Using Open Database Connectivity (ODBC) with STORET Tutorial

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Using Open Database Connectivity (ODBC) With STORET

Open Database Connectivity (ODBC) is a programming interface that enables programs to access data in database management systems that use Structured Query Language (SQL) as a data access standard. Software applications that are "ODBC compliant" can seamlessly exchange data. The capability to use ODBC is inherent in STORET because STORET is an Oracle-based system, and Oracle is ODBC compliant. As a result, any ODBC-compliant application can read STORET data without having to extract or convert data to a compatible form.

ODBC has become an industry standard, with the result that most applications[1] are ODBC compliant. Thus, STORET can be used with ODBC in many ways, including

- Linking STORET tables into database management applications (e.g., MS Access, SQL Server, Paradox),
- Analyzing STORET data with query or reporting tools (e.g., BrioQuery or Crystal Reports),
- Making maps or performing spatial analysis in GIS applications (e.g., ESRI ArcGIS),
- Creating business graphics or pivot tables with MS Excel,
- Performing statistical analysis with SAS, StatView, or other statistical software, and
- Creating a MS Visual Basic application that can access information shared by STORET to create custom reports.

This tutorial covers using ODBC to work with STORET data in Access and ArcGIS. The intent of this tutorial is to give you general experience in using ODBC with STORET, and specific experience using ODBC to share data between STORET and Access or between STORET and ArcGIS. STORET contains several data views that further facilitate the use of ODBC. This tutorial will walk you through the process of using ODBC with data from the DEMOTEST database to bring selected STORET data into Access and ArcGIS.

[1] In this tutorial, a number of different proprietary software products are referenced. Referencing these products implies no specific EPA endorsement. Most specifically, Access and ArcGIS are proprietary products developed by Microsoft and ESRI, respectively. These two products are used in this tutorial solely for demonstration purposes. Note also that this tutorial was created using Windows XP. If you are using a different operating system, you may experience some differences.

To complete this tutorial, you will need to have STORET installed (including the DEMOTEST data), a folder with the ArcGIS tutorial files, as well as Access and ArcGIS v. 8.1 or higher. You will also need to have installed STORET data views. ***(If you have not installed STORET data views, stop here, and install the data views by downloading them from the STORET web site, www.epa.gov/storet).*** To become more familiar with the data views, you may also wish to review the downloadable document "STORET v. 2.0 Database Views Quick Reference Guide." These data views enable you to access (but not alter) the data in STORET without requiring a detailed knowledge of the underlying relational database structure. (STORET data tables can also be accessed directly through ODBC, although doing so is not demonstrated in this exercise.) For the ArcGIS section of the tutorial, you will also need to have the ODBC_Tutorial.mxd file available in a folder you can navigate to. This file includes the data used for a basemap.

Note that this tutorial is not intended to be a template for doing this type of work, and the data elements included in the tutorial may not be representative of the data you typically generate or use. However, by working through this tutorial, you will gain an understanding of what you need to do to take advantage of the power of ODBC when working with STORET. Depending on different factors, the entire tutorial should take you between 40 and 80 minutes to complete. The estimated times for the different sections are shown below:

A. Configuring an ODBC Driver (5-10 minutes)

B. Using ODBC with STORET and Access (20-40 minutes)

- Linking Access to STORET Data Views (5-10 minutes)
- Viewing STORET Data in a Access Table (5-10 minutes)
- Filtering STORET Data in Access (5-10 minutes)
- Querying STORET Data in Access (5-10 minutes)

C. Using ODBC with STORET and ArcGIS (15-30 minutes)

- Linking ArcGIS to STORET Data Views (5-10 minutes)
- Exporting a STORET Data View to a Shapefile (5-10 minutes)
- Querying STORET Data in ArcGIS (5-10 minutes)

Depending on your experience with Access, and ArcGIS, and your installation, you may need to consult with your database administrator or another technical support person. If you encounter difficulties, you can also contact the STORET assistance hotline, 1-800-424-9067.

To provide a context for this tutorial, you can assume that you have been asked to report on fish tissue sampling in the Blackwater National Wildlife Refuge in Maryland. You have already entered these data into STORET.

A. Configuring an ODBC Driver for STORET

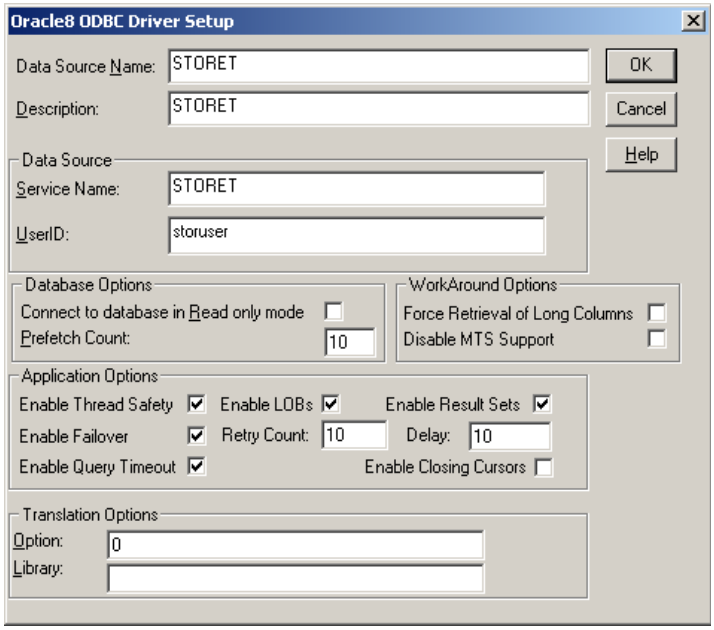
Before you can use ODBC with STORET, you must make sure your ODBC drivers are properly configured to use STORET.[2] If your ODBC drivers have not been configured for STORET, follow the directions in the box below to configure them. Note that these instructions are for a single workstation installation.

From Control Panel, click on **Administrative Tools**, then **Data Sources (ODBC)**.

Choose the System DSN tab. Click **Add**.

You will then need to choose a driver. Choose **Oracle ODBC Driver**. Click **Finish**.

The following screen should appear:



You will need to fill in the **Data Source Name, Description, Service Name,** and **User ID.** (How you do so will depend on your installation. You may need to consult with your database administrator or another technical support person, or contact the STORET assistance hotline (1-800-424-9067). Click **OK** when you are done and **Close** the Administrative Tools window. *Note: The Service Name should be the same as your STORET database name.*

[2] An ODBC driver is a dynamic-link library (DLL) file that allows different software programs to communicate with each other. Each program and database management system requires a different driver. Note: If you do not have a suitable Oracle driver, you may be able to download one from the Oracle Web site at www.oracle.com.

Once you have your STORET ODBC driver installed, you are ready to use ODBC with STORET.

B. Using ODBC with STORET and Access

In this part of the tutorial, you will perform the following tasks:

- Linking Access to STORET data views,
- Viewing STORET data in Access,
- Filtering of STORET data in Access,
- Querying of STORET data in Access,

To complete this part of the tutorial, you will need to have Microsoft Access installed and some very basic experience with Access. (The exercises were developed with Access 2002. If you have a different version of Access, you may experience some differences. Please note also that EPA does not support the use of MS Access as a tool for entering or editing STORET data.)

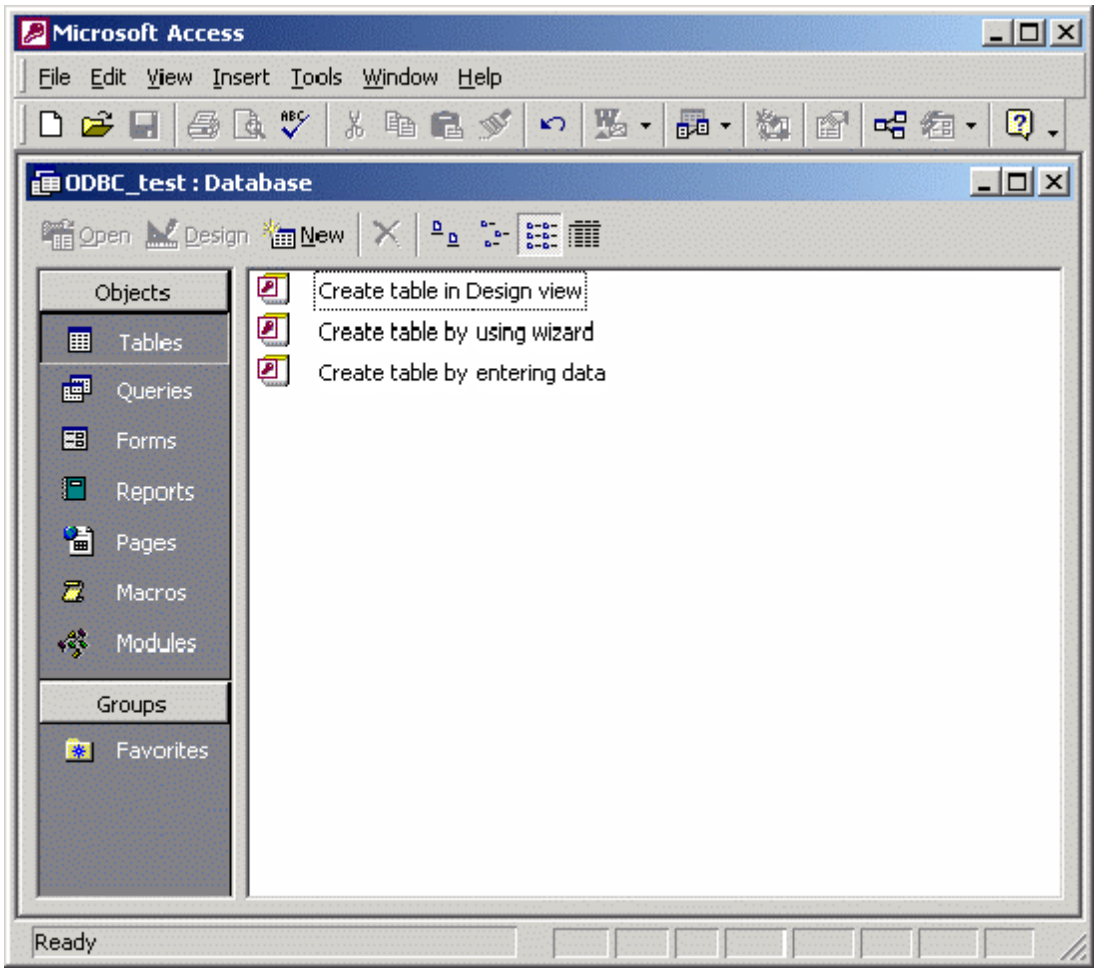
Linking Access to STORET Data Views

The first step you will need to pursue to load the STORET data views into Access is shown below:

Open Access, and create a new blank database.

Specify or create a folder, and name the database ODBC_test.

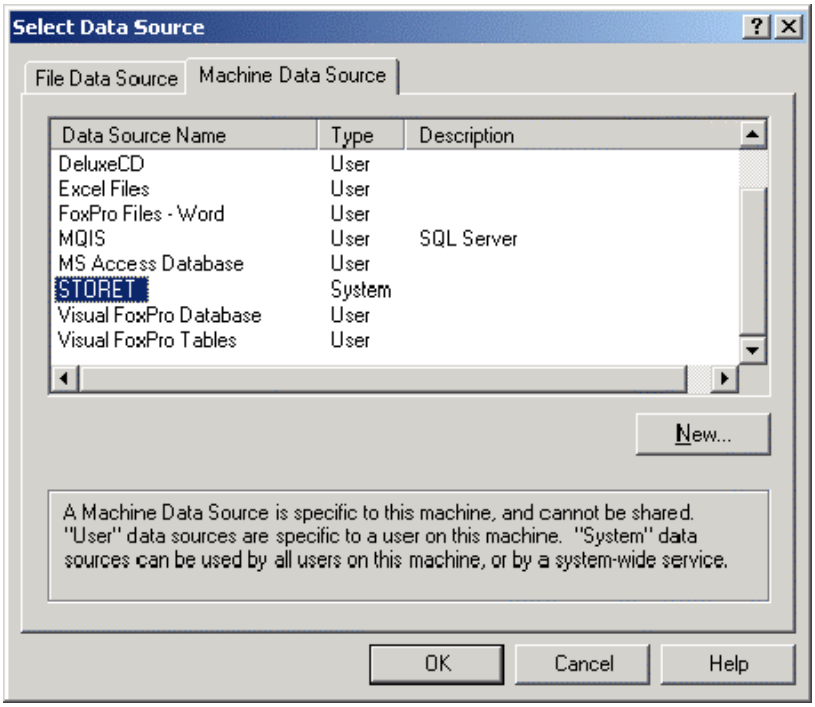
This should create a database as shown below.



To link your Access database to STORET data views:

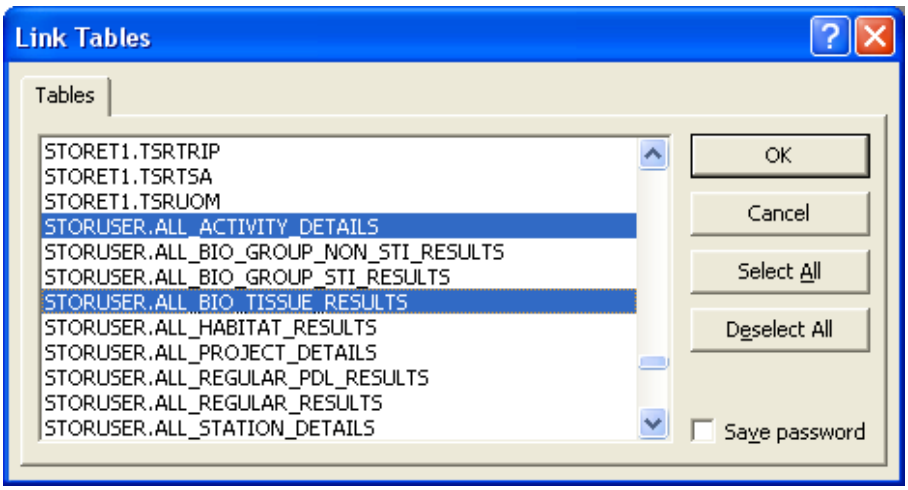
Select **File, Get External Data, Link Tables**.

In the **Files of type** pull down at the bottom of the window, scroll down and select **ODBC Databases**.



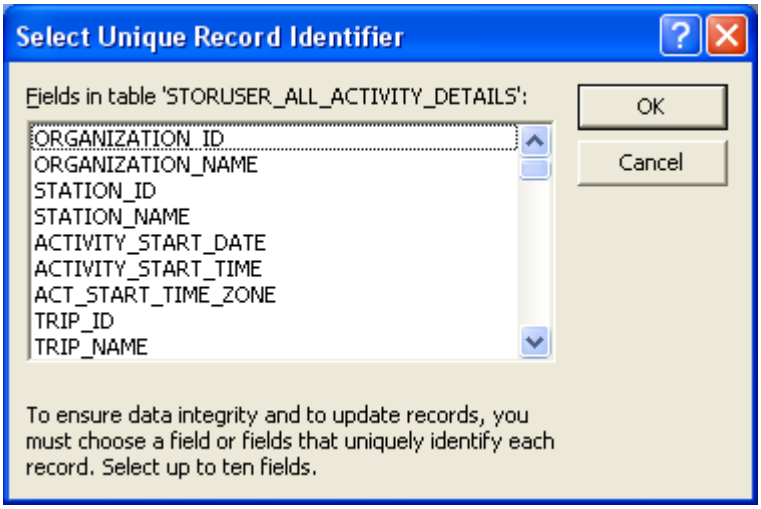
Select the Machine Data Source tab, and select **STORET**. Click **OK**.

Enter your STORET password when prompted. This will bring up the **Link Tables** box, which contains a number of tables. (The exact tables that you see depends on your installation of Oracle and STORET, and may include administration, system and user tables.) We are interested in the STORET data views that pull data from various STORET tables together.



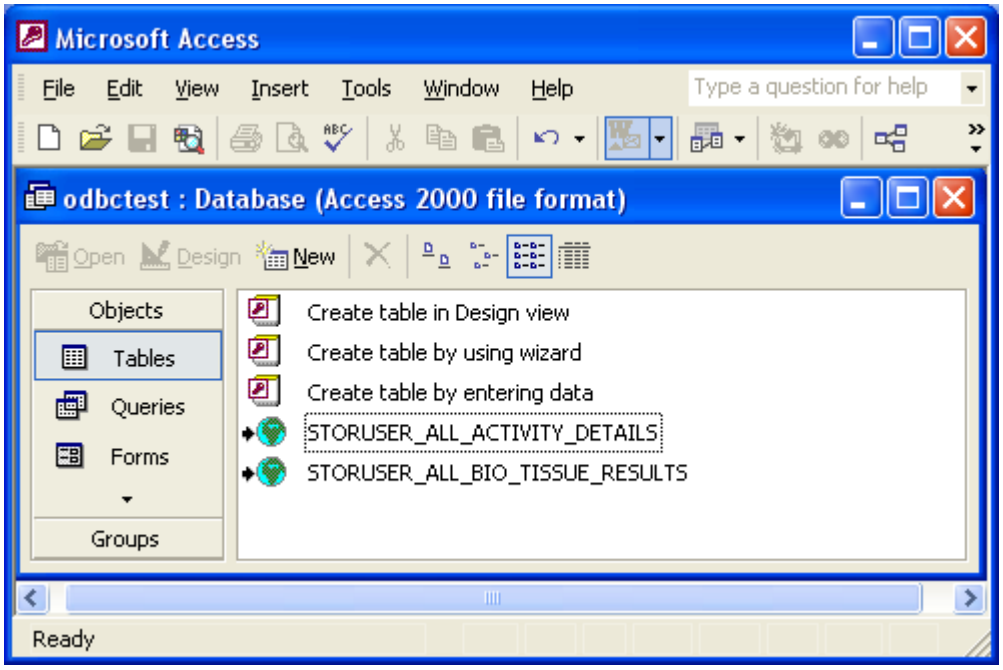
Scroll down and select the two views **STORUSER:ALL_ACTIVITY_DETAILS** and **STORUSER:ALL_BIO_TISSUE_RESULTS** as shown. Click **OK**.

You will be prompted to select “key” fields that uniquely identify records.



Click **Cancel** twice.

You should now have in your database two linked tables, as shown:

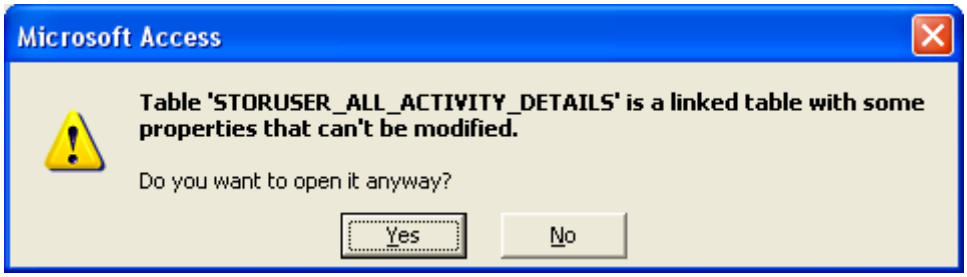


Viewing STORET Data in Access

Now that you've linked the STORET data to Access, you can look at these tables in more detail.

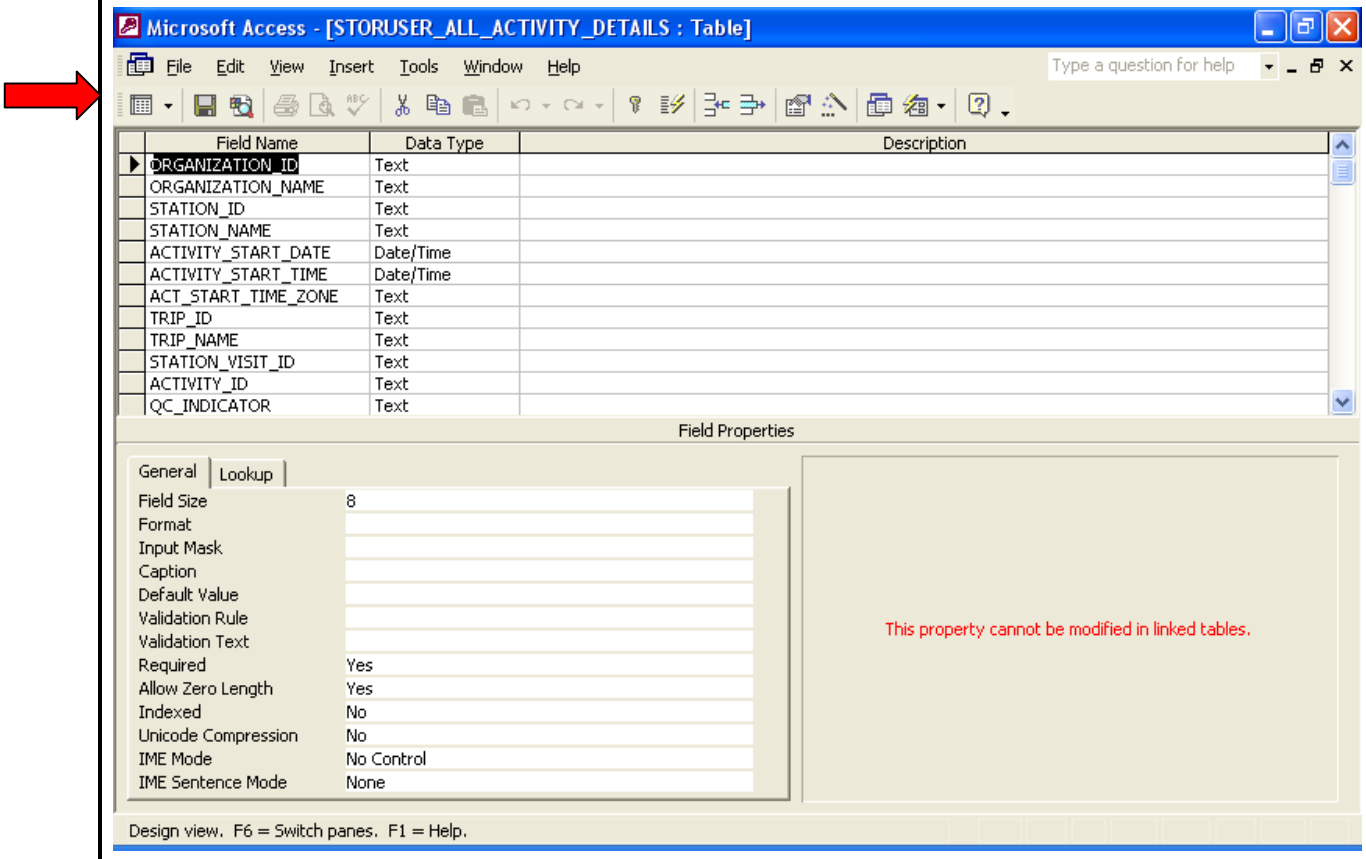
Highlight **ALL_ACTIVITY_DETAILS**, and click on the **Design** button on the menu bar.

You should get the following dialog box:



This message is telling you that you can read the linked data, but cannot modify the structure. Click **Yes**.

You should now see this window with all of the fields and data types in **ALL_ACTIVITY_DETAILS**. Notice the message in the bottom right of the window confirming that properties cannot be modified.



Click on the **View** button (note arrow) in the top left of the window to switch from design to datasheet view.

You should now see a window that looks like a spreadsheet.

Size some of the columns by placing the mouse over the column borders and dragging so that you can see more of the data.

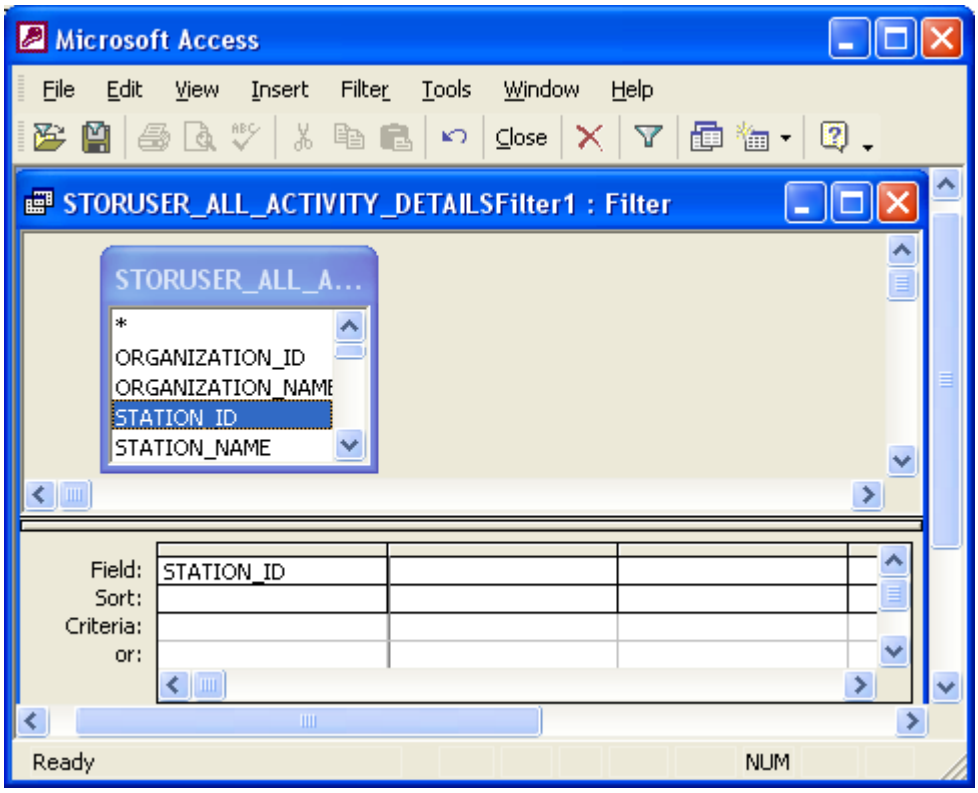
Take a minute to scroll up and down and right and left to familiarize yourself with the data.

Try to find the records associated with the Blackwater National Wildlife Refuge.

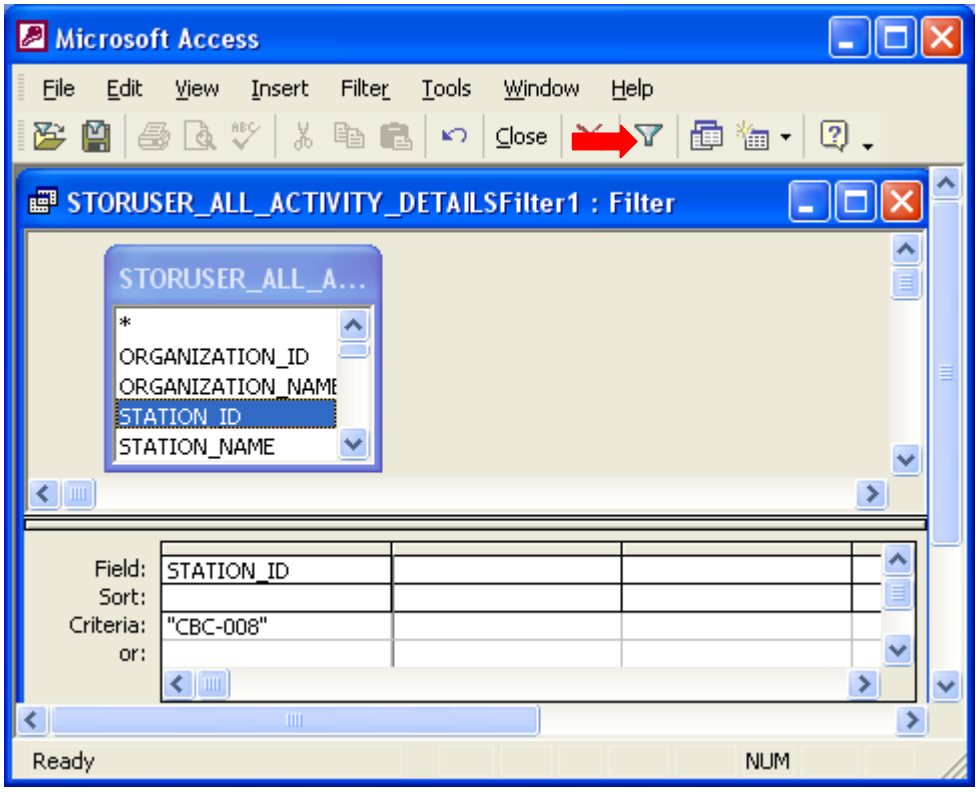
Filtering STORET Data in Access

You can filter the data to view only a subset of records and fields of interest.

Select **Records, Filter, Advanced Filter/Sort** from the menu bar.



We want to select only records from the Blackwater National Wildlife Refuge. To do this, double click on the **STATION_ID** field to select it for filtering.



In the criteria row, enter CBC-008.

Click on the **Apply Filter** button (which looks like a funnel) to view only those records meeting the criteria you have chosen. You should now see only the records for CBC-008. By viewing only the records associated with this station, you can more easily focus on features about activities at this site.

Close this window, and return to the main Access window. Click **No** when asked if you want to save.

Querying STORET Data in Access

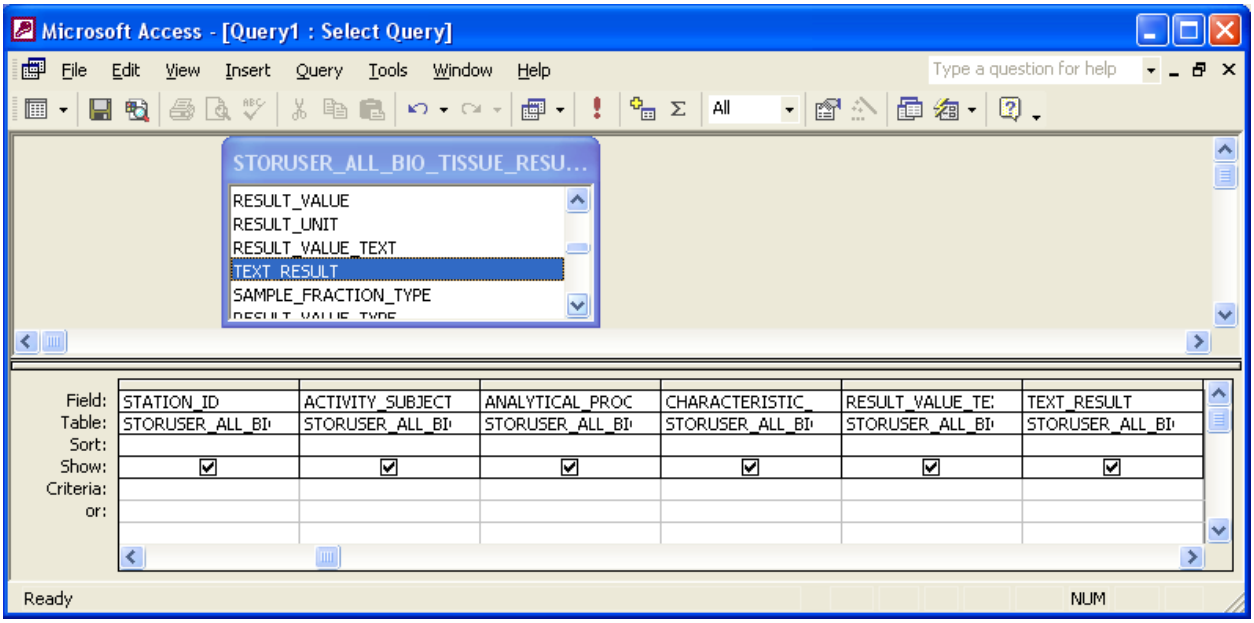
It is also possible to create queries that allow you to view your data in more specific ways. For example, you may want to view results of fish tissue sampling at this station.

Click on the **Queries** button on the left side of the window under **Objects**

Double click on **Create Query in Design View**.

Select the **Tables** tab and select **STORUSER_ALL_BIO_TISSUE_RESULTS** and click **Add**.

Close the **Show Table** dialog. You should have a query window as shown here:

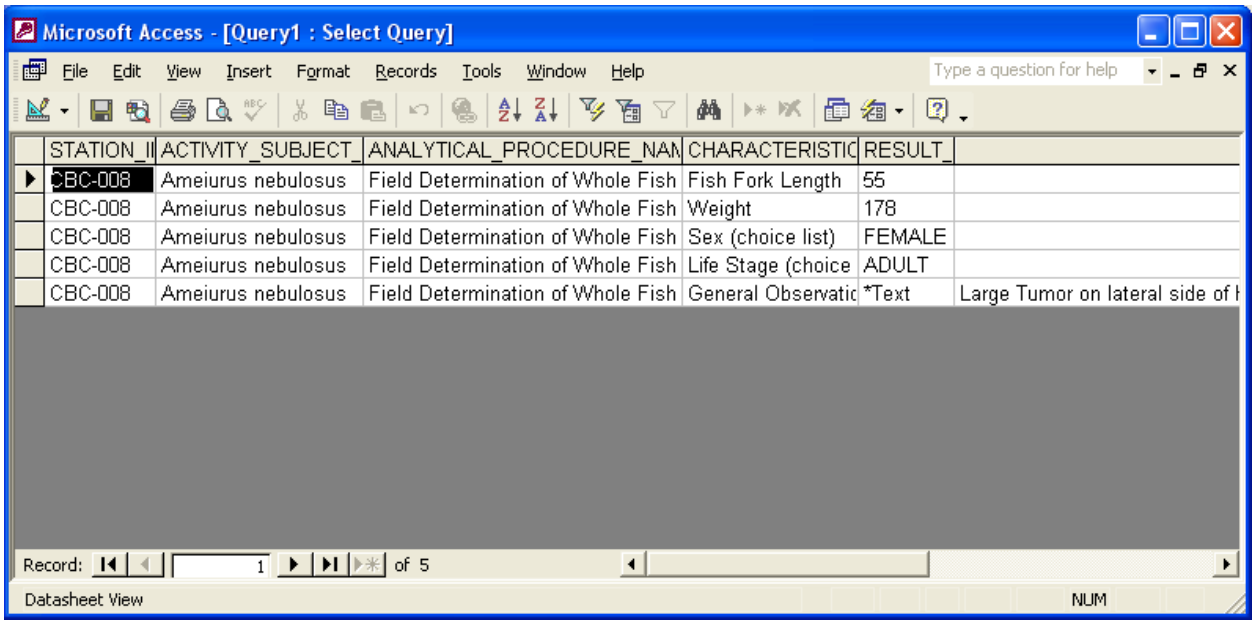


One-by-one, and in the order shown, locate and double click on the following fields in the **STORUSER_ALL_BIO_TISSUE_RESULTS** query box:

STATION_ID
ACTIVITY_SUBJECT_TAXON
ANALYTICAL_PROCEDURE_NAME
CHARACTERISTIC_NAME
RESULT_VALUE_TEXT
TEXT_RESULT

Type "CBC-008" in the **Criteria** box for the **Station_ID** field to select data from only this station.

Click on the **Run (!)** button to run the query. You should see the following query results.



From this query, you can quickly see the fish tissue sampling results for this station.

To save the query to allow you to use it in the future, click on the **Save** button (looks like a disk), and when prompted **Save As**, type "BIO_SUMMARY" as the query name.

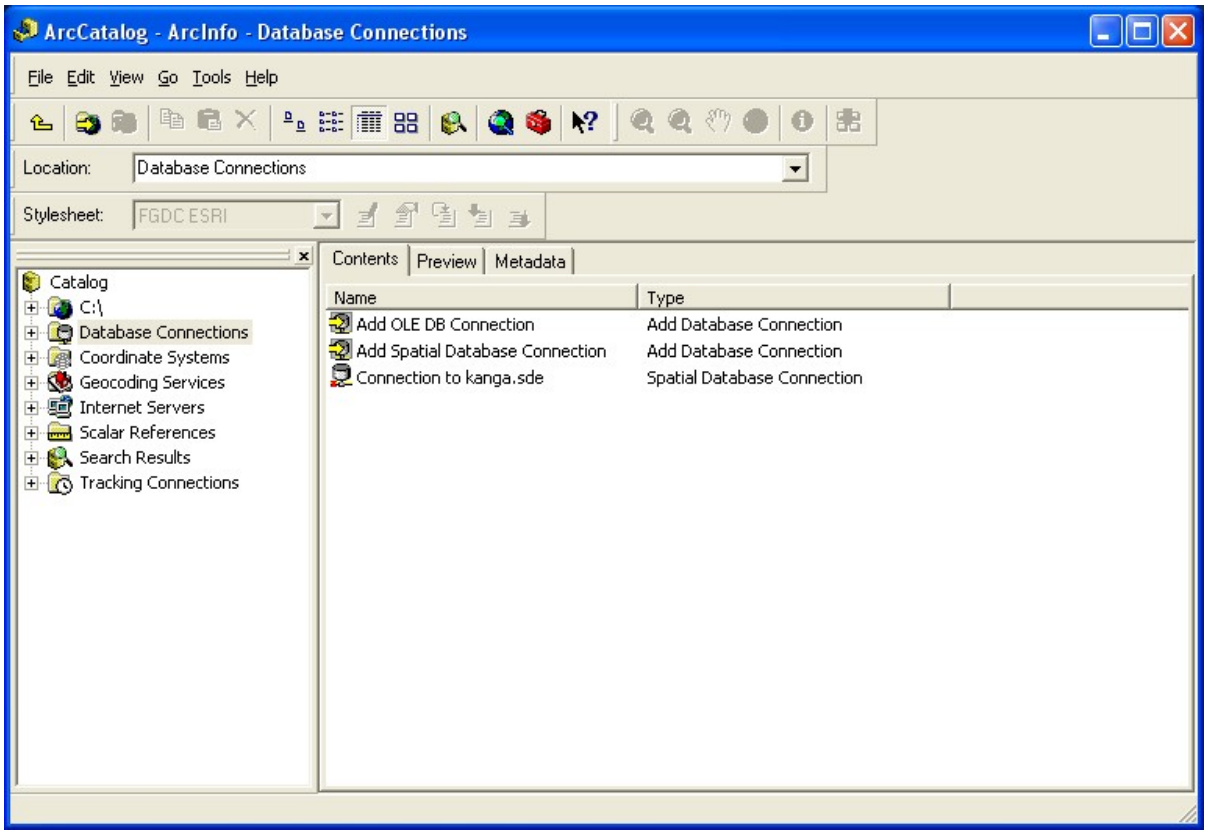
Close the query window and any other open Access windows, and close the database. You will note when you reopen the database that the linkages you created to STORET data views and the query you created are still there.

C. Using ODBC with STORET and ArcGIS

ArcGIS enables you to create a spatial representation of your STORET data. For this part of the tutorial, you will create an ArcGIS shapefile of STORET sampling stations, as well as a map of the sampling points in the Blackwater National Wildlife Refuge. You will use a STORET ODBC connection in ArcGIS to add these sampling points to a basemap. The basemap contains state, major road, county, and National Hydrography Dataset (NHD) data.

To complete this part of the tutorial, you will need to have ArcGIS version 8.1 or higher installed on your computer, and a folder with ODBC_Tutorial.mxd and basemap shapefiles available in a folder you can navigate to. You will use ArcCatalog and ArcMap to display your STORET data on a map. You will build a map that displays Maryland's waters, major roads, county boundaries, and state boundaries along with your STORET sampling points.

To begin, open ArcCatalog by clicking on **Start, Program, ArcGIS, ArcCatalog** from your desktop. A window similar to the one below should appear:

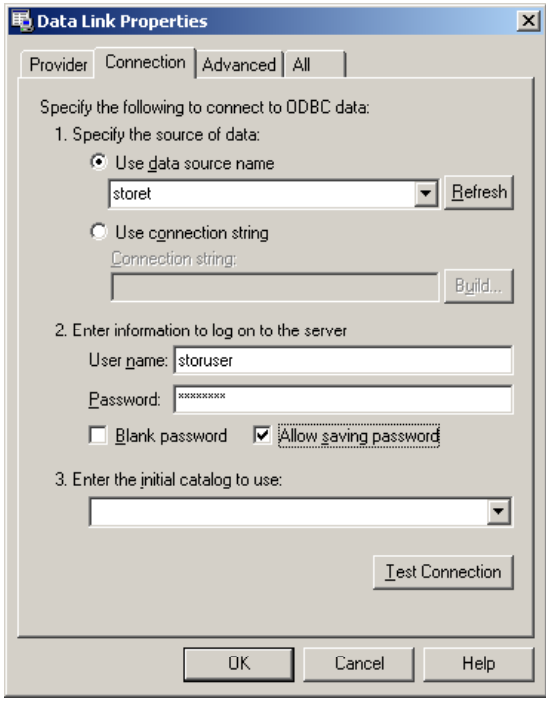


Select **Database Connections** on the left hand side of the window. On the right hand side of the window, under the **Contents** tab, double click on **Add OLE DB Connection** (OLE stands for "object linking and embedding").

Linking ArcGIS to STORET Data Views

You are now ready to use ODBC to bring a STORET data view with spatial data into ArcGIS.

On the Data Link Properties screen, select the Provider tab and choose **Microsoft OLE DB Provider for ODBC Drivers**. Then click on the Connection tab.



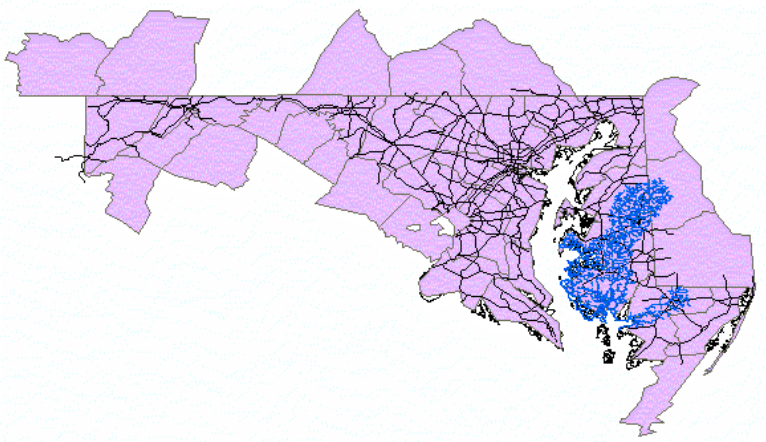
Select your data source and enter your login information. (This should be the same information you entered to set up your ODBC connection in Part A of the tutorial.)

Check the box next to **Allow Saving Password** or your connection may not work. Click the **Test Connection** button.

A screen that says "Test connection succeeded" should appear. Click **OK** to close out of that box. Click **OK** to return to ArcCatalog's main menu.

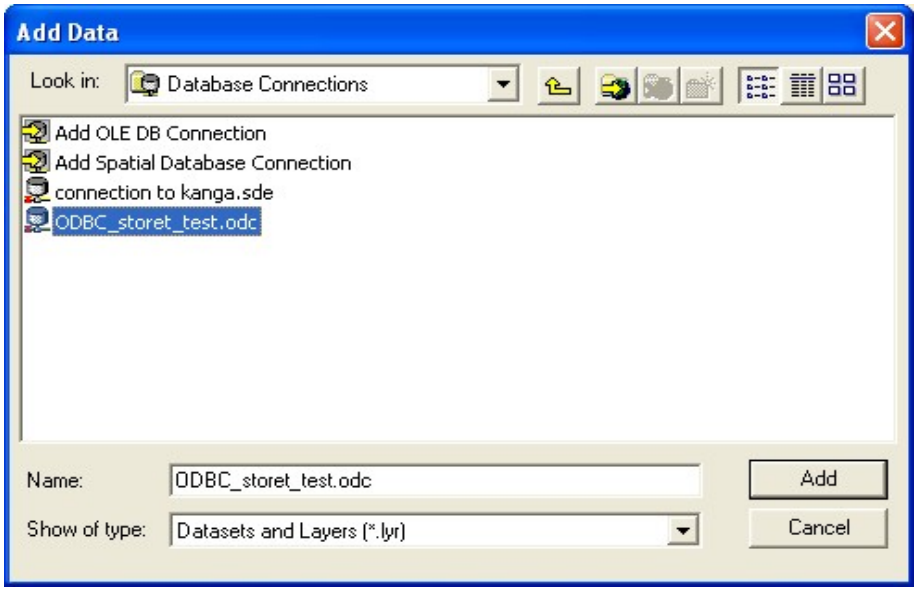
Your connection should now appear as an OLE DB connection in the ArcCatalog main menu. Rename this to **ODBC_storet_test.odc**.

Open ArcMap by clicking on your desktop on **Start, Program, ArcGIS, ArcMap**.
Choose **An Existing Map** and navigate to the **ODBC_Tutorial.mxd** file located in your sample data folder. Click **OK**. (You may get a printer error message. If so, simply click **OK**.)
Your map should look like this:



(If the map does not display automatically, click **File** on the menu bar, then **Map Properties**, then **Data Source Options**. Select **Store Relative Path Names**. Click **OK** twice.)

To load your STORET data, click on the **Add Data** button and choose **Database Connections**.



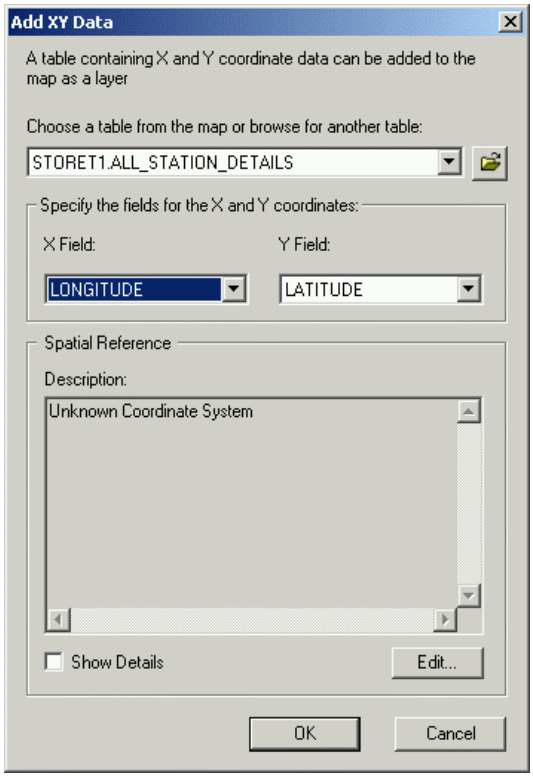
Choose the database connection you set up earlier in the tutorial and click **Add**.

Navigate to **STORET1.ALL_STATION_DETAILS** and click **Add**. This source table should now be added to your legend.

To view the contents of this table, right click on **STORET1.ALL_STATION_DETAILS** and select **Open**. A table should appear in your view.

Take a moment to explore the data.Click the **X** in the upper right hand corner to close this table when you are done viewing it.

To display the data points, go to the **Tools** menu and click on **Add X,Y Data**. The following screen should appear:



Make sure your **Add XY Data** dialog box is filled out as shown here and click **OK**. Your map should now display the latitude and longitude points from the STORET table.

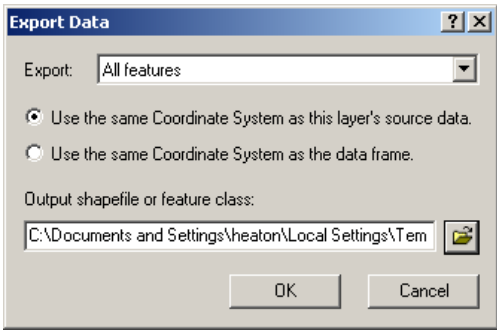
Exporting a STORET Data View to a Shapefile

Shapefiles are a native, convenient, and desirable ArcGIS format that allows you to store and share data. To export the STORET data you have just accessed to a shapefile:

Right click on the **STORET1.ALL_STATION_DETAILS** event and choose **Open Attribute Table**.

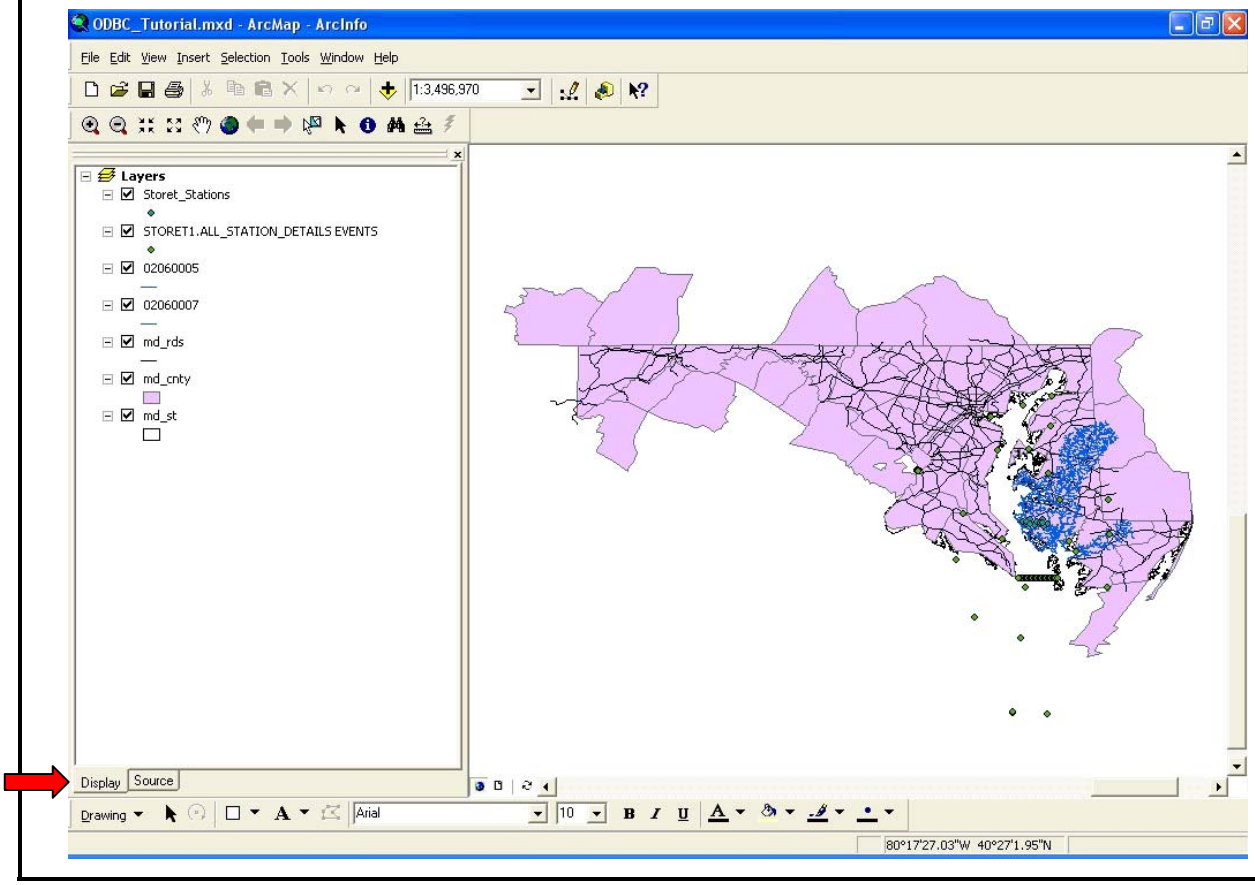
In the **STORET1.ALL_STATION_DETAILS** attribute table, click on **Options** (located at the bottom center of the table) and choose **Select All**. All the STORET records should be highlighted. Click on the **X** in the upper right hand corner to close this table.

Right click on the **STORET1.ALL_STATION_DETAILS** event and choose **Data**, then **Export Data**. A box will prompt you for a storage location and a name for the new shapefile. Click the **File** button to browse for a folder.



Store this shapefile in your sample data folder and call it "STORET_STATIONS.SHP". Make sure that the **Save as type** pulldown indicates **Shapefile**. Click **OK**. When asked if you want to add this shapefile, click **Yes**.

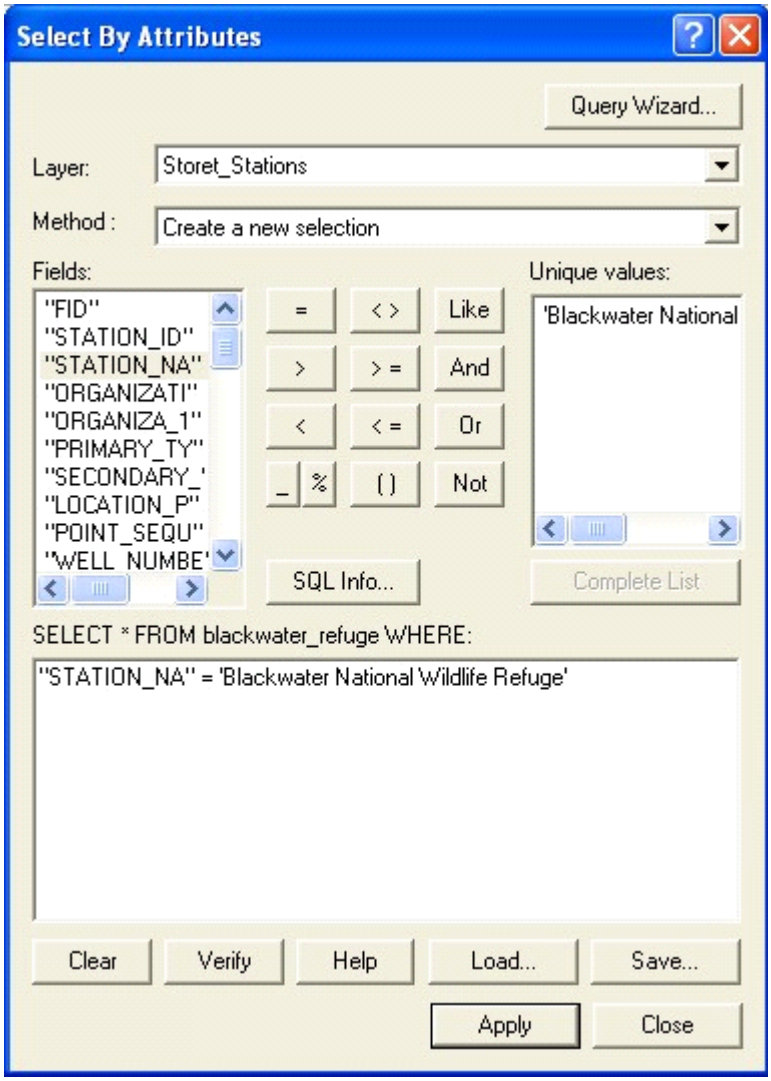
To turn off the **STORET1.ALL_STATION_DETAILS** event and turn on the **STORET_STATIONS** shapefile, go to the **Display** menu and check the boxes next to the layers.



Querying STORET Data in ArcGIS

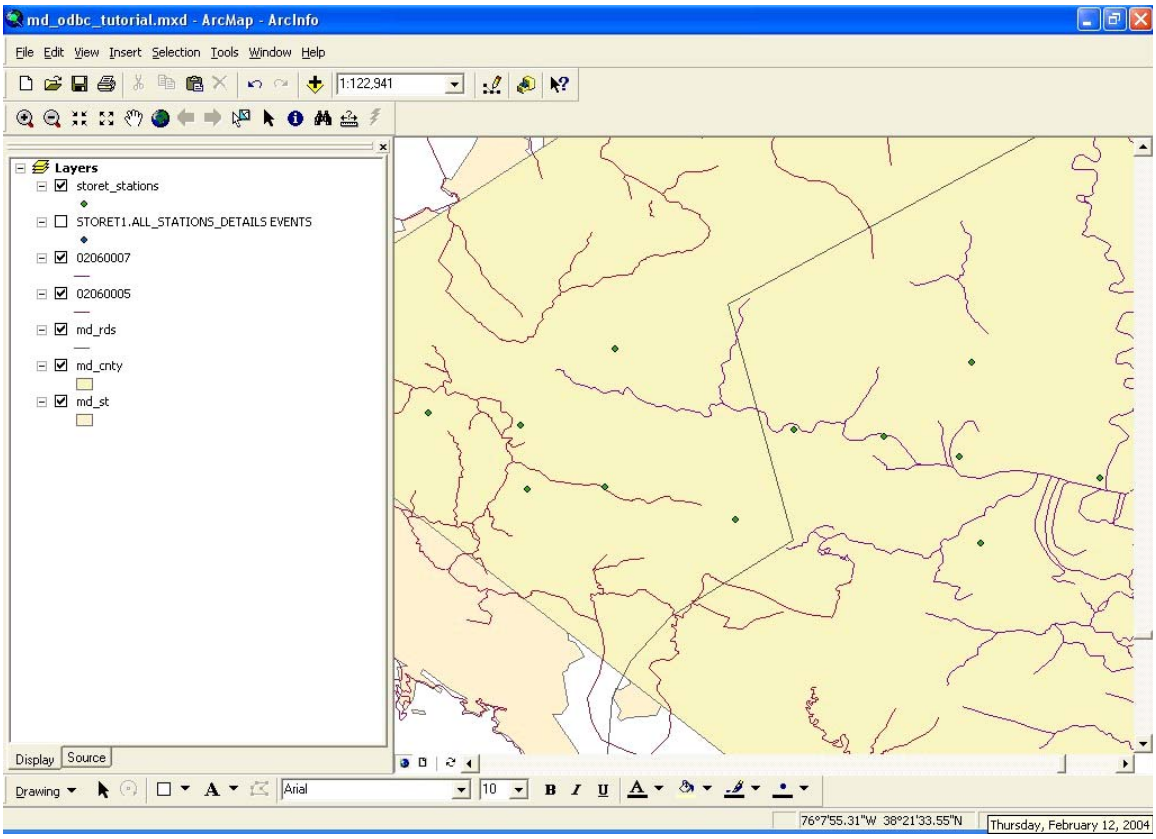
It is often desirable to query data to access specific features of the data. For this example, we are interested in limiting our spatial data to stations located in the Blackwater National Wildlife Refuge.

Under the **Selection Menu**, choose **Select by Attributes**.



Double click on **Station_NA**, click on =, double click on **Blackwater National Wildlife Refuge**, then click **Apply**. The Blackwater National Wildlife Refuge points should now be highlighted on your map. Click **Close** to exit the Select by Attributes dialog box.

Under the **Selection Menu** and choose **Zoom to Selected Features**. You should be zoomed in to the Blackwater National Wildlife Refuge area.



You can now create a shapefile of just the Blackwater National Wildlife Refuge points. To do so, right click on the **STORET_STATIONS** shapefile in the legend and choose **Data**, then **Export Data.** When prompted, rename the shapefile "Blackwater_refuge**".** When asked if you want to add this shapefile, click **Yes.**

You now have a detailed map and shapefile of the Blackwater National Wildlife Refuge. Close your ArcMap session by choosing **File/Exit**. When prompted if you would like to save the file, choose **No**.

This concludes the ODBC with STORET tutorial.