Environmental Assessment
Finding of No Significant Impact and
Section 404(b)(1) Evaluation for
Maintenance Dredging

Kennebec River
Sagadahoc County, Maine

US ARMY CORPS
OF ENGINEERS
New England District

June 2011

Environmental Assessment
Finding of No Significant Impact
Section 404 (b)(1) Evaluation

Maintenance Dredging of the Kennebec River Federal Navigation Channel Sagadahoc County, Maine

Prepared by:

New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, Massachusetts 01742

June 2011

ENVIRONMENTAL ASSESSMENT

Page

Environmental Assessment

1.0 INTRODUCTION

The purpose of this Environmental Assessment (EA) is to present information on the environmental features of the project area and to review design information to determine the potential impacts of the proposed project on the environment. This EA describes project compliance with the National Environmental Policy Act of 1969 (NEPA) and all appropriate Federal and State environmental regulations, laws, and executive orders. This report provides an assessment of the potential environmental effects of maintenance dredging the Federal Navigation Project (FNP) in the Kennebec River, Bath and Phippsburg, Maine. Methods used to evaluate the environmental resources of the area include biological sampling, sediment analysis, review of available information, and coordination with appropriate environmental agencies and knowledgeable persons. This report provides an assessment of environmental impacts and alternatives considered along with other data applicable to the Clean Water Act Section 404 (b) 1 Evaluation requirements.

The authorized FNP in the lower Kennebec River is located in Sagadahoc County below Bath, Maine (Figure 1). The FNP consists of a channel 27 feet below Mean Lower Low Water (MLLW) and 500 feet wide extending from the river mouth to just above the Route 1 highway bridge in Bath. Frequent shoaling of the Kennebec River means that maintenance dredging is required every few years. Typically, maintenance dredging occurs during a one month period between late fall and spring. The two areas most frequently in need of dredging are: 1) south of the city of Bath near Doubling Point, and 2) the mouth of the Kennebec River near Popham Beach (near North Sugarloaf Island). Historically dredged material removed from the channel at Doubling Point has been disposed of at an in-river disposal area located just north of Bluff Head. This area is also known as the Kennebec Narrows or Fiddlers Reach (Figure 2). Material dredged from the channel at the river mouth near Popham Beach has been placed at a previously used nearshore disposal site just south of Jackknife Ledge (Figure 3).

The frequent need for maintenance dredging in the Kennebec River prompted the preparation of a generic EA in March 2002 to cover maintenance dredging in the Kennebec River for ten years (i.e. until the year 2012). The generic EA concluded that in order to protect the shortnose sturgeon *(Acipenser brevirostrum)*, a species listed as endangered under the Federal Endangered Species Act (ESA), maintenance dredging in the Doubling Point area should only occur between November 1 and April 30. However due to extensive shoaling of the FNP and the critical need to move a U.S. Navy destroyer in the fall of 2011, it is anticipated that dredging of the FNP will need to be performed in August 2011, outside of the recommended dredging window for shortnose sturgeon. Since the 2002 EA was prepared, the upper Kennebec River remnant population of the Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon was included in the endangered species listing pursuant to the ESA by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (US FWS). This listing provides measures to protect the Atlantic salmon in the Kennebec River from adverse effects of dredging as well as other activities. In addition, the GOM DPS of Atlantic sturgeon is proposed to be listed as threatened by the NMFS. Therefore, dredging of the FNP will need to be conducted in accordance with the requirements of the ESA. This EA will

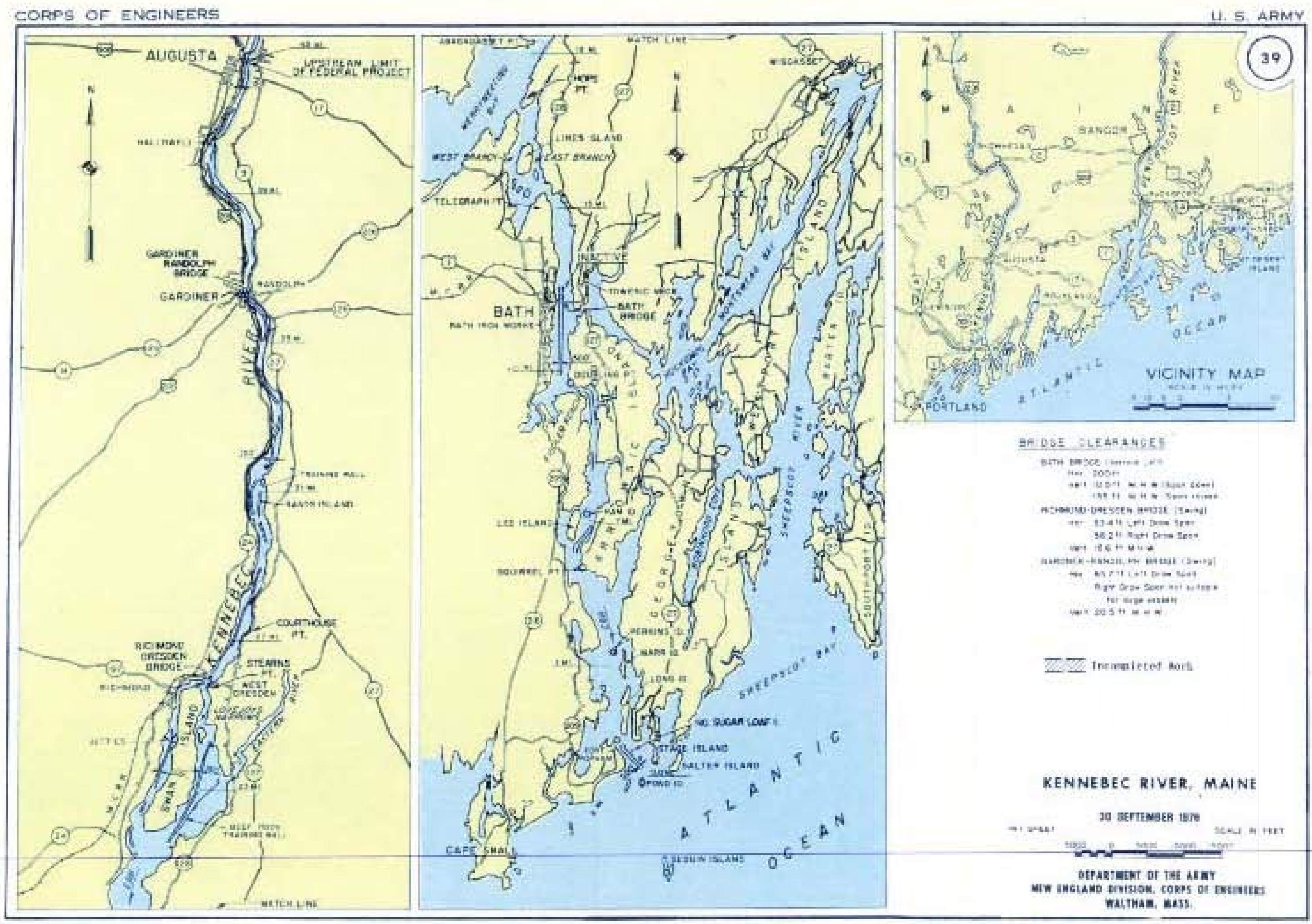

Figure 1. Map of the Kennebec River Federal Navigation Channel

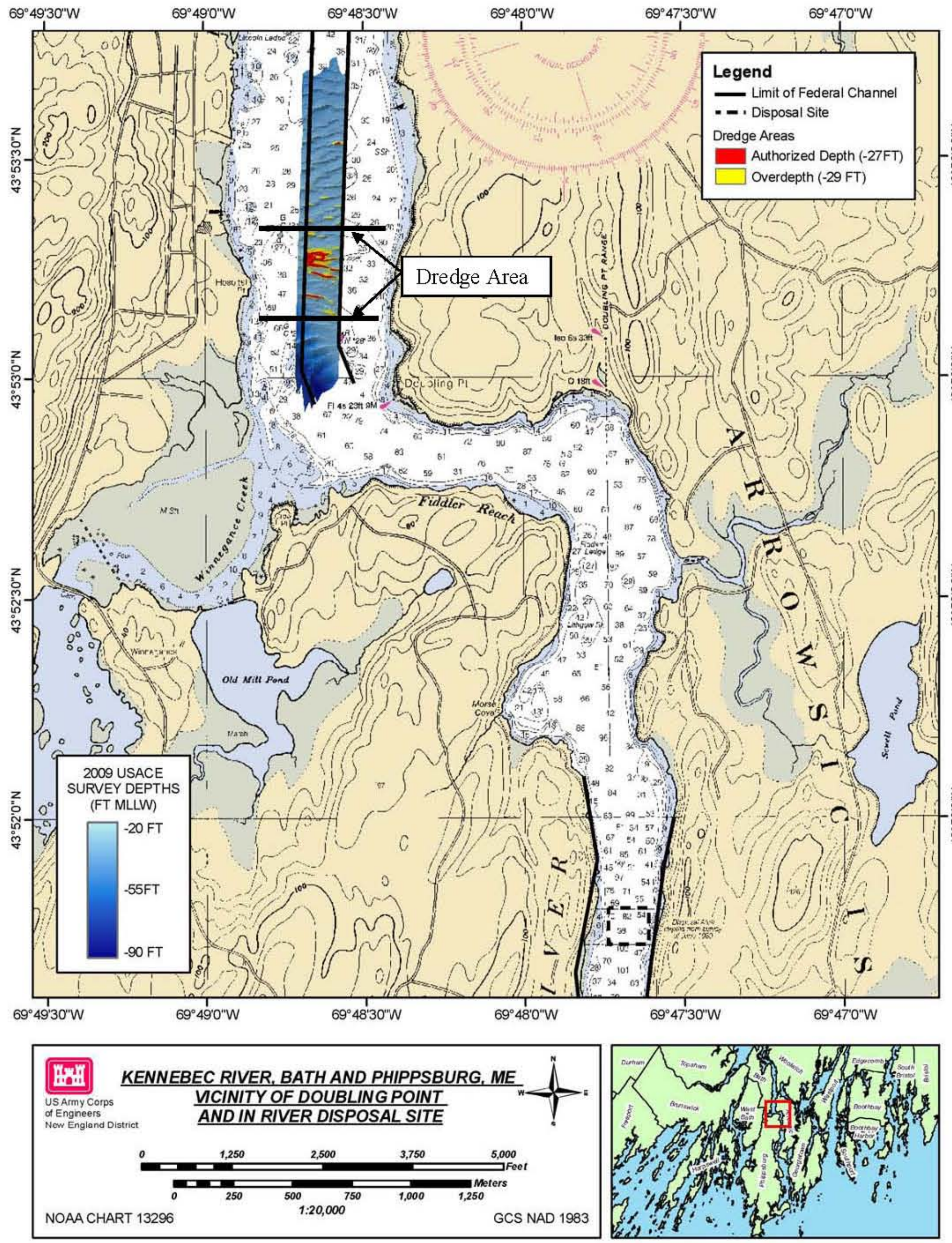

Figure 2. Doubling Point dredge area and Bluff Head disposal area of the Kennebec River Federal Navigation Project.

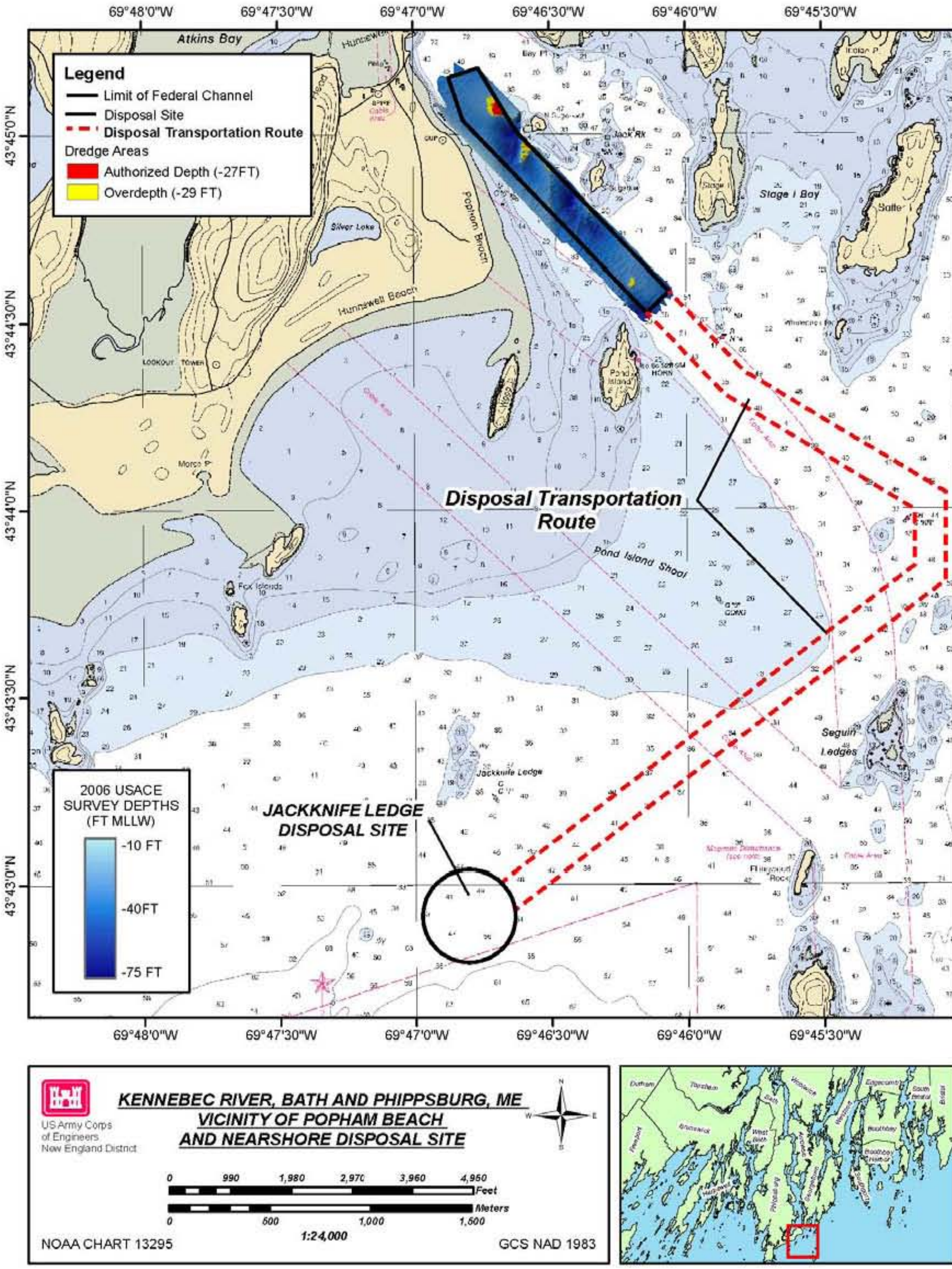

Figure 3. Map of Popham Beach dredge area and Jackknife Ledge disposal area of the Kennebec River Federal Navigation Project.

cover the dredging that is proposed to be performed in August 2011 and its potential associated environmental impacts.

2.0 PURPOSE AND NEED

2.1 Project Purpose and Need

The purpose of the proposed activity is to maintain the Kennebec River FNP to allow safe navigation of the lower Kennebec River consistent with the levels of navigation Congress intended in authorizing the FNP. In evaluating alternatives to achieve the proposed project purpose, the Corps is responding to the navigation needs in the Kennebec.

Deep draft vessels transit the Kennebec to and from Bath Iron Works (BIW), a large shipbuilding facility presently under contract with the U.S. Navy. These vessels include frigate, destroyer and cruiser class ships for the U.S. Navy and container cargo ships for commercial firms. Shoaling at Doubling Point and near Popham Beach inhibits passage of vessels being constructed or repaired at BIW to and from open water. A December 2010 hydrographic survey indicated that the channel had shoaled to 19.7 feet below mean lower low water (MLLW) near Doubling Point, and to less than 27 feet MLLW at the Popham Beach area (Appendix G). Additional surveys conducted during February and May of 2011 have shown that shoaling in the channel remains at approximately 22.4 feet below MLLW at Doubling Point and 22.3 feet at Popham Beach (Appendix G). The river turns sharply near Doubling Point, making this section of the Kennebec challenging for large ships to navigate. The Navy has indicated that the shoaling of the channel has created a critical safety impact on deep draft vessels attempting to use the FNP, and there is concern that US Navy destroyers cannot transit the channel safely even during high tides.

The newly constructed U.S. Navy destroyer, the U.S.S. SPRUANCE is scheduled to sail away from BIW and transit the Kennebec River to sea on or about September 1, 2011. The SPRUANCE has been deemed critical to national defense and its departure from the BIW cannot be delayed. The Navy has indicated that failure of the SPRUANCE to sail on the required date will have a critical impact to Navy fleet operations and national defense. The Navy has indicated that this will seriously and negatively affect operational schedules, and will restrict the Navy Fleet Commander's ability to surge deployable strike capability as directed by the National Command Authority (NCA). The Navy has indicated that delay to the ship's schedule creates an unacceptable limitation to the Navy's ability to execute NCA tasking while on a wartime footing.

2.2 AUTHORIZED FEDERAL NAVIGATION PROJECT

The existing FNP for the lower Kennebec River, Maine was adopted in 1902, and supplemented by River and Harbor Acts in 1907, 1913, and 1940. The project provides for a navigation channel 27 feet deep at MLLW and at least 500 feet wide, extending from the mouth of the river near Popham Beach to about 13 miles upstream to the city of Bath. The portion of the 27-foot navigation channel above the bridge is considered inactive (Figure 1).

3.0 PROPOSED PROJECT DESCRIPTION

Maintenance dredging of the Kennebec River FNP is needed to remove hazardous shoals from the channel in the vicinity of Doubling Point (just below Bath) and at the mouth of the river near Popham Beach in advance of the departure date of the newly constructed USN Destroyer, the U.S.S. SPRUANCE scheduled to depart from Bath Iron Works on September 1, 2011. A total of about 70,000 cubic yards (i.e. 50,000 cubic yards from Doubling Point and 20,000 cubic yards from Popham Beach) of clean sandy material would be removed from the channel. The shoals, especially those in the Doubling Point area consist of massive sandwaves oscillating within vertical and horizontal ranges; the elevation at the tips of these sandwaves vary from -22.4 to -26.8 feet MLLW. As part of this proposal, advance maintenance at Doubling Point may be performed to remove the sandwaves to an elevation of -30 feet MLLW, with an allowable overdepth of up to 2 feet (to a total maximum elevation of -32 feet) in an effort to improve the chance that adequate depths will endure in the channel near Doubling Point. The proposed work will be performed with a hopper dredge over a three to five week period beginning on or about August 1, 2011. The material dredged from the Doubling Point area will be disposed of at the previously used in-river disposal site located north of Bluff Head in about 30 to 100 feet of water with an average depth of 76.5 feet (Figure 2). This site was used in 1986, 1991, 1997, 2000, 2002 and 2003. Material dredged from the channel near Popham Beach will be disposed at a 500 yard circular disposal site located about 0.4 nautical miles south of Jackknife Ledge in depths of about 40 to 50 feet below MLLW (Figure 3). The Jackknife Ledge disposal site was most recently used in 1989, 1997, 2000, 2002 and 2003. As in previous years, the material dredged from the channel at the mouth of the river will be transported to Jackknife Ledge within a designated haul route (Figure 3).

See Table 1 for a dredging history of the project.

TABLE 1. Kennebec River Federal Navigation Channel Dredging History
(DP= Doubling Point, PB=Popham Beach)

Work Dates	Work Accomplished	Quantities
1941 – 1943	Improvement Dredging of the 27-Foot Channel up to Bath	27,196 cy Plus 35,794 cy Ledge
1947	Maintenance Dredging of the 27-Foot Channel up to Bath by US Hopper Dredge	93,835 cy
1950	Maintenance Dredging (4 areas incl. DP & PB) of the 27-Foot Channel up to Bath by US Hopper Dredge	108,830 cy
1953	Maintenance Dredging of the 27-Foot Channel up to Bath by US Hopper Dredge	58,390 cy
1955	Maintenance Dredging (DP & PB) of the 27-Foot Channel from Popham up to Bath by US Hopper Dredge	14,100 cy
1956	Maintenance Dredging (DP & PB) of the 27-Foot Channel up to Bath by US Hopper Dredge	4,707 cy
1958	Maintenance Dredging (DP & PB) of the 27-Foot Channel up to Bath by US Hopper Dredge	26,183 cy
1964	Maintenance Dredging (DP & PB) of the 27-Foot Channel up to Bath (Contract Terminated)	4,900 cy
1965	Maintenance Dredging (DP & PB) of the 27-Foot Channel up to Bath (completion of 64 contract)	14,400 cy
1967	Maintenance Dredging (DP & PB) of the 27-Foot Channel up to Bath by US Hopper Dredge	64,200 cy
1968	Maintenance Dredging of the 27-Foot Channel up to Bath by US Hopper Dredge	32,070 cy
1971	Maintenance Dredging (4 areas) of the 27-Foot Channel up to Bath by US Hopper Dredge	54,534 cy
1975	Maintenance Dredging (DP only) of the 27-Foot Channel by US Hopper Dredge	102,930 cy
1982	Maintenance Dredging (DP only) of the 27-Foot Channel	53,300 cy
1986	Maintenance Dredging (DP only) of the 27-Foot Channel by US Hopper Dredge	57,902 cy

Table 1. (Continued)

Work Dates	Work Accomplished	Quantities
1989	Maintenance Dredging (DP & PB) of the 27-Foot Channel up to Bath by US Hopper Dredge	77,362 cy
1991	Maintenance Dredging (DP only) of the 27-Foot Channel	69,000 cy
1997	Maintenance Dredging (DP & PB) of the 27-Foot Channel below Bath by Hopper Dredge	21,660 cy
2000	Maintenance Dredging (DP & PB) of the 27-Foot Channel below Bath by Hopper Dredge	19,900 cy
2002	Maintenance Dredging (DP & PB) of the 27-Foot Channel below Bath by Hopper Dredge	21,582 cy
2003	Emergency Maintenance Dredging (DP & PB) of the 27-Foot Channel below Bath by Hopper Dredge	22,310 cy

4.0 ALTERNATIVES

4.1 No Action

The "No Action" alternative would consist of not dredging the shoaled areas of the Federal navigation project at Doubling Point and Popham Beach. The effects of a "No Action" approach are discussed here, both in terms of environmental and navigation impacts.

The Kennebec River is a dynamic system influenced by strong tidal currents and occasional significant storm runoff events. Shoals, especially those at Doubling Point typically consist of massive sand-waves that generally begin to form in the summer and continue to worsen into the fall and winter months. Shoaling at Doubling Point can be somewhat unpredictable as the extent of shoaling is highly dependent on the river flow throughout the year, and significant runoff events (typically occurring in the springtime) have on occasion completely dispersed the shoaling there. Conversely, significant runoff events can also exacerbate shoaling by scattering them to different locations within the river near Doubling Point.

The Corps performed hydrographic surveys of the Federal channel and an area outside of the east channel limit near Doubling Point in December 2010 and again in February 2011 (Appendix G) prior to scheduled transits of the SPRUANCE to and from sea trials. These surveys indicated that shoaling to a controlling depth of 19.7 feet below MLLW had occurred in the authorized 27 foot deep Federal channel just north of Doubling Point. At the time that these surveys were performed, shoals near Doubling Point extended from the west channel limit and stretched across almost the entire width of the authorized 500 foot wide navigation channel. The surveys also indicated that there was a narrow area near Doubling Point with deeper depths outside (adjacent to) the east channel limit, and closer to the east bank of the Kennebec River. The Corps performed another hydrographic survey (Appendix G) in mid-May 2011 to re-examine the conditions in the river and determine to what extent the spring runoff events had affected the shoaling. These surveys showed that some scouring of the material had occurred in the channel with the controlling depth of the channel near Doubling Point deepening to 22.4 feet below MLLW, but sand wave shoals now crossed the entire channel and began to extend outside the channel to the east.

With the benefit of the surveys from December 2010, February 2011, and May 2011 (see Appendix G), the Corps evaluated the viability of the "No Action" alternative from a navigation perspective, particularly as to the passage of the SPRUANCE in September 2011. Earlier in 2011, Bath Iron Works (BIW), with the assistance of Captain Earl Walker of the Portland Pilots, had safely navigated the SPRUANCE around the shoals in the channel to and from sea trials during February and March. To accomplish this, the SPRUANCE left the Federal channel near Doubling Point and navigated in an area to the east of the channel. Given the length, breadth and draft of the SPRUANCE, the significant currents in the river, and that there is almost a 90 degree bend to the east in the river just downstream of the shoals, transiting the ship outside the limits of the authorized Federal navigation channel was a maneuver that carried substantial risk. By leaving the channel to the east in this manner, the vessel was brought away from the centerline of the river and closer to the east bank; an area where ledge and other shoals and obstructions exist. With the results of the May 2011 surveys, the Corps coordinated with Navy personnel, BIW, and Captain Earl Walker (who will be aboard the SPRUANCE when it sails in September to assist the Navy Commanding Officer). Although some of the shoaling had been reduced—likely due to spring runoff events—the sand wave shoals now crossed the entire channel, and some now extended to the east, into the areas where the SPRUANCE had navigated to the sea trials. With the typical pattern of additional shoaling during summer months, it is anticipated that the sand waves will grow in size and may continue to develop to the east of the channel.

Because spring runoff events have not dispersed the shoaling to an acceptable level, failure to dredge the authorized Federal channel (under the "No Action" alternative) will likely result in further accretion of sand to the existing shoals during the summer months in a manner that will exacerbate navigation concerns. The "No Action" alternative would result in avoidance of the impacts of dredging and disposal activities that are described and analyzed in this document, but there would be negative consequences to navigation that could lead to potentially severe environmental impacts. Further shoaling could make the river (i.e. the channel and adjacent areas) totally impassible to deep draft vessels, and the Navy would be unable to deploy the SPRUANCE to accomplish its national security mission. If the shoals are not removed and the Navy attempts the transit of the SPRUANCE, there would be a substantial risk of grounding the vessel. Grounding the SPRUANCE could cause significant damage to the sonar dome, the hull and the propellers as well as cause injury to Navy personnel. Such damage to the ship and injuries to personnel would delay the departure date of the SPRUANCE and impact the Navy's ability to perform its mission in support of national security. Similar harms could occur to other deep draft ships attempting passage through this area. As noted above, sand wave shoals have begun to develop in the area to the east of the channel in which the SPRUANCE transited in

February and March 2011. This area is adjacent to ledge, and attempting to navigate the ship further to the east than was done for the sea trials would create greater risk of grounding on ledge. In addition to the harms to the SPRUANCE and Navy personnel described above, a grounding of the vessel--or other deep draft vessels--on ledge is more likely to cause an oil spill or a release of other hazardous materials that may have significant and potentially irreversible environmental impacts. Additionally, BIW is a major employer in the state; the inability of Navy vessels and other deep draft vessels to access and egress from this facility would represent a significant negative impact on the economic stability of the region.

Based on the hydrographic surveys, historic shoaling patterns, and coordination with the Navy, BIW, and Captain Walker, the Corps determined that maintenance dredging of the channel is warranted and the "No Action" alternative would not be viable to address the navigation needs of the Navy. This determination was made in light of the most current information concerning the sand wave shoals, a projection of what the channel conditions might be in late August 2011 (i.e. prior to the scheduled departure date of the SPRUANCE), and the contract procurement process. Likewise, beyond failing to address the immediate navigation needs, over the long term, the "No Action" alternative will result in additional shoaling and failure to provide the authorized project depths that Congress has deemed appropriate for navigation in the Kennebec River.

4.2 Dredging the Federal Navigation Channel

DEFINITIONS:

Allowable Overdepth: Allowable overdepth is a construction design method for dredging that occurs outside the required authorized dimension prism to compensate for physical conditions and inaccuracies in the dredging process and allow for efficient dredging practices.

Advance Maintenance Dredging: Advance maintenance dredging is dredging to a specified depth and/or width beyond the authorized channel dimensions in critical or fast-shoaling areas to avoid frequent redredging and ensure the reliability and least overall cost of operating and maintaining the project's authorized dimensions.

4.2.1 Maintaining the Channel to Authorized Dimensions

In this alternative, the channel would be dredged to its authorized dimension of 27 feet deep MLLW and 500 feet wide in both the Doubling Point and Popham Beach reaches of the river. In standard dredging contracts, two feet of additional dredging (i.e. beyond the authorized depth) termed "allowable overdepth" is provided for to account for inaccuracies in the dredging process; therefore, under this alternative, removal of dredged material may occur down to elevation -29 feet MLLW. This would involve removing approximately 40,000 cy of material from the river at Doubling Point and Popham Beach. This alternative would remove only the material required to restore the channel to its authorized depth and not include any advance maintenance dredging. Since it would involve the removal of less material from the river than advance maintenance dredging, it would take less time to complete the work (approximately two to four weeks), and therefore possibly lessen the potential environmental impacts associated with the dredging (due to a shorter exposure time).

However because of the nature of the shoals (i.e. sandwaves) at Doubling Point removing less material (there) may mean that maintenance dredging is required sooner and more frequently than it would if advance maintenance dredging to deeper depths is performed. Therefore, there would potentially be less time between dredging events and less time for the affected biological communities to recover from any negative effects that may have occurred from the previous dredging. In addition, it would require remobilization of the dredging equipment which would incur a disproportionately larger expense to do the work. However it could result in the next maintenance dredging of the channel being performed in the recommended windows that have been established to minimize the negative effects to the biological community, including the endangered shortnose sturgeon, presuming there are not future emergency needs to be addressed outside these windows. However, with the unpredictability of the shoaling in the river, it may still be necessary to dredge outside of the windows in order to clear shoaling that may be interfering with navigation.

4.2.2 Maintaining the Channel to Authorized Dimensions Plus Advance Maintenance Dredging at Doubling Point

This alternative encompasses the alternative described in section 4.2.1 "Maintaining the Channel to Authorized Dimensions" and also includes advance maintenance dredging to remove the sand-waves at Doubling Point to an elevation of -30 feet, plus 2 feet of allowable overdepth. Under this alternative, dredging may occur down to a maximum elevation of 32 feet below MLLW. Advance maintenance dredging is proposed at Doubling Point in an effort to improve the chance that adequate depths will endure there and increase the length of time before dredging is necessary again. The area of the proposed advance maintenance dredging is within the footprint of the authorized FNP and is concentrated in an area adjacent to Doubling Point. Advance maintenance dredging of this portion of the FNP has been performed previously. An analysis of previous maintenance dredging projects involving advance maintenance dredging at Doubling Point indicates that advance maintenance dredging may extend the time between when dredging is needed again by almost 2 years. Although this may require additional time to complete (up to one additional week), this alternative provides the greatest public benefits, results in no significant, long-term adverse impacts on the environment, and satisfies the Corps of Engineers' Congressionally-mandated direction to maintain the Kennebec River Federal project sufficiently for project users.

4.3 Alternative Dredging Methods

The proposed work will be conducted using a hopper dredge, but use of a mechanical and cutterhead pipeline dredge were also evaluated as well as dragging in response to public comments.

4.3.1 Hydraulic Cutterhead Dredge

Hydraulic dredges consist of a cutterhead on the end of an arm connected to a pump, which loosens the bottom sediments and entrains them in a sediment-water slurry that is pumped up from the bottom. The dredged material can then either be discharged away from the work area (sidecast), or pumped via pipeline to a dewatering area or disposal site. A hydraulic dredge is generally used for material that will be disposed in an upland area or directly onto a nearby beach or for pumping any type of unconsolidated material (e.g. silty material) to a confined (diked) disposal/dewatering area. Strong currents in the Kennebec River would make positioning the dredge and pipeline extremely difficult. The pipeline may need to be separated to allow vessels to transit the area. These conditions would decrease the efficiency of the dredging operation, generating increased turbidity and increasing cost and time of the operation. This option was eliminated from further consideration because of the anticipated dredge operating difficulties due to swift river conditions and weather conditions especially at the mouth of the river and the lack of a suitable and viable disposal site. Additionally removing the sand from the river system for upland disposal is not a preferred action (see Section 4.4.1 below).

4.3.2 Hopper Dredge

Hopper dredges are best suited and most productive for dredging sandy material over long straight reaches (e.g. entrance or bar channels). Hopper dredges work in a "back and forth" motion over the dredge area. A hopper dredge uses a suction pump (similar to a hydraulic pipeline dredge) and drag-arms that hang down from the side of the vessel to loosen and remove material from the bottom. The dredged material is drawn up through the drag-arms in a slurry of water and sediment and is deposited into hoppers or holds aboard the dredge vessel. As pumping continues, the sand settles to the bottom of the hopper and excess water flows overboard though troughs. When the hoppers are full, the drag-arms are raised and the dredge proceeds to the disposal site and either releases the material through bottom opening doors to the ocean floor. The doors are then closed and the dredge returns to the dredging area to repeat the cycle. A hopper dredge is suitable for the Kennebec work because it typically dredges while moving against the current, taking advantage of river conditions rather than opposing them. Hopper dredges are classified as small, medium and large based on their size and their capacity. Bin (or hopper) capacities range from a few hundred cubic yards to several thousand yards capacity. For the Kennebec River a medium sized hopper dredge is likely to be used and the material will be placed in-river and at a nearshore disposal area, thereby keeping the sand with the littoral system.

4.3.3 Mechanical Dredge and Attendant Scow

Mechanical bucket dredging involves the use of a stationary barge-mounted crane, backhoe or cable-arm with a bucket to dig the material from the harbor bottom. Typical dredging buckets come in various sizes from five or so cubic yards to fifty or more cubic yards. A mechanical dredge is well suited to work in tight quarters such as small harbors and in and around berthing areas and slips. The material is placed in a scow for transport to the disposal site by tug. For open-water or ocean disposal, a split-hull scow is generally used for ease of disposal and to minimize the discharge plume. Material is typically discharged at a dump buoy, or by using preset coordinates monitored by the tug.

A mechanical dredge is not the preferred dredge since it is not as efficient as a hopper dredge for this type of dredging due to the currents and weather factors, especially at the mouth of the Kennebec River. Although a large mechanical dredge might be able to accomplish this work, due to its stationary nature and conditions in the Kennebec River, it would require more time to complete the work than a hopper dredge, and therefore may increase the opportunity for interactions between the dredge and the endangered shortnose sturgeon. Moreover, while a hopper dredge may entrain and injure sturgeon, there is still a risk of injuries to sturgeon with mechanical dredge operations (NMFS, 2004), though detection of injured or killed sturgeon would be more difficult with a mechanical dredge. The National Marine Fisheries Service (NMFS), the Federal agency with authority over ESA listed and proposed species, has indicated a preference for the shorter-duration hopper dredge over a mechanical dredge operation.

4.3.4 Dragging

During the public comment period several commenters suggested that dragging be employed to knock the sand crests into the adjacent trough instead of using conventional dredging techniques to accomplish this project. Dragging an I-beam behind a dredge or tug to move the sand in a high current environment would be tenuous at best and would create high levels of turbidity and does not remove most of the material from the channel. This technique has not proved to be successful for large quantities of sand (Levin *et al*., 1992). Also since the material would not be removed from the channel and the physical parameters that create the sand waves are still occurring there is no guarantee that the shoals will not reform immediately. In the SAIC (1984) study looking at the effectiveness of dredging the sand shoals in the Doubling Point area found that renewed shoaling was observed four months after dredging. Due to potential safety concerns with dragging an I-beam in a strong current, the lack of success in using dragging for removal of large sand waves, the lack of information on how long it would take the shoals to reform without removal of the material, and the impact to the surrounding resources in terms of burial and turbidity, dragging is not a viable alternative.

4.4 Alternative Disposal Methods

Alternative disposal methods examined for this project include riverine, nearshore disposal, beach nourishment, open water disposal, and upland disposal. In-river and nearshore disposal have been identified as the least costly environmentally acceptable and practicable dredged material management alternatives.

4.4.1 Riverine Disposal

The proposed in-river disposal site is located north of Bluff Head in the Fiddlers Reach of the Kennebec River. This area is also referred to as Kennebec Narrows. The sand dredged from Doubling Point is compatible with the material found in this disposal area and has been found suitable for disposal (see Suitability Determination and Memo in Appendix C). Also, this disposal site has previously received sandy material from maintenance dredging of the Doubling Point region of the FNP at least as far back as the 1940’s (see Table 1). Results of these disposal activities have not identified any significant adverse environmental impacts associated with continued use of the site (see Water Quality Certificate, dated April 2011 in Appendix A). The continued use of this site for the disposal of sand is the preferred alternative over the establishment of any additional riverine dredge material disposal sites in this estuary since the continued use of this site does not dedicate any additional areas to periodic disturbance from dredge material disposal.

The use of the riverine site maintains the supply of downriver transported sand for the Kennebec River sand budget. The Maine Geological Survey expects the sand will disperse in less than a year and remain part of the natural river bedload (2011 WQC in Appendix A). The movement of the sand from the shoal areas at Doubling Point to the Bluff Head disposal site approximately 1.7 nautical miles downstream does not constitute a major alteration in the overall sand budget of the Kennebec River.

According to Stephen Dickson of the Maine Geological Survey (Personal Communication), permanent removal of large volumes of sand from portions of the river near Bath could possibly affect Popham Beach in the future. Since this disposal alternative is economically feasible for use with a hopper dredge and removing large volumes of sand from the river near Bath may be detrimental to the sand budget of the river, in-river disposal is the preferred alternative for material dredged from Doubling Point.

The use of the upstream disposal area off Bluff Head for the shoals downstream near Popham Beach is impractical due to the additional time and distance required to travel upstream. It is expected that the material disposed near the Bluff Head disposal site will eventually travel downstream.

4.4.2 Nearshore Disposal

The proposed nearshore disposal area is a previously used 500-yard circular area located about 0.4 nautical miles south of Jackknife Ledge in depths of about 40 to 50 feet. Material placed at the Jackknife Ledge disposal site is expected to remain in the littoral system and potentially re-nourish nearby beaches. The dredge material has been found suitable for placement at the Jackknife Ledge disposal area (See Suitability Determination and Memo in Appendix C). This disposal area was first used in 1989, then again in 2000, 2002, and 2003. The disposal area was selected in coordination with the Maine Geological Survey based on studies that predicted that the material would be retained in the nearshore system.

This nearshore disposal area is approximately 3 nautical miles from the dredge area by Popham Beach which is less than half the distance to the previously used in-river Bluff Head disposal area. Since this disposal alternative keeps the sand within the littoral system and potentially re-nourishes nearby beaches, this is the preferred alternative for disposal of material from the Popham Beach shoal area.

4.4.3 Beach Disposal

The material from both dredge areas is suitable for beach nourishment, but this alternative requires further investigation; the compatibility of the sand with any specific beach would need to be determined based upon a comparison of grain size. The beach disposal alternative would likely involve cost sharing by a non-Federal sponsor to incur any additional costs associated with that alternative. Additional equipment (pump out capability) and time

(time to pump the material out versus just opening the hopper doors) would be necessary to place the material on a beach using a hopper dredge. The involvement of local cost-sharing was declined by the state and local municipalities in the past and the Corps has not been approached by any cost-sharing sponsor recently. The small quantity of material that is typically dredged from the channel at the mouth of the river, and the costs associated with placing this material directly on a beach might explain why this alternative has not been attractive to a non-Federal sponsor due to the limited benefits realized versus the associated cost. The direct beach nourishment alternative was not selected due to the lack of a sponsor to cost share in the project.

Placement of sand from the Popham Beach shoal area would not affect the overall sand budget, but direct placement of sand from the Doubling Point dredge area might negatively affect some beaches if these beaches were bypassed to nourish areas further away.

In the future, if a non-federal sponsor is identified that is willing to pay the additional cost associated with direct beach nourishment then this alternative could possibly be used, but for now without a cost-sharing sponsor beach disposal is not a viable alternative.

4.4.4 Open Water Disposal at Sequin Island

Open water disposal was last used in 1971 when dredged material from the river mouth was placed at the Sequin Island open water disposal site. This disposal site consists of an area about three quarters of a nautical mile square with a center point 2 nautical miles from Pond Island Light on a bearing 117° 15" true and 1.75 nautical miles from Sequin Light on a bearing of 49° 55" True in water depths of 87 to 116 feet. Local fishermen claimed to be impacted by use of this disposal site and this site does not retain the material in the littoral system. It is the Corps of Engineers policy to keep sand in the littoral system whenever possible. Therefore this is not a preferred disposal alternative.

4.4.5 Open Water Disposal at Portland Disposal Site

In this alternative, the material would be brought to the Portland Disposal Site (PDS). The Portland Disposal Site has an area of one square nautical mile, the center is located 8.1 nautical miles east of Dyer Point, Cape Elizabeth, Maine and encompasses a 1.32 square mile area centered at 43° 34.105′ N, 70° 01.969′ W (NAD 83). The seafloor topography at PDS is rocky and irregular, with water depths that range from 138 to 243 feet. Surveys indicate that the disposal site is in a depression. The U.S. Environmental Protection Agency approved the existing PDS for interim use in 1979, under authority granted in the Marine Protection, Research, and Sanctuaries Act of 1972, based on historical use of the disposal site. The Final Environmental Impact Statement for the designation of the Portland, Maine Dredged Material Disposal Site was released in 1983. The regulated and monitored placement of dredged material has been occurring at this site since 1977. However, documented use of this area for dredged material placement dates back to 1946, when material was disposed over a 5.2 square nautical mile irregularly-shaped area of seafloor surrounding the current PDS boundaries.

This area is located approximately 18 miles from the mouth of the Kennebec River and approximately 29 miles from Doubling Point. A fully loaded dredge travelling at full speed travels between 11 and 15 miles/hour. Given the distance from Doubling Point to the Portland disposal site, it would take between 2 and 3 hours to complete a one way trip to the disposal area, or almost 6 hours for a round trip added to the time required for one dredging cycle. Given a hopper dredge with a capacity of approximately 1000 cy, this would mean that to dredge and dispose of 20,000 cy of material, 5 additional days would be required to complete the job (at a minimum) in that area. Although travelling from Popham Beach would be shorter, it would still take much longer to complete the job than if the near shore site at Jackknife Ledge was used. Using this site would be impracticable due to the increased amount of time and expense that would be incurred for the dredging project. In addition, the sand would be removed from the sand budget, which according to the MGS, could eventually result in increased erosion of the beaches in the area (discussed previously). The PDS is a monitored site with a limited capacity. Disposing of clean sand (material that does not need to be monitored) in a monitored site will take up the capacity of that site for material that does need to be monitored. Therefore this site is not a preferred disposal alternative.

4.4.6 Upland Disposal

The state of Maine lists dredged material as a "special waste". The Maine Department of Environmental Protection, Solid Waste Bureau regulations allow for dredged material that falls below certain analytical thresholds to be used as a beneficial use. The BIW currently utilizes an upland site to dispose of a minor amount of dredged material that is removed from their berths and the landing grid for the drydock. The material dredged from these areas is typically comprised of more fine material (>20%) than that found within the sinking basin (i.e. in the middle of the river) and that found in the Federal channel adjacent to Doubling Point (~1 %) and therefore is not suitable for disposal at the in-river disposal site hence the need for upland disposal. About 2,000 cubic yards is removed from these areas every other year. The BIW is beneficially reusing the dredged material removed from the nearshore areas to reclaim a privately-owned, former clay pit. The BIW has indicated that it is quite rare to find a beneficial use site that meets the state's criteria and that is close to the dredge site. The clay pit being used is approximately 6 miles (one-way) from the BIW and has limited finite capacity to hold dredged material. Should an upland site be identified, the use the upland site has many complicating factors that must be overcome (e.g. the need to identify a dewatering site, neighbor/abutter concerns, trucking logistics, groundwater issues, city issues, and the ongoing costs of erosion controls at the site) in order for it to be considered a viable alternative. It currently costs the BIW over $50 per cubic yard to dispose of dredged material at the upland site which is significantly greater cost than in-river disposal. Additionally, at the end of the site's life, the site will need go through a state-mandated closure process which will ultimately add to the overall costs of using the site.

In general, upland disposal tends to increase the cost of the project because the material may need to be handled multiple times (three or more) before the dredged material reaches its final disposition. Upland disposal of dredged material removed from the channel near Doubling Point may be a viable alternative; however, further investigation would be required including identifying a suitable site with sufficient capacity and that meets the above mentioned criteria. Additionally, a non-Federal sponsor would need to be identified that is willing to pay for the increased cost of disposal above the Federally selected plan of in-river disposal.

The material to be dredged from the channel in the vicinity of Doubling Point and Popham Beach is composed of clean sand and disposal of the material at an upland site would remove it from the river's sand budget. The Maine Geological Survey has indicated that continually removing the sand from the river's sand-budget may eventually impact the beaches by exacerbating erosion at the mouth of the river. Given the above, this alternative was removed from further consideration at this time.

5.0 AFFECTED ENVIRONMENT

5.1 Physical and Chemical Environment

The Kennebec River is located about 25 miles north of the city of Portland. The Kennebec River flows southerly for about 150 miles from Moosehead Lake at Greenville and Moosehead to its mouth between Bay Point and Popham Beach where it empties into the Atlantic Ocean. The Kennebec River basin encompasses 5,893 square miles of drainage area, constituting almost one-fifth of the total area of the State of Maine (NRPD, 1993). Both the Kennebec River and Androscoggin River (located to the west of the Kennebec) flow into a freshwater tidal bay called Merrymeeting Bay, which is about six miles north of the city of Bath. The U.S. Fish and Wildlife Service characterizes the Kennebec River north of Merrymeeting Bay as "tidal riverine" and the area below Merrymeeting Bay as an estuarine subsystem (Fefer and Schettig, 1980). The Kennebec River estuary at the outlet of Merrymeeting Bay forms a complex with the Sheepscot River (located to the east of Kennebec River) estuary (NRPD, 1993). The Sheepscot River begins in Montville, and flows southward toward Westport where it becomes divided by Westport Island. The western branch flows into Montsweag Bay and then into Hockomock Bay, which are connected to the Kennebec River by the Sasanoa River, a tidal river. The Sasanoa River diverges from the Kennebec River upstream from Doubling Point and flows south, joining the Sheepscot River system at Hockomock Bay, continuing southward to rejoin the Sheepscot River below Westport Island. It then flows into Sheepscot Bay (to the northeast of the Popham Beach area), before entering into the Atlantic Ocean. Both the Hockomock and Montsweag Bays, act as mixing basins for the Kennebec and Sheepscot Rivers (Figure 1).

The Kennebec River estuary is an elongate, rock-bound estuary where the lower estuary (~ 17 miles from the mouth) is characterized by salt-water intrusion, extending from the river mouth to the constriction at the confluence of the Kennebec and Androscoggin Rivers. These semidiurnal tides have a mean range of 8 feet and a maximum spring range of 11.5 feet.

The Kennebec River estuary has a strong ebb-current dominance that is produced primarily through spring snowmelt floods (freshets) (Fenster and FitzGerald, 1996; Fenster *et al.*, 2001). The combination of estuarine geometry (narrow, rock- bound estuary), extreme discharge seasonality, large tidal ranges create sediment-transport regimes that provide coarse-grained sediment from the lower 17 miles of the river to the nearshore and coastal region of south-central Maine (Fenster and FitzGerald, 1996; Fenster *et al.*, 2001; Fenster *et al.*, 2005; FitzGerald *et al.*, 2005).

Freshwater annual discharge averages approximately 341 yd^3/s at the Kennebec River estuary mouth, but varies seasonally from summer and mid-winter low flows to early winter and late spring high flows (Fenster and FitzGerald, 1996). Spring flood freshwater discharge can exceed average daily flows by an order of magnitude in the lower estuary (Stumpf and Goldschmidt, 1992).

The water quality classification for the Kennebec River north of the mouth of the river is Class SB, as designated by the State of Maine. The State recently corrected an error defining the upper end of Class SA waters in Phippsburg, which did not have a northerly boundary delineation. Since the classification of these waters in 1990, ME DEP has treated them and evaluated activities in these waters consistent with a Class SB designation. The error in the designation was discovered this year, and would create the bizarre result of having a Class SB designation for waters on the Georgetown and Arrowsic sides of the Kennebec, but a Class SA designation on the Phippsburg side—with the boundary appearing in the middle of the river. The Maine Legislature clarified the designation to make it consistent with the interpretation and practice of ME DEP—that the Class SA designation ends at the mouth of the Kennebec. Indeed, in light of the fact that in the Bluff Head area shellfish harvest is prohibited, it would not seem logical to consider such waters as Class SA. Class SB waters are the second highest classification and shall be of such quality that they are suitable for the designated uses of recreation in and on the water; fishing; aquaculture; propagation and harvesting of shellfish, industrial process and cooling water supply; hydroelectric power generation; navigation; and as habitat for fish and other estuarine and marine life. 38 M.R.S. § 465-B(2). Discharges to Class SB waters may not cause adverse impact to estuarine and marine life in that the receiving waters shall be of sufficient quality to support all estuarine and marine species indigenous to the receiving water without detrimental changes in the resident biological community. There may be no new discharge to Class SB waters that would cause closure of open shellfish areas.

In the lower Kennebec River water quality can be negatively affected by both point and non-point pollution sources in the watersheds of the Kennebec and Androscoggin rivers, located north and/or upstream of Merrymeeting Bay. These pollution sources include 8 municipal waste water treatment plants (with 6 containing combined sewer overflows), multiple agricultural farms, and multiple acres of impervious surfaces located in urban and suburban areas of the watersheds. One of the primary pollutants from these areas are coliform bacteria. Following rain events, pollution from these sources can be transported into the Kennebec and Androscoggin rivers as either overland runoff, or discharged directly into the river via combined sewer overflows and wastewater treatment plant bypasses. These pollutants (from both rivers) are eventually transported downstream to the lower Kennebec River, and can negatively affect the water quality and its designated uses (such as shellfish harvesting) (MEDMR, 2011).

5.1.1 Dredge Sites

The proposed maintenance dredging activity will remove sand shoals from the Federal navigation channel in the Kennebec River. Sand will be removed from shoal areas near Doubling Point reach and near Popham Beach (See Figures 2 and 3).

5.1.1.1 Doubling Point

The west side of the Kennebec River in the vicinity of Doubling Point reach is the developed riverbank of Bath. The east side of the riverbank is largely underdeveloped land of Arrowsic.

The current flow in the Doubling Point area of the Kennebec River (Figure 2) has north/south orientation that is abruptly shifted 90 degrees east across Fiddler Reach for 4,500 feet then south (180 degrees) through Bluff Head. At the Doubling Point area, the Winnegance Creek marsh system is supplied by riverflow southwestward from Hospital Point. The semidurinal tides in this region flood to a mean depth of 6.4 feet running 300 degrees northwest by west at a maximum of 2.6 knots and ebbing 127 degrees southeast by east at 3.0 knots (NOAA, 1999). High and low water occur approximately one hour after the tide at the river mouth.

The project site is an estuarine system exhibiting classical "salt-wedge" layering with seasonal salinity variations (approximately 10-28 practical salinity units (PSU), 10-20 in mid estuary (Mayer *et al.*, 1996; Wong and Townsend, 1999). The freshwater outflow of the Kennebec River is a result of the seasonal runoff from rain and snowmelt. The influx of salt water reverses the outflow causing an approximate six-foot tidal flux. The physical properties of fresh water make it less dense than saltwater and, as the outflow of freshwater encounters the saline influx a layering effect (halocline) occurs. The intrusion of saltwater is greater along the bottom of the river and the outflow of freshwater is strongest at the surface. The mixing and dilution along the salinity gradient is therefore oblique and hence the term "salt wedge." The extent, range and concentrations for the salt wedge are dependent on lunar cycles, precipitation levels and other meteorological conditions. The salt wedge has been identified as extending seven kilometers upstream of the project area, classifying the riverine dredging site as estuarine.

Salinity data collected in the Kennebec River by Larsen and Doggett (1976) and Hubbard (1986) depicted a riverine/estuarine interaction. The results reflect a dominance of riverine influence at this upstream area from the proposed dredging. The biota in the vicinity of the upstream river project area is estuarine. Field work conducted by the Corps in 1986 (Hubbard, 1986) showed that saline intrusion does occur through and above the Doubling Point area. As noted previously, the water quality classification for the Doubling Point area is Class SB.

Grain size analysis of the dredged material has been performed in 1971, 1977, 1979, 1986, 1988, 1989, 1991, and 1995, and 2010 (see Appendix B). The results of this testing has always shown the material to be sand, usually medium or medium to fine grained; sometimes with traces of silt and/or gravel. This material is a result of the current scour that prohibits settling of fine grained silts and clays. Chemical analyses were not performed on the proposed material due to the absence of any sediments (2010 Sample Sites E, F, H, I) containing more than 1 % fines (silt/clay). Chemical contaminants are not expected to adsorb to the coarse particles and the well scoured nature of the substrate would disallow any significant chemical buildup. In addition, there are no significant sources of contaminants located in the vicinity of the proposed dredging.

On a daily time frame, the Kennebec River below the Chops (upstream of the City of Bath) has reversing currents driven by the rise and fall of the tides (Fenster *et al*., 2001). Bi-directional (flood and ebb) transport of bedload (river-bottom) sand in the Kennebec River estuary results in a "bedload convergence zone" in Doubling Point Channel. The term bed-load convergence zone describes an area where bottom material moves around on a daily basis and where dual-directional sediment transport converges and induces sediment deposits causing a sinusoidal sand-wave formation (Anthony, 2009). Sand is transported downstream in the river-dominated section of the Kennebec River from Merrymeeting Bay (FitzGerald *et al*., 2000; Fenster *et al*., 2005) where it accumulates in the form of large sand waves in a bedload convergence zone. These sand waves are what need to be periodically dredged.

Downstream of Doubling Point, sand on the river bed can be carried upstream by flood currents that are stronger than ebb currents (using salinity as a conservative tracer in data provided in Larsen and Doggett, 1976). Tidal mean velocities at Hospital Point (at the south end of Doubling Point Channel) measured in September 1994 show net northerly currents near the river bed (Mayer *et al*., 1996) as do measurements in May 1994 near Bluff Head (Mayer *et al*., 1996). Flood velocities near the river bed reported by Mayer *et al*. (1996) were in excess of 25 cm/sec and sufficient to move sand (Dyer, 1986; Gadd *et al*., 1978). Thus sand can be carried upstream to the bedload convergence zone from south of Doubling Point.

5.1.1.2 Popham Beach

At the mouth of the river looking upstream, the town of Phippsburg is to the west of the Federal channel and the town of Georgetown is found to the east. Just east of the dredge area is North Sugarloaf and Sugarloaf Islands with Pond Island to the south. Popham and Hunnewell beaches are found on the Phippsburg shoreline in this area and bordering the south side of the mouth of the Kennebec River, one finds Popham Beach State Park that features a long stretch of sand beach. Sunbathers relaxing on Popham's State Park sands can see Fox and Wood Islands offshore, and the Kennebec and Morse rivers border each end of the beach. At low tide one can walk to Fox Island. Behind the beaches and frontal dunes, one finds high-relief back dune field and a pitch pine maritime forest (http://www.maine.gov/doc/nrimc/mgs/explore/marine/ sites/mar08.htm).

Water movement in the vicinity of the Popham Beach dredging area reflects the riverine outwash nature of this coastal constriction. Tidal range here (43 degrees 45'; 69 degrees 47') has a mean tide range of 8.4 feet and a spring tide range to 9.7 feet (NOAA, 1996). Maximum flood tides run 332 degrees at 2.4 knots while maximum ebb tides run 151 degrees at 2.9 knots. The waters are classified as type SB like the Doubling Point area.

Extreme shoreline change and dune erosion occurs along the beaches in this area. The Hunnewell and Popham Beaches adjacent to the shoal west of the Sugarloaf Islands have historically undergone drastic episodes of erosion and accretion. Historical file photographs document a changing shoreline. Local residents confirm these phenomena and have indicated numerous cottages built on the dunes have either been lost or moved inland over the years. See Section 5.1.2.2 for Jackknife Ledge for more information on the movement of sediment at the mouth of the river.

Grain size samples were collected from the Popham beach dredge area in 1995 and 2010. In general, the material was coarser in 1995 with a larger percentage of gravel and coarse sand than was collected in 2010. Overall the material from this area of the Kennebec is medium to fine sand with 0.8 % or less fines (silt/clay). See Appendix B for grain size data and curves from 2010 samples.

The biota in the vicinity of the Popham Beach project area is characteristically more marine then the Doubling Point and Bluff Head areas, but the salinity will vary with the amount of freshwater moving downstream especially after spring storms.

5.1.2 Disposal Sites

5.1.2.1 Bluff Head

The disposal of material dredged from the channel near Doubling Point will occur at an in-river site 2,500 feet north of Bluff Head (Figure 2). The disposal site is located at a deep portion of the channel, with waters up to approximately 30-100 feet deep with an average depth of 76.5 feet and is 500 feet wide by 500 feet long located within the Federal channel. The site is about two miles downriver of the proposed dredge site. The shoreline is rocky intertidal or marsh and with much of the upland areas forested.

The water flow at the upriver disposal site is directed north and south with a maximum flood of 2.5 knots (133.7 cm/sec) and maximum ebb of 3.0 knots (154.3 cm/sec) (NOAA, 1999), but ebb currents of up to 6 knots have been observed and larger velocities may be expected during freshets (NOAA, 2009). The disposal area is estuarine with salinities varying (10-20 psu) with river runoff (Mayer *et al*., 1996, Wong and Townsend, 1999). The water quality classification in this section of the river is the same as the dredge site, class SB waters as corrected by the 125^{th} Session of the Maine Legislature.

Sediments from the river bed in this area of the Kennebec can be carried upstream by flood currents that are stronger than ebb currents or downstream in the mouth of the river when freshwater discharge exceeds 294 – 425 yd^3/s (FitzGerald *et al*., 2005). In 1981 the Corps conducted several hydrographic surveys, before disposal, one month post-disposal and 10 months post-disposal. The average depth for the disposal area and surveyed regions up to approximately 1000 feet downstream were all slightly shallower (5-10 feet) one month after disposal, but all surveyed areas even the site 300 feet upstream of the disposal area had eroded some (2-7 feet) 10 months post-disposal (Hubbard,1982).

Only one grain size sample was collected from the Bluff Head disposal area in 1986 and the material consisted medium grained sand (see Appendix B). The Corps attempted to collect additional samples from the Bluff Head disposal area on December 10, 2010 without success. On the first attempt, the grab came up empty. On the second attempt, the sampling equipment was lost most likely due to being lodged in a crack along the hard bottom area due to the narrow constriction of the channel in this area, the bathymetry and current speed at the time of sampling. Fenster and FitzGerald (1996) describe the particularly narrow regions of the channel (i.e. 820 feet in Fiddler Reach) as absent of all semi-consolidated and unconsolidated sediment units and the bedrock basement forming the channel bottom. The Bluff Head disposal area is an erosional area with sand moving through the area but not expected to stay in the area over the long-term.

5.1.2.2 Jackknife Ledge

Jackknife Ledge is located southwest of the mouth of the Kennebec River in the Gulf of Maine. The proposed disposal area for material dredged from the Popham Beach area is located about 0.4 nautical miles south of Jackknife Ledge in depths of about 40 to 50 feet. This previously used site is a 500-yard circular near-shore disposal area.

In 1989 the Maine Geological Survey Unit conducted a side-scan sonar survey of Jackknife Ledge disposal area. The disposal area was mapped as sand with some gravel located 50-100 yards south of the outer edge of the site and the closest mapped rock was approximately 400 yards from the edge (see Appendix F). In 2010 a grab sample was taken from the center of the disposal area and analyzed for grain size; the material was found to be medium to fine grained sand with 0.5 % fines.

The water quality classification for this area is SB waters with class SA waters just to the west of the disposal site.

This disposal area was chosen in close coordination with the Maine Department of Environmental Protection - Geological Survey. This site was selected because it is believed that sand deposited there will remain in the near shore system and may help to indirectly re-nourish the glacially deposited beach due to the prevalent sediment gyre (Goldschmidt *et al.*, 1991). There is a clockwise, sand-circulation cell that involves the exchange of bedload among the entrance channel to the Kennebec estuary, adjacent beaches, nearshore, and offshore region (FitzGerald *et al*., 2000). Fitzgerald and Fink (1987) first described the cyclic nature of the sand budget for this area. Their study concludes that the glacially deposited beach is renourished by a sediment gyre. Wave action moves sediments easterly along the beachfront to be transported into the Kennebec River by flood tidal and wave energy. The rivers ebb delta brings the sand back seaward to be reworked onto the beach face. Their study also notes that due to the downstream migration of larger sandwaves in the Kennebec River, it appears that the Kennebec River is a present day source of sediment for Popham Beach. The disposal area was situated to take advantage of the sediment gyre so the potential exists for sands to be reworked onshore.

5. 2 Biological Resources

5.2.1 General Habitat

The Kennebec River is a complex estuarine system draining Sagadahoc County below Merrymeeting Bay. The area has extensive salt marshes dominated by *Spartina patens* and *Spartina alterniflora*. Along the river reaches sand flats occur with productive shellfisheries (*Mya arenaria*) and worm (*Glycera* and *Nereis* spp.) habitat. Much of the area immediately adjacent to the dredging activity and disposal sites is undeveloped marsh with silty sand sediments, rocky intertidal areas or sandy beaches.

5.2.2 Fisheries Resources

The Kennebec River is an important corridor for migratory movements of various species of fish. The biota in the deepwater areas of Maine's estuarine rivers is not well described. Various species exhibit seasonal utilization of the estuary including alewife, *Alosa pseudoherengus*; American eel, *Anguilla rostrata*; Atlantic salmon, *Salmo salar*; Atlantic sturgeon, *Acipenser oxyrhynchus*; blueback herring, *Alosa aestivalis*; American shad, *Alosa sapidissima*; shortnose sturgeon, *Acipenser brevirostrum*; rainbow smelt, *Osmerus mordax*; striped bass, *Morone saxatilis*; and lobster, *Homarus americanus*.

5.2.2.1 Finfish

There are two species of river herring found in the Kennebec River, the alewife and the blueback herring. The alewife is the predominant species found in the state of Maine and the Kennebec River, the blueback herring have only been found in small numbers in Merrymeeting Bay (http://www.link75.org/mmb/cybrary/kenfish/krfish.html#rivher). Alewives usually enter the estuary from early May to early June and run upstream into lakes and ponds to spawn. Blueback herring usually spawn later than alewives with the runs extending from mid May to late June and spawns in the moving currents of rivers and streams. The majority of the surviving adults then migrate back downstream shortly after spawning. The juvenile fish of both species migrate downstream to the ocean in the fall.

The American shad move through the estuary in the spring, spawn and return before summer's end. The juveniles follow before fall ends. Rainbow smelt, move upriver in the /early spring to spawn, during the spring high water run-off and the young quickly leave the upper tidal section shortly after hatching. The adults return to the ocean shortly after spawning (http://www.link75.org/mmb/cybrary/kenfish/krfish.html).

The striped bass, inhabit the entire coastal area of Maine from late April through early November. This species enters the freshwater upriver in the summer and leave in the fall.

The American eel is a catadromous organism, spawning in the offshore marine environment. The adults move seaward through the estuary during the fall and juveniles return in the spring.

The Atlantic salmon move upriver in the spring, to breed in the fall, and return to the marine environment in early winter. After spending approximately two years in freshwater, the juveniles migrate to sea in the spring.

The shortnose sturgeon moves upriver to spawn in the spring through summer (see Section 5.3 Endangered Species). Adults return through the project area in the fall to overwinter in the deeper waters near Merrymeeting Bay. The Atlantic sturgeon has a greater abundance than the shortnose sturgeon especially in more saline waters. The adult Atlantic sturgeon move upriver in April through June, spawning and returning to the estuary in late summer to early fall. The juvenile also return seaward in late summer.

Both the shortnose sturgeon and the Gulf of Maine Distinct Population Segment of Atlantic salmon have been listed as Federally endangered by the National Marine Fisheries Service under the Endangered Species Act. In addition, the Gulf of Maine Distinct Population Segment of Atlantic sturgeon are proposed to be listed as Federally threatened by the National Marine Fisheries Service under the Endangered Species Act. These species will be discussed further in Section 5.3.1 of this EA.

5.2.2.1.1 Recreationally Important Finfish

5.2.2.1.1.1 Striped Bass

Striped bass are seasonal migrants to the Gulf of Maine, moving into the area in the summer through early fall. They are one of Maine's most important saltwater gamefish, inhabiting shallow bays, rocky shores, coastal rivers and the surf line of barrier beaches (http://www.maine.gov/dmr/recreational/anglerguide/doyouknowyourcatch/documents/stripedbass.pdf, accessed 5/11/2011). Spawning occurs in estuaries and rivers located in the vicinity of the Hudson River, Delaware River and Chesapeake Bay. Fish hatched in the Chesapeake Bay exhibit more extensive migrations, some being captured as far north as the Bay of Fundy in coastal Canada (http://www.mass.gov/dfwele/dmf/recreationalfishing/stripedbass.htm#profile, website accessed 5/11/2011).

From late April through early November, migratory striped bass inhabit the entire coastal area of Maine, inland to the first upstream dam on major river systems and seaward to the outer Maine islands. These migratory fish move into the area primarily in pursuit of food which includes alewife (in the spring) which become abundant along the coast and in rivers and streams; and later sea herring and mackerel (http://www.link75.org/mmb/cybrary/kenfish/krfish.html).

5.2.2.1.1.2 Bluefish

Bluefish (*Pomatomus saltatrix*) inhabit both inshore and offshore areas of coastal regions, with young of the year fish (those in the first year of life), called "snappers", often frequenting estuaries and river mouths. This species normally travels in large schools, which may contain up to several thousand individuals. Bluefish display an annual migration pattern that is keyed to the seasonal warming and cooling of coastal waters. They begin arriving along the southern New England coast during April and May (http://www.mass.gov/dfwele/dmf/recreationalfishing/bluefish.htm#profile).

Larger fish arrive somewhat later in the spring, initially inhabiting deeper waters but moving progressively shoreward into shallow areas as the summer progresses. They generally appear in Maine waters during the summer, swimming together in large schools, following schools of fish such as menhaden, mackerel and butterfish upon which they feed (http://www.maine.gov/dmr/recreational/anglerguide/doyouknowyourcatch/documents/bluefish.pdf, accessed 5/12/2011).

Although bluefish are basically an open ocean, or pelagic, species, they are known to travel well up the Kennebec River in pursuit of prey, especially menhaden. Large schools of bluefish have been recorded in Merrymeeting Bay and in the Cathance River as well, although they are not normally known to inhabit fresh water. Merrymeeting Bay above The Chops is considered fresh water (http://www.link75.org/mmb/cybrary/kenfish/krfish.html accessed 5/12/2011).

Adult bluefish largely disappear from coastal waters of southern New England during October as water temperatures cool to 60° F. Although many adult fish migrate southward in the fall, their major migratory movement appears to be offshore toward the warmer, deep waters of the continental shelf (http://www.mass.gov/dfwele/dmf/recreationalfishing /bluefish.htm#profile accessed 5/12/2012).

Bluefish occurring between Cape Hatteras, North Carolina and New England spawn between June and August. Spawning occurs primarily offshore over the continental shelf when water temperatures warm to between 64° and 74° F. After hatching, larvae inhabit surface waters and are swept along the continental shelf by prevailing currents. Snappers (young of year bluefish) eat a variety of small-bodied animals such as copepods, shrimp, small lobsters and crabs, larval fish and larval mollusks. Adult bluefish are opportunistic feeders, commonly focusing upon schooling species such as menhaden, squid, sand eels, herring, mackerel, and alewives, as well as scup, butterfish, and cunners (http://www.mass.gov/dfwele/dmf/recreationalfishing/bluefish.htm#profile).

Recreational fishing for striped bass and bluefish occurs in the lower Kennebec River including Merrymeeting Bay. In the summer months the river and surrounding areas are heavily fished for these species. Several charter fishing services are located in Phippsburg and other towns along the river. Fishing for these species also occurs from the shores at of the Kennebec River in the general Phippsburg area.

5.2.2.2 Shellfish

Shellfish harvesting areas in the Kennebec River are located in the lower estuary in Phippsburg, including Drummore Bay, the Upper Flats, Parker Head, Wyman's Bay and Atkins Bay and the Popham/Small Point Beach and Morse/Sprague River. According to the Maine Department of Marine Resources and mapped by MEGIS, the conditionally approved shellfish beds along the lower Kennebec River are soft-shell clams (*Mya arenaria*) with some blue mussels (*Mytilus edulis*) found in Parker Head, Wyman's Bay and Atkins Bay (see Figure 4). Along the coast outside the River, surf clams (*Spisula solida*) can be found with soft-shell clams (See Figure 4). These areas are located approximately 2.5 to 6.5 miles downstream from the Bluff Head disposal area and are used by local commercial clam harvesters. Shellfish beds can be closed to harvesting due to elevated levels of fecal coliform bacteria that often occur following significant rain events which wash pollutants in from upstream sources.

Soft-shell clams (*Mya arenaria*) line the intertidal areas of the lower Kennebec River and this species of shellfish is a major commercial fishery in Maine. In 2010 soft-shell clam accounted for 4% by weight of all harvested species in the state.

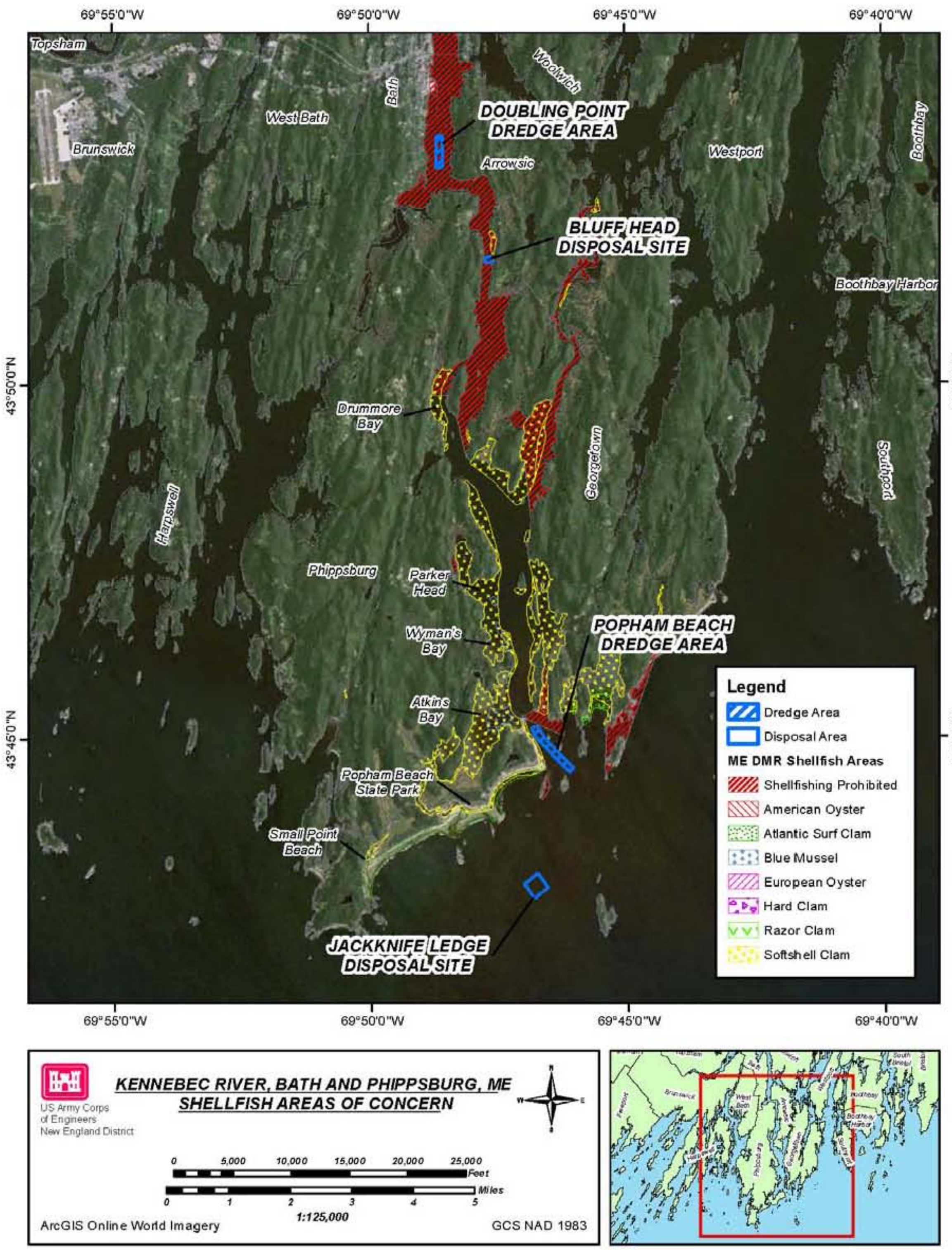

Figure 4. **Mapped shellfish areas in the lower Kennebec River with regions of the river prohibited for shellfishing identified.**

Soft-shell clams populate soft muds, sands, compact clays and coarse gravel substrates in both intertidal and subtidal estuarine habitats (Newell and Hidu, 1986). Soft-shell clams are most abundant intertidally along the New England Coast. Many of these habitats are chronically turbid (Newell and Hidu 1986). Soft-shell clams along with mussels are adapted to turbid conditions resulting from resuspended silts often present in shallow water, soft bottom estuaries. Clams feed by filtering seawater. Filter rates become reduced in unfavorable conditions and increase when increased food is detected in the water column.

In Maine the clams spawn in the summer usually June through August, once water temperatures reach at least 54° - 59° F (12° - 15° C) (Newell and Hidu, 1986). North of Cape Cod clams spawn once a year. Fertilization is external and occurs in the water column. There is high fecundity of soft-shell clams with wide larval dispersion and high mortality during both larval and juvenile stages. The pelagic larval phase lasts about 2-5 weeks, followed by spat settlement on the seabed, settlement can be delayed if conditions are not optimal. Most larvae do not metamorphose until a size of 0.2 mm (Strasser, 1999). The clam spat may float or move around with the help of byssal threads. As it grows the spat will drop to the bottom and burrow into the sediment. Juvenile seed clams may migrate shoreward as they exceed 5 mm in length (Matthiessen, 1960b) due to hydrodynamic forces. New settlers less than 10 mm in length tend to live in the upper 2 cm of the substrate making them susceptible to movement with bedload sediment transport (Emerson and Grant, 1991). Soft-shell clams do not establish permanent burrows until they are approximately 20 mm in size. Adults usually burrow 20 to 30 cm into the sediment, and burrows as deep as 40 to 50 cm can be found for large clams. The siphon's reach increases with shell length.

The shell length can reach 60-100 mm with some exceeding 140 mm with a lifespan of 10-12 years (Strasser, 1999). The clams retain a connection with the surface through a long siphon through which water is drawn for gas exchange & filtration of particulate matter from the water column.

Soft-shell clams are euryhaline species with optimal salinity concentrations between 25 and 35 ‰ with a tolerance as low as 4 ‰. They have the ability to tolerate sudden and appreciable changes in salinity (estuarine condition); Matthiessen (1960a) found fluctuations of an order of 18 ‰. Larger members of this species are more tolerant to low salinity conditions than the juveniles (Matthiessen, 1960a). Pumping rates are reduced when the salinity has dropped to approximately 8 ‰ and ceases at salinities of 4 ‰ or below. Larvae are more sensitive to the salinity than adults.

In a study looking at the effects of harvesting mature soft-shell clams on the remaining population, Emerson *et al*. (1990) found that exposed, small clams (< 30 mm) have the ability to re-burrow into the sediment rapidly while large clams (60-80 mm) required 10 to 22 hours to re-burrow themselves. Sediment type will also affect the ability to burrow; clams exposed on mud took approximately 1.6 times longer to burrow under the sediment surface than those on sand. The study also looked at the effects of burial on the clams. All size classes of clams successfully burrowed upwards to re-establish connection with the water column when buried under 25 cm of sand, but at increased depths (50 cm and 75 cm) mortality was greatest for clams larger than 5 cm shell length (Emerson *et al*., 1990). Under mud, clams can survive a 15 cm burial, but further increases in depth (25 cm and 75 cm) resulted in mortality of all size classes, except large clams. The large soft-shell clams were probably able to extend their siphons to the sediment-water interface (Emerson *et al*., 1990).

5.2.2.3 Lobster

Lobsters (*Homarus americanus*) are an important commercial species that are found throughout the Gulf of Maine, including the lower Kennebec River and surrounding areas. Lobster fishing occurs near the mouth of the river in the vicinity of Jackknife Ledge and Popham Beach as well as upstream toward Phippsburg up to the Cox Head region. The Maine annual catch of lobsters in 2010 was 93 million pounds and approximately 81 million pounds were landed in 2009 (http://www.maine.gov/dmr/commercialfishing/documents/ lobster.table_000.pdf), these were at record catch levels. Sagadahoc County landings accounted for approximately 1.5 million pounds of lobster. Coastal lobsters are concentrated in rocky areas for shelter, but mud substrates suitable for burrowing can also have high densities of lobster. In summer months, adult lobsters migrate to inshore waters and then return to deeper water as the temperature decreases. Migrations also take place prior to storms. The distance lobsters travel is a function of their size, age, and location. Larger lobsters generally travel further than the small, inshore lobsters. Large lobsters can travel hundreds of miles in the summer (USFWS, 1993). Lobsters are omnivorous and are primarily a predator upon invertebrates such as crabs, polychaetes, clams, mussels, starfish, and sea urchins; lobsters are also a successful scavenger (Krouse, 1984). Larval lobsters in the upper water column feed on small animals and plants, including other larval lobsters (MEDMR, 1981). Once the larval lobsters descend to the bottom of the water column, they will readily attack and eat isopods and amphipods (MEDMR, 1981).

Lobster eggs hatch between May and October; the warmer the water the earlier the hatch (Mackenzie and Moring, 1985). Stage I larvae are collected from June to early August off the coast of Maine (Mackenzie and Moring, 1985). The lobsters go through four free-swimming stages before settling to the bottom where they burrow into the substrate and molt into juveniles. Lobsters inshore appear to have a limited home range. Sixty-five percent of the lobsters tagged in the spring of 1975 and released from three locations in Maine were captured; and within two and one-half years, 75.9% of the lobsters had been recaptured (Krouse, 1981). Most returns (88%) occurred within a less than six mile radius of the release site (Krouse, 1981).

5.2.3 Avian Species

The restoration of anadromous fish runs and the maintenance of high water quality in the Kennebec River also serve to enhance the habitat of the bald eagle, *Haliaetus leucocephalus* which was recently delisted both federally and statewide from endangered status. This raptor occasionally forages the Maine coastal areas such as the estuarine region of the Kennebec River. North of the project site bald eagles have been observed in Merrymeeting Bay. Since the removal of the Edwards Dam, many anadromous and resident fish have unimpeded access to the base of the Lockwood Dam in Waterville, which would also increase the habitat of many other piscivorous avian species including eagles as well as ospreys. In addition several other state and/or Federally listed (threatened/species of concern) avian species can be found in the project area at various times. These will be discussed further in Section 5.3.1 of this EA.

5.2.4 Seals

The Western Atlantic harbor seal, *P. vitulina concolor*, is found from the eastern Canadian Arctic and Greenland down to New Jersey. A northward movement from southern New England to Maine and eastern Canada occurs prior to the pupping season, which takes place from mid-May through June along the Maine Coast (http://www.nefsc.noaa.gov/publications/tm/tm213/pdfs/F2009HASE.pdf). Harbor seals can occasionally be found in the tidal areas of the Kennebec River. Most harbor seal haul-out sites are used daily, based on tidal cycles and other environmental variables, although foraging trips can last for several days. They will haul out on rocks, sand and shingle beaches, sand bars, mud flats, vegetation, a variety of man-made structures, glacial ice, and to a very limited extent sea ice in some areas. Harbor seals are opportunistic feeders; they prey primarily upon fish such as menhaden, alewives, sea bass, herring, and flatfish (Thompson and Härkönen, 2008).

5.2.5 Dredge Sites

5.2.5.1 Doubling Point

The shorelands along the Kennebec River in the vicinity of the upriver dredging site is predominantly forested dominated by eastern white pines, *Pinus strobus* and hemlock, *Tsuga canadensis*. The banks of the river consist of vertical cliffs of approximately 10-20 feet in height. The intertidal slope at the base of these cliffs formed narrow bands of marsh and rocky/sandy crevice areas with algal growth. Hubbard (1986) found the marsh was generally less than 30 feet wide. The shoreland border of the marsh band was dominated by the common reed *Phragmites australis*, transitioning to spike grass *Distichlis spicata* and high marsh, and then to cord grass, *Spartina alterniflora* (308 culms/square yard) border above the algal covered rocks in the low intertidal areas (Hubbard, 1986).

The rocky intertidal area, sampled near a creek branch across from Fiddlers Ledge in Arrowsic (Station 1, Hubbard 1986) contained various shelves and flats that accrue fine sand and silts. This habitat was dominated by the amphipod *Gammarus lawrencianus* (2,762/square yard) inhabiting the algal cover of the rock and sand filled crevices. The dominant alga was the rockweed *Fucus vesiculosus*. Additionally, some sea lettuce *Ulva lactuca* and some hollow green weeds *Enteromopha intenstinalis* were present. The algal cover and its associated crustaceans are probably significant forage at flood tides for river finfish.

A crescent shaped intertidal sandy-mudflat near the rocky intertidal area was also sampled (Station 2, Hubbard, 1986). This area graded from shoreland to marsh to mudflat over a 164 foot shelf. The mudflat was dominated by the bivalve *Mya arenaria* (31/square yard) called the softshell clam, and the polychaete *Nereis virens* (29.8/square meter), the clam worm.

The channel itself is in a high energy area where the sediments are reworked on a regular basis so any benthic communities would be those species that can tolerate changing conditions and has the ability to rapidly colonize an area after a disturbance.

Since dredging will take place in August, some of the migratory and/or anadromous fish species (shad and bass) mentioned above could be found migrating through this area as well as sturgeon. Endangered species such as sturgeon will be discussed in Section 5.3 of this Environmental Assessment.

There are no mapped shellfish beds in the vicinity of the Doubling Point dredge area. The dredge area is also in waters where shellfishing is prohibited. See Figure 4 for species specific shellfish areas and prohibited fishing areas.

5.2.5.2 Popham Beach

A sand shoal has formed in the Federal navigation channel in the vicinity of Popham Beach. Shorelands in the immediate area include typical Maine rocky intertidal and sandflat (beach) habitat. Dense algal mats (*Fucus* and *Ascophyllum* spp.) and rocky crevices provide a diverse niche for numerous species. The shore in this area is an intertidal beach.

At the mouth of the river both estuarine and marine fish species could be found. In addition, recent tagging data indicates that shortnose sturgeon may move through this area.

There is a narrow area of soft-shell clam beds mapped along the Popham Beach shore (Figure 4). Also mapped are surf clam and soft-shell clam shellfish beds along the southern coastal areas of Phippsburg and in the Sprague and Morse Rivers. The shellfish beds in the rivers and protected areas along the southern coastal areas are fished. The shellfish beds at the mouth of the Kennebec River have not been identified as areas of concern by the local fishermen.

American lobster move into the lower Kennebec River estuary in spring/summer. They begin movement to deeper waters offshore in fall. Previous coordination with local fishermen indicated that lobsters leave the project area by the end of October. The lobsters usually return to the area during early May.

5.2.6 Disposal Sites

5.2.6.1 Bluff Head

The Bluff Head disposal site is located in a deep water hole within a fast three knots (154.3 cm/sec) flowing river. The organisms inhabiting this disposal area can be anticipated to be able to exploit a dynamic environment. Anadromous and catadromous finfish are transients of the site moving through the area to seasonal spawning habitat. The riverine habitat, in general, is the same as described for the dredging site.

Shellfish harvesting areas in the Kennebec River are located in the lower estuary in Phippsburg, including Drummore Bay, the Upper Flats, Parker Head, Wyman's Bay and Atkins Bay. These areas are located approximately 2.5 to 6.5 miles downstream from the Bluff Head disposal area and are used by local commercial clam harvesters. Shellfishing is prohibited from the center of the Bluff Head disposal area south for approximately the next 2.5 miles. See Figure 4 for species specific shellfish areas and prohibited fishing areas.

5.2.6.2 Jackknife Ledge

The nearshore disposal site is in a high energy area. Benthic species adapt to shifting sands that form among ridges and gullies of rock. Seasonal lulls of storm activity allow benthic fauna to colonize this area. Storm action may overturn the bottom which reinitiates the re-colonization cycle.

The benthic community of the nearshore disposal site for the Kennebec River dredged material was dominated by organisms adaptive to shifting sands (Hubbard, 1986). On a community level, the species guilds represent colonization stages of pioneering organisms on disturbed substrates. Storm activity and littoral processes most likely perpetuate this type of pioneering community.

In July 1989 the benthic community was sampled (Hubbard, 1989). The average sampling results define a community of 36 species with a density of 21,946 organisms per square yard. The community was dominated by *pioneering* organisms of the oligochaete sp. (27.8%); and the polychaetes *Prionospio steenstrupi* (22.2%) and *Capitella capitata* (11.6%) representing 61.6% of all organisms. The bivalve *Nucula delphinodonta* (9.6%), the nut clam, and the predatory polychaete *Aricidea catherinae* (8.6%) were also abundant. The top ten numerically dominant species comprised 91.3% of all organisms.

This community type is probably the result of winter storm disturbance of the substrate and subsequent recolonization of benthos. The spring recruitment of less dominant species and the low energy of summer storms potentially accounts for the high number of species (36). This type of community will quickly recolonize any disturbed area if the grain size after disturbance is similar to pre-existing conditions.

There are surf clam and soft-shell clam shellfish beds along the southern coastal areas of Phippsburg and in the Sprague and Morse Rivers which are located approximately 1.5 miles or more from the center of the Jackknife ledge disposal area.

Lobsters are found and fished in the vicinity of the disposal area.

5.3 Threatened and Endangered Species

5.3.1 Birds

The proposed maintenance dredging project will occur in the Doubling Point and Popham Beach areas of the Kennebec River. The piping plover *Charadrius melodus*, a Federally listed threatened species and state listed endangered species, is known to nest on Popham State Park Beach. In recent years nesting has occurred near the Morse River spit. No piping plovers have nested on Hunnewell Beach in recent years. No least terns *Sterna antillarum*, a State endangered species have nested on these beaches in many years (U.S. Fish and Wildlife Service coordination, see letter in Appendix A).

Common terns, *Sterna hirundo* a Federally listed species of concern (http://www.fws.gov/endangered) nest on Pond Island, which is a component of the Petit Manan National Wildlife Refuge, and the nearby Sugarloaf Islands. Common terns have begun to nest on Pond Island since the control of gulls by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife letters dated October 8, 1997 and March 15, 2002). Both of these islands have historically supported a nesting colony of the Federally and state endangered roseate tern *Sterna dougallii dougallii*, although roseate terns have not been present in the past few years. Both common and roseate terns have nested on Pond Island from 2002-2006. It is anticipated that the Island will support a large colony of common terns and has the potential to support breeding roseate terns this year. Roseate terns from nesting areas throughout the Northeast are known to gather in late summer at the mouth of the Kennebec and Popham Beach as a staging area prior to autumn migration. According to the Maine Endangered Species Program, piping plovers and least terns are sensitive to disturbance during their nesting season. Generally this is between May 1 and August 31 but may vary slightly from year to year.

5.3.2 Fish

The area of the proposed project is a known seasonal corridor for the anadromous migration of the shortnose sturgeon *Acipenser brevirostrum,* as well as the Gulf of Maine Distinct Population Segment of Atlantic salmon (*Salmo salar*) both listed as Federally endangered under the Endangered Species Act (ESA). In addition, the Gulf of Maine Distinct Population Segment of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus* has recently been proposed to be listed as “threatened” under the ESA. All of these species either seasonally migrate through or use the areas of the proposed dredging and disposal areas for forage habitat. Coordination with the National Marine Fisheries Service (NMFS) under Section 7 of the ESA has been ongoing with regard to the effects of dredging and disposal operations in the Kennebec River on Federally listed species. Recent consultation with NMFS on the effects of dredging and disposal operations on the endangered shortnose sturgeon occurred when the channel was dredged in 2002 and then under an emergency action in 2003. A Biological Opinion (BO) was prepared by NMFS on January 14, 2004 for the October, 2003 emergency dredging of Doubling Point and Popham Beach that determined that the October, 2003 dredging of the Doubling Point and Popham Beach reaches of the Kennebec River may have adversely affected, but not jeopardized the continued existence of the Federally endangered shortnose sturgeon.

Consultation under Section 7 of the ESA was reinitiated in March of 2011 requesting a Biological Opinion on the effects of the proposed August 2011 dredging of the Kennebec River at Doubling Point and Popham Beach on the Federally endangered shortnose sturgeon, and the Gulf of Maine Distinct Population Segment of Atlantic salmon of which the Kennebec River remnant population was included in the listing of that endangered species (i.e. Atlantic salmon) in June of 2009. A biological assessment (BA) on the effects of the Federal action on both the shortnose sturgeon and Atlantic salmon was submitted as part of the consultation request (see Appendix E). In May of 2011, an addendum to that BA was submitted summarizing the effects of the dredging on the proposed to be listed as Federally threatened Gulf of Maine Distinct

Population Segment of Atlantic sturgeon (see Appendix E). A BO is being prepared by NMFS concerning the effects of the proposed action on these species, and will be attached to this document once completed. At this time a draft statement of Reasonable and Prudent Measures and Terms of Conditions for the proposed August 2011 dredging has been issued by NMFS concerning shortnose sturgeon (See Appendix E). No takes of Atlantic salmon are anticipated (Julie Crocker, NMFS, e-mail, Appendix E).

5.3.2.1 Shortnose Sturgeon

The shortnose sturgeon was identified as an endangered species in 1967 by the U.S. Fish and Wildlife Service, 32 Fed. Reg. 4001 (Mar. 11, 1967). With the passage of the Endangered Species Act of 1973 (and as amended, 16 U.S.C. 1531 *et seq*.) it became unlawful to take or possess shortnose sturgeon. In 1974 the National Marine Fisheries Service assumed jurisdiction over the species, 39 Fed. Reg. 41367, (Nov. 27, 1974). Various studies (McCleave *et al*., 1977; Taubert and Reed, 1978; Squires and Smith, 1979; Dadswell, 1979; Taubert, 1980; and Dadswell *et al*., 1984) have analyzed the life history of the species. A petition by the Edwards Manufacturing Company to remove the shortnose sturgeon in the Kennebec River from the List of Endangered and Threatened Wildlife (50 CFR § 17.11) was denied by the NMFS, 61 Fed. Reg. 53893 (Oct. 16, 1996). NMFS concluded that available data was insufficient to warrant designating individual populations in the Androscoggin and Kennebec River as distinct population segments under the Endangered Species Act.

Shortnose sturgeons occur in large rivers along the western Atlantic coast from the St. Johns River, Florida, (where they have possibly been extirpated) to the Saint John River in New Brunswick, Canada. They are a large and long lived species, with an average lifespan of 30-40 years (the oldest female captured being 67 years old). They are anadromous in the southern portion of their range (south of Chesapeake Bay) but northern populations are amphidromous (NOAA, 1998 in NMFS, 2004). Known shortnose sturgeon populations that occur in the U.S. portion of the Gulf of Maine include those that inhabit the major rivers in Maine, such as the Androscoggin River (Squires, 1983), the Kennebec and Penobscot Rivers (Squires and Smith, 1979; Squires *et al*., 1979), Montsweag Bay in the Sheepscot River estuary (Fried and McCleave, 1973), and in Massachusetts, the Merrimack River (Kieffer and Kynard, 1993). The Sheepscot River estuary is part of the estuarine complex formed by the Androscoggin, Kennebec and Sheepscot Rivers.

The shortnose sturgeon forages primarily on insects, annelids, finfish, molluscs and crustaceans, frequenting shallow waters and seldom exceeding 135 cm in standard length (McCleave *et al*., 1977) with life spans of 50 years (Boreman *et al*., 1984). Tracking of the daily movement of this species identified extensive use of 3.3 to 6.6 feet (1-2 meter) depths for foraging. Mean swimming speed ranged from 8.1 to 34.0 cm/sec, with orientation predominantly with or against the tide. Additionally, McCleave *et al*. (1977) documented the euryhaline tolerances of this anadromous species, traversing salinity gradients fluctuating 10 ‰ in less than two hours.

These organisms have been found to be nocturnal, foraging the shallows, usually spending daylight in deep water. Substrate preferred for forage includes shallow, muddy bottom in freshwater areas and gravel-silt bottoms 15 to 45 feet (5-15 meters) deep in saline areas. Juveniles (remaining upriver in freshwater) may prefer sand or gravel (high current) areas (Dadswell *et al*., 1984).

Shortnose sturgeon females spawn only once every three years (Boreman *et al*., 1984). The spawning period is estimated to last from a few days to several weeks (NMFS, 2004). The eggs are released and hatched in freshwater above the saline tidal influence. The eggs are demersal (adhered to the substrate) and juveniles nurture in freshwater until approximately 45 cm in length. Juveniles (and larvae) are benthic, occupying deep (greater than nine meters) areas of strong (15-40 cm/sec) currents in the river. Once adult size (45-50 cm), the fish commence fall downstream and spring upstream migratory behavior. Some of the spring spawning adults may not migrate, but overwinter in deep, freshwater holes upstream of the tidal range near their spawning grounds. The remaining populations spend the winter in 30 to 100 foot deep (10-30 m) saline areas (Dadswell *et al*., 1984) and the summer in low current, shallow 6 to 30 foot (2-10 m) areas.

In the Kennebec River system, general movement of shortnose sturgeon appears to be a composite of both the spawning migration and the feeding migration (Squires *et al*., 1982). In addition, shortnose sturgeon seasonally move to and from overwintering areas (Squires, 2001). Water temperatures of 6° and 8°C appear to trigger a portion of the population that is ripe, and possibly some non-ripe fish to migrate upstream to the spawning grounds. The number of shortnose sturgeon peaks on the spawning grounds at water temperatures of 7.5° to 14.5° C (Squires *et al*., 1982). These water temperatures occur from mid-April to mid-May, depending on weather and river flows.

Two large concentrations of shortnose sturgeon in spawning condition were discovered in 1980 (Squires *et al*., 1982) in the Kennebec River System. The largest concentration was near the head of the tide on the Androscoggin River and the second site was located in the Kennebec River at South Gardiner, approximately nine miles south from the head of the tide. Both spawning sites are characterized by substrate of gravel, rubble, cobblestone and/or large boulders. The spawning sites are also characterized by faster river flows and deep channels or holes (19 to 27 feet below MLW).

Seasonal movements in the Kennebec River indicate a general downriver movement in the summer and upriver movement in late summer and early fall (Squires and Smith, 1979; see Appendix A of attached biological assessment, Appendix E). Shortnose sturgeon are found in large concentrations during the summer months (June, July, August, September) in the mid-estuary near the Bath region. In particular, the main area they are found is in Pleasant Cove on the Sasanoa River (Squires *et al*., 1982). Pleasant Cove is characterized by having extensive mud flats which are mostly covered with rooted aquatic plants. Additional tracking and trawl data collected from 1996 -1999 indicate that shortnose sturgeon may be found in the Bath area from at least late March through the beginning of December (Normandeau Associates, 2001). Additional studies have shown shortnose sturgeon to be present in the mouth of the Sasanoa River and Montsweag Bay during September and October. Some occasional fish have also been observed in areas south of Bath in the Kennebec River (Squires *et al*., 1982). In addition, large numbers of sturgeon were seen jumping near Chops Point and Days Ferry (which is located between Bath and Merrymeeting Bay) during late September and early October, areas with deep turbulent waters (Squires and Smith, 1979). These areas are upstream from Doubling Point.

In October of 1996, the Maine Department of Transportation tagged 15 shortnose sturgeon from Pleasant Cove in the Sasanoa River and further downstream in the Kennebec River to identify the overwintering location for these fish. Contrary to other migratory studies on shortnose sturgeon, the sturgeon from Kennebec River moved upstream to overwintering sites, instead of downstream. All of the tagged fish located to an area near Swan Island, at the upper end of Merrymeeting Bay, since November of 1996 through at least February 1997 (ME DOT, 1997).

It should be noted, that recent tagging studies in the Penobscot River, approximately 93 miles (150 km) north of the Kennebec River, have recovered adult shortnose sturgeon that had been tagged in Kennebec River. In addition, adult shortnose sturgeon that were tagged in the Penobscot River have been found in the Kennebec, indicating migrations between these two populations. It is possible that the Kennebec River shortnose sturgeon may be using the Penobscot River for summer feeding and/or as an additional overwintering site. This represents a migratory distance of approximately 143 miles (230 km) between these two areas (Fernandes, 2008).

The adult shortnose sturgeon population in the Kennebec River was estimated at 7,222 based on tagging and recapture efforts from 1977-1981 (NMFS Letter dated September 29, 2003a). Since that time additional tagging studies have been conducted, and the population has appeared to have increased. Based upon the mark and recapture data from 1998-2000 the estimated population was approximately 9,488 fish with a 95% confidence interval ranging from 6,942 to 13,358 fish (Squires, 2003). This represents greater than a 20% increase in the population since the previous study in 1981. However, this does not include an estimate of the juvenile population.

During the October 2003 emergency dredging of Doubling Point and Popham Beach, five incidental shortnose sturgeon takes occurred at Doubling Point. Also as noted previously recent tagging studies have shown movement of shortnose sturgeon between the Penobscot and Kennebec rivers. This suggests that these fish could be seasonally present in the Popham Beach dredging and disposal areas during the times of the proposed dredging. This species is discussed further in the "Biological Assessment For Shortnose Sturgeon (*Acipenser brevirostrum*) And The Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) in the Kennebec River, Bath, Maine" (Appendix E).

5.3.2.2 Atlantic Salmon

In 2000, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service listed the Gulf of Maine (GOM) Distinct Population Segment (DPS) of anadromous Atlantic salmon (*Salmo salar*) as an endangered species. The GOM DPS includes all naturally reproducing wild populations and those river specific hatchery populations of Atlantic salmon having historical, river specific characteristics found north of and including tributaries of the lower Kennebec River, to, but not including the mouth of the St. Croix River at the United

States-Canada border. The Penobscot River and its tributaries downstream from the site of the Bangor Dam are included in the range of the GOM DPS (65 FR 69459; November 17, 2000 as cited in 71 FR 66299, November 14, 2006). At that time, a decision to include the salmon that inhabited the main stems of the Kennebec River above the former site of the Edwards Dam and the Penobscot River above the former site of the Bangor Dam was deferred by the Fish and Wildlife Service and the National Marine Service pending genetic analysis of those populations. The upper Kennebec River and upper Penobscot River stocks were added in 2009.

Atlantic salmon are an anadromous species that historically inhabited the North Atlantic Ocean and its freshwater tributaries, ranging from Ungava Bay in Canada, to the White Sea in Russia. In eastern North America, they ranged as far south as Long Island Sound. Atlantic salmon in Maine were historically found in all of the major river systems and their tributaries which had suitable habitat. Atlantic salmon spawn in freshwater rivers and tributaries (in the fall), where they generally will spend 2-3 years before undergoing a physiological change (i.e. smoltification) and then migrate to the ocean (in the spring of the year). After spending 2-3 years in the ocean, they will return to their natal rivers in the spring to spawn again and complete their life cycle. Atlantic salmon can spawn more than once, and once spawning has occurred, post spawning adults (known as kelts) may either remain in their streams or return to the ocean to repeat the migration cycle.

Adult Atlantic salmon return to rivers from their high seas feeding migrations in the spring, to spawn in their natal streams in the fall. The upstream migration continues into the fall. In Maine although spawning does not occur until late fall, the majority of Atlantic salmon enter freshwater between May and mid-July with the peak occurring in June (Fay *et al*., 2006).

In the spring when water levels increase due to freshets, and water temperatures increase to 4.5 to 5.5^{o} C, smolts begin to migrate downstream toward the ocean. In the Penobscot River, Maine, full migratory behavior was expressed at 9^{o}-10^{o} C (Danie, 1984). Generally this occurs during May at which time the smolts will enter the ocean to begin their first ocean migration (USASAC, 2004).

The Kennebec River has a small population of returning Atlantic salmon which are confined to the portion of the river and its tributaries located below the first impassable dam in Waterville (i.e. the Lockwood Dam). Surveys conducted by the Maine Atlantic Salmon Commission have shown that spawning has occurred in the mainstem of the Kennebec River below the Lockwood Dam (2004 Annual Report Of The Maine Atlantic Salmon Commission). Recently, with the implementation of fish passage (i.e. transport) over the Lockwood Dam in Waterville, spawning is occurring in the Sandy River which joins the Kennebec River in Madison. In addition fish are now entering the Sebasticook River (Paul Christman, 2009, Personal Communication). Therefore in order for the fish to reach these upstream locations, the up-migrating adults would have to pass through the Popham beach and Doubling Point areas during the spring and early summer (typically from May-July). In addition, the down-migrating smolts would have to pass these areas in the spring (predominantly in May) en route to the ocean, and the post spawning adults would have to migrate through these same areas in the fall. This species is discussed further in the “Biological Assessment For Shortnose Sturgeon

(*Acipenser brevirostrum*) And The Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) in the Kennebec River, Bath, Maine" (Appendix E).

5.3.2.3 Atlantic Sturgeon

As noted, the Gulf of Maine Distinct Population Segment of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus* has recently been proposed to be listed as "threatened" under the ESA, 75 Fed. Reg. 61872 (Oct. 6, 2010). The Atlantic sturgeon is an anadromous species which were historically present in approximately 38 rivers in the United States, from St. Croix, ME to the Saint Johns River, FL. Thirty five of those rivers were confirmed to have supported spawning for Atlantic sturgeon (ASSRT, 2007 as cited in Fed. Reg., 2010). In addition they reportedly occurred in Canadian rivers as far north as the lower George River in Ungava Bay and the Hamilton Inlet in Labrador, although it is not known if spawning occurred in any river in Labrador (Vladykov and Greeley, 1963; Leim and Scott, 1966, in ASSRT, 2007). Although once abundant throughout their range, over fishing and other environmental stressors have led to a significant decline in their population, and they are now proposed to be listed under the endangered species act (ESA) as "endangered" in their southern and mid Atlantic ranges, and "threatened" in their northern range, which includes the Gulf of Maine.

Generally, the life history pattern of Atlantic sturgeon is that of a long lived, (approximately 60 years; Mangin, 1964; Stevenson and Secor, 1999), late maturing, estuarine dependent, anadromous species (ASSRT, 2007). They can reach lengths of up to 14 feet (4.26 m) and weigh over 800 pounds (364 kg) (FR, 10/6/2010). Atlantic sturgeon are omnivorous benthic feeders and filter quantities of mud along with their food. The diets of adult sturgeon include mollusks, gastropods, amphipods, isopods and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates (ASSRT, 2007).

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment, and generally spawning adults migrate upriver between April – May in mid Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco, 1977; Smith, 1985; Bain, 1997; Smith and Clugston, 1997; Caron *et al*., 2002, in ASSRT, 2007). It is likely Atlantic sturgeon do not spawn every year, and multiple studies have indicated spawning intervals ranging from 1-5 years for males (Smith, 1985; Collins *et al*., 2000; Caron *et al*., 2002) and 2-5 years for females (Vladykov and Greeley, 1963; Van Eenennaam *et al*., 1996; Stevenson and Secor, 1999, in FR, 2010). Spawning is believed to occur between the salt front of estuaries and the fall line of large rivers, in flowing waters, with optimal flows ranging from 46-76 cm/s and depths from 36 to 88 feet (11-27 m) (Borodin, 1925; Leland, 1968; Scott and Crossman, 1973; Crance, 1987; Bain *et al*., 2000, in FR, 2010). Their highly adhesive eggs are deposited on the bottom substrate usually on hard surfaces such as cobble (Gilbert, 1989; Smith and Clugston, 1997, in FR, 2010). Eggs hatch in approximately 94 and 104 hours after deposition at temperatures of 20^{o} to 18^{o} C respectively and the larvae are demersal after hatching (Smith *et al*., 1980 in FR).

After hatching, Atlantic sturgeon larvae move downstream to their rearing grounds during the yolk sac larval stage, which is completed in about 8-12 days (Kynard and Horgan, 2002 in ASSRT, 2007). Downstream movement occurs only during the night in the first half of their migration (Kynard and Horgan, 2002), and in the latter half of their migration during both day and night. During the first half of their downstream migration, the larvae use benthic structure such as gravel matrix for refuge during the day. The larvae continue downstream movement toward the estuary, transitioning to juveniles in the process and developing a tolerance for increased salinity. They may reside in the estuary as juveniles for months or years before migrating to the open ocean as sub-adults (Holland and Yelverton, 1973; Doevel and Berggen, 1983; Waldman *et al*., 1996a; Dadswell, 2006; in ASSRT, 2007).

The subadults move to coastal waters once they reach a size of approximately 2.5 to 3 feet (76-92 cm) (Murawski and Pacheco, 1977; Smith, 1985 in ASSRT, 1997) where populations undertake long range migrations (Dovel and Berggren, 1983; Bain, 1997; T. King supplemental data 2006, in ASSTR, 2007). When at sea, the adults mix with populations from other rivers, but return to their natal rivers to spawn as indicated from tagging records (Collins *et al*., 2000; K. Hattala, NYSDEC, Pers. Comm. 1998 in ASSTR, 2007) and population genetic studies showing relatively low rates of gene flow (King *et al*., 2001; Waldman *et al*., 2002 in ASSTR, 2007).

The Kennebec River is one of the few rivers in Maine where Atlantic sturgeon have historically and are believed to still spawn. Evidence indicating Atlantic sturgeon spawning activity in the Kennebec has included the capture of several Atlantic sturgeon in a small commercial fishery on the Kennebec River near Rolling Dam (in Gardiner) in 1980. From June 15 – July 26, 1980, thirty-one adult Atlantic sturgeon were captured (in the fishery noted above), which included 27 males of which four were ripe, and 4 females, of which one was ripe. Additional evidence of spawning in the Kennebec River includes the capture of 7 Atlantic sturgeons in spawning condition by the Maine DMR, just below the spillway of Edwards Dam in July of 1994. These data indicate not only that spawning is likely occurring in the Kennebec River, but where it is occurring (i.e. upstream from the head of tide) and when it is occurring (i.e. approximately in June-July).

Additional sampling data show the locations of adult and subadult Atlantic sturgeon in the Kennebec River. In September of 1997 subadults were captured by the Maine Department of Marine Resources (MEDMR) in the Eastern River (n = 18) and the Cathance River (n = 5), which are freshwater tributaries to the Kennebec, in overnight sets of gill nets (T. Squiers, MEDMR, Pers. Comm. 1998 from ASSRT). In addition, the MEDMR collected 13 subadults at the mouth of the Kennebec River in a 2000-2003 inshore groundfish trawl survey. Out of five regions sampled along the New Hampshire and Maine coasts, the mouth of the Kennebec River had the greatest number of occurrences of Atlantic sturgeon (Squiers, 2003, in ASSRT).

Additional tagging studies of Atlantic sturgeon in the Penobscot River have been conducted in order to determine their seasonal movement/migrations (Fernandes 2008, Fernandes *et al*., 2006; Fernandes *et al*., 2008) and have provided further information concerning their use of the Kennebec River. In 2007, two individual acoustically tagged Atlantic sturgeon were detected moving out of the Penobscot River estuary, and were detected in the Kennebec River near the Sasanoa River. One of these fish was a large potentially mature individual that had been tagged in the Penobscot River in July (2007) and was detected in the Kennebec River seven days after its last detection in the Penobscot River. It remained in the Kennebec River (intermittently) until the middle of October. The other fish left the Penobscot River in October of 2007 and was detected in the Kennebec River from October 31 – November 4. This indicates a minimum coastal migration distance of approximately 93 miles (150 km) from the mouth of the Penobscot River to the first acoustic receiver in the Kennebec River located at the Sasanoa River (Fernandes, 2008), which is located approximately 2 miles upstream from Doubling Point. Therefore in order for these fish to access the upstream areas of the Kennebec River for spawning or foraging, they would be required to pass through both the Popham Beach and Doubling Point proposed dredging and disposal areas. Additional information on this species can be found in the "Summary of the Effects of Maintenance Dredging on the Proposed Federally Threatened Atlantic Sturgeon, (*Acipenser oxyrinchus oxyrinchus*) in the Kennebec River, Sagadahoc County, Maine" which is an addendum to the "Biological Assessment For Shortnose Sturgeon (*Acipenser brevirostrum*) And The Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) in the Kennebec River, Bath, Maine" (Appendix E).

5.4 Essential Fish Habitat

Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act and amended by the Sustainable Fisheries Act of 1996, an Essential Fish Habitat (EFH) consultation is necessary for this project. EFH is broadly defined as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." Kennebec River FNP and Jackknife Ledge nearshore disposal area fall into this category and thus have the potential to provide habitat for fish species in the area.

The National Marine Fisheries Service Guide to Essential Fish Habitat web site was used to determine which species have designated EFH in the Kennebec River FNP, Bath and Phippsburg, ME. The location of this site is http://www.nero.nmfs.gov/ro/doc/webintro.html. The species and the life stages of those species that have EFH in the study area were determined by using the quick reference 10 x 10 minute squares of latitude and longitude. The coordinates of the 10 x 10 minute squares that are representative of the geographic area where the Popham Beach dredging and disposal may occur are 43°50.0' N, 69°40.0' W, 43° 40.0' N, 69° 50.0' W. The coordinates of the 10 x 10 minute squares that are representative of the geographic area where the Doubling Point dredging and disposal may occur are 44° 00.0' N, 69°50.0' W, 43° 40.0' N, 69° 50.0' W. Fifteen Federally managed species of finfish have the potential to occur within the proposed dredge and disposal areas. These include: Atlantic salmon (*Salmo salar*), Atlantic cod (*Gadus morhua*), pollock (*Pollachius virens*), white hake (*Urophycis tenuis*), winter flounder (*Pseudopleuronectes americanus*), yellowtail flounder (*Pleuronectes ferruginea*), windowpane flounder (*Scopthalmus aquosus*), American plaice (*Hippoglossoides platessoides*), ocean pout (*Macrozoarces americanus*), Atlantic halibut (*Hippoglossus hippoglossus*), Atlantic sea scallop (*Placopecten magellanicus*), Atlantic sea herring (*Clupea harengus*), bluefish (*Pomatomus saltatrix*), Atlantic mackerel (*Scomber scombrus*), and bluefin tuna (*Thunnus thynnus*).

See Appendix for D for more details in the Essential Fish Habitat Assessment.

5.5 Historic and Archaeological Resources

The proposed maintenance dredging of the Kennebec River at Doubling Point and Popham Beach with disposal at the Bluff Head region and Jackknife Ledge is limited to areas previously disturbed during past maintenance dredging and disposal operations. The potential for the presence of any historic properties is very low in these areas. There are no known historic shipwrecks in the vicinity of the proposed disposal site near Jackknife Ledge.

5.6 Social and Economic Resources

Bath, Maine has been known as the "City of Ships," and has long been identified with shipbuilding (http://www.cityofbath.com/). With a population of approximately 10,000, it is home to Bath Iron Works one of the largest employers in the State of Maine, having an annual payroll of more than 325 million dollars, and employing almost 6,000 people. Greater than 2000 of its employees reside in either Sagadahoc County or Cumberland County, which are either directly adjacent or in close proximity to the Kennebec River (General Dynamics and BIW Feb. 2011 power point). In addition, Bath Iron works does business (with other companies) in approximately 11 counties in Maine. Bath Iron works is directly dependent on the proposed maintenance dredging project to continue operation. Large container vessels and deep draft U.S. Navy vessels are manufactured and repaired at the Bath facility. The Bath Iron Works relies upon extreme high tides to move U.S. Navy Destroyers. The delay of vessel traffic through shoals in the project area impacts construction and repair processes potentially having an effect on the local economy.

The Kennebec River estuary is an area that is utilized for commercial shellfishing (including lobster fishing). Since 2008, approximately 500-700 active commercial harvesters (finfish, shellfish and lobsters) were reported in Sagadohoc County, which includes the waters in and adjacent to the Kennebec River (www.Maine.gov/dmr/commercialfishing/active Harvestersbycounty.pdf). Preliminary landing data for 2011 from the State of Maine was estimated at approximately 245,249,120 live pounds for all landings (including finfish) of which 37% consisted of lobster, and another 10% consisted of blue mussel (6%) and soft shelled clams (4%). All of these species can be harvested in the Kennebec River in the vicinities of the dredging and disposal areas (http://www.maine.gov/dmr/commercialfishing/MaineLandings ByLive Pounds.PieChart.pdf.pdf). As noted previously, soft-shell clams are present in the areas of Drummore Bay, Parker Head Wyman Bay, Atkins Bay and Popham Beach/Small Point Beach and Morse/Sprague River, and blue mussels are present near Parker Head and Wyman Bay and Atkins Bay. All of these areas are downstream from the Bluff Head disposal area, and in the case of Popham Beach, adjacent to one of the dredging areas. Total soft-shell clam landing for the State of Maine in 2010 was approximately 858.31 metric tons with a value of 11.7 million dollars. Historic levels from between 2000 and 2005 appear to have been higher with total landings for the state averaging approximately1050 metric tons with an approximate average value of 15 million dollars. In Phippsburg approximately 40 families are reportedly dependent upon commercial shellfishing and derive the bulk of their income during the month of August with an estimated total value of $400,000.00 (Letter from Stephen Hinchman, March 30, 2011).

In Phippsburg, the peak harvest period for clams is from June – September with the price per bushel of clams reaching its maximum during these months. During the spring, late fall and winter, the average price per bushel of clams ranges from $25 to $50, however during July, August and September the price can more than double, averaging between $90 and $110 (Darcie Coutier, 2011, Personal Communication).

During the summer months, the Kennebec River estuary in the vicinity of the proposed dredging and disposal areas are heavily fished for lobsters. Lobster traps are set in the area offshore of Popham beach near Jackknife Ledge and it has been reported that numerous lobster traps/buoys are present in these waters during the summer. This area is generally most heavily fished during the month of August, however, the amount of lobster fishing can vary each year depending upon where the lobsters are located (John Cornish, Phippsburg Maine Marine Patrol, personal communication). It has been reported that one commercial lobster fisherman from the Phippsburg area generally sets 60 -70 traps in the vicinity of Jackknife Ledge during the summer (Letter from Stephen Hinchman, March 30, 2011). Assuming that other commercial lobster fisherman from surrounding areas also fish these waters, it is understandable how the area could be covered with lobster gear. As noted in Section 5.2.2.3 of this EA, during the summer months, adult lobsters migrate to inshore waters and then return to deeper water as the temperature decreases. Therefore it is expected that lobsters will be in closer to the shore areas during the time of the proposed dredging and disposal, although their locations would vary depending on water temperatures at the time of dredging.

The Kennebec River is a source of tourism and recreation that provides a livelihood for many people living in the surrounding areas. Recreational fishing, boating, kayaking, and swimming are some of the activities that draw people to the Kennebec River. There are commercial fishing charter boats especially for striped bass and bluefish, which in the summer months can move upstream into Merrymeeting Bay and even into freshwater sections of the river upstream in pursuit of prey. In addition to the charter recreational fishing boats, much of the tourism and recreational boating, kayaking and swimming occur during the summer months.

There are numerous Bed and Breakfast inns that are dependent on tourists visiting the area for scenic and recreational activities in the towns of Arrowsic, Phippsburg, and Georgetown. Some of the recreational facilities in the area include: Fort Popham, Popham Beach, Fort Baldwin, Popham State Park Beach, Hunnewell Beach, Sewall Beach, Bates-Morse Mountain Conservation Area, Josephine Newman Wildlife Sanctuary, Sequin Island Lighthouse, and Arrowsic has four lighthouses. The Bates-Morse Mountain Conservation Area is located near Seawall Beach and includes trails that end inshore from Jackknife Ledge. This area is reportedly used by 16,000 visitors per year for hiking as well as water related recreation (including swimming) (Letter from Laura Sewall, 2011).

5.7 Air Quality

Ambient air quality is protected by Federal and state regulations. The U.S. Environmental Protection Agency (EPA) has developed National Ambient Air Quality Standards (NAAQS) for certain air pollutants, with the NAAQS setting concentration limits that determine the attainment status for each criteria pollutant. The six criteria air pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

Sagadahoc County, Maine is not designated as a non-attainment area for any of the six air pollutants (US EPA, 2011).

5.8 Noise

The region around the project areas of the Kennebec FNP tends to be quiet recreational areas with noise generated by people at the parks and beaches, vessels transiting through the river, and fishing boats within the river and coastal areas.

6.0 ENVIRONMENTAL CONSEQUENCES

6.1 Physical and Chemical Effects

6.1.1 No Action Alternative

The "No Action" alternative would consist of not dredging the shoaled areas of the Federal navigation project at Doubling Point and Popham Beach. The effects of a "No Action" approach are discussed here, both in terms of environmental and navigation impacts.

The Kennebec River is a dynamic system influenced by strong tidal currents and occasional significant storm runoff events. Shoals, especially those at Doubling Point typically consist of massive sand-waves that generally begin to form in the summer and continue to worsen into the fall and winter months. Shoaling at Doubling Point can be somewhat unpredictable as the extent of shoaling is highly dependent on the river flow throughout the year and significant runoff events (typically occurring in the springtime) have on occasion completely dispersed the shoaling there. Conversely, significant runoff events can also exacerbate shoaling by scattering them to different locations within the river near Doubling Point.

The Corps performed hydrographic surveys of the Federal channel and an area outside of the east channel limit near Doubling Point in December 2010 and again in February 2011 (Appendix G) prior to scheduled transits of the SPRUANCE to and from sea trials. These surveys indicated that shoaling to a controlling depth of 19.7 feet below MLLW had occurred in the authorized 27 foot deep Federal channel just north of Doubling Point. At the time that these surveys were performed, shoals near Doubling Point extended from the west channel limit and stretched across almost the entire width of the authorized 500 foot wide navigation channel. The surveys also indicated that there was a narrow area near Doubling Point with deeper depths outside (adjacent to) the east channel limit, and closer to the east bank of the Kennebec River. The Corps performed another hydrographic survey in mid-May 2011 (see Appendix G) to re-examine the conditions in the river and determine to what extent the spring runoff events had affected the shoaling. These surveys showed that the some scouring of the material had occurred in the channel with the controlling depth of the channel near Doubling Point deepening to 22.4 feet below MLLW, but sand wave shoals now crossed the entire channel and began to extend outside the channel to the east.

With the benefit of the surveys from December 2010, February 2011, and May 2011, the Corps evaluated the viability of the "No Action" alternative from a navigation perspective, particularly as to the passage of the SPRUANCE in September 2011. Earlier in 2011, Bath Iron Works (BIW), with the assistance of Captain Earl Walker of the Portland Pilots, had safely navigated the SPRUANCE around the shoals in the channel to and from sea trials during February and March. To accomplish this, the SPRUANCE left the Federal channel near Doubling Point and navigated in an area to the east of the channel. Given the length, breadth and draft of the SPRUANCE, the significant currents in the river, and that there is almost a 90 degree bend to the east in the river just downstream of the shoals, transiting the ship outside the limits of the authorized Federal navigation channel was a maneuver that carried substantial risk. By leaving the channel to the east in this manner, the vessel was brought away from the centerline of the river and closer to the east bank; an area where ledge and other shoals and obstructions exist. With the results of the May 2011 surveys, the Corps coordinated with Navy personnel, BIW, and Captain Earl Walker (who will be aboard the SPRUANCE when it sails in September to assist the Navy Commanding Officer). Although some of the shoaling had been reduced—likely due to spring runoff events—the sand wave shoals now crossed the entire channel, and some now extended to the east, into the areas where the SPRUANCE had navigated to the sea trials. With the typical pattern of additional shoaling during summer months, it is anticipated that the sand waves will grow in size and may continue to develop to the east of the channel.

Because spring runoff events have not dispersed the shoaling to an acceptable level, failure to dredge the authorized Federal channel (under the "No Action" alternative) will likely result in further accretion of sand to the existing shoals during the summer months in a manner that will exacerbate navigation concerns. The "No Action" alternative would result in avoidance of the impacts of dredging and disposal activities that are described and analyzed in this document, but there would be negative consequences to navigation that could lead to potentially severe environmental impacts. Further shoaling could make the river (i.e. the channel and adjacent areas) totally impassible to deep draft vessels, and the Navy would be unable to deploy the SPRUANCE to accomplish its national security mission. If the shoals are not removed and the Navy attempts the transit of the SPRUANCE, there would be a substantial risk of grounding the vessel. Grounding the SPRUANCE could cause significant damage to the sonar dome, the hull and the propellers as well as cause injury to Navy personnel. Such damage to the ship and injuries to personnel would delay the sail away date of the SPRUANCE and impact the Navy's ability to perform its mission in support of national security. Similar harms could occur to other deep draft ships attempting passage through this area. As noted above, sand wave shoals have begun to develop in the area to the east of the channel in which the SPRUANCE transited in February and March 2011. This area is adjacent to ledge, and attempting to navigate the ship further to the east than was done for the sea trials would create greater risk of grounding on ledge. In addition to the harms to the SPRUANCE and Navy personnel described above, a grounding of the vessel--or other deep draft vessels--on ledge is more likely to cause an oil spill or a release of other hazardous materials that may have significant and potentially irreversible environmental impacts. Additionally, BIW is a major employer in the state; the inability of Navy vessels and other deep draft vessels to access and egress from this facility would represent a significant negative impact on the economic stability of the region.

Based on the hydrographic surveys, historic shoaling patterns, and coordination with the Navy, BIW, and Captain Walker, the Corps determined that maintenance dredging of the channel is warranted and the "No Action" alternative would not be viable to address the navigation needs of the Navy. This determination was made in light of the most current information concerning the sand wave shoals, a projection of what the channel conditions might be in late August 2011 (i.e. prior to the scheduled departure date of the SPRUANCE), and the contract procurement process. Likewise, beyond failing to address the immediate navigation needs, over the long term, the "No Action" alternative will result in additional shoaling and failure to provide the authorized project depths that Congress has deemed appropriate for navigation in the Kennebec River.

6.1.2 Dredge Sites

The impacts of dredging sand from the project areas will be limited to potential turbidity increases and removal of benthic organisms. These impacts are expected to be both spatially and temporally limited. Dredging will occur only within two sections of the designated Federal channel (see Figures 2 and 3). Dredging is expected to be completed within three to five weeks between approximately August 1 and August 31 for the Doubling Point and Popham Beach areas. Since a hopper dredge is being used, the dredging is not continuous because the dredge leaves the area to transit to the disposal site. Also the two dredge areas are miles apart and turbidity impacts will be localized to each dredge area when maintenance is occurring in that area and not continuous throughout the entire lower river.

A hopper dredge will fill the hoppers with a slurry of sand and water in approximately a one to four ratio. As stated earlier, the river environment is dynamic and its inhabitants are adaptable to increased turbidity, shifting sand and other natural stresses associated with fast currents. Increased turbidity associated with spring runoff and storms would have a greater impact than the anticipated sand resuspension from hopper overflow since runoff and storms will input silt into the river from runoff under naturally occurring conditions (Fenster *et al*., 2001).

Coastal and estuarine organisms are exposed to suspended sediments from tidal flows, currents and naturally occurring storm events; therefore they have adaptive behavioral and physiological mechanisms for dealing with this feature of the habitat. Dredging related suspended sediments or turbidity plumes may differ in scope, timing, duration, and intensity from natural conditions (Clarke and Wilber, 2000). Major storms can displace larger amounts of sediments than dredging operations, and tend to occur one to three times a year. This is more frequent than most dredging operations at a particular area and dredging affects much smaller regions (i.e. a localization of impacts) than these major storms (Wilber and Clarke, 2001). The duration and concentration gradients of suspended sediment plumes from dredging are dependent on numerous factors, such as specific dredge plant, sediment characteristics, and environmental conditions (Collins, 1995).

However, the turbidity effects for this project are anticipated to be short-term and localized around the dredging areas due to the sandy nature of the material to be removed. Re-suspension of fine–grained material is usually restricted to the vicinity of the operation and decreases rapidly with increasing distance from the operation. The majority of resuspended sediments from a hopper dredge are due to overflow of the hoppers into surrounding waters. A hopper dredge without overflow could suspend 25-200 mg/l of silty sediments ($\leq$ 50 % fines) within 100 to 400 feet downcurrent of the dredge (Hayes, 1986). With overflow, these amounts increase to 250-700 mg/l within 100 to 400 feet downcurrent of the dredge (Hayes, 1986). Since the dredged material from the River is sand, with low silt content, very little turbidity is expected. Also, sandy material is generally not associated with high levels organic carbon or considered a carrier of contaminants (40 CFR 230.60 (a)), and dredging the sandy material from the channel is not likely to result in the release of nutrients or decreases in dissolved oxygen levels.

Field evaluation of hopper dredge overflow was completed for two regions of the Delaware River, lower Delaware Bay (a predominantly coarse-grained material) and at the Deepwater Point range just below the Delaware Memorial Bridge (typical fine-grained material; sand, silt and clay) (Miller *et al*., 2002b). The plume study results showed that the coarse-grained material settled quite rapidly and that no lateral dispersion of the plume out of the channel was observed and no significant change above background levels could be detected. At 1 hour elapsed time following the end of the overflow dredging operation, the levels of suspended material had returned to background conditions. At the fine grained site, an increase in the suspended material was observed, however, after an elapsed time of 1 hour following the completion of the overflow dredging operation, levels of suspended materials had returned to background conditions. Again, no lateral dispersion of the dredge plume beyond the channel limits was observed.

6.1.2.1 Doubling Point

The substrate at the Doubling Point region of the Kennebec River is in a dynamic flux of shifting sands. Dredging removes sand that has formed irregular sand waves with crests above the project depths. Surveys (SAIC, 1984) have defined the formation of these sand waves within four months after dredging. The site undergoes daily volume changes (SAIC, 1984). These total volume changes and sand waves are a result of hydrodynamic forces of riverflow and semidiurnal tides. The total volume of sand does not increase appreciably, but the sand wave formation occurs rapidly. Therefore, displacing the tops of the sandwaves without removing additional material would most likely result in rapid reformation of the sandwaves.

The water quality at the dredge site is not expected to be appreciably degraded during dredging operations. As the hopper dragarm is moved, some sand will be displaced. The turbidity associated with sand dredging is minimal since sand settles rapidly. The grain size curves (see Appendix B) for the dredge sites reveal the sediment to be sand. Secchi determinations (Hubbard, 1986) during previous surveys determined the river to have high background turbidity (Secchi 2-2.5 m) during the tidal cycles.

Water quality studies conducted using a mechanical dredge in the vicinity of the Bath Iron Works (upstream from the proposed project at Doubling Point) by Normandeau Associates in 1997 and 2001 indicate that this is a naturally turbid area with naturally occurring fluctuations in turbidity. In 2001, Normandeau Associates monitored water quality during dredging operations at Bath Iron Works. Pre-dredge total suspended solids (TSS) levels ranged from 20-49 mg/l. The maximum observed TSS levels during and after dredging was 55 mg/l. This level was recorded during an ebb tide, 50 feet from the dredge. Additional monitoring was conducted during dredging at the Pier 2 berthing area in 2002. Pre-dredge turbidity ranged from 5.0-7.9 NTU with TSS values ranging from 12 -18 mg/l. During dredging, TSS ranged from 24 to 43 mg/l. While increased turbidity was experienced at a distance of 150 feet from the dredge, the highest concentrations were limited to the area within 50 feet of the dredge (NMFS, 2009, page 46).

Monitoring of nine mechanical dredge operations of fine grained material (high organic content) in the Delaware River (Burton, 1993) in 1992 indicated that sediment plumes have fully dissipated by 3300-feet from the dredge area. The Delaware River study also indicated that mechanical dredging does not alter turbidity or dissolved oxygen to a biologically significant degree and analysis did not reveal a consistent trend of higher turbidity and lower dissolved oxygen within the sediment plume. Dredging of coarse grained material (sand) would be expected to have less of an impact.

The results of the monitoring program for the maintenance dredging of New Haven Harbor, Boston Harbor Improvement Project, and Providence River can be compared to the proposed dredging of Kennebec River as a worst case scenario since the material from these projects were silt and not sand like the Kennebec. Monitoring was conducted as a result of concerns by the various State Department of Environmental Protection agencies (CT, MA, RI respectively) relative to the transport and fate of the resuspended sediments resulting from the dredging operations. For these projects, shallow water areas were located adjacent to the navigation channel which had been identified as winter flounder spawning habitat.

The results from the New Haven Harbor study (Bohlen *et al*., 1996) showed that the sediment suspended by the dredge did, at times, migrate outside of the navigation channel onto the adjacent shoal areas. Excursions onto the shoals only occurred when the dredge was in the immediate vicinity and during maximum tidal currents. The plume was more likely to stay within the confines of the channel during early or late ebb tides. This is supported by the water sampling data which showed that concentrations dropped fairly quickly away from the dredging activity. The highest concentration of suspended sediment measured (662 mg/l) was located within 100 meters of the barge and associated with the near bottom waters. Most of the higher concentration data were within a 100 meter range of the barge, regardless of the tide state. Beyond that distance, most of the data indicates that the concentrations with the dredge-induced plume were relatively low, decreasing rapidly under the combined effects of settling, advective and turbulent diffusion and mixing.

Monitoring during the Boston Harbor Navigation Improvement Project (BHNIP) was conducted as specified in the Water Quality Certification (WQC) for dredging of the surface silty material (approximately 90 % fines) during construction of the first confined aquatic disposal (CAD) cell for Phase 1 of the BHNIP. This monitoring included: 1) documentation of the spatial and temporal distribution of the sediment plume for the four extremes of tidal currents (high water slack, maximum ebb, low water slack, maximum flood) on two days within the first week of dredging; 2) collection of water samples from the lower half of the water column at two locations – 1,000 feet up current of the dredging and 500 feet down current from the dredging; 3) analysis of water samples for TSS. Additional parameters (turbidity, DO, arsenic, and copper) were analyzed when dredging the parent material.

During dredging, turbidity measurements ranged from 3-5 NTU (Nephelometric Turbidity Units) at the reference station 1,000 feet up current from dredging the silty surface material using an environmental bucket. Turbidity was only slightly elevated at the station 500 feet down current of the dredging ranging from 4-11 NTU. TSS ranged from 4-5 mg/l at the reference station and from 5-9 mg/l at the down current station. No plume was visible at the surface outside the immediate area of the dredging operation, and no significant plume was detected in the water column (ENSR, 1997).

Monitoring of the Providence River and Harbor maintenance dredging project (> 85 % fines) included surveys to characterize the spatial extent and suspended sediment concentrations of plumes generated by maintenance dredging, CAD cell construction, disposal into CAD cells, and disposal at Rhode Island Sound Disposal Site. All suspended solids plumes studied were found to be near-field and short-lived phenomena, concentrated near the bottom of water column for the higher suspended solids component of the plumes. Lower concentrations of suspended solids were generally detected for up to several hours and up to 3,000 feet down-current of the source, at which point suspended solids concentrations returned to ambient or near-ambient conditions (ENSR, 2008).

Monitoring of dredged material comprised of either sand or silt dredged by either a mechanical or hopper methods showed that associated turbidity plumes remain within the channels without impacts to nearby shallow regions that may contain sensitive biological resources. Also total suspended solid concentrations return to ambient conditions quickly especially with a hopper dredge removing sandy material. The Kennebec River normally is a turbid river with sediments moving with the tidal currents.

6.1.2.2 Popham Beach

The Popham Beach dredging area is a spillover area for sands in the Popham Beach sediment gyre. Removal of the shoal will not appreciably change the sand budget since the disposal site was selected to retain the sand within the gyre. Local concerns for increased dune erosion resulting from maintenance of authorized channel depths have been reviewed with State agency experts. It is unlikely that removal of these small shoals will contribute to significant erosion of the beach. In a review of historical Popham/Hunnewell Beach shorelines it was noticed that the erosional-depositional trends west of Fox Island were out of phase with the trends east of Fox Island. The accretion or erosion of the shoreline is speculated to be caused by migrations of the Morse River Inlet channel, large magnitude storms and major flood discharge events in the Kennebec River (FitzGerald and Fink; 1987; Goldschmidt *et al*., 1991).

6.1.3 Disposal Sites

The disposal of sand at the in-river disposal site and at Jackknife Ledge during a three to five week period will bury those organisms inhabiting the disposal sites, potentially entrain organisms in the water column during disposal, and possibly temporarily disrupt fish movement.

There are three distinct phases when dredged material is released from a barge and descends through the water column as dense fluid-like jet (Truitt, 1986). The three physical phases have been described as 1) convective descent, 2) dynamic collapse, and 3) long-term or passive diffusion. Truit (1986) concluded from an analysis of several studies that the short-term impacts resulting from suspended sediment are confined to a well-defined layer near the bottom. Suspended sediment concentrations above the bottom layer, are one to two orders of magnitude less than the bottom layer. Data from disposal of silt/clay material showed approximately one to five percent of solids from the original material are dispersed over longer distances and data from sandy silt had approximately 1 percent loss (Truit, 1986). Disposal of sandy material would have less potential for the loss of sediments in the water column since it is the fines (silt/clay) portion that has the greatest potential for resuspension into the water column.

The government-owned special purpose dredge CURRITUCK which has a 315 cubic yard hopper of split-hull design is often used to dredge shallow sandy high energy Federal channels with nearshore disposal. Monitoring efforts of disposal at a nearshore disposal area by Sesuit Harbor, Dennis, Massachusetts showed disposal plumes to be relatively small in spatial extent and dissipated to ambient levels as measured by total suspended sediment (TSS) concentrations within one hour of release (draft report, Clarke *et al.*). The monitoring showed the rapid settling of the coarse material within minutes of disposal.

Even in a high velocity channel such as the Kennebec River, the sandy dredged material is expected to rapidly settle to the bottom with a spatially limited and rapidly decaying plume from any of the finer material within the sediments. The sediments are clean sand that is considered to be free of contaminants, so there would be no release of contamination to the water column.

The placement of material from the hopper dredge occurs in the water, depending on the size of the dredge, the material is released at depths of about 14 to 21 feet below the surface. Most of the fines that do not settle out of the water column with the sand would move with the tidal currents within the water column not at the surface.

Merrymeeting Bay is one of the few places in the estuary where fine sediments may be found and could supply particles to the estuarine turbidity maximum found in the River (Kistner and Pettigrew, 2001). The estuarine turbidity maximum is usually found during moderate and low flow conditions near the upstream limit of the salinity intrusion and can move up and down the channel with the semi-diurnal tide. Local resuspension events occur approximately 5 miles from the mouth of the River in Phippsburg (near the Parker Flats), when near-bottom currents reach a maximum exceeding 75 cm/sec in either direction (Kistner and Pettigrew, 2001). This phenomenon could provide fine sediments to the lower regions of the Kennebec. Therefore, the river has recurring movements of sediments outside the high flow events.

6.1.3.1 Bluff Head

The movement of sand from disposal through the water column will be an occasional and short-lived phenomenon. All material to be disposed will quickly settle through the water column. River bottom currents will also move the sand, to some extent, until it reaches equilibrium with the Kennebec River's normal sand budget. Analysis of the bathymetric surveys of previous disposals at the Bluff Head disposal site (Hubbard, 1982) has shown that the sand remains predominantly within the disposal area. After one month, the effects of disposal were evident onsite and 500 feet downstream. All surveyed areas even the site 500 feet upstream of the disposal area have eroded some (2-7 feet) 10 months post-disposal. Although Bluff Head is an erosional disposal area, the retention of the sands within the local sediment budget represents a minimal impact to the overall system.

Water quality monitoring was conducted to meet the Water Quality Certification (WQC) conditions for the 1997 dredging (Doubling Point) and disposal activities (Bluff Head). The WQC conditions specified that bacterial levels be monitored just south of the Bluff Head disposal site immediately before and soon after disposal episodes, and that turbidity be monitored before and after disposal events at Bluff Head. The monitoring was conducted by Normandeau Associates (1997) and concluded that the "turbidity levels near Bluff Head dredging and disposal areas in the Kennebec River were low, before, during and after the November 1997 dredging. There was no apparent trend related to station, depth, or dredging/disposal. Fecal coliform levels were low with one exception, possibly related to the pre-dredge storm activity, which may affect runoff or WWTP function. There was no evidence of an increase related to dredging."

Increases in bacterial levels and nutrients in rivers and nearshore regions are common with storm activity due to runoff of agricultural lands within the watershed, combined sewer overflows, failing septic systems, and runoff from storm drains. As mentioned previously, the lower Kennebec River can experience water quality impacts from rainfall events that occur throughout the entire Kennebec and Androscoggin river watersheds which include eight wastewater treatment plants (six with combined sewer overflows), acres of impervious surfaces, as well as agricultural sources. Depending on the season, many of the shellfish beds in the lower Kennebec River that are conditionally approved are closed when river discharge meets or exceeds 30,000 cubic feet per second (Maine DMR, 2011). Sandy material that contains few fines is not likely to contain the nutrients and bacteria that affect water quality.

In 1966 there were also concerns about disposal of dredged material at Bluff Head and the effects on shellfish growing areas. At the time the shellfish beds were harvested under restricted conditions, but even when the waters of the Kennebec were polluted, during the spring freshet period the shellfish beds were closed due to the increase in bacteria-laden fresh water moving down the river (Mitchell, 1967). Sampling the river from April through June 1966 and April through July 1967 covered the period of freshet and the dredging by the Corps and BIW. The fecal coliform counts were inversely proportionate to the salinities. The Corps dredged the first week of July and showed no significant effect on the natural river conditions (Mitchell, 1967).

6.1.3.2 Jackknife Ledge

The material from Popham Beach dredging area will be disposed of at the Jackknife Ledge disposal area. Disposal off Jackknife Ledge is considered by the State of Maine to be a beneficial use of the dredged material compared to disposal at the previously used offshore site. The retention of the sands within the local sediment budget represents a minimal impact to the overall system. Any material that does not directly enter the gyre circulation and passes west of Fox Island will be transported back into the gyre with the tides or join the Morse River Inlet sediments (Goldschmidt *et al*., 1991). As the Morse River inlet moves over time this material will migrate east as well. The Morse River inlet channel migrates over a period of ten to fifteen years (Goldschmidt *et al*., 1991) from a long sinuous river that flows toward Popham Beach to a shorter more direct channel to the sea. The eastward migration of the channel causes erosion along the beaches, but eventually the sand spit that forms in front of the river entrance channel breaches creating the shorter river channel and providing sand to the eroded beaches (http://maine.gov/doc/nrimc/mgs/explore/marine/sites/mar08.htm; Goldschmidt *et al*., 1991). The movement of sand from the Jackknife Ledge disposal area would be through tidal and storm events. The sand bar complexes between the disposal area and shore contain 200,000 to 300,000 cubic meters of sand (FitzGerald *et al*., 2000) so the natural movement of 20,000 cy or less from the disposal area of material should have no noticeable effect on the shore.

6.2 Biological Effects

The proposed August dredging of the Kennebec River Federal Channel will have minimal interference with the passage of various anadromous and catadromous fish, since many of the upstream and downstream migrations have been completed and any fish present are likely to avoid the dredging operations in the Kennebec River. Spawning of finfish and larval recruitment of benthos occurs primarily during spring through summer. There may be some impact to sensitive life stages within the water column, but the majority of the dredged material will rapidly settle out in the dredge or disposal areas. Also dredging and disposal are limited to small areas, therefore no significant impacts to any of the sensitive life stages within the water column are anticipated from this project. In addition, recreationally important species such as striped bass and bluefish that would be moving through the channel during this time are expected to avoid the areas of higher turbidities and dredging areas. The dredging operations may disturb benthic invertebrates. This could attract fish to the areas downstream from the dredging and disposal activity.

6.2.1 No Action Alternative

The No Action Alternative of not dredging the Kennebec River FNP would only have an impact on the biological resources of the river if the Navy vessel is unable to successfully transit through the channel to the ocean. If the vessel hits any section of the rock bottom found in the Kennebec River because it had to travel outside of the channel boundaries due to shoaling there could be long-term environmental impacts. Besides the loss of expensive equipment on the vessel hull, there is the potential to rip open the hull plating and release many gallons of fuel into the river. Due to the strong currents the fuel would rapidly spread and most likely impact the biologically sensitive marsh areas and the clam flats downstream of the shoal area. Even if the vessel does not leak any fuel it could become a navigation hazard to another vessel that has the potential to release pollutants into the river.

6.2.2 Dredge Sites

Dredging operations from the proposed maintenance dredging are not likely to have a significant impact on the overall biological resources of the area. Dredging would destroy the existing benthic invertebrate community in dredged areas resulting in most sedentary organisms being killed. Most motile organisms, such as crabs, lobsters, and finfish, would likely have the ability to avoid the dredge and move from the area of impact. Recolonization of the dredged areas should take place within a short period of time by organisms in the surrounding areas and from seasonal recruitment. The post-dredging community should closely resemble the existing community since there will be no change in sediment structure.

6.2.2.1 Resources

6.2.2.1.1 Benthos

Newell *et al*. (2004) provided a time sequence of recovery of macrofauna in coastal marine deposits in an area of high energy after cessation of dredging activities. Initial colonization of small mobile species and larval recolonization was seen in as little as 7 days, but it took about 100 days for species diversity to be restored within 70-80% of that occurring in surrounding areas. At about 175 days, population density is restored to 60-80% of that in surrounding area. Restoration by growth of individuals or biomass takes about 2 to 3 years. The level of recolonization in the shoal areas of the channel will be dependent on how often dredging activities occur in the area. Frequent periodic dredging may prevent the development of stable long term communities found in the surrounding environments. However, these areas by their very nature are high energy unstable environments and as a result do not promote stable long-term benthic communities regardless of project activities, but a return to current pre-dredging conditions is expected for the channel.

6.2.2.1.2 Finfish

Because the material to be dredged is sand, with low silt content, only a localized area in the vicinity of the dredge site is likely to be impacted by elevated concentrations of suspended sediments, or sedimentation. The effects of increased suspended sediments on fish has been studied for more than 30 years, but currently most of the data concerning fish responses to suspended sediment doses is based on salmonoid fish and less is known about estuarine fish. In general the concerns with increased suspended sediments include reduced egg and larval survival due to physical damage to the eggs through abrasion or adherence of silt, altered breeding behavior, reduced feeding efficiency, reduced growth rates, and interference with respiration (Bruton, 1985). Originally researchers only looked at the effects of exposure concentration. Newcombe and MacDonald (1991) recognized the importance of duration of exposure as well as concentration of exposure in determining the effects of suspended sediments on fish and invertebrates. Newcombe and Jensen (1996) generated tables where the biological response can be inferred from concentration and duration of suspended sediments. General reviews of the biological effects of suspended sediments on fish and shellfish (Wilber and Clarke, 2001) as well as corals and aquatic plants (Berry *et al*., 2003) have also been completed. After consolidating the available information, generalizations are difficult to make because biological response to increased suspended sediments varies with species and sediment characteristics.

In general for non-salmonid estuarine fish, the eggs and larvae exhibit some of the most sensitive responses to suspended sediment exposures for all taxa with available data (Wilber and Clarke, 2001). Durations of egg exposure would differ depending on the egg form; demersal adhesive eggs would have longer exposure to sediment plumes caused by dredging than semi-buoyant or pelagic eggs. Atlantic herring eggs were found to have earlier hatching and shorter hatching lengths when exposed to high concentrations of suspended sediments (Messieh *et al*., 1981). Behaviors of fish when exposed to increased levels of suspended sediments varied due to different foraging strategies for different species. Colby and Hoss (2004) found that prey availability interacts with total suspended sediment concentrations to affect fish feeding success on a species by species basis. See Wilber and Clarke (2001) for more details of sublethal and lethal effects from suspended sediments. Juvenile Atlantic salmon behavior was seasonally affected when exposed to elevated turbidities and suspended sediments, increasing foraging activity and decreasing use of cover in the water column (in the fall) but reacted differently during the winter (Robertson *et al*., 2007).

Finfish also have the ability to leave the area of disturbance. It is also expected that any larger motile organisms will temporarily move away from the area.

6.2.2.1.3 Lobsters

Throughout the 1990's, the Maine lobstermen have landed record catches and deployed nearly 2.5 times more traps than 25 years ago (MEDMR, 1998). The majority of the landings (85%) now occur during a five month period from July to November when lobsters are molting and becoming legal size (MEDMR, 1998). Lobstermen fish the mouth of the Kennebec River (from Cox Head south) and the nearshore areas in the Gulf of Maine.

American lobsters pass through one prelarval and four free-swimming larval stages before settling to the bottom and molting into juveniles. Depending on the water temperature, it can take between 22 and 103 days for the larvae to pass through the four larval stages, (McKenzie and Moring, 1985). The distribution and abundance of larvae are affected by the distribution of spawning females, hydrostatic pressure, larval mortality, light intensity, temperature, salinity, and surface current velocity and direction (McKenzie and Moring, 1985). As no section of the project areas are comprised of cobble, there would be no impact to the early juvenile benthic phase lobsters and the Kennebec River is not anticipated to be a lobster nursery area.

Although lobsters occur at all depths, from shallow subtidal areas to deep offshore waters out to the Continental shelf, the juveniles are generally found in shallow water (less than 50 feet). Older motile juvenile lobsters may be found in open sandy areas during the summer months, but the Jackknife ledge disposal area is approaching the limit of the depths where juveniles would be found.

Lobsters are migratory animals and are expected to move from any disturbance caused by dredging or disposal. Lobsters commonly burrow into the sediments and are tolerant of short-term exposure to suspended sediments (Stern and Stickle, 1978) such as the turbidity created by storm activity. Therefore, no impacts to lobsters are anticipated from any increases in turbidity. Older juvenile and adult lobsters have the ability to move from the area if the turbidity is too severe.

6.2.2.1.4 Shellfish

Shellfish spawning in the immediate vicinity could be impacted by dredging activities. The increased turbidity during dredging could negatively affect egg and larval bivalve development in the nearby region (Clarke and Wilber, 2000), but there would only be minimal localized increases in turbidity at the dredge sites.

6.2.2.1.5 Seals

Any seals in the dredge areas would either be swimming through the area, feeding or on a haul out along the shore. There are no large intertidal sand bars or rocks within the Federal channel to provide a resting area for the animals. The dredging process stirs up the bottom sediments which can attract fish which might attract any nearby seals. While the underwater noise level from the dredge is most likely higher than background levels, the dredge moves so it is not sitting in one area continuously for long periods of time. Also the dredge moves away from the dredge area to the disposal site once the hopper is full leaving the area and limiting any impact to a seal that may be in the area. The activities of any seals in the dredge areas will not be restricted by the dredging. No impacts to harbor seals have been observed during previous dredging operations in the Kennebec River or while dredging with the Currituck on Cape Cod, Massachusetts.

The Corps contacted NMFS, Office of Protected Resources in Silver Spring, MD concerning the Marine Mammal Protection Act and Incidental Harassment Authorizations (IHAs). NMFS responded that they do not typically provide IHAs for dredging projects (Michelle Magliocca, Personal Communication).

6.2.2.2 Doubling Point

The majority of benthic organisms inhabiting the dredged material will be destroyed by the dredging operations. This area has been previously dredged and is constantly changing since it is in the bedload convergence zone. Only organisms that can survive changing condition would survive in this type of habitat. The substrate will probably undergo larval and adult recruitment of organisms from surrounding areas resulting in the re-establishment of the pre-dredging benthic community.

Striped bass can be found feeding in this section of the river. The stripers are known to be fished as far north in the river as The Chops. There could be people fishing from the shore or boats near the dredge site. If present the fish might stay at the site to feed, since sediments are being stirred up by the dredge, or move to another feeding site. The stripers move as their prey moves through the river. Bluefish may also be found in the dredge area following their prey species through the river. Other fish of importance found in this area are discussed in Section 6.3 Endangered Species.

There are no lobsters or commercially fished shellfish beds found in this section of the river.

6.2.2.3 Popham Beach

At the Popham Beach dredge area lobsters can be found. Lobsters are actively fished at the mouth of the Kennebec from the Cox Head region south. Any lobsters within the dredge area have the potential to be impacted by the dredge operation itself. As dredging occurs the lobsters may start moving from the area, but those under the drag arms may be entrained in the dredge. Lobstermen will be notified of the dredging ahead to time to remove any gear that may be within the dredge site or transit route to the disposal area. Overall no significant impact to the local lobster population is anticipated from this maintenance project, as there is no concentration of lobster populations expected at the dredge site.

The nearest soft-shell clam beds are half to one mile away, but any resuspension of the sediments is expected to stay in the channel (draft report, Clarke *et al*.; ENSR, 1997; ENSR, 2008; Miller *et al*., 2002b). Therefore no impacts to the shellfish beds are anticipated due to dredging at the Popham Beach area.

Striped bass and mackerel can be found in the waters around the dredge area. They are commonly fished from Pond and Sequin Islands, along Popham Beach from the Fort South and up by Squirrel Point. As mentioned previously, the fish could feed by the dredge or avoid the area completely, depending on the movements of their food source. Therefore, no significant impacts to striped bass or mackerel are expected from this project. The physical presence of the dredge should have no impact on anyone fishing for these species since the dredge will be in the Federal channel, and fishing is not supposed to occur in the channel.

6.2.3 Disposal Sites

6.2.3.1 Resources

6.2.3.1.1 Benthos

The disposal areas are high energy environments that are subject to currents, tidal influence, and coastal storm events to which the benthic communities have had to adapt. Organisms inhabiting these types of areas are highly capable of adapting to frequent disruptions (Miller *et al*., 2002a). Any impacts from localized turbidity and sedimentation as a result of disposal activities would be similar to that at the dredge areas. Turbidity impacts to the water column as a result of disposal activities would be short-lived and not significant given the sandy nature of the material. Burial of the surface sediments and associated benthic community will occur with disposal. Some organisms have the ability to dig to the surface when buried but some will be smothered by the weight and/or depth of the sediments. The dredged material will be released in the center of the disposal site to limit the extent of impact within the site.

6.2.3.1.2 Finfish

Finfish that cannot avoid the disposal area may be impacted, but most juveniles and adults would be expected to have the ability to move away from any disturbances.

6.2.3.1.3 Shellfish

Two concerns were raised by commercial shellfisherman during a public hearing held in Phippsburg, Maine on October 9, 1997 regarding the dredging and disposal of material at the Doubling Point area. The first concern was that disposal of material at Doubling Point would cause siltation of soft-shell clam flats located downstream. The clam flats are located in Drummore Bay, near Parker Head, in Wyman Bay, and Atkins Bay. The second concern was that the disturbance of dredged material would increase the fecal coliform levels in the water causing the flats to be closed to shellfishing. Similar concerns were raised during a meeting that occurred in March of 2011, in Phippsburg concerning the August 2011 proposed dredging.

Discussions in the previous section show that the majority of material placed at the in-river disposal site would settle out before reaching the tip of Bluff Head. The tip of Bluff Head is located almost one and a half miles north of the nearest clam flat of concern (Drummore Bay). Based on the type of material to be dredged (sand), and the distance of the disposal site from the clam flats, no sedimentation from dredging and disposal activities is expected to occur in these areas. This is further confirmed by a previous investigation (Larson and Johnson, 1982) which analyzed the downriver sedimentation rates on five commercially viable intertidal clam flats in the Kennebec River (Drummore Bay, Upper Todd Bay, Lower Todd Bay, Wyman Bay, Atkins Bay). Alterations of sediment characteristics on these intertidal flats would correspondingly alter the indigenous biota. Each flat was measured at upper and lower intertidal stations three days prior, through one week after dredging and disposal (October 5 through November 4, 1981). A total of six temporal measurements at ten stations exhibited a net decrease in sediment depth, not an increase. This substrate fluctuation represents the dynamic nature of the Kennebec River bottom. The study did not identify any relationship between dredging or disposal of dredged material and sedimentary alterations on the Kennebec River clam flats. Since the material currently proposed to be dredged and disposed in-river consists of sand (coarse grained sediments) it is unlikely that there will be any accumulation of sediment on the tidal flats downstream from Bluff Head from the proposed August 2011 dredging and disposal operations.

Also, it might be expected that the amount of material carried downstream by the Kennebec River from upland sources during spring runoff would be several orders of magnitude greater than the amount of dredged material deposited near Doubling Point. If sedimentation of the clam flats is not observed during the spring runoff period, then it is even more unlikely that disposal of dredged material would cause sedimentation of the flats. There have been claims that the BIW dredging in November 2009 resulted in the accumulation of several inches of mud on the river banks in the vicinity of the Bluff Head disposal area. Since the dredge material was primarily sand it is very unlikely that the mud came from the dredged material. The surrounding environment has marsh and mud flats on both sides of the river. Any storm event could move fine material from upstream, or from the sediment storage area within Merrymeeting Bay (Fenster *et al*., 2005) or from any of flats within the river. Also any erosion of the river banks could add fine sediment to the river system. It is worth noting that during the dredging operation, on the evening of 14 November 2009, there was a significant storm event in which nearly three inches of rain were recorded at Bath, including a period in which the rain fell at a rate between 1 and 1.5 inches/hr for over an hour (http://www.bathmaineweather.com/wxwuhistory.php (Website visited 13 June 2011)). Likewise, the November 2009 BIW dredging followed an extremely wet summer, the wettest summer ever recorded by the National Weather Service's Portland, Maine station, and the fourth wettest season since Portland precipitation records were first kept in 1871 (http://www.erh.noaa.gov/er/gyx/climate_f6.shtml (Website visited 13 June 2011)). Such a rainy season, and a massive storm in November 2009, are far more likely explanations for silty materials appearing on the shore than BIW's disposal of sandy materials at Bluff Head.

Newly settled larvae and juveniles are more susceptible to sediment deposition (as distinguished from turbid conditions) than larger adults that are better equipped to move up or down in the substrate as conditions change. Filtering rates become reduced during periods of stress, but can increase if more food is detected with increased turbidity. While laboratory studies showed that adult clams could survive TSS concentrations of 10,000 mg/l for up to three weeks, sublethal effects such as reduced feeding occurred at low TSS levels (100-200 mg/l) over a period of weeks (Grant and Thorpe 1991). Sediment grain size of suspended material also is a factor affecting feeding rates, as clogging of gills can occur if excessive ingestion of particulates is consumed (Wilber and Clarke 2001). Clams are not considered to be very mobile and tend to be more at risk to adverse effects of excess turbidity and sedimentation that could result in burial and suffocation than other shellfish. Emerson *et al*. (1990) conducted studies on burial impacts that may be experienced during clamming activities and found the burial of the soft-shell clam under 25 cm of sand resulted in no mortality for any size class. Clams were found to survive burial under 15 cm of mud, but only large clams greater than 50 mm in length, survived under 25 cm of mud (Emerson *et al*., 1990). Spat and juvenile clams up to 13 mm can crawl about and dig with its foot. The spat and juveniles can attach to sand grains with byssal threads to stabilize itself against movement, but tend to be found near the sediment surface. Studies have shown that juvenile soft-shell clams up to 5 mm in shell length were routinely redistributed in tidal flats by the tidal currents (Hunt and Mullineaux, 2002). Emerson and Grant (1991) looked at the clams from 6-15 mm in shell length and their transport in bedload sediment. The juvenile clams have the ability to move themselves and survive movement with the substrate. Therefore any potential dusting of finer sediments on clam flats should have minimal impacts to the organisms.

Concerns about increased fecal coliform levels can be partly addressed by the type of material to be dredged. Investigations for the Providence River maintenance dredging project (USACE, 2001) showed that based on the following tests, coliform would not be a concern in Providence and should be less of a concern in the Kennebec River. Samples taken from Providence River were predominantly fine-grained muds (>85% silt-clay), which would be expected to produce coliform levels higher than those likely to occur in Kennebec River. In addition, Providence River is influenced by sewage treatment plant effluent, combined sewer outfalls, riverine input and non-point pollution sources. Sediment samples were taken from both the top of the sediment column and the fluff layer just above the sediment. Total coliform levels in the fluff layer were 390 to 9300 MPN (most probable number of coliform bacteria per 100/ml sample). The fluff layer above the sediment surface was selected to provide a worst case sample that would overestimate the actual potential to resuspend coliform bacteria when the entire sediment column is dredged. Coliform bacteria are expected to be practically non-existent through most of the sediment column. The sediment surface, where coliforms were measured (93 to 390 MPN), represented only a few percent of the overall sediment column to be dredged and thus would contribute only a small proportion to the sediment plume. This would result in relatively low initial coliform levels in the plume. Modeling of the worst-case coliform measurement (9300 MPN) during the disposal process showed rapid dilution to below 15 MPN (standard) within 3 h (11,000 sec) after disposal. Actual expected initial plume values were expected to be much less than those modeled. It is not unreasonable to assume that they would be 10 to 1000 less than the modeled values, based on dilution effects (USACE, 2001). Thus it is expected that the 15 MPN level would be attained quickly or not even exceeded. Because the source material is the same, this analysis applies to the expected plume both during dredging and disposal (USACE, 2001). Initial levels in the Kennebec River should be considerably lower than those observed in the Providence River. Therefore, any exceedance of the fecal coliform standard resulting from either dredging or disposal activities is extremely unlikely. This is supported by the 1997 dredging/disposal monitoring results conducted by Normandeau Associates and discussed above in Section 6.1.2.1.

The clean sand being disposed is not expected to have any adverse impacts on adjacent biota. The benthic organisms that have colonized the site since the previous disposal operation will be buried. Re-colonization is anticipated to occur rapidly from recruitment of setting larval and adults moving into the impacted area.

6.2.3.1.4 Lobsters

Lobster may be found in one of the disposal areas. Lobsters that may be in the open sandy area of the disposal site will potentially be buried by the sediment. Lobsters have the ability to build burrows so if they are not buried too deeply some may be able to escape. Those animals not buried by the disposal mound may stay by the mound to feed or move from the area of disturbance.

6.2.3.1.5 Seals

During the month of August seals may be in the project areas. Although harbor seals can stay submerged for more than 20 minutes, the majority of their natural dives are only two to six minutes long (Elliott *et al*., 2002). The dredging vessel transits to the disposal area releases the dredged material and returns to the dredge site. Besides the few minutes for release of the material it is the same as any other vessel moving through the area. The seals will most likely avoid the vessel. Therefore, no impacts to the seals are expected from disposal activities.

6.2.3.2 Bluff Head

Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993). The studies reviewed by Burton demonstrated lethal effects to fish at concentrations of 580 mg/l to 700,000mg/l depending on species. Sublethal effects have been observed at substantially lower turbidity levels. For example, prey consumption was significantly lower for striped bass larvae tested at concentrations of 200 and 500 mg/l compared to larvae exposed to 0 and 75 mg/l (Breitburg, 1988). Studies with striped bass adults showed that prespawners did not avoid concentrations of 954 to 1,920 mg/l to reach spawning sites (Summerfelt and Moiser 1976 and Combs 1979 in Burton, 1993). The Normandeau 2001 report identified five species in the Kennebec River for which TSS toxicity information was available. The most sensitive species reported was the four spine stickleback which demonstrated less than 1% mortality after exposure to TSS levels of 100mg/l for 24 hours. Striped bass showed some adverse blood chemistry effects after 8 hours of exposure to TSS levels of 336 mg/l. While there have been no directed studies on the effects of TSS on shortnose sturgeon, shortnose sturgeon juveniles and adults are often documented in turbid water and Dadswell *et al*. (1984) reports that shortnose sturgeon are more active under lowered light conditions, such as those in turbid waters. As such, shortnose sturgeon are assumed to be as least as tolerant to suspended sediment as other estuarine fish such as striped bass (NMFS, 2009 page 46). It should be noted that these studies were done with a mechanical dredge, and not a hopper dredge as will be used for this proposed project. However a hopper dredge will take less time to complete the job, so any associated turbidity impacts will be for a shorter duration.

There have been claims that the BIW dredging in November 2009 resulted in the accumulation of several inches of mud on the river banks in the vicinity of the Bluff Head disposal area. Since the dredge material was primarily sand it is very unlikely that the mud came from the dredged material. The surrounding environment has marsh and mud flats on both sides of the river. Any storm event could potentially move fine material from upstream, or from the sediment storage area within Merrymeeting Bay (Fenster *et al*., 2005) or from any of the flats within the river. Also any erosion of the river banks could add fine sediment to the river system.

There have been concerns about seals that may be present in the vicinity of the Bluff Head disposal site. Disposal of dredged material would have no impact to any seal that may be in this area. Seals do not spend large amounts of time at the river bottom so there is no concern about burial of a large motile animal. Disposal of dredge material is a very rapid event and any seals in the channel can avoid any increased turbidity associated with the activity.

6.2.3.3 Jackknife Ledge

At the Jackknife Ledge disposal area burial of the benthic community in the center of the disposal area is expected. This would include the burial of any lobsters within the area of the disposal mound during the placement of material. As with the Popham Beach dredge area, the local lobstermen will be provided information pertaining to the disposal area and haul route to and from the dredge site to eliminate potential impacts to fishing gear in the area. In order to confine the area of impact within the disposal area the dredge material is to be placed in the center of the site. No significant impacts to the lobster population would be expected since the disposal site is an open sandy area, which is not used by larval/juvenile benthic lobsters and adult lobsters would be traversing through the area in search of food and shelter.

No commercially fished shellfish areas have been identified at the disposal area, but soft-shell clams are fished along the shoreline and in Sprague and Morse Rivers. These areas are more than 1.5 miles away from the disposal site. As previously mentioned the material placed at the dredge is expected to remain part of the beach sand budget with the majority of the sand moving into the sand gyre circulation. No impacts to the soft-shell clam flats along the shore are expected from the use of Jackknife Ledge disposal site.

6.3 Threatened and Endangered Species

6.3.1 Birds

Any piping plovers that nest on Popham or Hunnewell Beach will have fledged by August when the dredging will occur, so there are no anticipated impacts to the Federally threatened piping plovers from the proposed project. It is possible that terns may also be in the vicinity of Popham Beach during the time of the proposed dredging. As discussed previously, the U.S. Fish and Wildlife Service has been restoring nesting populations of common terns to Pond Island at the mouth of the Kennebec River, which is part of the Petit Manan National Wildlife Refuge with the goal of increasing the endangered roseate tern population. Roseate terns are expected to recolonize the island once the common tern population becomes established. Nesting season generally occurs from the middle of May through the end of August. By August young from the earliest nests will be fledged and young from any later nests will be within 2 to 3 weeks of fledging (U.S. Fish and Wildlife Service letter Appendix A). Also, staging roseate terns frequent the area in August. The distance of the dredge area from the nesting sites is approximately one half mile, and therefore this further reduces the likelihood of adversely affecting these nesting terns. Minimal impacts from turbidity on prey fish for the birds are expected.

6.3.2 Shortnose Sturgeon

It is likely that the proposed dredging may have an effect on the shortnose sturgeon in the Kennebec River. In the 2002 Biological Opinion, the National Marine Fisheries Service recommended a dredging window for the Doubling Point area from November 1 through March 30 of any year, with this being the time when shortnose sturgeon would be less likely to occur in the vicinities of the proposed dredging and disposal areas. As noted previously, shortnose sturgeon have been known to occur in the Doubling Point area during the summer and early fall, and the October 2003 dredging of this area resulted in 5 takes, with 3 of them presumed lethal. At that time, the National Marine Fisheries Service issued a Biological Opinion on the emergency dredging operation and determined that the emergency action affected the Federally endangered shortnose sturgeon, but did not jeopardize it. It was also found at that time that mortality of sturgeon taken by the dredge could be reduced by the removal of the protective screens on the intake, since the sturgeon that had been taken after the screens were removed were released with only minor injuries, and therefore were more likely to have survived.

Recent unpublished acoustic tracking data from the State of Maine, DMR, shows concentrations of shortnose sturgeon in vicinity of the Phippsburg boat ramp (river kilometer 16) near Morse Cove, downstream from Doubling Point during May and June of 2008, and then again in October of that year, moving between that station and the next upstream tracking station at the Sasonoa River (river km 21) which would indicate that they would have to move through the Doubling Point reach at some time during the summer. Similar movement was shown in 2009, with concentrations near Morse Cove in May and June, and then no detections through July and August, with detections again at the Sasanoa River receiver, upstream from Doubling Point in October. Morse Cove is approximately one mile downstream from the proposed dredging area; however it is within the migration corridor for these fish. The Sasanoa River and

Phippsburg sections of the river are known feeding areas for sturgeon (Gail Wipplehauser, Maine DMR, personal communication). In addition, historical sampling data from the Maine DMR shows many shortnose sturgeon collected in sampling nets at the mouth of Winnegeance Cove (just downstream from the Doubling Point dredging location) during the month of August in both 1998 and 1999. Based upon this information, it is possible that shortnose sturgeon would be in the vicinity of the dredging and disposal operations during the time of active dredging.

Recent population studies have shown a greater than 20% increase in the Kennebec River shortnose sturgeon population (mentioned previously). Some of these studies have also shown that there is movement of the Kennebec River Sturgeon between the Kennebec River and the Penobscot River, located approximately 93 miles (150 km) to the north east (Fernandes, 2008). In order to move to this location, the sturgeon would need to move out of the Kennebec River through the area of Popham Beach. Therefore, it is possible that shortnose sturgeon could be found in the vicinity of Popham Beach during the time of active dredging as well as at Doubling Point. However, as noted, the increased population of shortnose sturgeon would further reduce the likelihood that any incidental takes would jeopardize the shortnose sturgeon population.

Prior to the proposed dredging event, the National Marine Fisheries Service will issue a statement of Reasonable and Prudent Measures, Terms and Conditions, and a statement of Incidental Take, for the proposed August dredging. The Reasonable and Prudent Measures (RPMs) are those measures that the National Marine Fisheries Service believes will be necessary and appropriate to minimize impacts of incidental take on the Kennebec River population of shortnose sturgeon, and the Terms and Conditions outline the appropriate steps necessary to effectively implement the RPMs. NMFS has provided draft RPMs to the Corps, and included in the RPMs is the requirement to use draghead deflectors on the hopper dredge. The use of draghead deflectors (or turtle deflectors) has been an accepted standard practice for hopper dredges operating in places and at times of the year when sea turtles are known to be present, and has been documented to reduce the risk of entrainment for sea turtles, thereby minimizing the potential for take of these species. It is expected that the use of draghead deflectors would also reduce the potential for entrainment of sturgeon.

The RPMs also require that a NOAA trained endangered species observer be present on board the dredge in order to monitor for the presence and/or taking of shortnose sturgeon. In the past this was required only for dredging activities at Doubling Point, however, given the fact that there could be sturgeon near Popham Beach (based on the data showing sturgeon movement between the Penobscot and Kennebec Rivers), an endangered species observer will also be required for dredging activities at the Popham Beach dredging area. At this time a draft statement of Reasonable and Prudent Measures and Terms of Conditions for the proposed August 2011 dredging has been issued by NMFS concerning shortnose sturgeon (See Appendix E). This species is discussed further in the "Biological Assessment For Shortnose Sturgeon (*Acipenser brevirostrum*) And The Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) in the Kennebec River, Bath, Maine" (Appendix E).

Therefore although it is possible that shortnose sturgeon takes may occur during the August 2011 dredging, it is unlikely that these would cause jeopardy to the Kennebec River population of Shortnose Sturgeon. All Reasonable and Prudent Measures and Terms of

Conditions, provided by the National Marine Fisheries Service will be adhered to during these dredging activities including the use of a NOAA trained endangered species observer on board the dredge, coordination with NMFS if any interaction with a sturgeon occurs, and the use of draghead deflectors on the dredge.

6.3.3 Atlantic Salmon

As noted, the Federally endangered Gulf of Maine Distinct Population Segment of Atlantic salmon, (*Salmo salar*) inhabits the Kennebec River and seasonally migrates through the proposed dredging areas of Doubling Point and Popham Beach, during various life stages. The dredging of these two areas is planned to occur during August, which is after the time when most of the upstream spawning migrations and downstream smolt migrations have been completed. It is also before the downstream migration of kelts (post spawning adults) which generally occurs in November (see section 5.3.2.2 of this EA). In addition, the dredging will occur in estuarine sections of the river, which are not used by the adults for spawning, and are only temporarily occupied the by the smolts during the final stage of their seaward migration. Therefore it is unlikely that the proposed dredging activity will have any effects on the Federally endangered GOM DPS of Atlantic salmon. Preliminary coordination with NMFS has indicated that no takes of Atlantic salmon are anticipated from the proposed dredging and disposal activities in the Kennebec River in August of 2011 (see e-mail from Julie Crocker). Further discussion on the effects of the proposed dredging on this species can be found in the “Biological Assessment For Shortnose Sturgeon (*Acipenser brevirostrum*) And The Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) in the Kennebec River, Bath, Maine” (Appendix E).

6.3.4 Atlantic Sturgeon

It is possible that the proposed “threatened” Gulf of Maine Distinct Population Segment of Atlantic sturgeon could be affected by the proposed dredging operations. Although during July, sampling data has shown many adults to be in the freshwater sections of the river, recent unpublished data from Maine DMR shows acoustically tagged Atlantic sturgeon in the vicinity of Morse Cove in Phippsburg throughout most of August. This occurred in 2007, 2008 and 2009. These acoustically tagged sturgeon were all adults (Gail Wipplehauser, Maine DMR, personal communication, May 11, 2011). Although this area is downstream from the Doubling Point dredging area, the 2009 tracking data indicates movement of Atlantic sturgeon between the Morse Cove acoustic receiver at river kilometer 16, and the acoustic receiver at river kilometer 34 upstream in the upper section of Merrymeeting Bay, upstream from Doubling Point. This also occurred in 2007. Therefore these fish would have to pass through the dredging area of Doubling Point during August, which could result in contact with the dredging equipment.

In addition, many of these fish can be found feeding near the mouth of the Kennebec River during the summer (Gail Wipplehauser, personal communication), which could increase the chances that they could encounter the dredging equipment at Popham Beach. However, as noted for the shortnose sturgeon, a trained NOAA endangered species observer will be onboard the dredge for the duration of the dredging at both Doubling Point and Popham Beach to monitor takes of shortnose sturgeon (as well as Atlantic sturgeon) and to ensure that methods to reduce injury or mortality to any entrained shortnose and Atlantic sturgeon are implemented. Also as noted previously in Section 6.3.2, draghead deflectors will be used on the dredge in order to minimize the potential for entrainment of shortnose sturgeon. It is expected that these would also minimize the potential for entrainment of Atlantic sturgeon.

Recent sampling data suggest that the GOM DPS of Atlantic sturgeon is expanding (i.e. increasing) out to other rivers, with adults now being found in the Saco River (NOAA, 2007; Gail Wipplehauser, 2011, personal communication). Also there is evidence of movement of this species between the Kennebec and Penobscot rivers indicating that these populations could be mixing. Therefore any incidental takes of Atlantic sturgeon that may occur as a result of the proposed dredging and disposal activities in the Kennebec River during the proposed 2011 dredging operation are unlikely to jeopardize the continued existence of this species. Further discussion of the effects of the proposed dredging on this species can be found in the "Summary of the Effects of Maintenance Dredging on the Proposed Federally Threatened Atlantic Sturgeon, (*Acipenser oxyrinchus oxyrinchus*) in the Kennebec River, Sagadahoc County, Maine" which is an addendum to the "Biological Assessment For Shortnose Sturgeon (*Acipenser brevirostrum*) And The Gulf of Maine Distinct Population Segment of Atlantic Salmon (*Salmo salar*) in the Kennebec River, Bath, Maine" (Appendix E).

6.4 Essential Fish Habitat

6.4.1 No Action Alternative

The No Action Alternative would have no impacts on EFH since the sand waves move over time there should be no substantial changes in the existing habitat type over time due to increased shoaling.

6.4.2 Dredging the Kennebec with In-River and Nearshore Disposal

The dredging and disposal activities conducted for the Kennebec River FNP maintenance dredging project could potentially have some limited temporary impacts on EFH species found within the vicinity of the Federal channel and disposal sites. The dredged material has been found to be suitable for disposal at the disposal sites. The River and Jackknife Ledge disposal area are well flushed by the daily tides and wave action. Any impacts from dredging and disposal are expected to be short-termed, and localized. Recolonization of any benthic organisms buried by disposal should occur quickly. An assessment of the Kennebec River project areas indicates that there will be no significant impacts to Essential Fish Habitat, as defined by the Magnuson-Stevens Fishery Conservation and Management Act and amended by the Sustainable Fisheries Act of 1996, with this project. "Essential fish habitat" is broadly defined to include "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." Impacts to essential fish habitat from this project include temporary increases in turbidity from dredging activities and the temporary loss of benthic organisms associated with the dredged material. Due to the sandy nature of the dredged material, neither the schooling life stages nor spawning and nursery habitats are expected to be significantly impacted by the proposed project. Appendix D contains a complete EFH assessment.

The dredging and disposal activities conducted for the Kennebec River FNP maintenance dredging project could potentially have some limited temporary impacts on EFH species found within the vicinity of the Federal channel and disposal sites. The EFH species with the most potential to be affected by the Kennebec River maintenance dredging and disposal are those with planktonic eggs and larvae suspended in the water column (red hake, yellowtail flounder, windowpane flounder, ocean pout, halibut, herring, and sea scallops) and most of these would only be found at the high salinity areas of Popham Beach and Jackknife Ledge. These eggs and larvae may be physically damaged or killed from exposure to elevated concentrations of suspended solids. However, given the limited amount of suspended solids expected from dredging sand no significant impacts to the overall resource would be anticipated. The dredging and disposal activities are localized and temporary in nature. Dredging will occur in August outside the peak season for these sensitive life stages. The dredging and disposal activities are localized and temporary in nature. Mobile organisms such as finfish and lobsters are expected to avoid dredging activities. See Appendix D for more details.

6.5 Historical and Archeological Resources

The proposed maintenance dredging of the existing Federal navigation project in the Kennebec River in the Vicinity of Bath, Maine and the disposal of the dredged material near Jackknife Ledge and at the riverine disposal area north of Bluff Head, is unlikely to have an effect upon any structure or site of historic, architectural, or archaeological significance as defined by the National Historic Preservation Act of 1966, as amended. The Maine Historic Preservation Commission in a letter dated March 28, 2011 has concurred with this finding.

6.6 Social and Economic Resources

The maintenance dredging of the Federal channel may have some temporary short term effects on the local social and economic resources in the vicinity of the proposed dredging and disposal areas. As noted the Kennebec River Estuary including the vicinity of the mouth of the river near Popham Beach is heavily fished for lobsters during the summer, with numerous lobster traps set throughout the area including in the proposed dredging and disposal areas and travel/haul routes of the dredge. Therefore, the local lobster fisherman will be notified of the times of the scheduled dredging as well as the locations of the proposed areas affected, so that traps will not be set in those locations during the time of dredging. Lobster fishing outside of the actual dredging/disposal foot print and haul routes would not be affected. Only those areas within the dredged channel, disposal area and haul routes would require the relocation of gear. Prior to the dredging and disposal activities, the proposed transportation routes for the dredge will be published in a newspaper of general circulation in the area adjacent to the routes. Meetings between the USACE and the local lobster fisherman will be scheduled to discuss these temporary restrictions on fishing areas. Since the areas outside of the actual footprint of the dredging activities would continue to be fished for lobsters, the overall effects would be minimal due to the availability of a large area that would still be fishable for lobsters. Dredging and disposal activities are not expected to have any long term negative effects to the overall lobster population in the proposed dredging and disposal areas (see Sections 5.2.2.3, 5.2.5.2, 5.2.6.2, 6.2.2.1.3, and 6.2.3.1.4). Therefore no long term negative economic effects would be expected from the proposed activity.

As discussed in Section 6.2.3.1.3 of this EA, the dredging and disposal of approximately

70,000 CY of clean sand from the Doubling Point and Popham Beach areas of the Kennebec River are not expected to have significant long term effect on the shellfish harvesting areas in the estuary. Therefore, it is not expected that there will be any significant long term negative economic effect that would result from the proposed activity. During the actual dredging and disposal operations, the State of Maine Department of Marine Resources will be monitoring downstream water quality for elevated coliform bacteria levels that could potentially lead to closure of shellfish beds. However based upon the low percentage of silt sized particles in the dredged material and the relatively short time that would be required to complete the dredging, the proposed project is not expected to cause any such increases in bacteria levels and therefore will not have an unreasonable impact on the clam flats near the mouth of the river (See Water Quality Certificate, April 2011).

As noted in Section 5.6 of this EA, the peak harvest period along the Kennebec River for clams is from June –September, which is also when the maximum price per bushel can be obtained. Therefore any closure of these beds during the peak harvesting season can disproportionately affect the yearly income of the shellfish harvesters in this area. Most of the shellfish beds along the Kennebec River in these areas can be closed when river discharges exceed 30,000 cfs, (as would occur in a significant rain/flood event). In addition they can be closed when bacterial sampling indicates levels of *E.coli* bacteria in excess of 31 colony forming units (CFU) per 100 ml. As discussed in Section 6.2.3.1.3 of this EA, the dredging of clean sand is not expected to result in an increase in bacteria levels, since dilution of the dredge plume and settling of bacteria occurs quickly, generally within a few hundred yards downstream of the dredging and several hours post dredging. Therefore, the proposed project is not expected to increase bacteria levels in the river that would result in closure of the shellfish beds and therefore the project is not expected to have any significant economic effect on clam harvesters using the areas along the Kennebec River.

The proposed project is not expected to have any long term negative effects on the local tourism and recreational activities in the Kennebec River Estuary. As noted the dredging areas and transportation routes will be published in the local newspaper. The recreational users will need to avoid the dredge as they would need to stay away from any large vessel in the channel. In addition, as noted previously, the dredging and disposal of clean sand in the Kennebec River are not expected to negatively affect pelagic species such as bluefish or striped bass (or their prey) in the river, due to their ability avoid the areas of higher turbidity and active dredging. Since the material is clean sand it is expected to settle out quickly. Effects of the dredging will be short term and temporary. Therefore recreational fishing charter boats travelling between the mouth of the river and Merrymeeting Bay should be able to avoid these areas. Merrymeeting Bay is well upstream from the proposed dredging locations. The active dredge and transportation areas comprise a relatively small section when compared to the available space in the river. Therefore the proposed activity is not expected to have any long term negative economic effects on tourism or recreational use in the Kennebec River in the vicinities of the dredging and disposal areas.

The Bates-Morse Mountain Conservation Area is located near Seawall Beach which includes trails that end inshore from Jackknife Ledge. This area is reportedly used by 16,000 visitors per year for hiking as well as water related recreation (including swimming). The dredged material is not expected to increase levels of fecal coliform in the water, and therefore should not affect swimmers and water based recreational users in the vicinity of Seawall and Popham Beach. In addition, the disposal area is over a mile from Seawall Beach. As noted in Section 6.1.2.2 of this EA, the clean sand that is being disposed should settle out within the disposal site and therefore should not affect activities at Seawall Beach.

It is likely that the proposed project may have some temporary noise effects on the local lodging areas in the immediate vicinity of Popham Beach. Although the dredging of this single area is not expected to last for more than two weeks, (probably considerably less time given that this area has the least amount of material to be removed), there will be increased noise for the duration of the dredging activities that would continue for 24 hours a day. However, the dredge is required to comply with the local noise ordinance for the Town of Phippsburg. Therefore, any noise produced by the dredging activities would not be in excess of the maximum allowable levels for the area and therefore would not be expected to cause any long term negative economic effects to these local businesses.

The proposed dredging of Kennebec River Federal Navigation Project is expected to accrue long-term positive effects for local businesses. This dredging will allow the river traffic to operate normally, maintaining the accessibility of the Bath Iron Works shipyard to deep draft vessels allowing the facility to operate normally without cost incurring delays and/or cancellations. As noted in Section 5.6 of this EA, this facility employs nearly 6000 people in the state, and is therefore a significant economic resource for the surrounding area, particularly the City of Bath Maine.

6.7 Noise

The dredge is required to obey all state and local ordinances pertaining to noise. Therefore the sound from dredging at night should not be a major sound nuisance to the local residents beyond the residents not being accustomed to regular vessel traffic at night.

Organisms within the water can also be impacted by sound. Because sound attenuates more with quickly with distance in shallow waters, river and estuarine habitats may be less affected by sound generated by dredging activities than deeper open, ocean waters. Motile animals can move away from the dredge and the sound if necessary.

A 2008 study was conducted on shortnose sturgeon movements in the Penobscot River during dredging and pile driving in the July-October time frame (Zydlewski, 2009). The study noted an initial decrease in sturgeon numbers at the onset of dredging (which could be related to noise, suspended materials, or both), but no subsequent movements could be related to the occurrence of any in-river construction work, including dredging and pile driving.

7.0 AIR QUALITY

U.S. Army Corps of Engineers guidance on air quality compliance is summarized in Appendix C of the Corps Planning Guidance Notebook (ER1105-2-100, Appendix C, Section C-7, pg. C-47). Section 176 (c) of the Clean Air Act (CAA) requires that Federal agencies assure that their activities are in conformance with Federally-approved CAA state implementation plans for geographic areas designated as non-attainment and maintenance areas under the CAA. The EPA General Conformity Rule to implement Section 176 (c) is found at 40 CFR Part 93.

Clean Air Act compliance, specifically with EPA's General Conformity Rule, requires that all Federal agencies, including Department of the Army, review new actions and decide whether the actions would worsen an existing NAAQS violation, cause a new NAAQS violation, delay the SIP attainment schedule of the NAAQS, or otherwise contradict the State's SIP.

The State of Maine is authorized by the EPA to administer its own air emissions permit program, which is shaped by its SIP. The SIP sets the basic strategies for implementation, maintenance, and enforcement of the National Ambient Air Quality Standards (NAAQS). The SIP is the Federally enforceable plan that identifies how that state will attain and/or maintain the primary and secondary National Ambient Air Quality Standards (NAAQS) established by the EPA (US EPA, 2011). In Maine, Federal actions must conform to the Maine state implementation plan or Federal implementation plan. For non-exempt activities, the Corps must evaluate and determine if the proposed action (construction and operation) will generate air pollution emissions that aggravate a non-attainment problem or jeopardize the maintenance status of the area for ozone. When the total direct and indirect emissions caused by the operation of the Federal action/facility are less than threshold levels established in the rule (40 C.F.R. § 93.153), a Record of Non-applicability (RONA) is prepared and signed by the facility environmental coordinator.

7.1 General Conformity

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions "conform with" (i.e., do not undermine) the approved SIP for their geographic area. However, this maintenance dredging project is exempt from performing a conformity review based on 40 CFR 93.153(c)(2) which states: "*The following actions which would result in no emissions increase or an increase in emissions that is clearly de minimis:* (ix) *Maintenance dredging and debris disposal where no new depths are required, applicable permits are secured, and disposal will be at an approved disposal site.*"

The dredging of the Kennebec River Federal Navigation Project falls into this category and is therefore exempt and a RONA does not need to be prepared for this project.

8.0 ENVIRONMENTAL JUSTICE and PROTECTION OF CHILDREN

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" require Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its program, policies, and activities on minority and low-income populations in the U.S., including Native Americans. The proposed action will not have any disproportionate high or adverse impacts on minority or low-income populations, or any adverse short or long-term environmental justice impacts because the proposed action will be dredging a Federal channel located in the waters of the Kennebec River, with in river disposal of the dredged material a downstream of Bluff Head, and nearshore disposal at Jackknife Ledge. There are no environmental justice populations located in these areas.

Executive Order 13045 "Protection of Children from Environmental Health Risks and Safety Risks" seeks to protect children from disproportionately incurring environmental health risks or safety risks that might arise as a result of Army policies, programs, activities and standards. Environmental health risks and safety risks include risks to health and safety attributable to products or substances that a child is likely to come in contact with or ingest.

The proposed project involves the maintenance dredging of an existing Federal navigation channel. Work will be done in the Federal navigation channel, and therefore away from public access and in adherence to navigational safety regulations. The dredged material is clean sand, and therefore suitable for disposal at the designated disposal area. Therefore the activity is not expected to disproportionately affect the safety of children, including negatively affecting fisheries/shellfisheries resources, which could be consumed by children.

9.0 CUMULATIVE EFFECTS

Cumulative impacts are those resulting from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. Past and current activities in Kennebec River include the maintenance dredging of the Federal channel and non-Federal maintenance dredging by Bath Iron Works, and navigation through the channel. Reasonably foreseeable future actions include the continuation of current maintenance and navigation activities. The effects of these previous, existing and future actions are generally limited to infrequent disturbances of the benthic communities in the dredging and disposal areas. Water quality, air quality, hydrology, and other biological resources are generally not significantly affected by these actions with any disturbance being short-lived. Consequently, the direct effects of this project are not anticipated to add to impacts from other actions in the area. Therefore, no adverse cumulative impacts are projected as a result of this project.

10. ACTIONS TAKEN TO MINIMIZE IMPACTS

The dredging will be conducted in accordance with anyRecommended Prudent Measures (RPMs) issued by the National Marine Fisheries Service to protect listed fish species. In addition water quality monitoring will be conducted by the Maine DMR during the dredging to ensure that if coliform levels are exceeded, contaminated shellfish will not jeopardize the health of consumers.

11.0 COORDINATION

This project was coordinated with state, local and Federal agencies including the Environmental Protection Agency; the U.S. Fish and Wildlife Service; the National Marine Fisheries Service; the Maine Department of Environmental Protection; and the Maine State Office of Historic Preservation. A public notice was issued on March 1, 2011. There were public comments in response to the notice of application for the Maine Water Quality Certification.

11.1 Coordination Letters

Coordination letters were mailed to the following agency representatives. Copies of these letters and agency responses can be found in Appendix A.

Mr. Peter Colosi
Assistant Regional Administrator
NOAA Fisheries
Habitat Conservation Division
55 Great Republic Drive
Gloucester, MA 01930-2276

Ms. Patricia Kurkul
Regional Administrator
NOAA Fisheries
Northeast Regional Office
55 Great Republic Drive
Gloucester, Massachusetts 01930-2276

Ms. Lori Nordstrom, Field Supervisor
U.S. Fish and Wildlife Service
17 Godfrey Dr., Suite #2
Orono, Maine 04473

Mr. Mel Cote, Chief
Water Quality Unit
U.S. Environmental Protection Agency
Region I
5 Post Office Square - Suite 100
Boston, Massachusetts 02109-3912

Mr. Earl G. Shettleworth Jr.
Director, Maine Historic Preservation Commission
55 Capitol Street
65 State House Station
Augusta, ME 04333

11.2 Correspondence /Personal Communication

Communication and/or correspondence with the following people occurred during the preparation of this Environmental Assessment:

Lt. Jon Cornish
Maine Marine Patrol
Maine Department of Marine Resources
PO Box 8

West Boothbay Harbor, ME 04575-0008

Ms. Darcie Couture
Acting Director, Public Health Division
Maine Department of Marine Resources
PO Box 8
West Boothbay Harbor, ME 04575

Ms. Julie Crocker
Fisheries Biologist
National Marine Fisheries Service
Northeast Regional Office
Protected Resources Division
55 Great Republic Drive
Gloucester, MA 01930

Mr. Robert L. Green, Jr., Project Manager
Maine Department of Environmental Protection
Division of Land Resource Regulation
Bureau of Land and Water Quality
Southern Maine Regional Office
312 Canco Road
Portland, Maine 04103

Ms. Michelle Magliocca
NMFS, Office of Protected Resources
Permits, Conservation and Education Division
1315 East-West Highway
Silver Spring, MD 20910-3226

Mr. Brian Swan
Maine Department of Marine Resources
21 State House Station
Augusta ME 04333-0021

Ms. Gail Wippelhauser
Marine Resources Scientist
Maine Department of Marine Resources
#172 State House Station
Augusta, ME 04333

Ms. Laury Zicari, Project Leader
U.S. Fish and Wildlife Service
Maine Field Office-Ecological Services
17 Godfrey Drive, Suite #2
Orono, ME 04473

11.3 Public Notice

A public notice describing the project was released on March 1, 2011.

11.4 Comments Received

Public comments were received from the people listed below. Their comments are summarized with responses, noted below. The Letters can be found in Appendix A of this report.

1. Stephan F. Hinchman, Attorney at Law. The Law Offices of Stephen F. Hinchman, LLC, 37 Fosters Point Road, West Bath, Maine 04530. .
Letter Dated March 26, 2011.

Comments: Mr. Hinchman was concerned with the effects of the dredging and disposal on the water quality, biological, economic, and recreational resources in the Kennebec River. He states that the dredging will have severe adverse impacts to virtually all other uses and users of the Kennebec River estuary and surrounding waters including shellfish harvesting, lobstering, tourism and recreation, commercial and recreational fishing, swimming, boating, hiking, property owners, wildlife and other aquatic life and he believes that there are more cost effective and less environmentally damaging alternatives to enable delivery of the SPRUANCE. He incorporates the comments of several local residents who represent shellfish and lobster harvesters, recreational users, tourism and land-owners/abutters. Mr. Hinchman also states that the proposed activity is not in compliance with the Clean Water Act, due to there being another available alternative which is practicable and less environmentally damaging; which is to move the SPRUANCE around the channel outside the shoals as was done during the sea trials in February and March with the assistance of a local pilot. In addition, he states that the proposed dredging is in violation of the National Environmental Policy Act, since it will have a significant impact on the human environment. In support of this statement he includes the comments of the Phippsburg residents (referred to in the letter as the Phippsburg Commenters) and their interests.

The Phippsburg Commenters and their interests:

Bob Cummings- A Drummore Bay resident whose concerns include the effects of the dredging operations on recreational users and disturbance of the natural environment surrounding the Kennebec River estuary and Popham Beach areas, as well as negatively effecting the shellfish harvesters (by causing contamination) and other users of the area.

Capt. Ethan DeBerry- A Phippsburg resident and owner and operator of recreational fishing charter and ferry service. His concern is that the dredging will impact his charter and ferry services during the height of the season as well as creating a disturbance for the fish.

Brett Gilliam – A Phippsburg resident and commercial lobsterman. His concerns are that the dredging of the area of Popham Beach and disposal at Jackknife Ledge would prevent him from fishing the area and cause damage to his traps, as well as destruction of lobsters and their habitat by burial with dredged material

Peggy Johannessen – Owner of a local Bed and Breakfast. Her concerns include the effects of dredging on tourists/visitors during the busiest time of the year. She believes that the noise of the dredging equipment will disturb guests/users and negatively impact business, since the dredging is conducted 24 hours a day.

Dot Kelly - A Phippsburg property owner, a member of the conservation committee and riverfront abutter. She is concerned about the effect of the dredging on the tidal flats adjacent to her property as well as the effects on the overall water quality in the Kennebec River. She is concerned that the entire river will become turbid with material settling out along the tidal flats covering them with a layer of silt several inches deep. This is what she states occurred during the BIW dredging and disposal activities in November 2009.

Dick Lemont – A Phippsburg resident and commercial clam harvester. He is concerned with siltation of clam flats resulting from the dredging and the potential for closure which would affect his income (as well as those of other clammers) during the peak of the clam harvesting season when the selling prices are the highest. He is also concerned about the effects on the juvenile clams which would impact future clam harvesting and income.

Lawrence Pye – A Phippsburg resident, Town Selectman and commercial lobster fisherman. His concern is that the effects of the dredging at Popham Beach and disposal at Jackknife Ledge will prevent him from fishing the area and result in lost habitat and gear.

Laura Sewall – A Phippsburg resident near Seawall Beach. She is concerned about the potential negative effects of the dredging on recreation (swimming and kayaking) as well as usage of the Bates-Morse Mountain Conservation Area used by more than 16,000 visitors per summer. She is concerned that elevated levels of contaminants could be in the dredged material that could ultimately affect swimmers at Seawall Beach, as well as the aesthetics for users of the conservation area.

The Small Point Association (SPA) – Owners of Sewall Beach, adjacent to Popham Beach. Their concerns are similar to those noted above from the Phippsburg Commenters. They are primarily concerned about the effects upon recreational users of the conservation area, the negative impacts to wildlife (i.e. migratory birds) on Seawall Beach and effects to clammers whose livelihood would be severely impacted from a project that occurs during the summer months.

Responses - Mr. Hinchman's comments are addressed in several locations in the Environmental Assessment. Responses to those comments concerning Section 404(b)1 of the Clean Water Act specifically the "least environmentally damaging practicable alternative" are discussed in Section 4.0, Alternatives. Comments concerning the National Environmental

Policy Act are addressed throughout the Environmental Assessment primarily in Section 6.0 Environmental Consequences section. In summary, to address the comment concerning the least environmentally damaging practicable alternative: shoaling has since occurred in the previously used route outside of the channel (at Doubling Point) and additional shoaling is expected to occur during the coming summer months, making that area unavailable as an alternate transit route. To address the comment concerning the effects to local resources, (including economic): the dredging and disposal of clean sand at both the Doubling Point and Popham Beach areas is not expected have a significant long or short term negative effect on the local resources based upon the information discussed in the above noted sections of the Environmental Assessment.

Responses to Individual Commenters:

Bob Cummings:- Comments are addressed in Section 6.1.3.1 Bluff Head; Section 6.2, Biological Effects; Section 6.2.2.1.3, Lobsters; Section 6.2.2.1.4,Shellfish; Section 6.2.3.1.3, Shellfish; and Section 6.6, Social and Economic Resources.

Capt. Ethan DeBerry – Comments are addressed in Section 6.2.2.2, Doubling Point, Section; 6.2.3.1.2, Finfish (disposal area); and Section 6.6 Social and Economic Resources.

Brett Gilliam –Comments are addressed in Section 6.2.2.1.3 Lobsters; Section 6.2.3.1.4 Lobsters (disposal area); and Section 6.6, Social and Economic Resources.

Peggy Johannessen – Comments are addressed in Section 6.6, Social and Economic Resources.

Dot Kelly – Comments are addressed in Section 6.1.2 Dredge Sites; 6.1.2.1, Doubling Point; 6.1.3, Disposal Areas; 6.1.3.1, Bluff Head; 6.2, Biological Effects; 6.2.2.1.4, Shellfish;; Section 6.2.3.1.3, Shellfish; Section 6.2.2.1.5 Seals; 6.2.3.1.5, Seals; and Section 6.6, Social and Economic Resources.

Dick LeMont – Comments are addressed in Section 6.2.2.1.4, Shellfish; Section 6.2.3.1.3, Shellfish; Section 6.2.3.2, Bluff Head; and Section 6.6, Social and Economic Resources.

Lawrence Pye – Comments are addressed in Section 6.2.2.1.3 Lobsters; Section 6.2.3.1.4 Lobsters (disposal area); and Section 6.6, Social and Economic Resources.

Laura Sewall – Comments are addressed in Section 6.2.2 Dredge Sites; 6.2.2.3, Popham Beach; 6.2.3 Disposal Areas; 6.2.3.1.3, Shellfish; and 6.6 Social and Economic Resources.

The Small Point Association – Comments are addressed in Section 6.2.2 Dredge Sites; 6.2.2.3, Popham Beach; 6.2.3 Disposal Areas; 6.2.3.1.3, Shellfish; 6.3 Threatened and Endangered Species; and 6.6 Social and Economic Resources.

2. Friends of Merrymeeting Bay, P.O. Box 233, Richmond, ME 04357
Letter Dated March 26, 2011.

Comments: The letter states that there are violations of 1) the state water quality statute-past and proposed; 2) the proposed clarification to the water classification – Maine and Clean Water Act issues; 3) 40 CFR Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material; and 4) the Endangered Species and Marine Mammal Protection Acts. In addition, they reserved the right to present discussion and evidence covered by any or all of the Pertinent Laws, Regulations and Directives listed in their attached letter. In summary, the letter states that the waters of the Kennebec River including those in the dredging area are classified as SA, and therefore dredging and disposal operations are prohibited in these areas. In addition, the proposed clarification to the water classification is in violation of the Clean Water Act, since it requires additional public hearings as well as EPA approval. The letter also states that the dredging and disposal alternatives that are being considered are not the least environmentally damaging practicable alternatives, and recommends using upland or offshore disposal areas as well as investigating alternative pilotage solutions (to navigate the SPRUANCE outside of the channel). It also notes that there will be impacts to marine mammals and endangered species.

Responses- The comments are addressed in the Environmental Assessment. In summary, the Maine State Legislature recently clarified the ambiguity concerning the designation of Class SA waters, to show that they do not extend to the areas previously stated in the above letter. Therefore, the areas of dredging and disposal are classified as SB, as originally intended at the time of designation. According to ME DEP, such a clarification is of a ministerial nature and does not represent a substantive change to water quality classification that would trigger the procedural requirements cited by the commenter. In addition, due to the recent shoaling of the areas outside of the channel at Doubling Point, using that area to transit the SPRUANCE may no longer be a viable option. Also disposal at offshore and upland disposal areas are not considered practicable for this dredging due to either extended time required to transport the material, and/or excessive cost, as well it resulting in removal of sand from the system. Specific locations where the comments are addressed include Section 3. Proposed Project Description, Section 4.0 Alternatives; 5.0, Affected Environment; Section 5.1 – Section 5.1.2.2 Physical and Chemical Environment (including subsections); Section 6.0 Environmental Consequences; Section 6.1.2.1, Doubling Point; Section 6.1.3, Disposal Areas; Section 6.2, Biological Effects, Section 6.2.2.1.5, Seals; Section 6.2.3.1.5, Seals; Section 6.3, Threatened and Endangered Species; and the Clean Water Act Section 404(b)(1) Evaluation. In summary, the dredging of clean sand is not considered a carrier of contaminants and is not expected to have a long term negative impact on water quality and the associated habitats. A suitability determination was conducted and determined that the material is suitable for disposal in the proposed disposal areas.

3. Phippsburg Land Trust, P.O. Box 123, Phippsburg, ME 04562
Letter Dated March 30, 2011

Comments: The land trust is responsible for protecting approximately 800 acres in the Phippsburg peninsula. There are six Phippsburg Land Trust preserves at Fiddlers Reach that are potentially affected by the proposed dredging and disposal activity at Bluff Head. In addition, there are approximately 10 acres at Cox's Head, which is an area potentially affected by the dredging and disposal activity at the mouth of the river. They are concerned with the environmental and recreational impacts of the proposed project. The impacts that they are concerned with include impacts to marshy wetlands at Greenleaf Preserve which includes possible shoaling; silt deposition on wetlands which is believed to have occurred following the 2009 dredging; the noise of the dredging operations which can effect serenity for visitors; impacts to lobsterman and clammers, effects of sediment deposits caused by dredging on marine life; contaminants in the sediments, the suitability of the disposal areas, impacts of the dredging operation on biological community, the effects on the littoral system at Popham Beach/Jackknife Ledge. They suggest the Corps consider other alternatives such as that dredging should be done in winter or only minimal dredging be conducted, or that the SPRUANCE should transit around the shoals as was done in February and March, before planning to dredge in August.

Responses: The comments are addressed in the EA. In summary, the dredging of clean sand is not expected to cause silt deposition on adjacent tidal flats and wetlands. The clean sand is also not expected to have significant negative impact on the biological, recreational or economic resources of the area. Although there may be noise from the dredging operations, the area is a Federal navigation channel, with existing boat traffic. These vessels also produce noise. Therefore the associated noise is expected to be temporary, and of short duration. Specific locations where these concerns are addressed include Section 4.0, Alternatives; Section 5.1.2.2, Jackknife Ledge; Section 6.0, Environmental Consequences; 6.1 Physical and Chemical Effects; Section 6.1.2; Dredge Sites; Section 6.1.2.1, Doubling Point; Section 6.1.3.2, Jackknife Ledge; Section 6.2.2.1.4, Shellfish; Section 6.2.3.1.3, Shellfish; Section 6.3, Threatened and Endangered Species and Section 6.6, Social and Economic Resources.

4. Laura Sewall, PhD, Director, Bates-Morse Mountain Conservation Area Assistant Director, The Harward Center for Community Partnerships, Bates College, 161-163 Wood Street, Lewiston, ME 04240. Letter Dated March 29, 2011.

Comments: There is concern that disposal at Jackknife Ledge will result in aesthetic and recreational impacts on Sewall and Popham Beaches, including elevated levels of fecal coliform bacteria. In addition there is concern that disposal will affect the experience of the users of the Bates Morse Mountain Conservation Area. In addition, she is concerned about the effects of dredging and disposal on lobsters, clams and the associated fisheries. Also she expressed concern with the downgrading of the water quality classification from SA to SB.

Responses: The comments are addressed throughout the EA. Generally, the dredging and disposal of clean sand is not expected to cause elevated levels of fecal coliform bacteria, therefore impacts to recreational users are not expected. In addition, the material is not believed to be a carrier of contaminants. Concerning the water quality classifications, the Maine State Legislature recently clarified the original classification of the waters in the vicinity and including the dredging areas as class SB, which is what they were originally designated to be. Additional information concerning the comments/concerns can be found in Section 4.0, Alternatives; Section 5.1.2.2, Jackknife Ledge; Section 6.0, Environmental Consequences; 6.1 Physical and Chemical Effects; Section 6.1.2; Dredge Sites; Section 6.1.2.1, Doubling Point; Section 6.1.3.2, Jackknife Ledge; Section 6.2.2.1.4, Shellfish; Section 6.2.3.1.3, Shellfish; Section 6.3, Threatened and Endangered Species and Section 6.6, Social and Economic Resources.

5. Letter From Phippsburg Shellfish Committee, 1042 Main Road, Phippsburg, ME 04562. Letter Dated March 25, 2011.

Comments- There is concern that the dredging and disposal operations in the Kennebec River will have a severe negative effect on the shellfish downstream from the Bluff Head disposal area as well as those near the Morse River from disposal Jackknife Ledge. These impacts include silting in/burial of clam flats with silt, loss of productivity, closure of beds during the busiest season causing an economic impact, effects to lobsters and lobster gear, as well as finfish. In addition, there is the request that the SPRUANCE be brought out around the channel without dredging as was done previously.

Responses: The comments are addressed throughout the EA. Generally, the dredging and disposal of clean sand is not expected to cause long term negative impacts to the shellfish beds downstream from Bluff Head, or in the Morse River near Jackknife Ledge. Sections of the EA that discuss these effects include Section 4.0, Alternatives; Section 5.1.2.2, Jackknife Ledge; Section 6.0, Environmental Consequences; 6.1 Physical and Chemical Effects; Section 6.1.2; Dredge Sites; Section 6.1.2.1, Doubling Point; Section 6.1.3.2, Jackknife Ledge; Section 6.2.2.1.4, Shellfish; Section 6.2.3.1.3, Shellfish; Section 6.3, Threatened and Endangered Species and Section 6.6, Social and Economic Resources.

6. E-mail from Bob Cummings dated March 25, 2011.

Comments: Concern that according to Maine Dept. of Marine Resources official, shellfish harvesting will need to be suspended during dredging in the vicinity of Phippsburg. This will cause a major loss of income for 40 shellfish harvesters in the area.

Responses: Comments are addressed throughout the EA. The Maine DMR is planning to monitor levels of fecal coliform bacteria during dredging to ensure that they are within mandated criteria, but there will not be a "preemptive closure" based solely on the commencement of dredging activities. Generally, the dredging and disposal of clean sand is not expected to cause significantly increased levels of bacteria downstream in the Phippsburg shellfish areas. Specific sections where this is discussed include Section 6.1.3.1, Bluff Head; Section 6.2.2.1.4, Shellfish; Section 6.2.3.1.3, Shellfish; and Section 6.6 Social and Economic Resources.

7. Dot Kelly, Phippsburg Resident, Letter Dated March 20, 2011.

Comments: The letter states that the last dredging and disposal in November 2009 by BIW resulted in an accumulation of mud on the shoreline near her property and that alternative disposal options such as upland disposal should be should be used instead to minimize impacts. She recommended that we should use the no dredge alternative, minimal dredging, or using dragging to flatten the sand crests. Ms. Kelly interpretation of the Normandeau Study which found minimal water quality impacts from dredging was that the data was flawed. The study was done during a storm event and monitored above and below at only one location that was far from the disposal area. Also another study on clam flats did not address the effects of sedimentation on clam breathing holes. The letter also states that the choice of Bluff Head is not consistent with the Corps Regulations or 1992 dredging brochure since the disposal area has not been monitored. She noted that the depths at Bluff Head in the sampling plan are not accurate and she also questioned the current speeds in the river. She also recommended more study of the sand transport in the area be conducted before any "over-dredging," and conducting only minimal dredging. She stated that the August dredging will disrupt numerous users of the resources, the water quality designation for the areas was Class SA and disposal of dredge material would violate water quality law, and that dredging outside the November window isn't minimizing impacts.

Responses: The comments/concerns are addressed throughout the Environmental Assessment. In summary, the dredging of clean sand is not expected to negatively affect the resources noted. Concerning the Normandeau study, the fact that a storm event occurred showed that the turbidities associated with dredging were within the ranges of those normally experienced during a storm event. Concerning the inaccuracy of the depth at the sampling plan, an explanation and a depth range was provided in the May 15, 2011 memo to Bill Kavanaugh concerning the suitability determination. Sections of the EA where the comments/concerns are addressed in more detail include Section 4.0, Alternatives; Section 5.1.2.2, Jackknife Ledge; Section 6.0, Environmental Consequences; 6.1 Physical and Chemical Effects; Section 6.1.2; Dredge Sites; Section 6.1.2.1, Doubling Point; Section 6.1.3.1, Bluff Head; Section 6.1.3.2, Jackknife Ledge; Section 6.2.2.1.4, Shellfish; Section 6.2.3.1.3, Shellfish; and Section 6.6, Social and Economic Resources.

12.0 REFERENCES

Anthony, E. J., 2009, Shore Processes and their Paleoenvironmental Applications, Elsevier Press, Oxford, UK, 519 p.

Atlantic Sturgeon Status Review Team (ASSRT), 2007. (*Acipenser oxyrinchus oxyrinchus)* Prepared by the Atlantic Sturgeon Status Review Team for the National Marine Fisheries Service National Oceanic and Atmospheric Administration. February 23, 2007. *Updated with corrections on July 27, 2007*.

Atlantic Salmon Commission, 2004. Annual Report of the Maine Atlantic Salmon Commission for the Period of January 1, 2004 through December 31, 2004. Compiled and Edited By Patrick Keliher, Executive Director. ASC, Augusta Office 323 State Street, 172 State House Station, Augusta, Maine 04333.

Bain, M. B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and Divergent Life History Attributes. *Environmental Biology of Fishes* 48: 347-358.

Bain, M. B., N. Haley, D. Peterson, J. R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815, in the Hudson River Estuary:

Lessons for Sturgeon Conservation. Instituto Espanol de Oceanografia. Boletin 16: 43-53.

Berry, W., N. Rubinstein, B. Melzian, and B. Hill. 2003. The biological effects of suspended and bedded sediment (SABS) in aquatic systems. Internal Report to US EPA, Office of Research and Development, National Health and Environmental Effects Laboratory, Narragansett, RI.

Bohlen, W.F., M.M., Horward-Strobel, D.R Cohen, and E.T.,Morton. 1996. An investigation of the dispersion of the sediments resuspended by dredging operations in New Haven Harbor: Disposal Area Monitoring System, U.S. Army Corps of Engineers, DAMOS Contribution 112, 202 p.

Boreman, J., W.J. Overholtz, and M.Sissenwine. 1984. A preliminary analysis of the effects of fishing on shortnose sturgeon. Woods Hole Laboratory Reference Document No. 84-17. National Marine Fisheries Service, Woods Hole, MA 02543.

Borodin, N. 1925. Biological observations on the Atlantic Sturgeon, *Acipenser sturio*. Transactions of the American Fisheries Society 55: 184-190.

Breitburg, D.L. 1988. Effects of turbidity on prey consumption by striped bass larvae. *Transactions of the American Fisheries Society*. 117: 72-77.

Bruton, M.N. 1985. The effects of suspendoids on fish. *Hydrobiologia*. 125:221-241.

Burton, W.H. 1993. Effects of Bucket Dredging on Water Quality in the Delaware River and the Potential For Effects on Fisheries Resources. Prepared for the Delaware Basin Fish and Wildlife Management Cooperative, West Treton, N.J. June 1993.

Caron, F., D. Hatin, and R. Fortin. 2002. Biological characteristics of adult Atlantic sturgeon (*Acipenser oxyrinchus*) in the Saint Lawrence River estuary and the effectiveness of management rules. Journal of Applied Ichthyology 18: 580-585.

Christman, Paul. June, 2009. Maine Department of Marine Resources, 172 State House Station, Augusta ME 04333-0021. Personal Communication.

Clarke, D.G. and D.H. Wilber. 2000. Assessment of potential impacts of dredging operations due to sediment resuspension. DOER Technical Notes Collection (ERDC TN-DOER-E9). US Army Engineer Research and Development Center, Vicksburg, MS.

Colby, D. and D. Hoss. 2004. Larval fish feeding responses to variable suspended sediment and prey concentrations. DOED Technical Notes Collection (ERDC TN-DOER-E16). US Army Engineer Research and Development Center, Vicksburg, MS.

Collins, M.A. 1995. Dredging-induced near-field resuspended sediment concentrations and source strengths. Miscellaneous Paper D-95-2, U.S. Army Engineer Waterways

Experimental Station, Vicksburg, MS.

Collins, M. R., T. I. J. Smith, W. C. Post, and O. Pashuk. 2000. Habitat utilization and biological characteristics of adult Atlantic sturgeon in two South Carolina Rivers. *Transactions of the American Fisheries Society*. 129: 982-988..

Cornish, J. 2011. Maine Marine Patrol, Maine Department of Marine Resources, PO Box 8, West Boothbay Harbor, ME 04575. Personal Communication.

Couture, D. 2011. Maine Department of Marine Resources, Public Health Division, Maine Department of Marine Resources, PO Box 8, West Boothbay Harbor, ME 04575. Personal Communication.

Crance, J. H. 1987. Habitat suitability index curves for anadromous fishes. In: Common Strategies of Anadromous and Catadromous Fishes, ed. M. J. Dadswell. Bethesda, Maryland, American Fisheries Society. Symposium 1: 554. In FR, 2010.

Dadswell, M.J. 1979. Biology and population characteristics of the shortnose sturgeon, *Acipenser brevirostrum*, Le Sueur 1818 (Osteicthyes: Aciparseridae), in the St. John River Estuary, New Brunswick, Canada. *Canadian Journal of Zoology*. Vol. 57. Number 11. pp 2186-2210.

Dadswell, M. J., B. D. Taubert, T. S. Squires, D. Marchette, and J. Buckley. 1984. Synopsis of biological data on shortnose sturgeon, *Acipenser brevirostrum*. NOAA Technical Report NMFS 14.

Dadswell, M. 2006. A review of the status of Atlantic sturgeon in Canada, with comparisons to populations in the United States and Europe. *Fisheries* 31: 218-229, in ASSRT 2007.

Danie, D., J. Trial, J. Stanley, L. Shanks, and N. Benson. 1984. Species profiles: life histories and environmental requirements of coastal fish and invertebrates (North Atlantic): Atlantic salmon. USFWS, report FWS/OBS-82/11.22.

Dovel, W. L. and T. J. Berggren. 1983. Atlantic sturgeon of the Hudson River estuary, New York. New York Fish and Game Journal 30: 140-172. In ASSRT 2007.

Dyer, K.R. 1986. Coastal and Estuarine Sediment Dynamics. John Wiley & Sons, New York. 342 p.

Elliott, N,M., R.D. Andrews, and D.R. Jones. 2002. Pharmacological blockade of the dive response: effects on heart rate and diving behavior in the harbor seal (*Phoca vitulina*). *Journal of Experimental Biology*. 205: 3757-3765.

Emerson, C.W., and J. Grant. 1991. The control of soft-shell clam (*Mya arenaria*) recruitment on intertidal sandflats by bedload sediment transport. *Limnology and Oceanography*. 36(7): 1288-1300.

Emerson, C.W., J. Grant, and T.W. Rowell. 1990. Indirect effects of clam digging on the viability of soft-shell clams, Mya arenaria L. *Netherlands Journal of Sea Research*. 27(1): 109-118.

ENSR. 1997. Summary Report of Independent Observations Phase 1 – Boston Harbor Navigation Improvement Project. Prepared for Massachusetts Coastal Zone Management.

ENSR. 2008. Providence River and Harbor Maintenance Dredging Project Synthesis Report. DAMOS Contribution No. 178. U.S. Army Corps of Engineers, New England District, Concord, MA, 133 pp.

Fay, C., M. Bartron, S. Craig, A. Hecht, J. Pruden, R. Saunders, T. Sheehan, and J. Trial. 2006. Status Review for Anadromous Atlantic Salmon (*Salmo salar*) in the United States. Report to the National Marine Fisheries Service and U.S. Fish and Wildlife Service. 294 pages. Available at: http://www.nmfs.noaa.gov/pr/species/statusreviews.htm

Federal Register (FR). 2010. /Vol. 75. No 193/ Wednesday, October 6, 2010/ Proposed Rules. Department of Commerce, National Oceanic and Atmospheric Administration, 50 CFR Parts 223 and Part 224 RIN 0648-XJ00 [Docket No. 100903414-0414-02], Endangered and Threatened Wildlife and Plants; Proposed Listing Determinations for Three Distinct Population Segments of Atlantic Sturgeon in the Northeast Region. Agency National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

FR, November 17, 2000 (65 FR 69459) as cited in Federal Register, November 14, 2006 (71 FR66299).

Fefer, S.I. and P.A. Schettig. 1980. An Ecological Characterization of Coastal Maine (North and East of Cape Elizabeth). U.S. Fish and Wildlife Service Report FWS/OBS-80/29.

Fenster, M.S. and D. M. FitzGerald. 1996. Morphodynamics, stratigraphy, and sediment transport patterns of the Kennebec River estuary, Maine, USA. *Sedimentary Geology*. 107: 99-120.

Fenster, M.S., D. M. FitzGerald, J.T. Kelley, D.F. Belknap, I.V. Buynevich, and S.M. Dickson. 2001. Net ebb sediment transport in a rock-bound, mesotidal estuary during spring-freshet conditions: Kennebec River estuary, Maine. *Geological Society of America*. 113(12): 1522-1531.

Fenster, M.S., D.M. FitzGerald, D.F. Belknap, B.A. Knisley, A. Gontz, and I.V. Buynevich. 2005. Controls on Estuarine Sediment Dynamics in merry Meeting Bay, Kennebec River Estuary, Maine, U.S.A. IN: FitzGerald, D.M. and J. Knight (ed). High Resolution Morphodynamics and Sedimentary Evolution of Estuaries. Springer, Netherlands. pp.173-194.

Fernandes, S.J. 2008. Population Demography, Distribution and Movement Patterns of Atlantic and Shortnose Sturgeons in the Peonobscot River Estuary, Maine. A Thesis submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science (in Ecology & Environmental Science), The Graduate School, University of Maine

Fernandes, S.J., M.T. Kinnison, and G.B. Zydlewski. 2006. Investigation into the distribution and abundance of Atlantic sturgeon and other diadromous species in the Penobscot River, Maine. 2006 Annual Report prepared by the University of Maine Sturgeon Research Working Group. (*Cited with permission from M.T. Kinnison, 2009*).

Fernandes, S.J., M.T. Kinnison and G.B Zydlewski. 2008. Investigation into the distribution and abundance of Atlantic sturgeon and other diadromous species in the Penobscot River, Maine. 2007 Annual Report prepared by the University of Maine Sturgeon Research Working Group. (*Cited with permission from M.T. Kinnison, 2009*).

FitzGerald, D.M. and L.K. Fink. 1987. Sediment dynamics along an indented coast: Popham Beach - Kennebec River Maine. IN: N.C. Kraus (ed.), Coastal Sediments 1987 Proceedings of a Specialty Conference on Advances in Understanding of Coastal Sediment Processes, New Orleans, LA. May 12-14, 1987. Volume II: 2047-2061.

FitzGerald, D.M., I.V. Buynevich, M.S. Fenster, and P.a. McKinlay. 2000. Sand dynamics at the mouth of a rock-bound, tide-dominated estuary. Sedimentary Geology 131: 25-49.

FitzGerald, D.M., I.V. Buynevich, M.S. Fenster, J.T. Kelley, and D.F. Belknap. 2005. Coarse-Grained Sediment Transport in Northern New England Estuaries: A Synthesis. IN: FitzGerald, D.M. and J. Knight (ed). High Resolution Morphodynamics and Sedimentary Evolution of Estuaries. Springer, Netherlands. pp.195-213.

Fried, S.M. and J.D. McCleave. 1973. Occurrence of the Shortnose Sturgeon (*Acipenser brevirostrum*), an endangered species, in Montsweag Bay, Maine. J. *Fish Res. Board Can*. 30:563-564.

Gilbert, C. R. 1989. Atlantic and shortnose sturgeons. United States Department of Interior Biological Report 82: 28 pp. in FR 2010.

Gadd, P.E., J.W. Lavelle, and D.J. Swift. 1978. Estimates of sand transport on the New York Shelf using near-bottom current meter observations. *Journal of Sedimentary Petrology*. 48(1): 239-252.

Goldschmidt, P.M., D.M. FitzGerald, and L.K. Fink, Jr. 1991. Processes affecting shoreline changes at Morse River Inlet, central Maine coast. *Shore and Beach*. 55: 33-40.

Grant, J. And B. Thorpe. 1991. Effects of suspended sediments on growth, respiration, and excretion of the soft-shell clam (*Mya arenaria*). *Can.J.Fish.Aquatic Sci*. 48: 1285-1292.

Hayes, Donald F. 1986. Guide to Selecting a Dredge for Minimizing Resuspension of Sediment. Environmental Effects of Dredging Technical Notes EEDP-09-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Holland, B.F. Jr. and G.F. Yelverton. 1973. Distribution and biological studies of anadromous Fishes from offshore North Carolina. North Carolina Dep. Nat. Econ. Res. Spec. Sci. Rep. 24. 132 pp. *in* . Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight)--Atlantic and shortnose sturgeons. U.S. Fish Wildl.Serv. Biol. Rep. 82(11.122). U.S. Army Corps of Engineers TR EL82-4. 28 pp

Hubbard, W. 1982. Analysis of Survey Data, Kennebec River Disposal Site, Sagadahoc County, Maine. U.S. Army Corps of Engineers, New England Division, Waltham MA.

Hubbard, W. 1986. BR-IAB-86-4 Biological Report, Kennebec River, Sagadahoc County, Maine. Impact Analysis Branch, New England Division, U.S. Army Corps of Engineers, 424 Trapelo Road, Waltham, MA.

Hubbard, W. 1989. Biological Report, Jackknife Ledge Nearshore Disposal Site, Kennebec River, Maine. U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Hunt, H.L. and L.S. Mullineaux. 2002. The role of predation and postlarval transport in recruitment of the soft shell clam (*Mya arenaria*). *Limnology and Oceanography*. 47(1):151-164.

King, T. L., B. A. Lubinski, and A. P. Spidle. 2001. Microsatellite DNA variation in Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and cross-species amplification in the Acipenseridae. Conservation Genetics 2: 103-119, *in* ASSRT 2007.

Kistner, D.A. and N.R. Pettigrew. 2001. A variable turbidity maximum in the Kennebec Estuary, Maine. *Estuaries*. 24(5): 680-687.

Krouse, J. 1981. Movement, Growth, and Mortality of American Lobsters *Homarus americanus*, Tagged Along the Coast of Maine. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, NOAA Technical Report NMFS SSRF-747.

Krouse, J. 1984. What do Lobsters Eat and Who Eats Lobsters? Lobster Research Program, Maine Department of Marine Resources. Lobster Informational Leaflet #13.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus,* and shortnose sturgeon, *A. brevirostrum,* with notes on social behavior. *Environmental Behavior of Fishes.* 63: 137-150. In ASSRT, 2007.

Larsen , P.F., and L.F. Doggett. 1976. The salinity and temperature distributions of selected Maine estuaries. Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, Maine. Bigelow Laboratory Contribution Number 2-76. Revised 1978.

Larson, P. F. and A.C. Johnson. 1982. A final report on the effects of dredging and spoil disposal on the sediment characteristics of the clam flats of the lower Kennebec estuary. Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, Maine. Bigelow Technical Report No. 24.

Leim, A. H. and W.B. Scott. 1966. Fishes of the Atlantic Coast of Canada. *Fisheries Research Board of Canada, Bulletin* No. 117. 485 pp in ASSRT, 2007.

Leland, J. G., III. 1968. A survey of the sturgeon fishery of South Carolina. Contributed by Bears Bluff Labs. No. 47: 27 pp. In FR, 2010.

Levin, D.R., W.J. Lillycrop, and M.P. Alexander. 1992. Sand Waves: Report 1; Sand wave shoaling in navigation channels. Hydraulic Laboratory Technical Report HL-90-17. Vicksburg, MS: U.S. Army Corps of Engineer Waterways Experiment Station. 56 pp.

Mackenzie, C., and J.R. Moring. 1985. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic)--American Lobster. U.S. Fish Wildl. Serv. Biol. Rep. 82 (11.33). U.S. Army Corps of Engineers, TR EL-82-4. 19 pp.

Maine Department of Marine Resources (MEDMR). Some Life History Notes on Lobsters. Lobster Research Project. Lobster Informational Leaflet #9.

Maine Department of Marine Resources (MEDMR). 2011. Conditional Area Management Plan, Growing Area WM, Kennebec River, Area Number 20. (Updated 3/23/2011).

Maine Department of Transportation (ME DOT). 1997. Biological Assessment of Potential Impacts to the Shortnose Sturgeon (*Acipenser brevirostrum*); Replacement of the Carlton Bridge over the Kennebec River between the City of Bath and the Town of Woolwich, Maine. Submitted to: National Marine Fisheries Service. Submitted by: Federal Highway Administration. Prepared under the direction of the Maine Department of Transportation, with the assistance from the Maine Department of Marine Resources and Bath Iron Works.

Mangin, E. 1964. Croissance en Longueur de Trois Esturgeons d'Amerique du Nord: *Acipenser oxyrhynchus,* Mitchill, *Acipenser fulvescens*, Rafinesque, et *Acipenser brevirostris* LeSueur. Verh. Int. Ver. *Limnology*. 15: 968-974. In ASSRT, 2007.

Matthiessen, G.C. 1960 a. Observations on the ecology of the soft clam, *Mya arenaria*, in a salt pond. *Limnology and Oceanography*. 5(3): 291-300.

Matthiessen, G. C. 1960b. Intertidal zonation in populations of *Mya arenaria*. *Limnology and Oceanography*. 5(4): 381-388.

Mayer, L.M., D.W. Townsend, Pettigrew, N.R., T.C. Loder, M.W. Wong, D. Kistner-Morris, A.K. Laursen, A.D. Schoudel, C. Conairis, J. Brown, C. Newell. 1996. The Kennebec, Sheepscot and Damariscotta River Estuaries: Seasonal Oceanographic Data. University of Maine, Department of Oceanography Technical Report No. 9601, June 1996. Orono, Maine, pp. 110.

McCleave, J.D., Fried, S.M.; and Town, A.K. 1977. Daily movements of shortnose sturgeon, *Acipenser brevirostrum*, in a Maine estuary. *Copeia*. No. 1 pp 149-157.

MacKenzie, C., and J.R. Moring. 1985. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic)--American Lobster. U.S. Fish Wildl. Serv. Biol. Rep. 82 (11.33). U.S. Army Corps of Engineers, TR EL-82-4. 19 pp.

Messieh, S.N., D.J. Wildish, and R.H. Peterson. 1981. Possible impact from dredging and spoil disposal on the Miramichi Bay Herring Fishery. *Canadian Technical Report of Fisheries and Aquatic Sciences*. No. 1008. 33 pp.

MEDMR. 1998. Status of Nearshore Maine American Lobster Resource. Prepared by the Biological Monitoring Division.

Miller, D.C., C.L. Muir, and O.A. Hauser. 2002a. Detrimental effects of sedimentation on marine benthos: what can be learned from natural processes and rates? *Ecological Engineering* 19:211-232.

Miller, J., M. Palermo, and T. Groff. 2002b. Field evaluation of hopper dredge overflow for the Delaware River. U.S. Army Engineer Research and Development Center, Environmental Laboratory Technical Report ERDC/EL TR-02-17, 41 pp. plus appendices.

Mitchell, E. M. 1967. Kennebec River Dredging Operations. State of Maine, Department of Sea and Shore Fisheries.

Murawski, S. A. and A. L. Pacheco. 1977. Biological and fisheries data on Atlantic Sturgeon, *Acipenser oxyrhynchus* (Mitchill). National Marine Fisheries Service Technical Series Report 10: 1-69, in ASSRT, 2007).

Nielson J.P., W.B. Higgins, and R.G. Lippert. 1996. Water Resources Data – Maine Water Year 1995. U.S. Geological Survey, Augusta, Maine. USGS-WDR-ME-95-1.

Newcombe, C.P. and J. Jensen. 1996. Channel suspended sediment and fisheries: A synthesis for quantitative assessment of risk and impact. *North American Journal of Fisheries Management*. 16(4):693-727.

Newcombe, C.P. and D.D. MacDonald. 1991. Effects of suspended sediments on aquatic ecosytems. *North American Journal of Fisheries Management*. 11:72-82.

Newell, CR. and H. Hidu. 1986. Species profiles: life histories and environmental requirements of coast fishes and Invertebrates (North Atlantic)—softshell clam. US Fish and Wildlife Service Biological Report. 82 (11.35). US Army Corps of Engineers, TR EL-82-4. 17 pp.

Newell, R.C., L.J. Seiderer, N.M. Simpson, and J.E. Robinson. 2004. Impacts of marine aggregate dredging on benthic macrofauna off the south coast of the United Kingdom. *Journal of Coastal Research*. 20(1): 115-125.

National Oceanic and Atmospheric Administration (NOAA). 1996. Tide Tables 1997, High and Low Water Predictions, East Coast of North and South America including Greenland. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Silver Springs, Maryland.

NMFS. 2003a. Letter from Patricia A. Kurkul, Regional Administrator, National Marine Fisheries Service, Northeast Region, 1 Blackburn Drive, Gloucester MA 01930 to Colonel Thomas L. Koning District Engineer, Department of the Army, New England District, Corps of Engineers 696 Virginia Road, Concord, MA 01742-2751l. September 29.

NMFS. 2003. National Marine Fisheries Service, Endangered Species Act Biological Opinion for the U.S. Army Corps of Engineers – New England District, Maintenance Dredging of Bath Iron Works Sinking Basin, Kennebec River, Maine. F/NER/2003/01220.

NMFS. 2004. National Marine Fisheries Service Endangered Species Act Biological Opinion for the U.S. Army Corps of Engineers-New England District, Emergency Dredging of Federal Navigation Channel, Kennebec River, Maine. F/NER/2003/01461.

NMFS. 2009. National Marine Fisheries Service Endangered Species Act Biological Opinion for the Issuance of a 10 Year Permit to Bath Iron Works for Maintenance Dredging at their Facility Along the Kennebec River at Bath Maine. F/NER/2009/04518.

NOAA. 1997. Tide Tables 1997, High and Low Water Predictions, East Coast of North and South America, Including Greenland. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service.

NOAA. 1998. Final Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*) prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service National Oceanic and Atmospheric Administration as cited in NMFS. 2004. National Marine Fisheries Service Endangered Species Act Biological Opinion for the U.S. Army Corps of Engineers-New England District, Emergency Dredging of Federal Navigation Channel, Kennebec River, Maine. F/NER/2003/01461.

NOAA. 1999. Tide Current Tables 1999, Atlantic Coast of North America. U.S Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Silver Springs, Maryland.

NOAA. 2009. United States Coast Pilot, Atlantic Coast: Eastport to Cape Cod 39th edition. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Silver Springs, Maryland.

NOAA as cited in NMFS. 2004. National Marine Fisheries Service Endangered Species Act Biological Opinion for the U.S. Army Corps of Engineers-New England District, Emergency Dredging of Federal Navigation Channel, Kennebec River, Maine. F/NER/2003/01461.

Normandeau Associates, Yarmouth, ME. 1997. Letter dated December 5, 1997 to Bath Iron Works, Bath, Maine.

Normandeau Associates. 2001. Bath Iron Works dredge monitoring results. Prepared by Normandeau Associates, Inc. Yarmouth, Maine, unpublished report. 11pp. as cited in NMFS. 2005. National Marine Fisheries Service Endangered Species Act Biological Opinion for the Federal Energy Regulatory Commission, New License for the Lockwood Hydroelectric Project (FERC Project No. 2574-032).

NRPD. 1993. Kennebec River Resource Management Plan: Balancing Hydropower Generation and Other Uses. Prepared by: Natural Resources Policy Division, Maine State Planning Office, Augusta, ME.

Robertson, M.J., D.A. Scruton, and K.D. Clarke. 2007. Seasonal Effects of Suspended Sediment on the Behaviour of Juvenile Atlantic Salmon. *Transactions of the American Fisheries Society*, 136:822-828..

SAIC (Science Applications International Corporation). 1984. Evaluation of the Effectiveness of Dredging on the Kennebec River, Maine. Science Applications, Incorporated, Newport, RI. SAI Report #SAI-84/7500 & C42. Contract # DACW33-83-D-001. Submitted to: U.S. Army Corps of Engineers, New England Division, Waltham, MA.

Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. *Fisheries Research Board of Canada Bulletin* 184: 966 pp. In FR, 2010.

Smith, T. I. J., E. K. Dingley, and E.E. Marchette. 1980. Induced spawning and culture of Atlantic sturgeon. *Progressive Fish Culturist* 42: 147-151.

Smith, T. I. J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, in North America. *Environmental Biology of Fishes* 14(1): 61-72, in ASSRT, 2007).

Smith, T. I. J. and J. P. Clungston. 1997. Status and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. *Environmental Biology of Fishes* 48: 335-346 in ASSRT, 2007).

Smith, T. I. J. and J. P. Clugston. 1997. Status and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. *Environmental Biology of Fishes* 48: 335-346. In FR, 2010.

Squires, T. 1983. Evaluation of the 1982 Spawning Run of Shortnose Sturgeon (*Acipenser brevirostrum*) in the Androscoggin River, Maine. Study contracted to the Department of Marine Resources by the Central Maine Power Co. to fulfill the requirements of Article 43 of FERC License #2284.

Squires, T.S. 2003. Completion Report. Kennebec River Shortnose Sturgeon Population Study, 1998-2001. Maine Department of Marine Resources, Augusta ME.

Squiers, T.S. and Smith, H. 1979. Distribution and abundance of shortnose and Atlantic sturgeon in the Kennebec River estuary. Completion Report Project HAFC-19. Department of Marine Resources State House Augusta, Maine 04333. pp 1-51.

Squires, T.S. and M. Smith. 1979. Distribution and Abundance of Shortnose and Atlantic Sturgeon in the Kennebec River Estuary; Period Covered: June 1, 1976 to April 30, 1979. Completion Report Project #AFC-19. Department of Marine Resources, Augusta, Maine.

Squires, T.S. and M. Smith and L. Flagg. 1982. American Shad Enhancement and Status of Sturgeon Stocks in Selected Maine Waters; Period Covered: May 1, 1979 to April 30, 1982. Completion Report Project #AFC-20. Department of Marine Resources, Augusta, Maine.

Stern, E.M. and W.B. Stickle. 1978. Effects of turbidity and suspended materials in aquatic environments; literature reviews. Tech. Rept. D-78-21. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

Stevenson, J. T., and D. H. Secor. 1999. Age determination and growth of Hudson River Atlantic sturgeon, *Acipenser oxyrinchus*. *Fishery Bulletin* 97: 153-166..

Strasser, M. 1999. *Mya arenaria*- an ancient invader o the North Sea coast. *Helgoländer Meeresunters*. 52: 309-324.

Stumpf, R.P., and P.M. Goldschmidt. 1992. Remote sensing of suspended sediment discharge into the western Gulf of Maine during the April 1987 100-year flood. *Journal of Coastal Research*. 8(1): 218-225.

Taubert, S.D. 1980. Reproduction of shortnose sturgeon, *Acipenser brevirostrum*, in Holyoke Pool, Connecticut River, Mass. *Copeia*. pp. 114-117.

Taubert, B.D. and Reed, R.J. 1978. Observations of shortnose sturgeon, *Acipenser brevirostrum*, in the Holyoke Pool, Connecticut River, Mass. During 1978. pp 1-1O.

Thompson, D. & Härkönen, T. 2008. *Phoca vitulina*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. Downloaded on 17 May 2011.

Truitt, C. 1986. "Fate of Dredged Material During Open Water Disposal," Environmental Effects of Dredging Programs Technical Note EEDP-01-2, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

USASAC (United States Atlantic Salmon Assessment Committee). 2005. Annual Report of the U.S. Atlantic Salmon Assessment Committee Report No. 17 – 2004 Activities. Annual Report 2005/17. Woods Hole, MA – February 28-March 3, 2005. 110pp. and appendices.

US Army Corps of Engineers (USACE). 2001. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Prepared by U.S. Army Corps of Engineers, New England District, Concord, MA.

US Environmental Protection Agency (EPA). Website visited on May 2, 2011. Site last updated on April 21, 2011. http://www.epa.gov/airquality/greenbk/oncs.html#MAINE.

US Fish and Wildlife Service. (US FWS). 1986. Personal Communication 25 April 1986. Mr. Ron Josephs-Raptor Ecologist.

Van Eenennaam, J. P., S. I. Doroshov, G. P. Moberg, J. G. Watson, D. S. Moore and J. Linares. 1996. Reproductive conditions of the Atlantic sturgeon (*Acipenser oxyrhynchus*) in the Hudson River. Estuaries 19: 769-777, in FR, 2010.

Vladykov, V. D. and J. R. Greely. 1963. Order Acipenseroidei. In: Fishes of Western North Atlantic. Sears Foundation. Marine Research, Yale Univ. 1 630 pp. in ASSRT, 2007.

Waldman, J. R., J. T. Hart, and I. I. Wirgin. 1996a. Stock composition of the New York Bight Atlantic sturgeon fishery based on analysis of mitochondrial DNA. Transactions of the American Fisheries Society 125: 364-371.in ASSRT, 2007.

Waldman, J. R., C. Grunwald, J. Stabile, and I. Wirgin. 2002. Impacts of life history and biogeography on the genetic stock structure of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus*, Gulf sturgeon *A. oxyrinchus desotoi*, and shortnose sturgeon *A. brevirostrum*. *Journal of Applied Ichthyology* 18: 509-518..

Wilber, D.L. and D.G. Clarke. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. *North American Journal of Fisheries Management*. 21:855-875.

Wippelhauser, G. 2011. Maine Department of Marine Resources, 172 State House Station, Augusta ME 04333. Personal Communication.

Wong, M.W. and Townsend D.W. 1999. Phytoplankton and Hydrography of the Kennebec Estuary, Maine, USA. *Marine Ecology Progress Series*, Vol. 178: 133-144.

13.0 COMPLIANCE WITH ENVIRONMENTAL FEDERAL STATUTES AND EXECUTIVE ORDERS

Federal Statutes

1. *Archaeological Resources Protection Act of 1979, as amended, 16 USC 470 et seq.*

Compliance: Issuance of a permit from the Federal land manager to excavate or remove archaeological resources located on public or Indian lands signifies compliance.

2. *Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.*

Compliance: Project has been coordinated with the State Historic Preservation officer.

3. *American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.*

Compliance: Must ensure access by Native Americans to sacred sites, possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

4. *Clean Air Act, as amended, 42 U.S.C. 7401 et seq.*

Compliance: Public notice of the availability of this report to the Environmental Protection Agency is required for compliance pursuant to Sections 176c and 309 of the Clean Air Act.

5. *Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.*

Compliance: A Section 404(b)(1) Evaluation and Compliance Review have been incorporated into this report. A Water Quality Certification pursuant to Section 401 of the Clean Water Act has been received from the state.

6. *Coastal Zone Management Act of 1782, as amended, 16 U.S.C. 1451 et seq.*

Compliance: A CZM consistency determination has been provided to the State for review and the state has issued concurrence that the proposed project is consistent with the approved State CZM program.

7. *Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.*

Compliance: Coordination with the U.S. Fish and Wildlife Service (USFWS) has been completed and coordination with National Marine Fisheries Service (NMFS) is ongoing pursuant to Section 7 of the Endangered Species Act.

8. *Estuarine Areas Act, 16 U.S.C. 1221 et seq.*

Compliance: Applicable only if report is being submitted to Congress.

9. *Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.*

Compliance: Public notice of availability to the Environmental Assessment to the National Park Service (NPS) and Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

10. *Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.*

Compliance: Coordination with the USFWS, NMFS, and State fish and wildlife agencies signifies compliance with the Fish and Wildlife Coordination Act.

11. *Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.*

Compliance: Public notice of the availability of this Environmental Assessment to the National Park Service (NPS) and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

12. *Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.*

Compliance: Not applicable; project does not involve the transportation nor disposal of dredged material in ocean waters pursuant to Sections 102 and 103 of the Act, respectively.

13. *National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.*

Compliance: Coordination with the State Historic Preservation Office signifies compliance.

14. *Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3000-3013, 18 U.S.C. 1170*

Compliance: Regulations implementing NAGPRA will be followed if discovery of human remains and/or funerary items occur during implementation of this project.

15. *National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.*

Compliance: Preparation of an Environmental Assessment signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact or Record of Decision is issued.

16. *Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.*

Compliance: No requirements for Corps' projects or programs authorized by Congress. The proposed maintenance dredging has been Congressionally approved.

17. *Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.*

Compliance: Floodplain impacts must be considered in project planning.

18. *Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.*

Compliance: The project is not located in a designated Wild and Scenic River area.

19. *Magnuson-Stevens Act, as amended, 16 U.S.C. 1801 et seq.*

Compliance: Coordination with the National Marine Fisheries Service and preparation of an Essential Fish Habitat (EFH) Assessment signifies compliance with the EFH provisions of the Magnuson-Stevens Act.

Executive Orders

1. *Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971.*

Compliance: Coordination with the State Historic Preservation Officer signifies compliance.

2. *Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979.*

Compliance: Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2).

3. *Executive Order 11990, Protection of Wetlands, 24 May 1977.*

Compliance: Public notice of the availability if this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

4. *Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.*

Compliance: Not applicable to projects located within the United States.

5. *Executive Order 12898, Environmental Justice, 11 February 1994.*

Compliance: Not applicable, the project is not expected to have a significant impact on minority or low income population, or any other population in the United States.

6. *Executive 13007, Accommodation of Sacred Sites, 24 May 1996*

Compliance: Not applicable unless on Federal lands, then agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites.

7. *Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. 21 April 1997.*

Compliance: Not applicable, the project would not create a disproportionate environmental health or safety risk for children.

8. *Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.*

Compliance: Consultation with Indian Tribal Governments, where applicable, and consistent with executive memoranda, DoD Indian policy, and USACE Tribal Policy Principles signifies compliance.

Executive Memorandum

1. *Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.*

Compliance: Not applicable if the project does not involve or impact agricultural lands.

2. *White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.*

Compliance: Consultation with Federally Recognized Indian Tribes, where appropriate, signifies compliance.

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Maintenance Dredging of the Kennebec River Federal Navigation Project

The project will involve the maintenance dredging of the Kennebec River Federal channel in Sagadahoc County, Maine, in order to provide safe passage for the newly constructed Navy destroyer, the U.S.S. SPRUANCE. The SPRUANCE is scheduled to depart from Bath Iron Works on September 1, 2011. Shoaling has reached critical levels in the Doubling Point and Popham Beach areas of the of the river hindering the safe passage of this ship as well as other deep draft vessels transiting the channel from Bath Iron Works. Approximately 70,000 cubic yards (cy) of material will be removed from the channel in order restore it to its authorized depth of 27 feet MLLW (plus 2 feet overdepth) at Popham Beach and includes advance maintenance to 30 feet (plus 2 feet overdepth) at Doubling Point; 50,000 cy from Doubling Point and 20,000 cy from Popham Beach. Work will be performed by a hopper dredge. Material dredged from the Doubling Point area will be disposed of at the previously used disposal site north of Bluff Head (approximately 1.7 nautical miles downriver of Doubling Point) in about 30 to 100 feet of water with an average depth of 76.5 feet. Material dredged from the Popham Beach area will be disposed at a 500 yard circular disposal site located about 0.4 nautical miles south of Jackknife Ledge in depths of about 40 to 50 feet below MLLW (See Figures 2 and 3 in Environmental Assessment). Dredging is planned to begin on approximately August 1, 2011 and will continue for approximately four weeks. Due to the critical need to move the ship on the scheduled date, it will be necessary to dredge the channel outside November 1 – April 30 dredging window that was recommended by the National Marine Fisheries Service to minimize impacts to the endangered shortnose sturgeon. Consultation with the National Marine Fisheries Service is currently being conducted and it is expected that an incidental take statement will be issued for the endangered shortnose sturgeon. A NOAA trained endangered species observer will be on board the dredge during dredging of both sections of the river to monitor for takes of shortnose sturgeon. In addition, draghead deflectors will be used on the dredge which are expected to minimize the potential for entrainment of shortnose sturgeon (as well as Atlantic sturgeon).

This environmental assessment has been prepared in accordance with the National Environmental Policy Act of 1969 and all applicable environmental statutes and executive orders. My determination is based upon the information contained in the Environmental Assessment and the following considerations:

a). The project is not expected to significantly adversely affect any state or Federal rare, threatened or endangered species pursuant to the Endangered Species Act. Coordination with the National Marine Fisheries Service has been conducted concerning the Federally endangered shortnose sturgeon and the Federally endangered Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon, and the proposed Federally threatened GOM DPS of Atlantic sturgeon. The National Marine Fisheries Service is expected to issue a biological opinion concerning the anticipated effects of the proposed dredging on the shortnose sturgeon and Atlantic salmon. Based upon past dredging activities in the Kennebec River it is expected that this August 2011 dredging may adversely affect the endangered the shortnose sturgeon population but not jeopardize it, and no effect is expected on the Federally endangered Atlantic salmon. Although a Biological opinion on the proposed to be listed (as threatened) Atlantic sturgeon was not issued (due the fact that it is proposed, not listed), the Reasonable and Prudent Measures to minimize the impacts of incidental takes on the Kennebec River population of shortnose sturgeon will be employed for Atlantic sturgeon as well. Therefore, potential negative effects to this species will be minimized. In addition, coordination with the U.S. Fish and Wildlife Service has concurred that the proposed dredging is not expected to adversely affect the Federally threatened piping plover and Federally endangered roseate tern. Also there will be minimal impacts to Essential Fish Habitat.

b). Dredging and disposal operations will cause minimal turbidity and sedimentation increases in the immediate vicinity of the project area. These effects will be of short duration, with turbidity impacts ceasing upon project completion. Based on grain size analyses, material at the project site consists of clean sand and is not expected to have a significant long term adverse effect upon existing water quality in the dredging or disposal areas.

c). The project is not expected to have any significant adverse effect upon shellfish resources downstream of the dredging and disposal areas due to the nature of the material (clean sand). The Maine DMR is planning to conduct water quality monitoring downstream from the dredging activities to ensure that clambeds are not contaminated with coliform bacteria at levels that would jeopardize consumers' health.

d.) Coordination with local lobster fisherman will be conducted, and the dredge and disposal transportation routes areas will be published in order to avoid affecting lobster fishing gear.

e.) A temporary impact on the benthic communities is expected due to the removal of benthic organisms from the Federal channel by dredging operations and by burial with sediments at the disposal sites. These organisms will be rapidly replaced by recolonization from adjacent areas and larval recruitment.

f.) Recent coordination with the State Historic Preservation Office has indicated that the proposed dredging or disposal is not expected to have any impact on cultural resources.

g.) The proposed project is not expected to have any significant long term negative effect on the local economic resources including tourism and commercial/fisheries. As noted the travel routes of the dredge will be published for avoidance by vessel traffic including fishing boats, recreational fishing charters and recreational boaters. The clean sand is not expected to have any adverse affects on water quality and therefore is not expected to have any long term negative effects on recreationally/commercially important fish species.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the Maintenance Dredging of the Kennebec River Federal Navigation Project is not a major Federal action significantly affecting the quality of the human environment. Under the Council on Environmental Quality ("CEQ") NEPA regulations, "NEPA significance" is a concept dependent upon context and intensity (40 C.F.R. § 1508.27). When considering a site-specific action like the proposed dredging project, significance is measured by the impacts felt at a local scale, as opposed to a regional or nationwide context. Thus, the intensity of the impacts is measured here in the local context of the Phippsburg and Bath Maine areas. The CEQ regulations identify a number of factors to measure the intensity of impact. These factors are discussed below, and none are implicated here to warrant a finding of NEPA significance. A review of these NEPA "intensity" factors reveals that the proposed action would not result in a significant impact—neither beneficial nor detrimental--to the human environment. Hence, an environmental impact statement is not required.

Impacts on public health or safety: The dredging will not create a long term negative effect on public health and safety, and the removal of shoals will improve the safety of navigation through the lower Kennebec. Although there will be movement of the dredge between the dredging and disposal areas, the transportation routes will be clearly marked and published in the local newspaper in order to avoid impacts to fishing gear and collisions with other vessels operating in the vicinity of the project. The activity will be temporary lasting approximately three to five weeks.

Unique characteristics: The dredging of clean sand will not have any significant adverse affects to the biological and physical resources unique to the Kennebec River estuary in the vicinity of the project. As noted, coordination is in process with the appropriate agencies for listed threatened and endangered species inhabiting the affected area and it is expected that effects would be either minimal, (not causing jeopardy) or nonexistent.

Controversy: The concept of "controversy" in NEPA significance analysis is not simply whether there is opposition to the proposal, but whether there is a substantial technical or scientific dispute over the degree of the effects on the human environment. In cases where the controversy factor is implicated, it is typically where serious scientific disagreements over the impacts of a proposal are presented. Opposition does not equate to NEPA controversy, "[o]therwise, opposition, and not the reasoned analysis set forth in an environmental assessment, would determine whether an environmental impact statement would have to be prepared. The outcome would be governed by a `heckler's veto.'" North Carolina v. Federal Aviation Administration, 957 F.2d 1125, 1133-1134 (4th Cir. 1992) (citations omitted). Here, while there is opposition to the proposal, the various state and Federal resource agencies reviewing the project are in concurrence as to the expected environmental impacts. Opponents to the project have not presented scientific evidence that contradicts or undermines the findings of the various agencies with expertise and jurisdiction over the resource issues impacted by the project. In such a situation, there is no "controversy" as this term is understood in the NEPA context.

Uncertain impacts: The impacts of the proposed project are not uncertain, they are understood based on past experiences the Corps has had with dredging these same areas in the past, as well as other projects similar in scope and with the same material. These impacts are discussed in the Environmental Assessment.

Precedent for future actions: The decision here is based upon the facts of the proposed project, and will not create a precedent for future Corps permit decisions, which, like this decision, will be based upon their own merits and their own facts.

Cumulative significance: As discussed in the Environmental Assessment, to the extent that other actions are expected to be related to the proposed dredging project, these actions will provide little measurable cumulative impact, certainly not to the level of NEPA significance.

Historic resources: Coordination has occurred and indicated that the proposed project will not affect any historic resource in the area.

Endangered species: Consultation with National Marine Fisheries Service and U.S. Fish and Wildlife Service has indicated either no jeopardy or no effects (see unique Characteristics subheading above).

Potential violation of state or federal law: This action would not violate federal law, and as evidenced by the issuance of state permits and water quality certification, does not violate state law.

Therefore, this project is not expected to result in significant impacts to the environment, and it is not necessary to prepare an Environmental Impact Statement.

16 June 2011
Date

Philip T. Feir
Colonel, Corps of Engineers
District Engineer

NEW ENGLAND DISTRICT
U.S. ARMY CORPS OF ENGINEERS, WALTHAM, MA
CLEAN WATER ACT SECTION 404 (b) (1) EVALUATION

PROJECT: Kennebec River Maintenance Dredging

PROJECT MANAGER: William Kavanaugh PHONE NO.: (978) 318-8328

FORM COMPLETED BY: Kenneth Levitt PHONE NO: (978) 318-8114
Valerie Cappola PHONE NO.: (978) 318-8067

PROJECT DESCRIPTION:

The project will involve the maintenance dredging of the Kennebec River Federal channel in Sagadahoc County, Maine, in order to provide safe passage for the newly constructed Navy destroyer, the U.S.S. SPRUANCE. The SPRUANCE is scheduled to depart from Bath Iron Works on September 1, 2011. Shoaling has reached critical levels in the Doubling Point and Popham Beach areas of the of the river hindering the safe passage of this ship as well as other deep draft vessels transiting the channel from Bath Iron Works. Work will be performed by a hopper dredge. Approximately 70,000 cubic yards (cy) of material will be removed from the channel in order restore it to its authorized depth of 27 feet MLLW (plus 2 feet overdepth) at Popham Beach and includes advance maintenance to 30 feet (plus 2 feet overdepth) at Doubling Point; 50,000 cy from Doubling Point and 20,000 cy from Popham Beach. Material dredged from the Doubling Point area will be disposed of at the previously used disposal site north of Bluff Head (approximately 1.7 nautical miles downriver of Doubling Point) in about 30 to 100 feet of water with an average depth of 76.5 feet. Material dredged from the Popham Beach area will be disposed at a 500 yard circular disposal site located about 0.4 nautical miles south of Jackknife Ledge in depths of about 40 to 50 feet below MLW (See Figures 2 and 3 in Environmental Assessment). Dredging is planned to begin on approximately August 1, 2011 and will continue for approximately four weeks. Due to the critical need to move the ship on the scheduled date, it will be necessary to dredge the channel outside November 1 – April 30 dredging window that was recommended by the National Marine Fisheries Service to minimize impacts to the endangered shortnose sturgeon. Consultation with the National Marine Fisheries Service is currently being conducted and it is expected that a take statement will be issued for the endangered shortnose sturgeon. A NOAA trained endangered species observer will be on board the dredge during dredging of both sections of the river to monitor for takes of shortnose sturgeon. In addition, draghead deflectors will be used on the dredge which are expected to minimize the potential for entrainment of shortnose sturgeon (as well as Atlantic sturgeon).

NEW ENGLAND DISTRICT
U.S. ARMY CORPS OF ENGINEERS, CONCORD, MA
EVALUATION OF CLEAN WATER ACT SECTION 404 (B) (1) GUIDELINES

PROJECT: Maintenance Dredging of the Kennebec River Federal Navigation Channel

1. Review of Compliance (Section 230.10(a)-(d)).

	YES	**NO**
a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose.	X	
b. The activity does not appear to: 1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of Federally listed threatened and endangered species or their habitat; and 3) violate requirements of any Federally designated marine sanctuary.	X	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values.	X	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.	X	

2. Technical Evaluation Factors (Subparts C-F).

		N/A	**Not Significant**	**Significant**
a.	Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
	1) Substrate		X	
	2) Suspended particulates/turbidity		X	
	3) Water column impacts		X	
	4) Current patterns and water circulation		X	
	5) Normal water fluctuations		X	
	6) Salinity gradients		X	
b.	Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)			

		N/A	Not Significant	Significant
	1) Threatened and endangered species		X	
	2) Fish, crustaceans, mollusks, and other organisms in the aquatic food web		X	
	3) Other wildlife (mammals, birds, reptiles, and amphibians)		X	
c.	Potential Impacts on Special Aquatic Sites (Subpart E).			
	1) Sanctuaries and refuges	X		
	2) Wetlands	X		
	3) Mud flats		X	
	4) Vegetated shallows		X	
	5) Coral reefs	X		
	6) Riffle and pool complexes	X		
d.	Potential Effects on Human Use Characteristics (Subpart F).			
	1) Municipal and private water supplies	X		
	2) Recreational and commercial fisheries		X	
	3) Water related recreation		X	
	4) Aesthetics impacts		X	
	5) Parks, national and historic monuments, national seashores, wilderness areas, research sites and similar preserves		X	

3. Evaluation and Testing (Subpart G).

a.	The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)	
	1) Physical characteristics	X
	2) Hydrography in relation to known or anticipated sources of contaminants	X
	3) Results from previous testing of the material or similar material in the vicinity of the project	X
	4) Known, significant sources of persistent pesticides from land runoff or percolation	
	5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA)	X
	6) Public records of significant introduction of contaminants from industries, municipalities, or other sources.	X

	7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	
	8) Other sources (specify)	
	List appropriate references. See Environmental Assessment for Maintenance Dredging of the Kennebec Federal Navigation Project, Sagadahoc County, Maine. Suitability Determination for Kennebec River Federal Navigation Project.	

	YES	NO
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged material is not a carrier of contaminants or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria.	X	

4. Disposal Site Delineation (Section 230.11(f)).

a.	The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)	
	1) Depth of water at disposal site	X
	2) Current velocity, direction, variability at disposal site	X
	3) Degree of turbulence	
	4) Water column stratification	X
	5) Discharge vessel speed and direction	
	6) Rate of discharge	X
	7) Dredged material characteristics (constituents, amount, and type of material, settling velocities)	X
	8) Number of discharges per unit of time	X
	9) Other factors affecting rates and patterns of mixing (specify)	
	List appropriate references. See Environmental Assessment for Maintenance Dredging of Kennebec River Federal Navigation Project, Sagadahoc County, ME.	

	YES	NO
b. An evaluation of the appropriate information factors in 4a above indicated that the disposal sites and/or size of mixing zone are acceptable.	X	

5. Actions to Minimize Adverse Effects (Subpart H).

	YES	NO
All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken

Conservation recommendations issued by the National Marine Fisheries Service for the for the protection of the endangered shortnose sturgeon and Atlantic salmon will be followed, including the use of endangered species observers on the hopper dredge. Haul routes to dredging and disposal area will be identified and published for recreational and commercial users.

6. Factual Determination (Section 230.11).

A review of appropriate information, as identified in Items 2 – 5 above, indicates there is minimal potential for short or long term environmental effects of the proposed discharge as related to:		
	YES	**NO**
a. Physical substrate at the disposal site (review Sections 2a, 3, 4, and 5 above)	X	
b. Water circulation fluctuation and salinity (review Sections 2a, 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a, 3, 4 and 5)	X	
d. Contaminant availability (review Sections 2a, 3, and 4)	X	
e. Aquatic ecosystem structure, function and organisms (review Sections 2b and 2c, 3, and 5)	X	
f. Proposed disposal site (review Sections 2, 4, and 5)	X	
g. Cumulative effects on the aquatic ecosystem	X	
h. Secondary effects on the aquatic ecosystem	X	

7. Findings of Compliance or Non-compliance

	YES	NO
The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines.	X	

16 June 2011

Date

Philip T. Feir
Colonel, Corps of Engineers
District Engineer