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of Engineers®**

Prepared by:

Galveston District Southwestern Division

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ATTACHMENT 1 – TEAM ROSTERS (FOUO)

(TO BE REMOVED PRIOR TO POSTING ON DISTRICT WEBSITE)

ATTACHMENT 2 – PROJECT RISK INFORMATION (FOUO)

TO BE REMOVED PRIOR TO POSTING ON DISTRICT WEBSITE

ATTACHMENT 3 – REVIEW PLAN REVISIONS

1. INTRODUCTION

1.1 Purpose

This Review Plan (RP) for Sabine Pass to Galveston Bay, TX Coastal Storm Risk Management (CSRM) Project (P2#453291, 476070, 476071), will help ensure a quality-engineering project is developed by the Corps of Engineers in accordance with EC 1165-2-217, "Review Policy for Civil Works". As part of the Project Management Plan this RP establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products and lays out a value added process and describes the scope of review for the current phase of work. The EC outlines five general levels of review: District Quality Control/Quality Assurance (DQC), Agency Technical Review (ATR), Biddability, Constructability, Operability, and Sustainability (BOCES) Review, Independent External Peer Review (IEPR), and Policy and Legal Compliance Review. This RP will be provided to Project Delivery Team (PDT), DQC, ATR, BCOES, and IEPR Teams. The technical review efforts addressed in this RP, DQC and ATR, are to augment and complement the policy review processes. The Galveston District Chief of Engineering and Construction has assessed that the life safety risk of this project is significant; therefore a Type II IEPR/Safety Assurance Review (SAR) will be required, see Paragraph 5.1.

1.2 References

- EC 1165-2-217, Review Policy For Civil Works, 20 February 2018
- EM 1110-2-1913, Design, Construction, and Evaluation of Levees, 30 April 2000
- ER 1110-1-12, Quality Management, 31 Mar 2011
- ER 1110-1-8159, Engineering and Design DrChecks, 1 January 2015
- ER 405-1-12, Real Estate Handbook, 1 May 1998
- ER 415-1-11, Biddability, Constructability, Operability, Environmental and Sustainability (BCOES) Reviews, 1 January, 2013
- Sabine Pass to Galveston Bay, Texas, Coastal Storm Risk Management and Ecosystem Restoration, Final Integrated Feasibility Report – Environmental Impact Statement, May 2017
- Sabine Pass to Galveston Bay Project Management Plan Feasibility Study
- Galveston District Engineering and Construction Design Quality Management Plan

<https://team.usace.army.mil/sites/SWG/EC/Shared%20Documents/EC%20Division/Quality%20Management%20Initiatives/EC%20QMP%20Formatted%2020160526.pdf>

1.3 Review Management Organization

The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for this project. The RMO, in cooperation with the vertical team, will determine/select/approve the ATR team members. This RP will be updated for additional project phases and for the construction phase.

2. PROJECT DESCRIPTION

2.1 Project Description

Sabine Pass to Galveston Bay is located along the upper Texas coast, comprising the coastlines of six counties: Galveston, Harris, Brazoria, Jefferson, Chambers and Orange. The project covers a 120-mile (160-km) stretch of the upper Texas coast along the Gulf of Mexico shoreline from the Texas/Louisiana border at Sabine Pass in the east, to the western end of Galveston Island at San Luis Pass in the southwest. The project area includes Gulf and bay waters, barrier islands, marshes, coastal wetlands, rivers and streams and adjacent areas that make up the interrelated coastal area. Critical coastal ecosystems including sea turtle nesting habitat, piping plover critical habitat as well as two state and Federal wildlife refuges are within the project area. This region is home to more than five million people and is a major economic hub for Houston (Nation's second largest city), Freeport, Beaumont, and Port Arthur. Three of the Nation's top ten deep-draft ports, and 40 percent of the Nation's petrochemical industry lies within the project's footprint. In the entire study area, over 200 houses and up to 40,000 people are affected by shore erosion. This reach of the upper Texas coastal zone is at risk from wind and surge damage during storm events. The area has experienced significant shoreline erosion causing the destruction of nationally significant wetlands, loss of land and damage to homes, commercial property, and State Highway 87. On September 13, 2008, Hurricane Ike moved directly over the entire project area with category two storm winds of 110 mph (sustained) and an estimated category four storm surge ranging between 10-15 feet above normal tides. The entire area was significantly altered both physically and economically causing billions in damages. The Civil Works Review Board was held in May 2017 and the feasibility study was completed in December 2017 with the signed Chief's Report. The project was fully funded by the Supplemental Appropriations in the Bipartisan Budget Act of 2018. The project is estimated to cost \$3,957,134,000 with an estimated Federal cost of \$2,572,137,100 and an estimated non-Federal cost of \$1,384,996,900. The CSRM plan consists of three levee systems; Port Arthur and Vicinity CSRM – includes levee raises, replacement of existing floodwalls, and road/railroad closure gates; Freeport and Vicinity CSRM – includes levee raises, replacement of existing floodwalls and new floodwalls, additional pumping capacity in one pump station and a sector gate; Orange County CSRM – includes a new levee system which entails earthen embankment, floodwall, road/railroad closure gates, pump stations, vertical lift gates, sector gates and interior drainage features. The Coastal Hazards Modeling Report will require a separate review, outside of any contract design milestone review. A list of construction contracts for the project are included below per levee system, with descriptions of what each contract entails.

- Port Arthur and Vicinity CSRM:
 - Contract PAV01 – Levee Raise (\$15M)
 - 5,535 linear feet of levee raise (ranging from 1.5 – 2.0 feet) to include reconstruction of a section of the levee due to inadequate erosion protection and replacement of the road surface on the crown of the levee.
 - Design: USACE (SWG)
 - Construction: Design-Bid-Build
 - Contract PAV02 – Floodwall (\$15.5M)
 - Replacement of 1,040 linear feet of existing cantilever and braced cantilever concrete pile I-wall. This section of floodwall contains a failed portion of wall that occurred in 2017. An interim risk reduction measure was constructed behind this section and is still in place.
 - Design Build RFP: Architect-Engineer (A-E)
 - Design/Construction: Design-Build
 - Contract PAV03 – Floodwall (Valero) (\$101M)
 - 50 linear feet of levee raise (ranging from 1.0-2.0 ft), to include replacement of the levee road surface where applicable; replacement of 5,039 linear feet of cantilever steel sheet pile I-wall; 7 road closure gates; 4 railroad closure gates; and 1 levee to floodwall tie-ins for erosion protection
 - Design: USACE (LRD)

- Construction: Design-Bid-Build
 - Contract PAV03A – Floodwall and Levee Raise (\$195M)
 - 18,616 linear feet of levee raise (ranging from 1.5 – 2.0 feet), to include replacement of the levee road surface where applicable; replacement of 10,754 linear feet of concrete T-type floodwall and cantilever steel sheet pile I-wall; 1 road closure gate; 1 railroad closure gate and 21 levee to floodwall tie-ins for erosion protection
 - Design: A-E
 - Construction: Design-Bid-Build
 - Contract PAV03B – Floodwall (Port of Port Arthur) (\$63M)
 - 100 linear feet of levee raise (ranging from 1.0-2.0 ft), to include replacement of the levee road surface where applicable; replacement of 2,877 linear feet of concrete T-type floodwall and cantilever steel sheet pile I-wall; 2 road closure gates; 5 railroad closure gates; and 2 levee to floodwall tie-ins for erosion protection
 - Design: USACE (LRD)
 - Construction: Design-Bid-Build
 - Contract PAV04 – Floodwall and Levee Raise (\$182M)
 - 2,721 linear feet of 1.5 ft levee raise; 1,830 linear feet of new levee; replacement of 10,337 linear feet of concrete T-type floodwall, concrete pile I-wall, and cantilever steel sheet pile I-wall; 1 road closure gates; 2 railroad closure gates; and 12 levee to floodwall tie-ins
 - Design: USACE (SWG)
 - Construction: Design-Bid-Build
- Freeport and Vicinity CSRM
 - Contract FPV02 – Dow Barge Canal Sector Gate and Floodwall (\$98M)
 - Sector gate structure on the DOW Barge Canal (approximate opening of 74 ft for barge traffic), 1,040 ft of new floodwall; adding pumping capacity to one pump station (due to the sector gate on the DOW Barge Canal); add a new drainage overflow structure at the northern end of the DOW Barge Canal; and 2 levee to floodwall tie-ins for erosion protection
 - Design-Build RFP: A-E
 - Design/Construction: Design-Build
 - Contract FPV03 – Floodwall and Levee Raise (DOW Thumb) (\$195M)
 - 3,030 linear feet of 3.0 ft levee raise to include replacement of levee road surface as appropriate; 158 linear feet of 3.5 ft levee raise; replacement of 5,692 linear feet of concrete T-type floodwall, concrete capped steel sheet-pile I-wall, concrete I-wall and floodwall as dock face; 10,660 linear feet of new floodwall; replacement of 2 road closure gates; and 6 levee to floodwall tie-ins
 - Design: A-E
 - Construction: Design-Bid-Build
 - Contract FPV04 – Floodwall and Levee Raise (\$160M)
 - 66,345 linear feet of levee raise (ranging from 0.5 – 3.5 ft); replacement of 9,393 linear feet of floodwall (I-wall and T-type floodwall); 2,471 linear feet of new floodwall; 8 road closure gates; 18 levee to floodwall tie-ins; and replacement of 3 gravity drainage structures
 - Design: A-E
 - Construction: Design-Bid-Build

- Orange County CSRM
 - Contract OC01 – Cow Bayou Complex (\$282M)
 - Sector gate structure (approximate opening of 84 ft); 2 vertical lift gates; 4 gravity drainage structures; pump station (approximately 8,190 CFS); 4,829 linear feet of floodwall; 800 linear feet of new levee and 2 levee to floodwall tie-ins
 - Design-Build RFP: A-E
 - Design/Construction: Design-Build
 - Contract OC02 – Floodwall and Levee(\$200M)
 - 15,675 linear feet of levee; 12,475 linear feet of floodwall; 14 road closure gates; 4 railroad closure gates; 9 gravity drainage structures (6 within levee section); and 10 levee to floodwall tie-ins
 - Design: A-E
 - Construction: Design-Bid-Build
 - Contract OC02A – Floodwall and Levee (\$321M)
 - 25,330 linear feet of levee; 22,300 linear feet of floodwall; 5 road closure gates; 18 gravity drainage structures (8 within levee section); and 4 levee to floodwall tie-ins
 - Design: A-E
 - Construction: Design-Bid-Build
 - Contract OC03 – Adams Bayou Complex (\$195M)
 - Sector gate structure (approximate opening of 84 ft); 1 vertical lift gate; pump station (approximately 1,891 CFS); 100 linear feet of levee; 60 linear feet of floodwall and 2 levee to floodwall tie-ins
 - Design-Build RFP: A-E
 - Design/Construction: Design-Build
 - Contract OC04 – Pump Stations (\$244M)
 - 5 pump stations ranging from 131 to 1,391 CFS pumping capacity; one existing pump station will have capacity added and may require structural modifications to the existing structure; 250 linear feet of levee; 3,590 linear feet of floodwall; 2 road closure gates; and 10 levee to floodwall tie-ins
 - Design-Build RFP: A-E
 - Design/Construction: Design-Build
 - Contract OC05 – Floodwall and Levee (\$233M)
 - 40,362 linear feet of levee; 13,498 linear feet of floodwall; 7 road closure gates; 22 gravity drainage structures (15 within levee section); and 14 levee to floodwall tie-ins
 - Design: A-E
 - Construction: Design-Bid-Build
 - Contract OC06 – mitigation (\$20M)
 - 4 marsh restoration sites and 2 forested wetland sites
 - Design: A-E (SWG SATOC)
 - Construction: Design-Bid-Build

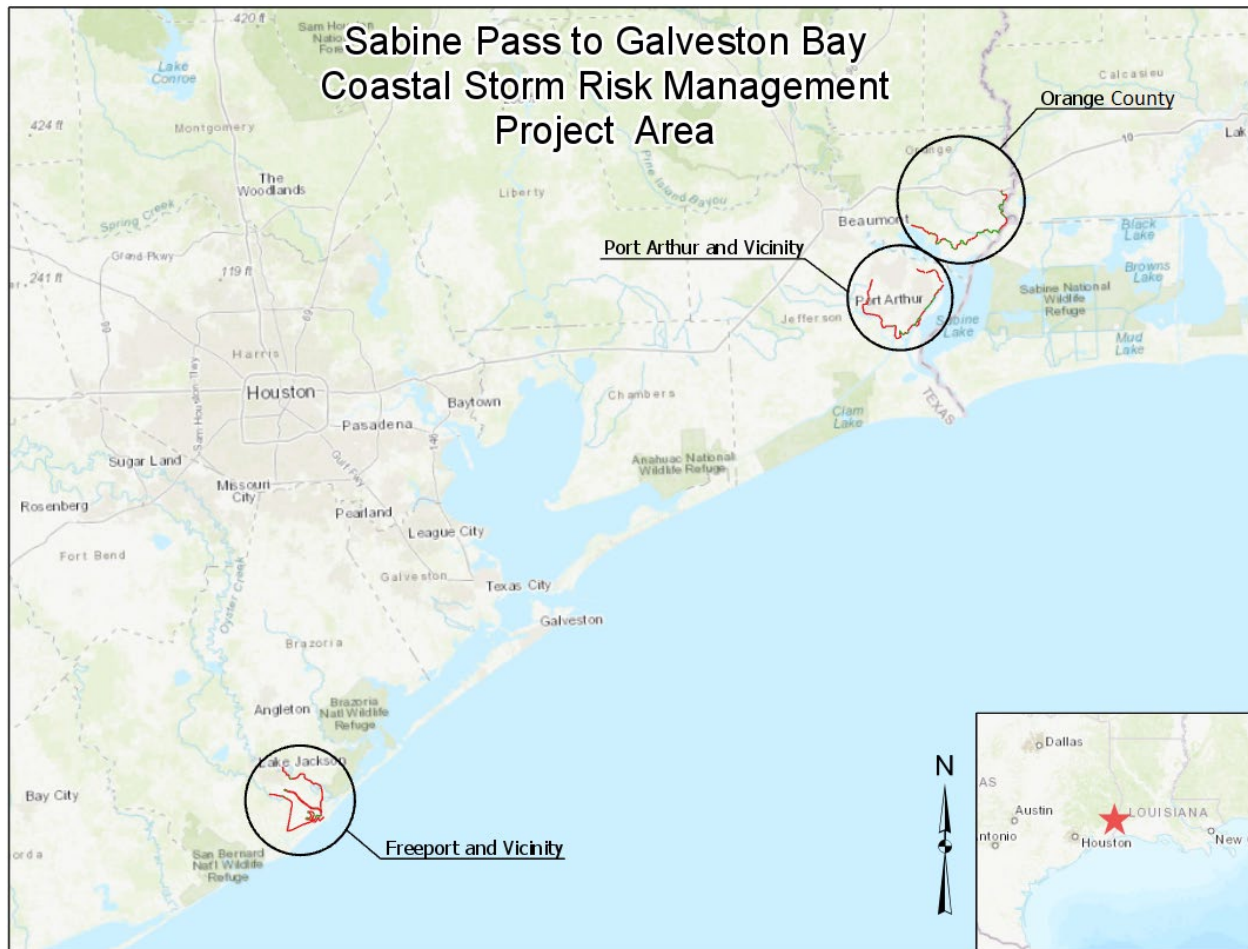


Figure 1-1: Sabine Pass to Galveston Bay, Texas Project Area

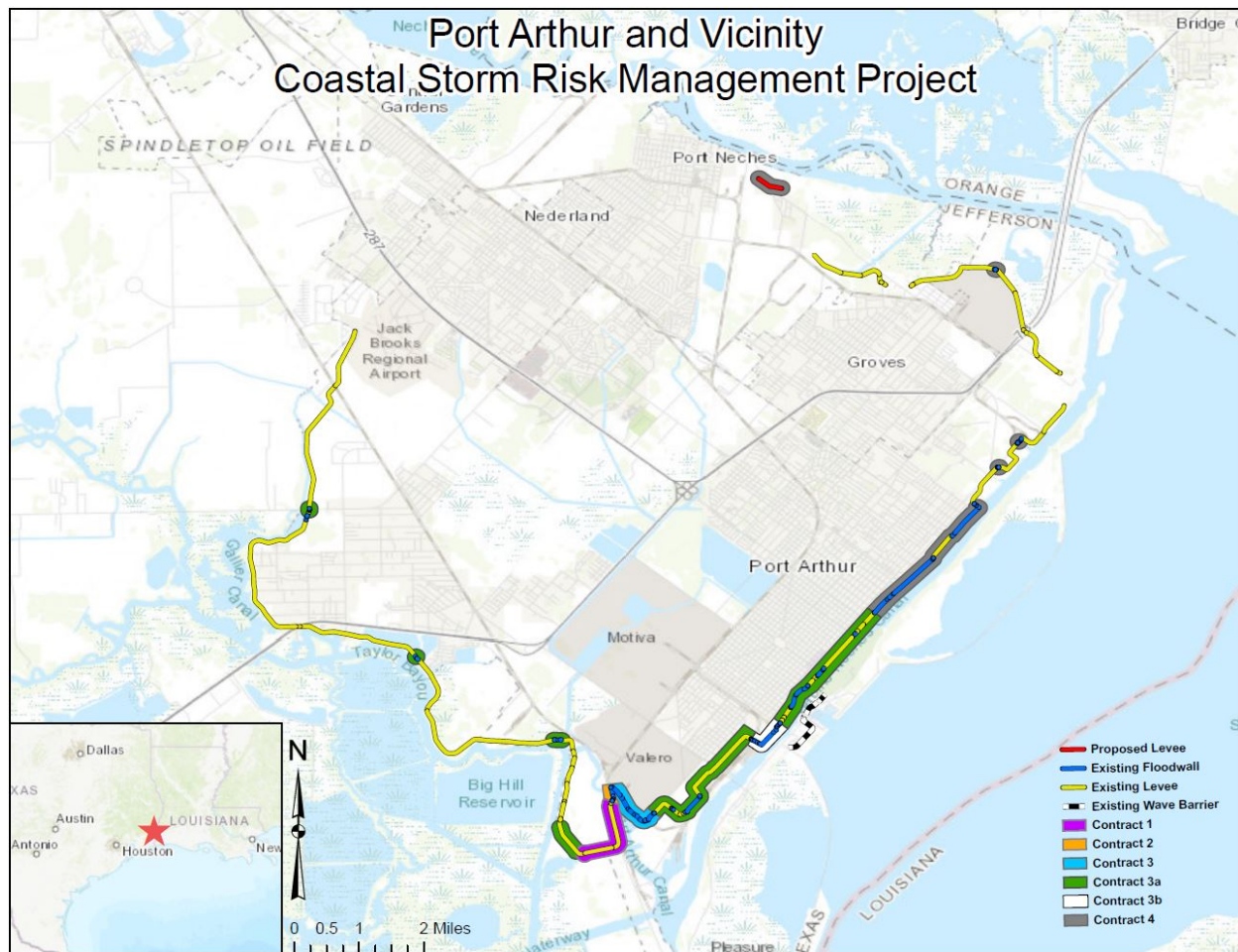


Figure 1-2: Sabine Pass to Galveston Bay, Texas; Port Arthur and Vicinity Area

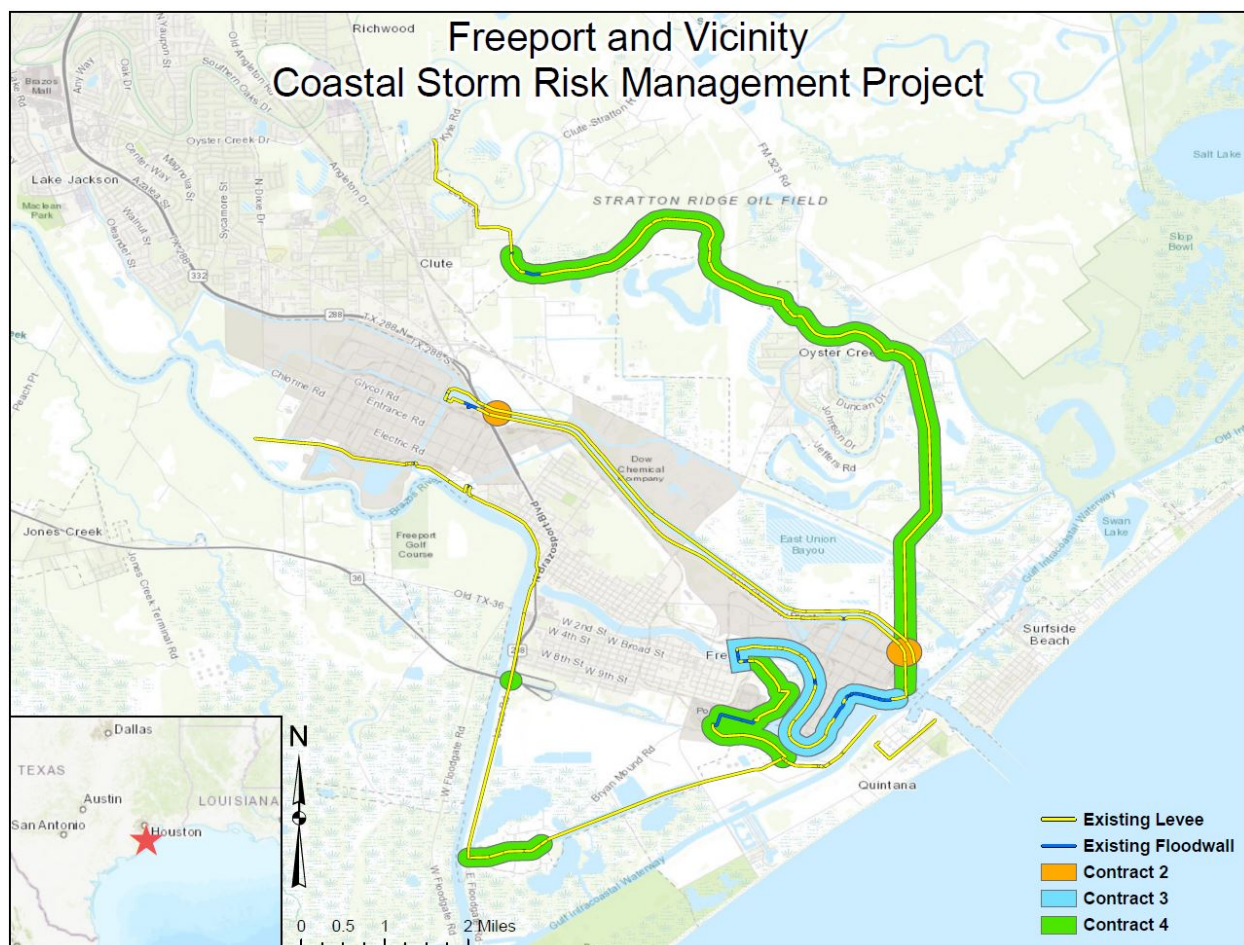


Figure 1-3: Sabine Pass to Galveston Bay, Texas; Freeport and Vicinity Area

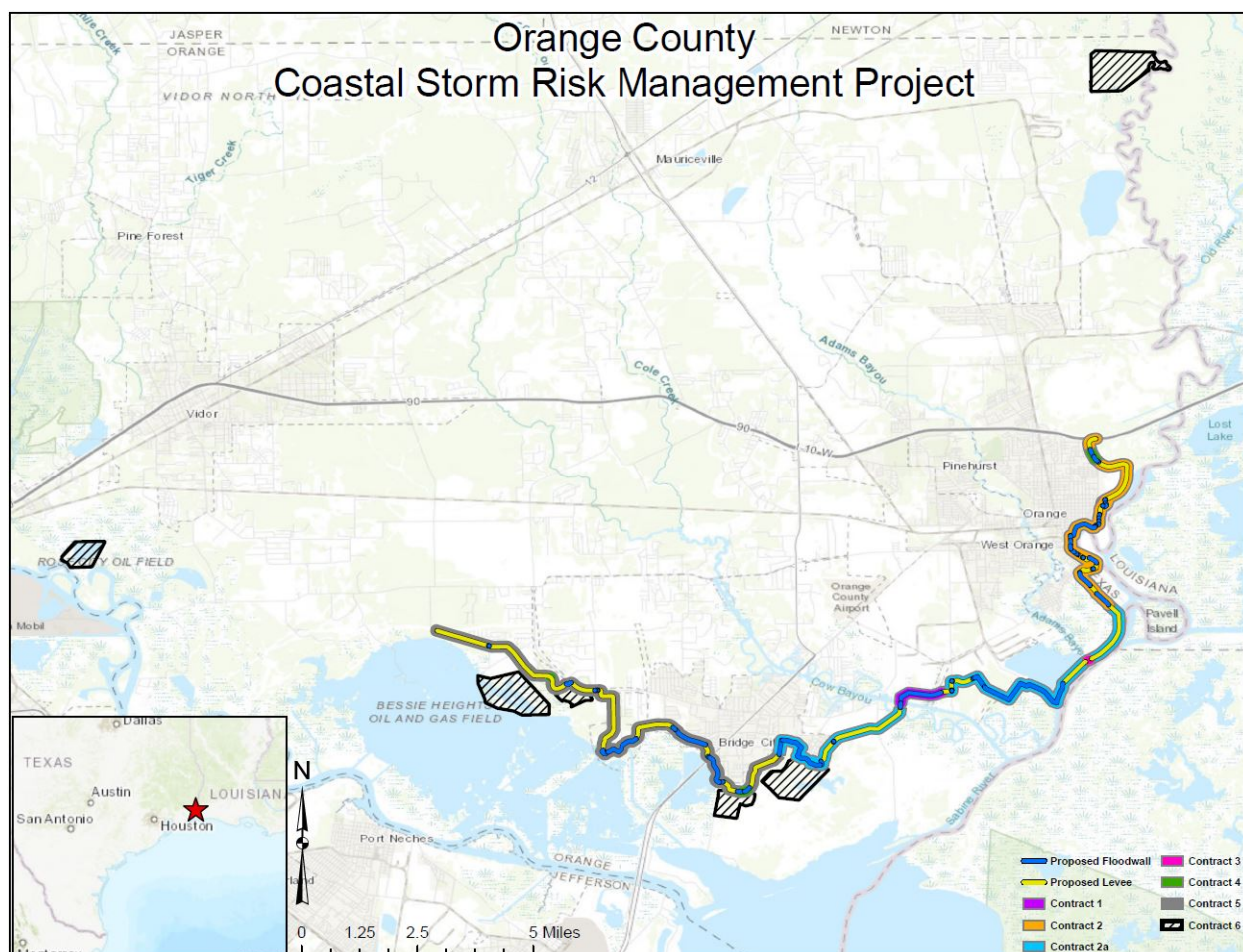


Figure 1-4: Sabine Pass to Galveston Bay, Texas; Orange and Vicinity Area

2.2 Project Sponsors

Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, policy and legal compliance, BCOES, and SAR reviews. Sponsor Peer Review of In-Kind Contributions - There will be in-kind contributions for this effort (all in-kind contributions are to be determined). Due to the project being comprised of 3 separate levee systems, 3 local sponsors have previously signed letters of intent to cost share in the design and construction of the project. The project currently has the potential for different sponsor arrangements. The Texas General Land Office (GLO) is potentially a sponsor, with possibly having agreements with local entities for future operations and maintenance. Also the previously identified local sponsors have the potential to be cost sharing sponsors for the project. They are as follows: Jefferson County Drainage District No. 7 (DD7) for the Port Arthur and Vicinity CSRM, Velasco Drainage District (VDD) for the Freeport and Vicinity CSRM Plan, and Orange County for the Orange County CSRM. The GLO and local sponsors understand the requirements and currently working towards signing Project Partnership Agreements (PPA) in some form. The combined benefit-cost ratio is 3.1 to 1 at 2.875% at FY2017 price level and 1.4 at 7%, based upon the final Feasibility Report dated (May 2017). The individual Benefit to Cost Ratios are as follows: Orange is 1.2 at 2.875%, Port Arthur and Vicinity is 4.6 at 2.875%, and Freeport and Vicinity is 8.8 at 2.875% - all at FY2017 price level. Preconstruction, engineering and design will be cost shared and financed at the rate for the project to be constructed as described in the Corps of Engineers Civil Works, Planning and Policy Division (CECW-PC) memorandum of 24 May 2013, Modification of non-federal contribution in Design Agreement above in para I-2.2b.(2)(a).

Any additional adjustments that may be necessary to bring the non-federal contribution in line with the project cost sharing will be accomplished in the first year of construction. The project cost-sharing percentages for the PED phase is 65% Federal and 35% non-Federal.

3. DISTRICT QUALITY CONTROL

3.1 Requirements

All implementation documents (plans and specifications; including supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) shall undergo DQC in accordance with EC 1165-2-217. Quality control on Galveston District design products will follow the Galveston District Engineering and Construction Design Quality Management Plan, which includes having a Design Quality Control Plan for each design/construction contract. DQC reviews will be led by the Galveston District for its own design products, design products completed by other USACE Districts (MVN and LRC/LRB) will conduct their own DQC reviews, with QA being completed by the Galveston District for compliance. A significant portion of this project will require design performed by Architect-Engineers (A-E) and their Quality Control process is required to be described in their Quality Control Plans. The A-E's QCP states that all work was checked and certified by independent well qualified reviewers in accordance with Paragraph 8 of EC 1165-2-217 and that reviews assuring compliance with appropriate USACE guidance are completed. A certification letter is to accompany the corresponding submittal. The Government will QA all A-E design work for compliance.

See Attachment 1 for the DQC Lead, reviewers, and reviewer's disciplines.

3.2 Documentation

The Galveston District, Other Districts or A-E's will conduct a full district quality control assessment and documentation of DQC activities as required and in compliance with EC 1165-2-217. The District Quality Control/Quality Assurance (DQC) will follow the Galveston District Engineering and Construction Design Quality Management Plan. The DQC will cover all contract products and any in-kind services provided by the local sponsors. Microsoft Word (using track changes) or Adobe Acrobat may be used to provide editorial and typographical comments. Technical DQC comments and responses will be recorded, responded to, and backchecked using DrChecksSM, and provided to the ATR team to assess appropriateness and effectiveness of the DQC activities. A certification of DQC review (95% review) will be completed by the entity performing the DQC review.

3.3 DQC Schedule and Estimated Cost

The DQC reviews will be seamless with the design process and tentatively follow the review schedule shown in Section 10. The cost for the DQC is approximately \$30,000 per design milestone.

4. AGENCY TECHNICAL REVIEW

4.1 Requirements

All implementation documents (plans and specifications; including supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) shall undergo ATR in accordance EC 1165-2-217. ATR reviews will occur seamlessly, including early involvement of the ATR team for validation of key design decisions, and at the scheduled milestones as shown in Section 10. A site visit will be scheduled for the ATR Team early in the design process and periodically during construction (i.e. mid-point). The design build request for proposal (D-B RFP) will be reviewed by the ATR team during its

development. These reviews have been designated in Section 10. The ATR team is provided in Attachment 1.

4.2 Documentation of ATR

Documentation of ATR will occur using the requirements of EC 1165-2-217. ATR comments will be documented in the DrChecksSM model review documentation database. DrChecksSM is a module in the ProjNetSM suite of tools developed and operated at ERDC- CERL (www.projnet.org).

4.3 Products to Undergo ATR

See Section 9, Review Deliverables, for products to undergo ATR.

4.4 Required Team Expertise and Requirements

ATR teams will be established in accordance with EC 1165-2-217. For the disciplines that play a crucial part in the project, Subject Matter Experts (SMEs) are preferred for filling the ATR team roster. The following disciplines will be required for ATR of this project:

Sabine Pass to Galveston Bay Coastal Storm Risk Management	
ATR Team Member/Disciplines	Expertise Required
Team Lead	The ATR team lead will be a senior professional outside the home MSC with extensive experience in preparing Civil Works documents and conducting ATRs for levee safety projects. The lead has the necessary skills and experience to lead a virtual team through the ATR process. The ATR lead may also serve as a reviewer for a specific discipline, in this case: Structural Engineering, Geotechnical Engineering, etc. (as applicable). Since a SAR is required, the ATR Lead will be an engineer/geologist with a strong levee safety background.
Risk	The team member shall have experience performing at least two previous risk assessments on levee safety assurance projects. The team member shall not have a co-duty for any other discipline on the ATR team.
Geotechnical Engineer*	The team member(s) shall have at least 10 years' experience in the field of geotechnical engineering, analysis, design, and construction of coastal storm risk management levee systems. The geotechnical engineer(s) shall have experience in subsurface investigations, rock and soil mechanics, internal erosion (seepage and piping), slope stability evaluations, erosion protection design, and earthwork construction. The geotechnical engineer(s) shall have knowledge and experience in the forensic investigation of seepage, settlement, stability, and deformation problems associated with earthen embankment, floodwalls, flood risk management structures, and appurtenances constructed on soil foundations. The team

	member(s) shall be a registered Professional Engineer (PE) or Professional Geologist (PG),
Civil/Construction Engineer	The team member shall have at least 10 years' experience in civil works design/construction of levee safety projects. The team member shall be a Registered Professional engineer (PE).
Hydraulic Engineer*	The team member(s) shall have at least 10 years' experience in the analysis and design of coastal storm risk management measures and interior drainage infrastructure including the design of levees, flood walls, closure gate structures, pump stations, spillways, outlet works, drainage culverts, channels, and stilling basins. The hydraulic engineer(s) shall be knowledgeable and experienced with the numerical modeling of hurricane surge, waves, rainfall-induced flooding, fluid-structure interactions (e.g. overtopping and hydraulic loads on structures), scour and erosion assessment, ship-generated waves and their impacts, and the routing of inflow hydrographs through multipurpose flood control reservoirs utilizing multiple discharge devices, statistical analysis of coastal and riverine hazards (JPM-OS and Extremes analysis) Corps application of risk and uncertainty analyses in flood damage reduction studies, and standard Corps hydrologic and hydraulic computer models used in coastal hazards modeling (ADCIRC, STWAVE, Boussinesq models, empirical overtopping formulae), hydrologic modeling (HEC-HMS) and hydraulic analysis (HEC-RAS) for flood risk assessments and flood risk management design analysis and investigations.
Mechanical/Electrical Engineer	The team member shall have at least 10 years' experience in machine design, machine rehabilitation and familiarity with design of mechanical gates and controls for flood control structures.
Structural Engineer*	The team member shall have experience and be proficient in performing stability analysis, finite element analysis, seismic time history studies, and external stability analysis including foundations on floodwalls, large concrete or steel hydraulic structures, and pump stations. The structural engineer shall have specialized experience in the design, construction and analysis of pile founded floodwalls and other coastal storm risk management structures. The team member shall be a registered Professional Engineer (PE) and have a minimum of 10 years' experience in the above areas.
Climate Assessment	The team member shall be a certified ATR reviewer from the Climate Preparedness and Resilience (CPR) Community of Practice (CoP).
Environmental/Cultural Resources	The environmental/cultural resources reviewer shall be experienced in National Environmental Policy Act (NEPA) process and analysis, and have a biological or environmental background.
Real Estate	The Real Estate (RE) team member shall be an expert in real estate acquisitions for civil works projects. The RE team member will have experience working with non-federal sponsors, ROW (right-of-way) determination, maps and evaluation of necessary easements.

Cybersecurity	The ATR team member shall be a member of the USACE Cybersecurity MCX.
SCADA	The ATR team member shall be a subject matter expert, within USACE, for SCADA systems.

Table 1: Design/Construction Contracts with Required ATR Reviewer Expertise

*Team members are preferred to be SMEs.

The table below shows which type of expertise is required for each design/construction contract:

Design/Construction Contract	Risk	Geotechnical	Civil	Mech/Elec	H&H	Structural	Climate Assessment	Environmental	Real Estate	Cybersecurity	SCADA
Coastal Hazards Modeling Report					X(2)		X				
Port Arthur 1	X	X	X		X				X		
Port Arthur 2	X	X	X		X	X			X		
Port Arthur 3	X	X	X		X	X			X		
Port Arthur 3a	X	X	X		X	X			X		
Port Arthur 3b	X	X	X		X	X			X		
Port Arthur 4	X	X	X		X	X			X		
Freeport 2	X	X	X	X	X	X			X	X	X
Freeport 3	X	X	X		X	X			X		
Freeport 4	X	X	X		X	X			X		
Orange 1	X	X	X	X	X	X		X	X	X	X
Orange 2	X	X	X		X	X		X	X		
Orange 2a	X	X	X		X	X		X	X		
Orange 3	X	X	X	X	X	X		X	X	X	X
Orange 4	X	X	X	X	X	X		X	X	X	X
Orange 5	X	X	X		X	X		X	X		
Orange 6			X					X	X		

Table 2: Design/Construction Contracts with Required ATR Reviewers

4.5 Statement of Technical Review Report

At the conclusion of each ATR effort, the ATR team will prepare a review report with a completion and certification memo. The report will be prepared in accordance with EC 1165-2-217. The report will include at a minimum the Charge to Reviewers, ATR Certification Form from EC 1165-2-217, and the DrChecksSM printout of the comments, evaluations, and backchecks. The RMC's Statement of Technical Review Report template should be used with the ATR Completion of Agency Technical Review showing David E. Carlson, P.E., Chief, Eastern Division, CEIWR-RMC-E signing for the RMO.

4.6 ATR Schedule and Estimated Cost

The preliminary ATR milestone schedule is listed in Section 10. The cost for each review milestone ATR is approximately \$30,000 to 50,000.

5. SAFETY ASSURANCE REVIEW

5.1 Decision on SAR

The Galveston District Chief of Engineering and Construction Division has made a risk-informed-decision that this project poses a significant threat to human life (public safety) and therefore a SAR will be performed. The documents being prepared for the design/construction phase of the project are implementation documents and not decision documents; therefore a Type I IEPR is not required.

The Sabine Pass to Galveston Bay Coastal Storm Risk Management Project is intended to provide risk management to the public for coastal storms. Two existing levee systems will be improved, which includes levee raises and floodwall improvements. Both areas pose a risk to the public during construction as sections of the current levee system will have to be degraded in order to construct the improvements under this project. For all three project areas (Freeport, Port Arthur, & Orange), the levee systems provide coastal storm risk management to the public and are therefore considered life safety risks and possible threats to human life. All contracts (except for Orange Contract 6) have life safety or a threat to human life aspect involved. The Orange Contract 6 is for the mitigation component of the Orange CSRM and does not pose a risk to life safety and therefore does not require a SAR.

5.2 Products to Undergo SAR

The technical products the SAR panel will review include, but are not limited to, plans, specifications, DDR, Design-Build Request For Proposal (D-B RFP) and Coastal Hazards Modeling Report.

- Coastal Hazards Modeling Report
 - Separate report for each project: Freeport, Orange, Port Arthur
- 65% Design Review for DBB/95% Design Review for D-B
 - Plans
 - Specifications
 - DDR
 - Geotechnical report
- Risk Assessment Reports for Risk Based Design
- Draft Design-Build RFP

5.3 Required SAR Panel Expertise

SAR panels will be established in accordance with EC 1165-2-217. The following disciplines will be required for SAR of this project:

Sabine Pass to Galveston Bay Coastal Storm Risk Management	
SAR Panel Member/Disciplines	Expertise Required
Geotechnical Engineer	The Geotechnical Engineering panel member(s) shall be a senior-level geotechnical engineer with a minimum of 15 years' experience in the field of geotechnical engineering, analysis, design, and construction of levees, floodwalls, pump stations, and sector gates. The panel member(s) should have knowledge and experience in the forensic investigation and evaluation of seepage and piping, settlement, slope stability, and deformations problems associated with embankments constructed on alluvial soils. The panel member(s) should have experience in the design and construction of seepage barriers or cutoff walls. The panel member(s) should have experience in failure mode analysis, risk assessment of levees, and evaluating risk reduction measures for levee safety assurance projects. The team member(s) should have experience in the engineering construction field with particular emphasis on coastal levee safety projects. The team member(s) shall be a registered Professional Engineer (PE) or Professional Geologist (PG),
Hydraulic Engineer	The Hydraulic Engineering panel member(s) shall have experience in the analysis and design of coastal storm risk management measures and interior drainage infrastructure including the design of levees, flood walls, closure gate structures, spillways, outlet works, drainage culverts, channels, and stilling basins. The hydraulic engineer(s) should be knowledgeable and experienced with the numerical modeling of hurricane surge, waves, rainfall-induced flooding, fluid-structure interactions (e.g. overtopping and hydraulic loads on structures), scour and erosion assessment, ship-generated waves and their impacts, and the routing of inflow hydrographs through multipurpose flood control reservoirs utilizing multiple discharge devices, statistical analysis of coastal and riverine hazards (JPM-OS and Extremes analysis) Corps application of risk and uncertainty analyses in flood damage reduction studies, and standard Corps hydrologic and hydraulic computer models used in coastal hazards modeling (ADCIRC, STWAVE, Boussinesq models, empirical overtopping formulae), hydrologic modeling (HEC-HMS) and hydraulic analysis (HEC-RAS) for flood risk assessments and flood risk management design analysis and investigations.
Structural Engineer	The structural engineer(s) shall be a senior level, professionally registered engineer with a minimum of 15 years' experience in the design, construction and analysis of pile founded floodwalls, sector gates, and other coastal storm risk management structures. The team member(s) should have experience in the engineering

	construction field with particular emphasis on coastal levee safety projects.
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Table 3: Design/Construction Contracts with Required SAR Reviewer Expertise

The design/construction contracts (as described in Section 2) require varying disciplines and levels of expertise by reviewers. The table below shows which type of expertise is required for each design/construction contract:

Design/Construction Contract	Geotechnical	H&H	Structural
Coastal Hazards Modeling Report		X	
Port Arthur 1	X		
Port Arthur 2	X		X
Port Arthur 3	X		X
Port Arthur 3a	X		X
Port Arthur 3b	X		X
Port Arthur 4	X		X
Freeport 2	X		X
Freeport 3	X		X
Freeport 4	X		X
Orange 1	X		X
Orange 2	X		X
Orange 2a	X		X
Orange 3	X		X
Orange 4	X		X
Orange 5	X		X
Orange 6			

Table 4: Design/Construction Contracts with Required SAR Reviewers

5.4 Documentation of SAR

Documentation of SAR will be prepared in accordance with EC 1165-2-217.

5.5 Scope, Schedule, and Estimated Cost of SAR's

The SAR's will be performed in accordance with EC 1165-2-217. The estimated cost for the SAR's of this project are in the range of \$25,000 to \$100,000 per design/construction contract review. This estimate will be refined when the Scope of Work for the SAR task order is completed. The SAR reviews for this project are anticipated to occur around the 65% milestone for the design, plans, and specifications (etc.) of the design package for Design-Bid-Build contracts, for Design-Build contracts the Draft Design-Build Request for Proposal, at the 95% design stage for the design, plans, and specifications (etc.) of the design package for Design-Build contracts, and the mid-point of construction. All construction contracts (except for Orange Contract 6) will have a SAR review completed. The reviews are tentatively scheduled to occur within the timeframes included in Section 10. Site visits will occur for the design reviews and the mid-point construction reviews.

6. BCOES REVIEW

6.1 Requirements

All implementation documents (including supporting data, analyses, reports, environmental compliance documents, water control manuals, etc.) shall undergo BCOES review in accordance ER 415-1-11 and ER 1110-1-12. BCOES reviews are done during design for a project using the design-bid-build (D-B-B) method or during development of the request for proposal (RFP) for a design-build (D-B) project. The BCOES review results are to be incorporated into the procurement documents for all construction projects. The value of BCOES reviews is based on minimizing problems during the construction phase through effective checks performed by knowledgeable, experienced personnel prior to advertising a contract. Biddability, constructability, operability, environmental, and sustainability requirements must be emphasized throughout the planning and design processes for all programs and projects, including during planning and design charrettes. This will help to ensure that the government's contract requirements are clear, executable, and readily understandable by private sector bidders or proposers. It will also help ensure that the construction may be done efficiently and in an environmentally sound manner, and that the construction activities and projects are sufficiently sustainable. Finally, effective BCOES reviews of design and contract documents will reduce risks of cost and time growth, unnecessary changes and claims, as well as support safe, efficient, sustainable operations and maintenance by the facility users and maintenance organization after construction is complete.

6.2 Documentation of BCOES

The BCOES review will be documented using DrChecksSM. The BCOES reviewers will include local sponsors' facility operators and maintenance staff, as well as construction, operations, and environmental staff to improve the BCOES aspects of designs. The BCOES roster is provided in Attachment 1.

7. POLICY AND LEGAL COMPLIANCE REVIEW

The Galveston District Office of Counsel reviews all contract actions for legal sufficiency in accordance with Engineer Federal Acquisition Regulation Supplement 1.602-2 responsibilities. The subject implementation documents will be reviewed for legal sufficiency prior to advertisement.

8. RISK

8.1 Risk-Informed Design

The previously completed semi-quantitative risk assessments (SQRA) on the existing systems (Port Arthur & Freeport) were used to determine the appropriate modifications for the levee systems in order to decrease the risk to life safety, property and the environment. A SQRA will be completed for the new levee system in Orange during the PED phase for the same purposes. Risk-informed design will be used to inform the design team where traditional design standards should be made more or less conservative. The designers will utilize risk-informed decisions in order for the resulting project to meet Tolerable Risk Guidelines (TRG). All risk-informed decisions will be documented in the DDR.

8.2 Risk Assessments

SQRAs were previously completed for the Port Arthur and Freeport levee systems. During the PED phase, the risk assessment team will review the proposed plan for improvements in Port Arthur and Freeport, as well as the new system in Orange, and ensure that the design reduces risk as low as reasonably possible and compare plausible proposed alternatives to consider risk vs cost at critical areas. One or more risk cadre members will be members of the ATR team to review the design documents throughout the design process so that the designs are meeting TRG. All completed documents by the risk assessment team will be included as appendices in the DDR for each project area.

A separate review plan will be created for the SQRA reports of this project.

9. REVIEW DELIVERABLES

9.1 Products to Review

The deliverables required for each review are as indicated below. The documents stated below should be the minimum included at each review stage. (DDR – Design Documentation Report, ECIFP – Engineering Considerations and Instructions to Field Personnel).

- Coastal Hazards Modeling Report
 - Separate report for each project: Freeport, Orange, Port Arthur
- Design-Build RFP

Design-Bid-Build Contracts (Same for Design-Build Contracts, except for no BCOES reviews)

- 35% Review
 - DDR, Geotechnical Report, Plans, Specifications
- 65% Review
 - DDR, ECIFP, Geotechnical Report, Plans, Specifications
- 95% Review
 - DDR, ECIFP, Geotechnical Report, Plans, Specifications
- Final BCOES
 - All documents listed above; revised per the 95% Reviews
- 100% - BCOES Review Backcheck
 - All documents

10. REVIEW SCHEDULE

10.1 Project Milestones – Coastal Hazards Modeling Report

Coastal Hazards Modeling Report	
Project Phase/Submittal	Estimated Completion
DQC	FY20-Q2
ATR, SAR	FY20-Q2/Q3

Table 5 Coastal Hazards Modeling Report Milestones

10.2 Project Milestones – Port Arthur

Port Arthur Contract PAV01	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	Apr-19
65% Review – DQC, ATR, SAR, & BCOES	Jun-19
95% Review – DQC, ATR	Oct/Nov-19
100% Review - BCOES	Dec-19
Midpoint of Construction – SAR	FY21 – Q1/Q2

Table 6 Port Arthur Contract PAV01 Milestones

Port Arthur Contract PAV02	
Project Phase/Submittal	Estimated Completion
Draft D-B RFP Review – DQC, ATR, SAR, & BCOES	FY20 – Q3/4
Final D-B RFP Review – DQC, ATR, BCOES	FY20 – Q4
Corrected Final D-B RFP Review – DQC, ATR, BCOES	FY20 – Q4
Conformance Reviews – QA, ATR	FY21
95% Design Review – SAR	FY21 – Q2/Q3
Midpoint of Construction – SAR	FY21 – Q3/Q4

Table 7 Port Arthur Contract PAV02 Milestones

Port Arthur Contract PAV03	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	FY20 – Q2
65% Review – DQC, ATR, SAR, & BCOES	FY20 – Q4
95% Review – DQC, ATR	FY21 – Q1
Final BCOES Review	FY21 – Q1

100% Review - BCOES Backcheck	FY21 – Q2
Midpoint of Construction – SAR	FY24 – Q1

Table 8 Port Arthur Contract PAV03 Milestones

Port Arthur Contract PAV03A	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	FY20 – Q4/FY21 Q1
65% Review – DQC, ATR, SAR, & BCOES	TBD
95% Review – DQC, ATR	TBD
Final BCOES Review	TBD
100% Review - BCOES Backcheck	TBD
Midpoint of Construction – SAR	TBD

Table 9 Port Arthur Contract PAV03A Milestones

Port Arthur Contract PAV03B	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	FY20 – Q2
65% Review – DQC, ATR, SAR, & BCOES	FY20 – Q4
95% Review – DQC, ATR	FY21 – Q1
Final BCOES Review	FY21 – Q1
100% Review - BCOES Backcheck	FY21 – Q2
Midpoint of Construction – SAR	FY24 – Q1

Table 10 Port Arthur Contract PAV03B Milestones

Port Arthur Contract PAV04	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	FY22 – Q3
65% Review – DQC, ATR, SAR, & BCOES	FY22 – Q4
95% Review – DQC, ATR	FY23 – Q1
Final BCOES Review	FY23 – Q1
100% Review - BCOES Backcheck	FY23 – Q2
Midpoint of Construction – SAR	FY24 – Q4

Table 11 Port Arthur Contract PAV04 Milestones

10.3 Project Milestones - Freeport

Freeport Contract FPV02	
Project Phase/Submittal	Estimated Completion
Draft D-B RFP Review – DQC, ATR, SAR, & BCOES	TBD
Final D-B RFP Review – DQC, ATR, BCOES	TBD
Corrected Final D-B RFP Review – DQC, ATR, BCOES	TBD
Conformance Reviews – QA, ATR	TBD
95% Design Review – SAR	TBD
Midpoint of Construction – SAR	TBD

Table 12 Freeport Contract FPV02 Milestones

Freeport Contract FPV03	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	TBD
65% Review – DQC, ATR, SAR, & BCOES	TBD
95% Review – DQC, ATR	TBD
Final BCOES Review	TBD
100% Review - BCOES Backcheck	TBD
Midpoint of Construction – SAR	TBD

Table 13 Freeport Contract FPV03 Milestones

Freeport Contract FPV04	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	TBD
65% Review – DQC, ATR, SAR, & BCOES	TBD
95% Review – DQC, ATR	TBD
Final BCOES Review	TBD
100% Review - BCOES Backcheck	TBD
Midpoint of Construction – SAR	TBD

Table 14 Freeport Contract FPV04 Milestones

10.4 Project Milestones - Orange County

Orange Contract OC01	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	FY20 – Q2
Draft D-B RFP Review – DQC, ATR, SAR, & BCOES	TBD
Final D-B RFP Review – DQC, ATR, BCOES	TBD
Corrected Final D-B RFP Review – DQC, ATR, BCOES	TBD
Conformance Reviews – QA, ATR	TBD
95% Design Review – SAR	TBD
Midpoint of Construction – SAR	TBD

Table 15 Orange Contract OC01 Milestones

Orange Contract OC02	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	TBD
65% Review – DQC, ATR, SAR, & BCOES	TBD
95% Review – DQC, ATR	TBD
Final BCOES Review	TBD
100% Review - BCOES Backcheck	TBD
Midpoint of Construction – SAR	TBD

Table 16 Orange Contract OC02 Milestones

Orange Contract OC02A	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	TBD
65% Review – DQC, ATR, SAR, BCOES	TBD
95% Review – DQC, ATR	TBD
Final BCOES Review	TBD
100% Review - BCOES Backcheck	TBD

Midpoint of Construction – SAR	TBD
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Table 17 Orange Contract OC02A Milestones

Orange Contract OC03	
Project Phase/Submittal	Estimated Completion
Draft D-B RFP Review – DQC, ATR, SAR, BCOES	TBD
Final D-B RFP Review – DQC, ATR, BCOES	TBD
Corrected Final D-B RFP Review – DQC, ATR, BCOES	TBD
Design Conformance Reviews – QA, ATR	TBD
95% Design Review – SAR	TBD
Midpoint of Construction – SAR	TBD

Table 18 Orange Contract OC03 Milestones

Orange Contract OC04	
Project Phase/Submittal	Estimated Completion
Draft D-B RFP Review – DQC, ATR, SAR, BCOES	TBD
Final D-B RFP Review – DQC, ATR, BCOES	TBD
Corrected Final D-B RFP Review – DQC, ATR, BCOES	TBD
Conformance Reviews – QA, ATR	TBD
95% Design Review – SAR	TBD
Midpoint of Construction – SAR	TBD

Table 19 Orange Contract OC04 Milestones

Orange Contract OC05	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	TBD
65% Review – DQC, ATR, SAR, BCOES	TBD
95% Review – DQC, ATR	TBD
Final BCOES Review	TBD
100% Review - BCOES Backcheck	TBD
Midpoint of Construction – SAR	TBD

Table 20 Orange Contract OC05 Milestones

Orange Contract OC06	
Project Phase/Submittal	Estimated Completion
35% Review – DQC, ATR	TBD
65% Review – DQC, ATR, BCOES	TBD
95% Review – DQC, ATR	TBD
Final BCOES Review	TBD
100% Review - BCOES Backcheck	TBD

Table 21 Orange Contract OC06 Milestones

11. PUBLIC POSTING OF REVIEW PLAN

As required by EC 1165-2-217, the approved RP will be posted on the District public website (<https://www.swg.usace.army.mil/>). This is not a formal comment period and there is no set timeframe for the opportunity for public comment. If and when comments are received, the PDT will consider them and decide if revisions to the RP are necessary.

12. REVIEW PLAN APPROVAL AND UPDATES

The MSC Commander, or delegated official, is responsible for approving this RP. The Commander's approval reflects vertical team input (involving the District, MSC, and RMC) as to the appropriate scope, level of review, and endorsement by the RMC. The RP is a living document and should be updated in accordance with 1165-2-217. All changes made to the approved RP will be documented in Attachment 3, Table 27 RP Revisions. The latest version of the RP, along with the Commanders' approval memorandum, will be posted on the District's webpage and linked to the HQUSACE webpage. The approved RP should be provided to the RMO.

13. ENGINEERING MODELS

The use of certified, validated, or agency approved engineering models is required for all activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to DQC, ATR, BCOES, policy and legal review, and SAR (if required). Where such approvals have not been completed, appropriate independent checks of critical calculations will be performed and documented. The following engineering models, software, and tools are anticipated to be used:

Model Name	Version	Validation/Release Date
ADCIRC	52.30.xx	March, 2017
STWAVE	6.2.xx	August, 2018
FUNWAVE	3.3	July, 2018
EuroTop	EurOtop 2018 Final Version	December, 2018

HEC-HMS	4.2.1	March, 2017
HEC-RAS (routing models)	5.0.6	November, 2018
Riverware	7.3.1	October, 2018
HEC-SSP	2.1.1	June, 2017
STORMSIM	1.0	February, 2019
Geo Studio 2018	9.0.4.15639	2017
StaadPro	20.07.11.90	2018
Other (will update as needed)		

Table 22 Models and Status

14. REVIEW PLAN POINTS OF CONTACT

Title	Organization	Phone
Galveston District Project Manager	CESWG-PMJ	(409) 766-3130
Galveston District Lead Project Engineer	CESWG-ECE-S	(409) 766-6351
Galveston District Chief, Engineering Branch	CESWG-ECE	(409) 766-6373
Senior Reviewer	CEIWR-RMC	(304) 399-5217

Table 23 RP POC