CHAPTER 3: ENVIRONMENTAL ANALYSIS

3.0 APPROACH AND METHODOLOGY

This chapter combines the description of baseline environmental conditions (Affected Environment) and the analysis of environmental effects (Environmental Consequences) for each resource. Though these two aspects are often in separate chapters in an EIS, they are combined here to facilitate continuity for the reader from baseline conditions to potential effects to each resource. Following the description of baseline conditions, the Environmental Consequences Section under each resource provides the scientific and analytic basis for evaluation of the potential effects of each of the alternatives described in Chapter 2 on the physical, biological, and social environments. Direct and indirect effects to each resource are analyzed in this chapter. Cumulative effects and the potential contribution of the alternatives to the effects of the past, present, and reasonably foreseeable future actions are analyzed in Chapter 4, Cumulative Effects. These terms are defined and steps are described in more detail below.

3.0.1 DEFINITION OF IMPACT TYPES

The following terms are used throughout this document to discuss effects:

- Direct Effects – caused by the action and occur at the same time and place (40 Code of Federal Regulations [CFR] 1508.8). The EIS Analysis Area and areas of potential effects are further described below.
- Indirect Effects – defined as effects which are "caused by an action and are later in time or farther removed in distance but are still reasonably likely. Indirect impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (40 CFR 1508.8). Indirect effects are caused by the project, but do not occur at the same time or place as the direct effects.
- Cumulative Effects – additive or interactive effects that would result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7). Direct effects are limited to the proposed action and alternatives only, while cumulative effects pertain to the additive or interactive effects that would result from the incremental impact of the proposed action and alternatives when added to other past, present, and reasonably foreseeable future actions. Interactive effects may be either greater or less than the sum of the individual effects; thus, the action's contribution to the cumulative case could increase or decrease the net effects.
- Reasonably Foreseeable Future Actions – this term is used in concert with the Council on Environmental Quality (CEQ) definitions of indirect and cumulative effects, but the term itself is not further defined. Most regulations that refer to "reasonably foreseeable," do not define the meaning of the words, but do provide guidance on the term. For this analysis, reasonably foreseeable future actions (RFFAs) are those that are external to the proposed action, and likely (or reasonably certain) to occur, although they may be

uncertain. Typically, they are based on documents such as existing plans, permit applications, and fiscal appropriations. RFFAs considered in the cumulative effects analysis consist of projects, actions, or developments that can be projected, with a reasonable degree of confidence, and for this analysis would occur over the next 10-30 years. For a listing of RFFAs see Table 4.2-1 in Chapter 4, Cumulative Effects.

3.0.2 EIS ANALYSIS AREA AND SCOPE OF ANALYSIS

The EIS Analysis Area is described in relation to the action alternatives identified in Chapter 2. The action alternatives each consist of a mine site (Mine Site), transportation facilities (Transportation Corridor), and pipeline (Pipeline) components. While the EIS Analysis Area can be delineated based on the physical footprint of the action alternatives, potential resource impacts are considered in a spatial context appropriate to each resource. For example the analysis of impacts to soils may be limited to disturbance within the physical footprint of the project component. The impacts to wetlands, however, would be considered in relation to wetland functions and values in watersheds. For migratory fish, waterfowl, and other wildlife, the analysis must consider the effects in relation to stocks and populations throughout their migratory range.

3.0.2.1 INTERRELATED NATURE OF ENVIRONMENTAL RESOURCES

For organizational purposes, Chapter 3 is divided into sections by subject area (e.g., groundwater hydrology, wildlife, human health). Though they are described and analyzed in discrete sections, these subjects are dynamic and interrelated. A change in one resource can have cascading or synergistic impacts to other resources. For example, water quality affects fish populations, which in turn influence subsistence harvests, which can have implications for other human outcomes such as health and socioeconomics. As a result, there is some overlap among the resource sections in Chapter 3 and the impacts described in one section may depend on the analysis from another section. During the writing process, subject-level authors collaborated by sharing data and discussing interrelated aspects of the analyses to better capture the interrelated nature of environmental resources.

There are also interdisciplinary topics that span several sections in Chapter 3. During scoping, barge traffic emerged as a key issue based on a variety of concerns including riverbank erosion, increased vessel traffic, and impacts to subsistence. As a result, barging is addressed in Sections 3.1, Geology; 3.5, Surface Water Hydrology; 3.11, Wetlands; 3.13, Fish and Aquatic Resources; 3.21, Subsistence; 3.23, Transportation; 3.24, Spill Risk; and 3.26, Climate Change. Similarly, the Iditarod National Historic Trail is covered in Sections 3.15, Land Ownership, Management, and Use; 3.16, Recreation; 3.17, Visual Resources; and 3.20, Cultural Resources.

3.0.2.2 ISSUES SELECTED FOR ANALYSIS

In compliance with NEPA scoping requirements and to focus the EIS, the Corps and cooperating agencies selected substantive impact topics for further analysis and eliminated others from evaluation. Based on scoping comments, issues were selected for analysis and are organized below by their relationship to the physical, biological, and social environments. These issues are briefly described in this section and documented as Statements of Concern (SOCs) in the Scoping Report (Appendix B).

3.0.2.2.1 PHYSICAL ENVIRONMENT

Air Quality: The mine, transportation facilities, and pipeline have the potential to generate human-caused air quality impacts (fugitive dust/particulates and suspended heavy metals from mining, blasting, vehicles, power generation, incineration) in the Project Area.

Emissions and Greenhouse Gas: The project could contribute to greenhouse gas emissions through both the removal of carbon sinks (such as permafrost and vegetation) and the addition of carbon source emissions from vehicles, power generation, and incineration.

Floodplains: The project and alternatives could construct facilities in floodplains, which could increase the risk of hazardous spills, sedimentation, and impacts to water quality. Potential for changes in river geomorphology, and impacts on fish, wildlife, habitat, and subsistence activities are analyzed under physical, biological and social environments in the EIS. (See Section 1.10.27, Executive Order 11988, Floodplain Management.)

Geology: Construction activities could alter soils, permafrost, topography, landforms, and affect paleontological resources. Surface disturbance could result in greater erosion and sedimentation at the Mine Site and rivers. Geological hazards, particularly seismic events, could affect vulnerable components including the tailings storage facility, buried pipeline, and fuel storage tanks. Surface and subsurface geological conditions, including avalanche hazards and permafrost, could affect project construction unless properly mitigated. Slope stability hazards along the pipeline route need to be identified and assessed.

Groundwater: Potential impacts to groundwater systems and aquifers including mercury contamination from Construction and Operations of all project sources will be evaluated. The potential for mine operations to reduce the water table and to reduce flow in Crooked Creek will be assessed.

Hazardous Materials and Waste Management: This issue area is particularly broad and included 29 separate statements of concern. Analyses were requested for potential effects from mercury and cyanide handling and detoxification; mobility, toxicity, and management of naturally occurring arsenic; and risk of and response to chemical and fuel spills and accidents.

Hydrology (Surface Water): The project could affect streams and local water bodies, and disrupt local water patterns. Analysis of precipitation regimes and storm events are critical to evaluating the design and risks of impacts from water holding facilities, including the tailings storage pond. Barge traffic could affect riverine systems, including through wave-induced erosion to shore banks. The project will need a source of water for construction and operations activities. The analysis of the mine site will include an assessment of surface water inputs, outputs, and net changes (water budget) over the longer term.

Water Quality: The project could affect water quality from construction, operations, reclamation, and long-term tailings and rock storage. Acid rock drainage, metal leaching, erosion, turbidity, temperature changes, and fuel and chemical spills are among the potential risks to be addressed in this EIS.

3.0.2.2.2 BIOLOGICAL ENVIRONMENT

Migratory Birds and Their Habitat: The project could have potential impacts to migratory birds, waterfowl, and shorebird population abundance, diversity, and migratory patterns. There is potential for displacement, contamination, and mortality from project components or spills;

strikes from above-ground infrastructure; removal of nests; and attraction of scavengers; these issues will be considered in light of the requirements of the Migratory Bird Treaty Act (Section 1.10.17).

Bald and Golden Eagles and Their Habitat: The project could have potential impacts to bald and golden eagles and their habitat. Activities may result in removal of nests, loss of habitat, contamination of prey, and disturbance of birds during Construction, Operations, and Closure phases. Issues will be considered in accordance with the Bald and Golden Eagle Protection Act (Section 1.10.18).

Fish, Aquatic Organisms, and Their Habitat: The project could affect salmon and resident fish (e.g., whitefish, pike, and trout) and EFH through barge traffic, water diversion, noise and visual disturbance, changes in temperature regime and water quality, and displacement in streambeds. Pipeline construction and operations could affect salmon spawning beds and passage. Roads and project construction could increase sediment loads in streams, alter stream banks, cause erosion in adjacent areas, and introduce pollution to fish habitat from accidental spills. (The Magnuson-Stevens Fishery Conservation and Management Act is covered in Table 1.10 2 under the National Oceanic and Atmospheric Administration [NOAA] in relation to "Essential Fish Habit" consultation responsibilities.)

Marine Mammals: The increase in marine and river barge traffic and the potential for spills could affect marine mammals and their habitat. This EIS analyzes the potential for such impacts considering the Marine Mammal Protection Act (Section 1.10.16) prohibition of "takes" of marine mammals.

Terrestrial Wildlife: The project would traverse a range of habitat types important to terrestrial wildlife species. Construction impacts of the project may include loss of habitat, permanent and long-term alteration of habitat, obstruction of migratory patterns, and disturbance. Following Construction, additional disturbance may occur during Operations and Closure. Other potential impacts could include disturbance from increased recreational use and changes in hunting and trapping pressure due to changes in access. Concern has been expressed about the long-term impacts to terrestrial wildlife populations in the area.

Threatened and Endangered Species: Section 7(a)(2) of the ESA states that each federal agency shall ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Construction and operations plans for the project are analyzed to determine whether these activities could directly or indirectly affect these species or their habitat.

Vegetation: Vegetation would be cleared at the Mine Site, within the Transportation Corridor, and in the Pipeline component right-of-way. Removal of vegetation could result in soil erosion; loss of topsoil with its native vegetative seed bank; changes in hydrology affecting vegetation; delayed reclamation; and spread of nonnative invasive plant species. In addition, fugitive dust could affect adjacent vegetation and habitats.

Wetlands and Aquatic Communities: Potential effects to wetlands and aquatic communities are key to this EIS because of Section 404 of the CWA. Comments also cited Executive Order 11990, Protection of Wetlands (Section 1.10.28). The project would occur in and affect wetlands and streams; construction of the mine and pipeline would require the fill of wetlands and the placement of fill, culverts, and associated structures in streams. The project could cause

fragmentation of wetlands, changes in surface and groundwater hydrology, introduction of increased levels of disturbance from human activities, and introduction of exotic or invasive species. Aquatic resources habitat and water quality sensitivities are fully analyzed. Streams, and high value wetlands or wetlands that might be unique or relatively scarce in the Project Area are analyzed.

3.0.2.2.3 SOCIOECONOMIC ENVIRONMENT

Cultural and Historic Resources: Consideration of effects to cultural resources and historic properties is required under the NHPA and NEPA. Historic properties are defined as "any prehistoric or historic district, site, building, structure or object included in, or eligible for inclusion in, the National Register of Historic Places." Historic properties must meet National Register criteria. Cultural resources could be affected by the project, particularly during the Construction Phase.

Environmental Justice: Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (Section 1.10.29), requires all federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The project will be assessed for potential environmental justice impacts.

Iditarod National Historic Trail: Scoping comments cited potential effects that construction and operations of the pipeline may have on the physical trail, uses of the trail, the viewshed along the trail, and the recreational experience of individuals and commercial recreational activity in the vicinity of the trail.

Land Ownership, Management, and Use: Commenters expressed concerns about impacts from an increase in legal and non-legal access; compatibility of alternatives with land management objectives (e.g., the Yukon Delta Wildlife Refuge or the Susitna Flats State Game Refuge); and impacts to scenic and visual characteristics, wildlife, opportunities for solitude and primitive recreation; and existing trail usage.

Public Health: Scoping comments included requests to document existing health status and access to care. Large projects may be associated with impacts to behavioral health, including substance abuse and domestic violence. Commenters urged that the analysis also evaluate wellness initiatives and the potential for communities to plan ahead to address new health needs.

Recreation: Potential impacts on recreation, tourism, recreational hunting and recreation usage near the mine, along river systems, and in the pipeline corridor during Construction and Operations phases will be evaluated.

Socioeconomics: The project could alter aspects of the socioeconomic environment on a local and regional scale. Demographics (population trends with in-migration and out-migration), employment (direct and indirect), household income, housing, and public infrastructure are among the factors that could be affected. The analysis should assess both the project itself and longer term effects after the project is complete. Socioeconomics will also address and assess financial assurances including bonding associated with mine closure, reclamation, and monitoring.

Subsistence and Traditional Way of Life: Subsistence practices could be affected due to changes in resources from habitat loss or disturbance and disruption of movement patterns of certain fish, terrestrial mammals, and birds. Impacts to subsistence uses could include disruption of access to subsistence hunting and fishing during Construction, increasing competition for subsistence resources through improved access (mine access or pipeline shoofly roads or airstrips). New jobs and incomes may also result in socio-cultural effects on subsistence practices. An ANILCA Section 810(a) Evaluation and Finding conducted by the BLM will be required to determine if the project may result in a significant restriction of subsistence uses.

Transportation: Construction and Operations of the project could affect regional and local transportation systems, with crowding or displacement of current uses at airports, roads, ports, and rivers supporting barge traffic.

Visual Resources: The mine, related infrastructure, and pipeline corridor could affect visual resources and scenery in the project vicinity. Potential impacts to scenic resources could occur from vegetation clearing, development of the Mine Site, river crossings, and overall increased activity in areas that are considered visually sensitive. Decreases in the quality of visual landscape could occur during Construction, Operations, and Closure phases.

Wilderness Characteristics: Some of the Project Area contains lands with wilderness characteristics. The construction and brushing of the pipeline corridor could affect wilderness characteristics.

3.0.2.2.4 OTHER SECTIONS

Spill Risk: Analysis of non-routine spill impacts on all resources was consolidated into one section. Nine spill scenarios analyze the risks associated with potential spills of oil and other substances associated with the project.

Pipeline Safety and Reliability: Discusses relevant background to natural gas pipeline safety standards, including relation of relevant incident and safety statistics to the project.

Climate Change: Project activity contributions to atmosphere impacts are assessed by analyzing greenhouse gas (GHG) emissions. Climate driven changes over time that could contribute to impacts expected in the Project Area are analyzed for impacts to: the physical environment (water resources, permafrost); biological environment (vegetation and wetlands, wildlife and threatened and endangered species, fish and aquatic resources) and social environment (subsistence). Climate change models were analyzed to predict the range of climate driven change that may be expected over the life of the project.

Other Considerations: Unavoidable, irreversible, and irretrievable effects are discussed for applicable resource areas.

3.0.2.3 ISSUES DISMISSED FROM ANALYSIS

Among the scoping comments were comments that raised issues beyond the scope of the EIS of the Donlin Gold Project. The following issues were dismissed without further analysis, for the reasons outlined in each section.

3.0.2.3.1 POTENTIAL FINANCIAL UNCERTAINTY OF PROJECT PARTNERS

Scoping comments suggested this EIS was premature given published reports that one of the partners has not committed to investment in construction of this project. The permit applications that led to this effort are active and have not been withdrawn. Accordingly, speculation about whether or not this project will be constructed by the partners will not be further considered in this EIS.

3.0.2.3.2 LAND MANAGEMENT POLICY OR DECISIONS OF ANCSA CORPORATIONS

Scoping comments indicated concern about ANCSA corporation land management policy, or permitting decisions regarding private lands and the potential to exclude traditional uses of these lands. A commenter stated that Calista and The Kuskokwim Corporation had not held meetings in Crooked Creek to address these concerns.

The decisions of the ANCSA corporations as private land owners to make their lands available for mining and related activities are beyond the scope of this EIS because those private lands are not owned or managed by federal entities. The potential effects of mining on those lands are within the purview of this EIS because federal permits would be required.

3.0.2.3.3 SOURCE OF AND METHOD OF PRODUCTION FOR NATURAL GAS USED BY THE PROJECT

Scoping comments indicated concern about whether natural gas that would be used by the project would be produced using "fracking" techniques. Other comments addressed where the gas would or should be produced. The source of and production methods of natural gas are beyond the scope of this EIS because they are not a component of any federal permit required for this project. Additionally, the project proposes to purchase natural gas on the open market by linking with the existing pipeline system near Beluga, Alaska. Gas for the project would not be from a specific source. Potential sources at this time include any natural gas producer in Cook Inlet, Alaska.

3.0.2.3.4 EFFECTS ON LIMITS OF THE TERRITORIAL SEA (33 CFR 320.4(F))

Discussion of this factor was determined to be unnecessary for analysis because the project is not located near territorial seas. The Corps' record of decision (ROD) will further define the limits of analysis required for this factor.

3.0.2.3.5 FOOD AND FIBER PRODUCTION (33 CFR 320.4(A))

Discussion of this factor, which is a consideration in the Corps' Public Interest Review, was determined to be unnecessary for analysis because the project does not affect agricultural lands. The Corps' ROD will further define the limits of analysis required for this factor.

3.0.2.3.6 PRIME AND UNIQUE FARMLAND (40 CFR 1508.27(B)(3))

CEQ regulations require the analysis of impacts to unique characteristics of a geographic area, such as prime farmland. Prime farmland is land which has the best combination of physical and

chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed, including water management. This project does not affect prime and unique farmland. The Corps' ROD will further define the limits of analysis required for this factor.

3.0.3 INCOMPLETE AND UNAVAILABLE INFORMATION

The CEQ guidelines require that:

> When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking (40 CFR 1502.22).

In the event that there is relevant information, but "the overall costs of obtaining it are exorbitant or the means to obtain it are not known" (40 CFR 1502.22), the regulations instruct that the following should be included:

- A statement that such information is unavailable;
- A statement of the relevance of such information to evaluate reasonably foreseeable significant adverse impacts;
- A summary of existing information that is relevant to evaluating the adverse impacts; and
- The agency's evaluation of adverse impacts based on generally accepted scientific methods.

In the analysis, this EIS identifies those areas where information is unavailable to support a thorough evaluation of the environmental consequences of the alternatives. The Corps initiated a data gap analysis in early 2013, in which specialists reviewed the data and source documents from the Donlin Gold Environmental Evaluation Document (ARCADIS 2013a) and the additional technical literature known for each resource area. The preliminary analysis was reviewed by the cooperating agencies and a final report was developed in July 2013. A second round of review resulted in an updated data gap analysis focused on selected resources in April 2014.

In order to clarify the status of existing data for several resource areas, technical working groups were assembled. Specialists from the Corps, cooperating agencies, Donlin Gold, and the EIS team, met for one- to two-day long workshops (see Table 3.0-1).

As a result of the data gap reviews, several additional field studies were initiated: additional deep well pump testing to evaluate streambed hydraulic conductivity in 2013; Kuskokwim River rainbow smelt spawning study in May 2014; and Kuskokwim River juvenile salmon habitat use study in July and August-September 2014. Additional field work on rainbow smelt spawning and out-migrating juvenile salmon habitat was conducted in 2015.

In addition, 107 Requests for Additional Information (RFAIs) were submitted. In many cases, these requests resulted in significant new analysis and reanalysis of models for detailed technical issues. Other requests resulted in new data and engineering information.

Table 3.0-1: Technical Working Groups to Address Data Gaps

April 15-16, 2013	Anchorage	Surface and Subsurface Water Hydrology
June 4, 2013	Anchorage	Geochemical Characterization and Water Quality Prediction
June 24, 2013	Anchorage	Fisheries and Aquatics
July 9, 2013	Anchorage	Visual Resource Management
November 5-7, 2013	Aniak	Subsistence and Traditional Ecological Knowledge
March 26-27, 2014	Anchorage	Subsistence and Traditional Ecological Knowledge
April 15, 2014	Anchorage	Barging

Efforts have been undertaken to obtain relevant information necessary for the EIS, as required under CEQ guidelines. The resource impact analyses in Chapter 3 discuss limitations of data, where appropriate.

3.0.4 METHODS FOR DETERMINING IMPACTS

3.0.4.1 DIRECT AND INDIRECT EFFECTS

Direct and indirect effects, as defined above, could be associated with the Construction, Operations, and Closure phases for the major components of the Mine Site, Transportation Corridor, and Pipeline under review in this EIS. The direct and indirect effects for each resource or resource use are analyzed on the basis of the factors of intensity (magnitude), duration, extent (scope), and context of the impact (40 CFR 1508.27).

Definitions and general scales for these four factors are provided below. Criteria were developed based on federal NEPA guidance and other recent NEPA analyses. This framework is used throughout the EIS and is adapted as necessary for each resource.

Intensity (Magnitude): a measure of change in a resource condition that would be expected to occur. Change is described by how perceptible the change is, and to what degree the change impacts the resource's function in the ecosystem or cultural context.

Duration: a measure of length of time that impacts would be expected to occur, which may range from temporary to permanent.

Extent (Scope): a geographic measure of where impacts would be expected to occur, which may range from impacts to discrete portions of the EIS Analysis area, to larger areas.

Context: a measure of the role the resource fills within the particular analysis framework for that resource. As noted in this section’s introduction, several resource sections have refined descriptions for the context criteria. Resource-specific definitions are presented in the respective sections, as applicable.

Impacts may be beneficial or adverse. Impacts are generally assumed to be adverse, unless specifically noted as beneficial.

3.0.5 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS

Relevant past and present actions are those that have influenced the current condition of the resource. For the purposes of this EIS, past and present actions include both naturally caused and human-controlled events. The past and present actions applicable to the cumulative effect analysis are presented in Table 4.2-1 in Chapter 4, Cumulative Effects. That discussion describes the types of past, present, and future activities that may interact with the effects of the Donlin Gold Project and alternatives. A detailed list of relevant RFFAs is provided. Those activities considered but eliminated from further consideration are also listed in Table 4.2-2.