Deepwater Horizon

Open Ocean Trustee Implementation Group

MONITORING AND ADAPTIVE MANAGEMENT ACTIVITY IMPLEMENTATION PLAN:

CONCEPTUAL MODEL TO INFORM OPEN OCEAN ECOSYSTEM INDICATORS

December 2022

1.0 Introduction and Purpose

The Deepwater Horizon (DWH) oil spill settlement in 2016 provides the Natural Resource Damage Assessment (NRDA) Trustees (Trustees) up to $8.8 billion, distributed over 15 years, to restore natural resources and services injured by the spill. As described in the DWH oil spill Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (PDARP/PEIS; DWH NRDA Trustees. 2016a), the Trustees selected a comprehensive, integrated ecosystem approach to restoration. The Final PDARP/PEIS considers programmatic alternatives, composed of Restoration Types, to restore natural resources, ecological services, and recreational use services injured or lost as a result of the DWH oil spill incident. As shown in the PDARP/PEIS, the injuries caused by the DWH oil spill affected such a wide array of linked resources over such an enormous area that the effects must be described as constituting an ecosystem-level injury. The PDARP/PEIS and information on the settlement with British Petroleum Exploration and Production Inc. (called the Consent Decree) are available at the Gulf Spill Restoration website.

Given the unprecedented temporal, spatial, and funding scales associated with the DWH oil spill restoration effort, the Trustees recognized the need for robust Monitoring and Adaptive Management (MAM) to support restoration planning and implementation. As such, one of the programmatic goals established in the PDARP/PEIS is to "Provide for Monitoring, Adaptive Management, and Administrative Oversight to Support Restoration Implementation" to ensure that the portfolio of restoration projects provides long-term benefits to natural resources and services injured by the spill (Appendix 5.E of the PDARP/PEIS). This framework allows the Trustees to evaluate restoration effectiveness, address potential uncertainties related to restoration planning and implementation, and provide feedback to inform future restoration decisions.

The Trustees also established a governance structure that assigned a Trustee Implementation Group (TIG) to each of the eight designated Restoration Areas, including the Open Ocean (OO) Restoration Area. Each TIG makes restoration decisions for the funding allocated to its Restoration Area and is also responsible for identifying MAM priorities for its respective TIG. The OO TIG includes the four federal Trustee agencies: U.S. Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA); U.S. Department of the Interior (DOI); U.S. Department of Agriculture (USDA); and U.S. Environmental Protection Agency (EPA). The Open Ocean TIG is responsible for restoring the natural resources and services within the Open Ocean Restoration Area that were injured by the DWH oil spill and associated spill response efforts.

The DWH Trustees opened a publicly available Administrative Record for the NRDA of the DWH oil spill, including restoration planning activities, concurrently with publication of the 2010 Notice of Intent (pursuant to 15 CFR § 990.45). DOI is the lead federal Trustee for maintaining the Administrative Record, which can be found at http://www.doi.gov/deepwaterhorizon/adminrecord. This administrative record is used by the OO TIG to provide the public with information about DWH restoration planning, including MAM activities. Additional information is also provided at http://www.gulfspillrestoration.noaa.gov. Information about restoration projects and MAM activities, including any data and/or analyses produced and annual reports, are made publicly available via the Data Integration Visualization Exploration and Reporting portal (DIVER), available at https://www.diver.orr.noaa.gov/web/guest/deepwater-horizon-nrda-data.

To articulate its approach to MAM, the OO TIG released its MAM strategy in April 2019 and updated it in June 2020. The strategy describes the TIG's responsibilities, goals, and priorities for the use of the OO

Restoration Area MAM allocation. Three goals were identified for the use of OO MAM funds: (1) the evaluation of outcomes of the OO restoration effort across the portfolio of OO projects; (2) the identification and filling of data gaps that affect the OO TIG's ability to meet and/or evaluate progress toward restoration goals for OO resources; (3) and the identification of benefits and outcomes from OO restoration activities to resource, cross-resource, and ecosystem restoration across the northern Gulf of Mexico. The strategy also identifies three priorities for OO MAM: evaluation of restoration progress, identification of stressors, and assessment of focal species and important habitats. In addition to MAM goals and priorities, the strategy also describes the TIG's process to develop and release MAM Activities. MAM activities are projects or other MAM efforts (e.g., monitoring, modeling, data collection, studies) developed to address identified MAM priorities.

This MAM Activities Implementation Plan (MAIP) describes the MAM activity, "Conceptual Model to Inform Open Ocean Ecosystem Indicators" to begin to address MAM priorities preliminarily identified by the OO TIG for fish & water column invertebrates (FWCI), marine mammals, birds, mesophotic & deep benthic communities (MDBC), and sea turtle restoration types. The purpose of the conceptual model (CM) is to organize what we know and don't know about how restoration activities implemented by the OO TIG affect the resources and habitats that are the focus of Open Ocean restoration. The model will also illustrate the linkages among these resources and habitats, the threats and stressors that are a focus of the OO TIG's restoration work, specific OO TIG restoration actions, and the outside drivers, interactions, or uncertainties that could affect restoration outcomes.

The CM process will build on the OO TIG MAM ecosystem objectives and indicators effort underway to inform the selection of indicators of restoration progress and provide information on the stressors that have the greatest impact on resources. Specifically, the CM will aid in the refinement of indicators at the resource and ecosystem levels by providing information on variables likely to be sensitive to OO TIG restoration activities. This effort should help the OO TIG finalize its ecosystem-level indicators and evaluate how current and future projects may contribute to meeting ecosystem-level objectives. It will also identify data and other information gaps with recommendations on how best to fill them, addressing a key goal of the OO MAM Strategy and all three priorities identified above. This document provides details on how the MAM activity will be implemented and how data gaps and uncertainties can be addressed. It also describes the consistency of this activity with the programmatic alternative selected by the Trustees in the PDARP/PEIS.

2.0MAM Activity Description

2.1 Background

The objectives of this activity are to (1) support evaluation of restoration outcomes within the OO Restoration Area; (2) synthesize existing knowledge relevant to restoration of the OO TIG restoration types; (3) identify potential ecosystem indicators; and (4) assess uncertainties that are most important to consider for restoration planning and informing restoration decision-making and assessing restoration outcomes. This activity will compile current understanding of OO TIG restoration types by utilizing a CM framework to assess the drivers and stressors affecting multiple OO resources (i.e., FWCI, marine mammals and birds; MDBC; and sea turtles) and associated important habitats, thereby creating the building blocks to inform and refine evaluation of the OO TIG's ecosystem objectives and adaptive management of the TIG's restoration efforts. The conceptual modeling process is designed to identify

the information needed to evaluate the outcomes of OO TIG restoration work conducted under the restoration types and not assess overall ecosystem change. However, a key reason for selection of this activity is to look across all OO TIG restoration types in an ecosystem context (including considering the interactions among restoration types) to identify common parameters needed to evaluate restoration outcomes.

Maddox et al. (1999) identified three roles of CMs in guiding the development of monitoring and adaptive management programs: (1) summarize the most important ecosystem descriptors, spatial and temporal scales of biological processes, and current and potential threats to the system; (2) determine indicators for monitoring; and (3) help interpret monitoring results and explore alternative courses of management. Conceptual models provide a framework to synthesize substantial quantities of existing information into a single location that will evolve as understanding of the ecosystem increases (Gentile et al. 2001). The objective is to use and/or refine existing relevant CMs, or if needed build new CMs that will support ecosystem restoration and monitoring and evaluation efforts of the OO TIG. The CMs are a communication tool for development of a shared strategy, purpose, spatial domain, objectives, and indicators to inform priorities for restoration monitoring and adaptive management investments (Fischenich 2008). Scientific knowledge and other sources of information will be synthesized in the CM to help the OO TIG further develop and refine indicators of restoration type and ecosystem restoration outcomes, design restoration monitoring and evaluation approaches, inform future restoration decisions, and assess restoration outcomes within an adaptive management framework. Ideally, the CMs should be considered "living" documents that the TIG will regularly update as new or other existing science emerges.

No new data will be collected as this work will inventory and evaluate the literature, data, models, and projects within the OO TIG's restoration work already assembled by the DWH Trustees and other relevant programs or efforts. Because of this approach, this work has a high likelihood of success in compiling our current state of our knowledge to meet the MAM objectives and needs in a timely fashion.

2.2 Task Description

Task 1: Conceptual model development

The CM will compile information about (1) specific external and internal *Drivers* and *Stressors* that affect the current Open Ocean ecosystem related to the OO restoration types; (2) the *Pressures* from human activities or natural processes that generate stressors that affects ecosystem *State*; (3) the *Effects* of those drivers and stressors on processes and conditions related to the Open Ocean restoration types within the ecosystem; and (4) the physical, chemical, biological, and/or ecological *Attributes* that can best serve as indicators of ecological *Response* to OO TIG restoration actions. It will focus on the stressors and threats identified in the OO MAM Strategy, the Fish and Water Column Invertebrates Restoration Strategy, and current OO TIG projects and PDARP restoration approaches and the processes and conditions that could affect the TIG's ability to reduce those stressors and threats through planned restoration activities. Utilizing synthesis of scientific/technical literature and the Trustees' subject matter expertise, the CM will illustrate the relationships between the elements in the model (positive, negative, non-linear); the importance, understanding and predictability of the relationships (high, medium, low); and the quality of data currently available (good, fair, poor). One example that illustrates

how those relationships are incorporated in a CM is shown in Figure 1. By utilizing a similar approach, the CM will help assemble uncertainties across species, habitats and processes of the OO TIG restoration types, allowing for a fuller understanding of what we know and don't know within the ecosystem, and setting the stage for identifying which sources of uncertainty are most important to reduce (through monitoring, modeling, data synthesis, and other scientific inquiry) to improve restoration/management outcomes and assessments of outcomes over time.

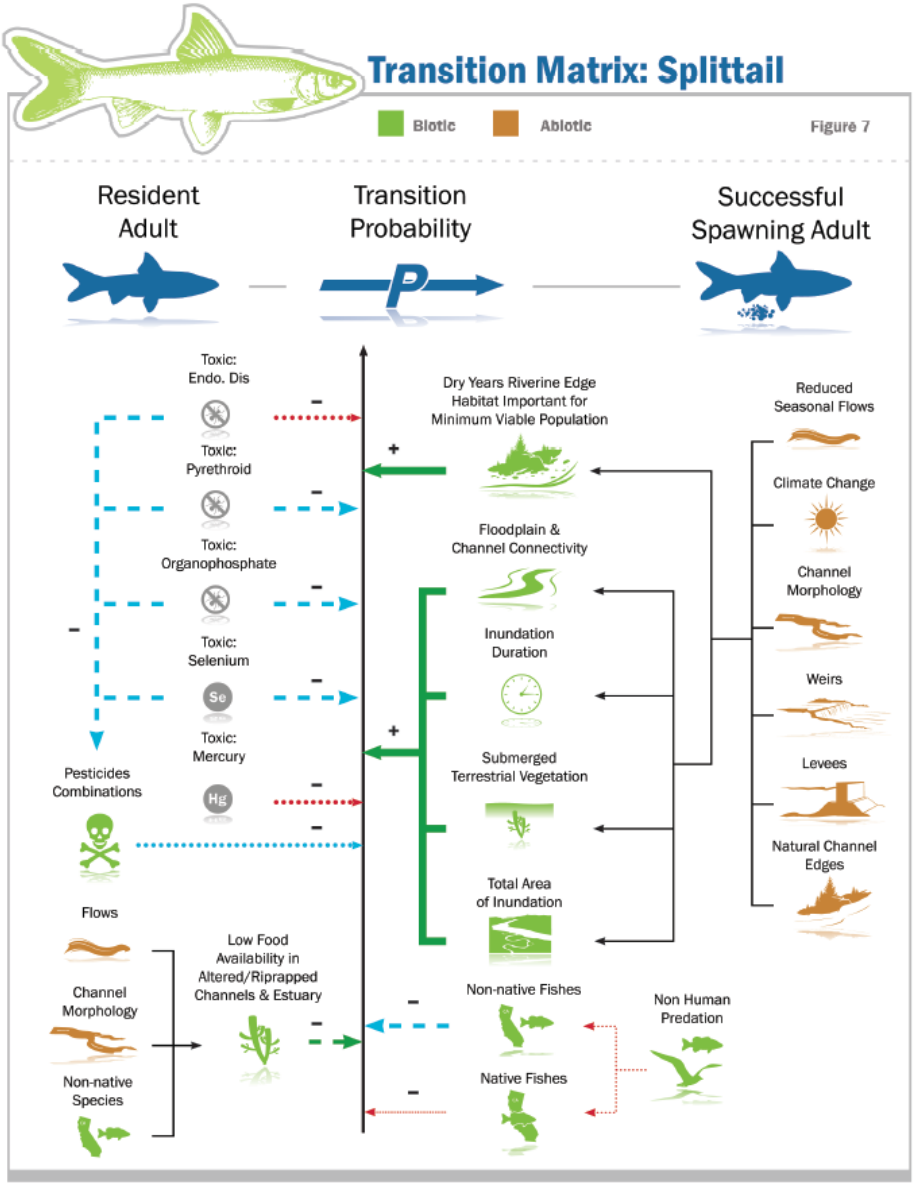

Fig. 1. Example conceptual model of Sacramento splittail life history that demonstrates how arrows in the CM represent the importance of the processes, the level of understanding of the processes, and the predictability of the processes. Red, blue and green; dotted, dashed and solid; and thin, thicker, thick arrows represent low, medium and high levels, respectively (From DiGennaro et al. 2012; Available: https://doi.org/10.15447/sfews.2012v10iss3art1).

In developing the CM, we will describe the causal pathways between existing and potential OO TIG restoration actions and the fundamental outcomes of interest for the OO TIG restoration types and the ecosystem. There are a number of published CMs that have been developed in the Gulf of Mexico that will serve as a starting point for a CM tailored to the Open Ocean TIG's restoration work related to open ocean resources and habitats (Kelble et al. 2013; Sandifer et al. 2017; Harwell et al. 2019; Murawski et al. 2020; Reum et al. 2021). This project would also leverage any previously developed restoration-focused CMs, causal chains, logic models, objectives and indicators developed by the Trustees and the subject matter experts participating in the OO TIG restoration type resource teams. The DWH Trustees and the OO TIG have developed programmatic documents that will provide key sources of information that will be synthesized in the CM. These documents will include, but are not limited to, the Regionwide TIG Strategic Frameworks for birds, marine mammals and sea turtles; Open Ocean TIG Monitoring and Adaptive Management Strategy; Fish and Water Column Invertebrates Restoration Strategy, and extensive literature reviews recently conducted by the Mesophotic and Deep Benthic Communities project teams. Information relevant to the CM includes goals and objectives, restoration approaches, planning needs, desired outcomes, priorities, threats, stressors, indicators, data gaps, and potential monitoring and adaptive management actions.

The OO TIG developed draft ecosystem objectives and indicators that target stressors identified in the OO TIG MAM Strategy document. This work should help inform and refine those objectives and indicators by looking across restoration types as well as at ecosystem scale to identify key drivers, stressors and threats, and critical uncertainties most important to reduce to improve ability to assess integrated ecosystem outcomes over time.

This activity will be conducted by an implementation team and include key tasks that are described below.

Task 1 implementation team:

(1) Core Team –They will serve as administrative and technical leads for the entire project and will be involved in all elements of the project. They will lead the compilation and synthesis of the scientific literature, direct the virtual meetings/workshop, participate in drafting and finalizing the CM, coordinate with all appropriate TIG small groups/resource teams/subject matter experts/etc., and be responsible for all outputs and deliverables.
(2) Lead CM Developers –They will have expertise in developing CMs and will lead the development of the CM with the core team, while also participating on the CM development team. They will participate in virtual meetings/workshop and in drafting and finalizing the CM.
(3) CM Development Team – The CM development team is comprised of the lead CM developers, and subject matter experts for OO resources (MDBC, FWCI, sea turtles, marine mammals, and birds) and the ecosystem. The subject matter experts on the CM development team will serve to refine CM drafts and assign values of importance, understanding and predictability to pertinent linkages in the model. They will participate in virtual meetings/workshops.

Task 1a: Coordination among OO TIG MAM and resource teams

The core team will develop regularly scheduled coordination meetings and expert elicitation sessions throughout the entire project life cycle. The primary goals of the coordination and expert elicitation will be to ensure (1) synergy between this activity and other OO TIG MAIPs being developed; (2) alignment with OO TIG development of ecosystem objectives and indicators; and (3) appropriate level of effort and

scheduling of OO resource teams. This task will ensure that the CM will be built upon existing pertinent literature, data and models and will incorporate through expert elicitation our current state of understanding of open ocean resources and the stressors that affect them.

Task 1b: Literature review

A literature review will be conducted to compile and synthesize scientific knowledge on the OO TIG resources and associated habitats, and the conditions, drivers, and processes within the Gulf ecosystem that affect those resources. Different CM framework options will be archived with the benefits and drawbacks of each approach (e.g., Kelble et al. 2013). This review will not be exhaustive but will focus on peer-review literature and technical reports that provide the current state of understanding such that a narrative can be written with appropriate citations to accompany the conceptual diagram. This synthesis will also include previous related MAM efforts conducted by the OO TIG. Data and models that inform linkages in the CM will also be compiled. The compiled literature will be provided to the OO TIG and made available to all Trustees and the public.

Task 1c: Drafting and refinement of conceptual model

The literature review will document the numerous CM frameworks that can be used to meet the objectives of this MAM activity. A determination will be made at the beginning of the project on which framework to use in consultation with the CM development team. We anticipate that we may utilize composite or nested sub-models that will provide interrelated layers of information such that one model may provide inputs to a second model (e.g., MDBC sub-model linked to FWCI sub-model). This would allow interactions among the OO TIG resources and habitats to be most efficiently captured in the context of the Gulf ecosystem. The core team along with the CM lead developers will draft the initial CM and will incorporate input from the OO TIG. The OO resource team members, as subject matter experts (SMEs), will then work closely with the developers of the CM to refine CM drafts. A virtual workshop (or series of virtual resource-specific meetings) will be conducted to review CM drafts, led by the Core Team and CM Development Team, and will include invitations to the OO TIG members, and other identified SMEs (primarily internal) familiar with relevant science. Team members will provide expert knowledge on key model components, sub-models, and interactions, and through iterative resource-specific roundtable discussion, values of importance, understanding and predictability will be assigned to pertinent linkages in the model and agreed upon.

Outputs

- The CM documentation will be included in a report which will identify the intended scope of the model, the content and structure of the model, the supporting literature and information synthesis, summaries of important uncertainties to reduce and processes to understand to improve predictability, and guidance regarding its application as part of the TIG's adaptive management framework.
- Compiled literature will be placed on the NOAA SharePoint OO TIG MAM site and made available to all Trustees.
- A peer-reviewed publication.
- Annual progress reports, including progress on deliverables within each fiscal year.

Timeline

This activity will occur over a period of two years starting at the development of an active agreement and receipt of funding. We anticipate this activity will begin in December 2022 and continue through the end of December 2024.

	FY23	FY24	FY25
Coordination			
Literature review			
Draft CM			
Final products			

Budget

The total budget requested for this MAM activity is $347,349.

Cost Category	DOI Cost Estimate	NOAA Cost Estimate
Planning and Design (Core Team)	$49,460	$59,400
Implementation (CM Development Team)	$71,925	$78,950
MAM Activity Management, Oversight, and Reporting	$17,765	$38,272
TOTAL	**$139,150**	**$176,622**
TOTAL MAM ACTIVITY COST WITHOUT CONTINGENCY	**$315,772**	
Contingency (10%)	$13,915	$17,662
TOTAL ESTIMATED COST	**$153,065**	**$194,284**
OVERALL ESTIMATED COST	**$347,349**	

3.0 Roles and Responsibilities

NOAA and DOI will be the Implementing Trustees responsible for implementing this MAM activity. The CM Core team will be comprised of two project managers, one from NOAA and one from USGS, that will serve as both technical and administrative leads. Both Trustees will be responsible for coordinating with the OO TIG and providing overall direction and oversight for this MAM activity, including administration of any contracts or cooperative agreements, completing compliance requirements, financial tracking, annual reporting, and DIVER data management.

4.0 Data Management and Reporting

The DWH Trustees, as stewards of public resources under the Oil Pollution Act (OPA), will inform the public on the MAM activity's progress and performance. Therefore, NOAA and DOI will report the status of the proposed activity via the Data Integration, Visualization, Exploration, and Reporting (DIVER) Restoration Portal annually, as outlined in Chapter 7 of the PDARP/PEIS (DWH NRDA Trustees 2016). All reports and documentation created or compiled as part of this MAM activity, including the CM, associated documentation, literature review, and peer-reviewed publication, will also be stored on the DIVER Restoration Portal. Data storage and accessibility will be consistent with the guidelines in Section 3.1.3 of the MAM Manual (DWH NRDA Trustees 2021).

5.0 Consistency with the DWH Programmatic Restoration Plan

This MAM activity is consistent and aligns with the comprehensive, integrated ecosystem restoration approach selected as the preferred alternative in the PDARP/PEIS (section 5.5). This activity will specifically demonstrate how restoration activities conducted for the OO TIG restoration types collectively contribute to the Restoration Type goals described in the PDARP/PEIS, including the goals for *Fish and Water Column Invertebrates*, (section 5.5.6), *Sea Turtles* (section 5.5.10), *Marine Mammals* (section 5.5.11), *Birds* (section 5.5.12) and *Mesophotic and Deep Benthic Communities* (section 5.5.13), along with the intent of the comprehensive, integrated ecosystem approach described in the summary of the preferred alternative (section 5.10.1). This MAM activity has direct linkages to the PDARP/PEIS, *Monitoring and Adaptive Management Framework* (section 5.E), in that the resulting CM will assist the Trustees in synthesizing monitoring information and evaluating restoration outcomes across multiple injured resources and will inform adaptive management of OO TIG restoration at regional scales.

6.0 Compliance Considerations

6.1 NEPA Review and Conclusion

The Trustees' approach to compliance with NEPA summarized in this section is consistent with, and tiers where applicable from the PDARP/PEIS Section 6.4.14. Resources considered and impact definitions (minor, moderate, major) align with the PDARP/PEIS. Relevant analyses from the PDARP/PEIS are incorporated by reference. Such incorporation by reference of information from existing plans, studies or other material is used in this analysis to streamline the NEPA process and to present a concise document that briefly provides sufficient evidence and analysis to address the OO TIG's compliance with NEPA (40 CFR 1506.3, 40 CFR § 1508.9). All source documents relied upon are available to the public and links are provided in the discussion where applicable.

As discussed in Chapter 6 of the PDARP/PEIS, a TIG may propose funding a planning phase (e.g., initial engineering, design, and compliance) in one plan for a conceptual project, or for studies needed to maximize restoration planning efforts. This would allow the TIG to develop information needed leading to sufficient project information to develop a more detailed analysis in a subsequent restoration plan, or for use in the restoration planning process. Where these conditions apply and activities are consistent with those described in the PDARP/PEIS, NEPA evaluation is complete, and no additional evaluation of individual activities is necessary at this time.

NEPA Review of MAM Activity

The activities and tasks described here consist exclusively of desktop analysis of existing literature, existing data resources, report development, and engagement of subject matter experts. This activity would include data collation and synthesis with no field data collection. Consequently, there will be no impact to resources as defined within the PDARP/PEIS.

NEPA Conclusion

After review of the proposed activities against those actions previously evaluated in the PDARP/PEIS, the OO TIG determined that the environmental consequences resulting from this MAM activity falls within the range of impacts described in Section 6.4.14 of the PDARP/PEIS, thus no additional NEPA evaluation is necessary at this time.

6.2 Compliance with Other Environmental Laws and Regulations

There will be no fieldwork as part of this MAM activity, thus further compliance reviews are not necessary because there will be no effects to protected species, their habitats, or to cultural resources. No consultations, permits or authorizations are needed to complete this MAM activity. See the table below for the compliance status by statute at the time of this MAIP.

Federal environmental compliance responsibilities and procedures follow the Trustee Council Standard Operating Procedures (SOP), which are laid out in Section 9.4.6 of that document. Following the SOP, the Implementing Trustees for each activity will ensure that the status of environmental compliance (e.g., completed vs. in progress) is tracked through the Restoration Portal.

Documentation of regulatory compliance will be available in the Administrative Record that can be found at the DOI's Online Administrative Record repository for the DWH NRDA (https://www.doi.gov/deepwaterhorizon/adminrecord). The current status of environmental compliance can be viewed at any time on the Trustee Council's website: http://www.gulfspillrestoration.noaa.gov/environmental-compliance/.

Status of federal regulatory compliance reviews and approvals.

Federal Statute	Compliance Status
Bald and Golden Eagle Protection Act (USFWS)	N/A
Coastal Barrier Resources Act (USFWS)	N/A
Coastal Zone Management Act	N/A
Endangered Species Act (NMFS)	N/A
Endangered Species Act (USFWS)	N/A

Essential Fish Habitat (NMFS)	N/A
Marine Mammal Protection Act (NMFS)	N/A
Marine Mammal Protection Act (USFWS)	N/A
Migratory Bird Treaty Act (USFWS)	N/A
National Historic Preservation Act	Complete
Rivers and Harbors Act/Clean Water Act	N/A
National Environmental Policy Act	Complete, based on Section 6.4.14 of the Final PDARP/PEIS and above in the Summary NEPA Review section

7.0 References

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