

# Florida Department of Environmental Protection



## **Draft Lake Okeechobee Basin Management Action Plan (BMAP) Overview**

**September 17, 2014**





# Presentation Overview

- Chapter 1: Context, Purpose, and Scope of the Plan.
- Chapter 2: Lake Okeechobee Watershed Setting.
- Chapter 3: Pollutant Sources and Anticipated Outcomes.
- Chapter 4: Watershed Load Estimates.
- Chapter 5: Management Strategies.
- Chapter 6: Assessing Progress and Making Changes.
- Appendices.
- BMAP Review.



# Chapter 1: Context, Purpose, and Scope of the Plan



# Basis of the BMAP

- Northern Everglades and Estuaries Protection Program (NEEPP) is implemented by the Coordinating Agencies (South Florida Water Management District [SFWMD], Florida Department of Agriculture and Consumer Services [FDACS], and Florida Department of Environmental Protection).
- NEEPP states that the Lake Okeechobee Watershed Construction Project-Phase II Technical Plan should provide the basis for the BMAP.



# Basis of BMAP, continued

- BMAP contents and process are defined in Chapter 403.067, Florida Statutes.
- Statute requires BMAP development to be a stakeholder-driven process.
- BMAP is adopted by Secretarial Order.
- BMAP will be periodically updated.

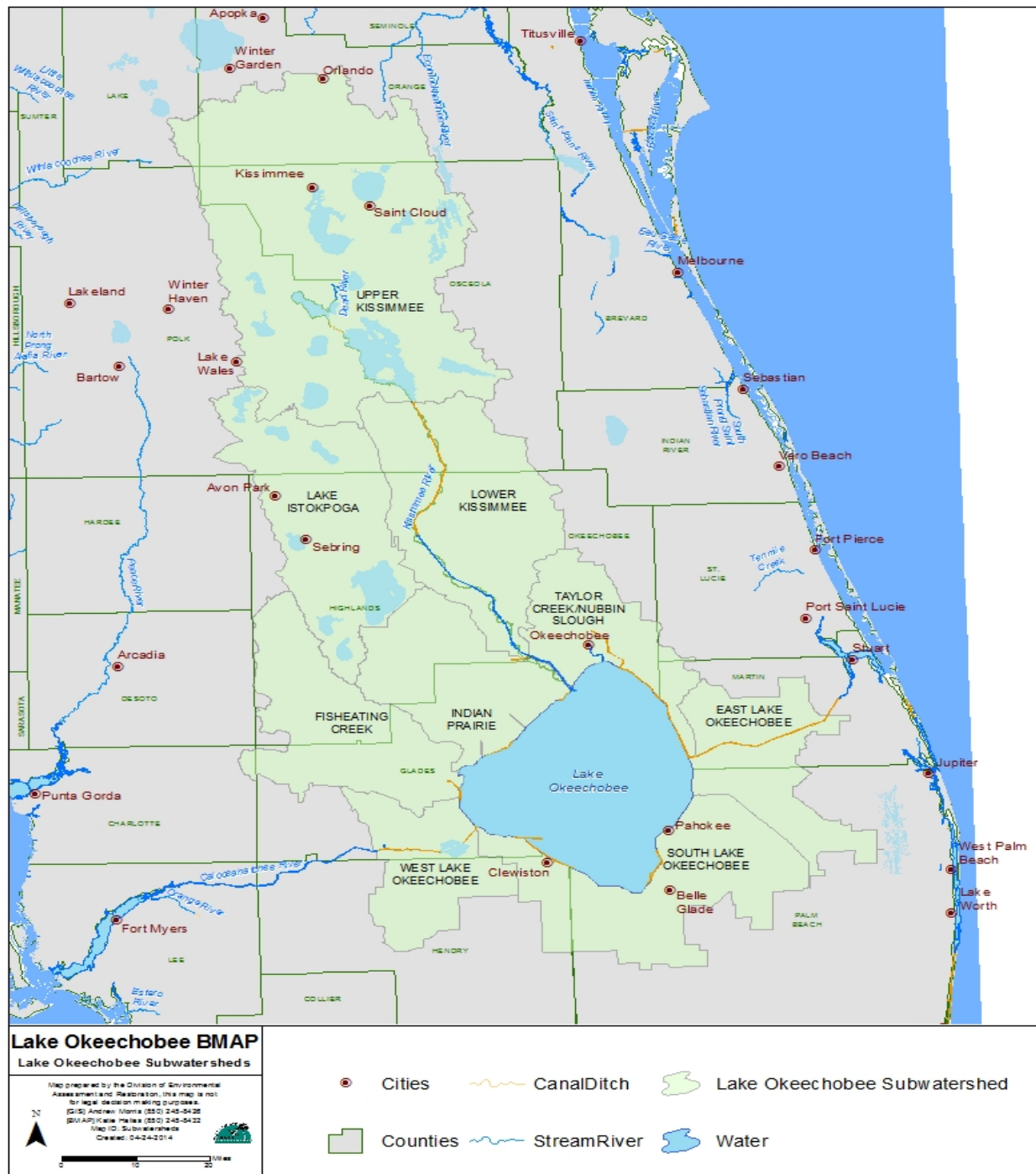


# BMAP Process

- Engages local stakeholders and promotes coordination and collaboration to address total phosphorus (TP) reductions.
- BMAP development process began in February 2013.
- The BMAP's goal is to implement TP load reductions to achieve the Lake Okeechobee total maximum daily load (TMDL).



## LOW's Sub-watersheds





# TMDL

- The Department adopted the TP TMDL in May 2001.
- The TMDL is a total annual TP load to Lake Okeechobee of 140 metric tons (MT).
  - Five-year rolling average.
- The TMDL includes the nine sub-watersheds that contribute to the lake.



# Assumptions

- Focus of initial BMAP phase is on six northern sub-watersheds:
  - ~89.1% of TP load to Lake Okeechobee.
  - ~88.3% of discharge to Lake Okeechobee.
- Provisional BMPs.
- Nutrient reduction benefits.



# Considerations

- Land uses.
- Watershed boundaries.
- Watershed Assessment Model (WAM)/load estimation tool.
- Complexity of problem.
- Legacy phosphorus.
- Downstream attenuation factors.
- Attenuation factors.
- Elevated TP identification.
- Lake Kissimmee and Kissimmee Chain of Lakes TMDLs.
- Total nitrogen (TN).



# Chapter 2: Lake Okeechobee Watershed Setting



# Land Uses in the LOW

- Anthropogenic land uses for the LOW's nine sub-watersheds:
  - Agriculture = 44.45%.
  - Urban and built-up = 9.08%.
  - Barren land = 0.62%.
  - Transportation, communication, and utilities = 1.00%.
- The remaining 44.85% of the LOW consists of largely natural land uses.

| Level 1 Land Use Code | Land Use                                     | Acres               | % Total     |
|-----------------------|----------------------------------------------|---------------------|-------------|
| 1000                  | Urban and Built-Up                           | 353,823.72          | 9.08%       |
| 2000                  | Agriculture                                  | 1,732,481.38        | 44.45%      |
| 3000                  | Upland Nonforested                           | 206,351.05          | 5.29%       |
| 4000                  | Upland Forests                               | 251,384.07          | 6.45%       |
| 5000                  | Water                                        | 574,715.67          | 14.74%      |
| 6000                  | Wetlands                                     | 702,773.74          | 18.03%      |
| 7000                  | Barren Land                                  | 24,118.46           | 0.62%       |
| 8000                  | Transportation, Communication, and Utilities | 39,114.36           | 1.00%       |
| 9000                  | Inactive Dairy                               | 13,076.76           | 0.34%       |
| -                     | <b>Total</b>                                 | <b>3,897,839.22</b> | <b>100%</b> |



# LOW Hydrology

| Sub-watershed              | 2001–2012<br>Discharge (Ac-ft) | Percent (%)   | 2013 Discharge<br>(Ac-ft) | Percent (%)   |
|----------------------------|--------------------------------|---------------|---------------------------|---------------|
| East Lake Okeechobee       | 124,121                        | 5.3%          | 197,686                   | 9.2%          |
| Fisheating Creek           | 243,180                        | 10.3%         | 204,560                   | 9.5%          |
| Indian Prairie             | 263,475                        | 11.1%         | 299,311                   | 13.9%         |
| Lake Istokpoga             | 273,600                        | 11.6%         | 280,540                   | 13.0%         |
| Lower Kissimmee            | 335,527                        | 14.2%         | 423,814                   | 19.7%         |
| South Lake Okeechobee      | 96,297                         | 4.1%          | 93,047                    | 4.3%          |
| Taylor Creek/Nubbin Slough | 143,780                        | 6.1%          | 208,380                   | 9.7%          |
| Upper Kissimmee            | 826,015                        | 35.0%         | 439,646                   | 20.4%         |
| West Lake Okeechobee       | 57,611                         | 2.4%          | 5,070                     | 0.2%          |
| <b>Total</b>               | <b>2,363,336</b>               | <b>100.0%</b> | <b>2,152,054</b>          | <b>100.0%</b> |



# Water Quality

| Sub-watershed              | Average 2001–2012<br>TP Load (MT) | Percent<br>(%) | 2013 TP<br>Load (MT) | Percent<br>(%) |
|----------------------------|-----------------------------------|----------------|----------------------|----------------|
| East Lake Okeechobee       | 26.5                              | 5.2%           | 36.7                 | 6.9%           |
| Fisheating Creek           | 70.3                              | 13.7%          | 47.6                 | 8.9%           |
| Indian Prairie             | 103.0                             | 20.1%          | 105.8                | 19.8%          |
| Lake Istokpoga             | 34.8                              | 6.8%           | 31.8                 | 6.0%           |
| Lower Kissimmee            | 62.0                              | 12.1%          | 96.5                 | 18.1%          |
| South Lake Okeechobee      | 19.7                              | 3.8%           | 29.0                 | 5.4%           |
| Taylor Creek/Nubbin Slough | 98.9                              | 19.3%          | 137.0                | 25.7%          |
| Upper Kissimmee            | 87.5                              | 17.1%          | 48.7                 | 9.1%           |
| West Lake Okeechobee       | 9.8                               | 1.9%           | 0.4                  | 0.1%           |
| <b>Total</b>               | <b>512</b>                        | <b>100.0%</b>  | <b>534</b>           | <b>100.0%</b>  |



# Chapter 3: Pollutant Sources and Anticipated Outcomes



# Municipal Separate Storm Sewer Systems (MS4s)

- Entities with an MS4 permit are responsible for managing stormwater in the LOW:
  - 22 Phase I MS4s.
  - 16 Phase II MS4s.
- The MS4 permits include a self-implementing clause, requiring the entity to implement actions in an adopted BMAP.



# Nonpoint Sources

- Reductions in loads carried by stormwater that are separate from discharges by a permitted MS4 were established in the “load allocation” component of the TMDL.
  - 37 nonpoint source entities in the LOW.
- These “non-MS4 sources” must also implement the actions in a BMAP.



# Agriculture

- Primary agricultural land uses in the LOW:
  - Improved pastures.
  - Unimproved pastures.
  - Citrus groves.
  - Woodland pastures.
- All agricultural nonpoint sources in the BMAP area are statutorily required either to implement appropriate BMPs or to conduct water quality monitoring that demonstrates compliance with state water quality standards.



# Chapter 4: Watershed Load Estimates



# Load Estimation Tool

- Developed using the 11 WAM domains that encompass six northern sub-watersheds.
- WAM implicitly includes agricultural and urban BMPs.
  - Agricultural BMPs were explicitly included in the S-191 basin but were removed as part of the tool.
- The Coordinating Agencies are working on a contract to revise the WAM.



# Load Estimation Tool, continued

- Unit TP loads per hectare were determined from the WAM output for land uses within each sub-watershed.
- Unattenuated loads (load at the source) were used in the tool and an attenuation factor was applied for each WAM domain.
  - Attenuation factor is the difference between the inlet load and outlet load in each domain.
- The final loads reaching Lake Okeechobee are the sum of the attenuated loading from each sub-watershed.



# TP Baseline Loads

| Sub-watershed                           | Area (acres)       | Watershed TP Loads (MT/year) | Percent Loads (%) |
|-----------------------------------------|--------------------|------------------------------|-------------------|
| Fisheating Creek                        | 318,042.2          | 79.0                         | 18%               |
| Indian Prairie                          | 276,577.2          | 72.7                         | 16%               |
| Lake Istokpoga                          | 394,203.3          | 26.2                         | 6%                |
| Lower Kissimmee                         | 429,187.6          | 103.0                        | 23%               |
| Taylor Creek/Nubbin Slough              | 196,733.1          | 100.8                        | 22%               |
| Upper Kissimmee                         | 1,028,421.3        | 66.6                         | 15%               |
| <b>Total TP Loads from Northern LOW</b> | <b>2,643,164.7</b> | <b>448.3</b>                 | <b>100%</b>       |



# Schedule for WAM Revisions

| Action                                                                         | Completion Date |
|--------------------------------------------------------------------------------|-----------------|
| Develop scope of work for contract.                                            | Fall 2014       |
| Execute contract.                                                              | Fall 2014       |
| Complete WAM refinements.                                                      | Winter 2015     |
| Conduct pre-drainage characterization and sensitivity/uncertainty analyses.    | Spring 2016     |
| Use WAM results to update sub-watershed starting loads and project reductions. | Fall 2016       |
| Identify hot spots for additional project locations and prioritization.        | Winter 2016     |



# Chapter 5: Management Strategies



# Management Strategies

- Strategies completed since January 1, 2009 and planned during the first BMAP iteration, as well as projects that are currently under development by the Coordinating Agencies and other initiatives are included.
- BMAP focuses on current, planned, and future projects to reduce TP loads to Lake Okeechobee.



# Types of Strategies

- Urban stormwater BMPs.
- Dispersed water management (DWM) and payment for environmental services.
- Stormwater treatment areas (STAs).
- Hydrologic restoration.
- Hybrid wetland treatment technologies (HWTT) and floating aquatic vegetation treatment (FAVT) systems.
- Agricultural BMPs.



# Urban Stormwater BMPs

- Example BMPs include:
  - Wet detention ponds.
  - Dry retention.
  - Swales.
  - Baffle boxes.
  - Stormwater reuse.
  - Street sweeping.
  - Public education.
- Credit was assigned based on area treated and BMP efficiency.



# DWM Program

- DWM Program provides shallow water storage, retention, and detention to improve Lake Okeechobee and estuary health.
- DWM projects are temporary in nature.
- Program was developed as an interim means to store water until larger regional projects come on line.
- DWM projects in the BMAP are considered “temporary,” and the number and type of projects may change from year to year.



# DWM, continued

- Water quality data were used to determined BMAP reductions for:
  - Buck Island Ranch.
  - Rafter T Ranch.
  - West Waterhole.
  - XL Ranch.
- Reductions for other DWM projects were based on acre-feet of storage and TP concentration associated with land uses in project area.



# STAs

- STAs are large-scale treatment systems, which capture stormwater runoff and/or flows from waterbodies, and treat water with vegetation within the system.
- Large-scale implementation of STAs in the Northern Everglades is a relatively new practice.
- Estimated reductions associated with these projects will be refined as additional long-term data become available.



# Hydrologic Restoration

- These projects restore more natural flow to help attenuate regional stormwater and restore habitat, while improvements in water quality are ancillary.
- Kissimmee River Restoration = largest of these projects.
  - Reductions were based on the estimated TP reductions at S-65D and S-65E.
  - Estimates will be refined as additional long-term data become available.
- The reductions for the other restoration projects were based on design estimates.



# HWTT and FAVT

- HWTT = chemical treatment + wetland technologies
  - Five active or planned HWTT facilities in the LOW.
- FAVT uses floating aquatic vegetation for the reduction of phosphorus.
  - One FAVT facility in the LOW.
- Load reductions calculated by multiplying estimated flow capacity of each system (based on 75% of full design capacity) and inflow TP concentration to system.

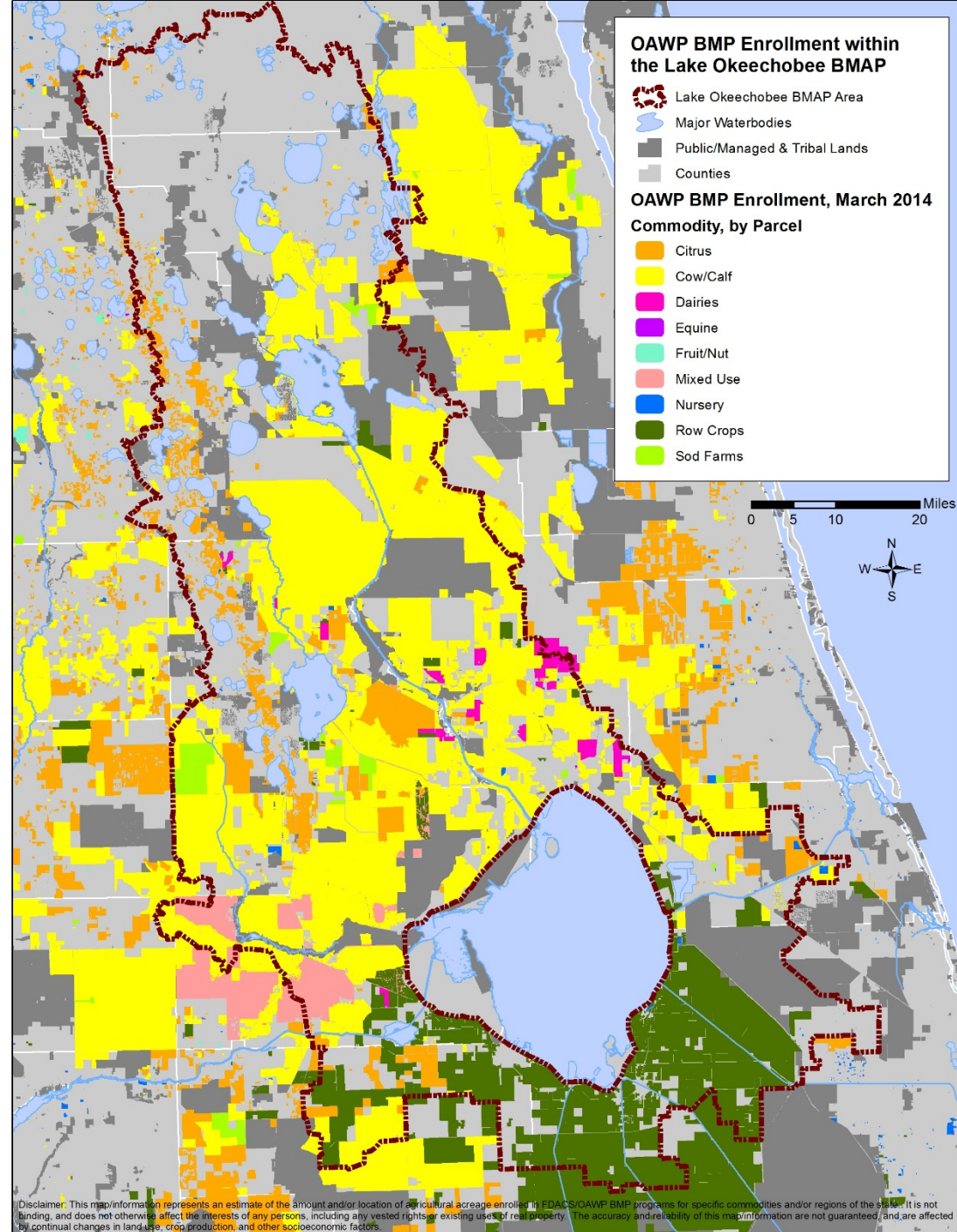


# Agricultural BMPs

- For purposes of estimating nutrient reductions from agriculture, all agricultural lands are assumed to be enrolled in the FDACS BMP program, excluding properties that were enrolled in FDACS BMPs prior to 2009.
  - This is consistent with the methodology used for estimating nutrient reductions from urban BMPs.



## LOW Agricultural Enrollment





# Projects Under Development with Coordinating Agencies

- Istokpoga Marsh Watershed Improvement District-Phase II.
- Lakeside Ranch STA Phase II.
- MacArthur Agro-Ecology Research Center “Buck Island” Ranch/Rafter T Realty, Inc.
- Brighton Valley – Lykes.
- Rolling Meadows Wetland Restoration - Phase II.
- Inactive Dairies- Lagoon Remediation.
- PL-566 Funded/Fisheating Creek Structure.
- State Road 710 Regional Project.
- Legislative Cost-Share Appropriation Program (\$10 million annually for seven years).



# Other Efforts and Restoration Strategies

- Alternative BMP nutrient reduction projects.
- Everglades Headwaters National Wildlife Refuge and Conservation Area.
- SFWMD's Regulatory Nutrient Source Control Program.
- Comprehensive Everglades Restoration Plan (CERP) projects.
- Rolling Meadows Phase II.
- Lake Okeechobee low water level habitat enhancement plan development.
- Expanded water quality monitoring.
- Cost-share BMP effectiveness verification.
- Owner-implemented BMP verification.



# Summary of Reductions

| Category                                                        | TP reduction<br>(MT/yr)        |
|-----------------------------------------------------------------|--------------------------------|
| Baseline Load (Six Northern Sub-watersheds)                     | 448.3                          |
| Reductions Needed to Achieve TMDL (105 MT)                      | 343.3                          |
| Total Reductions Achieved (from completed and planned projects) | 103.44                         |
| Projects Under Development with Coordinating Agencies           | 46.12–49.14                    |
| Total Reductions                                                | 149.56–152.58<br>(43.5%–44.4%) |
| Total Reductions Remaining to Meet TMDL                         | 193.74–190.72                  |



# Southern Sub-watersheds

- BMP implementation required as part of the SFWMD's Everglades Regulatory Source Control Program under Chapter 40E-63, Florida Administrative Code, or as part of FDACS BMP program.
- Other management strategies:
  - Urban stormwater.
  - Public education and outreach.
  - Diversions.
  - Muck removal/canal cleaning.
  - Bolles Cross Canal improvements.



# Chapter 6: Assessing Progress and Making Changes



# Tracking Progress

- Project status and water quality information will be compiled annually into a progress report for the BMAP.
- Adaptive management will be used to adjust the BMAP, as necessary, in future iterations.



# Water Quality Monitoring Plan

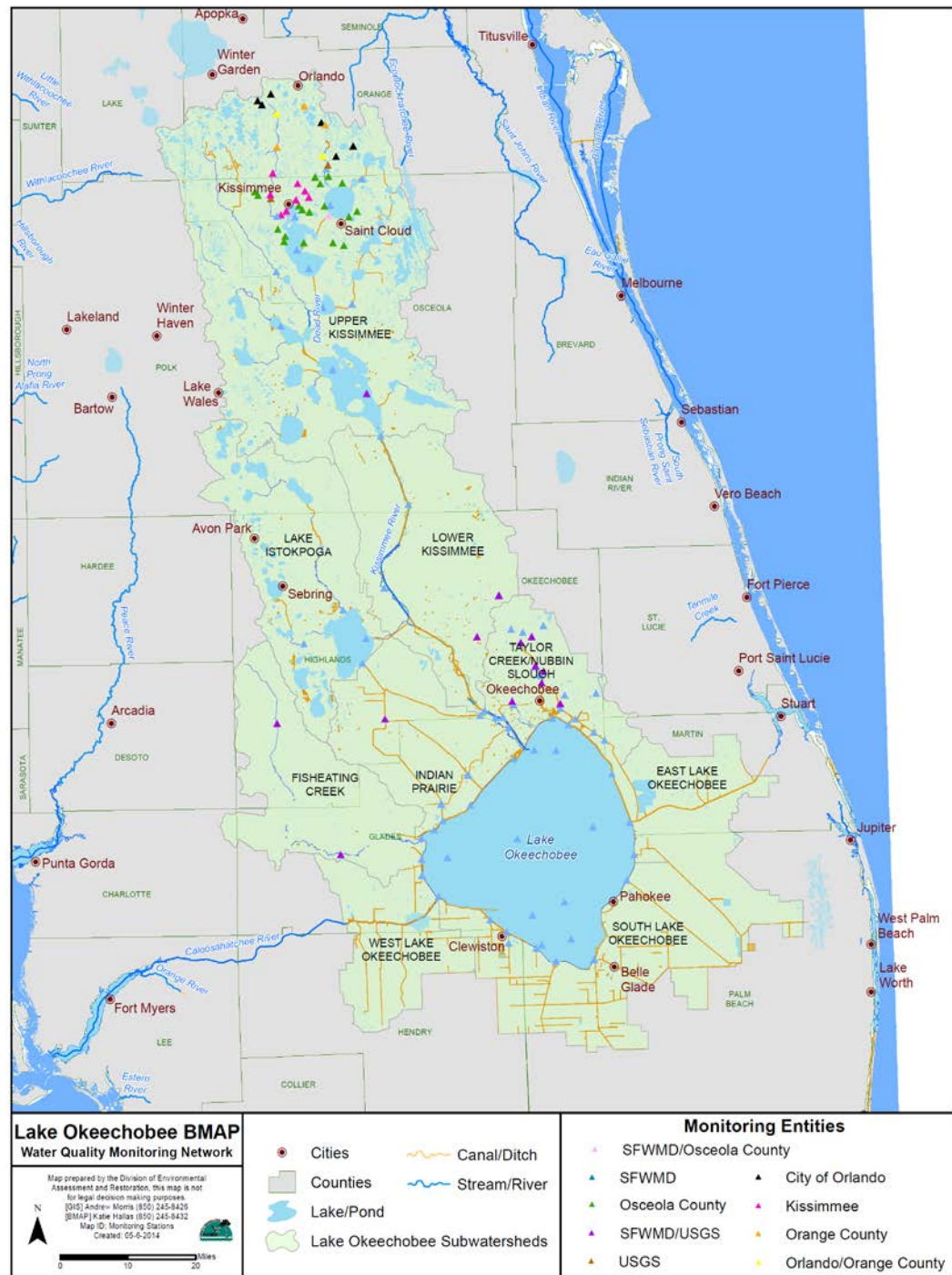
- Primary objective:
  - To continue to track trends in TP concentrations and loads by sub-watershed.
- Secondary objectives:
  - To continue to track trends in TN concentrations and loads by sub-watershed.
  - To continue to identify areas within LOW with high TP loading to better focus management efforts.
  - To continue to measure effectiveness of individual or collective projects in reaching TMDL target-pollutant loadings.



# Monitoring Plan, continued

- The monitoring network for this plan builds on existing efforts in the basin by the following entities:
  - Osceola County.
  - Orange County.
  - City of Kissimmee.
  - City of Orlando.
  - SFWMD.
  - U.S. Geological Survey (USGS).

# LOW BMAP Monitoring Network





# Monitoring Plan Reassessment

- After BMAP adoption, the Department, Coordinating Agencies, and stakeholders will refine monitoring plan to focus on additional areas with existing projects/BMPs to evaluate water quality improvements.
- Revised WAM output will be used to identify areas where additional monitoring may be necessary.



# Appendices



# Appendices

- Appendix A: BMP Efficiencies and Projects to Achieve the TMDL.
- Appendix B: FLUCCS Codes and WAM Land Use Classifications.
  - Cross walk between the Florida Land Use and Cover Classification System (FLUCCS) codes and the land uses in WAM.
- Appendix C: Potential Funding Sources.
- Appendix D: Bibliography of Key References and Websites.



# BMAP Review



# BMAP Review

- The BMAP is posted at <http://publicfiles.dep.state.fl.us/DEAR/BMAP/LakeOkeecho/Draft BMAP>.
- General comments should be provided in the comment matrix.
- Detailed comments should be made in track changes.
- All comments should be submitted to Katie Hallas ([Katie.Hallas@dep.state.fl.us](mailto:Katie.Hallas@dep.state.fl.us)) and Yesenia Escribano ([Yesenia.Escribano@dep.state.fl.us](mailto:Yesenia.Escribano@dep.state.fl.us)) by close of business *Monday, October 6th*.