DRAFT ENVIRONMENTAL BASELINE STUDIES
2004 PROGRESS REPORTS

CHAPTER 19. DATA MANAGEMENT

NOVEMBER 2005
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### ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AASHTO</td>
<td>American Association of State and Highway Transportation Officials</td>
</tr>
<tr>
<td>ABA</td>
<td>acid-base accounting</td>
</tr>
<tr>
<td>ac-ft</td>
<td>acre-feet</td>
</tr>
<tr>
<td>ADEC</td>
<td>Alaska Department of Environmental Conservation</td>
</tr>
<tr>
<td>ADF&amp;G</td>
<td>Alaska Department of Fish and Game</td>
</tr>
<tr>
<td>ADNR</td>
<td>Alaska Department of Natural Resources</td>
</tr>
<tr>
<td>agl</td>
<td>above ground level</td>
</tr>
<tr>
<td>AHRS</td>
<td>Alaska Heritage Resource Survey</td>
</tr>
<tr>
<td>ALS</td>
<td>ALS Environmental Laboratory</td>
</tr>
<tr>
<td>ANCSA</td>
<td>Alaska Native Claims Settlement Act</td>
</tr>
<tr>
<td>AP</td>
<td>acid potential</td>
</tr>
<tr>
<td>APE</td>
<td>area of potential effect</td>
</tr>
<tr>
<td>ASCI</td>
<td>Alaska Stream Condition Index</td>
</tr>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>ASTt</td>
<td>Arctic Small Tool tradition</td>
</tr>
<tr>
<td>BBNA</td>
<td>Bristol Bay Native Association</td>
</tr>
<tr>
<td>BEESC</td>
<td>Bristol Environmental &amp; Engineering Services Corporation</td>
</tr>
<tr>
<td>bgs</td>
<td>below ground surface</td>
</tr>
<tr>
<td>BIA</td>
<td>Bureau of Indian Affairs</td>
</tr>
<tr>
<td>BLM</td>
<td>Bureau of Land Management</td>
</tr>
<tr>
<td>BP</td>
<td>before present</td>
</tr>
<tr>
<td>BTEX</td>
<td>benzene, toluene, ethylbenzene, and xylenes</td>
</tr>
<tr>
<td>°C</td>
<td>degrees Celsius</td>
</tr>
<tr>
<td>¹⁴C</td>
<td>Carbon 14</td>
</tr>
<tr>
<td>CEMI</td>
<td>Canadian Environmental and Metallurgical Laboratory</td>
</tr>
<tr>
<td>cfs</td>
<td>cubic feet per second</td>
</tr>
<tr>
<td>CIRCAC</td>
<td>Cook Inlet Regional Citizens Advisory Council</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter(s)</td>
</tr>
<tr>
<td>CPUE</td>
<td>catch per unit effort</td>
</tr>
<tr>
<td>CQ</td>
<td>continuous flow</td>
</tr>
<tr>
<td>CRM</td>
<td>cultural resources management</td>
</tr>
<tr>
<td>CUEQ%</td>
<td>copper equivalent grade</td>
</tr>
<tr>
<td>DEM</td>
<td>digital elevation model</td>
</tr>
<tr>
<td>DI</td>
<td>deionized</td>
</tr>
<tr>
<td>DOT&amp;PF</td>
<td>Alaska Department of Transportation and Public Facilities</td>
</tr>
</tbody>
</table>
DRO  diesel-range organics
EBD  environmental baseline document
EIS  environmental impact statement
EPT  Ephemeroptera, Plecoptera, or Trichoptera
EPA  Environmental Protection Agency
FAA  Federal Aviation Administration
FHWA  Federal Highway Administration
FL  fork length
fps  feet per second
ft  foot (feet)
ft²  square foot (feet)
g  gram(s)
GIS  geographic information system
GLM  general linear model
GMU  Game Management Unit
gpm  gallons per minute
GPS  global positioning system
GRO  gasoline-range organics
GS  gauging station
HC-3  high-gradient, contained channel
HDR  HDR Alaska, Inc.
HGM  hydrogeomorphic
HWM  high-water mark
ICP  inductively coupled plasma
IIE  Iniskin/Iliamna Estuary
IQ  instantaneous flow
KC  Kaskanak Creek
kg  kilogram(s)
km²  square kilometers
KP  Knight Piesold
KR  Koktuli River Main Stem
L  liter(s)
LC-1  low-gradient, contained channel
LIDAR  light detection and ranging
m  meter(s)
m²  square meter(s)
M.A.  Master of Arts
MC-1  moderate-gradient, narrow, shallow, contained channel
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
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<tbody>
<tr>
<td>MCHTWG</td>
<td>Mulchatna Caribou Herd Technical Working Group</td>
</tr>
<tr>
<td>MDC</td>
<td>mine development concept</td>
</tr>
<tr>
<td>MDL</td>
<td>method detection limit</td>
</tr>
<tr>
<td>me-Hg</td>
<td>methyl-mercury</td>
</tr>
<tr>
<td>MEND</td>
<td>mine environment neutral drainage</td>
</tr>
<tr>
<td>mg</td>
<td>milligram(s)</td>
</tr>
<tr>
<td>mi²</td>
<td>square mile(s)</td>
</tr>
<tr>
<td>ml</td>
<td>milliliter(s)</td>
</tr>
<tr>
<td>ML/ARD</td>
<td>metal leaching/acid rock drainage</td>
</tr>
<tr>
<td>MLLW</td>
<td>mean lower low water</td>
</tr>
<tr>
<td>mm</td>
<td>millimeter(s)</td>
</tr>
<tr>
<td>MM-1</td>
<td>moderate-gradient, mixed-control channel</td>
</tr>
<tr>
<td>MMS</td>
<td>Minerals Management Service</td>
</tr>
<tr>
<td>MODIS</td>
<td>moderate resolution imaging spectroradiometer</td>
</tr>
<tr>
<td>mph</td>
<td>miles per hour</td>
</tr>
<tr>
<td>MRL</td>
<td>method reporting limit</td>
</tr>
<tr>
<td>m/s</td>
<td>meters per second</td>
</tr>
<tr>
<td>μg</td>
<td>microgram(s)</td>
</tr>
<tr>
<td>μL</td>
<td>microliter(s)</td>
</tr>
<tr>
<td>μmhos</td>
<td>micromhos</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>ND</td>
<td>non-detect</td>
</tr>
<tr>
<td>NDM</td>
<td>Northern Dynasty Mines Inc.</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>ng</td>
<td>nanogram(s)</td>
</tr>
<tr>
<td>NK</td>
<td>North Fork Koktuli River</td>
</tr>
<tr>
<td>NMFS</td>
<td>National Marine Fisheries Service</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NP</td>
<td>neutralization potential</td>
</tr>
<tr>
<td>NPS</td>
<td>National Park Service</td>
</tr>
<tr>
<td>NRCS</td>
<td>Natural Resources Conservation Service</td>
</tr>
<tr>
<td>NRHP</td>
<td>National Register of Historic Places</td>
</tr>
<tr>
<td>Nv</td>
<td>calculated variance</td>
</tr>
<tr>
<td>NWR</td>
<td>National Wildlife Refuge</td>
</tr>
<tr>
<td>OCSEAP</td>
<td>Outer Continental Shelf Environmental Assessment Program</td>
</tr>
<tr>
<td>OHMP</td>
<td>Office of Habitat Management and Permitting</td>
</tr>
<tr>
<td>OHW</td>
<td>ordinary high water</td>
</tr>
<tr>
<td>PA-1</td>
<td>narrow, placid-flow habitat</td>
</tr>
</tbody>
</table>
PA-3  shallow-ground, water-fed slough
PA-5  palustrine beaver habitat
PAG  potentially acid-generating
PJD  preliminary jurisdictional determination
PSD  Prevention of Significant Deterioration
PVC  polyvinyl chloride
Q    discharge
QA   quality assurance
QAPP quality assurance project plan
QC   quality control
RBP  Rapid Bioassessment Protocols
RDI  Resource Data, Inc.
RRO  residual-range organics
SHPO State Historic Preservation Officer
SK   South Fork Koktuli River
SLR  SLR Alaska
SRB&A Stephen R. Braund & Associates
SRK  SRK Consulting (Canada) Inc.
SVOC semivolatile organic compound
SWE  snow/water equivalent
3PP  Three Parameters Plus
TDS  total dissolved solids
TOC  total organic carbon
TSS  total suspended solids
UAF  University of Alaska Fairbanks
USACE U.S. Army Corps of Engineers
USC  United States Code
USDA United States Department of Agriculture
USDI United States Department of Interior
USFS United States Forest Service
USFWS United States Fish and Wildlife Service
USGS United States Geological Survey
UT   Upper Talarik Creek
VHF  very high frequency
VOC  volatile organic compound
WMC  Water Management Consultants Inc.
WRIR water-resources investigations report
WY   water year
19. DATA MANAGEMENT AND GIS

19.1 Introduction

This section presents the 2004 results of the data management and geographic information system (GIS) program currently in progress at Resource Data Inc. (RDI) for the Northern Dynasty Mines Inc. (NDM), Pebble Project. The GIS and scientific data generated as part of the permitting process are valuable assets to NDM. In the short term, NDM must make the data available to the environmental-baseline project team. In the long term, NDM must maintain the data to support the requisite environmental impact statement and permitting process and ultimately to support the monitoring of Pebble Mine activities throughout the life of the project. A sound data management strategy assures that the data are accurate, timely, and integrated into a multidisciplinary database.

RDI’s data management solution is completely automated. This automated system helps eliminate errors caused by manual editing and analysis of scientific data. This methodology was used to define clear requirements for data deliverables and to provide data sources with the necessary tools to verify compliance with these requirements prior to delivery.

RDI’s primary scope of work consists of the following activities:

- GIS work.
- Website and data management.

The GIS work covers managing all mapping data collected during baseline studies, creating and loading base-map and Pebble-specific data, supplying GIS support for the wetlands study, and providing cartographic services to support the entire project. Website and data management includes building a central data repository for the project, providing web-based tools to enter and report on project data, and developing tools to upload data into the project database. The website and database are being designed to provide long-term storage and access to baseline data throughout the projected 50-year life of the mine.

19.2 Program Objectives

The objectives of 2004 GIS activities were as follows:

- Develop standards for spatial data including datum, projection, and accuracy.
- Compile base-map data.
- Compile 2004 study data.
- Distribute data to all investigators.

The objectives of 2004 activities related to website and data management were as follows:

- Establish standards for data format, content, and transfer.
- Support 2004 field operations through the development of web-based software for data entry, document management, project management (calendar, logistics tools, etc.), and mapping.
- Support data analysis and reporting.
- Manage documents.
- Ensure NDM ownership of system hardware, software, and data.
19.3 Scope of Work

19.3.1 GIS

RDI’s scope of services included developing GIS standards, building a GIS to support the permitting process, and providing GIS support to NDM and its contractors. The activities outlined below have been completed.

19.3.1.1 GIS Management

RDI created standards for managing the GIS data associated with the Pebble Project. Standards included creating or defining types and versions of software to be used, spatial data-naming conventions, standard projection, standard map templates, metadata requirements, and map and data transfer procedures.

The standard mapping software used in Pebble is ESRI ArcGIS 8.3. This ensures that all figures and maps produced for the project are compatible. Data-creation software is up to the individual consultants as long as the resulting data are 100 percent compatible with ArcGIS 8.3.

Standard map projection for the project is Alaska State Plane Zone 5 using the 1983 North American Datum.

Data storage and naming conventions include the following:

- All GIS data are stored in the GIS_FINAL folder.
- Data inside of GIS_FINAL are stored in subfolders named by a three- or four-character abbreviation of data originator.
- Inside of the data originator subfolders, consultants create CATEGORY folders at their discretion.
- All SHP-file (shape-file) names are limited to 13 characters and must contain a version number. An example is hydro_V02.
- Data are stored in ESRI SHP file format.

All data must have metadata populated using the ESRI metadata tool set.

Standard map templates for use by the project team also have been created. The templates were created as ArcGIS MXT files. They include the following:

- 8 ½" X 11" Portrait.
- 8 ½" X 11" Landscape.
- 11" X 17" Portrait.
- 11"X 17" Landscape.
- 24" X 36" Landscape.
- 35" X 50" Landscape.

RDI keeps the master GIS data repository and coordinates all data transfers from RDI to project consultants via portable hard drives or via the project data management website described in Section 19.3.2.
19.3.1.2 Compile Base-map Data

RDI compiled base-map data for use by the project team. All data were converted from their native format for use in ArcGIS 8.3. Data include the following:

- U.S. Geological Survey (USGS) 1:63360 Digital Line Graph (DLG) hydrography.
- Fifty-foot contours generated from USGS 1:63360 Digital Elevation Models (DEMs).
- Hand-entered geographic labels and waterbody labels from USGS Digital Raster Graphs.
- 1:2400-scale ortho-photography for the inner mine area developed by Eagle/Kodiak Mapping.
- 1:2400-scale vector mapping for the inner mine area developed by Eagle/Kodiak Mapping.
- 1:2400-scale Lidar mapping produced by Eagle/Kodiak mapping developed for the inner mine area.
- 1:4800-scale ortho-photography for the outer mine area developed by Eagle/Kodiak Mapping.
- 1:4800-scale vector mapping produced by Eagle/Kodiak mapping developed for the outer mine area.
- Township, range, and section information.
- National Parks and Preserves data.
- Native regional corporation boundaries.
- 1:2400-scale ortho-photography for the road corridor developed by AeroMap U.S.
- 1:2400-scale Lidar mapping produced by AeroMap U.S.

19.3.1.3 Load Pebble Data

RDI processed 34 individual mine development concepts and 7 road and port preliminary design concepts for the project. The mine design concepts were delivered to RDI from Knight Piesold in AutoCAD format. Upon receipt of the mine designs, RDI converted the data to polygonal ESRI SHP files for use in potential impact assessment and distribution to consultants. Road and port design concepts were delivered to RDI from PND Inc. as AutoCAD files. RDI converted the data into ESRI SHP files for use by the consultants.

19.3.1.4 Environmental Data

RDI gathered and converted various environmental data sets into ArcGIS 8.3 for the Pebble Project. In some cases data only existed in paper format and were digitized. Data sets include the following:

- Anadromous fish streams.
- U.S. Fish and Wildlife Service (USFWS) caribou habitat.
- Alaska Department of Fish and Game habitat mapping, including bear habitat, bird habitat, caribou habitat, clam habitat, crab habitat, fish habitat, marine mammal habitat, moose habitat, and sheep habitat.

19.3.1.5 Data Acquisition for Three Parameters Plus and Others

RDI acquired and processed data sets for use by Three Parameters Plus (3PP) and other environmental consultants. Certain data sets only existed in paper form and required digitizing. All data were converted into ESRI SHP format. Data include the following:
Draft Environmental Baseline Studies, 2004 Progress Report

- Surficial geology.
- USFWS National Wetland Inventory (NWI).
- National Resource Conservation Service soil maps.
- USGS Earth Resources Observation Systems (EROS) Bristol Bay land cover.

19.3.1.6 Ongoing support for 3PP and Others

RDI supports 3PP and HDR Alaska, Inc., in the wetlands delineation process. The following activities were completed in 2004:

- Produced field maps and photo reports—RDI created field maps on Rite in the Rain paper for use by 3PP and HDR during the field season.
- Wetlands data scrubbing—RDI scrubbed wetlands data to remove slivers and close polygons and to maintain the integrity of the wetlands mapping.
- Processed photos and photo location information—HDR and 3PP delivered their digital photographs and location information to RDI for processing into the wetlands application described Section 19.3.2.5.
- Provided analysis of mapping—RDI provided 3PP with summary tables showing acres disturbed by vegetation type and hydrogeomorphic (HGM) classification.
- Impact analysis of alternatives—RDI provided data tables of potential impacts of mine development concepts. Data tables were generated by intersecting potential mine designs with environmental GIS data and creating tables which contained impact of habitat by species.

19.3.1.7 Cartographic Services

RDI provided cartographic services to the project team on an as-needed basis. Maps were typically for internal project meetings or agency meetings. Over 100 individual custom maps or variations of maps have been produced for the NDM team.

19.3.2 Data Management

RDI created a web-based data management application. The website is a secure site with varying levels of internal security. The role-based security allows different types of functionality based on a user’s log-in. This document is a summary of functionality present in the system.

19.3.2.1 Document Repository

A document repository was created which allows members of the Pebble project team to share digital documents. The repository allows users to upload and download any type of digital file. Document information is captured via user-entered metadata and is tracked by version number. Role-based security determines user privileges for adding, viewing, editing, and deleting files. Because it is expected that the repository will hold a large number of documents, search functionality was created so that users could enter specific criteria to target specific documents and document types. Files are stored within folders and displayed in a “collapsible” tree-view allowing for easy viewing and retrieval of documents (Figures 19-1 and 19-2).
19.3.2.2 Calendar

RDI developed a project calendar for use by the project team. The calendar has two views: project team view and NDM management team view. A user has access to one or both calendar views based on their login. The calendar allows users to schedule meetings, set recurring meetings, and attach digital documents to meetings (Figure 19-3).

19.3.2.3 Contacts

A project team contact list was created. The list is generated dynamically and is updateable by administrators. The contact list (Figure 9-4)—exportable to Microsoft Excel—captures, stores, and reports the following information:

- Name.
- Title.
- Phone Number.
- Fax Number.
- Email Address.
- Area of Expertise.
- Company.
- Company Description.
- Address.

19.3.2.4 Logistics

RDI created a series of logistics forms to support the project. Logistics information includes the following:

- Emergency Procedures—Lists contact information and procedures to follow in the event of an emergency (Figure 19-5).
- Helicopter Request Form—Allows users to enter information to schedule helicopters for field work (Figure 19-6).
- Bear Guard Support Form—Allows users to enter information for scheduling bear guard support when conducting field work at sites where wildlife could pose a potential threat to team members (Figure 19-7).

19.3.2.5 Wetlands

The wetlands application allows certain users to enter field information on wetlands and to create reports using this information. The application stores all information related to the wetlands program, including field data, site location maps, and digital photographs of each wetland plot location.

Primary input for wetlands information is accomplished using the Jurisdictional Wetlands Input Form. The input form allows users to enter applicable information based on the following sections:

- Site Location—Information relating to the location of an individual field plot including a site location map (Figure 19-8).
- Vegetation—Information relating to the vegetation located at a field-plot location (Figure 19-9).
• Hydrology—Information relating to the hydrology present at a field-plot location (Figure 19-10).

• Soil Profile—Information relating to the soil profile present at a field-plot location (Figure 19-11).

• Other Soil—Additional information on the soil present at a field-plot location (Figure 19-12).

• Determination—Final information on whether or not the field plot is a wetland; also allows for storage of multiple digital photographs of the field plot and surrounding area (Figure 19-13).

• Assessment—If the wetland is designated as a wetland on the Determination tab, an Assessment tab will appear, allowing the user to select from a pre-defined list of wetland variables (e.g., hydrologic, landscape, and vegetation variables; Figure 19-14).

Wetlands reports include the following:

• Jurisdictional Wetland Plot Report—Retrieves all data related to a specific wetland field plot and displays a comprehensive report with detailed information on vegetation, hydrology, soil profiles and indicators, determination, and assessment (Figures 19-15 and 19-16).

• Master Plant-list Report—Allows a user to search for plant types by watershed and firm. Report is exportable to MS Excel (Figure 19-17).

• Jurisdictional (JD) Wetland Determination Photo Report—Provides photos and basic information about a wetland plot including location, soils, hydrology, and dominant plants by stratum. Report is exportable to MS Word (Figure 19-18).

• Plant Community Report—Allows user to search for plant life based on a variety of criteria. Report includes information on species location, composition, soil horizon, and wildlife observations in a specified range. Entire report is exportable to MS Word with some table sections exportable to MS Excel (Figure 19-19).

• Functional Assessment Models—Eight models used to determine functional capacity of a wetland as described in A Rapid Procedure for Assessing Wetland Functional Capacity, Based on Hydrogeomorphic (HGM) Classification (Magee, 1998). The models run in an automated format based on user input and administrative settings. Model results are exportable in MS Word format (Figure 19-20).

19.3.2.6 Links

Links are provided to relevant web-based resources for associations, publications, and government and regional agencies (Figure 19-21).

19.3.2.7 Field Forms

Field forms were developed to capture information relating to studies conducted during the 2004 and 2005 field seasons. Data captured in these forms will be exportable to MS Excel for future analysis. Forms include the following (Figure 19-22):

• Water Quality Monitoring.
• Habitat Assessment.
• Diatom Live/Dead Count.
• Diatom Identification.
• Subsampling.
• Physical Characterization.
• Benthos/Water Quality.
• Chironomidae ID.
• Periphyton Field Data Sheet.
• Periphyton Sample Lab Processing Sheet.
• Sample Login Sheet.
• Sample Login/Tracking Sheet.
• Spawning Count
• Removal Form
• Identification
• Iliamna Lake Study
• Macroinvertebrate/Periphyton/Water Quality

19.3.2.8 Analytical Data

The analytical data application contains a generic data loader which is user configurable. The data loader checks incoming data for a variety of problems such as duplicate sample numbers, missing rows within a column, previously loaded samples, etc. It is composed of the following functionality (Figure 19-23):

• Create New Data Loader—Allows users to create a new data loader for the system. The data loader controls the electronic data definition (EDD), which specifies the format of the columns to be added to the database.
• Edit Data Loader—Provides the ability for users to edit an existing data loader (Figure 19-24).
• Delete Data Loader—Removes a data loader from the system.
• View Loader History—Allows users to search through a history log of all data loaded to the system (Figure 19-25).
• Load Data—Allows users to load analytical data to the system in the format specified in the electronic data definition.
• Reload Data—Allows users to reload data which has been loaded to the system previously.
• Data Extractor, Run Existing Report - Allows user to run an existing report by selecting the columns to display and performing simple filtering on those columns using boolean operations
• Data Extractor, Define New Report - Allows user to define a new report by binding metadata with a Oracle view.
• COC List Reports - Allows users to access filter page and result screen for reporting COC Header information (Date, Company, Location, etc.)
• COC Details Report - Allows users to access filter page and result screen that shows all COC samples collected.
• COC Sample Exception Report - Report that shows samples that are on the COC, but are not in the laboratory reported samples.
• COC Lab Analysis vs. Requested Method - Report that shows samples whose tested methods differ from the field requested methods.
19.3.2.9 GIS Map

The GIS map is an interactive web-based mapping application. It allows users to view GIS data which has been collected and generated for the Pebble Project (Figure 19-26).

19.4 Technologies Used

19.4.1 GIS Technology

The Pebble Project GIS is based on ESRI technology.

- ArcView 3.3 is used for habitat mapping.
- ArcGIS 8.3 is used for all other functionality, including map production and data creation.
- Vector data are stored as ESRI shape files.
- Raster imagery is stored as Geotiffs with ESRI pyramids.
- Data are distributed via portable hard drives or the project website.
- Web-based GIS is developed on ArcIMS 9.02.
- All GIS data are documented using the metadata tools in ArcGIS.
- Standard map projection is Alaska State Plane Zone 5 Feet.
- Datum is 1983 North American Datum.

19.4.2 Data Management Technology

The project website was developed using the following technologies:

- Oracle 10g.
- Microsoft Internet Information Server.
- Microsoft C#.NET.
- Dell Poweredge 2600 XEON Server.

19.5 References

FIGURES
FIGURE 19-1. Document Repository, Files List

FIGURE 19-2, Document Repository Metadata Form
FIGURE 19-3, Calendar, Project Team View

FIGURE 19-4, Contacts
FIGURE 19-5, NDM Emergency Procedures

FIGURE 19-6, Helicopter Request Form
FIGURE 19-7, Bear Guard Support Form

FIGURE 19-8, Site Location Tab, Jurisdictional Wetlands Input Form
### FIGURE 19-9, Vegetation Tab, Jurisdictional Wetlands Input Form

#### Table: Dominant Species that are GBL, FACW, or FAC (excluding FACc)

<table>
<thead>
<tr>
<th>Species</th>
<th>Lati Name</th>
<th>Common Name</th>
<th>Strat</th>
<th>InML Status</th>
<th>% Cover</th>
<th>Dist</th>
<th>Trunk Height</th>
<th>Trunk DBH</th>
<th>Mag Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big-leaf maple</td>
<td>1308</td>
<td>1308</td>
<td>1308</td>
<td>1308</td>
<td>1308</td>
<td>1308</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Red maple</td>
<td>1309</td>
<td>1309</td>
<td>1309</td>
<td>1309</td>
<td>1309</td>
<td>1309</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Vegetation Remarks
- % By Stratum (in ML - Wetlands Only):
  - TRE = Tree: 56%
  - SAP = Sapling: 15%
  - TS = Tall Shrub: 29%

#### Additional Observations
- Field Data: Open for shrub and certain herbaceous plants.
- Vegetation:
  - European dogwood
  - European hawthorn

### FIGURE 19-10, Hydrology Tab, Jurisdictional Wetlands Input Form

#### Field Observations
- Depth of Surface Water
- Depth of Free Water in M: 0.5
- Depth to Saturation Soil

#### Wetland Hydrology Indicators
- Primary Indicators:
  - No Vegetation
  - No Water
  - No Sediment
  - No Drainage Patterns

- Secondary Indicators (for more required):
  - Local Soil Survey Data
  - FAC, MAF, or Other

#### Additional Observations
- Soil Type:
  - Mostly Silt
  - Some clay

- Vegetation:
  - European dogwood
  - European hawthorn

- Hydrology Comments:
  - Horizon very mild but not saturated
FIGURE 19-11, Soil Profile Tab, Jurisdictional Wetlands Input Form

FIGURE 19-12, Other Soil Tab, Jurisdictional Wetlands Input Form
FIGURE 19-13, Determination Tab, Jurisdictional Wetlands Input Form

FIGURE 19-14, Assessment Tab, Jurisdictional Wetlands Input Form
FIGURE 19-15, Jurisdictional Wetlands Plot Report, Part 1
FIGURE 19-16, Jurisdictional Wetlands Plot Report, Part 2
Pebble Gold Copper Project: Master Plant List

Search Criteria:
- Watershed(s): Pile Bay
- Firm(s): HDR

Master Plant List:

<table>
<thead>
<tr>
<th>Latin Name</th>
<th>Common Name</th>
<th>Stratum</th>
<th>Range</th>
<th>Stratum</th>
<th>Ind. 1985</th>
<th>Ind. 1988</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betula chrysantha</td>
<td>Yellow Birch</td>
<td>S</td>
<td>D</td>
<td>S</td>
<td>FACU</td>
<td>FACU</td>
</tr>
<tr>
<td>Picea glauca (Tree)</td>
<td>White Spruce (Tree)</td>
<td>T</td>
<td></td>
<td>TREE</td>
<td>FACU</td>
<td>FACU</td>
</tr>
<tr>
<td>Alnus rubra (Shrub)</td>
<td>Slippery Elm</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>FACU</td>
<td>FACU</td>
</tr>
<tr>
<td>Andromeda polifolia</td>
<td>Blueberry</td>
<td>S</td>
<td>S</td>
<td>DS</td>
<td>OBL</td>
<td>OBL</td>
</tr>
<tr>
<td>Betula nigra</td>
<td>Swamp Birch</td>
<td>S</td>
<td>S</td>
<td>SS</td>
<td>FACU</td>
<td>FACU</td>
</tr>
<tr>
<td>Empetrum nigrum</td>
<td>Black Crowberry</td>
<td>S</td>
<td>S</td>
<td>DS</td>
<td>FACU</td>
<td>FACU</td>
</tr>
<tr>
<td>Ledum decumbens</td>
<td>Narrow-Leaf Labrador-Tee</td>
<td>S</td>
<td>D</td>
<td>S</td>
<td>FACW</td>
<td>FACW</td>
</tr>
<tr>
<td>Lomatium hookerianum</td>
<td>Twinflower</td>
<td>S</td>
<td>D</td>
<td>S</td>
<td>FACU</td>
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<tr>
<td>Mentzelia crassica</td>
<td>Mealy-Goosefoot</td>
<td>S</td>
<td>S</td>
<td>SS</td>
<td>FACU</td>
<td>FACU</td>
</tr>
<tr>
<td>Picea glauca (Sprig)</td>
<td>White Spruce (Sprig)</td>
<td>S</td>
<td>S</td>
<td>SAP</td>
<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Potentilla fruticosa</td>
<td>Shrub Blue Cinquefoil</td>
<td>S</td>
<td>S</td>
<td>SS</td>
<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Ribes lacustre</td>
<td>Trailing Black Currant</td>
<td>S</td>
<td>S</td>
<td>SS</td>
<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Salix eriocarpa</td>
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<td>S</td>
<td>S</td>
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<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Salix exigua</td>
<td>Alaska Bog Willow</td>
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<tr>
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<tr>
<td>Sophora staphylea</td>
<td>Mountain-Ash</td>
<td>S</td>
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<td>S</td>
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<td>SS</td>
<td>FACU</td>
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<td>Vaccinium macrocarpos</td>
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<td>S</td>
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<tr>
<td>Vaccinium oxycoccos</td>
<td>Early Blueberry</td>
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<td>S</td>
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<td>FACU</td>
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<tr>
<td>Vaccinium uliginosum</td>
<td>Big Blueberry</td>
<td>S</td>
<td>S</td>
<td>DS</td>
<td>FACU</td>
<td>FACU</td>
</tr>
<tr>
<td>Vaccinium uliginosum</td>
<td>Mountain Cranberry</td>
<td>S</td>
<td>D</td>
<td>S</td>
<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Viburnum edule</td>
<td>Squirrelberry</td>
<td>S</td>
<td>S</td>
<td>SS</td>
<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Achillea millefolium</td>
<td>Yarrow</td>
<td>H</td>
<td>SH</td>
<td></td>
<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Calamagrostis canadensis</td>
<td>Blue-Joint Roadgrass</td>
<td>H</td>
<td>H</td>
<td>SH</td>
<td>FACU</td>
<td>FACU</td>
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<tr>
<td>Carex aquatilis</td>
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<td>H</td>
<td>SH</td>
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<tr>
<td>Carex canescens</td>
<td>Heavy Sedge</td>
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<td>SH</td>
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</tr>
<tr>
<td>Carex limprichtii</td>
<td>Longleaf Sedge</td>
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<td>SH</td>
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<tr>
<td>Carex pulicaria</td>
<td>Five-Flowered Sedge</td>
<td>H</td>
<td>H</td>
<td>SH</td>
<td>OBL</td>
<td>OBL</td>
</tr>
<tr>
<td>Carex phlyaeoides</td>
<td>Coastal Stiffleaf Sedge</td>
<td>H</td>
<td>H</td>
<td>SH</td>
<td>OBL</td>
<td>OBL</td>
</tr>
<tr>
<td>Carex plantosus</td>
<td>Several-Flowered Sedge</td>
<td>H</td>
<td>H</td>
<td>SH</td>
<td>OBL</td>
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<tr>
<td>Carex retusa</td>
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<td>H</td>
<td>H</td>
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<td>OBL</td>
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<tr>
<td>Carex saxatilis</td>
<td>Russian Sedge</td>
<td>H</td>
<td>SH</td>
<td></td>
<td>FACW</td>
<td>FACW</td>
</tr>
<tr>
<td>Carex spicata</td>
<td>Sedge</td>
<td>H</td>
<td>SH</td>
<td></td>
<td>FACU</td>
<td>FACU</td>
</tr>
</tbody>
</table>

FIGURE 19-17, Master Plant List Report
FIGURE 19-18, Jurisdictional Wetland Determination Photo Report
FIGURE 19-19, Plant Community Report

FIGURE 19-20, Wetlands Functional Assessment Report
FIGURE 19-23, Data Loader Menu

FIGURE 19-24, Editing or Defining Data Definition
FIGURE 19-25, Data Loader History

FIGURE 19-26, GIS Map