Wisconsin Geological and Natural History Survey
3817 Mineral Point Road
Madison, Wisconsin 53705-5100
TEL 608/263.7389 FAX 608/262.8086
http://www.uwex.edu/wgnhs

James M. Robertson, Director and State Geologist

TILL*PRO:* A Database Containing Physical Properties of Unlithified Sediment Samples

Version 1.0

2008

OPEN-FILE REPORT 2008-05

1 CD-ROM

18 p.

Table of Contents

Acknowledgments

The Wisconsin Geological and Natural History Survey (WGNHS) is grateful to David M. Mickelson and many graduate students from the University of Wisconsin–Madison, Department of Geology and Geophysics, for providing much of the information for the TILL*PRO* database.

The WGNHS is also grateful to Anne Santipiromkul, Shannon Wilson, and many other students at the University of Wisconsin who assisted on the project by compiling the data from various sources. This project would not have been completed without their assistance. We also thank the Indiana Geological Survey for providing various Visual Basic scripts that were modified to make several of the forms in TILL*PRO*.

Thomas S. Hooyer coordinated the development of TILL*PRO*. Valuable input was provided by Apichart Santipiromkul, Peter Schoephoester, Deborah Patterson, Bill Bristoll, John W. Attig, Kent M. Syverson and many others who spent time locating missing sample coordinate information. To all of them we are thankful.

Suggested citation

Wisconsin Geological and Natural History Survey, 2008, TILL*PRO:* A Database Containing Physical Properties of Unlithified Sediment Samples: Wisconsin Geological and Natural History Survey Open-File Report 2008-05, version 1.0, 1 CD-ROM.

System requirements for using TILL*PRO*

Hardware/operating system

Intel® Pentium® processor or equivalent

Microsoft® Windows® Millennium, Windows NT 4.0, Windows 2000, Windows XP, or higher operating system with most recent service pack

At least 16 MB RAM (32 MB or greater recommended)

Software for viewing PDF files

Adobe® Acrobat® (6.x or higher) (available free from http://www.adobe.com/), or

GSView (available free from http://www.cs.wisc.edu/~ghost/)

Software for viewing data files

Microsoft® Access® (2003 or higher)

Introduction

The TILL*PRO* database is a compilation of physical data of unlithified sediment including grain size, shear strength, preconsolidation stress, plasticity, and hydraulic conductivity. The grain-size data were analyzed in the Quaternary Laboratory at the Department of Geology and Geophysics, University of Wisconsin–Madison. The remaining data, including shear strength, preconsolidation stress, and hydraulic conductivity, was compiled from a variety of sources including journal articles, miscellaneous databases at the Wisconsin Geological and Natural History Survey and M.S. theses and Ph.D. dissertations.

TILL*PRO* is a Microsoft® Access® database containing physical properties of unlithified sediment samples collected in Wisconsin. Grain-size analyses were only performed on the fraction of the sample less than 2 mm and exclude any gravel-size particles (>2 mm). For the sample fraction less than 2 mm, the grain-size distribution was determined by sieve and hydrometer methods using 2 mm, 0.0625 mm, and 0.002 mm boundaries for sand silt and clay, respectively. The colors of the samples, in the field and in the laboratory, were measured using a Munsell soil color chart. Carbonate content and magnetic susceptibility of the samples were measured using a Chittick Apparatus and a magnetic susceptibility meter, respectively. For more information about the methods used in sample analyses, please contact David M. Mickelson at (608) 262-7863 and request a copy of the following unpublished document:

> Grender, L., and Sutherland, A.W., 1989. Standard procedures for the analysis of Quaternary deposits at the Quaternary Research laboratory [unpublished manuscript]: Madison, University of Wisconsin, 32 p.

Hydraulic conductivity was determined by a host of different field and laboratory methods that range from pumping and slug tests conducted in the field to consolidometer tests in the laboratory. A variety of different techniques were used to evaluate the data that range from the Hvorslev to Hazen methods. A list of the different methods and analyses can be found in standard hydrogeology and civil engineering text books. The same goes for the method and analyses used to determine shear strength, preconsolidation stress, and plasticity of various sediment samples.

TILL*PRO* is a Microsoft Access database where the data, or records, are organized in a set of related tables. Forms and queries supplied with TILL*PRO* allow a user with rudimentary database skills to view, sort, select, and evaluate the information. Users familiar with Microsoft Access can also use standard Access functions to work with the information contained in the TILL*PRO* tables. More sophisticated knowledge of Microsoft Access will aid in more efficient use of this dataset.

Users may perform searches on the records that are included in TILL*PRO* and may customize the format for their particular use or interpretation. Records can be selected from TILL*PRO* and exported to other software programs for further analysis.

TILL*PRO* contains a large part of the data produced by the Quaternary Laboratory and other available sources; however, not all the data have been included because of the nature of the information. An additional restriction on the information available in TILL*PRO* is that, due to limited resources, not all of the data have been added to this digital format. Copies of the sample analyses may be available at the Quaternary Laboratory or in the numerous graduate theses prepared by students at the University of Wisconsin. Additionally, some of the data included in TILL*PRO* have partial entries. For example, not all records have sample coordinates or stratigraphic formation names.

Part of the mission of the WGNHS is to provide objective scientific information about the geology, mineral resources, water resources, soil, and biology of Wisconsin. We collect, interpret, disseminate, and archive natural resource information. As such, this release of TILL*PRO* as an open-file report represents a major commitment on the part of the WGNHS to make geologic data available in a user-friendly, digital format. Although TILL*PRO* is not complete, because it does not contain all of the grain-size data analyzed in the Quaternary Laboratory, the WGNHS intends to release additional updated versions as records are added to the digital database and as resources permit.

Additional information

Many records in TILL*PRO* do not have entries for all fields in the database. This may be due to a lack of that information, or the information may be available but not yet entered in the digital database. If you suspect that additional data exist, then please check the reference list at the following Web address: <http://www.geology.wisc.edu/%7Edavem/abstracts/contnew.htm>.

If a suitable reference cannot be found, please contact David M. Mickelson at (608) 262-7863 and ask for assistance. Indicate the type of data you need, and the geographic location of your area of interest.

If you have questions involving data in TILL*PRO* or use of the program, please email us at TILLPRO@wgnhs.uwex.edu. We are interested in your comments and suggestions regarding the data and the TILL*PRO* format. As with any database, there may be database entry errors or problems with the original data contained in TILL*PRO*. If you suspect database entry problems, please email us, and include the Sample ID number and the field entry in question. If you run across a bug or glitch in TILL*PRO*, contact the Information Manager at the WGNHS at (608) 263-7386, or email us at the address above.

TILL*PRO* and other databases maintained by the WGNHS

TILL*PRO* is one of several geologic databases maintained, used, and distributed by the WGNHS. Another important database is *Geobase*, which contains records of subsurface information including water wells—municipal, industrial, public, private—and related physical samples and written documentation/information. *Geobase* also includes information related to mineral exploration cores, engineering and Wisconsin Department of Transportation logs, and certain other data, such as aerial photographs, topographic quadrangle maps, geophysical logs, and information on study of the physical samples by WGNHS staff. Part of this information can be reviewed using the database *wisc*LITH, which focuses primarily on the well information contained in *Geobase*, including location, lithologic descriptions, stratigraphic interpretations, and some groundwater-level and pump-test information. Users interested in this information and other available databases should contact the WGNHS.

Sample identification numbers and location information

TILL*PRO* contains a broad array of identifying information. First, each sample collected for analyses was initially assigned a number by the original collector (referred to as sample number).

Second, each sample was assigned a WGNHS identification number as part of the database compilation (referred to as ID number).

In addition to these numbering systems for samples, the county in which each sample is located and the collector's identification are noted where available. Collectors have traditionally described sample locations in the Public Land Survey system (PLSS), which includes township, range, section numbers, and quarter sections. For most of the samples, this PLSS location is included in TILL*PRO*. More recently, some samples have been located using a global positioning system (GPS) to determine latitude/longitude or UTM coordinates. The original method by which samples were located is noted in the database. For most samples, the PLSS system has been converted to latitude/longitude and vice versa. These conversions have not been reviewed for each record, and the user is encouraged to check location information for the accuracy required for their application.

A limited number of samples do not have specific locations associated with them, but general regions instead. For example, some only specify *Lake Michigan shoreline*. Some samples also had obvious location errors, but reasonable coordinates were estimated when appropriate.

To make this spatial location information available in a more digital-friendly format, we have converted the latitude/longitude, UTM, and PLSS descriptions to Wisconsin Transverse Mercator 91 (WTM) coordinates. These coordinates were generated using the Wisconsin Department of Natural Resources (WDNR) 1:24,000-scale Landnet database. For a more detailed explanation, the reader is referred to the following Web address:

http://dnr.wi.gov/maps/gis/documents/landnet_doc.pdf

The conversion to WTM has not been reviewed for each sample record, and the user is encouraged to check location information for the accuracy required for their application.

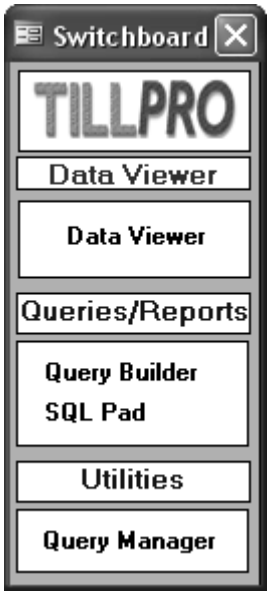
Getting started using TILL*PRO*

Using the TILL*PRO* software with Access 2003 or greater:

1. Choose or create a directory on your hard drive to place the program in.
2. Copy the TILLPRO.mdb file from the CD-ROM to the directory you created.
3. Go to the location you placed the program and RIGHT mouse click on the TILLPRO.mdb icon.
4. Choose (LEFT click) Properties from the menu.
5. At the bottom of the Properties screen, make sure the read only check box *is not* checked.
6. Double LEFT click on the TILL*PRO* icon and begin.

NOTE: Running the software directly from the CD is not recommended because performance will suffer and any changes or queries you make cannot be saved.

The Switchboard

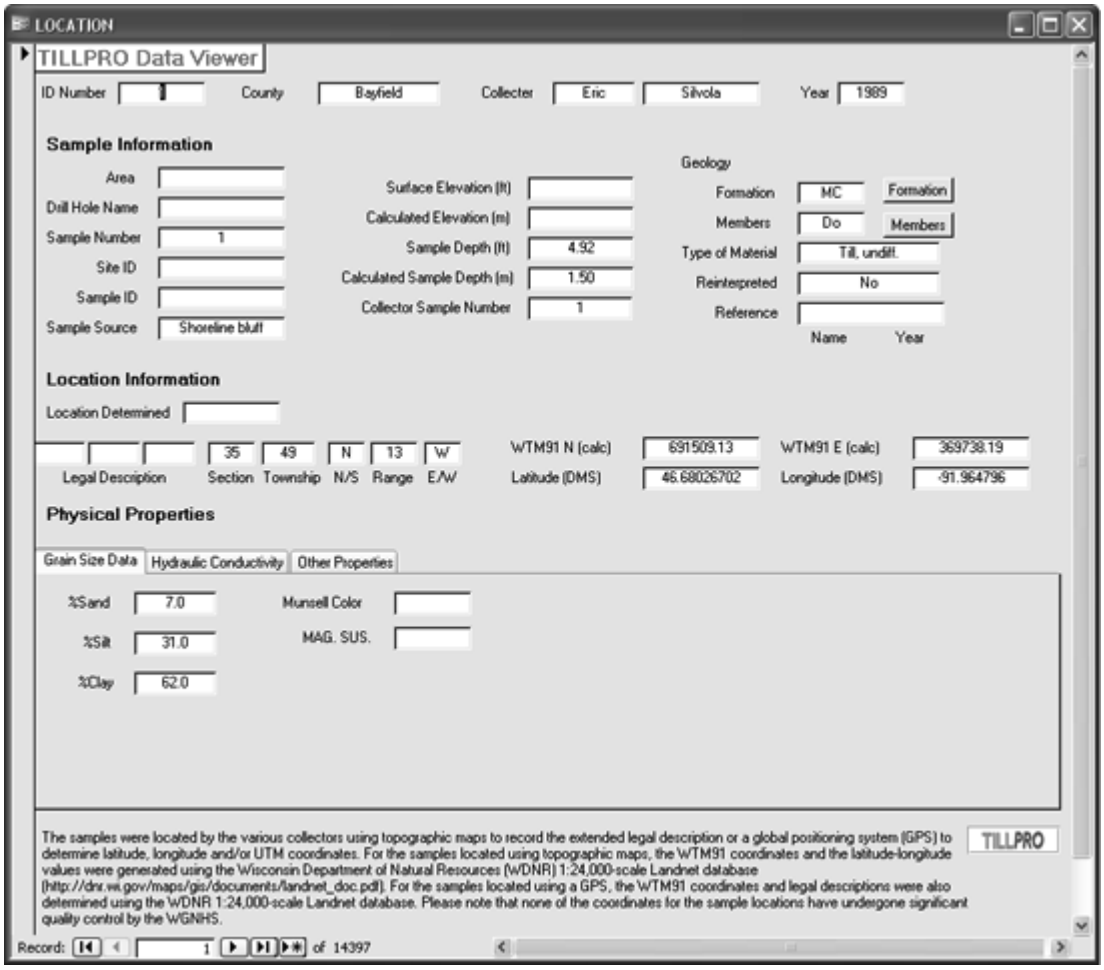


The Switchboard provides an easy interface to interact with the TILL*PRO* database. The user can:

- browse, find, and filter sample data based on sample identification or other user-defined criteria in the database. TILL*PRO* is in a Microsoft Access database and all of the search capabilities of Access are available to the user.
- find the physical properties for a given set of samples.
- perform queries using predefined choices or user-defined Structured Query Language (SQL) statements.
- save queries and reports for use in other software applications.
- delete, open, create or save your own queries.

The Switchboard helps you navigate through the TILL*PRO* database. If you prefer, you can close the Switchboard and open TILL*PRO* in Access directly and interact with the various component tables, queries, reports, or forms.

Viewing the data



Explore the TILL*PRO* sample data by clicking on **Data Viewer** on the **Switchboard**. The resulting window that opens presents sample identification, location, and other information. Note that you will initially be viewing the first of 14,397 records.

You can search many of the fields by clicking on the field you want. Then go to the Access menu bar and click on Edit, Find, or press Ctrl + F.

In addition to searching, you can also filter any field by right clicking on the field you want to filter then select Filter For: type information that you want to filter and press Enter. For more information, consult a Microsoft Access manual or the help file.

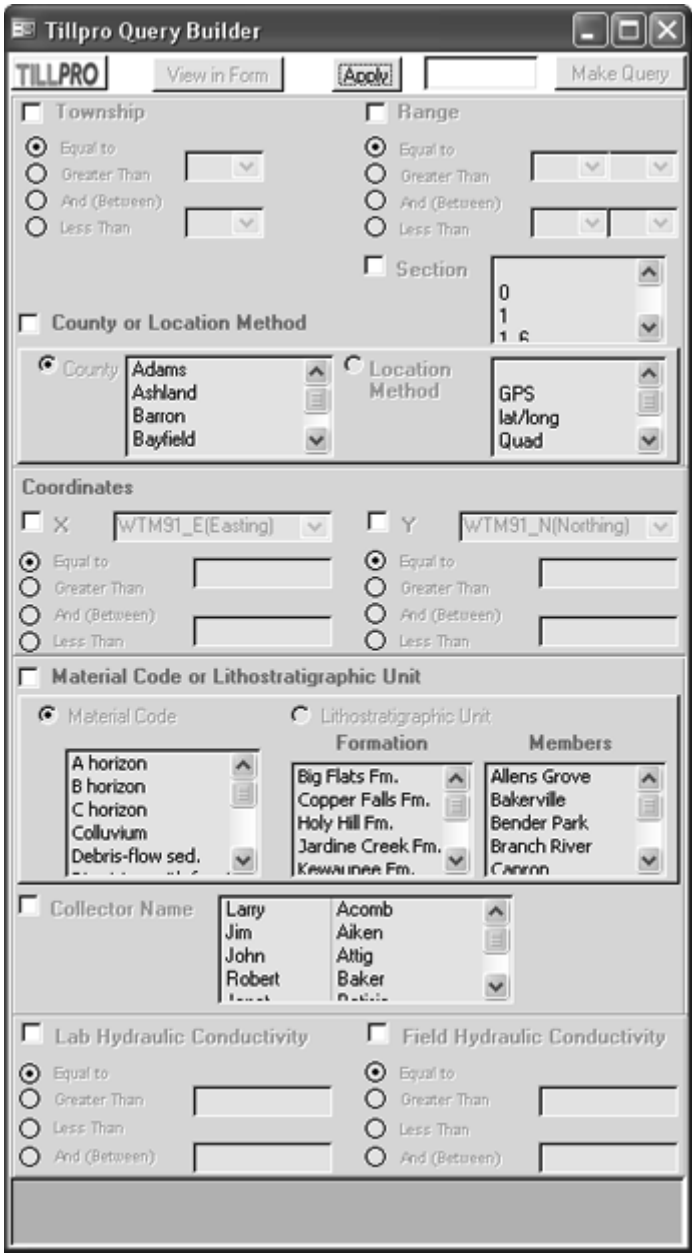
When using this data form, a blank space in a field means that the information is either not available or it has not yet been entered into TILL*PRO*. For a full description of the Formation and Member names, click on the Formation or Member buttons. The physical properties of each sample can be viewed by clicking on the appropriate tabs labeled *Grain Size*, *Hydraulic Conductivity*, and *Other Properties*.

Warning: You can alter data when you directly open a table. If you inadvertently alter TILL*PRO* records, the original version of the database remains on the CD ROM and can be copied again to your computer's hard drive.

Queries/reports

Query builder

You can make a query using the Query Builder's predefined choices. From the Switchboard, click on Query Builder beneath the Queries/Reports Heading.



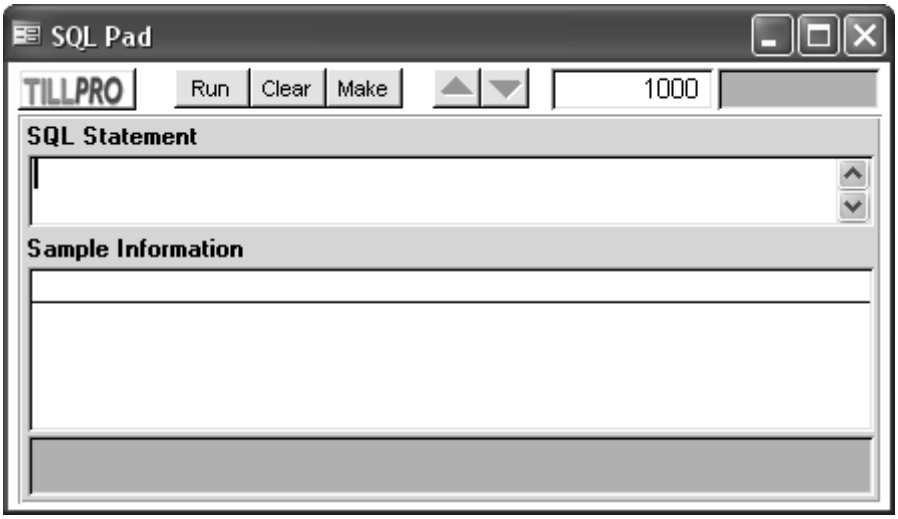
1. Use the check boxes, radio buttons, and value boxes to begin a query based on location, material code or lithostratigraphic unit, collector name, or hydraulic conductivity. A location query can be performed using township/range/section deselected.

2. Click **Apply** at the top to gather these records and determine the number of records that will be included in the query.

3. Click **View in Form** to see the results of the query in a convenient viewing form. Scroll through the records (using the arrow key at the bottom of the form) to browse the results sample by sample.

4. Click **Make Query** to generate a data table with the query results. Name the query when prompted, and it will be saved in your TILL*PRO* database. Each query that you perform generates all the available information for those specified samples. None of the information in a query is saved unless a table is created. This table can be imported into various software platforms.

SQL language pad

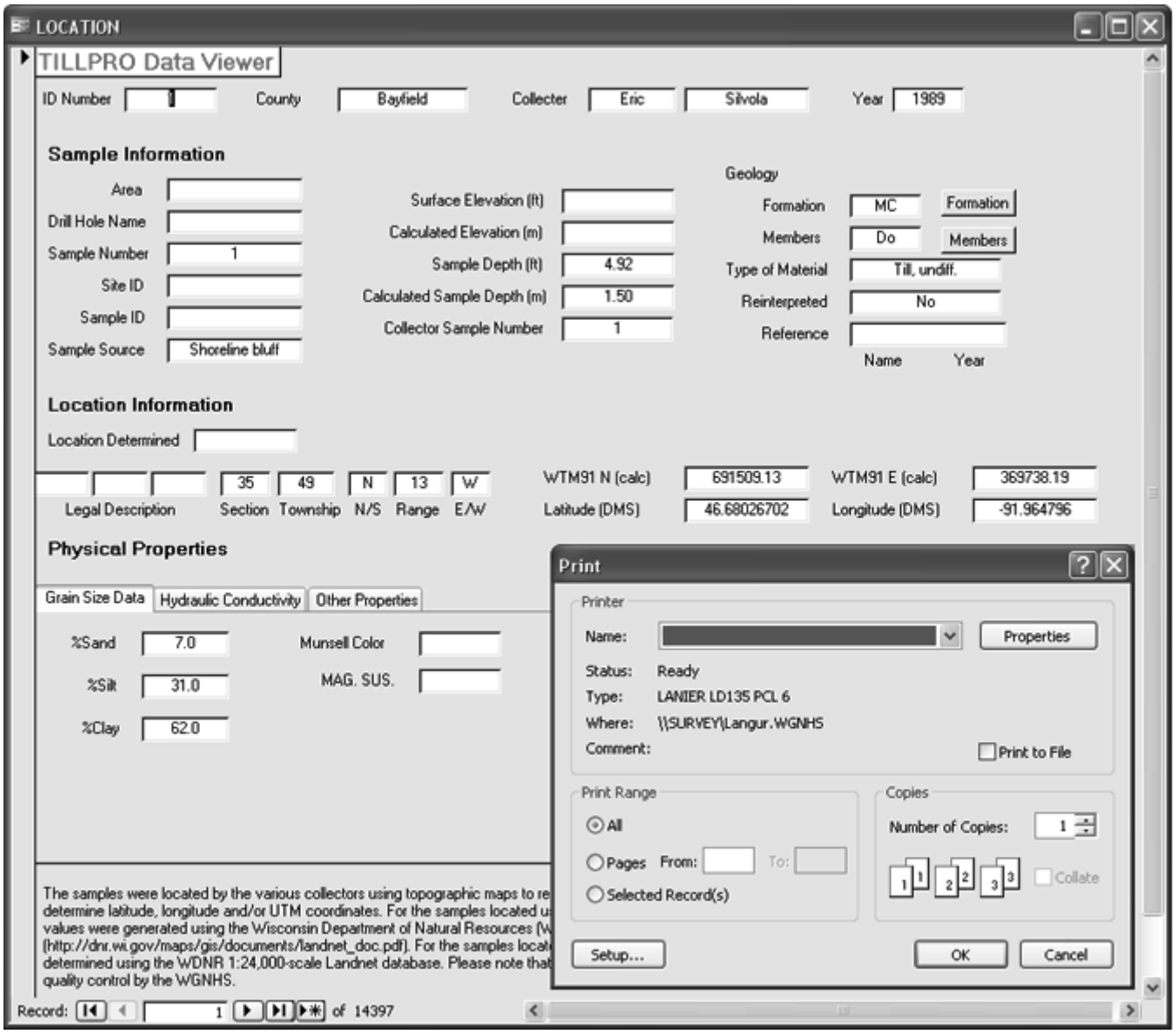


If you would like to make your own SQL statement and view the results:

1. Type the syntax in the SQL Statement box.
2. Click **Run** to view the results.
3. Click **Clear** to clear results and make a new statement.
4. Click **Make** to name and create a saved query.

When you have the results of the query displayed, you can click a record in the Location Data window to see its associated information in the window.

Printing records

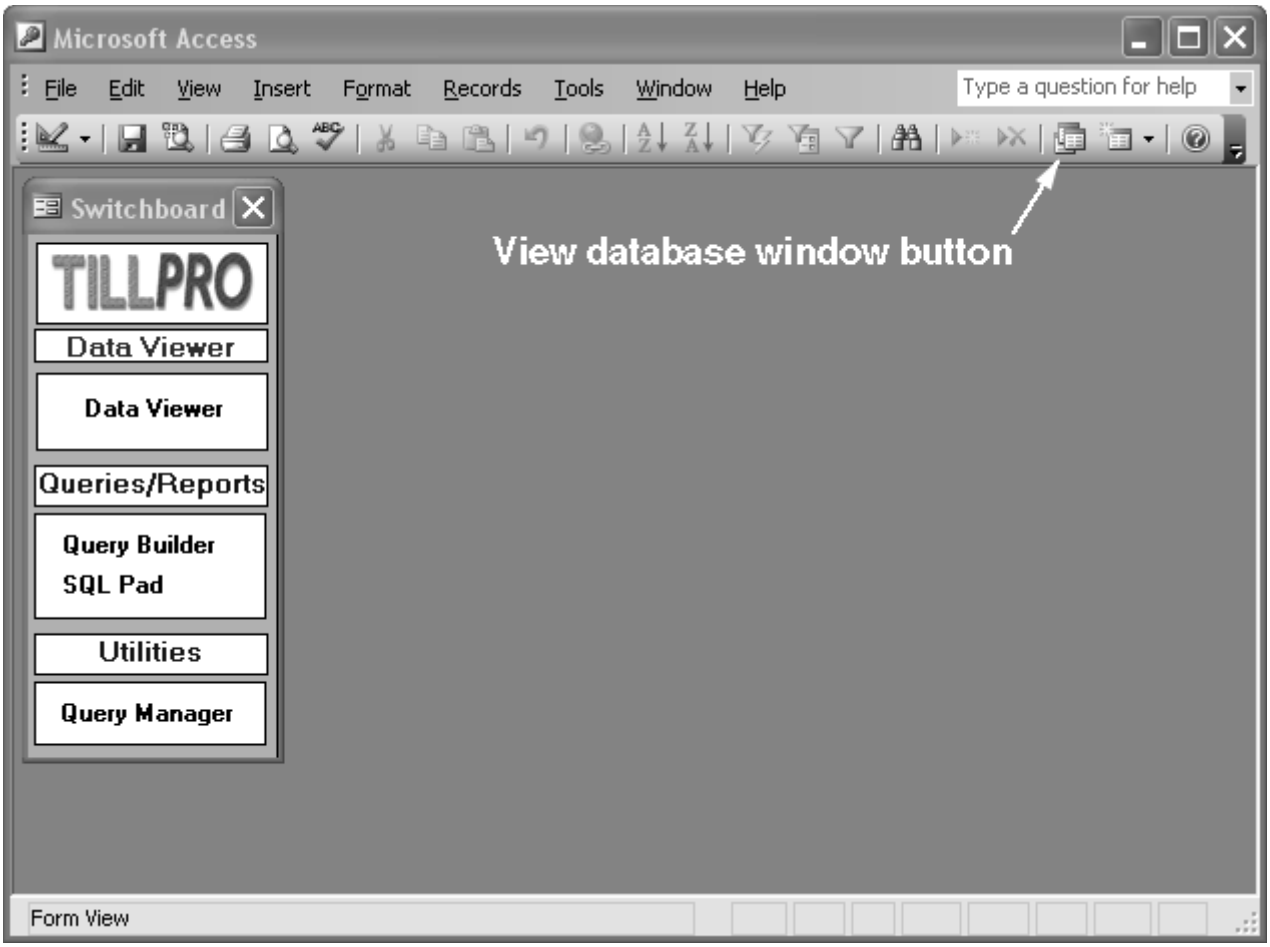


To print selected records from TillPRO, go to **File, Print,** and choose **Selected Record(s)** in **Print Range.** Check or change settings in **Properties** and **Setup** to control margins and paper orientation (landscape or portrait) as best suited for your printer. *Beware: The default **PRINT RANGE** setting of **ALL** may result in a large part of the database being sent to your printer!*

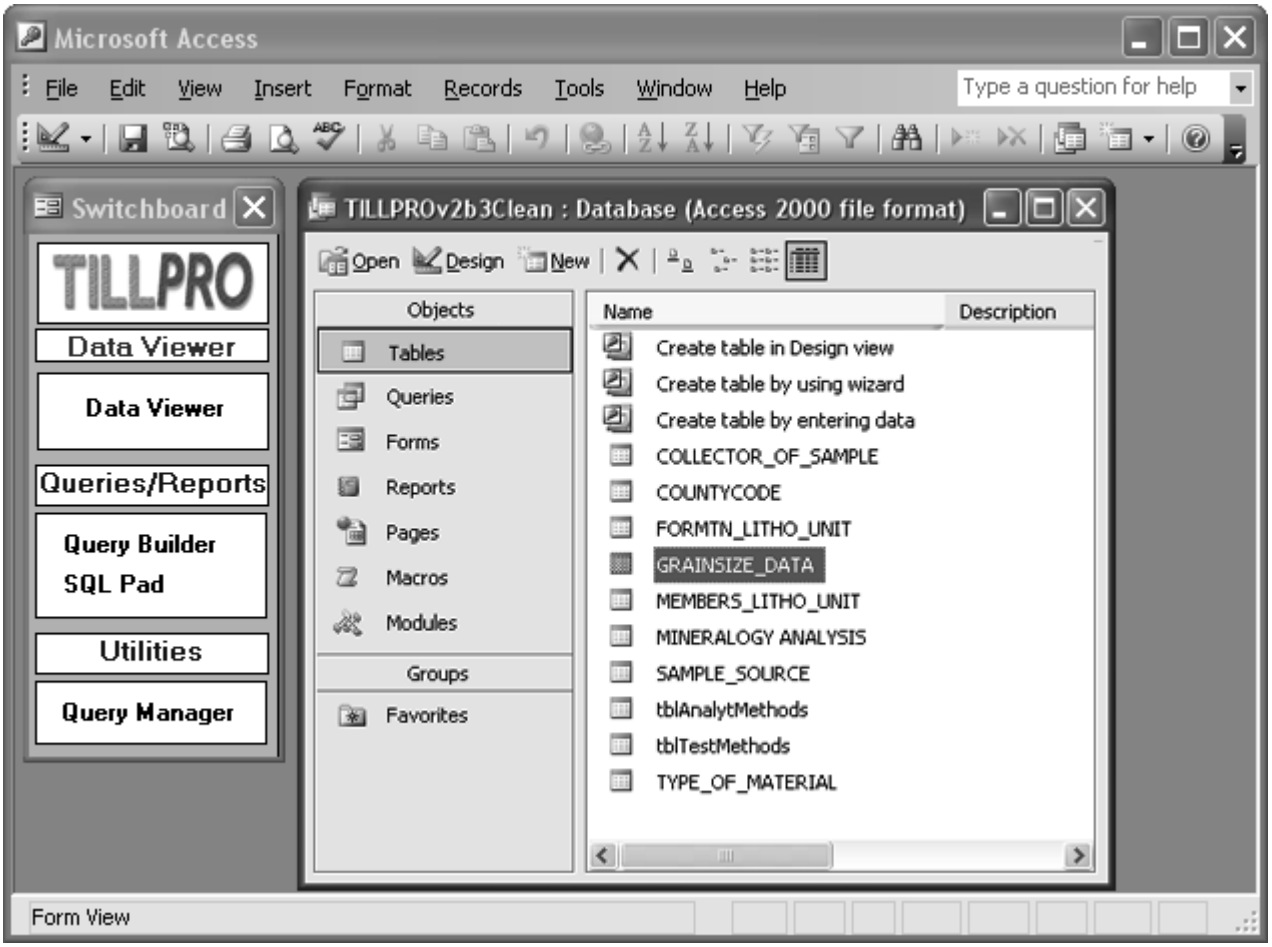
Viewing data tables

Another method of finding information without writing a query is to access the data tables directly. Use this method to access information from the following tables: **COUNTY_CODE, MINERALOGY_ANALYSES, FORMTN_LITHO_UNIT, MEMBERS_LITHO_UNIT, COLLECTOR_OF_SAMPLE, SAMPLE_SOURCE, TYPE OF MATERIAL, GRANSIZE_DATA, tblAnalytMethods, and tblTestMethods.**

1. Click on the View Database Window button.



2. Under Objects, select Tables.

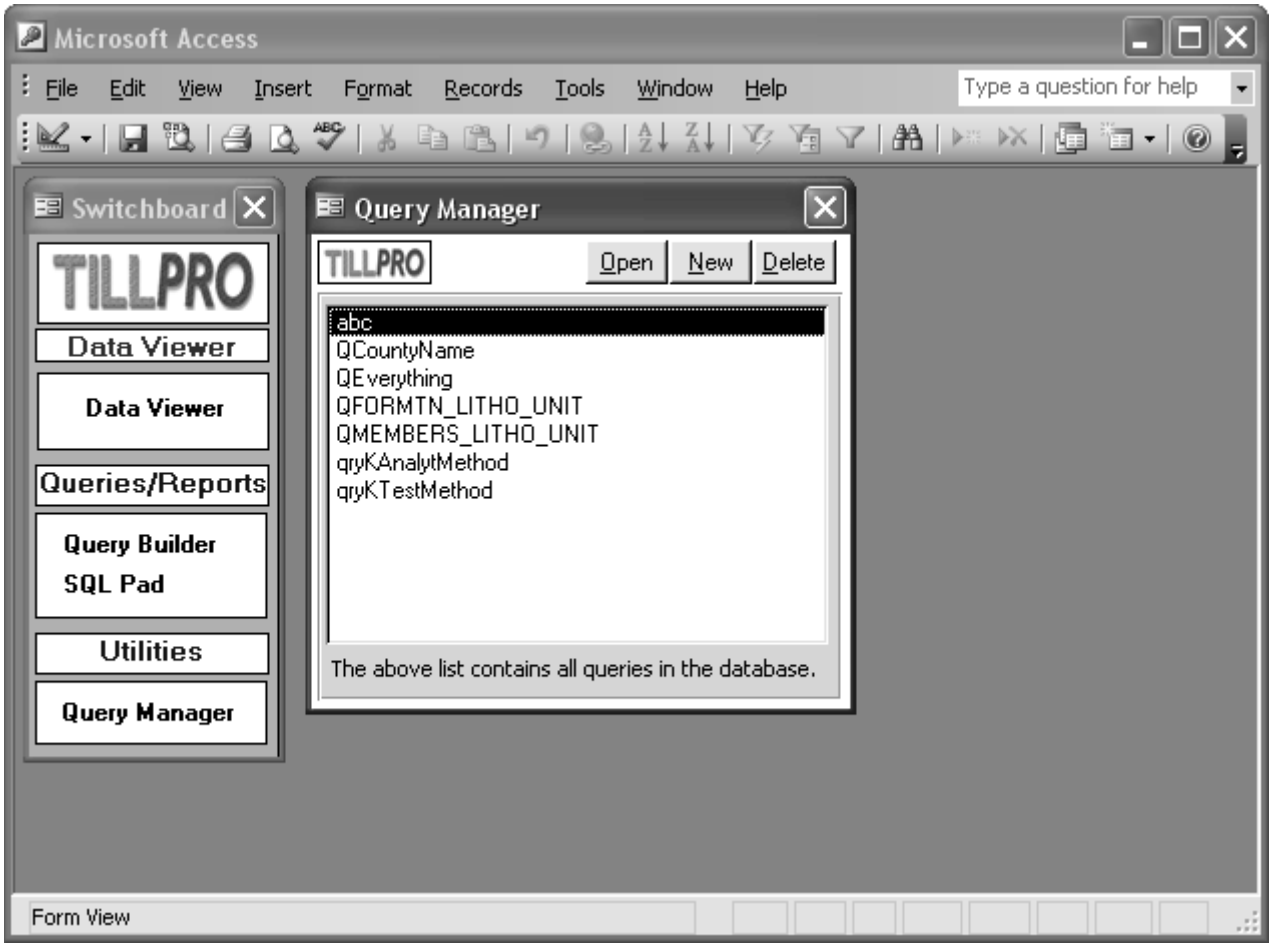


3. Click on the table of interest; see the descriptions of each column in the Till*PRO* Data Dictionary of this report.

4. Sort or scroll through tables, identify the record of interest using the **ID Number** field.

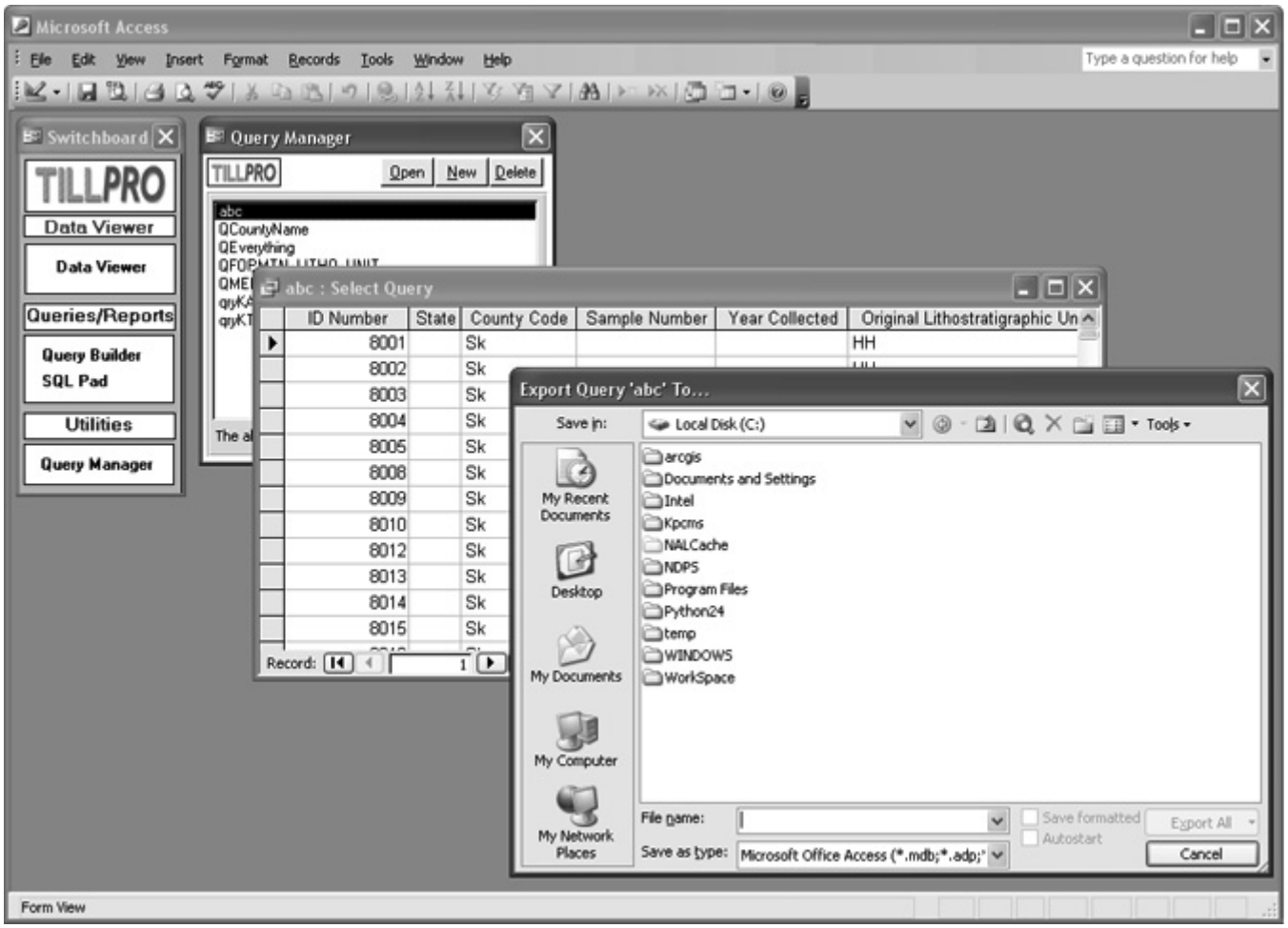
Utilities

Query manager



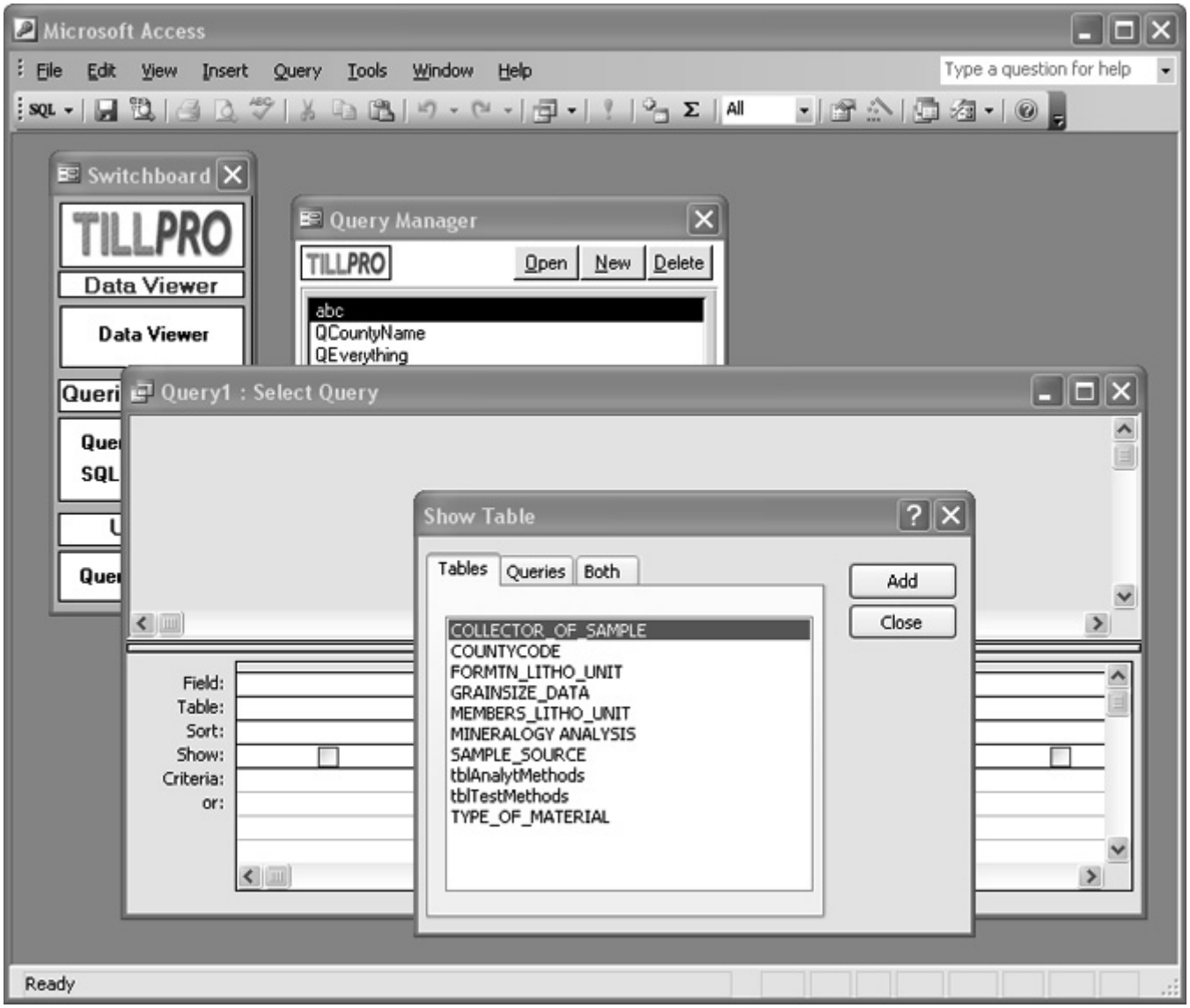
Open, delete, or create your own queries with the Query Manager on the Switchboard:

1. Select the query and click the appropriate button to **Open** or **Delete** it.



2. You can export the text of a query in a variety of formats by opening up the results of the query as a table, selecting **Export** from the **File menu** and selecting the file type useful to you.

3. To create your own query, click the **New** button to open the Access query wizard, select **Design View**, and use the **Show Table** dialog box to select from the tables included in Till*PRO*.



Data dictionary

Formation and member names

The formation and member name fields appear in the Data Viewer and in the drop-down menu of the Query Builder. Entries in this field contain typical stratigraphic nomenclature used to describe Wisconsin geology. Where the field appears empty, the lithostratigraphy has not been interpreted or reinterpreted by the sample collector. Much of this information exists in the form of graduate theses and publications available from the WGNHS.

In addition, the Test Methods and Analysis name fields appear in the hydraulic conductivity tab in the Data Viewer. Entries in this field include methods and analyses that are commonly used in hydrogeology and civil engineering.

Field Name	Tables containing field	Field definition
ID number	GRAINSIZE_DATA Mineralogy Analysis	WGHNS assigned sample number
State	GRAINSIZE_DATA Mineralogy Analysis	State in which sample was collected
County code	GRAINSIZE_DATA, County Code, Mineralogy Analysis	Two letter abbreviation for Wisconsin counties
Sample number	GRAINSIZE_DATA Mineralogy Analysis	Sample number assigned by sample collector
Year collected	GRAINSIZE_DATA Mineralogy Analysis	Year that sample was collected and/or analyzed
Original lithostratigraphic unit formation	GRAINSIZE_DATA Formtn_Litho_Unit	Two-letter abbreviation for the formation name originally assigned by the sample collector
Original lithostratigraphic unit member	GRAINSIZE_DATA Members_Litho_Unit	Two-letter abbreviation for the member name originally assigned by the sample collector
Reinterpreted lithostratigraphic unit formation	GRAINSIZE_DATA	Two-letter abbreviation for the reinterpreted formation name assigned by sample collector or others
Reinterpreted lithostratigraphic unit member	GRAINSIZE_DATA	Two-letter abbreviation for the reinterpreted member name assigned by sample collector or others
Lithostratigraphic unit reference	GRAINSIZE_DATA	Published reference where formation or member names were reinterpreted
Material code	GRAINSIZE_DATA TYPE_OF_MATERIAL	Numeric code identifying the type of material collected for analyses
Collector	GRAINSIZE_DATA, COLLECTOR_OF_SAMPLE	Numeric code identifying the collector
Sample source	GRAINSIZE_DATA, SAMPLE_SOURCE	Numeric code identifying sample source (i.e., drillhole, road cut, surface sample)
Sample depth (ft)	GRAINSIZE_DATA	Depth - in feet below land surface
Drillhole number	GRAINSIZE_DATA	The number of the drillhole where the sample was collected
Drillhole name	GRAINSIZE_DATA	The name of the drillhole where the sample was collected
1/4, 1/4, 1/4	GRAINSIZE_DATA	The third quarter section of the sample location
1/4, 1/4	GRAINSIZE_DATA	The second quarter section of the sample location
1/4	GRAINSIZE_DATA	The first quarter section of the sample location
Section	GRAINSIZE_DATA	Section number of the legal description of the sample location
Township	GRAINSIZE_DATA	Township number of the legal description of the sample location
Range	GRAINSIZE_DATA	Range number of the legal description of the sample location
N_S	GRAINSIZE_DATA	North or south component of the range
E_W	GRAINSIZE_DATA	East or west component of the range
Plotted latitude	GRAINSIZE_DATA	Latitude of the sample location
Plotted longitude	GRAINSIZE_DATA	Longitude of the sample location
WTM91 north	GRAINSIZE_DATA	The north component of the Wisconsin Transverse Mercator 91 (WTM) coordinate system
WTM91 east	GRAINSIZE_DATA	The east component of the Wisconsin Transverse Mercator 91 (WTM) coordinate system

UTM zone	GRAINSIZE_DATA	Accuracy - in feet- (+/-) of the elevation (half the topographic map contour if estimated from topographic map
(UTM-N)	GRAINSIZE_DATA	North component of the Wisconsin State Plane South Zone coordinate system (UTM-E)
(UTM-E)	GRAINSIZE_DATA	East component of the Wisconsin State Plane South Zone coordinate system
Location determined	GRAINSIZE_DATA	Acronym indicating whether sample location was determined by 1:24,000 quadrangles (Quad) or GPS (UTM)
Munsell color (lab)	GRAINSIZE_DATA	Color of sample determined in laboratory using the Munsell color system
Munsell color (field)	GRAINSIZE_DATA	Color of sample determined in field using the Munsell color system
Magnetic susceptibility	GRAINSIZE_DATA	The magnetic susceptibility of the sample measure in the laboratory
%Sand	GRAINSIZE_DATA	Percentage of the sample consisting of sand
%Silt	GRAINSIZE_DATA	Percentage of the sample consisting of silt
%Clay	GRAINSIZE_DATA	Percentage of the sample consisting of clay
Surface Elevation	GRAINSIZE_DATA	Elevation - in feet above sea level - of the land surface at the site
Elevation source	GRAINSIZE_DATA	Method by which the surface elevation at the sample location was determined (i.e., topographic map)
1 mm	GRAINSIZE_DATA	Weight of sample, in grams, retained on the 1 mm mechanical sieve
0.5 mm	GRAINSIZE_DATA	Weight of sample, in grams, retained on the 0.5 mechanical sieve
0.25 mm	GRAINSIZE_DATA	Weight of sample, in grams, retained on the 0.25 mechanical sieve
0.125 mm	GRAINSIZE_DATA	Weight of sample, in grams, retained on the 0.125 mechanical sieve
0.0625 mm	GRAINSIZE_DATA	Weight of sample, in grams, retained on the 0.0625 mechanical sieve
0.00610	GRAINSIZE_DATA	Weight of sample, in grams, determined using 0.00610 mechanical sieve
0.003094	GRAINSIZE_DATA	Weight of sample, in grams, greater than 0.003094 mm determined using a hydrometer
0.001187 mm	GRAINSIZE_DATA	Weight of sample, in grams, greater than 0.001187 mm determined using a hydrometer
%retained>2 mm	GRAINSIZE_DATA	Weight of sample, in grams, determined using 2 mm mechanical
Complete	GRAINSIZE_DATA	
Lab data	GRAINSIZE_DATA	Indicates whether laboratory data exists for sample
Mineralogy data	GRAINSIZE_DATA Mineralogy Analysis	Indicates whether mineral data exists for sample
yplace	GRAINSIZE_DATA	
Original data	GRAINSIZE_DATA	Original method used to determine sample location (PLSS, LL, or UTM)
Reinterpreted	GRAINSIZE_DATA	Reinterpreted formation and member name
Reference	GRAINSIZE_DATA	Published reference for reinterpreted formation and member name
Expandables	Mineralogy Analysis	Percentage of sample less than 2 microns (clay fraction) that contains vermiculite and smectite
Drillhole	Mineralogy Analysis	Drillhole from which samples were collected for mineralogy analysis
siteid	GRAINSIZE_DATA	Number associated with a given sampling site by the sample collector
sampid	GRAINSIZE_DATA	Number and/or letter associated with a given sample from a known site id
Area	GRAINSIZE_DATA	Site or project name where sample collected
coord_type	GRAINSIZE_DATA	Type of coordinate system used to locate sample
x_coord	GRAINSIZE_DATA	x-coordinate in the state plane system

y_coord	GRAINSIZE_DATA	y-coordinate in the state plane system
samp_top	GRAINSIZE_DATA	Top of sample
samp_bot	GRAINSIZE_DATA	Bottom of sample
labk	GRAINSIZE_DATA	Laboratory hydraulic conductivity (cm/s)
labK_method	GRAINSIZE_DATA	Test method used to determine laboratory hydraulic conductivity
fldk	GRAINSIZE_DATA	Field hydraulic conductivity (cm/s)
Fldk_meth	GRAINSIZE_DATA	Test method used to determine field hydraulic conductivity
analcode	GRAINSIZE_DATA	Code for analytical method used to evaluate hydraulic conductivity data
USCS_Class	GRAINSIZE_DATA	Unified soil classification system based on grain-size analyses
P200	GRAINSIZE_DATA	Percentage of grains that pass through 200 sieve
dry_wt	GRAINSIZE_DATA	Dry unit weight(lb/ft3)
moist_wt	GRAINSIZE_DATA	Moist unit weight (lb/ft3)
STP	GRAINSIZE_DATA	Standard penetration test (blows/ft)
moisture_con	GRAINSIZE_DATA	Moisture content, weight of water divided by weight of solids
LL	GRAINSIZE_DATA	Liquid limit
PI	GRAINSIZE_DATA	Plasticity index
PP/UC	GRAINSIZE_DATA	Pocket penetrometer measurements use estimate unconfined compressive strength (tsf)
precon_stress	GRAINSIZE_DATA	Preconsolidation stress or maximum effective stress (kPA)
cohesion	GRAINSIZE_DATA	Cohesion (kPA)
int_ang_fric	GRAINSIZE_DATA	Internal angle of friction
triax_test_meth	GRAINSIZE_DATA	Triaxial test method
Notes	GRAINSIZE_DATA	
Ilite	Mineralogy Analysis	Percentage of sample less than 2 microns (clay fraction) that contains illite
Chlorite + kaolinite	Mineralogy Analysis	Percentage of sample less than 2 microns (clay fraction) that contains chlorite and kaolinite
Vermcite	Mineralogy Analysis	Percentage of sample less than 2 microns (clay fraction) that contains vermiculite
Smecitite	Mineralogy Analysis	Percentage of sample less than 2 microns (clay fraction) that contains smecitite
Calcite	Mineralogy Analysis	Percentage of sample less than 2 mm (sand, silt and clay fraction) that contains calcite
Dolomite	Mineralogy Analysis	Percentage of sample less than 2 mm (sand, silt and clay fraction) that contains dolomite
Abbr	Mineralogy Analysis	One-letter abbreviation indicating mineralogy analysis performed on sample
Total carbonate	Mineralogy Analysis	Percentage of sample less than 2 mm (sand, silt and clay fraction) that contains calcite and dolomite