SURFACE WATER QUALITY MONITORING AND ASSESSMENT 2022 ANNUAL REPORT

1.0 Introduction

Since October 1990, the Pinellas County's Public Works Department Division of Environmental Management (PCDEM) has monitored surface water quality in four lakes, nine coastal receiving water areas, and the majority of the County's 52 drainage basins. In January 2003, a revised monitoring program (Janicki, 2003) was implemented to provide better geographical coverage of County waters and to provide more statistically defensible results in comparison to the original (1990–2002) program. The current ambient water quality monitoring program consists of two types of sample sites: fixed "land run" sites and stratified random "probabilistic" open water sites.

As required in the Pinellas County MS4 permit, Part V.B.3, this report provides a summary of the water quality monitoring and assessment program in Pinellas County for 2022 and discusses the 2022 water quality data as well as trends over time. A majority of the streams sampled in 2022 exceeded the total phosphorus (TP) criterion, while all of the western coastal strata exceeded the TN criteria set for those segments for the fifth year in a row.

This report presents the long-term trends from 2013 to present, a ten-year timeframe. Long-term trend analyses were performed for each waterbody that has a minimum of 60 observations over at least seven years (the required minimum amount of data for the trend analysis). The trends over this most recent ten-year period indicate stable conditions (no significant increasing or decreasing trend) for most parameters at most stream sites; however, there are a number of worsening trends, as discussed later in the report. Most of the coastal receiving waters exhibit significant increasing long-term trends in nutrients, as measured by TN and TP. This pattern is of concern, and Pinellas County has initiated a nitrogen source tracking study to determine potential causes of this elevated TN. Additionally, all of the eastern strata show increasing trends in TN and turbidity, although none exceeded criteria in 2022. Environmental challenges in the past few years like the Piney Point emergency discharge, red tide events, and *Pyrodinium* blooms may have contributed to the observed coastal trends.

Pinellas County's Surface Water Management Plan (SWMP), two Bacteria Pollution Control Plans, two Total Maximum Daily Load (TMDL) Implementation Plans, four 4e ongoing Restoration

Activities Plans, and Reasonable Assurance Plans (RAPs) for Lake Seminole and Tampa Bay lay out recommended activities which should reduce nutrient loads into County waterbodies. As the recommendations in these documents continue to be implemented and further studies help guide necessary adaptations to best management practices and target hotspots to address, water quality should improve.

2.0 Methodology

Field sample collections and measurements are carried out according to FDEP Standard Operating Procedures (SOPs) (FDEP, 2017) and PCDEM SOPs (PCDEM, 2022). PCDEM sampling consists of fixed “land run” sites as well as randomly selected “probabilistic” sites for open water bay regions.

2.1 - OPEN WATER STRATA AND MONITORING SITES

The water quality of the bays surrounding Pinellas County are monitored using a stratified random monitoring program designed for the PCDEM by Janicki Environmental, Inc. (Janicki, 2003). This monitoring program has a probabilistic design consisting of an Environmental Protection Agency (EPA) Environmental Monitoring Assessment Program (EMAP)-based element and a stratified random element. The EMAP-based design element consists of overlaying hexagonal grids on strata (water body segments) and randomly selecting a sample location within each grid. This allows for estimating surface area for water quality conditions within each stratum. The stratified random element allows for statistical methods to be used to estimate population means and confidence limits for water quality metrics. Samples collected using this method are used to assess status and trends in County receiving water bodies.

Lake Tarpon, Lake Seminole, and the marine waters along the shores of Pinellas County have been subdivided into 19 strata (Figure 1). East and west coast reporting units were selected based on the location of causeways, bridges, and the Tampa Bay Estuary Program boundaries (Pribble et al., 1999). West coast strata extend from the mainland shoreline to the eastern shore of the barrier islands, and east coast strata extend from the mainland shore to approximately the middle of Tampa Bay. Lake Seminole is stratified geographically into a northern and southern lobe to ensure that an equal number of samples are collected in each lobe. Lake Tarpon comprises a single monitoring stratum. The strata E6 and E7, which are receiving waters for the

City of St. Petersburg in Middle Tampa Bay, have been monitored by the City of St. Petersburg since 2014.

Sites were originally sampled nine times per year, but in 2008, the fixed sampling was reduced to eight times a year. Monitoring occurs over four dry season (October through early June) sample periods, during which sites are visited every 50.75 days, and four wet season (June through September) sample periods of 40.5 days. Four sites are selected randomly each monitoring period within each of the strata for a total of 32 samples per stratum per year. In addition, two temporal units, morning and afternoon, are considered each day of sampling, and the order of visitation (i.e., morning vs. afternoon) within each stratum is randomized. The eastern strata sample effort is further stratified by depth, with 6 sample sites randomly selected from waters greater than 2 meters deep and 26 sites randomly selected from waters less than 2 meters deep. If a primary sampling site cannot be used for some reason (i.e., too shallow), sets of randomly selected secondary and tertiary sites are available as alternates.

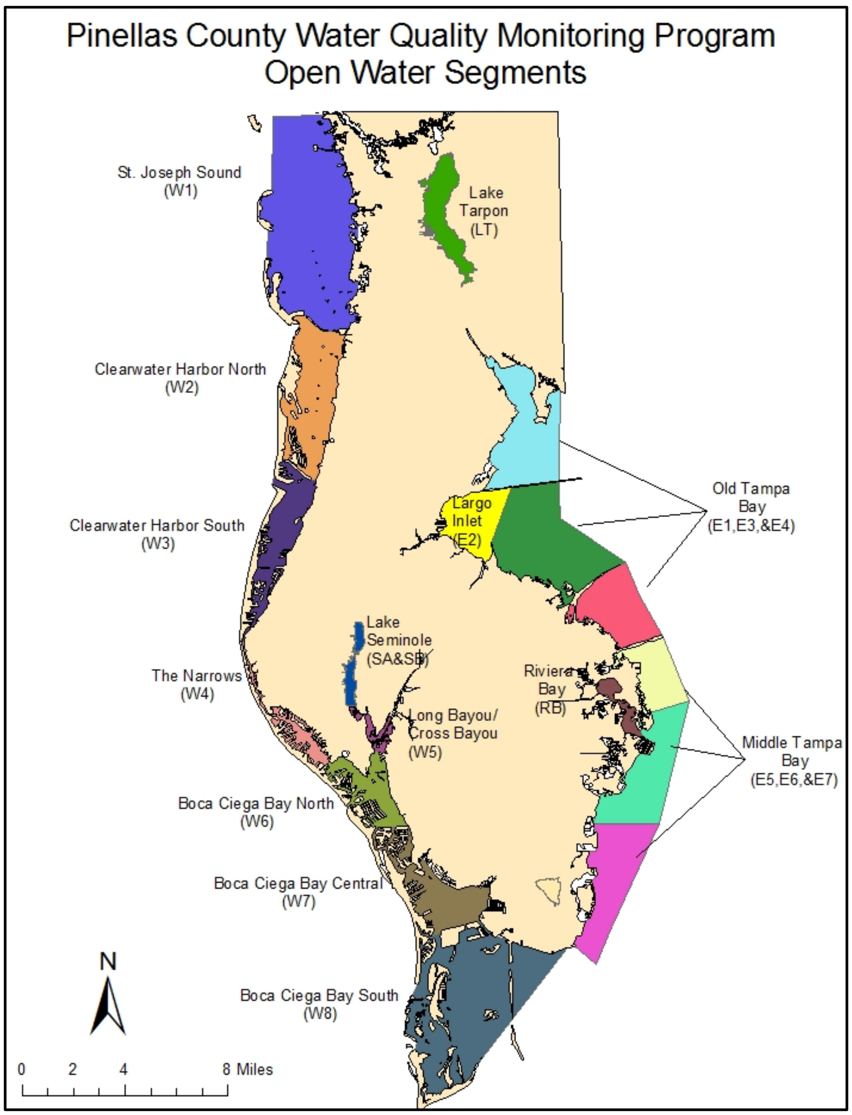

Figure 1. Pinellas County Open Water Monitoring Strata.

2.2 - LAND BASINS AND SITE LOCATIONS

The second monitoring type is a set of fixed land-based sites in streams, ditches, canals, and the Anclote River (Figure 2 and Table 1). Lake Chautauqua and Alligator Lake are also monitored as fixed sites. Water quality samples and flow data are collected each sample period on the same random schedule determined for the open water program and are used to assess the condition of the waterway and to estimate nutrient and sediment loads from these waterways to receiving waterbodies.

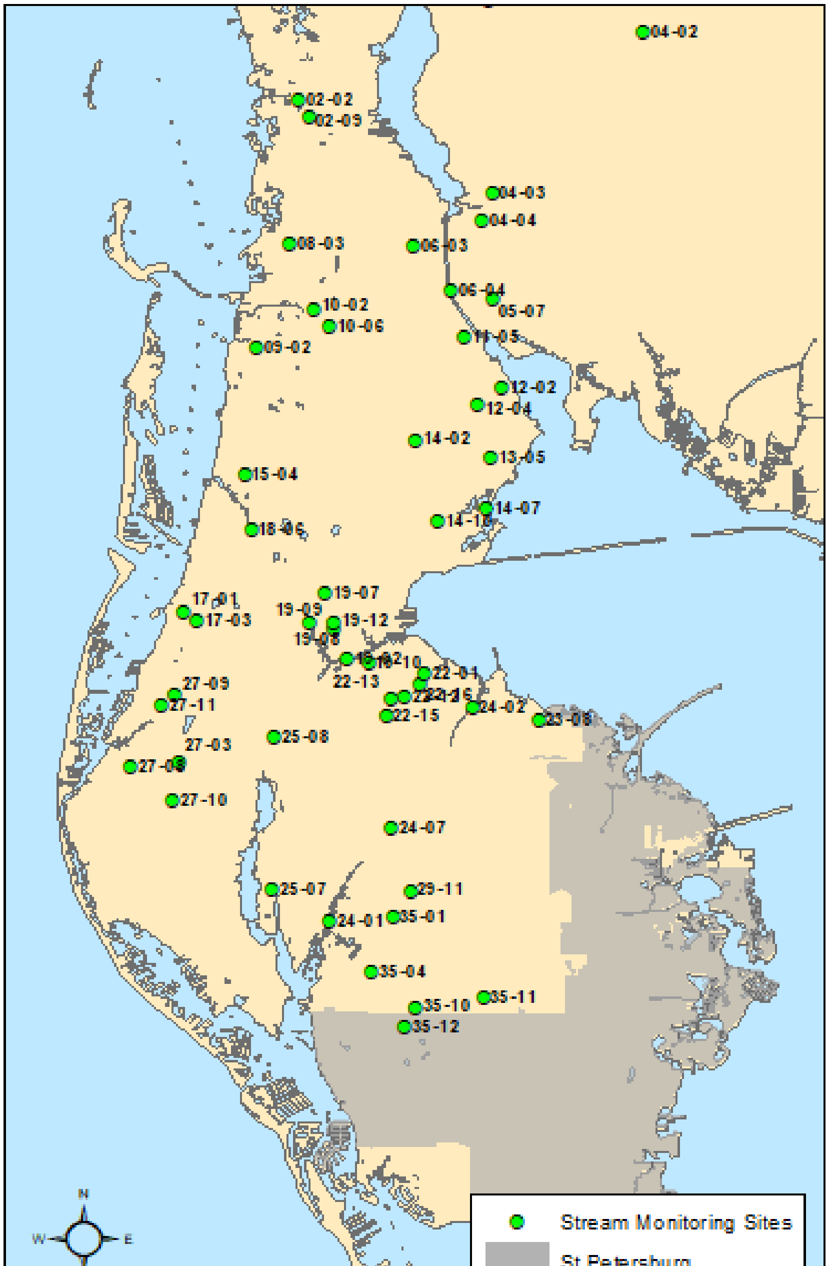

Figure 2. Fixed land run sites.

The County is composed of 52 watersheds. Most of the watersheds, excluding the 11 watersheds solely in St. Petersburg's jurisdiction, contain at least one fixed monitoring station near the final discharge point of the tributary or watershed and just upstream of tidal influence. Fifty ambient sites were included in the land runs in 2022. Land run sites are grouped by proximity, with typically between seven and nine sites sampled on a single day, including both ambient sites and special project sites (not included in this report). Nine sites were in lakes or tidally influenced areas in which measurement of flow is not possible, so only water quality data were collected. At all other sites, both water quality data and flow data were collected. USGS continuous volume discharge data are available for 12 sites. Another 13 sites have continuous volume discharge data available from Hydrologic Data Collection, Inc (HDI). County staff manually measured flow at the time of sample collection at all remaining sites.

Table 1. Fixed "land run" information (2022 monitoring), with site IDs and site names. Sites in a land run are sampled on a single day.

Land Run	Site ID	Site Name	Land Run	Site ID	Site Name
LR1	01-01	Anclote River	LR4	19-02	Allens Creek
	01-08	Anclote River		19-08	Allens Creek
	01-09	Hollin Creek		19-10	Allens Creek
	02-02	Klosterman		19-12	Allens Creek
	02-09	Klosterman		19-13	Allens Creek
	04-02	Brooker Creek	LR5	24-01	Cross Bayou
	04-03	Brooker Creek		24-07	Cross Bayou
	04-04	Brooker Creek		35-01	Pinellas Park Ditch #5
LR2	08-03	Bee Branch/Smith Creek		35-04	Bonn Creek
	09-02	Cedar Creek		35-10	Joes Creek
	14-07	Alligator Lake		35-12	Miles Creek
	14-10	Alligator Creek		35-15	Joes Creek
	15-04	Spring Branch	LR6	22-01	Long Branch
	17-01	Rattlesnake Creek		22-12	Long Branch
	17-03	Rattlesnake Creek		22-16	Long Branch
	18-06	Stevenson Creek		24-02	Cross Bayou
LR3	05-06	Moccasin Creek		25-02	Seminole Bypass
	06-03	Cow Branch		25-07	Seminole Bypass
	06-06	Tarpon Outfall		29-11	Pinellas Park Ditch #1
	11-05	Briar Creek	LR7	27-01	McKay Creek
	12-02	North Bishop		27-08	Church Creek
	12-04	South Bishop		27-09	McKay Creek
	13-05	Mullet Creek		27-10	McKay Creek
	14-02	Lake Chautauqua		27-11	McKay Creek
				27-14	McKay Creek
			LR8	10-02	Curlew Creek
				10-06	Jerry Creek

2.3 - FIELD MEASUREMENTS AND SAMPLE COLLECTION

For all sites, *in-situ* physical parameters including temperature, pH, dissolved oxygen, conductivity, salinity, and depth are measured using YSI DSS multiprobe units. Surface readings are taken at a depth of 0.2 m from the surface. If the total water column depth is greater than 1.0 m, data are recorded at the surface and 0.2 m from the bottom.

Water samples are collected for analysis by the Pinellas County Utilities Department Laboratory. For both fixed land sites and open water strata sites, most water samples are collected via bottle immersion ("grabs") at 0.2 m from the surface. For a few land sites which are too deep at mid-channel, water samples are collected using a horizontally-oriented Alpha™ bottle water sampler as described in the PCDEM SOPs. For open water sites, a secchi disk is used to measure water clarity to the nearest tenth of a meter.

Flow measurements are collected using a modification of the US Geological Survey's (USGS) stream flow methodology with a Marsh McBirney Model 2000 Flow-Mate® or by using data collected at either real-time USGS continuous flow monitoring locations or HDI data logging continuous flow monitoring locations. Water quality samples are not collected if flow is not detectable.

2.4 - LABORATORY METHODS

Water samples are delivered to the Pinellas County Utilities Laboratory (PCUL) within six hours of sample collection at any given site. The PCUL, a National Environmental Laboratory Accreditation Conference (NELAC) certified lab, performs most sample analyses. If needed, Pace Analytical (formerly E-lab), a NELAC certified laboratory, may provide analysis services for this program. The laboratories follow analysis protocol from:

Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. Revised March 1983.

Standard Methods for the Examination of Water and Wastewater, 21st Edition. APHA, WEF, AWWA, 2012

2.5 - PARAMETER DESCRIPTIONS

The following is a list of water quality metrics assessed in the sample program. Unless otherwise specified, these parameters are assessed at each site every monitoring period.

Alkalinity: (measured in lakes only) Alkalinity is a measure of the capacity of water to neutralize acids and is reported in units of mg/L $CaCO_3$. Water samples contain alkaline chemicals like carbonates, bicarbonates, and hydroxides that neutralize acid and buffer water against pH changes. Total alkalinity is measured by adding acid to a water sample until the water sample pH reaches a standard, accepted pH endpoint. At this standard pH, all alkaline chemicals are neutralized by the acid.

Aluminum: (measured in Lake Seminole and Seminole Bypass Canal only) Dissolved aluminum is measured in streams and lakes treated with alum, an aluminum chemical, to remove nutrients. Water samples are filtered so only dissolved aluminum is measured. Dissolved aluminum is expressed in mg/L units.

BOD5: (measured only in freshwater, every other monitoring period) Biochemical oxygen demand is the quantity of dissolved oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five days at 20°C, expressed in mg/L.

Chlorophyll-a: Water column chlorophyll-a (Chl-a) concentrations are a measure of the quantity or biomass of planktonic algae or phytoplankton in a water body. Excessive nutrient loadings into a water body can result in high phytoplankton biomass conditions known as algae blooms. High algal biomass can greatly reduce water clarity, which in turn may limit the growth and distribution of desirable bottom vegetation such as seagrasses and can seriously degrade the aesthetic quality of a water body. In addition, persistent conditions of high algae biomass often result in die-off, sinking, and decay of the algae in water bodies. Decaying matter consumes oxygen and may result in fish kills. Chl-a is measured in µg/L.

Color: (measured only in lakes) Color is a measure of dissolved inorganic and organic substances in a water sample. Color is measured in platinum-cobalt units (PCU).

Conductivity: Conductivity is a measure of water's capability to pass electrical flow. This ability is directly related to the concentration of ions in the water such as dissolved salts and inorganic materials like chlorides, sulfides, and carbonate compounds. Conductivity is measured in millisiemens per centimeter (mS/cm).

Dissolved Oxygen: Dissolved oxygen (DO), measured in mg/L and percent saturation, strongly influences where organisms live. Oxygen enters the aquatic environment from the atmosphere (wind, waves, direct diffusion), plant photosynthesis, and mixing and diffusion from more oxygenated water masses. A physical property of water is that the solubility of oxygen is greater in cold water than in warm water therefore, less oxygen can be dissolved in water as water temperature increases. Biological factors such as increased metabolic rates and oxygen uptake rates of aquatic organisms may further reduce DO levels. Since biological oxygen uptake is often the greatest in bottom waters compared to surface waters, the first signs of an oxygen stressed water body are usually observed as low bottom water DO levels. Such conditions may result in isolated or widespread fish kills.

Enterococcus: (measured only in tidally influenced waters that experience salinity greater than 2.7 ppt) Enterococci, indicators of water column pathogens, are found in intestinal tracts of animals and humans. Its presence can be natural or from an anthropogenic source like a sewage spill. *Enterococcus* is expressed as most probable number (MPN)/100mL.

Escherichia coli: (measured only in waters with salinity less than 2.7 ppt) *Escherichia coli* (*E. coli*), indicators of water column pathogens, are found in intestinal tracts of animals and humans. Its presence can be natural or from an anthropogenic source like a sewage spill. *E. coli* is expressed in MPN/100mL.

Flow: (measured only at fixed land sites without an USGS or HDI continuous flow station and not at lakes). Width and depth data are collected to estimate cross sectional areas of channels. Water velocity is measured on-site using a flowmeter. The flow is then calculated in cubic feet per second (cfs). Flow volume is combined with water quality parameter concentrations to estimate loading for total nitrogen, total phosphorus, and total suspended solids.

Nutrients: Nutrients are chemical elements that sustain life and promote growth. Total phosphorus (TP), total nitrogen (TN), nitrate-nitrite (NOx), total Kjeldahl nitrogen (TKN), ammonia (NH_3), and orthophosphate (OP) are common constituents used to assess nutrients in water. They are all measured in mg/L. TN, calculated by summing lab reported values of NOx and TKN, and TP are the primary nutrient parameters used to assess water health. Waters containing few nutrients cannot support a large plant community and will not attract animal life, as there will not be a source of food. An overabundance or imbalance of nutrients can cause algae blooms, which may produce toxins and lead to decreased DO in the water. The water clarity from such nutrient-induced algae blooms can also limit water column light transparency, which may limit available light necessary for desirable submerged aquatic vegetation to grow.

pH: pH is measured on a scale from 0 (acidic) to 14 (basic), with 7.0 considered neutral. If pH is too high or low, aquatic organisms will not be able to live. Additionally, pH can affect the solubility and toxicity of chemicals and heavy metals in water.

Salinity: Salinity is a measure of the total amount of dissolved solids in seawater and is measured in parts per thousand (ppt). Sodium and chloride make up 86% of sea salts, with sulfur, magnesium, potassium, and calcium accounting for 13%. Salinities in Pinellas County generally vary between 0 ppt (freshwater) and 33 ppt. Salinity is affected by precipitation, evaporation, freshwater inputs, springs, and mixing with other water masses such as the Gulf or streams.

Secchi Depth: The Secchi disk is a black and white circular disk used to measure water clarity. The depth at which the disk is no longer visible is recorded to the nearest tenth of a meter.

Total Suspended Solids: Totals suspended solids (TSS) are the amount of particulate material in the water including algae, sediments, and microorganisms. TSS is measured in mg/L. TSS affects the amount of light that can penetrate the water column and thus is part of what determines where plants grow. Increases in TSS can be caused by algae blooms, increased runoff into a system, erosion, and by resuspension of bottom sediments in shallow areas.

Turbidity: Turbidity is an expression of the optical property that causes light to be scattered and absorbed rather than transmitted. It is an indication of water clarity and is measured in nephelometric turbidity units (NTU).

In addition to measuring these water quality parameters, Pinellas County has conducted **biological monitoring** at certain sites twice a year on alternate years since 2014. Sites in the Springs Coast Basin (west side of the County) are monitored in even years, and those in the Tampa Bay Basin (east side of the County) are monitored in odd years. This monitoring uses FDEP methods in order to determine the following:

- **SCI**: The Stream Condition Index (SCI) is a composite macroinvertebrate index for use in flowing streams. Sampling consists of 20 dipnet sweeps of the most productive habitats found in a 100 m stretch of a stream. Organisms collected in these sweeps are preserved and brought back to the PCDEM laboratory for processing, and data generated from the taxonomy and relative abundance of these organisms is used to calculate ten biological metrics, each of which has been shown to respond predictably to human disturbance. These scores are then summed to obtain an overall score of biological health. A balanced macroinvertebrate community is attained if the average score of at least two temporally independent SCIs, performed at representative locations and times, is 40 or higher, with neither of the two most recent SCI scores less than 35.

- **HA**: A Habitat Assessment (HA) is performed concurrently with each SCI collection. Eight attributes known to have potential effects on stream biota are rated to produce a score between 8 and 160, with a higher score indicating less human disturbance. Parameters examined include substrate diversity, substrate availability, water velocity, habitat smothering, artificial channelization, bank stability, riparian buffer zone width, and riparian zone vegetation quality.
- **RPS**: A Rapid Periphyton Survey (RPS) measures the relative abundance of algae growing on stream substrates within the 100 m observed area. Nine observations are made every 10 meters which include presence or absence of algae and average length of algae if present. If less than 25% of the algae is longer than 6 mm, flora is considered balanced.
- **LVS**: The Linear Vegetation Survey (LVS) for flowing streams documents the plant community in the 100 m stream reach. The average sensitivity, measured by the Coefficient of Conservatism (COC), of the plant community is calculated based on species ecological tolerance to environmental changes. If the average sensitivity is greater than or equal to 2.5, the plant community is in balance. The percentage of invasive exotics is also noted, with a balanced plant community being less than 25% of the plants being invasive. Two separate floral evaluations are required for assessment, and the assessment is considered unresolved if both evaluations do not agree (i.e., one passes or has no plants but the other fails).
- **LVI**: The Lake Vegetation Index (LVI) is a multi-metric tool which assesses lake health based on the plant community structure. The field method involves dividing a lake into 12 units and identifying plants to the lowest possible taxonomic level in four of the 12 units. Plants are identified in each unit by performing a visual boat “drive by” and by a transect approach. A frotus is deployed a minimum of five times along the transect to assess the presence of submersed aquatic plants. Data generated on the presence of species is used to calculate four biological metrics, each of which has been shown to respond to human disturbance: native taxa, invasive taxa, sensitive taxa, and dominant coefficient of conservatism (COC). A lake is considered impaired if the average of all LVI scores is less than 43.

3.0 - ANALYSIS AND DISCUSSION OF RESULTS

Data analyses focused on water quality metrics are used by the FDEP to determine impairment of water bodies and on water quality metrics related to water clarity.

3.1 - DETERMINATION OF WET AND DRY SEASONS

Annual rainfall and wet and dry seasons for the period of record were determined using rainfall data from the Southwest Florida Water Management District. The annual dry season is from January through May and from October through December. The annual wet season is from June through September. Average annual rainfall for the period 1915-2022 is 45.97 inches. Rainfall by month is summarized for 2003 through 2022 in Figure 3. Annual rainfall as well as wet and dry season rainfall totals are summarized for 2002 through 2022 in Figure 4. The year 2022 was a drier year on average with a couple of abnormally wet months, especially November.

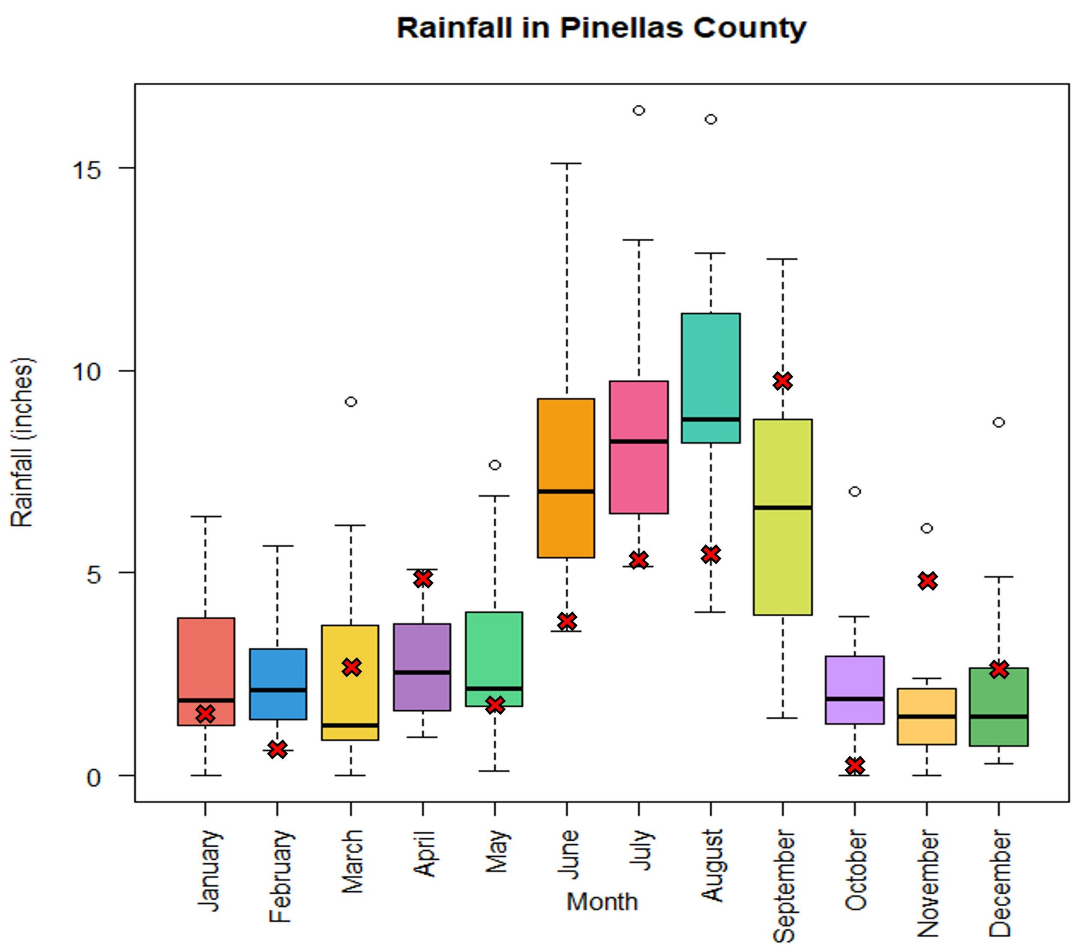

Figure 3. Average monthly rainfall totals for Pinellas County from 2003 through 2022 (from Southwest Florida Water Management District data). The red X's are the 2022 monthly totals.

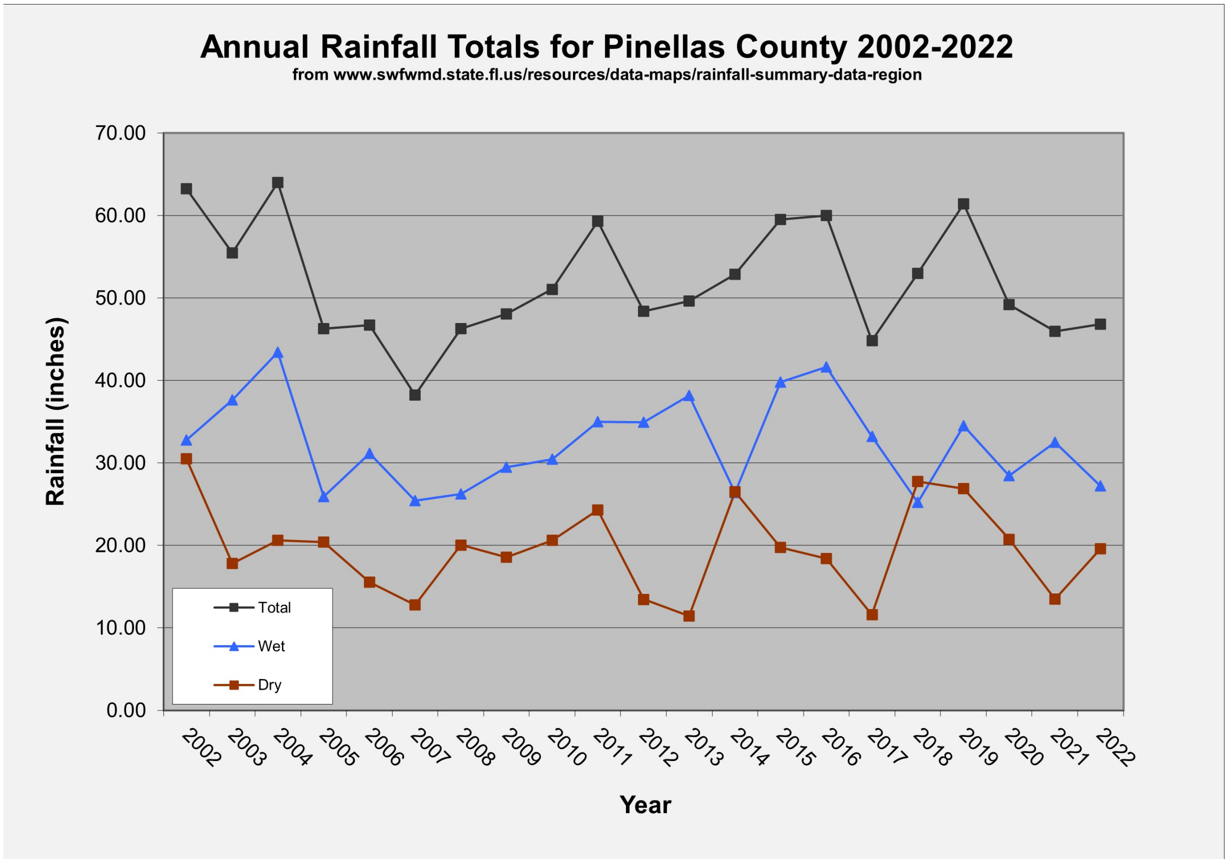

Figure 4. Annual Total, Dry Season, and Wet Season weighted rainfall for Pinellas County from Southwest Florida Water Management District Data (2002 to 2022).

3.2 - LONG-TERM WATER QUALITY CONCENTRATION TREND ANALYSIS (2012-2022)

Pinellas County hired Janicki Environmental Inc. to perform long-term trend analyses on key water quality parameters (described in Janicki, 2014). Currently, the time period for this analysis is from 2013 through 2022, with at least 60 data points needed. The core statistical test used to determine long-term trends is the seasonal Kendall Tau Test for Trend. The “seasonal” aspect of the test was defined by the eight sampling periods currently used by Pinellas County for conducting their routine monitoring. A multi-step process is used to implement the Kendall Tau trend test, as summarized in the following paragraphs. For each step in the analysis, the procedure produces a page of graphical output and intermediate datasets that are combined and used to provide detailed results for each test as well as graphical output provided for each result on the water quality parameters.

In the first step of each trend analysis, a time series plot of the raw time series is prepared for the period of record. In the second step of the trend analysis, the distribution of values for each sampling period is provided to describe the variability within and across seasons over all years. A complete set of univariate statistics is calculated, and a figure provides a valuable overall view of the seasonality of the data. In the third step of the analysis, a correlation analysis is performed for each seasonal value, the previous season's value, two seasons prior, etc., until correlation statistics have been calculated for all previous seasons up to 15 seasons prior. A table of these values is provided in the output. In the fourth step of the analysis, a determination is made as to whether seasonality exists in the time series of data.

If the data are determined to be seasonal, then the data are adjusted for season by subtracting the median seasonal value from each data point. The season-adjusted data are then applied to a Kendall Tau test which determines the slope of the time series of data and *p*-values for various data conditions. The next step is to test the data for autocorrelation in a similar fashion used to identify seasonality. In the first phase of this analysis, the season-adjusted data are de-trended by removing the effects of the slope identified. In the next step of the analysis, the season-adjusted and de-trended data are prepared in the form of a correlogram to test for the presence of autocorrelation in the time series. If the 1-season lag or the 2-season lag are significantly correlated with the present values, then the data are identified as auto-correlated and an adjustment is made to the *p*-value. In the final step of each trend analysis, the appropriate *p*-value (corrected for auto-correlation if necessary), significance assessment (based on alpha=0.05), slope, autocorrelation assessment (present/absent), and seasonality assessment (present/absent) of the trend analysis are compiled to provide a result for each parameter for each site/stratum.

Some of the monitoring sites did not have sufficient data to perform the trend analysis due to changes in site locations or recent initiation of monitoring. A minimum of seven years of data (60 data points) is required. Table 2 shows the results of long-term trend analyses for select parameters for the fixed land run sites. Overall, water quality at most stream sites has remained stable over time. Unfortunately, significant increasing trends are being seen at about 25% of long-term sites for TN and TP and at 35% of sites for turbidity.

Table 2. Long-term trends analysis results for select parameters for fixed land run sites based on data collected 2013-2022. Increasing or decreasing indicates a statistically significant trend (p<0.10), with dark red cells indicating a larger magnitude trend (p<0.05).

Site Name	Station	TN	TP	DO (%Sat)	Chlorophyll-a	TSS	Turbidity
Anclote River	01-01	Increasing	Decreasing	Increasing	No Trend	No Trend	No Trend
Anclote River	01-08	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Brooker Creek	04-03	No Trend	N/A	No Trend	No Trend	No Trend	Increasing
Cow Branch	06-03	No Trend	Increasing	No Trend	Increasing	No Trend	No Trend
Bee Branch	08-03	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Cedar Creek	09-02	No Trend	No Trend	No Trend	Increasing	Increasing	Increasing
Curlew Creek	10-02	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Jerry Branch	10-06	No Trend	No Trend	Increasing	No Trend	Increasing	Increasing
Briar Creek	11-05	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
South Bishop	12-04	Increasing	No Trend	No Trend	No Trend	No Trend	Increasing
Mullet Creek	13-05	Increasing	No Trend	Increasing	Increasing	No Trend	Increasing
Alligator Creek	14-10	No Trend	No Trend	Decreasing	Decreasing	Decreasing	No Trend
Spring Branch	15-04	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Rattlesnake	17-01	No Trend	Increasing	No Trend	No Trend	No Trend	No Trend
Rattlesnake	17-03	Increasing	Increasing	No Trend	Increasing	No Trend	Increasing
Stevenson's Creek	18-06	Increasing	Increasing	No Trend	No Trend	No Trend	Increasing
Allen's Creek	19-02	Increasing	No Trend	No Trend	No Trend	No Trend	No Trend
Allen's Creek	19-08	Increasing	Increasing	Increasing	No Trend	Increasing	Increasing
Allen's Creek	19-10	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Allen's Creek	19-12	No Trend	No Trend	No Trend	No Trend	No Trend	Increasing
Longbranch Creek	22-01	No Trend	Increasing	No Trend	No Trend	No Trend	Increasing
Longbranch Creek	22-12	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Cross Bayou	24-01	No Trend	Increasing	No Trend	No Trend	No Trend	No Trend
Cross Bayou	24-02	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Cross Bayou	24-07	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Church Creek	27-08	No Trend	No Trend	Decreasing	No Trend	No Trend	No Trend
McKay Creek	27-09	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
McKay Creek	27-10	No Trend	No Trend	Decreasing	Decreasing	No Trend	No Trend
Joe's Creek	35-09	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
Joe's Creek	35-10	Increasing	Increasing	No Trend	No Trend	Increasing	Increasing
Miles Creek	35-12	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend

Lake Tarpon and Lake Chautauqua exhibited stable trends for most parameters, with DO and chl-a improving in Chautauqua (Table 3). Alligator Lake shows significantly worsening trends in TN, chl-a, and TSS. The north lobe of Lake Seminole has improving or stable trends except for worsening DO, and the south lobe is mostly stable, although there are worsening trends in TP and DO.

Most of the open water strata/bays have worsening TN, except for W5, with large magnitude increases in most of the western strata over the past 10 years (Table 3). Additionally, turbidity is worsening in all of the eastern strata. Maps showing the results of the long-term trend analyses for select parameters are presented in Figure 5.

Table 3. Long-term trends analysis results for select parameters for open water strata and lakes based on data collected 2013-2022. Increasing or decreasing indicates a statistically significant trend (p<0.10), with dark green and red cells indicating a larger magnitude trend (p<0.05).

Stratum	TN	TP	DO (%Sat)	Chlorophyll-a	TSS	Transmissivity	Turbidity
E1	Increasing	No Trend	No Trend	No Trend	No Trend	No Trend	Increasing
E2	Increasing	No Trend	No Trend	No Trend	Increasing	No Trend	Increasing
E3	Increasing	No Trend	No Trend	No Trend	No Trend	No Trend	Increasing
E4	Increasing	Decreasing	No Trend	No Trend	No Trend	No Trend	Increasing
E5	Increasing	Decreasing	No Trend	No Trend	No Trend	No Trend	Increasing
RB	Increasing	Decreasing	No Trend	No Trend	No Trend	No Trend	Increasing
W1	Increasing	Decreasing	No Trend	No Trend	No Trend	No Trend	No Trend
W2	Increasing	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
W3	Increasing	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
W4	Increasing	Decreasing	No Trend	No Trend	No Trend	No Trend	No Trend
W5	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
W6	Increasing	No Trend	No Trend	No Trend	Increasing	No Trend	No Trend
W7	Increasing	No Trend	No Trend	No Trend	No Trend	No Trend	No Trend
W8	Increasing	No Trend	No Trend	No Trend	No Trend	Increasing	No Trend
Lake Chautauqua	No Trend	No Trend	Increasing	Decreasing	No Trend	N/A	No Trend
Alligator Lake	Increasing	No Trend	No Trend	Increasing	Increasing	N/A	Increasing
Lake Tarpon	No Trend	No Trend	No Trend	No Trend	Increasing	No Trend	Increasing
Lake Seminole N	Decreasing	No Trend	Decreasing	Decreasing	Decreasing	Increasing	No Trend
Lake Seminole S	No Trend	Increasing	Decreasing	No Trend	No Trend	No Trend	No Trend

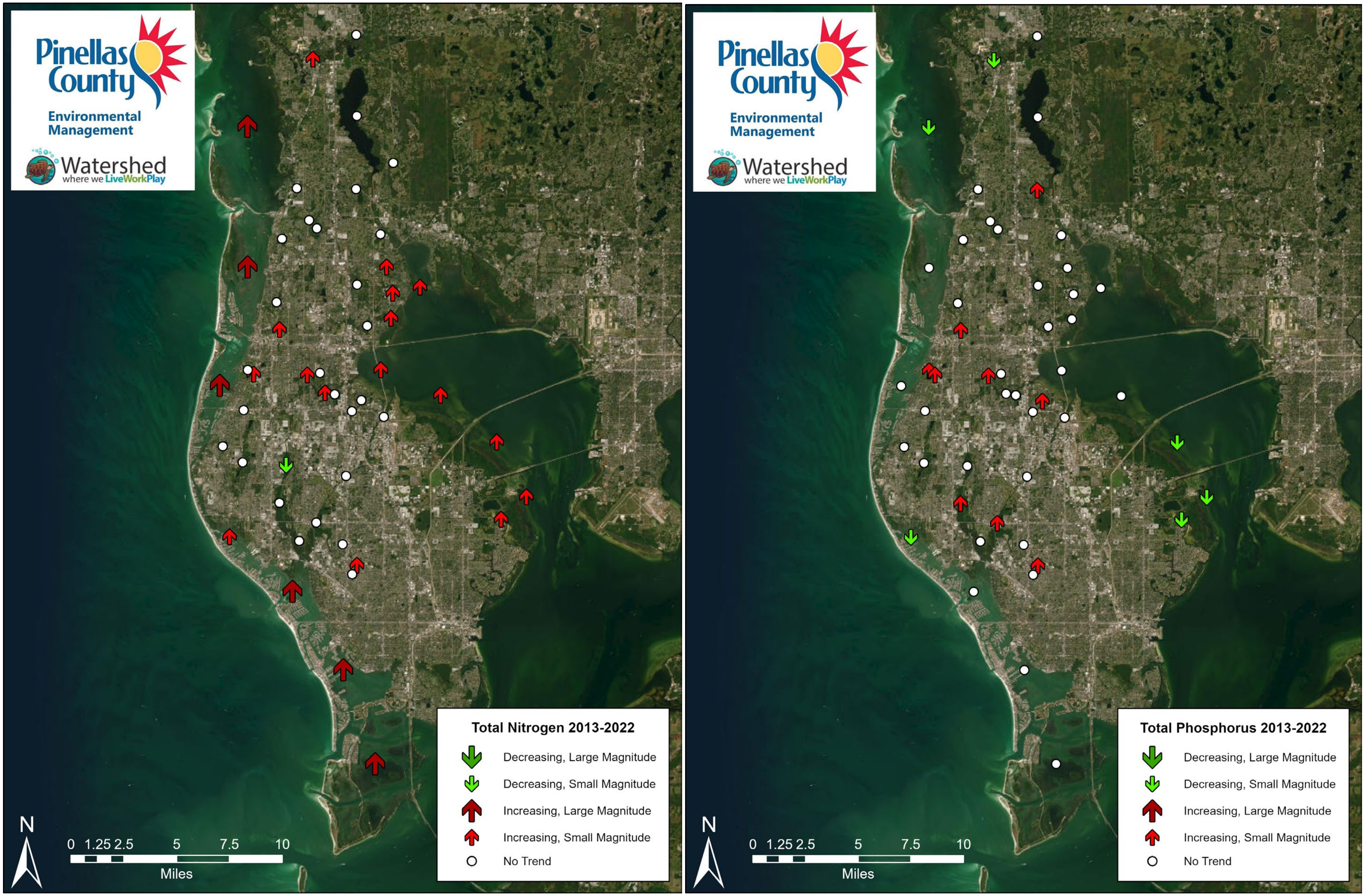

Figure 5. Results of long-term trend analyses (2013-2022) for ambient water quality monitoring sites.

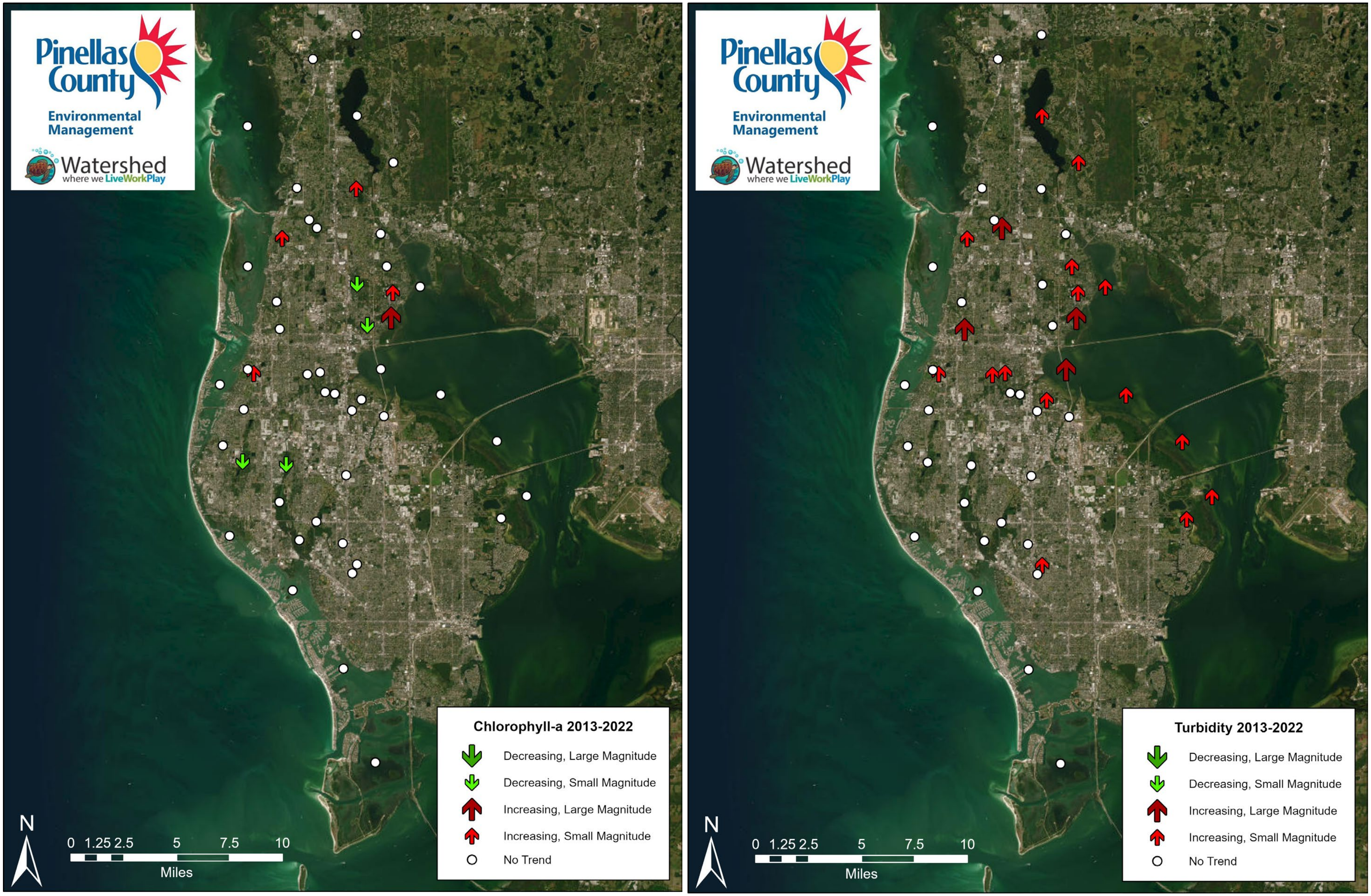

Figure 5, cont. Results of long-term trends analysis (2013-2022) for ambient water quality monitoring sites.

Monitoring sites were also analyzed to determine attainment based on State water quality standards. Data from sites monitored within a single waterbody identification basin (WBID) are combined to determine water quality status for each WBID. The results for each WBID based only on data collected in 2022 are given in Table 4. Impairment or attainment of the water quality standards is based on at least three years and up to seven years of data and may include data from multiple sources, so the "pass/fail" in this table does not necessarily indicate impairment as determined by the official FDEP Impaired Waters Rule assessment. Based on data collected only in 2022 by DEM, most stream WBIDs were attaining water quality criteria: 91% of sites passed TN criteria, 88% passed Chl-a criteria, and 74% passed DO criteria; however, only 32% passed the TP criterion (Figure 6). Freshwater versus tidal streams showed approximately the same pass/fail rates in 2022.

Table 4. Results of application of criteria using only 2022 data for each stream WBID.

WBID	Tidal?	Site(s)	Name	TN	TP	DO (%Sat)	Chl-a
1440	X	01-01, -08	Anclote River	Pass	Pass	Pass	Pass
1475		01-09, -10, -11	Hollin Creek	Pass	Pass	Pass	Pass
1508	X	02-02	Klosterman Creek	Fail	Fail	Fail	Fail
1508A		02-09	Klosterman Creek	Fail	Fail	Pass	Fail
1474		04-02, -03, -04	Brooker Creek	Pass	Pass	Fail	Pass
1530A		05-06	Moccasin Creek	Pass	Fail	Pass	Pass
1529		06-03	Cow Branch	Pass	Fail	Pass	Pass
1541B		06-06	Tarpon Outfall Canal	Pass	Pass	Pass	Pass
1527B		08-03	Bee Branch	Pass	Fail	Pass	Pass
1556	X	09-02	Cedar Creek	Pass	Fail	Fail	Fail
1538A		10-02	Curlew Creek	Fail	Fail	Pass	Pass
1550		10-06	Jerry Creek	Pass	Fail	Pass	Pass
1541C		11-05	Briar Creek	Pass	Fail	Pass	Pass
1569	X	12-02	North Bishop Creek	Pass	Fail	Pass	Pass
1569A		12-04	South Bishop Creek	Pass	Fail	Pass	Pass
1575A		13-05	Mullet Creek	Pass	Fail	Pass	Pass
1574		14-10	Alligator Creek	Pass	Fail	Pass	Pass
1567B		15-04	Spring Branch	Pass	Fail	Fail	Pass
1614		17-01, -03	Rattlesnake Creek	Pass	Fail	Pass	Pass
1567C		18-06	Stevenson Creek	Pass	Fail	Pass	Pass
1604	X	19-02	Allens Creek	Pass	Fail	Pass	Fail
1604B		19-07, -08, -09, -10, -11, -12, -13	Allens Creek	Pass	Fail	Pass	Pass

WBID	Tidal?	Site(s)	Name	TN	TP	DO (%Sat)	Chl-a
1627B	X	22-01	Longbranch Creek	Pass	Fail	Fail	Pass
1627		22-12, -16	Longbranch Creek	Pass	Fail	Fail	Pass
1641	X	24-01, -07	South Cross Bayou	Pass	Fail	Fail	Pass
1625	X	24-02	North Cross Bayou	Pass	Fail	Fail	Pass
1618D		25-02, -07	Seminole Bypass Canal	Pass	Pass	Pass	Pass
1633	X	27-01, -14	McKay Creek	Pass	Fail	Pass	Pass
1643		27-08	Church Creek	Pass	Pass	Pass	Pass
1633B		27-09, -10, -11	McKay Creek	Pass	Pass	Pass	Pass
1662A		29-11	PPD #1	Pass	Pass	Pass	Pass
1668B		35-01	PPD #5	Pass	Pass	Pass	Pass
1668D		35-04	Bonn Creek	Pass	Pass	Pass	Pass
1668A		35-10, -12	Joes Creek	Pass	Pass	Fail	Pass

The 2022 results for each open water area and lakes are in Table 5. Again, impairment or attainment of the water quality standards is based on at least three years and up to seven years of data, so the "pass/fail" in this table does not necessarily indicate impairment as determined by the FDEP Impaired Waters Rule assessment. All of the open water coastal strata met the criteria for TP and DO in 2022, but the western strata all failed the TN criteria for the fifth year in a row. However, the TN mean concentrations in 2022 are lower than the last few years, as seen in Figure 6. Chl-a is high for one of the six eastern strata and one of the eight western strata.

Lake Seminole is not currently attaining the chl-a criterion overall, and the south lobe is also not attaining the TN criterion; however, the north lobe does attain this criterion, and the long-term trends are improving in the lake in both lobes (Table 3). Alligator Lake does not meet TN, TP, or chl-a criteria, and Lake Tarpon is not attaining the chl-a criterion currently.

Appendix 1 at the end of this report provides the 2022 means, geometric means for TN and TP, and medians for each land run site, for each coastal strata, and for the four lakes which are monitored as part of the ambient program.

Table 5. Results of application of criteria using 2022 data for open water strata and lakes.

Site	Name	TN	TP	DO (%Sat)	Chl_a
W1	St. Joseph Sound	Fail	Pass	Pass	Pass
W2	Clearwater Harbor North	Fail	Pass	Pass	Pass
W3	Clearwater Harbor South	Fail	Pass	Pass	Pass
W4	The Narrows	Fail	Pass	Pass	Pass
W5	Long Bayou/Cross Bayou	Fail	Pass	Pass	Fail
W6	Boca Ciega North	Fail	Pass	Pass	Pass
W7	Boca Ciega Central	Fail	Pass	Pass	Pass
W8	Boca Ciega South	Fail	Pass	Pass	Pass
E1	Old Tampa Bay	Pass	Pass	Pass	Pass
E2	Largo Inlet	Pass	Pass	Pass	Fail
E3	Old Tampa Bay	Pass	Pass	Pass	Pass
E4	Old Tampa Bay	Pass	Pass	Pass	Pass
E5	Middle Tampa Bay	Pass	Pass	Pass	Pass
RB	Riviera Bay	Pass	Pass	Pass	Pass
SA, SB	Seminole Lake	Fail	Pass	Pass	Fail
14-02	Lake Chautauqua	Pass	Pass	Pass	Pass
14-07	Alligator Lake	Fail	Fail	Pass	Fail
LT	Lake Tarpon	Pass	Pass	Pass	Fail

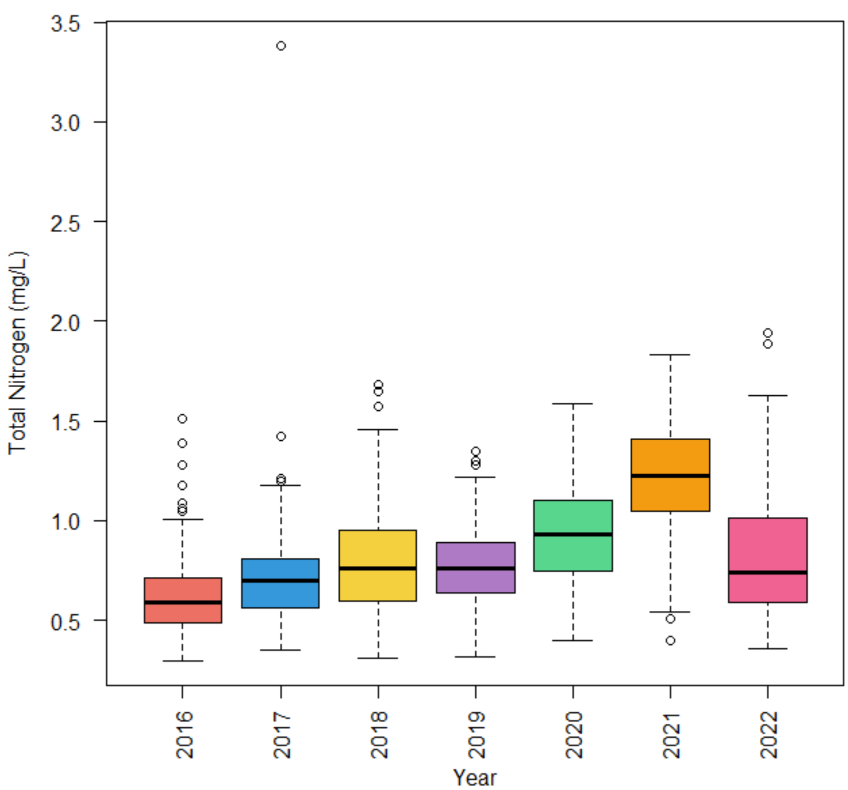

Figure 6. Boxplots of total nitrogen (TN) concentrations for the western strata (W1-W8) each year, 2016-2022. The solid line inside each box is the annual mean, the boxes show upper and lower quartiles.

3.3 -- BIOLOGICAL MONITORING

Results for 17 Pinellas County streams sampled from 2014 through 2022 are summarized in Table 6. As described in the methodology section, only the Springs Coast basins (west side of the County) were sampled in 2022. Six lakes were assessed using the Lake Vegetative Index (LVI) methodology in 2022, as summarized in Table 7.

Habitat Assessment

Scores may vary from sampling event to sampling event. In the current round of sampling, average habitat scores indicated that only Hollin and Brooker Creeks are in the "optimal" category (greater than 120), Bee Branch, Jerry Branch, Briar, Bishop, Alligator, Spring Branch, Rattlesnake, and Church scored in the sub-optimal (81-120), and all other habitat assessment scores were in the marginal category (41-80).

Stream Condition Index

Five streams have SCI scores that are currently passing the criteria: Hollin, Brooker, Curlew, Alligator, and Stevenson Creeks. To pass the SCI criteria, average SCI (of temporally independent scores) must be 40 or higher, with neither of the most recent two SCI scores below 35. Cow Branch, Bee Branch, Jerry Branch, Briar, Bishop, Mullet, Spring Branch, Rattlesnake, Allen, Church, McKay, and Joes Creeks are in the impaired category in 2022.

Floral Measures

All WBIDs sampled in 2020-2022 complied with the NNC criteria for RPS (filamentous algae < 25%). Of the streams sampled this round, ten are currently passing the NNC criteria for sensitive plants and nuisance exotics, with less than 25% invasive exotic species present and a COC greater than or equal to 2.5.

Table 6. Results of biological monitoring in streams. Green cells indicate scores that pass criteria, red cells indicate failing scores, and orange cells indicate unresolved scores (i.e., scores do not agree). NP denotes no aquatic plants. For the Habitat Score column, green=optimal, blue=sub-optimal, yellow=marginal. If a WBID has more than one site that was assessed on the same date, the SCI score is highlighted in light beige and the scores were averaged for that date, indicated in ( ) in the average SCI column.

Field ID	Station Name	WBID	Sample Date	SCI Score	Average SCI	Habitat Score	RPS (%)	Sensitivity (COC)	Nuisance Exotics
01-09	Hollin Creek	1475	4/7/2015	52	50	101	0	NP	0
			12/6/2017	52		107	0	NP	NP
			11/2/2018	45		105	0	NP	NP
			3/26/2020	44		96	14	NP	NP
			1/12/2021	66		121	0	NP	NP
			11/9/2022	40		112	0	NP	NP
04-03	Brooker Creek	1474	10/31/2016	46	52	118	0	NP	NP
04-04			2/3/2015	54		138	0	4.45	0
			10/27/2017	49		140	0	NP	NP
			4/5/2019	38		139	0	4.57	0
			10/31/2016	46	(46)	118	0	NP	NP
			10/15/2020	62	(61)	141	0	5.41	0
04-05			10/15/2020	60		117	0	4.4	0
06-03	Cow Branch	1529	2/17/2015	44	36	71	5	NP	NP
			11/18/2015	37		77	5	1.2	64.7
			3/3/2017	34		78	8	NP	NP
			11/15/2017	21		79	12	NP	NP
			3/22/2019	38		85	3.7	NP	NP
			11/22/2019	41		79	0	NP	NP
			4/29/2021	46		80	0	NP	NP
			1/5/2022	28		68	0	NP	NP
08-03	Bee Branch	1527B	4/17/2014	49	37	87	2	0.88	56.2
			12/16/2014	37		80	2	0.15	59.2
			2/10/2016	33		76	1	0.91	66.7
			4/11/2017	28		76	0	1.7	37.8
			2/1/2018	44		81	4	1.29	57.1
			10/26/2018	26		80	0	NP	NP
			2/19/2020	39		89	11	NP	NP
			9/30/2020	47		99	1	0	100
			12/9/2022	34		91	0	NP	NP
10-02		1538A	5/8/2014	33	42	72	0	NP	0

Field ID	Station Name	WBID	Sample Date	SCI Score	Average SCI	Habitat Score	RPS (%)	Sensitivity (COC)	Nuisance Exotics
	Curlew Creek		10/24/2014	43		80	0	NP	NP
			4/10/2016	47		94	0	NP	NP
			11/16/2016	37		92	2	NP	NP
			2/16/2018	51		95	0	NP	NP
			11/30/2018	34		77	0	NP	NP
			3/27/2020	48		70	0	NP	NP
			11/24/2020	43		93	0	NP	NP
			11/8/2022	43		75	0	3.2	0
10-06	Jerry Branch	1550	11/24/2014	43	44	83	0	NP	NP
			12/10/2015	41		95	4	NP	NP
			4/13/2016	56		88	2	NP	NP
			12/16/2016	36		84	0	NP	NP
			1/26/2018	54		82	0	NP	NP
			11/30/2018	39		99	0	NP	NP
			2/21/2020	53		94	0	NP	NP
			11/24/2020	31		104	0	NP	NP
			12/9/2022	43		100	0	NP	NP
11-05	Briar Creek	1541	2/25/2015	36	28	72	5	NP	NP
			12/4/2015	30		69	0	NP	NP
			11/21/2017	28		72	0	NP	NP
			3/8/2018	34		92	9	NP	NP
			5/31/2019	19		77	0	NP	NP
			11/1/2019	18		75	0	NP	NP
			4/2/2021	40		77	0	NP	NP
			11/19/2021	18		93	0	NP	NP
12-04	Bishop Creek	1569A	2/25/2015	37	28	68	2	NP	NP
			12/4/2015	27			0	0.67	83.9
			12/15/2017	28		79	1.8	0.39	83.3
			3/30/2018	20		78	4	1.27	75
			6/4/2019	14		75	0	NP	NP
			10/19/2020	31		99	1	0	85.7
			3/12/2021	39		109	0	2.31	57.1
			12/17/2021	31		97	0	0.45	90
13-05	Mullet Creek	1575A	3/15/2015	34	33	104	0	0.23	94.4
			11/13/2015	24		80	13	1.4	Q

Field ID	Station Name	WBID	Sample Date	SCI Score	Average SCI	Habitat Score	RPS (%)	Sensitivity (COC)	Nuisance Exotics
			11/28/2017	23		54	0	NP	NP
			5/9/2018	18		75	7	0.36	82.4
			3/29/2019	48		71	0	0	100
			1/14/2020	40		55	0	NP	NP
			3/12/2021	53		72	0	1	50
			1/5/2022	24		61	0	1.18	72.7
14-10	Alligator Creek	1574	3/19/2015	58	49	110	10	3	51.4
			10/12/2015	63		119	0	NP	NP
			4/6/2016	51		114	0	NP	NP
			8/3/2016	45		125	0	NP	NP
			4/12/2019	45		109	3	1.63	37.5
			11/8/2019	39		112	0	NP	NP
			3/3/2021	49		101	1	1.05	54.5
			11/16/2021	41		94	0	NP	NP
15-04	Spring Branch	1567B	5/15/2014	38	31	64	0	5.9	40
			1/6/2015	32		83	0	4.3	14.3
			3/9/2016	41		78	0	NP	NP
			11/30/2016	21		74	0	NP	NP
			5/22/2018	22		107	4.4	NP	NP
			1/10/2019	31		96	0	NP	NP
			3/10/2021	35		89	0	NP	NP
17-01	Rattlesnake Creek	1614	4/24/2014	43	32	84	0	NP	NP
			11/14/2014	34		82	0	NP	NP
			4/26/2016	46		91	0	0	100
			10/19/2016	41		77	5	0	100
			4/3/2018	28		97	0	NP	NP
			11/16/2018	18		92	0	NP	NP
			3/27/2020	31		85	0	NP	NP
			10/8/2020	20		73	0	NP	NP
			12/2/2022	23		87	0	NP	NP
18-06	Stevenson Creek	1567C	5/1/2014	42	44	75	5	0.4	81.9
			10/9/2014	32		66	0	0.21	96.2
			2/17/2016	60		80	10	0.58	80.9
			11/9/2016	50		76	0	0.16	96
			3/27/2018	48		87	4.9	1.3	62.5

Field ID	Station Name	WBID	Sample Date	SCI Score	Average SCI	Habitat Score	RPS (%)	Sensitivity (COC)	Nuisance Exotics
			10/29/2018	44		86	6.2	0.53	80
			2/13/2020	36		88	0	1.2	35
			11/5/2020	41		72	2	0.67	80
			12/2/2022	43		58	0	0	100
19-12	Allen Creek	1604B	3/31/2015	25	36	104	0	0.38	64.3
			10/26/2015	36		92	0	0	100
			4/5/2017	33		80	0	1.3	66.7
			10/18/2017	32		84	0	0.95	76.2
			12/6/2019	45		79	0	NP	NP
			1/14/2020	40		55	0	NP	NP
			4/29/2021	20		78	0	1.33	66.7
			2/23/2022	43		79	0	0	100
27-08	Church Creek	1643	4/28/2014	30	39	85	0	NP	NP
			12/3/2014	39		102	2	NP	NP
			3/9/2016	52		105	0	NP	NP
			11/23/2016	25		77	0	NP	NP
			2/22/2018	47		116	4.8	NP	NP
			2/8/2019	39		120	7.9	NP	NP
			3/27/2020	31		116	0	NP	NP
			12/14/2020	38		122	0	NP	NP
			3/9/2022	45		115	0	NP	NP
			11/30/2022	42		114	0	0	100
27-11	McKay Creek	1633B	4/23/2014	46	44	98	0	0.95	64.3
			5/7/2015	42		93	0	0.68	70.8
			1/26/2016	38		68	0	NP	NP
			10/5/2016	40		91	5	1.45	59.2
			2/20/2018	49		89	13	0.03	96.8
			10/22/2018	47		88	0	0.25	75
			3/27/2020	42		79	0	0.61	71.4
			12/11/2020	49		91	0	0.37	75
			3/9/2022	50		77	0	0	100
			11/30/2022	39		77	0	1.72	82.4
35-10	Joes Creek	1668A	5/14/2014	33	35	56	4	1	50
			10/28/2014	22		61	7	0.33	66.7
			2/23/2016	30		53	33	2.4	25.9

Field ID	Station Name	WBID	Sample Date	SCI Score	Average SCI	Habitat Score	RPS (%)	Sensitivity (COC)	Nuisance Exotics
			12/7/2016	54		71	8	2	25
			2/27/2018	39		68	14	1.54	47.9
			1/4/2019	33		63	19.2	1.21	52.9
			3/4/2020	30		58	6	1.83	51
			12/10/2020	43		72	2	0	100
			12/2/2022	27		64	0	2	75

LVI

As shown in Table 7, Lakes Seminole, Walsingham, and Chautauqua had passing scores and are considered not impaired. Lakes Tarpon, Taylor, and Alligator had average scores in the impaired range.

Table 7. LVI results of lake monitoring. Scores greater than 43 are passing.

Lake Name	WBID	Sample Date	LVI Score	Average LVI
Tarpon	1486A	9/12/2014	34	**40**
		8/26/2015	38	
		8/10/2016	35	
		8/25/2017	42	
		9/6/2019	43	
		7/16/2020	34	
		6/9/2021	45	
		8/23/2022	50	
Alligator	1574A	8/29/2014	16	**12**
		9/28/2016	9	
		8/4/2017	11	
		10/1/2019	17	
		6/25/2020	16	
		7/16/2021	7	
		7/15/2022	8	
Chautauqua	1603D	7/18/2014	72	**64**
		7/10/2015	71	
		7/27/2016	65	
		8/11/2017	67	
		8/9/2019	64	
		8/14/2020	57	
		5/20/2021	62	
		7/27/2022	52	

Lake Name	WBID	Sample Date	LVI Score	Average LVI
Seminole	1618	7/9/2014	49	**46**
		7/6/2016	57	
		8/18/2017	57	
		9/20/2019	48	
		8/26/2020	29	
		7/13/2021	51	
		8/26/2022	32	
Taylor	1633A	8/27/2014	48	**38**
		8/26/2015	51	
		6/22/2016	40	
		9/29/2017	50	
		7/19/2019	52	
		9/28/2020	25	
		6/25/2021	22	
		7/28/2022	18	
Walsingham	1650	9/2/2014	61	**56**
		9/24/2015	59	
		7/7/2016	55	
		7/21/2017	58	
		8/7/2019	68	
		8/27/2020	50	
		6/4/2021	53	
		8/16/2022	45	

3.4 – SUMMARY OF MONITORING RESULTS BY BASIN

Table 8 gives a basin-by-basin synopsis of the results described in the previous sections as well as discussing impairment according to the Impaired Waters Rule (FAC 62-302 and 303), which considers data over a seven-year window. As described in section 3.2 of this report, long-term trend analyses require a minimum of seven years and 60 data points, so not all sites have been sampled for a long enough time or with enough frequency to meet this requirement.

Table 8. Individual basin summary for the period of record based on the long-term trend results and 2022 results presented in Figures 8 through 12 and Tables 2 through 5.

TP = total phosphorus, TN = total nitrogen, TSS = total suspended solids, Chl-a = chlorophyll a, DO=dissolved oxygen.

Basin/Stratum Number	Basin Name	Municipality % of Area	Analysis
1	Anclote River	TARPON SPRINGS, 40%; UNINCORPORATED, 60%	Long-term trend analyses indicate improving TP and DO but increasing TN over the past 10 years. A 4e “Ongoing Restoration Activities” plan has been written which describes activities in the watershed to address the current Chl-a, TN, and bacteria impairments. Chl-a, TN, TP, and DO values did not exceed criteria in 2022.
1	Hollin Creek	UNINCORPORATED, 100%	This subbasin comprises the upper portion of the Pinellas County portion of the Anclote River watershed. There is not enough data for long-term trend analyses of the water quality of this stream. The waterbody is impaired for *E. coli*. All other values attained criteria for 2022. There is a healthy biological and floral community.
2	Klosterman Bayou	TARPON SPRINGS, 11.32%; UNINCORPORATED, 88.68%	Long-term trend analyses (from 2012-2021 due to low flow in 2022) for this basin indicate significantly decreasing TP and turbidity. Both tidal and freshwater portions of the stream did not pass criteria for nutrients (TN, TP, and Chl-a) in 2022. This waterbody is impaired for nutrients (DO, chl-a, TN, TP) and Enterococcus.
4	Brooker Creek	OLDSMAR, 9.77%; UNINCORPORATED, 90.23%	Long-term trend analyses show increasing turbidity but stable values for other parameters. This stream is currently meeting the criterion for TN, TP, and Chl-a. The waterbody is impaired for *E. coli*. There is a healthy biological and floral community in this stream.
5	Moccasin Creek	OLDSMAR, 75.95%; UNINCORPORATED, 24.05%	There is insufficient data to perform the long-term trend analyses for this basin due to no flow on many sampling dates. The tidal portion of this stream is impaired for DO and bacteria. 2022 data indicated elevated TP.
6	Cow Branch/ South Creek	CLEARWATER, 3.81%; OLDSMAR, 5.56%; UNINCORPORATED, 90.64%	Long-term trend analyses indicate increasing TP and chl-a but stable concentrations for other parameters. The stream is impaired for bacteria but passing other criteria. In 2022, TP was elevated above criteria. The floral community is healthy, but the biological community did not pass criteria.

Basin/Stratum Number	Basin Name	Municipality % of Area	Analysis
6	Lake Tarpon Outfall Canal	Clearwater Safety Harbor Oldsmar Unincorporated	There is insufficient data to perform the long-term trend analyses for this basin due to no flow on many sampling dates. This waterbody attained criteria for Chl-a, TN, TP, and DO in 2022.
8	Bee Branch/ Smith Creek	DUNEDIN, 10.50%; UNINCORPORATED, 89.50%	Long-term trend analyses indicate stable water quality over the past 10 years. The stream is currently impaired for nutrients (TP), bacteria, biology, and macrophytes; however, 2022 data resulted in TN, DO, and Chl-a averages that pass criteria. TP in 2022 was elevated. The biological score did not pass in 2022 and the habitat was suboptimal, but the floral score attained criteria.
9	Cedar Creek	DUNEDIN, 98.51%; UNINCORPORATED, 1.49%	Long-term trend analyses indicate significantly increasing Chl-a, turbidiy, and TSS, with all other parameters stable. The tidal portion of the stream is currently impaired for nutrients (Chl-a), DO, and bacteria. Average TN in 2022 passed the criterion, but TP, chl-a, and DO did not pass criteria. A Bacteria Pollution Control Plan is being implemented by the City of Dunedin which should improve water quality.
10	Curlew Creek	CLEARWATER, 21.06%; DUNEDIN, 24.71%; UNINCORPORATED, 54.23%	Long-term trend analyses indicate stable water quality. Average TN and TP in 2022 was above criteria. The stream is impaired for bacteria. The most recent biological and vegetation monitoring resulted in passing SCI and floral scores, although habitat is suboptimal.
10	Jerry Branch	DUNEDIN, 32%; CLEARWATER, 28%; UNINCORPORATED, 40%	Long-term trend analyses indicate increasing turbidity and TSS and improving DO. This stream is currently impaired for bacteria. TP was elevated in 2022, and the waterbody is on the study list for nutrients. The 2022 biological assessment indicated a healthy macroinvertebrate and flora community, although the habitat is suboptimal.
11	Briar Creek/ Possum Branch	CLEARWATER, 56.01%; OLDSMAR, 19.25%; SAFETY HARBOR, 21.94%; UNINCORPORATED, 2.80%	Long-term trend analyses show stable water quality for all parameters. The stream is currently impaired for nutrients (TP and biology) and bacteria. In 2022, TP was above the criterion. The biological community had much worse scores in 2021 than in previous years and marginal habitat, although it passed the floral criteria.
12	Bishop Creek	CLEARWATER, 26.49%; SAFETY HARBOR, 60.50%;	Long-term trend analyses show stable water quality at the North site and increasing TN and turbidity at the South site. The tidal portion of the stream is impaired for bacteria, and the freshwater portion is impaired

Basin/Stratum Number	Basin Name	Municipality % of Area	Analysis
		UNINCORPORATED, 13.00%	for nutrients (TP, macrophytes, and biology) and bacteria. 2022 data indicate passing Chl-a, TN, and DO values, but TP is exceeding criteria at both sites. The macroinvertebrate and floral communities were not attaining criteria. A Bacteria Pollution Control Plan was developed for both tidal and freshwater portions of the stream by the cities of Clearwater and Safety Harbor, which will help guide improvement activities.
13	Mullet Creek	CLEARWATER, 24.36%; SAFETY HARBOR, 63.18%; UNINCORPORATED, 12.46%	Long-term trend analyses indicate increasing TN, Chl-a, and turbidity but improving DO. The stream is currently impaired for nutrients (TP and biology), dissolved oxygen, and bacteria. TP was elevated in 2022. In 2022, the biological and floral communities were not attaining criteria.
14	Alligator Creek and Lake	CLEARWATER, 66.28%; SAFETY HARBOR, 5.46%; UNINCORPORATED, 28.26%	Long-term trend analyses indicate improving Chl-a and TSS for the creek, but worsening DO. The lake shows an increasing trend for TN, Chl-a, and TSS. The lake is currently impaired for nutrients based on high TP and poor plant community (LVI) scores. The stream is currently not impaired, but TP was elevated for the lake in 2022. Biological sampling resulted in passing SCI and floral scores in 2021. A Bacterial Pollution Control Plan has been developed for both tidal and freshwater portions of the stream by the City of Clearwater.
14	Lake Chautauqua	CLEARWATER, 94%; UNINCORPORATED, 6%	Lake Chautauqua is attaining all water quality standards. It showed a significant improving trend in DO and stable long-term trends for all other parameters. It has a healthy vegetative community.
15	Spring Branch	CLEARWATER, 30.54%; DUNEDIN, 61.82%; UNINCORPORATED, 7.64%	Long-term trend analyses show stable water quality over the past 10 years. The stream is currently impaired for nutrients (TP, biology), DO, and bacteria. 2022 data indicate elevated TP and low DO. The biological community is impaired, but improved in 2021, and the plant community is healthy.
17	Rattlesnake Creek	BELLEAIR, 38.76%; BELLEAIR BLUFFS, 4.05%; CLEARWATER, 36.62%; LARGO, 10.44%; UNINCORPORATED, 10.13%	Long-term trend analyses show significantly increasing TP concentrations at the lower site. The upper site has increasing trends in TN, TP, Chl-a, and turbidity. The stream is currently impaired for bacteria, and 2022 average TP exceeded criteria for both sites. The biological community is impaired, although the plant community is passing criteria in 2022.

Basin/Stratum Number	Basin Name	Municipality % of Area	Analysis
18	Stevenson Creek	CLEARWATER, 83.22%; LARGO, 2.14%; UNINCORPORATED, 14.64%	The tidal portion of the stream is currently impaired for bacteria, and the freshwater portion is impaired for bacteria and nutrients due to TP and macrophytes. Long-term trend analyses show significantly increasing TN, TP, and turbidity in the freshwater portion. Average TP in 2022 was elevated. The most recent biological monitoring resulted in passing SCI scores; however, the plant community is impaired.
19	Allens Creek	CLEARWATER, 34.41%; LARGO, 36.07%; UNINCORPORATED, 29.52%	Long-term trend analyses indicate generally stable concentrations at two of four sites. One of the freshwater sites has significantly increasing TN, TP, and turbidity but improving DO. The tidal site has an increasing trend for TN. Currently, the tidal portion of the stream is impaired for nutrients (Chl-a), DO, and bacteria. The freshwater portion is impaired for bacteria and nutrients (biology, macrophytes, TP). In 2022, both portions had elevated TP. The macroinvertebrate community is passing but the floral community is not attaining criteria in 2022.
22	Long Branch	LARGO, 63.13%; UNINCORPORATED, 36.87%	Long-term trend analyses indicate stable trends for all parameters at freshwater sites but increasing TP and turbidity in the tidal portion. The tidal portion is currently impaired for DO and bacteria, and the 2022 average TP was elevated. The freshwater portion of the stream is currently impaired for DO, nutrients (chl-a, TP, biology, macrophytes), and bacteria. 2022 data showed low DO and high TP. A TMDL Implementation Plan and Bacteria Pollution Control Plan have been written for this basin, which should help address these impairments.
23	Roosevelt Creek	LARGO, 0.08%; PINELLAS PARK, 20.14%; ST PETERSBURG, 51.85%; UNINCORPORATED, 27.93%	Currently, monitoring has been suspended on this site until completion of a salinity barrier removal project.
24	Cross Bayou	LARGO, 21.03%; PINELLAS PARK, 34.13%; SEMINOLE, 1.34%; UNINCORPORATED, 43.50%	Long-term trend analyses indicate significantly increasing TP concentrations at the south site, and all other parameters stable. Currently, South Cross Bayou is impaired for nutrients (Chl-a), DO, and bacteria. North Cross Bayou is currently impaired bacteria. In 2022, TP and DO did not meet criteria in North or South Cross Bayou.

Basin/Stratum Number	Basin Name	Municipality % of Area	Analysis
25	Seminole Bypass Canal/ Starkey Road	CLEARWATER, 0.03%; LARGO, 48.16%; PINELLAS PARK, 1.83%; SEMINOLE, 9.17%; UNINCORPORATED, 40.81%	Long-term trend analyses indicate all parameters are stable. The canal is currently impaired for nutrients (Chl-a). In 2022, TN, TP, chl-a, and DO passed criteria. Activities detailed in the Lake Seminole Reasonable Assurance Plan are expected to continue to improve water quality in the canal.
27	McKay Creek	BELLEAIR BLUFFS, 3.12%; LARGO, 46.29%; SEMINOLE, 8.01%; UNINCORPORATED, 42.57%	Long-term trend analyses indicate generally stable water quality. The tidal portion is impaired for DO and bacteria, and 2022 data failed the TP criterion. The freshwater portion of the stream is currently impaired for bacteria and macrophytes, and 2022 values passed for TN, TP, DO, and chl-a. The macroinvertebrate and floral communities did not meet criteria in 2022.
27	Church Creek	LARGO, 66%; UNINCORPORATED, 34%	Long-term trend analyses indicate stable values for all parameters except worsening DO. The stream is currently impaired for bacteria. TN, Chl-a, TP, and DO averages attained criteria in 2022. The biological community is passing criteria, although the plant community is not attaining criteria.
29	Pinellas Park Ditch #1	PINELLAS PARK, 100%	There is insufficient data to perform the long-term trend analyses for this basin. This waterbody is currently impaired for bacteria. Chl-a, TN, TP, and DO averages attained criteria in 2022.
35	Joes Creek	KENNETH CITY, 5.25%; PINELLAS PARK, 14.88%; ST PETERSBURG, 41.86%; UNINCORPORATED, 38.02%	Long-term trend analyses indicate increasing TN, TP, TSS, and turbidity at one of two sites and stable water quality at the other site. Miles Creek, a tributary to Joes, has stable water quality trends. The biological and floral communities have declined and are now impaired. In 2022, the freshwater portion of Joes Creek attained nutrient criteria but there is a DO impairment. Pinellas Park Ditch 5 and Bonn Creek (tributaries) attained criteria for TN, TP, Chl-a, and DO in 2022. The tidal portion is impaired for Chl-a and DO. The macroinvertebrate and floral communities did not pass criteria in 2022. This watershed has a TMDL Implementation Plan and a Bacteria Pollution Control Plan, which will help guide water quality improvement activities.
E1	Old Tampa Bay	Clearwater Oldsmar, Safety Harbor, Unincorporated	Long-term trend analyses indicate significantly increasing TN and turbidity concentrations. TN, TP, Chl-a, and DO criteria are being met for 2022.

Basin/Stratum Number	Basin Name	Municipality % of Area	Analysis
E2	Old Tampa Bay	Clearwater, Largo, Unincorporated	Long-term trend analyses indicate increasing TN, TSS, and turbidity. The TP and DO criteria are being met, but Chl-a was above the criterion in 2022.
E3	Old Tampa Bay	Unincorporated	Long-term trend analyses indicate significantly increasing TN and turbidity concentrations. 2022 results indicate that TN, TP, Chl-a, and DO criteria are being met.
E4	Middle Tampa Bay	Unincorporated	Long-term trend analyses indicate significantly increasing TN and turbidity concentrations but decreasing TP. TN, TP, Chl-a, and DO criteria are being met for 2022.
E5	Middle Tampa Bay	Unincorporated	Long-term trend analyses indicate significantly increasing TN and turbidity concentrations but decreasing TP. 2022 results indicate that TN, TP, Chl-a, and DO criteria are being met.
LT	Lake Tarpon	Tarpon Springs, Unincorporated	Long-term trend analyses indicate generally stable water quality, but TSS and turbidity are increasing. In 2022, Chl-a did not attain the criterion, although TN and TP are consistently below the criteria. The lake is currently impaired for biology based on vegetation surveys as well as nutrients due to Chl-a. The County has completed a water quality study for the lake which suggests that the Chl-a criteria may not be appropriate for this lake. The County has developed site-specific alternative criteria (SSAC), which were submitted to FDEP for consideration.
RB	Riviera Bay	Unincorporated	Long-term trend analyses indicate significantly increasing TN and turbidity concentrations but decreasing TP. 2022 results indicate that TN, TP, Chl-a, and DO criteria are being met.
SA/SB	Lake Seminole	Seminole, Unincorporated	Long-term trend analyses indicate significantly decreasing TN, Chl-a, TSS, and improving water clarity in both the northern (SA) portion of the lake. The southern lobe (SB) stable clarity but worsening TP and DO. The lake is impaired for TN, TP, and Chl-a. In 2022, Chl-a and TN were elevated, but the LVI score attained the criterion.
W1	St Joseph Sound	Dunedin, Tarpon Springs, Unincorporated	Long-term trend analyses indicate a large increasing TN trend over the past 10 years but decreasing TP. This stratum is currently impaired for nutrients (TN). The geometric mean for TN was above criteria in 2022. There are some management activities, ongoing

Basin/Stratum Number	Basin Name	Municipality % of Area	Analysis
			and planned, in the tributaries to this stratum which should help arrest the decreasing water quality.
W2	Clearwater Harbor North	Clearwater Dunedin	Long-term trend analyses indicate a large increasing TN trend over the past 10 years. This stratum is currently impaired for nutrients (TN). The geometric mean for TN was above criteria in 2022. There are some management activities, ongoing and planned, in the tributaries to this stratum which should help arrest the decreased water quality.
W3	Clearwater Harbor South	Belleair, Belleair Beach, Belleair Bluffs, Clearwater, Indian Rocks Beach, Largo, Unincorporated	Long-term trend analyses indicate a large increasing TN trend over the past 10 years. This stratum is currently impaired for nutrients (TN). The TN geometric mean was above the criterion in 2022. There are some management activities, ongoing and planned, in the tributaries to this stratum which should help arrest the decreased water quality.
W4	The Narrows	N Redington Beach, Madeira Beach, Redington Beach, Redington Shores, Unincorporated	Long-term trend analyses indicate an increasing TN trend over the past 10 years but decreasing TP. This segment represents a very constricted area of the Intracoastal called The Narrows, which has very poor flushing. This waterbody is currently impaired for nutrients (Chl-a), and the TN was above criterion in 2022.
W5	Long Bayou / Cross Bayou	Seminole, Unincorporated	Long-term trend analyses indicate stable water quality. This waterbody is currently impaired for nutrients (TN and Chl-a), and both TN and Chl-a were above criteria in 2022.
W6	Boca Ciega Bay (North)	Madeira Beach, Treasure Island, Unincorporated	Long-term trend analyses indicate a large increasing TN trend over the past 10 years as well as increasing TSS. This stratum is currently impaired for nutrients (Chl-a), and the average TN in 2022 was above the criterion.
W7	Boca Ciega Bay (Central)	Gulfport, St Pete Beach, South Pasadena, Treasure Island, Unincorporated	Long-term trend analyses indicate a large increasing TN trend over the past 10 years. The average TN in 2022 was above criteria.
W8	Boca Ciega Bay (South)	St Pete Beach, Unincorporated	Long-term trend analyses indicate significantly increasing TN but improving clarity. The average TN in 2022 was above the criterion.

3.4 – PROGRAM STRENGTHS

Pinellas County is committed to reducing stormwater pollution from its municipal separate storm sewer system. The Pinellas County SWMP has been in effect since the early 1990's, prior to the inception of the first Non-Point Source Discharge Elimination System (NPDES) Permit in 1997. In addition to the County's robust Countywide Ambient Water Quality Monitoring Program, the SWMP has also historically included a Capital Improvement Program funded by the Penny for Pinellas (one percent sales tax) since 1990. This Capital Improvement Program has funded many drainage and water quality projects over the years.

In 2013, Pinellas County established a dedicated Non-Ad Valorem Surface Water Assessment for all properties in unincorporated county. This dedicated revenue of over $19 million per year currently funds all operational and maintenance needs of the NPDES program, as well as water quality monitoring, outreach efforts, and support for stormwater compliance programs. Highlights of strengthened programs and increased level of service under the SWMP in the last 10 years include:

- Continued implementation of the 2010 Fertilizer Ordinance, including retail sales and application restrictions on both phosphorus and nitrogen, backed by a strong compliance program
- Increased outreach regarding reduced fertilizer use
- BMP certification requirements for landscapers and lawn companies
- Increased frequency and proactive planning of work in the ditch and channel maintenance
- Increased frequency in the street sweeping program
- Implementation of a site plan drainage compliance program to improve water quality discharging from private stormwater management systems
- Implementation of a biological monitoring program to support the ambient water quality monitoring program
- Continued pollutant source tracking studies, with enhanced work and focus in highest priority TMDL watersheds each permit cycle
- New permitted facilities studies to investigate opportunities for water quality retrofits
- Increased level of service for public outreach and water quality enforcement

Pinellas County has completed multiple water quality studies and watershed management plans over the years, including:

- Allen's Creek
- Anclote River
- Bishop and Mullet Creek
- Brooker Creek
- Clearwater Harbor / St Joseph Sound
- Coastal Zone 5
- Cross Bayou
- Curlew Creek and Smith Bayou
- Joe's Creek
- Klosterman Bayou
- Lake Seminole
- Lake Tarpon
- Long Branch
- McKay Creek
- Roosevelt Creek
- Starkey Basin
- South Creek

Each of these studies results in measures being recommended to improve water quality in the watershed. Most of the watershed plans or studies listed above are already in the implementation phase, and several are now being updated. More information pertaining to best management practices (BMPs) and SWMP measures being implemented in each watershed is available from the County by request.

Pinellas County successfully applied for and received SWFWMD Cooperative Funding Initiative (CFI) grant funding for a nutrient source tracking study in Allens, Curlew, and McKay Creek watersheds. This project concluded in 2023 and provided information about the primary nutrient sources in these watersheds and suggested BMPs to address the sources. Additionally, a CFI grant was awarded for a nitrogen source tracking study to examine the increasing nitrogen in St Joseph Sound and Clearwater Harbor over the next four years. These studies will allow implementation of projects to reduce nutrient loadings in a targeted way and should help to improve water quality in the County.

3.5 – TMDL IMPLEMENTATION UPDATES

As mentioned above, a nutrient source tracking study was performed to investigate nutrient issues in the McKay Creek watershed, the County's highest priority TMDL watershed for this permit cycle, in addition to Curlew Creek and Allens Creek, two other nutrient-impaired watersheds. As part of this study, additional sites were monitored and more parameters were measured in order to tease out sources of elevated nutrients. Information from this study will be incorporated into the McKay Creek TMDL Implementation Plan which is currently being drafted.

Tables 9 and 10 describe some of the activities that have been implemented or are ongoing to address the Joe's Creek and Long Branch Creek TMDLs. These are the watersheds for which Pinellas County has active TMDL Implementation Plans and Bacteria Pollution Control Plans, written during the last permit cycle.

Table 9. Status of TMDL implementation activities for Joes Creek in 2022.

Partner	BMP Type	Progress	Load Reduction Estimate
Pinellas County	Ditch Maintenance	Inspected 67,017 linear feet of ditches; cleaned out 34,260 linear feet (manual and mechanical) and removed 831 cubic yards of debris and trash	360 kg TP; 587 kg TN
	Stormwater pipe/structure cleanouts	Inspected 1,325 pipe locations; cleaned 6,757 linear feet of pipe, removing 62 cubic yards of material; lined and replaced 80 linear feet of storm pipes and drains; inspected and maintained 1,395 structures; cleaned out 271 cubic yards of debris from structures, repaired 18 structures, and replaced 3	126 kg TP; 311 kg TN
	Stormwater pond maintenance	Maintained 22 stormwater facilities covering more than 400 acres	
	WMP	Completed in 2016	
	Street sweeping	A total of 1,583 miles swept; 296 cubic yards of debris removed	111 kg TP; 173 kg TN
	Fertilizer/landscape management	Ongoing inspections and enforcement of fertilizer ordinance; proactive landscape management inspections	
	Outreach/education	17 events	
	New projects	Major stream restoration project is in initial planning phase for 4 miles of stream; focus will be on improving water quality and flood resiliency; stormwater pond improvement project is scheduled for 2024-2025	
St Petersburg	See St Petersburg’s report		
Kenneth City	See Kenneth City’s report		

Table 10. Status of TMDL implementation activities for Long Branch Creek in 2022.

Partner	BMP Type	Progress	Load Reduction Estimate
Pinellas County	Ditch maintenance	Inspected 22,597 linear feet; cleaned out 28,990 linear feet of ditches (manual and mechanical) and removed 364 cubic yards of debris and trash	158 kg TP; 257 kg TN
	Stormwater pipe/structure cleanouts	Inspected 246 pipe locations; cleaned out 5,491 linear feet of storm pipes and drains and removed 102 cubic yards of material inspected 294 structures, cleaned out 5 structures and repaired 5 structures; removed 106 cubic yards of material	90 kg TP; 147 kg TN
	Stormwater pond maintenance	Maintained 7 stormwater facilities	
	Street sweeping	A total of 272 miles swept and removed 65 cubic yards of material	24 kg TP; 38 kg TN
	Fertilizer/landscape management	Ongoing inspections and enforcement of fertilizer ordinance; proactive landscape management inspections	
	Outreach/education	17 events	
	New projects	6 water quality projects are being considered for construction in the next 10 years, mostly focused on stormwater pond expansion	
Largo	See Largo's report		

3.6 – CONCLUSION

Long-term analysis of the last ten years of Pinellas County data indicates that nutrients are trending up in a majority of Pinellas County watersheds. The coastal increases could be influenced by red tide and other events that have occurred in the past few years. The County is conducting an intensive investigation into the potential causes/sources in Clearwater Harbor/St Joseph Sound, and the Tampa Bay Estuary Program is continuing to lead studies in the Tampa Bay strata. Pinellas County will continue to monitor its waters regularly to ensure identification of potential risks to the environment and to track progress toward maintaining and improving the health of the streams, lakes, and bays. The County is committed to continued and increased implementation of structural and non-structural BMPs as part of the Pinellas County SWMP in coming years.

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Appendix 1

2022 Summary Statistics for Sites

Summary statistics for fixed land run sites for 2022. The first number in each column is the mean and is followed by the median in the next row. Additionally, geometric means are given for TN and TP after the semicolon on the top row for each site.

Site (N= sample size)	Diss. Oxygen (mg/L)	Diss. Oxygen (%)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)	Chl-a (μg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Enterococci (MPN/100 mL)	E. coli (MPN/100 mL)
01-01	5.96	84.3	0.756; 0.72	0.745	0.0313	0.0113	0.03; 0.0277	0.0113	2.93	9.25	1.44	35.3	NA
(N=8)	5.64	87.9	0.705	0.695	0.02	0.01	0.025	0.01	2.6	10	1.45	10	
01-08	4.47	58.2	0.655; 0.623	0.62	0.0275	0.035	0.05; 0.046	0.0186	4.85	3.13	2.31	92	NA
(N=8)	4.48	61.5	0.635	0.625	0.025	0.04	0.04	0.01	3.95	2.5	1.85	90.5	
01-09	4.04	45.7	1.09; 1.07	0.968	0.102	0.122	0.108; 0.106	0.0633	4.45	2.67	1.88	NA	969
(N=6)	4.43	51.2	1.11	1.02	0.085	0.13	0.12	0.07	2.2	2.5	1.75		960
02-02	3.37	39.4	2.39; 2.29	2.33	0.153	0.0525	0.333; 0.324	0.163	60.3	20	14.8	891	NA
(N=8)	2.89	37.3	2.39	2.38	0.08	0.01	0.335	0.14	56.3	18.5	12	598	
02-09	6.1	68	4.6; 4.55	2.39	0.565	2.21	0.79; 0.788	0.665	41	7	5.85	NA	353
(N=2)	6.1	68	4.6	2.39	0.565	2.21	0.79	0.665	41	7	5.85		353
04-02	1.71	18.7	1.18; 1.14	1.17	0.042	0.012	0.114; 0.071	0.014	5.74	2.2	1.7	NA	396
(N=5)	1.39	15.3	0.97	0.96	0.03	0.01	0.05	0.01	4	1	1.6		137
04-03	3.97	44.3	1.25; 1.21	1.23	0.0257	0.0271	0.097; 0.083	0.04	2.06	4.43	1.84	NA	4250
(N=7)	3.87	45.8	1.15	1.08	0.02	0.02	0.07	0.02	1.4	2	1.3		245
04-04	3.67	40.3	1.75; 1.61	1.7	0.075	0.0475	0.143; 0.131	0.0525	3.75	8.5	3.6	NA	6830
(N=4)	4.04	43.1	1.55	1.54	0.09	0.01	0.14	0.03	1.1	5	3.4		1490
05-06	6.98	91.1	1.33; 1.26	1.31	0.06	0.022	0.222; 0.17	0.02	9.38	24.4	17.1	NA	402
(N=5)	5.1	65.8	1.13	1.12	0.02	0.01	0.14	0.02	7	10	7.1		47
06-03	7.57	88	0.67; 0.667	0.554	0.0113	0.116	0.13; 0.127	0.1	1.99	3.63	2.06	NA	650
(N=8)	7.39	88.8	0.68	0.55	0.01	0.11	0.125	0.095	1.7	2	1.5		336
06-06	5.81	71	0.958; 0.954	0.948	0.01	0.01	0.044; 0.043	0.01	18.5	4	2.35	NA	54.5
(N=8)	5.58	66.9	0.915	0.905	0.01	0.01	0.045	0.01	18.6	4	2.35		44
08-03	7.83	89.6	1.08; 1.07	0.7	0.0238	0.38	0.168; 0.161	0.136	1.63	3.5	1.92	NA	1450
(N=8)	7.54	91.8	1.02	0.655	0.02	0.395	0.155	0.125	1.3	1.5	1.35		727
09-02	3.41	40.8	1.04; 1.03	0.935	0.0875	0.109	0.206; 0.194	0.108	21.6	8.25	6.71	2430	NA
(N=8)	3.32	44.7	1.05	0.905	0.095	0.095	0.21	0.105	14.6	10	6.85	604	
10-02	7.63	88.2	2.19; 1.97	1.3	0.0586	0.883	0.294; 0.239	0.151	10.4	24.9	11.7	NA	679

Site (N= sample size)	Diss. Oxygen (mg/L)	Diss. Oxygen (%)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)	Chl-a (µg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Enterococci (MPN/100 mL)	E. coli (MPN/100 mL)
(N=7)	7.14	88.5	2.26	0.82	0.04	0.84	0.2	0.13	3.4	2	1.6		589
10-06	7.26	83.5	1.48; 1.34	1.27	0.0813	0.213	0.246; 0.195	0.095	13.8	61.6	50.7	NA	2920
(N=8)	7.01	82.9	1.1	0.895	0.06	0.225	0.15	0.09	9.1	5.5	4.15		364
11-05	7.2	83.5	0.957; 0.936	0.809	0.0171	0.149	0.167; 0.166	0.107	2.77	2.86	2.89	NA	979
(N=7)	7.09	88.4	0.92	0.75	0.01	0.15	0.16	0.1	1	2	2.4		953
12-02	6.08	72.9	0.726; 0.724	0.632	0.05	0.094	0.192; 0.191	0.138	2.62	2.6	2.46	408	NA
(N=5)	5.89	73.3	0.75	0.63	0.05	0.11	0.2	0.14	1.7	2	2.1	328	
12-04	6.79	80	0.813; 0.8	0.57	0.0157	0.243	0.133; 0.123	0.0886	1.7	2.14	2.17	NA	515
(N=7)	6.6	81.7	0.81	0.55	0.01	0.25	0.1	0.08	0.8	2	2.2		265
13-05	4.33	51.1	0.98; 0.974	0.85	0.0675	0.13	0.183; 0.168	0.12	10.1	4.88	3.06	NA	157
(N=8)	4.15	50.1	0.955	0.835	0.07	0.13	0.16	0.11	8	3.5	2.3		130
14-10	5.86	68.9	0.703; 0.699	0.62	0.0313	0.0825	0.134; 0.126	0.0988	2.38	1.88	1.16	NA	79
(N=8)	5.79	71.4	0.7	0.6	0.03	0.07	0.135	0.105	2.8	1	0.875		63
15-04	4.31	48.8	1.22; 1.16	1.1	0.156	0.123	0.327; 0.305	0.194	10.1	8.71	8.57	NA	3310
(N=7)	3.98	49	1.25	1.16	0.1	0.12	0.3	0.17	5.1	7	6.6		327
17-01	7.7	91.4	1.68; 1.66	1.06	0.101	0.618	0.29; 0.281	0.209	8.15	7	6.36	NA	972
(N=8)	7.31	93	1.62	0.93	0.08	0.62	0.275	0.2	4.1	2	2.05		844
17-03	5.33	63.6	1.46; 1.43	1.12	0.196	0.34	0.281; 0.272	0.204	9.21	3.88	3.69	NA	2950
(N=8)	5.21	64.8	1.36	1.06	0.175	0.31	0.26	0.195	6.4	3	3		1880
18-06	4.94	57.8	1.05; 1.02	0.934	0.0588	0.116	0.434; 0.319	0.184	9.86	25.1	19.3	NA	1580
(N=8)	4.81	60.8	0.93	0.875	0.06	0.095	0.285	0.165	8.7	3.5	3.9		358
19-02	4.22	55.3	0.905; 0.887	0.891	0.02	0.0138	0.159; 0.153	0.0913	27	11.6	4.06	93.9	NA
(N=8)	3.93	55.7	0.895	0.885	0.01	0.01	0.155	0.08	16.3	11	4.15	63	
19-08	6.76	80.9	1.45; 1.39	0.523	0.03	0.928	0.194; 0.192	0.154	1.95	3.88	1.89	NA	1490
(N=8)	6.56	79.8	1.37	0.455	0.025	0.855	0.185	0.145	1.25	2	1.15		1550
19-10	4.18	47.1	1.07; 1.05	0.848	0.15	0.225	0.298; 0.29	0.1	2.03	4.75	7.21	NA	2430
(N=8)	3.68	46.8	1.03	0.825	0.1	0.235	0.3	0.105	1.8	4.5	7.7		383

Site (N= sample size)	Diss. Oxygen (mg/L)	Diss. Oxygen (%)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)	Chl-a (µg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Enterococci (MPN/100 mL)	E. coli (MPN/100 mL)
19-12	6.13	70.9	0.823; 0.813	0.563	0.0675	0.26	0.231; 0.228	0.186	1.18	1.63	1.56	NA	220
(N=8)	5.57	69.9	0.855	0.54	0.065	0.235	0.23	0.185	0.95	1.5	1.5		163
19-13	3.15	39.1	1.07; 1.06	0.904	0.173	0.161	0.155; 0.153	0.0975	8.61	3.13	3.04	NA	1530
(N=8)	3.65	46.5	1.07	0.89	0.18	0.15	0.145	0.1	7.95	3	3.1		1170
22-01	3.31	39.1	1.05; 1.02	0.89	0.123	0.157	0.174; 0.166	0.0914	2.09	7.86	3.63	1910	NA
(N=7)	3.17	37.6	1.05	0.95	0.06	0.18	0.18	0.07	2.1	3	3.1	1270	
22-12	1.8	21.2	1.13; 1.09	1.1	0.298	0.0225	0.219; 0.197	0.105	7	5.75	5.25	NA	314
(N=8)	1.57	19.1	1.07	1.05	0.26	0.01	0.26	0.07	5.75	4	3.95		148
22-16	2.45	28.2	0.971; 0.947	0.866	0.17	0.105	0.174; 0.149	0.0713	2.85	4.25	3.08	NA	429
(N=8)	2.23	27.1	0.97	0.84	0.11	0.07	0.15	0.065	2.4	4	3.1		344
24-01	3.6	48.1	0.922; 0.919	0.825	0.0583	0.0967	0.18; 0.174	0.128	12.4	5.67	2.78	224	NA
(N=6)	3.59	48.4	0.915	0.84	0.06	0.075	0.16	0.1	12.1	5.5	2.75	147	
24-02	2.85	37.7	0.889; 0.88	0.833	0.0888	0.0563	0.136; 0.131	0.095	6.8	7.38	3.56	517	NA
(N=8)	2.49	34.4	0.915	0.81	0.08	0.03	0.14	0.1	7.45	6.5	3.2	161	
24-07	8.02	51.3	1.07; 1.06	0.966	0.0671	0.1	0.164; 0.162	0.11	10.6	8.43	4	683	NA
(N=7)	3.7	42	1.04	0.96	0.07	0.09	0.16	0.11	11.1	3	1.9	650	
25-02	3.78	44.5	0.903; 0.886	0.853	0.0283	0.05	0.1; 0.088	0.04	24.3	3.33	2.03	NA	61.8
(N=8)	3.42	44.7	0.855	0.835	0.01	0.01	0.095	0.03	17.3	3.5	1.8		22
25-07	5.57	69.3	0.953; 0.922	0.925	0.0113	0.0275	0.071; 0.068	0.02	22.6	3.75	2.45	NA	15.6
(N=8)	5.75	67.2	0.975	0.965	0.01	0.01	0.065	0.01	23.4	4	2.3		13
27-08	17.2	84.6	1.41; 1.38	0.735	0.0563	0.675	0.114; 0.11	0.065	2.53	5.75	2.89	NA	1160
(N=8)	7.04	85.2	1.31	0.66	0.05	0.595	0.105	0.06	1.65	2.5	1.95		1010
27-09	17.2	83.2	0.796; 0.784	0.666	0.0225	0.13	0.146; 0.128	0.106	2.5	4.5	3.07	NA	792
(N=8)	6.74	83.9	0.755	0.64	0.015	0.13	0.095	0.08	1.65	2	1.85		326
27-10	14.5	78.1	0.636; 0.629	0.623	0.0188	0.0138	0.018; 0.017	0.01	3.48	1.5	0.963	NA	5.68
(N=8)	7.02	71.6	0.675	0.655	0.01	0.01	0.02	0.01	3.3	1.5	0.8		2

Site (N= sample size)	Diss. Oxygen (mg/L)	Diss. Oxygen (%)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)	Chl-a (µg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Enterococci (MPN/100 mL)	E. coli (MPN/100 mL)
27-11	19.4	104	0.839; 0.803	0.718	0.0338	0.121	0.16; 0.142	0.124	2	3.5	3.48	NA	1540
(N=8)	8.55	101	0.705	0.645	0.02	0.135	0.12	0.105	1.95	1.5	1		323
29-11	10.8	136	0.901; 0.884	0.861	0.0314	0.04	0.08; 0.074	0.0243	2.43	9.29	4.33	NA	452
(N=7)	8.28	101	0.84	0.83	0.03	0.01	0.07	0.02	1.5	4	2.5		372
35-01	6.98	90.8	0.888; 0.882	0.832	0.035	0.0567	0.078; 0.077	0.0167	12	4.5	3.98	NA	723
(N=6)	6.59	90.5	0.925	0.84	0.04	0.02	0.075	0.02	8.95	4	3.9		366
35-04	6.41	77.1	0.789; 0.776	0.663	0.055	0.126	0.078; 0.073	0.0375	6.11	2.63	3.26	NA	290
(N=8)	6.15	69.4	0.795	0.655	0.04	0.105	0.07	0.035	2.3	2	2.15		240
35-10	4.65	56.7	0.874; 0.869	0.768	0.0938	0.106	0.099; 0.095	0.0238	13.8	4.13	3.58	NA	386
(N=8)	4.53	53.9	0.88	0.715	0.105	0.1	0.095	0.02	6.85	3	3.15		325
35-12	2.97	35.3	0.768; 0.75	0.646	0.045	0.121	0.104; 0.089	0.0463	4.89	2.5	1.99	NA	212
(N=8)	2.78	34.8	0.79	0.645	0.03	0.09	0.1	0.05	3.05	2	1.9		165
35-15	5.53	68.7	1.1; 1.08	1.07	0.06	0.0271	0.103; 0.102	0.01	43.9	11.7	5.53	NA	175
(N=7)	6.21	73.3	1.1	1.09	0.01	0.01	0.1	0.01	38.1	10	5.1		182
53-06	3.81	49.1	4.56; 4.49	0.298	0.02	4.26	0.089; 0.088	0.0688	3.68	3.63	0.919	89.4	NA
(N=8)	3.5	44	4.6	0.275	0.015	4.34	0.09	0.07	3.6	2	0.775	20	

Summary statistics for coastal strata for 2022. The first number in each column is the mean and is followed by the median in the next row. Additionally, geometric means are given for TN and TP after the semicolon on the top row for each site.

Stratum (N=sample size)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)	Chl-a (µg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Transmis-sivity (%)
E1	6.76	91.7	0.796; 0.773	0.785	0.0145	0.0106	0.0906; 0.0854	0.0403	8.87	11.7	3.44	80.1
(N=31)	6.93	93.8	0.83	0.82	0.01	0.01	0.08	0.03	6.1	10	3	79.3
E2	6.36	86	0.906; 0.875	0.896	0.0161	0.01	0.133; 0.12	0.0655	14.8	18.3	5.24	80.2
(N=31)	5.84	85.5	0.93	0.92	0.01	0.01	0.13	0.04	11.7	14	4.6	80.6
E3	6.85	95	0.703; 0.691	0.693	0.0106	0.01	0.0963; 0.0887	0.0534	6.1	12.6	3.26	78
(N=32)	7.16	100	0.715	0.705	0.01	0.01	0.095	0.045	4.6	10	2.2	83.3
E4	6.87	95.2	0.705; 0.688	0.695	0.011	0.01	0.0768; 0.0731	0.0429	6.24	12.3	2.8	79.5
(N=31)	7.05	97.7	0.69	0.68	0.01	0.01	0.07	0.04	4.8	12	2.6	81.6
E5	6.84	97.7	0.682; 0.645	0.672	0.0128	0.0106	0.0647; 0.0635	0.0384	4.26	9.59	2.31	87.2
(N=32)	6.86	96.6	0.645	0.635	0.01	0.01	0.06	0.04	3.65	10	1.85	88
RB	6.68	94	0.752; 0.726	0.742	0.0116	0.01	0.0634; 0.0627	0.0328	6.44	11.3	2.46	81.3
(N=32)	6.63	93.5	0.71	0.7	0.01	0.01	0.06	0.03	5.55	11	2.45	79.4
W1	6.79	96.9	0.777; 0.718	0.765	0.0163	0.012	0.011; 0.0107	0.01	1.43	11.1	1.95	94.1
(N=30)	7.01	98.9	0.66	0.65	0.01	0.01	0.01	0.01	1.15	10.5	1.25	96.4
W2	6.37	92	0.852; 0.771	0.841	0.0175	0.0109	0.0194; 0.0161	0.0103	5.11	13.4	3.43	86.5
(N=32)	6.36	93.5	0.68	0.67	0.01	0.01	0.015	0.01	2.9	12	3.15	92
W3	7.03	103	0.823; 0.766	0.812	0.0166	0.0103	0.0238; 0.0207	0.01	4.36	13.3	3.21	85.4
(N=32)	6.84	98.9	0.72	0.71	0.01	0.01	0.02	0.01	4.15	13	3	86.6
W4	6.08	88.9	0.923; 0.893	0.912	0.0288	0.0113	0.05; 0.0758	0.0103	6.59	17.6	4.9	82.3
(N=32)	5.71	87.5	0.84	0.83	0.015	0.01	0.05	0.01	4.7	15	3.85	84.2
W5	4.64	66.1	0.971; 0.943	0.946	0.0622	0.0253	0.107; 0.102	0.0566	12	11.1	4.16	77.7
(N=32)	4.4	63.1	0.915	0.895	0.045	0.01	0.1	0.05	6.45	11	3.4	82.3
W6	6.84	100	0.84; 0.777	0.827	0.0203	0.0126	0.0313; 0.029	0.0116	4.35	13.8	4.26	85.5
(N=31)	6.92	101	0.68	0.66	0.01	0.01	0.03	0.01	3.4	13	3.6	86.9

Stratum (N=sample size)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)	Chl-a (µg/L)	Total Suspended Solids (mg/L)	Turbidity (NTU)	Transmis-sivity (%)
W7	7.19	106	0.712; 0.69	0.7	0.0116	0.0116	0.0316; 0.0288	0.0113	4.11	12.9	2.91	86.4
(N=32)	6.69	101	0.675	0.665	0.01	0.01	0.03	0.01	4.2	12.5	2.45	88.4
W8	7.1	102	0.684; 0.658	0.674	0.0155	0.01	0.0316; 0.03	0.0148	3.47	12.1	2.34	89.6
(N=31)	6.89	96.1	0.62	0.61	0.01	0.01	0.03	0.01	2.9	11	2.2	92.1

Summary statistics for ambient monitoring lakes for 2022. The first number in each column is the mean and is followed by the median in the next row. Additionally, geometric means are given for TN and TP after the semicolon on the top row for each site.

Site (N=sample size)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Total Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ammonia (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L)	Ortho-phosphate (mg/L)	Chl-a (µg/L))	Total Suspended Solids (mg/L)	Turbidity (NTU)	Color (PCU)	Transmis-sivity (%)
Lake Chautauqua	7.57	93.4	0.784; 0.775	0.774	0.01	0.01	0.01; 0.01	0.01	2.55	1.25	0.888	39.9	NA
(N=8)	7.45	91.5	0.8	0.79	0.01	0.01	0.01	0.01	2.55	1	0.8	34	
Alligator Lake	6.44	76.4	1.21; 1.16	1.19	0.0225	0.02	0.161; 0.159	0.0488	40.3	9.75	5.91	36.1	NA
(N=8)	6.25	79.1	1.03	1.02	0.01	0.01	0.165	0.05	35.8	8.5	5.1	36.5	
Lake Tarpon	7.25	88.1	1.01; 1	1	0.0103	0.01	0.035; 0.034	0.01	23.2	8.31	3.9	50.1	54.1
(N=32)	7.32	86.6	1.03	1.02	0.01	0.01	0.035	0.01	21.9	8	3.75	49	52.8
Lake Seminole North	6.7	82.4	1.23; 1.21	1.22	0.014	0.0107	0.062; 0.06	0.01	32.6	13.8	6.99	30.9	38.5
(N=15)	6.93	89.3	1.27	1.26	0.01	0.01	0.06	0.01	31.9	14	7.5	30	40.1
Lake Seminole South	7.56	93.1	2.42; 2.36	2.41	0.0247	0.01	0.08; 0.08	0.01	73.9	29.3	15.3	30.2	16.2
(N=15)	7.86	98.4	2.47	2.46	0.02	0.01	0.08	0.01	74.1	27	14	30	15.6