Documentation in Support of Category 4e

Waterbody/Watershed Identification

Organization	Orange County
Point of Contact	Julie Bortles 3165 McCrory Place, Suite 200 Orlando, Florida 32803 Julie.Bortles@ocfl.net 407-836-1456
Waterbody(s)	Waterbody Identification (WBID) # 3168F Lake Bass
No. Waterbody / Pollutant Combinations	Based on Impaired Waters Rule (IWR) Run 60, one waterbody segment, 3168F, has the following assessment status: • Nutrients (Chl-a) Group 4/Cycle 3, 2017 verified list • Nutrients (Total Phosphorus), 2022 verified list • Nutrients (Total Nitrogen), 2022 delist list Lake Bass falls within Lake Okeechobee Basin Management Action Plan (BMAP) area.
EPA Completed TMDL	The Environmental Protection Agency (EPA) has not approved a Total Maximum Daily Load (TMDL) for the impaired waterbody segment listed in this document. Currently, Lake Bass is on the FDEP TMDL Planning List through 2022.

Description of Baseline Conditions

Watershed(s)	Basin Group 4: Kissimmee River
Baseline Data	Parameter: Nutrients (Chl-a) Criterion Concentration or Threshold Not Met: ≤ 20 µg/L. Annual geometric mean chlorophyll-a values exceeded the criterion in 2009, 2010, 2011, 2012, 2016, 2018, 2019 with values of 28 µg/L, 38 µg/L, 21 µg/L, 27 µg/L, 48 µg/L, 30 µg/L and 28 µg/L respectively. Parameter: Nutrients (TN) Criterion Concentration or Threshold Not Met: TN AGM ≤ 1.91 mg/L if Chl-a AGM ≤ 20 µg/L; If Chl-a has Insufficient or No Data to calculate AGM or if Chl-a AGM > 20 µg/L, TN AGM ≤ 1.05 mg/L. Annual geometric mean TN values exceeded the criterion in 2009, 2010, 2016 with values of 1.13 mg/L, 1.33 mg/L, and 1.6 mg/L respectively.

Parameter: Nutrients (TP) Criterion Concentration or Threshold Not Met: TP AGM ≤ 0.09 mg/L if Chl-a AGM ≤ 20 µg/L; If Chl-a has Insufficient or No Data to calculate AGM or if Chl-a AGM > 20 µg/L, TP AGM ≤ 0.03 mg/L. Annual geometric mean TP values exceeded the criterion in 2016 and 2018 with values of 0.06 mg/L and 0.04 mg/L respectively.

Table 1 lists the annual geometric means from 2008-2019 for Chl-a, TN and TP. Data highlighted in red indicates the criterion threshold was exceeded. Data highlighted in green indicates the criterion threshold was not exceeded.

Nutrient AGMS- Assessment Data					
Year	Chl-a (µg/L)	TN (mg/L)	TN Criteria (mg/L)	TP (mg/L)	TP Criteria (mg/L)
2008	16	0.79	≤ 1.91	0.04	≤ 0.09
2009	28	1.13	≤ 1.05	0.03	≤ 0.03
2010	38	1.33	≤ 1.05	0.03	≤ 0.03
2011	21	Insufficient Data	≤ 1.05	Insufficient Data	≤ 0.03
2012	27	0.97	≤ 1.05	0.03	≤ 0.03
2013	Insufficient Data	Insufficient Data	≤ 1.05	Insufficient Data	≤ 0.03
2014	16	0.88	≤ 1.91	0.04	≤0.09
2015	17	0.92	≤ 1.91	Insufficient Data	≤0.09
2016	48	1.6	≤ 1.05	0.06	≤ 0.03
2017	18	0.74	≤ 1.91	0.06	≤0.09
2018	30	1.03	≤ 1.05	0.04	≤ 0.03
2019	28	1.05	≤ 1.05	0.03	≤ 0.03

Stations used in the Chl-a, TN and TP assessment:

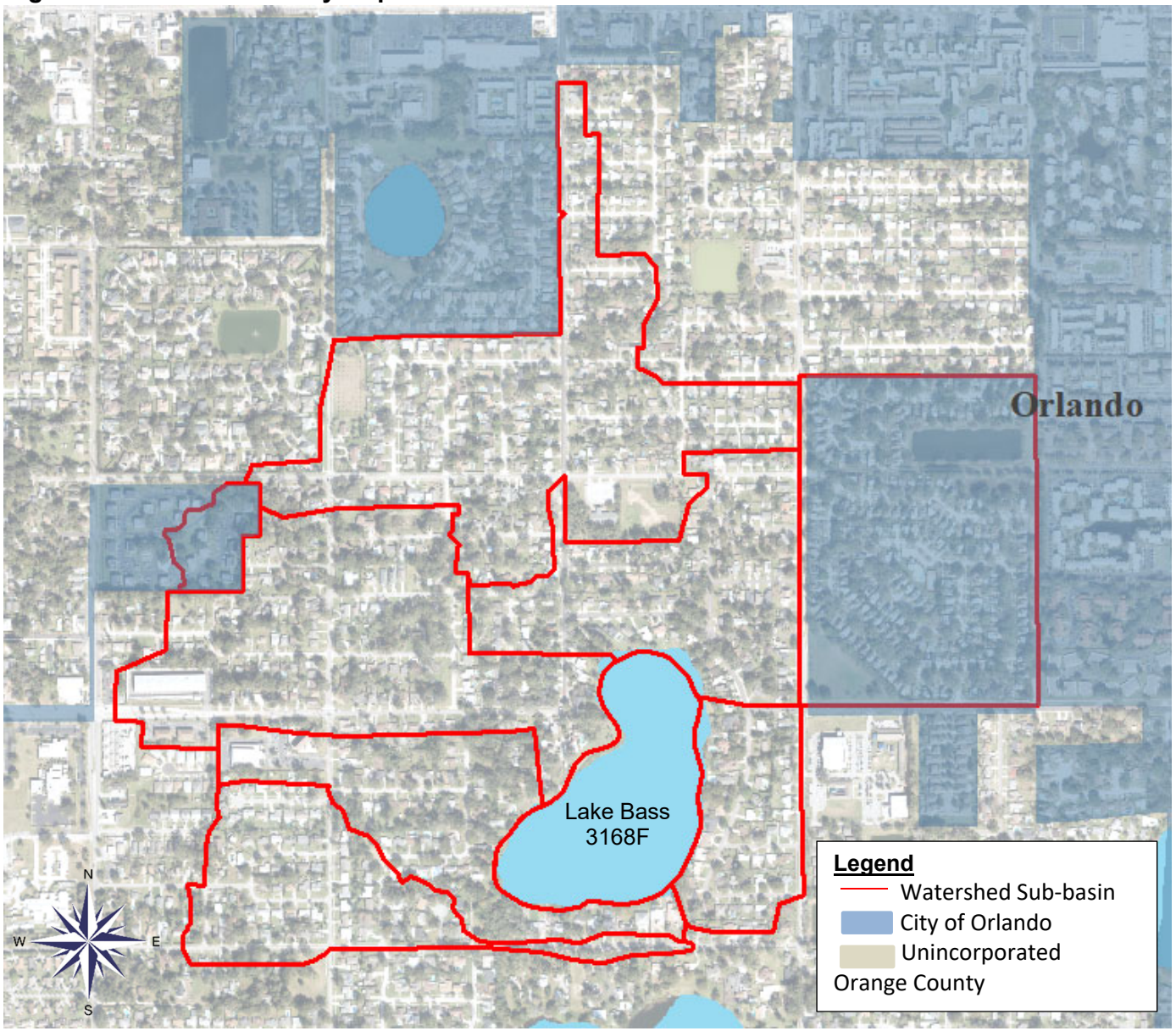
21FLORANBC3 (28.511784, -81.342173) and 21FLCENG4CE0147 (28.51155618, -81.34269921)

Map

Figure 1 provides a Lake Bass Vicinity map that includes the watershed and jurisdictional boundaries.

Figure 2 provides the WBID boundary and monitoring stations that fall within the WBID. Note that based on IWR Run 60 data (the period when the WBID was verified impaired), monitoring stations 21FLORANBC3 and 21FLCENG4CE0147 were sampled.

Figure 1: Lake Bass Vicinity Map



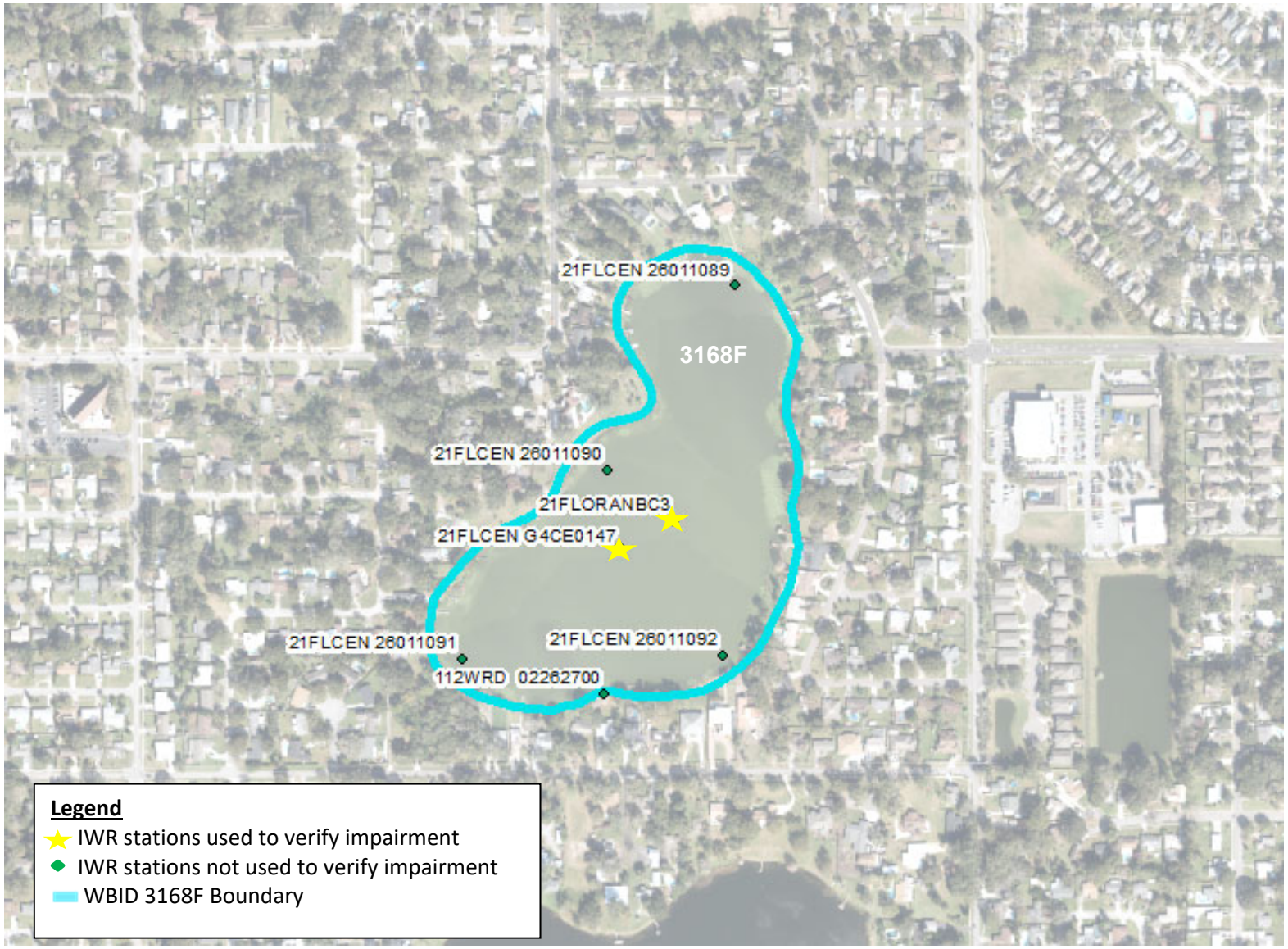
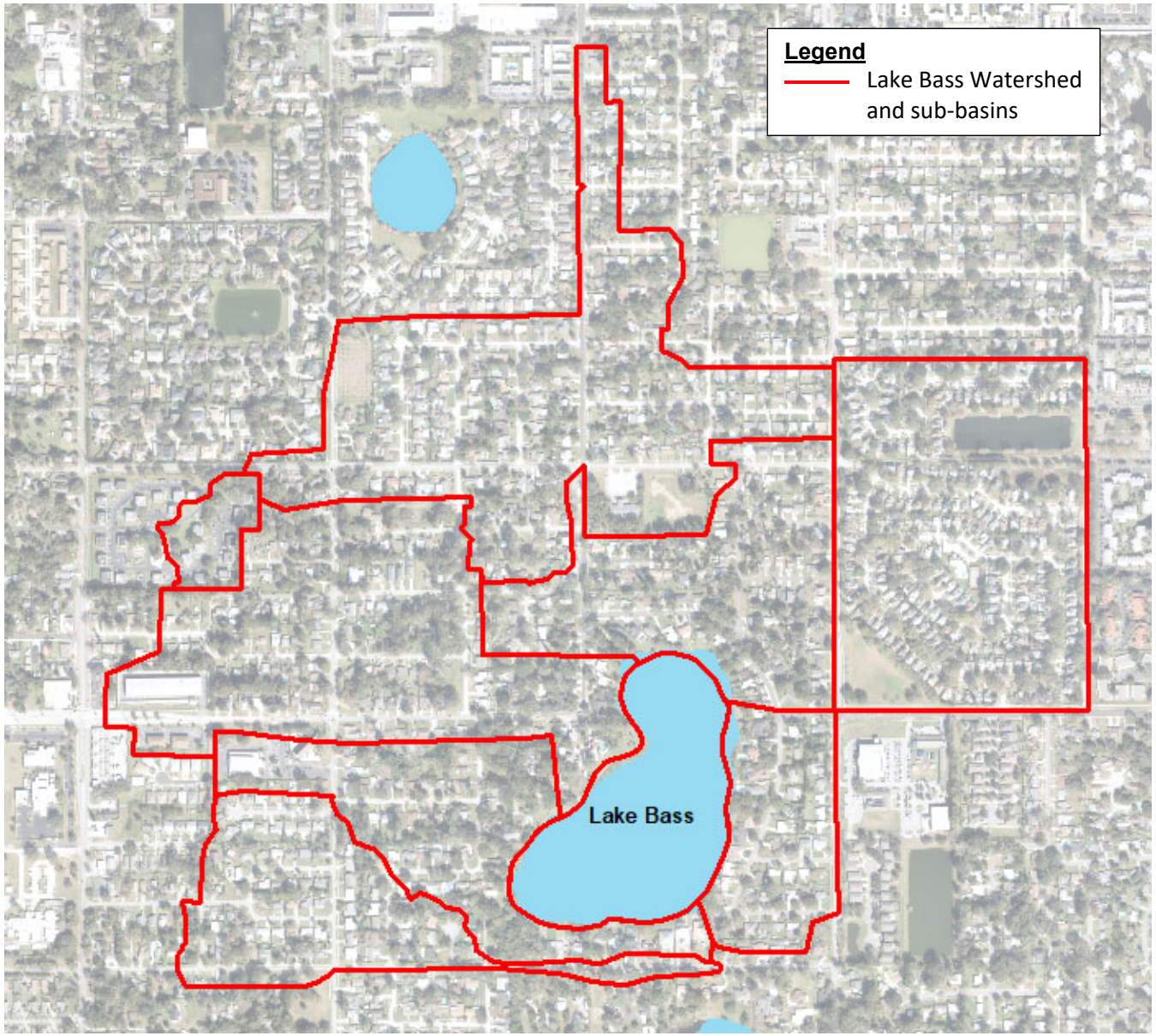


Figure 2: Lake Bass WBID Boundary and IWR Stations

Evidence of Watershed Approach

Area of Effort	**Figure 3** shows an aerial image of the 300-acre Lake Bass Watershed and the 8 sub-basins outlined in red. Lake Bass is a 24-acre low color, high alkalinity urban lake located approximately one-mile north of Lake Conway within the Boggy Creek drainage basin. The lake is located within the Upper Kissimmee River planning unit and the drainage basin is largely within unincorporated Orange County, but portions fall within City of Orlando.
Key Stakeholders Involved and Their Roles	Key Stakeholders: • Orange County • City of Orlando • Bass Lake MSTU Additional Stakeholders: • Bass Lake Property Owner's Association; potential participant in future projects • Touraine Estates neighborhood south of Lake Bass; potential participant in future projects • Dover Heights neighborhood east of Lake Bass; potential participant in future projects • Green Fields neighborhood north of Lake Bass; potential participant in future projects • Others; potential participants in future projects

Figure 3: Lake Bass Watershed Boundary with Sub-basins



Watershed Plan & Other Supporting Documentation

The 4e area includes the watershed draining to WBID ID # 3168F Lake Bass. This WBID is impaired for Nutrients (chl-a) and Nutrients (TP). The objectives outlined by this 4e Alternative Restoration Plan and the *Bass Lake Loading Study and Lake Management Plan* (Lake Management Plan) address this impairment.

Orange County has taken a proactive approach to addressing Lake Bass water quality issues. In 2020, EPD commissioned a nutrient pollutant loading study to identify pollutant loading sources contributing to the water quality impairments. The study also contains a list of recommended best management practices, ranked by nutrient reduction efficiency, intended to address the chl-a and TP impairment and attain surface water quality standards.

The WBID drainage area includes existing key project(s) that Orange County has already completed or budgeted (**Figure 4**), as follows:

- Curb & Grate inlet basket installation and their ongoing maintenance,
- Aeration System
- Aquatic Plant Management
- Education and Ordinances, and
- Street sweeping

The Lake Management Plan identified and ranked a list of additional structural and non-structural projects and programmatic activities that can be undertaken to further reduce nutrient load to Lake Bass, thereby reducing chl-a and TP within the lake.

Point Sources and Indirect Source Monitoring (Sites)

No point sources were identified in the Lake Bass drainage basin.

The drainage basin is regulated by a two Municipal Separate Storm Sewer System (MS4) permits. Permit FLS000011-004 for Orange County and Permit FLS000014 for City of Orlando.

Note: Generic Permits for stormwater discharge from large and small construction activities are considered temporary; therefore, are not included in this listing.

Nonpoint Sources

Land Use	Approximate % of Watershed
Residential, High Density	<1
Residential, Medium Density	75
Residential, Low Density	92
Commercial and Services	1
Institutional	3
Reservoirs	<1
Wet Prairies	<1
Emergent Aquatic Vegetation	<1
Roads and Highways	<1
Surface Water Collection Basins	1

Hydrologic Soil Group	Approximate % of Watershed
A/D	3
A	96
Water	<1

Pollutant loadings sources were evaluated in the Lake Management Plan. Stormwater loads were estimated based on land use, soil types, percent impervious area, event mean concentrations, and site-specific measured data. The land use types, hydrologic soil groups, and approximate percentages above were calculated in the Lake Management Plan. The following other sources were also evaluated: precipitation, groundwater seepage, evapotranspiration, and internal recycling from lake sediments.

Water Quality Criteria

Lake Bass is expected to meet Class III surface water quality standards as defined in Chapter 62-302 of the Florida Administrative Code upon successful completion of all projects.

Restoration Work

EXISTING PROJECTS:

Existing projects are currently implemented and ongoing.

PROJECT 1: BASS LOADING STUDY & LAKE MANAGEMENT PLAN

Orange County funded a hydrologic and nutrient loading study on Lake Bass during 2020-2021. The study included significant field monitoring for a year and resulted in the identification of multiple projects for water quality improvement. The cost of this study was $169,973.82.

PROJECT 2: CURB INLET BASKETS AND ONGOING MAINTENANCE

Orange County maintains two curb inlet baskets (CIBs) and one grate inlet basket (GIB) around Lake Bass. These baskets have been in use since 2008 and collected a total of 1,318 lbs. of material in 2020 resulting in a reduction of 1 lb. TN/year. This project had a capital cost of $5,430 and ongoing annual maintenance cost of approximately $665. Weights of recovered material are provided by the maintenance contractor for calculation of load reductions using the FSA Tool recommended by FDEP. Locations of the baskets are shown on **Figure 4.**

PROJECT 3: AERATION SYSTEM

Orange County maintains an aeration system for Lake Bass that includes four diffusors throughout the lake. This project has an annual maintenance budget of approximately $1,240. Location of the aeration system is shown in **Figure 4.**

PROJECT 4: AQUATIC PLANT MANAGEMENT

Since 2014, Orange County has implemented an aquatic plant management program. The program includes quarterly surveys and treatments when needed. The program has an annual budget of $2,500.

PROJECT 5: STREET SWEEPING

Orange County Public Works operates a street sweeping program that includes approximately 7.5 curb miles in the Lake Bass watershed at a frequency of every six-weeks. In 2019 the street sweeping in the Lake Bass watershed resulted in a reduction of 2 lbs. TP and 3 lbs. of TN. Locations of street sweeping shown in **Figure 4.**

PROJECT 6: EDUCATION AND ORDINANCES

- Orange County has installed storm drain markers at curb/grate inlets throughout the Lake Bass watershed.

- Orange County coordinates with the local Institute of Food and Agricultural Sciences (IFAS) Extension office to provide TMDL and impaired waters elements in their presentations.
- Orange County also has Ordinances in place for:
  - Fertilizer, Chapter 15 Article XVII: https://library.municode.com/fl/orange_county/codes/code_of_ordinances?nodeId=PTIIORCOCO_CH15ENCO_ARTXVIIFEMAOR
  - Pet Waste, Chapter 5 Article II: https://library.municode.com/fl/orange_county/codes/code_of_ordinances?nodeId=PTIIORCOCO_CH5AN_ARTIIANSE and
  - Landscape and Irrigation, Chapter 24 Article I: https://library.municode.com/fl/orange_county/codes/code_of_ordinances?nodeId=PTIIORCOCO_CH24LABUOPSP_ARTIINGE.
- Public Service Announcements are shown on Orange TV.
- Orange County maintains its website as well as providing additional water quality, fertilizer, and NPDES information on the Orange County Water Atlas.
- Brochures are provided to the public explaining the ordinances and encouraging nutrient-reducing activities in the watershed.

FUTURE PROJECTS:
Projects 7 & 8 include structural and non-structural projects that were identified during the Lake Management Plan and will be evaluated further during Feasibility Studies.

PROJECT 7: Phase 1 Feasibility Study Nutrient Removal Structural and Non-Structural Projects
Nutrient Removal projects were identified during the Lake Bass Lake Management Study (2020-2021) and will be evaluated further during a Phase 1 feasibility study. The feasibility study is budgeted in EPD's Fiscal year 2020/2021 and estimated to cost $114,000. The Phase 1 feasibility study is expected to be completed by summer 2022. The feasibility of the following projects will be evaluated:

- **Southeast BAM Bioretention Basin**: BAM (Biosorption Activated Media) Bioretention Basin with undrain and overflow control structures located in the SE sub-basin of Lake Bass (**Figure 5**). Currently, the stormwater runoff in this sub-basin receives no treatment. The Lake Management Study proposed that this BMP would treat 11.7 acre-ft of runoff/yr and remove 21.1 lbs/yr of TN and 5.3 lbs/yr of TP. It is estimated that the project design/ construction (including maintenance and 20-year life span) would cost $250,000.

- **West BAM Upflow Filter**: BAM Upflow filter with continuous recirculation/lake filtration system located on the NW side of the lake by a dry detention pond (**Figure 6**). Currently, the stormwater runoff in this sub-basin is treated by the existing dry detention pond. With the addition of the proposed BMP it is estimated that an additional 1.99 lb/yr TP and 42.96 lb/yr TN will be removed. It was estimated that the design/construction of the project (including maintenance and 20-year life span) would cost $718,495.

- **Street Sweeping**: Increase Street Sweeping efforts in Lake Bass Watershed. The frequency and geographic coverage of the current program will be evaluated to determine if enhancements would result in higher annual nutrient load reductions.

Based on the conclusions of the Phase 1 feasibility study the design for the above projects would start summer 2022 and be completed by summer 2023. Followed by construction starting in summer 2023 and ending in summer 2024.

PROJECT 8: Phase 2 Feasibility Study Nutrient Removal Structural and Non-Structural Projects

Nutrient Removal projects were identified during the Lake Bass Lake Management Study (2020-2021) and will be evaluated further during a Phase 2 feasibility study. The Phase 2 feasibility study will be budgeted in EPD's Fiscal Year 2022/2023 for $150,000. The Phase 2 feasibility study is expected to be completed by summer 2023.The feasibility of the following projects will be evaluated:

- **In-Lake Sediment Nutrient Inactivation**: Using Phoslock and/or liquid aluminum sulfate a sediment inactivation project will be evaluated. The Lake Management Study estimated to inactivate 300-360 lbs. of phosphorus with a Phoslock treatment. The costs are estimated to range between $200,000-$250,000.

- **North BAM Bioretention Basin**: BAM bioretention basin with underdrain to be created using an existing dry detention pond located North of Lake Bass (**Figure 7**). The Lake Management Study estimated that the BMP will treat 51.4 acre-ft of runoff per year and an additional 61.84 lb/yr TN and 12.6 lb/yr TP would be removed. It was estimated that the design/construction of the project (including maintenance and 20-year life span) would cost $1,272,450.

- **Southwest BAM Bioretention Swale**: Linear BAM Bioretention Swale with underdrain and overflow control structures located in the SW sub-basin of Lake Bass (**Figure 8**). Currently, the stormwater runoff in this sub-basin receives no treatment. The Lake Management Study proposed that this BMP would treat 17.7 acre-ft of runoff/yr and remove 32.5 lbs/yr of TN and 8.5 lbs/yr of TP. It was estimated that the design/construction of the project (including maintenance and 20-year life span) would cost $275,000.

Based on the conclusions of the Phase 2 feasibility study the design for the above projects would start summer 2023 and be completed by summer 2024. Followed by construction starting in summer 2024 and ending in summer 2025.

Figure 4: Lake Bass Existing BMPs (Curb Inlet Basket, Aeration System & Diffusors and Street Sweeping)

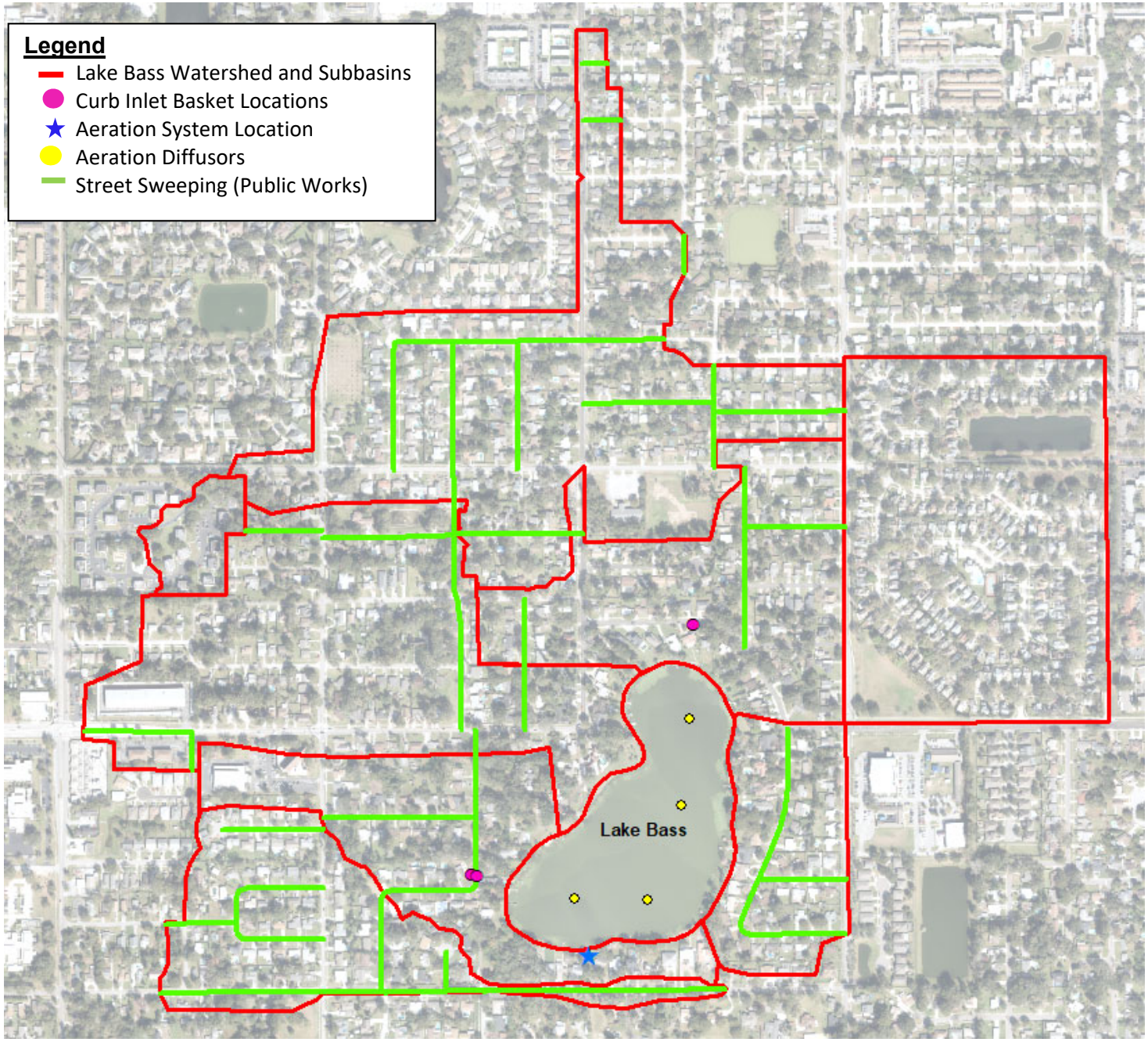


Figure 5: Southeast BAM Bioretention Basin

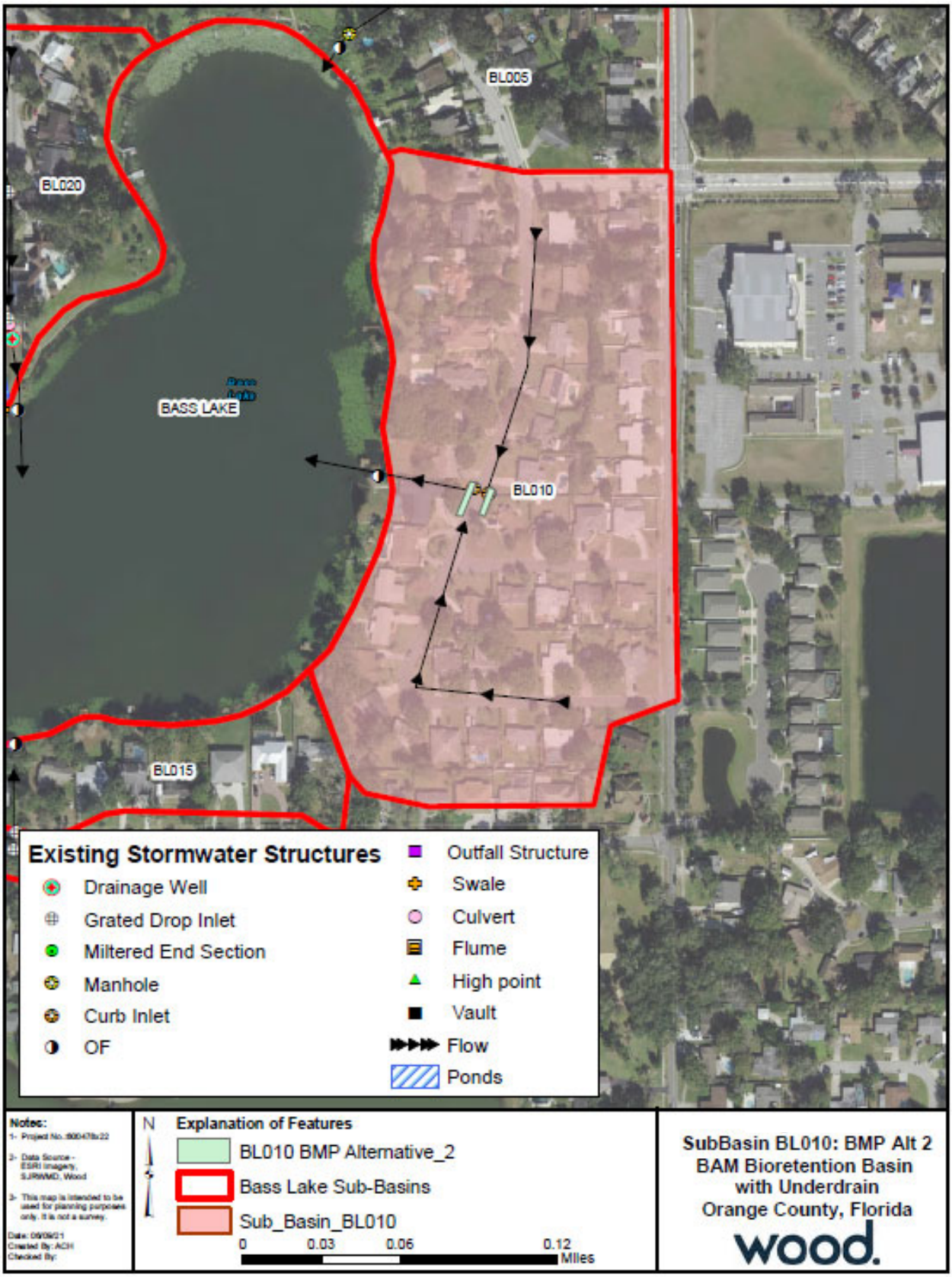


Figure 6: West BAM Upflow Filter

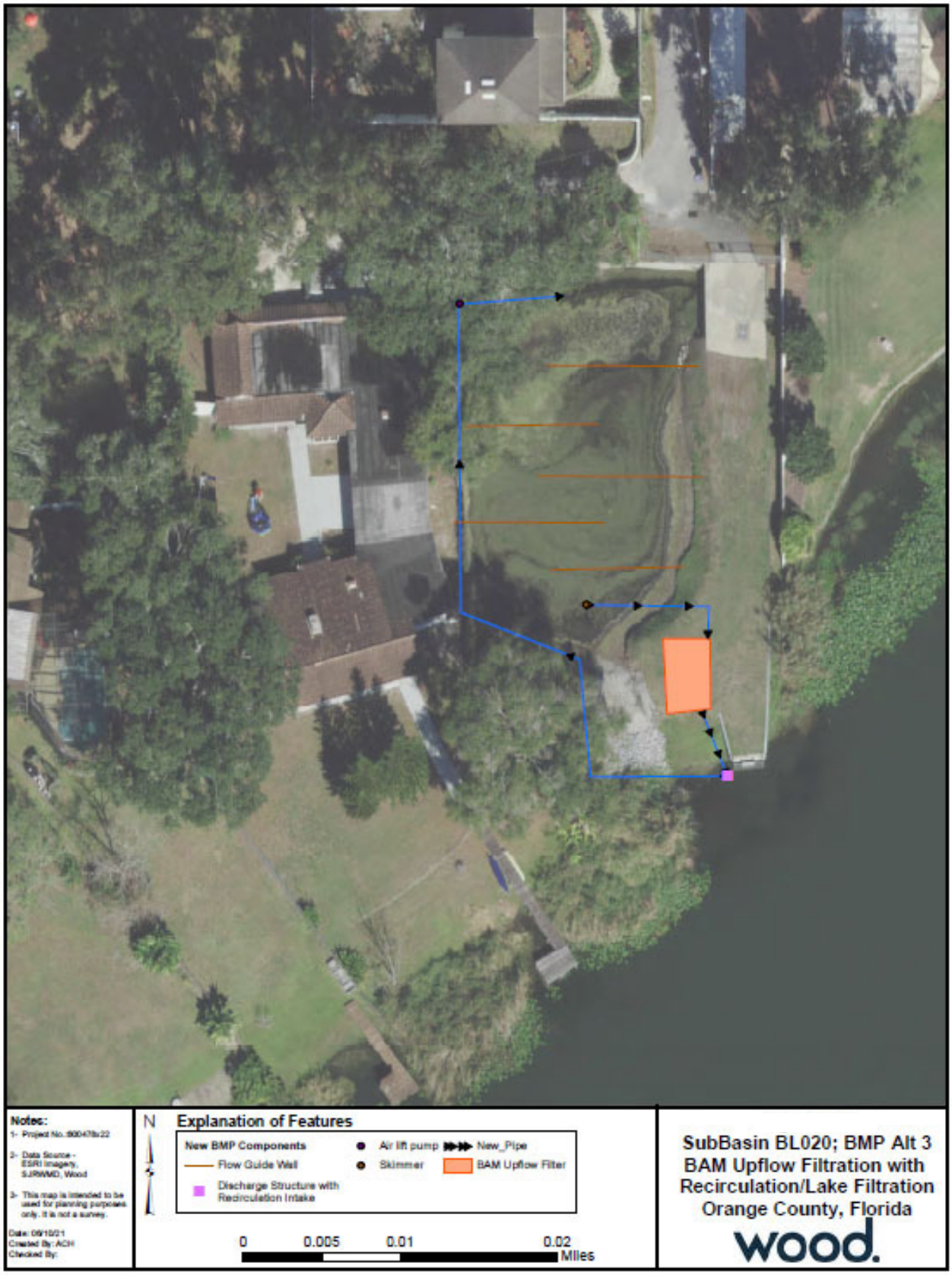


Figure 7: North BAM Bioretention Basin

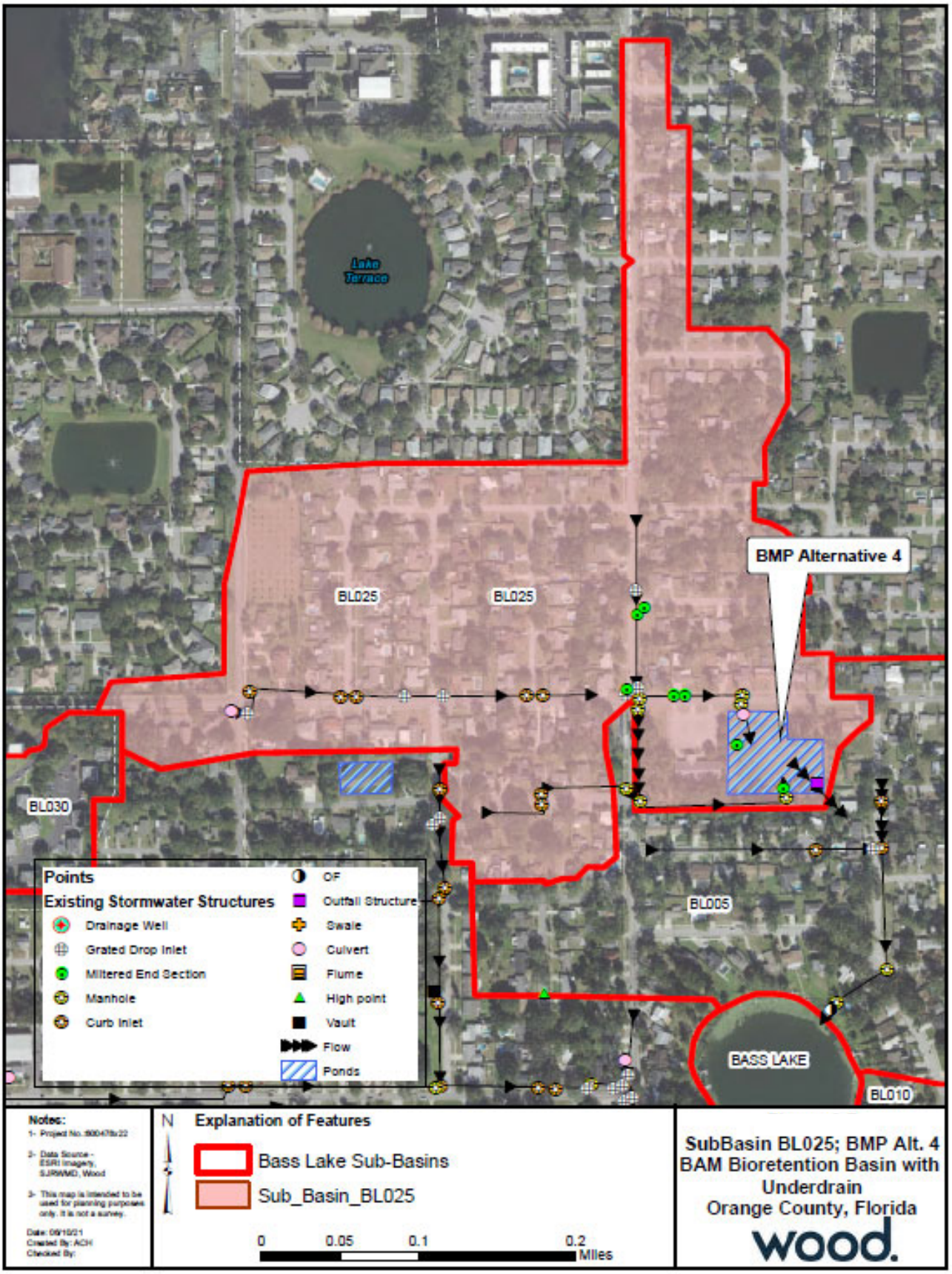


Figure 8: Southwest BAM Bioretention Swales

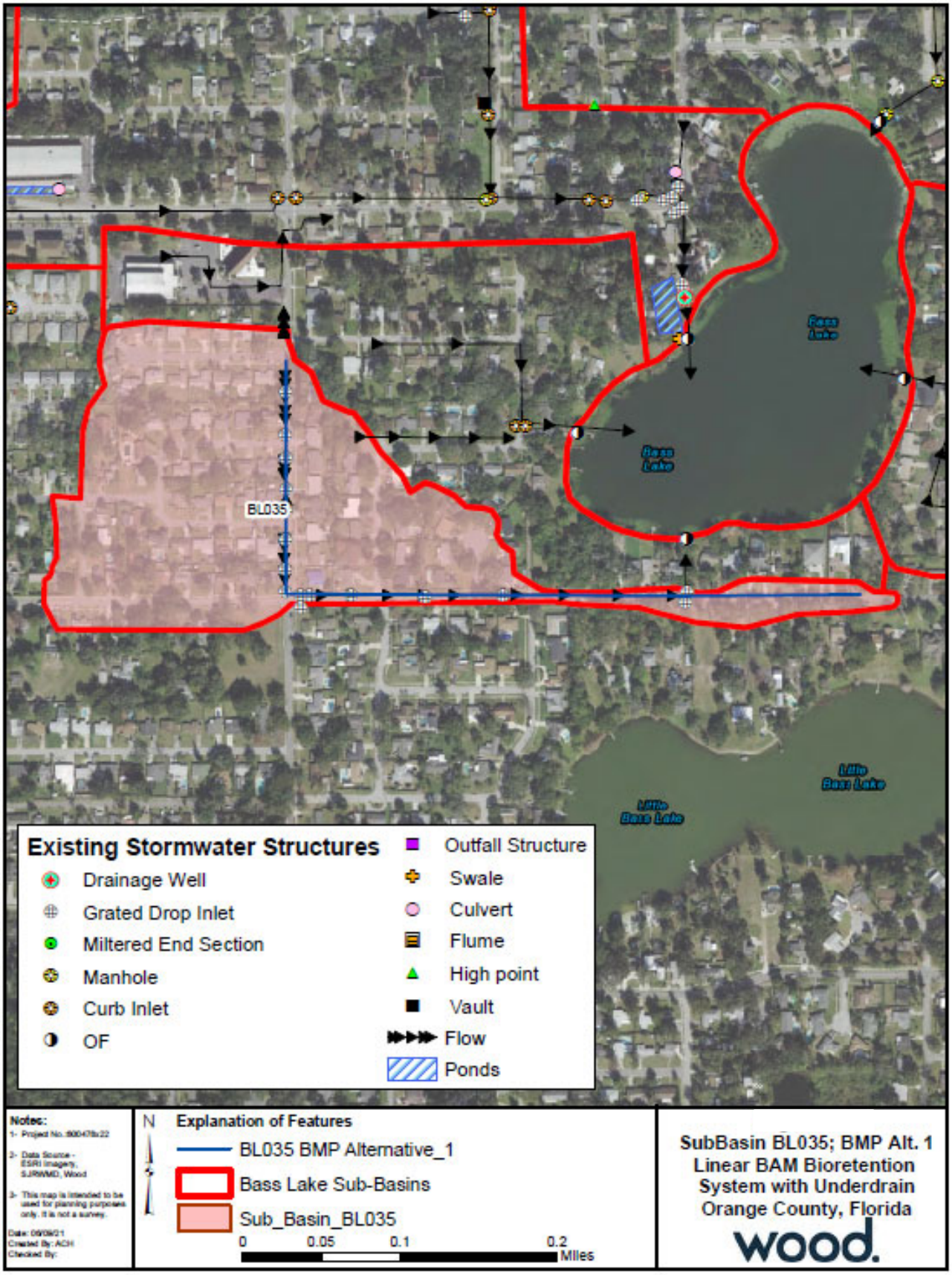


Figure 9: Orange County Monitoring Location BC3 (21FLORANBC3)

Critical Milestones/Monitoring

Anticipated Critical Milestone(s) and Completion Dates:

Orange County Existing Projects:

- Project 1: Bass Loading Study & Lake Management Plan completed during 2020-2021,
- Project 2: Curb & Grate Inlet Basket Installation in 2008 and continues to fund ongoing maintenance of these structures,
- Project 3: Aeration System Installation and continues to fund ongoing maintenance of system,
- Project 4: Aquatic Plant Management
- Project 5: Street Sweeping
- Project 6: Education and Ordinances

Orange County Future Projects:

- Project 7: Phase 1 Feasibility Study Nutrient Removal Structural and Non-Structural Projects to begin in 2021 and completed in summer 2022. Design phase to begin summer 2022 and completed summer 2023. Construction phase to begin summer 2023 and completed summer 2024.

- Project 8: Phase 2 Feasibility Study Nutrient Removal Structural and Non-Structural Projects to begin 2022 and completed summer 2023. Design phase to begin summer 2023 and completed summer 2024. Construction phase to begin summer 2024 and completed summer 2025.

Monitoring Component	
	ORANGE COUNTY AMBIENT MONITORING PROGRAM - Ongoing The Orange County monitoring location is provided on **Figure 9** and coordinates are 28.51178 Latitude and -81.3422 Longitude. Trend graphs for TN, TP and chl-a are provided in the **Attachment** for the period 2005 through 2020. Orange County will continue to monitor on a quarterly basis to review nutrient and chlorophyll-a trends. The first data reported from this monitoring station was in 1967 and Orange County will evaluate all historical data from that location. Samples from the monitoring location, the center of Lake Bass (monitoring location ID FLORANBC3, aka BC3), will be analyzed for the following parameters: • Alkalinity • Chloride • Color • Chl-a • Sulfate • Turbidity • Hardness • Metals (200.7 and 200.8) • *Escherichia coli* • Ammonia • Nitrite • Nitrate • Nitrate + Nitrite (NOx) • Total Kjeldahl nitrogen (TKN) • Organic nitrogen • TN • Orthophosphate • TP • Dissolved phosphorus • Total suspended solids (TSS) • Total dissolved solids (TDS) • Total solids (TS) Water quality field parameters are also collected from the surface (0.5 meters) for pH, barometric pressure, specific conductance, temperature, and dissolved oxygen (% saturation and concentration). Water quality data is and will continue to be uploaded to the Orange County Water Atlas and the FDEP Watershed Information Network (WIN). ***ORANGE COUNTY BIOLOGY PROGRAM- Ongoing*** Orange County periodically performs Lake Vegetation Index Surveys to monitor impaired lakes, record pre and post construction conditions, and record characteristics pre and post alum treatments. EPD completed an LVI on Lake Bass in July 2014.

LAKE MANAGEMENT PLAN MONITORING PROGRAM-Completed

Orange County funded a hydrologic and nutrient loading study on Lake Bass during 2020-2021. The study included significant field monitoring for one year and resulted in the identification of multiple projects for water quality improvement. The cost of this study was $169,973.82.

Field monitoring included:

- Seepage Meter Monitoring (6 grab samples at 3 locations; bimonthly collection for a year):
  - Total Suspended Solids
  - Total Ammonia Nitrogen
  - Total Kjeldahl Nitrogen
  - NOx
  - TN
  - Orthophosphate
  - TP

- Surface Water Monitoring (bimonthly grab samples, 6 at one location):
  - Ammonia
  - Total Kjeldahl Nitrogen
  - NOx
  - TN
  - Orthophosphate
  - TP
  - Alkalinity
  - Color
  - Chl-a
  - Turbidity
  - Total Suspended Solids

Water quality profiles were also collected from the surface and every 0.5 meters to total depth for pH, specific conductance, temperature, and dissolved oxygen (% saturation and concentration).

- Stormwater monitoring (3 autosamplers: 6 flow-weighted composite samples, 0.25-inch or greater storm events; 3 wet season and 3 dry season)
  - Ammonia
  - NOx
  - Total Kjeldahl Nitrogen
  - TN
  - Orthophosphate
  - TP
  - TSS

- Sediment phosphorus fractionation and flux (four cores for fractionation, four locations (8 cores) for flux study)

Specific monitoring locations from the Lake Management Plan monitoring activities are included in the final report.

Other Key Dates

Estimated Date for Delisting from Verified List or Removal from Study List	WBID 3168F (Lake Bass) is in the state's Group 4 Kissimmee River basin. The current review and assessment cycle (the initial biennial assessment) is scheduled for completion in 2022. This waterbody is currently impaired for nutrients (chlorophyll-a, TP). Based on the 2022 draft assessment lists Lake Bass will be delisted for chlorophyll-a and TN. Total nitrogen is no longer impaired and Chlorophyll-a and TP will be added to the state's Study List. Applicable data sufficiency will be required to fully assess the impaired parameters. If it is determined that the parameters in question are no longer impaired, DEP is expected to request the WBID be delisted from the federal 303(d) List.

Financial Commitments

Estimated Implementation Cost	Project 1: Bass Loading Study & Lake Management Plan The cost to complete a year-long hydrologic and nutrient loading study was $169,973.82. Project 2: Curb Inlet Baskets The capital cost of installing curb/grate inlet baskets in the Lake Bass watershed in 2008 was $5,430. The estimated 20-year operation and maintenance (O&M) costs for Project 2 are $13.300. Project 3: Aeration System Orange County maintains an aeration system with an estimated 20-year operation and maintenance (O&M) cost of $24,800. Project 4: Aquatic Plant Management Orange County manages an Aquatic Plant Management program with an annual cost of $2,500. Project 5: Street Sweeping Orange County Public Works Department implements the current street sweeping program as part of its regional program. Annual Costs for street sweeping in the Lake Bass watershed are estimated to be $2,163. Project 6: Education and Ordinances Orange County has implemented several ordinances that positively affect water quality. Orange County provides educational outreach and educational materials and works with other local stakeholders to share resources. Project 7: Phase 1 Feasibility Study Nutrient Removal Structural and Non-Structural Projects The budgeted feasibility study is estimated at $114,000. The design and construction (including maintenance and 20-year life span) of the two structural projects in this phase are estimated as costing a total of $968,495. Project 8: Phase 2 Feasibility Study Nutrient Removal Structural and Non-Structural Projects The budgeted feasibility study is estimated at $150,000. The design and construction (including maintenance and 20-year life span) of the two structural projects in this phase are estimated as costing a total of $1,547,450. The structural projects may be eligible for Section 319(h) Clean Water Act grants. The total estimated capital cost of all other projects, including land acquisition (if applicable), and estimated 20-year O&M costs will be determined by which projects are prioritized for the EPD WQ-CIP.

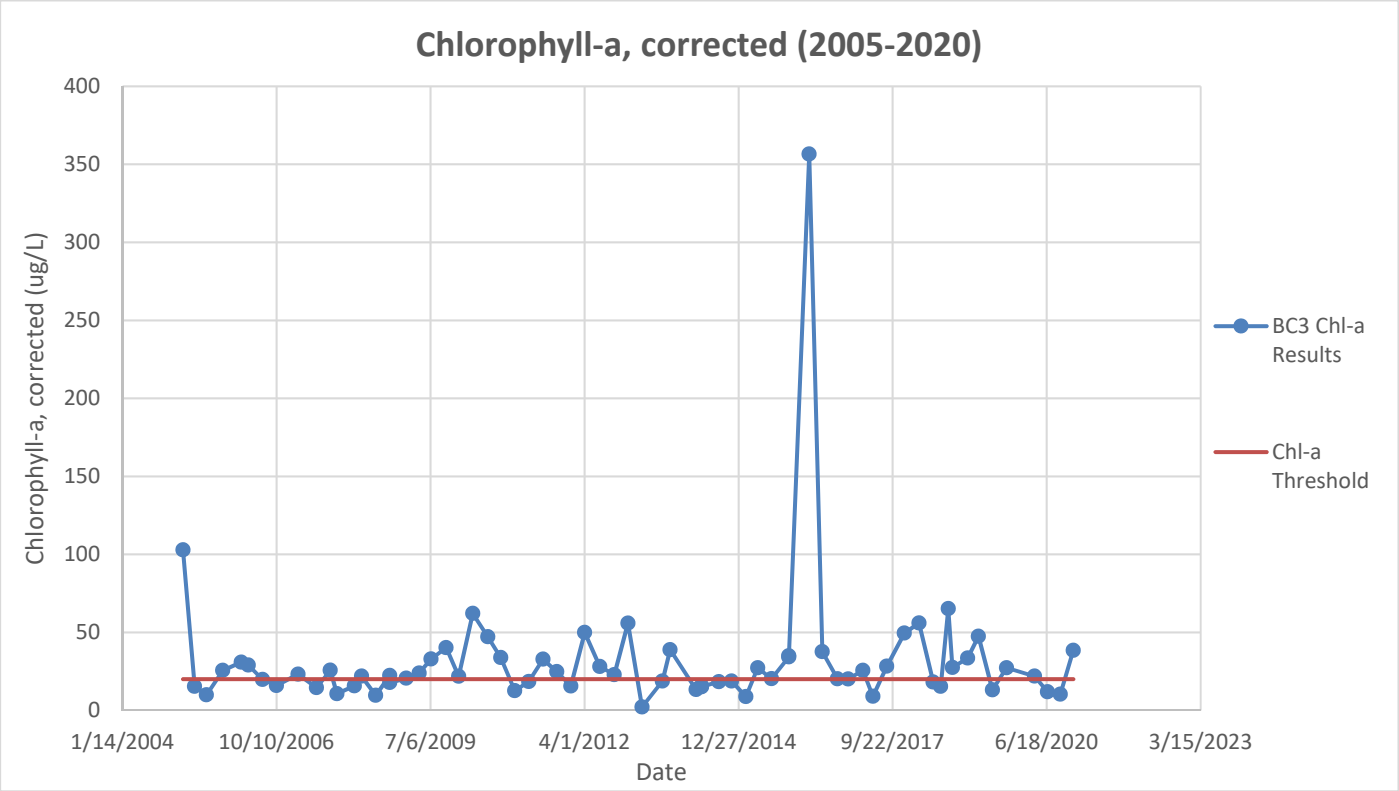
Land Acquisition (if applicable)	**Funding Source (NA)** Total ..... $ NA
Design and Construction (if applicable)	**Primary Funding Source: Orange County** **With Potential Support From: City of Orlando, SJRWMD, FDEP, and others.**
	Total estimated future project costs are dependent on Feasibility Study results and County Prioritization and Budgeting procedures. Orange County has budgeted a feasibility study for structural and non-structural water quality improvement projects identified during the Lake Management Plan which will be evaluated further. The Design for the structural projects proposed by Feasibility Phase 1 is budgeted for EPD's Fiscal Year 2022/2023 for $100,000. Implementation of Design and Construction of Structural Projects will be included in the prioritization process for development of future EPD WQ-CIP.

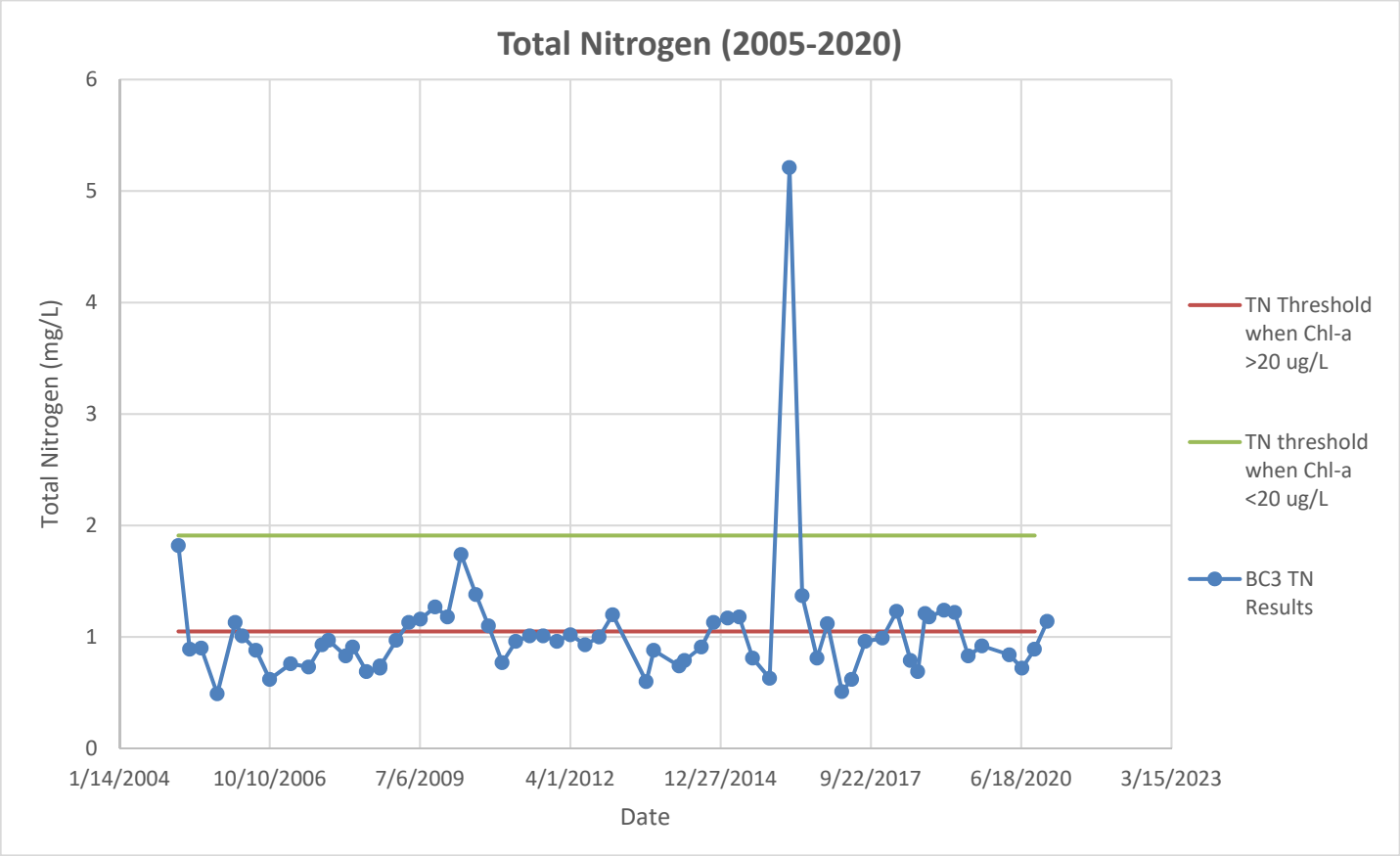
Figures:

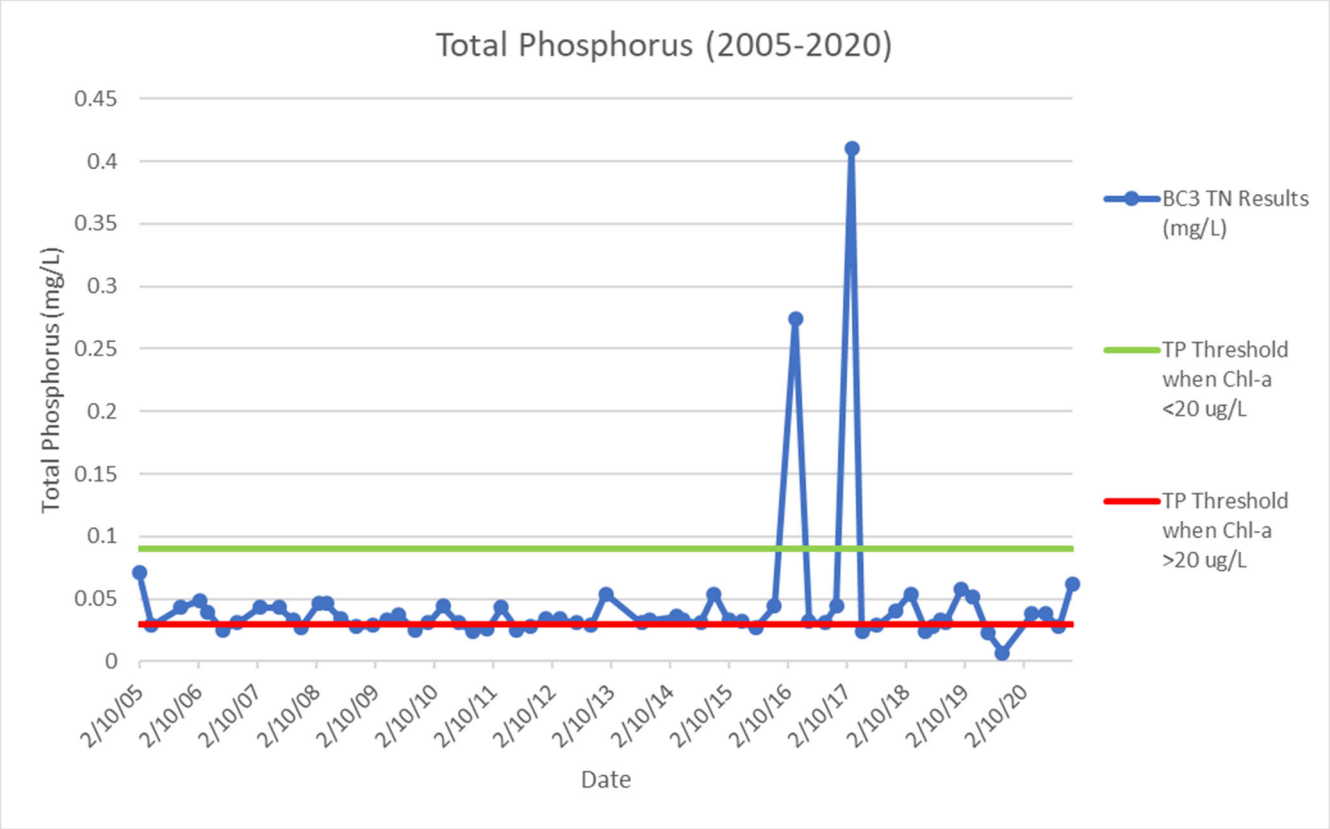
Figure 1: Lake Bass Vicinity Map
Figure 2: Lake Bass WBID Boundary and IWR Stations
Figure 3: Lake Bass Watershed Boundary with Sub-basins
Figure 4: Lake Bass Existing BMPs (Curb/Grate Inlet Baskets, Aeration System& Diffusors and Street Sweeping)
Figure 5: Southeast BAM Bioretention Basin
Figure 6: West BAM Upflow Filter
Figure 7: North BAM Bioretention Basin
Figure 8: Southwest BAM Bioretention Swale
Figure 9: Orange County Monitoring Location BC3 (21FLORANBC3)

ATTACHMENT: Trend Graphs (2005 to 2020)

ATTACHMENT: TREND GRAPHS (2005 to 2020)






Total Phosphorus (2005-2020)
Total Phosphorus (mg/L)
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2/10/05
2/10/06
2/10/07
2/10/08
2/10/09
2/10/10
2/10/11
2/10/12
2/10/13
2/10/14
2/10/15
2/10/16
2/10/17
2/10/18
2/10/19
2/10/20
Date
BC3 TN Results (mg/L)
TP Threshold when Chl-a <20 ug/L
TP Threshold when Chl-a >20 ug/L