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User's Manual for the National Water Information System of the U.S. Geological Survey: Aggregate Water-Use Data System, Version 3.2

Open-File Report 2017–1114

U.S. Department of the Interior
U.S. Geological Survey

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Abstract

The Aggregate Water-Use Data System (AWUDS) is the database management system used to enter, store, and analyze state aggregate water-use data. It is part of the U.S. Geological Survey National Water Information System. AWUDS has a graphical user interface that facilitates data entry, revision, review, and approval. This document provides information on the basic functions of AWUDS and the steps for carrying out common tasks that are a part of compiling an aggregated dataset. Also included are explanations of terminology and descriptions of user-interface structure, procedures for using the AWUDS operations, and dataset-naming conventions. Information on water-use category definitions, data-collection methods, and data sources are found in the report "Guidelines for preparation of State water-use estimates," available at https://pubs.er.usgs.gov/publication/ofr20171029.

1 Introduction

The Aggregate Water-Use Data System (AWUDS) is a database application used for the entry, editing, storage, and retrieval of aggregate water-use data at the state and national levels. Water-use data are stored for each state (and U.S. territories), by county, 8-digit hydrologic unit code (HUC-8), 4-digit hydrologic unit code (HUC-4), aquifer, or state, and represent annual water use. AWUDS has been used in the 5-year compilations of national water-use estimates presented in the report series "Estimated Use of Water in the United States" since the 1985 compilation. This manual presents instructions and tips for using AWUDS. Underlined words are defined in the Glossary.

1.1 AWUDS Development History

The initial version of AWUDS was designed for a UNIX operating system and written in the FORTRAN programming language using an ASCII-based menu-driven interface. This software was used for the 1985, 1990, and 1995 U.S. Geological Survey (USGS) national water-use compilations.

For the 2000 compilation, AWUDS version 1.0 (August 2001) used the Microsoft Windows operating system with Microsoft Access databases and a Graphical User Interface (GUI) written in the Microsoft Visual Basic programming language. Data were entered and maintained in Microsoft Access files stored locally by each USGS District office and sent to regional specialists on the National Water Use Science Project team for review. Version 1.0 introduced AWUDS data entry templates and reports, which used Microsoft Excel files. This Windows-based AWUDS changed the user interface, including the manner in which data were entered, retrieved, and reviewed. In addition, the terms and methods defining the data were updated to respond to the data requirements of the 2000 compilation. With this Windows-based AWUDS version, Aquifer was added as a new area type. The water-use categories Livestock (Stock) and Livestock (Animal Specialties) were redefined as Livestock and Aquaculture. The thermoelectric power category was reported historically by fuel type, but cooling methods (Once-through cooling systems or Other than once-through cooling) were the new reporting designations. Values for the population served by public suppliers could be designated by groundwater or surface-water sources. Irrigation values could be classified by crop (field irrigation) or by golf-course irrigation.

For the 2005 compilation, AWUDS version 1.4 (released January 2007) was developed. Data were maintained separately in state databases throughout the USGS, but data corrections (historical and current) were not reflected in the official copy of the compilation data. Although the state database retained a Microsoft Access file, all the approved or published Access database files were stored in a central repository as the official copy of the compilation data. These data were made available for download as part of the 1.4 release. This version more clearly defined the use of water in the thermoelectric power category as Thermoelectric Power (Once-through cooling) and Thermoelectric Power (Closed-loop cooling).

For the 2010 compilation, AWUDS version 2.0 was modified to use a central Oracle database, and the GUI was converted (ported) to the Visual Basic.NET programming language. AWUDS 2.0 was significantly expanded functionally to enhance support for multiple datasets for a given state, year, and area type. In AWUDS 1.4.2 and earlier releases, only one dataset per state (the collection of all data for a given year and area type such as county, HUC-8, or aquifer) could exist in an AWUDS Access database. The dataset could be flagged as the Best Available dataset so that other users would know which data were preferred. In addition, data aging was added to the AWUDS program to identify and track the review status of data. Datasets with published data aging status were required to be associated with one or more report citations for published reports.

In November 2012, AWUDS 2.1 was released. This release was a patch of version 2.0; version 2.1 corrected aquifer reporting and a serious flaw in the security system that prevented some Water Science Centers (WSCs) from gaining write access to their state datasets.

For the 2015 compilation, AWUDS version 3.1 (June 2016) added a new log report to document metadata for individual datasets. Metadata contain information about the database; in other words, metadata are data about data. The name of a data element and date created or modified, but not the value stored, are considered to be metadata. Version 3.1 extended the AWUDS data model to include full support for functions, calculations, quality-assurance checks, and metadata-driven reporting. Metadata that were stored in the local state Microsoft Access database were transferred to the national Oracle database.

Additional enhancements introduced the state-level area type for storing state-level historical data for 1960–80 and the county-aquifer area types for aggregating groundwater data by aquifer at the county level. The following reports were added: Log Report, State Trends Report, National Trends Report, and Data Dictionary Report. In AWUDS version 3.1, the Facility Table, Calculated Table, and Basic Tables by Area were removed from the operation tab and are no longer supported.

The AWUDS 3.2 version (released fall 2017) provided additional functionality for users. The Basic Table by Category reports (State and Multi-State) can be retrieved in units of million gallons per day or thousand acre-feet per year. A StudyDeleteLog table was added to store the dataset header record when the dataset was deleted. The log table retains a list of datasets that have been deleted and the reason the datasets were deleted. Data in a deleted dataset are not retained. The existing Log Report was modified to trace the history of copied datasets. The Copied From-To worksheet of the Log Report was extended to include a full copy history. Additional background on the development of AWUDS is available at http://nwis.usgs.gov/Project_Management/wu/projects.html (internal USGS access only).

1.2 Getting Help within AWUDS

This manual can be accessed within the AWUDS application by clicking on the Help button available on all screens. AWUDS documentation also is available as a PDF at http://nwis.usgs.gov/currentdocs/awuds/AWUDS.user.book.htm

1.3 Getting Help with Water Use

General familiarity with water-use data collection is helpful for understanding and using AWUDS. Information on USGS Water-Use Science and the previous water-use compilations is available at http://water.usgs.gov/watuse/. More detailed information on water-use category definitions, data-collection methods, and data sources is available in the report "Guidelines for preparation of State water-use estimates for 2015" (Bradley, 2017).

1.4 AWUDS Installation

AWUDS system requirements and installation instructions are available on the National Water Information System (NWIS) website at http://nwis.usgs.gov/IT/awuds/awuds_rel.html.

2 AWUDS Basics

AWUDS stores information in data elements, which are identified by area type, geographic or hydrologic unit (county, HUC, aquifer, county-aquifer, or state-level). Within area types, data elements are identified by water-use category, such as Public Supply, and type of value, such as fresh groundwater withdrawal. Data elements are further grouped into datasets by state and year. Access for reading and writing data for individual states is controlled by Water Science Centers. Using Multi-State datasets, a collection of state datasets of published and approved data, AWUDS users can access a limited number of reports (Basic Tables by Category and Export), including Best Available and published national circular data.

For more than 60 years (since 1950), water-use data have been collected by USGS personnel and cooperators. Throughout this time, the number and definitions of water-use categories, and the set of data elements stored for each category, have changed. Additionally, mandatory or non-mandatory data elements in compilation years (years ending in 0 or 5 from 1950 to present) were revised. In AWUDS, a group of valid (by date range) water-use categories and data elements is referred to as a data dictionary.

The AWUDS user interface is designed chiefly as a series of tabs across the top of the AWUDS application window, and workflow generally moves through these tabs from left to right (fig. 1). Data aging functions in AWUDS control the

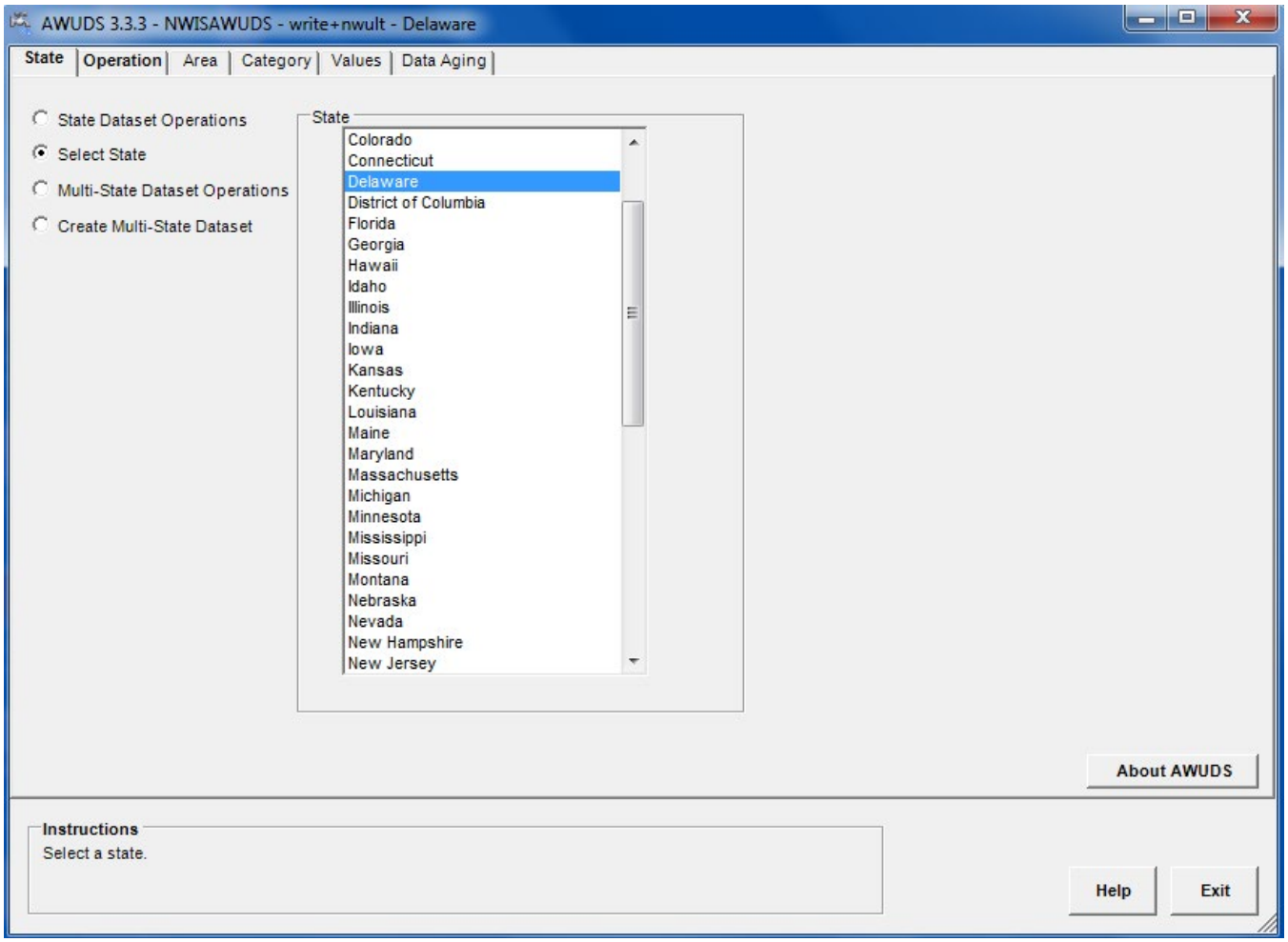


Figure 1. The State tab in the AWUDS program.

user's access to the data as the data move from initial entry through publication.

- Tip: The first area dataset created for a compilation year and a single area type are automatically assigned the database name, Compilation. The name of each state dataset should be consistent to facilitate the data review process. When a HUC-8, aquifer, or county-aquifer dataset is generated for a compilation year, but does not include mandatory data for a national report, the system automatically assigns a database name of Compilation that can be changed using the Edit Metadata function. For compilation years, data elements may be mandatory; for non-compilation years, all data elements for any area type are non-mandatory.

- Tip: Before entering any data remember that a null (blank value) is not the same as a zero. A null means no value was estimated or entered, but a zero means an estimate was made, and the value was zero or was below the minimum value that can be stored in AWUDS. A calculated value, including totals, will display as a blank in most reports if one or more values included in the calculation are null. Users have the option of having totals calculated in the Basic Tables by Category Report whether or not null values are present in the data. Users are encouraged to enter zeros for those values that are estimated and are zero, rather than leave the values blank.

- Tip: Area types were designated from Federal sources. For county or county-equivalent area types, see the U.S. Census Bureau website at https://www.census.gov/geo/reference/codes/cou.html. For changes in counties or county equivalents since 1970 refer to the Census Bureau website at https://www.census.gov/geo/reference/county-changes.html. To understand hydrologic unit designations, see the USGS website at https://pubs.usgs.gov/tm/11/a3/pdf/tm11-a3_1ed.pdf. For National Aquifer designations, see the website at https://water.usgs.gov/ogw/aquifer/atlas.html.

2.1 Data Elements, Data Dictionary, Datasets, and Best Available Datasets

A data element is the smallest unit of data stored in AWUDS. Data elements are stored as numeric values and can be entered by the user or calculated by the program from other data elements for use in reports and quality-assurance programs. Except for Total Population for the state, each data element is identified by a water-use category, such as Public Supply or Irrigation. For each category, there is a set of data fields, such as fresh groundwater withdrawals, and a reporting unit name, such as million gallons per day (Mgal/d) or number of facilities. Each data element is represented by an abbreviated reference code that is used in exporting and importing files and appears in some AWUDS operation windows.

Changing water-use categories and mandatory data elements required the development of data dictionaries. In AWUDS, the set of water-use categories and the associated data elements for a given compilation are referred to as a data dictionary. As an example of these changes, the 1985–1995 data dictionaries contain categories that subdivide Thermoelectric Power by fuel type (Fossil fuel, Nuclear, and Geothermal). The 2000–2015 data dictionaries contain categories that subdivide Thermoelectric by cooling type (Once-through cooling and Closed-loop cooling).

Data entered into AWUDS are organized in datasets. A dataset consists of all of the data elements for a single year and a single area type (county, HUC-8, aquifer, county-aquifer, or state-level). A dataset is created for a single state, except state-level datasets used to store state totals for the 1960–80 compilations or for intervening years during this period.

The first dataset created for a compilation year and a single area type (except state-level) is automatically assigned the database name Compilation. For non-compilation years, the user must assign a name to a dataset when it is created. This dataset name will appear in picklists in the program. A longer database description and optional descriptive information can be viewed using the Dataset Metadata operation (see section 3.1.4, Dataset Metadata in this manual). For most data dictionaries, the user makes one or more choices (total or split) for the data to be stored, such as entering Irrigation as a total value or splitting Irrigation into Crop Irrigation and Golf Course Irrigation. These choices define the storage option for the dataset. AWUDS can store multiple datasets for a given state, area type, and year. For example, an additional dataset might be created to correct errors found after publication, to store data from an alternative source, or derived using a different estimation method. The user-entered dataset description can be used to note revisions or alternate data sources used in such a dataset.

To help users select the appropriate dataset for retrieval, which includes the preferred data (original and revised data), AWUDS has a Best Available designation. A dataset is designated as Best Available if it includes at least one approved or published data element. (See section 2.2.2, Data Aging for information on Approved and Published status.) The first dataset for a given state, area type, and year that contains approved or published data is automatically marked Best Available. If another dataset is created and approved, the user can change the Best Available designation to the other qualified dataset using the Dataset Metadata operation. AWUDS displays the phrase Best Available in dataset picklists along with the year of data and the user-created dataset name.

2.2 User Access and Data Aging

The Microsoft Active Directory (AD) service verifies and approves all users and computers attempting to use the AWUDS program. Any user with a valid USGS user account in the Geological Survey (GS)-AD domain is by default a read-only user in AWUDS. A read-only user has access to all approved and published data in AWUDS. To enter or edit data, the user must have write access. Each USGS Water Science Center has one or more AD groups registered with NWIS, which are used to grant users write access to state data. AD group names that end in AWUDSWW control AWUDS write access. Refer to the AWUDS installation page (http://nwis.usgs.gov/IT/awuds/awuds_rel.html) for information related to accessing state data.

- Tip: Write access refers to permission to enter, modify, or delete AWUDS data for a specific state and is locally controlled by the Water Science Center where the NWIS data reside.

2.2.1 User Types and Read/Write Access

There are two classes of AWUDS users—general users and National Water-Use Leadership Team (NWULT) users. The NWULT users include the regional specialists on the National Water Use Science Project team who review and approve AWUDS data. In addition, each user has either read-only or read/write access to the data for each state, controlled by AD groups.

General user with read/write access: A general user with read/write access to a state database can view all data, create new datasets, edit data, and delete datasets for that state. The user can also change the data aging status from Working to In-Review. A general user with read/write access can also assign citations to published reports.

NWULT user with read-only access: An NWULT user with read-only access to a state database can view all data for that state regardless of data aging status and can change the data aging status of the data for that state. However, this category of users cannot edit values, create new datasets, copy, or delete datasets for the state.

NWULT user with read/write access: A NWULT user with read/write access to a state database can view all data, create new datasets, edit data, delete datasets, and change the data aging status of the data. NWULT users can also delete

user-created multi-state datasets when necessary. A NWULT user must contact the State Water Science Center to be added to the appropriate AD group for read/write access.

2.2.2 Data Aging

Data aging indicates the data review stage. This process assigns a status level to data in AWUDS. The data aging status determines who can view or modify the data and whether the data are available for continued review. Note that data aging in AWUDS is applied to blocks of data selected by category or data element(s), not to individual data values. All of the individual areas (counties, HUCs, aquifers, county-aquifers, states) within a dataset have the same data aging status for a given data element. Data aging changes can be retrieved using the log report (see section 3.2.4, Log Report in this manual). Data reported for a compilation year can be mandatory or non-mandatory. Mandatory data elements within a category must be completed before the dataset block can be aged.

There are four AWUDS data aging statuses.

Working: When data values are initially entered into AWUDS, they are given the default data aging status of Working. Working data can be modified only by users with write access to that state and can be viewed only by users with write access and NWULT users.

In-Review: When Working data are ready for review by the regional specialists on the National Water Use Science Project team, a user with write access to that state changes the data aging status to In-Review. In-Review data can be viewed only by users with write access to that state and NWULT users. Once data are in In-Review status they cannot be edited or deleted. A general user cannot change In-Review status back to Working status. After review, only a NWULT user with write access to the state data can change the data aging status to Approved or back to Working.

Approved: Data marked Approved have been reviewed and approved by a NWULT user. Approved data can be viewed by all AWUDS users but cannot be edited or deleted. Approved data may be released to the public but must still follow USGS Fundamental Science Practices (https://www2.usgs.gov/fsp) for release as a standalone dataset or as a publication. If approved but unpublished data are found to be in error, the status can be reversed to Working by an NWULT user for editing or deletion by any user with write access to that state.

Published: Data in Published status have been disseminated in a publication such as USGS or cooperator reports, or as a stand-alone dataset using a Digital Object Identifier (DOI), a standardized method of uniquely identifying academic, professional, and government information. Only Approved data can be changed to Published status. General users with write access to a state or a NWULT user can change the data aging code to Published after the data have been approved. When data in a dataset are first marked Published, a report or DOI citation must be associated with the dataset.

- Tip: If you are a general user who has been granted write access to a state's data, you can create, enter, edit, or delete any dataset or data element in Working data aging status related to the state. No revisions can be made by the general user after the data elements have been aged to In-Review. Any subsequent data changes must be coordinated through a NWULT member who can change the data aging status back to Working.

2.3 AWUDS User Interface

The AWUDS user interface is organized with tabs at the top of the program window. When the State tab is clicked, the user can begin a Single-State or Multi-State task (fig. 1). Once a single state is selected, the Operation tab provides the list of available operations. Area, Category, Values, and Data Aging are used during various operations. Some operations use pop-up windows.

Workflow in AWUDS generally moves from left to right, and the program will automatically move to the next tab for a given operation once the user has made all the necessary selections on the current tab. However, the user can click on a previous tab to change an earlier selection. Not all tabs are accessed for all operations.

The bottom left section of each tab provides an instruction box for the current operation. The information in the instruction box changes according to the selection made or highlighted. To the right of the instruction box and throughout the current tab view are buttons for the current operation. These buttons may change for the current operation and for the type of user.

2.3.1 State Tab

The State tab allows the user to select a single state or navigate to the state dataset Operations tab (fig. 1). AWUDS will advance automatically to the Operations tab when a state has been selected and will retain the last selected state between AWUDS sessions. The name of the currently selected state is displayed in the AWUDS window title bar. Additional radio buttons on the State tab can also move the user to the window to create a multi-state dataset or to navigate to the multi-state dataset operations tab. See section 3.6, AWUDS Operations for Multi-State Datasets for more information on multi-state datasets.

The About AWUDS button will display the pathname for the AWUDS report directory. The report directory is set for each user and is retained by AWUDS until changed by the user. About AWUDS also displays the version number and release date of the AWUDS software and contact information for program inquiries.

2.3.2 Operation Tab

The Operation tab allows users to specify which operation they wish to perform. Operations are grouped under the headings Data Entry and Editing, Reports, Quality-Control Reports, and Other (fig. 2).

Additional controls may appear on this tab depending on the user's choice of operation. These controls allow the user to make additional selections needed for the operation or to provide a pathname for an input file.

2.3.3 Area Tab

The Area tab allows the user to select one or more areas to be included in a report or operation. The list of areas is not displayed until the user selects a dataset by first selecting the area type, such as county, HUC-8, aquifer, or county-aquifer. Once an area type has been selected, a list of available datasets for that area type will be displayed. Depending on the operation, the user should then select one or two datasets, after which the list of available areas will be displayed. The Add button moves a selection from the Available list box on the left to the Selected list box on the right. A summary of the data aging status of the selected dataset is displayed to the right of the Available Datasets list box (red outline, fig. 3).

Once the necessary area selections have been made for the chosen operation, the Finalize Selection button becomes active. Once this button is clicked, AWUDS advances to the next tab.

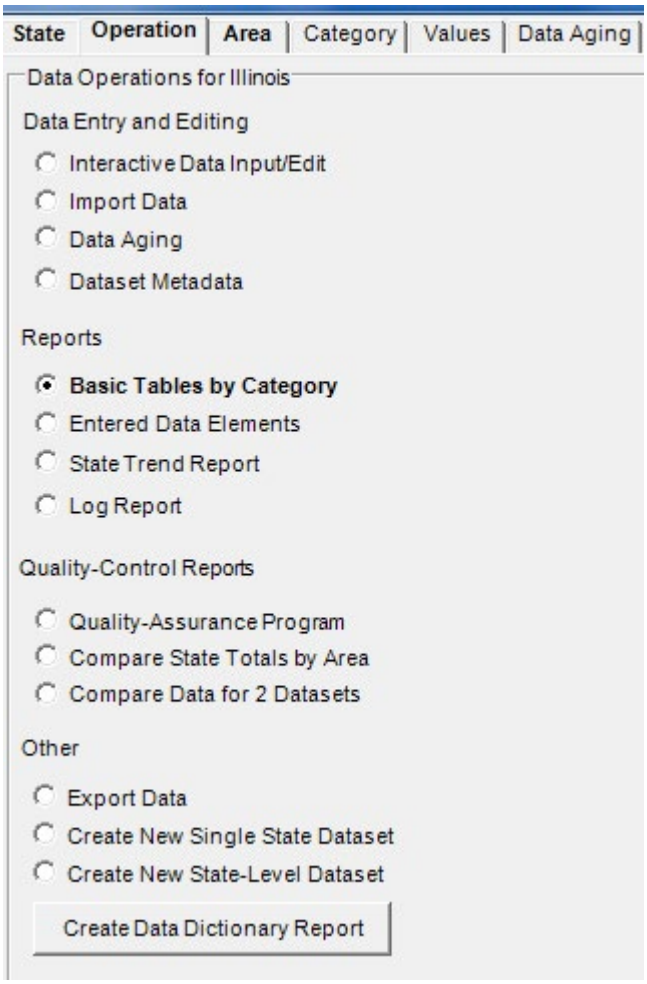


Figure 2. The Operation tab in the AWUDS program.

2.3.4 Category Tab

On the Category tab the user selects one or more data categories. The Add button allows the user to move a selection from the Available list box on the left to the Selected list box on the right (fig. 4). An asterisk (*) before the category name indicates that no values have been entered for the category (that is, all the values for the category are currently null for the selected dataset).

For a report operation, when all applicable categories are included in the Selected list box, clicking on the Produce Report button will generate the retrieval of the selected data category. A pop-up window will allow the user to navigate to an output directory and to change the default name for the report, if applicable. For the Interactive Data Input/Edit operation, a single category is selected, and clicking on the Edit Data button will advance to the next tab.

2.3.5 Values Tab

The Values tab is available only for the Interactive Data Input/Edit operation (see section 2.3.2, Operation Tab). The Values tab will display values for the data elements of the selected area and category (fig. 5). The backgrounds for mandatory data-entry fields are shaded red when values are required (that is, when null values are not allowed) and blue when the value is required but null values are allowed, such as the reclaimed wastewater field in the 2000 and later data dictionaries. Fields with a white background are optional data elements. For non-compilation years, all data elements are optional. If values are displayed but are grayed out, the values are locked for editing by this user. Values are locked when the data aging status is In-Review, Approved, or Published. Working values also are locked for users without read/write access. The Delete All Values in Category button will set all the displayed values to null for the currently selected area and category when the data are in working data aging status only.

2.3.6 Data Aging Tab

The Data Aging radio button can be found under the Data Entry and Editing heading on the Operations tab (fig. 2). A secondary set of tabs on the Data Aging tab enables the user to switch between Mandatory Data Elements and Non-Mandatory Data Elements. Depending on the dataset chosen for the

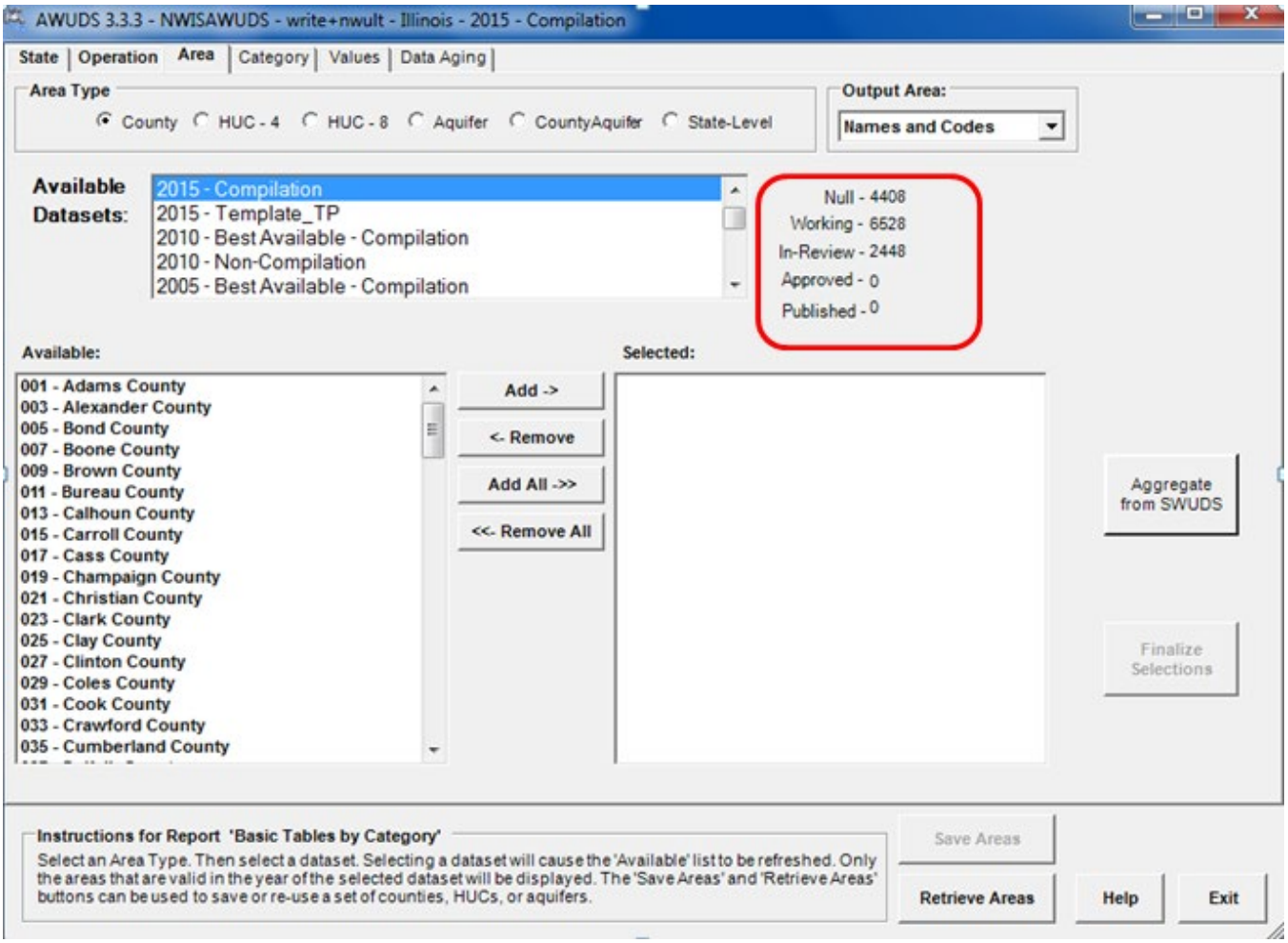


Figure 3. The Area tab in the AWUDS program showing an example of counts of data elements and data aging status.

data aging operation, one or both of these secondary tabs will be accessible (fig. 6).

On the Data Aging secondary tabs, the relevant water-use categories are shown as buttons labeled with the two-character category abbreviation (see appendix 1). These buttons are color coded to show the current data aging status of the data elements in that category. Clicking on a category button will display the list of data elements for that water-use category in the selected subset (Mandatory or Non-Mandatory) and allow the user to change the status of all elements in the list or selected elements, subject to the restrictions for the type of user.

Refer to the AWUDS Basics and AWUDS Operations sections of this manual for additional information about data aging.

- Tip: There are two tabs on the Data Aging window. For a compilation year for any area type, the default tab will be Mandatory Data Elements (look for bold text on tab). If non-mandatory data elements, such as number of facilities are entered, these data elements will appear on the Non-Mandatory tab. If HUC, aquifer, or county-aquifer datasets are populated, the data aging status will appear on the Non-Mandatory tab; therefore, the user must select this tab to view or change the data aging status.

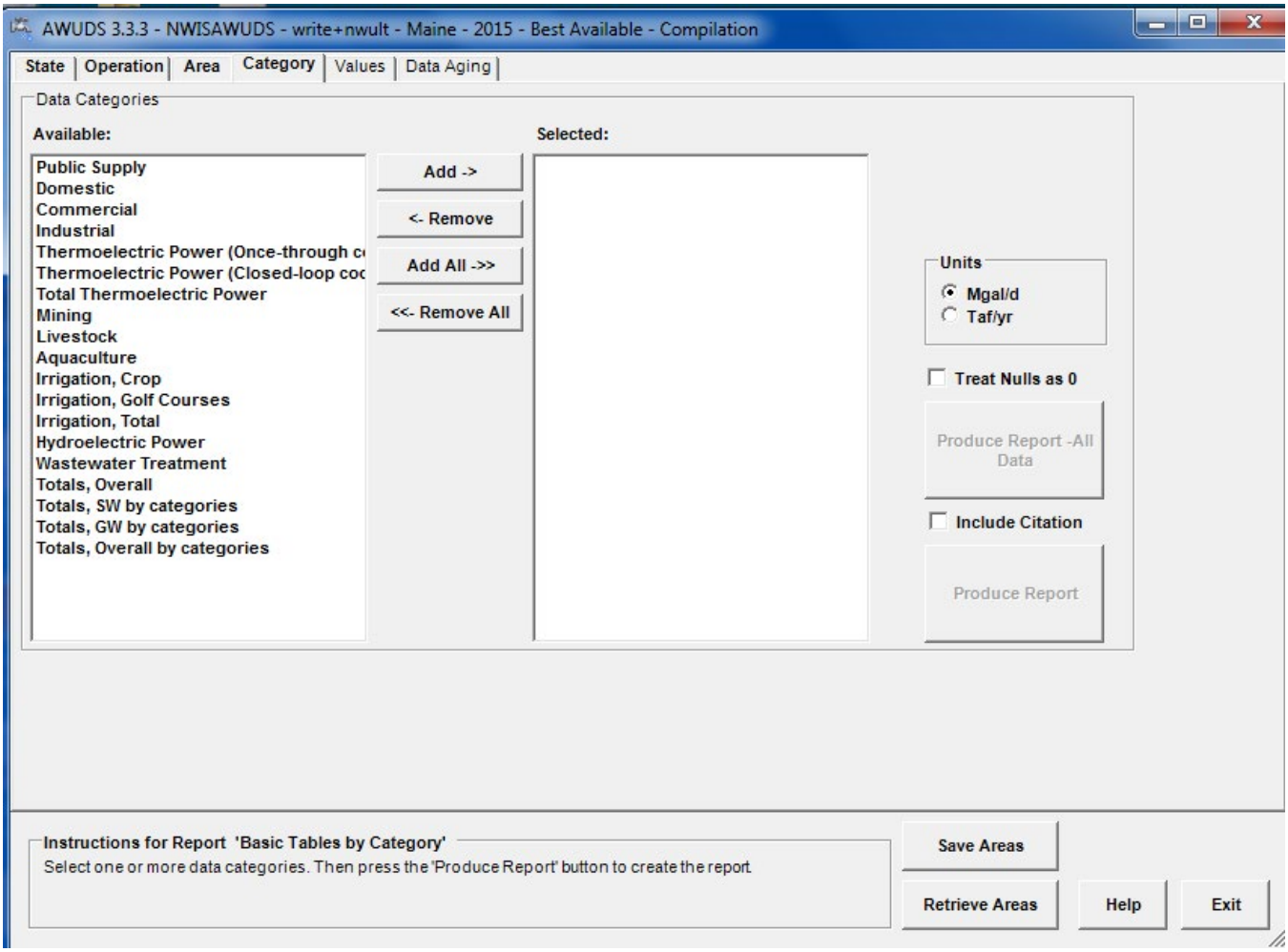


Figure 4. The Category tab in the AWUDS program showing an example of a single selected data category for Interactive Data Input/Edit.

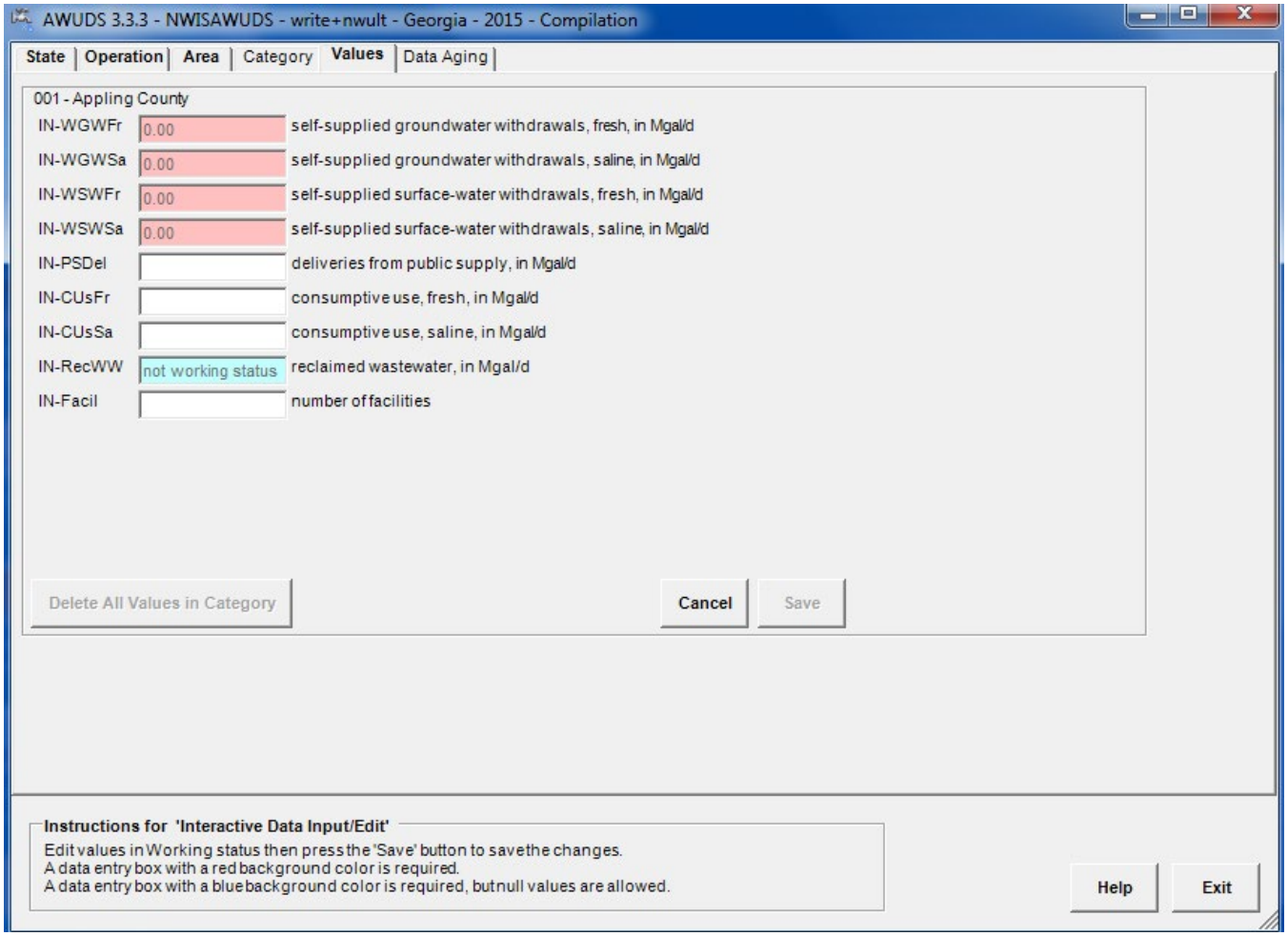


Figure 5. Example of Values tab in the AWUDS program with values status levels and colors used in AWUDS.

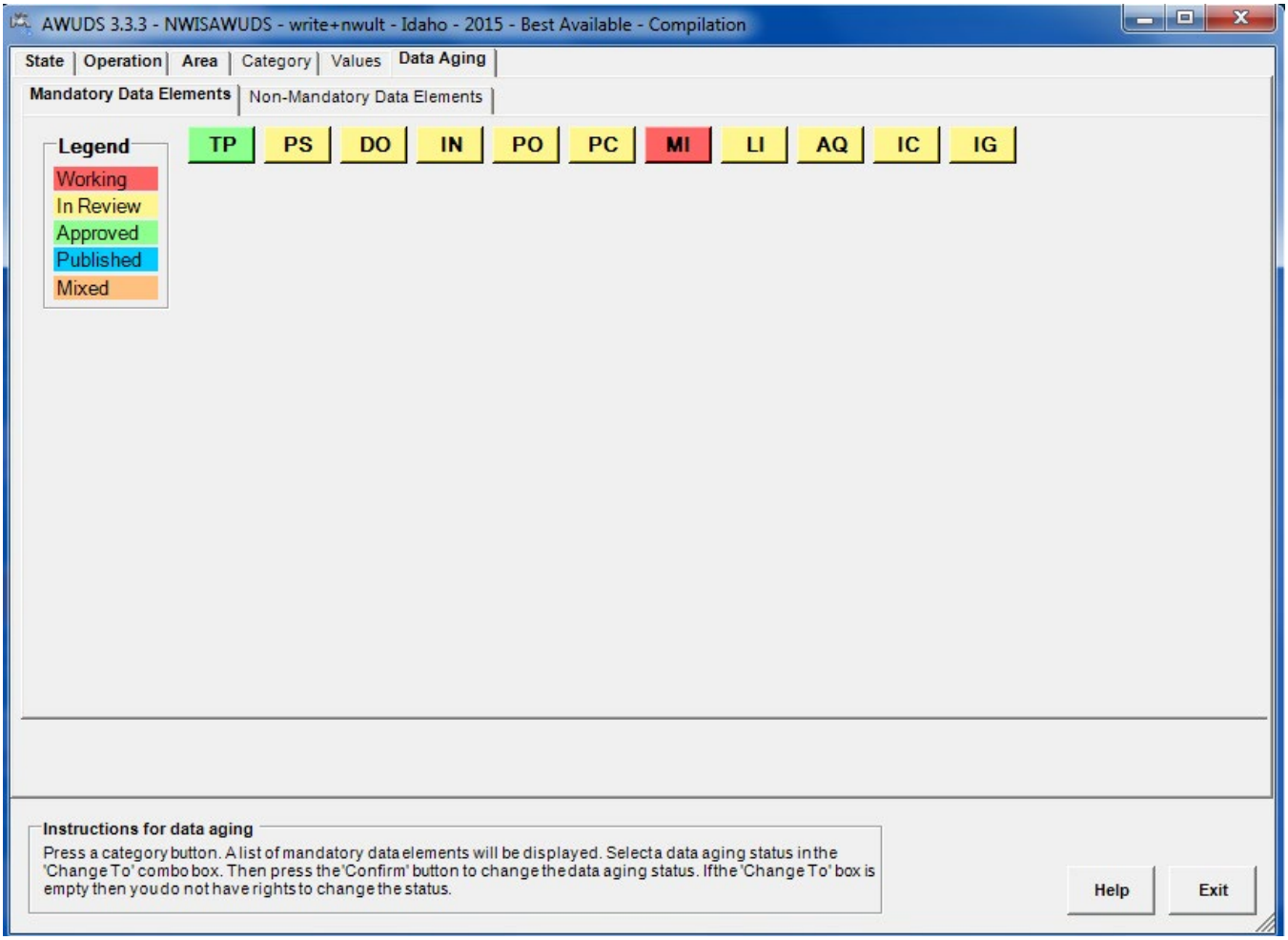


Figure 6. Example of Data Aging tab in AWUDS with mandatory data elements for a compilation year.

3 AWUDS Operations

AWUDS operations, which are the main functions of the AWUDS database, allow the user to enter and edit data, produce reports, run quality-assurance checks, and import and export data to and from Microsoft Excel (table 1). AWUDS moves to the Operation tab automatically once a selection is made from the State list box on the State tab (fig. 1) and on subsequent uses of the program. The Operation tab is the initial screen. There are four groups of operations:

- Data Entry and Editing,
- Reports,
- Quality-Control Reports, and
- Other.

3.1 Data Entry and Editing

Data elements can be individually entered or modified by data category for a single area or by batch loading of the entire dataset. The Interactive Data Input/Edit method is used for a small number of data elements on an AWUDS data entry form. The Import Data method typically is used for most data entry because this operation reads some or all data for a dataset from a specially formatted Microsoft Excel spreadsheet.

The Data Aging operation allows the editing of the data aging status for a dataset. The Dataset Metadata operation allows the user to view and edit additional descriptors for a dataset.

3.1.1 Interactive Data Input/Edit

This operation allows the user to quickly enter or edit individual values in a state dataset. With this method, the user may enter or edit the values for one water-use category for one area (for example, the Public Supply data elements for New Castle County, DE). Use the Export and Import operations for larger amounts of data.

During Interactive Input/Edit, a user will receive a warning if the values entered contain too much precision (extra decimal places). After the warning message, the values will automatically be rounded to the appropriate number of decimal places (3 for populations reported in thousands of persons and 2 for all other data elements) using USGS rounding rules. The exception is facilities which must be integers. Non-integer facility entries will be rejected with an error message.

3.1.2 Import Data

AWUDS allows the user to import data from a specially formatted Microsoft Excel spreadsheet. If the Import Data operation is chosen (fig. 2), the user will be asked to browse to the file location and select a Microsoft Excel workbook from which to import data. The file must be in the default Excel format for the most recent version of Microsoft Excel installed on the computer, .xls for Excel 2003 or .xlsx for Excel 2007 and later.

To obtain a properly formatted Microsoft Excel file, the user can use the AWUDS Export operation to export some or all of the water-use categories, even if the dataset is currently empty. Although a Microsoft Excel input file can be created from scratch, the report generated from the Export operation will be formatted so that it can be used with the Import operation without problems. See section 4.2, Creating a Dataset Input Template for the requirements for a properly formatted Microsoft Excel file that can be used as a source of data for the Import operation and step-by-step instructions.

After selecting a properly formatted Microsoft Excel file, AWUDS will populate the Available Datasets list box with all datasets that match the area type in the selected file. The user must select one dataset from the list to use for the Import operation, then press the Execute button to import the data.

The user will receive a warning if the values in the Microsoft Excel file being imported contain values with too much precision. These values will be rounded to the appropriate number of decimal places (integers for facilities, 3 for populations, and 2 for all other data elements) using USGS rounding rules. AWUDS will also inform the user if the import will overwrite existing data values.

AWUDS performs several quality-control checks on the data being imported, including

- Checking that the data element identified in the column header is valid for the selected dataset,
- Checking that the area type identified in the row header actually exists for the selected state,
- Insuring that all values are numeric and within the acceptable range [0 to 99999.99, except for Hydroelectric power generated by offstream use (HY-OfPow), which can be in the range -999.99 to 99999.99], and
- Checking the data aging status. If the data element is not in working status, new data cannot be imported, and existing data cannot be modified.

♦ Tip: When starting a new project, use Create New Single State Dataset (fig. 2) to create the structure, and then Export all categories. Save the resulting file as the input template. Add additional worksheets to this file for other calculations or source data, but do not edit the column headings, area codes, or the worksheet names for the worksheets that AWUDS created.

3.1.3 Data Aging

The Data Aging operation allows a user to define the status of the data elements in a dataset. There are four AWUDS data aging status levels (described in section 2, AWUDS

Table 1. Description of AWUDS operations.

Operation	Description
	Data Entry and Editing
Interactive Data Input/Edit	Enter new data values or edit existing values through the AWUDS interface. Primarily for working with single values or small numbers of values.
Import Data	Import data from a Microsoft Excel spreadsheet. Multiple areas, categories, and data elements can be entered in a single operation. This is the principal method of entering new or revised data to AWUDS datasets.
Data Aging	View and change the data aging status in a selected dataset, as permitted by the current status of the dataset and the user's access privileges.
Dataset Metadata	View and edit metadata, add citations to a dataset, copy a dataset, and delete a dataset. Most metadata are assigned by the system and cannot be edited by the user.
	Reports
Basic Tables by Category	Formatted tables by water-use category similar to the tables in the national water-use circulars. Data for each area are displayed in a row with totals for all areas at the bottom.
	Reports
Entered Data Elements	Report displays all manually entered data values (that is, those that are not calculated from other data values) for each area selected. The optional State total output includes information about the data aging status for each entered data element. The data element report format mimics the AWUDS coding form. (See "Guidelines for preparation of State water-use estimates for 2015" at https://pubs.usgs.gov/of/2017/1029/ofr20171029.pdf for the coding form.) The Entered Data Elements report is useful when checking data input where the calculated values are not of interest and to see an overview of the data-aging status of each data element.
State Trend Report	Report displays state totals of the Best Available county-level datasets for all compilation years combined with state totals from state-level datasets from 1960 to 1980.
Log Report	Report displays metadata, data aging history, dataset name changes, citations, best-available status, and the source dataset, if any, for a single dataset.
	Quality-Control Reports
Compare State Totals by Area	Report displays the differences between the state totals for each data element in two different datasets of different area types from the same year. The report format is similar to the Entered Data Elements report and mimics the layout of the AWUDS coding form. It is useful to confirm that county, HUC-8, and aquifer datasets for the same year result in the same total water use for a state.
Quality-Assurance Program	Report displays the results of a number of quality-assurance checks on a dataset, including checks for errors in population, withdrawals, consumptive use, irrigation, hydroelectric power, reservoir evaporation, and facility counts. The report also includes calculations of water coefficients, per capita, percent consumptive use, and percent of reclaimed wastewater.
Compare Data for 2 Datasets	Report displays the comparison of two datasets for different years for the same area type (individual areas or state totals). The report displays the values of each dataset and the absolute and percent differences between the two datasets. The values are displayed area by area with each data element listed on a single row. This enables the report to be sorted by the reported differences in values for review. It is useful for reviewing the changes from one year to the next for each value. The report can compare individual areas or state totals.
	Other
Export Data	Export data for selected categories for a dataset to a Microsoft Excel spreadsheet. The data can then be edited and re-imported using the Import Data operation. Only entered data (no calculated totals) are exported. It is also used to generate a blank input template for a newly created dataset.
Create New Single State Dataset	Creates a new state dataset with null values for all data elements.
Create Data Dictionary Report	Creates files listing all available entered and calculated data elements for each data dictionary, the equations for calculated values, and other metadata.

Basics): Working, In-Review, Approved, and Published. The Data Aging tab has a data aging color key located on the left-hand side of the window. A secondary set of tabs at the top of the Data Aging tab allows the user to access data aging status for mandatory and non-mandatory data elements. Depending on the dataset chosen, one or both of these secondary tabs will become accessible. For pre-2000 compilation years, all data elements were mandatory. For 2000 and later compilation years, there is a mix of mandatory and non-mandatory data elements. For non-compilation years, all data elements are non-mandatory.

On the Mandatory and Non-Mandatory tabs (fig. 6), the relevant water-use categories are shown as buttons labeled with the two-character category abbreviation (see appendix 1). These buttons are color-coded to show the current data aging status of the data elements in that category. Passing the cursor over the button will show the full name of the category and the data aging status in a text tooltip.

To age data, a user selects a category by pressing one of the water-use category buttons. Once the user has selected a category, AWUDS will display the list of data elements that will be aged for the selected category.

All mandatory data elements for a category age as a single block. AWUDS does not support aging for subsets of areas (counties, HUCs, aquifers); all areas in a dataset age together. A Change-To pull-down menu is used to display the data aging status options for the user. To age data, the user selects a new data aging status from the Change-To pull-down menu, then presses the Confirm button. The process to age non-mandatory data is the same as the process for mandatory data, except that non-mandatory data elements can age either as a block or separately. A Change-To pull-down menu is displayed for each non-mandatory data element.

Mandatory data elements cannot be aged from Working if there are null values for some or all areas, unless the data element allows nulls. The exception to this rule is for state-level datasets, where datasets must accommodate historical datasets that did not include all states. A null (blank value) is not the same as a zero. A null means no value was estimated or entered, but a zero means an estimate was made and the value was zero or the value was below the minimum that can be stored in AWUDS. A calculated value, including totals, will display as a blank in most reports if one or more values included in the calculation are null. Users have the option to have totals calculated in the Basic Tables by Category Report (fig. 2) whether or not null values exist in the data. Users are encouraged to enter zeros for those values that were estimated and are zero, rather than leaving the values blank.

For a dataset to contain data in Published status, at least one report citation must be assigned to the dataset. When the first block of data is aged to Published and the Confirm button is pressed, the Assign Citation window opens. The user must select a report citation from the list of citations to complete the data aging to Published. If an applicable report citation is not in the reference list, use the AWUDS Citation Request button to be directed to the citation request form. Adding the citation to AWUDS may take a few days. See section 3.1.4.3, Assign Citations for more information on requesting citations.

- Tip: All mandatory data elements within a category are aged as a group. Non-mandatory data elements can be aged separately. Only data in working data aging status can be edited. Prepared data for review are aged by the user (with write access) from Working to In-Review. Only NWULT reviewers can approve data or change In-Review data back to Working for editing.

3.1.4 Dataset Metadata

Metadata are information about a dataset, most of which is defined by the system and cannot be changed. The Dataset Metadata operation contains several functions, including viewing the metadata of a dataset, assigning additional publication citations to a dataset, changing the selection of the Best Available dataset for a given year and area type, and deleting or copying a dataset. These functions are accessed from buttons displayed on the Area tab (fig. 3). Dataset metadata operations are logged with user ID, date, and time. Dataset metadata can be retrieved using the Log report.

3.1.4.1 Edit Metadata

In Edit Metadata, the system displays the current metadata for the dataset in a new window. Most metadata cannot be modified because it is defined by the system. A user can change a dataset name or description. If the dataset name is changed, a reason for the change should be entered in the given field. After changes are made, pressing the Save and Close button will save any changes and close the Edit Metadata window.

3.1.4.2 Change Best Available

The Change Best Available function allows a user with write access to designate a preferred dataset from among the qualified datasets for a given year and area type. A qualified dataset contains at least one data element in Approved or Published status. If only one qualified dataset exists, AWUDS automatically flags it as Best Available.

3.1.4.3 Assign Citations

The Assign Citations button, active only for Published datasets, allows the user to indicate where the data have been published. The first citation must be assigned when data in the dataset are first aged to Published status in the Data Aging operation. The Assign Citations operation allows additional citations to be assigned to datasets if the data were published in more than one publication or as a stand-alone data release in addition to a publication.

Pressing the Assign Citations button will open the citations popup window. The window will contain a reference list of available citations that includes only citations relevant to

the state and optionally a list of citations for national reports. Currently assigned citations appear in a list at the bottom of the window. The user has the ability to assign additional citations to the dataset and remove citations if necessary, as long as at least one citation remains associated with the Published dataset.

The master list of citations is maintained in an AWUDS reference list. To request that a publication be added to the AWUDS citation list, fill out the AWUDS citation request form (http://goo.gl/forms/FUyCTxm0Ka) with the following information:

1. Full reference, in USGS bibliographic format (example: Maupin, M.A., and Barber, N.L., 2005, Estimated withdrawals from principal aquifers in the United States, 2000: U.S. Geological Survey Circular 1279, 46 p.),
2. Uniform Resource Locator (URL), if the report is available electronically (example: http://pubs.water.usgs.gov/circ1279), and
3. Extent, either national or a list of all states included in the report. The extent must be given by state even if the report was based on HUC or aquifer areas. The Citation Request form is also accessible via a button on the AWUDS Dataset Citations screen. The information must be manually added to the reference list after the form is submitted and may take a few days.

3.1.4.4 Delete Dataset

The Delete Dataset button will remove a dataset permanently, although an internal log entry is kept with dataset information and the user ID, date, and time of the deletion. A user must have write access to delete a dataset. Only datasets with all data in working data aging status can be deleted.

3.1.4.5 Copy Dataset

A dataset might be copied to allow one or more data elements from a Published dataset (which cannot be changed) to be revised, or to develop a dataset where one or more data elements use an alternative source or estimation method. The Copy Dataset function copies any dataset, regardless of data aging status, into a new dataset. A user must have write access to copy a dataset. When a dataset is copied, the data aging status of the copy is set to Working for all data elements. A revised copy of a published dataset should not be assigned the same citation as the original published dataset unless the cited publication has been updated with official errata.

3.1.4.6 Retrieve Delete Log

The Delete Log records the history of a deleted dataset. This information includes who created, modified, and deleted the dataset and the date of the action. In addition, characteristics such as the state, storage option, and Best Available designation are among the reported categories. NWULT members can view all datasets deleted. Read/write access users may view only deleted datasets of the single state selected. A deleted dataset's data are not retained.

3.2 Reports

AWUDS produces several reports (fig. 3), plus additional output in the Quality Control and Other operations. All reports are generated in Microsoft Excel. The data included in a report are controlled by the data aging status. General users with read-only access to a state will not be able to view data in Working or In-Review status, or any data elements such as totals that are calculated partly or completely from Working or In-Review data. In addition, Quality-Assurance Program and Compare State Totals by Area report types (fig. 3) are disabled if the user has read-only access.

The dataset name and information about whether it is the Best Available dataset are noted on the report. In addition, in most reports information about data aging status of the data elements is noted.

Report files will be saved in the folder where the most recent report was generated by the user. The first time AWUDS is used the program will create a default report folder named AWUDSReports in the user home area. This folder can be moved to any convenient location. The user can press the About button on the State tab to find the current reports folder location, or the user can run a report and note the last report folder location in the file browser window.

- Tip: If AWUDS has begun writing a Microsoft Excel output file and the user opens a separate instance of Excel, the report in progress may stop at the point where Excel was opened. Therefore, it is not recommended that Microsoft Excel be opened while AWUDS is writing an Excel file. Wait until the last button that was clicked becomes active again.

3.2.1 Basic Tables by Category

The Basic Tables by Category report is similar in format to the national water-use circular and presents the data first by category and then by area; each category is a separate table (output as a separate worksheet in Microsoft Excel) with the areas as rows. Additional tables in the Basic Tables by Category report give various water-use totals. A total row will be displayed at the bottom of each table if no null values are present or if the Treat Nulls as 0 option is chosen. Note that treating nulls as zero will mask an incomplete dataset and should be used with caution. A warning message will be appended to each worksheet title line when Treat Nulls as 0 is used.

The dataset name and a summary of the data aging status are included in the table headers. The user can optionally include the citation(s) in the header for datasets containing

published data. This report supports either million gallons per day or thousand acre-feet per year output.

3.2.2 Entered Data Elements

The Entered Data Element report (fig. 2) displays all user-entered values (that is, values not calculated by AWUDS) in a format similar to the AWUDS coding form. A separate table is produced for each area type (county, HUC, aquifer, county-aquifer, and state-level) selected; the tables are written one after the other on one Microsoft Excel worksheet. The user may also choose to output the totals of each entered data element in the dataset by selecting 000–STATE VALUES on the Area tab. The totals will be output on a separate worksheet tab from the individual area tables.

The Entered Data Elements report provides a compact summary of data entry and data aging status for a dataset. The individual area type tables display NR (No Record) if no value has been entered for that data element; the NR is bold and in red text if the data element is mandatory. The State table (worksheet) displays NR (No Record) if no values have been entered for that data element for all areas; the NR is bold and in red text if the data element is mandatory. If some values are still null for a mandatory data element, then the State totals table displays the total value as bold, red text. In addition, the State totals table indicates the data aging status of each data element using cell shading and cell comments.

3.2.3 State Trend Report

The State Trend Report (fig. 2) displays state totals for all compilation years from 1960 to current. The data for years 1985 to current are retrieved from the Best Available county datasets; state totals for 1960 to 1980 are retrieved from the Best Available state-level datasets. During the data review period for a compilation year and until the compilation data are released to the public, the Best Available dataset will be calculated from data elements in all data aging statuses. For the early years (1960–2010), totals will be calculated only from approved and published data elements. The report is formatted like the trends table in the 5-year national circular and can be produced with rounded or unrounded values.

The first time the State Trend Report is run, the user must generate the trends dataset. For subsequent runs, the trends dataset should be regenerated if any of the underlying county or state-level datasets might have changed. Only users with write or NWULT access to the state can activate the Regenerate Trend Dataset button. Users with read access may create the rounded or unrounded values reports from data generated by others with authorized access.

If no historical data for a data category are available, N/A (not available) is displayed in the State Trend Report. For the 2015 compilation, the U.S. territories American Samoa, Guam, and Northern Mariana Islands were added as new states.

3.2.4 Log Report

The log reports provide access to metadata, data aging history, dataset names, citations, Best-Available status, and the source dataset name, if any, for a single dataset. When the Log Report is created, it makes a single Excel workbook with individual tabs for six reports. The user, date, and time are logged for all of these activities and are displayed in the reports. The six reports are listed below.

- Metadata includes basic information about the dataset such as area type, year, data dictionary, and storage option.
- Data Aging History records the old and new aging status of data elements.
- Best Available History tracks the period of time the dataset was the Best Available.
- Dataset Name Changes includes the old and new names and an explanation for the change.
- Citation History reports the citations added and deleted from the dataset. Only NWULT members have the capability to manage the citation reference list using an application that allows citations to be added, edited, or deleted.
- Copied From-To displays when a new dataset was copied from an existing dataset. This report includes a copy of the dataset history.

3.3 Quality Control Reports

Once data have been compiled and entered into AWUDS, they need to be checked. AWUDS produces three Quality-Control Reports (fig. 2) to assist with data checking, in addition to the Entered Data Elements, which is also useful for data checking.

3.3.1 Quality-Assurance Program

The Quality-Assurance Program checks for a number of errors and inconsistencies in a dataset, such as Domestic withdrawals in a county that has no self-supplied population, and generates a report of the results in Microsoft Excel. Not all of the errors detected are necessarily a problem. For example, if the irrigation withdrawal occurs in one county but the irrigated acreage is in another, the program will report an error. It is good practice to note false errors and the reasons for them in the compilation documentation. The list of error checks performed by the Quality-Assurance (QA) program is listed on the ReadMe worksheet in the output file.

The Quality-Assurance Program also performs a number of calculations such as per capita, consumptive-use percentage, water coefficients (such as water to produce a

gigawatt-hour of power), irrigation application rate, and reclaimed wastewater percentage (which may be useful to spot outliers in the dataset). The Quality-Assurance Program cannot be run on datasets created with the 1960–1965 or 1970–1980 data dictionaries. The user will receive a warning message stating that the Quality-Assurance Program for the selected dataset cannot be run.

3.3.2 Compare State Totals by Area

The Compare State Totals by Area quality-control measure compares the state totals for the same year for two different area types, such as county and HUC-8, county and aquifer, or HUC-8 and aquifer. The report will display the difference between the sums of the data elements for the two area types in the two selected datasets. If more than one area type is mandatory for a compilation, the total for each data element must be the same for the different area types. The report layout is in a format similar to the AWUDS coding form. This program should be run often when entering and editing data for more than one area type for the same year.

3.3.3 Compare Data for 2 Datasets

The Compare Data for 2 Datasets is a quality-control report that compares data values between two datasets for the same area type (county, HUC-8, aquifer, county-aquifer, or state-total). In practice, this report is used to compare data for the current compilation with the previous compilation. The results are presented on one Excel worksheet organized by the area types first, then by category with one data element per row. Included in each row is the name and code for the area type, the water-use category, the data element name, the value from dataset 1, the value from dataset 2, the absolute difference, and the percent difference. Because the presentation is one data element per row, the report can be sorted by the different columns to identify the entries with the greatest changes. If a specific area (county, HUC, aquifer, county-aquifer) is present in one dataset but not in the other, AWUDS will display a pop-up warning message and will not include the unmatched area in the report.

The difference calculations are not performed when the data element for one year is null and the other year has a non-zero value. However, if the base dataset value is zero and the second dataset has a non-zero value, then **** is used in the percent change cell to indicate an infinite percent increase.

3.4 Other

AWUDS offers three additional operations: Export Data, Create a New Single State Dataset, and Create a New State-Level Dataset (available to NWULT users only). The Export Data utility allows the user to export data to a Microsoft Excel spreadsheet. The Create a New Single State Dataset operation allows the use to create a new dataset with area type and data dictionary options.

3.4.1 Export Data

AWUDS allows the user to export data for multiple water-use categories and areas within a state. The data are written to a specially formatted Microsoft Excel spreadsheet, which is the required format for the Import Data operation. The Export Data output file provides a data entry template for a new dataset for the current AWUDS application.

The Export Data output has color-coded cell outlines to indicate mandatory data elements. Red-bordered cells are mandatory data elements, blue-bordered cells are mandatory but nulls-allowed data elements, and black-bordered cells are optional data elements.

This utility is useful for batch editing of a large number of values. The user can export selected data, edit data in that file in Microsoft Excel, and then re-import the modified data to the same or a different dataset.

- Tip: Do not copy and paste cells from older versions of AWUDS export spreadsheets because data element names may have changed or additional changes may have been implemented in the current application.

3.4.2 Create New Single State Dataset

At the beginning of a new compilation or other project, the user must create a new dataset for the area type to be stored. All values are null and are assigned the data aging status of working in a newly created dataset. Write access for the state is required to create a new dataset. Datasets can be created for compilation years through 2015 and for non-compilation years through 2099.

The user selects the unit area (county, HUC-8, aquifer, or county-aquifer) and the data dictionary to be used. As of 2017, AWUDS utilizes five data dictionaries (1960–1965, 1970–1980, 1985–1995, 2000, and 2005–2015). Depending on the data dictionary selection, other selections will appear for the data elements to be included in the dataset. The user must also indicate the year of the data.

For the 2000 and 2005–2015 data dictionaries, there are two categories, Public Supply and Irrigation, with storage option choices for the user. The Public Supply population served can be reported as the total population served or reported separately for groundwater population served and surface-water population served. For the irrigation storage option, the user must select whether irrigation data will be reported as the total irrigation water use or whether crop irrigation and golf-course irrigation will be reported separately. The storage options selected apply to all areas in the dataset.

Each dataset must be defined by a unique name that is limited to 32 characters and must not include a comma. Note that the name should not include the year of the data because AWUDS appends the year of the dataset to the beginning of

the dataset name in all picklists. The first dataset created in a compilation year will be named Compilation by the system. A Description field is available to store additional information about the dataset.

3.5 Create Data Dictionary Report

The data dictionary for a dataset defines the set of water-use categories and associated data elements stored for that dataset, and definitions are dependent on the area type for the dataset as well as the compilation year. The user also chooses several storage options, which define the allowed data elements, when creating a dataset. The Data Dictionary Report shows the full list of data elements and associated metadata for each AWUDS storage option and lists the data elements that are calculated by AWUDS for reports and the equations used.

Clicking the Create Data Dictionary Report button immediately generates the reports. A popup window at report completion states the directory where the reports were written, which will be the current AWUDS report directory. AWUDS writes one Excel file for each area type with a date-time tag on the filename:

- DataDictionaryAquifer-[date]-[time].xlsx,
- DataDictionaryCounty-[date]-[time].xlsx,
- DataDictionaryCountyAquifer-[date]-[time].xlsx,
- DataDictionaryHUC4-[date]-[time].xlsx,
- DataDictionaryHUC8-[date]-[time].xlsx, or
- DataDictionaryState-[date]-[time].xlsx.

Each Data Dictionary Report file contains worksheets for the storage options available for that area type. For example, the county data dictionary report contains worksheets for the following storage options: 1960 POPsplit (Population split), 1970 POPsplit, 1985 POPsplit, 2000 IRsplit (Irrigation split) and POPsplit, 2000 IRsplit, 2000 POPsplit, 2000, 2005 IRsplit and POPsplit, 2005 IRsplit, 2005 POPsplit, and 2005.

3.6 AWUDS Operations for Multi-State Datasets

A Multi-State dataset is a collection of Single-State datasets for one year and one area type. A Multi-State dataset must use the same data dictionary but can use different storage options. When mixed storage options are included in the multi-state dataset, the application will alert the user that publicly supplied population and (or) irrigation values will be reported as a sum for each area in the multi-state dataset.

The AWUDS program creates two types of Multi-State datasets: Published Multi-State and Best Available Multi-State. Published Multi-State datasets include all state datasets for a given compilation year (1985–current) assigned to a specific citation. Best Available Multi-State datasets consist of the state datasets for a specific year with the original approved data or subsequent revisions to this data. All users can retrieve these datasets.

In addition to the datasets created automatically, users can create custom Multi-State datasets. To limit the type of Multi-State datasets visible in report picklists, use the Multi-State Dataset Selection options on the State tab. To create a custom Multi-State dataset, click on the Create Multi-State Dataset radio button on the State tab, then click the Create Multi-State Dataset button. The Create Multi-State Dataset window opens and allows the user to select a unit area type, data dictionary, year, and datasets from the Available State Datasets list. The user enters a name and a description for the custom Multi-State dataset being created. Retrievals from a Multi-State dataset created by a general user will contain only Approved and Published data. Retrievals from a Multi-State dataset created by an NWULT user will contain all data regardless of data aging status.

Available operations for Multi-State datasets include

- Dataset Metadata (Edit Metadata, Delete Dataset),
- Basic Tables by Category, and
- Export Data.

With the Dataset Metadata operation, users can edit the Multi-State dataset name and description and can delete any datasets they created. NWULT users can delete any user-created Multi-State dataset. Publication and Best Available Multi-State datasets are system generated and cannot be deleted. Dataset Metadata also allows a user to see a list of the state datasets included in a Multi-State dataset.

The Basic Tables by Category report for a Multi-State dataset is available only for county datasets. The report uses the same format as the Basic Tables by Category for a single state, but the rows of the report give state totals.

The Export Data operation exports all data for the Multi-State dataset and is available for all area types except HUC-4. Export Data for a Multi-State dataset includes a number of calculated values such as totals, per capita values, and application rates, which are not included in the Single-State dataset Export format. Calculations will not be performed unless the components of the calculation are complete with no nulls.

4 How-To For Selected AWUDS Tasks

This section gives step-by-step instructions for the primary of operations of data creation, data entry and editing, quality assurance, and data aging. The tasks are described and referenced by section number in the following overview of a typical AWUDS workflow.

- Create the AWUDS dataset that will store the data (see section 4.1, Creating a New Dataset).

- After creating the new dataset, make a Microsoft Excel input template for data entry (see section 4.2, Creating a Dataset Input Template).
- Once one or more data elements have been compiled and entered in the Excel file, the data can be imported into AWUDS (see section 4.3, Importing Data).
- Use the AWUDS QA tools for review of the inputted data. Run the Compare 2 Datasets using the current and previous compilation datasets to identify any unreasonable or unexplainable changes in values or percentages.
- Once data are entered into AWUDS, the review process may require revising many values (see section 4.4.1, Editing Data Using Microsoft Excel) or revising just a few values (see section 4.4.2, Editing Data Interactively).

After editing is complete, the data are aged to indicate they are ready for review by a regional specialists on the National Water Use Science Project team (see section 4.6, Mark Data as Ready for Review). When the review and approval process is complete, some or all of the data in an AWUDS dataset may be published in a USGS publication or another outlet, or released as a dataset with a Digital Object Identifier (DOI). When the publication or dataset is released to the public, the supporting AWUDS dataset can be marked Published in AWUDS (see section 4. 7, Marking Data Published and Assigning Citations). If a later project or a revision to a publication produces a second approved or published AWUDS dataset for the same state, year, and area type, the user can designate which of these two datasets should be the preferred data (see section 4.8, Designating Best Available Data).

When working with a sub-area of a state, the retrieval process in AWUDS can be simplified by saving the selection of counties, HUC-8s, or aquifers in the sub-area to a file that can be reloaded for later retrievals (see section 4.9, Saving and Retrieving User Selection Areas).

4.1 Creating a New Dataset

Before new data can be entered in AWUDS, the user must decide what data will be collected and create the structure (storage option) for the data by creating a new dataset. If data will be compiled for aquifer, county-aquifer, or HUC-8 areas as well as counties, an individual dataset for each area type must be created.

Step By Step:

1. When AWUDS is opened, the State tab will appear on the screen. Begin by selecting the state from the State picklist. Once a state has been selected, the Operations tab will automatically open. Select the Create New Single State Dataset radio button. Additional fields will appear on the Operation tab.
2. Chose one of the Area Types: county, HUC-8, aquifer, or county-aquifer.
3. The Data Dictionary defaults to the current data dictionary for the area type selected. Use the default, or select the applicable data dictionary from the pull-down menu and enter the year of data. For compilation years, the data dictionary for that specific compilation must be used. In non-compilation years any available data dictionary can be used.
4. Select one option from the PS Population Served choices if creating a new year for county or HUC-8 dataset. Choose the radio button by Unit Area (GW/SW) when reporting the publicly supplied population by groundwater and surface-water sources. Select the other [by Unit Area (Total)] button when reporting the total publicly supplied population served for each county or HUC-8. For aquifer and county-aquifer datasets, only groundwater population served is reported.
5. Select one option from the Irrigation choices. Report Irrigation data are split into the subcategories of Crop Irrigation and Golf-Course Irrigation or appear as total Irrigation. If the Irrigation category is not split into Crop and Golf-Course Irrigation, water withdrawals for irrigating golf courses should be added to the water withdrawals for crop irrigation to determine the total irrigation withdrawals.
6. If the user is creating a county dataset for a compilation year, the program will assign the name Compilation. If not, enter a short (32 characters or less) name for the new dataset, and an optional description if applicable. Do not include the year of data or the terms Compilation or Best Available in the dataset name; AWUDS will append these to the name chosen in the dataset picklists, when applicable.
7. The naming conventions used for the datasets transferred to the AWUDS 2.0 release from earlier databases include

- Compilation datasets support the 5-year national circulars,
- Compilation–Revised identifies revisions of Compilation datasets, and
- Non-Compilation with all non-compilation-year datasets and datasets for non-mandatory areas in compilation years.

8. The 512-character description field can be used for notes on alternative sources or methods for secondary datasets.

9. Click Execute to create the new dataset. A message box will be generated indicating the name of the dataset that was successfully created.

4.2 Creating a Dataset Input Template

To minimize data entry errors, use the Microsoft Excel files generated by the AWUDS application to enter data. These template files contain row and column labels in the format AWUDS needs to read the data into the database and have the full data-element name in tooltips that appears as the cursor is moved over a cell. Cells for mandatory data elements will be outlined in red. Data elements identified as mandatory-but-nulls-allowed are outlined in blue.

There are several data validation checks on the input worksheets. Cell formats are set to the correct number of decimal places for each data element, but this will be overridden if blocks of data from another spreadsheet are cut and pasted. An alternative is to use the paste special option in Excel and paste with values (only) selected. This will retain the cell formats yet allow the user to move a great amount of data at once.

If data are typed into the template file, Microsoft Excel will give a warning when a value is out of the valid range for the data element or when an alphabetic character is entered. If values are entered with too many decimal places, they will be automatically rounded to the correct precision (integer for facilities, 3 decimal places for populations reported in thousands of persons, and 2 decimal places for all other data elements) using USGS rounding rules during the Import procedure.

AWUDS input template requirements:

- The file must be in the default Excel format for the most recent version of Microsoft Excel installed on the computer, .xls for Excel 2003 or .xlsx for Excel 2007 and later.
- Worksheets must be named with a valid water-use category code (see appendix 1). Additional worksheets can be present in the workbook but will be ignored by the Import operation.
- An individual worksheet cannot contain data elements for more than one water-use category.
- The first column of the block of data to be imported must be labeled Area and contain valid area codes for the target dataset—FIPS (Federal Information Processing Standards) codes for counties, hydrologic unit codes for HUC-8s, and national aquifer codes for aquifers. AWUDS uses the length of the area code to determine the type. Leading zeros in area codes must be retained.
- The remaining column labels for the import data must be valid data element codes for that category and the target dataset. At least one data element must be present. See the Data Dictionary report for the list of entered data elements.
- The import program will read a continuous Excel region that begins with the column header Area. The data block can reside anywhere in a worksheet; however, it usually starts around column one and row four. The Area column must be the left-most column. The data block will be read row by row until the first null or blank value is found in the Area column. Columns will be read left to right until the first column having a null or blank data element header is read. Hidden columns or rows will be read as if they were not hidden.
- Any columns of data labeled with invalid codes or other text strings will generate an error message during the import operation. However, the properly labeled data will be imported.

Step By Step:

1. Create a new dataset for the year and area type. (See section 4.1, Creating a New Dataset).

2. From the Operation tab, choose Export Data. AWUDS moves to the Area tab.

3. Choose the Area Type for the newly created dataset.

4. Choose the dataset from the Available Datasets box. The counts to the right of the Available Datasets box should show all values as null values and in working data aging status.

5. Choose the Add All button to create a template with fields for all the counties, HUC-8s, aquifers, or county-aquifers in the state, or select the areas individually if working with a sub-area of the state.

6. Click the Finalize Selections button. AWUDS moves to the Category tab.

7. Select the category or categories of water-use data elements for the template. During Import operations, AWUDS imports all data in a workbook containing cells with recognizable area and data element codes. Work with one category at a time or with a group of related categories such as Public Supply and Domestic. Make separate input templates for each category or groups of categories.

8. Click Export Data. A file dialog window will prompt for a directory and filename. For compilation datasets, accept the default name. For all other datasets assign a name, and click Save. A pop-up window will show the progress of creating the blank export file in Microsoft Excel.

9. To create additional templates from this dataset, change the selections on the Category tab and click Export Data again. Another option is to return to the Area tab, change the selections, and click Finalize Selections to move to the Category tab to complete the template.

♦ Tip: Use the Export/Import functions of AWUDS for data entry. If you must cut-and-paste values, don't forget to change the formatting (fig. 7).

4.3 Importing Data

After the user has selected the applicable storage options, the exported report serves as the data entry template for the new dataset. This export file should be populated with the required data and consists of formatted Microsoft Excel worksheets (See section 4.2 for the format requirements) that provide additional data validation checks. If attempting to input invalid entries, Microsoft Excel provides a Bad Data Value popup message box.

If values with too much precision are in the spreadsheet, they will be rounded off to the appropriate number of decimal places (zero or an integer for facilities, 3 for population reported in thousands of persons, and 2 for all other data elements) during import using the USGS rounding method. Values that are outside the valid range for the data element (valid range is generally 0 to 99999.99, -999.99 to 9999.99 for Hydroelectric power generated by offstream use) will produce an error message in a popup window. Error messages will also be written to an external file. Once the dataset has been populated, the Step by Step instructions must be performed to import data into AWUDS from a Microsoft Excel spreadsheet.

Step By Step:

1. Select Import Data from External File from the Operation tab. The Import Data File frame will appear on the Operation tab.

2. Click on the Browse button. A dialog box will pop up, which is based in the directory where AWUDS reports are stored. Select a file for import.

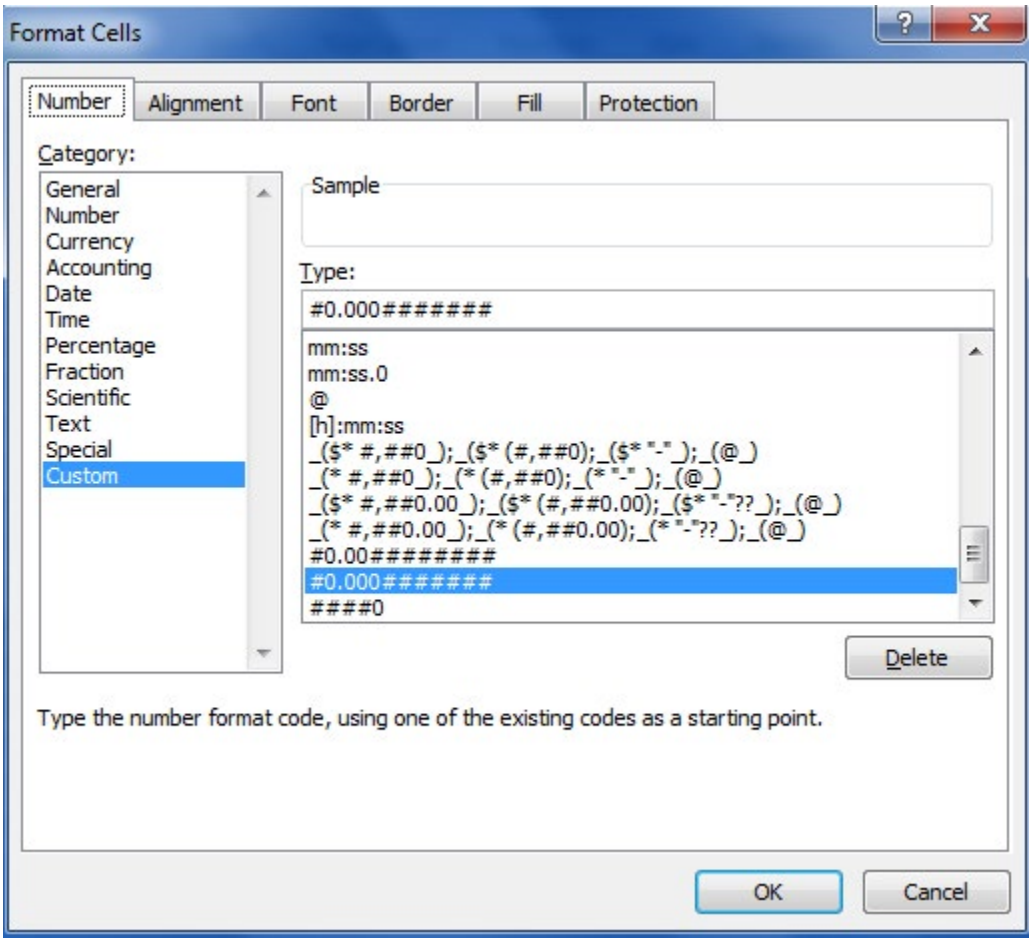


Figure 7. Example of custom formatting of AWUDS Export file for data entry.

3. AWUDS will read the file to determine the area type and will populate the Available Datasets list box with datasets for the same area type. Select the dataset to use for the import. Note that any existing value in the dataset will be overwritten during the import operation. Any cells that have blank values in the import area of the worksheet will delete any existing value. The user will be prompted by a Confirm Overwrite of Data message box before any data are changed.

4. Once a file and dataset have been selected, the Execute command button will become enabled and should be clicked.

5. AWUDS performs multiple quality-control checks on the data being imported and displays a progress bar while the import process is underway. Errors are written to the text file ImportError.txt, and data elements that were rounded on import are written to a text file named ImportRounding.txt in the same directory as the import file.

Attempts to modify or delete In-Review, Approved, or Published data elements will cause AWUDS to stop the import operation, and the values will be written to a text file named ImportErrorDataAging.txt in the same directory as the import file.

4.4 Editing Data

Only data elements in working data aging status can be edited. There are two methods to enter or edit data in AWUDS. The Interactive Data Input/Edit operation allows the user to edit values directly through the AWUDS interface. However, the user is restricted to editing one category of one area type (county, HUC-8, aquifer, or county-aquifer). To edit multiple categories and multiple area units, the user should use the Import Data/Export Data method.

4.4.1 Editing Data Using Microsoft Excel

To modify data by batch editing, first export the existing data, make the edits in Microsoft Excel, then re-import the data. To edit data using Microsoft Excel, complete the following steps.

Step By Step:

1. Export selected area types and categories from the dataset using the Export operation.

2. Close AWUDS and open the newly created spreadsheet in Microsoft Excel.

3. Edit the values for the data fields.

4. Save and then close the Microsoft Excel spreadsheet.

5. Restart the AWUDS program.

6. Import the values from the modified export file. (See section 4.3, Importing Data.) AWUDS will present a warning when the import will overwrite an existing value. If there are many changes and the import file is correct, click the Yes to All button in the message window to suppress the remaining warnings.

4.4.2 Editing Data Interactively

If there are only a few edits to make in a dataset, the Interactive Data Input/Edit operation provides a means of editing data elements for one area (county, HUC-8, aquifer, or county-aquifer) and water-use category at a time.

Step By Step:

1. Select Interactive Data Input/Edit from the Operation tab and AWUDS will move to the Area tab.

2. Select the applicable Area Type radio button. The Available Datasets list box will be populated with all areas for that state.

3. Select the applicable dataset from the Available Datasets list.

4. Select the area to be edited from the Available list. Only areas that are valid in the year of the selected dataset will be displayed. To select an area from the list, either double-click on the item or click on the item and select the Add button to move the area name to the Selected list. This selection process refreshes the Available list. Only one area can be selected at a time.

5. The Finalize Selections button should now be enabled and should be clicked. AWUDS moves to the Category tab.

6. Select the applicable category from the Available list box. Only one category can be selected at a time.

7. The Edit Data command button should now be enabled and should be clicked. AWUDS moves to the Values tab.

8. For a compilation year, the Values tab for county data is color coded. Red-shaded cells indicate mandatory data elements. One or more mandatory elements can be entered and saved during an interactive session. Fields with a light blue background are mandatory, but nulls are allowed. White fields are optional data elements.

9. Edit the applicable values on the Values tab, and press the Save command button when finished. This button will not become enabled until a data value has

been changed from its original value. Clicking on the Delete All Fields in Category button will replace all data fields in the category with null values.

10. Click on the Category or Area tabs to select other data elements to edit without returning to the Operation tab.

4.5 Running the Quality-Assurance Program

Values are checked in many ways along the data entry path before the Quality-Assurance Program is run. Follow the two steps outlined below to minimize user error.

- Avoid formatting mistakes—First, the Input worksheet (generated by the first Export of a dataset) is formatted to alert the user of values that do not conform to permitted values, including too many decimal places. Cutting and pasting values from other Excel worksheets defeats this error check.
- Use the correct storage option for population served by public supply and for irrigation—If the user attempts to enter a worksheet to a dataset with a different storage option for population served or irrigation, that worksheet is rejected, although properly formatted values in other worksheets included in the Export template are accepted.

Step By Step:

1. Select the Quality-Assurance Program from the Operation tab. AWUDS moves to the Area tab.
2. Select the Area Type (county, HUC-8, aquifer, or county-aquifer), then select the dataset from the Available Datasets list. Choose one or more areas from the Available list. The Selected list will display the area choices. Select the Output Areas radio button (by name, by code, or by name and code). Click on the Finalize Selection button. AWUDS moves to the Category tab.
3. All water-use categories are pre-selected by the software. Click the Perform Quality Control Measure button. The user will be prompted to assign a file name. A progress bar will indicate when the operation has been completed.

The Quality-Assurance report is a multi-worksheet Microsoft Excel file that includes a Read Me tab (fig. 8) identifying the error conditions and formulas used to generate the error report. The Read Me text is specific to the data storage options chosen. A Summary tab indicates the number of errors generated by each subject area tab. The subject tabs are

- Population—mismatches between population and withdrawals,
- Consumptive Use Errors—consumptive use exceeds withdrawals or is null,
- Irrigation—mismatches between irrigated acreage and withdrawals,
- Hydroelectric—mismatches between power generated and instream use or withdrawals,
- Thermoelectric—mismatches between power generated and withdrawals, and
- Facility Count—mismatches between facility counts and withdrawals.

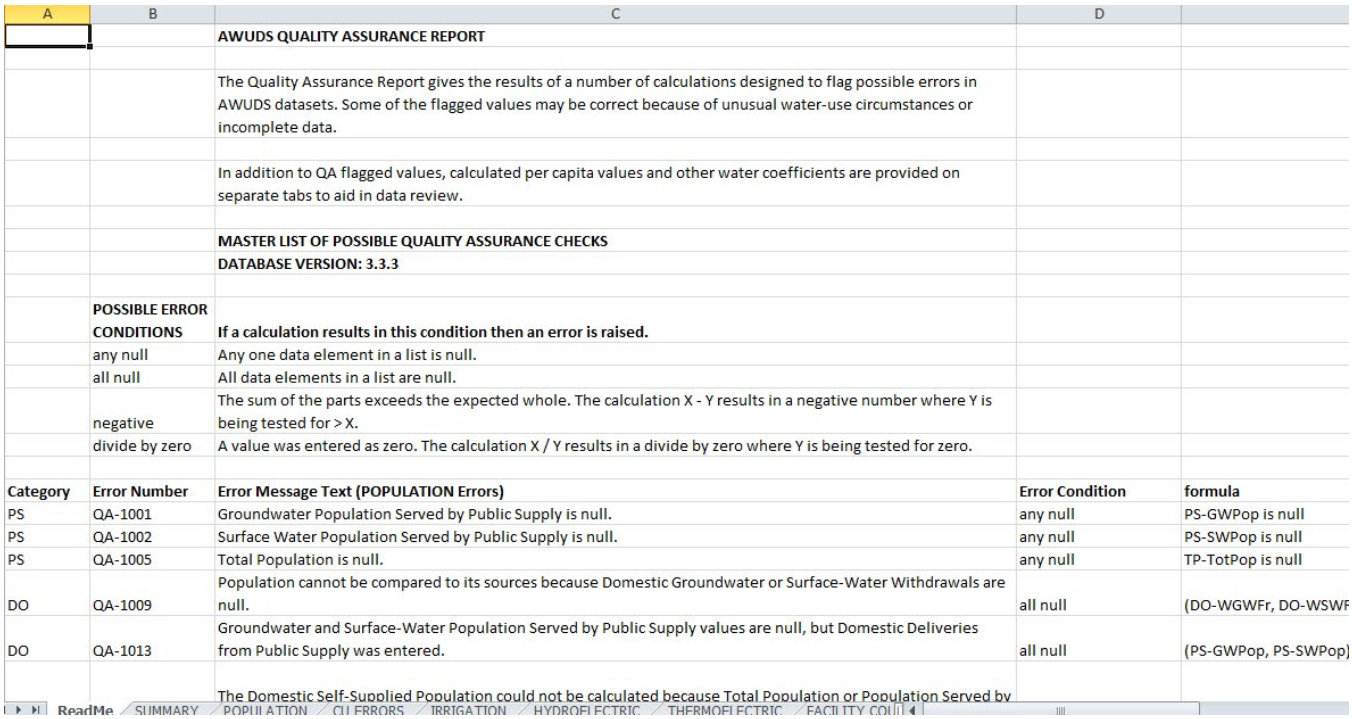
The QA Program evaluates 1 of 4 primary error conditions in related data for each of the subject area formulas. This syntax check evaluates the following:

- Any null—any one data element in a formula is null,
- All null—all data elements in a formula are null,
- Negative—the sum of the parts exceeds the expected whole,
- The calculation X/Y results in a negative number where Y is being tested for X, and
- Divide by zero—a value was entered as zero. The calculation X/Y results in a divide by zero where Y is being tested for zero.

For each subject area, a tab displays errors by, for example,

- Area Name (Atlantic County),
- Area Code (001),
- Category (PS),
- Error Number (QA-1001),
- Error Message Text (Groundwater Population Served by Public Supply is null),
- Error Condition (any null), formula [PS-GWPop (Groundwater Population Served by Public Supply) is null], and
- Values of Interest [PS-GWPop: is null; PS-SWPop (Surface water Population Served by Public Supply): is null; DO-PSDel (Domestic, deliveries from public supply): 1.00].

The QA Program searches for missing values in all areas, not just mandatory data elements. Some errors may not be relevant because data were not collected or reported in all water-use categories for the same type of data element (such as saline withdrawals). This issue can be resolved by sorting the subject area output by error number. Research consistent errors throughout the dataset that should be corrected. Cull the worksheet by eliminating error messages that are not related to the dataset. Sort the culled worksheet by Area Name or



		AWUDS QUALITY ASSURANCE REPORT		
		The Quality Assurance Report gives the results of a number of calculations designed to flag possible errors in AWUDS datasets. Some of the flagged values may be correct because of unusual water-use circumstances or incomplete data.		
		In addition to QA flagged values, calculated per capita values and other water coefficients are provided on separate tabs to aid in data review.		
		MASTER LIST OF POSSIBLE QUALITY ASSURANCE CHECKS		
		DATABASE VERSION: 3.3.3		
	POSSIBLE ERROR CONDITIONS	**If a calculation results in this condition then an error is raised.**		
	any null	Any one data element in a list is null.		
	all null	All data elements in a list are null.		
	negative	The sum of the parts exceeds the expected whole. The calculation X - Y results in a negative number where Y is being tested for > X.		
	divide by zero	A value was entered as zero. The calculation X / Y results in a divide by zero where Y is being tested for zero.		
Category	**Error Number**	**Error Message Text (POPULATION Errors)**	**Error Condition**	**formula**
PS	QA-1001	Groundwater Population Served by Public Supply is null.	any null	PS-GWPop is null
PS	QA-1002	Surface Water Population Served by Public Supply is null.	any null	PS-SWPop is null
PS	QA-1005	Total Population is null.	any null	TP-TotPop is null
DO	QA-1009	Population cannot be compared to its sources because Domestic Groundwater or Surface-Water Withdrawals are null.	all null	(DO-WGWFr, DO-WSWF
DO	QA-1013	Groundwater and Surface-Water Population Served by Public Supply values are null, but Domestic Deliveries from Public Supply was entered.	all null	(PS-GWPop, PS-SWPop)
		The Domestic Self-Supplied Population could not be calculated because Total Population or Population Served by		

ReadMe | SUMMARY | POPULATION | CU ERRORS | IRRIGATION | HYDROELECTRIC | THERMOELECTRIC | FACILITY COU

Figure 8. The Read Me tab in the AWUDS program showing an example of error messages for the Quality-Assurance Program.

Area Name	**Area Code**	**Category**	**Error Number**	**Error Message Text (CU ERRORS ERRORS)**	**Error Condition**	**formula**
Atlantic County	001	DO	QA-1017	The Domestic, Fresh, Consumptive Use is null, but, the Domestic, fresh, groundwater and surface-water withdrawals and public supply deliveries were entered.	any null	DO-CUsFr is null, but either DO-WGWFr, DO-WSWF
Atlantic County	001	MI	QA-1021	The Mining, Fresh, Consumptive Use cannot be compared to its sources because the Fresh Consumptive Use is null.	any null	MI-CUsFr is null, but either MI-WGWFr, MI-WSWFr
Atlantic County	001	PO	QA-1025	Thermoelectric Power (Once-through cooling), Fresh, Consumptive Use cannot be compared to its sources because the Fresh Consumptive Use is null.	any null	PO-CUsFr is null, but either PO-WGWFr, PO-WSWF
Atlantic County	001	IC	QA-1027	The Irrigation, Crop, Fresh, Consumptive Use cannot be compared to its sources because the Fresh Consumptive Use is null.	any null	IC-CUsFr is null, but either IC-WGWFr, IC-WSWFr, c
Atlantic County	001	IG	QA-1028	The Irrigation, Golf, Fresh, Consumptive Use cannot be compared to its sources because the Fresh Consumptive Use is null.	any null	IG-CUsFr is null, but either IG-WGWFr, IG-WSWFr,
Atlantic County	001	LI	QA-1030	The Livestock, Fresh, Consumptive Use cannot be compared to its sources because the Fresh Consumptive Use is null.	any null	LI-CUsFr is null, but either LI-WGWFr or LI-WSWFr
Atlantic County	001	MI	QA-1053	The Mining, Saline, Consumptive Use cannot be compared to its sources because the Saline Consumptive Use is null.	any null	MI-CUsSa is null, but either MI-WGWSa or MI-WSV
Atlantic County	001	CO	QA-1071	The Commercial, Fresh, Consumptive Use cannot be compared to its sources because the fresh withdrawals, public supply deliveries, and reclaimed wastewater were not entered.	all null	(CO-WGWFr , CO-WSWFr , CO-PSDel , CO-RecWW)
Atlantic County	001	IN	QA-1073	The Industrial, Fresh, Consumptive Use cannot be compared to its sources because the fresh withdrawals, public supply deliveries, and reclaimed wastewater are null.	all null	IN-WGWFr, IN-WSWFr, IN-PSDel, and IN-RecWW ar
Atlantic County	001	AQ	QA-1097	The Aquaculture, Saline, Groundwater and Surface-water Withdrawals are null, but the the Aquaculture, Saline, Consumptive Use was entered.	any null	Either AQ-WGWSa or AQ-WSWSa are null, but AQ-C
Atlantic County	001	AQ	QA-8070	The Aquaculture, Saline, Consumptive Use is greater than the sum of saline withdrawals.	negative	AQ-WGWSa + AQ-WSWSa - AQ-CUsSa
Bergen County	003	CO	QA-1016	The Commercial, Fresh, Consumptive Use cannot be compared to its sources because the Fresh Consumptive Use is null.	any null	CO-CUsFr is null, but either CO-WGWFr, CO-WSWF
Bergen County	003	MI	QA-1021	The Mining, Fresh, Consumptive Use cannot be compared to its sources because the Fresh Consumptive Use is null.	any null	MI-CUsFr is null, but either MI-WGWFr, MI-WSWFr
				The Irrigation, Crop, Fresh, Consumptive Use cannot be compared to its sources		

Figure 9. The Consumptive Use tab in the AWUDS program showing an example of error messages for the Quality-Assurance Program.

Category to view errors related to a specific area type (county, HUC) or water-use category. Verify that all mandatory data elements are included.

There are other tabs to identify problem data. These areas include water coefficients, per capita, consumptive-use percentages, and reclaimed wastewater.

- Water Coefficients relate to power generation and irrigation application rates.
- Per Capita Water Use relates to total, public supply, and domestic populations.
- CU Percents (Percent Consumptive Use) is presented by water-use category.
- Reclaimed WW (Reclaimed Wastewater) is presented by water-use category.

The Quality-Assurance Program is available only to users with write or NWULT access.

♦ Tip: The Quality-Assurance Program identifies many inconsistencies with the dataset that are not problems for the reviewer or things to be changed to correct data values.

4.6 Mark Data as Ready for Review

When the data input has been verified following the quality-assurance checks, change the data element block from Working to In-Review data aging status. No additional modifications are allowed until the regional specialists on the National Water Use Science Project team review the dataset and either approve the data element block or return the data aging status to Working, allowing the dataset creator to edit the data. A general user cannot change data from In-Review to Working status. Note that for mandatory data elements, every data category must have a value: data elements cannot be moved to In-Review status if any mandatory elements are null.

Step By Step:

1. Select Data Aging from the Operation tab. AWUDS moves to the Area tab.
2. Select the Area Type (county, HUC-8, aquifer, or county-aquifer), then select the dataset from the Available Datasets list. Click on the Proceed to Data Aging button. AWUDS moves to the Data Aging tab.
3. On the Mandatory Data Elements sub-tab of the Data Aging tab, click on a button to select a category. The buttons use the two-character category codes listed in appendix 1. The list of mandatory data elements for that category will appear on the tab. Only one category of data elements can be aged at a time, and all areas for that data element must be aged as a block.
4. Use the Change to: pull-down menu to select In-Review for all mandatory data elements for this category. All mandatory data elements must be aged as a block.
5. Repeat for all categories that are complete for review.
6. If there are non-mandatory data elements to be reviewed, click on the Non-Mandatory Data Elements sub-tab of the Data Aging tab.
7. Select a water-use category. The list of non-mandatory data elements for that category will appear on the tab. Only one category of data elements can be aged at a time. All data elements for that category can be aged to In-Review using the top Change to: pull-down menu or the data elements can be aged individually.
8. When all of the review-ready data elements have been aged to In-Review status, notify the regional specialists on the National Water Use Science Project team of the name of the dataset that is ready for review.

4.7 Marking Data Published and Assigning Citations

AWUDS stores publication citations for datasets that have been published; in fact, a dataset cannot be aged to Published status unless a citation is associated with it as part of the data aging process. The user must wait until the publication has been released before assigning the dataset to Published status. However, once one citation has been associated with the dataset, citations for other related publications (such as a cooperator report of approved data) can be added at any time.

A limitation of the AWUDS data aging structure is that, while data elements are aged to different statuses individually or in blocks of mandatory elements, a citation is linked to the dataset as a whole. If a publication covers only certain categories, AWUDS cannot track which data elements were published in that publication. AWUDS also cannot track information on a publication that covers only part of a state.

Step By Step:

1. Determine whether the publication is available on the AWUDS citation list. If not, request that it be added (see section 3.1.4.3, Assign Citations for how to request that a citation be added to AWUDS). To view the AWUDS citation list, use the Dataset Metadata operation. Select a Published dataset, such as a previous compilation, then click on the Assign Citations button. The reference list of citations is displayed in a list box. Use the Include national cita-

tions option below the Available Citations list box to show or hide reports of national extent.

2. To mark the first data elements in a dataset as Published and assign a citation, select the Data Aging operation. AWUDS moves to the Area Type tab.

3. Select the Area Type and dataset on the Area tab. Click on the Proceed to Data Aging button. AWUDS moves to the Data Aging tab.

4. On the Mandatory or Non-Mandatory Data Elements tab, select the first category of Approved data to be marked Published.

5. Use the Change To: pull-down menu to change the Data Aging status to Published, and click the Confirm button. AWUDS will open a pop-up window and ask to confirm; a second window will warn that a citation must be assigned to move data to Published status. The Dataset Citations popup window will open for selection of a citation from the list of Available Citations.

6. Select the correct citation from the list and click Assign Citation, then press Save and Close to save the assignment. If the appropriate citation is not on the reference list, click Cancel to stop the data aging process and leave the dataset unchanged. (Follow the procedure given in section 3.1.4.3, Assign Citation to have the citation added to the reference list.)

7. Repeat the data aging steps to move the rest of the published data elements to Published status. AWUDS will not ask for the citation again because the citation is already associated with this dataset.

8. If data from the same dataset already in Published status is published in a second publication, an additional citation can be assigned to the dataset. Select Dataset Metadata on the Operation tab. AWUDS moves to the Area tab.

9. Select the Area Type and dataset on the Area tab. Click on the Assign Citations button. AWUDS opens the Dataset Citations popup window showing the citations already assigned to this dataset and other citations in the reference list.

10. Click on the citation to add, then the Assign Citation button. Press the Save and Close button to save the assignment.

4.8 Designating Best Available Data

Data can be updated with the current or most accurate data for an area by creating a new dataset or modifying an existing dataset. The Best Available flag designates the dataset that in the judgment of the user is the best data to use for that year and area type. The Best Available flag is separate from the data aging status, but a Best Available dataset must contain at least one Approved or Published data element.

The phrase Best Available appears in the title bar when working with such a dataset. Best Available also appears in all dataset picklists and in the header of reports generated with the dataset.

Step By Step:

1. If there is only one dataset for a given year and area type, it will become the Best Available dataset when one data element is aged to Approved or Published status. If all of the Approved or Published data elements are reverted to Working or In-Review, AWUDS will remove the Best Available flag automatically.

2. If there are two datasets for the same year and area type with data elements in Approved or Published status, the Best Available flag can be changed from one to the other. Select the Dataset Metadata operation on the Operation tab. AWUDS moves to the Area tab.

3. Select the Area Type and dataset, and click on the Change Best Available button.

4. In the popup window, click on the radio button beside the dataset that should be flagged as Best Available, and click OK.

The user can view the history of the Best Available designation for a single year and area type by retrieving the Log Report with the Best Available History tab (see section 3.2.4, Log Report in this manual).

4.9 Saving and Retrieving User Selection Areas

The user can save the selection of a sub-area of a state (counties, HUC-8s, aquifers, or county-aquifers) to a file that can be reloaded for later retrievals. The Basic Tables by Category, Export Data, and Entered Data Elements reports can generate a Selected Areas file that can be used interchangeably among the reports.

Step By Step:

1. Select one of the following report types on the Operation tab: the Basic Tables by Category, Export Data, or Entered Data Elements. On the Area tab, select the Area Type and dataset, and select the counties, HUCs, or aquifers in the sub-area. The Save Areas button will be enabled.

2. Click on the Save Areas button, and a dialog box will appear. Type in a file name to identify the selected subset, then click Save. A text file will be

saved in the AWUDS Reports directory or in another chosen directory.

3. To re-use the saved selection, select the applicable Operation and dataset. The Retrieve Areas button will be enabled. Browse to the saved file of sub-areas, and click the open button. AWUDS will read the stored selections and place the saved areas in the Selected list box on the Area tab.

5 AWUDS and NWISWeb

A limited set of data from AWUDS is made available on NWISWeb for each state. The data included are all Best Available datasets of county data in Approved or Published data aging status from compilation years beginning in 1985. The AWUDS data in NWISWeb is refreshed quarterly.

Data for the current compilation are withheld from NWISWeb until the publication of the national circular so that the data and report are made available simultaneously to all users, USGS personnel, and the public. The quarterly updates are suspended during the data review period of the compilation to assure that data subject to later revisions are not identified as final data prior to publication of the national circular.

State water-use specialists periodically check their state's water-use data on NWISWeb with the data in the AWUDS database to make sure the correct data are reported to the web.

6 NWULT User Functions

NWULT users have access to additional functionality in AWUDS chiefly for data review. In addition, NWULT users work with state-level datasets that involve multiple states. Some of this functionality is mentioned in other sections of the documentation but is repeated here for easy reference.

6.1 Access to Data

NWULT users can view all data regardless of the data aging status but cannot edit the data unless they have AWUDS write access to the state data.

6.2 Data Aging

Only NWULT users can change the data aging status of a dataset from In-Review to Approved or "de-age" data from In-Review or Approved to Working to allow the user with write access to edit the data. NWULT users can change Approved data to Published status and assign a citation to the dataset. Published data cannot be modified by a NWULT user.

6.3 Reports

When running reports, NWULT users can run the report as a general user with the Produce Report button or can use the Produce Report-All Data button. This function will retrieve all data regardless of data aging status and whether the NWULT user has write access to the state data.

6.4 State-Level Datasets

A State-Level dataset is a dataset that stores state total values, as opposed to the county, HUC, aquifer, or county-aquifer values stored in a Single-State dataset. State-Level datasets store the historical data from the national circulars that were published from 1960 to 1980, prior to the compilation of data at the county and HUC-8 level.

Only NWULT users can create, edit, or delete State-Level datasets. When creating the State-Level dataset, the user must select the data dictionary, the year, and the name the dataset. NWULT users have write access to all State-Level datasets because the access is not dependent on the Active Directory groups used to control write access to Single-State datasets.

All users can retrieve State-Level datasets. These datasets can be accessed by selecting the area type State-Level.

Data aging for State-Level datasets allows nulls to be present in mandatory data elements because many of the historical datasets did not include all of the current states stored by AWUDS.

6.5 Other NWULT Functionality

NWULT users can retrieve all data stored in AWUDS by area type. A separate program can be run to output the data as text files that can be imported into a Microsoft Access database. Only a NWULT member has the ability to access all data stored or Best Available data for county, HUC-8, aquifer, and county-aquifer datasets in the AWUDS dump format.

With NWULT access, an Edit Citation function is available when a user selects Dataset Metadata from the Operations tab. The Edit Citation allows citations to be added, edited, or deleted.

Reference Cited

Bradley, M.W., comp., 2017, Guidelines for preparation of State water-use estimates for 2015: U.S. Geological Survey Open-File Report 2017–1029, 54 p., https://doi.org/10.3133/ofr20171029.

Glossary

Aggregate water-use data Data on water use and related information which is presented as a total for a political or hydrologic area, such as county, HUC-8, and principal aquifer. The aggregate value may be a sum of site-specific water-use values, an estimated value, or a combination.

Area Type or area unit The geographic or water resource area for which aggregated data are stored in a dataset. The options are county, HUC-4, HUC-8, aquifer, or county-aquifer. At this time (2017) HUC-4 data cannot be entered in AWUDS but can be aggregated from HUC-8 data for retrievals.

Best Available This is a designation in AWUDS identifying the preferred dataset for retrievals. A Best Available dataset must have at least one approved or published data element. If only one dataset for a given state, area type, and year is qualified, that dataset is automatically flagged as Best Available. The phrase Best Available will be displayed before the dataset name in AWUDS picklists and will be printed in the header of reports.

Citation This is a publication reference in which some or all of the data in a dataset were published. Publications can include USGS reports, cooperator reports, or any other scientific article or report. A citation is associated with a dataset as a whole.

Creator This is the user name of the person who created the dataset. This is not an editable field.

Data aging status This indicator shows the stage in the process of data entry and review for a data element or a group of data elements. There are four AWUDS data aging status levels: Working, In-Review, Approved, and Published.

Data dictionary Serves as a metadata repository for a set of national water-use categories with associated entered and calculated data elements. Except for the 2000 compilation year, data dictionaries are associated with multiple compilations. Because some of the water-use category components, mandatory data elements, and calculation formulas have changed, it was necessary to create data dictionaries that share characteristics and data definitions. As of 2017, five data dictionaries are defined, including 1960–1965, 1970–1980, 1985–1995, 2000, and 2005–2015. The data dictionary year is not the same as the year of data.

Data element This is a piece of data that can be stored for every area in a dataset, defined by the water-use category and an additional descriptor (for example, Public Supply surface-water withdrawals, in million gallons per day). Data elements can be thought of as the open cells on the AWUDS coding form. Data elements are frequently identified by a reference code in AWUDS screens and reports. The set of data elements in a dataset depends on the data dictionary and storage option used for that dataset. (See guidelines for 2015 national circular at https://pubs.er.usgs.gov/publication/ofr20171029.)

Dataset The suite of data stored in AWUDS for a single year and area type (county, hydrologic unit, aquifer, or county-aquifer) made up of a single value for each valid area and data element for that year. The list of valid data elements is dependent on the selected data dictionary.

Dataset description This is additional information about a dataset such as the sources of the data, the method of collection, or other characteristics of the data entered by the user. Dataset description is a 512-character field.

Dataset name This is a unique name assigned to a dataset by the user. Dataset name is limited to 32 characters and must not include a comma. The name should not include the year of the data or the phrase Best Available.

Metadata Metadata contain information about the database—data about data. Metadata consist of names of data elements, dataset creator, creation date, and whether the data

element is calculated or an entered value, but not the numeric or character value.

Multi-State dataset A Multi-State dataset is created from two or more state datasets for a single year and area type. The selected state datasets must use the same data dictionary. Multi-State datasets are used only for retrieving data. In previous versions of AWUDS, the phrase national database was used for a Multi-State dataset.

Null Value A null (blank value) is not the same as a zero; a null means no value was estimated or entered. However, a zero means an estimate was made, and the value was zero or was below the minimum value that can be stored in AWUDS.

State dataset A State dataset (also referred to as a Single-State dataset) is a dataset for a single state, year, and area type. The data are displayed for each area (county, HUC, aquifer, or county-aquifer) in the state in retrievals and exports.

State-Level dataset A State-Level dataset is a dataset that stores state total values, as opposed to the county, HUC, or aquifer values stored in a Single-State dataset. State-Level datasets store the historical data from the national circulars which were published prior to the compilation of data at the county and HUC-8 level (1960–1980).

Storage option The storage option defines the subset of data elements in a given data dictionary that can be stored in a given dataset. An example is choosing between storing total irrigation or reporting individual crop and golf-course irrigation. Another user choice is reporting the total population served by public suppliers or the population served individually by source of groundwater, and (or) surface water.

Appendix 1. Water-Use Category Abbreviations Used in AWUDS

Not every water-use category is valid in each data dictionary. Some abbreviations are used only for output, as totals of other categories, or for labeling worksheet tabs. Abbreviations are not in alphabetical order but are in the order in which they appear in the AWUDS program and on most AWUDS tables.

Table 1–1. Water-use category abbreviations used in AWUDS.

Abbreviation	Category name	Data dictionaries
TP	Total Population	All
PS	Public Supply	All
CO	Commercial	All
DO	Domestic	All
IN	Industrial	All
OI	Other Industrial	1960–1965, 1970–1980
PT	Thermoelectric Power Total	All
PF	Fossil-Fuel Thermoelectric Power	Pre-2000
PG	Geothermal Thermoelectric Power	Pre-2000
PN	Nuclear Thermoelectric Power	Pre-2000
PO	Thermoelectric Power (Once-through cooling systems)	2000 and later
PC	Thermoelectric Power (Closed-loop cooling systems)	2000 and later
MI	Mining	All
LI	Livestock	2000 and later
AQ	Aquaculture	2000 and later
LA	Livestock-Animal Specialties	Pre-2000 (data collected for 1990 and 1995)
LS	Livestock-Stock	Pre-2000
LV	Livestock Total (calculated)	Pre-2000
IR	Irrigation	All
IC	Irrigation, Crop	2000 and later
IG	Irrigation, Golf	2000 and later
IT	Irrigation total (calculated)	2000 and later
HY	Hydroelectric Power	All
WW	Wastewater Treatment	All
RE	Reservoir Evaporation	All
TO	Totals, Overall	All
TS	Totals, Surface Water by Category	All
TG	Totals, Groundwater by Category	All
TW	Totals, Overall by Category	All

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