# User Guide

ESSA 35 YEARS

# Site C Fisheries & Aquatic Data Management System

Prepared by

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for

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# 1 Introduction

The BC Hydro Site C Fisheries and Aquatic Data Management System (FADMS) provides a structured index and access to all aquatic and environmental monitoring information collected by BC Hydro and its contractors. Reports, databases, and other supporting documents are grouped together into "deliverables packages" and are described by a range of searchable metadata tags. Additionally, data from Climate, Air Quality, and Water Quality continuous monitoring sensors can be loaded into the FADMS database and can be accessed in tabular formats through the FADMS interface. Data can also be exported to Excel for further custom analysis and reporting.

The FADMS is designed to provide access to reports and data collected from the pre-Project phase through construction and post-Project monitoring (Table 1). It is also designed for a wide variety of users, including BC Hydro staff and consultants, agency personnel, First Nations, and stakeholders.

Table 1: Potential users and uses of the Site C Fisheries & Aquatic Data Management System.

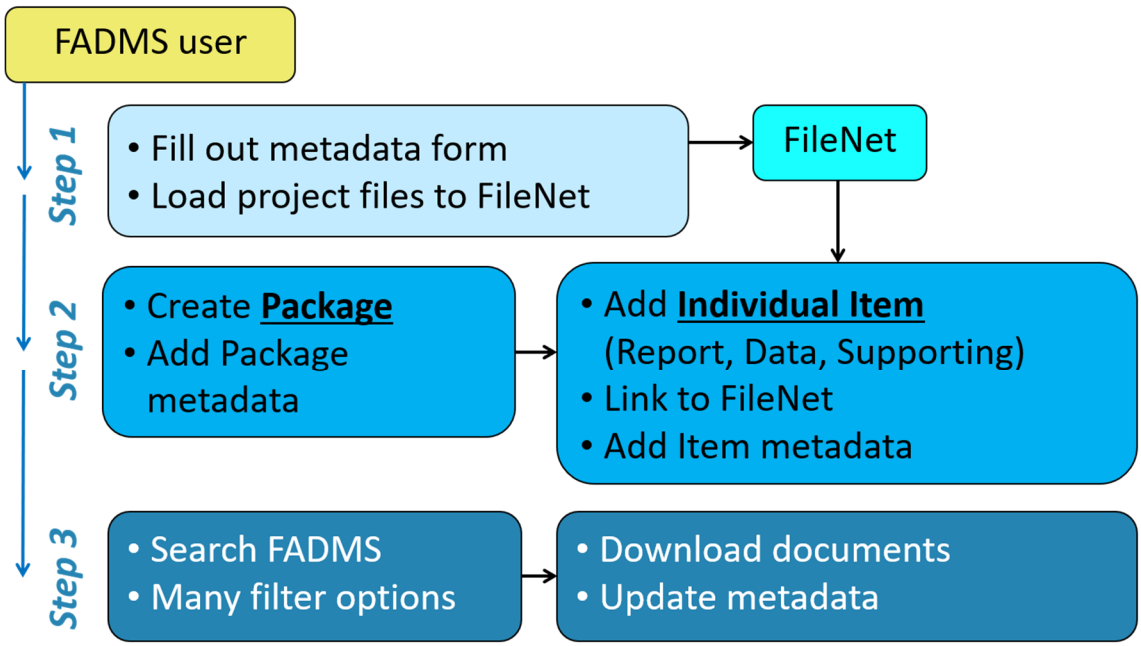
| Data Users | Data Uses |
|---|---|
| BC Hydro Technical Staff and BC Hydro consultants | **Pre-Project**<br>• Addressing detailed questions from stakeholders and regulatory agencies (latter particularly relevant to permitting)<br>• Designing monitoring and mitigation plans at a detailed level<br>• Power analyses (ongoing) |
| | **Construction**<br>• Monitoring during construction (compliance monitoring for water quality, fish plus effectiveness monitoring for mitigation) |
| | **Post-Project**<br>• Evaluating hypotheses described in EA and monitoring plans during construction and operation, e.g. distribution, abundance, survival and biomass of fish populations<br>• Post-Project vs pre-Project condition comparisons (for compensation)<br>• Testing EA predictions (water quality, habitat, primary and secondary production, fish abundance and biomass)<br>• Diagnosing problems<br>• Evaluating effectiveness of mitigation projects<br>• Iteratively refining monitoring protocols and analytical methods<br>• Testing and refining water quality and fish population models |
| DFO, MOE, FLNRO | • Reviewing reports produced by BC Hydro and BC Hydro consultants<br>• Making harvest decisions |

| | |
|---|---|
| FNs, Stakeholders | • Getting the big picture overview from reports and presentations, traditional ecological knowledge (TEK) |

This document provides guidance to help users navigate the FADMS and use its features to explore existing data, add new data, and manage data properties.

## 1.1 Getting Started

The FADMS is a web-based application that organizes the multi-year, multi-disciplinary scientific studies related to the Site C Clean Energy Project (the Project); making them more accessible and searchable across disciplines over the extended lifetime of the Project. The application works with the Windows Internet Explorer browser and is closely integrated with the FileNet documentation repository used by BC Hydro. This close association requires that new documents and data be processed in a specific order prior to actually using the FADMS for its search capabilities; beginning with loading new documents into FileNet followed by adding information into the FADMS itself. The figure below shows the three main steps.




Step 1 begins with completing a metadata checklist for the monitoring program (see Appendix A: FADMS Metadata Checklist). Monitoring program documents may consist of one or more high-level **Packages**, each of which contains one or more **Items**. A checklist should be completed for each Package and for each Item with the Package. When complete, the Package/Items checklist document should be submitted to the FADMS steward along with all

of the electronic documents. The FADMS steward will then load the documents into FileNet, completing Step 1.

In Step 2 the FADMS steward will use the information in the metadata checklist to create the Package and its metadata using the FADMS software, as well as all of the package's Items and their metadata. In this step the documents previously loaded into FileNet are linked to the relevant Item.

In Step 3 all users of the FADMS, including BC Hydro staff and outside consultants, can use the system to search for and extract relevant documents and data. As the number of documents currently stands at nearly 1,000 (and is expected to continue growing) the value of the search capabilities is very useful. Users fall into three groups:

1. Users supplied with a BC Hydro computer and situated within a BC Hydro office, linked directly to the BC Hydro network.
2. Users supplied with a BC Hydro computer and situated outside a BC Hydro office, who link directly to the BC Hydro network using a VPN.
3. Users with their own computer situated anywhere, who link directly to the BC Hydro network using a Citrix connection.

Regardless of their connection to the FADMS, all users must have a valid account on the BC Hydro computer network and know their account password. Users outside Group 1 must also know the four-digit PIN for their account and be in possession of a configured RSA Token Code which generates a unique time-sensitive six-digit tokencode (either from a physical fob or a digital phone app); both of which are required as part of the BC Hydro security authentication system.

**BC Hydro security standards require that passwords be changed every 90 days. The FADMS steward can be contacted for help with expired passwords or other connection problems.**

Prospective FADMS users must also apply to the FADMS steward to be added to one of these two Active Server groups: **Site C DMS** or **Site C DMS Admin**. Users in the Admin group are able to perform additional FADMS configuration tasks described in Section 2.5.

Group 1 users can use the FADMS as described in Section 1.2 once they have been added to the appropriate Active Server group by the FADMS steward.

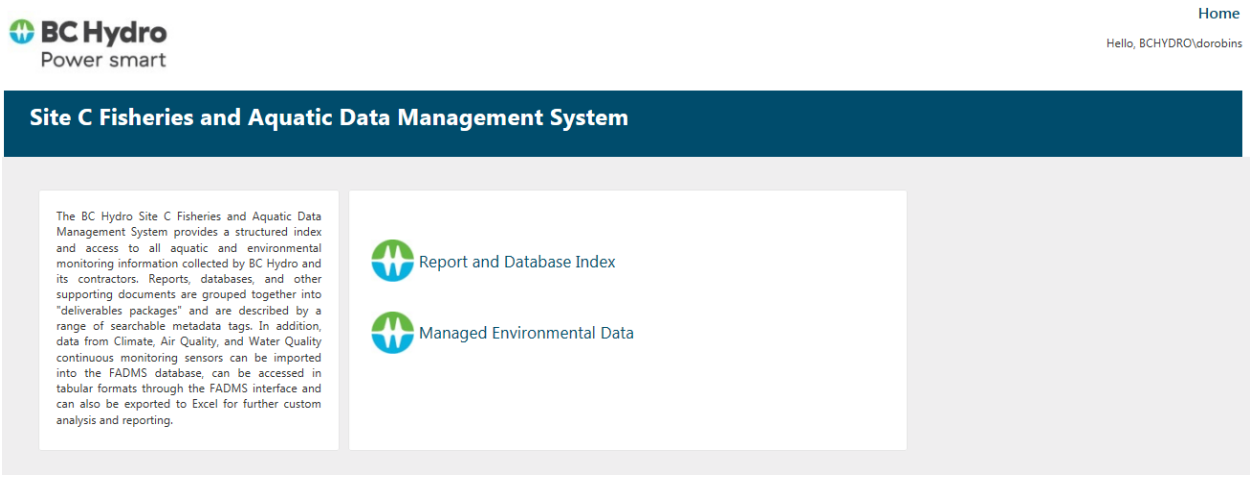
Group 2 users must first log onto their BC Hydro account and have a working internet connection. Next, they should use the Cisco AnyConnect Secure Mobility Client software installed on their BC Hydro computer to establish a VPN connection with the BC Hydro

network at vpn.bchydro.com. To establish the VPN connection, the user must provide the Cisco software with their Username (i.e. BC Hydro LAN ID), and provide their 10-digit PIN+tokencode. Once they are authenticated on the BC Hydro network, they can use the FADMS as described below in Section 1.2.

Group 3 includes most contractors and users without Cisco VPN access to the BC Hydro network. Instead they connect to the FADMS using the Citrix portal using their BC Hydro account and password, and a PIN+tokencode at this URL: https://citrix.bchydro.com/vpn/index.html. First time users will be prompted to install the Citrix Receiver (also found here: http://receiver.citrix.com). They can then use the Internet Explorer browser provided through the Citrix portal.

## 1.2 Accessing the System

The FADMS is a web-based system that runs on BC Hydro servers and can be accessed through the Windows Internet Explorer browser. Other browsers are not supported but may provide some functionality. At the time of preparation of this User Guide, the web-address (URL) for the FADMS is: http://10.242.150.48. When regular users log in,[1] they are taken to a **Home** screen with the BC Hydro logo and a **Home** link in the white header bar. Clicking on the BC Hydro logo at any time will the user to the Home screen. Users will also find a description of the current page in the blue title bar, and a description of the FADMS along with links to view either the **Report and Database Index** or **Managed Environmental Data**.

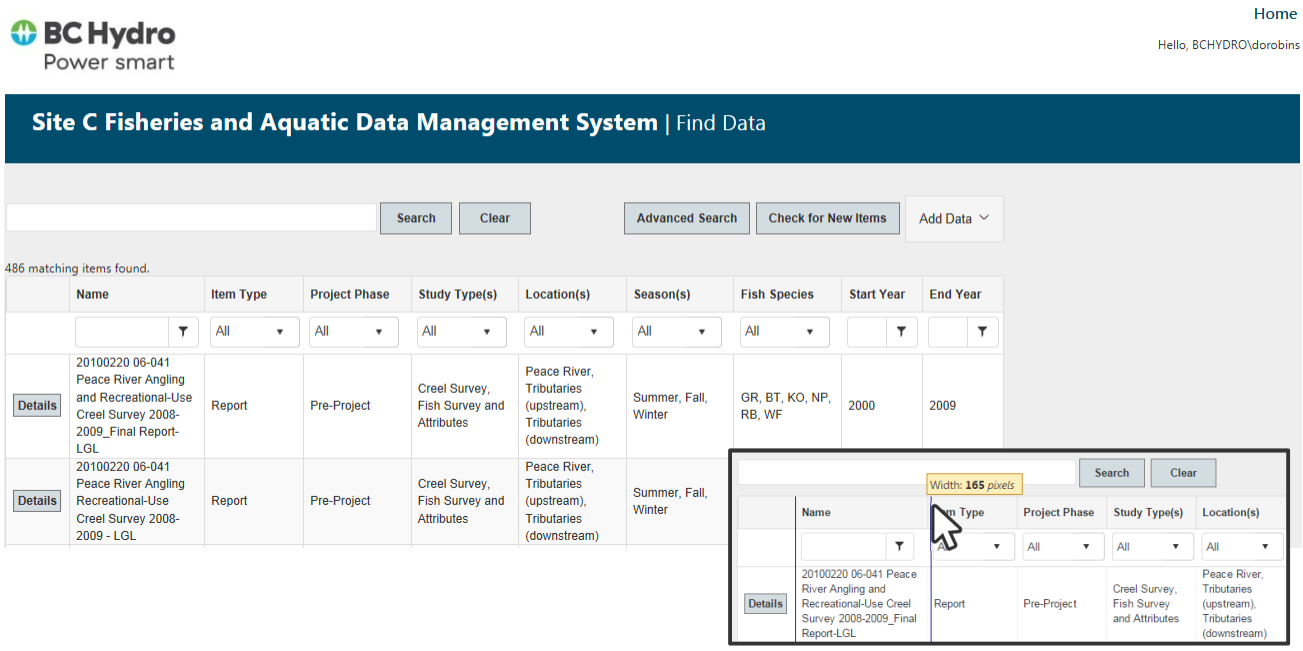



[1] If a user is the first one to use the FADMS after its server has been rebooted, they will experience a delay of about one minute as the app initializes and builds its linkage to the FileNet system. Subsequent users will not experience this long delay.

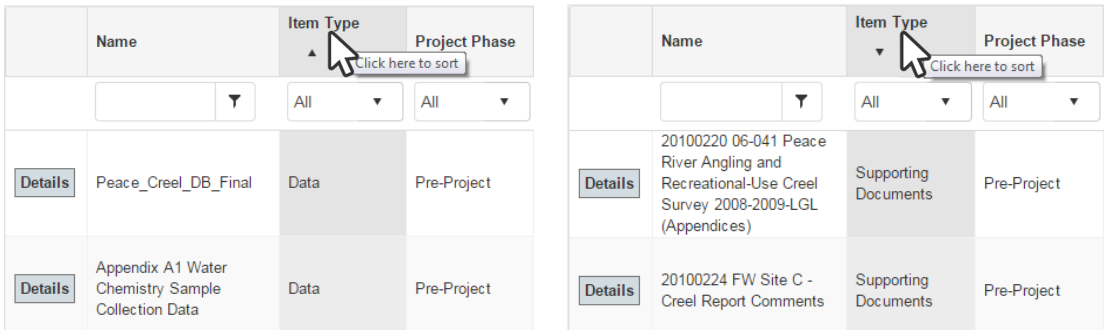
# 2 Report and Database Index

## 2.1 Browsing Data

Users who select the **Report and Database Index** will be taken to the main data browsing interface of the FADMS, the **Find Data** screen, which is presented in an interactive spreadsheet format as shown below. Data types include: file **Name**, **Item Type**, **Project Phase**, **Study Type(s)**, **Location(s)**, **Season(s)**, **Fish Species**, **Start Year**, and **End Year**. Users can customize the appearance of this spreadsheet by clicking and dragging the vertical bar between header cells to resize columns (see inset).



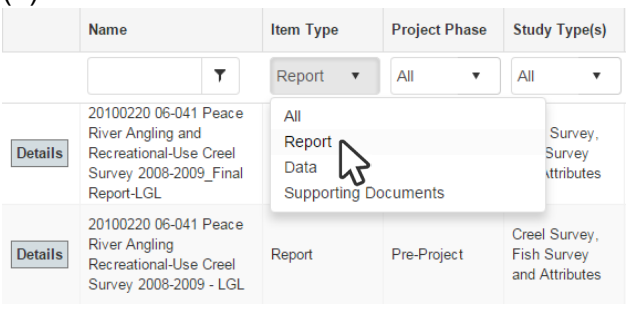

Users can sort data into alphabetical or numerical order by clicking directly on the header of each column, once for ascending order, again for descending order, and once more to clear the sorting.



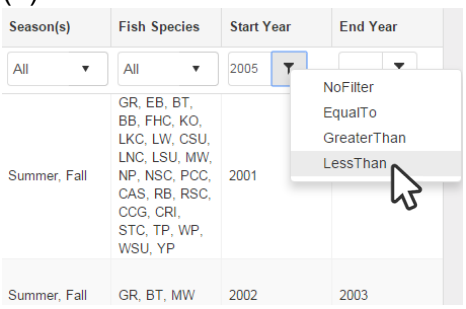
Users can browse data by scrolling through entries and using various combinations of filters (▼) and drop-down menus (▼) in each of the column headers to narrow their search to specific data characteristics.

For example, **Item Type** can be filtered to show only reports by selecting **Report** from the drop-down menu (a), or the start year can be filtered to show only studies that began before 2005 by first typing 2005, then clicking on the filter button and selecting **LessThan** (b). More complex searches that involve more than one drop-down selection (e.g., multiple species of fish) can be accomplished through the search functions described in the next section.

(a)



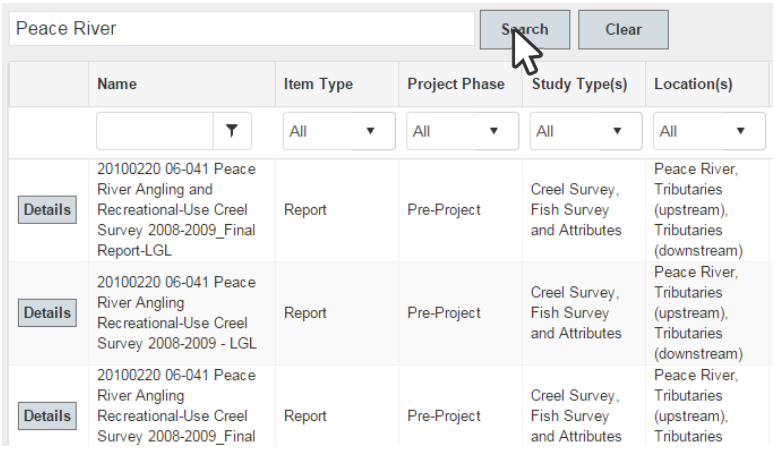

(b)



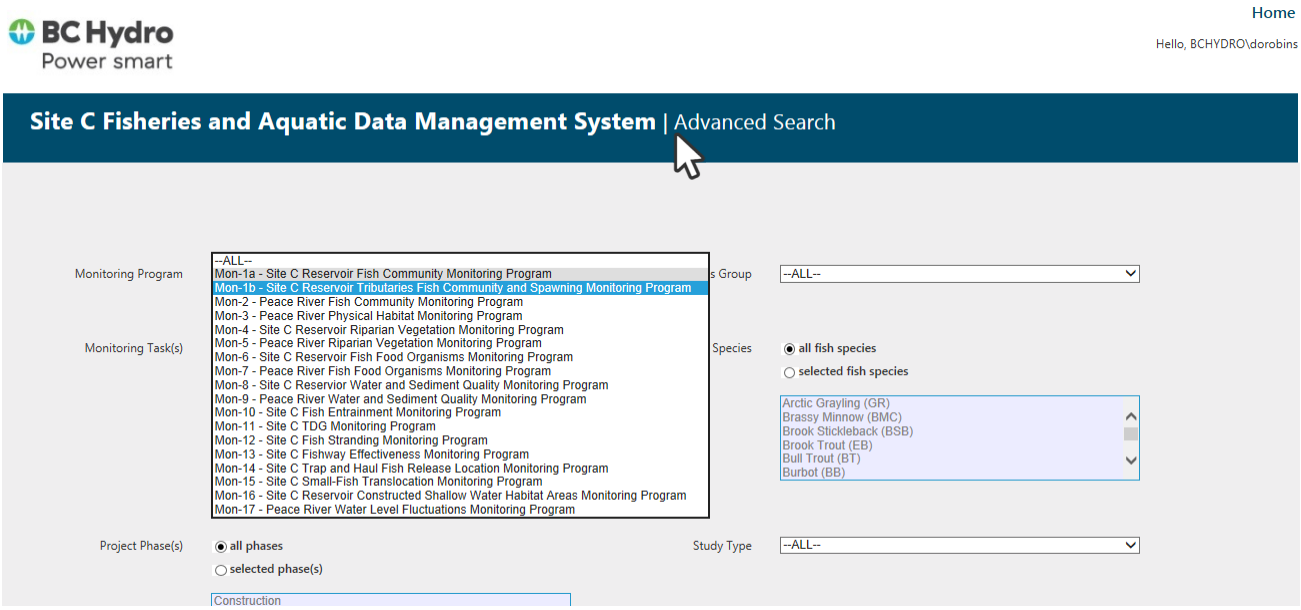

These criteria can be cleared one at a time by selecting **NoFilter** on filter menus and **All** on drop-down menus. To clear ALL filters, click **Clear** next to the search bar.

## 2.2 Searching for Data

Users can also locate entries according to more specific or complex criteria using the simple search bar or the advanced search feature. The simple search bar works as expected – simply type a word and either click **Search** or press Enter/Return on your keyboard to run the search. Note that this search function returns entries with the search term anywhere in their attributes or project description, including the name of the Deliverable Package which contains them; and these search terms may not necessarily appear in the spreadsheet view of the returned results.



Users can execute even more specific multi-criteria searches by selecting the **Advanced Search** button on the right-hand side of the screen. This takes users to the advanced search interface where they can select multiple combinations of criteria for one or more categories of data attributes. Some categories allow users to choose a single option from a drop-down list, such as the **Monitoring Program** category.



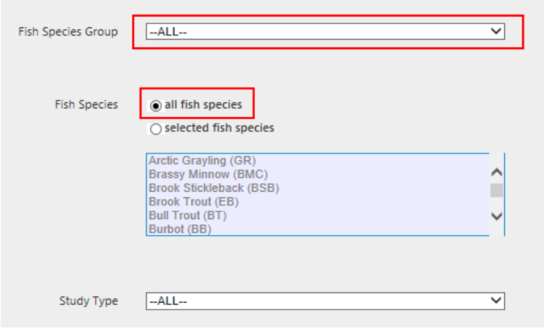

Others, like the **Monitoring Task(s)** category, allow users to select multiple options from within that category by first choosing the “selected…” radio button and then using either Shift-click to select the start and end of a contiguous selection (a), or using Ctrl-click to select several non-contiguous options (b).

(a) Shift-click to select…

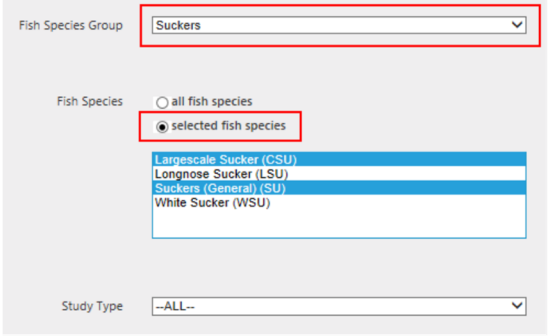

(b) Ctrl-click to select…


**Fish Species** can also be included in searches. Because of the large number of species, users are provided with the **Fish Species Group** drop-down list to help refine their search. By default, the Fish Species Group ‘ALL’ is selected, and ‘all fish species…’ are available for selection (a). By selecting a defined Fish Species Group (these groups are defined using the Management screens described in Section 2.5.2), a user-defined subset of all species is displayed. From that group, either the entire group or a subset of the group can be selected for the search (b). The Fish Species Group selection does not automatically include any of the species in the search; it simply refines the list to a more manageable length. Final species selection for the search can be made using Shift-click to select the start and end of a contiguous selection, or Ctrl-click to select several non-contiguous options.

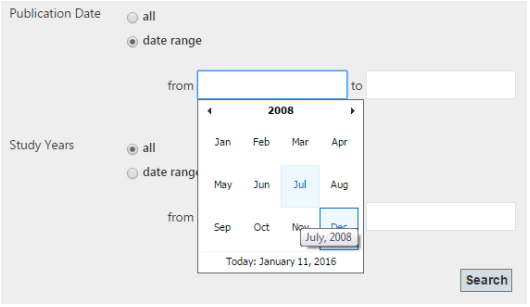
(a) default search

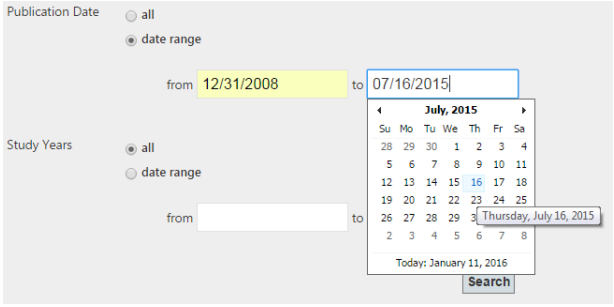



(b) search within Suckers, then select two species




Finally, time-related search fields require users to type in the date range they are looking for, or select specific dates from a series of pop-up calendar menus.



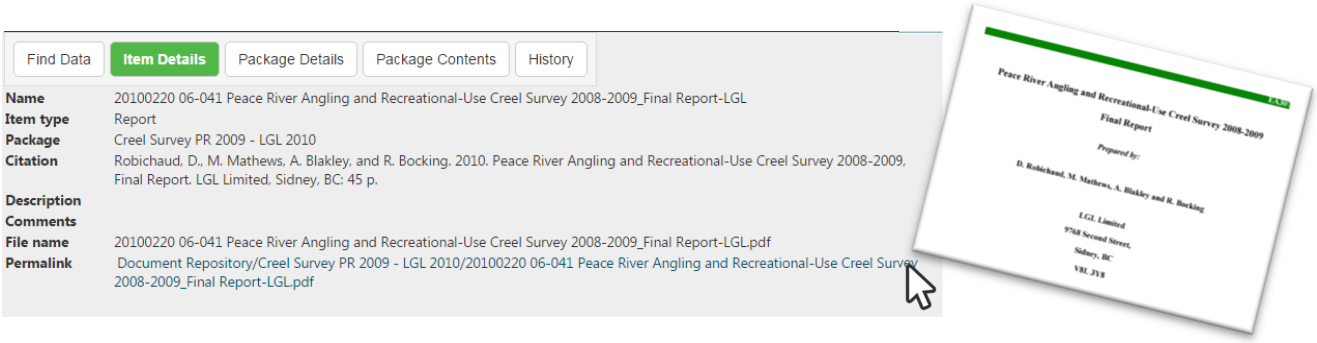




It is important not to specify too many options in the advanced search, or the search becomes more likely to return no results.

## 2.3 Exploring Data Attributes

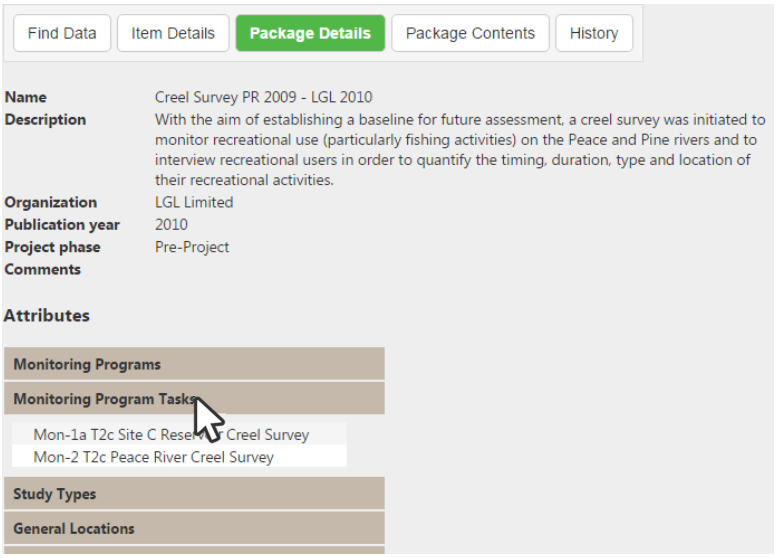
Each item in the FADMS is referred to as a **Deliverable Item**, and is associated with other related **Deliverable Items** to form a **Package**. Users can access the document associated with each item and explore details on each individual item and the package to which it belongs by clicking on the **Details** button at the start of each data row to access the **Find Data** screen.

For example, clicking **Details** next to the “Peace River Angling and Recreational-Use Creel Survey 2008-2009” item takes the user to the **Item Details** screen. This screen includes basic information on the item and a permalink to download the item, in this case a PDF of a report.

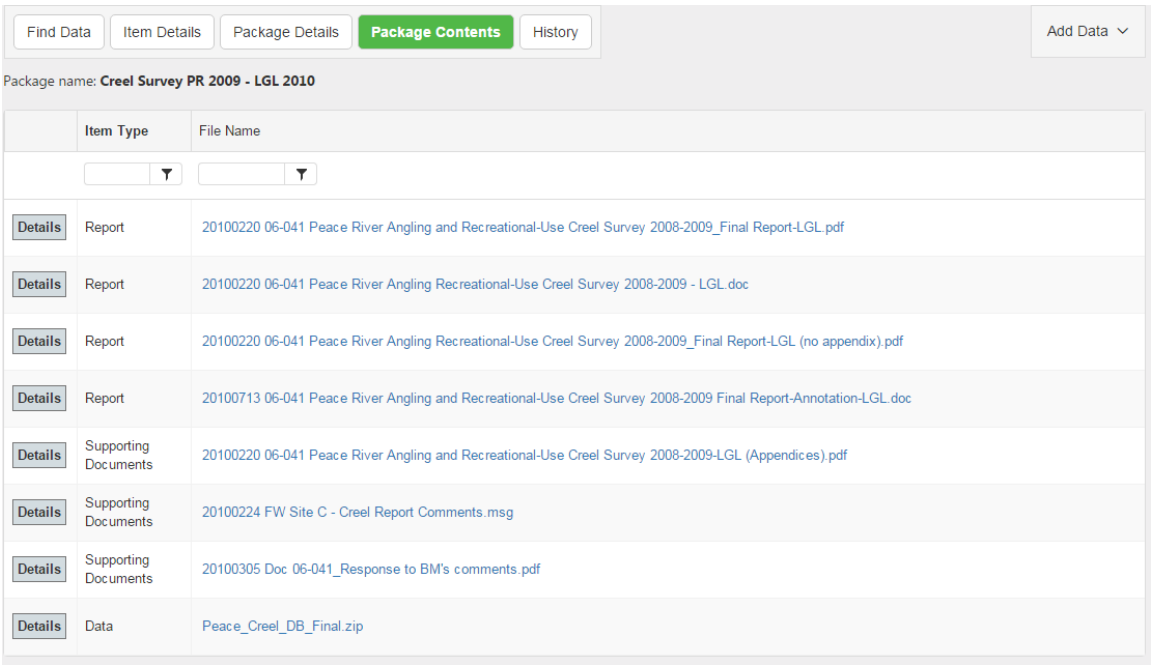



From this page, users can click the other buttons along the top menu for more information.

**Package Details** lists the package with which this item is associated, and shows users the package attributes (e.g., associated monitoring programs, fish types studied, years of study) through a series of more/less toggles.



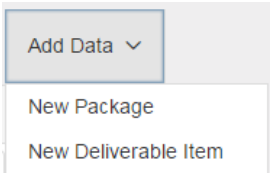

**Package Contents** shows users what other related items are included in the package, and lets users download these items by clicking the permalink. Users can also view details about each related item by clicking on **Details**. When packages include many items, users can use the filter functions at the top of each column to find specific item types (e.g., reports).




The **History** shows users an audit trail which states when package items were added or deleted or edited, and by which user. This can be useful when expected Items are missing, and the details of the document's removal need to be understood.

## 2.4 Adding New Data

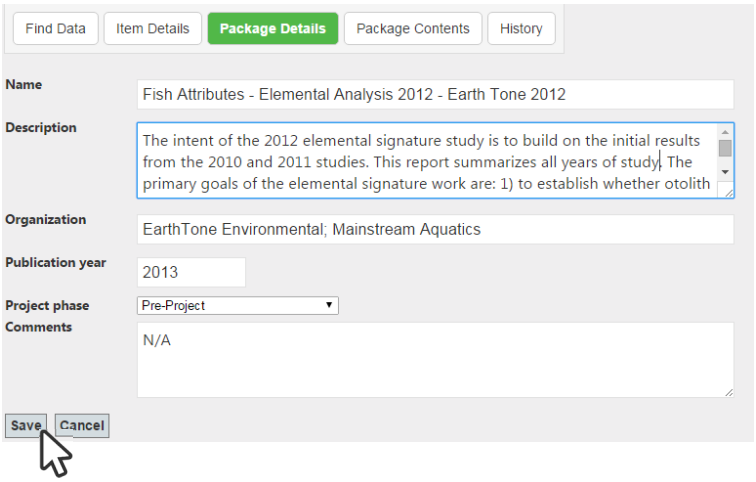
Users can also add new data to the database by creating either a **New Package**, which encompasses multiple related documents pertaining to a project, or a **New Deliverable Item**, which is a single document like a data file or report that is associated with an existing package. To add new data, navigate to the main data browsing interface (i.e., **Report and Database Index**), choose **Add Data** at the top right side of the screen, and select what type of data you want to add.



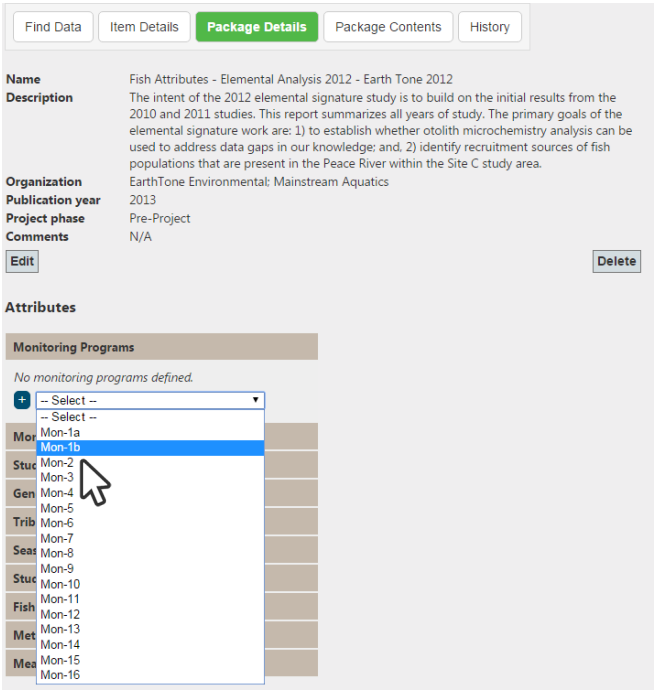

Alternatively, users can add a **New Deliverable Item** to a specific package in the same way from the **Package Contents** screen. Users should only add final, not draft, versions of documents to the FADMS, and can only edit and delete data they have added themselves. (FADMS Administrators are able to edit and delete Packages and Items created by any user.)

### 2.4.1 Adding a package

Selecting **Add Data** > **New Package** takes users to the screen shown below, where all the relevant package details must be provided. In particular, the **Name** and **Project phase** are two required fields which must be filled in before the FADMS will allow the user to click **Save** to create the package.




After saving, users will be prompted to assign **Attributes** to the Package using drop-down menus. Users open each category by clicking on the title, selecting one attribute from the drop-down list, and clicking the + button to add it. Users must select and add attributes within each category one at a time. Users can also delete the package from this page if they have made an error. Once a package is created, it can be populated with items from the **Package Contents** screen. At least one **Deliverable Item** must be added to the package.

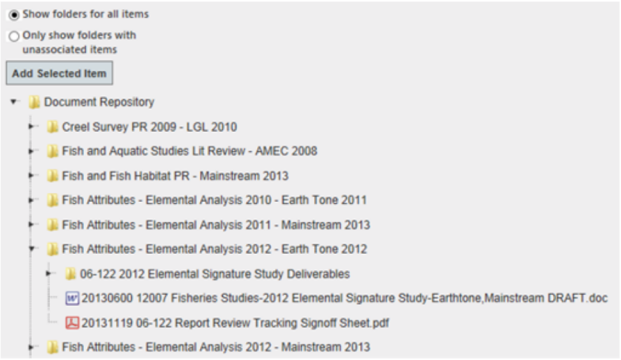


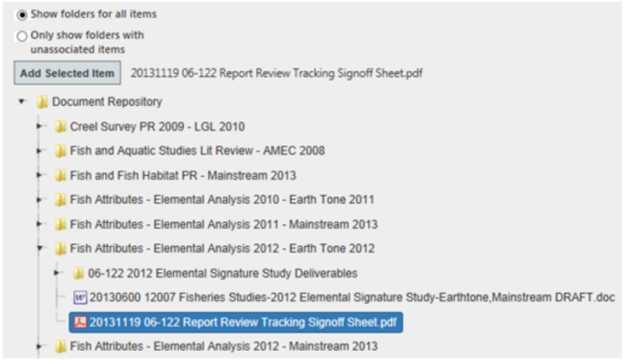

## 2.4.2 Adding an item

Deliverable Items can be added to the database in two ways:

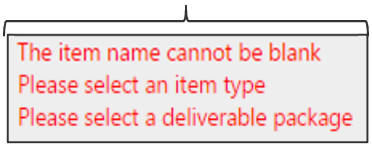
- From the main data browsing interface by using **Add Data** > **Add Deliverable Item**.
- From the **Package Contents** screen by using the same button.

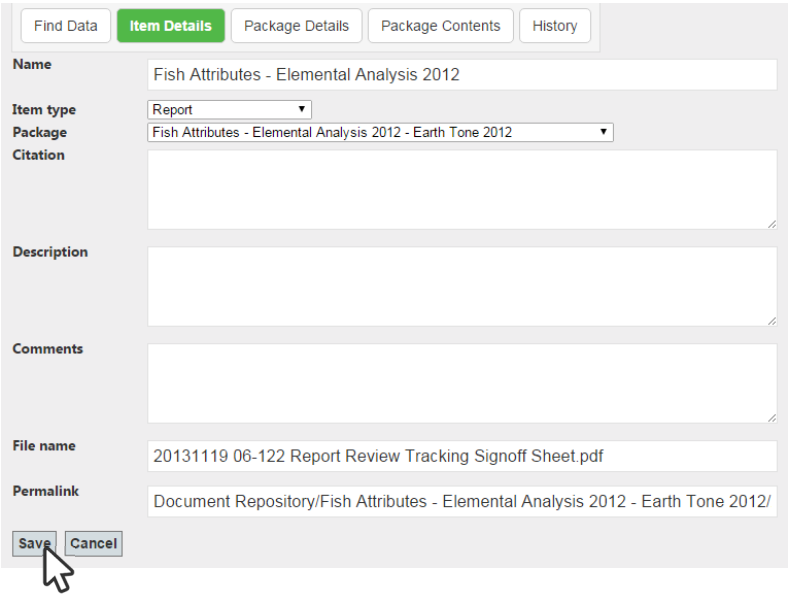
In either case, selecting **Add Deliverable Item** will take users to a screen where they can browse the inventory of environmental data files contained in BC Hydro's FileNet documentation system, to find the item they wish to add. Users can choose to show all items, or only those folders which contain one or more items that have not yet been added to the FADMS. Users can click on the small arrows (▸) to toggle the folders open and view their contents. Once users find the file they wish to add, they can select it and click **Add Selected Item** to import it into the FADMS database.




After selecting the file to add, users will be prompted to fill in the item details, including the package, and to click **Save** to add the item to the FADMS. The item name, item type, and deliverable package are required fields and the FADMS will display an error message if they are not filled in before saving.



## 2.5 Additional Tools for Administrators

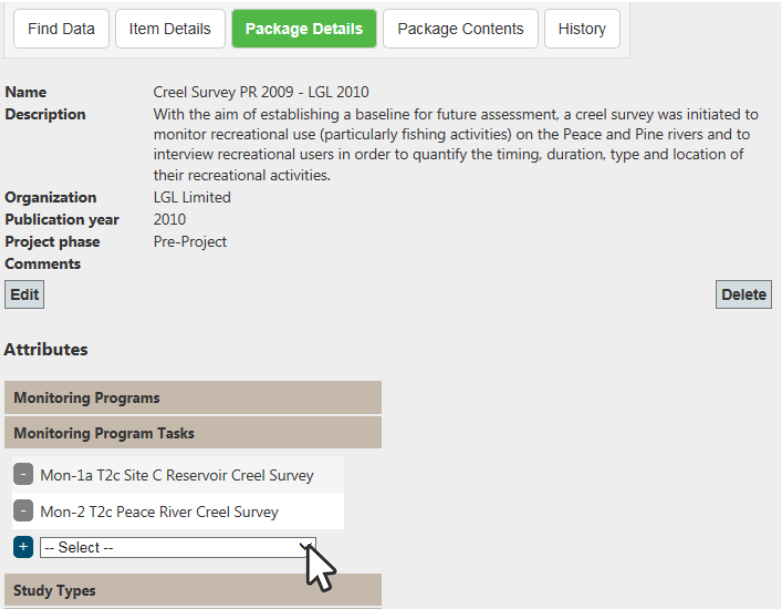
Additional options are available in the FADMS for administrators, who can also manage data added by other users and manage the list of attribute options available for assigning to packages.

### 2.5.1 Managing data

Adding data and managing data added by other users is accomplished through the same **Report and Database Index** interface as previously described.

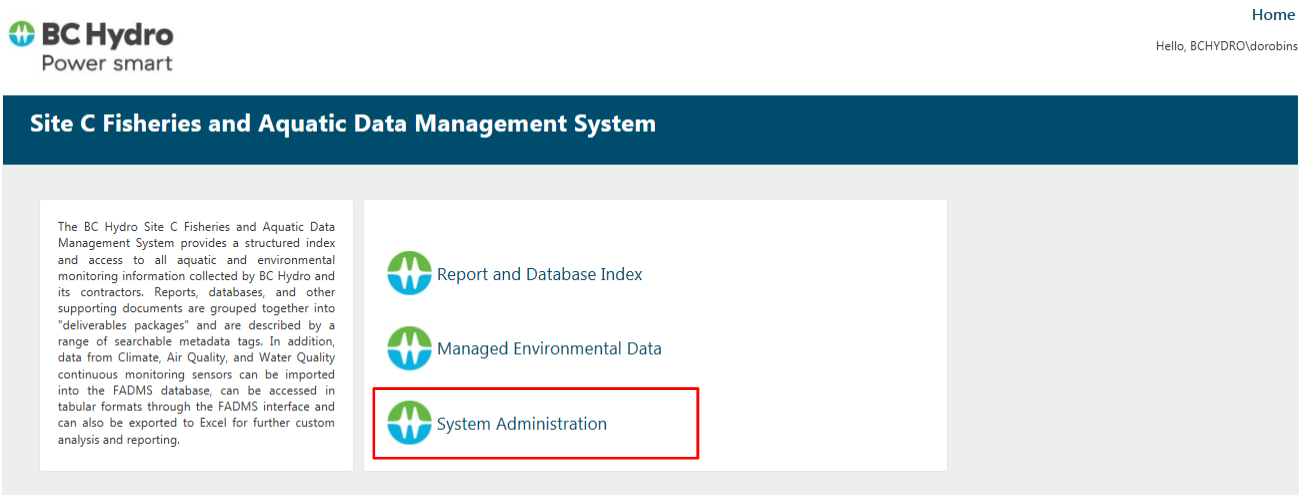
When administrators choose to view the details of any Item in the database, regardless of whether or not they added it, they will see that each of the details tabs now features a **Delete** option. As a precaution against accidental data loss, choosing to **Delete** an Item or Package will trigger a prompt to confirm the action.


Unlike regular users, administrators can also change the attributes of any Package from the **Package Details** screen using the drop-down menus.



### 2.5.2 Managing attribute lists

When administrators log into the FADMS, they will see an additional menu option on the **Home** screen for **System Administration** to access these functions.




This will take administrators to the existing attribute lists, which are:

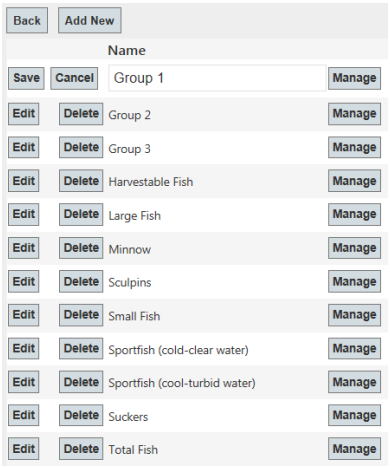
| | | |
|---|---|---|
| Fish Species Groups | Measures | Study Types |
| Fish Species | Methods | Tributaries |
| General Locations | Project Phases | Units |
| Item Types | Seasons | |

The options available for managing each list vary by list type.

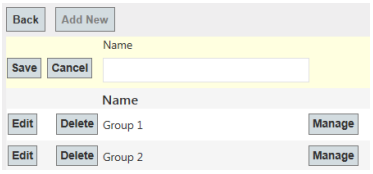
### *Lists Made up of Other Lists*

e.g., Fish Species Groups, Study Types

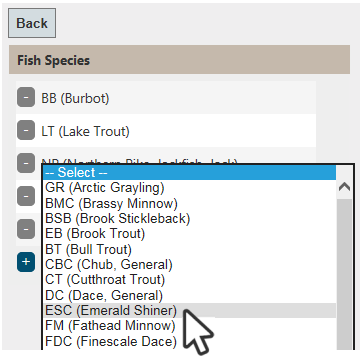
**Add New**
To add a new group to the list



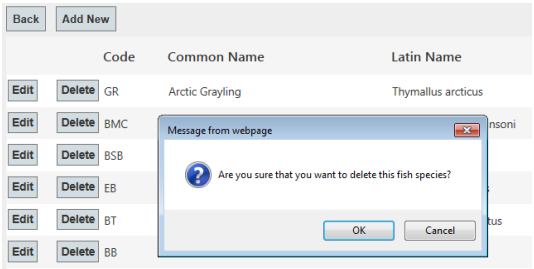

**Edit**
To modify the group name




**Manage**
To change the list of individual items that make up each group



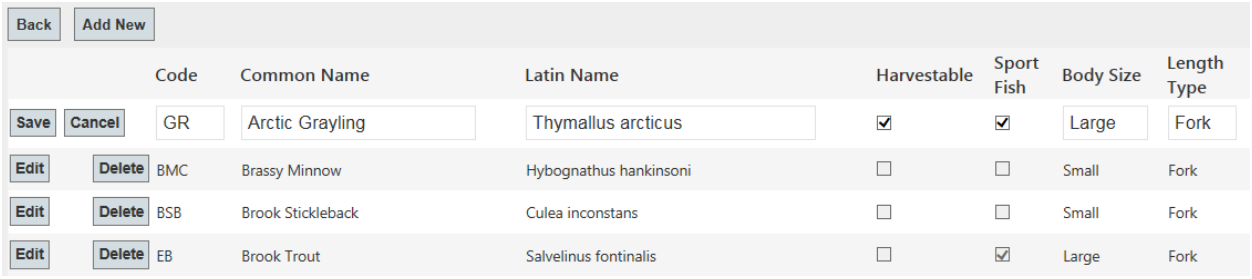

As a precaution against accidental data loss, choosing to **Delete** an attribute will trigger a prompt to confirm the deletion.



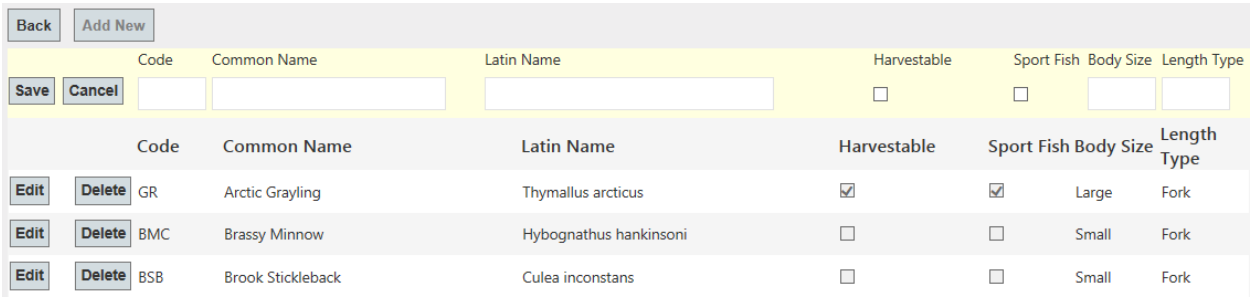

### *Lists with Multiple Fillable Fields and Check Boxes*

e.g., Fish Species

**Edit:** to modify the species codes, names, and other properties of existing entries.

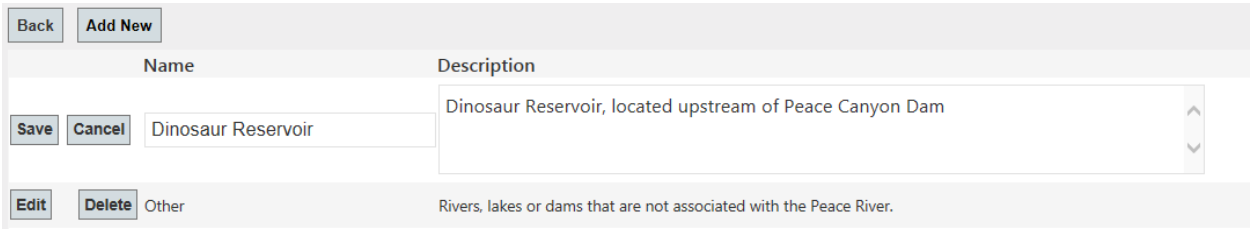


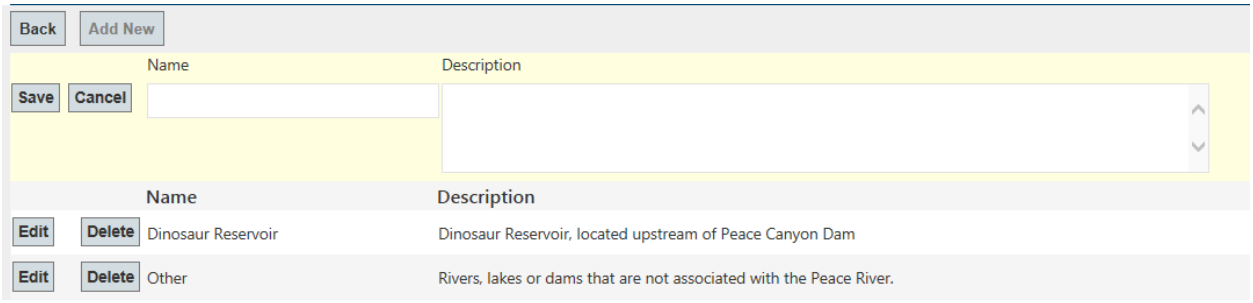
**Edit:** to create a new species entry.




### *Lists with Fillable Fields Only*

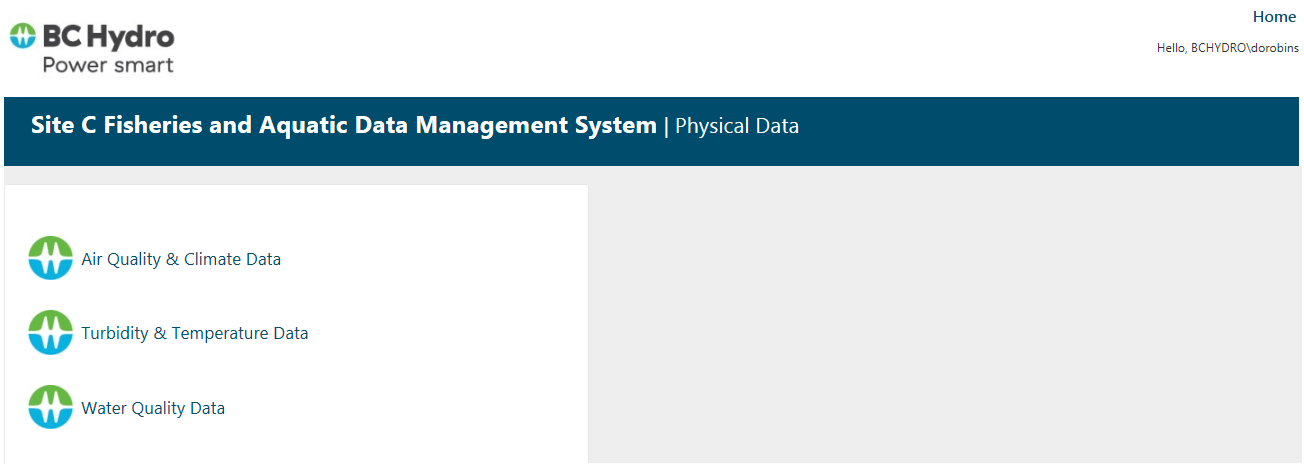
e.g., General Locations, Item Types, Measures, Methods, Project Phases, Seasons, Tributaries, Units



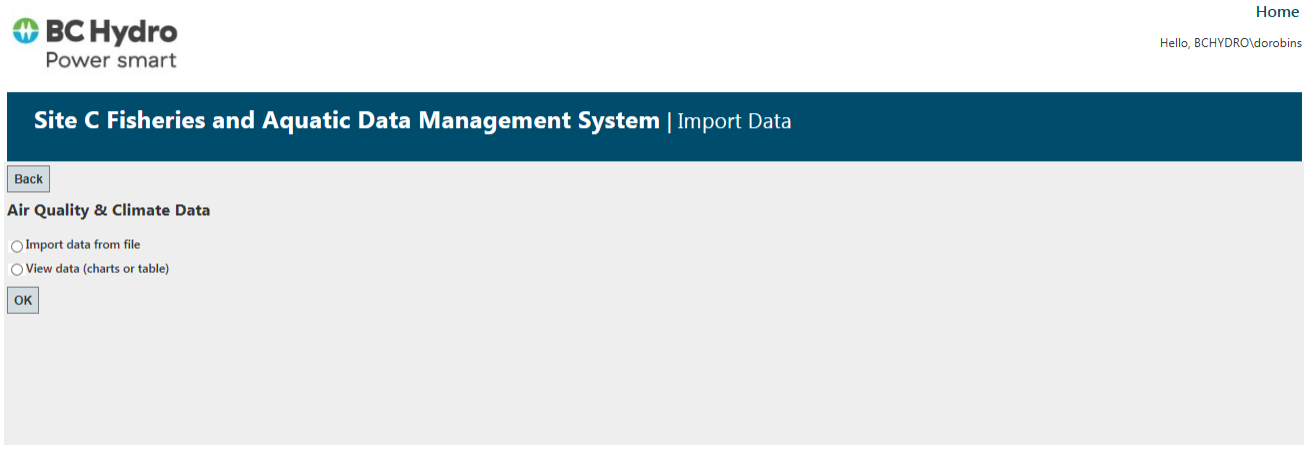




# 3 Managed Environmental Data

From the **Home** screen of the FADMS, click on the **Managed Environmental Data** link to access an environmental database of information that is collected routinely for BC Hydro at a number of permanent sampling stations, e.g., air and water quality, climate data. Clicking on the **Managed Environmental Data** link will take users to a **Physical Data** screen containing links for importing, exporting, graphing, and viewing these different types of environmental data.




Click on any one of the three data type links on the **Physical Data** screen to switch to an **Import Data** screen. From there, users can either import into the BC Hydro database from an Excel spreadsheet file or view selected data from the database in the form of tables and charts.



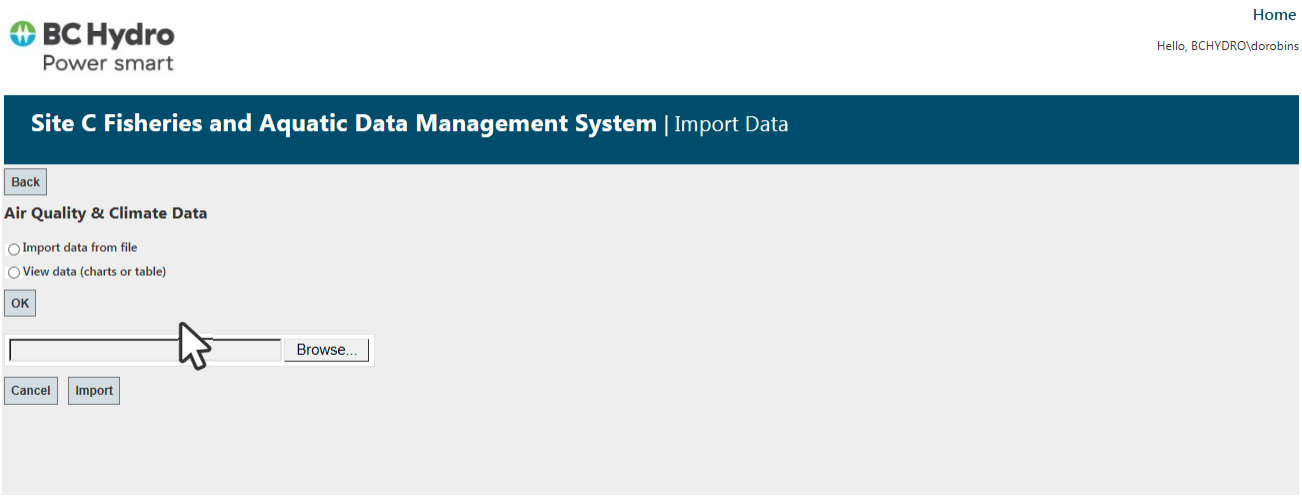

Use the **Back** button on the **Import Data** screen to return to the **Physical Data** screen (e.g., to select a different data type), or click on the **Home** link or the BC Hydro logo to return to the FADMS **Home** screen.

## 3.1 Importing Data

Before attempting to import data into the BC Hydro environmental information database, it will be necessary to ensure that the data comply with the required format. Specific formatting requirements for each type of environmental data are provided in Appendix B: Formatting Requirements for Importing Data. Additionally, if the new data relate to sites or parameters that are not already represented in the environmental database, a **System Administrator** will need to add them to the master lists of sites and parameters (see Section 3.3), otherwise the import will fail (in the case of sites) or the imported data will be inaccessible to users (in the case of parameters).

To import new data, go to the **Physical Data** screen and click on the link that corresponds to the type of data to be imported, e.g., to import air quality data, click on the **Air Quality & Climate Data** link. This action will take the user to the **Import Data** screen.

The options available for importing data differ depending on the data type selected. For **Air Quality & Climate Data** and **Turbidity & Temperature Data**, select the **Import data from file** option by clicking the adjacent radio button followed by **OK.**




A **Browse** button and single-line text box will appear. Clicking on **Browse** allows the user to navigate to and select the Excel file (*.xlsx) containing the data to be imported.[2] Click **Open** and the filename will appear in the text box on the **Import Data** screen. Click **Import** to import the data into the environmental database. If the import is successful, a confirmation message will appear. If errors occur, e.g., a mismatch on site name, a message with red text will appear identifying the error.

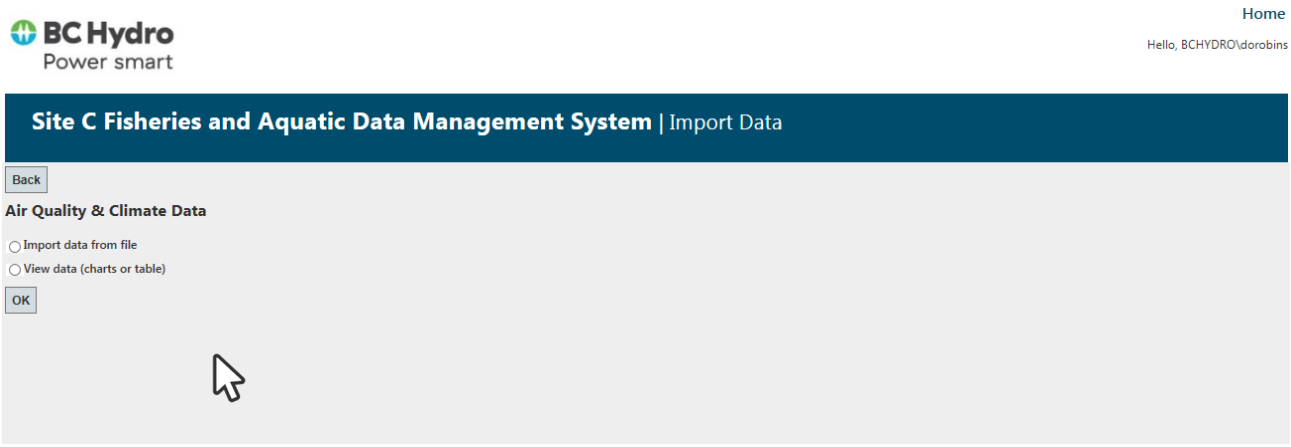
For **Water Quality Data**, select the **Import data from file** option by clicking the adjacent radio button followed by **OK.** Four types of water quality data will be listed. Select a data type by clicking in the adjacent radio button and then clicking **OK**. A **Browse** button and single-line text box will appear. Proceed as above by clicking on the **Browse** button to select the file to be imported. Repeat for any other data types to be imported.

Note that the FADMS will not prevent users from importing the same dataset more than once. All imported data will be added to the environmental database. The data associated with redundant imports can be deleted from the database by users with administrative privileges (see Section 3.3.3).

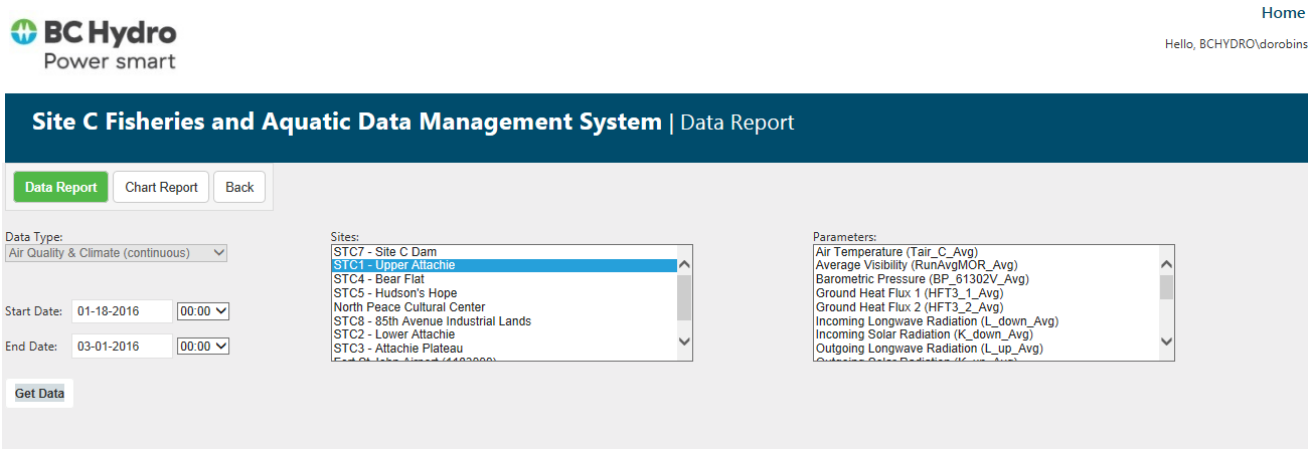
[2] Other file formats may be added in the future, depending on demand.

## 3.2 Viewing Data (Tables and Charts)

To view and export environmental data from the environmental database, select **View data (charts or tables)** on the **Import Data** screen by clicking the adjacent radio button followed by **OK**.



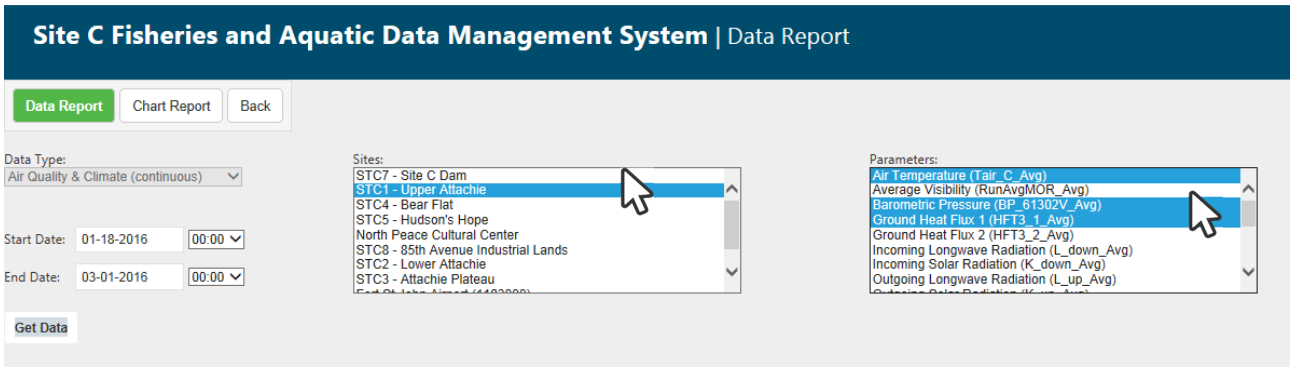

This action will open a **Data Report** screen that features two options: **Data Report** (for tabular data) and **Chart Report** (for graphical data).




### 3.2.1 Data Report

The **Data Report** screen provides access to the fields available for querying the data in the environmental database and allows users to generate customized datasets in tabular format. Note that the **Data Type** field will already be populated with the data type selected by the user on the **Physical Data** screen. For example, if the user clicked on the **Air Quality & Climate Data** link on the **Physical Data** screen, that data type will be listed under **Data Type** on the **Data Report** screen. To switch to a different data type, users need to return to the **Physical Data** screen and change their selection there.

Options on the **Data Report** screen for querying the database include type of data (for Water uality Data only, make a selection from the **Water Type** drop-down), start and end date/time, location, and parameter. Users can specify a start date by clicking in the **Start Date** field to open a calendar with which to select a date. Select a start time from the adjacent drop-down list. Repeat for **End Date** and time. Specify sampling location by selecting one or more entries from the list of **Sites**. Use Shift-click to make multiple contiguous selections, or Ctrl-click to make multiple non-contiguous selections. Specify the sampling parameter(s) of interest by selecting one or more entries from the **Parameters** list. Use Shift-click to select multiple contiguous parameters or Ctrl-click to select multiple non-contiguous parameters.



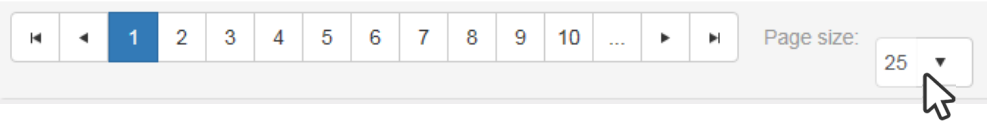

When at least one entry from each field has been selected, click on the **Get Data** button to generate a table of data captured by the query. An error message will appear if the query is incomplete.

Tabular data always include a unique record number (**Record Num**), import identifier (**Import ID**), and sampling time (**Timestamp**). The remaining columns in the table correspond to the site names and parameters chosen by the user. For water quality (spot) data, additional fields are present. Whenever there is more than a single page of data, the total number of rows and pages (based on the default of 25 rows per page) in the table will be shown in the far right corner of the screen. If there are no data in the environmental database that correspond to the user's query criteria, the message "No records to display" will appear under the table's column headings.

The columns in the table can be sized to accommodate the length of the column headings. To do this, the user can hover the cursor over the vertical line between two columns until a double-headed arrow appears. Left-click, hold and drag to the right to widen and to the left to narrow a column. Release when the desired width is achieved.

| Record Num | Import ID | Site Name | Timestamp | Tair_C_Av | BP_61302V_Av | HFT3_1_Av |
|---|---|---|---|---|---|---|
| 1 | 4 | STC1 - Upper Attachie | 2/1/2016 1:00:00 AM | -3.198 | 1009 | -3.505 |
| 2 | 4 | STC1 - Upper Attachie | 2/1/2016 2:00:00 AM | -3.26 | 1009 | -3.507 |
| 3 | 4 | STC1 - Upper Attachie | 2/1/2016 3:00:00 AM | -3.222 | 1009 | -3.45 |
| 4 | 4 | STC1 - Upper Attachie | 2/1/2016 4:00:00 AM | -3.627 | 1009 | -3.448 |
| 5 | 4 | STC1 - Upper Attachie | 2/1/2016 5:00:00 AM | -3.783 | 1008 | -3.623 |
| 6 | 4 | STC1 - Upper Attachie | 2/1/2016 6:00:00 AM | -4.004 | 1008 | -3.751 |
| 7 | 4 | STC1 - Upper Attachie | 2/1/2016 7:00:00 AM | -4.134 | 1008 | -3.832 |

Specify the number of rows to display per page using the drop-down list below the table.




The default is 25 rows of data, and the maximum is 50. Scroll through datasets containing more than one page of data using the navigation bar below the table. Single-headed arrows advance or go back one page at a time. Arrows with a vertical bar jump to the first or last page of data. Access a specific page of data by clicking on the numbered box in the navigation bar that corresponds to the required page. The navigation bar shows 10 pages at a time. Click on the right-most box containing three dots to advance the display to the next 10 pages or click on the left-most box containing three dots to show the previous 10 pages.

Users can save the data captured by their queries. Click on the **Export to Excel** button to export the data in the table to an Excel spreadsheet. When the export is complete, a menu bar appears at the bottom of the screen giving the user a choice of opening the file (called RadGridExport.xlsx) and/or saving it.


Clicking **Open** will open the file in Excel, and users can use Excel's menu options for saving the file. Alternatively, there are three options in the **Save** drop-down: **Save**, **Save as**, and **Save and open**.

Choose **Save** to save the file with its default filename to the default location specified on the user's computer (e.g., the **Downloads** folder). Successive exports will not overwrite earlier exports. Each time an exported dataset is saved, the FADMS appends a number in parentheses to keep all filenames unique, e.g., RadGridExport (1).xlsx. After saving the file, the options on the menu bar change to **Open**, **Open folder**, and **View downloads**.


**Open** launches Excel and opens the file. Although **Open with** is an option here, only Excel can be used to open the file.

The **Open folder** option on the menu bar opens the folder in which the file containing the exported data was saved (e.g., the **Downloads** folder). From there, users can rename the file, open the file in Excel, make a copy of the file, or cut/copy the file to another folder.

Users can view a searchable list of their downloads, including data files exported from the FADMS, by clicking on the **View downloads** button on the menu bar.

This list is generated in a separate window by the user's Internet Explorer (IE) browser. Files can be opened from this window or removed from the downloads list. In IE, this window also provides users an opportunity to change the default folder into which downloads are saved. To change the default downloads folder, click on the **Options** link in the lower left corner of the window. **Browse** to and select the new destination folder for downloads and click **OK**. Changing the default downloads folder will affect all downloads, not just the ones generated by FADMS.

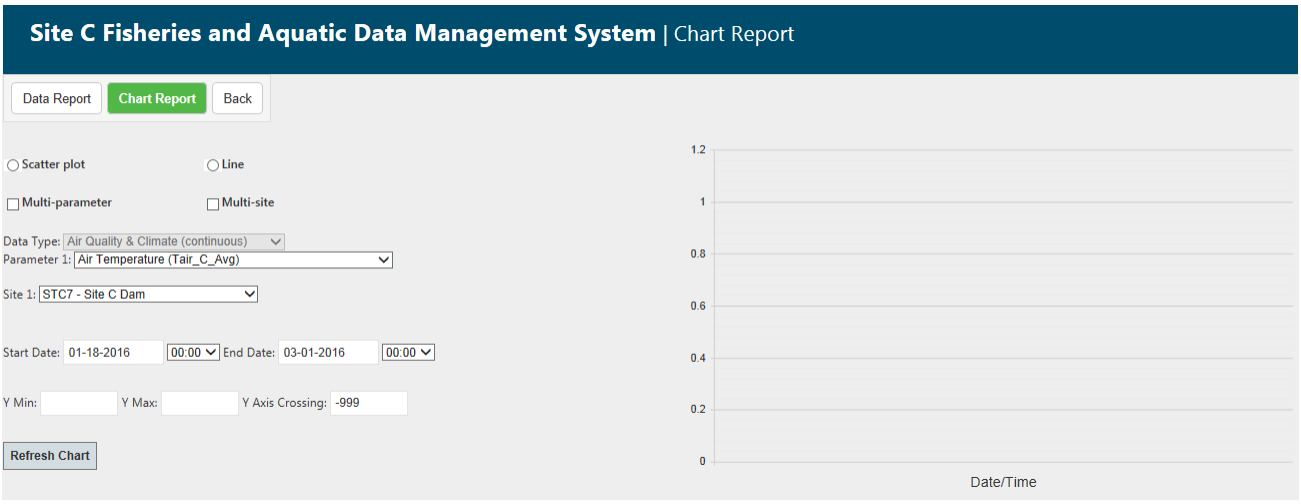
Back on the menu bar, the other options for saving exported datasets are **Save as** and **Save and open**. Choose **Save and open** to save the file to the downloads folder and open it in Excel to view and work with the data. Use **Save as** to save the file with a different filename and/or to a different folder.

As soon as you choose one of these options, the menu bar will close.

### 3.2.2 Chart Report

On the **Data Report** screen, click on the **Chart Report** button to access the fields available for querying the data in the environmental database and generating graphical data reports. Note that the **Data Type** field will already be populated with the data type selected by the user on the **Physical Data** screen. For example, if the user clicked on the **Air Quality & Climate Data** link on the **Physical Data** screen, that data type will be listed under **Data Type** on the **Data Report** screen. To switch to a different data type, users need to return to the **Physical Data** screen and change their selection there.

Options on the **Chart Report** screen for querying the database include plot type, number of parameters and sites, and start and end date/time.

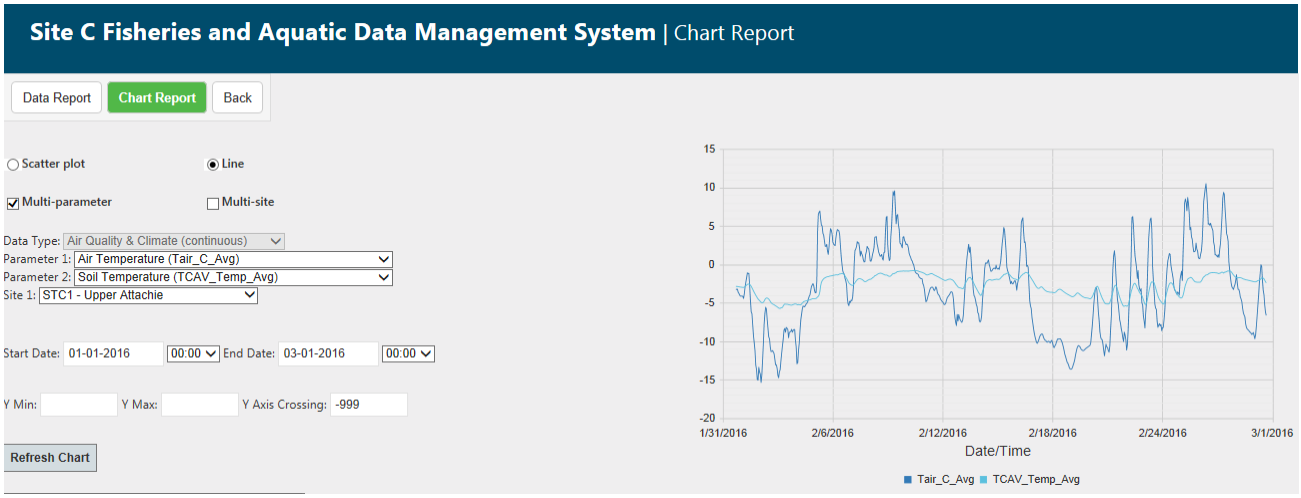



Users can select only one plot type, and they can plot either multiple parameters or multiple sites, but not both. If no plot type is selected, the FADMS will generate a scatter plot by default. If neither of the "multi-" options are checked, the plot will include only one site and one parameter.

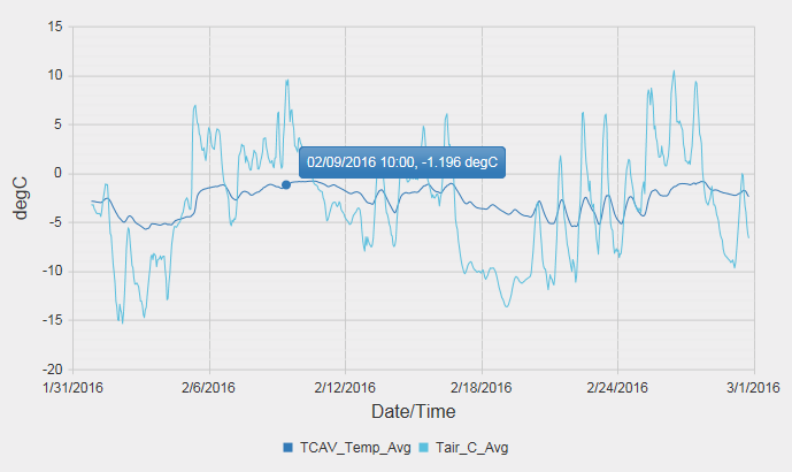
Specify either a **Scatter plot** or a **Line** plot by clicking the corresponding radio button. Checking the **Multi-parameter** checkbox opens another parameter drop-down from which users can choose a second parameter to graph. Alternatively, checking the **Multi-site** checkbox opens a second site drop-down from which users can select one additional site to graph.

Start and end dates and times are specified in the same fashion as described for **Data Reports**. Minimum and maximum Y-axis values can also be specified by the user by entering values into the **Y Min** and **Y Max** fields. Note, however, that the FADMS graphing function automatically sets minimum and maximum Y-axis values that optimize the way the data are displayed. The **Y Axis Crossing** field is present and populated with the value -999 to ensure that the X-Axis labels display below the graph. Users do not need to change this value.

Click on the **Refresh Chart** button to generate a graph of the data captured by the selected criteria. The image below shows a line graph of two temperature parameters (air and soil) for the Upper Attachie site from January 1, 2016 00:00 to March 1, 2016 23:00. The two temperature parameters are distinguished by different colours which are defined in the legend below the X-Axis label.



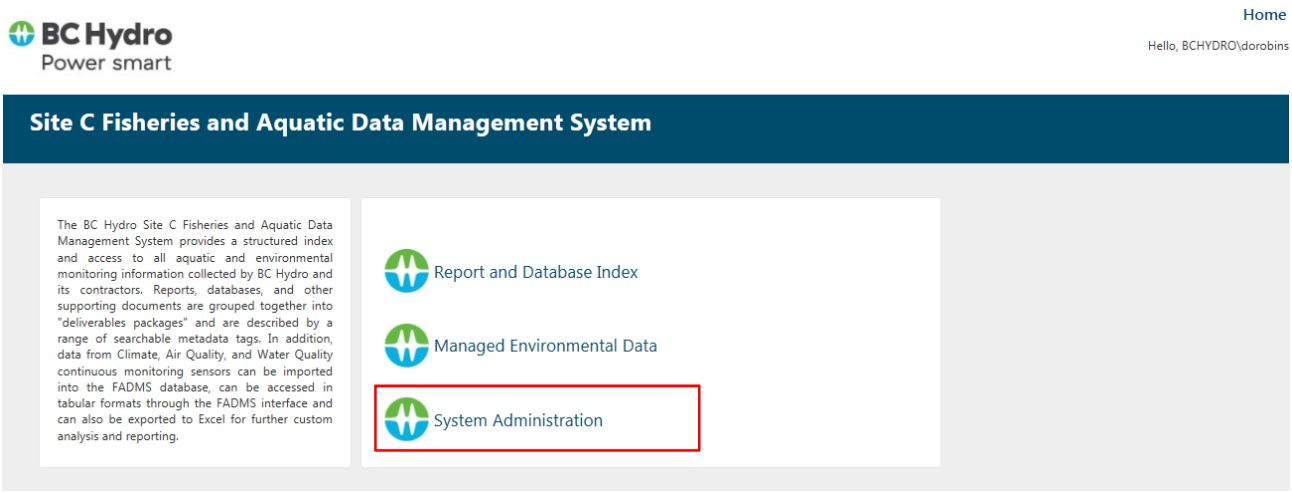

To see the values associated with individual data points in the plots, hover the mouse over the area of interest. A box containing the date, time, and data value will appear. The colour of the box identifies the parameter, corresponding to the colours in the legend. For example, the image below shows a data point for air temperature in degrees Celsius at 10:00 on February 9, 2016.



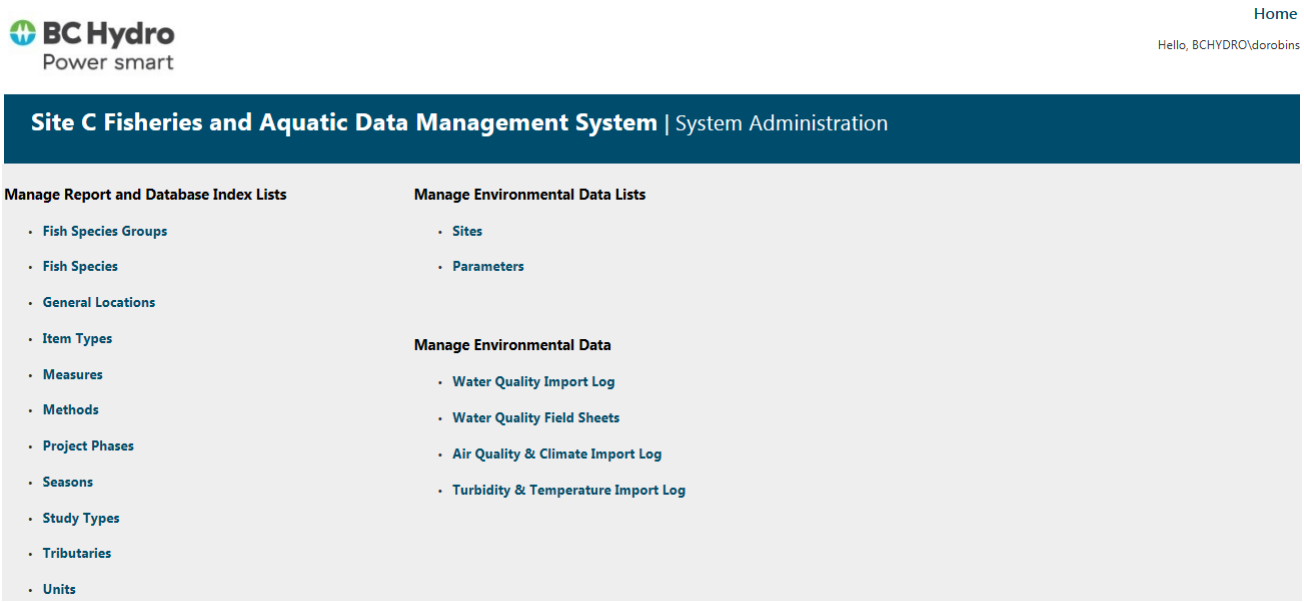

## 3.3 Additional Tools for Administrators

Users with administrative access to the FADMS can add, delete, and edit data in the environmental database. For example, an administrator can delete all of the data from a specific import event, e.g., if the user who imported the data reports errors and wishes to re-import a corrected dataset.

When administrators log into the FADMS, they will see an additional menu option on the home screen for **System Administration**.




Clicking on the **System Administration** link on the **Home** screen opens the **System Administration** screen. This screen provides access to all administrative features and functions of the FADMS, i.e., for both the **Report and Database Index** and the **Managed Environmental Data** components.




The following text applies only to the **Managed Environmental Data** component of the FADMS; the administrative features and functions for the **Report and Database Index** are described in Section 2.5.

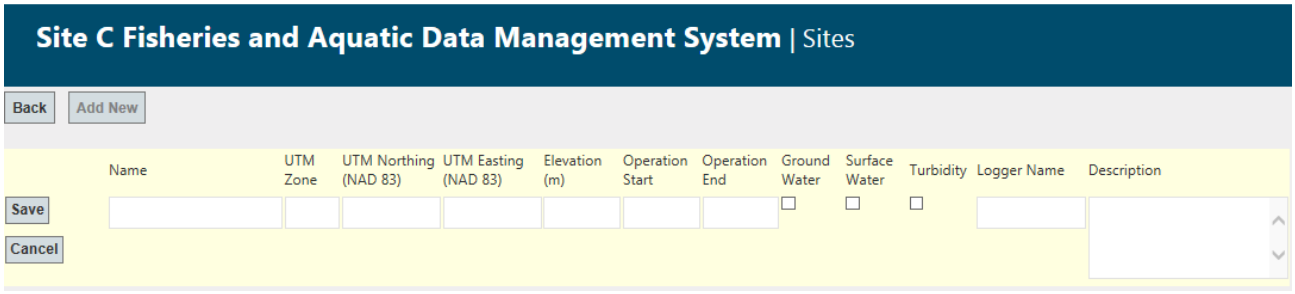
In the context of the **Managed Environmental Data** component of the FADMS, the **System Administration** screen allows administrators to manage master tables of sites and parameters, and to track and manage data import events by system users.

### 3.3.1 Manage Environmental Data Lists – Sites

Clicking on the **Sites** link opens a screen that contains a master table of all locations available in the site drop-downs used for generating data and chart reports. Administrators can **Edit** or **Delete** any site listed in the master sites table, and they can **Add New** sites.

The master sites table is linked to the environmental database. The FADMS reads the **Name** field in this table when users import new data into the environmental database (Section 3.1), and the value in the **Name** field of the master sites table must exactly match the value in the **Name** field of the data spreadsheet for the import to be successful. The only exception is for the turbidity data in which the **Logger Name** field is the one which must match the **Name** field in the data spreadsheet. *Sites names are case sensitive*. Before data for a new site can be imported into the database by a user, the new site must be added to the master sites table by the administrator.

Clicking on the **Add New** button opens a suite of fields that correspond to those in the sites table.




Enter the site **Name** exactly as it appears in the spreadsheet of data to be imported. **Name** is a required field, and the value must be unique relative to all other entries in the master sites table. If the new site is one at which water quality data are being collected in field sheets, the administrator must indicate the type of water quality site by checking the relevant water quality checkbox. For sites at which turbidity data are being collected, the **Logger Name** field must also be populated, be the same as the **Name** field in the data spreadsheet, and be unique. In this one case, the **Name** field does not need to match the spreadsheet. All other fields are optional.

Click **Save** to add the new site to the sites table. Use the **Back** button to return to the master sites table.

To make changes to an existing entry in the sites table, click on the **Edit** button adjacent to the entry. The site details will open in editable text boxes in situ. Edit the required fields with caution, keeping in mind the constraints noted above. Also, be aware that changing the type of data associated with a site, e.g., from ground water to surface water, may change what data users will be able to access through the FADMS. Click **Save** when done editing.

Remove unwanted sites from the table, one at a time, by clicking on the **Delete** button adjacent to the entries to be removed. Choosing to **Delete** a site will trigger a prompt to confirm the deletion. Because the sites table is linked to the environmental database, and data are linked to specific sites, deleting a site removes all data associated with that site from the database and removes the site name from all **Sites** drop-downs in which it was listed.

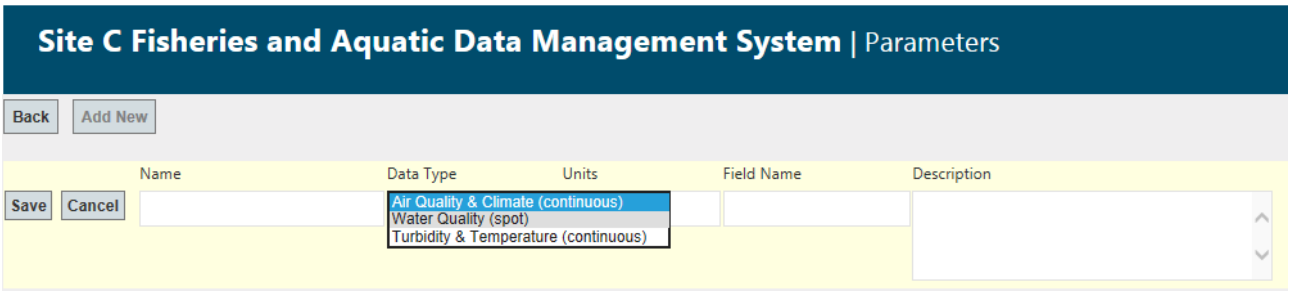
When the sites table opens, the entries are sorted in ascending order by **Name**. Sort on any field by clicking on the column headings. Repeated clicks toggle the sort between ascending and descending order.

From the master sites tables, use the **Back** button to return to the **System Administration** screen.

### 3.3.2 Manage Environmental Data Lists – Parameters

From the **System Administration** screen, click on the **Parameters** link to open a screen that contains a master parameters table. The parameters table lists all the parameters available in the **Parameters** drop-downs used for generating data reports and charts. The FADMS reads the parameter **Field Name** and **Units** from this table when generating tables and charts. Administrators can **Add New** parameters, and they can **Edit** or **Delete** any listed parameter.

Clicking on **Add New** opens a suite of fields that correspond to those in the parameters table. New entries must include a **Name**, **Units**, and **Data Type** in order to be successfully saved to the parameters table. Enter any additional details about the parameter that are available. Click **Save** to add the parameter to the parameters table. Although entering a **Field Name** is not required for adding parameters to the table, only parameters with a **Field Name** that matches one already in the database will appear in parameter drop-down list and be available for generating data reports and charts.




To make changes to an existing entry in the parameters table, click on the **Edit** button adjacent to the entry. The parameter details will open in editable text boxes in situ. Changes can be made to **Name**, **Units**, and **Description** fields without issue, but **Data Type** and **Field Name** should not be changed. **Field Name** is linked to **Field Name** in the database, so editing this value in the parameters table may generate an error. Also, changing the **Data Type** assigned to a parameter will result in the wrong parameters appearing in the data report and charting screens. Click **Save** when done editing.

There are two options for removing unwanted parameters from the parameters table: (1) delete the **Field Name**; or (2) click on the **Delete** button adjacent to the entry to be removed, and then click **OK** on the deletion confirmation request to finish. Removing a parameter by deleting its **Field Name** in the parameters table keeps the information about the parameter in the parameters table but renders the data associated with the parameter inaccessible to users by removing the parameter name from all **Parameters** drop-downs. Deleting a parameter altogether from the parameters table removes the entire entry from the table. Because the deletion includes the **Field Name**, all data associated with the deleted parameter will become inaccessible to users. Neither method for removing a parameter from the parameters table results in the loss of data from the environmental database.

When the parameters table opens, the entries are sorted in ascending order by **Data Type** and then **Name**. Sort on other fields by clicking on the column headings. Repeated clicks toggle the sort between ascending and descending order.

Use the **Back** button to return to the **System Administration** screen.

### 3.3.3 Manage Environmental Data

On the **System Administration** screen, four types of data imports are listed:

1. Water Quality Import Log
2. Water Quality Field Sheets
3. Air Quality & Climate Import Log
4. Turbidity & Temperature Import Log

Each import type shown here links to a master table that lists all successful data imports of that type that have been made by users (see about Importing Data, Section 3.1). System administrators can track and manage (edit, delete) data imports as needed. Deleting an entry from one of these tables removes the imported data from the environmental database, e.g., if a user reports an error in the data contained in an import, the data can be removed from the database, corrected, and re-imported. When an administrator clicks **Delete**, a message requesting confirmation of the deletion will open. Click **OK** to complete the deletion.

Clicking on **Water Quality Import Log** or **Air Quality & Climate Import Log** opens a table that lists all imports that have been made by users of that data type. Each entry in the table includes a unique **Import ID**, specifies the **Data Type** imported, gives the dates associated with the first (**Record Start**) and last (**Record End**) record in the imported dataset, identifies the user who imported the data (**Added By**), and gives the date of the import (**Added On**). The dates associated with the first and last records in the dataset along with the identity of the importer can be used by administrators to determine if a dataset has been inadvertently imported more than once. Redundant imports can only be deleted by a system administrator.

No water quality data from field sheets has been imported into the FADMS yet, so no table of import events for this data type exists.

Clicking on **Turbidity & Temperature Import Log** opens a table that lists all turbidity and temperature imports that have been made by users. Each entry in the table includes all of the same fields as the water and air quality import log tables, plus a **Site** field. Like the air quality import log table, the dates associated with the first and last records in the dataset along with the identity of the importer can be used by administrators to determine if a dataset has been inadvertently imported more than once. Redundant imports can only be deleted by a system administrator.

# Appendix A: FADMS Metadata Checklist

*The Metadata Checklist shown here is also available as a fillable-form PDF document. The fillable form should be used to enter document information. Please contact the FADMS steward to obtain a copy of the fillable document.*

BC Hydro
Power smart

## Metadata Checklist

### Instructions

Use this sheet to record your information before it is entered into the Site C FADMS. This sheet corresponds closely with the data that is requested in the FADMS, including its use of the same terminology. In each case, either fill in the appropriate information (e.g., name, description, citation, etc.) or check the relevant items (e.g., study type, methods, measures, etc.). Definitions of some of the terms are on the final pages.

This document is designed to match the two sections of the FADMS: **Packages** and I**tems**. A Package contains most of the information about the study: name, location, study years and methods, etc. Items are the specific documents related to the study, such as reports, spreadsheets, or maps. This checklist includes blank templates for 3 Items; but as many Items can be added as is needed.

### Best Practices

There is a lot of flexibility as to naming and location of the files. There are, however, some limitations and some guidelines that should be followed:

1. Project files should be loaded into FileNet directories using whatever logic is consistent with the files, and a top-level directory name that follows the naming pattern of top-level directories. In general, remember that other users are looking for concise high-level descriptions in the names of directories. Subdirectory names such as \Reports, \Data, \GIS, and \Photos may be useful, depending on the project. Subdirectories for locations may also be appropriate.
2. For highly repetitious data loaded into FileNet (e.g. 500 photos), consider putting the files in a ZIP file before adding to FileNet. This makes it simpler (i.e. less repetitious) to link them to the FADMS.
3. In the FADMS, the longest full path name for any document (including all subdirectories) is 250 characters. Documents that exceed this limit will not be visible within the FADMS even though they may exist in FileNet. When such very long filenames are detected by the FADMS, a file called “FileNet-Error-*nn*.txt” is created (where *‘nn’* is the number of files found) at the top of the file tree; and can be downloaded to identify and correct these files by shortening their name or the pathname.

File names and locations can be recorded later in the document.

## Package

**Name:** *(A Short Name. Use the key words from the report. For example, "Peace River Angling and Recreational-Use Creel Survey 2008-2009" becomes "Creel Survey" or "Fish Otolith Collection for Elemental Signature Analyses Data Report" becomes "Fish Attributes – Elemental Analysis"*

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**Description:** *(do not include the full abstract. This should just contain enough information so that someone knows what they might be getting. For example, "this report summarizes the collection of water chemistry samples for dissolved metal concentrations and fish otolith samples in the Pine River."; or "A creel survey was initiated to monitor recreational use (particularly fishing activities) on the Peace and Pine rivers and to interview recreational users in order to quantify the timing, duration, type and location of their recreational activities.")*

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**Organization:** *(e.g., Golder Associates Ltd.)*

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**Author (actual names, not company name):** *(e.g., Joe Smith, Mary Brown)*

---

**Comments:** *(optional, anything else you might want to add about this study)*

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**Monitoring Programs:**

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**Monitoring Program Tasks:**

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**Years: Publication** *(year that the report was produced)* _____
**Start Year:** *(first year of study **in this report**)* _____
**End Year:** *(last year of study **in this report**)* _____

**Project Phase:**

- ☐ Pre-Project
- ☐ Construction
- ☐ Construction – Channelization
- ☐ Construction – Diversion
- ☐ Construction - Reservoir Filling
- ☐ Operations

**Season** *(Select one or more seasons in which this data were collected)*:

☐ Spring ☐ Summer ☐ Fall ☐ Winter

**Study Types:** *Level 1 or high level study type (see Appendix). Select one or more.*

| | | |
|---|---|---|
| ☐ Air Quality | ☐ Climate | ☐ Creel Survey |
| ☐ Fish Habitat | ☐ Fish Movement | ☐ Fish Passage |
| ☐ Fish Survey and Attributes | ☐ Flow | ☐ Ground Water Quality |
| ☐ Literature Review | ☐ Noise | ☐ Operations |
| ☐ Lower Trophic Levels | ☐ Sediment | ☐ Soil |
| ☐ Spawning | ☐ Terrestrial Vegetation | ☐ Water Quality |
| ☐ Wildlife Habitat | ☐ Wildlife Survey | |

**General Locations:**

- ☐ Peace River
- ☐ Tributaries (downstream)
- ☐ Dinosaur Reservoir
- ☐ Other
- ☐ Tributaries (upstream)
- ☐ Site C Reservoir
- ☐ Williston Reservoir

**Tributaries:** *In which creeks or rivers were the data collected? Select one or more. If your detailed location is not on the list, please write it in. Note: "PR" is Peace River*

| | | | |
|---|---|---|---|
| ☐ AG SITE 1B | ☐ AG SITE 2 | ☐ Blueberry River | ☐ Burnt River |
| ☐ Cadotte River | ☐ Callazon Creek | ☐ Cameron River | ☐ Charlie Lake |
| ☐ Chowade River | ☐ Clear River | ☐ Cypress Creek | ☐ Doig River |
| ☐ Farrell Creek | ☐ Fellers Creek | ☐ Fiddes Creek | ☐ Gething Creek |
| ☐ Graham River | ☐ Halfway River | ☐ Johnson Creek | ☐ Kiskatinaw River |
| ☐ Little Smoky River | ☐ Lynx Creek | ☐ Maurice Creek | ☐ Milligan Creek |
| ☐ Moberly River | ☐ Montney Creek | ☐ Murray River | ☐ Needham Creek |
| ☐ Notekiwin River | ☐ Peace River (PR) | ☐ PR Section 1 | ☐ PR Section 1A |
| ☐ PR Section 2 | ☐ PR Section 3 | ☐ PR Section 5 | ☐ PR Section 6 |
| ☐ PR Section 7 | ☐ PR Section 8 | ☐ PR Section 9 | ☐ Pine River |
| ☐ Pouce Coupe R. Split | ☐ Pouce Coupe River | ☐ Smoky River | ☐ Stoddard Creek |
| ☐ Turnoff Creek | ☐ Upper Farrell River | ☐ Upper Halfway River | ☐ Upper Moberly River |
| ☐ Upper Pine River | ☐ Whitemud River | ☐ Wolverine River | |

Other? _____

**Fish species:** *For which species was information collected? Full English and Latin names are in the Appendix.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ☐ GR | ☐ BMC | ☐ BSB | ☐ EB | ☐ BT | ☐ BB | ☐ CBC | ☐ CT |
| ☐ DC | ☐ ESC | ☐ FM | ☐ FDC | ☐ FHC | ☐ GE | ☐ KO | ☐ LKC |
| ☐ CL | ☐ LT | ☐ LW | ☐ CSU | ☐ LNC | ☐ LSU | ☐ C | ☐ MW |
| ☐ NSB | ☐ NP | ☐ RDC | ☐ XDC | ☐ NSC | ☐ PCC | ☐ PDC | ☐ P |
| ☐ CAS | ☐ PW | ☐ RB | ☐ RSC | ☐ CC | ☐ CCG | ☐ CRI | ☐ STC |
| ☐ SB | ☐ SU | ☐ TR | ☐ TP | ☐ WP | ☐ WSU | ☐ WF | ☐ YP |

**Methods:** *Select one or more. This is a list of **how** the data were collected. For example, the fish may have been caught using a type of electrofishing or a type of trap. Then there may have been collection of tissue or scales, and spot water quality measurements. Definitions are in the Appendix.*

| | | | |
|---|---|---|---|
| ☐ aerial photo assessment | ☐ aerial (survey) | ☐ ageing structure analysis | ☐ ageing structure collection |
| ☐ angling | ☐ barrier net or fence | ☐ beach seine | ☐ benthic invertebrates |
| ☐ boat-based wildlife/bird survey | ☐ call play back | ☐ continuous (water measurements) | ☐ creel survey |
| ☐ DNA analysis | ☐ DNA collection | ☐ dredge | ☐ electrofishing - backpack |
| ☐ electrofishing - boat (large fish) | ☐ electrofishing - boat (small fish) | ☐ elemental analysis | ☐ fin ray collection |
| ☐ foot survey (for wildlife) | ☐ gill net | ☐ grab | ☐ habitat assessment |
| ☐ kick disturbance | ☐ larval drift net | ☐ mark | ☐ minnow trap |
| ☐ modelling | ☐ net capture (for wildlife) | ☐ otolith collection | ☐ passive listening |
| ☐ periphyton | ☐ photographs time-lapse | ☐ phytoplankton | ☐ rotary screw trap |
| ☐ sample pits | ☐ shore-based fish count | ☐ shovel | ☐ snorkel survey |
| ☐ spot water quality measurement | ☐ stable isotopes analysis | ☐ stomach content analysis | ☐ stomach content collection |
| ☐ telemetry - acoustic | ☐ telemetry - radio | ☐ Terrestrial Ecosystem Mapping (TEM) | ☐ time-constrained sampling |
| ☐ tissue sampling | ☐ traps | ☐ variable radius point counts | ☐ vehicle-based wildlife/bird survey |
| ☐ wildlife/bird observation | ☐ zooplankton | | |

**Measures:** *Select one or more. This is a list of **what** was actually measured as part of the study, independent of how it was collected. Definitions are in the Appendix.*

| | | | | |
|---|---|---|---|---|
| ☐ absorbable organic halogens | ☐ abundance | ☐ access type | ☐ activity type | ☐ age |
| ☐ algal cover | ☐ alkalinity | ☐ angler demographics | ☐ angling type | ☐ bank erosion |
| ☐ bank irregularities | ☐ bankfull width & height | ☐ benthic invertebrates | ☐ catch count | ☐ cation exchange |
| ☐ channel gradient | ☐ chlorophyll a | ☐ clarity | ☐ conductivity | ☐ count |
| ☐ cover | ☐ D90 | ☐ DELT | ☐ depth | ☐ discharge |
| ☐ dissolved metals | ☐ dissolved organic carbon | ☐ dissolved oxygen | ☐ distribution | ☐ effort |
| ☐ egg count | ☐ elemental analysis | ☐ fish count | ☐ full width | ☐ gender |
| ☐ genetic information | ☐ habitat | ☐ habitat type | ☐ instream cover | ☐ large organic debris |
| ☐ length | ☐ light intensity | ☐ location | ☐ maturity | ☐ mercury |
| ☐ mercury levels | ☐ metalloids | ☐ metals | ☐ methyl mercury | ☐ mineral analysis |
| ☐ moisture content | ☐ movement | ☐ near shore slope | ☐ nest location | ☐ nitrogen |
| ☐ nutrients | ☐ organic carbon | ☐ overhead cover | ☐ oxygen | ☐ particulate size |
| ☐ Periphyton | ☐ pH | ☐ Phytoplankton | ☐ polycyclic aromatic hydrocarbons | ☐ recreational area type |
| ☐ recreational user demographics | ☐ redd count | ☐ redox potential | ☐ relative water velocity | ☐ riparian vegetation type |
| ☐ rooted width | ☐ shoreline type | ☐ silt content | ☐ spatial origin | ☐ spawning behaviour |
| ☐ species | ☐ stable isotope | ☐ stomach contents | ☐ substrate compaction & embeddedness | ☐ substrate compactness |
| ☐ substrate composition | ☐ sulphides | ☐ suspended solids | ☐ tag information | ☐ taxonomy |
| ☐ TDS | ☐ TGP | ☐ total inorganic mercury | ☐ total mercury | ☐ total metals |

| | | | | |
|---|---|---|---|---|
| ☐ total organic carbon | ☐ trophic level | ☐ TSS | ☐ turbidity | ☐ velocity |
| ☐ water temperature | ☐ weight | ☐ wetted areas | ☐ wetted width | ☐ zooplankton |

## Item 1

**Citation:** *(full citation)*

---

**Item Type(s)**

- ☐ Report
- ☐ Data (spreadsheet or database)
- ☐ Supporting documents

**Description:** *(a description of this particular item: e.g., interim report, spreadsheet with raw data and analyses, map of sampling areas etc.)*

---

**Comments:** *(optional, anything else you might want to add about this study)*

---

**File Name:** *(including location)*

---

## Item 2

**Citation:** *(full citation)*

---

**Item Type(s)**

- ☐ Report
- ☐ Data (spreadsheet or database)
- ☐ Supporting documents

**Description:** *(a description of this particular item: e.g., interim report, spreadsheet with raw data and analyses, map of sampling areas etc.)*

---

**Comments:** *(optional, anything else you might want to add about this study)*

---

**File Name:** *(including location)*

---

## Item 3

**Citation:** *(full citation)*

---

**Item Type(s)**

- ☐ Report
- ☐ Data (spreadsheet or database)
- ☐ Supporting documents

**Description:** *(a description of this particular item: e.g., interim report, spreadsheet with raw data and analyses, map of sampling areas etc.)*

---

**Comments:** *(optional, anything else you might want to add about this study)*

---

**File Name:** *(including location)*

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# Definitions

| Study Type | Description |
|---|---|
| Air Quality | |
| Climate | |
| Creel Survey | Survey of angler effort |
| Fish Habitat | Study related to the assessment of habitat for fish |
| Fish Movement | Study of fish movement often through the use of radio or acoustic telemetry or tag recovery |
| Fish Passage | Study of fish passage through a hydroelectric facility |
| Fish Survey and Attributes | Survey of fish, often used to enumerate and collect fish for fish life history metrics (e.g., growth, body condition) using many methods including electrofishing, seining, and angling. |
| Flow | |
| Ground Water Quality | |
| Literature Review | Review of literature |
| Noise | |
| Operations | Study related to the operation of the Project |
| Lower Trophic Levels | Studies measuring primary or secondary trophic levels. These include the biomass and production of zooplankton, benthic invertebrates, periphyton, and phytoplankton. |
| Sediment | Study of sediment quality |
| Soil | Study of terrestrial soil quality |
| Spawning | Study related to fish spawning information |
| Terrestrial Vegetation | Study related to terrestrial vegetation |
| Water Quality | Study related to water quality including water temperature, pH, TDG |
| Wildlife Habitat | Study related to the assessment of habitat for wildlife |
| Wildlife Survey | Study related to the survey of type, location, or abundance of wildlife |

| Project Phase | Description |
|---|---|
| Pre-Project | The period where data are collected prior to the construction of the Project. For some monitoring, the Pre-Project phase will extend into the Construction Phase as the river will still exhibit riverine conditions. |
| Construction | The first 9 years from when the Project commences. This does not distinguish between the Channelization, Diversion, and Reservoir Filling stages. |
| Construction - Channelization | Years 1 to 4 of the Construction phase |
| Construction - Diversion | Years 5 to 9 of the Construction phase |
| Construction - Reservoir Filling | Years 8 to 9 of the Construction phase |

| | |
|---|---|
| Operations | The Operations phase begins when Project construction is completed and the dam is fully functional |

| Location | Description |
|---|---|
| Peace River | Prior to the construction of the Project, the Peace River consists of everything from the Peace Canyon Dam to the Many Islands area in Alberta. After the construction of the Project, the Peace River consists of only the Peace River section downstream of the Project. The area upstream of the project is the Reservoir. |
| Tributaries (upstream) | Any river that flows into the Peace River upstream of the Site C dam site, or that flows into one of these tributaries. For example, the Halfway River is a main tributary upstream of the Site C dam site that has other creeks and rivers that are also considered tributaries (e.g., the Cameron River). |
| Tributaries (downstream) | Any river that flows into the Peace River downstream of the Site C dam site, or that flows into one of these tributaries. For example, the Pine River is a main tributary downstream of the Site C dam site that has other creeks and rivers that are also considered tributaries (e.g., the Sukunka River). |
| Site C Reservoir | Site C Reservoir |
| Dinosaur Reservoir | Dinosaur Reservoir, located upstream of Peace Canyon Dam |
| Williston Reservoir | Williston Reservoir, located upstream of W.A.C. Bennett Dam |
| Other | Rivers, lakes or dams that are not associated with the Peace River. |

**Fish Species Codes**

| CODE | COMMON NAME | LATIN NAME |
|---|---|---|
| GR | Arctic Grayling | *Thymallus arcticus* |
| BMC | Brassy Minnow | *Hybognathus hankinsoni* |
| BSB | Brook Stickleback | *Culea inconstans* |
| EB | Brook Trout | *Salvelinus fontinalis* |
| BT | Bull Trout | *Salvelinus confluentus* |
| BB | Burbot | *Lota lota* |
| CBC | Chub (General) | |
| CT | Cutthroat Trout | *Oncorhynchus clarki* (formerly *Salmo clarki*) |
| DC | Dace (General) | *Rhinichthys* spp., *Phoxinus* spp. |
| ESC | Emerald Shiner | *Notropis atherinoides* |
| FM | Fathead Minnow | *Pimephales promelas* |
| FDC | Finescale Dace | *Phoxinus neogaeus* (formerly *Pfrille neogaea* and *Chrosomus neogaeus*) |
| FHC | Flathead Chub | *Platygobio gracilis* |
| GE | Goldeye | *Hiodon alosoides* |
| KO | Kokanee | *Oncorhynchus nerka* |
| LKC | Lake Chub | *Couesius plumbeus* |

| CODE | COMMON NAME | LATIN NAME |
|---|---|---|
| CL | Cisco | *Coregonus artedii* |
| LT | Lake Trout | *Salvelinus namaycush* |
| LW | Lake Whitefish | *Coregonus clupeaformis* |
| CSU | Largescale Sucker | *Catostomus macrocheilus* |
| LNC | Longnose Dace | *Rhinichthys cataractae* |
| LSU | Longnose Sucker | *Catostomus catostomus* |
| C | Minnows (General) | many, all cyprinids |
| MW | Mountain Whitefish | *Prosopium williamsoni* |
| NSB | Ninespine Stickleback | *Pungitius pungitius* |
| NP | Northern Pike, Jackfish, Jack | *Esox lucius* |
| RDC | Northern Redbelly Dace | *Phoxinus eos* (formerly *Chrosomus eos*) |
| XDC | Northern Redbelly Dace x Finescale Dace | *Phoxinus eos* (Cope) *x Phoxinus neogaeus*(Cope) |
| NSC | Northern pikeminnow | *Ptycheilus oregonensis* |
| PCC | Peamouth | *Mylocheilus caurinus* |
| PDC | Pearl Dace | *Margariscus margarita* |
| P | Perch (General) | *Perca* sp., *Stizostedion* sp. |
| CAS | Prickly Sculpin | *Cottus asper* |
| PW | Pygmy Whitefish | *Prosopium coulteri* |
| RB | Rainbow Trout | *Oncorhynchus mykiss* (formerly *Salmo gairdneri*) |
| RSC | Redside Shiner | *Richardsonius balteatus* |
| CC | Sculpins (General) | Primarily *Cottus* spp. |
| CCG | Slimy Sculpin | *Cottus cognatus* |
| CRI | Spoonhead Sculpin | *Cottus ricei* |
| STC | Spottail Shiner | *Notropis hudsonius* |
| SB | Sticklebacks (General) | |
| SU | Suckers (General) | *Catostomus* sp. |
| TR | Trout (General) | *Oncorhynchus* sp |
| TP | Trout-perch | *Percopis omiscomaycus* |
| WP | Walleye | *Sander vitreus* (formerly *Stizostedion vitreum)* |
| WSU | White Sucker | *Catostomus commersoni* |
| WF | Whitefish (General) | *Prosopium* spp., *Coregonus* spp., *Stenodus*sp. |
| YP | Yellow Perch | *Perca flavescens* |

| Measurement | Measurement Description or Example |
|---|---|
| absorbable organic halogens | AOX |
| access type | e.g., bank trail, boat ramp, bushwhacking |
| activity type | e.g., fishing, hunting, birding, wildlife viewing, boating, swimming, camping, hiking, and many more potential uses |

| Measurement | Measurement Description or Example |
|---|---|
| age | age calculated from otolith, scales, fin ray analysis, length, or unknown |
| angler demographics | age and community of origin |
| angling type | how are they fishing? Catch/release?, shore/boat? Gear type? |
| bank irregularities | also called 'roughness': smooth, irregular or rough |
| catch count | how many fish were caught? |
| clarity | water clarity |
| conductivity | water conductivity |
| cover | unspecified in report as instream or overhead |
| DELT | deformity, erosion, lesion, tumor |
| depth | water depth |
| effort | hours spent |
| habitat | description |
| habitat type | instream and/or bank and/or off-channel habitat |
| instream cover | potential cover for fish within the stream. Examples include backwater areas, rock, large woody debris, non-wood vegetation |
| large organic debris | includes large woody debris |
| length | fork length or total length of fish |
| location | |
| maturity | e.g., immature, maturing to spawn current year, ripe, spent, resting, juvenile, and as defined in Appendix B of Mainstream (Mainstream Aquatics Ltd. 2009. Site C fisheries studies – Juvenile fish use and habitat inventory of Peace River tributaries in summer 2008. Prepared for B.C. Hydro. Report No. 08008CF: 78 p. + Appendices) |
| metalloids | These are defined as the elements in the periodic table that lie between the metals and the non-metals. They are: boron, silicon, germanium, arsenic, antimony, tellurium, polonium, and astatine |
| near shore slope | 'low', 'moderate', or 'steep'. |
| particulate size | also called grain size or particulate class |
| recreational area type | e.g. boat access, shore access, campsite, picnic area, trail, cabin, view site |
| shoreline type | rocky, sandy beach, etc. |
| substrate compaction and embeddedness | Embeddedness is the amount of fine particles (sand, silt, and clay) present within the substrate. Compaction evaluates the density or looseness of the substrate within the channel. Compaction and embeddedness were evaluated as low (1), moderate (2), or high (3). |
| substrate composition | also called 'substrate type': the material forming the bottom of the stream bed |
| suspended solids | includes sediment loading |
| tag information | information about the tag, such as color, type, number |
| TDS | Total dissolved solids |
| TGP | Total gas pressure |
| TSS | total suspended solids |

| Method | Method Description or Example |
|---|---|
| aerial photo assessment | Usually used for habitat assessment |
| aerial survey | e.g., for fishing |
| ageing structure analysis | Actual analysis of the structures collected previously |
| ageing structure collection | Usually collection of scales |
| angling | |
| barrier net or fence | e.g., conduit fence, barrier fence, general fish fence |
| beach seine | |
| benthic invertebrates | |
| boat-based wildlife/bird survey | |
| call play back | |
| continuous water measurements | |
| creel survey | e.g., interviews |
| DNA analysis | |
| DNA collection | |
| dredge | |
| electrofishing - backpack | |
| electrofishing - boat (large fish) | |
| electrofishing - boat (small fish) | |
| elemental analysis | |
| fin ray collection | |
| foot survey (for wildlife) | |
| gill net | |
| grab | |
| habitat assessment | |
| kick disturbance | e.g., kick disturbance, kick nets |
| larval drift net | |
| mark | |
| minnow trap | |
| modelling | |
| net capture (for wildlife) | e.g., butterfly collection |
| otolith collection | |
| passive listening | |
| periphyton | |
| photograph time-lapse | |
| phytoplankton | |
| rotary screw trap | |
| sample pits | |
| shore-based fish count | |
| shovel | |
| snorkel survey | |
| spot water quality measurement | |

| Method | Method Description or Example |
|---|---|
| stable isotopes analysis | |
| stomach content - analysis | |
| stomach content - collection | e.g., gastric lavage, lethal stomach content collection |
| telemetry - acoustic | |
| telemetry - radio | |
| terrestrial ecosystem mapping (TEM) | |
| time-constrained | |
| tissue sampling | Lethal or non-lethal |
| traps | |
| variable radius point counts | |
| vehicle-based wildlife/bird survey | |
| wildlife/bird observation | |
| zooplankton | |

# Appendix B: Formatting Requirements for Importing Data

One part of the Fish & Aquatic Data Management System (FADMS) is the ability to load and view data. The initial process for this is the same.

1. From the **Home** screen, select **Managed Environmental Data**.
2. Click on the type of data that you wish to import.
3. Select **Import data from file** and click **OK**.
4. If you are working with Water Quality data, you will then need to select the type of data, and click **OK**.
5. Use the **Browse** button to navigate to the spreadsheet that contains the data to be imported into the database system. Select the file from the **Choose File to Upload** window, and click **Open**.
6. Click **Import** on the **Import Data** screen to import the data.
7. If all the data are imported successfully, a message will appear. Otherwise, check for any messages in red as they will indicate potential errors, such as a mismatch in site name.
8. You can now import more data of the same type, view these data, click the **Back** button to return to the screen that allows you to pick the type of data, or the **Home** button or BC Hydro icon to return to the **Home** screen.

There are three different categories of data that can be imported into the system. In each case, the data must be for predetermined sites and must be loaded from a spreadsheet. Below, for each category, is a description of the key required formats.

There are some common requirements in each case:

- Data must be in an Excel spreadsheet (xlsx format).
- Site names are case sensitive, and must be one of those listed below. New sites may be added by a FADMS system administrator.

Sites primarily associated with Water Quality:

| | | | |
|---|---|---|---|
| DH11-10, P1 | DH11-49, P1 | Halfway | Peace 1 |
| DH11-14, P1 | DH11-51, P1 | Howe Pit - Tap | Peace 2 |
| DH11-15, P1 | FSJ Well (TPW-1) | Howe Pit - Well | Peace 3 |
| DH11-16, P1 | FSJ Well 2 (TPW-5) | Moberly DS | Peace 4 |
| DH11-18, P1 | FSJ Well 3 (TPW-6) | | Pine |
| DH11-22, P1 | FSJ Well 4 (TPW-7) | | Taylor |
| DH11-45, P1 | FSJ Well 5 (TPW-8) | | Taylor Wells |

Sites primarily associated with Air Quality:

| | |
|---|---|
| STC1 - Upper Attachie | STC6 - Farrell Creek |
| STC2 - Lower Attachie | STC7 - Site C Dam |
| STC3 - Attachie Plateau | STC8 - 85th Avenue Industrial Lands |
| STC4 - Bear Flat | Fort St John Airport (1183000) |
| STC5 - Hudson's Hope | North Peace Cultural Center |

Sites primarily associated with Turbidity (Note: Logger Name is synonymous with the site name used internally within the FADMS):

| **Logger Name** | **(Location)** |
|---|---|
| NEP3952 | Peace above Moberly Left Bank |
| NEP3952 | Peace above Moberly Right Bank |
| NEP3953 | Spectra Intake |
| NEP395PT | Peace above Pine Right Bank |
| Turbidity Station | Taylor Intake |

- Multiple pages may be in the spreadsheet, but only the sheet with the appropriate name (see below) will be imported.
- Multiple stations may be on the same page.
- Order of the columns does not matter.
- Extra or missing columns are ignored (unless explicitly mentioned below). Missing values will be recorded as a null and cannot be replaced at a later date (unless the data are deleted from the database and imported anew).
- In all cases, the date-time format must be: DD-MM-YY H:MM such as 13-02-16 1:15. In some cases, the date and time are in separate columns, but must still follow the appropriate format (date portion or time portion).

Specifics about the different data formats are given below.

## Air Quality

Air quality data are the data that come from the continuous monitoring systems. Usually these data are recorded hourly, and will need to be manually imported into the FADMS.

The tool imports only data on the page labelled “Hourly Data”. Any other pages in the spreadsheet, even if they contain data, will be ignored.

The data columns in the table below are imported into the FADMS. Any other columns will be ignored. There are two types of columns: those that contain the data (e.g., Relative Humidity)

and those that contain a flag regarding data quality or other issues (i.e., all columns that end in _Flag). The data and flag values are separated in this table for ease of reading. Column order in the spreadsheet does not matter to the tool.

| Column name in spreadsheet | FADMS name | Required? |
|---|---|---|
| Station Name | SiteName | YES |
| TIMESTAMP | Timestamp | YES |
| Wind Speed - m/s | WS_ms_S_WVT | |
| Wind direction - Degrees from North | WindDir_D1_WVT | |
| STDEV(wind direction) - Degrees from North | WindDir_SD1_WVT | |
| Hourly Precipitation rate - tipping bucket - mm | Precip_mm_tot | |
| Hourly Precipitation rate - weighing gauge - mm | Precip_mm_gauge | |
| Air Temperature - Degrees C | Tair_C_Avg | |
| Relative Humidity - % | RH_Avg | |
| Barometric Pressure - HPa | BP_61302V_Avg | |
| Soil heat flux (1) - W/m2 | HFT3_1_Avg | |
| Soil heat flux (2) - W/m2 | HFT3_2_Avg | |
| Downwelling shortwave radiation - W/m2 | K_down_Avg | |
| Upwelling shortwave radiation - W/m2 | K_up_Avg | |
| Downwelling longwave radiation - W/m2 | L_down_Avg | |
| Upwelling longwave radiation - W/m2 | L_up_Avg | |
| PM10 - ug/m3 | PM10_Avg | |
| PM2.5 - ug/m3 | PM2_5_Avg | |
| Visibility - km | RunAvgMOR_Avg | |
| Soil temperature - DegreesC | TCAV_Temp_Avg | |
| Soil volumetric water content - fraction | SoilWater_Avg | |
| Wind Speed_FLAG | WS_FLAG | |
| Wind direction_FLAG | WindDir_FLAG | |
| Hourly Precipitation rate_FLAG | Precip_Tip_FLAG | |
| Hourly Precipitation rate gauge_FLAG | Precip_gauge_FLAG | |
| Air Temperature_FLAG | Tair_FLAG | |
| Relative Humidity_FLAG | RH_FLAG | |
| Barometric Pressure_FLAG | BP_FLAG | |
| Downwelling shortwave radiation_FLAG | K_down_FLAG | |
| Upwelling shortwave radiation_FLAG | K_up_FLAG | |
| Downwelling longwave radiation_FLAG | L_down_FLAG | |
| Upwelling longwave radiation_FLAG | L_up_FLAG | |
| Soil heat flux (1)_FLAG | HFT3_1_FLAG | |
| Soil heat flux (2)_FLAG | HFT3_2_FLAG | |
| Soil temperature_FLAG | TCAV_Temp_FLAG | |
| Visibility_FLAG | RunAvgMOR_FLAG | |
| PM10_FLAG | PM10_FLAG | |
| PM2.5_FLAG | PM2_5_FLAG | |

| Column name in spreadsheet | FADMS name | Required? |
|---|---|---|
| Soil volumetric water content_FLAG | SoilWater_FLAG | |

## Turbidity

Turbidity data come from loggers that are permanently recording this information in various locations. Data will need to be periodically uploaded into the FADMS, manually.

The tool imports only data on the page labelled “Sheet1”. Any other pages in the spreadsheet, even if they contain data, will be ignored.

The data columns in the table below are imported into the FADMS.

| Column name in spreadsheet | | Name in FADMS | Required? |
|---|---|---|---|
| Date | | | YES |
| Time | | Timestamp | YES |
| Logger Name | | LoggerName | YES |
| Battery(RAW) | OR | | |
| Battery(AVG) | | BatteryRaw | |
| Turbidity(RAW) | OR | | |
| Turbidity(AVG) | | TurbidityRaw | |
| Variance(RAW) | OR | | |
| Variance(AVG) | | VarianceRaw | |
| Water Temperature(RAW) | OR | | |
| Water Temperature(AVG) | | WaterTemperatureRaw | |

Logger names must be one of those given in the list of sites.

The spreadsheet will contain Date and Time in separate columns. These are joined together inside the database to make a single column that will match those used by other data types.

Most of the columns in this data type can be labelled in one of two ways: either ending in “(AVG)” or “(RAW)”. The tool will not allow both to be present. For example, the column must be labelled “Battery(AVG)” or “Battery(RAW)”, but both these columns cannot be present. However, “Battery(AVG)” and “Turbidity(RAW)” is permissible. Note that there is no space between the data label (e.g., Battery) and the “(“.

## Water Quality

Water quality data can come in four different formats. The most detailed format, in terms of the type of information, is the spreadsheet that contains the lab analysis of the water. The other formats are based on field water quality measurements. Each has its own format.

## Lab

The tool imports only data on the page labelled “Sheet1”. Any other pages in the spreadsheet, even if they contain data, will be ignored.

The data columns in the table below are imported into the FADMS.

| Column name in spreadsheet | Name in FADMS | Required? |
|---|---|---|
| Locator | Locator | |
| LSD | LSD | |
| LoginNum | LoginNum | |
| ReceiveDate | ReceiveDate | |
| ClientID | ClientID | YES |
| SampleNum | SampleNum | |
| ETLCode | ETLCode | |
| JobName | JobName | |
| PCode | PCode | |
| Analyte | Analyte | |
| Result | Result | |
| Qualifier | Qualifier | |
| Units | Units | |
| DL | DL | |
| AnalDate | AnalDate | |
| Analyst | Analyst | |
| Category | Category | |
| SMPDate | SMPDate | YES |
| SMPTime | SMPTime2 | YES |
| Method | Method | |
| Prefix | Prefix | |
| Parm_Type | ParmType | |
| MatNum | MatNum | |

ClientID corresponds to the site name and must be one of those listed in the site table.

The spreadsheet contains several date or time columns. The most important one for the database is the SMPDate column as this contains the date and time of the sample.

## Surface Water Quality Field Forms

The first of the field forms is the one that measures surface water quality.

The tool imports only data on the page labelled “Surface water”. Any other pages in the spreadsheet, even if they contain data, will be ignored.

| Column name in spreadsheet | Name in FADMS | Required? |
|---|---|---|
| Site | SiteName | YES |
| Date | Date | YES |
| Time | Time | YES |
| Location | Location | |
| Water Temperature | WaterTemperature | |
| pH | pH | |
| Conductivity (Us) | Conductivity_Us | |
| Salinity (ppm) | Salinity_ppm | |
| TDS (ppm) | TDS_ppm | |
| DO (mg/L) | DO_mgL | |
| DO (%) | DO_percent | |
| Turbidity (NTU) | Turbidity_NTU | |
| ORP | ORP | |
| Comments/Notes | Comments | |

Site names are those that are in the column labelled **Site** and must be one or more of the ones listed. Note that the model does not recognize labels such as “Travel Blanks”, “Field Blanks” or “Duplicate” as valid site names.

## Ground Water Quality Field Forms

The second field form is the one that measures ground water quality.

The tool imports only data on the page labelled “Ground water”. Any other pages in the spreadsheet, even if they contain data, will be ignored.

Site names are those that are in the column labelled **Site** and must be one or more of the ones listed. Note that the model does not recognize labels such as “Travel Blanks”, “Field Blanks” or “Duplicate” as valid site names.

| Column name in spreadsheet | Name in FADMS | Required? |
|---|---|---|
| Site | SiteName | YES |
| Date | Date | YES |
| Time of Sampling | Timestamp | YES |
| Time In | TimeIn | |

| Column name in spreadsheet | Name in FADMS | Required? |
|---|---|---|
| Time Out | TimeOut | |
| Depth to bottom | DepthToBottom | |
| Depth to water | DepthToWater | |
| Depth of water | DepthOfWater | |
| Volume bailed | VolumeBailed | |
| Location | Location | |
| Water Temperature | WaterTemperature | |
| pH | pH | |
| Conductivity (Us) | Conductivity_Us | |
| Salinity (ppm) | Salinity_ppm | |
| TDS (ppm) | TDS_ppm | |
| DO (mg/L) | DO_mgL | |
| DO (%) | DO_percent | |
| Turbidity (NTU) | Turbidity_NTU | |
| ORP | ORP | |
| Comments/Notes | Comments | |

## Turbidity Field Forms

The third of the field forms is the one that measures turbidity. Note that these are different data than those from an in-place regular data logger. These data are collected at a point in time and information recorded onto a field form.

The tool imports only data on the page labelled “Turbidity”. Any other pages in the spreadsheet, even if they contain data, will be ignored.

| Column name in spreadsheet | Name in FADMS | Required? |
|---|---|---|
| Site | SiteName | YES |
| Date | Date | YES |
| Time | Timestamp | YES |
| Location | Location | |
| Sample collected | SampleCollected | |
| Water Temperature | WaterTemperature | |
| LaMotte - Turbidity | Turbidity | |
| Temperature | Temperature | |
| Turbidity | Turbidity_YSI | |
| Temperature | Temperature_probe | |
| Turbidity | Turbidity_NTU | |
| Comments/Notes | Comments | |

Site names are those that are in the column labelled **Site** and must be one or more of the ones listed. Note that the model does not recognize labels such as “Travel Blanks”, “Field Blanks” or “Duplicate” as valid site names.

# Appendix C: FADMS Server Configuration

## IIS Web Server

The FADMS is written in the Visual Basic/ASPX languages using .NET framework 4.5 and two sets of 3rd party software, Telerik graphic controls (Version ASP.NET version 2016.1.113.45 with AjaxControlToolkit version 15.1.4.0)[3]) and CMIS controls (version 0.7). The Telerik controls provide the graphical controls (buttons, check-boxes, etc.) for the application and the CMIS controls allow communication with BC Hydro's FileNet document repository system, which is the ultimate location for all documentation.

FADMS source code is currently held by ESSA Technologies in a Git repository managed with GitKraken software. Code development is done with Microsoft Visual Studio 2013 Community Edition. When development and debugging is at an advanced stage and the application needs to be tested (and eventually deployed) in a live environment, the FADMS application is published as a collection of files and directories which are copied to a Windows-based host server (2008 R2 Standard) running Microsoft Internet Information Services (IIS version 7.5).

BC Hydro currently hosts the FADMS on a dedicated VM server which is accessible to authorized users inside the BCH firewall. The FADMS has been developed to work with the IE browser using a local URL (http://10.242.150.48). For configuration, administrators with the necessary privileges (i.e. the necessary Active Directory credentials) can log into the host server stcbchtsdb1 using RDP.

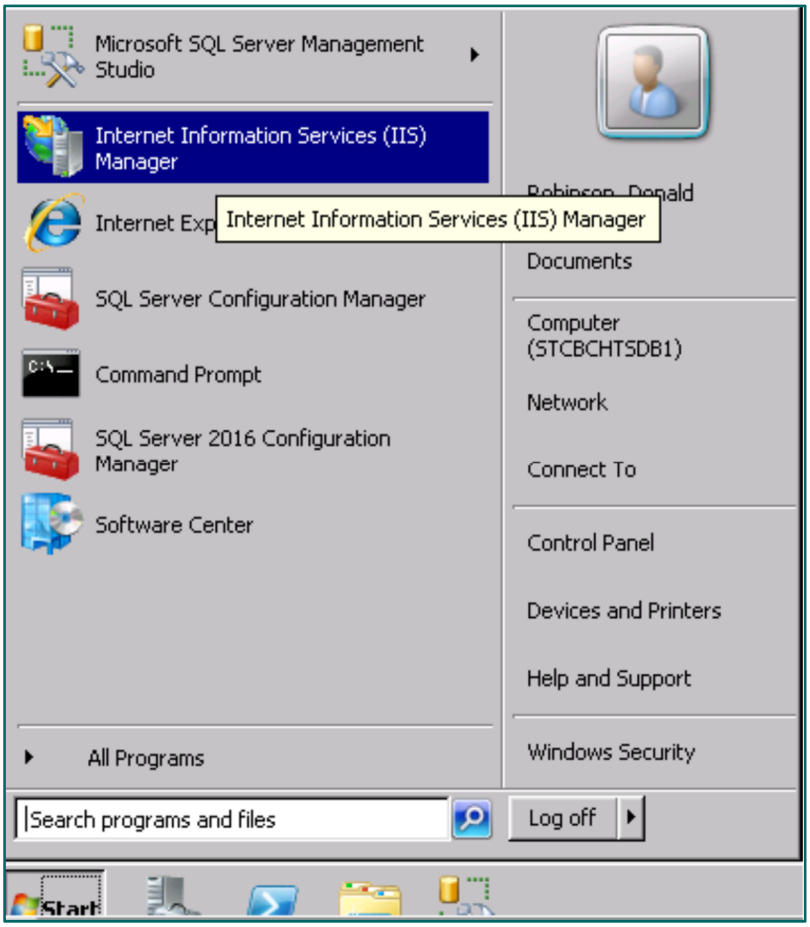
## SQL Server

The FADMS uses SQL Server 2016 (version 11.0.5058) software and a custom database installed on the host server, which maintains all the information used by the FADMS. The SQL server STCBCHTSDB1 contains the FADMS database ("SiteCDMS") and can be accessed using SQL Server Management Studio using SQL Server Authentication with login ID BCHOwner. This database is backed up nightly and FADMS administrators should not normally need to interact with it.

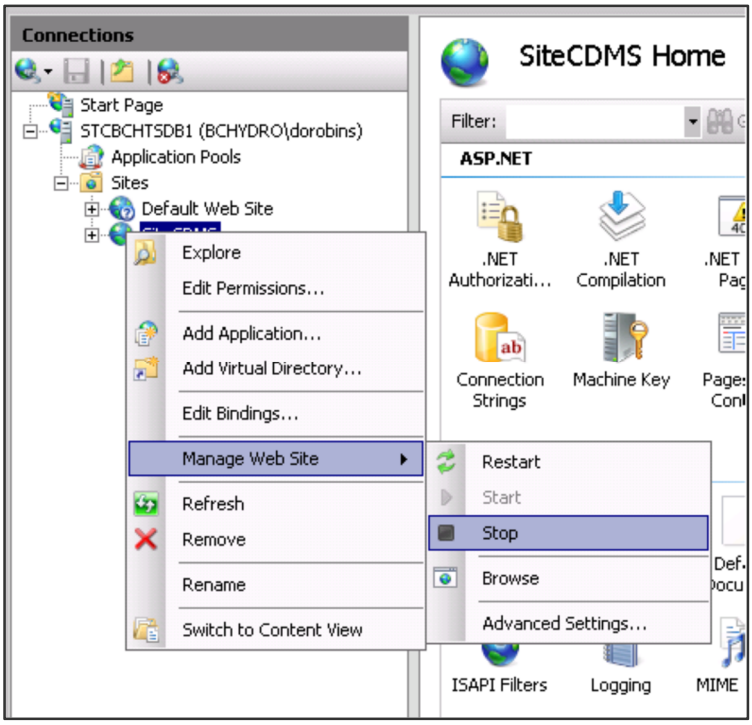
## Stopping the FADMS

The FADMS must be stopped prior to updating the application software or after updating the documents stored in FileNet. When logged into the FADMS server using RDP, the IIS control panel can be opened as shown below, by pressing the Start key of the remote server and clicking on the Internet Information Services (IIS) Manager.

[3] ESSA Technologies license is valid up to version 2016.3.1027 (October 27, 2016) "UI for ASP.NET AJAX R3 2016 SP2"




When the IIS Manager opens, expand the Sites folder found in the left panel tree control and right-click to highlight SiteCDMS, as shown below. To stop the FADMS, click on Manage Web Site and then click on Stop, as shown below. This will disconnect any users and allows the newer version to be installed.




## Updating the FADMS Application

The FADMS application files are found in this directory on the VM server:

C:\wwwroot\SiteCDMS

With the FADMS application stopped, it is good practice to create a backup of the current version by making a “snapshot” of the application before copying a new version of the FADMS into its place. For example, if an earlier version created on 21-November-2017 is being replaced by a more recent version, the previous version can be copied to a “backup” directory:

C:\wwwroot\SiteCDMS.21.Nov.2017

until the more recent version has been shown to be stable and reliable; after which the earlier version can be deleted. With the FADMS application stopped, the newer application files and directories can then be copied directly to this location on the host server:

C:\wwwroot\SiteCDMS

After the updated application software is installed, select Start to restart the FADMS, as shown in the screen capture found at the end of this Appendix.

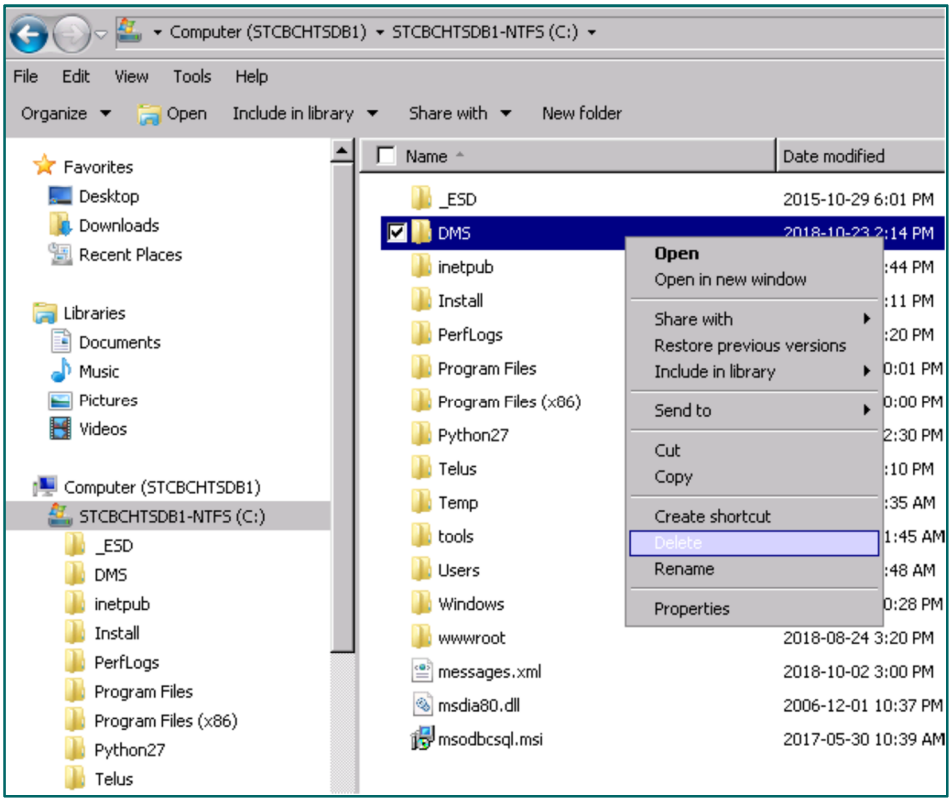
## Updating Document Content

Site C documentation is added to the FileNet document repository by personnel from Site C Document Control using collections of files and directories organized into data packages provided to the FADMS steward by BCH personnel and consultants. Once these documents have been added to the FileNet repository system, the FADMS should be stopped (as described above) so that the linkage between the FADMS and FileNet can be updated. Without following this step, the FADMS is not aware that new documents have been added and they will not be accessible from the FADMS.

As part of the interaction between the FADMS and FileNet, the FADMS creates a private copy of the directory and file structure used by FileNet. Although it appears as if the documentation files are found on the VM server, the server-side files and directories actually contain FileNet-specific shortcuts and not the document content itself. This directory is stored on the VM server here:

C:\DMS

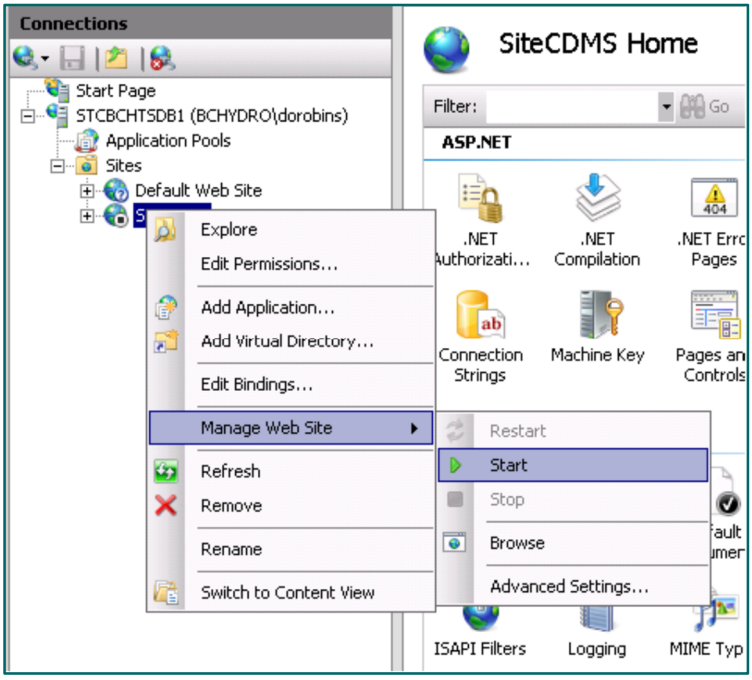
After new documents have been added to FileNet this entire directory should be deleted as shown below. When the FADMS software is restarted a new copy of the FileNet directory and file structure will be automatically recreated, a one-time process that takes about 2 minutes.



## Starting the FADMS

Once new documents have been added or the FADMS application software has been updated, the FADMS can be restarted by opening the IIS Manager, expanding the Sites folder found in the left panel tree control and right-clicking to highlight SiteCDMS as was described above in the steps required to shut down the application.

To start the FADMS, click on Manage Web Site and then click on Start. This will start the application and enable FADMS users to access the application, including the reconstruction of the files and directories found at C:\DMS.



# *Data Management System User Guide*

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