LR20221025COE

Independent External Peer Review of the Baltimore Coastal Storm Risk Management Feasibility Study

Comment/Response Record

25 October 2022

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Prepared for: **Department of the Army**
U.S. Army Corps of Engineers
Coastal Storm Risk Management Center of Expertise
Baltimore District

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1 Introduction

This document provides the comment/response record for the Independent External Peer Review (IEPR) of the Baltimore Coastal Storm Risk Management Feasibility Study by the Baltimore District of the U.S. Army Corps of Engineers (USACE). This comment/response record contains the following:

- IEPR panel members' comments on the documents that they reviewed
- USACE final evaluator responses to the IEPR panel member comments
- IEPR panel member responses (called BackChecks) to the USACE final evaluator response.

Each IEPR panel comment consists of four parts:

1. Clear statement of the concern
2. Basis for the concern
3. Significance of the concern
4. Recommended actions necessary to resolve the concern.

Comments have a rating to indicate the general significance that the comment has to the project implementability. The definitions of the significance ratings are as follows:

- **High** – There is a fundamental issue within study documents or data that will influence the technical or scientific basis for selection of, justification of, or successful implementation of the recommended plan.
- **Medium High** – There is a fundamental issue within study documents or data that has a strong probability of influencing the technical or scientific basis for selection of, justification of, or the ability to implement the recommended plan.
- **Medium** – There is a fundamental issue within study documents or data that has the potential of influencing the technical or scientific basis for selection of, justification of, or the ability to implement the recommended plan.
- **Medium Low** – There is missing, incomplete, or inconsistent technical or scientific information that affects clarity, understanding, or completeness of study documents, and there is uncertainty whether the missing information may affect selection of, justification of, or the ability to implement the recommended plan.
- **Low** – There is a minor technical or scientific discrepancy or inconsistency in study documents or data that does not influence the selection or, justification of, or the ability to implement the recommended plan.

The IEPR panel comments are presented in order of significance from high to low in Section 2.

For each IEPR panel comment, the USACE has provided a final evaluator response, selecting Concur or Non-Concur for each panel comment. For each panel Recommendation, the USACE has stated Adopt or Not Adopt.

The Panel has provided backcheck responses to the final USACE evaluator responses stating either Concur or Non-concur. If needed, the Panel has added an explanatory text about the rating. The IEPR panel comments, USACE Evaluator Responses, and IEPR Panel BackCheck Response have been entered into the USACE Design Review and Checking System (DrChecks[1]).

[1] Hosted on the USACE's PROJect extraNET (ProjNet), a web service that allows the secure exchange of information.

2 Comment/Response

2.1 Significance: High

COMMENT #1
The nonstructural element of the Recommended National Economic Development (NED) Plan is not supported by the data and analysis presented in the study documents.
Basis for Comment
Appendix E: Economics, Section 8.4, Recommended National Economic Development Plan, p. 78, last paragraph states: "Tunnels and their facilities are one entity. In addition, nonstructural alternatives MA 9 NS_20YR, MA 10 NS_20YR, MA 11 _NS50YR, MA 12 NS_50YR, MA 14 NS_100YR and MA 15 NS20YR were included in the selected plan because either their net benefits are positive or are near positive." However, the contradictions and inconsistencies in the analysis, assumptions, and assessments do not support including the nonstructural element in the NED Plan as illustrated by the following sections of the study documents: 1. Section 6.1, Plan Accomplishments, p.141 of the *Draft Integrated Feasibility Report/Environmental Assessment* (Draft IFR/EA) states: "Past storm events have led some building owners to install nonstructural solutions to flood risk and enabled these structures to continue to be habitable and productive." The documents do not indicate how many of the structures in the structure inventory have already installed nonstructural solutions to flood risk and were excluded from the damages and benefit analysis. 2. *Appendix E: Economics*, p. 45, states: "Nonstructural treatments have been applied on 1096 structures in 1% AEP, 493 structures in 2% AEP, and 286 structures in 5% AEP". However, Section 3.5.1.3 Alternative Plan 3: Nonstructural Plan, p. 98 of the Draft IFR/EA states: "1,400 structures have been identified as being at risk within the study area by 2080, under the one percent AEP with intermediate SLC scenario." No explanation is provided for why the 304 structures were excluded in the nonstructural element. 3. *Appendix F: Real Estate Plan*, p. 5 states: "The TSP also includes a non-structural component where 293 structures are to receive either wet or dry floodproofing to various level of protections (See Table 1 below). At the current level of design, it has not yet been determined which structures will receive dry floodproofing treatments and which will be wet floodproofed." The costs of wet and dry floodproofing are different, but no information is provided on how total costs of floodproofing were determined for the benefit-cost analysis or why the number of structures being considered is 293 instead of 1096 structures in 1% AEP, 493 structures in 2% AEP and 286 structures in 5% AEP. 4. In *Appendix F: Real Estate Plan*, p. 5, Table 1, Number of Structures affected is 293 and in Table 2 Number and Type $_{of}$ Impacted Structures is 242. No explanation is provided for the difference in the number of structures in the two tables. 5. *Appendix F: Real Estate Plan*, Section 21: Real Estate Risk Analysis, p. 18, Item 3, states: "Environmental justice issues. The non-structural measures in the TSP are voluntary and as such, an owner may need to make improvements to the structure in order to participate or expend their own funds in other ways such as obtaining partial releases or subordination agreements from existing lienholders. This may cause a hardship for some owners causing them to decline to participate in the project. If a property owner wants to participate, Best Practice Guide 2020-02 from the National Non-structural Committee advises that property owners must first correct existing violations of state and local health, sanitary and safety

codes which have been identified by a local code enforcement official and which are the minimum necessary to ensure decent, safe, and sanitary (DSS) living conditions. Some examples expected to be encountered are lead-based paint and asbestos. While the Best Practice Guide is not official policy, if it is followed, there should be a pre-construction assessment of each property that desires to participate in the non-structural program to determine if any corrections need to be made before project construction. The fact that the property owner will need to self-fund these repairs before participating in the project is expected to affect participation rates for the project." The assumption of a 100% participation rate in the analysis of the nonstructural elements of the NED Plan is not reasonable, especially in light of these environmental justice issues.

6. *Appendix F: Real Estate Plan,* Section 21: Real Estate Risk Analysis, p. 19, Item 8 states: "Participation rates for non-structural portion of the TSP are assumed to be 100% for the purposes of the BCRE so that we can obtain the maximum cost exposure to NFS for the project." A Non-Federal Sponsor for the nonstructural elements of the NED Plan has not been identified.

   Item 11. states: "For some structures, the cost of the proposed floodproofing treatment may be close to or exceed the value of the property. If, and when, this project is funded, this issue should be revisited to determine whether it makes economic sense to floodproof the property." It would not make economic sense to floodproof the properties if the property value is less than the cost to floodproof, and these properties should be eliminated from the analysis.

   Item 33. states: "There may also be schedule and cost risks related to affected properties subject to a homeowner association, subordination, or partial releases for lienholders, and for any renters who may be residing in the basement of an affected structure as a roommate of an owner occupant. Finally, there may be situations where participation is impacted by a structure being owned by multiple owners who disagree about whether they would like to participate in the project." The Draft IFR/EA, p. 143, points out: "Typically, these options are also not practical for row homes considering many of these buildings have multiple owners." This would seem to make the nonstructural element of the NED Plan impractical.

7. *Appendix C: Cost Engineering and Risk Analysis*, Summary of Scope of Work states:

   "Account 01. Land and Damages. Real estate cost for nonstructural plan includes estimated cost to temporary relocate local residents while nonstructural measures such as floodproofing or structural elevation is applied." Structural elevation as a nonstructural measure was screened out in the Draft IFR/EA and no cost or temporary relocations or structural elevations should be included in the analysis.

   "Account 19. Buildings, Grounds, and Utilities. This account is for nonstructural costs for properties available in study areas. There are two (2) types of nonstructural methods being considered, floodproofing and structural raising or elevation. The nonstructural cost is based on MII estimate done for the 2020 Denville study in New Jersey. It is upgraded to 2022 price level using escalation and latest cost libraries such as 2021 Labor Library and 2020 Equipment Library for Region 2 with updated fuel and Cost of Money rates. The average cost of floodproofing and the average cost for structural elevation for different types of properties are computed. These two (2) average costs are applied to each property according to whether it is selected to be either floodproofing or structural elevation. The total nonstructural cost for all properties for each level of protection is included in separate TPCSs. For example, for the 100-years protection, there is a TPCS, and likewise for 50 years and 20 years of protection." Structural elevation as a nonstructural measure was

screened out in the DIDR/EA and no cost for temporary relocations or structural elevation should be included in the analysis.

8. *Appendix C: Cost Engineering and Risk Analysis*, Summary of Scope of Work states:

   "Account 01. Land and Damages. Real estate cost for nonstructural plan includes estimated cost to temporary relocate local residents while nonstructural measures such as floodproofing or structural elevation is applied." Structural elevation as a nonstructural measure was screened out in the Draft IFR/EA and no cost for structural elevation or temporary relocations should be included in the analysis.

"Account 19. Buildings, Grounds, and Utilities. This account is for nonstructural costs for properties available in study areas. There are two (2) types of nonstructural methods being considered, floodproofing and structural raising or elevation. The nonstructural cost is based on MII estimate done for the 2020 Denville study in New Jersey. It is upgraded to 2022 price level using escalation and latest cost libraries such as 2021 Labor Library and 2020 Equipment Library for Region 2 with updated fuel and Cost of Money rates. The average cost of floodproofing and the average cost for structural elevation for different types of properties are computed. These two (2) average costs are applied to each property according to whether it is selected to be either floodproofing or structural elevation. The total nonstructural cost for all properties for each level of protection is included in separate TPCSs. For example, for the 100 years' protection, there is a TPCS, and likewise for 50 years and 20 years of protection." Structural elevation as a nonstructural measure was screened out in the Draft IFR/EA and no cost for structural raising or elevation or temporary relocations should be included in the analysis. The PDT does not know how many structures are being considered for floodproofing so there is no way to know how many properties to apply the average costs to in developing the estimated costs.

Significance: High

There is a fundamental issue within study documents and data that will influence the technical and scientific basis for the selection of, justification for, and ability to implement the recommended plan.

Recommendation for Resolution

Recommendation #1: Provide additional information and analysis in the Final IFR/EA to correct the contradictions and inconsistencies needed to support and justify the nonstructural element of the Recommended NED Plan. Discuss the risk and uncertainty associated with the analysis based on the data determined to be available for evaluation at this stage of the project.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation:

1. No individual structure assessments have been accomplished. A full understanding of the extent of current floodproofing in structures that are potentially eligible for

floodproofing will not be known until PED phase when rights of entry are secured and structures may be evaluated. It is known that some structures in the study area installed floodproofing in the wake of Hurricane Isabel in 2004. For example, the World Trade Center installed stop log structures at building entrances and the National Aquarium has deployable panels for building entrances. However, no evaluation of all structures in the study area has been conducted.

2. Thank you for pointing out the inconsistency which will be rectified within the main report where we did identify over 1,000 structures at risk.
3. This information is provided in Appendix C- Cost Engineering and Risk Analysis. A statement has been added to page 5 of the REP.
4. The numbers in the Real Estate Plan, page 5, Table 1 add to 293.
5. Concur that 100% participation is not feasible but we provided these number for the specific purpose of providing the eventual NFS a maximum cost exposure. Participation rate analysis will be conducted in the next planning iteration. However, plan selection will be based on a 100% participation rate.
6. It does not make sense to floodproof if cost to do so exceeds value of properties but our numbers are too preliminary at this point to eliminate properties. The ability to floodproof specific rowhouse structures will be evaluated during PED phase – the ability to floodproof a structure if the adjacent structure is not treated may depend on specific structural characteristics.
7. Structural elevations and temporary relocations should not have been referenced in Appendix C as potential costs. Utility relocations and other similar relocations will remain as Lands, Easements, Rights-of-Way, Relocation, and Disposal Area (LERRD) costs. For account 01, real estate cost write up will be revised to state that the nonstructural RE costs are for administrative cost to get the property owners to agree to allow access for nonstructural measures to be implemented, not to relocate the property owners. Just FYI, the actual nonstructural cost included in the estimate is only for dry flood proofing, not structural elevation. As far as the number of properties that the average floodproofing cost is multiplied to, it was determined by PDT and economist in choosing properties in selected areas of NED plan. However, if the number of properties is changed due to re-evaluation caused by comments, the nonstructural cost will be revised accordingly. To further clarify, the backup MII estimate for nonstructural costs includes both structural raising/elevation and dry floodproofing, but only average dry flood proofing cost is used.
8. Structural elevations and temporary relocations should not have been referenced in Appendix C as potential costs. Utility relocations and other similar relocations will remain as LERRD costs.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation:

The report and appendices will be edited for clarity and consistency, with attention to the points raised in this comment. During the next planning iteration the G2CRM model will be rerun with a revised structure inventory, based on a check of structure age, structure type, and error

checks of the inventory. A new discount rate will be applied, the value of structures will be adjusted, and costs for measures will be refined for general structure types. Real estate costs are also being revised for the next planning iteration. The outcome of these changes will be included in the final report.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #2

No documentation is provided in the study documents on how the damages were calculated for infrastructure and cargo at the following locations: Port of Baltimore; Ft. McHenry Tunnel with the depreciated replacement value (DRV) with $4.1 billion on Interstate 95; Harbor Tunnel with DRV of $2.2 billion on Interstate 895; Baltimore Shot Tower Metro Station with DRV of $60.5 million; and the munition depot with $50 million at Martin State Airport.

Basis for Comment

Appendix E: Economics, Section 5.2 Future Without Project Condition Modeling Results, Table 13 - FWOP Condition Expected Annual Damages by MA, p. 36, shows present value (PV) damages and equivalent annual damages by modeled areas. However, there is no explanation of how the damages were calculated or what they are based on. For example, are the damages to the Ft. McHenry Tunnel on Interstate 95 and Harbor Tunnel on Interstate 895 limited to damages to the physical structure or do the damages include transportation costs due to delays and detours? The study documents need to provide more documentation of how expected PV damages were calculated. Stating only that “G2CRM used Monte Carlo simulation to derive the expected PV damages” is not sufficient.

Significance: High

This is a fundamental issue within study documents that determines the selection of, justification of, and ability to implement the recommended plan.

Recommendation for Resolution

Recommendation #1: Include a description of how the present value damages were calculated and what they are based on in the study documents.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT ‘concurs’ or ‘non-concurs’ with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a “concur,” unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: The following text will be added to sections 1 and 4.1 in the final feasibility report.

Section 1:

This analysis was conducted in accordance with USACE policy dictates in Engineer Regulation (ER) 1105-2-100, Planning Guidance Notebook, and ER 1105-2-101, Planning Guidance, Risk Analysis for Flood Damage Reduction Studies. The National Economic Development Procedures Manual for Flood Risk Management and Coastal Storm Risk Management, prepared by the Water Resources Support Center, Institute for Water Resources, was also used as a reference, along with the USACE Generation II Coastal Risk Model (G2CRM) User's Manual v4.556.3. G2CRM is the coastal flood risk management certified model used to analyze the inundation damages. The damages were originally assessed exclusively on physical buildings in the inventory using fiscal year FY2019 price levels, and a period of analysis of 50 years to the Alternative Milestone Meeting. Currently, the analysis is conducted using the fiscal year 2022 discount rate (October 2021 price level). 2031 is the base year. It is also used as the basis for plan comparison for each alternative using the FY22 discount rate of 2.25 percent.

Section 4.1:

Infrastructure and cargos at Port of Baltimore, tunnels, Baltimore Shot Tower Metro Station, and the munition depot at Martin State Airport were modeled as physical assets in the inventory. The office of engineers at Martin State airport provided the DRV of the munition depot. The tunnels' replacement values are prepared by the Maryland Transportation Authority consultant. The consultant used National Highway Consultation Cost Index (NHCCI) to develop the DRV. Air National Guard unit station at the airport provided the munition depot DRV. Cargos DRV used vehicle valuation methods provided in section 4.1.1. Transportation disruption costs were not available hence, they are not included in the analysis.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: DRVs are in the inventory used to compute damages. They have an impact on damage computations. The method explained above was used by the model to derive present value damages and will be incorporated in the analysis.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #3

The Tentatively Selected Plan (TSP) floodwalls, dry floodproofing enclosures and other remedial measures proposed for planning units designated for *non-structural measures* will not protect communities and infrastructure from flooding (through the *back* door) by flood waves and backwater effects on the streams and rivers of the Gunpowder-Patapsco watershed during the extreme precipitation that often accompanies extreme tropical and extratropical frontal cyclone events. Consequently, the proposed designs of the TSP structural and non-structural measures may not be sufficient to mitigate coastal flooding within the Baltimore Study Area.

Basis for Comment

The basis of design for the ensemble of TSP measures is to secure vulnerable populations, properties, and infrastructure along the banks of the Patapsco River in the vicinity of Baltimore City from flooding entering through the front door by walling them off from storm surge and hurricane-generated swell and wind waves propagating up the north arm of the Chesapeake Bay from the open ocean. However, these TSP measures do not secure these communities from being flooded through the back door by flood waters overtopping the banks of the Patapsco River that discharges into the Bay.

As presently described and deployed in the Draft IFR/EA the structural and non-structural measures of the TSP still leave the mouth and banks of the Patapsco River unprotected from flood waves and back water impacts arising from heavy local rainfall that often accompanies extreme tropical cyclones such as Hurricane Agnes (1972). This extreme event storm produced 10 to 15 inches of rain and large volumes of surface runoff throughout Baltimore, causing flash floods concurrent with storm surge that resulted in $400 million in damages (per present dollar valuations). Flood damages would be even greater if a Hurricane Agnes storm event were to occur circa 2080, when higher sea levels would increase back-water impacts and extend bank overtopping and flood damages further upstream along the Patapsco River. Unless the results of extreme event fluvial modeling at future sea levels is included in the Baltimore CSRM analysis, the capability of the proposed structural and non-structural measures to protect against fluvial coastal flooding is not known.

If extreme event fluvial modeling at 2080 sea level shows significant bank overtopping into the communities and infrastructure behind and further inland of the proposed non-structural measures, then an amendment to the TSP could be to extend these remedial measures further inland along the banks of the Patapsco River. However, dimensioning amendments to the non-structural measures will require quantifying the flood hydrographs for extreme tropical cyclone events at future sea levels and revising the G2CRM modeling and Benefit Cost Ratio (BCR) projections.

Significance: High

Unless the occurrence of river flooding concurrent with storm surge is included in the analysis, the adequacy of the proposed TSP structural and non-structural measures cannot be determined, which makes it difficult to assess the accuracy of BCR projections for the TSP and other actionable alternatives.

Recommendation for Resolution

Recommendation #1: Determine the flood hydrographs in the Patapsco River during storm surge events that are accompanied by extreme precipitation and incorporate this information into the flooding analysis. One way to accomplish this is by performing extreme event fluvial modeling of the Patapsco River utilizing HEC RAS v 5.0.7 in the full momentum equation mode to produce flood hydrographs for a select set of tropical and extratropical frontal cyclone events having precipitation return periods of 10 years and greater. Utilize HEC RAS model results to assess potential interior inundation from bank over-pour flows and to develop TSP design amendments of additional structural or non-structural measures that remediate bank over-pour flows into back-bay communities. To capture post-project backwater effects in these modeled hydrographs, downstream hydraulic control for the fluvial modeling effort should be based on Bay water levels that include storm surge superimposed on future sea levels.

Recommendation #2: Revise the floodwall and dry floodproofing enclosure designs as needed to mitigate problematic fluvial flooding at future sea levels. Reassess benefit-cost ratios and the TSP selection process with revised G2CRM results based on additional costs for amended structural or non-structural measures that remediate bank over-pour flows into back-bay communities.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: The Baltimore CSRM study is to investigate solutions to coastal flooding problems leading to a USACE recommendation for implementation. The focus of the Baltimore CSRM was to protect citizens from the coastal flood risk. New riverine analysis/modeling was beyond the scope of this study. Instead of new riverine flood study for Jones Falls and Gwynns Falls, we utilized the 2014 FEMA Flood Insurance Study (now, there is a new FEMA study dated June 2021). The 2021 FEMA study includes 2018 riverine flood hazard analysis (using HEC-RAS) for both Jones Falls and Gwynns Falls. Both FEMA studies includes 100-year WSELs and floodplains for both riverine and coastal flooding sources. FEMA Coastal flood hazard is based on 2012 USACE ADCIRC modeling performed by ERDC Coastal Hydraulic Lab. A total of 156 synthetic tropical and 30 historical extratropical storms were simulated and the maximum modeled water levels for each storm were compiled and statistically analyzed to determine the return period for the stillwater levels. The model was calibrated for Hurricane Isabel, Hurricane Ernesto, and extratropical storm Ida. The extent of the coastal and riverine flooding is shown in the attached map (Baltimore CSRM Study Area FullMap.pdf).

For coastal flood hazards for Baltimore CSRM study, we utilized the North Atlantic Coast Comprehensive Study (NACCS) model data as outlined in the hydrologic and Hydraulic Appendix. The NACCS study is based on a suite of 1050 synthetic and historic storms and was calibrated against historic storms.

FEMA's riverine 100-year flood hazard model and mapping is the best available information at this time, therefore will be utilized to analyze project alternatives. No new HEC-RAS modeling is necessary to analyze riverine flood hazard. We utilized both NACCS study and FEMA flood insurance study for the area. It is evident that the coastal hazards from the NACCS study is much higher than that of the FEMA study in this area. Attached map shows the extent of floodplain based on 12.2 NAVD88 WSEL and that of FEMA study.

Structural measures proposed for the TSP only protects I-95 and I-895 tunnels, ventilation facility and visitor center. These project elements are not even close to the riverine flooding sources. Therefore, fluvial flood has no impact on any TSP structural alternatives. FEMA's 100-year riverine model & mapping is still valid and relevant for our study, no new HEC-RAS modeling is necessary.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: FEMA's riverine 100-year flood hazard model and mapping is the best available information at this time, therefore it was utilized to analyze project alternatives for Baltimore CSRM. No new HEC-RAS modeling is necessary to analyze riverine flood hazard. We

utilized both NACCS study for coastal hazards and FEMA flood insurance study for riverine flood hazards.

Structural measures proposed for the TSP only protects I-95 and I-895 tunnels, ventilation facility and visitor center. These project elements are not even close to the riverine flooding sources and not affected by them at all. Therefore, fluvial flood has no impact on any TSP structural alternatives. FEMA's 100-year riverine model & mapping is still valid and relevant for our study, no new HEC-RAS modeling is necessary.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Explanation: As mentioned above, no new HEC-RAS modeling is necessary. Because FEMA's riverine flood hazards were already utilized for TSP alternatives, no revision to the floodwall and dry floodproofing enclosure design are necessary. Therefore, this panel recommendation will not be adopted. Cost will be revised pending on the revised structural concept design.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #4

The makeup of the flood remediation measures in the planning units designated for non-structural measures are not described and cannot be evaluated for efficacy or adequacy of design.

Basis for Comment

The Draft IFR/EA provides several-structural alternatives, but no specific combination of these alternatives is given for any of the planning units. The non-structural measures in the Draft IFR/EA are defined as dry floodproofing, wet floodproofing, building elevation, and acquisition/relocation. However, additional non-structural alternatives are also described in the Draft IFR/EA that are referred to as nature-based features and include living shorelines, marsh creation, marsh restoration, oyster reefs, and beach restoration. The Table 3-1 Screening Matrix in the Draft IFR/EA indicates that several of the nature-based non-structural alternatives have been retained (e.g., living shorelines, marsh creation/restoration, and oyster reefs), but the vagueness of the descriptions of the non-structural measures to be incorporated in the TSP leaves considerable uncertainty as to whether the non-structural measures in any given planning unit will include any nature-based components. Recent Federal Highway Administration studies have emphasized nature-based non-structural alternatives as viable solutions for reducing coastal flooding at future sea levels (FHWA, 2018 & 2019). It is possible that there could be resistance to the TSP if the non-structural measures did not include at least some nature-based non-structural alternatives. No explanation is provided in the Draft IFR/EA regarding how any of these alternatives (nature-based or otherwise) might work together to provide storm risk management in any given planning unit.

Significance: High

Since the non-structural measures are tasked with reducing coastal flood risk over the preponderance of the planning units in the TSP, the project documentation in the Draft IFR/EA is insufficient to evaluate the feasibility of federal participation in implementing the TSP

solutions to coastal storm damage along the banks of the Patapsco River in the vicinity of Baltimore City.

Recommendation for Resolution

Recommendation #1: Revise the Draft IFR/EA to clarify the composition of non-structural measures in each planning unit of the TSP and provide a discussion of how each combination of non-structural alternatives will work together to reduce or manage risk of coastal flooding.

Recommendation #2: Consider incorporating nature-based alternatives among the combinations of non-structural measures wherever feasible and effective as these will provide additional environmental benefits beyond flood risk reduction at future sea levels.

References:

FHWA, 2018, *White Paper: Nature Based Solutions for Coastal Highway Resilience*, No. FHWA-HEP-18-037, February 2018, 42 pp.

FHWA, 2019, *Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide*, No. FHWA-HEP-19-042, August 2019, 232 pp.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: A general description of dry and wet floodproofing is provided in section 6.2, along with several descriptions of typical measures that could be applied on structures within the TSP area. As described in this section, only wet or dry floodproofing is proposed for the TSP and no elevation or relocation would be proposed. Wet or dry floodproofing would be applied to individual structures and the benefits would accrue to the individual structures.

Natural and Nature Based Features (NNBF) were considered as measures where their implementation would be compatible with existing and future land use. For the main study area, the shoreline is generally hardened with a bulkhead, is highly developed, and the adjacent water is used for recreational or commercial purposes. Available areas for NNBF development is limited. There may be opportunity for some small-scale NNBF features such as oyster reefs or reef balls, but these features would likely effect wave action rather than flooding, which has historically been a relatively minor coastal storm problem for the study area. The Middle Branch area presents the greatest opportunity for incorporation of large-scale NNBF features such as wetlands. The Middle Branch Resiliency Initiative, a partnership between the City of Baltimore, the Parks and People Foundation, the South Baltimore Gateway Partnership, and many other organization, has secured funding for several pilot projects to design and construct wetland and other NNBF features, which will be incorporated into a larger reimagining of the Middle Branch area. These future without project features are mentioned in Section 2.4.16.1. This description will be updated and expanded in the final report along with the inclusion of an overall site plan.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: Section 6.2 will be edited to include more information the specific types of wet and dry floodproofing measures that may be implemented in the TSP areas. Measures such as installation of floodproof doors and windows, stoplog closures, skimmer pumps, backflow preventers, and electrical panel relocations may be needed for dry floodproofing. While some structures may be able to have wet floodproofing with elevation of storage, relocation of mechanical or electrical systems, and installation of flood louvers. It is unlikely NNBF solutions will be feasible at a scale that would be provide risk reduction to multiple structures in most of the TSP areas.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Section 2.4.16.1 will be revised to provide a more detailed description of the Middle Branch Resilience Initiative along with a map/site plan outlining the NNBF features that are funded and currently in the permit process. Section 6 will be revised to provide a description of the proposed actions of the USACE plan and how they will complement the actions being undertaken through the Middle Branch Resilience Initiative.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #5

The Draft IFR/EA does not mention or discuss the presence of chromium ore processing residue (COPR) in the Baltimore area or the potential impact of the presence of COPR on the selected plans and under sea level rise.

Basis for Comment

It is known that COPR was used as a fill material in certain areas around the Inner Harbor (e.g., at the Dundalk Marine Terminal and Harbor Point). Disturbance of such fill may contaminate the ground and surface waters.

Significance: High

Given the amount of contaminated soil in the area, this issue will influence the technical or scientific basis for selection, justification, or successful cost-effective implementation of the recommended plan.

Recommendation for Resolution

Recommendation #1*:* Address the issue of COPR contamination and discuss the potential for and the mitigating measures needed to prevent the spread of contamination with CSRM flooding anticipated, including sea level rise scenarios and with fluvial flooding.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: The PDT will include a subsection to discuss COPR and potential impacts and mitigation measures needed to prevent the potential spread of contamination due to coastal flooding and sea level rise. The PDT will also include language pertaining to current mitigation efforts being performed around Baltimore City.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: A subsection under the 4.2.2 Soils will be included to discuss COPR and its potential impacts from coastal flooding and sea level rise.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #6

The Draft IFR/EA does not discuss the erodibility of contaminated soils and its impact in the case of sea level rise and storms.

Basis for Comment

Appendix G: Environmental and Cultural Resources Coordination describes the presence of contaminated soils and waste sites in the study area. With sea level rise, contaminated areas could be flooded by storm surge that are not currently flooded. Erosion of these contaminated soils and chromium ore processing residue fills during future storm events can result in significant contamination in the area.

Significance: High

This issue has high significance as it will influence the technical or scientific basis for selection, justification, or successful, cost-effective implementation of the recommended plan.

Recommendation for Resolution

Recommendation #1: Discuss in the Final IFR/EA the potential for eroding contaminated soils, the potential impacts of such erosion, and mitigating measures that would be used to prevent or eliminate the impacts.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: The PDT has examined background information pertaining to soil erodibility within the study area. According to the United States Department of Agriculture – Natural

Resource Conservation Service (USDA-NRCS), the primary soil type within the Baltimore study area is Udorthents, Urban land, and Woodstown-Urban land complex. The K-factor for these soil types, or the susceptibility of a soil to sheet and rill erosion by water range from .10-.32. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water. Once the PDT performs the Phase II Environmental Site Assessment in the Pre-Construction, Engineering and Design (PED) phase of the study, and samples have been analyzed and validated, the PDT will have a clearer understanding of potential contaminated soils within the study area in Baltimore and can formulate a more precise conclusion on how to mitigate for potential impacts. More detail will be included as it pertains to soil erodibility and sea level rise around Martin State Airport.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: The PDT will discuss the potential for eroding contaminated soils in a FWOP and FWP condition, the potential impacts, and mitigation measures to prevent or eliminate impacts.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

2.2 Significance: Medium High

Comment #7

The design level of 10% creates uncertainty undermining the current analysis's ability to accurately determine the efficiency of and discriminate among the various alternatives in alleviating the specified problems.

Basis for Comment

The evaluation is, for the most part, based upon some existing data identified to date, standard design templates, and preliminary numerical modeling. As a result, the level of analysis is low. Assumptions, calculation examples, and design bases are not provided in many sections of the EA/FS. This low-level detail renders the determination of the TSP highly uncertain. Integrating a thorough risk and uncertainty analysis would strengthen the USACE decision-making process, as alternatives that are currently eliminated may become more or less cost-effective with increased design information.

The panel understands that the SMART Planning process calls for relying mainly on existing data for the analysis at this stage of a project and that this approach is crucial to the process. The panel believes, however, that there may be additional existing data that could be identified and used to improve and refine the current analysis and that this is crucial to supporting the analysis and conclusions at this stage of the project. For example, the Maryland Department of Transportation may have archived soil borings and soil composition and contamination data at the tunnel entrances obtained when the tunnels were constructed. There also may be some data on the distribution and location of COPR and other contaminated soil in the study area. Additional data such as these could help improve the analysis and support the conclusions in the final report.

Significance: Medium High
This issue has a strong probability to affect the conclusions and possibly render the entire proposal questionable.
Recommendation(s) for Resolution
Recommendation #1: Identify to the extent possible additional existing data that could be used in the analysis. Use these data to add additional analysis, detail, discussion, and information to the Final IFR/EA to reduce the level of uncertainty and improve the confidence of the TSP selection in the final report. Re-evaluate the TSP as necessary based upon the new information. **Recommendation #2:** Incorporate a risk and uncertainty analysis into the Final IFR/EA as it affects the selection of the TSP at this stage of the project. **Recommendation #3:** Describe in the Final IFR/EA the types of information and data that the USACE will need to obtain in future project stages to refine and improve the analysis and to confirm and justify a TSP.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: Existing engineering data, boring logs, and other information has been requested from the Maryland Transportation Authority (MdTA), the branch of Maryland Department of Transportation (MDOT) who owns and manages the tunnels. The information received has been used to inform some assumptions, such as tunnel operations before and during storms, existing mechanical systems, and existing storm preparedness. However, more information is likely available that has not been provided. As that information is received and incorporated, engineering risk should decrease. Regarding COPR, the project team has located current monitoring reports of remediated sites and past investigative reports. The team has also contacted local experts on COPR to help inform the risk analysis. As more information is known, it will be incorporated into engineering designs, cost assumptions, and other documents.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: The PDT will continue to work with MDOT MdTA to identify existing engineering documents that may assist in project design. Additional information will be incorporated into the final report and the engineering supporting the final report. Additionally, local experts in COPR will be consulted for their knowledge of the extent of COPR contamination in the Baltimore area as well as mitigation strategies for COPR.
Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Explicit risk and uncertainty will be explicated within the final report, based on any additional information provided or found. Cost risk analysis will also be updated based on additional information and detail.

Recommendation #3: _X_ Adopt __ Not Adopt

Additional soils and geotechnical information, at a minimum, will be required to advance design during the PED phase. A general plan for the types of information that will be needed in the PED phase will be included with the final report.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #8

There has not been enough public involvement to determine how the public feels about this project.

Basis for Comment

Appendix F: Real Estate Plan, p. 17, Section 19 states: "Attitudes of Landowners and Project Support - At the time this report was drafted, there has only been one public meeting which was an open house/kickoff meeting and took place several years ago before the project was canceled due to a lack of funding. It was not well-attended by the public, so it is not yet clear how affected property owners feel about this project." There has not been enough public involvement to determine if the public supports or opposes this project.

Significance: Medium High

The lack of documentation of public involvement in the study documents is a fundamental issue that has a strong probability of influencing the selection of and ability to implement the recommended plan.

Recommendation for Resolution

Recommendation #1: Conduct adequate public involvement efforts to be able include documentation of the public's support for or opposition to the Recommended NED Plan.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: CENAB held an initial public scoping meeting in 2019, which was very lightly attended by members of the public. A news release was issued on 05 July 2022 indicating that the draft IFR/EA was available for public review and providing information for upcoming public meetings to be held. The news release and a stakeholder update was also provided to

multiple stakeholder and community groups. Two public meetings (one in-person, one virtual) were held during the public comment period for the draft IFR/EA in August 2022. Multiple meetings were held with any stakeholder groups that requested one to discuss the project. All public comments and their associated responses from the PDT will be included in the Final IFR/EA as part of the Appendix H- Agency and Public Coordination. Though the PDT disagrees with the comment stating that there has not been enough public involvement to determine how the public feels about this project, the team is implementing the recommended change to the final IFR/EA. Text to describe the additional public and agency coordination completed will also be included in the Final IFR/EA.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: Public involvement efforts to document the public's support for or opposition to the Recommended NED Plan have taken place since the draft report was released for public review.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #9

The Draft IFR/EA does not describe the foundation treatment, foundation support, or seepage control that was assumed for the T-Walls and included in the estimated costs.

Basis for Comment

The Draft IFR/EA, *Appendix A: Civil Engineering*, includes a figure that shows the general configuration of the T-Walls and a table that indicates the member dimensions for Wall Types 1 and 2. Mathcad spreadsheets were used to perform the stability analysis and to determine the member structural dimensions. No information is provided on how the walls will be supported on the existing or modified ground or how seepage and erosion under the walls will be controlled. Depending on the strength and density of the existing foundation materials, the T-walls would typically be supported by piling and a cutoff wall or sheet piling would be used to control seepage under the wall.

Appendix D: Geotechnical Analysis, includes estimated design parameters of on-site soils for the floodwall analysis. Estimated design parameters are provided for the effective cohesion, effective friction, and lateral earth pressures. No information is provided on the allowable bearing pressure for use in the stability and structural analysis and cost estimates. In addition, no information is provided for potential foundation treatment or seepage control that might be required for the floodwalls.

Significance: Medium High

This is a fundamental technical issue related to the stability and integrity of the flood walls that has a strong probability of influencing the technical basis and ability to implement the TSP and increases the risk and uncertainty of the estimated cost and schedule.

Recommendation for Resolution
Recommendation #1: *Appendix A* should be revised to include a description of the foundation support and seepage control that was assumed for T-Walls Type 1 and 2. **Recommendation #2:** The Draft IFR/EA should be revised to include a section that describes the structural measures and the related risks and uncertainties of the project.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: Foundation treatment and support as well as flood wall seepage control will be addressed in later design phases. Additional discussion will be added to the final IFR/EA.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: Description will be added "At this stage of feasibility study measures (10% design), no site-specific geotechnical investigation and testing program were conducted. Based on the provided rough geotechnical profile, it is assumed at this stage that the walls can be supported by shallow foundation with an allowable bearing pressure of 2,000 psf. It is further assumed that no special foundation treatment or seepage control is needed at this stage. Foundation treatment and seepage control for the flood walls should be addressed in later design stages after site-specific core boring logs are available. A sheet pile cutoff was not included in this stage of preliminary T wall design for controlling seepage but shall be considered in the final design if deemed necessary."
Recommendation #2: _X_ Adopt __ Not Adopt Explanation: Pending the revision of structural concept design to include foundation support and seepage control, the construction cost estimate for structural plan will be revised accordingly.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **__ Concur _X_ Non-Concur** **Recommendation #2:** The response to this recommendation does not indicate that a section will be included in the Draft IFR/EA that describes the structural measures and the related risks and uncertainties of the project.

Comment #10

The Draft IFR/EA does not include any discussion, design parameters, or assumed section dimensions for the proposed levees or road elevations included in the alternatives.

Basis for Comment

Design parameters regarding the stability and integrity of the levees and road elevations influence the technical basis and costs of the alternatives considered for the selection of TSP. *Appendix C: Cost Engineering and Risk Analysis*, indicates that the length of floodwalls and levees and assumed typical cross section dimensions are provided by the Project civil engineer. *Appendix A: Civil Engineering*, provides the estimated lengths of the floodwalls and road elevations and the estimated cross section dimensions for the floodwalls but does not indicate the estimated cross section dimensions for the road elevations or levees. *Appendix D: Geotechnical Analysis*, does not provide estimated design parameters or a discussion on the design of levees or road elevations. The Draft IFR/EA indicates the locations of levees and road elevations for each alternative but does not provide design parameters, cross-section dimensions, or lengths of these flood protection measures.

Significance: Medium High

This is a technical issue related to the stability and integrity of the levees and road elevations that has a strong probability of influencing the technical basis and costs of the alternatives considered for selection of the TSP and adds to the risk and uncertainty of the evaluation process and the estimated costs and schedule.

Recommendation for Resolution

Recommendation #1: The Draft IFR/EA and Appendices A, C, and D should be revised to include a discussion of the design approach and design parameters that were used to estimate the volumes and costs of the levees and road elevations.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: There are no proposed earthen levees on the project. The alternatives that proposed road elevations were previously screened out and are not currently being evaluated in the study.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: The Cost Appendix will be revised to eliminate all references to levees. No discussion of the dimensions of the road elevations will be included since the currently proposed alternatives do not include them. The Construction cost estimate for the levees and road elevation will be revised pending the revision of concept design for road elevation

parameters. Just FYI, this portion of the project has very low-cost impact because it is only 3% of construction and only exists in Alternative 7 which has highest cost in all alternatives. Construction cost estimate for floodwalls will not be revised due to this comment since it is already based on concept design parameters and assumptions from Civil and Geotech designers.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Condition: Alternative 7 includes a levee and is mentioned in Appendix D and included in Appendix C cost estimates. It doesn't appear to be appropriate to eliminate all references to levees in the Cost Appendix.

Comment #11

The MathCAD spreadsheets for the stability check and strength design of the floodwalls may contain errors or omissions in the calculation of some of the forces and stresses used in the stability analysis.

Basis for Comment

The depth of water used for calculation of the uplift at the heel (upstream edge) of the footing should be to the bottom of the key instead of to the bottom of the footing. The depth for the uplift at the heel of the wall (Uh) does not include the depth of the key. Increasing the uplift depth (Uh) by the depth of the key will increase the uplift force and increase the tension stress at the upstream edge of the heel and compression stress at the downstream edge. In addition, it should be assumed that the contact between the footing and the soil cannot take tension, as shown at the bottom of MathCAD page 6. The stress calculation on MathCAD page 7 indicates the heel is in tension. The maximum compression stress with no tension at the heel is shown on page 6 as -617 lbf/ft, which is the value that should be compared to the allowable bearing stress. This compression stress will increase with the increase in uplift at the bottom of the key. The length of the footing may need to be increased to maintain 75% of the base in compression.

The sliding factor of safety should be calculated for a horizontal failure plane at the bottom of the key and for an inclined failure plane from the bottom of the key sloping up to the bottom of the footing at the toe. The weight of the soil between the bottom of the footing and the failure plane should be included as a vertical downward force. (See example 3 on page N-4 of EM 1110-2-2502.)

The basis for the saturated soil weight of 120 psf and allowable bearing stress of 2000 psf should be provided. Neither of these parameters are provided in the geotechnical appendix. The basis for the allowable factor of safety for sliding of 1.5 for the unusual and extreme loading conditions also should be provided. EM 1110-2-2100 indicates factors of safety for sliding that are different for the different loading conditions and different site information categories.

Wave loading is not included in the stability analysis or reinforced concrete design, but no justification is provided for why the loading is omitted. It appears the USACE New Orleans District Design Guidelines, cited as a reference in *Appendix A*, requires a wave loading for the analyses. Wave heights are mentioned in *Appendix B*, but no values are indicated.

Stresses used for the reinforced concrete design of the footing on page 9 are based on the stresses calculated on page 7, which indicate tension between the concrete and soil at the

upstream heel of the footing. Tension stresses cannot develop between the concrete and soil. The stresses used for the reinforced concrete design of the footing should be revised to eliminate the tension.

Significance: Medium High

Errors in the structural engineering stability analysis and reinforced concrete design could result in a structure that is inadequate to withstand the loadings from coastal storm surge, resulting in possible misleading costs for comparison of alternatives and selection of the TSP and increased risk and uncertainty for the feasibility study.

Recommendation for Resolution

Recommendation #1: Revise calculations for uplift at heel to the bottom of the key, horizontal, and inclined sliding plane, and no tension of the bottom of the heel.

Recommendation #2: Provide basis for sliding factor of safety of 1.5, saturated soil weight of 120 psf, and allowable bearing pressure of 2000 psf.

Recommendation #3: Provide justification for not including wave loading in the stability analysis and structural design.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: Mathcad spreadsheets will be updated as recommended. Should the structural concept design be revised due to this comment, the construction cost estimate will be revised accordingly.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: Mathcad spreadsheets will be updated as recommended.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Sliding factor of safety will be verified and soil properties coordinated with Geotechnical Section.

Recommendation #3: _X_ Adopt __ Not Adopt

Explanation: Wave loading was not included at this 10% design stage for the stability analysis and structural design. These analyses will be updated during PED phase to include wave loading.

Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

Comment #12
The final screened array of five actionable alternatives within the Baltimore CSRM project domain have not been reported with sufficient detail or rigor in the project documentation to assess the sufficiency of design, sustainability, or feasibility of proposed structural and non-structural measures. In particular, nonstructural measures will provide the preponderance of coastal storm risk management in the TSP, yet the specific combinations of non-structural remedial measures and how these are to work together to reduce storm risk within each planning unit are not described in the project documentation.
Basis for Comment
The stated purpose of the Draft IFR/EA is to reduce coastal flood risk to vulnerable populations, properties, infrastructure, and environmental and cultural resources along the banks of the Patapsco River in the vicinity of Baltimore City including flood-prone low-lying areas of the Inner Harbor promenade, Lower Fells Point, Canton, Locust Point, Middle Branch, Port Covington, Riverside, Westport, Fairfield, Curtis Bay and Martin State Airport. However, the TSP (Alternative 5A) only incorporates floodwalls and closure structures at the I-95 and I-895 Tunnels and ventilation buildings while relying on unspecified “nonstructural measures” in the neighborhoods of Canton, Fells Point, Riverside, Locust Point, and isolated portions of the Inner Harbor. Structural and non-structural remedial measures at Middle Branch, Port Covington. Westport, Fairfield, Curtis Bay, Martin State Airport and many other sections along the Inner Harbor promenade and Patapsco River have been judged “infeasible”. The critical metrics determining infeasibility have not been adequately explained but appear to be based primarily on the benefit-cost-ratio (BCR) output from the G2CRM economic model outlined in *Appendix E: Economic Analysis*. The details of how the four Principles and Guidelines (P&G) criteria have been applied to the five actionable alternatives are not adequately detailed, consequently, it is not clear why the TSP is the most viable among those five alternatives or how the TSP conforms to the requirements of USWRC (1983). *Appendix E: Economic Assessment* defers critical details about the initialization of the driving forces and protective system elements of the G2CRM model to *Appendix A: Civil Engineering* and *Appendix B: Hydrology and Hydraulics Analysis*. However, there are no explicit statements in either Appendix A or B that explain how the content of these appendices was formatted and used as inputs to the G2CRM economic model. Furthermore, there are significant inconsistencies between Appendix E and engineering and hydrologic/hydraulic details presented in Appendices A & B regarding inputs to the G2CRM economic model. Descriptions of the driving forces for the G2CRM model in Appendix E only included surge and wave height data, omitting any considerations of fluvial flooding in the lower reaches of the Gunpowder-Patapsco watershed, in spite of the fact that Appendix B evaluated climate change effects in this watershed using the Climate Hydrology Assessment Tool (CHAT) to project future flood impacts on proposed floodwalls, closure structures pump stations and gravity inlet drainage systems. How these types of fluvial flood impacts were incorporated into the *protective system elements inputs* of the G2CRM model is not explained. *Appendix E: Economic Analysis* states that inputs for *protective system elements* in the G2CRM model were based on *Appendix A: Civil Engineering*, which contains no details regarding the *nonstructural measures* that comprise the predominant CSRM remedial measure in the TSP for the Inner

Harbor, Canton, Fells Point, Riverside, and Locust Point. Furthermore, *Appendix A* states that the floodwalls have 3 ft. of freeboard, with a floodwall crest elevation of 12.2 ft. NAVD to prevent flooding at the 95% confidence limit for 2080 sea levels during the 100-year storm. However, Tables 2a, 2b, 2c and 4 in *Appendix B: Hydrology and Hydraulics Analysis* indicate the water surface elevation (WSEL) at the 95% confidence limit during the 100-year storm at 2080 sea levels leaves significantly less than 3 ft. of freeboard to prevent overtopping of the floodwalls by storm surge and waves propagating up the north arm of the Chesapeake Bay from the open ocean.

The WSEL solutions from the ADCIRC modeling in the North Atlantic Coast Comprehensive Study (USACE, 2015, 2015a) do not account for dynamic water levels due to water motion at the vertical faces of the proposed floodwalls. The design calculations in Appendices D and E for forces and tipping moments acting on the floodwalls in the TSP are static solutions based on the assumption that the WSEL's represent still water elevations in the presence of perfectly motionless water, as on the face of a dam in a quiescent lake. Because dynamic water levels and pressures at future sea levels from the motion of combined storm surge and surface gravity waves incident on the face of the flood walls is not accounted for, there is considerable uncertainty about the adequacy of the design wall height and freeboard, the efficacy of the force and monument calculations, and the ultimate stability the flood walls during extreme event storms at 2080 sea levels.

Significance: Medium High

Failure to provide adequate detail addressing the design and layout of the various structural and non-structural components of the TSP propagates into the risk and cost/benefit analyses, resulting in uncertainty about the performance, feasibility, and efficacy of the TSP. The absence of any detail on the specific combinations of non-structural remedial measures and how these are to work together to reduce storm risk within each planning unit is a severe omission that amplifies the uncertainty in the TSP conceptual design. The TSP appears to be the most minimal of solutions among the five actionable alternatives considered and is predominantly reliant on unspecified "nonstructural measures*"*. Vagueness in the discussions about the initialization of the *driving forces* and *protective* system elements input to the G2CRM model brings into question how determinations of infeasibility were made and whether the four P & G criteria (completeness, effectiveness, efficiency, and acceptability) were applied in a balanced manner during the screening process. This raises the decisive question: how can a minimal TSP be judged as most feasible when its predominant remedial components (non-structural measures) are unspecified? More detail is required in the main CSRM report and in Appendices A, B, and E to mitigate this uncertainty about the performance, feasibility, and efficacy of the TSP.

Recommendation for Resolution

Recommendation #1: Explain which combinations among the various non-structural remedial measures listed in Section 3.4.2 will be implemented in the TSP and how these combinations are to work together to reduce storm risk within each planning unit. Provide more detail in the Final IFR/EA regarding how the four P & G criteria (completeness, effectiveness, efficiency, and acceptability) were applied in the screening process to the five actionable alternatives.

Recommendation #2: Revise the calculation sheets of forces and moments to incorporate dynamic water levels and pressure forces due to wave and surge motion at 2080 sea levels and increase the floodwall freeboard as required by the revised calculations. Incorporate calculation sheets for each floodwall and enclosure structure in *Appendix A: Civil Engineering*.

Recommendation #3: Provide an explanation of how the engineering design of floodwalls and enclosure structures was parameterized for protective system elements of the G2CRM economic model and how driving forces were parameterized for input to the G2CRM economic model. Include flood hydrographs for the Gunpowder-Patapsco watershed.

Recommendation #4: Provide conceptual designs for the non-structural measures for each planning unit and include maintenance plans. This could be accomplished by preparing a new appendix for this purpose.

Recommendation #5: Revise the G2CRM modeling to include complete initialization of the driving forces and accurate parametrization of the effectiveness of the protective system elements (including non-structural measures) in order to reassess the P&G evaluation of the array of CSRM alternatives.

References:

USACE, 2015, *North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk, Main Report*, U. S. Army Corps of Engineers, January 2015, 140 pp

USACE, 2015a, *North Atlantic Coast Comprehensive Study: D-8 State of Maryland*, U. S. Army Corps of Engineers, January 2015, 148 pp

USWRC, 1983, *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* U. S. Water Resources Council, March 1983, 147 pp.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: Section 2 of H&H appendix discusses the newly developed Generation 2 Coastal Risk Model (G2CRM) inputs. G2CRM is being used to assess the economic performance of alternative protective measures. G2CRM requires as input a description of the environmental forcing in terms of expected storm surge hydrographs and associated wave information. The data applied for the Baltimore study were obtained from the North Atlantic Coast Comprehensive Study (NACCS). NACCS produced storm tracks that cover the probability space of potential storms. These tracks allow for selection of relevant storms for study sites. The study applied any storm with a track within a 200 km radius circle of the project site. This resulted in the selection of 291 tropical storms and 100 extra-tropical storms for the project. The storm recurrence rates developed within the NACCS dataset give the relative probability listed in the storms excel file used as input for G2CRM. These rates are used to randomly select the occurrence of a given storm. A rate of 0.015 storms per month was applied from June to November for the Tropical season and 0.1689 storms per month was applied for the extratropical season. A poisson distribution is applied using these rates to populate the storm events in each life cycle. The datum conversions for the tide and surge

were calculated based on NOAA tide gauge 8574680 and applied within the metadata files to transform water levels to the NAVD88 datum used for the asset inventory.

Structural measures proposed for the TSP only protects I-95 and I-895 tunnels, ventilation facility and visitor center. These project elements are not even close to the riverine flooding sources. Therefore, fluvial flood has no impact on any TSP structural alternatives. FEMA's 100-year riverine model & mapping is still valid for both structural and non-structural project elements. No new HEC-RAS modeling is necessary.

Water Surface Elevation used is not only from ADCIRC model but also from STAVE. NACCS study is very comprehensive and not just looking at still water elevation. This study also utilized total WSEL based on still water elevation, wave, tides and Sea Level Rise through Year 2080.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: More detail will be provided in the final IFR/EA regarding how the four P & G criteria (completeness, effectiveness, efficiency, and acceptability) were applied in the screening process to the five actionable alternatives.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Wave forces were not accounted for in the global stability analysis of the floodwalls. Because of the 10% design level of this study report, revised computation for the stability analysis may not be necessary at this study phase. Revise calculation sheets for each floodwall and enclosure structure will be updated during PED phase for *Appendix A: Civil Engineering*

Recommendation #3: _X_ Adopt __ Not Adopt

Explanation: The G2CRM is a desktop computer model that implements an object-oriented probabilistic life cycle analysis (PLCA) model using event-driven Monte Carlo simulation (MCS). This allows for incorporation of time-dependent and stochastic event-dependent behaviors such as sea level change, tide, and structure raising and removal. The model is based upon driving forces (storms) that affect a coastal region (study area).

The coastal hazard system (CHS) is a repository of synthetic and historic storms, storm tracks, and associated storm probabilities that have been developed by the USACE Coastal Hydraulics Laboratory. It is a source of hydraulic & hydrologic data, H5 in HDF5 format, used to run simulations in G2CRM.

In contrary to other USACE economic models that use static WSELs, G2CRM uses H5 file, which is based on hydrodynamic theory. H5 file contains data that predicts current storm water levels and over time storm water levels on a detailed finite element mesh representation of a coastal region.

GIS can be used to create locational and attribute information on the Modeled Areas and Protective System Elements, in shapefile format. Because all structural and non-structural elements are within coastal flood hazard zones, there is no need to include flood hydrographs for the Gunpowder-Patapsco watershed for the G2CRM model.

Recommendation #4: _X_ Adopt __ Not Adopt

Explanation: Many non-structural measures including building elevation, acquisition, relocation, as well as nature-based features were evaluated during the initial array of alternatives. In the final array (Alternative 5A), these listed measures have been screened out. NNBF do not provide any coastal storm benefits. Table 3-1 shows the management measures screened and Table 3-3 presents measures at the initial array of alternatives.

Recommendation #5: _X_ Adopt __ Not Adopt

Explanation: Discussion of the methodology of G2CRM, including model inputs, model parameters, initial model state, and protective system elements will be revised in the next report iteration. Discussion will be included in the economics appendix.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #13

Potential scour and erosion of the soils around the footings of proposed floodwalls have not been analyzed. This results in significant uncertainty regarding the sufficiency of the TSP conceptual design, its sustainability, maintenance costs, and consequently the accuracy of the BCR assessments by the G2CRM model.

Basis for Comment

Scour around the footings of proposed floodwalls has not been analyzed but could affect design stability considerations, construction, and maintenance costs of the floodwalls. The potential for flanking erosion and other sediment transport processes at work on the non-hardened surfaces near the floodwalls and elsewhere in the planning units designated for non-structural measures have not been analyzed when developing remediation measures for flood impacts during extreme event storms at future sea levels.

In the past, the USACE has built hard structures (e.g., piers, bulkheads, and groins) along the banks of the Patapsco River in the Inner Harbor promenade. All too often, these hard structures produce an unanticipated erosional/depositional response that results in unexpected long-term dredging and other maintenance costs. Although the floodwalls of the TSP are being proposed in predominantly industrialized areas away from the shoreline with hardened surfaces, extreme event storms like Hurricane Hazel (1954) and Hurricane Isabel (2003) will inundate these areas with swift storm surge flows as deep as 6 to 8 ft. above future sea levels. Hurricane generated swell and wind waves propagating up the north arm of the Chesapeake Bay from the open ocean will shoal across these flooded areas atop the storm surge. Any non-hardened surface in the vicinity of the floodwalls or elsewhere in planning units designated for yet unspecified combinations of non-structural measures will be severely scoured by the combined hurricane wave/storm surge-induced flows, likely undercutting adjacent hardened surfaces. Unless the footings of the floodwalls are protected by anti-scour blankets that tie into adjacent hardened surfaces, the footings of the floodwalls could be undercut and the stability of the floodwalls compromised. The same concern applies to flood shields, flood gates, and other types of enclosure structures being considered for planning units designated in the TSP for non-structural measures that allow floodwaters to flow around critical infrastructure and buildings. Anti-scour blankets are design features of the floodwalls and dry floodproofing enclosures that have not been contemplated in the TSP documentation, and the associated costs of such

features could be substantial depending upon how much of the area around the floodwalls and dry floodproofing must be hardened to tie into surrounding hardened surfaces. This oversight will in turn impact the BCR assessment of the TSP and possibly alter the TSP selection relative to the four other actionable CSRM alternatives discussed in Section 3.7 of the Draft IFR/EA. Therefore, potential scour and erosion of the non-hardened surfaces near the floodwalls and elsewhere in the planning units designated for non-structural measures must be known with some certainty to determine the design and operational requirements of these structural and non-structural measures. That certainty is not provided by the ADCIRC modeling done in USACE, 2015a.

Significance: Medium High

Resolution of this issue will improve the overall understanding of extreme event flood impacts at future sea levels on non-hardened surfaces throughout the project domain of the TSP. Such an assessment will reduce uncertainty regarding stability and maintenance requirements of the TSP floodwalls and dry floodproofing enclosures proposed for planning units designated for non-structural measures, as well as identify potentially problematic changes to existing grade post-extreme event that could threaten stability of existing hardened surfaces as a consequence of scour undercutting. Resolving these uncertainties is critical to the cost justification of the project. Resolution may also result in maintenance cost increases to the project.

Recommendation for Resolution

Recommendation #1: Determine the effects of scour and erosion around the floodwalls and other structures in the TSP. A way to accomplish this would be the following. Construct a GIS map with layers for hardened and non-hardened surfaces within the Baltimore CSRM project domain. Perform AdH modeling of the surge velocity field utilizing the GIS map developed under Recommendation 1 to specify boundary conditions and storm surge data for Hurricane Isabel superimposed on 2080 sea levels to provide hydraulic forcing. Overlay the AdH velocity field on the non-hardened areas of the GIS map and compare to the Hjulstrom curve to determine in which non-hardened areas the surge velocity exceeds the threshold scour speed.

Recommendation #2: Quantify the scour-depths of non-hardened surfaces around the proposed floodwalls and other dry floodproofing enclosures proposed for planning units designated for non-structural measures. Amend the floodwall and dry floodproofing enclosure designs as needed to mitigate problematic scour. Reassess BCRs and the TSP selection process with revised G2CRM results based on additional costs for anti-scour blankets and maintenance. Scour depths can be quantified by utilizing models such as the Vortex Lattice scour/burial model (Jenkins, et al, 2007) or a comparable model.

References:

Jenkins, S. A., Inman, D.L., Michael D. Richardson, M.D., Thomas F. Wever, T.F. and J. Wasyl, 2007, *Scour and burial mechanics of objects in the nearshore*, *IEEE Jour.Oc.Eng*, vol.32, no. 1, pp 78-90.

USACE, 2015a, *North Atlantic Coast Comprehensive Study: D-8 State of Maryland*, U. S. Army Corps of Engineers, January 2015, 148 pp

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided

if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: No, scour or erosion analysis at the toe of the floodwall was not computed. The floodwall near these tunnels are highly urbanized and already paved with concrete. No significant erosion is expected. However, we can revisit the erosion issue during the design phase as appropriate.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: Because TSP floodwalls are near these tunnels are highly urbanized and already paved with concrete, not much erosion is expected. Therefore, any erosion analysis is not necessary at this 10% design stage, and it can be deferred until the PED phase.
Recommendation #2: _X_ Adopt __ Not Adopt Explanation: As indicated for the recommendation #1 explanation, no erosion analysis is necessary at this 10% design stage, so it will be deferred till the PED Phase. No revision is required to the TSP BCR computations for the erosion hazards.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

2.3 Significance: Medium

Comment #14
The Draft IFR/EA analysis of visual impacts/aesthetics does not provide the reader with an objective view of the viewshed with and without the project from any local residences or other vantage points from which the flood walls will be visible.
Basis for Comment
Ascertaining the extent of potential impacts is critical to objective analysis of project impacts before a finding of no significant impact can be concluded. The public should be afforded the opportunity to "see for themselves" what the extent of visual impacts would be.
Significance: Medium High
Conclusions of the Draft IFR/EA could be changed if significant adverse impacts are identified on the basis of public comment.
Recommendation for Resolution
Recommendation #1: In Section 2.4.17, include some visual representation from existing vantage points showing the viewshed as it now exists in areas where project elements are proposed. Photographs from the vantage points is one way that this could be accomplished

Recommendation #2: Include a visual representation of what the proposed flood walls would look like (to scale) from the same vantage points so the public has an objective view of how things would change if the TSP were implemented. This could be included in Section 4.2.16.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: The PDT concurs with the comment and will include visual representation from existing vantage points that shows the viewshed as it now exists.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: The PDT will adopt recommendation #1 and will include a include visual representation from existing vantage points that shows the viewshed as it now exists. Photographs of potential project areas (Ft. McHenry Tunnel/Harbor Tunnel bore entrances, Fells Point area, harbor promenade) will be added to the final report in Section 2.4.17.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: A visual representation of the areas outlined in recommendation 1, with the proposed protective elements in place, will be added to section 4.2.16. The proposed structure heights will be included with the representation.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #15

The Draft IFR/EA document does not indicate clearly under existing and future without project (FWOP) conditions the extent to which flooding currently affects disadvantaged communities/residents in the area.

Basis for Comment

Often the Environmental Justice (EJ) section of an EA will focus on whether the proposed project construction would impact disadvantaged communities. While the EA addresses this issue, the EJ section does not address the extent to which these residents are impacted by flooding and whether those residents would receive increased benefits in the form of flood protection from the TSP. For the purposes of analysis, Census Block groups were identified within one mile of each study area, based on USEPA guidance. However, the actual extent of

existing flooding may extend further than one mile in some cases. This is not known or identified in the Draft IFR/EA.

Significance: Medium

This issue has the potential of affecting the conclusions of the EA with respect to EJ issues. Analysis and presentation of the effects of the TSP relative to current and FWOP conditions may reveal greater project benefits to EJ communities than is currently presented.

Recommendation for Resolution

Recommendation #1: Clarify the extent to which existing disadvantaged residents in the study are affected in both the present and the future by major flood events (e.g., 100-year storm events or greater).

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: After coordination with EPA, a 1-mile buffer was determined to be appropriate for the study area. The maps included in the report depict EJ communities within this buffer that is centered on proposed alternatives. This has allowed for impact assessment. However, these maps do not include all the EJ areas within the total study area. Therefore, these maps and FWOP analysis will be modified to include FWOP conditions in the entire study area.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: Maps and FWOP analysis will be modified to include a 1-mile study buffer for the entire study area, and an overlay with projected flooding will be included.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #16

The Draft IFR/EA document does not indicate existing and future without project (FWOP) conditions regarding hazardous waste spills, orphan tanks, and other environmental impacts that have occurred within the study after major storm events (e.g., hurricane), nor how the TSP might reduce these impacts.

Basis for Comment
EPA-managed environmental responses after several major hurricane events (Katrina, Gustav, Irene, Sandy) with storm surge and flooding resulted in mobilization of chemical and petroleum tanks, uncontrolled release of household hazardous wastes, ruptured above-ground pipelines, and other forms of environmental damage. If the TSP protects communities from flooding, then this potential project benefit should be described in the Final IFR/EA.
Significance: Medium
The conclusions of the study might be modified to indicate higher benefits should this be accounted for in the Draft IFR/EA.
Recommendation for Resolution
Recommendation #1: Include a discussion in the Final IFR/EA of 1) past storm events and an accounting of wastes retrieved by EPA, spills, tanks, or similar impacts from these storm event flooding, and 2) net benefits if any of preventing these events by controlling flooding.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: During initial analysis, the PDT investigated reporting mechanisms for hazardous spills resulting from catastrophic events and storms. Only 15 states participate in this reporting mechanism, none of them being within the DMV area. However, the PDT will investigate this topic further and incorporate its findings in the Final IFR/EA.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: The PDT will investigate this topic further and incorporate its findings in the Final IFR/EA.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

Comment #17
There is considerable uncertainty regarding the analysis of environmental impacts which makes the findings of 'no significant impact' questionable unless the analysis is accompanied by substantial qualification.

Basis for Comment
The Draft IFR/EA, p. 12 indicates that the Future Without Project (FWOP) and Future with Project (FWP) conditions were assessed over the proposed project life from the years 2031 through 2080 based on a project design that has been interpreted by USACE Baltimore District as 10%. The results of the analyses were that there would be no significant impacts. However, there is significant uncertainty associated with a 10% design since the final project footprint is unknown and there are many project details yet to be worked out. Therefore, it is questionable how much value the environmental analysis is at this point.
Significance: Medium
Obviously, as more information is collected there is more of a possibility that impacts will be identified that could modify the benefit/cost ratio of the project or result in issues that would prohibit or limit construction.
Recommendation for Resolution
Recommendation #1: Add qualifying language throughout each section of the environmental impacts analysis to indicate the level of uncertainty regarding the analysis results at this point, perhaps referring to it as a screening analysis at this point in time.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: The PDT will add language throughout the report to confirm the level of analysis is still in its preliminary stages of feasibility.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: The PDT will add language throughout the report to confirm the level of analysis is still in its preliminary stages of feasibility.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

Comment #18
The Draft IFR/EA text does not identify whether controlling storm surge will do anything to improve water quality.

Basis for Comment
Water quality is addressed in Section 2.3 where it is noted that “Water draining from the Chesapeake Bay watershed has a significant impact on water quality in the Chesapeake Bay. Within the study area, the urban nature of the Patapsco River watershed has detrimental impacts on the water quality of the Patapsco River and its tributaries, due to urban runoff and contaminants from industrial pollution.” The EA is silent on whether proposed coastal storm control measures would do anything to improve water quality or if fluvial flooding issues would be addressed to improve water quality.
Significance: Medium
The water quality issue is not likely to be significant enough to result in changes to alternative selection or significance of impacts, but it could be an additional project benefit that is presently not quantified.
Recommendation for Resolution
Recommendation #1: Add text indicating whether any water quality improvement is anticipated with the TSP.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT ‘concurs’ or ‘non-concurs’ with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a “concur,” unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: Implementation of the floodwalls around the tunnels would inhibit potential floodwaters from reaching impervious surfaces that could possess various amounts of pollutants from motor vehicles; thus, reducing the likelihood of contaminated floodwaters reaching the Harbor or Patapsco River from these specific areas.
2. For each recommendation, please indicate whether the PDT will ‘adopt’ or ‘not adopt’ the recommendation and provide an explanation. If ‘adopt’, please provide information on how this recommendation will be adopted. If ‘not adopt’, please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: The PDT will add text indicating whether any water quality improvement is anticipated with the TSP.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

Comment #19

The estimated costs as shown in the MCACES Second Generation (MII) cost are too high for the preconstruction, engineering, and design (PED) effort to support the TSP.

Basis for Comment

The current MII cost estimate included with the Draft IFR/EA includes about 46% of the construction cost for PED activity costs associated with structural measures for the TSP components (*Appendix C: Cost Engineering and Risk Analysis*, Summary of the Scope of Work). This percentage is much greater than standard values used by private industry. For the private sector, this percentage would typically be in the range of 5 to 15%. Other USACE districts in the USA use values ranging from 5 to 20% of the construction cost for PED activities. For non-structural measures PED, USACE proposes to use a value of 15.3% of construction for PED activities. This cost seems much more reasonable. In addition, the mean and standard deviation and the form of probability distribution (used for the risk-based cost estimate) are the controlling factors of a Monte Carlo analysis. Thus, the reviewers need to know these to assess the validity of the results. The Panel assumes that a normal distribution was assumed for all cost estimating parameters although various options might be applicable including both a triangular and beta-pert distribution.

Significance: Medium

Resolution of this issue will improve the overall understanding of the analysis recommendation and justification of the project. Resolution of the issue has the potential of reducing the overall project cost.

Recommendation for Resolution

Recommendation #1: Revise the proposed PED costs in *Appendix C* to reflect more realistic industry norms. If the costs are not revised, provide a detailed explanation of how the USACE calculated the costs and a justification for using these high values.

Recommendation #2: Revise the IFR/EA cost tables and associated cost-sharing calculations accordingly.

Recommendation # 3: Include in the Final IFR/EA a description of how the mean and standard deviation were calculated for the Monte Carlo simulations used in the risk-based cost estimate.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: To clarify, the PED cost in Total Project Cost Summary (TPCS) does not include 46% of construction cost. It is 27.8 percent costs are based on Corps-wide typical percentages of various collective spending on procedures and submissions within the PED phase. It is above private industry norms. Individual accounts and percentages are provided in the table below:

	% of Construct	Districts % Vary	30/31 Accounts		
Program Management:	2.5%	2.50%	30.0	27.8%	Sum per % of 30 Account
			30.0		
Planning & Environmental Compliance:	1.0%	2.00%	30.0		
Engineering & Design:	15.0%	15.50%	30.0		
Reviews, ATRs, IEPRs, VE:	1.0%	1.25%	30.0		
Life Cycle Updates (cost, schedule, risks):	1.0%	1.30%	30.0		
Contracting & Reprographics:	1.0%	0.75%	30.0		
Engineering During Construction:	3.0%	3.00%	30.0		
Planning During Construction	2.0%	0.50%	30.0		
Adaptive Mgmt & Monitoring:	1.0%	1.00%	30.0		
Project Operations	1.0%	0.00%	31.0		
Supervision & Assurance:	10.0%	7.50%	31.0	10.0%	Sum per % of 31 Account
Project Operation:	2.0%	0.00%	30.0		
Program Management:	2.5%	2.50%	31.0		

The PDT will continue to evaluate the costs and percentages applied to the different elements of PED.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: The team will consider revising PED costs. In particular, if elements of the recommended plan change, PED costs may be adjusted to reflect different effort levels. However, in the absence of recommendations from the project team, typical percentages would continue to be used.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Cost tables and cost-sharing calculations will be updated as appropriate and as costs are updated during subsequent planning iterations during the study process.

Recommendation #3: _X_ Adopt __ Not Adopt

Explanation: A description of how the mean and standard deviation were calculated for the Monte Carlo simulations used in the risk-based cost estimate will be included in the Final IFR/EA.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #20

The Draft IFR/EA does not discuss the potential for using ground improvement methods to improve the foundation conditions for flood walls near the I-95 and I-895 tunnel entrances/exits based upon the presence of fill materials revealed at these TSP locations.

Basis for Comment

The Figure 4 "Type Log" presented in *Appendix D: Geotechnical Analysis*, clearly depict the presence of extensive fill deposits in the subsurface. These materials in their natural state may

make the selection of shallow foundation types for flood walls infeasible thus pointing to deep foundation options (e.g., pile foundations or drilled shafts) as the only viable foundation support alternative. Ground improvement options such as pre-loading, compaction grouting, and soil densification could permit the use of shallow foundations at a lower total cost than other comparable deep foundation alternatives that are discussed in the Risk Register as a potential cost risk.

Significance: Medium

This is a fundamental technical issue related to the overall foundation conditions and stability.

Recommendation for Resolution

Recommendation #1: The document should be modified to include a discussion of the application and feasibility of various ground improvement alternatives for the benefit of the TSP. *Appendix D: Geotechnical Analysis*, is an appropriate place to do that.

Recommendation #2: Revise the Draft IFR/EA to include a summary discussion of the application and feasibility of various ground improvement alternatives for the benefit of the TSP.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: Additional discussion on the potential for using ground improvement methods for the construction of the floodwalls around the I-95 andI-895 tunnels will be added to the final IFR/EA.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: Additional discussion added in 6.1 of Appendix D

"Further data collection and analyses will be necessary during the Planning, Engineering, and Design (PED) phase of this study. At this 10% design, the assumed preliminary geotechnical profile appears suitable to provide shallow foundation support for the floodwalls. However, the additional site-specific geotechnical investigation in the vicinity of the Interstate I-95 and I-895 tunnel entrances may encounter deep, soft uncontrolled fill thus pointing to deep foundation options (e.g., pile foundations or drilled shafts) as the only viable foundation support alternative. If undesirable foundation conditions were encountered, there are some ground improvement options such as undercut and replacement, pre-loading, compaction grouting, and soil densification could permit the use of shallow foundations at a lower total cost than other comparable deep foundation alternatives. These ground improvement options shall be evaluated before making the final foundation recommendation and design."

Costs will be updated pending the ground improvement analysis.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Text added

"At this 10% design, it is assumed that the geotechnical condition is suitable for shallow foundation support of flood walls. If undesirable foundation conditions were encountered, there are some ground improvement options such as undercut and replacement, pre-loading, compaction grouting, and soil densification could permit the use of shallow foundations at a lower total cost than other comparable deep foundation alternatives. These ground improvement options shall be evaluated before making the final foundation recommendation and design"

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #21

Freeboard allowances are included for flood walls in the civil engineering design and cost estimate, which is counter to USACE's current policy.

Basis for Comment

Appendix A: Civil Engineering and *Appendix C – Cost Engineering and Risk Analysis* include a three-feet allowance for freeboard for flood walls and levees. USACE technical guidance and policy are explicitly moving away from including freeboard in any designs for flood protection. Rather, a risk-based performance level is preferred that directly incorporates uncertainties in design water elevations (ER 1105-2-101, *Risk Assessment for Flood Risk Management,* for some discussion regarding levees and EC 1110-2-6066, *Design of I-Walls*, Section 2-13 (b), for some discussion regarding levees and floodwalls). The approach described in the document appears to be inconsistent with current USACE guidance, resulting in a more conservative project conceptual design.

Significance: Medium

Resolution of this issue will improve the overall understanding of the analysis recommendation and justification of the project by improving the cost estimate to reflect actual conditions.

Recommendation for Resolution

Recommendation #1: Revise the conceptual engineering design for levees and flood walls to exclude the inclusion of freeboard.

Recommendation #2: Revise the project costs accordingly to account for the modified top elevations for floodwalls and levees for the TSP.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and

Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: _X_ Concur __ Non-Concur

Explanation: The original design included freeboard. However, any reference to freeboard was removed when it was determined not acceptable under current policy. References to freeboard were changed in the main report and other appendices and a risk-based approach was used. However, references to freeboard remained accidentally in the Appendix A, will be removed.

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: The design height will not change. The freeboard comments were residual comments for a stage of the study prior to the latest H&H analysis. The references to freeboard will be replaced with the new H&H design determination, which was a risk-based approached. The current design height is 1% AEP flood to the approximate 95% confidence level plus the medium sea level rise for the year 2080. Appendix A will be updated accordingly.

Recommendation #2: __ Adopt _X_ Not Adopt

Explanation: As outlined in Recommendation # 1, no revision to the wall height is necessary. Therefore, cost modification is not applicable.

Panel BackCheck Response

Based on the evaluator response above, the panel provides the following response:

_X_ Concur __ Non-Concur

Comment #22

The basis for the geotechnical design parameters presented in the Draft IFR/EA is not clear.

Basis for Comment

In general, the geotechnical work presented in *Appendix D: Geotechnical Analysis*, is based upon existing information only. Table 1 provides a summary of soil parameters used for design. The range of the values appears reasonable but no summary discussion of the basis for each parameter assignment is provided thus making it difficult to make a reasonable evaluation. The Panel presumes that friction angles, cohesion values, and lateral earth pressure coefficients presented were derived from SPT blow count correlations, however, this is not presented or discussed in the appendix.

Significance: Medium

Resolution of this issue will improve the overall understanding of the recommendation and justification of the project. Resolution may also result in cost changes to the project.

Recommendation for Resolution
Recommendation #1: Provide a more thorough discussion of the basis for all the geotechnical parameters presented in Table 1. It would be helpful to include examples of the correlations used and discuss how each parameter was derived. **Recommendation #2:** Revise the Draft IFR/EA to present the justification for the assumptions used for the soil design values presented in *Appendix D*.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: The basis for the geotechnical design parameters will be clarified in the Final IFP/EA.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: Statement added under Table 1: "The estimated design values: Bulk Density Effective strength parameters in Figure 4 and Table 1 are based on the values from Seagirt Terminal, Berth IV- Geotechnical report by D. W. Kozera, Inc. They developed these soil parameters for Sheet pile Cut-off wall based on the soil borings performed and the soil laboratory tests (soil classification tests, two CU triaxial tests, & two unconfined compression tests) and the available empirical relations of soil parameters to the SPT values. It should no noted that the generalized subsurface profile and these design values are only rough estimate for this feasibility study and a very rough design for cost purpose and not for detail and final flood walls design. Further data collection and analyses will be necessary during the Planning, Engineering, and Design (PED) phase of this study. Allowable bearing pressure was not provided and will be provided at later stages of design after site-specific core boring logs are available."
Recommendation #2: _X_ Adopt __ Not Adopt Explanation: Clarification added such as "At this stage of feasibility study measures (10% design), no site-specific geotechnical investigation and testing program were conducted. The geotechnical analysis appendix only provides a conceptual geology setting assumption and a generalized subsurface profile for feasibility consideration and was not intended for detail design purpose. A conceptual local geology setting was assumed to be consists of recent geologic deposits of alluvial soils overlain by artificial fill soils, and dredge fill material which is generally true for the areas around the harbor. It's assumed the geotechnical condition at the tunnel entrance to be similar to those encountered for construction of Seagirt Terminal. The geotechnical design parameters in Appendix D were only for feasibility consideration and

were not intended for detail design purpose. Further data collection and analyses will be necessary during the Planning, Engineering, and Design (PED) phase of this study."
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

Comment #23
A risk and uncertainty analysis report and risk register are not included in the documentation.
Basis for Comment
One of the Panel's Charge Questions was to evaluate the adequacy of the Integrated Risk and Uncertainty Analysis. Risk and uncertainty are discussed briefly in Section 6.6 of the Draft IFR/EA report. Environmental and nonstructural plan risks are discussed. No discussion of risk and uncertainty is provided for the structural plans or the schedule. The Draft IFR/EA report indicates that a Cost and Schedule Risk Analysis was performed for the pre-TSP milestone completed on March 14, 2022, but this risk analysis report is not included in *Appendix C*. A copy of that Cost and Schedule Risk Analysis Report is not included in *Appendix C*. A cost and schedule risk analysis has been performed for other CSRM feasibility studies to identify the cost and schedule risks and recommended contingencies, and the report has been included in the appendix of the Draft IFR/EA report.
Significance: Medium
The panel was unable to evaluate the adequacy of the integrated Risk and Uncertainty because the Risk Analysis Report was not included in *Appendix C: Cost Engineering and Risk Analysis* for the Draft IFR/EA. Including the Risk Analysis Report would improve the quality of the panel review and allow for evaluation according to the charge question.
Recommendation for Resolution
Recommendation #1: Include a copy and discussion of the integrated risk analysis and risk register in *Appendix C*. **Recommendation #2:** Revise Section 6.6 of the Draft IFR/EA feasibility report to include discussions of the risks and uncertainties for the structural plans and the schedule. **Recommendation #3:** Include the Cost & Schedule Risk Analysis Report in *Appendix C*.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur

Explanation: The Cost Appendix has been updated to include the revised CSRA and risk register.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: The risk register and integrated risk analysis have been included in the updated version of Appendix C. A discussion of the risks and uncertainties that were considered has also been included.
Recommendation #2: _X_ Adopt __ Not Adopt Explanation: A discussion on the risks and uncertainties will be added to Section 6.6 of the Final IFR/EA.
Recommendation #3: _X_ Adopt __ Not Adopt Explanation: The CSRA will be incorporated into Appendix C with the Final IFR/EA.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **__ Concur _X_ Non-Concur** **Recommendation #1:** The risk register is not included in the updated Appendix C. **Recommendation #3**: The CSRA has been included in Appendix C, but the risk register is not included in the CSRA as indicated in the first paragraph in Section 6.1. There is a table on pdf page 26 of Appendix C that may be the risk register, but it does not include a title for the table to indicate what it represents.

2.4 Significance: Medium Low

Comment #24
Subsidence is not considered in calculating future without- and with- project damages.
Basis for Comment
In *Appendix E: Economics*, Section 5.1 Background, p. 32, subsidence is acknowledged to increase over time. However, no information on historical subsidence or estimates of expected future subsidence is presented or included in the analysis of future without or future with project damages.
Significance: Medium Low
This missing information affects the completeness of study documents and results in uncertainty about whether the missing information will affect the justification of the recommended plan.

Recommendation for Resolution
Recommendation #1: Include information on historical subsidence and estimates of expected future subsidence in the study documents. **Recommendation #2:** Include an evaluation of the impacts of expected future subsidence in the analysis of future without or future with project damages and the costs of the TSP.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: A desktop analysis concluded that subsidence was not an issue in the study area. A summary of this analysis and the conclusions reached will be included in the Final IFP/EA.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: __ Adopt _X_ Not Adopt Explanation: Initially the PDT conducted desk top analysis on subsidence in Baltimore. After receiving IEPR comments, further research shows land subsidence might be found in Baltimore, but it is not found within the Baltimore Metropolitan study area. Hence, the following sentence "Subsidence will increase as soil deposited naturally, or by humans, compacts over time" will be removed from the document. Instead, the Final IFR/EA will include a discussion of the subsidence desktop analysis.
Recommendation #2: _X_ Adopt _ _ Not Adopt Explanation: Since land subsidence is not a concern in the Baltimore Metropolitan study area the following sentence "Subsidence will increase as soil deposited naturally, or by humans, compacts over time" will be removed from the document. Text will be added to the Final IFR/EA explaining that subsidence is not a concern within the study area.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

Comment #25
The report provides no justification for the assumption that the soil conditions at the I-95 and I-895 tunnel entrances are the same as the conditions at the Seagirt Terminal.

Basis for Comment

The subsurface conditions at tunnel entrances were assumed to be the same as at Seagirt Terminal, which is quite far away from the tunnel entrances. Subsurface conditions can vary over short distances, and such an assumption made in the report is not justifiable without data to support the assumption.

Significance: Medium Low

There is missing, incomplete, or inconsistent technical data that may affect clarity, understanding, and completeness of study documents.

Recommendation for Resolution

Recommendation #1: Determine if more appropriate boring data are available and use these data to revise the analysis. For example, there may be boring data available at the tunnel locations that were obtained during tunnel construction.

Recommendation #2: If better data are not available, provide in the report a justification for assuming that the soil conditions at the tunnel entrances are the same as at the Seagirt Terminal. The discussion should include the project risk associated with the uncertainty associated with the assumption.

USACE Evaluator Response

1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.

Comment: Concur _X_ Non-Concur

Explanation: At this feasibility stage (10%), the generalized subsurface profile is not intended for final design purpose. It is not assumed the subsurface conditions at tunnel entrances the same in Seagirt Terminal. Clarification will be added "Site-specific geotechnical investigation and testing program shall be conducted during the Planning, Engineering, and Design (PED) phase of this study for detail design purpose."

2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.

Recommendation #1: _X_ Adopt __ Not Adopt

Explanation: During the PED phase of this study, USACE will continue looking for boring data available at the tunnel locations and conduct borings for the wall construction.

Recommendation #2: _X_ Adopt __ Not Adopt

Explanation: Clarification added "A conceptual local geology setting was assumed to be consists of recent geologic deposits of alluvial soils overlain by artificial fill soils, and dredge fill material which is generally true for the areas around the harbor. It's assumed the geotechnical condition at the tunnel entrance to be similar to those encountered for construction of Seagirt Terminal. For design of floodwalls at tunnel entrance, soil borings will be needed to develop the subsurface profile." It may need additional foundation treatment

such as undercut and replacement or sheet pile cut off for seepage control which are not included at this preliminary flood wall design and should be included in the final design if deemed necessary"
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

2.5 Significance: Low

Comment #26
A recommended typical section floodwall for the TSP is not provided.
Basis for Comment
In general, the civil engineering work presented in *Appendix A: Civil Engineering*, is based upon existing information only. Figure 7 presents very generalized typical sections for various types of floodwalls that were considered. However, the selected design type is not presented with any drawings or schematics. A more detailed drawing of the type(s) of wall proposed for use at the project site would provide much-needed clarity.
Significance: Low
Resolution of the issue will improve the clarity of the proposed engineering design.
Recommendation for Resolution
Recommendation #1: Provide a drawing or figure showing the selected floodwall design.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: Floodwall sections will be provided.
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: Structural calculations for the Floodwalls for both the tunnels and the ventilation buildings have been provided. The calculations include a cross section with detailed dimensions.

Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**

Comment #27
Uplift pressures are included in the design of the floodwalls, but no seepage analysis discussion is provided to support the evaluation.
Basis for Comment
Appendix A: Civil Engineering, provides Figure 8 showing the various forces acting on the design floodwall for the project. Uplift force caused by seepage beneath the wall is included but no discussion of the basis for this analysis is provided. Will seepage be low or high based upon the materials expected to be encountered? If fill is present, seepage might be very high. Only a cursory discussion of the issue is presented.
Significance: Low
Resolution of the issue will improve the clarity of the proposed engineering design.
Recommendation for Resolution
Recommendation #1: Provide a discussion of the potential extent of seepage that might occur beneath the floodwalls. Use this information to support the discussion of uplift force that was considered in the design.
USACE Evaluator Response
1. Please indicate below whether the project delivery team (PDT 'concurs' or 'non-concurs' with the comment statement in the first row above. A concur should be provided if the PDT will revise the document or conduct activities to address the issue presented in the Final Panel Comment (statement and Basis for Comment). Please note that agreeing with the statement does not constitute a "concur," unless an action is provided. A non-concur should be provided if the PDT does not agree that the issue presented in the Final Panel Comment (statement and Basis for Comment) should be addressed and will not revise the document or conduct other activities in response to this issue.
Comment: _X_ Concur __ Non-Concur Explanation: Uplift force calculation is based on the water head at the bottom of wall. Soil property such as permeability will determine the seepage quantities and the time required to reach the steady state seepage condition in which the bottom of wall experiencing the maximum water head as seepage front move from water side to land side of the wall. The current floodwall uplift calculation set the tailwater on the land side toe of the wall at the ground level (assuming that the seepage (quantities) can be controlled with toe drain, and not emerging from the land side. Current analyses apply uniform reducing of water pressure head from flooding water side to the land side toe along the seepage path (Line-of-Creep Method). Line-of-Creep Method assumes the shortest seepage path along the bottom of the wall under steady state condition and is conservative. At final design, advanced seepage analysis shall be completed to determine the seepage quantities and ensure proper seepage control measures are included (toe drains, seepage cut off pile, etc.) to ensure seepage water will not emerging

from the land side (that need to be verified during final design with seepage analysis when soil properties are available).
2. For each recommendation, please indicate whether the PDT will 'adopt' or 'not adopt' the recommendation and provide an explanation. If 'adopt', please provide information on how this recommendation will be adopted. If 'not adopt', please explain why.
Recommendation #1: _X_ Adopt __ Not Adopt Explanation: PDT will add a note in the Civil Engineering Appendix that uplift force is based only the water head and not on soil properties such as permeability.
Panel BackCheck Response
Based on the evaluator response above, the panel provides the following response: **_X_ Concur __ Non-Concur**