Pebble Project
Environmental Baseline Document
2004 through 2008

CHAPTER 38.
VEGETATION
Cook Inlet Drainages

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ACRONYMS AND ABBREVIATIONS

AKNHP	Alaska Natural Heritage Program
GIS	geographic information system
LIDAR	Light Detection and Ranging
RDI	Research Data, Inc.
USGS	U.S. Geological Survey

38. VEGETATION—COOK INLET DRAINAGES STUDY AREA

38.1 Introduction

This chapter summarizes the vegetation study for the Cook Inlet drainages study area. Chapter 13 discusses the vegetation study in the mine study area (Section 13.1) and the transportation-corridor study area (Section 13.2). The vegetation study in the Cook Inlet drainages is similar to the vegetation studies in the Bristol Bay drainages.

38.2 Study Objectives

The primary objective of the vegetation study was to describe the predominant vegetation types found in the Cook Inlet drainages study area. More specifically, the objectives of the vegetation study were as follows:

- Customize an existing vegetation-classification system to include Project Vegetation Types amenable to photo-interpretation (i.e., identification of vegetation types in photographs, particularly aerial photographs).
- Provide descriptions of Project Vegetation Types, including typical plant species composition and vegetation structure.
- Map Project Vegetation Types.
- Compile and document information on plant species observed at the study plots, including incidental observations of the following types of plant species:
  - Nonvascular plant species (e.g., moss and lichen).
  - Species considered rare according to the Alaska Natural Heritage Program (AKNHP).
  - Species that are considered weeds by the Alaska Committee for Noxious and Invasive Plants Management.

38.3 Study Area

The vegetation study area in the Cook Inlet drainages extends from the boundary between the Bristol Bay and Cook Inlet drainages to the southwestern shore of Iniskin Bay. Data have been collected throughout the study area, but mapping has been completed only for an approximately 2,000-foot-wide corridor within the study area, referred to as the "mapping area" (see overview map for Figure Series 38-1).

Scientists consider the information gathered outside the mapping area to be useful for characterizing the environment surrounding the mapping area; therefore, data collected from all sites are discussed here and presented in data tables. No additional mapping is planned for the Cook Inlet drainages study area.

Several Alaska Native corporations own land within the Cook Inlet drainages study area. Access was granted for data collection on all properties.

38.4 Previous Studies

The Cook Inlet drainages study area falls within the Alaska Range ecoregion (Nowacki et al., 2001). The dominant vegetation of the Alaska Range is shrub communities of willow, birch, and alder that occupy lower slopes and valley bottoms. Forests are rare and are usually limited to low-elevation drainages. The published descriptions of the vegetation in these areas as described above, is consistent with the predominant vegetation in the study area.

38.5 Scope of Work

The research and field work for this study were conducted primarily in 2004 and 2005. Data analysis and mapping were started after the first field season concluded in 2004. The scope of work for the vegetation study includes the following elements:

- Review existing information on the study area and evaluate its usefulness for characterizing the study area vegetation.
- Collect vegetation data during wetland determinations at locations representing the diversity of vegetation, landforms, slope angles, and aspects found in the study area. Use methods that are typical for characterizing vegetation for the purpose of wetland determinations (Chapter 39).
- Enter field data, including site photographs and geographic coordinates of field plots, into the Pebble Project relational database and verify its accuracy.
- In the geographic information system (GIS) for Pebble Project, on an orthorectified aerial photograph base, draw boundaries between different vegetation types and create mapping polygons based on these differences.
- Using field data, Project Vegetation Type photo signature guides, and other GIS layers as supporting information, assign a Project Vegetation Type to each digitized polygon to produce vegetation mapping. In addition, identify any areas with human-disturbed vegetation by coding the polygons representing those areas as “disturbed.”
- Compile and document information on plant species observed at the study sites, including incidental observations of nonvascular plant species (e.g., moss and lichen), species considered rare by AKNHP and species considered weeds by the Alaska Committee for Noxious and Invasive Plants Management.
- Prepare a document that describes the study and the Project Vegetation Types found in the vegetation mapping area (this report).

HDR Alaska, Inc., conducted the field work, analysis, and mapping for the Cook Inlet drainages study area. Three Parameters Plus, Inc., developed the overall study methods and performed the literature review. Resource Data, Inc. (RDI), compiled the digital data sets, coordinated use of GIS among firms, and maintained the relational database.

38.6 Methods

The study methods used in the Cook Inlet drainages study area were essentially the same as the methods for the two study areas in Bristol Bay drainages (Chapter 13). The methods for Cook Inlet drainages study area are described below.

38.6.1 Literature Review

A literature search was conducted to identify reports and technical documents with relevant information about the study area. Libraries, government agencies, and other data sources in the Anchorage area provided reference materials. In addition, information was obtained from online sources. The data sets that were identified are described below.

38.6.2 Compilation of Digital Data Sets

The review of existing data resulted in the creation of project-specific GIS layers for the Cook Inlet drainages study area. In addition, Pebble Partnership commissioned several captures of aerial imagery. The following data sets were compiled by RDI, for digital presentation and review for this study:

- National Wetlands Inventory mapping (from the U.S. Fish and Wildlife Service, orthorectified and digitized from paper maps by RDI).
- U.S. Geological Survey (USGS) topographic mapping.
- Land-cover mapping from the Earth Resources Observation System and vegetation and land-cover types from the USGS associated with the Bristol Bay Management Plan.
- Vegetation mapping and cover classes found on the National Park Service website for Lake Clark National Park and Preserve.
- Exploratory soil-survey data (from the U.S. Department of Agriculture, Natural Resources Conservation Service).
- Land-ownership information (from the Alaska Department of Natural Resources, with contributions from the Bureau of Land Management and the U.S. Census Bureau).
- Color infrared photographs from the National Aeronautics and Space Administration, orthorectified by Aero-Metric, Inc., at a scale of 1:60,000. The dates of the imagery are August 1978 and August 1982, depending on the location.
- Aerial photographs acquired by Aero-Metric, Inc., in October of 2004 and 2005 captured at a scale of 1:8,000. These aerial photographs were orthorectified at a scale of 1.5-foot pixels and were used for analysis and interpretation in the GIS.
- Light detection and ranging (LIDAR) imagery acquired by Aero-Metric, Inc., in October 2004 and August 2008, used to produce a GIS layer of 4-foot contour lines for the study area.
- IKONOS (GeoEye) satellite imagery captured in July 2004. Field investigators used this imagery for some basemaps in 2004 and 2005.

A GIS spatial data set was constructed from the above sources. The 2004 and 2005 orthophotographs are the basemap for the vegetation and wetland studies.

38.6.3 Field Data Collection

Vegetation field data were collected as part of the field work for the wetland study. Data were collected following the procedures described in the study plan for wetlands (see Appendix E of this environmental baseline document).

38.6.3.1 Study Site Selection

Study sites were selected primarily to assist in the identification and mapping of wetlands. Additional goals in the selection of study sites were to ensure data collection from each aerial photo signature and in each Project Vegetation Type across the full range of landscape positions and soil types found throughout the study area.

38.6.3.2 Types of Study Sites

At detailed-data collection plots, plant species composition and abundance were recorded within representative stands of vegetation. (Detailed-data collection plots are the study sites termed wetland determination plots and functional assessment plots for the wetlands study [Chapter 39].) Vegetation data collected at each 1/10th-acre plot generally included percent coverage of all observed vascular plant species and estimated average tree height and diameter at breast height. Percent coverage for each vascular plant species was estimated visually, and species with less than 3 percent coverage were recorded as trace. In many plots, coverage estimates for non vascular mosses and lichens also were recorded, along with their names, if known. This information was used to refine Project Vegetation Types and to facilitate interpretation of photo signatures. At limited-data collection plots, the focus of sampling was to document the site's vegetation type with photographs. (Limited-data collection plots are the study sites termed representative upland, representative wetland, waterbody, and stream crossing photo points or plots for the wetlands study [Chapter 39].) Data collection at limited-data collection plots was limited to taking photographs and collecting minimal physical site data (e.g., landscape position, macro- and microtopography, and very basic water chemistry); vegetation data were not collected at these plots. Limited-data collection plots also were used to document species being tracked by the AKNHP (see the section below on Tracked Species).

Field Technology

At each study site, scientists determined and recorded the global positioning system (GPS) coordinates for the site; took photographs of the dominant vegetation, soils, and landscape features; entered key site attributes into a digital recording device; marked the site location on a field map; and recorded other key information on hardcopy data forms. Scientists used imaging systems equipped with digital cameras and GPS units (accuracy less than 50 feet) to record a subset of the field data, to watermark pictures with latitude and longitude, and to provide a direct interface to the GIS. RDI developed downloading procedures to efficiently process these data into the existing web-based database application.

Investigators from both firms used backup digital cameras, GPS units, and hand-recorded field notes if their primary systems failed.

38.6.3.3 Vegetation Characterization

Numerous taxonomic references and field guides, including those listed below, were used to identify trees, shrubs, and herbs over the course of field surveys.

- *Alaska Trees and Shrubs* (Viereck and Little, 1972).
- *Flora of Alaska and Neighboring Territories: A Manual of Vascular Plants* (Hultén, 1968).
- *Plants of the Pacific Northwest Coast* (Pojar and MacKinnon, 1994).
- *Willows of Southcentral Alaska* (Collet, 2002).
- *Wetland Sedges of Alaska* (Tande and Lipkin, 2003).
- *Flora of North America*, Volume 23: *Cyperaceae*, and Volumes 24 and 25: *Poaceae* Parts 1 and 2 (Flora of North America Editorial Committee, 2002, 2007, and 2003, respectively).

During the spring of 2006, scientists reviewed the vegetation field data collected to that time and developed Project Vegetation Types. The Project Vegetation Types were developed to ensure that vegetation mapping was consistent for all study areas and among all consultants. Vegetation types that could not be easily distinguished from each other on aerial photographs were combined in the Project Vegetation Types. Vegetation types that were common in the study area but were not well described in *The Alaska Vegetation Classification* (Viereck et al., 1992) were refined and added to the list of Project Vegetation Types.

Project Vegetation Types frequently are named for the species that dominated the principal vegetation stratum in study plots with that Project Vegetation Type. For example, for the Project Vegetation Type Open White Spruce Forest, white spruce trees dominated the tree stratum. Project Vegetation Types that are not are not named for specific species (e.g., Closed Broadleaf Forest or Open Mixed Forest) may have more than one dominant species in the principal vegetation stratum. Dominant species are those species that are predominant in their stratum (tree, shrub, or herb) in a given study plot based on percent coverage (as determined by the 50/20/20 rule, which is described in detail in Chapter 39 of the *Pebble Project Environmental Baseline Document*).

38.6.3.4 Tracked Species

Documentation of vascular plant species that are tracked by the AKNHP was not included in the scope of work for 2004 and 2005; however, some incidental observations of plants on the AKNHP vascular plant tracking list were noted.

The AKNHP vascular plant tracking list (AKNHP, 2008) includes more than 300 vascular plant species that AKNHP considers rare within Alaska. AKNHP ranks the species with a code that describes their population status on a global level (G-rank) and on a statewide level (S-rank). The status levels are ranked on a scale from 1 to 5, where 5 is a common species with demonstrably secure populations, and 1 is a critically imperiled species whose populations are vulnerable to extirpation or extinction. If the rank is uncertain, it is described with a range of two rankings (for example, S2S3) or with a ranking followed by

a question mark (for example, G5?). Taxonomic uncertainty is indicated by the letter Q following the ranking (for example, G1Q).

As noted above, researchers occasionally encountered plant species on the AKNHP tracking list during vegetation sampling. These incidental observations often were supported by collecting a plant specimen to be used for species verification by a botanist (a voucher specimen), taking photographs of identifying traits, and collecting additional data to be used for reporting species of interest. However, scientists collected voucher specimens only if they deemed the species population large enough to support loss of a specimen without endangering the population.

All collected voucher specimens of putative rare species were forwarded to the University of Alaska, Fairbanks, herbarium for final taxonomic review, confirmation of identity, and archiving.

38.6.4 Data Entry

Data collected in the field were uploaded or typed into a web-based relational database. All data were related to the associated plot's location in a GIS, which is managed by RDI. As plot locations were generated in the GIS upon uploading, some fields of the database were auto-populated with information drawn from geographic information already in the database, such as quadrangle names and section numbers. Upon completion of the data entry and applicable quality control processes, data became available in the GIS for use in vegetation mapping and development of the list of observed plant species.

The vegetation field data were used to assign final Project Vegetation Types in the project database. Because field data collection was refined and standardized in minor ways through the years of field study, certain data were re-interpreted and modified in the office during quality control reviews to maximize data consistency and usefulness. In particular, because the vegetation classification system was refined as data were collected, scientists reviewed vegetation types assigned in the field in early years and sometimes reassigned Project Vegetation Types according to the investigators' current shared understanding of those types (see the section on Vegetation Characterization above).

38.6.5 Digital Mapping

Scientists mapped vegetation in the Cook Inlet drainages mapping area based on interpretation of aerial photographs and using information gained at the field investigation sites for reference. The 2004 and 2005 orthophotography with 4-foot contours, derived from the aerial photographs and LIDAR imagery, served as the basemap for the vegetation studies.

The vegetation map was drawn to a scale ranging between 1:1,200 and 1:1,500, and open water was drawn at 1:400 in GIS with a minimum polygon size of approximately 0.05 acre.

Project vegetation codes listed in draft photo signature guides for Pebble Project (3PPI, 2006, 2007, 2008) were assigned to the vegetation mapping polygons using available field data, including site photographs.

Field data were accessible in the relational database during mapping to assist in interpreting and assigning Project Vegetation Types to polygons. Scientists determined vegetation types on the aerial photographs using the project photo signature guides, field data collected within a given polygon, and field data for nearby polygons with similar photo signatures and landscape positions. For individual study sites, the

data collected in the field may appear not to match the final Project Vegetation Type assigned to that area. Such discrepancies may be the result of heterogeneity of vegetation that cannot always be reliably detected in or practically mapped from aerial photographs.

38.7 Results and Discussion

38.7.1 Project Vegetation Types

In 2004 and 2005, scientists collected detailed vegetation data at 139 plots in the Cook Inlet drainages study area. Data from these detailed-data collection plots were used to develop the descriptions of Project Vegetation Types, as well as for ground reference for mapping. Scientists identified vegetation types, took photos, and collected data on site characteristics (e.g., topography) at 88 limited-data collection plots. Those data were used as reference for mapping. All of these sites, including those outside the mapping area, are shown on Figure Series 38-1.

Thirty-seven Project Vegetation Types were identified for the Cook Inlet drainages study area (Tables 38-1 through 38-3). Field investigators collected detailed vegetation data in the Cook Inlet drainages study area for 22 of these vegetation types. Five Project Vegetation Types (including three sparsely vegetated or unvegetated land cover types) were documented only at limited-data collection plots, which provide enough data to fully characterize these vegetation types. Nine Project Vegetation Types were not documented in the field in the Cook Inlet drainages study area, although these types were visible on aerial photographs. These vegetation types are similar in the Bristol Bay and Cook Inlet watersheds, and detailed-data collection plots from Bristol Bay drainages can be used to fully characterize these vegetation types in Cook Inlet drainages. (Vegetation data for these Project Vegetation Types are available from the vegetation studies in the Bristol Bay drainages and are provided in Appendix 38A.) One type, Open Sitka Spruce Forest, was not documented in the field with data collection plots in either the Bristol Bay or Cook Inlet watershed, but was identified after the field work on aerial photographs. This vegetation type is differentiated from Closed Sitka Spruce Forest (which has been documented by detailed-data collection plots) by canopy cover, which can be assessed by aerial photographs. Except for the three partially or unvegetated land-cover types, none of the Project Vegetation Types that were not studied at detailed-data collection plots constituted more than 1 percent of the mapping area. Appendix 38A contains representative photographs and descriptions of all the Project Vegetation Types found in the Cook Inlet drainages study area, except Open Sitka Spruce Forest.

38.7.2 Vegetation Mapping

During the mapping process 3,870-acres in the Cook Inlet drainages mapping area were analyzed on aerial photography, divided into areas of homogenous vegetation by drawing vegetation type boundaries, and coded according to the Project Vegetation Type (Figure Series 38-2). The mapping shows 33 Project Vegetation Types (including three sparsely vegetated or unvegetated land-cover types). Four Project Vegetation Types (Closed Sitka Spruce Forest, Open Broadleaf Forest, Closed Willow Low Shrub, and Open Willow Low Shrub Fen) were identified at study plots in the study area, but were not identified in units large enough to map in the smaller mapping area; therefore, these Project Vegetation Types are not shown on Figure Series 38-2, nor are they listed in Table 38-4. Table 38-4 lists the acreage for each mapped Project Vegetation Type in the Cook Inlet drainages mapping area and the percentage of the mapping area that each type comprised. Vegetation types included forested types (the dominant growth

form consists of trees at greater than ten percent cover), shrub types (the dominant growth form are multi-stemmed woody plants), herbaceous types (dominated by plants whose stem does not produce woody, persistent tissue and generally dies back at the end of each growing season), and unvegetated or sparsely vegetated areas ("land cover" types).

Shrub alder thickets (Project Vegetation Types: Closed Alder Tall Shrub, Open Alder Tall Shrub, and Open Alder Low Shrub) constituted 54 percent of the mapped area (76 percent of the area that was not open water). Open water, including unvegetated intertidal mudflats, (Project Vegetation Type: Open Water) comprised 29 percent of the mapped area. Rocky outcrops and beaches (Project Vegetation Types: Partially Vegetated and Barren) comprised 12 percent of the mapping area. (Definitions of canopy density classes [closed, open, woodland] and shrub height categories [tall, low, dwarf] are presented in Tables 38-1 and 38-2.)

For clearer display on maps, the 33 Project Vegetation Types were aggregated into 9 vegetation structure types. The groupings were based on the dominant growth form described above (forested, shrub, or herbaceous), vegetation density (open or closed canopy), and average height (dwarf, low, or tall; Table 38-5, Figure Series 38-3). The four forested types shown in Table 38-4 were condensed into one grouped forested type: Open/Closed Forest. The 18 shrub types in the table were condensed into four grouped shrub types: Open Tall, Closed Tall, Open Low, and Dwarf Shrub. The eight herbaceous types were condensed into two grouped herbaceous types: Dry to Moist, and Wet Herbaceous. In addition, the three land cover types were grouped into two land cover types; Open Water and Other. Upon examining the abundance of each of the 9 grouped vegetation types, it is evident that the closed tall shrub and open water accounted for 31.3 and 29.2 percent, respectively, of the transportation-corridor mapping area (Table 38.2-5). The open low shrub group and the open tall shrub group accounted for 13.0 percent and 11.7 percent, respectively, of the area. The dwarf shrub group and the dry to moist herbaceous group covered 1.0 percent of the mine mapping area, each, while the open/closed forest group covered 0.6 percent of the area. The wet herbaceous covered only 0.3 percent of the transportation-corridor mapping area, mostly at the mouth of rivers and along the coast. Bare and partially vegetated cover types comprised 11.8 percent of the transportation-corridor mapping area, since this is an area with steep slopes and rocky coastline.

38.7.3 Ecological Zones

While the transportation corridor in the Bristol Bay drainages study area passes through zones of distinct landforms and climate that determine the vegetation types, the Cook Inlet drainages study area is all in one ecological zone; it is all strongly affected by the steep mountains and the maritime climate of lower Cook Inlet. As a result, the vegetation does not vary greatly throughout the Cook Inlet drainages mapping area. Along the coast, mudflats (Project Vegetation Type: Open Water) are extensive, and bedrock outcrops (Project Vegetation Types: Barren and Partially Vegetated) form cliffs in some areas. Salt-tolerant vegetation (Project Vegetation Types: Halophytic Dry Graminoid and Halophytic Graminoid Wet Meadow) occupies relatively protected areas in the upper intertidal zone along the coast. The mountain slopes support alder thickets (Project Vegetation Types: Closed Alder Tall Shrub and Open Alder Tall Shrub), in some areas interspersed with herb meadows (Project Vegetation Types: Mesic Herb and Bluejoint Herb). The mountain slopes are dissected by streams that flow directly down the mountainsides to the ocean. Forested areas are limited, in part, by snow avalanches.

38.7.4 Plant Species List

The draft plant species list (Appendix 38B) is a list of vascular plant species observed at the detailed-data collection plots in the study area. In this draft list, some species are shown under more than one valid Latin name (as a result of taxonomic revisions). The plants most frequently found in the Cook Inlet drainages study area are listed in Appendix 38C.

The AKNHP, part of the NatureServe program established by the Nature Conservancy, tracks population information on over 300 Alaskan plant species they consider rare (AKNHP, 2008). During the field investigations, one population of one of these species was recorded at one location in the transportation-corridor study area and is listed in Table 38-6. A voucher specimen was collected and sent to the University of Alaska, Fairbanks, herbarium, where the species' identity was confirmed. The study plot where the species was observed is not within the Cook Inlet drainages mapping area. Detailed information on the observed population is recorded in the project database.

This species, *Eleocharis kamtschatica*, was ranked by AKNHP based on factors contributing to rarity, including population number and size, trends, and threats. The ranking of G4 S2S3 indicates that the species is apparently secure (uncommon but not rare, having some cause for long-term concern due to declines or other factors) throughout its entire global range, but within the State of Alaska, it ranges between being vulnerable (due to restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation) and apparently secure (uncommon but not rare, having some cause for long-term concern due to declines or other factors).

38.8 Summary

Scientists characterized vegetation in the Cook Inlet drainages study area using methods similar to methods used in the two study areas in the Bristol Bay drainages. Field studies in the Cook Inlet study area occurred primarily in 2004 and 2005. Field crews collected detailed vegetation data at 139 locations in the Cook Inlet drainages. They identified vegetation types, took photos, and collected data on site characteristics (e.g., topography) at 88 limited-data collection sites. All of these sites are shown on Figure Series 38-1. The 37 Project Vegetation Types identified in the Cook Inlet drainages study area are listed in Tables 38-1 through 38-3, and photographs with full descriptions of all but one Project Vegetation Type are shown in Appendix 38A.

The vegetation study area in the Cook Inlet drainages extends from the boundary between the Bristol Bay and Cook Inlet drainages to the southwestern shore of Iniskin Bay. Data have been collected throughout the study area, but mapping has been completed only for an approximately 2,000-foot-wide corridor within the study area, referred to as the "mapping area" (see overview map for Figure Series 38-1). Scientists mapped vegetation in the 3,870-acre mapping area based on interpretation of aerial photographs and using information gained at the field investigation sites for reference. The Project Vegetation Types are mapped on Figure Series 38-2, and grouped vegetation types are mapped on Figure Series 38-3.

The vegetation of the Cook Inlet drainages study area is strongly influenced by the mountainous terrain and the Cook Inlet climate. Alder thickets dominated the steep mountain slopes. Rocky outcrops were found in the steepest and most exposed areas, and beaches occurred along the ocean shoreline. Open water and intertidal mudflats occupied a large portion of the mapping area.

Investigators observed more than 200 species of vascular plants during the course of field investigations, including one species that is on the Alaska Natural Heritage Program's list of tracked species (AKNHP, 2008).

38.9 References

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38.10 Glossary

Aerial photo signature—a unique texture, pattern, or color that vegetation has when captured in photographs taken from an airplane.

Ericaceous plants—plants in the heath family (Ericaceae), mostly plants that thrive in acid soils; includes numerous plants from mostly temperate climates: cranberry, blueberry, heather, huckleberry, azalea, and rhododendron are well-known examples.

Graminoids—grasses and grass-like plants, including sedges and rushes.

Halophytic—adapted to living in a saline environment.

Herbaceous plants—plants that have leaves and stems that die to the soil level at the end of the growing season.

Mesic—type of habitat with a moderate or well-balanced supply of moisture; relates to an ecological habitat classified as “moderately moist.”

Orthophotography (orthophotographs)—digital imagery that has been orthorectified (see below); orthorectified photos have already been processed.

Orthorectify— to rectify digital imagery by removing distortion resulting from camera angle and topography, thus equalizing the distances represented on the image.

Photo signature—see aerial photo signature.

Signature—see aerial photo signature.

Stratum—a layer of vegetation in a plant community, usually of the same or similar height (plural is strata).

Tussock—the mound formed by any grass or sedge that grows in clumps or tufts, rather than forming sod or a mat.

Vegetation signature—see aerial photo signature.

Voucher specimen—any specimen that serves as a basis of study and is retained as a reference; it should be in a publicly accessible scientific reference collection. For purposes of this study, voucher specimens of AKNHP tracked species were collected and sent to the University of Alaska, Fairbanks, herbarium for species verification.

TABLES

TABLE 38-1
Project Vegetation Types in Which the Tree Stratum (≥10% tree cover) Is Dominant, Cook Inlet Drainages Study Area, 2004-2008

Project Vegetation Type and Number of Study Plots [a]	Definition [b]	Typical Vegetative Composition Based on Sample Plots [c]
Closed Sitka Spruce Forest (CSSF) *n* = 2	Closed forests dominated by Sitka spruce trees	In these two plots, *Picea sitchensis* trees formed the principal vegetation stratum. Frequently occurring shrubs included *Menziesia ferruginea, Oplopanax horridus*, and *Vaccinium ovalifolium*. Common herbs included *Dryopteris dilatata*, *Gymnocarpium dryopteris*, and *Rubus pedatus*.
Open Sitka Spruce Forest (OSSF) *n* = 0	Open forests dominated by Sitka spruce	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in any Pebble Project study area; therefore, species data were not available for this Project Vegetation Type.
Open White Spruce Forest (OWSF) *n* = 0	Open forests dominated by white spruce	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
White Spruce Woodland (WSW) *n* = 1	Woodlands dominated by white spruce	In this plot, *Picea glauca* trees formed the principal vegetation stratum. *Salix pulchra* was the most abundant shrub. Most abundant herbs included *Calamagrostis canadensis* and *Epilobium angustifolium*.
Open Broadleaf Forest (OBF) *n* = 4	Open forests dominated by broadleaf tree species	*Betula kenaica* and *Populus balsamifera* trees formed the principal vegetation stratum. Frequently observed shrubs included *Alnus sinuata* and *Oplopanax horridus*. Common herbs included *Calamagrostis canadensis, Dryopteris dilatata, Equisetum arvense, Gymnocarpium dryopteris,* and *Thelypteris phegopteris.*
Broadleaf Woodland (BW) *n* = 2	Woodlands dominated by broadleaf tree species	*Betula kenaica* and *Populus balsamifera* formed the principal vegetation stratum. *Alnus sinuata, Calamagrostis canadensis,* and *Gymnocarpium dryopteris w*ere the most frequently occurring species in the understory.

Notes:

a. Number of plots (*n*) includes plots where field investigators collected detailed vegetation data. It does not include limited-data collection plots.

b. Forest density classes (closed, open, woodland) are differentiated based on tree canopy cover (>60%, 25-59%, 10-24%, respectively).

c. See Appendix 38A for photos and further detail, including the common names associated with the Latin names given in this column. These descriptions are not necessarily based on statistical dominance but are based on a combination of frequency, cover, and professional experience to list species that create a typical picture of the site.

TABLE 38-2
Project Vegetation Types in Which the Shrub Stratum Is Dominant (shrub cover is >25%), Cook Inlet Drainages Study Area, 2004-2008
Tree coverage is <10%.

Project Vegetation Type and Number of Study Plots [a]	Definition [b]	Typical Vegetative Composition Based on Sample Plots [c]
Closed Willow Tall Shrub (CWTS) *n* = 0	Thickets of tall willows	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
Closed Alder Tall Shrub (CATS) *n* = 33	Thickets of tall alder	*Alnus sinuata* formed the principal vegetation stratum. Other common shrubs included *Oplopanax horridus* and *Rubus spectabilis.* Frequently occurring herbs included *Calamagrostis canadensis, Dryopteris dilatata*, and *Gymnocarpium dryopteris*.
Closed Alder Willow Tall Shrub (CAWTS) *n* = 0	Mixed-species thickets of tall alders and willows	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
Open Willow Tall Shrub (OWTS) *n* = 0	Open stands of tall willow	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
Open Alder Tall Shrub (OATS) *n* = 8	Open stands of tall alder	*Alnus sinuata* formed the principal vegetation stratum. Other frequently observed shrubs included *Empetrum nigrum, Rubus spectabilis*, *Spiraea beauverdiana,* and *Vaccinium uliginosum*. Common herbs included *Athyrium filix-femina*, *Calamagrostis canadensis*, and *Dryopteris dilatata.*
Open Alder Willow Tall Shrub (OAWTS) *n* = 0	Tall, open shrub stands co-dominated by alder and willow	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
Closed Willow Low Shrub (CWLS) *n* = 1	Thickets of low willow	Willows, especially *Salix barclayi,* formed the principal vegetation stratum. *Calamagrostis canadensis* and *Carex macrochaeta* were the most abundant herbs.
Open Mixed Shrub Sedge Tussock (OMSST) *n* = 3	Open stands of low shrubs co-dominant with an herbaceous layer of sedge tussocks	A mixture of shrubs and sedges formed the principal vegetation stratum. Shrubs most commonly included *Betula nana* and *Vaccinium uliginosum*. Herbs most commonly included *Calamagrostis canadensis* and *Carex aquatilis*,

Project Vegetation Type and Number of Study Plots [a]	Definition [b]	Typical Vegetative Composition Based on Sample Plots [c]
Open Dwarf Birch Shrub (ODBS) *n* = 7	Open stands of low birch shrubs	Low shrubs formed the principal vegetation stratum with 10% or more *Betula nana* cover. Other common shrubs included *Alnus sinuata*, *Empetrum nigrum, Salix barclayi*, and *Vaccinium uliginosum*. Common herbs included *Calamagrostis canadensis*, *Carex spectabilis*, *Cornus suecica*, and *Dryopteris dilatata.*
Low Ericaceous Shrub Tundra (LEST) *n* = 6	Open to closed stands of low ericaceous shrubs	The principal vegetation stratum was formed by low shrubs including *Alnus sinuata*, *Empetrum nigrum*, and *Ledum decumbens.* Common herbs included *Calamagrostis canadensis, Carex macrochaeta, Dryopteris dilatata, Epilobium angustifolium,* and *Rubus arcticus.*
Open Dwarf Birch Ericaceous Shrub Bog (ODBESB) *n* = 7	Bogs and fens with abundant mosses, ericaceous shrubs, and dwarf birch. Drainage is poor and soils generally are composed of peat >8 inches thick.	*Betula nana* together with ericaceous shrubs formed the primary vegetation stratum. Common shrubs included *Empetrum nigrum*, *Ledum decumbens*, and *Vaccinium uliginosum*. Frequently occurring herbs included *Calamagrostis canadensis*, *Cornus suecica,* and *Scirpus cespitosus*. *Sphagnum* moss was abundant (30% or greater cover).
Ericaceous Shrub Bog (ESB) *n* = 0	Bogs and fens with abundant mosses and ericaceous shrubs, but only sparse dwarf birch. Drainage is poor and soils generally are composed of peat >8 inches thick.	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
Open Willow Low Shrub (OWLS) *n* = 3	Open stands of low willow	*Salix barclayi, S. pulchra,* and *Spiraea beauverdiana* shrubs formed the principal vegetation stratum. Common herbs included *Calamagrostis canadensis, Carex macrochaeta, Cornus suecica, Epilobium angustifolium*, and *Thelypteris phegopteris.*
Open Willow Low Shrub Fen (OWLSF) *n* = 1	Fens and other wet areas characterized by open stands of low willows	The principal vegetation stratum was composed of *Salix pulchra*. Common herbs included *Carex macrochaeta* and *Scirpus cespitosus*.
Open Sweetgale Graminoid Bog (OSGB) *n* = 0	Bogs and fens dominated by sweetgale (>25 percent cover)	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
Open Alder Willow Low Shrub (OAWLS) *n* = 0	Low, open shrub stands co-dominated by alder and willow	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.
Open Alder Low Shrub (OALS) *n* = 3	Open stands of low alder	In these three plots, *Alnus* shrubs formed the principal vegetation stratum. Common herbs included *Calamagrostis canadensis*, *Carex spectabilis*, *Dryopteris dilatata*, *Gymnocarpium dryopteris*, and *Thelypteris phegopteris*.

Project Vegetation Type and Number of Study Plots [a]	Definition [b]	Typical Vegetative Composition Based on Sample Plots [c]
Dwarf Ericaceous Shrub Lichen Tundra (DESLT) *n* = 0	Open stands of dwarf ericaceous shrubs on lichen-dominated (>60% cover) ground	This Project Vegetation Type was documented in the study area only by a limited-data collection plot. See Appendix 38A.
Dwarf Ericaceous Shrub Tundra (DEST) *n* = 10	Open to closed stands of dwarf ericaceous shrubs that do not satisfy the requirements of other Project Vegetation Types	Ericaceous shrubs less than 8 inches tall formed the principal vegetation stratum. Frequently observed shrubs included *Betula nana*, *Empetrum nigrum*, *Ledum decumbens*, *Spiraea beauverdiana*, and *Vaccinium uliginosum*. Common herbs were *Calamagrostis canadensis, Carex spectabilis,* and *Cornus suecica*.
Dwarf Ericaceous Shrub Tundra—Hummocks (DEST-H) *n* = 0	Open to closed stands of dwarf ericaceous shrubs growing on hummocks >6 inches tall	This Project Vegetation Type was identified only on aerial photographs and was not documented in the field in the Cook Inlet drainages study area. See Appendix 38A.

Notes:

a. Number of plots (n) includes plots where field investigators collected detailed vegetation data. It does not include limited-data collection plots.

b. Shrub density classes (closed thickets, open) are differentiated based on shrub canopy cover (>75%, 25-75%, respectively). Shrub height classes (tall, low, dwarf) are differentiated based on average shrub height (>5 feet tall, between 5 feet and 8 inches tall, <8 inches tall, respectively).

c. See Appendix 38A for photos and further detail, including the common names associated with the Latin names given in this column. These descriptions are not necessarily based on statistical dominance but are based on a combination of frequency, cover, and professional experience to list species that create a typical picture of the site.

TABLE 38-3
Project Vegetation Types in Which the Herb Stratum Is Dominant or Which Lack Vegetation, Cook Inlet Drainages Study Area, 2004-2008

Trees provide <10% coverage and shrubs either contribute <25% coverage or are not apparent on photographs because of a dense, tall herbaceous stratum.

Project Vegetation Type and Number of Study Plots [a]	Definition	Typical Vegetative Composition Based on Sample Plots [b]
Halophytic Dry Graminoid (HDG) *n* = 4	Dominated by beach rye grass; site may be dry or wet	*Elymus arenarius* was found in almost pure stands. Other grasses (such as *Festuca rubra*) may have been present. This vegetation type was found along the coastal fringe.
Bluejoint Tall Grass (BTG) *n* = 7	Dominated by bluejoint reedgrass; other herbs may be present but are not co-dominant	*Calamagrostis canadensis* formed the principal vegetation stratum. Scattered shrubs included *Alnus sinuata, Rubus spectabilis, Salix barclayi, S. pulchra,* and *Spiraea beauverdiana*. Other common herbs included *Athyrium filix-femina* and *Gymnocarpium dryopteris*.
Bluejoint Herb (BH) *n* = 11	Co-dominated by bluejoint reedgrass and other herbs	*Calamagrostis canadensis* along with other herbs formed the principal vegetation stratum. Other common herbs included *Epilobium angustifolium*, *Achillea borealis*, *Angelica lucida*, *Dryopteris dilatata*, *Geranium erianthum*, and *Gymnocarpium dryopteris.* Shrubs were less common.
Subarctic Sedge Moss Wet Meadow (SSMWM) *n* = 8	Sedge-dominated communities found on wet sites that do not satisfy the requirements of other Project Vegetation Types. Moss cover ranges from sparse to nearly complete.	Sedges and cottongrasses, including *Carex aquatilis, C. lyngbyei, C. pluriflora, Eriophorum angustifolium,* and *E. russeolum,* formed the principal vegetation stratum. Some common shrubs included *Betula nana, Empetrum nigrum,* and *Salix fuscescens.*
Fresh Sedge Marsh (FSM) *n* = 0	Standing water 6 to14 inches deep dominated by members of the sedge family (*e.g., Carex* spp., *Eriophorum* spp.), often near open water.	This Project Vegetation Type was documented in the study area only by a limited-data collection plot. See Appendix 38A.
Halophytic Graminoid Wet Meadow (HGWM) *n* = 12	Characterized by grasses, sedges, and forbs adapted to living in saline environments.	Halophytic graminoids formed the herb stratum. Shrubs were scarce, but included *Salix fuscescens*. Herbs included *Calamagrostis deschampsioides, Carex lyngbyei, Chrysanthemum arcticum, Poa eminens,* and *Potentilla egedi.* This vegetation type was found along the coastal fringe.
Mesic Herb (MH) *n* = 6	Herb-dominated communities without a strong component of bluejoint, that occur on mesic sites, and that do not satisfy the requirements of other Project Vegetation Types	Shrub cover was less than 25% except in open, low communities of *Spiraea beauverdiana,* where mesic herbs dominated the aerial photograph vegetation signature. Other common shrubs included *Salix barclayi* and *Spiraea beauverdiana*. Common herbs included *Angelica lucida*, *Calamagrostis canadensis, Epilobium angustifolium, Gymnocarpium dryopteris,* and *Rubus arcticus.*

Project Vegetation Type and Number of Study Plots [a]	Definition	Typical Vegetative Composition Based on Sample Plots [b]
Fresh Herb Marsh (FHM) *n* = 1	Persistently flooded areas dominated by non-graminoid herbs that extend above the water surface (i.e., "emergents"). Water is >6 inches deep.	Emergent forbs in deep water formed the dominant stratum. The dominant species was *Equisetum fluviatile*.
Barren (BARE) *n* = 0	Less than 10% cover of vascular plants	This Project Vegetation Type was documented in the study area only by a limited-data collection plot. See Appendix 38A.
Partially Vegetated (PV) *n* = 0	Sparse (10-25%) cover of vascular plants	This Project Vegetation Type was documented in the study area only by a limited-data collection plot. See Appendix 38A.
Open Water (OW) *n* = 0	Standing or flowing water with <25% cover of vascular plants	This Project Vegetation Type was documented in the study area only by a limited-data collection plot. See Appendix 38A.

Notes:

a. Number of plots (*n*) includes plots where field investigators collected detailed vegetation data. It does not include limited-data collection plots.

b. See Appendix 38A for photos and further detail, including the common names associated with the Latin names given in this column. These descriptions are not necessarily based on statistical dominance but are based on a combination of frequency, cover, and professional experience to list species that create a typical picture of the site.

TABLE 38-4
Project Vegetation Types and Associated Acreages, Cook Inlet Drainages Mapping Area, 2004-2008

Project Vegetation Mapping Code	Project Vegetation Type	Number of Acres [a]	Percentage of Mapping Area [a]
Forest Types			
OSSF	Open Sitka Spruce Forest	1.4	0.04
OWSF	Open White Spruce Forest	8.9	0.23
WSW	White Spruce Woodland	11.5	0.30
BW	Broadleaf Woodland	1.0	0.03
Forest Types Totals		**22.8**	**0.59**
Shrub Types			
CWTS	Closed Willow Tall Shrub	1.2	0.03
CATS	Closed Alder Tall Shrub	1,205.4	31.15
CAWTS	Closed Alder Willow Tall Shrub	5.4	0.14
OWTS	Open Willow Tall Shrub	0.7	0.02
OATS	Open Alder Tall Shrub	450.7	11.65
OAWTS	Open Alder Willow Tall Shrub	2.5	0.06
OMSST	Open Mixed Shrub Sedge Tussock	3.0	0.08
ODBS	Open Dwarf Birch Shrub	32.7	0.85
LEST	Low Ericaceous Shrub Tundra	7.7	0.20
ODBESB	Open Dwarf Birch Ericaceous Shrub Bog	4.9	0.13
ESB	Ericaceous Shrub Bog	1.2	0.03
OWLS	Open Willow Low Shrub	1.2	0.03
OSGB	Open Sweetgale Graminoid Bog	<0.1	0.00
OAWLS	Open Alder Willow Low Shrub	3.3	0.08
OALS	Open Alder Low Shrub	450.4	11.64
DESLT	Dwarf Ericaceous Shrub Lichen Tundra	12.0	0.31
DEST	Dwarf Ericaceous Shrub Tundra	25.2	0.65
DEST-H	Dwarf Ericaceous Shrub Tundra–Hummocks	0.2	0.01
Shrub Types Totals		**2,207.7**	**57.05**
Herbaceous Types			
HDG	Halophytic Dry Graminoid	2.5	0.07
BTG	Bluejoint Tall Grass	6.3	0.16
BH	Bluejoint Herb	12.8	0.33
SSMWM	Subarctic Sedge Moss Wet Meadow	3.3	0.09
FSM	Fresh Sedge Marsh	3.0	0.08
HGWM	Halophytic Graminoid Wet Meadow	5.5	0.14
MH	Mesic Herb	16.3	0.42
FHM	Fresh Herb Marsh	0.9	0.02
Herbaceous Types Totals		**50.7**	**1.31**

Project Vegetation Mapping Code	Project Vegetation Type	Number of Acres [a]	Percentage of Mapping Area [a]
Land-cover Types			
BARE	Barren	142.2	3.67
PV	Partially Vegetated	316.2	8.17
OW	Open Water	1,130.3	29.21
Land-cover Types Totals		**1,588.6**	**41.05**
TOTAL MAPPING AREA		**3,869.9**	**100.00**

Note:

a. All numbers are rounded. Apparent inconsistencies in sums are the result of rounding.

TABLE 38-5
Grouped Vegetation Types and Associated Acreages, Cook Inlet Drainages Mapping Area, 2004-2008

Grouped Vegetation Type [a]	Project Vegetation Mapping Code [b]	Number of Acres [c]	Percentage of Mapping Area [c]
Open/Closed Forest	BW, OSSF, OWSF, WSW	22.8	0.6
Open Tall Shrub	OATS, OAWTS, OWTS	453.9	11.7
Closed Tall Shrub	CATS, CAWTS, CWTS	1,211.9	31.3
Open Low Shrub	OALS, OWLS, OAWLS, OSGB, OMSST, LEST, ESB, ODBESB, ODBS	504.4	13.0
Dwarf Shrub	DESLT, DEST, DEST-H	37.4	1.0
Dry to Moist Herbaceous	BTG, BH, MH, HDG	37.9	1.0
Wet Herbaceous	FHM, FSM, SSMWM, HGWM	12.8	0.3
Open Water	OW	1,130.3	29.2
Other	BARE, PV	458.4	11.8
TOTAL COVERAGE		**3,869.9**	**100.0**

Notes:

a. Project Vegetation Types were aggregated into vegetation type groups based on the dominant growth form (tree, shrub, or herb), vegetation density (open or closed canopy), and average height (low, dwarf, or tall).

b. Project Vegetation Mapping Codes are defined in Table 13.2-4.

c. All numbers are rounded. Apparent inconsistencies in sums are the result of rounding.

TABLE 38-6
AKNHP Tracked Vascular Plant Species Observed in the Cook Inlet Drainages Study Area, 2004-2008

Latin Name	Common Name	AKNHP Rank (Global and State) [a]	Project Vegetation Type	Plot Number, Approximate Location	Plant Identification Verification Status (Voucher Specimen Number)
Eleocharis kamtschatica	Kamchatka spikerush	G4 S2S3	Halophytic Graminoid Wet Meadow	HDR1265 Iniskin Bay	Identity of a voucher specimen was confirmed by C. Parker of the University of Alaska herbarium (MD04-388 and HDR1265)

Note:

a. The Alaska Natural Heritage Program (AKNHP) ranks plants with a code that describes their population status on a global (Gx) and on a statewide (Sx) level, where "x" represents a rank from 1 to 5, where 5 is a common plant with demonstrably secure populations, and 1 is a critically imperiled plant whose populations are vulnerable to extirpation or extinction. If the rank is uncertain, it is described as a range between two numbers (for example, S2S3) or with a question mark (for example, G5?). Tracked species are those with a state rank of S1 through S4. AKNHP rank is based on factors contributing to rarity, including population number and size, trends, and threats. An AKNHP rank of G4 S2S3 means that the species is apparently secure (uncommon but not rare, having some cause for long-term concern due to declines or other factors) throughout its entire global range, but within the State of Alaska, it ranges between being vulnerable (due to restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation) and apparently secure (uncommon but not rare, having some cause for long-term concern due to declines or other factors).

FIGURES

153°54'0"W 153°48'0"W 153°42'0"W 153°36'0"W 153°30'0"W 153°24'0"W 153°18'0"W

59°51'0"N
59°48'0"N
59°45'0"N
59°42'0"N
59°39'0"N
59°36'0"N

Tile 13
Tile 12
Tile 11
Tile 10
Williamsport
Bristol Bay Drainages
Cook Inlet Drainages
Iliamna Bay
Iniskin Bay
Knoll Head
Cook Inlet

153°54'0"W 153°48'0"W 153°42'0"W 153°36'0"W 153°30'0"W 153°24'0"W 153°18'0"W

THE pebble PARTNERSHIP

Figure 38-1
Overview
Vegetation Study Sites,
Cook Inlet Drainages Study Area,
2004 and 2005

Legend

- Cook Inlet Drainages Mapping Area
- Cook Inlet Drainages Study Area
- Grid for Detailed Mapping Tiles
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities
- Detailed-data Collection Plots
- Limited-data Collection Plots

Note: For detailed mapping see the individual tiles in this figure series.
Tiles 1-9, 14, and 15 are presented in the mapping for the Bristol Bay Drainages (EBD Chapter 13).

0 1 2 3 4 5 Miles
0 1 2 3 4 5 6 Kilometers

N

Scale 1:125,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

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Version: 3	Author: RDI- LS

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59°43'0"N 59°42'0"N 59°41'0"N 59°40'0"N 59°39'0"N

Williamsport

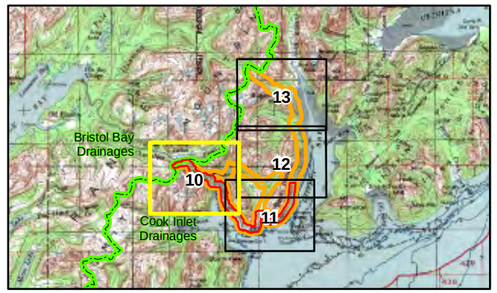
Iliamna Bay

THE pebble PARTNERSHIP

Figure 38-1
Tile 10
Vegetation Study Sites, Cook Inlet Drainages Study Area, 2004 and 2005

Legend

- Transportation-corridor Mapping Area
- Transportation-corridor Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities
- Detailed-data Collection Plots
- Limited-data Collection Plots



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Kilometers
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N

Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

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Version: 2	Author: RDI- LS

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59°40'0"N
59°39'0"N
59°38'0"N
59°37'0"N

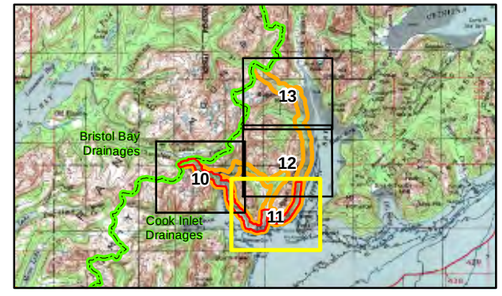
Iniskin Bay
Knoll Head
Turtle Reef
30
48
30
500
39

THE pebble PARTNERSHIP

Figure 38-1
Tile 11
Vegetation Study Sites, Cook Inlet Drainages Study Area, 2004 and 2005

Legend

- Transportation-corridor Mapping Area
- Transportation-corridor Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities
- Detailed-data Collection Plots
- Limited-data Collection Plots



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0 0.5 1 1.5 Kilometers

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Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig38-1_Veg_Fldplots_Tiled_11X17L_1of4_D02.mxd	Date: July 14, 2011
Version: 2	Author: RDI- LS

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59°44'0"N 59°43'0"N 59°42'0"N 59°41'0"N 59°40'0"N

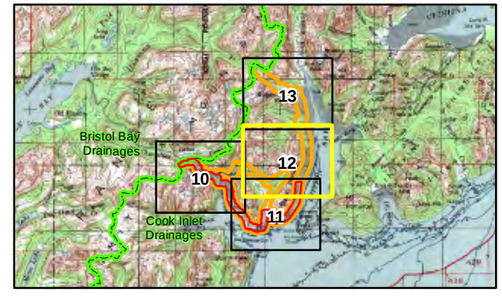
Iniskin Bay

THE pebble PARTNERSHIP

Figure 38-1
Tile 12
Vegetation Study Sites, Cook Inlet Drainages Study Area, 2004 and 2005

Legend

- Transportation-corridor Mapping Area
- Transportation-corridor Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities
- Detailed-data Collection Plots
- Limited-data Collection Plots



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0 0.5 1 1.5 Kilometers

N

Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig38-1_Veg_Fldplots_Tiled_11X17L_1of4_D02.mxd	Date: July 14, 2011
Version: 2	Author: RDI- LS

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59°48'0"N 59°47'0"N 59°46'0"N 59°45'0"N 59°44'0"N

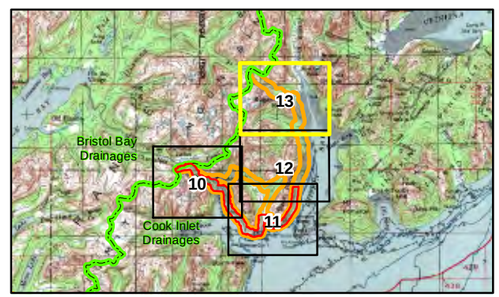
Iniskin River

THE pebble PARTNERSHIP

Figure 38-1
Tile 13
Vegetation Study Sites, Cook Inlet Drainages Study Area, 2004 and 2005

Legend

- Transportation-corridor Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities
- Detailed-data Collection Plots
- Limited-data Collection Plots



Miles
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Kilometers
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N

Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig38-1_Veg_Fldplots_Tiled_11X17L_1of4_D02.mxd	Date: July 14, 2011
Version: 2	Author: RDI- LS

153°42'0"W 153°36'0"W 153°30'0"W 153°24'0"W

59°42'0"N

59°39'0"N

59°36'0"N

Bristol Bay Drainages

Williamsport

Tile 10

Cook Inlet Drainages

Iliamna Bay

Tile 11

Knoll Head

Iniskin Bay

Turtle Reef

South Head

Cook Inlet

Project Vegetation Type (Acres in Cook Inlet Drainages Mapping Area)

Forested Types

- Open Sitka Spruce Forest (1)
- Open White Spruce Forest (9)
- White Spruce Woodland (11)
- Broadleaf Woodland (1)

Shrub Types

- Closed Willow Tall Shrub (1)
- Closed Alder Tall Shrub (1,205)
- Closed Alder Willow Tall Shrub (5)
- Open Willow Tall Shrub (1)
- Open Alder Tall Shrub (451)
- Open Alder Willow Tall Shrub (2)
- Open Mixed Shrub Sedge Tussock (3)
- Open Dwarf Birch Shrub (33)
- Low Ericaceous Shrub Tundra (8)
- Open Dwarf Birch-Ericaceous Shrub Bog (5)
- Ericaceous Shrub Bog (1)
- Open Willow Low Shrub (1)
- Open Sweetgale Graminoid Bog (<1)
- Open Alder Willow Low Shrub (3)
- Open Alder Low Shrub (450)
- Dwarf Ericaceous Shrub Lichen Tundra (12)
- Dwarf Ericaceous Shrub Tundra (25)
- Dwarf Ericaceous Shrub Tundra-Hummocks (<1)

Herbaceous Types

- Halophytic Dry Graminoid (3)
- Bluejoint Tall Grass (6)
- Bluejoint Herb (13)
- Subarctic Sedge Moss Wet Meadow (3)
- Fresh Sedge Marsh (3)
- Halophytic Graminoid Wet Meadow (6)
- Mesic Herb (16)
- Fresh Herb Marsh (1)

Land Cover Types

- Barren (142)
- Partially Vegetated (316)
- Open Water (1,130)

THE pebble PARTNERSHIP

Figure 38-2
Overview
Vegetation Mapping, Cook Inlet Drainages Mapping Area, 2004 and 2005

Legend

- Cook Inlet Drainages Mapping Area
- Cook Inlet Drainages Study Area
- Grid for Detailed Mapping Tiles
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities

Note: For detailed mapping see the individual tiles in this figure series.
Tiles 1-9, 14, and 15 are presented in the mapping for the Bristol Bay Drainages (EBD Chapter 13).
Tiles 12 and 13 are not presented because mapping did not extend into those areas.

Miles
0 0.5 1 1.5 2 2.5

Kilometers
0 0.5 1 1.5 2 2.5 3

Scale 1:70,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig39-2_Veg_Detail_Overview_11X17L_1of1_D03.mxd	Date: August 9, 2011
Version: 3	Author: RDI- LS

153°44'0"W 153°42'0"W 153°40'0"W 153°38'0"W 153°36'0"W

59°42'0"N

59°40'0"N

Williamsport

Iliamna Bay

Project Vegetation Type

Forested Types

- Open Sitka Spruce Forest
- Open White Spruce Forest
- White Spruce Woodland
- Broadleaf Woodland

Shrub Types

- Closed Willow Tall Shrub
- Closed Alder Tall Shrub
- Closed Alder Willow Tall Shrub
- Open Willow Tall Shrub
- Open Alder Tall Shrub
- Open Alder Willow Tall Shrub
- Open Mixed Shrub Sedge Tussock
- Open Dwarf Birch Shrub
- Low Ericaceous Shrub Tundra
- Open Dwarf Birch-Ericaceous Shrub Bog
- Ericaceous Shrub Bog
- Open Willow Low Shrub
- Open Sweetgale Graminoid Bog
- Open Alder Willow Low Shrub
- Open Alder Low Shrub
- Dwarf Ericaceous Shrub Lichen Tundra
- Dwarf Ericaceous Shrub Tundra
- Dwarf Ericaceous Shrub Tundra-Hummocks

Herbaceous Types

- Halophytic Dry Graminoid
- Bluejoint Tall Grass
- Bluejoint Herb
- Subarctic Sedge Moss Wet Meadow
- Fresh Sedge Marsh
- Halophytic Graminoid Wet Meadow
- Mesic Herb
- Fresh Herb Marsh

Land Cover Types

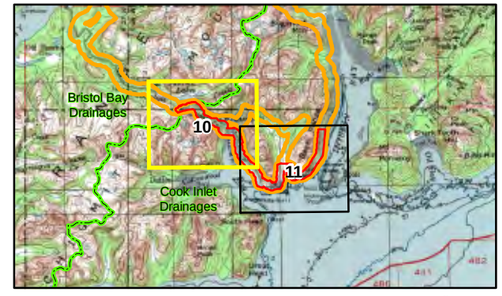
- Barren
- Partially Vegetated
- Open Water

THE pebble PARTNERSHIP

Figure 38-2
Tile 10
Vegetation Mapping, Cook Inlet Drainages Mapping Area, 2004 and 2005

Legend

- Cook Inlet Drainages Mapping Area
- Cook Inlet Drainages Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities



Miles
0 0.25 0.5 0.75 1 1.25

Kilometers
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N

Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig38-2_Veg_Detailed_Tiled11X17L_1of2_D02.mxd	**Date: July 15, 2011**
Version: 2	**Author: RDI- LS**

153°34'0"W 153°32'0"W 153°30'0"W 153°28'0"W 153°26'0"W

59°40'0"N

59°38'0"N

Inlskin Bay

Knoll Head

Turtle Reef

30

500

Project Vegetation Type

Forested Types
- Open Sitka Spruce Forest
- Open White Spruce Forest
- White Spruce Woodland
- Broadleaf Woodland

Shrub Types
- Closed Willow Tall Shrub
- Closed Alder Tall Shrub
- Closed Alder Willow Tall Shrub
- Open Willow Tall Shrub
- Open Alder Tall Shrub
- Open Alder Willow Tall Shrub
- Open Mixed Shrub Sedge Tussock
- Open Dwarf Birch Shrub
- Low Ericaceous Shrub Tundra
- Open Dwarf Birch-Ericaceous Shrub Bog
- Ericaceous Shrub Bog
- Open Willow Low Shrub
- Open Sweetgale Graminoid Bog
- Open Alder Willow Low Shrub
- Open Alder Low Shrub
- Dwarf Ericaceous Shrub Lichen Tundra
- Dwarf Ericaceous Shrub Tundra
- Dwarf Ericaceous Shrub Tundra-Hummocks

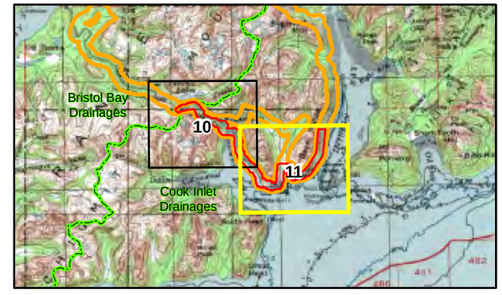
Herbaceous Types
- Halophytic Dry Graminoid
- Bluejoint Tall Grass
- Bluejoint Herb
- Subarctic Sedge Moss Wet Meadow
- Fresh Sedge Marsh
- Halophytic Graminoid Wet Meadow
- Mesic Herb
- Fresh Herb Marsh

Land Cover Types
- Barren
- Partially Vegetated
- Open Water

THE pebble PARTNERSHIP

Figure 38-2
Tile 11
Vegetation Mapping, Cook Inlet Drainages Mapping Area, 2004 and 2005

Legend
- Cook Inlet Drainages Mapping Area
- Cook Inlet Drainages Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities



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0 0.25 0.5 0.75 1 1.25 1.5 Kilometers

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Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig38-2_Veg_Detailed_Tiled11X17L_1of2_D02.mxd	Date: July 15, 2011
Version: 2	Author: RDI- LS

153°42'0"W 153°36'0"W 153°30'0"W 153°24'0"W

59°42'0"N

59°39'0"N

59°36'0"N

Bristol Bay Drainages

Williamsport

Tile 10

Cook Inlet Drainages

Iliamna Bay

Tile 11

Knoll Head

Iniskin Bay

Turtle Reef

South Head

Brown Peak

Cook Inlet

THE pebble PARTNERSHIP

Figure 38-3
Overview
Grouped Vegetation Mapping, Cook Inlet Drainages Mapping Area, 2004 and 2005

Legend

- Cook Inlet Drainages Mapping Area
- Cook Inlet Drainages Study Area
- Grid for Detailed Mapping Tiles
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities

Grouped Vegetation Types

- Open/Closed Forest
- Open Tall Shrub
- Closed Tall Shrub
- Open Low Shrub
- Dwarf Shrub
- Dry to Moist Herbaceous
- Wet Herbaceous
- Open Water
- Other (Barren, Partially Vegetated)

Note: For detailed mapping see the individual tiles in this figure series.
Tiles 1-9, 14, and 15 are presented in the mapping for the Bristol Bay Drainages (EBD Chapter 13).
Tiles 12 and 13 are not presented because mapping did not extend into those areas.

0 0.5 1 1.5 2 2.5 Miles

0 0.5 1 1.5 2 2.5 3 Kilometers

Scale 1:70,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

N

File: RDI_HDR_EBD_Fig38-3_Veg_Group_Overview_11X17L_1of1_D03.mxd	Date: August 9, 2011
Version: 3	Author: RDI- LS

153°44'0"W 153°42'0"W 153°40'0"W 153°38'0"W 153°36'0"W

59°42'0"N

59°40'0"N

Williamsport

Iliamna Bay

THE pebble PARTNERSHIP

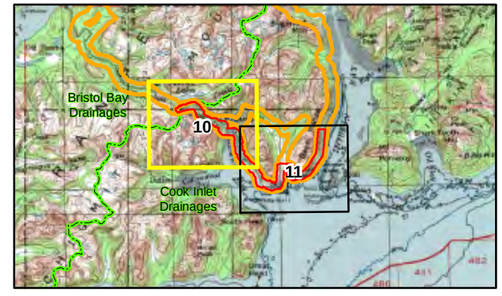
Figure 38-3
Tile 10
Grouped Vegetation Mapping, Cook Inlet Drainages Mapping Area, 2004 and 2005

Legend

- Cook Inlet Drainages Mapping Area
- Cook Inlet Drainages Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities

Grouped Vegetation Types

- Open/Closed Forest
- Open Tall Shrub
- Closed Tall Shrub
- Open Low Shrub
- Dwarf Shrub
- Dry to Moist Herbaceous
- Wet Herbaceous
- Open Water
- Other (Barren, Partially Vegetated)



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0 0.25 0.5 0.75 1 1.25 1.5 Kilometers

N

Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig38-3_Veg_Group_Tiled11X17L_1of2_D02.mxd	Date: July 15, 2011
Version: 2	Author: RDI- LS

153°34'0"W 153°32'0"W 153°30'0"W 153°28'0"W 153°26'0"W

59°40'0"N

59°38'0"N

Knoll Head

Iniskin Bay

Turtle Reef

30 48 30 500 39

153°34'0"W 153°32'0"W 153°30'0"W 153°28'0"W 153°26'0"W

THE pebble PARTNERSHIP

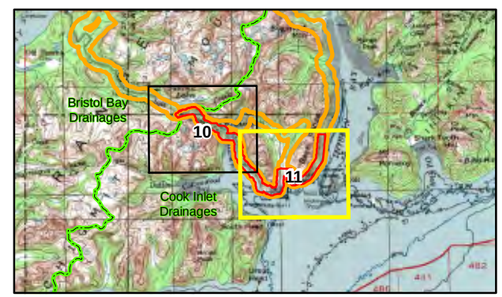
Figure 38-3
Tile 11
Grouped Vegetation Mapping, Cook Inlet Drainages Mapping Area, 2004 and 2005

Legend

- Cook Inlet Drainages Mapping Area
- Cook Inlet Drainages Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities

Grouped Vegetation Types

- Open/Closed Forest
- Open Tall Shrub
- Closed Tall Shrub
- Open Low Shrub
- Dwarf Shrub
- Dry to Moist Herbaceous
- Wet Herbaceous
- Open Water
- Other (Barren, Partially Vegetated)



0 0.25 0.5 0.75 1 1.25 Miles

0 0.25 0.5 0.75 1 1.25 1.5 Kilometers

N

Scale 1:31,680

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: RDI_HDR_EBD_Fig38-3_Veg_Group_Tiled11X17L_1of2_D02.mxd	Date: July 15, 2011
Version: 2	Author: RDI- LS

APPENDICES

APPENDIX 38A

Photographs and Descriptions of Project Vegetation Types, Cook Inlet Drainages Study Area 2004-2008

Photographs and Descriptions of Project Vegetation Types Cook Inlet Drainages Study Area, 2004-2008

This document shows photographs and descriptions of the Project Vegetation Types identified during 2004-2008 vegetation and wetland studies in the Cook Inlet drainages study area for Pebble Project. Project Vegetation Types frequently are named for the species that dominated the principal vegetation stratum in study plots with that Project Vegetation Type. For example, for the Project Vegetation Type Open White Spruce Forest, white spruce trees dominated the tree stratum. Project Vegetation Types that are not are not named for specific species (e.g., Closed Broadleaf Forest or Open Mixed Forest) may have more than one dominant species in the principal vegetation stratum. Dominant species are those species that are predominant in their stratum (tree, shrub, or herb) in a given study plot based on percent coverage (as determined by the 50/20/20 rule, which is described in detail in Chapter 39 of the *Pebble Project Environmental Baseline Document*).

Plant species listed in the descriptions of the Project Vegetation Types are categorized as either characteristic or frequently observed. In species-specific Project Vegetation Types, the characteristic species is always the eponymous dominant species. In the broader Project Vegetation Types, the characteristic species are those that were most frequently dominant in the study plots for the specified Project Vegetation Type. For instance, the dominant tree species in any given study plot for Open Broadleaf Forest may be cottonwood, Kenai birch, or paper birch, or some mix thereof. The characteristic species for that Project Vegetation Type overall is cottonwood, because that species was the dominant species in greatest number of study plots characterized as Open Broadleaf Forest. Frequently observed species are not necessarily dominant species. Frequently observed species are those found in a majority of plots for the particular Project Vegetation Type, but although they were widespread throughout the Project Vegetation Type, they may have occurred in small numbers (a few plants in each of many plots).

If detailed vegetation data were collected only in the Bristol Bay drainages study areas, this information is noted below the name of the Project Vegetation Type.

Representative photograph: CSSF, Closed Sitka Spruce Forest from plot #HDR0242, September 2004.

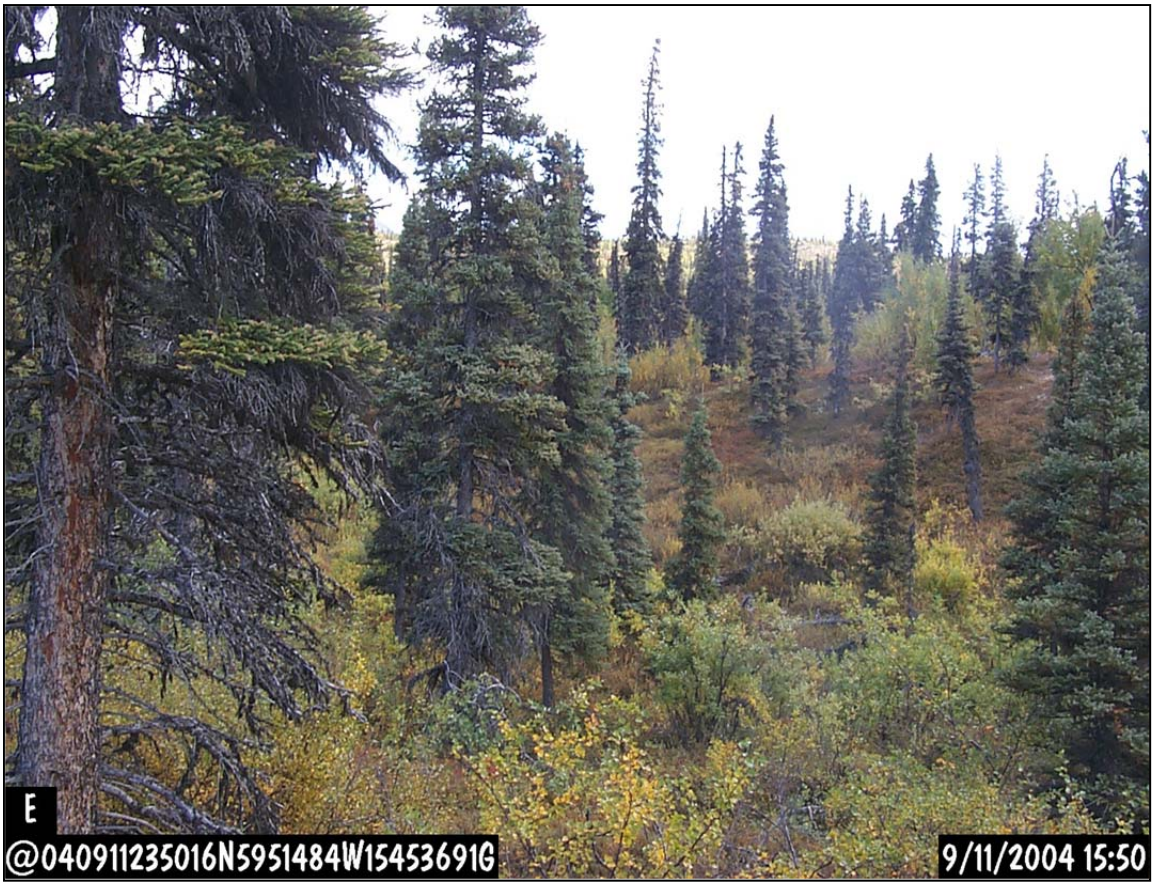
Closed Sitka Spruce Forest (CSSF)

Vegetation Type Requirements:	Closed forest (tree canopy cover >60 percent) dominated by Sitka spruce
Characteristic Species:	Sitka spruce (*Picea sitchensis*)
Other Frequently Observed Species:	Devil's club (*Oplopanax horridus*), mock azalea (*Menziesia ferruginea*), oak fern (*Gymnocarpium dryopteris*), early blueberry (*Vaccinium ovalifolium)*, and strawberry leaf raspberry (*Rubus pedatus*)

Representative photograph: OWSF, Open White Spruce Forest from plot #3PP02910, July 2006.

Open White Spruce Forest (OWSF)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Open forest (tree canopy cover 25-60 percent) dominated by white spruce
Characteristic Species:	White spruce (*Picea glauca*)
Other Frequently Observed Species:	Bog blueberry (*Vaccinium uliginosum*), dwarf birch (*Betula nana* ssp*. exilis*), black crowberry (*Empetrum nigrum*), and narrow-leaf Labrador tea (*Ledum decumbens*)



Representative photograph: WSW, White Spruce Woodland from plot #HDR3325, September 2004.

White Spruce Woodland (WSW)

Vegetation Type Requirements:	Woodland forest (tree canopy cover 10-24 percent) dominated by white spruce
Characteristic Species:	White spruce (*Picea glauca*)
Other Frequently Observed Species:	Willows (*Salix* spp.), bluejoint reedgrass (*Calamagrostis canadensis*), and fireweed (Epilobium angustifolium) were most abundant in the understory.

Representative photograph: OBF, Open Broadleaf Forest from plot #HDR3367, July 2005.

Open Broadleaf Forest (OBF)

Vegetation Type Requirements:	Open forest (tree canopy cover 25-60 percent) dominated by broadleaf tree species
Characteristic Species:	Kenai birch (*Betula kenaica)* and cottonwoods (*Populus balsamifera*)
Other Frequently Observed Species:	*Sitka alder* (*Alnus sinuata*), devil's club (*Oplopanax horridus*), bluejoint reedgrass (*Calamagrostis canadensis*), horsetails (*Equisetum* spp.), oak fern (*Gymnocarpium dryopteris*), mountain woodfern (*Dryopteris dilatata*), narrow beech fern (*Thelypteris phegopteris*), and fireweed (*Epilobium angustifolium*)

Representative photograph: BW, Broadleaf Woodland from plot #HDR 1703, August 2005.

Broadleaf Woodland (BW)

Vegetation Type Requirements:	Woodland forest (tree canopy cover 10-24 percent) dominated by broadleaf species
Characteristic Species:	Cottonwood (*Populus balsamifera)*, Kenai birch (*Betula kenaica*)
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*), Sitka alder (*Alnus sinuata*), and oak fern (*Gymnocarpium dryopteris*)

Representative photograph: CWTS, Closed Willow Tall Shrub from plot #3PP00325, July 2004.

Closed Willow Tall Shrub (CWTS)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Closed stands (>75 percent cover) of tall willow (>5 feet tall)
Characteristic Species:	Diamondleaf willow (*Salix pulchra*), Barclay's willow (*Salix barclayi*)
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*) and sedges (*Carex* spp.)
General distribution, if notable:	Riparian corridors

Representative photograph: CATS, Closed Alder Tall Shrub from plot #HDR0146, August 2004.

Closed Alder Tall Shrub (CATS)

Vegetation Type Requirements:	Closed stands (>75 percent cover) of tall alder (>5 feet tall)
Characteristic Species:	Sitka alder (*Alnus sinuata)*
Other Frequently Observed Species:	Mountain woodfern (*Dryopteris dilatata* ssp. *americana)*, bluejoint reedgrass (*Calamagrostis canadensis),* devil's club (*Oplopanax horridus*), oak fern (*Gymnocarpium dryopteris*), and salmonberry (*Rubus spectabilis*)
General distribution, if notable:	Drier microsites on slopes and mountainsides

Representative photograph: CAWTS, Closed Alder Willow Tall Shrub from plot #3PP00510, August 2004.

Closed Alder Willow Tall Shrub (CAWTS)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Closed shrub stands (>75% cover) co-dominated by tall alder and willow (>5 feet tall)
Characteristic Species:	Sitka alder (*Alnus sinuata*) and felt-leaf willow (*Salix alaxensis*)
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*)

Representative photograph: OWTS, Open Willow Tall Shrub from plot #3PP00290, July 2004.

Open Willow Tall Shrub (OWTS)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Open stands (25-75 percent cover) of tall willow (>5 feet tall)
Characteristic Species:	Diamondleaf willow (*Salix pulchra*), gray-leaf willow (*Salix glauca*), and Barclay's willow (*Salix barclayi*)
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*), horsetails (*Equisetum* spp.), and bog blueberry (*Vaccinium uliginosum*)
General distribution, if notable:	Riparian corridors

Representative photograph: OATS, Open Alder Tall Shrub from plot #HDR1639, July 2005.

Open Alder Tall Shrub (OATS)

Vegetation Type Requirements:	Open stands (25-75 percent cover) of tall alder (>5 feet tall)
Characteristic Species:	Sitka alder (*Alnus sinuata*)
Other Frequently Observed Species:	Mountain woodfern (*Dryopteris dilatata* ssp. *americana*), bluejoint reedgrass (*Calamagrostis canadensis*), Beauverd spirea (*Spiraea beauverdiana*), subarctic lady fern (*Athyrium filix-femina*), bog blueberry (*Vaccinium uliginosum*), black crowberry (*Empetrum nigrum*), and salmonberry (*Rubus spectabilis*)
General distribution, if notable:	Drier microsites on slopes and mountainsides, including dry swales and benches

Representative photograph: OAWTS, Open Alder Willow Tall Shrub from plot #3PP01689, August 2005.

Open Alder Willow Tall Shrub (OAWTS)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Open shrub stands co-dominated by alder and willow (>5 feet tall). The combined cover of alder and willow is 25-75 percent.
Characteristic Species:	Sitka alder (*Alnus sinuata*) and Barclay's willow (*Salix barclayi*)
Other Frequently Observed Species:	Mountain woodfern (*Dryopteris dilatata* ssp. *americana*) and bluejoint reedgrass (*Calamagrostis canadensis*).

Representative photograph: CWLS, Closed Willow Low Shrub from plot #HDR1611, July 2004.

Closed Willow Low Shrub (CWLS)

Vegetation Type Requirements:	Closed stands (>75 percent cover) of low willow (<5 feet tall)
Characteristic Species:	Barclay's willow (*Salix barclayi*)
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*) and Alaska long-awn sedge (*Carex macrochaeta*)

Representative photograph: OMSST, Open Mixed Shrub Sedge Tussocks from plot #HDR0098, August 2004.

Open Mixed Shrub Sedge Tussock (OMSST)

Vegetation Type Requirements:	Tussock tundra co-dominated by low shrubs (<5 feet tall) and tussock-forming graminoids
Characteristic Species:	Low and dwarf shrubs and members of the sedge family (Cyperaceae), including cottongrass (*Eriophorum* spp.).
Other Frequently Observed Species:	Dwarf birch (*Betula nana* ssp. *exilis*), blueberries and cranberries (*Vaccinium* spp.), water sedge (*Carex aquatilis*), and bluejoint reedgrass (*Calamagrostis canadensis*)

Representative photograph: ODBS, Open Dwarf Birch Shrub from plot #HDR0235, September 2004.

Open Dwarf Birch Shrub (ODBS)

Vegetation Type Requirements:	Open stands (25-75 percent cover) of dwarf birch and/or shrub birch
Characteristic Species:	Dwarf birch (*Betula nana* ssp. *exilis)*
Other Frequently Observed Species:	Willows (*Salix* spp.), Sitka alder (*Alnus sinuata*), bog blueberry (*Vaccinium uliginosum*), black crowberry (*Empetrum nigrum*), bluejoint reedgrass (*Calamagrostis canadensis*), Canada bunchberry (*Cornus suecica*), mountain woodfern (*Dryopteris dilatata* ssp. *americana*), cloudberry (*Rubus chamaemorus*), and sedges (*Carex* spp.)

Representative photograph: LEST, Low Ericaceous Shrub Tundra from plot #HDR2105, August 2004.

Low Ericaceous Shrub Tundra (LEST)

Vegetation Type Requirements:	Tundra dominated by low ericaceous shrubs (>8 inches)
Characteristic Species:	Black crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), narrow-leaf Labrador tea (*Ledum decumbens*), and dwarf birch (*Betula nana* ssp. *exilis)*
Other Frequently Observed Species:	Sitka alder (*Alnus sinuata*), bluejoint reedgrass (*Calamagrostis canadensis*), scattered sedges *(e.g., Carex microchaeta s.l.),* mountain woodfern (*Dryopteris dilatata*), fireweed (*Epilobium angustifolium*), and arctic raspberry (*Rubus arcticus)*

Representative photograph: ODBESB, Open Dwarf Birch Ericaceous Shrub Bog from plot #HDR0241, September 2004.

Open Dwarf Birch Ericaceous Shrub Bog (ODBESB)

Vegetation Type Requirements:	Bogs with abundant ericaceous shrubs and dwarf birch
Characteristic Species:	Dwarf birch (*B. nana* ssp. *exilis*), bog blueberry (*Vaccinium uliginosum*), narrow-leaf Labrador tea (*Ledum decumbens*), black crowberry (*Empetrum nigrum*)
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*), Canada bunchberry (*Cornus suecica*), tufted bulrush (*Scirpus cespitosus*), and sphagnum mosses (*Sphagnum* spp.)

Representative photograph: ESB, Ericaceous Shrub Bog from plot #3PP02685, August 2005.

Ericaceous Shrub Bog (ESB)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Bogs with abundant mosses and ericaceous shrubs, but only sparse dwarf birch
Characteristic Species:	Bog blueberry (*Vaccinium uliginosum*), narrow-leaf Labrador tea (*Ledum decumbens*), black crowberry (*Empetrum nigrum*), scattered dwarf birch (*Betula nana* ssp. *exilis*), bog rosemary (*Andromeda polifolia*)
Other Frequently Observed Species:	Cottongrass (*Eriophorum* spp.), sedges (*Carex* spp.), cloudberry (*Rubus chamaemorus*), *Sphagnum* spp.

Representative photograph: OWLS, Open Willow Low Shrub from plot #HDR0236, September 2004.

Open Willow Low Shrub (OWLS)

Vegetation Type Requirements:	Open stands (25-75 percent cover) of low willow (<5 feet tall)
Characteristic Species:	Diamondleaf willow (*Salix pulchra*), Barclay's willow (*S. barclayi*)
Other Frequently Observed Species:	Beauverd spirea *(Spiraea beauverdiana),* bluejoint reedgrass (*Calamagrostis canadensis*), fireweed (*Epilobium angustifolium*), Canada bunchberry (*Cornus suecica*), Alaska long-awn sedge (*Carex macrochaeta*), and narrow beech fern (*Thelypteris phegopteris)*

Representative photograph: OWLSF, Open Willow Low Shrub Fen from plot #HDR3368, July 2005.

Open Willow Low Shrub Fen (OWLSF)

Vegetation Type Requirements:	Fens characterized by open stands (25-75 percent cover) of low willows (<5 feet tall)
Characteristic Species:	Diamondleaf willow (*Salix pulchra*)
Other Frequently Observed Species:	Alaska long-awn sedge (*Carex macrochaeta*), tufted bulrush (*Scirpus cespitosus*), and Sphagnum moss *(Sphagnum spp.)*
General distribution, if notable:	Wet sites, including seeps and springs

Representative photograph: OSGB, Open Sweet Gale Bog from plot #HDR4024, July 2007.

Open Sweetgale Graminoid Bog (OSGB)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Bogs characterized by an abundance of sweetgale (>25 percent cover)
Characteristic Species:	Sweetgale (*Myrica gale*)
Other Frequently Observed Species:	Dwarf birch (*Betula nana* ssp. *exilis*), bog rosemary (*Andromeda polifolia*), shrubby cinquefoil (*Potentilla fruticosa*), cottongrass (*Eriophorum* spp.), and sedges (*Carex* spp.), particularly water sedge (*Carex aquatilis*)
General distribution, if notable:	Saturated soils

Representative photograph: OAWLS, Open Alder Willow Low Shrub from plot #3PP01002, July 2004.

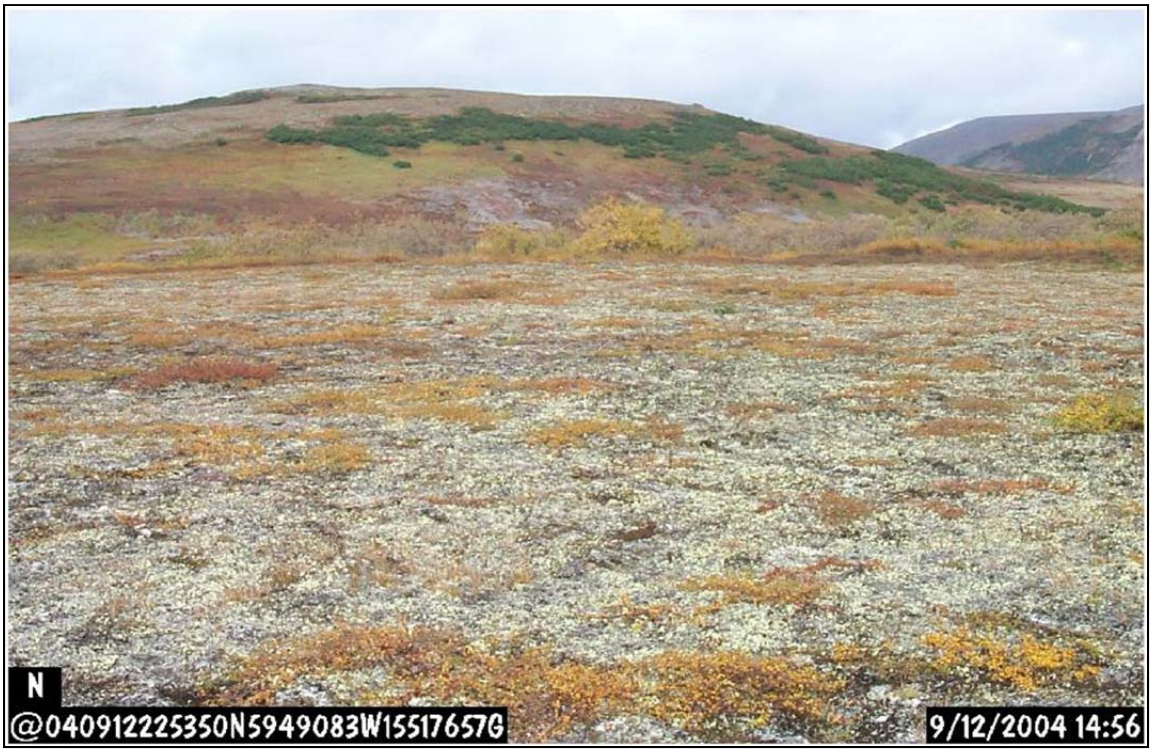
Open Alder Willow Low Shrub (OAWLS)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Open shrub stands co-dominated by alder and willow (<5 feet tall). The combined cover of alder and willow is 25-75 percent
Characteristic Species:	Sitka alder (*Alnus sinuata*), diamondleaf willow (*Salix pulchra*), Barclay's willow (*Salix barclayi*)
Other Frequently Observed Species:	Beauverd spirea (*Spiraea beauverdiana*), crowberry (*Empetrum nigrum),* bog blueberry *(Vaccinium uliginosum),* and bluejoint reedgrass (*Calamagrostis canadensis).*

Representative photograph: OALS, Open Alder Low Shrub from plot #HDR0096, August 2004.

Open Alder Low Shrub (OALS)

Vegetation Type Requirements:	Open stands (25-75 percent cover) of low alder (<5 feet tall)
Characteristic Species:	Sitka alder (*Alnus sinuata)*
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*), showy sedge (*Carex spectabilis*), mountain woodfern (*Dryopteris dilatata*), oak fern (*Gymnocarpium dryopteris*), narrow beech fern (*Thelypteris phegopteris*)



Representative photograph: DESLT, Dwarf Ericaceous Shrub Lichen Tundra from plot #3PP00749, September 2004.

Dwarf Ericaceous Shrub Lichen Tundra (DESLT)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Lichen-dominated ground (>60 percent cover) with >25 percent cover of dwarf ericaceous shrubs (<8 inches tall)
Characteristic Species:	Reindeer lichens (*Cladonia* spp., *Cladina* spp.), black crowberry (*Empetrum nigrum*), narrow-leaf Labrador tea (*Ledum decumbens*), dwarf birch (*Betula nana* ssp. *exilis*), and bog blueberry (*Vaccinium uliginosum*)
Other Frequently Observed Species:	Bluejoint reedgrass (*Calamagrostis canadensis*), scattered sedges (*e.g.,* Bigelow's sedge [*Carex bigelowii s.l. and* smallawned sedge [*Carex microchaeta s.l.*]), and dwarf willows (*e.g., Salix arctica, S. phlebophylla)*

Representative photograph: DEST, Dwarf Ericaceous Shrub Tundra from plot #HDR0237, September 2004.

Dwarf Ericaceous Shrub Tundra (DEST)

Vegetation Type Requirements:	Tundra that does not satisfy the requirements of other Project Vegetation Types and is dominated by dwarf ericaceous shrubs (<8 inches tall)
Characteristic Species:	Black crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), narrow-leaf Labrador tea (*Ledum decumbens*), dwarf birch (*Betula nana* ssp. *exilis*)
Other Frequently Observed Species:	Beauverd spirea *(Spiraea beauverdiana),* bluejoint reedgrass (*Calamagrostis canadensis*), sedges (*e.g.,* showy sedge, *Carex spectabilis.*), and Canada bunchberry (*Cornus suecica*)

Representative photograph: DEST-H, Dwarf Ericaceous Shrub Tundra- Hummocks from plot #3PP03280, June 2006.

Dwarf Ericaceous Shrub Tundra—Hummocks (DEST-H)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Tundra characterized by dwarf ericaceous shrubs (>25 percent cover) growing on moderate to large hummocks (>6 inches tall)
Characteristic Species:	Narrow-leaf Labrador tea (*Ledum decumbens*), dwarf birch (*Betula nana* ssp. *exilis*), black crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum)*, and mountain cranberry (*V. vitis-idaea* ssp. *minus*), alpine bearberry (*Arctostaphylos alpina*)
Other Frequently Observed Species:	Sedges (*e.g.,* Bigelow's sedge [*Carex bigelowii s.l.*]), lichens, Beauverd spirea (*Spiraea beauverdiana*), Alaska bog willow (*Salix fuscescens*), diamondleaf willow (*S. pulchra*), bluejoint reedgrass (*Calamagrostis canadensis*), arctic raspberry (*Rubus arcticus*), and cloudberry (*Rubus chamaemorus*).

Representative photograph: HDG, Halophytic Dry Graminoids from plot #HDR0233, September 2004.

Halophytic Dry Graminoid (HDG)

Vegetation Type Requirements:	Dominated by beach rye grass
Characteristic Species:	Beach rye grass (*Elymus arenarius*)
Other Frequently Observed Species:	Lyngbye's sedge *(Carex lyngbyei)* and red fescue (*Festuca rubra*)
General distribution, if notable:	Found in valley bottoms in the coastal fringe

Representative photograph: BTG, Bluejoint Tall Grass from plot #HDR0094, August 2004.

Bluejoint Tall Grass (BTG)

Vegetation Type Requirements:	Abundant bluejoint reedgrass; other herbs and grasses may be present but are not co-dominant
Characteristic Species:	Bluejoint reedgrass (*Calamagrostis canadensis*)
Other Frequently Observed Species:	Sitka alder (*Alnus sinuata*), salmonberry (*Rubus spectabilis*), Barclay's willow (*Salix barclayi*), diamondleaf willow (*Salix pulchra*), Beauverd spirea *(Spiraea beauverdiana)*, subacrctic lady fern (*Athyrium filix-femina*), and oak fern (*Gymnocarpium dryopteris)*
General distribution, if notable:	Floodplains and hillsides

Representative photograph: BH, Bluejoint Tall Grass Herb from plot #HDR0243, September 2004.

Bluejoint Herb (BH)

Vegetation Type Requirements:	Abundant bluejoint reedgrass interspersed with other herbs
Characteristic Species:	Bluejoint reedgrass (*Calamagrostis canadensis)* and fireweed (*Epilobium angustifolium)*
Other Frequently Observed Species:	Yarrow (*Achillea borealis*), seawatch angelica (*Angelica lucida*), mountain woodfern (*Dryopteris dilatata*), oak fern *(Gymnocarpium dryopteris),* and wooly geranium (*Geranium erianthum*)

Representative photograph: SSMWM, Subarctic Sedge Moss Wet Meadow from plot #HDR0232, September 2004.

Subarctic Sedge Moss Wet Meadow (SSMWM)

Vegetation Type Requirements:	Graminoid-dominated communities found on wet soils and that do not satisfy the requirements of other Project Vegetation Types
Characteristic Species:	Sedges (*e.g.,* water sedge [*Carex aquatilis],* Lyngbye's sedge [*C. lyngbyei*]*,* several flowered sedge [*C. pluriflora*]), sphagnum mosses (*Sphagnum* spp.), cottongrasses (*e.g.,* narrow-leaf cottongrass *[Eriophorum angustifolium*], Russet's cottongrass [*E. russeolum]*)
Other Frequently Observed Species:	Dwarf birch (*Betula nana* ssp. *exilis*), Alaska bog willow (*Salix fuscescens*), and black crowberry *(Empetrum nigrum*)

Representative photograph: FSM, Fresh Sedge Marsh from plot #3PP02781, September 2005.

Fresh Sedge Marsh (FSM)
Documented in the field only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Dominated by members of the sedge family (*e.g.,* sedges [*Carex* spp.], cottongrass [*Eriophorum* spp.]) rooted in standing water
Characteristic Species:	Water sedge (*Carex aquatilis*), Lyngbye's sedge (*Carex lyngbyei*), Northwest Territory sedge (*Carex rhynchosphysa s.l.*)
Other Frequently Observed Species:	Marsh cinquefoil (*Potentilla palustris*) and bluejoint reedgrass (*Calamagrostis canadensis*), narrow-leaf cottongrass (*Eriophorum angustifolium*), russet cottongrass (*Eriophorum russeolum s.l.*); Alaska bog willow (*Salix fuscescens*) and dwarf birch (*Betula nana* ssp. *exilis)* are often observed in drier microsites
General distribution, if notable:	Shallow standing water

Representative photograph: HGWM, Halophytic Graminoid Wet Meadow from plot #HDR1273, September 2004.

Halophytic Graminoid Wet Meadow (HGWM)

Vegetation Type Requirements:	Characterized by herbaceous plants adapted to living in saline environments
Characteristic Species:	Circumpolar small-reedgrass *(Calamagrostis deschampsioides),* Lyngbye's sedge *(Carex lyngbyei),* few flowered sedge *(C. pauciflora),*several flowered sedge *(C. pluriflora),* Ramensks sedge *(C. ramenskii),*tufted hairgrass *(Deschampsia cespitosa),* sea lyme-grass *(Elymus arenarius),* red fescue *(Festuca rubra),* four-leaf mare's tail *(Hippuris tetraphylla),* arctic rush *(Juncus arcticus),* seaside plantain *(Plantago maritime),* large-flower bluegrass *(Poa eminens),* silverweed *(Potentilla anserine),* silverweed cinquefoil *(Potentilla egedii),* marsh cinquefoil *(Potentilla palustris),* and creeping alkali grass *(Puccinellia phryganodes)*.
Other Frequently Observed Species:	Alaska bog willow *(Salix fuscescens),* arctic daisy (*Chrysanthemum arcticum)*
General distribution, if notable:	Found in valley bottoms and along shorelines in the coastal fringe

Representative photograph: MH, Mesic Herb from plot #HDR3347, July 2005.

Mesic Herb (MH)

Vegetation Type Requirements:	Herb-dominated communities that occur on mesic sites and do not satisfy the requirements of other Project Vegetation Types
Characteristic Species:	Bluejoint reedgrass (*Calamagrostis canadensis*), arctic raspberry (*Rubus arcticus)*, oak fern *(Gymnocarpium dryopteris)*, and fireweed (*Epilobium angustifolium)*
Other Frequently Observed Species:	Beauverd spirea (*Spiraea beauverdiana*), Barclay's willow (*Salix barclayi),* and seawatch angelica (*Angelica lucida)*

Representative photograph: FHM, Fresh Herb Marsh from plot #HDR1735, August 2005.

Fresh Herb Marsh (FHM)

Vegetation Type Requirements:	Dominated by emergent herbaceous plants rooted in standing water
Characteristic Species:	Horsetails (*e.g., Equisetum fluviatile, E. hyemale*)
Other Frequently Observed Species:	Sedges (*Carex* spp.) and buckbean (*Menyanthes trifoliata*)
General distribution, if notable:	Shallow standing water

Representative photograph: BARE, Barren from plot #HDR0141, August 2004.

Barren (BARE)

Vegetation Type Requirements:	Very sparse (<10 percent cover) of vascular plants
Characteristic Species:	N/A
Other Frequently Observed Species:	N/A
General distribution, if notable:	Seasonally flooded gravel bars and ponds, exposed areas along hillsides and ridge tops, and shorelines

N/A = Not applicable

Representative photograph: PV, Partially Vegetated from plot #3PP00762, July 2004.

Partially Vegetated (PV)
Detailed vegetation data collected only in the Bristol Bay drainages study areas.

Vegetation Type Requirements:	Sparse (10-25 percent) cover of vascular plants
Characteristic Species:	Scattered short herbs, particularly bluejoint reedgrass *(Calamagrostis canadensis)*
Other Frequently Observed Species:	Dwarf ericaceous shrubs, low or dwarf willows (*Salix* spp.)
General distribution, if notable:	Seasonally flooded gravel bars or ponds and in exposed areas along hillsides and ridge tops

Representative photograph: OW, Open Water from plot #HDR1612, July 2005.

Open Water (OW)

Vegetation Type Requirements:	Unvegetated to very sparsely vegetated
Characteristic Species:	N/A
Other Frequently Observed Species:	N/A
General distribution, if notable:	Streambeds, river channels, lakes, and ponds

N/A = Not applicable

APPENDIX 38B

Draft List of Plant Species Observed in the Cook Inlet Drainages Study Area 2004-2008

Draft List of Plant Species Observed in the Cook Inlet Drainages Study Area, 2004-2008

Latin Name	Common Name
Trees	
Alnus sinuata (tree)	Sitka alder
Betula kenaica (tree)	Kenai birch
Picea glauca (tree)	White spruce
Picea sitchensis (tree)	Sitka spruce
Populus balsamifera (tree)	Cottonwood
Salix alaxensis (tree)	Felt-leaf willow
Picea glauca (sapling)	White spruce
Picea sitchensis (sapling or dwarf)	Sitka spruce
Shrubs	
Alnus sinuata (shrub)	Sitka alder
Andromeda polifolia	Bog rosemary
Arctostaphylos alpina	Alpine bearberry
Arctostaphylos uva-ursi	Kinnikinnick
Artemisia tilesii	Sagebrush
Betula glandulosa	Shrub birch
Betula hybrid	Birch hybrid
Betula kenaica (shrub)	Kenai birch
Betula nana ssp. *exilis*	Dwarf birch
Cassiope lycopodioides	Clubmoss mountain heather
Diapensia lapponica	Pincushion plant
Empetrum nigrum	Black crowberry
Harrimanella stelleriana	Alaska moss heather
Juniperus communis	Juniper
Ledum decumbens	Narrow-leaf Labrador tea
Ledum palustre s.l.	Marsh Labrador tea
Linnaea borealis	Twinflower
Loiseleuria procumbens	Alpine azalea
Menziesia ferruginea	Mock-azalea
Oplopanax horridus	Devil's club
Potentilla fruticosa	Shrubby cinquefoil
Ribes glandulosum	Skunk currant
Ribes hudsonianum	Hudson Bay currant
Ribes laxiflorum	Trailing black currant
Ribes sp.	Unspecified currant
Ribes triste	Swamp red currant
Rubus sp.	Unspecified rubus
Rubus spectabilis	Salmonberry
Salix alaxensis (shrub)	Felt-leaf willow
Salix arctica	Arctic willow

Latin Name	Common Name
Salix barclayi	Barclay's willow
Salix fuscescens	Alaska bog willow
Salix glauca	Gray-leaf willow
Salix pulchra	Diamondleaf willow
Salix sp.	Unspecified willow
Sambucus racemosa	European red elder
Sorbus sitchensis	Mountain ash
Spiraea beauverdiana	Beauverd spirea
Vaccinium alaskaense	Alaska blueberry
Vaccinium ovalifolium	Early blueberry
Vaccinium oxycoccos	Small cranberry
Vaccinium uliginosum	Bog blueberry
Vaccinium vitis-idaea ssp. *minus*	Mountain cranberry
Viburnum edule	Squashberry
Herbs	
Achillea borealis	Yarrow
Achillea millefolium s.l.	Common yarrow
Aconitum delphiniifolium	Monkshood (larkspur-leaf)
Agrostis alaskana	Alaska bentgrass
Agrostis borealis	Northern bentgrass
Agrostis scabra	Rough bentgrass
Agrostis sp.	Unspecified agrostis
Androsace chamaejasme	Sweet-flower rock-jasmine
Anemone narcissiflora	Narcissus-flowered anemone
Angelica genuflexa	Kneeling angelica
Angelica lucida	Seawatch angelica
Arctagrostis latifolia	Arctic-bentgrass, broad-leaf
Arnica sp.	Unspecified arnica
Artemisia arctica	Mountain sagewort
Artemisia sp.	Unspecified artemisia
Aruncus dioicus	Hairy goat's beard
Athyrium filix-femina ssp. *cyclosorum*	Subarctic lady fern
Boschniakia rossica	Northern groundcone
Calamagrostis canadensis	Bluejoint reedgrass
Calamagrostis deschampsioides	Circumpolar small-reedgrass
Calamagrostis nutkaensis	Pacific small-reedgrass
Calamagrostis sp.	Unspecified reedgrass
Campanula lasiocarpa	Common Alaska bellflower
Cardamine umbellata	Umbel-flower bitter-cress
Carex anthoxanthea	Grassy-slope arctic sedge
Carex aquatilis	Water sedge

Latin Name	Common Name
Carex bigelowii s.l.	Bigelow's sedge
Carex brunnescens s.l.	Brownish sedge
Carex canescens	Hoary sedge
Carex limosa	Mud sedge
Carex livida	Livid sedge
Carex lyngbyei	Lyngbye's sedge
Carex mackenziei	Mackenzie's sedge
Carex macrochaeta	Alaska long-awn sedge
Carex media	Intermediate sedge
Carex pauciflora	Few-flower sedge
Carex pluriflora	Several flowered sedge
Carex ramenskii	Ramensk's sedge
Carex rotundata	Round-fruit sedge
Carex sp.	Unspecified sedge
Carex spectabilis	Showy sedge
Chrysanthemum arcticum	Arctic daisy
Cicuta mackenzieana	Mackenzie's water hemlock
Cochlearia sessilifolia	Sessile-leaf scurvy-grass
Composite sp.	Unspecified composite
Conioselinum chinense s.l.	Hemlock-parsley
Conioselinum gmelinii	Western hemlock-parsley
Cornus canadensis	Canada bunchberry
Cornus suecica	Swedish dwarf dogwood
Deschampsia beringensis	Bering hairgrass
Deschampsia cespitosa s.l.	Tufted hairgrass
Drosera rotundifolia	Round-leaf sundew
Dryopteris dilatata ssp. *americana*	Mountain woodfern
Eleocharis kamtschatica	Kamchatka spikerush
Elymus arenarius	Sea lyme-grass
Epilobium angustifolium	Fireweed
Epilobium ciliatum	Hairy willowherb
Epilobium latifolium	River beauty
Epilobium palustre	Marsh willowherb
Epilobium s.l. sp.	Unspecified epilobium
Equisetum arvense	Field horsetail
Equisetum fluviatile	Water horsetail
Equisetum palustre	Marsh horsetail
Equisetum pratense	Meadow horsetail
Equisetum sp.	Unspecified horsetail
Equisetum sylvaticum	Woodland horsetail
Erigeron peregrinus	Wandering fleabane

Latin Name	Common Name
Eriophorum angustifolium	Narrow-leaf cottongrass
Eriophorum russeolum s.l.	Russet's cottongrass
Eriophorum scheuchzeri	Scheuchzer's cottongrass
Festuca altaica	Rough fescue
Festuca rubra	Red fescue
Festuca sp.	Unspecified fescue
Fritillaria camschatcensis	Kamchatka mission-bells/chocolate lily
Galium boreale	Northern bedstraw
Galium sp.	Unspecified galium
Galium trifidum	Small bedstraw
Galium triflorum	Sweet-scent bedstraw
Geranium erianthum	Woolly geranium
Geum macrophyllum	Large-leaf avens
Grass sp.	Unspecified grass
Gymnocarpium dryopteris	Oak fern
Heracleum lanatum	Cow parsnip
Heuchera glabra	Alpine heuchera
Hieracium triste	Hawkweed
Hierochloe alpina	Alpine sweetgrass
Hierochloe odorata	Holy grass
Hippuris tetraphylla	Four-leaf mare's tail
Honkenya peploides	Seabeach sandwort
Hordeum brachyantherum	Meadow barley
Iris setosa	Beach-head iris
Juncus arcticus s.l.	Arctic rush
Juncus biglumis	Two-flower rush
Juncus sp.	Unspecified juncus
Lathyrus japonicus	Beach peavine
Lathyrus maritimus	Beach pea
Lathyrus palustris	Vetchling peavine
Ligusticum scoticum	Scotch lovage
Luetkea pectinata	Partridge-foot
Lupinus arcticus	Arctic lupine
Lupinus nootkatensis	Nootka lupine
Luzula arcuata	Curved woodrush
Luzula sp.	Unspecified woodrush
Lycopodium alpinum	Alpine clubmoss
Lycopodium annotinum s.l.	Stiff clubmoss
Lycopodium clavatum s.l.	Running pine
Lycopodium sp. s.l.	Unspecified clubmoss
Lycopodium selago s.l.	Fir clubmoss

Latin Name	Common Name
Minuartia arctica	Arctic stitchwort
Moehringia lateriflora	Grove sandwort
Moneses uniflora	Shy maiden
Montia chamissoi	Water miners lettuce
Pedicularis labradorica	Labrador lousewort
Pedicularis sp.	Unspecified lousewort
Petasites frigidus s.l.	Arctic sweet coltsfoot
Plantago maritima	Seaside plantain
Poa eminens	Large-flower bluegrass
Poa sp.	Unspecified bluegrass
Polemonium acutiflorum	Sticky tall Jacob's-ladder
Polemonium pulcherrimum	Showy Jacob's-ladder
Polemonium sp.	Unspecified Jacob's-ladder
Polygonum bistorta ssp. *plumosum*	Meadow bistort
Polygonum viviparum	Viviparous knotweed
Potamogeton s.l. sp.	Unspecified pondweed
Potentilla anserina	Silverweed
Potentilla egedii	Silverweed cinquefoil
Potentilla palustris	Marsh cinquefoil
Prenanthes alata	Western rattlesnake root
Puccinellia nutkaensis	Nootka alkali grass
Puccinellia phryganodes	Creeping alkali grass
Pyrola asarifolia	Pink wintergreen
Pyrola secunda	One-sided wintergreen
Pyrola s.l. sp.	Unspecified wintergreen
Ranunculus macounii	Macoun's buttercup
Rhinanthus minor	Little yellow rattle
Rhodiola integrifolia	Ledge stonecrop
Rubus arcticus s.l.	Arctic raspberry
Rubus chamaemorus	Cloudberry
Rubus pedatus	Strawberry-leaf raspberry
Rubus stellatus	Nagoonberry
Rumex arcticus	Arctic dock
Rumex occidentalis	Western dock
Rumex sp.	Unspecified rumex
Sanguisorba canadensis	Canada burnet
Sanguisorba stipulata	
Saxifraga punctata s.l.	Dotted saxifrage
Scirpus cespitosus	Tufted bulrush
Sedum rosea ssp. *integrifolium*	Roseroot stonecrop
Senecio pseudoarnica	Seabeach groundsel

Latin Name	Common Name
Solidago canadensis s.l.	Canada goldenrod
Solidago multiradiata	Mountain goldenrod
Solidago sp.	Unspecified goldenrod
Sparganium hyperboreum	Northern bur-reed
Spiranthes romanzoffiana	Hooded ladies' tresses
Stellaria calycantha	Northern starwort
Stellaria crispa	Crisp starwort
Stellaria humifusa	Low starwort
Stellaria sitchana	Sitka starwort
Stellaria sp.	Unspecified starwort
Streptopus amplexifolius	Clasp-leaf twisted-stalk
Swertia perennis	Felwort
Thalictrum sparsiflorum	Few-flower meadow-rue
Thelypteris phegopteris	Narrow beech fern
Tiarella trifoliata var. *unifoliata*	Three-leaf foamflower
Tofieldia coccinea	Northern false-asphodel
Trichophorum caespitosum	Tufted bulrush
Trientalis europaea s.l.	European starflower
Triglochin maritimum	Seaside arrow-grass
Triglochin palustris	Marsh arrow-grass
Triglochin sp.	Unspecified arrow-grass
Vahlodea atropurpurea	Mountain hairgrass
Veratrum viride var. *eschscholzianum*	American false-hellebore
Viola epipsila ssp. *repens*	Dwarf marsh violet
Viola langsdorffii	Alaska violet
Viola sp.	Unspecified violet
Lichens, Fungi, and Bryophytes [a]	
Cladina sp.	Lichen
Feather moss	Unspecified feather moss
Foliose lichen	Unspecified foliose lichen
Fruticose lichen	Unspecified fruticose lichen
Lichen sp.	Unspecified lichen
Moss sp.	Unspecified moss
Mushroom sp.	Unspecified mushroom
Polytrichum juniperinum	Juniper polytrichum moss
Sphagnum sp.	Unspecified sphagnum moss

Notes:

a. These records were not intended as a comprehensive list of lichens, fungi, and bryophytes. Identification of lichens, fungi, and bryophytes at study sites was optional or incidental, not intended to be of the same quality as the vascular plant data.

APPENDIX 38C

Draft List of the Most Common Plant Species Observed in the Cook Inlet Drainages Study Area 2004-2008

Draft List of the Most Common Plant Species Observed in the Cook Inlet Drainages Study Area, 2004-2008

Latin Name	Common Name
Trees	
Picea glauca	White spruce
Picea sitchensis	Sitka spruce
Populus balsamifera	Cottonwood
Shrubs	
Alnus sinuata	Sitka alder
Andromeda polifolia	Bog rosemary
Arctostaphylos alpina	Alpine bearberry
Betula nana ssp. *exilis*	Dwarf birch
Empetrum nigrum	Black crowberry
Ledum decumbens	Narrow-leaf Labrador tea
Loiseleuria procumbens	Alpine azalea
Menziesia ferruginea	Mock-azalea
Ribes laxiflorum	Trailing black currant
Rubus spectabilis	Salmonberry
Salix barclayi	Barclay's willow
Salix fuscescens	Alaska bog willow
Salix pulchra	Diamondleaf willow
Sambucus racemosa	European red elder
Spiraea beauverdiana	Beauverd spirea
Vaccinium uliginosum	Bog blueberry
Vaccinium vitis-idaea ssp. *minus*	Mountain cranberry
Viburnum edule	Squashberry
Herbs	
Achillea borealis	Yarrow
Achillea millefolium s.l.	Common yarrow
Aconitum delphiniifolium	Monkshood (larkspur-leaf)
Angelica lucida	Seawatch angelica
Artemisia arctica	Mountain sagewort
Athyrium filix-femina ssp. *cyclosorum*	Subarctic lady fern
Calamagrostis canadensis	Bluejoint reedgrass
Calamagrostis deschampsioides	Circumpolar small-reedgrass
Carex aquatilis	Water sedge
Carex lyngbyei	Lyngbye's sedge
Carex macrochaeta	Alaska long-awn sedge
Carex sp.	Unspecified sedge
Carex spectabilis	Showy sedge
Chrysanthemum arcticum	Arctic daisy

Latin Name	Common Name
Cornus suecica	Swedish dwarf dogwood
Dryopteris dilatata ssp. *americana*	Mountain woodfern
Elymus arenarius	Sea lyme-grass
Epilobium angustifolium	Fireweed
Equisetum arvense	Field horsetail
Eriophorum angustifolium	Narrow-leaf cottongrass
Festuca rubra	Red fescue
Galium trifidum	Small bedstraw
Geranium erianthum	Woolly geranium
Gymnocarpium dryopteris	Oak fern
Heracleum lanatum	Cow parsnip
Heuchera glabra	Alpine heuchera
Iris setosa	Beach-head iris
Ligusticum scoticum	Scotch lovage
Lycopodium annotinum s.l.	Stiff clubmoss
Oplopanax horridus	Devil's club
Poa eminens	Large-flower bluegrass
Potentilla egedii	Silverweed cinquefoil
Potentilla palustris	Marsh cinquefoil
Rubus arcticus s.l.	Arctic raspberry
Sanguisorba stipulata	
Scirpus cespitosus	Tufted bulrush
Solidago multiradiata	Mountain goldenrod
Streptopus amplexifolius	Clasp-leaf twisted-stalk
Thelypteris phegopteris	Narrow beech fern
Trientalis europaea s.l.	European starflower
Veratrum viride var. *eschscholzianum*	American false-hellebore
Viola sp.	Unspecified violet
Lichens, Fungi, and Bryophytes [b]	
Lichen sp.	Unspecified lichen
Moss sp.	Unspecified moss
Sphagnum sp.	Unspecified sphagnum moss

Notes:

a. These records were not intended as a comprehensive list of lichens, fungi, and bryophytes. Identification of lichens, fungi, and bryophytes at study sites was optional or incidental, not intended to be of the same quality as the vascular plant data.