Florida Department of Environmental Protection

Lake Okeechobee Basin Management Action Plan (BMAP) Meeting

January 22, 2014





Agenda

- Overview of Watershed Loading Tool.
- Status Updates on BMAP Components:
  - Project Update.
  - Monitoring Update.
- Questions, Comments, and Discussion.

Overview of Watershed Loading Tool

Review of Lake Okeechobee Nutrient Total Maximum Daily Load (TMDL)

- Phosphorus Concentration Target (40 parts per billion [ppb])
  - When total phosphorus (TP) concentration > 30 ppb, the algal bloom (chlorophyll-*a* concentration > 40 micrograms per liter [µg/L]) frequency significantly increase.
  - Pre-impact TP concentration fell in a range between 30 and 50 ppb for the lake.
- Phosphorus Loading Target (140 metric tons [mt]/year)
  - Assuming Lake Okeechobee is a Continuous-Stirred Tank Reactor (CSTR).
  - TMDL = $(Q_0 + K_{ss}*A) * C_{target}$

    Where,

    Q_0 = flow, A = lake surface area, C=target TP concentration

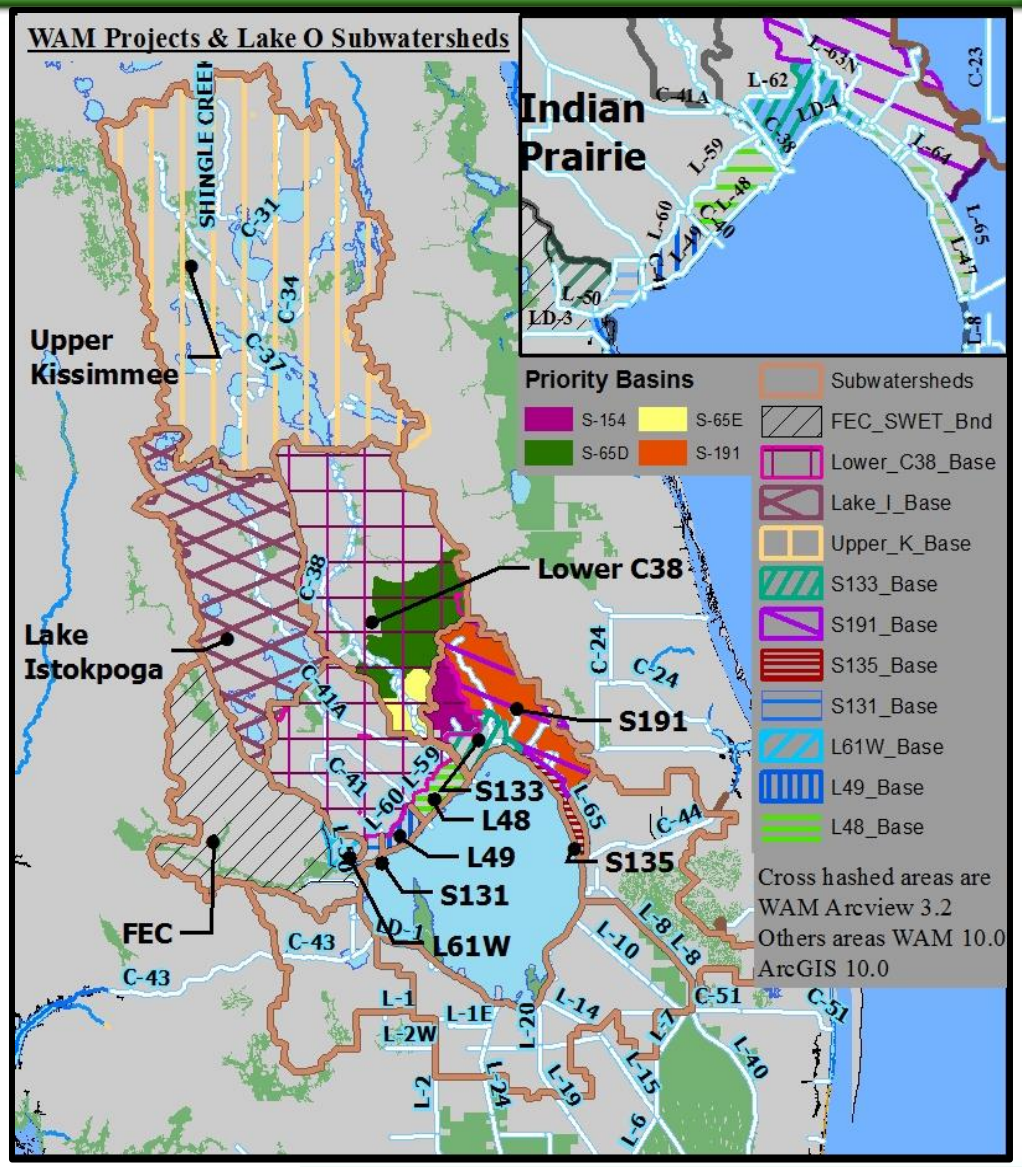
    K_{ss} = net sedimentation rate, influenced by calcium concentration and sediment nutrient release.

TMDL Allocation

- TMDL = 140 mt/year:
  - —35 mt/year direct atmospheric deposition onto lake.
  - —105 mt/year watershed loads (entire watershed).
- Allocation needs a tool that covers entire Lake Okeechobee Watershed and considers spatial distribution of:
  - — Land use type.
  - — Soil condition.
  - — Hydrological condition.
  - — Land surface topography.
  - — Transport attenuation.

Watershed Assessment Model (WAM)

- Developed by Soil and Water Engineering Technology (SWET), Inc. for South Florida Water Management District (SFWMD).
- Includes 11 model domains.
- Covers six sub-watersheds delineated by SFWMD:
  - Upper Kissimmee.
  - Lower Kissimmee (C-38).
  - Lake Istokpoga.
  - Indian Prairie.
  - Fisheating Creek.
  - Taylor Creek/Nubbin Slough.



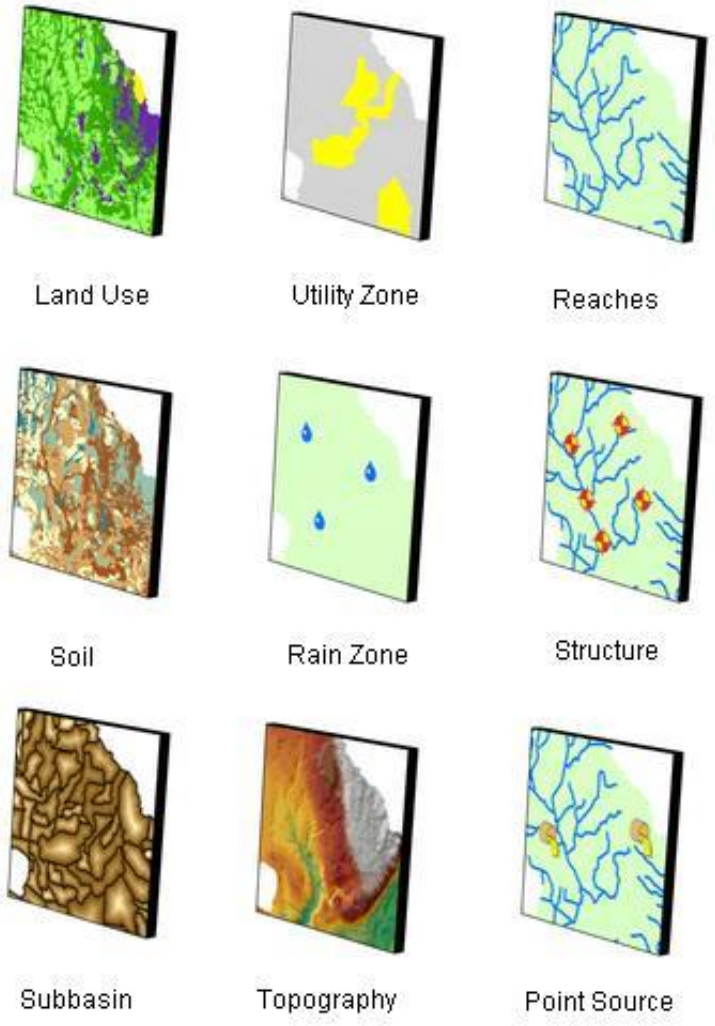
WAM– General Concept of Watershed Model

Physical-based model that simulates hydrology and water quality responses within a watershed based on watershed loading and receiving water transport.

WAM – General Concept of Watershed Model

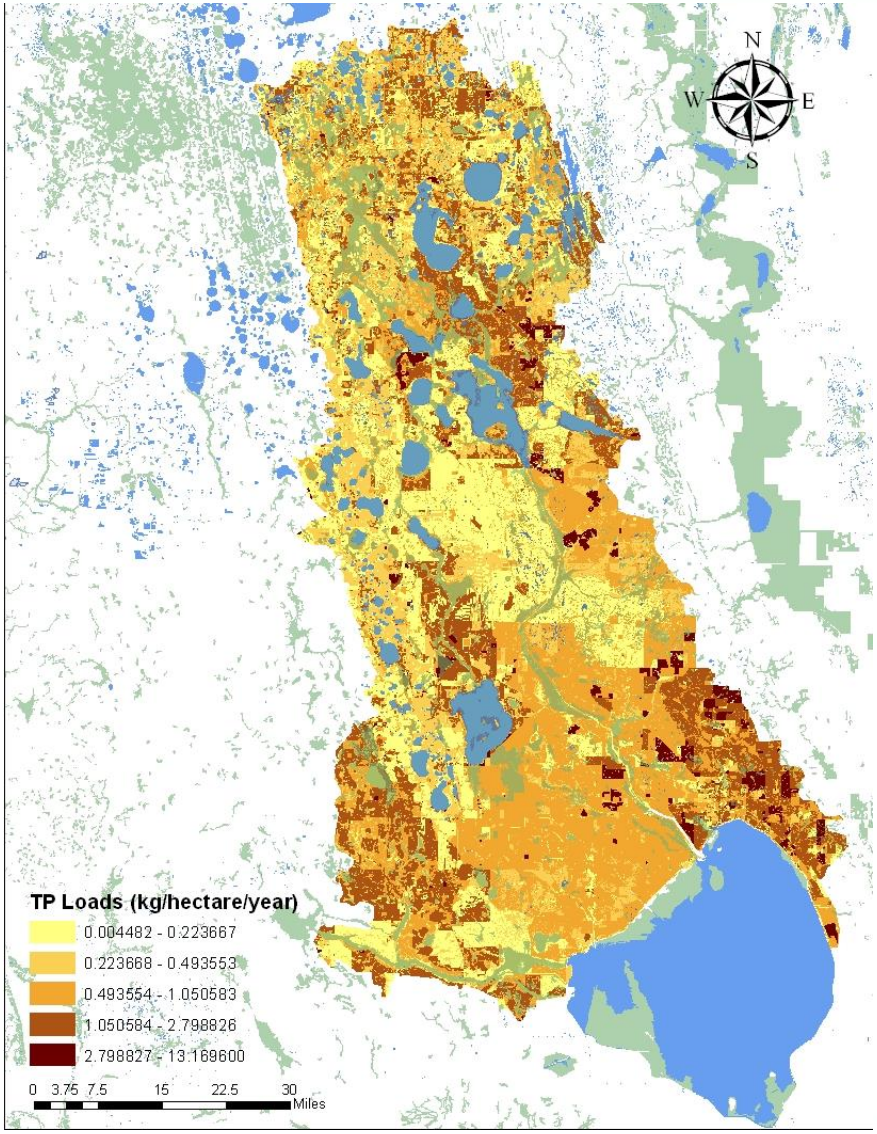
- WAM uses various data for watershed loading simulation:
  - —Rainfall.
  - —Land use.
  - —Soil.
  - —Land surface topography.
  - —Point sources [e.g., National Pollutant Discharge Elimination System (NPDES) facilities].
  - —Best management practices (BMPs).

WAM – A Geographic Information System (GIS) Model



- Provides the convenience to integrate multiple data layers to form a combined data input.
- Provides the capability of identifying projects areas that meet multiple criteria.

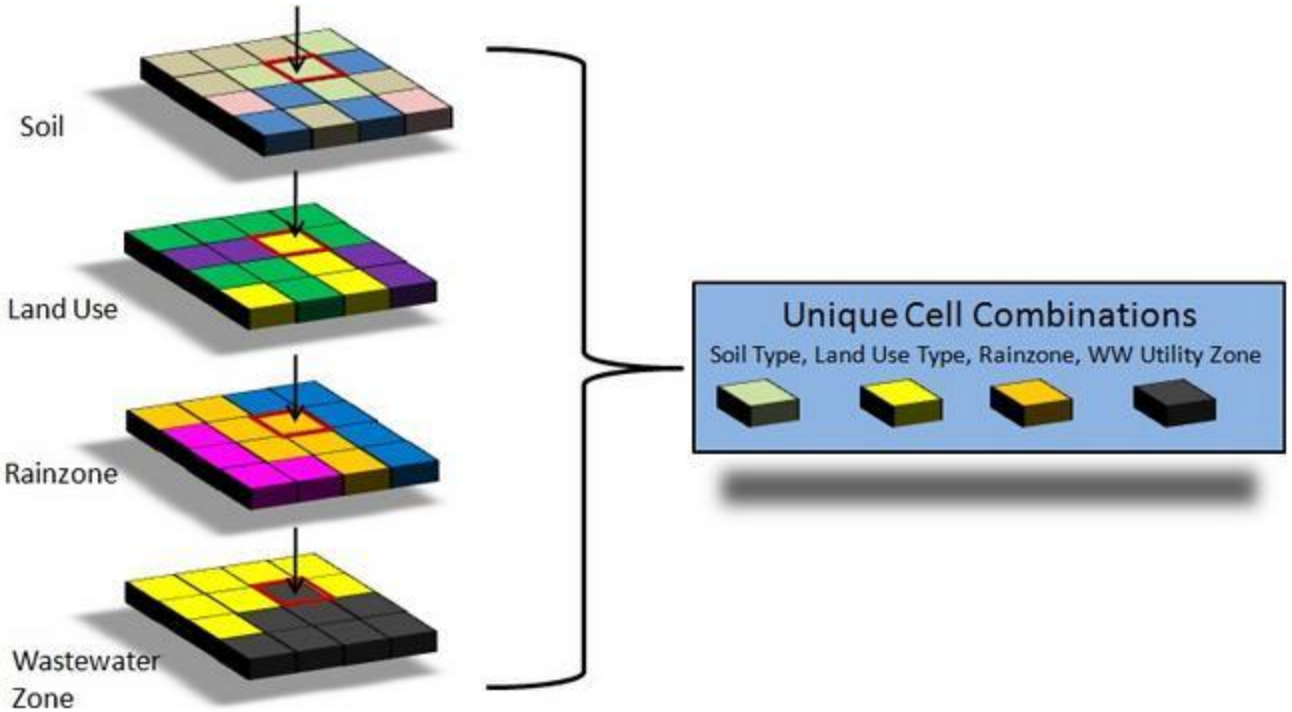
WAM – A GIS Model



- Provides a tool to identify pollutant load hot spots.
- Helps identify potential project areas.

WAM– A Grid Cell Model

- Provides nutrient loads at a high spatial resolution.

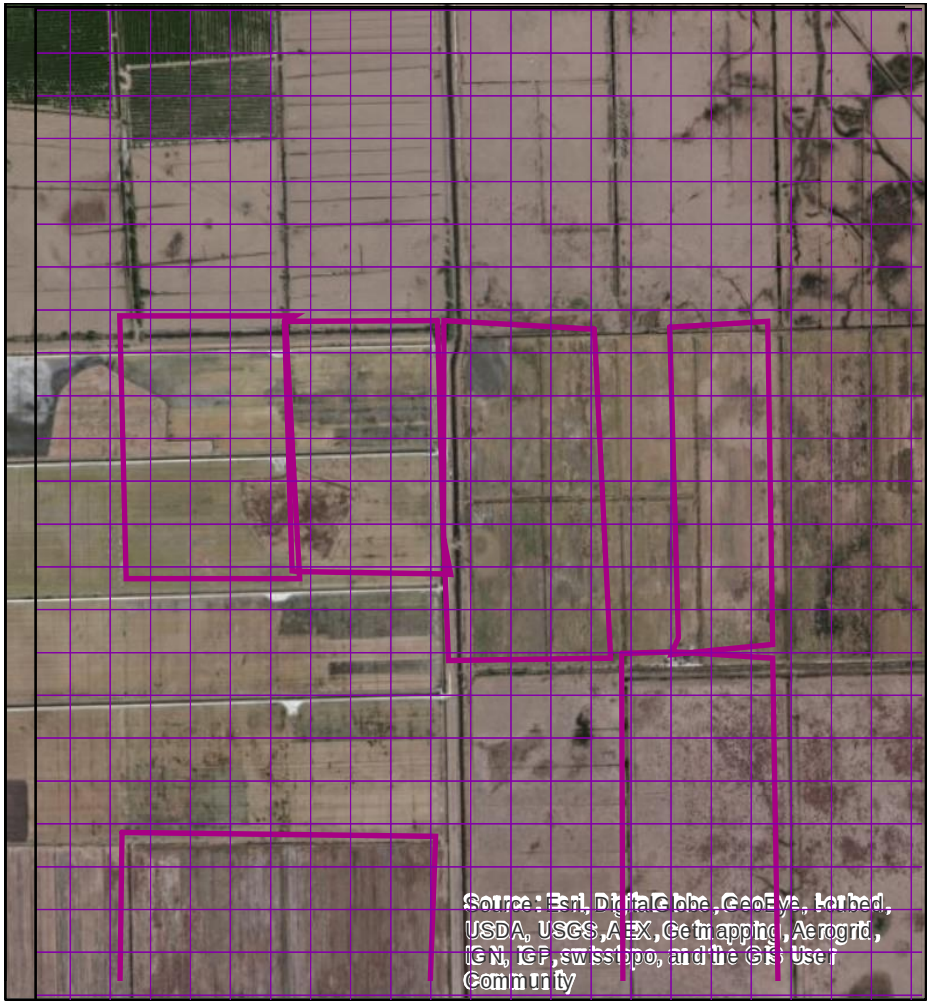


WAM Modeling Scale

- Example area in Northern Indian Prairie.
- WAM uses a 1 hectare (ha) grid cells.

  1 ha = 10,000 square meters (m)

  = 100 m * 100 m



WAM Output

- From watershed:
  - —Original nutrient loads from land areas of different watershed characteristics.
  - —Nutrient loads attenuated through the land surface transport process.
- From receiving waterbodies:
  - —Nutrient loads adjusted for atmospheric deposition, sediment nutrient release, and attenuation in the receiving waters.
- Need for the allocation tool:
  - —The final nutrient loads reaching Lake Okeechobee.

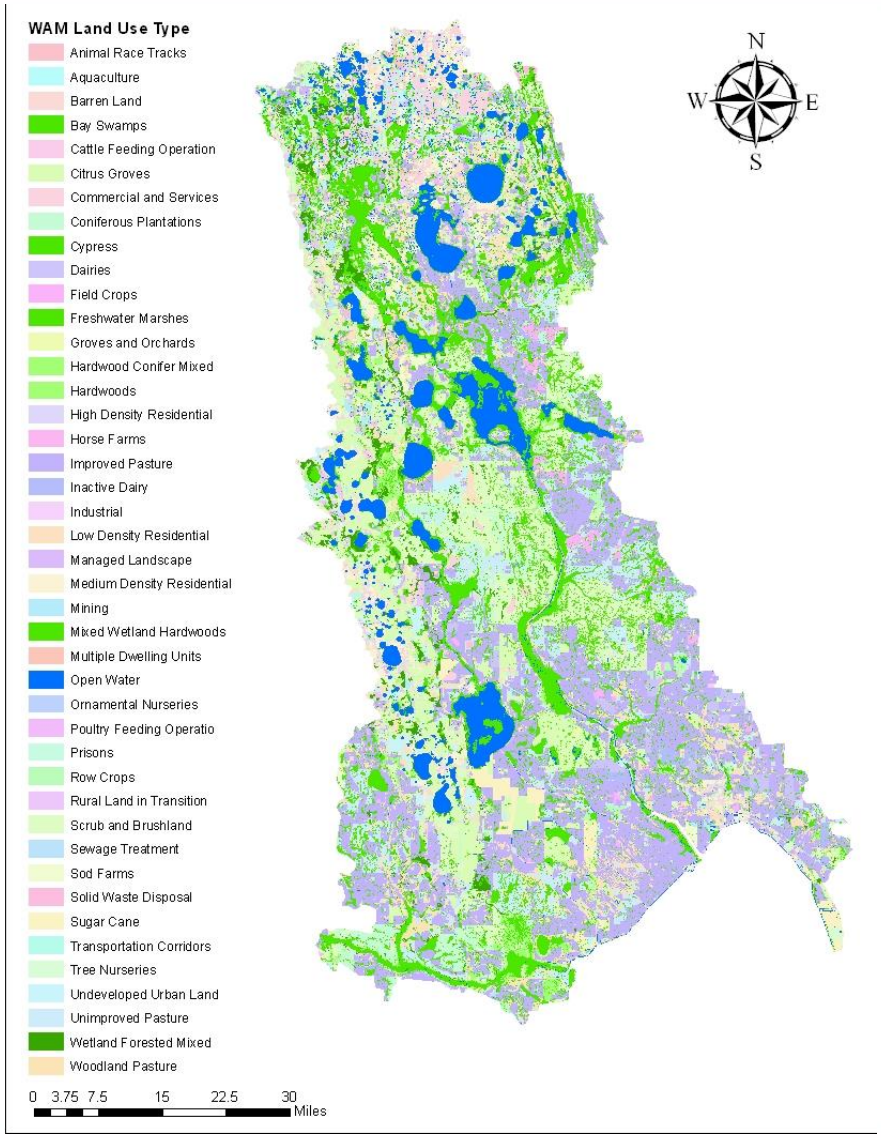
Simplify WAM into An Allocation Tool

- WAM is complicated to use as an allocation tool directly.
  - —Requires extensive modeling expertise to manipulate the model.
  - —Takes a long time to run.
  - —Includes time variable information not needed for spatial allocation.
- The TMDL allocation tool needs:
  - — A long-term average spatial nutrient loading pattern.
  - — A critical index to represent the spatial trend.
  - —The index should include spatial variations of land use, soil, rainfall, topography, etc.

Simplify WAM into An Allocation Tool

- Land use was chosen as the index to represent the spatial loading pattern:
  - —Increase of watershed nutrient loads is caused by the change of land use pattern.
  - —Spatial land use pattern helps determine the background loads from natural land areas .
  - —WAM nutrient loads associated with different land use types take into consideration of soil type, rainfall, topography, etc.
- Basic land use information needed for calculating the land use specific loads:
  - — Land use type.
  - — Land use area (ha).
  - —Areal nutrient loads (kg/ha/year).
  - —Nutrient loads = area (ha) * areal loads (kg/ha/year).

Information Needed to Create the Allocation Tool



- The tool is a GIS shapefile.
- The shapefile should include the following information:
  - Sub-watershed.
  - Basin.
  - Land use type.
  - Land use area.
  - Land use specific areal loads.
  - Receiving water attenuation rate.
  - Final loads reaching Lake Okeechobee.

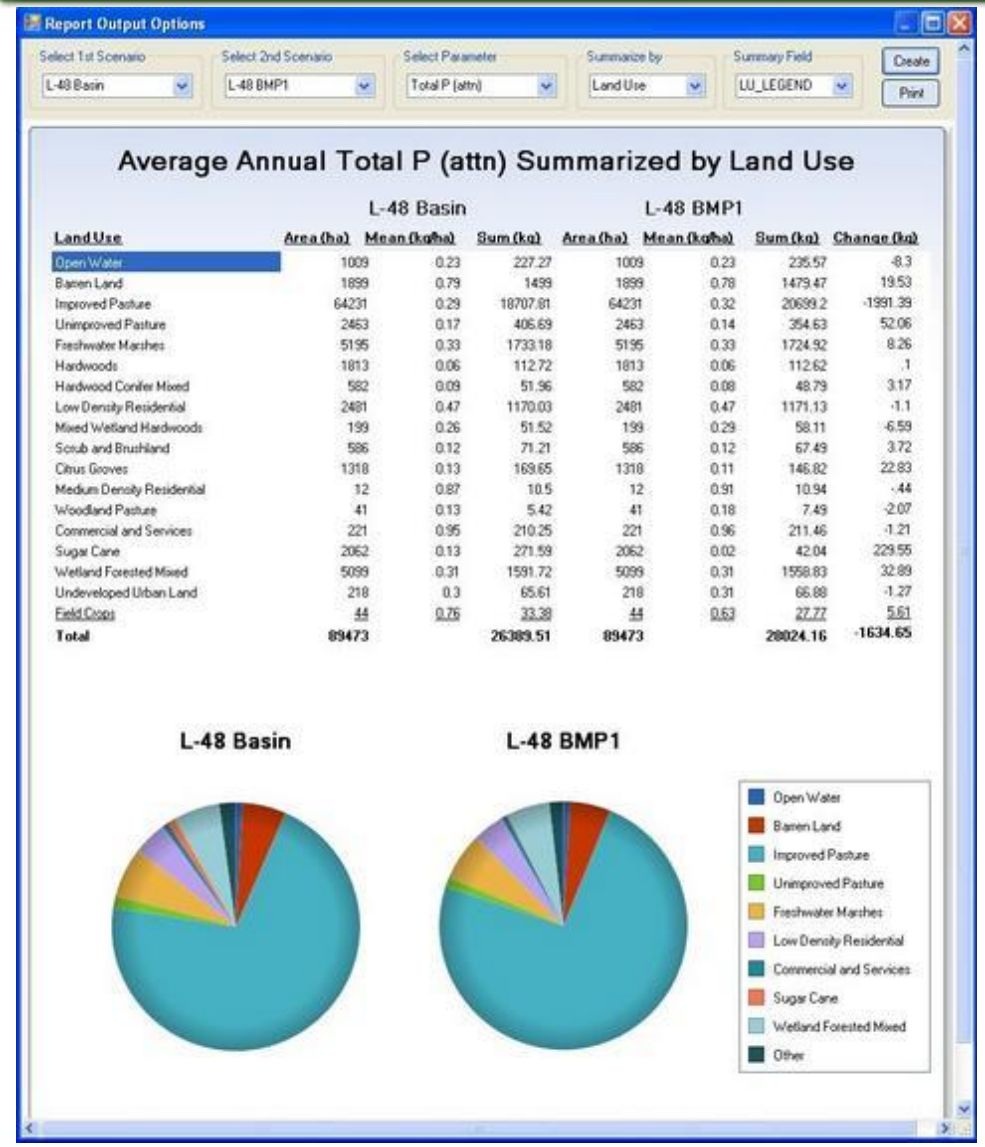
Base Shapefile for the Allocation Tool

- A base shapefile for the allocation tool was provided by SFWMD.
- The shapefile was primarily a 2008-2009 land use shapefile.
- SFWMD edited the shapefile in 2013 to:
  - Included the Lake Okeechobee Watershed areas that fall in the St. Johns River Water Management District (SJRWMD) and Southwest Florida Water Management District (SWFWMD) territories.
  - Updated the land use classification based on ground truthing.
  - Linked Florida Land Use and Cover Classification System (FLUCCS) land use with WAM land use.

SFWMD Land Use Shapefile

- SFWMD refined land use shapefile includes:
  - Sub-watershed.
  - Basin.
  - FLUCCS level III land use type.
  - Updated level III land use type.
  - WAM land use type.
  - Land use area.
- To create the allocation tool, the Department needed to add:
  - Land use specific areal nutrient loads.
  - Receiving water attenuation rate.
  - Final land use specific nutrient loads reaching Lake Okeechobee.

Land Use Specific Areal Loads



- Model domain average land use specific areal loads were obtained for each of the 11 model domains.
- Agricultural BMPs were all removed.
- The areal loads were attenuated through land surface transport.

Agricultural BMPs

- Out of the 11 WAM domains, agricultural BMPs were only included in the original S-191 model.
- As part of the allocation tool, these BMPs, which were implemented on dairies and citrus groves, were removed from the model. To remove them from the model, a TP adjustment factor was used.

WAM LUID	WAM Land Use Description	TP Load Adjustment Factor
39	Dairies	1.18
84	Citrus Groves	1.27

- Nutrient-reduction benefits for these BMPs will be calculated and added to the overall nutrient-reduction benefits in each of the sub-watersheds north of Lake Okeechobee.

Receiving Water Attenuation Rate

- A receiving water attenuation rate was calculated for each of the 11 WAM domains using the following equation:

  Attenuation Rate = (Total Inlet Load – Total Outlet Load)/Total Inlet Load

- WAM domain total inlet loads include:
  - Watershed loads.
  - Upstream boundary loads.
  - Atmospheric loads directly deposit onto the surface of receiving waterbodies.
  - Possible sediment nutrient release.

- Total outlet loads:
  - Major outlet flow * Nutrient concentration of the flow.

Total Loads That Reach Lake Okeechobee

- For each sub-watershed, the total nutrient loads that eventually reach Lake Okeechobee was the sum of nutrients from areas occupied by all different land use types.

$$L = \sum_{1}^{i} Pi * Ai * (1 - Att)$$

- Where,
  - L is the final nutrient load reaching Lake Okeechobee (kg/year).
  - i represent the ith land use type.
  - Pi is the areal nutrient load (kg/ha/year) for ith land use.
  - Ai is the area of ith land use (ha).
  - Att is the receiving waterbody attenuation rate (%).

Lake Okeechobee Sub-watershed TP Loads

Lake Okeechobee Sub-watersheds	Area (ha)	Total Load to Lake Okeechobee (kg/year)
Fisheating Creek	128,708	63,908.47
Indian Prairie	111,927	83,071.20
Lake Istokpoga	159,529	23,766.25
Lower Kissimmee	173,687	117,658.59
Taylor Creek/Nubbin Slough	80,045	102,554.04
Upper Kissimmee	416,189	65,786.37
TOTAL	**1,070,085**	**456,744.93**

Next Steps: Allocation Process

- Efforts are still being taken to refine the allocation tool:
  - ❖ Identify all the waterbodies that should be treated as receiving water instead of part of the watershed
  - ❖ Calculate the accumulative receiving water attenuation
  - ❖ Produce areal nutrient loads for finer hydrologic units

- The starting loads for each sub-watershed will be compared against individual sub-watershed targets to determine the necessary reductions needed to meet the individual sub-watershed targets.

- A percent reduction goal for each sub-watershed will be discussed at a future meeting.

- The Department will determine the most appropriate starting loads for natural lands.

Status Updates on BMAP Components

Project Collection

- To achieve TP reductions, each stakeholder was asked to provide projects and activities that reduce nutrient loads.

- Projects already submitted by:
  - Cities of Kissimmee and Orlando.
  - Florida Department of Transportation (FDOT) Districts 1, 4, and 5.
  - Highlands, Martin, Orange, Polk, Okeechobee, and Osceola Counties.
  - Istokpoga Marsh Watershed Improvement District.
  - Spring Lake Improvement District.
  - SFWMD.

Project Collection, continued

- The Department has also been coordinating with the Florida Department of Agriculture and Consumer Services (FDACS) on the agricultural BMP enrollment in the watershed.

- The Department and FDACS are evaluating where owner implemented BMPs and cost-share BMPs have been added in the watershed.
  - The associated load reductions for these BMPs will be calculated.

- This evaluation will also help to identify other areas of the watershed where cost-share BMPs should be implemented to achieve greater reductions.

Project Collection, continued

- Additional project information should be submitted **by Friday, February 14th**.
- Recently completed projects (construction completed since 2009) should be submitted.
- In addition, projects planned to be completed during the first BMAP iteration, which goes through 2019, should also be submitted.
- All of the project collection information is posted to the FTP site: http://publicfiles.dep.state.fl.us/DEAR/BMAP/LakeOkeechobee/Meetings/TechMeeting_Aug2013/ProjectCollection/ .

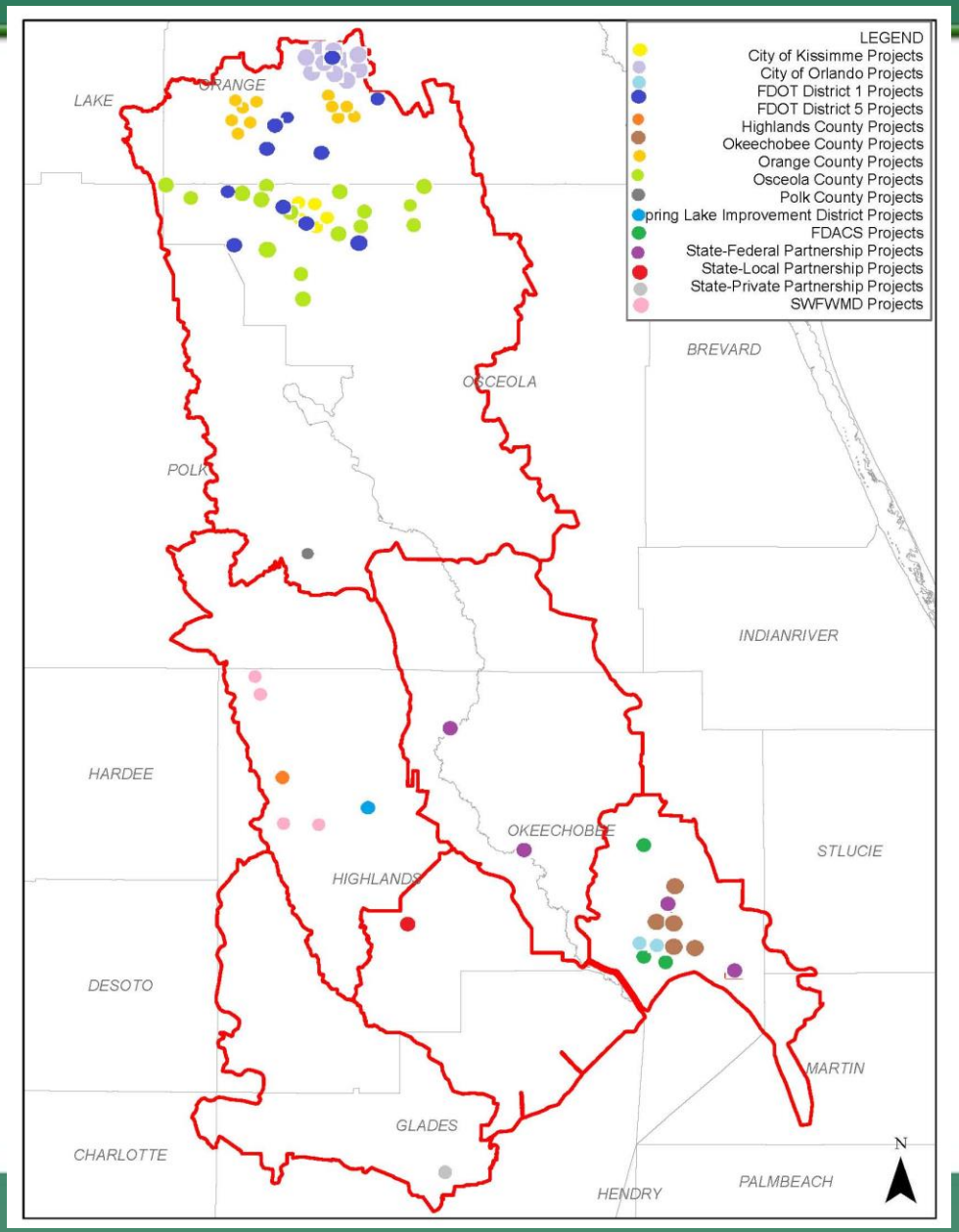
Funding Sources for BMAP Projects

- Funding sources:
  - Section 319 Grant.
  - TMDL Grant.
  - State Revolving Fund Loan.

- Projects listed in a BMAP receive extra points in the scoring for these funding sources.

- A handout was provided at the June meeting with additional details about funding sources. This handout can also be found at http://www.dep.state.fl.us/water/waterprojectfunding/docs/WaterFundingAssistanceHandout2013.pdf.

Existing and Planned Projects in the Watershed



Monitoring Update

- The Department and the SFWMD are working together to develop a preliminary monitoring plan.
- The plan will be presented at the next meeting.
- If you have not provided monitoring information to us, please do so **by Friday, January 31st**.

Monitoring Update, continued

- The Department is working internally to determine a trend analysis network.

- The Department is working with FDACS to design a BMP verification program.

Next Steps

- Determine target loading by sub-watershed.
- Calculate nutrient reduction benefits for projects submitted.
- Identify types of projects needed at sub-watershed level.
- Continue outreach to develop specific projects.

Action Items

- Please submit project collection information **by Friday, February 14th**.

- Please submit any monitoring information **by Friday, January 31st**.

Questions?

- **Lake Okeechobee Watershed BMAP Coordinators**
  - Kim Dinkins

    Phone: (850) 245–8825

    E-mail: Kimberleigh.Dinkins@dep.state.fl.us

  - Katie Hallas

    Phone: (850) 245–8432

    E-mail: Katie.Hallas@dep.state.fl.us