APPENDIX C.
DATA MANAGEMENT AND GEOGRAPHIC INFORMATION SYSTEM

PREPARED BY:
RESOURCE DATA, INC.
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## ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
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<td>3PPI</td>
<td>Three Parameters Plus, Inc.</td>
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<td>BBMP</td>
<td>Bristol Bay Management Plan</td>
</tr>
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<td>CAD</td>
<td>computer-aided drafting</td>
</tr>
<tr>
<td>CQM</td>
<td>comments and questions management</td>
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<td>EDD</td>
<td>electronic data deliverables</td>
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<td>Environmental Systems Research Institute</td>
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<td>hydrogeomorphic</td>
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<tr>
<td>PDF</td>
<td>portable document format</td>
</tr>
<tr>
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<td>Resource Data, Inc.</td>
</tr>
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<td>SHAW</td>
<td>The Shaw Group, Inc.</td>
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<td>SHP</td>
<td>ESRI shapefile</td>
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<td>USFWS</td>
<td>U.S. Fish and Wildlife Service</td>
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<td>U.S. Geological Survey</td>
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C. DATA MANAGEMENT AND GEOGRAPHIC INFORMATION SYSTEM

C.1 Introduction

This report describes the data management and geographic information system (GIS) program currently in progress at Resource Data, Inc. (RDI) for the Pebble Project. The GIS and scientific data generated from the baseline studies are extensive and require careful management to support the characterization of the affected environment for the Pebble Project. Sound data management strategies ensure that the data are accurate, timely, and integrated into a multidisciplinary data repository.

Data management is automated to the extent possible to minimize errors that might be caused by manual editing and analysis of scientific data.

C.2 Program Objectives

The objectives of the GIS activities are as follows:

- Develop standards for spatial data, including datum, projection, and accuracy.
- Compile basemap data.
- Compile study data.
- Distribute data to all study consultants.
- Support the habitat-mapping team.

The objectives of website and data management activities are as follows:

- Establish standards for data format, content, and transfer.
- Support field operations through the development and maintenance of web-based software for data entry and document management.
- Support data analysis and reporting.
- Manage documents.
- Maintain the project website.

C.3 Scope of Work

The scope of work for the data management program consists of GIS work, and website and data management.
GIS work includes managing mapping data submitted by the consultants during baseline studies, creating and loading basemap and Pebble-specific data, supplying GIS support for the wetlands study, and providing cartographic services to support the project. Resource Data provides GIS work on an on request basis from the consultants.

Website and data management tasks include building a central data repository for the project, providing web-based tools for entering and reporting on project data, and developing tools for uploading data into the project database. The website and database provide long-term storage and access to baseline data. Data management software is provided by Resource Data, Incorporated.

## C.4 Technologies Used

### C.4.1 GIS Technology

The Pebble GIS uses the following technologies:

- ArcGIS 9.3, used for all GIS related functionality, including map production and data creation.
- Vector data, stored as Environmental Systems Research Institute (ESRI) shapefiles.
- Raster imagery, stored as Geotiffs with ESRI pyramids.
- Data are distributed by means of portable hard drives or through the project website.
- 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.

### C.4.2 Data Management Technology

The Pebble Project website was developed using the following technologies:

- Oracle 9.2g.
- Microsoft Internet Information Server.
- Microsoft C#.NET.
- Dell PowerEdge 2600 Xeon Server.

## C.5 Program Description

### C.5.1 Geographic Information System

The data management program included developing GIS standards, and building a GIS to support the Pebble Partnership and its contractors. The activities outlined in Sections C.5.1.1 through C.5.1.5 were completed by the end of 2008.
C.5.1.1 GIS Management

Standards developed for managing the GIS data associated with the Pebble Project include 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 the Pebble Project is ESRI ArcGIS Version 9.3. This software ensures that all figures and maps produced for the project are compatible. As long as the resulting data are fully compatible with ESRI ArcGIS Version 9.3, individual consultants may use other data-creation software systems.

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 the GIS_FINAL folder are stored in subfolders named by a three- or four-character abbreviation of the data originator’s name.
- Inside of the data-originator subfolders, consultants create CATEGORY folders at their discretion, and then the data are submitted to RDI.
- Data are stored in the ESRI shapefile (SHP) format.
- All SHP names are limited to 13 characters and must contain the version number (e.g., hydro_V02).

GIS data have metadata populated using the ESRI metadata tool set.

Standard map templates (ArcGIS map template files) for use by the project team are created in the following sizes:

- 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 maintains the master GIS data repository and coordinates all data transfers from RDI to project consultants by means of portable hard drives or other data media.

C.5.1.2 Basemap Data

Basemap data were compiled for use by the project team. These data were converted from their native format for use in ArcGIS 9.3. Basemap data include the following:
• United States Geological Survey (USGS) 1:63,360 digital line graph (DLG) hydrography.
• 50-foot contours generated from USGS 1:63,360 digital elevation models (DEM).
• Hand-entered geographic labels and water-body labels from USGS digital raster graphs.
• 1:2400-scale orthophotography 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 for the inner mine area produced by Eagle/Kodiak Mapping.
• 1:4800-scale orthophotography for the outer mine area developed by Eagle/Kodiak Mapping.
• 1:4800-scale vector mapping for the outer mine area produced by Eagle/Kodiak Mapping.
• Township, range, and section information.
• National parks and preserve data.
• Native regional corporation boundaries.

C.5.1.3 Environmental Data

Various environmental data sets were converted into ArcGIS 9.3 for the Pebble Project. In some cases, data existed only 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 habitats for bears, birds, caribou, clams, crabs, fish, marine mammals, moose, and sheep.

C.5.1.4 Data Acquisition for Wetlands Consultants

Data sets for use by Three Parameters Plus, Inc. (3PPI), and other environmental consultants that existed only in paper form and required digitizing were converted into ESRI shapefile format. Data include the following:

• Surficial geology.
• USFWS National Wetlands Inventory (NWI).
• National Resource Conservation Service (NRCS) soil maps.
• USGS Earth Resources Observation System (EROS) Bristol Bay land cover.

C.5.1.5 Ongoing Support for Wetlands Consultants

Support for the 3PPI and HDR Alaska, Inc. (HDR) wetlands delineation process was provided through the following activities:

• Produced field maps and photo reports. Field maps were created on weather-resistant paper for use during the field seasons. Photo reports, including field data, were generated at the completion of each field season (through summer 2008) to be used in quality control.
• Wetlands data were scrubbed to remove slivers, close polygons, and maintain the integrity of the wetlands mapping.
• Digital photographs and location information were processed.
• Summary tables were developed that show, for the study area, the number of acres for each vegetation type and hydrogeomorphic (HGM) classification.

C.5.1.6 Cartographic Services

Cartographic services were provided to the consultants on the Pebble Project team on an as-needed basis (with approval from Pebble Partnership).

C.5.2 Data Management

A web-based data management application was created to support the Pebble Project environmental baseline team and ensure data security is protected. An integrated data management system is critical for ensuring data consistency and reliability. 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 login credentials. Types of functionality present in the system are summarized below.

C.5.2.1 Meteorological Data

From the home page of the Pebble Project website (Figure C-1) users can access the following data related to meteorology:

• Camera images at meteorological stations at the mine and Cook Inlet study areas.
• Current weather-station data updated regularly and are used to help plan helicopter flights to and from Iliamna.
• Maps of weather stations in the possible mine area and possible port area.
• Data for USGS stream-gage stations.
• A list of current enhancements for the different modules within the website.

C.5.2.2 Document Repository

The document repository provides a centralized storage location for project documents (Figure C-2). The repository stores electronic project-related documents including spreadsheets, images, portable document format (PDF) files, and map files. The repository also stores metadata such as title, author, keywords, and citations (Figure C-3). When a new version of a document is created, it can be uploaded to the repository and associated with the document to create an historical archive. Role-based security determines user permissions for adding, viewing, editing, and deleting files. Users can search for specific documents and document types. Files are stored in a folder structure, and users can expand or collapse these structures to see more or fewer subfolders and files.
C.5.2.3 Wetlands

The wetlands page enables users to enter wetlands data and review existing data for plots of land in the wetlands study area. The data captured for each plot are: site location, vegetation, hydrology, soil profile and other soil information, determination on whether the plot is a wetland, and wetland functional capacity assessments. In addition, the wetlands page includes a number of wetland-specific reports and digital photographs of each wetland plot.

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

- Site Location—information relating to the location of an individual field plot including a site-location map (Figure C-4).
- Vegetation—information relating to the vegetation located at a field plot (Figure C-5).
- CRP-AK06—information relating to bryophyte vegetation located at a field plot (Figure C-6). (Bryophytes are land plants that have tissues and enclosed reproductive systems, but which lack vascular tissue that circulates liquids. They do not have flowers or seeds but instead reproduce with spores).
- MORPH-AK06—information relating to plant morphological adaptations observed at a field plot (Figure C-7).
- HYD-87—information relating to the hydrology present at a field plot (Figure C-8).
- HYD-AK06—information relating to wetlands indicators at a field plot (Figure C-9).
- Soil Profile—information relating to the soil profile at a field plot (Figure C-10).
- Other Soil—additional information on the soil present at a field plot (Figure C-11).
- Determination—final information on whether the field plot is a wetland; also allows for storage of multiple digital photographs of the field plot and surrounding area (Figure C-12).
- Assessment—if the wetland is designated as a wetland on the Determination tab, the Assessment tab will appear; allows users to describe the wetland by selecting choices under a predefined list of wetland variables (e.g., hydrology, landscape, vegetation; Figure C-13).

C.5.2.4 Links

Links are provided to relevant web-based resources for associations, publications, governmental, and regional agencies.

C.5.2.5 Field Forms

Field forms were developed to capture information collected during or related to field studies (Figure C-14). Data captured in these forms will be exportable to Microsoft Excel for future analysis.

At the request of the Field Data Manager, user access to the field forms was restricted in September 2008 to ensure security and integrity of the data.
C.5.2.6 Analytical Data

The analytical data application includes three features: data loader, data extractor, and data changer.

**Data Loader**

The data loader, which can be configured by the user, checks incoming data for a variety of problems such as duplicate sample numbers, blank cells within a column, and previously loaded samples. Access to the data loader is strictly controlled to ensure security and integrity of the data—only those people approved by the Pebble Partnership have authority to load data. The primary use of the data loader has been to upload laboratory results and meteorological data. The data loader is composed of the following functionalities (Figure C-15):

- New Data Loader—allows users to create a new data loader for the system. The data loader controls the EDD (electronic data deliverables), which specifies the format of the columns to be added to the database.
- Edit Data Loader—allows users to edit an existing data loader (Figure C-16).
- Delete Data Loader—removes a data loader from the system.
- View Loader History—allows users to search through a log of all data loaded to the system (Figure C-17).
- Load Data—allows users to load analytical data to the system in the format specified in the EDD.
- Batch Removal—allows users to remove data that have been loaded to the system previously.

**Data Extractor**

The data extractor is used to query the database and to save the result sets to Microsoft Excel files. It is highly configurable and includes the following features:

- Report creation based on multiple data types (e.g., analytical chemistry and field water quality).
- Mandatory fields that must accompany each result set (e.g., the validation flag and units must accompany all result sets for analytical chemistry).
- Option to include or remove fields from result sets (with the exception of mandatory fields).
- Ability to filter result sets using logical (Boolean) operators.

Environmental consultants for Pebble Project were instructed in the use of the data extractor to support their report writing.

**Data Changer**

The data changer is used in controlled situations to change the data—only the Field Data Manager can use this tool. The data changer enables authorized users to run existing reports and to edit the chemistry data and the analyte criteria data. These data can be used for review, performing calculations, or creating customized reports. The data changer also allows authorized users to use existing Data Extractor Reports as a basis for editing data within the Data Changer.
C.6 References


C.7 Glossary

Functionality—a particular set of functions or capabilities associated with computer software.

Hydrogeomorphic—a wetlands classification system.

Metadata—data about other data; used in describing the data and putting them into context.

Receipt (in the CQM system)—a document from government agencies containing agency comments. A receipt is broken down into individual comments in the CQM system, and responses are developed or positions are assigned for each comment.
Welcome to the Pebble Project Website

This website is designed to support the Pebble Project Environmental Baseline Team, and to ensure that Pebble Limited Partnership has ultimate control and possess all necessary data. The data and metadata generated as part of the permitting process is a valuable asset to Pebble Limited Partnership. The data must be under the control of Pebble Limited Partnership.

Current features of the site include:
- File sharing system
- Project team contact list
- Project data entry forms
- Analytical data storage and reporting capabilities
- Links to related or useful web sites
- Current Camera Image: Pebble 1
- Current Camera Image: Pebble 2
- Current Weather Station Data

USGS Streamgage Station Data
- USGS Real-Time Water Data for Roeschle Creek
- USGS Real-Time Water Data for Upper Tazlina
- USGS Real-Time Water Data for Susitna River
- USGS Real-Time Water Data for South Fork Kuskulna River
- USGS Real-Time Water Data for North Fork Kuskulna River

This web site will be updated with new functionality on a regular basis. Future enhancements include the following:
- Interactive GIS

Enhancements and fixes to the site in the current release (6/23/2008) include:
- Wetlands
- Under certain conditions life is now highlighted on the Soil Profile tab. In addition, if the Upper Depth is <= 12, and Aquic Moisture Regime and Rad.

FIGURE C-1
Types of Data Accessible from Pebble Project Website Home Page
## FIGURE C-2
Document Repository, Example Files List
FIGURE C-3
Document Repository, Example Metadata Form
FIGURE C-4
Jurisdictional Wetlands Input Form Example, Site Location Tab
FIGURE C-5
Jurisdictional Wetlands Input Form Example, Vegetation Tab
FIGURE C-6
Jurisdictional Wetlands Input Form Example, CRYP-AK06 Tab
FIGURE C-7
Jurisdictional Wetlands Input Form Example, MORPH-AK06 Tab
FIGURE C-8
Jurisdictional Wetlands Input Form Example, HYD-87 Tab
FIGURE C-9
Jurisdictional Wetlands Input Form Example, HYD-AK06 Tab
FIGURE C-10
Jurisdictional Wetlands Input Form Example, Soil Profile Tab
FIGURE C-11
Jurisdictional Wetlands Input Form Example, Other Soil Tab
**FIGURE C-12**
Jurisdictional Wetlands Input Form Example, Determination Tab
FIGURE C-13
Jurisdictional Wetlands Input Form Example, Assessment Tab
FIGURE C-14
Field Form Example, Physical Characterization
FIGURE C-15
Data Loader, Main Menu
FIGURE C-16
Example Edit Data Definition Screen
### FIGURE C-17

Example Data Loader History

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