



# Florida Department of Environmental Protection

## Silver Springs and Rainbow Springs Basin Management Action Plan

August 31, 2017  
Mary Paulic





# Agenda

- Welcome and Opening Remarks
- Revisions to the Silver and Rainbow Springs Nutrient Source Inventory and Loading Tool (NSILT) – Celeste Lyon – FDEP
- Revised Calculation of Load Reduction and Milestones – Mary Paulic – FDEP
- Agriculture BMP Implementation Update – Maddy Hart – FDACS
- Predictive Modeling of Groundwater Nitrate Levels – Andy Canion – SJRWMD
- Improvements to the SWFWMD Groundwater Nutrient Monitoring Network in the Rainbow Springs Basin – Dave DeWitt – SWFWMD
- Public Comment and Next Steps
  - Next meeting date and location and agenda
  - Summary of action items



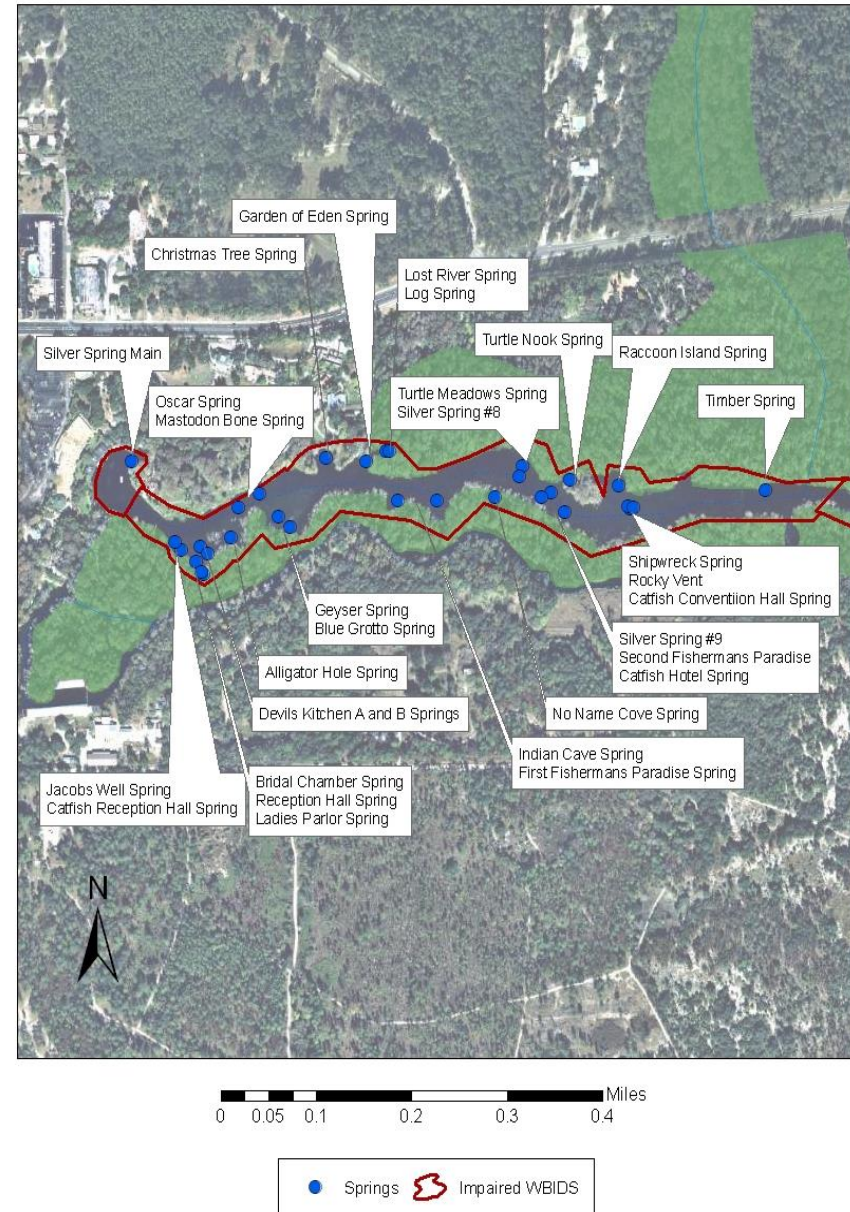
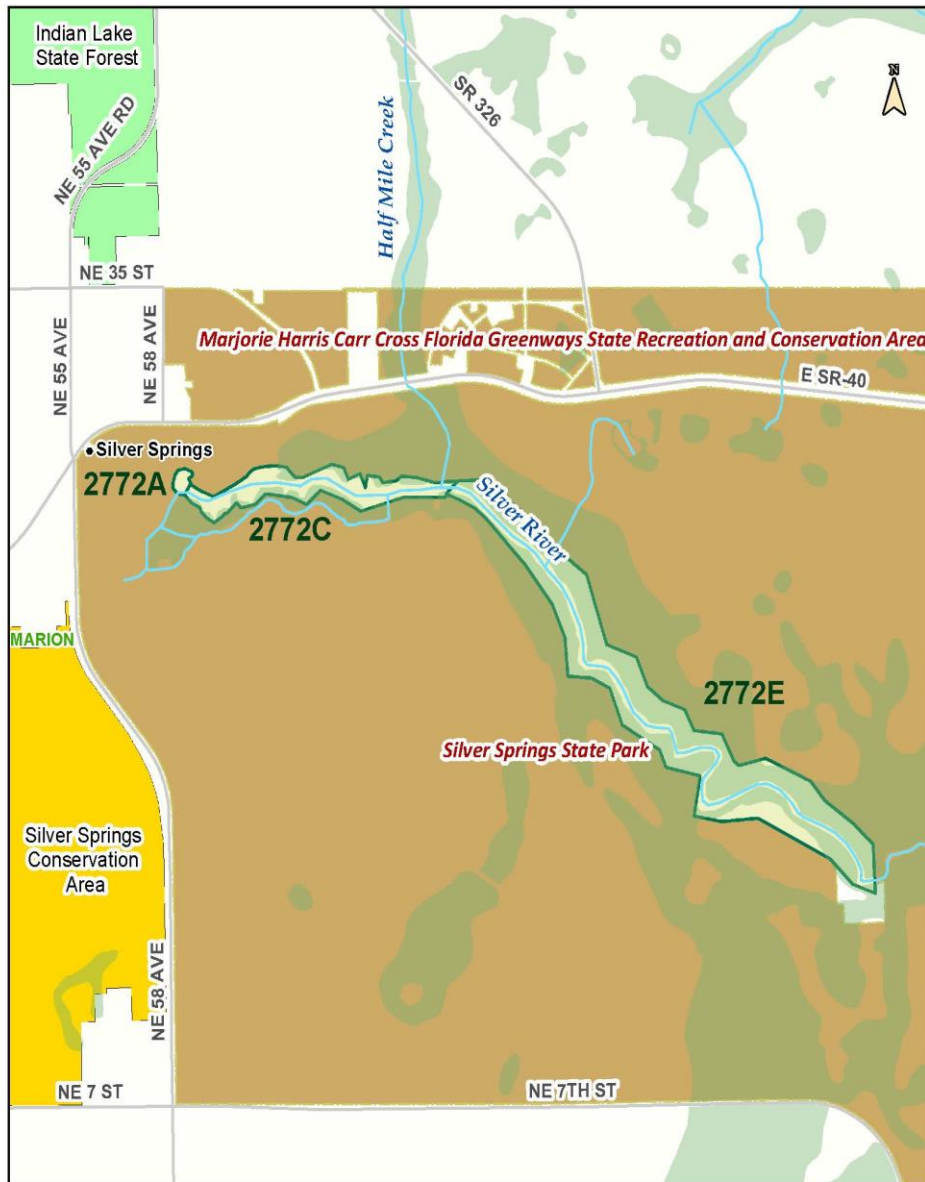


# Silver Springs / Silver River Loadings and Reductions



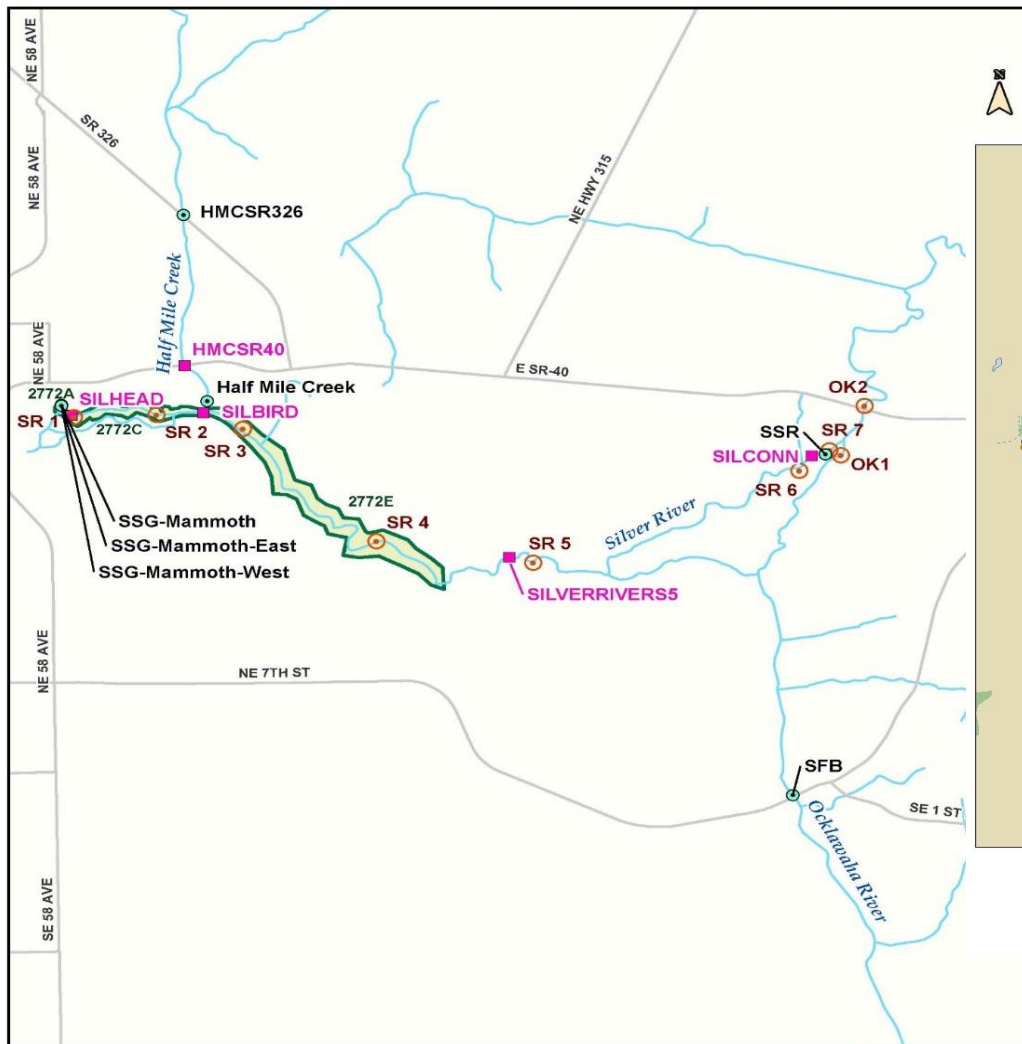


# Silver Springs Impaired Waters





# Silver Springs Monitoring



0 0.1 0.2 0.4 0.6 0.8 Miles

- ▲ Biological Sampling Stations
- Water Quality Sampling Stations
- ⊗ USGS Gaging Stations
- ⬭ Silver Springs WBIDs

**Silver River and Springs BMAP**  
Ocklawaha Group 1 Basin  
Surface Water Monitoring



0 1,000 2,000 3,000 4,000 5,000 Feet

Map prepared May 7, 2015 by the Bureau of Watershed Restoration, Division of Environmental Assessment and Restoration. This map is not for legal decision making purposes. For more information or copies, contact Mary Paine at (850) 245-8860, or mary.paine@dep.state.fl.us. (850) 245-8860, or mary.paine@dep.state.fl.us

- Aquatic Preserve Water Quality Stations
- SJRWMD Water Quality Stations
- Continuous Monitoring Stations
- ⬭ Local Roads
- ⬭ Silver Springs BMAP
- ⬭ Impaired WBIDs





# Sampling Location Changes

## **Changes for nitrate data collection**

### **WBID 2772A Mammoth Spring:**

- Discontinue SSG-Mammoth-East and SSG-Mammoth-West.
- SSG-Mammoth sampled bimonthly.

### **WBID 2772C Silver Springs Group:**

- SR1 and SR2 sampled quarterly.
- Discontinue SILHEAD.
- SILBIRD sampled monthly and continuous recorder.

### **WBID 2772E Upper Silver River:**

- SR3 and SR4 quarterly.

### **Downstream:**

- SR 5, SR6, SR7 sampled quarterly.
- SSR sampled bimonthly.
- SILVERRIVERS5 and SILCONN discontinued.





# Draft Silver River Nitrate Averages

Estimates are for  
WBID 2772C.

| Draft Nitrate Average         |              |              | Combined                   |
|-------------------------------|--------------|--------------|----------------------------|
| Year                          | Spring mg/L  | Stream mg/L  | Average mg/L<br>(all data) |
| 2005                          | 1.525*       |              | 1.525                      |
| 2006                          | 1.387        |              | 1.387                      |
| 2007                          | 1.375*       |              | 1.375                      |
| 2008                          | 1.680*       |              | 1.680                      |
| 2009                          | 1.608        |              | 1.608                      |
| 2010                          | 1.604        |              | 1.604                      |
| 2011                          | 1.710*       |              | 1.710                      |
| 2013                          |              | 1.400*       | 1.400                      |
| 2014                          |              | 1.222        | 1.222                      |
| 2015                          |              | 1.230        | 1.230                      |
| 2016                          | 1.557        | 1.193        | 1.272                      |
| <b>Average 2005-<br/>2016</b> | <b>1.488</b> | <b>1.218</b> | <b>1.348</b>               |

\* only 1 or 2 quarters of data.



# Silver River Water Quality

- Used riverine locations only.
- Focused on WBID 2772C as downstream end of predominately ground water input.
- Draft average for time period is 1.218 mg/L. (data available from 2013-2016)

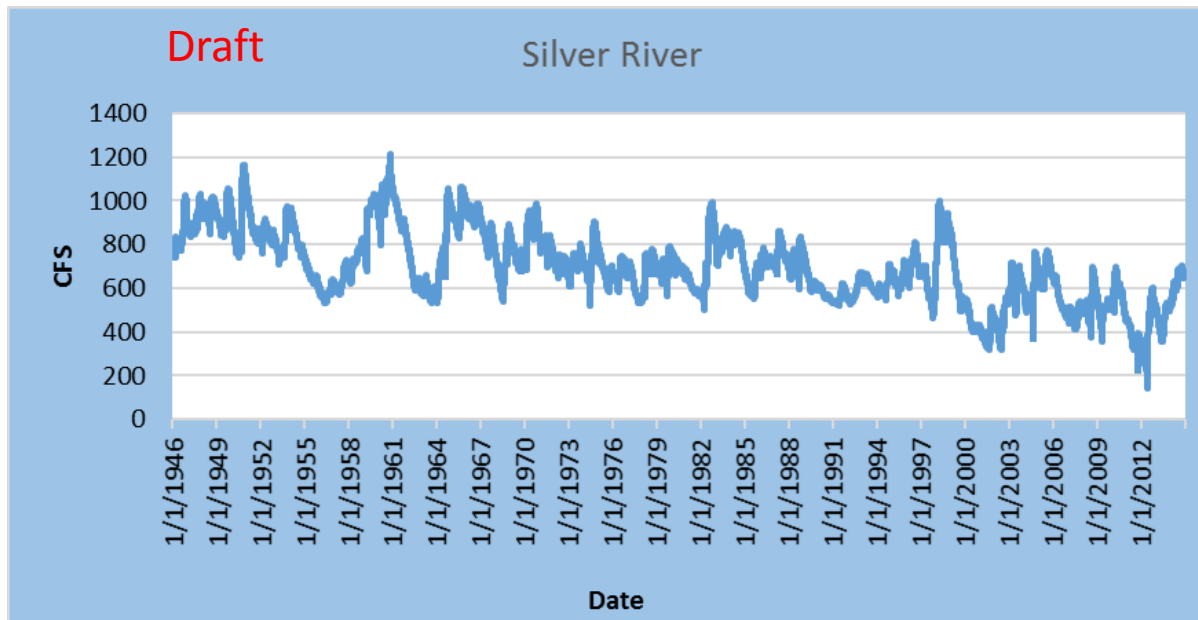






# Silver River Draft Flow Record

- USGS gaging stations 02239501.
- Data period used 2005-2016. Daily average flow.
- Average flow of 531.4 CFS.





# Loading and Confidence Limits

## Draft

- Calculated 95% confidence limit around means for flow and concentration. Added upper confidence limit to mean as a margin of safety.
- New concentration =  $1.218 \text{ mg/L} + 0.018 \text{ mg/L} = 1.236 \text{ mg/L}$ .
- New flow =  $531.36 \text{ CFS} + 3.25 \text{ CFS} = 534.6 \text{ CFS}$ .



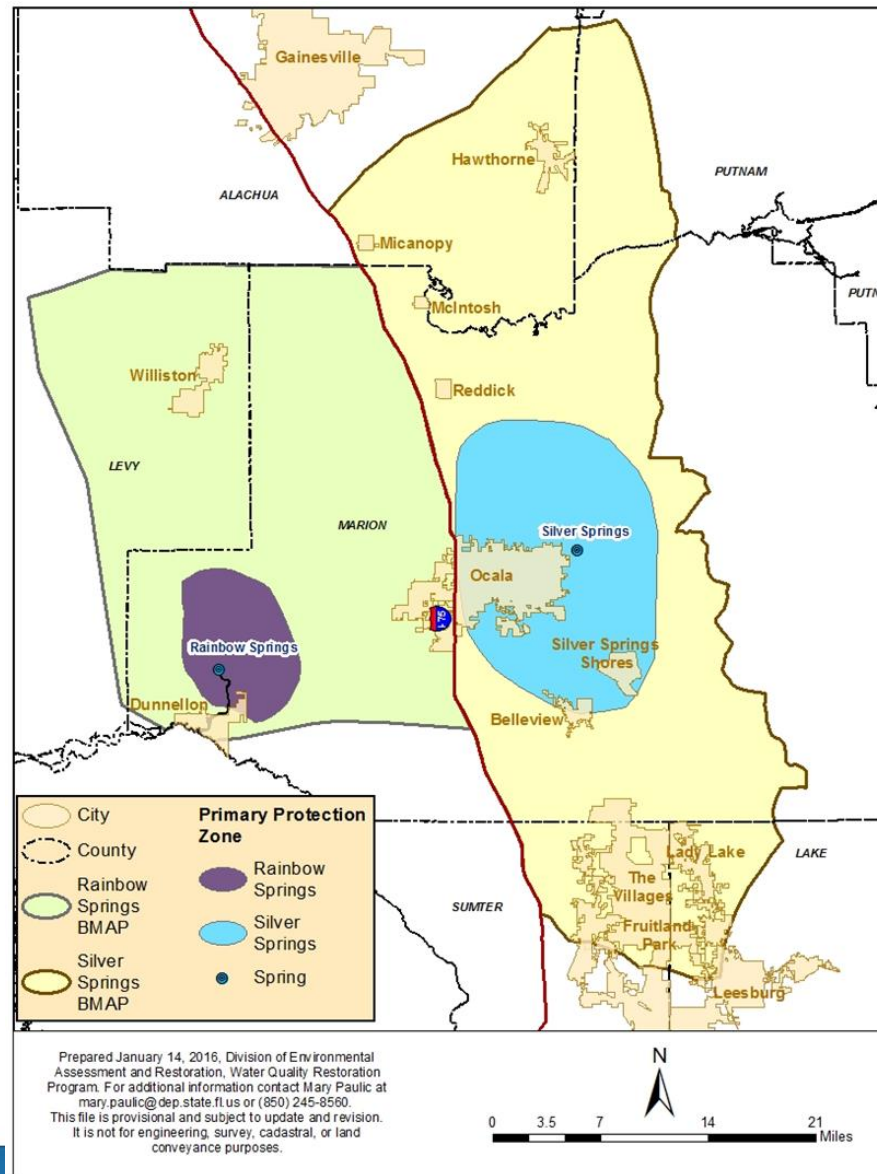
# Draft Silver River Loading Calculations

- All loadings are draft estimates.
- Flow times concentration = loading.
- Loading at discharge = 1,298,498 lbs-N/year.
- Loading calculated at TMDL concentration of 0.35 mg/L for same flow volume = 368,363 lbs-N/year.
- Reduction = Loading at discharge – TMDL loading.
- Reduction = 930,135 lbs-N/year.
- NSILT estimate of loading = 1,674,531 lbs-N/year for all sources.





# Silver Springs Priority Focus Area





# Silver PFA Loading Estimate

## Draft

- NSILT estimate of loading for PFA = 501,696 lbs-N/year.
- Portion of NSILT predicted loading in PFA /NSILT predicted loading for BMAP area.
- Approximately 30% of NSILT predicted loading within PFA.
- Proportional reduction for PFA is approximately 30% of 930,135 lbs-N/year for the BMAP area.
- PFA reductions = 278,672 lbs-N/year.



# Draft Silver Springs Priority Focus Area Reductions

Draft

| Source Category                                              | Source as Percent of Loading (based on NSILT) | Portion of BMAP Loading Reduction in PFA lbs-N/year |
|--------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------|
| Atmospheric Deposition                                       | 9.0%                                          | -                                                   |
| WWTF                                                         | 7.0%                                          | 19,507                                              |
| OSTDS                                                        | 31.0%                                         | 86,388                                              |
| Urban Turf                                                   | 12.0%                                         | 33,441                                              |
| Sports Turf                                                  | 8.0%                                          | 22,294                                              |
| Cattle Farms                                                 | 10.0%                                         | 27,867                                              |
| Horse Farms                                                  | 11.0%                                         | 30,654                                              |
| Crop Fertilizer                                              | 7.0%                                          | 19,507                                              |
| Miscellaneous Livestock                                      | 0.3%                                          | 836                                                 |
| Drainage wells                                               | 5.0%                                          | 13,394                                              |
| <b>PFA is about 30% of BMAP Loading Reduction lbs-N/year</b> |                                               |                                                     |



# DRAFT Silver Springs BMAP Loading Reductions

**DRAFT** Loading Reduction for Entire Silver Springs BMAP Area.

| Source Category         | Source as a Percent based on NSILT | Loading Reduction lbs- N/year | Loading Reduction Adjusted for PFA lbs- N/year |
|-------------------------|------------------------------------|-------------------------------|------------------------------------------------|
| Atmospheric Deposition  | 10.0%                              | -                             | -                                              |
| WWTF                    | 2.0%                               | 18,603                        | 0                                              |
| OSTDS                   | 28.0%                              | 260,438                       | 174,049                                        |
| Sports Turf             | 10.0%                              | 93,014                        | 70,720                                         |
| Urban Turf              | 10.0%                              | 93,014                        | 59,573                                         |
| Cattle Farms            | 18.0%                              | 167,424                       | 139,557                                        |
| Horse Farms             | 10.0%                              | 93,014                        | 62,360                                         |
| Crop Fertilizer         | 7.0%                               | 65,110                        | 46,659                                         |
| Miscellaneous Livestock | 1.0%                               | 9,301                         | 8,465                                          |
| Drainage wells          | 2.0%                               | 18,603                        | 4,669                                          |
| Reuse                   | 2.0%                               |                               |                                                |





# Estimated Reductions by Period

- Reduction goal is for each 5 year period and not a cumulative total.

| Spring System | Draft Estimated Loading Reduction lbs-N/year | Draft 5 Year Reduction Goal lbs-N/year | Draft 10 Year Reduction Goal lbs-N/year | Draft 15 Year Reduction Goal lbs-N/year |
|---------------|----------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|
| Rainbow BMAP  | 1,783,607                                    | 535,082                                | 713,443                                 | 535,082                                 |
| Rainbow PFA   | 175,818                                      | 52,745                                 | 70,327                                  | 52,745                                  |
| Silver BMAP   | 930,135                                      | 279,040.5                              | 372,054                                 | 279,040.5                               |
| Silver PFA    | 278,672                                      | 83,601                                 | 111,469                                 | 83,602                                  |
|               |                                              |                                        |                                         |                                         |

## Targets:

- 5 years 30% reduction (of original loading reduction)
- 10 years 40% reduction
- 15 years 30% reduction

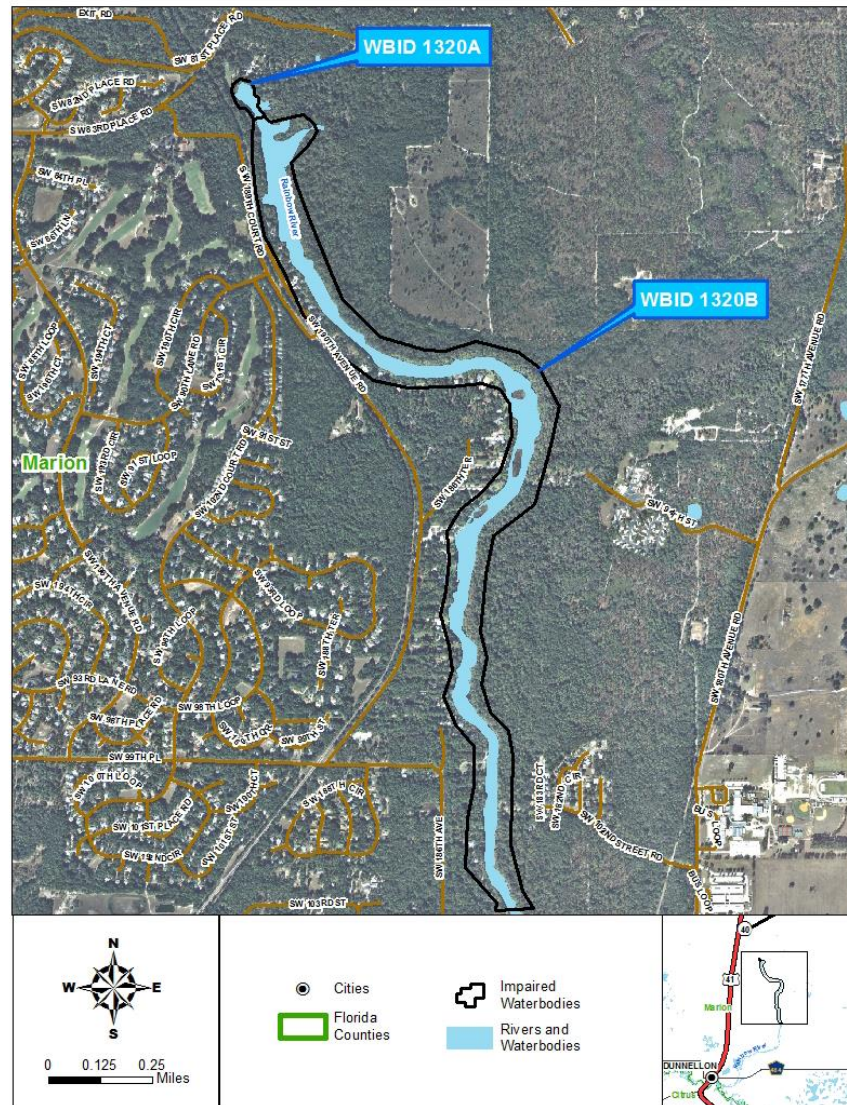
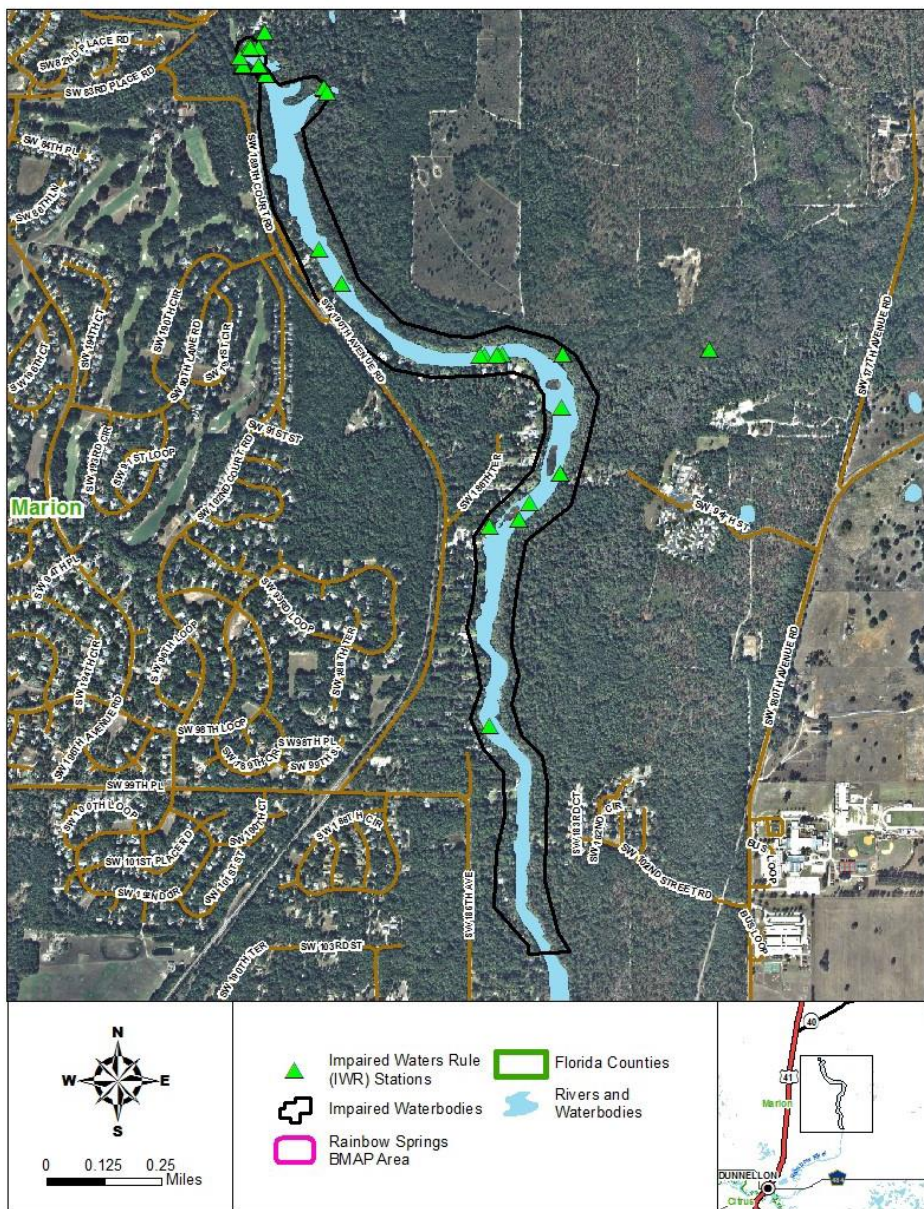
An aerial photograph of a river flowing through a dense forest. The water is a vibrant turquoise color, contrasting with the surrounding green trees. A wooden boardwalk or bridge crosses the river in the upper left portion of the image. The text "Rainbow Springs / River Loading and Reductions" is overlaid in the center of the image in a bold, yellow, sans-serif font.

# Rainbow Springs / River Loading and Reductions





# Rainbow Springs WBIDs

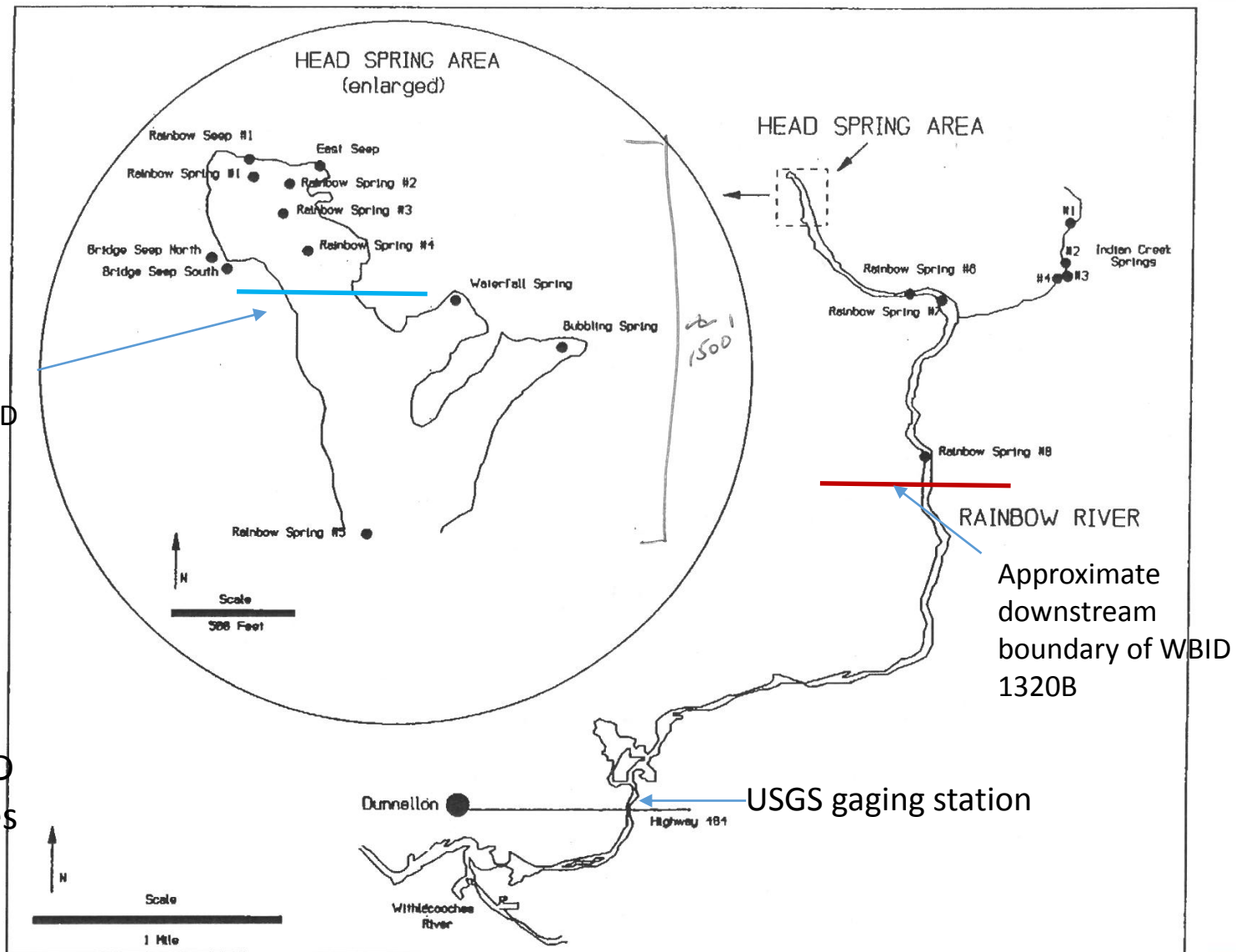






# Rainbow Springs

Approximate  
downstream  
boundary of WBID  
1320A



Approximate  
downstream  
boundary of WBID  
1320B

USGS gaging station

Graphic from  
1996 SWFWMD  
report, by Jones  
et al.



# Rainbow River Draft Nitrate Average

**Draft** averages for WBID 1320B. \* only 1 or 2 quarter's data points.

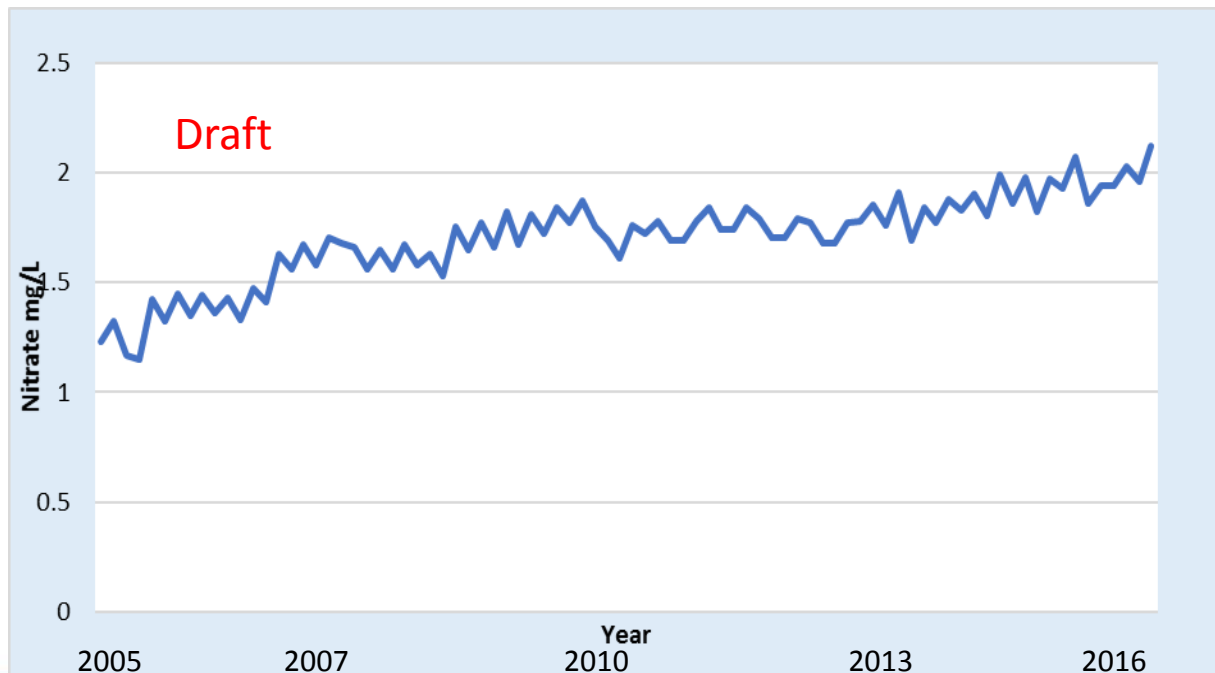
| Year              | Spring mg/L | Stream mg/L | Average 2005-2016 mg/L (all data) |
|-------------------|-------------|-------------|-----------------------------------|
| 2005              | 1.260       | 1.240*      | 1.255                             |
| 2006              | 1.313       | 1.379       | 1.354                             |
| 2007              | 1.363       | 1.419       | 1.399                             |
| 2008              | 1.469       | 1.455       | 1.461                             |
| 2009              | 1.472       | 1.579       | 1.533                             |
| 2010              | 1.500*      | 1.622       | 1.602                             |
| 2011              |             | 1.731       | 1.731                             |
| 2012              |             | 1.751       | 1.751                             |
| 2013              | 1.540       | 1.749       | 1.679                             |
| 2014              | 1.553       | 1.810       | 1.681                             |
| 2015              | 1.618       | 1.894       | 1.756                             |
| 2016              | 1.688       | 1.981       | 1.856                             |
| Average 2005-2016 | 1.464       | 1.629       | 1.566                             |





# Monitoring Locations

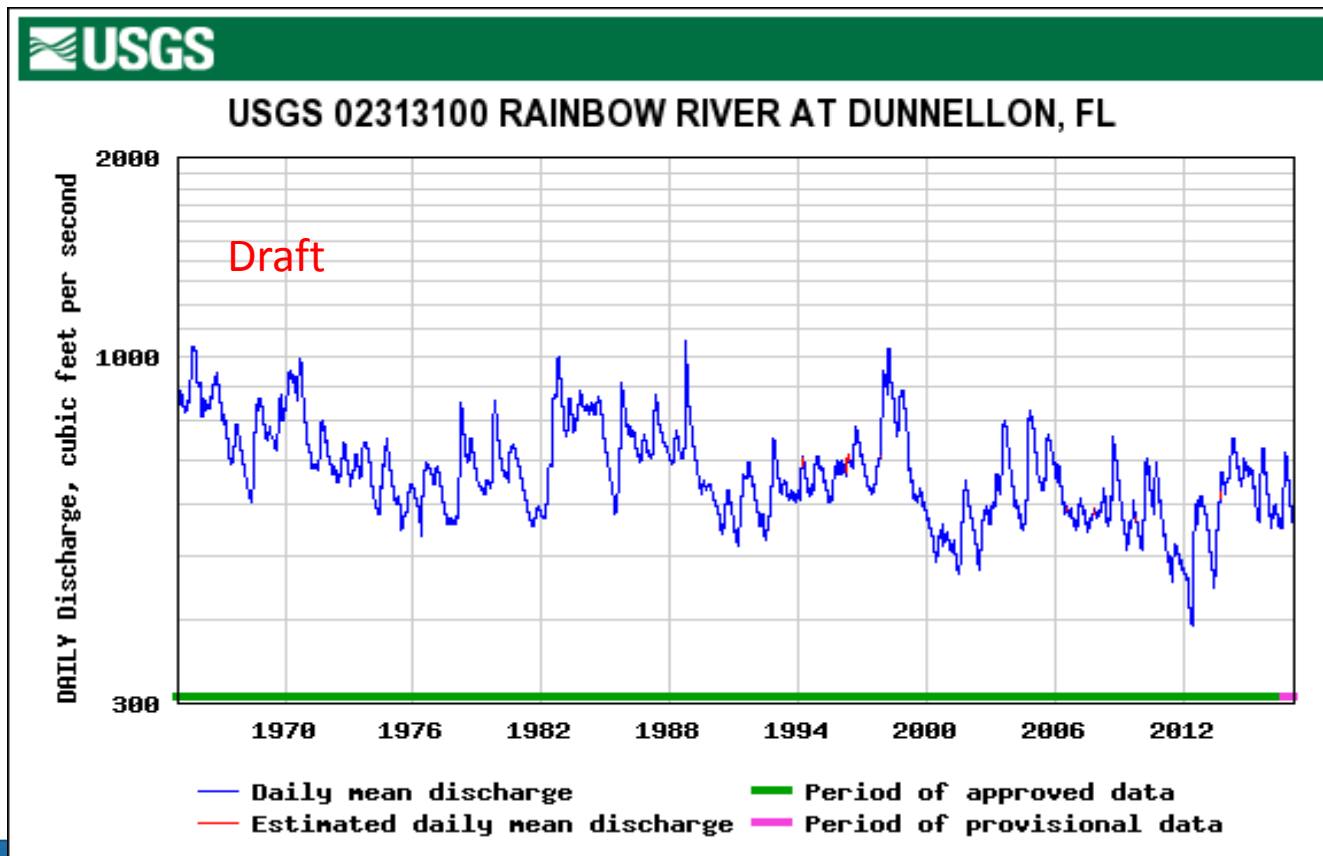
- Utilized riverine stations.
- Rainbow River RR2.
- Rainbow River RR3.
- Concentration increasing – adjusted to 2012 to 2016 data period.





# Rainbow River Draft Flow Data

- Gaging station 02313100 located at CR 484 downstream of WBID 1320B.
- Used 2005-2016 data period.
- Average flow for the data period is 599.7 CFS.





# Draft Loading and Confidence Limits

- Calculated 95% confidence limit around means for flow and concentration. Added upper confidence limit to mean as a margin of safety.
- New concentration =  $1.822 \text{ mg/L} + 0.033 \text{ mg/L} = 1.855 \text{ mg/L}$ .
- New flow =  $599.7 \text{ CFS} + 2.2 \text{ CFS} = 601.9 \text{ CFS}$ .



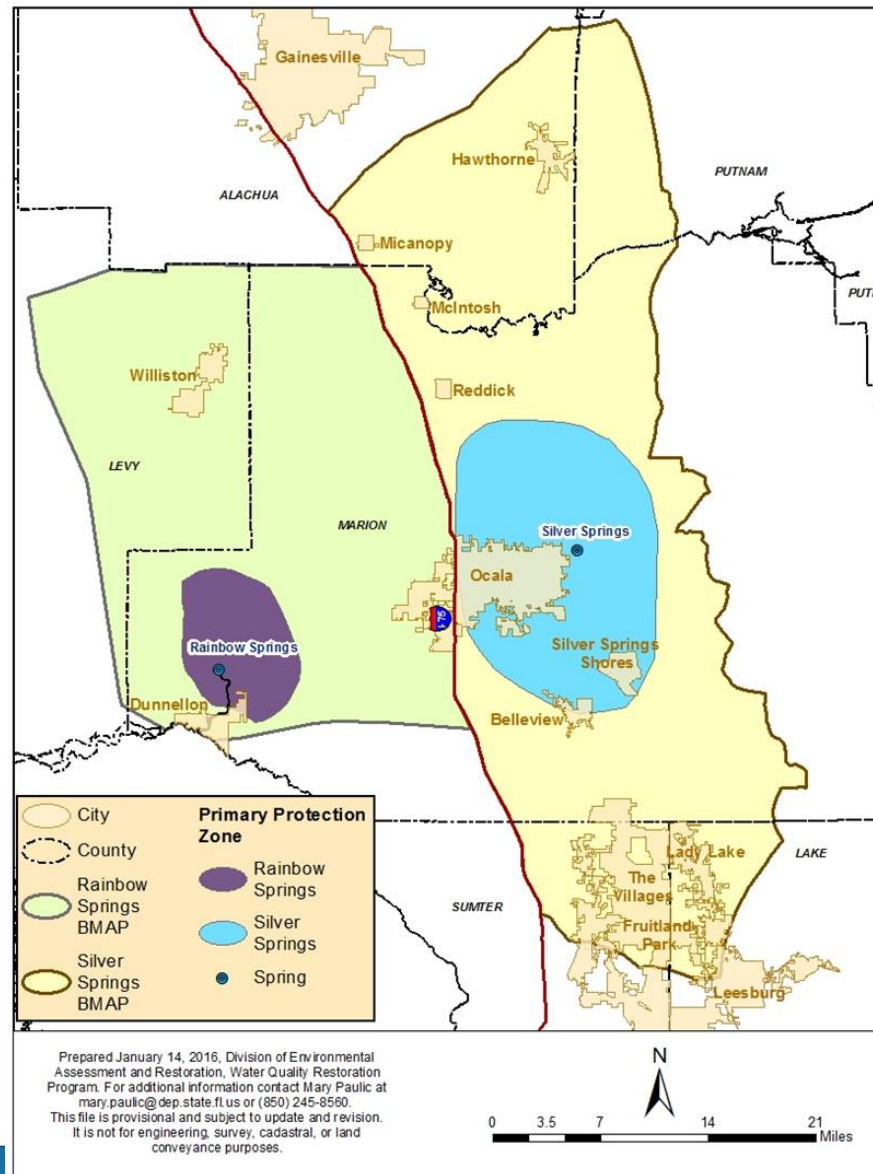
# Rainbow River Draft Loading Calculations

- Flow times concentration = loading.
- Loading at discharge = 2,198,348 lbs-N/year.
- Loading calculated at TMDL concentration of 0.35 mg/L for same flow volume = 414,741 lbs-N/year.
- Reduction = Loading at discharge – TMDL loading.
- Reduction = 1,783,607 lbs-N/year.
- NSILT estimate of loading = 1,532,328 lbs-N/year.





# Rainbow Springs Priority Focus Area





# PFA Loading Estimate

## Draft

- Portion of NSILT predicted loading in PFA /NSILT predicted loading for BMAP area.
- Approximately 9.9% of NSILT predicted loading is within PFA.
- Proportional reduction for PFA is 9.9% of 1,783,607 lbs-N/year for the BMAP area.
- PFA reduction = 175,818 lbs-N/year.



# Draft Rainbow Springs Priority Focus Area Loading Reduction

Draft subject to change

| Source Category         | Source Percent<br>(from NSILT) | Loading Reduction<br>lbs-N/year |
|-------------------------|--------------------------------|---------------------------------|
| Atmospheric Deposition  | 10%                            | -                               |
| WWTF                    | 1%                             | 1,759                           |
| OSTDS                   | 23%                            | 40,439                          |
| Sports Turf             | 2%                             | 3,517                           |
| Urban Turf              | 11%                            | 19,340                          |
| Cattle Farms            | 29%                            | 50,988                          |
| Horse Farms             | 20%                            | 35,164                          |
| Crop Fertilizer         | 3%                             | 5,275                           |
| Miscellaneous Livestock | 1%                             | 1,934                           |



# Draft Rainbow Springs BMAP Loading Reduction

Draft subject to change

| Source Category         | Source Percent<br>(from NSILT) | Loading Reduction<br>lbs-N/year | Loading Reduction<br>Adjusted for PFA lbs-<br>N/year |
|-------------------------|--------------------------------|---------------------------------|------------------------------------------------------|
| Atmospheric Deposition  | 11%                            | -                               | -                                                    |
| WWTF                    | 1%                             | 17,837                          | 16,078                                               |
| OSTDS                   | 20%                            | 356,722                         | 316,283                                              |
| Sports Turf             | 4%                             | 71,345                          | 67,828                                               |
| Urban Turf              | 9%                             | 160,525                         | 141,185                                              |
| Cattle Farms            | 25%                            | 445,902                         | 394,914                                              |
| Horse Farms             | 16%                            | 285,378                         | 250,214                                              |
| Crop Fertilizer         | 12%                            | 214,033                         | 208,758                                              |
| Miscellaneous Livestock | 1%                             | 17,837                          | 15,903                                               |





# Estimated Reductions by Period

- Reduction goal is for each 5 year period and not a cumulative total.

| Spring System | Draft Estimated Loading Reduction lbs-N/year | Draft 5 Year Reduction Goal lbs-N/year | Draft 10 Year Reduction Goal lbs-N/year | Draft 15 Year Reduction Goal lbs-N/year |
|---------------|----------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|
| Rainbow BMAP  | 1,783,607                                    | 535,082                                | 713,443                                 | 535,082                                 |
| Rainbow PFA   | 175,818                                      | 52,745                                 | 70,327                                  | 52,745                                  |
| Silver BMAP   | 284,784                                      | 85,435                                 | 113,914                                 | 85,435                                  |
| Silver PFA    | 496,483                                      | 148,945                                | 198,594                                 | 148,943                                 |
|               |                                              |                                        |                                         |                                         |

## Targets:

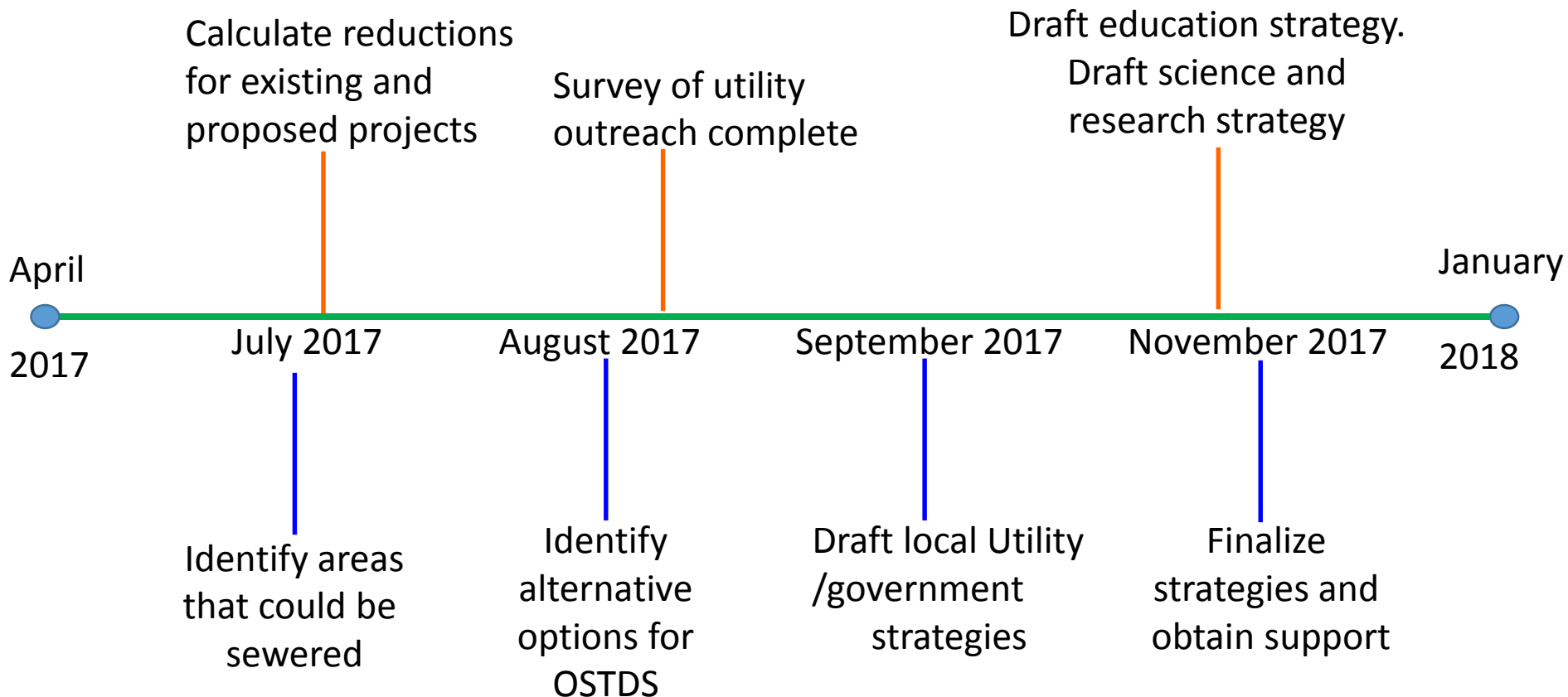
- 5 years 30% reduction (of original loading reduction)
- 10 years 40% reduction
- 15 years 30% reduction





# BMAP Time Line

- April through December 2017.





# Education Survey

- Florida Stormwater Association distributed a “Public Education Needs Assessment” to members.
  - Both public and private sectors.
- Purpose to collect data about local OSTDS and fertilizer education programs.
  - First survey is broad in scope. Will be followed up with more detailed survey for agencies with more extensive outreach programs.
  - Results needed by September 13.
- Goal of second survey is to document case studies that could be used as references by other organizations or governments in designing outreach.
- Not limited to OSTDS. Includes other sources.





# Education Workshop

- Planned for mid to late October.
  - Focus of workshop is OSTDS, urban fertilizer, and agriculture fertilizer outreach.
- Draft Framework for education strategy.
  - State level or regional message.
    - Responsibility of DEP and DOH.
    - Research to support message.
    - Documentation to support message.
  - BMAP or sub-BMAP message.
    - Joint responsibility of state agencies and local government.
  - Local neighborhood message.
- What is role of non-governmental organizations?



# Next BMAP Meeting

- Set BMAP date for November.
- Tentative topics for next meeting.
  - What we can do to manage the problem.
    - Projects and projected reductions.
    - Selection of options.
  - Calculation of loading reductions by different options.



# Summary and Action Items

- TMDL needs to be achieved no more than 20 years after adoption of BMAP.
- Need to update information (data, projects, studies, etc.) and start gathering necessary information.
  - Identify projects to meet the 5-year, 10-year and 15-year targets for all sources.
  - Identify what and where scientific information is needed.
  - Identify what public education efforts exist & what needs to be done.
  - Finalize OSTDS Remediation Plan.





Questions?



# Contacts

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- Mary Paulic, Silver Springs Basin Coordinator, [mary.Paulic@dep.state.fl.us](mailto:mary.Paulic@dep.state.fl.us).
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