

## 4.11 AESTHETICS

Aesthetic impacts include those that could result from changes in the visual landscape (including night sky), soundscape, or olfactory attributes. For this analysis, visual impacts are defined as changes to the scenic attributes of the landscape resulting from the introduction of visual contrasts (discharge of dredge for fill material in wetlands or other waters), and the associated changes in the human visual experience of the landscape (NPS 2014b). The analysis was based on conclusions presented in Section 4.22, Wetlands and Other Waters/Special Aquatic Sites, including permanent impacts to wetlands, open waters, and streams. Impacts to soundscape are defined by changes in A-weighted decibel (dBA) levels that alter soundscape from a “wilderness ambient” character using the information described in Section 3.19 and Section 4.19, Noise. Impacts to soundscape included potential noise generation from the mine, and ground-based transportation corridors and overflights. Because changes in olfactory attributes are subjective, this aesthetic attribute is not analyzed in detail. It is assumed that localized changes to smells could result from project-related activities that alter the natural smells that exist under current conditions. Potential impacts to contemporary, traditional, and cultural uses of areas are discussed in Section 4.7, Cultural Resources, and Section 4.9, Subsistence.

The Environmental Impact Statement (EIS) analysis area for aesthetic resources extends westward from Happy Valley on the Kenai Peninsula and the Bristol Bay and Cook Inlet drainages to the eastern side of the Iniskin Peninsula, encompassing Iliamna Lake and the surrounding communities. For each alternative, the EIS analysis area includes a 50-mile radius from the mine site; a 10-mile radius from the ferry terminals, a 20-mile buffer from the transportation corridor and natural gas pipeline, and a 25-mile radius around the port. For night-lighting impacts, the EIS analysis area includes a 20-mile radius around the mine site, and a 13-mile radius around ferry terminals and port locations. A discussion of potential visual and auditory impacts from overflights is provided.

Scoping comments expressed concern that the project would have permanent and significant impacts on the appearance of the landscape as viewed from Key Observation Points (KOPs), and that this would impact use and enjoyment of the area. Comments also requested that visual impacts of the mine, roads, and Amakdedori port include recreation; and secondary industries like flightseeing and wildlife viewing.

Mitigation measures and Best Management Practices (BMPs) to be followed to reduce impacts to visual resources and aesthetics are described in Chapter 5, Mitigation.

### 4.11.1 Summary of Key Issues

**Table 4.11-1: Summary of Key Issues for Aesthetic Resources**

Project Component	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alterantive 3 and Variant
Mine Site	Aesthetic resources would be affected by moderate to strong visual contrast that would appear dominant in the landscape. Impacts would be limited in geographic extent by rugged topography. Impacts from lighting would be visually evident, particularly during winter months. Night sky could be affected as far as 20 miles from the mine site. Impacts to soundscape would be limited to within 10 miles of the mine site.			
Transportation Corridor	Aesthetic resources would be affected by weak to moderate visual contrast impacts that would be visually evident in the	Impacts would be similar to Alternative 1a. Under the Kokhanok East Ferry Terminal	Impacts would be similar to Alternative 1a; however, the northern route would affect	Impacts would be the same as described in Alternative 2, with the exception of those pertaining to ferry

**Table 4.11-1: Summary of Key Issues for Aesthetic Resources**

Project Component	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	<p>landscape. Movement of vehicles and ferries could be more apparent during dark sky conditions, because lighting would be evident. Night sky could be affected as far as 13 miles from the ferry terminals. Impacts to soundscape would be limited to within 0.5 mile of the transportation corridor. Kokhanok, Iliamna, and Newhalen would be affected by the transportation corridor and ferry activities.</p>	<p>Variant, potential impacts to aesthetic resources would be similar to those described for the south ferry terminal; however, the perception of impacts would be higher due to the close proximity of viewer and noise receptors to the ferry route. Under the Summer-Only Ferry Operations Variant, the visual contrast would not be created from open water on the lake where the icebreaking ferry crosses. Impacts to the night sky would also be much less.</p>	<p>residents of Iliamna, Newhalen, and Pile Bay due to proximity to the access route and ferry terminals. Impacts would include those that result from movement and lighting. Under the Summer-Only Ferry Operations Variant, reduction of season-specific impacts to aesthetic resources during winter months would be similar to Alternative 1; however, reduction in impacts would be experienced by residents in the communities along the northern shore of Iliamna Lake. Under the Newhalen River North Crossing Variant, the bridge would be just as visible, and perhaps more visible, from Roadhouse Mountain as Alternative 2.</p>	<p>terminals. Impacts would occur in the community of Pedro Bay due to the proximity to the transportation route.</p>
<p>Amakdedori Port and Diamond Point Port</p>	<p>Aesthetic resources would be affected by weak to moderate visual contrast that would be visually evident when viewed within 5 miles. Scale dominance of the port facility would decrease with distance. Night sky could be affected as far as 13 miles from the ports. Soundscape-related impacts could extend to almost 2 miles from the port.</p>		<p>Impacts would be similar to those described for Alternative 1a; however, the port site would be in Iliamna Bay, where steep topography would limit geographic extent of visual and soundscape-related impacts.</p>	
<p>Natural Gas Pipeline</p>	<p>The magnitude of impacts from the pipeline would be greatest between the junction with the mine access road and where the pipeline comes ashore north of Newhalen, because visual contrast of the cleared ROW would contrast the existing natural landscape. There would be no impacts on the night sky, and no impacts to the soundscape would be expected.</p>	<p>Because the natural gas pipeline corridor would follow the transportation corridor, it would not introduce additional impacts to visual resources, the night sky, or the soundscape distinct from the road.</p>	<p>The magnitude of impacts from the pipeline would be greatest between the junction with the Eagle Bay ferry terminal access road, because visual contrast of the cleared ROW would contrast the existing natural landscape. There would be no impacts on the night sky, and no impacts to the soundscape would be expected.</p>	<p>Same as Alternative 1.</p>

**Table 4.11-1: Summary of Key Issues for Aesthetic Resources**

Project Component	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
All Components	Visual impacts would appear dominant to viewers in recreational or local low-altitude aircraft. When viewed from the air, the project would result in moderate to strong visual contrast due to vegetation removal and ground disturbance in access roads and the mine site. For air-based viewers flying to recreational destinations such as the McNeil River State Game Refuge, and the western end of Lake Clark National Park and Preserve, the transportation corridor would be visually evident. Visual impacts are expected to be of medium to high magnitude, and would decrease with distance from the facilities. There would be some minimal impacts to the soundscape from project-related aircraft.	Visual impacts from all components would be similar to those described for Alternative 1a. There would be some small impacts to the soundscape from project-related aircraft.	Visual impacts from all components would be similar to those described for Alternative 1a. There would be some small impacts to the soundscape from project-related aircraft.	Visual impacts from all components would be similar to those described for Alternative 2, with the exception of ferry terminals and operations; however, the magnitude of impacts would be greater due to operation of the north access road. The road would be visually evident, appearing as a curvilinear line with contrasting color and texture against the surrounding landscape. There would be some small impacts to the soundscape from project-related aircraft.

Note:  
ROW = right-of-way

### 4.11.2 Visual Impacts

Visual impacts were assessed by first determining the magnitude and geographic extent of visual contrast and scale dominance, and then assessing perceived impacts based on viewer duration, geometry, and distance. Impacts from the project to the night sky were analyzed using estimated skyglow.

**Magnitude and Geographic Extent**—The magnitude of impacts on aesthetics and visual resources was assessed by determining the overall change in landscape character based on visual contrast and scale dominance. The geographic extent of the effects was measured by the range of moderate to strong visual contrast, and was summarized as localized, extended, or regional.

- **Visual Contrast:** The Bureau of Land Management (BLM) Contrast Rating Procedure was used to determine visual contrast that could result from construction and operation of the project (BLM 1986). The project would not directly affect federal land; however, the BLM Contrast Rating Procedure is an established and developed methodology commonly used to assess visual impacts. This method assumes that the extent to which a project results in adverse effects on visual resources is a function of the visual contrast between the project components and the existing landscape character. Levels of contrast are defined as follows:
  - None—The element contrast is not visible or perceived.

- Weak—The element contrast can be seen but does not attract attention.
- Moderate—The element contrast begins to attract attention and to dominate the characteristic landscape.
- Strong—The element contrast demands attention, would not be overlooked, and is dominant in the landscape.
- **Scale Dominance:** The contrast created by a project is directly related to its size and scale, as compared to the surroundings in which it is placed. Scale dominance refers to the scale of an object relative to the visible expanse of the landscape that forms its setting (BLM 1986). A dominant feature of a landscape tends to attract attention, and becomes the focal point of the view. Where two or more features both attract attention and have generally equal visual influence over the landscape, they are considered co-dominant. An object or feature that is easily overlooked or absorbed by the surrounding landscape is considered subordinate. Scale dominance was classified using the following metrics:
  - Not Visually Evident (NVE), where “evident” refers to that which is noticeable, apparent, conspicuous, or obvious.
  - Visually Subordinate (VS), where “subordinate” refers to landscape features that are inferior to, or placed below, another in size, importance, brightness, and other relevant factors.
  - Visually Evident (VE), where “evident” refers to that defined above.
  - Dominant (D), where “dominant” refers to that defined above.

**Visual Impacts**—Potential visual impacts perceived by viewers were assessed at each KOP identified in Section 3.11, Aesthetics, based on the level of exposure to moderate or high-magnitude impacts, viewer sensitivity to change, the potential for those effects to alter the human experience of the landscape, and the context of the impact. Exposure was measured based on viewer duration, viewer geometry, and distance from the project component. These metrics were assessed as follows:

- **Viewer Duration:** Viewer duration or exposure refers to the length of time project features may be in view. This description discloses whether expected viewer exposure would be limited to a short duration and/or small number of viewpoints, or would be of a prolonged duration and/or experienced from multiple viewpoints.
- **Viewer Geometry:** Viewer geometry refers to the spatial relationship of the observer to the viewed object (i.e., the project), including both the vertical and horizontal angles of view (BLM 2013). The vertical angle of view refers to the observer’s elevation relative to the viewed object. The horizontal angle of view refers to the compass direction of the view from the observer to the object. Visibility is typically greater for observers whose viewing angle is directed toward a project feature than for those with a lateral view.
  - Superior geometry occurs when the viewer is elevated with respect to the facility (looking down on it).
  - Inferior geometry occurs when the viewer is lower in elevation than the facility (looking up at it).
  - At-grade geometry occurs when the view is level with the facility (looking across it).
- **Distance:** The degree of perceived visual contrast and scale dominance of an object is influenced by the object’s distance from the viewer. As viewing distance increases,

the project appears smaller and less dominant; likewise, the apparent contrast of color decreases (BLM 1986). Distance from project components is classified as follows:

- Immediate foreground (less than 3 miles)
- Foreground–middle ground (3 to 5 miles)
- Background (5 to 15 miles)
- Seldom seen (beyond 15 miles)

**Night Sky**—Night-lighting associated with project components could result in light pollution, which is defined as the change to natural night-lighting levels from human-caused sources (Falchi et al. 2016a). Light pollution effectively reduces visibility of natural sources of light at night, such as moonlight, starlight from individual stars and planets, the Milky Way, the zodiacal light, the aurora borealis, and meteors. Project components would result in light pollution in the form of glare when viewed from short distances and over water, but would have further-reaching effects from skyglow, which is defined as the brightening of the night sky over areas with artificial lighting (NPS 2016g). Because a lighting plan is not available for the project, impacts are evaluated qualitatively, and the magnitude and geographic extent of impacts are estimated using existing data in the New World Atlas of Artificial Night Sky Brightness (Falchi et al. 2016a, b). Development of a lighting plan has been added to Appendix M1.0, Mitigation Assessment, to propose ways to minimize impacts. Some impacts may be minimized through BMPs, such as orienting lights downward. To estimate the distance that skyglow would be observed from the mine site, data were used from the Red Dog Mine in northwestern Alaska. To estimate the distance that skyglow would impact the night sky from the ferry terminals and ports, data from the Red Dog Port were used. These two facilities were used as proxies for estimating night-lighting impacts from the mine site, ferry terminals, and ports because of their similar size and type of operations to the Pebble project and associated facilities. These data are summarized in Table 4.11-2 below.

**Table 4.11-2: Estimated Night-Sky Effects by Distance from Artificial Lighting**

Distance from Mine Site <sup>1,2</sup>	Distance from Ferry Terminals and Ports <sup>1,3</sup>	Ratio to Natural Brightness <sup>4</sup>	Description of Effects
20 miles	13 miles	1%	In areas protected for scenic or wilderness character, a significant impact on the values of solitude and the absence of visual intrusion of human development occurs. Attention should be given to protect the site from future increase in light pollution.
8 miles	5 miles	8%	Area is considered polluted from an astronomical point of view. Visibility of stars and other astronomical observations are affected.
2 miles	<1 mile	128%	Visibility of the Milky Way during winter months is affected.
<1 mile	N/A <sup>5</sup>	>512%	Sky has same luminosity as a natural sky at twilight; true night conditions are never experienced.

Notes:

<sup>1</sup> Data estimated from Falchi et al. 2016a, b.

<sup>2</sup> Distance based on data for Red Dog Mine in northwestern Alaska.

<sup>3</sup> Distance based on data for Red Dog Port.

<sup>4</sup> Ratio (in percent) between the artificial brightness and the natural background sky brightness.

<sup>5</sup> An increase in sky brightness of 512 percent or greater over existing conditions is not anticipated to result from the ferry terminals or ports at any distance, based on impacts from the Red Dog Port per the New World Atlas of Artificial Sky Brightness.

Source: Falchi et al. 2016a, b

The National Park Service (NPS 2013b) monitoring report also includes photographs that depict natural air glow, as well as monitoring data and narrative, including the Bortle Class, based on

the Bortle Dark-Sky Scale as reported by NPS observers at Keyes Point in Lake Clark National Park and Preserve. The Bortle Dark-Sky Scale is a nine-step scale used to rate sky conditions at an observation site; with Class 1 indicating an excellent dark-sky site, and Class 9 indicating an inner-city sky (Bortle 2001).

Data from these two sources were used to estimate existing night-sky quality in the EIS analysis area.

#### **4.11.3 No Action Alternative**

Under the No Action Alternative, federal agencies with decision-making authorities on the project would not issue permits under their respective authorities. The Applicant's Preferred Alternative would not be undertaken, and no construction, operations, or closure activities specific to the Applicant's Preferred Alternative would occur. Although no resource development would occur under the Applicant's Preferred Alternative, Pebble Limited Partnership (PLP) would retain the ability to apply for continued mineral exploration activities under the State's authorization process (ADNR 2018-RFI 073) or for any activity not requiring federal authorization. In addition, there are many valid mining claims in the area, and these lands would remain open to mineral entry and exploration by other individuals or companies.

It would be expected that current State-authorized activities associated with mineral exploration and reclamation, as well as scientific studies, would continue at levels similar to recent post-exploration activity. The State requires that sites be reclaimed at the conclusion of their State-authorized exploration program. If reclamation approval is not granted immediately after the cessation of activities, the State may require continued authorization for ongoing monitoring and reclamation work as it deems necessary. No additional direct or indirect effects on aesthetics would be expected as a result of the project.

PLP would reclaim any remaining sites at the conclusion of their exploration program. The state determines reclamation approval, which may include continued authorization for ongoing monitoring and reclamation work as deemed necessary. Reclamation would benefit the aesthetics of the setting.

#### **4.11.4 Alternative 1a**

Due to the remoteness of the project and the distribution of components across a large geographic area, many of the components are geographically isolated; therefore, visual impacts of the project may be limited to that caused by one component. For example, viewers situated on Cook Inlet may only be exposed to potential impacts from Amakdedori port, but would not experience potential impacts from activities at the mine site. However, some viewer locations may be characterized by broader or expansive views (i.e., from higher elevations or aircraft), and therefore have the potential for exposure to more than one project component. To address this, potential visual and aesthetic impacts are provided below by project component, and collectively for all project components.

Note that because views of the EIS analysis area from aircraft would include all project components, potential impacts from this viewer position are described under a separate heading below, "All Components."

#### **4.11.4.1 Mine Site**

##### **Visual Impacts**

Specific mine site components would result in variable levels of visual contrast and scale dominance. In terms of magnitude and extent, the open pit mine, tailings storage facility overburden stockpiles, material sites, and quarries would create strong visual contrast in form, line, color, and texture due to alterations in the existing natural contours of the landscape and removal of vegetation. Smooth texture and the reflective surface of water management ponds would result in strong contrast against the coarse textures and natural matte colors of the landscape. Milling and processing facilities, along with supporting infrastructure such as the power plant, water treatment plants, camp facilities, and storage facilities, would appear industrial. These industrial straight lines and geometric forms would contrast against the softer, less-angular lines of the landscape. These features would be visually evident and appear dominant on the landscape when viewed from within background distance zones.

Collectively, and where visible in the background distance zone (5 to 15 miles), the mine site would appear dominant in the landscape, and would alter scenic quality. Viewshed models indicate that visibility of mine components from ground-based locations would be limited by topography and vegetation screening (see Appendix K4.11 for figures of the viewshed). Visibility would generally be limited to high-elevation areas on Sharp Mountain and Groundhog Mountain, and the upper Stuyahok River Valley. The mine site could also be visible from higher elevations west of Lake Clark (but outside of Lake Clark National Park and Preserve); however, visual contrast is expected to attenuate to a weak level at this distance (approximately 20 miles away). See Appendix K4.11 for visual simulations of the project at defined KOPs. At Iliamna Lake, views of the mine site would largely be screened by vegetation and topography. The mine would be highly visible to passengers in overflights. See Appendix K3.12, Transportation and Navigation, for common flightpaths over the area.

In terms of magnitude and extent, impacts of the mine site perceived by residents, recreationists, or subsistence users in the EIS analysis area for the mine site would be of moderate to strong visual contrast, have VE or D scale dominance, and occur in the immediate foreground, due to the remoteness of the site and the existing topographic and vegetation screening. Viewer duration would be intermittent to prolonged, depending on the activity of the viewer. If remote recreation or subsistence use should occur in the foreground or middle-ground distance zone of the mine site and in the seen area, the magnitude of impacts would increase as a function of distance. The duration of impacts would be long-term, extending beyond the life of the project. The likelihood of impacts would be certain.

##### **Night Sky**

Mine site facility lighting would have a strong contrast level against the existing night sky. Lighting could be visible at distances from high-elevation locations due to the lack of existing night-lighting and high quality of night sky. During periods of snow cover, lighting at the mine site would reflect against the snow, thereby creating a halo effect that could extend outward to background distance zones and contribute to skyglow. Increases in brightness and associated impacts to night sky would be noticeably greater during periods of snow cover. Conversely, impacts would be less noticeable during summer months, when daylight hours are longer and there is no snow cover.

Due to the lack of viewing locations in the foreground or middleground distance zones, the mine site would not produce glare visible from any KOPs; however, glare could be observed by overhead flights. Mine lighting could be directly visible from locations in the modeled viewshed,

such as high-elevation areas on Sharp Mountain and Groundhog Mountain, the upper Stuyahok River Valley, and higher elevations west of Lake Clark National Park and Preserve.

Skyglow from the mine site would brighten the night sky, affecting the human eye from fully adapting to the dark; and reduce visibility of stars and other astronomical observations at some distances. The magnitude and extent of the impact would be that areas 8 to 20 miles from the mine site could begin to experience skyglow from artificial lighting (Table 4.11-2). Impacts may not be readily apparent; however, the introduction of this visual intrusion into an otherwise pristine night sky would begin to put the integrity of the night sky at risk. In terms of magnitude and extent, about 1 percent of the Lake Clark National Park and Preserve would experience these types of effects, as shown in Table 4.11-3. No areas in the Katmai National Park and Preserve, McNeil River State Game Refuge, or the Alaska Maritime National Wildlife Refuge would be impacted. No change to Bortle Class is expected at these distances from the mine site lighting alone, and the magnitude of impacts would be low.

**Table 4.11-3: Estimated Night-Sky Effects from the Mine Site**

Distance from Mine Site <sup>1</sup>	Total Acres Affected	Affected Acres in Lake Clark National Park and Preserve
8 to 20 miles	846,074	54,487
2 to 8 miles	208,143	0
1 to 2 miles	21,755	0
<1 mile	23,640	0

Notes:

<sup>1</sup> Data estimated from Falchi et al. 2016a, b. The ratio of natural brightness as a function of distance was assumed to be the same as data measured from the artificial light produced from Red Dog Mine.

Source: Falchi et al. 2016 a, b

The magnitude of additional effects would be that nighttime views in areas 2 to 8 miles from the mine site would begin to experience reduced visibility of stars and other astronomical observations, and could become affected (degraded) in these areas. However; the number of viewers experiencing these effects would be low, and no areas in national parks and preserves, state game refuges, or national wildlife refuges would experience impacts of this magnitude.

In areas 1 to 2 miles from the mine site, effects to the night sky would become apparent to casual observers; the magnitude of impacts would increase and the Bortle Class would be affected. However, the number of viewers experiencing these effects would be low, and no areas in national parks and preserves, state game refuges, or national wildlife refuges would experience impacts of this magnitude.

In terms of extent, areas less than 1 mile from the mine site would experience a sky that would never appear darker than twilight, and true night conditions would never be experienced. In terms of magnitude, this would be considered strong visual contrast. The Bortle Class would be degraded; however, the number of viewers experiencing these effects would be low, and no areas in national parks and preserves, state game refuges, or national wildlife refuges would experience impacts of this magnitude. The duration of impacts to the night sky would be long-term, lasting through the life of the mine; and they would be certain to occur under Alternative 1a.

### **Soundscape**

Operations at the mine site would involve noise-producing activities (including those related to discharge of fill) and processes that include blasting and extracting rock at the pit and transporting rock material to milling facilities or the pyritic tailings storage facility/potentially acid-generating



storage facility. Section 4.19, Noise, describes anticipated noise-related impacts that could result from construction, operation, and closure of the mine. Based on the results of the noise analysis, it was determined that—in terms of magnitude and extent—the existing “wilderness ambient” soundscape would be unaffected beyond a distance of 10 miles from the mine site. Within approximately 18,450 feet, the estimated operational noise level would be at least 30 dBA equivalent continuous sound level ( $L_{eq}$ ), and therefore would risk causing sleep disturbance for recreationists and subsistence hunters sleeping outdoors during any seasonal activities on lands considered “wilderness ambient.” Within approximately 12,900 feet, the estimated operational noise level would be at least 45 times day-night sound level (dBA  $L_{dn}$ ) at a building exterior. These impacts to the soundscape would last for the duration of project operations. See Section 4.19, Noise, for more information.

During construction, impacts to soundscape could also result from increases in project-related flights that could occur between Anchorage and Iliamna to transport material and personnel. The magnitude of the impact would be seven low-elevation flightpaths (lower than 14,000 feet) between these two locations that cross sensitive receptors at Lake Clark National Park and Preserve and communities (see Appendix K3.12, Transportation and Navigation, for flightpaths). If these routes are used frequently for the project, there could be additional impacts to the soundscape from these flights. Project-related flights into and out of Iliamna and Kokhanok would increase noise levels in those communities and surrounding areas for the life of the project, and would be expected to occur, as discussed in Section 4.5, Recreation. During operations, there would be fewer flights traveling to Iliamna, because materials would be shipped via barge and not flown, and there would be fewer employees.

## **Reclamation**

Following reclamation, the magnitude and extent of visual contrast and scale dominance of the mine site is expected to decrease due to removal of mine components, and regrading and replanting of vegetation. However, the mine site would still be visually evident in the foreground-middleground, resulting in high-magnitude impacts when viewed from this distance zone. Magnitude of impacts would decrease with distance to medium in background distance zones. Night sky and soundscape-related impacts would be reduced, because operation of the mine would cease.

### **4.11.4.2 Transportation Corridor**

#### **Visual Impacts**

Specific components of the transportation corridor would result in variable levels of visual contrast and scale dominance. In terms of magnitude, access roads could result in strong visual contrast in form, line, color, and texture against the surrounding landscape, because linear/curvilinear lines and gray-brown color and coarse texture of the road would contrast surrounding natural color, textures, and lines of the landscape. Mine-related traffic on the roadway could be visually evident due to movement and associated dust plumes. Vehicle traffic may be visible from areas along the Gibraltar and Newhalen rivers where recreational and subsistence fishing takes place, especially where the port and mine access roads would cross the rivers. Movement of vehicles would be more apparent during dark sky conditions, because vehicle lighting would be evident.

The magnitude and extent of these impacts would be greatest when viewed from higher elevation or superior viewer positions (such as overflights) in the western end of Lake Clark National Park and Preserve, because roads would not be screened by vegetation, and visual contrast of the cleared vegetation of the roadway would contrast to the surrounding landscape. When viewed from Nondalton, the mine access road would be expected to result in weak visual contrast,

because viewers would be primarily situated at a similar grade to the road, and visibility would be minimized by vegetation screening. In terms of geographical extent, the mine access road would be greater than 5 miles from this community, thereby further minimizing the potential for visual contrast or scale dominance. The magnitude of impacts from the mine access road would be strong visual contrast when viewed from higher elevations on Roadhouse Mountain. Approximately 3 miles from Roadhouse Mountain, the road would appear as a discrete curvilinear line that results in strong visual contrast against the landscape and would be visually evident. The crossing of the Newhalen River would also be visible (see Appendix K4.11).

The magnitude of impacts resulting from both the Eagle Bay and south ferry terminals would be a moderate to strong visual contrast when viewed in the foreground-middleground distance zone from Iliamna Lake or higher-elevation locations (see Appendix K4.11 for visual simulations from defined KOPs). Ferry terminal facilities would be NVE or VS from villages on the shoreline of Iliamna Lake, because the communities are either outside of the seen area, or are situated greater than 25 miles away. The south ferry terminal would be within 2 miles of the mouth of the Gibraltar River, where the terminal and the ferry traffic could be seen by recreationist and subsistence users. From Iliamna Lake, the ferry terminals would appear distinct against the shoreline, because the form and line of the structures would contrast with the natural character of the surrounding landscape. Visual contrast would primarily result from the angular lines, varied colors, and smooth texture of cargo containers where they would be stockpiled at the terminals. Strong visual contrast would result from night-lighting where direct views of artificial lighting for the Eagle Bay and south ferry terminals would be experienced. Reflection and glare off Iliamna Lake would further increase the visual contrast from the artificial lighting at the ferry terminals. In terms of geographic extent, reflections off the lake could potentially be viewed by individuals living and recreating in/near Newhalen, Iliamna, and Kokhanok. There are commercial lodges in/near each of these communities that would also experience effects from night-lighting.

Ferry traffic would appear dominant from Kokhanok, Newhalen, and Iliamna, because these communities are within 5 miles of the ferry route. Other communities are more than 10 miles from the route; given the size and low stature of the ferries, the magnitude of visual contrast is expected to be weak, and ferries would appear visually subordinate.

Season-specific operational impacts to aesthetic resources during winter months primarily pertain to lighting, the visual contrast created from ice break on the lake where the ferry would cross, and ferry noise associated with icebreaking. The magnitude and extent would be visual impacts experienced by residents of Kokhanok, Newhalen, and Iliamna due to the proximity of villages to the ferry terminal and crossing route. Individuals engaged in winter subsistence activity may also experience impacts from vehicle lighting on access roads and facility lighting at the ferry terminals.

The magnitude of impacts of the mine and port access roads perceived from residents, recreationists, or subsistence users in the EIS analysis area would be of weak to strong visual contrast and NVE to D dominance; the geographic extent would be foreground-middleground, due to screening of the road corridor by vegetation and the low stature of the ferry terminals (see Appendix K4.11 for project viewshed models). The visual contrast would be greater under dark sky conditions due to the contrast of night-lighting described below. Viewer exposure to the transportation corridor and associated uses would be intermittent to prolonged, depending on the activity of the viewer. The duration of impacts would be long-term, extending beyond the life of the project. Visual impacts would not impact viewers in areas identified as special management areas (e.g., national parks or wildlife management areas). The likelihood of impacts would be certain under Alternative 1a.

## Night Sky

The magnitude of impacts on the night sky would be strong visual contrast resulting from night-lighting where direct views of artificial lighting for the Eagle Bay and south ferry terminals would be experienced. Reflection and glare off Iliamna Lake would further increase the visual contrast from the artificial lighting at the ferry terminals. In terms of geographic extent, reflections off the lake could potentially be viewed by individuals living and recreating in/near Newhalen, Iliamna, and Kokhanok. There are commercial lodges in/near each of these communities that would also experience effects from night-lighting.

Skyglow from the Eagle Bay and south ferry terminals would brighten the night sky, affecting the human eye's ability to fully adapt to the dark; and would reduce visibility of stars and other astronomical observations at some distances. In terms of geographical extent, areas 5 to 13 miles from the ferry terminals could begin to experience effects to skyglow from artificial lighting (Table 4.11-4). Impacts may not be readily apparent; however, the introduction of this visual intrusion into an otherwise pristine night sky would begin to put the integrity of the night sky at risk. The magnitude and extent of impacts from skyglow would result in less than 1 percent of the Lake Clark National Park and Preserve and Katmai National Park and Preserve experiencing these types of effects from the Eagle Bay and south ferry terminals. Therefore, no change to night-sky quality or Bortle Class is expected at these distances from the ferry terminals' lighting alone.

**Table 4.11-4: Estimated Night-Sky Effects from Eagle Bay and South Ferry Terminals**

Distance from Ferry Terminal <sup>1</sup>	Eagle Bay Ferry Terminal <sup>2</sup>		South Ferry Terminal <sup>3</sup>	
	Total Acres Affected	Acres in Lake Clark National Park and Preserve Affected	Total Acres Affected	Affected Acres in Katmai National Park and Preserve
5 to 13 miles	293,680	30,911	295,133	10,021
1 to 5 miles	50,355	0	51,073	0
<1 mile	2,546	0	2,741	0

Notes:

<sup>1</sup> Data estimated from Falchi et al. 2016a, b. The ratio of natural brightness as a function of distance was assumed to be the same as data measured from the artificial light produced from Red Dog Port.

<sup>2</sup> Eagle Bay ferry terminal would have no night-sky impacts to Katmai National Park and Preserve.

<sup>3</sup> The south ferry terminal would have no night-sky impacts to the Lake Clark National Park and Preserve.

Source: Falchi et al. 2016a, b

In terms of magnitude and extent, areas 1 to 5 miles from the ferry terminals would begin to experience reduced visibility of stars and other astronomical observations. The night-sky quality could become degraded in these areas. The community of Kokhanok could experience these types of effects. No areas in national parks and preserves, state game refuges, or national wildlife refuges would experience impacts of this magnitude.

Also, in terms of magnitude and extent, effects to the night sky would become apparent to casual observers with reduced visibility in areas less than 1 mile from either ferry terminal. The night-sky quality would be degraded. No areas in Lake Clark National Park and Preserve, Katmai National Park, communities, or commercial lodges would experience these types of effects (Table 4.11-4). Therefore, the number of individuals experiencing impacts of this magnitude would be low.

## **Soundscape**

During operations, truck traffic, light vehicles, and maintenance along the mine access road (including those related to construction, dredge, or fill material) could result in impacts to soundscape that extend up to 0.5 mile from the road corridor, as measured by the potential for a 45 dBA  $L_{max}$  value, assuming a 15 miles per hour (mph) speed limit for large diesel-engine vehicles, and a 30 mph speed limit for passenger vehicles (maximum value level) (see Section 4.19, Noise, for more information). The presence of dense vegetation or terrain features like ridgelines or hills could narrow this distance. Impacts to soundscape from the access route would endure for as long as the project is in the operations phase, and would be expected to occur.

Primary impacts to soundscape from operation of the ferry terminals would result from continuous (day and night) operation of the power supply (generator) at each ferry terminal. The magnitude of impacts from this feature would be the production of a reference sound level no greater than 70 dBA  $L_{eq}$  at 50 feet (see Section 4.19, Noise, for more information). In terms of extent, within approximately 2,250 feet from the ferry terminal, the estimated operational noise level would be at least 30 dBA  $L_{eq}$ , and therefore would risk causing sleep disturbance for any recreationists and subsistence users sleeping outdoors during their seasonal activities on lands considered “wilderness ambient.” Also in terms of extent, within approximately 1,000 feet, the estimated operational noise level would be at least 45 dBA  $L_{dn}$  at a building exterior. Other indirect impacts to soundscape may result from icebreaking as the ferry crosses the lake during winter operations. Anticipated impacts to soundscape would persist through operations, and would be expected to occur under Alternative 1a.

Following reclamation, visual contrast and scale dominance of the transportation corridor would persist, because roads would remain operational. Visual impacts associated with ferry terminals and ferry transportation would cease, because these facilities would be removed. Ferry terminals would be replaced with contoured gravel landings. Although landings would appear distinct from the natural shoreline, they would not be visually evident beyond the foreground-midground. Night sky-related impacts would be reduced, because landings would not be outfitted with night-lighting. Soundscape-related impacts would also be reduced due to the limited and intermittent use of barge operations and lack of generators.

### **4.11.4.3 Amakdedori Port**

#### **Visual Impacts**

The magnitude and visual contrast of the Amakdedori port would be similar to those described for the Eagle Bay and south ferry terminals. The port facility would be larger in size, and involve different types and frequencies of vessel operations. Visual contrast may be stronger when viewed from close proximity or overflights, due to the larger stature of this facility. Vertical lines and geometric shape of the facility would contrast against the low marshlands, with the backdrop of the rolling hills and mountains. As a result of the unobstructed horizon of Cook Inlet, the geographic extent of impacts would continue until moderate to strong contrast attenuated to a weak level (anticipated beyond 10 miles). See Appendix K4.11 for project viewshed models. Development of the port would result in direct effects to aesthetics by changing the configuration of the shoreline and creating an industrial feature in an otherwise natural landscape in Kamishak Bay. The geographical impact of indirect effects would be that increased project-related boat traffic on Kamishak Bay in Cook Inlet would be visually evident from the foreground, midground, and background distance zones. The port would not be visible from the mouth of McNeil River at the edge of McNeil State Game Refuge; however, vessel traffic (including lighting) at the southern location would be evident, and could be a dominant part of the viewers’ experience

when vessels are present. Visual impacts could affect viewers in areas identified by special designations; namely, the McNeil River State Game Refuge (including Chenik Lagoon) and Alaska Maritime National Wildlife Refuge. These impacts would primarily affect visitors during the summer season. Peak visitation and viewing is from early summer into fall, and would be extremely low during the winter. Such impacts could indirectly affect the naturalness of the recreation experience at this destination. Although seasonal, the duration would be considered long-term, because impacts would occur throughout the life of the project.

### **Night Sky**

The magnitude and extent of impacts from glare and skyglow would be similar to those described for the Eagle Bay and south ferry terminals. As discussed for ferry terminals, strong visual contrast would be expected to result from night-lighting and the potential for haloing during winter months, when lighting is reflected off the snow's surface. Increases in brightness and associated impacts to night sky would be noticeably greater during periods of snow cover. Reflection off of Cook Inlet would occur, although it would only be visible to a small number of viewers.

The magnitude and geographical extent of impacts on the night sky would be such that areas 5 to 13 miles from Amakdedori port could begin to experience effects to skyglow from artificial lighting that would begin to put the integrity of the existing pristine night sky at risk. In terms of magnitude, about 38 percent of the McNeil River State Game Refuge, and less than 1 percent of the Alaska Maritime National Wildlife Refuge would experience moderate to strong visual contrast from night-lighting. No specific communities or commercial lodges were identified that would be impacted.

In terms of magnitude and geographical extent, areas 1 to 5 miles from Amakdedori port would begin to experience reduced visibility of stars and other astronomical observations, and the night-sky quality could become degraded in these areas. No national parks and preserves, communities, or commercial lodges would experience these impacts. About 7 percent of the McNeil River State Game Refuge and less than 1 percent of the Alaska Maritime National Wildlife Refuge would experience impacts of the same magnitude (Table 4.11-5).

In terms of magnitude and extent of impacts, effects to the night sky would become apparent to casual observers in areas less than 1 mile from Amakdedori port, and the Bortle Class night-sky quality would be degraded. No national parks and preserves, national wildlife refuges, state game refuges, communities, or commercial lodges would experience effects of this magnitude (Table 4.11-5). Therefore, the number of individuals experiencing impacts of this magnitude would be low.

**Table 4.11-5: Estimated Night-Sky Effects from Amakdedori Port<sup>1</sup>**

<b>Distance from Port<sup>2</sup></b>	<b>Total Acres Affected</b>	<b>Acres in McNeil River State Game Refuge Affected</b>	<b>Affected Acres in Alaska Maritime National Wildlife Refuge</b>
5 to 13 miles	304,492	49,941	286
1 to 5 miles	55,770	9,073	105
<1 mile	4,126	0	0

Notes:

<sup>1</sup> Amakdedori port would have no night-sky impacts to the Lake Clark National Park and Preserve or Katmai National Park and Preserve.

<sup>2</sup> Data estimated from Falchi et al. 2016a, b. The ratio of natural brightness as a function of distance was assumed to be the same as data measured from the artificial light produced from Red Dog Port.

Source: Falchi et al. 2016a, b

## **Soundscape**

Although the equipment and types of vehicles used are different, the technique used for estimating noise exposure attributable to Amakdedori port operations is similar to and uses the same conservative assumptions as the technique used for estimating aggregate noise emissions from mine site operations. In addition, noise from vessel operations, whether during lightering or transit of ore concentrate vessels, could also be audible to people in coastal areas of McNeil River State Game Refuge and the Alaska Maritime National Wildlife Refuge. The magnitude and extent of impacts determined from the predictive analysis, and considering sound attenuation with distance and other factors, would be:

- Within approximately 9,750 feet, the estimated operations-attributed noise level would be at least 30 dBA  $L_{eq}$ , and therefore would risk causing sleep disturbance for any recreationists and subsistence hunters sleeping outdoors during their seasonal activities on lands considered “wilderness ambient.”
- Within approximately 5,800 feet, the estimated operational noise level would be at least 45 dBA  $L_{dn}$  at a building exterior, and therefore would be 10 dBA greater than the existing outdoor ambient sound level.

The duration of impacts in the two latter above-stated distance buffers would be long-term throughout port operations. See Section 4.19, Noise, for more detailed analysis.

## **Reclamation**

Following reclamation, the magnitude and extent of visual contrast and scale dominance of the Amakdedori port would be considered not visually evident, because most port facilities would be removed. Because the remaining terminal would no longer operate with the same frequency of vessel traffic, soundscape-related impacts would also be reduced. Likewise, because the terminal would no longer be outfitted with night-lighting, night-sky impacts would be eliminated.

### **4.11.4.4 Natural Gas Pipeline Corridor**

Because the natural gas pipeline corridor would follow much of the transportation corridor, it would not introduce additional visual contrast in form, line, color, or texture that is distinct from the port and mine access roads.

The exception would be the segment from the northern shore of Iliamna Lake to the mine access road. In that segment, visual moderate-strong contrast of the cleared right-of-way (ROW) would contrast the existing natural landscape. As described in the transportation corridor, visual contrast would be perceived by viewers situated in close proximity to the pipeline, or in elevated viewer positions. The pipeline ROW would follow, roughly, the route of an existing road, although not co-located. Viewers from high elevations would see both the ROW clearing and the existing road. Some portions of the cleared ROW would be visible to those traveling along the road.

Pipeline construction activities for this segment would create noise in conjunction with construction, which would be of limited duration. Residents of Newhalen and Iliamna would hear the construction noise within 0.5 mile of activities. Gas traveling through the buried pipeline would not emit audible noise.

In terms of magnitude, the compressor station on the Kenai Peninsula would result in weak visual contrast against the surrounding landscape, and would be visually subordinate against the natural landscape. In terms of geographical extent, the compressor station would not be seen from Anchor River State Recreation Area or Stariski Campground, and therefore would be unlikely to occur. The impacts on visual contrast would be long-term, lasting though the life of the project.

Although pipeline construction activities would create noise in conjunction with road construction, the duration would be limited to 2 years. No noise-producing sources would be situated along the pipeline corridor during pipeline operation. Gas traveling through the buried pipeline would not emit audible noise. The compressor station on the Kenai Peninsula would produce some noise, but would not be expected to impact sensitive receptors; therefore, no noise impacts associated with pipeline operations would occur under Alternative 1a.

The natural gas pipeline corridor is not expected to have any impacts on the night sky.

#### **4.11.4.5 All Components**

Due to the scale of the project, many of the components are geographically isolated from each other and from population centers or areas of frequent visitation; as a result, opportunity to experience visual contrast of more than one component is limited. An exception to this limitation applies to those experiencing views of the project from recreational or local low-altitude aircraft, as well as skyglow effects. Fourteen low-elevation flightpaths cross the analysis area that could experience views of the project, as shown in Appendix K3.12, Transportation and Navigation (FAA 2018). In terms of magnitude when viewed from the air, the project would result in moderate to strong visual contrast due to vegetation removal and ground disturbance in access roads and the mine site. For air-based viewers flying to recreation destinations such as the McNeil River State Game Refuge, the transportation corridor and Amakdedori port would be visually evident. Additionally, skyglow effects from different project components could also be visible from one location, which together could increase the magnitude of effects to night sky. The magnitude and duration of visual impacts would be moderate to strong visual contrast that would last for the life of the project. The extent of impacts would decrease with distance from the facilities.

During construction, impacts to the visual environment and soundscape could also result from increased project-related air traffic. As described in Section 4.12, Transportation and Navigation, in terms of magnitude and extent, a Twin Otter or similar aircraft would make 20 to 40 flights per month (average of 5 to 10 flights per week) to Amakdedori port, before the Kokhanok airstrip could be accessed by road. Once the Kokhanok spur road was established, there would be up to 10 flights per month by Twin Otters to Kokhanok. The duration of impacts would be intermittent, but long-term, and could affect important scenic resources at the Lake Clark or Katmai National Parks and Preserves, McNeil River State Game Refuge, Alaska Maritime National Wildlife Refuge, communities, or commercial lodges.

During operations, the magnitude of project flights would include those transporting employees on 2-week rotations, as well as cargo flights. Section 4.12, Transportation and Navigation, includes details on the number and location of project flights. In terms of extent, increases of air traffic have the potential to be observed by visitors to Lake Clark National Park and Preserve, where small aircraft are the primary transportation for park visitors. The potential for impacts would be reduced, however, because flights from Anchorage to Bristol Bay generally fly over Iliamna Lake or the project area (FAA 2018) (see Section 3.12, Transportation and Navigation), rather than the preserve, and therefore would be unlikely to occur. Additionally, the project-related air traffic would not conflict with small planes, which fly at lower altitudes and use narrow passes, such as Lake Clark Pass. The duration of impacts from helicopter traffic would remain throughout operations, because helicopters would be used to perform ongoing environmental monitoring (variable by frequency and season) and aerial inspections of the transportation corridor (weekly or monthly) (PLP 2018-RFI 027b). These effects would be long-term, occurring through the life of the project under Alternative 1a.

The magnitude, extent, and duration of impacts from air traffic would be intermittent, but lasting though the life of the project, and could affect important scenic resources at the Lake Clark or

Katmai National Parks and Preserves, McNeil River State Game Refuge, Alaska Maritime National Wildlife Refuge, communities, or commercial lodges.

Following reclamation, visual contrast and scale dominance of the project would be reduced; however, the remaining roadway, airstrips, and mine site infrastructure would remain visually evident. When viewed from the air, the project would result in moderate visual contrast due to ground disturbance in access roads and the mine site. Night-sky impacts are expected to be reduced to a low-medium level, largely due to removal of lighting from ferry terminals and the port. During project closure, impacts from overflights would decline, because fewer personnel would travel to and from the project area.

#### **4.11.5 Alternative 1**

The magnitude, duration, extent, and likelihood of impacts to aesthetic resources (visual, including night sky, and soundscape) at the mine site, south ferry terminal, port access road, and Amakdedori port under Alternative 1 under construction, operations, and reclamation would be the same as or similar to those described for Alternative 1a.

##### **4.11.5.1 Transportation Corridor**

The transportation corridor under Alternative 1 would result in variable levels of visual contrast and scale dominance, as described under Alternative 1a. Impacts from the port access road would be the same as Alternative 1a, including the crossing of the Gibraltar River. Impacts from the mine access road would be similar to those for Alternative 1a: the magnitude and extent of impacts would be greatest when viewed from higher elevation or superior viewer positions—such as overflights—and roads not screened by vegetation; and visual contrast of the cleared vegetation of the roadway would contrast to the surrounding landscape.

As described for the Eagle Bay and south ferry terminals in Alternative 1a, in terms of magnitude and extent, the north ferry terminal and the south ferry terminal would result in moderate to strong visual contrast when viewed in close proximity (3 to 5 miles) from Iliamna Lake or higher-elevation locations. From this distance zone, the ferry terminals would appear distinct against the shoreline, because the form and line of the structures would contrast with the natural character of the surrounding landscape. Impacts to the community of Kokhanok would be the same as described under Alternative 1a. Other villages on Iliamna Lake would be greater than 10 miles from the ferry terminals and route. Given the size and low stature of the ferries, the magnitude and extent of visual contrast would be weak, and ferries would appear visually subordinate.

The magnitude, geographical extent, and duration of impacts to the night sky from the north ferry terminal would be similar to those described for the Eagle Bay and south ferry terminals in Alternative 1a. There would be no impacts to the night sky from the land-based transportation corridor. Reflection off Iliamna Lake would occur, but it would only be visible to a small number of viewers. Areas 5 to 13 miles from the ferry terminals could begin to experience effects to skyglow from artificial lighting (Table 4.11-6). Impacts may not be readily apparent; however, the introduction of this visual intrusion into an otherwise pristine night sky would begin to put the integrity of the night sky at risk. Impacts to the McNeil River State Game Refuge are discussed with the port access road under Alternative 1a.

The magnitude, duration, extent, and likelihood of impacts to soundscape would be similar to those described for Alternative 1a. Noise-related impacts would not be expected to affect local communities, because communities are more than 0.5 mile from the transportation corridor.

The magnitude, duration, extent, and likelihood of impacts following reclamation would be similar to those described for the transportation corridor under Alternative 1a.



**Table 4.11-6: Estimated Night-Sky Effects from North and South Ferry Terminals**

Distance from Ferry Terminal <sup>1</sup>	North Ferry Terminal <sup>2</sup>	South Ferry Terminal	
	Total Acres Affected	Total Acres Affected	Affected Acres in Katmai National Park and Preserve
5 to 13 miles	292,285	295,133	10,021
1 to 5 miles	49,651	51,073	0
<1 mile	2,366	2,741	0

Notes:

<sup>1</sup> Data estimated from Falchi et al. 2016a, b. The ratio of natural brightness as a function of distance was assumed to be the same as data measured from the artificial light produced from Red Dog Port.

<sup>2</sup> The north ferry terminal would have no night-sky impacts to the Katmai National Park and Preserve.

Source: Falchi et al. 2016a, b

#### 4.11.5.2 Natural Gas Pipeline Corridor

The magnitude, duration, extent, and likelihood of impacts under Alternative 1 would be the same as those described above for the transportation corridor, because these components would be co-located. The magnitude, duration, extent, and likelihood of impacts expected to result from the compressor station on the Kenai Peninsula would be the same as Alternative 1a.

Impacts following reclamation would be similar to those described for the natural gas pipeline under Alternative 1a.

The natural gas pipeline corridor is not expected to have any impacts on the night sky.

#### 4.11.5.3 All Components

The magnitude, duration, extent, and likelihood of visual impacts would be similar to those described for Alternative 1a for the mine site, port access road, south ferry terminal, and Amakdedori port. The magnitude, duration, extent, and likelihood of visual impacts from the mine access road would be similar to those described for the port access road. The proximity of the port and mine access roads to popular recreation destinations could result in viewer exposure to those features. For example, the transportation corridor, pipeline corridor, and Amakdedori port would be visually evident for air-based viewers flying to recreation destinations such as the Lake Clark National Park and Preserve, McNeil River State Game Refuge, Katmai National Park and Preserve, and area sport fishing lodges. The magnitude of visual impacts would be expected to be of moderate to strong visual contrast, and would decrease with distance from the facilities.

The magnitude, duration, extent, and likelihood of impacts following reclamation would be similar to those described for all components under Alternative 1a.

#### 4.11.5.4 Alternative 1—Kokhanok East Ferry Terminal Variant

The magnitude, duration, and extent of potential impacts to visual resources and soundscapes would be similar to those described for the south ferry terminal; however, the perception of impacts would be greater due to the close proximity of the ferry traffic to residential viewers and noise-receptors in Kokhanok. Kokhanok and commercial lodges in the vicinity would be approximately 5 miles from the Kokhanok east ferry terminal; therefore, visibility of stars and other astronomical observations from these areas would be affected. All these impacts would be long-term, occurring through the life of the project, and would be certain to occur under this variant.

Impacts following reclamation would be similar to those described above for ferry terminals, because similar reduction of visual contrast and scale dominance would occur. Likewise, similar reduction in impacts to night-lighting and soundscape would be expected.

#### **4.11.5.5 Alternative 1—Summer-Only Ferry Operations Variant**

Under the Summer-Only Ferry Operations Variant, in terms of magnitude and extent, visual and soundscape impacts from ferry operations would not occur during the winter, but would be more intense during the summer, with twice the number of ferry trips. Impacts to night sky would be substantially less than other alternatives due to the use of less lighting and less visibility from lighting from extended daylight hours. The duration of impacts, although seasonal, would be long-term, lasting for the life of the project, and they would be certain to occur under this variant.

Under the Summer-Only Ferry Operations Variant, the magnitude of impacts from the transportation corridor would be less in the winter due to the decrease in lighting-related impacts, the reduction of truck traffic, and the lack of ice breaks from the ferry operations. This would be offset to some degree by the doubling of truck traffic during the summer, with accompanying visual and noise impacts. The reduction in impacts would be primarily experienced under the Kokhanok East Ferry Variant, because residents of this community would experience the greatest visual and soundscape-related impacts during winter months, when the transportation corridor was operational; due to proximity of these receptors to the port; and due to increased number of trips.

Impacts following reclamation would be similar to those described above for ferry terminals, because similar reduction of visual contrast and scale dominance would occur. Likewise, similar reduction in impacts to night-lighting and soundscape would be expected.

#### **4.11.5.6 Alternative 1—Pile-Supported Dock Variant**

In terms of magnitude, duration, extent, and likelihood, the Pile-Supported Dock Variant would result in similar impacts to those described above for visual impact, night sky, and soundscape for the Amakdedori port.

Also, impacts following reclamation would be similar to those described above for ferry terminals, because similar reduction of visual contrast and scale dominance would occur. Likewise, similar reduction in impacts to night-lighting and soundscape would be expected.

#### **4.11.6 Alternative 2—North Road and Ferry with Downstream Dams**

The magnitude, duration, extent, and likelihood of impacts to aesthetic resources (visual, including night sky, and soundscape) at the mine site under Alternative 2—North Road and Ferry with Downstream Dam would be the same as or similar to those described for Alternative 1a under construction, operations, and reclamation.

##### **4.11.6.1 Transportation Corridor**

###### **Visual Impacts**

The transportation corridor under Alternative 2 would result in variable levels of visual contrast and scale dominance, as described under Alternative 1a. The magnitude and extent of impacts from the mine access road would be the same as discussed under Alternative 1a.

Between Pile Bay and Diamond Point port, the magnitude and extent of impacts of operation of the port access road would be weak visual contrast, particularly in areas where the new access road would lie in the same location as the existing roads.

As described for the north and south ferry terminals, in terms of magnitude and extent, the ferry terminals at Eagle Bay and Pile Bay would result in moderate to strong visual contrast when viewed in close proximity (3 to 5 miles) from Iliamna Lake or higher-elevation locations. From this distance zone, the ferry terminals would appear distinct against the shoreline, because the form and line of the structures would contrast with the natural character of the surrounding landscape.

The communities of Newhalen and Iliamna are the only residential areas within approximately 10 miles of the ferry terminals. From these locations, the magnitude and extent of visual contrast would be weak, and the facilities would not be visually evident under daylight conditions. Noise from ferry icebreaking activities could be apparent to these communities.

Other villages on Iliamna Lake would be greater than 15 miles from the ferry terminals and route. Given the size and low stature of the ferries, the magnitude and extent of visual contrast would be weak, and ferries would appear visually subordinate. There is one small research camp on the peninsula of Pedro Bay. From this location, passing ferry traffic would be considered visually evident.

As described in Alternative 1a, the magnitude and extent of season-specific impacts to aesthetic resources during winter months primarily pertain to those that would result from lighting, and the visual contrast created from ice break on the lake where the ferry crosses. The extent of visual impacts would be primarily experienced by residents of Iliamna, Newhalen, and Pedro Bay due to the proximity of these communities to the ferry terminals and crossing route. Individuals engaged in winter subsistence activity would also experience impacts from vehicle lighting on access roads and facility lighting at the ferry terminals.

The duration of viewer exposure to visual impacts would be intermittent to prolonged at any given time depending on the activity of the viewer, but would be long-term, extending beyond the life of the project. Visual impacts would not impact viewers in areas identified by special designations (see the project viewshed models in Appendix K4.11). The likelihood of impacts would be certain under Alternative 2.

### **Night Sky**

The magnitude, duration, and geographical extent of impacts to the night sky from the Eagle Bay ferry terminal would be the same as described in Alternative 1a, and the Pile Bay ferry terminal would be similar. There would be no impacts to night sky from the land-based transportation corridor. Reflection off of Iliamna Lake would occur, but it would only be visible to a small number of viewers.

Areas 5 to 13 miles from Eagle Bay or Pile Bay ferry terminals, in terms of magnitude and extent, could begin to experience effects to skyglow from artificial lighting that would begin to put the integrity of the existing pristine night sky at risk. Less than 1 percent of the Lake Clark National Park and Preserve would be affected by the Eagle Bay and Pile Bay ferry terminals (Table 4.11-7). Pedro Bay and commercial lodges in the vicinity would also experience these impacts.

The magnitude and extent of impacts to areas 1 to 5 miles from Eagle Bay or Pile Bay ferry terminals would be the beginning of reduced visibility of stars and other astronomical observations, and the Bortle Class night-sky quality could become degraded. No communities, national parks, state game refuges, or national wildlife refuges would experience this level of impacts. Therefore, the number of individuals experiencing these effects would be low.

**Table 4.11-7: Estimated Night-Sky Effects from Eagle Bay and Pile Bay Ferry Terminals**

Distance from Ferry Terminal <sup>1</sup>	Eagle Bay Ferry Terminal		Pile Bay Ferry Terminal	
	Total Acres Affected	Acres in Lake Clark National Park and Preserve Affected	Total Acres Affected	Affected Acres in Lake Clark National Park and Preserve
5 to 13 miles	293,680	30,911	293,682	6,425
1 to 5 miles	50,355	0	50,345	0
<1 mile	2,546	0	2,545	0

Notes:

<sup>1</sup> Data estimated from Falchi et al. 2016a, b. The ratio of natural brightness as a function of distance was assumed to be the same as data measured from the artificial light produced from Red Dog Port.

Source: Falchi et al. 2016a, b

Also in terms of magnitude and extent, effects to the night sky would become apparent to casual observers, because visibility of the night sky would be reduced in areas less than 1 mile from Eagle Bay or Pile Bay ferry terminals. The night-sky quality would be degraded at distances 1 mile or less from the ferry terminals. No areas in national parks and preserves, state game refuges, or national wildlife refuges or communities would experience impacts of this magnitude; therefore, the number of individuals experiencing these effects would be low. These impacts on the night sky would be long-term, lasting through the life of the project. Their likelihood of occurrence would be certain under Alternative 2.

### **Soundscape**

The magnitude, duration, extent, and likelihood of impacts to soundscape would be similar to those described for Alternative 1a; however, noise-related impacts would not be expected to affect local communities, because communities are more than 0.5 mile from the transportation corridor.

**Reclamation:** The magnitude, duration, extent, and likelihood of impacts following reclamation would be similar to those described for the transportation corridor under Alternative 1a.

#### **4.11.6.2 Diamond Point Port**

### **Visual Impacts**

The magnitude of impacts from the Diamond Point port would be less than that described for the Amakdedori port under Alternative 1a because of the level of existing development. Visual contrast would appear strong when viewed from the foreground distance zone due to the larger stature of this facility; the vertical lines and geometric shape of the facility would contrast against the natural backdrop of Iliamna Bay. The geographic extent of impacts would be more limited than Amakdedori port due to the steep landforms and enclosure of views created by topography surrounding the bay (see Appendix K4.11 for project viewshed models). For viewers situated in the bay, the port would appear dominant and focal due to the enclosure of the landscape in the bay.

Increased project-related boat traffic in Cook Inlet would be visually evident from the foreground, middleground, and background distance zones. The port would be visible from the Alaska Maritime National Wildlife Refuge, and vessel traffic would be evident and could dominate the viewers' experience. The duration of impacts would be long-term, extending beyond the life of the project if the port remains in operation. Visual impacts could impact viewers in areas identified by

special designations, including the Alaska Maritime National Wildlife Refuge. In terms of likelihood, the impacts would be expected to occur under Alternative 2.

### **Night Sky**

The magnitude, duration, and extent of impacts to the night sky from the Diamond Point port would be similar those described for Amakdedori port. There would be no impacts to night sky from the land-based transportation corridor.

In terms of magnitude and extent, areas 5 to 13 miles from Diamond Point port could begin to experience effects to skyglow from artificial lighting that would begin to put the integrity of the existing pristine night sky at risk.

The Lake Clark and Katmai National Parks and Preserves, and McNeil River State Game Refuge and all identified communities and commercial lodges are further than 13 miles from Diamond Point port; less than one-tenth of 1 percent of the Alaska Maritime National Wildlife Refuge falls within that distance.

These impacts on the night sky from the Diamond Point port would be long-term, lasting through the life of the project (Table 4.11-8). Their likelihood of occurrence would be certain under Alternative 2.

**Table 4.11-8: Estimated Night-Sky Effects from Diamond Point Port for Alternative 2**

<b>Distance from Port<sup>1</sup></b>	<b>Total Acres Affected</b>	<b>Affected Acres in Alaska Maritime National Wildlife Refuge</b>
5 to 13 miles	303,601	92
1 to 5 miles	55,322	14
<1 mile	3,874	1

Notes:

<sup>1</sup> Data estimated from Falchi et al. 2016a, b. The ratio of natural brightness as a function of distance was assumed to be the same as data measured from the artificial light produced from Red Dog Port.

Source: Falchi et al. 2016a, b

### **Soundscape**

The magnitude, duration, extent, and likelihood of impacts to the soundscape would be similar to those described for Amakdedori port (see Section 4.19, Noise, for more information). Noise-related impacts would be largely contained in Iliamna Bay due to the steep topography of the surrounding landforms.

### **Reclamation**

The magnitude, duration, extent, and likelihood of impacts following reclamation would be similar to those described for the Amakdedori port under Alternative 1a.

#### **4.11.6.3 Natural Gas Pipeline Corridor**

### **Visual Impacts**

The magnitude of impacts from the pipeline would be greatest between the junction with the Eagle Bay ferry terminal access road and the Pile Bay ferry terminal access road because visual moderate-strong contrast of the cleared right-of-way would contrast the existing natural landscape. As described in the transportation corridor, visual contrast would be perceived by

viewers situated in close proximity to the pipeline, or in elevated viewer positions (e.g., Roadhouse Mountain). Visual contrast of the segment between Diamond Point port and Ursus Cove would be weak-moderate because of the rugged topography of the Chigmit Mountains. Individuals traveling between Dutton and Meadow Lake would be exposed to visual contrast where the pipeline crossed the access trail. Air-based viewers would perceive moderate contrast of this feature when viewed from low-elevation aircraft. Where aligned with the exiting Williamsport-Pile Bay Road, the pipeline would result in weak to moderate visual contrast resulting primarily from roadway upgrades.

### **Night Sky**

The natural gas pipeline corridor is not expected to have any impacts on the night sky.

### **Soundscape**

As described for Alternative 1a, pipeline construction activities would create noise in conjunction with road construction, the duration of which would be limited to 2 years. No noise-producing sources would be situated along the pipeline corridor during pipeline operation. Gas traveling through the buried pipeline would not emit audible noise, and the compressor station on the Kenai Peninsula would not be expected to impact sensitive receptors; therefore, no noise impacts associated with pipeline operations would occur under Alternative 2.

#### **4.11.6.4 All Components**

The magnitude, duration, extent, and likelihood of visual impacts from all components would be similar to those described for Alternative 1a; however, the proximity of the port and mine access roads to popular recreation destinations could result in increased viewer exposure to those features. For example, the transportation corridor, pipeline corridor (including between Diamond Point port and Ursus Cove), and Diamond Point port would be visually evident for air-based viewers flying to recreation destinations such as the Lake Clark National Park and Preserve, McNeil River State Game Refuge, Katmai National Park and Preserve, and area sport fishing lodges, although not as visually evident as the Amakdedori port under Alternative 1a. The magnitude of visual impacts would be expected to be of moderate to strong visual contrast, and would decrease with distance from the facilities.

Frequency and impacts of flights to and from Iliamna would be the same as Alternative 1a. Construction cargo and passenger flight frequencies to the airstrip in Pile Bay would be similar to flight frequencies to Kokhanok under Alternative 1a. Impacts to Pedro Bay and Pile Bay would be similar to those discussed for Kokhanok in Alternative 1a, including the use of the airport at Pedro Bay during construction. Potential effects on Kokhanok would be limited to resident crew change flights. PLP would not construct a new airstrip at Diamond Point, but would improve the existing airstrip near Pile Bay for limited use during construction. In terms of likelihood, these impacts would be expected to occur under Alternative 2.

### **Reclamation**

The magnitude, duration, extent, and likelihood of impacts following reclamation would be similar to those described for all components under Alternative 1a.

#### **4.11.6.5 Alternative 2—Summer-Only Ferry Operations Variant**

Under the Summer-Only Ferry Operations Variant, visual and soundscape impacts from ferry operations would not occur during the winter, but would be more intense during the summer with twice the number of ferry trips. The magnitude of impacts to night sky would be substantially less

than other alternatives due to the extended daylight hours. The duration of impacts would be long-term.

The magnitude, duration, extent, and likelihood of impacts following reclamation would be similar to those described for Summer-Only Ferry Operations Variant under Alternative 1.

#### **4.11.6.6 Alternative 2—Pile-Supported Dock Variant**

The Pile-Supported Dock Variant would result in similar impacts in terms of magnitude, duration, extent, and likelihood to those described above for visual resources, soundscape, and night sky.

Impacts following reclamation would be similar to those described for the Pile-Supported Dock Variant under Alternative 1.

#### **4.11.6.7 Alternative 2—Newhalen River North Crossing**

The Newhalen River North Crossing Variant would result in similar impacts in terms of magnitude, duration, extent, and likelihood to those described above for visual resources, soundscape, and night sky. The river crossing would be just as visible, and perhaps more visible, from Roadhouse Mountain as Alternative 2.

#### **4.11.7 Alternative 3—North Road Only**

The magnitude, duration, extent, and likelihood of impacts to aesthetic resources (visual, including night sky and soundscape) at the mine site under Alternative 3—North Road Only would be the same as or similar to those described for Alternative 1a under construction, operations, and reclamation.

##### **4.11.7.1 Transportation Corridor**

The magnitude, duration, extent, and likelihood of impacts from the transportation corridor under Alternative 3 would be similar to Alternative 2 in portions of the network that are the same under both alternatives (mine site to junction leading to Eagle Bay ferry terminal; Pile Bay to Diamond Point port). However, because the access road would extend along the northern shore of Iliamna Lake, impacts would be of greater magnitude and larger geographic extent (see Appendix K4.11 for project viewshed models). Visual contrast would be strong, and the road would appear dominant when viewed from the foreground-middleground of the community of Pedro Bay; from areas within 3 miles of the shoreline of Iliamna Lake; and from high points in Lake Clark National Park and Preserve. The magnitude, duration, extent, and likelihood of impacts to night sky would be the same as those under Alternative 2.

Given the proximity of the access road to Pedro Bay, noise from construction activities and operational truck traffic could be heard in the community up to 3,000 feet from the activity.

#### **Reclamation**

Impacts following reclamation would be similar to those described for the transportation corridor under Alternative 1a.

##### **4.11.7.2 Diamond Point Port**

The duration, extent, and likelihood of impacts under Alternative 3 would be similar those described for Alternative 2. The magnitude of visual impacts would be higher than Alternative 2 because the development at the port site would be in addition to the development of the quarry at Diamond Point. There would be no impacts to night sky from the land-based transportation

corridor. Impacts following reclamation would be similar to those described for Amakdedori port under Alternative 1a.

In terms of magnitude and extent, areas 5 to 13 miles from Diamond Point port could begin to experience effects to skyglow from artificial lighting that would begin to put the integrity of the existing pristine night sky at risk.

The Lake Clark and Katmai National Parks and Preserves, and McNeil River State Game Refuge and all identified communities and commercial lodges are further than 13 miles from Diamond Point port; less than one-tenth of 1 percent of the Alaska Maritime National Wildlife Refuge falls within that distance.

These impacts on the night sky from the Diamond Point port would be long-term, lasting through the life of the project (Table 4.11-9). Their likelihood of occurrence would be certain under Alternative 3.

**Table 4.11-9: Estimated Night-Sky Effects from Diamond Point Port for Alternative 3**

Distance from Port <sup>1</sup>	Total Acres Affected	Affected Acres in Alaska Maritime National Wildlife Refuge
5 to 13 miles	309,829	91
1 to 5 miles	58,572	14
<1 mile	4,647	2

Notes:

<sup>1</sup> Data estimated from Falchi et al. 2016a, b. The ratio of natural brightness as a function of distance was assumed to be the same as data measured from the artificial light produced from Red Dog Port.

Source: Falchi et al. 2016a, b

#### 4.11.7.3 Natural Gas Pipeline Corridor

The magnitude, duration, extent, and likelihood of impacts under Alternative 3 would be the same as those described above for the transportation corridor, because these components would be co-located. The magnitude, duration, extent, and likelihood of impacts expected to result from the portion of the pipeline between Diamond Point port and Ursus Cove would be the same as those described under Alternative 2.

Impacts following reclamation would be similar to those described for the natural gas pipeline under Alternative 1a.

#### 4.11.7.4 All Components

The magnitude, duration, extent, and likelihood of visual impacts from all components would be similar to those described for Alternative 2; however, the magnitude of visual impacts would be greater due to operation of the north access road. The road would be visually evident, appearing as a curvilinear line with contrasting color and texture against the surrounding landscape.

Frequency of flights, and associated magnitude of effects, to and from Iliamna would be the same as for Alternative 1a. Flight frequencies to Pedro Bay, and associated magnitude of effects, would be similar to Alternative 2; but the connecting of Pedro Bay by road to the Cook Inlet would affect frequency of flights after construction, if the road leads to more traffic through Pedro Bay. Potential effects on Kokhanok would be limited to resident crew change flights. These impacts would last for the life of the project, and would be expected to occur under Alternative 3.



Impacts following reclamation would be similar to those described for all components under Alternative 1a.

#### **4.11.7.5 Alternative 3—Concentrate Pipeline Variant**

The Concentrate Pipeline Variant would result in impacts similar in magnitude, duration, extent, and likelihood to those described above for visual impacts, soundscape, night sky, and reclamation.

#### **4.11.8 Cumulative Effects**

As described above for the analysis of direct and indirect effects, impacts to aesthetics would include those that could result from changes in the visual landscape (including night sky), soundscape, or olfactory attributes. For this analysis, visual impacts are defined as changes to the scenic attributes of the landscape resulting from the introduction of visual contrasts (e.g., development), and the associated changes in the human visual experience of the landscape (NPS 2014b). Impacts to soundscape are defined by changes in dBA levels that alter soundscape from a “wilderness ambient” character (see Section 3.19, Noise). Potential impacts to traditional and cultural use of areas are discussed in Section 4.7, Cultural Resources.

The cumulative effects analysis area for aesthetics encompasses Iliamna Lake and the surrounding communities and west to Cook Inlet. For night-sky impacts, the cumulative effects analysis area would be 140 miles from the mine site and 50 miles from the ferry terminals and ports.

A number of the actions identified in Section 4.1, Introduction to Environmental Consequences, are considered to have no potential of contributing to cumulative effects on aesthetic and visual resources because they are outside the EIS analysis area, or are the type of activities that do not create a permanent change in visual or aesthetics effects, or there is no indication that development would occur during the operations timeframe of the project.

Potential cumulative impacts to aesthetics and soundscape include visual impacts from the air, ground, and water transport and activities. Visual impacts at nighttime would be different than during the day, because development often includes lighting features.

##### **4.11.8.1 Past and Present Actions**

Currently, there is little development outside of communities in the EIS analysis area. Other activities in the region that impact aesthetics include subsistence, recreation, and mining exploration activities. Mining exploration activities have been supported by aircraft, which generate temporary but regular noise that has been noticeable to local residents, as documented in scoping comments. Temporary mining exploration camps in support of drilling programs have also generated visual and noise impacts in their immediate area. Support of commercial recreation by guides, lodges, and air taxis has generated aircraft and small boat noise in the vicinity of their activities. Transport of fishing vessels and cargo over the Williamsport-Pile Bay Road has historically generated summer truck traffic and increased vessel traffic on Iliamna Lake during the summer, which is noticeable to local residents and non-resident recreational users. These would be expected to continue to contribute to the cumulative impacts of aesthetics, although impacts are low in intensity and generally seasonal in duration. The Iliamna Airport has introduced skyglow to the night sky, extending approximately 6 miles from the airport.

#### **4.11.8.2 Reasonably Foreseeable Future Actions**

Reasonably foreseeable future actions (RFFAs) in the cumulative impact analysis area identified in Section 4.1, Introduction to Environmental Consequences, have the potential to contribute cumulatively to impacts on aesthetics that are carried forward in this analysis. These include contiguous mining claims located roughly between Iliamna Lake and the Chuitna River, as well as more geographically isolated claims in the watershed, oil, and gas development in Cook Inlet, and smaller-scale onshore oil and gas, as summarized below.

The No Action Alternative would not contribute to cumulative effects on Aesthetics.

Collectively, the project alternatives with RFFAs' contribution to cumulative effects on aesthetics are summarized in Table 4.11-10.

**Table 4.11-10: Contribution to Cumulative Effects on Aesthetics**

Reasonably Foreseeable Future Actions	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
<p>Pebble Project Expansion Scenario</p>	<p><b>Mine Site:</b> The mine site footprint would have a larger open pit and new facilities to manage water and store tailings and waste rock, and would contribute to the cumulative impacts of aesthetics in the region. Expansion of the open pit and tailings/waste rock storage facilities would increase the visual and noise impacts that could be experienced by local subsistence hunters in the area, and by recreational users that are dropped off and float the upper reaches of the Kuktuli and Stuyahok rivers.</p> <p><b>Other Facilities:</b> A north access road and concentrate and diesel pipelines would be constructed along the Alternative 3 road alignment and extended to a new deepwater port site at Iniskin Bay. The transportation corridors between the mine site/Amakdedori port and the mine access road would operate concurrently, affecting those communities in the vicinity of both routes, although truck traffic to Amakdedori would decrease because concentrate would be transported to the Iniskin deepwater port by pipeline. Concentrate and diesel pipelines from the mine site to the Iniskin port facility would be in the access road corridor, and would not noticeably increase the visual impact of that corridor. The prolonged use of the Amakdedori port facility and port access road would continue to contribute adverse effects to the cumulative impacts in the region, and the development of a port in Iniskin Bay would have additive effects that alter landscape character from naturally evolving to industrial across a large geographic extent during the day and at night. Such impacts could be experienced by recreationists in Cook Inlet and would be of moderate magnitude, and dominant when viewed from high elevations, flightpaths, and nearby vessels. Operations would be audibly apparent within a</p>	<p><b>Mine Site:</b> Identical to Alternative 1a.</p> <p><b>Other Facilities:</b> Similar to Alternative 1a, except that the portion of the access road from the north ferry terminal to the existing Iliamna area road system would need to be constructed. The north access road would be constructed from the mine site to the Pile Bay terminus of the Williamsport-Pile Bay Road. Concentrate and diesel pipelines would be constructed along the Alternative 3 road alignment and extended to a new deepwater port site at Iniskin Bay.</p> <p><b>Magnitude:</b> The magnitude of cumulative aesthetic and visual impacts would be similar to the magnitude of Alternative 1a, although affecting a larger geographic area.</p> <p><b>Duration/Extent:</b> The duration and extent of cumulative aesthetic and visual impacts would be similar to duration and extent of Alternative 1a.</p> <p><b>Contribution:</b> The contribution to cumulative</p>	<p><b>Mine Site:</b> Identical to Alternative 1a.</p> <p><b>Other Facilities:</b> Under Alternative 2, there would be a road constructed between the ferry terminals along the north access road corridor described under Alternative 3, adversely impacting aesthetics by introducing development and use in a natural area. Impacts from the Diamond Point port would also continue, and development in Iniskin Bay would impact aesthetics in the same ways as Alternative 1a. The addition of a service road would add to the adverse impacts for the region's aesthetics.</p> <p><b>Magnitude:</b> Overall expansion would affect fewer acres than Alternative 1a, given that a portion of the north access road and all of the gas pipeline would already be constructed. Aesthetic and visual impacts from mine expansion would be less than Alternative 1a in that one road/pipeline corridor would be constructed and operated rather than two.</p>	<p><b>Mine Site:</b> Identical to Alternative 1a.</p> <p><b>Other Facilities:</b> Under Alternative 3, project expansion would continue to use the existing Diamond Point port facility; would use the same natural gas pipeline; and would use the same north access road and the Concentrate Pipeline Variant infrastructure, but extend the concentrate pipeline to Iniskin Bay. The port site and associated facilities would be constructed at Iniskin Bay, as discussed under Alternative 1a. A diesel pipeline from the mine site to Iniskin Bay would be constructed, as discussed under cumulative effects for Alternative 1a.</p> <p><b>Magnitude:</b> Overall, expansion would affect fewer acres than Alternative 1a, given that the north road and gas pipeline would already be constructed. Aesthetic and visual impacts from mine expansion would be less than Alternative 1a, or Alternative 1 and Alternative 2.</p>

**Table 4.11-10: Contribution to Cumulative Effects on Aesthetics**

Reasonably Foreseeable Future Actions	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	<p>certain distance of facilities. There would be further impacts to the region from the pipeline ROW from the mine site to Iniskin Bay, and the development of a road to Diamond Point. Impacts to the night sky from the Iniskin Bay port would be similar to impacts from the Diamond Point port in magnitude and geographic extent.</p> <p><b>Magnitude:</b> The Pebble Project expansion scenario project footprint would impact approximately 31,892 acres under Alternative 1a. The magnitude of impacts would be greater due to the larger mine site footprint and construction and operation of two separate access roads. The direct and indirect analysis conservatively assumed skyglow effects similar to Red Dog Mine. The Pebble Project expansion scenario is not expected to exceed the magnitude and geographic extent of those effects.</p> <p><b>Duration/Extent:</b> The Pebble Project expansion scenario would extend the impacts to aesthetics for a longer duration (78 total years of mining, with another 20 years of processing), and over a larger geographic area based on the operation of two road corridors and port systems.</p> <p><b>Contribution:</b> There would be additive effects to the viewshed for visitors flying over the region, because the landscape as a whole is more visible from a higher elevation, and the mine site would be more noticeable as it expands. With increased production, the frequency of vessel traffic to the Iniskin port facility would also increase. Similarly, impacts to night sky would have a longer duration. The operation of two road corridors would expand visual and audible effects over a larger geographic area, although truck traffic associated with shipping concentrate would cease along the south access road after 20 years of initial operations.</p>	<p>effects would be slightly less than Alternative 1, but more than Alternative 2 and Alternative 3.</p>	<p><b>Duration/Extent:</b> The duration and extent of cumulative aesthetic and visual effects would be similar to duration and extent of Alternative 1a.</p> <p><b>Contribution:</b> Cumulative effects of construction disturbance would be similar to those discussed under Alternative 1a. Overall, cumulative impacts to aesthetics from Alternative 2, combined with the Pebble Project expansion scenario, would be of lesser magnitude and geographic extent than Alternative 1a, because the south access road system/ferry would not be in place.</p>	<p><b>Duration/Extent:</b> The duration and extent of cumulative aesthetic and visual effects would be similar to the duration and extent of Alternative 1a.</p> <p><b>Contribution:</b> Because the Pebble Project expansion scenario would use the north access road system that would already be built under Alternative 3 and not include any ferry operation, cumulative impacts to aesthetics from Alternative 3, combined with the Pebble Project expansion scenario, would be less than Alternative 1a or Alternative 1 and Alternative 2.</p>

**Table 4.11-10: Contribution to Cumulative Effects on Aesthetics**

Reasonably Foreseeable Future Actions	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
Other Mineral Exploration Projects	<p><b>Magnitude:</b> Reasonably foreseeable locatable mineral exploration in the project area of Iliamna Lake and the Chuitna River, and east to Lake Clark, could contribute cumulatively to visual and audible impacts across a large geographic extent. These would be associated with helicopter support traffic and temporary camp facilities. Such impacts could be experienced by communities close to mineral deposits, and recreationists in Lake Clark National Park and Preserve and surrounding areas.</p> <p><b>Duration/Extent:</b> Exploration activities typically occur at a discrete location for one season, although a multi-year program could expand the geographic area affected in a specific mineral prospect. Table 4.1-1 in Section 4.1, Introduction to Environmental Consequences, identifies seven mineral prospects in the EIS analysis area where exploratory drilling is anticipated (four are in relatively close proximity to the Pebble Project).</p> <p><b>Contribution:</b> There would be additive effects to the viewshed for visitors flying over the region, because the activity would be more visible from a higher elevation. There would be increased impacts to recreationists and subsistence users in the area. Impacts to night sky would be of low magnitude, because activity for most mineral exploration projects would occur during summer months, and work is anticipated to be sporadic and of low intensity. Noise from helicopter support traffic would be audible along the flight path, in the vicinity of mining exploration activities, and near airports used for support, including at Iliamna.</p>	Similar to Alternative 1a.	Similar to Alternative 1a.	Similar to Alternative 1a.
Oil and Gas Exploration and Development	<p><b>Magnitude:</b> Oil and gas development in Cook Inlet would contribute cumulatively to impacts in Cook Inlet, with the magnitude dependent on the level of on- and offshore oil and gas development. Marine</p>	Similar to Alternative 1a.	Similar to Alternative 1a.	Similar to Alternative 1a.

**Table 4.11-10: Contribution to Cumulative Effects on Aesthetics**

Reasonably Foreseeable Future Actions	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	<p>support vessel and helicopter traffic may be visible and audible to marine and coastal recreational users. Lighting required would create reflection and glare on the surface of Cook Inlet, which—in combination with impacts from the Amakdedori port—would increase nighttime glare in the inlet. Night-lighting from the alternative oil and gas exploration and development could also increase overall skyglow in the vicinity. Construction of the Alaska LNG or the ASAP projects would increase ship traffic in the vicinity of Cook Inlet during the period of construction. Operation of the Alaska LNG project would generate monthly Alaska LNG carrier traffic for the duration of operations.</p> <p><b>Duration/Extent:</b> Seismic exploration and exploratory drilling are typically single-season temporary activities that have an increase in vessel traffic. Visual and audible effects associated with ship traffic from either Alaska LNG or ASAP would occur for the life of operations of those projects.</p> <p><b>Contribution:</b> Helicopter traffic associated with offshore development, combined with concentrate shipment from project development, and increased ship traffic would be noticeable to local residents and visitors using coastal areas along Cook Inlet in the vicinity of the project.</p>			
Road Improvement and Community Development Projects	<p><b>Magnitude:</b> Road improvements projects would take place in the vicinity of communities, and have visual and aesthetics impacts through grading, filling, and potential increased erosion. Communities in the immediate vicinity of project facilities, such as Iliamna, Newhalen, and Kokhanok, would have the greatest contribution to cumulative effects. Some limited road upgrades could also occur in the vicinity of the natural gas pipeline starting point near Stariski</p>	Similar to Alternative 1a.	Similar to Alternative 1a.	Similar to Alternative 1a.

**Table 4.11-10: Contribution to Cumulative Effects on Aesthetics**

Reasonably Foreseeable Future Actions	Alternative 1a	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	<p>Creek, or in support of mineral exploration previously discussed.</p> <p><b>Duration/Extent:</b> The project would contribute to cumulative impacts, and there would be no difference across alternatives. Impacts to night sky would be minimal, because the majority of projects would be upgrades or improvements, and increase in night-lighting would be minimal. Night-lighting associated with new road corridors is also anticipated to be minimal.</p> <p><b>Contribution:</b> Transportation and infrastructure development in communities would contribute to cumulative impacts to a minor extent; however, when combined with other RFFAs, these actions would contribute to overall change in character in the region from one that is more remote and undeveloped to one that is more developed.</p>			
Summary of Project contribution to Cumulative Effects	<p>Overall, the contribution of Alternative 1a to cumulative aesthetic and visual effects, when taking other past, present, and RFFAs into account, would be minimal. There would be additive effects to the viewshed for visitors flying over the region, because the landscape as a whole is more visible from a higher elevation, and the mine site would be more noticeable as it expands. Similarly, impacts to night sky would have a longer duration. The analysis conservatively assumed skyglow effects similar to Red Dog Mine. The Pebble Project expansion scenario may exceed the magnitude and geographic extent of those effects.</p>	Similar to Alternative 1a.	Similar to Alternative 1a, but of lesser magnitude and geographic extent than Alternative 1a, because the ferry infrastructure would not have been constructed.	Similar to Alternative 2, but would be of lesser magnitude and geographic extent, because ferry infrastructure would not have been constructed.

Notes:  
 ASAP = Alaska Stand Alone Pipeline  
 EIS = Environmental Impact Statement  
 LNG = liquefied natural gas  
 RFFA = reasonably foreseeable future action  
 ROW = right-of-way