# 4.0 ENVIRONMENTAL CONSEQUENCES

## 4.1 Introduction

This section of the DeLong Mountain Terminal EIS discusses how navigation improvements (and the No-Action alternative) might affect environmental resources of concern. This chapter brings together the following:

- Concerns identified during scoping and interagency coordination described in Section 1;

- The no-action, construction, and maintenance alternative features described in Section 2;

- The resources of concern described in Section 3.

This section follows the same general format and headings as Section 3 to help readers compare information about impacts in Section 4 with information about the resources in Section 3. Impact analysis in Section 4 is focused on the resources that were of particular concern and on the alternatives that are more likely to be implemented.

### 4.1.1 Types of Effect

All potential impacts to each resource are addressed under each resource heading to the extent feasible. For example, under the resource heading "Pacific Walrus," the text presents information about effects of existing DMT facilities at Portsite on Pacific walrus and the effects of each of the four alternatives considered in detail. Effects considered under each alternative include both direct effects of constructing and operating that alternative and indirect effects of past and reasonably foreseeable actions added to those direct effects.

***Effects*** are defined in Council on Environmental Quality (CEQ) regulations (40 CFR 1508.8). Those regulations state that effects "…..includes ecological…...., aesthetic, historic, cultural, social, or health, whether direct, indirect, or cumulative."

***Direct effects*** are defined by the CEQ regulations as effects … "which are caused by the action and occur at the same time and place."

***Indirect effects*** are defined by the same CEQ regulations as effects … "which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems."

***Cumulative effects*** are defined by defined by another part of CEQ regulations (40 CFR 1508.7) as "……the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."

Each type of effect is addressed in discussions that follow under the separate resource headings. Different approaches were used to identify each type of effect. Those approaches were as follows:

***Direct effects*** were evaluated by identifying how predicted activities or changes to resources might affect each resource during construction or operation, and then estimating the intensity of that effect (intensity of effect is discussed later in this introduction to Section 4).

***Indirect effects*** evaluation requires identification of possible future actions that could affect or be affected by alternatives being evaluated. The Corps independently described potential future actions that might affect or be affected by DMT alternatives and modified those descriptions with the help of USEPA. Those potential future actions include various types of development and other activities and are presented in a series of "scenarios" later in the Environmental Consequences section (Section 4.12.5). Those potential future actions, as presented in the 12 scenarios, were evaluated by the Corps to determine whether DMT navigation improvements would "induce" or "open the door" for those potential future actions. The potential for indirect effects from induced development, if any were identified, would be addressed along with direct effects under the resource headings in this Environmental Consequences section.

***Cumulative effects*** evaluation requires that possible future actions be screened by applying CEQ and USEPA guidance (Council on Environmental Quality 1997; USEPA 1998) to determine which of those actions are "reasonably foreseeable future actions." The USEPA, as a cooperating agency in the DMT EIS, undertook this difficult task and contracted with the consulting firm of Gannett Fleming, Inc. to identify both reasonably foreseeable future actions and cumulative impacts related to navigation improvements at DMT. Gannett Fleming Inc. is preparing a report that will be incorporated into the final EIS. Cumulative effects identified by Gannett Fleming Inc. and in the Corps' evaluation of cumulative impact potential are presented under each resource heading along with potential direct and indirect effects.

Conflicting information and opinions about potential impacts are identified under each resource heading.

### 4.1.2 Significance of Effect

The National Environmental Policy Act (NEPA) and CEQ regulations for implementing NEPA require an EIS for actions "significantly affecting the human environment." In CEQ regulations, "significantly" "…..requires considerations of both context and intensity."

***Context*** CEQ regulations state: "the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short-term and long-term effects are relevant."

***Intensity*** CEQ regulations state that intensity refers to the severity of impact. The regulations state that in evaluations to determine significance of impact, intensity should include consideration of the degree an action would affect public health or safety and unique characteristics of the geographic area, and other factors.

The CEQ regulations related to intensity are intended to determine whether an action would significantly affect the human environment, so they are based primarily on determining whether the threshold of "significant affect" is reached. They do not establish criteria for rating impacts individually or in degrees of intensity less than "significant."

The descriptions of environmental consequences to resources that follow in this section identify impacts to specific resources that could be significant in the context of CEQ regulations. All other impacts are considered to be less than significant. Lesser levels of intensity are estimated in terms of the following values.

<u>Context of Effect</u>

| | |
|---|---|
| Local | Area around potential project features where resources would be directly and immediately affected by an alternative. For practical purposes, this is generally about 15 miles seaward of Portsite and within 1 mile inland. |
| Regional | For physical and cultural resources: Northwest Arctic Borough and southeastern Chukchi Sea. For biological resources: the range of potentially affected populations. |

Duration of Effect

| | |
|---|---|
| Short-term | Effects during construction and maintenance and no more than 2 years following those events |
| Long-term | Effects lasting longer than 2 years after construction or periodic maintenance events. |

Intensity of Effect

| | |
|---|---|
| Significant | This is based in National Environmental Policy Act (NEPA) implementing regulations, guidance, and court interpretation. In general, it means: The alternative could, as compared with existing conditions, broadly and substantially alter the value of affected social or cultural resources, species role and function in the ecosystem, species regional abundance or range; or that the alternative could substantially affect a broad area of habitat essential to one or more species; or could substantially and broadly affect other resources of particular ecological or social importance. Cumulative effects could, acting together with past and reasonably foreseeable future effects, cause significant impacts, or could significantly increase already substantial and broad effects. |
| Less than significant | Effect of the alternative cannot be accurately predicted with available data, but can be demonstrated to be less than significant in relationship to established NEPA regulations, guidance, and case law. |
| Minor effect | Direct effects of the alternative would cause negligible changes from existing conditions or would result in no more than local alteration of cultural and social resources, habitat, species behavior, or species availability to prey species, but would not affect observable regional abundance, geographic range, social importance, or ecosystem function. Cumulative effects would not add to other past or reasonably foreseeable future effects sufficiently to cause significant effects. |
| No effect | The alternative would not alter the existing condition of a resource, its behavior, or its biological, cultural, or economic importance to the ecosystem or the importance of its social value. |

### 4.1.3 Data and Risk Uncertainty

Four questions that should be considered in evaluations of potential environmental consequences are:

(1) What information is needed about the project and about the affected resources to predict the effects of each alternative?
(2) Is the needed information available?
(3) If information is incomplete or uncertain, then how does that potential "data gap" affect the evaluation of effects and the reliability assumptions about the impacts that would result?
(4) If information is incomplete and there is uncertainty about environmental effects, then what are potential high-risk low-probability effects and how should those potential effects be considered in the decision-making process?

The first two questions are addressed in major subsections of Section 4 under the headings "Data Quality" and "Data Uncertainty." The third and fourth questions are addressed, where necessary, in the text of the evaluations.

## 4.2 Land Use

Data Quality: *Available data are sufficient to determine consequences of each alternative to land ownership and use, communities, regional planning, and visual resources with reasonable certainty.*

Data Uncertainty: *An area of data uncertainty related to how fuel distribution might be changed and effects on Kotzebue is noted in Section 4.2.3.*

### 4.2.1 Land Ownership and Use

The following alternatives would not directly affect land ownership or human use, except that the breakwater alternative could offer emergency shelter to small boats navigating the coast.

- **No-Action Alternative**
- **Third Barge Alternative**
- **Breakwater/Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

Potential for the breakwater or the dredged channel to affect the shoreline owned by others is examined along with the effects of other physical processes in Section 4.5. No property or real estate interest would be acquired for any alternative except that the non-Federal sponsor might acquire state tidelands leases for submerged land offshore from Portsite for some parts of the project.

Direct effects of any alternative considered in detail on land ownership or use would be localized and minor. Existing mine and associated transportation development has caused locally significant effects and regionally less than significant effects to land ownership. Cumulative effects to existing or reasonably foreseeable future land ownership from any alternative considered in detail would be negligible.

### 4.2.2 Communities

- **No-Action Alternative**
- **Third Barge Alternative**

The No-Action and Third Barge alternatives, if implemented alone, would have little effect on the communities in Northwest Alaska. Fuel prices and delivery would be unaffected by the project, and communities would see little direct monetary or environmental benefit or cost related to land use. Under the No-Action alternative, no construction would take place and the existing DMTS at Portsite would remain as currently configured. The regional Native Corporation (NANA), which owns the land at Red Dog Mine and which leases Portsite land to the Alaska Industrial Development and Economic Authority (AIDEA), would continue to benefit at levels contingent on production levels at the mine and shipping from Portsite. Direct and cumulative effects would be negligible.

- **Breakwater/Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

The Trestle-Channel alternative and the Breakwater/Fuel Transfer alternatives could allow substantial reduction in costs of fuel transferred for delivery to bulk transfer facilities as far north and east as Kaktovik and as far south as communities in Norton Sound and along the Yukon River. Lower fuel prices would be unlikely to induce significant community growth, but could result in locally valuable savings to schools, electric producers, and others. Effects, both direct and cumulative, on communities could be beneficial but would be less than significant in terms of community viability or long-term development.

### 4.2.3 Transportation and Transportation Facilities

None of the alternatives considered in detail would require support from additional roads, airport, or any other major transportation facilities at Portsite, at the existing Red Dog Mine, or in the surrounding region.

- **No-Action Alternative**
- **Third Barge Alternative**

The No-Action or Third Barge alternatives, if implemented alone, would have little effect on transportation outside the immediate Portsite area. Fuel and commodity delivery would be unaffected by the project, and communities would see little direct monetary or environmental benefit or cost related to transportation or utilities from the action. Direct and cumulative effects would be negligible.

- **Breakwater/Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

The Trestle-Channel alternative and the Breakwater/Fuel Transfer alternatives could allow fuel to be delivered directly by tankers, stored in the existing tanks at Portsite, and transferred by barges to communities throughout the region.

Scenario 8 in Section 4.12.5 discusses effects of these alternatives on fuel transfer. Fuel sales from Puget Sound and the Kenai Peninsula of Alaska would be lost to those distributors, although current world fuel demand indicates that other markets would absorb any excess fuel from either location. Fuel delivery in western and northern Alaska could become more localized, but this cannot be predicted with any certainty. Adverse effects to transportation and fuel sales on the west coast of the continental United States would be minor to negligible because shipments to Alaska do not represent a major part of those sales and because other markets for fuel are readily available.

Effects to transportation in Northwest Alaska would be localized. Deliveries from Portsite to regional hubs would be by ocean barges, as are currently used in this region. Deliveries from regional hubs to other communities would be by lighter from ocean barges or by lighter from regional hubs, as is currently practiced. Fuel could be lightered directly from Portsite to communities that are now served by lighter barges from Kotzebue, but instead, the lighters probably would be operated from Kotzebue and use existing infrastructure. This is discussed in more detail in scenario 8 (Section 4.12.5). Effects to fuel transportation in the Kotzebue area would be localized and less than significant. Effects to fuel transportation in western and northern Alaska would minor and beneficial in terms of cost and efficiency. Cumulatively, fuel transportation improvements resulting from either the Breakwater-Fuel Transfer or Trestle-Channel alternative would add a valuable increment of capability and cost reduction to existing and future fuel transportation and efficiency.

None of the construction activities at Portsite would adversely affect local transportation infrastructure or facilities, except that traffic might have to divert a half-mile farther offshore to avoid construction activity. This would be a minor local impact. In a region with almost no in-water coastal development, this would be a negligible regional impact.

After construction, traffic along the shore would be able to navigate easily beneath the 40-foot-high trestle of the Trestle-Channel alternative, but might be advised not to do so by a safety zone or other safety restrictions. The Breakwater/Fuel Transfer alternative would not impact transportation by small boats.

One of the chief concerns voiced during scoping for this draft EIS was that improved navigation facilities at Portsite would lead to expansion of mining development and transportation systems throughout northwestern Alaska. Potential for this type of induced impact is addressed in Section 4.12.

Direct and cumulative effects to transportation and transportation infrastructure other than those associated with ore concentrate and fuel transfer would be negligible. Direct and cumulative effects to ore concentrate and fuel transportation to Portsite and northern and western coastal communities would be significantly and beneficially affected by the Trestle-Channel or Breakwater/Fuel Transfer alternatives.

### 4.2.4 Regional Planning Consistency

- **No Action Alternative**

The No-Action alternative would not affect regional planning.

- **Third Barge Alternative**

Moored barges require a substantial amount of scope in the mooring lines to swing with current and wind, and existing mooring buoys are positioned with sufficient room to safely swing the barge in a 360 degree circle. A third barge would require an additional mooring buoy. Moorage of an additional barge for the third barge alternative could require modification of the existing moorage permit (COE JJ-83059) under Section 10 of the Rivers and Harbors Act of 1899. This would be consistent with regional planning and coastal zone management standards.

- **No-Action Alternative**
- **Breakwater/Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

The alternatives considered in detail would be consistent with coastal zone management standards to the maximum extent practicable. Enforceable standards of the Northwest Arctic Borough Coastal Management Program are identified in Section 3.2.6.1. The anticipated effects of each alternative on resources protected by the enforceable standards are addressed in the individual resource evaluations presented in this section. All proposed actions appear to be consistent with enforceable standards. However, overall consistency with the standards will be determined through a coordinated review by appropriate agencies.

### 4.2.5 Visual Resources

The existing Portsite development consists of the barge loader and trestle, administration buildings, maintenance shops, a shipping container storage lot, fuel tanks, one 3.3-acre and one 4-acre concentrate storage building. Within the existing Portsite infrastructure, the barge loader, fuel tanks, and ore storage sheds are the most visible features on the landscape. Existing visual impacts at Portsite are substantial, in relation to the undeveloped character of the surrounding lands, in the Portsite and Red Dog Mine areas, and adjacent to the DMTS corridor through Cape Krusenstern National Monument.

- **No-Action Alternative**
- **Third Barge Alternative**

These alternatives would not impact the existing visual landscape other than the additional temporary presence of a barge and one or two supporting tug boats during the shipping season. Reasonably foreseeable development at Noatak and Kivalina would cause local or regional impacts that would depend on locations or routing selected. The No-Action and Third Barge alternatives would add no more than a negligible increment to direct and cumulative impacts caused by those alternatives.

- **Breakwater/Fuel Transfer Alternative**

This alternative would appear as a permanent low rubblemound breakwater offshore from Portsite. It would be visible during most winters as a snow-covered mound similar to the many pileups of ice in the vicinity. The breakwater would be visible as a low island during the open water season. It would not screen the existing Portsite from the view of approaching boats unless they were very close to the breakwater.

Three designs for an offshore fuel terminal were considered. The alternative considered in detail is a multi-buoy mooring (MBM) system to moor the tankers and a pipeline end manifold (PLEM) on the sea floor. A flexible pipeline from the PLEM would be raised from the sea floor to unload the tankers and lowered to the sea floor when not in use. The MBM-PLEM terminal design would have the least visual impact because it would be under water except when in use. The tanker off loading fuel would look very much like a ship moored offshore, about like the bulk ore concentrate carriers that moor offshore now to await loading.

Development at Portsite and the DMTS road is visible from parts of Cape Krusenstern National Monument, and particularly from higher elevations. This alternative would not substantially alter the distance that development could be seen, but the new fuel handling facilities and storage tank would add to the visual density of buildings and other on-land structures. Effects to visual resources, both direct and cumulative, would be minor and localized in the context of existing development and reasonably foreseeable future development.

- **Trestle-Channel Alternative**

The existing trestle and barge loader is visible from the sea and from the coastline for up to about 10 miles in clear weather conditions. The trestle-channel alternative would increase this visibility with a larger structure extending seaward approximately twice the distance of the existing structure. The new fuel handling facilities and storage tank would add to the visual density of buildings and other on-land structures. Effects to visual resources, both direct and cumulative, would be minor and localized in the context of existing development and reasonably foreseeable future development.

## 4.3 Subsistence

### 4.3.1 Introduction

Subsistence is defined in Section 3.3 as the non-commercial hunting, fishing, and gathering of wild renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools and handicrafts, and for trade barter, or sharing. Most subsistence hunting, fishing, and gathering in the Portsite area and in the marine waters north and south of Portsite is by people from Kivalina, Noatak, Point Hope, and Kotzebue. People from other communities in northwestern and northern Alaska also may visit the area for subsistence harvests or may rely on animals that migrate through the Portsite area each year. This section discusses potential for each of the four alternatives considered in detail to affect the availability and quality of resources harvested for subsistence. Information about possible effects that constructing and operating new navigation facilities at Portsite might have on plants and animals harvested for subsistence is presented in the other sections of Section 4.

Principal concerns identified during scoping and public involvement in the planning process can be grouped in the following general categories:

1. Concern that subsistence plants and animals might be killed or injured by construction or operation of new project features at Portsite, and that this loss might affect availability of plants and animals for subsistence harvest. This concern is addressed elsewhere in this section in discussions of potential effects of project alternatives on plants and animals in the Portsite area.

2. Concern that habitat for plants and animals might be altered so that it would be of less value and that animals might not come back to the Portsite area where they could be harvested. This concern is addressed here in Section 4.3.

4. Concern that noise and activity from construction and operation and the presence of new structures and other features might frighten animals away or otherwise make them stay away so they could not be harvested or would be more difficult to harvest. This concern is addressed here in Section 4.3.

5. Concern that project features might make travel to subsistence resources more difficult by directly blocking travel or by causing changes in the environment that would make travel more difficult (for example: concern that structures in the water might cause ice leads that would be difficult to cross.) This access concern is addressed here in Section 4.3, but the possible effects of project alternatives on physical features are addressed in other sections (those sections discuss effects on ice, currents, and so on).

*<u>Data Quality</u>. Scoping identified several ways subsistence data might be used in evaluating project alternatives. As part of the planning process, we evaluated whether the existing data could be used to resolve scoping concerns and whether additional data would produce a more meaningful analysis of potential impacts. The potential uses and objectives were as follows:*

1. *Identify resources important in subsistence harvests of Northwestern Alaska so those resources would be given appropriate weight in impact evaluation and decisionmaking.*
2. *Identify locations where important resources used in subsistence would be directly or indirectly affected by any of the alternatives considered in detail.*
3. *Determine whether important resources used in subsistence are harvested in locations where alternatives considered in detail might affect access.*
4. *Identify changes in harvests of and utilization of important subsistence resources as a way of determining effects of the existing DMT facilities and Red Dog Mine on subsistence harvests.*
5. *Predict effects of actions considered in detail on harvest of subsistence resources.*

*Objective 1 clearly can be met with existing data. Subsistence resource harvest data from Kivalina covering various periods in the last 40 years are shown in table 3.5. The relative importance of those same resources today was confirmed by subsistence users in communities throughout the region who contributed to this report.*

*Objective 2, related to direct effects of alternatives considered in detail, can be met with existing data. Each of those alternatives would be constructed at and offshore from Portsite. Data collected within the last 5 years and supported by traditional ecological knowledge from subsistence users of the region are sufficient to identify what resources may at least occasionally be in areas that could be directly affected by construction and operation of navigation improvements at Portsite. Areas that might be indirectly affected by future use are addressed in Section 4.12.*

*Objective 3 asks that we know whether any of the important subsistence resources are harvested in locations where the alternatives considered in detail might affect the ability of people to reach those resources. Observations by people from surrounding communities and people working at Portsite tell us about where marine mammals are harvested offshore from Portsite. We are told, and accept as fact without further data collection, that subsistence harvest areas vary from year to year, depending largely on ice conditions; that those areas rarely are within a mile of Portsite; and sometimes are in the same areas that could be dredged for a navigation channel, trenched for a fuel transfer line, or used as a disposal site for dredged material. Those areas also are used for moorage by ships being loaded and waiting to be loaded. The data about subsistence harvest areas are draft data, just as this is a draft EIS. The subsistence harvest maps presented in figures 3-7 through 3-14 are draft information* *that may be revised after public review of this draft EIS. If they are revised, then any conclusions based on those maps may also be revised. Taking these facts into consideration, we consider the available information to be sufficient to present draft subsistence harvest information for public review and comment.*

*Objective 4 is to identify changes in harvests of and utilization of important subsistence resources as a measure of effects of Red Dog Mine and associated transportation development. The available data are not sufficient to identify changes in harvest and utilization of resources that may have resulted from mining and other development in Northwest Alaska, changes in migration routes and species abundance, or changes in technology and equipment that affect the ability of subsistence users to access those resources. Additional and more recent harvest data could be collected, but would not help us separate effects of mining and development from effects of migration changes, game animal population declines or increases, effects of weather and river conditions on travel, and other variables. More information about differences in subsistence harvest from year to year without knowing what caused those differences would not do much to help us determine how navigation improvements at Portsite would affect harvests.*

*Rather than collect data with so many variables that it is unlikely to be usable, we have elected instead to make the assumption that project effects to subsistence resources are directly associated with the distribution and well-being of the plants and animals important to subsistence in the Portsite area and in the region. Potential effects that navigation improvements may have on subsistence resources are addressed in later sections of this draft EIS. The data gap caused by not having more recent or comprehensive subsistence harvest data does not prevent meaningful evaluation of project impacts to natural resources identified as important subsistence resources or evaluation of impacts on access to those resources.*

*Objective 5 is to predict effects of alternatives considered in detail on harvest of subsistence resources. Existing information appears to be sufficient to predict direct effects to terrestrial animals and plants of the navigation alternatives considered in detail. There is enough information to assess effects of navigation improvements on most marine mammals from a science-based viewpoint. There also is ample information to identify the range of concerns raised by residents and users in the vicinity and to develop a discussion of impacts from that viewpoint for the principal marine mammals used in subsistence. Direct and cumulative effects of navigation improvements on plants and animals including those used in subsistence, are discussed in Section 4.9. Indirect effects of navigation improvements and the potential for those improvements to lead to further development are discussed in Section 4.12. Scoping input and other discussions with subsistence users of Northwest Alaska has made it clear that if healthy populations (meaning in good physical conditions and without contaminants that would affect human health) of subsistence plants and animals are present, and if access to those plants and animals is preserved, then subsistence harvests would continue and would not diminish as a result of development in the region, including navigation improvements at Portsite.*

*Data Uncertainty is addressed where appropriate in discussions of individual resources and issues that follow in this section.*

### 4.3.2 Access to Subsistence Resources

Red Dog Mine, the existing terminal and other facilities at Portsite, and the DMTS road connecting the mine and the terminal, together with restrictions on use may occasionally affect access to some subsistence resources on land. Although access through DMTS facilities is protected, some subsistence users expressed a reluctance to travel past Portsite to reach substance resources near the coast. Effects of the Red Dog Mine, Portsite, and the DMTS road system on access to resources are cumulative to the much broader effects of land status changes and regulatory changes, including establishment of parks, monuments, and other national interest land units in the last three decades.

None of the navigation improvement alternatives considered in detail would alter existing access to subsistence resources on land. The existing access corridor along the beach past Portsite that guarantees access to subsistence resources north and south of Portsite would be maintained in each alternative.

Potential for each alternative considered in detail to affect access to marine subsistence resources in the Chukchi Sea is as follows.

- **No-Action Alternative**

Existing facilities at Portsite may occasionally impede or divert boat traffic traveling along the coast to reach sites used for subsistence. Snow machines and all-terrain vehicles that occasionally travel the beach to reach subsistence harvest sites also may have to go around project features. DMTS, including Portsite and Red Dog Mine, affect access to subsistence resources to varying degrees. Those effects have not been defined sufficiently to allow this draft EIS to present meaningful conclusions. Further, effects of development on subsistence access inland from Portsite are outside the scope of the DeLong Mountain Terminal draft EIS, so effects of the existing mine and associated facilities to subsistence access are not defined here.

The existing barge loader extends about 750 feet offshore and could affect lead formation in moving ice, which could adversely affect access to marine mammals hunted farther offshore. Potential effects of lead formation on subsistence access are discussed later in this subsection. Observations of people working on the loader and information from satellite photography indicate that the existing loader has not regularly caused appreciable lead formation. This may be in part because the loader usually is surrounded by land-fast ice until late spring, when most of the ice pack is melting and moving, with leads forming and reforming relatively rapidly.

- **Third Barge Alternative**

Adding a third barge to existing operations at Portsite would not affect existing subsistence access or add more than negligibly to effects of reasonably foreseeable future development.

- **Breakwater-Fuel Transfer Alternative**

A breakwater would require minor detours for passing boats or snow machines running close to the coast. Activities during the 3 years of construction would require a slightly wider detour. Construction of the fuel transfer facilities might require a detour by the occasional traffic along the beach. This would have no more than minor local effect on access to subsistence resources and would add no more than a minor local increment to cumulative effects from reasonably foreseeable future development.

A breakwater would have little effect on shorefast ice, and consequently little effect on travel over shorefast ice. During periods when the shorefast ice did not extend offshore to the breakwater and the ice pack was moving, the breakwater would be struck by the moving ice. The moving ice would pile up on the breakwater and individual and weakly connected pieces of ice would be slowed and/or broken. This would create an open lead and or an elongated zone of broken ice down-current from the breakwater. This is discussed in Section 4.6.3.

At least part of the Arctic ice pack is often moving in response to wind, atmospheric pressure, and current. Those movements open leads, some of which are relatively predictable, and others that are not. Some of the largest, most enduring, and most predictable are called *polynya.* Leads offer opportunities for marine mammal hunters because marine mammals tend to follow leads in migration movements and to congregate along open leads and along the thin ice that forms in leads. Leads also can impede or almost stop marine mammal hunting by blocking access to hunting areas. Hunting camps on the ice for whales and bearded seals often are several miles offshore, close to preferred habitat, and the more frequently used migratory pathways. Poor ice conditions and/or leads closer to shore can greatly increase the risk of travel on the ice and can reduce or stop access to those offshore hunting areas. Hunters along the southeastern Chukchi Sea coast and elsewhere along the Arctic Ocean sometimes attribute poor hunting success to poor ice conditions.

Some of the people who live and hunt in the Chukchi Sea and are intimately familiar with the ice conditions there are convinced that climate changes in the last few decades have caused thinner ice, earlier breakups, and poorer hunting conditions. Any fixed structures, including natural shoals, islands, and man-made structures can contribute to lead formation in moving ice. Section 4.6.3 notes this type of effect associated with man-made structures in the Beaufort Sea.

The breakwater would not affect lead formation when the shorefast ice zone extended out to it. It would only affect lead formation in moving ice. When ice was moving within about 1,350 feet from shore off Portsite, the breakwater could cause a lead of open water or broken ice to form down-current or down-wind. The breakwater would be wider than pilings for the existing loader and farther offshore, so it would have more potential for lead formation and for adverse effects to subsistence access.

Leads formed down-current from the breakwater would tend to extend northward and generally parallel to the shoreline.

<u>Risk Uncertainty</u>. *Wind direction and speed, temperature, current direction and speed, and location of shore-fast ice all affect lead formation and duration. None of those variables can be predicted with confidence. The frequency that lead formation would be caused by the Breakwater-Fuel Transfer Alternative, how far they would reach, and how they would affect access across the ice to offshore marine mammal hunting areas cannot be predicted with confidence. A high-risk, low probability evaluation would suggest that access to marine mammals could be adversely affected north and south of Portsite for an undetermined distance during periods when ice was moving within 1,750 feet from shore.*

- **Trestle-Channel Alternative**

Trestle piling clusters would be 250 to 300 feet apart. Dredging and construction activities might require small detours by boat, snow machine, and other traffic along the beach. Coast Guard or other safety restrictions might limit boat traffic under the trestle, but the widely-spaced pilings would present no physical barrier to boat movement along the beach. If boats traveling along the shoreline went around a new trestle instead of between the pilings, they would have to go about a half mile farther offshore than to go around existing facilities.

This alternative would not alter beach processes, waves, or currents enough to affect access to subsistence resources. It also would not greatly affect formation or persistence of shore-fast ice. This alternative would have effects similar to those of the Breakwater Fuel Transfer Alternative.

### 4.3.3 Contamination

- **No-Action Alternative**
- **Third Barge Alternative**
- **Breakwater/Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

Contamination of water and subsistence resources were identified as scoping issues related to subsistence harvest of plants and animals in Northwest Alaska. The potential for air and water to be affected by contamination from navigation improvements at Portsite is examined in Sections 4.6 and 4.7. Information presented in those sections indicates that existing marine water quality at Portsite meets state standards and generally recognized criteria. This indicates that marine water quality at Portsite does not adversely affect subsistence resources.

None of the alternatives considered in detail would cause more than minor water quality effects except from localized effects of turbidity during dredging and disposal of dredged material. Those effects would not be compounded by reasonably foreseeable future actions.

Concern among people in Northwest Alaska that plants or animals might be contaminated from various sources may affect their willingness to harvest and use traditional subsistence resources. Effects related to contamination concerns associated with the operation of the DMTS facilities are addressed in Section 4.4.

Section 4.4 reports that testing has not shown elevated contamination levels in animals and plants collected for subsistence or in the people who consume those resources. There is no indication that reasonably foreseeable future actions, including any of the alternatives considered in detail, would cause cumulative effects to reach a significant level.

### 4.3.4 Terrestrial Plants and Animals

- **No-Action Alternative**
- **Third Barge Alternative**
- **Breakwater-Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

Plants and animals that live on land make up a large part of the subsistence diet throughout northwestern Alaska. They are of utmost importance, but none of the project alternatives considered in detail would substantially and directly affect subsistence resources on land. The only on-land construction from any of the alternatives would be in an area of about 3.5 acres in the existing Portsite terminal complex where subsistence resources are not being harvested. There is no indication that the built-up area of the terminal or the land immediately adjacent produces plants or animals in quantities that would be significant to the subsistence harvest by people in northwestern Alaska. None of the alternatives would directly alter subsistence status of lands in northwestern Alaska. None of the navigation improvement alternatives considered in detail would affect subsistence harvest of terrestrial plants or animals. Potential for impacts from induced or other secondary development are addressed in Section 4.12. That analysis indicates that navigation improvements at Portsite on the scale addressed in this draft EIS would not induce substantial additional development.

On-going operations at Red Dog Mine, the DMTS road, the associated barrow and quarry sites along the DMTS road, and the developed area of about 160 acres at Portsite, all have removed plants, including some unquantified number of terrestrial plants that could have been harvested for subsistence. Those same facilities also largely excluded land animals from those developed areas and may affect local migratory movements. Traditional knowledge, as told by some residents of Kivalina and Noatak, is that the DMTS road and traffic on the road may be avoided by caribou in particular and possibly by other animals. Hunters in the region have told us that this has at times adversely affected caribou harvest. This information is not quantified and effects of the DMTS road and other facilities on subsistence harvest cannot be quantified with any degree of confidence.

While current facilities and operations could affect harvest of subsistence plants and animals, the alternatives considered in detail would not to any appreciable degree affect moose, caribou, grouse, fur bearers, or other land animals or the harvest of those animals. Those alternatives also would affect, at most, 3.5 acres in the industrial area at Portsite, where plants and animals are not harvested for subsistence. None of the alternatives considered in detail would add cumulatively to effects of past actions on the harvest of land plants or animals, and none would cause or contribute to impacts that would affect harvest of land plants or animals in the reasonably foreseeable future.

The alternatives considered in detail would have negligible direct or cumulative effects on subsistence harvest of plants or terrestrial animals.

### 4.3.5 Marine Plants and Invertebrates

- **No-Action Alternative**
- **Third Barge Alternative**
- **Breakwater-Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

No marine kelps or other macrophytes are in the Portsite area. Marine algae and invertebrates are not harvested for subsistence in the Portsite area, although a small subsistence fishery for king crab and marine snails that could extend to the Portsite area is developing around Kotzebue. The importance of algae and marine invertebrates to the Chukchi Sea food chain is recognized in concerns that were expressed repeatedly during scoping and in public meetings for this EIS. Potential effects to those essential components of the Chukchi Sea ecosystem are addressed in Section 4.9. Findings in that section suggest that the Trestle-Channel Alternative could cause short-term local losses of food chain organisms offshore from Portsite. Other alternatives would affect an area too small to cause more than negligible effects to regional resources.

There is no indication that existing development in the Chukchi Sea has affected subsistence harvest of marine plants or invertebrates or that reasonably foreseeable future development would affect their harvest.

### 4.3.6 Fish

- **No-Action Alternative**
- **Third Barge Alternative**
- **Breakwater-Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

Fish generally categorized as freshwater, anadromous, and marine are harvested for food in the Portsite area and throughout the region. Freshwater fish do not enter salt water, are not affected by existing loading operations, and would not be affected by any of the alternatives considered in detail. None of the alternatives considered in detail would directly or cumulatively affect subsistence harvest of freshwater fish.

Marine and anadromous fish are harvested for personal use from Kotzebue Sound and the coastal waters north of the Sound, but there is little indication of a regular, substantial harvest of fish from the marine waters of the Chukchi Sea near Portsite or Kivalina.

Large numbers of anadromous and smaller numbers of marine fish are taken from Kivalina Lagoon and other coastal lagoons. If the Dolly Varden, salmon, cod, and other marine and anadromous fish were affected by the existing loading operations at Portsite, then the loading operations could affect the number of fish harvested or the quality of those fish. If those operations do not affect the number of fish that return to places they are harvested or the size or quality of those fish, then the loading operations have no direct effect on the subsistence take of those fish. This also is true of the other alternatives considered in detail. If the numbers and quality of salmon and Dolly Varden returning to the rivers of northwestern Alaska for example were unaffected, then the alternatives would appear to have no effect on subsistence harvest of those species. If any of those alternatives reduced the number or the quality of returning fish, then subsistence harvest could be affected.

The potential for each of the alternatives considered in detail to adversely affect fish is considered in Section 4.9. Extensive experience reported by many sources in the fisheries literature indicates that the level of noise and activities that would be associated with construction and operation of any of the alternatives considered in detail would cause no more than local, short-term effects on anadromous or marine fish movement. The discussion also indicates that localized potential for habitat and food losses would not affect populations of these fish or their harvest and use.

Fish harvest in northwestern Alaska, which is largely in lagoon and freshwater systems, may be affected by population trends of the targeted species, but may be affected much more by water levels, weather, and ice conditions that control access by people harvesting the fish. Large seasonal variations in fish harvest (table 3-5c) can be associated with those events rather than variations in population, which would extend over periods of several years. There is a large body of fisheries literature and experience related to anadromous fish, their populations, and their harvest in freshwater systems. There is nothing in the professional and scientific literature to indicate that marine navigation improvements on the scale of those currently at Portsite or that would be constructed by any of the alternatives considered in detail have, or would, affect anadromous fish harvests in surrounding freshwater systems. This also is true of harvest of marine fishes on lagoons and estuaries away from the immediate influence of development.

None of the alternatives considered in detail would directly affect harvest of anadromous or marine fish. Reasonably foreseeable future actions identified in Section 4.12 would not affect marine fish harvests.

Existing regional development, including development of Red Dog Mine, Portsite, and DMTS has resulted in localized spills and habitat modification that may have locally or temporary affected fish in freshwater. There are no specific data to indicate that those impacts have substantially affected freshwater or anadromous fish populations or their availability for subsistence. Reasonably foreseeable future activities (Section 4.12) could adversely affect freshwater and anadromous fish and the harvest of those fish by habitat changes, improved access, and increased potential for spills of fuels and other materials. Those effects would be cumulative to the localized effects of mining and other development in the NAB. The scope of activities identified as reasonably foreseeable in Section 4.12.5 does not require extensive freshwater habitat modification or other activities that would represent a particular hazard to freshwater or anadromous fish or their habitat. This indicates that those reasonably foreseeable activities would cause no more than minor additional (cumulative) effects provided those actions were properly planned, permitted, and operated. There is no indication that DMT navigation improvements directly or cumulatively with other reasonably foreseeable action would significantly affect fish harvest.

### 4.3.7 Marine Mammals

Section 4.9 discusses the effects of existing operations and potential effects of alternatives considered in detail that could affect the marine mammals that live in the marine waters at Portsite. Gray whales and harbor porpoises are not typically harvested for food or other subsistence uses by Inupiaq Eskimos of northwestern Alaska, so they are not considered here. The effects of existing operations and the alternatives considered in detail are discussed as follows for each of the other subsistence-harvested marine mammals.

**Beluga Whales.**

- **No-Action Alternative**
- **Third Barge Alternative**

Traditional ecological knowledge related to existing loading operations and beluga movements is discussed in Section 4.9. Traditional knowledge as related by some hunters in northwestern Alaska tells us that construction and operation of DMTS facilities at Portsite has affected the subsistence harvest of belugas in the Beaufort Sea around Portsite. Table 3-7 also shows that the total harvest of beluga whales by hunters from Kivalina dropped off between 1984 and 1987, before construction began at Portsite and has continued to be relatively low in the years that followed.

In other marine waters of Alaska, and in other seas of the world, belugas have adapted to industrial and transportation noises after they have learned that those noises do not represent a direct threat (Huntington and Mymrin 1996). Reports by Kivalina hunters indicate that either belugas of both spring and summer stocks have not yet become acclimated to structures or activities at Portsite or that some other factor has reduced Kivalina's beluga harvest since construction began at Portsite in the late 1980's. While data from the Beaufort Sea, Cook Inlet, and other locations indicates that the presence and operation of marine transportation facilities have not caused long-term avoidance by belugas, the Kivalina combined spring and summer subsistence harvest declined about the time the facilities were constructed and have remained below preconstruction levels in most years since.

The Kivalina harvest data do not contradict views expressed by some hunters of the community about DMTS facility effects on beluga harvest, and by inference, on localized behavior and movements of belugas. The data are far from conclusive because there are too many other factors that could have affected beluga harvest in that period. Those factors may include: long term changes in ice conditions, beluga mass mortality reported in Siberian waters, and changes in beluga response to increased noise and activity. Table 3-8 shows just how much variation in beluga harvest there is from one year to the next.

<u>Data Quality</u>. *Because we cannot develop data to determine the cause of beluga harvest declines by Kivalina hunters before and after construction at Portsite, we conclude that construction and operation of the existing facilities at Portsite may be related to reductions in the beluga harvest by Kivalina hunters.*

<u>Impact Uncertainty</u>. *In accordance with Council on Environmental Quality guidance for evaluating high-risk low-probability effects, this analysis will assume that there is a causal relationship between reductions in beluga harvest by Kivalina hunters and the construction and operation of existing DMTS facilities at Portsite. That relationship has not been tested by organized research, but is held by many marine mammal hunters of the area and is a useful assumption to examine potential high-risk low-probability outcomes.*

There is at least a low probability that the existing Portsite facilities have been a factor in reduced beluga harvest by Kivalina hunters and that harvest decline may be culturally important and may have significantly affected the people who used those belugas. This potential for impact is not apparent in the harvests by other communities that hunt belugas in the southeastern Chukchi Sea. Any effects from the existing facilities and operations at Portsite would be cumulative to other causes for subsistence harvest decline in the region. As stated previously, those factors may include: long term changes in ice conditions, beluga mass mortality reported in Siberian waters, and changes in beluga response to increased noise and activity.

Belugas may eventually become accustomed to activities at Portsite, as they have to noise in some other places. There is no certainty of this, however, and so a high-risk, low probability evaluation must assume that if belugas are avoiding Portsite because of activity and noise, then they will continue to do so in the foreseeable future, with or without any further navigation improvements or operations changes of the DMT.

Adding a third barge to the existing operations at Portsite would not be likely to affect the harvest of belugas because it would not alter operations or structures and would have little effect on the overall noise produced by operations. Any additional noise or activity would be in the same area as existing operations and would be masked by operation of the other barges.

- **Breakwater-Fuel Transfer Alternative**

The breakwater and marine components of the fuel transfer facility would be constructed during the open-water season after the northward migration of the main body of both the eastern Chukchi and Beaufort Sea beluga whale stocks. During construction, noise and activity from existing loading operation would mask most sounds of construction. Anchoring the mooring system could produce noise that would be heard farther off shore than ship-loading activities, indicating that marine mammals might be able to hear sounds farther offshore than they can now from Portsite operations. The noisiest activities associated with constructing the offshore terminal would be timed to avoid beluga migration. This would be coordinated with subsistence users if this alternative were selected.

Other construction activities would have little apparent effect on subsistence harvest of belugas because the main beluga migration would be over when construction would begin. The eastern Chukchi Sea stock of belugas occasionally moves past Portsite later in the summer when the ore concentrate is being loaded. Traditional knowledge tells us that these late migrants may move farther offshore to avoid the noise and activity, and therefore, may be less available for subsistence harvest by hunters from Kivalina. Beluga harvest data (table 3-8) tell us that hunters from Kivalina harvest an average of one beluga from the summer migrants about every 2 years. This suggests that on average, the 1-year construction period for the fuel transfer terminal and mooring system could lessen the chance for subsistence harvest of one of these summer belugas.

<u>Impact Uncertainty</u>. *In accordance with Council on Environmental Quality guidance for evaluating high-risk low-probability effects, this analysis will assume that construction of the Breakwater-Fuel Transfer alternative at Portsite would reduce the harvest of summer eastern Chukchi Sea belugas by one during the two years of construction. This loss would be in addition to any previous effect that might have resulted from operation of the existing facilities.*

Operation of the breakwater-fuel transfer alternative would be similar to the existing operation; however, the presence of the breakwater could affect Kivalina hunters' harvest of belugas in some way that cannot be predicted with scientific knowledge and cannot be quantified by traditional ecological knowledge.

Information related to fuel spills, spill response capabilities, and the potential for large spills to marine waters to affect a wide range of marine-based resources is provided in Section 4.6.5. That information indicates that increasing fuel volumes transferred and the number of fuel transfer events at DMT would increase the potential for fuel spills. There is a low potential for a spill large enough to impact subsistence activities. Belugas and other marine mammals would not be particularly susceptible to effects of an oil spill, however, because the spring-early summer marine mammal migration would have almost entirely passed Portsite before fuel transfer begins each year.

No effects to subsistence harvests of belugas from the spring migration of the Beaufort Sea stock would be anticipated.

<u>Impact Uncertainty</u>. *In accordance with Council on Environmental Quality guidance for evaluating high-risk low-probability effects, this analysis will assume that operation of the Breakwater-Fuel Transfer Alternative at Portsite would reduce the combined spring and summer harvest of belugas by some undetermined amount during project operation. This loss would be in addition to any previous effect that might have resulted from operation of the existing facilities. From 1987 to 1999, Kivalina harvested an average of just under three belugas each year. In 2000, exceptional marine and ice conditions apparently trapped a large number of belugas near Kivalina and allowed them to strike more than 90 belugas and recover 43. If the exceptional 2000 harvest is not included, then Kivalina has harvested an average of a little less than three belugas per reporting year since construction began at Portsite. Harvest of some percentage of those three belugas per year might be at risk to some undetermined degree for the life of the project if the presence of the breakwater or presence and operation of the fuel terminal affected subsistence harvests. Belugas are sometimes seen close to the existing DMTS loading facilities at Portsite, so there apparently is at least some degree of acclimation to the existing facilities. This indicates there would likely be some degree of acclimation to additional facilities at Portsite and a continued, although possibly reduced, presence of belugas that might be harvested by hunters from Kivalina. Because the potential for harvest reduction cannot be determined with available data or data that can be reasonably obtained, this analysis uses the low-probability high-impact assumption that the direct consequences of this action would be to eliminate harvest of beluga whales by hunters in the Kivalina area. This is not a forecast or prediction. Rather, this assumption is a tool for analyzing effects when the likelihood for those effects is unknown.*

If Kivalina hunters no longer harvested belugas near Kivalina, they would lose an average of 3 belugas each year. Belugas may weigh as much as 3,000 pounds, but average weight is considerably less. If harvested belugas weighed 2,000 pounds each, and 75 percent of the weight was usable as food, then Kivalina would lose 4,500 pounds of food in an average year. This equates to an average loss of about 12 pounds of food per person each year. As a “worst-case,” this does not indicate a significant effect on caloric intake. People who eat beluga flesh, however, may get dietary benefits that go beyond mere caloric intake. Those benefits cannot be accounted for in any meaningful way by the preceding figures. The cultural benefits derived from taking and using belugas also cannot be quantified.

The foregoing high-risk low-probability impact evaluation indicates that the maximum impact of the Breakwater-Fuel Transfer Alternative on subsistence harvest of beluga whales would result in less than significant losses of caloric intake to the people of Kivalina and unquantifiable, but potentially important losses of other dietary and cultural benefits. Those non-caloric dietary and cultural impacts could, if beluga harvest was greatly reduced from present levels, constitute significant local dietary and cultural impacts.

There is no indication that beluga subsistence harvests by other communities of Northwest Alaska would be adversely affected if belugas avoided future navigation improvements at Portsite. Regionally, adverse effects from the hypothetical loss in harvest of a maximum of three belugas per year would appear to be less than significant to subsistence dietary, and cultural needs.

None of the reasonably foreseeable futures actions identified in Section 4.12.5 would be likely to affect subsistence beluga harvests and would not add cumulatively to existing effects and potential future effects of this alternative.

- **Trestle-Channel Alternative**

The Trestle-Channel Alternative would produce more noise, activity, and environmental change during construction. It also would be the quietest of the alternatives considered in detail during operation.

Construction would require about 3 years and the heavy construction would not take place when the early (Beaufort Sea) stock of belugas was passing Portsite. Some of the construction noise, particularly the dredged material disposal activities, would be heard farther from Portsite than existing operations. The additional noise and activity could deflect migrating summer belugas farther offshore. This effect would be limited to the construction period (about late June through late October or early November) in each of the 3 years of construction. If construction caused all the summer belugas to move so far offshore hunters from Kivalina could not harvest them, based on average harvest in recent history Kivalina would lose the one or two summer belugas they take on average during that 3-year period.

Maintenance dredging at 5, 17, 33, and 49 years after construction also might lessen the opportunity for hunters in the Portsite and Kivalina area to harvest belugas from the summer (eastern Chukchi-Sea) stock during each maintenance year. Average subsistence harvest of summer belugas by Kivalina indicate that the loss in those 4 maintenance years might be expected to total 1 to 3 belugas in the 50-year economic life of the project.

<u>Impact Uncertainty</u>. *In accordance with Council on Environmental Quality guidance for evaluating high-risk low-probability effects, this analysis will assume that construction of the Trestle-Channel Alternative at Portsite would reduce the harvest of summer eastern Chukchi Sea belugas by two during the 3 years of construction. This loss would be in addition to any previous effect that might have resulted from operation of the existing facilities.*

After construction, belugas migrating northward within 3 miles of shore would swim over the shipping channel at Portsite and belugas migrating 5 to 7 miles offshore would cross the dredged material disposal area. Belugas encounter many natural irregularities in the sea bottom during their migration, but if some of the summer (eastern Chukchi Sea) stock moved farther offshore to avoid the changes in the bottom at the channel and disposal site, Kivalina hunters could lose the opportunity to harvest some of the small number of summer beluga they now harvest.

Information related to fuel spills, spill response capabilities, and the potential for large spills to marine waters to affect a wide range of marine-based resources is provided in Section 4.6.5. That information indicates that increasing fuel volumes transferred and the number of fuel transfer events at DMT would increase potential for fuel spills. There is a low potential for a spill large enough to impact subsistence activities. Belugas and other marine mammals would not be particularly susceptible to effects of an oil spill, however, because the spring-early summer marine mammal migration would have almost entirely passed Portsite before fuel transfer begins each year.

In the last 10 years, 2 belugas have been harvested from those summer migrants. Applied to the 50-year economics project life, this would indicate that about 10 belugas could be lost to Kivalina if they harvested no belugas from the eastern Chukchi Sea stock during that 50-year period. This is a “worst-case” example. Actually, the quieter and more confined operation of the alternative should to some degree compensate for the relatively small changes in bottom contour produced by the channel and disposal area.

Belugas of the Beaufort Sea stock usually migrate past Portsite through leads in the ice. They are unlikely to stop or substantially delay their major seasonal migrations to avoid a shallow channel or relatively small change in bottom contour. A half-mile offshore, the shipping channel would be less than 25 feet deeper than the bottom around it and would have gently sloping sides. The bottom at the disposal area typically would be raised less than 5 feet in 60 to 70 feet of water.

Other than those changes, the new trestle and loading facility would extend about 1,050 feet farther offshore than the existing loader. These localized changes from the channel, disposal area, and longer loading structures are unlikely to keep belugas from moving northward each spring through ice leads. This is discussed in more detail in Section 4.9.

Experience and observation in other parts of beluga whale range indicated that they would soon return to areas that are altered by humans. They may be temporarily displaced by noise and activity associated with hunting or other direct threats, but will tolerate considerable noise and activity if they are not pursed or harmed. That experience indicates that a channel, disposal area, and loader extension at Portsite would be unlikely to cause long-term changes in the northward migration of beluga through ice leads in the spring. There are various views among subsistence hunters about potential for this alternative to affect beluga movements through ice leads and about their availability to hunters.

*Impact Uncertainty. Operation of the Trestle-Channel Alternative would lead to the same uncertainties in impact analysis of subsistence resources as the Breakwater-Channel Alternative. Therefore, in accordance with Council on Environmental Quality guidance for evaluating high-risk low-probability effects, this analysis will assume that operation of the Trestle-Channel Alternative at Portsite would reduce the combined spring and summer harvest of belugas by some undetermined amount during project operation. This loss would be in addition to any previous effect that might have resulted from operation of the existing facilities. From 1987 to 1999, Kivalina harvested an average of just under three belugas each year. In 2000, exceptional marine and ice conditions apparently trapped a large number of belugas near Kivalina and allowed them to strike more than 90 belugas and recover 43. If the exceptional 2000 harvest is not included, then Kivalina has harvested an average of a little less than three belugas per reporting year since construction began at Portsite. Harvest of some percentage of those three belugas per year might be at risk to some undetermined degree for the life of the project if the presence of the breakwater or presence and operation of the fuel terminal affected subsistence harvests. Belugas are sometimes seen close to the existing DMTS loading facilities at Portsite, so there apparently is at least some degree of acclimation to the existing facilities. This indicates there would likely be some degree of acclimation to additional facilities at Portsite and a continued, although possibly reduced, presence of belugas that might be harvested by hunters from Kivalina.*

The high-risk low-probability evaluation for the preceding Breakwater-Fuel Transfer Alternative applies equally to this alternative. That foregoing high-risk low-probability evaluation indicates that the maximum impact of the Trestle-Channel Alternative on subsistence harvest of beluga whales would result in less than significant losses of caloric intake to the community of Kivalina and unquantifiable, but potentially important losses of other dietary and cultural benefits. Those non-caloric dietary and cultural impacts could, if beluga harvest was greatly reduced from present levels, constitute significant local dietary and cultural impacts.

There is no indication that beluga subsistence harvests by other communities of Northwest Alaska would be adversely affected if belugas avoid future navigation improvements at Portsite. Regionally, adverse effects from the hypothetical loss in harvest of a maximum of three belugas per year would appear to be less than significant to subsistence dietary and cultural needs.

None of the reasonably foreseeable future actions identified in Section 4.12.5 would be likely to affect subsistence beluga harvests, and would not add cumulatively to existing effects and potential effects of this alternative.

**Bowhead Whales.** Bowheads migrate north past Portsite in the spring as well-defined leads began to appear in the Arctic ice pack. The majority of the bowhead population migrates through leads well offshore from the coastline, but a few bowheads occasionally use near-shore leads. Traditional knowledge explains that if several leads are available, bowhead will choose the lead farthest from shore. At Point Hope, 80 miles north of Portsite, the recurring spring leads in the Arctic ice pack often bring bowheads close to the coast. Point Hope hunters are successful harvesters of bowheads in Alaska waters. Bowheads travel close to shore less often near Portsite, and Kivalina hunters have harvested eight bowheads since they recommenced hunting them in 1966.

- **No-Action Alternative**

Existing operations only produce noise and activity in the Chukchi Sea during the open-water season long after bowheads have passed Portsite. Traditional ecological knowledge suggests that the existing structures and human presence at Portsite may affect bowhead movements and their availability to hunters, but those effects are not readily apparent in the harvest data from Kivalina. Since records have been kept, Kivalina hunters harvested five bowheads in the 19 years they were hunted before Portsite construction began and three bowheads in the 16 years since it was completed. The average harvest was slightly higher before DMTS construction at Portsite, with one bowhead taken about every 4 years (0.26/year) before construction and one about every 5 years (0.19/year) after, a difference of 0.07 bowhead whales per year, or about one bowhead whale every 14 years. The small difference in harvest success could have been caused by a number of factors not associated with DMTS at Portsite.

There is no apparent causal relationship between production rate increases at Red Dog Mine and lack of whaling success by Kivalina hunters since 1994. Increasing mine production has not altered Portsite operations except that it has increased the number of barge loads between Portsite and cargo ships in the late summer and autumn, when bowheads typically are not hunted near Kivalina.

Any effects of existing facilities and operations at Portsite would be cumulative to those from increased shipping, boating, petroleum exploration and extraction, and the limited shoreline development along the northern and northwestern Alaska coasts.

Those other effects have not been shown to have affected bowhead harvest in the Chukchi and Beaufort seas, although there are so many variables affecting this harvest that effects would be difficult to identify. Overall harvest in the region, however, appears to remain strong.

- **Third Barge Alternative**

The No-Action and Third Barge alternatives would continue operations with the same facilities. Adding a third barge to these operations would not alter the facilities, would not alter the distance that sounds from the operation could be detected, and would not otherwise affect subsistence harvest of bowheads. Direct and cumulative effects would be the same as for the No-Action Alternative.

- **Breakwater-Fuel Transfer Alternative**

Construction would begin after the bowhead migration had passed Portsite each year. The breakwater would be constructed in 2 or 3 years and the marine components of the fuel transfer system would be constructed in 1 or 2 years. All noise and activity would be completed, and all turbidity from dredging and other underwater activities would be gone from the water long before the bowheads returned again each spring.

Bowheads might be aware of the breakwater and of the narrow strip of sea bottom that would be altered by pipeline construction and the anchors and underwater end of the pipeline about 3.5 miles offshore. Experience related to petroleum exploration and production in the Beaufort Sea does not show any indication that that bowheads avoid disturbed areas after the noise and activity have ceased. This indicates that changes in the sea bottom from pipeline construction and an off-shore terminal and mooring system would not stop or divert bowhead following ice leads along the coast past Portsite during their spring migration.

Bowheads are known in both traditional ecological knowledge and in the scientific literature to avoid loud sounds and to avoid weaker sounds from sources that might threaten them. Traditional ecological knowledge tells us that bowheads are aware of even small changes in the marine environment, so they probably would be aware of the changes from this alternative.

While bowheads would not be exposed to additional noise or activity by construction of any of the alternatives at Portsite, they may be aware of changes on the sea floor and of project components constructed in marine waters. Observations at developed areas sited in the Beaufort Sea have not shown that the presence of such alterations causes bowheads to avoid the disturbed areas. On the other hand, those changes could make bowheads more wary, or otherwise make them less available to hunters. There is insufficient information about bowhead behavior related to large dredging and disposal projects to conclusively determine that the Breakwater-Fuel Transfer Alternative would not affect subsistence harvest of bowheads.

<u>Impact Uncertainty</u>. *In accordance with Council on Environmental Quality guidance for evaluating high-risk low-probability effects, this analysis will assume that operation of the Breakwater-Fuel Transfer Alternative at Portsite would reduce the harvest of bowhead whales by some undetermined amount during project construction and operation. This loss would be in addition to any previous effect that might have resulted from operation of the existing facilities. From 1987 to 2003, Kivalina harvested three bowheads, about one every 5 years. Harvest of some percentage of that harvest might be at risk to some undetermined degree for the life of the project if the presence of the breakwater or presence and operation of the fuel terminal affected subsistence harvests. Bowhead whales are known to acclimate to many kinds of non-threatening noise and activity in the Beaufort Sea. This indicates there would likely be some degree of acclimation to additional facilities at Portsite and a continued, although possibly reduced, presence of bowhead whales that might be harvested by hunters from Kivalina.*

Evaluation of potential impacts of this alternative on bowhead whales closely follows the logic used in the preceding evaluation of potential impact on beluga whales. There is insufficient data to reliably predict effects of the Breakwater-Fuel Transfer Alternative on the subsistence harvest of bowhead whales in the Portsite area. The same analysis used for belugas would indicate that: *if all harvest of bowheads by Kivalina ended as a result of construction of this alternative, Kivalina hunters would lose an average of one bowhead every 5 years. The average bowhead yields about 20 percent meat, 40 percent blubber, and about 2 percent baleen by weight (Durham 1972). A 50 to 60-foot long bowhead weighing between 120,000 and 140,000 pounds might produce between 72,000 and 84,000 pounds of meat and blubber. This indicates that if the Breakwater-Fuel Transfer Alternative prevented Kivalina hunters from harvesting any more bowheads, the community would lose up to 84,000 pounds of edible meat and blubber every 5 years, or about 42 pounds per person per year depending on the size of the whale harvested. This indicates that in some years this "worst case" loss event could result in a significant loss of food to Kivalina hunters and the people dependant upon those hunters. People who eat bowhead flesh also may get dietary benefits that go beyond mere caloric intake. Those benefits cannot be accounted for in any meaningful way by the preceding figures. The cultural benefits derived from taking and using bowheads cannot be quantified.*

*The foregoing high-risk low-probability impact evaluation indicates that the maximum impact of the Breakwater-Fuel Transfer Alternative on subsistence harvest of bowhead whales could result in significant loss of caloric intake to people in the community of Kivalina and unquantifiable, but potentially important, losses of other dietary and cultural benefits. Those non-caloric dietary and cultural impacts could, if bowhead harvest was greatly reduced from present levels, constitute significant local dietary and cultural impacts.*

There is no indication that bowhead subsistence harvests by other communities of Northwest Alaska would be adversely affected if bowheads avoided future navigation improvements at Portsite. Regionally, adverse effects from the hypothetical loss in harvest of a maximum of one bowhead per 5 years would appear to be less than significant to subsistence dietary and cultural needs.

None of the reasonably foreseeable actions evaluated in section 4.12.5 would cumulatively add to effects of the Breakwater-Fuel Transfer Alternative to the harvest of bowhead whales.

- **Trestle-Channel Alternative**

Construction would be timed to avoid loud noises or intensive activity on the Chukchi Sea during bowhead migration. Bowheads might know about changes in the sea bottom and about new loading structures being constructed, but during construction, they would be in the Beaufort Sea, much too far from Portsite for sounds of construction to be detected by even the most sensitive instruments, and much too far away to see construction activities. More information about how far sounds can be detected is sections 3.4.8 and 4.8. Information about how marine mammals may react to noise is in Section 4.9.

Bowheads migrating past Portsite after construction began could cross the disposal area and the low mounds of silt, sand, and gravel there. They could also swim over the channel, which would be about 2 to 25 feet deeper than the surrounding bottom for as much as 3 miles offshore and next to the loading platform as much as 30 feet deeper than the surrounding bottom. Traditional ecological knowledge tells us that bowheads would detect these changes, while reports of bowhead behavior in the Beaufort Sea indicate that bowheads do not go any great distance to avoid underwater pipelines and other man-made structures. The North Slope Borough limits activities that require transportation through the Beaufort Sea during critical periods of bowhead movements, but careful development has continued in the Beaufort Sea for many years. That development, planned to avoid major bowhead movements, has had no apparent affect on subsistence harvest of bowheads by coastal communities along the Beaufort Sea.

<u>*Impact Uncertainty*</u>*. Operation of the Trestle-Channel Alternative would lead to the same uncertainties in impact analysis of subsistence resources as the Breakwater-Fuel Transfer Alternative. Therefore, in accordance with Council on Environmental Quality guidance for evaluating high-risk low-probability effects, this analysis will assume that operation of the Trestle-Channel Alternative at Portsite would reduce the harvest of bowhead whales by some undetermined amount during project operation. This loss would be in addition to any previous effect that might have resulted from operation of the existing facilities. From 1987 to 1999, Kivalina harvested an average of one bowhead whale every 5 years. Harvest of some percentage of that harvest might be at risk to some undetermined degree for the life of the project if maintenance dredging or the presence of the trestle, channel, or disposal area affected bowhead migration behavior. Harvest of bowhead whales since DMTS facilities were constructed indicates that bowheads have at least partially acclimated to existing facilities or that ice conditions at least sometimes overcome any tendency*

*by bowhead whales to avoid Portsite. This indicates there would likely be some degree of acclimation to additional facilities at Portsite, at least use of leads in the ice that would make bowhead whales accessible to Kivalina hunters during operation of the Trestle-Channel Alternative. This indicates a continued, although possibly reduced, presence of bowhead whales that might be harvested by hunters from Kivalina.*

The high-risk low-probability evaluation for the preceding Fuel Transfer-Breakwater Alternative applies equally to this alternative. That foregoing high-risk low-probability evaluation indicates that if the Trestle-Channel Alternative eliminated all future harvest of bowhead whales, that effect could result in significant losses of caloric intake to people in the community of Kivalina and unquantifiable, but potentially important losses of other dietary and cultural benefits. Those non-caloric dietary and cultural impacts could, if bowhead harvest was greatly reduced from present levels, constitute significant local dietary and cultural impacts.

There is no indication that bowhead subsistence harvests by other communities of Northwest Alaska would be adversely affected if bowheads avoid future navigation improvements at Portsite. Regionally, adverse effects from the hypothetical loss in harvest of a maximum of one bowhead per 5 years would appear to be less than significant to subsistence dietary and cultural needs of the region.

None of the reasonably foreseeable future actions identified in section 4.12.5 would be likely to affect subsistence bowhead harvests, and would not add cumulatively to existing effects and potential effects of this alternative.

**Bearded Seals.**

- **No-Action Alternative**
- **Third Barge Alternative**

As noted in sections 3.3 and 3.5 bearded seals typically occupy ice near open leads as they follow the receding ice pack north each spring. Those leads are typically more than 3 miles offshore in the Portsite area. Bearded seals are hunted wherever they are most accessible to the hunters. Observations from the existing loader showed that bearded seals were relatively abundant along leads about 3 miles directly offshore from Portsite during the spring migration. Those observations and aerial counts did not show that bearded seals were less or more abundant offshore from Portsite than from other areas along the coast adjacent to Portsite.

Subsistence harvest data do not show any decrease in numbers of bearded seals harvested since Portsite was developed. Observations from the existing loader at Portsite indicate that bearded seals are approximately as abundant on the ice at Portsite and are about as close to shore there as they are elsewhere along the shoreline. The existing operations at Portsite have had no apparent affect on subsistence harvest of bearded seals. There is no indication that other human activities in the Chukchi Sea have affected the availability of bearded seals to subsistence hunters. Adding a third barge, which would be operated along with the two barges now used, would not increase effects as compared with the existing facilities or operations. There is no indication that existing development in the Chukchi Sea has affected subsistence harvest of bearded seals or that reasonably foreseeable future development would affect their harvest.

- **Breakwater/Fuel Transfer Alternative**

The breakwater would be about 1,350 feet directly offshore from the existing loader at Portsite. The breakwater would occupy about 13 acres of habitat well shoreward from the ice pack leads typically used by bearded seals. The fuel transfer pipeline and offshore terminal, however, would extend into areas used by bearded seals near Portsite. Burying the pipeline and installing the offshore mooring and terminal facilities would disturb about 9 acres in waters more than 30 feet deep where bearded seals are likely to occur. Modification of this small area of available habitat would not be likely to reduce feeding opportunities.

Bearded seals might be capable of detecting the bottom area disturbed by a buried pipeline and mooring system. There are no recorded observations of bearded seals avoiding habitat disturbed as it would be by this alternative, but traditional ecological knowledge as related by some hunters of the region indicates that avoidance is possible. If bearded seals avoided the fuel lines or breakwater, then a relatively small area of habitat, and a correspondingly small number of bearded seals might be displaced from a minor percentage of their habitat located 17 miles from the nearest hunting community. This indicates the possibility that small a number of bearded seals might be less available for subsistence harvest.

Bearded seals migrate north past the coast of Northwest Alaska each year. Although the seals are present each year, hunters of the region relate that weather, sea, and ice conditions cause considerable variation in the numbers taken each year. Those variations would have more effect on harvest than modification of a small percentage of available habitat 17 miles from the nearest hunting community. Direct effects would be locally less than significant and regionally would be negligible.

The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in Northwest Alaska that would cause additional cumulative effects to the harvest of bearded seals. Effects of climatic changes, which cannot be predicted with confidence, may have far greater influence on bearded seal harvest than existing or reasonably foreseeable future development, including DMT navigation improvements. Effects of navigation improvements at Portsite or other reasonably foreseeable development would be negligible in comparison with even minor climate changes that could greatly affect ice conditions and bearded seal distribution.

- **Trestle-Channel Alternative**

The channel for this alternative would extend into habitat used by bearded seals. The channel and disposal area together would substantially modify and would at least temporarily reduce productivity in as much as about 9.5 square miles of habitat used by bearded seals. There is no certainty that the loss of benthic productivity would translate into any loss in abundance of the shrimp and other organisms bearded seals eat, but there a possibility that there could be fewer shrimp until the bottom communities recovered, and consequently fewer bearded seals for subsistence harvest. The Portsite channel and disposal area would be about 17 miles from Kivalina, the nearest community with subsistence hunters.

There are more than 100 square miles of similar habitat in the same water depths between Kivalina and Portsite and many times as much area in deeper water used by bearded seals. This would be a negligible loss of the total spring migration habitat used by bearded seals, but loss of productivity at the disposal area and channel could cause a small percentage of bearded seals to be displaced to adjacent habitat in the region. This might reduce bearded seal densities at Portsite and increase densities in neighboring areas. Any displacement due to habitat modification would be short-term. The benthic invertebrate community near Portsite is made up of species that are motile or that would recolonize in one or two seasons. This indicates that construction of the Trestle-Channel Alternative would have minor, local, short-term effects on bearded seal habitat that might cause minor, short-term reductions in the number of bearded seals harvested by hunters from Kivalina. Broader regional effects would be negligible because the area affected would a small part of available habitat, during the principal hunting periods bearded seal eat shrimp and other marine organisms that can move back into the disposal area during the winter, and because effects would be temporary.

Maintenance dredging would produce about 20 percent of initial construction amounts several times during the economic life of the project. The channel and turn-around areas would be dredged during the open-water season when bearded seals rarely are present. Effects would be limited to the immediate disposal area with minor or negligible short-term local effects and negligible regional effects on subsistence harvest. The disposal site and restrictions on its use could be modified based on observations of seal behavior during and after initial construction.

Potential for cumulative effects would be approximately the same as for the Breakwater-Fuel Transfer Alternative. The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in Northwest Alaska that would cause additional cumulative effects to the harvest of bearded seals. Effects of climatic changes, which cannot be predicted with confidence, may have far greater influence on bearded seal harvest than existing or reasonably foreseeable future development, including DMT navigation improvements. Effects of navigation improvements at Portsite or other reasonably foreseeable development would be negligible in comparison to even minor climate changes that could greatly affect ice conditions and bearded seal distribution.

**Ringed Seals.**

- **No-Action Alternative**
- **Third Barge Alternative**

Ringed seals are abundant in the spring near Portsite. They have been observed on the ice within a half-mile of the existing barge loader. Although human activity can disturb ringed seals, there are a great number of ringed seals along the coast of the southwestern Chukchi Sea. During the spring of 2000, observers on the existing DMT loader at Portsite recorded more than 80,000 observations of ringed seals on the ice off Portsite (section 3.5.4.1). They are present longer than any other seals and can be hunted in shorefast ice closer to shore and earlier in the spring than is usually possible for other seals. During scoping for this DMT draft EIS, hunters from Kivalina and other communities indicated that they are able to harvest as many ringed seals as they require for subsistence, but prefer instead to hunt bearded seals because they produce better oil and meat. The existing loading facilities and activities at Portsite have had no apparent effect on subsistence harvest of ringed seals.

A third barge alternative would not alter facilities at Portsite or activities when ringed seals are hunted. This alternative would not affect subsistence harvest of ringed seals.

- **Breakwater-Fuel Transfer Alternative**

The breakwater and fuel pipeline would alter about 13 acres of habitat that may be used by ringed seals. Ringed seals could be displaced at least temporarily from those project areas and into adjoining habitat. This minor, localized distribution change would be unlikely to affect the numbers of ringed seals harvested by hunters in the Portsite area.

When the breakwater is surrounded by actively moving ice, it could create a down-current lead in the ice that could, in turn, attract ringed seals. Northwest Arctic Borough correspondence indicates this has been observed down-current from artificial islands in the Beaufort Sea, but studies on the effects of offshore developments in the Beaufort Sea show that the effects of development on the distribution and local abundance of ringed seals is inconsequential compared with natural forces (Moulton et al 2005).

The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in Northwest Alaska that would cause additional cumulative effects to subsistence harvest of ringed seals. The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in Northwest Alaska that would cause additional cumulative effects to harvest of bearded seals. Effects of climatic changes, which cannot be predicted with confidence, may have far greater influence on ringed seal harvest than existing or reasonably foreseeable future development, including DMT navigation improvements. Effects of navigation improvements at Portsite or other reasonably foreseeable development would be negligible in comparison to even minor climate changes that could greatly affect ice conditions and bearded seal distribution.

- **Trestle-Channel Alternative**

The Trestle-Channel Alternative would alter habitat in as much as 9.5 square miles of the Chukchi Sea bottom. That entire habitat is under ice that may be used by ringed seals. Habitat modification could reduce the value of the habitat in the project area and displace some of the ringed seals from that habitat and into adjacent habitat. Ringed seals are abundant near Portsite and along most of the northwestern Alaska coastline, so displacement at Portsite would be unlikely to affect the ability of local hunters to harvest all the ringed seals they require for subsistence.

The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in Northwest Alaska that would cause additional cumulative effects to subsistence harvest of ringed seals. Effects of climatic changes, which cannot be predicted with confidence, may have far greater influence on ringed seal harvest than existing or reasonably foreseeable future development, including DMT navigation improvements. Effects of navigation improvements at Portsite or other reasonably foreseeable development would be negligible in comparison with even minor climate changes that could greatly affect ice conditions and ringed seal distribution.

**Walrus.** Pacific walrus are rare visitors to the Portsite area and subsistence hunting is typically conducted far from shore. Walrus normally migrate north through the central Chukchi Sea in June along the receding edge of pack ice. They generally pass 30 to 40 miles or more offshore of Portsite, and are only occasionally brought near the Portsite on ice floes driven by currents and winds. Traditional knowledge tells us that walrus sometimes range near Portsite (Braund 1999), but Portsite is so far off the main migration route of the species that observations of walrus in the Portsite area are rare.

- **No-Action Alternative**
- **Third Barge Alternative**

The No-Action Alternative would leave the existing Portsite loading operations as they are now, while the third barge alternative would compress the same number of trips between the barge loader and the ships anchored offshore into a slightly shorter transportation season. There is no indication that construction, presence, or operation of existing DMT facilities at Portsite has affected local or regional harvest of walrus.

The Third Barge Alternative would not change the shipping season and the total volume of ore concentrate loaded. The Third Barge Alternative, like the No-Action Alternative, would not affect subsistence hunting for walrus.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would have a 13-acre footprint about 1,350 feet offshore in 24 feet of water. The breakwater and the fuel transfer alternatives would be constructed well outside the typical migratory range of Pacific walrus. Traditional knowledge tells us of walrus offshore of Portsite, but walrus are rarely present that close to the shore near Portsite.

Areas in the Bering and Chukchi seas where walrus concentrate to feed are generally associated with high benthic biomass, and are well known to science (Section 3.5.4.1). None of those areas are within 30 miles of Portsite. The Breakwater-Fuel Transfer Alternatives would not change the main migration path of walrus from the central portion of the Chukchi Sea, and would not diminish the opportunity to harvest walrus from Kivalina or other communities of the region.

The evaluation of reasonably foreseeable development in Section 4.12.5 did not identify any future activity in Northwest Alaska that would cause additional cumulative effects to subsistence harvest of walrus.

- **Trestle-Channel Alternative**

The Trestle-Channel Alternative would be constructed during the open-water season over 3 consecutive years. Construction would not begin until the ice had cleared the Portsite area and barges could reach Portsite. Ice normally clears Portsite by late June or early July. Pacific walrus migrate from the Bering Sea through the Chukchi Sea along the edge of the ice as it recedes and in summer and advances in winter. The general pattern of migration is described in Section 3.5.4.1. The main population of walrus migrates up through the central Chukchi Sea, and only seldom are small numbers carried near Portsite on currents. Walrus, with exception of possibly a few stragglers, would have migrated past Portsite by the time shipping or construction of the trestle at Portsite commences.

The disposal area does not contain the species or biomass found in areas where walrus typically feed in the Chukchi Sea. Use of the site for dredged material disposal would not affect walrus distribution during construction or operation of the Trestle-Channel Alternative and would not affect harvest closer to the central Chukchi Sea in the more generally used migratory pathway for walrus.

The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in Northwest Alaska that would cause additional cumulative effects to subsistence harvest of walrus.

**Polar Bear.** Polar bears are migratory and are generally found along the margins of polar ice where there are concentrations of ringed and other seals (Section 3.5.4.1). Most polar bears of the Chukchi Sea population migrate south in winter with the advancing ice. Most pregnant females move to inland or offshore denning areas, but some females den in snow caves on the ice. Most males, juveniles, and non-birthing females typically follow ring seal concentrations south, with many bears moving south along the coastline.

- **No-Action Alternative**
- **Third Barge Alternative**

Polar bears are occasional visitors to the Portsite area. The few that do reach the Portsite-Kivalina area are gone before shipping activities begin. There is no indication that they were ever a major subsistence component in the Portsite region, and no indication that the existing DMTS Portsite facilities or operations have substantially affected subsistence harvest of polar bears locally or regionally.

The Third Barge Alternative would not diminish opportunities for northwestern Alaskans to hunt polar bears.

- **Breakwater/Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

Polar bears are hunted in the southeastern Chukchi Sea primarily on the pack ice and are occasionally taken in the general Kivalina and Portsite areas. Any of the alternatives considered in detail would temporarily affect a comparatively small area of the polar bear habitat and prey species in an area of thousands of square miles used by this species. Effects on prey species abundance would be negligible. Polar bears are known to adapt to man-made structures and activity. Activity and potential for prey at or near structures could become a mild attraction for polar bears, although populations are so sparse in the area that this would be unlikely to affect harvest of these bears. Effects of any alternative considered in detail to subsistence harvest of polar bears would be locally and regionally negligible.

The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in northwestern Alaska that would cause additional cumulative effects to subsistence harvest of polar bears.

**Birds.** Portsite is on the migration route for many species of birds including waterfowl, seabirds, and terrestrial birds (section 3.5.5). During the spring migration, thousands of ducks, geese, loons, and other water birds migrate north and sometimes fly very low along the beach or over the near-shore ice. Most waterfowl shot for subsistence are harvested during the spring because they provide a welcome change in diet for subsistence users.

- **No-Action Alternative**
- **Third Barge Alternative**

The existing DMTS facilities and Red Dog mine have produced local long-term effects to relatively small areas of terrestrial and migratory bird habitat and cause minor, local effects to migration movements. The existing Portsite barge loading facilities are about 75 feet high and extend about 700 feet offshore from the beach. Traditional knowledge confirmed by observations of biologists tells us that when the wind blows hard from northerly directions in the spring, many duck and geese fly north low along the beach or over the near-shore ice. Some of those flocks fly around the seaward end of the barge loader while others gain altitude and fly over the top. During our observations at Portsite those northward-bound waterfowl bucking strong headwinds began to change their flight path about a half-mile south of Portsite and returned to their normal flight path along the beach within about a half-mile north of Portsite. The total length of the affected migratory pathway affected was approximately 1 mile. Some subsistence hunting takes place north of Portsite on the lagoons between Portsite and Kivalina, but the waterfowl returned to their normal migration path well before reaching hunting areas farther north.

Most Portsite activity, including the shipping season, starts after the main migration has passed, but a significant number of ducks and geese spend the summer near Portsite. Birds that stay in the area appear to be both breeders and non-breeders. These summer residents quickly become habituated to shipping activity at Portsite and spend the summer nesting or living near Portsite without apparent harm. In the spring of 2000, Corps biologists saw subsistence hunters killing geese in the North Port Lagoon and shooting at geese in the South Port Lagoon during marine mammal surveys from the Portsite barge loader observation platform.

Effects of the existing mine, road, and Portsite facilities on subsistence harvest of local and migratory birds appear to be both local and minor. The limited development and associated coastal and wetland habitat loss is unlikely to have substantially affected subsistence harvest of birds. Broader national and international factors affecting west coast waterfowl populations are probably more important as cumulative stressors than local effects of development and associated activity.

The Third Barge Alternative would not be expected to cause additional impact.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would be built about 1,350 feet offshore in 24 feet of water, and would have a 13-acre footprint. It would resemble a low island about 10 feet in elevation. The existing barge loader would be used for this alternative and the conditions described for the No-Action and Third Barge alternatives above would likewise apply. The breakwater itself would resemble one of the hundreds of low barrier islands these waterfowl encounter along their migration route and would not affect flight paths of duck and geese or the ability of local hunters to harvest them.

The fuel pipeline part of this alternative would use about 10 acres of sea bottom for the pipeline and PLEM, but would have no meaningful effect on feeding opportunities or migration. This part of the alternative would not be visible to migrating duck and geese and would have no effect on the flight path of duck and geese or the ability of local hunters to harvest them.

The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any future activity in northwestern Alaska that would cause additional cumulative effects to subsistence harvest of birds, including waterfowl.

- **Trestle-Channel Alternative**

Duck, geese, and loons were observed to fly low along the beach during northerly winds. Construction of a trestle and loader 1,050 feet farther seaward might increase the distance some waterfowl fly around the trestle and loader, but most effects on migratory pathways would be local and would cause negligible effects on subsistence waterfowl harvest.

Summer resident waterfowl would likely habituate to the proposed trestle as they apparently do to the existing trestle, and the ability of subsistence hunters to harvest these waterfowl would not likely be adversely impaired by the Trestle-Channel alternative.

The evaluation of reasonably foreseeable development in section 4.12.5 did not identify any reasonably foreseeable future activity in northwestern Alaska that would cause additional cumulative effects to subsistence harvest of birds, including waterfowl.

## 4.4 Air Quality

Existing air quality, climate, and related environmental factors are described in section 3.4. Exhaust emissions from diesel-powered generators, trucks, and equipment and fugitive dust from mining, trucking, and loading operations have been identified as effects of existing operations on local air quality. Fugitive ore concentrate dust has left visible coatings on the snow and ice in winter and on the water surface at times during the summer. Air pollutants of primary concern at Portsite are nitrogen oxides, sulfur oxides, particulate matter from diesel fuel combustion, and fugitive ore-concentrate dust containing high concentrations of lead, zinc, and cadmium.

Activities at Portsite and Red Dog Mine generate exhaust and evaporative and fugitive dust emissions. Exhaust pollutants are generated by electric power and heat generation equipment, and the fleet of diesel-powered light and heavy-duty trucks operating at the mine, DMT, and on the DMTS road. Evaporative emissions are primarily associated with the storage, transfer, and distribution of bulk fuel products. Currently, diesel (for summer use) and Jet A (for winter use) are the only fuels offloaded and stored in bulk quantities. Gasoline and other products that are used in much smaller quantities are generally delivered and distributed in drums. The combination of low temperatures typical at the site and the low volatility of the fuels

used results in only insignificant evaporative emissions.
Fugitive dusts, including ore concentrate containing high concentrations of zinc (Zn), cadmium (Cd), and lead (Pb), are released by mining, production, transportation, and loading operations throughout the year. During the shipping season, operations near Portsite generate exhaust pollutants in emissions from up to four bulk-carrier ships at a time anchored 3 to 5 miles offshore, and four tug boats that tend two unpowered lightering barges used to lighter concentrate from the terminal to the ships. Loading ore concentrate onto the barges and the offshore transfer to the ships also generates fugitive ore-concentrate dust during the shipping season.

Although substantial air emissions are produced at the mine, Portsite, and along the DMTS road, existing operations are not significantly impacting air quality in areas extending more than a few miles from the operations. An ambient air boundary has been established around the perimeter of the Portsite facilities. For compliance with regulatory and permit requirements, air at this boundary is evaluated against National Ambient Air Quality Standards (NAAQS) and Alaska Ambient Air Quality Standards (AAAQS). Air quality in operational areas within the ambient air boundary are protected and regulated by occupational safety and health standards. ADEC completed its latest evaluation of the operation and documentation associated with the Portsite facilities in April 2004. It covered the period from July 2002 through December 2003 and found the facilities to be in full compliance for that period.

Studies to investigate the impacts of fugitive ore-concentrate dust and spilled ore-concentrate at the mine, Portsite and/or along the DMTS road have been conducted by the NPS and TCAK. The investigations identified elevated metal concentrations associated with fugitive dust emissions and resulted in extensive equipment and operational modifications to reduce the release of ore concentrate dust from port and mine facilities and the trucks used to transport ore-concentrate. Recent modifications to reduce fugitive dust emissions at Portsite included a new truck unloading building, bag house, improved barge loader conveyor enclosure, and improvements at the concentrate storage buildings, conveyors, surge silo between conveyors, barge loader, and barges. New trucks and load covers, cleaning of equipment, and modified operating procedures are being used to reduce fugitive dust on the road and at Portsite. However, the process of double handling ore concentrate that includes loading of lightering barges at a fixed-position loader and subsequent offshore transfer to bulk freighters probably generates more fugitive dust than would be produced by direct loading of bulk freighters.

TCAK implemented air-monitoring programs at Portsite, Kivalina, and Noatak, and along the DMTS road to determine if unacceptable air quality impacts exist at locations away from operational activities. The results of the air monitoring indicate that air quality is not significantly impacted outside the immediate vicinity of the operations.

A risk assessment (TCAK 2005) is also currently being conducted to estimate the magnitude and probability of unacceptable risks to human and ecological receptors posed by current and future exposures to metals in soil, water, sediment, and biota in areas surrounding the DMTS. The human health risk assessment evaluates exposure to DMTS-related metals through incidental soil ingestion, water ingestion, and subsistence food consumption under three separate scenarios: (1) Child subsistence use, (2) Adult subsistence use, and (3) Combined worker/subsistence use. Based on the results in the draft report, the risks presented by the release of fugitive ore concentrate dust from the DMTS are well within generally accepted limits. The results support continued harvesting of subsistence foods without limitation. The ecological risk assessment evaluates the risks to receptors inhabiting terrestrial, freshwater, and coastal lagoon habitats. The results indicate an increased risk to some receptors adjacent to significant operations but show that risks and observable impacts are primarily limited to areas within about 100 yards of active facilities. Additionally, the observed impacts may be caused by a number of other factors and cannot be directly or easily associated with the ore concentrate component of fugitive dust emissions.

Effects of dust and combustion emissions from Red Dog Mine and the DMTS are cumulative with those from other existing emission sources in the NAB. Total electrical generating capacity of the NAB, an area the size of Indiana, is less than 100 megawatts, including the Red Dog Mine and DMTS generation. A large percentage of that generation is diesel-powered. Vehicular emissions are light because there is no interconnecting road system and relatively few vehicles. Barge traffic and ship operations associated with DMTS and Red Dog Mine in terms of ship and tug operating hours each year probably exceed all the other shipping in the Chukchi Sea combined, but barges delivering fuel and goods for regional and local distribution also contribute exhaust emissions. Wood burning for heat produces smoke in the communities and wildfires may also occasionally contribute smoke.

Each of the reasonably foreseeable future actions identified in Section 4.12.5 would increase fugitive dust and/or exhaust emissions. Each of those actions is relatively minor in comparison with the size of the NAB and should not cause substantial air quality problems provided standard permitting requirements and operating conditions are met.

<u>Data Quality</u>. *Although air quality is subject to a variety of environmental and operational factors, the precise methods of construction and types of equipment that would be utilized cannot be accurately forecast. The approach to construction, types of equipment that would be used, and the nature and characteristics of the facilities that would be constructed can be defined in general terms. Available meteorological, operational, and emission data are sufficient to determine the consequences of each alternative to air quality with reasonable certainty.*

- **No-Action Alternative**

With or without Federal action related to navigation improvements at the DMT, measures implemented by TCAK are likely to continue to reduce dust and related contamination along the DMTS road and some mine and terminal facilities. However, no changes to loading operations that would eliminate the double handling of the ore concentrate or significantly reduce the associated fugitive dust emissions would be likely. Fuel delivery, storage, and distribution operations would remain unchanged. There would be no short or long-term adverse or beneficial effects to local or regional air quality.

- **Third Barge Alternative**

This alternative would concentrate more of the ore concentrate loading into the early open-water season, but would not alter loading operations or associated fugitive dust emissions. Fuel consumption and associated exhaust emissions would increase by a small percentage due to the annual mobilization, operation, and demobilization of the third barge and the tugs needed to support it; additional barge conflicts at the loader, dock, and navigation lanes; and an incremental increase in hoteling near Portsite. Fuel delivery, storage, and distribution operations would remain unchanged.

There would be no construction-related air quality effects associated with this alternative. Direct effects of its operation on air quality would be local and minor. The increases in exhaust emissions from the mobilization, operation, and demobilization of the additional barge and tugs would be minor and primarily located offshore. The evaluation of reasonably foreseeable development in Section 4.12.5 indicates that most reasonably foreseeable future activities in northwestern Alaska would cause additional fugitive dust and exhaust emissions. Operation of this alternative would add a negligible increment to reasonably foreseeable cumulative effects to air quality, but would not likely cause any pollutant concentrations to exceed air quality standards or violate ADEC’s PSD Class II requirements.

- **Breakwater-Fuel Transfer Alternative**

Air quality in the immediate vicinity would be affected by construction and operation to a limited extent. Construction would temporarily generate minor amounts of additional fugitive dust and exhaust emissions. After construction, the breakwater would have a negligible effect on overall exhaust and fugitive dust emissions from loading operations. As fuel distribution patterns adapted to the efficiencies created by the fuel transfer portion of this alternative, exhaust emissions associated with fuel transfer activities would increase. Additional maintenance dredging and breakwater maintenance would also contribute a minor increment to local exhaust emissions.

Construction and maintenance activities for this alternative would primarily use diesel-powered tugs/barges, dredging equipment and land-based trucks, and heavy construction and drilling equipment. Fugitive dust emissions would be minimized by the wet working conditions generally associated with dredging, underwater drilling, and breakwater construction. Additionally, a requirement to maintain wet working conditions during land-based construction activities would mitigate the remaining fugitive dust emissions. Overall, construction-related increases in emissions would be minor and localized.

After construction, the breakwater would shelter the barge loading process from waves. This protection would increase safety and efficiency and would slightly reduce fugitive dust emissions during the barge loading process. It would not substantially affect exhaust or total fugitive dust emissions from ore concentrate loading.

Direct effects associated with this alternative would include minor effects to air quality during construction and operation. Those effects would be cumulative to existing emissions, but would not be expected to cause any pollutant concentrations to exceed air quality standards or violate ADEC's PSD Class II requirements. Future effects would be cumulative to other reasonably foreseeable and more distant potential developments discussed in Section 4.12.5. Those effects would also be primarily from fugitive dust and exhaust emissions. Operation of this alternative would add a minor increment to those emissions and to reasonably foreseeable cumulative effects.

- **Trestle-Channel Alternative**

Local air quality near Portsite would be affected by construction and operation of the new facilities. Construction activities would temporarily generate additional fugitive dust and exhaust emissions. After construction, operation of the ore concentrate loading facilities would be expected to reduce fugitive dust and exhaust emissions from loading operations, but additional electrical demand would increase exhaust emissions from power generation facilities. As fuel distribution patterns adapted to the efficiencies created by the fuel transfer portion of this alternative, exhaust emissions associated with fuel transfer and transportation activities would increase. Maintenance dredging would also intermittently contribute minor increments to local offshore emissions.

The dredging and construction activities would primarily use diesel-powered dredging equipment and land-based heavy construction equipment and trucks. Fugitive dust emissions would be minimized by the wet working conditions generally associated with dredging and underwater drilling and construction. Additionally, a requirement to maintain wet working conditions during land-based construction activities would mitigate the remaining fugitive dust emissions. Overall, construction-related increases in emissions would be minor and localized. Dredging operations would increase offshore exhaust emissions, but exhaust emissions from shore-based construction activities would be an insignificant component of the total emissions from Portsite facilities. Collectively, construction-related emissions would be intermittent, relatively minor compared with existing operations, and would stop at the end of each construction season. Emissions from dredging operations would usually be downwind, too far offshore, and too far outside the existing ambient air quality boundary to impact air quality or compliance at Portsite.

Operation of the proposed facilities would permit direct loading of ore concentrate into bulk carriers and eliminate the offshore transfer portion of the process where fugitive dust is more difficult to control. Improved loaders and better ship hatch and hold designs on ships would allow the loaders to discharge deeper into the ship's holds and would further reduce fugitive dust emissions by containing more of the transfer operation within the ship. The new conveyor system would be equipped with a vacuum system to minimize fugitive dust emissions. The amount of fugitive dust released by the existing loading operations has not been quantified. However, direct loading of ore concentrate into bulk carriers could substantially reduce the fugitive ore concentrate dust emissions from current levels.

The proposed loading facilities would also eliminate most of the existing tug operations and the associated marine-based exhaust emissions. However, this alternative would require about 2 megawatts of additional electrical power generation capacity at Portsite. The increased electrical demand would result in additional exhaust emissions from land-based power generation facilities during the shipping season (July thorough October). Assuming that emission rates per unit generated associated with the new power generation equipment would not be significantly greater than the existing power generation equipment, the relative increase in capacity would not result in violations of AAAQS, NAAQS, or violate ADEC PSD Class II requirements. Overall, operation of the new loading facilities would reduce annual diesel fuel consumption and shift some remaining fuel consumption to less polluting shore-based power generation facilities operated under more controlled conditions and equipped with superior pollution control systems.

Direct effects of this alternative on air quality would be localized and minor. Those effects would be cumulative to existing sources and the reasonably foreseeable and more distant potential developments discussed in Section 4.12.5. Those effects would also be primarily from fugitive dust and exhaust emissions and would not likely cause any pollutant concentrations at Portsite or cumulatively in the NAB to exceed air quality standards or violate ADEC's PSD Class II requirements. Operational reductions in fuel use and exhaust and fugitive dust emissions would improve local air quality after the facilities were constructed. The additional generation capacity and new equipment used to control fugitive dust emissions would require air quality control permits and modifications of existing permits for their construction and operation. The non-Federal project sponsor would be responsible for permits to construct and modifications of permits to operate the facilities. Those permits would be reviewed by regulatory agencies for compliance with State and EPA air quality standards.

## 4.5 Geology and Soils

The region's soil and geologic characteristics and mineral, oil, coal, and natural gas resources are described in sections 3.4.3 and 3.4.5. Reasonably foreseeable and more distant potential development and the potential for navigation improvements at Portsite to influence future development in northwestern Alaska are discussed in Section 4.12. The potential for each alternative to affect existing geologic conditions, processes, and resources is discussed below.

*Data Quality. Available data are sufficient to determine consequences of each alternative to geologic, mineral, soil, and beach material processes and resources.*

None of the alternatives considered in detail would directly affect mineral extraction or geologic resources on land. Although about 3.5 acres of wetlands adjacent to existing facilities would be filled to construct new facilities for the Trestle-Channel Alternative, none of the alternatives considered in detail would appreciably affect upland soils or geologic resources. No other reasonably foreseeable or more distant potential developments have been identified that would directly impact geologic resources in the southeastern Chukchi Sea. As noted in Section 4.12, the large number and high variability of the factors that would contribute to a decision to expand metallic ore or coal mining in the region do not permit reliable evaluation or forecasting of the those developments. Indirect effects on mining and regional development are addressed in Section 4.12.

The only potential direct effect identified during scoping and resource data collection was related to beach processes. Waves and near-shore currents move sand, small gravel, and sediment south along the beach. The existing loading facility does not appear to have affected this movement, but the smaller solid-fill dock used for tug moorage and cargo transfer from barges appears to have interrupted this movement and to have altered the contour of the beach in the Portsite area (figure 3-19). This has led to concerns about beach erosion south of Portsite. More details relevant to potential impacts and an evaluation potential impacts to local bathymetry and sediment transport dynamics are presented in Section 4.6.1.

## 4.6 Oceanography

The region's wave, tide, current, ice, and bathymetric characteristics are described in Section 3.4.6. Scoping identified concerns that a channel running from shallow to deep water might affect currents flowing across it or might create a "rip tide" effect with water flowing seaward. There also were concerns that structures in the water or discharged material might affect currents, ice, or the other physical features of the Chukchi Sea. Principal oceanographic concerns related to construction were that dredging and dredged material discharge would increase suspended material and turbidity with subsequent effects on fish and other organisms. There was concern about water quality related to many aspects of mining and handling ore concentrate. Those concerns included fear that marine waters and sediments were contaminated by concentrate lost during loading.

Existing coastal development is minor and localized in the southeastern Chukchi Sea. Reasonably foreseeable and more distant potential development and the potential for navigation improvements at Portsite to influence future development in northwestern Alaska are discussed in Section 4.12. None of those reasonably foreseeable future actions would substantially affect oceanography in the southeastern Chukchi Sea. No other reasonably foreseeable or more distant potential developments have been identified that would cumulatively impact oceanographic processes or conditions in the southeastern Chukchi Sea, except that changes in climatic, ice pack, and sea level could cause substantial changes beyond the reasonably foreseeable future as it is defined in Section 4.12. The potential for each alternative to affect existing oceanographic processes and conditions is discussed in each subsection, below.

*Data Quality. Available data are sufficient to determine consequences of each alternative to oceanographic processes and conditions with reasonable certainty.*

### 4.6.1 Bathymetry

- **No Action Alternative**
- **Third Barge Alternative**

Existing barge operations appear to have caused a small, localized increase in depth of about 2 feet near the barge loader, and the existing solid-fill dock interrupts sediment transport along the beach. The increase in depth is likely attributable to scouring by prop-wash from tugs as they power-up to move loaded barges. This minor depression in the bathymetry would fill if tug operations ceased.

Under the No-Action and Third Barge alternatives, existing scouring and interruption of beach processes would continue. The effects to the transport of beach material would continue to be mitigated, to some extent, by excavation and mechanical transport of material past the dock. This on-going action may have prevented more extensive erosion, but has not fully replaced natural processes.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would be a linear island covering about 13 acres of sea bottom along the –24 MLLW contour offshore from the existing loading dock. The breakwater would add rock, a relatively rare substrate type to the environment, which would replace soft-bottom habitat that would be lost.

The depression in bathymetry described for the existing conditions would continue to exist. The breakwater would also be expected to accelerate the accretion of coarse sands and gravels north of the existing dock. Those sediments would be expected to build outward from the beach north of the dock resulting in a shallower beach slope on the north side of the dock. The accreted material would be dredged or excavated and deposited along the active portion of the beach south of the project to simulate natural sediment transport processes.

A trench would be dredged in the sea bottom to install the fuel transfer pipeline. It would be about 10 feet deep with sides sloping at roughly 1 vertical to 3 horizontal. The trench would begin in water about 24 feet deep and run seaward into water about 55 feet deep. A trench of this dimension would have a negligible effect on physical oceanographic processes. After installation, the trench would be back-filled with imported material and capped with concrete below the bottom surface elevation to prevent the pipeline from floating or being damaged. Migrating sediment would eventually cover the trench. Sedimentation data used to predict channel maintenance requirements indicate a sediment rate of about 4 inches per year 3 miles offshore and faster rates near shore. The concrete cap could be covered by about 4 inches of sediment within about one year after construction. The effects from the fuel transfer components on regional bathymetry would be negligible.

After construction, the breakwater would reduce inshore wave energy near Portsite and interrupt sediment transport in the area. The rate of accretion would be dependent on the frequency of severe storms out of the northwest that account for the net southern drift of beach material. Under existing Portsite conditions, roughly 5,000 cubic yards of sediment are mechanically moved from the north side of the dock to the south side of the dock annually to maintain access to the dock and for beach nourishment. With the Breakwater-Fuel Transfer Alternative, an estimated 26,000 cubic yards would be moved annually for an estimated net increase of about 21,000 cubic yards per year. This would avoid locally significant adverse effects on beach material transport along the coast of the southeastern Chukchi Sea at DMT. This periodic Federal dredging would prevent large-scale effects. The breakwater would not substantially affect the existing character of the beaches south or north of Portsite.

Direct effects of the breakwater-fuel transfer alternative on local and regional bathymetry would be minor and localized. Those effects would be cumulative to the effects from future actions. However, no reasonably foreseeable future actions would contribute to the bathymetric effects of this alternative.

- **Trestle-Channel Alternative**

The sheet-pile cells could cause minor local depressions or mounding at the piling bases and cause the accretion of a total of about 26,000 cubic yards of material along the beach north of the solid-fill dock. Annual by-pass dredging would be conducted as a Federal project feature and would protect the flow of beach material to the south of Portsite in the same manner as the Breakwater-Fuel Transfer Alternative.

Dredging for the channel, turning basin, and berthing area would create a seafloor depression, including required over-depth dredging for efficient maintenance (RODFEM), of as much as 39 feet deeper than the existing sea floor. The sides would slope at about 3 horizontal to about 1 vertical after construction, but would soon slump to about 10 horizontal to 1 vertical, or about roughly the same or a little less than the natural beach slope at Portsite or Kivalina. Initial dredging for the channel, turning basin, and berthing area would remove about 8.1 million cubic yards of bottom material and deposit it in an offshore disposal site. The dredged areas, including a sediment accumulation sump, would accumulate about 70,000 cubic yards of sediment per year. Sedimentary material in the deeper water where maintenance dredging would be conducted is finer and is transported in through different processes than the beach material.

Disposing the dredged material at the proposed ocean disposal site would raise the sea bottom there. If the estimated 9.3 million cubic yards of material from the initial construction and first maintenance dredging effort were evenly distributed over the entire site, the lift thickness would be about 1 foot. However, the material would not be evenly distributed over the entire site.

Based on the volumes, sea conditions, and the general types of equipment that would be used, it is estimated that approximately 3,000 disposal actions from a hopper dredge, barge or scow would likely be performed over three construction seasons. Overall, the relative compositions of gravel, sand, and fines that would be dredged for initial construction is estimated to be about 6 percent, 25 percent, and 69 percent, respectively. Based on the relatively large number of disposal events and the fact that the proposed dredged material is composed primarily of fines, the overall distribution of material would be relatively uniform over the majority of the receiving seafloor. However, for individual disposal actions, the distribution would be dependent on the composition of the dredged material, depth of water, and the equipment used to dredge and dump it. Because particle size and density are the primary factors that determine particle settlement rates, gravel would be dispersed over a smaller area than sand, and sand would be dispersed over a smaller area than the fines.

To contain the material within the site boundaries, no direct placement of material along the margins of the site would be allowed. Based on the composition of the material, anticipated currents and the general types of equipment expected to be used, the material from a single dump from a large moving hopper dredge containing 4,600 cubic yards of typical bottom material would probably be deposited in mounds 1 to 3 feet high containing most of the fines and nearly all the sand and gravel portions. The primary mound would cover up to about 2 acres. Beyond the primary mound, a relatively small amount of finer material would be dispersed in a gradually thinning layer down current. Material from clamshell dredges and dumped from smaller barges or scows would typically be deposited in mounds of similar height but would cover a smaller area.

To maintain the maximum lift thickness and elevation limits, care would be exercised to avoid placing multiple loads at precisely the same location. Information from current gauges that could be deployed near the disposal site could be combined with Global Positioning System (GPS) data associated with individual disposal events and bathymetry data obtained during construction and used to track deposition and prevent the creation of large mounds of material.

Up to about 2,000 acres of seafloor would likely be covered with 1 foot or more of dredged material annually during construction. A total of about 2,500 to 3,500 acres within the 5,600-acre site would be covered with 1 to 5 feet of dredged material from initial construction work. Due to predominant northward currents, most of it would be deposited in the southern and central portions of the site. Depending on the equipment and processes utilized, about 1,500 to 2,500 additional acres of seafloor within the site would be covered with less than 1 foot of dredged material consisting primarily of fines transported by currents. This would not produce enough change in the bottom to significantly affect currents or other physical processes. Overall, the effects of the trestle-channel alternative on local and regional bathymetry would be no more than minor and local.

In the regional context, the direct effects of the Trestle-Channel Alternative on local and regional bathymetry would be relatively minor and localized. Those effects would be cumulative to the effects from future actions in the region. However, no reasonably foreseeable future actions would contribute to the bathymetric effects of this alternative.

### 4.6.2 Currents

- **No-Action Alternative**
- **Third Barge Alternative**

Existing DMT development has no appreciable effect on currents at Portsite. The No-Action and Third Barge alternatives would not impact existing currents.

- **Breakwater-Fuel Transfer Alternative**

The fuel transfer system would not affect currents. The breakwater would form a reef that would slow currents downstream of the structure. The effects would be relatively minor, local, and would not be noticeable away from the project. Overall, the effects of the Breakwater-Fuel Transfer Alternative on currents would be negligible.

- **Trestle-Channel Alternative**

Pilings for the trestle and loading platform would create small eddies in the currents, but would have no other effect on currents. The effects on currents would be negligible, but might be enough to serve as a minor fish attractant. The dredged channel, turning basin, and berth would have little effect on currents. The net effect of the channel would be to provide a greater cross-sectional area to water flowing over it. Current would slow slightly as it flowed across the channel and returned to its original velocity down current of the channel. A “rip tide” is created when waves bring water into shore over a shallow reef or sandbar. Water running back out to sea tends to flow out through channels perpendicular to the beach that cut through a reef or sandbar. There is no reef or sandbar at Portsite where water brought in by waves can flow seaward through channels and create a “rip tide.” Overall, both direct and cumulative effects of the Trestle-Channel Alternative on currents would be negligible.

### 4.6.3 Ice

- **No-Action Alternative**
- **Third Barge Alternative**

The No-Action and Third Barge alternatives would not affect ice conditions at Portsite beyond the effects that are observed there now. Currently, drifting ice sometimes makes contact with the existing loader during breakup. In June 2000, Corps biologists observed a sheet of shorefast ice several miles long and a few miles wide suddenly move north and contact the outer cell of the existing loader. The ice formed a large ice pile on the leading edge of the cell and a corresponding open lead on the downcurrent side of the cell. The ice sheet eventually made contact with the beach south of Portsite and split in two at the cell where one part of the sheet continued to drift north toward Kivalina and the other part came to a rest against the cell and the beach. An expanse of open water formed between the parting floes. Similar ice movement is expected to continue under the No-Action or Third Barge alternatives.

The existing direct effects on local and regional ice conditions would be cumulative to the effects from future actions. However, other than the navigation improvements that are the subject of this DEIS, no other reasonably foreseeable actions would affect ice conditions near Portsite.

- **Breakwater-Fuel Transfer Alternative**

The fuel transfer system would have no effect on ice. The breakwater would have little effect on ice when the breakwater was in the shore-fast zone. When the breakwater was in the actively moving ice zone, the ice would pile up on the breakwater and overtop it or pile up behind it if forces moving the ice were strong enough.

Direct effects of the Breakwater-Fuel Transfer Alternative on local and regional ice conditions would be minor and localized. Those effects would be cumulative to the effects from future actions. However, no reasonably foreseeable future actions would contribute to the ice-related effects of this alternative.

- **Trestle-Channel Alternative**

The channel would not substantially affect ice movement or accumulation, although there might be a tendency for very deep floating ice masses to collect in the channel under some wind and current conditions.

The trestle pilings would be most likely to affect sea ice during the fall when it is first forming and in the spring during breakup when large sheets of shorefast ice sometimes drift north on the current. During winter the trestle pilings might stabilize shorefast ice in their immediate vicinity (D. Hinna personal communication), but if mass movement of shorefast ice was to occur, a large floe would likely drift north during which the trestle pilings could form narrow leads on the downcurrent side. Leads formed by the trestle pilings are expected to be similar to those formed downcurrent of the STRICE ice research station lighthouse in the North Sea (STRICE 2003, figure 4-1). The STRICE lighthouse is 24 feet in diameter (7.2 meters) and forms a narrow lead in thick, unbroken ice as far as can be seen (Kolari personal communication) and possibly until the lead freezes closed. Leads formed in new, thin ice in the fall are expected to be similar in appearance, but would tend to freeze closed rather quickly. Leads formed in broken ice during spring breakup could close quickly or remain open for extended distances depending on the prevailing wind and currents.

**Figure 4-1.** Formation of lead down current of the STRICE research lighthouse in the North Sea (used with permission).

Direct effects of the Trestle-Channel Alternative on local and regional ice conditions would be minor and localized. Those effects would be cumulative to the effects from future actions. However, no reasonably foreseeable future actions would contribute to the ice-related effects of this alternative.

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### 4.6.4 Sediments

- **No-Action Alternative**
- **Third Barge Alternative**

With the No-Action or Third Barge alternatives, ore concentrate dust lost from loading operations would continue to accumulate on and in sediments near Portsite. Tests on samples collected in 2000 reported levels of ore concentrate-related metals in surface sediment near the loading operations at greater concentrations than in other surface samples from the surrounding area. The amounts present were well below levels that are generally considered thresholds for concern, but indicated a potential to accumulate to levels that could require action sometime in the future. Results from subsequent studies that included samples collected as recently as 2004, (TCAK 2005), indicate that metals concentrations in sediments impacted by existing loading operations continue to be below conservative sediment screening levels that are intended to preclude observable adverse impacts to marine organisms. Results from the final risk assessment report are expected to be available for incorporation in the final EIS.

Only minor local changes in bottom sediments have been realized under existing conditions. Erosion of sediments around the barge loader by scour from the tug operations and accumulation of ore-concentrate-related metals in sediments near loading operations would continue if a construction alternative was not implemented.

Those effects would be cumulative to the effects from future actions. However, no reasonably foreseeable future actions would contribute to the existing sediment-related effects.

- **Breakwater-Fuel Transfer Alternative**

The Breakwater-Fuel Transfer Alternative would have the same effects as the No-Action Alternative, except there may be a small decrease in amount of ore concentrate that is lost at the barge loader due to improved wave protection and that bypass operations to remove accumulated sediment would need to move more material each year because littoral materials would tend to accrete at a faster rate on the north side of the existing dock. It would not cause any other direct or cumulative effect that would change the chemical or physical characteristics of local or regional sediments. The potential for minor local beneficial effects to sediment chemistry would be cumulative to the effects from future actions. However, reasonably foreseeable future actions would not contribute to the sediment-related effects of this alternative.

- **Trestle-Channel Alternative**

The trestle channel alternative would have more effect on sediments than the other alternatives considered in detail. Initial dredging would excavate 8.1 million cubic yards of bottom material and dispose of it in deeper water off Portsite. It would eliminate double handling of ore-concentrate and create a cleaner and more efficient loading operation that significantly reduces the loss of ore-concentrate to the environment. Periodic dredging to maintain depths in the berthing area would prevent future accumulation of any ore concentrate that was lost during loading operations. Although a large volume of sediments would be dredged and disposed of over the life of the project, regional sediment transport process would be maintained, sediment chemical, and physical characteristic changes would be no more than local and minor. Reasonably foreseeable future actions would not contribute to sediment-related effects of this alternative.

### 4.6.5 Marine Water Quality

Scoping identified three primary marine water quality concerns related to effects of existing operations at Portsite and potential navigation improvements there. They were: potential water contamination from spills or release of ore concentrates; potential increases in turbidity and suspended solids and their attendant effects on biological processes, and potential for fuel spills during fuel transfer and by vessels transporting ore concentrate and fuel. Those concerns are given particular attention in this section.

Existing water quality at Portsite meets all applicable standards and is typical of the southeastern Chukchi Sea. Water quality at Portsite is affected to a minor degree by discharge of treated sewage and release of ore concentrate during the loading process. Fugitive ore concentrate particles may be present in the water column, but have not regularly been identified in water quality samples from Portsite. Water quality elsewhere in the southeastern Chukchi Sea is affected by treated and untreated sewage discharge, metals from naturally occurring minerals, and industrial pollutants brought in by currents and mixing from oceans around the world.

#### 4.6.5.1. Ore concentrate spills

Although some ore concentrate is lost during loading, and sediment collected from the bottom near the existing loader contained elevated metals concentrations, water quality at Portsite is similar to other marine water in the region. Since metals have not accumulated to hazardous levels in the sediment near the barge loader (Section 3.4.6.4), this indicates that amounts of ore concentrate lost are relatively small and/or are rapidly dispersed by water currents and sediment transport mechanisms. Although there have been no significant spills from loaded barges, the potential for a much larger spill from major damage to lightering barges carrying thousands of tons of ore concentrate during hundreds of trips per season exists.

No-Action and Third Barge alternative. If a construction alternative were not implemented, the amount of fugitive dust released would not change appreciably. The level of risk associated with a large release from a loaded barge may increase with the Third Barge Alternative due to increased exposure and traffic. Based on existing data, it does not appear that fugitive dust from continued operation would jeopardize marine water quality. However, if 5,000 tons of ore concentrate were spilled during a storm or as the result of an accident or mechanical failure, water quality in the immediate vicinity of the spill would be temporarily degraded. The magnitude and persistence of the impacts would depend on the volume spilled, location, and a number of environmental factors. It would probably not be feasible to recover the material. The water quality impacts would probably decrease rapidly and not be measurable in the water column after a year. Effects of ore concentrate spills would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly to ore concentrate spills near Portsite or anywhere else in the nearby marine environment.

Breakwater-Fuel Transfer Alternative. Once constructed, fugitive dust emissions from ore concentrate loading operations would continue but might be slightly reduced at the barge loader. The risk associated with a large ore concentrate spill from a loaded barge during a storm would be reduced by the wave protection afforded by the breakwater. However, the risk of a large spill caused by an accident or mechanical failure would not change appreciably. Offshore ore concentrate transfer operations would remain unchanged. The effects would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly to ore concentrate spills near Portsite.

Trestle-Channel Alternative. After construction, the loss of ore-concentrate from loading operations would be reduced by the elimination of the double-handling requirements and use of more efficient equipment. The potential for a large spill from lightering barges would be eliminated. The effects would be cumulative to existing and reasonably foreseeable future actions.

#### 4.6.5.2. Turbidity and Suspended Solids

Activities that suspend particulate matter in the water column increase turbidity and decrease local dissolved oxygen concentrations. Impacts to dissolved oxygen concentrations are typically limited to smaller areas than turbidity plumes. Two factors, the time it takes suspended material to precipitate and the current velocities within the impacted water bodies, determine the size and migration characteristics of construction-related turbidity/suspended solids plumes. Precipitation times are highly dependent on, and inversely related to, particle size and density. The largest impacts to turbidity would be generated by dredged material disposal. During disposal activities, loads containing more gravel/sand and fewer fines would settle out quickly, while loads containing higher proportions of fines would tend to spread out over a larger area down current. Dredged material disposal, from both initial and maintenance dredging, is addressed in Appendix 2 and is incorporated here by reference and in summary form. Material suspended during dredging activities is not addressed in Appendix 2 and is considered in this section.

No-Action and Third Barge Alternative. The No-Action and Third Barge alternatives would not affect existing turbidity or suspended solids concentrations. Dredging to prevent beach erosion south of existing facilities would continue to cause relatively minor, intermittent, and temporary increases in turbidity and suspended solid concentrations and negligible decreases in dissolved oxygen concentrations in local marine waters. The effects would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly in turbidity or total suspended solids (TSS) concentrations near Portsite.

Breakwater-Fuel Transfer Alternative. Dredging and side-casting material for construction of the fuel line for the Breakwater-Fuel Transfer Alternative would cause short-term, local increases in turbidity that would be limited to the area immediately adjacent to the trench and within about 1 mile down current during relatively strong current events. Effects would be minimized by the trenching and side-casting methods that would keep dredged material close to the bottom and keep the resulting sediment plume in the lower water column where it would not be visible and settle out quickly. Dredging to prevent beach erosion south of existing facilities would continue to cause relatively minor, intermittent, and temporary increases in turbidity and suspended solids concentrations and negligible decreases in dissolved oxygen concentrations in local marine waters. The effects would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly in turbidity or TSS concentrations near Portsite.

Trestle-Channel Alternative. Dissolved oxygen levels in aquatic habitats may be reduced by the introduction of high concentrations of suspended particulates, particularly organic material, generated during dredging and open-water disposal operations. However, the reduction in dissolved oxygen concentrations associated with dredging is usually relatively small and brief (Nightingale and Simenstad 2001). In the open-water conditions offshore from Portsite, dredging effects on dissolved oxygen would be negligible.

During construction, dredging/disposal, and filling activities would cause temporary increases in turbidity and suspended solid concentrations and decreased dissolved oxygen concentrations in local marine waters. Suspended particulates would impact water quality in the vicinity of the activities and down current for an extended period of time. The size of individual plumes would depend upon the amount of fine particles in the material being dredged, the means and methods of dredging and disposal, and the currents at the dredging and disposal sites. When the current was unusually fast (more than 1 knot), the turbidity plume might be visible for several miles down current.

Based on potential water quality impacts from disposal activities, the Alaska District used the numerical model STFATE to determine the fate of the dredged material after disposal. The results are summarized below. Complete results of settling tests and model results are presented in Appendix 2.

The model was run assuming the use of a six-bin hopper dredge with a capacity of 10,000 $yd^3$ traveling at 12 feet per second. Until the dredging contract is awarded, the type of equipment (a hopper dredge is presumed because of the large quantity of material, short dredging window, and the sediment composition) will not be known. However, the assumptions used to run the model are conservative because the 10,000-cubic yard hopper dredge assumed for the STFATE model is at the large end of the dredges that would likely be used. Additionally, for safety reasons, it is unlikely that the dredges would be loaded to capacity. Thus, water quality impacts from individual disposal events would be expected to be lower than those predicted by the model. Disposal volumes and water quality impacts associated with material from barges or scows from clamshell operations would be smaller

The model followed the silt plume for a distance of over 2 miles. Suspended solid concentrations at three depths (18, 45 and 60 feet) were estimated at 20, 40, 60, and 80 minutes after disposal. The predicted near-surface (18-foot depth) plume is presented at 20-minute intervals in figures 4-2 and 4-3.

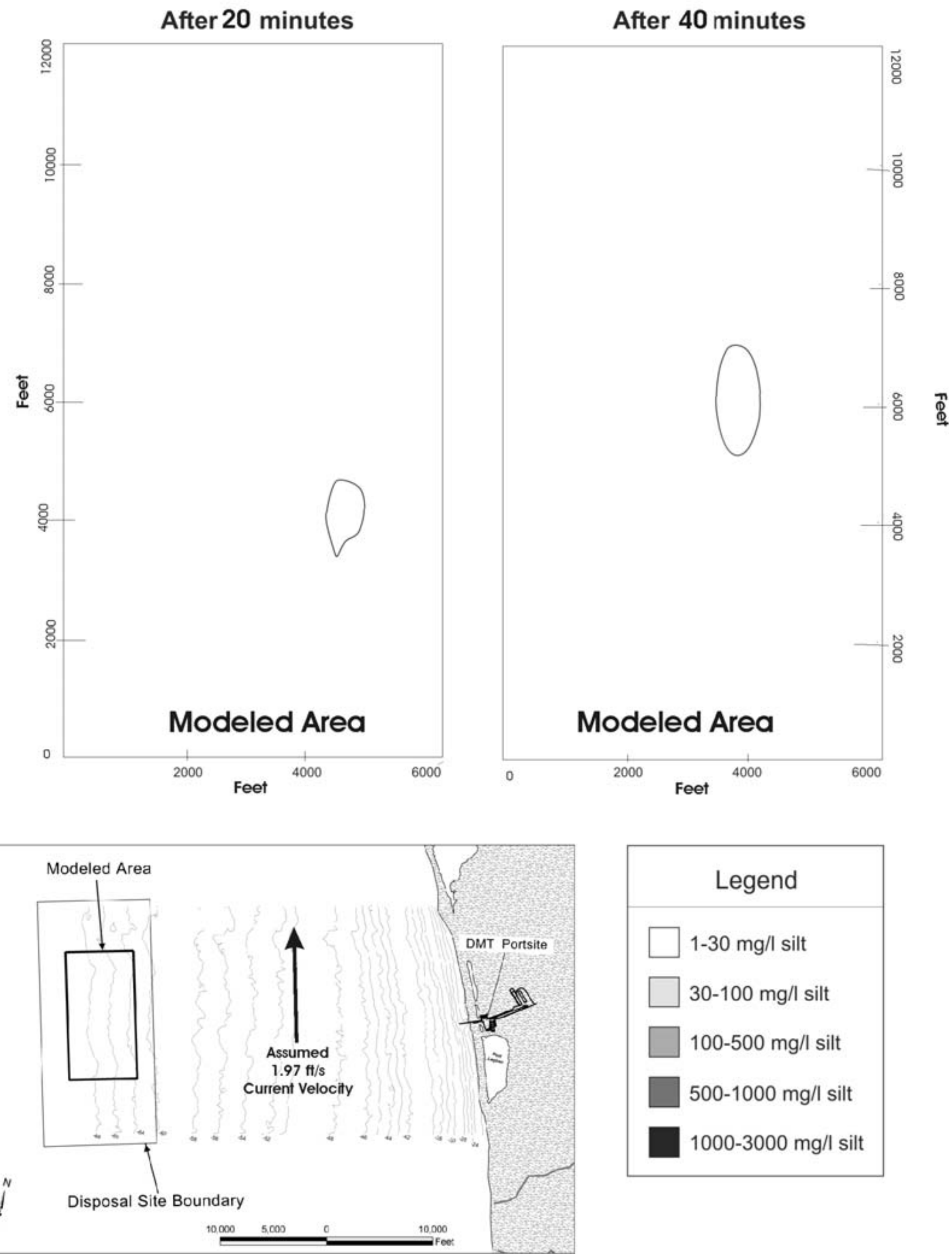


**Figure 4-2**: Suspended solids concentrations at 18-foot depth.

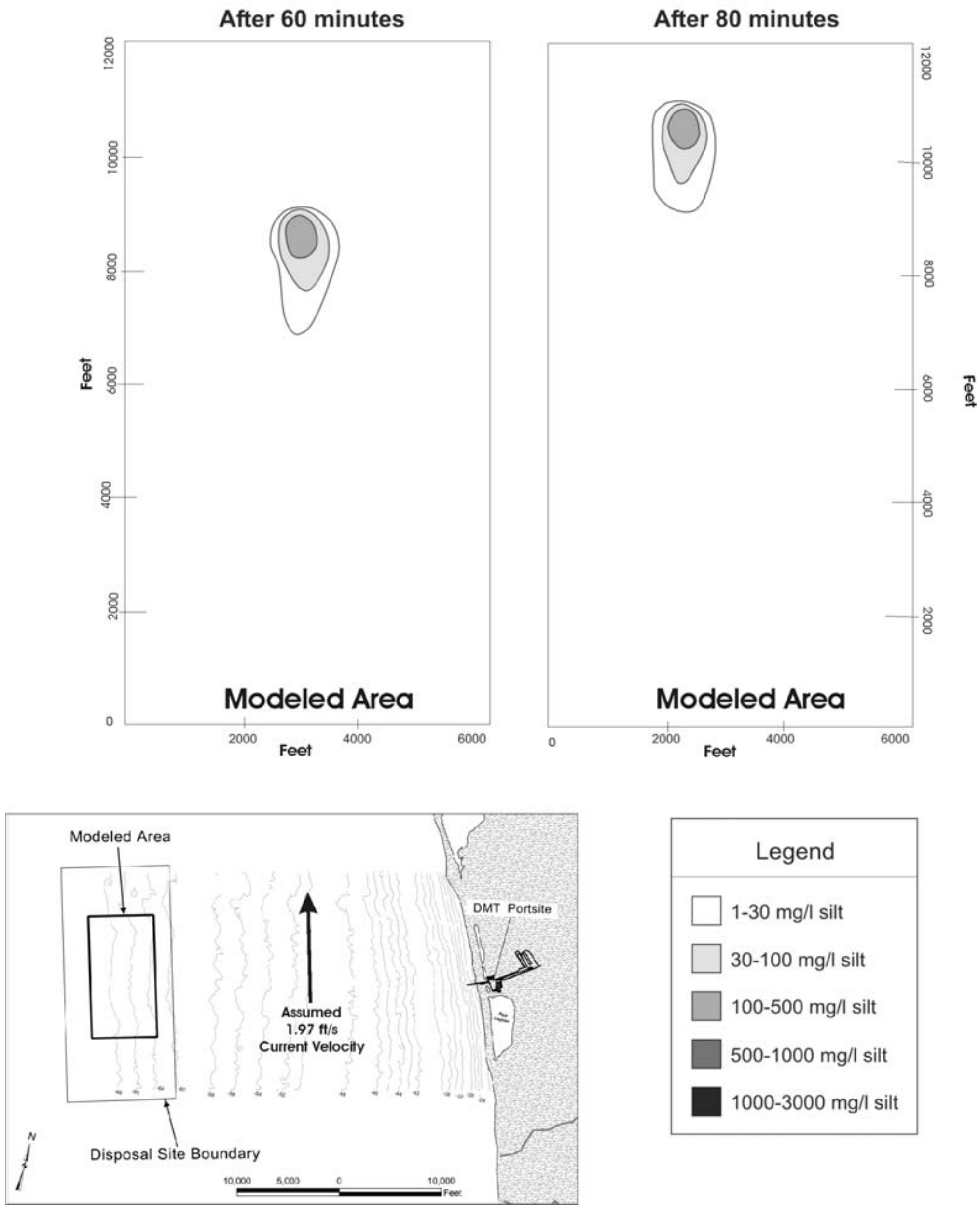


**Figure 4-3**: Suspended solids concentrations at 18-foot depth.

Based on the results of the model, sediment testing, local conditions, and the equipment likely to be used, dredging and disposal operations would nearly continuously generate plumes of suspended particulates that would extend various distances down current from the sites during the dredging intervals. Total suspended solids (TSS) concentrations from 5.8 to 13.4 mg/L were measured under relatively calm but typical summer conditions offshore of shipping operations. Samples from near shore ranged from 8.8 to 74.8 mg/L. Sediment testing and column settling results indicate that TSS concentrations would be greatly increased during dredging and disposal operations but would decrease significantly in the first 2 hours after release. In general, disposal operations would generate greater water quality impacts than dredging operations. The plume at the disposal site may be visible from the surface 2 to 3 miles down current from disposal activities under typical conditions and up to 5 to 7 miles down current under more severe wave and current conditions. Sea conditions that would extend the plume beyond 5 to 7 miles would be rare and probably would noticeably increase ambient turbidity and TSS.

Settling of the proposed dredge material and the anticipated migration characteristics of the related TSS plume were used to determine the appropriate size and approximate orientation of the proposed disposal area. Changes in bathymetry at the 5,600-acre disposal area due to sediment deposition would vary depending on the specific dredging and disposal methods and particle sizes in the individual loads being disposed of. The tentatively recommended disposal area averages about 70 feet deep. To maintain navigability for deep-draft vessels, no mounding above –55 feet MLLW would be allowed.

Additional sediment requiring disposal would be generated from boring holes for pilings. Side-casting the boring material (estimated at 240 cubic yards) adjacent to the piling sites would create local, short-term turbidity. Overall, construction-related impacts would temporarily degrade local water quality, but not result in any long-term, adverse impacts to marine water quality. A short-term variance from water quality regulations would be required for construction activities.

The dredging contractor would select the dredging method and equipment but would be required to meet contractual and state and federal water quality requirements including requirements specified in the short-term variance and to place material in the up current portion of the disposal area. Although the turbidity plumes associated with the disposal events would be larger than the plumes associated with any other activities, the effects would be temporary and primarily confined to the disposal area. Turbidity plumes might be visible to about 3 down-current miles from the disposal site under some conditions, but such conditions would likely be infrequent and temporary because the conditions that would cause the plume to migrate that distance would be infrequent. Conditions severe enough to cause maximum down-current sediment plume migration might be severe enough to halt dredging and disposal operations.

After construction, the dredged channel would accumulate sediments that generally are moved north by bottom currents. Maintenance dredging of the channel and turning basin is planned for years 5, 17, 33, and 49, with each effort removing between 1.1 and 1.2 million cubic yards of material. The sediment generated during construction and maintenance dredging efforts would have similar chemical and physical characteristics, but due to the smaller volumes involved, water quality impacts from maintenance dredging would be less than during construction.

Overall, the effects of the Trestle-Channel Alternative on turbidity, TSS, and dissolved oxygen concentrations in marine water would be minor. The effects would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly in turbidity, TSS or dissolved oxygen concentrations near Portsite.

#### 4.6.5.3. Petroleum Spills

In the 16 years of operation at Portsite, the largest single spill of petroleum products into marine waters was about 40 gallons of hydraulic fluid from a ship loader on the DMT loading platform. During the project life to date, with more than 200 million gallons of fuel offloaded to Portsite, the largest single spill of diesel (or similar jet fuel) into marine waters was 0.13 gallons. This record is due in part to the relative simplicity of the existing fuel transfer system and to exceptional operating standards that require fuel lines to be inspected at least weekly throughout the operating season and hourly during fuel transfer operations. Operation procedures and operator training also apparently have contributed to this record.

A fuel spill risk-analysis is presented in Appendix 10. It presents an evaluation of the potential for the construction and operation of the each of the alternatives to influence the likelihood, magnitude, and potential impacts of future spills at Portsite relative to the existing conditions. The overall risks associated with fuel spills from bulk fuel transportation and bulk fuel storage and transfer operations are calculated using historic spill data, a common assumed spill volume, conservative assumptions related to the likelihood of a spill, and information about the existing and proposed facilities and their operation. Additionally, the less quantifiable risk associated with large fuel spills involving non-bulk fuel operations are considered in a more general manner.

Based on a survey of the history of marine-based operations at Portsite, the single event that probably best illustrates the greatest risk for large marine-based spills at Portsite occurred in October 2002 when one of the two lightering barges broke away from its tug during a storm and became grounded on the beach in severe storm conditions. The barge was carrying about 22,000 gallons of diesel fuel. Although it was damaged, the barge did not spill any fuel. The incident reveals the nature and magnitude of the exposure that existing operations have to significant spills from non-bulk fuel operations. Although spill rates associated with the existing fleet of non-tanker vessels cannot be reliably calculated using existing data, it is clear that the potential for a significant spill exists.

The accident in 2002 occurred after approximately 13 years of operation. If it were assumed that a similar accident would happen once every 15 years and that half of the accidents would result in the release of half of the barge's 75,000-gallon typical early-season storage volume, about 37,500 gallons would be released every 30 years. The annual spill rate would be about 1,250 gallons per year. That annual rate is about 100 times the rates calculated for storage/transfer facilities and tanker vessels (Appendix 10). Although this rate cannot be supported with actual spill data, the hypothetical scenario illustrates the reasonable potential for spill rates from non-tanker vessels to eclipse the spill rates associated with all other sources.

Planning volumes are used to determine the minimum fuel spill response capabilities that must be maintained to comply with regulatory requirements. The U.S. Coast Guard (USCG) Worst-Case Discharge (WCD) volume is used to determine minimum response capabilities for spills to water. It is calculated by adding the volume of the pipeline from the marine manifold to the first valve located inside a lined surface impoundment and the volume that would be lost based on the time to detect a spill and the time to cease fuel off-loading. The USCG's existing WCD for the existing Portsite facilities is 40,000 gallons and is based on 3,431.5 feet of 12-inch pipeline, a transfer rate of 5,600 gallons per minute and conservative estimates of 3 minutes to detect a spill and 30 seconds to shut down transfer operations once a spill is detected. Maximum Most Probable Discharge (MMPD) and Average Most Probable Discharge (AMPD) volumes are calculated to estimate approximate the volumes of spills that would likely occur. The MMPD and AMPD are 10 percent and 1 percent of the WCD, respectively.

<u>No-Action and Third Barge Alternatives</u>. The USCG worst-case discharge would be unchanged at 40,000 gallons. Other than the mobilization and demobilization of an additional barge and tugs between Puget Sound and Portsite for the Third Barge Alternative, there would be no change in fuel distribution patterns or spill likelihood or severity outside of Portsite. At Portsite, the risk of fuel spills caused by accidents or component failures associated with lightering barge operations would increase if a third barge and its tugs were exposed to the harsh operating conditions and the intensity of the vessel traffic were increased. Although the additional personnel and equipment associated with the Third Barge Alternative may improve spill response capabilities to a limited extent, access and proximity to shore-based spill response equipment would continue to afford a similar level of fuel spill response capability. The Third Barge Alternative would, however, increase the risk that a lightering barge carrying fuel could be damaged and spill diesel fuel into the Chukchi Sea.

Overall, the frequencies and magnitudes of spills associated with bulk fuel transportation and storage/transfer activities of existing operations would not change significantly. Based on a 50-year project life and conservative assumptions, risk analysis predicts that there would be a 14 percent chance and 21 percent chance of 4,000-gallon spills related to bulk fuel transportation and bulk fuel transfer/storage operations, respectively, over the life of the project.

The effects would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly to fuel spills near Portsite.

Breakwater-Fuel Transfer Alternative. Based on fuel spill analyses (Appendix 10), the fuel transfer system for the Breakwater-Fuel Transfer Alternative would reduce the overall (world-wide) likelihood of fuel spills by reducing the total number of transfer events and long-distance barge trips needed to supply fuel to users in Northwest Alaska. Regionally, the number of transfer events would not change significantly, and both the frequency and the methodology for transfers from barges to on-shore users in western and northern Alaska would not change. Although the existing facilities generally spill less fuel than similar facilities in the Northwest Arctic Borough, the increased complexity of the system and inaccessibility of the buried pipeline would probably cause additional spills over the life of the project. The additional pipeline volume would cause the WCD planning volume to increase from 40,000 gallons to about 200,000 gallons and would almost certainly require significant increases in fuel spill response capability requirements. The overall risk at Portsite would increase due to the larger volume of bulk fuel processed, the increased length of the pipeline, and the lack of easy access to most of the pipeline for inspection and maintenance. Additionally, it would increase the risk of fuel spills farther off shore where response efforts would be more difficult. However, the presence of the breakwater would lower the risk of fuel spills and damage to vessels during storms.

Overall, the frequencies and magnitudes of spills associated with bulk fuel transportation, transfer, and storage activities in the region would not change significantly. However, the increase in the volume transferred through Portsite facilities, and the associated increase in the number of transfers to barges for distribution to communities, would increase the risks at Portsite. Based on a 50-year project life and conservative assumptions, risk analysis predicts that there would be a 34 percent chance of a 4,000-gallon spill related to bulk fuel transportation over the life of the project. Using the same assumptions, a 4,000-gallon spill related to storage and transfer activities would be predicted to occur once every 11 years. The predictions associated with the assumed 4,000-gallon spill are presented as a relative indicator of risk for comparison purposes. In practice, a portion of the increased spill rate would be expected to be manifested in larger spills as well as more frequent spills. The effects would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly to fuel spills near Portsite.

Trestle-Channel Alternative. Based on fuel spill analyses, the new fuel transfer system would reduce the overall (world-wide) likelihood of fuel spills by reducing the total number of transfer events and long-distance barge trips needed to supply fuel to users in Northwest Alaska. Additionally, the elimination of most barge and tug operations would eliminate the risk associated with lightering barge operations and significantly reduce the number of small marine-based fuel transfer events needed to fuel the tugs. Although the increased volumes anticipated and slightly longer pipeline would increase the risks associated with offshore fuel spills where cleanup would be more difficult with less tug support, the trestle would serve as staging platform and would provide access to equipment and materials needed to effectively respond to an offshore fuel spill. Additionally, TCAK currently maintains three vessels dedicated to spill response on-site and some tug operations would still be required.

The slightly longer pipeline would increase the WCD planning volume from 40,000 gallons to about 46,000 gallons, but response capability requirements would not change significantly. The increase in volume processed and the number of transfers to barges for distribution to communities would increase the risks at Portsite. Based on a 50-year project life and conservative assumptions, risk analysis predicts that there would be a 34 percent chance and 54 percent chance of 4,000-gallon spills related to bulk fuel transportation and bulk fuel transfer/storage operations, respectively, over the 50-year life of the project.

The effects would be cumulative to existing and reasonably foreseeable future actions. However, no reasonably foreseeable actions would contribute significantly to fuel spills near Portsite.

## 4.7 Freshwater Resources

*Data Quality. Available data are sufficient to determine consequences of each alternative to freshwater biological and physical resources, including wetlands, with reasonable certainty.*

*Impact Uncertainty. The limited development of upland facilities required, and the presence of similar activities and facilities at Portsite allow characterization of the area's freshwater resources and the consequences to them from construction and operational activities associated with each alternative. The impacts to natural processes and environment can be determined with reasonable certainty.*

### 4.7.1 Groundwater and Surface Water

Existing development in the NAB has affected far less than 1 percent of surface water bodies. Groundwater resources have not been well mapped, but also are not extensively developed. None of the alternatives considered in detail would require work in or placing fill in any stream or river, so there would be no direct effects from any of the alternatives considered in detail and incremental addition to cumulative local or regional effects on groundwater or surface water. Reasonably foreseeable development could be expected to locally affect water bodies, both surface water and groundwater. Those potential effects are outside the scope of this draft EIS.

### 4.7.2 Floodplains and Flood Hazard Areas

Executive Order (EO) 11988 requires federal agencies to evaluate the potential effects of any actions they may take in a floodplain. The evaluation is required to ensure that planning programs and budget requests reflect consideration of flood hazards and floodplain management to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains.

EO 11988 defines the term "floodplain" as the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a 1 percent or greater chance of flooding in any given year. The 100-year floodplain and flood hazard areas have not been delineated in the Portsite area. However, the DMT facilities are not within the floodplain of any substantial drainage and the risk of flood damage from upland sources is extremely low.

Although flooding from upland sources is extremely unlikely, some DMT facilities could be affected by a 100-year storm surge from the Chukchi Sea. Recent estimates put the 100-year surge event at 12 feet excluding waves (S. Hunt personal communication). The primary existing Portsite facilities and fuel tanks are at around 18 to 20 feet elevation, but the dock and lower portions of gravel pads that support the marine-based facilities at Portsite would be flooded during a 12-foot storm surge.

Marine-based facilities, by their nature, are susceptible to occasional inundation and are generally designed accordingly. In this case, there are no practical alternatives to marine-based facilities to meet the project's objectives. Other than foundations, the new land-based components for all alternatives considered in detail, are well above 12 feet of elevation. The fuel pipeline and ore concentrate loading components within areas that could be flooded would be elevated on pilings or sheet-pile cell foundations to avoid filling large areas that are currently susceptible to occasional inundation. All foundation components would be designed to withstand the effects of a 100-year surge event.

### 4.7.3 Wetlands

Alternatives that would connect on-land facilities with new systems or structures offshore would require new onshore structures or fill. Since the lands at Portsite adjacent to shore are predominantly wetlands, those alternatives would impact wetlands.

- **No-Action Alternative**
- **Third Barge Alternative**

Existing development has affected wetlands at Portsite, along the DMTS road, and at Red Dog Mine. Regionally, much of the road and community development has been in wetlands because most of the region is wetland. Available data indicate that less than 1 percent of the NAB wetlands have been developed or otherwise substantially affected by development. Important regional wetland functions and values appear to be maintained, although they may be impaired near the relatively few communities and other developed sites. Reasonably foreseeable development is likely to cause further local impacts to wetlands, although none of the reasonably foreseeable actions would be likely to cause extensive wetland loss or significant direct or cumulative effects.

- **Breakwater-Fuel Transfer Alternative**

Breakwater construction and operation/maintenance would have no effect on wetlands, floodplains, or other resources related to freshwater resources. Material for the breakwater would come from an existing quarry. Any effects of quarrying to wetlands would be considered in regulatory actions before the source was approved for the project.

The fuel line would be constructed by boring beneath the beach and the wetlands immediately adjacent to the beach, but the boring pad and the onshore end of the pipeline would be in wetlands. Altogether, about 0.5 acre of wet tundra would be filled to construct and operate the fuel line. That wetland does not function well as fish or waterfowl habitat, but is part of a larger complex that includes the coastal lagoons that are habitat for waterfowl and other coastal birds. The lagoons drain an extensive moist and wet tundra complex on the surrounding hillsides. The conversion of habitat by this alternative would not likely affect essential processes or values of the system, but would add an increment of wetlands loss due to existing development. Overall, the effects of the Breakwater-Fuel Transfer Alternative on freshwater quality would be minor both in terms of direct and cumulative effects.

- **Trestle-Channel Alternative**

The approach and abutment for the trestle would be constructed adjacent to the existing loading facility. The new land-based components would be on a gravel pad. The pad would be located between the Chukchi Sea and the existing pad that supports the Portsite administrative building. The pad would have a footprint of about 2.5 acres and an elevation of about 25 to 32 feet above mean lower low water (MLLW). It would be constructed partially in wetland habitat and partially on a gravel beach berm and developed uplands. (See Section 3.5.1.2 for a description of this habitat.). This habitat type could be characterized as an estuarine wetland system transitioning from marine habitat to terrestrial habitat, including palustrine wetlands (wet tundra). A new fuel tank to allow gasoline to be stored and distributed regionally would be constructed adjacent to existing fuel storage. This would require fill in 1 acre of wetland habitat to provide a base and working area for the new storage tank. Figure 1-1 of Appendix 1 shows the area that would be affected by both project features. Appendix 1 is an evaluation of fill activities in wetlands and waters of the United States. It provides additional information about the wetlands that would be filled and their functions and values. No practicable alternatives for filling about 3.5 acres of wetland for these purposes could be identified.

The wetlands do not function as fish habitat, but are connected to a larger complex that includes the coastal lagoons that are habitat for waterfowl and other coastal birds. The lagoons drain an extensive moist and wet tundra complex on the surrounding hillsides, but this alternative would not impact freshwater streams or significantly affect drainage to the lagoon system. Cumulatively, wetlands used for these project features added to past and reasonably foreseeable future effects would not appear to be so extensive that important wetland functions and values would be significantly impaired.

## 4.8 Noise

The effects of sounds on marine mammals, fish, and other organisms were one of the most frequently expressed concerns during scoping for this study. The people of the Northwest Arctic Borough and the North Slope Borough to the north were especially concerned about noise. Many of those people hunt and fish for most or at least a substantial part of their food and are well aware of how quickly seals, whales, and terrestrial animals respond to any careless sound during a stalk, and how fish may flee from sound transmitted through the water.

Section 3.4.8 discusses sound characteristics, how the distance that sound can be detected is influenced by the environmental conditions, and the sounds that are being generated by existing operations at Portsite. It also reported sound measurements made in the air and in the water at Portsite and compared those data with information from other studies. Information in Section 3.4.8 indicates that strong sounds produced in the water are detectable much farther away than sounds carried through the air. It also pointed out that sounds produced in the air may not efficiently transition into water.

On-going operations at Portsite have substantially increased the strength and variety of sounds generated on the remote seacoast. Periodic blasting at the nearby quarry was the strongest sound propagated through the air during data collection at Portsite. The strongest sounds measured in the waters of the Chukchi Sea were the low-frequency sounds produced by propeller cavitation of bulk ore carriers as they left their anchorage offshore from Portsite. These very strong sounds are infrequent (only about 26 bulk carriers visit Portsite each year according to the Draft Interim Feasibility Report Economic Appendix) but were estimated to travel about 16 miles seaward from the anchorage and initial departure route as the carrier came up to speed. Since the bulk carriers moor about 3.5 to 5.0 miles offshore, our data indicate that the underwater low-frequency sounds produced by cavitation might be detectable about 20 miles from Portsite.

Propeller cavitation noise from the five tugs that move the ore concentrate barges and position the bulk carriers is the strongest regularly produced underwater sound. Those tugs operate almost constantly through the open-water season (typically July through October) whenever wind and wave conditions are suitable for loading. Sound from tugboat propeller cavitation is estimated to travel about 6.5 miles through the water off Portsite, based on measurements made there. Since the tugs are operating as far offshore as the ships (about 4 miles), the sound they produce is estimated to be detectable as far as about 10.5 miles offshore under especially good conditions for sound propagation.

Section 3.4.8 also presented calculations showing that two sources of about the same sound strength and from the same location can be detected only a little farther from the source than a single sound. This makes intuitive sense as well: two people shouting cannot be heard twice as far away, and four snowmachines typically can be heard farther than one, but not four times as far, or even twice as far. The data and the equations used for calculating sound also show that if there are several sound sources, the strongest sound usually determines the overall distance sound is detectable; adding additional weaker sound that is otherwise similar in characteristics does not have much effect on the total distance the sound carries. At Portsite, for example, both loading operations and tugs produced underwater sounds. The loading operations were measured at about 120 to 137 dB at 100 meters, while the tugs were measured at about 130 dB at 100 meters. Strength of sound diminishes rapidly with distance. When the tugs were operating, the sounds made by the loader did not make much difference in the distance that the sounds of Portsite operations could be detected since the tugs ranged several miles offshore, while the loader generated sound from a stationary location near the shore. Tug operations, not loading operations, therefore determined how far offshore operating sounds could be heard.

- **No-Action Alternative**
- **Third Barge Alternative**

If there was no Federal action to construct loading facilities at Portsite, then the sounds produced would continue to be about as they are now. Loading and shipping operations sounds would continue to be detectable for a mile or more inland on calm days, but would be masked by the noise of vehicles, electrical generation, and activities to maintain and operate Portsite. Heavy maintenance work on the loader might produce sounds detectable through the air for a mile or more seaward. Sounds produced in the air by operating tugs might typically be detectable a mile or more in every direction. The less frequent operation of ships arriving and departing might be heard through the air for 10 miles or more. The tugs are the source of the strongest regularly produced noise in the air and are likely to be detectable through the air on a regular basis as far as 10.5 miles offshore from Portsite. The arrival and departure of about 26 bulk carriers each year might produce sounds in the air that could be detected well offshore from Portsite.

Sounds of loading and activity on the loader and on land at Portsite might typically be detectable in the air only as far as about 4,000 feet offshore, so they have little effect on the total distance Portsite sounds can be detected.

Sounds produced on land (except for very strong sounds from quarrying that also transmit through ground and water) also have little effect on how far sounds from

Portsite operations can be detected in the water. With no Federal action, the sounds of tugs would be detectable underwater farther off shore than any other regularly occurring sounds and the underwater sounds of ships would be detected farther offshore than any other noise.

Sounds from Portsite add to the overall noise environment of the region, but rarely are heard in addition to other strong man-made sounds. Other sources of man-made noise heard through the air include those from Red Dog Mine; vehicles including boats, autos, trucks, all-terrain vehicles, and airplanes; and gunshots. Man-made noise in the water is largely from waterborne transportation, although the DMT loader and other docking facilities in the region add local increments of sound. Noise from land-based activities and aircraft do not transition into water effectively, but may also contribute small increments. Existing man-made sounds add incrementally to natural sounds from wind, ice, water, and other sources to cumulatively form the sound environment of the region.

Adding a third barge and tugs to accompany it would add additional sources of sound, but would not make any appreciable difference in the strength of sounds in the water around Portsite or the distances those sounds could be heard in the air or water. Direct and cumulative effects of implementation and operation would be negligible.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would be constructed of armor rock over core rock and other material. It would be constructed by placing materials from one or more barges served by one or more additional tugs. Cost estimates for this alternative were based on the assumption that up to 10 barges carrying 4,000 tons each could be used during the peak of construction. More barges would be used initially to haul the bedding material than later to haul the armor stone. The barges would be towed by 3 to 6 tugs, depending on the phase of construction. Construction would go on for three open-water seasons and 150 or more barge loads of rock and other material and equipment would be shipped to the site. Sounds, both above and under water, produced by unloading and placing rock are not as strong and would not be produced as far offshore as sounds that would be produced by barges loading ore concentrate onto bulk carriers at the same time. Breakwater construction therefore would not increase the distance that sounds could be detected from Portsite, although sound characteristics would be different from those produced by existing operations and might cause different responses by animals accustomed to sounds from existing operations. Noise from barge traffic between Portsite and the quarry used for breakwater material would substantially increase during construction. This noise would be similar to existing sources, and well offshore, but would add a minor increment to existing sources.

Dredging, constructing, and backfilling the fuel transfer line and offshore terminal would add sounds to those from on-going loading operations at Portsite. Dredging typically does not produce as much sound (under water or above water) as the tugs that already operate at Portsite. While constructing the pipeline would add an increment of sound to the loading operations, it would not appreciably alter how far sounds from Portsite might be detected. It would alter sound characteristics in the air and water near Portsite.

After construction, the breakwater would require yearly bypass dredging, with material disposal on or near the beach. Annual bypass dredging would produce sounds that could be detected in the immediate vicinity of Portsite, but that would be masked farther away by tugs and other components of the loading operations. The breakwater would be in 24 feet of water and about 1,350 feet offshore. In most years this is in a land-fast ice zone where ice movement and the noise produced by ice is limited. When the active ice zone extended inshore as far as the breakwater, moving ice rubbing against or impacting the breakwater or ice attached to it would produce noise both in the air and underwater. In the existing environment at Portsite, moving ice rubs and bumps pieces of various sizes together and produces background sounds of appreciable strength, but noise from ice moving against the breakwater could produce additional sounds that could be heard offshore from Portsite for at least a short distance.

After the fuel line was constructed, about four more ships assisted by tugs would arrive at Portsite each year to unload fuel. Other, smaller, shallower-draft barges that would distribute fuel to coastal communities would replace the barges that now deliver fuel to Portsite. Other than the four additional fuel tankers and a small increase in barge traffic to deliver fuel, there would be little change in the strength or frequency of sounds produced by Portsite operations.

From a regional perspective, this alternative would add a minor increment of sound at Portsite to the regional air and water mediums during construction.

- **Trestle-Channel Alternative**

Constructing the trestle-channel alternative would produce a variety of sounds, most notably the sounds of metal-on-metal as the pilings were driven and as the trestle and loading platform were assembled. Those sounds would be produced at a variety of frequency tones and durations, and they often would be abrupt. Work on the loading platform might produce the strongest sounds heard in the air, but the strongest sounds produced in the water probably would be from pile driving. Pile driving may produce underwater sounds well above ambient levels. In the Beaufort Sea sounds produced by pile driving have been detected 2.5 to 12.5 miles from the source.

**Comment [BW1]:** Page: 307
This Seems low. It probably needs a distance from the source associated with it to be this low.

Sounds from pile driving and steel erection for the trestle and loading platform might be detectable through the air for more than a mile and through the water for as much as 12 miles. This means that those sounds might be heard about as far offshore as the tugs and barges that would be loading ships during the same period, but would be at different frequencies and durations than tug noise.

Sounds from pile-driving and steel assembly would continue at least intermittently through the full 3-year construction of the loading platform and trestle. Most components would be constructed during the open-water season, and activities could be heavily restricted from the end of March until ice-out as a mitigation measure to minimize effects on marine mammals and their harvest by northwestern Alaska hunters.

Dredging the channel and disposing of the dredged material would produce sounds during 3 years of construction. Studies in Cook Inlet (Dickerson et al. 2001) reported that the sounds of a dredge bucket striking the bottom were detectable at 4.4 miles. If dredging sounds traveled that far from the seaward end of the channel, then they would be detectable about 8 miles offshore, about a mile beyond the proposed disposal area.

The sounds produced by the tugs towing barges with ore concentrate to bulk carriers can be detected appreciably farther offshore than the sounds that would be produced by the dredging. Construction-related underwater sounds that would be heard farthest offshore would be produced by tugs transporting barges filled with dredged material to the disposal site. Two possible dredged material transportation mechanisms could be employed for construction and the later maintenance for the Channel-Trestle Alternative. Dredged material could be placed in barges, towed by tugs to the disposal site, and then emptied, or hopper dredges also could dredge, fill their on-board hoppers, travel to the disposal site, empty the dredged material, and return to the channel alignment to continue dredging. The contractor would choose the method to be employed.

If tugs and barges were used to transport dredged material, sounds of the tugs would be heard farther offshore than sounds from existing loading operations or the loading operations that would continue during construction. Sounds of the tugs could be expected to be detectable about 6.5 miles from the source, based on peak sound energy measured from tugs operating at Portsite. Sounds from tugs going to the farthest offshore edge of the disposal site, about 7 miles offshore, might be detectable underwater as much as 13.5 miles offshore and in the air as far as about 8 miles offshore. This sound environment would be repeated during maintenance dredging about 5, 17, 33, and 49 years after construction was completed.

Largest ocean-going hopper dredges would produce about the same cavitation and running sounds as the ore concentrate carriers that load offshore from Portsite. Hopper dredges constructing the channel and turning area could each make about six trips a day to the dredged material disposal area. Propeller cavitation sounds at the beginning and end of each trip could be as strong as the sounds recorded from a loaded freighter departing from Portsite (Section 3.4.8.2) and could be detected underwater for about 16.5 miles. This means that a big hopper dredge operating at the offshore boundary of the proposed disposal site (about 7 miles offshore) would produce sounds strong enough to be heard as much as 23.5 miles offshore from Portsite. An average of about six times a day for three consecutive construction seasons, marine mammals, fish, and other underwater organisms might be able to detect sounds from dredged material disposal as far as an estimated 23.5 miles from Portsite.

It is anticipated that one or more clamshell dredges would be used for 1 or 2 years of the 3-year construction period. They would load bottom material into a bottom-dumping scow or barge, which would be towed to the disposal site by a tug and dumped. Sounds from the tug would reach ambient levels about 2 miles farther offshore than noise from existing loading operations.

After construction, the loading operations at Portsite would be much quieter than they are now. The loading equipment would produce sounds similar to those produced by existing equipment, but the almost continuous sound of tugs would be greatly reduced. Instead of 3 or 4 tugs working constantly, about once every 5 days tugs would assist a deep-draft bulk carrier away from the loading platform. The tugs would then assist a waiting empty bulk carrier from the mooring buoy (about 4 miles offshore) to the loading platform. A single round trip for each of the 26 bulk carriers would replace the estimated 323 round trips by tugs typically required to load bulk carriers each year. The almost continuous operation of another tug to position the ore concentrate ship for loading also would cease. The only added sounds would be from the four or five tanker ships each year that would replace the four or five ocean-going tug and barge deliveries each year and the occasional visits from tugs and barges distributing fuel to coastal communities.

Construction of the Trestle-Channel Alternative would increase sound energy in the Portsite area and would alter the characteristics of sounds transmitted through the water offshore from Portsite during the 3-year construction period. After construction, sound energy in the water at Portsite would be lower in some respects. Effects would be adverse during construction and maintenance dredging, and beneficial after construction and maintenance events.

## 4.9 Biological Resources

### 4.9.1 Vegetation and Algae

In section 3.5.1, the types of vegetation found in the Portsite area were separated into three groups: (1) plants associated with land habitat (land vegetation); (2) plants associated with the near-shore lagoons (transitional vegetation); and (3) plants associated with the marine environment (marine vegetation and algae). A 404(b)(1) evaluation for fill in the waters of the United States is presented in Appendix 1. The potential impacts to each of these vegetation groups at Portsite from the proposed navigation improvements are discussed below.

- **No-Action Alternative**
- **Third Barge Alternative**

Portsite facilities have substantially modified or segmented about 160 acres of vegetation typical of moist tundra and wet tundra in northwestern Alaska. Development also has affected small areas of emergent and coastal vegetation. The 55 miles of road that make up the DMTS road system covers about 500 acres that largely consisted of moist, wet, and alpine tundra vegetation. Dust from the road affects adjacent vegetation to varying degrees. Development at Red Dog mine, including the mine pit, processing facilities, airstrip, parking and work areas, storage areas, tailings, and other development has removed or adversely affected alpine vegetation in an area of several hundred acres. The existing project features have had no identified effect on algae in the Chukchi Sea, except that they have modified a small area (less than 1 acre) of habitat by occluding sunlight or altering small areas of sea bottom.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would have no effect on terrestrial vegetation at Portsite, but could require expansion of an existing quarry (which would be selected by the contractor), with associated impacts on wetlands and vegetation. Potential effects of quarry development would be considered during review of the contractor's quarry management plan and would be reviewed to determine if further NEPA action was required.

Bypass dredging of 26,000 cubic yards annually for the breakwater would affect algae on the bottom at the accretion zone that would be dredged and in the disposal area to the south. This amount of material would be equal to about 5 acres of sediment 3 feet deep. The area dredged might be this large, and the disposal area might be of similar size, so altogether, about 10 acres of bottom habitat might be disturbed during by-pass dredging each year. Productivity of benthic algae and phytoplankton would be diminished as algae were smothered on the bottom and as light penetration was diminished temporarily during the by-pass activities. The disposal of the bypass sediments would be just above and within the intertidal zone south of the existing Portsite dock (Appendix A, Figure A1-1) so the dredged material could be transported farther south along the beach as littoral longshore drift.

A fuel transfer line to an offshore terminal would be buried beneath the beach and shallow water zones offshore. Boring for the pipeline would require fill of less than 1 acre for the drilling platform, staging, the boring operation, and protection of the opening during drilling. The onshore transition, valves, and work area also would be constructed and permanently retained on the gravel pad. Onshore fuel transfer facilities would be constructed entirely on wet tundra, predominantly sedges, alkali grass, and herbaceous wetland vegetation. Less than 0.1 acre of terrestrial vegetation would be disturbed to construct pads for pipe supports, valves, and booster pumps along the pipeline as needed and about 1 acre would be disturbed to construct the new fuel storage tank and containment berms. The probable route of the pipeline from the onshore transition pad to the storage tanks is alongside the existing staging area pad (Figure A-1 in Appendix A).

The first 2,500 feet of the pipeline would be bored beneath land and the seabed floor. The transition to a trenched pipeline burial and the trench itself would excavate about 10 acres of sea bottom. Side casting of dredged material and sediment from dredging would affect a similar area. The work would be completed in a single season, so algae on the 10 acres of bottom affected would be lost for most of the growing season. The sediment plume from excavating and backfilling a 10-foot-deep trench would be local and of short duration, but primary productivity might be briefly diminished in the water column at the site and immediately down current.

Areas of sea bottom that would be impacted by dredging, construction, and maintenance of the Breakwater-Fuel Transfer Alternative are estimated in table 4-1.

Direct effects of this alternative on vegetation would be local and minor. The evaluation of reasonably foreseeable development in section 4.12.5 indicates that any reasonably foreseeable future activity in northwestern Alaska would cause additional effects in localized areas of vegetation. There is no indication that present and reasonably foreseeable development would cause significant adverse effects to functions and values of regional vegetation and algal resources.

- **Trestle-Channel Alternative**

Terrestrial Vegetation. The approach and abutment for the Trestle-Channel Alternative would be constructed adjacent to the existing loading facility, and an additional fuel tank would be constructed adjacent to existing fuel storage. The new land-based components would be on gravel foundations and would have a footprint of about 3.5 acres. They would be constructed partially in wetland and lagoon habitat and partially on a gravel beach berm and developed uplands. (See Section 3.5.1.2 for a description of this habitat). This habitat type could be characterized as a transition from marine to wetland tundra habitats. This habitat type is characterized as an estuarine wetland system transitioning from marine habitat to palustrine wetlands (wet tundra). Figure A1-1 of Appendix 1 shows the area that would be affected. Appendix 1 is an evaluation of potential project effects on waters of the United States. It was prepared to meet requirements of the Clean Water Act. The wetlands are part of a larger complex that includes the coastal lagoons that are habitat for waterfowl and other coastal birds. The habitat conversion by this alternative would not likely affect essential processes or values of the system.

Most of the construction would be in wet tundra, but a small area at the south end of North Port Lagoon and a small adjacent vernal pond would be filled for trestle approach and abutment construction. The habitat is immediately adjacent to existing fill and ongoing industrial activity. Construction traffic would use existing DMTS roads and staging areas.

Marine Vegetation and Algae.

*Data Quality. Data to evaluate phytoplankton productivity are approximate, but adequate. Current data, which are important to modeling sediment transport are believed to be adequate for the periods when dredging would be conducted, but we do not have a long enough data record to accurately estimate how often maximum current velocities are likely to occur. Our transport modeling, presented in Section 4.6.5 assumes a greater frequency than we actually encountered . Models for predicting sediment transport are well tested and reasonably reliable. Project effects on phytoplankton are exaggerated in this analysis. We do not have specific data about phytoplankton reproduction in the Bering Sea, so we assume that phytoplankton destroyed by dredging effects would not be replaced in the same growing season. In other locations, diatoms have been shown to reproduce rapidly, often reproducing in less than a week, so potential effects on marine algae are exaggerated in this analysis.*

Impacts on marine algae species at Portsite associated with marine construction and maintenance activities can be summarized as follows: (1) algae on the sea bottom would be killed by smothering, abrasion, pressure changes, and other effects of mechanical or suction dredging; (2) algae on the sea bottom would be covered and killed by bottom material placed in the offshore disposal area and by material disturbed during dredging that settled out down-current; (3) algae would be covered and killed by placement of structures, including any breakwater piling or other in-water construction; and (4) algal productivity and viability on the sea bottom and in the water would be affected by bottom material suspended during dredging, which would reduce light penetration and primary productivity. Areas of sea bottom that would be impacted by dredging, construction, and maintenance of the Trestle-Channel alternatives are estimated in table 4-1.

**Table 4-1.** Area of sea bottom directly affected by construction and maintenance.

| Alternative | Component | Sea Bottom Area (Approx. Acres)** |
|---|---|---|
| **Breakwater** | Breakwater Structure Footprint | 13 |
| | Sediment Accumulation and By-pass Material Disposal | 10-15 per year |
| **Subtotal** | | 23-28 |
| **Trestle-channel** | Shipping Channel – Turning Basin Footprint. | 430 |
| | Disposal Area Footprint. | 6,000 |
| | Trestle/Loading Dock Supports Footprints. | 0.5 |
| **Subtotal** (rounded) | | 6,500 |

** Reflects worst-case scenarios, see text below for explanation.

Construction and maintenance activities in the marine environment associated with the Trestle-Channel alternatives would impact the microscopic marine algae that are abundant on the sea bottom and in the water column in the southeastern Chukchi Sea, including in the Portsite area. Dredging, disposal, and construction activities would affect algae in the 20 to 70-foot water depths offshore from Portsite. Suspended sediments and their effects on light penetration might affect more distant populations.

Dredging would require 3 years and would probably be conducted in specific segments each year, so effects would not be produced over the entire dredging and disposal area for the each of the 3 years of dredging. Construction dredging would destroy benthic algae in the dredged areas, although algae would recolonize to some degree soon after dredging. Because algae on the bottom recolonize every year after the ice goes out, the entire dredged area would be fully recolonized by benthic algae in the year following construction. Limiting use of the disposal area and confining dredging to less than half of the channel and turning basin each year would reduce the effects of the action each year to less than half the estimated 6,500 acres of total bottom area that might be affected by the project.

Dredging creates a plume of suspended material that varies in size and composition. Clamshell dredges lose a small percentage of material as it is lifted to the surface. Suction dredges do not lose significant amounts after the material enters the dredging apparatus, but spillage and overflow from the hopper at the dredge site may create a plume of suspended material equal to about 30 percent of the total material dredged. Most of this overflow material is fine, loose material. Fine dredged material entrained in the sediment plume likely would be deposited over an area so wide and in a manner so like natural processes that it would not cause a major impact to survivability of algae on the bottom.

Construction of the trestle itself and of the loading platform would disturb, in total, less than an acre of sea bottom and the algae growing on it. The trestle and loading platform together would shade slightly more than an acre of sea bottom, with subsequent reduction in phyto-productivity.

During the summer filamentous diatoms (e.g., *A. ratilans)* and other microscopic marine algae (e.g., *Gyrosigma*, *Licmophora, Navicula)* are abundant on the bottom in the Portsite area and generally throughout the southeastern Chukchi Sea. Excavation of the channel, turning basin, and berthing area would incorporate algae on the bottom into the dredged material and most of them would be lost. Sediment down current from the channel and at the disposal site would bury algae on the sea floor. Altogether, excavation and disposal would bury or substantially disturb benthic algae populations on about 6,500 acres of the Chukchi sea bottom during some period of the dredging process. In addition, suspended sediment from the dredging site would be carried down current. The bulk of the material would deposit out onto the bottom in the first few minutes after dredging and within 0.2 mile of the dredging site. This indicates that another area as much as 500 acres might be affected by suspended sediment deposition down-current from the areas being dredged. Altogether, most of the algae and most of the primary productivity of those algae could be lost during the construction period and for the remainder of the growing season.

As shown in table 4-1, the combined footprints of (1) the breakwater and sediment accumulation area; (2) the shipping channel, turning basin, and sediment plume; (3) the disposal area; and (4) the trestle support cells and dock pilings total approximately 6,500 acres.  That area represents about 0.17 percent of the area in the southeastern Chukchi Sea between the 20-foot and 70-foot depth contours, the depths where these navigation improvements would be placed, and about 0.04 percent of the 16.6-million-acre southeastern Chukchi Sea.  About half the total affected area, about 4,000 acres, would be disturbed substantially during each of the 3 years of dredging.

If the distribution and abundance of bottom diatoms and other algae in the southeastern Chukchi Sea were relatively uniform, then the algae on the bottom of the area that would be taken, covered, or otherwise disturbed by construction of the Trestle-Channel alternative at Portsite would be about 0.17 percent of the southeastern Chukchi Sea benthic algae between the 20-foot and 70-foot depth contours, and about 0.04 percent of benthic algae in the 16.6-million-acre southeastern Chukchi Sea. The actual impacts would be less because diatoms and other algae associated with the sea bottom are adapted to intermittent disturbances such as ice movement, wind, wave action, and high natural turbidity levels. Algae also reproduce and recolonize rapidly, so even if an area were to be depopulated, it would be likely to support at least a partial population for at least part of the season.

The loss of diatoms and other algae from construction and maintenance of the navigation improvements would be a temporary phenomenon, in that during the years between dredging cycles, the surface of the bottom sediments in the channel and turning basin and area covered by the sediment plume would become populated with diatoms and other algae during each summer season as before.

Construction and maintenance, including dredging and disposal activities, would release and stir up fine sediments.  The suspended sediments would increase turbidity in the area immediately surrounding and down current from these activities. Turbidity would reduce light penetration through the water column, which would temporarily reduce photosynthesis in bottom and floating algae. Turbidity might cause at least minor effects for a mile or more down-current, depending upon composition of material being dredged, current velocity, and water depth.  Algae in the Chukchi Sea may be well adapted to reduced light, turbidity, and other harsh conditions, but diminishing light penetration would be expected to cause some loss of photosynthetic productivity.  Natural processes, including wave action, currents, and feeding by large marine mammals suspend far more material each year and also produce turbidity.  During construction and maintenance, the Trestle-Channel Alternative would add an increment of turbidity to these other sources.

Turbidity effects on light penetration would be temporary and unlikely to result in substantial direct mortality of the hardy phytoplankton of the Chukchi Sea, but it would reduce the light required for photosynthetic processes and the food that process adds to the "food chain" of the Chukchi Sea. Quantifying those losses is not feasible because there are too many variables. A rough (and perhaps "worst-case") example would be to assume that all the phytoplankton productivity in the water column above the affected bottom area (about 4,000 acres each year) would be totally lost each year.

Primary Productivity Loss. The (temporary) loss of approximately 4,000 acres of bottom diatoms and algae in the water column in the Portsite area from the trestle-channel alternatives would temporarily reduce primary productivity in the southeastern Chukchi Sea during each construction season of the initial 3-year construction period and during the subsequent maintenance cycles. This would represent (as a worst-case calculation) a temporary loss of about 0.04 percent of the annual primary productivity of the southeastern Chukchi Sea each year. Table 4-2 presents this admittedly high estimate of total productivity loss, assuming total loss of all productivity from all algae in the water column and on the bottom in the entire affected area and no replacement by reproduction. The mass of algal material and resulting primary productivity potentially lost for each component in the Breakwater-Fuel Transfer and Trestle-Channel alternatives are presented in table 4-2.

Direct effects of this alternative on vegetation and algae would be local and minor. The evaluation of reasonably foreseeable development in section 4.12.5 indicates that any reasonably foreseeable future activity in northwestern Alaska would cause additional effects in localized areas of vegetation and algae. There is no indication that present and reasonably foreseeable development would cause significant adverse effects to functions and values of regional vegetation and algae resources. Effects of suspended sediment and bottom disturbance caused by dredging would be cumulative to the much larger natural processes of waves, currents, inflow from tributaries, and bottom disturbance by feeding whales and walrus that disturb the Chukchi Sea bottom and suspend billions of tons of sediment in the water column each year (Section 3.5.4.1).

**Table 4-2**. Primary productivity losses for components and alternatives.

| Alternative | Component | Tons of Algal Material Lost | Percent of Primary Productivity in Southeastern Chukchi Sea |
|---|---|---|---|
| **Breakwater** | Breakwater Structure | 15.7 | 0.00008 % |
| | Sediment Accumulation Area | 18.2 | 0.00009 % |
| **Subtotal** | | 33.9 | 0.00017 % |
| **Trestle-channel** | Shipping Channel – Turning Basin (including sediment plume*). | 1,125 | 0.00559 % |
| | Disposal Area. | 6776 | 0.03365 % |
| | Trestle/Loading Dock Supports | 0.6 | 0.000003 % |
| **Subtotal** (Rounded) | | 7,900 | 0.03925 % |

### 4.9.2 Marine Invertebrates

Existing development at Portsite and other development in the Chukchi Sea have caused little apparent effect to marine invertebrates. Small areas of near-shore sea bottom have been modified by tug use and transportation facilities at Portsite and coastal communities of the Chukchi Sea.

Nearly all the construction and maintenance activities associated with any action alternative for DMT navigation improvements would take place in the marine environment of the Portsite area. Construction and maintenance of a Federal action could impact marine invertebrates at Portsite by: (1) killing bottom-dwelling (macro) invertebrates during dredging, dredged material disposal, and placement of structures; (2) increasing turbidity, which may affect feeding and other life processes of invertebrates living in the bottom and in the water column; and (3) decreasing food by killing algae. Dredging and disposal also might expose nutrients and prey animals in the bottom that would be eaten by invertebrates. Some components of navigation improvements might improve habitat or feeding opportunities for some more motile invertebrates.

Construction and maintenance activities would be more likely to adversely affect worms, clams, sea stars and isopods, and other non-mobile or slow-moving species of marine invertebrates than it would crabs, amphipods, krill, shrimp, and other mobile marine invertebrates that can move away from adverse conditions.

Concerns regarding marine invertebrates expressed during public scoping for navigation projects at Portsite focused chiefly on invertebrates that might be useful in subsistence or commercial catches (particularly king crab), on invertebrates that are eaten by marine mammals or that might attract marine mammals to the area, and on the importance of marine invertebrates in the food chain.

Spring (under-ice) and summer collections of marine invertebrates at Portsite in 2000 (Section 3.5.2) contained the following, in descending order of abundance:

1. Sea Star
2. Helmet Crab
3. King Crab
4. Lyre Crab
5. Shrimp
6. Jellyfish
7. Brittle Star

Those collections were generally similar to past marine invertebrate collections in the southeastern Chukchi Sea that employed similar methods. Smaller-mesh trawl nets would have collected more isopods and other small crustaceans. Collections of bottom material in the same area also contained large numbers of small marine worms and smaller numbers of clams (Section 3.5.2).

Analysis of potential impacts to invertebrates focuses on crabs (king, helmet, and lyre) and various shrimp species because they may someday be harvested for subsistence (king crab have recently become a subsistence target for people out of Kotzebue) and/or are important to bearded seal and other marine mammals that are harvested for food.

Clams are extremely important to walrus, but are not accorded special attention in this evaluation for two reasons: first, because clams are much more abundant in other parts of Pacific walrus' range in the Chukchi Sea, and second, because walrus are not common in the Portsite area. Clams also are particularly important food for sea stars, which are common on the bottom off Portsite and throughout most of the Chukchi Sea. Sea stars are regionally abundant, are not harvested by people, and are not particularly important as food for any of the marine animals that are harvested or that are of particular concern for some other reason. For these reasons, sea stars also are not given particular attention in the analysis of impacts. Jellyfish and brittle stars also are regionally abundant and widespread. Their life history and abundance suggests that any population effects to sea stars, brittle stars, and jellyfish would be soon remedied through migration and reproduction and that losses would have little effect on subsistence uses or other marine biota.

- **No-Action Alternative**
- **Third Barge Alternative**

The existing development at Portsite and associated operation does not appear to represent a substantial source of impact to marine invertebrates. The existing dock disrupts coastal processes, which may produce localized effects to the sparsely populated shoreline south of Portsite. Barge operations scour an area of less than a half-acre at the dock and can be expected to cause minor impacts to benthic invertebrates and their habitat. The Third Barge Alternative would not add appreciably to those minor effects. Lead is present at higher than background levels in samples from a thin surface layer near the barge loader. It presumably has accumulated from on-going loading operations. Concentrations present (Section 3.5.2) are below screening levels, indicating that the lead is not affecting invertebrates. Continuing loading operations could increase the amount of lead in the surface layer of bottom material near the loader, although recent changes in equipment and operations at Portsite may prevent further accumulation.

A large fuel spill could kill or injure invertebrates in the immediate vicinity of the spill. The 4,000-gallon fuel spill calculated as the Maximum Most Probable Discharge (MMPD) in Section 4.6.5 would be largely recovered if it was spilled in moderate weather or would be rapidly dispersed if the wave climate was severe. A review of spill effects cited in Appendix 10 of this draft EIS found that fuel spills of less than 5,000 gallons in open marine waters rapidly dispersed and that while invertebrates ingest fuel components, they excrete or otherwise lose those components within a few weeks. Fuel spills of this magnitude can cause beach oiling and locally severe effects where intertidal communities are well developed. While every effort should be taken to protect beaches from any fuel spill, the intertidal invertebrate community near Portsite is sparse and limited in ecosystem function and value.

- **Breakwater-Fuel Transfer Alternative**

The area of sea bottom required for this alternative is identified in table 4-1. Breakwater construction would kill most of the non-mobile worms, clams, sea stars, snails, sponges, bryozoans, and at least some of the slow-moving invertebrates that inhabit the breakwater's 13-acre footprint. Benthic fauna collections indicate that the primary invertebrates that would be affected by breakwater construction would be polychaete worms, clams, and sea stars. This loss would have little effect on local or regional biomass, productivity, or the food chain. The breakwater would be colonized by a variety of invertebrates that prefer rocky habitats. Barnacles, sea stars, shrimp, many crab species, bryozoans, and other invertebrates that prefer to attach to or inhabit rocky substrates could be expected to use the new habitat. King crabs prefer, or even require, hard substrates to settle on during the early stages of their lives and might be attracted to a breakwater.

Bypass dredging for the breakwater would disturb several acres of soft-bottom habitat at the same location each year. Placement of the material for beach nourishment might disturb several more acres, again, at the same location each year. Invertebrates might be disturbed or destroyed, but pioneering invertebrate communities in recently deposited material tend to be sparse. Effects would be minor and local.

Effects of Habitat Modification. Constructing a breakwater at Portsite could promote increased local abundance of some crab species. The structure would have a large surface area and ample hiding places that could provide crab larvae habitat on which to settle, develop, and hide from predators through several juvenile molts. One of the major reasons why crabs, including king crabs, are not more abundant in the Portsite area may be the lack of suitable substrate on which the larvae can settle to safely develop into young crabs.

- **Trestle-Channel Alternative**

Some invertebrates would survive dredging and transportation to the disposal site, but most would be killed. More might be able to survive burial at the disposal site, particularly in the less-used disposal areas, but the majority of non-motile and slow-moving invertebrates in the disposal areas might be lost for at least part of construction and maintenance dredging periods.

King Crab. Collection data from marine waters off Portsite indicate that king crab larvae and early juvenile stages would not be affected by the Trestle-Channel Alternative. King crab larvae at Portsite do not find the hard substrate that they prefer to settle on and there is no indication that they are common in the Portsite area during open water periods. No juvenile king crabs were collected through the ice off Portsite, but two sub-adults were collected off Rabbit Creek, an area known to have more gravel bottom than off Portsite, during summer. Others have reported sparse summer catches of king crabs in the general area offshore from Portsite, but they were much less abundant than in winter collections.

King crabs are known to move offshore into deeper, cooler water during the summer. The scarcity of king crabs in summer collections off Portsite indicate that the bulk of the king crab population using the potential project area in the winter is well offshore during the open-water season and would not be present in any numbers during the dredging season. This indicates that a relatively small segment of the king crab population that uses the tentatively recommended disposal area in the winter would be subject to impacts from dredging or dredged material disposal.

The relatively few king crabs that might be present in the project area during the construction seasons may move away from dredging, but any king crab in the 430-acre area that would be dredged for the channel and turning basin might be injured or killed by the dredging activity.

Dredging during construction of the Trestle-Channel Alternative would produce enough material to cover the bottom at the 6,000-acre disposal site to a depth of about 1 foot. If the entire area was covered at once, then almost all the king crabs in the disposal area might be killed. If dredged material was dumped from a barge all at once and all in the same place, much of it would descend in a dense mass that would cover an area that might not be too much bigger than the barge. At the bottom, the material would flow outward for a distance determined largely by the composition of the dredged material. Anything directly beneath the barge would likely be buried beneath the mass of dredged material. King crabs are strong and mobile, but most would not be able to escape from beneath several feet of dredged material. Dredged material flowing out from the impact area and material that dispersed from the main mass in the water column would be thinner and would not cover the bottom as deeply or as quickly. King crabs buried under a few inches of this outward-flowing dredged material would stand a good chance of escaping.

One possible way to reduce impacts to king crabs and other crabs at the disposal site would be to require dredging contractors to empty the barges within the site, but to do so “on the move” so the material is deposited in thinner successive layers rather than in dense masses. This might increase suspension times for fine sediments but would minimize effects on bottom-dwelling organisms that are mobile. A barge traveling at 8 knots releasing 5,000 cubic yards of dredged material would deposit material about 1 foot deep in the area directly beneath the barge path. Spreading the material out this way might improve survivability for king crabs, but mortality might still be relatively high in the 6,000-acre disposal area.

King crabs also might be affected by loss of food organisms that were destroyed by dredging or covered by the discharge. Loss of food organisms could reduce king crab use of an area or reduce food availability to them so they moved into adjacent undisturbed habitat, this would be unlikely to cause substantial impacts to local or regional populations and would have little effect to adjacent sparse summer populations.

Noise and human activity has not been reported in scientific or fisheries management literature to displace king crabs or cause avoidance. Mating aggregations migrate into harbors in some parts of coastal Alaska, and important king crab habitat at Kodiak and other places in Alaska is in areas that are heavily used by boats, commercial shipping, and other activities. Traditional knowledge accounts of animal behavior indicate that animals may avoid areas that are changed or where there is too much activity, but no specific reference to king crabs or other invertebrates was found in written accounts of traditional knowledge.

A dredged channel and turning basin would create side-slopes that could be easily navigated by king crabs. In much of their range, king crabs readily move over steep, rocky bottoms and through channels and depressions steeper and deeper than the channel would be for the trestle-channel alternative at Portsite.

Maintenance dredging 5 years after construction and at intervals thereafter would produce the same types of impacts as the initial construction, but on a smaller scale because less material would be dredged.

Trestle and loading platform construction and operation would affect a small area of sea bottom and would present little direct risk of impact to king crabs. The vertical structure of pilings and other structures is known to be attractive to king crabs in other locations. At Kodiak, the National Marine Fisheries Service requested that the Corps install a vertical structure to replace habitat lost to harbor construction. The mitigation structure was constructed and monitoring showed that king crabs heavily used it. In other locations, king crabs have been regularly observed moving freely under and past active docks and other marine structures. These observations indicate that the presence and operation of the trestle and loading platform at Portsite would not appreciably affect king crab distribution or other life history attributes.

As reported in Section 3.5.2, studies of mining in waters 30 to 66 feet deep off Nome in the Bering Sea reported that during 4 years of dredging over 7 million $yd^3$ of bottom material produced no discernable effects on king crab abundance in the area. Comparisons between mined and un-mined stations revealed that the mining and displacement of the sediment had almost no noticeable effect on crab population size or distribution. Crab catches, size, quantity, and contribution of most prey groups in crab stomachs were similar between the mined and un-mined areas, but eelgrass (*Zostera marina*) and hydroids that tended to collect in mined depressions, were more common in the stomachs of crabs in the mined areas.

In summary, data from the Portsite area and from other areas of the Chukchi Sea indicate that king crab are widely distributed in the region but populations are too sparse to support intensive commercial fishing. Regional collections did not identify any specific habitat affinities associated with king crabs, and none of the information available indicate that the dredging and disposal sites for any of the alternatives considered in detail are likely to be populated by unusual numbers of king crabs or be of unusual importance as habitat. Dredging and disposal of dredged material for the

Trestle-Channel Alternative would cause minor local mortality and minor temporary effects among king crab in the immediate project vicinity, but would not be expected to cause more than negligible long-term or regional effects.

Other Crabs. Helmet and lyre crabs were regularly collected through the ice in collections at Portsite, but lyre crabs, like king crabs, were not collected during more intensive sampling during the summer. Collections by others indicate that lyre crabs typically move to deeper water during the summer. We therefore conclude that dredging and disposal of dredged material would not directly affect appreciable numbers of lyre crabs, but that a small percentage of available habitat would be modified. We cannot predict whether that modification would improve or lessen the value of the habitat to lyre crabs, so we assume that about 4,000 acres of winter lyre habitat would be reduced in value during each of the 3 years of construction dredging and for a year following each periodic maintenance dredging. This would be a minor short-term local effect.

Helmet crabs are comparatively abundant and collections indicate they are present throughout the region throughout the open water season. They would be subject to the same potential for impacts as king crab. They are tough, mobile marine animals, but those caught up by a dredge probably would be lost. As with king crab, they would be unlikely to survive if they were on the bottom directly beneath the mass of a complete discharge of dredged material, but could probably survive and escape from several inches of material.

We conclude that helmet crabs present in the area dredged during the 3-year channel construction period would be lost and that populations in the 4,000 acres of disposal area used each year would be reduced by some undetermined amount. Habitat value for this species could be reduced in both the dredging and disposal area and could be reduced for a year or more following construction until benthic communities recolonized the disturbed bottom habitat. Those losses would be greatest in the channel, turning basin, and disposal area, but regionally minor and of relatively short duration. Regional collection data indicate that a small percentage of regional populations would be affected, indicating that effects would not be regionally significant to other species that feed on helmet crabs.

Shrimp and Other Invertebrates. Shrimp, amphipods, krill, and other more mobile invertebrate species would be better able to escape from dredging or disposal than sedentary invertebrates, but mortality still could be high in the areas that would be dredged and in the portion of disposal site used each year. Many of the clams, marine worms, bryozoans, and other sedentary invertebrates that inhabit the areas to be dredged would be killed or injured. A percentage of clams, marine worms, and other small, tough, or adaptable marine invertebrates would survive the mechanical effects of dredging and the subsequent mixing, exposure, or burying at the disposal site. Also, some of the invertebrates at the disposal site would be able to burrow up through the overburden and survive. Further, some area of the disposal site might not receive any of the dredged material in one or more of the construction years, so invertebrates in those areas would be almost unaffected. For impact analysis, the extreme worst-case of complete loss of invertebrates at both the dredging and disposal areas was examined.

The area within the combined footprints of the proposed navigation improvements (6,500 acres) represents about 0.04 percent of the southeastern Chukchi Sea floor. About half (about 200 acres) of the area to be dredged would be affected each year. In the disposal site, if dredged material was released by vessels on the move, about a third of the disposal site would be covered to a depth of about 1 foot. Part of that material would drift onto the surrounding area down current from the disposal, so on average an area 50 percent larger than the disposal area for each barge or hopper load of material that is released, or a total of about 4,000 acres. Assuming a homogenous distribution and abundance of invertebrates in the bottom material of the southeastern Chukchi Sea, the worst-case mortality would be a loss of about 0.02 percent of the invertebrates of this group in the southeastern Chukchi Sea during each construction year. This estimate is unreasonably high because it ignores recruitment through reproduction and ability of species to escape from the dredged material plume or dig up through the material deposited on the bottom. It does, however, serve to suggest the most severe risks to this assemblage of invertebrates.

Re-establishment of the invertebrates to pre-dredging levels in the channel, turning basin, and disposal site would be rapid. The invertebrates that would be affected are either mobile as adults (for example crabs, shrimp, and amphipods), or have highly mobile larvae (for example crabs, shrimp, clams, and marine worms).

Turbidity could temporarily interfere with the feeding ability of some filter-feeding organisms that are reached by the plume, including clams and worms. Turbidity could also temporarily interfere with the ability of crab, shrimp and other floating invertebrate larvae to feed and function normally. Temporary reduction in primary productivity would reduce the food supply of micro-invertebrates in the water. This could affect local availability of food, although these small invertebrates reproduce and repopulate rapidly and also are rapidly replaced by dispersion from other areas.

Operation of the Trestle-Channel Alternative would have little effect on invertebrates, but the periodic maintenance dredging would produce the same types of impacts as the original construction dredging and disposal. The area to be dredged for each maintenance event would be about the same as for initial construction of the project; about 480 acres, but the total dredged volume would use only about a quarter of the disposal area (about 1,600 acres, with a 50 percent factor for drift, a total of about 2,400 acres). Maintenance dredging would require 1 year. Effects to invertebrates would be similar to construction effects, but to a smaller population segment and for a shorter period.

Dredging and disposal of dredged materials would impact shrimp and other invertebrates in the 6,500-acre dredging and disposal area. Those impacts would be short term and less than significant locally. Effects would be short-term and minor in the southeastern Chukchi Sea. None of the reasonably foreseeable future actions would add cumulatively to effects of navigation improvements at Portsite. The expanding recreational and potential commercial harvest of king crabs would be cumulative to the effects of dredging. There is no indication that dredging would affect king crab populations sufficiently to reduce harvest or that dredging along with the small local harvests together would cause significant cumulative effects.

### 4.9.3 Fish

- **No-Action Alternative**
- **Third Barge Alternative**

Principal existing project components at Portsite and their effects on fish may be categorized as follows:

Structures. The short dock used for tug moorage and transfer of cargo and people from shallow-draft vessels affects water movement and is vertical structural habitat in a marine system where such structures are rare. The sheet-pile cells also contribute vertical structure to the environment. Many fish are attracted to structures like the pilings and dock. They may find food attached to the structures, protection from predators, relief from currents, shade, or other advantages associated with structures. Fishermen often find it worthwhile to fish in water next to cut banks, boulders, fallen trees, and man-made structures that may concentrate fish. Biologists collecting data for this EIS noted adult Dolly Varden holding near the existing steel sheet pilings during collections in the summer of 2000. Out-migrating juveniles from the Wulik River and other streams in the area are likely to remain in near-shore waters for a week or more after their initial out-migration and may be exposed to minor increases in predation if larger fish are attracted to the underwater structures.

Some fish may benefit from these man-made habitat changes, but traditional ecological knowledge points out that habitat changes from man-made structures may make a place less attractive to animals, possibly including fish. We have no way to quantify effects of the existing structures at Portsite on fish. We do know that in other marine waters of Alaska, salmon, Dolly Varden, and other fish are often found near similar structures and pass through and around similar structures during migration and in other phases of their life cycles. If the existing structures have any direct adverse or beneficial effect on fish, those effects would appear to be limited to the area very close to the structures.

Loading Operations and Other Activities. Noise and activity are produced by loading ore concentrate into the barges, tugs moving the loaded barges to the ore-carrying ships, idling tugs, fuel and cargo transfer from barges, and maintenance. Noise produced by the loudest components is described in

Section 3.4.8. There are no metrics that would meaningfully describe how movements of people, tugs, props, and equipment at Portsite that might be sensed by and reacted to by fish.

Several variables might determine whether fish would be affected by activity at the existing terminal at Portsite. Those variables include, for example: intensity of activity, seasonal habitat requirements of fish, and changing life cycle requirements of fish as the seasons change, and availability of other habitat. Effects of noise on fish from the existing operations cannot be measured with any certainty because there are too many variables and because the habitat at Portsite is so localized that the act of sampling itself would influence fish distribution.

Auditory tests on Atlantic salmon show that they, and possibly the closely related Pacific salmon and Dolly Varden found at Portsite, hear very poorly and are "hearing generalists" (Popper Labs 2003). In some parts of their range Pacific salmon and Dolly Varden are common in places where they are subjected to noise levels stronger than levels we recorded at Portsite. For example, at the Port of Anchorage, Chinook and coho salmon and other anadromous fish stage among the dock pilings next to tugs and moored ships before entering Ship Creek. The Port of Anchorage is beneath the approaches for the Anchorage International Airport and Elmendorf Air Force Base, and fish that stage there are exposed to the repeated noise and vibration of heavy jet aircraft in addition to tugs, barges, ships, activity on the docks, and annual maintenance dredging that may approach 2 million cubic yards. At Seward and Valdez, coho salmon regularly move through heavy boat traffic, past major port facilities, cruise ships, super tankers, and ferries both to out-migrate and in their return at maturity. Juvenile out-migrating salmon often are especially abundant in boat harbors, where they find vertical structure, protection from at least some predators, and relatively calm water. The noise and activity of hundreds of boats and people may disturb them occasionally, but they seem to be well acclimated to activity.

It is known that Dolly Varden and other anadromous fish shy away from sudden movement or noise, particularly in streams and rivers. They may also avoid loud noise and sudden movement in the ocean, but there is no evidence that activity or noise in the ocean causes fish to avoid more than the area immediately around the noise or activity. There also is no evidence in the professional literature that localized noise or activity at the levels present at Portsite causes long-term or widespread effects to migration or habitat use. Some subsistence users suggest that changes in activity or noise may make fish, along with other animals, abandon a wider area or to no longer return to be harvested if a place becomes noisy. Other subsistence users point out that returning salmon and trout have strong instincts that will lead them back to home waters even through very difficult conditions.

The No-Action Alternative would allow the existing activity and effects to continue. Adding a third barge and the tugs to move it would add additional noise and activity, but would not substantially change any other aspect of loading at Portsite. The additional activity would not add any significant increment to the distance noise could be heard, but it would be another noise source heard by fish near Portsite. The same structures would be used, with the single addition of another mooring buoy for idle periods. Effects to fish would be similar to those from the existing loading operations at Portsite.

Contamination. A small amount of ore concentrate is lost during loading. Testing in the surface layer of the bottom material beneath the loader showed more lead in some samples than in comparable samples from other bottom material in the area, but presence was well below screening levels. Contaminant threshold levels were established to protect marine organisms and the people who eat them. The data do not indicate that lead in sediments at the existing loader is a threat to fish, the organisms they eat, or the people who eat them. The No-Action Alternative would not alter the causes of contamination in sediments at Portsite.

A large fuel spill could kill or injure fish in the immediate vicinity of the spill. The 4,000-gallon fuel spill calculated as the Maximum Most Probable Discharge (MMPD) in Section 4.6.5 would be largely recovered if it was spilled in moderate weather or would be rapidly dispersed if the wave climate was severe. A review of spill effects cited in Appendix 10 of this draft EIS found that no reports of fish kills from fuel spills of less than 5,000 gallons in open marine waters. This may be because fish move away from toxic levels of petroleum and/or that fuel components rapidly disperse, evaporate, and break down in seawater.

Effects of the existing operations on fish are minor and local. None of the reasonably foreseeable future actions would add cumulatively to effects on fish of existing facilities at Portsite.

- **Breakwater-Fuel Transfer Alternative**

A breakwater seaward of the existing loader would reduce wave height at the loader and would allow loading during more days each year. It would not otherwise alter operations. Barge traffic would increase during the open-water construction season and the noise of tugs moving them would be added to the noise of tugs supporting existing operations. Noise from constructing the breakwater would add to noise around Portsite, but noise from tug operations is so much stronger that the additional noise from breakwater construction probably would not be a significant factor to fish. Fish that are not displaced or otherwise affected by activity or noise from existing operations probably would not be adversely affected by breakwater construction.

A breakwater would alter about 13 acres of sea bottom that is about like the bottom habitat of almost all the near-shore Chukchi Sea. It would replace that silty or sandy sea bottom with rocky features that are rare in the Chukchi Sea. The hard vertical structure, the attached organisms, and protection offered by the structure all would be attractive habitat to some fish species including Dolly Varden, coho, and Chinook salmon. The breakwater might be similar in form and ecological function to artificial reefs that are established along soft-bottom coastlines in other parts of the United States to enhance fish habitat.

The fuel transfer component of this alternative would disturb about 10 acres of the sea bottom offshore from Portsite. Habitat loss, dredging, and backfill would displace fish from this relatively small area of the Chukchi Sea. Fish might temporarily avoid construction activity and habitat alternation, but it would cause no more than local and temporary effects to marine and anadromous fish.

Maintenance dredging noise, activity, and turbidity would tend to displace fish during and for a short time after the dredging period. Fish would be affected both at the site being dredged and at the disposal site. The locations of those sites, their areas, and the frequency and lengths of dredging periods are identified in Section 2.3.3.

Construction activity for the Breakwater-Fuel Transfer Alternative would cause minor short-term local effects to marine and anadromous fish, which might avoid the immediate area of active construction. After construction, by-pass dredging, presence of the breakwater, and operation of the project would cause long-term minor local habitat alteration, which would cause minor and local effects on fish movement and distribution.

None of the reasonably foreseeable future actions would add cumulatively to effects on fish.

- **Trestle-Channel Alternative**

Structures. This alternative would put substantially more vertical structure in the Chukchi Sea than is there from the existing loader, and it would extend those structures farther seaward. The loader and trestle would have about the same kinds of effects on fish as the existing loader, but some of those effects would be multiplied. In terms of structures in the water, this alternative would place about the same kinds of sheet pile cells in shallower water, and would place clusters of pilings in deeper water. The clusters could be seasonally used as cover and feeding habitat by a variety of fish, including cod, Dolly Varden, and juvenile salmon, and probably by other less common species of the Chukchi Sea. Observations of fish habitat used at other areas indicate that the pilings supporting the trestle and loader could become small, but locally important additions to marine habitat.

Construction of the trestle would be noisy and would be accompanied by considerable activity. Construction would be largely during the open-water period and would take about 3 years. Pile driving; placement of fill in sheet-pile cells; erection of the trestle, roadway, and loader components; and other elements of the trestle and loader construction would produce loud noise through the open-water seasons of 3 construction years. The noise of tugs towing barges delivering construction materials and equipment would be added to noise from continuing loading operations. Other than the transient noise from barges bringing materials up from the south, trestle construction noise likely would not be heard much farther from Portsite than the tugs that move ore concentrate from the existing loader to the ore ships. Close to Portsite, there would be more noise, more frequently, and with more variety.

Fish might avoid areas close to intensive construction activity, but similar construction activity at other marine sites has not been shown to cause more than local effects on fish distribution and no effect on their return to streams for spawning or over-wintering.

Channel Dredging. The channel for this alternative would substantially modify about 430 acres of bottom to produce a trough as much as about 34 feet deeper than the existing bottom with gently sloping sides after the side-slope had slumped for a few years. During the dredging, estimated to require 3 consecutive open-water seasons, fish might be repelled by some aspects and attracted by others. Bottom material disturbed by dredging would increase turbidity at dredging sites along the 3-mile channel and for varying distances down-current from the sites. The noise, activity, and turbidity would displace fish from the immediate area being dredged. During periods of strong currents, turbidity might be perceptible for several miles down current.

Salmon, Dolly Varden, and most other anadromous fish are adapted to finding their home streams through turbidity and in the presence of noise or other disturbances. Changes in water chemistry from marine dredging does not significantly affect the homing ability of returning anadromous fish in other parts of the Pacific and Arctic oceans. Some subsistence users were concerned that turbidity, activity, and noise would reduce the return of Dolly Varden and other anadromous fish to the Wulik River and other streams along the coast of northwestern Alaska. No instance of marine construction causing a reduction in return of anadromous fish in similar conditions could be found in the literature or in the experience of the people who harvest anadromous fish in the Northern Pacific or Arctic oceans.

After dredging, the channel might be less valuable as habitat to fish because it might be less productive. On the other hand, it might be better habitat because of the bottom relief and because the more dynamic system might be more likely to expose bottom organisms eaten by fish and might collect organic detritus that would grow more food organisms. Disturbances may diminish efficiency of energy use and nutrient transfer, so over the long term, the channel might not have the same worms and other organisms in the same abundance and in the same ratios as similar areas that were not disturbed, and the channel might not produce as much food for fish as other similar areas. During scoping, there was concern among some subsistence users that the channel could block fish migrations and cause other broad effects to fish movement and regional distribution. No instance of a dredged channel causing reduction in returns of salmon or other anadromous fish in similar conditions could be found in the literature or in the experience of the people who harvest anadromous fish in the Northern Pacific or Arctic oceans.

While the new channel might not produce as much biomass of potential food as the surrounding seabed, more of the potential food produced might be available to fish. Nutrient release may substantially increase productivity in disturbed environments. Bottom material in Norton Sound, Alaska, is generally similar to the sea bottom offshore from Portsite and was dredged for gold from 1986 through 1990. Jewett (1999) suggests that worms and other sea-bottom organisms exposed during dredging and disposal of dredged material may have attracted fish, crabs, and other marine life. Dredging at Portsite also would expose worms and other foods, which might attract and feed fish. The channel would be more dynamic than the existing bottom. It would tend to collect sediment and organic debris moving over the bottom and would be altered by periodic dredging. Debris collection and the dynamic nature of the channel might attract small organisms that fish eat and might make them more available to fish.

Periodic maintenance dredging would repeat, on a smaller scale, the effects of initial project dredging. Fish would be displaced from the dredge sites along the channel alignment and would be affected in the same manner, for a shorter time period, as the initial dredging.

Dredging the channel for this alternative would produce minor short-term effects that could include localized fish displacement and minor reduction of habitat value in the channel and dredged material disposal site.

Dredged Material Disposal. A significant part of the 6,000-acre disposal site would be covered by the 8.1 million yards of material that would be dredged for this alternative. Productivity in that area would be diminished during initial dredging. Although Jewett (1999) reported that the sediments suspended from dredge mining on similar bottom types in Norton Sound settled out within about $^1/_3$ mile of the dredging activity, the plume of suspended sediments at Portsite might be visible for a mile or more down-current from the disposal site during dredging and disposal operations (Section 4.6.5). Marine and anadromous fish might avoid active dredging and disposal activities. Fish that feed primarily on the bottom might find more food on the bottom at the disposal site during and immediately after dredged material disposal, and less in the first season following disposal. This could temporarily affect local bottom fish distribution, including distribution of flounder, sole, saffron cod, sculpins, blennys, and other bottom fish that were common in collections off Portsite (table 3-31). Local changes in bottom conditions would be unlikely to affect feeding and distribution of fish, including herring, smelt, Dolly Varden, and salmon that move and feed more actively in the water column and range over broad areas of the Arctic Ocean.

Fish collections in the tentatively selected disposal site (site 2) were comparable in species and size with other collections in the area. All the collections indicated sparse assemblages of marine and anadromous species. There was no apparent substantial difference in fish habitat value or use among the potential disposal sites.

Summary of Effects on Fish. In Section 3.5.3, three main categories of fish species were identified as inhabiting the Portsite area: freshwater fish species, including Arctic grayling, whitefish, burbot, northern pike, Alaska blackfish, nine-spine stickleback, and sculpins; anadromous fish species (those spending part of their lives in fresh water and part in salt water), including pink, coho, sockeye, Chinook, and chum salmon, Dolly Varden char, whitefish, smelt; and 20 species of marine fish species (those living only in salt water), the most common of which are starry flounder, Arctic flounder, rainbow smelt, saffron cod, Pacific herring, yellowfin sole, and Alaska plaice.

Freshwater fish would not be affected directly by any of the alternatives considered in detail. No project activities and no activities required for support of project construction would be conducted in freshwater fish habitat, and none of the alternatives considered in detail would affect freshwater fish. Reasonably foreseeable future development could cause local effects to freshwater fish, depending upon how the development was implemented and operated. Reasonably foreseeable future development in or affecting freshwater fish habitat would not be induced by any of the alternatives considered in detail.

Traditional views of animal's relationship to humans sometimes warn against making changes in places the animals use. Some people who expressed concerns during scoping thought that construction activities and the changes caused by dredging would chase fish away, reduce returns to the Wulik River, and reduce the marine fish that would be available to seals that use the ice off Portsite each spring. Others who participated thought that effects would be less severe or wanted more information before forming an opinion.

The scientific and professional literature also deals extensively with the effects of habitat modification and other human changes to the environment. Both the traditional and scientific views emphasize the need to carefully consider actions and to apply lessons learned at other places to decisions about new activities.

Both the traditional users of marine resources and the professional biologists who participated in scoping for this draft EIS were concerned that marine and anadromous fish in the marine phases of their life history would be affected by noise and activity, habitat modification, and water quality. Those specific concerns are addressed in the remainder of this section.

**Noise and Activity.** Anyone who fishes knows that sudden movements and unusual noises scare fish and that fish will avoid places where there is too much noise and activity. Fish certainly would avoid areas where there was active dredging, dredged material disposal, or loading platform construction. While fish avoid noise and activity, they usually do not stay away from good habitat for very long after the noise and activity stop. Chase a salmon or a Dolly Varden off an active spawning bed, and it will soon return. Make enough noise or activity in a stream and migrating salmon may stop coming upstream for a time, but will continue their migration soon after the noise and activity cease. The same thing happens in marine conditions. Fish move out of the immediate area to avoid noise and activity and may move back soon after. Those local movements do not affect broader seasonal or migratory movements.

Construction noise and activity would drive fish away from those activities during the 3 years of construction at Portsite, just as a boat going up a river will chase fish away from some places. There is a great deal of information about migratory fish returns to rivers near big marine projects and about marine fish use of those project areas after construction. Literature about fish behavior and observations by many people at other construction and dredging projects all show the following about noise and activity in marine waters:

- Salmon and other anadromous fish may temporarily avoid the immediate area near dredging or construction activities, but they do not go very far to avoid that noise.
- Dredging, construction activity, and operations of harbors and other major marine projects do not stop salmon and other anadromous fish from returning to their home streams. They may swim around the noise, but the homing instinct is a much stronger influence that noise and activity that they can avoid.
- Marine fish will return to favorable habitat soon after noise and activity are reduced, and will tolerate relative strong noises to stay in habitat they prefer.

All this information from both common experience and from observations at many other sites demonstrates that effects of noise and activity would be both local and temporary. Local and regional runs of Dolly Varden, salmon, cod, and other fish important to people and animals would not be damaged by noise and activity from construction and operation of navigation improvements at Portsite.

**Habitat Modification**. Both dredging and disposal of dredged material would affect fish by changing the habitat near Portsite where those fish live. This may change, at least temporarily, the species of fish that use those altered sites. There is no way to predict exactly how fish would use the modified habitat. We do know that fish that usually swim up in the water column often are less affected by bottom conditions than fish that live on or close to the bottom. We also know that bottom fish all can move easily over the slopes and mounds, although they may or may not prefer the habitat after it was altered by dredging or dredged material disposal. Based on observations by fishermen and others who study fish, we can make the observations about effects of habitat modification by the tentatively selected plan on fish:

- Habitat modification from construction of any of the project alternatives would not keep fish from returning to home streams like the Wulik River. Marine habitat changes on the scale of those tentatively recommended at Portsite have never been shown to reduce anadromous fish returns.

- Herring, Arctic cod, smelt, Atka mackerel, and anadromous fish that roam the oceans in the mid and upper waters would be unlikely to avoid or to particularly favor the modified habitat.

- Bottom fish might prefer or tend to avoid the altered habitat. Soles, pricklebacks, dabs, flounders, snailfish, and plaice might be more abundant or less abundant in the dredged and disposal areas after project construction. Effects to those species would be limited to the dredging and disposal areas.

- Changes to the bottom would not affect fish use of other areas away from construction.

**Water Quality.** Construction and maintenance dredging for the tentatively recommended plan would release small particles from the bottom into the water column. This would make the water turbid (cloudy) at the dredging and disposal sites and for at least a short distance around those activities. If there was a current, then those suspended particles would move with the current (down-current) until they settled out. If there were heavy metals or other materials in the bottom that could be harmful to fish, they also could be suspended in the water.

Fish can be harmed by heavy loads of fine material in the water. It can clog their gills and over long periods of exposure can kill fish. Very fine material, which can be suspended in the water for longer periods may not cause physical harm, but can affect the feeding ability of fish that catch prey by sight. Fish can and will avoid levels of suspended particles heavy enough to hurt them, but salmon, Dolly Varden and other anadromous fish will readily travel through heavy suspended solids loads to return to home waters.

Based on information derived from fish returns and studies on fish migrations and movements from studies of environments with heavy metals, high turbidity, and/or heavy loads of suspended material by fishermen and others who study fish, we can make the observations about effects of water quality factors on marine and anadromous fish:

- Section 3.4.6 of this draft EIS addressed suspended material from dredging and dredged material disposal. It shows that most material from dredging and disposal would fall to the bottom soon after it was released into the water, but that turbidity may be visible in the water column for several hours (and for several miles down current. In table 3-26, total suspended solids levels ranged from 5.8 to 13.4 milligrams per liter (mg/L), and averaged 9.2 mg/L in the tentatively recommended disposal area, so there always is a certain amount of turbidity in the Chukchi Sea. A few hours after release, turbidity from dredging or dredged material would approach background levels and would be difficult to see. Well before that it would be at levels that would not impair fish feeding or other life requirements. Water quality effects from suspended bottom material would be localized, temporary, and would have minor adverse effects on fish.

- Minor elevation in lead samples at the existing DMT loader would not represent a threat to fish if they were dredged. The tentatively recommended plan would not dredge the affected area and would not disturb that lead.
- The tentatively recommended plan would reduce loss of ore concentrate and maintenance dredging would prevent build up of ore concentrate that was lost. Any impacts of lead or other heavy metals to fish would be avoided.
- The 4,000-gallon fuel spill calculated as the Maximum Most Probable Discharge (MMPD) in Section 4.6.5 could adversely affect fish close to the spill site, but experience at other spills show that it would not cause a major loss of fish or damage to fish in a broad area.

### 4.9.4 Marine Mammals

Two frequently expressed concerns related to development at Portsite were that development at Portsite would adversely affect marine mammals and that development would affect subsistence harvest of marine mammals and other animals important to subsistence. This section addresses specific concerns about marine mammals identified during scoping. It also presents information from knowledgeable people of the northwestern and northern coasts of Alaska and the western Chukchi Sea and from the scientific literature.

Much of the traditional knowledge about marine mammals and a considerable part of the scientific data were acquired during subsistence hunting and from analysis of subsistence-harvested marine mammals. The consequences to subsistence from navigation improvements at Portsite are discussed in Section 4.3. Effects to the marine mammals themselves, rather than harvest and use of those mammals, are discussed in this section.

**Beluga Whales.** Two stocks of beluga whales migrate past the Portsite area during their northward spring migrations. That spring migration is separated in time and by migration route. The southward migration of the Beaufort Sea stock is through the western Chukchi Sea, far from Portsite and the coast of western Alaska, while the southward migration of the eastern Chukchi Sea stock is mostly offshore down the center of the Chukchi Sea. There is little potential for any of the alternatives considered in detail to affect belugas in the central or western Chukchi Sea, so this discussion deals primarily with belugas in their spring migration.

The first stock to enter the southeastern Chukchi Sea each spring is the Beaufort Sea stock, which migrates through during April and May on the way to summer areas near the Mackenzie River delta in northwestern Canada. Most of the Beaufort Sea stock moves through offshore leads in broken pack ice, but some may move along leads in the shear zone that separates the drifting pack ice from shore-fast ice attached to shore in shallow water. This persistent lead typically forms 3 or more miles offshore at Portsite, and well outside the influence of any structural features considered in detail for this EIS. Inshore leads occasionally open closer to shore during the periods when Beaufort Sea belugas are migrating past Portsite.

The second beluga stock to move northward through the southeastern Chukchi Sea is the eastern Chukchi Sea stock, some of which may migrate close along the beach for at least part of their northward migration. Most of this stock passes Portsite soon after pack ice breaks up in June and early July. This stock is often reported to be especially sensitive to boat traffic, activity on the beach, and other sources of noise and activity (Huntington and Mymrin 1996 and other sources of local and traditional knowledge).

- **No-Action Alternative**

The no-action alternative would leave the existing Portsite loading operations as they are now.

The existing loading and shipping operations only generate sounds during the open-water season. The strength of the sounds generated and their characteristics are discussed in Section 3.4.8. Ice moving against the structures during breakup and other periods also may produce sounds. However, when ice is moving, ambient sound levels are higher too, which reduces the distance those sounds may be perceived.

The effects of the existing loading operations on beluga distribution are not definable by scientific method because there are too many different factors (variables) that cannot be isolated. Some are associated with other changes in human hunting and other activities in the last 30 or 40 years, and some may be related to climate and oceanic changes that are affecting the Arctic Ocean and the polar ice pack.

Section 3.3 identifies changes in the subsistence take of the two beluga stocks in the last 40 years, which coincides with the much greater presence of motor-driven small boats and the observed changes in marine conditions in the Chukchi Sea. Many elder hunters in the area between Kotzebue and Point Hope said belugas no longer go, or rarely go, to many of the shallower areas they frequented before there were so many motorboats with big engines. Hunters from Noatak told us they used to regularly catch belugas in nets at Sheshalik, but harvest reports show belugas are rarely caught there now. People of Kotzebue and Buckland who used to hunt beluga in the estuaries and shallow waters of Kotzebue Sound and its tributaries say they rarely see belugas in those areas now and that the belugas flee at the first sound of a boat (Huntington and Mymrin 1996).

People working at Portsite occasionally see belugas close to the loading facilities, but there is no organized survey for belugas during the open-water season, and no observation database from before the existing loader was construct that would serve as a baseline for comparison.

Joe Swan Sr., a hunter from Kivalina with many years of experience, stated during public hearings at Kivalina in 1996 that after the dock was built at Portsite, not one beluga followed the shoreline in the summer. He stated that they would not pass by the noise. In the early spring the belugas and whales traveled through the broken ice and followed the patterns allowed for by the ice (J. Swan.1996). During scoping in 2000 and in later meetings, Mr. Swan and other hunters from Kivalina reported the same pattern of belugas following available leads during earlier migrations when ice was still present but avoiding Portsite during the summer. The subsistence maps in Section 3.3 were produced from information collected at Kivalina in 1999 and indicate this same view of the effects of the existing loader and other facilities at Portsite on summer beluga movements.

The best information available regarding effects of the existing loader on summer (eastern Chukchi Sea stock) belugas is from traditional ecological knowledge and the experience of the marine mammal hunters along the coast north and south of Portsite. Their view of effects is supported by subsistence harvest data (table 3-8) and is the basis for the evaluation of Portsite effects on the summer stock of belugas as they pass Portsite. Fraker (1984) also reported that belugas temporarily avoid areas of repeated tug and barge traffic in the Beaufort Sea, which supports statements by the hunters. In other areas where belugas are not so intensively hunted, for example around the Port of Anchorage, they may become acclimated to noises associated with shipping.

Effects of Portsite on belugas of the Beaufort Sea (spring) stock are less clearly evident. Those belugas migrate past Portsite as leads develop in the ice (primarily in April and May) and are gone before the ice is off the southeastern Chukchi Sea. As Mr. Swan stated in 1996, early belugas follow the leads in the ice. They cannot breathe without the leads, so if the only leads pass close to Portsite, the belugas must either pass relatively close to Portsite or wait until the ice opens farther offshore. Some people who hunt off the coast north of Portsite believe belugas will stop their movement north if the only leads are close to Portsite and will wait until other leads open up farther offshore. Others say that spring belugas usually follow the leads farther offshore anyway and will continue past if there is not too much noise or activity at Portsite. No one has reported seeing belugas waiting for an offshore lead so they could pass Portsite, and harvest data from the south do not indicate that large numbers of migrating belugas are regularly held up south of Portsite during April or May.

While information related to subsistence hunting provides excellent information about the beluga population segment that migrates north relatively close shore in the Portsite area, subsistence data and long-standing traditional ecological knowledge tells us that the main migration of both spring (Beaufort Sea) and summer (eastern

Chukchi Sea) beluga migrants typically does not come close to shore except at relatively few locations in the Chukchi Sea. Point Hope is one of those locations. Point Lay is near another important beluga habitat. There is no information to suggest the shoreline between Portsite and Cape Thompson is particularly important to the main migratory body of Beaufort Sea or eastern Chukchi Sea belugas. There are no known calving, breeding, or other areas along that coast that are required for the well being of either beluga stock. Although belugas may feed as they move northward through the Chukchi Sea, their feeding is not associated with any particular area. Northward movement of the main body of belugas well offshore indicates that there is no essential near-shore beluga-feeding habitat between Portsite and Cape Thompson.

Portsite facilities and activities may not be heard or otherwise sensed by belugas in the main migration body of either the Beaufort Sea or eastern Chukchi stocks (estimated minimum population 32,453 and 3,710 respectively) in most years as they migrate northward, but the smaller segments of those migrating stocks that sometimes pass close to Portsite would hear, see, or otherwise sense the DMT facilities. That near-shore segment of either stock may move farther offshore to avoid Portsite.

The only identified potential effects of Portsite and associated DMT activities on belugas are associated with potential avoidance. Some of the northward migrating belugas that might have migrated closer to shore as they pass Portsite may now, at least in some years, move farther off shore to avoid Portsite. Any shift to farther offshore would, presumably, be related to noise or activity at Portsite.

Portsite is not in operation when the earlier Beaufort Sea stock is moving past Portsite. Sounds measured during normal late winter operations (Section 3.4.8) could be detected in the water under the ice as far as about 2,700 feet from shore. Those same operating sounds from vehicles and generators could be detected in the air about 1,300 feet from shore. Noise intentionally produced to measure sounds during studies at Portsite in 2000 were much stronger than those produced by normal late winter operations. Those sounds could be detected at near-background levels in the air about a mile off shore on a moderately windy day. Those same sounds transmitted into the ice and the water under the ice at the DMT loader were estimated to be detectable in the water to about 3.7 miles offshore. This indicates that belugas moving northward past Portsite within a half-mile from shore might hear sounds of normal on-shore winter operations. If particularly noisy maintenance work was being performed on the existing loader during the same late winter-early spring period, those sounds might be detectable in the water as far as 3.7 miles off shore. If belugas were passing Portsite through leads in the ice pack during exceptionally noisy activity on the existing loader, then they would have to be about 3.7 miles offshore to be outside the range of detectable noise. Belugas might have to find leads farther offshore to be outside the range of sounds from DMT, or move past DMT even though they hear the noise, or they could be held up for a short time until the noise stopped or offshore leads opened.

During the open water period, when ore concentrate is being delivered to bulk carriers moored offshore, sounds from tugs might be heard to about 6.5 miles offshore, with occasional ship departures and arrivals that sound might be heard to about twice that far. Tug noise is almost continuous during summer when weather allows loading, so Chukchi (summer stock) belugas passing Portsite near the end of the late spring-early summer migration might be within range of detectable sounds of tugs as much as 6.5 miles offshore from Portsite. To be outside the range of detectable noise from tugs and ore concentrate loading operations as they pass DMT, belugas might have to swim as much as 6.5 miles offshore.

Prop cavitation from bulk carrier ships departing or arriving at Portsite about twice a week during the shipping season could be detected as much as about 16.5 miles offshore from Portsite.

The three different potential noise sources from maintenance, loading and ship movement may be detectable at varying distances from Portsite, up to as much as 16.5 miles offshore. Belugas hearing noise from those and other sources could move offshore, closer to the main beluga migration, to avoid noise or to lessen exposure to those sounds. Avoidance could take belugas closer to the main northward migration pathway, but there is no indication that it would have any other effect on belugas. Avoidance of near-shore activity, when that avoidance would not keep belugas from using critical habitat or performing important life functions, would be no more than a minor and local adverse effect.

Available traditional and local knowledge and scientific information indicates that Chukchi Sea beluga whales are affected cumulatively by changes in climate and ice conditions, and noise and activity that may affect their use of calving or other sites important in their life histories. Marine mammal mortality in the Chukchi Sea appears to be related primarily to natural causes and hunting. Vessel strikes are an important cause of mortality to marine mammals in some seas where boating and shipping is intensive, but vessel strikes are not a reported source of mortality in the Chukchi Sea. There is no indication that shipping in the Chukchi Sea will increase appreciably in the foreseeable future, but non-commercial boating may increase as population grows. This could add potential for collisions with belugas, porpoises, and whales. There are no current data about current non-commercial boating, no estimates of future non-commercial boating in the Chukchi Sea, and there is no feasible way to develop useful estimates of boating trends in the foreseeable future.

Noise from transportation, construction, and other activities may cause belugas to avoid the noise source. This avoidance could be biologically significant if noise avoidance kept marine mammals from using habitats that are critical for calving, intensive feeding, or other essential activities. This has been a concern related to petroleum exploration and development in the Beaufort Sea. Other than activities at Portsite and related shipping, there are no reasonably foreseeable future construction or shipping activities that would add to existing effects to marine mammals in the Chukchi Sea.

There has never been a large petroleum spill into marine waters at Portsite. Analysis of spill potential (appendix 10) indicates a maximum most probable discharge (MMPD) of 4,000 gallons for the existing DMT facilities. The analysis also shows that any substantial marine petroleum spill event would be during the July-October operating season. This means that any large spill would be after the main spring migration of both beluga stocks in this region. Spilled petroleum would be cleaned up, biologically and chemically degraded, or dissipated before belugas returned the following spring.

Human-related impacts to availability of food for belugas are minor and localized. Reasonably foreseeable future effects appear to be localized and regionally unimportant to marine mammal populations.

- **Third Barge Alternative**

Whether Portsite affects spring (Beaufort Sea stock) beluga or not, the third barge would not be operating when this stock was migrating past and would not affect belugas of this stock.

The Third Barge Alternative would compress the same number of trips between the loading facility and the ships anchored offshore into a slightly shorter period. More tugs would produce sounds of about the same tone and strength as existing operations. As discussed in Section 3.4.8, adding multiple sound sources of similar strength does not greatly affect the combined strength of the sound or the distance it is heard. This indicates that the No-Action and Third Barge alternatives would have very similar effects.

Adding a third barge would have little effect on summer stock belugas at Portsite. The types of activities would remain the same as for existing conditions, the distance sounds would change little, and the tones and sound energy produced would be very similar to the existing condition. If belugas are avoiding Portsite with the existing conditions, and we have no evidence they are not, then continued avoidance with a third barge would represent no change in effect. Cumulative effects would be the same as for the No-Action Alternative.

- **Breakwater-Fuel Transfer Alternative**

Breakwater-Fuel Transfer Alternative. The breakwater and fuel line would be constructed during the open-water season of 2 consecutive years. Construction would not begin each year until loading operations began at Portsite, so construction could begin in early July when part of the Chukchi beluga stock was still migrating past. A committee of subsistence hunters from the region decides when the main beluga migration has passed and loading can begin, but any late migrants could be displaced offshore, just as hunters in the area tell us they are now by existing operations. Sounds from construction would not travel any farther than sounds from existing loading operations, so if belugas move offshore far enough to get away from the sounds of loading, then they would also be far enough offshore to avoid sounds of construction.

The breakwater alternative would be a 200-foot wide by 2,800-foot-long, 13-acre breakwater constructed parallel to the beach along the 24-foot depth contour, approximately 695 feet seaward of the existing loading facility. Belugas would be able to swim around either side of the breakwater during their migration if they wanted to migrate that close to shore.

The fuel transfer line would also be constructed during the open-water season. It would extend offshore about as far as vessels moor now to be loaded with ore concentrate. Sounds from dredging and installation of the pipeline and mooring facilities would not ordinarily be heard farther than the sounds of tugs moving barges of ore concentrate to the waiting ships. Construction of the fuel transfer facilities would not likely be heard farther away than sounds from existing sources and would not be expected to adversely affect belugas.

Operation of Portsite after construction of the breakwater and fuel line would not produce more noise than existing operations except that four or five tankers each year would replace the ocean-going barges that now deliver fuel to Portsite, and additional barges would distribute fuel from Portsite to coastal communities, primarily to the south. Neither activity would appreciably alter the noise environment at or near Portsite or the noise that might be heard by late belugas migrating past Portsite. Bypassing the 26,000 cubic yards of beach material accumulated each year would produce dredging or excavation sounds. Those sounds would be produced during the same time as normal loading operations. Dredging would produce weaker sounds than loading and would not be audible as far offshore as the sounds produced by tugs moving the ore concentrate to ships.

Moving ice in the later stages of breakup would be pushed against the breakwater and would produce noise that could be heard at least a short distance underwater. The breakwater would be about 250 yards farther offshore than the loader, so the sounds of ice striking the breakwater might be heard a short distance farther offshore than sounds from ice striking the existing loader. During the same period, ice would be striking the existing loader, as it does now.

Moving ice would not be in contact with the exposed end of fuel line, which would be lowered to the sea floor each year or with the mooring facilities, which would be removed or placed on the sea floor at the end of each open-water season. Those features would not change the noise environment during the spring beluga migration.

Belugas do not calve near Portsite or have major life cycle events (other than migration) associated with marine habitat offshore from Portsite. Belugas eat fish and a variety of larger invertebrates. Construction and operation of this alternative would not substantially affect fish or invertebrates in an area large enough to significantly alter feeding opportunities for belugas. Effects of construction would be negligible or minor because construction would be in the summer when the main migration of belugas has passed. After construction, the project features would be adjacent to existing structures at Portsite and would produce similar noise levels. Effects would not be appreciably different from the existing facilities, so there would be no more than minor additional effects.

The MMPD marine petroleum spill would be much larger for this alternative than for the existing facilities (appendix 10), but would occur in the same timeframe and would be largely dissipated before the next spring beluga migration.

Commercial transportation and construction activities in the Chukchi Sea in the reasonably foreseeable future would not be likely to add to impacts on marine mammals from construction and operation of the Breakwater-Fuel Transfer Alternative.

- **Trestle-Channel Alternative**

This alternative would be constructed during the open-water season of 3 consecutive years. Construction would not begin each year until loading operations began at Portsite, so construction could begin in early July when part of the eastern Chukchi beluga stock was still migrating past. A committee of subsistence hunters from the region decides when the main beluga migration has passed and loading can begin, but any late migrants could be displaced offshore, just as they may be by existing operations. Sounds from construction of the trestle and loading platform would not travel any farther than sounds from existing loading operations, so if belugas move offshore far enough to get away from the sounds of loading, then they would also be far enough offshore to avoid sounds of construction. Sounds of tugs and/or dredges traveling to the disposal site would be heard farther offshore than existing loading operations, and would extend by several miles the distance Portsite activities might be heard during construction. Section 4.8 discusses the distance construction sounds might be heard for this alternative.

In the second and third years of construction, and in the years following construction, migrating belugas would pass by the changes in the marine environment created by construction. By the time construction was complete, those changes would include as much as 9.5 square miles of bottom covered to a depth in some places of as much as several feet by dredged material, an 18,500-foot channel as much as 30 feet deeper than the bottom at the shoreward end, and the loading platform and trestle. The new loading platform would extend about 1,050 feet farther seaward than the existing platform and would have more pilings beneath it, but the pilings would be smaller in diameter.

These changes would not be expected to have any substantial effect on the summer stock belugas, which according to traditional knowledge already recognize the activity at Portsite and move offshore to avoid it on their way north. The spring migrants following ice leads would not likely be inshore as far as the loading platform (about a third of a mile offshore), but could follow the leads over the dredged material and the channel. Traditional ecological knowledge emphasizes respect for animals and the value of maintaining the habitat undisturbed so the animals will be willing to return. Those traditions indicate that belugas encountering a strange new channel or dredged material disposal site might not want to continue on, or would look for another path for their migration. Traditional knowledge can provide more information than any other source about some aspects of beluga behavior, particularly as their behavior relates to responses to observed human activity. Traditional knowledge collected during research for this report, however, does not incorporate much information from direct observations of effects on belugas from dredging or dredged channels.

Observations at other places inhabited by belugas have noted that belugas continue to use accustomed habitats after depths and channel changes or structures are erected. Belugas often inhabit extremely turbid waters where river channels across tidal flats have steep (sometimes almost vertical) walls and shift from season to season. The mouth of the Susitna River in Cook Inlet, Alaska, is one such environment. They also readily move past and around dredged moorage areas in the Port of Anchorage and developed areas in the waters along the Kenai Peninsula. The same Beaufort Sea beluga stock that migrates past Portsite each spring is exposed to offshore development in the Beaufort Sea that includes artificial islands with production facilities and causeways from shore to some of these facilities.

Noise and activities associated with construction of the trestle and loader for this alternative would be largely overshadowed by the stronger sounds of tugs. Ore concentrate loading would continue during construction, so tugs would continue to move the self-unloading barges of ore concentrate to bulk freighters waiting offshore. Other tugs would be moving dredged material to the disposal site throughout the 3-year construction of the trestle and loader.

Two components of trestle and loader construction would add distance or strength to the sounds and activity produced by other construction and on-going operations, and would temporarily increase distance that sounds for construction might be heard. One component of the added sounds and activity would be the ships and barges bringing the loading platform and construction materials to Portsite. The other would be construction of the first cells of the trestle through the ice as early in the winter as the ice would support construction equipment.

As discussed in the No-Action and Third Barge alternatives, summer belugas may move offshore to avoid the existing DMT loading structures. If they avoid the DMT structures now, then they would continue to do so, or might even move farther offshore. On the other hand, if noise rather than the presence of a structure is the main factor affecting their behavior, then the summer belugas might be affected less by operation of the Trestle-Channel Alternative than operation of the existing loader. The Trestle-Channel Alternative would produce far less sound energy than the existing ore concentrate shipping from Portsite and would confine most of that sound to the loading area close to shore, which means it would not be heard as far offshore.

There is no certainty that fewer sounds from Portsite shipping would translate into fewer effects on movements of summer belugas, but it does indicate that sounds from operation of this alternative would not affect those belugas more than the existing operations.

Spring belugas passing Portsite through ice leads might be aware of the longer trestle and loader of this alternative. Belugas during the spring migrations usually follow leads that are farther offshore than the new loading platform would be (about a third of a mile), but could occasionally be forced shoreward as far as the loader. If they were, they could easily swim through the supporting pilings, if they chose to do so. They might choose to avoid the pilings and follow a lead farther offshore, even if they had to wait for another lead to form.

Biological effects to belugas would be temporary and local. If they move away from Portsite during their spring and summer migrations, then this would not keep them from returning to usual migratory pathways farther north and would keep them from using important habitat or meeting other biological requirements. Potential for impacts from a marine petroleum spill associated with this alternative would be about the same as with the existing facilities and operations (Appendix 10).

Potential cumulative effects to belugas are discussed in the No-Action Alternative. That discussion indicates that commercial transportation and construction activities in the foreseeable future in the Chukchi Sea would not be likely to add to impacts on marine mammals from construction and operation of the Trestle-Channel Alternative.

**Bowhead Whales.** The western Arctic stock of bowhead whales is the only remaining bowhead stock in the Alaskan Arctic Ocean (Section 3.5.4.1). This stock migrates from the Bering Sea to the Beaufort Sea, and passes Portsite from as early as late March through early June. The migration peak, however, generally passes in April and May.

The great majority of the bowhead population migrates through leads in broken pack ice well offshore of Portsite, but individuals or small numbers may occasionally migrate through leads that form along the shear zone between drifting pack ice and the anchored shore-fast ice. Those leads typically form intermittently 3 or more miles offshore from Portsite.

- **No-Action Alternative**

Bowhead movements apparently are not affected more than locally by existing DMT ore concentrate loading and shipping operations. These operations do not begin until after the bowhead spring migration is past Portsite. Autumn migration southward is through the western Chukchi Sea, far west of Portsite and its influences.

The presence of the Portsite structures may at least occasionally affect local bowhead movement in the immediate Portsite area. Traditional ecological knowledge tells us that bowheads have acute hearing ability, and observations of bowhead noise avoidance in the Beaufort Sea confirms this.

A summary of data by the National Academy of Sciences (2003) reported that bowheads avoided areas around ships conducting seismic exploration, drill platforms, and drill ships that are actively drilling. Data in the National Academy of Science 2003 summary and in other reports of observations in the Beaufort Sea show that bowheads actively avoid noise sources when they receive sounds stronger than about 105 dB. Sounds from tugs that almost continuously deliver ore concentrate to waiting ships through the summer might be as strong as 105 dB as far as 10 miles offshore from Portsite. If the Portsite areas were to be used by bowhead whales as summer habitat, then noise and activity would be expected to affect bowhead distribution and habitat use in a radius of 10 miles or more seaward from Portsite. The Beaufort Sea bowhead population, however, is far north of Portsite when shipping begins each summer, well beyond the range the sounds could be separated from background sounds with scientific instruments. This suggests that bowheads are not affected by existing operations at Portsite.

Traditional ecological knowledge and information shared during scoping tells us that bowheads are able to hear or sense sounds, changes in the environment, and actions of people far beyond the distance that sounds and actions can be seen or that scientific instruments can receive. This would indicate that bowheads can perceive the presence of the existing dock and loader, even when far away, and may adjust their movements and behavior accordingly. The same sources also relate that bowheads remember where those distant sounds came from and may avoid those areas during migrations months or years later. This store of traditional ecological knowledge suggests that bowhead whales may be affected by operations even though they may be hundreds of miles away during the operating period.

If bowhead whales are reacting to the presence of or the operation of the existing loader and dock at Portsite, the effects are not strongly evident in the subsistence harvest by Kivalina. That harvest provides the only specific data we have to measure bowhead presence or effects of the existing facilities. Information in Section 3.3.3 shows that Kivalina harvested four bowheads between 1968 and 1982 (before development began at Portsite) and three in the period between 1991 and 2002 (after the loading facilities were constructed).

The existing facilities and operations at Portsite have no apparent effect on the invertebrates that bowhead eat or on any of the other important aspects of bowhead life history.

The distances that sounds from existing operations at Portsite can be heard offshore are addressed in the previous discussion of belugas. That discussion indicates that belugas moving northward past Portsite within a half-mile from shore might hear sounds of normal on-shore winter operations. If particularly noisy maintenance work was being performed on the existing loader during the same late winter-early spring period, those sounds might be detectable in the water as far as 3.7 miles offshore. If bowheads were passing Portsite through leads in the ice pack during exceptionally noisy activity on the existing loader, then they would have to be about 3.7 miles offshore to be outside the range of detectable noise. Bowheads might find leads farther offshore to be outside the range of sounds from DMT, might move past DMT even though they hear the noise, or might be held up for a short time until the noise stopped or offshore leads opened. Later in the year, long after bowheads have passed Portsite, noise sources from maintenance, loading, and ship movement may be detectable at varying distances from Portsite, up to as much as 16.5 miles offshore, but would not be detectable in the Beaufort Sea summer bowhead habitat.

Bowhead whales hearing noise from maintenance at DMT could move offshore to lessen exposure to those sounds. Avoidance could take those bowheads closer to the main northward bowhead migration pathway, but there is no indication that it would have any other effect on them. Avoidance of near-shore activity, when that avoidance would not keep bowheads from using critical habitat or performing important life functions, would be no more than a minor and local adverse effect.

Available traditional and local knowledge and scientific information indicates that bowhead whales in the Chukchi and Beaufort seas are affected cumulatively by changes in climate and ice conditions, and noise and activity that may affect their use of calving or other sites important in their life histories. Marine mammal mortality in the Chukchi Sea appears to be related primarily to natural causes and hunting. Vessel strikes are an important cause of mortality to marine mammals in some seas where boating and shipping is intensive, but vessel strikes are not a reported source of mortality in the Chukchi Sea. There is no indication that shipping in the Chukchi Sea will increase appreciably in the foreseeable future, but non-commercial boating may increase as population grows. This could add potential for collisions with belugas, porpoises, and whales. There are no data about current non-commercial boating, no estimates of future non-commercial boating in the Chukchi Sea, and there is no feasible way to develop useful estimates of boating trends in the foreseeable future.

Noise from transportation, construction, and other activities may cause bowheads to avoid noise sources. Avoidance could be biologically significant if it kept marine mammals from using habitats that are critical for calving, intensive feeding, or other essential activities. This has been a concern related to petroleum exploration and development in the Beaufort Sea. Other than activities at Portsite and related shipping, there are no reasonably foreseeable future construction or shipping activities that would add to existing effects to marine mammals in the Chukchi Sea.

Effects of a marine petroleum spill would be about the same as for beluga whales. Potential for a spill would be limited to seasons when bowheads are not present and any petroleum spilled into the Chukchi Sea would be cleaned up, degraded, or dissipated before bowheads returned.

Human-related impacts to bowheads are minor and localized. Reasonably foreseeable future effects appear to be localized and regionally unimportant to marine mammal populations.

- **Third Barge Alternative**

An additional barge, if added as the Third Barge Alternative to the existing operations, would add little to the total activity at Portsite and would not expand the distance the sounds of tug movement and other operations could be heard. Effects of this alternative on bowhead whales would be the same as the No-Action Alternative–local and minor throughout the life of the project.

- **Breakwater-Fuel Transfer Alternative**

A breakwater would be well inshore of observed bowhead migratory pathways. The fuel transfer facility would be a small terminal on the sea bottom at the seaward end of the fuel line. The fuel line itself would be evident by the filled 10-foot-deep trench where it would be buried. Bowheads might detect these relatively minor changes in the environment and could react to them. Nothing in the data regarding bowhead reactions to construction in the Beaufort Sea indicates that the small changes caused by a buried pipeline and small exposed sea-bottom terminal would greatly affect bowhead movement.

The Breakwater-Fuel Transfer Alternative would be constructed during the open-water season, when bowheads are far north in the Beaufort Sea. Operation of this alternative would add little to the total activity at Portsite and would not expand the distance the sounds of tug movement and other operations could be heard. Effects of construction and operation of this alternative on bowhead whales would be the same as the No-Action Alternative–local and minor throughout the life of the project. Potential for effects from a marine petroleum spill would be about the same as for beluga whales (Appendix 10).

- **Trestle-Channel Alternative**

Peak sounds produced by pile driving and construction of the trestle and loader might be as strong as 105 dB as far offshore as 12 miles. Sounds produced by dredging and dredged material disposal might be as strong as 105 dB as far as 5 miles offshore from the disposal site (a total of about 12 miles offshore from Portsite).

The channel and turning basin would be dredged and the trestle and loading platform would be constructed at times when bowheads were far north of the Portsite area in the Beaufort Sea. Bowheads might sense activities beyond the range that they can be detected by humans or man-made instruments and react accordingly. No other direct effects of construction would be expected.

The completed channel would extend to about 3.5 miles offshore and could be sensed by the occasional bowheads passing by Portsite that close to shore. The channel 3 miles offshore would be less than 10 feet deep, with gently sloping sides. The offshore end of the channel, while detectable, would not be a major change where the bottom already is more than 45 feet deep.

The disposed dredged material would raise the bottom in the disposal area by a few feet in some areas, which might be sensed by bowheads migrating north. Suspended solids and turbidity from each construction season would have settled during the winter, long before the bowhead's spring migration that occasionally brings a few bowheads closer to Portsite, and would have no affect on water clarity or quality during the migration period. Changes from channel dredging probably would not present a substantial obstacle to bowhead passage, although their perception of environmental change could lead them to react and move farther offshore. There are no data to apply to this question, but there are varying opinions. If bowhead movement patterns were altered by environmental changes, then they would move offshore into waters closer to the path followed by the main body of migrating bowheads. If ice conditions did not allow a bowhead to readily shift its course farther offshore, then it might be held up in its migration north until a pathway opened. Minor delays are frequent in the northward migration of bowheads and are unlikely to cause more than minor, local, short-term adverse effects to bowheads.

Periodic maintenance dredging would have the same potential for effect as construction dredging, although for a shorter period and with smaller potential for change in area and bathymetry.

Potential for effects from a marine petroleum spill would be about the same as for beluga whales. Major adverse effects would be avoided because petroleum is and would be transferred in the marine environment only during the July-October operating period when bowheads are far north of Portsite.

Operation of the Trestle-Channel Alternative would greatly reduce tug activity in the Chukchi Sea and would produce less noise than existing operations. This would have little or no beneficial effect, however, because bowheads are far from Portsite during the loading season when the tugs operate.

Summary of Effects. The main spring bowhead migration route, as the Chukchi ice pack begins to open, takes the whales from the Bering Strait through the central Chukchi Sea to the waters off Point Hope, and then north and east through the Beaufort Sea. This migration route is documented in commercial whaling records dating back more than 150 years, in traditional knowledge dating to thousands of years before the whaling ships came, and in observations by biologists and by the people of the Chukchi and Beaufort Sea who now hunt the whale. Some years, a few of those bowheads follow leads in the ice well to the east of the main migration route. Those bowheads, separated from the main migration, are the whales that are sometimes taken by whaling crews hunting along the coast between Cape

Krusenstern and Cape Thompson. Those also are the bowheads that might come close enough to Portsite to swim over the channel, to hear noise from the new trestle, or to feel the presence of the dredged material in the disposal site.

Mitigation measures would be taken to minimize effects of the Trestle-Channel Alternative to all bowhead whales and to avoid effects to the main body of whales migrating north in each spring. Those actions are:

- Construction, operation, and maintenance dredging and other construction for this alternative would not begin until after the main bowhead migration was well past Portsite. Any winter construction would cease before the first bowheads entered the Chukchi Sea. These restrictions are similar to and consistent with restrictions on activity that are used to protect these same whales in the Beaufort Sea.

- The dredged channel would be a wide and relatively shallow bottom feature that would develop smooth, gently sloping sides in the years immediately after construction, so it would be similar to the natural, gently sloping bottom in this region of the Chukchi Sea.

- The dredged material disposal area would be kept as close to shore as possible to stay away from the main bowhead migration route.

- Dredged material would be spread thinly over the disposal area so the bottom would not have large mounds or other features very different from the natural bottom.

Those mitigation measures would help ensure that the Trestle-Channel Alternative would not affect bowhead whales in the main migration route. Even with the mitigation measures, we cannot be sure that the bowheads that occasionally travel east of the main migration would not sense the Trestle-Channel Alternative. Those whales might sometimes come close enough to the project so that even without the noise of construction and operation they might sense the project and avoid it. This could cause them to move farther offshore as they passed Portsite. Avoiding Portsite could cause them to swim farther in their migration or to be held up to wait for leads to open in the ice farther offshore. Both potential effects could make the bowheads less available to local hunters, but would not cause more than minor short-term adverse effects to the bowheads themselves.

Experience with bowheads and in-water development in the Beaufort Sea indicates that bowheads may move away from noise and activity, but there is no indication that they have made major changes in migration routes or other movements. This suggests that if bowheads avoided the Trestle-Channel Alternative, they might move farther offshore toward the main migration route and then continue on the northward migration.

Existing and reasonably foreseeable development has not caused, and is not likely to cause, more than minor effects to bowhead whales in the Chukchi Sea. Effects from existing conditions at Portsite, effects of the Trestle-Channel alternative if it was constructed, and reasonably foreseeable actions in the region would cause no more than minor biological effects to bowhead whales in the Chukchi Sea. Potential effects to subsistence hunting of bowhead whales are addressed in Section 4.3.7 of the draft EIS.

**Gray Whales.** Gray whales of the eastern Pacific stock migrate each spring along the western coast of North America from the central Baja Peninsula, Mexico, to feeding grounds in the Bering and Chukchi seas (section 3.5.4.1). The principal feeding areas for gray whales in the eastern Chukchi Sea are in the resource-rich Bering Strait area, and a relatively small offshore area near Point Lay and Wainwright. Gray whales typically do not feed near the Portsite area, but sometimes pass through the general Portsite area during summer as they migrate to feeding grounds in the Point Lay/Wainwright area.

- **No-Action Alternative**
- **Third Barge Alternative**

Gray whales probably are more likely than any other whale species to be struck by vessels near Portsite because they migrate through the eastern Chukchi Sea during the shipping season, but no collisions or vessel strikes have been reported. Gray whales migrate great distance through and close to busy industrial areas. They apparently are well acclimated to man-made sounds and activity. There are no data that indicate existing structures or operations at Portsite have any discernable effect on gray whales, although whales may avoid strong sounds and other activity. There also is no traditional knowledge or local observations that indicate any direct impact of existing operations to gray whales.

Adding a third barge would add an increment of activity and another source of operating sounds, but would not substantially expand the distance that loading and other operations at Portsite would be heard or potential for vessel strikes to gray whales.
Unlike bowhead and beluga whales, gray whales are commonly present in the southeastern Chukchi Sea during operations at Portsite. Individual gray whales close to Portsite could be harmed by inhalation or ingestion of petroleum if it was spilled into the Chukchi Sea at Portsite. Gray whales are subjected to a variety of man-induced stresses, including petroleum spills in their annual migrations between Mexican and Alaskan waters. Gray whales are occasionally harmed by those stresses, and the existing and potential future risk of marine petroleum spills at Portsite are among the potential sources of stress for this species.

Gray whales have been recently hunted in the western Chukchi Sea and occasionally in other parts of their range. Hunting and other human activities have not appreciably affected Pacific and Arctic gray whale populations. Operations at Portsite contribute a small and local increment to potential for collisions with gray whales. None of the reasonably foreseeable future actions would affect gray whales. Direct and cumulative effects of existing DMT facilities and operations on gray whales appears to be negligible.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would be constructed during periods when gray whales may be present in the waters off Portsite or in the general Portsite area. Breakwater construction, activities of work barges, noise, and activity associated with excavating a channel for the fuel line and installation of terminal and mooring facilities all could locally displace gray whales from migratory paths and at least small areas of feeding habitat.

Operation of the breakwater-fuel transfer alternative would have about the same effect on gray whales as the existing Portsite operations except that ships would be present a few more days a year to transfer fuel to Portsite facilities, and barges would be used to distribute fuel from Portsite. By-pass dredging would result in a localized, near-shore sediment plume. Sounds of the by-pass dredging would be masked by other activities at Portsite. Potential for effects from a petroleum spill would be greater than from the existing DMT facilities at Portsite (Appendix 10).

- **Trestle-Channel Alternative**

Dredging and dredged material disposal would produce sounds, activities, and sediments that could displace gray whales from the channel area and the disposal site during their summer migration north. Displacement would be temporary (three construction seasons) and would affect a part of the Chukchi Sea that is not critical to gray whale biological requirements.

Trestle and loader construction noise and activity could temporarily displace gray whales from the Portsite area for the 3-year construction period. The sounds of construction probably would be heard at about the same distance that gray whales are able to sense on-going operations at Portsite. The tentatively recommended plan would not increase potential for petroleum-related effects to gray whales, but would represent about the same risk as existing operations. Operation of the Trestle-Channel Alternative would produce less noise and could have less potential to affect gray whales than existing operations. Direct and cumulative effects would be minor and local.

**Harbor Porpoise.**

- **No-Action Alternative**
- **Third Barge Alternative**
- **Breakwater/Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

Harbor porpoise range or migrate past Portsite after the ice pack recedes in late spring and summer. They also may range through the area during the entire open-water season. Harbor porpoise response to noise and activity has not been documented in the Arctic Ocean, but they are likely to avoid strong sounds. Existing operations at Portsite have had no apparent effect on this small cetacean. There are no data or traditional information sources indicating that effects of new or expanded navigation facilities at Portsite would directly or cumulatively affect harbor porpoises.

**Ringed Seal.** Ringed seals are the smallest of the Arctic seals. They migrate with the advancing and retreating ice and mostly inhabit near-shore areas including shore-fast ice during winter (Section 3.5.4.1). Large numbers of ringed seals may be in the Portsite area during the winter. They are common within about 4,000 feet of the existing bargeloader where they often are seen basking on the ice during the spring.

- **No-Action Alternative**
- **Third Barge Alternative**

Existing operations at Portsite have had no apparent effect on ringed seal presence, distribution, or life cycle requirements. Aerial counts and observations from the existing loader detected no differences between distribution of ringed seals on the ice off Portsite and ringed seal numbers and distribution on the ice in other comparable areas (Section 3.5.4.1).

Normal operating noises during winter when ringed seals are present consist of low-level background generator noise, vehicles, and early spring maintenance on the conveyor and barge loader. From traditional knowledge, we know that ringed seals are likely to avoid noise and activity from hunters. At Portsite, where seals are not usually hunted within about 1 mile of the bargeloader, the on-going noise of winter and spring operations did not keep ringed seals from basking within 900 yards of the loader, so where ringed seals are not hunted and where people do not approach too closely, they may become accustomed to at least some noise and activity. This appears to be happening at least to some degree close to the Portsite bargeloader. They also were observed to be only temporally disturbed by even the very loud sounds from blasting conducted 2 to 3 miles away, indicating that even very strong sounds from Portsite do not cause major changes in ringed seal behavior or distribution in the waters farther offshore from Portsite. Ringed seal abundance and distribution in the eastern Chukchi Sea and in the vicinity of Portsite do not appear to have been greatly affected by existing activity at Portsite. Ringed seal, however, probably avoid or less frequently use the habitat within a few hundred yards of the existing loader. The diminished use of habitat could cause minor adverse effects to ringed seals in that small area of available habitat.

Ringed seals leave the Portsite area during and shortly after breakup and are not present when the tugs, barges, and ships are loading ore concentrate during the summer. Consequently, the No-Action and Third Barge alternatives would not have any direct impact on the distribution of ringed seals. Ringed seals mostly eat small

Arctic cod and other fish that sometimes gather in large schools under the ice. Existing DMT structures and loading activities at Portsite do not appear to have affected food resources of ringed seals at Portsite or to have affected distribution more than locally.

A petroleum spill late in the operating season would be more likely to affect ringed seals than any other marine mammal because they are present in at least small numbers throughout the winter and may use habitat closer to shore than other seals. If petroleum was spilled into the southeastern Chukchi Sea late in the operating season (for example, late October), and if the majority of the spill could not be cleaned up, and if the spill did not go onto the beach (which near-shore spills usually do), then remnants of the spill still present at freeze up might make their way into open leads or into pockets under the ice where they could be encountered by ringed seals. Petroleum does not cause the loss of insulation to seals that it does to birds and sea otters, but it can be damaging if it is ingested or inhaled. The MPPD spill does not represent a threat to a large area, but could adversely affect ringed seals. Effects would be local, temporary, and of minor regional importance.

Pacific and Arctic Ocean stocks of ringed seals may be affected by global climate and ice changes. Development, transportation, and hunting in the Chukchi and Beaufort seas have not had more than local effects on ringed seal abundance and distribution. Reasonably foreseeable actions in northwestern Alaska together with existing structures and operations at Portsite would not cause more than minor cumulative effects to ringed seals.

The No-Action Alternative and the Third Barge Alternative would not be expected to cause more than minor local effects to ringed seals in the Portsite area.

- **Breakwater/Fuel Transfer Alternative**

The breakwater would have a 13-acre footprint about 1,400 feet offshore in 24 feet of water. The breakwater would be locked in shorefast ice during most winters, but might also be subjected to ice piling on the seaward side during other years. A breakwater locked in shorefast ice would be similar to artificial islands constructed for oil development in the Beaufort Sea, and as such would have no significant effects on the local distribution and abundance of ringed seals (Moulton et al. 2005).

A breakwater at Portsite would provide a significant surface area of vertical cover on a homogenous sea bottom devoid of vertical cover. Ringed seals mostly eat small Arctic cod that sometimes gather in large schools under the ice. Vertical cover including rocks and pilings are known to attract invertebrate and vertebrate marine animals, including fish, in other marine areas, and a breakwater could attract food resources that would benefit ringed seals in the Portsite area. Any benefits would, however, be local and unimportant to regional populations.

This alternative would be constructed during the summer when ringed seals are not in the Portsite area. The fuel transfer facility pipeline end manifold (PLEM) on the sea bottom would be 45 feet deep and about 10,000 feet offshore. The pipeline would be buried and covered with a concrete mat to protect it from near-shore ice gouging. Neither the PLEM nor the covered pipeline would be expected to adversely affect the distribution of ringed seals on the surface ice.

The pipeline would be drained and sealed during winter. This alternative would have greater potential for marine fuel spills than the existing DMT facilities at Portsite. The protective mat over the buried pipeline would likely be covered soon after construction by a layer of sediment and would not be discernable on the bottom. It is unlikely that the pipeline or the PLEM would affect the distribution or schooling behavior of Arctic cod in the Portsite area when ringed seals are present.

- **Trestle-Channel Alternative**

The trestle-channel alternative would result in a vertical structure extending about 1,750 feet from shore and a dredged channel extending about 3 miles offshore from the end of the trestle and loading platform (figures 2-4 and 2-6). Noise and activity from construction and operation of the trestle would be similar to noise and activity experienced during construction of Northstar Island for oil development in the Beaufort Sea. Moulton et al. (2005) studied the effects of Northstar construction on ringed seals, and concluded that, with inclusion of environmental variables (Moulton et al. 2002), there was no evidence of reduced seal densities close to Northstar as a result of construction activities, and that seal densities could be higher within 0.1 to 1.1 miles distance from Northstar than in areas farther away. Ringed seals might avoid the immediate area of the trestle and loading platform because of its physical presence, but based on observations near the existing bargeloader and the experience of researchers in the Beaufort Sea (Mouton et al. 2002, 2003, 2005), the distance of avoidance would not be more than about 1 mile.

Fish, including Arctic cod, might be attracted to the vertical pilings that support the trestle and platform, and ringed seals might benefit from attraction. Whether or not fish are attracted, there is no indication that the trestle would adversely affect fish presence during the periods when ringed seals are abundant in the Portsite area.

The dredged channel might also attract cod or “lead” them to the area from deeper water. Many species of fish are naturally attracted to depressions in sea bottoms that otherwise have homogenous bathymetry like that in the southeastern Chukchi Sea. Depressions in a homogenous bottom can result in subtle changes in current that attract or capture invertebrate species and attract larger fish. Numerous natural channels and depressions similar in character to the proposed channel at Portsite exist within the geographical range of ringed seals.

Some hunters were concerned that a dredged channel at Portsite might disrupt the natural ecology of the area and affect the ability of ringed seals to find food. Construction noise might increase the distance that ringed seals avoid DMT structures at Portsite for part of one winter during construction of near-shore trestle supports in

February and March. This noise would be temporary and might affect the local distribution of ringed seals for about 2 months prior to the main ringed seal migration.

This alternative has about the same potential for petroleum spill effects on ringed seals as existing operations at Portsite. Additional information is in Appendix 10.

There is no indication that existing or reasonably foreseeable actions, including construction and operation of the Trestle-Channel Alternative would cause more than minor local adverse effects to ringed seals in the southeastern Chukchi Sea. Reasonably foreseeable actions would not cumulatively add to effects of the Trestle-Channel Alternative to cause more than minor local effects to ringed seals.

**Bearded Seal.** Most bearded seals in the Bering and Chukchi Seas migrate north and south with the receding and advancing ice front (Section 3.5.4.1). Traditional knowledge and experience of hunters in the southeastern Chukchi Sea also relates that some juveniles stay behind during the open-water season and are sometimes found in near-shore waters off the mouths of rivers and streams, including the Wulik River, 17 miles north of Portsite, and Rabbit Creek, 10 miles south of Portsite.

- **No-Action Alternative**
- **Third Barge Alternative**

Observed bearded seal densities and distribution on the southeastern Chukchi Sea ice during spring migration were about the same off Portsite as in similar water depths along the coast to the north and south (figure 3-34), and observers on the existing loader recorded more than 500 observations on the ice offshore in one afternoon. Late in the breakup of Chukchi Sea ice, bearded seals carried close to Portsite on ice floes may move farther offshore to avoid structures and activity there. This would represent a minor shift in distribution during a short period of the late spring migration.

The No-Action Alternative would leave the existing Portsite loading operations as they are now, while the Third Barge alternative would compress the same number of yearly trips between the bargeloader and the ships anchored offshore into a slightly shorter period. The shipping season and the total volume of ore concentrate loaded would not change with the No-Action or Third Barge alternatives.

No written or oral information collected from hunters in the region indicated that the existing Portsite structures or operation have greatly affected the relatively few bearded seals that remain in the southeastern Chukchi Sea during the July through September or October shipping season.

The existing Portsite structures and operations showed no apparent effect to bearded seal abundance or distribution of migrating bearded seals that congregate offshore from the Chukchi Sea coast each spring and had no apparent effect to the small numbers of bearded seals that remain in that region through the summer. The No-

Action Alternative appears to have no more than minor effects to bearded seals in their habitat offshore from Portsite. The Third Barge Alternative would have same low potential for effects on the species or its distribution.

Potential for effects from a marine fuel spill associated with this alternative would be about the same as potential effects to beluga whales.

Cumulative effects to bearded seals may include natural changes in climate and ice conditions, cyclic changes in food abundance, and hunting. The DMT facilities may lead to avoidance of the area around the loader, although bearded seals on the ice typically are well offshore throughout their range along the southeastern Chukchi Sea.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would have a 13-acre footprint about 1,400 feet offshore in 24 feet of water. The breakwater would be locked in shorefast ice during most spring migration periods. Unlike the smaller ringed seal that often lives on shorefast ice, bearded seals live in areas of thin and broken ice along the flaw leads that typically form 3 to 4 miles or more offshore from the Chukchi Sea coast near Portsite. A breakwater locked in shorefast ice would have little if any adverse effect on the local distribution of bearded seals.

Unmolested, bearded seals tend to move closer to Portsite on drifting ice during and after breakup. A breakwater would occasionally hold northward drifting floes that are carrying bearded seals if the seals were on floes in water that shallow. This would be an occasional and temporary occurrence that would not be biologically important to bearded seals. Some hunters expressed concerns during scoping meetings that any structure, including a breakwater offshore of Portsite, might reduce the forage for bearded seals in the area, resulting in fewer seals. Bearded seals generally do not feed in water as shallow as the breakwater location, so there would be little potential affect to feeding habitat important to bearded seals. Bearded seals feed mostly on invertebrates, including crabs and shrimp, and a breakwater would likely increase the diversity and productivity of these invertebrates in the Portsite area, as noted in Section 4.9.3. Even if that habitat were less valuable, the loss of 13 acres of potential food-producing habitat would be no more than a minor loss to the local or regional migrating populations.

The fuel transfer facility would result in a pipeline end manifold (PLEM) on the sea bottom 45 feet deep and 10,000 feet offshore. The pipeline would be buried and covered with a concrete mat to protect it from near-shore ice gouging. Neither the PLEM nor the covered pipeline would be expected to disturb or change the existing habitat enough to adversely affect the distribution of bearded seals.

Construction of the pipeline would disrupt 10 acres of benthic habitat, of which at least the offshore portion might currently contribute food for bearded seals. The sea bottom covered by the protective concrete mat could be temporarily “taken out of production" as a food-producing habitat for bearded seals. This area of habitat is small relative to the amount of equal habitat in the southeastern Chukchi Sea.

Potential for effects from a marine fuel spill associated with this alternative would be about the same as potential effects to beluga whales.

The Breakwater-Fuel Transfer Alternative would have no more than minor effects on bearded seals or their habitat. The cumulative effects of this alternative, existing development, and reasonably foreseeable development in the Chukchi Sea on bearded seals would not cause more than minor local effects to habitat availability or other important biological requirements of bearded seals.

- **Trestle-Channel Alternative**

The trestle part of a Trestle-Channel Alternative would extend about 1,750 feet from shore (figures 2-4 and 2-6). Bearded seals occupy the offshore leads and broken ice beyond the dynamic "shear zone" where pack ice meets the shorefast ice. At Portsite, the shear zone is generally in deeper water 3 or more miles offshore, although bearded seals occasionally come closer to shore on drifting floes during breakup or when a lead forms close to shore.

Observations from the existing loader did not indicate the existing loader and activities at Portsite had any effect on bearded seal distribution or abundance. The Trestle-Channel Alternative would extend a structure of about the same appearance approximately 1,050 feet farther offshore than the existing loader. This would still be almost 3 miles from the nearest bearded seal groups seen from the existing loader or in aerial observations. There is no written account in traditional knowledge or other observations related to how offshore bearded seals react to on-shore or near-shore structures several miles away. Some of the hunters we talked to thought that extending the trestle farther offshore would not bother bearded seals as long as the trestle was not constructed or operated in the spring when bearded seals were migrating past Portsite. Others thought that the bearded seals would move farther offshore or away to the north or south to stay away from a longer structure.

The distance bearded seals stayed offshore was the same at Portsite as it was to the north or south when data were collected in the spring, so they apparently were not being displaced farther offshore by existing structures at Portsite. If the trestle from the Trestle-Channel Alternative extended an additional 1,050 feet offshore, then it might be expected to push bearded seals a maximum of 1,050 feet farther offshore or offshore to the next lead in the ice. Altogether, that would push bearded seals out of as much as 50 acres of otherwise available habitat. This would be a minor biological effect, considering the area of available similar habitat in the southeastern Chukchi Sea.

Potential for effects from a marine fuel spill associated with this alternative would be about the same as potential effects to beluga whales.

Some seal hunters expressed concern that a dredged channel and disposal area offshore of Portsite might affect the ability of bearded seals to forage, resulting in fewer seals in the area. Bearded seals feed mostly on benthic invertebrates including crabs and shrimp. Dredging and disposal would disrupt about 9.5 square miles of benthic habitat used by bearded seals in the southeastern Chukchi Sea. Recolonization of dredged and disposal areas can be rapid in temperate waters, but new colonizers are unlikely to represent the same assemblage as the original inhabitants (Univ. of Maine 2002). Recolonization is slower in Arctic waters (Dunton, et al.1982). The dredged and disposal areas may largely recolonize in one year, but maintenance dredging 5 years after initial dredging would disrupt the channel area and part of the disposal area again. Maintenance dredging schedules after construction would allow sufficient time for the area to recolonize between dredging events.

Bearded seals would lose partial value of up to 10 square miles of potential food-producing habitat for one or more years after each dredging event. Bearded seals can travel several miles under the ice in search of food. The temporary reduction in value of this habitat would not likely affect the ability of bearded seals in the region to find food during their northward spring migration. If there was less food in the dredged and disposal areas, then bearded seals might move into adjacent habitat. This could put additional pressure on resources in those areas, increase competition, and reduce food intake by bearded seals in this segment of their migration. Bearded seals in their northward migration, however, are spread over thousands of square miles and are able to move great distances among the ice floes and leads. The small percentage of habitat affected and the mobility of bearded seals during this period indicates that effects on food availability would be localized and of minor biological importance. Reasonably foreseeable future actions would not add significantly to potential effects of the Trestle-Channel Alternative to bearded seals.

<u>Impact Uncertainty</u>. *There has been relatively little in-water construction within the range of migrating bearded seals, so there is relatively little information about impacts from other actions. The existing in-water loading facilities at Portsite have no apparent effect on bearded seal aggregations on ice flows directly offshore. Constructing a trestle and loader 1,750 feet offshore would place structures about 1,050 feet closer to bearded seal migratory habitat than the structures now present. This would be a short distance nearer to the closest bearded seal concentrations on the ice. There appears to be little risk that project structures would displace bearded seals by any appreciable amount.*

*The channel would be in water closer to shore than is usually inhabited by migrating bearded seals and so would have little effect on their movement or food resources.*

*The disposal area would be in habitat used in the late spring by bearded seals on the ice, as would any other disposal area that might be developed in similar water depths. Their principal prey species are mobile and recolonize quickly, but prey availability could be reduced in the disposal area by some percentage that cannot be* *predicted. Based on numbers observed from Portsite and from aerial surveys, a 50 percent reduction in prey organisms and a comparable reduction in carrying capacity. If that prey reduction displaced all the bearded seals in the disposal area, then it could displace a maximum of about 250 to 300 bearded seals for a short period at the peak of their migration from parts of the 9.5-square-mile disposal area in each of the 3 construction years and in the spring following each maintenance dredging period.*

**Pacific Walrus.** Pacific walrus normally migrate north along the receding edge of the pack ice through the central Chukchi Sea in June. Traditional knowledge tells of walrus feeding near Portsite (Braund 1999), but Portsite is far off the usual migration route of the species, and observations of feeding in the Portsite area are rare. A marine fuel spill at Portsite associated with any of the alternatives considered in detail would be unlikely to affect walrus because they typically range so far from Portsite even in the winter when operations are halted.

- **No-Action Alternative**
- **Third Barge Alternative**

There is no indication in traditional knowledge or in the scientific literature that existing facilities or operations at Portsite have adversely affected walrus or their distribution. The No-Action Alternative would leave the existing Portsite loading operations as they are now, while the Third Barge Alternative would compress the same number of trips between the bargeloader and the ships anchored offshore into a slightly shorter period. The shipping season and the total volume of ore concentrate loaded would not be changed by the No-Action and Third Barge alternatives. No effects to walrus would be expected.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would cover about 13 acres about 1,400 feet offshore in 24 feet of water. The Breakwater-Fuel Transfer Alternative would be constructed well outside the typical range of Pacific walrus. The Breakwater-Fuel Transfer Alternative would adversely affect habitat that contains relatively sparse populations of clams and other species eaten by walrus, but walrus are rarely seen along the southeastern coast of the Chukchi Sea, including the Portsite area.

Walrus would not be present during construction or operation of the Breakwater-Fuel Transfer Alternative. There is no indication in traditional or scientific knowledge that walrus fear land or would avoid a breakwater structure that would appear to them as a low island. Their only contact with the breakwater or other project features would be during a rare event that brought walrus on ice flows far out of their normal range to the southeastern coast of the Chukchi Sea. If walrus avoided the breakwater, or the breakwater impeded their movements, the effects would be short-term, local, and of no more than minor biological importance to walrus life history requirements.

- **Trestle-Channel Alternative**

The Trestle-Channel Alternative would be constructed during the open-water season over 3 consecutive years. Construction would not begin until the ice had receded past the Portsite area and barges could reach Portsite. The ice normally clears Portsite by late June or early July. Pacific walrus migrate from the Bering Sea through the Chukchi Sea along the edge of the ice as it recedes in spring and summer and as it advances in winter. The general pattern of migration is shown in Section 3.5.4.1. The main spring walrus migration is northward through the central Chukchi Sea, and only seldom are small numbers carried on currents near Portsite. The main body of walrus migration would have passed Portsite by the time shipping or construction of the trestle at Portsite began. The two shoreward support cells for the trestle would be constructed during the winter, but construction of these cells would be before the ice began to recede and well before walrus began moving north through the Chukchi Sea.

The Trestle-Channel Alternative would have no more than minor local effects on walrus because the habitat that would be affected is not typically used by walrus, because walrus do not typically migrate through the Portsite area, and because even if walrus did pass to Portsite, the only effect would be short-term avoidance of a insignificantly small area of their habitat.

**Polar Bear.** Polar bears are migratory and are generally found along the margins of polar ice where there are concentrations of ringed and other seals (Section 3.5.4.1). Most polar bears of the Chukchi Sea population migrate south in winter with the advancing ice. The pregnant females move to inland or offshore denning areas, but most males, juveniles, and non-birthing females typically follow ringed seal concentrations south, with many bears moving south along the coastline. Coastal waters of the southeastern Chukchi Sea are not used by a large number of polar bears and there are no identified sites of particular importance to them. They are seen occasionally by hunters of the region and sometimes are seen close to communities or Portsite.

- **No-Action Alternative**
- **Third Barge Alternative**

The No-Action Alternative would leave the existing Portsite loading operations as they are now. The Third Barge Alternative would not alter conditions at Portsite during the seasons when polar bears are present, and so would have the same effect as no action.

Polar bears in the Chukchi Sea tend to follow concentrations of ringed seals (Section 3.5.4.1) and migrate northward along with the seals and the receding ice pack each spring and summer. The occasional polar bears that range into the Portsite area are gone before operations begin at Portsite, so the existing DMT operations at Portsite have not had any observable effects on polar bears. There also has been no observable effect from the presence of the facilities during periods when the loading facilities are not being operated. Polar bears occasionally pass on the ice close to the loader, but have not been reported to remain near it or other facilities at Portsite. The No-Action Alternative does not appear to affect polar bears. The Third Barge Alternative would not alter facilities or operations when polar bears are present and would have a similar lack of effect.

Polar bears are cumulatively affected by climate and ice changes throughout their range, by cyclic changes in food abundance, and by hunting. Development has not notably displaced polar bears, but has lead to bear-human conflicts in regions where polar bears are abundant and are attracted to potential food sources in developed areas. Portsite is not in an area where polar bears are plentiful and does not appear to be an important attraction to polar bears, but does add a small increment of development to other cumulative effects to polar bears.

A fuel spill at Portsite associated with any of the alternatives considered in detail would not affect polar bears during the open-water season, but there is a small risk that remnants of a spill late in the operating season could persist under the ice and cause loss of insulation or ingestion effects to one or more of the polar bears that occasionally range there.

Effects, both cumulative and direct, of the No-Action and Third Barge alternatives to polar bears would be minor and local.

- **Breakwater-Fuel Transfer Alternative**

Fuel transfer facilities would not be seen when polar bears are present and would have no effect. The small island created by the breakwater would be similar in appearance during the winter to natural coastal features encountered by polar bears. It would not be expected to displace polar bears from habitat near Portsite. Ice moving past man-made islands in the Beaufort Sea sometimes creates open-water leads that may persist long enough to attract seals, which, in turn, have been reported to attract polar bears. This might happen at Portsite if the Breakwater-Fuel Transfer Alternative is constructed. While this is possible, several factors indicate this alternative would be unlikely to attract polar bears feeding on seals. These factors are:

- Polar bears are uncommon in the Portsite area, while ringed seals are both abundant and widely distributed. Observers on the existing loader in 2000 counted as many as 9,000 ringed seals in a single day (figure 3.38). There are many ringed seals that polar bears can catch without getting close to Portsite.

- Leads caused by islands only form when ice is moving. Ice within 1,400 feet of shore at Portsite is land-fast most of the time until active breakup begins.

- Large persistent leads (including the Point Hope Polynya) often are present in the Portsite area and offer other leads to attract both seals and polar bears.

- Water is shallow at the breakwater site, only about 24 feet deep. Ringed seals may use leads in water of this depth, but may prefer deeper water with better food resources.

Although polar bears are not often in the area around Portsite, the occasional bears that move through the area could be attracted to an open lead if one formed down current from an island breakwater. Attracted bears could become hazardous to people working at Portsite, so measures could be required to drive them away. Potential polar bear attraction would represent a potential minor local biological effect on polar bears. This effect would be cumulative to other natural and man-made effects. Effects of the Breakwater-Fuel Transfer Alternative on polar bears would be minor and local. Reasonably foreseeable future actions would not add significantly to potential of the Breakwater-Fuel Transfer Alternative to affect polar bears.

- **Trestle-Channel Alternative**

The Trestle-Channel Alternative would be constructed during the open-water season over 3 consecutive years. Construction would not begin until the Chukchi Sea was clear of ice and when polar bears and the seals they hunt have typically migrated north.

The two shoreward support cells for the trestle could be constructed during 2 months of one winter, and polar bears could be in the Portsite area during the construction of these cells. Construction of the cells could displace ringed seals and polar bears that feed on them from a small area of their range during this period.

Polar bears are curious and are sometime attracted to human activity. Bear-human conflicts sometimes result from this contact. The probability is low, but winter construction could result in the harvest of a polar bear by local hunters hired to protect crews, if a bear approached the construction area. Some bears might also be attracted to the trestle and loading platform out of curiosity after its construction, or they could be attracted to a down-current lead as discussed for the Breakwater-Fuel Transfer Alternative. Others might avoid the trestle, loading platform, and the area around it. Although the Trestle-Channel Alternative would be constructed to about 300 feet farther off shore than the Breakwater-Fuel Transfer Alternative, water depths and potential for lead formation in the ice would be about the same. Potential polar bear attraction would represent a potential minor local biological effect on polar bears. This effect would be cumulative to other natural and man-made effects. Effects of the Trestle-Channel Alternative on polar bears would be minor and local. Reasonably foreseeable future actions would not add significantly to the potential of the Trestle-Channel Alternative to affect polar bears.

### 4.9.5 Terrestrial Mammals

Caribou and moose seasonally occupy tundra habitat near Portsite and are seasonally common in the hills and on the tundra inland from the Portsite. Moose may be in the Portsite area year round. Caribou are more migratory and their abundance varies from season to season and year to year.

Other larger terrestrial mammals in the Portsite area include Arctic fox during winter, red fox and musk oxen year round, grizzly bears during summer, and Dall sheep in the mountains of the region. Arctic fox range across the shorefast ice while red fox live and prosper among the Portsite buildings. Musk oxen range among the hills behind Portsite and do not come into contact with Portsite. Grizzly bears hibernate in the hills behind Portsite during winter and sometimes patrol the beaches north and south of Portsite where they feed on marine mammal carrion during summer.

A variety of small mammals including Arctic hares, ground squirrels, lemmings, voles, and weasels live on the tundra around Portsite.

- **No-Action Alternative**
- **Third Barge Alternative**

The No-Action and Third Barge alternatives would continue the transportation and loading of ore concentrate as it currently exists. Caribou are sometimes in view of the trucks that transport ore concentrate over the DMTS road and occasionally may be close enough to Portsite to see and hear activities there.

Moose do not migrate but do seasonally move from one habitat type to another. They often congregate in vegetated areas along the rivers during winter (Section 3.5.4.2). Moose are sometimes seen near lagoons in the Portsite area and along the DMTS road, but seldom close enough to Portsite to be affected.

Many differing views have been expressed about the effects of Red Dog Mine and the DMTS road on caribou and their movements, and to a lesser extent about effects on other animals. Caribou and other animals at least sometimes react to the immediate physical presence of the DMTS road and associated transportation and mining features. They also, at least sometimes, react to traffic and other activities associated with those features. Dust from the road may reduce plant productivity for at least a short distance off the road, and the dust collected from plants near the road contains lead and other metals. Productivity may reduce food availability to some undetermined extent in the affected area, and metals on the plants, if eaten in sufficient quantity, could affect caribou and other animals along the road. Tissue tested from caribou near the DMTS road, however, have not shown higher levels of lead than tissue from caribou elsewhere.

The existing facilities at Portsite, Red Dog Mine, and the DMTS road may cause local effects to caribou movement and have reduced plant productivity in a small percentage of habitats in the region around those facilities. The No-Action and Third Barge alternatives would not add to or otherwise alter those effects or effects of the existing facilities on other terrestrial mammals. None of the alternatives considered in detail would increase the potential for on-land fuel spills away from Portsite where they could impact terrestrial mammals.

- **Breakwater/Fuel Transfer Alternative**

The breakwater and most of the fuel transfer features of this alternative would be constructed during the summer and well offshore from Portsite. About 1 acre of terrestrial habitat used by small mammals would be modified and potentially reduced in value.

- **Trestle-Channel Alternative**

The features of this alternative would be constructed at Portsite adjacent to existing facilities and activities. Any direct effects to moose, caribou, or other terrestrial mammals would be limited to the immediate area surrounding Portsite where construction might be seen or heard. This would be about the same area where existing activities can be seen and heard. Direct impacts would be, at most, localized and minor.

A variety of small mammals live on the tundra around Portsite. About 3.5 acres of land, including wetlands would be covered with gravel to build a pad for the trestle abutments and a new fuel tank. This pad would displace small mammals from wetland habitat to adjacent wetland habitat. Displacement of those small mammals would not result in substantial adverse impacts to small mammal populations in the Portsite area. The new facilities would not cause any appreciable impacts to owls, foxes, or other predators that prey on small mammals and would not induce additional development that would cumulatively affect terrestrial mammals.

### 4.9.6 Birds

Portsite is on a coastal migration route for many species of birds including waterfowl, seabirds, and terrestrial birds (Section 3.5.5). During the spring migration, thousands of ducks, geese, loons, and other waterbirds typically migrate north along the coast and sometimes fly very low along the beach and over near-shore ice.

According to traditional knowledge, many ducks and geese in the spring migrate along the coast when the wind is strong from the north and migrate more inland when winds are calm or are more southerly. Seaducks and seabirds, including eiders and murres (crowbills), generally migrate along offshore leads and mostly far from land. Some species of seaducks, including oldsquaw and black scoter, commonly spend the summer on lagoons along the coast of Northwest Alaska including the Portsite area.

Large numbers of raptors, shorebirds, and passerine birds accompany the migration. Willow ptarmigan live in the Portsite area year round.

- **No-Action Alternative**
- **Third Barge Alternative**

The existing facilities have reduced the value of a relatively small habitat area near Portsite. Birds, including migratory waterfowl, may fly into the existing loader or other structures and wires at Portsite, but biologists at the site observed no bird-strike mortality during studies for this draft EIS, and none have been reported. Passing birds, including waterfowl, are seen to fly over or around existing facilities, as they may also sometimes avoid humans and other structures in their environment. There is no indication that Portsite and operations there have caused more than minor, localized effects to birds or their habitat or that other development in the sparsely populated region has cumulatively caused significant effects to migratory waterfowl or other birds of the region.

A marine fuel spill during the summer associated with any of the alternatives considered in detail could affect the relatively sparse seabird and waterfowl populations directly exposed to the spill plume. A spill in the late summer would have a greater potential to affect migrating waterfowl. Effects would be local and temporary.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would be built about 1,400 feet offshore in 24 feet of water, and have a 13-acre footprint. Low numbers of seaducks (typically less than 100) including oldsquaw or long tailed ducks, common eiders, and harlequin ducks are typically seen using this habitat during early summer. Those seaducks would be inhibited from using the area of the breakwater during the 3 summers of construction.

Diversity and density of invertebrates that are food for seaducks is relatively low in the near-shore waters at Portsite, but the presence of those ducks suggests that there is food enough to attract a small number of seaducks. This small number of seaducks would lose 13 acres of bottom habitat to the footprint of the breakwater. The fuel pipeline part of this alternative would use about 10 acres of sea bottom for the pipeline and PLEM. The less than 25 acres of habitat that would be disturbed by this alternative represents a very small portion of the over 410,000 acres of similar habitat available to the seaducks along this section of the northwestern Alaska coastline and does not represent a substantial impact. Loss of habitat would be a minor effect in an area with almost no marine development and with no appreciable potential for cumulative effects from development.

- **Trestle-Channel Alternative**

A trestle and loader 1,050 feet farther seaward than the existing loader might increase the distance some waterfowl fly around or over the trestle. Daylight is present almost around the clock during the spring migration, and the trestle would be fully visible to migrating waterfowl, except on foggy days. Birds would be, however, more likely to strike the trestle at least occasionally.

<u>Information Gap</u>. *Potential for bird strike mortality at a new loader constructed for this alternative cannot be estimated with any confidence. The existing loader, which reaches about 700 feet offshore and more than 40 feet above the Chukchi Sea, apparently has not been the instrument of major bird-strike mortality. Other structures, particularly those with support wires and small-diameter structural components along the northern coast of Alaska have been the sites of bird strike episodes that caused substantial mortality of waterfowl and other birds. There is no way to predict the potential for bird-strike mortality that might be associated with a new trestle and loader at Portsite. Mitigation measures specifically intended to avoid or minimize bird strikes are recommended in the mitigation plan for this alternative (Section 2.4)*

Some waterfowl including Canada geese, pintail ducks, shoveler ducks, gadwalls, and greenwing teal were common in both the north and south Portsite lagoons during surveys for this EIS and other reports. About 3.5 acres of land that may be used by ducks and shorebirds during early summer would be used for construction of the trestle approach, fuel storage tank and other project features. Less than 0.5 acre of this wetland is seasonally or permanently flooded habitat that could be used by transient or nesting waterfowl. Waterfowl and shorebirds would be displaced from this 0.5-acre of wetland. There are extensive areas of similar habitat in the region. Effects would be minor and local. Cumulatively, the region has extensive wetlands with only minor losses to development, so this would represent no more than a minor cumulative effect.

### 4.9.7 Special Status Resources

#### 4.9.7.1 Threatened and Endangered Species

Three species that have special Federal status are found in and near the southeastern Chukchi Sea and might be at least seasonally present in the general Portsite area. Those species are two threatened seaducks (Steller’s eiders and spectacled eiders) and the endangered bowhead whale. The life histories of Steller’s and spectacled eiders are discussed in the biological opinion prepared for these species by the U.S. Fish and Wildlife Service (Appendix 5).

Steller’s and spectacled eiders migrate north through the eastern Chukchi Sea to nesting habitat on Arctic tundra. They typically migrate north by flying low along offshore leads, but they can be blown inshore during extended storms and may fly north along the coastal beaches. Steller’s eiders do not typically use airspace near

Portsite except under those conditions. Portsite and associated shipping lanes are not near any area designated as critical habitat for Steller's eiders. According to traditional knowledge, Steller's eiders are seldom seen in the Portsite area (Georgette 2000), but a few small flocks were seen during the wildlife surveys at Portsite in 2000 (Section 3.5.6). Steller's eiders may have historically nested on the coast of northwestern Alaska, but none are known to nest near Portsite, and no nests were identified during surveys near Portsite or Kivalina.

Spectacled eiders also migrate north across the Chukchi Sea along offshore leads (Section 3.5.6). According to biologists who tag and track spectacled eiders, Portsite is far from their migration route and they might only rarely be seen in the Portsite area (M. Petersen personal communication). This data is supported by local traditional knowledge (Georgette 2000).

Although the migration route of spectacled eiders is well known, the summer areas of non-breeding spectacled eiders is not well known and they are believed to scatter in small flocks within their summer range (USFWS 2002). There are no recorded sightings of spectacled eiders on lagoons near the Portsite, but there have been sightings on lagoons north of Kivalina Lagoon (Dames and Moore 1983). The closest designated critical habitat for spectacled eiders to Portsite is the Ledyard Bay molting area near Cape Lisburne, almost 100 miles from Portsite.

Bowhead whales migrate through ice leads in the Chukchi Sea on their way to the Beaufort Sea from late March through June (Section 3.5.4). The majority of the population migrates far offshore from Portsite, but occasionally a few bowheads migrate through leads close to Portsite. Their autumn migration from the Beaufort Sea to their winter area in the Bering Sea is down the Siberian shore of the western Chukchi Sea. During informal consultation, the National Marine Fisheries Service determined that construction of the tentatively recommended plan would not have an adverse impact on bowhead whales (Appendix 4-NOAA Letter 9/12/2003).

- **No-Action Alternative**
- **Third Barge Alternative**

Existing facilities at Portsite and associated mining and transportation facilities have apparently not affected Steller's or spectacled eiders or their habitats. The existing loader and Portsite structures may have caused some of the bowhead whales that occasionally pass Portsite to go farther offshore to avoid the presence of structures or activities at Portsite. There is no indication that minor alteration to bowhead migration movements has or would adversely affect that species. Additional information about potential effects to bowhead whales is presented in Section 4.9.4

- **Breakwater-Fuel Transfer Alternative**

The breakwater would have no effect on special status species at Portsite. The breakwater would appear as a low island similar to hundreds of natural barrier islands within the range of Steller's and spectacled eiders. It would have no appreciable effect on Steller's or spectacled eiders. Bowhead whales would not ordinarily come into water as shallow as 24 feet deep (the depth of the breakwater for this alternative) when ice was present.

The fuel transfer pipeline for this alternative would be buried beneath the beach and through shallow water to a pipeline end manifold (PLEM) 10,000 feet offshore. Construction details for the pipeline are in Section 2.0. Neither of the threatened eiders is known to feed in the Portsite area and the temporary disturbance of the sea bottom necessary to lay the pipeline would not have any adverse impact on the eiders. Bowhead whales swim over and near undersea pipelines in the Beaufort Sea, but traditional knowledge, as sometimes related, indicates that bowheads may sense the presence of foreign objects or changes and may avoid those changes. If bowheads avoided a buried undersea pipeline for this alternative, then they might move farther offshore to move past Portsite. There is no indication that a temporary displacement of this magnitude would be biologically significant. More information about potential effects on bowhead whales is presented in Section 4.9.4.

- **Trestle-Channel Alternative**

The trestle and loading platform for this alternative would extend about 1,750 feet offshore. Eiders are known to collide with obstacles on other parts of their range and there is at least some potential that they could strike the loader, trestle, or associated structures. Potential for adverse effects to Steller's and spectacled eiders is evaluated in the USFWS draft biological opinion (Appendix 5) and is summarized here.

The USFWS estimates that 18 adult spectacled eiders will be taken during the life of the proposed project. Over the 50-year life of the project, this equates to an average of 0.36 adult spectacled eiders taken per year. Thus, on average, less than 0.01 percent of the adult breeding population will be taken as a result of this project (assuming a breeding population size of 6,919 adults. This level of loss will not significantly affect the likelihood of survival and recovery of the spectacled eider. It should be noted that the impacts to spectacled eiders were evaluated at the scale of the North Slope breeding population. However, the impacts of the proposed project would also not jeopardize the survival and recovery of the larger global population.

The USFWS also estimates that three adult Steller's eiders will be taken during the life of the proposed project. Over the 50-year life of the project, this equates to an average of 0.06 adult Steller's eiders taken per year. Thus, on average, less than 0.01 percent of the adult breeding population will be taken per year as a result of this project (assuming a breeding population size of 1,250 adults). The USFWS believes that this level of loss will not significantly affect the likelihood of survival and recovery of the Alaska-breeding population of the Steller's eider.

Construction activities for each alternative considered in detail would be timed to avoid periods when bowhead whales were migrating past Portsite, so they would not be directly affected by construction noise or activity.

Spring bowhead migration past Portsite typically is through leads in the ice 3 or more miles offshore.  Local traditional knowledge tells us that if more than one lead is present offshore from the southeastern Chukchi Sea off Portsite, bowheads generally will move through the lead most distant from shore.  The loading trestle and platform would extend less than one-half mile offshore and into much shallower water than is typically used by bowheads during their spring migrations along this coast.  This indicates that their northward spring migration would not typically pass near the trestle for this alternative.

Some of the northward migrating bowhead whales could be expected to at least occasionally migrate through leads over the dredged channel and the disposal area. Three miles offshore, where the closest leads typically form during the spring bowhead migration in most years, the Portsite channel would only be a few feet deeper than the natural sea bottom.  The bottom at the disposal area could be mounded as much as 15 feet above the surrounding seafloor.

Changes to the sea bottom in the channel and at the disposal site would affect a small part of the available habitat in the region and would not directly obstruct movement of bowhead whales.  The trestle and loading platform would occupy and directly affect only a small area of near-shore marine habitat that typically is not used by migrating bowheads.  This indicates that the Trestle-Channel Alternative would not directly obstruct bowhead whale movement or otherwise substantially affect their ability to migrate, feed, or perform other important life functions.

Bowhead whales pass over and around naturally irregular sea bottoms in their yearly migratory movements.  They also pass close to constructed islands and other man-made features in the Beaufort Sea.  This indicates that natural changes in the bottom and man-made structures do not stop or greatly alter the main migratory movements of bowhead whales.  Traditional knowledge and observations near constructed islands and noise-producing activities show that bowhead whales may sometimes avoid or move away from noise, activity or man-made structures.  In the case of very strong noises from ice breakers, bowheads may show avoidance behavior almost 20 miles from the noise source.

Noise sources, activity, and man-made structures have not been shown to cause bowhead whales to alter broad seasonal migrations or to avoid areas that are known to be biologically important to them.  While the Trestle-Channel Alternative would not be constructed or operated during bowhead whale migration through the adjacent region of the Chukchi Sea, bowheads close enough to the facilities will recognize them as unusual and may move away to avoid them.  This may cause them to swim at least a short distance farther in their northward migration, but there is nothing to suggest that whales avoiding Portsite would not continue on their usual migration farther north.  This level of effect would not be a “take” of bowhead whales in the context of the Endangered Species Act and would not cumulatively act with reasonably foreseeable future actions to cause a take of bowhead whales.

#### 4.9.7.2 Essential Fish Habitat

- **No-Action Alternative**
- **Third Barge Alternative**

The National Marine Fisheries Service lists only Pacific salmon as requiring essential fish habitat in the Portsite area (Appendix 4-NOAA Letter 8/22/2002), although relatively low numbers of other fish designated as requiring essential fish habitat are present near the Portsite (Section 3.5.6.3). Essential fish habitat for the five North American species of Pacific salmon present in the Chukchi Sea includes marine, estuarine, and freshwaters used by these species. Adult Pacific salmon may use coastal waters near Portsite as a migration corridor to nearby rivers including the Wulik River, and juveniles may feed in marine waters near Portsite during their migration south (Section 3.5.3.2 Anadromous Fish). Although not abundant, pink salmon are the dominant salmon species near Portsite and the fry of this species typically migrate alongshore during the first few weeks of marine life.

The existing facilities at Portsite are in marine waters and do not encroach on estuarine or freshwater essential fish habitat used by Pacific salmon. There is no indication that the existing Portsite structures or operations have caused any substantial effect to essential fish habitat.

The Third Barge Alternative would not substantially alter existing facilities or operations and would not cause any additional effect to essential fish habitat.

- **Breakwater-Fuel Transfer Alternative**
- **Trestle-Channel Alternative**

Adult salmon would migrate through the Portsite area during the construction period and could detour around active dredging, disposal, and other construction activities because of disturbance and turbidity. Detours around construction activity, however, would not have a quantifiable effect on salmon migration timing, river of destination, or spawning success. Habitat directly affected by construction of either alternative would be a small area of the habitat used by salmon in the Arctic and Pacific oceans. Material dredged to bypass beach material and other material moving along the shore would be placed in intertidal or shallow subtidal waters near the beach.

Pacific salmon juveniles may preferentially use near-shore waters for a period after they enter the sea. Although not abundant, pink salmon are the dominant salmon species near Portsite and the fry of this species typically migrate alongshore during the first few weeks of marine life (Section 3.5.3.2 Anadromous Fish). Construction activity related to these alternatives may temporarily force the migrating fry farther offshore than normal. Post construction operations would not affect the migration of pink salmon fry, but bypass dredging and discharge could temporarily delay migration and temporarily alter EFH for a few hundred feet near Portsite.

No substantial anadromous streams are near Portsite, but there could be a minor, temporary effect to this coastal habitat. The much larger volumes of material dredged for construction of the shipping channel and turning basin would be disposed well offshore where it would not affect this habitat.

The affected habitat does not represent unique or unusually important habitat for Pacific salmon. Additional information about Pacific salmon and potential project effects to those salmon is presented in Section 4.9.3.

## 4.10 Cultural Resources

- **No-Action Alternative**
- **Third Barge Alternative**

These alternatives would have no additional effect on cultural resources. Letters from the National Park Service and the Alaska State Historic Preservation Officer noted that historic properties immediately south of the Portsite were being eroded because the existing dock interrupts sediment movement. Erosion and any effects of erosion on cultural resources would continue if no action was taken.

- **Breakwater-Fuel Transfer Alternative**

Because the potential for cultural resources to be present offshore from Portsite is low, the breakwater would not be expected to affect cultural resources.

The addition of a breakwater could change water flow and wave action that affect erosion rates. The breakwater would reduce wave action on the adjacent shoreline, reducing erosion potential, but would tend to cause material to accrete to the north and starve the beach to the south. Periodic dredging to maintain access to mooring behind the breakwater would be required. Dredged material would be placed on or close to the shore to restore and maintain shoreline transport functions to prevent further erosion.

The source of material for the breakwater (alternative 3) would be examined for cultural resources if a source is selected that has not been surveyed for cultural resources.

Construction of an onshore pumping station would have no effect on cultural resources provided it is limited to the existing pad. Construction of the pipeline would affect cultural resources. The first 2,500 feet of the pipe would be in a drilled tunnel beneath known historic properties (NOA-00074 and NOA-00307). The cut-and-cover trench could affect cultural resources on the remaining alignment to the offshore transfer manifold, although the potential for cultural resources in the area is low. This alternative constitutes an “effect” in the context of the National Historic Preservation Act, but would not be expected to substantially disturb or otherwise impact cultural material in the sites. If the Breakwater-Fuel Transfer Alternative is selected, the Corps will consult with the Alaska State Historic Preservation Officer to assess effects to the sites, as required under Section 106 of the National Historic Preservation Act.

- **Trestle and Channel Alternative.**

Dredging a channel and construction of a new trestle could change natural processes that transport material down the beach at Portsite. Unless action was taken to maintain along-shore transport of beach material, the beach south of Portsite could erode. This could affect any cultural resources along that beach. Specific action is planned and documented in the mitigation plan (Section 2.4) to avoid or minimize impacts to cultural resources on or near the coastline.

Construction of the trestle, loading platform, and channel would not be expected to cause effects on cultural resources in the marine environment off Portsite because the potential for cultural resources in the offshore areas of the Portsite is low.

The fill area of the proposed trestle would be placed within the boundaries of NOA-00074 and would disturb parts of the reindeer corral feature of this site. NOA-00074 was determined to be ineligible for the National Register of Historic Places. This would be a minor or negligible effect to cultural resources. If the Trestle and Channel Alternative is selected, the Corps will consult with the Alaska State Historic Preservation Officer to assess effects to the sites, as required under Section 106 of the National Historic Preservation Act.

## 4.11 Environmental Justice

Executive Order 12898, directs Federal agencies to address disproportionately high and adverse human health and environmental effects on minority and low income populations. As discussed in Section 3.2.3, 97 percent of the population in Kivalina and 87 percent of the population of the Northwest Arctic Borough are minorities. In addition, 26.5 percent of the people in Kivalina are living below the poverty level. This section describes potential impacts to minority and low-income communities. CEQ guidance states, “where a potential environmental justice issue has been identified… the agency should state clearly… whether in light of all the facts and circumstances, a disproportionately high and adverse… impact on minority populations, low income populations, or Indian tribe is likely to result from the proposed action and any alternatives.”

Several scoping meetings were conducted at Noatak, Kivalina, Point Hope, and Kotzebue. The following environmental justice issues were brought up during these meetings and are addressed below:

**Changes to unique visual and cultural associations important to the community.** Unique environmental characteristics that are valued by the community include access to subsistence and wilderness areas, both marine and terrestrial, the visual qualities such as miles of undeveloped coastline, gravel beaches topped by tall grass that give way to low tundra covered by low vegetation, lagoons and lakes, and the Mulgrave Hills.

- **No-Action Alternative**
- **Third Barge Alternative**

The existing facilities have altered the visual environment as seen from Kivalina and by people passing near Portsite and the Red Dog Mine. Those changes allow ships holding offshore to be seen from Kivalina. Lights of Portsite also can be seen from Kivalina, and the DMTS facilities at Portsite can be seen from higher elevations in and near Kivalina. Portsite and other features associated with DMTS and the Red Dog Mine may have affected cultural associations with traditionally used campsites, food gathering sites, and other uses.

The No-Action and Third Barge alternatives would not alter the existing facilities or the visual or cultural attributes of the Portsite area that might be culturally important to the minorities of the region.

- **Breakwater-Fuel Transfer Alternative**

The breakwater would be visible during the summer and would appear as a mound of snow and ice in the winter. The fuel transfer facility would be constructed on shore near the existing facility.

This alternative would cause minor additional alterations to Portsite's visual attributes and to traditionally used areas in and immediately adjacent to the existing Portsite.

- **Trestle-Channel Alternative**

On-land areas, including wetlands and lagoon habitat (maximum of about 2.5 acres) would be filled, but would be adjacent to the existing Portsite facilities, and would cause minor changes to visual and traditionally used areas. The trestle would extend into the sea beyond the existing structure and would be visible from higher elevations in and near Kivalina.

**The effects of mining on communities.** None of the alternatives would directly increase mining or affect the way mining is conducted.

**Secondary effects.** Some of the people at scoping meetings for this study were concerned that improved navigation facilities at Portsite would lead to expansion of mining development and other development in the region. These issues are addressed in Section 4.12.

**Lead levels and their effect on the environment and human health.** Concerns about the effect of mining on the community were repeatedly raised by the communities and other concerned groups. These concerns include potential for increases in fugitive dust and accumulations of lead in the sediments below the existing dock. During scoping meetings, how lead levels were measured, what they indicated, and the effect of lead on the environment and human health were brought up repeatedly. This issue will continue to be controversial because some people feel that any elevation of lead levels in the environment from mine operations or shipping is unacceptable and a threat to human health. None of the alternatives would increase the amount of lead and other metals in the environment from mining or the transportation of ore concentrate. Effects of lead from existing operations and the alternatives considered in detail for navigation improvements are addressed in Section 4.4. Much more detailed information about existing conditions and their potential to effect human health and the environment are available in the recently released Draft DMTS Fugitive Dust Risk Assessment (TCAK 2005).

**Effect of increased noise, activity, and structural changes on animal behavior and health.**
The affects of changes in noise, activity, and structures are addressed in sections 4.3, 4.8, and 4.9.

**Effect on the economy of the region and individual communities.** Several comments were made during scoping about the effects of Red Dog Mine on the economy of the region.

- **No Action and Third Barge alternatives.**

The No-Action and Third Barge alternatives are not expected to change the availability or delivery of fuel or other commodities.

- **Breakwater-Fuel Transfer Alternative.**

The Breakwater and Fuel Transfer Alternative would allow barges and other ships to dock and transfer fuel and freight to the Portsite more safely and efficiently. These changes at the Portsite could reduce fuel costs along the entire northwest coast of Alaska. Opposition and support related to the use of Portsite as a regional hub were voiced at the scoping meetings. Section 4.12 discusses why Portsite would not be suitable as a regional distribution point for freight and other materials, although it could work as a fuel distribution center. This alternative would not have a significant effect on the economy of Kivalina or the Northwest Arctic Borough, but could lower fuel delivery costs.

- **Trestle-Channel Alternative.**

This alternative would have little effect on the economy of Kotzebue or other communities of the region except that it could reduce costs of fuel delivered to those communities. Construction of this alternative could require labor, goods, and services from surrounding communities, which could produce temporary economic benefits.

**Other issues.** The discussion of the Breakwater-Fuel Transfer and Trestle-Channel alternatives in previous sections identified uncertainty about potential for both alternatives to adversely affect the take of beluga and bowhead whales by Native hunters from the predominantly Native population at Kivalina. High-risk low-probability evaluation indicated that if either of those alternative actions caused harvest of all those marine mammals to be lost, then the community of Kivalina would lose an average of about 12 pounds of beluga and about 48 pounds of bowhead flesh each year, based on recent harvest data.

Loss of beluga and bowhead whale flesh and related cultural values, if it occured as a result of either alternative, would be a disproportionate effect on a minority population, as defined by Executive Order 12898. As noted in Section 4.3, the potential for all or some portion of that loss to occur cannot be predicted.

## 4.12 Secondary Effects of Alternatives

### 4.12.1 Introduction

Actions such as construction that cause direct environmental effects or other changes also may cause, add to, or lead to other effects. These additional effects may be termed “secondary effects,” and may include cumulative effects and induced or indirect effects. These secondary effects may be defined in various ways. General definitions with examples used in this EIS are listed below:

**Cumulative Impacts.** “Cumulative impact,” as defined by Council on Environmental Quality regulations for implementation of the National Environmental Policy Act (40CFR 1508.8) *is the impact on the environment that results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking placed over a period of time.* For example, effects of the Trestle-Channel Alternative would be cumulatively additive to other existing marine coastal development. Environmental effects of new navigation facilities at Portsite and existing navigation and loading facilities, added to future shoreline development in the region, would cumulatively affect resources that depend upon the shoreline habitat.

**Induced or indirect effects.** An action may make it more likely that other actions will occur later. They can be said to “open the door” to other development or activity. If navigation facilities at Portsite opened the way for changes in regional fuel distribution, then the effects of that change could be called induced or indirect effects. Council on Environmental Quality regulations for implementation of the National Environmental Policy Act (40CFR 1508.8) define indirect effects as effects *which are caused by the action and are later in time or farther removed in distance, but are still are reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.*

### 4.12.2 Magnitude of Induced Effects

Secondary effects caused by an action may be relatively insignificant, but they can be the most important impacts of an action. For example, a bridge crossing a river may have little secondary effect if the land across the river already is accessible, but could cause significant secondary effects if bridging the river opened the land for extensive new development.

One of the concerns most often voiced during scoping for the DMT EIS was that construction of new navigation facilities could open the lands inland from Portsite to new mining and other development. This concern was stated in many different ways, sometimes narrowly focused on specific problems or resources, sometimes broadly stated in terms of "setting a new baseline for development."

Evaluating secondary effects addresses both what might happen and how much an action might "open the door" for future actions. For example, if the bridge crossing a river cleared away all the obstacles to land development across the river, then it might have a much greater effect than if the bridge cleared away only one obstacle and there were still significant additional costs, landownership problems, and permit requirements to be resolved before development. The question to be addressed here is: How much would new navigation facilities at Portsite "open the door" or "set a new baseline" for new mining and other development locally and in the northwestern Alaska region?

The remainder of this Secondary Effects section looks at potential future development that might be influenced by new navigation and loading facilities at Portsite. It first deals with direct effects, including effects of maintenance and operating, then cumulative and indirect effects.

### 4.12.3 Direct Secondary Effects

Maintenance activities may be viewed as direct secondary effects. Effects of the alternatives considered in detail on maintenance requirements would be approximately as follows:

**"No-Action" Alternative.** Maintenance requirements and activities would be unchanged. This would include repairs to barges, tugs, and the loading facilities. It also would include occasionally moving accreted beach sands and gravels around the existing cells to prevent beach erosion down current.

**Third Barge Alternative.** This alternative would require the same maintenance as the existing operation.

**Breakwater-Fuel Transfer Alternative.** This alternative would require periodic maintenance to repair ice and wave damage to the breakwater and to move sediment from near the breakwater where it would accumulate. Hydrologists estimate that breakwater maintenance would seldom require maintenance. Placing new rock and resetting old rock would cause short-term noise and activity once or twice during the project economic life.

Coastal engineers estimate that about 26,000 cubic yards ($yd^3$) of sediment would be dredged every year and deposited along the beach to the south to prevent beach “starvation” and erosion. Dredging would increase turbidity and sedimentation down current, which generally would be to the north. Considering near-shore maximum current velocities, water depth, and particle size of material to be dredged, turbidity might be visible for less than a mile down current, and sediment from the dredging might cover several acres of the sea floor along the beach south of the breakwater. Effects of dredging noise, activity, turbidity at both the dredge site and disposal site are considered in detail in other parts of this section. The relatively small area and quantities could be dredged in a few weeks each year with equipment left at the site.

**Trestle-Channel Alternative.** This alternative would require occasional mechanical maintenance and repairs for ice damage. It also would require periodic maintenance dredging to maintain the channel. The amount of maintenance would depend largely on the wave environment, as described in the hydrology appendix for the DeLong Mountain Navigation Improvements Draft Interim Feasibility Report. Coastal engineers estimate that maintenance dredging would be expected to occur in years 5, 17, 33, and 49 after construction. The impacts of maintenance dredging are addressed along with the impacts of initial dredging in the other discussions of project impacts on environmental resources.

Fuel transfer at Portsite for regional distribution would increase the volume of fuel handled and the number of transfer operations at Portsite as barges of varying sizes were loaded for delivery to coastal communities. Overall barge traffic might increase slightly in the Chukchi and Bering seas as the larger barges for distribution were loaded at Portsite rather than at Kenai. The additional fuel handling could increase the risk of spills at Portsite, although regional spill risks could decrease because fuel handling would be centralized at a location with the best available equipment to handle it.

### 4.12.4 Cumulative Impacts

There are more than 600 miles of shoreline between Kotzebue to the south of Portsite and Barrow at the northern-most tip of Alaska. Almost all the coastal waters along that shoreline are as shallow as, or more shallow than, the waters off Portsite, which typically reach depths of 20 to 25 feet within a half-mile offshore and depths of 45 to 50 feet about 3.5 miles off shore. This means that between Kotzebue and Barrow there are more than 1,800 square miles of water similar in depth to the 0.5 square mile of bottom that would be disturbed by dredging for a channel for any alternative considered in detail. Essentially none of those 1,800 square miles of sea bottom has been disturbed by development. There is no indication that any ecosystem function has been impaired by any existing development in that area.

The proposed disposal area is in 60 to70 feet of water, which is 5 to 7 miles off shore, with similar bottom composition and conditions beginning within a half mile of shore and continuing offshore into deeper water well beyond 10 miles off shore. This band of habitat similar in composition and extending from Kotzebue to Barrow represents more than 5,700 square miles of sea bottom undisturbed except by very limited fishing and the much greater sediment redistribution mechanisms of ice and marine mammals.

That summarizes all the in-water coastal development in the miles of coast and near-shore waters between Kotzebue and Barrow. Considerably less than 0.001 percent of the coastline is developed now, and considerably less than that area would be developed or disturbed by development even if the proposed action is constructed. Dredging the channel would impact less than .003 percent of the shoreline habitat in roughly similar depth, and dredged material disposal would temporarily affect less than .02 percent of the bottom in similar depths in that expanse. Because there is essentially no other development in that area, these totals represent the cumulative impact of the proposed action and other impacts of existing development.

Onshore and inland development is greater, but still light by standards anywhere else in the United States. The entire 36,000-square-mile land area of the Northwest Arctic Borough has only one heavy-duty road outside the communities—the DMTS road that spans the 52 miles between Portsite and Red Dog Mine. There also are smaller "pioneer" unimproved roads, winter trails, a number of all-terrain-vehicle trails, and backcountry unimproved airstrips. The DMTS components at Portsite and the Red Dog Mine are the only large industrial developments in the whole borough. The only other commercial developments outside Kotzebue and the other communities in the region are occasional dwellings, fishing camps, and lodges.

The Breakwater-Fuel Transfer and Trestle-Channel alternatives would add a small increment of onshore development to this total.

A number of possible future developments have been considered or proposed for the Northwest Arctic Borough (NAB) or adjacent areas of the North Slope Borough (NSB). They include commercial fisheries, other mines for extracting coal and various non-ferrous metals, natural gas or coal production to power electrical generators for the region, a road system to connect various potential mining sites, and new or expanded seaports and airports. All these developments may be possible, but no projects outside the existing communities are funded or proposed for near-term Federal, State or private funding.

### 4.12.5 Induced Impacts

Any prediction of indirect secondary effects must be based on fact, insofar as facts are available, but also must contain a large measure of speculation. Based on available planning documents and on information gathered during the course of the EIS process, the Corps developed the following list of various kinds of development in the NAB or on adjacent lands of the NSB that might follow construction of new facilities at Portsite:

1. Increased through-put from Red Dog Mine
2. New zinc mining in the Delong zinc belt
3. Other metallic mining in the area
4. Coal mining in northern NAB and NSB
5. Development of land transportation corridors
6. New airport at Portsite
7. Trans-shipment of goods for communities
8. Fuel transfer to communities
9. Road system from DMTS to communities
10. Kivalina Relocation

A draft cumulative impact analysis prepared for the USEPA (Gannett Fleming and SWCA 2005) identified several "reasonably foreseeable future actions, " based on the status of planning, funding, site information, and expressed intent of responsible agencies or corporations. The criteria they used to define reasonably foreseeable future actions are shown in table 4-3.

**Table 4-3.** Criteria for evaluating reasonable foreseeable future actions.

| Actions Which Are Anticipated to Occur | Reasonably Foreseeable Actions | Remote or Speculative Actions |
|---|---|---|
| 1. Action is underway or imminent | 4. Action is planned, funded and anticipated to occur | 7. Implementation of action is vague, unfunded or speculative. |
| 2. Officially adopted plans and programs | 5. Intent expressed, some level of planning underway | 8. No planning process undertaken. |
| 3. Can identify and assess impact, adverse and beneficial impacts are identifiable, as well as equity and distribution of impacts. | 6. Can anticipate adverse and beneficial project impacts based on project planning and other general examples. Location is known. | 9. Too many unknown factors or too long of a time period to accurately predict impacts. |

Source: Modified from PENNDOT EQAD Technical Reference Library Cumulative Effects.

They identified construction of a road to Noatak, expansion of the Noatak airport, relocation of Kivalina, and continued natural gas exploration near Red Dog Mine as reasonably foreseeable future actions. They reviewed the available information about each of the future development possibilities listed at the beginning of this section and concluded that the remainder of the possible developments were not reasonably foreseeable, based on the criteria in table 4-3. Based on the Gannett Fleming and SWCA (2005) evaluation, the discussion that follows is divided into reasonably foreseeable future actions and potential future actions that may or may not develop in a longer timeframe, which will be termed "more distant future actions."

Adding the Gannett Fleming and SWCA (2005) list to the Corps list of potential development, and dividing it into "reasonably foreseeable" and "more distant" future actions produces the following list of potential cumulative impacts:

**More Distant Future Actions**

1. Increased throughput from Red Dog Mine
2. New zinc mining in the Delong zinc belt
3. Other metallic mining in the area
4. Coal mining in northern NAB and NSB
5. Development of land transportation corridors
6. New airport at Portsite
7. Trans-shipment of goods for communities

**Reasonably Foreseeable Future Actions**

8. Fuel transfer to communities
9. Road system from DMTS to communities
10. Kivalina relocation
11. Expanded airport at Noatak
12. Natural gas exploration

Each of these possible types of development is examined in the 12 scenarios that follow. The scenarios focus on:

1. The magnitude and cost of overall development for each scenario.
2. The importance of loading facilities or other features of a Federal project at Portsite to the action in each scenario.
3. Effects of a "without project" condition on the action in each scenario and how the scenario might work without a federal project.
4. Regulatory requirements that must be met to implement each scenario both with and without new navigation facilities at Portsite.

Cumulative environmental impacts of these potential development scenarios are addressed in sections 4.2 though 4.11. Depth of the discussion of cumulative impacts in each section is determined by how much information has been developed about where, how, and when each of the actions might be implemented. In general, there is more information about the reasonably foreseeable future actions, while the cumulative impact evaluations focus more on those actions.

**Mining scenarios.** The first four of the listed scenarios deal with mining and the potential for increased in mining in northwestern Alaska. Looking at existing operations, constraints, and costs, we can make some useful assumptions and estimates that help define the costs of shipping and how constructing a new loader would influence decisions about opening new mines or increasing production from the existing Red Dog Mine. Those assumptions apply to the first four scenarios.

Assumption 1. The road, ore concentrate storage buildings, existing loader, and some of the other facilities at Portsite are owned by AIDEA. If a Federal action constructs a new loader at Portsite, the non-Federal sponsor and source of most of the construction funds would be AIDEA. Under this assumption, additional users would pay AIDEA for the use of the new loader, just as TCAK pays AIDEA for the use of the existing loader and other facilities at Portsite. Costs to the user for operation would include amortized cost of construction, maintenance, depreciation, and operation.

The four mining scenarios that follow all assume that if the Federal government does not construct navigation improvements at Portsite, then AIDEA would construct additional loading facilities at Portsite if more loading capacity was needed in the future. The minimum structure for high-volume ore concentrate loading probably would be a loading dock and barge arrangement very much like the existing facility. This also might be the least difficult loader to get through the permitting process because it would not extend farther offshore than the existing loader, would not require permitting or designation of an ocean disposal site, and could be placed adjacent to the existing loader so it would minimize the area impacted.

Assumption 2. Operation, maintenance, depreciation, and costs for barge transfer of ore concentrate through the existing facility cost about $25 million per year to load up to about 1.544 million tons of ore concentrate. That $25 million per year equates to about $0.008 per pound of concentrate loaded. If a new loader like the existing loader was constructed, the user of that new loader would incur similar costs for lightering and use of the loader. The existing loader could be duplicated for an estimated $70 million. The feasibility report Economics Appendix estimates that with the Trestle-Channel Alternative, the present maximum Red Dog Mine production could be loaded for about $20 million per year, or about $0.007 per pound of concentrate.

Assumption 3. Another loader like the existing loader could handle about the same amount of ore concentrate as the existing loader if it was served by two self-unloading barges, and it could be expected to transfer a similar amount of concentrate at a similar cost of about $0.008 per pound. It could load a little more than half as much (750,000 tons) if there was only a single barge. But costs per pound would rise substantially if the loader was used at less than full capacity. The existing two-barge lightering contract is estimated to cost about $14.3 million per year.

Operating a new loader with only one additional self-unloading barge and two tugs to handle additional loading of up to about 750,000 tons might cost about half as much as the contract in place for the existing loader (about $7 million). Loader depreciation and operating costs would be proportionately lower, or an estimated $2.5 million per year, so costs including amortization might be roughly $14 million for loading 750,000 tons (about $0.009 per pound). Loading less than 750,000 tons would lower the costs, but not proportionately because amortization is fixed, as are some of the operating and contract costs. Loading 300,000 tons through this hypothetical new loader might cost about $10 to $12 million, or about $ 0.016 to $ 0.020 per pound if amortization remained the same, barge costs were halved, and depreciation and operation expenses were reduced by about one-third from the cost of loading 750,000 tons.

Assumption 4. The Trestle-Channel Alternative would allow direct off-loading of cheaper fuel that could be used to support Red Dog mining operations and to fuel communities of the region. Fuel tanks and fuel distribution systems would be owned by AIDEA and probably would be operated by a contractor to AIDEA. Fuel would cost TCAK about $.21 per gallon less, about $4.2 million per year, but much of that savings would go towards paying for costs of project construction. AIDEA or a vendor contracted to AIDEA would set bulk fuel prices to distributors.

***Scenario 1—Increased through-put from Red Dog Mine (a "more distant future action").*** The existing production facilities at Red Dog Mine are worked at full capacity when world zinc prices make full production economical. Very little increase in production capacity could be achieved without a large incremental increase in the entire production facility and a new agreement with NANA Regional Corporation, which is the landowner. Red Dog Mine extraction is capped by NANA at 3.5 million wet metric tonnes of feed material for the mill annually. There is no indication from NANA that they would raise production caps or from TCAK that they would request an increase. Production may be expanded in the northwestern Alaska zinc belt sometime, but there are no specific plans to expand in the foreseeable future.

The existing Red Dog mining operation might be feasibly expanded to produce more ore concentrate. More mining and production capacity will be needed if current production levels are to be maintained later in the project life of the mine as lower quality ore deposits are mined and more material must be extracted for each ton of concentrate produced. The existing milling, concentrating, and storage capacities are fully utilized at 1.544 million tons of annual production. TCAK has already removed production "bottlenecks" that previously limited production. Capacity is now balanced to the point that new production increases would be achieved only by major expansion of several components of the existing facilities. Fuel storage, personnel facilities, and transportation components could be added in relatively small increments, but milling, concentrating, and storage for ore concentrate, along with other critical components could only be expanded in major increments.

This means that in a practical sense, if we are concerned with potential for production increase at Red Dog mine, we should examine a large jump in production rather than small increments. Looking at large increases also makes sense from the standpoint of environmental consequence analysis because effects of small increments might be difficult to detect against the background of existing operations. For example, a 10 percent production increase would slightly increase the volume of the ore excavated each month, would add about three truck loads of concentrate to be hauled to Portsite every day, and might require construction of one new fuel storage tank. Environmental effects would be masked by existing facilities and operations.

If production was increased by any substantial amount, major components of the milling and ore concentration facility would have to be replicated almost to the point of building a whole new facility. New crushing, milling, floatation, onsite storage, transportation, electrical generation, and concentrate storage structures at Portsite would have to be constructed. Altogether, new construction to substantially increase production capacity would be like opening a new mine.

Cominco (now TCAK) was not able to record a profit from Red Dog Mine until production reached about 1 million tons of concentrate per year. Based on TCAK's experience, a new zinc-lead mine in northwestern Alaska would probably require similar levels of production to be profitable. The existing transportation, production facilities, and mine are estimated to have cost in the neighborhood of $1 billion. To double present Red Dog Mine production to about 3 million tons per year would require that TCAK almost replicate the present facilities. This could be expected to cost an amount close to their present value, another $1 billion. New facilities of that size would take a minimum of about 10 years to design, permit, and construct. If TCAK, or any other entity, wanted to make an expansion of this magnitude, they probably would not construct it at the existing Red Dog Mine site where known deposits would be depleted less than 20 years after the new facilities reached full production. Instead, major expansion to increase production would likely be constructed as a new mine closer to other known reserves east or northeast of the Red Dog Mine. The possibility of a new mine is explored in scenario 2.

Suppose this analysis is wrong and TCAK found a way to expand production at Red Dog mine by some smaller increment. Then clearly the existing loader would not be able to handle a substantial production increase. If the Federal government and AIDEA together built a new Portsite loader with excess capacity, TCAK could use that excess capacity to load the additional production. How much would having it already in place influence a decision to expand production at Red Dog Mine?

A new loader with excess capacity would lessen initial costs for an incremental production increase. If production could be increased by a few percent, then having assured capacity to load that material at no additional capital cost could be a deciding factor. A large increase of say 20 percent (about 300,000 tons of ore concentrate per year) would require capital investment of hundreds of millions of dollars for new production, storage, electrical generation, and other facilities. If a loader was already in place, the mine could use the excess capacity without the time, expense, and permit acquisition effort required to construct a new loader.

If TCAK decided to increase production at the Red Dog mine by about 20 percent, and if NANA agreed to the increase (unlikely with present knowledge of zinc reserves), and if a new loader was in place to handle the additional ore concentrate, then TCAK would pay for additional costs of operation, maintenance, depreciation, and fees to AIDEA.

If there was no new loader, and TCAK wanted to increase production by 20 percent, TCAK, AIDEA, or some other entity would have to construct new loading facilities. Assumption 3, preceding this scenario, indicates that loading ore concentrate from a 20 percent production increase would cost about half as much (about $0.008 versus

$0.016 to $0.020) per pound if a trestle-channel loader was already in place with excess capacity, as compared with constructing and operating a new twin to the existing loader and used at far less than its capacity.

Altogether, including fuel savings, having the Trestle-Channel Alternative in place might save as much as $0.012 per pound of concentrate over existing capacity loaded if production at the Red Dog Mine was increased by 300,000 tons per year. That would be a total of about $7.8 million per year. Again, we emphasize there are no plans to expand production at the mine or to alter the existing NANA (landowner) cap on mine production. We do not know how much it would cost to raise production by 20 percent. If the cost was pro-rated at the estimated capital value of the entire mine, then a 20 percent increase would cost about $200 million. Amortized over 40 years that would be about $15 million per year. Proportionate operating costs for the mine would be about another $25 million per year.

How much influence would savings of $0.012 per pound to load and ship concentrates have on a corporate decision about whether to expand mine production? Those savings certainly would be considered in a mine expansion evaluation, but in a market where zinc prices have ranged from $.35 to $.60 per pound and lead prices have ranged from $.20 to $.45 per pound in the last 3 years, how much would that savings of 1.3 cents per pound of ore concentrate, or about 2.2 cents per pound of refined zinc or lead influence a decision to expand? Would it really have much effect on a commitment that would span the next 40 or 50 years?

Existence of a new loader with excess capacity would lower loading costs, but forecasts and assumptions about long-term world zinc prices would have a far greater effect and ultimately would be the principal economic factor in any expansion decision. Scenario 1 suggests that a new Trestle-Channel loader at Portsite would lower shipping costs for production increases of up to about 450,000 tons per year. It also estimates that the per-ton savings could be as great as about $0.012 per pound of concentrate. Scenario 1 also suggests that savings of this magnitude would have little effect on decisions about major production increases for a commodity like zinc, which has large short-term price fluctuations, and where major production increases would require capital investment of hundreds of millions of dollars.

A number of other factors would influence a decision about production increases that would require substantial capital expenditures. One factor is that a production increase would require accelerated underground mining. At present TCAK does not know enough about the cost and production impacts to estimate the production cost effect. Moreover, TCAK regards mining in new areas as carrying a financial risk that they are not eager to take on sooner than they need to.

If TCAK increased production by 20 percent to about 1,852,000 tons of concentrate per year, the life of the mine, based on known reserves, would be reduced to about 25 years from the time the new loader would be available. The alternatives considered in detail in Section 2 are evaluated based on 50-year economic lives, so if TCAK rushed to ship the concentrate, the project benefits would be eroded because there would be fewer years of transportation savings. The shorter period also would make profits more vulnerable to downswings in the price cycle.

Sustained, higher world zinc demand could lead to more annual production from the northwestern Alaska zinc belt. Production might be increased, theoretically, by expanding production at the existing mine or by opening a new mine. Incremental expansion of the existing mine would deplete the four mineral deposits at the mine site well before the end of the economic life of any expanded facilities, so a new mine at another location would be a more likely approach. This is addressed in scenario 2.

If mining production was expanded, then there would be more solid waste and wastewater from production, more electrical generation and accompanying air emissions, more traffic on the DMTS road and in the mine and Portsite areas, more shipping, and more construction of production and support facilities. Potential effects to air quality, water quality, cultural resources, human health, fish, and terrestrial animals would depend on where the new mine or expanded facilities were placed, how they were designed, and how they were operated.

Permits, regulations, and landowner agreements would govern, in part, construction and operating parameters and their effects. Because there is insufficient information about where mining projects would be developed, how they would be operated, or how their operations would be regulated, no meaningful analysis of future mining impacts in the northwestern Alaska zinc belt is possible now. Any new mine, or any major construction to expand production at an existing mine, would require public involvement, permit reviews, and an EIS or environmental assessment. It also would require Coastal Zone Consistency review and landowner agreement. New navigation facilities at Portsite would not open the way for mine expansion or new mine construction by shortening the permitting or environmental coordination processes.

***Scenario 2—New Zinc Mining in the Delong Zinc Belt (a "more distant future action").*** The existing Red Dog Mine is in a mineralized belt of deposits that trend miles to the northwest into the North Slope Borough. As ore in the existing open-pit mine is depleted, we can expect nearby deposits to be mined and for ore from those deposits to be processed in the existing facilities. This probably would happen with or without a new Federal project at Portsite. Under the right economic conditions, it is possible that another zinc mine could be opened, possibly to mine deposits north and east of NANA lands. Reserves and mining conditions that would support a major new mine have not yet been defined, but they may be found and could either support longevity of the existing mining operations or could be developed into a second mine.

The first question is: how big would a new zinc mine be? As noted in scenario 1, Cominco (now TCAK) was not able to show a profit on the Red Dog Mine until they had increased production to about 1 million tons of concentrate per year. It appears that smaller mines (assuming the same ore quality and extraction requirements) would have difficulty achieving economy of scale necessary for profitable operation. A new zinc mine would require duplication of almost all the infrastructure and production facilities that now support production from the existing mine. The new mine would need those new facilities at both the new mine site and at Portsite. That would include new ore concentrate and fuel storage capacity, electrical generation, housing, trucks and heavy equipment, production facilities, mine waste handling capacity, and all the other necessary infrastructure to independently support an economically feasible mining operation. Total cost, not including loading facilities at Portsite, would be comparable to the value of the existing mine, about $1 billion, plus about $1 to $1.5 million per mile for any roads required to connect the new mine to the existing road system. Anyone proposing a new mine of this magnitude might expect to spend at least 5 years getting permits and land-use documents in place and then another several years in construction.

This production level also is useful for analysis because it is sufficiently larger than the incremental increase discussed in scenario 1, so that the Trestle-Channel Alternative would not have enough capacity to ship it all out each year. Although the Trestle-Channel Alternative would have the base capacity to load 2.5 million tons of concentrate per year, delays for fuel transfer, maintenance, weather, and ship maneuvering would all reduce the number of days concentrate could be loaded and the total that could be loaded each year. The practical limit for dependable loading capacity would probably be about 2 million tons of concentrate per year. Any new mine that produced enough to push the total loading through Portsite to more than that 2 million tons, or about 450,000 tons more than present peak production, would require additional loading capacity.

How much difference would a loading facility at Portsite make in the overall cost of opening and operating a new mine? How much would having or not having the use of a loading facility influence a decision about whether to open a new zinc mine?
If the new hypothetical mine produced more than about 450,000 tons of concentrate per year, then a second loader would be required to ensure that full production could be loaded each year. If a Trestle-Channel Alternative was already in place, and was constructed so that another loader could be added to the loading platform, then adding a new loader, modifying facilities to move concentrate from surge bins through the concentrate storage building, and modifying and installing new conveyors would cost about $82,500,000 (based on cost estimates prepared during early alternatives evaluation). Amortized over 40 years, it would be about $5.5 million per year at present Federal interest rates. Operation and maintenance of the improvements would cost about $1.5 million per year, so annual costs of loading an additional 1 million tons would be about $6.5 million per year or about $0.004 per pound.

If no navigation improvements were constructed at Portsite, and only the existing loader and lightering barges were available, then the hypothetical new mine would require additional loading facilities. Any of the alternatives considered in this DEIS or some other alternative could be developed to meet those needs. If the Corps and AIDEA did not construct a trestle-channel project to support existing mining and fuel transportation needs, then a new mine would certainly offer enough economic incentive for AIDEA or the mine operators to construct a trestle-channel system or some other facility that could load directly into bulk carriers.

If a new trestle-channel loader was not constructed until after a new mine was developed, it would be sized initially to load both existing Red Dog Mine production and production from the new mine. The economics and project costs discussed in the Economics Appendix and the feasibility report offer an approximation of project costs and benefits. A new trestle-channel project constructed later to handle throughput from both Red Dog Mine and a new mine producing 1 million tons per year might be expected to load ore concentrate from both mines together for about $0.005 per pound.

If a trestle-channel alternative could not be constructed, then a new system could be constructed similar to the existing short trestle and barge lightering system now being used to handle ore concentrate from and fuel to the Red Dog Mine. Constructing a new loading facility similar to the existing facility would cost roughly $70 million (personal communication, John Wood, AIDEA). The costs and other considerations of that alternative are considered in Scenario 1, and would be about $25 a ton to load a million tons of ore concentrate, or a little more than $0.01 per pound.

Altogether, having the Trestle-Channel Alternative in place at Portsite would save a new million-ton-per-year mine about the same amount per ton as the Trestle-Channel Alternative would save the existing mine. This is about $ .005 per pound in zinc or lead concentrate production and shipping costs, compared with present shipping costs.

Developing another Red Dog Mine would cost about $1 billion. This amount annualized at 6 1/8 percent over a 40-year mine-life, yields an estimated new development cost of about $70,000,000 annually. Company annual reports show that the Red Dog operating expenses in 2000 were over $300,000,000, so the annual economic cost of the mine operation for a mine constructed and operated in 2002 would have been more than $370,000,000. If a hypothetical new mine cost as much as the existing Red Dog Mine to construct and operate, then having a trestle-channel loading facility already in place would save the new mining operation shipping costs for fuel and ore concentrate equivalent to less than 6 percent of the yearly annual operating and amortized operating costs. Any business would appreciate saving 6 percent of it's operating costs, but on the other hand, the prospect of 6 percent savings is not likely to have much influence on a decision to invest $1 billion in a venture as speculative as a new mine in northwestern Alaska.

Both increased production and new mining are addressed. New loading or other navigation facilities at Portsite would reduce shipping costs by as much as $0.012 per pound of concentrate loaded if Red Dog Mine production was expanded or as much as $.005 if a new mine was developed and concentrate was exported through Portsite. While this could be important savings to a mine already in operation, it would be unlikely to "open the door" for extensive zinc lead mineral extraction or concentrate production, whether at a new mine or in expansion of an existing mine in the Delong Mountain region.

***Scenario 3—Other Metallic Mining in the Area (a "more distant future action")*.** Data gathered for the analysis of transportation needs in northwestern Alaska identified several major non-zinc metallic deposits that might be eventually mined (figure1-4). The Arctic deposit, one of the most promising of those deposits, has indicated reserves of 40 million tons grading 4.0 percent copper, 5.5 percent zinc, 0.8 percent lead, 1.6 oz/ton silver, and 0.02 oz/ton gold. Ore concentrate production from the Arctic deposit might be less than 200,000 tons per year. Arctic, like most other metallic deposits in the region, is undeveloped and is not on a road or other transportation system. It is about 270 miles from Portsite. Developing the Arctic deposit into a producing and economically feasible mine would cost roughly $400 million (John Wood, AIDEA, personal communication). Road costs might be about $1 million per mile, but could be higher because of bridging costs, so a 270-mile, year-round road connecting to the DMTS road might cost $200 to $300 million.

Ore concentrate from the Arctic deposit could be shipped through Portsite or could be transported to new loading facilities if they were developed at Cape Blossom or some other location. At any shipping location, new infrastructure, storage buildings, fuel storage, conveyor systems, electrical generation, and other facilities would be required to load the ore concentrate and unload fuel and mine supplies. Like the new zinc mine in Scenario 2, ore concentrate from Arctic could be loaded over the proposed Trestle-Channel Alternative at Portsite if the loader had enough capacity. If the Trestle-Channel Alternative was not constructed, the Arctic deposit concentrate could be loaded through a new loader constructed specifically to handle production from the new mine.

The economics of start-up and production to develop the Arctic deposit and other mines of similar size in northwestern Alaska might benefit if additional low-cost loading and fuel handling capacity were available at Portsite. Constructing a loader, or paying amortization costs of a new loader, would be a significant part of development and operating costs for Arctic Mine or any other mine in northwestern Alaska. If loading capacity was already in place, then operating costs would be reduced. Scenario 1 examined the costs of loading a hypothetical 20 percent ore concentrate production increase. Similar economic benefits would be realized from a new mining operation similar in scale and producing about 300,000 tons per year.

Loading ore concentrate would not be the greatest expense of developing a new mine, and developing loading capacity would not present the greatest regulatory hurdles, but if new loading facilities were constructed at Portsite, then the cost and permitting barriers to new mining would be lowered by at least a small increment.

Permitting and land use requirements for mining the Arctic deposit probably would be greater than for the Scenario 2 zinc mine because the Arctic deposit is more distant from shipping facilities. An EIS probably would be required for the mine and the road from the mine to a port or other point where ore concentrate could be trans-shipped and where supplies for the mine could be landed. Federal legislation might be required to alter land status for the access road, and an extensive regulatory process would be required for mining, processing, electrical generation, wastewater disposal, wetland fill, and other actions associated with construction and operation of the mine. The permitting process would thoroughly examine effects of the action and would offer many opportunities for public input in the process.

Scenario 3 focused on potential mining for metals at a site that is one of the better-known and best delineated northwestern Alaska ore bodies outside the zinc belt. New loading or other navigation facilities at Portsite could reduce shipping costs from the Arctic deposit by as much as $0.012 per pound of concentrate loaded, about $4.8 million per year. While this could be important savings to a mine already in operation, it would be unlikely to “open the door” for extensive mineral extraction or concentrate production, whether at a new mine or in expansion of an existing mine, that would require a 40 or 50- year capital commitment of more than $500 million.

A new mine more distant from the existing Red Dog Mine would have the same potential to cause environmental effects, with the added potential for effects related to the road that would be required from the mine to Portsite. Much of the assessment for new or expanded mining in the zinc belt also is true for other metallic mining in northwestern Alaska, and even less is known about how a new, more distant metallic mine would be constructed, operated, or regulated.

***Scenario 4—Coal Mining (a “more distant future action”).*** Huge reserves of low-sulfur coal north of the Brooks Range might be mined if it could be done economically and it was feasible to ship North Slope coal to market. Transportation and regional development studies have considered a variety of options for mining, handling, and shipping coal from the North Slope. Portsite, along with possible new facilities at Point Lay and several other locations, has been suggested as a port for coal shipping. Coal offers mining and handling problems different from metallic ores. First, coal is much bulkier. A cubic yard of coal weighs about a ton. A cubic yard of zinc ore concentrate from Red Dog mine weighs several tons. That means several trucks (or one truck several times as big) would be required to carry the same weight of coal as one truck carrying ore concentrate from Red Dog Mine.

About a million tons of ore concentrate can be stored at Portsite. The same buildings could store less than 250,000 tons of coal. The same problems with bulk affect loading; a loading facility that could handle the bulk of 1.5 million tons per year of ore concentrate might be able to handle less than 300,000 tons per year of coal. Finally, coal is not worth very much per ton compared with ore concentrate, so it must be handled efficiently and in much greater quantity to be economically feasible. A ton of zinc ore concentrate at current world prices contains zinc worth about $600. A ton of North Slope coal would be worth about $30 to $40 per ton on the world market. You would have to mine, handle, and ship more than 15 times as much coal by weight and more than 60 times as much by volume to bring the same gross return

as the zinc in a given weight of Red Dog Mine zinc ore concentrate.
This problem of bulk greatly affects ship loading. The Trestle-Channel Alternative at Portsite constructed with a single loader would be sized to load a maximum of about 2 million tons of ore concentrate each shipping season. Even if the entire capacity was adapted to coal, less than 0.5 million ton of coal could be loaded in a shipping season.

There are many substantial obstacles to Arctic coal mining and shipping in Alaska. They include regulatory air and water quality concerns, expense, land ownership, and environmental considerations associated with constructing a new road to haul coal to a port, problems with marketing coal that can only be shipped seasonally and cannot be economically stored through the winter, and high production costs. The proposed Trestle-Channel Alternative at Portsite would do very little to make coal production more feasible or to "open the door" to coal mining in Alaska.

Coal may be mined in northwestern Alaska sometime in the future, but there are no specific plans for mining or transportation of coal. If mining production was expanded, then there would be more solid waste and wastewater from production, more electrical generation and accompanying air emissions, a new road to a port, new shipping activity, and construction of production and support facilities. Potential for effects to air quality, water quality, human health, fish, and terrestrial animals would depend upon where the new mine or expanded facilities were placed, how they were designed, and how they were operated. Permits, regulations, and landowner agreements would govern, in part, those construction and operating parameters and their effects. Because there is insufficient information about where mining projects would be developed, how they would be operated, what port location would be best, or how their operations would be regulated, no meaningful analysis of future coal mining impacts in northwestern Alaska is possible at this time.

Any new coal mine would require public involvement, permit reviews, and an EIS or environmental assessment. It also would require Coastal Zone Consistency review and landowner agreement. New navigation facilities at Portsite would not open the way for mine expansion or new mine construction by shortening the permitting or environmental coordination processes.

***Scenario 5—Transportation Corridor Development (a "more distant future action").*** State and Federal planners have identified transportation needs and potential corridors and sites for roads, ports, and other transportation facilities in northwestern Alaska (Alaska DOT-PF 2001). With or without additional navigation improvements, Portsite is identified as a port in regional transportation planning because it is the only existing port in the region suitable for export of mine production. It also has the capability to land and stage the heavy equipment and support materials that might be required for transportation corridor construction. Portsite also is connected with the interior of the region by more length of heavy-duty road than anywhere else in the region or, for that matter, more heavy-duty road than in all the rest of northwestern Alaska combined.

A number of transportation corridors, port sites, and other transportation planning components have been proposed and evaluated for northwestern Alaska. None of these plans have specific routing or design information, and no major transportation funding is available at this time to develop transportation corridors or other major transportation facilities in northwestern Alaska. Any plans for transportation improvements in northwestern Alaska would take into account existing or future development at Portsite and along the DMTS. Any future roads or other surface transportation improvements in northwestern Alaska would likely be tied to the DMTS, with or without new navigation facilities at Portsite.

Any major new road system in northwestern Alaska would require Federal involvement in funding and permitting. Land issues, an EIS, permitting, and coordination would take several years, would allow considerable opportunity for public involvement, and would thoroughly examine effects of any road project. Construction of the proposed Trestle-Channel Alternative at Portsite would not substantially alter planning for surface transportation in northwestern Alaska nor would it “open the door” for new development.

There is not enough information about specific routing, siting, design, and other project-related information to make a meaningful evaluation of potential environmental effects of future transportation corridor development in northwestern Alaska. Effects would depend upon design, operation, and permitting restrictions. The EIS, permitting, and coordination for any major transportation construction would allow many opportunities for public involvement.

***Scenario 6—New Airport at Portsite (a “more distant future action”).*** State and Federal agencies have considered constructing a new airstrip on the NANA-owned land near Portsite. A Portsite airstrip constructed to support the heavy carriers that serve Red Dog Mine could serve as an alternate to the existing mine airstrip, which often is closed to operation by visibility or cloud ceilings below flight minimums. Weather at the coast sometimes is appreciably different than in the mountain valley that surrounds the mine airstrip, so an alternative airstrip at Portsite could reduce delays, improve logistic support, and improve safety by allowing alternative emergency access.

Along with improving access to Portsite and Red Dog Mine, a new airstrip at Portsite could be used to fly fuel and goods out of Portsite to surrounding communities. Air delivery of fuel is considered in Scenario 8. A recent study (ASCG Inc. 2001) examined potential locations and costs for airport alternatives at Portsite. The relatively small land area available at Portsite, existing development, and topography combined to limit siting choices, but several potentially feasible alternatives were identified. The best of those sites has more slope than is preferred and narrowly fits onto the available land, but could be constructed at an estimated cost of about $11 million (AIDEA 2001). No funding has been committed to further study or construction, and neither State nor Federal aviation agencies have any immediate

plans to pursue this project.
A new Portsite airstrip would require further study, detailed planning and design, landowner agreements, and extensive environmental coordination and documentation. A number of permits would be required. Potential use conflicts would have to be resolved with the National Park Service, which administers the Cape Krusenstern National Monument adjacent to Portsite and with the NANA-sponsored subsistence committee that participates in decisions about activities at Red Dog Mine and in the DMTS. Construction of an airstrip at Portsite does not seem to be likely in the near term, but evolving conditions at Portsite could lead to its re-evaluation.

If a business began to fly goods and fuel out to villages from Portsite, then an airstrip at Portsite would be used if it was available. On the other hand, the low transportation volume would not add much to the economics that might influence a decision to construct a new airstrip at Portsite.

Portsite already has the loading and storage capacity for the limited amount of goods and fuel transportation that require air transport to the surrounding villages. If transporting this volume of fuel and goods was economically feasible and compatible with port operations and the objectives of AIEDA and TCAK, then it could be transported by road to the mine airstrip and flown out from there. A new airstrip would slightly lower transportation costs (Scenario 8 notes a cost of $.05 per gallon to haul fuel to storage tanks at Red Dog Mine), but the potential cost savings would be too small to have much influence on a decision to construct and maintain an $11 million airstrip.

A new airport at Portsite would not require, or be very much affected by, navigation improvements. In early studies of potential navigation improvements at Portsite, it appeared that economic benefits might be generated by landing cargo and fuel at Portsite and then flying it out from a new, project-built airport. Evaluation showed little potential for economic benefit from that combination.

New navigation facilities at Portsite would not require or benefit from an airstrip. The reasons for constructing an airstrip appear to be more closely associated with needs for better access and safety. This possibility is explored in Scenario 9.

***Scenario 7—Trans-shipment of Commodities and Goods to Communities (a "more distant future action").*** Portsite could be used as a distribution hub for food, building supplies, vehicles, and other goods and materials that are shipped to communities in Northwest Alaska. These supplies could be delivered by barge and then flown or barged to smaller communities.

Economically, landing goods and materials at Portsite from barges and then flying them to consumers does not appear to be practical. Shipping might be less expensive if local goods could accompany materials off-loaded at Portsite for Red Dog Mine, but not enough to offset capital and operating costs. The warehousing and shipping infrastructure required for sporadic handling of goods would be unlikely to justify the capital set-up costs to move goods through Portsite or for bringing workers to the site to handle the goods. It would be cheaper to use the existing facilities and labor base at Kotzebue.

Transferring goods from ocean-going barges or ships onto aircraft or light barges for delivery to coastal towns seemed like a project purpose when studies began for navigation improvements at Portsite. Further study showed that this concept was infeasible and would be infeasible in the foreseeable future. If trans-shipping goods through Portsite was economically viable, then it could be done now using the existing barge dock and the existing airstrip at the mine.

While flying goods to surrounding communities would be economically infeasible, goods and fuel could be trans-shipped at Portsite for delivery to Noatak if a connecting road was constructed from DMTS to that community.

***Scenario 8—Fuel transfer to communities (a "reasonably foreseeable future action").*** Fuel, food, building materials, and other commodities are expensive in the communities of northwestern Alaska. Retail fuel oil and gasoline in Noatak and other inland towns, for example, may cost more than $4.00 a gallon. Transportation costs contribute substantially to those costs. Distribution now is by barge and aircraft to coastal communities and communities on rivers that can be navigated by barge, and by air alone for communities not on navigable waters. Information in this scenario is extracted largely from the feasibility report Economic Appendix that provides more information about fuel transportation costs.

Bulk fuel is transported to northwestern Alaska in big ocean-going barges out of Puget Sound that deliver fuel from there and from refineries at Kenai, Alaska. Fuel is transferred from the ocean-going barges directly to some communities by a lighter accompanying the ocean-going barge. The lighter is loaded to a draft appropriate for conditions at individual communities receiving the fuel. Some of the fuel off-loaded at Kotzebue or Nome also may be redistributed by smaller barges to villages that cannot be economically supplied directly by the ocean-going barge or its lighter.

Each year Kotzebue, for example, receives about 7,750,000 gallons of fuel, including heating fuel #1, diesel fuel #2, aviation fuels, and unleaded gasoline. In a typical year, approximately 6 million gallons of that fuel is consumed at Kotzebue. The remainder, about 1,750,000 gallons, is transported to nine other communities.

The average combined purchase and delivery cost per gallon of fuel delivered to a sample of communities in western and northwestern Alaska in 2002 was estimated to vary from $1.12 for lighter delivery at Russian Mission to $2.99 per gallon at Noatak by a combination of barge and air. Retail sales price would be higher as storage, transfer, finance, risk, and profit costs are added. Fuel costs vary from year to year based on delivery difficulties, fuel origin, and purchase cost.

A small part of the shipment to small communities, about 180,000 gallons, is transported by air when emergencies arise or when water transportation is unworkable. Most of that air delivery may be to Noatak because the Noatak River has become too shallow for barge traffic. About 116,000 gallons is estimated to be air delivered to Noatak (Economic Appendix – draft Feasibility Report), although not all the fuel into Noatak comes from Kotzebue.

The fuel storage tanks at Portsite have a total capacity of 15 million gallons, much of which is not needed during the summer. Portsite has connections, pumps, pipelines, a dock, fuel spill prevention plans and equipment, and enough excess storage during the summer to fuel most of northwestern Alaska. This capacity and capability cannot be used now to distribute fuel to northwestern Alaska communities because ore concentrate loading operations must be shut down during fuel handling. Loading lightering barges at Portsite would delay concentrate loading and could keep the mine from loading all the stored concentrate during the shipping season. Another reason that the facility is not used as a fuel terminal for surrounding communities is that fuel is now delivered to Portsite by the same barges that go to other regional depots such as Kotzebue. Delivering fuel to Portsite instead of another regional hub would do little to lower fuel costs.

If Portsite could receive fuel from deeper-draft fuel tankers, then it could be a viable regional fuel distribution hub. Fuel purchased and unloaded directly from large tankers and stored in the fuel tanks at Portsite could be reloaded onto barges and distributed to coastal villages during the summer. After summer fuel deliveries, the storage tanks could be filled again to fuel operations at the mine. Several contractual, logistics, and economic problems might require resolution, but most of the infrastructure and almost all the fuel storage capacity would be in place with a new loading facility at Portsite. The size of the market that might be served by Portsite as a fuel hub could depend upon market and shipping conditions in northwestern Alaska, and also on markets and transportation economics on the west coast of the U.S. and in Pacific Rim countries. The feasibility report Economic Appendix estimates that, depending upon shipping economics, as much as 52,674,200 gallons of fuel could be offloaded by tankers at Portsite and more than 30,000,000 gallons could be transferred by barge to communities in northwestern, northern, and western Alaska. Figure 1-3 shows the area that might be economically reached with fuel off-loaded at Portsite. Table 4-4 lists the principal communities in that region.

**Table 4-4.** Communities that could economically receive fuel from Portsite with navigation improvements.

| Norton Sound/Bering Sea | Yukon River & Delta | Kobuk River | Kotzebue Sound | Chukchi Sea |
|---|---|---|---|---|
| Nome | Alakanuk | Ambler | Kotzebue | Point Hope |
| Brevig Mission | Emmonak | Kobuk | Deering | Point Lay |
| Diomede | Kotlik | Shugnak | Selawik | Wainwright |
| Elim | Pilot Station | Kiana | Kivalina | Barrow |
| Gambell | Marshall | Noorvik | | |
| Savoonga | Mt Village | Buckland | | |
| Golovin | Pitkas Point | | | |
| Koyuk | St Marys | | | |
| St Michael | Russian Mission | | | |
| Shaktoolik | Holy Cross | | | |
| Shishmaref | Anvik | | | |
| Stebbins | Shugeluk | | | |
| Teller | Grayling | | | |
| Unalakleet | Kaltag | | | |
| Wales | Nulato | | | |
| | Koyukuk | | | |
| | Galena | | | |

At current prices, diesel could be delivered to Portsite by tankers at about $.21 per gallon less than current cost for fuel delivered by ocean barges if it could be unloaded directly at Portsite. Lightering costs to bulk storage tanks at coastal communities would vary with delivery quantities and distance, but would not add a major cost over lighter delivery that is used now. At current prices, diesel could be delivered to nearby Kivalina, for example, for a local shipping and handling cost saving of roughly $.21 per gallon. Without the capability to accept fuel delivered directly to Portsite by tankers, those savings could not be realized, and Portsite could not serve as an economically viable fuel distribution center.

AIDEA, as the project sponsor and owner of navigation improvements at Portsite, would be responsible for determining how a fuel distribution system would be operated at Portsite, if fuel delivery by tanker became feasible. Up to four tankers might offload fuel each year if Portsite was developed into a fuel transportation hub. They would replace the five ocean-going barge shipments that now typically fuel Portsite and the Red Dog Mine each year.

The number of barges delivering fuel from Portsite each year would depend upon how a distribution system evolved. The feasibility report Economics Appendix presents the data used to calculate economics benefits for fuel distribution from Portsite. The analysis assumes that the least-cost barging options would be used and that a total of about 26 million gallons of fuel would be distributed from Portsite each year. Estimated delivery to Nome and surrounding communities would require about 17 ocean barge trips. The Economics Appendix also estimates that two trips would be required to Kotzebue each year, and two trips would be required to deliver fuel to Point Hope, Point Lay, Wainwright, Barrow, and Kaktovik. This appendix assumes that 1,750,000 gallons of fuel would be delivered by lighter in 200,000-gallon loads directly from Portsite to surrounding communities. This would equate to about nine additional trips out of Portsite with the smaller lighters. However, those deliveries could continue to originate from Kotzebue because operations from there can be more responsive to local conditions and would be better situated for the smaller loads that are required by the shallow water at some of the Kotzebue-area communities.

The data from the Economics Appendix indicate that four tankers would be added to the 20 to 22 bulk carriers that call at Portsite each year, for a total of about 26 per year. The data also indicate that about 21 trips by ocean barge would originate at Portsite each year. Two trips to communities to the north would replace an equal number of ocean barge trips from Puget Sound that deliver fuel to those communities now. The five ocean barge trips that deliver fuel to Portsite now would be eliminated. Altogether, an estimated 14 additional ocean barge round trips would originate from Portsite each year. Smaller lightering barges would make an estimated nine additional round trips between Portsite and communities in the region around Kotzebue. Seasonal fuel needs by communities indicate that those trips would be about evenly divided between early summer, immediately after Portsite receives its first fuel delivery, and early autumn, just before icing threatens shipping.

Establishing Portsite as a regional fuel distribution center would not be likely to adversely affect existing Kotzebue-based fuel distribution services. If fuel was delivered to Kotzebue from Portsite for distribution to other communities in the area, then the existing distribution pattern would be unchanged. If fuel was lightered directly from Portsite to surrounding communities, then the same lightering barges, tugs, and crews that work out of Kotzebue now would be expected to make that distribution.

Fuel is delivered by water to most of the villages in northwestern Alaska. Villages that cannot be reached by water, sometimes because of temporary conditions, are supplied by aircraft tankers. In the Northwest Arctic Borough, Noatak, Ambler, Shungnak, Kobuk, and the mining camp at Candle typically get substantial amounts of fuel by air. Altogether, about 1,000 residents in these communities rely on air tankers to supply at least part of their fuel. The feasibility report Economics Appendix estimates that about 600,000 gallons of fuel are flown into nine communities around Kotzebue each year. Some of that fuel is flown in from Fairbanks, but most probably is flown out of Kotzebue. TCAK has provided fuel to Noatak that was flown from the Red Dog Mine airstrip when other delivery failed.

Flying fuel out of the existing airstrip at the mine or a new airstrip at Portsite might be considered if Portsite developed into a major fuel distribution hub, but aerial fuel deliveries to the region are likely to continue to be from Kotzebue rather than from an existing or future airstrip at Red Dog Mine. Kotzebue has the facilities for aircraft maintenance, aircraft fueling, and crew support. It also can support aircraft landings and departures in much lower ceilings and visibility than at the Red Dog Mine airstrip. Also, fuel could be barged to Kotzebue for less cost than it could be trucked to the Red Dog Mine airstrip. TCAK has not shown any interest in becoming a fuel distributor, which would require developing seasonal capabilities and a distribution network and which could substantially increase potential liability.

In summary, fuel is not regularly being flown from Portsite to surrounding communities now for the following reasons:

- TCAK does not want to compete with fuel distributors. If TCAK started to move large quantities of fuel to nearby communities, it would adversely affect smaller local businesses, many of which are Native-owned.

- Distributors do not have enough profit incentive to establish contracts, infrastructure, and to meet permit requirements to fly out the relatively small volume of fuel that would be required to meet seasonal needs. It is cheaper and there is less economic risk to fly fuel out of another location.

- Regular, high-volume transportation and handling could interfere with mine operations

A new loading facility would make it easier to fit fuel deliveries into activities at Portsite, but would do little to resolve the remaining problems. TCAK is not likely to develop a fly-out fuel distribution operation from Portsite. If some other entity wanted to fly fuel out, the economics and the infrastructure requirements would be about the same with a new loading facility as they are now.

In summary, navigation improvements could allow a regional fuel distribution hub to be developed at Portsite. Fuel delivered to Portsite would cost about $.21 per gallon less than current bulk fuel. The savings would not be enough to bring other businesses or development to the region and would not cause cumulative or induced effects from new development.

***Scenario 9—Road System from DMTS to Communities (a "reasonably foreseeable future action").*** Roads to nearby communities from the Red Dog Mine, Portsite, or somewhere along the DMTS road might offer benefits to both the community and the mine. A connecting road, even if it was much narrower and more lightly constructed than the DMTS road, could allow goods and fuel to be delivered from Portsite and could allow workers to reach the mine from the connecting community. It also might allow the community airstrip to be used as an alternate to the Red Dog Mine airstrip to reduce weather delays in work shift change-outs and to serve other transportation needs for the mine.

Two communities are close enough to DMTS to be considered. Kivalina, about 17 miles north of Portsite is on the coast. It can be supplied by barge, so might derive comparatively little economic advantage by a land connection to the Portsite transportation system. The existing airstrip at Kivalina could not handle the aircraft used for crew change-outs and other heavy transportation and it is unlikely to be reconstructed to have that capability. Planning for the relocation of Kivalina considered a number of needs and opportunities. During that planning process, the leaders of Kivalina did not express interest in developing a road connection between Kivalina and Portsite.

Noatak is less than 25 miles from the closest point on the DMTS road east of Cape Krusenstern National Monument. The Noatak airstrip is larger and of better construction than the Kivalina strip, but is not big enough or constructed heavily enough to accept the heavy aircraft that supports most of the passenger movement, that delivers perishable foods, and that carries other time-critical materials to and from the mine system. The Noatak airstrip may be upgraded or reconstructed to accept heavier aircraft in the foreseeable future. The Portsite system and mine would benefit from a road between Noatak and DMTS by improving safety and accessibility in poor weather. Noatak would benefit by having a larger airstrip that might lower transportation costs to the village and from being on a land transportation system that could be used for delivery of fuel and goods. A road could substantially reduce fuel costs for Noatak, which now must get almost all its fuel by air.

A road routed far enough east to avoid Cape Krusenstern National Monument might join the existing haul road about halfway between Portsite and the mine, cross over and through the Mulgrave Hills, and across the broad Noatak River Valley to Noatak. The road might be 25 to 35 miles long. With no major rivers or streams to cross, a light-duty road might not be particularly expensive to construct or to maintain.

New navigation and loading facilities at Portsite would have little influence on a decision of whether to build a road to Noatak. Existing fuel handling, storage tanks, and fuel trucks serving Red Dog Mine could, and sometimes do, easily handle the additional fuel required for Noatak with no delays to other shipping for the mine. The decision of whether to build a road to Noatak would have to consider a number of potential social, economic, cultural, and biological factors, but that decision would not be significantly influenced by new navigation and loading facilities at Portsite.

A new road connecting the DMTS road to Noatak would cross 25 to 35 miles of habitat that is largely undisturbed. Wetlands would be filled, streams crossed, and animals would be disturbed by construction and by traffic. The aesthetics and other values of the adjacent Cape Krusenstern National Monument could be affected and habitat adjacent to the road would be impacted by dust. While the idea of a road is being considered, no proposed route has been identified, no funding has been committed to developing specific plans, and there are no plans to construct a road at this time. There is insufficient information about routing, construction methods, restrictions on use, permitting, and other essential information to allow a meaningful assessment of road impacts.

Navigation improvements at Portsite would not alter reasons a road is needed nor would they alter the benefits or costs of a road. Navigation improvements at Portsite would not induce or facilitate road construction to connect any community to the DMTS road.

***Scenario 10—Kivalina Relocation (a" reasonably foreseeable future action").*** The City of Kivalina, about 17 miles north of Portsite, has voted to move to a new site. The primary candidate site is about a mile south of the present townsite. The move would reduce or eliminate erosion and storm surge threats to the community and would increase the land available for housing, water and wastewater utilities, roads, and a bigger airstrip. The move, if undertaken, would require construction of a whole new community for the 377 residents of Kivalina. The new community, as currently envisioned, would be built on imported fill that would raise it above flood threat and form a base for standard arctic construction techniques. Gravel would be required for the fill because finer material holds water and becomes saturated permafrost, which causes huge construction and maintenance problems. Early estimates indicate that about 4 million cubic yards of fill would be required for the alternative that the Kivalina Relocation Committee prefers.

That 4-million-cubic-yard fill requirement for Kivalina matches well with the amount that would be dredged for the Trestle-Channel Alternative. If good fill material could be produced during dredging for navigation improvements at Portsite and used for fill at a new Kivalina relocation site, then both projects might benefit. This was considered in the analysis of disposal alternatives for dredged material in Section 2, but was not given detailed consideration. Core testing and sonar surveys have established that most of the bottom material that would be dredged for a channel and turning basin is fine-grained material that would be unsuitable for construction fill in the Arctic.

New navigation facilities would not substantially affect staging or construction of a new community site for Kivalina. Staging, shipping, and other support for the move would be independent of the port and mine operations.

Relocation of Kivalina would require many acres of fill for construction, with attendant effects on habitat, transportation routes, and material sources. Construction of new navigation features at Portsite would not provide usable material for relocation nor would they lower construction costs or facilitate access or other transportation needs. The proposed action at Portsite would not induce or facilitate relocation of Kivalina.

***Scenario 11– Expanded Airport at Noatak (a "reasonably foreseeable future action").*** The Noatak airstrip is being threatened by erosion and is in a location that limits community growth. The airstrip and other facilities are likely to be extensively modified or relocated farther from the Noatak River. The Department of Transportation is in an extensive program to modernize and add capability to airports in rural Alaska communities. They can be expected to work toward meeting needs of Noatak and the surrounding region. If a new airport could be connected to the DMTS, then it could serve both Noatak and the activities associated with Red Dog Mine as an alternate to the mine airport. A new Noatak airport would likely be constructed to accept airline turbojets to meet those multiple needs.

Most regional airports that handle a mix of airline and general aviation traffic have runways that are about 5,000 to 6,000 feet long and 150 feet wide–a total area of about 18 to 20 acres. Shoulders, taxiways, parking areas, and associated facilities would more than double that area, so a new airport at Noatak might be expected to cover about 50 acres of the relatively flat valley floor near the community. A larger area might be fenced around the airstrip, so a total area approaching 100 acres might be fenced. Most air traffic in the foreseeable future would continue to be single-engine and light twin-engine aircraft, with occasional large jet traffic when the Red Dog Mine airstrip was closed or below meteorological minimums. In the more distant future, a larger airstrip at Noatak could make the community more attractive as a destination for visitors.

There is no assurance at this time that an airport would be modified or constructed at Noatak, when it would be constructed, how it would be sized, or where it would be placed. Airport development at Noatak would not be affected by any of the navigation improvements at Portsite addressed in this draft EIS and would not influence a decision to construct or use those improvements. Future airport development would almost certainly require Federal funding, an environmental impact assessment, coastal Consistency review, and permits. There would be ample opportunity for public review and input into the process.

***Scenario 12–Natural Gas Exploration Near Red Dog Mine (a "reasonably foreseeable future action").*** TCAK has conducted exploratory drilling for natural gas in the vicinity of Red Dog Mine in a search for producible amounts of natural gas to replace some of the fuel now used for electrical generation. Their drillers have found natural gas, but not in quantities that warranted production.

Exploratory drilling to date has been near Red Dog Mine, where disturbance to the natural environment has been minor and localized. Effects of future exploratory drilling would depend largely on the selection of drilling sites, access to the sites, and timing of the drilling. Navigation improvements at Portsite would not affect future natural gas exploration.

## 4.13 Relationship Between Short-Term Uses of the Environment, the Maintenance and Enhancement of Long-Term Productivity, and of any Irreversible or Irretrievable Commitments of Resources

In accordance with NEPA requirements, this EIS must include an analysis of both the relationship between short-term uses of the environment, the maintenance and enhancement of long-term productivity, and of any irreversible or irretrievable commitments of resources that would occur should an action alternative be implemented. Additionally, the U.S. Army Corps of Engineers has formalized a set of "Environmental Operating Principles" applicable to all its decision-making efforts and programs to ensure they consider conservation, environmental preservation, restoration, and long-term sustainability in all Corps activities. This section addresses these subjects from a broad perspective incorporating the information and conclusions from detailed analysis provided in previous sections. First, the permanent commitment of resources is compared with the benefits of each alternative. That discussion is followed by a generalized analysis of the relationship between expending resources to implement action alternatives in the short-term and gaining efficiency, productivity, and sustainability in the long-term.

Natural resources include minerals, energy, land, water, forestry, and biota. Renewable natural resources are those resources that can be replenished by natural means, such as water, lumber, and soil. Nonrenewable resources are those resources that cannot be replenished by natural means, such as oil, natural gas, and iron ore. Pursuant to NEPA, significant irreversible environmental changes are described as uses of nonrenewable resources during the initial and continued phases of a project that may be irreversible if removal of the resources occurs, or nonuse of the resources after the project is unlikely. Also irreversible damage can result from environmental accidents associated with a project.

Nonrenewable resources that may be irreversibly and irretrievably committed to the construction, maintenance and operation of navigation improvements at Portsite include some construction materials, energy, and terrestrial, intertidal, and marine habitat.

- **No-Action Alternative**

The construction of the existing facilities at Portsite substantially modified or segmented about 160 acres of terrestrial habitat and similarly affected much smaller areas of intertidal and marine habitat. The existing ore concentrate loading operations use about 150,000 gallons of diesel fuel each season and generate vessel traffic and sound that may affect some uses of marine habitat for up to several miles around loading activities. Additionally, the loading operations release significant volumes of ore concentrate containing high concentrations of lead, cadmium, and zinc to the local environment. These resource commitments would continue to exist under the No-Action Alternative, and there would be no change to long-term efficiency, productivity or sustainability of Portsite operations.

- **Third Barge Alternative**

Adding a third barge to the loading operation would not change the nature or extent of the existing impacts to local terrestrial, intertidal, or marine habitat. However, nonrenewable resources would be permanently committed to manufacture and maintain a new custom barge that would not be readily adaptable to serve other projects or functions and relatively minor amounts of additional fuel would be expended each year to mobilize and demobilize an additional barge and its accompanying tugs between Portsite and Puget Sound. The commitment of these additional resources would decrease overall ore concentrate loading efficiency at current production levels but would increase the reliability and flexibility of the operation and could allow it to maintain production levels during seasons when adverse sea conditions may otherwise limit production. There would be no change in the amount of ore concentrate that is released to the environment or regional fuel distribution patterns. The overall risk of an accident involving vessels operating at Portsite to result in the loss or damage to resources would not change significantly. Overall, there would be no more than minor changes to long-term efficiency, productivity, and sustainability of Portsite operations.

- **Breakwater-Fuel Transfer Alternative**

Construction of the breakwater would not significantly change existing operations at Portsite or the nature or extent of the resulting impacts to local terrestrial, intertidal, or marine habitat. However, its construction could require expansion of an existing quarry and would cover about 13 acres of locally ubiquitous marine habitat with rocky habitat that does not currently exist in the area. Bypass dredging required to mitigate the effects of the breakwater would affect an additional 10 to 15 acres of intertidal habitat each year.

Onshore fuel transfer facilities would permanently commit about 2 acres of terrestrial habitat to project use. Operation of the fuel transfer facilities would generate opportunities and efficiencies that would significantly lower fuel transportation costs and change distribution patterns over a large portion of northwestern Alaska. However, increase in volumes transferred through Portsite and the system's size, complexity, and lack of accessibility for inspection and maintenance could significantly increase the risk of accidental fuel spills near Portsite over the long term and result in increased loss and damage to local resources. Although the risks of spills and damage to resources could increase near Portsite, there would be no appreciable change in overall regional accidental spill-related risks.

The expenditure of energy resources (primarily fuel) and permanent commitment of habitat resources to construct the new facilities would not significantly change the efficiency or productivity of existing loading operations but would increase its reliability and flexibility and could allow it to maintain production levels during seasons when adverse sea conditions may otherwise limit production. Those commitments also would lower fuel transportation costs over a wide area. Part of the lower costs would result from shifting fuel delivery to tanker ships that use less fuel per gallon of fuel transported. Overall, there would be no more than minor changes to long-term efficiency, productivity, and sustainability related to ore concentrate loading operations but significant increases to long-term efficiency, productivity, and sustainability related to regional fuel distribution.

- **Trestle-Channel Alternative**

Construction of the trestle and channel would permanently commit about 3.5 acres of terrestrial habitat and intermittently affect about 6,500 acres of locally ubiquitous marine habitat over the life of the project. Additionally, bypass dredging required to mitigate the effects of the in-water structures would affect an additional 10 to15 acres of intertidal habitat each year. Although up to about 6,500 acres of marine habitat would be intermittently affected by dredging and dredged material disposal activities during construction and maintenance dredging efforts, it would not become completely unproductive. Those areas would quickly recolonize after the activities ceased. Both the channel and disposal site would function similarly to other nearby habitats when they were not being used by the project.

The operation of the Trestle-Channel Alternative would significantly change existing ore concentrate loading and fuel handling operations at Portsite. The new ore concentrate loading facilities would extend farther into the Chukchi Sea but would significantly reduce the magnitude and extent of noise and vessel traffic effects and the release of ore concentrate to the marine environment. The elimination of the existing tug and barge loading system would reduce fuel consumption and eliminate a significant source of risk for large fuel spills from vessel accidents. Operation of the fuel transfer facilities would generate opportunities and efficiencies that would significantly lower fuel transportation costs, reduce transportation-related fuel consumption, and change fuel receiving and distribution patterns over a large portion of northwestern Alaska.

The expenditure of energy resources (primarily fuel) and permanent and intermittent commitment of habitat resources to construct and maintain the new facilities would significantly increase the efficiency, productivity, reliability and flexibility of Portsite ore concentrate loading and fuel handling operations. Overall, there would be significant increases in long-term efficiency, productivity, and sustainability of both ore concentrate loading and regional fuel receiving and distribution operations.

## 4.14 Views of Other Agencies

The U.S. Fish and Wildlife Service (USFWS) draft Coordination Act Report (Appendix 3) provides supportive suggestions for implementation of the tentatively recommended plan. Pending resolution of final mitigation plans following public review and joint determination of reasonable and prudent endangered species measures, the USFWS does not object to the tentatively recommended plan.

The National Marine Fisheries Service has determined that the tentatively recommended plan will not adversely affect threatened or endangered marine mammals. Pending review of essential fish habitat evaluation, they do not object to the tentatively recommended plan.

Views of other agencies will be determined after public and agency review of the draft EIS. Those views will be presented in the final EIS.