Annual Report Form
For Individual NPDES Permits For Municipal Separate Storm Sewer Systems
(RULE 62-624.600(2), F.A.C.)

- This Annual Report Form must be completed and submitted to the Department to satisfy the annual reporting requirements established in Rule 62-621.600, F.A.C.
- Submit this fully completed and signed form and any REQUIRED attachments by email to the NPDES Stormwater Program Administrator or to the MS4 coordinator (http://www.dep.state.fl.us/water/stormwater/npdes/contacts.htm). Files larger than 10MB may be placed on the FTP site at: ftp://ftp.dep.state.fl.us/pub/NPDES_Stormwater/. After uploading files, email the MS4 coordinator or NPDES Program Administrator to notify them the report is ready for downloading; or by mail to the address in the box at right.
- Refer to the Form Instructions for guidance on completing each section.
- **Please print or type information in the appropriate areas below.**

Submit the form and attachments to:
Florida Department of Environmental Protection
Mail Station 3585
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

SECTION I.	BACKGROUND INFORMATION		
A.	Permittee Name: Town of Jupiter		
B.	Permit Name: Palm Beach County MS4		
C.	Permit Number: FLS000018-004		
D.	Annual Report Year: ☐ Year 1 ☐ Year 2 ☐ Year 3 ☒ Year 4 ☐ Year 5 ☐ Other, specify Year:		
E.	Reporting Time Period (month/year): 10/ 19 through 9 / 2020		
F.	Name of the Responsible Authority: David L. Brown		
	Title: Director of Utilities		
	Mailing Address: 210 Military Trail		
	City: Jupiter	Zip Code: 33458	County: Palm Beach
	Telephone Number: 561-748-2270	Fax Number: 561-746-2792	
	E-mail Address: davidb@jupiter.fl.us		
G.	Name of the Designated Stormwater Management Program Contact (if different from Section I.F above): David Rotar		
	Title: Utility Services Manager		
	Department: Utilities/Parks & Public Works		
	Mailing Address: 210 Military Trail		
	City: Jupiter	Zip Code: 33458	County: Palm Beach
	Telephone Number: 561-748-2705	Fax Number: 561-746-2792	
	E-mail Address: davidr@jupiter.fl.us		

SECTION II.	MS4 MAJOR OUTFALL INVENTORY (Not Applicable in Year 1)
A.	Number of outfalls ADDED to the outfall inventory in the current reporting year (insert “0” if none): 0 (Does this number include non-major outfalls? ☐ Yes ☐ No ☒ Not Applicable)
B.	Number of outfalls REMOVED from the outfall inventory in the current reporting year (insert “0” if none): 0 (Does this number include non-major outfalls? ☐ Yes ☐ No ☐ Not Applicable)
C.	Is the change in the total number of outfalls due to lands annexed or vacated? ☐ Yes ☐ No ☒ Not Applicable

SECTION III.	PART V.B. ASSESSMENT PROGRAM
A.	Provide a brief statement as to the status of water quality monitoring plan implementation. Status may include sampling frequency changes, monitoring location changes, or sampling waiver conditions. *DEP Note: If permittee participates in a collaborative monitoring plan, permittee may refer to a joint response as defined by the interlocal agreement.* Name and date of the approved plan: Group Monitoring Plan, 5/15/2018 (via email) Town of Jupiter Assessment Plan, Status: The monitoring program is carried out jointly by the PBC Co-permittees. See the PBC Joint Annual Report. The information relevant to the Permittee's MS4 is addressed within the Annual Assessment Report document, provided herewith.
B.	Provide a brief discussion of the monitoring and loading results to date which includes a summary of the water quality monitoring data and / or stormwater pollutant loading changes from the reporting year. *DEP Note: Results must be specific to the permittee's SWMP.* See provided Annual Assessment Report and Permittee's Year 3 Pollutant Loading Report
C.	Attach a monitoring data summary as required by the permit. An analysis of the data discussing changes in water quality and/or stormwater pollutant loading from previous reporting years. *DEP Note: Analysis must be specific to the permittee's SWMP.* Same as B above.

SECTION IV.	FISCAL ANALYSIS
A.	Total expenditures for the NPDES stormwater management program for the current reporting year: $2,558,478
B.	Total budget for the NPDES stormwater management program for the subsequent reporting year: $3,060133
C.	Did the current reporting year resources decrease from the previous year? Y ☐ / N ☒ If program resources decreased, provide a discussion of the impacts on the implementation of the SWMP. N/A

SECTION V. MATERIALS TO BE SUBMITTED WITH THIS ANNUAL REPORT FORM

Only the following materials are to be submitted to the Department along with this fully completed and signed Annual Report Form (check the appropriate box to indicate whether the item is attached or is not applicable):

Attached	N/A	Required Attachments	Permit Citation	Attachment Number/Title
☐	☒	Any additional information required to be submitted in this current annual reporting year in accordance with Part III.A of your permit that is not otherwise included in Section VII below.	Part III.A	
☐	☒	An explanation of why the minimum inspection frequency in Table II.A.1.a. was not met, if applicable.	Part II.A.1	
☐	☒	A list of the flood control projects that did not include stormwater treatment and an explanation for each of why it did not (if applicable).	Part III.A.4	
☒	☐	A monitoring data summary as directed in Section III.C above and in accordance with Rule 62-624.600(2)(c), F.A.C.	Part V.B.3	See Joint Annual Report & Jupiter Assessment Report
☐	☒	YEAR 1 ONLY: An inventory of all known major outfalls and a map depicting the location of the major outfalls (hard copy or CD-ROM) in accordance with Rule 62-624.600(2)(a), F.A.C.	Part III.A.1	
☐	☒	YEAR 2: A summary review of codes and regulations to reduce the stormwater impact from development.	Part III.A.2	
☐	☒	Year 3 ONLY: The estimates of pollutant loadings and event mean concentrations for each major outfall or each major watershed in accordance with Rule 62-624.600(2)(b), F.A.C.	Part V.A	
☐	☒	YEAR 3: Summary of TMDL Monitoring Results (if applicable).	Part VIII.B.2	
☒	☐	YEAR 3: Bacteria Pollution Control Plan (if applicable).	Part VIII.B.3	Water Quality Master Plan (Jones & Simms Creek) May 2015
☒	☐	YEAR 4: A follow-up report on plan implementation of changes to codes and regulations to reduce the stormwater impact from development.	Part III.A.2	See attached Year 4 Land Development Code Update
☐	☒	YEAR 4: A report on any amendments to the applicable legal authority (if applicable).	Part III.A.7.a	
☒	☐	YEAR 4: Permit re-application information in accordance with Rule 62-624.420(2), F.A.C. • The monitoring plan (with revisions, if applicable). • If the total annual pollutant loadings have not decreased over the past two permit cycles, revisions to the SWMP, as appropriate.	Part V.B.3 Part V.A.3	See Joint Annual Report
☐	☒	YEAR 4: TMDL Supplemental SWMP (if applicable).	Part VIII.B.3	

DO NOT SUBMIT ANY OTHER MATERIALS

(such as records and logs of activities, monitoring raw data, public outreach materials, etc.)

SECTION VI. CERTIFICATION STATEMENT AND SIGNATURE

The Responsible Authority listed in Section I.F above must sign the following certification statement, as per Rule 62-620.305, F.A.C:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name of Responsible Authority (type or print): David L. Brown

Title: Director of Utilities

Signature: [signature] Date: 3 / 17 / 2021

SECTION VII.	STORMWATER MANAGEMENT PROGRAM (SWMP) SUMMARY TABLE				
A.	**B.**	**C.**	**D.**	**E.**	**F.**
Permit Citation/ SWMP Element	**Permit Requirement/Quantifiable SWMP Activity**	**Number of Activities Performed**	**Documentation / Record**	**Entity Performing the Activity**	**Comments**
Part III.A.1	**Structural Controls and Stormwater Collection Systems Operation**				

Report the current known inventory.

Report the number of inspection and maintenance activities conducted for each applicable type of structure included in Table II.A.1.a, and the percentage of the total inventory of each type of structure inspected and maintained.

Note: Delete structures that are not in your MS4's inventory. The permittee may choose its own unit of measurement for each structural control to be consistent with the unit of measurement in the documentation. Unit options include: miles, linear feet, acres, etc.

Type of Structure	Number of Structures	Number of Inspections	Percent Inspected	Number of Maintenance Activities	Percent Maintained			
Dry retention systems	0	0	0	0	0	None	TOJ Staff	Do not have
Underdrain filter systems	0	0	0	0	0	None	TOJ Staff	Do not have
Exfiltration trench / French drains (lf)	4221	6	100	0	100	Lucity WO 20-001442	TOJ Stormwater Crew	Six areas have exfiltration trenches.
Grass treatment swales (miles)								
Dry detention systems	5	72	100	72	100	Invoices from Contractor / Inspections in Lucity	Property Works, TOJ Stormwater Crew	
Wet detention systems	3	36	100	36	100	Invoices from Contractor / Inspections in Lucity	TOJ Stormwater Crew, Future Horizons	
Detention with filtration systems								
Alum Injection systems								
Pollution control boxes	9	36	100	36	100	Inspections in Lucity	TOJ Stormwater Crew	
pump stations	2	104	100	104	100	Pump Station Log/ Lucity WO	TOJ Stormwater Crew	
Major outfalls	13	26	100	26	100	Lucity WO	TOJ Stormwater Crew	
Weirs or other control structures								
pipes / culverts (miles)	94.6	26	67.9	3	N/A	Contractors Invoices / Lucity WO	TOJ Stormwater Crew	Inspections are done annually when doing

A.	B.						C.	D.	E.	F.
Permit Citation/ SWMP Element	**Permit Requirement/Quantifiable SWMP Activity**						**Number of Activities Performed**	**Documentation / Record**	**Entity Performing the Activity**	**Comments**
										structure inspections 26 Atlas sheets showing the drainage system. The number in "Inspection" indicates the number of sheets that were inpected. Number of Activities is the number of repairs that were performed on drainage lines. Sinkholes repaired, Joints wrapped Riverside Dr replaced 180 ft of pipe, Jupiter Village wrapped joint, Daly Park replace 20 ft of pipe.
	Canals	0	0	0	0	0		None	TOJ Staff	Do not have
	Inlets / catch basins / grates	5448	3665	67.3	1571	28.8		Lucity	TOJ Stormwater Crew Contractor	There were 10 structures that were repaired the other activities are cleaning of the grates. New structure installed at Daly Park
	Ditches / conveyance swales (miles)	59.2	2	100	6	100		Lucity	TOJ Stormwater Crew, Property Works	The ditches are inspected twice a year. Mowing done quarterly
	If the minimum inspection frequencies set forth in Table II.A.1.a. were not met, provide as an attachment an	☐						N/A	N/A	Met or exceeded inspections

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	explanation of why they were not and a description of the actions that will be taken to ensure that they will be met.				frequencies

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Part III.A.1 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: Inspection and maintenance of structural components of the Town's MS4 system helps to enhance water quality. The inspections also help to identify areas that may be developing problems.				
	Limitations: None				
	SWMP revisions implemented to address limitations: None				
Part III.A.2	**Areas of New Development and Significant Redevelopment**				
	Report the number of significant development projects, including new and redevelopment, reviewed and approved by the permittee for post-development stormwater considerations.				
	Number of significant development projects reviewed	4	Energov	TOJ Stormwater	
	Number of significant development projects approved	1	Energov	TOJ Staff	
	Provide in the Year 2 Annual Report the summary report of the review activity. Provide in the Year 4 Annual Report the follow-up report on plan implementation.				
	Year 2 ONLY: Attach the summary report of the review activity	☐			
	Year 4 ONLY: Attach the follow-up report on plan implementation	☒	Yr 4 Land Ordinance Report	TOJ Staff	See attached
Part III.A.2 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: Works in conjunction with South Florida Water Management District requirements. Redevelopment allows for the stormwater system to be upgraded.				
	Limitations: None				
	SWMP revisions implemented to address limitations: None				
Part III.A.3	**Roadways**				
	Report on the litter control program, including the frequency of litter collection, an estimate of the total number of road miles cleaned or amount of area covered by the activities, and an estimate of the quantity of litter collected. *Note: If the permittee does not contract activities, delete CONTRACTOR activities.*				
	PERMITTEE Litter Control: Frequency of litter collection	0	None	TOJ Staff	Part of Right of Way mowing contract(s)
	PERMITTEE Litter Control: Estimated amount of area maintained (lf)	0	None	TOJ Staff	See above
	PERMITTEE Litter Control: Estimated amount of litter collected (cy)	0	None	TOJ Staff	See above
	CONTRACTOR Litter Control: Frequency of litter collection	30	Invoices	Terracon	
	CONTRACTOR Litter Control: Estimated amount of area maintained (lf)	132,979	Lucity	TOJ Staff	
	CONTRACTOR Litter Control: Estimated amount of litter collected (cy)	0	Contract requires pickup by contractor	Terracon	Litter is picked up prior to cutting the grass. A count is not kept

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	OPTIONAL: If an Adopt-A-Road or similar program is implemented, report the total number of road miles cleaned and an estimate of the quantity of litter collected. If you do not participate in an Adopt-A-Road program, report "0".				
	Trash Pick-up Events: Total miles cleaned	0	None	TOJ Staff	Town of Jupiter does not have a program
	Trash Pick-up Events: Estimated amount of litter collected (cy)	0	None	TOJ Staff	No program
	Adopt-A-Road: Total miles cleaned	0	None	TOJ Staff	Town of Jupiter does not have a program
	Adopt-A-Road: Estimated amount of litter collected (cy)	0	None	TOJ Staff	No program
	Report on the street sweeping program, including the frequency of the sweeping, total miles swept, an estimate of the quantity of sweepings collected, and the total nitrogen and total phosphorus loadings that were removed by the collection of sweepings. If no street sweeping program is implemented, provide the explanation of why not in column F.				
	Frequency of street sweeping	Quarterly/ Weekly	Contractor Invoices/ Lucity	U.S. Sweeping Inc. TOJ Staff	All Town owned curbed roads quarterly. Selected State and County roads are swept quarterly. Additional sweeping of selected Town owned roads are done in Dec., Jan., Feb., March
	Total miles swept	2178	Invoices	U.S. Sweeping Inc	
	Estimated quantity of sweeping material collected (cy / ~~tons~~)	1523	Invoices	U.S. Sweeping Inc	
	Total phosphorous loadings removed (pounds)	1,159	Load Reduction Excel sheet	TOJ Personnel	Calculated using FDEP Load Reduction Tool
	Total nitrogen loadings removed (pounds)	2,130	Load Reduction Excel sheet	TOJ Personnel	Calculated using FDEP Load Reduction Tool
	Report the equipment yards and maintenances shops that support road maintenance activities, and the number of inspections conducted for each facility.				
	Name of Facility	**Number of Inspections**			
	Town of Jupiter Maintenance Facility	12	Municipal Maintenance	Charles Jones	

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			Yard Inspection Check List		
Part III.A.3 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: Street sweeping has helped reduce the amount of pollutants being discharged into the stormwater system.				
	Limitations: None				
	SWMP revisions implemented to address limitations: None				
Part III.A.4	**Flood Control Projects**				
	Report the total number of flood control projects that were constructed by the permittee during the reporting period and the number of those projects that did NOT include stormwater treatment. The permittee shall provide a list of the projects where stormwater treatment was not included with an explanation for each of why it was not. Report on any stormwater retrofit planning activities and the associated implementation of retrofitting projects to reduce stormwater pollutant loads from existing drainage systems that do not have treatment BMPs.				
	Flood control projects completed during the reporting period	**1**	Town CIP	Stormwater Utility	Evernia St. Alley
	Flood control projects completed that did not include stormwater treatment	0	Town CIP	Stormwater Utility	All projects have stormwater treatment
	Stormwater retrofit projects planned/under construction	1	Town CIP	Stormwater Utility	Clemons St, Love St.
	Stormwater retrofit projects completed	0	Town CIP	Stormwater	None done
	If there were projects that did not include stormwater treatment, provide as an attachment a list of the projects and an explanation for each of why it did not.	☐			
Part III.A.4 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: Works in conjunction with South Florida Water Management District requirements. Redevelopment allows for the stormwater system to be upgraded.				
	Limitations: None				
	SWMP revisions implemented to address limitations: None				

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Part III.A.5	**Municipal Waste Treatment, Storage, and Disposal Facilities Not Covered by an NPDES Stormwater Permit**				
	Report the applicable facilities and the number of the inspections conducted for each facility.				
	Name of Facility	**Number of Inspections**			
	None	0	None	TOJ Staff	Not applicable Town does not own any
Part III.A.5 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: N/A				
	Limitations: N/A				
	SWMP revisions implemented to address limitations: N/A				
Part III.A.6	**Pesticides, Herbicides, and Fertilizer Application**				
	Report the number of permittee personnel applicators and contracted commercial applicators of pesticides and herbicides who are FDACS certified / licensed. Report the number of permittee personnel who have been trained through the Green Industry BMP Program and the number of contracted commercial applicators of fertilizer who are FDACS certified / licensed.				
	PERSONNEL: FDACS public applicators of pesticides/herbicides	1	Copy of State License	Town of Jupiter Parks & Public Works	
	CONTRACTORS: FDACS commercial applicators of pesticides/ herbicides	2	Copy of State License	Terracon Services	
	PERSONNEL: Green Industry BMP Program training completed	0	Copy of State License	TOJ	Employee is already trained
	CONTRACTORS: FDACS certified / licensed applicators of fertilizer	1	Copy of State License	Terracon Services	
	Provide a copy of the adopted ordinance with the Year 2 Annual Report. If this provision is not applicable because the permittee is not within the watershed of a nutrient-impaired water body, indicate that in Column F.				
	Year 2 ONLY: Attach copy of adopted Florida-friendly ordinance	☐			
	Report on the public education and outreach activities that are performed or sponsored by the permittee within the permittee's jurisdiction to encourage citizens to reduce their use of pesticides, herbicides and fertilizers including the type and number of activities conducted, the type and number of materials distributed, and the number of Web site visits (if applicable).				
	Public Education and Outreach Program	The public outreach and education plan is carried out as a joint effort by the Palm Beach County Co-permittees. Please see the Palm Beach County Joint Annual Report for the public education and outreach information.			
	Brochures/Flyers/Fact sheets distributed				
	Neighborhood presentations: Number conducted				
	Neighborhood presentations: Number of participants				

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	Newspapers & newsletters: Number of articles/notices published				
	Newsletters: Number of newsletters distributed				
	Public displays (e.g., kiosks, storyboards, posters, etc.)				
	Radio or television Public Service Announcements (PSAs)				
	School presentations: Number conducted				
	School presentations: Number of participants				
	Seminars/Workshops: Number conducted				
	Seminars/Workshops: Number of participants				
	Special events: Number conducted				
	Special events: Number of participants				
	Number of visitors to stormwater-related pages				
Part III.A.6 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: Making sure that all commercial applicators contracted with the Town have received training. Seasonal ban on use of fertilizers with nitrogen and phosphorus should help reduce loads to impaired parts of the Loxahatchee River				
	Limitations: None				
	SWMP revisions implemented to address limitations: None				
Part III.A.7.a	**Illicit Discharges and Improper Disposal — Inspections, Ordinances, and Enforcement Measures**				
	Report amendments in Year 4.				
	Year 4 ONLY: Attach a report on amendments to applicable legal authority	☐	Town of Jupiter Codes Chapter 20-Utilities Article VI Stormwater Management		There are no current amendments to the legal authority for the Town of Jupiter
Part III.A.7.c	**Illicit Discharges and Improper Disposal — Investigation of Suspected Illicit Discharges and/or Improper Disposal**				
	Report on the proactive inspection program, including the number of inspections conducted by the permittee, the number of illicit activities found, and the number and type of enforcement actions taken.				
	Proactive inspections for suspected illicit discharges	3665	Lucity	TOJ Stormwater/ Public Works employees	Look for illicit discharges when inspecting inlets
	Illicit discharges found during a proactive inspection	0	Lucity	TOJ Staff	None found
	NOV/WL/citation/fines issued for illicit discharges found during proactive inspection	0	Lucity	TOJ Staff	None found
	Report on the reactive investigation program as it relates to responding to reports of suspected illicit discharges, including the number of reports received, the number of investigations conducted, the number of illicit activities found, and the number and type of enforcement actions taken.				
	Reports of suspected illicit discharges received	1	Lucity	TOJ Stormwater Employee	No illicit discharge found

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	Reactive investigations of reports of suspected illicit discharges etc.	1	Lucity	TOJ Stormwater	No illicit discharge found
	Illicit discharges etc. found during reactive investigation	0	Lucity	TOJ Stormwater	None found
	NOV/WL/citation/fines issued for illicit discharges etc. found during reactive investigation	0	Lucity	TOJ Staff	All cases were resolved in the field by Stormwater.
	Report the type of training activities, and the number of permittee personnel and contractors trained (both in-house and outside training) within the reporting year.				
	Personnel trained	0	N/A	N/A	Training will be provided in 2021
	Contractors trained	0	N/A	N/A	No training provided
Part III.A.7.d	**Illicit Discharges and Improper Disposal — Spill Prevention and Response**				
	Report on the spill prevention and response activities, including the number of spills addressed.				
	Hazardous and non-hazardous material spills responded to	1	Lucity	TOJ Stormwater employee	Small spilled cleaned up by employee
	Report the type of training activities, and the number of permittee personnel and contractors trained (both in-house and outside training) within the reporting year.				
	Personnel trained	0	Attendance Log	TOJ Staff	Training will be provided in 2021
	Contractors trained	0	Attendance Log	TOJ Staff	No training provided
Part III.A.7.e	**Illicit Discharges and Improper Disposal — Public Reporting**				
	Report on the public education and outreach activities that are performed or sponsored by the permittee within the permittee's jurisdiction to encourage the public reporting of suspected illicit discharges and improper disposal of materials, including the type and number of activities conducted, the type and number of materials distributed, and the number of Web site visits (if applicable).				
	Public Education and Outreach Program	The public outreach and education plan is carried out as a joint effort by the Palm Beach County Co-permittees. Please see the Palm Beach County Joint Annual Report for the public education and outreach information.			
	Brochures/Flyers/Fact sheets distributed	32,000	2020 Hurricane & Flood Guide	Town of Jupiter	Hurricane Guide is sent out annually to all Town properties. Section on Drainage Maintenance has information pertaining to

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					Illegal dumping
	Neighborhood presentations: Number conducted				
	Neighborhood presentations: Number of participants				
	Newspapers & newsletters: Number of articles/notices published				
	Newsletters: Number of newsletters distributed				
	Public displays (e.g., kiosks, storyboards, posters, etc.)				
	Radio or television Public Service Announcements (PSAs)				
	School presentations: Number conducted				
	School presentations: Number of participants				
	Seminars/Workshops: Number conducted				
	Seminars/Workshops: Number of participants				
	Special events: Number conducted				
	Special events: Number of participants				
	Number of visitors to stormwater-related pages				
Part III.A.7.f	**Illicit Discharges and Improper Disposal — Oils, Toxics, and Household Hazardous Waste Control**				
	Report on the public education and outreach activities that are performed or sponsored by the permittee within the permittee's jurisdiction to encourage the proper use and disposal of oils, toxics, and household hazardous waste, including the type and number of activities conducted, the type and number of materials distributed, the amount of waste collected / recycled / properly disposed, and the number of Web site visits (if applicable).				
	Public Education and Outreach Program	The public outreach and education plan is carried out as a joint effort by the Palm Beach County Co-permittees. Please see the Palm Beach County Joint Annual Report for the public education and outreach information.			
	Brochures/Flyers/Fact sheets distributed				
	Neighborhood presentations: Number conducted				
	Neighborhood presentations: Number of participants				
	Newspapers & newsletters: Number of articles/notices published				
	Newsletters: Number of newsletters distributed				
	Public displays (e.g., kiosks, storyboards, posters, etc.)				
	Radio or television Public Service Announcements (PSAs)				
	School presentations: Number conducted				
	School presentations: Number of participants				
	Seminars/Workshops: Number conducted				
	Seminars/Workshops: Number of participants				
	Special events: Number conducted				
	Special events: Number of participants				
	Storm sewer inlets newly marked/replaced				
	Number of visitors to stormwater-related pages				
Part III.A.7.g	**Illicit Discharges and Improper Disposal — Limitation of Sanitary Sewer Seepage**				
	Report on the type and number of activities undertaken to reduce or eliminate SSOs and inflow/ infiltration, the number of SSOs or inflow / infiltration incidents				

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	found and the number resolved, and the name of the owner of the sanitary sewer system within the permittee's jurisdiction. Report only the SSOs and inflow / infiltration incidents into the MS4.				
	Owner of the sanitary sewer system	Loxahatchee River District (LRD)			
	Activity to reduce/eliminate SSOs and I&I: (description)	0	LRD	LRD	Town is not responsible for the sanitary sewer system
	Activity to reduce/eliminate SSOs and I&I: (description)	0	LRD	LRD	Town is not responsible for the sanitary sewer system
	SSO incidents discovered	1	Lucity	TOJ Stormwater employee	LRD discovered the problem and cleaned up the SSO
	SSO incidents resolved	1	LRD	Loxahatchee River District	LRD took care of the issue
	Inflow / infiltration incidents discovered	0	LRD	LRD	Town is not responsible for the sanitary sewer system
	Inflow / infiltration incidents resolved	0	LRD	LRD	Town is not responsible for the sanitary sewer system
Part III.A.7 Summary	For activities required by Part III.A.7: Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: None				
	Limitations: None				
	SWMP Revisions implemented to address limitations: Allow Town of Jupiter to remove from report				
Part III.A.8.a	**Industrial and High-Risk Runoff — Identification of Priorities and Procedures for Inspections**				
	Report on the high-risk facilities inventory, including the type and total number of high risk facilities and the number of facilities newly added each year. Report on the high-risk facilities inspection program, including the number of inspections conducted and the number and type of enforcement actions taken.				

Type of Facility	Number of Facilities	Number of Inspections	Enforcement Actions			

SECTION VII.	STORMWATER MANAGEMENT PROGRAM (SWMP) SUMMARY TABLE							
A.	B.			C.	D.	E.	F.	
Permit Citation/ SWMP Element	Permit Requirement/Quantifiable SWMP Activity			Number of Activities Performed	Documentation / Record	Entity Performing the Activity	Comments	
	Operating municipal landfills	**0**	0	0	FDEP database	TOJ Staff	Jupiter does not have a landfill	
	Hazardous waste treatment, storage, disposal and recovery (HWTSDR) facilities	**0**	0	0	FDEP database	TOJ Staff	County operated	
	EPCRA Title III, Section 313 facilities (TRI)	**1**	1	0	EPA database/Lucity inspection of structures	TOJ Stormwater Staff	Facility has EPA permit	
	Facilities determined as high risk by the permittee	**0**	0	0	Lucity	TOJ Staff	No facilities to our knowledge	
Part III.A.8.b	**Industrial and High-Risk Runoff — Monitoring for High Risk Industries**							
	Report the number of high risk facilities sampled.							
	High risk facilities sampled			0	SOP	TOJ Staff	No sampling done	
Part III.A.8 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.							
	Strengths: None Identified							
	Limitations: Duplication when EPA and FDEP permits are required with annual reporting							
	SWMP revisions implemented to address limitations: Remove duplication from NPDES requirement							
Part III.A.9.a	**Construction Site Runoff — Site Planning and Non-Structural and Structural Best Management Practices**							
	Report the number of permittee and private pre-construction site plans reviewed for stormwater, erosion, and sedimentation controls, and the number approved.							
	PERMITTEE SITES: Construction site plans reviewed			1	Energov	Town of Jupiter		
	PERMITTEE SITES: Construction site plans approved			1	Energov	Town of Jupiter		
	PRIVATE SITES: Construction site plans reviewed			4	Energov	Town of Jupiter		
	PRIVATE SITES: Construction site plans approved			1	Energov	Town of Jupiter		
	Report the number of development permit applicants notified of the ERP and CGP, and the number of applicants who confirmed ERP and CGP coverage.							
	Notified of ERP stormwater permit requirements			5	Energov	Town of Jupiter		
	Confirmed ERP coverage			5	Energov	Town of Jupiter		
	Notified of CGP stormwater permit requirements			4	Energov	Town of Jupiter		
	Confirmed CGP coverage			0	Energov	N/A	Construction has not started	
Part III.A.9.b	**Construction Site Runoff — Inspection and Enforcement**							
	Report on the inspection program for privately-operated and permittee-operated construction sites, including the number of active construction sites during the reporting year, the number of inspections of active construction sites, the percentage of active construction sites inspected, and the number and type of enforcement actions / referrals taken.							
	PERMITTEE SITES: Active construction sites			1	Energov	TOJ Staff		
	PERMITTEE SITES: Pre-, During, and Post inspections of active construction sites for E&S and waste control BMPs			34	Lucity/ Compliance	TOJ Stormwater employee	Police Building	

SECTION VII. STORMWATER MANAGEMENT PROGRAM (SWMP) SUMMARY TABLE					
A.	**B.**	**C.**	**D.**	**E.**	**F.**
Permit Citation/ SWMP Element	**Permit Requirement/Quantifiable SWMP Activity**	**Number of Activities Performed**	**Documentation / Record**	**Entity Performing the Activity**	**Comments**
			Inspection form		
	PERMITTEE SITES: Percentage of active construction sites inspected	100	Lucity	TOJ Staff	
	PRIVATE SITES: Active construction sites	13	Lucity	TOJ Staff	
	PRIVATE SITES: Pre-, During, and Post inspections of active construction sites for E&S and waste control BMPs	316	Lucity/ Compliance Inspection form	TOJ Stormwater employee	
	PRIVATE SITES: Percentage of active construction sites inspected	100	Lucity	TOJ Staff	
	Enforcement Action	0	Lucity	TOJ Staff	No enforcement action was necessary
Part III.A.9.c	**Construction Site Runoff — Site Operator Training**				
	Report the type of training activities, the number of inspectors, site plan reviewers and site operators trained (both in-house and outside training).				
		DEP Certification	**Annual Training**		
	Permittee construction site inspectors	**8**	0		No training held
	Permittee construction site plan reviewers		0		No training held
	Permittee construction site operators		0		No training held
Part III.A.9 Summary	Provide an evaluation of the Stormwater Management Program according to Part VI.B.2 of the permit.				
	Strengths: Town inspects construction runoff on every routine inspection of each construction site to ensure SWPPP and BMPs are followed.				
	Limitations: Annual training of personnel is not necessary and is time consuming.				
	SWMP revisions implemented to address limitations: Change requirement for annual training to biannual.				

SECTION VIII. CHANGES TO THE STORMWATER MANAGEMENT PROGRAM (SWMP) ACTIVITIES (Not Applicable in Year 4)		
A.	**Permit Citation/ SWMP Element**	**Proposed Changes to the Stormwater Management Program Activities Established as Specific Requirements Under Part III.A of the Permit (Including the Rationale for the Change) — REQUIRES DEP APPROVAL PRIOR TO CHANGE IF PROPOSING TO REPLACE OR DELETE AN ACTIVITY.**
		N/A
B.	**Permit Citation/ SWMP Element**	**Changes to the Stormwater Management Program Activities NOT Established as Specific Requirements Under Part III.A of the Permit (Including the Rationale for the Change)**
		N/A

SECTION IX. TMDL Status Report

A.

YEAR 1 Provide a table summarizing the status of the TMDL process. Include a list of prioritized TMDLs and their monitoring and implementation schedule; and include the Identification number of the outfall prioritized for TMDL monitoring.

WBID Number	Segment/ Waterbody/ Basin	Pollutant of Concern	TMDL DEP / EPA	Percent Reduction (WLA)	Priority Rank	Priority Outfall	Monitoring Summary / BPCP Due Date	Supplemental SWMP Due Date
3226C	SW Fork of Loxahatchee River	Fecal	☒ / ☐	46	1	0	Refer to Joint Report, Jupiter Assessment Report, Bacterial Pollution Control Plan for SW Fork of the Loxahatchee River (WBID 3226C)	Refer to Joint Report & Jupiter Assessment Report, Bacterial Pollution Control Plan for SW Fork of the Loxahatchee River (WBID 3226C)

B.

YEAR 3 and annually thereafter, provide a summary of the estimated load reductions that have occurred for the pollutant(s) of concern being discharged from the MS4 to the TMDL water body during the reporting period and cumulatively since the date the Supplemental SWMP was implemented.

Year 3: Submit a Monitoring data summary or BPCP (if applicable).

Year 4: Submit a Supplemental SWMP (if applicable).

WBID Number	Pollutant of Concern	Monitoring Summary / BPCP Submitted	Supplemental SWMP Submitted	Projected load reductions OR Actual load reductions to date
3226C	Bacteria	Assessment Report	Loxahatchee River Pollutant Reduction plan February 2020	See Loxahatchee River Pollutant Reduction Plan dated February 2020

C. Provide a brief statement as to the status of TMDL implementation according to Part VIII.B of the permit (e.g. status of monitoring to validate WLA):

Attached is the final Loxahatchee River Pollutant Reduction Plan dated February 2020 (e4 plan) developed in conjunction with the stakeholders and the Division of Environmental Assessment and Restoration. Annual report due in January 2021.

January 25, 2021

To: Town of Jupiter

From: Chris Guth, P.E. – Federico & Associates, Inc.
Eric Stanley, P.E. – Hazen and Sawyer

Monitoring and Fecal Coliform Control Plan Report; and Follow-Up Report On Cycle 4, Year 2 On Changes in Regulations for Controlling Stormwater Impacts From Development

Cycle 4, Year 4 – Annual Report

Introduction

An assessment program was developed as part of the Cycle 4, Year 1 annual report to assist in determining the overall effectiveness of the Town of Jupiter (Town) Stormwater Management Program (SWMP) in reducing stormwater pollutant loadings, to the Maximum Extent Practicable (MEP), from its Municipal Separate Storm Sewer System (MS4) to receiving water bodies. This Water Quality Monitoring Assessment Report is a summary of the data collected as part of the assessment program.

Additionally, as part of the Year 2 Annual Report requirements of the NPDES MS4 Cycle 4 permit, review of the Town's land development codes was performed in order to evaluate the potential for techniques/procedures that may be incorporated into the regulations in an effort to augment their stormwater management practices. A brief follow-up report on implementation of changes to codes and regulations to reduce the stormwater impact from development is provided.

1. Review of Water Quality Monitoring Plan

As part of the Town of Jupiter's (Town) Water Quality Monitoring Plan, ambient water quality data collectively obtained through a joint program by the Palm Beach County MS4 permittees (Permit No. FLS000018-003) are being used. The Town is also utilizing additional monitoring locations which have been placed in areas that represent centralized collection zones for major stormwater outfalls and thus characterize water quality conditions in the watershed.

In addition to the combination of ambient water quality data collected through the joint program and the additional monitoring locations being utilized by the Town at strategic points throughout the system, a short-term monitoring plan is being implemented in the upstream reaches of the Jones Creek Watershed to assist in identifying the source(s) of the elevated fecal bacteria levels often observed in Jones Creek. Sample locations are adjusted based on the obtained results in order to hone in on the area(s) of the Jones Creek watershed that are most problematic.

1.1 Monitoring Locations

A total of six (6) MS4 monitoring locations have historically been utilized by the Town (**Figure 1**). Two (2) of those locations represent sites currently monitored under the Joint MS4 Program with the remaining four (4) being selected by the Town to provide additional detail on observed water quality impairments. A seventh monitoring location is broadly known as the Jones Creek Watershed (JCWS) and is comprised of multiple individual sampling points. The focus area for the JCWS sampling is shown in purple hatch in **Figure 1**.

2. Data Analysis

Samples that were collected from the permanent monitoring locations were tested for the parameters listed in **Table 1**. Of particular importance are fecal coliform bacteria, Total Nitrogen (TN), Total Phosphorous (TP), and Chlorophyll-α due to fecal coliform TMDL for the Southwest Fork of the Loxahatchee River (published in 2012) and Loxahatchee River Reasonable Assurance Plan (RAP). An overview of these specific parameters is included in this report.

Table 1 – MS4 Monitoring Parameters Table

Parameters	Field Analysis	Laboratory Analysis
Alkalinity		X
Chlorophyll-α		X
Color		X
Conductivity (salinity)	X	
Dissolved Oxygen	X	
Enterococci (marine only)		X
Fecal Coliform		X
Nitrate/Nitrite		X
Organic Nitrogen		X
Orthophosphorus		X
pH	X	
Temperature	X	
Total Kjeldahl Nitrogen (TKN)		X
Total Ammonia		X
Total Nitrogen (TN)		X
Total Phosphorous (TP)		X
Total Organic Carbon (TOC)		X
Total Suspended Solids (TSS)		X

2.1 Fecal Coliform Bacteria

Fecal Coliform bacteria counts are problematic within the Town's MS4 as evidenced by the fact that a fecal bacteria TMDL has been developed for the Southwest Fork of the Loxahatchee River. The criteria for class II waters, such as the Southwest Fork, are summarized in **Table 2**.

Fecal Coliform bacteria counts measured at each of the permanent water quality monitoring stations are provided in **Figure 2**. The single sample limits of 43 counts/100 mL and 800 counts/100 mL for the TMDL and general Class II Waters, respectively, are included for comparison purposes. The average annual counts are depicted in **Figure 3**. There does not appear to be significant changes in Fecal Coliform Bacteria in any monitoring stations with the exception of Station 74, where levels have generally increased since 2010.

Table 2 – Applicable Water Quality Standards for Fecal Coliform Bacteria

Governing Criteria	Description
Class II Water Body (per 62-302.530 F.A.C)	Median Most Probable Number (MPN) shall not exceed 14 counts/100 milliliters (mL)
	MPN shall not exceed 43 counts/100 mL in more than 10% of samples
	MPN shall not exceed 800 counts/100 mL on any one day
Loxahatchee River Southwest Fork TMDL	MPN shall not exceed 43 counts/100 mL in any one sampling event

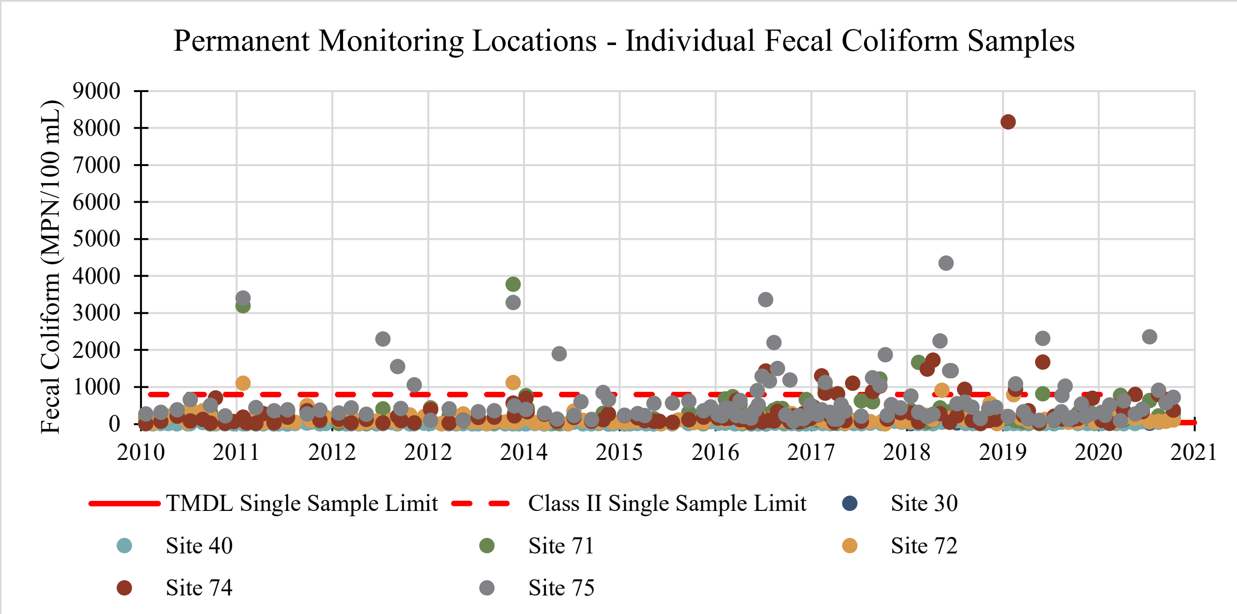

Figure 2 – Fecal Coliform Bacteria Counts at the Six Permanent Water Quality Monitoring Locations

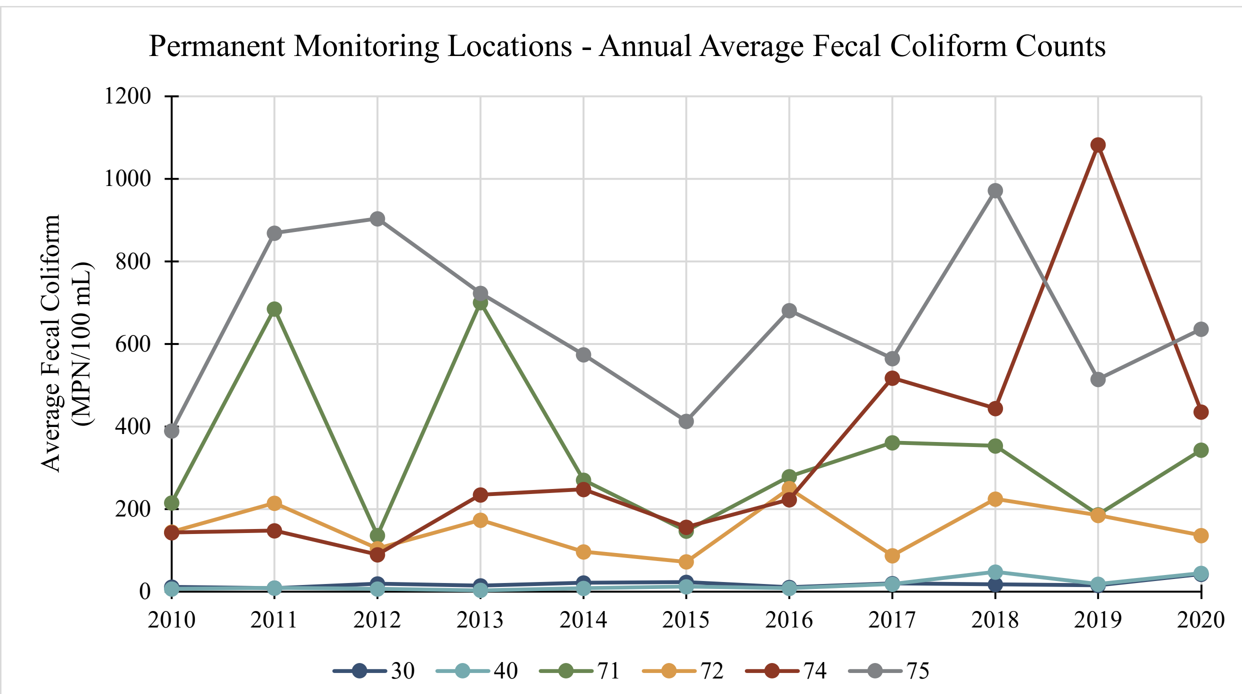

Figure 3 – Annual Average Fecal Coliform Bacteria Counts at the Six Permanent Water Quality Monitoring Locations

While the annual average has not changed significantly in most cases, the frequency of exceeding the 800 count/100 mL Class II water criteria has generally increased since 2010. A summary of total exceedances of the TMDL single sample limit and the Class II single sample limit is presented in **Table 3**.

Table 3 – Summary of Fecal Coliform Bacteria Exceedances

Station	Collection Period of Record (MM/YY)	Total Samples (n)		Quantity of Samples >43 counts/100 mL (% of samples)		Quantity of Samples >800 counts/100 mL (% of samples)	
		2016 and Later	Total Period of Record	2016 and Later	Total Period of Record	2016 and Later	Total Period of Record
30	01/91 – 10/20	23	166	2 (9%)	17 (10%)	0 (0%)	0 (0%)
40	08/92 – 10/20	57	249	8 (14%)	27 (11%)	0 (0%)	0 (0%)
71	08/92 – 10/20	73	216	70 (96%)	191 (88%)	4 (5%)	8 (4%)
72	02/92 – 10/20	140	252	53 (38%)	183 (73%)	3 (2%)	9 (4%)
74	07/09 – 10/20	74	125	68 (92%)	107 (86%)	15 (20%)	15 (12%)
75	09/07 – 10/20	81	138	81 (100%)	138 (100%)	20 (25%)	27 (20%)

Exceedances of both limits (43 counts/100 mL and 800 counts/100 mL) are most commonly observed in the upstream reaches of Jones and Sims Creek (Stations 75 and 74, respectively). The monitoring locations near the confluence of Jones and Sims Creek and the Southwest Fork of the Loxahatchee River are similar in quality when evaluating the frequency of exceedances compared to both the TMDL and Class II water quality criteria. In contrast, Stations 30 and 40 both show Fecal Coliform levels which meet the general Class II water quality criteria for samples collected and exceed the Southwest Fork TMDL limit of 43 counts/100 mL at a much less frequent rate than other sampling locations. It should be noted that monitoring stations 30 and 40 are outside of WBID 3226C, which is covered by the fecal coliform TMDL. The frequency of fecal coliform levels exceeding the TMDL limit of 43 counts/100 mL were included for comparison purposes but measurements exceeding this amount do not represent water quality that is not in compliance with the water quality standards.

Due to the frequent impairments observed at water quality monitoring station 75 (upstream reach of Jones Creek), additional short-term sampling is being conducted in an effort to identify the contaminant source(s). The Town partnered with the Loxahatchee River District (LRD) to perform a detailed evaluation of the elevated fecal coliform levels in the basin (**Attachment 1**). The analysis consisted of deploying two near-continuous water quality monitoring instruments (Data Sondes) to test for turbidity, chlorophyll, salinity, temperature, dissolved oxygen, pH and water level at a 15-minute sampling interval. Furthermore, quantitative polymerase chain reaction (qPCR) was used to determine if human genetic material was present. Results showed that human waste was present while chemical indicators were absent indicating possible pollution from a single household or homeless encampment. The genetic tests, coupled with the data sonde data, have not yet been able to be used to pinpoint a timeframe, specific site/location, or specific hydrologic/physical condition related to the observed contamination of the waterway. The issue will continue to be evaluated in an effort to ultimately formulate a remedy as more data become available.

2.2 Nutrients

While exceedances are more commonly observed with Fecal Coliform bacteria compared to other parameters within the Town's MS4, nutrients remain an important water quality metric that is tracked by the Town as part of the continuous monitoring performed within the MS4 and the short-term monitoring performed in the headwaters of Jones Creek. Furthermore, the Town continues to be a cooperative stakeholder in the implementation of the Loxahatchee River Reasonable Assurance Plan (RAP). A brief review of nutrient concentrations within the limits of the Town's MS4 is provided below.

Total Nitrogen

Total Nitrogen (TN) concentrations are evaluated for compliance based on the comparison to an annual geometric mean (AGM) limit of 1.26 mg/L for the water quality monitoring located within the Southwest Fork or waterbodies which discharge to it. Station 30 is located within the Intracoastal Waterway and Station 40 is located within the Lower Loxahatchee River which have a criterion that the TN AGM concentration not exceed 0.66 mg/L and 0.63 mg/L, respectively. AGMs recorded since 2010 are summarized in **Table 4** and **Figure 4** for the six permanent monitoring stations.

When comparing the water quality data collected at the permanent monitoring stations to the AGM criteria it is clear concentrations are commonly in compliance throughout the Town's monitoring network. Only one exceedance is observed (Station 74) from 2010 to present.

Table 4 - Total Nitrogen AGM

Monitoring Station ID	Total Nitrogen Compliance											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	Samples (n)
30	0.291	0.274	0.237	0.232	0.244	0.200	0.262	0.297	0.327	0.257	0.423	4
40	0.202	0.279	0.212	0.206	0.219	0.246	0.275	0.265	0.307	0.271	0.340	10
71	0.421	0.436	0.389	0.409	0.411	0.449	0.498	0.411	0.469	0.427	0.662	4
72	0.462	0.582	0.492	0.481	0.549	0.548	0.703	0.741	0.674	0.608	0.592	10
74	1.160	1.067	1.207	0.927	0.993	1.032	1.404	1.249	1.157	1.044	1.039	4
75	0.781	0.577	0.708	0.471	0.667	0.617	0.644	0.670	0.601	0.643	0.780	5

Footnote 1: Based on samples collected at the permanent water quality monitoring stations.

Footnote 2: Red entries represent values that exceed the AGM limit. Compliance at Stations 30 is based on comparison with the Intracoastal Waterway NNC (0.66 mg/L) and Station 40 is based on comparison with the Lower Loxahatchee NNC (0.63 mg/L) while all other stations are compared to the Southwest Fork NNC (1.26 mg/L).

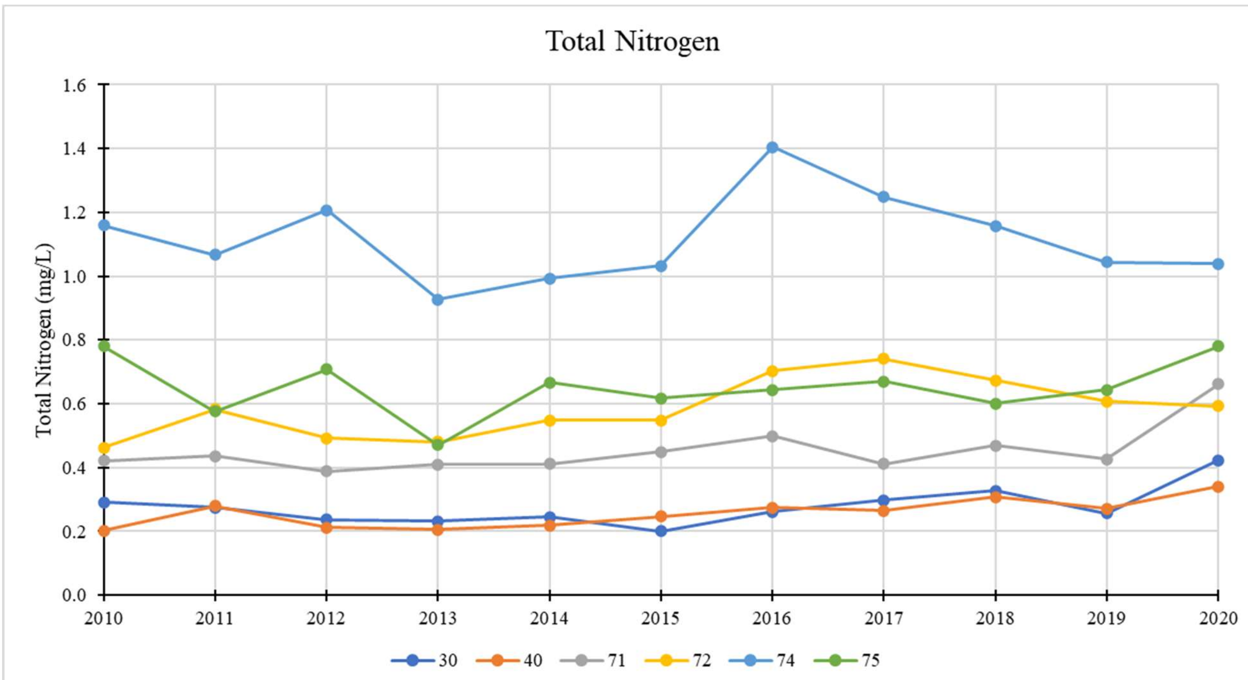

Figure 4 – Annual Average Total Nitrogen Concentrations (Graphical Representation of Table 4)

Total Phosphorus

Total Phosphorus (TP) concentrations are evaluated for compliance based on the comparison to an AGM limit of 0.075 mg/L for stations within or adjacent to the Southwest Fork. Limits of 0.035 mg/L (Intracoastal Waterway) and 0.032 mg/L (Lower Loxahatchee River) were used for Stations 30 and 40, respectively. AGMs recorded since 2010 are summarized in **Table 5** and **Figure 5** for the six permanent monitoring stations.

TP concentrations exceed the AGM criteria at only two (2) of the six (6) permanent water quality monitoring stations with the impacted stations being the upstream reach of Jones Creek and the upstream reach of Sims Creek. Exceedances are commonly observed at those two locations from 2010 to present. Recent trends show concentrations at Station 74 decreasing from previous highs and retreating to levels observed in 2010-2012. No significant changes were observed at Station 75.

Despite the upstream reach of Jones Creek (Station 75) meeting the AGM criteria in 2017 and 2018, single sample concentrations measured at the headwaters of the basin commonly exceed the AGM criteria. The Town has performed rigorous analyses of the short-term sampling results coupling the concentrations with other parameters such as rainfall and tide but a strong correlation between concentrations and other conditions has yet to be established. The Town will continue to monitor the upstream reaches of Jones Creek and modify the sampling locations as appropriate in an attempt to more accurately locate the source(s) of phosphorus being discharged to the creek. Much of the loading is likely a nonpoint source from the community surrounding Jones Creek. Many of the yards for the homes abut the canal bank and therefore pet waste, yard waste/grass clippings, and improper fertilizer applications may be contributing to the observed exceedances.

Table 5 - Total Phosphorus AGM

Monitoring Station ID	Total Phosphorus Compliance											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	AGM (mg/L)	Samples (n)
30	0.028	0.024	0.024	0.022	0.022	0.025	0.022	0.025	0.029	0.022	0.028	4
40	0.014	0.015	0.018	0.014	0.013	0.013	0.019	0.021	0.018	0.016	0.019	10
71	0.047	0.045	0.036	0.046	0.044	0.046	0.040	0.033	0.041	0.032	0.056	4
72	0.035	0.033	0.040	0.036	0.038	0.039	0.037	0.033	0.034	0.037	0.033	10
74	0.061	0.052	0.049	0.085	0.077	0.084	0.071	0.086	0.106	0.062	0.055	4
75	0.098	0.072	0.102	0.079	0.088	0.087	0.075	0.067	0.069	0.094	0.100	5

Footnote 1: Based on samples collected at the permanent water quality monitoring stations.

Footnote 2: Red entries represent values that exceed the AGM limit. Compliance at Stations 30 is based on comparison with the Intracoastal Waterway NNC (0.035 mg/L) and Station 40 is based on comparison with the Lower Loxahatchee NNC (0.032 mg/L) while all other stations are compared to the Southwest Fork NNC (0.075 mg/L).

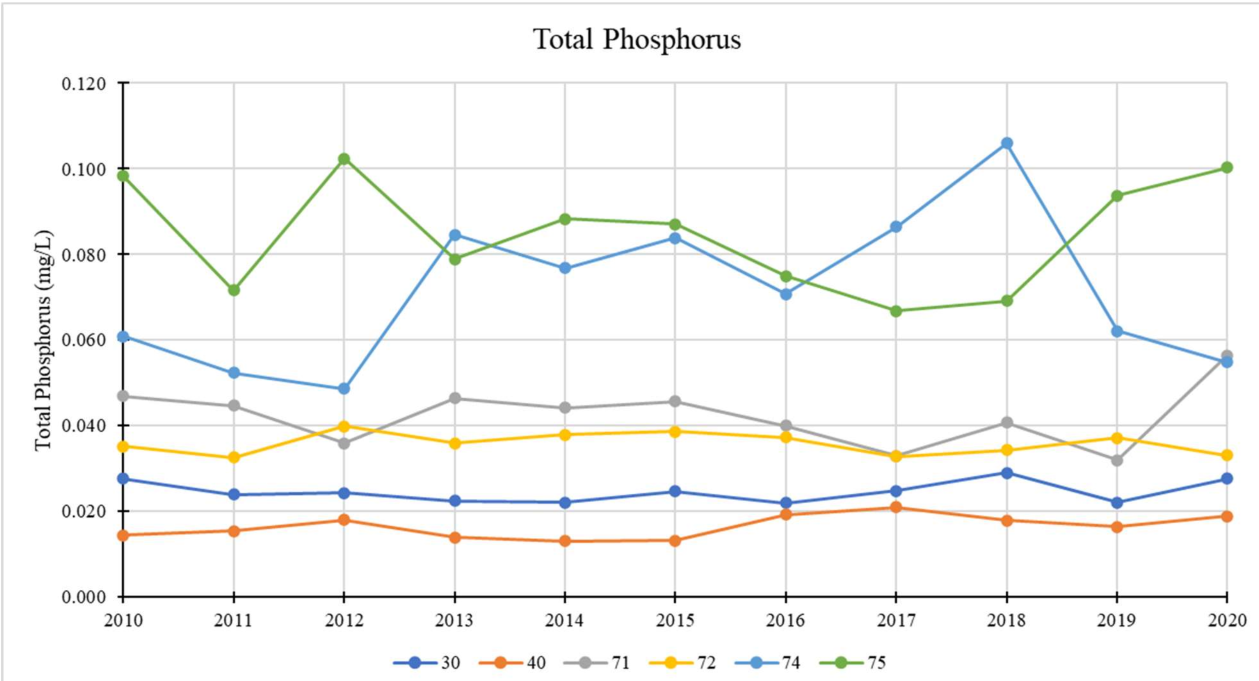

Figure 5 – Annual Average Total Phosphorus Concentrations (Graphical Representation of Table 5)

2.3 Chlorophyll-α

The Chlorophyll-α AGM criteria is 5.5 ug/L for stations located within or adjacent to the Southwest Fork, 4.7 ug/L for Station 30 located in the Intracoastal Waterway, and 1.8 ug/L for Station 40 located in the Lower Loxahatchee. The AGMs calculated at each of the permanent water quality monitoring stations within the Town's MS4 from 2010 to present are provided in **Table 6** and **Figure 6**. Not including Station 30, which has been consistently in compliance with the exception of 2020 (based on a partial year of data), exceedances occur regularly at monitoring stations located within the Town's MS4. All other monitoring locations have exceeded the AGM criteria every year from 2010 to present except for Station 71, which has been in compliance for one year.

The consistent exceedances of the Chlorophyll-α AGMs are a driving factor for the development of the Loxahatchee River RAP. Stakeholders within the Loxahatchee River watershed (including the Town) have identified projects and/or programs to help reduce nutrient concentrations in order to ultimately achieve Chlorophyll-α concentrations in compliance with the applicable Numeric Nutrient Criteria (NNC). In addition, unimpaired nutrient reductions are required by FDEP in the Loxahatchee River RAP in order to comply with NNC.

Table 6 – Chlorophyll-α AGM

Monitoring Station ID	Chlorophyll α Compliance											
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	AGM (ug/L)	Samples (n)
30	5.45	3.90	3.95	3.12	3.94	3.93	3.93	2.93	4.13	4.280	4.800	4
40	2.42	2.55	2.54	1.52	1.97	2.38	2.71	2.07	2.33	2.386	2.569	10
71	9.96	6.52	8.18	9.17	7.21	6.94	8.43	5.30	6.21	6.876	10.279	4
72	14.77	8.97	10.53	9.81	10.00	10.28	9.79	6.08	5.89	8.612	7.371	10
74	18.31	9.46	10.64	15.85	17.54	12.25	12.57	15.77	25.18	9.777	7.933	4
75	16.43	6.05	8.84	7.30	8.54	9.21	8.26	5.90	10.83	6.222	7.401	5

Footnote 1: Based on samples collected at the permanent water quality monitoring stations.

Footnote 2: Red entries represent values that exceed the AGM limit. Compliance at Stations 30 is based on comparison with the Intracoastal Waterway NNC (4.7 ug/L) and Station 40 is based on comparison with the Lower Loxahatchee NNC (1.8 ug/L) while all other stations are compared to the Southwest Fork NNC (5.5 ug/L).

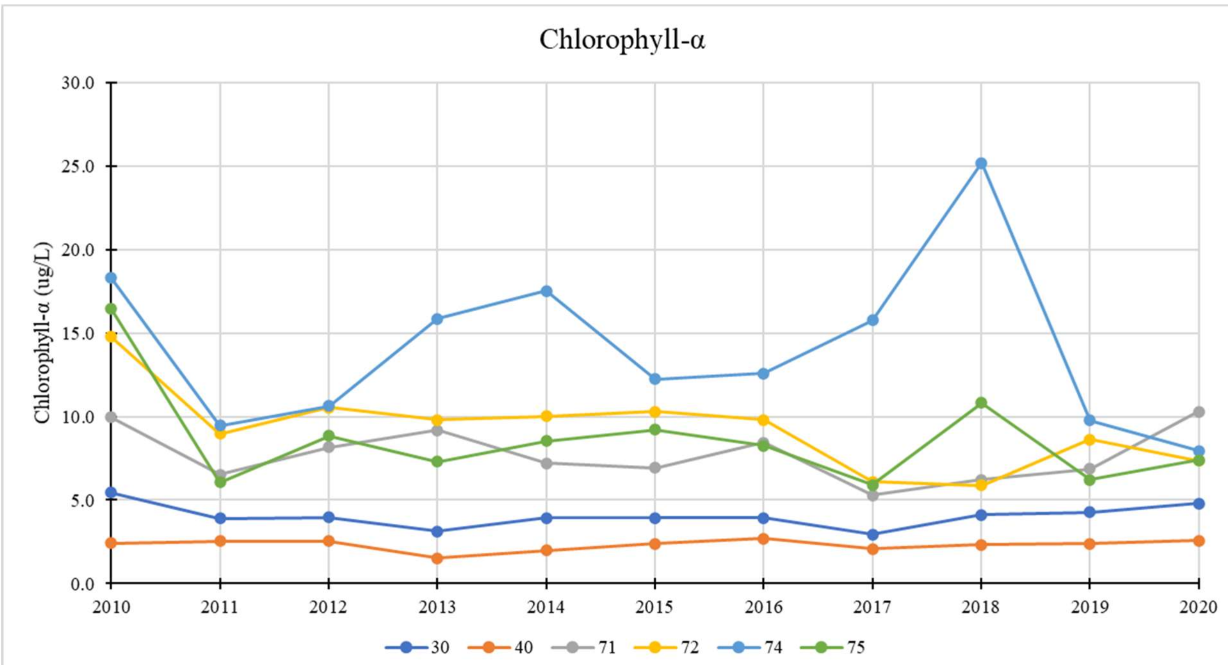

Figure 6 – Annual Average Chlorophyll-α Concentrations (Graphical Representation of Table 6)

3. Plan for Implementing Changes

As part of the Year 2 Annual Report requirements of the NPDES MS4 Cycle 4 permit, review of the Town's land development codes was performed in order to evaluate the potential for techniques/procedures that may be incorporated into the regulations in an effort to augment their stormwater management practices. The Town of Jupiter is continually updating its development practices standards. In the Year 2 report, the numerous areas in the Town's current regulations and programs were documented where the Town has already developed, incorporated and implemented many practices in their stormwater management program aimed at controlling stormwater impacts from development. The Year 2 report stated that the Town does not currently have any specific plans for implementing changes, but the following steps were suggested and will be continued to follow as the opportunities arise:

- Revise the Town of Jupiter Utilities Guide for Development to include any proposed changes.
- Prepare and recommend to the planning commission and Town council, any proposed amendments to the Comprehensive Plan that will facilitate the additional goals / refinements.
- Once CP Amendments are approved, the CP shall be implemented by the adoption and enforcement of revisions to the applicable land development regulations in the Code. Develop ordinances that will be reviewed for codification.

Since the year 2 report, the following techniques/procedures have been incorporated into the regulations in an effort to augment stormwater management practices:

- Increased the frequency of street sweeping by 18% year over year from 2019 to 2020.
- Actively designing a mangrove and exotic species trimming and removal project in accordance with the previously completed 2003 dredging project under Environmental Resource Permit (ERP) 50-0206897-003, at Jupiter River Estates in part to improve documented water quality issues.

4. Conclusions

Fecal Coliform bacteria continue to be problematic throughout the Town's MS4 as evidenced by frequent exceedances of the single sample limit prescribed in the TMDL, in addition to frequent exceedances of the less stringent Class II single sample limit. In contrast, TN concentrations are generally in compliance with the AGM criteria throughout the MS4 and TP concentrations often exceed the limit in the Jones and Sims Creek upstream monitoring stations but are in compliance throughout the rest of the MS4.

While nutrient concentrations are not elevated across the entire MS4, Chlorophyll-α concentrations nearly always exceed the limit (with the lone exception being Station 30). Elevated Chlorophyll-α levels could be partially attributed to excessive nutrient loadings accelerating algae growth within the receiving waterbody.

The Town has been successful in significantly reducing pollutant loadings to the receiving water bodies and will continue to strive for additional reductions with future projects whenever possible. In addition to the work already completed, the Town continues to implement water quality improvement features in projects whenever possible with many of these future projects being incorporated in the Loxahatchee River RAP.

Attachment 1

Jones Creek Drainage Basins Fecal Indicator Bacteria (FIB) and Turbidity Monitoring Preliminary Findings Summary (Prepared by Loxahatchee River District)

Jones Creek Drainage Basins Fecal Indicator Bacteria (FIB) and Turbidity Monitoring Preliminary Findings Summary – November 2019

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Summary

This report provides a summary of preliminary findings from a special project conducted by the Loxahatchee River District (LRD) in partnership with the Florida Department of Environmental Protection (FDEP). The goal of this project is to try and improve our understanding of the source(s) of elevated Fecal Indicator Bacteria (FIB) concentrations and high turbidity events in the Jones Creek drainage basin in the Loxahatchee River watershed in Jupiter, Florida.

Some noteworthy observations include:

- Genetic testing indicates the presence of low levels of human waste. The concentrations and lack of common chemical tracers are indicative of a single household, rather than broken wastewater infrastructure. These findings are leading us to adjust our monitoring locations to try and narrow in on potential pollution sources such as a camper discharge, a homeless encampment, a residence still utilizing a septic system, or a broken sewer lateral line joining an individual home to the main gravity sewer line.
- Water quality instrumentation ('Data Sonde') has provided insight into the ranges and variation of turbidity, chlorophyll, light, salinity, pH, dissolved oxygen, and tide stage within the creek, as well as interesting patterns and relationships between the parameters.
- Our research is confounded by, and we urge residents to stop detrimental behaviors such as the dumping of fish and (reported) alligator carcasses, pet waste, grass clippings, vegetation and other wastes into Jones Creek.

While we do not fully understand all the factors driving the high bacteria and turbidity issues in Jones Creek, we are building on our understanding of factors, and identifying key problem areas that we can focus on for water quality improvements. LRD will continue to monitor the water quality in Jones Creek and will proceed with the dry season sampling in this collaborative study with FDEP.

Background

FIB are used as an indicator of human waste in surface waters. Studies have linked high FIB concentrations to an increase in human-born illnesses/pathogens. Thus, the concentrations of FIB are a concern to any recreational waterway. Turbidity is a measure of water clarity, where particles (mineral or organic debris) remain suspended in the water column and this decrease water clarity. Turbidity can be a natural occurrence due to wind, waves and tides, or can be related to surface discharges, such as sediment/mineral or pollutant inputs upstream. The decrease in water clarity can be detrimental to organisms requiring light penetration on the seafloor and makes the water unappealing for recreational use.

Over the past several years, the LRD, in partnership with the Town of Jupiter, has conducted extensive water quality monitoring and thoroughly explored the watersheds to try and identify the potential source(s) of FIB and high turbidity. With no obvious source of the high FIB values, LRD and FDEP partnered to capitalize on FDEP's more sophisticated analytical methods to further investigate the potential sources of FIB. In addition, LRD deployed a pair of near-continuous water quality monitoring instruments in Jones Creek to explore the results and relationships between turbidity, chlorophyll, salinity, temperature, light, dissolved oxygen, pH and water level. This project includes twice monthly wet season monitoring from August through September, and dry season sampling to January 2020. These preliminary results summarize the wet season results of water quality samples collected through September 25th, 2019.

Wet Season Sampling & Results

Enterococci and fecal coliform are both FIB commonly used as an indicator of human waste when detected in high counts in surface waters. Enterococci exceedances in Jones Creek range from the 100+ to 5,000+ MPN/100mL, well above the Environmental Protection Agency's (EPA's) recommended Beach Action Value (BAV) of 71 MPN/100mL for recreational waters. This is a concern for the residents and environmental managers.

LRD has conducted extensive water quality monitoring and thoroughly explored the watershed to try and identify the potential source(s) of FIB. With no obvious source of the high FIB values, LRD is now collaborating with Florida Department of Environmental Protection (FDEP) experts to further investigate the potential sources of FIB.

Samples were collected from the locations indicated in Fig. 1; further described in Table 1. Each sample location is near a source of incoming water (e.g., creek, culvert or storm drain) and chosen to assist in the determination of a FIB source. In Jones Creek, sample location 75 reflects tidal inputs (75 is also directly upstream of a possible homeless encampment), PLE discharges through a slough (PLE is a Town of Jupiter natural area and possible homeless encampment), during extreme rains and high lake levels TPJ drains a golf course community to the south and JCU drains adjacent commercial/residential neighborhoods (flow in and out of JCU is restricted by vegetation and mangrove overgrowth). Add statement to describe site CALC.

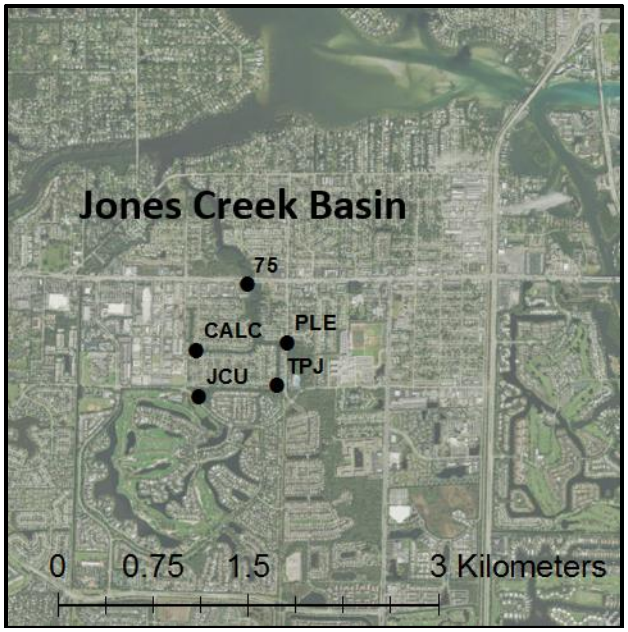


Figure 1. Map of sample locations in Jones Creek, a tributary into the Loxahatchee River in Jupiter, Florida.

Table 1. Description of water quality sampling locations

Site Name	Site ID	Description	Latitude	Longitude
Indiantown Rd Bridge	75	Deep mangrove lined channel.	26.933685	-80.113127
Caloosahatchee Culvert	CALC	Culvert bridge on Caloosahatchee Dr.; shallow mangrove creek with low sunlight.	26.929011	-80.117231
Toney Penna Jones Creek	TPJ	Toney Penna Foot Bridge; clearing in mangrove tidal creek.	26.926428	-80.110738
Jones Creek Upper	JCU	Culvert across from Jupiter Christian Academy; shaded, freshwater vegetation, flow often restricted.	26.925715	-80.116983
Pennock Lane East	PLE	Immediately upstream of weir structure draining natural area.	26.929480	-80.109928

All samples were collected by LRD's Wildpine laboratory staff. 5 samples were collected per sampling event at 0.3 m depth during an outgoing tide (preferably mid to end ebb). Wet season sampling included Aug 12, Aug 27, Sep 10, Sep 25, 2019. Samples were processed according to the standard/NELAC certified methods and/or using FDEP's pre-packaged 'kits' and sent on ice overnight to FDEP's Laboratory for confirmatory FIB and further analysis.

Environmental Parameters and Water Quality

During sample collection LRD staff collected environmental data including (methods in parenthesis): temperature (EPA 170.1), salinity (SM 2520 B), conductivity (EPA 120.1), pH (EPA 150.1), dissolved oxygen (mg/L EPA 360.1; percent FDEP FT1500), rainfall and tidal stage. After collection samples were processed for chlorophyll-a (SM 10200 H), turbidity (EPA 180.1), orthophosphorous (SM 4500-P F), total phosphorous (SM 4500-P E), nitrate and nitrite (EPA 353.2), total kjeldahl nitrogen (EPA 351.2), total nitrogen (calculation) and Enterococci (Enterolert/QT) at LRD's WildPine Laboratory.

Across the entire watershed average rainfall ranged from 13 inches in August to 4 inches in September (See https://loxahatcheeriver.org/river/rainfall/). In the Wet season temperatures ranged from 25.4°C (77.7°F) to 31.84°C (89.3°F). Both turbidity and chlorophyll-a (measure of algal biomass) increased as temperatue, pH and dissolved oxygen decreased (Fig. 2).

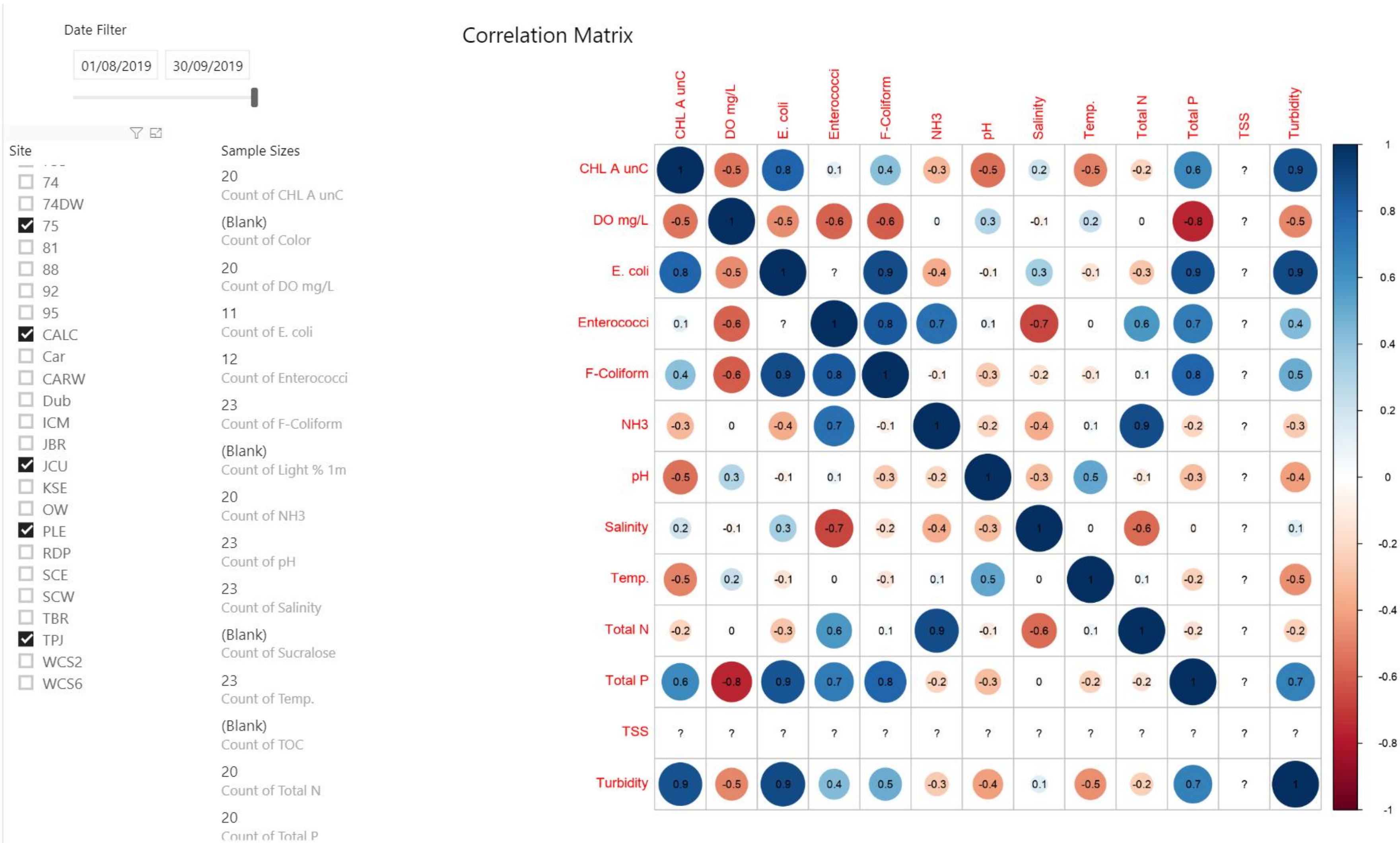


Figure 2. Correlation Matrix of water quality parameters measured in Jones Creek. Interactive version available at LRD's website: Loxahatcheeriver.org/river/river-keeper.

Chemical Indicators

Most humans ingest forms of chemicals that are not processed during digestion and can be detected in human waste material. Common chemicals include: Acetaminophen, Naproxen, Ibuprofen, hydrocodone and sucralose. All five chemical tracers were analyzed, however in the wet season in Jones Creek only sucralose (a sweetner found in treated and untreated human waste) was measured above the FDEP minimum detection limits. See https://fldeploc.dep.state.fl.us/sop

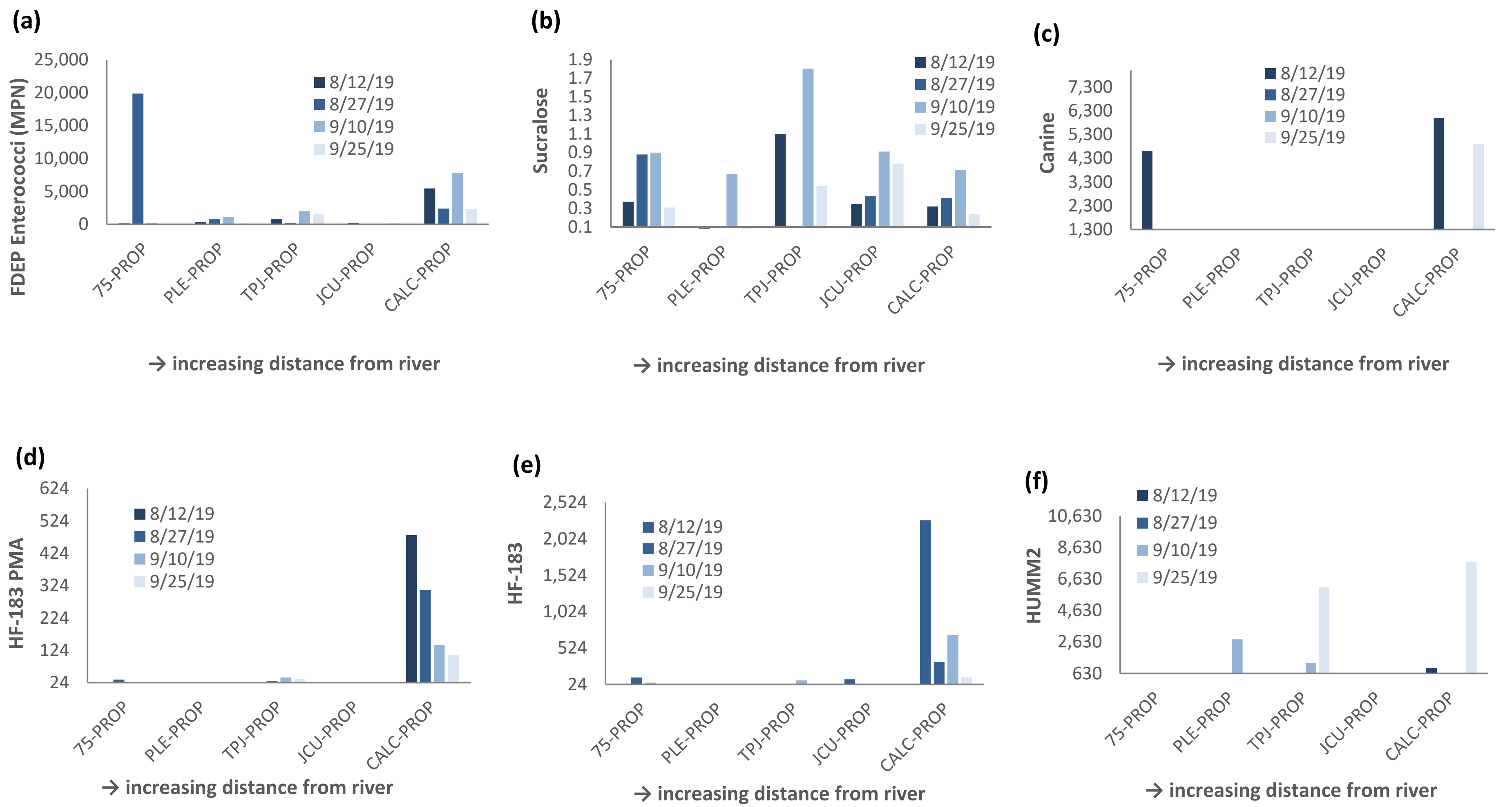
Genetic Markers

Quantitative polymerase chain reaction (qPCR) is a laboratory technique used to detect genetic material. Here three markers/methods were used to determine human genetic material; *Bacteroides* 16S rRNA gene targets using HF-183, *Bacteroides* 16S rRNA gene targets using HF-183 propidium monoazide (PMA) to differentiate between live and dead cells and a *Bacteroides* non-16S rRNA gene target PCR-HUMM2. Markers were also used to detect the genetic material of canines. Populations of raccoons and wading birds have been noted in this basin, There is no current genetic marker available to determine the presence of raccoons, and bird markers were not tested. LRD collected samples and all qPCR analyses was conducted by FDEP at the FDEP Molecular Biology Laboratory following the designated standard operating procedures (SOPs). See https://floridadep.gov/dear/florida-dep-laboratory/content/molecular-biology

Initial results indicate continued high levels of FIB in Jones Creek. The caloosahatchee culvert station (CALC-PROP) upstream in Jones Creek consistantly had higher FIB (Fig. 3a), higher HF-183 PMA (Fig. 3d), and HF-183 (Fig. 3e) human genetic material, as well as the highest concentration of canine genetic material (Fig. 3c). The exception was high FIB (Fig 3a) and canine genetic material (Fig. 3c) at station 75 – the closest monitoring station to the Loxahatchee River- on August 12th 2019.

The presence of human waste in the genetic markers, with the absence in the chemical indicators is indicative of low concentrations indicative of a single household, rather than broken wastewater infrastructure. These findings are leading us to adjust our monitoring locations to try and narrow in on those potential pollution sources such as a camper discharge, a homeless encampment, a residence still utilizing a septic system, or a broken sewer lateral line joining the home to the gravity sewer line.

Figure 3. Initial results for (a) enterococci FIB, (b) sucralose (chemical indicator of human waste), (c) qPCR canine genetic material, and qPCR Human genetic markers showing (d) Propidium monoazide (PMA) treated 'live' Bacteroides , (e) HF-183 live and dead Bacteroides and (f) HUMM2 Bacteroidetes non-16S rRNA gene targets.

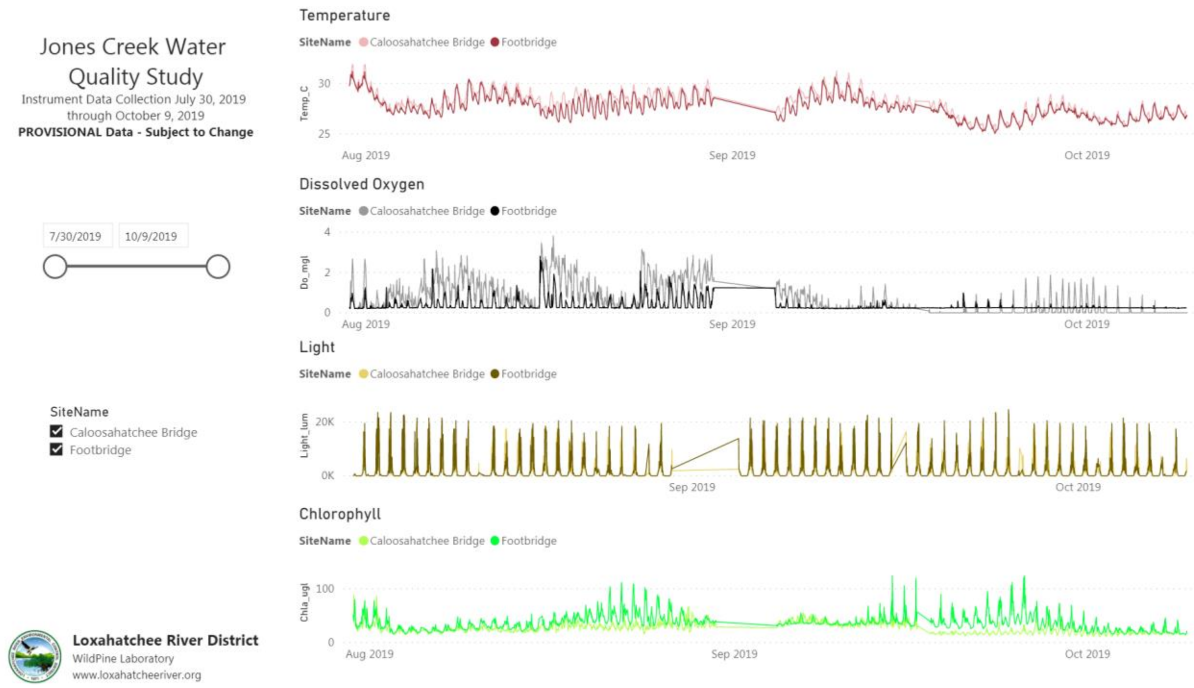


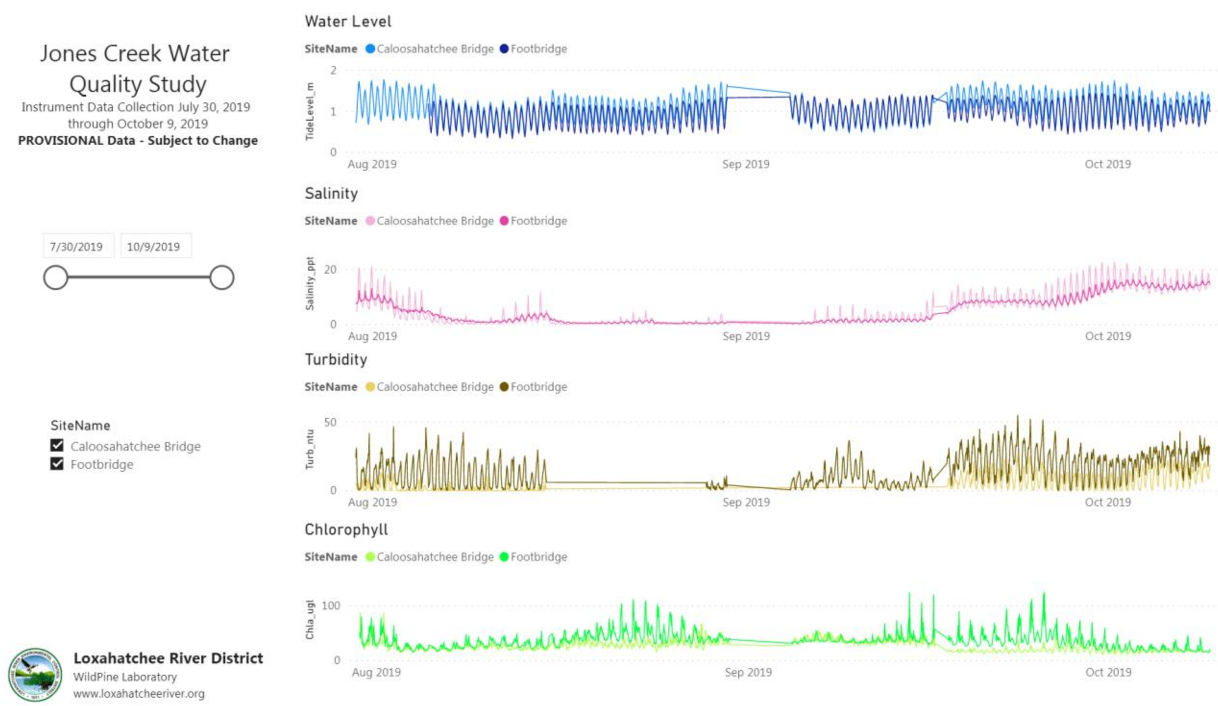
High Frequency Water Quality Data Collection – Data Sonde Instruments

In support of this special project, and to improve our understanding of the patterns and magnitude of changes in various water quality parameters, LRD deployed a pair of near-continuous water quality monitoring instruments ('Data Sondes') in Jones Creek. The instruments (Hydrolab DS5X) had sensors for turbidity, chlorophyll, salinity, temperature, dissolved oxygen, pH and water level set to record data every 15-minutes. The instruments were deployed from residential docks near the Caloosahatchee Bridge (near the CALC water quality monitoring station) and near the Footbridge (near the TPJ water quality monitoring station) from July 30, 2019 through October 9, 2019. The instruments were deployed for two weeks then brought back to the laboratory for data download, cleaning and calibration. Quality control (QC) measurements were made at the time of deployment, at one week out, then just prior to removal with a separate instrument and/or known calibration concentration. If the data for that deployment was glaringly wrong it was deleted from the dataset, though for this preliminary data review we were less aggressive with data filtering to preserve as much as the information as possible. Light sensors (Onset Computer Corp) were also deployed to assess diurnal patterns in water quality parameters. All instruments were removed on August 30 because a powerful hurricane (Dorian) was forecast to strike our area, then redeployed on September 4.

All of the Data Sonde data is presented in a multitude of interactive data visualizations available from the Jones Creek web page provided by LRD: www.loxahatcheeriver.org/JonesCreek. Not surprisingly water temperatures were high with some measurements over 31^{o}C (89^{o}F). Temperatures dipped to approximately 25^{o}C (77 ^{o}F) during a few early mornings. Dissolved oxygen (DO) levels were generally very low and hypoxic (<2 mg/L), common in mangrove tidal creeks. DO showed more variability during the period prior to the hurricane when there were more rain events compared to September when there was very little rain. Salinity ranged from near zero to over 22 psu and was highly influenced by the tide cycle. In general, salinity tended to decrease during periods of increased rainfall. The Caloosahatchee site showed more variability in salinity that the Footbridge site further upstream. Turbidity values varied with substantial diurnal fluctuations ranging from zero to near 50 NTU in each tide cycle. This common in shallow tidal regions, where sediments are easily resuspended by tidal currents. Unfortunately, the turbidity data did not pass QC for several deployments and was deleted (shown as gaps in Fig. 4), but the data indicated high variability and generally higher readings during periods of little rainfall. Lastly, chlorophyll values, a measure of algae productivity, were also high and variable ranging from the teens to over 100 ug/L. The chlorophyll values and light data confirmed the diurnal pattern with high chlorophyll concentrations during daylight hours. Like other parameters, the Caloosahatchee site showed greater variability and generally higher concentrations of chlorophyll. On the Jones Creek website page 7 of the visualizations shows the correlation matrix with some moderate positive and negative correlations between parameters, but some of these relationships are notably different between the two sites.

Figure 4. Sample screens of the interactive data visualization tools to explore the water quality data collected by instrumentation near the Caloosahatchee Bridge and the Footbridge in Jones Creek available on LRD's website: www.loxahatcheeriver.org/JonesCreek.





Conclusions

Neither the high FIB nor the high turbidity in Jones Creek can be attributed to an isolated timeframe, specific site/location, or related to any singular water quality measure. This suggests a combination of factors leading to decreased water quality in Jones Creek. LRD will continue to collaborate with FDEP to both isolate problem areas and develop potential solutions starting with priority site CALC.

During data collection we have noticed a several issues that can be addressed by the public. Some of these examples include finding fish, lobster, and alligator carcasses, pet waste bags and landscape vegetation floating and along the bridge banks of Jones Creek. Any dead and/or decaying matter is likely to harbor bacteria and will not improve water quality. We urge residents to refrain from discarding waste products into the creek.

Dry season sample collection is underway until January 2020. We intend to prepare a summary report once all of the results are finalized.

Town of Jupiter

Water Quality Master Plan
(Jones and Sims Creeks)

May 29, 2015

Prepared by:

HAZEN AND SAWYER
Environmental Engineers & Scientists

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Executive Summary

The Loxahatchee River was recently classified as being impaired along certain segments for water quality parameters such as Chlorophyll α, fecal coliform, and dissolved oxygen (DO). Water quality data were collected by the Loxahatchee River District (LRD) at five sampling locations along Jones and Sims Creeks (four grab sample locations and one datasonde location). These data were compared to the current Florida Department of Environmental Protection (FDEP) criteria in order to determine which parameters were of greatest concern in both creeks. After a detailed analysis of water quality data was completed, drainage area characteristics were analyzed in order to identify potential pollutant sources and corresponding remedial actions.

Fecal coliform and Chlorophyll α levels commonly exceeded the FDEP criteria in three of the four grab sample locations. Based on the high percentage of residential area within both drainage areas, the elevated fecal coliform levels may have been primarily attributable to pet waste. Based on sucralose concentrations, which are an indicator of either treated or untreated human waste, a portion of the fecal coliform load may have originated from septic tanks. Active septic tanks exist in the Sims Creek drainage area and in areas such as Pennock Point, which is outside of the drainage area but may still have an effect due to tidal fluctuations. The elevated Chlorophyll α concentrations may have been a result of stagnant water in each creek, which increases the availability of nutrients to be assimilated by aquatic vegetation. A high nutrient input to each creek may have also played a role in the observed Chlorophyll α concentrations. DO levels are directly related to Chlorophyll α and were typically lower in the upstream reach of both creeks, further indicating that stagnant water may have been detrimental to the water quality in these locations.

Due to the developed nature of both drainage areas, it is recommended that a series of programmatic efforts such as educational flyers and signage be implemented prior to other actions which may require more capital. Furthermore, additional water quality samples should be collected in both creeks, particularly in the upstream reach of Jones Creek. These additional data may allow for greater spatial and temporal specificity of the pollutant sources and could allow for a more effective approach to be developed for reducing pollutant loads in both creeks.

Section 1.0
Introduction

The Loxahatchee River was recently classified as being impaired along certain segments for water quality parameters such as Chlorophyll α, fecal coliform, and DO. Jones and Sims Creeks are primary tributaries of the Loxahachee River. Historical monitoring of these creeks has shown evidence of pollution relative to the existence of Chlorophyll α and fecal coliform. Evaluating the drainage area for both creeks is a proactive approach to identifying areas for pollution reduction in advance of pending regulation. This will improve the health of these tributaries as well as contribute to the continued protection and enhancement of the Loxahatchee Estuary.

While a Total Maximum Daily Load (TMDL) was developed for fecal coliform by the Florida Department of Environmental Protection (FDEP) in May 2012, it was developed for the Waterbody Identification Number 3226C, which includes the entire drainage area between the S-46 structure on the western edge of Jupiter and the confluence with the northwest fork of the Loxahatchee River located approximately one mile downstream. The drainage areas for Jones and Sims Creeks are sub basins within this previously evaluated drainage area and predominantly consist of residential land use. A TMDL has not yet been established by FDEP for the Southwest Fork of the Loxahatchee River for other pollutants.

The Loxahatchee River District (LRD) provided water quality data for multiple parameters of interest, though the primary pollutants analyzed for the purposes of this report are Total Nitrogen (TN), Total Phosphorus (TP), fecal coliform, Chlorophyll α, and DO. TN and TP are nutrients which primarily originate from fertilizer, animal waste, human waste, or organic debris (e.g. yard waste). Fecal coliform levels are typically dictated by animal and human waste while Chlorophyll α and DO can be dependent on a variety of conditions including temperature, amount of sunlight, and availability of nutrients.

A total of five sampling locations within the Jones and Sims Creeks drainage areas were utilized for the water quality analysis. Both tributaries contain an upstream and downstream grab sample location: one near Indiantown Road and another at the confluence with the Southwest Fork of the Loxahatchee River. Jones Creek contains an additional location where a datasonde is installed to continually measure parameters such as water level and conductivity (see **Figure 1-1** at the end of this section). Other sampling locations in the Southwest Fork of the Loxahatchee River were also referenced to further evaluate observed fecal coliform trends. In addition to the sampling locations of interest, the watersheds associated with the Jones and Sims Creek tributaries are also illustrated in **Figure 1-1**. Land use and rainfall characteristics were coupled with the obtained water quality data to determine potential sources of pollutants within each drainage area. It is important to note that Egret Landing was excluded from the analysis. Under certain conditions surface water may be passed through Egret Landing into Sims Creek; however, under normal operating conditions this area is not hydraulically connected to Sims Creek, and as such was not included in this evaluation.

Following the analysis of the water quality data and the comparison of those data to the current FDEP standards, pollutants of concern were identified. FDEP provides separate surface water quality standards for estuarine and freshwater systems. Jones Creek and the downstream reach of Sims Creek are classified as estuarine systems while the upstream reach of Sims is classified as freshwater. The freshwater and estuarine classifications were used to compare water quality data to the appropriate FDEP criteria. After identifying pollutants of concern the sources of these pollutants were then estimated based on available data, leading to the formation of pollutant reduction strategies and a corresponding implementation plan. This implementation plan is to act as a guide for the Town of Jupiter when considering future actions aimed at remediating the water quality issues in Jones and Sims Creeks.

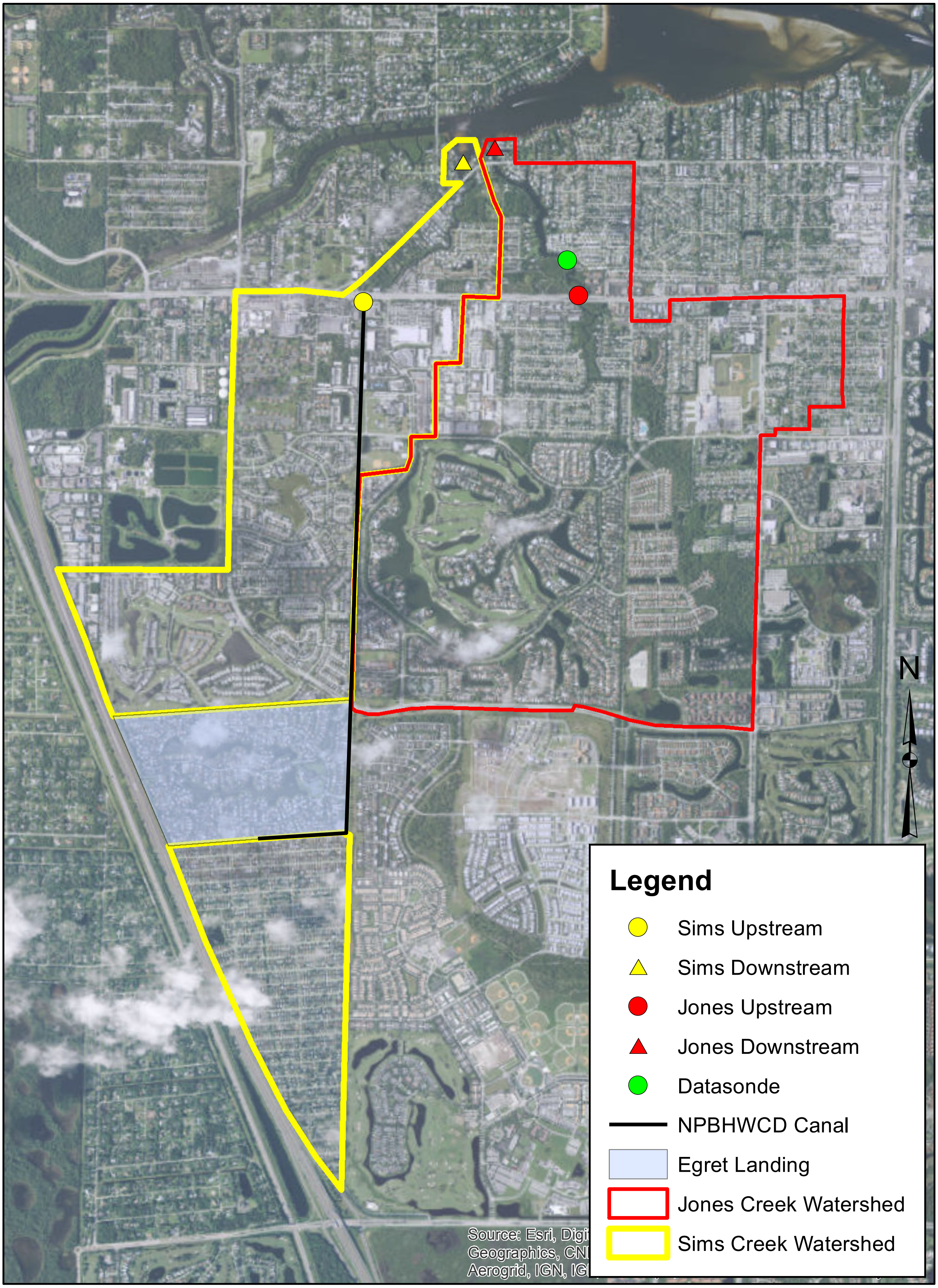

Figure 1-1 - Jones and Sims Creek Drainage Areas

Section 2.0
Data Analysis

2.1 Data Comparison

The data provided by LRD were compiled and compared to the various water quality criteria outlined by FDEP. The current FDEP numeric nutrient criteria (NNC) for TN, TP, and Chlorophyll α along with the proposed FDEP limits for DO, fecal coliform, and enterococci are provided in **Table 2.1**. Many of the parameters require samples to be collected at a higher frequency than the currently available data. For example, many of the criteria are based on daily or monthly geometric means, but the data provided typically consisted of one sample every two months. Furthermore, the FDEP criteria which stipulate that 10% of samples shall not exceed a specified threshold are exceeded if only a small number of samples during the five years exceeded the threshold due to the small number of total samples. In these cases, the annual geometric mean (AGM) was compared to the 10% exceedance criteria for sake of comparison.

The annual average concentrations measured by LRD between January 1, 2010 and December 31, 2014 for TN, TP, and Chlorophyll α are compared to the current FDEP criteria in **Table 2.2**. This time frame was used in the analysis because data for all parameters were collected throughout the entire period. While pollutants had been monitored prior to January 1, 2010 these additional data did not lead to conclusions which differ from those presented in this report and were therefore not included in the evaluation. Comparisons of DO, fecal coliform, and enterococci to FDEP criteria are provided in **Table 2.3** and the percent of total samples which failed to meet the respective FDEP 10% exceedance criteria are provided in **Table 2.4**.

Table 2.1
Summary of FDEP Criteria for the Parameters of Interest

	FDEP Criteria		Notes
	Freshwater	Estuarine	
Total Nitrogen	1.54 mg/L as AGM[1]	1.26 mg/L as AGM[2]	Annual Geometric Means (AGM) shall not be exceeded more than once in a three year period
Total Phosphorus	0.12 mg/L as AGM[1]	0.075 mg/L as AGM[2]	
Chlorophyll α	20 µg/L as AGM[3]	5.5 mg/L as AGM[2]	
Dissolved Oxygen	38% Saturation[4]	42% Saturation[4]	No more than 10% of the daily average percent DO saturation are to be below the levels shown. For estuarine waters the seven-day average DO percent saturation shall not be below 51% more than once in any twelve week period and the 30-day average DO % saturation shall not be below 56% more than once per year.
Fecal Coliform	400[5]	43[5]	Most Probable Number (MPN) counts shall not exceed the value shown in more than 10% of samples or exceed 800 in any one day. For freshwater the monthly average shall not exceed 200 and in estuarine water the median value must not be more than 14.
Enterococci		135 CFU/100 mL[6]	Monthly geometric mean shall not exceed 35 CFU/100 mL. A value of 135 CFU/100 mL shall not be exceeded on 10% of samples during any 30 day period. Monthly geometric means shall be based on a minimum of 5 samples over a 30 day period.

[1]Rule 62-302.531 F.A.C.
[2]Rule 62-302.532 F.A.C.
[3]Rule 62-303.351 F.A.C.
[4]Rule 62-302.533 F.A.C.
[5]Rule 62-302.530 F.A.C.
[6]Proposed by FDEP

Table 2.2
Comparison of Observed TN, TP, and Chlorophyll α Concentrations in Jones and Sims Creeks to the Current FDEP Criteria

Monitored Parameter	Current FDEP Estuarine AGM Criteria	Annual Geometric Mean (AGM) Calculated From Data Provided by Loxahatchee River District														
		Jones Upstream (Estuarine)					Jones Downstream (Estuarine)					Sims Downstream (Estuarine)				
		2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Total Nitrogen (mg/L)	1.26	0.78	0.58	0.71	0.47	0.67	0.42	0.44	0.39	0.41	0.35	0.52	0.66	0.56	0.55	0.68
Total Phosphorus (mg/L)	0.075	0.10	0.07	0.10	0.08	0.09	0.05	0.04	0.04	0.05	0.04	0.05	0.05	0.05	0.06	0.07
Chlorophyll α (µg/L)	5.50	20.45	8.32	11.54	8.50	10.74	12.53	8.02	10.17	10.92	8.72	14.69	10.65	11.34	10.49	12.50
	Current FDEP Freshwater AGM Criteria	Sims Upstream (Freshwater)														
		2010	2011	2012	2013	2014										
Total Nitrogen (mg/L)	1.54	1.16	1.07	1.21	0.93	0.99										
Total Phosphorus (mg/L)	0.12	0.06	0.05	0.05	0.08	0.08										
Chlorophyll α (µg/L)	20.00	24.55	12.60	13.58	19.54	21.76										

Legend

Meets FDEP Criteria
Fails to Meet FDEP Criteria
Not Sampled

Table 2.3

Comparison of Observed DO, Fecal Coliform, and Enterococci Levels in Jones and Sims Creeks to the Current FDEP Criteria

Monitored Parameter	Current FDEP Estuarine Criteria	Annual Geometric Mean (AGM) and Percent of Total Samples Which Exceed 10% Criteria														
		Jones Upstream (Estuarine)					Jones Downstream (Estuarine)					Sims Downstream (Estuarine)				
		2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Dissolved Oxygen (% Saturation)	42 [1]	29.55	35.41	22.12	40.72	28.90	70.59	68.12	77.98	80.58	65.44	76.69	61.88	69.91	69.84	55.77
Fecal Coliform (CFU/100 mL)	43 [2]	363.56	521.70	711.47	337.53	398.73	208.91	250.88	81.33	214.60	161.11	745.07	478.37	296.41	488.98	726.06
Enterococci (CFU/100 mL)	35 [3]	NS	NS	NS	199.00	248.97	NS	109.54	65.28	118.32	92.56	NS	328.17	202.57	140.65	313.12

	Current FDEP Freshwater Criteria	Sims Upstream (Freshwater)				
		2010	2011	2012	2013	2014
Dissolved Oxygen (% Saturation)	38 [1]	71.93	59.81	52.74	45.33	65.35
Fecal Coliform (CFU/100 mL)	400 [2]	65.89	92.82	64.56	164.64	174.68
Enterococci (CFU/100 mL)	N/A	NS	NS	NS	533.10	45.30

[1]*Daily minimum limit for 90% of total samples*

[2]*Daily MPN maximum limit for 90% of samples*

[3]*Monthly geometric mean (proposed by FDEP)*

NS = Not Sampled

Legend

Meets FDEP Criteria
Fails to Meet FDEP Criteria
Not Sampled

Note: The FDEP requirements listed for dissolved oxygen, fecal coliform, and enterococci require a greater number of samples in order for a direct comparison to be made. Since a total of 6-8 samples were collected by LRD during each of the five years evaluated the FDEP criteria for each parameter were directly compared to the annual geometric mean (AGM) calculated for each parameter.

Table 2.4
Percent of Total Samples Which Failed to Meet FDEP Criteria

	Percent of Total Samples Collected Between January 1, 2010 and December 31, 2014 that Failed to Meet FDEP 10% Criteria			
Sampling Location	**Jones Upstream**	**Jones Downstream**	**Sims Upstream**	**Jones Downstream**
Dissolved Oxygen	67.7	12.9	8.3	16.1
Fecal Coliform	100.0	90.3	8.3	84.9
Enterococci	50.0	28.6	50.0	58.3

Legend
Meets FDEP Criteria
Fails to Meet FDEP Criteria
Not Sampled

2.2 Data Review

Data collected from each of the four grab sample stations along Jones and Sims Creeks indicate TN levels met the FDEP NNC for the Southwest Fork of the Loxahatchee River while potentially problematic concentrations of TP were only observed at the upstream monitoring station of Jones Creek. No clear or consistent trend in TP concentrations existed although local peak concentrations were often observed during the wet season months (**Figure 2-1**). Chlorophyll α concentrations exceeded FDEP criteria in three of the four grab sample locations with the exception being the upstream sampling location of Sims Creek. Although the measured Chlorophyll α concentrations were similar for both Sims Creek sampling locations, the FDEP criteria are different at the two locations since the upstream reach is classified as freshwater. Summaries of Chlorophyll α concentrations for Jones and Sims Creeks are provided in **Figure 2-2** and **Figure 2-3**, respectively. Similar to TP concentrations, no significant increasing or decreasing trend in Chlorophyll α was observed and local maximum concentrations were typically observed during the wet season months. All figures depicting pollutant concentrations are based on 6-8 samples collected annually while all rainfall data were collected on a daily basis.

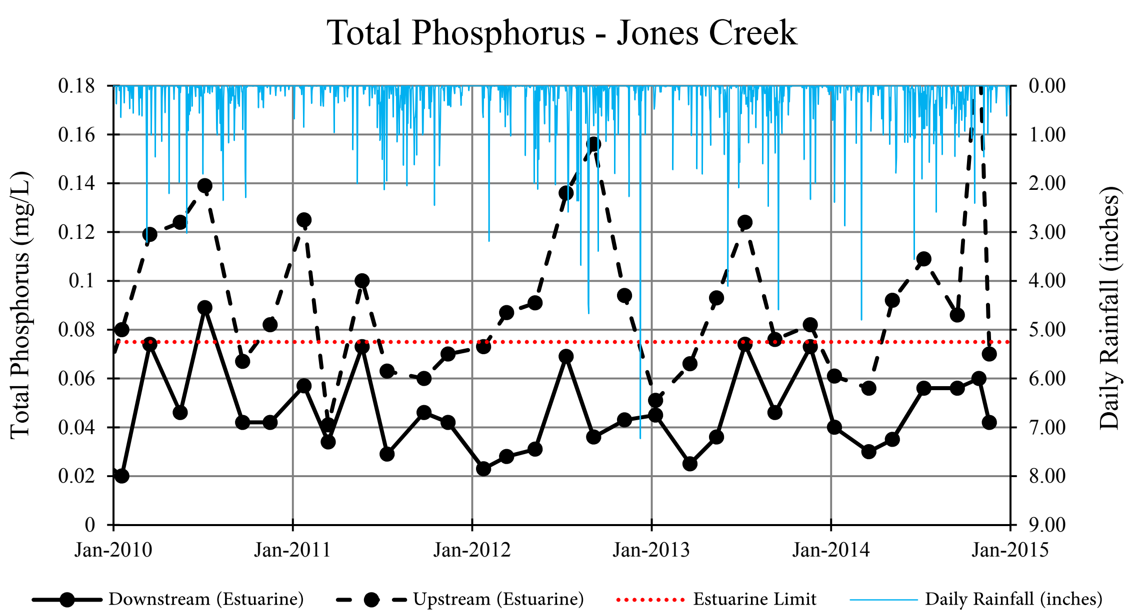

Figure 2-1: Total Phosphorus Concentrations Measured at Both Monitoring Locations Along Jones Creek

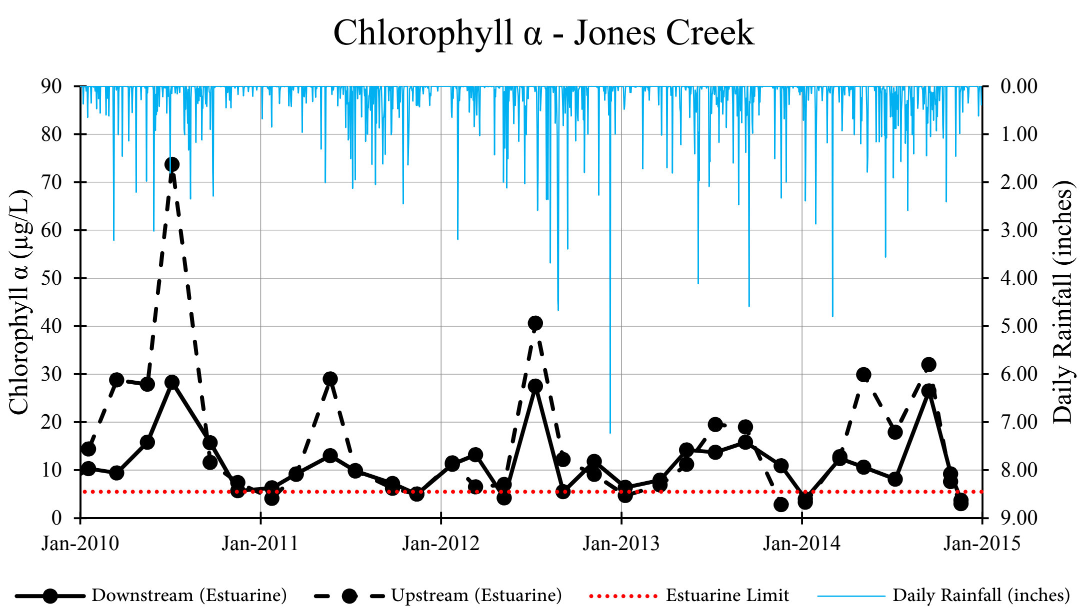

Figure 2-2: Chlorophyll α Concentrations Measured at Both Monitoring Locations Along Jones Creek

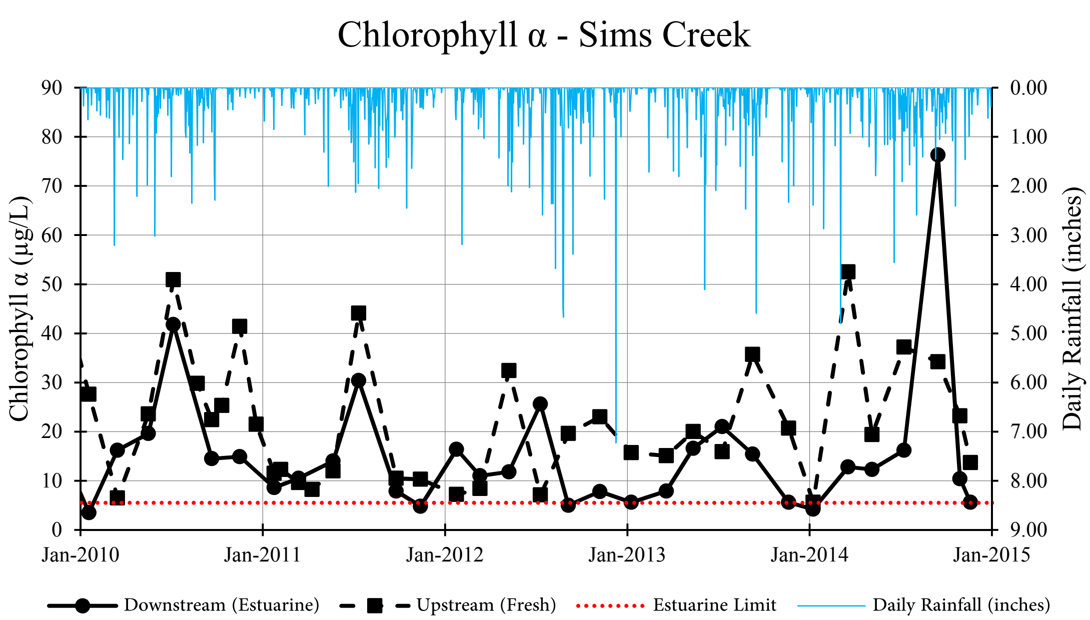

Figure 2-3: Chlorophyll α Concentrations Measured at Both Monitoring Locations Along Sims Creek

Measured DO, fecal coliform, and enterococci levels often failed to meet the current FDEP water quality criteria. The calculated AGM for DO failed to meet the threshold at which 90% of daily samples shall be above in each of the five years analyzed at the upstream grab sample location in Jones Creek, while the downstream grab sample location in Jones Creek met the FDEP criteria each year (**Figure 2-4**). Both sampling locations in Sims Creek included measured levels of DO which met the FDEP criteria in each of the five years analyzed (**Figure 2-5**). The comparison between the AGM of DO levels and the criteria outlined by FDEP is not entirely valid for determining compliance but was necessary due to the low sample count in each of the years of interest.

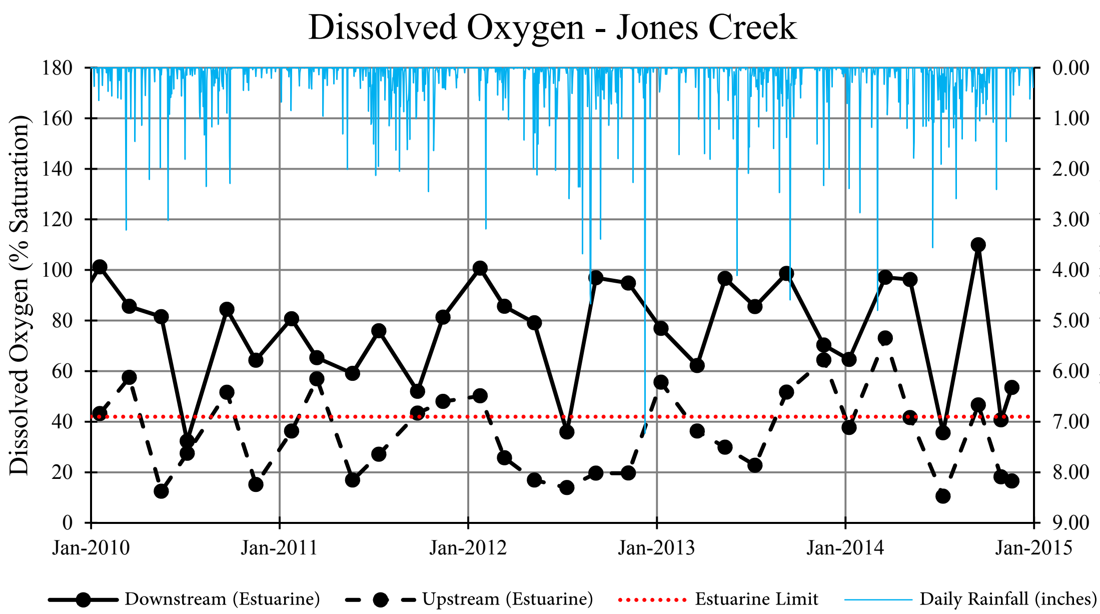

Figure 2-4: Dissolved Oxygen Levels Measured at Both Monitoring Locations Along Jones Creek

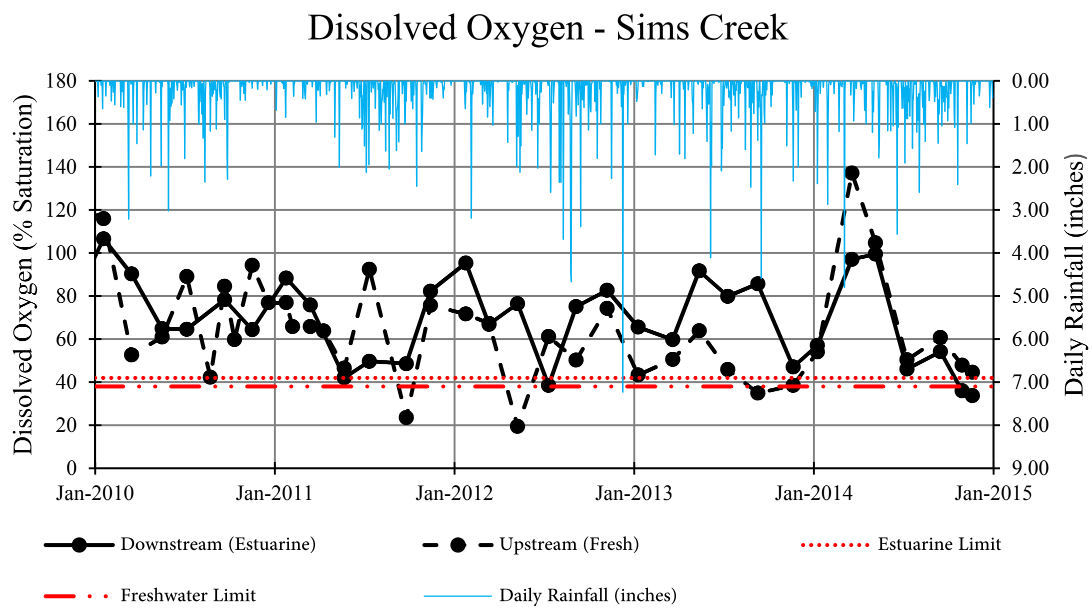

Figure 2-5: Dissolved Oxygen Levels Measured at Both Monitoring Locations Along Sims Creek

Multiple samples collected from Jones Creek indicated an exceedance of the FDEP maximum fecal coliform level of 800 CFU/100 mL (**Figure 2-6**). Data collected from Sims Creek suggest fecal coliform levels commonly exceededed the FDEP maximum limit at the downstream sampling location but never exceeded this limit in the upstream sampling location (**Figure 2-7**). FDEP criteria stipulate that fecal coliform levels exceeding 800 CFU/100 mL shall not be measured in any single sample.

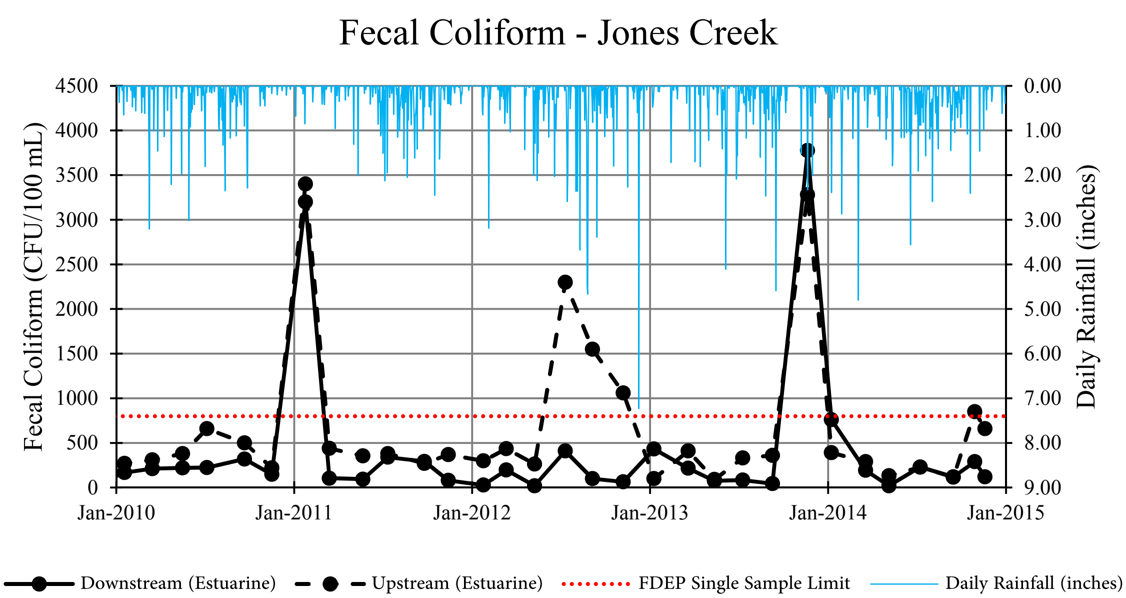

Figure 2-6: Fecal Coliform Levels Measured at Both Monitoring Locations Along Jones Creek

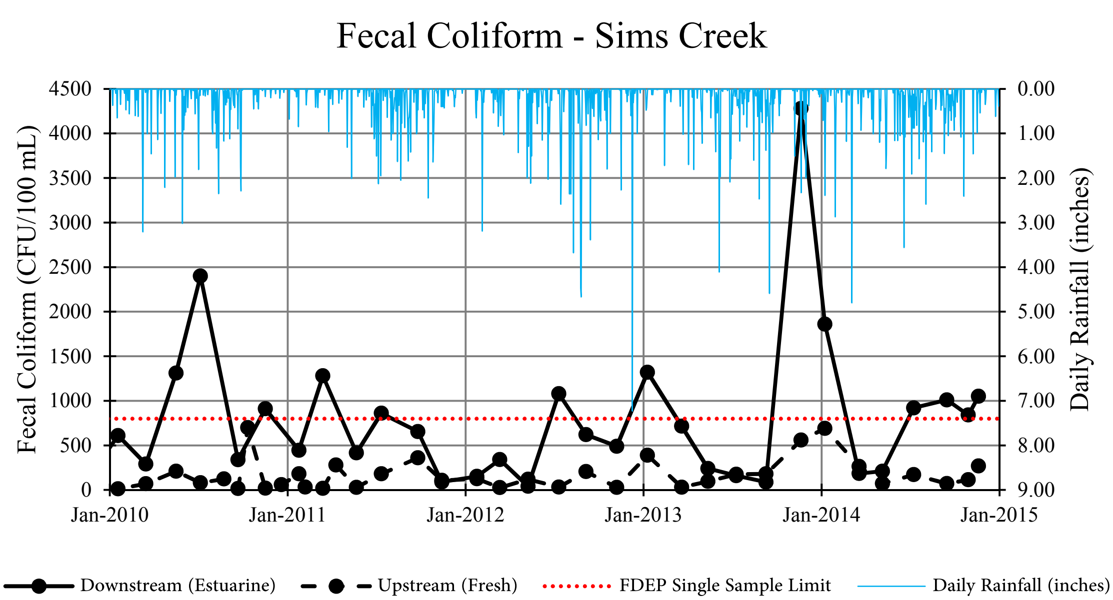

Figure 2-7: Fecal Coliform Levels Measured at Both Monitoring Locations Along Sims Creek

Enterococci is another parameter which was measured by LRD in Jones and Sims Creeks. The presence of enterococci is treated similarly to fecal coliform and is recommended by the Environmental Protection Agency (EPA) to be used when analyzing water quality in marine environments due to their ability to survive in salt water. The measured enterococci levels fluctuated in the same manner as the fecal coliform levels in both creeks and typically exceeded the FDEP standard. Therefore, due to the greater number of fecal coliform samples collected compared to the enterococci samples, the enterococci results were not used in the water quality analyses. Enterococci levels were used strictly to validate the accuracy of the fecal coliform data since three of the four grab sample locations were in brackish environments.

Sucralose concentrations were measured in Jones and Sims Creeks in order to identify the potential presence of human waste in both creeks. Sucralose is an artificial sweetener that is commonly measured as an indicator of human waste since it is not naturally occurring and is only present in products that humans consume. The presence of sucralose does not necessarily represent untreated human waste as it is not removed in the wastewater treatment process and is not consumed in the natural environment. Rather, the presence of sucralose indicates that treated or untreated human waste has mixed with surface water at some point upstream of the sampling location. Sucralose concentrations have only recently been evaluated in surface waters with greater scrutiny as its use as a tracer has become more established. Sucralose concentrations measured in samples collected in 2012 and 2014 are plotted with the daily rainfall in **Figure 2-8** and **Figure 2-9**, respectively.

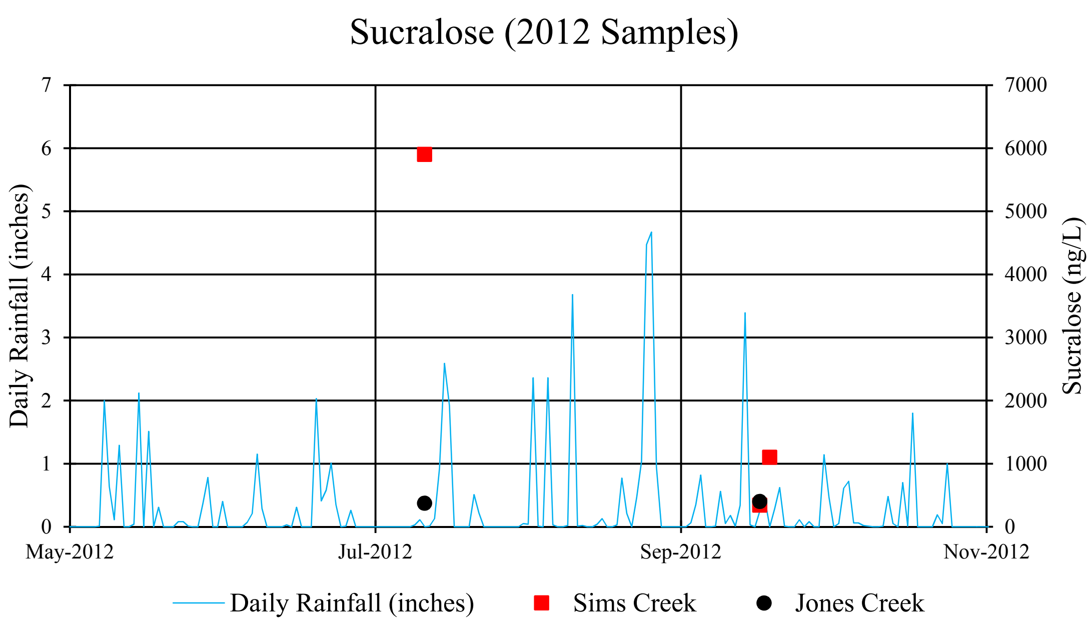

Figure 2-8: Sucralose Concentrations in Samples Collected in 2012

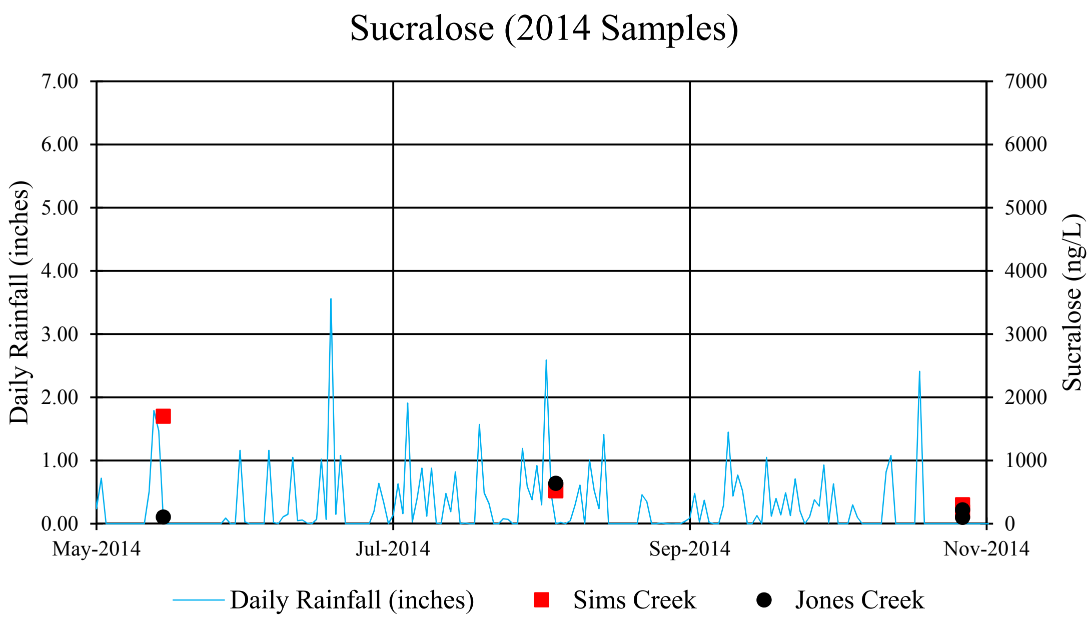

Figure 2-9: Sucralose Concentrations in Samples Collected in 2014

Section 3.0
Identification of Potential Pollutant Sources

3.1 Nutrient Sources

The AGM for TN was calculated as being lower than the FDEP criteria at each of the four grab sample locations since January 1, 2010. In many cases, the AGM was significantly lower than the standard. It therefore appears that TN concentrations may be acceptable based on the current NNC. However, based on the abundance of aquatic vegetation in Sims Creek, it is likely that a reduction to the current NNC will be required once a TMDL is developed since imbalances in flora and fauna dictate the site specific NNC.

While the TN concentrations measured at each sampling location met the current FDEP NNC between January 1, 2010 and December 31, 2014, the AGM for TP exceeded the NNC twice at the upstream grab sample location of Jones Creek (see **Table 2.2**). Since the criteria specify that the FDEP limit shall not be exceeded more than once in a three year period, the results indicated TP as being a pollutant of concern in Jones Creek. When taking into account the assumption that a 0.5-inch runoff event scours the majority of pollutants on ground surface, the data appeared to suggest a decreasing trend between TP concentrations in Jones Creek as the number of days since the last runoff event of this size increased (**Figure 3-1**). The 0.5-inch runoff event being a scouring event was used based on the South Florida Water Management District (SFWMD) criteria stipulating that for retention systems the first 0.5 inches of runoff must be retained to satisfy the water quality requirements. Based on the observed relationship between rainfall and TP concentrations, the TP load may have been primarily dependent on runoff from the surrounding area.

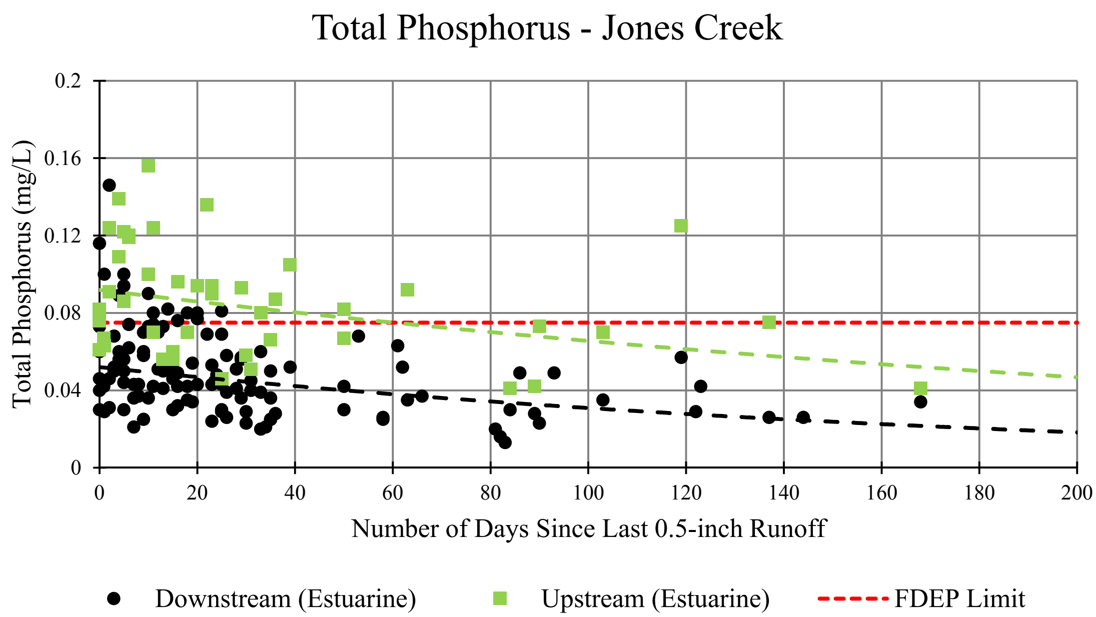

Figure 3-1: Comparison of TP Concentration in Jones to Number of Days Since Last 0.5-inch Runoff

Due to the predominantly residential land use within the Jones Creek drainage area, the primary source of phosphorus may have likely been residential fertilizer usage. There is a greater likelihood of residential fertilizer misuse compared to commercial misuse due to a potential lack of knowledge on how to properly apply fertilizer and/or not knowing which fertilizer type is appropriate. The Loxahatchee Club golf course purposefully does not include phosphorus as part of its fertilizing plan due to a lack of need for the turf type used. While the golf course does not actively use phosphorus, the use of reclaimed water for irrigation purposes may initially be identified as a potential pollutant source due to the elevated nutrient concentrations in reclaimed water compared to potable water. The effluent TP concentration from the LRD Wastewater Treatment Plant fluctuates between 1 and 4 mg/L. Although the effluent TP concentrations are in this range, the concentrations leaving the sprinkler head at the end of the distribution system are typically at least 50% lower. Furthermore, based on data outlined in the presentation titled “Nutrient Cycling in a Reuse Distribution System Significantly Lowers Landscape Irrigation Nutrient Loading Estimates” the TP concentrations measured in canals downstream of areas which use reclaimed water are typically near 0.1 mg/L [Arrington, 2013]. Therefore, the use of reclaimed water was likely not a significant contributor to the elevated nutrient levels observed in nearby surface waters.

A study is currently being conducted by EW Consultants examining the effects of reclaimed water on soil and leaf tissue nutrient concentrations. This study should be utilized by the Town in order to determine if adjustments in fertilizer application rates in areas which use reclaimed water are necessary. Although this Loxahatchee Club does not use Phosphorus, reducing the amount of Nitrogen applied to the golf course may help improve the Chlorophyll α and DO concentrations currently observed in Jones Creek. In addition to the commercial and residential use of fertilizer within the Jones Creek drainage area, animal waste may have also had a significant impact based on the consistently elevated observed fecal coliform levels (see **Figure 2-6**). The impact of animal waste on TP concentrations may be more significant in Jones Creek compared to Sims Creek due to the greater number of residential properties adjacent to the creek with little to no buffer to treat stormwater prior to discharge into the surface water body. Runoff from areas within the Sims Creek drainage area is typically routed through wet detention ponds or other stormwater management structures prior to reaching the creek, allowing for a potential increase in pollutant removal and therefore lower observed TP concentrations.

TP concentrations measured at the downstream sampling location in Jones Creek were generally less than those measured at the upstream sampling location. This suggests that there was a higher concentration upstream with dilution occurring before reaching the downstream location, tidal mixing and dilution reduced concentrations in the downstream reach, and/or there was a high level of assimilation between the upstream and downstream sampling locations. It is unlikely that residual contamination from septic tanks was a significant contributor to the TP levels based on the apparent inverse relationship between TP concentration and number of days since the last 0.5-inch runoff event. The length of time which has passed (10+ years in most areas of the Jones Creek watershed) since the conversion from septic to sewer also suggests that legacy pollution is likely not a major contributor to the observed pollutant concentrations. The observed relationship between rainfall and TP concentrations was indicative of pollution driven by overland flow and was reinforced by the annual patterns (observed in **Figure 2-1**), which showed peak concentrations typically observed during the wet season months.

The AGM for Chlorophyll α consistently exceeded the FDEP NNC for each of the past four years in three of the four grab sample locations (see **Table 2.2**). The only sampling location which appeared to have acceptable levels based on the FDEP criteria was the upstream sampling location of Sims Creek. However, concentrations measured at this location were similar to those measured at each of the other three sampling locations and only met the FDEP criteria due to its freshwater classification. Since there is a clear presence of excessive aquatic vegetation a reduction in the Chlorophyll α limit may be necessary once a TMDL is developed. Chlorophyll α is measured as a surrogate for algal biomass due to the lower cost and time required to measure, but does not directly affect water quality. In addition to algal biomass, elevated levels may also be indicative of an abundance of floating aquatic vegetation. Excess algae and floating aquatic vegetation can directly impact water quality by leading to depleted DO within the water column as dieback occurs. The relationship between the measured Chlorophyll α and DO levels for the upstream reaches of Jones and Sims Creeks are provided as **Figure 3-2** and **Figure 3-3**, respectively. As seen in the figures, the maximum Chlorophyll α concentrations commonly coincided with minimum DO levels in the upstream reach of each creek.

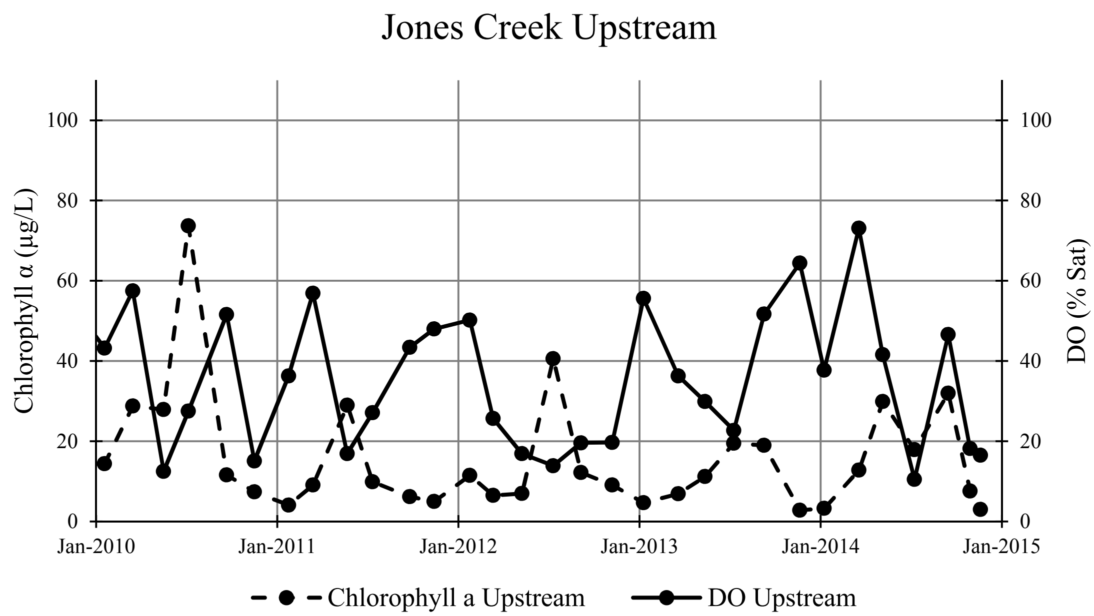

Figure 3-2: Comparison Between Chlorophyll α and DO Levels in the Upstream Reach of Jones Creek

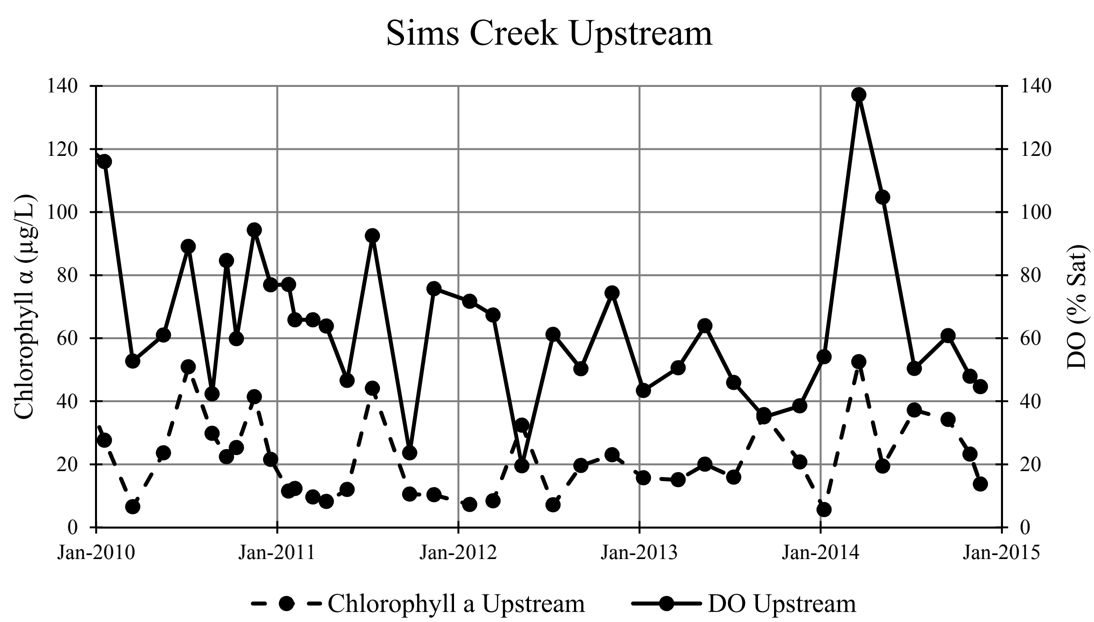

Figure 3-3: Comparison Between Chlorophyll α and DO Levels in the Upstream Reach of Sims Creek

An example of excess floating aquatic vegetation present in the upstream reach of Sims Creek is provided in **Figure 3-4**. While vegetation can increase DO through photosynthesis during daytime hours, DO can also be depleted during nighttime hours through respiration and/or aerobic degradation of organic matter resulting from dieback occurring. The same effects can result from aquatic vegetation blocking light from penetrating the water column during daytime hours. Therefore, reducing the presence of algae and floating aquatic vegetation might also increase the DO levels in areas which did not meet the FDEP criteria. Excess algae and floating aquatic vegetation may have been attributable to nutrients in runoff and/or stagnant water making the nutrients in the creek more readily available to be assimilated. While nutrients were not a concern in the upstream reach of Sims Creek, attempting to decrease the nutrients in runoff may improve other aspects of water quality such as Chlorophyll α and DO concentrations. Other actions such as physically removing excess vegetation and maintaining a more steady baseflow in each creek could also directly benefit the Chlorophyll α and DO levels.

Figure 3-4: Floating Aquatic Vegetation Growth in the North Palm Beach Heights Water Control District (NPBHWCD) Canal (Sims Creek)

While the water quality in the upstream reach of Sims Creek met the FDEP freshwater criteria, it failed to meet the estuarine criteria which governs the downstream reach of Sims Creek. Special conditions of the original surface water management permit (SFMWD permit number 50-01364-S) state that "the District reserves the right to require that water quality treatment methods be incorporated into the drainage system if such measures are shown to be necessary" and "the permittee shall be responsible for the correction of any water quality problems that result from the construction or operation of the surface water management system". The permittee (North Palm Beach Heights Water Control District) may therefore be obligated to take action due to the observed exceedances in the downstream reach despite currently meeting the FDEP criteria in the upstream reach.

To summarize:

- TN did not appear to be a parameter of concern in Jones and Sims Creeks as it was not measured in excess of the FDEP criteria in any of the sampling locations. However, based on the vegetation characteristics, reducing nutrient loads may be required once a TMDL is developed.

- Concentrations of TP were an immediate concern at the upstream sampling location of Jones Creek. Measured TP concentrations appeared to decrease as the number of days following a 0.5-inch runoff event increased, implying that the observed levels may be dependent on pollutants conveyed in overland flow.

- Chlorophyll α was a concern in three of the four grab sample locations and may have been a result of excess nutrients being discharged to the creeks or stagnant water allowing nutrients to become more available to be assimilated by aquatic or terrestrial vegetation. Chlorophyll α concentrations were similar at each of the four grab sample locations and only met the FDEP criteria in the upstream reach of Sims Creek due to the freshwater classification at that location.

3.2 Fecal Bacteria Sources

In both sampling locations in Jones Creek and the downstream sampling location of Sims Creek, fecal coliform levels were measured as exceeding the FDEP maximum limit of 800 CFU/100 mL. In order to determine if the fecal coliform levels were attributable predominantly to groundwater or runoff during storm events, fecal coliform levels in Jones and Sims Creeks were compared to the number of days since the last 0.5-inch runoff event for each sampling date (**Figure 3-5** and **Figure 3-6**, respectively). Similar to TP concentrations in Jones Creek, the greatest fecal coliform levels were typically observed soon after a significant rainfall event had occurred. This suggests that the greatest contribution to the fecal coliform levels originated from the surface (e.g. animal feces) and was dependent primarily on overland flow to migrate into the creeks rather than being a constant pollutant source via groundwater recharge. Further evidence that rainfall had a significant impact on the fecal coliform levels is that 2.33 inches of total rainfall occurred on November 21, 2014, which was the same day that the highest fecal coliform levels were recorded in three of the four grab sample locations. Although the time of day at which the rainfall occurred is unknown, it is assumed that it occurred prior to or during the time samples were collected. It is recommended that stormwater samples be collected during or immediately following future significant rainfall events to further establish the effect of runoff on pollutant concentrations within Jones and Sims Creeks.

The only sampling location within Jones and Sims Creeks which consistently exhibited fecal coliform levels in compliance with the FDEP criteria is upstream of a flow barrier (constant head weir located in Sims Creek), although the levels exceeded the estuarine limits outlined by FDEP. An analysis of fecal coliform levels observed at sampling locations in the Southwest Fork of the Loxahatchee River was completed in order to identify whether the primary source of fecal coliform originated within the Jones and Sims Creek drainage areas or if it was instead originating from the Southwest Fork and migrating into Jones and Sims Creeks during high tide. A comparison of fecal coliform levels in Jones and Sims Creeks to levels recorded at the River Road and Pennock Point sampling locations are provided in **Figure 3-7** and **Figure 3-8**. While there did appear to be some degree of correlation in the fecal coliform levels measured within Jones and Sims Creeks and in the Southwest Fork, levels in the Southwest Fork were commonly lower than those observed in the two creeks. Furthermore, sampling locations further upstream within the Southwest Fork (S.R. 706) and downstream (Railroad) consistently showed acceptable fecal coliform levels. Based on these locations being in compliance with the FDEP criteria, it is unlikely that the Southwest Fork water quality was a cause of the fecal coliform levels observed in Jones and Sims Creek since the levels measured in the Southwest Fork are commonly lower and are only elevated in areas nearest the confluence of Jones and Sims Creeks.

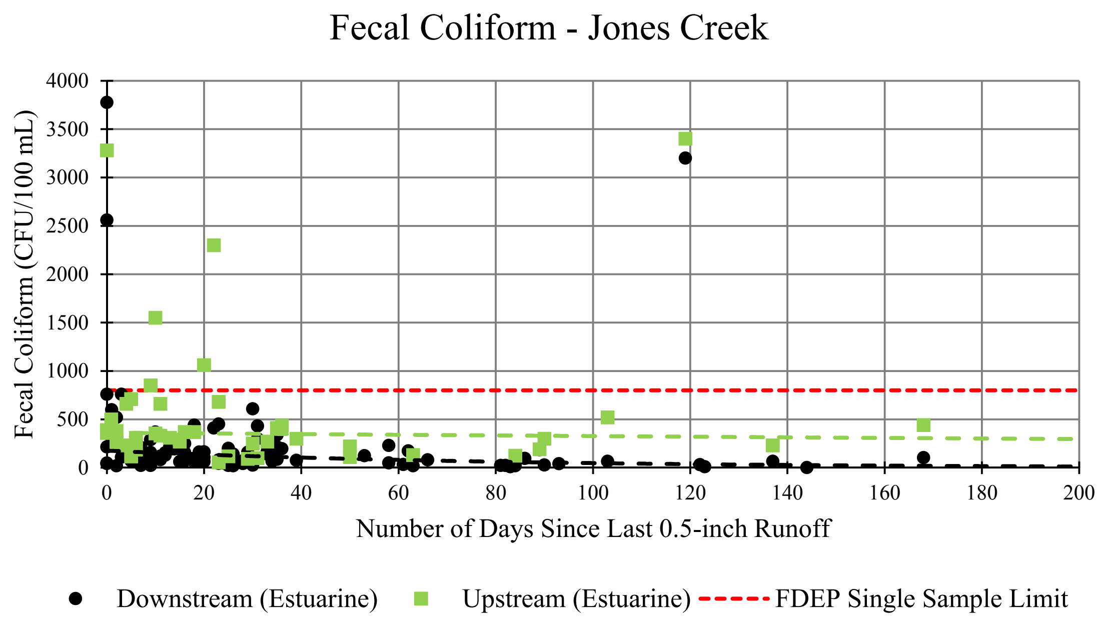

Figure 3-5: Comparison of Fecal Coliform Levels Measured in Jones Creek to Number of Days Since Last 0.5-inch Runoff Event

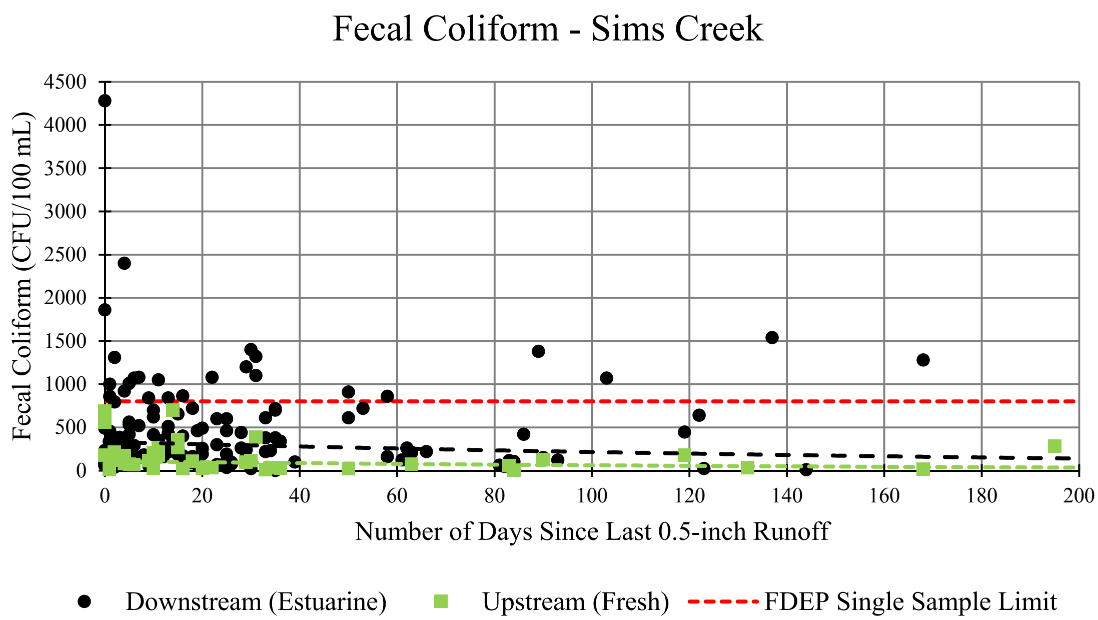

Figure 3-6: Comparison of Fecal Coliform Levels Measured in Sims Creek to Number of Days Since Last 0.5-inch Runoff Event

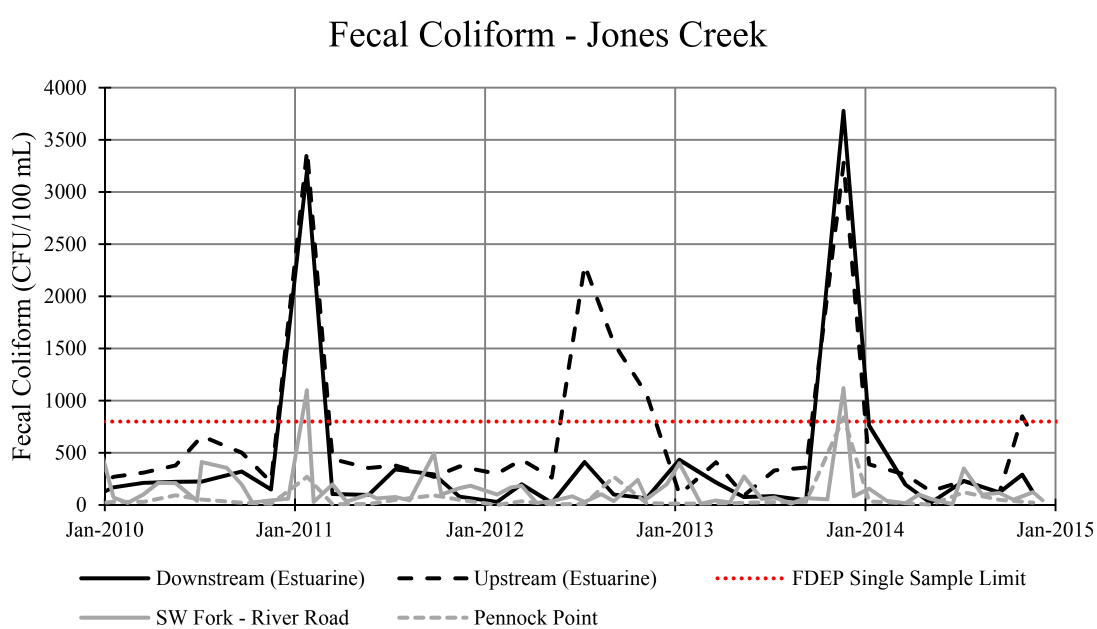

Figure 3-7: Comparison of Fecal Coliform Levels Measured in Jones Creek to Levels Measured at the River Road and Pennock Point Sampling Locations

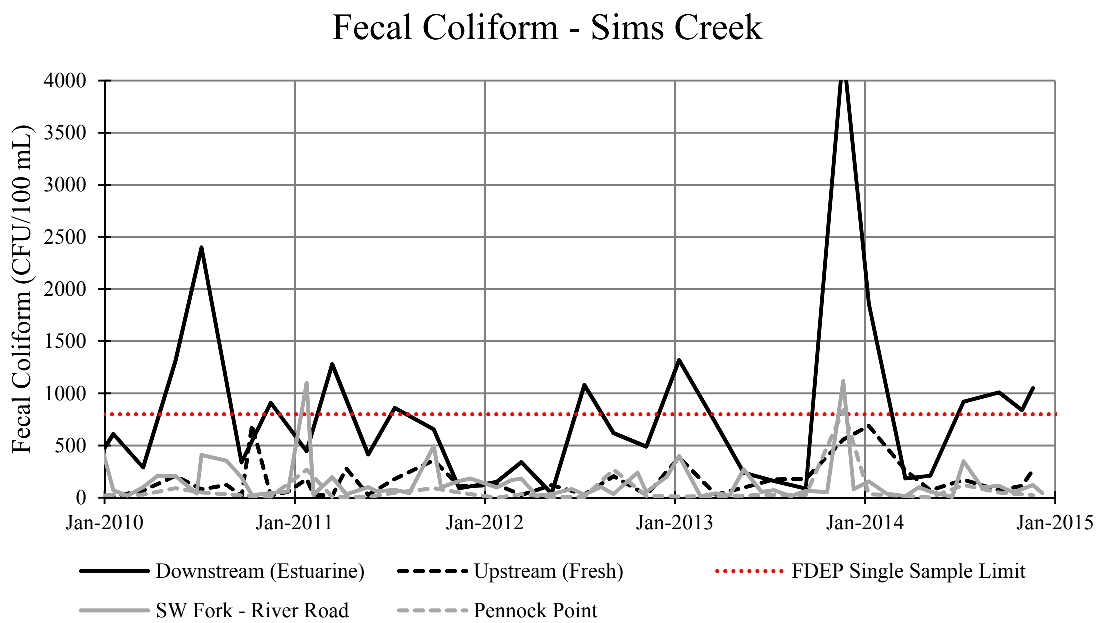

Figure 3-8: Comparison of Fecal Coliform Levels Measured in Sims Creek to Levels Measured at the River Road and Pennock Point Sampling Locations

Although analyzed differently, similar correlations between rainfall and fecal coliform levels were drawn during the formation of the fecal coliform TMDL for the Southwest Fork of the Loxahatchee River, which stated that a correlation exists between exceedances in fecal coliform levels and moderate to large rainfall events. Table 5.4 in the developed TMDL outlines the percent of samples collected during events which exceeded the 90% threshold outlined by FDEP. The results indicated the greatest percentage of exceedances were observed during medium size rainfall events (82% of samples) while the least number of exceedances were observed when samples were collected during periods of no rainfall (45% of all samples). This further demonstrates that rainfall may have been a controlling factor relative to observed fecal coliform levels in the receiving water body. While large rainfall events may likely scour the same mass of pollutants from ground surface, fewer exceedances were observed following moderately sized rainfall events likely due to dilution of the fecal coliform load. Conductivity data collected from the datasonde deployed in Jones Creek showed no clear decrease following rainfall events, as would typically be expected. This lack of correlation suggests that water quality parameters, such as fecal coliform levels, are affected by many complex factors (e.g. tidal mixing, incoming vs outgoing tide, etc.). This additional complexity in the system may explain the lack of a strong correlation between monitored water quality parameters and factors that affect the observed levels, such as rainfall and land use.

Unlike fecal coliform levels and TP concentrations, sucralose concentrations in Sims Creek typically increased as the numbers of days since the last 0.5-inch runoff event increased (**Figure 3-9**). This relationship was based on a very small sample size and may differ once additional samples are collected in the future. However, based on the available data, the indication is that the observed sucralose concentrations in Sims Creek may have been groundwater driven and were therefore higher when flows in the creek were lower. A potential cause of the elevated sucralose concentrations in groundwater within the Sims Creek drainage area is the presence of two active septic tanks (located at 5800 and 5942 Center Street). Based on the typical sucralose concentrations recorded in wastewater effluent, septic tanks, and runoff from areas irrigated with reclaimed water (**Table 3.1**), the elevated concentrations measured in Sims Creek appeared to be impacted the greatest by highly concentrated sources, potentially due to the close proximity of the monitoring location to the septic tank parcels (i.e. not entirely a result of reclaimed water usage by the Golf Club of Jupiter).

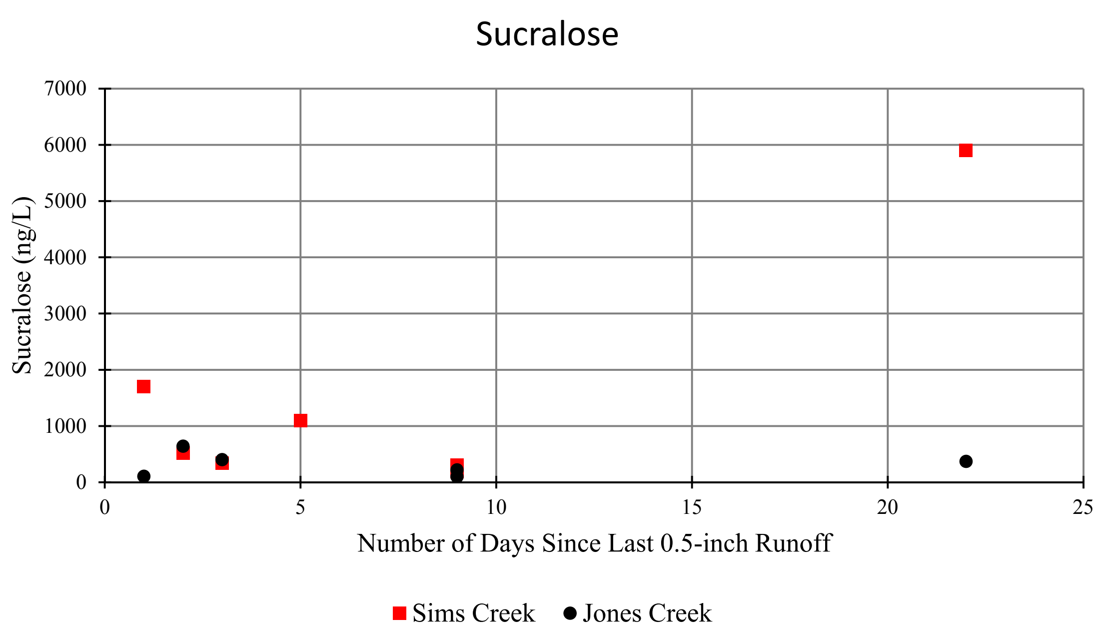

Figure 3-9: Sucralose Concentrations Measured Along Jones and Sims Creek

Table 3.1
Summary of Sucralose Concentrations From Different Sources

Source	Typical Sucralose Concentration (ng/L)
Wastewater Treatment Plant Effluent[1]	27,000
Septic Tank[2]	40,000
Runoff From Area Irrigated With Reclaimed Water[2]	1,100

[1] Schmidt H., P. Waller, J. Oppenheimer, M. Badruzzaman, J. Pinzon, and J. Jacangelo, No Sweetener in Your Stormwater, but What About Your Reclaimed Water?, Florida Water Resources Journal, Feb. 2013.

[2] Jacangelo, J. G., Development of Markers for Differentiating Sources of Nutrient Loading in Florida Waterways

Unlike Sims Creek, the sucralose data collected from Jones Creek showed relatively constant sucralose concentrations regardless of whether or not the sample was collected during a wet or dry period. The main source of sucralose within the Jones Creek drainage area may have likely been the application of reclaimed water at the Loxahatchee Club Golf Course. Another potential source of sucralose to both Jones and Sims creeks was flow from the Loxahatchee River during high tide. Based on the high density of active septic tanks in Pennock Point, north of Jones and Sims Creeks, this may have been a pollutant source which affected levels recorded in Jones and Sims Creeks. As previously discussed, the constant head weir located in Sims Creek may have acted as a barrier to these sources originating from the Southwest Fork. Although the septic tanks north of the Southwest Fork may have contributed to the pollutant load, based on the comparison between fecal coliform levels in the Southwest Fork and levels observed in Jones and Sims Creek it is unlikely that pollutants flowing into Jones and Sims Creek from the Southwest Fork during high tide is a major concern. Additional water quality sampling in the Southwest Fork which tests for sucralose and fecal coliform levels is recommended at the location described in Section 4.4. These data may that the primary fecal coliform and sucralose sources are located within the Jones and Sims Creek drainage areas.

It is important to note that while sucralose is not easily broken down, the constituents that sucralose is a surrogate for (e.g. fecal bacteria) may be removed via physical or chemical processes between the pollutant source and the monitoring location. Therefore, the presence of elevated sucralose concentrations may not always be coincident with elevated pollutant concentrations. However, based on the elevated fecal coliform levels observed in each creek the sucralose was likely an accurate tracer for pollutants such as fecal bacteria in this scenario.

To summarize:

- The elevated fecal coliform levels were likely a result of animal feces throughout the drainage areas with a potential contribution from human waste originating from active septic tanks.
- Fecal coliform levels in both Jones and Sims Creeks were often higher in the days following a rainfall event, implying that the primary source may have been located on ground surface and dependent on overland flow.
- Taking into account the sucralose data, a portion of the fecal coliform present in Sims Creek was likely a result of groundwater recharge into the creek since the highest sucralose concentrations were measured during the driest period at the downstream sampling location. The elevated sucralose concentrations observed in Sims Creek may have also been a result of the sampling location's close proximity to the two parcels still on septic and/or contamination originating within the Loxahatchee River flowing to the monitoring location during high tide.

Section 4.0
Pollutant Reduction Strategies

4.1 Total Phosphorus and Total Nitrogen

4.1.1 List of Strategies

1. Upon completion of the study by EW Consultants examining the effects of reclaimed water on fertilizer rates, adjust fertilizer usage to account for irrigation with reclaimed water, if applicable, at golf courses and locations of future reuse customers.
2. Encourage residents to reduce fertilizer usage based on soil conditions.
3. Encourage proper disposal of yard waste, particularly in residential areas adjacent to Jones Creek.

4.1.2 Discussion of Benefits and Drawbacks

- In areas that use reclaimed water for irrigation purposes within the Jones and Sims Creek drainage areas (i.e. The Golf Club of Jupiter and Loxahatchee Club Golf Course), the total applied fertilizer load could be reduced due to the elevated nutrient concentrations in reclaimed water. While the upstream reach of Sims Creek did not appear to have nutrient concentrations which fail to meet FDEP criteria, the abundance of aquatic vegetation is indicative of an imbalance of flora and therefore the nutrient criteria may be reduced upon formation of a TMDL.

  These potential changes in fertilizer application rates would be relatively easy to execute since there would be a clear financial benefit to both golf courses if a reduction in fertilizer demand were possible. Another benefit to this strategy would be the low cost associated with implementing any changes. While the Loxahatchee River District already communicates nutrient data to reuse customers so they can make fertilizer application adjustments, the results from the previously described study being completed by EW Consultants should also be communicated so the fertilizer usage by reuse customers can be further adjusted as needed. This pollutant reduction strategy has no apparent drawback since there would be mutual interest in making this adjustment if a reduction was deemed feasible.

- Encouraging residents within the Jones and Sims Creek drainage areas to adjust their fertilizer application rates based on the soil conditions would also be a low cost strategy for reducing nutrient loads in each creek. This strategy would require the collection of representative soil samples and determination of an appropriate fertilizer application rate for each neighborhood based on those results. In addition to being low cost, it would require minimal time for the Town to prepare and execute an effective strategy aimed at educating the residents throughout the area of the potential impacts from improper fertilizer application.

- While there is no direct evidence that it is occurring, improperly disposing of leaves and grass clippings can be a large source of nutrients within a drainage area, making the proper disposal of these materials critical. This strategy would again require little capital and could be executed quickly. Residents (particularly those adjacent to Jones Creek) should be encouraged not to dispose of their yard waste in the adjacent stream. It is estimated that one bushel of grass clippings contains approximately 0.1 pounds of phosphorus, which is enough to then produce 30 to 50 pounds of algae. Therefore, putting grass clippings into the adjacent creek may not only increase nutrient loads but also exacerbate the existing problems with Chlorophyll α and DO.

The primary drawback to these programmatic efforts (encouraging residents to reduce fertilizer usage and dispose of yard waste properly) is that it may be difficult to get public participation with an issue that many residents may feel does not affect them. Summarizing water quality information in quarterly flyers or web based reports may be a good way to demonstrate how activities of residents can impact local water quality. While reducing the fertilizer application rates in residential areas could save those who live in the area money, the savings would not be nearly as significant as it would be with the two golf courses. The perceived benefits may not be substantial enough to get significant participation, but at the low required cost the strategy should be implemented nonetheless.

Although the Town of Jupiter ordinance number 21-13 addresses fertilizer usage and yard waste disposal, enforcement of the laws outlined in the ordinance can be very difficult. For this reason it is important that the information outlined in the ordinance be communicated to the local residents to ensure the laws are fully understood. For example, it should be made clear to the residents who live adjacent to Jones and Sims Creeks that it is illegal to apply fertilizer within 10 feet of the creek. Furthermore, it should be made clear that it is illegal to intentionally wash, sweep, or blow grass clipping and vegetative material into water bodies, sidewalks, stormwater drains, or roadways per section 23-97 of the ordinance. Mailing informative flyers on the current laws to the residents in both drainage areas may result in greater compliance and would likely be more effective than attempting to increase enforcement.

4.2 Chlorophyll α and Dissolved Oxygen

4.2.1 List of Strategies

1. Maintaining a more steady baseflow in both creeks to decrease the potential of nutrients being assimilated by aquatic vegetation.
2. Periodic physical removal of aquatic vegetation.

4.2.2 Discussion of Benefits and Drawbacks

- Maintaining a steadier baseflow throughout both creeks may help reduce the potential for stagnation to occur in the upstream reaches, which are not significantly affected by tidal fluctuations. This reduction in stagnant water would likely make nutrients within the creeks less available to be assimilated by aquatic vegetation therefore reducing the potential for excess vegetative growth.

  The first issue with this pollutant load reduction strategy is that the potential benefits are not guaranteed even if the construction of a system to create said baseflow were completed. Furthermore, with each drainage area being heavily developed the logistics of routing water to the upstream reaches would become complex and could result in costly construction. Lastly, fresh water would be required for Sims Creek due to the presence of the salinity barrier. The cost associated with tapping into a constant source of fresh water to do this may end up being too costly and infeasible from a regulatory standpoint.

- Periodically removing aquatic vegetation from the upstream reach of Sims Creek may help improve the Chlorophyll α and DO levels in the downstream reach. If the vegetation mass were reduced, there may be less depletion of DO when dieback occurs. This solution is much more feasible and would carry a lower cost compared to maintaining a more steady baseflow. In addition to the potential water quality benefits, physical removal of aquatic vegetation would reduce the risk of stormwater infrastructure components getting clogged during high flow events and improve general aesthetics. The current method to control the aquatic vegetation in the NPBHWCD Canal consists of the periodic use of herbicides, which can lead to the release of nutrients and DO depletion during the subsequent decay of plant matter [*Helfrich* et al., 2009]. The release of nutrients after use of aquatic herbicides typically leads to the need for the herbicide to be used more frequently since regrowth will occur at a faster rate [*Helfrich* et al., 2009]. Although the upstream reach meets the chlorophyll α and DO criteria, these actions may be resulting in the downstream reach failing to meet the stricter estuarine criteria. It is recommended that physical removal be examined as an alternate method for vegetation removal in the upstream reach of Sims Creek.

One of the drawbacks for this strategy is that it would be a recurring action requiring consistent resources. The physical removal of vegetation would have to occur once regrowth occurs within the channel in order to maintain compliance with the Chlorophyll α and DO FDEP criteria. Additionally, this action could suspend sediments within the creek which could then potentially be transported downstream.

4.3 Fecal Bacteria and Sucralose

4.3.1 List of Strategies

1. Convert the two parcels in Sims Creek that are on septic over to sewer.
2. Increase the number of pet waste receptacles and/or educational signage in public parks.
3. Encourage residents to discard pet waste instead of leaving it in their yards, particularly those who live adjacent to Jones Creek.
4. Place signs in public areas requesting people not feed wildlife (e.g. birds).

4.3.2 Discussion of Benefits and Drawbacks

- Converting the two remaining parcels currently on septic over to sewer would likely reduce the fecal coliform levels as evidenced by a reduction in sucralose concentrations measured in the downstream monitoring location of Sims Creek. While sucralose itself is not harmful to human health or to water quality, a reduction in sucralose may be indicative of a reduction in human fecal bacteria and/or nutrient concentrations.

  The drawback to this strategy is that it would require cooperation from the residents who currently live in those two locations and the cost may become significant if there is resistance to convert. It is recommended that the Town and LRD work with the residents to identify options for converting these parcels to sewer.

- One of the main reasons pet waste is not properly discarded is likely due to lack of accessible disposal areas. Placing pet waste receptacles in public parks along with signs encouraging owners to properly dispose of the waste (e.g. **Figure 4-1**) would decrease the potential for waste to be left on the ground. This would be a relatively low cost strategy and could be quickly executed by the Town. If pet waste receptacles were made available, a collection schedule would need to be created which would result in an increase in time required for waste pickup. It is also recommended that the Town contact condominium and apartment complexes to determine their interest in the installation of these receptacles throughout their properties. There may be mutual benefit to doing so since the complexes may see an increase in cleanliness while the Town may see decreases in pollutant levels in Jones and Sims Creeks. The low capital cost associated with this proposed measure (see Section 5.1) would make it possible for the Town to provide all necessary materials while the complex supplies the labor to collect the waste on a weekly basis through the existing maintenance or landscaping services.

Figure 4-1: Sims Creek Drainage Area
Pet Waste Reduction Measure

- The actions that residents who live adjacent to Jones Creek take likely have the greatest potential to negatively affect the water quality due to the lack of a buffer area between them and the creek. This is not the case in the upstream reach of Sims Creek where stormwater must flow through the stormwater network where pollutant removal can occur prior to discharge into the creek. While the downstream reach of Sims Creek does contain residences immediately adjacent to it, the density is much lower than what is present in Jones Creek. Placing a focus on having residents in the Jones Creek drainage area and lower Sims Creek drainage area discard their pet waste rather than letting it linger in their yard could result in a significant reduction in observed fecal coliform levels. In addition to having a potentially significant impact, the strategy would be relatively easy to implement and would not demand much time or capital to execute.

Similar to the other programmatic strategies, the effectiveness of this strategy is entirely dependent on community involvement. Unlike the reduction of fertilizer application which may carry a financial benefit for the residents, removing pet waste from yards may not be seen as an action that directly effects home owners. Therefore, it may be more difficult to get those being targeted to cooperate with the Town's requests.

- Public parks are a common area where families visit to observe and occasionally feed the local wildlife. The placement of signs in these areas requesting visitors to refrain from feeding the wildlife could help control the populations, particularly with birds. The feeding of birds can artificially increase the population since the birds would no longer be dependent on the natural availability of food. This strategy would be a very low cost option and would have no continuous cost associated with it. Since fecal bacteria levels commonly exceeded the FDEP single sample limit, any programmatic efforts to reduce the levels should be taken due to their typically low cost. The only drawback to this strategy is that the water quality benefits may not be immediately recognizable and may not be noticeable until the bird population has a chance to equilibrate with the change in food availability.

4.4 General Strategies

- Future grab samples collected by LRD, the Town of Jupiter, or others should be obtained from other locations within the Jones and Sims Creek drainage areas (example locations provided in **Figure 4-2**). These additional sampling locations may assist in identifying more specific pollutant sources. Of the three total proposed sampling locations, the priority is to sample for fecal coliforms at the two proposed locations in the upstream reach of Jones Creek. These grab samples may help better identify where in the drainage area fecal coliforms are originating. It is recommended that samples be collected every other week for one year in order to identify potential seasonal variations. While collecting samples more than once every two weeks may provide greater detail, it is likely not critical for identifying pollutant sources. If resources are available to sample more than two locations at this frequency, it is recommended to sample for fecal coliforms at existing sampling locations at the bridge crossings of Indiantown Road and Center Street as well. Of the four existing locations, of greatest interest is the downstream sampling location in Sims Creek due to the elevated fecal coliform levels historically measured at this point. Having grab samples collected at the same increased frequency with one sample collected every two weeks at all locations will result in more uniformity within the water quality data. This increased sampling may also help in more accurately identifying pollutant source locations and relationships with factors such as rainfall to assist the Town of Jupiter in determining necessary remedial actions in the future.

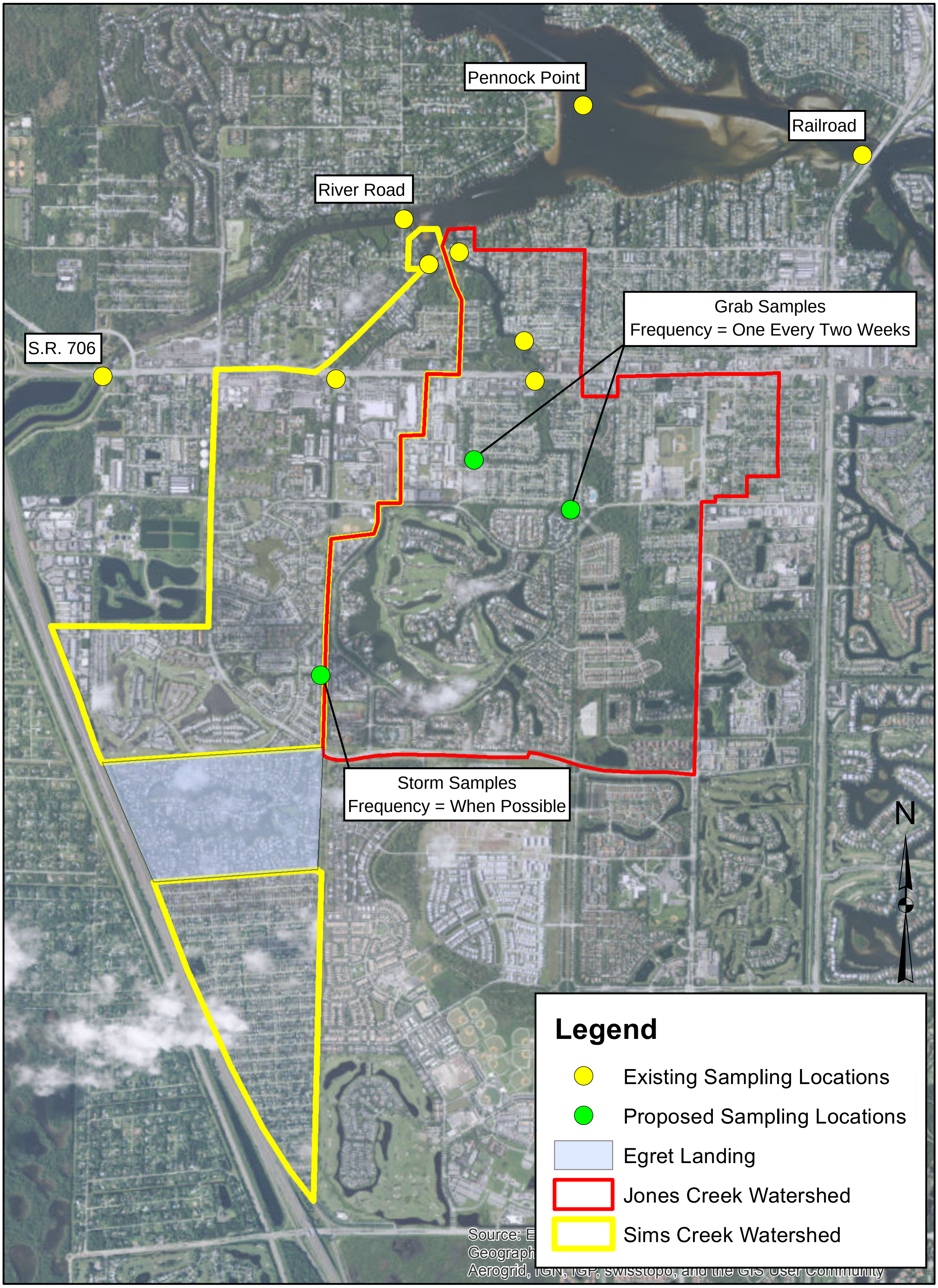

Figure 4-2 - Proposed Locations for Future Water Quality Sampling

In addition to grab samples, it is recommended that more datasondes be incorporated into the water quality monitoring of Jones and Sims Creeks. Due to the time required to process the datasonde data, the most efficient datsaonde placement would be the newly proposed sampling locations in the upstream reach of Jones Creek (**Figure 4-2**), since these locations are not as heavily influenced by tidal fluctuations and therefore the collected data may prove to be more useful.

- Of the proposed sampling locations illustrated in **Figure 4-2**, samples should be collected from the point where Indian Creek discharges to the NPBHWCD Canal, if resources to do so are available. These samples can either be collected manually or by using an automatic sampler and should be tested for fecal coliform, TN, and TP. These samples could help indicate whether maintenance to improve the pollutant removal efficiency may be necessary or if a change in BMPs is warranted. The estimated pollutant removal for different types of BMPs is summarized in **Table 4.1**. Based on the magnitude of exceedance of fecal coliforms compared to the other water quality parameters, it is recommended that the storm event sampling only be conducted if resources are available after collecting fecal coliform samples at the higher sampling frequency previously proposed.

Table 4.1
Estimated Percent Removal of Pollutants for Common BMPs

BMP / Design	Total Suspended Solids	Total Phosphorus	Total Nitrogen	Trace Metals	Bacteria
Dry Retention Pond	61[1]	19[1]	31[1]	40[1]	Insufficient Knowledge
Wet Detention Pond	67[1]	48[1]	31[1]	25[1]	65[1]
Exfiltration Trench	70[2]	50[2]	50[2]	70[2]	70[2]

[1]*United States Environmental Protection Agency*

[2]*SFWMD Best Management Practices for South Florida Urban Stormwater Management Systems, April 2002*

Section 5.0
Cost and Labor Estimate for Proposed Actions

Based on the analysis of water quality data collected within Jones and Sims Creeks, a list of proposed actions has been developed to help assist the Town with improving the water quality in both creeks. Estimates of the capital cost and man-hours associated with these actions are provided below.

5.1 Pet Waste Receptacles in Areas with Significant Pet Traffic

Based on the elevated fecal coliform levels and their apparent relationship to rainfall, it is recommended that efforts be taken to reduce pet waste in the Jones and Sims Creek drainage areas. The solution which is likely the simplest to implement and may result in the greatest benefit is the installation of pet waste receptacles in public parks where the density of dogs is typically the highest. The cost estimate for the materials and time required for installing these receptacles is provided in **Table 5.1**.

Table 5.1
Cost Estimate for Pet Waste Receptacle Installation and Maintenance

Item	Price	Note
Pet Waste Receptacle	$199.00 per receptacle	Source: www.dogwastedepot.com
Installation	0.5 man-hours per receptacle	
Price per 400 Waste Bags	$59.00	Amount of bags required based on demand
Continuous Waste Pickup	0.25 man-hours per receptacle	At least one pickup per week required

The typical recommendations are that one receptacle be placed every 500 feet in park areas or one be installed for every 50 dogs that may pass the location daily (source: www.zerowasteusa.com). It is recommended that these values be used as a guide when initially implementing these measures and be adjusted based on actual use. Fortunately, very few resources are required for the purchase and installation of the receptacles and therefore adjustments in the density and/or placement of receptacles can be easily made. If residential areas such as condos and apartments volunteer to implement similar measures, it is recommended to initially place one receptacle on the property for every

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fifty housing units and increase as needed based on actual demand (source: www.zerowasteusa.com).

5.2 Additional Water Quality Monitoring

Additional water quality monitoring is recommended for the primary purpose of more accurately identifying fecal coliform sources within the Jones and Sims Creek drainage areas. A secondary advantage of increased sampling is to evaluate the effectiveness of BMPs within the drainage areas (e.g. wet detention pond in Indian Creek discharging to the NPBHWCD Canal). It is recommended that datasondes be placed in Jones and Sims Creeks in the proposed sampling locations shown in **Figure 4-2** to continuously monitor important water quality parameters. If only one datasonde is available for deployment in either of the creeks, it is recommended that it be placed in one of the two proposed upstream locations of Jones Creek. These continuous measurements would allow for the effects of stormwater runoff on water quality to be quantified more accurately. Additionally, when coupled with fecal coliform levels observed in grab samples, the data may also provide greater clarity as to how fecal coliform levels are affected by stormwater runoff. The most cost effective solution would be to relocate datasondes currently owned and operated by LRD. This may easily be achieved if the datasondes are currently located in areas where collecting water quality data at a high frequency is not critical. If LRD datasondes are not available, it is recommended that the feasibility of purchasing additional instruments (approximately $12,000 per datasonde) be evaluated. The capital cost associated with additional datasondes for water quality monitoring extends past the purchase of the hardware. The analysis and processing of the data is time intensive and a recurring cost. Based on LRD input, it is estimated that 75% of one staff member's time is devoted to the management of ten monitoring locations. For this reason, it is recommended that relocation of existing datasondes be evaluated first with the purchase of additional datasondes being the alternative.

While the placement of datasondes in Jones and/or Sims Creeks would allow for the collection of data at a sufficiently high temporal resolution, the measured parameters would not allow for direct identification of fecal coliform sources. Therefore, grab samples should be collected to measure fecal coliform levels as well. These grab samples should at a minimum be collected from the two proposed sampling locations in the upstream reach of Jones Creek with a minimum of one sample being collected every other week. Samples should be collected during outgoing tide in an effort to collect the water originating from upstream. Fecal coliform samples were historically collected once every two months at the existing sampling locations on Indiantown Road and Center Street. It is recommended, if possible, to collect fecal coliform samples at these existing locations once every two weeks in order to have uniformity in sampling frequency within the dataset. However, if the resources are not available for collection and processing at this frequency, the preference would be to first collect samples from the two proposed Jones Creek locations and the existing sampling location in the downstream reach of Sims Creek.

Based on input from the Town and LRD, the collection and processing of water quality samples should be possible through a joint effort, with the Town collecting the samples and LRD processing the samples in their facilities. Since fecal coliform samples require a short hold time between collection and processing, LRD should be consulted prior to all sampling events to ensure there is sufficient time to process the samples in the LRD lab. It is requested that samples be collected on Monday or Tuesday since the LRD lab already processes bacteria samples on those days. Samples must be dropped off at the LRD lab (2500 Jupiter Park Drive) by 3 PM on the same day they are collected. Basic equipment such as bottles, gloves, and datasheets can be provided by LRD along with training of Town of Jupiter employees to ensure proper sampling technique. The additional materials needed by the Town of Jupiter for the sampling and an estimate of man-hours for the described sampling is provided in **Table 5.2**.

Table 5.2
Cost Estimates for Additional Sampling

Item	Estimated Cost
Sampling Pole	$150
Cooler for Sample Storage	$40
Ice for Sample Preservation	$5 Per Sample Event
Sample Collection and Delivery	0.5 Man-Hours Per Sample Location

5.3 Public Education and Awareness

A potentially significant improvement in water quality may be observed following actions to educate the public and increase their awareness of the current water quality issues in the Jones and Sims Creek drainage areas. While such actions have already been taken, these efforts have been broader in nature and did not focus solely on the residents within Jones and Sims Creeks. Educational materials should focus on ways to reduce nutrient (TN and TP) and fecal coliform levels in both creeks since these pollutants typically originate from human activities. It is recommended that a flyer be created and mailed to applicable residents which outlines the causes and effects of elevated nutrient and fecal coliform levels. Current regulations related to yard waste and fertilizer usage should be summarized since many residents are likely unaware that such laws are already in place. Simple infographics may also be helpful for communicating the current water quality issues being experienced in both creeks. Flyers should be distributed quarterly or made available on the Town website for at least one year while the proposed higher frequency sampling is occurring. The informational material on each flyer should typically stay the same, though it may be helpful if updated water quality data is communicated so residents can track any changes in water quality as the public outreach progresses. A cost estimate for the production and distribution of the proposed flyers is provided in **Table 5.3**.

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Table 5.3
Cost Estimate for Production and Distribution of Informative Flyers

Item	Estimated Cost
Design of Informative Flyer	20 Man-Hours
Analyze New Fecal Coliform Data	6 Man-Hours Per Quarter
Update Flyer With New Water Quality Data	2 Man-Hours Per Quarter
Compile Addresses for Residences of Interest	4 Man-Hours
Flyer Printing and Mailing	$0.50 Per Household

While educational flyers may be the most direct method for educating the public, other methods such as web-based materials and lessons in local elementary schools may also prove to be beneficial. These actions should be taken depending on the resources available to the Town to complete such tasks. These actions are not recommended as the top priority due to the indirect method in which the information is conveyed and the reduced likelihood that the information would result in actions taken by homeowners throughout the drainage areas.

Section 6.0
Conclusions

Based on the evaluation of pollutant exceedances within Jones and Sims Creeks and the estimated sources of those pollutants a series of actions are recommended. These actions would assist the Town in remediating the current water quality issues within Jones and Sims Creeks as well as to help better identify the pollutant sources and the mechanisms which allow for the migration of pollutants into the creeks. The recommendations are as follows:

- Programmatic efforts aimed at reducing nutrient and fecal coliform levels in Jones and Sims Creeks should be executed prior to any other actions being taken. These efforts may result in significant improvements in water quality while only requiring minimal resources to implement. Examples of the recommended programmatic practices include placing signage requesting residents not feed the local wildlife, adding pet waste receptacles in public parks, encouraging residents to reduce their fertilizer application rate, and informing the public of the negative water quality impacts that yard waste can have if not properly disposed of. Additional public outreach and education can be achieved through educational programs at local elementary schools outlining the effects that human activities can have on local water quality. It is also important to notify residents that laws pertaining to fertilizer usage and yard waste already exist since many may be unaware. Specific attention should be paid to neighborhoods such as Jupiter River Estates, where a large number of residences are directly adjacent to the residential canals which extend from Jones Creek (with no buffer or BMPs to mitigate runoff impacts).

- Conduct water quality sampling timed specifically during large rainfall events to gain a better understanding of the effects runoff has on pollutant concentrations in each creek. Not only should samples be taken at the current sampling locations along Jones and Sims Creeks, but also at stormwater system outfalls (e.g. the outfall which discharges runoff from Indian Creek into Sims Creek). These samples could provide a better spatial understanding as to where the areas of greatest concern are located.

- Based on the results from the additional sampling, the effectiveness of existing BMPs should be evaluated. Based on that evaluation, a determination should be made as to whether the BMP type should be changed/enhanced or if maintenance is needed.

- Continue to communicate with property owners to convert the two properties located in the Sims Creek drainage area currently on septic over to sewer. This would likely decrease the fecal coliform levels in Sims Creek, as evidenced by a reduction in sucralose concentrations, by reducing the amount of human waste being discharged into the creek via groundwater.

- If all other proposed strategies prove to be ineffective at significantly improving water quality, a method for maintaining a more steady baseflow in each creek could be further evaluated. While this action carries the greatest cost relative to the rest of the strategies, it may be the only action, other than addressing the existing BMPs, which does not require community involvement to improve the water quality. This action would likely have a greater benefit for Jones Creek due to the failure to meet FDEP criteria for both DO and Chlorophyll α in the upstream reach.

An implementation plan which prioritizes the proposed actions based on their feasibility and the assumed cost to benefit ratio is provided in **Table 6.1**. The primary pollutants listed in the provided table are those which would be directly affected by the proposed action. The secondary pollutants are those which would likely be affected if the primary pollutant concentrations were changed.

Table 6.1
Implementation Plan for Jones and Sims Creek Drainage Areas

Priority Number	Description of Proposed Actions	Primary Targeted Pollutant	Secondary Pollutants	Comments
1	Educate the public about the potential negative impacts fertilizer, yard waste, and animal waste can have on the surrounding water quality. Focus primarily on those living adjacent to Jones Creek due to the lack of stormwater treatment prior to discharge to the creek.	TN, TP, and fecal bacteria	Chlorophyll α and DO	Programmatic solutions that would require very little time and capital by the Town. Potential for significant water quality improvement exists if there is a high level of participation by residents. These programmatic efforts could also be aided by educational programs at local elementary schools.
2	Perform additional water quality sampling.	All pollutants of concern	N/A	Action will help Town more accurately identify areas of concern and potentially justify actions which require more capital.

Table 6.1 (continued)
Implementation Plan for Jones and Sims Creek Drainage Areas

Priority Number	Description of Proposed Actions	Primary Targeted Pollutant	Secondary Pollutants	Comments
3	Based on the results of the study being completed by EW Consultants, verify that fertilizer application rate of the golf courses using reclaimed water are appropriate.	TN and TP	Chlorophyll α and DO	Golf course and Town would have mutual interest in reducing fertilizer application rates. Would be easy solution if a reduction in fertilizer usage is deemed as being appropriate.
4	If additional water quality testing indicates bird fecal bacteria may be an issue, place signs requesting that visitors not feed wildlife in public parks.	Fecal bacteria	TN and TP	Low cost solution that has no continuous cost associated with it. Water quality benefits may be minimal and not noticeable until after populations equilibrate to change in available food.
5	Convert the two remaining parcels on septic in Sims Creek drainage area to sewer.	Fecal bacteria, as evidenced by sucralose	TN and TP	These septic tanks appear to be a significant source of fecal bacteria as evidenced by sucralose based on available data.
6	Physical removal of aquatic vegetation.	Chlorophyll α	DO	Recurring cost associated with the action but removal of excess vegetation would reduce potential for DO depletion along with reduced clogging of system during high flow events.
7	Perform maintenance and evaluation of existing BMPs.	TN, TP, and fecal bacteria	Chlorophyll α and DO	Strategy should be formulated upon completion of additional water quality sampling.
8	Maintaining a constant baseflow within each creek.	Chlorophyll α and DO	N/A	Solution has high cost associated with it and may not be feasible due to freshwater classification in the NPBHWCD canal. Should only be examined if all other solutions fail to produce results.

Section 7.0
References

1. Arrington, D. Albrey. "Nutrient Cycling in a Reuse Distribution System Significantly Lowers Landscape Irrigation Nutrient Loading Estimates." 2013. FWEA WateReuse Conference presentation.

2. "Dog Waste Removal Advice, The Professional Managers Original Guide to Dog Waste Management." Dog Waste Bags and Dog Waste Disposal Systems by Zero Waste USA. N.p., n.d. Web. 30 Apr. 2015. <http://www.zerowasteusa.com/>.

3. "Featured Products." Dog Waste Depot Blog. N.p., n.d. Web. 30 Apr. 2015. <http://www.dogwastedepot.com/>.

4. Helfrich, Louis A., et al. "Control methods for aquatic plants in ponds and lakes." (2009).

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March 8, 2021

Re: **Year 4 Land Development Code Update**

Jupiter's Year 2 Code and Land Regulation review covered the following review topics:

Code of Ordinances (including Land Development)

Comprehensive Plan

Jupiter Utilities Guide for Development

The year 2 review of the above topic noted that the Town of Jupiter programs are meeting and exceeding the goals of the MS4 permit.

The following items continue to help enhance water quality:

Ordinance No. 21-18 prohibiting the application of fertilizer from June 1 through September 30 was codified.

Resolution No. 108-19 calling for a reduction in the use of glyphosate products by the town and encouraging a reduction in the use of glyphosate products by the public was presented to Town Council. The Resolution was passed on November 19, 2019. And signed by the Mayor on December 3, 2019. The Town's landscape contracts call for products to be free of glyphosate.

Since the Year 2 report Jupiter has not added additional BMP's, green infrastructure or Low Impact Development Design Standards for new and redevelopment projects.

BACTERIAL POLLUTION CONTROL PLAN FOR SOUTH WEST FORK OF THE LOXAHATCHEE RIVER (WBID 3226C)

February 2021

Prepared By

MOCK • ROOS

CONSULTING ENGINEERS

Table of Contents

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Introduction and Background Information

Purpose

This report presents the Bacterial Pollution Control Plan (BPCP) for Units of Development 23, 29, 32, 33, 41, 45 and 47, in accordance with the Florida Department of Environmental Protection (FDEP) issued National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit for Palm Beach County and specifically, co-permittee Northern Palm Beach County Improvement District (NPBCID). The BPCP is required because a Total Maximum Daily Load (TMDL) for bacteria was established by FDEP for the Southwest Fork of Loxahatchee River, Water Body Identification (WBID 3266C) in an effort to restore the waterbody so that it meets its applicable water quality criteria for fecal coliform, in accordance with the 1972 Federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida). TMDLs are developed for waterbodies that are verified as impaired, i.e., not meeting their water quality standards, as set by the State of Florida. These NPBCID Units of Development identified above, and the WBID, are in the northeastern part of Palm Beach County, in FDEP's St. Lucie-Loxahatchee Group 2 Basin.

The purpose of this report is to identify the possible sources of bacteria pollution discharging from the MS4 of these Units of Development, and the activities that can be implemented to reduce them. The preparation of this report was a joint effort between NPBCID staff and Mock•Roos (MR).

Bacteria Impairment and TMDL

The Southwest Fork of Loxahatchee River was identified as impaired in a 1998 Consent Decree and was verified as impaired for fecal coliform during Cycle 1 (January 1996 – June 2003) of FDEP's ongoing water quality evaluation, and therefore was included on the Verified List of Impaired waters for the St. Lucie and Loxahatchee Basin that was adopted by Secretarial Order in May 2004. The waterbody was re-assessed during Cycle 2 (January 2001 – June 2008) and remained impaired for fecal coliform bacteria (FDEP, 2012). A TMDL was established by FDEP for the Southwest Fork of Loxahatchee River, and sets a restoration target by determining the maximum or allowable amount of fecal coliform loading that the waterbody can assimilate and still meet water quality standards and designated uses (Chapter 62-304, Florida Administrative Code [F.A.C.]).

The objective of a TMDL is to provide a basis for allocating acceptable loads among all known stakeholders in the contributing watershed. Therefore, it is critical to recognize and comprehend the pollution sources to ensure resources are effective and their allocations are targeted toward correct control measures. Potential sources that can impact the water quality for fecal coliform are agriculture, failed septic tanks, farm animals, pets, sanitary sewer overflows (SSOs), wildlife and homeless encampments. A TMDL is the sum of point sources (waste load allocations or WLAs), non-point sources (load allocations or LAs) and an appropriate margin of safety (MOS), which considers any uncertainty concerning the relationship between effluent limitations and water quality.

According to the TMDL Report prepared by FDEP in May 2012 named Fecal Coliform TMDL for Southwest Fork Loxahatchee River WBID 3226C, a 91.3% reduction from the 2012 estimated loading (based on water quality data from 2001 through 2007) is needed to reduce bacterial load and to achieve the concentration target of 43 counts/100mL.

Affected Units of Developments and bacteria water quality criteria.

NPBCID has over 75 geographical taxing areas called Units of Development that have unique budgets to defray the cost of services provided to that area. Some of the services that NPBCID provides are stormwater management, right-of-way maintenance including roadways and sidewalks, maintenance of canals, waterways and lakes, water quality monitoring, environmental mitigation, and management, permit and plat review as well as hurricane response and emergency operations.

For assessment purposes, the FDEP has divided the St. Lucie and Loxahatchee Basin into water assessment areas with a unique WBID number. The Southwest Fork of Loxahatchee River is WBID 3226C. NPBCID Units of Development 23, 29, 32, 33, 41, 45 and 47 are within the vicinity of WBID 3226C, as shown in Figures 1 through 8. The south end of Unit 23 and two sections of Unit 32 are within the WBID boundary, while the rest of the Units are located to the north of WBID 3226C, except for Unit 45 that is in the south east. Despite the fact that these Units, for the most part, are not within WBID 3226C, they are relevant to this study since these areas might be indirectly impacting the bacterial loadings into the Southwest Fork of the Loxahatchee River.

Drainage in this area of Palm Beach County is highly regulated by the South Florida Water Management District (SFWMD) Environmental Resources Permits and via a series of canals and control structures. The Southwest Fork of Loxahatchee River originates where the C-18 Canal passes through the SFWMD S-46 gated spillway structure on the western edge of Jupiter, in northeast Palm Beach County. The Loxahatchee River Southwest Fork flows generally in an easterly direction for approximately 1 mile until it meets with the Northwest Fork to form the Loxahatchee River that flows to the Atlantic Ocean, at Jupiter Inlet. Most of the Units of Development in this study drain into the Southwest Fork of Loxahatchee River, while the Units 29 and 33 drain east, into the Northwest Fork of Loxahatchee River.

The Southwest Fork of Loxahatchee River is a Class II (estuarine) waterbody. The bacteriological water quality criterion for the protection of Class II waters, as established by Rule 62-302, F.A.C., expresses that the most probable number (MPN) for fecal coliform shall not exceed a median value of 14, with not more than 10% of the samples exceeding 43, nor exceed 800 on any one day. However, considering that the surface waters within the Units of Development are predominantly fresh water, the Units were evaluated using Class III waters. The bacteriological criterion for fresh water is Escherichia Coli Bacteria (e. Coli). The standard for Class III waters states that the MPN counts of e. Coli shall not exceed a monthly geometric mean of 126 nor exceed the Ten Percent Threshold Value (TPTV) of 410 in 10% or more of the samples during any 30-day period.

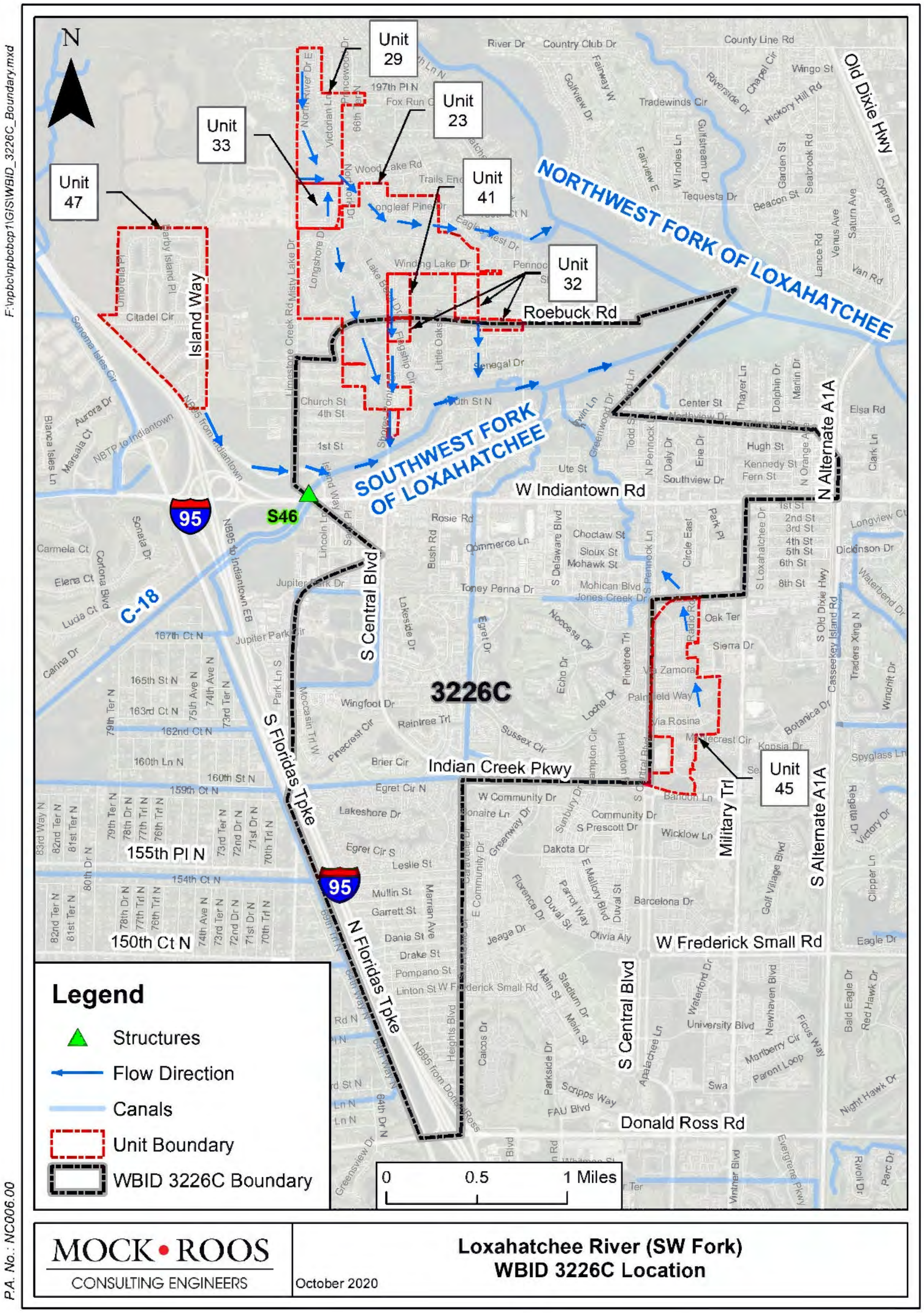

Figure 1. Location of the studied Units of Development and WBID 3226C.

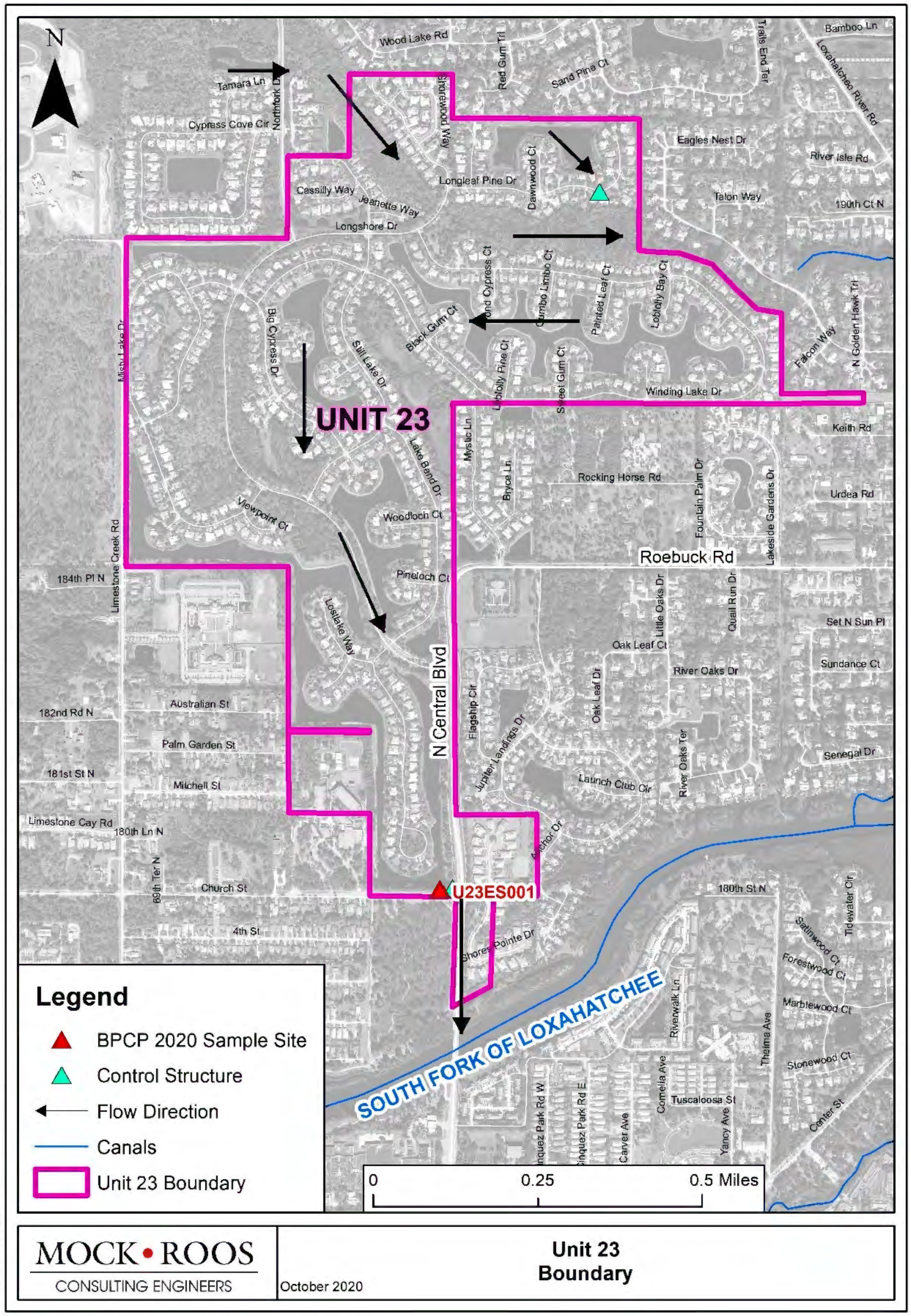

Figure 2.. Unit 23 drainage pattern into South Fork of Loxahatchee River.

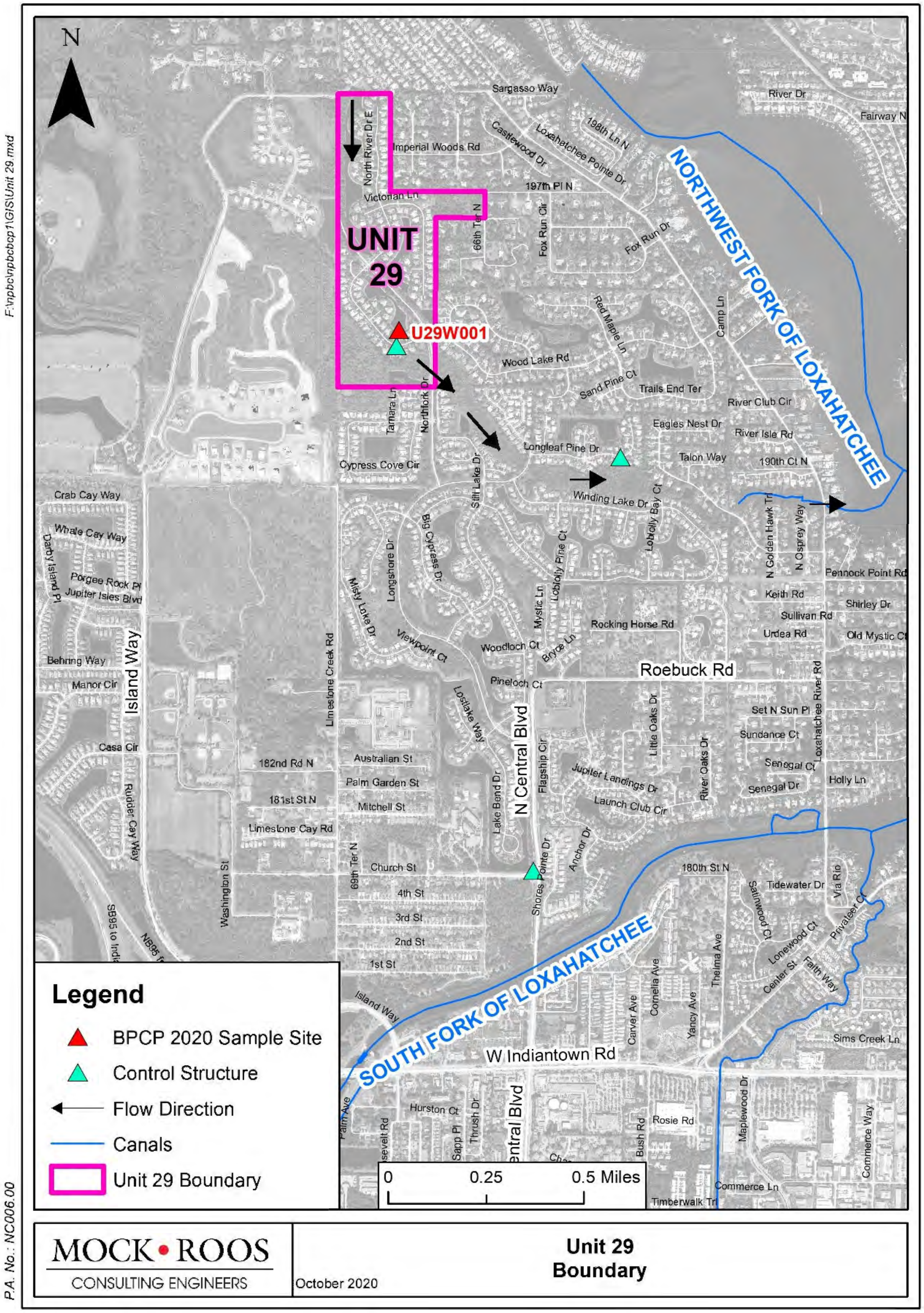

Figure 3. Unit 29 drainage pattern into Loxahatchee River.

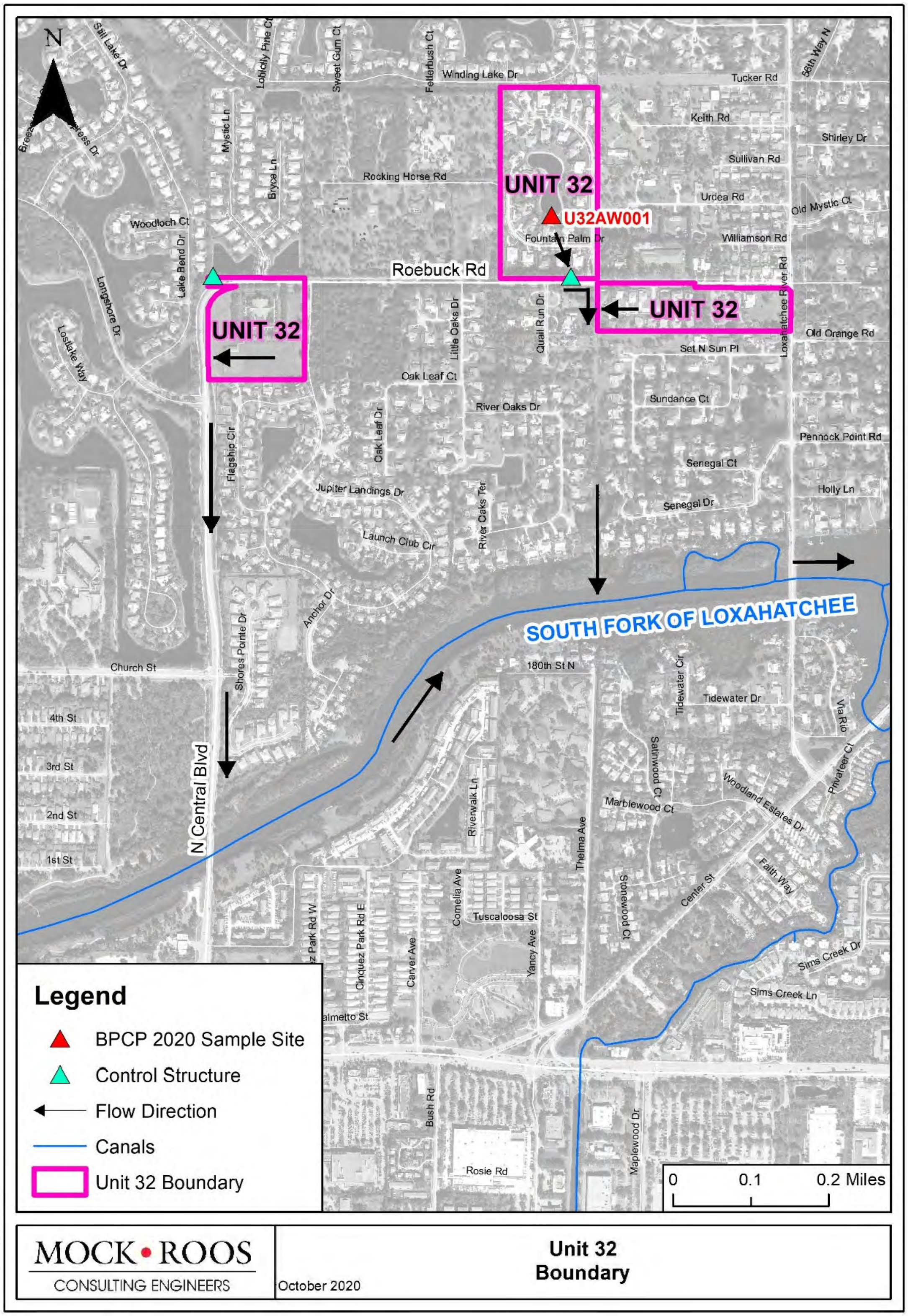

Figure 4. Unit 32 drainage pattern into South Fork of Loxahatchee River.

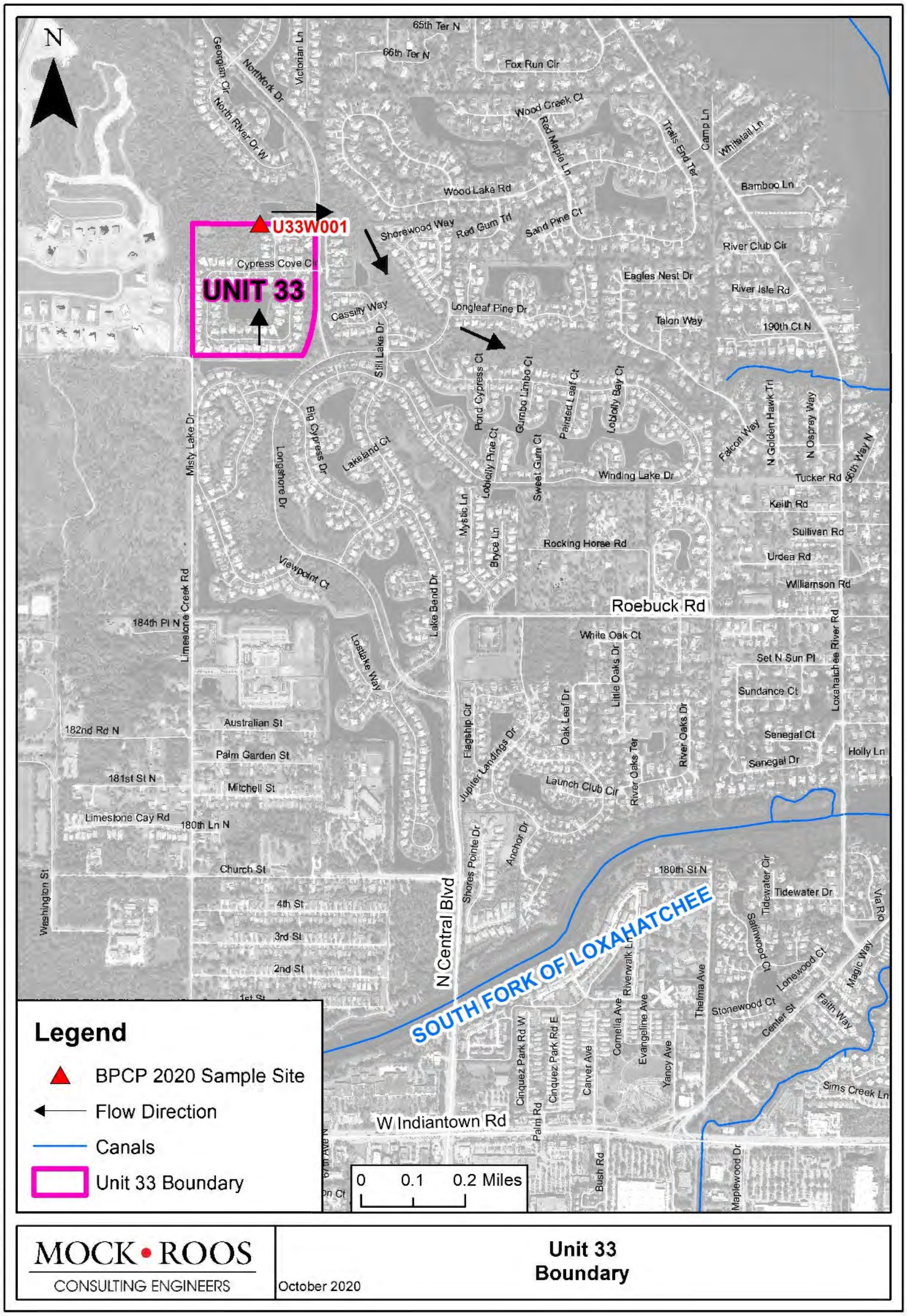

Figure 5. Unit 33 drainage pattern into Loxahatchee River.

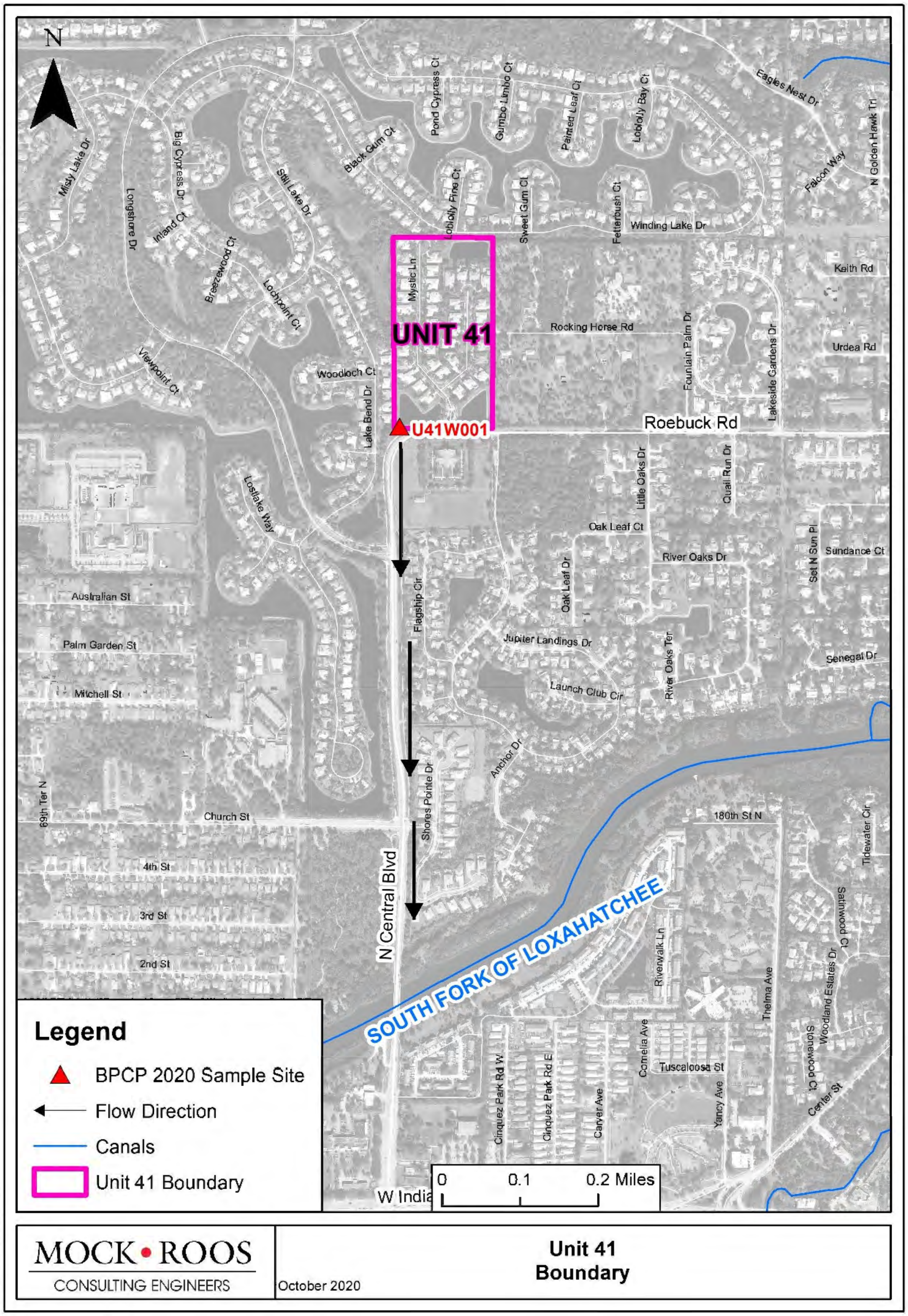

Figure 6. Unit 41 drainage pattern into South Fork of Loxahatchee River.

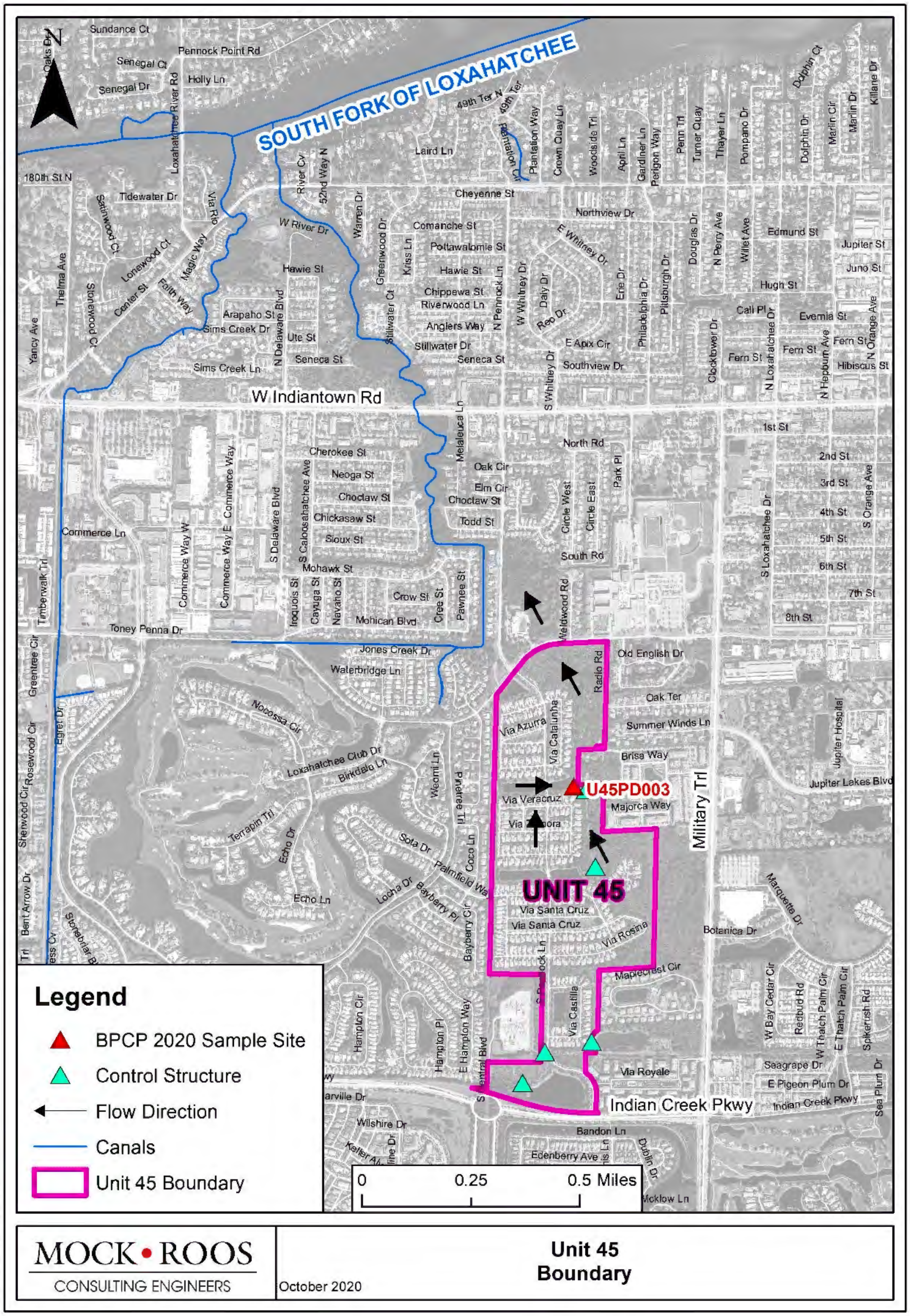

Figure 7. Unit 45 drainage pattern into South Fork of Loxahatchee River.

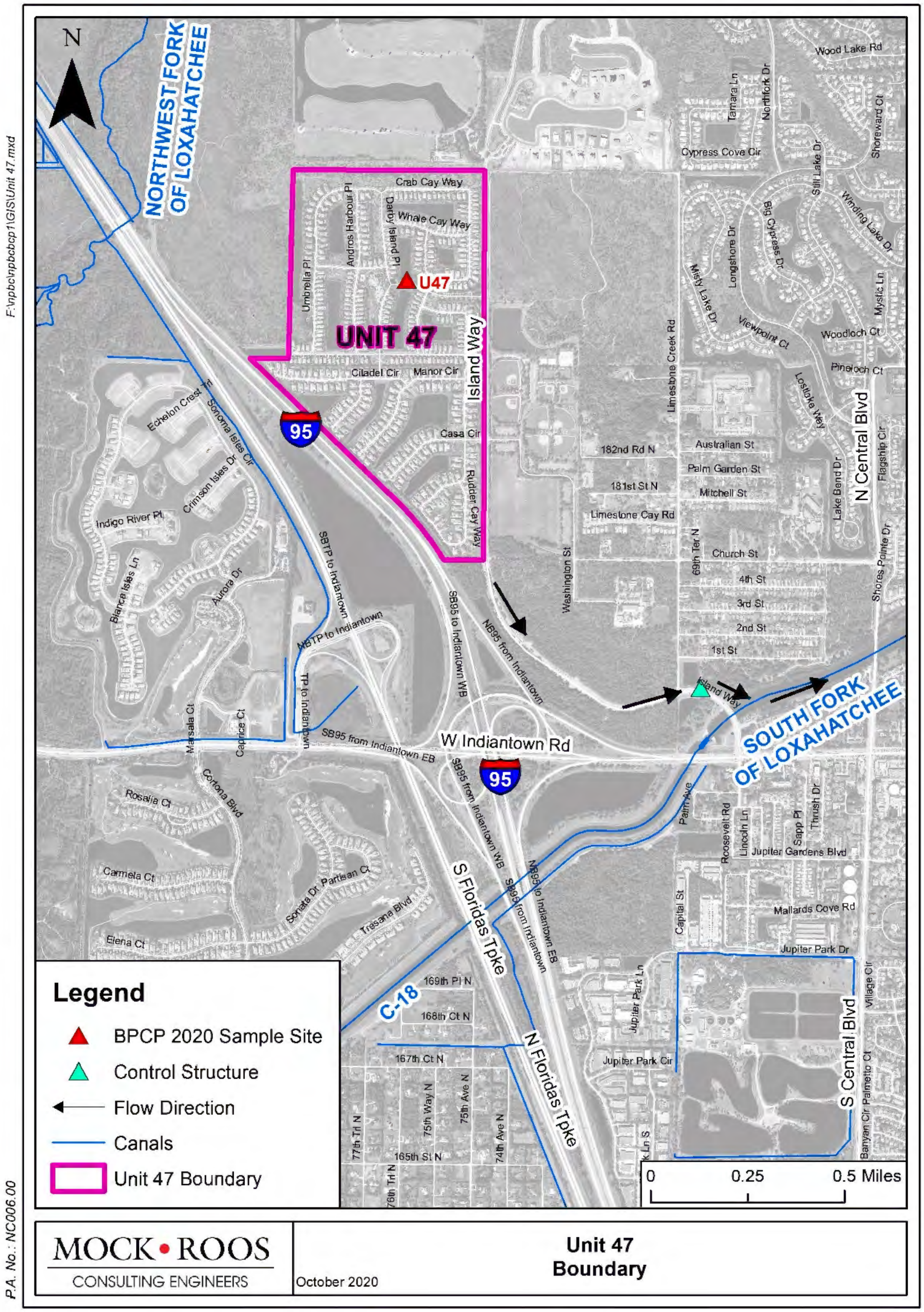

Figure 8. Unit 47 drainage pattern into South Fork of Loxahatchee River.

Potential Source Identification

Pet Waste

Pets whose waste is deposited outdoors can be a significant source of bacteria pollution through surface runoff in the Southwest Fork Loxahatchee River watershed. Studies report that up to 95 percent of the Fecal Indicator Bacteria (FIB) found in urban stormwater can have non-human origins. The most important nonhuman fecal coliform contributors appear to be dogs and cats. Using bacteria source tracking techniques, it was found in Stevenson Creek in Clearwater, Florida, that the bacteria contributed by dogs was as significant as those from septic tanks (Watson, 2002).

Sanitary Sewer System

The area where the Units are located is served by a sanitary sewer system that consist of 20 lift stations and 176,590 linear feet of force mains that convey raw sewage to the wastewater treatment plant (Figure 9). The system, built in the 1990s, was designed and constructed to achieve total containment of sanitary wastes and maximum exclusion of infiltration and inflow. Furthermore, since 2008, over 1,500 Onsite Sewage Treatment and Disposal Systems (OSTDS) have been converted to the public sewer system in the Loxahatchee River Neighborhood.

Sanitary Sewer Overflows

LRD recorded two sanitary sewer overflows (SSOs) that occurred within the area of the NPBCID Units of Development in the last 5 years. As shown in the map below (Figure 10), sewage was spilled in Unit 23 and inside the WBID boundary.

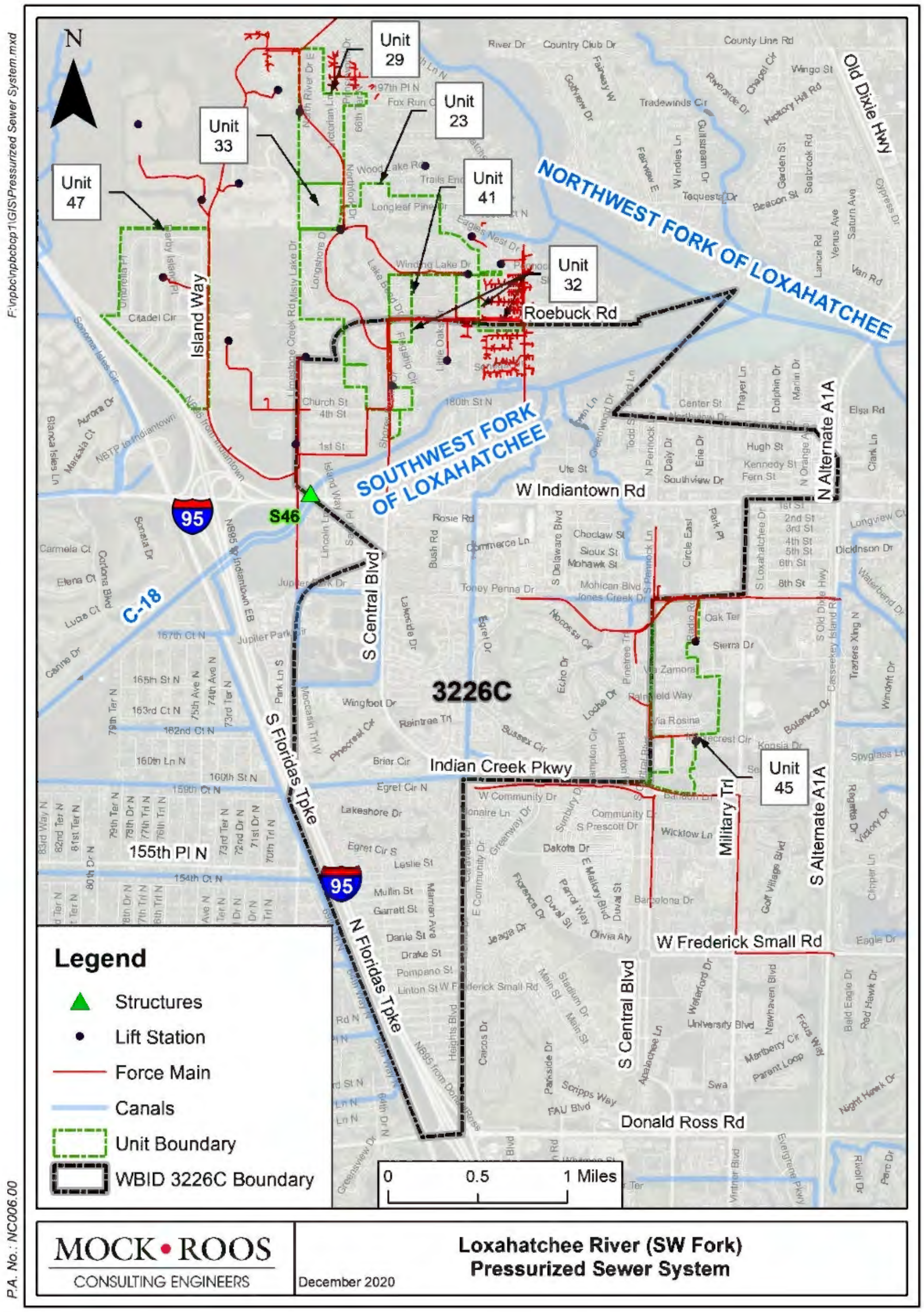

Figure 9. Lift Stations and Force Main System in the Units of Development.

Figure 10. Sanitary Sewer Overflow Events

Event 1: 100-gallon spill on 02/24/2020. Sewage bubbled out of ground when working valve LS161-VL001

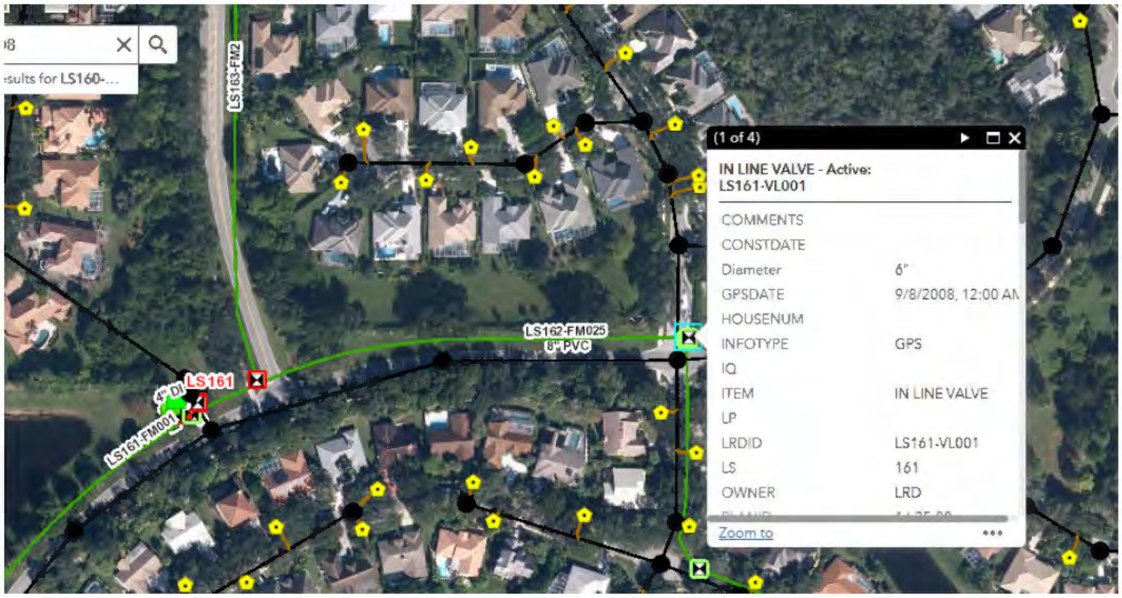

Figure 11. Sanitary Sewer Overflow Event 1 location

Event 2: 100,000-gallon spill on 06/06/2020. sewage coming out of manhole due to LS160 gravity system being flooded from rain event of 06/05/2020

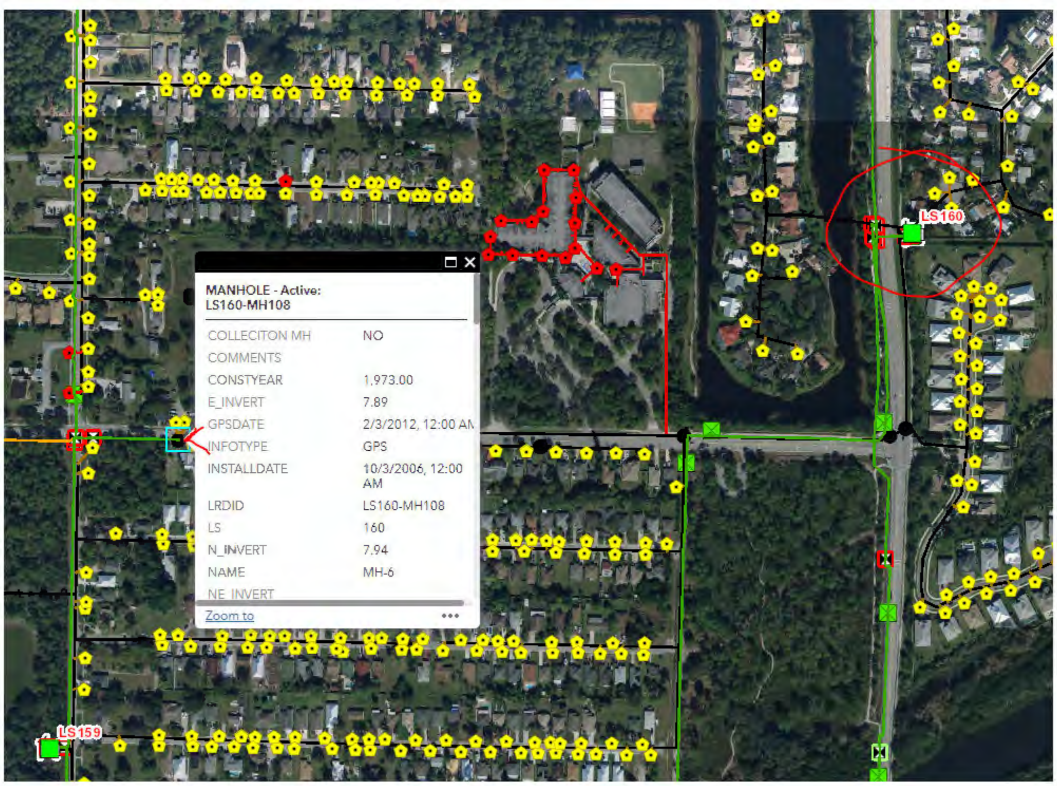

Figure 12. Sanitary Sewer Overflow Event 2 location

Land Uses and Mapping

The spatial distribution and acreage of different land use categories were identified utilizing the 2018-2019 land use coverage prepared by MR for the MS4 permit Year 3 pollutant loading estimates. The area of the Units of Development is predominantly comprised of built-up urban and residential areas, as shown in Figure 13 and Table 1. Development history begins with conversions of regional wet prairies to cattle operations, harvesting within flatwoods and cypress swamps, and ditching to lower water tables. Development began near the estuary and fanned outward. As residential development increased from the 1970s to date, pockets of residential development, most often with associated golf courses, converted wetland and mesic areas. Residential development increased rapidly in the 1990s through middle 2000s. NPBCID, South Indian River Water Control District (SIRWCD) and SFWMD manage stormwater control infrastructure in the area, including canals, sluices, and gate systems.

Table 1. Land Cover breakdown in the Units of Development

Land Use Description	Area (ac)	% of Total Area
Residential Medium Density	430.3119	41.83%
Forest/Open Land	176.2475	17.13%
Major Highways	167.5969	16.29%
Water	161.9014	15.74%
Wetlands	69.5762	6.76%
Commercial	23.1266	2.25%
Residential Low Density	0.0038	<1%
Residential High Density	0.0077	<1%
Total	**1,028.7720**	**100%**

Table 2. Acreage breakdown of the studied Units of Development

Unit	Acres of SF Homes	Acres of SW	Other acres
Unit 23: The Shores	368.80	97	3 created marshes
Unit 29: North Fork	106.3	16	2 created marshes
Unit 32: Palm Cove	38.66	1	-
Unit 33: Cypress Cove	37.27	4	-
Unit 41: Mystic Cove	20.20	2.2	-
Unit 45: Paseos	213.24	11.82	25.59 created Uplands 28.13 Preserves
Unit 47: Jupiter Isles	266	32.48	-

SF = Single Family, SW = Surface Water

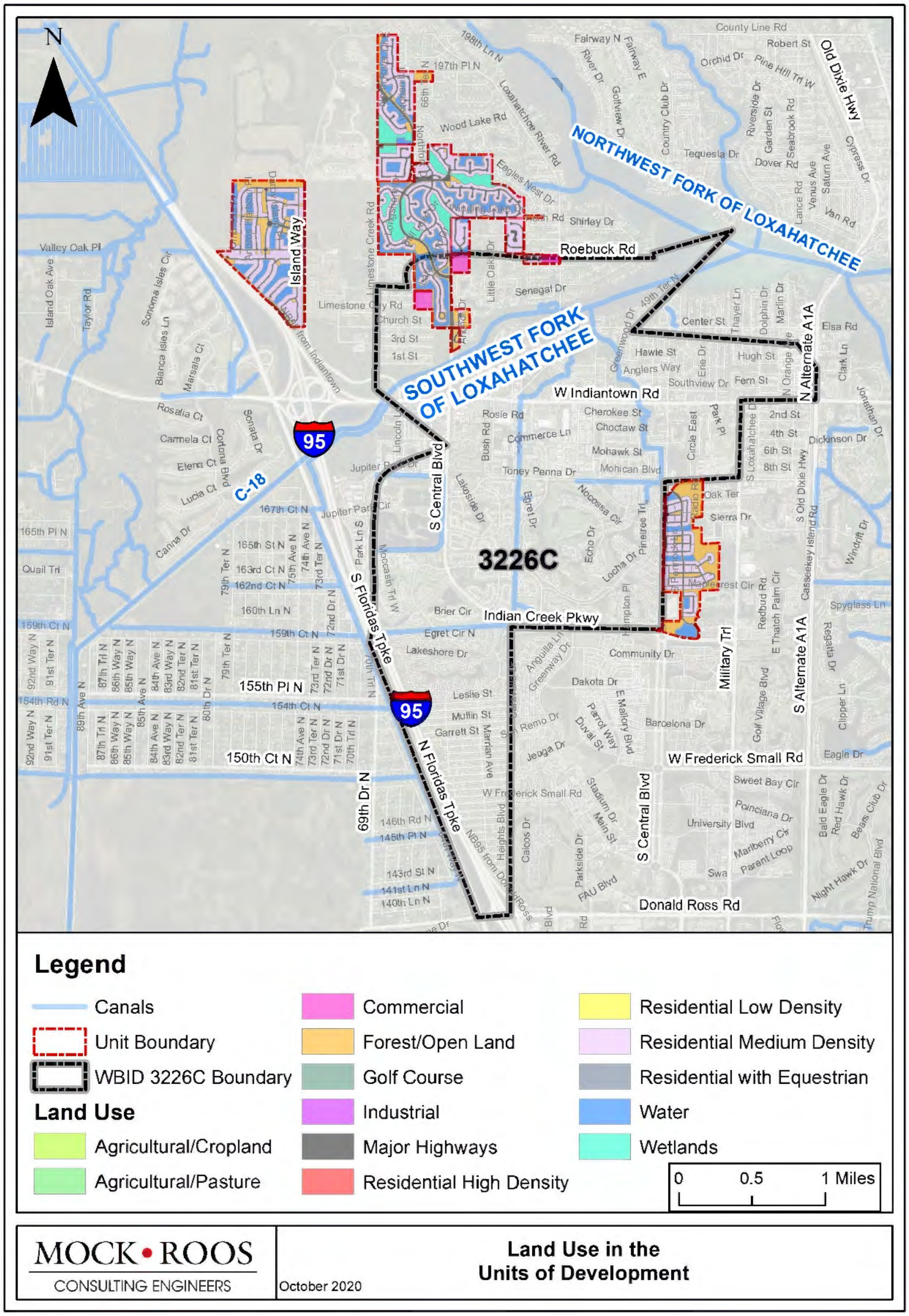

Figure 13. Land Use Classification within the studied Units of Development.

NPBCID's Walk the WBID

Walk the WBID or Watershed (WTW) is a field reconnaissance effort to gain a better understanding of a watershed, including the hydrology of the basin and its contributing area, where infrastructure (sewer and stormwater) is located, and what potential sources may be contributing bacterial pollution to the waterbody. This activity is a useful tool for impaired waterbodies in which the sources of the bacterial loading are not readily apparent.

On December 9th, 2020, NPBCID staff conducted a WTW survey. No homeless camps were found within the properties nor any signs of camps in the immediate surrounding area. Minimal wildlife – a few ducks and egrets – was observed in the retention areas during the walk. Tracks from other small species such as raccoons were observed. Property Owners Associations (POA) have contracted landscape services to collect trash during maintenance activities, therefore, trash and debris were minimal to non-existent. The following photos are representative of typical systems and conditions within the WBID under NPBCID control.

Unit 23

Figure 14. Outfall and Water Quality sample location of Unit 23

Figure 15. Unit 23 pet waste station

Unit 29

Figure 16. Unit 29 Water Quality sample site

Figure 17. Typical Pet Waste station in Unit 29

Unit 32

Figure 18. Unit 32 Water Quality sample site

Figure 19. Unit 32 typical road section with valley gutter

Unit 33

Figure 20. Outfall and Water Quality sample location of Unit 33

Figure 21. Unit 33 typical grass swale

Unit 41

Figure 22. Outfall location and water quality sample location in Unit 41

Figure 23. Unit 41 typical roadway with valley gutter system

Unit 45

Figure 24. Unit 45 water quality sample location

Figure 25. Typical pet waste stations installed throughout the development in Unit 45

Unit 47

Figure 26. Unit 47 water quality sample location

Figure 27. Greenspace in Unit 47

Monitoring

a. TMDL Stations

For the Cycle 2 verified period, FDEP analyzed samples from 6 stations to detect fecal coliform concentrations exceeding the state criterion of 43 counts/100mL (Figure 25) and to define the TMDL. The highest number of exceedances were recorded at Stations 21FLLOX 71 (Sims Creek) and 21FLLOX 73 (Jones Creek), located in the middle reach of the Southwest Fork of Loxahatchee River, an area receiving residential stormwater runoff from Sims Creeks and combination of residential and natural areas of stormwater runoff from Jones Creek.

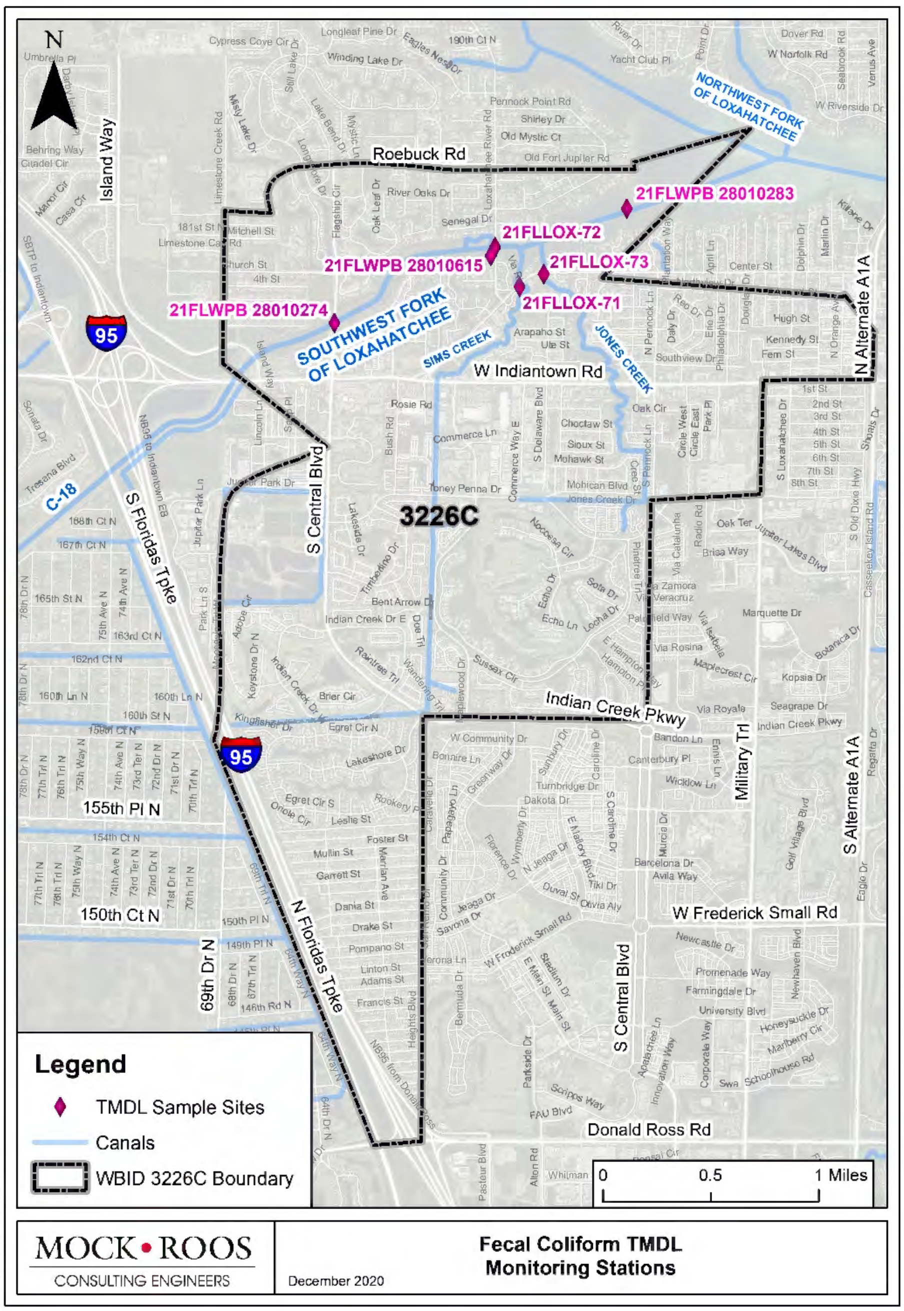

Figure 25. Fecal Coliform TMDL Monitoring Stations

The lowest number of exceedances (1 and 0 respectively) occurred at Stations 21FLWPB 28010274 and 21FLWPB 28010283 which may indicate that the bacterial loads influencing the Southwest Fork of the Loxahatchee River might be coming from Sims and/or Jones Creeks.

b. Northern Stations

NPBCID collected samples from the stormwater management system of each Unit in the period December 2019 – December 2020. As shown in the WTW photos above, the samples were collected near the ponds located in the neighborhoods. The monitoring stations are shown on Figure 25. A total of 27 samples were analyzed in the lab for e. Coli and the MPN/100mL results are summarized in Table 3.

Table 3. E. Coli Water Quality Monitoring Results

Date	Station	Result MPN/100 mL
12/23/2019	U23ES001	41
	U32AW001	31
	U45PD003	135
	U45PD003	201
	U45PD003	712
12/26/2019	U47	135
08/11/2020	U23ES001	86
	U29W001	10
	U32AW001	31
	U33W001	41
	U41W001	10
	U45PD003	31
	U47	10
09/08/2020	U23ES001	305
	U29W001	206
	U32AW001	259
	U33W001	63
	U41W001	327
	U45PD003	148
	U47	85
11/11/2020	U23ES001	350
	U29W001	399
	U32AW001	1260
	U33W001	471
	U41W001	813
	U45PD003	711
	U47	691

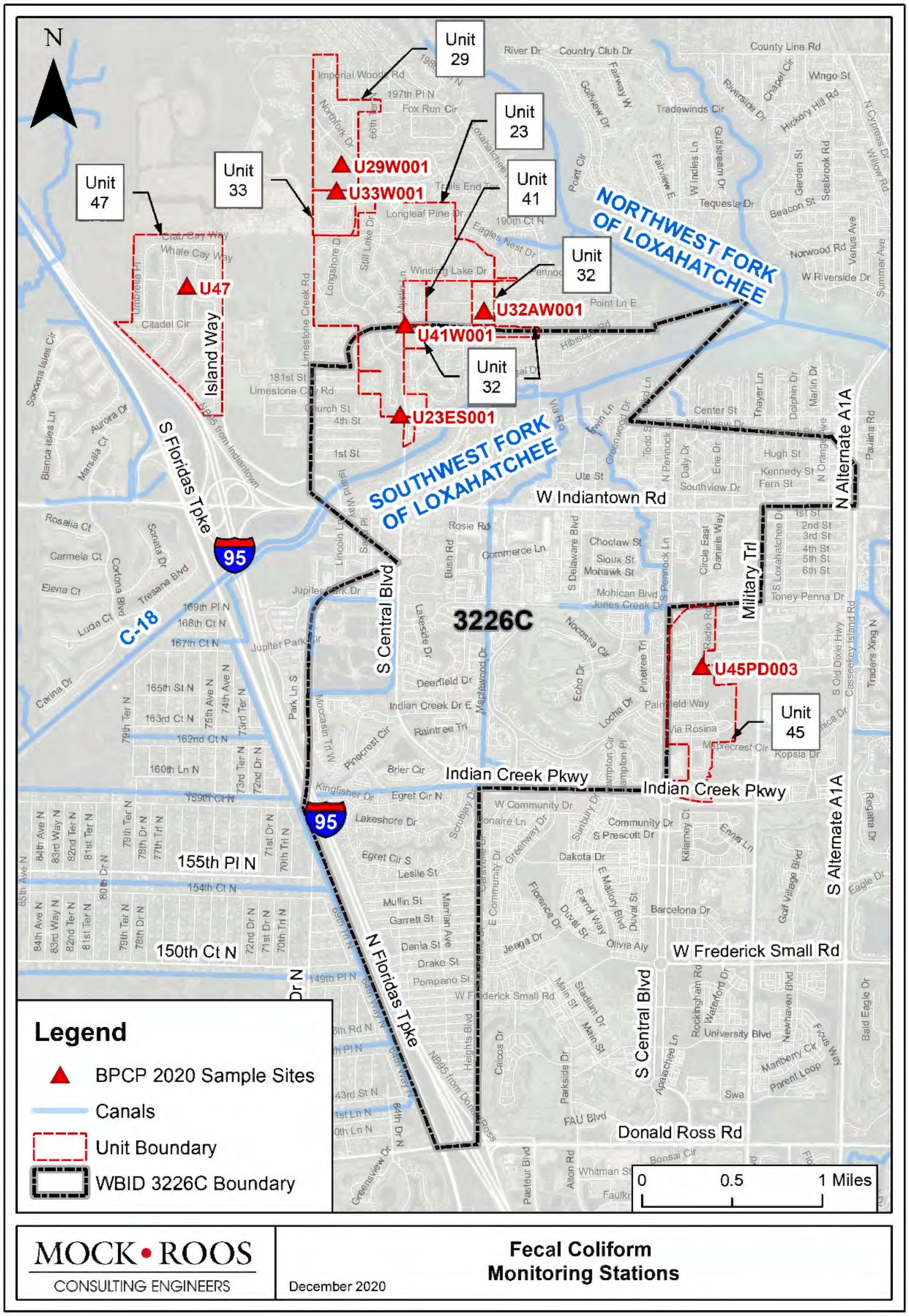

Figure 26. E. Coli Monitoring Stations

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Using the Hazen method for estimating percentiles, the 90th percentile, also called the 10 percent exceedance event or that threshold above which only 10% of exceedances occur, was calculated, to determine the percentile value of each data point and the exceedances. Data were ordered from the lowest to the highest and are shown in Table 4.

Table 4. Calculations of e. Coli Reductions based on the Hazen Method

Date	Station	Result MPN/100 mL	Rank	Percentile
08/11/2020	U29W001	10	1	2%
08/11/2020	U41W001	10	2	6%
08/11/2020	U47	10	3	9%
12/23/2019	U32AW001	31	4	13%
08/11/2020	U32AW001	31	5	17%
08/11/2020	U45PD003	31	6	20%
12/23/2019	U23ES001	41	7	24%
08/11/2020	U33W001	41	8	28%
09/08/2020	U33W001	63	9	31%
09/08/2020	U47	85	10	35%
08/11/2020	U23ES001	86	11	39%
12/23/2019	U45PD003	135	12	43%
12/26/2019	U47	135	13	46%
09/08/2020	U45PD003	148	14	50%
12/23/2019	U45PD003	201	15	54%
09/08/2020	U29W001	206	16	57%
09/08/2020	U32AW001	259	17	61%
09/08/2020	U23ES001	305	18	65%
09/08/2020	U41W001	327	19	69%
11/11/2020	U23ES001	350	20	72%
11/11/2020	U29W001	399	21	76%
11/11/2020	U33W001	471	22	80%
11/11/2020	U47	691	23	83%
11/11/2020	U45PD003	711	24	87%
12/23/2019	U45PD003	712	25	90%
11/11/2020	U41W001	813	26	94%
11/11/2020	U32AW001	1260	27	98%

Table 5. Summary statistics of e. Coli data for all the stations

Description	Value
Total # samples	27
Total # exceedances	6
62-302 maximum # of exceedances allowed	2
% of exceedances	22%

To calculate the percent reduction needed to reduce the bacterial load for NPBCID units in 2020, the following equations was used.

$$\% \, Reduction = \frac{90^{th} \, Percentile \, Concentration - Allowable \, Concentration}{90^{th} \, Percentile \, Concentration} x100 \qquad \text{(Eq. 1)}$$

From Table 5, the 90th Percentile Concentration is 712 MPN/100mL, which is above the Chapter 62-302, F.A.C. Ten Percent Threshold Value of 43. Using Eq. 1, the needed percent reduction is:

$$\% \, Reduction = \frac{(712 - 410) \, MPN/100mL}{712 \, MPN/100mL} x100$$

$$\% \, Reduction = 42.4\%$$

This is a significant improvement from the TMDL reduction goal of 91.3%

Temporal Patterns

E. Coli data for the NPBCID studied period were analyzed for annual and seasonal trends. Seasonally, a peak in bacterial concentrations and exceedance rates is expected during the summer (July–September), when conditions are rainy and warm (Florida's rainy season). Conversely, lower concentrations and fewer exceedances are often observed in the winter (January–March) and fall (October–December), when conditions are drier and cooler. Using rainfall data collected at the SFWMD structure S-46, and stored in SFWMD's DBHYDRO database, it was possible to compare monthly rainfall with e. Coli exceedance rates over the studied period. As shown in Table 6, most of the exceedances observed occurred in the month of November.

Table 6. Summary statistics of e. Coli data for all the stations by month

Month	Number of samples	Number of exceedances	% Exceedances
December	6	1	17
January	0		
February	0		
March	0		
April	0		
May	0		
June	0		
July	0		
August	7	0	0
September	7	0	0
October	0		
November	7	5	71
December	0		

Peak bacterial loads commonly coincide with periods of increased rainfall, especially rainfalls that individually or cumulatively provide volumes that flush through surface soils and flush through stormwater ponds to surface waters. Comparison of table 6 and Figure 28 confirms that there is a good correlation with rainfall and number of water quality exceedances.

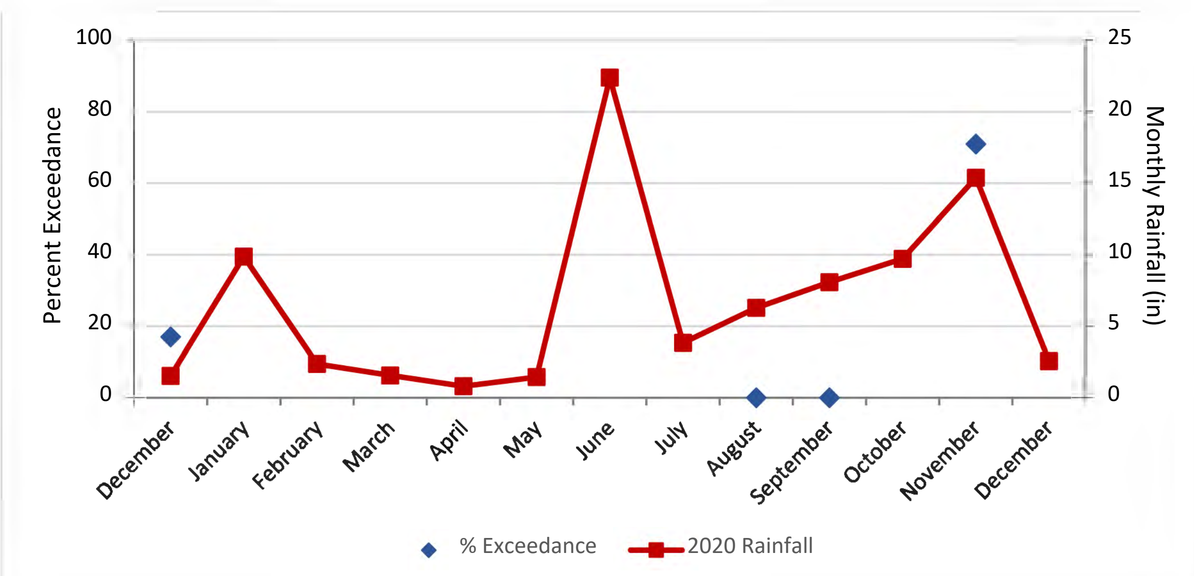

Figure 28. E. Coli exceedances and rainfall at all stations in the Units of Development in 2020 by month

Spatial Patterns

E. Coli data for the studied period from the stations were analyzed to detect spatial trends in the data (Table 7). Concentrations of E. Coli exceeding the state criterion (410 counts/100mL) were observed at the Units 32, 33, 41, 45 and 47. The highest concentration were recorded at stations U33W001, U41W001 and U45PD003, areas that receive mostly residential stormwater runoff (Figure 29). Station U32AW001 registered the maximum concentration of 1260 (counts/100mL). Station U45PD0003 had the most exceedance.

As previously shown on Figure 7, unit 45 discharges into Jones Creek, and as it was described in Table 2 and consists of a large residential area. According to the 2012 TMDL Report by FDEP, station 21FLLOX 73 (Jones Creek) reported the highest concentrations. Only one of seven NPBCID, Unit 45, drains into Jones Creek. As noted previously, Jones Creek is a suspected source of bacteria affecting concentrations in the Southwest Fork of the Loxahatchee River.

Table 7. Station Summary Statistics of E. Coli

Unit	Number of samples	Number of exceedances	% Exceedances
U23ES001	4	0	0
U29W001	3	0	0
U32AW001	4	1	25
U33W001	3	1	33
U41W001	3	1	33
U45PD003	6	2	33
U47	4	1	25

Since sampling activities were not performed in February nor June, the impact of the mentioned SSOs above in the Units waters and WBID were not evaluated.

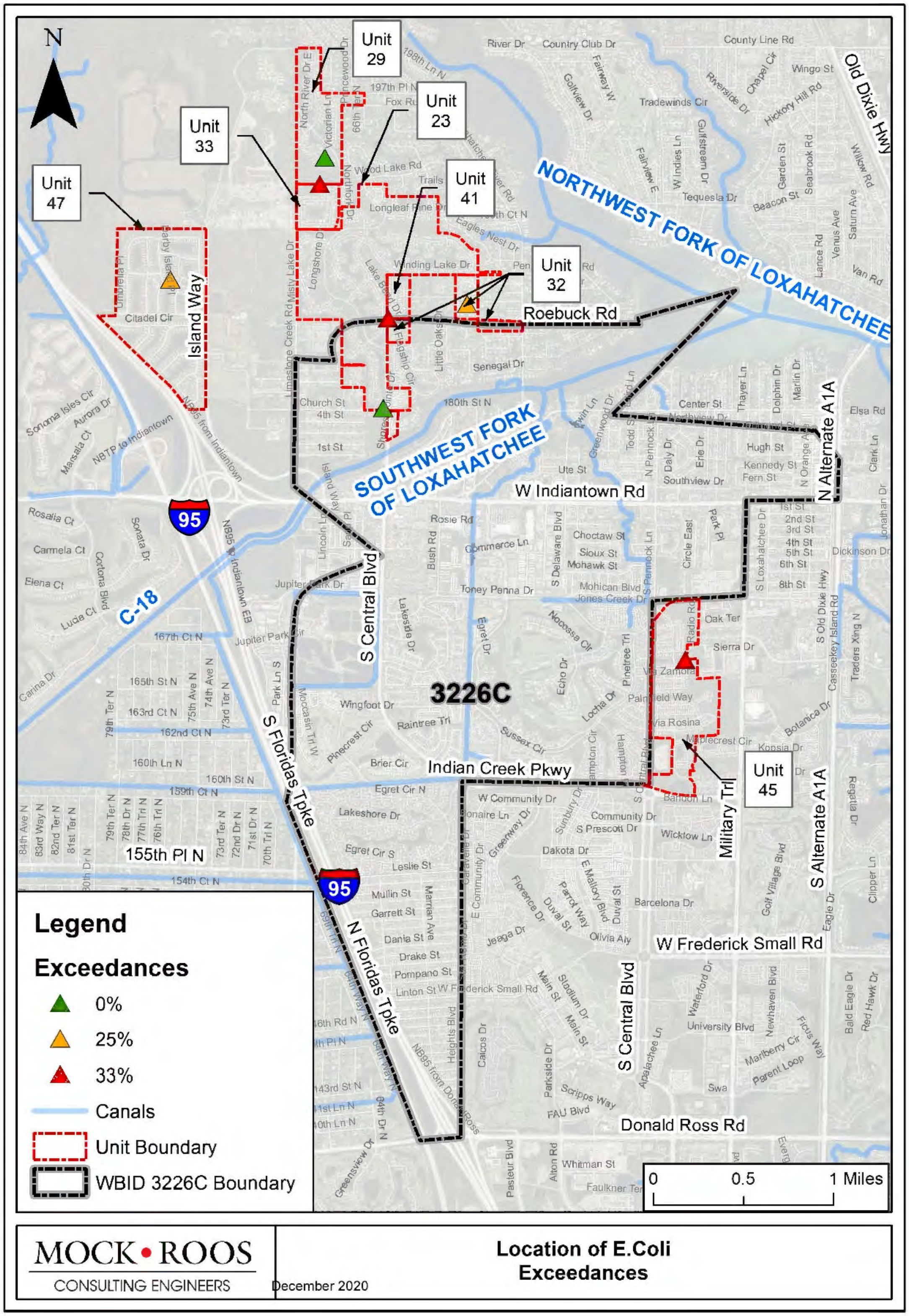

Figure 29. Location of E. Coli exceedances

c. LRD Stations

Over the past several years, the LRD, in partnership with the Town of Jupiter (TOJ), has conducted extensive water quality monitoring and thoroughly explored the watersheds to try and identify the potential source(s) of Fecal Indicator Bacteria (FIB). With no obvious source of the high FIB values, LRD and FDEP partnered to capitalize on FDEP's more sophisticated analytical methods to further investigate the potential sources of FIB in Jones Creek.

Samples were collected in the 2019 wet season from five Jones Creek locations between Indiantown Road and Toney Penna foot bridge. Samples were analyzed for Enterococci, five common chemicals that can be detected in human waste material (acetaminophen, naproxen, ibuprofen, hydrocodone, and sucralose), and genetic markers for human and canine material. Enterococci bacteria serve as an indicator for fecal contamination in salt and brackish waters. These organisms are not harmful themselves but indicate that other potentially harmful organisms may be present. Results of the sample testing indicated continued high levels of Enterococci in Jones Creek, the presence of human waste, and the presence of human and canine genetic material. Jupiter concluded that the presence of human waste in the genetic markers, with the absence in the chemical indicators is indicative of low concentrations indicative of a single household, rather than broken wastewater infrastructure.

The findings have led LRD to adjust its monitoring locations to try and narrow in on those potential pollution sources such as a camper discharge, a homeless encampment, a residence still utilizing a septic system, or a broken sewer lateral line joining the home to the gravity sewer line.

Dry season sample collection is under way and a summary report will be prepared once the test results are finalized.

LRD also collects and tests water quality samples for Enterococci bacteria each week throughout the Loxahatchee River Estuary in popular recreation areas (Figure 30).

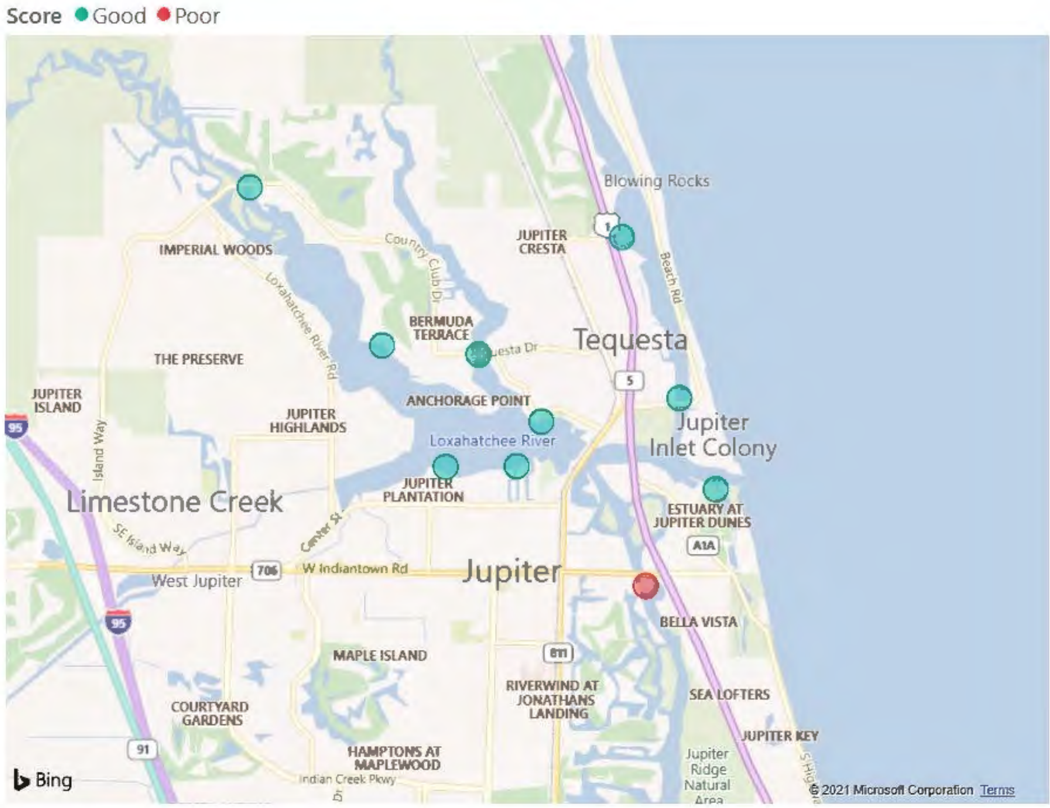

Figure 30. Loxahatchee River District monitoring locations

In 2020, 65 samples were taken from the Southwest Fork and South Channel West stations and were analyzed for enterococci bacteria (Figure 31). The Hazen method was applied to the data and the results are shown in Table 8. The bacteriological water quality criterion for enterococci bacteria states that MPN counts shall not exceed a monthly geometric mean of 35 nor exceed the Ten Percent Threshold Value (TPTV) of 130 in 10% or more of the samples during any 30-day period.

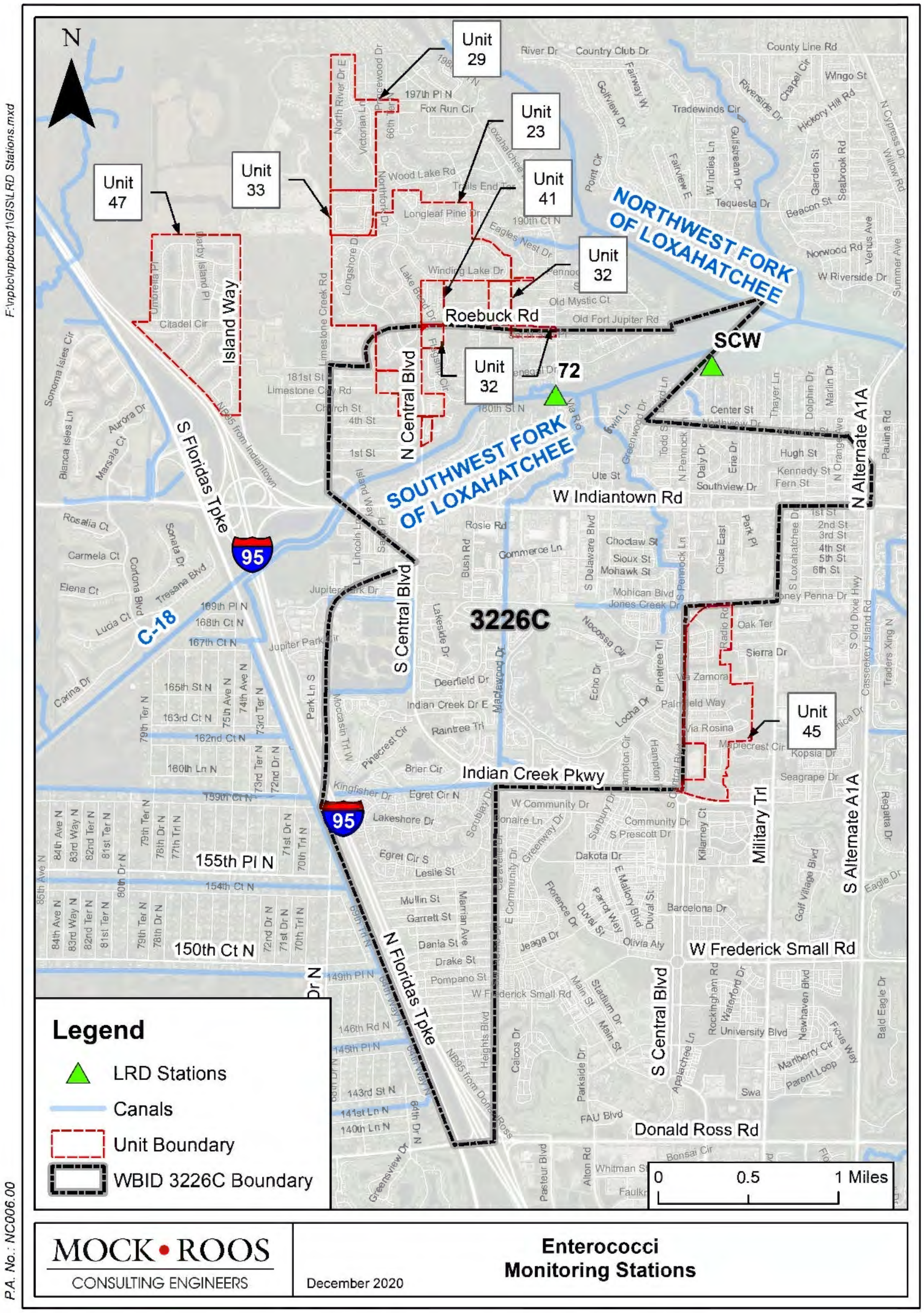

Figure 31. Enterococci Monitoring Stations

Table 8. Enterococci bacteria monitoring results

Date	Station ID	Site Name	Average of CURVALUE (MPN/100mL)	Rank	Percentile
15-Jan-20	SCW	South Channel West	5	1	1%
26-Feb-20	SCW	South Channel West	5	2	3%
4-Mar-20	SCW	South Channel West	5	3	4%
11-Mar-20	SCW	South Channel West	5	4	6%
25-Mar-20	SCW	South Channel West	5	5	7%
2-Apr-20	SCW	South Channel West	5	6	9%
15-Apr-20	SCW	South Channel West	5	7	10%
29-Apr-20	SCW	South Channel West	5	8	12%
7-May-20	SCW	South Channel West	5	9	14%
13-May-20	SCW	South Channel West	5	10	15%
20-May-20	SCW	South Channel West	5	11	17%
30-Jun-20	SCW	South Channel West	5	12	18%
22-Jan-20	SCW	South Channel West	10	13	20%
8-Apr-20	SCW	South Channel West	10	14	21%
22-Apr-20	SCW	South Channel West	10	15	23%
12-Aug-20	SCW	South Channel West	10	16	24%
30-Sep-20	SCW	South Channel West	10	17	26%
18-Aug-20	72	SW Fork - Lox. Riv. Rd.	10	18	27%
29-Jan-20	SCW	South Channel West	20	19	29%
18-Mar-20	SCW	South Channel West	20	20	30%
20-Aug-20	SCW	South Channel West	20	21	32%
28-Oct-20	SCW	South Channel West	20	22	34%
9-Dec-20	SCW	South Channel West	20	23	35%
16-Dec-20	SCW	South Channel West	20	24	37%
30-Dec-20	SCW	South Channel West	20	25	38%
14-Sep-20	72	SW Fork - Lox. Riv. Rd.	30	26	40%
13-Oct-20	72	SW Fork - Lox. Riv. Rd.	31	27	41%
2-Jan-20	SCW	South Channel West	31	28	43%
12-Feb-20	SCW	South Channel West	31	29	44%
2-Sep-20	SCW	South Channel West	31	30	46%
11-Feb-20	72	SW Fork - Lox. Riv. Rd.	41	31	47%
5-Feb-20	SCW	South Channel West	42	32	49%
19-Feb-20	SCW	South Channel West	42	33	50%
17-Sep-20	SCW	South Channel West	42	34	52%
11-Nov-20	72	SW Fork - Lox. Riv. Rd.	52	35	54%
17-Jun-20	SCW	South Channel West	53	36	55%
5-Aug-20	SCW	South Channel West	53	37	57%

Date	Station ID	Site Name	Average of CURVALUE (MPN/100mL)	Rank	Percentile
24-Nov-20	SCW	South Channel West	53	38	58%
9-Mar-20	72	SW Fork - Lox. Riv. Rd.	63	39	60%
14-Jul-20	72	SW Fork - Lox. Riv. Rd.	72	40	61%
6-Apr-20	72	SW Fork - Lox. Riv. Rd.	74	41	63%
23-Jun-20	SCW	South Channel West	75	42	64%
21-Jul-20	SCW	South Channel West	75	43	66%
22-Dec-20	SCW	South Channel West	75	44	67%
15-Jun-20	72	SW Fork - Lox. Riv. Rd.	86	45	69%
8-Jul-20	SCW	South Channel West	87	46	70%
29-Jul-20	SCW	South Channel West	87	47	72%
27-Aug-20	SCW	South Channel West	87	48	74%
21-Oct-20	SCW	South Channel West	87	49	75%
2-Dec-20	SCW	South Channel West	87	50	77%
13-Oct-20	SCW	South Channel West	97	51	78%
8-Jan-20	SCW	South Channel West	99	52	80%
4-Nov-20	SCW	South Channel West	111	53	81%
19-Nov-20	SCW	South Channel West	111	54	83%
10-Jun-20	SCW	South Channel West	114	55	84%
14-Jan-20	72	SW Fork - Lox. Riv. Rd.	132	56	86%
14-Dec-20	72	SW Fork - Lox. Riv. Rd.	158	57	87%
19-May-20	72	SW Fork - Lox. Riv. Rd.	228	58	89%
23-Sep-20	SCW	South Channel West	238	59	90%
15-Jul-20	SCW	South Channel West	254	60	92%
9-Sep-20	SCW	South Channel West	406	61	94%
27-May-20	SCW	South Channel West	504	62	95%
7-Oct-20	SCW	South Channel West	738	63	97%
3-Jun-20	SCW	South Channel West	2005	64	98%
10-Nov-20	SCW	South Channel West	2005	65	100%

From Table 8, the 90th Percentile Concentration is 238 MPN/100mL, which is above the Chapter 62-302, F.A.C. Ten Percent Threshold Value of 130. Using Eq. 1, the needed percent reduction is:

$$\%\,Reduction = \frac{(238-130)\ MPN/100mL}{238\ MPN/100mL} x100$$

$$\%\,Reduction = 45.4\%$$

Despite the fact, that the TMDL, NPBCID and LRD stations analyzed different types of bacterial indicators, all of them are indicators of fecal contamination, and the reductions needed to achieve the target concentrations can be compared. The reductions observed when analyzing e. Coli and Enterococci bacteria for the study period, showed that bacterial loads have been reduced approximately 46% from the required loading indicated in the 2012 TMDL Report.

Management Actions

Management Action Items and Responsible Entities

Most management actions to reduce bacterial pollution within the WBID are ongoing by Palm Beach County, Town of Jupiter, NPBCID, LRD and SIRWCD. Some of the continuous maintenance and operations work reported in this section are for a larger area than just WBID 3226C (i.e., inspections, street sweeping and pet waste ordinances). Reported management actions are divided into structural and nonstructural activities. Table 9 provides a summary of management actions and the responsible entity.

Table 9. Management Actions Related to Bacteria Sources Identified

Management Actions	PB County	Town of Jupiter	NPBCID	LRD	SIRWCD
Street Sweeping	X	X			
Public Outreach and Education	X	X	X		
Water Quality Monitoring		X		X	
Stormwater Ordinance	X	X			
Pet Waste Ordinance	X	X			
Sanitary Sewer Inspection and Maintenance				X	
Stormwater Inspection and Maintenance	X	X	X		X
Sanitary Sewer Improvement Projects				X	
Code and Stormwater Enforcement	X	X			

Non-Structural Controls

Sanitary: Inspections, Cleaning, and I&I programs

LRD has an ongoing program of assessment, prioritization and lining of systems that need rehabilitation. This program is focused in areas with older infrastructure and pipe materials more prone to problems. Furthermore, the program targets lift stations showing excess pumping during storm events as compared to dry conditions. The NPBCID Units are newer neighborhoods where the infrastructure is early in its life cycle and in good condition.

Stormwater: Inspections and Cleaning

NPBCID inspections and maintains a stormwater treatment ponds, littoral zone plantings, culverts, catch basins and control structures within its Units of Development. As such they constantly have personnel in the field which receive annual training regarding illicit discharges and how to document and report incidents.

SIRWCD is responsible for maintaining over 376 miles of swales and canals. Every effort is made to conserve the stormwater runoff generated from rainstorms by directing its flow into the natural holding areas in and around the District, such as the slough, water catchment areas and wetlands. The drainage system, maintained by SIRWCD, operates by gravity flow. First the water flows from impervious surfaces such as roofs, driveways and roadways into ponds, natural depressions, and swales. This initial drainage is referred to as the "tertiary" system. Any stormwater that is not held by the swales and absorbed into the ground, moves eastward across the District through a network of maintained canals and is known as the "secondary" drainage system. The final movement of the water is into the "primary" drainage system that consists of larger canals, such as the C-18, and the Loxahatchee River. The primary drainage system is the responsibility of the SFWMD. SIRWCD staff also receives training on illicit discharges and reporting requirements to governmental agencies with enforcement authority.

Litter Control

Periodic cleaning projects were scheduled by the Town of Jupiter in or near the Units of Development. These activities are listed in Table 10.

Table 10. Litter control scheduled projects

Lead Entity	Project Number	Project Name	Project Description	Project Type
Town of Jupiter	TOJ-FIB-04	Street Sweeping	Periodic street sweeping to enhance water quality.	FIB-Stormwater
Town of Jupiter	TOJ-FIB-13	Jupiter River Estates Community Clean-up	Clean-up and trash removal from Jones Creek tributary by volunteer residents in Jupiter River Estates Community.	FIB- Trash Cleanup of Impaired Waterbody

Pet Waste Ordinances

Pet waste disposal containers were observed in multiple residential areas within the Units of Development. All NPBCID Units are either within the Town of Jupiter or Palm Beach County jurisdiction and as such is subject to their respectively ordinances and regulations. The Palm Beach County has the following pet waste ordinance:

Sec. 4-9. - Animal waste.

The owner of every dog and cat shall be responsible for the removal of any feces deposited by his/her animal on public property, public walks, public beaches, recreation areas or private property of others. (Ord. No. 98-22, § 9, 6-16-98)

The Town of Jupiter has the following ordinance:

Sec. 5-8. - Animal waste.

The owner of every animal shall be responsible for the removal of any excreta deposited by his animal on public walks, recreation areas or private property of others. (Code 1975, § 4-16; Code 1992, § 5-10)

Public Education

The Palm Beach County MS4 permittees agreed to address the public education requirements of the MS4 NPDES permit as a joint effort. Outreach on the proper use of Pesticides, Herbicides, and Fertilizers and on the identification and reporting of illicit discharge and illegal dumping is carried out through the joint Stormwater And Me (SAM) public education program (Figure 32 and Figure 33). Two to four public service announcements (PSAs), targeting the public outreach topics are selected each year. An annual video PSA campaign (Figure 34) is carried out on a number of Comcast channels aired in Palm Beach County. The selected videos are also exposed over 50,000 times during each campaign via pre- and mid-roll impressions on the internet. In addition, the SAM program has created and produced educational materials such as posters, brochures, door hangers, and the StormwaterAndMe.org website for use by all permittees and the general public.

Figure 32. Public Education

Figure 33. SAM education program

Figure 34. Video PSA campaign

Furthermore, the Palm Beach County MS4 permit requires that permittees provide training on three topics. Annual follow-up (or "refresher") training is required for those that have received the initial training. The three topics are:

- Identification & reporting procedures for a suspected illicit discharge or dumping in the MS4 for all appropriate permittee personnel (including field crews, fleet maintenance staff, and inspectors) and contractors. (Part III.A.7.c)
- Spill prevention, containment & response procedures (including techniques for mitigating pollution from spills) for all appropriate permittee personnel (including field crews, firefighters, fleet maintenance staff, and inspectors. (Part III.A.7.d)
- Stormwater management and erosion and sedimentation control BMPs for construction sites for site plan reviewers, site operators, and site inspectors. Construction site inspectors must be certified through the Florida Stormwater, Erosion, and Sedimentation Control Inspector Training program, or equivalent. (Part III.A.9.c). Note that construction sites pollution presentation plan includes the proper collection and disposal of waste material which is a potential source of bacteria.

The TOJ developed a project (TOJ-03) for Public Education during public events, such as the annual Jupiter Jubilee (stormwater festival), that includes PSAs and information pamphlets on landscape, pet waste and irrigation ordinances. TOJ also provides annual soil and sediment control training and annual distribution of hurricane preparedness information including information on stormwater management and drainage maintenance.

Enforcement Referrals

NPBID does not have enforcement powers granted by the state legislature. NPBID staff is competent in observing and reporting an illicit discharge to the applicable legal authorities. Within NPBCID Units of Developments noted above, these authorities include Palm Beach County, Town of Jupiter, SFWMD, and FDEP. PBC Environmental Resources Management (ERM) is responsible for the protection of surface water in Palm Beach County. The County's Stormwater Pollution Prevention Ordinance NO. 2004-050 (administered by ERM) goal is to prohibit non-stormwater discharges (e.g., illicit) from entering all stormwater systems within Unincorporated Palm Beach County. Violations are subject to fines and corrective measures. Town of Jupiter stormwater ordinance No. 33-93 covers illicit discharges into the Towns stormwater system or into public waters.

Structural Controls

Sanitary: Planned Improvements

The Loxahatchee River Pollutant Reduction Plan, developed by the stakeholders in the Loxahatchee River Basin in February 2020, focuses its efforts on projects located mostly south of the Southwest Fork. However, the plan incorporates two major septic conversion projects relevant to the NPBCID Units:

Table 11. Sanitary Planned Improvements

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Estimated Completion Date
Loxahatchee River District	LRD-13	Loxahatchee River Neighborhood Sewering Phase 12	Convert 232 septic systems to sewer.	OSTDS Phase Out	Underway	2019
Loxahatchee River District	LRD-14	Loxahatchee River Neighborhood Sewering Phase 13	Convert 56 septic systems to sewer.	OSTDS Phase Out	Planned	2020

OSTDS = Onsite Sewage Treatment and Disposal System

Stormwater: Planned Improvements

Town of Jupiter recently completed the Stormwater System Redevelopment Grants project, of which the main objective was to renew or improve existing privately-owned stormwater systems under site redevelopment to ensure continued or enhanced functionality. Meanwhile, LRD is working on a project to evaluate storm drain filter boxes.

Table 12. Stormwater planned improvements

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Estimated Completion Date
Town of Jupiter	TOJ-09	Stormwater Quality Improvement Grants (Homeowners Association [HOA] Residential Grants)	Town cost-share program (50/50) with property owner and homeowner associations for storm water quality enhancements within their private systems. 28 grants awarded since 2008. Annual appropriation.	Stormwater System Rehabilitation	Underway	N/A

Summary

- The analyses carried out by NPBCID and LRD on data from a 2019 - 2020 period of record, indicate a loading rate that is approximately 45% less than the loading indicated in the 2012 FDEP TMDL Report.
- Unit 45, located in the Jones Creek basin showed the highest percentage of exceedances, consistent with the information in the TMDL Report of 2012. Both The LRD and Town of Jupiter have initiated additional bacteria source tracking studies in the Jones Creek Basin to identify the potential sources.
- Most of the sanitary and stormwater planned improvements described in the Loxahatchee River Pollutant Reduction Plan are already targeting the areas located south of the Southwest Fork of the Loxahatchee River, therefore it is expected that the loadings will continue to decrease.
- Non-structural management actions such as street sweeping, pet waste ordinances and public education are already demonstrating benefit in maintaining the bacterial loads below the accepted threshold or reducing them in all the NPBCID Units of Development.

References

- Municipal Separate Storm Sewer System National Pollutant Discharge Elimination System Joint Annual Report Cycle 4 Year 3 Northern Palm Beach Improvement District.
- Fecal Coliform TMDL for Southwest Fork Loxahatchee River WBID 3226C - Florida Department of Environmental Protection (May 2012).
- Restoring Bacteria-Impaired Waters toolkit - Florida Department of Environmental Protection (Version 3.0 August 2018).
- Loxahatchee River Pollutant Reduction Plan - Stakeholders in the Loxahatchee River Basin (February 2020).