

# Environmental Surveys Team

# **GIS Data Management Plan**

**Bay Delta Conservation Plan**

**Environmental Impact Report/  
Environmental Impact Statement**

**May 2010**

**Prepared for:**

California Department of Water Resources  
Bureau of Reclamation  
U.S. Fish and Wildlife Service  
National Marine Fisheries Service

**Prepared by:**

The HDR Team



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## **List of Acronyms**

|       |  |
|-------|--|
| APL   | file extension for an ESRI ArcPad layer file                   |
| APN   | Assessor Parcel Number   |
| AXF   | file extension for a Microsoft SQL Server Mobile file          |
| BDCP  | Bay Delta Conservation Plan                                    |
| BECT  | BDCP Environmental Coordination Team                           |
| BEST  | BECT Environmental Surveys Team                                |
| DBA   | Database Administrator   |
| CDFG  | California Department of Fish and Game                         |
| DHCCP | Delta Habitat Conservation and Conveyance Program              |
| DMP   | Data Management Plan   |
| DS    | Data Steward   |
| DWR   | California Department of Water Resources                       |
| EDR   | BEST Environmental Data Report                                 |
| EFS   | Environmental Field Staff                                      |
| EIR   | Environmental Impact Report                                    |
| EIS   | Environmental Impact Statement                                 |
| EME   | EPA Metadata Editor  |
| EPA   | U.S. Environmental Protection Agency                           |
| ESRI  | Environmental Systems Research Institute (GIS software vendor) |
| ESTL  | Environmental Survey Technical Lead                            |
| GDB   | file extension for an ESRI file geodatabase                    |
| GIS   | Geographic Information System                                  |
| GPS   | Global Positioning System                                      |
| KBC   | Key Business Customer  |
| MDB   | file extension for a Microsoft Access database                 |
| MXD   | file extension for an ESRI map document                        |
| PCE   | Project Collaboration Environment                              |
| PDA   | Personal Digital Assistant                                     |
| PM    | Project Manager  |
| QC    | Quality Control  |
| RDB   | Relational Database  |
| SDE   | Spatial Data Engine  |
| SDEA  | SDE Administrator  |
| SSF   | file extension for a Trimble GPS location file                 |

## DISTRIBUTION LIST

This BEST GIS Data Management Plan is distributed to the key personnel in **Table 1**:

**Table 1. Distribution List**

| Copy # | Name               | Title or Role  | Organization |
|--------|--------------------|--|--------------|
| 1      | Stephani Spaar     | Key Business Customer; DWR PM; Environmental Surveys Manager | DWR          |
| 2      | Tim Smith          | DWR Assistant PM; Environmental Surveys Assistant Manager    | DWR          |
| 3      | Dawn LoBaugh       | HDR PM; Environmental Survey Lead                            | HDR          |
| 4      | Pratibha Basrao    | GIS Manager  | HDR          |
| 5      | Janice Sutherland  | SDE Administrator  | DWR          |
| 6      | Terri Fong         | GIS Data Steward   | DWR          |
| 7      | Brandon Jones      | GIS Data Steward   | HDR          |
| 8      | Jean Witzman       | Botany Survey Technical Lead                                 | DWR          |
| 9      | Katherine Weaver   | Bat Survey Technical Lead                                    | DWR          |
| 10     | Mike Bradbury      | Avian and Riparian Mammals Survey Technical Lead             | DWR          |
| 11     | Laura Patterson    | Herpetofauna Survey Technical Lead                           | DWR          |
| 12     | Leah McNearney     | Invertebrates Survey Technical Lead                          | DWR          |
| 13     | Marcos Guerrero    | Cultural Survey Technical Lead                               | DWR          |
| 14     | Doug Rischbieter   | Recreation Survey Technical Lead                             | DWR          |
| 15     | Danny Luong        | Enterprise GIS Server Coordinator                            | DWR          |
| 16     | Ruppert Grauberger | DOE GIS Coordinator for DHCCP                                | DWR          |
| 17     | File               | PDCC-DHCCP Document Control                                  | DHCCP        |

## **INTRODUCTION**

The Bay Delta Conservation Plan (BDCP) Environmental Surveys Team (BEST) GIS Data Management Plan (DMP) has been written in support of the data collection activities associated with the BDCP and the Delta Habitat Conservation and Conveyance Program (DHCCP). Data collected will be used in support of proposed activities associated with the BDCP and DHCCP, including the BDCP Environmental Impact Report/Environmental Impact Statement (EIR/EIS) process.

The tasks involved in the BEST GIS DMP include:

1. Development of a comprehensive schema for the California BDCP area of interest that will incorporate the data requirements of all stakeholders, provide for project-level data applications, and improve data accessibility for potential users.
2. Oversight and support of the in-field data collection process.
3. Database population with field collected data.
4. Quality control (QC) assistance and review of database.
5. Any other tasks necessary for completion of the preceding tasks.

## PROJECT TEAM

### CALIFORNIA DEPARTMENT OF WATER RESOURCES

The California Department of Water Resources (DWR) Project Manager (PM) for the environmental surveys effort is Stephani Spaar:

California Department of Water Resources  
 3500 Industrial Boulevard  
 West Sacramento, CA 95691  
 (916) 651-0178 (work); (916) 376-9688 (cell)  
 Email: sspaar@water.ca.gov

Contact information for other key DWR staff appears in **Table 2**.

**Table 2. DWR Contact Information**

| Name              | Role  | Email                 | Phone Number   |
|-------------------|---|-----------------------|----------------|
| Tim Smith         | Secondary Key Business Customer; Assistant PM               | tsmith@water.ca.gov   | (916) 376-9758 |
| Janice Sutherland | SDE Administrator   | jsuther@water.ca.gov  | (916) 376-9813 |
| Pamela Lindholm   | GIS Data Steward  | plindhol@water.ca.gov | (916) 376-9754 |
| Terri Fong        | GIS Data Steward  | kfong@water.ca.gov    | (916)574-2632  |
| Roberta Elkins    | Equipment and Supplies Manager                              | relkins@water.ca.gov  | (916) 376-9736 |
| Jean Witzman      | Botany Survey Technical Lead                                | jwitzman@water.ca.gov | (916) 376-9794 |
| Katherine Weaver  | Bat Survey Technical Lead                                   | kweaver@water.ca.gov  | (916) 376-9793 |
| Mike Bradbury     | Avian and Riparian Mammals Survey Technical Lead            | mbradbur@water.ca.gov | (916) 296-2909 |
| Laura Patterson   | Herpetofauna Survey Technical Lead                          | lpatters@water.ca.gov | (916) 849-6415 |
| Leah McNearney    | Vernal Pool Invertebrates Survey Technical Lead             | lmcnearn@water.ca.gov | (916) 425-3948 |
| Marcos Guerrero   | Cultural Survey Technical Lead                              | mguerrer@water.ca.gov | (916) 376-9795 |
| Doug Rischbieter  | Recreation Survey Technical Lead                            | dougr@water.ca.gov    | (916) 296-0901 |
| Dat Tu            | Oracle Database Administrator: Production Server            | dattu@water.ca.gov    | (916) 653-1216 |
| Josef Kahr        | Oracle Database Administrator: Publish Server               | jkahr@water.ca.gov    | (916) 653-9410 |
| Danny Luong       | GIS Enterprise/ArcGIS Server Implementation and Maintenance | dluong@water.ca.gov   | (916) 654-6433 |

### HDR ENGINEERING, INC.

HDR's PM for the BDCP EIR/S environmental surveys is Dawn LoBaugh:

HDR Engineering, Inc.  
 1610 Arden Way, Suite 175  
 Sacramento, CA 95815  
 (916) 569-1023 (work); (916) 651-9693 (cell)  
 Dawn.LoBaugh@hdrinc.com

Contact information for other key HDR staff appears in **Table 3**.

**Table 3. HDR Contact Information**

| <b>Name</b>     | <b>Role</b>                         | <b>Email</b>               | <b>Phone Number</b>            |
|-----------------|-------------------------------------|----------------------------|--------------------------------|
| Adrian Pitts    | Environmental Surveys<br>Consultant | Adrian.Pitts@hdrinc.com    | (916)569-1086<br>(916)651-9690 |
| Pratibha Basrao | GIS Manager                         | Pratibha.Basrao@hdrinc.com | (916)817-4845                  |
| Brandon Jones   | GIS Data Steward                    | Brandon.Jones@hdrinc.com   | (916)569-1094<br>(916)651-0735 |

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## PROJECT COMMUNICATIONS

### PRIMARY AND SECONDARY CONTACTS

The DWR PM and the HDR PM are the primary contacts for the BDCP/DHCCP Environmental Surveys task. In the event that the primary contacts are not available for time-sensitive information, communications should be directed to the following secondary contacts:

- DWR Secondary Contacts:
  - Surveys Management – The Assistant PM will address issues involving scope and schedule.
  - Technical Issues – The GIS Data Steward will coordinate on issues involving field data collection and corresponding GIS data management.
- HDR Secondary Contacts:
  - Task Order Management – The Environmental Surveys Consultant will address issues involving scope and schedule.
  - Technical Issues – The GIS Data Steward will coordinate on issues involving the field data collection process and corresponding GIS data management.

### PROJECT CORRESPONDENCE

The HDR PM will maintain regular email and phone contact with the DWR PM to ensure that DWR is kept aware of all issues pertaining to successful completion of the GIS data collection effort. There are several forms of communication which may be passed between DWR and HDR. The following provides guidance on how specific forms of correspondence and communications should be handled:

- Surveys Management Correspondence – The HDR PM will be responsible for communications with DWR that concern HDR's management of this effort. Issues that would require coordination between DWR and HDR include, but are not be limited to:
  - Scope of work changes
  - Project schedule modifications
  - Project budget modifications
  - Technical issues involving design of project deliverables
- Technical Correspondence – Open communication between members of the BDCP/DHCCP project team is essential to success. At the same time, it is important that team members follow minimal procedures to ensure that the Project Managers are kept properly informed of team activities. The guidelines for technical correspondence between team members follows:
  - Members of the BDCP/DHCCP project team within HDR may freely contact one another as required to exchange technical information.
  - Contacts between HDR project team members and DWR project team members must first be cleared through the HDR PM. To obtain clearance, HDR staff should email the HDR PM and identify the DWR staff to be contacted, and the topics and issues that will be addressed in the communication.
    - Once clearance is received, the HDR staff member may coordinate freely with DWR staff as required, and share working materials (e.g., spreadsheets, GIS data, Visio diagrams).
    - During technical discussions, BDCP/DHCCP project team members may identify issues that affect the scope, schedule or budget of the project. When this happens, DWR and HDR team members should immediately notify their respective PMs, who will resolve the issues.

- Deliverables – The HDR PM will be responsible for transmitting deliverables to DWR. No HDR project team member may transmit draft or final deliverables to DWR except by direction from the HDR PM.

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## **ROLES AND RESPONSIBILITIES**

Within the scope and context of this plan, the following roles have been established, each of which will have specific responsibilities:

### **KEY BUSINESS CUSTOMER**

The Key Business Customer (KBC) for the BDCP/DHCCP data collection effort is Stephani Spaar of DWR. Stephani is the Environmental Surveys Manager for the BDCP/DHCCP effort, and is the final authority on the content of the field collection data. As KBC for the environmental survey data, her responsibilities include:

- Approve all GIS/Global Positioning System (GPS) hardware and software tools to be used in the BDCP/DHCCP Environmental Surveys process prior to installation.
- Approve all GIS/GPS application development prior to initiation.
- Oversee the DWR Environmental Surveys Technical Lead team in all activities related to the BDCP/DHCCP Environmental Surveys process; approve all output from the team prior to release.
- Define operational constraints on the design of the BDCP/DHCCP data collection effort and resulting field collection data.
- Review and approve this GIS Data Management Plan, including the Quality Control Plan.
- Define and approve final BEST Environmental Data Report (EDR) as developed from collected field data for use in BDCP/DHCCP processes.
- In the event that the KBC is not available for one of the activities listed above, an alternate DWR designee will be assigned by the KBC.

### **ENVIRONMENTAL SURVEYS TECHNICAL LEADS**

The Environmental Surveys Technical Leads (ESTL) are those staff leading the effort for their respective resource team with knowledge of the various kinds of scientific data represented in the BDCP/DHCCP GIS database. The ESTLs are responsible for directing the Environmental Field Staff (EFS) in all BDCP/DHCCP environmental survey activities. As the experts in the subject matter being captured in the GIS, the ESTLs are the authorities for defining the characteristics of the GIS data schema. These responsibilities include:

- Describe feature geometries and properties identified for the data collection effort, including:
  - Avian – Nesting location of bird species of concern or their lack of presence in surveyed areas.
  - Botany – Location of plant species of concern or their lack of presence in surveyed areas.
  - Cultural – Location of cultural resources or lack of presence in surveyed areas.
  - Herpetofauna – Location of amphibian and reptile species of concern or their lack of presence in surveyed areas; habitat suitability of surveyed areas for herpetofauna.
  - Vernal Pool Invertebrates – Location of invertebrate species of concern or their lack of presence in surveyed areas; habitat suitability of surveyed areas for vernal pool invertebrates.
  - Riparian Mammals – Location of species of concern or their lack of presence in surveyed areas; habitat suitability of surveyed areas for riparian mammals.
  - Site Assessment – Phase 1 environmental site assessment to ascertain current conditions of locations surveyed.

- Communicate feature descriptions and feature-level metadata to GIS Data Steward for inclusion in documentation.
- Communicate data field domain limits and spatial extent boundaries to GIS Data Steward for inclusion in documentation.
- Review and recommend revisions to features collected by EFS.
- Oversee Level 2 and conduct Level 4 QC (described in the Quality Control Tests section).

## **ENVIRONMENTAL FIELD STAFF**

Biologists from DWR, California Department of Fish and Game (CDFG), and the HDR team fall within the EFS group. Some of these staff might also have roles as ESTLs. All data collection activities by the EFS will follow the processes defined in this DMP and resulting data will be housed in the Field Data Repository.

A diagram of the collection process appears in **Figure 1**. The collection process includes the following responsibilities:

- EFS must be familiar with the standards and guidelines identified in this document.
- EFS must have familiarity with the field hardware and software used for the field data collection.
- EFS must have familiarity with the feature geometries and properties of the data collection effort specific to the resource team for which they are collecting data as identified by their ESTL.
- EFS will be responsible for Level 1 and level 2 QC (described in the Quality Control Tests section) and may also assist with the Level 2 QC.

The EFS will collect data in feature classes and tables within the Environmental Systems Research Institute (ESRI) ArcPad environment using standard ArcPad tools and custom applications developed for the BDCP/DHCCP data collection effort. The EFS will be responsible for the following activities during the collection of BDCP/DHCCP data:

- Communicate with their ESTL on all new data collection workflows and protocols, and any additional instructions that may be unique to that data collection activity or resource team.
- Transfer the latest data or empty data structure (collection features and background features) to the mobile devices from the Project Collaboration Environment (PCE) website.
- Perform QC checks during data collection (Level 1 QC).
- Communicate errors or other concerns that may arise to the Database Steward (DS) and ESTL for resolution.
- Collect data following the protocols and standards detailed in this DMP.
- Complete hard copy forms to accompany digital data collection as necessary.
- Sketch elements on hard copy forms that represent feature geometry that cannot be entered digitally.
- Collect photography of assets identified for collection by the ESTL or DS.
- Familiarize themselves with instructions included in **Appendix A** for uploading and downloading data from the PCE.

## **DATA STEWARD**

DWR and HDR staff will function as the DS group for the data collection effort. At present, those individuals are Brandon Jones and Terri Fong. The DS group will be responsible for evaluating new data submitted by the EFS in the PCE upload process.

Periodically, the DS will perform additional QC procedures on the database. These procedures are identified as Level 3 QC, as described in the Quality Control Tests section of this document. The responsibilities of the DS include:

- Review spatial data and QC checklists (**Appendix B**) submitted by EFS.
- Perform QC assessments and coordinate data revisions with EFS.
- Develop and maintain field data geodatabase and supporting databases, and create ArcPad forms as requested by ESTLs or PMs.
- Process data collected by EFS including:
  - Import field collected data into the appropriate interim geodatabase where applicable.
  - Differentially correct GPS data collected in the field.
  - Provide the up-to-date field data repository geodatabases for each survey type on PCE.
  - Manage the directory structure of all photographs referenced in the data.
- Copy features into GIS that were either digitized by EFS using desktop GIS software and the best available aerial photography captured by hand on hard copy maps in the field, or as otherwise directed by ESTLs.
- Complete edits within the geodatabase to correct errors identified in the QC process or to improve data formatting.
- Manage SDE multiuser geodatabase to include the granting of privileges per geodatabase object, version QC, reconciling and posting to the master geodatabase, archiving the geodatabase, and compressing the geodatabase.

## **SPATIAL DATA ENGINE ADMINISTRATOR**

The Spatial Data Engine (SDE) is GIS software that acts as the go between for the RDB and GIS programs like ArcMap. ArcMap cannot connect with the RDB without the SDE interface. As the SDE Administrator (SDEA), Janice Sutherland has the following responsibilities:

- Create the initial environmental surveys geodatabase as a workspace within Oracle.
- Accept edits and updates into the DEFAULT geodatabase version.
- Compress the geodatabase.
- Replicate the DEFAULT geodatabase version from the production server to the publish server.

## **DATABASE ADMINISTRATOR**

The Relational Database (RDB) being used for BDCP/DHCCP is Oracle. For further technical details regarding the RDB please contact the DHCCP GIS Coordinator for documentation. Dat Tu is the Database Administrator (DBA) for the RDB on the production server. Josef Kahr is the DBA for the RDB on the publish server. The DBA has the following responsibilities:

- Develop and manage RDB setup and configuration.
- Configure the RDB to work properly with GIS software. Add users to the RDB and assign them to predefined roles. Editors are assigned to an editor role while viewers are assigned a viewer role.
- Monitor usage and impact on system resources.
- Provide ongoing management of the RDB, including backups and recovery of lost files, as necessary.

## **HARDWARE STANDARDS**

### **TRIMBLE GEO XM — PROFESSIONAL GRADE GPS**

The Trimble Geo series is the “all in one” standard professional grade GPS receiver. This handheld device includes a built-in GPS with a Microsoft® Windows® operating system in a rugged (dustproof, water resistant) case. The XM allows for accuracy to 1-5 meters. The unit includes integrated Bluetooth® for wireless connectivity to other Bluetooth-enabled devices, including cell phones and PCs. The Geo runs multiple applications—the primary ones for Mobile GIS/GPS being TerraSync, ArcPad, and CartoPac—connects to the Internet, and includes both a familiar user interface that is similar to the Desktop environment and an advanced outdoor color touch screen with integrated backlight. The unit can be integrated with the User’s Desktop for two-way communication and is equipped with an all-day battery. This unit requires no additional hardware for data collection. See the following website for current additional information: <http://www.trimble.com/index.aspx>.

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## SOFTWARE STANDARDS

Software is often overlooked as a major component in the GPS/GIS data collection and management workflow. **Figure 1** provides the workflow diagram showing the various steps involved in GPS/GIS data processing, including where the software components are utilized. The software described below will be used to complete the Mobile GIS/GPS effort for the BDCP/DHCCP environmental surveys process.

### FIELD DATA COLLECTION SOFTWARE STANDARDS

#### ESRI ArcPad™ Mobile GIS Software

ESRI's ArcPad provides database access, mapping, GIS and GPS integration to users in the field via handheld and mobile devices. It offers an interface much like ArcGIS, thus for ESRI software users it will seem familiar. It is designed to offer a GIS environment on a Personal Digital Assistant (PDA) and includes a GPS. GIS layers are available and easy to manipulate in ArcPad. Data collection with ArcPad is fast, easy, and significantly improved in Version 7.1 with immediate data validation and availability.

#### Trimble® GPSCorrect™ for ArcPad Software

Trimble's GPSCorrect, as an extension to ArcPad software, provides the added ability to perform post-processing on shapefiles and AXF files used in ArcPad and advanced mission planning tools. GPSCorrect software must be installed along with ArcPad to allow for real-time differential correction of data or post-differential correction of data.

### OFFICE DATA PROCESSING SOFTWARE

#### Trimble® GPS Analyst™ Software

GPS Analyst™ is an extension for ESRI ArcGIS software, streamlining the workflow between field and office. GPS Analyst improves productivity by enabling the user to work directly with GPS data inside a GIS software environment. The GPS Analyst extension, in coordination with the GPSCorrect program, is the only software that allows users to differentially correct GPS data directly inside ArcGIS Desktop software. With GPS Analyst, the user can bring GPS data straight from the field into the geodatabase. GPS Analyst offers a seamless workflow for the ESRI ArcPad software with the Trimble GPSCorrect™ extension for ESRI ArcPad software. GPS Analyst allows for data check out/check in, use, verification, and updates.

### APPLICATION DEVELOPMENT

#### ESRI ArcPad™ Studio (Application Builder)

ESRI's ArcPad Studio is HDR's standard tool for mobile application development for the BDCP/DHCCP project. This tool is used for designing data entry forms for GIS files used in ArcPad. It is also the development environment for ArcPad automation and customized tools/settings. If additional programming is needed, a request should be submitted to the GIS Manager.

# DATA MANAGEMENT AND MAINTENANCE

## INTRODUCTION

The BDCP/DHCCP data development and management procedures described in this document assume that the users have the necessary skills to upload and download data from the PCE (refer to **Appendix A** for instructions), and the technical capability to create and update GIS data using ESRI's ArcGIS 9.x and ArcPad 7.1 software (refer to **Appendix F** for step-by-step tutorials).

Data are collected in the field using Trimble GeoXMs and ArcPad 7.1 equipped with Trimble GPSCorrect. EFS will use specially designed ArcPad forms created in ArcPad Application Builder for the majority of the data collection effort. All of the data collected will take the form of a previously designed schema for specific BDCP/DHCCP data needs (**Appendix C**). In most cases, EFS will not require previously collected field data, thus relying simply on base data and empty feature classes, which can be accessed and downloaded through the PCE website. On those occasions where the EFS, or other team member, require previously collected data, the necessary feature classes can be provided. For backup and accessibility purposes, the DS will upload a new version of the intermediary geodatabases on PCE whenever the geodatabases are updated. All of the data collected during the BDCP/DHCCP field efforts are found within the BDCP\_ENV\_FIELD Oracle SDE Multiuser Geodatabase, which is divided into the following categories (i.e., repositories) (**Appendix C**):

- Avian Data Repository – Data pertaining to the physical location and nesting sites of birds of concern identified in the field.
- Bat Data Repository – Data pertaining to the location of bat survey activities identified in the field. Data includes the locations of deployed acoustic monitoring equipment, habitat assessments, and bridge surveys.
- Botany Data Repository – Data pertaining to the location of identified plants of concern. Also contains elderberry bush observations, recorded as an indicator of available habitat for the Valley Elderberry Longhorn Beetle, an invertebrate species of concern.
- Cultural Data Repository – Data pertaining to cultural resource surveys, including sites found or visited during the environmental surveys.
- Herpetofauna Data Repository – Data pertaining to the location of reptile and amphibian species of concern identified during the environmental surveys. Also included are snake aquatic trap locations, morphological data and capture information.
- Incidental Observation Data Repository – Data collected by all survey resource teams of sightings incidental to the resource survey currently being conducted, but potentially valuable to other resource teams.
- Riparian Mammal Data Repository – Data pertaining to the location of terrestrial traps set to locate riparian mammals of special concern, as well as information related to any findings.
- Vernal Pool Invertebrate Data Repository – Data pertaining to the location of vernal pools surveyed, geomorphic information for each site, and associated invertebrate species identified.
- Site Reconnaissance Repository – Data pertaining to features of environmental concern found during a phase I environmental site assessment administered at accessible locations within the project area.

Each of the nine categories is contained in intermediary repositories which are stored on the PCE<sup>1</sup>. They are then transferred to the master storage location which is located on DWR's Oracle SDE multiuser geodatabase designated for the field data. The master storage site has been divided into feature datasets that represent each of the resource types or repositories shown above. Other than the Level 1 QC performed in the field by the EFS, all post-processing and upper-level QC on these data are performed after the field data have been uploaded to PCE. The actual data collection and post-processing methods are detailed below in the next two sections "Environmental Field Surveys Workflows, Methods, and Protocols" and "Multiuser Geodatabase Workflows, Methods, and Protocols".

Additional field project files are divided among the following folders which are subdirectories within the BDCP\_Field\_Data<sup>2</sup> directory:

- Completed\_QC\_Forms<sup>3</sup> – Contains QC forms that have been reviewed by the DS, including edits in response to errors indicated on the forms. This folder has been divided into folders for each resource type.
- Hard\_Copy\_Field\_Forms<sup>4</sup> – Contains both form templates used to create mobile GIS electronic forms and scans of hard copy forms completed in the field. Forms are organized into folders identified by survey resource.
- Imagery<sup>5</sup> – Contains the aerial imagery used on the GPS units. There are multiple imagery files, one for each county, and they are cropped to rectangles that bound the parcels to be surveyed in those counties.
- LayerFiles – Contains ESRI layer files that store symbology and other settings for a feature class. The layer files can be added to an ArcMap session, or a new ArcMap session containing the layer and its underlying feature class can be accessed by opening the layer file. These layer files open the feature classes that are stored in the Oracle SDE multiuser geodatabase.
- MapDocs – Contains ESRI map documents (.mxd) that are used to store the layers for each resource for viewing and/or editing the data.
- Pictures<sup>6</sup> – Photographs of features taken in the field and organized into a quaternary folder structure:
  - Year (1) –The year the photo was taken
  - Survey Resource (2) – The survey resource type for which the photographs were taken(e.g., riparian mammals or botany)
  - GPS ID (3) – The unique numeric identifier of the GPS unit used to capture electronic field information
  - Date (4) – The date (MM\_DD\_YYYY) the photographs were taken
- RAW\_GPS\_Data – Contains the GPS/GIS data files with collected data from the mobile GPS/GIS units and uploaded to the PCE. These files (AXF and SSF) are used by the DS to import the data into the final repository and to post-process for spatial accuracy. The files are named in this

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<sup>1</sup> Follow this link: <http://www.bdcpereis.com/section.do?section=2243#selected> Note: when searching for the repositories on PCE, titles will follow this format: Full <Repository Name> (e.g.; Full Bird Geodatabase).

<sup>2</sup> The BDCP\_Field\_Data directory is located on a DWR server at: \\DESSRV04\DES 23R Shared\BDCP\_DHCCP-EnvSurveys&Assessments\Surveys

<sup>3</sup> The forms can be found on PCE at: <http://www.bdcpereis.com/section.do?section=5518#selected>

<sup>4</sup> Completed field forms can be found on PCE at: <http://www.bdcpereis.com/section.do?section=4882#selected>

<sup>5</sup> The imagery is also located on PCE at: <http://www.bdcpereis.com/section.do?section=2243#selected>

<sup>6</sup> Both field photos and raw GPS data are stored together on PCE in subdirectories at: <http://www.bdcpereis.com/section.do?section=2243#selected>

format: BDCP\_<resource type>\_Field\_Data\_< date AXF was created>\_<GPS ID>\_< date data was collected>. An example file name is:  
BDCP\_Botany\_Field\_Data\_04\_07\_09\_215600\_09\_03.axf

Optimal quality of the BDCP/DHCCP field data is assured when the people who have been assigned to the roles above perform their work according to the workflows, methods, and protocols. When errors are found at any stage, the work is returned to the responsible staff for correction and the results are re-cycled through the QC process.

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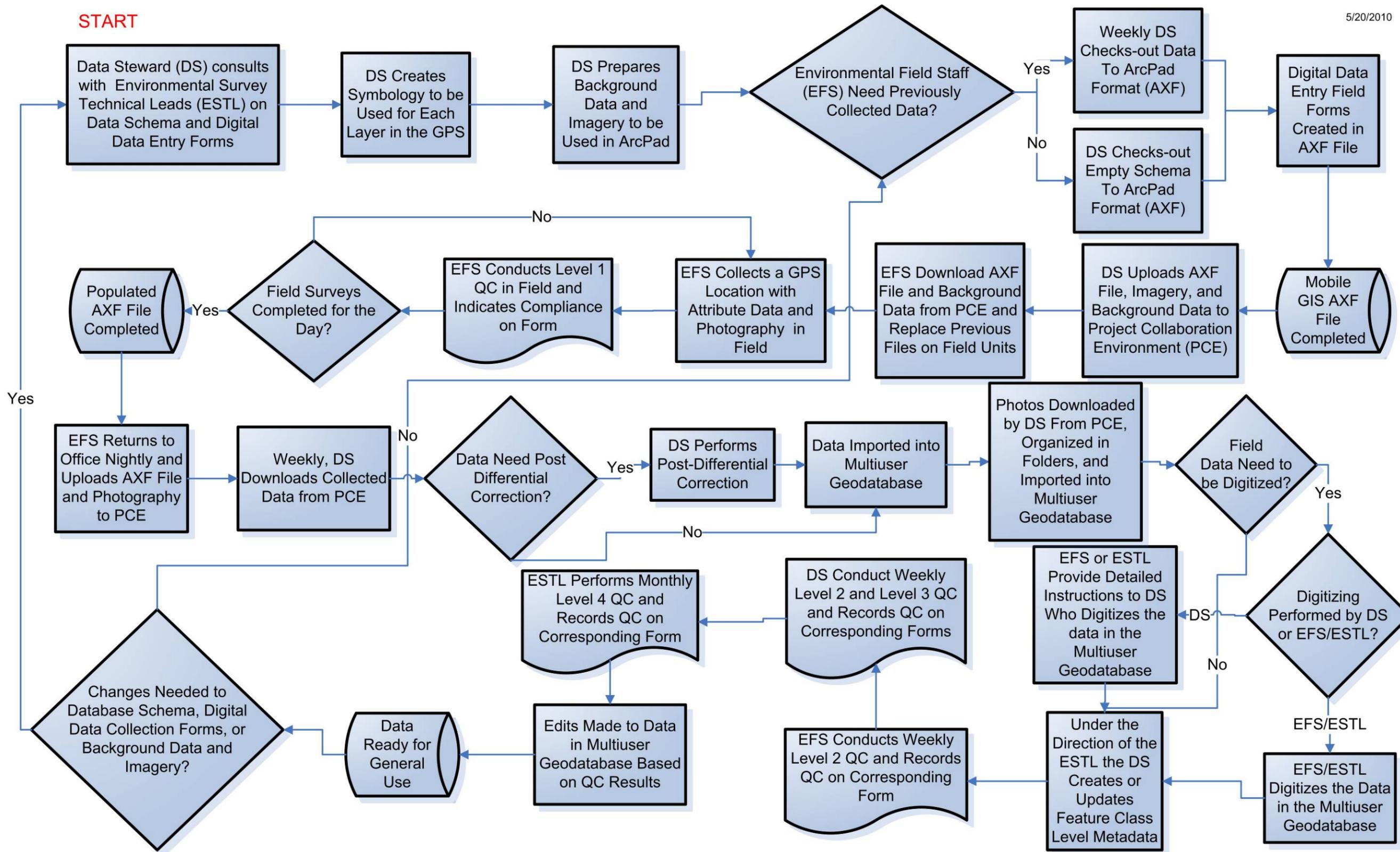


Figure 1. Environmental Field Surveys Data Management Workflow

## ENVIRONMENTAL FIELD SURVEYS WORKFLOWS, METHODS, AND PROTOCOLS

This section provides details for some of the key steps shown in **Figure 1** (previous page), beginning at “START”. Please refer to **Appendix D** for an alternate workflow diagram which illustrates the different time intervals in which tasks are to be performed and the division of labor between the DS and EFS/ESTLs. Refer to **Appendix F** for more detailed instructions for each step of the workflow.

- *Consult with ESTL* – Prior to collecting data, the DS will consult with the ESTL(s) to ensure that the data schemas and digital data entry forms are developed correctly. The ESTL will likely refer to already existing hard copy data collection forms like those contained in **Appendix E**. The DS will work with the DWR and HDR PMs to identify the appropriate ESTL to aid in the development of particular sets of data or a specific feature class. The DS should set up meetings and/or communicate in other ways with the ESTL(s) to resolve any questions, ambiguity, or errors in the database structure and data entry forms.
- *Create GPS Layer Symbology* – The DS creates appropriate symbology for each of the feature classes to be used on the GPS. These should be saved in a map document (.mxd) format that will be used when creating the ArcPad data file (AXF). This ensures that all data is displayed with accurate symbology in the field.
- *Prepare Background Data and Imagery* – The DS will prepare the background reference data to be displayed when viewing a map on the GPS unit (e.g.; roads, parcel boundaries). The DS will also provide the best available aerial imagery for use on the handheld devices.
- *Create AXF* – Data that had been previously collected, downloaded and processed by the DS can be provided to the surveyors as reference information as they go out to collect new data or for editing existing data. The DS will select the resource type data from the Oracle SDE Multiuser Geodatabase and create a replica<sup>7</sup> geodatabase from it. If the resource requires post-differential correction, the multiuser geodatabase will need to be replicated to a personal geodatabase. The personal geodatabase will then be GPS-enabled for use with GPS Analyst and a field to store GPS accuracy for each record will be selected. If the resource does not require post-differential correction for their data, the multiuser geodatabase will be replicated to a file geodatabase or a personal geodatabase. Using the ArcPad Data Manager in ArcMap for data *not* to be post-differentially corrected, the DS will create an AXF from the multiuser geodatabase. Alternatively, the DS will create an AXF from the replica personal geodatabase using the GPS Analyst toolbar for data that *is* to be post differentially corrected. If previously collected data is not required then the DS will choose the schema only (i.e.; empty database) option when creating the AXF. With schema only the AXF will not have to be constantly re-created like it does when the requirement is to have previously collected data unless the database schema is updated.
- *Digital Data Entry Forms*<sup>8</sup> – Using the ArcPad Application Builder, the DS creates the digital data entry forms that surveyors will use to enter their attribute information for each feature they collect in the field. The forms will typically be modeled after existing hard copy data collection forms as those contained in **Appendix E**. The DS will also program any automation for the entry forms that is requested by the ESTLs.

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<sup>7</sup> There are two reasons for exporting or replicating the data or schema to a geodatabase outside of the multiuser geodatabase. The first is when an EFS records data in the shape of a polygon. Polygons often require clean up before being copied into the multiuser geodatabase. An example is a situation in which a polygon crosses over itself. The second purpose is to allow for post-differential correction using the GPS Analyst extension in ArcMap which will only work with a personal geodatabases (i.e.; will not work with a multiuser or file geodatabase). If the data does not require post-differential correction and does not include data collected as a polygon, the AXF can be created directly from the multiuser geodatabase.

<sup>8</sup> This step will only be necessary when new data collection forms are created, or old data collection forms must be modified. Most of the data collection efforts will be repetitive, thus the database structure and forms for data collection will have been previously designed and can be reused.

- *Download AXF and Other Data onto Field Units* – EFS will download the required AXF files from PCE, remove any previous AXF files from their GPS unit (previous AXF files should have been deleted following their being uploaded to PCE in accordance with the PCE upload procedures in **Appendix A**), and save the most current AXF file on their GPS unit for field data collection.
- *Collect Data and Perform Level 1 QC* – While following the detailed protocols presented during training and described in this document, the EFS collects data in the field, performs the Level 1 QC for the data entered into the electronic and paper forms, and confirms the completion of QC by checking the QC field on each data collection form.
- *Upload Field Data* – At the end of each collection day, EFS upload the raw GIS files and photographs to the PCE (steps outlined in **Appendix A**).
- *Download Collected Data and AXF Check-in* – The DS will download all data (AXF files) to the RAW\_GPS\_DATA folder from PCE that were uploaded by the EFS. The DS renames the AXF files and associated SSF files to include the original name with the GPS ID and data collection date (MM\_DD) appended to the end. Using ArcPad Data Manager for data not to be post-differentially corrected, or the GPS Analyst toolbar for data that are, the AXF files are checked into the corresponding replica or exported geodatabase (or directly into the parent multiuser geodatabase for those survey resources that apply).
- *Post Processing* – The DS completes any post-differential corrections necessary on the collected data by using the GPS Analyst tools in ArcMap. For polygons, the DS confirms that each polygon does not cross itself. If one does, the DS modifies the polygon to correct the error. This is done because the Oracle SDE Multiuser Geodatabase does not allow entry of such errors.
- *Roll Data up to the Master Geodatabase* – This step pertains to replicated or exported geodatabases only. The DS synchronizes the replica geodatabases with the related parent multiuser geodatabase for each dataset that applies. In cases where a geodatabase is exported rather than replicated, any survey data updates must be copied to the parent multiuser geodatabase.
- *Organize and Import Photos* – The DS downloads and organizes photographs as detailed in the introduction to the “Data Management and Maintenance” section. Once the photos are organized, the DS will import them into the Oracle SDE Multiuser Geodatabase that is maintained at DWR. Please refer to the next section “Multiuser Geodatabase Workflows, Methods, and Protocols” for more detailed information on working with the Oracle SDE Multiuser Geodatabase.
- *Digitize Field Data Not Collected Electronically* – The DS or EFS/ESTL will digitize data collected in the field with notebooks or paper field forms (the data was not entered into the GPS unit). Data will be digitized on an as-needed basis. In most cases coordinates are included on the hard copy data sheets. In cases where coordinates are not recorded, but an Assessor Parcel Number (APN) number was captured, the point location for the record will be the center of the recorded parcel.

At this point, if appropriate, the offset feature class is also updated. This is a derived layer that moves the position of the original data point (derived from the position of the surveyor) a specified distance and direction as noted by the field surveyor in the attribute table. This tool is used to capture a more accurate point for an object (e.g.; a bird nesting in a tree 50 yards southeast of EFS). The tool has been primarily used by the Avian Resource Team, in an effort to limit disturbances to nesting or foraging birds. In addition, Song Sparrows have been assigned a unique offset feature class named “avian\_song\_sparrow\_offset”.

- *Populate Metadata* – Feature class level metadata are also important to maintain in accordance with the metadata standards adopted for this DMP. BDCP/DHCCP metadata standards reflect the minimum metadata requirements established by DWR (see section titled: Minimum Metadata Requirements).
- *Perform QC and Generate QC Reports* – As noted above, the Level 1 QC, which includes a visual review of collected data, is completed by the EFS/ESTL while in the field. A Level 2 QC, which includes a similar review of the data plus confirmation that all data has been uploaded to

PCE, is conducted by the EFS (ESTL may substitute) on a weekly basis for a series of individual field effort documentation packages from previous weeks' efforts. In addition, the DS completes a level 3 QC on a weekly basis that includes secondary reviews of data uploads, comparisons of electronic data to hand-captured data, and reviews of any post-field day edits. Finally, on a monthly basis the ESTL reviews data collected for the previous month to identify any errors that may have been missed in the previous QC steps, as well as both biological and/or spatial errors (e.g.; an aquatic species with a location point in uplands habitat). More information on the four levels of QC applied to all field data can be found in the section titled Quality Control Tests.

- *Make Corrections to Data* –The DS/EFS/ESTL will correct any errors in the data found by the QC process.
- *Change Schema and Data Entry Forms* – The workflow illustrated in **Figure 2** restarts on a weekly basis. If changes to the geodatabase schema or data entry forms are not requested, the workflow restarts at “Environmental Field Staff (EFS) Need Previously Collected Data?” (Step 4).

## **MULTIUSER GEODATABASE WORKFLOWS, METHODS, AND PROTOCOLS**

The multiuser geodatabase resides in a relational database (RDB). SDE (Spatial Data Engine) is the software/technology that allows the desktop GIS software (e.g.; ArcMap) to interact with the RDB and allows geodatabase functionality for data stored in the RDB. For this project, the RDB is Oracle. For further technical details regarding the multiuser geodatabase, the architecture of the hosting servers, details regarding the production and publish environments, SDE configuration, and the Oracle configuration being used for DHCCP, contact the DHCCP GIS Coordinator for documentation. A multiuser geodatabase allows for the following features:

- Simultaneous editing of the same data.
- Management of multiple versions of the data, including conflict identification and resolution tools that flag when different user edits conflict with each other.
- Archival of data to allow for snapshots in time of the data at predefined intervals. This allows the DS to observe how the data has changed over time and view previous field values to identify possible editing errors.
- Management of user view and edit privileges.

The multiuser geodatabase that stores the BDCP environmental field survey data is named “BDCP\_ENV\_FIELD”. For questions regarding access to the geodatabase, please refer to **Appendix F**, section “Connecting to ‘BDCP\_ENV\_FIELD’ Multiuser Geodatabase”.

This section expands on some of the key steps shown in **Figure 2** beginning at “START”. The order of the workflow illustrated above and described below is an example of the initiation of each step. After the first run through of the workflow, each step of the workflow may subsequently be completed out of sequence, depending on the needs of the day. Each preceding step has to have been performed at least once in a previous run. Please refer to the Multiuser Geodatabase Processes section in **Appendix F** for detailed step-by-step instructions of the following workflow.

- *Consult with ESTL* - The DS must consult with the ESTL(s) to ensure that the data schemas are created correctly. The DS will work with both the DWR and HDR PMs to identify the appropriate ESTL to aid in the development of particular sets of data or a specific feature class. Each DS will set up meetings and/or communicate in other ways with the ESTL(s) to resolve any questions or ambiguity in the data.

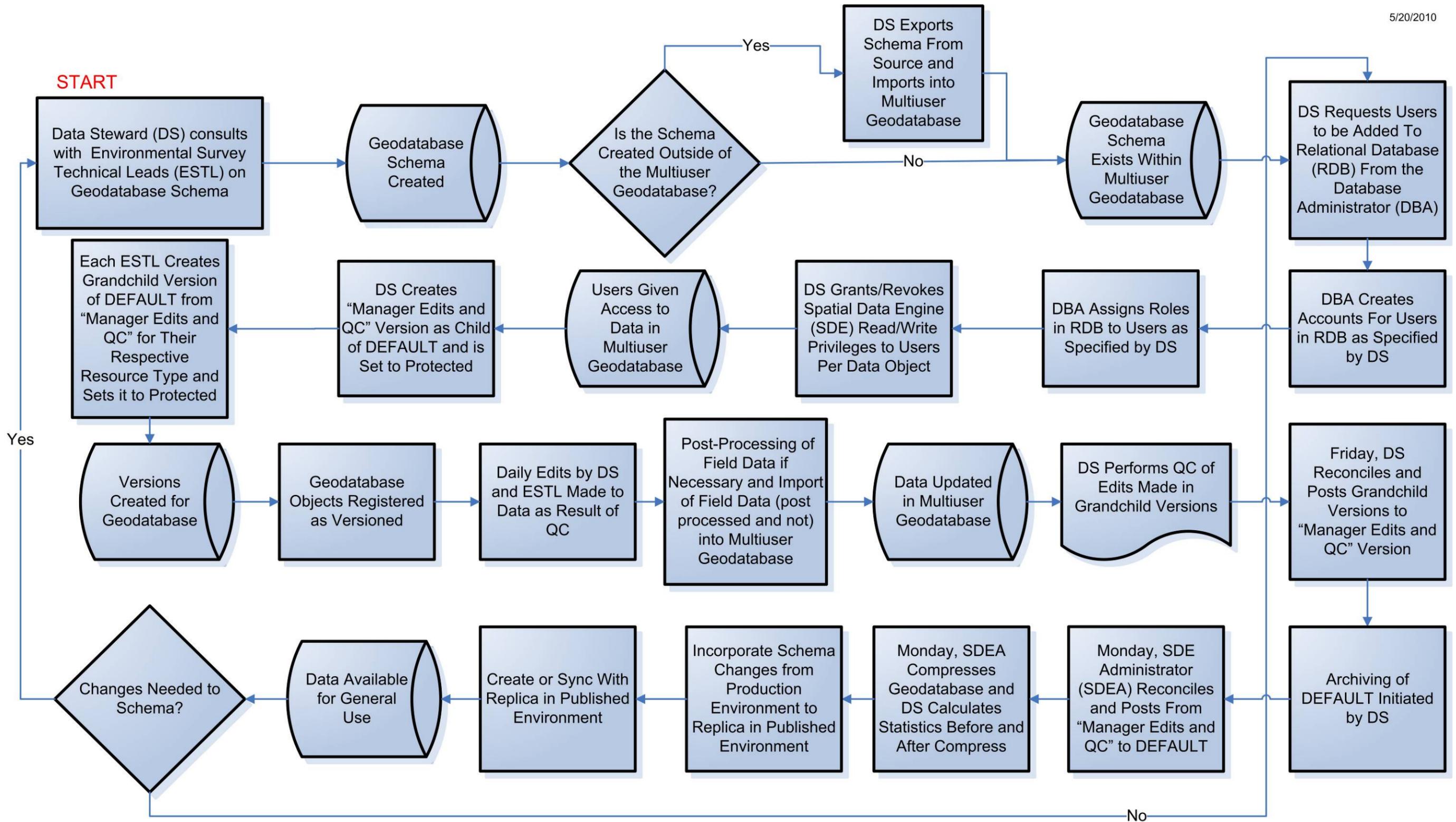
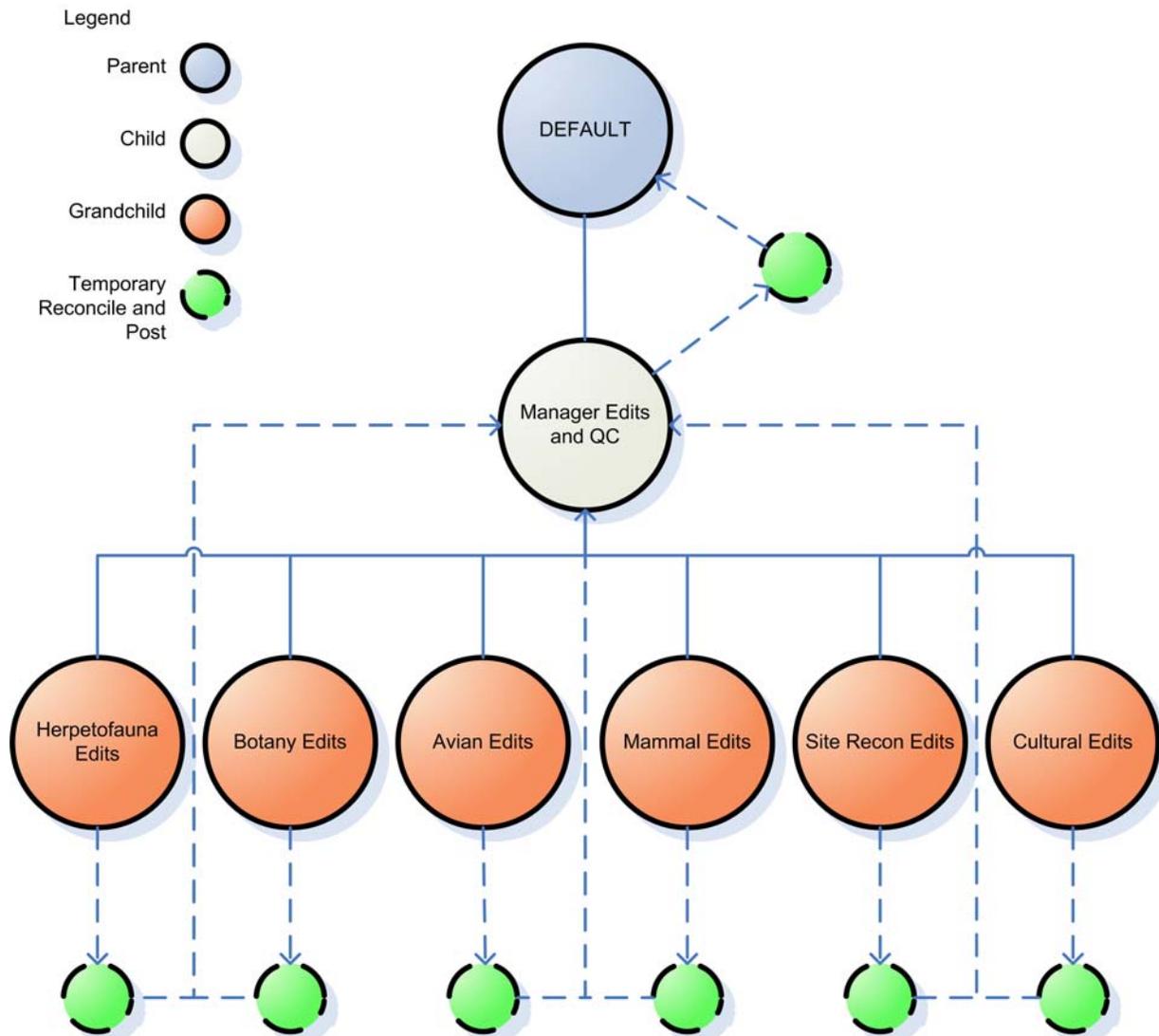


Figure 2. Multiuser Geodatabase Management Workflow

- *Export to Multiuser Geodatabase* – If the geodatabase schema is designed outside of the multiuser geodatabase, the DS will need to import that schema into the multiuser geodatabase. There are multiple methods to do this, but the “export to XML” tool in ArcCatalog is the preferred method for this effort.
- *Add Users to the RDB* –The DBA is responsible for adding new users to the RDB. The DS will make the request of the DBA to add new users and will specify the level of access to apply (e.g.; editor or viewer). If the new user is to be added as an editor, the DBA should assign the following roles: “edit\_field” and “view\_field”. If the new user is to be added as a viewer, the DBA will only assign the role of “view\_field”. The DBA will then provide the username and password to the new user.
- *Assign SDE Privileges* – For each feature class, new users added to the RDB must also be assigned either view or edit privileges within the SDE in order to use the data. The DS will grant these privileges. To grant editing privileges, the new editor’s username will be assigned to the individual feature dataset or table for which editing rights are to be assigned. For this effort, the global “edit\_field” role will not be used to assign editor SDE privileges. All users will be assigned the “view\_field” role to allow for view privileges of the field data.
- *Create Manager Edits and QC Version* – During creation of the multiuser geodatabase, a single version named “DEFAULT” is generated. This “DEFAULT” version should have access set to “protected”. The DS will then create a child version to be named “Manager Edits and QC”, which should also be set to “protected” access status. The “Manager Edits and QC” (i.e.; child) version will be used by the DS to make edits and comparisons of changes made over time during the QC process in the child versions of “Manager Edits and QC”. **Figure 3** illustrates the versioning tree which describes what versions should exist and the lineage of versions.
- *Create Child/Grandchild Versions of Manager Edits and QC* – For each of the resource types an individual grandchild version of “DEFAULT” (which is parent to “Manager Edits and QC”) will be created either by the ESTL or by the DS on behalf of the ESTL. For the grandchild naming convention, use the names shown in **Figure 3** and follow this pattern: “<resource name> Edits”. These will need to be set to “protected.” The ESTLs for each of the resource types will have the ability to edit data only within their resource’s grandchild version. Their edits will be reviewed by the DS prior to moving them from the grandchild version to the “Manager Edits and QC” child version. If the ESTL has other staff assisting in the editing process, each should have their own editing account and should create their own great grandchild version from the ESTL’s grandchild version. The naming convention for a great grandchild version is as follows: “<editor first name> <resource name> Edits” (e.g.; “John Botany Edits”).
- *Edit Tasks* – Prior to editing geodatabase objects, such as feature classes (if they do not reside in a feature dataset) or feature datasets, the DS will register them as versioned. During this activity, the “move to base” option should be left unselected. Edits will likely be made between the DS and ESTLs on a daily basis. Besides editing existing data, the DS will continue to check in or copy and insert newly collected and processed field data weekly (preferably Fridays) into the multiuser geodatabase. The processing performed is reflected in Figure 1.
- *QC, Reconcile, and Post Edits From Child/Grandchild/Great Grandchild Versions* – Each Friday the DS will review edits made by the ESTLs in their respective grandchild versions. If an edit looks questionable, the DS will notify the editor of his/her concern and await their back-check before posting the changes to the “Manager Edits and QC” version. Once the DS is satisfied with the edits performed in each grandchild version, he/she will reconcile and post to the “Manager Edits and QC” version. Since all versions are protected, the DS must create a temporary great grandchild version from each ESTLs grandchild version, then reconcile and post to the DS’ “Manager Edits and QC”. Once this has been completed, the temporary great grandchild versions should be deleted. If other staff supporting the ESTL created great grandchild versions, they need to be reconciled and posted by the ESTL to the ESTL’s grandchild version before the DS reconciles and posts to the child “Manager Edits and QC” version.



**Figure 3. Versioning Tree**

Once a version has been reconciled and posted, it should be deleted (unless it is one of the permanent versions as illustrated in **Figure 3**). When the reconciliation and posting has been completed, the DS will notify the SDEA that the geodatabase is ready for him/her to reconcile, post to the parent (i.e.; DEFAULT) version, and perform a geodatabase compress.

- *Archive DEFAULT* – If the parent multiuser geodatabase has not previously been archived, at this point archiving should be initiated. Archiving allows one to track how the DEFAULT version changes over time and records detail on when those changes to DEFAULT occurred. For this effort, archiving occurs when the post to DEFAULT occurs which has been scheduled for each Monday.
- *Reconcile and Post to DEFAULT and Compress Geodatabase* – On Mondays the SDEA should reconcile and post the previous week’s “Manager Edits and QC” version with DEFAULT. Again, since both versions are protected, the SDEA would need to create a temporary grandchild version from “Manager Edits and QC” to perform the reconciliation and post. Once the reconciliation and post has been completed, the SDEA will then run a compress of the geodatabase. Once finished the SDEA would notify the DS that the compression has been completed allowing the editing process to resume.

- *Sync with Replica Geodatabase in the Published Environment* – Initially the SDEA creates a one-way replica geodatabase located in the publishing environment. After the initial creation of the replica, every Monday following the compress, the SDEA uses the synchronization tool to transfer changes to the data in the production environment to the replica geodatabase in the publishing environment.
- *Transfer Schema Changes to Publishing Environment* – Schema changes will be made in the production environment (not the published environment). For the published environment to receive these changes, the SDEA will use schema change tools to transfer the changes from production to published.
- *Data Ready for General Use* – Once the data has been imported, gone through the QC process, been edited, and finally reconciled and posted to the DEFAULT version, the data is ready for general use and distribution following DHCCP distribution protocols (please contact the DHCCP GIS Coordinator for more documentation on distribution protocols).
- *Need to Make Changes to Schema?* – The multiuser geodatabase workflow will cycle back to the “adding users” step unless schema changes are needed for the geodatabase, which would require repeating the workflow from the beginning.

## **MINIMUM METADATA REQUIREMENTS**

DWR has adopted the same standards for metadata as those used by the U.S. Environmental Protection Agency (EPA) with a few exceptions. The EPA uses a software tool (an extension to ArcCatalog called the EME) to assist in development of metadata for each data object. DWR has modified this tool to fit its own standards, which includes the addition of specific information and the standardization of inputs for many of the required information fields. For a full list of the metadata required by DWR and optional fields, please refer to the document entitled “Spatial Data Standards for the California Department of Water Resources” published in 2009 by the DWR GIS Data Standards Committee.

## **COORDINATE SYSTEM**

The map projection used for all new data shall be UTM 10N NAD 83. The datum for vertical values will be left in the datum that the GPS units employ, in this case WGS 84. This is in accordance with the coordinate system standards established for the BDCP/DHCCP EIR/EIS. Please contact the DHCCP GIS Coordinator for documentation regarding EIR/EIS GIS data standards.

## **ACCURACY OF DIGITAL SPATIAL DATASETS**

With the equipment and software (see Standards section below) being used for this project, it is expected that the average accuracy of the non-post-differentially corrected data to be approximately 3-5 meters. Post-differentially corrected data is expected to be on average 1-3 meters accurate.

## **Attributes**

All GIS spatial datasets created during the data collection task by the HDR GIS Team will follow attribute standardization and documentation that meet the following guidelines:

- All datasets must be properly attributed. The schema must be developed and approved prior to data collection.
- Codes for attribute values, their domains, ranges and meanings must be documented in the metadata.
- A 99 percent level of accuracy (i.e., no more than 1 error detected within 100 values checked) standard will be maintained when coding attributes.

- A 99 percent level of accuracy standard will be maintained for values that have a documented range or domain.
- All attribute field names will begin with a letter.

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## QUALITY CONTROL PLAN

As discussed previously, the EFS, DS, and ESTL all play a part in controlling the quality of BDCP/DHCCP field data content by testing the features to ensure data has made it from the field to the data repository, and that the data collected while in the field is complete and contains no spelling or biological errors. When a question is raised as to the biological accuracy of the data, a follow-up visit to the location may be conducted. When errors are found, they are corrected in the multiuser geodatabase by either the DS or the EFS/ESTL.

### QUALITY CONTROL TESTS

Each DS is responsible for ensuring that new data generated for inclusion in the data repository meet or exceed DWR's quality standards. Please refer to the document entitled "Spatial Data Standards for the California Department of Water Resources" published in 2009 by the DWR GIS Data Standards Committee for details as to DWR's quality standards. It is the responsibility of the DS and ESTL to verify the work of the EFS and determine whether they have met the quality standards before incorporating the data into the field data repository.

**Table 4. QC Levels of Review**

| QC      | Summary of Tasks   | Frequency  | Responsibility  |
|---------|--|--|---|
| Level 1 | <ul style="list-style-type: none"> <li>Confirm complete and correct GPS data entry at time of collection</li> <li>Mark the QC checkbox in the GPS data form</li> </ul>   | The final step in collection of each field GPS feature | EFS   |
| Level 2 | <ul style="list-style-type: none"> <li>Ensure that EFS uploaded collected data, including photos, to PCE using proper PCE upload procedures</li> <li>Check that all GPS data was transferred from PCE to the data repository</li> <li>Review file attributes and geographic locations (GPS points) for errors</li> <li>Verify that the correct photo for each record was loaded into the Geodatabase</li> </ul>  | Weekly   | EFS (ESTL may substitute)<br>DS                             |
| Level 3 | <ul style="list-style-type: none"> <li>Complete a secondary check to make sure that everything that was uploaded to PCE (data and photos) was transferred to the data repository</li> <li>Review data digitized into data repository from data recorded on hard copy datasheets</li> <li>General review of data to identify obvious errors or omissions</li> <li>Verify edits made to data repository</li> </ul> | Weekly   | DS  |
| Level 4 | <ul style="list-style-type: none"> <li>Complete a biological and spatial QC to ensure data integrity</li> </ul>  | Monthly  | Subject matter expert (generally the ESTL for the resource) |

Following are detailed explanations of each level of QC for the BDCP/DHCCP field data review process (see **Table 4**):

#### Level 1

Level 1 requires that each individual data collector (i.e.; EFS) immediately review what has been entered into their data entry form(s) as they collect individual GPS features in the field. This step is intended to ensure completeness and accuracy in field entry for both electronic and hardcopy field forms. There is a checkbox on both the electronic and paper field forms to indicate that this QC step has been completed.

## Level 2

The EFS is responsible for Level 2 QC on a weekly basis. This QC process is conducted to ensure that the EFS uploaded their data and photographs to PCE correctly. The following tasks need to be conducted by the EFS (ESTL may substitute) for Level 2 QC:

- Ensure that all of the hard copy forms were provided to the ESTL by EFS and subsequently scanned and uploaded to PCE
- Ensure all data collected by mobile GIS or hard copy data forms and all photographs have been processed properly and imported into the GIS field data repository. This can be checked by accessing the data in the multiuser geodatabase that is described in the section above named Multiuser Geodatabase Workflows, Methods, and Protocols. While ensuring that all data has been included, the reviewer should also review for attribute or location errors.
- Complete QC checklist “Weekly Level 2 Environmental Survey Data QA/QC Form” found in **Appendix C** indicating steps completed during review. Upload a scanned copy of the QC form to the location on PCE called “Completed QC Forms”.<sup>9</sup>
- The DS is required at this QC level to monitor EFS uploads to PCE to ensure they are following the proper PCE upload procedures as stated in **Appendix A**.

Following are instructions for filling out the form. While reviewing the list below, please refer to **Figure 4**. The numbers in red on the figure correspond to the numbers for each paragraph listed below.

1. The name of the person performing the QC.
2. The date, or final day if the QC review spans multiple days, that the QC was performed.
3. The period of review for the QC. For example, this form may be used to record a QC review for a period that spans 10 days and ended 15 days prior to the date of the QC. All of Level 2 QC is intended to be performed on a weekly basis for the review period ending the Friday of the previous week. This form, however, can be used to refer to any data collection period.
4. The type of survey that was conducted. An example would be a bird survey.
5. The QC could be related to data collected by a single person, a team, or a GPS unit.
6. This QC step is to ensure that GPS data and scanned hard copy data sheets (e.g.; paper field forms, field notebook entries) have been uploaded to PCE.
7. This QC step involves using ArcGIS desktop to review the electronic data that has been downloaded from PCE and imported into the GIS data repository. This is also a second review to ensure that all data collected by GPS were made available on PCE for transfer to the data repository.
8. This step involves using ArcGIS desktop to ensure that all data collected with hardcopy data sheets have been downloaded from PCE and imported into the GIS data repository..
9. Within the “Attribute” table for each collected feature (e.g.; point or line), are there blank fields?
10. Within the “Attribute” table for each collected feature are there any recorded values that appear incorrect?
11. Were there any questionable sightings during this period that require a return site visit to confirm?
12. The DS should be regularly monitoring how field surveyors are using PCE. If individuals are not following proper PCE procedures (e.g.; naming protocols for files, placing files in appropriate folders), select the “no” checkbox and include a description of the problem in the “Outstanding Issues” field.

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<sup>9</sup> The link to this location on PCE is: <http://www.bdcpeireis.com/section.do?section=5518#selected>

| Weekly Level 2 Environmental Survey Data Quality Control (QC) Form (Ver. 4/14/2010)   |  |                             |                    |
|---|--|-----------------------------|--------------------|
| Name of Reviewer: <b>1</b>  |  |                             |                    |
| Review Date: <b>2</b>   |  |                             |                    |
| Review Period (survey dates included): <b>3</b>   |  |                             |                    |
| Survey Resource: <b>4</b>   |  | Data Collected by: <b>5</b> |                    |
| QC  | Item   | Performed by:               | Outstanding Issues |
| <input type="checkbox"/> <b>6</b>   | All data and photos collected during the review period specified above have been uploaded to PCE. This includes GPS data and scanned versions of the hard copy datasheets.<br><input type="checkbox"/> yes <input type="checkbox"/> no<br>If no, provide outstanding issues in space provided. | *EFS                        |                    |
| <input type="checkbox"/> <b>7</b>   | The GIS repository contains all GPS data and photos collected by the individual specified above in "Data Collected by" during the review period.<br><input type="checkbox"/> yes <input type="checkbox"/> no<br>If no, provide outstanding issues in space provided.                           | EFS                         |                    |
| <input type="checkbox"/> <b>8</b>   | The GIS repository contains data from all of the hard copy datasheets produced by the individual specified above in "Data Collected by" during the review period?<br><input type="checkbox"/> yes <input type="checkbox"/> no<br>If no, provide outstanding issues in space provided.          | EFS                         |                    |
| <input type="checkbox"/> <b>9</b>   | Data Fields blank? <input type="checkbox"/> yes <input type="checkbox"/> no<br>If yes, describe in the outstanding issues section where the omission is and what the value should be. If a field(s) is to remain blank, explain reason.  | EFS                         |                    |
| <input type="checkbox"/> <b>10</b>  | Data Fields Incorrect? <input type="checkbox"/> yes <input type="checkbox"/> no<br>If yes, explain issue and suggested resolution in the outstanding issues section.   | EFS                         |                    |
| <input type="checkbox"/> <b>11</b>  | If applicable, are all questionable species sightings resolved?<br><input type="checkbox"/> yes <input type="checkbox"/> no<br>If no, explain in the outstanding issues section.   | *ESTL                       |                    |
| <input type="checkbox"/> <b>12</b>  | Are surveyors following proper PCE upload procedures?<br><input type="checkbox"/> yes <input type="checkbox"/> no<br>If no, explain in the outstanding issues section.   | *DS                         |                    |
| <b>*EFS – Environmental Field Surveyor ESTL – Environmental Survey Technical Lead DS – Data Steward</b>   |  |                             |                    |
| <b>Signatures:</b>  |  |                             |                    |
| Survey Technical Lead (ESTL)  |  | Date                        |                    |
| Data Steward  |  | Date                        |                    |
| <b>Instructions:</b>  |  |                             |                    |
| <ol style="list-style-type: none"> <li>This QC is to be performed on a weekly basis.</li> <li>Because there will be lag time between the resource team's uploading of data to PCE and the data getting into the Oracle SDE geodatabase, the Level 2 QC should be initiated one week following the review period.</li> <li>Once the EFS and ESTL have completed the assigned sections of the form, including signature and date, a scanned copy should be uploaded to PCE at the following location: Surveys—EIR/EIS Team—Field Process and QA/QC—Completed QC Form. The QC level, resource name, and date range should be included in the file name of the QC form.</li> <li>The (DS) will download the scanned form(s), address any problems listed by the EFS or ESTL, complete the DS section, and sign and date the updated form. The completed form will then be reposted to the PCE at the same file location.</li> </ol> |  |                             |                    |

Figure 4. Level 2 QC Form

Confirm the check boxes to the left of each section to indicate that the QC described in that section was completed. The outstanding issues boxes are for listing or describing incorrect or absent information. Use the back of the form for more room if additional writing space is necessary.

Once the form is completed, scan and upload to PCE. Upload a scanned copy of the QC form to the related survey resource folder located on PCE in the "Completed QC Forms" folder in "Field Process and QA/QC" under "EIR\_EIS Team" under "Surveys".

### **Level 3**

On a weekly basis, the DS should conduct a Level 3 QC review of data that has been collected by both hard copy datasheets and GPS units. Review will include:

- Ensure all PCE uploads, whether GPS data, hard copy data sheets, or photos; have made it into the GIS data repository.
- Compare data that was collected in hard copy datasheets and later digitized into the database, to catch any data entry or digitizing errors.
- Visually scan attribute table to look for consistent omissions or other obvious errors that may signal a problem with the data entry form.
- Identify post data collection edits made to GIS data in the repository and identify appropriate staff (i.e.; the person who made the edits or the ESTL for that resource) to QC those data.
- Complete QC checklist "Weekly Level 3 Environmental Survey Data QA/QC Form" found in **Appendix C** indicating completion and upload a scanned copy to the same location on PCE as the level 2 QC forms.

Following are instructions for filling out the form. While reviewing the list below, please refer to **Figure 5**. The numbers in red on the figure correspond to the numbers for each paragraph listed below (please note the first three rows of the form are described with the Level 2 QC form instructions in the previous section).

1. For the QC period, compare the list of GIS and scanned data sheet files on PCE to downloaded materials. In addition, make sure that all files pulled from PCE were then successfully uploaded to data repository.
  - a. Open the "RAW\_GPS\_Data" folder that contains the downloaded PCE files. Sort the list of files within the resource folder on PCE by "File Title". The date at the end of each file's name in the "RAW\_GPS\_Data" folder should match the date at the beginning of the corresponding file title on PCE. If a data file is located on PCE that was not downloaded, make a note in the "Outstanding Issues" section of the QC form.
  - b. To confirm a file was uploaded to the data repository, try importing each ".axf" file again. To do so, follow the instructions shown in the section "GPS Data Download and Importing into Repositories", Step 2, located in Appendix F. When the import window opens, it will list each feature class in the ".axf" file to be imported and the number of new features that will be added when the import is performed for each feature class. If under the "Added" column all of the numbers are zero, then those data were already imported. If it is found that a feature was not imported, make a note of it in the "Outstanding Issues" section.
2. Compare the scanned hard copy datasheets to the data entered in the data repository. If differences between the two sources are found, make a note of it in the "Outstanding Issues" section.
3. This step is intended as a quick assessment of the collected data, reviewing for any errors that may have been caused by a systematic error. For instance, if the AXF file was set up incorrectly causing entered data to populate the wrong field. If errors are found, make a note of it in the "Outstanding Issues" section.

4. This review will occur after the “Attributes” in the data repository have been reviewed for any obvious errors and/or omissions. If errors and/or omissions are found, note them in the “Outstanding Issues” box.
  - a. To manage entering of redundant information, scan through the Attributes Table searching for blank cells within fields that typically contain redundant information. If blank cells are found, specify in the “Outstanding Issues” section.
  - b. A QC of photo imports should also be completed during this review cycle. Confirm that there is a photograph stored in the geodatabase for each photo number stored in the feature’s photo field.

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| Weekly Level 3 Environmental Survey Data Quality Control (QC) Form (Ver. 4/14/2010)  |   |                    |  |
|--|---|--------------------|--|
| Name of Reviewer:  |   |                    |  |
| Review Date:   |   | Survey Resource:   |  |
| Review Period (survey dates included):   |   |                    |  |
| QC   | Item  | Outstanding Issues |  |
| <input type="checkbox"/><br>1  | All GPS data and scanned data sheets uploaded to PCE for data collected during the review period specified above have been loaded into the GIS data repository.<br><input type="checkbox"/> yes <input type="checkbox"/> no<br>If no, provide outstanding issues in space provided. |                    |  |
| <input type="checkbox"/><br>2  | A comparison of digitized data in database with original hard copy datasheets has been performed.   |                    |  |
| <input type="checkbox"/><br>3  | A visual scan of field attributes for obvious or consistent errors/omissions in the data repository has been completed. If necessary, a discussion with the resource lead regarding any remaining errors or omissions has also occurred.  |                    |  |
| <input type="checkbox"/><br>4  | A verification of edits made to repository has been completed. (e.g.; updated photo links)  |                    |  |
| <b>Signatures:</b>   |   |                    |  |
|  |   |                    |  |
| Data Steward   |   | Date               |  |
| <b>Instructions:</b>   |   |                    |  |
| 1. Level 3 QC is performed on a weekly basis.<br>2. Form will be completed by Data Steward (DS).<br>3. Form will be uploaded to PCE at the following location: Surveys—EIR/EIS Team—Field Process and QA/QC—Completed QC Form. The QC level, resource name, and date range should be included in the file name of the QC form. |   |                    |  |

Figure 5. Level 3 QC Form

### Level 4

The fourth level is a biological and spatial QC. This includes review by a resource expert (generally the ESTL) to identify potential errors that the DS would not recognize or were missed until looking at the data

more globally. The ESTL should complete the “Monthly Level 4 Environmental Survey Data QC Form” found in **Appendix C** indicating completion of the QC effort. A scanned copy should be uploaded to the same location on PCE as the Level 2 QC forms.

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