WETBUD PLUS
PROJECT WIZARD

USER’S MANUAL

Zach Agioutantis, University of Kentucky
(zach.agioutantis@uky.edu)
Kathryn C. Haering, Virginia Tech
Stephen F. Stone, Old Dominion University
Benjamin Hiza, Old Dominion University
G. Richard Whittecar, Old Dominion University
W. Lee Daniels, Virginia Tech
Tess Thompson, Virginia Tech

April 11, 2016
# Table of Contents

- Introduction ............................................................................................................. 3
- Projects and Scenarios ............................................................................................. 3
- Data Required to Create a Project and a Scenario .................................................. 4
- Project Wizard Assumptions ..................................................................................... 5
- Operating the Project Wizard .................................................................................... 5
- Basic Scenario Water Budget Analysis ..................................................................... 13
- Exporting Basic Scenario Water Budget Results ....................................................... 16
- Appendix A. Wetbud Plus Installation Instructions .................................................. 18
**Introduction**

Wetbud is a tool for estimating wetland water budgets using available weather data and site-specific topographic, soil, and geohydrologic data. Wetbud has been developed in two versions, a Basic 2-D formulation with simplified groundwater functions and the Advanced 3-D version with full groundwater modeling capabilities. Wetbud is primarily intended as a planning tool for use in the design of created wetlands, but it can also be applied to native wetlands where the required input parameters can be specified.

Wetbud Plus is an enhanced version of the Basic formulation of Wetbud that features a preloaded database with data from 14 selected Virginia weather stations. A polygonal influence area has been defined for each of the preloaded weather stations. Preloaded weather data include precipitation, weather information, and calculated evapotranspiration (ET) values using either the Penman-Monteith method or the Thornthwaite equation, depending on data availability. A Project Wizard allows users to quickly set up Projects and Scenarios (see next section) using default parameters and to calculate water budgets using the basic model.

**Projects and Scenarios**

In Wetbud, the Project designates site-specific characteristics that are determined by the location of the site and will be held constant during different design iterations (e.g. name, latitude and longitude, elevation, reference weather station, wetland watershed characteristics, etc.). Once a Project is created, the user can create one or many Basic Scenarios for the Project. The following notes explain the steps users should follow to operate the Wetbud Setup Wizard to create a new Project and then a Basic Scenario within that Project.
Data Required to Create a Project and a Scenario

Before constructing a Basic Model with the Wetbud Project Wizard, the user should have collected the following information and data:

- **Project name** (up to 20 characters).
- **Latitude and longitude** of a central point within the study area, in decimal degrees. These values are used to select the appropriate reference weather station.
- **Wetland surface elevation**, in feet. (This value should be obtained from a topo map or actual survey data.)
- **Constructed wetland area**, in acres.
- **Wetland watershed area**, in acres. (Boundaries for these areas can be drawn using Google Earth Pro based on USGS topo maps available in Google Earth format. These measured areas can be determined by using Google Earth Pro and an on-line area conversion site.)
- **Wetland watershed NRCS Curve Number (CN)**. This ranges from 40-100, with a default of 70. The CN needed is the area-weighted value based on Hydrologic Soil Group (HSG) classes and land use for the watershed. The proportion of the watershed with each HSG class can be obtained most easily from NRCS Web Soil Survey; Google Earth images may be useful in assessing land use. CN values for each HSG and land use can be obtained from on-line tables. To get the single CN for the watershed, the CN values for each HSG must be multiplied by the proportion of the basin with that HSG classification; those weighted values must be totalled.
Project Wizard Assumptions
When creating a Basic Scenario, the Project Wizard assumes water inputs from precipitation, runoff from adjacent slopes, and an assumed initial fill depth of 2.00 inches. Water is assumed to be lost through evapotranspiration, groundwater seepage (@ 1 inch/month), and surface outflow when water depths overtop the designated weir elevation. The default water management assumes a weir height of 3.00 inches above the flat wetland soil surface, a soil storage factor of 0.2, and a surface storage factor of 1.

Once the Project and first Basic Scenario are established within the Wizard and the first calculations are made, the user may add more inputs (e.g. stream bank overflow) and may adjust any of the default values if/as necessary to better match anticipated field conditions.

Operating the Project Wizard
The screenshot in Figure 1 is what the user will see when the Wetbud program is opened. In the status line at the bottom of the home screen, the version number, the currently selected Project, and the Wetbud database location are identified.
From the Wetbud Home Screen, select the Wizard icon to run the *Project Wizard*. The disclaimer message will appear (Figure 2). Select **Yes** to proceed.

**Figure 1. Wetbud Home Screen**

**Figure 2. Wetbud Project Wizard Disclaimer**
To define a new Project, select “Define A New Project”, and enter the Project name, latitude and longitude in decimal degrees (e.g. 37.349), and elevation in feet (Figure 3), then select Next.

![Figure 3. Wetbud Project Wizard: Defining a new Project.](image)

The message in Figure 4 will appear. Select Yes to proceed.

![Figure 4. Wetbud Project Wizard: Creating a new Project.](image)

To use an existing Project, select “Use an existing Project”, highlight the Project that you want to use, and select Next (Figure 5).

![Next button](image)
Figure 5. Wetbud Project Wizard: Using an existing Project.

The message in Figure 6 will appear. Select **Yes** to proceed.

Figure 6. Wetbud Project Wizard: Selecting an existing Project.

After creating a new Project or selecting an existing Project, the weather station selection screen will appear. Weather stations are filtered based on the entered latitude and longitude of the Project and the following four options (Figure 7) will appear:

1. *Radius of Influence (All)* will display all weather stations that are within the selected range of miles from the Project (wetland) location as determined by its latitude and longitude.
2. *Radius of Influence (Preloaded)* will display only the preloaded weather stations within the selected range of miles from the Project (wetland) location.
3. **Polygon (All)** will display all the weather stations whose polygonal area of influence includes the Project (wetland) location as determined by its latitude and longitude.

   **Note:** If the project location is not included in any of the defined polygons, then no weather stations will be displayed under that option and the user can not continue.

4. **Polygon (Preloaded)**, which is the default, will select all the preloaded weather stations in the polygonal area of influence that includes the Project location.

   **Note:** The weather station selection options marked **Preloaded** currently apply only to the state of VA. If there are no preloaded stations covering the area of interest to the user, then no weather stations will be displayed under that option and the user can not continue.

To use the default [Polygon (Preloaded)] station, click on it and select (Figure 7). When the Polygon (Preloaded) option is selected, Wetbud will either display one station if the Project location falls within a predefined polygon, or no stations at all.

![Figure 7. Wetbud Project Wizard: Selecting a Polygon (Preloaded) weather station.](image)

Wetbud will then tell you what type of ET values are available for the default Wet, Normal, and Dry years at that station, as shown in Figure 8. When Penman ET values are not available for a preloaded station due to missing solar data, then Thornthwaite
ET values will be provided. This information is available in the Wetbud Plus database for the 14 preloaded VA stations. Select **Yes** to proceed.

**Note:** If a non-preloaded weather station is used, then the user should make sure that ET values are available for that station.

Figure 8. Wetbud Project Wizard: ET value notification.

To use the *Radius of Influence (Preloaded)* option, click on it, choose the desired mileage range, highlight your preferred weather station and select **Next** (Figure 9). More than one weather station may fulfill the radius of influence criterion, so the user should select a specific station.

Figure 9. Wetbud Project Wizard: Selecting a *Radius of Influence (Preloaded)* weather station.

In this following example, the *Polygon (Preloaded)* weather station will be used.
After weather station selection, the screen in Figure 10 will appear. To define a new Scenario, choose “Define a new Scenario”, and enter:

- the Scenario Code
- the area of the constructed wetland (in acres)
- the total area of the watershed for direct surface runoff (in acres)
- the watershed NRCS curve number

Then select Next.

![Image of Wetbud Project Wizard: Define a new Scenario](image)

**Figure 10. Wetbud Project Wizard: Define a new Scenario.**

The message in Figure 11 will appear. Select Yes to proceed to the screen shown in Figure 12, which summarizes the water inputs, outputs, and water management.

**Note:** The Project Wizard will let you create a Project and a Scenario, even if not all of the required data are in place. However, errors will occur when the user tries to run the Project without ensuring that all input data is in place.
Choose a wetbud project, and the Basic Scenario Analysis screen (Figure 13) will appear.

**Note:** If multiple scenarios are available for the selected project, only the currently selected scenario will be visible in the form shown in Figure 13.
Basic Scenario Water Budget Analysis

1. To complete a Basic Scenario water budget analysis, click (Figure 13). If adjustments are made to any parameters that may affect ET and/or runoff calculation (e.g. PET option, Curve Number, etc.), the user must check the box next to Recalculate ET, Runoff, and Overbank before recalculating the water budget for a water budget previously calculated within that Scenario.

2. The Analysis tab will then display a detailed progress log, a summary progress and data availability log, a display results log, and a table of monthly results for the year. Wetbud will then display the options selected in the Range and Display Options boxes on the right side of the window, respectively (Figure 14).
3. The *Detailed Progress Log* displays messages regarding the progress of model calculations and it should be reviewed when troubleshooting a scenario run.

4. The *Summary Progress and Data Availability Log* displays whether the different data components are present after calculations are completed. The color of the code box at the end of a run indicates whether the run was successful (green = all data was present; red = missing data). At the end of an unsuccessful run, the number in a red code box tells the of data components that failed.

5. The *Display Results Log* displays the number of records available for each water component and each year included in the water budget calculations.

6. The table to the right of the *Detailed Progress Log* panel displays monthly results for the year and variable selected in the *Range* and *Display Options* boxes on the right side of the *Basic Analysis* window. The user can view tabulated results for
each variable in the water budget analysis by adjusting the selection in the
Display Options box.

7. The Water Budget Chart tab (Figures 15 and 16) shows a graphical display of the
Basic Model results. The user can choose to display each variable individually or
combine all water budget components on the same graph by changing the
selection in the Display Options box. The first two variables in the Display
Options box, (T)otal Water (Figure 15) and Actual Water Level (J) are displayed
as a line graph. (T)otal values are the total monthly mass balance water levels.
Actual Water Level (J) values are water levels relative to the ground surface;
these values represent the monthly water surface or water table elevation within
the wetland. All other variables are displayed as a bar graph (Figure 16). Each
year in the standard analysis range can be displayed by changing the selection in
the Range (Dry, Normal, Wet) box.

Figure 15. Basic Scenario Analysis: Water Budget Chart (Total) for the dry year.
Figure 16. Basic Scenario Analysis: Water Budget Chart (All) for the dry year.

Exporting Basic Scenario Water Budget Results

The user can export all Basic Analysis water components of the current water budget analysis in an Excel file. To export results, click Export. Wetbud will produce a single Excel files with charts and a data summary for the Wet, Normal, and Dry years, on separate worksheet pages. (The user may generate a Word file with all these results through the Wetbud Report options.)

For example, the Excel worksheet in Figure 17 shows the water budget for the wet year that could be saved as its own worksheet, or automatically inserted into the Word document summarizing the scenario output. The Excel worksheet in Figure 18 shows the data summary for the same wet year.
Figure 17. Exported Excel worksheet showing water budget for the wet year.

Figure 18. Exported Excel worksheet showing data summary for the wet year.
Appendix A. Wetbud Plus Installation Instructions

The following applies to an installation where Wetbud is installed as a downloaded file, and the database and the executable files will reside on the same computer.

The following applies to an installation where Wetbud is installed as a downloaded file, and the database and the executable files will reside on the same computer.

1. Open the link provided and select Download, then select Save File. Wetbud will download to your computer. Open the download. The Welcome to the Wetland Budget Analysis (Wetbud) Setup Wizard screen will appear (Figure 1). Select Next.

![Figure 1. Welcome to Wetland Budget Analysis (Wetbud) Setup Wizard Screen.](image)

2. The License Agreement screen will appear (Figure 2). Select I Agree.
3. The Choose Components screen will appear (Figure 3). Firebird Server and Wetbud Files are mandatory. Wetbud Resources (user’s manuals and associated help and demonstration files) is optional, but we highly recommend that you keep it checked so that you can access those files. Select Next.

Figure 2. License Agreement screen.

Figure 3. Choose Components Screen
4. If you are installing Wetbud on a computer for the first time, the following two Choose Install Location screen will appear (Figures 4 and 5). Wetbud will install into C:\Wetbud as the default location. Select Next >.

![Figure 4. Choose Install Location screen.](image)

5. The Choose Install Location for Wetbud DATABASE screen will appear (Figure 5). The default location for the Wetbud Database is the "MyWetbud" folder. Select Next >.
Figure 5. Choose Install Location for Wetbud DATABASE screen.

6. For all installations, the Select Install Options 1 screen will appear (Figure 6). Note that Wetbud stores all associated data in a Firebird database (Firebird is open source software available in the public domain), so the Firebird database software will be installed along with Wetbud.

Choose your preferred options for installation. “Customize Firebird installation” will allow you to choose your preferred folder for the Firebird software, while “Notify User on Firebird Installation Status” will inform you of the progress of the Firebird software installation. We recommend that the user select the default options, as shown in Figure 6. Then select Next >.
7. If there is an existing installation of Wetbud or Wetbud Plus on your computer, the Select Install Options 2 screen will appear (Figure 7). Select from one of the following options and then choose Install:

Figure 6. Select Install Options 1 screen.

Figure 7. Select Install Options 2 screen.
a. The default choice is to “Delete Existing Database and Install a Fresh Database with Preloaded Stations and Examples.” This option will delete your existing database and install a new database with preloaded weather stations so that you may easily construct water budgets for sites in Virginia using the *Project Wizard*. This new database will also include examples of completed Wetbud Basic and Advanced Models and Scenarios.

    **Note for new users:** If you do not have an existing installation of Wetbud Plus on your computer, Wetbud will default to this option and you will not see the *Select Install Options 2* window.

b. If you have an existing installation of Wetbud Plus with that does not have the set of 14 completed Virginia weather stations, and you would like to estimate a water budget for a wetland in the state of Virginia but have no need for examples, choose “*Delete Existing Database and Install a Fresh Database with Preloaded Stations*”.

c. If you have an existing installation of Wetbud Plus on your computer, and you would like to delete your current database and install a fresh blank database that does not include preloaded weather stations or examples, choose “*Delete Existing Database and Install a Fresh Blank Database*”.

d. If you have already installed Wetbud Plus on your computer, and have projects and scenarios you would like to save, choose “*Update Existing Database*”. Figure 1.8 will appear as Wetbud compares and updates databases. Select **OK**.
**Note:** The *Database Comparer* executable compares the structure of the existing database to the structure of the database used in the latest release of Wetbud. The *Database Comparer* will only update the Wetbud2.fdb database located in the user’s Documents\MyWetbud folder.

![Database Comparer](image)

**Figure 8. Wetbud Database Comparer screens.**

8. Wetbud will then begin installing (1) the Wetbud software and (2) the Firebird database software (if new installation) on your computer.

   **Note:** If Wetbud is re-installed on a system, the installation script will automatically create a backup copy of the existing database and place it in a dated folder within C:\Wetbud. Therefore, an existing database cannot be accidentally overwritten during reinstallation.

9. When installation is concluded, the *Installation Complete* screen will then appear (Figure 9). Select **Next >**.
10. The Completing the Wetland Budget Analysis (Wetbud) Setup Wizard screen will appear (Figure 10). Select Finish.

11. If Run Wetland Budget Analysis (Wetbud) is checked, the Wetbud home screen (Figure 11) will open.
Figure 11. Wetbud Home Screen

12. Wetbud can be un-installed through the Windows Control Panel or by executing the “uninstall.exe” program in the c:\Wetbud directory.