

Documentation in Support of Category 4e

Waterbody/Watershed Identification

<i>Organization</i>	City of Lakeland (COL) and Polk County
<i>Point of Contact</i>	Laurie Smith, 407 Fairway Avenue, Lakeland, FL 33801, laurie.smith@lakelandgov.ne , 863-834-6276
<i>Waterbody(s)</i>	WBID 1497A, Crystal Lake
<i>No. Waterbody / Pollutant Combinations</i>	One waterbody segment; Verified Impaired for Nutrients (total nitrogen, total phosphorus, and chlorophyll-a) on the (Sarasota Bay- Peace- Myakka/Cycle 3 Verified List)

Description of Baseline Conditions

<i>Watershed(s)</i>	Basin Group 3, Sarasota Bay- Peace- Myakka																																												
<i>Baseline Data</i>	<p>Crystal Lake is a clear lake with high alkalinity. See table below with baseline water quality data summary (annual geometric means, AGMs, for chlorophyll-a, CHLAC, TN and TP) used to assess potential impairments for the period of 2009 – 2017.</p> <table><tr><th colspan="4">AGMs</th></tr><tr><th>YEAR</th><th>CHLAC</th><th>TN</th><th>TP</th></tr><tr><td>2009</td><td>54.90</td><td>1.62</td><td>0.07</td></tr><tr><td>2010</td><td>51.01</td><td>1.68</td><td>0.09</td></tr><tr><td>2011</td><td>70.24</td><td>1.96</td><td>0.09</td></tr><tr><td>2012</td><td>70.86</td><td>1.99</td><td>0.19</td></tr><tr><td>2013</td><td>88.57</td><td>2.15</td><td>0.19</td></tr><tr><td>2014</td><td>103.10</td><td>2.70</td><td>0.17</td></tr><tr><td>2015</td><td>42.93</td><td>1.27</td><td>0.08</td></tr><tr><td>2016</td><td>27.76</td><td>1.07</td><td>0.06</td></tr><tr><td>2017</td><td>35.34</td><td>1.30</td><td>0.07</td></tr></table>	AGMs				YEAR	CHLAC	TN	TP	2009	54.90	1.62	0.07	2010	51.01	1.68	0.09	2011	70.24	1.96	0.09	2012	70.86	1.99	0.19	2013	88.57	2.15	0.19	2014	103.10	2.70	0.17	2015	42.93	1.27	0.08	2016	27.76	1.07	0.06	2017	35.34	1.30	0.07
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Map

Crystal Lake and Contributing Drainage Areas



Evidence of Watershed Approach

Area of Effort

Crystal Lake, located on the eastern limits of the City of Lakeland (COL) and western limits of unincorporated Polk County, spans approximately 27.5 acres with a drainage area of approximately 181 acres. The lake has a mean depth of 6ft and a maximum depth of 17 ft. Crystal Lake is connected via emergency outfall to Fairway Lake, which is ultimately conveyed to Saddle Creek in the Peace River Basin. The Crystal Lake watershed is primarily composed of urban and high density residential development.

Key Stakeholders Involved and Their Roles

The COL and Polk County are partners for Crystal Lake assessment and restoration projects. The SWFWMD may be involved in future restoration projects by providing cooperative funding.

Watershed Plan & Other Supporting Documentation

The area includes the watershed drainage area from Crystal Lake watershed within WBID 1497A. This WBID is impaired for nutrients. Based on the current NNC for a clear, alkaline lake, Crystal Lake has exceeded chlorophyll a, TP, and TN in all 9 of the years assessed between 2009 and 2017 using AGMs calculated from ambient data monitored by Polk County. However, the lake has shown improvement in recent years.

The restoration objectives are outlined by two reports: 1) Crystal Lake Phase I TMDL Implementation Final Report - Results of Select Monitoring/Data Collection (completed), and 2) Crystal Lake Phase II Pollutant Source Verification & Concept BMP Development Report (in progress, draft expected to be completed by February 2019) and will address these impairments.

Amec Foster Wheeler completed the Crystal Lake TMDL Implementation Final Report in July 2017. The scope of work included identification of top pollutant load producing outfalls to Crystal Lake, stormwater monitoring at the chosen outfalls, lake water phytoplankton identification, sediment core sampling, bathymetric survey and updating pollutant load estimates. Laboratory analysis of stormwater and sediment samples as compared with historical surface water quality monitoring data indicated that additional nutrient sources from lake bottom sediment and ground water inflow may have a significant impact on nutrient content in the lake. The Phase II Pollutant Source Verification & Concept BMP Development Plan was submitted to COL by Amec Foster Wheeler in November 2017. This plan has been executed jointly by COL and Polk County Natural Resources Division and field work has recently commenced on the project. The Phase II report will include an evaluation of conceptual BMPs to address nutrient loads in Crystal Lake.

Because a considerable proportion of nutrient load contribution to Crystal Lake is from internal benthic flux, a study of bioavailable phosphorus in the lake sediments is being conducted as part of the Phase II study, which will be complete by August 2018. The preliminary sediment and phosphorus fractionation study results from Phase I estimated that lake sediments could contribute between 1,000 and 14,000 lb/yr of total phosphorus. Therefore, water quality restoration projects will focus on sediment management alternatives such as aeration, chemical amendment and/or targeted sediment removal. The type or combination of sediment management alternatives selected will be informed by the Phase II study results.

Point Sources and Indirect Source Monitoring (Sites)

There are 11 MS4 outfalls discharging to Crystal Lake (**Figure 2 in the Amec Foster Wheeler TMDL Implementation Final Report**) that are owned and operated by Polk County in conjunction with FDOT and City of Lakeland. The City of Lakeland outfalls, CL020/842802 and CL005/842104, were selected for monitoring as they represented the dominant single family residential land use type of the watershed. The phosphorus load from the MS4 to Crystal Lake is estimated as 122.7 lb/yr.

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	<p>There currently are no NPDES permitted surface water discharges within the watershed.</p> <p>The entire area is regulated by a Municipal Separate Storm Sewer System (MS4) permit # FLS000015-004 (see most recent MS4 annual report attached).</p> <p>Note: Generic Permits for stormwater discharge from large and small construction activities are considered temporary; therefore, are not included in this listing.</p>
<i>Nonpoint Sources</i>	<p>The land use in the Crystal Lake watershed (as of 2011) is 55% high density residential, 0.5% medium density residential, 15% commercial, 17% institutional, 0.03% rangeland, 10% water, and 2% wetlands. The primary nonpoint sources of pollutants are loadings from surface water runoff, groundwater seepage into the lakes, internal loading via benthic flux, and atmospheric deposition. Onsite sewage treatment and disposal systems (OSTDS) may also contribute nutrients and pollutants to the lake through the groundwater. There are approximately 124 OSTDS units in residential areas surrounding Crystal Lake.</p>
<i>Water Quality Criteria</i>	<p>Crystal Lake is a clear lake with high alkalinity (lake class 2). Based on the procedure for determining numeric nutrient criteria (NNC), outlined in F.A.C 62-302, the NNC for nutrients in Crystal Lake are 20 ug/L, 0.03 mg/L, and 1.05 mg/L for chlorophyll-a, total phosphorus, and total nitrogen, respectively, which is anticipated to be achieved upon successful completion of all water quality restoration projects.</p>
<i>Restoration Work</i>	<p>The City of Lakeland and Polk County have street sweeping programs in place where the streets are swept approximately 14 times per year. The City annexed a section around the lake in 1981, and began street sweeping in the area. Polk County began street sweeping in the basin in 2013. Within the watershed of Crystal Lake, the City of Lakeland sweeps 2.7 miles of road, and Polk County sweeps 3.9 miles of road (see Figure 1 in References section at the end of this document). Together, the City and County remove an estimated 27,250 lb of material from the stormwater system. The street sweeping efforts remove an estimated load of 10 lb/yr of total phosphorus and 15 lb/yr of total nitrogen from the Crystal Lake watershed. However, the City plans to increase street sweeping implementation by the end of the year after they revise their routes.</p> <p>Polk County passed a Fertilizer Ordinance in 2013. See attached for ordinance document. The City regularly participates in educational and outreach events that provide education regarding stormwater pollution and lake ecology. Recent events included Eco-fest on April 14, 2018 and Green Celebration on April 20, 2018. Other annual events include the Cardboard Boat Race and Lakes Festival, and Water, Wings, and Wild Things. In addition, the City pays for public service announcements that are shown before all movies that are played within all movie theaters in City limits, which gain >80,000 plays/yr. Additional relevant City ordinances are provided at the end of this document for reference. The County is planning to install environmental educational signage at the Crystal Lake boat ramp.</p> <p>Because internal nutrient loading from sediments was found to be a main contributing source of nutrients in Crystal Lake, targeted sediment removal and/or other capping alternatives such as chemical amendments (Phoslock or Alum) or aeration will be implemented to improve water quality. The sediment management and restoration plan will be developed based on the results of the Phase II monitoring and sediment flux studies, which will be completed by the end of 2018. A</p>

range of estimated costs for the sediment management options are provided in the table below. The City and County are committing to implement sediment management projects to achieve the NNC and have committed funding to achieve these goals. In addition to sediment flux, a groundwater seepage study will be conducted as part of the Phase II monitoring effort.

Additional information regarding planned and/or existing stormwater BMPs in regard to the City's MS4s is provided in the MS4 Annual Report (see **References** section at the end of this document for link to the report). Planned stormwater BMPs will be further assessed upon completion of the Crystal Lake Phase II Pollutant Source Verification & Concept BMP Development Report. However, the City and County are planning to incorporate the Phase I Report (which were included in the MS4 Annual Report) recommendations over the next several years and will include FDOT as a partner where possible. Planning for the diversion/retrofit project and the conversion of a dry detention pond to a dry retention pond is underway and should be implemented within 4 years, to allow a couple of years to secure funding and permitting activities to be completed. Lastly, the City and County are planning to implement some baffle boxes within the watershed to reduce pollutant and trash loads from entering the lake. Locations of the baffle boxes are to be determined. See table below for estimated implementation of the capital improvement water quality restoration stormwater BMP projects.

Stakeholder: BMP Element	Preliminary Schedule #	Cost (Estimate)*
COL: Additional Street Sweeping	C4-YR3 (Oct 2018- Sep 2019)	\$2,000
COL: Modify Existing Dry Det. Pond to Dry Retention in Basin CL005	C4- YR 4,5 (Oct 2019- Sep 2021)	\$10,000
Joint COL/County: Divert Outfall CL005 to Existing County Wet Det. Pond	C4- YR4 to C5-YR2 (Oct 2019- 2023)	\$50,000
COL, County & FDOT: Gross Pollutant Separators (Baffle Boxes or similar) Assessment/Installation	C4- YR5 to C5- YR5 (Oct 2020 to 2026)	\$60,000 per location
Joint COL/County: Targeted sediment removal and/or capping	C4- YR 4,5 (Oct 2019- Sep 2021)	\$250,000-850,000**
Total		\$372,000-972,000**

Notes: "C4"= MS4 Cycle 4 permit; "YR" = Permit year of noted permit

*Cost estimate does not include design and permitting.

**Cost range reflects range of sediment management actions TBD following Phase II study. completion. Range includes costs ranging from applying only Phoslock (\$250,000) to entire lake, or dredging portions of the lake (\$850,000).

#Schedule is subject to funding availability.

Critical Milestones/Monitoring

Anticipated Critical Milestone(s) and Completion Dates:

In addition to the stormwater related BMP projects listed in the table above, the City and County are committed to implementing targeted sediment removal and/or other alternatives such as chemical amendments (Phoslock or Alum) or aeration, expected to occur in 2019-2020, which is contingent on design and permitting, and funding approval.

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Existing and ongoing City of Lakeland and Polk County Division of Natural Resources ambient water quality monitoring program:

Station CRYSTAL1 at the center of the lake is sampled quarterly (since 2001 to present) for 28 parameters. A list of sampled parameters is provided in **Table A1** in the **References** section at the end of this document. Additional historical stations include station CRYSTAL 2 (quarterly data from 1992 to 1999), and stations CRYSTAL3 and CRYSTAL5 (periodic data from 2000-2001). The County will continue monitoring CRYSTAL1 station and it is expected that the CRYSTAL1 station will be used to assess progress following implementation of restoration projects due to its long term and continuous database.

Existing and ongoing City of Lakeland in-situ water column profile monitoring program:

The City has been collecting in-situ water quality data profiles at three locations in the lake since November 2017 to provide information regarding the level of potential stratification and oxygen conditions within the water column.

Florida Biological Research Associates (BRA) water quality monitoring:

Stations 1497-A, 1497-B were sampled monthly from 2007-2008 for 31 parameters. A list of sampled parameters is provided in **Table A1** in the **References** section at the end of this document.

SWFWMD water level monitoring program:

The SWFWMD collects water levels on a monthly basis (1993 to present) at Station 24902.

Amec Foster Wheeler targeted stormwater monitoring for City of Lakeland MS4 outfalls:

The sampling stations at Site 1 (CL020/842802) and Site 2 (CL005/842104) produced composite samples during storm events (triggered by flow volumes passing through the system). The monitoring stations consisted of a 3700 ISCO autosampler, a Campbell Scientific data logger, a pressure transducer, suction intake, and cell phone modem. Sampling equipment at Sites 1 and 2 were operational since May and July 2016 (respectively), until January 2017. The water quality parameters collected include orthophosphate, ammonia, total Kjeldahl nitrogen, total phosphorus, total suspended solids, nitrate + nitrite, and total nitrogen. Flow and rainfall were also measured (to calculate flow-weighted loads). The storm event characteristics of the seven sampled rainfall events are shown in **Table 7** and **Table 13** of the **Amec Foster Wheeler TMDL Implementation Final Report**.

Amec Foster Wheeler phytoplankton monitoring for the City of Lakeland:

Phytoplankton samples were collected quarterly from May 2016 to February 2017 and analyzed for nitrogen-fixing cyanobacteria.

Amec Foster Wheeler sediment flux sampling for City of Lakeland:

Intact sediment cores will be collected at representative locations throughout the lake and monitored for ammonia, total organic carbon, total phosphorus, and iron concentrations, which will be used to calculate sediment nutrient flux rates and loads. In-situ measurements of pH, temperature, specific conductance, and dissolved oxygen will also be collected in the lake at various depths to inform optimal lab test conditions. Results of this sampling plan will inform potential implementation of BMP or other chemical amendment alternatives.

Amec Foster Wheeler groundwater sampling for City of Lakeland:

Up to four groundwater seepage meters will be installed in or around Crystal Lake and sampled bi-monthly for pH, specific conductance, total ammonia nitrogen, nitrate + nitrite, total Kjeldahl

nitrogen, total nitrogen, total phosphorus, and orthophosphate. The groundwater sampling plan will determine the quantity and quality of shallow groundwater seepage into Crystal Lake.

Other Key Dates

Estimated Delisting Date

The WBID is in the state's Group 3 Basin in the West Central District. The next review and assessment cycle (cycle 4) is expected in 2020 at which time sufficient data will be acquired to fully assess the WBID, and if not impaired, DEP is expected to request the WBID be delisted from the federal 303(d) list (if applicable).

Financial Commitments

Estimated Implementation Cost

The total project costs, including land acquisition (if applicable) is \$372,000 - \$972,000 (depending on Phase II sediment management treatment alternative analysis results).

The cost includes potential SWFWMD CFI grants of up to \$486,000 (50% of construction costs – if approved by the SWFWMD)

The estimated 20 year operation and maintenance cost is \$ TBD (if applicable).

Land Acquisition (if applicable)

Funding

Source: N/A

Total.....\$ NA

Design and Construction (if applicable)

Funding Source: City of Lakeland, Polk County, and SWFWMD (contingent upon funding approval from each respective agency Boards and Commissions)

Total.....\$ 372,000 - 972,000 (TBD)___

References, Figures, and Tables are provided below:

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Figure 1: City of Lakeland Street Sweeping Zones within Crystal Lake Watershed

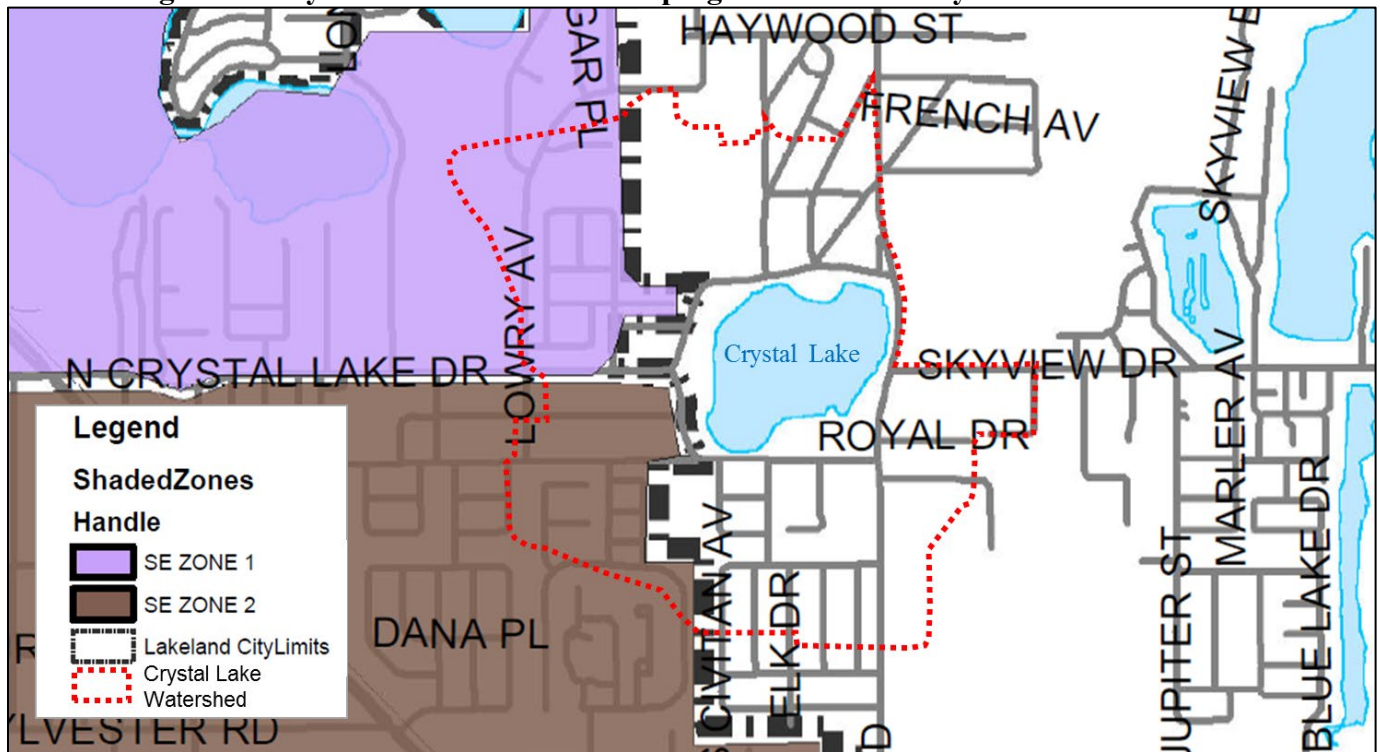


Table A1: Water Quality Monitoring Plans Sampled Parameters

Polk County Sampled Water Quality Parameters	Florida BRA Sampled Water Quality Parameters
pH	Calcium
Specific conductance	Secchi disk depth
Nitrogen, Nitrite (NO ₂) + Nitrate (NO ₃) as N	True Color
Chlorophyll a, uncorrected for pheophytin	Magnesium
True Color	Temperature, water
Temperature, water	Total Organic Carbon (TOC)
Turbidity	Specific conductance
Nitrogen, Kjeldahl	Nitrogen, Ammonium (NH ₄) as N
Nitrogen, ammonia (NH ₃) as NH ₃	Pheophytin-a
Nitrogen, mixed forms (NH ₃)+(NH ₄)+organic+(NO ₂)+(NO ₃)	Dissolved oxygen (DO)
Dissolved oxygen (DO)	pH
Total Organic Carbon (TOC)	Chloride
Chlorophyll a, corrected for pheophytin	Alkalinity, Total (total hydroxide+carbonate+bicarbonate)
Phosphorus as P	Dissolved Solids
Secchi disk depth	Phosphorus
Sulfur, sulfate (SO ₄) as SO ₄	Fluorides
Alkalinity, Total (total hydroxide+carbonate+bicarbonate)	Salinity
Sodium	Nitrogen, Kjeldahl
Magnesium	Escherichia coli
Phosphorus, orthophosphate as PO ₄	Phosphorus, orthophosphate as PO ₄
Total Solids	Chlorophyll a, corrected for pheophytin

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Polk County Sampled Water Quality Parameters	Florida BRA Sampled Water Quality Parameters
Chloride	Potassium
Iron	Sulfur, sulfate (SO ₄) as S
Calcium	Turbidity
Hardness, Ca + Mg	BOD, Biochemical oxygen demand
Total Suspended Solids (TSS)	Sodium
Phosphorus, orthophosphate as P	Nitrogen, Nitrite (NO ₂) + Nitrate (NO ₃) as N
Nitrogen, ammonia as N	Chlorophyll a, uncorrected for pheophytin
	Total Suspended Solids (TSS)
	Depth
	Secchi disk depth

Attached Reports Supporting Projects and Restoration Efforts:

- 1) Crystal Lake TMDL Implementation Final Report, 2017 (Phase I Report)
- 2) MS4 Annual Report: “Annual Report Form for Individual NPDES Permits for Municipal Separate Storm Sewer Systems (Rule 62-624.600(2), F.A.C)”, 2018 (available at this link: ftp://ftp.dep.state.fl.us/pub/NPDES_Stormwater/Phase_I_MS4s/FLS000015_Polk_County/Lakeland/COL_ReportPermit4Year%201/)

City of Lakeland Codes/Ordinances:

Code of the City of Lakeland, Ordinance no. 5080, Chapter 86, Section 86-3:

It shall be unlawful for any person to throw, spill, place deposit or leave, or cause to be thrown, spilled, placed, deposited or left, or to permit any servant, agent or employee to throw, spill, place deposit in or upon any street, highway, alley, sidewalk, park or other public place in the city any dirt, sweepings, filth, shells, garbage, vegetables, dead carcasses, sewage, slops excrement, compost, stable manure, ashes, soot, tin cans, rags, wastepaper, leaves, brush, weeds, grass, straw, hay, excelsior, shavings, barrels, crates, boxes, litter, or loose combustible material; materials subject to be carried by the wind, or unwholesome, noisome or putrescible matter of any kind.

Code of the City of Lakeland Land Development Regulations under Natural Resource Protection Regulations, *Article no. 34.06.05.01*:

Adequate measures of erosion control shall be established upon all applicable sites. Compilation of all features on site may necessitate unified measures of control. Adequate measure of control shall be defined as those needed to minimize or eliminate any transfer or removal of soil from a site during a rainfall event.

Code of the City of Lakeland, Chapter 86, Ordinance 5080 Section 86-4

It shall be unlawful for any person to allow any swill, slops or malodorous or noxious liquids to run, drop, or fall into or upon any sidewalk, street, alley, park, lake, stream, or other public place and it shall be unlawful for any person to allow any water, grease, or any slippery matter to fall, drop, or to be deposited upon any sidewalk, street, highway, or alley within the city.

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