

Wetbud: A model for mitigation wetland design

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Wetlands provide habitat, improve water quality, control erosion, and store flood water.



Percentage of Wetlands Acreage Lost, 1780s–1980s

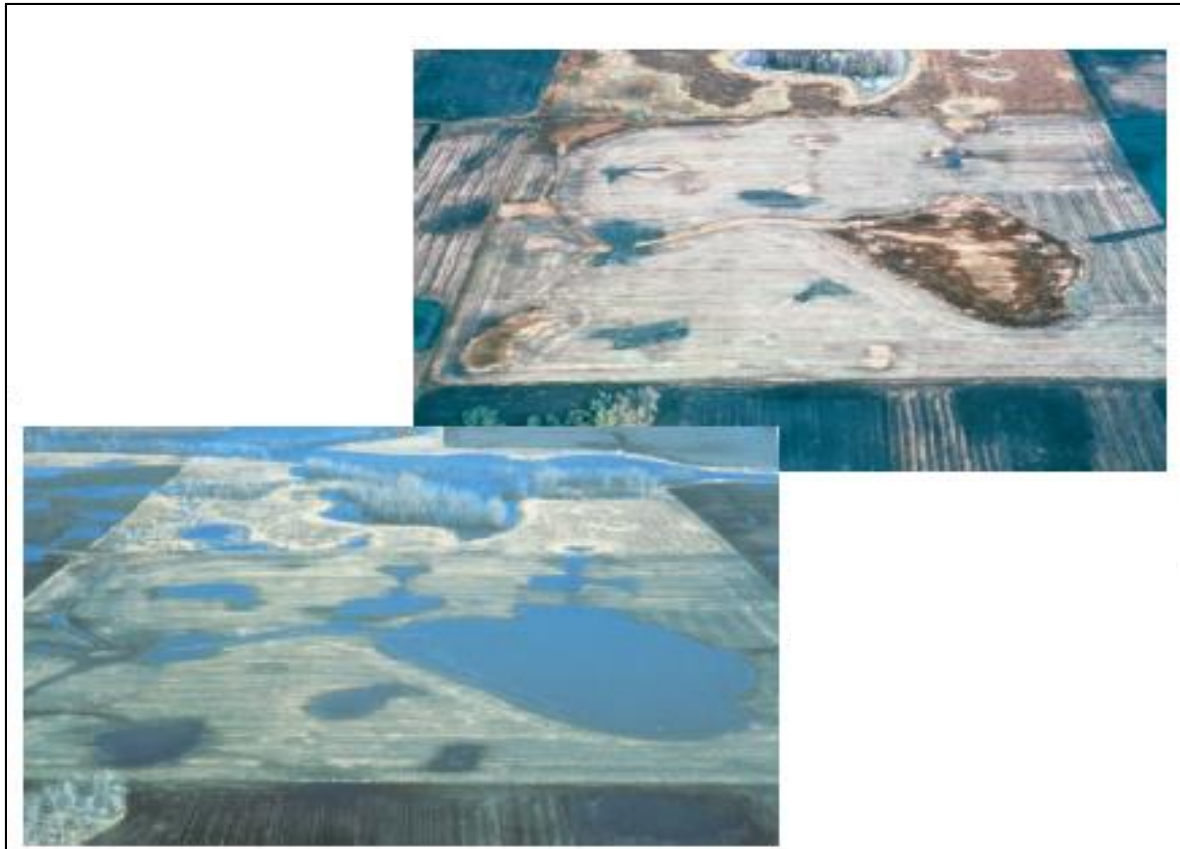


Since the 1780's, about 53% of all US wetlands have been lost (Dahl, 2000).

from US EPA, 2001



Wetland restoration and creation can help offset the effects of wetland loss.



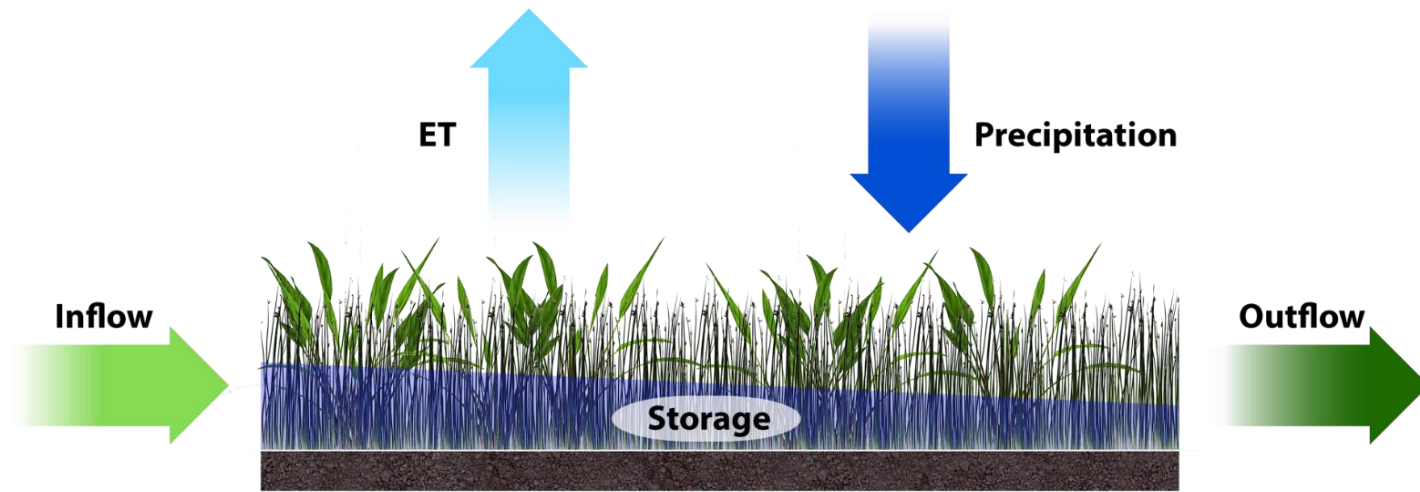
from Dahl, 2000 (US Fish and Wildlife)

Most wetlands are too wet to effectively function.

(Cole & Brooks, 2000)



A “simple” way to create a mitigation wetland is to create a perched system

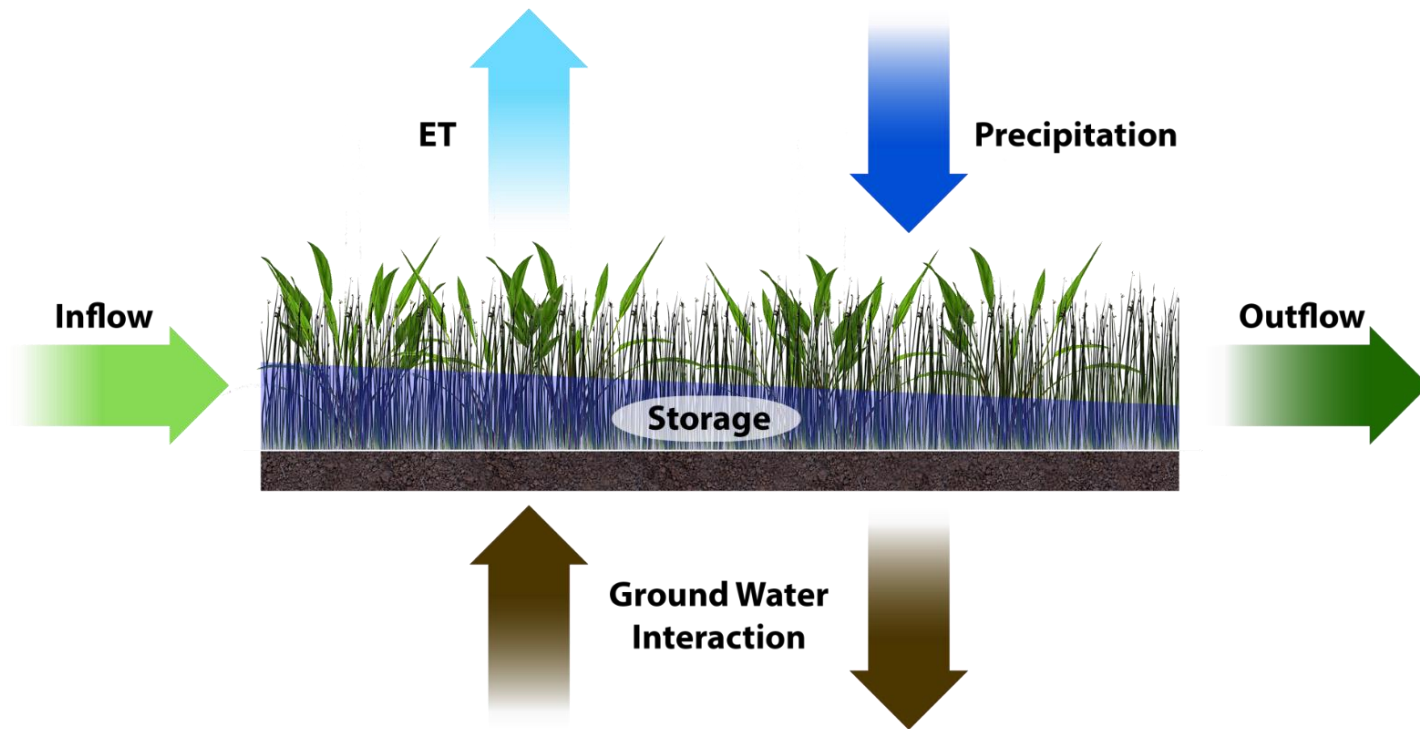


**assume
negligible**

OK assumption on hilltops with low permeability,
compacted subsoils



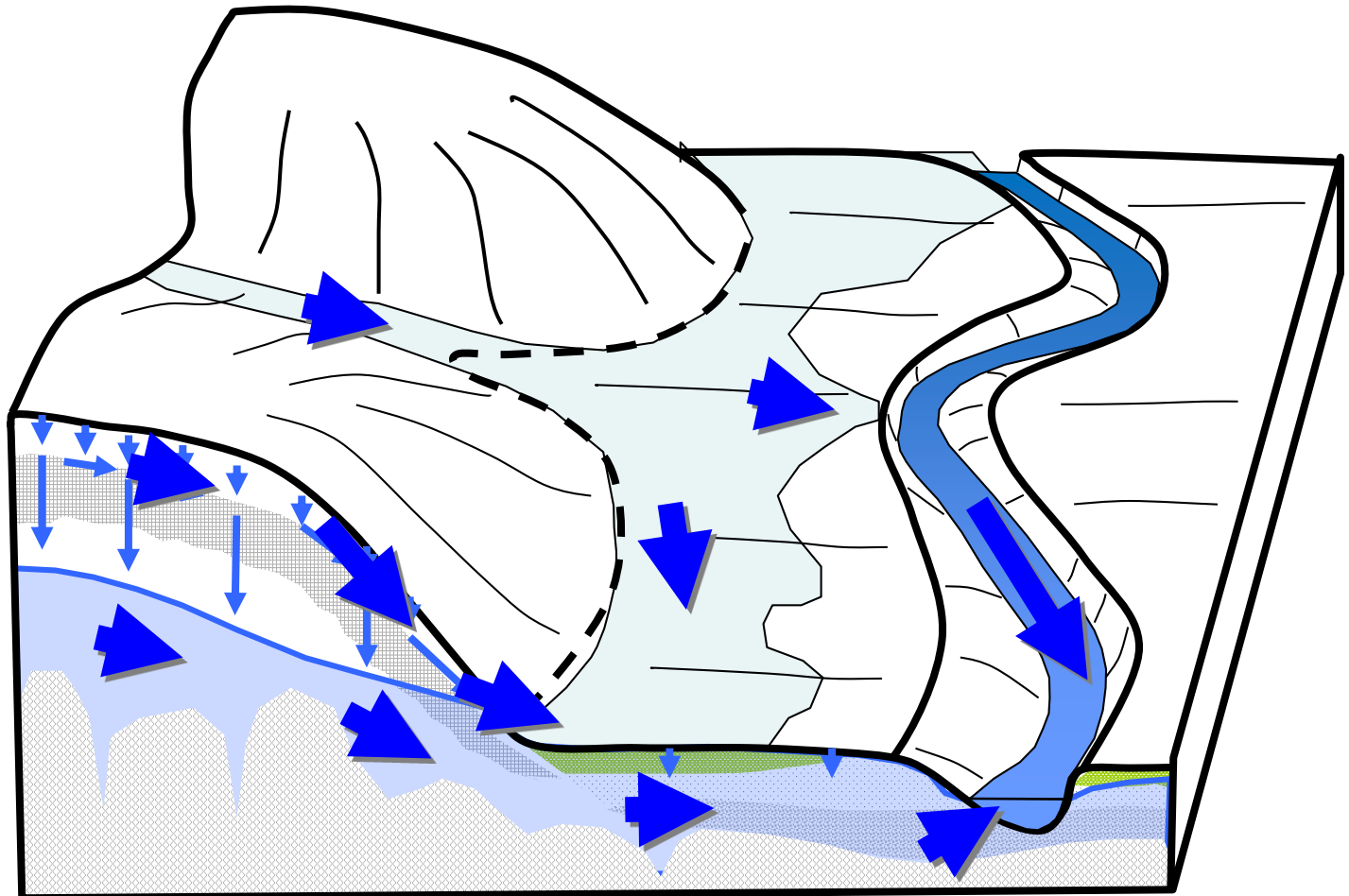
In most wetlands, groundwater can seep IN and OUT many places



**Ignore GW? The wetland can be “too wet.”
And does it perform as the wetland it is supposed to replace?**

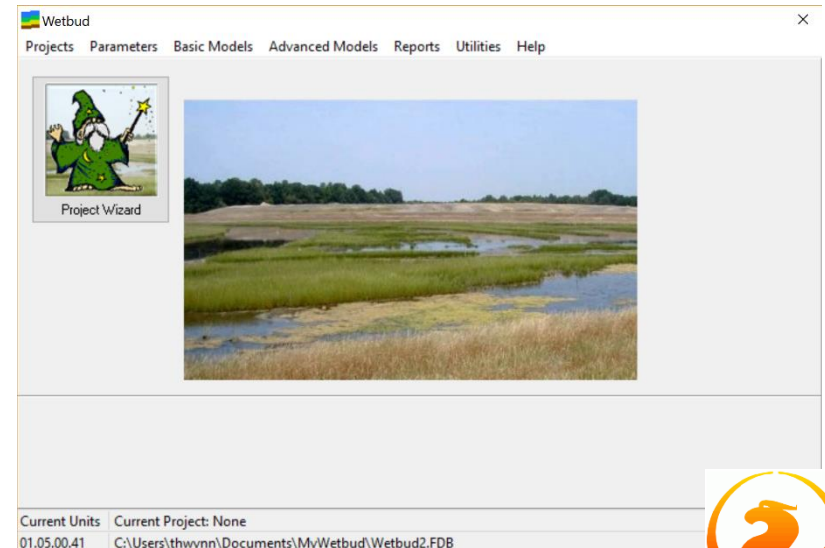


Wetbud model developed as a *design* tool for wetlands with groundwater interactions in the eastern US



Wetbud Program

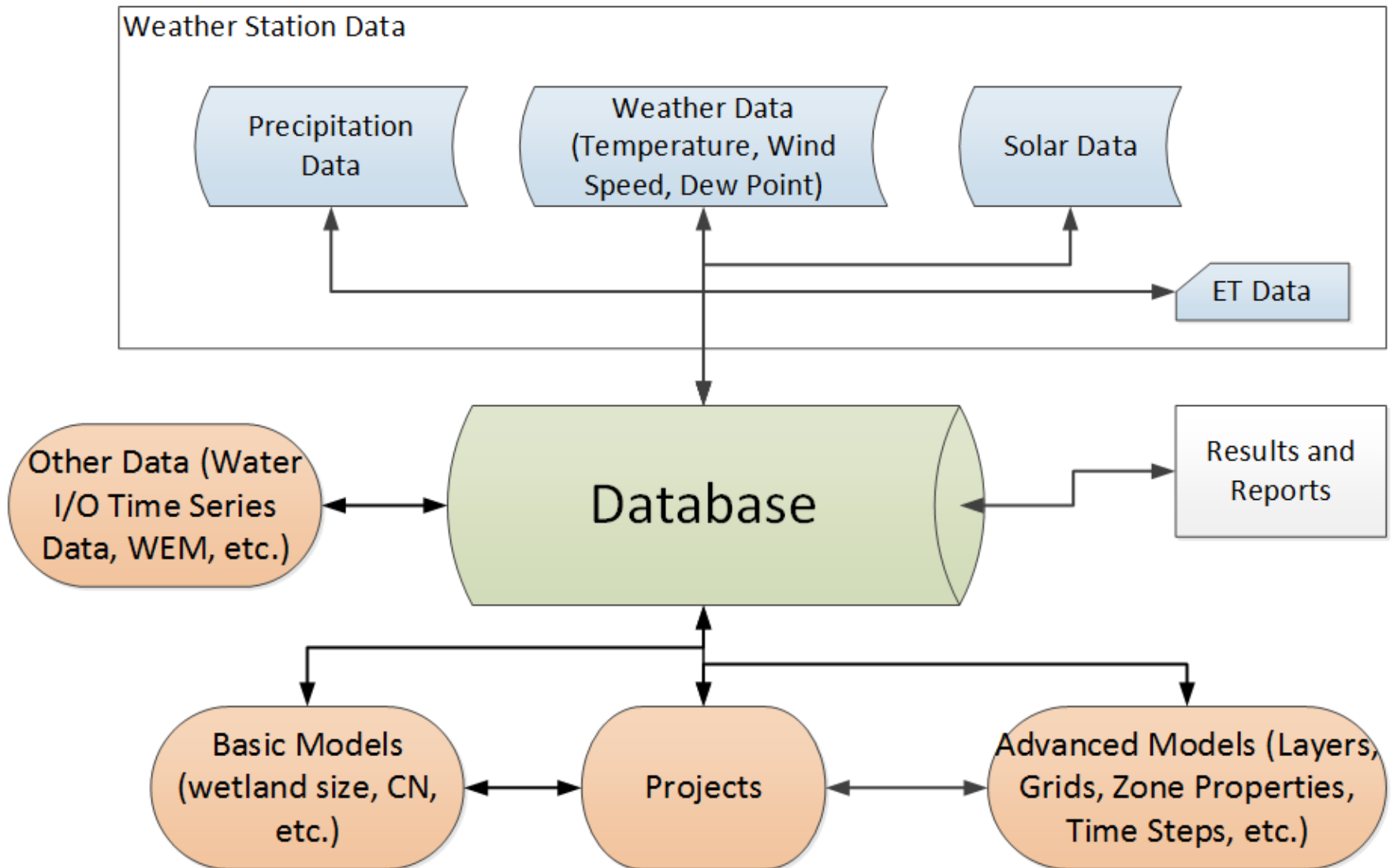
- Available for Windows™ Systems ONLY (7, 8.1, 10)
- Single user or a multi-user office environment



- Features multiple projects, multiple scenarios per project, and a project setup wizard
- Data stored using Firebird open source database software for fast data export and retrieval
- Multiple model output and graphing options

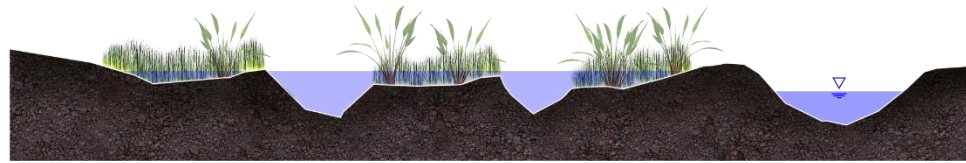


Wetbud Model Structure



The basic model computes a monthly water balance.

- Assumes “level-pool” routing
- All inputs and outputs are summed for the month as depth of water in the wetland
- Model assumes water volumes greater than the maximum wetland storage are removed from the water budget each month





Basic Scenarios



↓ New Basic Scenario



Export

Exit

Search

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General Wetland Watershed Inputs and Outputs Management and Options

Water Inputs Water Outputs Site Parameters Stream Overbank Flow

Code	Description
PptRO	PptRO
PptROStWem	Precip Runoff Strea
PptROStm	Ppt RO and Stream

Water Inputs

Initial Fill Depth

Dry Year (in)

Normal Year (in)

Wet Year (in)

Custom Period (in)

Precipitation

Direct Surface Runoff into Wetland

Groundwater IN Options

No Groundwater IN

Constant Rate

Calculated by Wetbud using WEM

User Time Series

Stream Overbank Flow

No Overbank Flow

Calculated by Wetbud based on NRCS DUH

User Time Series (MONTHLY Wetland Depth)

User Time Series (DAILY Stream Elevation)

User Water IN

Select Series

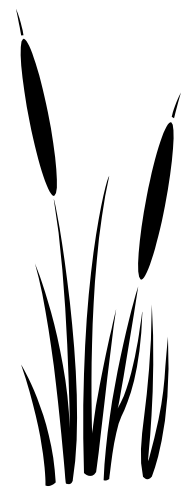
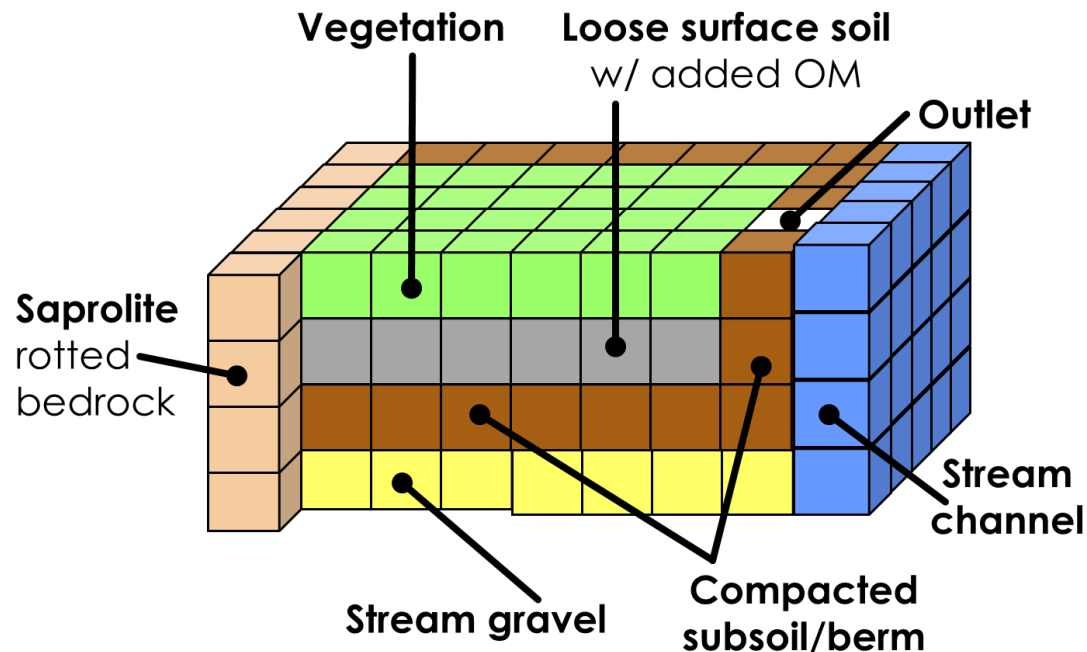
User IN Data

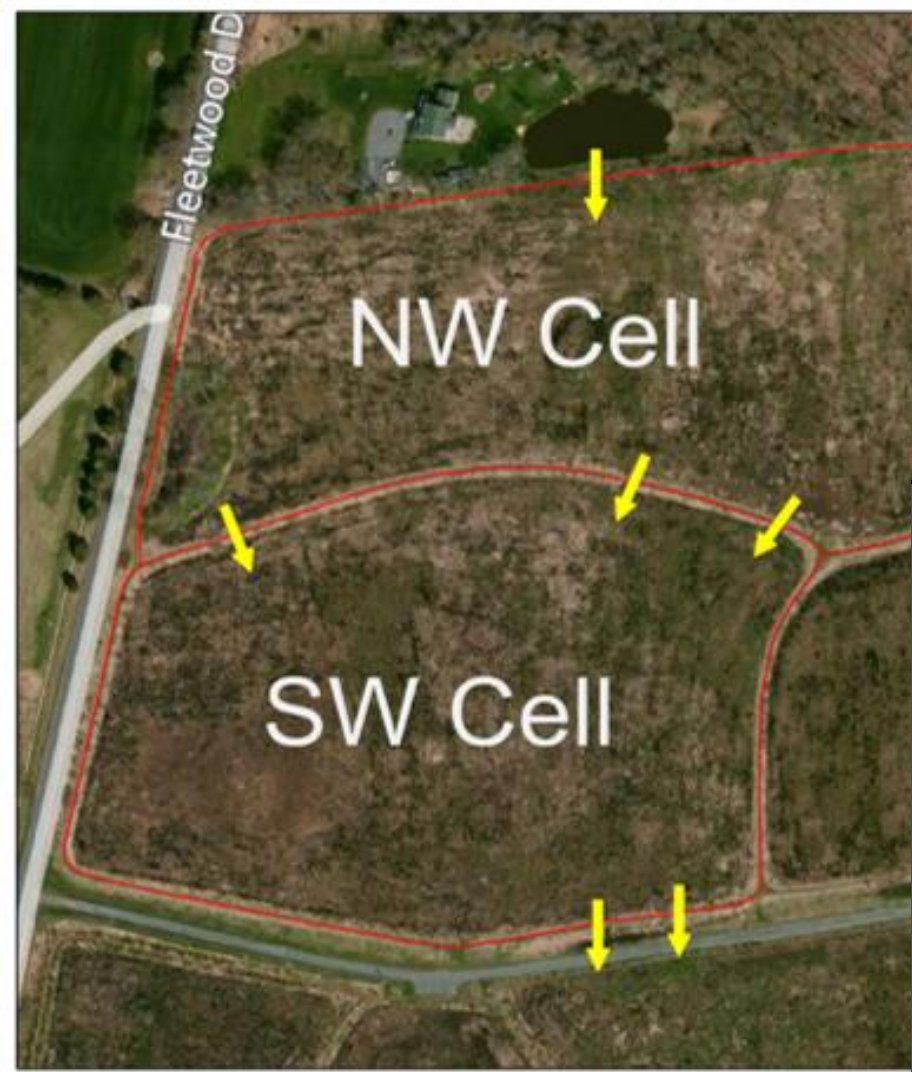
Select Series

Stream Overbank Data

The Advanced Model incorporates a GUI with the MODFLOW-NWT finite difference groundwater model

- Allows both flat and irregular wetland topography
- Up to four layers can be modeled
- Calculates water elevations on a daily basis





Modflow Grid Setup

Layer Zones

MP_CODE	MP_DESCR
-CR3_2009	Nw_SW_Thorn
-CR3_2009	Nw_SW_Perma
-CR3_2010	Nw_SW_Thorn
-CR3_2010	Nw_SW_Perma
-CR3_2011	Nw_SW_Thorn
-CR3_2012	Nw_SW_Thorn
-CR3_2012	Nw_SW_Perma
CR3_2009	2009Thornthwai
CR3_2009	Elevations
CR3_2010	2010Thornthwai
CR3_Compar	#2009Thornthwai
CR3_Small	Troubleshoot
CR3_Team	2010Thornthwai

Current Layer

Current Zone / Property Set

ZF_A | ZF_DESCR

1 | Outside_Brindy_CR3

Boundary Conditions | Properties

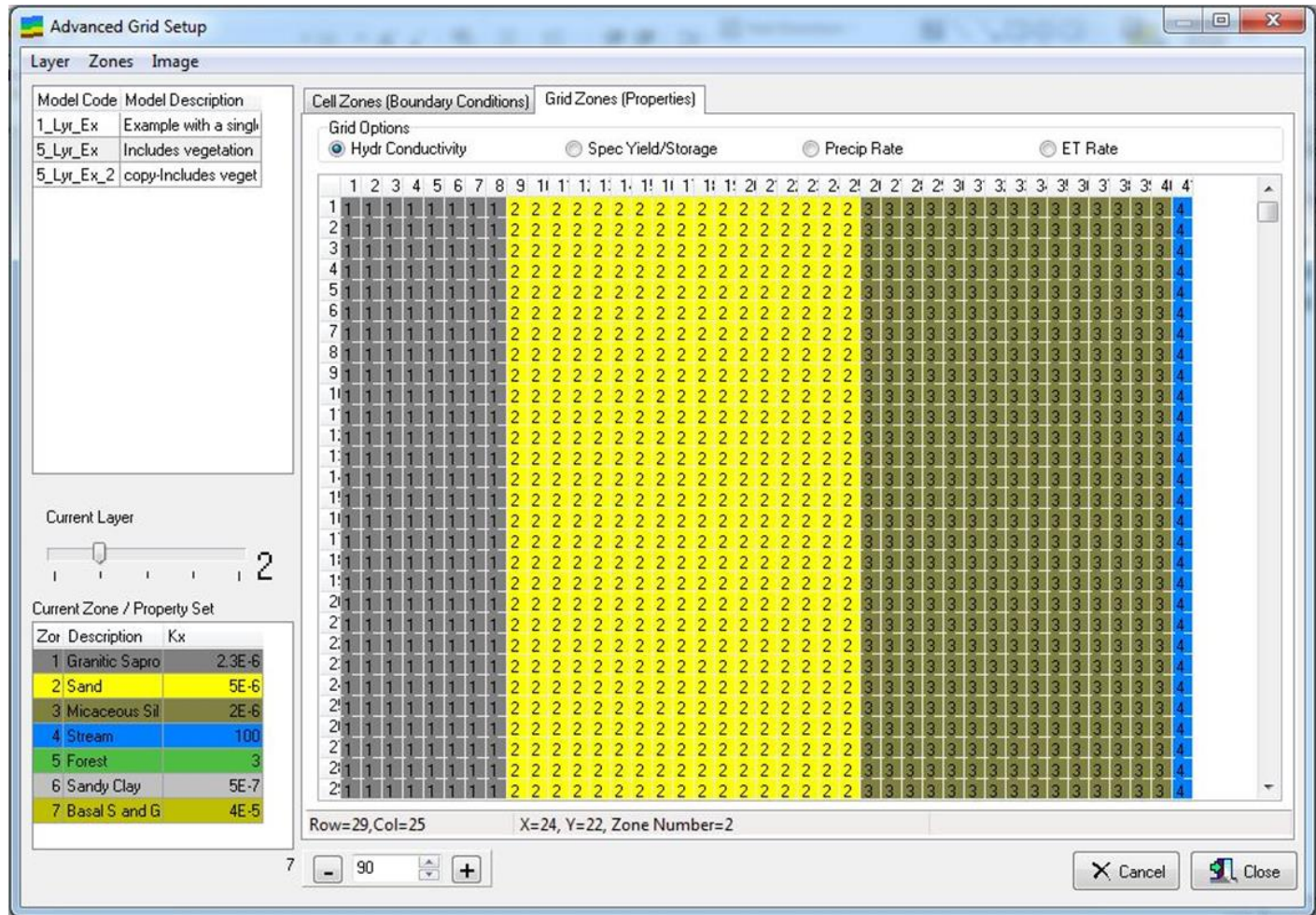
Grid Options

General Head
 Drains
 Monitoring Points
 No Flow Cells
 Wells
 Drain Returns

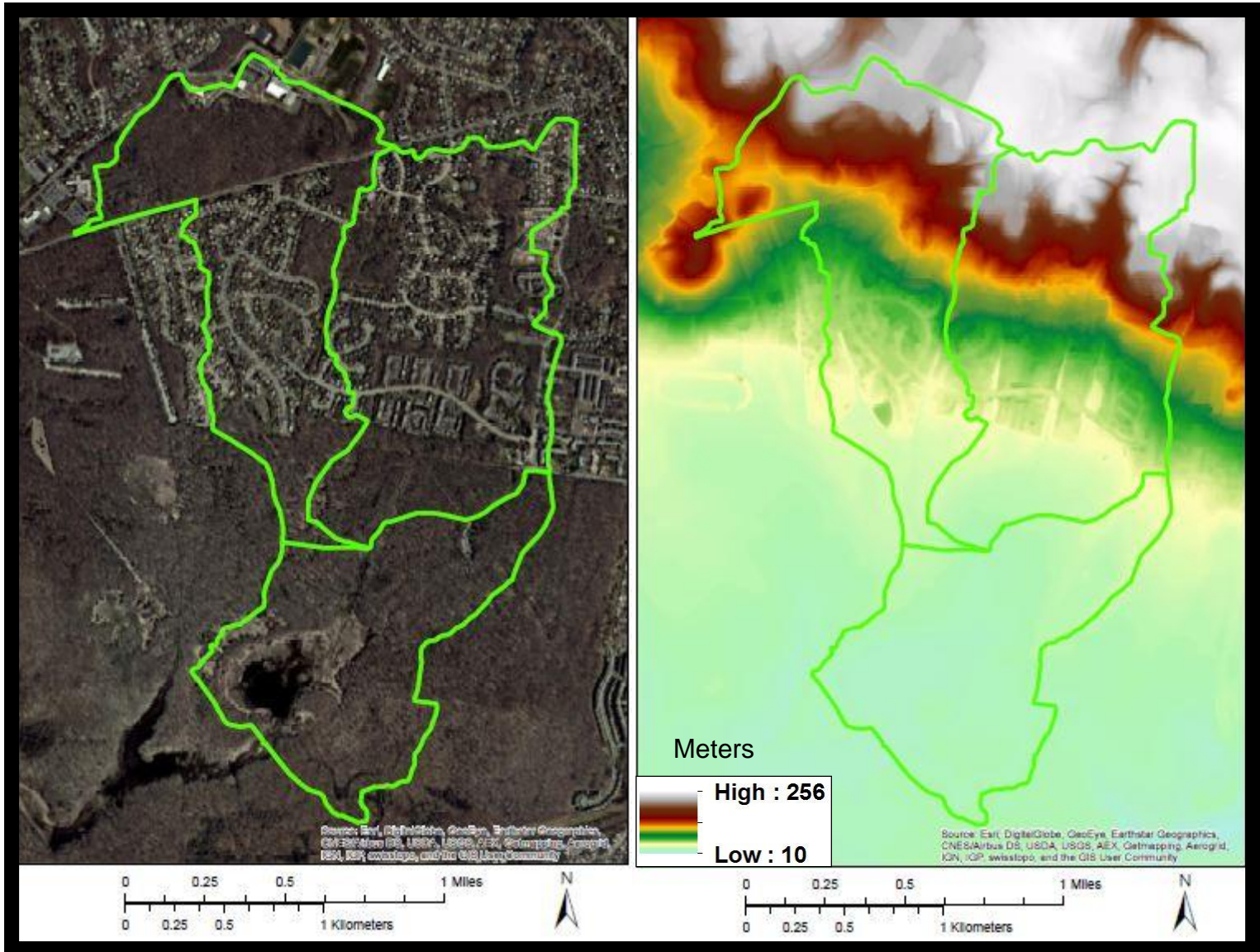
3.44

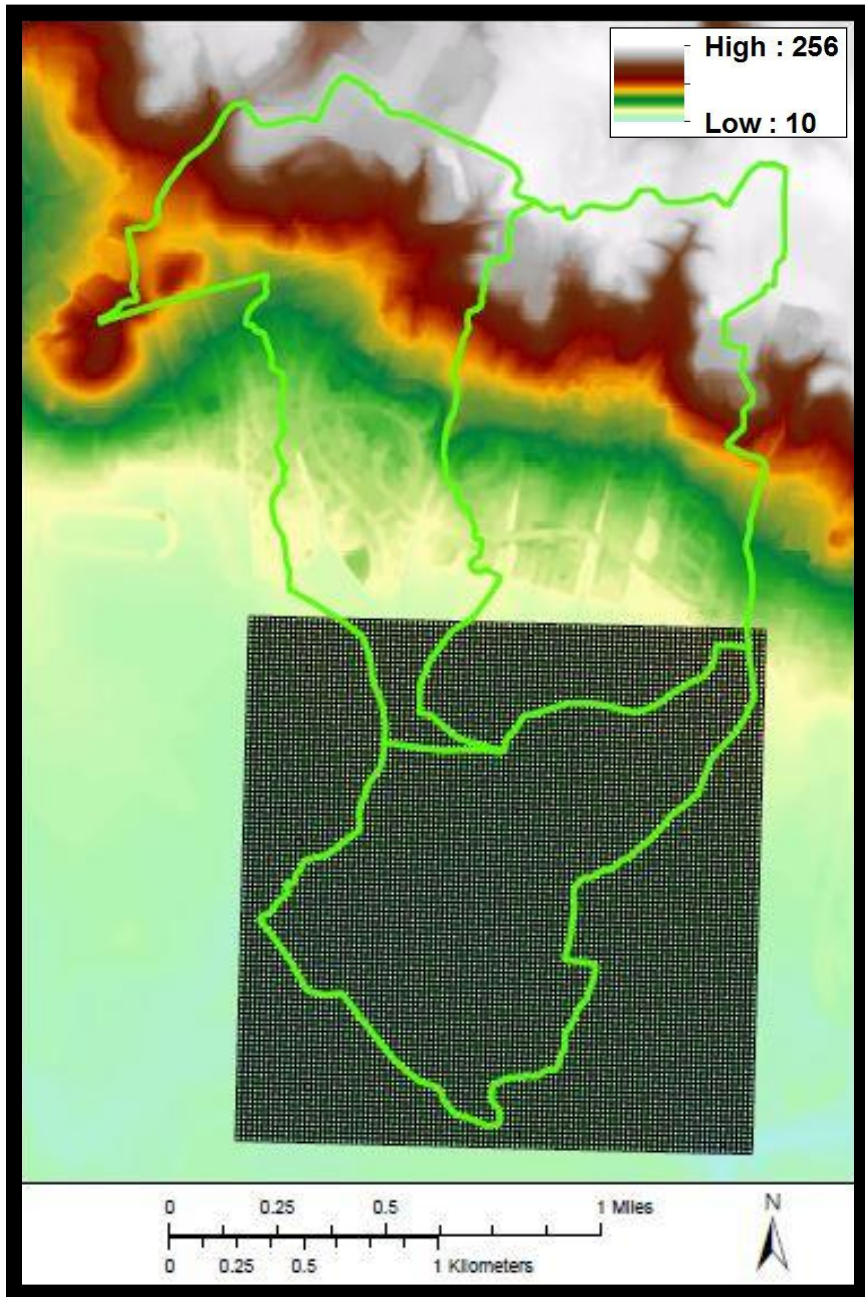
Test No Flow | Cancel | Close

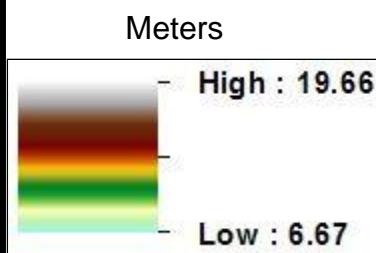
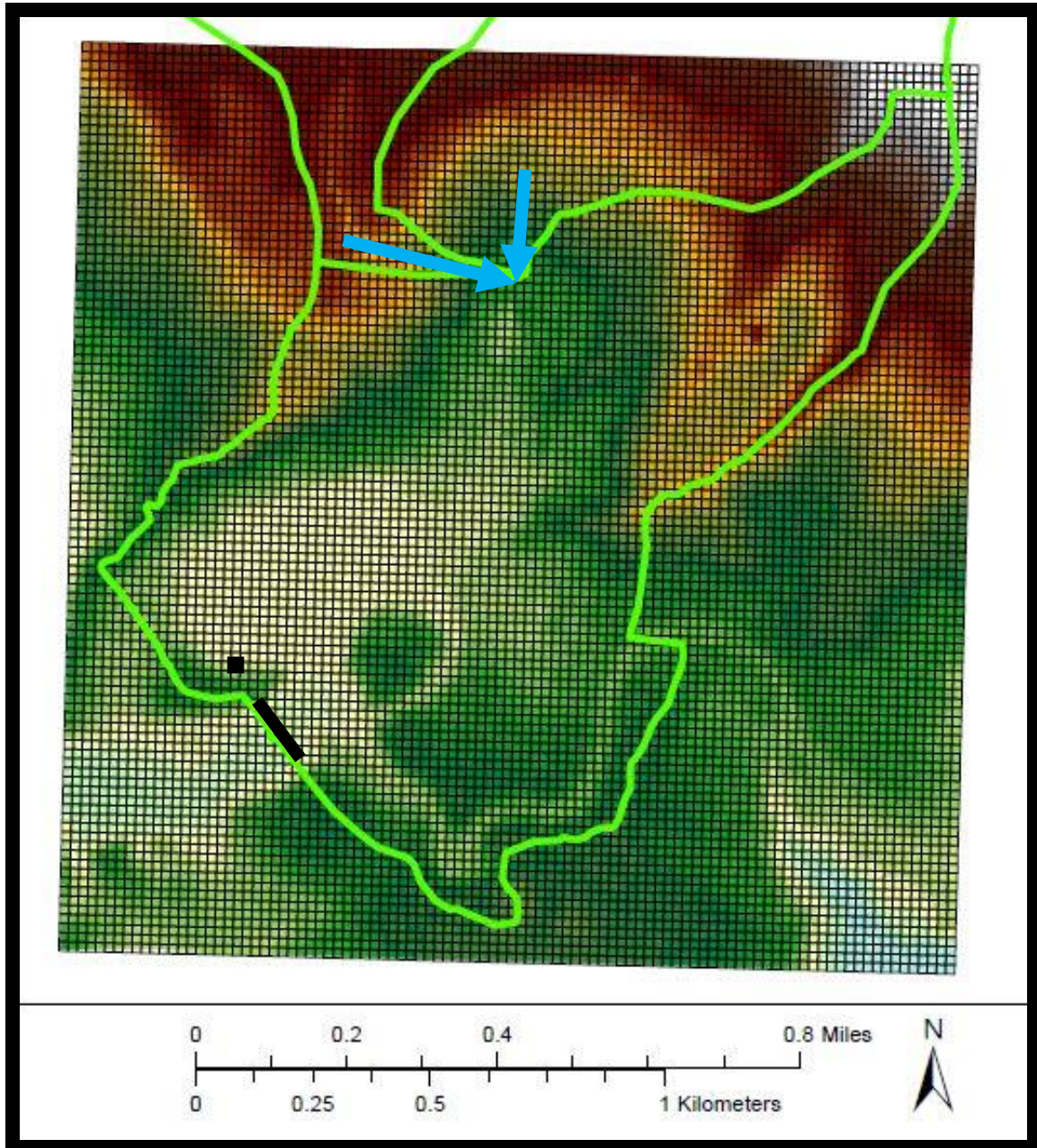
Grid utilities assist with the setup of model layers and the assignment of cell elevations and properties.



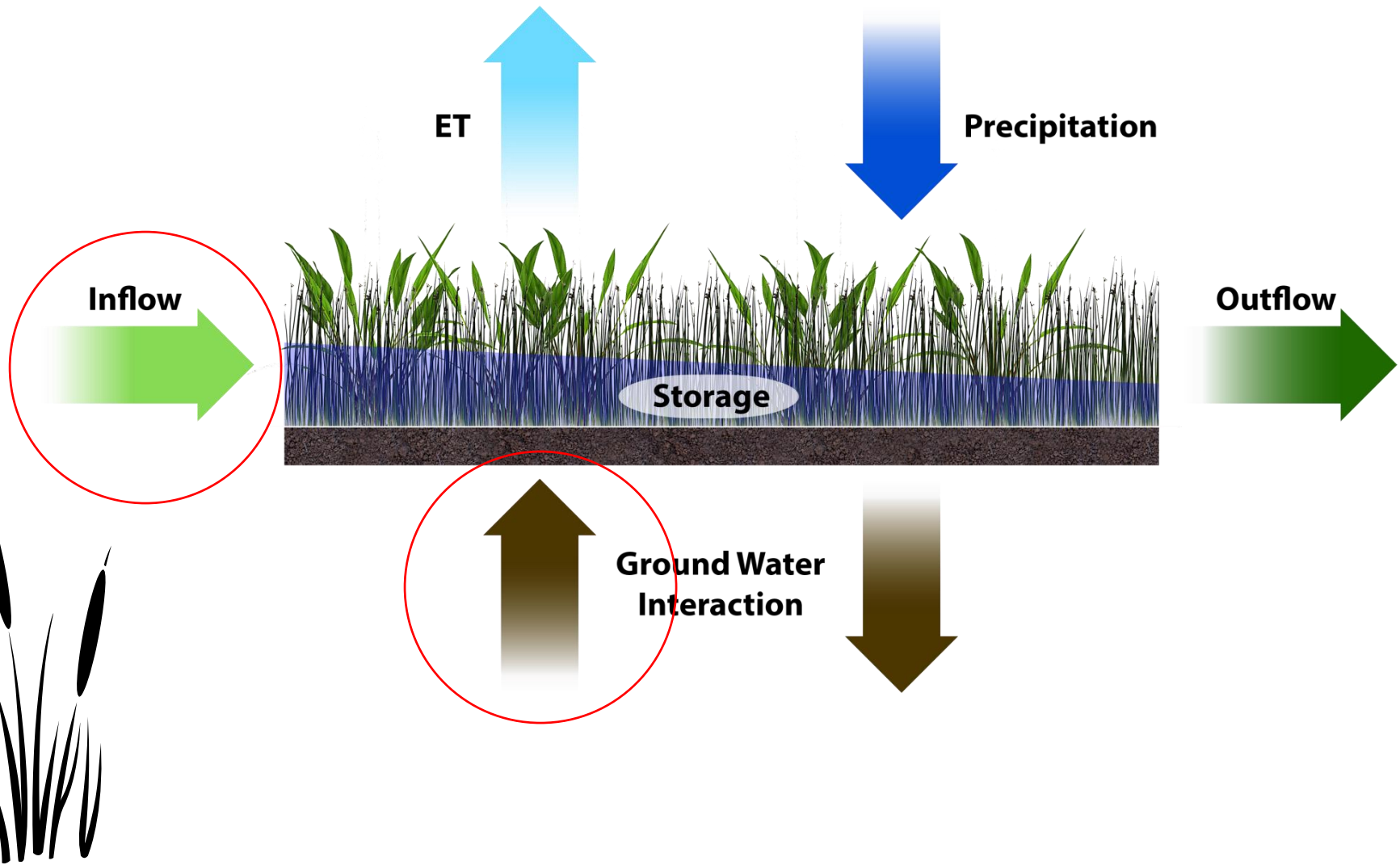
Huntley Meadows Park



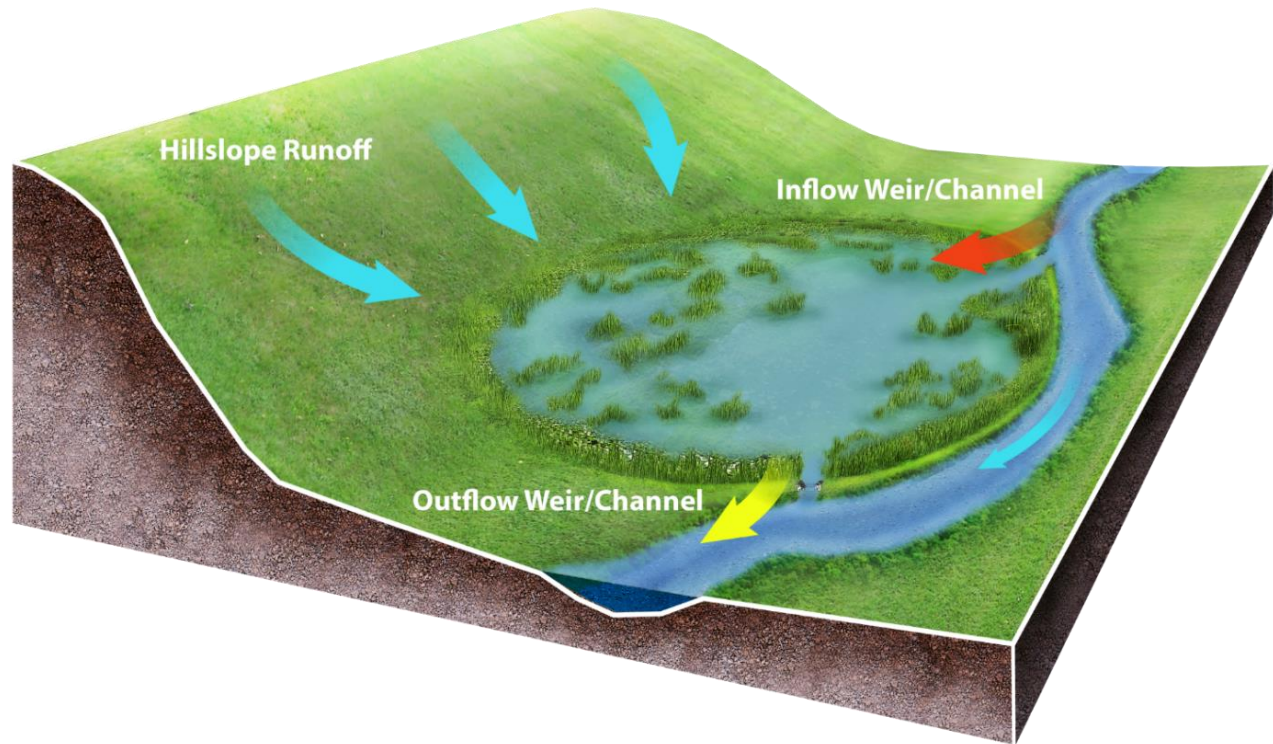




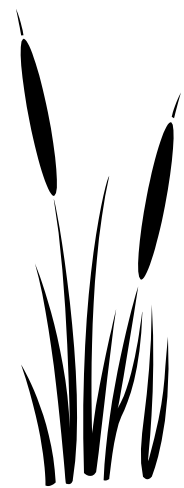
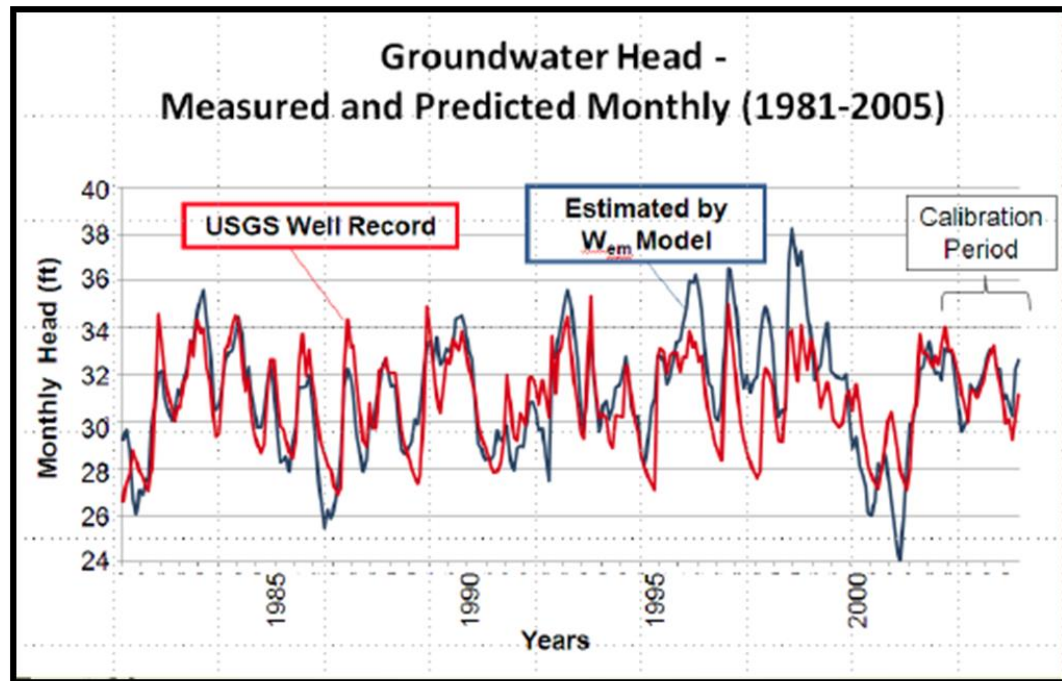
Inflows can be surface or ground water



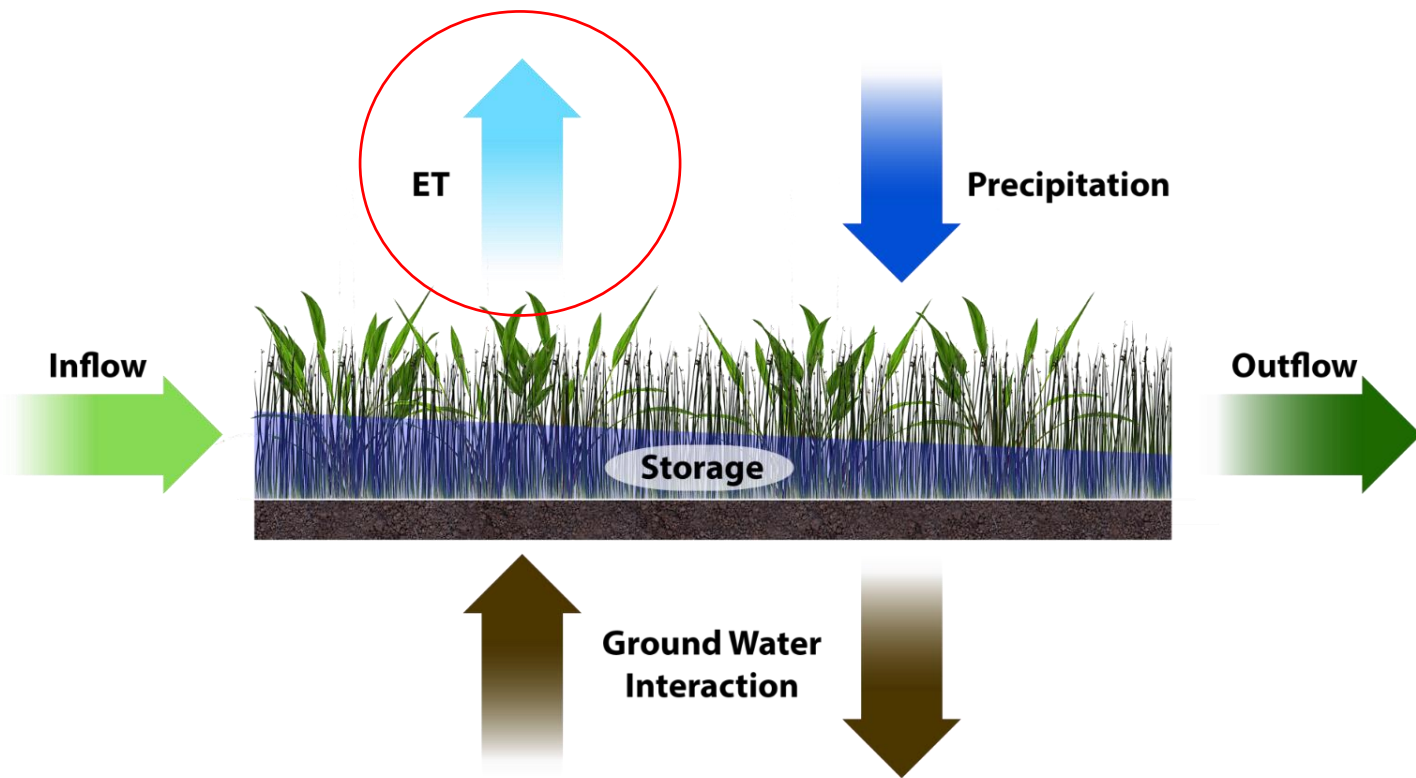
Surface water inflows can be runoff from the wetland watershed or overbank flows from an adjacent stream.



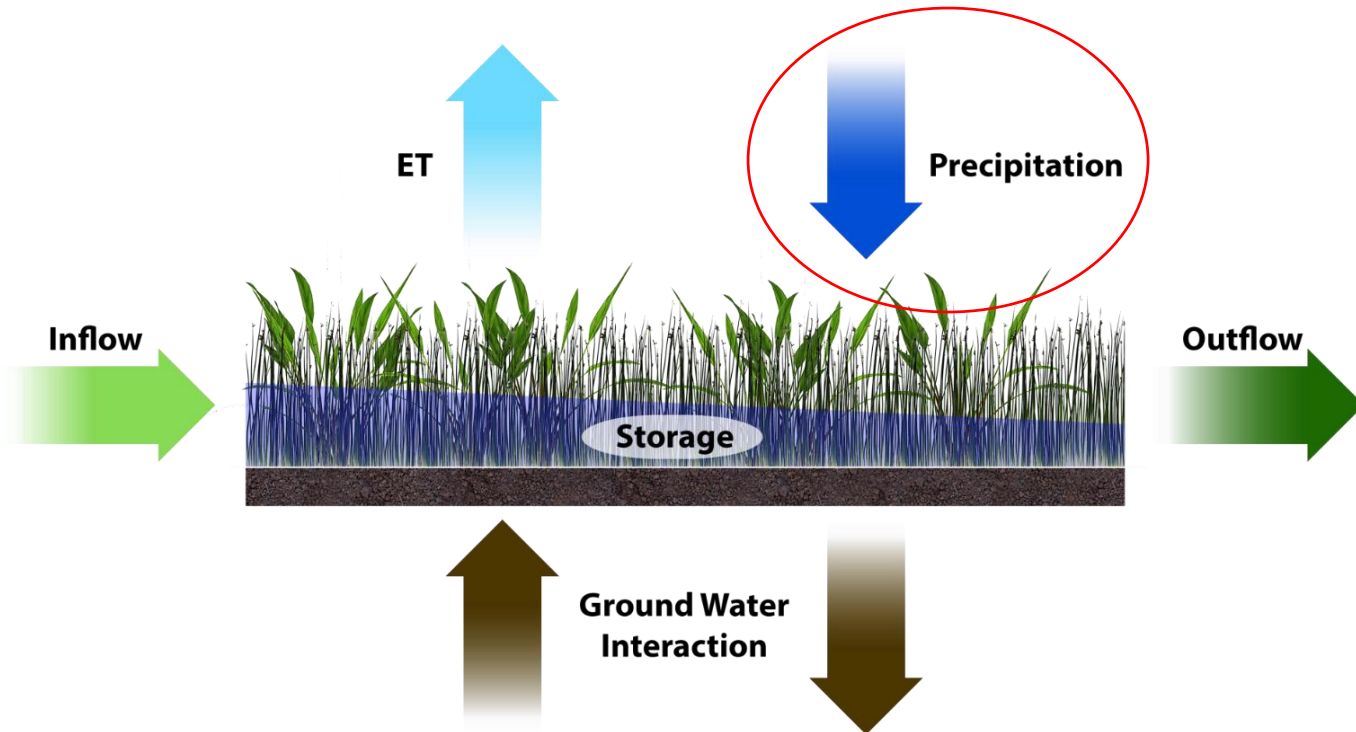
Groundwater inputs from adjacent hillslopes can be estimated for any year with historic weather data using the effective monthly recharge routine (WEM), if several months of well data are available at a site.



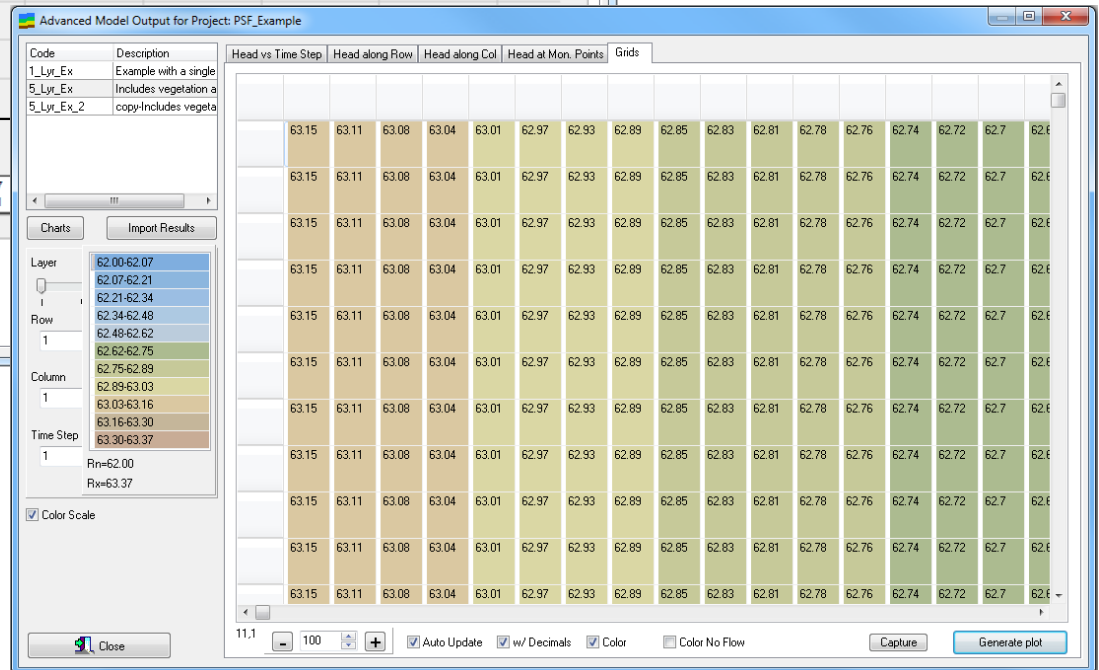
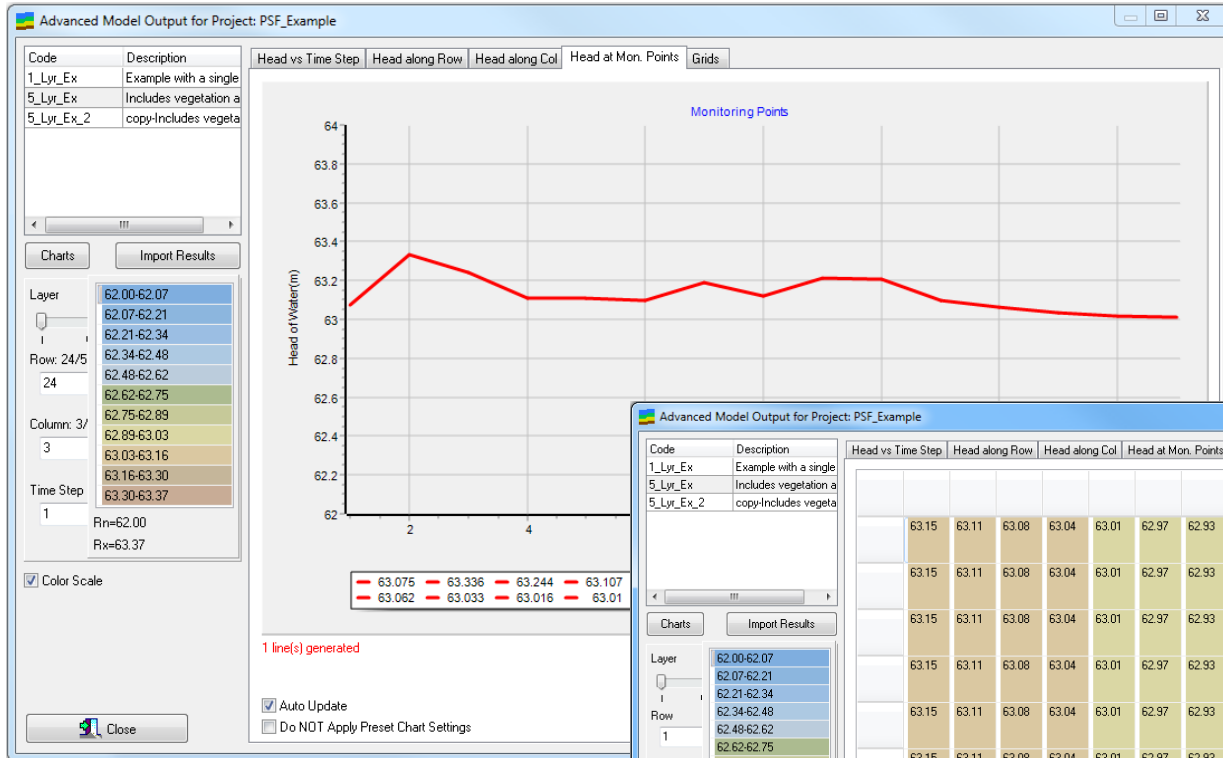
Evapotranspiration is calculated using Thornthwaite or FAO Penman-Monteith



Precipitation is simply added to the wetland from the weather station data



There are multiple graphing and output options



Wetbud is still under development and testing



Acknowledgements

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If you would like to try Wetbud...

- Download the latest Wetbud version:
<http://www.landrehab.org/wetbud/>
- The program is FREE, the code is proprietary
- User's group and manuel are available

