



DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
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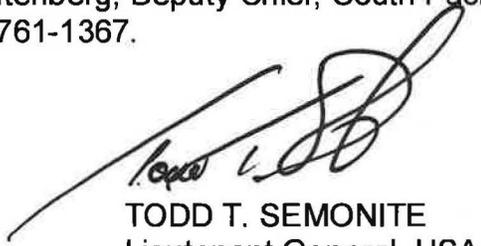
MEMORANDUM FOR Assistant Secretary of the Army (Civil Works)

SUBJECT: Westminster, East Garden Grove, California, Feasibility Study – Final U. S. Army Corps of Engineers (USACE) Response to Independent External Peer Review

1. An Independent External Peer Review (IEPR) was conducted for the subject project in accordance with Section 2034 of the Water Resources Development Act of 2007, Engineering Circular (EC) 1165-2-217, and the Office of Management and Budget's Final Information Quality Bulletin for Peer Review (2004).
2. The IEPR was conducted by Battelle Memorial Institute (Battelle). Battelle consulted with the Flood Risk Management Planning Center of Expertise to select panel members. The IEPR panel consisted of five panel members with technical expertise in civil works planning/economics, biological resources and environmental law compliance, hydrology and hydraulics, and geotechnical engineering, and civil/cost engineering.
3. The enclosed document contains the approved final written responses of the Chief of Engineers to the issues raised and the recommendations contained in the IEPR Report. The IEPR Report and the USACE responses have been coordinated with the vertical team and will be posted on the internet, as required by EC 1165-2-217.
4. If your staff have any questions on this matter, please contact me or have a member of your staff contact Bradd Schwichtenberg, Deputy Chief, South Pacific Division Regional Integration Team, at 202-761-1367.

Encl

*Great Collaboration
Between USACE and
Orange County! Significantly
Reduces Flood Risk and
Increases Life Safety
for 400,000 people!!*


TODD T. SEMONITE
Lieutenant General, USA
Commanding

**Westminster East Garden Grove, CA
Flood Risk Management Study
Integrated Feasibility Study and Environmental Impact Statement
April 2020**

**U.S. Army Corps of Engineers Response to
Independent External Peer Review
Dated April 2019**

Independent External Peer Review (IEPR) was conducted for the subject study in accordance with Section 2034 of WRDA 2007, EC 1165-2-217, and the Office of Management and Budget's *Final Information Quality Bulletin for Peer Review* (2004). The goal of the U.S. Army Corps of Engineers (USACE) Civil Works program is to always provide scientifically sound, sustainable water resources solutions for the nation. The USACE review processes are essential to ensuring project safety and quality of the products USACE provides to the American people. Battelle Memorial Institute (Battelle), a non-profit science and technology organization with experience in establishing and administering peer review panels for the USACE, was engaged to conduct the IEPR of the Westminster East Garden Grove, CA Flood Risk Management Study Integrated Feasibility Study and Environmental Impact Statement.

The IEPR Panel consisted of subject matter experts in the following key technical areas: plan formulation/economics, environmental law compliance, hydrology and hydraulic engineering, geotechnical engineering, and civil/cost engineering. The final IEPR report from Battelle was issued on April 10, 2019.

Overall, 15 final panel comments were identified and documented. Of these, two were identified as having high significance, two had medium/high significance, ten had medium significance, and one had medium/low significance. The following discussions present USACE's final responses to the comments.

A total of 45 recommendations were suggested to address these 15 comments. USACE adopted 35 of these recommendations and explained its rationale for not adopting the remaining 10. The IEPR Panel concurred with the responses provided by USACE for all 15 comments.

Comment 1 - High Significance: The alternatives analysis in the DIFR-DEIS/EIR is not fully compliant with the requirements of the California Environmental Quality Act.

This comment included two recommendations for resolution, both were adopted.

Recommendation 1: Provide an alternatives analysis in the DIFR-DEIS/EIR that fulfills CEQA requirements, including identification of:

- a) CEQA objectives
- b) a proposed project/action
- c) a reasonable range of potentially feasible alternatives.

USACE Response: Adopted.

Action Taken: The planning objectives stated in the main report are intended to also be CEQA objectives, and this has been clarified in the main report, as recommended (*Section 1.12.3, Planning Objectives*). The planning objectives were used to identify measures that could be combined into alternatives that would accomplish the planning objectives. USACE and the non-federal sponsor, Orange County Public Works (OCPW) ensured that the final report is in compliance with CEQA. The term ‘Proposed Project’ is terminology used to identify the project that is to be implemented under the CEQA. The Report uses the term ‘Recommended Plan’ instead in compliance with USACE policy. Therefore, in *Section 1.1, General* of the main report, the following was added to clarify the terminology: “The Recommended Plan is synonymous with the term ‘Proposed Project’ which is the terminology typically used under the California Environmental Quality Act (CEQA) to identify the project to be implemented.” Lastly, a reasonable range of potentially feasible alternatives was presented in the report in *Section 3.5, Initial Alternative Analysis*.

Recommendation 2: After environmental impacts of the proposed project and alternatives are identified, provide a comparison of environmental impacts between the proposed project and each alternative to determine an Environmentally Superior Alternative.

USACE Response: Adopted.

Action Taken: The final report includes a more detailed comparison of environmental impacts between the proposed alternatives (throughout *Chapter 5, Environmental Consequences*) in order to identify an Environmentally Superior Alternative. The final report includes detailed analysis that demonstrates that the Locally Preferred Plan (LPP) is the Environmentally Superior Alternative. A summary table of environmental consequences is found in Table 91 in *Section 5.17, Summary of Environmental Consequences*. Mandatory findings of significance are presented in *5.18, Mandatory Findings of Significance*. Cumulative impacts of the NED Plan and LPP are included in *Section 5.19, Cumulative Impacts* and *Section 5.20, Cumulative Impacts Analysis*.

Comment 2 - High Significance: The impact analysis in the DIFR-DEIS/EIR is not fully compliant with the requirements of the California Environmental Quality Act.

This comment included two recommendations for resolution that were both adopted.

Recommendation 1: Under each significance criterion in the DIFR-DEIS/EIR, the following should be included:

- a) a discussion of the impacts that would/could occur if the alternative is implemented
- b) a discussion of how design features would avoid/minimize impacts (if any are incorporate into the project)
- c) state if the impact would be significant (after inclusion of design features, if applied)
- d) if the impact is significant, list the mitigation measure(s) to be implemented and describe how each would reduce the impact and
- e) state a final CEQA conclusion (e.g., “less than significant with mitigation”).

USACE Response: Adopted.

Action Taken: The draft report used USACE’s SMART Planning principles to identify risks associated with implementation of the project. SMART Planning typically defers detailed analysis until later in the feasibility phase, after initial reviews and the initial public comment period.

USACE has also obtained additional detailed analyses which were used to better identify the potentially significant impacts due to implementation of both the National Economic Development (NED) Plan and LPP, as well as feasible mitigation measures that could reduce significant impacts. The recommendations provided by the reviewer are included in the final report throughout *Chapter 5, Environmental Consequences* to ensure the document complies with CEQA. A summary of the process used to determine the level of impact is included in *Section 5.0, Environmental Consequences*.

Recommendation 2: Bolster the discussion of potentially significant impacts and associated mitigation measures in the biological resources section including:

- a thorough and comprehensive discussion of the impacts on special-status species, including their habitat, and sensitive communities from the widening of the Outer Bolsa Bay channel, addition of floodwalls, replacement of tide gates, and channel modifications
- potential impacts due to construction disturbance, increased flow volumes, tidal changes, salinity and temperature changes, erosion, and loss of upland and soft bottom/wetland habitat and identification of appropriate mitigation measures that would reduce significant impacts.

USACE Response: Adopted.

Action Taken: The recommendations provided by the reviewer are incorporated in the final report (specifically *Section 5.8 – Biological Resources* and *Section 5.4 – Water Resources*) in order to ensure that the document complies with CEQA. The report includes a detailed analysis by potentially affected resource and includes recommended mitigation measures that will be incorporated in the development of construction documentation and management to reduce potentially significant impacts to less than significant.

Comment 3 – Medium/High Significance: The documents do not provide a quantitative, probability-based analysis of life safety risk or identify the threshold for acceptable life safety risk.

This comment included four recommendations for resolution that were all adopted.

Recommendation 1: Provide a quantitative, probability-based analysis of life safety risk for storms of varying magnitudes (20% ACE to 1% ACE).

USACE Response: Adopted.

Action Taken: A quantitative, probability-based analysis of life loss was completed using HEC-FIA under the future with and without project conditions (FWP and FWOP, respectively) for both the NED Plan and LPP, and is documented in the Economics Appendix (*Appendix E, Section 3.9*). The results indicate that there is a significant reduction in risk for FWP conditions for the 0.01 and 0.002 ACE.

Recommendation 2: Identify a threshold for acceptable life safety risk in accordance with the USACE guidance.

USACE Response: Adopted.

Action Taken: An “acceptable threshold” of life safety risk referred to by the commenter is typically identified for dam safety studies. The FIA model presented quantitative estimates of life loss, but does not establish a threshold of “acceptable” life safety risk. Results of the FIA modeling, which included conservative assumptions regarding warning times, indicates that implementation of the LPP addresses life safety risk to a greater extent than the NED Plan. Both plans substantially reduce life safety risk for the 4 categories evaluated: Daytime/under age 65; Daytime over age 65, Nighttime under age 65 and Nighttime over age 65. USACE also incorporated the principles included in existing draft guidance for levee safety into project design elements. Results and discussion of the life safety analysis are included in the Economics Appendix (*Appendix E, Section 3.9*).

Recommendation 3: Demonstrate that the proposed alternatives will meet the life safety risk threshold.

USACE Response: Adopted.

Action Taken: The life safety analysis conducted with HEC-FIA confirmed the implementation of proposed alternatives (NED/LPP Plans) would not result in an unacceptable life safety risk. While a threshold of acceptable life risk was not developed, this conclusion was based on the completion of a quantitative, probability-based analysis of life loss. Further, the life safety analysis provided additional justification for implementation of a project based upon consideration of the reduction in life safety risk based on with project conditions. The HEC-FIA estimated that life loss would be reduced between 90-100% at 0.01 ACE and between 87%-100% at 0.002 ACE in the FWP condition (*Appendix E – Economics, Section 3.9*). These estimated reductions in life loss represent a very low residual life safety risk in the study area for the NED Plan and a near zero residual life safety risk for the LPP.

Recommendation 4: Clarify how the flood warning system will be coordinated with the agencies responsible for evacuation planning and emergency response.

USACE Response: Adopted.

Action Taken: A flood warning system is already operational and is managed by OCPW. During the detailed design phase, additional analyses will be completed to address ongoing

requirements including operation of the warning system, and local responsibilities for public safety in the event of an overtopping event or other project exceedance/failure. USACE will work collaboratively with the non-federal sponsor, agencies responsible for evacuation planning and emergency response and protected communities to address anticipated life safety risk during detailed design.

Comment 4 – Medium/High Significance: The DIFR-DEIS/EIR does not describe the level of residual risks that will remain after implementation of the TSP if 1% ACE storms occur in the study area.

This comment included one recommendation for resolution which was adopted.

Recommendation 1: Identify in the DIFR-DEIS/EIR the anticipated level of residual risk that is expected for a 1% ACE with respect to flood hazard after TSP implementation.

USACE Response: Adopted.

Action Taken: The final report includes residual risk analysis based upon requirements included in “Risk Assessment for Flood Risk Management Studies” (ER 1105-2-101) for without and with project conditions (Minimum Channel (NED) and Maximum Channel (LPP)). The project performance and residual risk analyses were conducted for the without project as well as the two with project alternatives for multiple ACE storm events (2%, 1% and .20%). This information is included in *Section 8.7.2, Residual Risk* of the main report.

Comment 5 - Medium Significance: The flood mitigation plan primarily focuses on increasing flow efficiency and inadequately considers increasing flow capacity.

This comment included three recommendation for resolution that were all not adopted.

Recommendation 1: Add flood walls along trapezoidal channels in those reaches that are most at risk to flooding.

USACE Response: Not Adopted.

Action Taken: Consistent with the planning strategies outlined in the Main Report, the Minimum Plan focuses on increasing efficiency, while the Maximum Plan focuses on increasing efficiency *and* capacity. Other capacity-related measures such as a retention basin in Mile Square Park were evaluated earlier on in the planning process but ultimately screened out due to concerns related to performance, available real estate (proxy for cost), topography in the study area, and social/cultural/recreational values.

USACE prioritized channel widening to increase conveyance capacity over flood walls due to the flat topography of the watershed for tiebacks, and because maximizing channel capacity within the right-of-way represents a more complete alternative. Flood walls are included in the LPP in order to meet OCPW’s assurance requirements. If during detailed design an opportunity arises to provide the same level of protection with a floodwall rather than channel widening,

USACE would ensure all risk factors associated with the inclusion of the floodwalls are considered.

Recommendation 2: Convert some trapezoidal reaches into rectangular reaches, on a case-by-case basis, in addition to reaches 1 and 23.

USACE Response: Not Adopted.

Action Taken: USACE previously considered converting a smaller subsection of reaches from trapezoidal to rectangular, and this process is described in *Section 4.1, Channel Reaches and Impact Areas* through *Section 4.5, Selection of a Recommended Plan* of the main report and in the Plan Formulation Appendix. An incremental analysis was used to determine whether a combination of channel modification measures by reach would increase the net benefits compared to the Minimum or Maximum plans. The result of this analysis indicated that the Minimum Channel Modifications Plan maximized net benefits and, therefore, was identified as the NED Plan.

Recommendation 3: Consider adding redundancy in addition to robustness and resiliency for the flood mitigation plan (TSP) to be sustainable.

USACE Response: Not Adopted.

Action Taken: Adding redundancies to identified plan could potentially increase assurance. However, additional measures would need to be economically justified for inclusion in the Recommended Plan. Since the inclusion of redundant measures is unlikely to yield increases in project benefits, it is unlikely that they would be economically justified.

Residual risk is discussed in *Section 8.7.2, Residual Risk* of the Main Report, with tables comparing the long-term risk and assurance for the 2%, 1%, and 0.2% events for the without project condition, the Minimum Plan, and the Maximum Plan.

Comment 6 - Medium Significance: The mitigation alternatives do not incorporate the effects of climate change.

The comment had four recommendations for resolution which were all adopted.

Recommendation 1: Incorporate the effect of extreme precipitation events associated with climate change in order to reduce the uncertainty and risk posed by such events.

USACE Response: Adopted.

Action Taken: Additional content related to climate change and extreme precipitation was added to the Main Report (*Section 2.5.1, Qualitative Assessment of Climate Change Impacts on Hydrometeorology* through *Section 2.5.3, Residual Risk Due to Climate Change & Considerations of Climate Change Impacts in Project Planning*) and the H&H Appendix to reflect anticipated future changes in climate.

Recommendation 2: Incorporate a higher level of uncertainty related to sea level rise than is represented by the 0.61-foot adjustment currently used in the study, i.e., add a higher sea level rise to the boundary conditions of the hydraulic models.

USACE Response: Adopted.

Action Taken: Additional modeling was performed to evaluate the impacts related to the uncertainty of sea level rise and how a higher sea level rise would affect the computed assurance on the downstream leveed reaches. For this analysis, a downstream boundary condition representing the ‘high’ scenario (3.5 foot adjustment) was used with a target date of 2085. Hydraulic modeling was also performed with a downstream boundary condition one foot higher to represent the year 2100 with the ‘high’ scenario. The results of this analysis are presented described in Section 8.2 of the Hydrology and Hydraulics Appendix.

Recommendation 3: Use up-to-date literature on climate change for more recent projections of future precipitation and sea level rise, such as the report cited below.

State of California (2019). California’s Fourth Climate Change Assessment.
<http://www.climateassessment.ca.gov/>

USACE Response: Adopted.

Action Taken: Additional sensitivity analysis was performed and added to the final main report (*Section 2.5.1, Qualitative Assessment of Climate Change Impacts on Hydrometeorology* through *Section 2.5.3, Residual Risk Due to Climate Change & Considerations of Climate Change Impacts in Project Planning*) and H&H Appendix (*Appendix A, Section 9.1.10*), as appropriate. The analysis utilized multiple resources with relevant information specific to the State of California, including California’s Fourth Climate Change Assessment, as referenced by the commenter. The findings of the California Climate Change Assessment do not conflict with those presented in the H&H Appendix; there is strong consensus on sea level rise and temperature, with a lower consensus on precipitation.

Recommendation 4: Document the economic impacts on mitigation alternatives due to sea level rise.

USACE Response: Adopted.

Action Taken: Economic impacts are calculated based upon H&H modeling that takes into account sea level rise. Sensitivity analyses conducted on future sea level rise scenarios indicate that the level of project assurance (i.e. above the design level of protection) will be reduced as from 95% to 80% for the 1% ACE event for the Recommended Plan. This is described in Appendix A – H&H, *Section 8.2*. Re-evaluation of project functionality, including assurance, should be conducted during the project period of performance of construction.

Comment 7 - Medium Significance: The report and appendices use outdated hydrological and meteorological data in their analyses.

The comment had four recommendations for resolution; three were adopted, and one was not adopted.

Recommendation 1: Update the meteorological data using the most recent meteorological database (NOAA Atlas 14, Volume 6, California, updated 2014), and document/update hydrologic frequency analysis and supporting data using this atlas. Verify this hydrologic analysis across the watershed with the online NOAA Precipitation Data Server (updated 2017).

USACE Response: Adopted.

Action Taken: The frequency analysis presented in Figure 3 of the Hydrology & Hydraulics Appendix (Appendix A) includes updated periods of record. While the precipitation used by OCPW only contains records through 1987, a comparison to the Atlas 14 was made and the precipitation values compare favorably. This is documented in Section 7.5.4 the H&H Appendix report.

Recommendation 2: Since the USGS/Orange County gage on San Diego Creek does not have any flow data after 1999, use another stream-gage in the area with a longer record to estimate missing peak flow data at the San Diego gage after 1999. For example, use the USGS method to estimate flows from un-gaged watersheds by using another gage from the hydrologically similar watershed, such as the USGS gage 11078000 on Santa Ana River, just east of the study area, with 77 years of record (still operational) (<https://waterwatch.usgs.gov/?m=real&r=ca>), and adjust for the tributary watershed area at San Diego Creek. Note that the ratio of peak flows should be proportional to the ratio of corresponding drainage areas.

USACE Response: Adopted.

Action Taken: Annual maximum flow values were used to develop a flow frequency analysis using a number of gage locations in addition to San Diego Creek. A number of these gage locations have records that extend through 2016. These gage records were used to estimate a flow at San Diego Creek based on frequency. The San Diego Creek record was estimated and compared to the previous analysis to determine if there has been a significant shift (Appendix A – H&H, *Section 7.5.10* and *Section 8.1.10.1*).

Recommendation 3: Use an updated meteorological and marine database to re-calculate wave hindcasting.

USACE Response: Adopted.

Action Taken: An updated evaluation of the non-tidal residual was performed. The analysis includes the updated hindcast. The revised analysis is included in the updated report, along with an evaluation of the effects of larger sea level increases (*Appendix A – H&H, Section 4.1.2*).

Recommendation 4: Update sea level rise of 0.61 feet, currently used as the downstream boundary condition in hydraulic models, to a sea level rise of 2 feet, consistent with the updated climate study (referenced in DIFR DEIS/EIR *Section 2.5.1, Qualitative Assessment of Climate*

Change Impacts on Hydrometeorology through Section 2.5.3, Residual Risk Due to Climate Change & Considerations of Climate Change Impacts in Project Planning).

USACE Response: Not Adopted.

Action Taken: Additional modeling was performed to evaluate the impacts related to the uncertainty of sea level rise and how a higher sea level rise would affect the computed assurance on the downstream leveed reaches. For this analysis, a downstream boundary condition representing the ‘high’ scenario (3.5 foot adjustment) was used with a target date of 2085. Hydraulic modeling was also performed with a downstream boundary condition one foot higher to represent the year 2100 with the ‘high’ scenario. The results of this analysis are presented described in Section 8.2 of the Hydrology and Hydraulics Appendix.

Comment 8 – Medium Significance: The DIFR-DEIS/EIR report and Appendix A are based on the outdated hydrologic model HEC-1.

The comment had two recommendations for resolution that were both not adopted.

Recommendation 1: Compare the modeling results of the HEC-1 model with those of the most recent HEC-HMS model to see whether advances in modeling and science in the last three decades affect hydrologic results.

USACE Response: Not Adopted.

Action Taken: The USACE Los Angeles District and Orange County coordinated the hydrology development that resulted in the HEC-1 model currently used for the study. The coordinated discharges were developed using specific flow change locations along the channel. The 100 year discharge in the downstream reach of C05 was established using the 100 year discharge at San Diego Creek Culver Drive gage station. The original frequency analysis only extended through 1999, but subsequent updates to the frequency analysis show no significant change. USACE is not aware of an HEC-HMS model developed for the study area. However, since the modeled discharge values were calibrated to match this frequency analysis, developing a separate HMS model to match these values would not significantly advance the understanding of flood risk in the study area.

Recommendation 2: Consider using the Riverside County Flood Conservation District HEC-HMS pre-processor (Riverside County, 2016) for pre-processing the data, run the most recent version of the HEC-HMS model, and compare simulation results with the results from the HEC-1 model. Check whether the updated HEC-HMS results are significantly different than the HEC-1 results, and whether they would affect study conclusions and the basis for the design.

USACE Response: Not Adopted.

Action Taken: USACE is not aware of an HEC-HMS model developed for the study area. The coordinated discharges were developed using specific flow change locations along the channel. The 100 year discharge in the downstream reach of C05 was established using the 100 year

discharge at San Diego Creek Culver Drive gage station. Since the modeled discharge values were calibrated to match this frequency analysis, developing a separate HMS model to match these values would not significantly advance the understanding of flood risk in the study area.

Comment 9 - Medium Significance: Changes to existing development type and density can affect future runoff, which was not analyzed.

This comment had two recommendations for resolution that were both adopted.

Recommendation 1: Assess future-without- and future-with-project hydrologic conditions taking into account future vertical development and increased population density.

USACE Response: Adopted.

Action Taken: The study area is almost completely developed/impervious in the FWOP condition and therefore any future development and population changes are not expected to significantly affect the future-without- and future-with-project hydrologic conditions. Additional discussion on this topic has been added to the Main Report (*Section 2.19, Future Without Project Conditions*) and the Hydrology & Hydraulics Appendix (*Appendix A, Sections 7.1-7.5*), as well as a qualitative discussion of what the potential effects of vertical development would be on the FWOP hydrologic conditions.

Recommendation 2: Conduct sensitivity analysis on how projected changes in hydrologic conditions could result in changes in project performance and flood risk and uncertainty.

USACE Response: Adopted.

Action Taken: A sensitivity analysis on the hydrology was performed to determine how increases in discharge could impact the performance and flood risk. This analysis is included in Appendix A – H&H, *Section 10.3.4, Flow Uncertainty*.

Comment 10 - Medium Significance: The lack of contingency in the construction schedule could have an adverse impact on the transportation costs.

The comment had four recommendations for resolution that were all adopted.

Recommendation 1: Revise all DIFR-DEIS/EIR figures to show the limits of the proposed floodwall correctly.

USACE Response: Adopted.

Action Taken: Flooding of Pacific Coast Highway occurs regularly and can be safely managed in the FWOP condition. Additional flows as a result of implementing the NED Plan or LPP would not significantly increase the occurrence of this flooding. The Pacific Coast Highway floodwall presented in the draft report has since been eliminated from the formulation of both the

NED Plan and the LPP. This is discussed in *Section 3.3.6, Additional Analysis of a Potential PCH Floodwall* of the Main Report.

Recommendation 2: Describe the existing wall system and provide information on the location, length, age, condition, type of wall system, and proximity to the new PCH floodwall. Consider adding a typical section to the DIFR-DEIS/EIR that shows both the new floodwall and the existing wall. Evaluate and describe the potential risks.

USACE Response: Adopted.

Action Taken: The design and layout of the proposed floodwall was planned to be developed between ADM and the final report. However, the PCH floodwall presented in the draft report has since been eliminated from the formulation of both the NED Plan and the LPP. Flooding of Pacific Coast Highway occurs regularly and can be safely managed in the FWOP condition. Additional flows as a result of implementing the NED Plan or LPP would not significantly increase the occurrence of this flooding. The Pacific Coast Highway floodwall presented in the draft report has since been eliminated from the formulation of both the NED Plan and the LPP. Documentation of this decision is included in *Section 3.3.6, Additional Analysis of a Potential PCH Floodwall* of the Main Report.

Recommendation 3: Evaluate the risk of flooding for the PCH between the downstream end of the proposed floodwall and the Warner Avenue Bridge if floodwall protection will only be extended partially along Outer Bolsa Basin. If this is not a risk, then support this position.

USACE Response: Adopted.

Action Taken: The PCH floodwall presented in the draft report has since been eliminated from the formulation of both the NED Plan and the LPP. This decision was made based on a comment received in the PGM and through subsequent analysis and discussion at the ADM brief and a follow-up In-Progress Review to the ADM brief. Upon inspection of additional existing information, it was determined that flooding of PCH occurs regularly and can be safely managed in the FWOP condition. Additional flows as a result of implementing the NED Plan or LPP would not significantly increase the occurrence (or risk) of this flooding. Documentation of this decision is included in *Section 3.3.6, Additional Analysis of a Potential PCH Floodwall* of the Main Report.

Recommendation 4: Include and identify any additional risks, measures required, initial costs, and maintenance costs associated with scour prevention at the transitional boundary from hard concrete surface to soft surface at the downstream end of the PCH floodwall. If transitional zones are required, describe the environmental impacts.

USACE Response: Adopted.

Action Taken: Flooding of Pacific Coast Highway occurs regularly and can be safely managed in the FWOP condition. Additional flows as a result of implementing the NED Plan or LPP would not significantly increase the occurrence of this flooding. The Pacific Coast Highway

floodwall presented in the draft report has since been eliminated from the formulation of both the NED Plan and the LPP. Additional flows as a result of implementing the NED Plan or LPP would not significantly increase the occurrence of this flooding. Documentation of this decision is included in *Section 3.3.6, Additional Analysis of a Potential PCH Floodwall* of the Main Report.

Comment 11 - Medium Significance: The addition of concrete- or sheetpile-lined channels may potentially cause scour and damage to unlined channels and soft bottom channels resulting in risk and uncertainty in the concepts and construction costs.

The comment had three recommendations for resolution. Two were adopted and one was not adopted.

Recommendation 1: Perform necessary scour calculations for all TSP and LPP unlined channel reaches.

USACE Response: Not Adopted.

Action Taken: For the NED Plan, the existing channels without modification, with the exception of Mile Square Park on the east portion of channel C06, are either concrete-lined or concrete box type. Therefore the addition of concrete - or sheetpile - lined channels would not cause scour to unlined channels and soft bottom channels. USACE used projected channel velocities to determine the need and inform the design for scour protection around bridges and in other locations where infrastructure could be impacted by scour, such as in Huntington Harbour.

Recommendation 2: Evaluate whether natural inverts are appropriate for increased velocities in each unlined reach to evaluate risk and uncertainty.

USACE Response: Adopted.

Action Taken: In both the NED Plan and the LPP, natural channel inverts are being preserved in tidally influenced reaches (1 and 23) to lessen impacts to high-quality natural resources. USACE is continuing to coordinate with NOAA NMFS and USFWS to determine what the potential impacts of increased velocities are on species such as eel grass and green sea turtle. This coordination will continue as the mitigation plan is further developed during preconstruction engineering and design (PED), and during implementation.

Recommendation 3: If necessary, modify unlined channels to provide scour protection and modify DIFR DEIS/EIR concepts, costs, and maintenance costs as appropriate.

USACE Response: Adopted.

Action Taken: Unlined channel inverts (reaches 1 and 23) will be updated to incorporate scour protection measures during detailed design, as necessary, including updated cost and maintenance information.

Comment 12 - Medium Significance: Future-without-project and future-with-project population and other socioeconomic projections are lacking.

The comment had four recommendations for resolution. Three were adopted and one was not adopted.

Recommendation 1: Add FWP and FWOP population and land use projections to the DIFR-DEIS/EIR.

USACE Response: Adopted.

Action Taken: Historic and future population estimates through the year 2020 have been added to the Economics Appendix (Appendix E, Table 2 in *Section 2.4.1*) based on the 2010-2017 American Community Survey and projections from the U.S. Census Bureau (2017). Due to the built-out nature of the floodplain, population estimates are not anticipated to differ between the future with-project and future without-project conditions. Population change estimates for future years were not incorporated into the economic analysis since population growth is already near zero in the study area it is anticipated population growth will likely remain stagnant or slightly negative. Other socioeconomic factors, including poverty status, foreign language speakers, median income, home value, and household size were not projected for the future condition due to lack of future-year data. Land use projections are not anticipated to change significantly over the life of the study; the study area is almost entirely developed in the FWOP condition. This is described in multiple locations in both the Main Report (including *Section 2.19, Future Without Project Conditions*) and Appendix A – H&H.

Recommendation 2: Use projections as part of the evaluation of flood risk reduction benefits of proposed alternatives.

USACE Response: Not Adopted.

Action Taken: Consistent with EO 11988, the study will not use projection of increased population in the study area as part of the evaluation of flood risk reduction benefits. Additionally, due to the built-out nature of the floodplain, population estimates are not anticipated to increase significantly between the FWP and FWOP conditions (2010 American Community Survey and U.S. Census Bureau). Projected changes in population may potentially be used in a sensitivity analysis related to the life safety FIA model in the future.

Recommendation 3: Integrate population projections and changes to the land use distribution as part of the evaluation of life-safety impacts of the FWP and FWOP project alternatives.

USACE Response: Adopted.

Action Taken: USACE ran HEC-FIA life safety and ‘other social effects’ (OSE) analyses. The results of these additional analyses are included in the Economic Appendix (Appendix E, *Section 3.9*). Land use projections are not anticipated to change significantly over the life of the study;

the study area is almost entirely developed in the FWOP condition. This is described in multiple locations in both the Main Report and the Hydrology & Hydraulics Appendix.

Recommendation 4: Include ethnic composition projections in the impact analysis.

USACE Response: Adopted.

Action Taken: Additional information on ethnic composition in the study area has been added to Section 2.11 of the Main Report. Additional analysis of the potential impacts of the study alternatives on the total population, ethnic groups, and household income levels throughout the study area has been added to Section 5.11 of the Main Report.

Comment 13 - Medium Significance: The rationale for screening out measures is not well-developed, and a broad range of alternatives may have been dismissed due to possibly premature elimination.

The comment had four recommendations for resolution. Three were adopted and one was not adopted.

Recommendation 1: Provide further rationale for eliminating the measures that were screened out.

USACE Response: Adopted.

Action Taken: USACE believes that it has adequately considered an appropriate range of measures and alternatives based on the SMART Planning process and USACE's Risk Informed Decision Making paradigm. A more detailed description of the screening and formulation process was added to *Chapter 3, Plan Formulation* of the Main Report (*Section 3.3, Initial Screening of Measures* in particular). USACE also coordinated with the non-federal sponsor, the State of California, and resource agencies to identify additional measures for potential inclusion in the NED Plan and LPP, to include options for relocating or removing the tide gates, as well as an additional alternative for outletting flows into the Full Tidal Basin rather than Outer Bolsa Bay. Tide gate replacement/relocation and diversion into the Full Tidal Basin were screened out. Removal of the tide gates was retained in both the NED Plan and the LPP.

Recommendation 2: Reconsider inclusion of one or more of the eliminated measures in the formulation of alternatives.

USACE Response: Not Adopted.

Action Taken: Based on the USACE SMART Planning paradigm, USACE made risk-informed decisions to retain measures that were highly most likely to maximize net benefits, and screen those that were highly unlikely to do so. Measures screened from inclusion in the final array of alternatives include those that were highly unlikely to maximize net benefits; these include dams/reservoirs, diversion tunnels, and creating a new ocean outlet in Outer Bolsa Bay. However, recognizing that there is more uncertainty inherent to this approach, USACE

acknowledges the possibility of potentially re-incorporating certain measures at a later time if more detailed design work indicates a need. USACE believes that this is unlikely to occur in the future.

Recommendation 3: Consider reformulation of alternates based on the prematurely dismissed measures.

USACE Response: Adopted.

Action Taken: Based on the USACE SMART Planning paradigm, USACE made risk informed decisions not to expend the resources on in-depth analysis of measures that appear extremely likely *not* to maximize net benefits. Measures were not prematurely dismissed but rather a risk-informed decision was made not to over-invest time and tax payer dollars in detailed models and analyses for every conceivable measure and/or alternative. This is consistent with the USACE SMART Planning process.

Eliminated measures were reconsidered during feasibility level design and review processes, as appropriate. Also occurring during this time was the elimination of a floodwall along PCH and the replacement/relocation of tidal gates (as opposed to removal) in all of the retained action alternatives. These decisions demonstrate that measures were reevaluated to ensure that assumptions were correct, and changes were made to the Recommended Plan as described in *Section 3.3.5, Relocation versus Removal of Existing Tide Gates* and *Section 3.3.6, Additional Analysis of a Potential PCH Floodwall* of the Main Report.

Recommendation 4: Clarify how and at what stage non-structural measures will be integrated into the action plans.

USACE Response: Adopted.

Action Taken: Additional narrative screening information has also been provided to *Chapter 3, Plan Formulation* (especially *Section 3.3, Initial Screening of Measures*) based on ATR and PGM comments received for a number of the measures considered in this study, including nonstructural measures. USACE has focused on identifying and describing potentially compatible nonstructural measures that are likely to be economically justified and making recommendations for their incorporation.

The nonstructural measure of “reducing impediments to flow” would be applied universally throughout the study area and is included in both the NED Plan and LPP. The remaining nonstructural measures were screened out; justifications for each of these screening decisions are presented in *Section 3.3.1, Initial Screening of Measures* of the Main Report. This section of the report also acknowledges that although the nonstructural measures of “flood proofing” and “razing structures” are not likely to be economically justified throughout the project area, it is possible that smaller site specific applications of these measures may be. Localized applications of these measures could be incorporated into the NED Plan or LPP during Preconstruction Engineering and Design, if applicable. However, at this time USACE believes that this is

unlikely to occur for the reasons described in *Section 3.3.1, Initial Screening of Measures* of the Main Report.

Comment 14 - Medium Significance: The Moderate Channel Modification Plan, one of three action plans under consideration, is identical to the Minimum Modification Plan; effectively only two alternatives, the Minimum and Maximum Modification Plans were evaluated.

The comment had two recommendations for resolution. One was adopted and one was not adopted.

Recommendation 1: Consider broadening the range of alternatives evaluated.

USACE Response: Not Adopted.

Action Taken: USACE conducted an incremental analysis to identify an alternative (Moderate Plan) that combined reaches of the Maximum and Minimum Plans to maximize net benefits. However, results of the analysis indicated the Moderate (Hybrid) Plan was identical in composition (on a reach-by-reach basis) to the Minimum plan. Previously, this analysis was included in the cost/benefit tables, but USACE eventually decided that it was more confusing to show what appear to be duplicative results.

Recommendation 2: Alternatively, add additional analysis to justify why the potentially feasible range of alternatives were limited to two action alternatives.

USACE Response: Adopted.

Action Taken: USACE agrees that additional documentation of plan formulation decisions increases legibility and robustness of the decision making process. The updated Plan Formulation Appendix (*Appendix H, section 3.9*) includes expanded discussion on the reason that only two action alternatives were carried through the report.

A hybrid alternative was considered but ultimately eliminated based on an incremental analysis that showed it being identical to the Minimum Channel Modifications Plan. Other additional alternatives were also considered during the plan formulation process, including a diversion tunnel alternative and the development of a connection to the Pacific Ocean via the Full Tidal Basin of the Bolsa Chica Ecological Reserve.

Comment 15 – Medium/Low Significance: Although additional, site-specific geotechnical data will be collected during the PED phase of work, it is unclear how the data will be used to assess the static and dynamic stability of existing channel structures and modify their design if necessary.

The comment had four recommendations for resolution that were all adopted.

Recommendation 1: Collect site-specific geotechnical and groundwater data during the PED phase to evaluate the static and dynamic stability of channel structures, including stability against uplift pressure.

USACE Response: Adopted.

Action Taken: All unimproved channel reaches in the study area would become improved in both the NED Plan and the LPP. Therefore the static and dynamic stability of existing channel structures shouldn't affect their design. Updated fragility curves have been developed and are provided in the Geotechnical Appendix.

Data was used, and will continue to be used, to design specific structures such as bridge modifications, sheetpile depth and stability, seepage gradients, and dewatering requirements. Analysis includes both static and dynamic analyses. Geotechnical investigations that include strength and index property data are missing from C06 and most of C04 and C05 east of Goldenrod. Therefore additional investigations will be required during the design phase. USACE will collect site-specific geotechnical and groundwater data during the PED phase to evaluate the static and dynamic stability of channel structures, including stability against uplift pressure.

The scope of the recommended plan, which is located in Table 51 and 52, includes sheetpile in addition to concrete lined channel. For concrete lined channels, site specific information would be required should additional fill be proposed in order to evaluate settlement. Groundwater data would be required to evaluate dewatering and uplift requirements. For sheetpile, site specific information would be required to determine long and short term soil strength parameters as well as the depth and spatial location of peats and the engineering properties of other soils. In addition to sheetpile and channel lining, the project includes bridge modifications and construction adjacent to existing bridge. Therefore design of specific structures such as bridge modifications will be required. Analysis will include both static as well as dynamic analyses. Geotechnical investigations that include strength and index property data are missing from C06 and most of C04 and C05 east of Goldenrod. Therefore additional investigations will be required during the design phase.

Recommendation 2: Assess the need for providing drainage along channel reaches where the groundwater table is at shallow depth (just below or above the inverts) or has the potential to rise during the rainy season.

USACE Response: Adopted.

Action Taken: USACE will assess the need for providing drainage along channel reaches where the groundwater table is at shallow depth (just below or above the inverts) or has the potential to rise during the rainy season during PED.

With regard to groundwater, preliminary analyses show the shallow groundwater to be nearly equivalent to the water in the channels. Therefore little flow is expected through the channel floor. Additionally, downstream channels, which are the ones most likely to be filled with water

regularly such as C02 Reach 23 and C05 Reach 1 are soft bottom. However, additional analysis of groundwater inflow will be performed after site specific data are collected. The worst case conditions for uplift will be considered in the design phase.

Recommendation 3: Clarify how the existing channel lining will be modified based on additional site-specific data, if necessary, so that it meets the design standards for static and dynamic stability as well as stability with respect to uplift pressure.

USACE Response: Adopted.

Action Taken: It is agreed that problematic or unstable soils are present at all depths and throughout the study area. Therefore, the sentence “Construction of any of the Action Alternatives would not be located on a geologic unit or soil that is unstable, therefore there would be no impacts” has been removed. USACE will clarify how the existing channel lining will be modified based on additional site-specific data, if necessary, so that it meets the design standards for static and dynamic stability as well as stability with respect to uplift pressure during PED.

Recommendation 4: Clarify the methodology to be used to ascertain that the existing concrete lining is not placed on an unstable geologic unit or soil. Also, clarify the mitigation measures to be used if unstable geologic materials are found to underlie the current concrete lining during the PED phase.

USACE Response: Adopted.

Action Taken: It is agreed that problematic or unstable soils are present at all depths and throughout the study area. Therefore, the sentence “Construction of any of the Action Alternatives would not be located on a geologic unit or soil that is unstable, therefore there would be no impacts” has been removed. USACE will, generally, not be continuing to further evaluate existing channel reaches where no new work is planned. If during PED, however, it is determined that the existing concrete lining is placed on an unstable geologic unit or soil and it would negatively impact the federal project, then USACE would describe how that determination was made and what mitigation measures would be used.