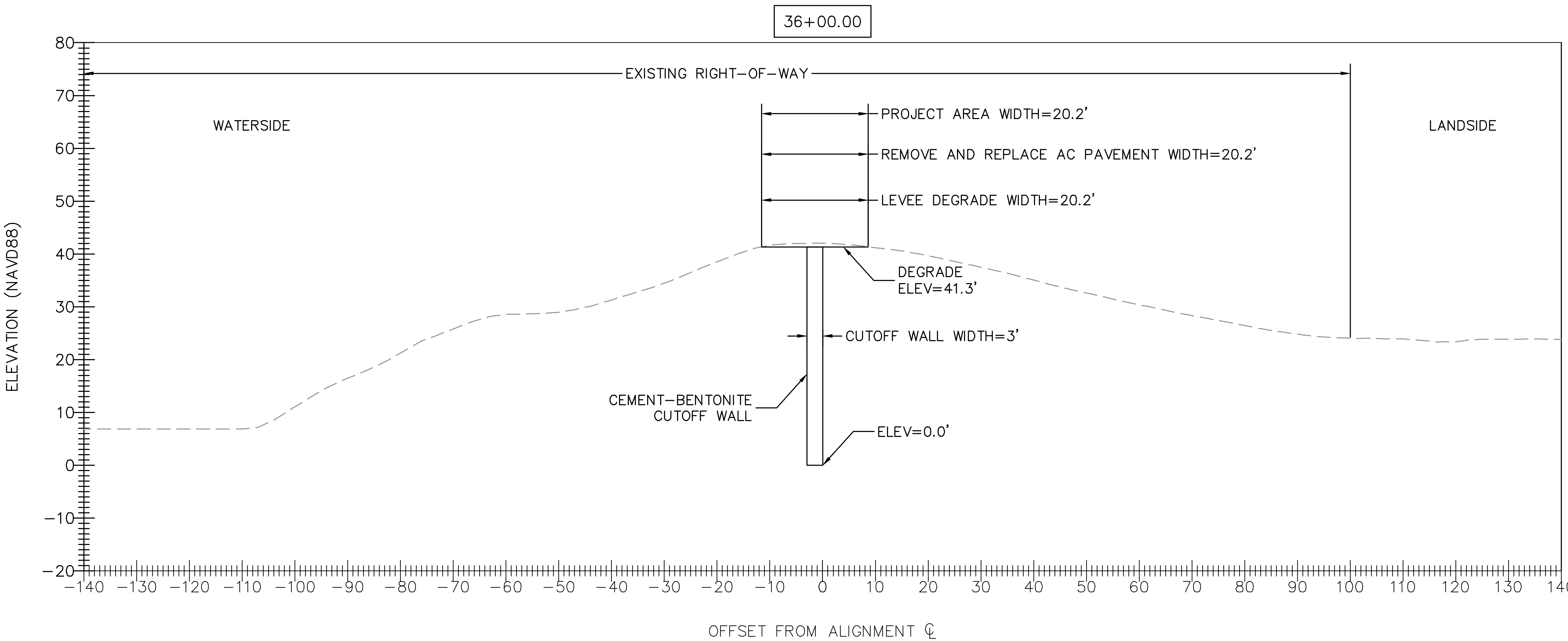
Figure 3b

ATTACHMENT B

Cross Sections

- Sacramento River West North Levee
- Sacramento River West South Levee
- Sacramento Bypass South Levee
- Training Berm
- Yolo Bypass East Levee
- South Cross Levee
- DWSC West Levee
- DWSC East Levee
- Port North Levee
- Port South Levee

Sacramento River West North Levee Cross Sections



LEVEE RAISE FILL (EMBANKMENT FILL) = 30.9 SQ FT

TOTAL DEGRADE AREA = 9.8 SQ FT

CLAY CAP FILL AREA = 0.0 SQ FT (CB WALL)

CUTOFF TRENCH AREA = 0.0 SQ FT (CB WALL)

CB CUTOFF WALL DEPTH = 41.3 FT

PROJECT AREA WIDTH = 20.2 FT

REACH 1 - STA 0+00 TO 71+50
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CB CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. FREEBOARD AND GEOMETRY REMEDIATION NOT SHOWN ON THIS SECTION, AS THEY ARE NOT TYPICAL.
3. EXISTING RIGHT–OF WAY IS ASSUMED TO EXTEND 20' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM PROJECT TEAM.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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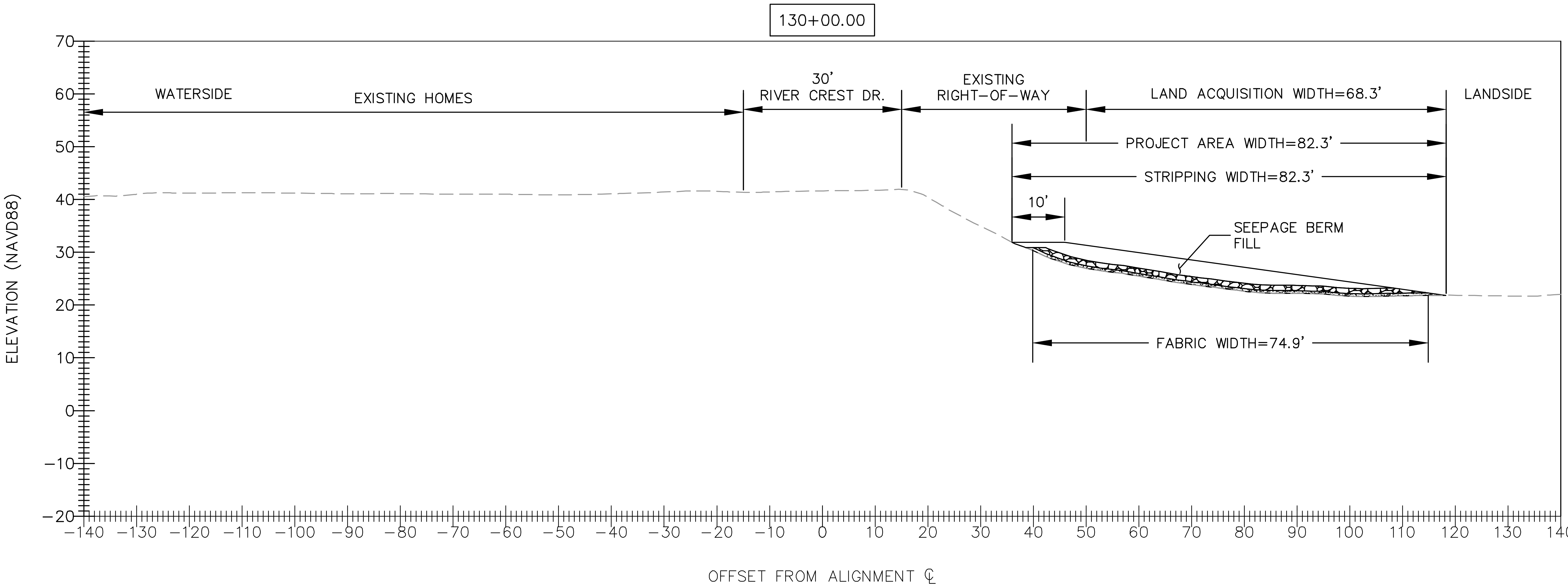
REACH 1 – STA 0+00 TO 71+50
ALTERNATIVE 1 CROSS SECTION



LAND ACQUISITION WIDTH = 68.3 FT

BERM EMBANKMENT FILL AREA = 159.7 SQ FT

DRAIN ROCK AREA = 71.3 SQ FT

FILTER SAND AREA = 37.4 SQ FT

PROJECT AREA WIDTH = 82.3 FT

STRIPPING WIDTH = 82.3 FT

FILTER FABRIC WIDTH = 74.9 FT

REACH 3 - STA 101+00 TO 136+00
ALTERNATIVE 1 - DRAINED STABILITY BERM

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. FOUNTAIN DRIVE IS LOCATED NEAR THE TOE OF THE PROPOSED SEEPAGE BERM. THEREFORE, A FUTURE NEEDS AREA NOT INCLUDED IN THIS REACH.

LEGEND

— — —	EXISTING GROUND
———	FINISHED GRADE
	DRAIN ROCK
	FILTER SAND
	CLAY FILL

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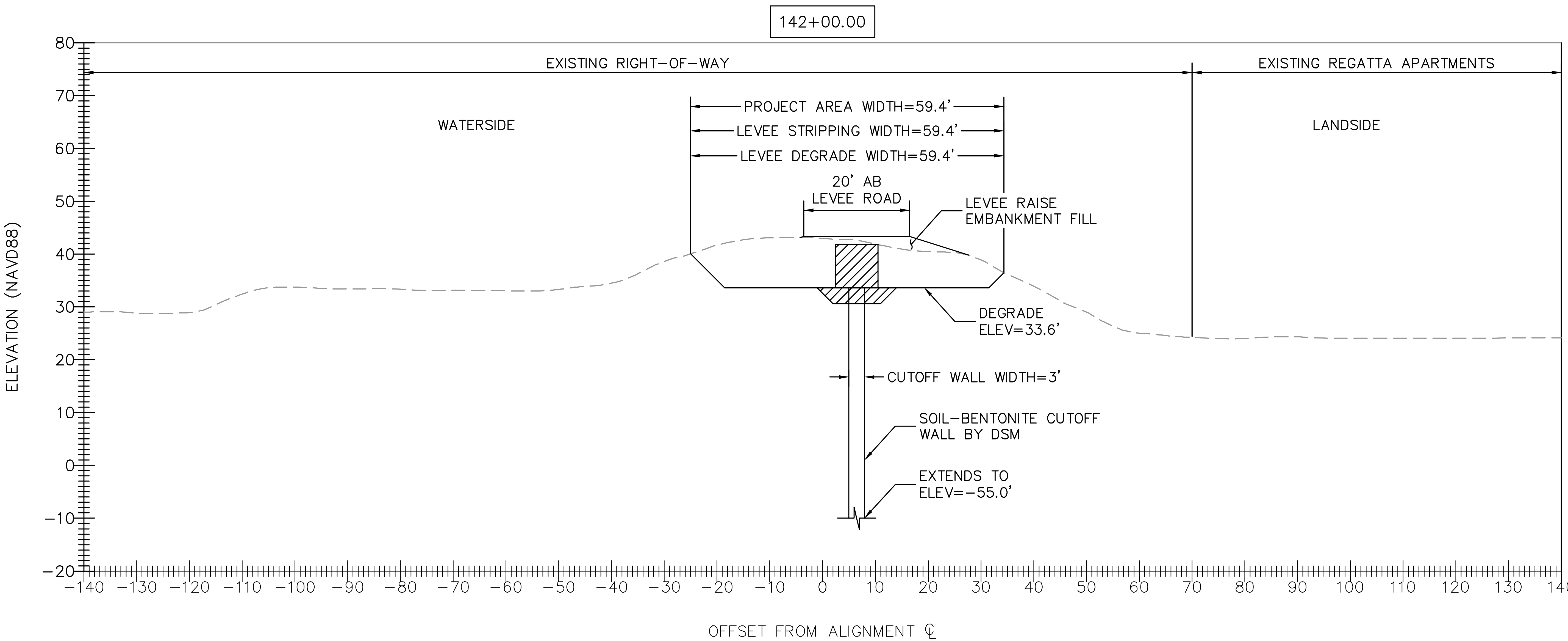
REACH 3 – STA 101+00 TO 136+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 34.9 SQ FT

TOTAL DEGRADE AREA = 444.5 SQ FT

CLAY CAP FILL AREA = 66.1 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 88.6 FT

PROJECT AREA WIDTH = 59.4 FT

STRIPPING WIDTH = 59.4 FT

REACH 4 - STA 136+00 TO 152+00
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. LANDSIDE ACQUISITION NOT POSSIBLE DUE TO EXISTING DEVELOPMENT AT THE LANDSIDE TOE

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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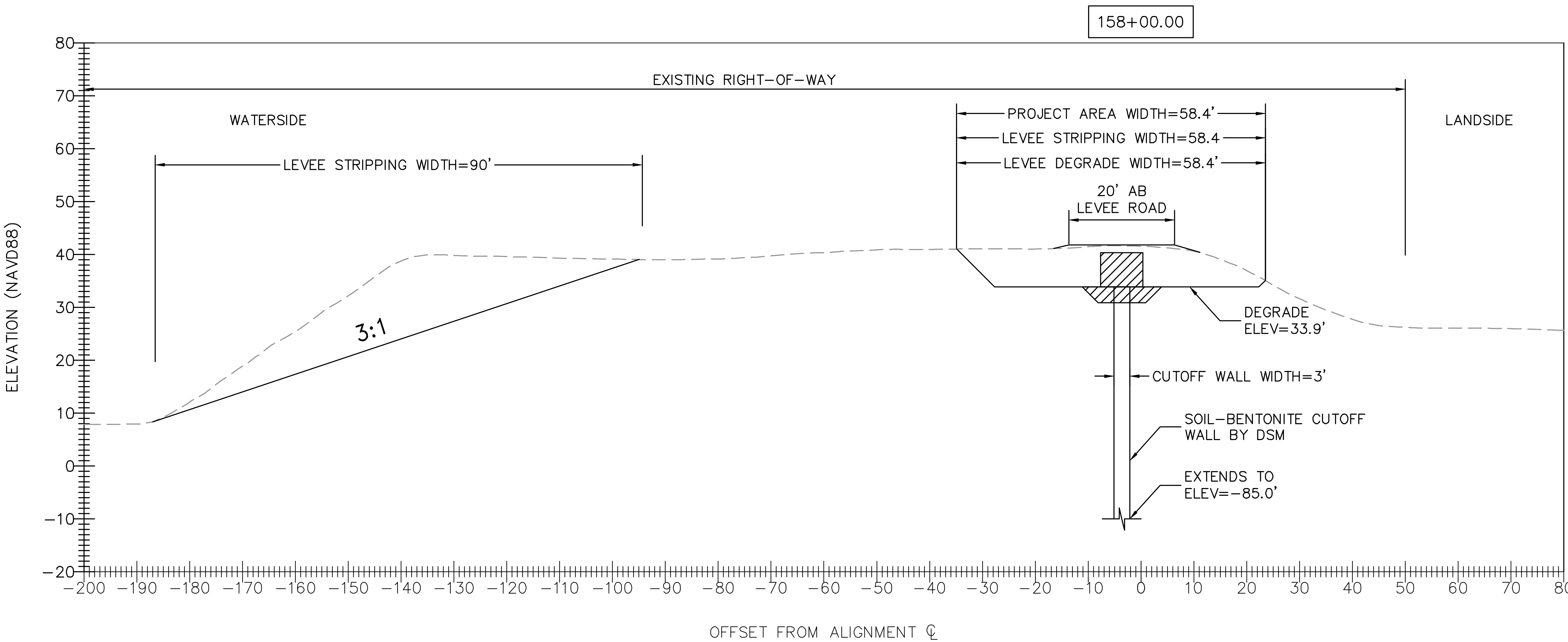
REACH 4 – STA 136+00 TO 152+00
ALTERNATIVE 1 CROSS SECTION



SLOPE FLATTENING DEGRADE AREA = 691.1 SQ FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 9.3 SQ FT

TOTAL DEGRADE AREA = 365.1 SQ FT

CLAY CAP FILL AREA = 51.9 FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 118.9 FT

PROJECT AREA WIDTH = 148.4 FT

REACH 5 - STA 152+00 TO 161+00
ALTERNATIVE 1 - WATERSIDE SLOPE FLATTENING WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. WATERSIDE SLOPE WILL BE ARMORED WITH ROCK SLOPE PROTECTION.
3. EXISTING RIGHT-OF WAY IS ASSUMED TO EXTEND 20' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM PROJECT TEAM.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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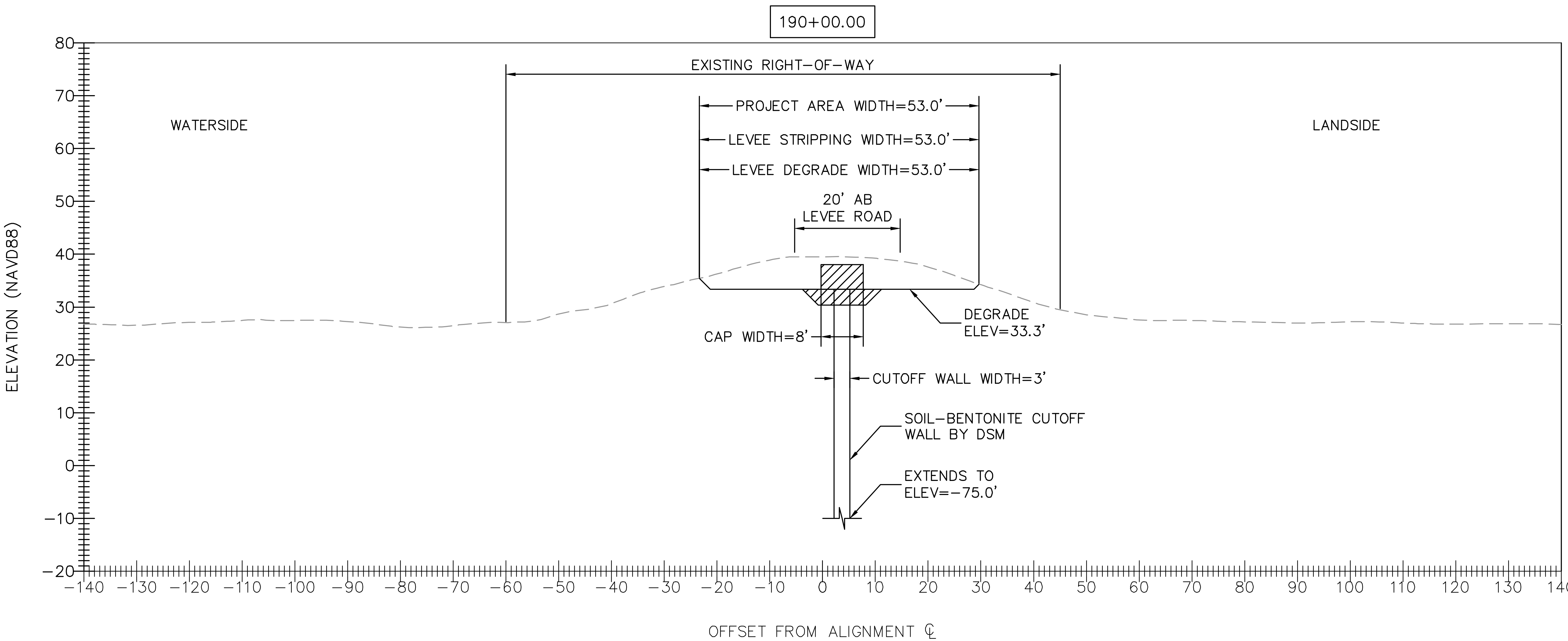
REACH 5 – STA 152+00 TO 161+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 64.0 SQ FT

TOTAL DEGRADE AREA = 247.7 SQ FT

CLAY CAP FILL AREA = 37.5 FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 108.3 FT

PROJECT AREA WIDTH = 53.0 FT

STRIPPING WIDTH = 53.0 FT

REACH 6 - STA 161+00 TO 194+60
ALTERNATIVE 1 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. FREEBOARD AND GEOMETRY REMEDIATION NOT SHOWN ON THIS SECTION, AS THEY ARE NOT TYPICAL.
3. LIMITS OF EXISTING RIGHT-OF-WAY ASSUMED TO BE CONFINED TO EXISTING LEVEE PRISM DUE TO EXISTING DEVELOPMENT ADJACENT TO LEVEE
4. WATERSODE SLOPE ROCK PROTECTION IS ONLY NEEDED FROM STA 165+00 TO 195+00

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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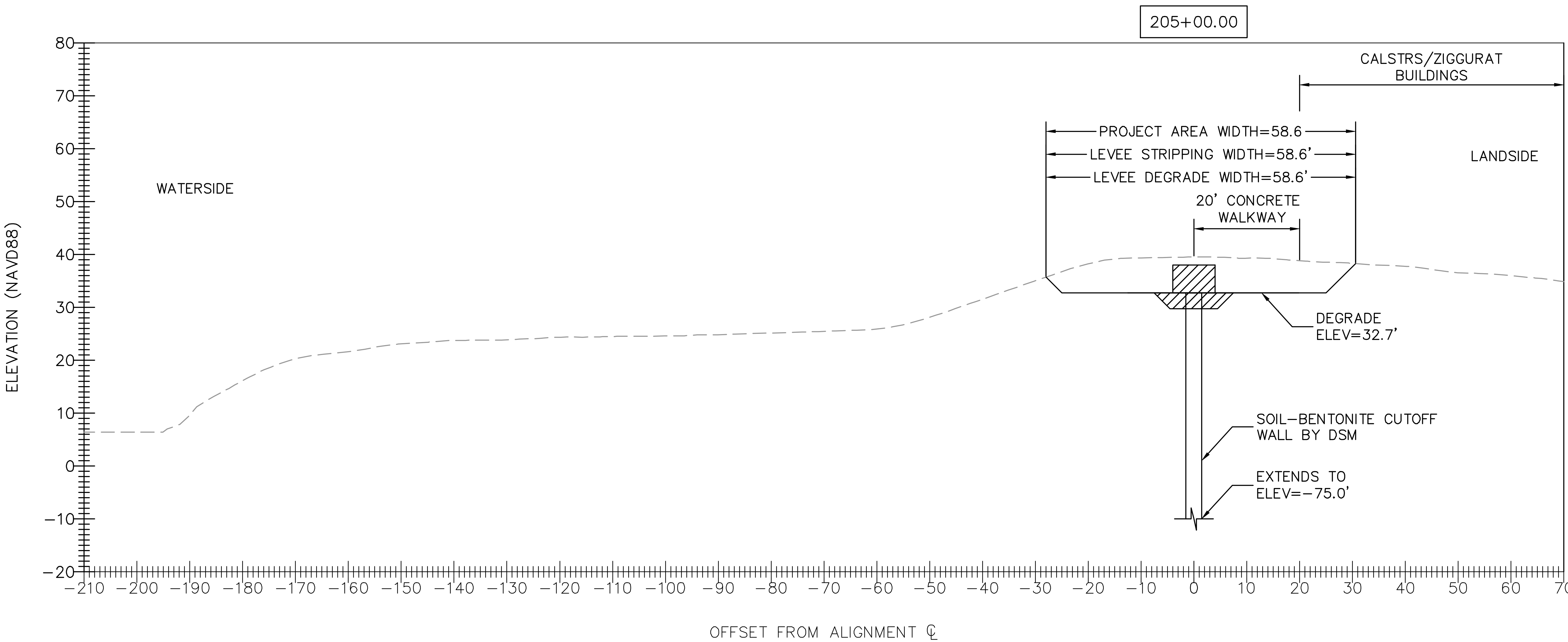
SACRAMENTO RIVER NORTH LEVEE
REACH 6 – STA 161+00 TO 194+60
ALTERNATIVE 1 CROSS SECTION



TOTAL DEGRADE AREA = 337.8 SQ FT

CLAY CAP FILL AREA = 42.4 FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 107.7 FT

PROJECT AREA WIDTH = 58.6 FT

STRIPPING WIDTH = 58.6 FT

REACH 8 - STA 199+60 TO 215+30
ALTERNATIVE 1 - DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. WATERSIDE SLOPE WILL BE ARMORED WITH ROCK SLOPE PROTECTION.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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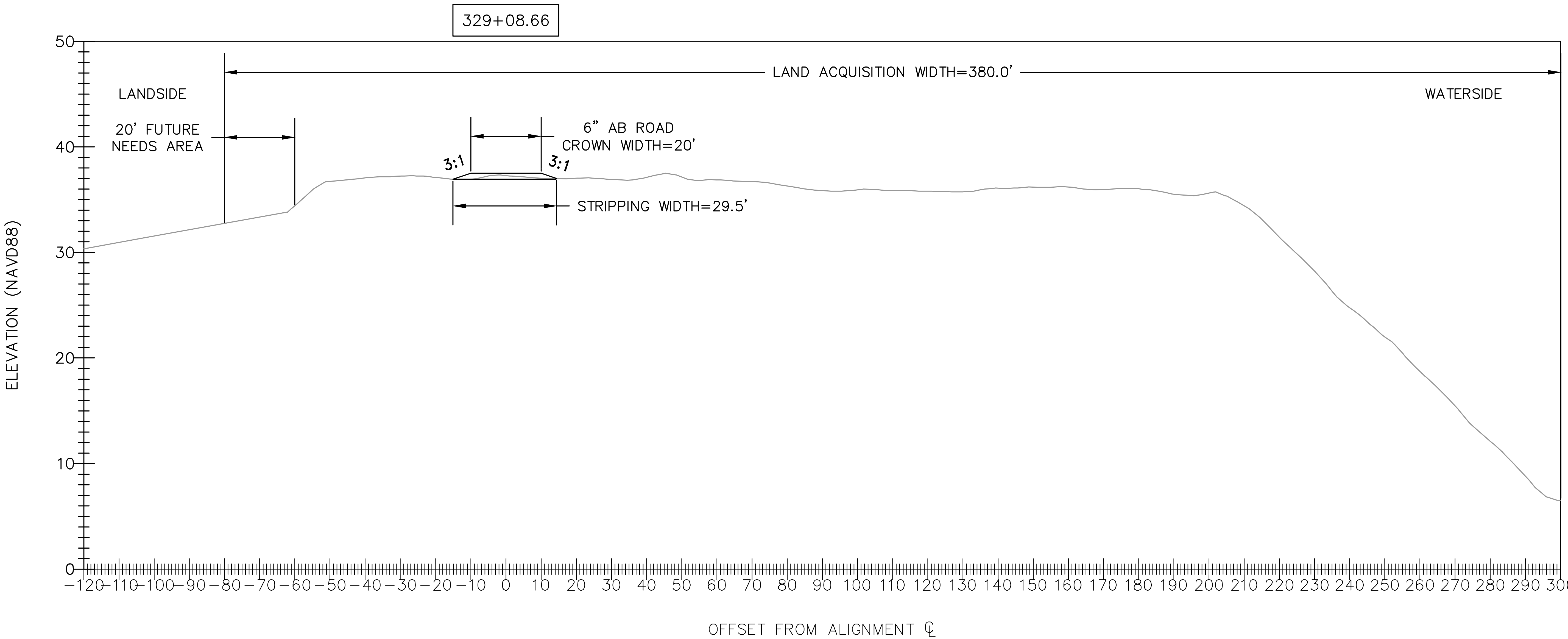
WEST SACRAMENTO FLOOD PROGRAM

SACRAMENTO RIVER NORTH LEVEE
REACH 8 – STA 199+60 TO 215+30
ALTERNATIVE 1 CROSS SECTION

Sacramento River West South Levee Cross Sections



LAND ACQUISITION WIDTH = 380.0 FT

AB ROAD TOP WIDTH = 20 FT

AB ROAD FILL AREA = 42.5 SQ FT

PROJECT AREA WIDTH = 29.5 FT

STRIPPING WIDTH = 29.5 FT

REACH 2 - STA 295+00 TO 332+70
ALTERNATIVE 1 - MINOR LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DUE TO MINOR FREEBOARD DEFICIENCIES, CONSTRUCTING AN ACCESS ROAD AT THE LEVEE CROWN IN THIS REACH WILL ADDRESS FREEBOARD DEFICIENCIES IN THIS REACH.
3. THE PORT IS ASSUMED TO OWN LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FROM THE PORT FOR THE LEVEE PRISM EXTENTS PLUS 10' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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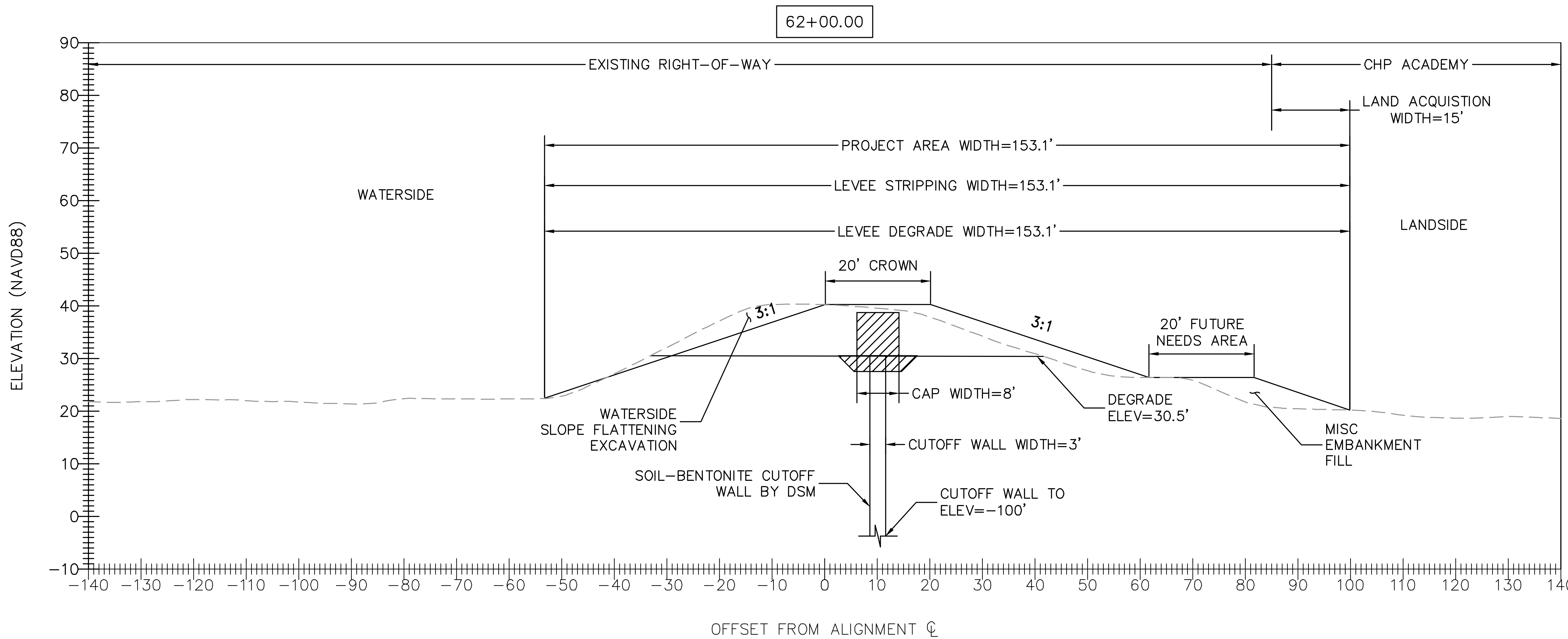
WEST SACRAMENTO FLOOD PROGRAM

SACRAMENTO RIVER SOUTH LEVEE
REACH 2 – STA 295+00 TO 332+70
ALTERNATIVE 1 CROSS SECTION

Sacramento Bypass South Levee Cross Sections



WS SLOPE FLATTENING EXCAVATION = 98.7 SQ FT

SLOPE FLATTENING FILL (EMBANKMENT FILL) = 113.8 SQ FT

MISC FILL (EMBANKMENT FILL) = 85.0 SQ FT

CUTOFF WALL DEGRADE AREA = 397.9 SQ FT

CLAY CAP FILL AREA = 65.5 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 130.5 FT

PROJECT AREA WIDTH = 153.1 FT

STRIPPING WIDTH = 153.1 FT

REACH 2 - STA 61+75 TO 64+60
ALTERNATIVE 1 - WATERSIDE SLOPE FLATTENING WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DEGRADE MATERIAL TO BE STOCKPILED AND REUSED.
3. WATERSIDE SLOPES WILL BE ARMORED WITH CONCRETE TO MATCH EXISTING CONDITION.

LEGEND

EXISTING GROUND
FINISHED GRADE
DRAIN ROCK
FILTER SAND
CLAY FILL

WOOD RODGERS
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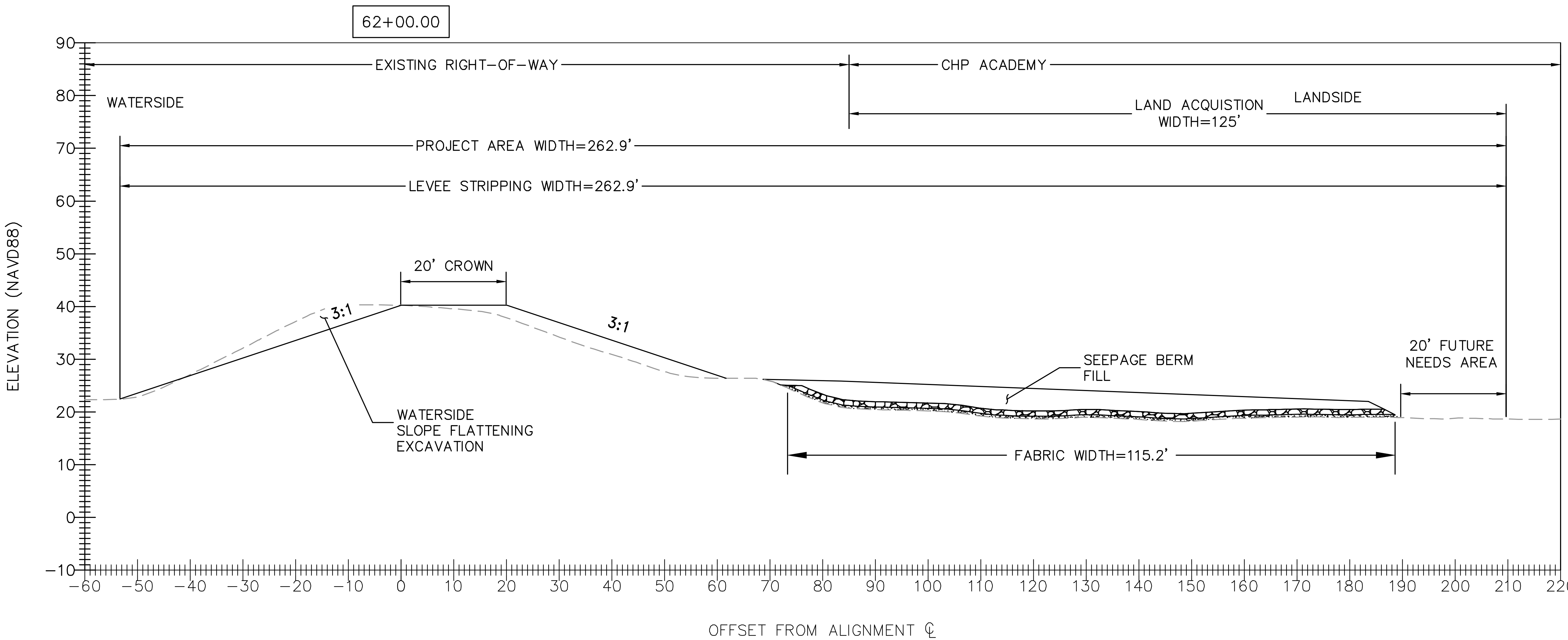
Sacramento, CA 95816 Fax 916.341.7767

WEST SACRAMENTO FLOOD PROGRAM

SACRAMENTO BYPASS SOUTH LEVEE
REACH 2 – STA 61+75 TO 64+60
ALTERNATIVE 1 CROSS SECTION



WS SLOPE FLATTENING EXCAVATION = 98.7 SQ FT

WS SLOPE FLATTENING FILL (EMBANKMENT FILL) = 113.8 SQ FT

DRAIN ROCK AREA = 113.6 SQ FT

FILTER SAND AREA = 58.6 SQ FT

SEEPAGE BERM FILL AREA = 354.6 SQ FT

PROJECT AREA WIDTH = 262.9 FT

STRIPPING WIDTH = 262.9 FT

FILTER FABRIC WIDTH = 115.2 FT

REACH 2 - STA 61+75 TO 64+60
ALTERNATIVE 2 - WATERSIDE SLOPE FLATTENING WITH SEEPAGE BERM

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DEGRADE MATERIAL TO BE STOCKPILED AND REUSED.
3. WATERSIDE SLOPES WILL BE ARMORED WITH CONCRETE TO MATCH EXISTING CONDITION.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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WEST SACRAMENTO FLOOD PROGRAM

SACRAMENTO BYPASS SOUTH LEVEE
REACH 2 – STA 61+75 TO 64+60
ALTERNATIVE 2 CROSS SECTION

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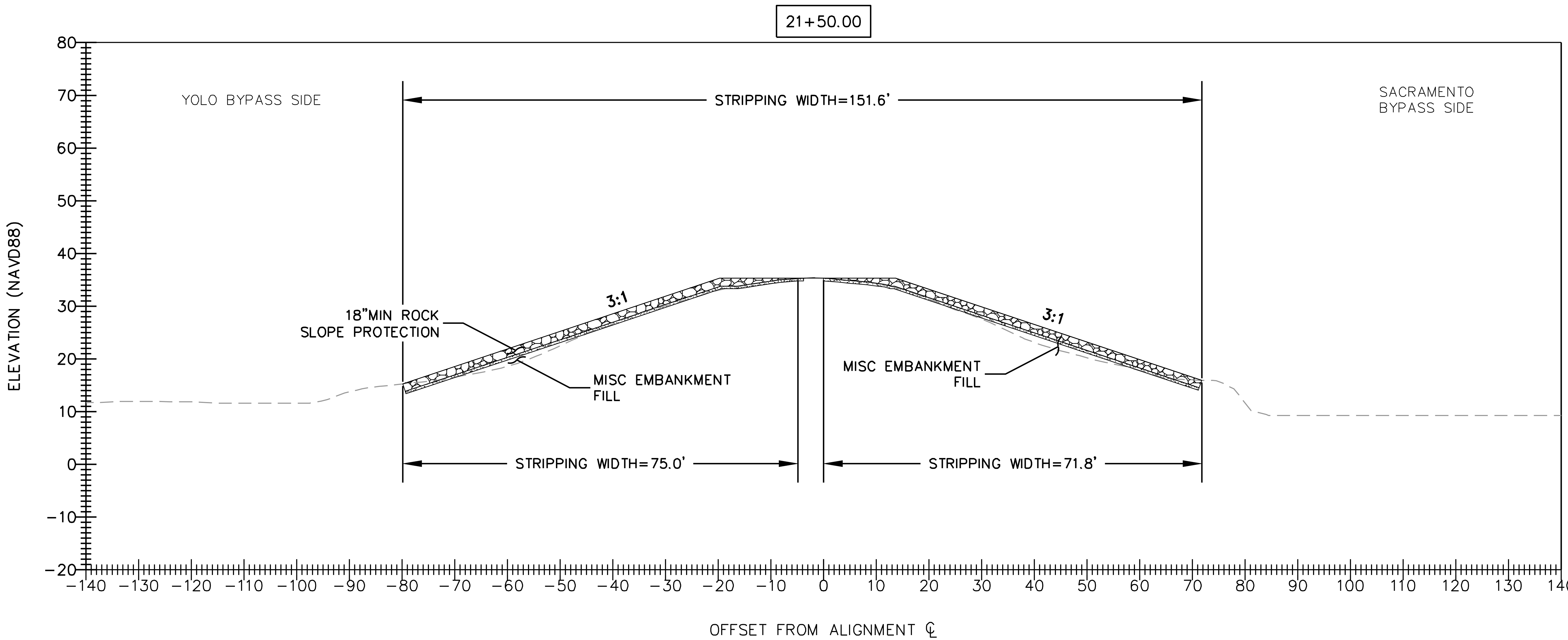
Training Berm Cross Section



MISC EMBANKMENT FILL = 43.0 SQ FT

ROCK SLOPE PROTECTION AREA = 208.2 SQ FT

STRIPPING WIDTH = 151.6 FT

FILTER FABRIC WIDTH = 71.8+75.0 = 146.8 FT

FILTER SAND AREA = 103.68 SQ FT

REACH 1 - STA 0+00 TO 29+10
ALTERNATIVE 1 - ROCK SLOPE PROTECTION & SLOPE FLATTENING

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. LAND ACQUISITION IS ASSUMED TO NOT BE NECESSARY FOR THE PROPOSED IMPROVEMENTS.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- ROCK SLOPE PROTECTION
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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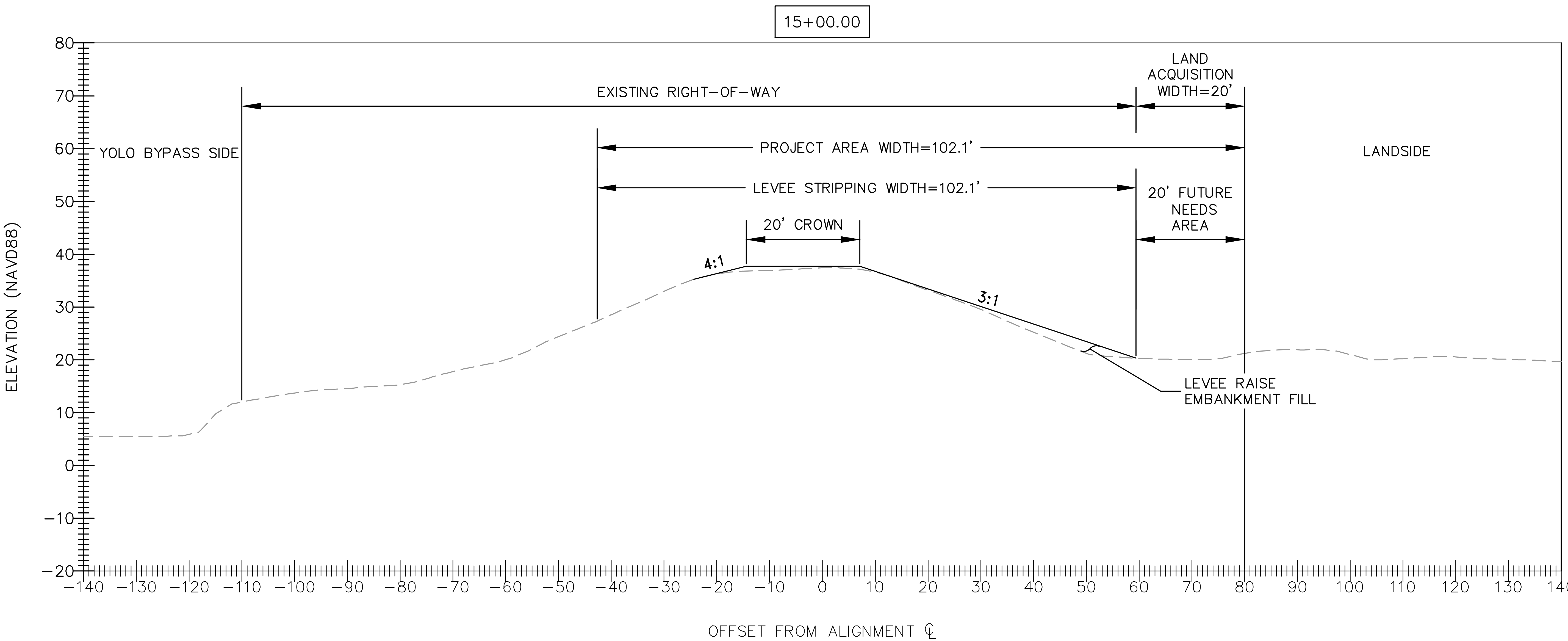
WEST SACRAMENTO FLOOD PROGRAM

TRAINING BERM
REACH 1 – STA 0+00 TO 29+10
ALTERNATIVE 1 CROSS SECTION

Yolo Bypass East Levee Cross Sections



LAND ACQUISITION WIDTH = 20.0 FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 62.9 SQ FT

PROJECT AREA WIDTH = 102.1 FT

STRIPPING WIDTH = 102.1 FT

REACH 1 - STA 0+00 TO 27+52
ALTERNATIVE 1 - MINOR LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. ROCK SLOPE PROTECTION IS NEEDED ALONG WATERSIDE TOE FROM ELEVATION 5.5 TO 10.0.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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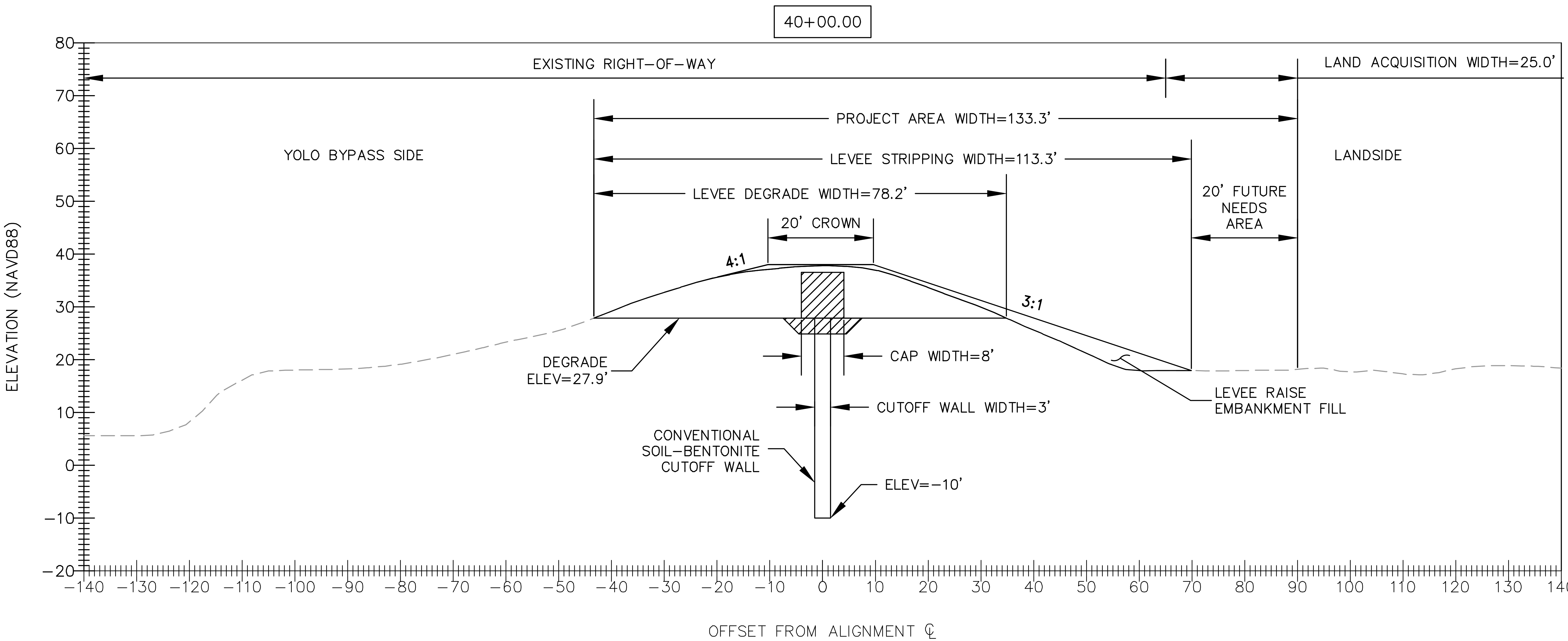
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 1 – STA 0+00 TO 24+52
ALTERNATIVE 1 CROSS SECTION



LAND ACQUISITION WIDTH = 25.0 FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 131.3 SQ FT

TOTAL DEGRADE AREA = 498.7 SQ FT

CLAY CAP FILL AREA = 69.4 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 37.9 FT

PROJECT AREA WIDTH = 113.3 FT

STRIPPING WIDTH = 113.3 FT

REACH 2 - STA 27+52 TO 51+63
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. ROCK SLOPE PROTECTION IS NEEDED ALONG WATERSIDE TOE FROM ELEVATION 5.5 TO 10.0.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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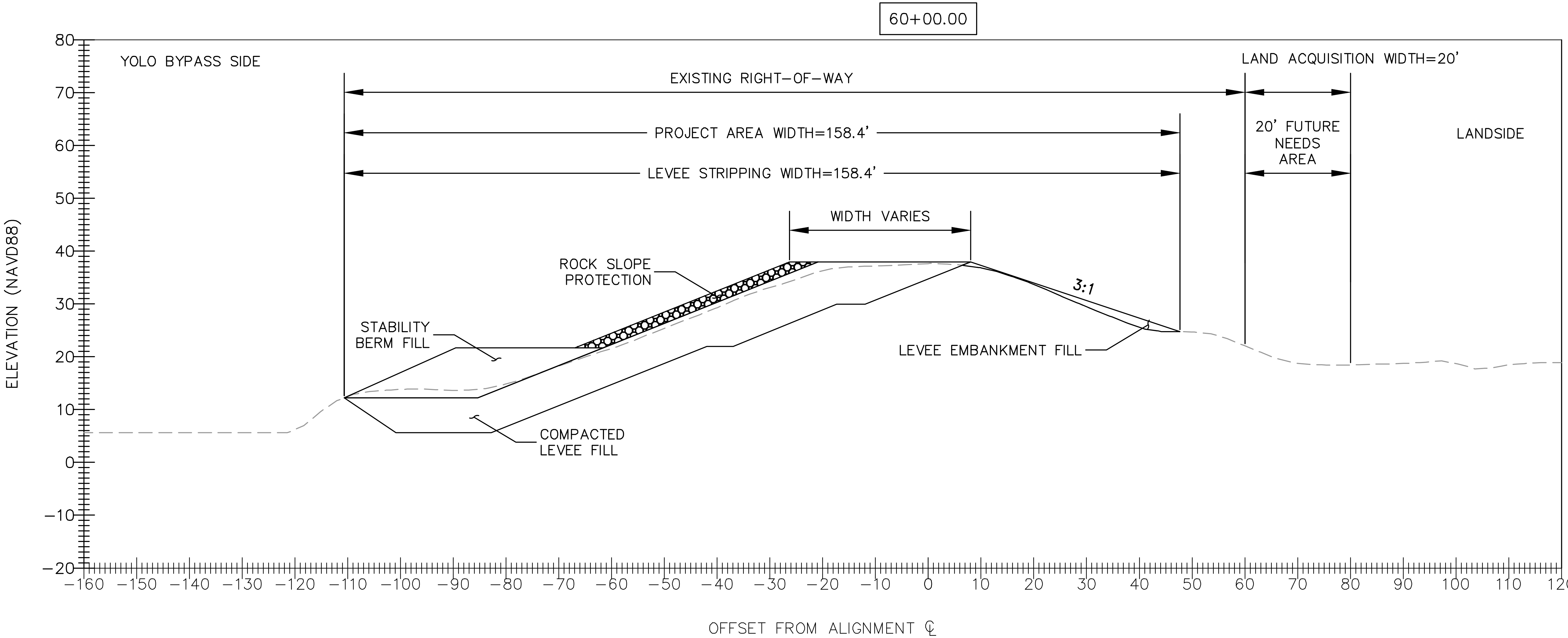
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 2 – STA 27+52 TO 51+63
ALTERNATIVE 1 CROSS SECTION



LAND ACQUISITION WIDTH = 20.0 FT

TOTAL DEGRADE AREA = 810.2 SQ FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 34.7 SQ FT

COMPACTED LEVEE FILL AREA = 810.2 SQ FT

STABILITY BERM FILL = 253.6 SQ FT

ROCK SLOPE PROTECTION AREA = 87.6 SQ FT

PROJECT AREA WIDTH = 157.7 FT

STRIPPING WIDTH = 157.7 FT

WIDTH OF ROADWAY WITHIN PROJECT = 12 FT

REACH 3 - STA 51+63 TO 70+00
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH WATERSIDE SLOPE RECONSTRUCITON

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. WATERSIDE SLOPE WILL BE COMPLETELY ARMORED WITH RSP.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- ROCK SLOPE PROTECTION
- FILTER SAND
- CLAY FILL

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WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 3 – STA 51+83 TO 70+00
ALTERNATIVE 1 CROSS SECTION

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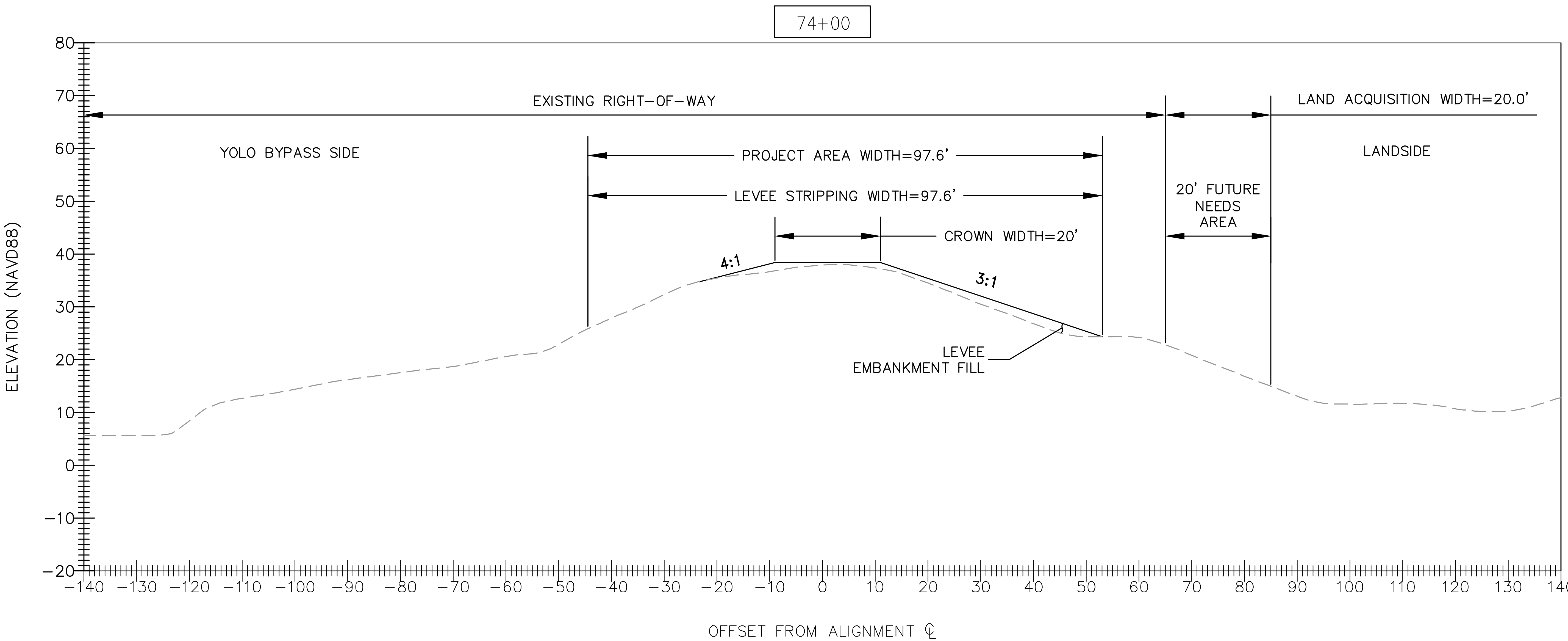

LAND ACQUISITION WIDTH = 20.0 FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 80.0 SQ FT

PROJECT AREA WIDTH = 76.5 FT

STRIPPING WIDTH = 76.5FT

REACH 4 - STA 70+00 TO 82+82
ALTERNATIVE 1 - MINOR LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT–OF–WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. ROCK SLOPE PROTECTION IS NEEDED ALONG WATERSIDE TOE FROM ELEVATION 5.5 TO 10.0.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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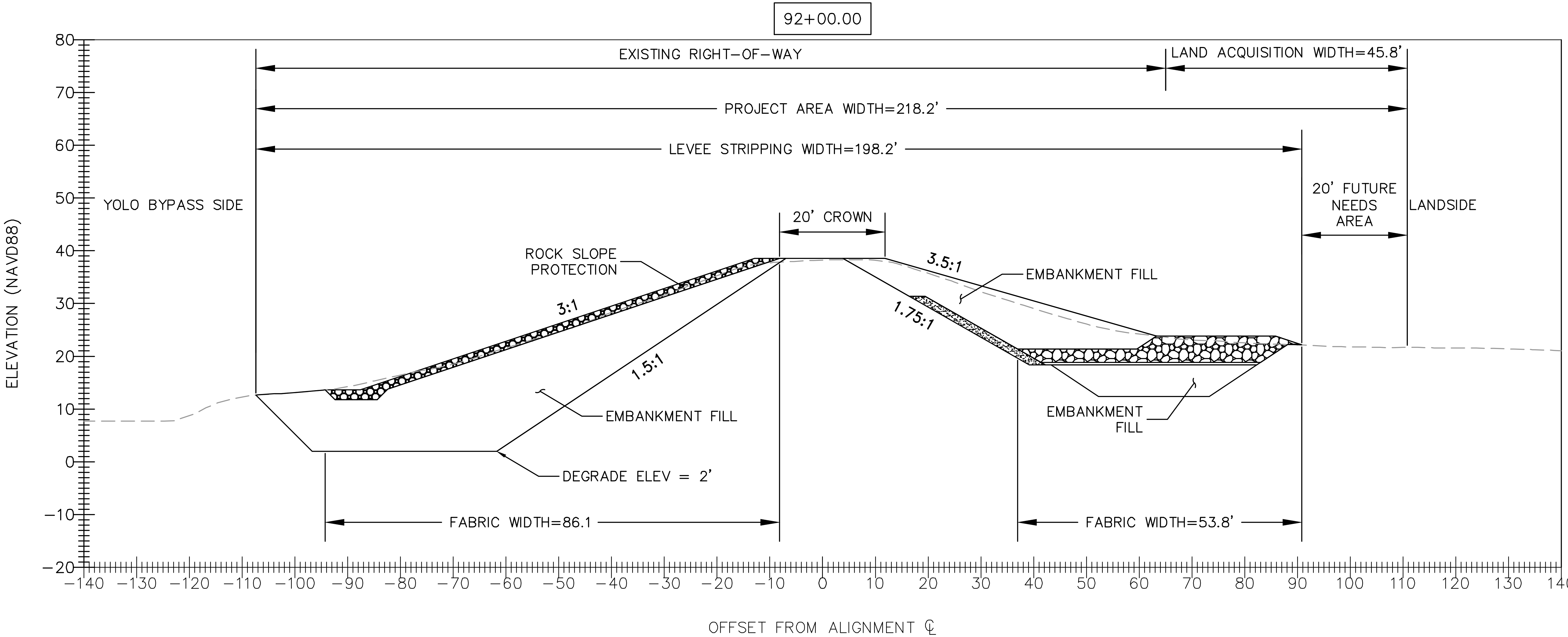
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 4 – STA 70+00 TO 82+82
ALTERNATIVE 1 CROSS SECTION



LAND ACQUISITION WIDTH = 45.8 FT

DRAIN ROCK AREA = 180.8 SQ FT

ROCK SLOPE PROTECTION AREA = 136.3 SQ FT

FILTER SAND AREA = 39.3 SQ FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 4.7 SQ FT

WS EMBANKMENT FILL AREA = 1046.2 SQ FT

LS EMBANKMENT FILL AREA = 350.5 + 180.0 = 530.5 SQ FT

PROJECT AREA WIDTH = 218.2 FT

STRIPPING WIDTH = 198.2 FT

FILTER FABRIC WIDTH = 86.1 + 53.8 = 139.9 FT

REACH 5 - STA 82+82 TO 95+50
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH WATERSIDE AND LANDSIDE SLOPE RECONSTRUCTION

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. WATERSIDE SLOPE TO BE ARMORED WITH ROCK SLOPE PROTECTION. (EXISTING ROCK SLOPE PROTECTION TO BE SALVAGED.)

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- ROCK SLOPE PROTECTION

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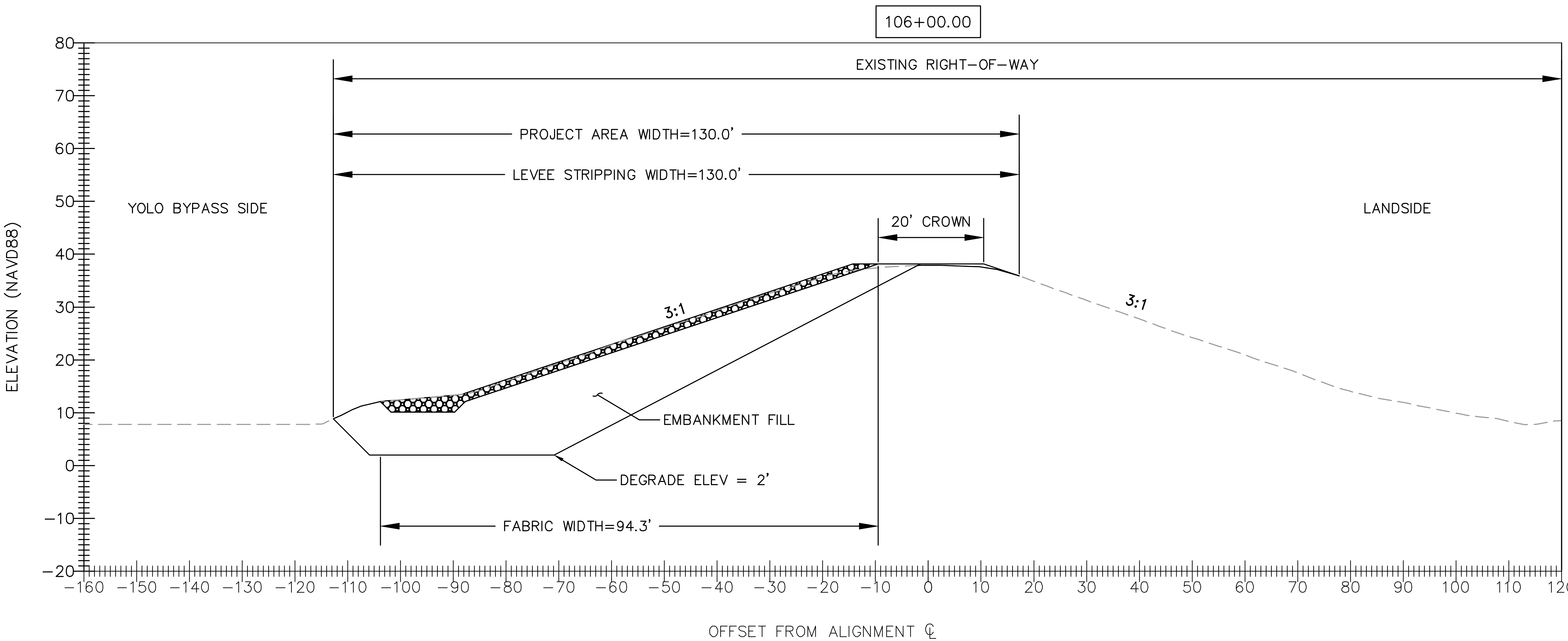
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 5 – STA 82+82 TO 95+50
ALTERNATIVE 1 CROSS SECTION



TOTAL DEGRADE AREA = 1033.1 SQ FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 50.3 SQ FT

EMBANKMENT FILL AREA = 1033.1 SQ FT

FABRIC WIDTH 94.3 FT

ROCK SLOPE PROTECTION AREA = 159.4 SQ FT

PROJECT AREA WIDTH = 111.2 FT

STRIPPING WIDTH = 111.2 FT

WIDTH OF ROADWAY WITHIN PROJECT = 12 FT

REACH 6 - STA 95+50 TO 114+50
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH WATERSIDE SLOPE RECONSTRUCTION

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. WATERSIDE SLOPE TO BE ARMORED WITH ROCK SLOPE PROTECTION. (EXISTING ROCK SLOPE PROTECTION TO BE SALVAGED.)

LEGEND

— — —	EXISTING GROUND
———	FINISHED GRADE
	ROCK SLOPE PROTECTION
	FILTER SAND
	CLAY FILL

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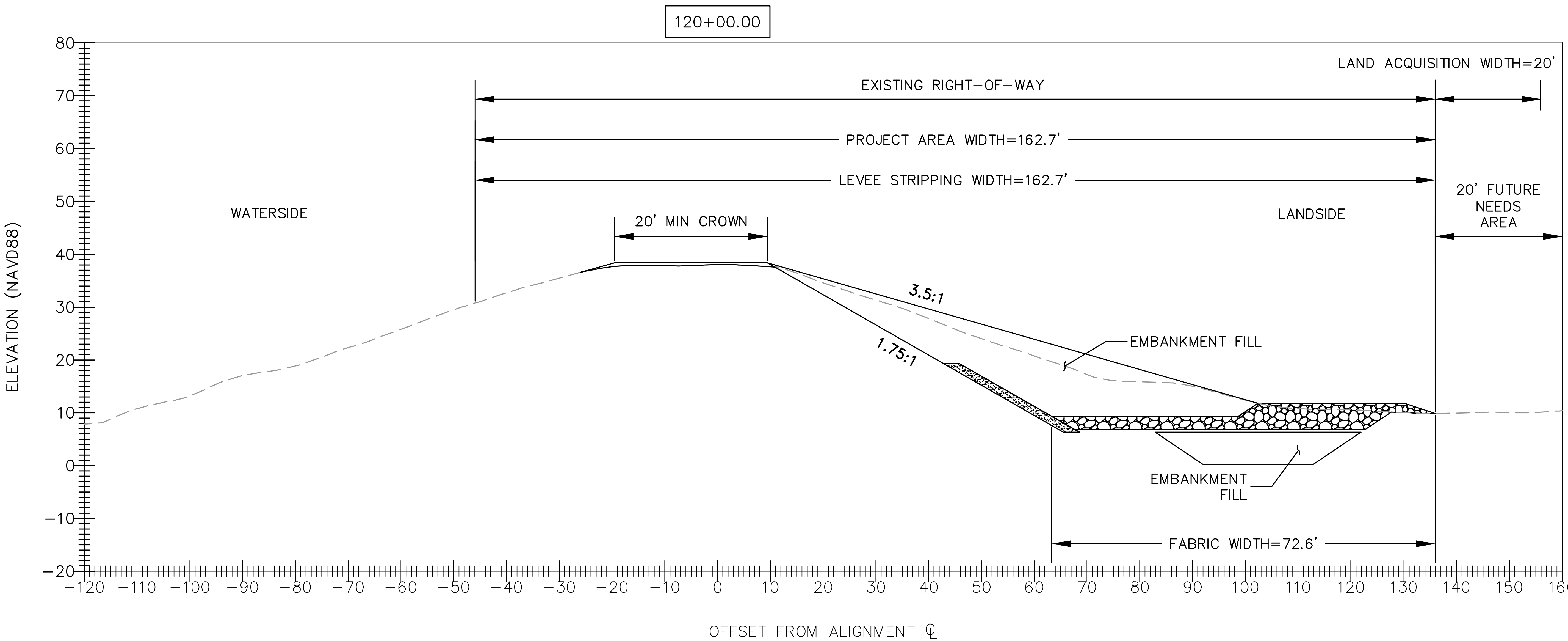
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 6 - STA 95+50 TO 114+50
ALTERNATIVE 1 CROSS SECTION



LAND ACQUISITION WIDTH = 20.0 FT

DRAIN ROCK AREA = 224.4 SQ FT

FILTER SAND AREA = 39.3 SQ FT

MINOR LEVEE RAISE FILL (EMBANKMENT FILL) = 15.8 SQ FT

EMBANKMENT FILL AREA = 693.2 + 180 = 873.2 SQ FT

PROJECT AREA WIDTH = 162.7 FT

STRIPPING WIDTH = 162.7 FT

FILTER FABRIC WIDTH = 72.6 FT

REACH 7 - STA 114+50 TO 130+00
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH LANDSIDE SLOPE RECONSTRUCTION

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT–OF–WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. WATERSIDE SLOPE TO BE ARMORED WITH ROCK SLOPE PROTECTION. (EXISTING ROCK SLOPE PROTECTION TO BE SALVAGED.)

LEGEND

EXISTING GROUND
FINISHED GRADE
DRAIN ROCK
FILTER SAND
CLAY FILL

WOOD RODGERS
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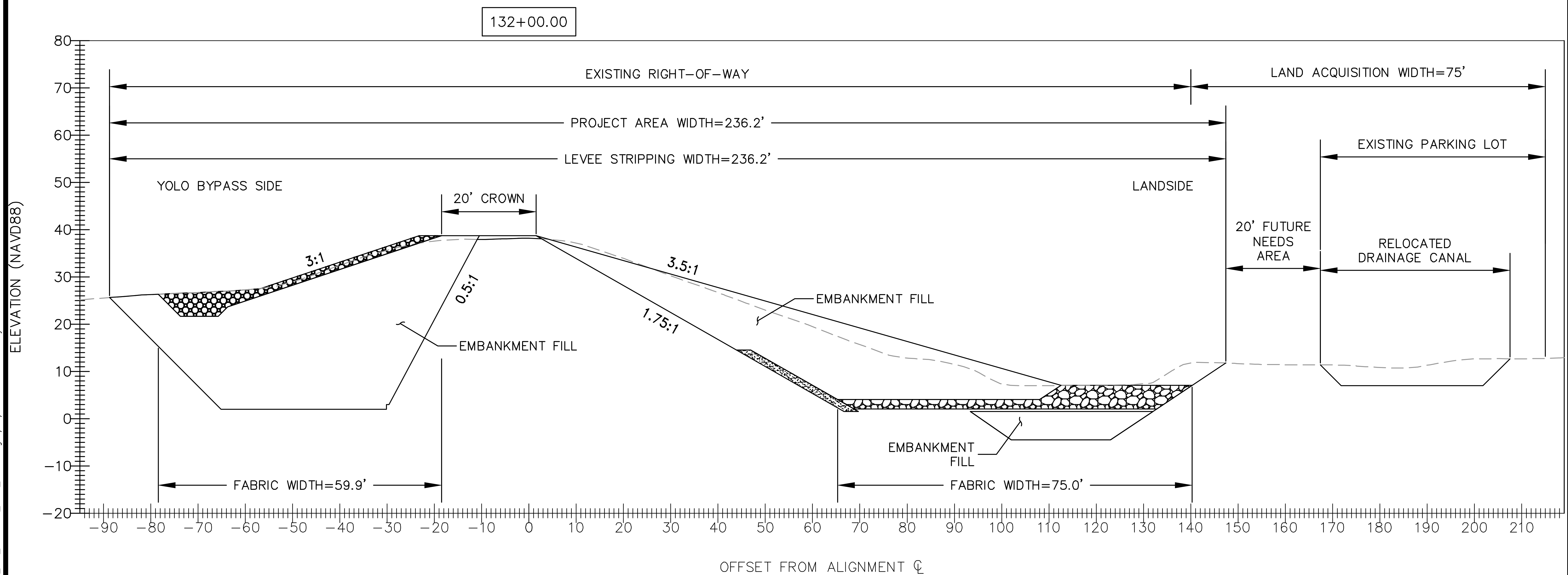
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 7 – STA 114+50 TO 130+00
ALTERNATIVE 1 CROSS SECTION



LAND ACQUISITION WIDTH = 75 FT

DRAIN ROCK AREA = 217.7 SQ FT
ROCK SLOPE PROTECTION AREA = 134.0 SQ FT
FILTER SAND AREA = 39.3 SQ FT

LEVEE RAISE FILL (EMBANKMENT FILL) = 8.7 SQ FT
WS EMBANKMENT FILL AREA = 1524.7 SQ FT
LS EMBANKMENT FILL AREA = 1000.9 + 179.0 = 1079.9 SQ FT

RELOCATED DRAINAGE CANAL EXCAVATION = 159.5 SQ FT

PROJECT AREA WIDTH = 236.2 FT
STRIPPING WIDTH = 236.2 FT
FILTER FABRIC WIDTH = 59.9 + 75.0 = 134.9 FT

REACH 8 - STA 130+00 TO 136+00
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH WATERSIDE AND LANDSIDE SLOPE RECONSTRUCTION

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO INCLUDE DRAINAGE CANAL ALONG LANDSIDE OF LEVEE.
3. WATERSIDE SLOPE WILL BE ARMORED WITH ROCK SLOPE PROTECTION. (EXISTING ROCK SLOPE PROTECTION TO BE SALVAGED)

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- ROCK SLOPE PROTECTION

WOOD RODGERS
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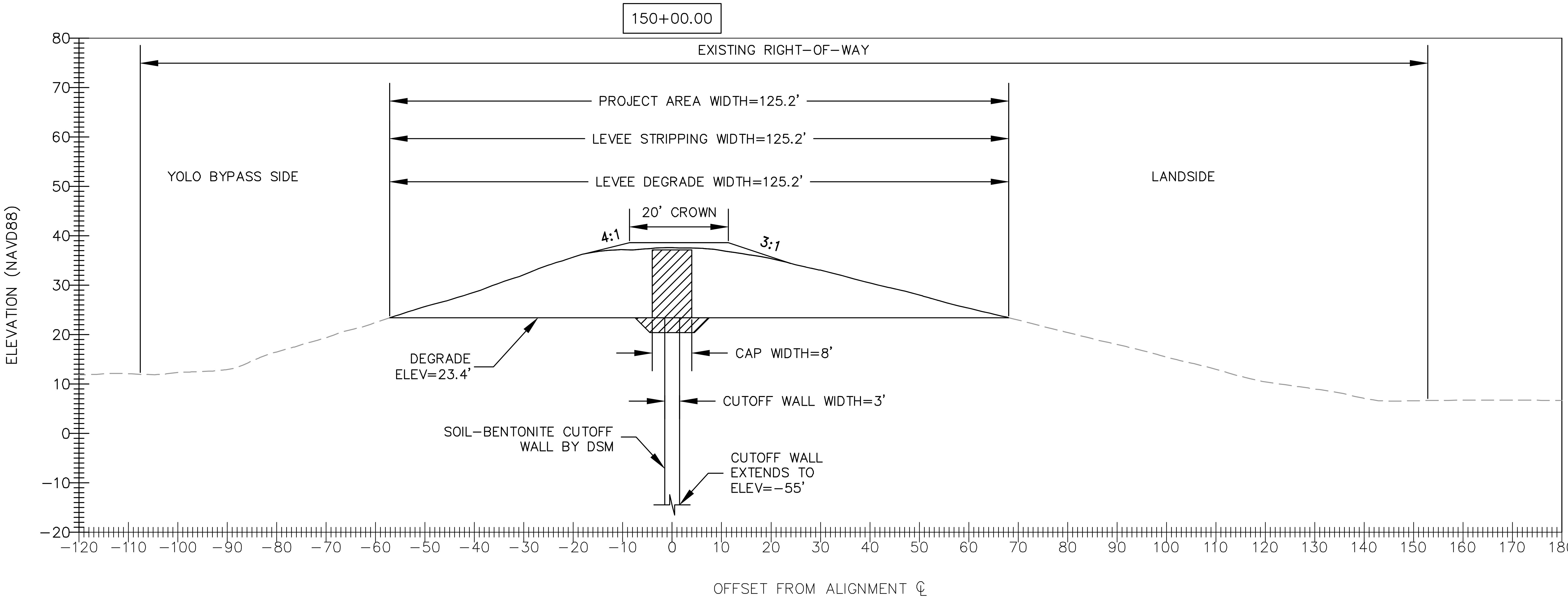
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 8 – STA 130+00 TO 136+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 39.4 SQ FT

TOTAL DEGRADE AREA = 1048.3 SQ FT

CLAY CAP FILL AREA = 109.5 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 78.4 FT

CUTOFF WALL AREA = 235.3 SQ FT

PROJECT AREA WIDTH = 125.2 FT

STRIPPING WIDTH = 125.2 FT

REACH 9 - STA 136+00 TO 155+00
ALTERNATIVE 1 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. WATERSIDE SLOPE WILL BE ARMORED WITH ROCK SLOPE PROTECTION. (EXISTING ROCK SLOPE PROTECTION TO BE SALVAGED)

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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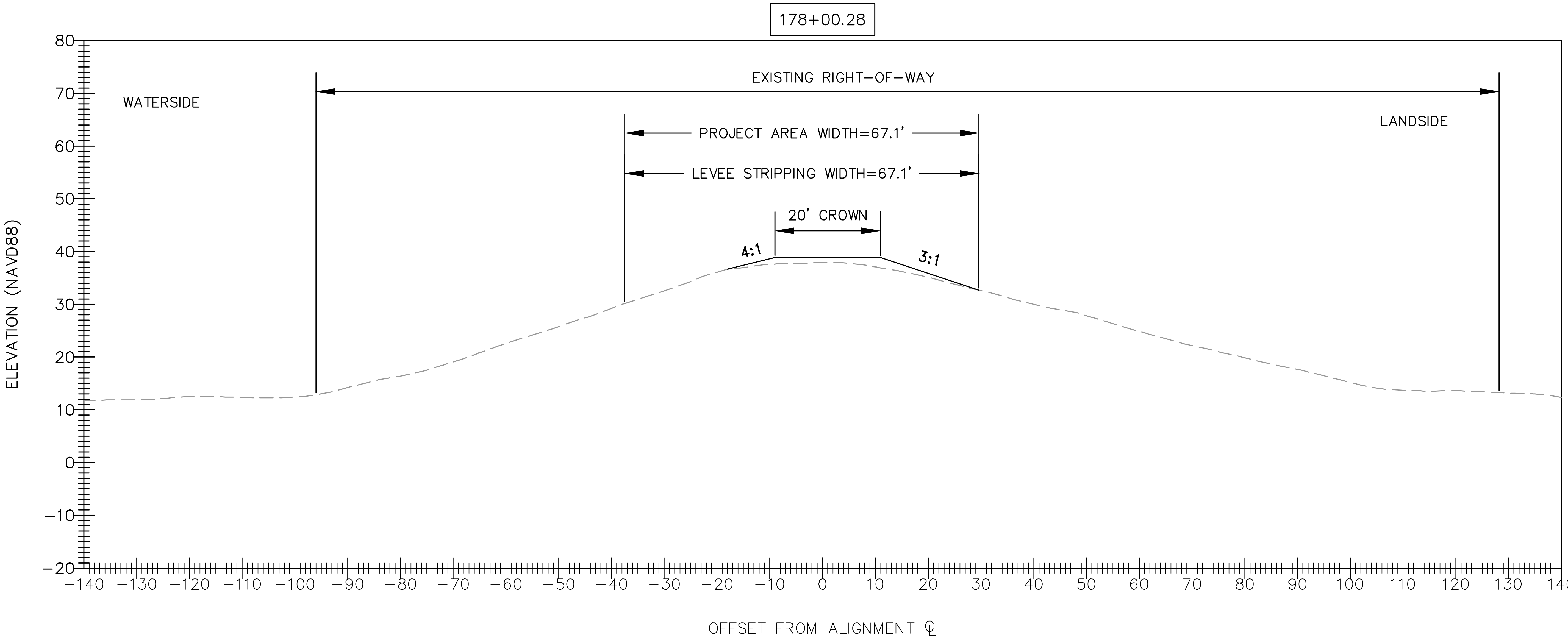
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 9 – STA 136+00 TO 155+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 45.5 SQ FT

PROJECT AREA WIDTH = 67.1 FT

STRIPPING WIDTH = 67.1 FT

REACH 10 - STA 155+00 TO 197+55
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY IS ASSUMED TO EXTEND 10' LANDWARD OF THE LANDSIDE TOE BASED ON INPUT FROM THE PROJECT TEAM.
3. WATERSIDE SLOPE WILL BE ARMORED WITH ROCK SLOPE PROTECTION. (EXISTING ROCK SLOPE PROTECTION TO BE SALVAGED)

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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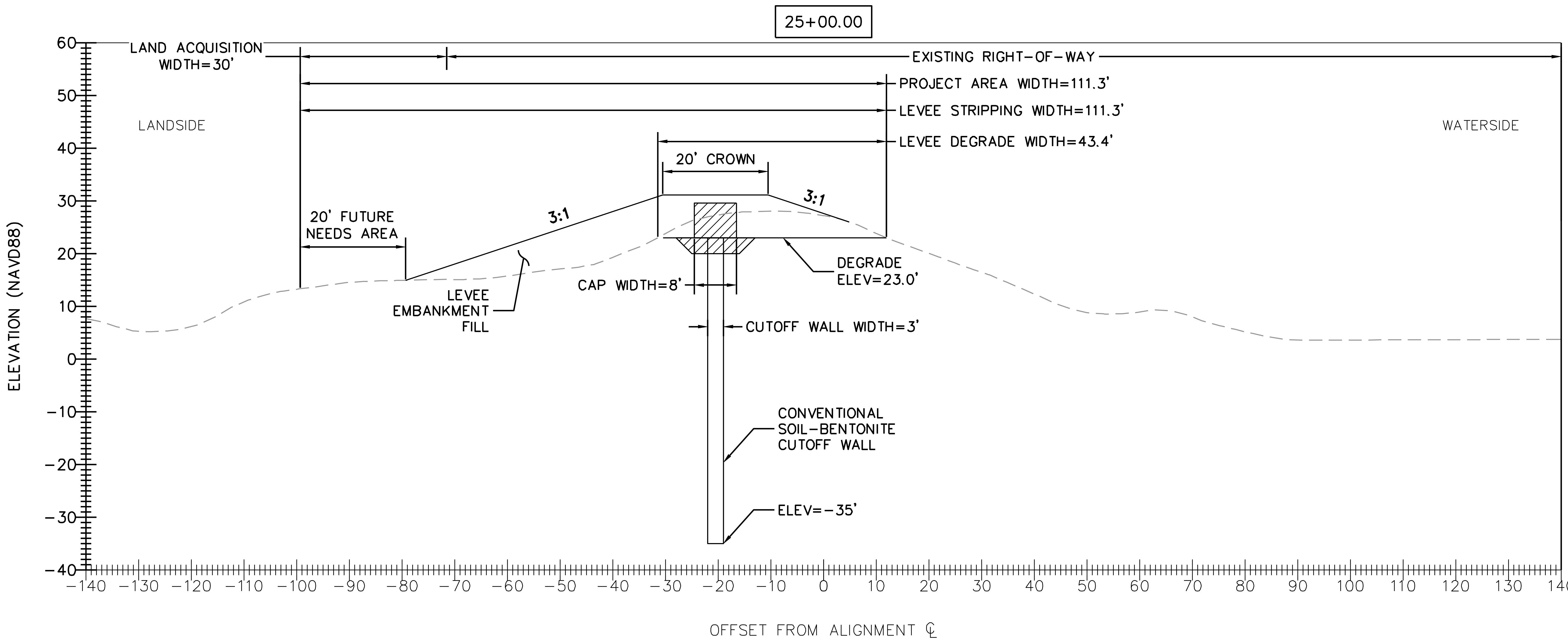
WEST SACRAMENTO FLOOD PROGRAM

YOLO BYPASS EAST LEVEE
REACH 10 – STA 155+00 TO 197+55
ALTERNATIVE 1 CROSS SECTION

South Cross Levee Cross Sections



LEVEE EMBANKMENT AREA = 388.1 SQ FT

TOTAL DEGRADE AREA = 154.6 SQ FT

CLAY CAP FILL AREA = 52.6 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 58.0 FT

PROJECT AREA WIDTH = 111.3 FT

STRIPPING WIDTH = 111.3 FT

REACH 1 - STA 0+00 TO 65+00
ALTERNATIVE 1 - LEVEE RAISE AND SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. EXISTING RIGHT-OF-WAY EXTENDS 20' LANDWARD OF LANDSIDE TOE AND 200' WATERWARD OF WATERSIDE TOE.
3. DEGRADE MATERIAL TO BE STOCKPILED AND REPLACED.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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WEST SACRAMENTO FLOOD PROGRAM

SOUTH CROSS LEVEE
REACH 1 – STA 0+00 TO 65+00
ALTERNATIVE 1 CROSS SECTION

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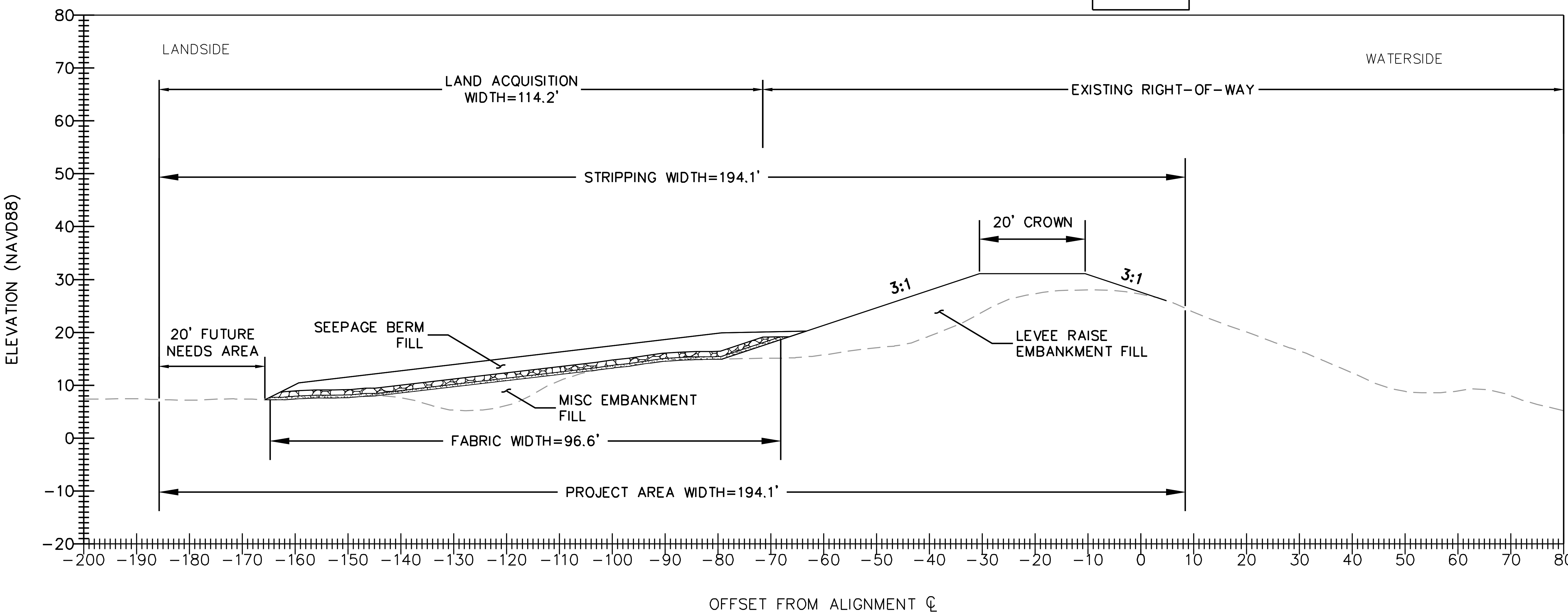

DRAIN ROCK AREA = 94.8 SQ FT

FILTER SAND AREA = 49.5 SQ FT

MISC EMBANKMENT FILL AREA = 110.8 SQ FT

SEEPAGE BERM FILL AREA = 238.9 SQ FT

LEVEE RAISE EMBANKMENT FILL AREA = 388.1 SQ FT

PROJECT AREA WIDTH = 194.1 FT

STRIPPING WIDTH =194.1 FT

FILTER FABRIC WIDTH = 96.6 FT

REACH 1 - STA 0+00 TO 65+00
ALTERNATIVE 2 - LEVEE RAISE WITH SEEPAGE BERM

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. FREEBOARD IMPROVEMENTS ONLY EXTEND FROM 0+27 TO 53+38
3. DEGRADE MATERIAL TO BE STOCKPILED AND REPLACED.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
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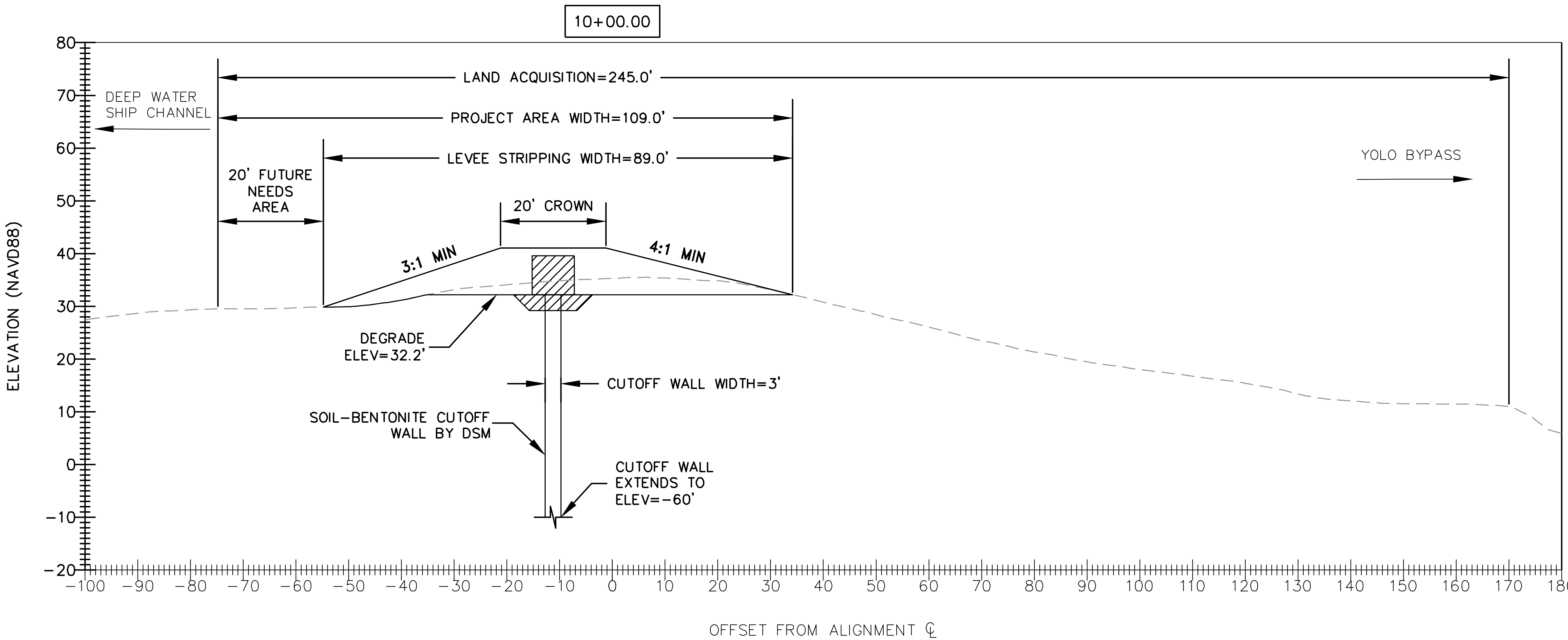
WEST SACRAMENTO FLOOD PROGRAM

SOUTH CROSS LEVEE
REACH 1 – STA 0+00 TO 65+00
ALTERNATIVE 2 CROSS SECTION

DWSC West Levee Cross Sections



LEVEE RAISE FILL (EMBANKMENT FILL) = 474.6 SQ FT

TOTAL DEGRADE AREA = 150.3 SQ FT

CLAY CAP FILL AREA = 58.8 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 92.2 FT

LAND ACQUISITION WIDTH = 245 FT

PROJECT AREA WIDTH = 109.0 FT

STRIPPING WIDTH = 89.0 FT

REACH 1 - STA 0+00 TO 35+00
ALTERNATIVE 1 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.
3. ROCK SLOPE PROTECTION IS NEEDED FOR THE TOP 30 FEET DOWNSLOPE FROM THE WATERSIDE CROWN HINGE. THE REST OF THE SLOPE WILL BE SEEDED (SOIL FILL PLACED TO ADDRESS SPOT REPAIRS) AS NECESSARY. FINALLY, A 50 FOOT VEGETATED BACKWATER/RIPARIAN CORRIDOR IS PROPOSED BEYOND THE LANDSIDE TOE.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
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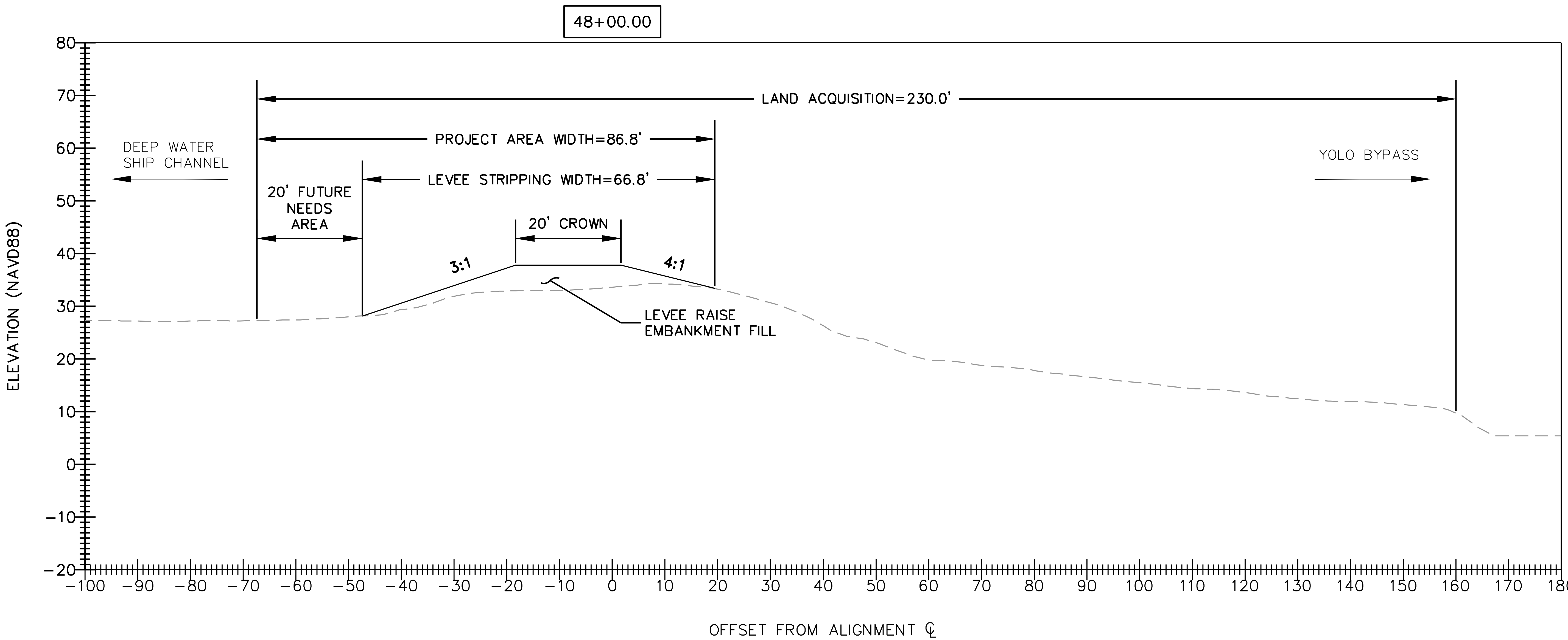
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 1 – STA 0+00 TO 35+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 184.7 SQ FT

TOTAL DEGRADE AREA = 0.0 SQ FT

LAND ACQUISITION WIDTH = 230 FT

PROJECT AREA WIDTH = 86.8 FT

STRIPPING WIDTH = 66.8 FT

REACH 2 - STA 35+00 TO 60+00
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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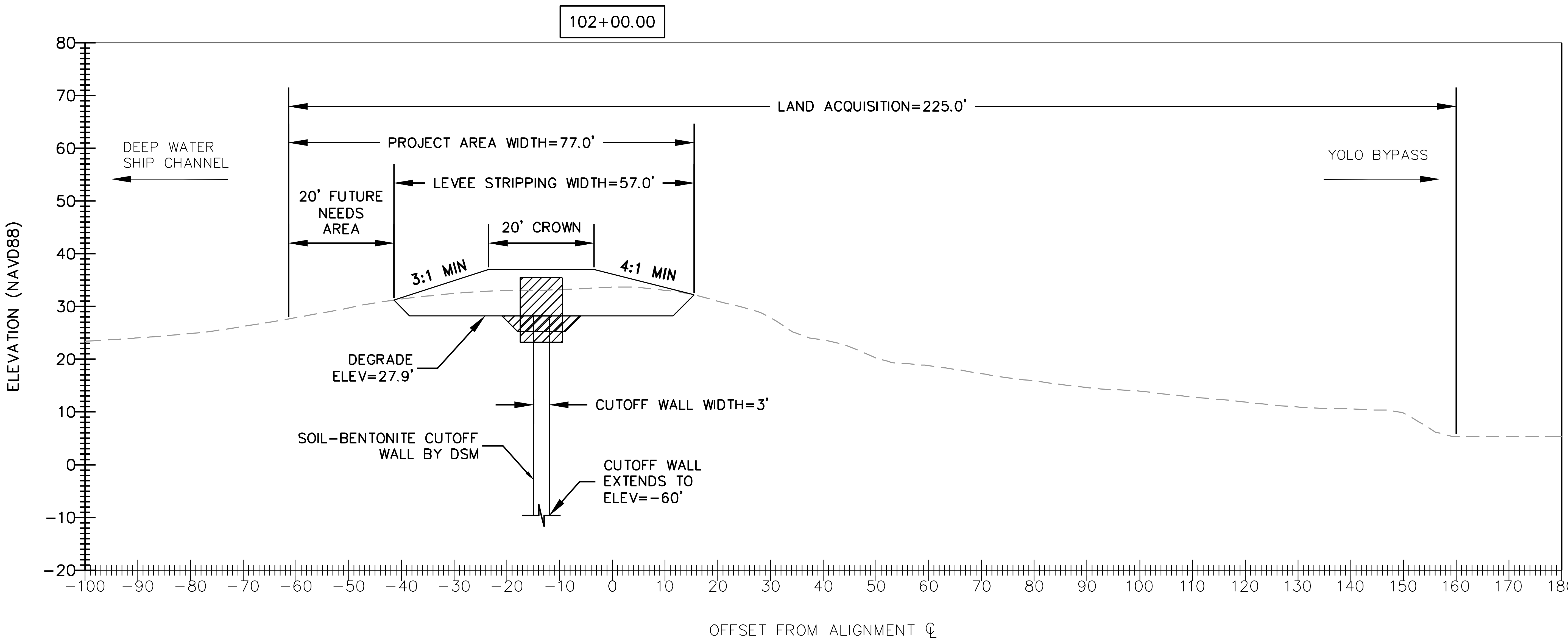
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 2 – STA 35+00 TO 60+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 136.6 SQ FT

TOTAL DEGRADE AREA = 252.3 SQ FT

CLAY CAP FILL AREA = 98.0 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 87.9 FT

LAND ACQUISITION WIDTH = 225 FT

PROJECT AREA WIDTH = 77.0 FT

STRIPPING WIDTH = 57.0 FT

REACH 3 - STA 60+00 TO 111+00
ALTERNATIVE 1 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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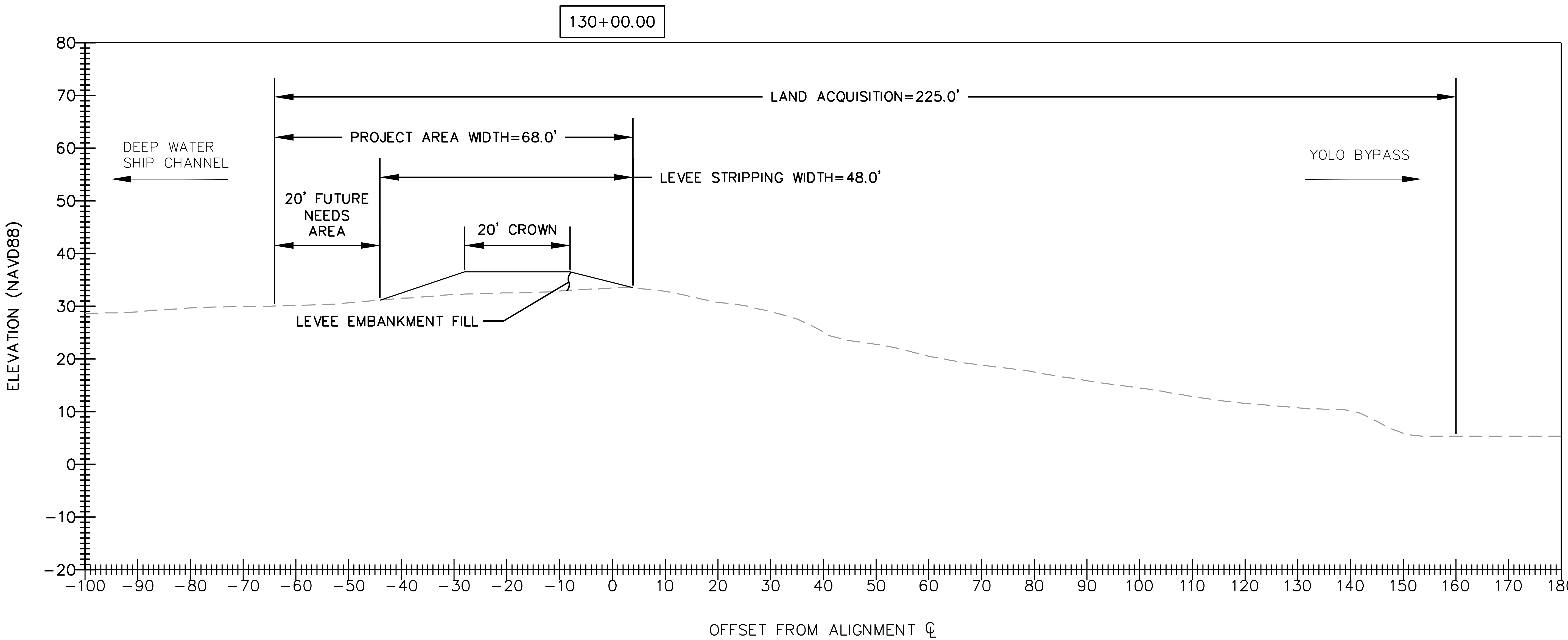
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 3 – STA 60+00 TO 111+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 132.1 SQ FT

TOTAL DEGRADE AREA = 0.0 SQ FT

LAND ACQUISITION WIDTH = 225 FT

ROJECT AREA WIDTH = 68.0 FT

STRIPPING WIDTH = 48.0 FT

REACH 4 - STA 111+00 TO 145+00
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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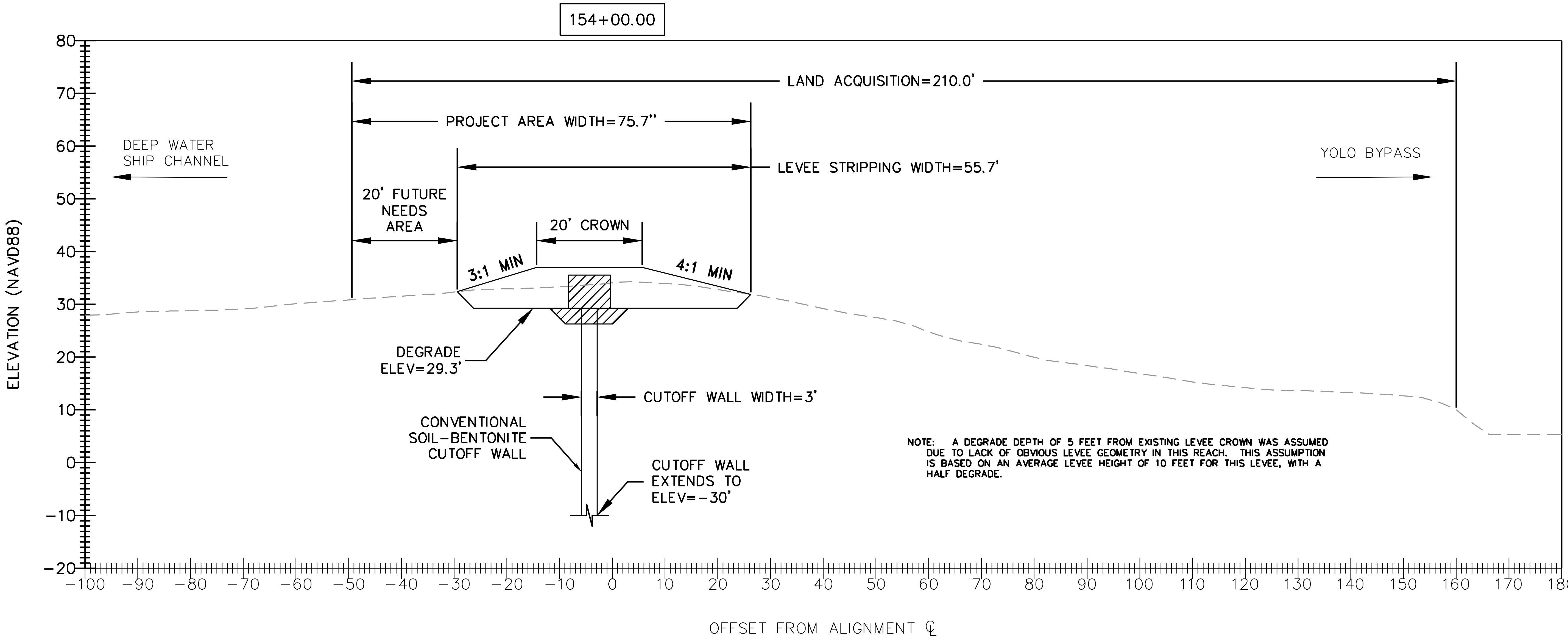
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 4 – STA 111+00 TO 145+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 334.8 SQ FT

TOTAL DEGRADE AREA = 215.7 SQ FT

CLAY CAP FILL AREA = 49.9 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 59.3 FT

LAND ACQUISITION WIDTH = 210 FT

PROJECT AREA WIDTH = 75.7 FT

STRIPPING WIDTH = 55.7 FT

REACH 5 - STA 145+00 TO 165+00
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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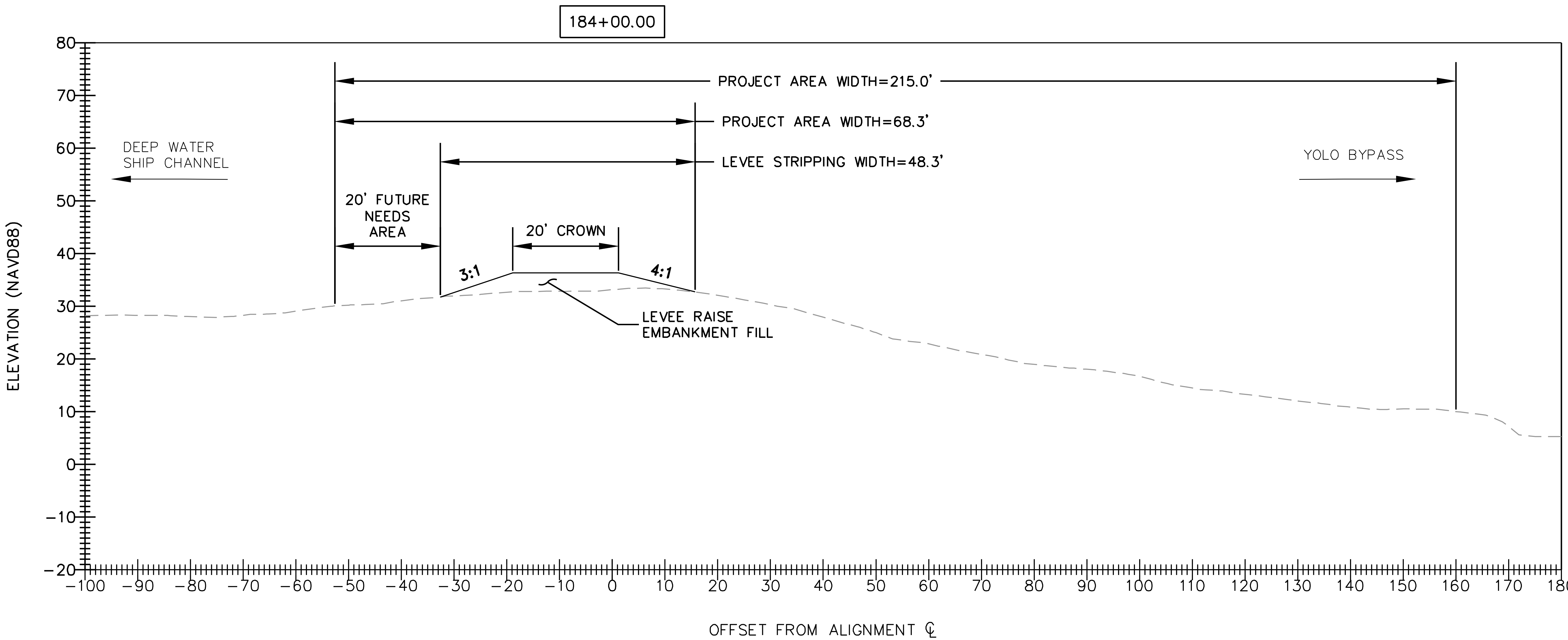
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 5 - STA 145+00 TO 165+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 113.4 SQ FT

TOTAL DEGRADE AREA = 0.0 SQ FT

LAND ACQUISITION WIDTH = 215.0 FT

PROJECT AREA WIDTH = 68.3 FT

STRIPPING WIDTH = 48.3 FT

REACH 6 - STA 165+00 TO 202+00
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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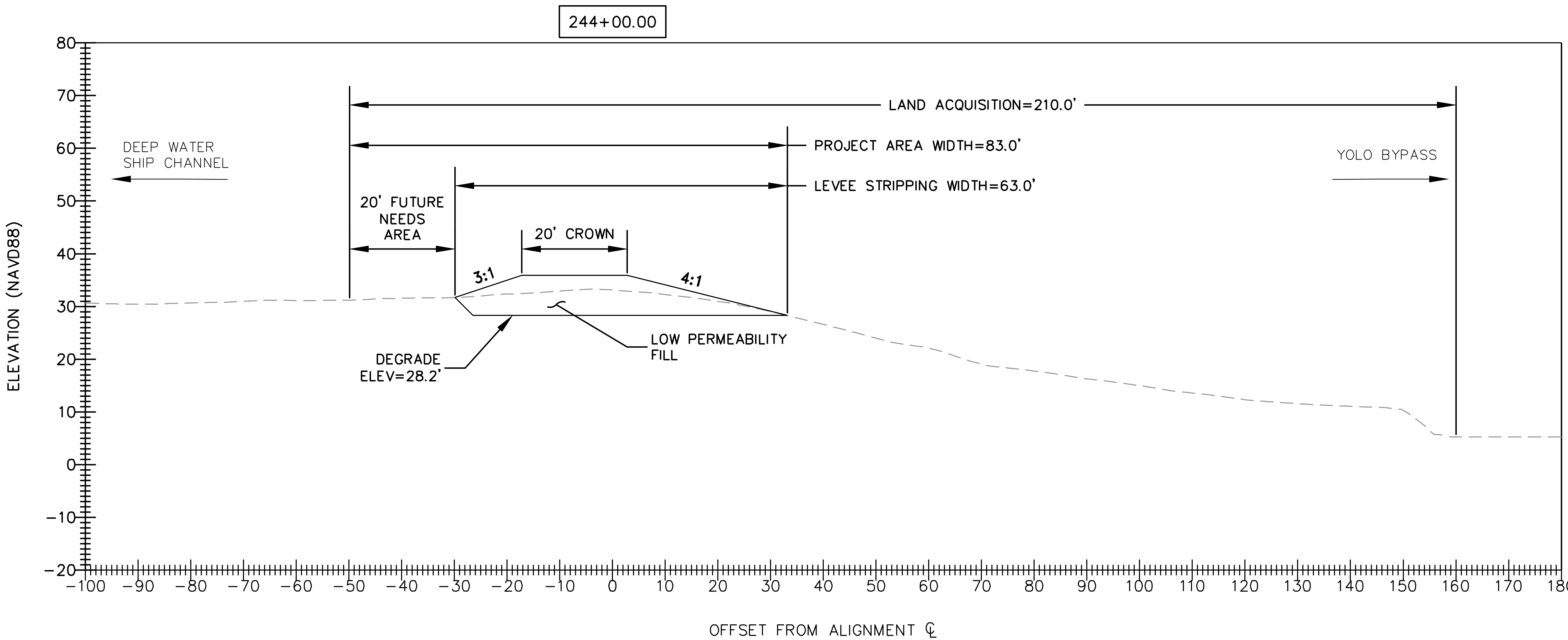
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 6 – STA 165+00 TO 202+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 111.3 SQ FT

LOW PERMEABILITY FILL = 219.7 SQ FT

TOTAL DEGRADE AREA = 219.7 SQ FT

LAND ACQUISITION WIDTH = 210.0 FT

PROJECT AREA WIDTH = 86.8 FT

STRIPPING WIDTH = 66.8 FT

REACH 7 - STA 202+00 TO 290+00
ALTERNATIVE 1 - LEVEE RAISE WITH EMBANKMENT RECONSTRUCTION

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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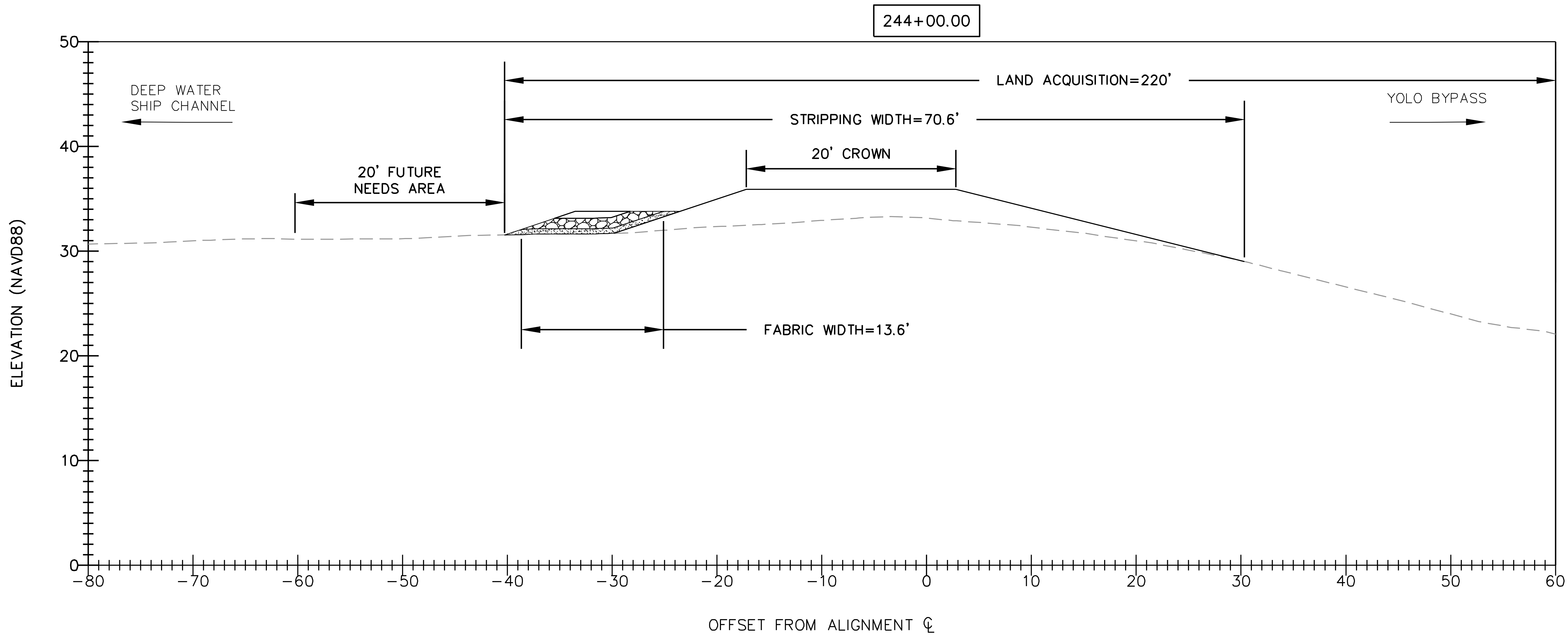
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 7 – STA 202+00 TO 290+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 111.3 SQ FT

BERM EMBANKMENT FILL AREA = 3.4 SQ FT

DRAIN ROCK AREA = 10.5 SQ FT

FILTER SAND AREA = 7.7 SQ FT

LAND ACQUISITION WIDTH = 220 FT

STRIPPING WIDTH = 70.6 FT

FILTER FABRIC WIDTH = 13.6 FT

REACH 7 - STA 202+00 TO 290+00
ALTERNATIVE 2 - LEVEE RAISE WITH STABILITY BERM

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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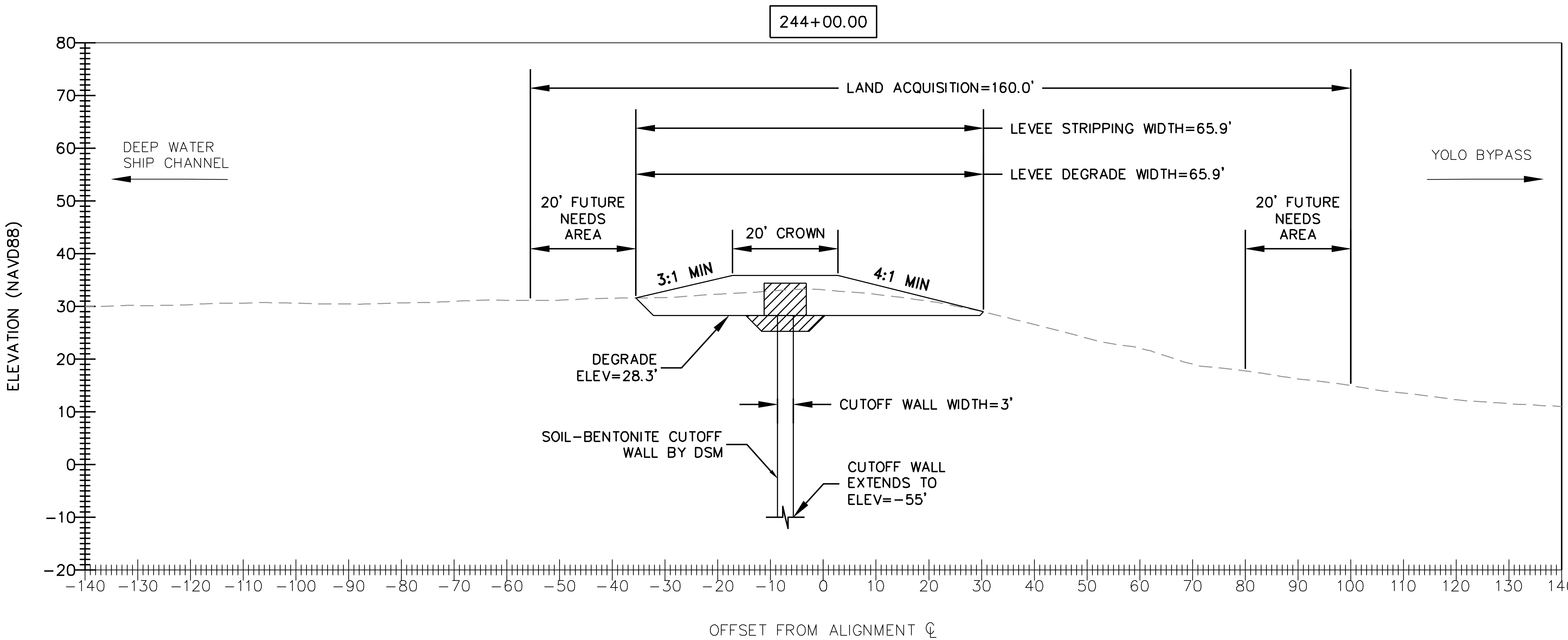
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 7 – STA 202+00 TO 290+00
ALTERNATIVE 2 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 123.0 SQ FT

TOTAL DEGRADE AREA = 237.9 SQ FT

CLAY CAP FILL AREA = 48.8 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 83.3 FT

LAND ACQUISITION WIDTH = 160 FT

PROJECT AREA WIDTH = 65.9 FT

STRIPPING WIDTH = 65.9 FT

REACH 7 - STA 202+00 TO 290+00
ALTERNATIVE 3 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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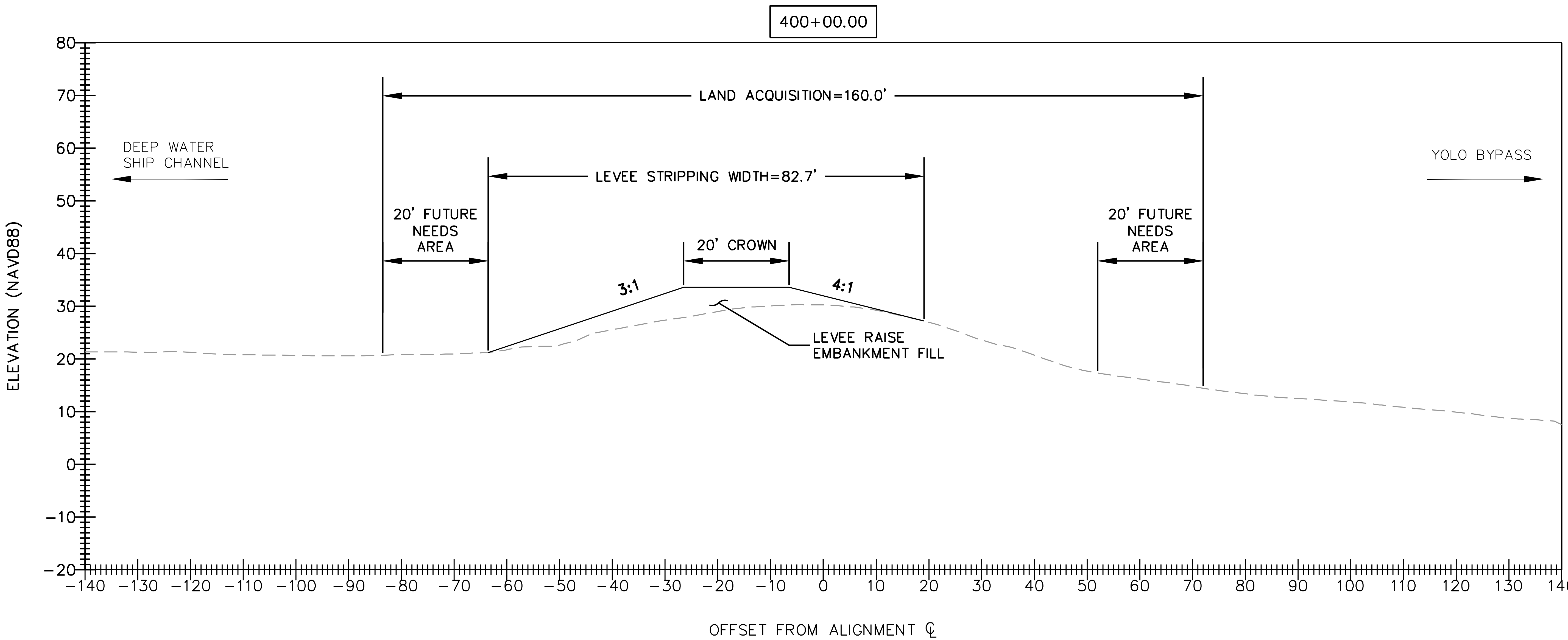
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 7 – STA 202+00 TO 290+00
ALTERNATIVE 3 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 224.1 SQ FT

LAND ACQUISITION WIDTH = 160.0 FT

STRIPPING WIDTH = 82.7 FT

REACH 8 - STA 290+00 TO 486+00
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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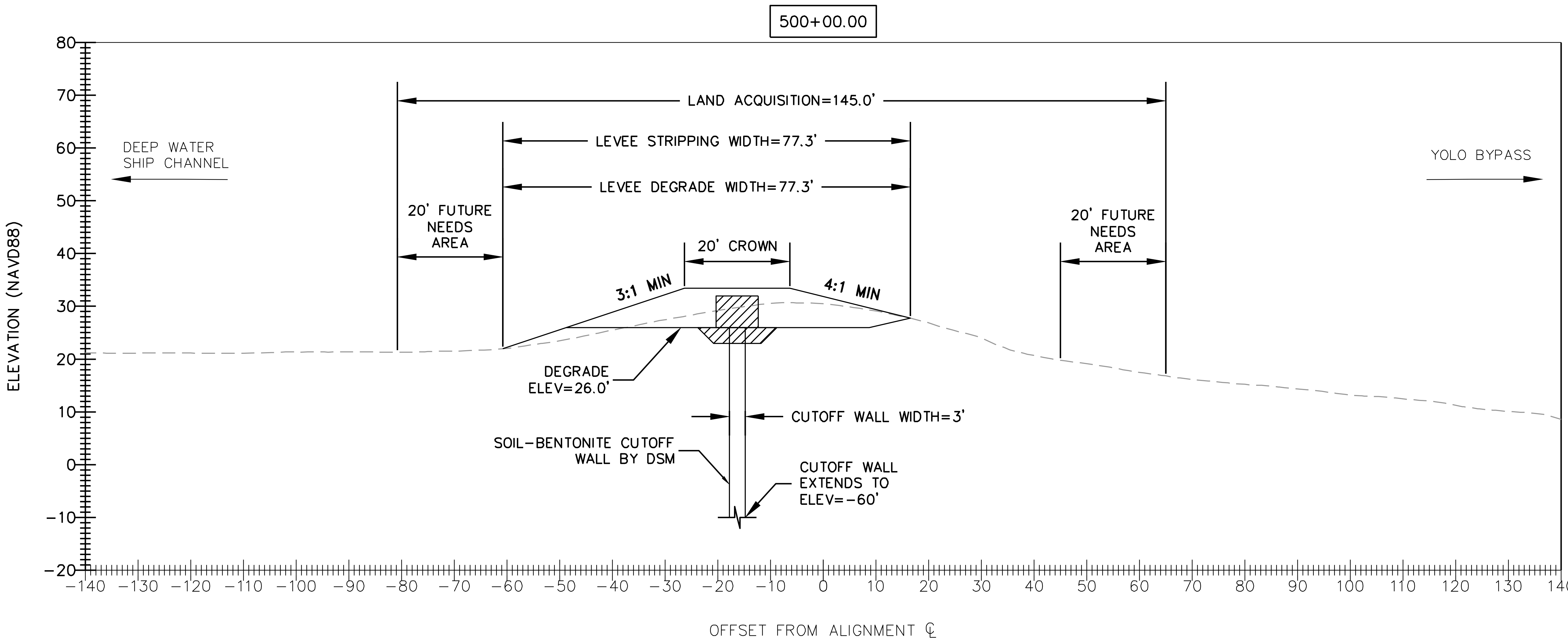
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 8 – STA 290+00 TO 486+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 359.7 SQ FT

TOTAL DEGRADE AREA = 163.7 SQ FT

CLAY CAP FILL AREA = 47.9 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 86.0 FT

LAND ACQUISITION WIDTH = 145 FT

STRIPPING WIDTH = 77.3 FT

REACH 9 - STA 486+00 TO 521+00
ALTERNATIVE 1 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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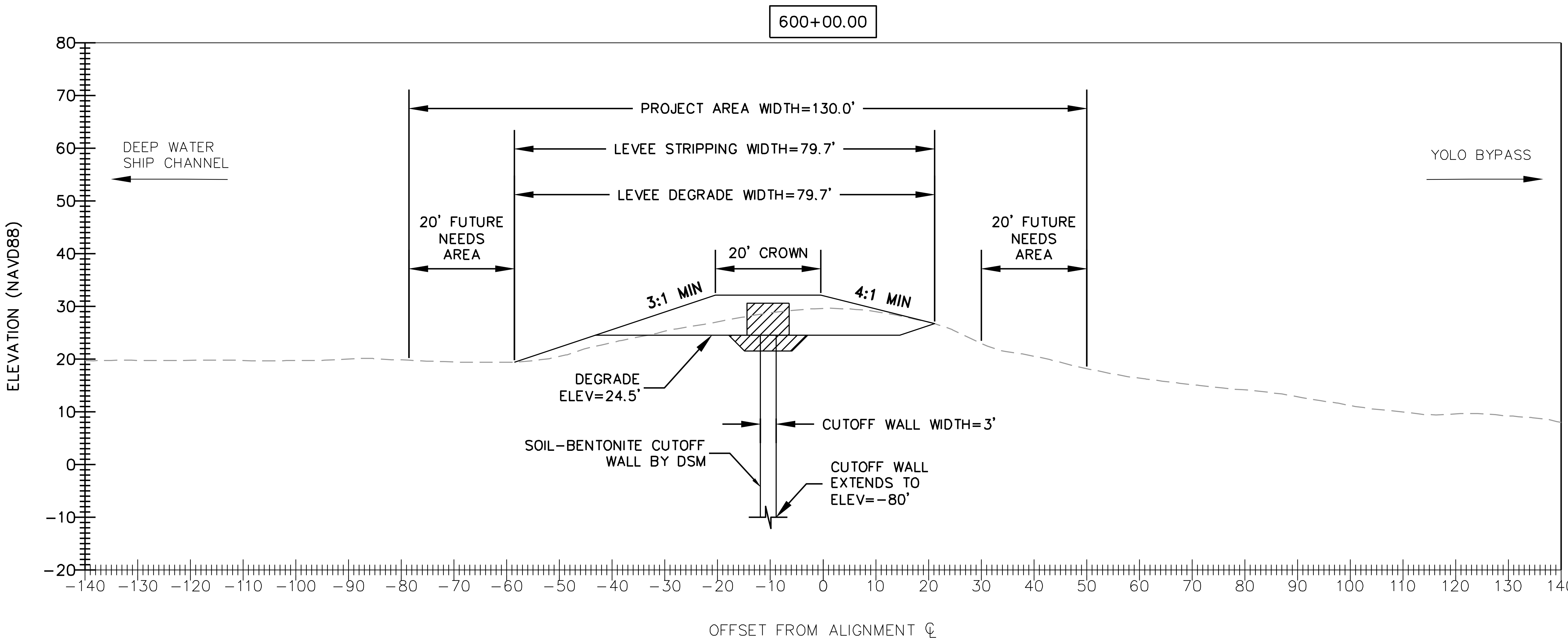
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 9 – STA 486+00 TO 521+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 188.5 SQ FT

TOTAL DEGRADE AREA = 181.3 SQ FT

CLAY CAP FILL AREA = 49.0 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 104.5 FT

LAND ACQUISITION WIDTH = 130 FT

PROJECT AREA WIDTH = 79.7 FT

STRIPPING WIDTH = 79.7 FT

REACH 10 - STA 521+00 TO 681+00
ALTERNATIVE 1 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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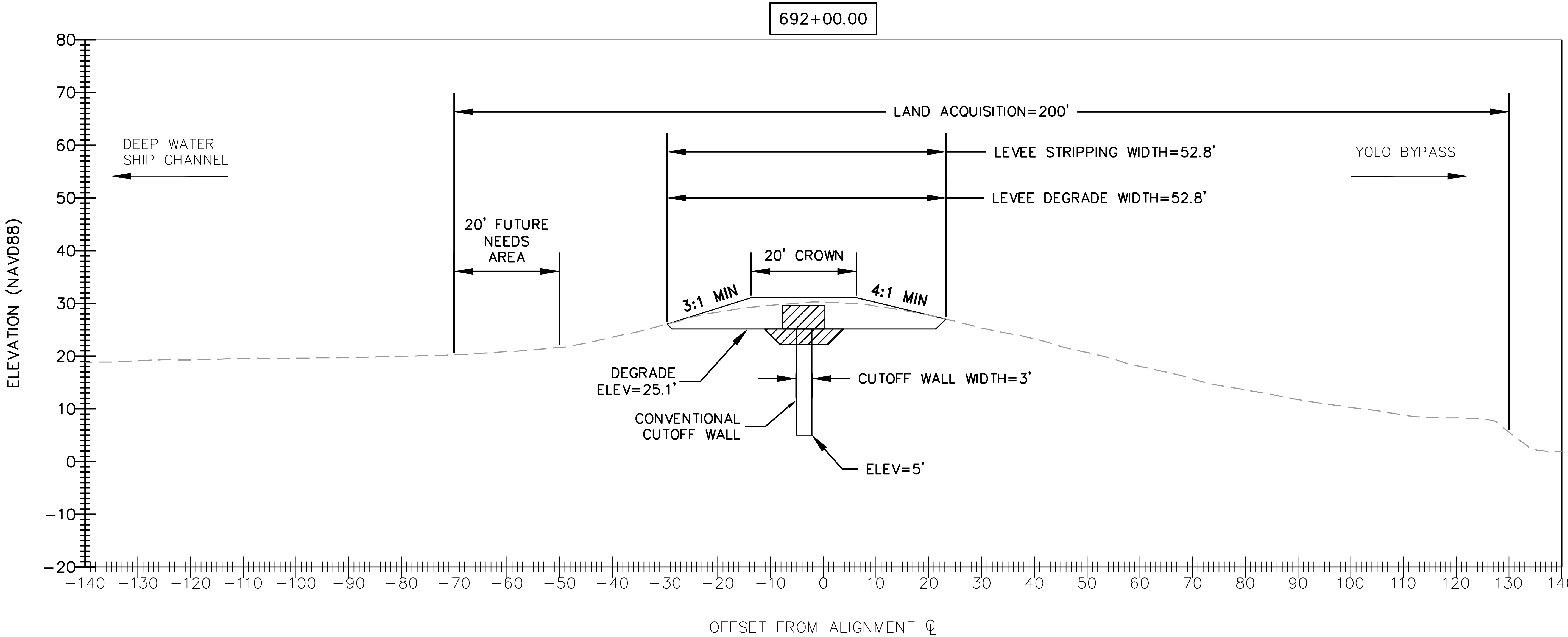
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 10 – STA 521+00 TO 681+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 238.0 SQ FT

TOTAL DEGRADE AREA = 198.4 SQ FT

CLAY CAP FILL AREA = 35.6 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 20.1 FT

LAND ACQUISITION WIDTH = 200 FT

PROJECT AREA WIDTH = 52.8 FT

STRIPPING WIDTH = 52.8 FT

REACH 11 - STA 681+00 TO 705+00
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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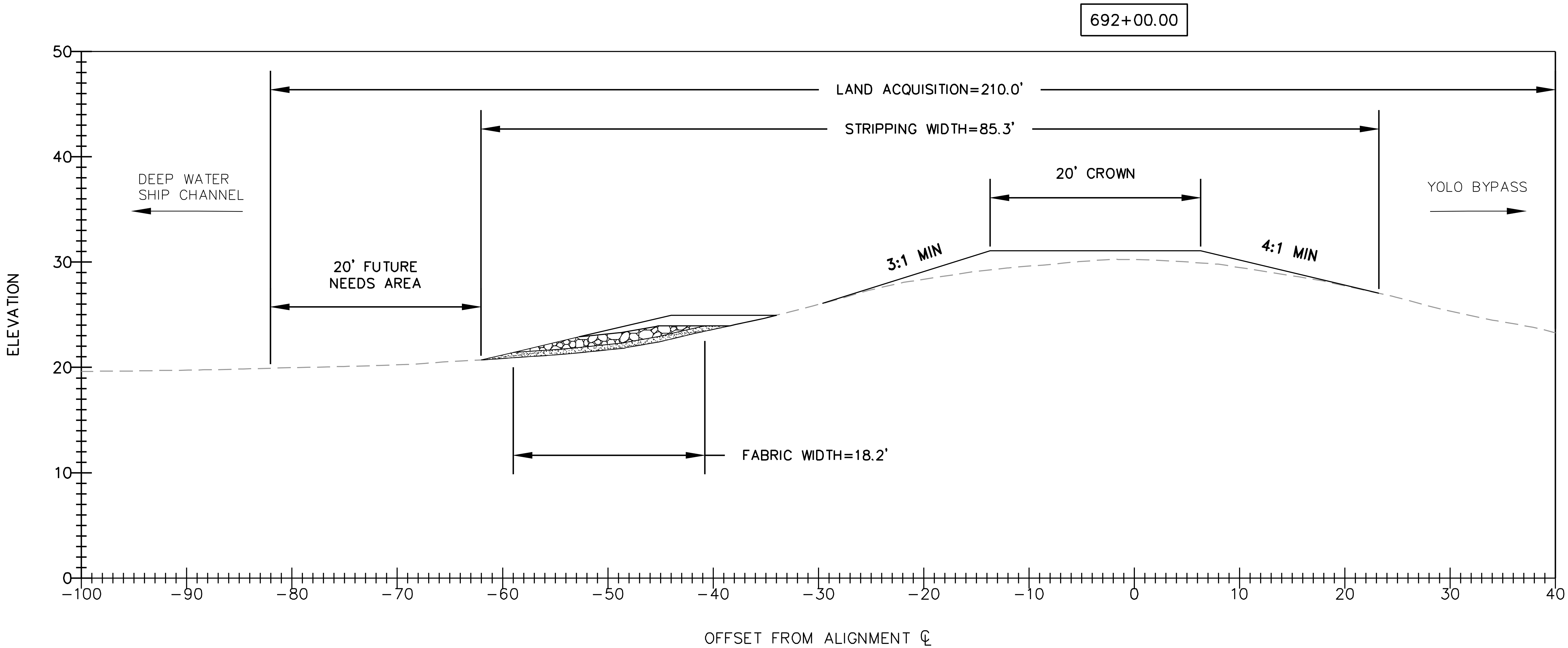
WEST SACRAMENTO
FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 11 – STA 681+00 TO 705+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 39.6 SQ FT

BERM EMBANKMENT FILL AREA = 12.1 SQ FT

DRAIN ROCK AREA = 13.4 SQ FT

FILTER SAND AREA = 10.6 SQ FT

LAND ACQUISITION WIDTH = 210 FT

STRIPPING WIDTH = 85.3 FT

FILTER FABRIC WIDTH = 18.2 FT

REACH 11 - STA 681+00 TO 705+00
ALTERNATIVE 2 - LEVEE RAISE WITH LANDSIDE STABILITY BERM

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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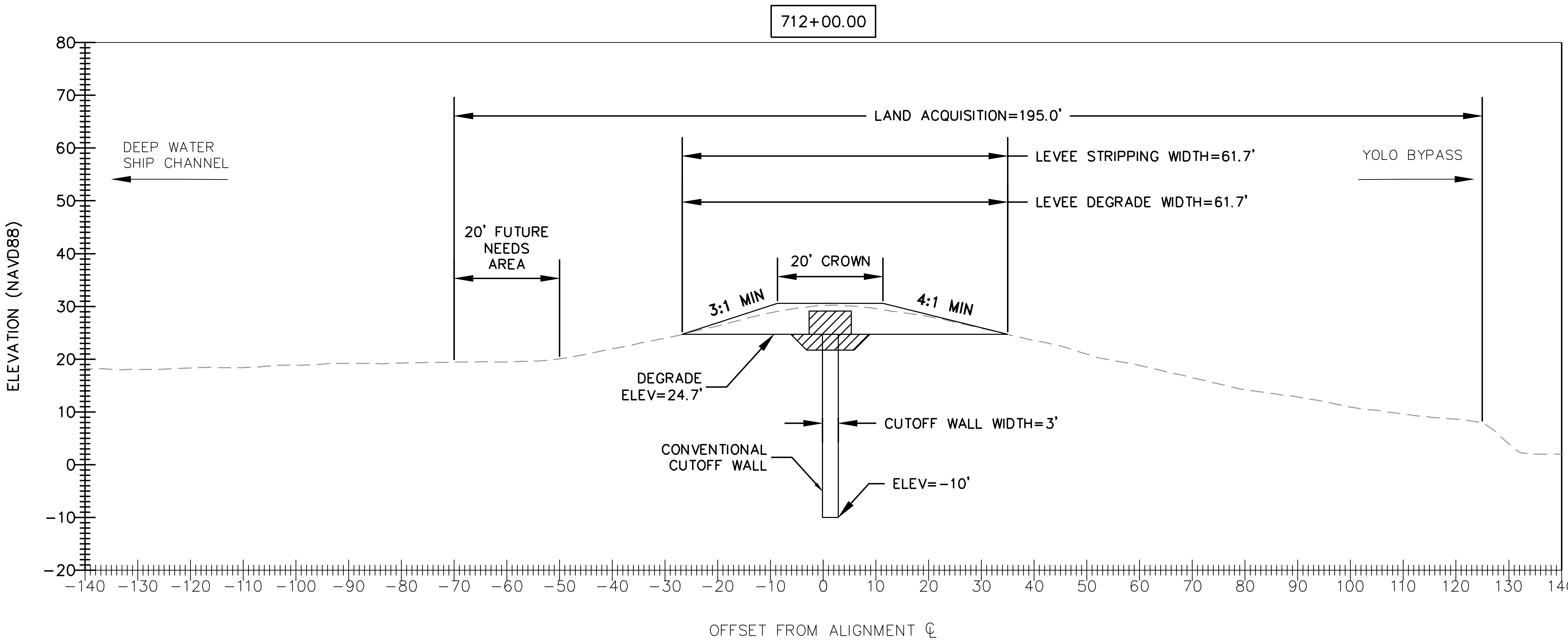
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 11 – STA 681+00 TO 705+00
ALTERNATIVE 2 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 241.4 SQ FT
TOTAL DEGRADE AREA = 204.7 SQ FT
CLAY CAP FILL AREA = 35.3 SQ FT
CUTOFF TRENCH AREA = 36.0 SQ FT
CUTOFF WALL DEPTH = 34.7 FT
LAND ACQUISITION WIDTH = 195.0 FT
STRIPPING WIDTH = 61.7 FT

REACH 12 - STA 705+00 TO 720+00
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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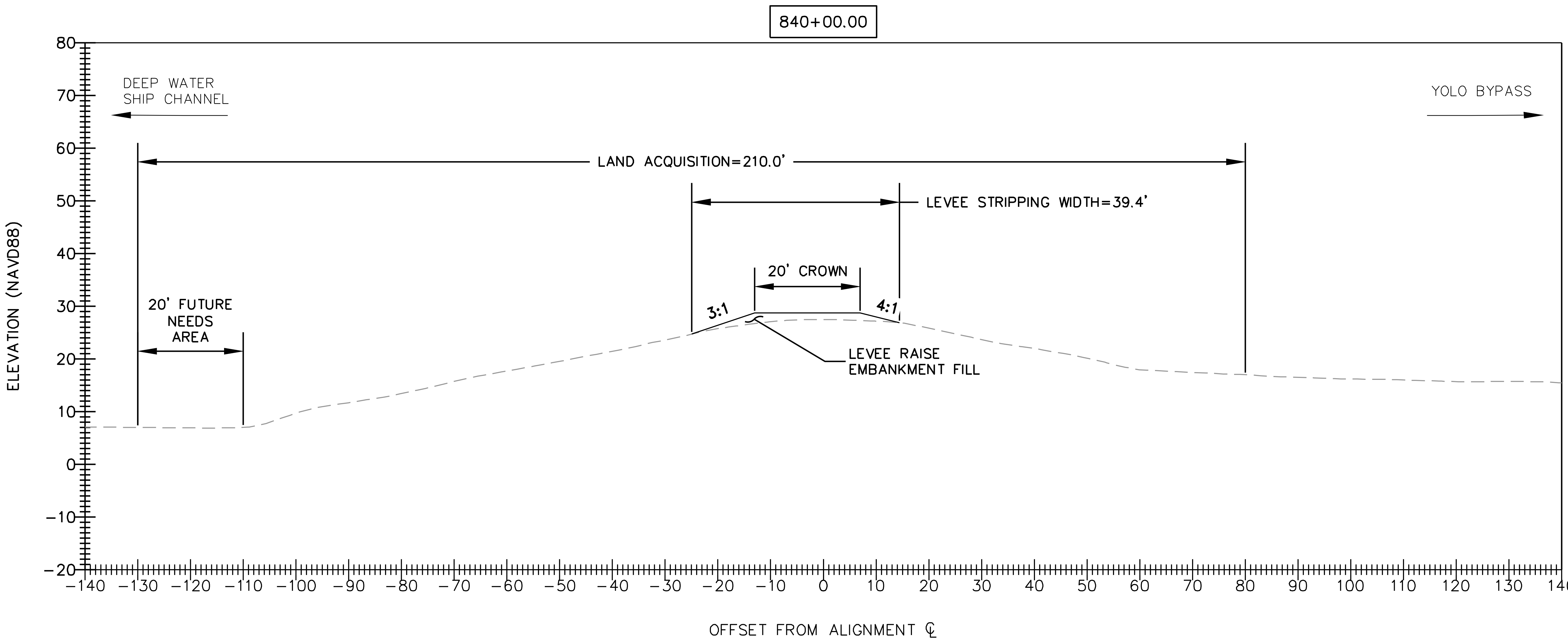
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 12 – STA 705+00 TO 720+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 42.9 SQ FT

TOTAL DEGRADE AREA = 0.0 SQ FT

LAND ACQUISITION WIDTH = 210.0 FT

STRIPPING WIDTH = 39.4 FT

REACH 13 - STA 720+00 TO 1001+11
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN THE DEEP WATER SHIP CHANNEL WEST LEVEE. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRTINT PLUS AND ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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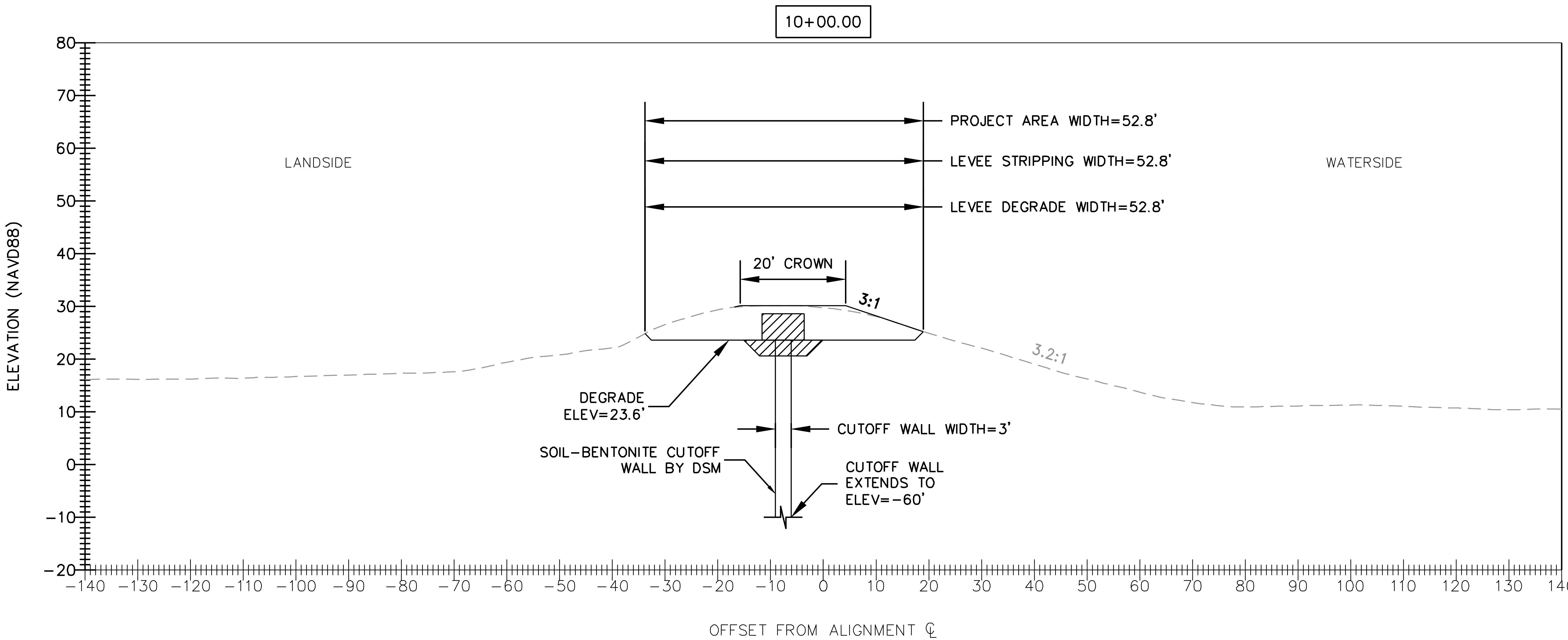
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL WEST LEVEE
REACH 13 – STA 720+00 TO 1001+11
ALTERNATIVE 1 CROSS SECTION

DWSC East Levee Cross Sections



SLOPE FLATTENING EMBANKMENT FILL = 6.8 SQ FT

TOTAL DEGRADE AREA = 259.2 SQ FT

CLAY CAP FILL AREA = 40.1 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 83.6 FT

PROJECT AREA WIDTH = 52.8 FT

STRIPPING WIDTH = 52.8 FT

REACH 2 - STA 8+00 TO 15+00
ALTERNATIVE 1 - DEEP CUTOFF WALL WITH WATERSIDE SLOPE FLATTENING

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DUE TO AN RD 900 MAINTAINED DRAINAGE CANAL AT THE LANDSIDE TOE AND THE YOLO BYPASS AT THE WATERSIDE TOE, ADDITIONAL LAND ACQUISITION IS ASSUMED TO NOT BE NEEDED IN THIS REACH.
3. LANDSIDE SLOPE WILL BE ARMORED WITH ROCK SLOPE PROTECTION FROM STA 13+73 TO 14+72.

LEGEND

— — —	EXISTING GROUND
———	FINISHED GRADE
	DRAIN ROCK
	FILTER SAND
	CLAY FILL

WOOD RODGERS
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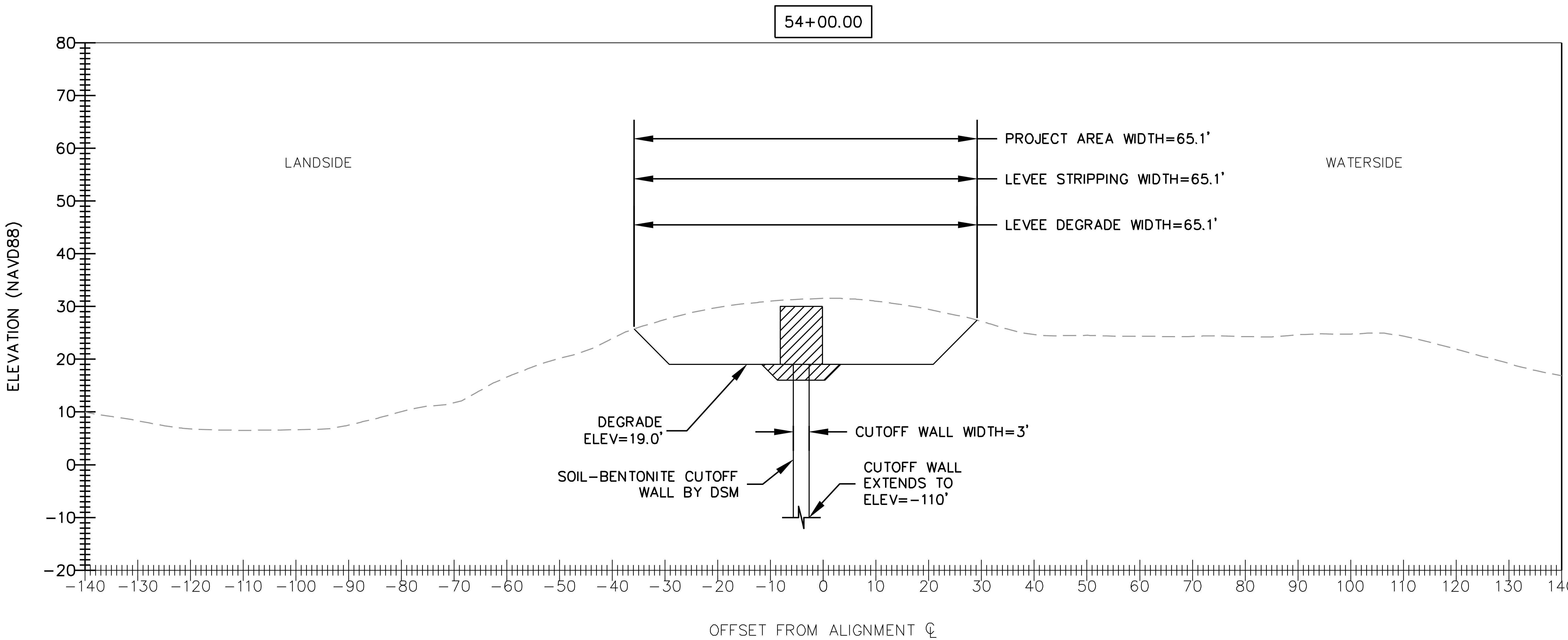
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL EAST LEVEE
REACH 2 – STA 8+00 TO 15+00
ALTERNATIVE 1 CROSS SECTION



TOTAL DEGRADE AREA = 644.8 SQ FT

CLAY CAP FILL AREA = 87.7 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 129.0 FT

PROJECT AREA WIDTH = 65.1 FT

STRIPPING WIDTH = 65.1 FT

REACH 3 - STA 15+00 TO 85+55
ALTERNATIVE 1 - DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DUE TO AN RD 900 MAINTAINED DRAINAGE CANAL AT THE LANDSIDE TOE AND THE YOLO BYPASS AT THE WATERSIDE TOE, ADDITIONAL LAND ACQUISITION IS ASSUMED TO NOT BE NEEDED IN THIS REACH.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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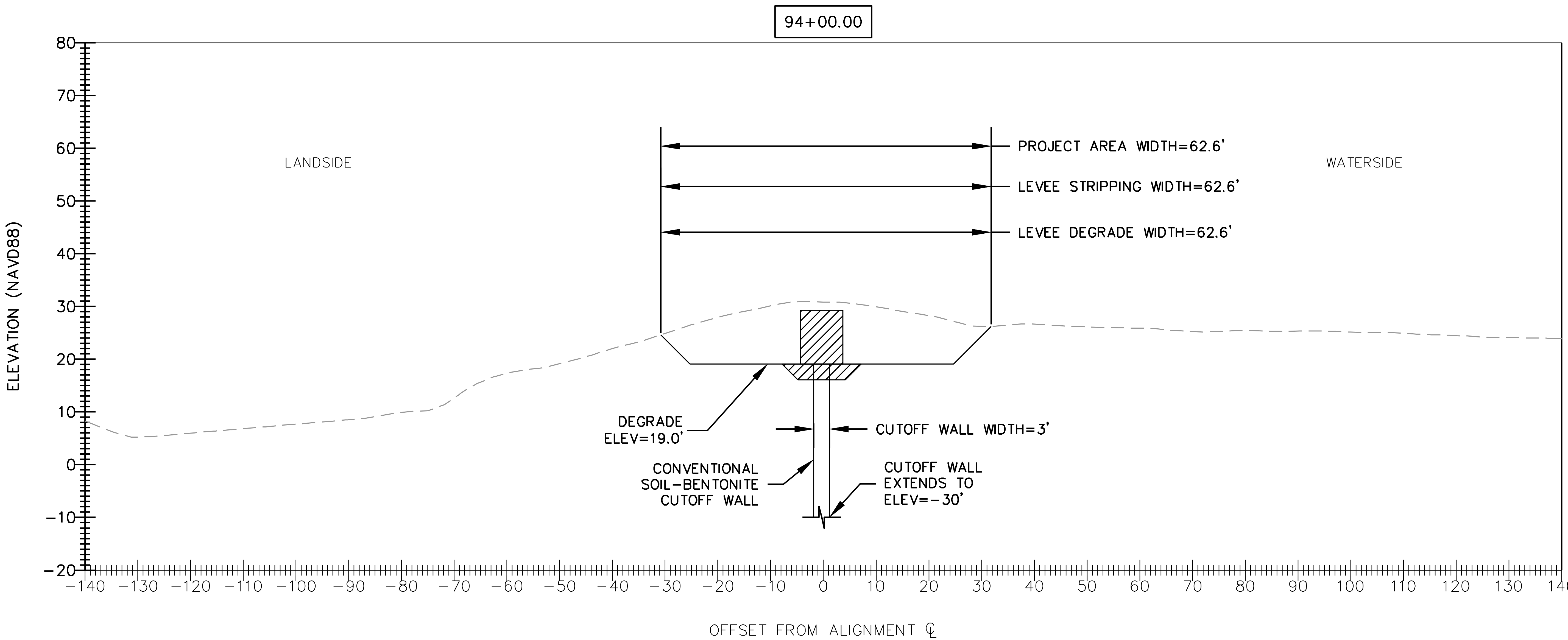
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL EAST LEVEE
REACH 3 – STA 15+00 TO 85+55
ALTERNATIVE 1 CROSS SECTION



TOTAL DEGRADE AREA = 560.2 SQ FT

CLAY CAP FILL AREA = 81.6 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 49.0 FT

PROJECT AREA WIDTH = 62.6 FT

STRIPPING WIDTH = 62.6 FT

REACH 4 - STA 85+55 TO 102+00
ALTERNATIVE 1 - SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DUE TO AN RD 900 MAINTAINED DRAINAGE CANAL AT THE LANDSIDE TOE AND THE YOLO BYPASS AT THE WATERSIDE TOE, ADDITIONAL LAND ACQUISITION IS ASSUMED TO NOT BE NEEDED IN THIS REACH.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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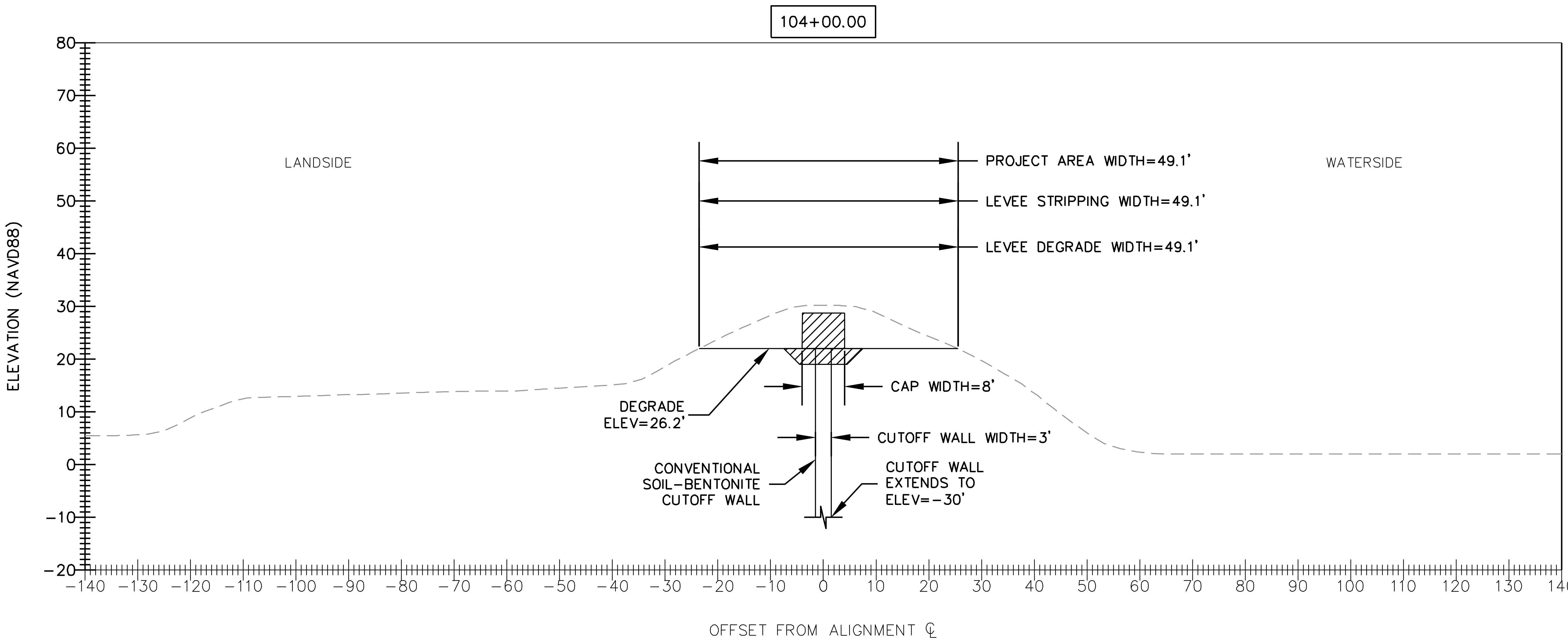
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL EAST LEVEE
REACH 4 – STA 85+55 TO 102+00
ALTERNATIVE 1 CROSS SECTION



TOTAL DEGRADE AREA = 251.7 SQ FT

CLAY CAP FILL AREA = 54.0 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 56.2 FT

PROJECT AREA WIDTH = 49.1 FT

STRIPPING WIDTH = 49.1 FT

REACH 5 - STA 102+00 TO 106+00
ALTERNATIVE 1 - SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DUE TO AN RD 900 MAINTAINED DRAINAGE CANAL AT THE LANDSIDE TOE AND THE YOLO BYPASS AT THE WATERSIDE TOE, ADDITIONAL LAND ACQUISITION IS ASSUMED TO NOT BE NEEDED IN THIS REACH.
3. SLOPE STABILITY WAS ALSO IDENTIFIED AS AN ISSUE IN THIS REACH, BUT FLATTENING SLOPES IS PROBLEMATIC DUE TO THE PRESENCE OF THE PUMP STATION.

LEGEND

EXISTING GROUND

FINISHED GRADE

DRAIN ROCK

FILTER SAND

CLAY FILL

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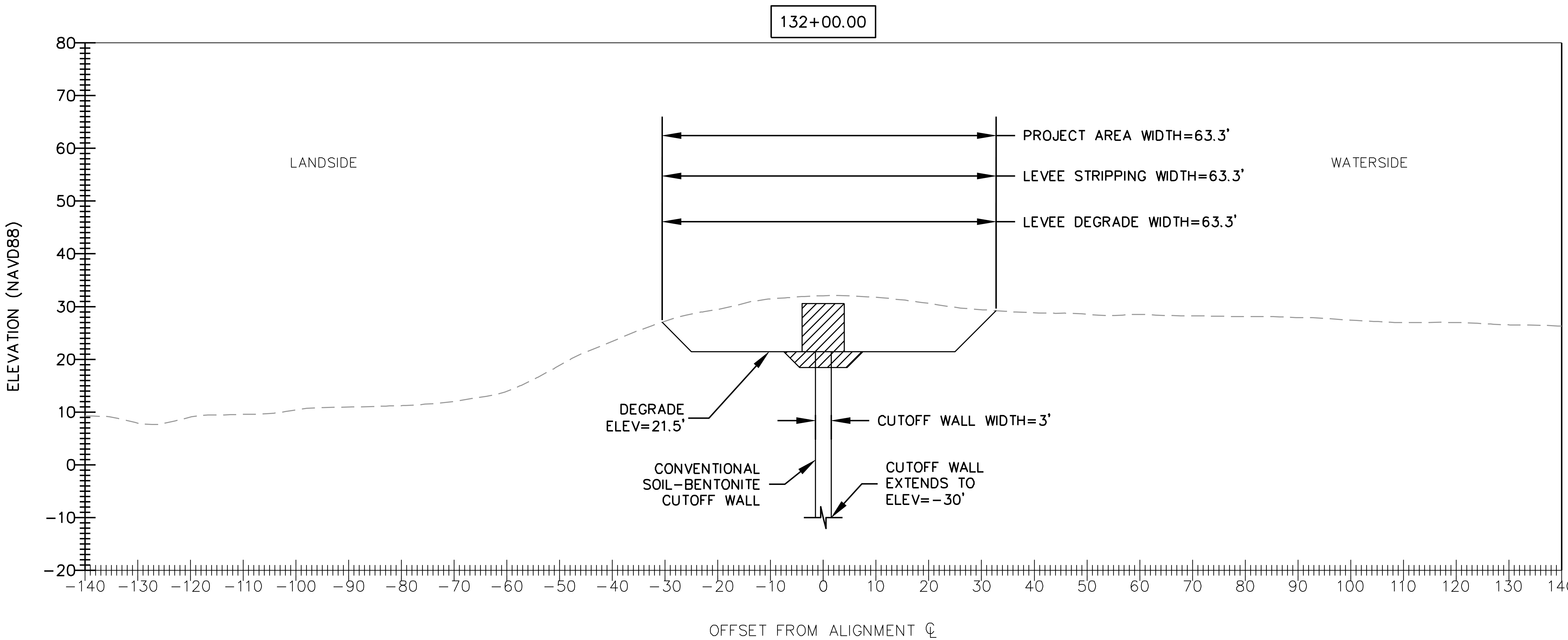
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL EAST LEVEE
REACH 5 – STA 102+00 TO 106+00
ALTERNATIVE 1 CROSS SECTION



TOTAL DEGRADE AREA = 531.4 SQ FT

CLAY CAP FILL AREA = 72.8 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 51.5 FT

PROJECT AREA WIDTH = 63.3 FT

STRIPPING WIDTH = 63.3 FT

REACH 6 - STA 106+00 TO 145+00
ALTERNATIVE 1 - SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. DUE TO AN RD 900 MAINTAINED DRAINAGE CANAL AT THE LANDSIDE TOE AND THE YOLO BYPASS AT THE WATERSIDE TOE, ADDITIONAL LAND ACQUISITION IS ASSUMED TO NOT BE NEEDED IN THIS REACH.

LEGEND

— — —	EXISTING GROUND
———	FINISHED GRADE
	DRAIN ROCK
	FILTER SAND
	CLAY FILL

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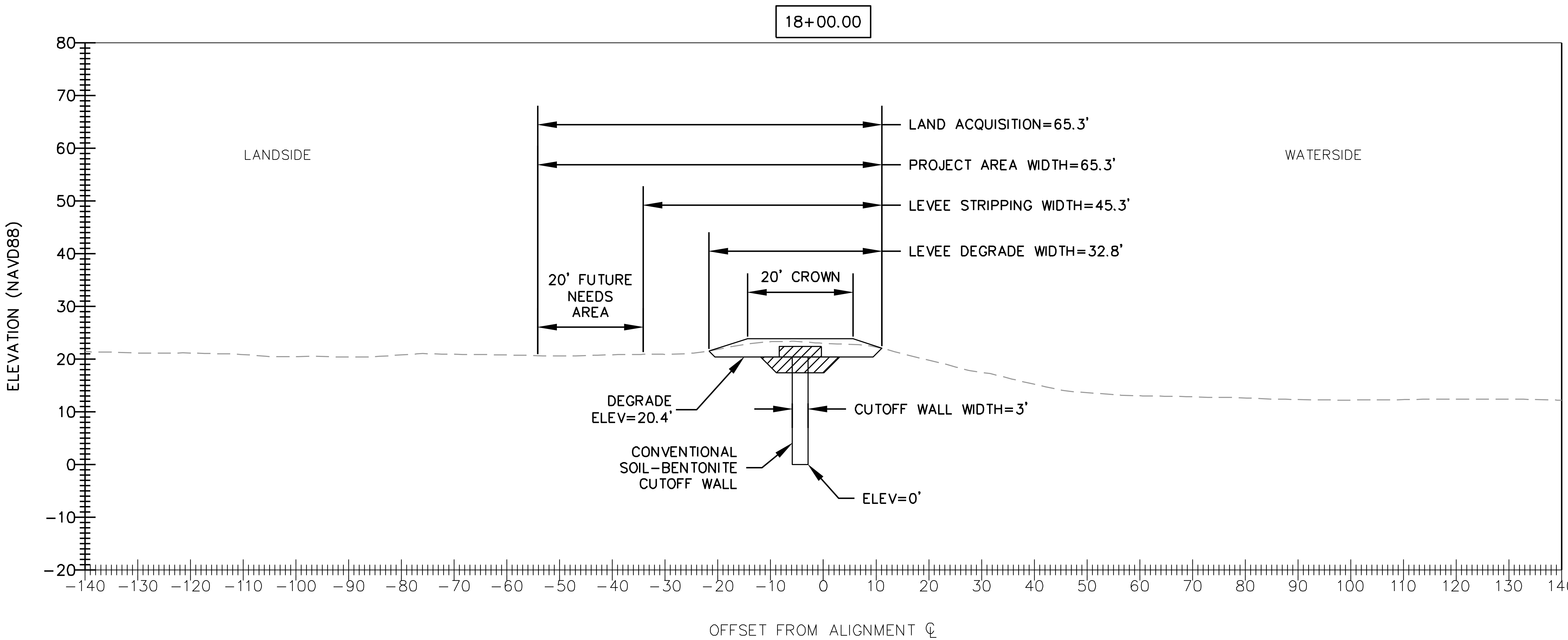
WEST SACRAMENTO FLOOD PROGRAM

DEEP WATER SHIP CHANNEL EAST LEVEE
REACH 6 – STA 106+00 TO 145+00
ALTERNATIVE 1 CROSS SECTION

Port North Levee Cross Sections



LEVEE RAISE FILL (EMBANKMENT FILL) = 21.1 SQ FT
TOTAL DEGRADE AREA = 78.2 SQ FT
CLAY CAP FILL AREA = 16.0 SQ FT
CUTOFF TRENCH AREA = 36.0 SQ FT
CUTOFF WALL DEPTH = 20.4 FT
LAND ACQUISITION WIDTH = 65.3 FT
PROJECT AREA WIDTH = 65.3 FT
STRIPPING WIDTH = 45.3 FT

REACH 2 - STA 8+00 TO 26+00
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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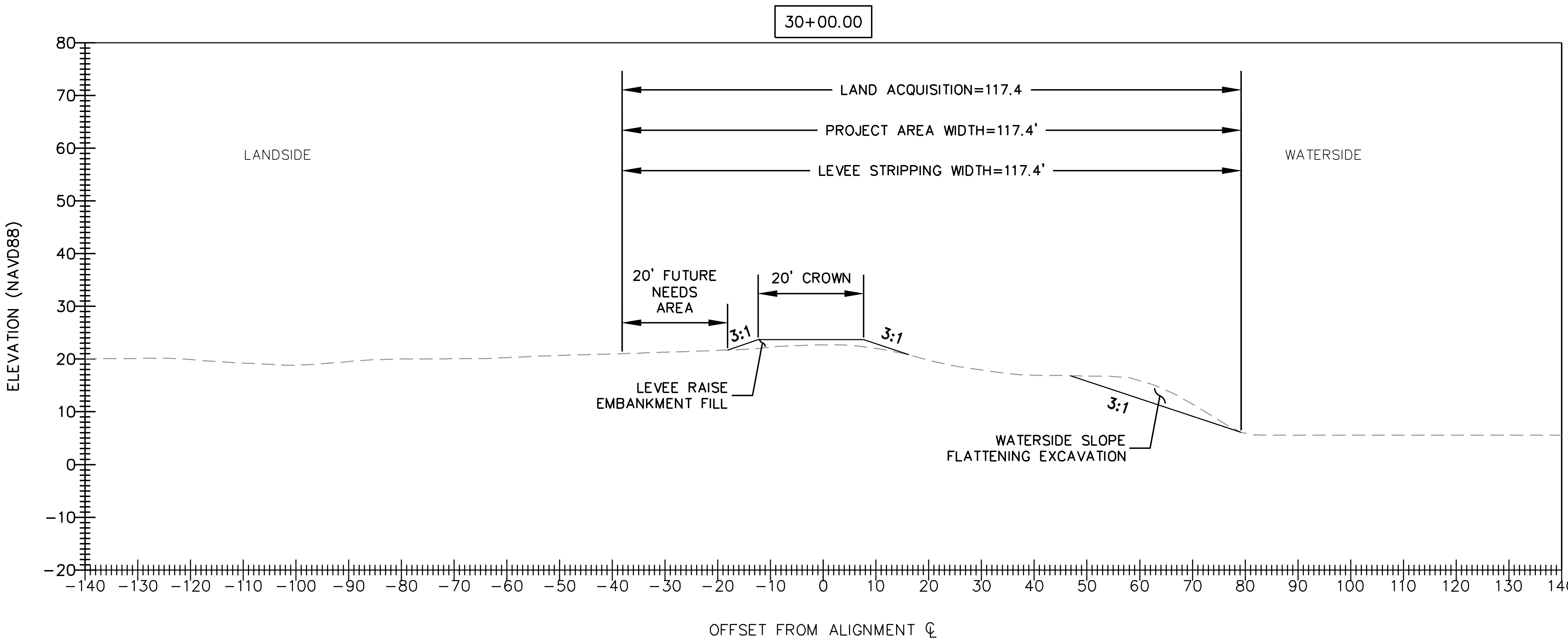
WEST SACRAMENTO FLOOD PROGRAM

PORT NORTH LEVEE
REACH 2 – STA 8+00 TO 26+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 32.9 SQ FT

WATERSIDE SLOP FLATTENING EXCAVATION = 67.1 SQ FT

LAND ACQUISITION WIDTH = 117.4 FT

PROJECT AREA WIDTH = 117.4 FT

STRIPPING WIDTH = 117.4 FT

REACH 3 - STA 26+00 TO 35+50
ALTERNATIVE 1 - LEVEE RAISE WITH WATERSIDE SLOPE FLATTENING

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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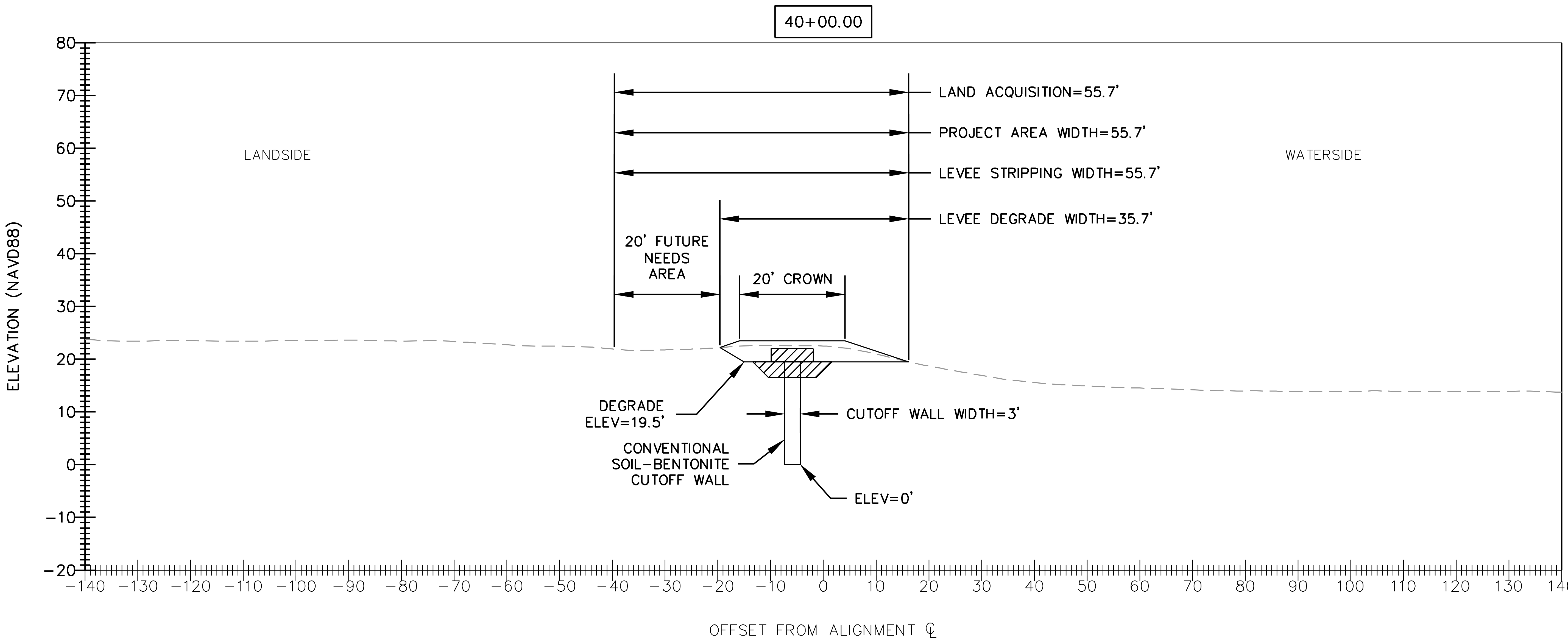
WEST SACRAMENTO FLOOD PROGRAM

PORT NORTH LEVEE
REACH 3 – STA 26+00 TO 35+50
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 28.5 SQ FT

TOTAL DEGRADE AREA = 82.0 SQ FT

CLAY CAP FILL AREA = 20.0 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 19.5 FT

LAND ACQUISITION WIDTH = 55.7 FT

PROJECT AREA WIDTH = 55.7 FT

STRIPPING WIDTH = 55.7 FT

REACH 4 - STA 35+50 TO 45+00
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

(1) EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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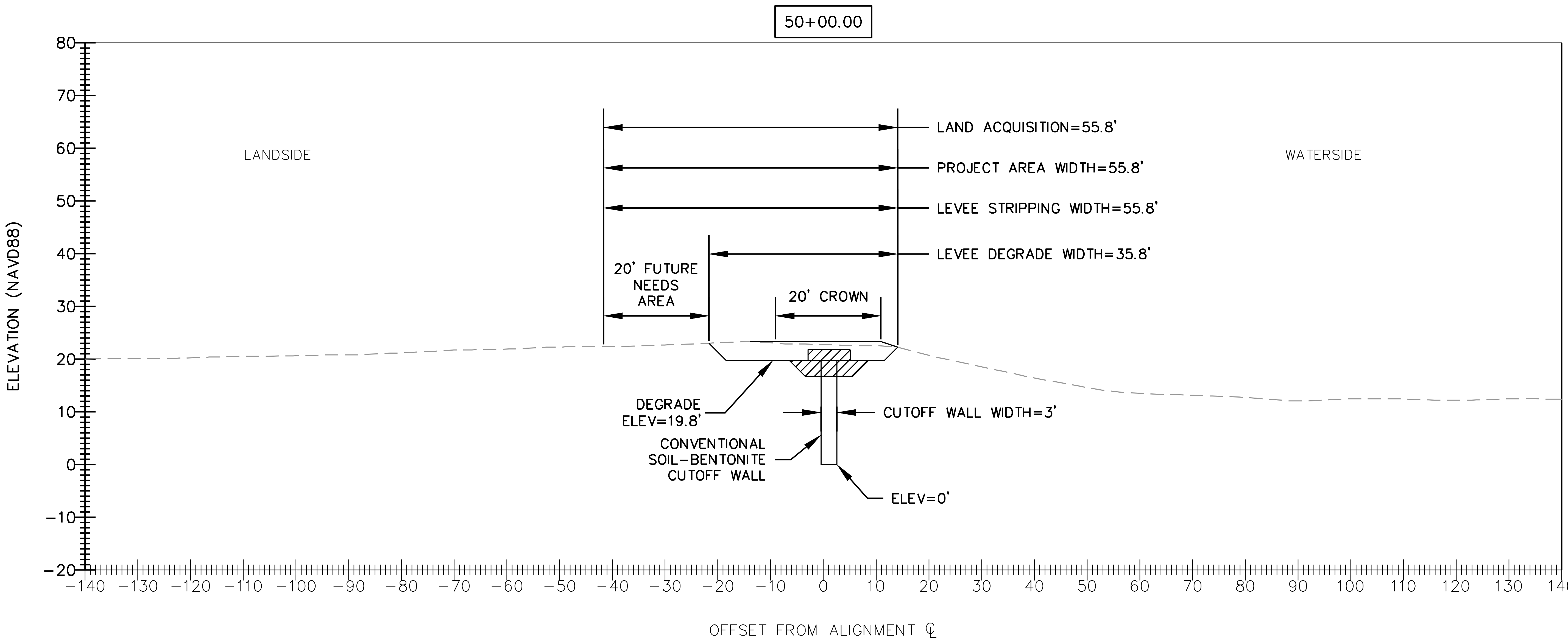
WEST SACRAMENTO FLOOD PROGRAM

PORT NORTH LEVEE
REACH 4 – STA 35+50 TO 45+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 14.1 SQ FT

TOTAL DEGRADE AREA = 103.1 SQ FT

CLAY CAP FILL AREA = 16.7 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 19.8 FT

LAND ACQUISITION WIDTH = 55.8 FT

PROJECT AREA WIDTH = 55.8 FT

STRIPPING WIDTH = 55.8 FT

REACH 5 - STA 45+00 TO 54+00
ALTERNATIVE 1 - MINOR LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).

LEGEND

- — — — EXISTING GROUND
- ——— FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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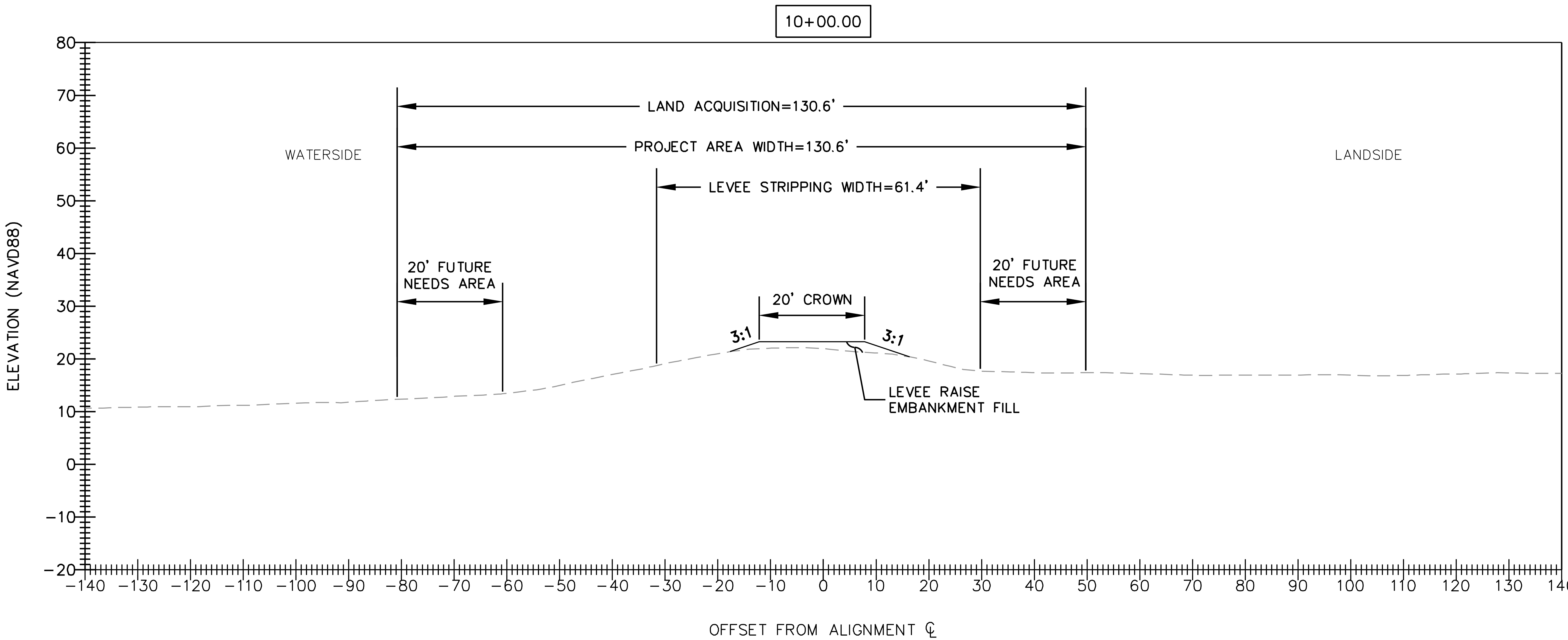
WEST SACRAMENTO FLOOD PROGRAM

PORT NORTH LEVEE
REACH 5 – STA 45+00 TO 54+00
ALTERNATIVE 1 CROSS SECTION

Port South Levee Cross Sections



LEVEE RAISE FILL (EMBANKMENT FILL) = 38.3 SQ FT

LAND ACQUISITION WIDTH = 130.6 FT

PROJECT AREA WIDTH = 130.6 FT

STRIPPING WIDTH = 61.4 FT

REACH 1 - STA 0+00 TO 23+00
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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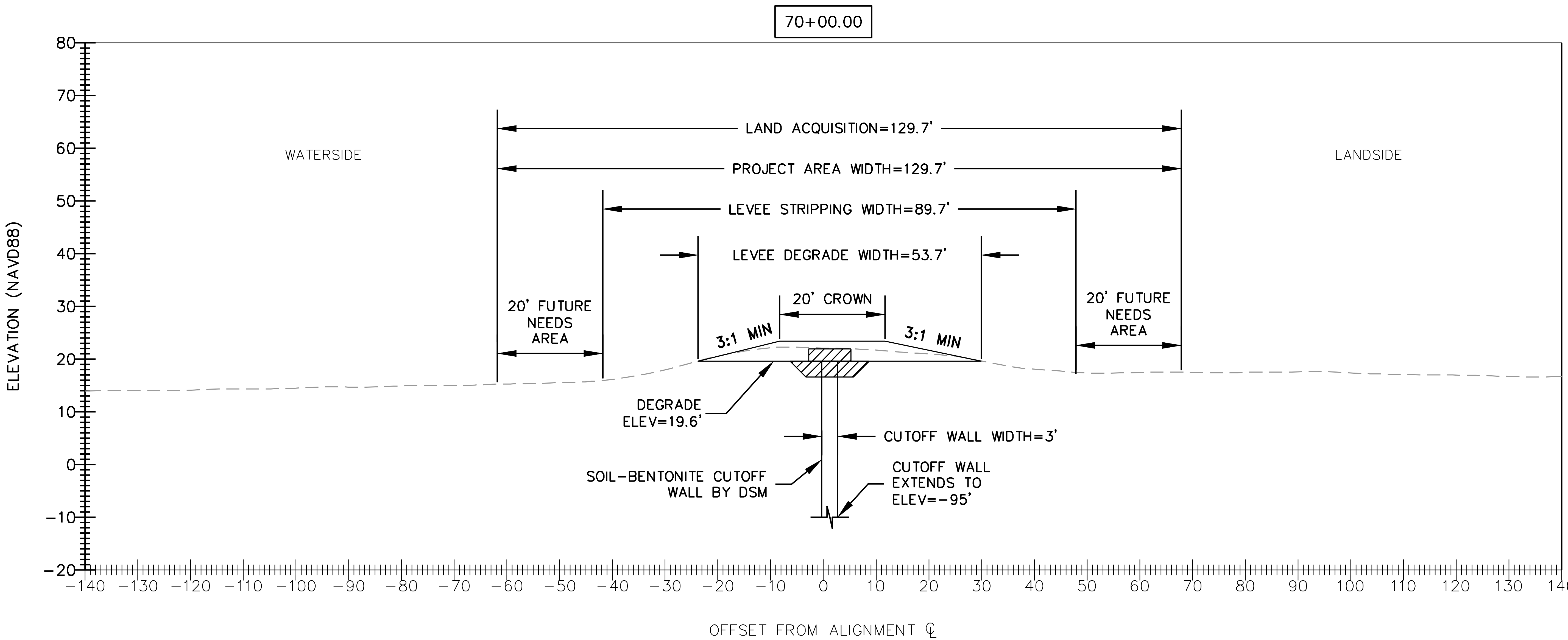
WEST SACRAMENTO FLOOD PROGRAM

PORT SOUTH LEVEE
REACH 1 – STA 0+00 TO 23+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 45.4 SQ FT

TOTAL DEGRADE AREA = 94.3 SQ FT

CLAY CAP FILL AREA = 18.3 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 114.6 FT

LAND ACQUISITION WIDTH = 129.7 FT

PROJECT AREA WIDTH = 129.7 FT

STRIPPING WIDTH = 129.7 FT

REACH 2 - STA 23+00 TO 116+00
ALTERNATIVE 1 - LEVEE RAISE WITH DEEP CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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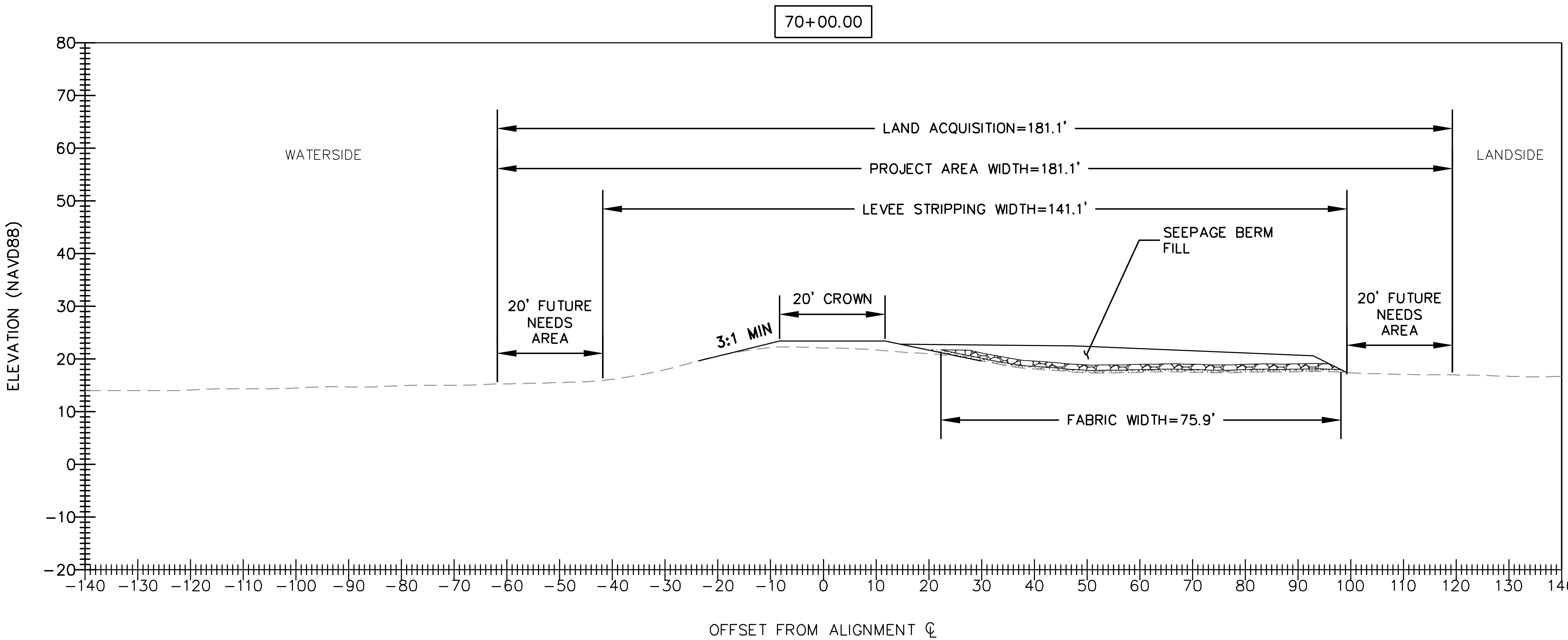
WEST SACRAMENTO FLOOD PROGRAM

PORT SOUTH LEVEE
REACH 2 - STA 23+00 TO 116+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 45.4 SQ FT

DRAIN ROCK AREA = 72.5 SQ FT

FILTER SAND AREA = 39.0 SQ FT

BERM EMBANKMENT FILL AREA = 180.1 SQ FT

LAND ACQUISITION WIDTH = 181.1 SQ FT

PROJECT AREA WIDTH = 181.1 FT

STRIPPING WIDTH = 141.1 FT

FILTER FABRIC WIDTH = 75.9 FT

REACH 2 - STA 23+00 TO 116+00
ALTERNATIVE 2 - LEVEE RAISE WITH SEEPAGE BERM

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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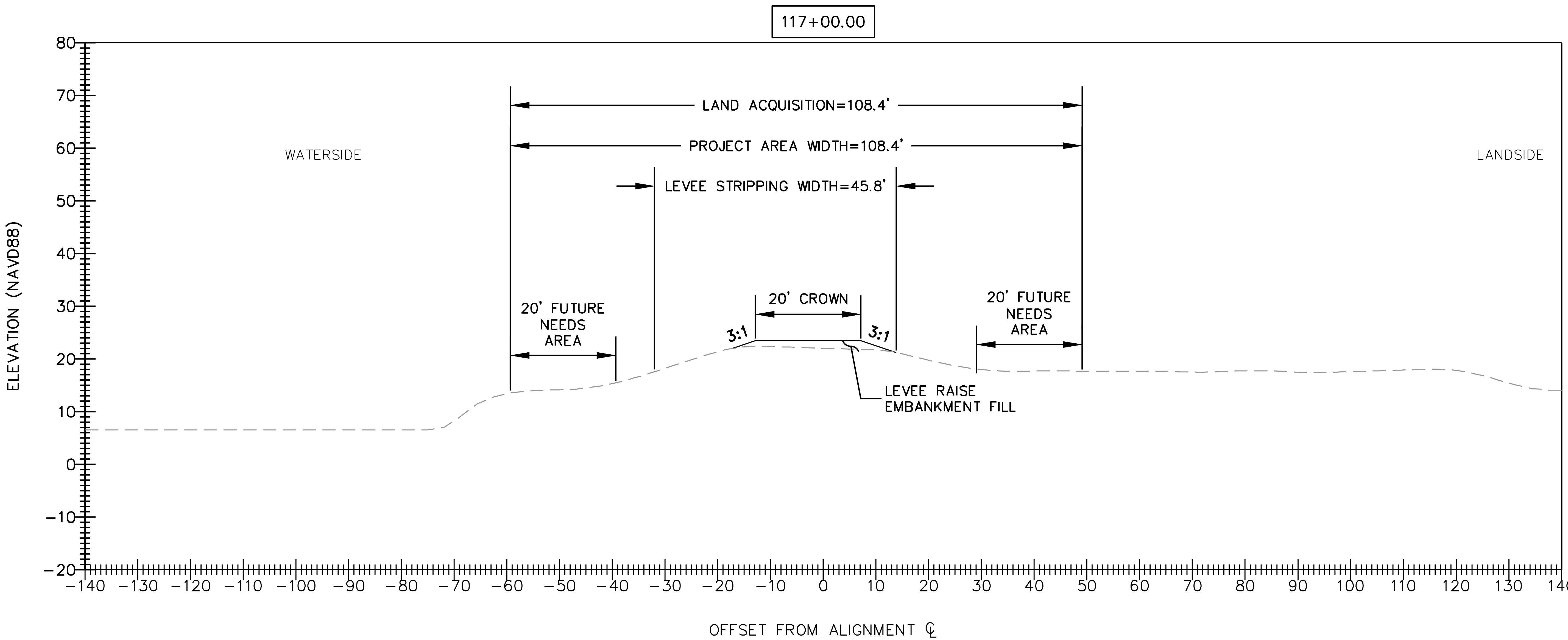
PORT SOUTH LEVEE
REACH 2 – STA 23+00 TO 116+00
ALTERNATIVE 2 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 33.0 SQ FT

LAND ACQUISITION WIDTH = 108.4 FT

PROJECT AREA WIDTH = 108.4 FT

STRIPPING WIDTH = 45.8 FT

REACH 3 - STA 116+00 TO 118+00
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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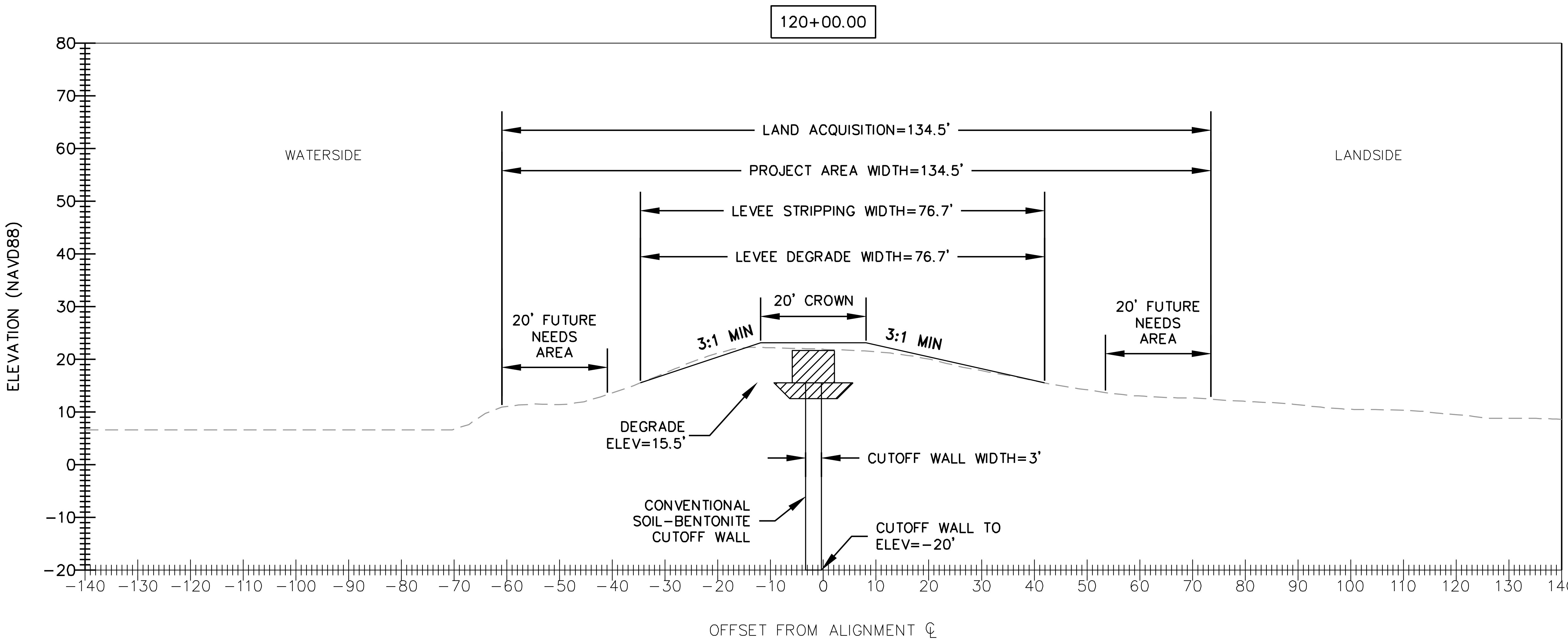
WEST SACRAMENTO FLOOD PROGRAM

PORT SOUTH LEVEE
REACH 3 – STA 116+00 TO 118+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 41.7 SQ FT

TOTAL DEGRADE AREA = 335.8 SQ FT

CLAY CAP FILL AREA = 48.9 SQ FT

CUTOFF TRENCH AREA = 36.0 SQ FT

CUTOFF WALL DEPTH = 35.5 FT

LAND ACQUISITION WIDTH = 134.5 FT

PROJECT AREA WIDTH = 134.5 FT

STRIPPING WIDTH = 76.7 FT

REACH 4 - STA 116+00 TO 123+50
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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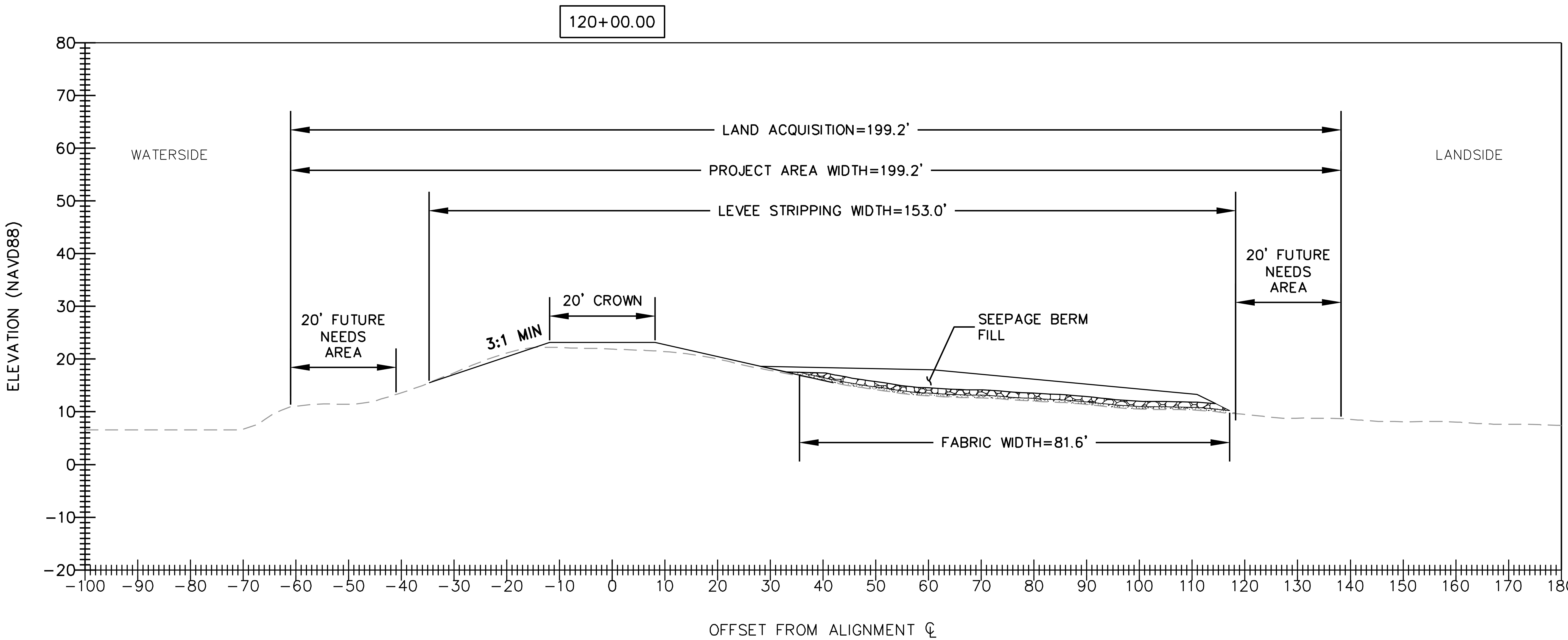
WEST SACRAMENTO FLOOD PROGRAM

PORT SOUTH LEVEE
REACH 4 - STA 118+00 TO 123+50
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 41.7 SQ FT

DRAIN ROCK AREA = 78.2 SQ FT

FILTER SAND AREA = 42.0 SQ FT

BERM EMBANKMENT FILL AREA = 191.1 SQ FT

PROJECT AREA WIDTH = 199.2 FT

STRIPPING WIDTH = 153.0 FT

FILTER FABRIC WIDTH = 81.6 FT

REACH 4 - STA 118+00 TO 123+50
ALTERNATIVE 2 - LEVEE RAISE WITH SEEPAGE BERM

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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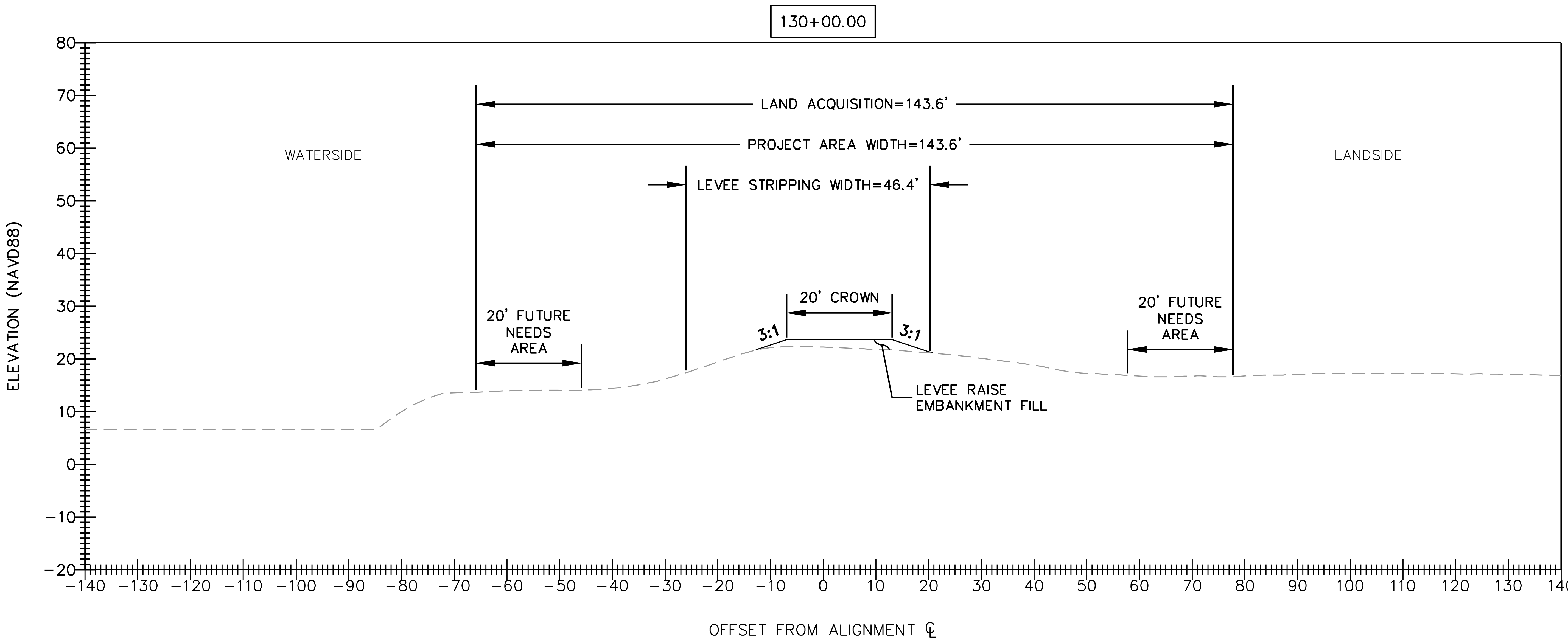
WEST SACRAMENTO FLOOD PROGRAM

PORT SOUTH LEVEE
REACH 4 – STA 118+00 TO 123+50
ALTERNATIVE 2 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 42.7 SQ FT

LAND ACQUISITION WIDTH = 143.6 FT

PROJECT AREA WIDTH = 143.6 FT

STRIPPING WIDTH = 46.4 FT

REACH 5 - STA 123+50 TO 138+00
ALTERNATIVE 1 - LEVEE RAISE

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

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WEST SACRAMENTO FLOOD PROGRAM

PORT SOUTH LEVEE
REACH 5 – STA 123+50 TO 138+00
ALTERNATIVE 1 CROSS SECTION

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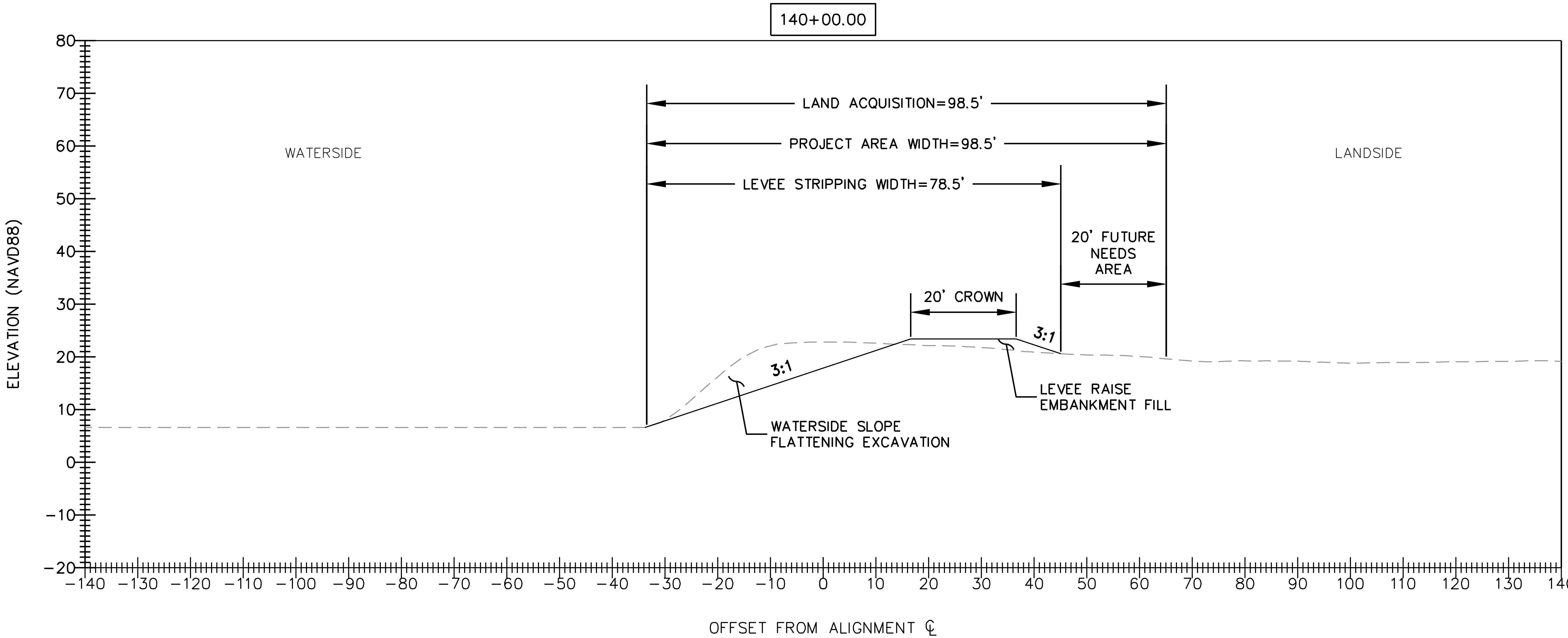

LEVEE RAISE FILL (EMBANKMENT FILL) = 42.2 SQ FT

WATERSIDE SLOP FLATTENING EXCAVATION = 190.9 SQ FT

LAND ACQUISITION WIDTH = 98.5 FT

PROJECT AREA WIDTH = 98.5 FT

STRIPPING WIDTH = 78.5 FT

REACH 6 - STA 138+00 TO 143+00
ALTERNATIVE 1 - LEVEE RAISE WITH WATERSIDE SLOPE FLATTENING

LEGEND

— — —	EXISTING GROUND
———	FINISHED GRADE
	DRAIN ROCK
	FILTER SAND
	CLAY FILL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

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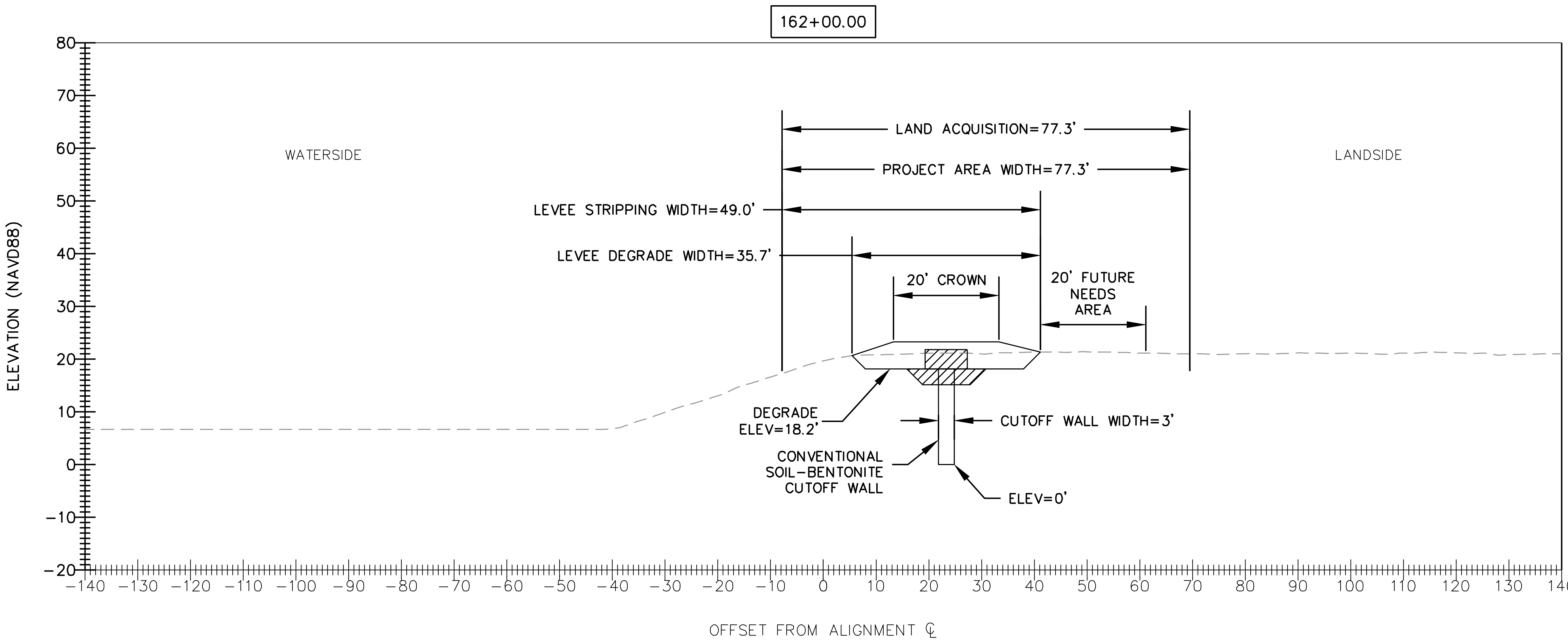
WEST SACRAMENTO FLOOD PROGRAM

PORT SOUTH LEVEE
REACH 6 – STA 138+00 TO 143+00
ALTERNATIVE 1 CROSS SECTION



LEVEE RAISE FILL (EMBANKMENT FILL) = 62.3 SQ FT
TOTAL DEGRADE AREA = 95.0 SQ FT
CLAY CAP FILL AREA = 29.1 SQ FT
CUTOFF TRENCH AREA = 36.0 SQ FT
CUTOFF WALL DEPTH = 18.2 FT
LAND ACQUISITION WIDTH = 77.3 FT
PROJECT AREA WIDTH = 77.3 FT
STRIPPING WIDTH = 49.0 FT

REACH 7 - STA 143+00 TO 186+93
ALTERNATIVE 1 - LEVEE RAISE WITH SHALLOW CUTOFF WALL

NOTES

1. EXISTING GROUND SURFACE USES DWR LiDAR DATA (2007).
2. THE PORT IS ASSUMED TO OWN ALL LAND IN THIS REACH. RIGHT-OF-WAY WILL NEED TO BE OBTAINED FOR THE NEW LEVEE FOOTPRINT PLUS AN ADDITIONAL 20' ALONG THE LANDSIDE AND WATERSIDE TOES.

LEGEND

- EXISTING GROUND
- FINISHED GRADE
- DRAIN ROCK
- FILTER SAND
- CLAY FILL

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
3301 C St, Bldg. 100-B Tel 916.341.7760
Sacramento, CA 95816 Fax 916.341.7767

WEST SACRAMENTO FLOOD PROGRAM
PORT SOUTH LEVEE
REACH 7 – STA 143+00 TO 186+93
ALTERNATIVE 1 CROSS SECTION

ATTACHMENT C

Cost Estimates

- Sacramento River West North Levee
- Barge Canal Bulkhead Closure Structure
- Sacramento River West South Levee
- Sacramento Bypass South Levee
- Training Berm
- Yolo Bypass East Levee
- South Cross Levee
- DWSC West Levee
- DWSC East Levee
- Port North Levee
- Port South Levee

Sacramento River West North Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 1 - STA 0+00 TO 71+50

WOOD RODGERS

Alternative 1 - Levee Raise with Shallow CB Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	0.9	AC	$20,000	$17,400	30%	$5,300	$22,700
1.6	Land Acquisition Soft Costs		%	20%	$4,000	15%	$600	$4,600
	Subtotal - Lands				***$21,400***		***$5,900***	***$27,300***
2	**Mitigation**							
	Environmental Mitigation		LS		$10,900	30%	$3,300	$14,200
	Environmental Permitting/Planning/Design		LS		$3,000	30%	$900	$3,900
	Subtotal - Mitigation				***$13,900***		***$4,200***	***$18,100***
3	**Relocations**							
3.1	Utility Pole Relocation	12.0	EA	$30,000	$360,000	30%	$108,000	$468,000
3.2	Sign Relocation	4.0	EA	$2,500	$10,000	30%	$3,000	$13,000
3.3	Fence/Gate Modification	8	EA	$5,000	$40,000	30%	$12,000	$52,000
3.4	Misc Relocations	10	EA	$10,000.00	$100,000	30%	$30,000	$130,000
3.5	2"-5" Pipe Modification	2.0	EA	$90,000	$180,000	30%	$54,000	$234,000
3.6	12" Pipe Modification	6	EA	$150,000	$900,000	30%	$270,000	$1,170,000
3.7	24" Pipe Modification	6.0	EA	$225,000	$1,350,000	30%	$405,000	$1,755,000
3.8	42" Pipe Modification	1.0	EA	$250,000	$250,000	30%	$75,000	$325,000
	Subtotal - Relocations				***$3,190,000***		***$957,000***	***$4,147,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$79,400	30%	$23,900	$103,300
4.2	Traffic Control		%	3%	$47,600	30%	$14,300	$61,900
4.3	AC Paving Removal	15,888.9	SY	$20	$317,800	30%	$95,400	$413,200
4.4	AC Paving Replacement	15,888.9	SY	$65	$1,032,800	30%	$309,900	$1,342,700
4.5	Aggregate Base, Class 2 (6")	5,362.5	TON	$40	$214,500	30%	$64,400	$278,900
4.6	Striping	21,000.0	LF	$1	$21,000	30%	$6,300	$27,300
	Subtotal - Roads				***$1,713,100***		***$514,200***	***$2,227,300***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$457,500	30%	$137,300	$594,800
5.2	Clearing and Grubbing (Levee)	3.0	AC	$5,500	$16,500	30%	$5,000	$21,500
5.3	Stripping (Levee)	3.3	AC	$6,500	$21,600	30%	$6,500	$28,100
5.4	Erosion Control Seeding (Levee)	3.0	AC	$4,000	$12,000	30%	$3,600	$15,600
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	4,887.4	CY	$6	$29,400	30%	$8,900	$38,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Cement Bentonite)	295,295.0	SF	$30	$8,858,900	30%	$2,657,700	$11,516,600
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	4,315.2	CY	$15	$64,800	30%	$19,500	$84,300
5.16	Excavation (Borrow Site)	6,982.0	CY	$5	$35,000	30%	$10,500	$45,500
5.17	Clearing and Grubbing (Borrow Site)	0.9	AC	$5,500	$4,800	30%	$1,500	$6,300
5.18	Stripping (Borrow Site)	0.9	AC	$6,500	$5,700	30%	$1,800	$7,500
5.19	Erosion Control Seeding (Borrow Site)	0.9	AC	$4,000	$3,500	30%	$1,100	$4,600
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	6,982.0	CY	$14	$97,800	30%	$29,400	$127,200
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$9,607,500***		***$2,882,800***	***$12,490,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$1,016,000	30%	$304,800	$1,320,800
6.2	Construction Management		%	5.00%	$726,000	30%	$217,800	$943,800
	Subtotal - Planning, Engineering, & Design				***$1,742,000***		***$523,000***	***$2,265,000***
	ESTIMATED REACH TOTAL				**$16,288,000**		**$4,888,000**	**$21,175,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$17,979,000**		**$5,395,000**	**$23,373,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 1 - STA 0+00 TO 71+50

WOOD RODGERS

Alternative 1 - Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	0.9	AC	$20,000	$17,400	30%	$5,300	$22,700
1.6	Land Acquisition Soft Costs		%	20%	$4,000	15%	$600	$4,600
	Subtotal - Lands				***$21,400***		***$5,900***	***$27,300***
2	**Mitigation**							
	Environmental Mitigation		LS		$10,900	30%	$3,300	$14,200
	Environmental Permitting/Planning/Design		LS		$3,000	30%	$900	$3,900
	Subtotal - Mitigation				***$13,900***		***$4,200***	***$18,100***
3	**Relocations**							
3.1	Utility Pole Relocation	12.0	EA	$30,000	$360,000	30%	$108,000	$468,000
3.2	Sign Relocation	4.0	EA	$2,500	$10,000	30%	$3,000	$13,000
3.3	Fence/Gate Modification	8	EA	$5,000	$40,000	30%	$12,000	$52,000
3.4	Misc Relocations	10	EA	$10,000.00	$100,000	30%	$30,000	$130,000
3.5	2"-5" Pipe Modification	2.0	EA	$90,000	$180,000	30%	$54,000	$234,000
3.6	12" Pipe Modification	6	EA	$150,000	$900,000	30%	$270,000	$1,170,000
3.7	24" Pipe Modification	6.0	EA	$225,000	$1,350,000	30%	$405,000	$1,755,000
3.8	42" Pipe Modification	1.0	EA	$250,000	$250,000	30%	$75,000	$325,000
	Subtotal - Relocations				***$3,190,000***		***$957,000***	***$4,147,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$4,500	30%	$1,400	$5,900
5.2	Clearing and Grubbing (Levee)	3.0	AC	$5,500	$16,500	30%	$5,000	$21,500
5.3	Stripping (Levee)	3.3	AC	$6,500	$21,600	30%	$6,500	$28,100
5.4	Erosion Control Seeding (Levee)	3.0	AC	$4,000	$12,000	30%	$3,600	$15,600
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	1,000.0	CY	$6	$6,000	30%	$1,800	$7,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Cement Bentonite)	0.0	SF	$30	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	1,000.0	CY	$5	$5,000	30%	$1,500	$6,500
5.17	Clearing and Grubbing (Borrow Site)	0.9	AC	$5,500	$4,800	30%	$1,500	$6,300
5.18	Stripping (Borrow Site)	0.9	AC	$6,500	$5,700	30%	$1,800	$7,500
5.19	Erosion Control Seeding (Borrow Site)	0.9	AC	$4,000	$3,500	30%	$1,100	$4,600
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	1,000.0	CY	$14	$14,000	30%	$4,200	$18,200
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$93,600***		***$28,400***	***$122,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$230,000	30%	$69,000	$299,000
6.2	Construction Management		%	5.00%	$165,000	30%	$49,500	$214,500
	Subtotal - Planning, Engineering, & Design				***$395,000***		***$119,000***	***$514,000***
	ESTIMATED REACH TOTAL				**$3,714,000**		**$1,115,000**	**$4,829,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$4,100,000**		**$1,231,000**	**$5,330,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 3 - STA 101+00 TO 136+00

WOOD RODGERS

Alternative 2 - Drained Stability Berm

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Residential	5.5	AC	$120,000	$660,000	15%	$99,000	$759,000
1.2	Land Acquisition Soft Costs	8.0	Parcel	$12,500	$100,000	15%	$15,000	$115,000
1.5	Borrow Site Royalties	4.6	AC	$20,000	$92,300	30%	$27,700	$120,000
	Subtotal - Lands				***$852,300***		***$141,700***	***$994,000***
2	**Mitigation**							
	Environmental Mitigation		LS		$0	30%	$0	$0
	Environmental Permitting/Planning/Design		LS		$0	30%	$0	$0
	Subtotal - Mitigation				***$0***		***$0***	***$0***
3	**Relocations**							
3.1	Utility Pole Relocation	5.0	EA	$30,000	$150,000	30%	$45,000	$195,000
	Subtotal - Relocations				***$150,000***		***$45,000***	***$195,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$113,600	30%	$34,100	$147,700
5.2	Clearing and Grubbing (Levee)	6.6	AC	$5,500	$36,400	30%	$11,000	$47,400
5.3	Stripping (Levee)	6.6	AC	$6,500	$43,000	30%	$12,900	$55,900
5.4	Erosion Control Seeding (Levee)	6.6	AC	$4,000	$26,500	30%	$8,000	$34,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	20,701.9	CY	$6	$124,300	30%	$37,300	$161,600
5.8	Levee Embankment Fill (Soil Type 2)	5,334.3	CY	$6	$32,100	30%	$9,700	$41,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Cement Bentonite)	0.0	SF	$30	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	18,716.3	TON	$45	$842,300	30%	$252,700	$1,095,000
5.13	Sand Filter Layer	4,848.1	TON	$45	$218,200	30%	$65,500	$283,700
5.14	Filter Fabric	29,127.8	SY	$3	$87,400	30%	$26,300	$113,700
5.15	Haul and Dispose of Unsuitable Material	5,334.3	CY	$15	$80,100	30%	$24,100	$104,200
5.16	Excavation (Borrow Site)	37,194.4	CY	$5	$186,000	30%	$55,800	$241,800
5.17	Clearing and Grubbing (Borrow Site)	4.6	AC	$5,500	$25,400	30%	$7,700	$33,100
5.18	Stripping (Borrow Site)	4.6	AC	$6,500	$30,000	30%	$9,000	$39,000
5.19	Erosion Control Seeding (Borrow Site)	4.6	AC	$4,000	$18,500	30%	$5,600	$24,100
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	37,194.4	CY	$14	$520,800	30%	$156,300	$677,100
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$2,384,600***		***$716,000***	***$3,100,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$177,500	30%	$53,300	$230,800
6.2	Construction Management		%	5.00%	$126,800	30%	$38,100	$164,900
	Subtotal - Planning, Engineering, & Design				***$305,000***		***$92,000***	***$396,000***
	ESTIMATED REACH TOTAL				**$3,692,000**		**$995,000**	**$4,686,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$4,075,000**		**$1,098,000**	**$5,172,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 3 - STA 101+00 TO 136+00
Minimum Remediation

WOOD RODGERS

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency	
1	**Lands**								
1.1	Improved Residential	0.0	AC	$90,000	$0	15%	$0	$0	0.3
1.2	Land Acquisition Soft Costs	0.0	Parcel	$12,500	$0	15%	$0	$0	0.15
1.3	Borrow Site Royalties	0.2	AC	$20,000	$4,600	30%	$1,400	$6,000	
	Subtotal - Lands				***$4,600***		***$1,400***	***$6,000***	
2	**Mitigation**								
	Environmental Mitigation		LS		$0	30%	$0	$0	
	Environmental Permitting/Planning/Design		LS		$0	30%	$0	$0	
	Subtotal - Mitigation				***$0***		***$0***	***$0***	
3	**Relocations**								
3.1	Remove and Salvage Ex. Agg. Surfacing	0.0	LF	$10	$0	30%	$0	$0	
3.2	Class 2 Aggregate Surfacing	0.0	TON	$35	$0	30%	$0	$0	
3.3	Sign Relocation	4.0	EA	$2,500	$10,000	30%	$3,000	$13,000	
3.4	Gate	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500	
	Subtotal - Relocations				***$15,000***		***$4,500***	***$19,500***	
4	**Roads**								
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0	
4.2	Traffic Control		%	3%	$0	30%	$0	$0	
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0	
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0	
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0	
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0	
	Subtotal - Roads				***$0***		***$0***	***$0***	
5	**Flood Control Features**								
5.1	Mobilization/Demobilization		%	5%	$800	30%	$300	$1,100	
5.2	Clearing and Grubbing (Levee)	1.6	AC	$5,500	$8,900	30%	$2,700	$11,600	
5.3	Stripping (Levee)	0.0	AC	$6,500	$0	30%	$0	$0	
5.4	Erosion Control Seeding (Levee)	1.6	AC	$4,000	$6,500	30%	$2,000	$8,500	
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0	
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0	
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0	
5.8	Levee Embankment Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0	
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0	
5.10	Cutoff Wall <75' (Cement Bentonite)	0.0	SF	$30	$0	30%	$0	$0	
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0	
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0	
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0	
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0	
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0	
5.16	Excavation (Borrow Site)	0.0	CY	$5	$0	30%	$0	$0	
5.17	Clearing and Grubbing (Borrow Site)	0.0	AC	$5,500	$0	30%	$0	$0	
5.18	Stripping (Borrow Site)	0.0	AC	$6,500	$0	30%	$0	$0	
5.19	Erosion Control Seeding (Borrow Site)	0.0	AC	$4,000	$0	30%	$0	$0	
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0	
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0	
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0	
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0	
	Subtotal - Levees				***$16,200***		***$5,000***	***$21,200***	
6	**Other Project Costs**								
6.1	Planning, Engineering, & Design		%	7.00%	$2,200	30%	$700	$2,900	
6.2	Construction Management		%	5.00%	$1,600	30%	$500	$2,100	
	Subtotal - Planning, Engineering, & Design				***$4,000***		***$2,000***	***$5,000***	
	ESTIMATED REACH TOTAL				**$40,000**		**$13,000**	**$52,000**	
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$44,000**		**$14,000**	**$57,000**	

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 4 - STA 136+00 TO 152+00

WOOD RODGERS

Alternative 1 - Minor Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.5	AC	$20,000	$29,600	30%	$8,900	$38,500
1.6	Land Acquisition Soft Costs		%	20%	$6,000	15%	$900	$6,900
	Subtotal - Lands				***$35,600***		***$9,800***	***$45,400***
2	**Mitigation**							
	Environmental Mitigation		LS		$15,600	30%	$4,700	$20,300
	Environmental Permitting/Planning/Design		LS		$4,300	30%	$1,300	$5,600
	Subtotal - Mitigation				***$19,900***		***$6,000***	***$25,900***
3	**Relocations**							
3.1	Utility Pole Relocation	5.0	EA	$30,000	$150,000	30%	$45,000	$195,000
3.2	Fence/Gate Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.3	2"-5" Pipe Modification	1.0	EA	$90,000	$90,000	30%	$27,000	$117,000
3.5	Remove and Salvage Ex. Agg. Surfacing	1,600.0	LF	$10	$16,000	30%	$4,800	$20,800
3.6	Class 2 Aggregate Surfacing	1,200.0	TON	$35	$42,000	30%	$12,600	$54,600
	Subtotal - Relocations				***$303,000***		***$90,900***	***$393,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$211,200	30%	$63,400	$274,600
5.2	Clearing and Grubbing (Levee)	1.4	AC	$5,500	$8,000	30%	$2,400	$10,400
5.3	Stripping (Levee)	1.4	AC	$6,500	$9,500	30%	$2,900	$12,400
5.4	Erosion Control Seeding (Levee)	1.4	AC	$4,000	$5,800	30%	$1,800	$7,600
5.5	Levee Degrading/ Excavation	26,714.1	CY	$9	$227,100	30%	$68,200	$295,300
5.6	Inspection Trench Excavation	2,133.3	CY	$9	$18,200	30%	$5,500	$23,700
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	2,282.1	CY	$6	$13,700	30%	$4,200	$17,900
5.9	Clay Cap Fill (Soil Type 1)	6,050.4	CY	$6	$36,400	30%	$11,000	$47,400
5.10	Cutoff Wall <75' (Cement Bentonite)	0.0	SF	$30	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	141,760.0	SF	$25	$3,544,000	30%	$1,063,200	$4,607,200
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	7,297.8	CY	$15	$109,500	30%	$32,900	$142,400
5.16	Excavation (Borrow Site)	11,903.5	CY	$5	$59,600	30%	$17,900	$77,500
5.17	Clearing and Grubbing (Borrow Site)	1.5	AC	$5,500	$8,200	30%	$2,500	$10,700
5.18	Stripping (Borrow Site)	1.5	AC	$6,500	$9,600	30%	$2,900	$12,500
5.19	Erosion Control Seeding (Borrow Site)	1.5	AC	$4,000	$6,000	30%	$1,800	$7,800
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	11,903.5	CY	$14	$166,700	30%	$50,100	$216,800
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$4,433,500***		***$1,330,700***	***$5,764,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$331,600	30%	$99,500	$431,100
6.2	Construction Management		%	5.00%	$236,900	30%	$71,100	$308,000
	Subtotal - Planning, Engineering, & Design				***$569,000***		***$171,000***	***$740,000***
	ESTIMATED REACH TOTAL				**$5,361,000**		**$1,609,000**	**$6,970,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,918,000**		**$1,776,000**	**$7,694,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 4 - STA 136+00 TO 152+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	0.2	AC	$20,000	$4,800	30%	$1,500	$6,300
1.6	Land Acquisition Soft Costs		%	20%	$1,000	15%	$200	$1,200
	Subtotal - Lands				***$5,800***		***$1,700***	***$7,500***
2	**Mitigation**							
	Environmental Mitigation		LS		$15,600	30%	$4,700	$20,300
	Environmental Permitting/Planning/Design		LS		$4,300	30%	$1,300	$5,600
	Subtotal - Mitigation				***$19,900***		***$6,000***	***$25,900***
3	**Relocations**							
3.1	Utility Pole Relocation	5.0	EA	$30,000	$150,000	30%	$45,000	$195,000
3.2	Fence/Gate Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.3	2"-5" Pipe Modification	1.0	EA	$90,000	$90,000	30%	$27,000	$117,000
3.5	Remove and Salvage Ex. Agg. Surfacing	0.0	LF	$10	$0	30%	$0	$0
3.6	Class 2 Aggregate Surfacing	0.0	TON	$35	$0	30%	$0	$0
	Subtotal - Relocations				***$245,000***		***$73,500***	***$318,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$9,400	30%	$2,900	$12,300
5.2	Clearing and Grubbing (Levee)	0.3	AC	$5,500	$1,500	30%	$500	$2,000
5.3	Stripping (Levee)	0.0	AC	$6,500	$0	30%	$0	$0
5.4	Erosion Control Seeding (Levee)	0.3	AC	$4,000	$1,100	30%	$400	$1,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	16.4	CY	$6	$100	30%	$100	$200
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	10,480.0	SF	$10	$104,800	30%	$31,500	$136,300
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	1,053.5	CY	$15	$15,900	30%	$4,800	$20,700
5.16	Excavation (Borrow Site)	1,928.3	CY	$5	$9,700	30%	$3,000	$12,700
5.17	Clearing and Grubbing (Borrow Site)	0.2	AC	$5,500	$1,400	30%	$500	$1,900
5.18	Stripping (Borrow Site)	0.2	AC	$6,500	$1,600	30%	$500	$2,100
5.19	Erosion Control Seeding (Borrow Site)	0.2	AC	$4,000	$1,000	30%	$300	$1,300
5.20	Hauling Level 1 (< 5 miles)	1,928.3	CY	$4	$8,400	30%	$2,600	$11,000
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	2,966.0	CY	$14	$41,600	30%	$12,500	$54,100
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$196,500***		***$59,600***	***$256,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$31,000	30%	$9,300	$40,300
6.2	Construction Management		%	5.00%	$22,100	30%	$6,700	$28,800
	Subtotal - Planning, Engineering, & Design				***$54,000***		***$16,000***	***$70,000***
	ESTIMATED REACH TOTAL				**$522,000**		**$157,000**	**$678,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$576,000**		**$173,000**	**$748,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 5 - STA 152+00 TO 161+00

WOOD RODGERS

Alternative 1 - Waterside Slope Flattening with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.7	AC	$20,000	$35,000	30%	$10,500	$45,500
1.6	Land Acquisition Soft Costs		%	20%	$7,000	15%	$1,100	$8,100
	Subtotal - Lands				***$42,000***		***$11,600***	***$53,600***
2	**Mitigation**							
	Environmental Mitigation		LS		$100,600	30%	$30,200	$130,800
	Environmental Permitting/Planning/Design		LS		$27,600	30%	$8,300	$35,900
	Subtotal - Mitigation				***$128,200***		***$38,500***	***$166,700***
3	**Relocations**							
3.1	12" Pipe Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.2	Misc Relocations	4.0	EA	$5,000	$20,000	30%	$6,000	$26,000
3.3	Remove and Salvage Ex. Agg. Surfacing	900.0	LF	$10	$9,000	30%	$2,700	$11,700
3.4	Class 2 Aggregate Surfacing	675.0	TON	$35	$23,700	30%	$7,200	$30,900
	Subtotal - Relocations				***$57,700***		***$17,400***	***$75,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$195,100	30%	$58,600	$253,700
5.2	Clearing and Grubbing (Levee)	2.7	AC	$5,500	$14,800	30%	$4,500	$19,300
5.3	Stripping (Levee)	2.7	AC	$6,500	$17,500	30%	$5,300	$22,800
5.4	Erosion Control Seeding (Levee)	2.7	AC	$4,000	$10,800	30%	$3,300	$14,100
5.5	Levee Degrading/ Excavation	33,906.7	CY	$9	$288,300	30%	$86,500	$374,800
5.6	Inspection Trench Excavation	1,200.0	CY	$9	$10,200	30%	$3,100	$13,300
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	6,945.8	CY	$6	$41,700	30%	$12,600	$54,300
5.9	Clay Cap Fill (Soil Type 1)	2,930.0	CY	$6	$17,600	30%	$5,300	$22,900
5.10	Cutoff Wall <75' (Cement Bentonite)	0.0	SF	$30	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	107,010.0	SF	$25	$2,675,300	30%	$802,600	$3,477,900
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	9,542.5	CY	$15	$143,200	30%	$43,000	$186,200
5.16	Excavation (Borrow Site)	14,108.3	CY	$5	$70,600	30%	$21,200	$91,800
5.17	Clearing and Grubbing (Borrow Site)	1.7	AC	$5,500	$9,700	30%	$3,000	$12,700
5.18	Stripping (Borrow Site)	1.7	AC	$6,500	$11,400	30%	$3,500	$14,900
5.19	Erosion Control Seeding (Borrow Site)	1.7	AC	$4,000	$7,000	30%	$2,100	$9,100
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	14,108.3	CY	$14	$197,600	30%	$59,300	$256,900
5.23	Rock Slope Protection	4,050.0	TON	$95	$385,800	30%	$115,800	$501,600
	Subtotal - Levees				***$4,096,600***		***$1,229,700***	***$5,326,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$290,900	30%	$87,300	$378,200
6.2	Construction Management		%	5.00%	$207,800	30%	$62,400	$270,200
	Subtotal - Planning, Engineering, & Design				***$499,000***		***$150,000***	***$649,000***
	ESTIMATED REACH TOTAL				**$4,824,000**		**$1,448,000**	**$6,271,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,325,000**		**$1,598,000**	**$6,922,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 5 - STA 152+00 TO 161+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.6	AC	$20,000	$32,900	30%	$9,900	$42,800
1.6	Land Acquisition Soft Costs		%	20%	$7,000	15%	$1,100	$8,100
	Subtotal - Lands				***$39,900***		***$11,000***	***$50,900***
2	**Mitigation**							
	Environmental Mitigation		LS		$100,600	30%	$30,200	$130,800
	Environmental Permitting/Planning/Design		LS		$27,600	30%	$8,300	$35,900
	Subtotal - Mitigation				***$128,200***		***$38,500***	***$166,700***
3	**Relocations**							
3.1	12" Pipe Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.2	Misc Relocations	4.0	EA	$5,000	$20,000	30%	$6,000	$26,000
3.3	Remove and Salvage Ex. Agg. Surfacing	900.0	LF	$10	$9,000	30%	$2,700	$11,700
3.4	Class 2 Aggregate Surfacing	675.0	TON	$35	$23,700	30%	$7,200	$30,900
	Subtotal - Relocations				***$57,700***		***$17,400***	***$75,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$55,800	30%	$16,800	$72,600
5.2	Clearing and Grubbing (Levee)	2.7	AC	$5,500	$14,800	30%	$4,500	$19,300
5.3	Stripping (Levee)	2.7	AC	$6,500	$17,500	30%	$5,300	$22,800
5.4	Erosion Control Seeding (Levee)	2.7	AC	$4,000	$10,800	30%	$3,300	$14,100
5.5	Levee Degrading/ Excavation	33,906.7	CY	$9	$288,300	30%	$86,500	$374,800
5.6	Inspection Trench Excavation	1,200.0	CY	$9	$10,200	30%	$3,100	$13,300
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	6,351.3	CY	$6	$38,200	30%	$11,500	$49,700
5.9	Clay Cap Fill (Soil Type 1)	2,930.0	CY	$6	$17,600	30%	$5,300	$22,900
5.10	Cutoff Wall <75' (Soil Bentonite)	30,510.0	SF	$10	$305,100	30%	$91,600	$396,700
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	8,948.0	CY	$15	$134,300	30%	$40,300	$174,600
5.16	Excavation (Borrow Site)	13,259.0	CY	$5	$66,300	30%	$19,900	$86,200
5.17	Clearing and Grubbing (Borrow Site)	1.6	AC	$5,500	$9,100	30%	$2,800	$11,900
5.18	Stripping (Borrow Site)	1.6	AC	$6,500	$10,700	30%	$3,300	$14,000
5.19	Erosion Control Seeding (Borrow Site)	1.6	AC	$4,000	$6,600	30%	$2,000	$8,600
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	13,259.0	CY	$14	$185,700	30%	$55,800	$241,500
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$1,171,000***		***$352,000***	***$1,523,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$86,100	30%	$25,900	$112,000
6.2	Construction Management		%	5.00%	$61,500	30%	$18,500	$80,000
	Subtotal - Planning, Engineering, & Design				***$148,000***		***$45,000***	***$192,000***
	ESTIMATED REACH TOTAL				**$1,545,000**		**$464,000**	**$2,008,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,705,000**		**$512,000**	**$2,216,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 6 - STA 161+00 TO 194+60

WOOD RODGERS

Alternative 1 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	3.0	AC	$20,000	$59,200	30%	$17,800	$77,000
1.6	Land Acquisition Soft Costs		%	20%	$12,000	15%	$1,800	$13,800
	Subtotal - Lands				***$71,200***		***$19,600***	***$90,800***
2	**Mitigation**							
	Environmental Mitigation		LS		$26,600	30%	$8,000	$34,600
	Environmental Permitting/Planning/Design		LS		$7,300	30%	$2,200	$9,500
	Subtotal - Mitigation				***$33,900***		***$10,200***	***$44,100***
3	**Relocations**							
3.1	Utility Pole Relocation	15.0	EA	$30,000	$450,000	30%	$135,000	$585,000
3.2	Remove and Salvage Ex. Agg. Surfacing	3,360.0	LF	$10	$33,600	30%	$10,100	$43,700
3.3	2"-5" Pipe Modification	4.0	EA	$90,000	$360,000	30%	$108,000	$468,000
3.4	10" Pipe Modification	3.0	EA	$145,000	$435,000	30%	$130,500	$565,500
3.5	36" Pipe Modification	3.0	EA	$250,000	$750,000	30%	$225,000	$975,000
3.6	Fence/Gate Modification	6.0	EA	$5,000	$30,000	30%	$9,000	$39,000
3.7	Class 2 Aggregate Surfacing	2,520.0	TON	$35	$88,200	30%	$26,500	$114,700
	Subtotal - Relocations				***$2,146,800***		***$644,100***	***$2,790,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$572,500	30%	$171,800	$744,300
5.2	Clearing and Grubbing (Levee)	2.5	AC	$5,500	$14,000	30%	$4,200	$18,200
5.3	Stripping (Levee)	2.5	AC	$6,500	$16,600	30%	$5,000	$21,600
5.4	Erosion Control Seeding (Levee)	2.5	AC	$4,000	$10,200	30%	$3,100	$13,300
5.5	Levee Degrading/ Excavation	32,007.1	CY	$9	$272,100	30%	$81,700	$353,800
5.6	Inspection Trench Excavation	4,480.0	CY	$9	$38,100	30%	$11,500	$49,600
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	7,556.7	CY	$6	$45,400	30%	$13,700	$59,100
5.9	Clay Cap Fill (Soil Type 1)	9,146.7	CY	$6	$54,900	30%	$16,500	$71,400
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	363,888.0	SF	$25	$9,097,200	30%	$2,729,200	$11,826,400
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	10,476.4	CY	$15	$157,200	30%	$47,200	$204,400
5.16	Excavation (Borrow Site)	23,861.9	CY	$5	$119,400	30%	$35,900	$155,300
5.17	Clearing and Grubbing (Borrow Site)	3.0	AC	$5,500	$16,300	30%	$4,900	$21,200
5.18	Stripping (Borrow Site)	3.0	AC	$6,500	$19,300	30%	$5,800	$25,100
5.19	Erosion Control Seeding (Borrow Site)	3.0	AC	$4,000	$11,900	30%	$3,600	$15,500
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	23,861.9	CY	$14	$334,100	30%	$100,300	$434,400
5.23	Rock Slope Protection	13,050.0	TON	$95	$1,243,100	30%	$373,000	$1,616,100
	Subtotal - Levees				***$12,022,300***		***$3,607,400***	***$15,629,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$991,900	30%	$297,600	$1,289,500
6.2	Construction Management		%	5.00%	$708,500	30%	$212,600	$921,100
	Subtotal - Planning, Engineering, & Design				***$1,701,000***		***$511,000***	***$2,211,000***
	ESTIMATED REACH TOTAL				**$15,976,000**		**$4,793,000**	**$20,767,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$17,635,000**		**$5,291,000**	**$22,923,000**

5/26/2016

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 6 - STA 161+00 TO 194+60

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	2.7	AC	$20,000	$54,300	30%	$16,300	$70,600
1.6	Land Acquisition Soft Costs		%	20%	$11,000	15%	$1,700	$12,700
	Subtotal - Lands				***$65,300***		***$18,000***	***$83,300***
2	**Mitigation**							
	Environmental Mitigation		LS		$26,600	30%	$8,000	$34,600
	Environmental Permitting/Planning/Design		LS		$7,300	30%	$2,200	$9,500
	Subtotal - Mitigation				***$33,900***		***$10,200***	***$44,100***
3	**Relocations**							
3.1	Utility Pole Relocation	15.0	EA	$30,000	$450,000	30%	$135,000	$585,000
3.2	Remove and Salvage Ex. Agg. Surfacing	3,360.0	LF	$10	$33,600	30%	$10,100	$43,700
3.3	2"-5" Pipe Modification	4.0	EA	$90,000	$360,000	30%	$108,000	$468,000
3.4	10" Pipe Modification	3.0	EA	$145,000	$435,000	30%	$130,500	$565,500
3.5	36" Pipe Modification	3.0	EA	$250,000	$750,000	30%	$225,000	$975,000
3.6	Fence/Gate Modification	6.0	EA	$5,000	$30,000	30%	$9,000	$39,000
3.7	Class 2 Aggregate Surfacing	2,520.0	TON	$35	$88,200	30%	$26,500	$114,700
	Subtotal - Relocations				***$2,146,800***		***$644,100***	***$2,790,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$170,100	30%	$51,100	$221,200
5.2	Clearing and Grubbing (Levee)	2.5	AC	$5,500	$14,000	30%	$4,200	$18,200
5.3	Stripping (Levee)	2.5	AC	$6,500	$16,600	30%	$5,000	$21,600
5.4	Erosion Control Seeding (Levee)	2.5	AC	$4,000	$10,200	30%	$3,100	$13,300
5.5	Levee Degrading/ Excavation	32,007.1	CY	$9	$272,100	30%	$81,700	$353,800
5.6	Inspection Trench Excavation	4,480.0	CY	$9	$38,100	30%	$11,500	$49,600
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	6,156.7	CY	$6	$37,000	30%	$11,100	$48,100
5.9	Clay Cap Fill (Soil Type 1)	9,146.7	CY	$6	$54,900	30%	$16,500	$71,400
5.10	Cutoff Wall <75' (Soil Bentonite)	111,888.0	SF	$10	$1,118,900	30%	$335,700	$1,454,600
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	9,076.4	CY	$15	$136,200	30%	$40,900	$177,100
5.16	Excavation (Borrow Site)	21,861.9	CY	$5	$109,400	30%	$32,900	$142,300
5.17	Clearing and Grubbing (Borrow Site)	2.7	AC	$5,500	$15,000	30%	$4,500	$19,500
5.18	Stripping (Borrow Site)	2.7	AC	$6,500	$17,700	30%	$5,400	$23,100
5.19	Erosion Control Seeding (Borrow Site)	2.7	AC	$4,000	$10,900	30%	$3,300	$14,200
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	21,861.9	CY	$14	$306,100	30%	$91,900	$398,000
5.23	Rock Slope Protection	13,050.0	TON	$95	$1,243,100	30%	$373,000	$1,616,100
	Subtotal - Levees				***$3,570,300***		***$1,071,800***	***$4,642,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$400,200	30%	$120,100	$520,300
6.2	Construction Management		%	5.00%	$285,900	30%	$85,800	$371,700
	Subtotal - Planning, Engineering, & Design				***$687,000***		***$206,000***	***$892,000***
	ESTIMATED REACH TOTAL				**$6,504,000**		**$1,951,000**	**$8,453,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$7,179,000**		**$2,154,000**	**$9,331,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 8 - STA 199+60 TO 215+30

WOOD RODGERS

Alternative 1 - Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.2	AC	$20,000	$23,600	30%	$7,100	$30,700
1.6	Land Acquisition Soft Costs		%	20%	$5,000	15%	$800	$5,800
	Subtotal - Lands				***$28,600***		***$7,900***	***$36,500***
2	**Mitigation**							
	Environmental Mitigation		LS		$20,800	30%	$6,300	$27,100
	Environmental Permitting/Planning/Design		LS		$5,700	30%	$1,800	$7,500
	Subtotal - Mitigation				***$26,500***		***$8,100***	***$34,600***
3	**Relocations**							
3.1	Utility Pole Relocation	1.0	EA	$30,000	$30,000	30%	$9,000	$39,000
3.2	2"-5" Pipe Modification	3.0	EA	$90,000	$270,000	30%	$81,000	$351,000
3.3	24" Pipe Modification	1.0	EA	$225,000	$225,000	30%	$67,500	$292,500
3.4	36" Pipe Modification	1.0	EA	$250,000	$250,000	30%	$75,000	$325,000
3.5	Fence/Gate Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.6	Remove and Salvage Ex. Agg. Surfacing	1,570.0	LF	$10	$15,700	30%	$4,800	$20,500
3.7	Class 2 Aggregate Surfacing	1,177.5	TON	$35	$41,300	30%	$12,400	$53,700
	Subtotal - Relocations				***$837,000***		***$251,200***	***$1,088,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$262,200	30%	$78,700	$340,900
5.2	Clearing and Grubbing (Levee)	1.4	AC	$5,500	$7,700	30%	$2,400	$10,100
5.3	Stripping (Levee)	1.4	AC	$6,500	$9,100	30%	$2,800	$11,900
5.4	Erosion Control Seeding (Levee)	1.4	AC	$4,000	$5,600	30%	$1,700	$7,300
5.5	Levee Degrading/ Excavation	20,032.0	CY	$9	$170,300	30%	$51,100	$221,400
5.6	Inspection Trench Excavation	2,093.3	CY	$9	$17,800	30%	$5,400	$23,200
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	2,090.7	CY	$6	$12,600	30%	$3,800	$16,400
5.9	Clay Cap Fill (Soil Type 1)	4,558.8	CY	$6	$27,400	30%	$8,300	$35,700
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	169,089.0	SF	$25	$4,227,300	30%	$1,268,200	$5,495,500
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	6,068.1	CY	$15	$91,100	30%	$27,400	$118,500
5.16	Excavation (Borrow Site)	9,499.3	CY	$5	$47,500	30%	$14,300	$61,800
5.17	Clearing and Grubbing (Borrow Site)	1.2	AC	$5,500	$6,500	30%	$2,000	$8,500
5.18	Stripping (Borrow Site)	1.2	AC	$6,500	$7,700	30%	$2,400	$10,100
5.19	Erosion Control Seeding (Borrow Site)	1.2	AC	$4,000	$4,800	30%	$1,500	$6,300
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	9,499.3	CY	$8	$71,300	30%	$21,400	$92,700
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	5,625.0	TON	$95	$535,800	30%	$160,800	$696,600
	Subtotal - Levees				***$5,504,700***		***$1,652,200***	***$7,156,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$444,000	30%	$133,200	$577,200
6.2	Construction Management		%	5.00%	$317,100	30%	$95,200	$412,300
	Subtotal - Planning, Engineering, & Design				***$762,000***		***$229,000***	***$990,000***
	ESTIMATED REACH TOTAL				**$7,159,000**		**$2,149,000**	**$9,307,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$7,902,000**		**$2,372,000**	**$10,273,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 8 - STA 199+60 TO 215+30

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.1	AC	$20,000	$21,300	30%	$6,400	$27,700
1.6	Land Acquisition Soft Costs		%	20%	$5,000	15%	$800	$5,800
	Subtotal - Lands				***$26,300***		***$7,200***	***$33,500***
2	**Mitigation**							
	Environmental Mitigation		LS		$20,800	30%	$6,300	$27,100
	Environmental Permitting/Planning/Design		LS		$5,700	30%	$1,800	$7,500
	Subtotal - Mitigation				***$26,500***		***$8,100***	***$34,600***
3	**Relocations**							
3.1	Utility Pole Relocation	1.0	EA	$30,000	$30,000	30%	$9,000	$39,000
3.2	2"-5" Pipe Modification	3.0	EA	$90,000	$270,000	30%	$81,000	$351,000
3.3	24" Pipe Modification	1.0	EA	$225,000	$225,000	30%	$67,500	$292,500
3.4	36" Pipe Modification	1.0	EA	$250,000	$250,000	30%	$75,000	$325,000
3.5	Fence/Gate Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.6	Remove and Salvage Ex. Agg. Surfacing	1,570.0	LF	$10	$15,700	30%	$4,800	$20,500
3.7	Class 2 Aggregate Surfacing	1,177.5	TON	$35	$41,300	30%	$12,400	$53,700
	Subtotal - Relocations				***$837,000***		***$251,200***	***$1,088,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$75,100	30%	$22,600	$97,700
5.2	Clearing and Grubbing (Levee)	1.4	AC	$5,500	$7,700	30%	$2,400	$10,100
5.3	Stripping (Levee)	1.4	AC	$6,500	$9,100	30%	$2,800	$11,900
5.4	Erosion Control Seeding (Levee)	1.4	AC	$4,000	$5,600	30%	$1,700	$7,300
5.5	Levee Degrading/ Excavation	20,032.0	CY	$9	$170,300	30%	$51,100	$221,400
5.6	Inspection Trench Excavation	2,093.3	CY	$9	$17,800	30%	$5,400	$23,200
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	1,436.6	CY	$6	$8,700	30%	$2,700	$11,400
5.9	Clay Cap Fill (Soil Type 1)	4,558.8	CY	$6	$27,400	30%	$8,300	$35,700
5.10	Cutoff Wall <75' (Soil Bentonite)	51,339.0	SF	$10	$513,400	30%	$154,100	$667,500
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	5,413.9	CY	$15	$81,300	30%	$24,400	$105,700
5.16	Excavation (Borrow Site)	8,564.8	CY	$5	$42,900	30%	$12,900	$55,800
5.17	Clearing and Grubbing (Borrow Site)	1.1	AC	$5,500	$5,900	30%	$1,800	$7,700
5.18	Stripping (Borrow Site)	1.1	AC	$6,500	$7,000	30%	$2,100	$9,100
5.19	Erosion Control Seeding (Borrow Site)	1.1	AC	$4,000	$4,300	30%	$1,300	$5,600
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	8,564.8	CY	$8	$64,300	30%	$19,300	$83,600
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	5,625.0	TON	$95	$535,800	30%	$160,800	$696,600
	Subtotal - Levees				***$1,576,600***		***$473,700***	***$2,050,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$169,000	30%	$50,700	$219,700
6.2	Construction Management		%	5.00%	$120,700	30%	$36,300	$157,000
	Subtotal - Planning, Engineering, & Design				***$290,000***		***$87,000***	***$377,000***
	ESTIMATED REACH TOTAL				**$2,757,000**		**$828,000**	**$3,584,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,043,000**		**$914,000**	**$3,956,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 9 - STA 215+30 TO 301+57

WOOD RODGERS

Alternative 1 - Waterside Slope Flattening

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	0.0	AC	$20,000	$0	30%	$0	$0
1.6	Land Acquisition Soft Costs		%	20%	$0	15%	$0	$0
	Subtotal - Lands				***$0***		***$0***	***$0***
2	**Mitigation**							
	Environmental Mitigation		LS		$1,237,800	30%	$371,400	$1,609,200
	Environmental Permitting/Planning/Design		LS		$338,600	30%	$101,600	$440,200
	Subtotal - Mitigation				***$1,576,400***		***$473,000***	***$2,049,400***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	2"-5" Pipe Modification	3.0	EA	$90,000	$270,000	30%	$81,000	$351,000
3.3	12" Pipe Modification	4.0	EA	$150,000	$600,000	30%	$180,000	$780,000
3.4	24" Pipe Modification	2.0	EA	$225,000	$450,000	30%	$135,000	$585,000
3.5	30" Pipe Modification	1.0	EA	$235,000	$235,000	30%	$70,500	$305,500
3.6	36" Pipe Modification	1.0	EA	$250,000	$250,000	30%	$75,000	$325,000
3.7	72" Pipe Modification	4.0	EA	$300,000	$1,200,000	30%	$360,000	$1,560,000
3.8	Fence/Gate Modification	5.0	EA	$5,000	$25,000	30%	$7,500	$32,500
3.9	Misc Modifications	8.0	EA	$10,000	$80,000	30%	$24,000	$104,000
3.10	Remove and Salvage Ex. Agg. Surfacing	8,627.0	LF	$10	$86,300	30%	$25,900	$112,200
3.11	Class 2 Aggregate Surfacing	6,470.3	TON	$35	$226,500	30%	$68,000	$294,500
	Subtotal - Relocations				***$3,482,800***		***$1,044,900***	***$4,527,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$116,200	30%	$34,900	$151,100
5.2	Clearing and Grubbing (Levee)	15.8	AC	$5,500	$87,200	30%	$26,200	$113,400
5.3	Stripping (Levee)	15.8	AC	$6,500	$103,000	30%	$30,900	$133,900
5.4	Erosion Control Seeding (Levee)	15.8	AC	$4,000	$63,400	30%	$19,100	$82,500
5.5	Levee Degrading/ Excavation	220,819.2	CY	$9	$1,877,000	30%	$563,100	$2,440,100
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	12,780.7	CY	$15	$191,800	30%	$57,600	$249,400
5.16	Excavation (Borrow Site)	0.0	CY	$5	$0	30%	$0	$0
5.17	Clearing and Grubbing (Borrow Site)	0.0	AC	$5,500	$0	30%	$0	$0
5.18	Stripping (Borrow Site)	0.0	AC	$6,500	$0	30%	$0	$0
5.19	Erosion Control Seeding (Borrow Site)	0.0	AC	$4,000	$0	30%	$0	$0
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$2,438,600***		***$731,800***	***$3,170,400***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$414,500	30%	$124,400	$538,900
6.2	Construction Management		%	5.00%	$296,100	30%	$88,900	$385,000
	Subtotal - Planning, Engineering, & Design				***$711,000***		***$214,000***	***$924,000***
	ESTIMATED REACH TOTAL				**$7,497,800**		**$2,249,700**	**$9,747,500**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$8,276,000**		**$2,483,000**	**$10,759,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West North Levee
REACH 9 - STA 215+30 TO 301+57
Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	0.0	AC	$20,000	$0	30%	$0	$0
1.6	Land Acquisition Soft Costs		%	20%	$0	15%	$0	$0
	Subtotal - Lands				***$0***		***$0***	***$0***
2	**Mitigation**							
	Environmental Mitigation		LS		$1,237,800	30%	$371,400	$1,609,200
	Environmental Permitting/Planning/Design		LS		$338,600	30%	$101,600	$440,200
	Subtotal - Mitigation				***$1,576,400***		***$473,000***	***$2,049,400***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	2"-5" Pipe Modification	3.0	EA	$90,000	$270,000	30%	$81,000	$351,000
3.3	12" Pipe Modification	4.0	EA	$150,000	$600,000	30%	$180,000	$780,000
3.4	24" Pipe Modification	2.0	EA	$225,000	$450,000	30%	$135,000	$585,000
3.5	30" Pipe Modification	1.0	EA	$235,000	$235,000	30%	$70,500	$305,500
3.6	36" Pipe Modification	1.0	EA	$250,000	$250,000	30%	$75,000	$325,000
3.7	72" Pipe Modification	4.0	EA	$300,000	$1,200,000	30%	$360,000	$1,560,000
3.8	Fence/Gate Modification	5.0	EA	$5,000	$25,000	30%	$7,500	$32,500
3.9	Misc Modifications	8.0	EA	$10,000	$80,000	30%	$24,000	$104,000
3.10	Remove and Salvage Ex. Agg. Surfacing	8,627.0	LF	$10	$86,300	30%	$25,900	$112,200
3.11	Class 2 Aggregate Surfacing	6,470.3	TON	$35	$226,500	30%	$68,000	$294,500
	Subtotal - Relocations				***$3,482,800***		***$1,044,900***	***$4,527,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
5.2	Clearing and Grubbing (Levee)	0.0	AC	$5,500	$0	30%	$0	$0
5.3	Stripping (Levee)	0.0	AC	$6,500	$0	30%	$0	$0
5.4	Erosion Control Seeding (Levee)	0.0	AC	$4,000	$0	30%	$0	$0
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	0.0	CY	$5	$0	30%	$0	$0
5.17	Clearing and Grubbing (Borrow Site)	0.0	AC	$5,500	$0	30%	$0	$0
5.18	Stripping (Borrow Site)	0.0	AC	$6,500	$0	30%	$0	$0
5.19	Erosion Control Seeding (Borrow Site)	0.0	AC	$4,000	$0	30%	$0	$0
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$0***		***$0***	***$0***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$243,800	30%	$73,200	$317,000
6.2	Construction Management		%	5.00%	$174,200	30%	$52,300	$226,500
	Subtotal - Planning, Engineering, & Design				***$418,000***		***$126,000***	***$544,000***
	ESTIMATED REACH TOTAL				**$5,059,200**		**$1,517,900**	**$6,577,100**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,584,000**		**$1,675,000**	**$7,260,000**

Barge Canal Closure Structure Cost Estimate

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Bulkhead Assessment

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
	Bulkhead Retrofit Cost Estimate							
1	**Lands**							
1.1	Land Acquisition	0.5	AC	$300,000	$150,000	100%	$150,000	$300,000
1.2	Land Acquisition Soft Costs		%	20%	$30,000	100%	$30,000	$60,000
	Subtotal - Lands				***$180,000***		***$180,000***	***$360,000***
2	**Mitigation**							
2.1	Environmental Mitigation	0.0	%	7%	$50,757	100%	$15,227	$66,000
	Subtotal - Mitigation				***$50,800***		***$15,300***	***$66,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$11,100	100%	$11,100	$22,200
4.2	Traffic Control		%	3%	$700	100%	$700	$1,400
4.3	AC Paving Removal	560.0	SY	$20	$11,200	100%	$11,200	$22,400
4.4	Aggregate Base, Class 2 (6")	275.0	TON	$40	$11,000	100%	$11,000	$22,000
	Subtotal - Roads				***$34,000***		***$34,000***	***$68,000***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$33,000	100%	$33,000	$66,000
5.2	Clearing and Grubbing (Levee)	0.5	AC	$5,500	$2,800	100%	$2,800	$5,600
5.3	Stripping (Levee)	0.5	AC	$6,500	$3,300	100%	$3,300	$6,600
5.4	Erosion Control Seeding (Levee)	0.3	AC	$4,000	$1,000	100%	$1,000	$2,000
5.5	Levee Embankment Fill (Soil Type 2)	600.0	CY	$6	$3,600	100%	$3,600	$7,200
5.6	Excavation (Borrow Site)	600.0	CY	$5	$3,000	100%	$3,000	$6,000
5.7	Hauling Level 3 (> 10 miles)	600.0	CY	$14	$8,400	100%	$8,400	$16,800
5.8	Abutment Raising and Misc. Modifications to Stone Lock Facilities	1	LS	$20,000	$20,000	100%	$20,000	$40,000
5.9	Steel for Bulkhead Retrofit	94,325	LBS	$6	$566,000	100%	$566,000	$1,132,000
5.10	Bulkhead Removal	1	LS	$15,000	$15,000	100%	$15,000	$30,000
5.11	Bulkhead Inspection	1	LS	$15,000	$15,000	100%	$15,000	$30,000
5.12	Bulkhead Silt Removal	1	LS	$20,000	$20,000	100%	$20,000	$40,000
	Subtotal - Levees				***$691,100***		***$691,100***	***$1,382,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	20.00%	$155,200	100%	$155,200	$310,400
6.2	Construction Management		%	5.00%	$38,800	100%	$38,800	$77,600
	Subtotal - Planning, Engineering, & Design				***$194,000***		***$194,000***	***$388,000***
	ESTIMATED REACH TOTAL				**$1,150,000**		**$1,115,000**	**$2,265,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,269,000**		**$1,231,000**	**$2,500,000**

5/4/2016

Sacramento River West South Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento River West South Levee
REACH 3 - STA 315+00 TO 332+70

WOOD RODGERS

Alternative 1 - Minor Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Water Related Commercial	13.0	AC	$200,000	$2,600,000	15%	$390,000	$2,990,000
1.2	Land Acquisition Soft Costs	4.0	Parcel	$12,500	$50,000	15%	$7,500	$57,500
1.3	Borrow Site Royalties	0.1	AC	$20,000	$2,300	30%	$700	$3,000
	Subtotal - Lands				***$2,652,300***		***$398,200***	***$3,050,500***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$14,500	30%	$4,400	$18,900
2.2	Environmental Permitting/Planning/Design		LS		$4,000	30%	$1,200	$5,200
	Subtotal - Mitigation				***$18,500***		***$5,600***	***$24,100***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	300.0	LF	$10	$3,000	30%	$900	$3,900
3.2	Class 2 Aggregate Surfacing	225.0	TON	$35	$7,900	30%	$2,400	$10,300
	Subtotal - Relocations				***$10,900***		***$3,300***	***$14,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$900	30%	$300	$1,200
5.2	Clearing and Grubbing (Levee)	0.1	AC	$5,500	$400	30%	$200	$600
5.3	Stripping (Levee)	0.1	AC	$6,500	$500	30%	$200	$700
5.4	Erosion Control Seeding (Levee)	0.1	AC	$4,000	$300	30%	$100	$400
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	636.1	CY	$6	$3,900	30%	$1,200	$5,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	52.8	CY	$15	$800	30%	$300	$1,100
5.16	Excavation (Borrow Site)	908.7	CY	$5	$4,600	30%	$1,400	$6,000
5.17	Clearing and Grubbing (Borrow Site)	0.1	AC	$5,500	$700	30%	$300	$1,000
5.18	Stripping (Borrow Site)	0.1	AC	$6,500	$800	30%	$300	$1,100
5.19	Erosion Control Seeding (Borrow Site)	0.1	AC	$4,000	$500	30%	$200	$700
5.20	Hauling Level 1 (< 5 miles)	908.7	CY	$4	$4,000	30%	$1,200	$5,200
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$17,400***		***$5,700***	***$23,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$2,000	30%	$600	$2,600
6.2	Construction Management		%	5.00%	$2,000	30%	$600	$2,600
	Subtotal - Planning, Engineering, & Design				***$4,000***		***$2,000***	***$6,000***
	ESTIMATED REACH TOTAL				**$2,704,000**		**$415,000**	**$3,118,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,985,000**		**$458,000**	**$3,442,000**

Sacramento Bypass South Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento Bypass South Levee
REACH 2 - STA 61+75 TO 64+60

Alternative 1 -Waterside Slope Flattening with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Public/Quasi Public	0.2	AC	$120,000	$24,000	15%	$3,600	$27,600
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	1.2	AC	$20,000	$24,600	30%	$7,400	$32,000
	Subtotal - Lands				***$61,100***		***$12,900***	***$74,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$166,400	30%	$50,000	$216,400
2.2	Environmental Permitting/Planning/Design		LS		$45,600	30%	$13,700	$59,300
	Subtotal - Mitigation				***$212,000***		***$63,700***	***$275,700***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	485.0	LF	$10	$4,900	30%	$1,500	$6,400
3.6	Class 2 Aggregate Surfacing	363.8	TON	$35	$12,800	30%	$3,900	$16,700
3.7	12" Fiber Optic	1.0	EA	$150,000	$150,000	30%	$45,000	$195,000
3.8	Gate	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.9	4" Pipeline Modification	4.0	EA	$90,000	$360,000	30%	$108,000	$468,000
3.10	Concrete Removal and Replacement	17,100.0	SF	$12	$205,200	30%	$61,600	$266,800
3.11	CHP Academy Fence Relocation	285.0	LF	$125	$35,700	30%	$10,800	$46,500
	Subtotal - Relocations				***$833,600***		***$250,300***	***$1,083,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$99,000	30%	$29,700	$128,700
5.2	Clearing and Grubbing (Levee)	1.5	AC	$5,500	$8,200	30%	$2,500	$10,700
5.3	Stripping (Levee)	1.5	AC	$6,500	$9,700	30%	$3,000	$12,700
5.4	Erosion Control Seeding (Levee)	1.5	AC	$4,000	$6,000	30%	$1,800	$7,800
5.5	Levee Degrading/ Excavation	8,192.0	CY	$9	$69,700	30%	$21,000	$90,700
5.6	Inspection Trench Excavation	646.7	CY	$9	$5,500	30%	$1,700	$7,200
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	5,112.9	CY	$6	$30,700	30%	$9,300	$40,000
5.9	Clay Cap Fill (Soil Type 1)	1,823.2	CY	$6	$11,000	30%	$3,300	$14,300
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	63,292.5	SF	$25	$1,582,400	30%	$474,800	$2,057,200
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	3,185.5	CY	$15	$47,800	30%	$14,400	$62,200
5.16	Excavation (Borrow Site)	9,908.8	CY	$5	$49,600	30%	$14,900	$64,500
5.17	Clearing and Grubbing (Borrow Site)	1.2	AC	$5,500	$6,800	30%	$2,100	$8,900
5.18	Stripping (Borrow Site)	1.2	AC	$6,500	$8,000	30%	$2,400	$10,400
5.19	Erosion Control Seeding (Borrow Site)	1.2	AC	$4,000	$5,000	30%	$1,500	$6,500
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	9,908.8	CY	$14	$138,800	30%	$41,700	$180,500
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$2,078,200***		***$624,100***	***$2,702,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$203,900	30%	$61,200	$265,100
6.2	Construction Management		%	5.00%	$44,200	30%	$13,300	$57,500
	Subtotal - Planning, Engineering, & Design				***$249,000***		***$75,000***	***$323,000***
	ESTIMATED REACH TOTAL				**$3,434,000**		**$1,026,000**	**$4,459,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,790,000**		**$1,133,000**	**$4,922,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento Bypass South Levee
REACH 2 - STA 61+75 TO 64+60

WOOD RODGERS

Alternative 2 - Waterside Slope Flattening with Seepage Berm

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Public/Quasi Public	1.4	AC	$120,000	$168,000	15%	$25,200	$193,200
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.5	Borrow Site Royalties	1.9	AC	$20,000	$38,200	30%	$11,500	$49,700
	Subtotal - Lands				***$218,700***		***$38,600***	***$257,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$166,400	30%	$50,000	$216,400
2.2	Environmental Permitting/Planning/Design		LS		$45,600	30%	$13,700	$59,300
	Subtotal - Mitigation				***$212,000***		***$63,700***	***$275,700***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	485.0	LF	$10	$4,900	30%	$1,500	$6,400
3.6	Class 2 Aggregate Surfacing	363.8	TON	$35	$12,800	30%	$3,900	$16,700
3.7	12" Fiber Optic	1.0	EA	$150,000	$150,000	30%	$45,000	$195,000
3.8	Gate	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.9	4" Pipeline Modification	4.0	EA	$90,000	$360,000	30%	$108,000	$468,000
3.10	Concrete Removal and Replacement	17,100.0	SF	$12	$205,200	30%	$61,600	$266,800
3.11	CHP Academy Fence Relocation	285.0	LF	$125	$35,700	30%	$10,800	$46,500
	Subtotal - Relocations				***$833,600***		***$250,300***	***$1,083,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$35,900	30%	$10,800	$46,700
5.2	Clearing and Grubbing (Levee)	2.7	AC	$5,500	$14,900	30%	$4,500	$19,400
5.3	Stripping (Levee)	2.7	AC	$6,500	$17,600	30%	$5,300	$22,900
5.4	Erosion Control Seeding (Levee)	2.7	AC	$4,000	$10,900	30%	$3,300	$14,200
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	6,369.7	CY	$6	$38,300	30%	$11,500	$49,800
5.8	Levee Embankment Fill (Soil Type 2)	4,409.9	CY	$6	$26,500	30%	$8,000	$34,500
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	4,132.2	TON	$45	$186,000	30%	$55,800	$241,800
5.13	Sand Filter Layer	1,052.6	TON	$45	$47,400	30%	$14,300	$61,700
5.14	Filter Fabric	6,208.0	SY	$3	$18,700	30%	$5,700	$24,400
5.15	Haul and Dispose of Unsuitable Material	2,182.5	CY	$15	$32,800	30%	$9,900	$42,700
5.16	Excavation (Borrow Site)	15,399.4	CY	$5	$77,000	30%	$23,100	$100,100
5.17	Clearing and Grubbing (Borrow Site)	1.9	AC	$5,500	$10,500	30%	$3,200	$13,700
5.18	Stripping (Borrow Site)	1.9	AC	$6,500	$12,500	30%	$3,800	$16,300
5.19	Erosion Control Seeding (Borrow Site)	1.9	AC	$4,000	$7,700	30%	$2,400	$10,100
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	15,399.4	CY	$14	$215,600	30%	$64,700	$280,300
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$752,300***		***$226,300***	***$978,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$111,100	30%	$33,400	$144,500
6.2	Construction Management		%	5.00%	$45,600	30%	$13,700	$59,300
	Subtotal - Planning, Engineering, & Design				***$157,000***		***$48,000***	***$204,000***
	ESTIMATED REACH TOTAL				**$2,174,000**		**$627,000**	**$2,800,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,400,000**		**$692,000**	**$3,091,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Sacramento Bypass South Levee
REACH 2 - STA 61+75 TO 64+60

WOOD RODGERS

Alternative 3 - Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Public/Quasi Public	0.2	AC	$120,000	$24,000	15%	$3,600	$27,600
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	1.2	AC	$20,000	$23,600	30%	$7,100	$30,700
	Subtotal - Lands				***$60,100***		***$12,600***	***$72,700***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$166,400	30%	$50,000	$216,400
2.2	Environmental Permitting/Planning/Design		LS		$45,600	30%	$13,700	$59,300
	Subtotal - Mitigation				***$212,000***		***$63,700***	***$275,700***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	485.0	LF	$10	$4,900	30%	$1,500	$6,400
3.6	Class 2 Aggregate Surfacing	363.8	TON	$35	$12,800	30%	$3,900	$16,700
3.7	12" Fiber Optic	1.0	EA	$150,000	$150,000	30%	$45,000	$195,000
3.8	Gate	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.9	4" Pipeline Modification	4.0	EA	$90,000	$360,000	30%	$108,000	$468,000
3.10	Concrete Removal and Replacement	17,100.0	SF	$12	$205,200	30%	$61,600	$266,800
3.11	CHP Academy Fence Relocation	285.0	LF	$125	$35,700	30%	$10,800	$46,500
	Subtotal - Relocations				***$833,600***		***$250,300***	***$1,083,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$25,400	30%	$7,700	$33,100
5.2	Clearing and Grubbing (Levee)	1.5	AC	$5,500	$8,200	30%	$2,500	$10,700
5.3	Stripping (Levee)	1.5	AC	$6,500	$9,700	30%	$3,000	$12,700
5.4	Erosion Control Seeding (Levee)	1.5	AC	$4,000	$6,000	30%	$1,800	$7,800
5.5	Levee Degrading/ Excavation	8,192.0	CY	$9	$69,700	30%	$21,000	$90,700
5.6	Inspection Trench Excavation	646.7	CY	$9	$5,500	30%	$1,700	$7,200
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	4,830.0	CY	$6	$29,000	30%	$8,700	$37,700
5.9	Clay Cap Fill (Soil Type 1)	1,823.2	CY	$6	$11,000	30%	$3,300	$14,300
5.10	Cutoff Wall <75' (Soil Bentonite)	12,367.5	SF	$10	$123,700	30%	$37,200	$160,900
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,902.5	CY	$15	$43,600	30%	$13,100	$56,700
5.16	Excavation (Borrow Site)	9,504.6	CY	$5	$47,600	30%	$14,300	$61,900
5.17	Clearing and Grubbing (Borrow Site)	1.2	AC	$5,500	$6,500	30%	$2,000	$8,500
5.18	Stripping (Borrow Site)	1.2	AC	$6,500	$7,700	30%	$2,400	$10,100
5.19	Erosion Control Seeding (Borrow Site)	1.2	AC	$4,000	$4,800	30%	$1,500	$6,300
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	9,504.6	CY	$14	$133,100	30%	$40,000	$173,100
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$531,500***		***$160,200***	***$691,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$95,600	30%	$28,700	$124,300
6.2	Construction Management		%	5.00%	$44,100	30%	$13,300	$57,400
	Subtotal - Planning, Engineering, & Design				***$140,000***		***$42,000***	***$182,000***
	ESTIMATED REACH TOTAL				**$1,778,000**		**$529,000**	**$2,306,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,963,000**		**$584,000**	**$2,545,000**

Training Berm Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Training Berm
REACH 1

WOOD RODGERS

Alternative 1 - Slope Flattening with Rock Slope Protection

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	2.3	AC	$20,000	$45,400	30%	$13,700	$59,100
1.6	Land Acquisition Soft Costs		%	20%	$10,000	15%	$1,500	$11,500
	Subtotal - Lands				***$55,400***		***$15,200***	***$70,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$359,800	30%	$108,000	$467,800
2.2	Environmental Permitting/Planning/Design		LS		$98,500	30%	$29,600	$128,100
	Subtotal - Mitigation				***$458,300***		***$137,600***	***$595,900***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,910.0	LF	$10	$29,100	30%	$8,800	$37,900
3.2	Class 2 Aggregate Surfacing	2,182.5	TON	$35	$76,400	30%	$23,000	$99,400
3.3	Gate	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
	Subtotal - Relocations				***$110,500***		***$33,300***	***$143,800***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$259,000	30%	$77,700	$336,700
5.2	Clearing and Grubbing (Levee)	8.8	AC	$5,500	$48,400	30%	$14,600	$63,000
5.3	Stripping (Levee)	8.8	AC	$6,500	$57,200	30%	$17,200	$74,400
5.4	Erosion Control Seeding (Levee)	8.8	AC	$4,000	$35,200	30%	$10,600	$45,800
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	12,804.0	CY	$6	$76,900	30%	$23,100	$100,000
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	47,465.3	SY	$3	$142,400	30%	$42,800	$185,200
5.15	Haul and Dispose of Unsuitable Material	7,091.8	CY	$15	$106,400	30%	$32,000	$138,400
5.16	Excavation (Borrow Site)	18,291.4	CY	$5	$91,500	30%	$27,500	$119,000
5.17	Clearing and Grubbing (Borrow Site)	2.3	AC	$5,500	$12,500	30%	$3,800	$16,300
5.18	Stripping (Borrow Site)	2.3	AC	$6,500	$14,800	30%	$4,500	$19,300
5.19	Erosion Control Seeding (Borrow Site)	2.3	AC	$4,000	$9,100	30%	$2,800	$11,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	18,291.4	CY	$14	$256,100	30%	$76,900	$333,000
5.23	Rock Slope Protection	45,439.7	TON	$95	$4,328,200	30%	$1,298,500	$5,626,700
	Subtotal - Levees				***$5,437,700***		***$1,632,000***	***$7,069,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$388,400	30%	$116,600	$505,000
6.2	Construction Management		%	5.00%	$277,500	30%	$83,300	$360,800
	Subtotal - Planning, Engineering, & Design				***$666,000***		***$200,000***	***$866,000***
	ESTIMATED REACH TOTAL				**$6,728,000**		**$2,019,000**	**$8,746,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$7,426,000**		**$2,229,000**	**$9,654,000**

Yolo Bypass East Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 1 - STA 0+00 TO 27+52

WOOD RODGERS

Alternative 1 - Minor Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Water Related Industrial	1.3	AC	$260,000	$338,000	15%	$50,700	$388,700
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	2.1	AC	$20,000	$41,200	30%	$12,400	$53,600
	Subtotal - Lands				***$404,200***		***$66,900***	***$471,100***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$73,400	30%	$22,100	$95,500
2.2	Environmental Permitting/Planning/Design		LS		$20,100	30%	$6,100	$26,200
	Subtotal - Mitigation				***$93,500***		***$28,200***	***$121,700***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,752.0	LF	$10	$27,600	30%	$8,300	$35,900
3.2	Class 2 Aggregate Surfacing	2,064.0	TON	$35	$72,300	30%	$21,700	$94,000
3.3	Fence/Gate Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
	Subtotal - Relocations				***$104,900***		***$31,500***	***$136,400***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$57,300	30%	$17,200	$74,500
5.2	Clearing and Grubbing (Levee)	5.2	AC	$5,500	$28,600	30%	$8,600	$37,200
5.3	Stripping (Levee)	5.2	AC	$6,500	$33,800	30%	$10,200	$44,000
5.4	Erosion Control Seeding (Levee)	5.2	AC	$4,000	$20,800	30%	$6,300	$27,100
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	11,614.5	CY	$6	$69,700	30%	$21,000	$90,700
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	4,184.1	CY	$15	$62,800	30%	$18,900	$81,700
5.16	Excavation (Borrow Site)	16,592.1	CY	$5	$83,000	30%	$24,900	$107,900
5.17	Clearing and Grubbing (Borrow Site)	2.1	AC	$5,500	$11,400	30%	$3,500	$14,900
5.18	Stripping (Borrow Site)	2.1	AC	$6,500	$13,400	30%	$4,100	$17,500
5.19	Erosion Control Seeding (Borrow Site)	2.1	AC	$4,000	$8,300	30%	$2,500	$10,800
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	16,592.1	CY	$8	$124,500	30%	$37,400	$161,900
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	7,224.0	TON	$95	$688,100	30%	$206,500	$894,600
	Subtotal - Levees				***$1,201,700***		***$361,100***	***$1,562,800***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$91,500	30%	$27,500	$119,000
6.2	Construction Management		%	5.00%	$65,400	30%	$19,700	$85,100
	Subtotal - Planning, Engineering, & Design				***$157,000***		***$48,000***	***$205,000***
	ESTIMATED REACH TOTAL				**$1,962,000**		**$536,000**	**$2,497,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,166,000**		**$592,000**	**$2,756,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 2 - STA 27+52 TO 51+63

WOOD RODGERS

Alternative 1 - Minor Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	1.4	AC	$260,000	$364,000	15%	$54,600	$418,600
1.2	Land Acquisition Soft Costs	5.0	Parcel	$12,500	$62,500	15%	$9,400	$71,900
1.3	Borrow Site Royalties	1.4	AC	$20,000	$28,100	30%	$8,500	$36,600
	Subtotal - Lands				***$454,600***		***$72,500***	***$527,100***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$82,900	30%	$24,900	$107,800
2.2	Environmental Permitting/Planning/Design		LS		$22,700	30%	$6,900	$29,600
	Subtotal - Mitigation				***$105,600***		***$31,800***	***$137,400***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,411.0	LF	$10	$24,200	30%	$7,300	$31,500
3.2	Class 2 Aggregate Surfacing	1,808.3	TON	$35	$63,300	30%	$19,000	$82,300
3.3	Sign Relocation	1.0	EA	$2,500	$2,500	30%	$800	$3,300
3.4	Fence/Gate Modification	3.0	EA	$5,000	$15,000	30%	$4,500	$19,500
3.4	Misc Relocation	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
	Subtotal - Relocations				***$115,000***		***$34,600***	***$149,600***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$90,200	30%	$27,100	$117,300
5.2	Clearing and Grubbing (Levee)	2.7	AC	$5,500	$15,200	30%	$4,600	$19,800
5.3	Stripping (Levee)	2.7	AC	$6,500	$17,900	30%	$5,400	$23,300
5.4	Erosion Control Seeding (Levee)	2.7	AC	$4,000	$11,000	30%	$3,300	$14,300
5.5	Levee Degrading/ Excavation	22,698.5	CY	$9	$193,000	30%	$57,900	$250,900
5.6	Inspection Trench Excavation	1,709.3	CY	$9	$14,600	30%	$4,400	$19,000
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	2,913.1	CY	$6	$17,500	30%	$5,300	$22,800
5.9	Clay Cap Fill (Soil Type 1)	5,004.5	CY	$6	$30,100	30%	$9,100	$39,200
5.10	Cutoff Wall <75' (Soil Bentonite)	91,376.9	SF	$10	$913,800	30%	$274,200	$1,188,000
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	7,024.6	CY	$15	$105,400	30%	$31,700	$137,100
5.16	Excavation (Borrow Site)	11,310.9	CY	$5	$56,600	30%	$17,000	$73,600
5.17	Clearing and Grubbing (Borrow Site)	1.4	AC	$5,500	$7,800	30%	$2,400	$10,200
5.18	Stripping (Borrow Site)	1.4	AC	$6,500	$9,200	30%	$2,800	$12,000
5.19	Erosion Control Seeding (Borrow Site)	1.4	AC	$4,000	$5,700	30%	$1,800	$7,500
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	11,310.9	CY	$8	$84,900	30%	$25,500	$110,400
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	3,365.3	TON	$95	$320,600	30%	$96,200	$416,800
	Subtotal - Levees				***$1,893,500***		***$568,700***	***$2,462,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$140,600	30%	$42,200	$182,800
6.2	Construction Management		%	5.00%	$100,500	30%	$30,200	$130,700
	Subtotal - Planning, Engineering, & Design				***$242,000***		***$73,000***	***$314,000***
	ESTIMATED REACH TOTAL				**$2,811,000**		**$781,000**	**$3,591,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,103,000**		**$862,000**	**$3,964,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 2 - STA 27+52 TO 51+63

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	1.4	AC	$260,000	$364,000	15%	$54,600	$418,600
1.2	Land Acquisition Soft Costs	5.0	Parcel	$12,500	$62,500	15%	$9,400	$71,900
1.3	Borrow Site Royalties	0.9	AC	$20,000	$18,700	30%	$5,700	$24,400
	Subtotal - Lands				***$445,200***		***$69,700***	***$514,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$82,900	30%	$24,900	$107,800
2.2	Environmental Permitting/Planning/Design		LS		$22,700	30%	$6,900	$29,600
	Subtotal - Mitigation				***$105,600***		***$31,800***	***$137,400***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,411.0	LF	$10	$24,200	30%	$7,300	$31,500
3.2	Class 2 Aggregate Surfacing	1,808.3	TON	$35	$63,300	30%	$19,000	$82,300
3.3	Sign Relocation	1.0	EA	$2,500	$2,500	30%	$800	$3,300
3.4	Fence/Gate Modification	3.0	EA	$5,000	$15,000	30%	$4,500	$19,500
3.4	Misc Relocation	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
	Subtotal - Relocations				***$115,000***		***$34,600***	***$149,600***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$44,500	30%	$13,400	$57,900
5.2	Clearing and Grubbing (Levee)	5.2	AC	$5,500	$28,500	30%	$8,600	$37,100
5.3	Stripping (Levee)	5.2	AC	$6,500	$33,600	30%	$10,100	$43,700
5.4	Erosion Control Seeding (Levee)	5.2	AC	$4,000	$20,700	30%	$6,300	$27,000
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	5,279.4	CY	$6	$31,700	30%	$9,600	$41,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	4,165.7	CY	$15	$62,500	30%	$18,800	$81,300
5.16	Excavation (Borrow Site)	7,542.0	CY	$5	$37,800	30%	$11,400	$49,200
5.17	Clearing and Grubbing (Borrow Site)	0.9	AC	$5,500	$5,200	30%	$1,600	$6,800
5.18	Stripping (Borrow Site)	0.9	AC	$6,500	$6,100	30%	$1,900	$8,000
5.19	Erosion Control Seeding (Borrow Site)	0.9	AC	$4,000	$3,800	30%	$1,200	$5,000
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	7,542.0	CY	$8	$56,600	30%	$17,000	$73,600
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	6,328.9	TON	$95	$602,900	30%	$180,900	$783,800
	Subtotal - Levees				***$933,900***		***$280,800***	***$1,214,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$73,500	30%	$22,100	$95,600
6.2	Construction Management		%	5.00%	$52,500	30%	$15,800	$68,300
	Subtotal - Planning, Engineering, & Design				***$126,000***		***$38,000***	***$164,000***
	ESTIMATED REACH TOTAL				**$1,726,000**		**$455,000**	**$2,181,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,905,000**		**$502,000**	**$2,407,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 3 - STA 51+63 TO 70+00

WOOD RODGERS

Alternative 1 - Minor Levee Raise with Waterside Slope Reconstruction

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	0.8	AC	$260,000	$208,000	15%	$31,200	$239,200
1.2	Land Acquisition Soft Costs	5.0	Parcel	$12,500	$62,500	15%	$9,400	$71,900
1.3	Borrow Site Royalties	1.4	AC	$20,000	$28,100	30%	$8,500	$36,600
	Subtotal - Lands				***$298,600***		***$49,100***	***$347,700***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$107,000	30%	$32,100	$139,100
2.2	Environmental Permitting/Planning/Design		LS		$29,300	30%	$8,800	$38,100
	Subtotal - Mitigation				***$136,300***		***$40,900***	***$177,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	1,837.0	LF	$10	$18,400	30%	$5,600	$24,000
3.2	Class 2 Aggregate Surfacing	1,377.8	TON	$35	$48,300	30%	$14,500	$62,800
3.3	Misc Relocation	1.0	EA	$30,000	$30,000	30%	$9,000	$39,000
3.4	Fence/Gate Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
	Subtotal - Relocations				***$101,700***		***$30,600***	***$132,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$189,800	30%	$57,000	$246,800
5.2	Clearing and Grubbing (Levee)	5.8	AC	$5,500	$32,200	30%	$9,700	$41,900
5.3	Stripping (Levee)	5.8	AC	$6,500	$38,000	30%	$11,400	$49,400
5.4	Erosion Control Seeding (Levee)	5.8	AC	$4,000	$23,400	30%	$7,100	$30,500
5.5	Levee Degrading/ Excavation	49,735.1	CY	$9	$422,800	30%	$126,900	$549,700
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	17,254.2	CY	$6	$103,600	30%	$31,100	$134,700
5.8	Levee Embankment Fill (Soil Type 2)	57,484.5	CY	$6	$345,000	30%	$103,500	$448,500
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	55,000.0	CY	$15	$825,000	30%	$247,500	$1,072,500
5.16	Excavation (Borrow Site)	106,769.6	CY	$5	$533,900	30%	$160,200	$694,100
5.17	Clearing and Grubbing (Borrow Site)	13.2	AC	$5,500	$72,800	30%	$21,900	$94,700
5.18	Stripping (Borrow Site)	13.2	AC	$6,500	$86,100	30%	$25,900	$112,000
5.19	Erosion Control Seeding (Borrow Site)	13.2	AC	$4,000	$53,000	30%	$15,900	$68,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	106,769.6	CY	$8	$800,800	30%	$240,300	$1,041,100
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	4,822.1	TON	$95	$459,400	30%	$137,900	$597,300
	Subtotal - Levees				***$3,985,800***		***$1,196,300***	***$5,182,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$286,200	30%	$85,900	$372,100
6.2	Construction Management		%	5.00%	$204,400	30%	$61,400	$265,800
	Subtotal - Planning, Engineering, & Design				***$491,000***		***$148,000***	***$638,000***
	ESTIMATED REACH TOTAL				**$5,014,000**		**$1,465,000**	**$6,478,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,535,000**		**$1,617,000**	**$7,150,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 4 - STA 70+00 TO 82+82

WOOD RODGERS

Alternative 1 - Minor Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	0.6	AC	$260,000	$156,000	15%	$23,400	$179,400
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	1.4	AC	$20,000	$28,100	30%	$8,500	$36,600
	Subtotal - Lands				***$209,100***		***$35,700***	***$244,800***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$31,700	30%	$9,600	$41,300
2.2	Environmental Permitting/Planning/Design		LS		$8,700	30%	$2,700	$11,400
	Subtotal - Mitigation				***$40,400***		***$12,300***	***$52,700***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	10" Pipe Modification	3.0	EA	$145,000	$435,000	30%	$130,500	$565,500
3.3	18" Pipe Modification	2.0	EA	$175,000	$350,000	30%	$105,000	$455,000
3.4	30" Pipe Modification	4.0	EA	$235,000	$940,000	30%	$282,000	$1,222,000
2.5	54" Pipe Modification	1.0	EA	$300,000	$300,000	30%	$90,000	$390,000
3.6	Remove and Salvage Ex. Agg. Surfacing	1,282.0	LF	$10	$12,900	30%	$3,900	$16,800
3.7	Class 2 Aggregate Surfacing	961.5	TON	$35	$33,700	30%	$10,200	$43,900
	Subtotal - Relocations				***$2,071,600***		***$621,600***	***$2,693,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$27,500	30%	$8,300	$35,800
5.2	Clearing and Grubbing (Levee)	2.3	AC	$5,500	$12,600	30%	$3,800	$16,400
5.3	Stripping (Levee)	2.3	AC	$6,500	$14,900	30%	$4,500	$19,400
5.4	Erosion Control Seeding (Levee)	2.3	AC	$4,000	$9,200	30%	$2,800	$12,000
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	6,115.6	CY	$6	$36,700	30%	$11,100	$47,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	1,842.3	CY	$15	$27,700	30%	$8,400	$36,100
5.16	Excavation (Borrow Site)	8,736.6	CY	$5	$43,700	30%	$13,200	$56,900
5.17	Clearing and Grubbing (Borrow Site)	1.1	AC	$5,500	$6,000	30%	$1,800	$7,800
5.18	Stripping (Borrow Site)	1.1	AC	$6,500	$7,100	30%	$2,200	$9,300
5.19	Erosion Control Seeding (Borrow Site)	1.1	AC	$4,000	$4,400	30%	$1,400	$5,800
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	8,736.6	CY	$8	$65,600	30%	$19,700	$85,300
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	3,365.3	TON	$95	$320,600	30%	$96,200	$416,800
	Subtotal - Levees				***$576,000***		***$173,400***	***$749,400***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$185,400	30%	$55,700	$241,100
6.2	Construction Management		%	5.00%	$132,400	30%	$39,800	$172,200
	Subtotal - Planning, Engineering, & Design				***$318,000***		***$96,000***	***$414,000***
	ESTIMATED REACH TOTAL				**$3,216,000**		**$939,000**	**$4,155,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,550,000**		**$1,036,000**	**$4,586,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 5 - STA 82+82 TO 95+50

Alternative 1 - Minor Levee Raise with Waterside and Landside Slope Reconstruction

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Agricultural	6.4	AC	$25,000	$160,000	15%	$24,000	$184,000
1.2	Land Acquisition Soft Costs	4.0	Parcel	$12,500	$50,000	15%	$7,500	$57,500
1.3	Borrow Site Royalties	1.4	AC	$20,000	$28,100	30%	$8,500	$36,600
	Subtotal - Lands				***$238,100***		***$40,000***	***$278,100***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$60,600	30%	$18,200	$78,800
2.2	Environmental Permitting/Planning/Design		LS		$16,600	30%	$5,000	$21,600
	Subtotal - Mitigation				***$77,200***		***$23,200***	***$100,400***
3	**Relocations**							
3.1	Utility Pole Relocation	4.0	EA	$30,000	$120,000	30%	$36,000	$156,000
3.2	30" Pipe Modification	2.0	EA	$235,000	$470,000	30%	$141,000	$611,000
3.3	Misc Relocation	2.0	EA	$10,000	$20,000	30%	$6,000	$26,000
3.4	Remove and Salvage Ex. Agg. Surfacing	1,268.0	LF	$10	$12,700	30%	$3,900	$16,600
3.5	Class 2 Aggregate Surfacing	951.0	TON	$35	$33,300	30%	$10,000	$43,300
	Subtotal - Relocations				***$656,000***		***$196,900***	***$852,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$271,000	30%	$81,300	$352,300
5.2	Clearing and Grubbing (Levee)	5.2	AC	$5,500	$28,600	30%	$8,600	$37,200
5.3	Stripping (Levee)	5.2	AC	$6,500	$33,800	30%	$10,200	$44,000
5.4	Erosion Control Seeding (Levee)	5.2	AC	$4,000	$20,800	30%	$6,300	$27,100
5.5	Levee Degrading/ Excavation	90,000.0	CY	$9	$765,000	30%	$229,500	$994,500
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	117,000.0	CY	$6	$702,000	30%	$210,600	$912,600
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	12,962.1	TON	$45	$583,300	30%	$175,000	$758,300
5.13	Sand Filter Layer	1,845.6	TON	$45	$83,100	30%	$25,000	$108,100
5.14	Filter Fabric	19,710.4	SY	$3	$59,200	30%	$17,800	$77,000
5.15	Haul and Dispose of Unsuitable Material	90,000.0	CY	$15	$1,350,000	30%	$405,000	$1,755,000
5.16	Excavation (Borrow Site)	117,000.0	CY	$5	$585,000	30%	$175,500	$760,500
5.17	Clearing and Grubbing (Borrow Site)	15.0	AC	$5,500	$82,500	30%	$24,800	$107,300
5.18	Stripping (Borrow Site)	15.0	AC	$6,500	$97,500	30%	$29,300	$126,800
5.19	Erosion Control Seeding (Borrow Site)	15.0	AC	$4,000	$60,000	30%	$18,000	$78,000
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	117,000.0	CY	$8	$877,500	30%	$263,300	$1,140,800
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	951.0	TON	$95	$90,600	30%	$27,200	$117,800
	Subtotal - Levees				***$5,689,900***		***$1,707,400***	***$7,397,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$444,300	30%	$133,300	$577,600
6.2	Construction Management		%	5.00%	$317,300	30%	$95,200	$412,500
	Subtotal - Planning, Engineering, & Design				***$762,000***		***$229,000***	***$991,000***
	ESTIMATED REACH TOTAL				**$7,424,000**		**$2,197,000**	**$9,620,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$8,195,000**		**$2,425,000**	**$10,619,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 6 - STA 95+50 TO 114+50

WOOD RODGERS

Alternative 1 - Minor Levee Raise with Waterside Slope Reconstruction

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.9	AC	$120,000	$104,700	15%	$15,800	$120,500
1.5	Borrow Site Royalties	3.6	AC	$20,000	$72,500	30%	$21,800	$94,300
1.6	Land Acquisition Soft Costs		%	20%	$36,000	15%	$5,400	$41,400
	Subtotal - Lands				***$213,200***		***$43,000***	***$256,200***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$50,200	30%	$15,100	$65,300
2.2	Environmental Permitting/Planning/Design		LS		$13,800	30%	$4,200	$18,000
	Subtotal - Mitigation				***$64,000***		***$19,300***	***$83,300***
3	**Relocations**							
3.1	Sign Modification	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
3.2	Remove and Salvage Ex. Agg. Surfacing	1,900.0	LF	$10	$19,000	30%	$5,700	$24,700
3.3	Class 2 Aggregate Surfacing	1,425.0	TON	$35	$49,900	30%	$15,000	$64,900
	Subtotal - Relocations				***$73,900***		***$22,200***	***$96,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$214,000	30%	$64,200	$278,200
5.2	Clearing and Grubbing (Levee)	4.8	AC	$5,500	$26,400	30%	$8,000	$34,400
5.3	Stripping (Levee)	4.8	AC	$6,500	$31,200	30%	$9,400	$40,600
5.4	Erosion Control Seeding (Levee)	4.8	AC	$4,000	$19,200	30%	$5,800	$25,000
5.5	Levee Degrading/ Excavation	84,000.0	CY	$9	$714,000	30%	$214,200	$928,200
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	110,000.0	CY	$6	$660,000	30%	$198,000	$858,000
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	84,000.0	CY	$15	$1,260,000	30%	$378,000	$1,638,000
5.16	Excavation (Borrow Site)	110,000.0	CY	$5	$550,000	30%	$165,000	$715,000
5.17	Clearing and Grubbing (Borrow Site)	3.6	AC	$5,500	$20,000	30%	$6,000	$26,000
5.18	Stripping (Borrow Site)	3.6	AC	$6,500	$23,600	30%	$7,100	$30,700
5.19	Erosion Control Seeding (Borrow Site)	3.6	AC	$4,000	$14,500	30%	$4,400	$18,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	110,000.0	CY	$8	$825,000	30%	$247,500	$1,072,500
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	1,425.0	TON	$95	$135,800	30%	$40,800	$176,600
	Subtotal - Levees				***$4,493,700***		***$1,348,400***	***$5,842,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$319,800	30%	$96,000	$415,800
6.2	Construction Management		%	5.00%	$228,400	30%	$68,600	$297,000
	Subtotal - Planning, Engineering, & Design				***$549,000***		***$165,000***	***$713,000***
	ESTIMATED REACH TOTAL				**$5,394,000**		**$1,598,000**	**$6,991,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,954,000**		**$1,764,000**	**$7,717,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 7 - STA 114+50 TO 130+00

WOOD RODGERS

Alternative 1 - Minor Levee Raise with Landside Slope Reconstruction

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Agricultural	0.7	AC	$25,000	$17,500	15%	$2,700	$20,200
1.2	Land Acquisition Soft Costs	4.0	Parcel	$12,500	$50,000	15%	$7,500	$57,500
1.3	Borrow Site Royalties	1.4	AC	$20,000	$28,100	30%	$8,500	$36,600
	Subtotal - Lands				***$95,600***		***$18,700***	***$114,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$147,100	30%	$44,200	$191,300
2.2	Environmental Permitting/Planning/Design		LS		$40,300	30%	$12,100	$52,400
	Subtotal - Mitigation				***$187,400***		***$56,300***	***$243,700***
3	**Relocations**							
3.1	30" Pipe Modification	2.0	EA	$235,000	$470,000	30%	$141,000	$611,000
3.2	Misc Relocation	1.0	EA	$50,000	$50,000	30%	$15,000	$65,000
3.3	Remove and Salvage Ex. Agg. Surfacing	1,550.0	LF	$10	$15,500	30%	$4,700	$20,200
3.4	Class 2 Aggregate Surfacing	1,162.5	TON	$35	$40,700	30%	$12,300	$53,000
	Subtotal - Relocations				***$576,200***		***$173,000***	***$749,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$238,300	30%	$71,500	$309,800
5.2	Clearing and Grubbing (Levee)	5.1	AC	$5,500	$28,000	30%	$8,400	$36,400
5.3	Stripping (Levee)	5.1	AC	$6,500	$33,100	30%	$10,000	$43,100
5.4	Erosion Control Seeding (Levee)	5.1	AC	$4,000	$20,400	30%	$6,200	$26,600
5.5	Levee Degrading/ Excavation	65,000.0	CY	$9	$552,500	30%	$165,800	$718,300
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	85,000.0	CY	$6	$510,000	30%	$153,000	$663,000
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	26,086.5	TON	$45	$1,173,900	30%	$352,200	$1,526,100
5.13	Sand Filter Layer	2,256.1	TON	$45	$101,600	30%	$30,500	$132,100
5.14	Filter Fabric	12,503.3	SY	$3	$37,600	30%	$11,300	$48,900
5.15	Haul and Dispose of Unsuitable Material	65,000.0	CY	$15	$975,000	30%	$292,500	$1,267,500
5.16	Excavation (Borrow Site)	85,000.0	CY	$5	$425,000	30%	$127,500	$552,500
5.17	Clearing and Grubbing (Borrow Site)	10.0	AC	$5,500	$55,000	30%	$16,500	$71,500
5.18	Stripping (Borrow Site)	10.0	AC	$6,500	$65,000	30%	$19,500	$84,500
5.19	Erosion Control Seeding (Borrow Site)	10.0	AC	$4,000	$40,000	30%	$12,000	$52,000
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	85,000.0	CY	$8	$637,500	30%	$191,300	$828,800
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	1,162.5	TON	$95	$110,800	30%	$33,300	$144,100
	Subtotal - Levees				***$5,003,700***		***$1,501,500***	***$6,505,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$390,600	30%	$117,200	$507,800
6.2	Construction Management		%	5.00%	$279,000	30%	$83,700	$362,700
	Subtotal - Planning, Engineering, & Design				***$670,000***		***$201,000***	***$871,000***
	ESTIMATED REACH TOTAL				**$6,533,000**		**$1,951,000**	**$8,484,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$7,211,000**		**$2,154,000**	**$9,365,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 7 - STA 114+50 TO 130+00

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Agricultural	0.7	AC	$25,000	$17,500	15%	$2,700	$20,200
1.2	Land Acquisition Soft Costs	4.0	Parcel	$12,500	$50,000	15%	$7,500	$57,500
1.3	Borrow Site Royalties	1.4	AC	$20,000	$28,100	30%	$8,500	$36,600
	Subtotal - Lands				***$95,600***		***$18,700***	***$114,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$147,100	30%	$44,200	$191,300
2.2	Environmental Permitting/Planning/Design		LS		$40,300	30%	$12,100	$52,400
	Subtotal - Mitigation				***$187,400***		***$56,300***	***$243,700***
3	**Relocations**							
3.1	30" Pipe Modification	2.0	EA	$235,000	$470,000	30%	$141,000	$611,000
3.2	Misc Relocation	1.0	EA	$50,000	$50,000	30%	$15,000	$65,000
3.3	Remove and Salvage Ex. Agg. Surfacing	1,550.0	LF	$10	$15,500	30%	$4,700	$20,200
3.4	Class 2 Aggregate Surfacing	1,162.5	TON	$35	$40,700	30%	$12,300	$53,000
	Subtotal - Relocations				***$576,200***		***$173,000***	***$749,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$20,200	30%	$6,100	$26,300
5.2	Clearing and Grubbing (Levee)	5.1	AC	$5,500	$28,000	30%	$8,400	$36,400
5.3	Stripping (Levee)	5.1	AC	$6,500	$33,100	30%	$10,000	$43,100
5.4	Erosion Control Seeding (Levee)	5.1	AC	$4,000	$20,400	30%	$6,200	$26,600
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	5,577.1	CY	$6	$33,500	30%	$10,100	$43,600
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	4,096.0	CY	$15	$61,500	30%	$18,500	$80,000
5.16	Excavation (Borrow Site)	7,967.3	CY	$5	$39,900	30%	$12,000	$51,900
5.17	Clearing and Grubbing (Borrow Site)	1.0	AC	$5,500	$5,500	30%	$1,700	$7,200
5.18	Stripping (Borrow Site)	1.0	AC	$6,500	$6,500	30%	$2,000	$8,500
5.19	Erosion Control Seeding (Borrow Site)	1.0	AC	$4,000	$4,000	30%	$1,200	$5,200
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	7,967.3	CY	$8	$59,800	30%	$18,000	$77,800
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	1,162.5	TON	$95	$110,800	30%	$33,300	$144,100
	Subtotal - Levees				***$423,200***		***$127,500***	***$550,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$70,000	30%	$21,000	$91,000
6.2	Construction Management		%	5.00%	$50,000	30%	$15,000	$65,000
	Subtotal - Planning, Engineering, & Design				***$120,000***		***$36,000***	***$156,000***
	ESTIMATED REACH TOTAL				**$1,403,000**		**$412,000**	**$1,814,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,549,000**		**$455,000**	**$2,002,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 8 - STA 130+00 TO 136+00

WOOD RODGERS

Alternative 1 - Minor Levee Raise with Waterside and Landside Slope Reconstruction

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Agricultural	1.0	AC	$25,000	$25,000	15%	$3,800	$28,800
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	1.4	AC	$20,000	$28,100	30%	$8,500	$36,600
	Subtotal - Lands				***$78,100***		***$16,100***	***$94,200***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$123,300	30%	$37,000	$160,300
2.2	Environmental Permitting/Planning/Design		LS		$33,800	30%	$10,200	$44,000
	Subtotal - Mitigation				***$157,100***		***$47,200***	***$204,300***
3	**Relocations**							
3.1	Misc Relocation	2.0	EA	$50,000	$100,000	30%	$30,000	$130,000
3.2	Remove and Salvage Ex. Agg. Surfacing	600.0	LF	$10	$6,000	30%	$1,800	$7,800
3.3	Class 2 Aggregate Surfacing	450.0	TON	$35	$15,800	30%	$4,800	$20,600
	Subtotal - Relocations				***$121,800***		***$36,600***	***$158,400***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$63,900	30%	$19,200	$83,100
5.2	Clearing and Grubbing (Levee)	3.0	AC	$5,500	$16,400	30%	$5,000	$21,400
5.3	Stripping (Levee)	3.0	AC	$6,500	$19,400	30%	$5,900	$25,300
5.4	Erosion Control Seeding (Levee)	3.0	AC	$4,000	$12,000	30%	$3,600	$15,600
5.5	Levee Degrading/ Excavation	63,886.7	CY	$9	$543,100	30%	$163,000	$706,100
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	15,595.1	CY	$6	$93,600	30%	$28,100	$121,700
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	15,179.6	CY	$15	$227,700	30%	$68,400	$296,100
5.16	Excavation (Borrow Site)	22,278.7	CY	$5	$111,400	30%	$33,500	$144,900
5.17	Clearing and Grubbing (Borrow Site)	2.8	AC	$5,500	$15,200	30%	$4,600	$19,800
5.18	Stripping (Borrow Site)	2.8	AC	$6,500	$18,000	30%	$5,400	$23,400
5.19	Erosion Control Seeding (Borrow Site)	2.8	AC	$4,000	$11,100	30%	$3,400	$14,500
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	22,278.7	CY	$8	$167,100	30%	$50,200	$217,300
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	450.0	TON	$95	$42,900	30%	$12,900	$55,800
	Subtotal - Levees				***$1,341,800***		***$403,200***	***$1,745,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$102,500	30%	$30,800	$133,300
6.2	Construction Management		%	5.00%	$73,200	30%	$22,000	$95,200
	Subtotal - Planning, Engineering, & Design				***$176,000***		***$53,000***	***$229,000***
	ESTIMATED REACH TOTAL				**$1,875,000**		**$557,000**	**$2,431,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,070,000**		**$615,000**	**$2,683,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 8 - STA 130+00 TO 136+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Agricultural	1.0	AC	$25,000	$25,000	15%	$3,800	$28,800
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	0.1	AC	$20,000	$2,700	30%	$900	$3,600
	Subtotal - Lands				***$52,700***		***$8,500***	***$61,200***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$123,300	30%	$37,000	$160,300
2.2	Environmental Permitting/Planning/Design		LS		$33,800	30%	$10,200	$44,000
	Subtotal - Mitigation				***$157,100***		***$47,200***	***$204,300***
3	**Relocations**							
3.1	Misc Relocation	2.0	EA	$50,000	$100,000	30%	$30,000	$130,000
3.2	Remove and Salvage Ex. Agg. Surfacing	600.0	LF	$10	$6,000	30%	$1,800	$7,800
3.3	Class 2 Aggregate Surfacing	450.0	TON	$35	$15,800	30%	$4,800	$20,600
	Subtotal - Relocations				***$121,800***		***$36,600***	***$158,400***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$3,800	30%	$1,200	$5,000
5.2	Clearing and Grubbing (Levee)	0.4	AC	$5,500	$2,300	30%	$700	$3,000
5.3	Stripping (Levee)	0.4	AC	$6,500	$2,700	30%	$900	$3,600
5.4	Erosion Control Seeding (Levee)	0.4	AC	$4,000	$1,700	30%	$600	$2,300
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	748.9	CY	$6	$4,500	30%	$1,400	$5,900
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	333.3	CY	$15	$5,000	30%	$1,500	$6,500
5.16	Excavation (Borrow Site)	1,069.8	CY	$5	$5,400	30%	$1,700	$7,100
5.17	Clearing and Grubbing (Borrow Site)	0.1	AC	$5,500	$800	30%	$300	$1,100
5.18	Stripping (Borrow Site)	0.1	AC	$6,500	$900	30%	$300	$1,200
5.19	Erosion Control Seeding (Borrow Site)	0.1	AC	$4,000	$600	30%	$200	$800
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	1,069.8	CY	$8	$8,100	30%	$2,500	$10,600
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	450.0	TON	$95	$42,900	30%	$12,900	$55,800
	Subtotal - Levees				***$78,700***		***$24,200***	***$102,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$14,100	30%	$4,300	$18,400
6.2	Construction Management		%	5.00%	$10,100	30%	$3,100	$13,200
	Subtotal - Planning, Engineering, & Design				***$25,000***		***$8,000***	***$32,000***
	ESTIMATED REACH TOTAL				**$436,000**		**$125,000**	**$559,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$481,000**		**$138,000**	**$617,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 9 - STA 136+00 TO 155+00

WOOD RODGERS

Alternative 1 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	4.0	AC	$20,000	$79,300	30%	$23,800	$103,100
1.6	Land Acquisition Soft Costs		%	20%	$16,000	15%	$2,400	$18,400
	Subtotal - Lands				***$95,300***		***$26,200***	***$121,500***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$188,500	30%	$56,600	$245,100
2.2	Environmental Permitting/Planning/Design		LS		$51,600	30%	$15,500	$67,100
	Subtotal - Mitigation				***$240,100***		***$72,100***	***$312,200***
3	**Relocations**							
3.1	6" Pipe Modification	1.0	EA	$125,000	$125,000	30%	$37,500	$162,500
3.2	10" Pipe Modification	1.0	EA	$145,000	$145,000	30%	$43,500	$188,500
3.3	24" Pipe Modification	1.0	EA	$225,000	$225,000	30%	$67,500	$292,500
3.4	Remove and Salvage Ex. Agg. Surfacing	1,900.0	LF	$10	$19,000	30%	$5,700	$24,700
3.5	Class 2 Aggregate Surfacing	1,425.0	TON	$35	$49,900	30%	$15,000	$64,900
	Subtotal - Relocations				***$563,900***		***$169,200***	***$733,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$272,400	30%	$81,800	$354,200
5.2	Clearing and Grubbing (Levee)	4.6	AC	$5,500	$25,300	30%	$7,600	$32,900
5.3	Stripping (Levee)	4.6	AC	$6,500	$29,900	30%	$9,000	$38,900
5.4	Erosion Control Seeding (Levee)	4.6	AC	$4,000	$18,400	30%	$5,600	$24,000
5.5	Levee Degrading/ Excavation	71,897.4	CY	$9	$611,200	30%	$183,400	$794,600
5.6	Inspection Trench Excavation	2,533.3	CY	$9	$21,600	30%	$6,500	$28,100
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	12,145.9	CY	$6	$72,900	30%	$21,900	$94,800
5.9	Clay Cap Fill (Soil Type 1)	10,238.9	CY	$6	$61,500	30%	$18,500	$80,000
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	148,960.0	SF	$25	$3,724,000	30%	$1,117,200	$4,841,200
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	18,908.5	CY	$15	$283,700	30%	$85,200	$368,900
5.16	Excavation (Borrow Site)	31,978.3	CY	$5	$159,900	30%	$48,000	$207,900
5.17	Clearing and Grubbing (Borrow Site)	4.0	AC	$5,500	$21,900	30%	$6,600	$28,500
5.18	Stripping (Borrow Site)	4.0	AC	$6,500	$25,800	30%	$7,800	$33,600
5.19	Erosion Control Seeding (Borrow Site)	4.0	AC	$4,000	$15,900	30%	$4,800	$20,700
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	31,978.3	CY	$8	$239,900	30%	$72,000	$311,900
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	1,425.0	TON	$95	$135,800	30%	$40,800	$176,600
	Subtotal - Levees				***$5,720,100***		***$1,716,700***	***$7,436,800***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$439,900	30%	$132,000	$571,900
6.2	Construction Management		%	5.00%	$314,200	30%	$94,300	$408,500
	Subtotal - Planning, Engineering, & Design				***$755,000***		***$227,000***	***$981,000***
	ESTIMATED REACH TOTAL				**$7,375,000**		**$2,212,000**	**$9,585,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$8,141,000**		**$2,442,000**	**$10,580,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 9 - STA 136+00 TO 155+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.3	AC	$20,000	$25,500	30%	$7,700	$33,200
1.6	Land Acquisition Soft Costs		%	20%	$6,000	15%	$900	$6,900
	Subtotal - Lands				***$31,500***		***$8,600***	***$40,100***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$188,500	30%	$56,600	$245,100
2.2	Environmental Permitting/Planning/Design		LS		$51,600	30%	$15,500	$67,100
	Subtotal - Mitigation				***$240,100***		***$72,100***	***$312,200***
3	**Relocations**							
3.1	6" Pipe Modification	1.0	EA	$125,000	$125,000	30%	$37,500	$162,500
3.2	10" Pipe Modification	1.0	EA	$145,000	$145,000	30%	$43,500	$188,500
3.3	24" Pipe Modification	1.0	EA	$225,000	$225,000	30%	$67,500	$292,500
3.4	Remove and Salvage Ex. Agg. Surfacing	1,900.0	LF	$10	$19,000	30%	$5,700	$24,700
3.5	Class 2 Aggregate Surfacing	1,425.0	TON	$35	$49,900	30%	$15,000	$64,900
	Subtotal - Relocations				***$563,900***		***$169,200***	***$733,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$22,900	30%	$6,900	$29,800
5.2	Clearing and Grubbing (Levee)	4.6	AC	$5,500	$25,300	30%	$7,600	$32,900
5.3	Stripping (Levee)	4.6	AC	$6,500	$29,900	30%	$9,000	$38,900
5.4	Erosion Control Seeding (Levee)	4.6	AC	$4,000	$18,400	30%	$5,600	$24,000
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	7,177.8	CY	$6	$43,100	30%	$13,000	$56,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	3,701.5	CY	$15	$55,600	30%	$16,700	$72,300
5.16	Excavation (Borrow Site)	10,254.0	CY	$5	$51,300	30%	$15,400	$66,700
5.17	Clearing and Grubbing (Borrow Site)	1.3	AC	$5,500	$7,000	30%	$2,100	$9,100
5.18	Stripping (Borrow Site)	1.3	AC	$6,500	$8,300	30%	$2,500	$10,800
5.19	Erosion Control Seeding (Borrow Site)	1.3	AC	$4,000	$5,100	30%	$1,600	$6,700
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	10,254.0	CY	$8	$77,000	30%	$23,100	$100,100
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	1,425.0	TON	$95	$135,800	30%	$40,800	$176,600
	Subtotal - Levees				***$479,700***		***$144,300***	***$624,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$73,100	30%	$22,000	$95,100
6.2	Construction Management		%	5.00%	$52,200	30%	$15,700	$67,900
	Subtotal - Planning, Engineering, & Design				***$126,000***		***$38,000***	***$163,000***
	ESTIMATED REACH TOTAL				**$1,442,000**		**$433,000**	**$1,873,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,592,000**		**$478,000**	**$2,067,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Yolo Bypass East Levee
REACH 10 - STA 155+00 TO 197+55

WOOD RODGERS

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	2.2	AC	$20,000	$44,200	30%	$13,300	$57,500
1.6	Land Acquisition Soft Costs		%	20%	$9,000	15%	$1,400	$10,400
	Subtotal - Lands				***$53,200***		***$14,700***	***$67,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$22,000	30%	$6,600	$28,600
2.2	Environmental Permitting/Planning/Design		LS		$6,100	30%	$1,900	$8,000
	Subtotal - Mitigation				***$28,100***		***$8,500***	***$36,600***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	4,255.0	LF	$10	$42,600	30%	$12,800	$55,400
3.6	Class 2 Aggregate Surfacing	3,191.3	TON	$35	$111,700	30%	$33,600	$145,300
	Subtotal - Relocations				***$154,300***		***$46,400***	***$200,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$38,400	30%	$11,600	$50,000
5.2	Clearing and Grubbing (Levee)	4.6	AC	$5,500	$25,400	30%	$7,700	$33,100
5.3	Stripping (Levee)	4.6	AC	$6,500	$30,000	30%	$9,000	$39,000
5.4	Erosion Control Seeding (Levee)	4.6	AC	$4,000	$18,500	30%	$5,600	$24,100
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	12,457.7	CY	$6	$74,800	30%	$22,500	$97,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	3,711.3	CY	$15	$55,700	30%	$16,800	$72,500
5.16	Excavation (Borrow Site)	17,796.7	CY	$5	$89,000	30%	$26,700	$115,700
5.17	Clearing and Grubbing (Borrow Site)	2.2	AC	$5,500	$12,200	30%	$3,700	$15,900
5.18	Stripping (Borrow Site)	2.2	AC	$6,500	$14,400	30%	$4,400	$18,800
5.19	Erosion Control Seeding (Borrow Site)	2.2	AC	$4,000	$8,900	30%	$2,700	$11,600
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	17,796.7	CY	$8	$133,500	30%	$40,100	$173,600
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	3,191.3	TON	$95	$304,000	30%	$91,200	$395,200
	Subtotal - Levees				***$804,800***		***$242,000***	***$1,046,800***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$67,200	30%	$20,200	$87,400
6.2	Construction Management		%	5.00%	$48,000	30%	$14,400	$62,400
	Subtotal - Planning, Engineering, & Design				***$116,000***		***$35,000***	***$150,000***
	ESTIMATED REACH TOTAL				**$1,157,000**		**$347,000**	**$1,502,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,277,000**		**$383,000**	**$1,658,000**

South Cross Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
South Cross Levee
REACH 1 - STA 0+00 TO 65+00

WOOD RODGERS

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	2.3	AC	$100,000	$234,200	15%	$35,200	$269,400
1.2	Land Acquisition (Agricultural)	2.1	AC	$45,000	$96,100	15%	$14,500	$110,600
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Borrow Site Royalties	17.4	AC	$20,000	$348,300	30%	$104,500	$452,800
1.5	Land Acquisition Soft Costs		%	20%	$136,000	15%	$20,400	$156,400
	Subtotal - Lands				***$814,600***		***$174,600***	***$989,200***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$386,100	30%	$115,900	$502,000
2.2	Environmental Permitting/Planning/Design		LS		$105,700	30%	$31,800	$137,500
	Subtotal - Mitigation				***$491,800***		***$147,700***	***$639,500***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	6,500.0	LF	$10	$65,000	30%	$19,500	$84,500
3.6	Class 2 Aggregate Surfacing	4,875.0	TON	$35	$170,700	30%	$51,300	$222,000
3.7	Asphalt Concrete (3.5")	0.0	TON	$90	$0	30%	$0	$0
3.8	Catch Basin	0.0	EA	$2,000	$0	30%	$0	$0
3.9	Remove Abandoned 4" Gas Line Along Levee	2,275.0	LF	$35	$79,700	30%	$24,000	$103,700
3.10	Fence/Gate Modification	5.0	EA	$5,000	$25,000	30%	$7,500	$32,500
3.11	12" Sewer Modification	1.0	EA	$150,000	$150,000	30%	$45,000	$195,000
3.12	Abandon 36" Bore Casing	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
3.13	Abandon 30" Sewer	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
	Subtotal - Relocations				***$570,400***		***$171,300***	***$741,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$340,800	30%	$102,300	$443,100
5.2	Clearing and Grubbing (Levee)	13.6	AC	$5,500	$75,000	30%	$22,500	$97,500
5.3	Stripping (Levee)	13.6	AC	$6,500	$88,600	30%	$26,600	$115,200
5.4	Erosion Control Seeding (Levee)	13.6	AC	$4,000	$54,500	30%	$16,400	$70,900
5.5	Levee Degrading/ Excavation	32,488.0	CY	$9	$276,200	30%	$82,900	$359,100
5.6	Inspection Trench Excavation	8,666.7	CY	$9	$73,700	30%	$22,200	$95,900
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	77,000.3	CY	$6	$462,100	30%	$138,700	$600,800
5.9	Clay Cap Fill (Soil Type 1)	21,329.6	CY	$6	$128,000	30%	$38,400	$166,400
5.10	Cutoff Wall <75' (Soil Bentonite)	377,000.0	SF	$10	$3,770,000	30%	$1,131,000	$4,901,000
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	19,581.9	CY	$15	$293,800	30%	$88,200	$382,000
5.16	Excavation (Borrow Site)	140,471.4	CY	$5	$702,400	30%	$210,800	$913,200
5.17	Clearing and Grubbing (Borrow Site)	17.4	AC	$5,500	$95,800	30%	$28,800	$124,600
5.18	Stripping (Borrow Site)	17.4	AC	$6,500	$113,200	30%	$34,000	$147,200
5.19	Erosion Control Seeding (Borrow Site)	17.4	AC	$4,000	$69,700	30%	$21,000	$90,700
5.20	Hauling Level 1 (< 5 miles)	140,471.4	CY	$4	$611,100	30%	$183,400	$794,500
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$7,154,900***		***$2,147,200***	***$9,302,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$540,800	30%	$162,300	$703,100
6.2	Construction Management		%	5.00%	$386,300	30%	$115,900	$502,200
	Subtotal - Planning, Engineering, & Design				***$928,000***		***$279,000***	***$1,206,000***
	ESTIMATED REACH TOTAL				**$9,960,000**		**$2,920,000**	**$12,879,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$10,994,000**		**$3,223,000**	**$14,216,000**

West Sacramento Flood Engineering Services
Alternative Analysis
South Cross Levee
REACH 1 - STA 0+00 TO 65+00

WOOD RODGERS

Alternative 2 - Levee Raise with Seepage Berm

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	8.9	AC	$100,000	$891,400	15%	$133,800	$1,025,200
1.2	Land Acquisition (Agricultural)	8.1	AC	$45,000	$365,800	15%	$54,900	$420,700
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Borrow Site Royalties	27.8	AC	$20,000	$556,900	30%	$167,100	$724,000
1.5	Residential Structure Acquisition	1.0	EA	$750,000	$750,000	15%	$112,500	$862,500
1.6	Agricultural Improvement Demoltion/Acquisition	1.0	EA	$300,000	$300,000	15%	$45,000	$345,000
1.7	Land Acquisition Soft Costs		%	20%	$573,000	15%	$86,000	$659,000
	Subtotal - Lands				***$3,437,100***		***$599,300***	***$4,036,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$1,469,400	30%	$440,900	$1,910,300
2.2	Environmental Permitting/Planning/Design		LS		$401,900	30%	$120,600	$522,500
	Subtotal - Mitigation				***$1,871,300***		***$561,500***	***$2,432,800***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	6,500.0	LF	$10	$65,000	30%	$19,500	$84,500
3.6	Class 2 Aggregate Surfacing	4,875.0	TON	$35	$170,700	30%	$51,300	$222,000
3.7	Asphalt Concrete (3.5")	0.0	TON	$90	$0	30%	$0	$0
3.8	Catch Basin	0.0	EA	$2,000	$0	30%	$0	$0
3.9	Remove Abandoned 4" Gas Line Along Levee	2,275.0	LF	$35	$79,700	30%	$24,000	$103,700
3.10	Fence/Gate Modification	5.0	EA	$5,000	$25,000	30%	$7,500	$32,500
3.11	12" Sewer Modification	1.0	EA	$150,000	$150,000	30%	$45,000	$195,000
3.12	Abandon 36" Bore Casing	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
3.13	Abandon 30" Sewer	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
	Subtotal - Relocations				***$570,400***		***$171,300***	***$741,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$473,300	30%	$142,000	$615,300
5.2	Clearing and Grubbing (Levee)	26.0	AC	$5,500	$142,900	30%	$42,900	$185,800
5.3	Stripping (Levee)	26.0	AC	$6,500	$168,900	30%	$50,700	$219,600
5.4	Erosion Control Seeding (Levee)	26.0	AC	$4,000	$104,000	30%	$31,200	$135,200
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	57,513.0	CY	$6	$345,100	30%	$103,600	$448,700
5.8	Levee Embankment Fill (Soil Type 2)	99,704.6	CY	$6	$598,300	30%	$179,500	$777,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	99,840.0	TON	$45	$4,492,800	30%	$1,347,900	$5,840,700
5.13	Sand Filter Layer	12,085.2	TON	$45	$543,900	30%	$163,200	$707,100
5.14	Filter Fabric	69,766.7	SY	$3	$209,300	30%	$62,800	$272,100
5.15	Haul and Dispose of Unsuitable Material	20,956.5	CY	$15	$314,400	30%	$94,400	$408,800
5.16	Excavation (Borrow Site)	224,596.5	CY	$5	$1,123,000	30%	$336,900	$1,459,900
5.17	Clearing and Grubbing (Borrow Site)	27.8	AC	$5,500	$153,200	30%	$46,000	$199,200
5.18	Stripping (Borrow Site)	27.8	AC	$6,500	$181,000	30%	$54,300	$235,300
5.19	Erosion Control Seeding (Borrow Site)	27.8	AC	$4,000	$111,400	30%	$33,500	$144,900
5.20	Hauling Level 1 (< 5 miles)	224,596.5	CY	$4	$977,000	30%	$293,100	$1,270,100
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$760,000***		***$116,000***	***$876,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$93,200	30%	$28,000	$121,200
6.2	Construction Management		%	5.00%	$66,600	30%	$20,000	$86,600
	Subtotal - Planning, Engineering, & Design				***$160,000***		***$48,000***	***$208,000***
	ESTIMATED REACH TOTAL				**$6,798,800**		**$1,496,100**	**$8,294,900**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$7,505,000**		**$1,651,000**	**$9,156,000**

West Sacramento Flood Engineering Services
Alternative Analysis
South Cross Levee
REACH 1 - STA 0+00 TO 65+00

Alternative 3 - Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	2.3	AC	$100,000	$234,200	15%	$35,200	$269,400
1.2	Land Acquisition (Agricultural)	2.1	AC	$45,000	$96,100	15%	$14,500	$110,600
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Borrow Site Royalties	15.9	AC	$20,000	$317,900	30%	$95,400	$413,300
1.5	Land Acquisition Soft Costs		%	20%	$130,000	15%	$19,500	$149,500
	Subtotal - Lands				***$778,200***		***$164,600***	***$942,800***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$386,100	30%	$115,900	$502,000
2.2	Environmental Permitting/Planning/Design		LS		$105,700	30%	$31,800	$137,500
	Subtotal - Mitigation				***$491,800***		***$147,700***	***$639,500***
3	**Relocations**							
3.1	Utility Pole Relocation	2.0	EA	$30,000	$60,000	30%	$18,000	$78,000
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	6,500.0	LF	$10	$65,000	30%	$19,500	$84,500
3.6	Class 2 Aggregate Surfacing	4,875.0	TON	$35	$170,700	30%	$51,300	$222,000
3.7	Asphalt Concrete (3.5")	0.0	TON	$90	$0	30%	$0	$0
3.8	Catch Basin	0.0	EA	$2,000	$0	30%	$0	$0
3.9	Remove Abandoned 4" Gas Line Along Levee	2,275.0	LF	$35	$79,700	30%	$24,000	$103,700
3.10	Fence/Gate Modification	5.0	EA	$5,000	$25,000	30%	$7,500	$32,500
3.11	12" Sewer Modification	1.0	EA	$150,000	$150,000	30%	$45,000	$195,000
3.12	Abandon 36" Bore Casing	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
3.13	Abandon 30" Sewer	1.0	EA	$10,000	$10,000	30%	$3,000	$13,000
	Subtotal - Relocations				***$570,400***		***$171,300***	***$741,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$118,800	30%	$35,700	$154,500
5.2	Clearing and Grubbing (Levee)	13.6	AC	$5,500	$75,000	30%	$22,500	$97,500
5.3	Stripping (Levee)	13.6	AC	$6,500	$88,600	30%	$26,600	$115,200
5.4	Erosion Control Seeding (Levee)	13.6	AC	$4,000	$54,500	30%	$16,400	$70,900
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	89,737.9	CY	$6	$538,500	30%	$161,600	$700,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	10,989.8	CY	$15	$164,900	30%	$49,500	$214,400
5.16	Excavation (Borrow Site)	128,197.0	CY	$5	$641,000	30%	$192,300	$833,300
5.17	Clearing and Grubbing (Borrow Site)	15.9	AC	$5,500	$87,500	30%	$26,300	$113,800
5.18	Stripping (Borrow Site)	15.9	AC	$6,500	$103,300	30%	$31,000	$134,300
5.19	Erosion Control Seeding (Borrow Site)	15.9	AC	$4,000	$63,600	30%	$19,100	$82,700
5.20	Hauling Level 1 (< 5 miles)	128,197.0	CY	$4	$557,700	30%	$167,400	$725,100
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$2,493,400***		***$748,400***	***$3,241,800***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$214,500	30%	$64,400	$278,900
6.2	Construction Management		%	5.00%	$153,200	30%	$46,000	$199,200
	Subtotal - Planning, Engineering, & Design				***$368,000***		***$111,000***	***$479,000***
	ESTIMATED REACH TOTAL				**$4,702,000**		**$1,343,000**	**$6,045,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,190,000**		**$1,482,000**	**$6,673,000**

DWSC West Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 1 - STA 0+00 TO 35+00

WOOD RODGERS

Alternative 1 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	12.9	AC	$20,000	$257,800	30%	$77,400	$335,200
1.2	Land Acquisition Soft Costs		%	20%	$52,000	15%	$7,800	$59,800
	Subtotal - Lands				***$309,800***		***$85,200***	***$395,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$136,000	30%	$40,800	$176,800
2.2	Environmental Permitting/Planning/Design		LS		$37,200	30%	$11,200	$48,400
	Subtotal - Mitigation				***$173,200***		***$52,000***	***$225,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	3,500.0	LF	$10	$35,000	30%	$10,500	$45,500
3.2	Class 2 Aggregate Surfacing	2,625.0	TON	$35	$91,900	30%	$27,600	$119,500
	Subtotal - Relocations				***$126,900***		***$38,100***	***$165,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$629,800	30%	$189,000	$818,800
5.2	Clearing and Grubbing (Levee)	5.5	AC	$5,500	$30,500	30%	$9,200	$39,700
5.3	Stripping (Levee)	5.5	AC	$6,500	$36,100	30%	$10,900	$47,000
5.4	Erosion Control Seeding (Levee)	5.5	AC	$4,000	$22,200	30%	$6,700	$28,900
5.5	Levee Degrading/ Excavation	18,381.5	CY	$9	$156,300	30%	$46,900	$203,200
5.6	Inspection Trench Excavation	4,666.7	CY	$9	$39,700	30%	$12,000	$51,700
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	60,470.9	CY	$6	$362,900	30%	$108,900	$471,800
5.9	Clay Cap Fill (Soil Type 1)	12,288.9	CY	$6	$73,800	30%	$22,200	$96,000
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	322,700.0	SF	$25	$8,067,500	30%	$2,420,300	$10,487,800
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	103,942.6	CY	$5	$519,800	30%	$156,000	$675,800
5.17	Clearing and Grubbing (Borrow Site)	12.9	AC	$5,500	$70,900	30%	$21,300	$92,200
5.18	Stripping (Borrow Site)	12.9	AC	$6,500	$83,800	30%	$25,200	$109,000
5.19	Erosion Control Seeding (Borrow Site)	12.9	AC	$4,000	$51,600	30%	$15,500	$67,100
5.20	Hauling Level 1 (< 5 miles)	103,942.6	CY	$4	$452,200	30%	$135,700	$587,900
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	4.0	AC	$32,000	$128,000	30%	$38,400	$166,400
5.24	Rock Slope Protection	26,250.0	TON	$95	$2,500,400	30%	$750,200	$3,250,600
	Subtotal - Levees				***$13,225,500***		***$3,968,400***	***$17,193,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$934,700	30%	$280,500	$1,215,200
6.2	Construction Management		%	5.00%	$667,700	30%	$200,400	$868,100
	Subtotal - Planning, Engineering, & Design				***$1,603,000***		***$481,000***	***$2,084,000***
	ESTIMATED REACH TOTAL				**$15,439,000**		**$4,625,000**	**$20,064,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$17,042,000**		**$5,105,000**	**$22,147,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 1 - STA 0+00 TO 35+00

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	11.9	AC	$20,000	$238,400	30%	$71,600	$310,000
1.2	Land Acquisition Soft Costs		%	20%	$48,000	15%	$7,200	$55,200
	Subtotal - Lands				***$286,400***		***$78,800***	***$365,200***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$136,000	30%	$40,800	$176,800
2.2	Environmental Permitting/Planning/Design		LS		$37,200	30%	$11,200	$48,400
	Subtotal - Mitigation				***$173,200***		***$52,000***	***$225,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	3,500.0	LF	$10	$35,000	30%	$10,500	$45,500
3.2	Class 2 Aggregate Surfacing	2,625.0	TON	$35	$91,900	30%	$27,600	$119,500
	Subtotal - Relocations				***$126,900***		***$38,100***	***$165,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$210,600	30%	$63,200	$273,800
5.2	Clearing and Grubbing (Levee)	5.5	AC	$5,500	$30,500	30%	$9,200	$39,700
5.3	Stripping (Levee)	5.5	AC	$6,500	$36,100	30%	$10,900	$47,000
5.4	Erosion Control Seeding (Levee)	5.5	AC	$4,000	$22,200	30%	$6,700	$28,900
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	67,290.7	CY	$6	$403,800	30%	$121,200	$525,000
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	96,129.6	CY	$5	$480,700	30%	$144,300	$625,000
5.17	Clearing and Grubbing (Borrow Site)	11.9	AC	$5,500	$65,600	30%	$19,700	$85,300
5.18	Stripping (Borrow Site)	11.9	AC	$6,500	$77,500	30%	$23,300	$100,800
5.19	Erosion Control Seeding (Borrow Site)	11.9	AC	$4,000	$47,700	30%	$14,400	$62,100
5.20	Hauling Level 1 (< 5 miles)	96,129.6	CY	$4	$418,200	30%	$125,500	$543,700
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	4.0	AC	$32,000	$128,000	30%	$38,400	$166,400
5.24	Rock Slope Protection	26,250.0	TON	$95	$2,500,400	30%	$750,200	$3,250,600
	Subtotal - Levees				***$4,421,300***		***$1,327,000***	***$5,748,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$318,400	30%	$95,600	$414,000
6.2	Construction Management		%	5.00%	$227,500	30%	$68,300	$295,800
	Subtotal - Planning, Engineering, & Design				***$546,000***		***$164,000***	***$710,000***
	ESTIMATED REACH TOTAL				**$5,554,000**		**$1,660,000**	**$7,214,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$6,131,000**		**$1,832,000**	**$7,963,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 2 - STA 35+00 TO 60+00

WOOD RODGERS

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	3.6	AC	$20,000	$71,600	30%	$21,500	$93,100
1.2	Land Acquisition Soft Costs		%	20%	$15,000	15%	$2,300	$17,300
	Subtotal - Lands				***$86,600***		***$23,800***	***$110,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$101,100	30%	$30,400	$131,500
2.2	Environmental Permitting/Planning/Design		LS		$27,700	30%	$8,400	$36,100
	Subtotal - Mitigation				***$128,800***		***$38,800***	***$167,600***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,500.0	LF	$10	$25,000	30%	$7,500	$32,500
3.2	Class 2 Aggregate Surfacing	1,875.0	TON	$35	$65,700	30%	$19,800	$85,500
	Subtotal - Relocations				***$90,700***		***$27,300***	***$118,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$118,700	30%	$35,700	$154,400
5.2	Clearing and Grubbing (Levee)	2.7	AC	$5,500	$14,800	30%	$4,500	$19,300
5.3	Stripping (Levee)	2.7	AC	$6,500	$17,500	30%	$5,300	$22,800
5.4	Erosion Control Seeding (Levee)	2.7	AC	$4,000	$10,800	30%	$3,300	$14,100
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	20,194.4	CY	$6	$121,200	30%	$36,400	$157,600
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	28,849.2	CY	$5	$144,300	30%	$43,300	$187,600
5.17	Clearing and Grubbing (Borrow Site)	3.6	AC	$5,500	$19,700	30%	$6,000	$25,700
5.18	Stripping (Borrow Site)	3.6	AC	$6,500	$23,300	30%	$7,000	$30,300
5.19	Erosion Control Seeding (Borrow Site)	3.6	AC	$4,000	$14,400	30%	$4,400	$18,800
5.20	Hauling Level 1 (< 5 miles)	28,849.2	CY	$4	$125,500	30%	$37,700	$163,200
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	3.0	AC	$32,000	$96,000	30%	$28,800	$124,800
5.24	Rock Slope Protection	18,750.0	TON	$95	$1,786,000	30%	$535,800	$2,321,800
	Subtotal - Levees				***$2,492,200***		***$748,200***	***$3,240,400***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$180,900	30%	$54,300	$235,200
6.2	Construction Management		%	5.00%	$129,200	30%	$38,800	$168,000
	Subtotal - Planning, Engineering, & Design				***$311,000***		***$94,000***	***$404,000***
	ESTIMATED REACH TOTAL				**$3,110,000**		**$933,000**	**$4,041,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,433,000**		**$1,030,000**	**$4,461,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 3 - STA 60+00 TO 111+00

Alternative 1 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	8.2	AC	$20,000	$164,200	30%	$49,300	$213,500
1.2	Land Acquisition Soft Costs		%	20%	$33,000	15%	$5,000	$38,000
	Subtotal - Lands				***$197,200***		***$54,300***	***$251,500***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$135,300	30%	$40,600	$175,900
2.2	Environmental Permitting/Planning/Design		LS		$37,100	30%	$11,200	$48,300
	Subtotal - Mitigation				***$172,400***		***$51,800***	***$224,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	5,100.0	LF	$10	$51,000	30%	$15,300	$66,300
3.2	Class 2 Aggregate Surfacing	3,825.0	TON	$35	$133,900	30%	$40,200	$174,100
	Subtotal - Relocations				***$184,900***		***$55,500***	***$240,400***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$829,400	30%	$248,900	$1,078,300
5.2	Clearing and Grubbing (Levee)	8.2	AC	$5,500	$45,100	30%	$13,600	$58,700
5.3	Stripping (Levee)	8.2	AC	$6,500	$53,200	30%	$16,000	$69,200
5.4	Erosion Control Seeding (Levee)	8.2	AC	$4,000	$32,800	30%	$9,900	$42,700
5.5	Levee Degrading/ Excavation	45,966.1	CY	$9	$390,800	30%	$117,300	$508,100
5.6	Inspection Trench Excavation	6,800.0	CY	$9	$57,800	30%	$17,400	$75,200
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	28,598.7	CY	$6	$171,600	30%	$51,500	$223,100
5.9	Clay Cap Fill (Soil Type 1)	17,755.6	CY	$6	$106,600	30%	$32,000	$138,600
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	448,290.0	SF	$25	$11,207,300	30%	$3,362,200	$14,569,500
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	66,220.4	CY	$5	$331,200	30%	$99,400	$430,600
5.17	Clearing and Grubbing (Borrow Site)	8.2	AC	$5,500	$45,200	30%	$13,600	$58,800
5.18	Stripping (Borrow Site)	8.2	AC	$6,500	$53,400	30%	$16,100	$69,500
5.19	Erosion Control Seeding (Borrow Site)	8.2	AC	$4,000	$32,900	30%	$9,900	$42,800
5.20	Hauling Level 1 (< 5 miles)	66,220.4	CY	$4	$288,100	30%	$86,500	$374,600
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	4.0	AC	$32,000	$128,000	30%	$38,400	$166,400
5.24	Rock Slope Protection	38,250.0	TON	$95	$3,643,400	30%	$1,093,100	$4,736,500
	Subtotal - Levees				***$17,416,800***		***$5,225,800***	***$22,642,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$1,232,200	30%	$369,700	$1,601,900
6.2	Construction Management		%	5.00%	$880,100	30%	$264,100	$1,144,200
	Subtotal - Planning, Engineering, & Design				***$2,113,000***		***$634,000***	***$2,747,000***
	ESTIMATED REACH TOTAL				**$20,085,000**		**$6,022,000**	**$26,106,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$22,170,000**		**$6,647,000**	**$28,816,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 3 - STA 60+00 TO 111+00

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	5.7	AC	$20,000	$114,200	30%	$34,300	$148,500
1.2	Land Acquisition Soft Costs		%	20%	$23,000	15%	$3,500	$26,500
	Subtotal - Lands				***$137,200***		***$37,800***	***$175,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$135,300	30%	$40,600	$175,900
2.2	Environmental Permitting/Planning/Design		LS		$37,100	30%	$11,200	$48,300
	Subtotal - Mitigation				***$172,400***		***$51,800***	***$224,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	5,100.0	LF	$10	$51,000	30%	$15,300	$66,300
3.2	Class 2 Aggregate Surfacing	3,825.0	TON	$35	$133,900	30%	$40,200	$174,100
	Subtotal - Relocations				***$184,900***		***$55,500***	***$240,400***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$171,700	30%	$51,600	$223,300
5.2	Clearing and Grubbing (Levee)	5.6	AC	$5,500	$30,900	30%	$9,300	$40,200
5.3	Stripping (Levee)	5.6	AC	$6,500	$36,600	30%	$11,000	$47,600
5.4	Erosion Control Seeding (Levee)	5.6	AC	$4,000	$22,500	30%	$6,800	$29,300
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	32,221.7	CY	$6	$193,400	30%	$58,100	$251,500
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	46,031.0	CY	$5	$230,200	30%	$69,100	$299,300
5.17	Clearing and Grubbing (Borrow Site)	5.7	AC	$5,500	$31,400	30%	$9,500	$40,900
5.18	Stripping (Borrow Site)	5.7	AC	$6,500	$37,100	30%	$11,200	$48,300
5.19	Erosion Control Seeding (Borrow Site)	5.7	AC	$4,000	$22,900	30%	$6,900	$29,800
5.20	Hauling Level 1 (< 5 miles)	46,031.0	CY	$4	$200,300	30%	$60,100	$260,400
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	4.0	AC	$32,000	$128,000	30%	$38,400	$166,400
5.24	Rock Slope Protection	26,250.0	TON	$95	$2,500,400	30%	$750,200	$3,250,600
	Subtotal - Levees				***$3,605,400***		***$1,082,200***	***$4,687,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$265,400	30%	$79,700	$345,100
6.2	Construction Management		%	5.00%	$189,600	30%	$56,900	$246,500
	Subtotal - Planning, Engineering, & Design				***$455,000***		***$137,000***	***$592,000***
	ESTIMATED REACH TOTAL				**$4,555,000**		**$1,365,000**	**$5,920,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,028,000**		**$1,507,000**	**$6,535,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 4 - STA 111+00 to 145+00

WOOD RODGERS

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	0.5	AC	$20,000	$10,800	30%	$3,300	$14,100
1.2	Land Acquisition Soft Costs		%	20%	$3,000	15%	$500	$3,500
	Subtotal - Lands				***$13,800***		***$3,800***	***$17,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$128,800	30%	$38,700	$167,500
2.2	Environmental Permitting/Planning/Design		LS		$35,300	30%	$10,600	$45,900
	Subtotal - Mitigation				***$164,100***		***$49,300***	***$213,400***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	3,400.0	LF	$10	$34,000	30%	$10,200	$44,200
3.2	Class 2 Aggregate Surfacing	2,550.0	TON	$35	$89,300	30%	$26,800	$116,100
	Subtotal - Relocations				***$123,300***		***$37,000***	***$160,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$136,200	30%	$40,900	$177,100
5.2	Clearing and Grubbing (Levee)	2.2	AC	$5,500	$12,100	30%	$3,700	$15,800
5.3	Stripping (Levee)	2.2	AC	$6,500	$14,300	30%	$4,300	$18,600
5.4	Erosion Control Seeding (Levee)	2.2	AC	$4,000	$8,800	30%	$2,700	$11,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	3,022.2	CY	$6	$18,200	30%	$5,500	$23,700
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	4,317.5	CY	$5	$21,600	30%	$6,500	$28,100
5.17	Clearing and Grubbing (Borrow Site)	0.5	AC	$5,500	$3,000	30%	$900	$3,900
5.18	Stripping (Borrow Site)	0.5	AC	$6,500	$3,500	30%	$1,100	$4,600
5.19	Erosion Control Seeding (Borrow Site)	0.5	AC	$4,000	$2,200	30%	$700	$2,900
5.20	Hauling Level 1 (< 5 miles)	4,317.5	CY	$4	$18,800	30%	$5,700	$24,500
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	6.0	AC	$32,000	$192,000	30%	$57,600	$249,600
5.24	Rock Slope Protection	25,500.0	TON	$95	$2,428,900	30%	$728,700	$3,157,600
	Subtotal - Levees				***$2,859,600***		***$858,300***	***$3,717,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$208,900	30%	$62,700	$271,600
6.2	Construction Management		%	5.00%	$149,200	30%	$44,800	$194,000
	Subtotal - Planning, Engineering, & Design				***$359,000***		***$108,000***	***$466,000***
	ESTIMATED REACH TOTAL				**$3,520,000**		**$1,057,000**	**$4,576,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,885,000**		**$1,167,000**	**$5,051,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 5 - STA 145+00 TO 165+00

WOOD RODGERS

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	2.6	AC	$20,000	$52,700	30%	$15,900	$68,600
1.2	Land Acquisition Soft Costs		%	20%	$11,000	15%	$1,700	$12,700
	Subtotal - Lands				***$63,700***		***$17,600***	***$81,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$60,700	30%	$18,300	$79,000
2.2	Environmental Permitting/Planning/Design		LS		$16,700	30%	$5,100	$21,800
	Subtotal - Mitigation				***$77,400***		***$23,400***	***$100,800***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,000.0	LF	$10	$20,000	30%	$6,000	$26,000
3.2	Class 2 Aggregate Surfacing	1,500.0	TON	$35	$52,500	30%	$15,800	$68,300
	Subtotal - Relocations				***$72,500***		***$21,800***	***$94,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$160,800	30%	$48,300	$209,100
5.2	Clearing and Grubbing (Levee)	1.6	AC	$5,500	$9,100	30%	$2,800	$11,900
5.3	Stripping (Levee)	1.6	AC	$6,500	$10,700	30%	$3,300	$14,000
5.4	Erosion Control Seeding (Levee)	1.6	AC	$4,000	$6,600	30%	$2,000	$8,600
5.5	Levee Degrading/ Excavation	16,581.5	CY	$9	$141,000	30%	$42,300	$183,300
5.6	Inspection Trench Excavation	2,666.7	CY	$9	$22,700	30%	$6,900	$29,600
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	8,497.4	CY	$6	$51,000	30%	$15,300	$66,300
5.9	Clay Cap Fill (Soil Type 1)	6,363.0	CY	$6	$38,200	30%	$11,500	$49,700
5.10	Cutoff Wall <75' (Soil Bentonite)	118,600.0	SF	$10	$1,186,000	30%	$355,800	$1,541,800
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	21,229.1	CY	$5	$106,200	30%	$31,900	$138,100
5.17	Clearing and Grubbing (Borrow Site)	2.6	AC	$5,500	$14,500	30%	$4,400	$18,900
5.18	Stripping (Borrow Site)	2.6	AC	$6,500	$17,200	30%	$5,200	$22,400
5.19	Erosion Control Seeding (Borrow Site)	2.6	AC	$4,000	$10,600	30%	$3,200	$13,800
5.20	Hauling Level 1 (< 5 miles)	21,229.1	CY	$4	$92,400	30%	$27,800	$120,200
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	2.5	AC	$32,000	$80,000	30%	$24,000	$104,000
5.24	Rock Slope Protection	15,000.0	TON	$95	$1,428,800	30%	$428,700	$1,857,500
	Subtotal - Levees				***$3,375,800***		***$1,013,400***	***$4,389,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$241,400	30%	$72,500	$313,900
6.2	Construction Management		%	5.00%	$172,500	30%	$51,800	$224,300
	Subtotal - Planning, Engineering, & Design				***$414,000***		***$125,000***	***$539,000***
	ESTIMATED REACH TOTAL				**$4,004,000**		**$1,202,000**	**$5,205,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$4,420,000**		**$1,327,000**	**$5,745,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 5 - STA 145+00 TO 165+00

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.9	AC	$20,000	$38,600	30%	$11,600	$50,200
1.6	Land Acquisition Soft Costs		%	20%	$8,000	15%	$1,200	$9,200
	Subtotal - Lands				***$46,600***		***$12,800***	***$59,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$60,700	30%	$18,300	$79,000
2.2	Environmental Permitting/Planning/Design		LS		$16,700	30%	$5,100	$21,800
	Subtotal - Mitigation				***$77,400***		***$23,400***	***$100,800***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,000.0	LF	$10	$20,000	30%	$6,000	$26,000
3.2	Class 2 Aggregate Surfacing	1,500.0	TON	$35	$52,500	30%	$15,800	$68,300
	Subtotal - Relocations				***$72,500***		***$21,800***	***$94,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$91,400	30%	$27,500	$118,900
5.2	Clearing and Grubbing (Levee)	1.6	AC	$5,500	$9,100	30%	$2,800	$11,900
5.3	Stripping (Levee)	1.6	AC	$6,500	$10,700	30%	$3,300	$14,000
5.4	Erosion Control Seeding (Levee)	1.6	AC	$4,000	$6,600	30%	$2,000	$8,600
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	10,885.2	CY	$6	$65,400	30%	$19,700	$85,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	15,550.3	CY	$5	$77,800	30%	$23,400	$101,200
5.17	Clearing and Grubbing (Borrow Site)	1.9	AC	$5,500	$10,700	30%	$3,300	$14,000
5.18	Stripping (Borrow Site)	1.9	AC	$6,500	$12,600	30%	$3,800	$16,400
5.19	Erosion Control Seeding (Borrow Site)	1.9	AC	$4,000	$7,800	30%	$2,400	$10,200
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	15,550.3	CY	$8	$116,700	30%	$35,100	$151,800
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	2.5	AC	$32,000	$80,000	30%	$24,000	$104,000
5.54	Rock Slope Protection	15,000.0	TON	$95	$1,428,800	30%	$428,700	$1,857,500
	Subtotal - Levees				***$1,917,600***		***$576,000***	***$2,493,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$139,400	30%	$41,900	$181,300
6.2	Construction Management		%	5.00%	$99,600	30%	$29,900	$129,500
	Subtotal - Planning, Engineering, & Design				***$239,000***		***$72,000***	***$311,000***
	ESTIMATED REACH TOTAL				**$2,354,000**		**$706,000**	**$3,060,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,598,000**		**$779,000**	**$3,378,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 6 - STA 165+00 TO 202+00

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	3.3	AC	$20,000	$66,800	30%	$20,100	$86,900
1.6	Land Acquisition Soft Costs		%	20%	$14,000	15%	$2,100	$16,100
	Subtotal - Lands				***$80,800***		***$22,200***	***$103,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$121,500	30%	$36,500	$158,000
2.2	Environmental Permitting/Planning/Design		LS		$33,300	30%	$10,000	$43,300
	Subtotal - Mitigation				***$154,800***		***$46,500***	***$201,300***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	3,700.0	LF	$10	$37,000	30%	$11,100	$48,100
3.2	Class 2 Aggregate Surfacing	2,775.0	TON	$35	$97,200	30%	$29,200	$126,400
	Subtotal - Relocations				***$134,200***		***$40,300***	***$174,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$161,900	30%	$48,600	$210,500
5.2	Clearing and Grubbing (Levee)	2.4	AC	$5,500	$13,300	30%	$4,000	$17,300
5.3	Stripping (Levee)	2.4	AC	$6,500	$15,700	30%	$4,800	$20,500
5.4	Erosion Control Seeding (Levee)	2.4	AC	$4,000	$9,700	30%	$3,000	$12,700
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	18,849.4	CY	$6	$113,100	30%	$34,000	$147,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	26,927.8	CY	$5	$134,700	30%	$40,500	$175,200
5.17	Clearing and Grubbing (Borrow Site)	3.3	AC	$5,500	$18,400	30%	$5,600	$24,000
5.18	Stripping (Borrow Site)	3.3	AC	$6,500	$21,700	30%	$6,600	$28,300
5.19	Erosion Control Seeding (Borrow Site)	3.3	AC	$4,000	$13,400	30%	$4,100	$17,500
5.20	Hauling Level 1 (< 5 miles)	26,927.8	CY	$4	$117,200	30%	$35,200	$152,400
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	4.3	AC	$32,000	$136,000	30%	$40,800	$176,800
5.51	Rock Slope Protection	27,750.0	TON	$95	$2,643,200	30%	$793,000	$3,436,200
	Subtotal - Levees				***$3,398,300***		***$1,020,200***	***$4,418,500***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$247,300	30%	$74,200	$321,500
6.2	Construction Management		%	5.00%	$176,700	30%	$53,100	$229,800
	Subtotal - Planning, Engineering, & Design				***$424,000***		***$128,000***	***$552,000***
	ESTIMATED REACH TOTAL				**$4,193,000**		**$1,258,000**	**$5,450,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$4,628,000**		**$1,389,000**	**$6,016,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 7 - STA 202+00 TO 290+00

WOOD RODGERS

Alternative 1 - Levee Raise with Embankment Reconstruction

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	10.4	AC	$20,000	$208,400	30%	$62,600	$271,000
1.2	Land Acquisition Soft Costs		%	20%	$42,000	15%	$6,300	$48,300
	Subtotal - Lands				***$250,400***		***$68,900***	***$319,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$311,100	30%	$93,400	$404,500
2.2	Environmental Permitting/Planning/Design		LS		$85,100	30%	$25,600	$110,700
	Subtotal - Mitigation				***$396,200***		***$119,000***	***$515,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	8,800.0	LF	$10	$88,000	30%	$26,400	$114,400
3.2	Class 2 Aggregate Surfacing	6,600.0	TON	$35	$231,000	30%	$69,300	$300,300
	Subtotal - Relocations				***$319,000***		***$95,700***	***$414,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$428,700	30%	$128,700	$557,400
5.2	Clearing and Grubbing (Levee)	8.7	AC	$5,500	$47,800	30%	$14,400	$62,200
5.3	Stripping (Levee)	8.7	AC	$6,500	$56,500	30%	$17,000	$73,500
5.4	Erosion Control Seeding (Levee)	8.7	AC	$4,000	$34,800	30%	$10,500	$45,300
5.5	Levee Degrading/ Excavation	61,339.3	CY	$9	$521,400	30%	$156,500	$677,900
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	58,810.1	CY	$6	$352,900	30%	$105,900	$458,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	84,014.4	CY	$5	$420,100	30%	$126,100	$546,200
5.17	Clearing and Grubbing (Borrow Site)	10.4	AC	$5,500	$57,300	30%	$17,200	$74,500
5.18	Stripping (Borrow Site)	10.4	AC	$6,500	$67,700	30%	$20,400	$88,100
5.19	Erosion Control Seeding (Borrow Site)	10.4	AC	$4,000	$41,700	30%	$12,600	$54,300
5.20	Hauling Level 1 (< 5 miles)	84,014.4	CY	$4	$365,500	30%	$109,700	$475,200
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	10.0	AC	$32,000	$320,000	30%	$96,000	$416,000
5.24	Rock Slope Protection	66,000.0	TON	$95	$6,286,500	30%	$1,886,000	$8,172,500
	Subtotal - Levees				***$9,000,900***		***$2,701,000***	***$11,701,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$652,400	30%	$195,800	$848,200
6.2	Construction Management		%	5.00%	$466,000	30%	$139,800	$605,800
	Subtotal - Planning, Engineering, & Design				***$1,119,000***		***$336,000***	***$1,454,000***
	ESTIMATED REACH TOTAL				**$11,086,000**		**$3,321,000**	**$14,406,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$12,237,000**		**$3,666,000**	**$15,902,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 7 - STA 202+00 TO 290+00

WOOD RODGERS

Alternative 2 - Levee Raise with Drained Stability Berm

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	9.1	AC	$20,000	$181,700	30%	$54,600	$236,300
1.2	Land Acquisition Soft Costs		%	20%	$37,000	15%	$5,600	$42,600
	Subtotal - Lands				***$218,700***		***$60,200***	***$278,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$311,100	30%	$93,400	$404,500
2.2	Environmental Permitting/Planning/Design		LS		$85,100	30%	$25,600	$110,700
	Subtotal - Mitigation				***$396,200***		***$119,000***	***$515,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	8,800.0	LF	$10	$88,000	30%	$26,400	$114,400
3.2	Class 2 Aggregate Surfacing	6,600.0	TON	$35	$231,000	30%	$69,300	$300,300
	Subtotal - Relocations				***$319,000***		***$95,700***	***$414,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$421,800	30%	$126,600	$548,400
5.2	Clearing and Grubbing (Levee)	13.2	AC	$5,500	$72,600	30%	$21,800	$94,400
5.3	Stripping (Levee)	13.2	AC	$6,500	$85,800	30%	$25,800	$111,600
5.4	Erosion Control Seeding (Levee)	13.2	AC	$4,000	$52,800	30%	$15,900	$68,700
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	1,108.1	CY	$6	$6,700	30%	$2,100	$8,800
5.8	Levee Embankment Fill (Soil Type 2)	50,176.3	CY	$6	$301,100	30%	$90,400	$391,500
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	6,930.0	TON	$45	$311,900	30%	$93,600	$405,500
5.13	Sand Filter Layer	2,509.6	TON	$45	$113,000	30%	$33,900	$146,900
5.14	Filter Fabric	17,795.6	SY	$3	$53,400	30%	$16,100	$69,500
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	73,263.5	CY	$5	$366,400	30%	$110,000	$476,400
5.17	Clearing and Grubbing (Borrow Site)	9.1	AC	$5,500	$50,000	30%	$15,000	$65,000
5.18	Stripping (Borrow Site)	9.1	AC	$6,500	$59,100	30%	$17,800	$76,900
5.19	Erosion Control Seeding (Borrow Site)	9.1	AC	$4,000	$36,400	30%	$11,000	$47,400
5.20	Hauling Level 1 (< 5 miles)	73,263.5	CY	$4	$318,700	30%	$95,700	$414,400
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	10.0	AC	$32,000	$320,000	30%	$96,000	$416,000
5.24	Rock Slope Protection	66,000.0	TON	$95	$6,286,500	30%	$1,886,000	$8,172,500
	Subtotal - Levees				***$8,856,200***		***$2,657,700***	***$11,513,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$642,300	30%	$192,700	$835,000
6.2	Construction Management		%	5.00%	$458,800	30%	$137,700	$596,500
	Subtotal - Planning, Engineering, & Design				***$1,102,000***		***$331,000***	***$1,432,000***
	ESTIMATED REACH TOTAL				**$10,893,000**		**$3,264,000**	**$14,155,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$12,024,000**		**$3,603,000**	**$15,624,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 7 - STA 202+00 TO 290+00

WOOD RODGERS

Alternative 3 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	11.8	AC	$20,000	$236,600	30%	$71,000	$307,600
1.2	Land Acquisition Soft Costs		%	20%	$48,000	15%	$7,200	$55,200
	Subtotal - Lands				***$284,600***		***$78,200***	***$362,800***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$311,100	30%	$93,400	$404,500
2.2	Environmental Permitting/Planning/Design		LS		$85,100	30%	$25,600	$110,700
	Subtotal - Mitigation				***$396,200***		***$119,000***	***$515,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	8,800.0	LF	$10	$88,000	30%	$26,400	$114,400
3.2	Class 2 Aggregate Surfacing	6,600.0	TON	$35	$231,000	30%	$69,300	$300,300
	Subtotal - Relocations				***$319,000***		***$95,700***	***$414,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$1,366,600	30%	$410,000	$1,776,600
5.2	Clearing and Grubbing (Levee)	9.3	AC	$5,500	$51,000	30%	$15,300	$66,300
5.3	Stripping (Levee)	9.3	AC	$6,500	$60,300	30%	$18,100	$78,400
5.4	Erosion Control Seeding (Levee)	9.3	AC	$4,000	$37,100	30%	$11,200	$48,300
5.5	Levee Degrading/ Excavation	78,531.9	CY	$9	$667,600	30%	$200,300	$867,900
5.6	Inspection Trench Excavation	11,733.3	CY	$9	$99,800	30%	$30,000	$129,800
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	39,155.1	CY	$6	$235,000	30%	$70,500	$305,500
5.9	Clay Cap Fill (Soil Type 1)	27,638.5	CY	$6	$165,900	30%	$49,800	$215,700
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	733,040.0	SF	$25	$18,326,000	30%	$5,497,800	$23,823,800
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	95,419.5	CY	$5	$477,100	30%	$143,200	$620,300
5.17	Clearing and Grubbing (Borrow Site)	11.8	AC	$5,500	$65,100	30%	$19,600	$84,700
5.18	Stripping (Borrow Site)	11.8	AC	$6,500	$76,900	30%	$23,100	$100,000
5.19	Erosion Control Seeding (Borrow Site)	11.8	AC	$4,000	$47,400	30%	$14,300	$61,700
5.20	Hauling Level 1 (< 5 miles)	95,419.5	CY	$4	$415,100	30%	$124,600	$539,700
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	10.0	AC	$32,000	$320,000	30%	$96,000	$416,000
5.24	Rock Slope Protection	66,000.0	TON	$95	$6,286,500	30%	$1,886,000	$8,172,500
	Subtotal - Levees				***$28,697,400***		***$8,609,800***	***$37,307,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$2,031,200	30%	$609,400	$2,640,600
6.2	Construction Management		%	5.00%	$1,450,900	30%	$435,300	$1,886,200
	Subtotal - Planning, Engineering, & Design				***$3,483,000***		***$1,045,000***	***$4,527,000***
	ESTIMATED REACH TOTAL				**$33,181,000**		**$9,948,000**	**$43,127,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$36,626,000**		**$10,981,000**	**$47,604,000**

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	8.2	AC	$20,000	$164,900	30%	$49,500	$214,400
1.2	Land Acquisition Soft Costs		%	20%	$33,000	15%	$5,000	$38,000
	Subtotal - Lands				***$197,900***		***$54,500***	***$252,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$311,100	30%	$93,400	$404,500
2.2	Environmental Permitting/Planning/Design		LS		$85,100	30%	$25,600	$110,700
	Subtotal - Mitigation				***$396,200***		***$119,000***	***$515,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	8,800.0	LF	$10	$88,000	30%	$26,400	$114,400
3.2	Class 2 Aggregate Surfacing	6,600.0	TON	$35	$231,000	30%	$69,300	$300,300
	Subtotal - Relocations				***$319,000***		***$95,700***	***$414,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$389,000	30%	$116,700	$505,700
5.2	Clearing and Grubbing (Levee)	8.7	AC	$5,500	$47,800	30%	$14,400	$62,200
5.3	Stripping (Levee)	8.7	AC	$6,500	$56,500	30%	$17,000	$73,500
5.4	Erosion Control Seeding (Levee)	8.7	AC	$4,000	$34,800	30%	$10,500	$45,300
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	46,542.2	CY	$6	$279,300	30%	$83,800	$363,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	66,488.9	CY	$5	$332,500	30%	$99,800	$432,300
5.17	Clearing and Grubbing (Borrow Site)	8.2	AC	$5,500	$45,400	30%	$13,700	$59,100
5.18	Stripping (Borrow Site)	8.2	AC	$6,500	$53,600	30%	$16,100	$69,700
5.19	Erosion Control Seeding (Borrow Site)	8.2	AC	$4,000	$33,000	30%	$9,900	$42,900
5.20	Hauling Level 1 (< 5 miles)	66,488.9	CY	$4	$289,300	30%	$86,800	$376,100
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	10.0	AC	$32,000	$320,000	30%	$96,000	$416,000
5.24	Rock Slope Protection	66,000.0	TON	$95	$6,286,500	30%	$1,886,000	$8,172,500
	Subtotal - Levees				***$8,167,700***		***$2,450,700***	***$10,618,400***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$594,100	30%	$178,300	$772,400
6.2	Construction Management		%	5.00%	$424,400	30%	$127,400	$551,800
	Subtotal - Planning, Engineering, & Design				***$1,019,000***		***$306,000***	***$1,325,000***
	ESTIMATED REACH TOTAL				**$10,100,000**		**$3,026,000**	**$13,126,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$11,149,000**		**$3,340,000**	**$14,489,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 8 - STA 290+00 TO 486+00

WOOD RODGERS

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	34.1	AC	$20,000	$682,600	30%	$204,800	$887,400
1.2	Land Acquisition Soft Costs		%	20%	$137,000	15%	$20,600	$157,600
	Subtotal - Lands				***$819,600***		***$225,400***	***$1,045,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$996,200	30%	$298,900	$1,295,100
2.2	Environmental Permitting/Planning/Design		LS		$272,500	30%	$81,800	$354,300
	Subtotal - Mitigation				***$1,268,700***		***$380,700***	***$1,649,400***
3	**Relocations**	0.0						
3.1	Remove and Salvage Ex. Agg. Surfacing	19,600.0	LF	$10	$196,000	30%	$58,800	$254,800
3.2	Class 2 Aggregate Surfacing	14,700.0	TON	$35	$514,500	30%	$154,400	$668,900
	Subtotal - Relocations				***$710,500***		***$213,200***	***$923,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$972,500	30%	$291,800	$1,264,300
5.2	Clearing and Grubbing (Levee)	28.2	AC	$5,500	$155,200	30%	$46,600	$201,800
5.3	Stripping (Levee)	28.2	AC	$6,500	$183,400	30%	$55,100	$238,500
5.4	Erosion Control Seeding (Levee)	28.2	AC	$4,000	$112,900	30%	$33,900	$146,800
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	192,697.0	CY	$6	$1,156,200	30%	$346,900	$1,503,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	275,281.5	CY	$5	$1,376,500	30%	$413,000	$1,789,500
5.17	Clearing and Grubbing (Borrow Site)	34.1	AC	$5,500	$187,700	30%	$56,400	$244,100
5.18	Stripping (Borrow Site)	34.1	AC	$6,500	$221,900	30%	$66,600	$288,500
5.19	Erosion Control Seeding (Borrow Site)	34.1	AC	$4,000	$136,600	30%	$41,000	$177,600
5.20	Hauling Level 1 (< 5 miles)	275,281.5	CY	$4	$1,197,500	30%	$359,300	$1,556,800
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	22.5	AC	$32,000	$720,000	30%	$216,000	$936,000
5.24	Rock Slope Protection	147,000.0	TON	$95	$14,001,800	30%	$4,200,600	$18,202,400
	Subtotal - Levees				***$20,422,200***		***$6,127,200***	***$26,549,400***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$1,479,300	30%	$443,800	$1,923,100
6.2	Construction Management		%	5.00%	$1,056,700	30%	$317,100	$1,373,800
	Subtotal - Planning, Engineering, & Design				***$2,536,000***		***$761,000***	***$3,297,000***
	ESTIMATED REACH TOTAL				**$25,757,000**		**$7,708,000**	**$33,465,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$28,431,000**		**$8,508,000**	**$36,939,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 9 - STA 486+00 TO 521+00

Alternative 1 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	6.4	AC	$20,000	$128,500	30%	$38,600	$167,100
1.2	Land Acquisition Soft Costs		%	20%	$26,000	15%	$3,900	$29,900
	Subtotal - Lands				***$154,500***		***$42,500***	***$197,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$161,000	30%	$48,300	$209,300
2.2	Environmental Permitting/Planning/Design		LS		$44,100	30%	$13,300	$57,400
	Subtotal - Mitigation				***$205,100***		***$61,600***	***$266,700***
3	**Relocations**	0.0						
3.1	Remove and Salvage Ex. Agg. Surfacing	3,500.0	LF	$10	$35,000	30%	$10,500	$45,500
3.2	Class 2 Aggregate Surfacing	2,625.0	TON	$35	$91,900	30%	$27,600	$119,500
	Subtotal - Relocations				***$126,900***		***$38,100***	***$165,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$562,500	30%	$168,800	$731,300
5.2	Clearing and Grubbing (Levee)	4.6	AC	$5,500	$25,400	30%	$7,700	$33,100
5.3	Stripping (Levee)	4.6	AC	$6,500	$30,000	30%	$9,000	$39,000
5.4	Erosion Control Seeding (Levee)	4.6	AC	$4,000	$18,500	30%	$5,600	$24,100
5.5	Levee Degrading/ Excavation	20,876.9	CY	$9	$177,500	30%	$53,300	$230,800
5.6	Inspection Trench Excavation	4,666.7	CY	$9	$39,700	30%	$12,000	$51,700
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	25,389.3	CY	$6	$152,400	30%	$45,800	$198,200
5.9	Clay Cap Fill (Soil Type 1)	10,875.9	CY	$6	$65,300	30%	$19,600	$84,900
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	301,000.0	SF	$25	$7,525,000	30%	$2,257,500	$9,782,500
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	51,807.4	CY	$5	$259,100	30%	$77,800	$336,900
5.17	Clearing and Grubbing (Borrow Site)	6.4	AC	$5,500	$35,400	30%	$10,700	$46,100
5.18	Stripping (Borrow Site)	6.4	AC	$6,500	$41,800	30%	$12,600	$54,400
5.19	Erosion Control Seeding (Borrow Site)	6.4	AC	$4,000	$25,700	30%	$7,800	$33,500
5.20	Hauling Level 1 (< 5 miles)	51,807.4	CY	$4	$225,400	30%	$67,700	$293,100
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	4.0	AC	$32,000	$128,000	30%	$38,400	$166,400
5.24	Rock Slope Protection	26,250.0	TON	$95	$2,500,400	30%	$750,200	$3,250,600
	Subtotal - Levees				***$11,812,100***		***$3,544,500***	***$15,356,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$835,800	30%	$250,800	$1,086,600
6.2	Construction Management		%	5.00%	$597,000	30%	$179,100	$776,100
	Subtotal - Planning, Engineering, & Design				***$1,433,000***		***$430,000***	***$1,863,000***
	ESTIMATED REACH TOTAL				**$13,732,000**		**$4,117,000**	**$17,849,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$15,158,000**		**$4,544,000**	**$19,702,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 9 - STA 486+00 TO 521+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	5.4	AC	$20,000	$107,800	30%	$32,400	$140,200
1.2	Land Acquisition Soft Costs		%	20%	$22,000	15%	$3,300	$25,300
	Subtotal - Lands				***$129,800***		***$35,700***	***$165,500***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$161,000	30%	$48,300	$209,300
2.2	Environmental Permitting/Planning/Design		LS		$44,100	30%	$13,300	$57,400
	Subtotal - Mitigation				***$205,100***		***$61,600***	***$266,700***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	3,500.0	LF	$10	$35,000	30%	$10,500	$45,500
3.2	Class 2 Aggregate Surfacing	2,625.0	TON	$35	$91,900	30%	$27,600	$119,500
	Subtotal - Relocations				***$126,900***		***$38,100***	***$165,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$168,900	30%	$50,700	$219,600
5.2	Clearing and Grubbing (Levee)	4.6	AC	$5,500	$25,400	30%	$7,700	$33,100
5.3	Stripping (Levee)	4.6	AC	$6,500	$30,000	30%	$9,000	$39,000
5.4	Erosion Control Seeding (Levee)	4.6	AC	$4,000	$18,500	30%	$5,600	$24,100
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	30,417.6	CY	$6	$182,600	30%	$54,800	$237,400
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	43,453.7	CY	$5	$217,300	30%	$65,200	$282,500
5.17	Clearing and Grubbing (Borrow Site)	5.4	AC	$5,500	$29,700	30%	$9,000	$38,700
5.18	Stripping (Borrow Site)	5.4	AC	$6,500	$35,100	30%	$10,600	$45,700
5.19	Erosion Control Seeding (Borrow Site)	5.4	AC	$4,000	$21,600	30%	$6,500	$28,100
5.20	Hauling Level 1 (< 5 miles)	43,453.7	CY	$4	$189,100	30%	$56,800	$245,900
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	4.0	AC	$32,000	$128,000	30%	$38,400	$166,400
5.24	Rock Slope Protection	26,250.0	TON	$95	$2,500,400	30%	$750,200	$3,250,600
	Subtotal - Levees				***$3,546,600***		***$1,064,500***	***$4,611,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$257,200	30%	$77,200	$334,400
6.2	Construction Management		%	5.00%	$183,700	30%	$55,200	$238,900
	Subtotal - Planning, Engineering, & Design				***$441,000***		***$133,000***	***$574,000***
	ESTIMATED REACH TOTAL				**$4,450,000**		**$1,333,000**	**$5,783,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$4,912,000**		**$1,471,000**	**$6,383,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 10 - STA 521+00 TO 681+00

Alternative 1 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	29.3	AC	$20,000	$586,700	30%	$176,100	$762,800
1.2	Land Acquisition Soft Costs		%	20%	$118,000	15%	$17,700	$135,700
	Subtotal - Lands				***$704,700***		***$193,800***	***$898,500***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$731,700	30%	$219,600	$951,300
2.2	Environmental Permitting/Planning/Design		LS		$200,200	30%	$60,100	$260,300
	Subtotal - Mitigation				***$931,900***		***$279,700***	***$1,211,600***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	16,000.0	LF	$10	$160,000	30%	$48,000	$208,000
3.2	Class 2 Aggregate Surfacing	12,000.0	TON	$35	$420,000	30%	$126,000	$546,000
	Subtotal - Relocations				***$580,000***		***$174,000***	***$754,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$2,946,300	30%	$883,900	$3,830,200
5.2	Clearing and Grubbing (Levee)	21.9	AC	$5,500	$120,700	30%	$36,300	$157,000
5.3	Stripping (Levee)	21.9	AC	$6,500	$142,600	30%	$42,800	$185,400
5.4	Erosion Control Seeding (Levee)	21.9	AC	$4,000	$87,800	30%	$26,400	$114,200
5.5	Levee Degrading/ Excavation	105,155.6	CY	$9	$893,900	30%	$268,200	$1,162,100
5.6	Inspection Trench Excavation	21,333.3	CY	$9	$181,400	30%	$54,500	$235,900
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	115,268.1	CY	$6	$691,700	30%	$207,600	$899,300
5.9	Clay Cap Fill (Soil Type 1)	50,370.4	CY	$6	$302,300	30%	$90,700	$393,000
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	1,672,000.0	SF	$25	$41,800,000	30%	$12,540,000	$54,340,000
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	236,626.5	CY	$5	$1,183,200	30%	$355,000	$1,538,200
5.17	Clearing and Grubbing (Borrow Site)	29.3	AC	$5,500	$161,400	30%	$48,500	$209,900
5.18	Stripping (Borrow Site)	29.3	AC	$6,500	$190,700	30%	$57,300	$248,000
5.19	Erosion Control Seeding (Borrow Site)	29.3	AC	$4,000	$117,400	30%	$35,300	$152,700
5.20	Hauling Level 1 (< 5 miles)	236,626.5	CY	$4	$1,029,400	30%	$308,900	$1,338,300
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	18.5	AC	$32,000	$592,000	30%	$177,600	$769,600
5.24	Rock Slope Protection	120,000.0	TON	$95	$11,430,000	30%	$3,429,000	$14,859,000
	Subtotal - Levees				***$61,870,800***		***$18,562,000***	***$80,432,800***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$4,371,600	30%	$1,311,500	$5,683,100
6.2	Construction Management		%	5.00%	$3,122,600	30%	$936,800	$4,059,400
	Subtotal - Planning, Engineering, & Design				***$7,495,000***		***$2,249,000***	***$9,743,000***
	ESTIMATED REACH TOTAL				**$71,583,000**		**$21,459,000**	**$93,040,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$79,014,000**		**$23,687,000**	**$102,699,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 10 - STA 521+00 TO 681+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	24.0	AC	$20,000	$479,300	30%	$143,800	$623,100
1.2	Land Acquisition Soft Costs		%	20%	$96,000	15%	$14,400	$110,400
	Subtotal - Lands				***$575,300***		***$158,200***	***$733,500***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$731,700	30%	$219,600	$951,300
2.2	Environmental Permitting/Planning/Design		LS		$200,200	30%	$60,100	$260,300
	Subtotal - Mitigation				***$931,900***		***$279,700***	***$1,211,600***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	16,000.0	LF	$10	$160,000	30%	$48,000	$208,000
3.2	Class 2 Aggregate Surfacing	12,000.0	TON	$35	$420,000	30%	$126,000	$546,000
	Subtotal - Relocations				***$580,000***		***$174,000***	***$754,000***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$768,900	30%	$230,700	$999,600
5.2	Clearing and Grubbing (Levee)	21.9	AC	$5,500	$120,700	30%	$36,300	$157,000
5.3	Stripping (Levee)	21.9	AC	$6,500	$142,600	30%	$42,800	$185,400
5.4	Erosion Control Seeding (Levee)	21.9	AC	$4,000	$87,800	30%	$26,400	$114,200
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	135,318.5	CY	$6	$812,000	30%	$243,600	$1,055,600
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	193,312.2	CY	$5	$966,600	30%	$290,000	$1,256,600
5.17	Clearing and Grubbing (Borrow Site)	24.0	AC	$5,500	$131,900	30%	$39,600	$171,500
5.18	Stripping (Borrow Site)	24.0	AC	$6,500	$155,800	30%	$46,800	$202,600
5.19	Erosion Control Seeding (Borrow Site)	24.0	AC	$4,000	$95,900	30%	$28,800	$124,700
5.20	Hauling Level 1 (< 5 miles)	193,312.2	CY	$4	$841,000	30%	$252,300	$1,093,300
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	18.5	AC	$32,000	$592,000	30%	$177,600	$769,600
5.24	Rock Slope Protection	120,000.0	TON	$95	$11,430,000	30%	$3,429,000	$14,859,000
	Subtotal - Levees				***$16,145,200***		***$4,843,900***	***$20,989,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$1,170,800	30%	$351,300	$1,522,100
6.2	Construction Management		%	5.00%	$836,300	30%	$250,900	$1,087,200
	Subtotal - Planning, Engineering, & Design				***$2,008,000***		***$603,000***	***$2,610,000***
	ESTIMATED REACH TOTAL				**$20,241,000**		**$6,059,000**	**$26,299,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$22,342,000**		**$6,688,000**	**$29,029,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 11 - STA 681+00 TO 705+00

WOOD RODGERS

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	1.7	AC	$20,000	$34,900	30%	$10,500	$45,400
1.2	Land Acquisition Soft Costs		%	20%	$7,000	15%	$1,100	$8,100
	Subtotal - Lands				***$41,900***		***$11,600***	***$53,500***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$72,800	30%	$21,900	$94,700
2.2	Environmental Permitting/Planning/Design		LS		$20,000	30%	$6,000	$26,000
	Subtotal - Mitigation				***$92,800***		***$27,900***	***$120,700***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,400.0	LF	$10	$24,000	30%	$7,200	$31,200
3.2	Class 2 Aggregate Surfacing	1,800.0	TON	$35	$63,000	30%	$18,900	$81,900
	Subtotal - Relocations				***$87,000***		***$26,100***	***$113,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$136,300	30%	$40,900	$177,200
5.2	Clearing and Grubbing (Levee)	1.8	AC	$5,500	$10,000	30%	$3,000	$13,000
5.3	Stripping (Levee)	1.8	AC	$6,500	$11,800	30%	$3,600	$15,400
5.4	Erosion Control Seeding (Levee)	1.8	AC	$4,000	$7,300	30%	$2,200	$9,500
5.5	Levee Degrading/ Excavation	18,488.9	CY	$9	$157,200	30%	$47,200	$204,400
5.6	Inspection Trench Excavation	3,200.0	CY	$9	$27,200	30%	$8,200	$35,400
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	3,468.0	CY	$6	$20,900	30%	$6,300	$27,200
5.9	Clay Cap Fill (Soil Type 1)	6,364.4	CY	$6	$38,200	30%	$11,500	$49,700
5.10	Cutoff Wall <75' (Soil Bentonite)	48,240.0	SF	$10	$482,400	30%	$144,800	$627,200
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	14,046.3	CY	$5	$70,300	30%	$21,100	$91,400
5.17	Clearing and Grubbing (Borrow Site)	1.7	AC	$5,500	$9,600	30%	$2,900	$12,500
5.18	Stripping (Borrow Site)	1.7	AC	$6,500	$11,400	30%	$3,500	$14,900
5.19	Erosion Control Seeding (Borrow Site)	1.7	AC	$4,000	$7,000	30%	$2,100	$9,100
5.20	Hauling Level 1 (< 5 miles)	14,046.3	CY	$4	$61,200	30%	$18,400	$79,600
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	3.0	AC	$32,000	$96,000	30%	$28,800	$124,800
5.24	Rock Slope Protection	18,000.0	TON	$95	$1,714,500	30%	$514,400	$2,228,900
	Subtotal - Levees				***$2,861,300***		***$858,900***	***$3,720,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$206,400	30%	$62,000	$268,400
6.2	Construction Management		%	5.00%	$147,500	30%	$44,300	$191,800
	Subtotal - Planning, Engineering, & Design				***$354,000***		***$107,000***	***$461,000***
	ESTIMATED REACH TOTAL				**$3,437,000**		**$1,032,000**	**$4,469,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,794,000**		**$1,139,000**	**$4,933,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 11 - STA 681+00 TO 705+00

WOOD RODGERS

Alternative 2 - Levee Raise with Landside Stablity Berm

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	1.5	AC	$20,000	$29,800	30%	$9,000	$38,800
1.2	Land Acquisition Soft Costs		%	20%	$6,000	15%	$900	$6,900
	Subtotal - Lands				***$35,800***		***$9,900***	***$45,700***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$72,800	30%	$21,900	$94,700
2.2	Environmental Permitting/Planning/Design		LS		$20,000	30%	$6,000	$26,000
	Subtotal - Mitigation				***$92,800***		***$27,900***	***$120,700***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,400.0	LF	$10	$24,000	30%	$7,200	$31,200
3.2	Class 2 Aggregate Surfacing	1,800.0	TON	$35	$63,000	30%	$18,900	$81,900
	Subtotal - Relocations				***$87,000***		***$26,100***	***$113,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$111,100	30%	$33,400	$144,500
5.2	Clearing and Grubbing (Levee)	3.6	AC	$5,500	$19,800	30%	$6,000	$25,800
5.3	Stripping (Levee)	3.6	AC	$6,500	$23,400	30%	$7,100	$30,500
5.4	Erosion Control Seeding (Levee)	3.6	AC	$4,000	$14,400	30%	$4,400	$18,800
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	1,075.6	CY	$6	$6,500	30%	$2,000	$8,500
5.8	Levee Embankment Fill (Soil Type 2)	7,311.1	CY	$6	$43,900	30%	$13,200	$57,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	2,412.0	TON	$45	$108,600	30%	$32,600	$141,200
5.13	Sand Filter Layer	942.2	TON	$45	$42,400	30%	$12,800	$55,200
5.14	Filter Fabric	4,853.3	SY	$3	$14,600	30%	$4,400	$19,000
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	11,981.0	CY	$5	$60,000	30%	$18,000	$78,000
5.17	Clearing and Grubbing (Borrow Site)	1.5	AC	$5,500	$8,200	30%	$2,500	$10,700
5.18	Stripping (Borrow Site)	1.5	AC	$6,500	$9,700	30%	$3,000	$12,700
5.19	Erosion Control Seeding (Borrow Site)	1.5	AC	$4,000	$6,000	30%	$1,800	$7,800
5.20	Hauling Level 1 (< 5 miles)	11,981.0	CY	$4	$52,200	30%	$15,700	$67,900
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	3.0	AC	$32,000	$96,000	30%	$28,800	$124,800
5.24	Rock Slope Protection	18,000.0	TON	$95	$1,714,500	30%	$514,400	$2,228,900
	Subtotal - Levees				***$2,331,300***		***$700,100***	***$3,031,400***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$169,300	30%	$50,800	$220,100
6.2	Construction Management		%	5.00%	$121,000	30%	$36,300	$157,300
	Subtotal - Planning, Engineering, & Design				***$291,000***		***$88,000***	***$378,000***
	ESTIMATED REACH TOTAL				**$2,838,000**		**$852,000**	**$3,689,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,133,000**		**$940,000**	**$4,072,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 11 - STA 681+00 TO 705+00

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	1.0	AC	$20,000	$20,800	30%	$6,300	$27,100
1.2	Land Acquisition Soft Costs		%	20%	$5,000	15%	$800	$5,800
	Subtotal - Lands				***$25,800***		***$7,100***	***$32,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$72,800	30%	$21,900	$94,700
2.2	Environmental Permitting/Planning/Design		LS		$20,000	30%	$6,000	$26,000
	Subtotal - Mitigation				***$92,800***		***$27,900***	***$120,700***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,400.0	LF	$10	$24,000	30%	$7,200	$31,200
3.2	Class 2 Aggregate Surfacing	1,800.0	TON	$35	$63,000	30%	$18,900	$81,900
	Subtotal - Relocations				***$87,000***		***$26,100***	***$113,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$98,600	30%	$29,600	$128,200
5.2	Clearing and Grubbing (Levee)	1.8	AC	$5,500	$10,000	30%	$3,000	$13,000
5.3	Stripping (Levee)	1.8	AC	$6,500	$11,800	30%	$3,600	$15,400
5.4	Erosion Control Seeding (Levee)	1.8	AC	$4,000	$7,300	30%	$2,200	$9,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	5,866.7	CY	$6	$35,200	30%	$10,600	$45,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	8,381.0	CY	$5	$42,000	30%	$12,600	$54,600
5.17	Clearing and Grubbing (Borrow Site)	1.0	AC	$5,500	$5,800	30%	$1,800	$7,600
5.18	Stripping (Borrow Site)	1.0	AC	$6,500	$6,800	30%	$2,100	$8,900
5.19	Erosion Control Seeding (Borrow Site)	1.0	AC	$4,000	$4,200	30%	$1,300	$5,500
5.20	Hauling Level 1 (< 5 miles)	8,381.0	CY	$4	$36,500	30%	$11,000	$47,500
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	3.0	AC	$32,000	$96,000	30%	$28,800	$124,800
5.24	Rock Slope Protection	18,000.0	TON	$95	$1,714,500	30%	$514,400	$2,228,900
	Subtotal - Levees				***$2,068,700***		***$621,000***	***$2,689,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$150,900	30%	$45,300	$196,200
6.2	Construction Management		%	5.00%	$107,800	30%	$32,400	$140,200
	Subtotal - Planning, Engineering, & Design				***$259,000***		***$78,000***	***$337,000***
	ESTIMATED REACH TOTAL				**$2,534,000**		**$761,000**	**$3,294,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,797,000**		**$840,000**	**$3,636,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 12 - STA 705+00 TO 720+00

WOOD RODGERS

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	2.9	AC	$20,000	$58,000	30%	$17,400	$75,400
1.2	Land Acquisition Soft Costs		%	20%	$12,000	15%	$1,800	$13,800
	Subtotal - Lands				***$70,000***		***$19,200***	***$89,200***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$49,300	30%	$14,800	$64,100
2.2	Environmental Permitting/Planning/Design		LS		$13,500	30%	$4,100	$17,600
	Subtotal - Mitigation				***$62,800***		***$18,900***	***$81,700***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	1,500.0	LF	$10	$15,000	30%	$4,500	$19,500
3.2	Class 2 Aggregate Surfacing	1,125.0	TON	$35	$39,400	30%	$11,900	$51,300
	Subtotal - Relocations				***$54,400***		***$16,400***	***$70,800***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$108,000	30%	$32,400	$140,400
5.2	Clearing and Grubbing (Levee)	1.4	AC	$5,500	$7,900	30%	$2,400	$10,300
5.3	Stripping (Levee)	1.4	AC	$6,500	$9,400	30%	$2,900	$12,300
5.4	Erosion Control Seeding (Levee)	1.4	AC	$4,000	$5,800	30%	$1,800	$7,600
5.5	Levee Degrading/ Excavation	11,658.3	CY	$9	$99,100	30%	$29,800	$128,900
5.6	Inspection Trench Excavation	2,000.0	CY	$9	$17,000	30%	$5,100	$22,100
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	12,412.5	CY	$6	$74,500	30%	$22,400	$96,900
5.9	Clay Cap Fill (Soil Type 1)	3,961.1	CY	$6	$23,800	30%	$7,200	$31,000
5.10	Cutoff Wall <75' (Soil Bentonite)	52,050.0	SF	$10	$520,500	30%	$156,200	$676,700
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	23,390.9	CY	$5	$117,000	30%	$35,100	$152,100
5.17	Clearing and Grubbing (Borrow Site)	2.9	AC	$5,500	$16,000	30%	$4,800	$20,800
5.18	Stripping (Borrow Site)	2.9	AC	$6,500	$18,900	30%	$5,700	$24,600
5.19	Erosion Control Seeding (Borrow Site)	2.9	AC	$4,000	$11,600	30%	$3,500	$15,100
5.20	Hauling Level 1 (< 5 miles)	23,390.9	CY	$4	$101,800	30%	$30,600	$132,400
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	2.0	AC	$32,000	$64,000	30%	$19,200	$83,200
5.24	Rock Slope Protection	11,250.0	TON	$95	$1,071,600	30%	$321,500	$1,393,100
	Subtotal - Levees				***$2,266,900***		***$680,600***	***$2,947,500***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$162,500	30%	$48,800	$211,300
6.2	Construction Management		%	5.00%	$116,100	30%	$34,900	$151,000
	Subtotal - Planning, Engineering, & Design				***$279,000***		***$84,000***	***$363,000***
	ESTIMATED REACH TOTAL				**$2,734,000**		**$820,000**	**$3,553,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,018,000**		**$905,000**	**$3,922,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 12 - STA 705+00 TO 720+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	2.4	AC	$20,000	$48,800	30%	$14,700	$63,500
1.2	Land Acquisition Soft Costs		%	20%	$10,000	15%	$1,500	$11,500
	Subtotal - Lands				***$58,800***		***$16,200***	***$75,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$49,300	30%	$14,800	$64,100
2.2	Environmental Permitting/Planning/Design		LS		$13,500	30%	$4,100	$17,600
	Subtotal - Mitigation				***$62,800***		***$18,900***	***$81,700***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	1,500.0	LF	$10	$15,000	30%	$4,500	$19,500
3.2	Class 2 Aggregate Surfacing	1,125.0	TON	$35	$39,400	30%	$11,900	$51,300
	Subtotal - Relocations				***$54,400***		***$16,400***	***$70,800***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$73,300	30%	$22,000	$95,300
5.2	Clearing and Grubbing (Levee)	1.4	AC	$5,500	$7,900	30%	$2,400	$10,300
5.3	Stripping (Levee)	1.4	AC	$6,500	$9,400	30%	$2,900	$12,300
5.4	Erosion Control Seeding (Levee)	1.4	AC	$4,000	$5,800	30%	$1,800	$7,600
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	13,752.8	CY	$6	$82,600	30%	$24,800	$107,400
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	19,646.8	CY	$5	$98,300	30%	$29,500	$127,800
5.17	Clearing and Grubbing (Borrow Site)	2.4	AC	$5,500	$13,400	30%	$4,100	$17,500
5.18	Stripping (Borrow Site)	2.4	AC	$6,500	$15,900	30%	$4,800	$20,700
5.19	Erosion Control Seeding (Borrow Site)	2.4	AC	$4,000	$9,800	30%	$3,000	$12,800
5.20	Hauling Level 1 (< 5 miles)	19,646.8	CY	$4	$85,500	30%	$25,700	$111,200
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	2.0	AC	$32,000	$64,000	30%	$19,200	$83,200
5.24	Rock Slope Protection	11,250.0	TON	$95	$1,071,600	30%	$321,500	$1,393,100
	Subtotal - Levees				***$1,537,500***		***$461,700***	***$1,999,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$111,500	30%	$33,500	$145,000
6.2	Construction Management		%	5.00%	$79,600	30%	$23,900	$103,500
	Subtotal - Planning, Engineering, & Design				***$192,000***		***$58,000***	***$249,000***
	ESTIMATED REACH TOTAL				**$1,906,000**		**$572,000**	**$2,476,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,104,000**		**$631,000**	**$2,733,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel West Levee
REACH 13 - STA 720+00 TO 1001+11

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	6.4	AC	$20,000	$128,200	30%	$38,500	$166,700
1.2	Land Acquisition Soft Costs		%	20%	$26,000	15%	$3,900	$29,900
	Subtotal - Lands				***$154,200***		***$42,400***	***$196,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$784,100	30%	$235,300	$1,019,400
2.2	Environmental Permitting/Planning/Design		LS		$214,500	30%	$64,400	$278,900
	Subtotal - Mitigation				***$998,600***		***$299,700***	***$1,298,300***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	28,700.0	LF	$10	$287,000	30%	$86,100	$373,100
3.2	Class 2 Aggregate Surfacing	21,525.0	TON	$35	$753,400	30%	$226,100	$979,500
	Subtotal - Relocations				***$1,040,400***		***$312,200***	***$1,352,600***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$1,131,800	30%	$339,600	$1,471,400
5.2	Clearing and Grubbing (Levee)	19.1	AC	$5,500	$105,100	30%	$31,600	$136,700
5.3	Stripping (Levee)	19.1	AC	$6,500	$124,200	30%	$37,300	$161,500
5.4	Erosion Control Seeding (Levee)	19.1	AC	$4,000	$76,500	30%	$23,000	$99,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	36,179.0	CY	$6	$217,100	30%	$65,200	$282,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	0.0	CY	$15	$0	30%	$0	$0
5.16	Excavation (Borrow Site)	51,684.3	CY	$5	$258,500	30%	$77,600	$336,100
5.17	Clearing and Grubbing (Borrow Site)	6.4	AC	$5,500	$35,300	30%	$10,600	$45,900
5.18	Stripping (Borrow Site)	6.4	AC	$6,500	$41,700	30%	$12,600	$54,300
5.19	Erosion Control Seeding (Borrow Site)	6.4	AC	$4,000	$25,700	30%	$7,800	$33,500
5.20	Hauling Level 1 (< 5 miles)	51,684.3	CY	$4	$224,900	30%	$67,500	$292,400
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Riparian Corridor	32.0	AC	$32,000	$1,024,000	30%	$307,200	$1,331,200
5.24	Rock Slope Protection	215,250.0	TON	$95	$20,502,600	30%	$6,150,800	$26,653,400
	Subtotal - Levees				***$23,767,400***		***$7,130,800***	***$30,898,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$1,736,600	30%	$521,000	$2,257,600
6.2	Construction Management		%	5.00%	$1,240,400	30%	$372,200	$1,612,600
	Subtotal - Planning, Engineering, & Design				***$2,977,000***		***$894,000***	***$3,871,000***
	ESTIMATED REACH TOTAL				**$28,938,000**		**$8,680,000**	**$37,617,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$31,942,000**		**$9,581,000**	**$41,522,000**

DWSC East Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel East Levee
REACH 2 - STA 8+00 TO 15+00

WOOD RODGERS

Alternative 1 - DEEP CUTOFF WALL WITH WATERSIDE SLOPE FLATTENING

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	0.5	AC	$20,000	$9,200	30%	$2,800	$12,000
1.6	Land Acquisition Soft Costs		%	20%	$2,000	15%	$300	$2,300
	Subtotal - Lands				***$11,200***		***$3,100***	***$14,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$19,900	30%	$6,000	$25,900
2.2	Environmental Permitting/Planning/Design		LS		$5,500	30%	$1,700	$7,200
	Subtotal - Mitigation				***$25,400***		***$7,700***	***$33,100***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	700.0	LF	$10	$7,000	30%	$2,100	$9,100
3.2	Class 2 Aggregate Surfacing	525.0	TON	$35	$18,400	30%	$5,600	$24,000
3.3	Gate Modification	3.0	EA	$5,000	$15,000	30%	$4,500	$19,500
3.4	Sign Relocation	4.0	EA	$2,500	$10,000	30%	$3,000	$13,000
3.5	18" Pipe Modification	1.0	EA	$175,000	$175,000	30%	$52,500	$227,500
3.6	30" Pipe Modification	1.0	EA	$235,000	$235,000	30%	$70,500	$305,500
	Subtotal - Relocations				***$460,400***		***$138,200***	***$598,600***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$82,900	30%	$24,900	$107,800
5.2	Clearing and Grubbing (Levee)	0.5	AC	$5,500	$2,900	30%	$900	$3,800
5.3	Stripping (Levee)	0.5	AC	$6,500	$3,500	30%	$1,100	$4,600
5.4	Erosion Control Seeding (Levee)	0.5	AC	$4,000	$2,200	30%	$700	$2,900
5.5	Levee Degrading/ Excavation	6,968.9	CY	$9	$59,300	30%	$17,800	$77,100
5.6	Inspection Trench Excavation	933.3	CY	$9	$8,000	30%	$2,400	$10,400
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	606.7	CY	$6	$3,700	30%	$1,200	$4,900
5.9	Clay Cap Fill (Soil Type 1)	1,973.0	CY	$6	$11,900	30%	$3,600	$15,500
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	58,520.0	SF	$25	$1,463,000	30%	$438,900	$1,901,900
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,144.1	CY	$15	$32,200	30%	$9,700	$41,900
5.16	Excavation (Borrow Site)	3,685.2	CY	$5	$18,500	30%	$5,600	$24,100
5.17	Clearing and Grubbing (Borrow Site)	0.5	AC	$5,500	$2,600	30%	$800	$3,400
5.18	Stripping (Borrow Site)	0.5	AC	$6,500	$3,000	30%	$900	$3,900
5.19	Erosion Control Seeding (Borrow Site)	0.5	AC	$4,000	$1,900	30%	$600	$2,500
5.20	Hauling Level 1 (< 5 miles)	3,685.2	CY	$4	$16,100	30%	$4,900	$21,000
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	300.0	TON	$95	$28,600	30%	$8,600	$37,200
	Subtotal - Levees				***$1,740,300***		***$522,600***	***$2,262,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$154,100	30%	$46,300	$200,400
6.2	Construction Management		%	5.00%	$110,100	30%	$33,100	$143,200
	Subtotal - Planning, Engineering, & Design				***$265,000***		***$80,000***	***$344,000***
	ESTIMATED REACH TOTAL				**$2,503,000**		**$752,000**	**$3,253,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,763,000**		**$830,000**	**$3,591,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel East Levee
REACH 3 - STA 15+00 TO 85+55

WOOD RODGERS

Alternative 1 - DEEP CUTOFF WALL

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	8.6	AC	$20,000	$172,700	30%	$51,900	$224,600
1.6	Land Acquisition Soft Costs		%	20%	$35,000	15%	$5,300	$40,300
	Subtotal - Lands				***$207,700***		***$57,200***	***$264,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$231,600	30%	$69,500	$301,100
2.2	Environmental Permitting/Planning/Design		LS		$63,400	30%	$19,100	$82,500
	Subtotal - Mitigation				***$295,000***		***$88,600***	***$383,600***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	7,055.0	LF	$10	$70,600	30%	$21,200	$91,800
3.2	Class 2 Aggregate Surfacing	5,291.3	TON	$35	$185,200	30%	$55,600	$240,800
3.3	Sign Relocation	7.0	EA	$2,500	$17,500	30%	$5,300	$22,800
3.4	Gate	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
	Subtotal - Relocations				***$278,300***		***$83,600***	***$361,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$1,307,200	30%	$392,200	$1,699,400
5.2	Clearing and Grubbing (Levee)	7.3	AC	$5,500	$40,200	30%	$12,100	$52,300
5.3	Stripping (Levee)	7.3	AC	$6,500	$47,500	30%	$14,300	$61,800
5.4	Erosion Control Seeding (Levee)	7.3	AC	$4,000	$29,300	30%	$8,800	$38,100
5.5	Levee Degrading/ Excavation	169,385.3	CY	$9	$1,439,800	30%	$432,000	$1,871,800
5.6	Inspection Trench Excavation	9,406.7	CY	$9	$80,000	30%	$24,000	$104,000
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	16,422.5	CY	$6	$98,600	30%	$29,600	$128,200
5.9	Clay Cap Fill (Soil Type 1)	32,322.4	CY	$6	$194,000	30%	$58,200	$252,200
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	910,095.0	SF	$25	$22,752,400	30%	$6,825,800	$29,578,200
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	44,825.4	CY	$15	$672,400	30%	$201,800	$874,200
5.16	Excavation (Borrow Site)	69,635.5	CY	$5	$348,200	30%	$104,500	$452,700
5.17	Clearing and Grubbing (Borrow Site)	8.6	AC	$5,500	$47,500	30%	$14,300	$61,800
5.18	Stripping (Borrow Site)	8.6	AC	$6,500	$56,200	30%	$16,900	$73,100
5.19	Erosion Control Seeding (Borrow Site)	8.6	AC	$4,000	$34,600	30%	$10,400	$45,000
5.20	Hauling Level 1 (< 5 miles)	69,635.5	CY	$4	$303,000	30%	$90,900	$393,900
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$27,450,900***		***$8,235,800***	***$35,686,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$1,941,100	30%	$582,400	$2,523,500
6.2	Construction Management		%	5.00%	$1,386,500	30%	$416,000	$1,802,500
	Subtotal - Planning, Engineering, & Design				***$3,328,000***		***$999,000***	***$4,326,000***
	ESTIMATED REACH TOTAL				**$31,560,000**		**$9,465,000**	**$41,024,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$34,836,000**		**$10,448,000**	**$45,283,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel East Levee
REACH 4 - STA 85+55 TO 120+00

Alternative 1 - Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	0.0	AC	$120,000	$0	15%	$0	$0
1.5	Borrow Site Royalties	1.7	AC	$20,000	$33,200	30%	$10,000	$43,200
1.6	Land Acquisition Soft Costs		%	20%	$7,000	15%	$1,100	$8,100
	Subtotal - Lands				***$40,200***		***$11,100***	***$51,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$53,200	30%	$16,000	$69,200
2.2	Environmental Permitting/Planning/Design		LS		$14,600	30%	$4,400	$19,000
	Subtotal - Mitigation				***$67,800***		***$20,400***	***$88,200***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	1,645.0	LF	$10	$16,500	30%	$5,000	$21,500
3.2	Class 2 Aggregate Surfacing	1,233.8	TON	$35	$43,200	30%	$13,000	$56,200
3.3	Sign Relocation	4.0	EA	$2,500	$10,000	30%	$3,000	$13,000
3.4	Gate	1.0	EA	$5,000	$5,000	30%	$1,500	$6,500
	Subtotal - Relocations				***$74,700***		***$22,500***	***$97,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$74,100	30%	$22,300	$96,400
5.2	Clearing and Grubbing (Levee)	1.6	AC	$5,500	$8,900	30%	$2,700	$11,600
5.3	Stripping (Levee)	1.6	AC	$6,500	$10,500	30%	$3,200	$13,700
5.4	Erosion Control Seeding (Levee)	1.6	AC	$4,000	$6,500	30%	$2,000	$8,500
5.5	Levee Degrading/ Excavation	34,417.1	CY	$9	$292,600	30%	$87,800	$380,400
5.6	Inspection Trench Excavation	2,193.3	CY	$9	$18,700	30%	$5,700	$24,400
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	2,195.2	CY	$6	$13,200	30%	$4,000	$17,200
5.9	Clay Cap Fill (Soil Type 1)	7,164.9	CY	$6	$43,000	30%	$12,900	$55,900
5.10	Cutoff Wall <75' (Soil Bentonite)	80,605.0	SF	$10	$806,100	30%	$241,900	$1,048,000
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	8,628.9	CY	$15	$129,500	30%	$38,900	$168,400
5.16	Excavation (Borrow Site)	13,371.5	CY	$5	$66,900	30%	$20,100	$87,000
5.17	Clearing and Grubbing (Borrow Site)	1.7	AC	$5,500	$9,200	30%	$2,800	$12,000
5.18	Stripping (Borrow Site)	1.7	AC	$6,500	$10,800	30%	$3,300	$14,100
5.19	Erosion Control Seeding (Borrow Site)	1.7	AC	$4,000	$6,700	30%	$2,100	$8,800
5.20	Hauling Level 1 (< 5 miles)	13,371.5	CY	$4	$58,200	30%	$17,500	$75,700
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$1,554,900***		***$467,200***	***$2,022,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$114,100	30%	$34,300	$148,400
6.2	Construction Management		%	5.00%	$81,500	30%	$24,500	$106,000
	Subtotal - Planning, Engineering, & Design				***$196,000***		***$59,000***	***$255,000***
	ESTIMATED REACH TOTAL				**$1,934,000**		**$581,000**	**$2,514,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,135,000**		**$641,000**	**$2,775,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel East Levee
REACH 5 - STA 102+00 TO 106+00

WOOD RODGERS

Alternative 1 - Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	2.3	AC	$120,000	$277,900	15%	$41,700	$319,600
1.5	Borrow Site Royalties	0.3	AC	$20,000	$5,100	30%	$1,600	$6,700
1.6	Land Acquisition Soft Costs		%	20%	$57,000	15%	$8,600	$65,600
	Subtotal - Lands				***$340,000***		***$51,900***	***$391,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$10,100	30%	$3,100	$13,200
2.2	Environmental Permitting/Planning/Design		LS		$2,800	30%	$900	$3,700
	Subtotal - Mitigation				***$12,900***		***$4,000***	***$16,900***
3	**Relocations**							
3.1	Sign Relocation	1.0	EA	$2,500	$2,500	30%	$800	$3,300
3.2	54" Pipe Modifcation	4.0	EA	$250,000	$1,000,000	30%	$300,000	$1,300,000
3.3	42" Pipe Modification	1.0	EA	$250,000	$250,000	30%	$75,000	$325,000
3.4	30" Pipe Modification	2.0	EA	$235,000	$470,000	30%	$141,000	$611,000
3.5	Remove and Salvage Ex. Agg. Surfacing	400.0	LF	$10	$4,000	30%	$1,200	$5,200
3.6	Class 2 Aggregate Surfacing	300.0	TON	$35	$10,500	30%	$3,200	$13,700
	Subtotal - Relocations				***$1,737,000***		***$521,200***	***$2,258,200***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$15,800	30%	$4,800	$20,600
5.2	Clearing and Grubbing (Levee)	0.3	AC	$5,500	$1,500	30%	$500	$2,000
5.3	Stripping (Levee)	0.3	AC	$6,500	$1,800	30%	$600	$2,400
5.4	Erosion Control Seeding (Levee)	0.3	AC	$4,000	$1,100	30%	$400	$1,500
5.5	Levee Degrading/ Excavation	3,898.5	CY	$9	$33,200	30%	$10,000	$43,200
5.6	Inspection Trench Excavation	533.3	CY	$9	$4,600	30%	$1,400	$6,000
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	83.1	CY	$6	$500	30%	$200	$700
5.9	Clay Cap Fill (Soil Type 1)	1,333.3	CY	$6	$8,000	30%	$2,400	$10,400
5.10	Cutoff Wall <75' (Soil Bentonite)	22,480.0	SF	$10	$224,800	30%	$67,500	$292,300
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	1,120.1	CY	$15	$16,900	30%	$5,100	$22,000
5.16	Excavation (Borrow Site)	2,023.5	CY	$5	$10,200	30%	$3,100	$13,300
5.17	Clearing and Grubbing (Borrow Site)	0.3	AC	$5,500	$1,400	30%	$500	$1,900
5.18	Stripping (Borrow Site)	0.3	AC	$6,500	$1,700	30%	$600	$2,300
5.19	Erosion Control Seeding (Borrow Site)	0.3	AC	$4,000	$1,100	30%	$400	$1,500
5.20	Hauling Level 1 (< 5 miles)	2,023.5	CY	$4	$8,900	30%	$2,700	$11,600
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$331,500***		***$100,200***	***$431,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$144,800	30%	$43,500	$188,300
6.2	Construction Management		%	5.00%	$103,500	30%	$31,100	$134,600
	Subtotal - Planning, Engineering, & Design				***$249,000***		***$75,000***	***$323,000***
	ESTIMATED REACH TOTAL				**$2,671,000**		**$753,000**	**$3,422,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$2,948,000**		**$831,000**	**$3,777,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Deep Water Ship Channel East Levee
REACH 6 - STA 106+00 TO 145+00

Alternative 1 - Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Land Acquisition (Residential)	0.0	AC	$100,000	$0	15%	$0	$0
1.2	Land Acquisition (Agricultural)	0.0	AC	$45,000	$0	15%	$0	$0
1.3	Land Acquisition (Commerial/Industrial)	0.0	AC	$200,000	$0	15%	$0	$0
1.4	Land Acquisition (Public/Quasi Public)	3.4	AC	$120,000	$411,600	15%	$61,800	$473,400
1.5	Borrow Site Royalties	3.7	AC	$20,000	$75,000	30%	$22,500	$97,500
1.6	Land Acquisition Soft Costs		%	20%	$98,000	15%	$14,700	$112,700
	Subtotal - Lands				***$584,600***		***$99,000***	***$683,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$71,200	30%	$21,400	$92,600
2.2	Environmental Permitting/Planning/Design		LS		$19,500	30%	$5,900	$25,400
	Subtotal - Mitigation				***$90,700***		***$27,300***	***$118,000***
3	**Relocations**							
3.1	Misc Relocations	10.0	EA	$5,000	$50,000	30%	$15,000	$65,000
3.2	Remove and Salvage Ex. Agg. Surfacing	3,900.0	LF	$10	$39,000	30%	$11,700	$50,700
3.3	Class 2 Aggregate Surfacing	2,925.0	TON	$35	$102,400	30%	$30,800	$133,200
	Subtotal - Relocations				***$191,400***		***$57,500***	***$248,900***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$247,400	30%	$74,300	$321,700
5.2	Clearing and Grubbing (Levee)	3.9	AC	$5,500	$21,400	30%	$6,500	$27,900
5.3	Stripping (Levee)	3.9	AC	$6,500	$25,200	30%	$7,600	$32,800
5.4	Erosion Control Seeding (Levee)	3.9	AC	$4,000	$15,600	30%	$4,700	$20,300
5.5	Levee Degrading/ Excavation	77,386.1	CY	$9	$657,800	30%	$197,400	$855,200
5.6	Inspection Trench Excavation	5,200.0	CY	$9	$44,200	30%	$13,300	$57,500
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	5,449.2	CY	$6	$32,700	30%	$9,900	$42,600
5.9	Clay Cap Fill (Soil Type 1)	15,715.6	CY	$6	$94,300	30%	$28,300	$122,600
5.10	Cutoff Wall <75' (Soil Bentonite)	200,850.0	SF	$10	$2,008,500	30%	$602,600	$2,611,100
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	22,873.5	TON	$45	$1,029,400	30%	$308,900	$1,338,300
5.13	Sand Filter Layer	6,066.7	TON	$45	$273,000	30%	$81,900	$354,900
5.14	Filter Fabric	35,360.0	SY	$3	$106,100	30%	$31,900	$138,000
5.15	Haul and Dispose of Unsuitable Material	19,720.3	CY	$15	$295,900	30%	$88,800	$384,700
5.16	Excavation (Borrow Site)	30,235.3	CY	$5	$151,200	30%	$45,400	$196,600
5.17	Clearing and Grubbing (Borrow Site)	3.7	AC	$5,500	$20,700	30%	$6,300	$27,000
5.18	Stripping (Borrow Site)	3.7	AC	$6,500	$24,400	30%	$7,400	$31,800
5.19	Erosion Control Seeding (Borrow Site)	3.7	AC	$4,000	$15,000	30%	$4,500	$19,500
5.20	Hauling Level 1 (< 5 miles)	30,235.3	CY	$4	$131,600	30%	$39,500	$171,100
5.21	Hauling Level 2 (5 miles - 10 miles)	0.0	CY	$8	$0	30%	$0	$0
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$5,194,400***		***$1,559,200***	***$6,753,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$377,100	30%	$113,200	$490,300
6.2	Construction Management		%	5.00%	$269,300	30%	$80,800	$350,100
	Subtotal - Planning, Engineering, & Design				***$647,000***		***$194,000***	***$841,000***
	ESTIMATED REACH TOTAL				**$6,709,000**		**$1,937,000**	**$8,646,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$7,405,000**		**$2,138,000**	**$9,544,000**

Port North Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 2 - STA 8+00 TO 26+00

Alternative 1 - Minor Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	2.7	AC	$260,000	$702,000	15%	$105,300	$807,300
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	0.9	AC	$20,000	$17,300	30%	$5,200	$22,500
	Subtotal - Lands				***$744,300***		***$114,300***	***$858,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$30,700	30%	$9,300	$40,000
2.2	Environmental Permitting/Planning/Design		LS		$8,400	30%	$2,600	$11,000
	Subtotal - Mitigation				***$39,100***		***$11,900***	***$51,000***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	0.0	LF	$10	$0	30%	$0	$0
3.2	Class 2 Aggregate Surfacing	1,350.0	TON	$35	$47,300	30%	$14,200	$61,500
	Subtotal - Relocations				***$47,300***		***$14,200***	***$61,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$31,400	30%	$9,500	$40,900
5.2	Clearing and Grubbing (Levee)	1.9	AC	$5,500	$10,300	30%	$3,100	$13,400
5.3	Stripping (Levee)	1.9	AC	$6,500	$12,200	30%	$3,700	$15,900
5.4	Erosion Control Seeding (Levee)	1.0	AC	$4,000	$4,200	30%	$1,300	$5,500
5.5	Levee Degrading/ Excavation	5,436.7	CY	$9	$46,300	30%	$13,900	$60,200
5.6	Inspection Trench Excavation	2,400.0	CY	$9	$20,400	30%	$6,200	$26,600
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	1,405.0	CY	$6	$8,500	30%	$2,600	$11,100
5.9	Clay Cap Fill (Soil Type 1)	3,466.7	CY	$6	$20,800	30%	$6,300	$27,100
5.10	Cutoff Wall <75' (Soil Bentonite)	36,180.0	SF	$10	$361,800	30%	$108,600	$470,400
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,798.3	CY	$15	$42,000	30%	$12,600	$54,600
5.16	Excavation (Borrow Site)	6,959.5	CY	$5	$34,800	30%	$10,500	$45,300
5.17	Clearing and Grubbing (Borrow Site)	0.9	AC	$5,500	$4,800	30%	$1,500	$6,300
5.18	Stripping (Borrow Site)	0.9	AC	$6,500	$5,700	30%	$1,800	$7,500
5.19	Erosion Control Seeding (Borrow Site)	0.9	AC	$4,000	$3,500	30%	$1,100	$4,600
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	6,959.5	CY	$8	$52,200	30%	$15,700	$67,900
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$658,900***		***$198,400***	***$857,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$49,500	30%	$14,900	$64,400
6.2	Construction Management		%	5.00%	$35,400	30%	$10,700	$46,100
	Subtotal - Planning, Engineering, & Design				***$85,000***		***$26,000***	***$111,000***
	ESTIMATED REACH TOTAL				**$1,575,000**		**$365,000**	**$1,940,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,739,000**		**$403,000**	**$2,141,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 2 - STA 8+00 TO 26+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	2.7	AC	$260,000	$702,000	15%	$105,300	$807,300
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	0.6	AC	$20,000	$12,700	30%	$3,900	$16,600
	Subtotal - Lands				***$739,700***		***$113,000***	***$852,700***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$30,700	30%	$9,300	$40,000
2.2	Environmental Permitting/Planning/Design		LS		$8,400	30%	$2,600	$11,000
	Subtotal - Mitigation				***$39,100***		***$11,900***	***$51,000***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	0.0	LF	$10	$0	30%	$0	$0
3.2	Class 2 Aggregate Surfacing	1,350.0	TON	$35	$47,300	30%	$14,200	$61,500
	Subtotal - Relocations				***$47,300***		***$14,200***	***$61,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$7,300	30%	$2,200	$9,500
5.2	Clearing and Grubbing (Levee)	1.9	AC	$5,500	$10,300	30%	$3,100	$13,400
5.3	Stripping (Levee)	1.9	AC	$6,500	$12,200	30%	$3,700	$15,900
5.4	Erosion Control Seeding (Levee)	1.0	AC	$4,000	$4,200	30%	$1,300	$5,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	3,583.3	CY	$6	$21,500	30%	$6,500	$28,000
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	1,510.0	CY	$15	$22,700	30%	$6,900	$29,600
5.16	Excavation (Borrow Site)	5,119.0	CY	$5	$25,600	30%	$7,700	$33,300
5.17	Clearing and Grubbing (Borrow Site)	0.6	AC	$5,500	$3,500	30%	$1,100	$4,600
5.18	Stripping (Borrow Site)	0.6	AC	$6,500	$4,200	30%	$1,300	$5,500
5.19	Erosion Control Seeding (Borrow Site)	0.6	AC	$4,000	$2,600	30%	$800	$3,400
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	5,119.0	CY	$8	$38,400	30%	$11,600	$50,000
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$152,500***		***$46,200***	***$198,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$14,000	30%	$4,200	$18,200
6.2	Construction Management		%	5.00%	$10,000	30%	$3,000	$13,000
	Subtotal - Planning, Engineering, & Design				***$24,000***		***$8,000***	***$32,000***
	ESTIMATED REACH TOTAL				**$1,003,000**		**$194,000**	**$1,196,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,107,000**		**$214,000**	**$1,320,000**

*Based on the subtotals for Relocations and Flood Control Features

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 3 - STA 26+00 TO 35+50

WOOD RODGERS

Alternative 1 - Levee Raise with Waterside Slope Flattening

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	2.6	AC	$260,000	$665,600	15%	$99,900	$765,500
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	0.6	AC	$20,000	$12,700	50%	$6,400	$19,100
	Subtotal - Lands				***$690,800***		***$108,200***	***$799,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$108,200	30%	$32,500	$140,700
2.2	Environmental Permitting/Planning/Design		LS		$29,600	30%	$8,900	$38,500
	Subtotal - Mitigation				***$137,800***		***$41,400***	***$179,200***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	1.0	EA	$100,000	$100,000	50%	$50,000	$150,000
3.2	Class 2 Aggregate Surfacing	712.5	TON	$35	$25,000	50%	$12,500	$37,500
	Subtotal - Relocations				***$125,000***		***$62,500***	***$187,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	50%	$0	$0
4.2	Traffic Control		%	3%	$0	50%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	50%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	50%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	50%	$0	$0
4.6	Striping	0.0	LF	$1	$0	50%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$9,700	50%	$4,900	$14,600
5.2	Clearing and Grubbing (Levee)	2.6	AC	$5,500	$14,100	50%	$7,100	$21,200
5.3	Stripping (Levee)	2.6	AC	$6,500	$16,700	50%	$8,400	$25,100
5.4	Erosion Control Seeding (Levee)	2.1	AC	$4,000	$8,500	50%	$4,300	$12,800
5.5	Levee Degrading/ Excavation	2,360.9	CY	$9	$20,100	50%	$10,100	$30,200
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	50%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	50%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	3,574.8	CY	$6	$21,500	50%	$10,800	$32,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	50%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	50%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	50%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	50%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	50%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	50%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,537.6	CY	$15	$38,100	50%	$19,100	$57,200
5.16	Excavation (Borrow Site)	5,106.9	CY	$5	$25,600	50%	$12,800	$38,400
5.17	Clearing and Grubbing (Borrow Site)	0.6	AC	$5,500	$3,500	50%	$1,800	$5,300
5.18	Stripping (Borrow Site)	0.6	AC	$6,500	$4,200	50%	$2,100	$6,300
5.19	Erosion Control Seeding (Borrow Site)	0.6	AC	$4,000	$2,600	50%	$1,300	$3,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	50%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	5,106.9	CY	$8	$38,400	50%	$19,200	$57,600
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	50%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	50%	$0	$0
	Subtotal - Levees				***$203,000***		***$101,900***	***$304,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$23,000	30%	$6,900	$29,900
6.2	Construction Management		%	5.00%	$16,400	30%	$5,000	$21,400
	Subtotal - Planning, Engineering, & Design				***$40,000***		***$12,000***	***$52,000***
	ESTIMATED REACH TOTAL				**$1,197,000**		**$326,000**	**$1,523,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,321,000**		**$360,000**	**$1,681,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 3 - STA 26+00 TO 35+50
Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	2.6	AC	$260,000	$665,600	15%	$99,900	$765,500
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	0.6	AC	$20,000	$12,700	50%	$6,400	$19,100
	Subtotal - Lands				***$690,800***		***$108,200***	***$799,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$108,200	30%	$32,500	$140,700
2.2	Environmental Permitting/Planning/Design		LS		$29,600	30%	$8,900	$38,500
	Subtotal - Mitigation				***$137,800***		***$41,400***	***$179,200***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	1.0	EA	$100,000	$100,000	50%	$50,000	$150,000
3.2	Class 2 Aggregate Surfacing	712.5	TON	$35	$25,000	50%	$12,500	$37,500
	Subtotal - Relocations				***$125,000***		***$62,500***	***$187,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	50%	$0	$0
4.2	Traffic Control		%	3%	$0	50%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	50%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	50%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	50%	$0	$0
4.6	Striping	0.0	LF	$1	$0	50%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$8,400	50%	$4,200	$12,600
5.2	Clearing and Grubbing (Levee)	2.6	AC	$5,500	$14,100	50%	$7,100	$21,200
5.3	Stripping (Levee)	2.6	AC	$6,500	$16,700	50%	$8,400	$25,100
5.4	Erosion Control Seeding (Levee)	2.1	AC	$4,000	$8,500	50%	$4,300	$12,800
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	50%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	50%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	50%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	3,574.8	CY	$6	$21,500	50%	$10,800	$32,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	50%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	50%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	50%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	50%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	50%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	50%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,065.4	CY	$15	$31,000	50%	$15,500	$46,500
5.16	Excavation (Borrow Site)	5,106.9	CY	$5	$25,600	50%	$12,800	$38,400
5.17	Clearing and Grubbing (Borrow Site)	0.6	AC	$5,500	$3,500	50%	$1,800	$5,300
5.18	Stripping (Borrow Site)	0.6	AC	$6,500	$4,200	50%	$2,100	$6,300
5.19	Erosion Control Seeding (Borrow Site)	0.6	AC	$4,000	$2,600	50%	$1,300	$3,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	50%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	5,106.9	CY	$8	$38,400	50%	$19,200	$57,600
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	50%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	50%	$0	$0
	Subtotal - Levees				***$174,500***		***$87,500***	***$262,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$21,000	30%	$6,300	$27,300
6.2	Construction Management		%	5.00%	$15,000	30%	$4,500	$19,500
	Subtotal - Planning, Engineering, & Design				***$36,000***		***$11,000***	***$47,000***
	ESTIMATED REACH TOTAL				**$1,165,000**		**$311,000**	**$1,475,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,286,000**		**$343,000**	**$1,628,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 4 - STA 35+50 TO 45+00

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	1.2	AC	$260,000	$312,000	15%	$46,800	$358,800
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.5	Borrow Site Royalties	0.5	AC	$20,000	$10,600	30%	$3,200	$13,800
	Subtotal - Lands				***$335,100***		***$51,900***	***$387,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$16,700	30%	$5,100	$21,800
2.2	Environmental Permitting/Planning/Design		LS		$4,600	30%	$1,400	$6,000
	Subtotal - Mitigation				***$21,300***		***$6,500***	***$27,800***
3	**Relocations**							
3.1	Class 2 Aggregate Surfacing	712.5	TON	$35	$25,000	30%	$7,500	$32,500
	Subtotal - Relocations				***$25,000***		***$7,500***	***$32,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$17,300	30%	$5,200	$22,500
5.2	Clearing and Grubbing (Levee)	1.2	AC	$5,500	$6,700	30%	$2,100	$8,800
5.3	Stripping (Levee)	1.2	AC	$6,500	$7,900	30%	$2,400	$10,300
5.4	Erosion Control Seeding (Levee)	0.8	AC	$4,000	$3,200	30%	$1,000	$4,200
5.5	Levee Degrading/ Excavation	3,171.9	CY	$9	$27,000	30%	$8,100	$35,100
5.6	Inspection Trench Excavation	1,266.7	CY	$9	$10,800	30%	$3,300	$14,100
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	998.6	CY	$6	$6,000	30%	$1,800	$7,800
5.9	Clay Cap Fill (Soil Type 1)	1,970.4	CY	$6	$11,900	30%	$3,600	$15,500
5.10	Cutoff Wall <75' (Soil Bentonite)	18,525.0	SF	$10	$185,300	30%	$55,600	$240,900
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	1,614.3	CY	$15	$24,300	30%	$7,300	$31,600
5.16	Excavation (Borrow Site)	4,241.3	CY	$5	$21,300	30%	$6,400	$27,700
5.17	Clearing and Grubbing (Borrow Site)	0.5	AC	$5,500	$2,900	30%	$900	$3,800
5.18	Stripping (Borrow Site)	0.5	AC	$6,500	$3,500	30%	$1,100	$4,600
5.19	Erosion Control Seeding (Borrow Site)	0.5	AC	$4,000	$2,200	30%	$700	$2,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	4,241.3	CY	$8	$31,900	30%	$9,600	$41,500
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$362,200***		***$109,100***	***$471,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$27,200	30%	$8,200	$35,400
6.2	Construction Management		%	5.00%	$19,400	30%	$5,900	$25,300
	Subtotal - Planning, Engineering, & Design				***$47,000***		***$15,000***	***$61,000***
	ESTIMATED REACH TOTAL				**$791,000**		**$190,000**	**$980,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$873,000**		**$210,000**	**$1,082,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 4 - STA 35+50 TO 45+00

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	1.2	AC	$260,000	$312,000	30%	$93,600	$405,600
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	0.4	AC	$20,000	$8,300	30%	$2,500	$10,800
	Subtotal - Lands				***$332,800***		***$98,000***	***$430,800***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$16,700	30%	$5,100	$21,800
2.2	Environmental Permitting/Planning/Design		LS		$4,600	30%	$1,400	$6,000
	Subtotal - Mitigation				***$21,300***		***$6,500***	***$27,800***
3	**Relocations**							
3.1	Class 2 Aggregate Surfacing	712.5	TON	$35	$25,000	30%	$7,500	$32,500
	Subtotal - Relocations				***$25,000***		***$7,500***	***$32,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$4,800	30%	$1,500	$6,300
5.2	Clearing and Grubbing (Levee)	1.2	AC	$5,500	$6,700	30%	$2,100	$8,800
5.3	Stripping (Levee)	1.2	AC	$6,500	$7,900	30%	$2,400	$10,300
5.4	Erosion Control Seeding (Levee)	0.8	AC	$4,000	$3,200	30%	$1,000	$4,200
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	2,334.5	CY	$6	$14,100	30%	$4,300	$18,400
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	979.9	CY	$15	$14,700	30%	$4,500	$19,200
5.16	Excavation (Borrow Site)	3,335.1	CY	$5	$16,700	30%	$5,100	$21,800
5.17	Clearing and Grubbing (Borrow Site)	0.4	AC	$5,500	$2,300	30%	$700	$3,000
5.18	Stripping (Borrow Site)	0.4	AC	$6,500	$2,700	30%	$900	$3,600
5.19	Erosion Control Seeding (Borrow Site)	0.4	AC	$4,000	$1,700	30%	$600	$2,300
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	3,335.1	CY	$8	$25,100	30%	$7,600	$32,700
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$99,900***		***$30,700***	***$130,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$8,800	30%	$2,700	$11,500
6.2	Construction Management		%	5.00%	$6,300	30%	$1,900	$8,200
	Subtotal - Planning, Engineering, & Design				***$16,000***		***$5,000***	***$20,000***
	ESTIMATED REACH TOTAL				**$495,000**		**$148,000**	**$642,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$546,000**		**$163,000**	**$709,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 5 - STA 45+00 TO 54+00

WOOD RODGERS

Alternative 1 -Minor Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	1.2	AC	$260,000	$312,000	15%	$46,800	$358,800
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	0.5	AC	$20,000	$9,200	50%	$4,600	$13,800
	Subtotal - Lands				***$346,200***		***$55,200***	***$401,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$5,800	30%	$1,800	$7,600
2.2	Environmental Permitting/Planning/Design		LS		$1,600	30%	$500	$2,100
	Subtotal - Mitigation				***$7,400***		***$2,300***	***$9,700***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	1.0	EA	$100,000	$100,000	50%	$50,000	$150,000
3.2	Class 2 Aggregate Surfacing	675.0	TON	$35	$23,700	50%	$11,900	$35,600
	Subtotal - Relocations				***$123,700***		***$61,900***	***$185,600***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$2,000	50%	$1,000	$3,000
4.2	Traffic Control		%	3%	$1,200	50%	$600	$1,800
4.3	AC Paving Removal	2,000.0	SY	$20	$40,000	50%	$20,000	$60,000
4.4	AC Paving Replacement	0.0	SY	$65	$0	50%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	50%	$0	$0
4.6	Striping	0.0	LF	$1	$0	50%	$0	$0
	Subtotal - Roads				***$43,200***		***$21,600***	***$64,800***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$16,700	50%	$8,400	$25,100
5.2	Clearing and Grubbing (Levee)	1.2	AC	$5,500	$6,400	50%	$3,200	$9,600
5.3	Stripping (Levee)	1.2	AC	$6,500	$7,500	50%	$3,800	$11,300
5.4	Erosion Control Seeding (Levee)	0.7	AC	$4,000	$3,000	50%	$1,500	$4,500
5.5	Levee Degrading/ Excavation	3,706.7	CY	$9	$31,600	50%	$15,800	$47,400
5.6	Inspection Trench Excavation	1,200.0	CY	$9	$10,200	50%	$5,100	$15,300
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	50%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	817.0	CY	$6	$5,000	50%	$2,500	$7,500
5.9	Clay Cap Fill (Soil Type 1)	1,756.7	CY	$6	$10,600	50%	$5,300	$15,900
5.10	Cutoff Wall <75' (Soil Bentonite)	17,820.0	SF	$10	$178,200	50%	$89,100	$267,300
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	50%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	50%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	50%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	50%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	1,770.3	CY	$15	$26,600	50%	$13,300	$39,900
5.16	Excavation (Borrow Site)	3,676.7	CY	$5	$18,400	50%	$9,200	$27,600
5.17	Clearing and Grubbing (Borrow Site)	0.5	AC	$5,500	$2,600	50%	$1,300	$3,900
5.18	Stripping (Borrow Site)	0.5	AC	$6,500	$3,000	50%	$1,500	$4,500
5.19	Erosion Control Seeding (Borrow Site)	0.5	AC	$4,000	$1,900	50%	$1,000	$2,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	50%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	3,676.7	CY	$8	$27,600	50%	$13,800	$41,400
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	50%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	50%	$0	$0
	Subtotal - Levees				***$349,300***		***$174,800***	***$524,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$36,200	30%	$10,900	$47,100
6.2	Construction Management		%	5.00%	$25,900	30%	$7,800	$33,700
	Subtotal - Planning, Engineering, & Design				***$63,000***		***$19,000***	***$81,000***
	ESTIMATED REACH TOTAL				**$933,000**		**$335,000**	**$1,267,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,030,000**		**$370,000**	**$1,399,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 5 - STA 45+00 TO 54+00
Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial	1.2	AC	$260,000	$312,000	15%	$46,800	$358,800
1.2	Land Acquisition Soft Costs	2.0	Parcel	$12,500	$25,000	15%	$3,800	$28,800
1.3	Borrow Site Royalties	0.3	AC	$20,000	$6,200	50%	$3,100	$9,300
	Subtotal - Lands				***$343,200***		***$53,700***	***$396,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$5,800	30%	$1,800	$7,600
2.2	Environmental Permitting/Planning/Design		LS		$1,600	30%	$500	$2,100
	Subtotal - Mitigation				***$7,400***		***$2,300***	***$9,700***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	1.0	EA	$100,000	$100,000	50%	$50,000	$150,000
3.2	Class 2 Aggregate Surfacing	675.0	TON	$35	$23,700	50%	$11,900	$35,600
	Subtotal - Relocations				***$123,700***		***$61,900***	***$185,600***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$2,000	50%	$1,000	$3,000
4.2	Traffic Control		%	3%	$1,200	50%	$600	$1,800
4.3	AC Paving Removal	2,000.0	SY	$20	$40,000	50%	$20,000	$60,000
4.4	AC Paving Replacement	0.0	SY	$65	$0	50%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	50%	$0	$0
4.6	Striping	0.0	LF	$1	$0	50%	$0	$0
	Subtotal - Roads				***$43,200***		***$21,600***	***$64,800***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$3,900	50%	$2,000	$5,900
5.2	Clearing and Grubbing (Levee)	1.2	AC	$5,500	$6,400	50%	$3,200	$9,600
5.3	Stripping (Levee)	1.2	AC	$6,500	$7,500	50%	$3,800	$11,300
5.4	Erosion Control Seeding (Levee)	0.7	AC	$4,000	$3,000	50%	$1,500	$4,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	50%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	50%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	50%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	1,733.3	CY	$6	$10,400	50%	$5,200	$15,600
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	50%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	50%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	50%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	50%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	50%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	50%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	930.0	CY	$15	$14,000	50%	$7,000	$21,000
5.16	Excavation (Borrow Site)	2,476.2	CY	$5	$12,400	50%	$6,200	$18,600
5.17	Clearing and Grubbing (Borrow Site)	0.3	AC	$5,500	$1,700	50%	$900	$2,600
5.18	Stripping (Borrow Site)	0.3	AC	$6,500	$2,000	50%	$1,000	$3,000
5.19	Erosion Control Seeding (Borrow Site)	0.3	AC	$4,000	$1,300	50%	$700	$2,000
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	50%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	2,476.2	CY	$8	$18,600	50%	$9,300	$27,900
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	50%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	50%	$0	$0
	Subtotal - Levees				***$81,200***		***$40,800***	***$122,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$17,400	30%	$5,300	$22,700
6.2	Construction Management		%	5.00%	$12,500	30%	$3,800	$16,300
	Subtotal - Planning, Engineering, & Design				***$30,000***		***$10,000***	***$39,000***
	ESTIMATED REACH TOTAL				**$629,000**		**$191,000**	**$818,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$694,000**		**$211,000**	**$903,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 6 - STA 54+00 TO 163+00

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Water Related Ind	25.0	AC	$260,000	$6,500,000	15%	$975,000	$7,475,000
1.2	Land Acquisition Soft Costs	10.0	Parcel	$12,500	$125,000	15%	$18,800	$143,800
1.3	Borrow Site Royalties	12.2	AC	$20,000	$243,400	50%	$121,700	$365,100
	Subtotal - Lands				***$6,868,400***		***$1,115,500***	***$7,983,900***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$355,800	30%	$106,800	$462,600
2.2	Environmental Permitting/Planning/Design		LS		$97,400	30%	$29,300	$126,700
	Subtotal - Mitigation				***$453,200***		***$136,100***	***$589,300***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	1.0	EA	$100,000	$100,000	50%	$50,000	$150,000
3.2	Class 2 Aggregate Surfacing	8,175.0	TON	$35	$286,200	50%	$143,100	$429,300
	Subtotal - Relocations				***$386,200***		***$193,100***	***$579,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	50%	$0	$0
4.2	Traffic Control		%	3%	$0	50%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	50%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	50%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	50%	$0	$0
4.6	Striping	0.0	LF	$1	$0	50%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$287,000	50%	$143,500	$430,500
5.2	Clearing and Grubbing (Levee)	25.0	AC	$5,500	$137,700	50%	$68,900	$206,600
5.3	Stripping (Levee)	25.0	AC	$6,500	$162,700	50%	$81,400	$244,100
5.4	Erosion Control Seeding (Levee)	20.0	AC	$4,000	$80,100	50%	$40,100	$120,200
5.5	Levee Degrading/ Excavation	34,718.5	CY	$9	$295,200	50%	$147,600	$442,800
5.6	Inspection Trench Excavation	14,533.3	CY	$9	$123,600	50%	$61,800	$185,400
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	50%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	46,103.0	CY	$6	$276,700	50%	$138,400	$415,100
5.9	Clay Cap Fill (Soil Type 1)	22,607.4	CY	$6	$135,700	50%	$67,900	$203,600
5.10	Cutoff Wall <75' (Soil Bentonite)	218,000.0	SF	$10	$2,180,000	50%	$1,090,000	$3,270,000
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	50%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	50%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	50%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	50%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	28,340.0	CY	$15	$425,100	50%	$212,600	$637,700
5.16	Excavation (Borrow Site)	98,157.7	CY	$5	$490,800	50%	$245,400	$736,200
5.17	Clearing and Grubbing (Borrow Site)	12.2	AC	$5,500	$67,000	50%	$33,500	$100,500
5.18	Stripping (Borrow Site)	12.2	AC	$6,500	$79,100	50%	$39,600	$118,700
5.19	Erosion Control Seeding (Borrow Site)	12.2	AC	$4,000	$48,700	50%	$24,400	$73,100
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	50%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	98,157.7	CY	$8	$736,200	50%	$368,100	$1,104,300
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	50%	$0	$0
5.23	Closure Structure Across Boathouse Road	1.0	EA	$500,000	$500,000	50%	$250,000	$750,000
	Subtotal - Levees				***$6,025,600***		***$3,013,200***	***$9,038,800***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$448,900	30%	$134,700	$583,600
6.2	Construction Management		%	5.00%	$320,600	30%	$96,200	$416,800
	Subtotal - Planning, Engineering, & Design				***$770,000***		***$231,000***	***$1,001,000***
	ESTIMATED REACH TOTAL				**$14,504,000**		**$4,689,000**	**$19,193,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$16,010,000**		**$5,176,000**	**$21,185,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 6 - STA 54+00 TO 163+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Water Related Ind	25.0	AC	$260,000	$6,500,000	15%	$975,000	$7,475,000
1.2	Land Acquisition Soft Costs	10.0	Parcel	$12,500	$125,000	15%	$18,800	$143,800
1.3	Borrow Site Royalties	10.7	AC	$20,000	$214,500	50%	$107,300	$321,800
	Subtotal - Lands				***$6,839,500***		***$1,101,100***	***$7,940,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$355,800	30%	$106,800	$462,600
2.2	Environmental Permitting/Planning/Design		LS		$97,400	30%	$29,300	$126,700
	Subtotal - Mitigation				***$453,200***		***$136,100***	***$589,300***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	1.0	EA	$100,000	$100,000	50%	$50,000	$150,000
3.2	Class 2 Aggregate Surfacing	8,175.0	TON	$35	$286,200	50%	$143,100	$429,300
	Subtotal - Relocations				***$386,200***		***$193,100***	***$579,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	50%	$0	$0
4.2	Traffic Control		%	3%	$0	50%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	50%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	50%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	50%	$0	$0
4.6	Striping	0.0	LF	$1	$0	50%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$140,000	50%	$70,000	$210,000
5.2	Clearing and Grubbing (Levee)	25.0	AC	$5,500	$137,700	50%	$68,900	$206,600
5.3	Stripping (Levee)	25.0	AC	$6,500	$162,700	50%	$81,400	$244,100
5.4	Erosion Control Seeding (Levee)	20.0	AC	$4,000	$80,100	50%	$40,100	$120,200
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	50%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	50%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	50%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	60,555.6	CY	$6	$363,400	50%	$181,700	$545,100
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	50%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	50%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	50%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	50%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	50%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	50%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	20,185.2	CY	$15	$302,800	50%	$151,400	$454,200
5.16	Excavation (Borrow Site)	86,507.9	CY	$5	$432,600	50%	$216,300	$648,900
5.17	Clearing and Grubbing (Borrow Site)	10.7	AC	$5,500	$59,000	50%	$29,500	$88,500
5.18	Stripping (Borrow Site)	10.7	AC	$6,500	$69,800	50%	$34,900	$104,700
5.19	Erosion Control Seeding (Borrow Site)	10.7	AC	$4,000	$42,900	50%	$21,500	$64,400
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	50%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	86,507.9	CY	$8	$648,900	50%	$324,500	$973,400
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	50%	$0	$0
5.23	Closure Structure Across Boathouse Road	1.0	EA	$500,000	$500,000	50%	$250,000	$750,000
	Subtotal - Levees				***$2,939,900***		***$1,470,200***	***$4,410,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$232,900	30%	$69,900	$302,800
6.2	Construction Management		%	5.00%	$166,400	30%	$50,000	$216,400
	Subtotal - Planning, Engineering, & Design				***$400,000***		***$120,000***	***$520,000***
	ESTIMATED REACH TOTAL				**$11,019,000**		**$3,021,000**	**$14,040,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$12,163,000**		**$3,335,000**	**$15,498,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 7 - STA 163+00 TO 236+00

Alternative 1 -Floodwall with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial - R	3.4	AC	$260,000	$871,000	15%	$130,700	$1,001,700
1.2	Improved Residential	3.4	AC	$90,000	$301,500	15%	$45,300	$346,800
1.3	Land Acquisition Soft Costs	5.0	Parcel	$12,500	$62,500	15%	$9,400	$71,900
1.4	Borrow Site Royalties	2.7	AC	$20,000	$53,700	30%	$16,200	$69,900
	Subtotal - Lands				***$1,288,700***		***$201,600***	***$1,490,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$34,700	30%	$10,500	$45,200
2.2	Environmental Permitting/Planning/Design		LS		$9,500	30%	$2,900	$12,400
	Subtotal - Mitigation				***$44,200***		***$13,400***	***$57,600***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	10.0	EA	$100,000	$1,000,000	50%	$500,000	$1,500,000
3.2	Misc Railroad Modifications	2.0	EA	$250,000	$500,000	50%	$250,000	$750,000
3.3	Misc Building Demolition	2.0	EA	$500,000	$1,000,000	30%	$300,000	$1,300,000
3.4	Class 2 Aggregate Surfacing	5,475.0	TON	$35	$191,700	30%	$57,600	$249,300
	Subtotal - Relocations				***$2,691,700***		***$1,107,600***	***$3,799,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$76,500	30%	$23,000	$99,500
4.2	Traffic Control		%	3%	$45,900	30%	$13,800	$59,700
4.3	AC Paving Removal	18,000.0	SY	$20	$360,000	30%	$108,000	$468,000
4.4	AC Paving Replacement	18,000.0	SY	$65	$1,170,000	30%	$351,000	$1,521,000
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$1,652,400***		***$495,800***	***$2,148,200***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$343,200	30%	$103,000	$446,200
5.2	Clearing and Grubbing (Levee)	3.0	AC	$5,500	$16,700	30%	$5,100	$21,800
5.3	Stripping (Levee)	3.0	AC	$6,500	$19,700	30%	$6,000	$25,700
5.4	Erosion Control Seeding (Levee)	3.4	AC	$4,000	$13,500	30%	$4,100	$17,600
5.5	Levee Degrading/ Excavation	34,325.9	CY	$9	$291,800	30%	$87,600	$379,400
5.6	Inspection Trench Excavation	9,733.3	CY	$9	$82,800	30%	$24,900	$107,700
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.9	Clay Cap Fill (Soil Type 1)	15,140.7	CY	$6	$90,900	30%	$27,300	$118,200
5.10	Cutoff Wall <75' (Soil Bentonite)	146,000.0	SF	$10	$1,460,000	30%	$438,000	$1,898,000
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	12,436.0	CY	$15	$186,600	30%	$56,000	$242,600
5.16	Excavation (Borrow Site)	15,140.7	CY	$5	$75,800	30%	$22,800	$98,600
5.17	Clearing and Grubbing (Borrow Site)	2.7	AC	$5,500	$14,800	30%	$4,500	$19,300
5.18	Stripping (Borrow Site)	2.7	AC	$6,500	$17,500	30%	$5,300	$22,800
5.19	Erosion Control Seeding (Borrow Site)	2.7	AC	$4,000	$10,800	30%	$3,300	$14,100
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	21,629.6	CY	$8	$162,300	30%	$48,700	$211,000
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Flood Wall	7,300.0	LF	$400	$2,920,000	30%	$876,000	$3,796,000
5.24	Closure Structures	3.0	EA	$500,000	$1,500,000	50%	$750,000	$2,250,000
	Subtotal - Levees				***$7,206,400***		***$2,462,600***	***$9,669,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$808,600	30%	$242,600	$1,051,200
6.2	Construction Management		%	5.00%	$577,600	30%	$173,300	$750,900
	Subtotal - Planning, Engineering, & Design				***$1,387,000***		***$416,000***	***$1,803,000***
	ESTIMATED REACH TOTAL				**$14,271,000**		**$4,697,000**	**$18,968,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$15,753,000**		**$5,185,000**	**$20,937,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port North Levee
REACH 7 - STA 163+00 TO 236+00

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Improved Mixed Industrial - R	3.4	AC	$260,000	$871,000	15%	$130,700	$1,001,700
1.2	Improved Residential	3.4	AC	$90,000	$301,500	15%	$45,300	$346,800
1.3	Land Acquisition Soft Costs	5.0	Parcel	$12,500	$62,500	15%	$9,400	$71,900
1.4	Borrow Site Royalties	0.9	AC	$20,000	$18,300	30%	$5,500	$23,800
	Subtotal - Lands				***$1,253,300***		***$190,900***	***$1,444,200***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$34,700	30%	$10,500	$45,200
2.2	Environmental Permitting/Planning/Design		LS		$9,500	30%	$2,900	$12,400
	Subtotal - Mitigation				***$44,200***		***$13,400***	***$57,600***
3	**Relocations**							
3.1	Misc Port Facility Modifications/Relocations	10.0	EA	$100,000	$1,000,000	50%	$500,000	$1,500,000
3.2	Misc Railroad Modifications	2.0	EA	$250,000	$500,000	50%	$250,000	$750,000
3.3	Misc Building Demolition	2.0	EA	$500,000	$1,000,000	30%	$300,000	$1,300,000
3.4	Class 2 Aggregate Surfacing	5,475.0	TON	$35	$191,700	30%	$57,600	$249,300
	Subtotal - Relocations				***$2,691,700***		***$1,107,600***	***$3,799,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$76,500	30%	$23,000	$99,500
4.2	Traffic Control		%	3%	$45,900	30%	$13,800	$59,700
4.3	AC Paving Removal	18,000.0	SY	$20	$360,000	30%	$108,000	$468,000
4.4	AC Paving Replacement	18,000.0	SY	$65	$1,170,000	30%	$351,000	$1,521,000
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$1,652,400***		***$495,800***	***$2,148,200***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$232,300	30%	$69,700	$302,000
5.2	Clearing and Grubbing (Levee)	3.0	AC	$5,500	$16,700	30%	$5,100	$21,800
5.3	Stripping (Levee)	3.0	AC	$6,500	$19,700	30%	$6,000	$25,700
5.4	Erosion Control Seeding (Levee)	3.4	AC	$4,000	$13,500	30%	$4,100	$17,600
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	5,148.1	CY	$6	$30,900	30%	$9,300	$40,200
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,444.4	CY	$15	$36,700	30%	$11,100	$47,800
5.16	Excavation (Borrow Site)	7,354.5	CY	$5	$36,800	30%	$11,100	$47,900
5.17	Clearing and Grubbing (Borrow Site)	0.9	AC	$5,500	$5,100	30%	$1,600	$6,700
5.18	Stripping (Borrow Site)	0.9	AC	$6,500	$6,000	30%	$1,800	$7,800
5.19	Erosion Control Seeding (Borrow Site)	0.9	AC	$4,000	$3,700	30%	$1,200	$4,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	7,354.5	CY	$8	$55,200	30%	$16,600	$71,800
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Flood Wall	7,300.0	LF	$400	$2,920,000	30%	$876,000	$3,796,000
5.24	Closure Structures	3.0	EA	$500,000	$1,500,000	50%	$750,000	$2,250,000
	Subtotal - Levees				***$4,876,600***		***$1,763,600***	***$6,640,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$645,500	30%	$193,700	$839,200
6.2	Construction Management		%	5.00%	$461,100	30%	$138,400	$599,500
	Subtotal - Planning, Engineering, & Design				***$1,107,000***		***$333,000***	***$1,439,000***
	ESTIMATED REACH TOTAL				**$11,626,000**		**$3,905,000**	**$15,529,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$12,833,000**		**$4,310,000**	**$17,141,000**

Port South Levee Cost Estimates

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 1 - STA 0+00 TO 23+00

WOOD RODGERS

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Heavy Industrial	6.9	AC	$90,000	$621,000	15%	$93,200	$714,200
1.2	Borrow Site Royalties	1.7	AC	$20,000	$33,800	30%	$10,200	$44,000
1.2	Land Acquisition Soft Costs	3.0	Parcel	$12,500	$37,500	15%	$5,700	$43,200
	Subtotal - Lands				***$692,300***		***$109,100***	***$801,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$69,700	30%	$21,000	$90,700
2.2	Environmental Permitting/Planning/Design		LS		$19,100	30%	$5,800	$24,900
	Subtotal - Mitigation				***$88,800***		***$26,800***	***$115,600***
3	**Relocations**							
3.1	Remove and Salvage Ex. Agg. Surfacing	2,300.0	LF	$10	$23,000	30%	$6,900	$29,900
3.2	Class 2 Aggregate Surfacing	1,725.0	TON	$35	$60,400	30%	$18,200	$78,600
	Subtotal - Relocations				***$83,400***		***$25,100***	***$108,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$15,900	30%	$4,800	$20,700
5.2	Clearing and Grubbing (Levee)	2.2	AC	$5,500	$12,100	30%	$3,700	$15,800
5.3	Stripping (Levee)	2.2	AC	$6,500	$14,300	30%	$4,300	$18,600
5.4	Erosion Control Seeding (Levee)	2.2	AC	$4,000	$8,800	30%	$2,700	$11,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	9,540.7	CY	$6	$57,300	30%	$17,200	$74,500
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	1,763.3	CY	$15	$26,500	30%	$8,000	$34,500
5.16	Excavation (Borrow Site)	13,629.6	CY	$5	$68,200	30%	$20,500	$88,700
5.17	Clearing and Grubbing (Borrow Site)	1.7	AC	$5,500	$9,300	30%	$2,800	$12,100
5.18	Stripping (Borrow Site)	1.7	AC	$6,500	$11,000	30%	$3,300	$14,300
5.19	Erosion Control Seeding (Borrow Site)	1.7	AC	$4,000	$6,800	30%	$2,100	$8,900
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	13,629.6	CY	$8	$102,300	30%	$30,700	$133,000
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$332,500***		***$100,100***	***$432,600***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$29,200	30%	$8,800	$38,000
6.2	Construction Management		%	5.00%	$20,800	30%	$6,300	$27,100
	Subtotal - Planning, Engineering, & Design				***$50,000***		***$16,000***	***$66,000***
	ESTIMATED REACH TOTAL				**$1,247,000**		**$278,000**	**$1,525,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,376,000**		**$307,000**	**$1,683,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 2 - STA 23+00 TO 116+00

WOOD RODGERS

Alternative 1 - Levee Raise with Deep Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Heavy Industrial	28.9	AC	$90,000	$2,599,400	15%	$390,000	$2,989,400
1.2	Borrow Site Royalties	7.3	AC	$20,000	$147,000	30%	$44,100	$191,100
1.3	Land Acquisition Soft Costs	3.0	Parcel	$12,500	$37,500	15%	$5,700	$43,200
	Subtotal - Lands				***$2,783,900***		***$439,800***	***$3,223,700***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$888,200	30%	$266,500	$1,154,700
2.2	Environmental Permitting/Planning/Design		LS		$243,000	30%	$72,900	$315,900
	Subtotal - Mitigation				***$1,131,200***		***$339,400***	***$1,470,600***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	9,700.0	LF	$10	$97,000	30%	$29,100	$126,100
3.6	Class 2 Aggregate Surfacing	7,275.0	TON	$35	$254,700	30%	$76,500	$331,200
3.7	12" Fiber Optic	0.0	EA	$150,000	$0	30%	$0	$0
3.8	Gate	0.0	EA	$5,000	$0	30%	$0	$0
3.9	4" Pipeline Modification	0.0	EA	$90,000	$0	30%	$0	$0
3.10	Concrete Removal and Replacement	0.0	SF	$12	$0	30%	$0	$0
3.11	CHP Academy Fence Relocation	0.0	LF	$125	$0	30%	$0	$0
	Subtotal - Relocations				***$351,700***		***$105,600***	***$457,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$1,481,600	30%	$444,500	$1,926,100
5.2	Clearing and Grubbing (Levee)	15.5	AC	$5,500	$85,400	30%	$25,700	$111,100
5.3	Stripping (Levee)	15.5	AC	$6,500	$100,900	30%	$30,300	$131,200
5.4	Erosion Control Seeding (Levee)	15.5	AC	$4,000	$62,100	30%	$18,700	$80,800
5.5	Levee Degrading/ Excavation	17,765.4	CY	$9	$151,100	30%	$45,400	$196,500
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	41,479.3	CY	$6	$248,900	30%	$74,700	$323,600
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	1,111,620.0	SF	$25	$27,790,500	30%	$8,337,200	$36,127,700
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	22,248.9	CY	$15	$333,800	30%	$100,200	$434,000
5.16	Excavation (Borrow Site)	59,256.1	CY	$5	$296,300	30%	$88,900	$385,200
5.17	Clearing and Grubbing (Borrow Site)	7.3	AC	$5,500	$40,500	30%	$12,200	$52,700
5.18	Stripping (Borrow Site)	7.3	AC	$6,500	$47,800	30%	$14,400	$62,200
5.19	Erosion Control Seeding (Borrow Site)	7.3	AC	$4,000	$29,400	30%	$8,900	$38,300
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	59,256.1	CY	$8	$444,500	30%	$133,400	$577,900
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$31,112,800***		***$9,334,500***	***$40,447,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$2,202,600	30%	$660,800	$2,863,400
6.2	Construction Management		%	5.00%	$32,400	30%	$9,800	$42,200
	Subtotal - Planning, Engineering, & Design				***$2,235,000***		***$671,000***	***$2,906,000***
	ESTIMATED REACH TOTAL				**$37,615,000**		**$10,891,000**	**$48,505,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$41,520,000**		**$12,022,000**	**$53,540,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 2 - STA 23+00 TO 116+00

Alternative 2 - Levee Raise with a Seepage Berm

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Heavy Industrial	27.7	AC	$450,000	$12,465,000	15%	$1,869,800	$14,334,800
1.2	Land Acquisition Soft Costs	3.0	Parcel	$12,500	$37,500	15%	$5,700	$43,200
1.3	Borrow Site Royalties	18.7	AC	$20,000	$374,400	30%	$112,400	$486,800
	Subtotal - Lands				***$12,502,500***		***$1,875,500***	***$14,378,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$851,900	30%	$255,600	$1,107,500
2.2	Environmental Permitting/Planning/Design		LS		$233,100	30%	$70,000	$303,100
	Subtotal - Mitigation				***$1,085,000***		***$325,600***	***$1,410,600***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	9,700.0	LF	$10	$97,000	30%	$29,100	$126,100
3.6	Class 2 Aggregate Surfacing	7,275.0	TON	$35	$254,700	30%	$76,500	$331,200
3.9	12" Fiber Optic	0.0	EA	$150,000	$0	30%	$0	$0
3.10	Gate	0.0	EA	$5,000	$0	30%	$0	$0
3.11	4" Pipeline Modification	0.0	EA	$90,000	$0	30%	$0	$0
3.12	Concrete Removal and Replacement	0.0	SF	$12	$0	30%	$0	$0
3.13	CHP Academy Fence Relocation	0.0	LF	$125	$0	30%	$0	$0
	Subtotal - Relocations				***$351,700***		***$105,600***	***$457,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$341,500	30%	$102,500	$444,000
5.2	Clearing and Grubbing (Levee)	27.0	AC	$5,500	$148,400	30%	$44,600	$193,000
5.3	Stripping (Levee)	27.0	AC	$6,500	$175,300	30%	$52,600	$227,900
5.4	Erosion Control Seeding (Levee)	27.0	AC	$4,000	$107,900	30%	$32,400	$140,300
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	64,702.6	CY	$6	$388,300	30%	$116,500	$504,800
5.8	Levee Embankment Fill (Soil Type 2)	40,983.5	CY	$6	$246,000	30%	$73,800	$319,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	52,743.8	TON	$45	$2,373,500	30%	$712,100	$3,085,600
5.13	Sand Filter Layer	14,011.1	TON	$45	$630,500	30%	$189,200	$819,700
5.14	Filter Fabric	81,803.3	SY	$3	$245,500	30%	$73,700	$319,200
5.15	Haul and Dispose of Unsuitable Material	21,753.1	CY	$15	$326,300	30%	$97,900	$424,200
5.16	Excavation (Borrow Site)	150,980.2	CY	$5	$755,000	30%	$226,500	$981,500
5.17	Clearing and Grubbing (Borrow Site)	18.7	AC	$5,500	$103,000	30%	$30,900	$133,900
5.18	Stripping (Borrow Site)	18.7	AC	$6,500	$121,700	30%	$36,600	$158,300
5.19	Erosion Control Seeding (Borrow Site)	18.7	AC	$4,000	$74,900	30%	$22,500	$97,400
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	150,980.2	CY	$8	$1,132,400	30%	$339,800	$1,472,200
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$7,170,200***		***$2,151,600***	***$9,321,800***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$526,600	30%	$158,000	$684,600
6.2	Construction Management		%	5.00%	$55,400	30%	$16,700	$72,100
	Subtotal - Planning, Engineering, & Design				***$582,000***		***$175,000***	***$757,000***
	ESTIMATED REACH TOTAL				**$21,692,000**		**$4,634,000**	**$26,325,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$23,944,000**		**$5,115,000**	**$29,058,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 2 - STA 23+00 TO 116+00

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Vacant Heavy Industrial	27.7	AC	$450,000	$12,460,900	15%	$1,869,200	$14,330,100
1.2	Borrow Site Royalties	5.5	AC	$20,000	$110,200	30%	$33,100	$143,300
1.3	Land Acquisition Soft Costs	3.0	Parcel	$12,500	$37,500	15%	$5,700	$43,200
	Subtotal - Lands				***$12,608,600***		***$1,908,000***	***$14,516,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$851,600	30%	$255,500	$1,107,100
2.2	Environmental Permitting/Planning/Design		LS		$233,000	30%	$69,900	$302,900
	Subtotal - Mitigation				***$1,084,600***		***$325,400***	***$1,410,000***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	9,300.0	LF	$10	$93,000	30%	$27,900	$120,900
3.6	Class 2 Aggregate Surfacing	6,975.0	TON	$35	$244,200	30%	$73,300	$317,500
3.9	12" Fiber Optic	0.0	EA	$150,000	$0	30%	$0	$0
3.10	Gate	0.0	EA	$5,000	$0	30%	$0	$0
3.11	4" Pipeline Modification	0.0	EA	$90,000	$0	30%	$0	$0
3.12	Concrete Removal and Replacement	0.0	SF	$12	$0	30%	$0	$0
3.13	CHP Academy Fence Relocation	0.0	LF	$125	$0	30%	$0	$0
	Subtotal - Relocations				***$337,200***		***$101,200***	***$438,400***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$62,500	30%	$18,800	$81,300
5.2	Clearing and Grubbing (Levee)	14.9	AC	$5,500	$81,900	30%	$24,600	$106,500
5.3	Stripping (Levee)	14.9	AC	$6,500	$96,800	30%	$29,100	$125,900
5.4	Erosion Control Seeding (Levee)	14.9	AC	$4,000	$59,600	30%	$17,900	$77,500
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	31,086.1	CY	$6	$186,600	30%	$56,000	$242,600
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	12,003.9	CY	$15	$180,100	30%	$54,100	$234,200
5.16	Excavation (Borrow Site)	44,408.7	CY	$5	$222,100	30%	$66,700	$288,800
5.17	Clearing and Grubbing (Borrow Site)	5.5	AC	$5,500	$30,300	30%	$9,100	$39,400
5.18	Stripping (Borrow Site)	5.5	AC	$6,500	$35,800	30%	$10,800	$46,600
5.19	Erosion Control Seeding (Borrow Site)	5.5	AC	$4,000	$22,100	30%	$6,700	$28,800
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	44,408.7	CY	$8	$333,100	30%	$100,000	$433,100
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$1,310,900***		***$393,800***	***$1,704,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$115,400	30%	$34,700	$150,100
6.2	Construction Management		%	5.00%	$28,000	30%	$8,400	$36,400
	Subtotal - Planning, Engineering, & Design				***$144,000***		***$44,000***	***$187,000***
	ESTIMATED REACH TOTAL				**$15,486,000**		**$2,773,000**	**$18,257,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$17,094,000**		**$3,061,000**	**$20,152,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 3 - STA 116+00 TO 118+00

WOOD RODGERS

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Water Related Industrial	0.5	AC	$260,000	$130,000	15%	$19,500	$149,500
1.2	Land Acquisition Soft Costs	3.0	Parcel	$12,500	$37,500	15%	$5,700	$43,200
1.3	Borrow Site Royalties	0.9	AC	$20,000	$17,600	30%	$5,300	$22,900
	Subtotal - Lands				***$167,500***		***$25,200***	***$192,700***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$5,100	30%	$1,600	$6,700
2.2	Environmental Permitting/Planning/Design		LS		$1,400	30%	$500	$1,900
	Subtotal - Mitigation				***$6,500***		***$2,100***	***$8,600***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	200.0	LF	$10	$2,000	30%	$600	$2,600
3.6	Class 2 Aggregate Surfacing	150.0	TON	$35	$5,300	30%	$1,600	$6,900
	Subtotal - Relocations				***$7,300***		***$2,200***	***$9,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$14,800	30%	$4,500	$19,300
5.2	Clearing and Grubbing (Levee)	5.7	AC	$5,500	$31,600	30%	$9,500	$41,100
5.3	Stripping (Levee)	5.7	AC	$6,500	$37,400	30%	$11,300	$48,700
5.4	Erosion Control Seeding (Levee)	5.7	AC	$4,000	$23,000	30%	$6,900	$29,900
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	4,953.0	CY	$6	$29,800	30%	$9,000	$38,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	4,634.4	CY	$15	$69,600	30%	$20,900	$90,500
5.16	Excavation (Borrow Site)	7,075.7	CY	$5	$35,400	30%	$10,700	$46,100
5.17	Clearing and Grubbing (Borrow Site)	0.9	AC	$5,500	$4,900	30%	$1,500	$6,400
5.18	Stripping (Borrow Site)	0.9	AC	$6,500	$5,800	30%	$1,800	$7,600
5.19	Erosion Control Seeding (Borrow Site)	0.9	AC	$4,000	$3,600	30%	$1,100	$4,700
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	7,075.7	CY	$8	$53,100	30%	$16,000	$69,100
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$309,000***		***$93,200***	***$402,200***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$22,200	30%	$6,700	$28,900
6.2	Construction Management		%	5.00%	$15,900	30%	$4,800	$20,700
	Subtotal - Planning, Engineering, & Design				***$39,000***		***$12,000***	***$50,000***
	ESTIMATED REACH TOTAL				**$530,000**		**$135,000**	**$663,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$585,000**		**$149,000**	**$732,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 4 - STA 118+00 TO 123+50

WOOD RODGERS

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Borrow Site Royalties	0.7	AC	$20,000	$13,900	30%	$4,200	$18,100
1.2	Land Acquisition Soft Costs		%	20%	$3,000	15%	$500	$3,500
	Subtotal - Lands				***$16,900***		***$4,700***	***$21,600***
2	**Mitigation**							
2.1	Environmental Mitigation	0.0	LS	0%	$0	30%	$0	$0
2.2	Environmental Permitting/Planning/Design		LS		$0	30%	$0	$0
	Subtotal - Mitigation				***$0***		***$0***	***$0***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	750.0	LF	$10	$7,500	30%	$2,300	$9,800
3.6	Class 2 Aggregate Surfacing	562.5	TON	$35	$19,700	30%	$6,000	$25,700
	Subtotal - Relocations				***$27,200***		***$8,300***	***$35,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$25,900	30%	$7,800	$33,700
5.2	Clearing and Grubbing (Levee)	1.0	AC	$5,500	$5,400	30%	$1,700	$7,100
5.3	Stripping (Levee)	1.0	AC	$6,500	$6,400	30%	$2,000	$8,400
5.4	Erosion Control Seeding (Levee)	1.0	AC	$4,000	$4,000	30%	$1,200	$5,200
5.5	Levee Degrading/ Excavation	9,262.5	CY	$9	$78,800	30%	$23,700	$102,500
5.6	Inspection Trench Excavation	1,000.0	CY	$9	$8,500	30%	$2,600	$11,100
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	1,556.8	CY	$6	$9,400	30%	$2,900	$12,300
5.9	Clay Cap Fill (Soil Type 1)	2,358.3	CY	$6	$14,200	30%	$4,300	$18,500
5.10	Cutoff Wall <75' (Soil Bentonite)	26,625.0	SF	$10	$266,300	30%	$79,900	$346,200
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,787.9	CY	$15	$41,900	30%	$12,600	$54,500
5.16	Excavation (Borrow Site)	5,593.1	CY	$5	$28,000	30%	$8,400	$36,400
5.17	Clearing and Grubbing (Borrow Site)	0.7	AC	$5,500	$3,900	30%	$1,200	$5,100
5.18	Stripping (Borrow Site)	0.7	AC	$6,500	$4,600	30%	$1,400	$6,000
5.19	Erosion Control Seeding (Borrow Site)	0.7	AC	$4,000	$2,800	30%	$900	$3,700
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	5,593.1	CY	$8	$42,000	30%	$12,600	$54,600
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$542,100***		***$163,200***	***$705,300***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$39,900	30%	$12,000	$51,900
6.2	Construction Management		%	5.00%	$28,500	30%	$8,600	$37,100
	Subtotal - Planning, Engineering, & Design				***$69,000***		***$21,000***	***$89,000***
	ESTIMATED REACH TOTAL				**$656,000**		**$198,000**	**$852,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$724,000**		**$219,000**	**$940,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 4 - STA 118+00 TO 123+50

WOOD RODGERS

Alternative 2 - Levee Raise with Seepage Berm

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Water Related Industrial	3.4	AC	$260,000	$884,000	15%	$132,600	$1,016,600
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	1.5	AC	$20,000	$29,400	30%	$8,900	$38,300
	Subtotal - Lands				***$925,900***		***$143,400***	***$1,069,300***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$43,100	30%	$13,000	$56,100
2.2	Environmental Permitting/Planning/Design		LS		$11,800	30%	$3,600	$15,400
	Subtotal - Mitigation				***$54,900***		***$16,600***	***$71,500***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	750.0	LF	$10	$7,500	30%	$2,300	$9,800
3.6	Class 2 Aggregate Surfacing	562.5	TON	$35	$19,700	30%	$6,000	$25,700
	Subtotal - Relocations				***$27,200***		***$8,300***	***$35,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$27,900	30%	$8,400	$36,300
5.2	Clearing and Grubbing (Levee)	2.3	AC	$5,500	$12,600	30%	$3,800	$16,400
5.3	Stripping (Levee)	2.3	AC	$6,500	$14,900	30%	$4,500	$19,400
5.4	Erosion Control Seeding (Levee)	2.3	AC	$4,000	$9,200	30%	$2,800	$12,000
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	5,308.3	CY	$6	$31,900	30%	$9,600	$41,500
5.8	Levee Embankment Fill (Soil Type 2)	2,974.4	CY	$6	$17,900	30%	$5,400	$23,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	4,398.8	TON	$45	$198,000	30%	$59,400	$257,400
5.13	Sand Filter Layer	1,166.7	TON	$45	$52,500	30%	$15,800	$68,300
5.14	Filter Fabric	6,800.0	SY	$3	$20,400	30%	$6,200	$26,600
5.15	Haul and Dispose of Unsuitable Material	1,847.2	CY	$15	$27,800	30%	$8,400	$36,200
5.16	Excavation (Borrow Site)	11,832.5	CY	$5	$59,200	30%	$17,800	$77,000
5.17	Clearing and Grubbing (Borrow Site)	1.5	AC	$5,500	$8,100	30%	$2,500	$10,600
5.18	Stripping (Borrow Site)	1.5	AC	$6,500	$9,600	30%	$2,900	$12,500
5.19	Erosion Control Seeding (Borrow Site)	1.5	AC	$4,000	$5,900	30%	$1,800	$7,700
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	11,832.5	CY	$8	$88,800	30%	$26,700	$115,500
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$584,700***		***$176,000***	***$760,700***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$42,900	30%	$12,900	$55,800
6.2	Construction Management		%	5.00%	$30,600	30%	$9,200	$39,800
	Subtotal - Planning, Engineering, & Design				***$74,000***		***$23,000***	***$96,000***
	ESTIMATED REACH TOTAL				**$1,667,000**		**$368,000**	**$2,033,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,840,000**		**$406,000**	**$2,244,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 4 - STA 118+00 TO 123+50

WOOD RODGERS

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Water Related Industrial	1.7	AC	$260,000	$442,000	15%	$66,300	$508,300
1.2	Borrow Site Royalties	0.3	AC	$20,000	$5,800	30%	$1,800	$7,600
1.3	Land Acquisition Soft Costs		%	20%	$90,000	15%	$13,500	$103,500
	Subtotal - Lands				***$537,800***		***$81,600***	***$619,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$21,600	30%	$6,500	$28,100
2.2	Environmental Permitting/Planning/Design		LS		$6,000	30%	$1,800	$7,800
	Subtotal - Mitigation				***$27,600***		***$8,300***	***$35,900***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	550.0	LF	$10	$5,500	30%	$1,700	$7,200
3.6	Class 2 Aggregate Surfacing	412.5	TON	$35	$14,500	30%	$4,400	$18,900
	Subtotal - Relocations				***$20,000***		***$6,100***	***$26,100***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$3,200	30%	$1,000	$4,200
5.2	Clearing and Grubbing (Levee)	0.7	AC	$5,500	$4,000	30%	$1,200	$5,200
5.3	Stripping (Levee)	0.7	AC	$6,500	$4,700	30%	$1,500	$6,200
5.4	Erosion Control Seeding (Levee)	0.7	AC	$4,000	$2,900	30%	$900	$3,800
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	1,630.6	CY	$6	$9,800	30%	$3,000	$12,800
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	577.5	CY	$15	$8,700	30%	$2,700	$11,400
5.16	Excavation (Borrow Site)	2,329.5	CY	$5	$11,700	30%	$3,600	$15,300
5.17	Clearing and Grubbing (Borrow Site)	0.3	AC	$5,500	$1,600	30%	$500	$2,100
5.18	Stripping (Borrow Site)	0.3	AC	$6,500	$1,900	30%	$600	$2,500
5.19	Erosion Control Seeding (Borrow Site)	0.3	AC	$4,000	$1,200	30%	$400	$1,600
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	2,329.5	CY	$8	$17,500	30%	$5,300	$22,800
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$67,200***		***$20,700***	***$87,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$6,200	30%	$1,900	$8,100
6.2	Construction Management		%	5.00%	$4,400	30%	$1,400	$5,800
	Subtotal - Planning, Engineering, & Design				***$11,000***		***$4,000***	***$14,000***
	ESTIMATED REACH TOTAL				**$664,000**		**$121,000**	**$784,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$733,000**		**$134,000**	**$865,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 5 - STA 123+50 TO 138+00

WOOD RODGERS

Alternative 1 - Levee Raise

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Water Related Industrial	4.8	AC	$260,000	$1,248,000	15%	$187,200	$1,435,200
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	0.6	AC	$20,000	$12,600	30%	$3,800	$16,400
	Subtotal - Lands				***$1,273,100***		***$192,900***	***$1,466,000***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$33,300	30%	$10,000	$43,300
2.2	Environmental Permitting/Planning/Design		LS		$9,200	30%	$2,800	$12,000
	Subtotal - Mitigation				***$42,500***		***$12,800***	***$55,300***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	1,450.0	LF	$10	$14,500	30%	$4,400	$18,900
3.6	Class 2 Aggregate Surfacing	1,087.5	TON	$35	$38,100	30%	$11,500	$49,600
	Subtotal - Relocations				***$52,600***		***$15,900***	***$68,500***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$6,000	30%	$1,800	$7,800
5.2	Clearing and Grubbing (Levee)	0.9	AC	$5,500	$4,900	30%	$1,500	$6,400
5.3	Stripping (Levee)	0.9	AC	$6,500	$5,800	30%	$1,800	$7,600
5.4	Erosion Control Seeding (Levee)	0.9	AC	$4,000	$3,600	30%	$1,100	$4,700
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	3,539.1	CY	$6	$21,300	30%	$6,400	$27,700
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	708.9	CY	$15	$10,700	30%	$3,300	$14,000
5.16	Excavation (Borrow Site)	5,055.8	CY	$5	$25,300	30%	$7,600	$32,900
5.17	Clearing and Grubbing (Borrow Site)	0.6	AC	$5,500	$3,500	30%	$1,100	$4,600
5.18	Stripping (Borrow Site)	0.6	AC	$6,500	$4,100	30%	$1,300	$5,400
5.19	Erosion Control Seeding (Borrow Site)	0.6	AC	$4,000	$2,600	30%	$800	$3,400
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	5,055.8	CY	$8	$38,000	30%	$11,400	$49,400
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$125,800***		***$38,100***	***$163,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$12,500	30%	$3,800	$16,300
6.2	Construction Management		%	5.00%	$9,000	30%	$2,700	$11,700
	Subtotal - Planning, Engineering, & Design				***$22,000***		***$7,000***	***$28,000***
	ESTIMATED REACH TOTAL				**$1,516,000**		**$267,000**	**$1,782,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$1,673,000**		**$295,000**	**$1,967,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 6 - STA 138+00 TO 143+00

WOOD RODGERS

Alternative 1 - Levee Raise with Slope Flattening

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	Water Related Industrial	1.1	AC	$260,000	$286,000	15%	$42,900	$328,900
1.2	Land Acquisition Soft Costs	1.0	Parcel	$12,500	$12,500	15%	$1,900	$14,400
1.3	Borrow Site Royalties	0.3	AC	$20,000	$5,400	30%	$1,700	$7,100
	Subtotal - Lands				***$303,900***		***$46,500***	***$350,400***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$36,300	30%	$10,900	$47,200
2.2	Environmental Permitting/Planning/Design		LS		$10,000	30%	$3,000	$13,000
	Subtotal - Mitigation				***$46,300***		***$13,900***	***$60,200***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	500.0	LF	$10	$5,000	30%	$1,500	$6,500
3.6	Class 2 Aggregate Surfacing	375.0	TON	$35	$13,200	30%	$4,000	$17,200
	Subtotal - Relocations				***$18,200***		***$5,500***	***$23,700***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$3,000	30%	$900	$3,900
5.2	Clearing and Grubbing (Levee)	0.7	AC	$5,500	$3,700	30%	$1,200	$4,900
5.3	Stripping (Levee)	0.7	AC	$6,500	$4,400	30%	$1,400	$5,800
5.4	Erosion Control Seeding (Levee)	0.7	AC	$4,000	$2,700	30%	$900	$3,600
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	1,508.3	CY	$6	$9,100	30%	$2,800	$11,900
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	541.7	CY	$15	$8,200	30%	$2,500	$10,700
5.16	Excavation (Borrow Site)	2,154.8	CY	$5	$10,800	30%	$3,300	$14,100
5.17	Clearing and Grubbing (Borrow Site)	0.3	AC	$5,500	$1,500	30%	$500	$2,000
5.18	Stripping (Borrow Site)	0.3	AC	$6,500	$1,800	30%	$600	$2,400
5.19	Erosion Control Seeding (Borrow Site)	0.3	AC	$4,000	$1,100	30%	$400	$1,500
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	2,154.8	CY	$8	$16,200	30%	$4,900	$21,100
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$62,500***		***$19,400***	***$81,900***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$5,700	30%	$1,800	$7,500
6.2	Construction Management		%	5.00%	$4,100	30%	$1,300	$5,400
	Subtotal - Planning, Engineering, & Design				***$10,000***		***$4,000***	***$13,000***
	ESTIMATED REACH TOTAL				**$441,000**		**$90,000**	**$530,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$487,000**		**$99,000**	**$585,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 7 - STA 143+00 TO 186+93

WOOD RODGERS

Alternative 1 - Levee Raise with Shallow Cutoff Wall

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	River Mixed Use	8.2	AC	$260,000	$2,132,000	15%	$319,800	$2,451,800
1.2	Land Acquisition Soft Costs	3.0	Parcel	$12,500	$37,500	15%	$5,700	$43,200
1.3	Borrow Site Royalties	3.3	AC	$20,000	$65,200	30%	$19,600	$84,800
	Subtotal - Lands				***$2,234,700***		***$345,100***	***$2,579,800***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$150,500	30%	$45,200	$195,700
2.2	Environmental Permitting/Planning/Design		LS		$41,200	30%	$12,400	$53,600
	Subtotal - Mitigation				***$191,700***		***$57,600***	***$249,300***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	4,593.0	LF	$10	$46,000	30%	$13,800	$59,800
3.6	Class 2 Aggregate Surfacing	3,444.8	TON	$35	$120,600	30%	$36,200	$156,800
	Subtotal - Relocations				***$166,600***		***$50,000***	***$216,600***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$84,100	30%	$25,300	$109,400
5.2	Clearing and Grubbing (Levee)	3.1	AC	$5,500	$16,900	30%	$5,100	$22,000
5.3	Stripping (Levee)	3.1	AC	$6,500	$19,900	30%	$6,000	$25,900
5.4	Erosion Control Seeding (Levee)	3.1	AC	$4,000	$12,300	30%	$3,700	$16,000
5.5	Levee Degrading/ Excavation	18,116.8	CY	$9	$154,000	30%	$46,200	$200,200
5.6	Inspection Trench Excavation	6,124.0	CY	$9	$52,100	30%	$15,700	$67,800
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	7,317.7	CY	$6	$44,000	30%	$13,200	$57,200
5.9	Clay Cap Fill (Soil Type 1)	11,074.2	CY	$6	$66,500	30%	$20,000	$86,500
5.10	Cutoff Wall <75' (Soil Bentonite)	83,592.6	SF	$10	$836,000	30%	$250,800	$1,086,800
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	6,554.4	CY	$15	$98,400	30%	$29,600	$128,000
5.16	Excavation (Borrow Site)	26,274.2	CY	$5	$131,400	30%	$39,500	$170,900
5.17	Clearing and Grubbing (Borrow Site)	3.3	AC	$5,500	$18,000	30%	$5,400	$23,400
5.18	Stripping (Borrow Site)	3.3	AC	$6,500	$21,200	30%	$6,400	$27,600
5.19	Erosion Control Seeding (Borrow Site)	3.3	AC	$4,000	$13,100	30%	$4,000	$17,100
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	26,274.2	CY	$8	$197,100	30%	$59,200	$256,300
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$1,765,000***		***$530,100***	***$2,295,100***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$135,300	30%	$40,600	$175,900
6.2	Construction Management		%	5.00%	$96,600	30%	$29,000	$125,600
	Subtotal - Planning, Engineering, & Design				***$232,000***		***$70,000***	***$302,000***
	ESTIMATED REACH TOTAL				**$4,590,000**		**$1,053,000**	**$5,643,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$5,067,000**		**$1,162,000**	**$6,229,000**

West Sacramento Flood Engineering Services
Alternative Analysis
Port South Levee
REACH 7 - STA 143+00 TO 186+93

Minimum Remediation

Item No.	Item	Quantity	Unit	Unit Price	Cost	Contingency (%)	Contingency ($)	Cost w/Contingency
1	**Lands**							
1.1	River Mixed Use	7.8	AC	$260,000	$2,028,000	15%	$304,200	$2,332,200
1.2	Land Acquisition Soft Costs	3.0	Parcel	$12,500	$37,500	15%	$5,700	$43,200
1.3	Borrow Site Royalties	2.5	AC	$20,000	$50,100	30%	$15,100	$65,200
	Subtotal - Lands				***$2,115,600***		***$325,000***	***$2,440,600***
2	**Mitigation**							
2.1	Environmental Mitigation		LS		$143,200	30%	$43,000	$186,200
2.2	Environmental Permitting/Planning/Design		LS		$39,200	30%	$11,800	$51,000
	Subtotal - Mitigation				***$182,400***		***$54,800***	***$237,200***
3	**Relocations**							
3.1	Utility Pole Relocation	0.0	EA	$30,000	$0	30%	$0	$0
3.2	Irrigation/Drainage Canal Relocation	0.0	LF	$110	$0	30%	$0	$0
3.3	Culvert Crossing Relocation	0.0	EA	$150,000	$0	30%	$0	$0
3.4	Disharge Pipe Crossing Relocation	0.0	EA	$100,000	$0	30%	$0	$0
3.5	Remove and Salvage Ex. Agg. Surfacing	4,393.0	LF	$10	$44,000	30%	$13,200	$57,200
3.6	Class 2 Aggregate Surfacing	3,294.8	TON	$35	$115,400	30%	$34,700	$150,100
	Subtotal - Relocations				***$159,400***		***$47,900***	***$207,300***
4	**Roads**							
4.1	Mobilization/Demobilization		%	5%	$0	30%	$0	$0
4.2	Traffic Control		%	3%	$0	30%	$0	$0
4.3	AC Paving Removal	0.0	SY	$20	$0	30%	$0	$0
4.4	AC Paving Replacement	0.0	SY	$65	$0	30%	$0	$0
4.5	Aggregate Base, Class 2 (6")	0.0	TON	$40	$0	30%	$0	$0
4.6	Striping	0.0	LF	$1	$0	30%	$0	$0
	Subtotal - Roads				***$0***		***$0***	***$0***
5	**Flood Control Features**							
5.1	Mobilization/Demobilization		%	5%	$23,000	30%	$6,900	$29,900
5.2	Clearing and Grubbing (Levee)	2.9	AC	$5,500	$16,100	30%	$4,900	$21,000
5.3	Stripping (Levee)	2.9	AC	$6,500	$19,100	30%	$5,800	$24,900
5.4	Erosion Control Seeding (Levee)	2.9	AC	$4,000	$11,700	30%	$3,600	$15,300
5.5	Levee Degrading/ Excavation	0.0	CY	$9	$0	30%	$0	$0
5.6	Inspection Trench Excavation	0.0	CY	$9	$0	30%	$0	$0
5.7	Seepage Berm Fill (Soil Type 2)	0.0	CY	$6	$0	30%	$0	$0
5.8	Levee Embankment Fill (Soil Type 2)	14,122.7	CY	$6	$84,800	30%	$25,500	$110,300
5.9	Clay Cap Fill (Soil Type 1)	0.0	CY	$6	$0	30%	$0	$0
5.10	Cutoff Wall <75' (Soil Bentonite)	0.0	SF	$10	$0	30%	$0	$0
5.11	Cutoff Wall >75' (SCB by DSM)	0.0	SF	$25	$0	30%	$0	$0
5.12	Drain Rock	0.0	TON	$45	$0	30%	$0	$0
5.13	Sand Filter Layer	0.0	TON	$45	$0	30%	$0	$0
5.14	Filter Fabric	0.0	SY	$3	$0	30%	$0	$0
5.15	Haul and Dispose of Unsuitable Material	2,359.2	CY	$15	$35,400	30%	$10,700	$46,100
5.16	Excavation (Borrow Site)	20,175.3	CY	$5	$100,900	30%	$30,300	$131,200
5.17	Clearing and Grubbing (Borrow Site)	2.5	AC	$5,500	$13,800	30%	$4,200	$18,000
5.18	Stripping (Borrow Site)	2.5	AC	$6,500	$16,300	30%	$4,900	$21,200
5.19	Erosion Control Seeding (Borrow Site)	2.5	AC	$4,000	$10,100	30%	$3,100	$13,200
5.20	Hauling Level 1 (< 5 miles)	0.0	CY	$4	$0	30%	$0	$0
5.21	Hauling Level 2 (5 miles - 10 miles)	20,175.3	CY	$8	$151,400	30%	$45,500	$196,900
5.22	Hauling Level 3 (> 10 miles)	0.0	CY	$14	$0	30%	$0	$0
5.23	Rock Slope Protection	0.0	TON	$95	$0	30%	$0	$0
	Subtotal - Levees				***$482,600***		***$145,400***	***$628,000***
6	**Other Project Costs**							
6.1	Planning, Engineering, & Design		%	7.00%	$45,000	30%	$13,500	$58,500
6.2	Construction Management		%	5.00%	$32,100	30%	$9,700	$41,800
	Subtotal - Planning, Engineering, & Design				***$78,000***		***$24,000***	***$101,000***
	ESTIMATED REACH TOTAL				**$3,018,000**		**$598,000**	**$3,615,000**
	ESTIMATED REACH TOTAL (w/Escalation @ 2.5% for 4 years)				**$3,331,000**		**$660,000**	**$3,990,000**

ATTACHMENT D

Comment and Response Register

<u>IPE COVER LETTER</u>

<u>COMMENT AND RESPONSE REGISTERS</u>

May 27, 2016

Mr. Greg Fabun, Flood Program Manager
West Sacramento Flood Control Agency
1110 West Capitol Avenue, 2nd Floor
West Sacramento, CA 95691

Subject: City of West Sacramento, Urban Level of Flood Protection – Review Conducted by Independent Panel of Experts in Association with Finding of Adequate Progress

Dear Mr. Fabun:

The Urban Level of Flood Protection Criteria published by the California Department of Water Resources in November 2013 requires the City of West Sacramento (City) to commission an Independent Panel of Experts (IPE) to review any reports prepared by a Professional Civil Engineer registered in California which serve as evidence that an urban level of flood protection can be achieved. For flood management facilities protecting 500 residents or more, this IPE shall consist of at least three experts with different expertise, including at least one with expertise in hydrology and hydraulics, and at least two with expertise in the design and construction of facilities relevant to those under review. Finally, selection of this IPE shall be consistent with U.S. Army Corps of Engineers (USACE) Engineer Circular (EC) 1165-2-214 dated, December 15th 2012, following the procedure for Type II Independent External Peer Review to the extent applicable.

The undersigned meet these Urban Level of Flood Protection Criteria requirements for serving on an IPE and have participated as approved Type II Independent External Peer Reviewers for the West Sacramento Levee Improvement Program since 2009. At the written request of the West Sacramento Area Flood Control Agency (WSAFCA), the undersigned agreed to serve as the IPE and review the reports developed to serve as evidence that an urban level of flood protection can be achieved for the City. This review was conducted using current levee design guidance including, but not limited to, the California Department of Water Resources Urban Levee Design Criteria (ULDC) dated May 2012.

Between March 7th and May 25th 2016, the undersigned conducted a thorough review of two reports prepared by Wood Rodgers, Inc. to serve as evidence that an urban level of flood protection can be achieved for the City. The first report was the draft City of West Sacramento, Flood Engineering Services, Problem Identification Report dated January 2016. The second report was the draft City of West Sacramento, Flood Engineering Services, Alternatives Analysis Report dated March 2016. The review of each report was documented through development of a comment, response and back-check spreadsheet. As of May 25th 2016, all IPE review comments were closed pending verification of the responses in the final published reports. The final IPE comment and response spreadsheet associated with the review of each report will be incorporated into each final report.

Based on a review of the Draft Problem Identification and Alternatives Analysis Reports, the undersigned, serving in the capacity of an IPE, concur that an urban level of flood protection from the identified sources of flooding ***will exist*** for the City upon implementing the improvements recommended to address the identified flood management facility deficiencies as outlined in these two reports.

West Sacramento Levee Improvement Program
Board of Senior Consultants (IPE)

David T. Williams

Dr. David T. Williams, P.E., CFM, PH

George L. Sills

Mr. George L. Sills, P.E.

R. E. Martin

Dr. Ray E. Martin, P.E., D.GE

City of West Sacramento Flood Program - Draft Alternatives Analysis Report Review

Internal Team Comments

REVIEWER					RESPONDENT							REVIEWER		
COMMENT NUMBER	REVIEWER NAME/ AGENCY	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
1	Eric Nagy / MBK	v. - Figures	4/5/16	Recommend including one or more figures that describe the typical erosion repairs or improvements recommended through this report.	Jesse Patchett / Wood Rodgers	4/12/16	The requested figures will be added to the report	X				Y	5/3/2016	
2	Eric Nagy / MBK	Page 1, § 1, ¶ 2	4/5/16	Bifurcation of the City is accomplished by both the DWSC which extends to the eastern side of the Port facilities and the Barge Canal which continues east from this point to the Sacramento River.	Jesse Patchett / Wood Rodgers	4/12/16	The Barge Canal will be included in this sentence.	X				Y	5/3/2016	
3	Eric Nagy / MBK	Page 2, § 2.A, ¶ 1	4/5/16	Recommend removing the portion of the sentence speculating that minor freeboard deficiencies will be eliminated through hydrologic analysis. While I agree with the statement, it strays from summarizing deficiencies identified through the PIR. A similar statement appears in the second paragraph.	Jesse Patchett / Wood Rodgers	4/12/16	The requested informaiton has been deleted	X				Y	5/3/2016	
4	Eric Nagy / MBK	Page 2, § 2.A, ¶ 2	4/5/16	The third sentence in this paragraph is unclear and requires revision. Consider replacing "levee rehabilitation" with "levee deficiencies".	Jesse Patchett / Wood Rodgers	4/12/16	This sentence has been revised as requested	X				Y	5/3/2016	
5	Eric Nagy / MBK	Page 3, § 2.A, ¶ 1	4/5/16	The mention of erosion as a noted deficiency in the area of high ground seems to warrant a discussion similar to that of waterside slope stability. The reader needs to understand why we care about erosion in an area of high ground.	Jesse Patchett / Wood Rodgers	4/12/16	More information has been added to expand on why erosion is a concern in this area.	X				Y	5/3/2016	
6	Eric Nagy / MBK	Page 3, § 2.B	4/5/16	While the bulkhead does protect the Port facilities from high water, it also provides protection to the floodplain north of the Port as well as much of Southport. Recommend replacing the word "Port" with "City" in the second sentence.	Jesse Patchett / Wood Rodgers	4/12/16	This section has been updated to reflect information contained in the Bulkhead TM.	X				Y	5/3/2016	
7	Eric Nagy / MBK	Page 4, § 2.D, ¶ 1	4/5/16	Recommend describing the nature of the geometry deficiency for which we would seek a variance. Also recommend stating that the design was approved by a panel of "Independent External Peer Reviewers".	Jesse Patchett / Wood Rodgers	4/12/16	This requested information has been added.	X				Y	5/3/2016	
8	Eric Nagy / MBK	Page 5, § 2.F, ¶ 2	4/5/16	In the last sentence, revise "high water stages in the river" to "high water stages in the bypass."	Jesse Patchett / Wood Rodgers	4/12/16	The requested revision has been made	X				Y	5/3/2016	
9	Eric Nagy / MBK	Page 5, § 2.F, ¶ 3	4/5/16	This discussion regarding freeboard and wind-wave study for bypass levees should include a brief statement regarding the corresponding ULDC requirements on this topic.	Jesse Patchett / Wood Rodgers	4/12/16	This requested information has been added.	X				Y	5/3/2016	
10	Eric Nagy / MBK	Page 6, § 2.G, ¶ 1	4/5/16	Recommend including a brief description of the flood event and breach scenario that results in the freeboard deficiency.	Jesse Patchett / Wood Rodgers	4/12/16	This requested information has been added.	X				Y	5/3/2016	

City of West Sacramento Flood Program - Draft Alternatives Analysis Report Review

Internal Team Comments

REVIEWER					RESPONDENT							REVIEWER		
COMMENT NUMBER	REVIEWER NAME/ AGENCY	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
11	Eric Nagy / MBK	Page 7, § 2.H, ¶ 1	4/5/16	Recommend briefly describing assumptions made regarding landslide dredge disposal cells along much of this levee for the seepage analysis. Assume all existing material remains in place or is harvested to support future dredging.	Jesse Patchett / Wood Rodgers	4/12/16	The PIR/AAR deficiencies noted were based on an assumption that the channel-side dredge spoils would be left in place, and therefore be effectively acting as a seepage berm. These conclusions were based on existing available evaluations, some of which assumed spoils would be removed beyond a levee prism and to a set bottom elevation (no seepage berm), and some of which assumed spoils would be left in place (seepage berm). Most mitigation recommendations identify an underseepage deficiency for the DWSC West Levee and therefore include limitations on removal of this material, effectively leaving this material to act as a seepage berm. This will be clarified in the text.	X				Y	5/3/2016	
12	Eric Nagy / MBK	Page 7, § 2.I, ¶ 1	4/5/16	Recommend including a brief description regarding why erosion is a concern along this reach. The concern is somewhat counterintuitive based on the low velocities. Is the concern boat wake or wind-wave driven?	Jesse Patchett / Wood Rodgers	4/12/16	This sentence was in error. Erosion issues in this levee were localized due to scour at existing pipe outlets. This sentence has been revised to indicate that erosion was only identified in a few localized areas.	X				Y	5/3/2016	
13	Eric Nagy / MBK	Page 8, § 2.J	4/5/16	Recommend clearly describing how much of this reach has an existing levee and how much will require the construction of a new levee. This is important context for understanding the limited coverage associated with the geotechnical analysis and inspection results.	Jesse Patchett / Wood Rodgers	4/12/16	This requested information has been added.	X				Y	5/3/2016	
14	Eric Nagy / MBK	Pages 9-12, § 3.A.1	4/5/16	Recommend reorganizing this section with subsections to clearly distinguish between different cutoff wall (1) compositions, (2) construction techniques, and, (3) locations. All three variables are currently blended together with a large introduction to the topic. The description for each variable in each subsection should be limited to concepts relative to that subsection. For example, mobilization is much more significantly tied to construction method than wall type.	Jesse Patchett / Wood Rodgers	4/12/16	The requested revision has been made	X				Y	5/3/2016	
15	Eric Nagy / MBK	Pages 9-12, § 3.A.1	4/5/16	The information presented in this section lends itself to presentation through a table. For example, construction methods variables like unit price, depth limitations, mobilization costs, and required working platform width can be easily compared in a tabular format.	Jesse Patchett / Wood Rodgers	4/12/16	A table has been developed and included for ease of comparison.	X				Y	5/3/2016	
16	Eric Nagy / MBK	Page 11, § 3.A.1	4/5/16	Recommend including a section describing CSM in a manner similar to DSM and TRD.	Jesse Patchett / Wood Rodgers	4/12/16	A description of CSM has been added to the report.	X				Y	5/3/2016	
17	Eric Nagy / MBK	Page 12, § 3.A.2	4/5/16	The width of a seepage berm is a key factor in determining the cost of implementation. Recommend including a brief description of minimum and maximum berm width and how it is determined.	Jesse Patchett / Wood Rodgers	4/12/16	We will add information regarding seepage berm widths which will include the ULDC guidelines for a minimum seepage berm width equal to four times the Minimum Top of Levee (MTOL), and generally a maximum seepage berm width equal to 300 feet. We will further add information on the assumed seepage berm width, as applicable.	X				Y	5/3/2016	

City of West Sacramento Flood Program - Draft Alternatives Analysis Report Review

Internal Team Comments

REVIEWER					RESPONDENT							REVIEWER		
COMMENT NUMBER	REVIEWER NAME/ AGENCY	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
18	Eric Nagy / MBK	Page 13, § 3.A.4	4/5/16	The extended discussion on relief well O&M seems out of context and inappropriate in this section. The topic of O&M is not addressed for any other measure in this section. Recommend removing this section and simply stating that "Due to water quality permitting, operations and maintenance, and vandalism concerns, relief wells are only considered as a seepage remediation measure in limited circumstances where cutoff walls and berms are impractical."	Jesse Patchett / Wood Rodgers	4/12/16	The requested revision has been made	X				Y	5/3/2016	
19	Eric Nagy / MBK	Page 14, § 3.B.1	4/5/16	Levee raises typically favor a landslide expansion of the levee footprint in order to avoid impacts to conveyance. This section should note that waterside expansion of the levee footprint will be considered where hydraulic and environmental analysis permits.	Jesse Patchett / Wood Rodgers	4/12/16	The requested information has been added	X				Y	5/3/2016	
20	Eric Nagy / MBK	Page 19, § 3.G	4/5/16	Is additional ROW also estimated in locations where significant slope flattening is required to address geometry or slope stability deficiencies?	Jesse Patchett / Wood Rodgers	4/12/16	Yes, ROW acquisitions extended 20' beyond needed improvements. However, for waterside slope flattening, this would fall within the levee prism and is therefore ROW is assumed to already be held in these areas. Land acquisition needs have been added to each of the typical improvement figures.			X		Y	5/3/2016	
21	Eric Nagy / MBK	Page 20, § IV, ¶ 2	4/5/16	Assuming removal and off-site disposal of the 20% of in-situ material determined to be unsuitable may not be reasonable. Most projects find a legitimate way to "lose" this material within the project site.	Jesse Patchett / Wood Rodgers	4/12/16	Assuming 20% disposal seems reasonable for most levees in the evaluation. The exception being the DWSC West Levee, where there appears to be ample room to "lose" material. This assumption will be 0% for this levee.			X		Y	5/3/2016	
22	Eric Nagy / MBK	Page 21, § V, General Comment	4/5/16	Overall, the descriptions and discussion included in this section is strongly biased toward only seepage remitting measures. The individual criteria description need to be presented in a manner where the reader can understand how they are applied in the decision between measures for any deficiency type.	Jesse Patchett / Wood Rodgers	4/12/16	Seepage is the primary consideration for the evaluation criteria since seepage measures typically drive costs for a remediation measure project. Information on erosion will also be provided in the context of each criteria.		X			Y	5/3/2016	
23	Eric Nagy / MBK	Page 22, § V.C	4/5/16	If effectiveness is considered equally across all measures, why is it included as a criteria?	Jesse Patchett / Wood Rodgers	4/12/16	In some instances, mitigation measures can be applied that are intuitively less effective (or robust). For example, waterside clay blankets can be an effective method for mitigating through seepage, but in comparison to a seepage cutoff wall (in Wood Rodgers opinion), they are less robust. If such a measure had been proposed for this analysis, it would have been rated as less effective. This is a valid comment, but we suggest that it remain a consideration even though in this case all are considered equal.			X		Y	5/3/2016	
24	Eric Nagy / MBK	Page 23, § VI.A.1.a	4/5/16	Is the CB wall only required where North Harbor Boulevard is coincident with the levee crown or is this approach assumed for the entire segment?	Jesse Patchett / Wood Rodgers	4/12/16	The CB wall approach is currently considered for the entire reach.			X		Y	5/3/2016	

City of West Sacramento Flood Program - Draft Alternatives Analysis Report Review

Internal Team Comments

REVIEWER					RESPONDENT							REVIEWER		
COMMENT NUMBER	REVIEWER NAME/ AGENCY	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)
25	Eric Nagy / MBK	Page 23, § VI.A.1.a	4/5/16	Is erosion an issue identified in the PIR along this segment?	Jesse Patchett / Wood Rodgers	4/12/16	Erosion deficiencies identified in this reach are due to being on the outside bend of the river as this represents an increased erosion risk. However, since the theoretical ULDC prism fits within the existing embankment and slope stability was not identified as an issue, RSP was not determined to be necessary in this reach.			X		Y	5/3/2016	
26	Eric Nagy / MBK	Page 23, § VI, General Comment	4/5/16	Recommend revising seepage remediation descriptions by including the levee crown height in order for the reader to understand the anticipated cutoff wall depth within a particular segment. Alternatively, the estimated wall invert elevations could be replaced with estimated wall depth.	Jesse Patchett / Wood Rodgers	4/12/16	Cutoff wall depth will be added to the text.	X				Y	5/3/2016	
27	Eric Nagy / MBK	Page 43, § VI.H.7.a	4/5/16	Considering revising 1st sentence in the 1st paragraph to more clearly introduce this alternative.	Jesse Patchett / Wood Rodgers	4/12/16	The requested edit has been made.	X				Y	5/3/2016	
28	Eric Nagy / MBK	Page 43, § VI.H.7.a	4/5/16	Recommend providing an explanation for the statement, "Landslide borrow restrictions to address under seepage issues".	Jesse Patchett / Wood Rodgers	4/12/16	At present, underseepage and some through seepage are mitigated by an unofficial berm created by the dredged spoils which therefore acts as a stability berm/seepage berm. The ULE evaluations showed that modeled removal of this material often led to high exit gradients, and existing explorations suggest that it may also lead to unacceptable through seepage in some locations. The ULE mitigation recommendations (SWS GER volume 2) analyzed each cross-section with a specific limited removal of this material effectively leaving material in place to act as a berm (in conjunction with other mitigation components) and found a planning-level limitation that provided adequate protection against underseepage. Per Comment 11, this information will be included in Section II.2.H of the text, and will not be repeated in this section.	X				Y	5/3/2016	
29	Eric Nagy / MBK	Page 57, § VI.K.2.b	4/5/16	The description of this alternative indicates that the storage tank is in conflict with the proposed berm footprint; however, it does not indicate how that conflict is resolved through implementation of the alternative.	Jesse Patchett / Wood Rodgers	4/12/16	The storage tank would be ~15' from the new toe, so it is possible that it could remain. A sentence noting that slightly shifting the freeboard improvement waterward could eliminate the need to relocate/modify the existing fence.	X				Y	5/3/2016	
30	Derek Larson / LWA	Page 1 and 2	4/4/16	Misc Text Edits	Jesse Patchett / Wood Rodgers	4/12/16	The requested edits have been made	X				Y	5/4/2016	
31	Derek Larson / LWA	Page 20, Section G	4/4/16	A map showing the assumptions for real estate would be helpful	Jesse Patchett / Wood Rodgers	4/12/16	Typical RE assumptions and land acquisition associated with each alternative has been added to the Figures.	X				Y	5/4/2016	
32	Derek Larson / LWA	Page 21, Section IV	4/4/16	Has this been Wood Rodgers' experience? How much material in volume would require off haul and disposal?	Jesse Patchett / Wood Rodgers	4/12/16	The reuse amount varies depending on the nature of the existing materials. We have seen it range between zero reusable and 100% reusable. The key is having good exploration data to understand the existing materials. Based on the data we have, 80% reusable is a reasonable assumption.			X		Y	5/4/2016	
33	Derek Larson / LWA	Page 21, Section IV	4/4/16	Longer averages over 20 to 30 years is close to 3.2%	Jesse Patchett / Wood Rodgers	4/12/16	Since this AAR is projecting estimated costs in the near-term, average escalation rates over the past few years was used.			X		Y	5/4/2016	

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1	IPE	General	4/17/2016	Suggest a list of abbreviations and acronyms.	Jesse Patchett Wood Rodgers	4/21/16	The requested list will be included.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
2	IPE	General	4/17/2016	Will this need to be signed by a PE?	Jesse Patchett Wood Rodgers	4/21/16	Yes.			X		Y	5/7/2016		n/a
3	IPE	Introduction paragraph	4/17/2016	The word "bifurcated" is used. Suggest just saying "divided into two parts".	Jonathan Kors Wood Rodgers	4/21/16	We are comfortable with the word "bifurcated".		X			Y	5/7/2016		n/a
4	IPE	Introduction paragraph	4/17/2016	AAR will inform the City's finding of adequate progress towards 200-year protection in July of 2016." Should stipulate that Adequate progress report is separate report and the 2 cited reports would be used in support of the Adequate progress report, not in lieu of it.	Jesse Patchett Wood Rodgers	4/21/16	The requested information will be included.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
5	IPE	II. Summary of Identified System Deficiencies.	4/17/2016	States the geotechnical deficiencies were determined with current levee grade and did not include any "levee raises for freeboard deficiencies". Would more have been determined if they had?	Jesse Patchett Wood Rodgers	4/21/16	Generally, we do not feel that more deficiencies would be identified where levee raises are proposed since most levees raises are for freeboard criteria (i.e. most of the levees contain the DWSE). The exception was the Port levees. For the Port levees, freeboard mitigation was considered. For levees outside of the Port, the team believes that, while it is possible that additional levee height could lead to additional stability deficiencies, we expect that most if not all could be mitigated via the freeboard mitigation design.			x		Y	5/7/2016		n/a
6	IPE	II. Summary of Identified System Deficiencies. A. Sacramento River West North Levee	4/17/2016	When will the "future modifications to the baseline 200-year Flood Program" be made? Would this help much with the seepage problems (here and other places) since the HTOL would be affected?	Jesse Patchett Wood Rodgers	4/21/16	The current PIR and AAR were developed using information from previous studies (i.e. ULE/NULE, GRR, etc.). No new explorations or analysis were conducted. Additionally, the DWSE used was based on the Comp Study Hydrology. WSAFCA anticipates having the team perform additional geotechnical exploration and evaluations in order to confirm, refine, and/or reduce currently recommended seepage and stability remediation measures. Finally, updating the freeboard evaluation using the CVHS hydrology may reduce the DWSE. Early on in the project, the client requested that the team track where additional exploration and analysis using updated information could have the potential to reduce estimated Flood Program Costs.			X		Y	5/7/2016		n/a
7	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee.	4/17/2016	We would hope that if the freeboard is low 6 to 8 inches, these would be corrected. If the 6 to 8 inches are other geometry issues, good engineering judgment and maybe "exceptions" be utilized if the levee can be document as adequate. Therefore, eliminating a levee modification.	Jesse Patchett Wood Rodgers	4/21/16	Even for areas of minor freeboard deficiencies, improvements and associated costs are included in the recommended plan. As noted in the previous comment, the client asked the team to track items that could potentially be eliminated. Since the team understands CVHS may reduce the DWSE, we highlighted areas with minor freeboard deficiencies to understand cost impacts due to future evaluations and analysis.			X		Y	5/19/2020	Could a sentences be added stating that if the levee is a few inches too low, numerous methods of achieving grade will be considered, like a cap being added and using steeper side slopes to minimize disturbing the entire levee slopes to just add a few inches of height.	We will add the requested sentence in Section III.B and will note that these measures could be considered in a future phase of the Flood Program.
8	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee	4/17/2016	In the second paragraph. The first two sentences are confusing and should be rewritten	Jesse Patchett Wood Rodgers	4/21/16	These will be rewritten to reduce confusion.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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9	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee	4/17/2016	It states "identification of a waterside rapid drawdown slope stability deficiency is dependent on the location of the assumed theoretical levee template." Please elaborate on these locations.	Jesse Patchett Wood Rodgers	4/21/16	If the levee template waterside slope is located immediately adjacent to the existing waterside slope, a waterside rapid drawdown slope instability could encroach into the existing levee template. If ongoing slope failures are not repaired, the waterward slope will progressively move landward, thereby continually moving the location of the theoretical levee prism within the existing wide embankment.	X				Y	5/19/2020	The last sentence is confusing	Please see the updated last sentence in red. If the levee template waterside slope is located immediately adjacent to the existing waterside slope, a waterside rapid drawdown slope stability deficiency would be identified as slope failure could encroach into this levee template. If the template is located further inland, then a rapid drawdown deficiency would not currently be identified. However, if a slope failure occurs and is not repaired, the waterside slope will progressively move landward, and potentially encroach on the landward template. To summarize, if the waterside slope levee template is located within approximately 5 feet of the existing waterside slope, a rapid drawdown slope stability deficiency will be identified and the slopes will require slope flattening. If the template is located inland, BCI would recommend that the waterslide slopes are maintained during and after high water events to maintain the existing waterside slope location. We can add this verbiage to the document.
10	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee	4/17/2016	Third paragraph. Are the seepage issues through or under or both?	Jesse Patchett Wood Rodgers	4/21/16	The text states "Seepage issues were not identified downstream of the Tower Bridge (Station 215+30)..." Neither through seepage nor underseepage issues were identified downstream of Sta 215+30. This will be clarified in the text.			x		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
11	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee	4/17/2016	It states "Future iterations of the AAR may reconsider this approach and defer them to long-term maintenance items." Who and how will this be determined?	Jesse Patchett Wood Rodgers	4/21/16	We expect that the design team, MBK, WSAFCA, the City, and the LMA would be the ones to collaboratively make this decision in the future. This one another area of possible Flood Program cost reductions, and was added at the request of the client.			X		Y	5/7/2016		n/a
12	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee	4/17/2016	Third paragraph. What about just looking at the location of the theoretical levee template?	Jesse Patchett Wood Rodgers	4/21/16	The theoretical levee prism is contained within the embankment at this location. Slope stability issues were identified due to steep slopes.			X		Y	5/7/2016		n/a
13	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee	4/17/16	Fourth paragraph. States "Erosion" was an issue, but gave no fix?	Jesse Patchett Wood Rodgers	4/21/16	This section presents deficiencies. Remediation measures are described elsewhere in the report.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
14	IPE	II. Summary of Identified System Deficiencies, A. Sacramento River West North Levee	4/17/2016	Fifth paragraph. References another report to look at "assessment ratings" for this area. Could a brief summary of these assessment ratings be included in this paragraph?	Jesse Patchett Wood Rodgers	4/21/16	Information on the ratings will be included in III.E.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
15	IPE	II. Summary of Identified System Deficiencies, B. Barge Canal Bulkhead Closure Structure	4/17/2016	States that the evaluation is "on going" and the IPE hopes that this paragraph will be completely rewritten when these analyses have been completed and will be given a chance to review	Jesse Patchett Wood Rodgers	4/21/16	Information on the Barge Canal Bulkhead assessment will be included in the Final AAR.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
16	IPE	II. Summary of Identified System Deficiencies, C. Sacramento River West South Levee.	4/17/2016	USACE recently worked on this area and left the levee grade "deficient"?	Jesse Patchett Wood Rodgers	4/21/16	Yes. This was confirmed with a field survey on February 24, 2016.			X		Y	5/7/2016		n/a
17	IPE	II. Summary of Identified System Deficiencies, C. Sacramento River West South Levee.	4/17/2016	Rather than saying issues will be "addressed" suggest saying, "they will be remediated to meet current requirements."	Jonathan Kors Wood Rodgers	4/21/16	Your suggestion is noted, but this appears to be a distinction without a difference.			X		Y	5/7/2016		n/a
18	IPE	II. Summary of Identified System Deficiencies, C. Sacramento River West South Levee	4/17/2016	Second paragraph. Suggest a rewrite for this paragraph. The levee is in such bad shape that two wooden post and a highway marker are "high hazards"?	Jesse Patchett Wood Rodgers	4/21/16	The post and marker are identified as high-hazards in the USACE PI. The Sacramento River South Levee is generally in good shape (or it will be once Southport is completed). We will make this clearer in the text.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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19	IPE	II. Summary of Identified System Deficiencies, C. Sacramento River West South Levee	4/17/2016	It states the freeboard deficiency "may be eliminated during future analyses." Is this because of the possible change in hydrology?	Jesse Patchett Wood Rodgers	4/21/16	Yes. The design team believes using CVHS models could reduce the DWSE, thereby potentially reducing and/or eliminating some freeboard deficiencies. However, this sentence (and others like it) have been removed throughout at the request of the client.			X		Y	5/7/2016	Comment closed pending confirmation in report. Suggest stating that the elimination is anticipated due to the future update of the hydrology.	n/a
20	IPE	II. Summary of Identified System Deficiencies, D. Sacramento Bypass South Levee	4/17/2016	This paragraph seems to imply that because this group has looked at this "deficiency" and passed it, its ok. A more substantial reason should be provided. If this sentence is left in, a comma should be added after (CVFPB).	Jesse Patchett Wood Rodgers	4/21/16	The team has reviewed the entire Sacramento Bypass South Levee and has concluded only 285 feet are deficient. This paragraph states... "The results of this evaluation indicate that the Sacramento Bypass South Levee mostly meets seepage, stability, freeboard, and erosion criteria. The only remaining deficiencies include a through and underseepage issue in the eastern-most 285 feet of the levee." The requested comma has been added.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
21	IPE	II. Summary of Identified System Deficiencies, D. Sacramento Bypass South Levee	4/17/2016	It says "variance" in the first paragraph. Wouldn't it be an "exception" to ULDC? It may be variance for CVFPB but is this for compliance to CVFPB or ULDC? This and in other places.	Jesse Patchett Wood Rodgers	4/21/16	Exception will replace variance throughout.	X				Y		Comment closed pending confirmation in report.	n/a
22	IPE	II. Summary of Identified System Deficiencies, D. Sacramento Bypass South Levee.	4/17/2016	States there are "high-hazard" encroachments within this reach, but does not describe what they are.	Jesse Patchett Wood Rodgers	4/21/16	Information will be included specifying the hazards	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
23	IPE	II. Summary of Identified System Deficiencies, E. Training berm	4/17/2016	It says "the berm appears to be important for hydraulic reasons.." You don't know for sure but then say "determining its susceptibility to erosion is important."	Jesse Patchett Wood Rodgers	4/21/16	That is correct. The team does not know the purpose of the training berm for sure, therefore it is important for us to determine its susceptibility to erosion. In this way, we are erring on the side of caution and recommending improvements, rather than not.			X		Y	5/7/2016		n/a
24	IPE	II. Summary of Identified System Deficiencies, F. Yolo Bypass East Levee.	4/17/2016	This refers to "Reference 7". Suggest using document name and reference number.	Jesse Patchett Wood Rodgers	4/21/16	The requested information will be included	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
25	IPE	II. Summary of Identified System Deficiencies, H. DWSC West Levee.	4/17/2016	States a "gas line at the levee toe is a "moderate hazard" and in other section, a "fiber optics line" is "high-hazard". Why the difference?	Jesse Patchett Wood Rodgers	4/21/16	Please refer to the PIR for a detailed discussion on how low, moderate, and high hazard encroachments and penetrations were defined. As noted previously, a very brief discussion on this will be included in the Final AAR, with a reference to the PIR for more details.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
26	IPE	III. Alternatives Considered, A. Seepage and Stability Mitigation Measures 1. Cutoff Walls	4/172016	In the second paragraph, 3 reasons to require a ½ degrade are listed. None of these 3 reasons make "good engineering sense". A 1/3 degrade has been shown to work and is much cheaper for the levee owners. If engineers still believe a ½ degrade is required, computations should be provided to backup their opinion for review.	Jonathan Kors Wood Rodgers	4/21/16	In the not to distant past, 1/2 levee degrade was performed for SB wall construction for the reasons noted in the report. It is correct that more recently projects have shifted to 1/3 levee degrade at a cost savings. We concur that this will likely be the case for this program. However, elevated risk for constructing with a 1/3 levee degrade remains. Considering a half levee degrade in the analysis now is a conservative assumption that can be modified if appropriate in later phases.			X		Y	5/25/2016	Can the math displaying this "risk" be furnished for review?	Text in this section has been updated to indicate that recent levee projects in the Sacramento area have used a 1/3 degrade, and that this approach will be reviewed during the design phase.
27	IPE	III. Alternatives Considered, A. Seepage and Stability Mitigation Measures 1. Cutoff Walls.	4/17/2016	The Dewind "One Pass" type wall should also be listed it is currently in other local (Sacramento) P&S.	Jonathan Kors Wood Rodgers	4/21/16	A description of this equipment has been added.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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28	IPE	III. Alternatives Considered, SCB Cutoff Walls	4/17/2016	These type walls as described here should not be proposed or used. They can be dangerous and can pose a public safety issue.	Jonathan Kors Wood Rodgers	4/21/16	Wood Rodgers does not agree that SCB walls are dangerous or pose a public safety issue. Many exist in the the Sacramento region and are not classified as a risk by the USACE/CVFPB/DWR or other agency responsible for levee safety. The construction of SCB walls does require an appropriate level of quality control and quality assurance to ensure they are constructed properly. Given their use in the region, it is appropriate to discuss them here. They are not proposed for the City's Flood Program other than where walls are to be constructed to depths greater than 75 feet where the DSM method would be used.		X			Y	5/25/2016	Wood Rodgers should talk to Rich Millet and ask his opinion and if he would recommend these walls. These walls have been used before designers discovered problems with their construction. So just because they were used in the area in the past is no reason to discuss them as a "possibility".	Text in this section will be updated to include information that these walls are unlikely to be used bsaed on costs.
29	IPE	III. Alternatives Considered, CB Cutoff Walls	4/17/2016	The statement about "intermediate panels" is not correct. Do panels require "trimming" also? Cost are way out of line.	Jesse Patchett Wood Rodgers	4/21/16	In Wood Rodgers' experience, CB walls have been constructed as described in the report. Unit costs cited for CB walls come from actual projects in northern California, as well as discussions with an experienced CB wall contractor.		X			Y	5/25/2016	Wood Rodgers should investigate this further. Most times CB walls are constructed as SB walls, not panels. A. V. Watkins Dam and Dallas Floodway are great examples.	Text in this section will be updated to indicate these wall can also be constructed using an open trench method.
30	IPE	III. Alternatives Considered, Waterside Versus Levee Centerline Cutoff Wall Installation	4/17/2016	States, "Existing levee excavation and reconstruction quantities are higher (versus typical degrading for a levee centerline installation). Explain why this is true.	Jesse Patchett Wood Rodgers	4/21/16	This sentence has been revised to indicate excavation and reconstruction quantities vary in relation to a typical degrade, depending on the degrade height used.			X		Y	5/7/2016		n/a
31	IPE	III. Alternatives Considered, Relief Wells.	4/17/2016	PVC screens should be added and concrete-lined ditches are not always required.	Jesse Patchett Wood Rodgers	4/21/16	Details regarding relief well O&M have been removed at the request of the client since these were not considered a suitable alternative. Therefore, this text has not been included in the revised AAR.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
32	IPE	III. Alternatives Considered, Relief Wells, Periodic Maintenance	4/17/2016	It is not required to run a camera down well yearly. It would only be required if the well was found to be producing sands. Only a percentage of the well field should be pumped every year in a manner so that each is pumped on a 5 year interval. Well may only need jet washing without chemicals.	Jesse Patchett Wood Rodgers	4/21/16	Details regarding relief well O&M have been removed at the request of the client since these were not considered a suitable alternative. Therefore, this text has not been included in the revised AAR.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
33	IPE	VI. Alternatives Analysis, A. Sacramento River West North Levee 2. Reach 2 (Station 71+00 to Station 101+00).	4/17/2016	What are the USACE identified unacceptable utilities?	Jesse Patchett Wood Rodgers	4/21/16	These utilities include sewer pipes, manholes, electrical conduits, vaults, fire hydrants, and irrigation lines. For more information, please see the Penetration and Encroachment Assessment included in the PIR.			X		Y	5/7/2016	Comment closed. Suggest referring to the PIR.	n/a
34	IPE	VI. Alternatives Analysis, Reach 3	4/17/2016	First sentence says a cutoff wall could be constructed then last sentence says it will not work. Why?	Jesse Patchett Wood Rodgers	4/21/16	The first sentence will be revised to clarify that a cutoff wall is an alternative, since homes on the levee make construction of a cutoff wall in this area infeasible.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
35	IPE	VI. Alternatives Analysis, Reach 6, Alternative 2.	4/17/2016	Do the designers know it would take a 150 ft berm? What about wells?	Jesse Patchett Wood Rodgers	4/21/16	Based on available information, the designers feel a 150-foot wide berm is reasonable for cost estimating purposes. Future geotechnical evaluations will be required to determine the recommended berm width. Due to the water quality permitting needs, increased operation and maintenance responsibilities, and potential impacts to pump stations and internal drainage facilities, relief wells were not identified as a preferred seepage remediation measure in the AAR.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
36	IPE	VI. Alternatives Analysis, Reach 9, B	4/17/2016	The IPE should be notified when the information on the Barge Canal Bulkhead is added.	Jesse Patchett Wood Rodgers	4/21/16	During a meeting with WSAFCA and MBK on 4/20/16, it was decided that the Bulkhead TMs would not be reviewed by the IPE at this time.			X		Y	5/7/2016		n/a

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37		VI. Alternatives Analysis, Reach 9, C	4/17/2016	Should the deficiencies in Reaches 1, 2, and 3 be listed?	Jesse Patchett Wood Rodgers	4/21/16	Reach 1 - measures to address known deficiencies are nearing construction and are therefore not included in the AAR. Reach 2 - no identified deficiencies. Reach 3 - minor freeboard deficiencies are described.			X		Y	5/7/2016	Suggest stating this in the report.	n/a
38	IPE	30. VI. Alternatives Analysis, Reach 9, D	4/17/2016	A better reason for a variance acceptance should be given. The last paragraph is unclear.	Jonathan Kors Wood Rodgers	4/21/16	We are assuming that because the USACE reviewed and ultimately provided a 408 permit for the EIP Project even though it does not meet geometry standards, we are confident that we will not need to modify existing, geotechnically stable slopes simply to meet geometry standards. We believe this to be an appropriate assumption.			X		Y	5/7/2016		n/a
39	IPE	VI. Alternatives Analysis, Reach 9, F. Yolo Bypass East Levee, Reach 7.	4/17/2016	States the "fiber-optic line was found to be unacceptable". What is the failure mode for this?	Jesse Patchett Wood Rodgers	4/21/16	This was the rating provided in the USACE PI.			X		Y	5/19/2020	Should you then comment on the USACE PI?	Commenting on the USACE PI Report is beyond the scope of work on this effort.
40	IPE	VI. Alternatives Analysis, Reach 9, F. Yolo Bypass East Levee, Reach 9	4/17/2016	This relative narrow seepage berm makes the IPE question the very deep cutoff wall.	Jesse Patchett Wood Rodgers	4/21/16	The team assumed a minimum-width seepage berm. However, a seepage berm may not address the failing exit gradient calculated at the landside ditch as shown in previous studies. For these reasons, the seepage berm was considered infeasible and was not advanced in the AAR.			x		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
41	IPE	VI. Alternatives Analysis, Reach 9, G. South Cross Levee, Alternative b	4/17/2016	The cost estimate for this alternative is about ½ the selected plan. Why pay so much more for the other plan?	Jesse Patchett Wood Rodgers	4/21/16	The client prefers the cutoff wall option due to sensitivities with landowners in this area.			X		Y	5/7/2016	Suggest stating this in the report.	n/a
42	IPE	VI. Alternatives Analysis, Reach 9, H. DWSC West Levee, Reach 2	4/17/2016	Why is a gas line a low hazard, but a fiber optics line is a high hazard?	Jesse Patchett Wood Rodgers	4/21/16	The gas line in this reach was identified as a moderate hazard in the USACE PI since it does not penetrate the levee.			X		Y	5/19/2020	What about the fiber optic line?	The fiber optic line was identified as a high hazard since it penetrates the levee below the 200-year WSE.
43	IPE	VI. Alternatives Analysis, Reach 9, H. DWSC West Levee, Reach 7	4/17/2016	Because we have never seen a "smart" seepage berm, the word "wise" should be "wide".	Jesse Patchett Wood Rodgers	4/21/16	The requested revision has been made	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
44	IPE	VI. Alternatives Analysis, Reach 9, I. DWSC East Levee, Reach 3	4/17/2016	So some fences are high hazard and some are moderate-hazard?	Jesse Patchett Wood Rodgers	4/21/16	The hazard assessment is a function of: location, permit status, and USACE PI rating.			X		Y	5/19/2020	Do you agree with USACE PI rating?	The draft AAR was developed using available information. Wood Rodgers did not conduct any site specific assessments that would provide the information necessary to comment on the USACE PI.
45	IPE	Figure 3.	4/17/2016	Is the 1V:3H landside slope correct?	Jesse Patchett Wood Rodgers	4/21/16	Yes. Our typical levee raising includes 3H:1V landside slopes.	X				Y	5/7/2016		n/a
46	IPE	Figure 4.	4/17/2016	Where did the "30 foot" minimum come from? This requires a large excavation into the levee.	Jesse Patchett Wood Rodgers	4/21/16	The 30 foot dimension is the required width for an excavator to construct the waterside toe cutoff wall. This measure was not included in any alternative, so the dimensions do not impact the results of the AAR.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
47	IPE	Figure 5.	4/172016	Why use such a complicated seepage berm? Why not use a cleaner SM?	Jesse Patchett Wood Rodgers	4/21/16	The AAR costs assumed local borrow, which may consist of fine grained material and may therefore require the incorporation of a drainage layer. Future evaluations may modify this detail.			X		Y	5/7/2016		n/a
48	IPE	Figure 6	4/17/2016	If the "Levee Embankment fill" is clay, is this drained berm necessary?	Jesse Patchett Wood Rodgers	4/21/16	The levee embankment fill may not be completely comprised of clay. Including a drained berm at this planning stage is appropriate for conservative cost estimating purposes.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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49	IPE	Figure 8	4/17/2016	So rainwater and back-flooding is allowed along the landside drain which will flood this zone?	Jesse Patchett Wood Rodgers	4/21/16	The detail shows a perforated drainage pipe which will direct water away from the landside levee toe.			X		Y	5/19/2020	Unresponsive	This repair detail is consistent with previous USACE repairs along this levee that are believed to be successful based on performance. The potential for flooding on the landside of the levee will be reviewed in detail during future design phases of the Flood Program.
50	IPE	References	4/17/2016	Please put references in alphabetical order.	Jesse Patchett Wood Rodgers	4/21/16	The requested revision has been made			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
51	IPE	Geotechnical Alternative Analysis Report, 3 Project Description	4/17/2016	Bifurcated. What a nice word to describe "divided into two".	Jonathan Kors Wood Rodgers	4/21/16	We have bifurcated your comments into two categories, those that are relevant to a SAR review and those that are not. This one is not.			X		Y	5/7/2016	Noted. This report will be made public and because of that the average person does not use that word. In general design reports can be "bifurcated" into reports that are easily read and understood and those with unused words inserted to impress. So designer can pick.	n/a
52	IPE	Geotechnical Alternative Analysis Report, 5 Geotechnical Deficiency Mitigation Measures.	4/17/2016	Why were relief wells not considered?	Jesse Patchett Wood Rodgers	4/21/16	Due to the water quality permitting needs, increased operation and maintenance responsibilities, and potential impacts to pump stations and internal drainage facilities, relief wells were not identified as a preferred seepage remediation measure in the AAR.			X		Y	5/7/2016	Suggest stating this in the report.	n/a
53	IPE	Geotechnical Alternative Analysis Report, Table 1	4/17/2016	What is X?	Juliana Fisher Blackburn	4/21/16	"X" is an identified deficiency similar to that used for the GPIR. We can add clarification to this table.			x		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
54	IPE	Geotechnical Alternative Analysis Report, Figure 5 of 10	4/17/2016	The IPE does not like the way the drainage berm is designed.	Juliana Fisher Blackburn	4/21/16	For clarification, these figures are not part of the Geotechnical Alternatives Analysis, but part of the overall AAR. For the AAR cost analysis, the design team assumed mitigation would be consistent with the successful mitigation performed by the USACE under Contracts C and D. This detail was extracted from the Contract D As-Built drawings. Future evaluations may refine this detail.			x		Y	5/7/2016		n/a
55	IPE	Geotechnical Alternative Analysis Report, Figure 2 of 2	4/17/2016	The IPE sees no real need for this complex of a seepage berm.	Juliana Fisher Blackburn	4/21/16	The seepage berms include an internal drainage layer in the event that the berms are constructed of fine grained material. Future evaluations may refine this detail.			x		Y	5/7/2016		n/a
56	IPE	II. Summary of Identified System Deficiencies, Para. A SRWN Levee, p. 2	4/18/16	The report states there is the potential for through seepage and landside slope stability that may be eliminated "---with additional monitoring and reporting during high water events." consideration should be given to eliminating this potential problem with additional analysis and if not then suggest monitoring. The approach seems backward.	Jesse Patchett Wood Rodgers	4/21/16	The previous analysis identified through seepage deficiencies. However, the team is not aware of past performance through seepage issues during previous high water events. The team and previous evaluators recommend monitoring and recording the landside slopes during high water events for indications of through seepage.			x		Y	5/7/2016		n/a
57	IPE	II. Summary of Identified System Deficiencies, Para. B Barge Canal Bulk Closure Structure, p. 3	4/18/16	It would be helpful to describe the Bulkhead Structure.	Jesse Patchett Wood Rodgers	4/21/16	Information on the Barge Canal Bulkhead assessment will be included in the Final AAR.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
58	IPE	II. Summary of Identified System Deficiencies, Para. C SRWS Levee, p. 4	4/18/16	The report states there are intermittent freeboard deficiency---of---less than 6 inches, and may be eliminated during future analyses." They either exist or they don't but exist but it seems if they do they should be corrected. How will analyses fix the problem? Why are there remaining vegetation, encroachment and penetration deficiencies after the previous USACE Project?	Jesse Patchett Wood Rodgers	4/21/16	Please refer to responses to comments 7, 16, and 18.			X		Y	5/7/2016		n/a

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59	IPE	II. Summary of Identified System Deficiencies, Para. D SBS Levee, p. 4	4/18/16	List Stationing with eastern-most 285ft. Why are there two high-hazard encroachments and three high-hazard penetrations after the EIP? Are these misidentified?	Jesse Patchett Wood Rodgers	4/21/16	Stationing will be cited for the 285 feet; the EIP didn't address the entire SBSL, so encroachments and penetrations are still identified in the USACE PI near Harbor Blvd.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
60	IPE	II. Summary of Identified System Deficiencies, Para. F Yolo Bypass East Levee, p. 6	4/18/16	Question: what is the rational behind the required 4H to 1V required for waterside slope in the ULDC? This seems arbitrary and unnecessary.	Jesse Patchett Wood Rodgers	4/21/16	California Title 23 requires bypass levees to have 4H:1V waterside slopes.			X		Y	**5/25/2016**	Yes we know but why - is this reasonable?	The AAR considers mitigation measures that would be compliant with ULDC and Title 23 criteria. Evaluating the rational and reasonableness of ULDC and TItle 23 criteria is beyond the scope of this AAR. If variances to these criteria can be supported with information obtained from future explorations and evaluations, the team may consider pursuing these, as appropriate at that time.
61	IPE	II. Summary of Identified System Deficiencies, Para. G South Cross Levee, p. 6	4/18/16	Explain why this levee should be considered. Is this because the DWSC East Levee is not considered?	Jesse Patchett Wood Rodgers	4/21/16	The South Cross Levee is a dryland levee that protects the City in the event of a levee failure of the Sacramento River West South Levee south of the SCL. It also protects the City in the event of a failure of the DWSC East Levee, south of the City.			X		Y	**5/7/2016**	Suggest stating this in the report.	n/a
62	IPE	II. Summary of Identified System Deficiencies, Para. H DWSC West Levee, p. 7	4/18/16	It would be helpful to explain why the DWSC West Levee is considered south of Station 170+00 but the DWSC East Levee is not evaluated? How was the apparent arbitrary ending point of Station 1000+00 selected?	Jesse Patchett Wood Rodgers	4/21/16	The DWSC West Levee is essentially the east levee of the Yolo Bypass. MBK has determined that a breach anywhere in the DWSC West Levee down to Miner Slough (approx. Station 1001+00) would allow water from the Yolo Bypass to enter the Deep Water Ship Channel and the resulting backwater could flood the Port (and significant portions of the City). This evaluation does not need to be performed for the DWSC East Levee since the South Cross Levee protects the City from a failure of this levee (and the Sac River West South Levee) south of the City. This will be clarified in the text.	X				Y	**5/7/2016**	Suggest stating this in the report.	n/a
63	IPE	II. Summary of Identified System Deficiencies, Para. K Port South Levee, p. 8	4/18/16	State which USACE and DWR inspections - vegetation, encroachment and penetrations?	Jesse Patchett Wood Rodgers	4/21/16	The requested information will be added	X				Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
64	IPE	III. Alternatives Considered Para. A Seepage and Stability Mitigation Measures, 1. Cutoff Walls, p. 9	4/18/16	It is typical to construct cutoff walls either at the levee centerline or waterward of the levee centerline?	Jesse Patchett Wood Rodgers	4/21/16	Yes			X		**Y**	**5/19/2020**	Need more explanation	Yes - it is typical to construct cutoff walls at either the levee centerline or waterward of the centerline.
65	IPE	III. Alternatives Considered Para. A Seepage and Stability Mitigation Measures, 1. Cutoff Walls, p. 10	4/18/16	Suggest that SB Cutoff Walls be discussed first - least expensive and most often used - before SCB Cutoff Walls. State a "minimum" 36-inch-wide trench. First two sentences under the SCB Cutoff Walls section are confusing. State issue with cracking of SCB walls in comparison to SB Cutoff Walls.	Jesse Patchett Wood Rodgers	4/21/16	The requested revision has been made	X				Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
66	IPE	III. Alternatives Considered Para. A Seepage and Stability Mitigation Measures, 4. Relief Wells, p. 13	4/18/16	In 6th bullet does "swabbing" mean surging	Jesse Patchett Wood Rodgers	4/21/16	Swabbing refers to the process used to remove drilling fluids and other materials from the gravel pack.					**Y**	**5/25/2016**	Never heard it used?	The details of the relief well development and O&M have been removed. FYI Information on well swabbing is available on the internet.

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67	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 1 Reach 1, p. 23, a Alternative 1	4/18/16	Report suggests a cutoff wall to El 0 to protect against through seepage but at this elevation underseepage mitigation is also provided. Please explain in more detail.	Nicole Hart Blackburn Consulting	4/21/16	A significantly deeper wall would be required if underseepage mitigation was necessary.		X			Y	5/19/2020	Then why so deep - explain?	Based on our assessment using available information, a cutoff wall is recommended to elevation 0 to address through seepage. This would address the sandy levee and shallow silty sand layers underlying the levee in order to effectively cut off the through seepage.
68	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 1 Reach 1, p. 23, a Alternative 1	4/18/16	Report suggests that cost may be reduced but it could also increase - same comment for all alternatives.	Jesse Patchett Wood Rodgers	4/21/16	The team feels that recommended selected plan represents the upper-end of the ultimate flood program costs. Since many of the geotechnical measures were based on existing information, some recommended measures may decrease or be eliminated with site specific geotechnical exploration and evaluation.		X			Y	5/7/2016		n/a
69	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 3 Reach 3, p. 24, a Alternative 1	4/18/16	A 36-inch-wide cutoff wall could be constructed to elevation 0 to address seepage issues in Reach 3. Insert "minimum" 36-inch-wide cutoff wall and describe what kind of seepage issues. This appears multiple times and should be corrected throughout the report.	Jesse Patchett Wood Rodgers	4/21/16	We will add "minimum" and through seepage	X				Y	5/7/2016		n/a
70	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 3 Reach 3, p. 24, b Alternative 2	4/18/16	Which is it a stability or a seepage berm and what kind of seepage?	Jesse Patchett Wood Rodgers	4/21/16	A stability berm is proposed for through seepage. We will make these corrections throughout.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
71	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 3 Reach 3, p. 25, b Alternative 2	4/18/16	First paragraph, last line add "drained" stability berm.	Jesse Patchett Wood Rodgers	4/21/16	The requested edit will be made.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
72	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 4 Reach 4, p. 25, a Alternative 1	4/18/16	Discuss seepage issue in Reach 4 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	Previous studies identified steady-state underseepage issues in this Reach as discussed in the GAAR and the GPIR. We will add this to the text.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
73	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 5 Reach 5, p. 26, a Alternative 1	4/18/16	Discuss seepage issue in Reach 5 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	Previous studies identified steady-state underseepage issues in this Reach as discussed in the GAAR and the GPIR. We will add this to the text.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
74	IPE	IV. Alternatives Analysis Para. A SRWN Levee, 6 Reach 6, p. 26, a Alternative 1	4/18/16	Discuss seepage issue in Reach 6 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	Previous studies identified steady-state underseepage issues in this Reach as discussed in the GAAR and the GPIR. We will add this to the text.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
75	IPE	IV. Alternatives Analysis Para. D SBS Levee, 2 Reach 2, p. 30, a Alternative 1	4/18/16	How can the Reach 1 have a cutoff wall to EL -5 and now in Reach 2 the recommendation is for cutoff wall to EL -100. Discuss underseepage issue of concern.	Nicole Hart Blackburn Consulting	4/21/16	The CHP construction terminated at Station 61+75. Reach 2 is significantly closer to the Sacramento River and therefore the aquifer underlying this Reach may be loaded by the Sacramento River aquifer, not only the aquifer for the Sacramento Bypass. This information is provided in the PIR.			X		Y	5/19/2020	You need to explain how why and state the CHP levee as constructed is adequate. Geology does not change abruptly unless an old river channel is encountered - just need more discussion.	Within the CHP design itself, a portion of the mitigation measure called for a deep cutoff wall to mitigate underseepage while other portions called only for a shallow wall to mitigate through seepage. We are not questioning the construction or design of the CHP Academy levee mitigation measures. As discussed, levee improvement measures were not constructed in this area. This will be reviewed in detail during future design phases of the Flood Program.
76	IPE	IV. Alternatives Analysis Para. D SBS Levee, 2 Reach 2, p. 31, a Alternative 1	4/18/16	Didn't CHP project terminate at Station 61+75 so how can statements at top of p 31 be correct?	Jesse Patchett Wood Rodgers	4/21/16	Agreed. This section will be updated pending further discussion with the team regarding the extent of USACE and DWR review of the CHP project.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
77	IPE	IV. Alternatives Analysis Para. D SBS Levee, 2 Reach 2, p. 31, b Alternative 2	4/18/16	Discuss how a 100ft wide seepage berm and slope flattening are equivalent to a cutoff wall to El -100. How much slope flattening?	Juliana Fisher Blackburn	4/21/16	Based on our experience in the area, the team assumed a 100-foot seepage berm will mitigate underseepage issues if identified in this Reach. The slope flattening recommendation refers to waterside slope flattening of 3(H):1(V) similar to that performed for the CHP Academy construction. We can add 3(H):1(V)			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
78	IPE	IV. Alternatives Analysis Para. F Yolo Bypass East Levee, 2 Reach 2, p. 33, a Alternative 1	4/18/16	Discuss seepage issue in Reach 2 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.	x		X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
79	IPE	IV. Alternatives Analysis Para. G South Cross Levee, 1 Reach 1, p. 39, a Alternative 1	4/18/16	Discuss seepage issue in Reach 1 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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80	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 1 Reach 1, p. 40, a Alternative 1	4/18/16	Discuss seepage issue in Reach 1 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
81	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 3 Reach 3, p. 41, a Alternative 1	4/18/16	Discuss seepage issue in Reach 3 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
82	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 5 Reach 5, p. 42, a Alternative 1	4/18/16	Discuss seepage issue in Reach 5 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
83	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 7 Reach 7, p. 43, a Alternative 1	4/18/16	Embankment reconstruction is described as another alternative but this is the first alternative. Discuss how this would be accomplished. Also discuss in more detail the landside borrow issue with respect to underseepage. Why is this levee discussed south of the South Cross Levee?	Jesse Patchett Wood Rodgers	4/21/16	Agreed, we will remove the word "another" and replace it with "an". The explorations indicate a silty sand layer within upper 1/2 of the levee embankment. Removal of this layer should mitigate identified through seepage. Regarding the landside borrow wrt underseepage the Geotechnical AAR provided greater detail. This information will be included in this section of the AAR. Please refer to response to comment 62 for a discussion of why the DWSC West Levee is evaluated	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
84	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 7 Reach 7, p. 43, b Alternative 2	4/18/16	Discuss the drainage requirements of the stability berm since it is discussed in the context of through seepage.	Juliana Fisher Blackburn	4/21/16	The requested information will be included.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
85	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 7 Reach 7, p. 43, c Alternative 3	4/18/16	If a deep cutoff wall would be required then how would the 10-foot wide stability berm noted in the previous alternative be adequate? Is the problem through seepage or underseepage?	Jesse Patchett Wood Rodgers	4/21/16	A stability berm would need to be coupled with landside borrow restrictions. This will be added to the text.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
86	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 9 Reach 9, p. 44, a Alternative 1	4/18/16	Discuss seepage issue in Reach 9 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
87	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 10 Reach 10, p. 45, a Alternative 1	4/18/16	Discuss seepage issue in Reach 10 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
88	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 11 Reach 11, p. 46, a Alternative 1	4/18/16	Good mentioned through seepage - more detail needed.	Jesse Patchett Wood Rodgers	4/21/16	A stability berm would need to be coupled with landside borrow restrictions. This will be added to the text.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
89	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 11 Reach 11, p. 46, b Alternative 2	4/18/16	Discuss the drainage requirements of the stability berm since it is discussed in the context of through seepage.	Juliana Fisher Blackburn	4/21/16	The requested information will be included.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
90	IPE	IV. Alternatives Analysis Para. H DWSC West Levee, 12 Reach 12, p. 47, a Alternative 1	4/18/16	Discuss seepage issue in Reach 12 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as both through seepage and underseepage. This alternative also needs to include landside borrow restrictions. This will be added to the text.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
91	IPE	IV. Alternatives Analysis Para. I DWSC East Levee, 2 Reach 2, p. 48, a Alternative 1	4/18/16	Discuss seepage and stability issues in Reach 2 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage, and stability as waterside rapid drawdown stability.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
92	IPE	IV. Alternatives Analysis Para. I DWSC East Levee, 3 Reach 3, p. 49, a Alternative 1	4/18/16	Discuss seepage issues in Reach 3 in more detail. How can the stratigraphy for the East and West levees be so different? A cutoff wall to El -60 on the west and to El -110 on the east. Should make a reality check. The east wall also extends about 2000 feet to the north from Station 15+00 to 35+00.	Juliana Fisher Blackburn	4/21/16	The depth of the cutoff walls are based on existing explorations along both levees. In addition, the DWSC West Levee is loaded with the Yolo Bypass DWSE while the DWSC East Levee is loaded with the DWSC DWSE.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
93	IPE	IV. Alternatives Analysis Para. I DWSC East Levee, 3 Reach 3, p. 50, b Alternative 2	4/18/16	Can an 80 foot wide seepage berm fix a problem that requires a 110 foot deep cutoff wall - discuss.	Juliana Fisher Blackburn	4/21/16	BCI assumed a minimum-width seepage berm to address identified underseepage issues. The depth of the deep wall is completely dependent on the location of the cutoff layer.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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94	IPE	IV. Alternatives Analysis Para. I DWSC East Levee, 4 Reach 4, p. 50, a Alternative 1	4/18/16	Discuss seepage issue in Reach 4 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
95	IPE	IV. Alternatives Analysis Para. I DWSC East Levee, 5 Reach 5, p. 50, a Alternative 1	4/18/16	Discuss seepage and stability issues in Reach 5 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage and stability as both landside steady-state and waterside rapid drawdown stability.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
96	IPE	IV. Alternatives Analysis Para. I DWSC East Levee, 6 Reach 6, p. 51, a Alternative 1	4/18/16	Discuss seepage issue in Reach 6 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
97	IPE	IV. Alternatives Analysis Para. J Port North Levee, 2 Reach 2, p. 52, a Alternative 1	4/18/16	Discuss "nuisance" seepage issue in Reach 2 in more detail. Is it worth spending many dollars on "nuisance" seepage.	Jesse Patchett Wood Rodgers	4/21/16	Recommendations for Port levees assume raised levees would be loaded. Since information is limited in this area, the extent of seepage resulting from raised levees or floodwall improvements is not currently known. However, available subsurface explorations indicate nuisance seepage may occur. To develop a conservative Flood Program cost estimate, we assumed that the identified potential for "nuisance" seepage could, in the future, detrimentally impact the levee with successive seepage immediately under the levee and exiting at or near the levee toe. We therefore included mitigation costs for this seepage. This is expected to be evaluated in further detail in future phases of the Flood Program.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
98	IPE	IV. Alternatives Analysis Para. J Port North Levee, 3 Reach 3, p. 53, a Alternative 1	4/18/16	Discuss slope flattening issue in Reach 3 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	Slope flattening will be specified as 3H:1V.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
99	IPE	IV. Alternatives Analysis Para. J Port North Levee, 4 Reach 4, p. 53, a Alternative 1	4/18/16	Discuss "nuisance" seepage issue in Reach 4 in more detail. Is it worth spending many dollars on "nuisance" seepage.	Jesse Patchett Wood Rodgers	4/21/16	Please see the response to Comment 97.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
100	IPE	IV. Alternatives Analysis Para. J Port North Levee, 5 Reach 5, p. 54, a Alternative 1	4/18/16	Discuss "nuisance" seepage issue in Reach 5 in more detail. Is it worth spending many dollars on "nuisance" seepage.	Jesse Patchett Wood Rodgers	4/21/16	Please see the response to Comment 97.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
101	IPE	IV. Alternatives Analysis Para. J Port North Levee, 6 Reach 6, p. 54, a Alternative 1	4/18/16	Discuss "nuisance" seepage issue in Reach 6 in more detail. Is it worth spending many dollars on "nuisance" seepage.	Jesse Patchett Wood Rodgers	4/21/16	Please see the response to Comment 97.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
102	IPE	IV. Alternatives Analysis Para. J Port North Levee, 7 Reach 7, p. 55, a Alternative 1	4/18/16	Discuss "nuisance" seepage and flood wall issues in Reach 7 in more detail. Is it worth spending many dollars on "nuisance" seepage.	Jesse Patchett Wood Rodgers	4/21/16	Please see the response to Comment 97.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
103	IPE	IV. Alternatives Analysis Para. K Port South Levee, 2 Reach 2, p. 57, a Alternative 1	4/18/16	Reality check - why do we need a cutoff wall to El -95 on the south levee but not on the north? Can the stratigraphy be that different across the waterway?	Jesse Patchett Wood Rodgers	4/21/16	The depth of the cutoff walls are based on existing explorations along both levees.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
104	IPE	IV. Alternatives Analysis Para. K Port South Levee, 2 Reach 2, p. 57, b Alternative 2	4/18/16	IF all that is needed is 45-foot-wide seepage berm than why considered the deep cutoff wall of the first alternative?	Jesse Patchett Wood Rodgers	4/21/16	An alternatives analysis was compared where two measures could address identified deficiencies, and were not otherwise determined to be infeasible. As discussed, Alternative 2 is the selected preferred remediation measure.			X		Y	5/7/2016		n/a
105	IPE	IV. Alternatives Analysis Para. K Port South Levee, 4 Reach 4, p. 58, a Alternative 1	4/18/16	Discuss seepage issue in Reach 4 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
106	IPE	IV. Alternatives Analysis Para. K Port South Levee, 6 Reach 6, p. 59, a Alternative 1	4/18/16	Discuss slope flattening issue in Reach 6 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	Slope flattening will be specified as 3H:1V.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
107	IPE	IV. Alternatives Analysis Para. K Port South Levee, 7 Reach 7, p. 60, a Alternative 1	4/18/16	Discuss seepage and slope flattening issues in Reach 7 in more detail.	Jesse Patchett Wood Rodgers	4/21/16	We will clarify identified seepage as underseepage, and will add 3(H):1(V) for slope flattening.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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108	IPE	Report	4/18/16	This report needs much work to be a finished document.	Jonathan Kors Wood Rodgers	4/21/16	The draft AAR will be updated as described herein and issued as a final AAR.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
109	IPE	Figure 3	4/18/16	Define dashed line on landside slope. Show DWSE schematically.	Jesse Patchett Wood Rodgers	4/21/16	The requested information will be included	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
110	IPE	Figure 4	4/18/16	Define dashed line on landside slope. Was this alternative ever discussed in the text?	Jesse Patchett Wood Rodgers	4/21/16	Yes. This was discussed in Section III.A.1: Waterside Versus Levee Centerline Cutoff Wall Installation. This option was ultimately not used as a remediation measure, however.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
111	IPE	Figure 5	4/18/16	Define dashed line on landside slope.	Jesse Patchett Wood Rodgers	4/21/16	The requested information will be included	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
112	IPE	Figure 6	4/18/16	Should this be defined as a drained stability berm?	Jesse Patchett Wood Rodgers	4/21/16	"Drained" has been added to the title of this figure.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
113	IPE	Figure 8	4/18/16	Should the filter material extend under the drainage material?	Jesse Patchett Wood Rodgers	4/21/16	For the AAR cost analysis, the design team assumed mitigation would be consistent with the successful mitigation performed by the USACE under Contracts C and D. This detail was extracted from the Contract D As-Built drawings as discussed in the title. Future evaluations may refine this detail.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
114	IPE	Figure 9	4/18/16	Consider using filter material instead of geotextile under the drainage material?	Jesse Patchett Wood Rodgers	4/21/16	For the AAR cost analysis, the design team assumed mitigation would be consistent with the successful mitigation performed by the USACE. This detail was extracted from the 2002 USACE Slump Repair As-Built drawings as discussed in the title. Future evaluations may refine this detail.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
115	IPE	Figure 12	4/18/16	Should state that the overlap may vary depending upon the conditions - also should state this in the text where appropriate.	Jesse Patchett Wood Rodgers	4/21/16	The requested information will be included on the Figure and in Section III.A.5.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
116	IPE	Figure 13	4/18/16	Define dashed line on landside slope.	Jesse Patchett Wood Rodgers	4/21/16	The requested information will be included	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
117	IPE	Figure 15	4/18/16	CLSM - it that suppose to me fill classified CL or SM and why would that wide a range be satisfactory?	Jesse Patchett Wood Rodgers	4/21/16	CLSM = Controlled Low Strength Material.			X		Y	5/7/2016	Should be in the abbreviations section.	n/a
118	IPE	Appendix A	4/18/16	It was assumed that the test was extracted from this report so it was not reviewed.	Jesse Patchett Wood Rodgers	4/21/16	Noted.			X		Y	5/7/2016		n/a
119	IPE	Appendix B, SRWN Levee, Station 36+00, Figure 1 of 6	4/19/16	Why would you recommend a CB cutoff wall when a SB would be much less costly? This is the only figure that defines the type of cutoff wall. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	A CB wall is proposed in this Reach due to limited construction footprint vs. an SB wall. This is briefly discussed in VI.A.1. DWSE will not be added to these figures since in some cases, the figures are typical over a mile or more of levee, and the DWSE is not constant over these lengths and this could lead to confusion. Adding this information to each figure will take a significant amount of effort with little value added. Water surface profiles are provided in the PIR.			X		Y	5/7/2016		n/a
120	IPE	Appendix B, SRWN Levee, Station 130+00, Figure 2 of 6	4/19/16	Consider using filter material instead of geotextile under the drain rock in the seepage berm. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Details regarding seepage berm construction will be refined during future iterations of the AAR, or during the design phase. A DWSE will not be added to these figures as discussed in response to comment 119.		X			Y	5/7/2016	Comment closed pending confirmation in report.	n/a
121	IPE	Appendix B, SRWN Levee, Station 142+00, Figure 3 of 6	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a

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122	IPE	Appendix B, SRWN Levee, Station 158+00, Figure 4 of 6	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
123	IPE	Appendix B, SRWN Levee, Station 190+00, Figure 5 of 6	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
124	IPE	Appendix B, SRWN Levee, Station 205+00, Figure 6 of 6	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
125	IPE	Appendix B, SRWS Levee, Station 329+08.66+00, Figure 1 of 1	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
126	IPE	Appendix B, SBS Levee, Station 62+00, Figure 1 of 2	4/19/16	The type of cutoff wall is not defined. This alternative seems incompatible with the adjacent shallow cutoff wall. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Compatibility with the adjacent wall will be evaluated in detail during later phases of the Flood Program.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
127	IPE	Appendix B, SBS Levee, Station 62+00, Figure 2 of 2	4/19/16	Consider using filter material instead of geotextile under the drain rock in the seepage berm. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Details regarding seepage berm construction will be refined during future iterations of the AAR, or during the design phase.		X			Y	5/7/2016	Comment closed pending confirmation in report.	n/a
128	IPE	Appendix B, Training Berm, Station 21+50, Figure 1 of 1	4/19/16	No Figure # listed. Extent of geotextile not labeled in drawing. Should there be a bedding layer under the riprap? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	A figure number will be added. Bedding and filter fabric are included in the cost estimates. Water surface will not be provided.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
129	IPE	Levee, Station 15+00, Figure 1 of 10	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
130	IPE	Appendix B, Yolo Bypass East Levee, Station 40+00, Figure 2 of 10	4/19/16	The type of cutoff wall is not defined. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
131	IPE	Appendix B, Yolo Bypass East Levee, Station 60+00, Figure 3 of 10	4/19/16	Should there be a bedding layer under the riprap? Thickness of rip rap? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Bedding and filter fabric will be included in the cost estimates, and quantities will be added to the figure.	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
132	IPE	Levee, Station 73+99.99, Figure 4 of 10	4/19/16	Why 73+99.99? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The station will be updated to be 74+00. Schematic WSE will not be added	X				Y	5/7/2016	Comment closed pending confirmation in report.	n/a
133	IPE	Appendix B, Yolo Bypass East Levee, Station 92+00, Figure 5 of 10	4/19/16	There does not appear to be a filter under the drain rock. Should there be a bedding layer under the riprap? Thickness of rip rap? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Filter fabric and bedding are not shown for clarity, but are included in the cost estimates.	X				Y	5/7/2016		n/a
134	IPE	Appendix B, Yolo Bypass East Levee, Station 106+00, Figure 6 of 10	4/19/16	Should there be a bedding layer under the riprap? Thickness of rip rap? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Filter fabric and bedding are not shown for clarity, but are included in the cost estimates.	X				Y	5/7/2016		n/a
135	IPE	Levee, Station 120+00, Figure 7 of 10	4/19/16	There does not appear to be a filter under the drain rock. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Filter fabric and bedding are not shown for clarity, but are included in the cost estimates.	X				Y	5/7/2016		n/a
136	IPE	Appendix B, Yolo Bypass East Levee, Station 132+00, Figure 8 of 10	4/19/16	There does not appear to be a filter under the drain rock. Should there be a bedding layer under the riprap? Thickness of rip rap? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Filter fabric and bedding are not shown for clarity, but are included in the cost estimates.	X				Y	5/7/2016		n/a

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137	IPE	Appendix B, Yolo Bypass East Levee, Station 150+00, Figure 9 of 10	4/19/16	The type of cutoff wall is not defined. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
138	IPE	Levee, Station 178+00.28, Figure 10 of 10	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
139	IPE	Appendix B, South Cross Levee, Station 25+00, Figure 1 of 2	4/19/16	The type of cutoff wall is not defined. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Did you mean Comment 114?	n/a
140	IPE	Appendix B, South Cross Levee, Station 25+00, Figure 2 of 2	4/19/16	Consider using filter material instead of geotextile under the drain rock in the seepage berm. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Filter material and filter fabric are included in the preliminary sections and cost estimates (see response to comment 168). This may be refined during later versions of the AAR or during design. Water surface will not be added as previously discussed.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
141	IPE	Appendix B, DWSC West Levee, Station 10+00, Figure 1 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
142	IPE	Appendix B, DWSC West Levee, Station 48+00, Figure 2 of 16	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
143	IPE	Appendix B, DWSC West Levee, Station 102+00, Figure 3 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
144	IPE	Appendix B, DWSC West Levee, Station 130+00, Figure 4 of 16	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
145	IPE	Appendix B, DWSC West Levee, Station 154+00, Figure 5 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
146	IPE	Appendix B, DWSC West Levee, Station 184+00, Figure 6 of 16	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
147	IPE	Appendix B, DWSC West Levee, Station 244+00, Figure 7 of 16	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
148	IPE	Appendix B, DWSC West Levee, Station 244+00, Figure 8 of 16	4/19/16	Label Stability Berm. If filter sand is being used what is the purpose of the geotextile? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The stability berm will be labelled. The schematic water surface will not be added as discussed in the response to comment 119. The filter sand is below the drain rock, the geotextile is above it.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
149	IPE	Appendix B, DWSC West Levee, Station 244+00, Figure 9 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
150	IPE	Appendix B, DWSC West Levee, Station 400+00, Figure 10 of 16	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a

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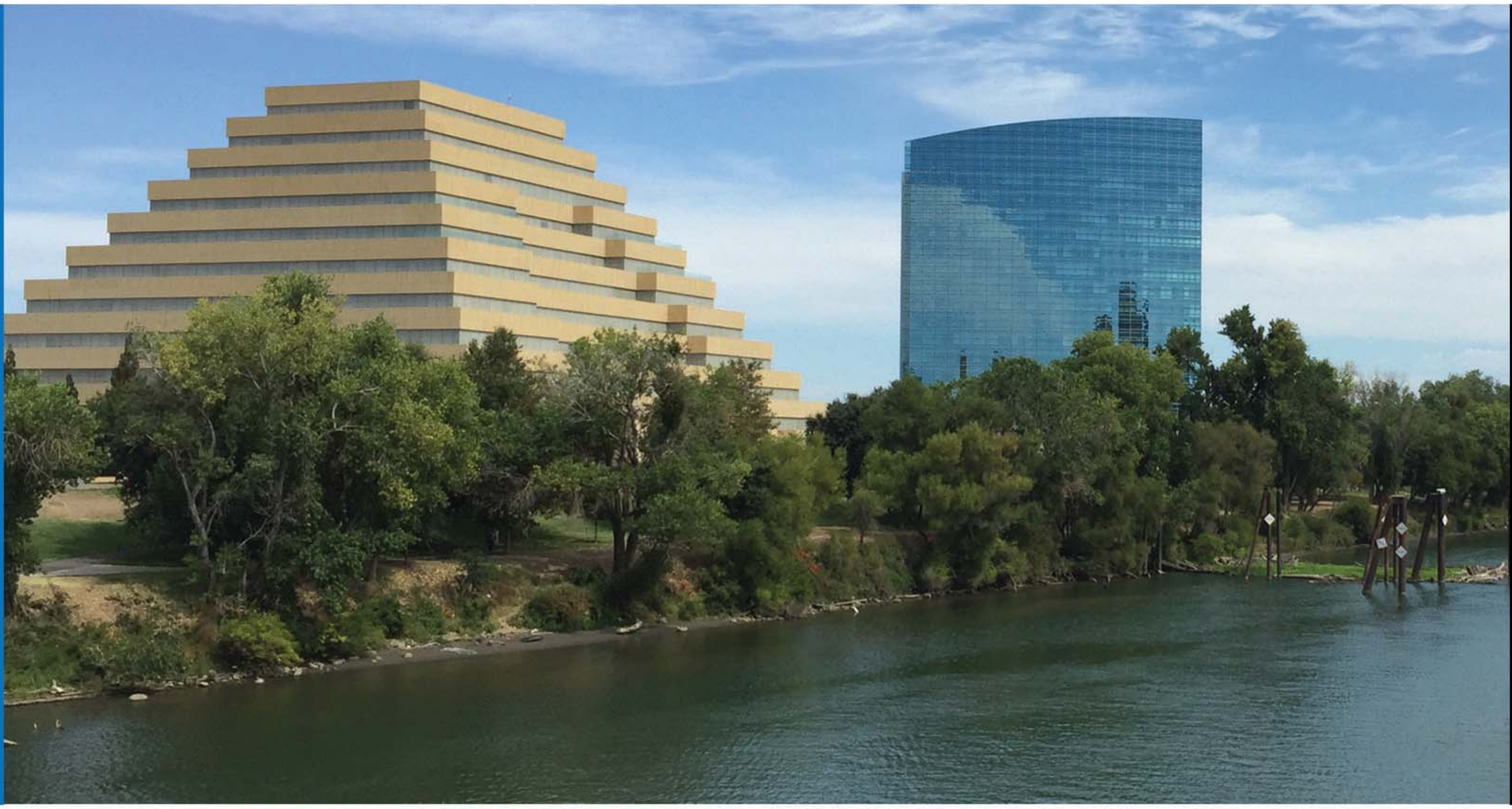
151	IPE	Appendix B, DWSC West Levee, Station 500+00, Figure 11 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
152	IPE	Appendix B, DWSC West Levee, Station 600+00, Figure 12 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
153	IPE	Appendix B, DWSC West Levee, Station 692+00, Figure 13 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
154	IPE	Appendix B, DWSC West Levee, Station 692+00, Figure 14 of 16	4/19/16	Label Stability Berm. If filter sand is being used what is the purpose of the geotextile? What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The stability berm will be labelled. The schematic water surface will not be added as discussed in the response to comment 119. The filter sand is below the drain rock, the geotextile is above it.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
155	IPE	Appendix B, DWSC West Levee, Station712+00, Figure 15 of 16	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
156	IPE	Appendix B, DWSC West Levee, Station 840+00, Figure 16 of 16	4/19/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	**5/7/2016**		n/a
157	IPE	Appendix B, DWSC East Levee, Station10+00, Figure 1 of 5	4/19/16	The type of cutoff wall is not defined. It would be to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
158	IPE	Appendix C, DWSC East Levee, Station 54+00, Figure 2 of 5	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
159	IPE	Appendix B, DWSC East Levee, Station 94+00, Figure 3 of 5	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
160	IPE	Appendix B, DWSC East Levee, Station 104+00, Figure 4 of 5	4/19/16	The type of cutoff wall is not defined. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a
161	IPE	Appendix B, DWSC East Levee, Station 132+00, Figure 5 of 5	4/19/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	**5/7/2016**	Comment closed pending confirmation in report.	n/a

City of West Sacramento Flood Program - Draft Alternatives Analysis Review

IPE Comments

ADMIN USE ONLY	REVIEWER				RESPONDENT							REVIEWER			RESPONDENT
COMMENT ID (DO NOT Edit this Column)	REVIEWER NAME / AGENCY	LOCATION IN REPORT/DOC	DATE OF ORIGINAL REVIEW COMMENT MM/DD/YY	ORIGINAL REVIEW COMMENT	RESPONDENT CONTACT INFO	DATE OF RESPONSE MM/DD/YY	RESPONSE	CONCUR	NON-CONCUR	FIO	CARRY FORWARD	CLOSED Y / N	DATE MM/DD/YY	BACK CHECK COMMENT (Needed Only If NOT Closing Comment)	BACK CHECK RESPONSE
162	IPE	Appendix B, Port North Levee, Station 18+00, Figure 1 of 4	4/20/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
163	IPE	Appendix B, Port North Levee, Station 30+00, Figure 2 of 4	4/20/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
164	IPE	Appendix B, Port North Levee, Station 40+00, Figure 3 of 4	4/20/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
165	IPE	Appendix B, Port North Levee, Station 50+00, Figure 4 of 4	4/20/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
166	IPE	Appendix B, Port South Levee, Station 10+00, Figure 1 of 9	4/20/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
167	IPE	Appendix B, Port South Levee, Station 70+00, Figure 2 of 9	4/20/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. Need break line across cutoff wall since it goes below El -20. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. A breakline will be added. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
168	IPE	Appendix B, Port South Levee, Station 70+00, Figure 3 of 9	4/20/16	Consider using filter material instead of geotextile under the drain rock in the seepage berm. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Filter material and filter fabric are included in the preliminary sections and cost estimates. The filter sand is below the drain rock, the geotextile is above it--do the estimates include both (two layers each) or just one layer of each? This may be refined during later versions of the AAR or during design. Water surface will not be added as previously discussed.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
169	IPE	Appendix B, Port South Levee, Station 117+00, Figure 4 of 9	4/20/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
170	IPE	Appendix B, Port South Levee, Station 120+00, Figure 5 of 9	4/20/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
171	IPE	Appendix B, Port South Levee, Station 120+00, Figure 6 of 9	4/20/16	Consider using filter material instead of geotextile under the drain rock in the seepage berm. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	Filter material and filter fabric are included in the preliminary sections and cost estimates (See response to comment 168). This may be refined during later versions of the AAR or during design. Water surface will not be added as previously discussed.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
172	IPE	Appendix B, Port South Levee, Station 130+00, Figure 7 of 9	4/20/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
173	IPE	Appendix B, Port South Levee, Station 140+00, Figure 8 of 9	4/20/16	What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The schematic water surface will not be added as discussed in the response to comment 119.		X			Y	5/7/2016		n/a
174	IPE	Appendix B, Port South Levee, Station 162+00, Figure 9 of 9	4/20/16	The type of cutoff wall is not defined. It would be nice to have dimensions on clay cap and clay fill above. What about a schematic water surface?	Jesse Patchett Wood Rodgers	4/21/16	The type of cutoff wall will be specified on these figures. The schematic water surface will not be added as discussed in the response to comment 119. Clay cap dimensions are provided in detail on Figure 3 and are omitted from these sections for clarity.			X		Y	5/7/2016	Comment closed pending confirmation in report.	n/a
175	IPE	Appendix C	4/18/16	Not reviewed.	Jesse Patchett Wood Rodgers	4/21/16	Noted.			X		Y	5/7/2016		n/a



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3301 C Street, Bldg. 100-B Tel: 916.341.7760
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