Byrd, Rosie

From: Laura Reynolds <lreynolds@conservationconceptsllc.org>
Sent: Thursday, June 11, 2020 12:48 PM
To: Byrd, Rosie
Subject: Fwd: Comments regarding the recent changes to the Power Plant Siting Act (PPSA) and proposed draft Joint Partnership Agreement (JPA) between Miami Dade County and Florida Power and Light
Attachments: FKAA-FKFGA Joint Letter Regarding PPSA and JPA.pdf; Executive Summary JPA PPSA Letter.pdf; Appendix.pdf; FKFGA FKAA Joint Letter -Full.pdf

[Please remember, this is an external email]

Please distribute this to the board to accompany the comments I just made on the Environmental Conditions and Sality of Biscayne Bay.

I very much want to understand the Salinity level requirements in Biscayne Bay as well as conflicts from the operations at Turkey Point. I am again requesting a meeting with SFWMD staff.

Thanks,
LR

Laura Reynolds
Founding and Managing Member
c: (786) 543- 1926
lreynolds@conservationconceptsllc.org

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---------- Forwarded message ---------
From: **Laura Reynolds** <lreynolds@conservationconceptsllc.org>
Date: Wed, Apr 8, 2020 at 2:32 PM
Subject: Comments regarding the recent changes to the Power Plant Siting Act (PPSA) and proposed draft Joint Partnership Agreement (JPA) between Miami Dade County and Florida Power and Light
To: <noah.valenstein@dep.state.fl.us>, <kevin.lynskey@miamidade.gov>
Cc: <Ron.DeSantis@myflorida.com>, <shane.strum@eog.myflorida.com>, <DBartlett@sfwmd.gov>, <cgoss@sfwmd.gov>, <swagner@sfwmd.gov>, <cmartinez@sfwmd.gov>, <cmeads@sfwmd.gov>, <croman@sfwmd.gov>, <JSteinle@sfwmd.gov>, Thurlow-Lippisch, Jacqui <jthurlowlippisch@sfwmd.gov>, Bergeron, Ron <rbergeron@sfwmd.gov>, <bbutler@sfwmd.gov>, Mayor <mayor@miamidade.gov>, <district3@miamidade.gov>, <district1@miamidade.gov>, District2 (DIST2) <district2@miamidade.gov>, <district4@miamidade.gov>, Eileen Higgins <district5@miamidade.gov>, Commissioner Rebeca Sosa <district6@miamidade.gov>, <district7@miamidade.gov>, <district8@miamidade.gov>, <district9@miamidade.gov>, Javier Souto <district10@miamidade.gov>, <district11@miamidade.gov>, <district12@miamidade.gov>, Commissioner Esteban Bovo, Jr. <district13@miamidade.gov>, William Nuttle <wknuttle@gmail.com>, Jim Fourqurean <fourqure@fiu.edu>, EJ Wexler <ejw@earthfx.com>, Ed A. Swakon <ESwakon@eas-eng.com>, Tom Walker <twalker@fkaa.com>, Steve Friedman <fkfgacommodore@gmail.com>

Dear Secretary Noah Valenstein and Director Kevin Lynskey,

We, the undersigned, are concerned that proposed changes in operations at Turkey Point recently approved in the Power Plant Siting Act (PPSA) by the Department of Environmental Protection (DEP) and which would be supported by the present language of a draft Joint Partnership Agreement between Miami Dade County and Florida Power and Light will exacerbate existing impacts on the Biscayne Aquifer and Biscayne Bay caused by the Turkey Point Facility's cooling canal system.

Based on the analysis of our experts, shown in the underlying report, we propose the following actions that will improve remediation efforts already being taken to address problems with the cooling canals and mitigate unintended consequences of the proposed changes in their operation.

For the State of Florida:
Immediately, begin working with all regulators and stakeholders to resolve conflicts with Everglades Restoration and impacts on water supplies, Biscayne National Park and Florida Keys Marine Sanctuary. Because of the 5th Supplemental Agreement we suggest that the SFWMD governing Board invite all stakeholders and regulators to the upcoming May 2020 Governing Board Workshop for a discussion and hopeful cooperation among regulators on a path forward that resolves the existing conflicts. This should occur before any new agreement or permit is issued to FPL or any final project is determined for C-111 and Biscayne Bay Coastal Wetlands.

For Miami Dade County:
Amend the draft Joint Partnership Agreement with FPL to address concerns in the following areas. In each of these areas our experts identify a number of issues in the full text of the attached letter.

1. Changes required to address legal liability
2. Changes required by compliance with the Consent Agreement
3. Changes required to address increased nutrient loading
4. Changes required to address changes in the water budget
5. Changes required to address conflicts with Everglades Restoration

The ecological health and vitality of Biscayne Bay and its coastal wetlands are a matter of critical importance to the many stakeholders which derive their health, wealth, and well-being from the use of these resources. DEP, SFWMD and Miami Dade County must consider all the information available when supporting operational changes which will affect us economically. Despite three years of remediation efforts, the contaminated groundwater plume has continued to advance westward and the requirement to lower salinity in the cooling canals has not been met. Furthermore, hydro-geological modeling shows that FPL's chosen strategy of diluting and flushing out cooling canal system water will result in additional westward movement of the hypersaline plume and negative impacts on surrounding water quality. The current approach to remediating the plume should be reevaluated.

The threats posed to the remaining potable water users in the area, adjacent land owners, federal and State ecosystem restoration objectives, and the Miami Dade and Florida Keys residents who

rely upon the wellfields threatened by the Turkey Point Cooling Canal System salt-front must be addressed through both prevention of further harm and mitigation of existing harm.

We hope the detailed information we have taken the time to provide will encourage all parties to work together to resolve these issues and that you will take this information and these suggestions into consideration in drafting final language for the Joint Partnership Agreement between Miami Dade County and the Florida Power and Light Company and in the pending draft NPDES permit that DEP is still reviewing. In additional we are hopeful that the terms of the 5th Supplemental Agreement are enforced to ensure there are no conflicts with Everglades Restoration or lower east coast water supply.

This is a complicated issue that impacts all of us greatly and it is imperative that all of us work together. We look forward to working with you to help resolve our concerns.

Sincerely,

_____

Thomas Walker;

Executive Director, Florida Keys Aqueduct Authority

Steve Friedman;

Commodore, Florida Keys Fishing Guides Association

April 8th, 2020 Executive Summary

Actions to Improve Outcomes of Changes to Turkey Point Operations

We, the undersigned, are concerned that proposed changes in operations at Turkey Point recently approved in the Power Plant Siting Act (PPSA) by the Department of Environmental Protection (DEP) and which would be supported by the present language of a draft Joint Partnership Agreement between Miami Dade County and Florida Power and Light will exacerbate existing impacts on the Biscayne Aquifer and Biscayne Bay caused by the Turkey Point Facility's cooling canal system.

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hypersaline plume and negative impacts on surrounding water quality. The current approach to remediating the plume should be reevaluated.

The threats posed to the remaining potable water users in the area, adjacent land owners, federal and State ecosystem restoration objectives, and the Miami Dade and Florida Keys residents who rely upon the wellfields threatened by the Turkey Point Cooling Canal System salt-front must be addressed through both prevention of further harm and mitigation of existing harm.

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Sincerely,

Steve Friedman;

Commodore, Florida Keys Fishing Guides Association

_____

Thomas Walker;

Executive Director, Florida Keys Aqueduct Authority

April 8th, 2020

Secretary Noah Valenstein
Florida Department of Environmental Protection
3900 Commonwealth Boulevard M.S. 49
Tallahassee, FL 32399
Noah.valenstein@dep.state.fl.us

Director Kevin Lynskey
Miami Dade County Water and Sewer Department
3071 SW 38th Ave, Miami, FL 33146
Kevin.Lynskey@miamidade.gov

RE: Comments regarding the recent changes to the Power Plant Siting Act (PPSA) and proposed draft Joint Partnership Agreement (JPA) between Miami Dade County and Florida Power and Light

Dear Secretary Noah Valenstein and Director Kevin Lynskey,

We are taking the opportunity to submit comments to both the State which has approved FPL's recent post-certification amendment to their site certification under the Power Plant Siting Act (PPSA) and Miami Dade County on the prospective Joint Partnership Agreement (JPA) between Miami Dade County and the Florida Power & Light Company (FPL). These comments are submitted on behalf of the Florida Keys Aqueduct Authority and the Florida Keys Fishing Guides Association and reflect concerns shared by multiple stakeholders and user groups. The continued operations of the cooling canal system impact the success of Everglades Restoration efforts, the lower east coast water supply, saltwater intrusion into the Biscayne Aquifer and the ecological health and well-being of Biscayne National Park and the Florida Keys Marine Sanctuary.

The purpose of this letter is to raise concerns resulting from the proposed changes in operations at Turkey Point recently approved in the PPSA that would allow the re-allocation of more than 14 MGD of Floridian water currently permitted for use in unit 5. We have analyzed the impacts of these prospective changes and have proposed conditions to improve the overall operations that would help to mitigate for impacts associated with the continued operations of the cooling canal system moving forward.

On October 29th, 2019 FPL requested a post-certification amendment to their Site Certification Application for FPL's Turkey Point Clean Energy Center under the Power Plant Siting Act (F.S. 403.501-.518) which would grant approval for the installation of a water conveyance pipeline, a portion of which would fall within the certified boundary. FPL states that the purpose of this pipeline would be to 'convey the unutilized portion of the 14.06 million gallons per day allocated for cooling water for Unit 5 and process water Units 1-5 to the cooling

canals systems to aid in salinity reduction"[1]. This requested amendment did not include a request for additional water by FPL, as the company anticipates the Floridan aquifer water currently in use in Natural Gas Unit 5 will be liberated for use in the canals as a result of the JPA currently under consideration. The path of this proposed pipeline is shown below in Figure 1. This would allow upwards of 14 MGD to be rerouted to the cooling canal system for 'freshening', i.e., the process of adding water with lower chloride content into the cooling canal system in order to reduce the average salinity in the cooling canal system as required by the Florida Department of Environmental Protection (FDEP) 2015 Consent Order.

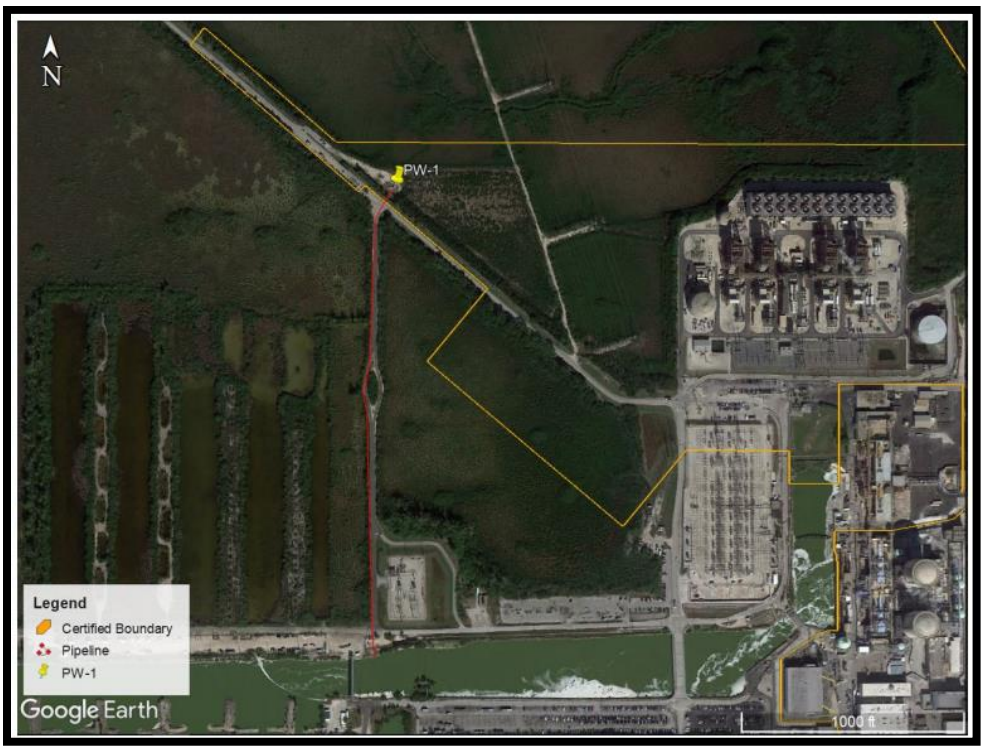

Figure 1. Unit 5 Upper Floridan aquifer well PW-1 with proposed pipeline route cooling canal system

Over the past 3 years FPL has failed to meet the mandates required under this Consent Order. The first objective of the consent order was for FPL to "cease discharges from the cooling canal system that impair the reasonable and beneficial use of the adjacent G-II ground waters to the west of the cooling canal system … accomplish this first objective by undertaking freshening activities as authorized in the Turkey Point site certification, by eliminating cooling canal system contribution to the hypersaline plume, by maintaining the average salinity of the cooling canal system at or below 34 Practical Salinity Units(PSU), by halting westward migration of hypersaline water from the cooling canal system, and by reducing the westward extend of the hypersaline plume to the L-31E within 10 years"[2].

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[1] Danielle Hall, P.E., Florida Power and Light, Email to SCO RE: FPL Turkey Point Unit 5 (PA 03-45) Amendment Request, October 30th, 2019.

[2] State of Florida Department of Environmental Protection V. Florida Power & Light Company, OGC File No. 16-0241, Consent Order

The underlying strategy behind FPL's 'freshening' strategy is best described as 'feed and bleed'. The mechanism for a reduction in cooling canal system salinity under this strategy is to dilute the cooling canal system water with fresher water while simultaneously flushing the canal's saline and nutrient loaded pollution into the surrounding area. This will worsen conditions in the area surrounding the cooling canal system and conflicts with the Consent Order's mandates to halt westward migration of the hypersaline plume.

By providing an alternative source of water for Unit 5, the JPA will allow FPL to double the amount of water from the Floridan aquifer currently added to the cooling canal system. Our collective data analysis and modeling shows that this process will have significant consequences that will impact the natural resources utilized by stakeholders in the region. We support the beneficial use of wastewater and recognize that Miami Dade County is obligated to treat and reuse 117.5 MGD of wastewater under the 2008 Ocean Outfalls Act. However, we cannot ignore the scientific evidence that FPL's plans to use reuse water at their Turkey Point plant will negatively impact the region's freshwater and ecological resources.

Under the JPA Miami Dade County would share costs on the development of wastewater treatment capacity at the South Dade Wastewater treatment center and promise delivery of Miami Dade County treated wastewater to FPL for use in their Turkey Point Facility. Upon its passage, the JPA will serve as a legal document enforceable by injunction, will commit the county to multiple obligations, and will forge a longstanding and mutually dependent relationship between Miami Dade County and FPL. Therefore, the terms of the agreement should at a minimum ensure that Florida Power and Light meet existing obligations to Miami-Dade County, specifically those mandated under the 2015 Consent Agreement, that are intended to mitigate the environmental impacts of the cooling canal system.

In its current form, i.e. the draft language as of October 18th 2019, the JPA does not protect Miami Dade County and its citizens and is not in the county's best interest. Our concerns with the present language of the draft agreement are as follows:

1. The present language of the agreement is incompatible with previous positions taken by the Miami Dade County Board of County Commissioners to seek the eventual decommissioning and replacement of the Turkey Point Nuclear Generating Station's unlined cooling canal system.
2. The present language of the agreement fails to adequately ensure that Florida Power and Light meet existing obligations to Miami-Dade County, specifically those mandated under the 2015 Consent Agreement.
3. The present language of the agreement will result in additional nutrient loading in the Surface Waters of Biscayne Bay, and no effort to mitigate this has been proposed.
4. The present language of the agreement would alter the cooling canal system water budget in a manner which modeling determines will have ecologically deleterious effects upon the surrounding ecosystem and no effort to mitigate this has been proposed.
5. The present language of the agreement stands in conflict with the goals of the Comprehensive Everglades Restoration Plan, specifically the C-111 Canal Project and the Biscayne Bay Coastal Wetlands Project.

This Joint Partnership Agreement should establish a mutually beneficial arrangement which will require Florida Power and Light to meet their obligations under state and local mandates, is aligned with existing legal positions Miami Dade county has established, and shows a commitment towards Everglades Restoration and mitigation of the pollution plume that is exacerbating the movement of the salt front in the Biscayne aquifer. This is necessary to ensure that goals for environmental restoration are met and to reassure threatened landowners and current water users in the vicinity of the Turkey Point Nuclear Facility. The language of this agreement should be amended to reflect these goals. We explore our concerns at length and provide examples of amendments which would address them in the following sections.

1. **The present language of the agreement omits crucial context and is incompatible with previous positions taken by the Miami Dade County Board of County Commissioners to seek the eventual decommissioning and replacement of the Turkey Point Nuclear Generating Station's unlined cooling canal system.**

The Turkey Point Facility's cooling canal system is composed of 5,900 acres of unlined cooling canals which are in open communication with both the groundwater of the surrounding class G-II potable aquifer and the surface waters of Biscayne Bay via subterranean channels[3,4,5]. The operation of this open cooling system has resulted in the formation of a hypersaline and nutrient rich plume of pollution, which was discovered by the South Florida Water Management District in 2012 as a result of an expanded monitoring program initiated in the 2009 Fifth Supplemental Agreement[6]. This pollution plume has extended into both the G-II designated potable aquifer to the West and the surface waters of Biscayne Bay to the East. The hydrologic connection in question is demonstrated in Figure 2.

The language of the JPA fails to include crucial context regarding the nature of the water budget and the uses which the agreement would support, nor does it provide any context on the legal and policy relationship between Miami Dade County and FPL regarding operation of the cooling canal system.

The 15 MGD treated water produced and directed to FPL for use in the cooling tower of Natural Gas Unit 5 under this agreement will replace Floridan aquifer water currently being directed towards this purpose. FPL will then direct the Floridan aquifer water in question into the

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[3] Reynolds, L. Fourqurean, J. Nuttle, W.K. Future Impacts on Biscayne Bay of Extended Operation of Turkey Point Cooling Canals [online: https://www.researchgate.net/publication/333717294_Future_Impacts_on_Biscayne_Bay_of_Extended_Operation_of_Turkey_Point_Cooling_Canals ; accessed 3 Mar 2020]

[4] The Cooling-Canal System at the FPL Turkey Point Power Station, Chin, 2015, University of Miami

[5] Miami-Dade County Report on Biscayne Bay Water Quality Observations associated with the Turkey Point cooling canal system Operations, March 7, 2016, Memorandum from Carlos A. Giménez, Mayor, to Chairman Jean Monestime and Members, Board of County Commissions, p. 4.

[6] FPL Turkey Point Power Plant Groundwater, Surface Water, and Ecological Monitoring Plan, South Florida Water Management District Florida Department of Environmental Protection Miami-Dade County Department of Environmental Resource Management, October 14, 2009

cooling canal system to assist in the process of diluting the saltwater content of the canals and flushing excess pollutants out of the cooling canal system and into the surrounding area. FPL hopes that this strategy will allow them to meet their state mandate to reduce the salinity of the cooling canal system to 34 PSU from its current level of 51 PSU, as per their obligations under the Florida Department of Environmental Protection's (FDEP) 2015 consent order. FPL has referred to this process as 'freshening'.

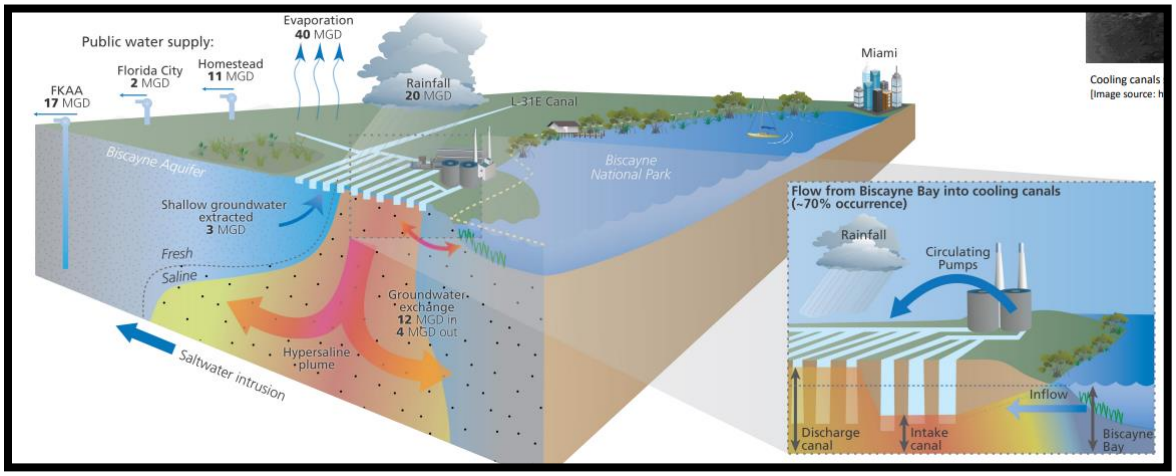

Figure 2. Hydrological Connection between the cooling canal system and Surrounding Waters

Out of recognition for the failure of the cooling canal system to function as a closed system, as per the 1971 Federal Consent Decree[7], the Miami Dade County Board of County Commissioners passed a resolution on July 19th, 2016 urging Miami Dade County Mayor Carlos Gimenez to seek a commitment from FPL to decommission the Turkey Point cooling canal system by 2033 and replace the outdated and failing technology with a modern alternative such as mechanical updraft cooling towers[8] (See attachment 1). The replacement of the cooling canal system with mechanical updraft cooling towers can be achieved in a cost effective manner that will not put undue financial burden on the residents of Miami Dade County, as demonstrated by the feasibility assessment developed by Powers Engineering on behalf of the Southern Alliance for Clean Energy[9]. This commitment is more important than ever, as Turkey Point Nuclear Generating Units 3 & 4 have received a subsequent license renewal from the Nuclear Regulatory Commission which would extend their lifetime of operation to 2052 and 2053 respectively[10].

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[7] United States of America v. Florida Power and Light Company. Civ. A. No. 70-328, September 10th, 1971

[8] Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

[9] Closed Cycle Cooling Tower Feasibility Assessment for Turkey Point Nuclear Units 3 and 4. Powers Engineering, San Diego, California. July 11th, 2016.

[10] ISSUANCE OF SUBSEQUENT RENEWED FACILITY OPERATING LICENSE NOS. DPR-31 AND DPR-41 FOR TURKEY POINT NUCLEAR GENERATING UNIT NOS. 3 AND 4 (EPID L-2018-RNW-0002), United States Nuclear Regulatory Commission, Washington, D.C. 20555-0001, December 4th, 2019

The JPA language also contains no reference to the many ways in which established county policy and objectives conflict with continued operation of the cooling canal system and operation of the recovery well system. The county has communicated these concerns regarding water losses associated with the operation of the Interceptor Ditch and their impacts upon county conservation lands and ecological restoration objectives to the Florida Department of Environmental Protection[11] (See attachment 2).

The conflict between FPL's operation of the cooling canal system with county objectives is noted in both the county's resolution urging the decommissioning of the cooling canal system[12] and through county communications to other regulatory authorities. Through omission of these important details, the JPA appears to validate the use of the cooling canal system. This agreement and the language therein should be considered within the full context of how it will affect future operations of the cooling canal system and how the operations of the cooling canal system impact county interests.

The JPA would allow FPL to significantly increase the volume of water employed in its dilution and flushing strategy for achieving compliance with state mandates, and yet the current language of the agreement completely ignores the context of this ongoing FPL initiative. As such, the language of this agreement could be construed as providing tacit support for the current cooling canal system "freshening" and recovery well system operations beyond 2033.

It is particularly important that the county and its various departments take a unified stance on the strategy of diluting and flushing out the saline content of the canals which FPL refers to as "freshening". FPL is currently in the process of seeking to "freshen" its cooling canal system to 34 PSU in order to comply with the mandates of the 2015 Florida Department of Environmental Protection Consent Order. This activity, while it has been accepted by the State as a solution, is misleading and merely represents a dilution of the pollution plume that has been created over 40 years of operations. We do not agree that this dilution and flushing activity is the correct way to solve this problem, The FPL recovery well system (RWS) does not represent an effective means of recovering contaminated water west of the cooling canal system. Modeling produced by the firm Earthfx using models developed and used by FPL show that this dilution and flushing strategy will result in additional saline pollution being pushed towards the model lands and wellfields to the west of the facility[13]. We elaborate upon this modeling and its implications in section 3 of this letter.

Now that the permitted operational lifetime of Turkey Point nuclear generating units 3 and 4 has been confirmed, it is important for the county to step back and articulate a clear and coherent set of objectives regarding its policy on the canals and its approach to negotiation with

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[11] Crandall, Lea. Rach, Timothy. Memo RE: Request of Time in accordance with Section 120.57, Florida Statutes, July 18th, 2018

[12] Miami Dade County Board of County Commissioners, Miami Dade County Board of County Commissioners, Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

[13] Earthfx modeling

FPL which may extend to the agreements and decisions made across all departments. There are viable alternative strategies for achieving compliance which Miami Dade County can and should push for, such as a technological upgrade of the plant to include additional cooling towers, which would require no additional salt and nutrients be loaded into the upper aquifer[14]. However, if this is not going to be required, there are other operational changes and improved mitigation requirements that can improve the situation markedly.

This concern can be addressed through the inclusion of a textual amendment recognizing that the Turkey Point cooling canal system is in open communication with surrounding groundwater and surface waters and as such changes in operations, updating the technology, or both would be required to mitigate the impacts of continued operations. Alternatively, Miami Dade County should clarify its current stance on the continued operation of the cooling canal system beyond 2033, and require actual progress on mitigation from the impacts of the current freshening strategy and recovery well system as required by both the Florida Department of Environmental Protection Consent Order and the Miami Dade County 2015 Consent Agreement.

In order to better align this agreement with positions taken by the county and current county objectives in the region as well as limit liability and ensure stronger oversight, the following changes should be made to the JPA language:

- The agreement should include "County as sovereign" language.
- The agreement should stipulate that FPL must appropriately maintain pipe infrastructure, assumes liability for malfunctions and can be held to county standards as opposed to state/federal
- The County must maintain strong regulatory oversight and control of the processes to be established under this agreement. In particular, the county must maintain control over the water supply and maintain the right to cease deliveries at its discretion.
- In light of the additional seepage that will occur from doubling the amount of water allocated to freshen the cooling canal system and the contamination risks associated with this process, one of the most critical operational changes which can be made to mitigate the impacts of the cooling canal system's continued operation is to review and modify or potentially discontinue use of the interceptor ditch pumps.
- The interceptor ditch pumps withdraw an average of 3 MGD of fresh water from the Biscayne Aquifer. Removing or scaling down the use of these pumps would liberate additional fresh water for productive use and slow saltwater intrusion
- Reuse water produced under this agreement should meet Biscayne bay anti-degradation target standards established by the Biscayne Bay Coastal Wetlands project delivery term.

[14] Closed Cycle Cooling Tower Feasibility Assessment for Turkey Point Nuclear Units 3 and 4. Powers Engineering, San Diego, California. July 11th, 2016.

2. **The present language of the agreement fails to adequately ensure that Florida Power and Light meet existing obligations to Miami-Dade County, specifically those mandated under the 2015 Consent Agreement.**

Shortly after the discovery of the hypersaline plume emanating from the Turkey Point cooling canal system, Miami Dade County placed Florida Power and Light under a Consent Agreement in 2015 stipulating that FPL must retract and eventually arrest discharges as well as engage in a variety of activities meant to monitor further pollution and mitigate the impacts of their operations[15]. To date, many of these mandates remain unfulfilled or only partially completed. What is worse is that after years of remediation the plume is still moving at the same rate to the west and the addition of water for to the cooling canal system for freshening will only increase the seepage rate generally.

It is inappropriate for the county to enter into any major new agreement with FPL regarding the operations of their Turkey Point Facility which does not address these existing obligations on the part of FPL. Some of these obligations which remain unfulfilled are as follows:

- Conduct a review of the interceptor ditch operations to determine if current design and or operations can be practicably modified to improve its function.
- The alternative water sources and modifications to ID design or operation shall be authorized through appropriate regulatory processes and shall demonstrate to not create adverse impacts to surface waters, GW, wetland or other resources.
- Raise control elevations in the FPL model lands to a minimum of 2.2 feet
- Fill portions of the Model Lands North Canal within the Everglades Mitigation Bank
- Acknowledge the benefits of hydrologic restoration projects contemplated by the Comprehensive Everglades Restoration Project ("CERP"), as well as other government entities, adjacent and to the west of the cooling canal system in controlling movement of hypersaline and saline waters in the Biscayne Aquifer, and commit to working with state, local and federal agencies to facilitate implementation of these projects to promote improved hydrologic conditions.
- FPL shall add three groundwater monitoring clusters (shallow, mid and deep) to monitor groundwater conditions in the model lands basin.
- The Miami Dade County Department of Environmental Resources Management and Florida Power and Light should expand monitoring operations and provide quarterly and annual reports on cooling canal system water and the environmental aspects of the project.

This concern may be addressed via an amendment to the JPA language which incorporates the amendment called for by Commissioner Rebecca Sosa at the April 10th 2018 Board of County Commissioners meeting discussing the draft JPA agreement stating that FPL must comply with the mandates of the Miami Dade County Consent Agreement within one year and prompting re-visitation of the agreement upon failure to meet county objectives within that time.

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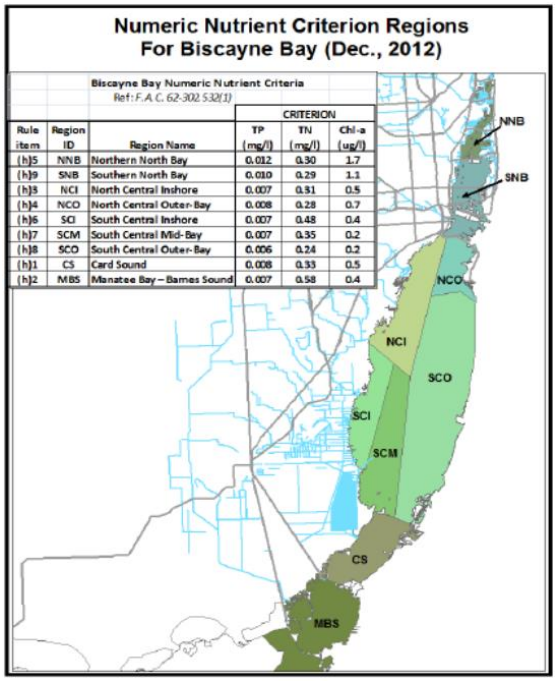
[15] Miami Dade County through its Department of Regulatory and Economic Resources, Division of Environmental Resources, Division of Environmental Resources Management v Florida Power and Light, Consent Agreement, October 6th, 2015.

3. The present language of the agreement will result in additional nutrient loading to Biscayne National Park and the Florida Keys Marine Sanctuary

Nutrient pollution is a dire problem in Biscayne Bay. A recent study published in the journal 'Estuaries and Coasts' focusing on rates of change in chlorophyll-a and nutrient concentrations at 48 stations throughout Biscayne Bay over a 20 year period determined that pollution emanating from Biscayne Bay's nearshore waters (i.e., from landward sources) have brought the bay to the precipice of a phase shift characterized by rapid eutrophication and seagrass die-offs which would change the character of the bay for decades to come[16].

Nutrient concentrations associated with the cooling canal system already exceed applicable criteria[17]. Figure 3 shows the criteria for total Nitrogen, total phosphorus, and chlorophyll-a established for the Bay's various regions under F.A.C 62-302 532(1). Figure 4 shows the best current estimate of the extent of the phosphorus loading to the East of the facility as measured via N:P concentrations in seagrass samples taken in July 2019.



Rule item	Region ID	Region Name	CRITERION TP (mg/l)	TN (mg/l)	Chl-a (ug/l)
(h)5	NNB	Northern North Bay	0.012	0.30	1.7
(h)9	SNB	Southern North Bay	0.010	0.29	1.1
(h)3	NCI	North Central Inshore	0.007	0.31	0.5
(h)4	NCO	North Central Outer-Bay	0.008	0.28	0.7
(h)6	SCI	South Central Inshore	0.007	0.48	0.4
(h)7	SCM	South Central Mid-Bay	0.007	0.35	0.2
(h)8	SCO	South Central Outer-Bay	0.006	0.24	0.2
(h)1	CS	Card Sound	0.008	0.33	0.5
(h)2	MBS	Manatee Bay – Barnes Sound	0.007	0.58	0.4

Figure 3. Seagrass N:P NNC for Biscayne Bay

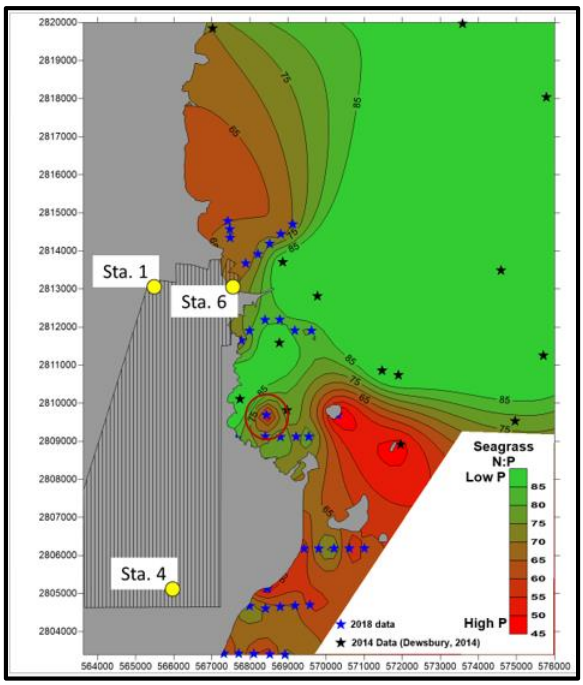


Figure 4. Nutrient Sampling Results, July 2019

Without significant amendments to the JPA, the operational changes which would result from its implementation will make nutrient loading even worse. Miami Dade County recognizes that the cooling canal system is an outdated technology in open communication with the

[16] Millette, N.C., Kelble, C., Linhoss, A. *et al.* Using Spatial Variability in the Rate of Change of Chlorophyll *a* to Improve Water Quality Management in a Subtropical Oligotrophic Estuary. *Estuaries and Coasts* **42,** 1792–1803 (2019). https://doi.org/10.1007/s12237-019-00610-5

[17] Review of Nutrient Treatment Target Levels, RER-DERM Water Resources Coordination Division, Final Report by Black and Veatch, October 30, 2018.

surrounding groundwater and surface waters of Biscayne Bay[18]. Out of recognition for this hydrological connection, Miami Dade County has long insisted that water used in the cooling canal system must meet Biscayne Bay Non-Degradation Standards[19]. There are several avenues by which the language of the JPA as currently written threatens to exacerbate the issue of nutrient loading and pollution emanating from the cooling canal system.

Increasing the input of water from the Floridan aquifer into the cooling canal system will increase the inputs of nutrients (nitrogen and phosphorous). Unless compensatory actions are taken, for example by instituting measures that will actively remove nutrients from the cooling canal system, nutrient concentrations in the cooling canal system can be expected to increase, and the associated impacts of those discharges will also increase. The proposed action to reallocate 15 MGD of Floridan aquifer water from Unit 5 for discharge into the cooling canal system will double the nitrogen and phosphorous inputs from the Floridan aquifer, which are currently estimated to be 977 pounds per month nitrogen and 23 pounds per month phosphorous. This would make inputs from the Floridan aquifer the fourth largest input of nitrogen, comparable to inputs from the interceptor ditch, and the largest source of phosphorous to the cooling canal system[20](See attachment 3). Figures 5 and 6 below from the report prepared for Miami Dade County by Black and Veatch demonstrate the additional loading which may be anticipated.

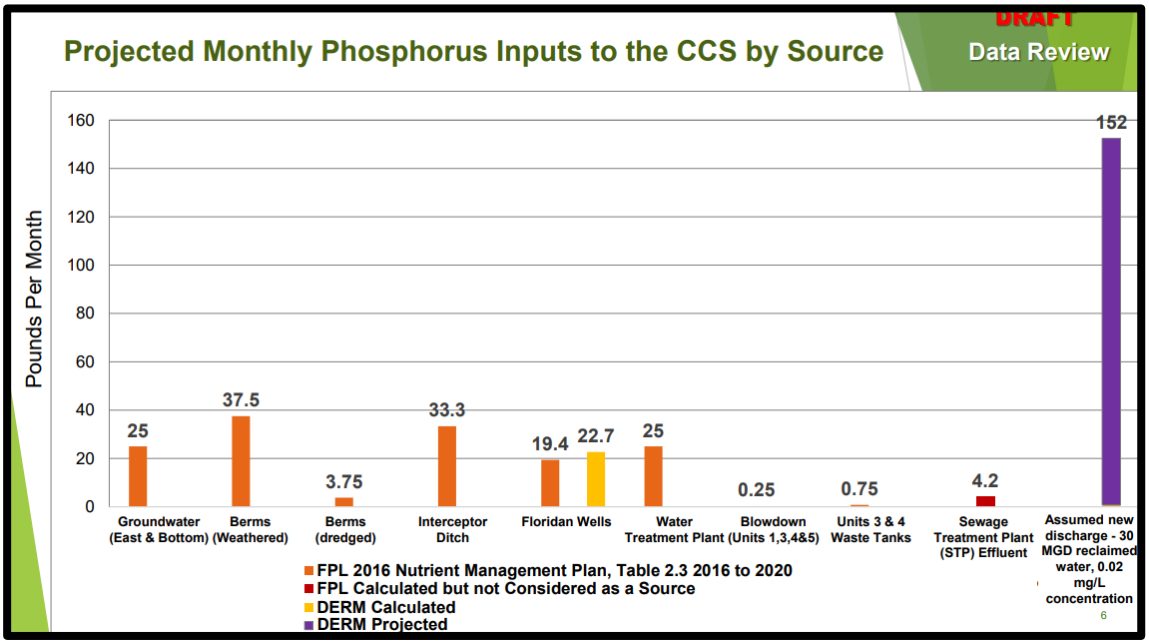


Figure 5. Projected Monthly Phosphorus inputs to the CCS by Source, Black & Veatch

[18] Miami Dade County Board of County Commissioners, Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

[19] CHAPTER 6-302: SURFACE WATER QUALITY STANDARDS Effective May 19, 2015

[20] Review of Nutrient Treatment Target Levels, RER-DERM Water Resources Coordination Division, Final Report by Black and Veatch, October 30, 2018.

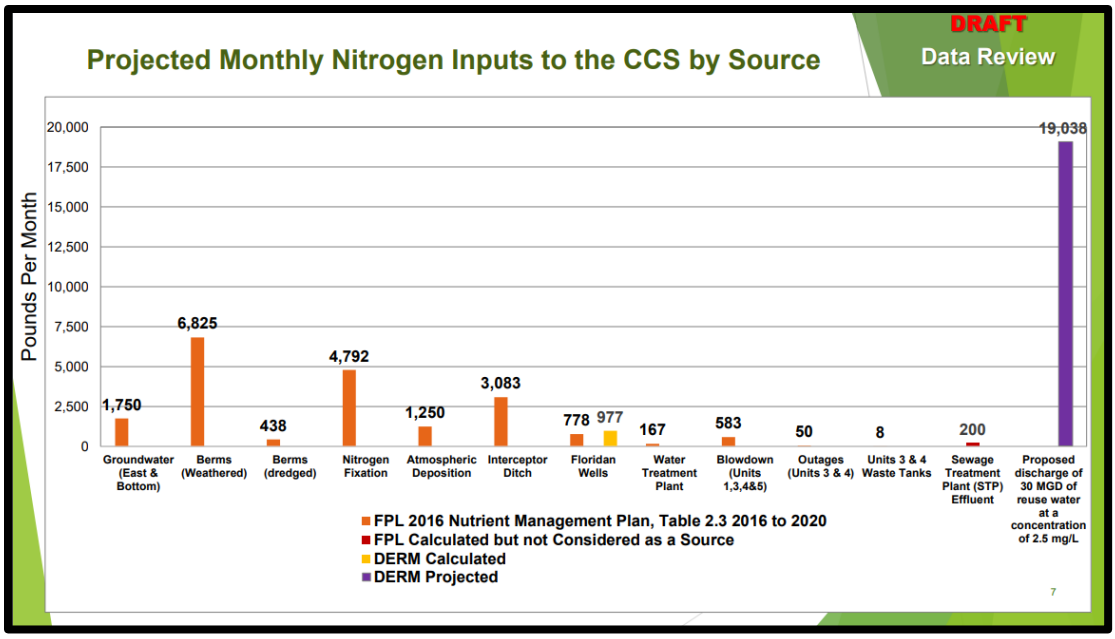


Figure 6. Projected Monthly Phosphorus inputs to the CCS by Source, Black & Veatch

In addition, while the use of wastewater for the cooling of unit 5 is theoretically safe, the JPA language fails to address what will come of the byproduct of nutrient rich 'blowdown' water produced when water is purged from the condenser to remove impurities. At present there is nothing preventing FPL from discharging this nutrient rich water into the hydrologically open cooling canal system.

The work of Dr. James Fourqurean demonstrates the impacts of such nutrient loading on the seagrass beds which form the basis of Biscayne Bay's marine ecosystem. An increase in nutrient loading, specifically phosphorus, encourages proliferation of organisms, particularly certain types of seaweed. When nutrient concentrations increase, seagrass beds are choked out by this "fast-growing, noxious" seaweed. At the most concentrated nutrient levels, seaweeds and microalgae replace the naturally occurring seagrass beds, and overgrowth of these organisms blocks access to sunlight—leading to losses of coral as well as seagrass. P concentrations in the deeper canals offshore of the cooling canal system and in caves offshore of Turkey Point are 10-20 times higher than the median concentrations (0.03 µM) of inorganic phosphorus in Biscayne Bay waters[21].

Nutrient delivery can be increased through higher concentrations of nutrients in discharges, but it can also be increased by increasing the volume of water containing nutrients, "even at very low concentrations that would pass drinking water quality standards over a long period of time". Phosphorus is the nutrient responsible for decreased water clarity, as well as the density and species composition of the seagrasses of southern Biscayne Bay. As phosphorus levels increase, a loss of seagrasses occurs. Disrupting populations of aquatic flora and fauna through nutrient

[21] Expert Report of James Fourqurean, Southern Alliance for Clean Energy, Tropical Audubon Society Incorporated, & Friends of the Everglades, Inc. v. Florida Power and Light Company. J.W. Fourqurean. May 14th, 2017.

pollution violates Florida's surface water quality statutes. The resulting harms to fish and wildlife will negatively affect activities like fishing and bird watching which stakeholders derive value from.

F.A.C. 62-302.520(48)(b) dictates that "in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna." F.A.C. 62-302(48)(a) declares that, "Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Rules 62-302.300, 62-302.700, and 62-4.242, F.A.C." Since Biscayne Bay is considered Outstanding Florida Waters by statute 62-302.700, nutrient pollution from the cooling canal system is considered degradation and is thus prohibited.

Dr. Fourqurean testified in Case No.: 1:16-cv-23017-DPG that the cooling canal system has "carried phosphorus-polluted groundwater to near-shore surface waters through the highly porous bedrock" and "dissolved carbonates in that bedrock, releasing additional phosphorus… As this phosphorus reaches the seagrass meadows offshore in Biscayne Bay, it will continue to degrade the ecosystem".

These concerns may be addressed via the inclusion of amendments to the JPA language stipulating the following:

- All blowdown water produced via the use of treated wastewater for the cooling of natural gas unit 5 must be deep-well injected and not disposed of in the open cooling canal system to prevent further contamination of Biscayne Bay. All solid waste produced via this process must be landfilled.
- Acceptance of the agreement must entail a corresponding mandate to update to the Turkey Point Nutrient Management Plan meant to take into account the proposed additional 15 MGD of Floridan aquifer water into the cooling canal system as well as other changes resultant from the JPA.
- Require annual reporting of the mass budgets for total nitrogen and total phosphorous to better track progress towards goals of reducing nutrient concentrations and controlling algal blooms, as called for in the Miami Dade County Consent Agreement.
- A TMDL should be set with the help of Dr. James Fourqurean, as seagrass death is already occurring in the nearshore of the Turkey Point Facility; ongoing research suggests the source is emanating from the cooling canal system[22].

[22] Reynolds, L. Fourqurean, J. Nuttle, W.K. Future Impacts on Biscayne Bay of Extended Operation of Turkey Point Cooling Canals [online: https://www.researchgate.net/publication/333717294_Future_Impacts_on_Biscayne_Bay_of_Extended_Operation_of_Turkey_Point_Cooling_Canals ; accessed 3 Mar 2020]

4. **The present language of the agreement will impact the water budgets in an ecologically deleterious manner which must be mitigated and calls for insufficient use of treated waste-water for beneficial purposes**

The coastal wetlands surrounding the Turkey Point Facility are already imperiled by saltwater intrusion[23]. To date; the spread of the saltwater plume further west from the cooling canal system has not been halted. In his 2018 update on the position of the saline water interface, Prinos calculated the movement of the saline water interface in the area of USGS Monitoring Wells G-1264 and G-3164 at approximately 470 feet per year[24] Figure 7 demonstrates the extent of this saltwater intrusion to the west as measured by USGS. It is also the only area in the county where significant change in the position of the saltwater front has occurred in the last 10 years.

Well data collected by the Florida Keys Aqueduct Authority (FKAA) indicates the hypersaline plume is moving westward at an even more alarming rate. The Florida Keys Aqueduct Authority constructed additional monitoring wells in 2017 where the saline water interface had passed existing monitoring wells making them obsolete. Analysis of that data indicated a very similar rate to the Prinos calculations which we rounded to approximately 500 feet per year. The locations of the FKAAs wells are shown in Figure 8.

Figure 7. Miami Dade County Salt Intrusion Extent, Prinos 2019 **Figure 8.** Location of FKAA Monitoring Wells

Continued monitoring of the new wells into 2019 showed further saline water migration in the area of new monitoring wells FKS-14 and G-3999 at a calculated rate of over 800 feet per year. The chloride concentrations at these wells over time are shown in Figure 9. The westward movement of the plume has been observed by additional stakeholders as well. The firm SDI, which operates a mining site west of the Turkey Point facility, measures specific conductivity at

[23] Miami Dade County, Crandall, 'Communication RE Request for an Extension of Time in accordance with section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Phase II Modification and Credit Release…', Miami Dade County Division of Environmental Resources Management, July 18th 2018.

[24] Map of the Approximate Inland Extent of Saltwater at the Base of the Biscayne Aquifer in the Model Land Area of Miami-Dade County, Florida, 2016

a series of monitoring wells located around their site. The locations of these wells are shown in Figure 10. The specific conductivity at the bottom of MW-05 continues to increase from the levels detected in previous surveys. This is indicative of a continued inland movement of the saltwater front at this location. The maximum specific conductance observed in February was 4,633 µS/cm, or about 1,494 mg/L equivalent chloride concentration based on relationship developed using past on-site water quality data. The specific conductance profile at MW-05 and at bottom over time are shown in Figures 11 and 12 respectively. The risk is sufficient that the owners of the property have begun preliminary design and cost estimates for the installation of a physical seepage barrier to block the salt front from migrating into the mining area[25].

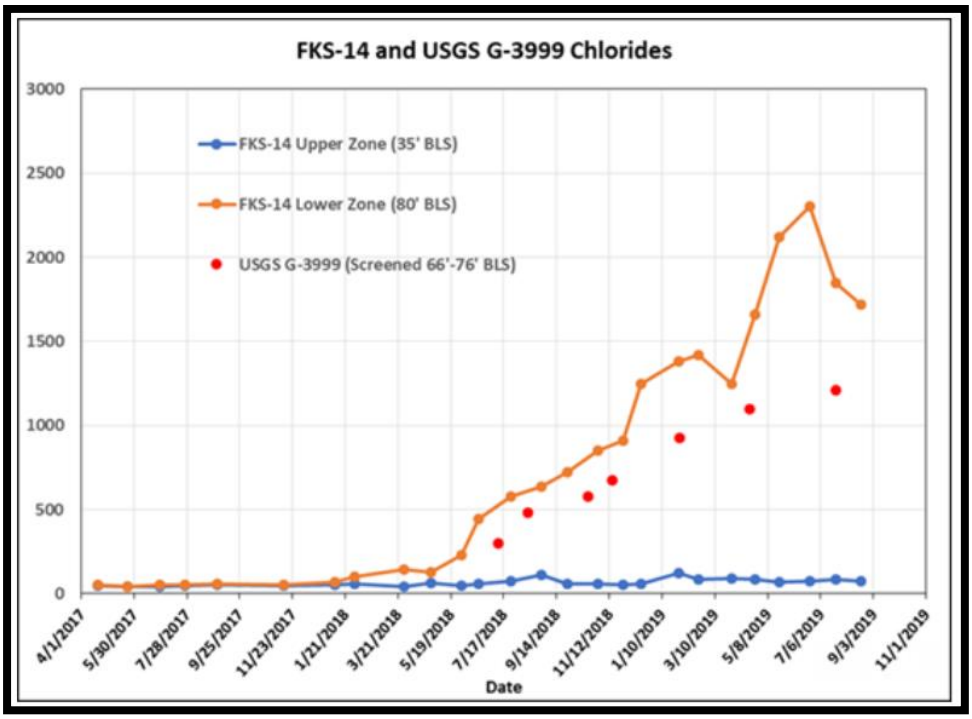


Figure 9. Chloride Concentration over Time at FKS-14 and USGA-3999

At a fundamental level, the nature of density-driven groundwater flow, hydrodynamic dispersion, and diffusion will continue to move chloride molecules from regions of higher concentration to areas of lower concentration. Thus, the plume will still move west by diffusion until equilibrium is achieved.

[25] MW-05 WATER QUALITY UPDATE for Permit No. MMR_226005-009. SDI Mine in Miami-Dade County, MacVicar Consulting, Inc. 4524 West Gun Club Road, Suite 201, West Palm Beach FL 33415, February 2019

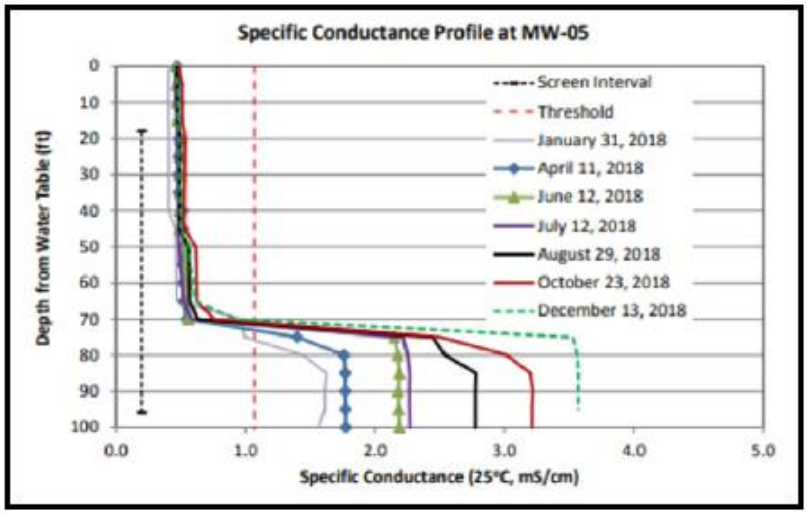


Figure 10. Location of SDI Monitoring Wells

Figure 11. Specific Conductance Profile at MW-05

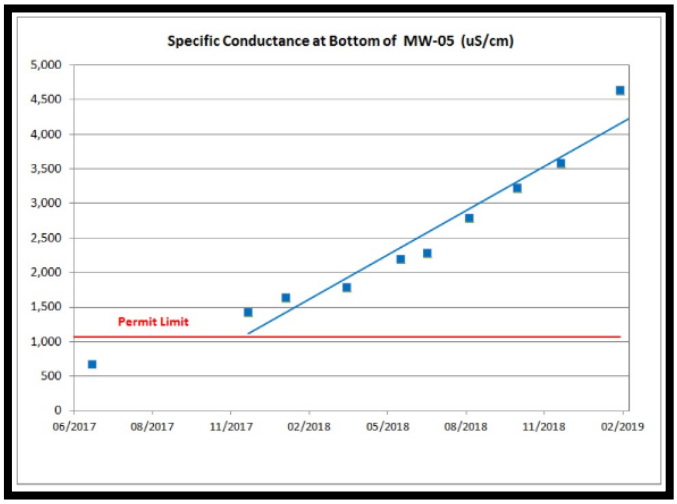


Figure 12. Specific Conductance at Bottom of MW-05 over Time

By allowing FPL to reallocate 15 MGD of Floridan aquifer water currently being used for the cooling of Natural Gas Unit 5 towards the freshening of the cooling canal system, the Power Plant Siting Act post-certification amendment links Miami-Dade County to the freshening activities. Expert analysis performed by Dr. William Nuttle demonstrates that this process which FPL calls "freshening" is really dilution, in which FPL adds water inputs of lower salinity value to replace freshwater evaporated from the cooling canal system (thereby reducing overall salinity) exacerbates cooling canal system discharges. When one compares discharge rates from prior to the beginning of these activities to the current operational period, a clear pattern emerges which demonstrates that net outflow from the cooling canal system has increased in direct correspondence to new inputs[26].

[26] Expert Report of Dr. William Nuttle, Case No.: 1:16-cv-23017-DPG, May 14, 2018

Increasing the amount of water added to the cooling canal system will raise water levels in the cooling canals. Multiple stakeholders have raised concerns that this will cause the further movement of the hypersaline ground water beyond the boundaries of the cooling canal system.

FPLs own water balance models demonstrate that their 'freshening' activities have pushed the plume further East into the surface waters of Biscayne Bay (see figure 13). This is supported by modeling performed by the firm Earthfx.

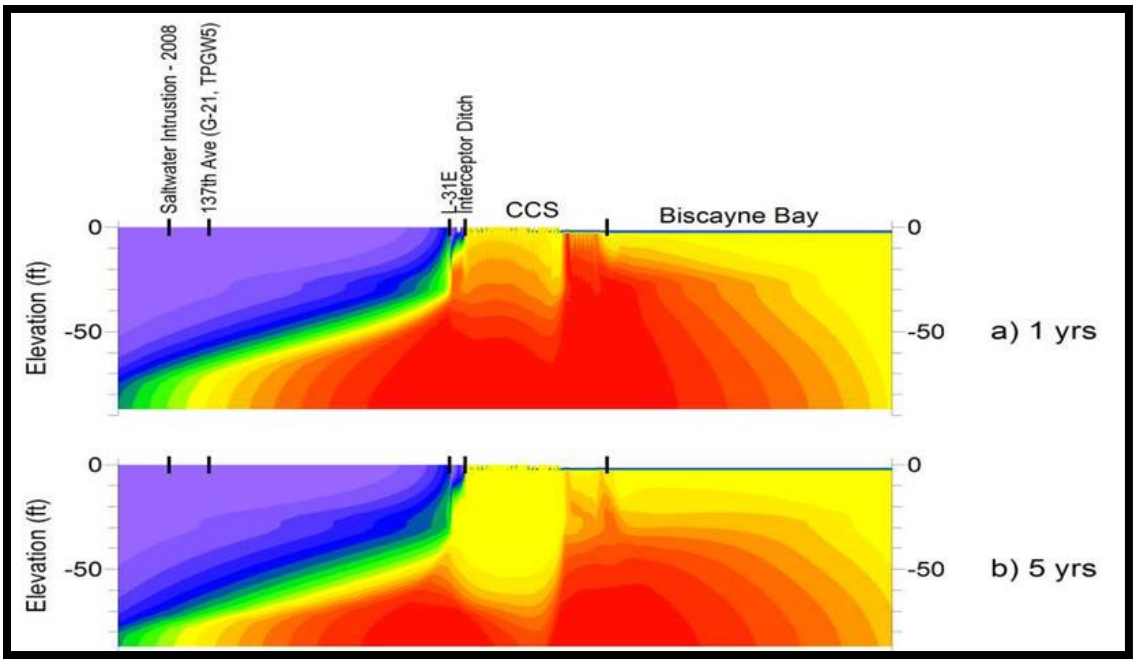


Figure 13. FPL Water Balance Model under 'freshening'

The firm Earthfx utilized the FPL 2018 Model to assess the movement of the saline groundwater under the conditions of adding an additional 15 MGD of Floridan aquifer water. Earthfx took a two-step approach to this modeling. First, they replicated the original analysis of the RWS under baseline conditions. Second, they assessed the change in groundwater salinity with the addition of 30 MGD to the cooling canal system.

It is important to note that the FPL 2018 model results are based on two assumptions:

1) The concentration of water in model Layer 1 representing the cooling canal system was set to 34 PSU at the start of the simulation, assuming that the cooling canal system had been "freshened" instantly and uniformly across the cooling canal system.

2) The elevation of the water in the cooling canal system has been raised by 0.1 ft. uniformly to represent the change in water levels caused by the addition of the Upper Floridan water.

Figure 14 shows the starting concentrations in Layer 8 of the 2018 FPL model at the start of remediation. The top of layer 8 ranges between 40 and 50 ft. below sea level in the Model Land Area. These results show that salinity levels in Layer 8 beneath the cooling canal system

are between 56 to 66 PSU and are higher than in Layer 1 (The cooling canal system) and show the western extent of FPL's hypersaline pollution plume extending into the Biscayne Aquifer past 137th Avenue, close to the extent of the saltwater interface mapped by the USGS. These conditions are borne out by other entities.

Figure 15 shows the simulated concentrations at the end of 10 years of pumping, operating the recovery well system (RWS), and "freshening" the cooling canal system at 30 MGD. Notice the very high salinity levels to the east as well as hypersaline contamination still remaining to the west. These results are consistent with those previously presented by FPL. Model results for Layer 8 shows a drop in simulated salinity values in the Biscayne Aquifer beneath the cooling canal system compared to the baseline simulation. However, salinity values west of the cooling canal system are higher as more saline water is pushed out into the Model Lands area due to the higher water levels in the cooling canal system and the reduced effectiveness of the RWS.

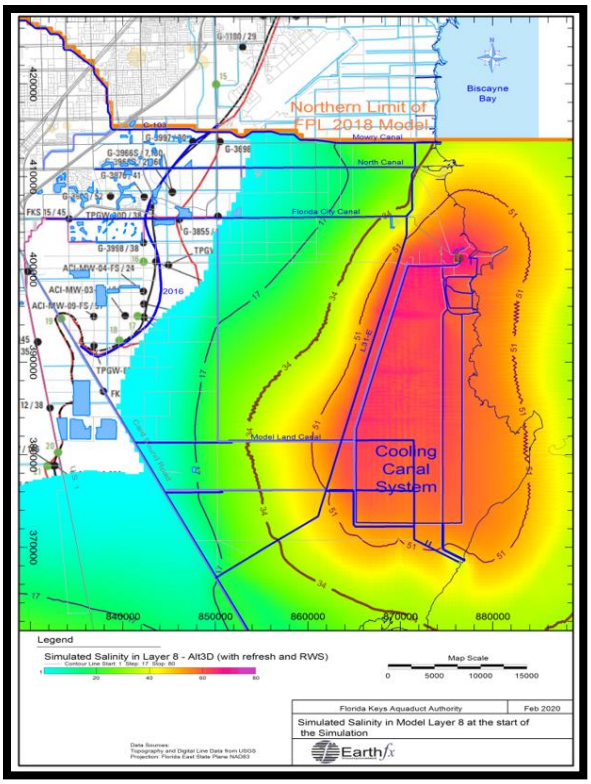


Figure 14. Simulated concentrations in Layer 8 at a depth of approx. 60 feet of the 2018 FPL Model at the start of the redial simulation.

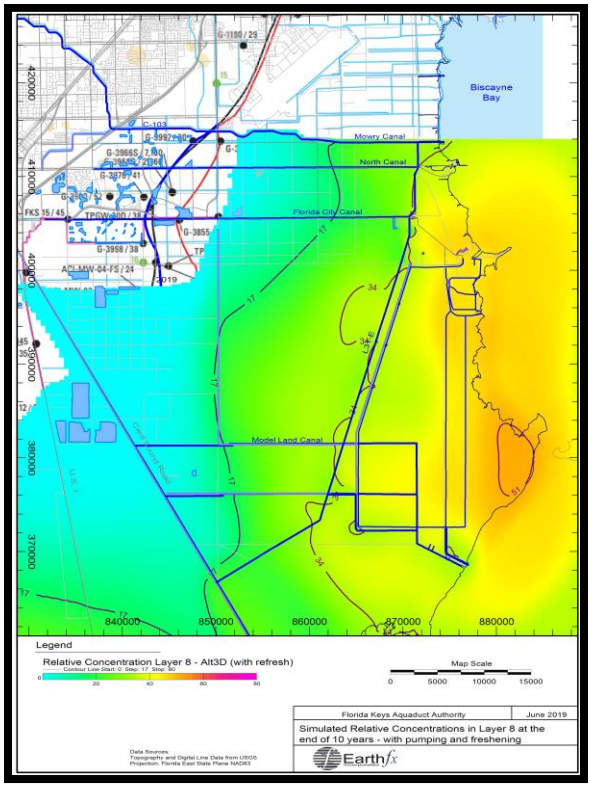


Figure 15. Simulated concentrations in Layer 8 or approx. 60 feet at the end of the 10-year remediation simulation with freshening of the cooling canal system at 30 MGD and RWS pumping.

FPL claims that these results justify that the recovery well system can achieve pullback of the hypersaline plume. However, upon closer examination one can see that only a portion of the saline plume is retracted under this model. The combination of dilution or "freshening" the cooling canal system and operating the RWS reduces the concentrations to below seawater salinity in only a portion of the Model Land area, leaving behind a large body of contaminated groundwater in the Model Lands area which could continue to migrate and threaten both wellfields and wetlands.

The simulations shown in the figures above serve as the baseline for assessing the effects of nearly doubling the volume of water in the cooling canal system. To estimate the effects of doubling the volume on the movement of saline water in the cooling canal system vicinity, two conditions must be set, the initial concentration of water in the cooling canal system at the start of remediation and water levels in the cooling canal system.

Although data is limited, injection of the 14MGD of freshwater into the cooling canal system was able to reduce salinities to between 50.9 and 51.1 PSU in 2018 and 2019, falling short of the 34 PSU target. FPL assumes it is reasonable that doubling the volume of freshwater inputs would achieve the goal of bringing cooling canal system saline concentrations to 34 PSU, as well as raising the water level by 0.1 feet across the cooling canal system. That assumption was used in this simulation.

The results of this modeling show that while saline concentrations within the cooling canal system fall more rapidly under higher volumes of freshwater input, concentrations of chloride outside the cooling canal system also rose as more chloride is pushed out into the Model Lands area due to the higher heads in the cooling canal system. The interceptor ditch and recovery well system have proven insufficient to address this issue. Our model shows an expanded area of hypersaline water (above 34 PSU) up to 7000 ft. from the cooling canal system under the condition of adding 30 MGD of freshwater to the cooling system. The two smaller closed 34 PSU contours are areas where the RWS has reduced concentrations. No significant change occurs in the vicinity of SW 137th Street and on the east side of the cooling canal system. Figure 15 above demonstrates this condition.

This agreement would allow for 15 MGD of nutrient-loaded Floridan aquifer water to be added to the cooling canal system for 'freshening' purposes, and would result in a similar level of exacerbation of cooling canal system discharges. As such, provisions should be included to counteract the impacts which this change will have on surrounding waters. Under the South Florida Water Management District's Fifth Supplemental Agreement with Florida Power and Light, FPL was mandated to 'operate the interceptor ditch system to restrict movement of saline water from the cooling water system westward of the Levee 31E adjacent to the cooling canal system to those amounts which would occur without the existence of the cooling canal system"[27] (See attachment 4). They have clearly failed in this objective, and the very viability of the Interceptor Ditch as a means of abating westward migration of polluted water has been proven

[27] Fifth Supplemental Agreement Between the South Florida Water Management District and Florida Power and Light Company, October 16th, 2009

lacking. Miami Dade County's Consent Agreement with Florida Power and Light states that an objective of the agreement is to "reduce the rate of, and, as an ultimate goal, arrest migration of hypersaline groundwater". As such, it would be inappropriate to sign on to an agreement which would result in additional saline pollution being extruded into the Model Lands. Thus, the agreement should contain language meant to minimize and mitigate the impacts of freshening operations.

In light of the additional seepage and head elevation that will occur from doubling the amount of water added to the cooling canal system, the agreement should be amended to include the following:

- Language stating that the use of the interceptor ditch pumps should be modified or discontinued to preserve upwards of 3MGD of freshwater to help prevent advancing the salt water intrusion front, pumps should be removed.

- Seek a higher and better use for the remaining 102 MGD than simply deep well injection that includes replacing some of the water damaged in the model lands by treating it to anti degradation standards and restoring the freshwater lens in this area to combat salt water intrusion.

5. The present language of the agreement stands in conflict with the goals of the Comprehensive Everglades Restoration Plan, specifically the C-111 Canal Project and the Biscayne Bay Coastal Wetlands Project.

Miami Dade County has a substantial interest in ensuring that the Comprehensive Everglades Restoration Plan, and specifically the C-111 Canal Project and the Biscayne Bay Coastal Wetlands Project which aim to improve the quality and quantity of freshwater entering Biscayne Bay are implemented successfully. Out of recognition for the importance of the project and the positive impacts it would have on county resources, in April of 2016 Miami Dade County passed a resolution urging the US Army Corps of Engineers and South Florida Water Management District to Expedite Phase II of the Biscayne Bay Coastal Wetlands project so that planning for Phase II may commence as soon as possible[28].

In their 2015 consent agreement with Miami Dade County, FPL agreed to acknowledge the benefits of hydrologic restoration projects contemplated by the Comprehensive Everglades Restoration Project ("CERP"), as well as other government entities, adjacent and to the west of the cooling canal system in controlling movement of hypersaline and saline waters in the Biscayne Aquifer, and commit to working with state, local and federal agencies to facilitate implementation of these projects to promote improved hydrologic conditions. And yet, the

[28] Miami Dade County RTSOTIITTONNO R-32s-r_6 RESOLUTION URGING THE U.S. ARMY CORPS OF ENGINEERS, THE T'LORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION AND THE SOUTH ELORIDA WATER MANAGEMENT DISTRICT TO EXPEDITE PHASE II OF THE BISCAYNE BAY COASTAL WETLANDS PROJECT SO THAT PLANNING FOR PHASE II MAY COMMENCE AS SOON AS POSSIBLE AND TO TAKE ALL NECESSARY ACTONS TO COMPLETE PHASE I OF THE BISCAYNE BAY COASTAL WETLANDS PROJECT, April 16th 2016

language of this JPA would validate the alteration of cooling canal system water budgets in a manner that would undermine the goals of both of these CERP projects. Furthermore, in the Fifth Supplemental Agreement, FPL is obligated to "immediately begin consultation with the district in order to identify measures to mitigate, abate or remediate impacts from the cooling canal system" upon any determination by the South Florida Water Management District that impacts of the cooling canal system are found "inconsistent with the goals and objectives of the CERP Biscayne Bay Coastal Wetlands project"[29].

The Biscayne Bay Coastal Wetlands projects aims to address nearshore hyper-salinity in Biscayne Bay and restore mesohaline conditions along the nearshore south/central bay in order to improve ecological conditions, specifically aiming to increase the duration and spatial coverage of mesohaline conditions of 5-20 PSU out to 250 m during the dry season and 500 m during the wet season[30] These targets are not currently being met[31]. A map detailing these targets can be seen in Figure 16.

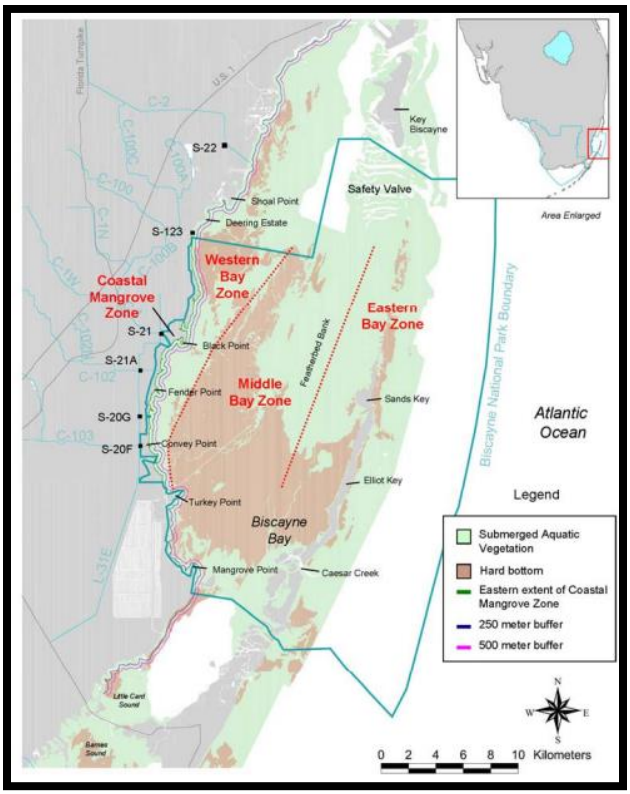


Figure 16. Biscayne National Park Western Bay Zone current and potential distribution of submerged aquatic vegetation on the bay bottom under restored conditions

[29] Fifth Supplemental Agreement Between the South Florida Water Management District and Florida Power and Light Company, October 16th, 2009

[30] Estimates of Flows to Meet Salinity Targets for Western Biscayne National Park, National Park Service, SFNRC Technical Series 2008: 2

[31] Erik Stabenau* and Donatto Surrat, Biscayne Bay: Current Conditions and CERP Objectives, National Park Service, http://nas-sites.org/cisrerp/files/2019/08/1335-NPS__BiscayneBay_Conditon_and_CERP_Objectives_2019-Stabenau.pdf

Saltwater intrusion imperils the coastal wetlands surrounding Turkey Point including the model lands and wetlands targeted for improvement under the C-111 canal and Biscayne Bay Coastal Wetlands Everglades Restoration projects. This was borne out in a letter sent by the director of the division of Environmental Resources Management to the Miami Dade County Office of General Counsel regarding a requested Everglades Mitigation Bank Phase II Modification delivered on July 18th, 2018[32]. FPL reports[33] that extreme high tides related to increased sea level are causing saltwater to encroach into the L31 canal. Data collected by the South Florida Water Management District shows that there has been a marked increase over the past 10 years in the number of days that water levels in the L31 canal are lower than water levels in Biscayne Bay[34]. This data is graphed in Figure 17. In 2019, conditions of lower water level in the L31 canal favored the encroachment of saline water on one out of every 6 days.

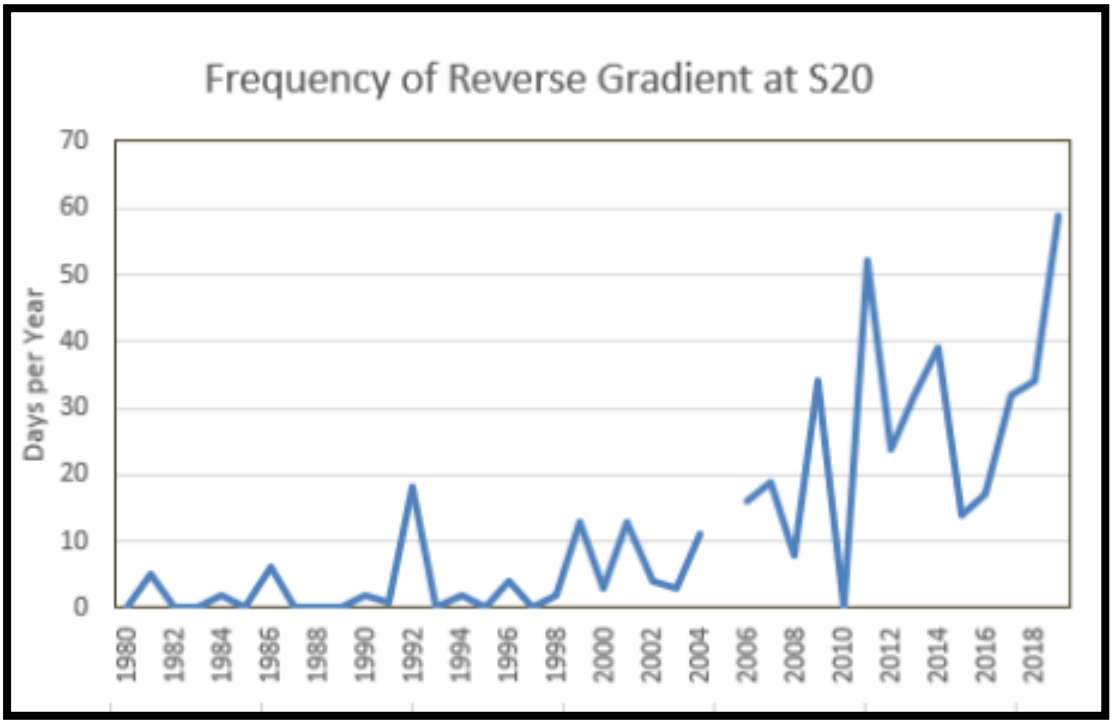


Figure 17: Frequency that average daily water levels in Biscayne Bay exceed water levels in the L31 canal at the S20 structure, which drives the encroachment of saline water into the surface water of the Model Lands Basin

Figures 18 and 19 demonstrate the unhealthy conditions which exist within the FPL Model Lands adjacent to the Turkey Point facility and were provided to FDEP by DERM on July 18th, 2018 in a letter for an extention of time peguarding FPL's Mitigation bank permit.

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[32] Letter RE Request for an Extension of Time in accordance with section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Phase II Modification and Credit Release, Miami Dade County Division of Environmental Resources Management, July 18th 2018.

[33] Turkey Point Annual Monitoring Report 2019

[34] Based on water level data collected at the S20 structure, located near the southwest corner of the Turkey Point cooling canal system,

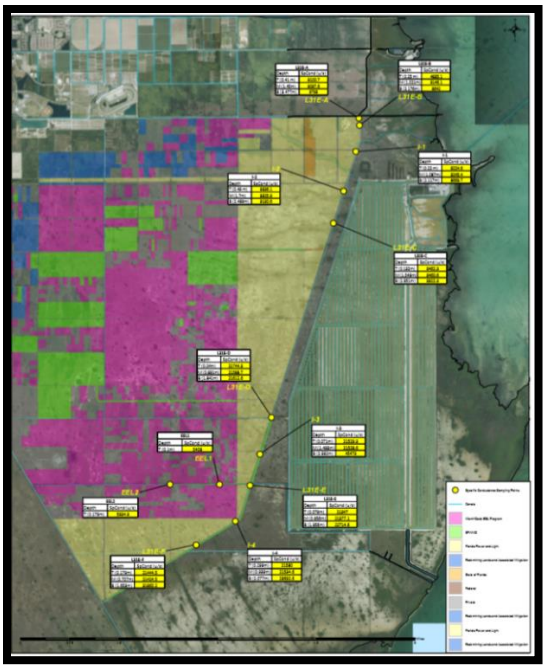

Figure18. Model Lands Surface Water Specific Conductance L-31E borrow canal and Model Lands South canal April 2018, showing surface water contamination in what was a freshwater wetland.

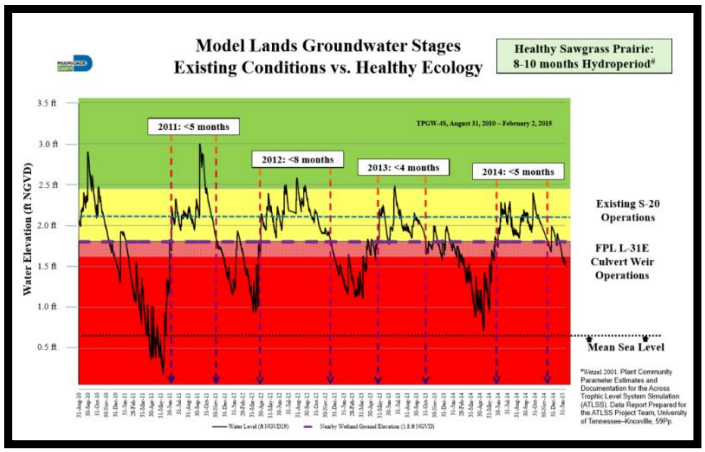

Figure19. Model Lands Groundwater Stages Existing Conditions vs. Healthy Ecology

The Earthfx modeling described above demonstrates that this JPA as currently written would run counter to the commitment to restore mesohaline conditions in this area, and undermine critical Everglades restoration projects meant to improve the health of Biscayne Bay and its coastal wetlands.

Additional land and water is needed for ecosystem restoration by the Biscayne Bay Coastal Wetlands Project and to mitigate the impacts on Biscayne National Park and the Florida Keys Marine sanctuary from continued operation of the cooling canal system via salt loading and nutrient loading. At the same time, the current version of the JPA would put far less treated water towards productive re-use than previous versions[35], and calls for only a fraction of the water re-use which Miami Dade County must provide. Previous versions of this agreement would have called for upwards of 90 MGD of treated wastewater to be reused in the Turkey Point facility. The 15 Million Gallons per day called for under this agreement does not adequately advance Miami Dade County obligations to reuse 117.5 MGD by 2025.

In light of the current threats to the wetlands surrounding the Turkey Point facility and the role which the JPA may play in exacerbating these threats, a greater emphasis should be placed on producing and using treated water for environmental restoration purposes as opposed

[35] Miami Dade County Water and Sewer Department, 5-Year Progress Report: Progress from 2008 through 2019, Section 403.086(9)(f), Florida Statutes, Task Authorization 49, December 2019.

to wasting this valuable resource through deep-well injection. This can be achieved through the inclusion of the following textual amendments:

- Because of the known conflicts with the C-111 CERP project, additional water storage should be realized in the model lands' 21,000 acres, sufficient to raise the freshwater head elevation from 1.8 feet to 2.2 feet at a minimum, as called for in the Miami Dade County Consent Agreement.

- Because the continued operations are in conflict with the BBCW CERP project the agreement should call for a future guaranteed amount of freshwater to be recycled for restoration purposes, potentially recharging the Bird Drive Basin area to seek a higher and better use for the remaining 102 MGD than simply deep well injection. Creating a recharge basin will help recharge the aquifer and ensure there is a driving head to the coastal structures.

- The additional contamination associated with this freshening effort calls for increase monitoring in Biscayne Bay and backfilling of the known areas where the greatest contamination has been shown to occur. Backfilling should be completed to where Mangrove restoration can occur at -1.5 feet to better benefit wildlife and restoration efforts.

Summary of Suggested Amendments

In light of the information presented above, we propose the following amendments to the JPA language:

For the State of Florida:

Work in partnership with all regulators and stakeholder; hold a public workshop with all of those impacted by these changes in operations to resolve conflicts with Everglades Restoration, water supply and impacts to Biscayne National Park and Florida Keys Marine Sanctuary. The venue for this could possibly be the May 2020 SFWMD Governing Board meeting, where board members can also consider their role under the Fifth Supplemental Agreement. The outcome of this meeting should drive required joint conditions to continued operations at Turkey Point that mitigate for impacts of the changes to the PPSA, JPA agreement and continued operations of the cooling canal system generally. This should occur before any new agreement or permit is issued to FPL.

For Miami Dade to Address Legal Liability:

- The agreement should include "County as sovereign" language.
- The agreement should stipulate that FPL must appropriately maintain pipe infrastructure, assumes liability for malfunctions and can be held to county standards as opposed to state/federal

- The agreement should include a textual amendment recognizing that the Turkey Point cooling canal system is in open communication with surrounding ground and waters and as such changes in operations are required or updating the technology would be required for continued operations to mitigate impacts.
- Alternatively, Miami Dade County should clarify its current stance on the continued operation of the cooling canal system beyond 2033, and require actual progress on mitigation from the impacts of the current freshening strategy and recovery well system as required by the consent Order and Consent Agreement.

To Address the Consent Agreement:

- FPL must comply with the mandates of the Miami Dade County Consent Agreement within one year. The County should also take the opportunity to strengthen the language of FPL's obligations in light of the new evidence surrounding the impacts of the cooling canal system "freshening" process.
- Alternatively, this agreement should incorporate the amendment called for by Commissioner Rebecca Sosa at the April 10th 2018 Board of County Commissioners meeting discussing the draft JPA agreement, which called for re-visitation of the agreement upon failure to meet county objectives within one year.

To Address Nutrient Loading:

- All 'Blowdown' water produced via the use of treated wastewater for the cooling of natural gas unit 5 must be deep-well injected and not disposed of in the open cooling canal system to prevent further contamination of Biscayne Bay. All solid waste produced via this process must be landfilled.
- Acceptance of the agreement must entail a corresponding mandate to update to the Turkey Point Nutrient Management Plan meant to take into account the proposed additional 15 MGD of Floridan aquifer water into the cooling canal system as well as other changes resultant from the JPA.
- Require annual reporting of the mass budgets for total nitrogen and total phosphorous to better track progress towards goals of reducing nutrient concentrations and controlling algal blooms, as called for in the Miami Dade County Consent Agreement.
- A TMDL should be set with the help of Dr. James Fourqurean, as seagrass death is already occurring in the nearshore of the Turkey Point Facility; ongoing research suggests the source is emanating from the cooling canal system[36].

To Address the Water Budget:

[36]Reynolds, L. Fourqurean, J. Nuttle, W.K. Future Impacts on Biscayne Bay of Extended Operation of Turkey Point Cooling Canals [online: https://www.researchgate.net/publication/333717294_Future_Impacts_on_Biscayne_Bay_of_Extended_Operation_of_Turkey_Point_Cooling_Canals ; accessed 3 Mar 2020]

- Language stating that the use of the interceptor ditch pumps should be modified or discontinued to preserve upwards of 3MGD of freshwater to help prevent advancing the salt water intrusion front.
- Seek a higher and better use for the remaining 102 MGD than simply deep well injection that includes replacing some of the water damaged in the model lands by treating it to anti degradation standards and restoring the freshwater lens in this area to combat salt water intrusion.

To Address Conflicts with Everglades Restoration:

- Because of the known conflicts with the C-111 CERP project, additional water storage should be realized in the model lands 21,000 acres, sufficient to raise the freshwater head elevation from 1.8 feet to 2.2 feet at a minimum, as called for in the Miami Dade County Consent Agreement.
- Because the continued operations are in conflict with the BBCW CERP project the agreement should call for a future guaranteed amount of freshwater to be recycled for restoration purposes, potentially recharging the Bird Drive Basin area to seek a higher and better use for the remaining 102 MGD than simply deep well injection. Creating a recharge basin will help recharge the aquifer and ensure there is a driving head to the coastal structures.
- The additional contamination associated with this freshening effort calls for increase monitoring in Biscayne Bay and backfilling of the known areas where the greatest contamination has been shown to occur. Backfilling should be completed to where Mangrove restoration can occur at -1.5 feet to better benefit wildlife and restoration efforts.

The ecological health and vitality of Biscayne Bay and its coastal wetlands are a matter of critical importance to the many stakeholders which derive their health, wealth, and well-being from the use of these resources. Because of the advancement of the plume despite 3 years of remediation efforts these conditions to protect the remaining potable water in the area, to protect adjacent land owners and Miami Dade and the Florida Keys drinking water supply must be addressed. We hope this information will encourage all regulators to work together to resolve these issues and that each of you will take this information and these suggestions into consideration in drafting final language for the Joint Partnership Agreement between Miami Dade County and the Florida Power and Light Company and in the pending draft NPDES permit. If you feel these negotiations with FPL will fail, then our suggestion is to suspend entering into any new agreement or issuance of any new permit with FPL until full compliance with the consent order and consent agreement is achieved and FPL has successfully shown what it continues to claim it can achieve through this remediation.

We look forward to providing you with any information we can and would be glad to address the SFWMD governing board at an upcoming workshop to address these conflicts. This analysis and report was produced for your consideration by the undersigned scientists on behalf of the Florida Keys Aqueduct Authority and the Florida Keys Fishing Guides Association.

William K Nuttle, Ph.D, PEng; Hydro-geologist
BS, Civil Engineering. MS, Civil Engineering. Ph.D Civil Engineering

James Fourqurean, Ph.D; Marine and Estuarine Ecologist
B.A. in Biology and Environmental Sciences, M.S. in Environmental Sciences, Ph.D. in Environmental Sciences
Professor of Biological Sciences and the Director of the Center for Coastal Oceans Research in the Institute for Water and Environment, Florida International University

E.J. Wexler; Hydro-geologist

B.E. in Civil Engineering, M.S. Civil Engineering, M.S. in Earth Sciences,
Director of Modeling Services for Earthfx, Inc.

Ed Swakon; Registered Engineer
President, EAS Engineering

Thomas Walker;
Executive Director, Florida Keys Aqueduct Authority

Laura L. Reynolds
Founding and Managing Member of Conservation Concepts LLC
Marine Biologist and Environmental Consultant

Cc:

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Mayor Carlos Gimenez,
Miami Dade County, mayor@miamidade.gov

Chairwoman Audrey Edmonson,
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Commissioner Sally A. Heyman
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Miami Dade County Board of County Commissioners, district11@miamidade.gov

Commissioner Jose "Pepe" Diaz
Miami Dade County Board of County Commissioners, district12@miamidade.gov

Commissioner Esteban L. Bovo, Jr.
Miami Dade County Board of County Commissioners, district13@miamidade.gov

Appendix:

Attachment 1:

Miami Dade County Board of County Commissioners, Miami Dade County Board of County Commissioners, Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

Attachment 2:

Miami Dade County, Crandall, 'Communication RE Request for an Extension of Time in accordance with section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Phase II Modification and Credit Release…', Miami Dade County Division of Environmental Resources Management, July 18th 2018.

Attachment 3:

Review of Nutrient Treatment Target Levels, RER-DERM Water Resources Coordination Division, Final Report by Black and Veatch, October 30, 2018.

Attachment 4:

Fifth Supplemental Agreement Between the South Florida Water Management District and Florida Power and Light Company, October 16th, 2009

Attachment 1:

Miami Dade County Board of County Commissioners, Miami Dade County Board of County Commissioners, Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

MEMORANDUM

Agenda Item No. 11(A)(7)

TO: Honorable Chairman Jean Monestime
and Members, Board of County Commissioners

DATE: July 19, 2016

FROM: Abigail Price-Williams
County Attorney

SUBJECT: Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power & Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant

The accompanying resolution was prepared and placed on the agenda at the request of Prime Sponsor Commissioner Rebeca Sosa.

Abigail Price-Williams
County Attorney

APW/cp

MEMORANDUM

(Revised)

TO: Honorable Chairman Jean Monestime
and Members, Board of County Commissioners

DATE: July 19, 2016

FROM: Abigail Price-Williams
County Attorney

SUBJECT: Agenda Item No. 11(A)(7)

Please note any items checked.

_____ **"3-Day Rule" for committees applicable if raised**

_____ **6 weeks required between first reading and public hearing**

_____ **4 weeks notification to municipal officials required prior to public hearing**

_____ **Decreases revenues or increases expenditures without balancing budget**

_____ **Budget required**

_____ **Statement of fiscal impact required**

_____ **Statement of social equity required**

_____ **Ordinance creating a new board requires detailed County Mayor's report for public hearing**

✓ **No committee review**

_____ **Applicable legislation requires more than a majority vote (i.e., 2/3's ____, 3/5's ____, unanimous _____) to approve**

_____ **Current information regarding funding source, index code and available balance, and available capacity (if debt is contemplated) required**

Approved _____ Mayor
Veto _____
Override _____

Agenda Item No. 11(A)(7)
7-19-16

RESOLUTION NO. _____

RESOLUTION SUPPORTING THE COUNTY MAYOR IN EFFORTS TO SEEK A COMMITMENT FROM FLORIDA POWER & LIGHT COMPANY TO DISCONTINUE USE OF THE COOLING CANAL SYSTEM AT THE TURKEY POINT POWER PLANT

WHEREAS, the Florida Power & Light's Turkey Point Power Plant, located in south Miami-Dade County, utilizes a cooling canal system which consists of a network of approximately 5,900 acres of unlined canals; and

WHEREAS, water from this cooling canal system communicates with the surrounding groundwater, and long-term monitoring data has shown that a hypersaline plume of cooling canal water has been migrating in the groundwater, beyond the boundaries of the cooling canals; and

WHEREAS, the County has taken action to address these issues, including, but not limited to, issuing a Notice of Violation in 2015 to Florida Power & Light for certain water quality violations in the groundwater, and requiring, through an administrative consent agreement, that Florida Power & Light take certain actions to retract and contain the hypersaline groundwater plume; and

WHEREAS, at that time, the issues were focused on the hypersaline groundwater plume migrating west of the cooling canal system; and

WHEREAS, more recent water quality sampling detected exceedances of Miami-Dade County water quality standards in certain surface water locations in or connected to Biscayne Bay, adjacent to and east of the cooling canal system; and

WHEREAS, this Board, as well as residents of this County and members of the general public, are concerned about these recent discoveries, and such discoveries further highlight the challenges posed by the continued operation of the cooling canal system; and

WHEREAS, Florida Power & Light has a license from the federal government to operate the Turkey Point power plant units that use the cooling canal system until 2033; and

WHEREAS, the County Mayor has sought a commitment from Florida Power & Light to discontinue the use of the cooling canal system by 2033 in favor of more modern technology such as cooling towers; and

WHEREAS, this Board wishes to express its support for the County Mayor's efforts to obtain such a commitment from Florida Power & Light,

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF MIAMI-DADE COUNTY, FLORIDA, that this Board supports the efforts of the County Mayor to seek a commitment from Florida Power & Light to discontinue the use of the cooling canal system at the Turkey Point Power Plant.

The Prime Sponsor of the foregoing resolution is Commissioner Rebeca Sosa. It was offered by Commissioner , who moved its adoption. The motion was seconded by Commissioner and upon being put to a vote, the vote was as follows:

Jean Monestime, Chairman
Esteban L. Bovo, Jr., Vice Chairman

Bruno A. Barreiro	Daniella Levine Cava
Jose "Pepe" Diaz	Audrey M. Edmonson
Sally A. Heyman	Barbara J. Jordan
Dennis C. Moss	Rebeca Sosa
Sen. Javier D. Souto	Xavier L. Suarez
Juan C. Zapata	

The Chairperson thereupon declared the resolution duly passed and adopted this 19th day of July, 2016. This resolution shall become effective upon the earlier of (1) 10 days after the date of its adoption unless vetoed by the County Mayor, and if vetoed, shall become effective only upon an override by this Board, or (2) approval by the County Mayor of this Resolution and the filing of this approval with the Clerk of the Board.

MIAMI-DADE COUNTY, FLORIDA
BY ITS BOARD OF
COUNTY COMMISSIONERS

HARVEY RUVIN, CLERK

By:_____
Deputy Clerk

Approved by County Attorney as
to form and legal sufficiency.

Abbie Schwaderer-Raurell

Attachment 2:

Miami Dade County, Crandall, ‘Communication RE Request for an Extension of Time in accordance with section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Phase II Modification and Credit Release…’, Miami Dade County Division of Environmental Resources Management, July 18th 2018.

MIAMI-DADE COUNTY
Carlos A. Gimenez, Mayor

Department of Regulatory and Economic Resources
Environmental Resources Management
701 NW 1st Court, 4th Floor
Miami, Florida 33136-3912
T 305-372-6754 F 305-372-6759
miamidade.gov

July 18, 2018

Lea Crandall, Clerk of the Department
Office of General Counsel
Florida Department of Environmental Protection
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

CERTIFIED MAIL NO 7001 2510 0001 1765 4022
RETURN RECEIPT REQUESTED

Timothy Rach, Program Administrator
Submerged Lands and Environmental Resources
Coordination Program
Florida Department of Environmental Protection
Bob Martinez Center
2600 Blair Stone Road MS 2500
Tallahassee, Florida 32399-2400

CERTIFIED MAIL NO 7001 2510 0001 1765 4176
RETURN RECEIPT REQUESTED

Re: Request for an Extension of Time in accordance with Section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Mitigation Bank Phase II Modification and Credit Release dated June 28, 2018, for FPL facilities located in southern Miami-Dade County, approximately 6 miles southeast of Florida City and Homestead, Between US Highway 1 and Card Sound Road, in Sections 5-8, 18, 19 and 28-33 in Township 58 Range 40 East; Sections 20-22, 25-29 and 32-36 in Township 58 South, Range 39 East; Sections 1 and 2 in Township 59 South, Range 39 East; and Section 6 in township 59 South, Range 40 East, Unincorporated Miami-Dade County, Florida.

Dear Ms. Crandall and Mr. Rach:

On June 28, 2018, Miami-Dade County Division of Environmental Resources Management (DERM) received via email the Florida Department of Environmental Protection (FDEP) letter issued June 28, 2018 regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Mitigation Bank Phase II Modification and Credit Release.

The subject permit modification "updates specific conditions based on recent data received to clarify the amount of freshwater Everglades Mitigation Bank Phase II (EMB 2) receives south of the L-31-E levee, allows for incremental vegetative success credit releases, and releases 98.55 freshwater herbaceous credits." Furthermore, FDEP has required the permittee to lower the control elevation of the Everglades Mitigation Bank culvert weirs from 2.2 feet to 1.8 feet NGVD within 72 hours of issuance "to assure that the area south of L-31-E is receiving appropriate amounts of freshwater flow...."

The purpose of this letter is to respectfully request additional information and clarification from FDEP on this action, and to hereby request a sixty (60) day extension of time to September 17, 2018 for DERM to further review and fully evaluate FDEP's action in this matter in order to contemplate action regarding a petition for an administrative hearing in accordance with Section 120.57, Florida Statutes.

Over the past several years, DERM has been working with FPL on concerns over water quality impacts associated with the FPL Turkey Point Cooling Canal System (CCS). On October 7, 2015, FPL entered into a Consent Agreement with DERM to address these water quality impacts. The Consent Agreement identified various remedial actions and hydrologic improvement projects that FPL was required to undertake to address water quality impacts, including one such requirement that FPL increase the Everglades Mitigation Bank culvert weirs elevation to no lower than 0.2 feet below the 2.4 foot NGVD trigger of the S-20 Structure. This condition was included in the Consent Agreement because of concerns associated with the impacts of the hyper saline plume emanating from the CCS on water resources in the area. The FPL Turkey Point CCS, as well as FPL's Everglades Mitigation Bank are located in the extreme southeast region of the county, in an area that is experiencing significant westward migration of the salt intrusion front at the base of the Biscayne aquifer, and where historically fresh surface water canals have recently been documented with higher conductivity and chloride levels uncharacteristic of fresh water bodies. Miami-Dade County is concerned that the subject modification, as issued, establishes operating criteria for the EMB2 culvert weir elevations and target water deliveries that: may result in adverse impacts to water resources upstream of this area; and that are not sustainable over the long term, particularly as it relates to existing inland migration of the salt intrusion front in this area, which is expected to be further exacerbated by sea level rise.

The following describes some of DERM's concerns regarding the aforementioned subject permit modification:

1. Upstream Water Levels and Salt Intrusion

    a. The DEP-mandated control elevation of 1.8 foot NGVD is 0.6 feet below the current drainage trigger elevation at the adjacent S-20 water control structure. DERM is concerned that setting the control elevation at 1.8 feet NGVD is not sustainable from a water management perspective. The stage in the L-31 E canal is dependent on the setting of the adjustable weirs in these 40 culverts. The decision to modify the permit and set the culverts to 1.8 feet will cause the water levels in the L-31 E canal to drain to this elevation. In addition, the wetlands in the Model Lands Basin will be drained by the L-31 E canal whenever the stage in the upstream wetlands exceeds the DEP mandated 1.8 feet NGVD control elevation of the canal. This drainage has and will continue to undermine the ecological functioning of the wetlands upstream of the L-31E, including wetlands that are part of the mitigation bank.

    b. The EMB 2 is located east of the salt intrusion line, as delineated by the 1000 ppm isochlor at the base of the Biscayne Aquifer. The salt front migrates westward (inland) in this area when water levels upstream of the L-31E are insufficient to prevent this salt intrusion, therefore, water management in the bank and the surrounding basin is critical for preventing the landward migration of the salt front, towards potable water wellfields in the Homestead area, including the Florida Keys Aqueduct Authority wellfield that provides drinking water for the Florida Keys and Miami-Dade County's Newton wellfields. **Attachment 1** demonstrates how low the surface and groundwater levels can fall in this basin which is drained by the EMB 2 culverts. It is notable that during some drought years, the groundwater levels in this basin can fall below sea level in the area upstream of the L-31E.

    c. The most recent USGS study indicates that the current average rate of landward migration of the saltwater interface in the groundwater is at 140 meters per year and that the salt front now extends beyond monitoring well cluster TPGW-7 of the FPL Turkey Point Uprate Project. This study supports the conclusion that the groundwater salt front in this basin has been advancing upgradient towards the aforementioned public wellfields and private drinking water wells as a result of unsustainable water management practices; this includes the removal of more water from this basin than it receives via rainfall. A copy of the aforementioned USGS study is provided as **Attachment 2**. It should be noted that the saltwater front is currently located more than 6.5 miles inland at the northern boundary

of the basin and more than 10.6 miles at the SW boundary of the basin at the 1000 ppm isochlor line. An illustration of this saltwater front is provided in **Attachment 3**.

d. The extent to which the L-31 E Canal (which historically was a freshwater canal) can be protected from saltwater contamination is dependent on the stage of the canal. **Attachment 4** depicts the recent extent of chloride contamination of this canal. It should be noted that the L-31 E canal is connected to upstream secondary canals including the Model Lands South canal, therefore chloride impacts observed in the L-31 can now become a potential surface water pathway for further chloride contamination of the secondary canal system as well. **Attachment 5** depicts the locations in the secondary canal where elevated conductivities have recently been detected. **Attachment 6** includes a meeting presentation with information on the hydrology of the Model Lands basin and how the basin is impacted by FPL's water management operations. **Attachment 7** summarizes salinity increases in the L-31 E over the Uprate Project monitoring period of record, demonstrating the high degree of salinization that has occurred in these surface waters. The water quality of the L-31 E was initially freshwater and salinities during the period of record have increased to over 29 PSU.

e. DERM has considered the cumulative impact of water losses from the Model Lands Basin with the permit-mandated minimum annual flows through the culverts, given other water losses from this basin and nearby areas. These include the losses associated with operation of the Interceptor Ditch (ID) pumps and the groundwater recovery well system (which is now operational). As an example, the flows mandated in this permit modification in combination with the recovery well system will result in more than 20,000 acre-feet of water lost from this area annually. This is the equivalent of more than one foot of surface water across the entire Model Lands wetlands and does not include other permitted water losses such as those associated with replacement of water from operation of the ID pumping into the cooling canals pursuant to the authority granted under the Fifth Supplemental Agreement with the South Florida Water Management District. It is also not clear if FDEP has considered the increased pumping losses that are expected from the ID operations since the stage triggers for the ID pumping have not been modified and since lower water levels in the L-31 E Canal in relation to cooling canal stage is the condition that triggers the operation of the ID pumps.

2. Comprehensive Everglades Restoration Plan (CERP) Consistency

a. A control elevation of 1.8 feet NGVD is not sustainable or consistent with Everglades restoration in this area including the restoration envisioned under the C-111 Spreader Canal Phase One CERP project. In order to restore more natural hydroperiods and stages to the wetlands in the Model Lands basin, this CERP project calls for a control elevation much higher than the 1.8 foot elevation mandated in the DEP permit modification. Please refer to the C-111 Spreader Western Project implementation report for further information relating to this CERP project. Under this CERP project, the adjacent S-20 water control structure will be operated at a 2.9 foot NGVD open trigger when the approved trigger changes are fully implemented, and the structure will close at an elevation not lower than 2.4 feet NGVD. A series of hydrographs depicting the aforementioned concept is provided as **Attachment 8**. In the absence of new water sources, this attachment helps to illustrate the concern that water levels in the Model Lands wetlands will not likely be able to reach the 2.9-foot CERP open trigger stage during typical (or even wet) water years based upon the DEP-mandated culvert control elevation. Therefore, setting the culvert weirs at the 1.8 foot control elevation will drain the water above this elevation through these culverts and, as a result, will prevent most or all of the hydroperiod and stage benefits to the Model Lands that were envisioned with the CERP S-20 operations change. In order to preserve the ability of the CERP S-20 operations change to provide stage and hydroperiod benefits (as well as salt intrusion prevention benefits), the water levels in the L-31E canal should be held to canal stages of 2.4 feet or higher as approved by CERP. This CERP restoration strategy to operate the S-20 structure at a 2.9-ft NGVD open trigger has been authorized by FDEP through

issuance of FDEP permit number 0293559-011; however, FDEP's recent permit modification to order lowering of the FPL culvert gate elevations is inconsistent with this CERP restoration strategy and negates it. FDEP's action appears inconsistent with the CERP S-20 operations change, and also appears inconsistent with the Army Corps permit for construction of the FPL Everglades Mitigation Bank (SAJ-1995-155(IP-TKW)), which states "This permit does not authorize interference with any existing or proposed Federal projects."

3. Miami-Dade-owned and other Conservation Lands

   a. Public conservation lands, a significant portion of which are owned by Miami-Dade County's Environmentally Endangered Lands Program, are located upstream of the culverts in the Model Lands Basin and are affected by competing freshwater needs. State and Federal agencies have recognized the need to restore more natural hydroperiods in this area as per the numerous CERP projects designed to restore wetlands in this specific area. The reset of the culvert weirs back to 1.8 feet NGVD as per the permit modification will serve to further drain and adversely impact these Miami-Dade County-owned conservation lands. Additionally, hydrologic impacts including salt intrusion and groundwater and surface water contamination have been documented on these lands. A map depicting the results of recent sampling that reveal water quality impacts to surface waters within these publically-owned wetlands is provided as **Attachment 9**. Evidence based on recent sampling indicate that saline water has entered the secondary canal from the L-31 E Canal. An illustration of the extent of the saline groundwater plume from the cooling canal system on these Miami-Dade County-owned conservation lands, based on tritium tracer contours, is provided as **Attachment 10**.

4. Methodology for Release of EMB Wetland Mitigation Credits

   a. As a regulatory agency that accepts State permitted mitigation banking credits, DERM is concerned about the manner in which the determination that a credit release was appropriate and how the calculations reflected in the credit release schedule were completed. The modification of the permit and credit release appears inconsistent with the findings of the FDEP inspection report dated March 21, 2018. Specifically, It appears that EMB2 was requesting a partial release of 98.55 credits for meeting herbaceous wetland vegetation interim success criteria; however, the FDEP inspection report documents that the success criteria is not being met. Furthermore, changes in the permit language appear to correlate the lowering of the L-31E culverts with the success of vegetation planted in graded and restored areas. However, it is not clear how the success of vegetation in areas upstream of the L-31E culverts is related to the lowering of the control elevation for the weirs.

   b. In addition, specific Condition 20 in the Modification refers to the "*Credit release schedule on the next page...*" – Yet, the attached credit release schedule has been modified to actually add credits and the "Time Lag & Risk" has been modified from 33.08 to -129.82. It is unclear whether there was an error in the calculation or if there was an actual increase in the allowable credits based on the subject permit modification.

   c. The modification document states "*This modification releases a total of 98.55 freshwater herbaceous credits to the EMB2. The credits are being released in accordance with Specific Condition 20 and the credit release schedule of Environmental Resources Permit (ERP) #0193232-055.*" However, the credit release schedule being referenced is actually from the 2013 permit modification and is different than the one that is attached to the current modification. Specifically, the credit release schedule referenced does not indicate that the credits can be released incrementally.

5. Miami-Dade County DERM Consent Agreement with FPL

   a. The subject modification conflicts with the October 7, 2015 DERM Consent Agreement in that resolution of paragraph 17.c.i. relating to the control elevation of the culverts has not been achieved. DERM and FPL have not concluded discussions on this matter and any submittals to DERM by FPL to change the culvert settings have not been finalized by both parties. Furthermore, the Consent Agreement requires FPL to take into account its efforts to improve CCS water quality and the potential and actual impacts of such actions on water resources outside the CCS, to not cause or contribute to the exacerbation of alleged violations of County water quality standards or criteria or future violations of County water quality standards or criteria in the groundwater or surface waters outside the CCS.

In order to adequately evaluate DEP's action, DERM is respectfully requesting the following records and information:

a) All information/data and analysis that FDEP has relied upon for the modification of the permit and for its determination that these permit modifications "are not expected to result in any adverse environmental impacts or water quality degradation, and will not be contrary to public interest" as stated in FDEP's June 28, 2018 letter approving the permit modifications.

b) All data that FDEP has received from the mitigation bank including, but not limited to, all stage and water quality data from the four monitored culverts, as well as all stage data from all monitoring locations downstream of the L-31 E canal.

c) Finally, DERM requests a copy of any notifications the permittee has provided to FDEP pursuant to the requirements of General Condition 10 of the above referenced permit.

Please contact me at 305-372-6754 if you have any questions regarding this matter.

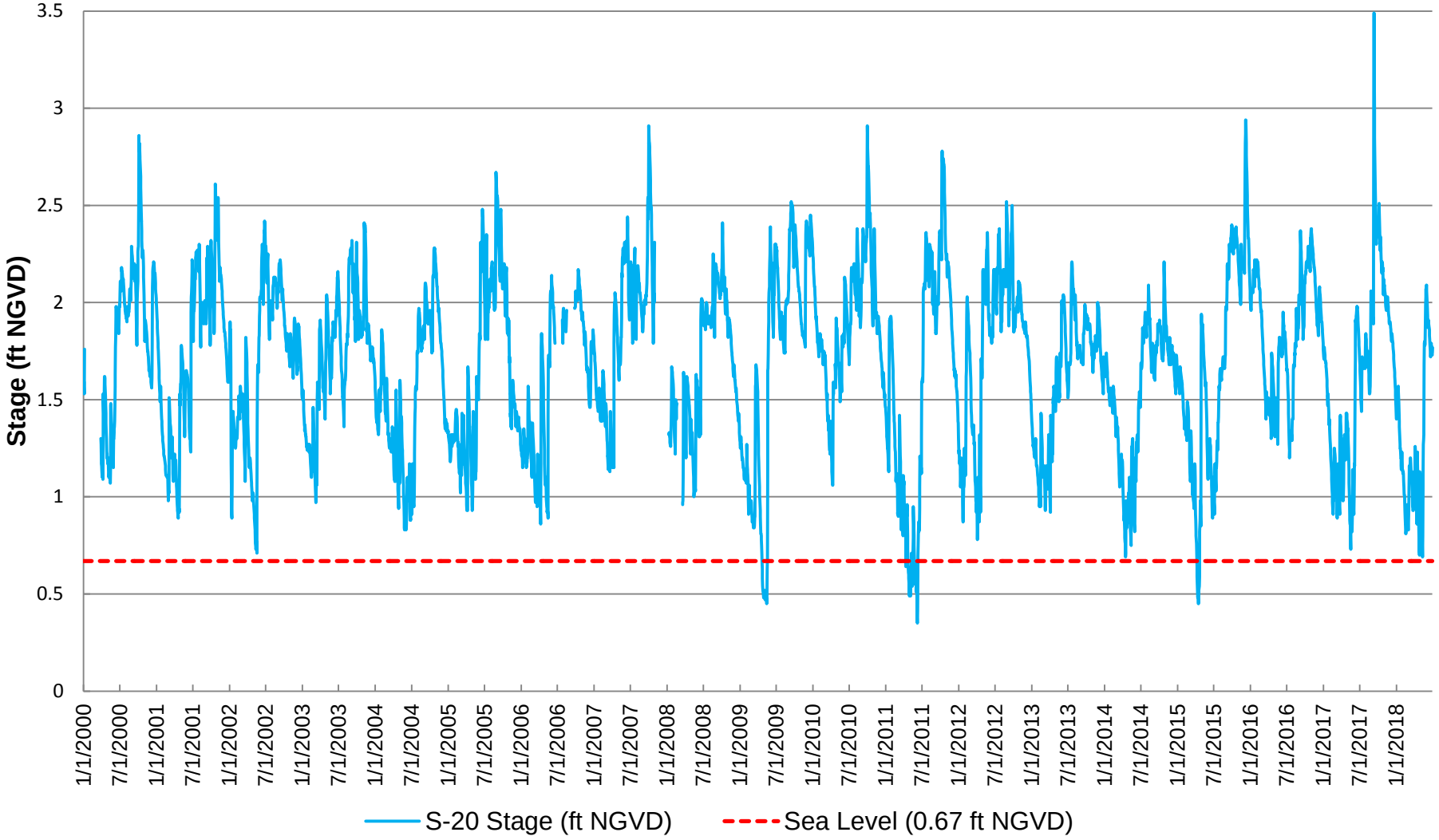
Sincerely,

Lee N. Hefty, Director FOR
Division of Environmental Resources Management

ec: John Truitt, Deputy Secretary Regulatory Programs, Florida Department of Environmental Protection
Ernest Marks, Executive Director, South Florida Water Management District
Michael W. Sole, Vice President, Environmental Services, NextEra Energy Inc.
Matthew Raffenberg, Senior Director – Environmental Services, FPL/NextEra
Abbie Schwaderer-Raurell, Assistant County Attorney, Miami-Dade County
Rashid Istambouli, RER Sr. Division Chief, Division of Environmental Resources Management
Craig Grossenbacher, RER Division Chief, Division of Environmental Resources Management
Lisa Spadafina, RER Division Chief, Division of Environmental Resources Management
Wilbur Mayorga, RER Division Chief, Division of Environmental Resources Management
Donna Gordon, RER Section Chief, Division of Environmental Resources Management

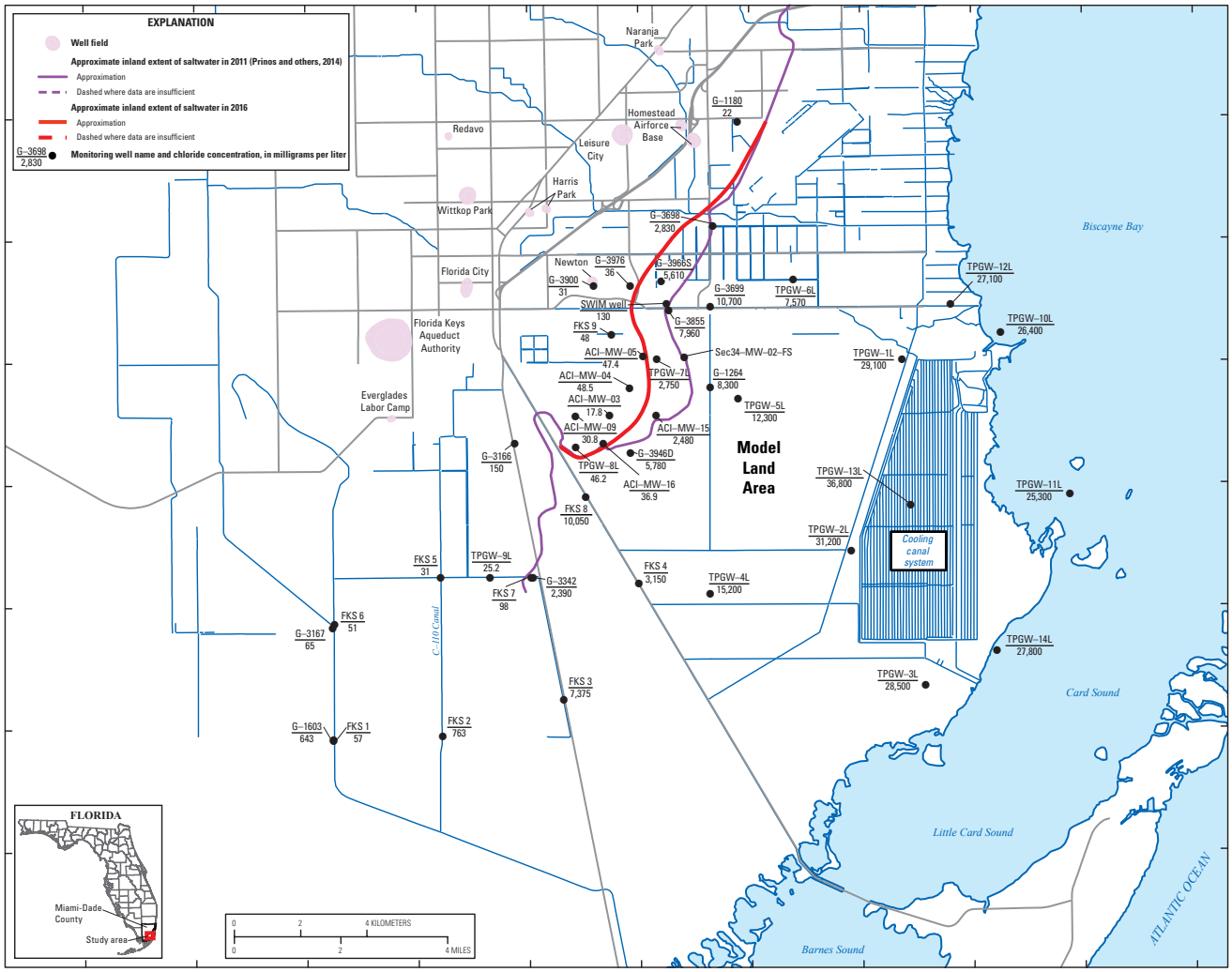
ATTACHMENTS

Model Lands Basin
L-31E Water Levels
1/1/2000 - 6/30/2018



Prepared in cooperation with Miami-Dade County

Map of the Approximate Inland Extent of Saltwater at the Base of the Biscayne Aquifer in the Model Land Area of Miami-Dade County, Florida, 2016



Scientific Investigations Map 3380

U.S. Department of the Interior
U.S. Geological Survey

Cover. Map showing the approximate extent of saltwater at the base of the Biscayne aquifer in the Model Land Area of Miami-Dade County, Florida, 2016. See https://doi.org/10.3133/sim3380 for map sheet.

Map of the Approximate Inland Extent of Saltwater at the Base of the Biscayne Aquifer in the Model Land Area of Miami-Dade County, Florida, 2016

By Scott T. Prinos

Prepared in cooperation with Miami-Dade County

Scientific Investigations Map 3380

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
RYAN K. ZINKE, Secretary

U.S. Geological Survey
William H. Werkheiser, Acting Director

U.S. Geological Survey, Reston, Virginia: 2017

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Suggested citation:
Prinos, S.T., 2017, Map of the approximate inland extent of saltwater at the base of the Biscayne aquifer in the Model Land Area of Miami-Dade County, Florida, 2016: U.S. Geological Survey Scientific Investigations Map 3380, 8-p. pamphlet, 1 sheet, https://doi.org/10.3133/sim3380.

ISSN 2329-132X (online)

Acknowledgments

The authors would like to acknowledge the organizations that provided data for the study area: EAS Engineering, Inc., Florida Keys Aqueduct Authority, Florida Power & Light Company, Miami-Dade County, and South Florida Water Management District. Without the data provided by these organizations, the map in this report could not have been created.

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Sheet

[Available from https://doi.org/10.3133/sim3380]

1. Map of the approximate inland extent of saltwater at the base of the Biscayne aquifer in the Model Land Area of Miami-Dade County, Florida, 2016

Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
	Length	
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
	Area	
square kilometer (km^2)	247.1	acre
square kilometer (km^2)	0.3861	square mile (mi^2)
	Volume	
liter (L)	0.2642	gallon (gal)
liter (L)	61.02	cubic inch (in^3)
	Flow rate	
meter per year (m/yr)	3.281	foot per year (ft/yr)
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)
kilogram (kg)	2.205	pound, avoirdupois (lb)
	Electrical conductivity	
siemens per meter (S/m)	10,000	microsiemens per centimeter (µS/cm)

Electrical conductivity σ in microsiemens per centimeter [μS/cm] can be converted to electrical resistivity ρ in ohm-meters [ohm m] as follows: $\rho = 10{,}000/\sigma$.

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$°F = (1.8 \times °C) + 32$

Datum

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Supplemental Information

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given in milligrams per liter (mg/L).

Abbreviations

bls	below land surface
GIS	geographic information system
TSEMIL	time-series electromagnetic-induction log (dataset)
USGS	U.S. Geological Survey

Map of the Approximate Inland Extent of Saltwater at the Base of the Biscayne Aquifer in the Model Land Area of Miami-Dade County, Florida, 2016

By Scott T. Prinos

Abstract

The inland extent of saltwater at the base of the Biscayne aquifer in the Model Land Area of Miami-Dade County, Florida, was mapped in 2011. Since that time, the saltwater interface has continued to move inland. The interface is near several active well fields; therefore, an updated approximation of the inland extent of saltwater and an improved understanding of the rate of movement of the saltwater interface are necessary. A geographic information system was used to create a map using the data collected by the organizations that monitor water salinity in this area. An average rate of saltwater interface movement of 140 meters per year was estimated by dividing the distance between two monitoring wells (TPGW-7L and Sec34-MW-02-FS) by the travel time. The travel time was determined by estimating the dates of arrival of the saltwater interface at the wells and computing the difference. This estimate assumes that the interface is traveling east to west between the two monitoring wells. Although monitoring is spatially limited in this area and some of the wells are not ideally designed for salinity monitoring, the monitoring network in this area is improving in spatial distribution and most of the new wells are well designed for salinity monitoring. The approximation of the inland extent of the saltwater interface and the estimated rate of movement of the interface are dependent on existing data. Improved estimates could be obtained by installing uniformly designed monitoring wells in systematic transects extending landward of the advancing saltwater interface.

Introduction

Seawater began intruding the Biscayne aquifer of Miami-Dade County early in the 20th century because of a decline in the fresh groundwater level, estimated to have been 2.9 meters (m) below predrainage conditions near Miami (Prinos and others, 2014). By 2011, approximately 1,200 square kilometers (km^2) of the mainland part of the Biscayne aquifer were intruded by saltwater (Prinos and others, 2014). Intrusion of the Biscayne aquifer by saltwater is a concern because it can render the water unpotable in affected parts of the aquifer. The maximum concentration of chloride allowed in drinking water is 250 milligrams per liter (mg/L; U.S. Environmental Protection Agency, 2014), whereas saltwater-intruded parts of the aquifer commonly have water with chloride concentrations of 1,000 mg/L or greater.

The inland extent of saltwater at the base of the Biscayne aquifer was last mapped by Prinos and others (2014) in 2011. Since that time, saltwater has continued to intrude beneath the Model Land Area. This area is a relatively flat and poorly drained wetland area in southeastern Miami-Dade County that is bordered on the east and south sides by Biscayne Bay, Card Sound, Little Card Sound, and Barnes Sound. A system of canals, water control structures, and levees regulate the flow of surface water in this area. There is an extensive system of cooling canals in the eastern part of this area that has been hypersaline at times (Hughes and others, 2010).

In the Model Land Area, the saltwater interface is near several active well fields; therefore, an updated approximation of the inland extent of saltwater and an improved understanding of the rate of movement of the saltwater interface are necessary. The U.S. Geological Survey (USGS), in cooperation with Miami-Dade County, mapped the approximate inland extent of saltwater in the Model Land Area in 2016 and approximated the average rate of movement of the saltwater interface in this area based on data collected between 2007 and 2014. This study aligns directly with the strategic science direction for the Water discipline outlined in USGS Circular 1309 (U.S. Geological Survey, 2007) by quantifying, forecasting, and securing freshwater for America's future. The purpose of this report is to provide a map of the saltwater interface (2016), an estimate of the rate of interface movement given the dates of arrival at two wells, and a description of the methodologies used to arrive at these results. The analyses and estimates are based on available data from existing monitoring wells in the Model Land Area.

Mapping the Approximate Inland Extent of the Saltwater Interface

The approximate inland extent of saltwater in the Biscayne aquifer was determined by using (1) chloride concentration and specific conductance of water samples collected from monitoring wells, (2) water conductivity profiles collected in long open-interval wells, and (3) time-series electromagnetic-induction log (TSEMIL) datasets collected in polyvinyl-chloride-cased monitoring wells. This information was provided by EAS Engineering, Inc., the Florida Keys Aqueduct Authority, the Florida Power & Light Company, the South Florida Water Management District (SFWMD), and the USGS. Almost all of the data provided by the SFWMD for this study area had been collected by the other four organizations, so they are mostly redundant. The information was entered into a geographic information system (GIS) for analysis and mapping. Data used to make the map are available as a data release (Prinos, 2017).

Sampling, analysis, and quality assurance procedures of the organizations collecting salinity data in the study area vary. Procedures used by the Florida Power & Light Company for sampling and quality assurance are described in the Turkey Point Quality Assurance Project Plan (Florida Power & Light Company, 2011). These procedures are likely among the most stringent used by organizations collecting salinity data in the study area. This plan was drafted jointly by the Florida Department of Environmental Protection, the Florida Power & Light Company, and the SFWMD and was approved by the SFWMD. Procedures for sampling by the USGS are generally based on those described in the USGS field manual, but procedures have been modified for expediency and efficacy of routine, long-term saltwater intrusion monitoring (U.S. Geological Survey, variously dated; Lee Massey, U.S. Geological Survey, written commun., March 7, 2017). EAS Engineering, Inc., and the Florida Keys Aqueduct Authority base their sampling on the specifications of the Florida Department of Environmental Protection (Florida Department of Environmental Protection, 2008). To ensure the quality of analyzed samples, the USGS laboratory participates in the Branch of Quality Systems Standard Reference Sample Semi-Annual Proficiency Testing Project. EAS Engineering, Inc., and the Florida Power & Light Company use laboratories that are certified through the National Environmental Laboratory Accreditation Program. Participation in this accreditation program likely assures that sample analyses are accurate; however, the USGS cannot completely verify this accuracy without reviewing the results of the accreditation testing for each laboratory used.

The approximate saltwater interface is represented by the 1,000-mg/L isochlor at the base of the Biscayne aquifer. The word “approximate” is used because the spatial distribution of monitoring wells is generally insufficient to create a precise representation. The accuracy and precision of this approximation is best evaluated on a location-by-location basis, based on the available monitoring wells. The locations of the monitoring wells and the chloride concentration values are shown on the map (sheet 1, available at https://doi.org/10.3133/sim3380). The line depicting the approximate inland extent of saltwater is dashed where the monitoring well distribution is insufficient to create a reasonably accurate and precise approximation.

The TSEMIL-derived vertical profiles of bulk conductivity provide additional qualitative insights for mapping, such as detection of any influxes of conductive water that do not correspond to the open interval of the well and temporal changes in the depth of the top of the saltwater interface. Where water conductivity profiles were used for monitoring, chloride concentrations were estimated by using a relation based on a linear regression of the chloride concentration and specific conductance as described in appendix 1.

The majority of the monitoring wells used for this analysis have short open intervals (about 1.5 meters [m] or less), but 37 percent have open intervals of 8 to 40 m (Prinos, 2017). The long open-interval wells are not ideal for salinity monitoring for the reasons summarized in Prinos (2013) and Prinos and Valderrama (2015), but they are the only wells available at some locations.

Approximating the Rate of Movement of the Saltwater Interface

The saltwater interface in the study area is advancing at an estimated average rate of 140 meters per year (m/yr). This estimate is based on limited data because there are few wells in this area where the date of arrival of the saltwater interface can be ascertained. Most wells were installed either after the saltwater interface had already passed the location or where the saltwater interface has not yet arrived. The estimate is based on data from monitoring wells Sec34-MW-02-FS and TPGW-7L, monitored by EAS Engineering, Inc., and the Florida Power & Light Company, respectively. Data from well TPGW-7L and selected conductance profiles from well Sec34-MW-02-FS are available in Prinos (2017). Well TPGW-7L is open to the aquifer from 24 to 26 m below land surface (bls), which is near the depth of the base of the Biscayne aquifer at this location (Fish and Stewart, 1991). The chloride concentration in water samples from well TPGW-7L increased from 180 to 825 mg/L between December 3, 2013, and March 11, 2014, and from 825 to 1,300 mg/L between March 11, 2014, and June 9, 2014. Water conductance profiles were collected from well Sec34-MW-02-FS. The maximum conductance of the profiles was found at a depth of about 25 m bls. Using equations 1 and 2 (appendix 1), conductance values measured at this depth equate to chloride concentrations of about 190, 530, 930, and 1,400 mg/L for November 12, 2007, January 15, 2008, April 4, 2008, and May 15, 2008, respectively.

The average rate of saltwater interface movement was estimated by dividing the distance between the wells (830 m) by the difference between the interpolated dates of arrival of chloride concentrations of 250 and 1,000 mg/L at each well. The interpolated dates of arrival at well Sec34-MW-02-FS were November 22, 2007, and April 8, 2008, for concentrations of 250 and 1,000 mg/L, respectively. The interpolated dates of arrival at well TPGW-7L were December 13, 2013, and April 13, 2014, for concentrations of 250 and 1,000 mg/L, respectively. Given these dates and the distance between these wells, the estimated rate of movement of the front is 137 m/yr based on a chloride concentration of 250 mg/L, and the estimated rate based on a concentration of 1,000 mg/L is 138 m/yr. These estimates can be rounded to an average estimate of 140 m/yr. This rate of movement was used to help interpolate the location of the 1,000-mg/L isochlor in the Model Land Area.

This estimate assumes that the direction of front movement is parallel to a line passing through these two well locations, and that the rate of front movement is constant. Use of this rate for interpolating the position of the saltwater interface elsewhere in the study area assumes that (1) effective porosity is uniform throughout this area, (2) direction of front movement is east to west, and (3) that the rate of front movement is the same throughout this area. Additional monitoring is needed to evaluate these assumptions (see Monitoring Network Improvements section of this report). Given the stated assumptions, the saltwater interface may move under the Newton well field by 2026. This estimate of future movement may be conservative because withdrawals from the well field may influence the rate and direction of travel.

Monitoring Network Improvements

Within the map, the line depicting the approximation of the inland extent of the saltwater interface is dashed near the Card Sound Road Canal and in the area around the C-110 Canal because there were insufficient data for an accurate delineation of the interface. These areas were previously mapped by using helicopter electromagnetic surveys (Fitterman and Prinos, 2012) and time-domain electromagnetic soundings (Fitterman and others, 2011). Monitoring in these areas currently consists of only a few wells that are too far from the expected current location of the interface to provide relevant information. Monitoring near the edge of the elongated extension of saltwater that had intruded along the Card Sound Road Canal (Prinos and others, 2014) is almost nonexistent.

Given the rate of movement of the saltwater interface estimated in this investigation, the chloride concentrations of samples from some of the monitoring wells on the freshwater side of the interface may not exceed 1,000 mg/L for many years. Monitoring well FKS 9, for example, is 0.86 km from the estimated location of the saltwater interface. The 1,000-mg/L isochlor may not arrive at this well until 2023, if the rate of movement of the saltwater interface proceeds at the average rate estimated in this study. Better estimates of the rates of movement are needed before 2023, particularly because the rate of movement may not be constant. Monitoring well FKS 5 is even farther from the approximated location of the saltwater interface than well FKS 9. The rate and direction of movement of the saltwater interface near well FKS 5 are unknown. If the rate of movement were the same as that between wells Sec34-MW-02-FS and TPGW-7L, the 1,000-mg/L isochlor may not reach this well for 26 years if the interface moves northward, or 17 years if the interface moves westward. Water managers would most likely need to have a better understanding of the location of the saltwater interface, its rate of movement, and direction of movement than currently provided near FKS 5.

Differences in the design, placement, quality of chemical analyses, and type of monitoring can add uncertainty to this analysis. The analysis of the rate of movement of the saltwater interface between monitoring wells Sec34-MW-02-FS and TPGW-7L, for example, required a number of estimations, including the relation between specific conductance and chloride, the relation between pumped water samples and in situ measurements of conductance, and the conversion of conductance to specific conductance. These relations and conversions increase uncertainty.

Some monitoring wells, such as well Sec34-MW-02-FS and many of the wells monitored by the Florida Keys Aqueduct Authority, are designed to monitor the depth of the top of the saltwater interface through the collection of water conductivity profiles and water samples from multiple depths. Because these wells have long open intervals, the sample results may be influenced by flow within the well bore during sampling or under ambient conditions (Prinos, 2013; Prinos and Valderrama, 2015). Although several organizations base their sampling on the Standard Operating Procedures of the Florida Department of Environmental Protection, Prinos (2013) states that these procedures “call for sampling of long open-interval wells by pumping from near the top of the water column or top of the open interval, which could result in samples that are not representative of maximum salinity in the aquifer.” Uncertainty is also increased because some analyses are performed in the field as opposed to in a laboratory that participates in a quality assurance testing program (see the Mapping the Approximate Inland Extent of the Saltwater Interface section of this report).

Estimates of the rate of movement of the interface could be improved by placing monitoring wells along a transect, spaced at distances that would allow timely detection of any variations in the rate of movement of the saltwater interface, and parallel to the direction of movement of the interface. If four or five such transects were installed in the county, the resulting data could be used to evaluate spatial differences in the rates of movement of the saltwater interface at locations where the interface is encroaching. Collecting TSEMIL

datasets in wells in each transect could provide information on how the depth of the interface is changing. Using consistent monitoring methods at wells in each transect could reduce the uncertainty in the estimated rate of movement.

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Appendix 1. Estimation of Chloride Concentrations at Wells Where Conductivity Profiles Were Used for Monitoring

At locations where water conductivity profiles were used for monitoring, chloride concentrations were estimated by using a relation based on a linear regression of the chloride concentration and specific conductance of 16,184 water samples collected between November 28, 1940, and September 26, 2016, from 178 monitoring sites sampled by the USGS in southern Florida (table 1–1). All of these sample results are available through the USGS National Water Information System website (U.S. Geological Survey, 2016). The relation is expressed as

$$cc = 0.3458sc - 176.32 \quad (1)$$

where

- cc is the chloride concentration in milligrams per liter, and
- sc is the specific conductance in microsiemens per centimeter.

Conductance was converted to specific conductance using the following relation (Carlson, [n.d.]).

$$sc = c/(1 + r(T - 25)) \quad (2)$$

where

- c is the actual conductance measured in microsiemens per centimeter,
- T is the temperature of the sample in degrees Celsius, and
- r is the temperature correction coefficient for the sample.

The TSEMIL-derived vertical profiles of bulk conductivity provide additional qualitative insights for mapping, such as detection of any influxes of conductive water that do not correspond to the open interval of the well and temporal changes in the depth of the top of the saltwater interface.

The majority of the monitoring wells used for this analysis have short open intervals (about 1.5 meters [m] or less), but 37 percent have open intervals of 8 to 40 m (Prinos, 2017). The long open-interval wells are not ideal for salinity monitoring for the reasons summarized in Prinos (2013) and Prinos and Valderrama (2015), but they are the only wells available at some locations.

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Table 1–1. Listing of U.S. Geological Survey monitoring sites in southern Florida from which water samples were collected to evaluate specific conductance and chloride concentration.

[USGS, U.S. Geological Survey]

USGS station identifier	Site name
262313080044401	PB -1457
262209080044702	PB -1669
261100080140401	G -1212
261122080083401	G -1232
260547080105801	G -2352
260920080092201	G -2898
260551080111901	G -2957
261740080054101	G -2893
255916080090401	G -1435
255910080085802	G -2294
255919080091202	G -2409
255919080091203	G -2410
255936080091701	G -2477
255936080091702	G -2478
255916080092001	G -2965
260037080100700	Hollywood Canal at Hollywood Blvd, Hollywood, FL
260104080101300	Hollywood Canal at Johnson St, Hollywood, FL
260225080095800	Hollywood Canal at N29 Ave, Hollywood, FL
260212080112500	Hollywood Canal at N46 Ave, Hollywood, FL
260132080094900	Hollywood Canal at Taft St, Hollywood, FL
260041080093101	G -2425
260041080093102	G -2426
260120080093401	G -2441
260155080092002	G -2612
260026080095801	G -2956
254943080121501	F - 45
254841080164401	G - 571
255350080105801	G - 894
254107080165201	G - 896
254201080173001	G - 901
254106080174601	G -1009B
252947080235301	G -1180
254813080161501	G -1351
254833080155801	G -1354
255222080123001	G -3224
254457080160301	G -3229
254946080172601	G -3250
252714080260901	G-3976
255453080110801	G-3978
254601080150301	G-3977
254156080172101	G -3607
252814080244101	G -3698
252652080244301	G -3699
252650080252701	G -3855
253253080221201	G -3885
253527080195401	G -3886
253924080174601	G -3887A
253924080174602	G -3887B
254542080145901	G -3888A
254542080145902	G -3888B
254542080145903	G -3888C
253948080250701	G -3897
254152080282601	G -3898
253419080223701	G -3899
252718080264901	G -3900
252506080300601	G -3901
252431080261001	G -3946D
252431080261002	G -3946S
255011080124501	G -3947
255515080103601	G -3948D
255515080103602	G -3948S
255733080195601	G -3949D
255733080195602	G -3949I
255733080195603	G -3949S
254824080155301	G -3964
254500080162801	G -3965
252719080253601	G -3966D
252719080253602	G -3966S
253335080213501	G -3967
255315080111501	F - 279
254828080161501	G - 354
254335080170501	G - 432
254855080163701	G - 548
253652080183701	G - 939
253202080232601	G -3162
253831080180204	G -3313C
253831080180206	G -3313E
255358080114101	G -3601
255116080120601	G -3602

Table 1–1. Listing of U.S. Geological Survey monitoring sites in southern Florida from which water samples were collected to evaluate specific conductance and chloride concentration.—Continued

[USGS, U.S. Geological Survey]

USGS station identifier	Site name
254908080125201	G -3603
254722080152201	G -3604
254629080143101	G -3605
254341080174001	G -3606
254108080170601	G -3608
254005080171601	G -3609
253819080183201	G -3610
253710080184701	G -3611
253457080195501	G -3612
253024080231001	G -3615
253027080234701	G -3700
253214080224601	G -3701
253334080213601	G -3702
254822080125501	G -3704
255625080094901	G -3705
261302081473901	C - 489
261156081475801	C - 516
261002081483701	C - 525
261018081484101	C - 526
261200081483001	C - 528
260549081441901	C - 600
261802081354801	C - 688
261347081351201	C - 953
261620081464402	C -1004R
261604081480901	C -1059
261311081480101	C -1061
260137081375901	C -1063
262228081361902	C -1080
261403080070801	G -2149
260342080115902	G -2264
261446080062801	G -2445
261724080054603	G -2693
260242080101101	G -2697
261643080055901	G -2752
261740080054101	G -2893
261304080072501	G -2896
261030080083301	G -2897
260804080092701	G -2899
260325080113901	G -2900
260638080104801	G -2902
255843080090901	G -2903
260534080110801	G -2904
262839081503100	L - 735
262022081464201	L - 738
263532081592202	L -1136
263813081552801	L -2640
263819081585801	L -2701
263955082083102	L -2820
263117082051002	L -2821
264053081572501	L -4820
262513081472002	L -5668R
261926081454702	L -5745R
264123080053801	PB - 809
263044080035102	PB -1195
262755080040101	PB -1707
262803080041101	PB -1714
263453080031501	PB -1717
263633080031401	PB -1723
265550080070701	PB -1732
265611080080201	PB -1733
265006081042502	GL - 334I
265006081042501	GL - 334S
265006081042503	GL - 334D
264912081024602	GL -332S
264912081024601	GL -332
264843080591502	GL - 333I
264843080591501	GL - 333S
264843080591503	GL - 333D
264532080545902	HE -1145S
264532080545901	HE -1145
264343080511601	PB -1843S
264343080511602	PB -1843I
264343080511603	PB -1843D
264154080480302	PB -1822S
264154080480301	PB -1822
264050080435502	PB -1842I
264050080435501	PB -1842S
264050080435503	PB -1842D
264814080414302	PB -1819S
264814080414301	PB -1819
264926080394503	PB -1848D
264930080394703	PB -1847D

Table 1–1. Listing of U.S. Geological Survey monitoring sites in southern Florida from which water samples were collected to evaluate specific conductance and chloride concentration.—Continued

[USGS, U.S. Geological Survey]

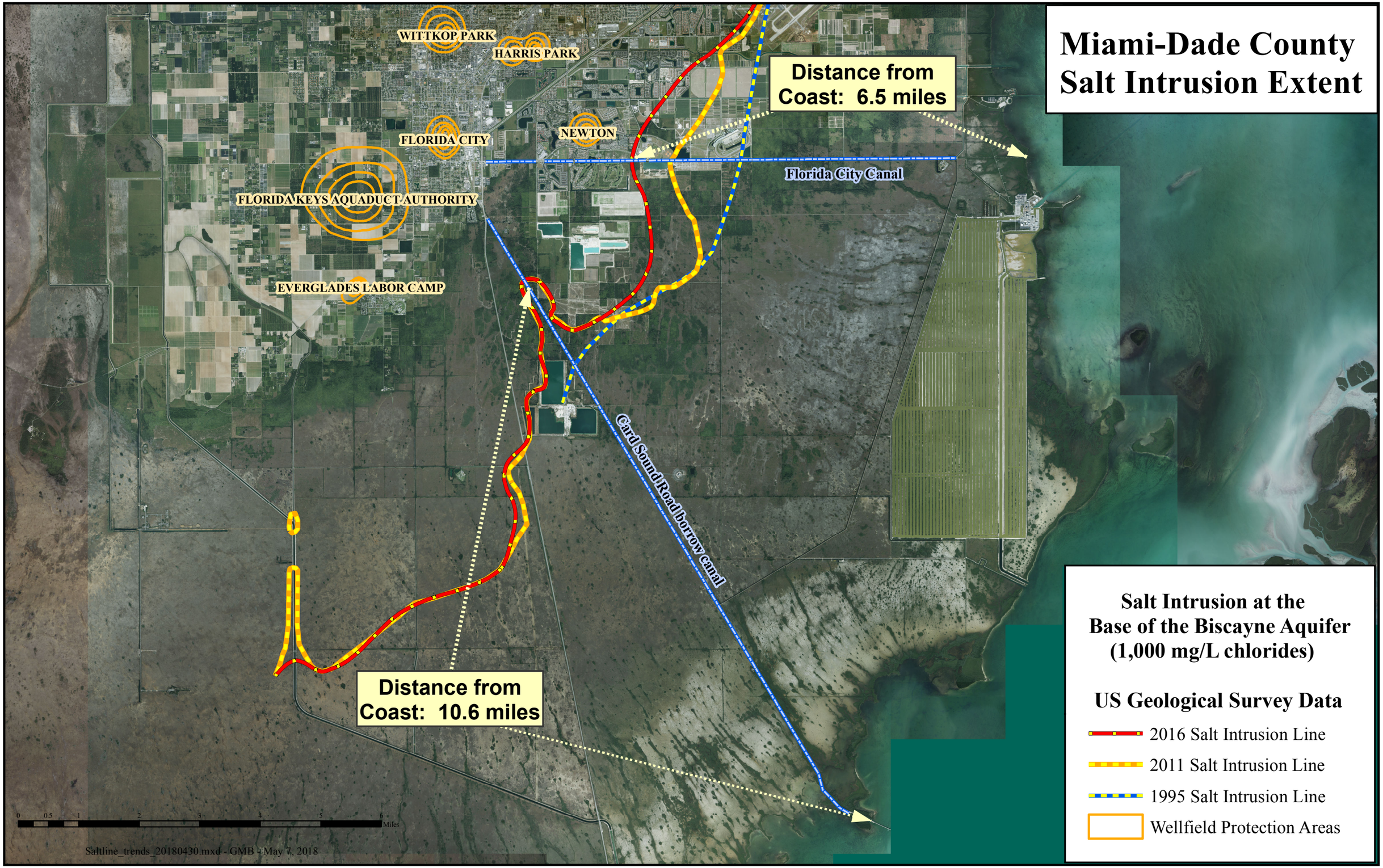
USGS station identifier	Site name
265138080375802	PB -1818S
265138080375801	PB -1818
265142080374202	PB -1817S
265142080374201	PB -1817
265208080373902	PB -1845I
265208080373901	PB -1845S
265208080373903	PB -1845D
265200080373101	PB -1846S
265428080364502	PB -1816S
265428080364501	PB -1816
265519080364902	PB -1815S
265519080364901	PB -1815
265701080363103	PB -1844D
265701080363102	PB -1844I
265701080363101	PB -1844S
265839080365202	M -1369I
265839080365201	M -1369D

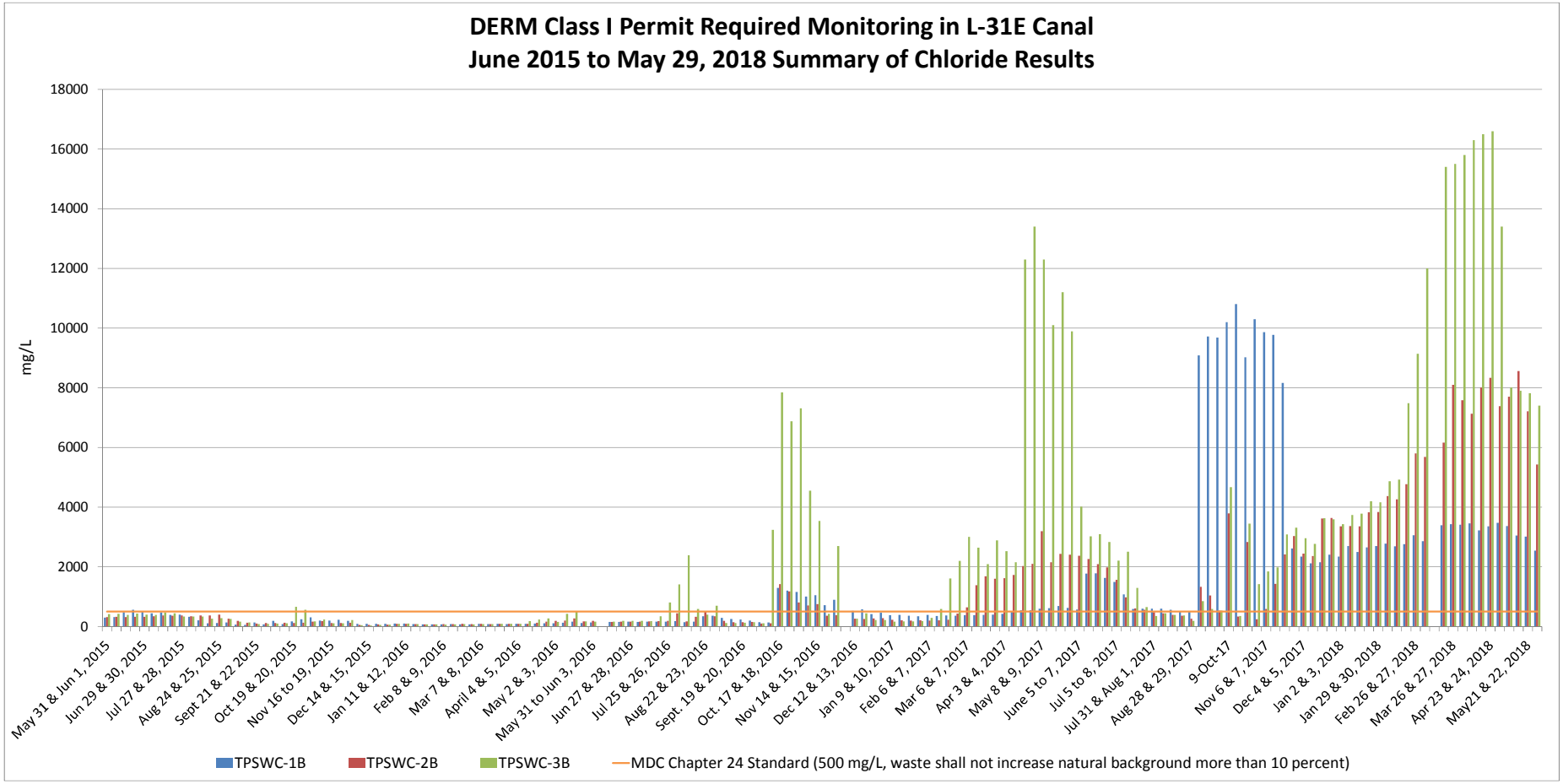
For more information about this publication, contact:
Director, Caribbean-Florida Water Science Center
U.S. Geological Survey
4446 Pet Lane, Suite 108
Lutz, FL 33559
(813) 498-5000

Or visit the USGS Caribbean-Florida Water Science Center website at:
https://fl.water.usgs.gov

Publishing support provided by
Lafayette Publishing Service Center

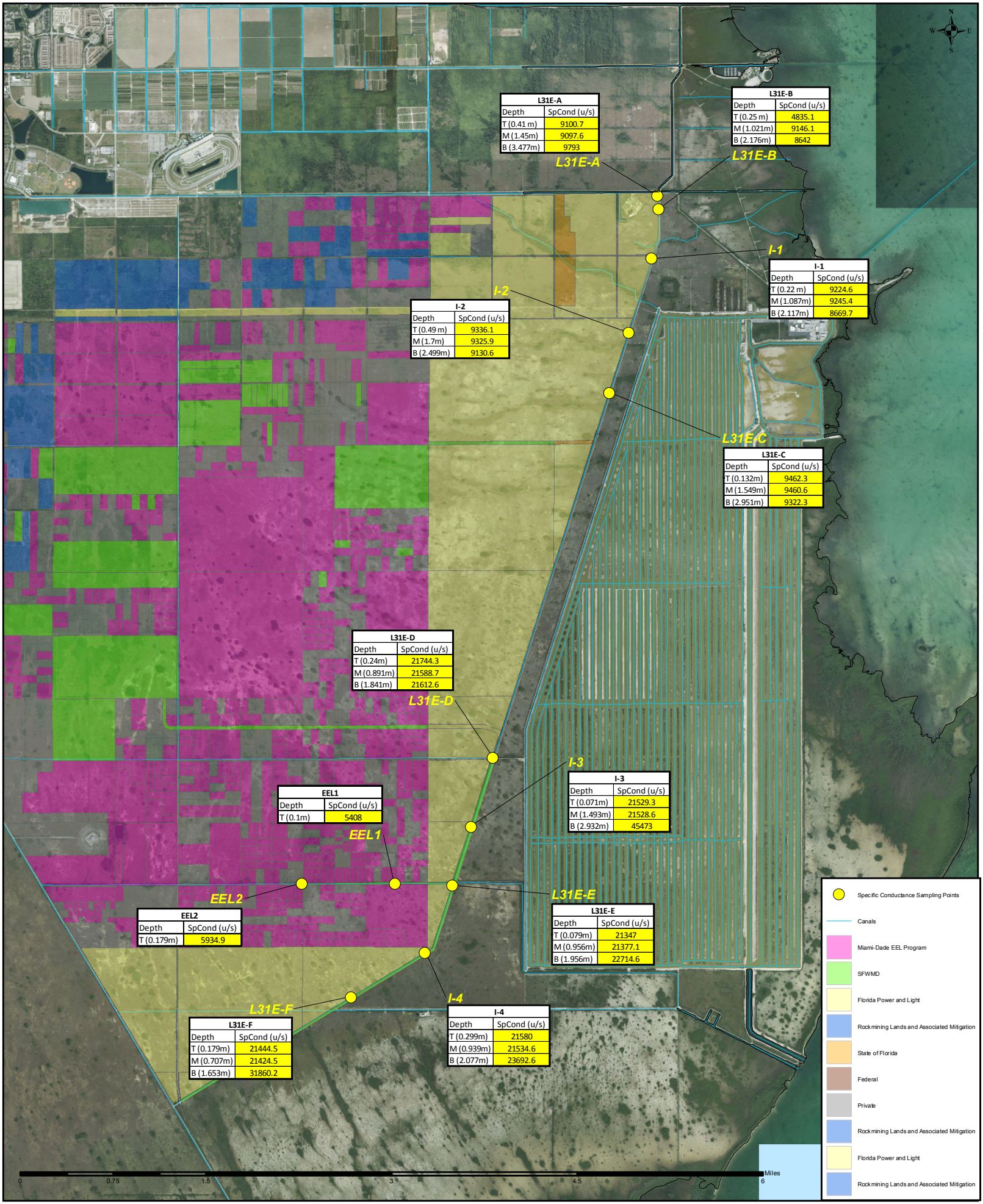
ISSN 2329-132X (online)
https://doi.org/10.3133/sim3380


Miami-Dade County
Salt Intrusion Extent
WITTKOP PARK
HARRIS PARK
FLORIDA CITY
NEWTON
FLORIDA KEYS AQUADUCT AUTHORITY
EVERGLADES LABOR CAMP
Distance from Coast: 6.5 miles
Florida City Canal
Card Sound Road borrow canal
Distance from Coast: 10.6 miles
Salt Intrusion at the Base of the Biscayne Aquifer (1,000 mg/L chlorides)
US Geological Survey Data
2016 Salt Intrusion Line
2011 Salt Intrusion Line
1995 Salt Intrusion Line
Wellfield Protection Areas
0 0.5 1 2 3 4 5 6 Miles
Saltline_trends_20180430.mxd - GMB - May 7, 2018


DERM Class I Permit Required Monitoring in L-31E Canal
June 2015 to May 29, 2018 Summary of Chloride Results
mg/L
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
May 31 & Jun 1, 2015
Jun 29 & 30, 2015
Jul 27 & 28, 2015
Aug 24 & 25, 2015
Sept 21 & 22 2015
Oct 19 & 20, 2015
Nov 16 to 19, 2015
Dec 14 & 15, 2015
Jan 11 & 12, 2016
Feb 8 & 9, 2016
Mar 7 & 8, 2016
April 4 & 5, 2016
May 2 & 3, 2016
May 31 to Jun 3, 2016
Jun 27 & 28, 2016
Jul 25 & 26, 2016
Aug 22 & 23, 2016
Sept. 19 & 20, 2016
Oct. 17 & 18, 2016
Nov 14 & 15, 2016
Dec 12 & 13, 2016
Jan 9 & 10, 2017
Feb 6 & 7, 2017
Mar 6 & 7, 2017
Apr 3 & 4, 2017
May 8 & 9, 2017
June 5 to 7, 2017
Jul 5 to 8, 2017
Jul 31 & Aug 1, 2017
Aug 28 & 29, 2017
9-Oct-17
Nov 6 & 7, 2017
Dec 4 & 5, 2017
Jan 2 & 3, 2018
Jan 29 & 30, 2018
Feb 26 & 27, 2018
Mar 26 & 27, 2018
Apr 23 & 24, 2018
May21 & 22, 2018
TPSWC-1B
TPSWC-2B
TPSWC-3B
MDC Chapter 24 Standard (500 mg/L, waste shall not increase natural background more than 10 percent)

Model Lands Surface Water Specific Conductance

L-31E borrow canal and Model Lands South canal April 2018



L31E-A	
Depth	SpCond (u/s)
T (0.41 m)	9100.7
M (1.45m)	9097.6
B (3.477m)	9793

L31E-B	
Depth	SpCond (u/s)
T (0.25 m)	4835.1
M (1.021m)	9146.1
B (2.176m)	8642

I-1	
Depth	SpCond (u/s)
T (0.22 m)	9224.6
M (1.087m)	9245.4
B (2.117m)	8669.7

I-2	
Depth	SpCond (u/s)
T (0.49 m)	9336.1
M (1.7m)	9325.9
B (2.499m)	9130.6

L31E-C	
Depth	SpCond (u/s)
T (0.132m)	9462.3
M (1.549m)	9460.6
B (2.951m)	9322.3

L31E-D	
Depth	SpCond (u/s)
T (0.24m)	21744.3
M (0.891m)	21588.7
B (1.841m)	21612.6

I-3	
Depth	SpCond (u/s)
T (0.071m)	21529.3
M (1.493m)	21528.6
B (2.932m)	45473

EEL1	
Depth	SpCond (u/s)
T (0.1m)	5408

EEL2	
Depth	SpCond (u/s)
T (0.179m)	5934.9

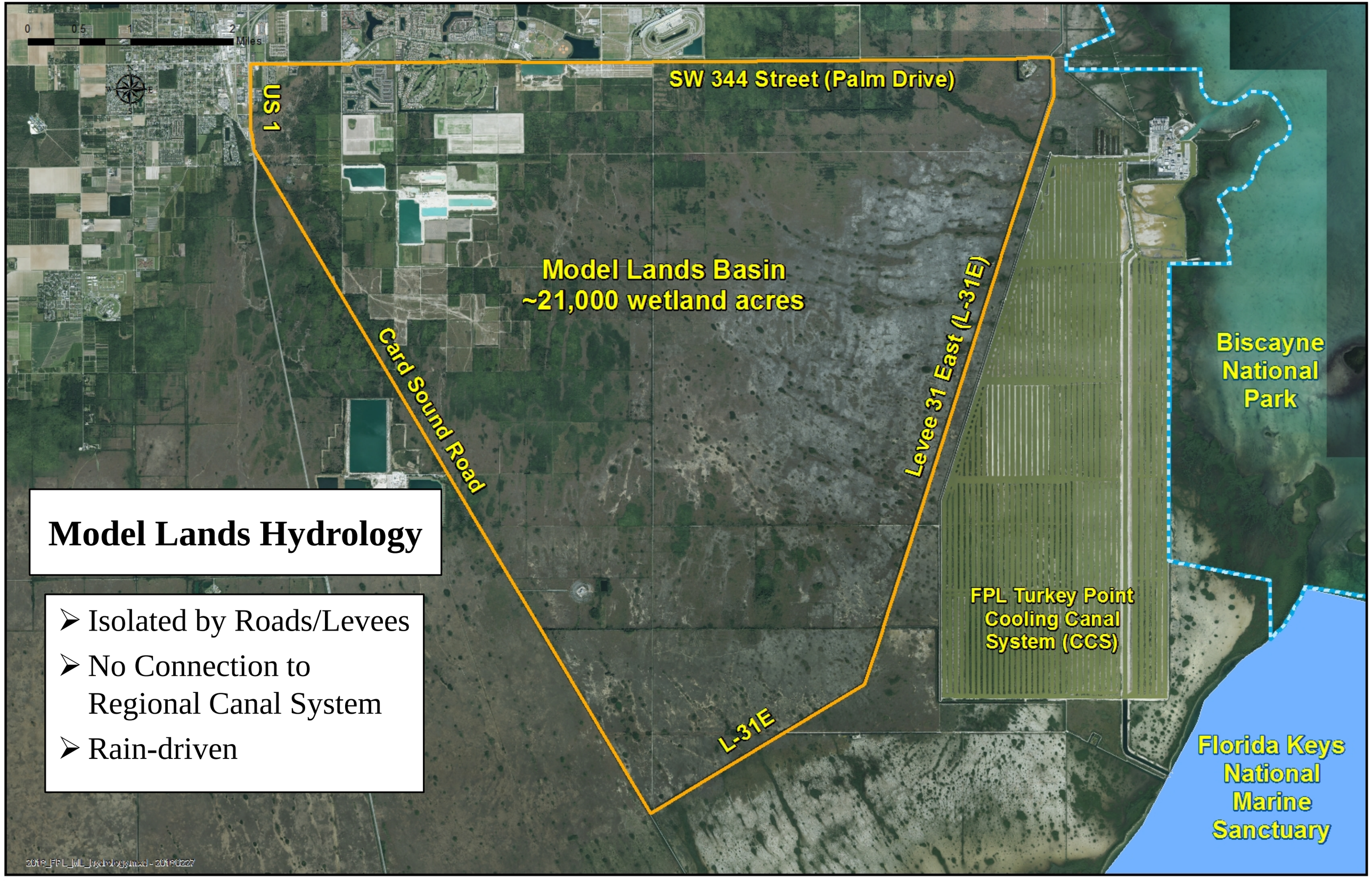
L31E-E	
Depth	SpCond (u/s)
T (0.079m)	21347
M (0.956m)	21377.1
B (1.956m)	22714.6

L31E-F	
Depth	SpCond (u/s)
T (0.179m)	21444.5
M (0.707m)	21424.5
B (1.653m)	31860.2

I-4	
Depth	SpCond (u/s)
T (0.299m)	21580
M (0.939m)	21534.6
B (2.077m)	23692.6

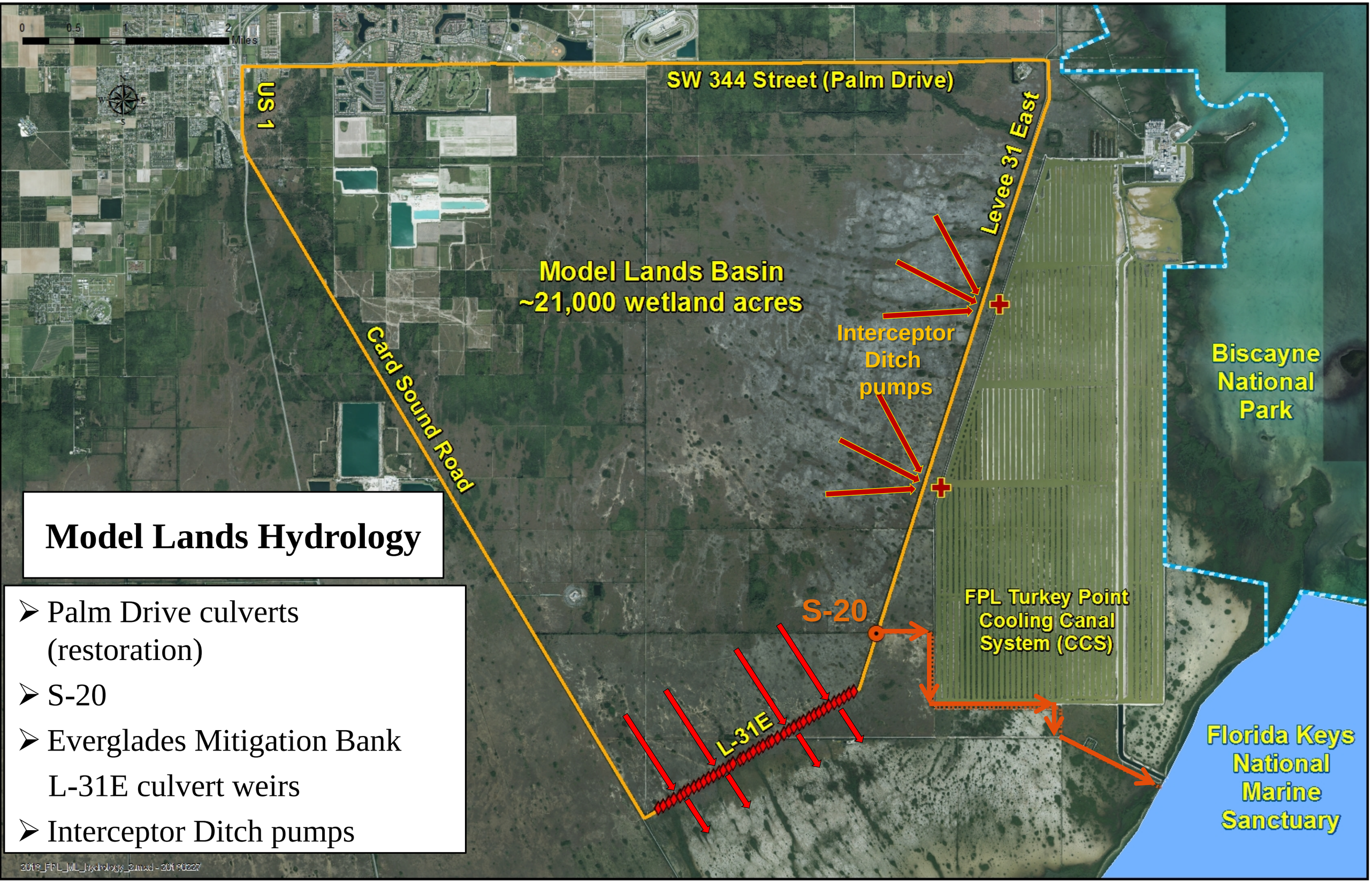
Model Lands Hydrology
and
FPL Everglades Mitigation Bank
L-31E Culvert Weir Operation

RER-DERM Water Resources Coordination
and Education Division
February 15, 2018



Model Lands Hydrology

- Isolated by Roads/Levees
- No Connection to Regional Canal System
- Rain-driven



Model Lands Hydrology

- Palm Drive culverts (restoration)
- S-20
- Everglades Mitigation Bank L-31E culvert weirs
- Interceptor Ditch pumps

Model Lands Hydrology and S-20 Operations

Central and Southern Florida Project for Flood Control and Other Purposes
Master Water Control Manual – East Coast Canals – Volume 5

Table 7-1

Optimum Water Control and Design Elevations (1)

Structure	Canal	Range	Headwater Elevation Auto Gate Operation Open	Optimum	Close	Design HW ft.	TW ft.	Disch cfs	Notes
S-5AE	C-51	---	---	---	---	---	---	---	(2)
S-9	C-11	---	---	---	---	---	---	---	(2)
S-9NX	L-37	---	---	---	---	---	---	---	(2)
S-9SX	L-33	---	---	---	---	---	---	---	(2)
S-13	C-11	All	---	2.5	---	2.2to2.5	6.2to6.5	540	(3,21)
S-13S	C-11	All	1.8	1.6	1.4	1.2	1.0	540	(4,21)
S-13A	C-11	Low		4.0		3.5	2.4	---	(5,16)
S-18	C-109	---	---	---	---	---	---	---	(6)
S-20	L-31	High	2.4	2.1	1.8	1.5	1.0	450	(8,18)
		Low	1.4	1.2	1.0				
S-20A	L-31	High	---	---	---	1.7	1.2	575	(9,18)
		Low	---	---	---				

Model Lands Hydrology and S-20 Operations

C&SF Project Structure Manual, S-20 Section (revised 1/16/2003):

OPERATION

This structure will be operated to maintain an optimum headwater elevation. The automatic controls on the main gates function as follows:

Low Range

When the headwater elevation rises to 1.4 feet, the gates will open at six inches per minute;

When the headwater elevation rises or falls to 1.2 feet, the gates will become stationary;

When the headwater elevation falls to 1.0 feet, the gates will close at six inches per minute.

High Range

When the headwater elevation rises to 2.4 feet, the gates will open at six inches per minute;

When the headwater elevation rises or falls to 2.1 feet, the gates will become stationary;

When the headwater elevation falls to 1.8 feet, the gates will close at six inches per minute.

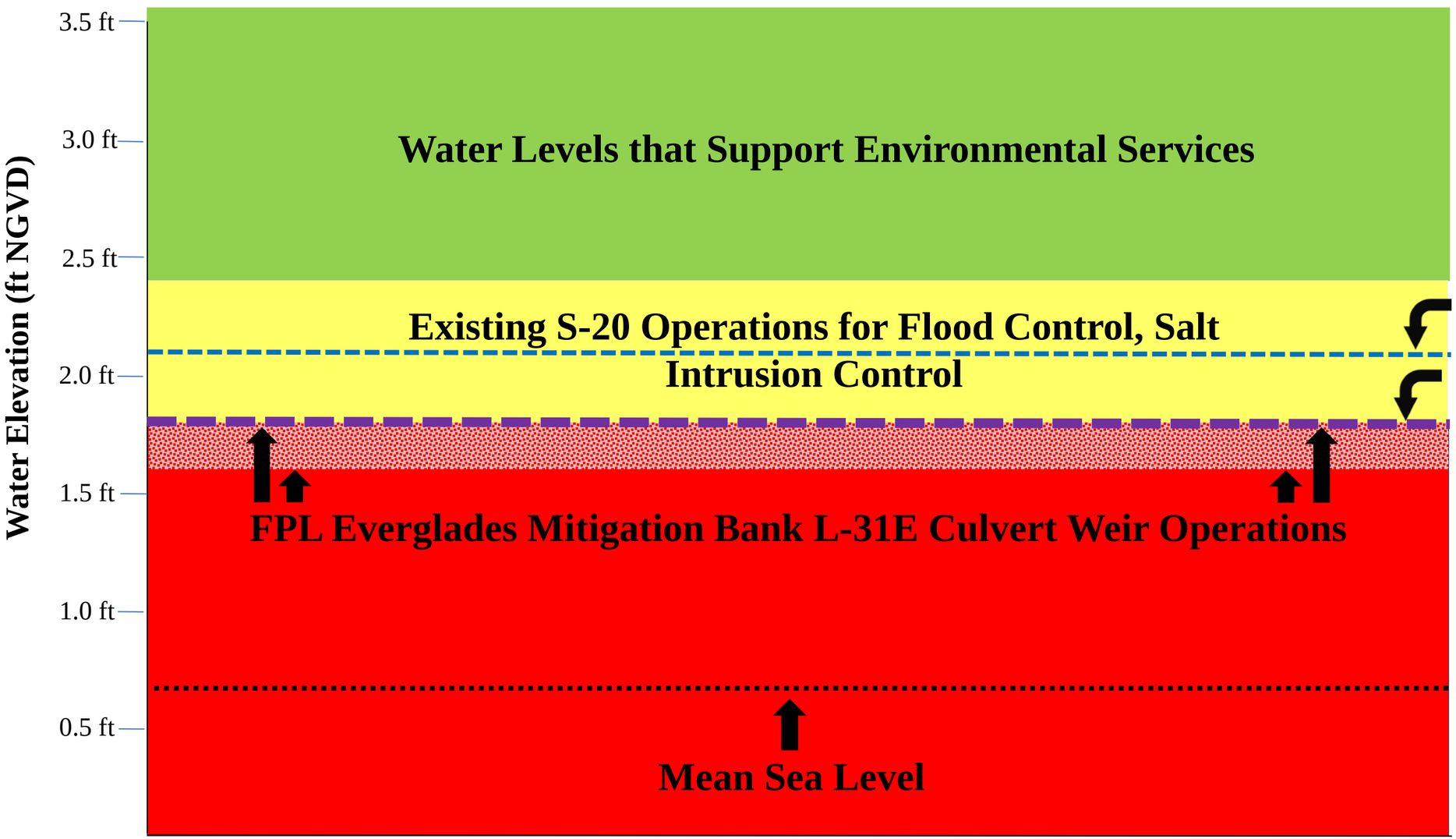
Do not use low setting unless under emergency condition because (per Tom MacVicar - 1/29/87):

(1) Florida Power & Light Co. cooling pond nearby will be drained.

(2) It is illegal to drain the wetlands.

(3) The nearest farm is away from the structure. It will not benefit the farmer.

Model Lands Groundwater Control Elevations
Current Water Management



Optimum S-20 Headwater Elevation (per C&SF Master Manual)

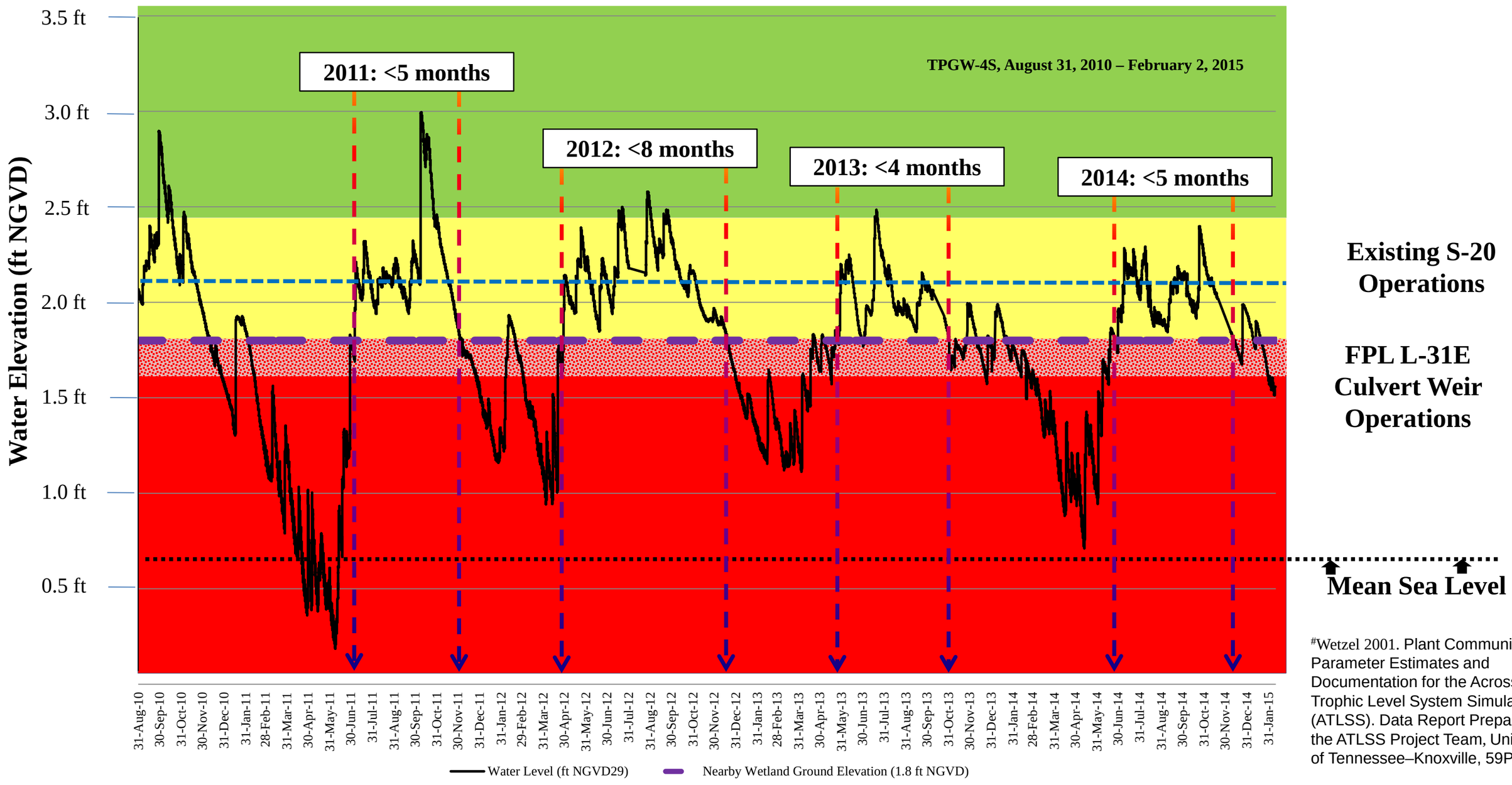
Local Wetland Ground Elevation
(1.8 ft NGVD at TPGW-4, close to both S-20 and EMB culverts)

FPL-EMB culvert operations, per Special Condition 15(d) of FDEP Permit 0193232-001, Mod 055 (June 25, 2013):

- **"Preliminarily, during the wet season (May – September), the L-31-E control structures shall be set at an elevation that is at least 0.2 feet lower than the water level invert setting of the S-20 structure.**
- **During the dry season (October – April), they will be set at 0.1 feet lower than the S-20 control elevation setting."**

Model Lands Groundwater Stages
Existing Conditions vs. Healthy Ecology

Healthy Sawgrass Prairie:
8-10 months Hydroperiod#



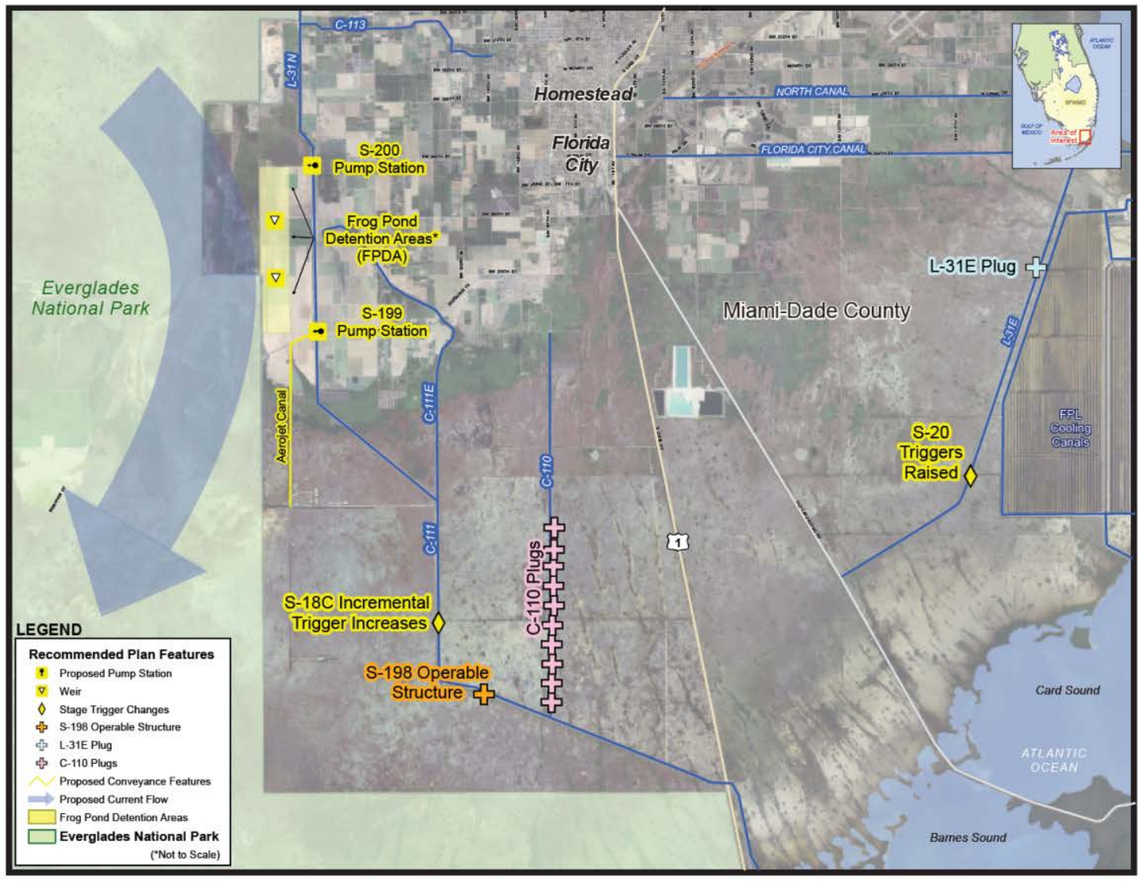
#Wetzel 2001. Plant Community Parameter Estimates and Documentation for the Across Trophic Level System Simulation (ATLSS). Data Report Prepared for the ATLSS Project Team, University of Tennessee–Knoxville, 59Pp.

C-111 | Spreader Canal Western Project

PROJECT STATUS

On June 10, 2014, the project received congressional authorization in the Water Resources Reform and Development Act (WRRDA) of 2014. Congressional authorization now makes the project eligible for funding during the appropriations process.

In February 2012, SFWMD completed construction of the C-111 Spreader Canal Western Project as part of its state-expedited program. The C-111 Spreader Canal Western Project includes the Frog Pond Detention Area, Aerojet Canal features, plugs in the C-110, a plug at S-20A, and operational changes at S-18C and S-20. A new structure in the lower C-111 Canal is scheduled for construction in the future.



FOR MORE INFORMATION

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904-232-1784

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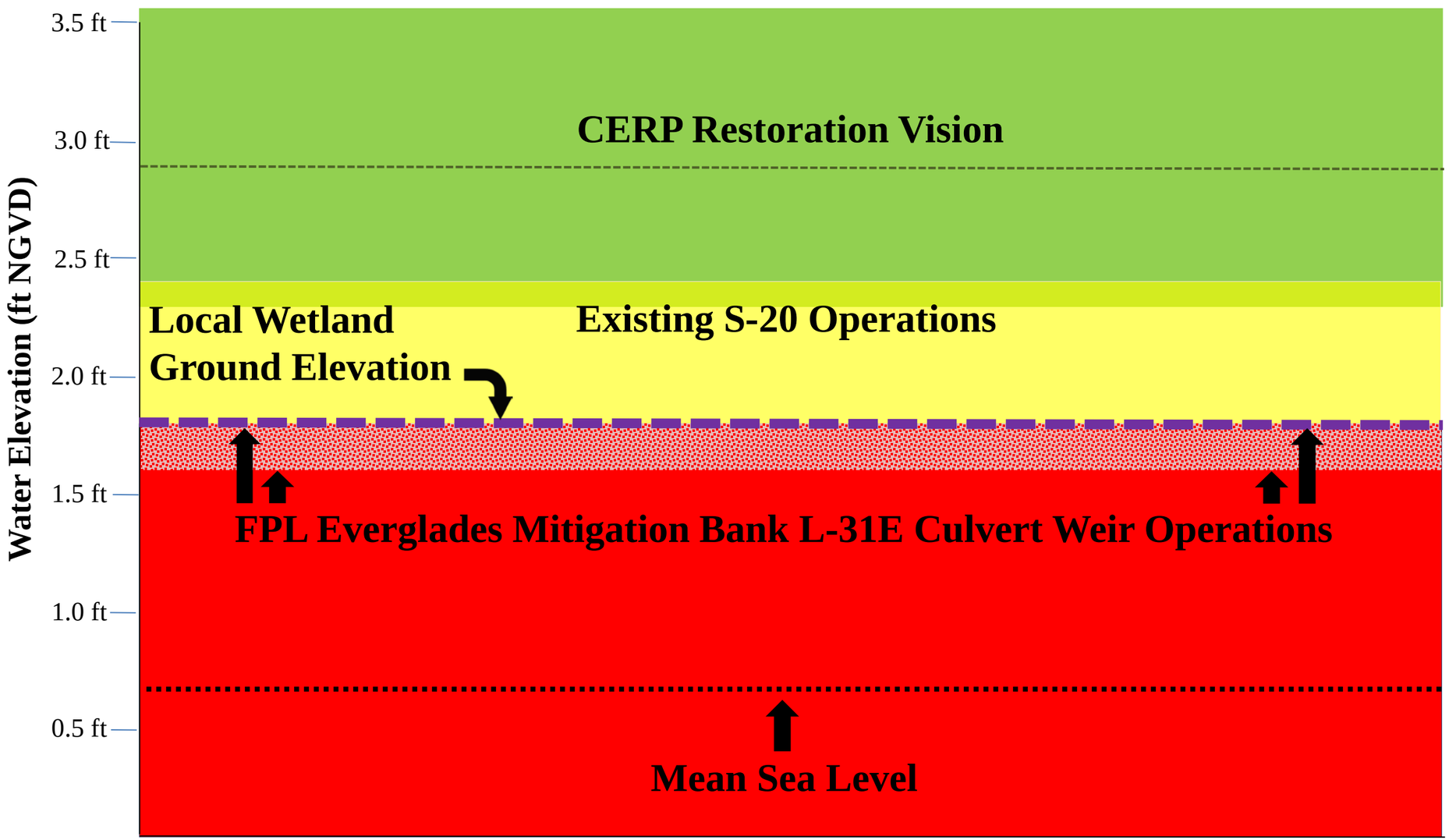
3301 Gun Club Road
West Palm Beach, FL 33406
bmills@sfwmd.gov
561-682-6536

U.S. ARMY CORPS OF ENGINEERS

C-111 Spreader Canal Western CERP Project

- February 2012 – Project Construction completed under SFWMD state-expedited program
- June 10, 2014 Congressional Authorization (WRDA 2014)
- Features:
  - ✓ Frog Pond Detention Area
  - ✓ Aerojet Canal Features
  - ✓ Plugs in C-110
  - ✓ Operational Changes at S-18C
  - ✓ Plug at S-20A
  - ✓ Operational Changes at S-20

Model Lands Groundwater Control Elevations
CERP Restoration Vision vs. Current Water Management



CERP Restoration, per C-111 Spreader Canal Western Project FEIS and BBCW Alt O Conceptual Design, Army Corps of Engineers):

- **S-20 open and close triggers to be increased 0.5 foot**
- **4 pump stations on Florida City Canal pump up to 150 cfs into the Model Lands**

C-111 Spreader Canal Western CERP Project

CENTRAL AND SOUTHERN FLORIDA PROJECT
COMPREHENSIVE EVERGLADES RESTORATION PLAN
C-111 SPREADER CANAL WESTERN

FINAL INTEGRATED
PROJECT IMPLEMENTATION REPORT
AND
ENVIRONMENTAL IMPACT STATEMENT

EXECUTIVE SUMMARY

Page xii:

PLUG AT S-20A AND OPERATIONAL CHANGES AT S-20

The plan includes the construction of a permanent plug at existing structure S-20A in the L-31E Canal, and operational changes at existing structure S-20. The proposed plug near S-20A and proposed operational changes at S-20, specifically raising the "open and close" triggers to 0.5-feet, are intended to restore hydroperiods within the Model Land.

OUR CONCLUSION: HYDROPERIOD RESTORATION IS DEPENDENT ON A REDUCTION IN OVERDRAINAGE CAUSED BY CANAL INFRASTRUCTURE

C-111 Spreader Canal Western CERP Project

Florida Department of Environmental Protection

COMPREHENSIVE EVERGLADES RESTORATION PLAN REGULATION ACT (CERPRA) PERMIT CONSTRUCTION AND OPERATIONS AUTHORIZATION

PERMITTEE:
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

ATTENTION:
Mr. Peter Antonacci
Executive Director

Permit Number: **0293559-011**
Project: C-111 Spreader Canal
Phase: Phase 1 (Western Features)
County: Miami-Dade

Date of Original
Permit Issuance: October 08, 2009
Renewal Date: December 16, 2015
Major Modification Date: December 20, 2016
Expiration Date: December 16, 2020

6. Incremental Operational Testing adjustments to Structures S-20

Temporary incremental changes to the operations at the S-20 Structure will be included as part of this project in order to maximize restoration efforts within the project area. Hydrometeorological monitoring and reporting of the upstream and adjacent areas will be required prior to implementation of each incremental change. Permanent changes to the operation of the S-20 structure shall require separate review and approval by the Department to determine whether a permit modification will be required.

C-111 Spreader Canal Western CERP Project

C-111 Spreader Canal Western Project

Preliminary Project Operating Manual

May 2016

2.2.6 S-20 Operational Changes

Temporary increases to the operating range at S-20 of up to one half foot are part of the Recommended Plan in the PIR to increase wetland hydroperiods within the Model Lands. The proposed increases in S-20 operating range will be implemented incrementally and on a temporary bases prior to proposing permanent changes to the PPOM or FOM. It should be noted that the full hydroperiod benefits of raising the S-20 operational range will require changes in the operation criteria for the FPL Mitigation Bank.

3.6 Florida Power and Light's South Dade Mitigation Bank

Florida Power and Light's (FP&L's) mitigation bank consists of approximately 13,367 acres of wetland interspersed within the Model Lands area. In addition to preservation, numerous hydrologic improvements have been, or will soon be, implemented. Operations in this PPOM should be complementary, such as raising water levels at S-20.

C-111 Spreader Canal Western CERP Project

Army Corps Permit for construction of the FPL Everglades Mitigation Bank:

PERMIT NUMBER: SAJ-1995-155(IP-TKW)
PERMITTEE: FLORIDA POWER & LIGHT
PAGE 5 of 8

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal projects.

FPL L-31E Culvert Elevations

Gate elevations were raised from 1.8 to 2.2 ft NGVD per DERM Consent Agreement (Condition 17(c)(i):

Raise control elevations in the Everglades Mitigation Bank. Within 30 days of the effective date of this Consent Agreement, FPL shall raise the control elevations of the FPL Everglades Mitigation Bank ("EMB") culvert weirs to no lower than 0.2 feet lower than the 2.4 foot trigger of the S-20 structure and shall maintain this elevation. After the first year of operation, FPL shall evaluate the change .in control elevation, in regards to improvements in salinity, water quality, and lift in the area, and if FPL determines that the change in control elevations is not effective, or that FPL is negatively impacted in receiving mitigation credits as a result of this action, FPL will consult with DERM and propose potential alternatives.

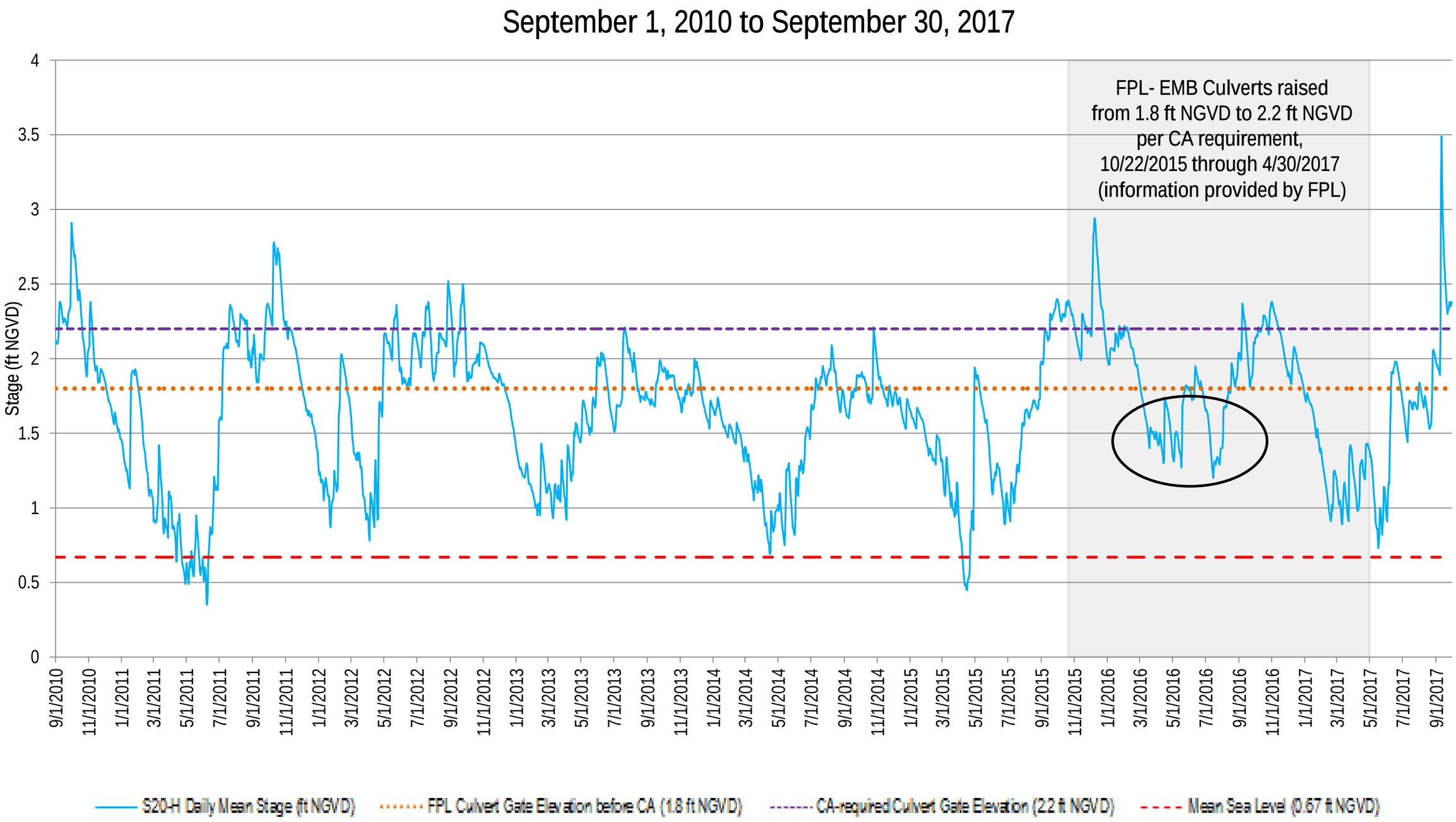
FPL EMB L-31E Culvert Elevations

FPL Annual Monitoring Report, Everglades Mitigation Bank Phase II (January 2018)

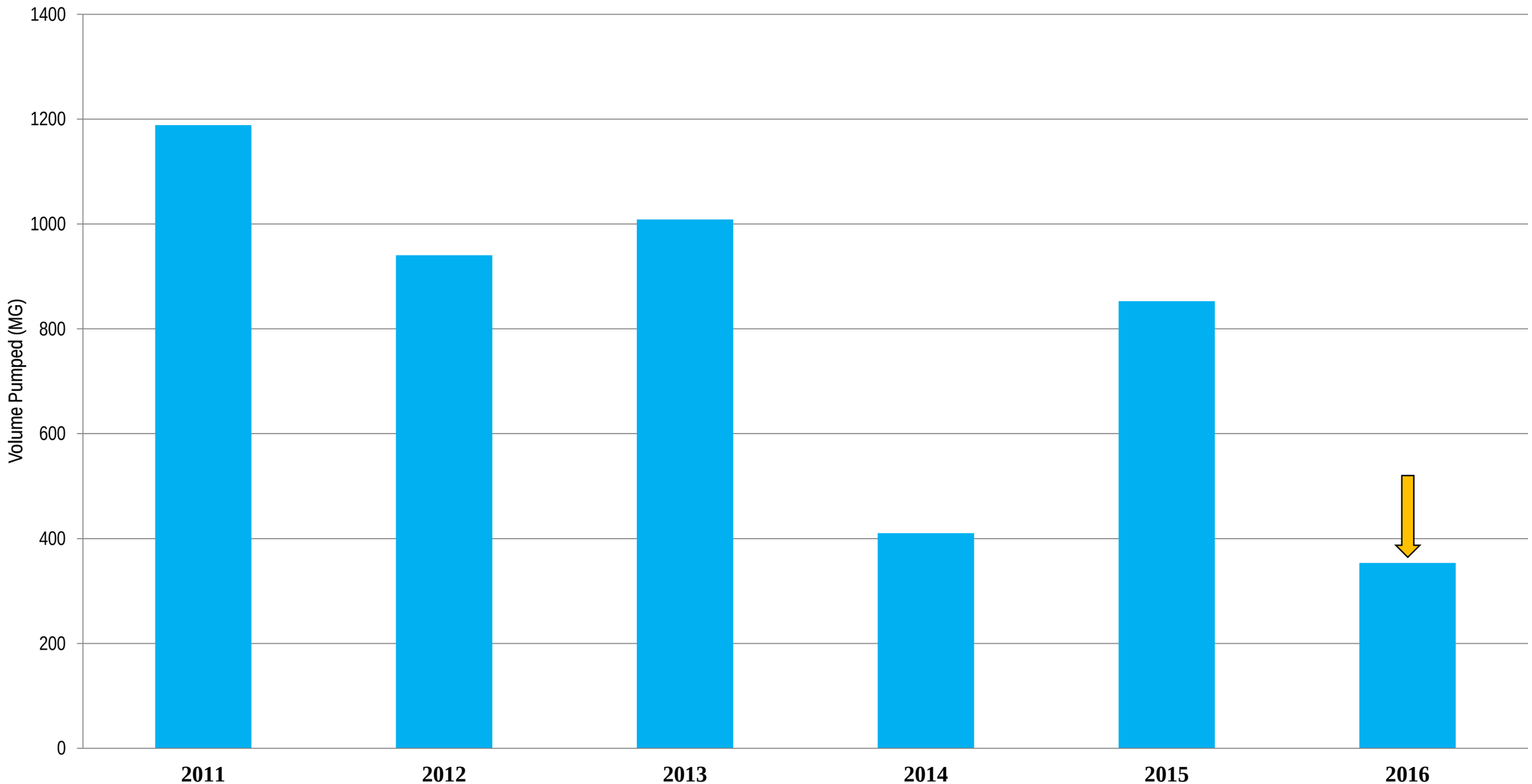
Below are the volumes of water transferred through the L31-E levee.

Monthly Flows													
Volume of Water Transferred from L31-E Borrow Canal to Freshen Coastal Wetlands													
Acre/Feet													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2009	Weir operation began 9/2009								2345.05	644.56	331.93	1133.93	4455.48
2010	122.55	28.05	83.89	52.66	107.44	620.59	995.01	1271.82	2939.86	3601.67	1799.45	122.49	11745.47
2011	132.54	36.08	0.00	0.00	0.00	0.00	1261.87	871.80	1043.62	3132.31	1122.76	111.10	7712.07
2012	0.67	255.29	10.21	30.43	1304.50	1086.05	1539.04	800.65	1020.71	882.22	907.84	170.83	8008.43
2013	0.00	88.66	371.98	1331.96	2731.44	4660.22	4911.62	1759.23	1275.59	1108.97	951.49	1712.62	20903.77
2014	936.57	459.68	57.42	0.00	1.50	485.24	4539.88	4778.91	3257.85	3743.64	2350.08	1669.59	22280.36
2015	1243.41	7.22	0.00	59.51	247.02	0.00	0.00	0.00	1539.56	2497.36	106.96	3226.86	8927.90
2016	40.41	371.57	0.00	59.62	0.00	18.55	0.00	0.00	68.45	200.31	126.56	0.00	885.47
2017	176.46	0.00	0.00	0.00	0.00	366.70	7.57	299.89	3354.95	2383.89	667.60	27.07	7284.13

FPL Everglades Mitigation Bank (EMB)
Culvert Elevations and Water Levels in L-31 E Canal

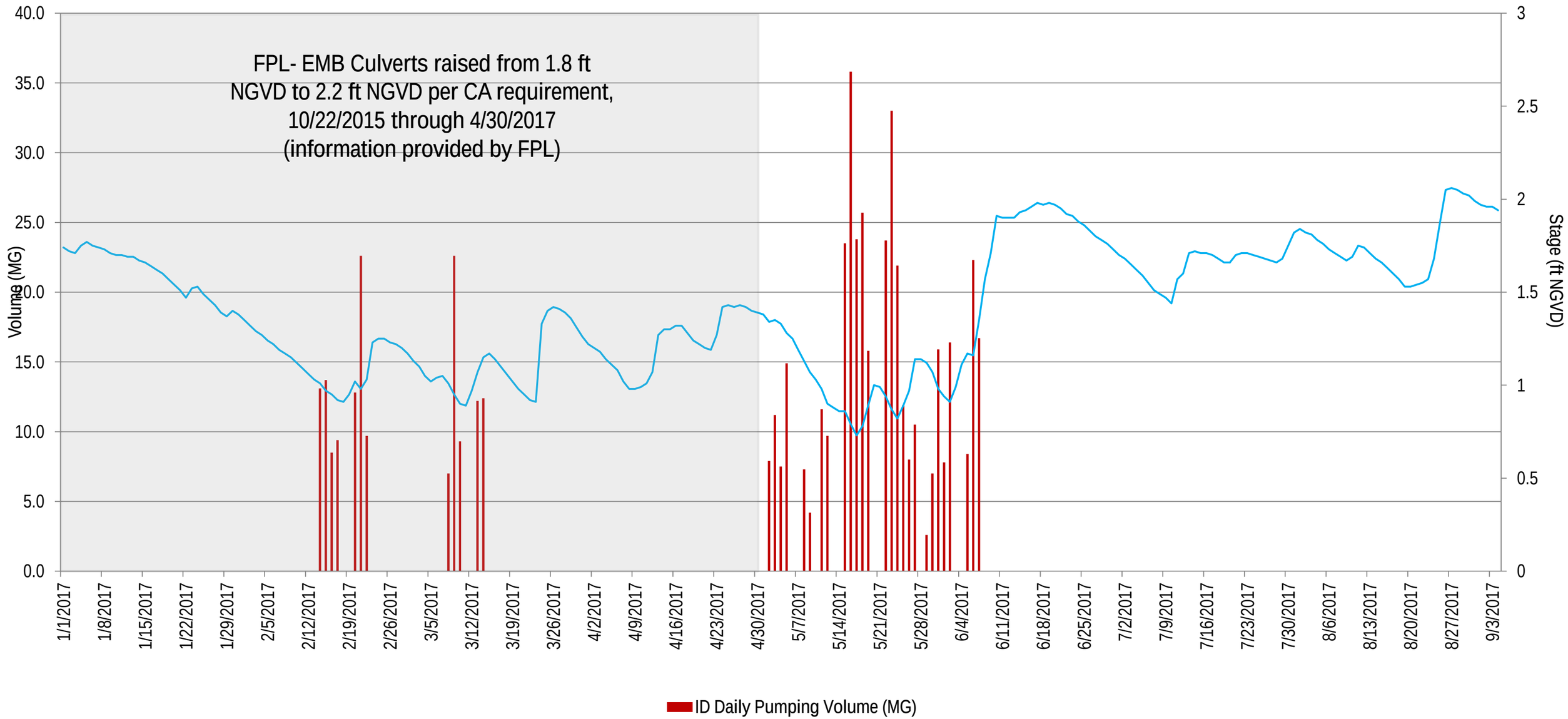


Interceptor Ditch Estimated Dry Season Volume Pumped
2011 - 2016 (January through May)

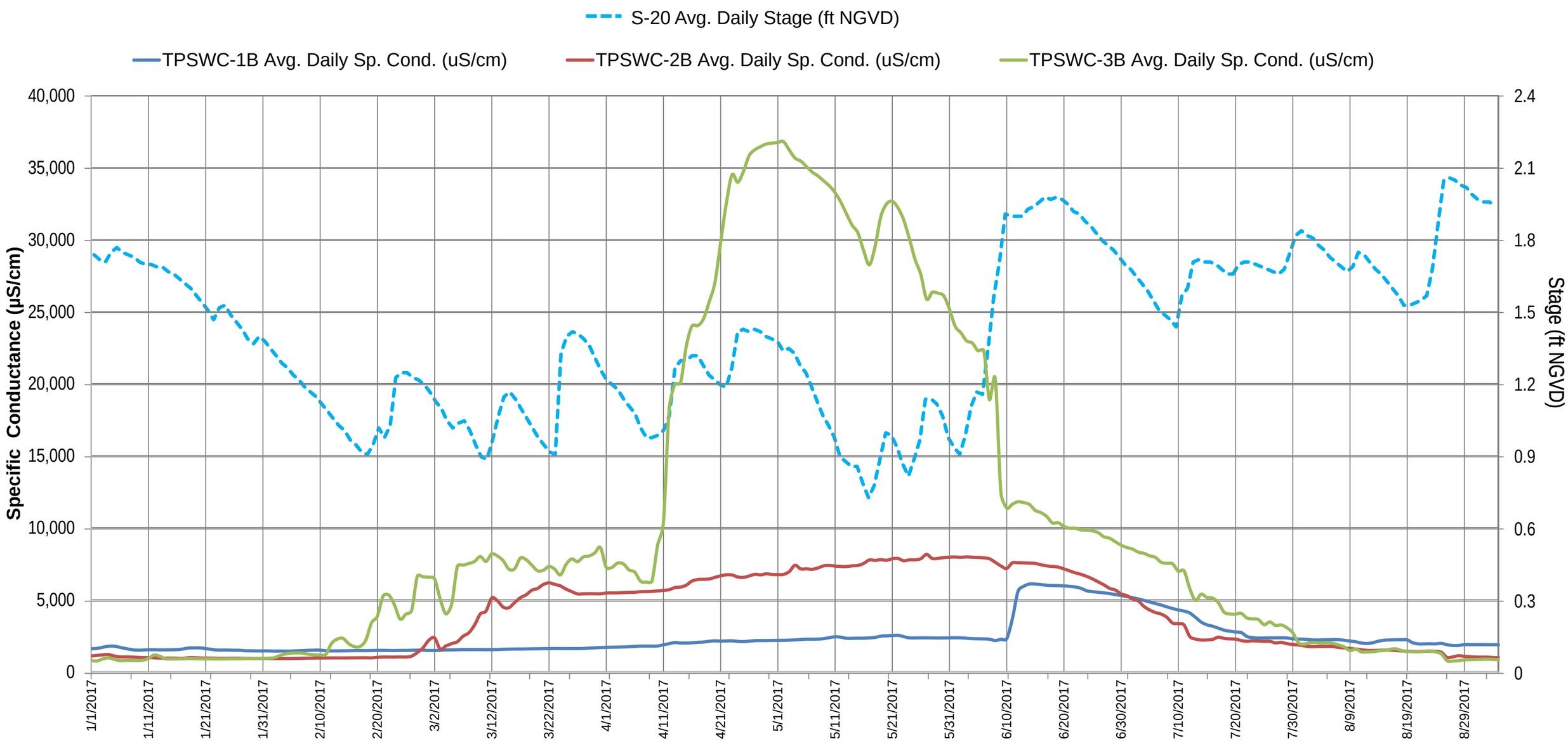


L-31E culvert gates were raised to 2.2 ft NGVD on October 22, 2015 and remained at 2.2 ft NGVD through April 30, 2017

L-31E Stage vs. Interceptor Ditch Pumping
January 1, 2017 to September 4, 2017

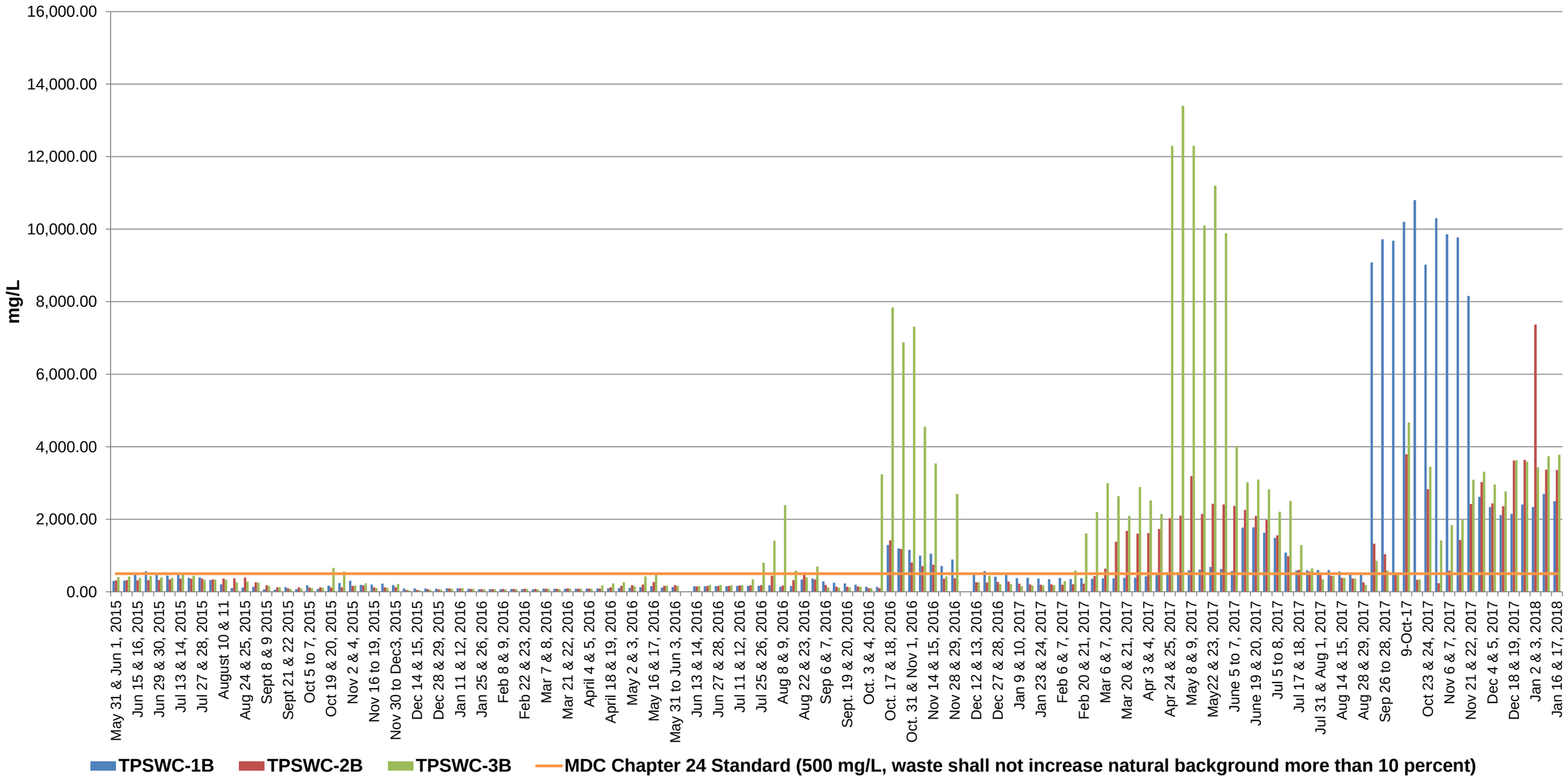


L-31E Canal Bottom Specific Conductance vs. Surface Water Stage
January 1 to September 4, 2017



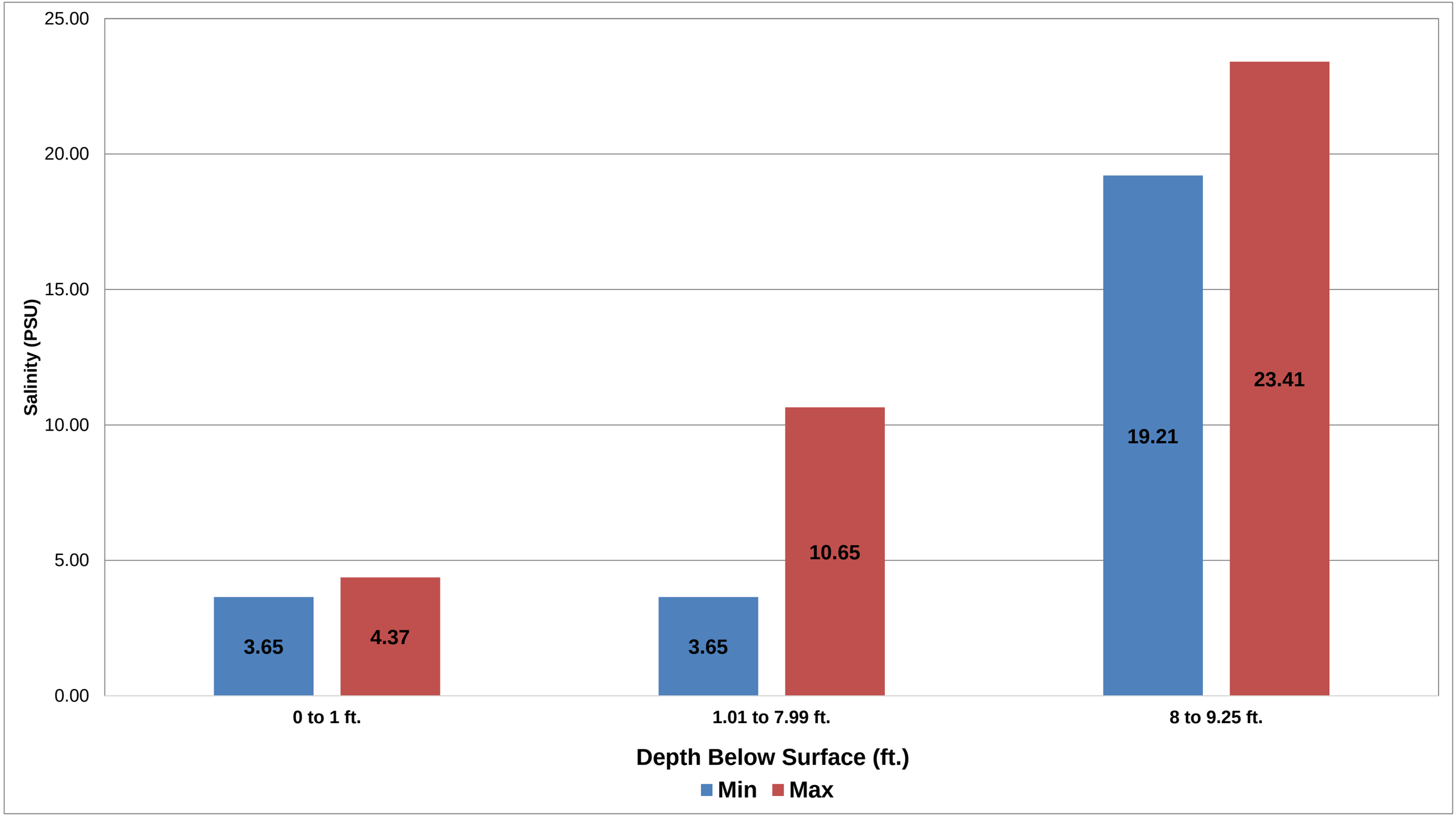
L-31E Canal Uprate and Class I Permit Required Surface Water Monitoring Stations

DERM Class I Permit Required Monitoring in L-31E Canal
Summary of Chloride Results
June 2015 to January 17, 2018



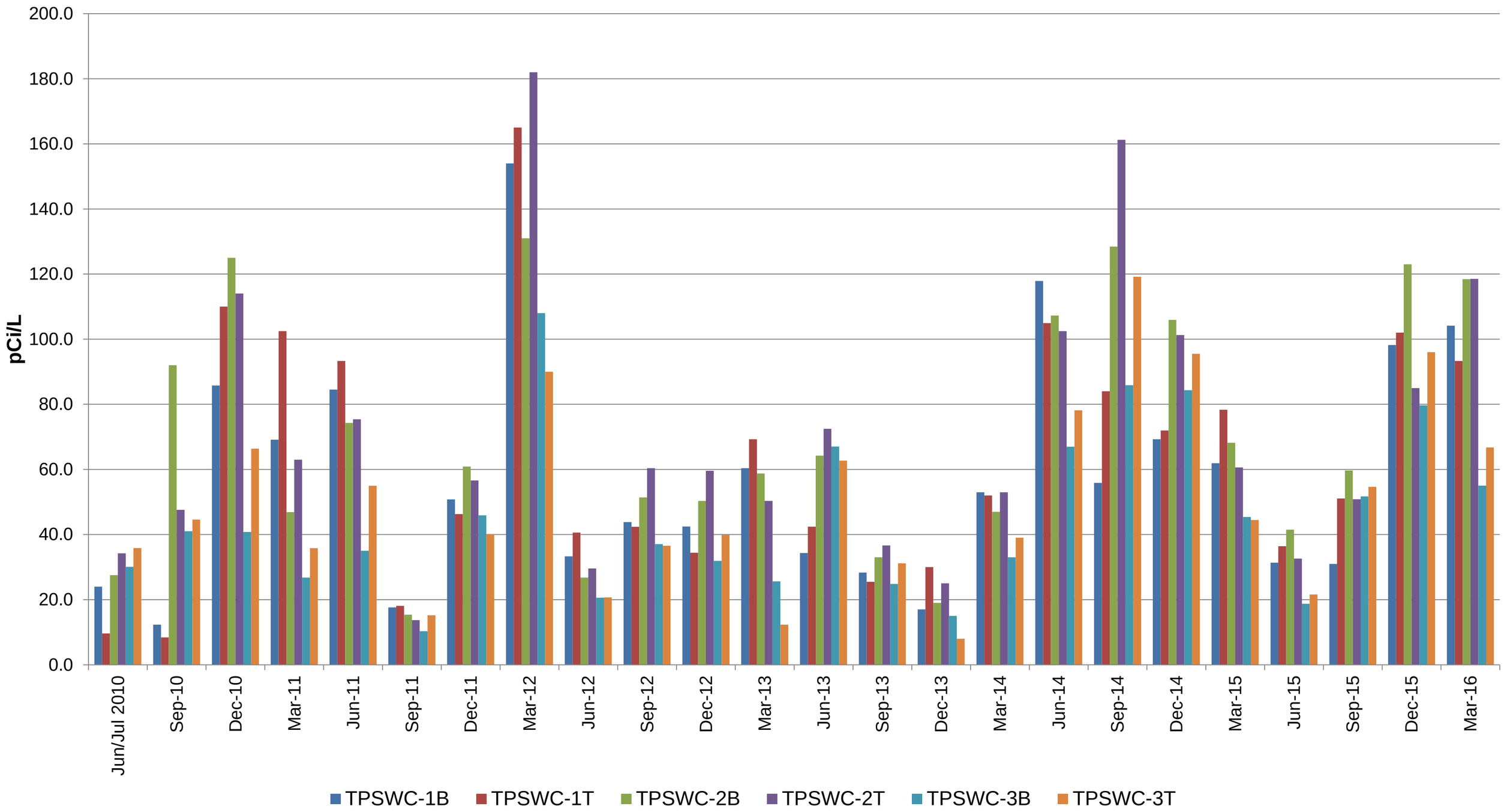
L-31E Canal May 12, 2017 Physical Parameter Surface Water Quality Survey Monitoring sites (20 sites)

L-31E Canal Water Column Physical Parameter Survey
Salinity Result Summary, May 12, 2017



L-31E Canal Uprate Monitoring Tritium Results

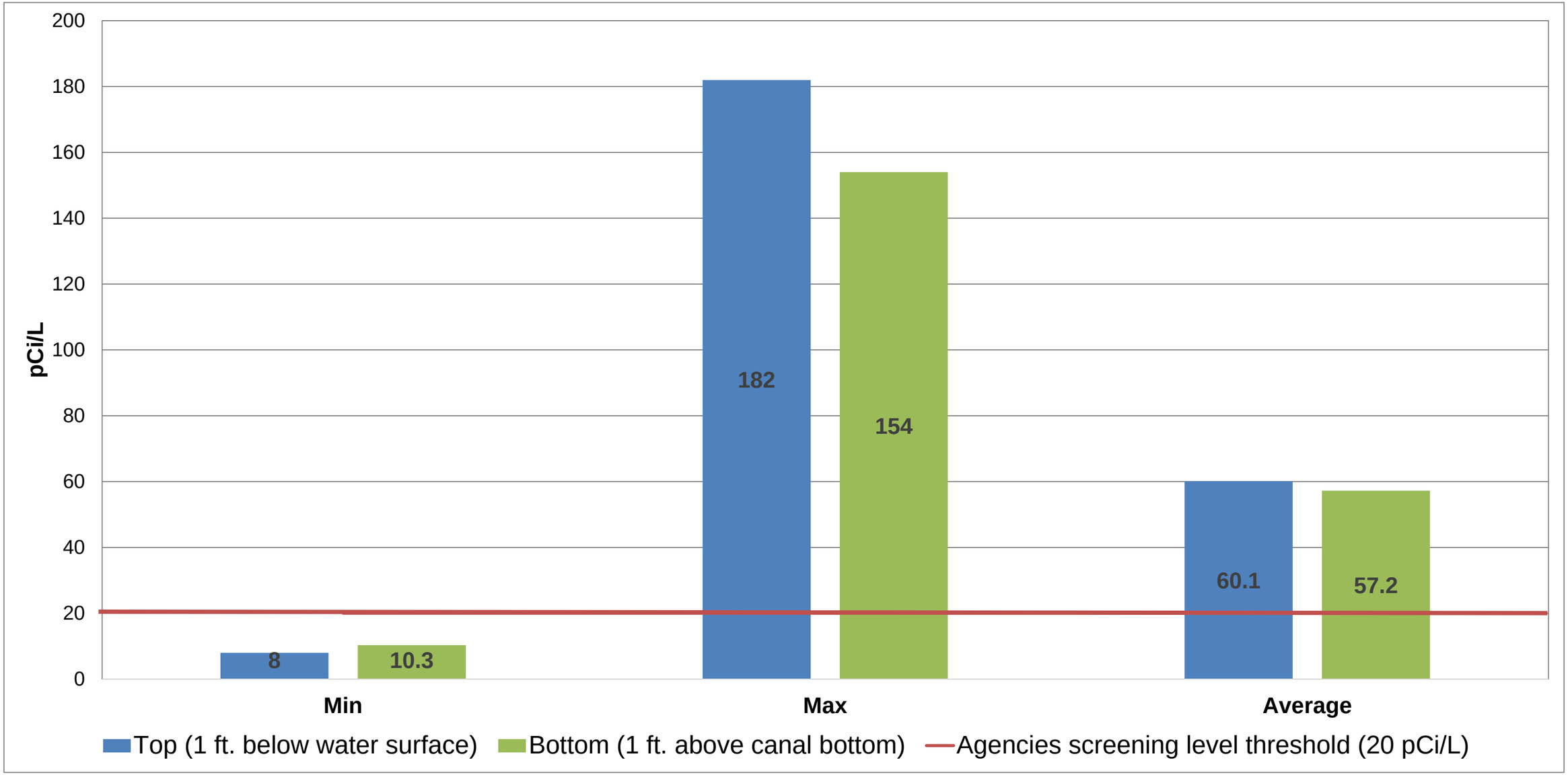
TPSWC-1B, TPSWC-1T, TPSWC-2B, TPSWC-2T, TPSWC-3B & TPSWC-3T



L-31E Canal Uprate Monitoring Tritium Result Summary

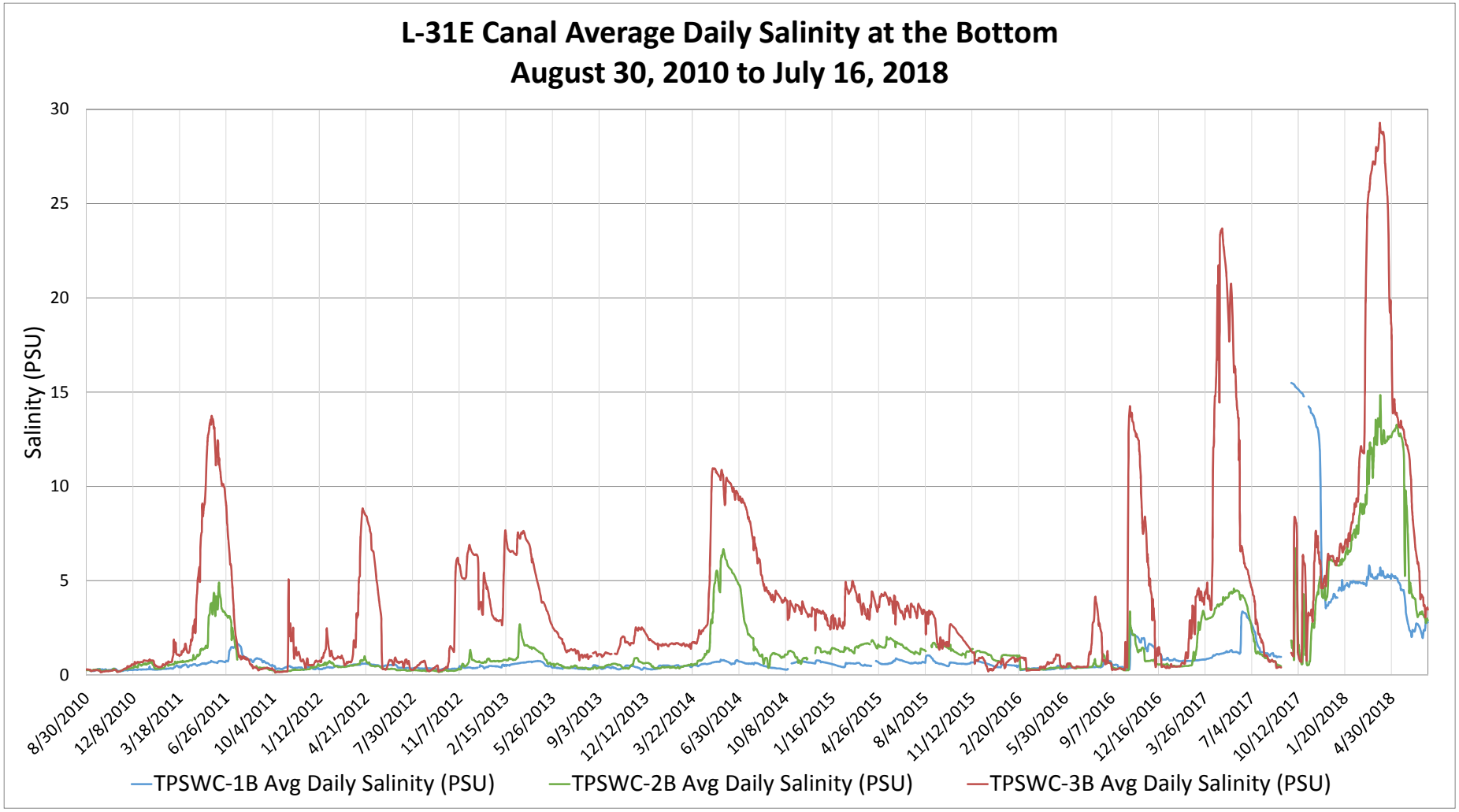
L-31E Canal Top vs. Bottom

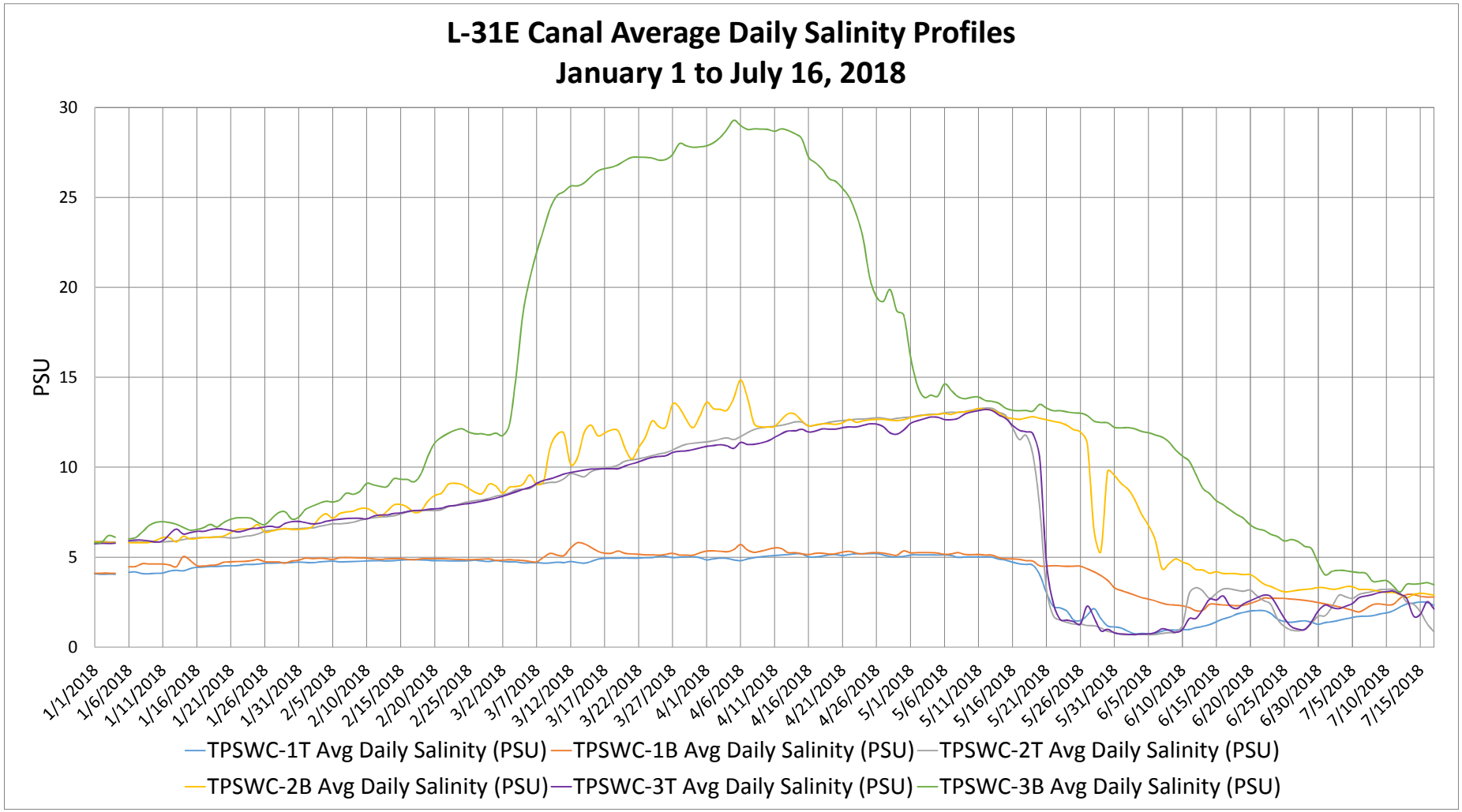
(N = 84 for each level)



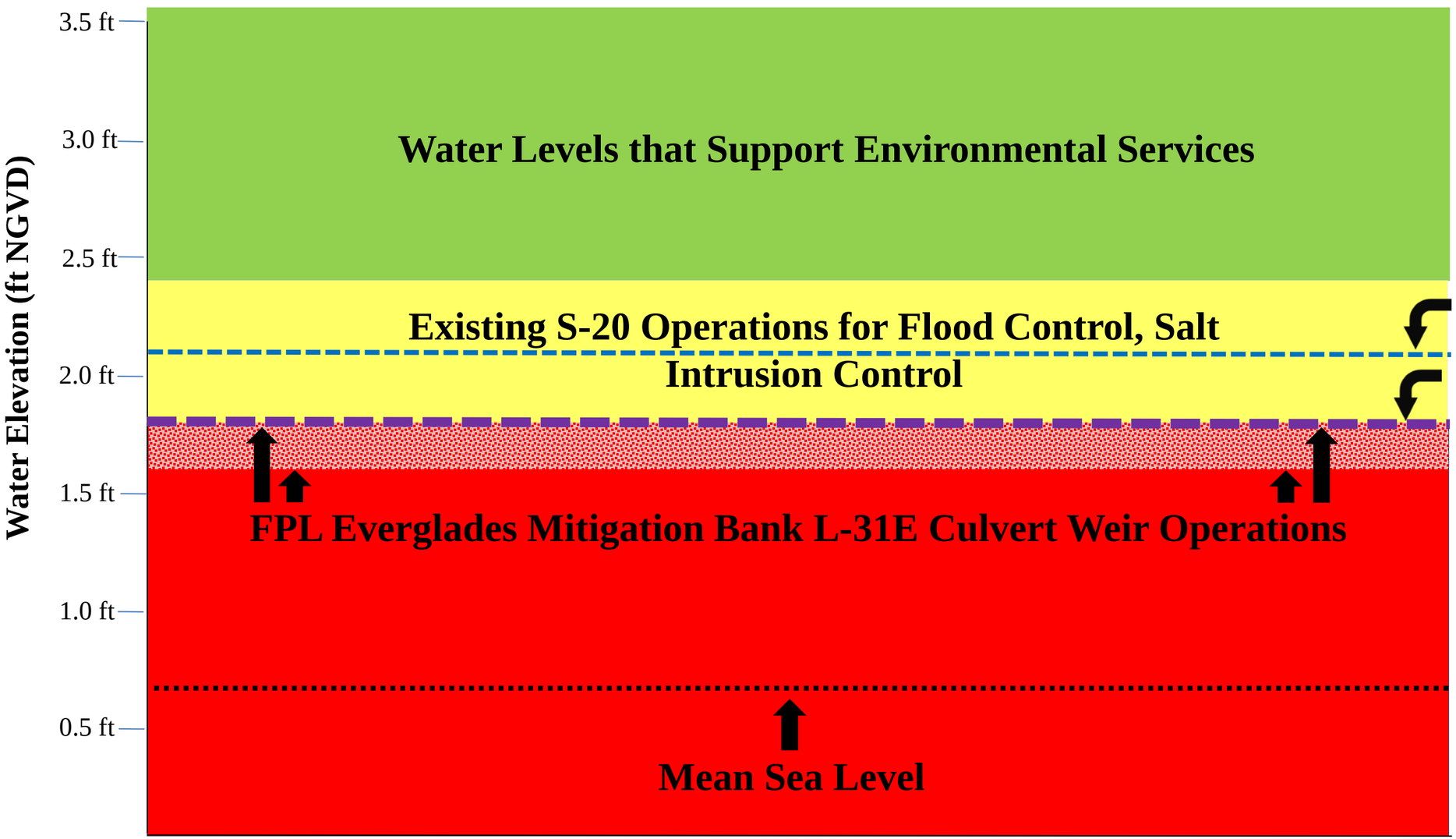
Model Lands Hydrology and FPL Culvert Operations
Summary

- Per CERP, the Model Lands Basin is overdrained by the L-31 E and S-20 water control structure, with water levels occasionally dropping below sea level
- Overdrainage needs to be stopped to restore both wetland stage and hydroperiod per CERP
- The amount of drainage from the L-31 Canal is established by the elevation of the water in the L-31 E Canal. The water in the L-31 E canal is drained through FPL's culverts to the stage established by these adjustable culvert weirs when the S-20 structure is closed.
- FPL's preferred setting for L-31 E canal water level at 1.8 ft NGVD is 1.1 feet lower than the planned CERP open trigger setting and 0.6 feet lower than the planned close trigger.
- EMB culvert weir settings at 2.2 ft NGVD reduces overdrainage of the basin
- CERP authorizes a change in S-20 operations to increase trigger stages by 0.5 ft in order to reduce overdrainage in the Model Lands
- The S-20 operations change has agency support at local, state, and federal levels
- The S-20 operations change is expected to make additional water available for release through the FPL culverts – a "win-win" for all parties


L-31E Canal Average Daily Salinity at the Bottom
August 30, 2010 to July 16, 2018
Salinity (PSU)
30
25
20
15
10
5
0
8/30/2010
12/8/2010
3/18/2011
6/26/2011
10/4/2011
1/12/2012
4/21/2012
7/30/2012
11/7/2012
2/15/2013
5/26/2013
9/3/2013
12/12/2013
3/22/2014
6/30/2014
10/8/2014
1/16/2015
4/26/2015
8/4/2015
11/12/2015
2/20/2016
5/30/2016
9/7/2016
12/16/2016
3/26/2017
7/4/2017
10/12/2017
1/20/2018
4/30/2018
TPSWC-1B Avg Daily Salinity (PSU)
TPSWC-2B Avg Daily Salinity (PSU)
TPSWC-3B Avg Daily Salinity (PSU)


L-31E Canal Average Daily Salinity Profiles
January 1 to July 16, 2018
PSU
30
25
20
15
10
5
0
1/1/2018
1/6/2018
1/11/2018
1/16/2018
1/21/2018
1/26/2018
1/31/2018
2/5/2018
2/10/2018
2/15/2018
2/20/2018
2/25/2018
3/2/2018
3/7/2018
3/12/2018
3/17/2018
3/22/2018
3/27/2018
4/1/2018
4/6/2018
4/11/2018
4/16/2018
4/21/2018
4/26/2018
5/1/2018
5/6/2018
5/11/2018
5/16/2018
5/21/2018
5/26/2018
5/31/2018
6/5/2018
6/10/2018
6/15/2018
6/20/2018
6/25/2018
6/30/2018
7/5/2018
7/10/2018
7/15/2018
TPSWC-1T Avg Daily Salinity (PSU)
TPSWC-1B Avg Daily Salinity (PSU)
TPSWC-2T Avg Daily Salinity (PSU)
TPSWC-2B Avg Daily Salinity (PSU)
TPSWC-3T Avg Daily Salinity (PSU)
TPSWC-3B Avg Daily Salinity (PSU)

Model Lands Groundwater Control Elevations
Current Water Management



Optimum S-20 Headwater Elevation (per C&SF Master Manual)

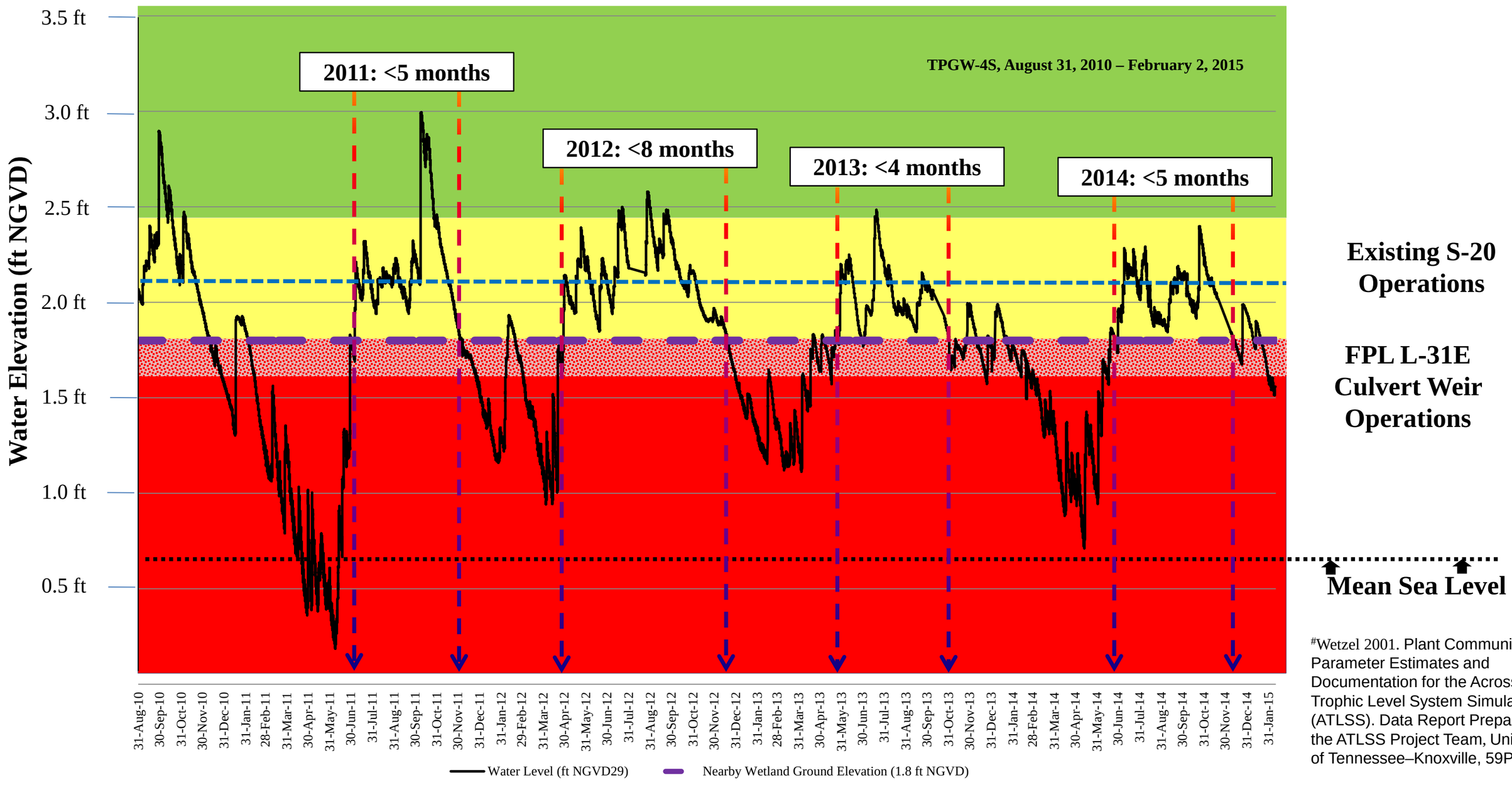
Local Wetland Ground Elevation
(1.8 ft NGVD at TPGW-4, close to both S-20 and EMB culverts)

FPL-EMB culvert operations, per Special Condition 15(d) of FDEP Permit 0193232-001, Mod 055 (June 25, 2013):

- **"Preliminarily, during the wet season (May – September), the L-31-E control structures shall be set at an elevation that is at least 0.2 feet lower than the water level invert setting of the S-20 structure.**
- **During the dry season (October – April), they will be set at 0.1 feet lower than the S-20 control elevation setting."**

Model Lands Groundwater Stages
Existing Conditions vs. Healthy Ecology

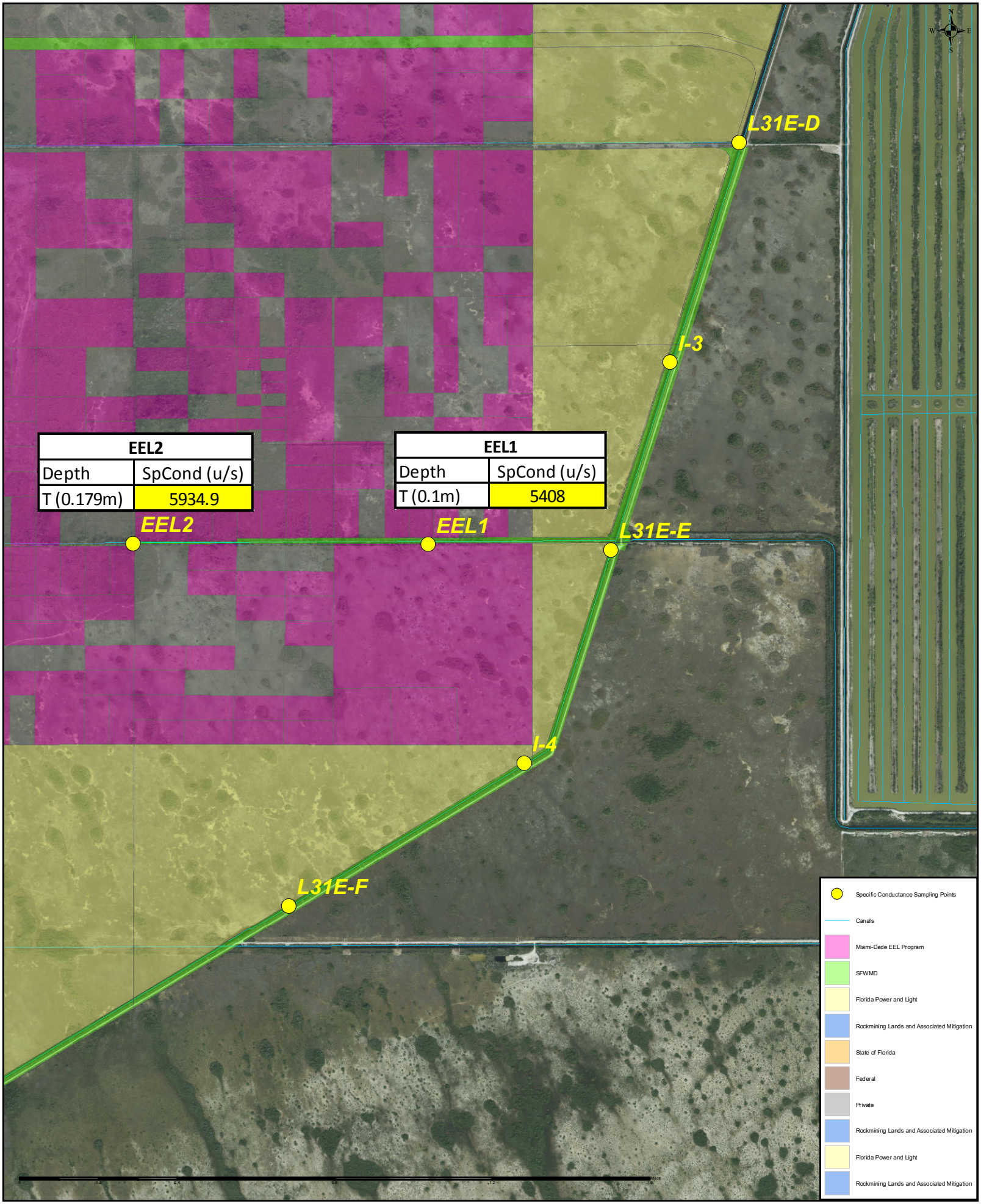
Healthy Sawgrass Prairie:
8-10 months Hydroperiod#



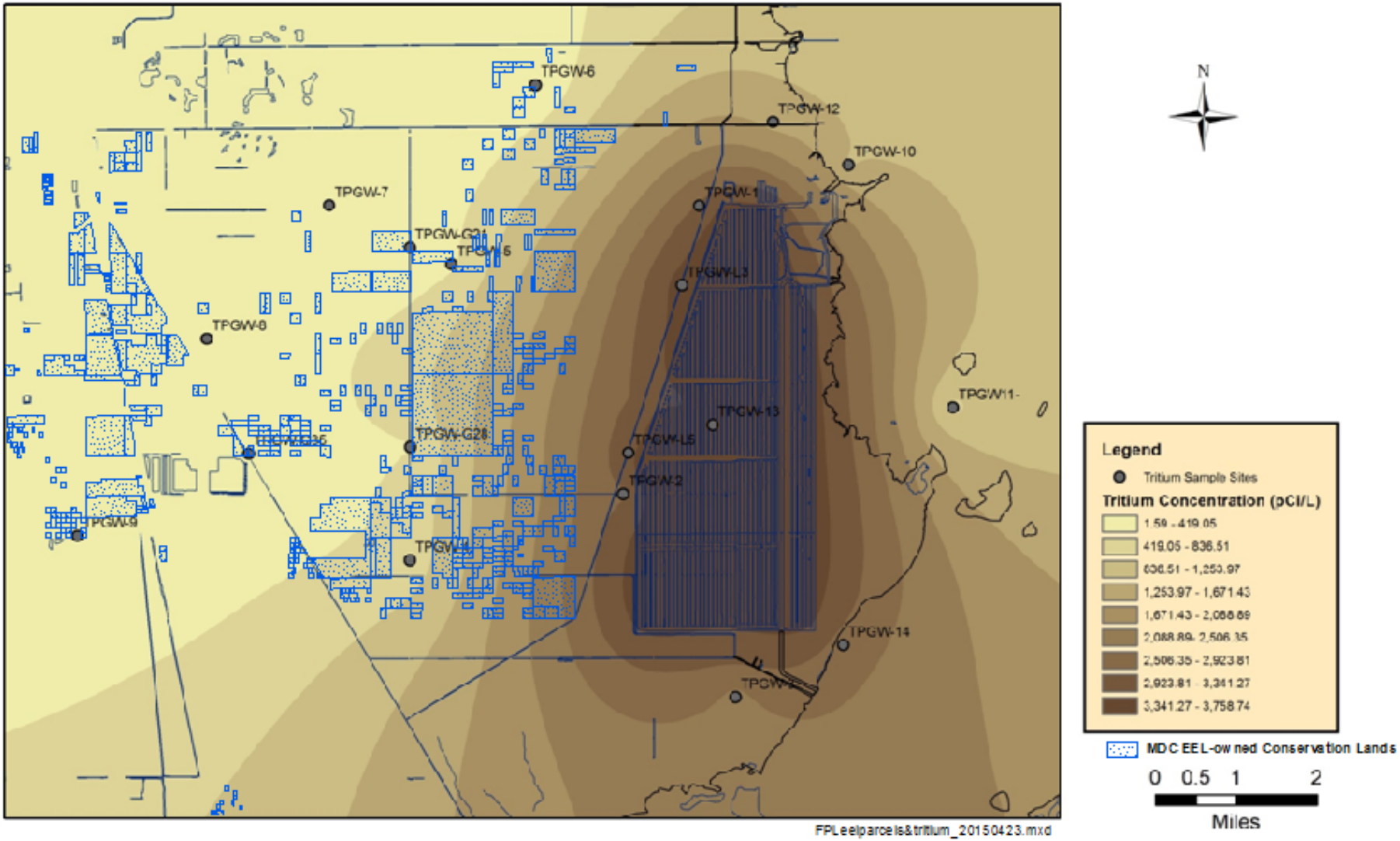
#Wetzel 2001. Plant Community Parameter Estimates and Documentation for the Across Trophic Level System Simulation (ATLSS). Data Report Prepared for the ATLSS Project Team, University of Tennessee–Knoxville, 59Pp.

Model Lands Surface Water Specific Conductance

L-31E borrow canal and Model Lands South canal April 2018



Contours Based On Deep Well Tritium Results From the March 2013 Quarterly Sampling



Attachment 3:

Review of Nutrient Treatment Target Levels, RER-DERM Water Resources Coordination Division, Final Report by Black and Veatch, October 30, 2018.

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Review of
Nutrient Treatment Target Levels

Based on data provided by FPL, supplementary DERM sampling data, and the Advanced Reclaimed Water Project, October 30, 2018 Final Report by Black and Veatch

RER-DERM Water Resources Coordination Division

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OVERVIEW OF PRESENTATION

- Assumptions on water quality targets from Black and Veatch report
- Data Review
- Findings
- Alternative Recommendation for County Consideration

DRAFT

Assumptions on water quality targets from Black and Veatch Report

DRAFT

Assumptions on water quality targets from Black and Veatch Report

Black & Veatch Treatment Train Analysis

- Assumption: total phosphorus concentration of the reclaimed water discharged to CCS would be 0.02 mg/L
- Assumption: total nitrogen concentration of the reclaimed water discharged to CCS would be 2.5 mg/L
- Assumption: 45 MGD output capacity from Advanced Reclaimed Water Project = 30 MGD reclaimed water discharge volume to CCS + 15 MGD reclaimed water volume to Unit 5 cooling towers

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Data Review

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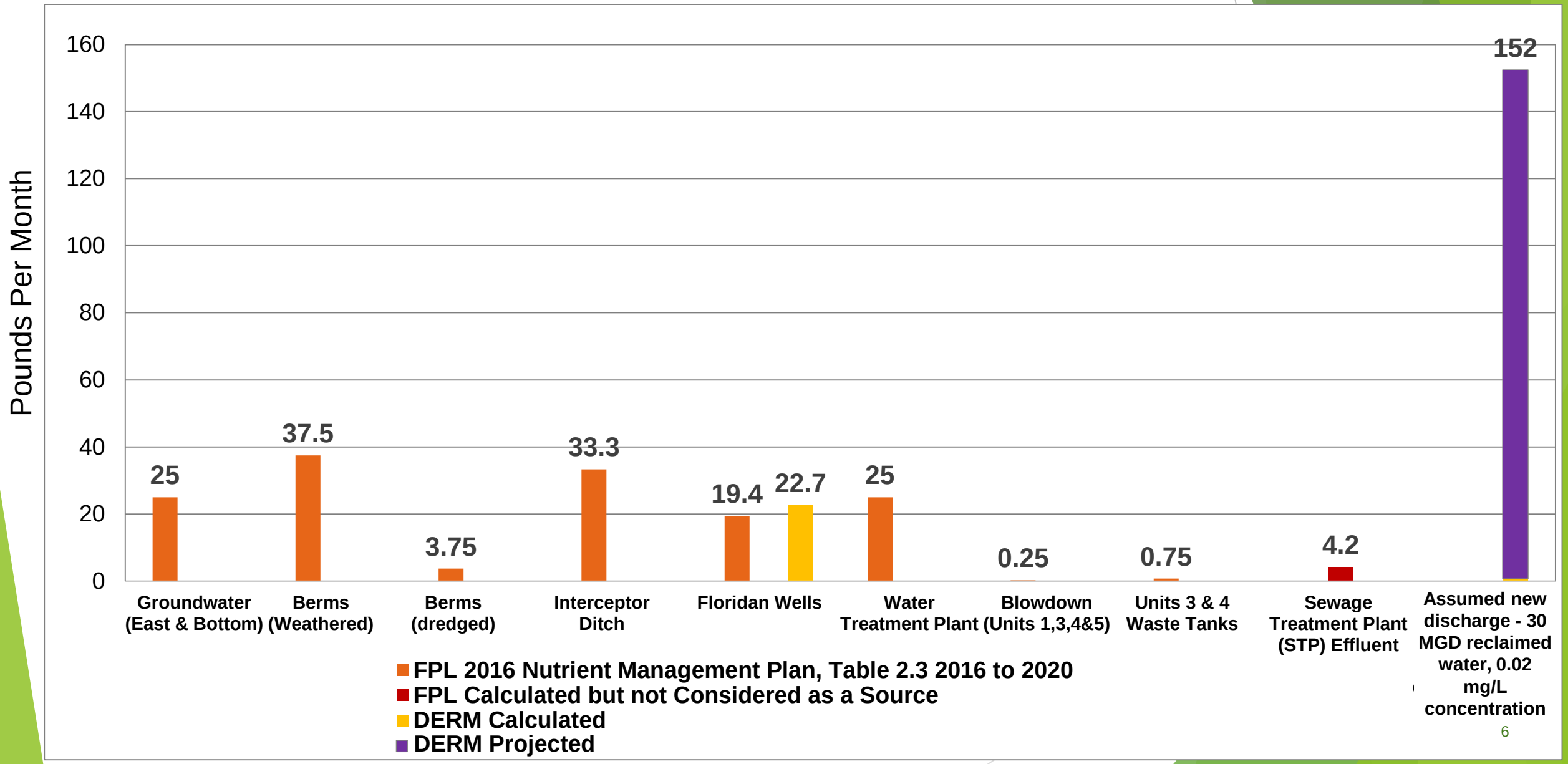
Data Review

Projected Monthly Phosphorus Inputs to the CCS by Source



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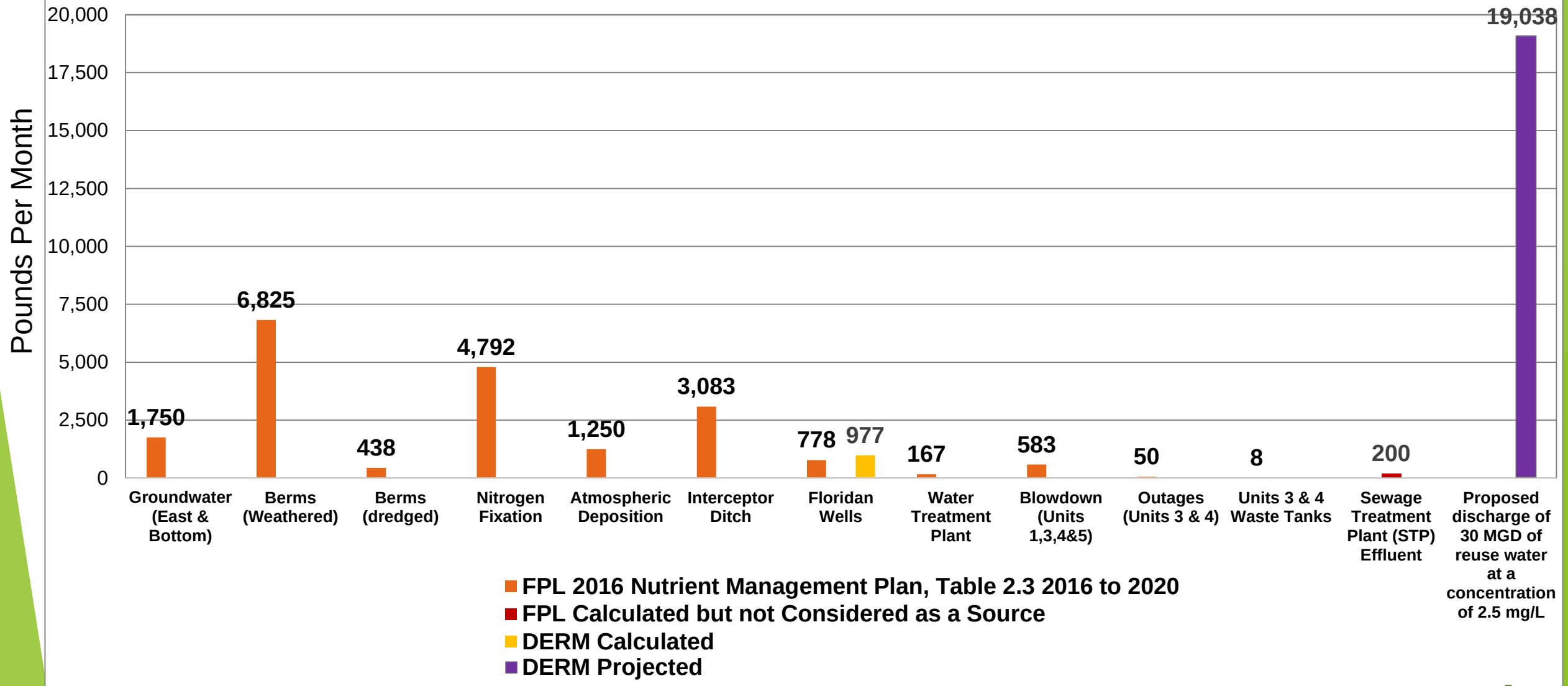
Data Review

Projected Monthly Nitrogen Inputs to the CCS by Source



Surface Water and Groundwater Average Total Phosphorus (TP) Concentration within and near CCS

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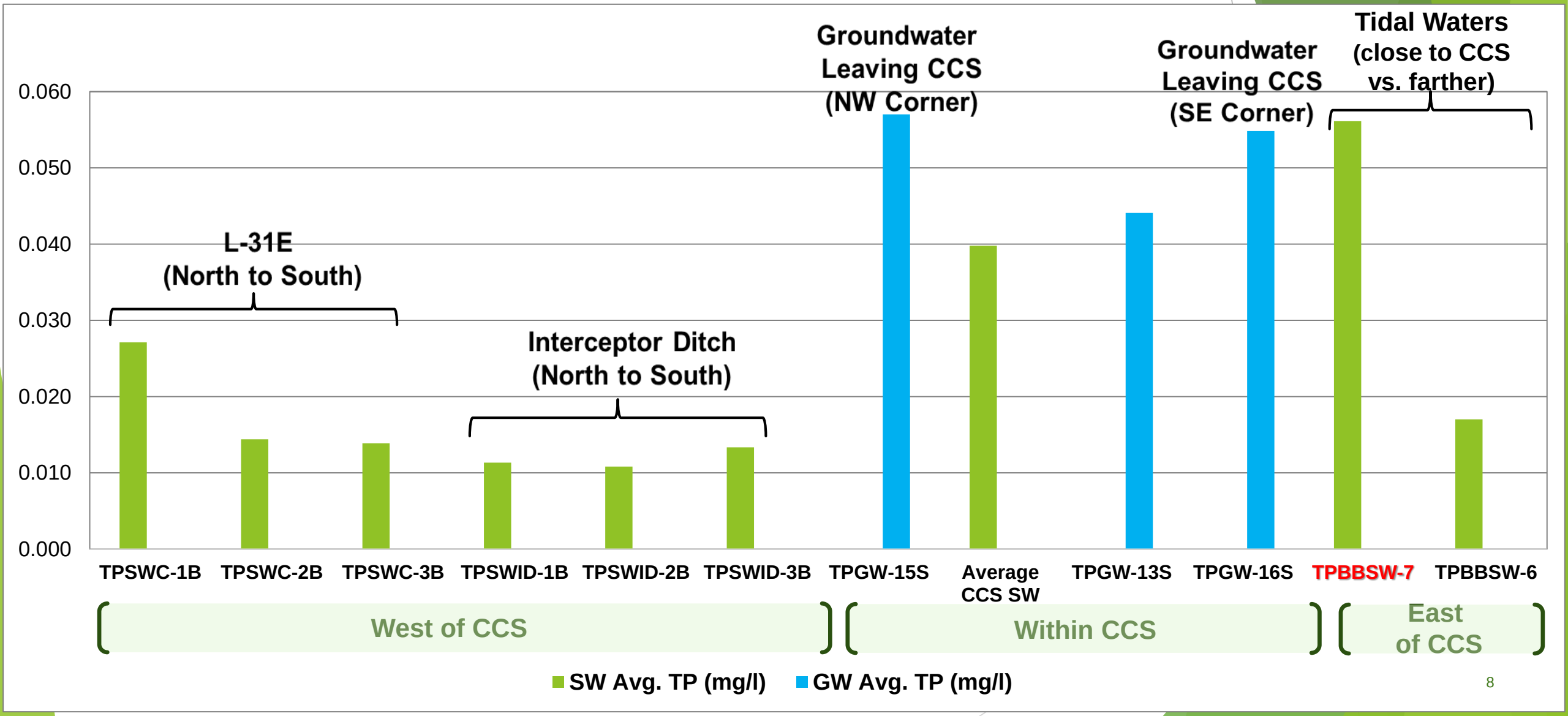
Data Review



Surface Water and Groundwater Average Total Nitrogen Concentration (as TKN) within and near CCS

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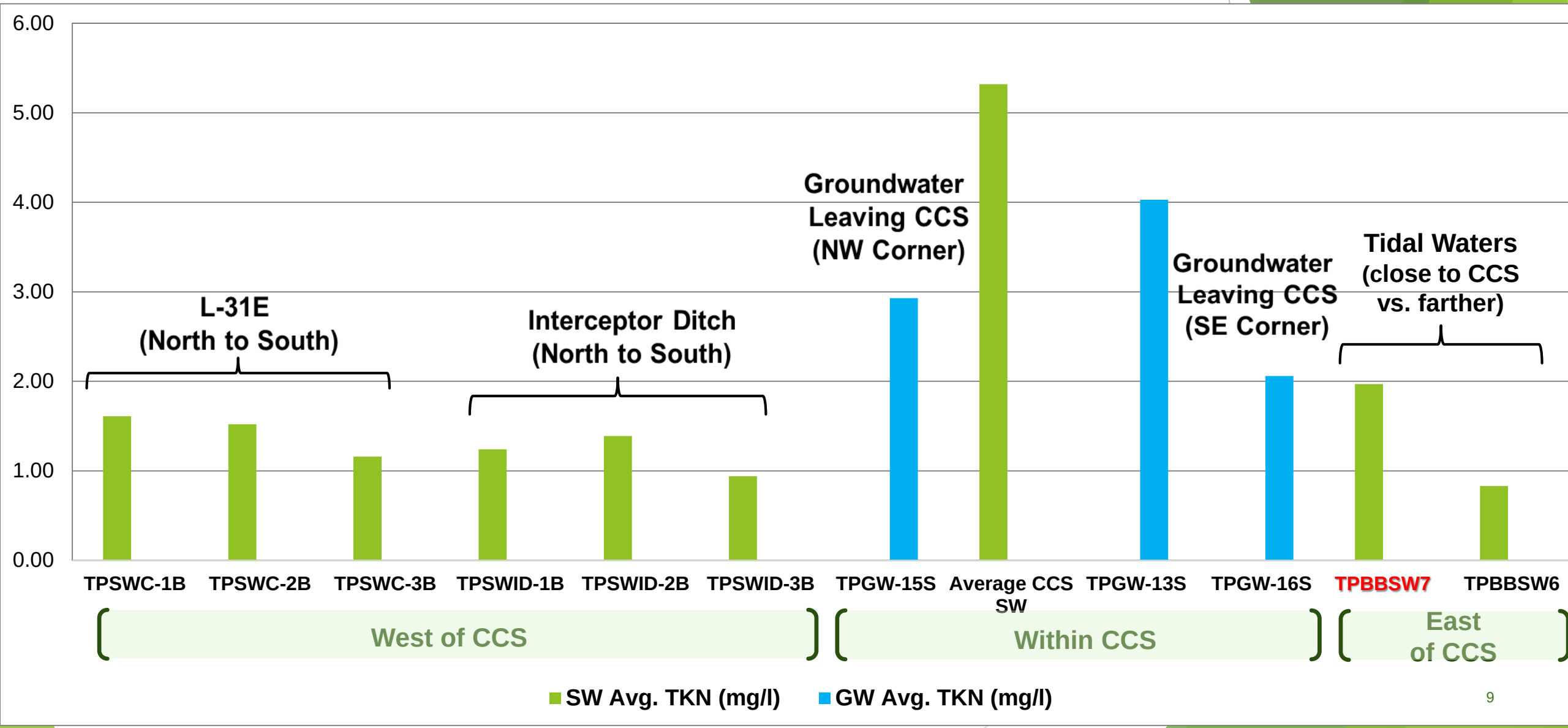
Data Review



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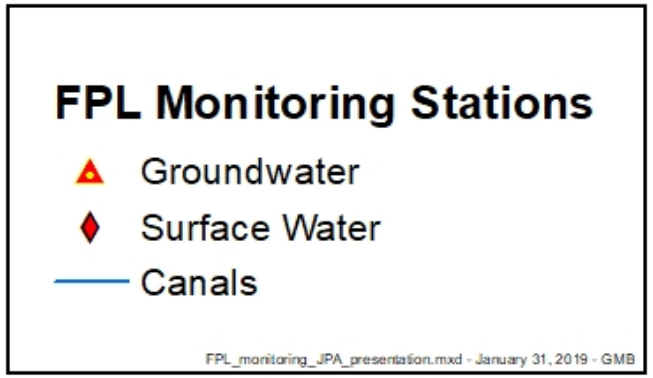
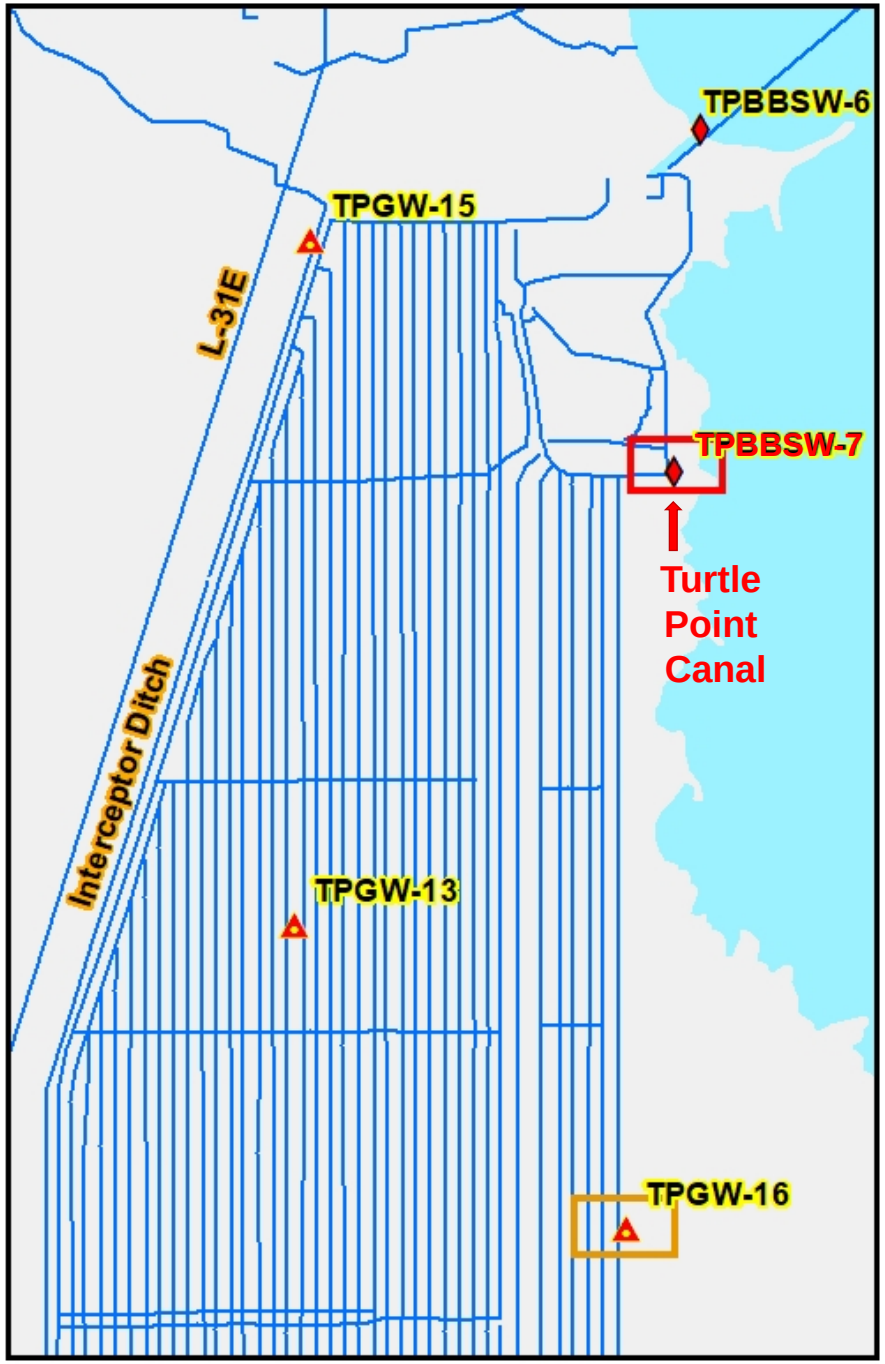
Data Review





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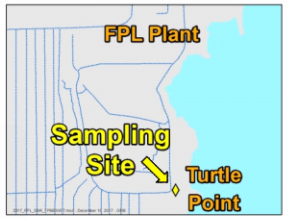
Data Review

SAR Sampling
Turtle Point Canal

TPBBSW-7B

The portion of the water column depicted in red is indicative of CCS plume water at this location based on the physical characteristics of the water as well as the concentrations of tritium as the tracer.



One ft below Surface

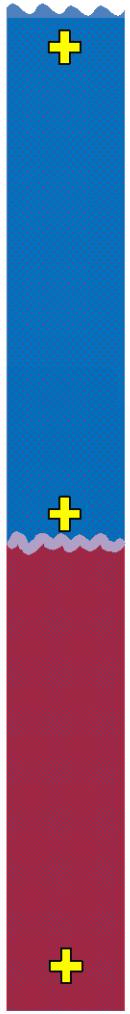
Ammonia (mg/L)	Temperature (°C)	Salinity (PSU)
0.19	18.5	29.6
DO	pH	
4.53	7.94	

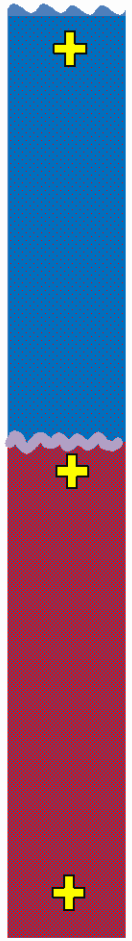
Mid-Depth

Ammonia (mg/L)	Temperature (°C)	Salinity (PSU)
0.16	18.6	29.3
DO	pH	
5.44	7.97	

One ft above Bottom

Ammonia (mg/L)	Temperature (°C)	Salinity (PSU)
1.98	26.6	34.9
DO	pH	
0.15	6.69	





One ft below Surface

Ammonia (mg/L)	Temperature (°C)	Salinity (PSU)
0.06	23.6	28.9
DO	pH	
3.76	7.84	

Mid-Depth

Ammonia (mg/L)	Temperature (°C)	Salinity (PSU)
1.4	25.9	33.9
DO	pH	
0.5	6.77	

One ft above Bottom

Ammonia (mg/L)	Temperature (°C)	Salinity (PSU)
1.93	26.6	35.8
DO	pH	
0.07	6.73	

HIGH TIDE
1/9/2017
Water Column
~23.9 Feet

LOW TIDE
1/6/2017
Water Column
~22.3 Feet

Per July 10, 2018 DERM response letter to FPL's Site Assessment Report (SAR) dated March 17, 2017 and the SAR Supplemental Information dated November 11, 2017:

2. DERM finds that the total ammonia concentrations documented in several sampling locations at the Barge basin, **Turtle Point Canal**, Card Sound Canal, S-20 Get Away Canal, and the Sea-Dade Canal exceeded the applicable Miami-Dade County surface water standard. DERM acknowledges that the documented elevated surface water ammonia concentrations may be attributable to several contributing sources, including factors not directly related to the operation of the CCS. However, based on an evaluation of other associated water quality data, such as tritium concentrations and temperature, **DERM finds that the data supports that the CCS is a contributing source to the ammonia concentrations observed in areas which exceed the applicable standard**.

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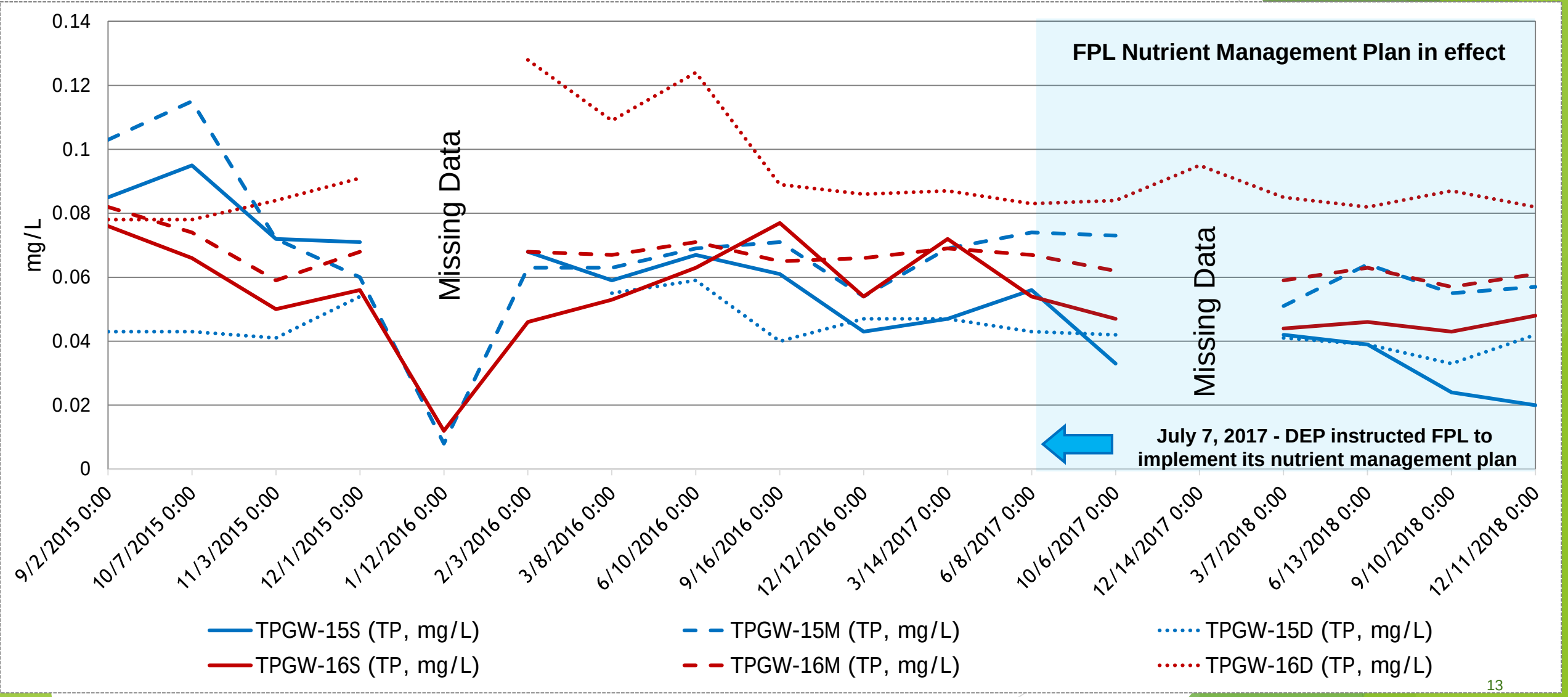
Data Review

Total Phosphorus in Groundwater Leaving the CCS

TPGW-15 and TPGW-16 TP Sampling Results, Sept. 2015 to Dec. 2018



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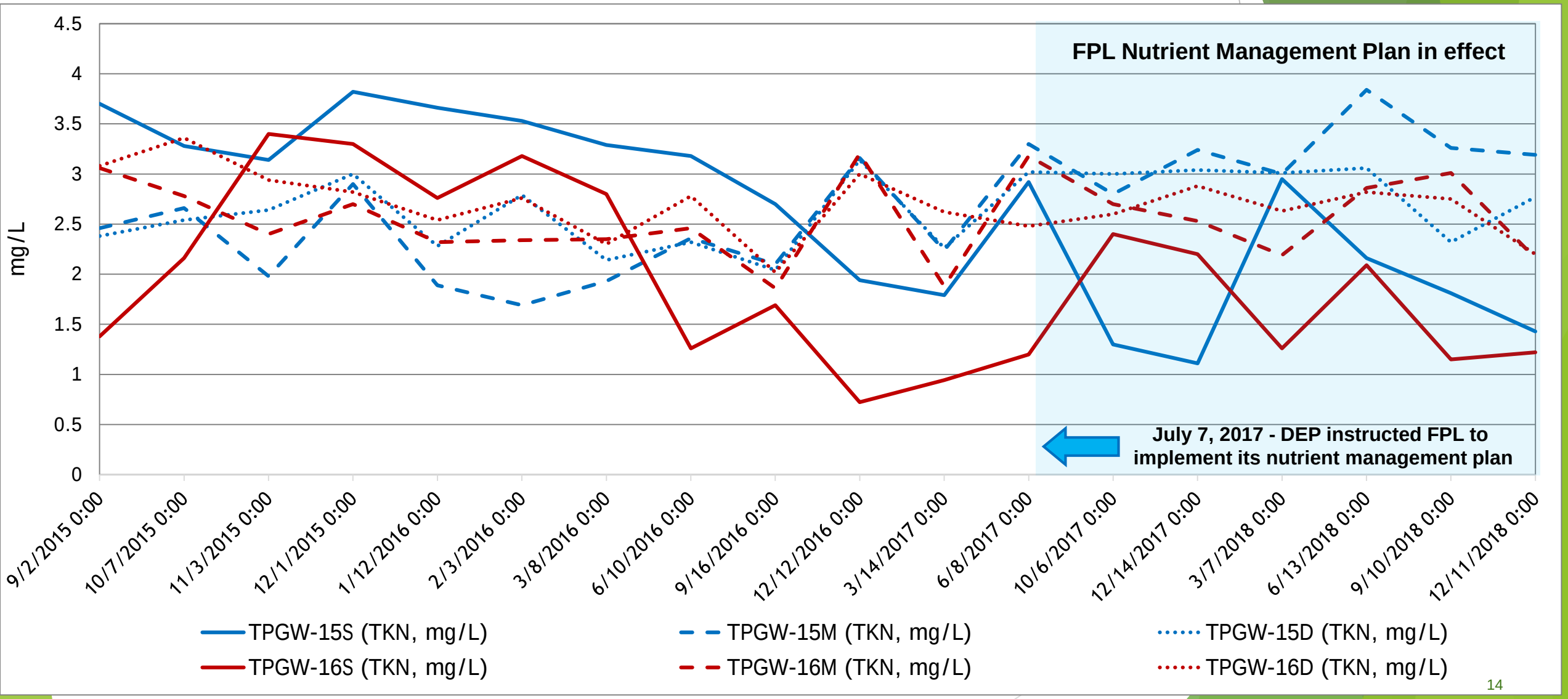
Data Review

Total Nitrogen as TKN in Groundwater Leaving the CCS

TPGW-15 and TPGW-16 TKN Sampling Results, Sept. 2015 to Dec. 2018



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Findings

Nutrients by the Numbers

Use of reclaimed water with Black & Veatch-assumed nutrient concentrations (assume Floridan “freshening” wells are turned off):

- **Phosphorus inputs to CCS would increase at least 572%** (net change between freshening well inputs** and FPL’s assumed reclaimed water inputs)
- **Nitrogen inputs to CCS would increase at least 1,849%** (net change between freshening well inputs** and FPL’s assumed reclaimed water inputs)

** This comparison between Floridan well nutrient inputs and reclaimed water nutrient inputs used the DERM calculated monthly nutrient input values for the Floridan wells, which results in a lower net change than a comparison between the FPL-provided Floridan well nutrient inputs and FPL’s assumed reclaimed water inputs.

Phosphorus Comparisons

Use of reclaimed water with Black & Veatch-assumed phosphorus concentrations with Floridan "freshening" wells turned off per FPL proposal:

- Concentration of **phosphorus** discharging into the CCS:
  - ~ 2 times more than the "Everglades standard" of 10 ppb
  - ~3 times higher than DEP numeric nutrient standard for adjacent section of Biscayne Bay (7 ppb South Central Inshore and South Central Mid-Bay WBIDS)
  - ~ 4 times higher than maximum 5 ppb recommended for discharge to distribution features for rehydration purposes by the CERP Wastewater Reuse Pilot project delivery team

Although not applicable to waters within the CCS, the waters within the CCS have been shown to seep into adjacent ground and surface waters. The standards in blue are applicable to waters adjacent to the CCS. These comparisons are shown to Illustrate the magnitude of the projected nutrient input increases.

Nitrogen Comparisons

Use of reclaimed water with Black & Veatch-assumed nitrogen concentrations with Floridan "freshening" wells turned off per FPL proposal:

- Concentration of nitrogen discharging into the CCS:
  - ~7 times higher than the DEP numeric nutrient standard for the adjacent section of Biscayne Bay (0.35 ppm South Central Mid-Bay WBID)
  - ~11 times higher than the maximum concentration of 0.22 ppm TKN recommended for discharge to distribution features for rehydration purposes by the CERP Wastewater Reuse Pilot project delivery team

Although not applicable to waters within the CCS, the waters within the CCS have been shown to seep into adjacent ground and surface waters. The standards in blue are applicable to waters adjacent to the CCS. These comparisons are shown to Illustrate the magnitude of the projected nutrient input increases.

Findings

At FPL's proposed input rate of 30 MGD, the total volume added to the CCS, based on continuous discharge, would be equivalent to the CCS control volume (4.2 billion gallons) in ~140 days (without considering losses to evaporation, seepage etc.)

This volume of water added to the CCS (at the Black & Veatch-assumed nutrient concentrations) equates to the addition of 701 pounds of phosphorus and 87,627 pounds of nitrogen.

Issues

Changing from the current use of up to 15 MGD of Floridan aquifer water for the purpose of freshening the CCS to 30 MGD of reclaimed water (at assumed Black and Veatch nutrient concentrations/volumes) would result in:

- Significant increase in CCS nutrient inputs, which would be expected to increase nutrient outputs in waters leaving the CCS, via seepage to adjacent ground and surface waters, e.g. canals

Depending on CCS stages, continuous addition of reclaimed water would:

- Lead to surcharging the CCS (i.e. filling beyond the usual control volume), resulting in increased seepage from the CCS
- Potentially further increase nutrient and other contaminant fluxes from the CCS to adjacent waters when CCS water levels are elevated above control volume

Issues

Based on the preceding, “not-to-exceed” stage(s) would need to be established for the CCS to prevent surcharge.

A protocol would also be needed to determine when to start and stop the assumed 30 MGD discharge to avoid filling the CCS beyond the “not-to-exceed” stage(s).

Summary

Nutrients leaving the CCS via the groundwater pathway are entering adjacent surface waters at elevated levels.

The proposal would greatly increase nitrogen and phosphorus inputs into the CCS, which would likely continue to impact water quality outside the CCS and exacerbate such problems in adjacent ground and surface waters.

Nutrient impacts to groundwater and surface water resources are to be addressed per DERM orders dated July 10, 2018 pursuant to the Consent Agreement.

THEREFORE

30 MGD of reclaimed water proposed for discharge to CCS should be treated to CERP Wastewater Pilot Project recommended water quality targets for direct discharge to wetlands with managed water delivery, based on

- DERM-calculated nutrient inputs
- data that indicate that the poor water quality adjacent to the CCS is related to poor water quality inside the CCS.

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Alternative Recommendation for County Consideration

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Alternative Recommendation for County Consideration

The following alternative recommendation to improve this partnership project is based on the preceding information and DERM's analysis of CCS plume nutrients entering surface waters via the groundwater pathway.

Potential Improvements to the FPL/County Reclaimed Water Partnership:

Cost Savings to County

Improved Efficiency

Hydrologic and Other Benefits

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Alternative Recommendation for County Consideration

30 MGD for the cooling canal system (CCS)

- Treat to CERP Wastewater Reuse Pilot Project recommended water quality targets for direct discharge to wetlands
- County and FPL would be cost-sharing partners for the 30 MGD
- Discharge 30 MGD highly treated water to Tallahassee Road canal or nearby groundwater consistent with CERP planning level concepts
- Model Lands basin temporarily holds treated water as it flows towards L-31E Canal
- Water is transferred to CCS via 2-3 small (10-15 MGD) pump stations on the L-31E (30 MGD daily maximum pumpage)

This scenario allows continuous treatment/pumping from the advanced reclaimed treatment project, even when stage elevation in the CCS precludes ID or other pumping.

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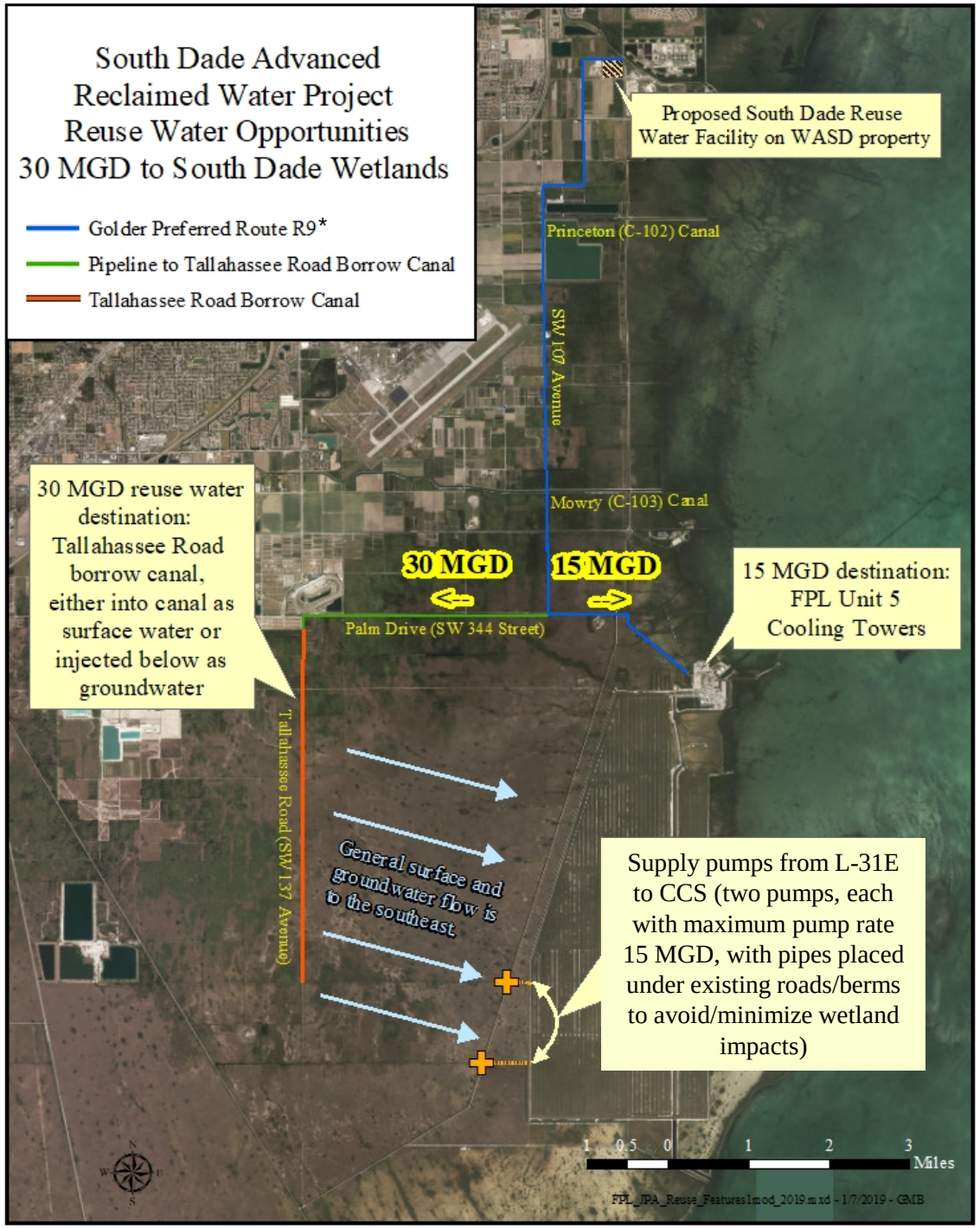
Alternative Recommendation for County Consideration



* Golder Associates Technical Memorandum, FPL Turkey Point Reuse Treatment Plant 45 MGD Layout and Costs, May 17, 2017

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Alternative Recommendation for County Consideration

Potential Cost Savings to County:

The County's cost to rehydrate wetlands with reclaimed water under the partnership could be significantly reduced

- Assuming treatment of water to the CERP standard, both FPL and County benefit from sharing cost if 30 MGD is used for ecological and salt intrusion benefits as well as CCS freshening

Approach is consistent with approved CERP projects, therefore CERP cost share participation may also be possible.

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Alternative Recommendation for County Consideration

Improved Efficiency:

- Reclaimed water treatment project could operate at all times (greater efficiency)
- More water treated/stored (unused water that would have been injected to Boulder Zone has a beneficial use)
- Increased freshwater stages in Model Lands could improve RWS effectiveness

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Alternative Recommendation for County Consideration

Hydrologic and Other Benefits:

- A large reservoir of water could be created and stored in the Model Lands to sustain CCS operations (possibly also during prolonged drought)
- Increased resiliency resulting from higher stages in the Model Lands
  - Built environment (Turkey Point and public wellfields) - protection from saltwater intrusion
  - Natural environment (Everglades) - provision of environmentally compatible supplementary water, protection from saltwater intrusion
- Improved water quality (lower nutrients) for water pumped into the CCS vs. FPL's proposed reclaimed water treatment targets for direct discharge
- Potential to pump from the L-31E canal into the CCS based on stage triggers to fix or replace the Interceptor Ditch
- Water introduced into CCS where stages are lower, reducing risk of surcharge and potentially increasing volumes that can be added to the CCS without causing surcharge

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Alternative Recommendation for County Consideration

15 MGD for Unit 5 cooling towers

- New UIC well is recommended for disposal of cooling tower blowdown to the boulder zone regardless of selected treatment train to reduce nutrient inputs to CCS
- New UIC well should be designed with additional capacity for disposal of other nutrient-containing wastewater streams including those currently discharged to CCS

Data Review Addendum

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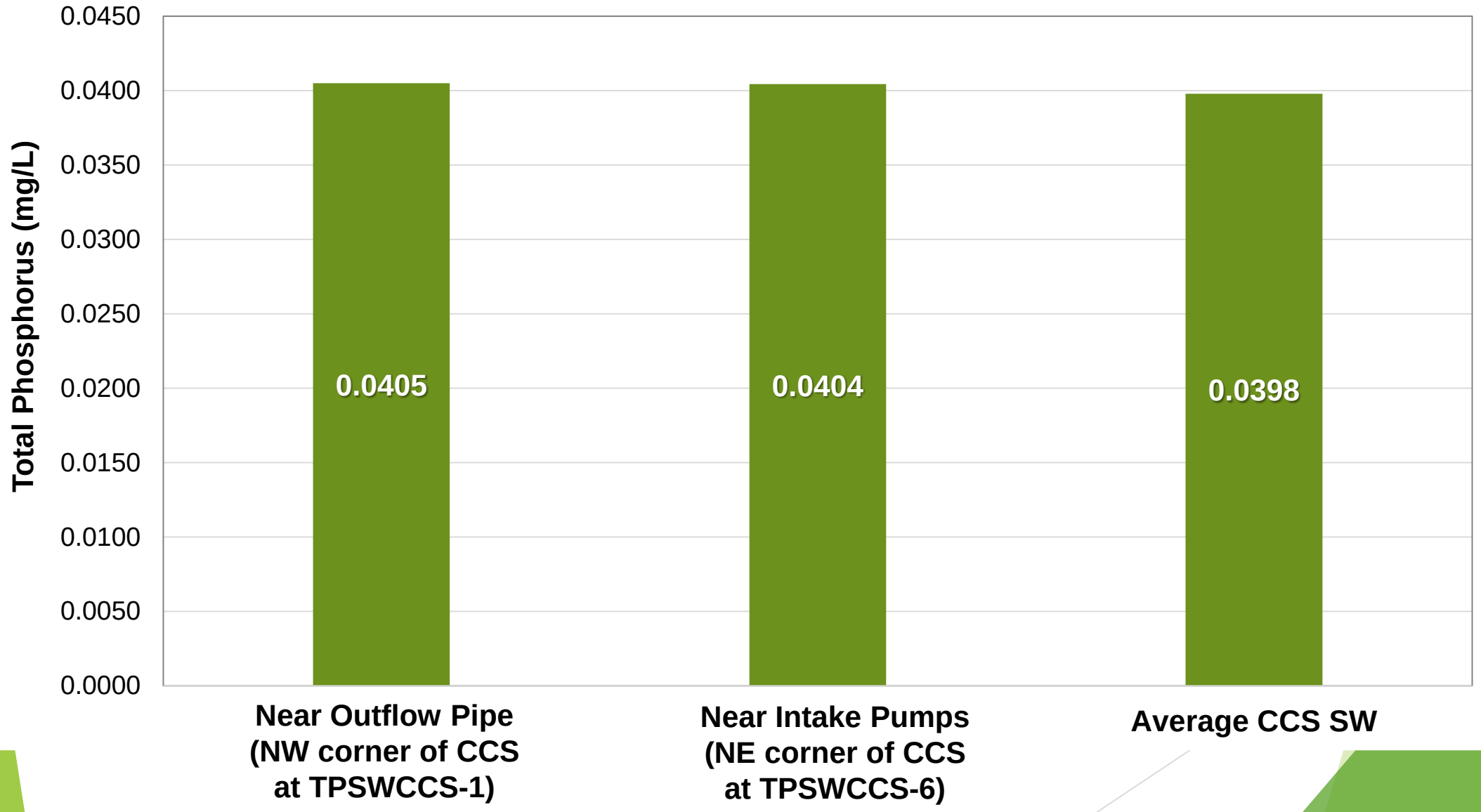
Data Review

CCS Surface Water
Average Total Phosphorus (mg/L)



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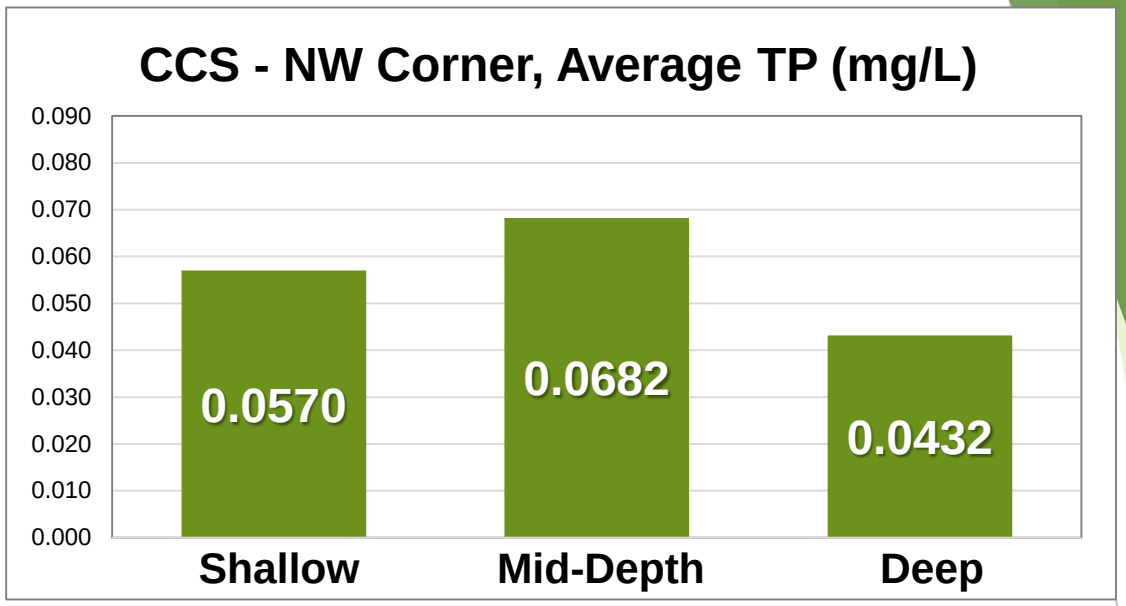
Data Review

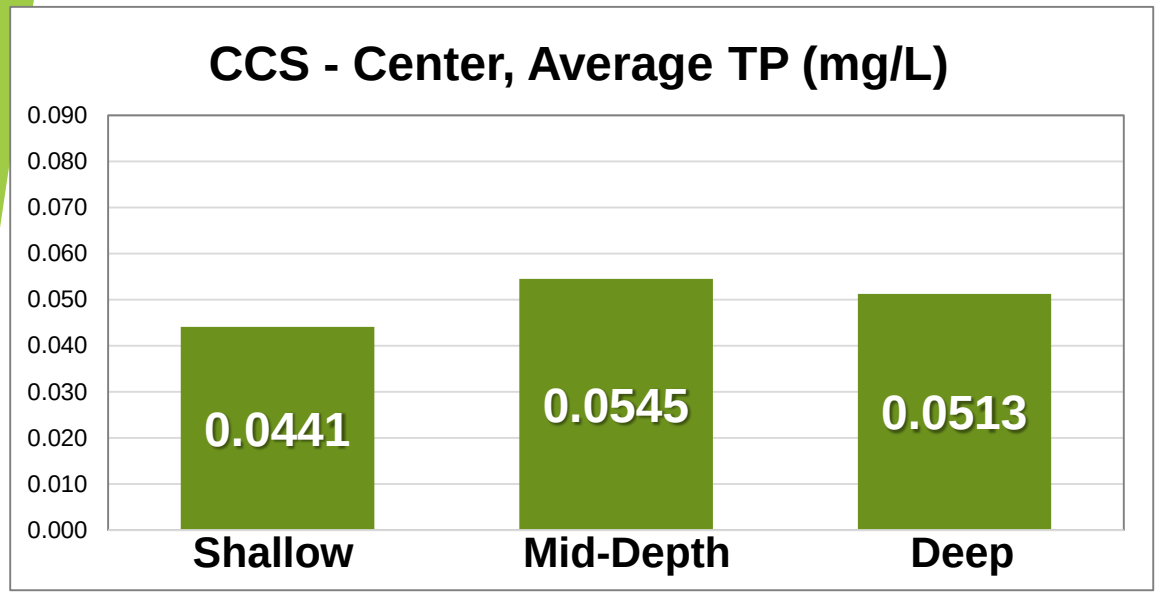
CCS Groundwater

Average Total Phosphorus with Depth

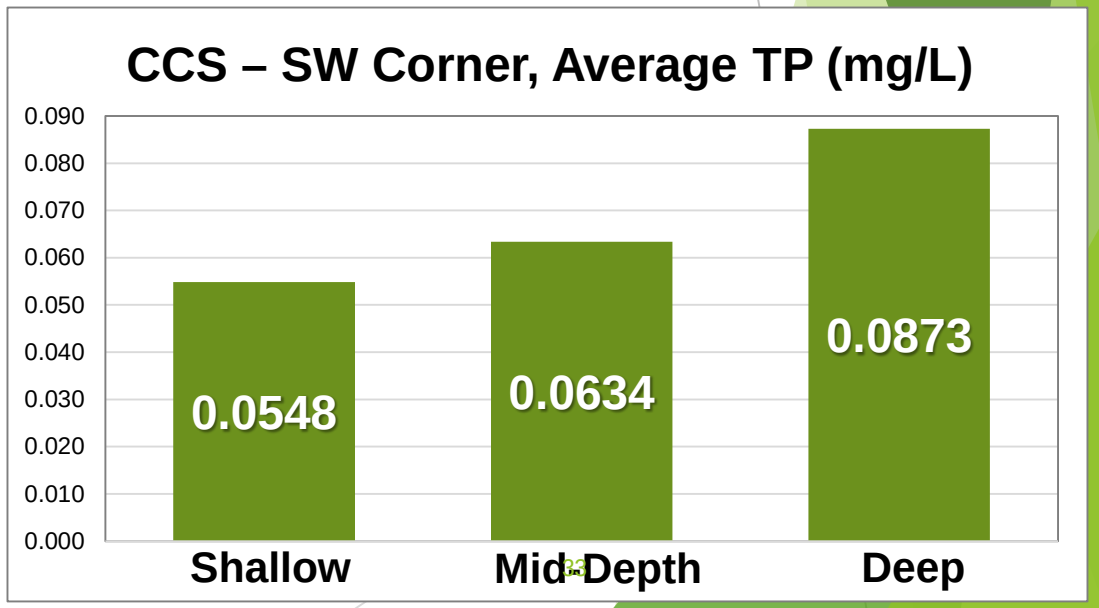
CCS - NW corner = TPGW-15
CCS - Center = TPGW-13
CCS - SW Corner = TPGW-16



There is a statistically significant difference with depth at TPGW-15



There is no statistically significant difference with depth at TPGW-13



No statistical analysis was done for TPGW-16

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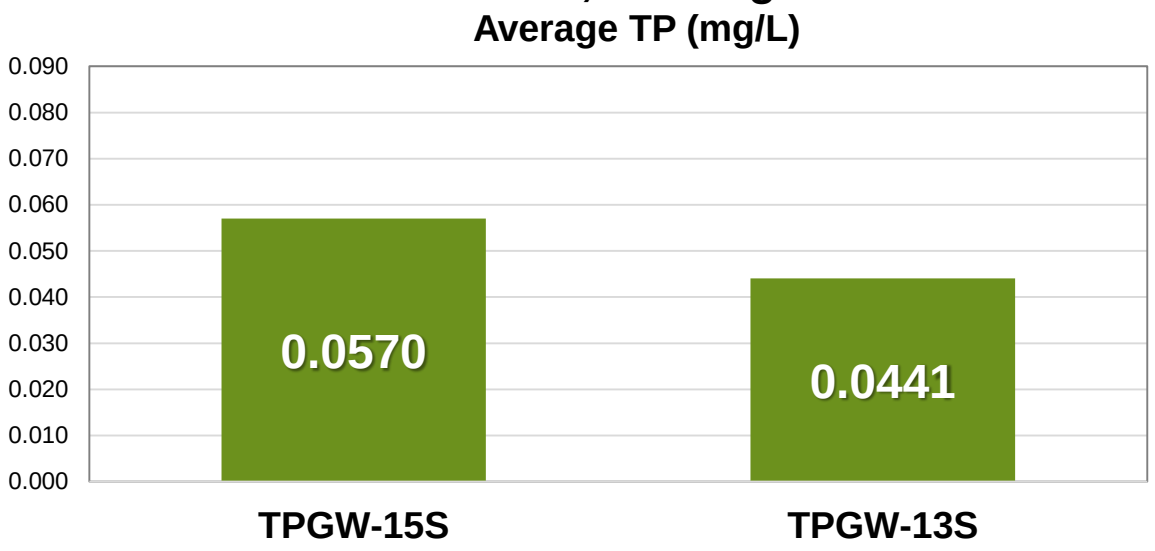
Data Review

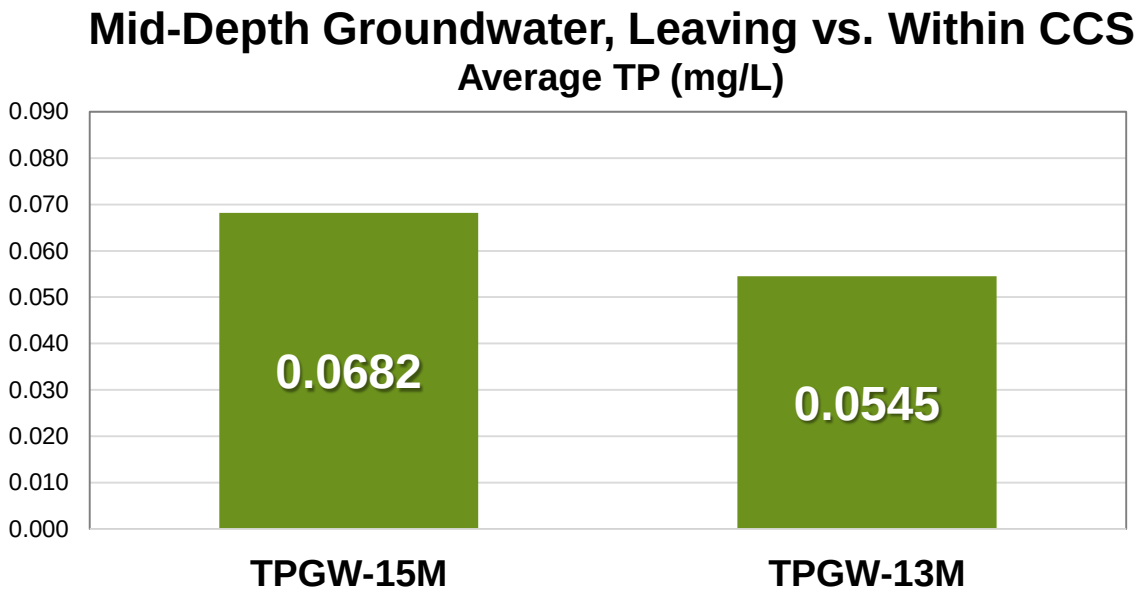
CCS Groundwater

Comparison of Average Total Phosphorus Leaving vs. Within CCS by Depth

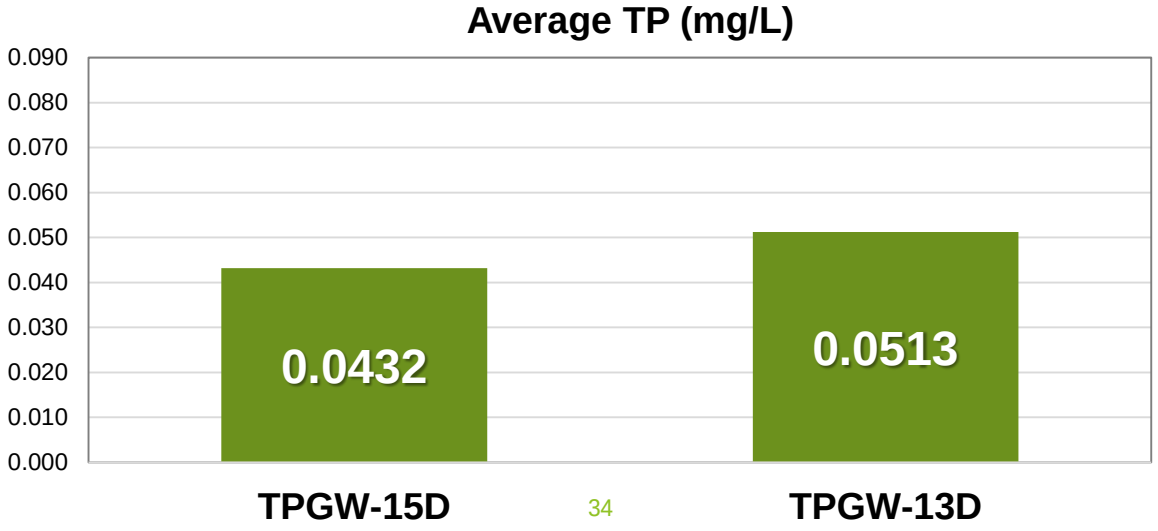
Within CCS = TPGW-13
Leaving CCS = TPGW-15



There is no statistically significant difference between the shallow wells for the two stations



There is a statistically significant difference between the mid-depth wells for the two stations

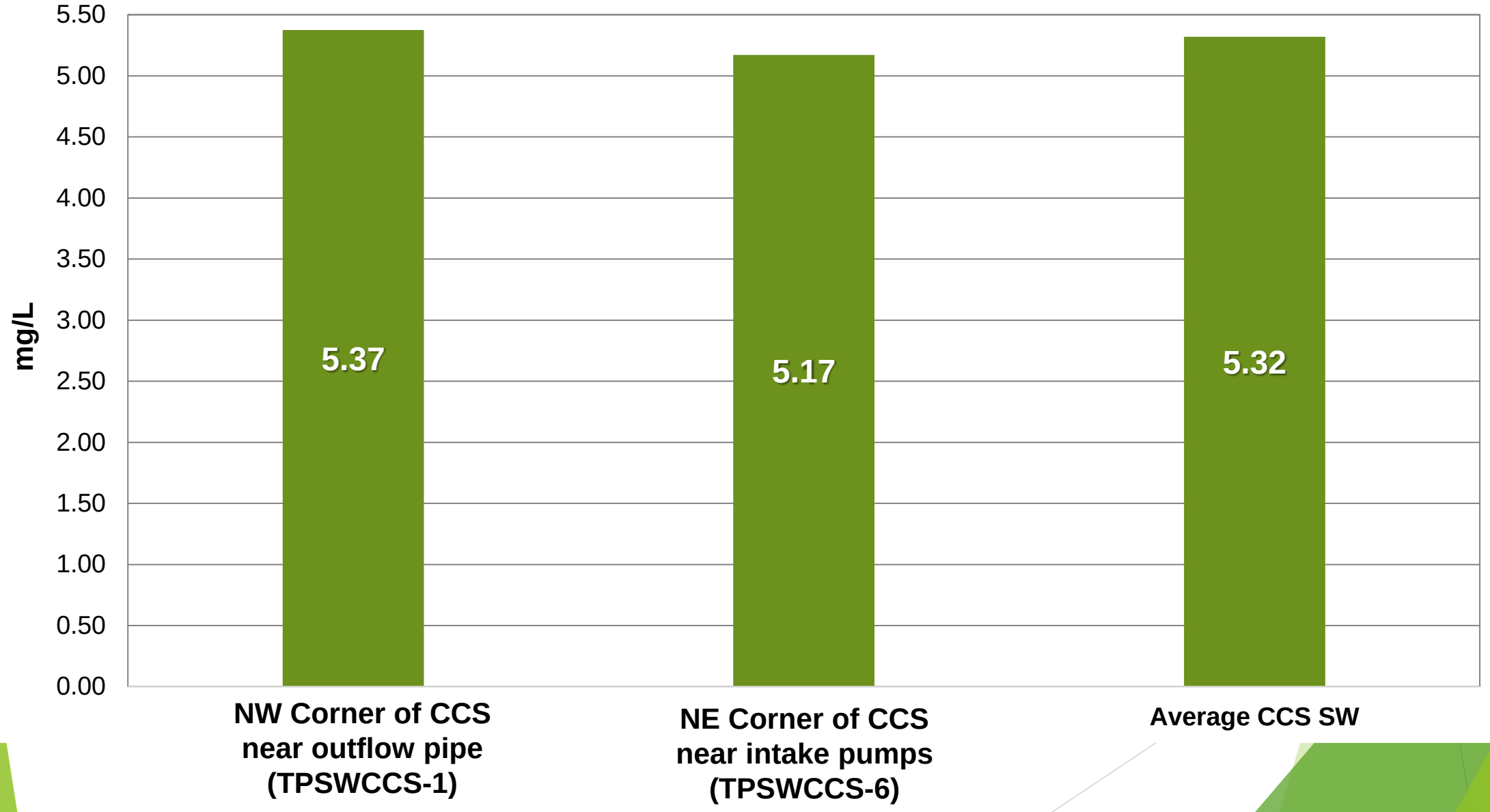


There is no statistically significant difference between the deep wells for the two stations

DRAFT

Data Review

CCS Surface Water
Average Total Nitrogen as TKN

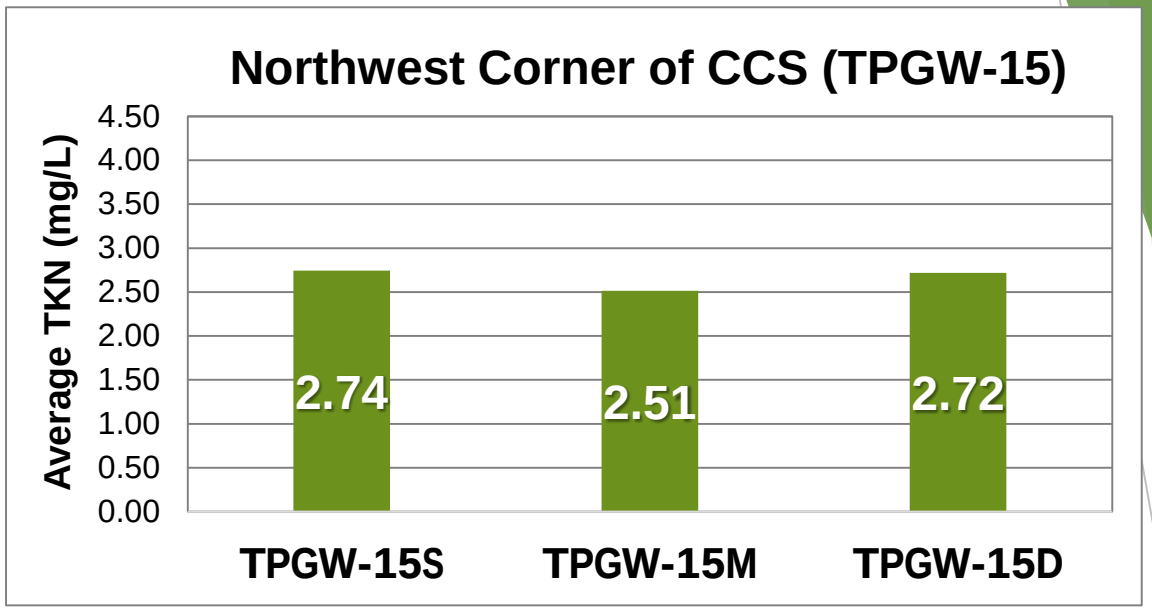


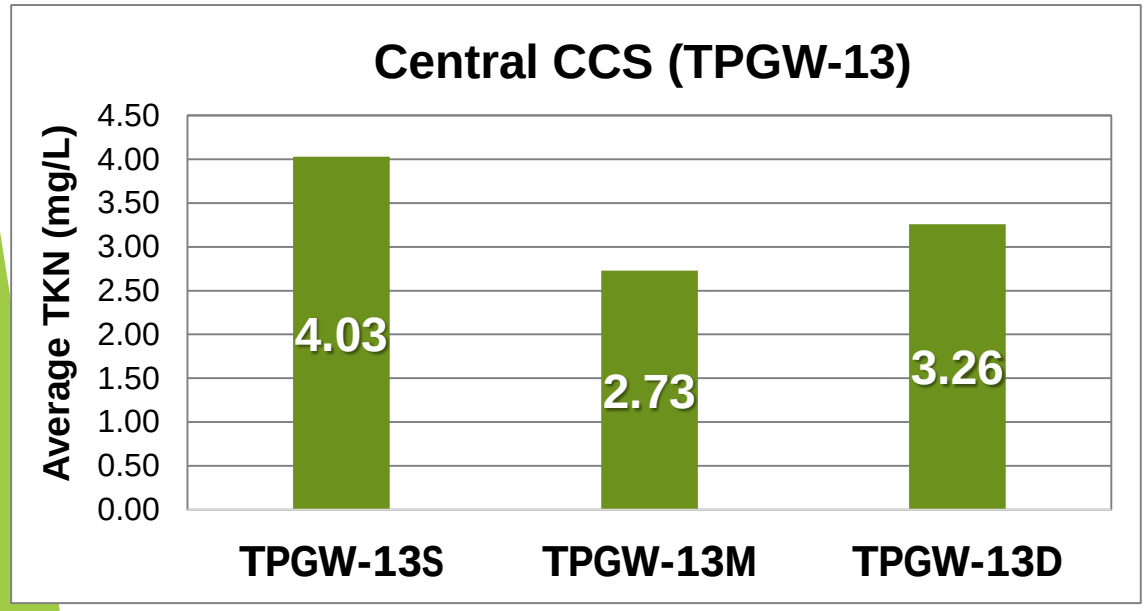
DRAFT

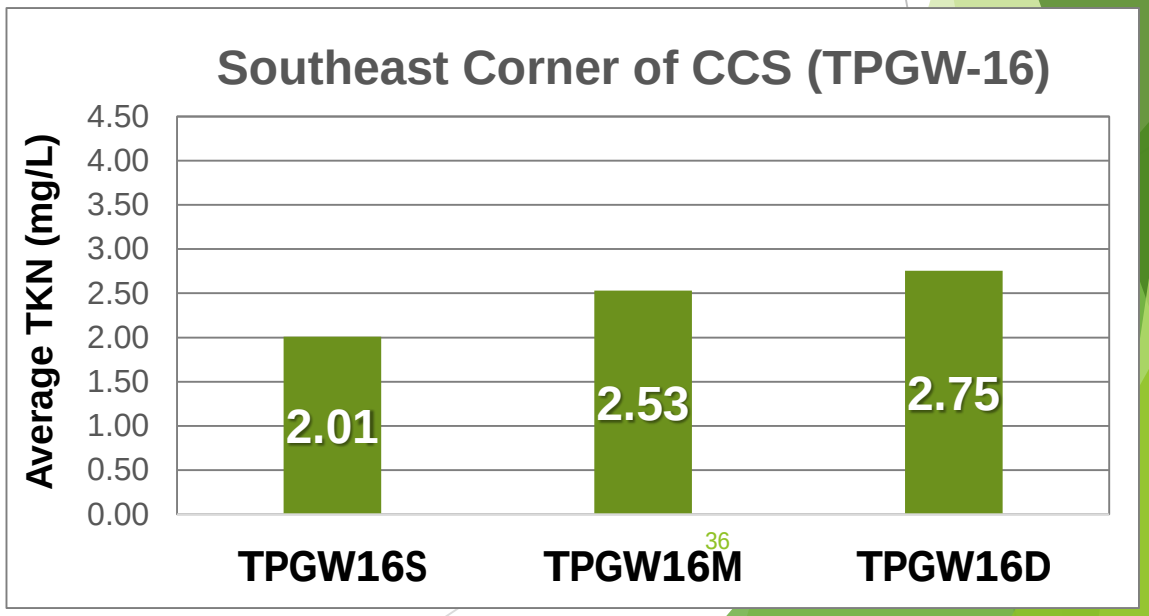
Data Review

CCS Groundwater Average Total Nitrogen as TKN with Depth

S = Shallow
M = Mid-Depth
D = Deep







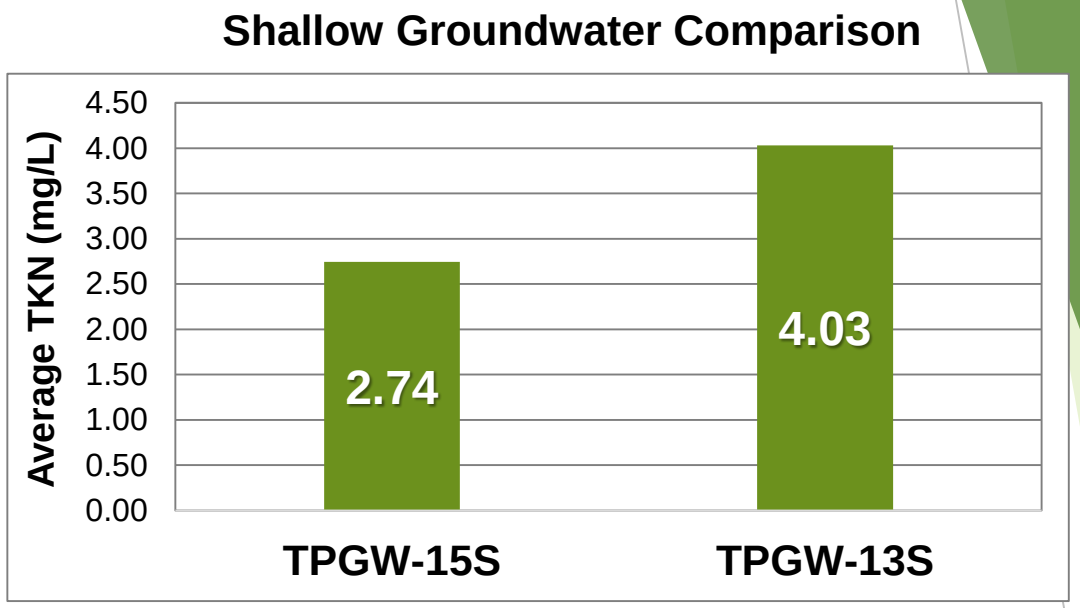
DRAFT

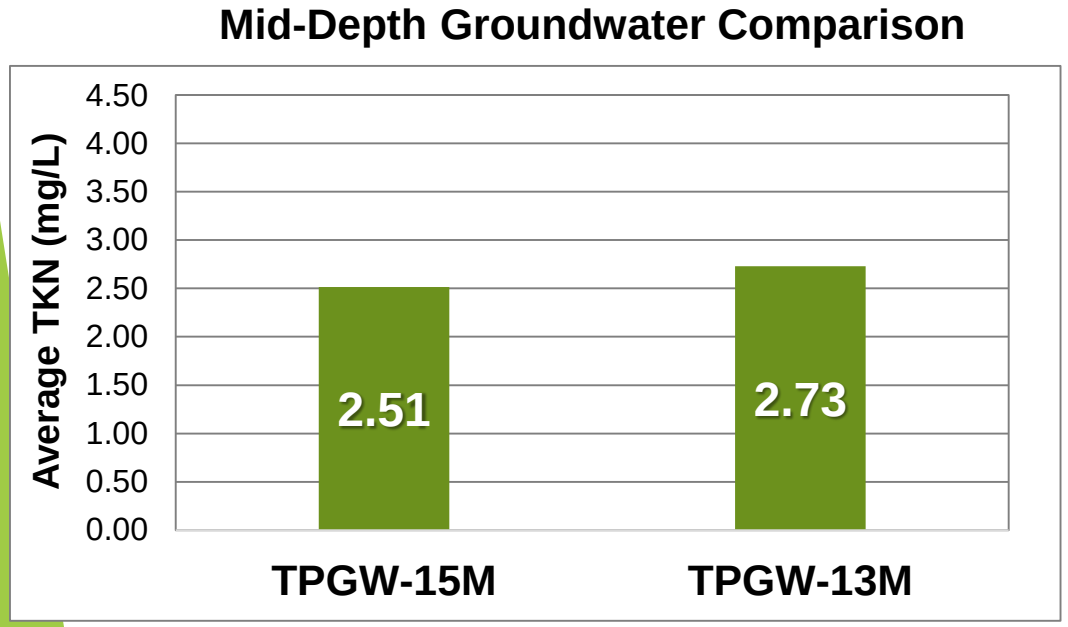
Data Review

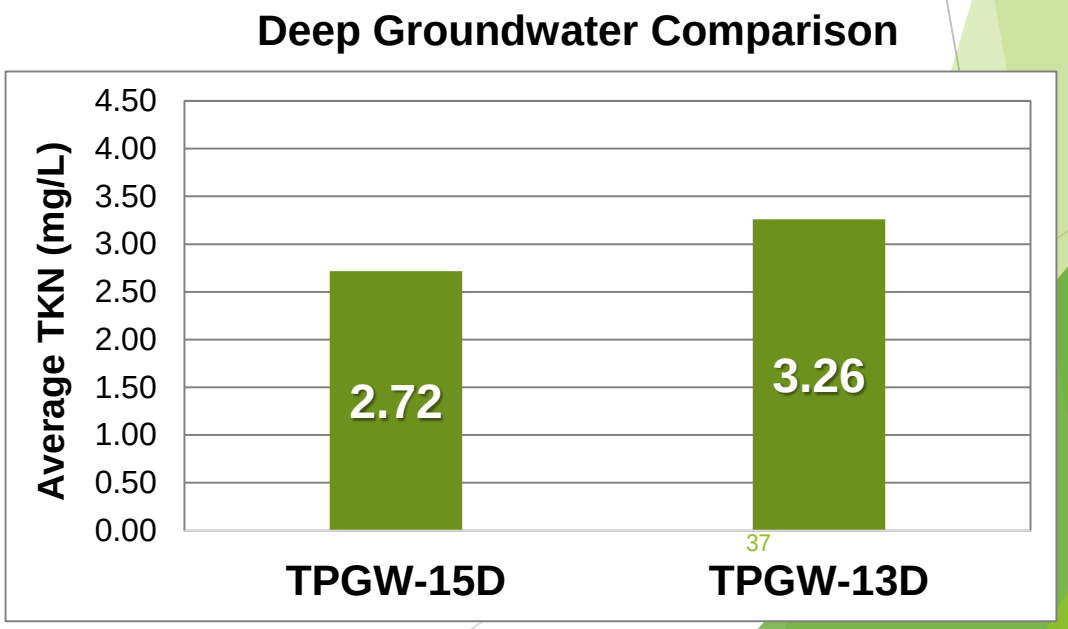
CCS Groundwater

Comparison of Average Total Nitrogen as TKN leaving CCS vs. within CCS by Depth

Leaving CCS = TPGW-15
Within CCS = TPGW-13







Attachment 4:

Fifth Supplemental Agreement Between the South Florida Water Management District and Florida Power and Light Company, October 16th, 2009

FIFTH SUPPLEMENTAL AGREEMENT

BETWEEN
THE SOUTH FLORIDA WATER MANAGEMENT DISTRICT

AND

FLORIDA POWER & LIGHT COMPANY

THIS AGREEMENT is made and entered into this 16 day of October, 2009, by and between FLORIDA POWER & LIGHT COMPANY ("FPL") and SOUTH FLORIDA WATER MANAGEMENT DISTRICT ("DISTRICT") (and collectively referred to as "the Parties").

WITNESSETH

1. WHEREAS, FPL and the CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT, (the "CSFFCD"), predecessor to the DISTRICT, entered into an agreement dated February 2, 1972, hereinafter referred to as "Original Agreement", governing rights and obligations of the Parties concerning the construction, operation and monitoring of the cooling canal system for FPL's power generating plant at Turkey Point in Miami-Dade County, Florida; and

2. WHEREAS, the Original Agreement has been supplemented and amended on four separate occasions; the First Supplemental Agreement having been executed on October 21, 1974; the Second Supplemental Agreement having been executed on August 14, 1975; the Third Supplemental Agreement having been executed on September 10, 1976; and the Fourth Supplemental Agreement having been executed on July 15, 1983 (the "1983 Agreement") and the Original Agreement together with the four Supplemental Agreements are hereinafter collectively referred to as the "Prior Agreements"; and

3. WHEREAS, the 1983 Agreement superseded the previous agreements. The 1983 Agreement provides that the purpose of the interceptor ditch system, which is part of the overall cooling canal system as depicted on the map attached hereto as Exhibit "A", made a part hereof, and located between the most westward cooling canal and Levee 31E, is to restrict movement of saline water from the cooling canal system westward of Levee 31E adjacent to the cooling canal system to those amounts which would occur without the existence of the cooling canal system; and

4. WHEREAS, the "cooling canal system," as referred to in this Agreement, is also referred to in Prior Agreements and related documents as the "cooling water system" and "cooling system;" and

5. WHEREAS, under the Prior Agreements, including the 1983 Agreement, FPL

has had continuing obligations to monitor for impacts of the cooling canal system on the water resources of the DISTRICT in general and on the DISTRICT'S facilities and operations in particular and to implement new operating criteria and/or engineering measures if the objectives of the 1983 Agreement are not being met.

6. WHEREAS, under the 1983 Agreement, those monitoring obligations include determining whether saline water has moved westward of Levee 31E; and

7. WHEREAS, as reasonable assurances for the DISTRICT's recommendation of approval of FPL's 2008 Uprate of Turkey Point Nuclear Units 3 and 4 ("Uprate Project"), FPL submitted information concluding that its operation of the interceptor ditch prevents seepage from the cooling canal system from moving westward of Levee 31E thereby maintaining fresh or potable water west of the interceptor ditch (FPL Turkey Point Units 3 and 4 Uprate Application, 2008, section 2.3.4.1); and

8. WHEREAS, based on FPL's assurances in the 2008 Uprate Certification application, the DISTRICT recommended approval of the Uprate Project conditioned on imposition of the consolidated three agency Condition of Certification X in the Power Plant Site Certification for the FPL Turkey Point Plant Units 3 and 4 Nuclear Power Plant Unit Combined Cycle Plant # PA 03-45 ("Certification"), requiring FPL to execute a SFWMD approved Fifth Supplemental Turkey Point Agreement ("Fifth Supplemental Agreement" or "Agreement") and to revise FPL's monitoring obligations for incorporation into the Agreement in a revised monitoring plan; and

9. WHEREAS, the DISTRICT'S evaluation of recent monitoring data indicates that the interceptor ditch may not be effective in restricting the movement of saline water westward from the cooling canal system; and

10. WHEREAS, as a necessary first step in evaluating existing conditions and, if necessary, identifying potential solutions to abate, mitigate, or remediate the movement of saline water and other water quality and ecological impacts from the cooling canal system, a full delineation of any historical and current ecologic, surface water and groundwater impacts, including, but not limited to, delineation of impacts westward of the Levee 31E and eastward of Turkey Point into Biscayne Bay, from the operation of the cooling canal system since 1972, as well as potential for future impacts of the cooling canal system, is needed; and

11. WHEREAS, FPL, the DISTRICT, Florida Department of Environmental Protection ("DEP"), and Miami-Dade County Department of Environmental Resource Management ("DERM") developed a revised monitoring plan, the Turkey Point Plant Groundwater, Surface Water, and Ecological Monitoring Plan (the "2009 Plan"). The 2009 Plan is attached hereto as Exhibit "B" and made a part hereof; and

12. WHEREAS, the 2009 Plan identifies monitoring for the purpose of delineating current ecologic, surface water and groundwater impacts, from the operation of the cooling canal system on the water resources of the DISTRICT in general and the

facilities and operations of the DISTRICT, including, but not limited to, delineation of impacts westward of the Levee 31E and eastward of Turkey Point into Biscayne Bay, and to assess whether mitigation, abatement, and other remedial measures would be necessary; and

NOW THEREFORE, for good and valuable consideration as set forth herein, the Parties hereto agree as follows:

I. RECITALS and EFFECTIVE DATE OF THIS AGREEMENT

The above recitals are true and correct and incorporated herein as a material and integral part of this Agreement. The Effective Date of this Agreement shall be the last date the Agreement is signed by the Parties.

II. OBLIGATIONS OF THE PARTIES

(A) INTERCEPTOR DITCH SYSTEM OPERATION

1. FPL shall operate the interceptor ditch system to restrict movement of saline water from the cooling water system westward of Levee 31E adjacent to the cooling canal system to those amounts which would occur without the existence of the cooling canal system.

2. The operating criteria and procedures for the interceptor ditch system have been established by FPL in the 1983 Agreement as the manual designated "THE THIRD REVISED FLORIDA POWER & LIGHT, COMPANY, TURKEY POINT, FLORIDA, INTERCEPTOR DITCH OPERATION PROCEDURES" (Interceptor Ditch Operation Procedures). These criteria and procedures are attached hereto as Exhibit "C" and made a part hereof. The Parties shall revise these procedures within six (6) months from the effective date of this Agreement.

3. FPL shall operate the interceptor ditch in accordance with the Interceptor Ditch Operation Procedures subject to the provisions of Paragraph II(D)., herein, which may require revision of such operations.

4. Revisions to the Interceptor Ditch Operation Procedures as may be proposed by FPL and agreed to by the Executive Director of the District or his/her designee may be accomplished by letter, for incorporation into Exhibit C without having to amend this Agreement.

5. FPL shall maintain pump operation logs in a mutually acceptable form for each interceptor ditch pumping installation and electronically transmit such pump

operation logs to the DISTRICT in the manner set forth in the Interceptor Ditch Operation Procedures and shall continue maintenance and transmittal of such logs for the duration of the operation of the Interceptor Ditch System.

6. Under this Section, the Parties shall have all rights identified under Paragraph II(E)7.

(B) WATER TRANSFER FACILITIES

1. FPL has accepted on its lands east of levee 31E, and is responsible for the conveyance of all excess surface waters from the drainage basin of Canal 106 and 107, as shown on attached Exhibit "D", made a part hereof, which can be delivered by Structure 20 ("S-20") regardless of time and duration of discharge and quality. For reference, the C-106 canal was originally envisioned to be part of the Central and Southern Florida system, but has since been deauthorized and as a consequence, not made part of this Agreement. C-106 notwithstanding, FPL shall, at its expense, operate and maintain the drainage system from S-20 seaward to the intersection with the Seadade Canal and must maintain the discharge capacity east of the S-20.

2. Operation of the water transfer facilities shall be in accordance with instruction given to FPL by the DISTRICT'S Director of Field Services or his designated representative. FPL shall designate an official or employee of FPL who will be responsible for the receipt of said operating instructions and for carrying them out

3. Within three months of execution of this Agreement FPL and the DISTRICT's Operations and Maintenance staff shall meet to identify required actions for maintaining that portion of the C-107 canal east of the L-31 E and downstream of S-20. FPL shall comply with such requirements, including providing a maintenance plan documenting required actions, in a timely manner.

4. Under this Section, the Parties shall have all rights identified under Paragraph II(E)7.

(C) MONITORING PROVISIONS

1. FPL shall commence implementing the 2009 Plan on the Effective Date of this Agreement and shall implement the 2009 Plan in accordance with its terms. FPL shall continue the monitoring and reporting in accordance with the 2009 Plan until the DISTRICT provides written notification to FPL that monitoring can be terminated.

2. The Executive Director of the DISTRICT or his/her designee may

require revisions to the 2009 Plan, including but not limited to, additional or revised monitoring parameters or locations and a fully coupled three-dimensional ("3D") surface and groundwater density dependent model or the Interceptor Ditch Operation Procedures. Any such revisions may be accomplished by letter for incorporation into the 2009 Plan without the need to amend this Agreement.

3. FPL shall collect and submit the data as provided in the 2009 Plan. Raw data shall be provided to the DISTRICT at the time it is received by FPL. The Parties recognize that quality control and quality assurance (QA/QC) procedures will be conducted by FPL on the laboratory data after its receipt by the DISTRICT and that revisions and re-submittal of data to the DISTRICT may be necessary based on such evaluations. FPL shall retain all data electronically for the duration of the plant's operation and shall review and analyze the data so collected consistent with the objectives of this Agreement. Raw data is defined as data, either electronic or hard copy, that is received from a sensor or as laboratory results, that has not gone through any analysis or evaluation for (QA/QC)or other purposes.

4. FPL shall submit to the DISTRICT all reports required by the 2009 Plan and the Interceptor Ditch Operation Procedures (hereinafter "Reports") in a timely manner as specified in the 2009 Plan. By August 31 of each year, FPL shall submit an annual report evaluating the preceding year's events in terms of historic trends (Annual Report). The Annual Report shall include the information called for in the 2009 Plan. The Annual Report shall also contain all associated raw data in an electronic format consistent with existing District software and consistent with Paragraph II(C)3, herein. FPL shall electronically transmit the Annual Report and associated raw data in the form and manner specified in the 2009 Plan and the Interceptor Ditch Operation Procedures, as applicable.

5. All data collected by FPL or its representatives under either the Interceptor Ditch Operation Procedures or the 2009 Plan shall be maintained, archived, and presented in a web based application, as set forth in the 2009 Plan. As technology changes or improves, the DISTRICT may require revisions to the manner and format that FPL is required to submit and present its reports, summaries, and/or data. Upon written notification by the DISTRICT that the reporting manner and/or format needs to be changed to meet current technology improvements or changes, FPL shall implement those changes within sixty (60) days, or upon a mutually agreed upon timeframe, from receipt of the notification or by the next reporting period, whichever occurs first.

6. Within ninety (90) days after the DISTRICT's receipt of each Annual Report or Reports, as referenced in Paragraph II (C)(4), the DISTRICT may send a written request to FPL that FPL address concerns, questions, or omissions in the Annual Report or Reports that are reasonably related to the Annual Report or Reports. Within ninety (90) days following FPL's receipt of the request. FPL shall

provide the DISTRICT with its response(s) to each issue raised or additional information as requested. FPL's response(s) shall be required to continue to the satisfaction of the DISTRICT.

7. Within 24 hours following a DISTRICT request, FPL shall allow the DISTRICT to enter the Turkey Point property and/or access to FPL owned or maintained monitoring wells and stations to sample the cooling canal system and surface or ground water from all stations and monitoring wells utilized pursuant to the 2009 Plan. The DISTRICT and FPL shall coordinate the timing and location of sampling to account for planned or unplanned plant outages or emergencies and to protect the public health and safety. The DISTRICT agrees to abide by standard FPL health and safety precautions while on the Turkey Point property.

8. Under this Section, the Parties shall have all rights identified under Paragraph II(E)7.

(D) MITIGATION, ABATEMENT, AND OTHER REMEDIAL MEASURES

1. If the DISTRICT determines that data acquired under the 2009 Plan or other sources is insufficient to evaluate impacts of the cooling canal system, the 2009 Plan or the Interceptor Ditch Operation Procedures shall be revised, as approved by the DISTRICT, pursuant to Paragraph II (C)2.

2. If the DISTRICT, in its sole discretion, determines that the data from the 2009 Plan or from any other source: (i) indicates that the interceptor ditch is not effective in restricting movement of the saline water westward of Levee 31E in a manner that is consistent with the objective articulated above in Paragraph II(A)1; (ii) indicates harm or potential harm to the water resources of the DISTRICT in general or the DISTRICT'S facilities and operations in particular, including ecological resources; (iii) indicates the cooling canal system water is impacting water quality under Chapter 373, Florida Statutes; or (iv) indicates impacts inconsistent with the goals and objectives of the CERP Biscayne Bay Coastal Wetlands project, then the Executive Director or his/her designee shall notify FPL in writing of such determination.

3. Upon receipt of the DISTRICT notification, FPL shall immediately begin consultation with the DISTRICT to identify measures to mitigate, abate or remediate impacts from the cooling canal system and then shall promptly implement those measures approved by the District. Measures may include revising the Interceptor Ditch Operation Procedures or other measures, including timelines for implementing such measures, under Paragraph II (D)5 to abate, mitigate or remediate identified impacts. Such measures and timelines for implementation shall be subject to DISTRICT approval.

4. If the DISTRICT and FPL cannot timely agree on feasible engineering and/or hydrologic solutions to abate, mitigate or remediate the impacts identified under Paragraph II (D)2, above, then the Executive Director of the DISTRICT or his/her designee shall notify FPL in writing that the Parties have reached an impasse. Such determination of an impasse shall be made at the sole discretion of the DISTRICT. The DISTRICT may then, in its sole discretion, require FPL to implement specified mitigation, abatement and remediation measures, within DISTRICT identified timeframes.

5. Measures to mitigate, abate, or remediate impacts identified under Paragraph II (D) 2, must be in writing and may include, but are not necessarily limited to:

(a) revisions to the cooling canal system/interceptor ditch operating criteria;

(b) reasonable alterations in the design of the interceptor ditch system;

(c) alterations to the cooling canal system;

(d) any other feasible engineering and/or hydrologic measures regarding the cooling canal system;

(e) any other feasible engineering and/or hydrologic measures to mitigate for the cooling canal system's impacts to the region's water supply or remediation thereof; and/or

(f) a District approved fully coupled 3D surface and groundwater density dependent flow model incorporating FPL operational components to evaluate the best alternatives for abatement, mitigation or remediation.

If the District notifies FPL to implement any alterations as outlined in paragraphs (a) through (f) above, any such alterations shall not impair the reasonable operations of the existing power plant.

6. Consultation and implementation of DISTRICT approved measures, pursuant to Paragraph II (D), shall be undertaken and implemented within the specified time frames in the written notification from the DISTRICT.

7. Nothing contained in this Agreement shall limit the DISTRICT from availing itself of all other rights and remedies it may now or hereafter have to achieve the objective of Paragraph II (A)1 and remedy the impacts identified under Paragraph II (D). Further, the Power Plant Site Certification for the FPL Turkey Point Plant Units 3 and 4 Nuclear Power Plant and Unit 5 Combined Cycle Plant # PA 03-45, issued under the Power Plant Siting Act, Chapter 403, Florida Statutes, does not limit, alleviate, or modify the rights and obligations of the Parties under Chapter 373, Florida Statutes, or this Agreement.

8. Under this Section, the Parties shall have all rights identified under Paragraph II(E)7.

(E) GENERAL PROVISIONS

1. This Agreement supersedes and replaces the Prior Agreements.

2. This Agreement shall be binding on the Parties and, subject to the approval of the DISTRICT which may not be unreasonably withheld, their assigns and successors.

3. Should any unusual event occur or should FPL contemplate any substantive physical, mechanical, structural or operational changes to be made to the cooling canal system, then FPL shall promptly notify the DISTRICT and, if the DISTRICT shall so request, a meeting of the representatives of both FPL and the DISTRICT, shall be convened at the earliest mutually convenient time to review and analyze such unusual occurrences or such contemplated substantive physical, mechanical, structural or operational changes and to determine by mutual agreement what action shall be taken in relation thereto.

4. This Agreement shall remain in effect until terminated by the written agreement of the Parties.

5. FPL shall construct, maintain and operate all monitoring facilities and other facilities required by this Agreement, including those required by the 2009 Plan, in accordance with applicable manufacturer requirements and as otherwise necessary to provide timely, reliable and accurate data. FPL shall bear all its costs associated with its obligations under this Agreement including but not limited to the construction, operation, maintenance, monitoring, replacement, alteration, modification, or relocation of any and all existing or future facilities required under this Agreement.

6. No delay or failure by either Party to exercise any right under this Agreement, and no partial or single exercise of that right, shall constitute a waiver of that or any other right.

7. (a) This Agreement shall be governed by and construed in accordance with the laws of the State of Florida and of the United States of America and the rules and regulations promulgated under the authority thereof. In the event it is necessary for either Party to initiate legal action regarding this Agreement, venue may be in the Fifteenth Judicial Circuit or an administrative tribunal under Chapter 120, as appropriate, for claims under state law and in the United States District Court for the Southern District of Florida for any claims which are subject to jurisdiction of federal law and the federal Court.

(b) Consistent with subparagraph II (E) 7(a.), FPL maintains all rights they may have to request a proceeding under Chapter 120, Florida Statutes, to challenge any proposed or final agency action taken by the DISTRICT that affects FPL's substantial interests under Sections II (A), (B), (C), and (D) of this Agreement, including the right to petition for an administrative hearing. This specifically includes the right of FPL to file a petition requesting a formal or informal administrative hearing pursuant to Section 120.569 and 120.57, Florida Statutes, objecting to the District's agency action under Section II (D). This Paragraph does not create, modify or expand FPL's rights provided under Chapter 120, Florida Statutes. Nothing in this Agreement is intended to expand, or limit, the jurisdiction of the District. The District shall not act arbitrarily or capriciously and FPL shall not cause undue delay in implementing its obligations under this Agreement.

(c) FPL shall indemnify, save and hold the DISTRICT and its directors, employees, and contractors (the "Indemnified Parties"), harmless and will defend against any and all claims, damages, costs, expenses, and liability arising from (1) the performance by FPL or its contractors, agents, or representatives of FPL's obligations under this Agreement, or (2) the construction, operation, maintenance, replacement, alteration, modification, or relocation of any existing or future interceptor ditch, monitoring facility, water transfer facility, or abatement, remediation or mitigation made necessary by the cooling canal system or required under this Agreement. The remedy in the preceding sentence is not intended to be an exclusive and does not preclude the Indemnified Parties' exercise of any other rights or remedies available under this Agreement or which may now or subsequently exist in law or at equity. If FPL fails to perform in accordance with the terms and conditions of this Agreement, then the DISTRICT shall have the right to seek specific performance and/or an action for damages based on the reasonable cost that would be incurred by the DISTRICT, including administrative, supervisory, and staff costs, to require implementation of the mitigation, abatement, and remedial measures identified in Paragraph II (D).

8. In the event any provision of this Agreement is held or adjudged to be invalid or illegal or unenforceable by any court of competent jurisdiction: (1) such portion or provision shall be deemed separate and independent; (2) the Parties shall negotiate in good faith to restore, insofar as practicable, the benefits to each Party that were affected by such ruling; and (3) the remainder of this Agreement shall remain in full force and effect.

9. This Agreement may be executed in any number of counterparts, all of which shall together constitute one and the same instrument. A facsimile or electronic signature shall be binding.

10. This Agreement states the entire understanding and Agreement between the Parties with respect to the subject matter contained herein and supersedes any and all prior written or oral representations, statements, negotiations, or agreements.

11. Unless expressly stated herein to the contrary, nothing in this Agreement, whether express or implied, is intended to confer any rights or remedies under or by reason of this Agreement on any person other than the Parties hereto. Nothing in this Agreement is intended to relieve or discharge the obligation or liability of any third persons to any Party, nor shall any provision give any persons any right of subrogation or action over or against any Party.

12. The Parties shall comply with all applicable laws. Each Party shall be solely responsible for the payment of any fines or penalties levied as a result of such Party's non-compliance with any applicable legal requirement, except to the extent caused or contributed by the other Party.

13. In the event a dispute arises which cannot be resolved by the Parties, the Parties may agree to submit to nonbinding mediation. The mediator or mediators shall be impartial, shall be selected by the Parties, and the cost of the mediation shall be borne equally by the Parties. The mediation process shall be confidential to the extent permitted by law. Either Party may pursue its remedies available under this Agreement.

14. The Parties agree that time is of the essence in the performance of the obligations under this Agreement.

15. This Agreement shall not be construed against any Party regardless of who is responsible for its preparation. The Parties acknowledge that each contributed to, and is equally responsible for its preparation and the Agreement shall be interpreted without regard to any presumption or other rule requiring interpretation against one party or the other.

16. FPL and the District have the reciprocal and continuing obligation to notify the other of any personnel changes of its designated official or employee who will maintain monitoring installations and collect monitoring data and records. The following individuals shall serve as the designated points of contact for all issues and correspondence between the Parties arising in conjunction with this Agreement and by written notice to the other Party:

DISTRICT REPRESENTATIVE:

Title: Assistant Deputy Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406
(561) 686-8800

FPL REPRESENTATIVE:

Title: Director of Environmental Licensing
Florida Power & Light Company
700 Universe Boulevard
Juno Beach, FL 33408-0420
(561) 691-7518

17. Each Party hereto represents and warrants that the execution of this Agreement has been duly authorized by it and that this Agreement, upon execution by the other Party, is binding on and enforceable against such Party in accordance with the terms of this Agreement. No consent to such execution is required from any person, judicial or administrative body, governmental authority or any other person other than any such consent which already has been unconditionally given. Each Party hereto represents and warrants that there is no pending litigation or, to the best of their knowledge, threatened litigation that would affect its obligations to perform hereunder.

IN WITNESS WHEREOF, the Parties hereto have set their hands and seals in duplicate originals, the day and year first above written.

FLORIDA POWER & LIGHT COMPANY,
a Florida Corporation

By: _____ (Sign)

Name: Mitchell S. Ross (Print)

Title: Vice President + General Counsel - Nuclear

Date: October 16, 2009

SOUTH FLORIDA WATER MANAGEMENT BY ITS GOVERNING BOARD, a public corporation of the State of Florida

By: Carol Ann Wehle (Sign)

Name: Carol Ann Wehle (Print)

Title: Executive Director

Date: 10/14/09

SFWMD Office of Counsel Approved: By:, Sarah Nell

Date: 10/14/09

C-103
Florida City Canal
Barge Turning Basin
L-31E
C-106
Card Sound Road Canal
Perimeter Canal
C-107
S-20 Discharge Canal
Sea Dade Canal
Card Sound Canal
C-111
SaltlineBiscayne2008_Revision1 *
FPL G-III Groundwater
* "Although these data have been processed successfully on a computer system at the U.S. Geological Survey, no warranty expressed or implied is made by the U.S. Geological Survey regarding the utility of the data on any other system, nor shall the act of distribution constitute any such warranty. No responsibility is assumed by the U.S. Geological Survey in the use of these data. These data are not constituted legal documents and are not intended to be used as such."
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Prepared by : RESM
Date: 9/28/09
Map Doc.: FPL_Location_Stations.mxd

Exhibit A

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

FPL Turkey Point Power Plant Groundwater, Surface Water, and Ecological Monitoring Plan

EXHIBIT B

South Florida Water Management District
Florida Department of Environmental Protection
Miami-Dade County Department of Environmental Resource Management

October 14, 2009

sfwmd.gov

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Acronyms and Abbreviations

ALKA	Alkalinity
APT	aquifer performance test
BBAP	Biscayne Bay Aquatic Preserve
BBSW	Biscayne Bay Surface Water
BNP	Biscayne National Park
B^{+}	Boron ion
Ba	Barium
BACI	Before-After-Control-Impact
Br^{-}	Bromide ion
bsl	below sea level
C	Carbon
°C	degrees Celsius
^{12}C	Carbon isotope
^{13}C	Carbon isotope
Ca^{2+}	Calcium ion
$CaCO_3$	Calcium carbonate
Cl^{-}	Chloride ion
CCS	cooling canal system
CDMP	Comprehensive Development Master Plan
CERP	Comprehensive Everglades Restoration Plan
cm	Centimeter
COC	Conditions of Certification
CRP	continuous resistivity profiling
D	Deuterium
DERM	Miami-Dade County Department of Environmental Resource Management
DIC	dissolved inorganic carbon
DO	dissolved oxygen
DOAH	Department of Administrative Hearings

DOC	dissolved organic carbon
DOH	Department of Health
DOI	U.S. Department of Interior
DTS	distributed temperature sensing
EPA	U.S. Environmental Protection Agency
ESRI	Environmental Systems Research Institute
F^-	Fluoride ion
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FKAA	Florida Keys Aqueduct Authority
FPL	Florida Power and Light Company
fpd	feet per day
FWS	U.S. Fish and Wildlife Service
GIS	Geographic Information System
H	Hydrogen
^3H	Tritium
^2H	Deuterium
HCO_3^-	Bicarbonate ion
ID	interceptor ditch
K^+	Potassium ion
km	kilometer
LSC	liquid scintillation counting
M	meters
µm	micrometer
µS/cm	microsiemens/centimeter
MDL	maximum developable limit
Mg^{2+}	Magnesium cation
mg/L	milligrams per liter
N	Nitrogen
Na	Sodium
NAD	North American Datum
NAVD	North American Vertical Datum of 1988
NELAC	National Environmental Laboratory Accreditation Conference

NH_3	Ammonia
NH_4	Ammonium
NGVD	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic & Atmospheric Administration
NO_x	Nitrate+Nitrite
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NSF	National Science Foundation
O	Oxygen
^{16}O	Oxygen isotope
^{18}O	Oxygen isotope
ORP	oxidation-reduction potential
P	Phosphorus
pCi/L	Picocuries per liter
pH	potential of hydrogen
ppm	parts per million
PSS78	Practical Salinity Scale of 1978
psu	practical salinity units
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RECOVER	Restoration Coordination and Verification
RTK	Real-time Kinematic
$\delta^{13}C$	stable carbon isotope
$\delta^{15}N$	stable nitrogen isotope
SAV	submersed aquatic vegetation
SFWMD	South Florida Water Management District
SiO_4	Silicate
SO_4^{2-}	Sulfate anion
Spp	species (plural)
SPT	standard penetration test
Sr^{2+}	Strontium
SR^{86}	Strontium isotope
SR^{87}	Strontium isotope

(SRP)[c]	soluble reactive phosphorus
TDS	total dissolved solids
TOC	total organic carbon
(TP)[c]	total phosphorus
TKN	Total Kjeldahl nitrogen
TPGW	Turkey Point groundwater
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

1
Introduction

This Monitoring Plan (Plan) has been developed pursuant to Conditions of Certification (COC) IX and X of the Power Plant Site Certification for the Florida Power & Light (FPL) Turkey Point Units 3 and 4 Nuclear Power Plant Unit Combined Cycle Plant PA 03-45A2 (Uprate Certification). COC IX and X are attached hereto as **Appendix A**. In addition, this Plan identifies monitoring required under the "Fifth Supplemental Agreement between the South Florida Water Management District and Florida Power and Light Company" (Fifth Supplemental Agreement or 2009 Agreement). The Plan is incorporated into and made a part of the 2009 Agreement as Exhibit B.

This Plan, and any resultant actions by the Agencies and FPL, is being conducted in order to satisfy the objectives of the 1983 Agreement, the Fifth Supplemental Agreement, and the COCs.

The Plan incorporates contributions from the Florida Department of Environmental Protection (FDEP), the South Florida Water Management District (SFWMD), and Miami-Dade County's Department of Environmental Resources Management (DERM), (collectively, the Agencies), and FPL. The following Federal entities are contributing to the development and implementation of the Plan: Everglades National Park (ENP) and Biscayne National Park (BNP).

The Monitoring Plan shall provide information to determine the vertical and horizontal effects and extent of the cooling canal system (CCS) water on existing and projected surface and groundwater, and ecological conditions surrounding Turkey Point (see **Figure 1-1**). The CCS is hypersaline. There shall be a minimum of two years of monitoring of surface water, groundwater, and ecological conditions prior to the first of either Unit 3 or 4 becoming operational (defined as pre-Uprate). Monitoring shall be continuous from this pre-Uprate period throughout commencement of the Uprate (defined as post-Uprate when both Units 3 and 4 operational). Monitoring under the Plan shall continue pursuant to the 2009 Agreement and the Conditions of Certification. Prior to and following the commencement of the Uprate period, data shall be collected including monitoring for ground and surface water levels, specific conductance, temperature, CCS tracer suite constituents, tidal influences, preferential groundwater flow paths, surface and groundwater quality (including CCS constituents), rainfall, any other information necessary for the water budget, and ecological conditions.

During the pre-Uprate period, FPL shall exercise due diligence, as defined below, and due care to perform its obligations under the Plan in a timely manner. If a Force Majeure Event,

as defined below, or an unforeseen permitting delay, beyond FPL's control and FPL has pursued the permit with due diligence, as explained below, occurs causing a delay in any portion of this Plan, the Turkey Point 3 and 4 Uprate will not be delayed.

If FPL anticipates a delay in implementation of any part of this Plan due to a Force Majeure Event or an unforeseen permitting delay outside FPL's control and FPL has pursued the permit with due diligence, within fourteen days of becoming aware of such event, FPL shall notify the SFWMD in writing of the anticipated length and cause of the delay, demonstrate that such delays are due to a Force Majeure Event or outside FPL's control, and identify the probable impact on FPL's performance, the measures taken or to be taken to prevent or minimize the delay and the time table by which FPL intends to implement these measures. Any portion of the Plan that is delayed shall not cause delays in any other unrelated portion of the Plan.

FPL shall exercise commercially reasonable due diligence to overcome the Force Majeure Event. To the extent it is able, FPL shall continue to perform under this Agreement and cause the suspension of its performance to be of no greater scope and no longer duration than the Force Majeure Event requires.

However, if FPL is not able to produce two years of monitoring data due to situations beyond its control despite FPL's exercise of due diligence and due care in the timely implementation of this plan, the Agencies shall reserve the right to evaluate the data collected to date and determine if it is sufficient to establish the pre-Uprate baseline condition.

When FPL is able to resume performance of its obligations under this Agreement, it shall immediately give SFWMD written notice to that effect and shall resume performance under this Agreement after the notice is delivered.

"Force Majeure Event" shall mean any event outside the control, and not the fault, of FPL that cannot be avoided or overcome by the exercise of due diligence, including but not necessarily limited to: an act of God, war, flood, lightning, fire, hurricane, tornado, explosion, civil disturbance, or the public enemy, terrorist act, military action, epidemic, work-to-rule action, go-slow or similar labor difficulty, each on an industry-wide, region-wide or nationwide basis; but does not include economic hardship, changes in market conditions, insufficiency of funds, or unavailability of equipment or supplies.

"Due diligence" in FPL's permitting applications means that: a) FPL submitted the permit application in sufficient time for the permitting agency to act on the application and for FPL to complete the project for which the permit is necessary in order to obtain a minimum of two years of pre-Uprate data for a sufficient baseline of data; b) FPL responded in a reasonable time to requests for information needed by the permitting agency to process the application or prepare any necessary environmental analysis; and c) FPL took practicable steps to ensure completion of the project as expeditiously as possible after issuance of the permit.

FPL maintains all rights it may have under Chapter 120, Florida Statutes (F.S.). However, nothing in this Plan is intended to create, modify, or expand FPL's rights it may have under Chapter 120, F.S., or under Chapter 403, Part II, F.S. FPL maintains its right to request a proceeding under Chapter 120, Florida Statutes, to challenge any proposed or final agency action taken in implementing this monitoring plan that affects FPL's substantial interests. This specifically includes the right of FPL to file a petition requesting a formal or informal administrative hearing pursuant to Section 120.569 and 120.57, Florida Statutes. The terms of the Plan do not limit any existing regulatory authority the individual Agencies have over FPL or its Turkey Point facility. The SFWMD and the FDEP have concurrent jurisdiction to determine impacts, harm or potential harm, require or allow Plan modifications, require or allow Plan termination, and require compliance as indicated in the Conditions for Certification or the Agreement.

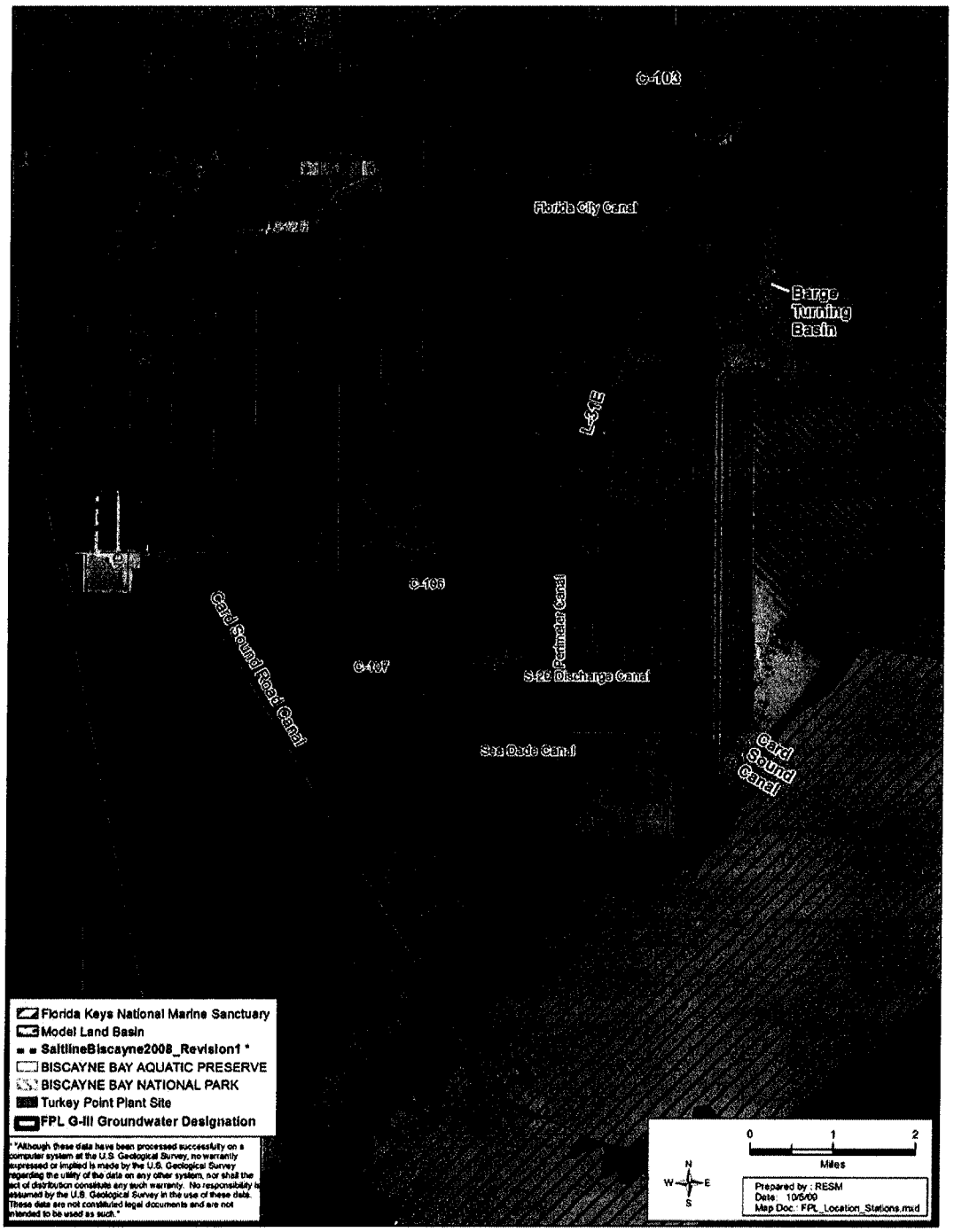

Figure 1-1. Turkey Point and surrounding area.

1.1 ADAPTIVE MONITORING APPROACH AND PLAN MODIFICATIONS

The development of this Plan was based on limited available hydrologic and ecological information. The intent of the adaptive monitoring approach is to streamline completion of the objectives related to the identification and monitoring through time of the CCS water tracers, state and county water quality constituents, water budget, and ecological effects. The adaptive monitoring approach includes the potential expansion or reduction of monitoring elements based on the findings of previous steps. Any party can propose enhancements or decreases in monitoring, however, such proposal by any party shall not be implemented without approval of the lead Agency (SFWMD).

Modification of the Plan may be proposed at any time either by the FDEP, SFWMD, DERM, or FPL. Any modification shall be approved/denied by FDEP or SFWMD, as applicable, after consultation with DERM. These procedures for Plan modification are in addition to any other regulatory enforcement authorities of the Agencies (FDEP, SFWMD, and DERM).

FPL shall implement Plan modifications within the timeframes established by the Agencies. Plan modifications during the pre-Uprate monitoring period shall be implemented expeditiously in light of the limited monitoring timeframes before the Uprate is operational.

Minor field changes, such as movement/adjustment of monitoring stations or locations over short distances, due to logistical constraints or to optimize monitoring, may be initiated after Agency approval by telephone during Plan implementation. If the adjustment is deemed more significant, SFWMD may require a written request be made prior to the modification and technical information be provided before the adjustment is made. The SFWMD shall make decisions promptly to avoid delays.

2

Monitoring Plan

2.1 MONITORING DESIGN STRATEGY

The Plan consists of an integrated system of surface, groundwater, porewater, and ecologic sampling. New monitoring wells shall be installed and a hydrogeologic investigation and surface and groundwater monitoring shall be conducted. All stage recorders and groundwater wells (top of casing) shall be referenced as described in **Appendix C** to allow comparison of results across the landscape and at depth. Where available or possible, data collected by other entities will be used to further enhance the understanding of baseline conditions and help determine impacts or potential impacts. Ecological monitoring shall be initiated in areas of presumed stress, along transects, and for spatial characterization.

The approach for monitoring of existing conditions at the FPL Turkey Point Power Plant (plant) and adjacent environments is to determine the relationship of CCS water and: a) the underlying groundwater in all directions; b) the freshwater wetlands and nearby canals, c) the adjacent saltwater wetlands; d) the eastern mangrove shoreline; e) the Biscayne Bay littoral zone; and f) within Biscayne Bay and Card Sound. The tracking of the CCS water movement is proposed using a combination of automated monitoring, along with manual data collection of water constituents and tracers of CCS water (discussed in Section 2.4).

The exact monitoring locations, as depicted in maps in the subsequent sections, may need to be adjusted based on access, environmental considerations (i.e., wetland and estuarine impacts), or other findings that warrant placement in alternative locations. The final locations of all sampling sites shall be approved by the Agencies prior to placement.

The monitoring area shall include the CCS and surrounding areas, as shown in **Figure 1-1**. Portions of the Florida Keys National Marine Sanctuary, Biscayne Bay Aquatic Preserve (BBAP), Biscayne National Park (BNP), and the Model Land Basin are also included.

2.1.1 Landward Delineation of Groundwater Plume

For groundwater beneath land (defined as being landward of the mean high water line), the vertical (to the base of the Biscayne aquifer) and horizontal extent of the plume will be determined by State and County groundwater quality standards and the CCS tracer suite, as determined by the Agencies.

The plume will be delineated starting from the CCS and continue landward if State or County groundwater quality standards are exceeded and one or more of the tracer suite values are above background, unless the Agencies agree expanded landward delineation is not necessary.

However, if at a given location, one or more of the tracer suite values are above background, but groundwater quality concentrations are lower than State and County standards, but projected to increase above those standards, continued monitoring will be required and potentially expanded to determine the zone of plume movement, as determined by the Agencies.

2.1.2 Seaward Delineation of the Groundwater Plume

For the purpose of groundwater plume delineation within and beneath Biscayne Bay and Card Sound (seaward of the mean high water line), monitoring will be conducted as described in the Plan. Criteria for seaward delineation shall be identified by the Agencies based on an evaluation of all available data, including initial monitoring conducted for a minimum of one year.

2.2 PARAMETER SUITE

Required parameters are listed in **Table 2-1** and described in the following sections of this monitoring plan: Sections 2.3.4 Groundwater Sampling; 2.4 CCS Monitoring; 2.5.2 Surface Water Collection; 2.6 Water Budget and Mass Balance Calculations; and Section 2.8 Ecological Monitoring.

2.2.1 Tracer Suite

For the purpose of identifying the vertical and horizontal extent of the CCS plume, the delineation methodology shall be based, in part, on the finding of tracer values above those which would not be present in the environment, except for a contribution of water from the CCS. The tracer shall be used to identify water originating from the CCS and differentiate it from water from other sources. A subset of the analytical parameters is collected for purposes of identification of a tracer suite. The final tracer suite shall be identified by the Agencies based on all available data, including initial monitoring data collected during a minimum of one year. Samples shall be collected quarterly at each surface and groundwater monitoring station.

At the end of the initial monitoring period, which is a minimum of one year, FPL shall submit a report to present its findings (to include raw data) regarding potential tracer monitoring parameters (tracer suite) to be used in future tracer monitoring in accordance with the reporting requirements, as specified in Section 3. The Agencies shall identify the tracer suite, applicable detection levels, background levels, and any recommended changes (i.e., increases/decreases) in sampling sites and sampling frequency. If at the end of the first

year of monitoring the Agencies determine that additional tracer monitoring parameters are needed to better assess the adequacy of specific tracers, the Agencies may require additional monitoring.

These tracer monitoring parameters are separated into three different categories and include, but are not limited to:

1. Stable Isotopes: this group includes the oxygen isotopes of water ($^{18}O/^{16}O$), hydrogen isotopes of water (D/H), strontium (Sr^{87}/Sr^{86}), and stable isotopes of carbon ($^{13}C/^{12}C$) in the dissolved inorganic carbon (DIC) in water.
2. Radioactive Isotopes: tritium (H^3).
3. Ions: listed in **Table 2-1**, plus Barium (Ba) and Iron (Fe).

The FDEP's drinking water standard for concentrations of tritium in groundwater is 20,000 pCi/L. The Agencies and FPL recognize that the concentrations of tritium from the CCS water are expected to fall below the regulatory standard used to identify the potential for human health concerns. Accordingly it is mutually understood tritium is being monitored only as a potential tracer for identifying contributions of CCS water as a source. According to the FDEP, pursuant to Chapter 62-520 and 62-550, F.A.C., the presence of tritium below 20,000 pCi/L in water does not represent a public health and safety issue.

Sample collection and analytical methodologies for potential tracer suite monitoring parameters and interpretation of tritium results are presented in **Appendix E**.

Table 2-1. Required parameters for groundwater/surface water characterization.

Field Parameters	
Temperature (T) Specific Conductance (conductivity at 25°C) in µS/cm Dissolved Oxygen (DO) Percent Oxygen Saturation	pH Oxidation-Reduction Potential (ORP) Salinity using the Practical Salinity Scale of 1978 (PSS78)
Laboratory Parameters	
CCS tracer suite [c] Hydrogen (^{3}H, ^{2}H) [Tritium, Deuterium] [d] Oxygen (^{18}O, ^{16}O) Barium (Ba)	Strontium ($^{87}Sr/^{86}S$) Carbon (^{13}C, ^{12}C) Dissolved Inorganic Carbon (DIC) Total Iron
Ions[c]: Calcium (Ca^{2+}) Sodium (Na^{+}) Magnesium (Mg^{2+}) Potassium (K^{+}) Strontium (Sr^{2+}) Chloride (Cl^{-}) Bromide (Br^{-}) Sulfate (SO_4^{2-}) Fluoride (F^{-}) Bicarbonate (HCO_3^{-}) Boron (B^{+}) Alkalinity (ALKA) Alkalinity as $CaCO_3$ Sulfides	Nutrients: Ammonia (NH_3)[c] - calculated as NH_3 Ammonium (NH_4^{+}) as N[c] Nitrate+Nitrite (NO_X) as N[c] Total Kjeldahl Nitrogen (TKN)[c] Total Nitrogen (TN)[c] - calculated Total Phosphorus (TP)[c] Soluble Reactive Phosphorus (SRP)[c] Silicate[a]
Total Dissolved Solids (TDS)[b]	Other: Gross Alpha[a]
Trace Elements[b]: Arsenic Barium Beryllium Cadmium Chromium (Hexavalent Chromium) Copper Iron Lead	 Mercury Manganese Molybdenum Nickel Selenium Thallium Vanadium Zinc

[a] Surface water CCS only.
[b] Groundwater only.
[c] Both surface and groundwater.
[d] At this time, it is FPL's position that tritium is not a suitable tracer.

2.3 GROUNDWATER MONITORING

The purpose of groundwater monitoring is described in COC IX and X of the Uprate **Appendix A** and the 2009 Agreement.

2.3.1 Groundwater Monitoring Well Locations

Fish and Stewart (1991) showed that the base of the Biscayne aquifer was approximately 106 feet below sea level (bsl) at the G-3321 well location, adjacent to the northwestern portion of the CCS and the L-31E Canal (**Figure 2-1**). The base of the Biscayne aquifer at G-3321 is shown within a few feet of the contact between overlying limestone with relatively high hydraulic conductivity [>1,000 feet per day (fpd)] and underlying sandstone with relatively low hydraulic conductivity (10 to 100 fpd) within the Tamiami Formation. The USGS is developing the hydrostratigraphic framework of the Biscayne aquifer system for Miami-Dade County (Cunningham et al 2004, 2006a, 2006b, 2008).

Based on input with the Agencies, a series of groundwater monitoring stations shall be installed. A total of 14 well clusters are included, as shown in **Figure 2-1** and **Table 2-2**. These well clusters are spatially distributed to facilitate plume monitoring and are generally aligned along transects to aid in determining concentration gradients on a sub-regional scale. The exact installation locations may need to be adjusted based on site-specific conditions (e.g., access considerations, minimization of environmental impacts) or permitting constraints.

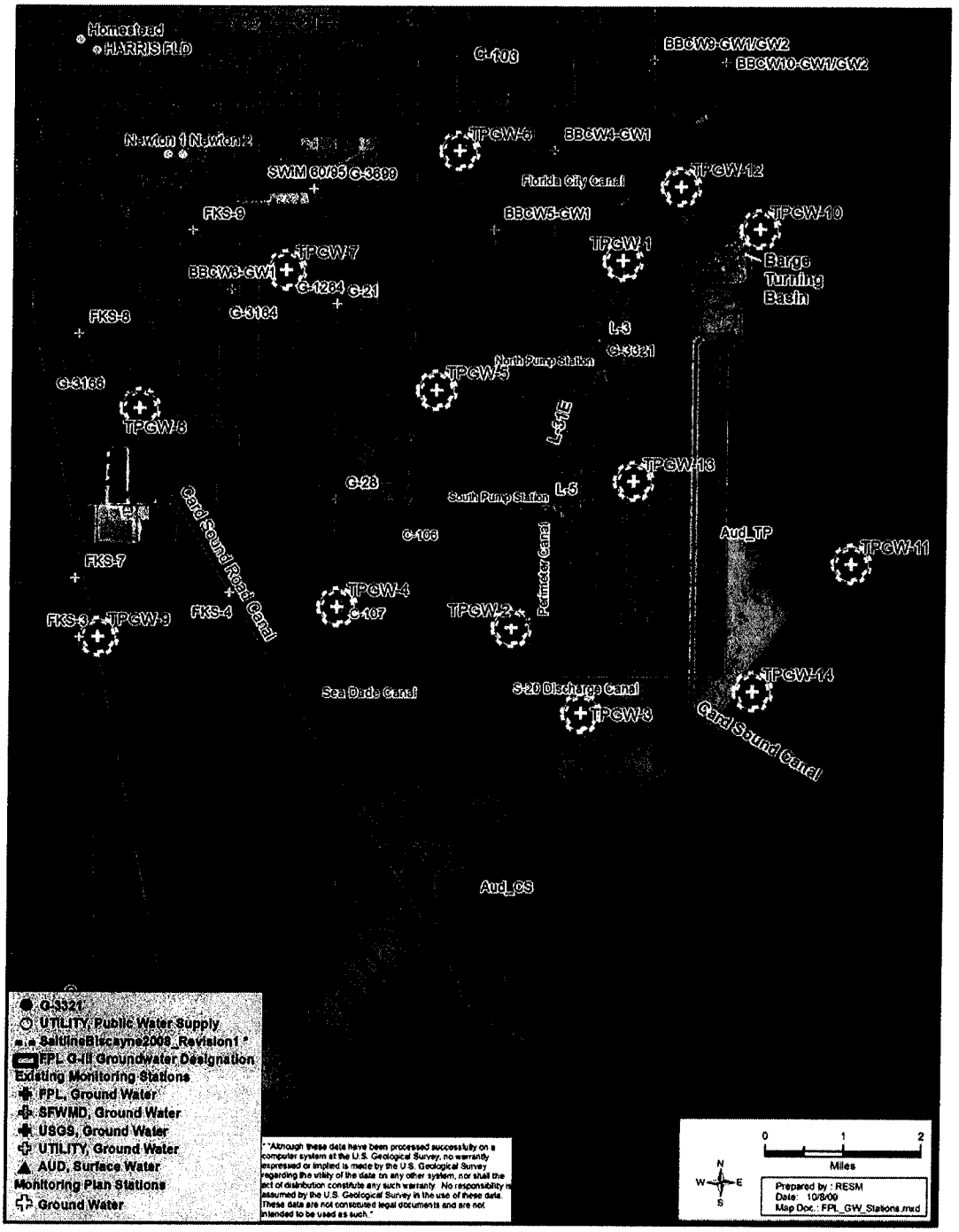

Figure 2-1. Groundwater well cluster locations.

Table 2-2. Rationale for the groundwater monitoring locations. All locations are approximate until field verification.

Location	Rationale
Groundwater stations will establish baseline conditions and delineate limits of the CCS plume. A cluster of three groundwater monitoring wells at each location will enable sampling from macroporous-permeable zones.	
TPGW-1	Monitor west/northwest of L-31E
TPGW-2	Monitor west of the south-central portion of the CCS
TPGW-3	Monitor south of the CCS
TPGW-4	Monitor westward of the CCS
TPGW-5	Monitor westward of the CCS
TPGW-6	Monitor northwest of the CCS
TPGW-7	Monitor west of the CCS and northwest of TPGW-5. Nearest well cluster to Newton Wellfield.
TPGW-8	Monitor west of the CCS and northwest of TPGW-4
TPGW-9	Reference Well
TPGW-10	Monitor offshore north of the entrance to the barge turning basin
TPGW-11	Monitor offshore of the CCS in Biscayne Bay
TPGW-12	Monitor north of the CCS
TPGW-13	Site is located in the approximate center of the CCS to monitor below the source area of the hypersaline plume.
TPGW-14	Monitor offshore of the CCS in Biscayne Bay

2.3.2 Groundwater Monitoring Well Installation

Each monitoring well cluster shall be completed with discrete screen intervals in the upper, middle, and lower portions of the Biscayne aquifer. No monitoring zone shall be placed below the Biscayne aquifer system and at least one monitoring zone shall include the base of the plume within the Biscayne aquifer system. To accomplish this task, a pilot hole shall be advanced at each cluster site to delineate to the base of the Biscayne aquifer and characterize the aquifer's characteristics and water quality. FPL shall conduct detailed geological sampling in the pilot hole of each cluster. Geological sampling of each pilot hole shall include continuous split spoon samples using the standard penetration test (SPT), in accordance with ASTM standards, and/or core sample collection from surface to total depth. Core samples shall be collected when SPTs are refused. Detailed geological samples shall be correlated to the downhole borehole videos in the final geological report.

Well development shall be conducted on all pilot holes prior to optical borehole imaging and all monitoring wells until clear, sand-free water is obtained and field parameters stabilize in accordance with FDEP criteria.

Monitoring well screen intervals shall be site-specific and shall represent macroporous and relatively high-permeability zones of the upper, middle, and lower Biscayne aquifer based on the combined results from optical borehole imaging (oriented camera system),

electromagnetic induction, caliper, flow, specific conductance, temperature, gamma ray, full wave form sonic, and borehole logging of the deepest hole (**Table 2-3**). If hydrogeologic testing of the flow intervals is not conducted at the time of well construction, such testing and data shall be provided, as determined by the Agencies, to evaluate the hydraulic conductivity of each screened flow zone in conjunction with any future model efforts.

Agency representatives shall be allowed onsite to observe field activities and shall be provided copies of field generated data upon request. The SFWMD representative(s) will pre-approve well screen intervals in the field prior to well construction. FPL shall notify SFWMD representatives in writing at least 14 calendar days, or less if agreed to by the SFWMD, before initiating well construction. If the SFWMD is notified in a timely manner and determines that no SFWMD representative will be present, FPL may proceed with the subject well construction without the SFWMD attending.

In addition, the deepest well at each cluster shall be constructed to facilitate once a year induction logging across the entire vertical extent of the well. Based on initial induction log results, a subset of wells may be selected by the Agencies for semi-annual logging. This will enable the monitoring of conductivity changes within the Biscayne aquifer and potential migration of the plume, even in zones that are not screened. Once installed, the network of wells shall be horizontally and vertically surveyed to second order accuracy and referenced to both NGVD and NAVD (**Appendix C**). **Appendix D** presents well construction requirements, which will facilitate electromagnetic induction logging.

Table 2-3. Borehole logging methods, descriptions of the properties measured, and types of data obtained.

Type of Log	Properties Measured	Purpose
Optical borehole imaging (OBI)	Imaging of borehole	Determines the 360-degree image of borehole and identifies borehole condition and macroporous zones. Provides an oriented optical image of the borehole that compensates for tool spinning.
Electromagnetic Induction	Formation and fluid conductivity	Provides data on specific conductance within fluid and formation around the borehole.
Caliper	Borehole diameter	Borehole diameter; determines presence of voids and cavities.
Flow	Flow rate	Identifies zones of groundwater flow within borehole.
Temperature	Fluid temperature	Determines temperature variations across depth within borehole.
Gamma Ray	Rock sediment gamma radiation	Provides information on formation characteristics, including rock types and changes in lithology.
Full Wave Form Sonic	Lithology and porosity of formation	Provides information on presence and location of potential preferential flow paths.

A well construction spreadsheet supplied by the SFWMD shall be constructed and maintained. The spreadsheet shall include the following parameters: drilling method, geologic sampling method, drilling mud used, well installation date, latitude, longitude, state planar, muck (ground) elevation, ground surface elevation, measuring point at top of casing, depth from top of casing, depth at top of screen, screen length, well construction material, screen slot size, gravel pack at screen interval, elevation at top of well screen, elevation at bottom of well screen, centralizers used, project manager, and the source of well information.

Data collected during well installation, including geological sampling (i.e., coring or SPTs), detailed lithologic logs, borehole geophysics, digital optical logs, initial induction logs, temperature and flowmeter logs, field water quality data, and well construction details shall be compiled and submitted to the Agencies within 60 days of completion of each well. In addition, a summary of well drilling procedures, geophysical logging procedures, and instrumentation used shall be provided. Based on wells installed from this monitoring effort and other subsurface geologic data, scaled geologic cross-sections, including macroporosity zone and geophysical log overlays, shall be generated and included in the report. This includes information from the induction logs that reveal zones of saline water. In addition, a plan view map showing the location of significant features shall be included. The information generated from this report will enable a better understanding of the movement of groundwater in the area and will provide the basis for interpretation of tracer and water quality monitoring.

2.3.3 Biscayne Bay Geophysical Survey

Broad-scale estimates of specific conductance and temperature of waters potentially influenced by the CCS are needed to assess the spatial extent and magnitude of this influence (including the identification of potential groundwater upwelling zones) and provide information to improve the monitoring design within the adaptive protocols of this Plan. Electromagnetic resistivity surveys can provide such broad-scale salinity estimates for both surface water and groundwater (Fitterman and Desczcz-Pan 2001; Swarzenski et al. 2006).

A boat-based electromagnetic resistivity survey shall be made over Biscayne Bay (south of the latitude of the Mowry Canal) and over Card Sound. The geophysical investigation shall be performed using a combination of continuous resistivity profiling (CRP) and distributed temperature sensing (DTS) investigation. GPS technology shall be used to establish horizontal control of the geophysical survey locations. Since water has different degrees of resistivity, a CRP survey can provide both horizontal and vertical insight of saline versus fresh versus hypersaline water. A DTS survey can provide a continuous profile of temperature over a large distance with a high degree of resolution. Its use is based on distinguishing temperature contrasts between groundwater, surface water, and potentially warmer CCS water. Relatively fine-scale tracks (less than 1 km apart) shall be made parallel from shoreline to 4 km east of the shoreline, from Card Sound Road to the Mowry Canal. South of this area, the remaining area of Biscayne Bay and Card Sound shall be coarsely surveyed with at least three transects that cross these bays eastward to Key Largo, Old

Rhodes Key, and Elliott Key. An additional track shall be made long-shore of these Keys at the eastern boundary of Biscayne Bay and Card Sound, between the southern end of Card Sound and the latitude of the Mowry Canal. The CRP survey shall be conducted from a boat with readings collected along transects. A DTS cable shall also be deployed on a grid pattern with data collected for at least two tidal cycles along the same transects. The logs of the well boreholes will be used to calibrate the results. Thus, the survey shall be initiated within three months after the Biscayne Bay wells are installed (Section 2.3.2). All available specific conductance and salinity data from the surveyed terrestrial and estuarine areas shall be used to provide the best estimates of salinity based on resistivity values.

Additional geophysical surveys may be required over the wetlands or bays in a later phase of this monitoring program to update estimated groundwater salinity distributions.

2.3.4 Groundwater Sampling

Each station shall comprise a combination of three monitoring wells at each site, designed to evaluate the extent of CCS influence and to determine hydraulic gradients (i.e., vertical and horizontal) with specific focus on macroporous hydrogeologic zones. Each monitoring well shall be instrumented and automatically monitored for groundwater levels, temperature, and specific conductance. The sensors in the monitoring wells shall be placed near the midpoint of the screened section of each well. Salinities measured by sensors shall be calculated using the PSS78.

Quarterly monitoring at each groundwater cluster shall consist of field parameters, ions, TDS, and the CCS tracer suite, as listed in **Table 2-1**. Semiannual monitoring at each groundwater cluster shall consist of all of the above, plus the nutrient parameters in the groundwater clusters (1, 2, 10, 13, and 14) labeled in **Figure 2-1**. In addition, trace elements shall be monitored semiannually for one year in the groundwater clusters (1, 2, 10, 13, and 14). If trace element concentrations exceed primary and secondary drinking water standards in groundwater samples, monitoring for these parameters shall continue and may be expanded to other stations as determined by the Agencies. All applicable samples shall be analyzed in accordance with Chapter 62-160 F.A.C. at an FDEP-approved laboratory capable of analyzing samples with a wide salinity range (including hypersaline waters).

FPL shall continue to manually collect all quarterly data (from two depths) from the existing wells L-3, L-5, G-21, G-28, and G-35 to compare the information with the new wells, which are more strategically screened. Since there are over 30 years of data from these existing wells, a comparison of the information to nearby wells shall give insight into the accuracy of the historical data. Previously, these wells were monitored quarterly with field instruments. While temperature, specific conductance, and water level shall continue to be monitored with field instruments, samples shall be collected and sent to a laboratory for analysis of the same parameters that shall be the subject of monitoring in the new wells.

To further supplement the groundwater data being collected by FPL, information collected by others, including but not limited to USGS and the FKAA, may be used upon the

Agencies' pre-approval. The Agencies will review each proposed well's applicability to the Plan based on geologic data and construction details submitted. Currently, the USGS collects chloride data on a semiannual or quarterly basis and conducts induction logs once a year from a network of coastal wells throughout Miami-Dade County. In some cases, there are only a few years of data, and in other cases, over 30 years. Some of these wells are located in the project area and are screened near the base of the Biscayne aquifer.

2.4 CCS MONITORING

The purpose of sampling within the CCS is to characterize the water. A total of seven stations are included, six along the interior boundary of the CCS, and one in the central portion of the CCS. These stations, labeled TPSWCCS-1 to TPSWCCS-7, are located both at the edge and the middle of the CCS system, as well as in the areas that are of the highest and lowest stage. These data shall provide a clear spatial and temporal understanding of the specific conductance and temperature variability within the CCS (**Figure 2-2** and **Table 2-4**).

All stations in the perimeter canals shall have a specific conductance, temperature, and depth sensor placed approximately 1 foot below the surface level, and one approximately 1 foot above the bottom of the canal. Stations in shallow water (<3 feet) shall use one water quality sensor. The site in the center of the CCS (TPSWCCS-2) shall only have one sensor approximately 1 foot above the bottom of the canal; a second sensor is not warranted due to this center canal's shallow depth (~3 feet). Sensors shall monitor for temperature and specific conductance (salinity calculated from specific conductance and temperature), which will help determine the vertical profiles in the CCS canals. Water level shall be measured at each station with a fixed sensor that is surveyed as described in **Appendix C**.

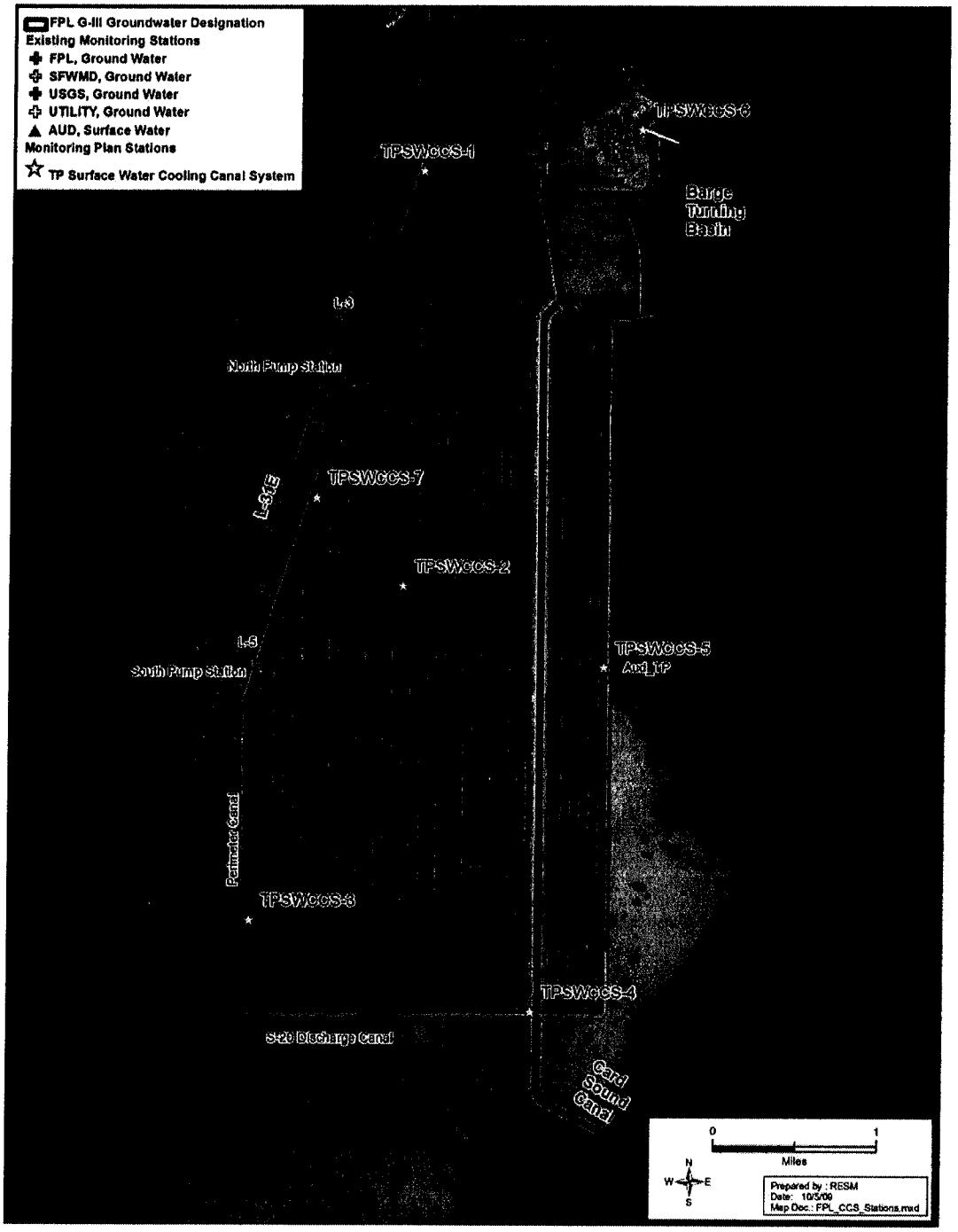

Figure 2-2. CCS monitoring stations.

In addition to the automated monitoring, quarterly monitoring at each surface water station shall consist of field parameters, major ions, and the CCS tracer suite, as listed in **Table 2-1**. Semiannual monitoring at each surface water station shall consist of all of the above parameters, as well as nutrients. The total count of alpha particle radioactivity (Gross Alpha)

shall be monitored semiannually for one year in all stations located within the CCS. All applicable samples shall be analyzed in accordance with Chapter 62-160 F.A.C. at an FDEP-approved laboratory capable of analyzing samples with a wide-range of specific conductance values, including hypersaline waters (salinity conditions in excess of typical marine conditions).

Table 2-4. Rationale for the CCS monitoring locations.

Location	Samples	Rationale
Cooling canal system (CCS) stations characterize CCS water and monitor changes. The monitoring of water will be just below the surface within the CCS and at bottom, unless otherwise noted.		
CCS	TPSWCCS-1	This site is located in Canal 32, which shall document the specific conductance and temperature of water leaving the plant, where the greatest hydraulic stage is observed and shall serve as a station associated with operation of the inceptor ditch (ID).
	TPSWCCS-2	This site is in the middle of the CCS, co-located with TPGW-13, and documents the change in specific conductance and temperature as the water travels down the CCS. This shallow site shall only have one monitoring sensor.
	TPSWCCS-3	This site is located in Canal 32 near the southwest corner of the CCS, characterizes water at this end of the CCS, and shall serve as a station associated with operation of the ID.
	TPSWCCS-4	This site is located in the Collector Canal at the southeast corner of the CCS, and characterizes water at this end of the CCS by the scrub mangrove forest.
	TPSWCCS-5	This site is located in the deepest portion of Canal E6 and characterizes the water on its return trajectory back to the plant, nearest the location where DERM has observed atypical mangroves.
	TPSWCCS-6	This location in the East Canal measures water as it enters the plant in the area of lowest hydraulic stage; this site will provide insight into the degree of exchange between the CCS and surrounding subsurface hydrology.
	TPSWCCS-7	This station is located in Canal 32, halfway down the CCS on the west side, and shall serve as a station associated with operation of the ID.

Preliminary investigation into the thermal anomaly located within the northwest side of the CCS shall be undertaken after the detailed bathymetric survey (Section 2.6.1) has been completed. This investigation includes detailed sampling and characterization and shall include surface water sampling for parameters required under the quarterly sampling. The approximate location of the thermal anomaly is Longitude 80 21 4.79 West, Latitude 25 24 47.13 North, and Longitude 80 21 5.46 West, Latitude 25 24 11.04 North. The exact location shall be measured during the bathymetric survey and shall be compared to existing reports.

2.4.1 Sediment and Porewater Sampling

Sampling within the sediment and porewater may be needed to help with the interpretation of geochemical and/or ecological findings. Such sampling may be phased in after initial Plan implementation based on ecological and/or geochemical results, as recommended by the Agencies. The determination of specific measurements and locations will be made by the Agencies, and may include sediment bulk analyses in duplicate cores per site and porewater analyses. Sample depths shall include surface (0-10 cm) and subsurface (40-50 cm) samples, where possible.

2.5 SURFACE WATER MONITORING

The purpose of surface water monitoring is described in COC IX and X of the Uprate Certification (see **Appendix A**) and the 2009 Agreement. This appendix focuses on the proposed surface water monitoring in Biscayne Bay and the nearby freshwater and tidal canals, including the L-31E Canal, tidal canal downstream of the S-20 Structure, and the Card Sound Canal. Monitoring surface water in the Model Land Basin freshwater wetlands and nearshore mangroves shall be addressed in Section 2.8: Ecological Monitoring.

2.5.1 Surface Water Locations

A total of five surface water stations are proposed in Biscayne Bay, extending offshore along the length of the CCS. BBSW-3 shall be co-located with groundwater cluster TPGW-11 (**Figure 2-3**). BBSW-1 is located in the barge cut, northeast of Barge Turning Basin. **Table 2-5** shows the locations of these surface water stations and the rationale for these locations respectively. The exact installation locations may need to be adjusted based on site-specific conditions (i.e., access considerations, minimization of environmental impacts) or permitting constraints. The surface water stations shall be located as close to shore as possible, but it is recognized that the water is quite shallow immediately east for much of the CCS.

As shown in **Figure 2-3** and **Table 2-5**, surface water monitoring stations are proposed at three non-tidal surface water locations in the L-31E Canal: one tidal location at the S-20 Discharge Canal, and one tidal location at the Card Sound Canal. A sixth location in the Card Sound Road Canal, away from the influences of the CCS, shall be monitored manually with the quarterly sampling events. This is a reference station and may indicate the Card Sound Road Canal's influence on regional saltwater intrusion and the possible impact on the area between Card Sound Road and the CCS.

The L-31E Canal is the closest freshwater water body to the CCS. The L-31E Canal stations shall serve a dual purpose of providing information for the assessment of CCS influences, as well as supporting the monitoring of water levels for ID operation.

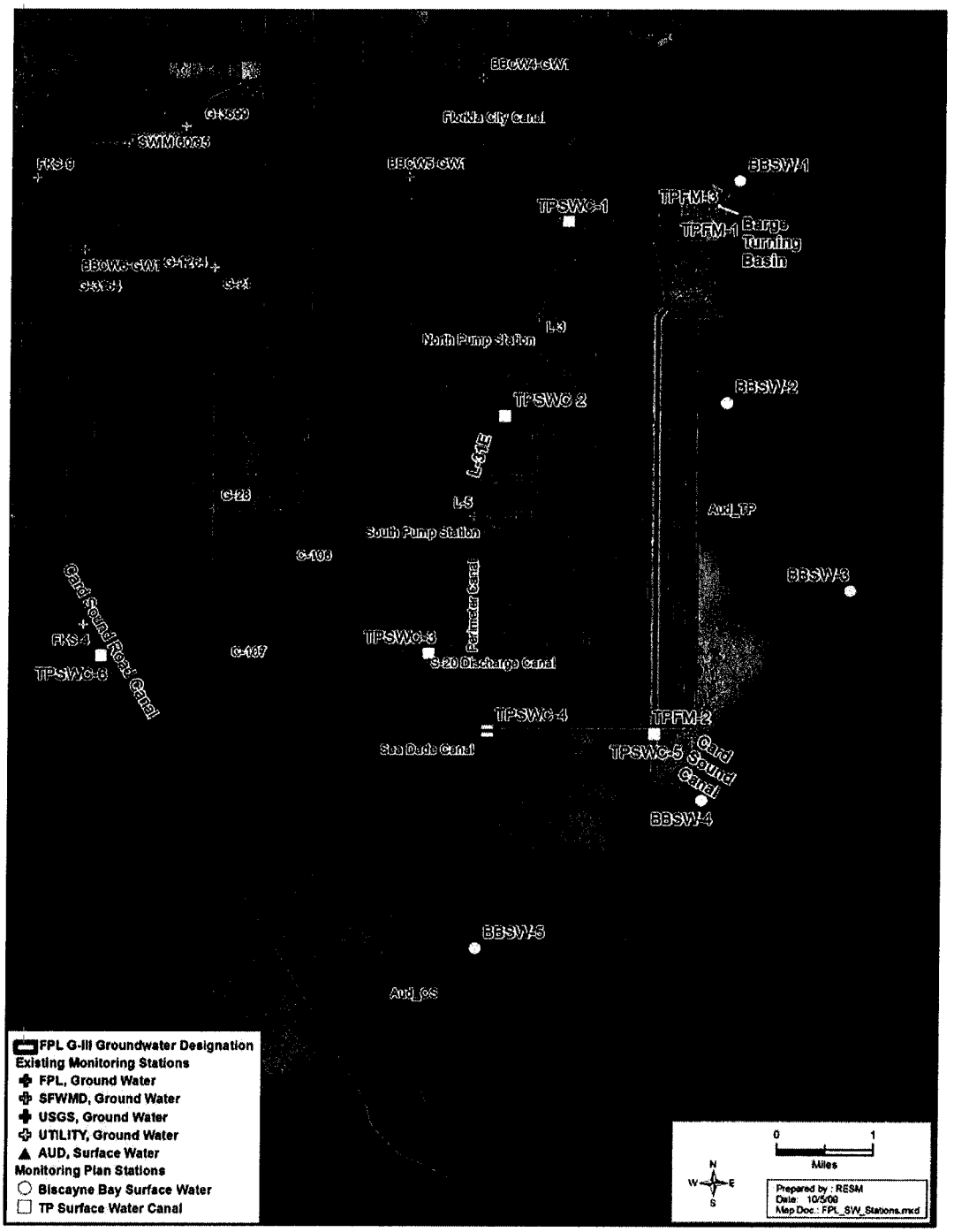

Figure 2-3. Surface water monitoring sites.

Table 2-5. Rationale for the surface water monitoring locations.

Location	Sample	Rationale
Biscayne Bay	BBSW-1	This site is in the cut and just offshore the Barge Turning Basin, northeast of the CCS.
	BBSW-2	This site is located offshore from the scrub mangrove where DERM has observed atypical mangroves to monitor for seepage from the CCS.
	BBSW-3	This site is located near the Arsenicker Keys, just offshore the mangrove forest and co-located with TPGW-11.
	BBSW-4	This site monitors the offshore portion of the CCS south of the Arsenicker Keys and near the mouth of the Card Sound Canal/historical CCS outlet, and co-located with TPGW-14. This site is located in close proximity to a Department of Health radiological monitoring site.
	BBSW-5	This site is located south of the CCS and mitigation bank.
L-31E Canal	TPSWC-1	This site is located northwest of the CCS along ID Transect A to monitor for seepage from the CCS and to aid in the operation of the ID.
	TPSWC -2	This site is located along the middle segment of the CCS and along ID Transect C to monitor for seepage from the CCS and to aid in the operation of the ID.
	TPSWC -3	This site is located by the S-20 structure, at the intersection of the L-31E and C-107 Canals to monitor for seepage from the CCS. It is also part of the ID operations located along Transect E.
S-20 Discharge Canal	TPSWC 4	This sampling station is located at the S-20 Discharge Canal. This site shall monitor the extent to which the tidal portions of the drainage canal downstream of the S-20 Structure is affected by the surface waters of the CCS, as well as the potential influence of Biscayne Bay on the canal around the CCS.
Card Sound Canal	TPSWC -5	This site is located in Card Sound Canal, just below the CCS, where manatees have been increasingly observed as reported by DERM.
Card Sound Road Canal	TPSWC-6	This site is located at Card Sound Road Canal, in the general proximity of FKS-4, and will serve as a reference station that will help document the influence of Card Sound Road Canal on groundwater. This station shall be manually monitored.

2.5.2 Surface Water Data Collection

The surface water stations in Biscayne Bay shall measure conditions just above the sediment surface. All stations, with the exception of the Card Sound Road canal station, shall be automated with one set of temperature and conductivity sensors installed horizontally, approximately 1 foot above the sediment surface (**Appendix B**). Stations in the Biscayne Bay not co-located with groundwater stations will not have telemetry and a surface water stage recorder. Sampling stations in **Table 2-5** shall be automated and instrumented similarly to the CCS stations. This will allow for the determination of water level, temperature, and specific conductance at each site.

Data from each surface water station discussed previously shall be collected at 15-minute intervals from the top of each hour and either manually or remotely uploaded to a database. This monitoring strategy shall allow a continuous assessment of specific conductance and temperature changes in Biscayne Bay and canals in the areas surrounding the FPL Turkey Point Power Plant. The stage sensors shall be tied to an established datum (NGVD and NAVD). All sensors shall be inspected and cleaned as needed to meet QA/QC requirements.

In addition to the proposed automated monitoring, quarterly monitoring at each surface water station shall consist of field parameters, major ions, and the CCS tracer suite, as listed in **Table 2-1**. Semiannual monitoring at each surface water station shall consist of all of the above parameters, as well as nutrients. All applicable samples shall be analyzed in accordance with Chapter 62-160 F.A.C. at an FDEP-approved laboratory facility capable of analyzing samples with a wide specific conductance range (including hypersaline waters).

Additional data from other entities, such as BNP, NRC, USACE, EPA, NOAA, DOI, NPS, DOH, USGS, FWS, DERM, other local governments, and the SFWMD will be added to the information collected from this effort to form a more comprehensive understanding of this area. BNP monitors salinity at 34 sites in the area at the same 15-minute sampling frequency (Bellmund et al. 2007), and the sites around the CCS (BISC08B, BISC12B, and BISC13S) will be used to complement the monitoring efforts. Information available from the sampling network in BNP, Audubon Society's nearby sites, and the SFWMD Water Quality sampling network will be reviewed for relevance and applicability in the inclusion of data reporting. Other data that will support this monitoring effort include the SFWMD operations of the S-20 structure, since that may affect the water quality at TPSWC-4.

2.6 WATER BUDGET AND MASS BALANCE CALCULATIONS

Developing a periodic water budget for the CCS is essential in evaluating the exchange, if any, between the CCS and the groundwater, fresh surface waters, Biscayne Bay waters and the atmosphere. The monitoring and reporting described herein includes updated bathymetric survey work and provides supportive data and calculations of water and material mass within, entering, and leaving the CCS. The requirements of this section are necessary to implement FPL obligations under the Conditions for Certification as well as the Agreement with SFWMD.

2.6.1 Bathymetric Survey

A key component of recharge/discharge in the water budget is a bathymetric survey because it will enable the estimation of the volume and water surface area of the CCS. A bathymetric/volumetric survey of the CCS and each segment of the interceptor ditch (ID) shall be conducted using sonar equipment, and results shall be tied to established horizontal and vertical datums as described in **Appendix C**. The positioning (x, y, and z) requires the

use of a high-accuracy GPS navigation system (or Real-Time Kinematic GPS survey grade equipment). The GPS vertical accuracy of the system shall be decimeter GPS. Since the volume of water in the CCS will vary hourly, the water surface shall be continuously monitored during the survey and all depths shall be corrected to reflect the depth below the vertical datums as described in **Appendix C**. The survey shall take into consideration the water levels collected electronically in the CCS and Biscayne Bay.

The raw sonar results of the bathymetric survey shall be converted into rectified electronic data sets with specific point elevations and coordinates and a three-dimensional rectified surface and subsurface mesh shall be developed in AutoCAD (version 14 or higher). These two surfaces must show the mean water surface elevations and actual depths within the CCS. The volumetric calculations shall be complemented by all field water level data.

2.6.2 Water Budget Parameters and Monitoring

The general water budget parameters to be collected are listed below. The units of all parameters shall be converted to similar volumes and rates.

- Daily rainfall quantities from three on-site locations and two off-site locations.
- Power plant intake and outflow velocity as measured by Acoustical Doppler current meters.
- Meteorological data (solar radiation, wind speed, wind direction, air temperature, relative humidity, or other components necessary to calculate evaporation).
- Groundwater and surface water levels in and surrounding the CCS.
- Interceptor ditch operations, flows, qualities, and rates for each segment.
- Other parameters (e.g., salinity measured from specific conductance) as needed to complete an estimated water budget.

Five rainfall stations shall be set up in and or near the CCS system. These stations will be co-located at stations TPRF-12 in the north, TPGW-13 in the center of the CCS, TPRF-L3 in the south, TPRF-L5 on the west side, and TPGW-11 on the east side (**Figure E-1**). Rainfall stations shall not be placed near structures that may obstruct rain or prevent accuracy in rainfall collection. Data from the rainfall buckets shall be collected with the same frequencies as the water level data. All data shall be transmitted to the FPL main server daily.

Permanent flow stations shall be established within the CCS using acoustic Doppler velocity meters. Volumetric and velocity measurements shall be conducted at three strategic locations in the CCS perimeter canal to assist in the estimation of water inputs and losses. The stream gauging locations shall be placed near the plant discharge (TPFM-1): at the constriction between the "C" series canals and the "E" series canals on the southeast side of the CCS (TPFM-2) and near the plant intake (TPFM-3) (**Figure 2-4**). Acoustical flow and velocity data at these stations shall be taken at each location concurrently and shall be collected at 15-minute intervals. The flow stations shall be integrated with existing CCS water quality monitoring stations when applicable. Inflows (timing, duration, and frequency) from the

Interceptor ditch shall be monitored electronically and reported with the other water budget components.

Evaporative losses shall be calculated based on a wind speed sensor co-located at TPGW-13. Additional parameters needed to calculate evaporative losses can be obtained from existing FPL meteorological stations. The wind parameter from the TPGW-13 station shall be combined with water temperature collected from the CCS surface water stations (**Figure 2-4**).

2.6.3 Water Budget Calculations

A time series volumetric spreadsheet (or equivalent) shall be developed based on actual field data. This spreadsheet shall include all measured and calculated components of the water budget. This includes water volumes and material mass exchanges across the CCS boundaries estimated on a daily time step. A salt budget, estimated from specific conductance and concurrent flow measurements, shall be a component of this exchange estimate. If the water budget spreadsheet contains summarized variables, all data and supportive information shall be included for these variables. The water budget report shall use the daily time step to calculate the monthly averages (January through December) and data shall be summarized annually.

The water budget shall include a breakdown for each contribution. This includes but is not limited to:

- Losses/gains to the atmosphere as measured by rainfall and evaporation.
- Losses/gains to the surficial aquifer vertically.
- Losses/gains to the surficial aquifer horizontally.
- Losses/gains to Biscayne Bay (differentiated between Biscayne Bay groundwater and surface water to the extent practical).

Total estimated contributions from each area of potential losses and gains (shown previously) shall be calculated. After each quarterly sampling, the water budget spreadsheet shall be updated to include the results of the laboratory analysis. Combining the results will yield total load contributions for the CCS. This shall be done for the major cations, anions, and tracer suites parameters.

The updated water budget shall be thoroughly documented using the new information, and all estimates and assumptions shall be clearly noted. The water budget shall be calculated on a monthly frequency, summarized at the end of each year, and reported as specified in and reported in the annual report. After the second year of post-Uprate (as defined in Section 1), a review of the approach and findings will be conducted.

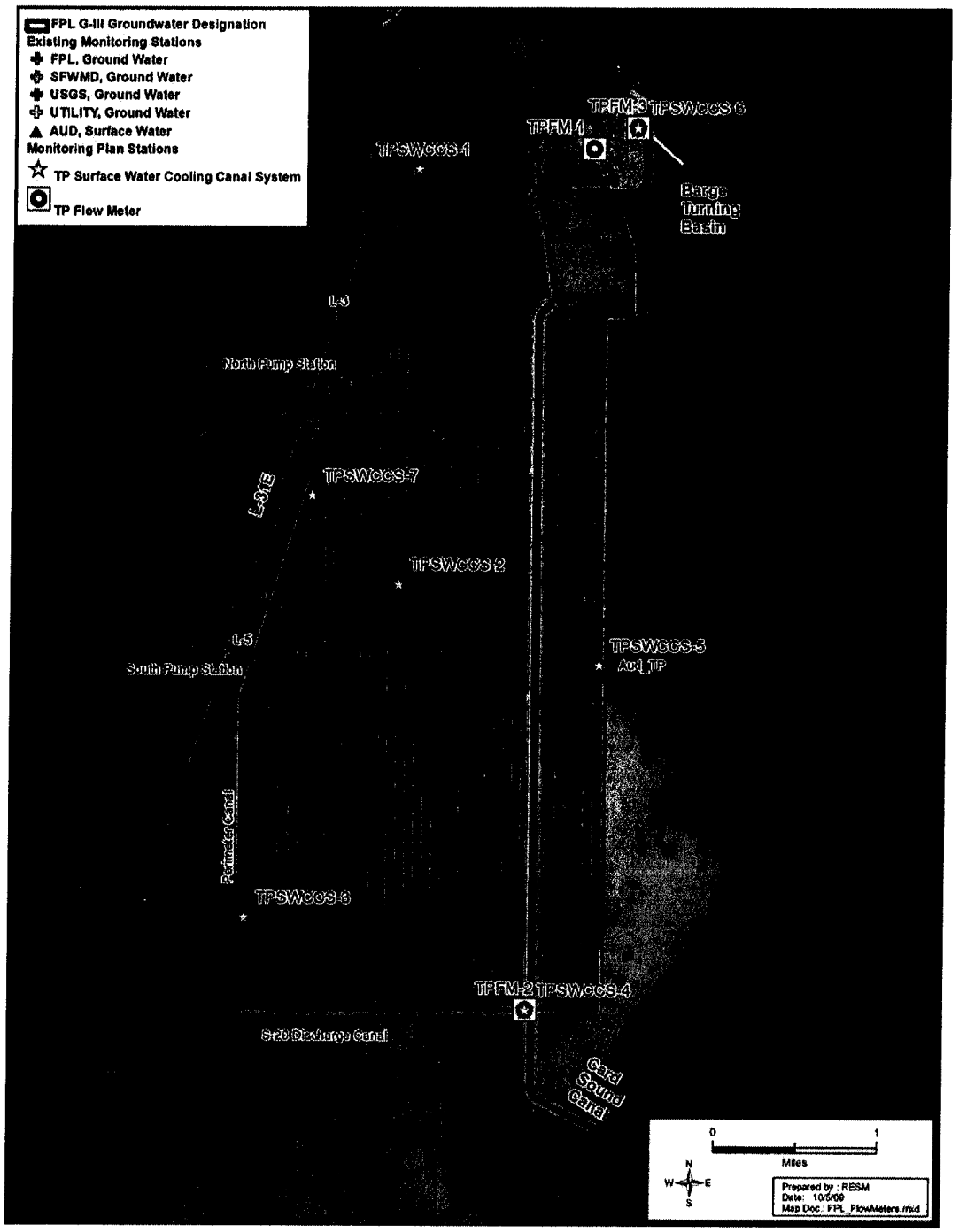

Figure 2-4. CCS flowmeter locations.

2.7 INTERCEPTOR DITCH WATER MONITORING

This Plan adds three water quality sensors at existing gauge stations in the ID coincident with Transects A, C, and E (TPSWID-1, TPSWID-2, and TPSWID-3) as shown in **Figure 2-5**. Each gauge station shall have a specific conductance, temperature, and depth sensor placed approximately 1 foot below the surface level, and one approximately 1 foot above the bottom of the ditch and be automated and instrumented similarly to the CCS stations. This will allow for the determination of water level, temperature, and specific conductance (salinity calculated) at each site. Transects B and D will still be monitored manually for stage unless automated in the future. Quarterly monitoring at each ID station shall consist of field parameters.

Data from each surface water station (Section 2.5) shall be collected at 15-minute intervals from the top of each hour and remotely uploaded to a database. This monitoring strategy shall allow a continuous assessment of stage, specific conductance, and temperature changes in the interceptor ditch. The stage sensors shall be tied to an established datum as described in **Appendix C**. All sensors shall be inspected and cleaned as needed.

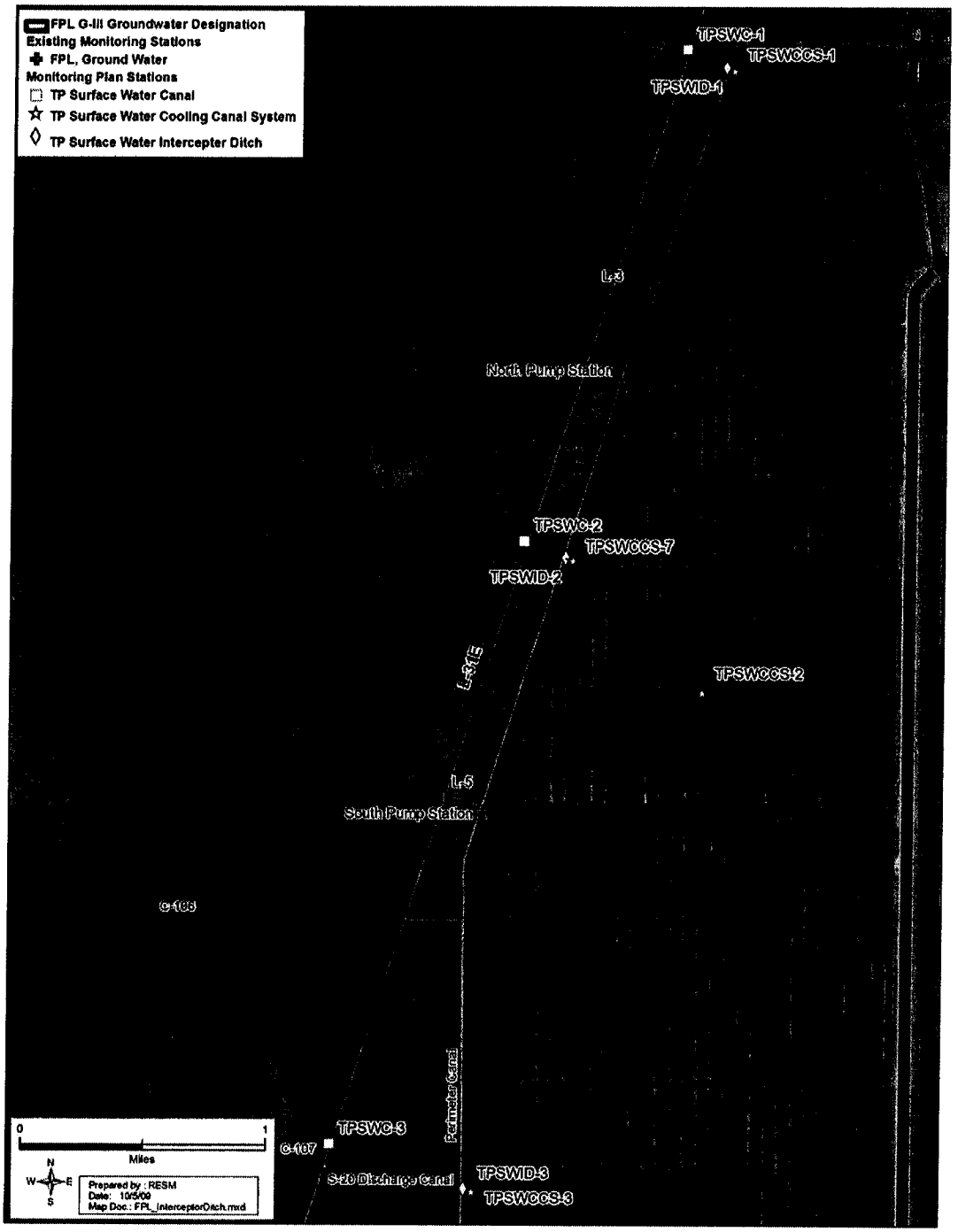

Figure 2-5. Proposed interceptor ditch monitoring sites.

2.8 ECOLOGICAL MONITORING

2.8.1 Overview and Strategy

The purpose of ecological monitoring design is to identify the existing baseline conditions and future impacts of CCS waters as described in the Conditions of Certification (COC) IX and X of the Uprate and in the Agreement (see **Appendix A**). Ecological monitoring is necessary to establish the current, pre-Uprate status of ecological conditions and biotic components, the extent to which CCS operations may be impacting conditions and components, and the extent to which Uprate implementation may result in further impacts and changes to these conditions and components now and into the future. Ecological conditions of primary, but not exclusive, interest related to CCS operations and ecological responses, are temperature, salinity, a CCS tracer suite, and nutrients. Biotic components of primary interest are marsh vegetation (i.e., freshwater graminoid and woody) in adjacent wetlands, mangroves, submersed aquatic vegetation (SAV), and benthic fauna in and adjacent to Biscayne Bay.

The strategy of this Plan is as follows:

- Spatially characterize ecological conditions via broad reconnaissance surveys. Wetland surveys shall be completed within six months of plan approval. Estuarine and bay surveys shall be conducted within one year of Plan approval and include a resistivity survey of Biscayne Bay and Card Sound (see Section 2.3.3), along with sampling of specific conductance (with salinity calculated) and a CCS tracer suite within the upper 60 cm of soils and sediments (porewater) in these bays and in the saline and freshwater wetlands adjacent to the CCS (Section 2.8.3 Initial Ecological Condition Characterization).
- Within three months of Plan approval, identify stressed areas in the vicinity of the CCS. This will be accomplished by synthesizing existing data relating to the distribution and density of vegetation using observations and cursory analysis of recent and historical aerial photographs. Aerial photographs of the region taken by the Comprehensive Everglades Restoration Plan (CERP) Restoration Coordination and Verification (RECOVER) team in April 2009 will be made available for this purpose. Analysis of such photographs combined with site visits will help determine the specific locations of sampling sites (Section 2.8.4 Broad Scale Vegetation Characterization).
- Establish transects and plots in freshwater and saline wetlands, including sampling of specific conductance and a CCS tracer suite, and nutrients in soils and sediments within six months of plan approval (Sections 2.8.5, 2.8.6, 2.8.7).
- Initiate Biscayne Bay benthic SAV and faunal assessment (Section 2.8.8 Biscayne Bay and Card Sound).

2.8.2 Design

Three zones, freshwater marshes, saline/coastal wetlands, and Biscayne Bay and Card Sound, shall be assessed for pre- and post-Uprate by establishing transects that are repeatedly measured over time. Results shall be compared with changes over this time in reference areas that are ecologically similar, with exposure to similar environmental factors other than CCS operations. The "Triangle Area," between Card Sound Road and US Highway 1 of the Model Lands, will serve as the reference area (**Figure 2-6**). It is anticipated that at least a minimum of two years of pre-Uprate monitoring (as defined Section 1) shall be performed.

Within each zone, a slightly different sampling design is recommended. A transect design is to be used within the northern, eastern, western, and southern marshes (**Figure 2-6**). Areas that have been currently identified as containing stressed or atypical vegetation patterns shall be included in the transects and subject to additional evaluation. Such stressed areas have been identified at the following locations:

1. An atypical mangrove area, east of the CCS (25.41N, 80.32W).
2. Short fringe mangroves, south of the Sea Dade Canal (25.34N, 80.33W).
3. Stunted sawgrass site, west of CCS (25.43N, 80.35W).
4. Pond area in saltwater mangrove area east of CCS (25.3799N, 80.3268W).
5. Nearshore benthic features within Card Sound (25.4072N, 80.3273W).

Additional areas that may be identified in initial site characterizations (described in Sections 2.8.3 and 2.8.4) shall also be considered in the final transect placement after consultation with the SFWMD. A transect approach shall also be used in the mangrove wetlands east of the CCS, but because of the small area involved, and the structure of existing or remnant creeks, these transects may be modified over time to spatially conform to landscape features and areas of potential impact.

Within Biscayne Bay and Card Sound, a combination of nearshore-offshore transects and nearshore areal sampling shall be used. For any of these zones, additional sites shall be added at locations where specific CCS influence is subsequently identified; concerns are noted (e.g., sites of CCS derived groundwater upwelling) and/or harm or potential harm is indicated.

2.8.3 Initial Ecological Condition Characterization

Assessment of biotic responses to CCS operations requires information on the spatial distribution of environmental conditions that affect biota and are potentially influenced by CCS water. A condition of primary interest is salinity, as calculated with specific conductance, especially soil and sediment specific conductance for vascular plants, but other conditions, such as temperature and nutrients, are important ecological factors (**Table 2-7**).

Measurement of a CCS tracer suite is essential to establish the extent of CCS connectivity if any in a given adjacent zone. Initial information on salinity distribution will be derived from two sources: 1) an electromagnetic resistivity survey of Biscayne Bay and Card Sound (Section 2.3.3); and 2) porewater surveys of freshwater and saline wetlands adjacent to the CCS and Biscayne Bay and Card Sound (described as follows). Porewater shall be analyzed for specific conductance within the root zone (about 30 cm deep, but limited to the top 60 cm), along with the CCS tracer suite analysis at a subset of locations. Results from these surveys shall identify potential zones of CCS water connectivity with surface sediments and soils via seepage and groundwater pathways, providing information on potential ecological influence of the CCS, as well as a basis to improve the monitoring design within the adaptive protocols of this Plan.

The resistivity survey of Biscayne Bay and Card Sound, described in Section 2.3.3, shall be used to locate potential upwelling zones containing CCS water within Biscayne Bay.

A broad-scale survey of porewater temperature, specific conductance, and the CCS tracer suite shall be made in adjacent wetlands during the first dry season (December through May) after Plan implementation and in Biscayne Bay and Card Sound during the first wet season (June through November) and dry season after Plan implementation. Specific conductance and temperature profiles (at 20 cm intervals to 60 cm or refusal) shall be measured in situ, using field meter and probes at more than 100 points in the wetlands, both freshwater and saline, and more than 100 points in Biscayne Bay and Card Sound. The boundaries of the surveyed wetlands shall be as far west as Tallahassee Road and Card Sound Road, as far north as the Florida City Canal and south to Card Point, and east to the estuarine shoreline. The boundaries of estuarine porewater surveys shall be as far east as 4 km offshore from the Biscayne Bay and Card Sound shoreline between the Mowry Canal and Card Sound Road. Sample sites shall be approximately even in distribution, but some samples may be taken in areas of special interest, such as apparently stressed areas, tree islands, remnant creeks, or sites where groundwater inputs are suspected. If such areas are found to be distinct from adjacent marsh areas, the transect design, described in Sections 2.8.6 and 2.8.7 may be modified and/or expanded to include these areas. Water level within wetlands, and water depth, within the Bay shall also be measured, and locations of all sampling shall be tracked and identified by GPS.

Following analysis of the survey results, and after consultation with the SFWMD, CCS tracer suite measurements shall be made from porewater about 30 cm deep at a subset of sites that, based on specific conductance results, indicate the strongest CCS influence. The CCS tracer suite measurements shall include at least 30 samples in each wetland zone, both freshwater and saline, yielding a total of 60 wetland samples, and 30 samples in Biscayne Bay and Card Sound. Wetland sampling shall include a subset of deeper samples (about 60 cm deep) to help distinguish groundwater and rainfall derived tracer sources. In Biscayne Bay and Card Sound, there shall be two separate samplings, each including 30 tracer suite analyses. One sampling shall be done during a neap tide period, January through March. A second sampling shall be performed in the wet season in June through August. Pending the results of this initial porewater survey and/or the resistivity survey, additional samplings may be conducted in a later phase and may include the tracer suite and/or additional parameters.

2.8.4 Broad Scale Vegetation Characterization

Within one month of Plan approval, a broad scale vegetation assessment shall be conducted in wetland areas adjacent to the FPL facility, by review of existing information supplemented by documented ground observation. Existing data shall be synthesized relating to the distribution and density of vegetation by cursory analysis of recent and historical aerial photographs. One set of photographs that may be used was taken by RECOVER in April 2009 and copies of these photos shall be made available to FPL upon request to the SFWMD. Additional ground observations that indicate stressed vegetation or other ecological conditions shall be made and described in field logs and recorded by photographs, including GPS locations during any initial site characterizations described in Section 2.8.3.

Vegetation mapping may be initiated at a later stage of this monitoring program if analysis of vegetation in plots along transects indicates a CCS effect on the wetlands.

2.8.5 Wetland Transect Locations

Ecological assessment of the wetlands shall focus primarily on patterns of plant community status and environmental conditions relevant to this community, along transects emanating from the CCS. The approximate locations are shown in **Figure 2-6** and the parameters are summarized in **Table 2-6**. Three east-west transects (approximately 6 km long) shall be established through the freshwater wetlands (shown in yellow in **Figure 2-6**) from the CCS into the Model Land Basin at least as far west as Tallahassee Road. Preliminary locations for these three western transects include an area of special concern, adjacent to the CCS western boundary, where observations of sparse and stressed vegetation have been made, as well as further areas to the west that do not indicate obvious stress. Two shorter transects shall run from the northern and southern CCS boundary through freshwater wetlands (in yellow) and saline wetlands (in pink) to the Biscayne Bay and Card Sound coastline. The southern transect traverses wetlands south of the CCS from the southwest corner of the CCS to Card Sound. The northern transect traverses wetlands from the northern CCS boundary to approximately the mouth of the Florida City Canal. Three additional short transects shall run from the eastern CCS boundary to the coastline in the saline mangrove wetlands (shown in pink in **Figure 2-6**) with an orientation dictated by the shape of this narrow coastal area and the location of previously identified atypical mangrove growth and mangrove mortality.

A reference transect (in turquoise in **Figure 2-6**), approximately 9 km long through freshwater and saline wetlands shall also be established in the Triangle Area. Water levels within wetlands and water depth within the Bay shall also be measured, and locations of all sampling shall be tracked and identified by GPS. Land based areas along the transects shall be referenced back to an established elevation as described in **Appendix C**. This effort does not require professional surveying. However, all measurements shall be tied back into an existing datum. This includes the use of existing benchmarks, LIDAR data, EDEN network elevations and/or ground surface elevation from nearby well surveys.

The specific site selection shall be made in consultation with the Agencies. The final location of these transects and the sample sites selected along them shall be subject to the review and approval by the Agencies within 30 days.

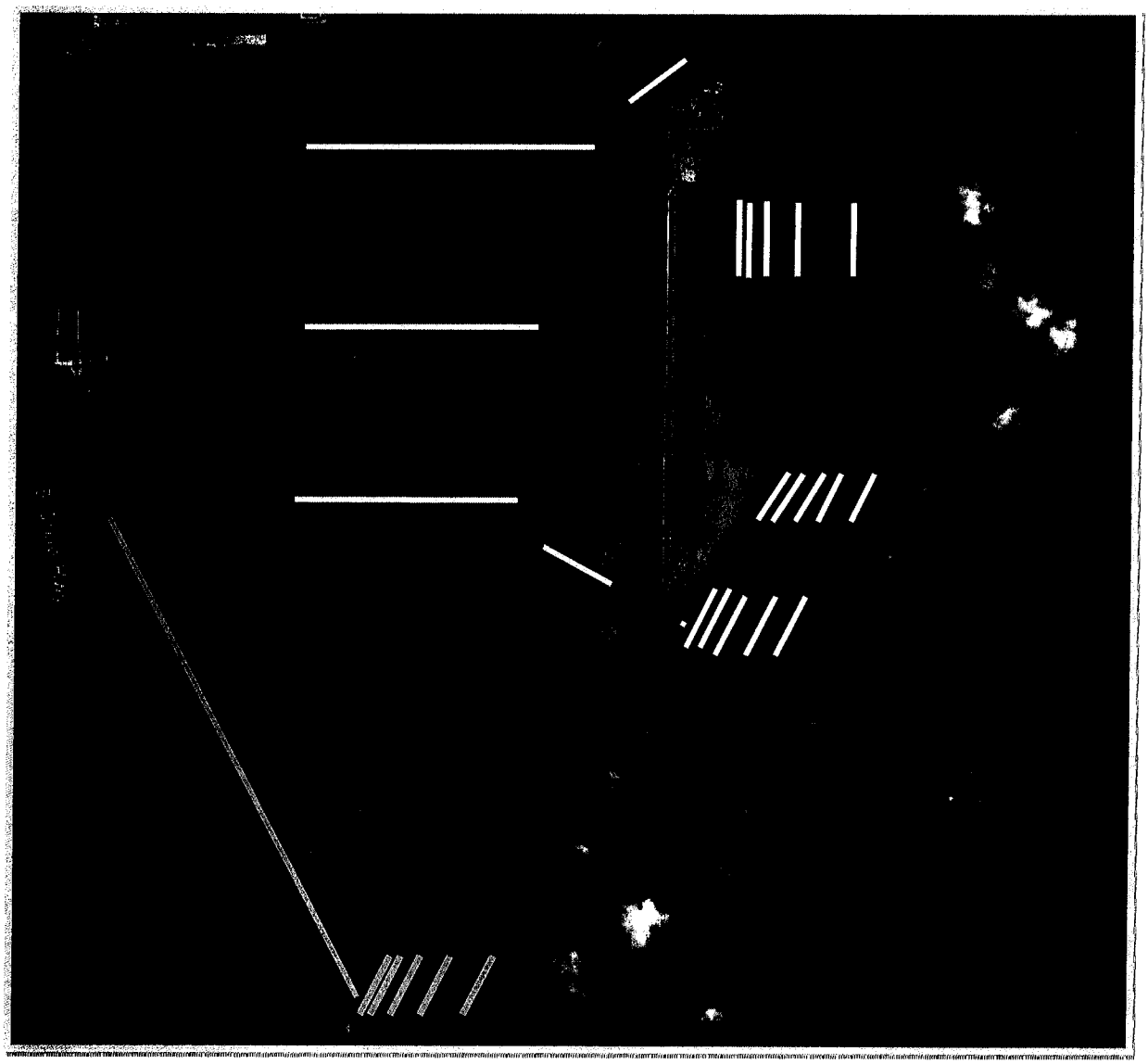

Figure 2-6. Ecological monitoring transects adjacent to the CCS. Freshwater wetlands are shown in yellow, saline wetlands in pink, Biscayne Bay and Card Sound benthic in white and associated reference transects in turquoise. Location of the interface of freshwater and saline wetlands shown here is conceptual.

2.8.6 Freshwater Wetland Transect Assessments

Sampling along all transects shall be at three spatial levels (shown in **Figure 2-6**): 20 m x 20 m major plots (turquoise squares), 5 m x 5 m subplots (pink squares), and 1 m x 1 m subplots (yellow squares). The exact locations of these plots along the transect shall be jointly determined among the Agencies after the initial dry season assessment along each transect. The measurements shall be every 500 m of field porewater specific conductance and temperature depth profiles to 60 cm depth. Each western transect shall be established with a total of four major plots, of which two are within 1.5 km of the CCS and one near the western end of the transect (**Figure 2-6**). This effort does not require professional surveying. However, all measurements shall be tied back into an existing datum. This includes the use of existing benchmarks, LIDAR data, EDEN network elevations, and/or ground surface elevation from nearby well surveys.

From each major (20m x 20m) plot, species composition and abundance, woody species cover, herbaceous species cover, and canopy height shall be measured. Percent vegetative cover shall be determined from the aerial imagery, while the other parameters shall be determined from ground assessment. Photographs for each plot shall be digitized, and classification of community types defined for each plot.

During the ground assessment, one 5 m x 5 m subplot shall be randomly established within each quadrant of the larger plot (**Figure 2-7**). Species diversity and characteristics of woody plant species (e.g., height, diameter at breast height) shall be measured within each subplot. Within the same quadrant, a 1 m x 1 m subplot shall also be randomly established in the marsh to determine the marsh species diversity and density. All sawgrass (*C. jamaicence)* culms and spikerush (*Eleocharis* spp.) stems shall be counted within each subplot. The number of leaves in ten *C. jamaicense* culms shall be counted and measured; similarly, the height of ten *Eleocharis* spp. stems shall be measured. Estimates of plant productivity shall be made in woody vegetation (5 x 5 m) plots from changes in morphology (e.g., diameter at breast height) and leaf litter production or alternative production methods, as approved by the Agencies. Plant productivity of dominant graminoid species (in 1 m x 1 m plots) shall be estimated by leaf biomass turnover measurements. The proposed methodology is consistent with methods used in Everglades National Park by the National Science Foundation (NSF) funded Long-Term Ecological Research Program based at Florida International University.

Major plot (20 m x 20 m) measurements shall be conducted once a year, while the 5 m subplot measurements shall be conducted twice a year, at the end of the wet season (June through November) and dry season (December through May). Leaf litter production shall be made quarterly or alternative production measurements made at a frequency as approved by the Agencies. The 1 m subplots shall be measured at three-month intervals.

Twice a year (i.e., once at the end of the wet and dry seasons), ten leaves per stems of each of the dominant species shall be randomly selected and collected from each subplot along each transect for morphological and physiological characterization. Leaf characteristics (i.e., leaf length, width, and thickness, water content) shall be measured prior to the leaves being dried and analyzed for C, N, and P contents, as well for $\delta^{13}C$. Changes in these plant

characteristics over time and among plants within and between transects shall be analyzed for trends and differences.

Water level and surface water (when present), temperature, and specific conductance shall be measured within one woody vegetation subplot (5 x 5 m) and one graminoid (1 x 1 m) subplot per each major plot every three months. Soil temperature and porewater, and specific conductance shall also be measured at two depths (about 30 cm and 60 cm) in these two subplots per each major plot every three months.

If specific conductance values of >725 μS/cm (derived from 250 mg/L Cl-) are observed, two subplots will be sampled and composited (within each major plot) for the tracer suite analysis from porewaters at a depth of about 30 cm. This conductance threshold is subject to revision based on the Initial Ecological Condition Characterization survey and/or other information.

Porewater nutrients (TP, SRP, NH_4, NO_X, TKN) shall be measured in one graminoid subplot (1 x 1 m) and one woody vegetation (5 x5 m) subplot of each major plot within the root zone (about 30 cm) twice per year. A composite sample may be made from the two samples. Bulk soil nutrients (TP, TN, TOC) and bulk density shall be measured initially (once) in 30 cm cores. For these measurements, composite samples shall consist of 10 cm horizons (0-10 cm, 10-20 cm, and 20-30 cm) from one 30 cm core from a graminoid subplot (1 x 1 m) and one 30 cm core from woody vegetation (5 x5 m) subplot. Additionally, specific conductance and temperature shall be measured in the L-31E Canal along the line of these transects.

As described in the Initial Ecological Condition Characterization (Section 2.8.3), the specific conductance and ecological condition of tree islands along potentially remnant streams and other sites of special interest shall be assessed in a preliminary survey. If results from this survey indicate the need for additional information, then additional transects or plots near the three established transects may be added at the discretion of the Agencies. Sampling shall be consistent with that occurring along transects, but the SFWMD will coordinate Agency review prior to initiation.

Plot site selection, plot design, and sampling along the two shorter freshwater marsh transects north and south of the CCS shall be as described previously for the western transects. However, only two major plots shall be established along each of these transects. Plot site selection, plot design, and sampling along the reference freshwater marsh transect within the Triangle Area shall be as previously described for the western transects, with a total of four plots.

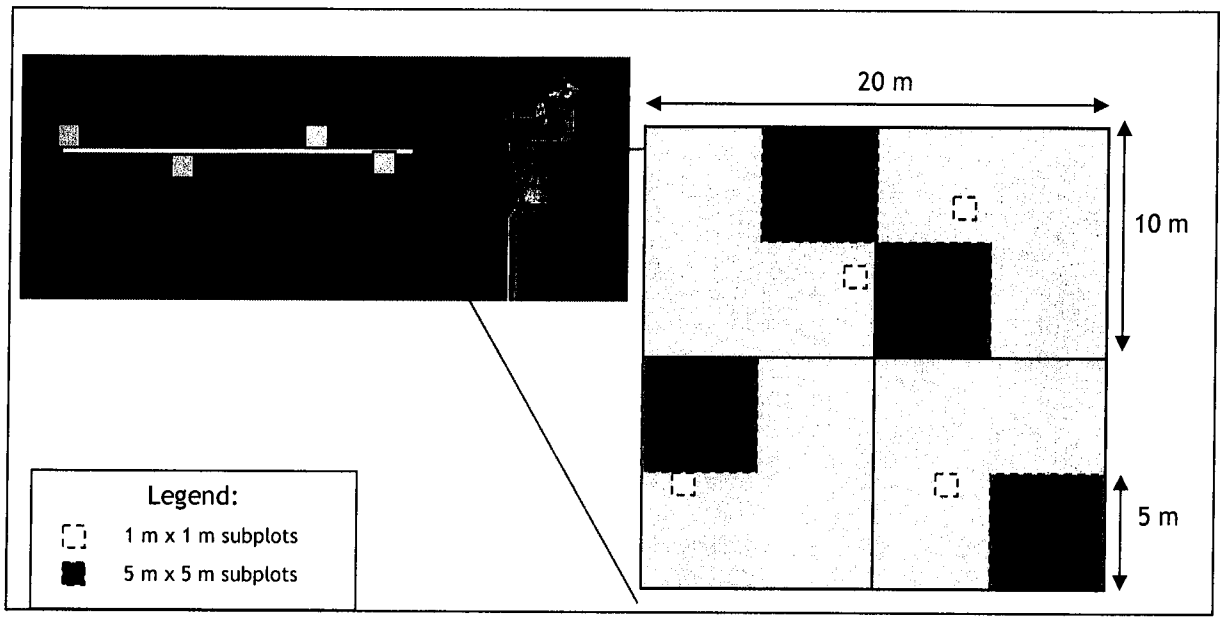

Figure 2-7. Example of a proposed sampling design for ecological monitoring along the transects.

2.8.7 Saline Wetland Transect Assessment

Assessment along the five transects containing saline wetlands (shown in pink in **Figure 2-6**) shall focus on plant community composition, morphology, productivity, and environmental conditions, similar to that described for the freshwater wetlands. The sampling design shall also be similar, with the establishment of two major (20m x 20 m) plots per transect, each with four to eight subplots, pending the presence of herbaceous vegetation. The specific location of these plots shall be determined with the approval of the Agencies after the initial site characterization survey with porewater salinity, temperature, and the tracer suite measurements as described previously. However, along the three short eastern transects, initial site survey points shall be spaced approximately 100 to 200 m apart.

The following shall be measured as previously described for freshwater wetlands: plant community composition; cover; canopy height; leaf litter production; stage; surface water temperature and specific conductance; soil temperature; porewater specific conductance; porewater nutrients; and bulk soil nutrients and density. The tracer suite shall be measured quarterly at 30 cm depth with composited samples from two subplots per each major plot. Should tracer suite results along a transect indicate potential contributions from the CCS, additional non-composited tracer suite sampling shall be conducted from two additional sites along the transect. Twice a year, at the end of the wet and dry seasons, ten leaves/stems from each of the dominant species shall be randomly selected and collected from each plot along the transect. Leaf characteristics (i.e., leaf length, width, thickness, and water content) shall be measured prior to the leaves being dried and analyzed for C, N, and P contents, as well as for $\delta 13C$. Changes in these plant characteristics over time and among plants within and among transects shall be analyzed for trends and differences.

The saline coastal portion of the reference transect within the Triangle Area (**Figure 2-6**) shall also include, at a minimum, two major plots with subplots and sampling of these subplots as described for the saline wetlands.

2.8.8 Biscayne Bay and Card Sound

Ecological monitoring shall document benthic biota of Biscayne Bay and Card Sound (i.e., SAV, benthic and epibenthic fauna), salinity (calculated with specific conductance), and a tracer suite to distinguish the extent of CCS connectivity to these conditions. Specific conductance and the tracer suite initially shall be surveyed as described previously (see Section 2.8.3). Benthic surveys and fish and invertebrate sampling, as specified in the Plan, shall use results from existing monitoring programs within Biscayne Bay, to the extent possible. Sample methodology for work in the Plan shall be consistent with other programs within Biscayne Bay and Card Sound, but is performed in locations near Turkey Point not sampled by the other programs. Data from these programs shall be used for assessment of reference area conditions.

Benthic surveys shall be made using a transect design to discern potential CCS effects as a function of distance from shore. A set of 15 fixed transects (white lines in **Figure 2-6**), each 2 km long, shall be sampled randomly along each transect twice per year. The transects shall be arrayed such that each set includes five transects approximately parallel to shore that are 0.25 km, 0.5 km, 1.0 km, 2.0 km, and 4.0 km offshore. If the area is inaccessible, transect locations may be re-evaluated in consultation with the Agencies. The array shall include four sets of these transects that project from the proposed saline wetland transects: one northern zone (offshore near the power plant), one central zone (offshore of the central CCS), one southern zone (offshore of the Sea Dade Canal - southeast CCS corner), and one reference set in northern Barnes Sound (starting north of Middle Key; in turquoise in **Figure 2-6**). Sampling shall be done to estimate the species composition, abundance and cover of benthic vegetation (SAV, including seagrass, and macroalgae) and large sessile fauna (e.g., corals and sponges), using the rapid Braun-Blanquet methodology currently used in Florida Bay and Biscayne Bay by RECOVER and other groups (Fourqurean et al. 2002). For each transect and sampling event, eight points shall be randomly selected, with measurements in four quadrats (0.25 m^2 each) per sample point. Sampling times shall be done twice per year, once during the months of March-May and once during the months of August-October.

For each benthic survey transect, light extinction shall be measured at one point per transect. Porewater specific conductance and temperature shall also be measured at each sampling point along these transects, with the tracer suite measured at a subset of points (one site per transect, selected based on the highest specific conductance and/or appearance of ecological stress). Should tracer suite results along a transect indicate potential contributions from the CCS, additional tracer suite sampling shall be conducted from two sites along each transect. Sampling depth shall reflect exposure within the seagrass root zone (upper 30 cm). Nutrients in porewater shall be measured twice per year and bulk sediments shall be measured once (initially) at two sites per transect and composited as described for the saline and freshwater wetland transects (Section 2.8.6). Seagrass leaf nutrients from the dominant species (likely

turtle grass) along each transect shall also be analyzed once per year for total nutrient content (C, N, P per dry weight), as well as $\delta^{13}C$ and $\delta^{15}N$ ratios.

Nearshore benthic fauna (i.e., small fish and epibenthic macroinvertebrates, such as pink shrimp) will be monitored using methods consistent with other sampling elsewhere in Biscayne Bay. This Monitoring Plan component shall fill a gap between Mangrove Point and Turkey Point, where no such monitoring has been done, using methods that allow quantitative spatial comparison. Sampling shall be done with 30 throw trap samples per sampling event, twice during the year in the wet season and dry season. If a contractor is used that previously has not performed such sampling, consultation with parties that use this method in other areas of the Bay shall be made to ensure sampling and reporting consistencies and allow comparison with other areas within Biscayne Bay. Supporting information, needed to interpret ecological findings, shall be collected along transects and at fish and macroinvertebrate sampling sites. Bottom water specific conductance, temperature, and water depth, along with observations regarding SAV habitat, shall be measured at each site during each sampling event.

Table 2-6. Ecologic monitoring: transect sampling.

Zone	Location(s) and number	Surface Water (SW) & Porewater (PW) Parameters	Biotic Parameters	Soil/ Sediment Parameters	Frequency
Freshwater Wetland	3 east-west transects, 2 (roughly) north-south transects, 1 reference transect (Figure 2-6). All with 3 spatial levels (20 m plots, 5 m and 1 m subplots; Figure 2-7).	SW: Water depth, temperature, and specific conductance. PW: temperature, specific conductance, tracer suite, andnutrients.	Plant community composition, cover, canopy height, productivity, leaf characteristics, C, N, P contents, and $\delta^{13}C$.	Nutrients (TOC,TN, TP), initial bulk density.	Annual, bi-annual, and once every three months, depending on plot level (see text).
Saline/ Coastal Wetland	Five transects plus reference transect (Figure 2-6). 3 spatial levels (20 m plots, 5 m and 1 m subplots; Figure 2-7).	SW: Water depth, temperature, and specific conductance. PW: temperature, specific conductance, tracer suite as indicated, nutrients.	Plant community composition, cover, canopy height, photosynthesis, leaf characteristics , C, N, P contents, and $\delta^{13}C$.	Nutrients (TOC,TN, TP), initial bulk density.	Annual, bi-annual, and once every three months, depending on plot level (see text).
Biscayne Bay and Card Sound	For SAV and sessile benthic fauna, 4 sets of 5 transects (each 2 km long). Eight random sample points per transect. For mobile epibenthic fauna, area between Mangrove and Turkey points, 30 stratified random points.	SW: Water depth, temperature, specific conductance, and light extinction PW: temperature, specific conductance, tracer suite as indicated, and nutrients.	Benthic (SAV, coral, sponge) community composition and cover, seagrass leaf nutrients (C,N,P), $\delta^{13}C$, and $\delta^{15}N$, fish and invertebrate species composition, and abundance.	Nutrients (TOC, TN, TP), bulk density.	Two times per year for biota and waters (including porewater), one time for sediments.

Table 2-7. Ecologic monitoring: initial characterization and survey sampling.

Zone	Type	Location(s) and number	Parameter(s)	Frequency
Saline and Freshwater Wetland	Porewater Survey	Spatially distributed within freshwater wetlands; minimum of 100 conductivity samples and 30 tracer suite samples, each for saline and freshwater wetland areas.	Temperature, specific conductance, tracer suite,and water depth.	1 time; initiate within the first dry season after Plan approval.
Biscayne Bay	Resistivity Survey	Biscayne Bay south of Mowry Canal, including Card Sound.	--	Within 3 months after groundwater wells within Biscayne Bay are operational.
	Porewater Survey	Spatially distributed within 4 km of shore; minimum of 100 conductivity samples and 30 tracer suite samples within the Bay.	Temperature, water depth, specific conductance, and tracer suite.	1 time in wetland and 2 times in bays (wet and dry season); initiate within 3 months after Plan approval.

3

Field Notification, Data Collection and Reporting

3.3 QUALITY ASSURANCE/QUALITY CONTROL PLAN

Pursuant to Chapter 62-160 F.A.C., preparation of a Quality Assurance/Quality Control (QA/QC) Plan shall be initiated immediately upon approval of the Monitoring Plan and submitted for the Agencies' approval within 60 days of this Plan's approval (effective date of the 2009 Agreement). The QA/QC Plan shall lay out the overall framework to ensure defensible monitoring results and quality reporting. The Plan shall outline procedures used in the field to install wells, manually collect samples, and conduct laboratory analysis. All data collected shall meet Chapter 62-160 F.A.C., SFWMD, and FDEP QA/QC requirements. More detailed information related to calibration and maintenance of probes and other automated instrumentation shall be provided. A major part of the QA/QC Plan shall describe data management procedures to ensure the data is properly recorded and reported. Detection limits for each parameter in the Plan shall be listed in the QA/QC Plan for Agency approval. Any request for long-term modification of sampling or analytical procedures shall be submitted in writing at least 90 days prior to the intended modification for review and approval by the Agencies. This shall include a proposed associated amendment of the QA/QC Plan.

To ensure appropriate methods are used to analyze saline and/or hypersaline samples, field measurements of salinity shall be logged and shall accompany all samples analyzed at laboratories. All contract laboratories shall be made aware of and be capable of analyzing constituents in saline and/or hypersaline waters. Field measurements for salinity shall be made in accordance with the Standard Method 2520B using the Practical Salinity Scale of 1978 (PSS78) (APHA 1998). Since the PSS78 is accurate to a salinity range of 0 to 40, it will be necessary to use chloride and TDS data from laboratory measurements to validate salinity values exceeding 40. The QA/QC plan shall include a methodology for performing these validations.

Laboratory analyses shall be performed by laboratories with NELAC certification (for analyses in this Plan that specify such certification) and methods shall be appropriate for samples with a wide range of salinities (i.e., from 0 to about 70 psu). Laboratory audits performed by the Agencies or Agency contractors shall be allowed for any facility analyzing samples from this monitoring program.

3.3.1 Field Sampling and Analysis Event Notifications

The lead Agency personnel or their designated contractor shall be notified of all field events no later than five days prior to initiation of field events, including but not limited to site surveys, well installation, surface and groundwater sampling, and ecological sampling and analysis. During long-term events, such as well installation, the lead Agency shall be notified for subtasks, such as well development and geophysical logging. Agency personnel shall have access onsite to observe field activities, with annual field audits by the Agencies, and FPL shall provide copies of field-generated notes and logs upon request. If field events are delayed, notification shall be provided as soon as practical and include the revised field event schedule.

3.3.2 Meetings

To facilitate communication and keep the Agencies apprised of the monitoring efforts and any significant findings, quarterly meetings for the first year, followed by semiannual meetings of FPL staff and contractors and the Agencies shall be held. Issues of concern or suggested improvements in the monitoring effort commensurate with focused objectives of the Conditions of Certification shall be discussed.

3.4 DATA COLLECTION AND REPORTING

Detailed information shall be provided to enable the Agencies to understand potential physical, chemical, and possibly ecological impacts of water movement and/or interchanges between the CCS, surface water, and groundwater. Data shall be submitted on a secure Web site and in the form of hard and electronic report copies. In accordance with the Conditions of Certification and unless stated otherwise in the Fifth Supplemental Agreement, electronic copies of all data and reports generated directly from this Monitoring Plan shall be provided to the SFWMD Director of Water Supply Management, Miami-Dade County Director of DERM, FDEP Director of the Southeast District Office, FDEP Siting Coordination Office Director, and Biscayne Bay Aquatic Preserve Manager.

Table 3-1 provides a summary of data collection efforts and frequency of collection for designated sites with continuous recorders.

Table 3-1. Sampling frequency for field and laboratory parameters.

Sample Type	Automated Field Parameters	Electronic Frequency	Field and Laboratory Parameters	Manual Frequency
CCS Water	Salinity[1], specific conductance, temperature, and water level	15 minutes	Salinity, specific conductance, temperature, tracer suite and water quality parameters	Quarterly to Semiannually (Section 2.2.4)
Groundwater Monitoring Wells	Salinity[1], specific conductance, temperature, and water level	15 minutes	Salinity, specific conductance, temperature, tracer suite and water quality parameters	Quarterly to Semiannually (Section 2.3.4)
Biscayne Bay Littoral Zone Surface Water	Salinity[1], specific conductance, temperature, and water level[3]	15 minutes	Salinity, specific conductance, temperature, tracer suite and water quality parameters	Quarterly to Semiannually (Section 2.5.2)
Canal Surface Water (L-31) (3 Stations), L-31 Discharge Canal, Card Sound Canal, Card Sound Road Canal	Salinity[1], specific conductance, temperature, and water level	15 minutes	Salinity, specific conductance, temperature, tracer suite and water quality parameters	Quarterly to Semiannually (Section 2.5.2)
Interceptor Ditch Control (3 Stations)	Salinity[1], specific conductance, temperature, and water level	15 minutes	Salinity, specific conductance, temperature	Quarterly
Ecological Monitoring	See Tables 2-6 and 2-7.			

[1] Salinity values calculated using the PSS78.
[2] All stations except for the Card Sound Road Canal Station shall be automated.
[3] Water levels recorded at stations co-located with monitoring well clusters

3.5 DATA COLLECTION

3.5.1 Automated Sample Collection

Proposed stations identified in **Figures 2-1**, **2-2**, **2-3**, **2-4**, and **2-5** of this document shall be electronically monitored by FPL. All automated time-series specific conductance, temperature, and water level data as discussed in Section 2 and provided in **Table 3-2** shall be compiled from the remote locations by telemetry. Each station as appropriate shall have a stand-alone solar power supply, onsite data loggers (with appropriate storage capacity), and the appropriate sensors needed to monitor the parameters described in **Table 3-2**. Each data logger shall initially be programmed to collect the required data at 15-minute intervals, unless otherwise noted, starting at the top of the hour based on time at the atomic clock and maintained in Eastern Standard Time. The data loggers shall also not account for Daylight Savings Time to retain consistency with SFWMD data collection efforts. Calibration of sensors shall be a function of the manufacturer's specifications. All sensors and equipment shall be maintained per the manufacturer's specifications.

Table 3-2. Proposed automated time-series data collection from surface and groundwater stations.

Parameter	Units
Temperature	degrees (Celsius)
Level	feet (NGVD and NAVD)
Specific Conductance	$\mu S\ cm^{-1}$
Salinity	psu

3.5.2 Manual Sample Collection

Data from efforts such as borehole logging, well and stage recorder surveying, manual water quality sampling, and biological monitoring shall be recorded in field notebooks prior to entry into an electronic database. As outlined in Section 2 and per **Table 3-1**, water quality samples shall be collected from groundwater wells, surface waters, and the CCS, as part of regular monitoring on a quarterly and/or semi-annual basis.

3.6 DATA REPORTING

3.6.1 Web Database

The database shall be maintained and archived by FPL on a Web portal. This server shall be backed up and archived weekly to minimize the risk of data loss. The Agencies shall be given passwords to access the data 24 hours a day/7 days a week. A web master's contact

information shall be clearly posted on the web page. The Web-based applications shall provide the following:

- Geologic and hydrogeologic data acquired during this investigation.
- Well construction data and spreadsheets.
- Downhole geophysical logs.
- Geophysical surveys.
- Water budget and material load input values, calculations, and sums.
- Bathymetric survey.
- Equipment calibration logs and maintained records.
- Manual sampling of COCs, field data sheets, analytical laboratory results with QA/QC documentation.
- Ecological data.

Summarized data shall include but is not limited to:

- Groundwater and surface water hydrographs.
- Spreadsheet summaries and graphical representations of current and historical manual sample results.
- Automated reports such as, but not limited to, water level, temperature, specific conductance, and ID pump operations, meteorological monitoring.
- Log of any plant operations change, system shut downs or deviations that might affect parameters in this investigation.
- All results generated as a result of ecological monitoring (Section 2.8) and, Geophysical Surveys (Section 2.3.3).
- Semiannual and annual reports in PDF formats.
- All other reports that pertain to this Monitoring Plan.
- Aerial imaging results.

If determined that additional information must be added or modified to enhance the Web site, FPL shall do this within 60 days of Agency notification.

3.6.2 Automated Data Reporting

The data generated from continuous electronic monitoring of meteorological, surface and groundwater stations, and ID stage and pump operations shall be accessible real-time to the SFWMD; however, the raw data shall not become official until FPL has had a chance to conduct a QA/QC review. The data shall be provided in the comma delimited format for use in the SFWMD databases. The column headings and format will be specified by the SFWMD after consultation with FPL. This shall be done within 50 days of the date of collection. FPL shall provide electronic accessibility of the results to the Agencies. All data

shall be stored in a database maintained by FPL; this server shall be backed up and archived weekly to minimize the risk of data loss. The data shall be tabulated in downloadable Excel®, comma delimited format, and where appropriate, graphically presented to allow monitoring of operations by FPL staff, quick review of time-series data variations, and sensor performance.

3.6.3 Manual Data Reporting

Data collected from manual sampling and monitoring shall be stored in a database maintained by FPL; this server shall be backed up and archived weekly to minimize the risk of data loss. Electronic copies of analytical data shall be provided simultaneously to FPL and the SFWMD; however, the data shall not become official until it has undergone a QA/QC review by FPL. A summary of QA/QC analytical results shall be posted on a secure Web site. While the length of time between collecting the data and posting it will vary depending on what is collected, FPL shall post the data within three months of collection or at minimum provide a status as to when the data shall be posted. The manual data shall be compiled with automated data into reports as outlined as follows. Data files shall be made electronically available to the Agencies.

3.6.3.1 Surveyor's Report

FPL shall obtain a licensed Florida surveyor to conduct detailed surveys at each location where monitoring is being done, except as specified in Section 2.8 (Ecological Monitoring). The data collected from this effort shall be compiled and documented in a report that documents all data and techniques. The order of surveying shall be documented (1st, 2nd, or 3rd order).

Data collected from the survey of the groundwater monitoring wells and surface water stations shall be documented. **Appendix C** provides surveying requirements for this Monitoring Plan. An electronic copy of the field notes, an electronic copy of all computation sheets, site photographs, and benchmark sheets shall also be included.

3.6.4 Geology and Hydrogeology Report

Geologic and hydrogeologic data, as outlined in this Monitoring Plan, shall be collected to better understand the movement of water within the Biscayne aquifer, in the immediate vicinity of the CCS. This is relevant because subsurface conditions may influence the extent and rate of CCS water migration.

This report shall provide relevant and available information on the lithology and hydrostratigraphy of the subsurface rocks and sediments of that area.

Data collected during well installation (Section 2.3.1), including detailed lithologic logs, borehole geophysics, optical borehole logs, initial induction logs, temperature and flowmeter logs, field water quality data, and well construction details shall be compiled and submitted

to the Agencies within 60 days of completion of each well cluster. Geophysical logs shall be provided electronically in a PDF and LAS formats. In addition, a summary of well drilling procedures, geophysical logging procedures, and instrumentation used shall be provided. Based on wells installed from this monitoring effort and other subsurface geologic data, scaled geologic cross-sections, including macroporosity zone and geophysical log overlays, shall be generated and included in the report. This includes information from the induction logs, which reveal zones of saline water. Also, a plan view map showing the location of significant features shall be included. The information generated from this report will be used to enhance understanding of groundwater movement in the area and may be used to aid in the interpretation of tracer suite and water quality monitoring data. The final geology and hydrogeology report shall be signed and sealed by a Florida-licensed geologist experienced in hydrogeologic investigation.

3.6.4.1 Biscayne Bay Geophysical Survey Report

Biscayne Bay geophysical surveys shall be initiated within three months after the Biscayne Bay wells are installed. Results from these wells shall be used to estimate salinity from resistivity values. Results from resistivity survey shall be reported within six months of completion of a survey. Reports shall include a detailed description of methodology, maps showing GPS-derived survey track line locations, and figures showing depth profiles of resistivity along track lines, and any associated measurements along the track line. Best estimates of salinity or conductivity, derived from resistivity and all available salinity or conductivity data shall be made with tabular documentation of data and calculations used for this estimate (in .xls or .xlsx format). All geophysical survey data shall be supplied to the Agencies as raw tabular data, as well as processed graphical output, and all geophysical survey reports shall be signed and sealed by a Florida-licensed geologist experienced in geophysical interpretation.

3.6.5 Initial Ecological Condition Characterization Report

Initial information on salinity distribution shall be derived from porewater surveys of the freshwater and saline wetlands adjacent to the CCS and Biscayne Bay and Card Sound. Results from these surveys shall be detailed in a report within one year of Plan approval. The report shall provide a detailed description of all sampling and analysis methods, all data (including field and laboratory measurements, with QA/QC results, such as instrument blanks and calibrations), the GPS coordinates of all sites sampled, and a map showing site locations. Climatic data from the previous month as recorded by onsite or nearby instrumentation (rain data, air temperature, etc.) shall also be indicated in the report. Results, including any calculations generated from the data, shall be provided in a spreadsheet (.xls or .xlsx format). The details and supporting data for specific transect establishment (i.e., wetland and Biscayne Bay) shall be included in this report. Field observations shall be recorded by photographs in field logs, specifying the dates and GPS coordinates, which shall also be provided in the report. The report shall identify areas of CCS water connectivity with surface sediments and soils as indicated by the CCS tracer suite, and discuss evidence

concerning the potential ecological influence of the CCS. Timelines and status of completeness for any other elements of the ecological monitoring shall also be included.

3.6.6 Semiannual and Annual Comprehensive Monitoring Reports

Semiannual and annual reports shall be provided to the Agencies during the pre-Uprate and post-Uprate monitoring periods. Comprehensive semiannual monitoring reports shall be submitted for documentation of site conditions, data generated as part of Plan implementation including but not limited to, groundwater monitoring, surface water monitoring, CCS monitoring, and ecological monitoring, as described in the Plan. The ecological component shall be a subsection of the report and shall provide all data generated in the report period as indicated in the Ecological Monitoring (Section 2.8), including all field and laboratory measurements made (with QA/QC results, such as instrument blanks and calibrations), the GPS coordinates of all sites sampled, and a map showing site sampling locations. The data and any calculations generated from the data shall be provided in electronic format (.xls or .xlsx format). The column headings and format will be specified by the SFWMD.

The report(s) shall be submitted within 90 days of the completion of each monitoring period (wet season [June through November] and dry season [December through May]) and include quarterly and semiannual monitoring results of the previous periods. The report(s) shall include a brief summary of the CCS operations and operational changes that result in changes in physical or chemical characteristics of cooling water effluent or flow rates. A description of monitoring activities, station modifications and station operational summaries, graphic summaries of electronic monitoring data with electronic data archives, spreadsheet summaries of physical parameters, sample results, sampling field forms and laboratory results, L-31E salinity profile reports, monitoring well induction logging reports, and ID monitoring logs shall be included. Annual reports submitted during the post-Uprate monitoring period shall include conclusions regarding change from the pre-Uprate monitoring period.

The collected monitoring information, shall be used to provide an analysis of the following, to the extent supported by the data: 1) estimates of the spatial extent of CCS derived plume migration and the rate and direction of this migration; 2) for a given location outside of the CCS, an estimated percent contribution of waters originating from the CCS (based on a comparison of tracer suite constituent concentrations and other select chemical constituent concentrations in CCS waters, with concentrations of such constituents in surface water and groundwater outside of the CCS); and 3) estimates of the quantity of water and salt load that the CCS produced based on the updated CCS water budget. The report shall include recommendations for installation of additional monitoring points or other Plan modifications if needed to complete the monitoring objectives. The report(s) shall include a completeness evaluation of specific Plan objectives and an updated monitoring schedule.

To estimate the rate at which water is transported or dispersed from the CCS, a water budget analysis shall be performed (Section 2.6). The results of the bathymetric survey, CCS characterization, water budget, and salt and ionic loads shall be included in the Water Budget Analysis Report. This report shall be generated annually. Following collection of data during the pre- and post-Uprate period, the salt and ionic loads shall be reassessed to see if there are any significant changes from the pre-Uprate period.

The water budget report shall include a breakdown for each of the contributions as described in Section 2.6.3 (Water Budget Calculations).

3.6.7 Comprehensive Pre-Uprate Report

A comprehensive Pre-Uprate Final Report shall be submitted for documentation of background conditions before implementation of the Uprate project. The report shall include summaries of data presentations included in semiannual reports with trends analysis, including incorporation of seasonal or other variations over the pre-Uprate monitoring period. The data and any calculations generated from the data shall be provided in electronic format (.xls or .xlsx format). The column headings and format will be specified by the SFWMD. To meet the objectives, the report shall include a completeness evaluation of specific Plan objectives and recommendations for additional investigation, if appropriate. The comprehensive Pre-Uprate Final Report will take the place of one of the annual reports.

4
Schedule

Within 60 days after the approval of the Plan (effective date of the 2009 Agreement), FPL shall submit a monitoring schedule with a detailed breakdown of timelines for implementation of monitoring components and plant Uprate activity.

Permits for installing monitoring wells and instrumentation in Biscayne National Park must be obtained and entities to conduct the work selected. It is envisioned that it will take at least six months to drill all wells, purchase instrumentation, set up the monitoring network, and be fully operational.

The Uprate project is expected by FPL to come online in the spring of 2012. Two years of data collection during the pre-Uprate (as defined in Section 1) is expected. Pre-Uprate monitoring shall continue until commencement of the Uprate. Post Uprate monitoring, as may be modified, shall continue for a time period as specified by the Agencies. During this time, both automated and manual data collection shall be conducted.

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A

FDEP's Conditions of Certification IX and X Related to the FPL Turkey Point Power Plant Uprate

IX. Biscayne Bay Surface Water Monitoring

As proposed, the Turkey Point Units 3 and 4 Uprate project may cause an increase in temperature and salinity in the cooling canal system. Field data is needed to determine impacts of the proposed changes in the Turkey Point cooling canal system on Biscayne Bay.

A. Within 180 days following certification of Units 3 & 4, FPL shall submit a Biscayne Bay Surface Water Monitoring Plan (Plan) pursuant to Chapter 62-302, F.A.C. to the FDEP Southeast District Office for review and approval. The Plan shall include, at a minimum, the following components:

   1. salinity and temperature monitoring within the surface waters of the Bay, including the Biscayne Bay Aquatic Preserve; (Specific parameters to be measured, including specific conductance and temperature, shall be sampled in accordance with Chapter 62-160, F.A.C.);
   2. a minimum of five monitoring stations located near shore in the vicinity of the FPL Turkey Point Power Plant; and three specific monitoring locations, sampling frequencies and methods, and specific parameters to be monitored.
   3. specific monitoring locations, sampling frequencies and methods, and specific parameters to be monitored.

B. This monitoring data shall be compared to data using compatible monitoring instrumentation already in place in Biscayne Bay.

C. FPL shall continue the monitoring of salinity and temperature in the cooling canals under its industrial wastewater facility permit.

D. If the Department determines that the pre- and post-Uprate salinity and temperature monitoring data indicate potential adverse changes in the surface water in Biscayne Bay, then the Department may propose additional measures to evaluate or to abate such impacts to Biscayne Bay.

E. The Plan, including monitoring locations, shall be approved prior to implementation. The Department shall indicate its approval or disapproval of the submitted Plan within 90 days of the originally submitted information. In the event that the Department requires additional information for the licensee to complete, and the Department to approve the Plan, the Department shall make a written request to the licensee for additional information no later than 30 days after receipt of the submitted information. Any changes to the approved Surface Water Monitoring Plan shall be approved by Coastal and Aquatic Managed Area personnel in consultation with other FDEP personnel. [62-160, 62-302, 62-302.700, 62-520.600, F.A.C.]

X. Surface Water, Groundwater, and Ecological Monitoring

This is a consolidated condition agreed upon by three Agencies: Department of Environmental Protection (FDEP), Miami-Dade County Department of Environmental Resource Management (DERM), and the South Florida Water Management District (SFWMD). This consolidated condition sets forth the framework for new monitoring and, as may be needed, abatement or mitigation measures, for approval of FPL's Turkey Point Units 3 and 4 Uprate Application. Specific monitoring and potential modeling parameters will be identified and implemented pursuant to a monitoring plan as part of a supplemental agreement between FPL and the SFWMD as described as follows.

A. In addition to the monitoring framework set forth in this consolidated condition, within 180 days after Certification, FPL shall execute a SFWMD approved Fifth Supplemental Turkey Point Agreement ("Fifth Supplemental Agreement") to the original 1972 Agreement between FPL and the SFWMD pertaining to FPL's obligation to monitor for impacts of the Turkey Point cooling canal system on the water resources of the SFWMD in general and the facilities and operations of the SFWMD (the "Agreement"). Subject to the SFWMD's approval, FPL shall also amend the Agreement's Revised Operating Manual as referenced in Paragraph C "Monitoring Provisions" (the "Revised Plan") of the Fourth Supplemental Agreement, dated July 15, 1983. The Revised Plan shall be incorporated into the Fifth Supplemental Agreement and shall include assessment of potential impacts to surface water and groundwater, including wetlands, as needed, in the vicinity of the cooling canal system. The specific monitoring boundaries shall be determined as part of the Revised Plan.

B. The Revised Plan shall be designed to be in concurrence with other existing and ongoing monitoring efforts in the area and shall include but not necessarily be limited to, surface water, groundwater, and water quality monitoring, and ecological monitoring to:

1. delineate the vertical and horizontal extent of the hyper-saline plume that originates from the cooling canal system and to characterize the water quality including salinity and temperature impacts of this plume for the baseline condition;
2. determine the extent and effect of the groundwater plume on surface water quality as a baseline condition; and
3. detect changes in the quantity and quality of surface and groundwater over time due to the cooling canal system associated with the Uprate project. The Revised Plan shall include installation and monitoring of an appropriate network of wells and surface water stations. The Revised Plan shall be approved by the SFWMD in consultation with the FDEP Office of Coastal and Aquatic Managed Areas, the FDEP Southeast District Office, and DERM.

C. FPL shall transmit electronic copies of all data and reports required under the Fifth Supplemental Agreement and the Revised Plan in accordance with timeframes as approved in the Fifth Supplemental Agreement to:

1. SFWMD, Director, Water Supply (or alternative transmittal procedures to be described in the Fifth Supplemental Agreement);
2. Miami-Dade County, Director, DERM; FDEP, Director, Southeast District Office;
3. FDEP Siting Coordination Office;
4. FDEP, Director, Biscayne Bay Aquatic Preserve Manager

D. If the FDEP in consultation with SFWMD and DERM determines that the pre- and post-Uprate monitoring data: is insufficient to evaluate changes as a result of this project; indicates harm or potential harm to the waters of the State including ecological resources; exceeds State or County water quality standards; or is inconsistent with the goals and objectives of the CERP Biscayne Bay Coastal Wetlands Project, then additional measures, including enhanced monitoring and/or modeling, shall be required to evaluate or to abate such impacts. Additional measures include, but are not limited to:

1. the development and application of a 3-dimensional coupled surface and groundwater model (density dependent) to further assess impacts of the Uprate Project on ground and surface waters; such model shall be calibrated and verified using the data collection during the monitoring period;

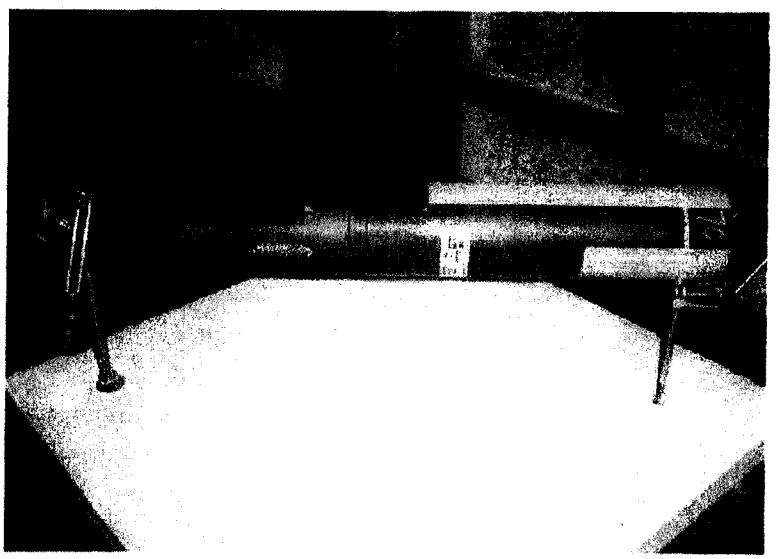
2. mitigation measures to offset such impacts of the Uprate Project necessary to comply with State and local water quality standards, which may include methods and features to reduce and mitigate salinity increases in groundwater including the use of highly treated reuse water for recharge of the Biscayne aquifer or wetlands rehydration;
3. operational changes in the cooling canal system to reduce any such impacts; and/or
4. other measures to abate impacts as may be described in the Revised Plan.

[Sections 373.016, 373.223, F.S.; Rules 40E-4.011, 40E-4.301, 40E-4.302, F.A.C.; Sections 62-302 and 62-520, F.A.C.; Section 24-42, Code of Miami-Dade County, Miami-Dade County Comprehensive Development Master Plan (CDMP) Land Use Element, Conservation Element, Intergovernmental Coordination Element, Coastal Management Element.]

B

Near Shore Sonde Deployment Methods

The near shore sites, or mangrove sites, have sondes deployed to measure salinity using differing methods. This is due to the extremely shallow water at these locations, as well as the composition of the bottom substrate. Normally the sondes are deployed in a vertical position attached to a mooring pin, which has been cemented in place by drilling a hole in the bay floor. However, at the mangrove sites, there is insufficient water for vertical deployments, so the instruments are deployed horizontally, and the bottom is composed mainly of mud, which is unsuitable for drilling. Therefore, the instruments are deployed affixed to cement paving slabs, which have been drilled in two places at opposing corners and fitted with stainless steel eyebolts that settle into the mud, with the eyes of the eyebolts well above the bottom and in the water column. The sonde is then locked to one of the eyebolts and fastened securely to both using nylon tie-wraps. This maintains a constant horizontal position, which will remain beneath the water surface even at low tide. This positioning also provides ample space for an additional sonde to be mounted simultaneously for concurrent sampling and overlapping data at deployment and retrieval times to ensure quality control. Per instruction by YSI personnel, the instruments are oriented in a way such that the sensor's hole is not facing directly down, which could cause air bubbles to accumulate and skew the salinity data.



C

Survey Parameters Collected during Groundwater and Surface Water Investigations

Data collected from the survey of the groundwater monitor well, and surface water sites shall include, but not be limited to the following:

- Latitude
- Longitude
- State Planar Coordinates North American Datum of 1983 (NAD), Florida East zone
- State Planar Coordinates NAD of 1927, Florida East zone
- Natural Ground Surface Elevation
    - Elevation in North American Vertical Datum of 1988 (NAVD)
    - Elevation in National Geodetic Vertical Datum of 1929 (NGVD)
- Elevation of bottom of surface water location
    - Elevation in NAVD
    - Elevation in NGVD
- Monitor Well Top-of-Casing Elevation
    - Elevation in NAVD
    - Elevation in NGVD
- Elevation of any nearby standing surface water at the time of surveying (15 feet radius from site)

An electronic copy of the field notes, an electronic copy of all computation sheets, site photographs, a surveyor report, and benchmark sheets shall also be included.

D

Special Requirements for an Electromagnetic Induction Well

In general, the groundwater monitoring wells shall meet normal State or Federal Regulations for monitoring wells. The USGS publication WRIR-96-4233, located on the Web, available at (http://water.usgs.gov/owq/pubs/wri/wri964233/), provides general guidelines for the installation of monitoring wells used to evaluate water quality. In addition to these general guidelines, there are some special requirements needed for a well to be logged using an electromagnetic induction probe, including:

Casing material PVC - Metal casing will interfere with the log.

Well Screen PVC - Metal screens will interfere with the log.

Well diameter generally 2" to 6" - The USGS is currently logging wells 2" to 6" in diameter. For shallow wells, 2" is acceptable. For deep wells (>150 feet), the USGS suggests 3" or 4" well diameters to make sure the probe does not get stuck. The probe is most sensitive to differences in conductivity within an 8" to 40" donut-shaped radius around the well because of bends or distortions in well casing.

Depth extending to the base of the Biscayne aquifer - This allows evaluation of changes throughout the zone of interest. Salinity is usually but not always highest at the base of the aquifer; this is generally a good depth to set the open interval. The driller needs to be careful not overshoot the bottom of the aquifer.

If the monitoring well is to be used for detecting "upconing" directly beneath a wellfield, there are alternate strategies. If only fresh water is found when drilling, finish the well at the base of the aquifer. Future upconing would most likely begin at or near the base of the aquifer.

If salt water is found when drilling, one can: (1) Stop drilling and screen the well at this depth so that the chloride level can be monitored at this depth, or (2) Keep drilling to the base of the aquifer and complete the well at this depth to evaluate the full thickness of encroachment and maximum salinity. This would allow one to determine if seawater is encroaching preferentially through just one zone or throughout the depth of aquifer. Either

way, induction logging can help detect future upconing. Option 2 describes what is happening in the aquifer, but Option 1 provides the ability to obtain a precise chloride value in mg/l.

Open Interval 5 to 10 feet - The idea of a short screen length is to be able to sample a discrete interval and avoid the effects of flow within the borehole.

Chloride Sampling - It is generally good to collect water chloride samples during drilling to determine if encroached seawater is present.

Annular Seal - Neat Cement is the best type of annular seal. A seal just above the filter pack is necessary to prevent the cement from infiltrating the filter pack. A very fine sand or bentonite is proven means of isolating the well screen.

Manhole cover - Metal is acceptable at the top of well, but no metal should be used down the hole or on the casing.

Well centralizers - Well centralizers are only acceptable if they are non-metallic; metallic screws used for well centralizers can cause problems.

Flush Mounted Finish This is usually best because the logging requires setting a tripod over the well.

Clustered wells - If wells are too close together, and one has a metal object in it, this can affect the log in the other well.

Well development - The well should be developed to clear and consolidate the filter pack. This also needs to be done to ensure that cement did not seep into the filter pack and clog it, as well as to verify that the well is not in an impermeable zone. Well development should be performed to clear up the hole prior to well installation. If there is a lot of mud or muddy water in the hole, the first few logs might detect this. Do not use salty or electrically conductive drilling fluid.

E

Tritium Sample Collection and Analysis Protocols

Introduction

The measured tritium values along with a measure of salinity (salinity, conductivity, or chlorinity) will be used in a ternary mixing model that will estimate the proportion of the three potential end members in the sample, CCS water, BBSW, and fresh groundwater. Most of the influence of the CCS on the groundwater will be through the sub-surface connection between the CCS and the Biscayne aquifer. It is possible that tritium-enriched rainfall, which originates from evaporated CCS water, could be deposited in the area immediately surrounding the CCS. Measurements of tritium in rainfall will be used to determine if tritium-enriched rainfall is occurring. If it is, the amount of this rainfall, and thus tritium, that reaches the aquifer will be estimated by taking into account the extent to which rainwater is recycled back into the atmosphere. These measurements and calculations, and other available data as applicable will be used to determine if an adjustment is needed in what is considered background levels of tritium for groundwater surrounding the CCS.

Sample Collection and Analysis of Tritium

Samples for tritium analysis will be collected in 1-L high-density polyethylene bottles. Water can be transferred into the sample bottles using any type of sampling pump. The sample bottles do not require rinsing before filling. Sampling personnel shall not wear luminous watches because these watches can contain relatively large amounts of tritium, which would contaminate the water sample. The samples will not be filtered. Samples will be stored and transported at room temperature. Each sample will at a minimum be labeled with the sample location, collection date and time, and sampler's name. All groundwater and surface water stations (7 samples in the CCS at varying depths) identified in this Monitoring Plan will be sampled for tritium quarterly. In addition to these samples, rainfall samples will be collected from at least nine stations (discussed as follows). These rainfall samples will be used to assess whether deposition of evaporated CCS water could contribute detectable amounts of tritium via rainfall to the surface and groundwater surrounding the CCS.

The detection limit for tritium analysis shall be $\leq$10 pCi/L for groundwater and surface water samples, except as specified below. The analytical uncertainty measurement will be $\leq$10 pCi/L or $\pm$3.5 percent, whichever is larger, and the methodology used for this analysis shall be consistent with these requirements. The laboratory performing the low-level tritium

analyses will participate in the International Atomic Energy Agency's tritium inter-laboratory comparison study. This proficiency testing program is carried out every four years using standards ranging in activity from <1 pCi/L to ~2000 pCi/L. The laboratory shall maintain active participation in the proficiency testing program. FPL shall propose specific tritium analytical techniques in the QA/QC plan, including the method detection limit and the uncertainty associated with the method, for review and approval by the Agencies.

During the initial monitoring period over the first year, a test methodology with a 10-pCi/L detection level will be used for all monitoring wells and surface water outside the CCS. Detection levels for sampling within the CCS will initially be at 350 pCi/L. The adaptive monitoring approach will be used to identify appropriate changes in detection levels for specified locations.

After the first year of sampling adjustments to detection levels may be implemented if surface water samples from the CCS and wells very close to the CCS (i.e., L3 and L5) and directly underneath the CCS, have tritium levels well above the detection limits of 350 pCi/L. An acceptable alternative method would be direct liquid scintillation counting (LSC), which has a detection limit of 350 pCi/L. It is possible that some other groundwater and surface water samples will have consistent tritium values well above the lower detection limit of 10 pCi/L. If a site has been established to have a tritium concentration >700 pCi/L by four consecutive samplings over a one-year period, then future samples may be analyzed by the LSC, or equivalent, method upon the notification and approval of the Agencies.

If eight quarterly samples taken over a two-year period from a particular groundwater or surface water sampling site indicate that the tritium concentration of these samples is < 15 pCi/L or background as determined by the Agencies, then tritium sampling at that site may be discontinued. As long as the chloride concentration of the samples collected at said sampling site remains below 250 mg/L, tritium does not need to be sampled. If chloride concentrations rise above 250 mg/L, then tritium sampling shall be resumed for a time period to determine if the source of the increased chloride is attributable to the CCS.

Tritium Measurements in Rainfall

FPL shall conduct an evaluation of the extent of influence of local rainfall on tritium levels in groundwater and surface water for purposes of providing additional data for identification of background levels of tritium. Eight rainfall collection stations will be co-located with monitoring well clusters north, east, south, and west of the CCS (shown in **Figure E-1**). One collector will be located to the north and one to the south. One collector will be located in Biscayne Bay to the east. One collector will be located adjacent to the L-31E Canal, two collectors will be located approximately two miles west of the plant, and two collectors will be located approximately four miles west of the plant. Collected rainfall data will be analyzed for a period of one year, and determination of future sampling will need to be assessed. After the testing period, based on all available information, a scientifically based level(s) of tritium in rainfall shall be identified across the area.

Rainfall Sample Collection Protocols

The following protocols shall be used for rainfall sample protection:

- Rainfall collectors will be sampled four times per year.
- Rainfall collectors will be deployed at the sampling locations continuously, and will be designed to integrate samples collected during a three-month time period.
- At the end of every three-month sampling period, collected rainfall will be sent to the laboratory for tritium analysis. Tritium rainfall averages have been reported <10 pCi/L, therefore a laboratory detection limit of <10 pCi/L shall be used for rainfall analysis. If the concentrations of tritium in the rainfall are less than or equal to the MDL, any rainfall contributions of tritium shall be considered negligible.
- Data will be correlated with either local (temporary setups alongside rainfall collectors) or nearby micrometeorological stations.
- If tritium is observed in the shallow (<30 feet deep) monitoring wells, sampling of porewater may be conducted to determine directionality of tritium movement in the ground.

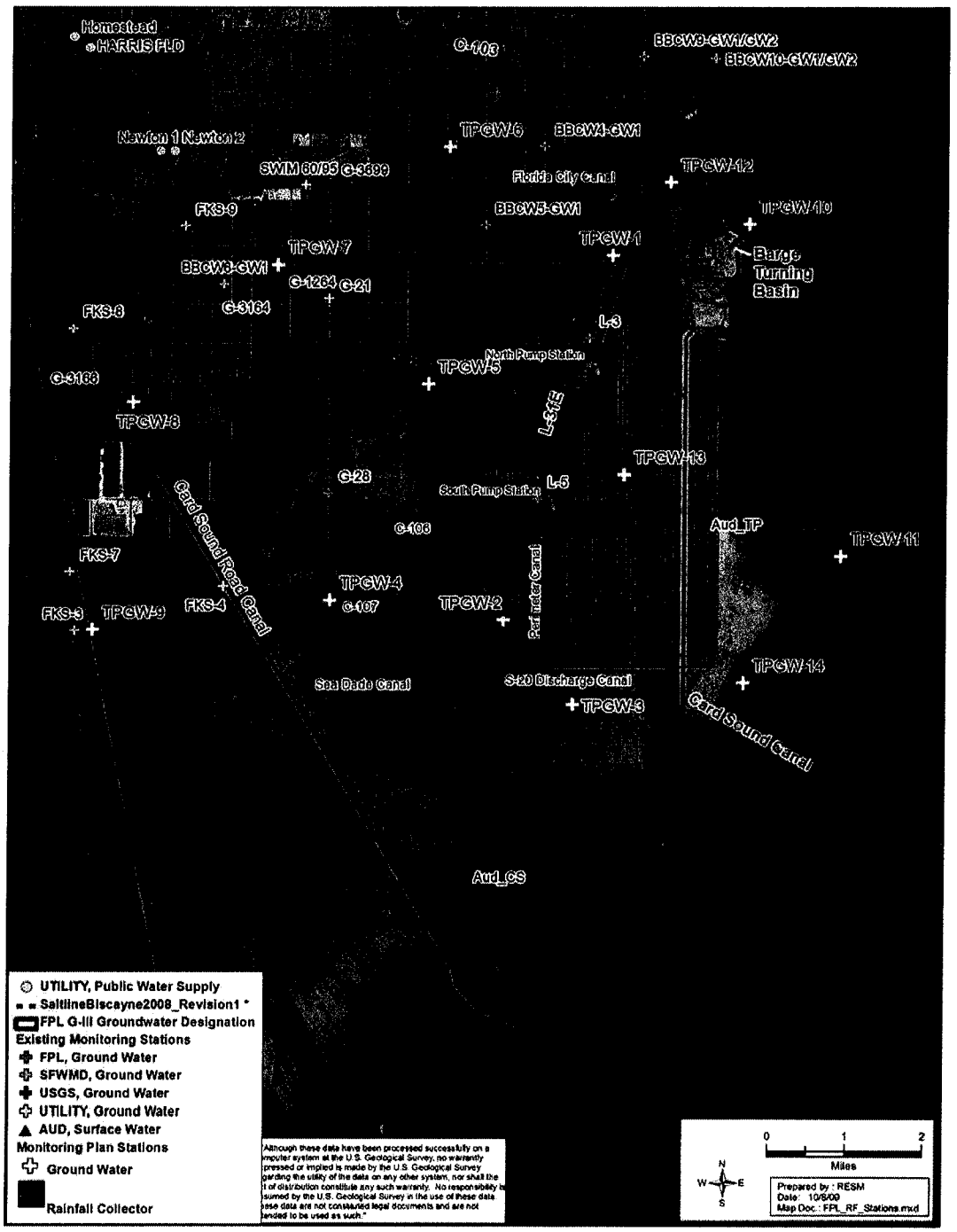


Figure E-1 Rainfall collection stations.

sfwmd.gov

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West Palm Beach, Florida 33406
561-686-8800 • FL WATS 1-800-432-2045
www.sfwmd.gov

MAILING ADDRESS: P.O. Box 24680
West Palm Beach, FL 33416-4680

4.0 INTERCEPTOR DITCH OPERATION

4.1 Introduction

The purpose of the Interceptor Ditch is to restrict inland movement of cooling canal water by maintaining a seaward ground water gradient during times when a natural seaward gradient does not exist. During the wet season and the early part of the dry season, a natural seaward gradient usually does exist. During the rest of the year, however, it is necessary to artificially generate a seaward gradient east to Levee 31 Borrow Canal by pumping water out of the Interceptor Ditch. The procedure for monitoring the ground water gradient and operation of the Interceptor Ditch is presented in the following sections.

4.2 Monitoring Locations

Surface water elevations shall be monitored at staff gauges in the West Feeder Canal of the Canal System, Levee 31 Borrow Canal and the Interceptor Ditch at five locations relative to Lines A, B, C, D and E, as shown on the inset, Figure 2. When pumping of the Interceptor Ditch commences, additional data shall be obtained at each of the two ID pump stations. Locations of the pump stations are also shown on Figure 2.

4.3. Monitoring Frequency

Water elevation data shall be collected at the fifteen locations twice a month during non-pumping periods. These elevations will be measured on or about the 1st of each month and again near the middle of the month. Non-pumping periods reflect the wet season high water levels, i.e., June through November.

During the period December through May, water elevation data will be collected once a week except during periods when pumping is necessary to create a seaward gradient. When pumping is required, water surface elevation data will be collected at least twice weekly. Adequate surveillance shall be set up to assure proper Interceptor Ditch operation. Data on pump run time and segments being pumped will be recorded in the Interceptor Ditch Pump Operation Log (Figure 9).

4.4 Pumping Criteria

As long as a natural seaward ground-water gradient exists, pumping of the Interceptor Ditch is not required. The following criteria define when a natural seaward gradient exists and when the Interceptor Ditch must be pumped to create an artificial gradient east of Levee 31 Borrow Canal.

Exhibit C

Seaward Gradient - A natural seaward gradient exists when the Levee 31 water surface elevation (ft., MSL) minus the West Feeder Canal water surface elevation (ft., MSL) is greater than 0.20 ft.

If this criterion is not met, a natural seaward gradient still exist if the Levee 31 water surface elevation (ft., MSL) minus the Interceptor Ditch water surface elevation (ft. MSL) is greater than 0.30 ft.

Landward Gradient – If a natural seaward gradient does not exist, pumping of the Interceptor Ditch must be initiated to artificially create a seaward gradient. Pumping shall be adjusted so that the water surface elevation (ft. MSL) in the Interceptor Ditch is maintained on the order of 0.30 feet lower than the water surface elevation (ft. MSL) in Levee 31. Pumping can be terminated when the criteria for a natural seaward gradient is met.

The flow chart on Figure 6 depicts the requirements for pump operation. This chart should be referred to each time water elevation data are obtained in order to more easily determine when pumping is or is not required.

As can be seen on Figure 2 the pump stations divide the Interceptor Ditch into three segments. Each segment is evaluated separately with respect to the operating criteria. One segment, therefore, might require pumping while another might not. Pumping shall be initiated when any of the lines of staff gauges governing that segment fails to meet the specified criteria for a seaward gradient. Adjustable intake gates (stop-logs) in each pump intake basin allow for various pumps combinations to drawdown specific Interceptor Ditch segments.

4.6 Data Processing

Data shall be complied on the forms provided (Figure 7-9). Field data will be kept for 24 months. Field data shall be distributed as follows:

a. Original – FPL Environmental Affairs Department.
b. One Copy – Retain on file at FPL Land Utilization Department at Turkey Point.
c. One Copy – Forwarded to FPL's Consultant.

4.7 Annual Report

An Annual Summary Report covering the preceding year's monitoring and operations data will be compiled and subsequently submitted to the South Florida Water Management District by the end of August of each year.

These reports, to be retained for the life of the Interceptor Ditch Program, will consist of the following elements:

a. a description of any operational or structural changes made to the Interceptor Ditch System,
b. a description of climatological conditions, including any unusual events,
c. a description of the results of the previous year's monitoring program,
d. updated time-history plots for all wells and parameters monitored and,
e. time-history plots for each Interceptor Ditch pumping station.

Distribution shall be in accordance with the following:

One Copy – Forward to South Florida Water Management District

4.8 Equipment Maintenance

Occasional cleaning of the staff gauges is required when algae and other marine growths inhibit reading of the staff gauges. Care must be taken when cleaning to prevent damage to or movement of the staff gauges.

FIGURES

1. Groundwater Monitoring Program well locations.

2. Interceptor Ditch, Levee-31 Well and Pump Locations.

3. Historical conductivity-chloride relationship.

4. Raw Data Forms.

5. Calibration Log.

6. Interceptor Ditch Program Operational Flow Diagram.

7. Interceptor Ditch, Levee-31, Canal 32 Water Level Data.

8. Interceptor Ditch, Levee-31, Canal 32 Water Level Data.

9. Interceptor Ditch Pump Operation Log.

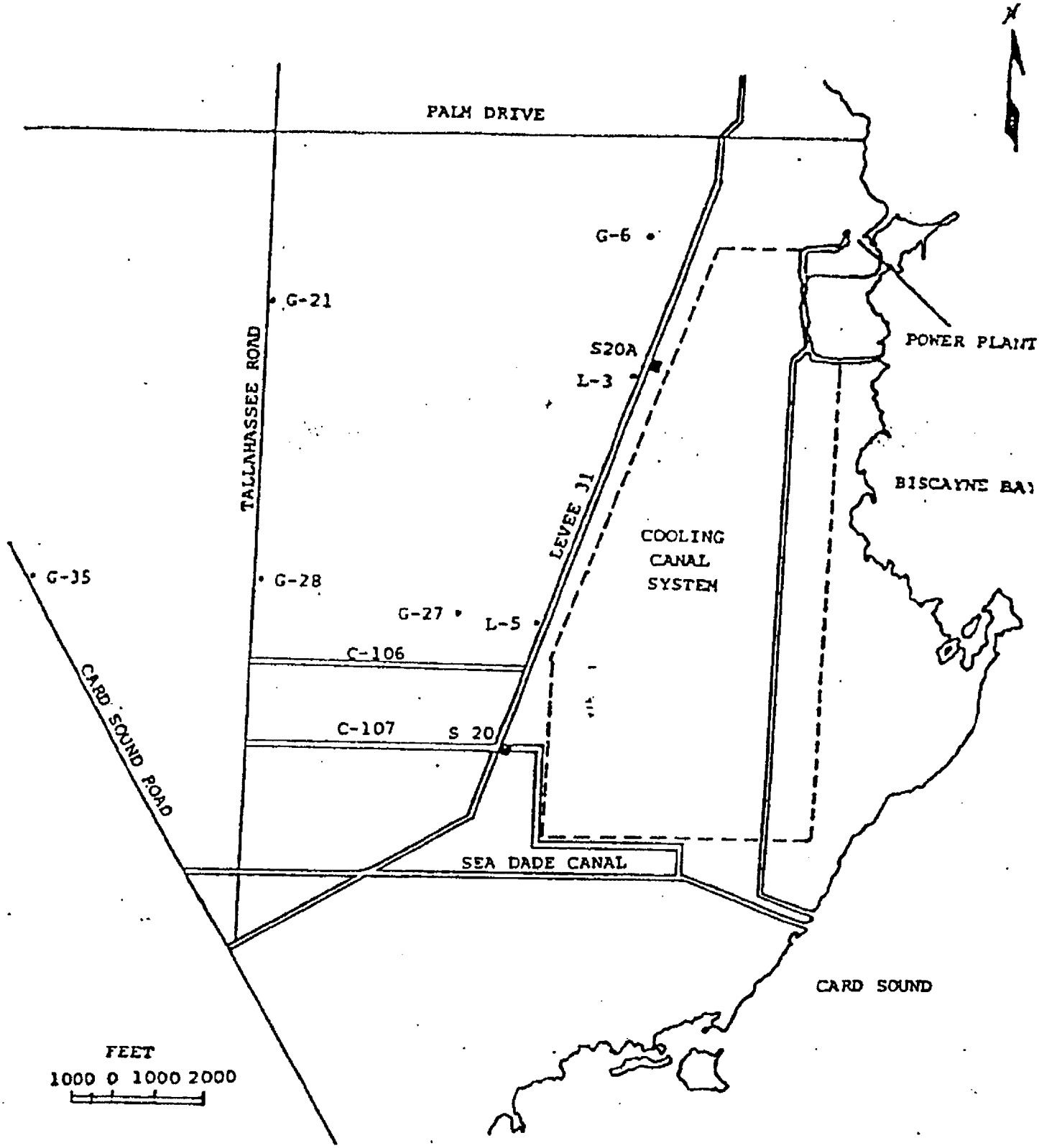

Figure 1. Groundwater Monitoring Program Well Locations

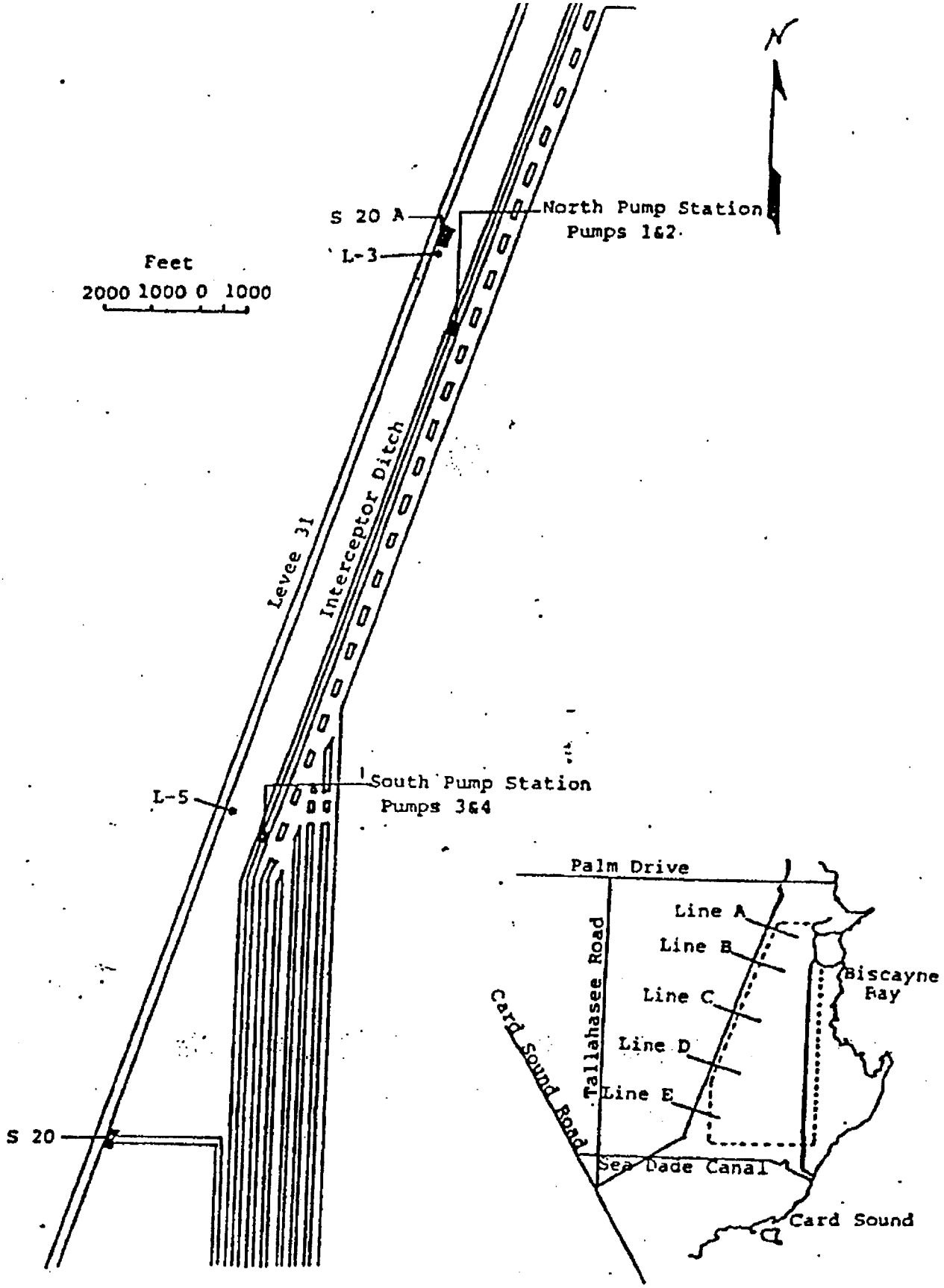

Figure 2. Interceptor Ditch, Levee-31, Well and Pump Locations

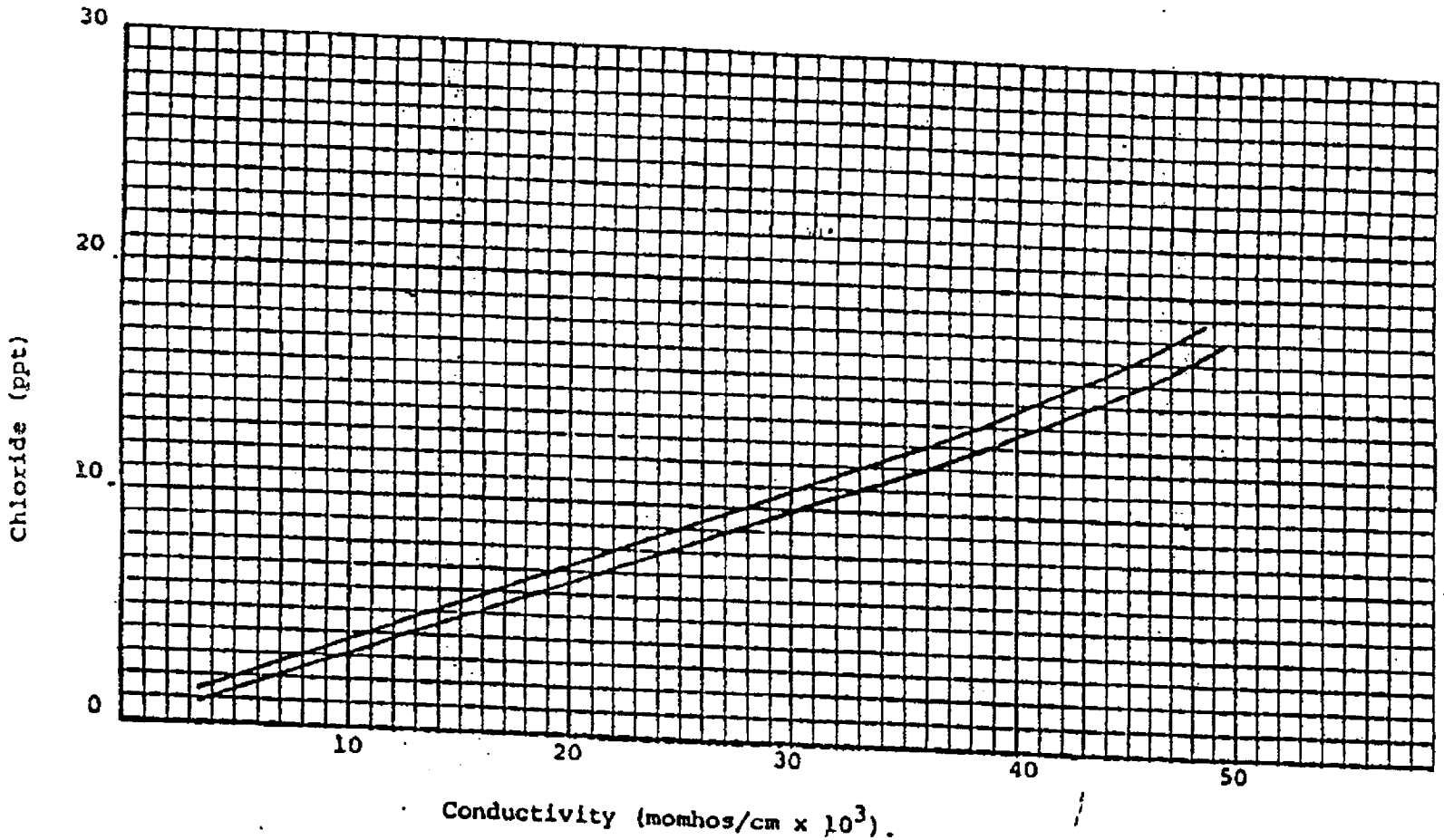

Figure 3. Conductivity-Chloride relationship, G-Wells.

FCD WELL SERIES
TURKEY POINT, FLORIDA

ELL ID (1-4)

DATE (MN/DD/YY) (10-17)

CHECKED BY _____

CASING ELEVATION (FT.MSL) _____

TIME (20-23)

RECORDER (25-27)

WATER LEVELS (FT)
(DEPTH BELOW CASING)

GROUND (30-33)

SURFACE (35-38)

CHARACTERISTIC DATE
MONTH-YY (40-46)

WATER ELEVATION (FT)

GROUND _____

SURFACE _____

DEPTH BELOW CASING (FT)	COND. (UMHOS/CM)	TEMP. (°C)	DEPTH BELOW CASING (FT)	COND. (UMHOS/CM)	TEMP. (°C)	DEPTH BELOW CASING (FT)	COND. (UMHOS/CM)	TEMP. (°C)

Instrument: _____

Date/Time: _____

Technician: _____

Checked By: _____

	Conductivity	Temperature
1. Before Monitoring (Laboratory)		
Calibration Standard		
Meter Reading		
Meter Adjusted to Read		
2. During Monitoring		
A.		
B.		
C.		
D.		
E.		
3. After Monitoring (Laboratory)		
Calibration Standard		
Meter Reading		
Deviation		

Correction Applied (Explain): _____

_____

_____

_____

INTERCEPTOR DITCH PROGRAM
OPERATIONAL FLOW DIAGRAM

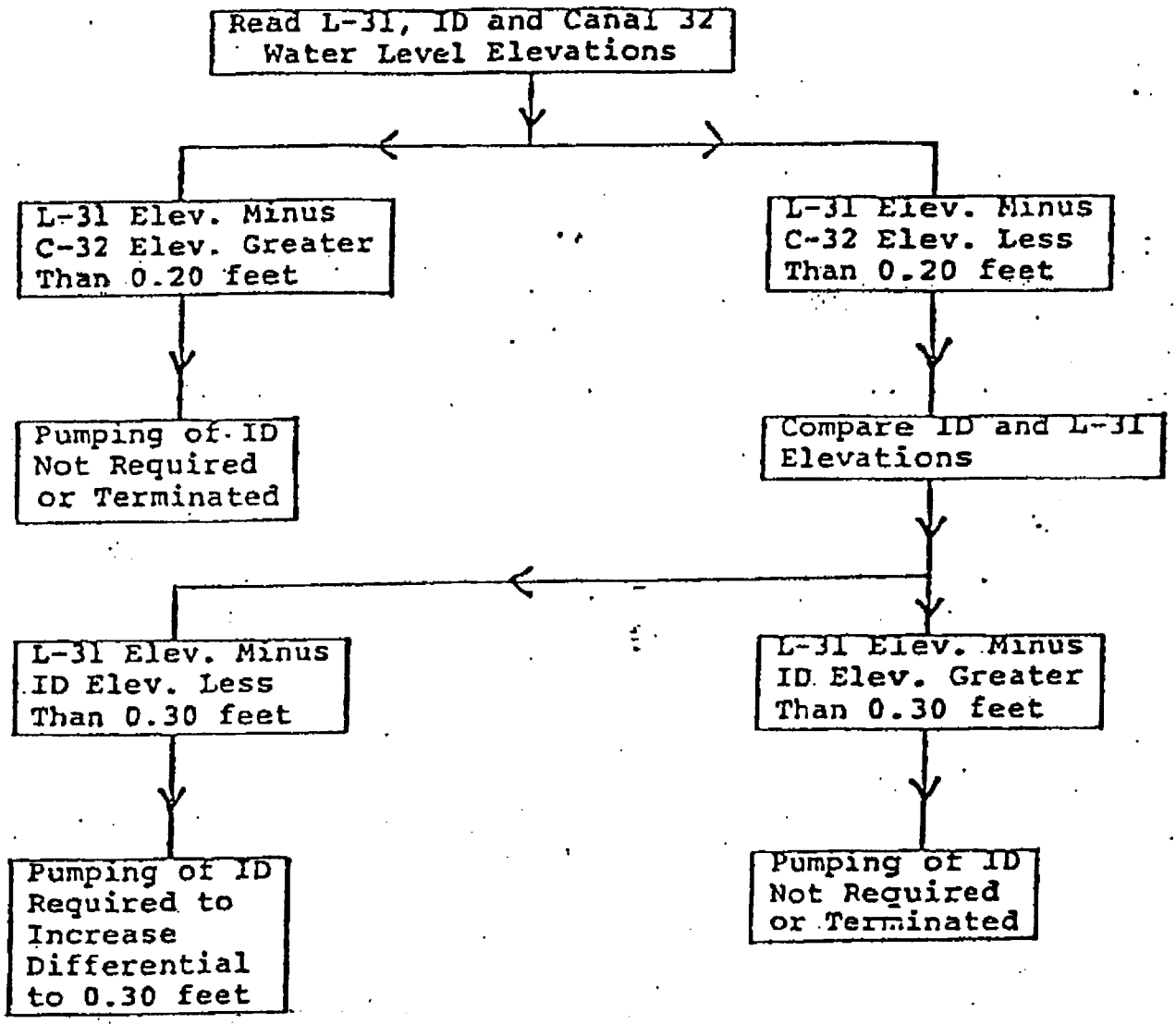

Figure 6.

WATER LEVELS - LEVEE 31, CANAL 32, INTERCEPTOR DITCH

INTERCEPTOR DITCH PROGRAM

MONTH/YEAR_____

LINE A						LINE B						LINE C						LINE D						LINE E					
L-31 FT, MSL	10 FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING RECORD	L-31 MINUS 10, FT	L-31 FT, MSL	10 FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING RECORD	L-31 MINUS 10, FT	L-31 FT, MSL	10 FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING RECORD	L-31 MINUS 10, FT	L-31 FT, MSL	10 FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING RECORD	L-31 MINUS 10, FT	L-31 FT, MSL	10 FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING RECORD	L-31 MINUS 10, FT

* IF L-31 MINUS C-32 IS LESS THAN 0.2 FEET, THEN COMPLETE NEXT TWO COLUMNS

Figure 7

WATER LEVELS - LEVEE 31, CANAL 32, INTERCEPTOR DITCH

INTERCEPTOR DITCH PROGRAM

MONTH/YEAR_____

	LINE A						LINE B						LINE C						LINE D						LINE E					
DAY	L-31 FT, MSL	ID FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING REQ'D	L-31 MINUS ID, FT	L-31 FT, MSL	ID FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING REQ'D	L-31 MINUS ID, FT	L-31 FT, MSL	ID FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING REQ'D	L-31 MINUS ID, FT	L-31 FT, MSL	ID FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING REQ'D	L-31 MINUS ID, FT	L-31 FT, MSL	ID FT, MSL	C-32 FT, MSL	L-31 MINUS C-32, FT *	PUMPING REQ'D	L-31 MINUS ID, FT
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31																														

* IF L-31 MINUS C-32 IS LESS THAN 0.2 FEET, THEN COMPLETE NEXT TWO COLUMNS

Figure 8

MONTH / YEAR _____

		PUMP NO. 1		PUMP NO. 2			PUMP NO. 3		PUMP NO. 4		
DAY OF MONTH	TIME	STAFF GAGE READING	I.D. SECTION BEING PUMPED	STAFF GAGE READING	I.D. SECTION BEING PUMPED	TIME	STAFF GAGE READING	I.D. SECTION BEING PUMPED	STAFF GAGE READING	I.D. SECTION BEING PUMPED	TOTALIZER
1											
2											
3											
4											
5											
6											
7											
8											
9											
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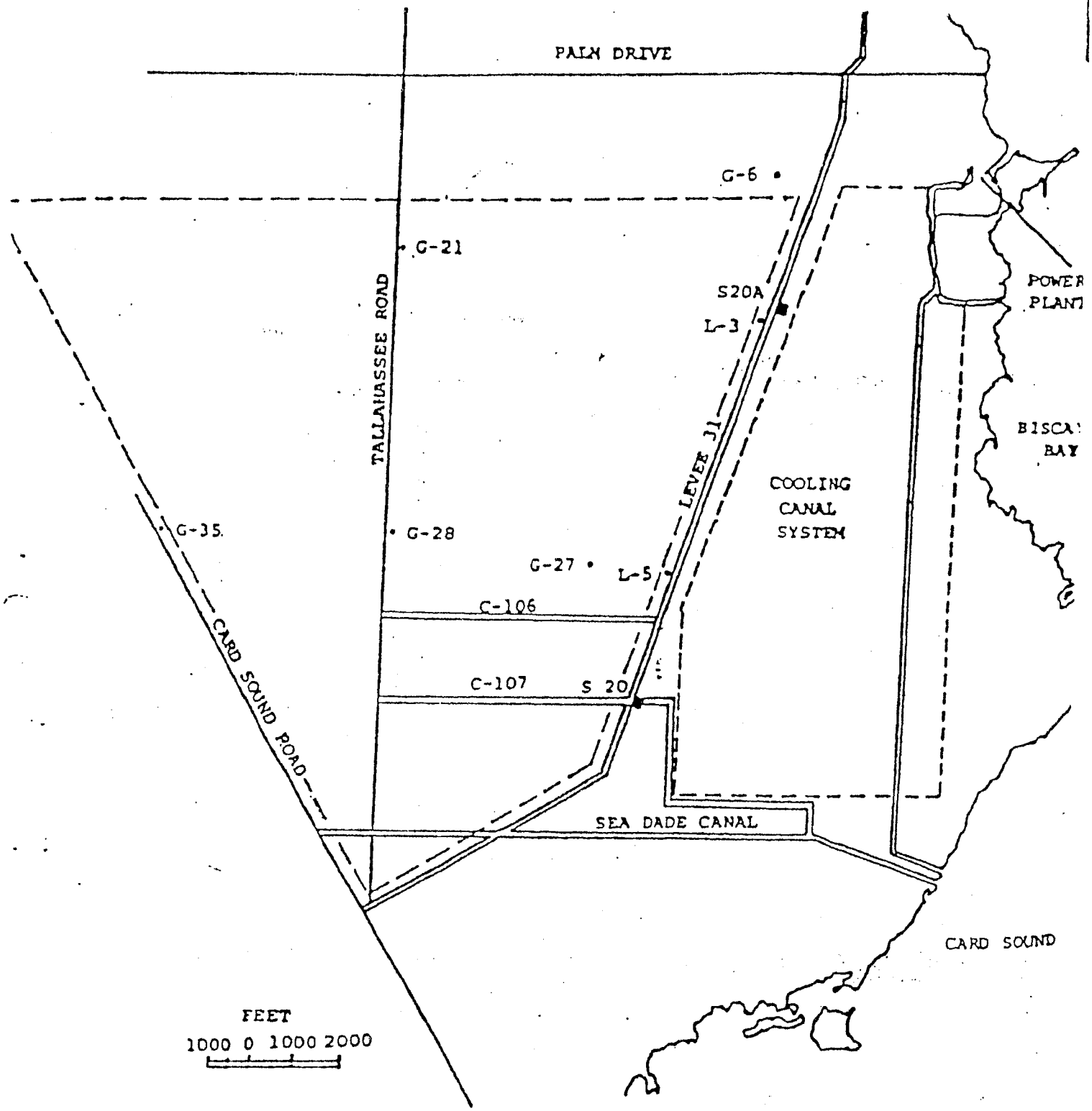
PALM DRIVE
G-6
G-21
TALLAHASSEE ROAD
S20A
L-3
LEVEE 31
POWER PLANT
BISCAYNE BAY
COOLING CANAL SYSTEM
G-35
G-28
G-27
L-5
C-106
C-107
S 20
CARD SOUND ROAD
SEA DADE CANAL
CARD SOUND
FEET
1000 0 1000 2000

Exhibit D

April 8th, 2020 Executive Summary

Actions to Improve Outcomes of Changes to Turkey Point Operations

We, the undersigned, are concerned that proposed changes in operations at Turkey Point recently approved in the Power Plant Siting Act (PPSA) by the Department of Environmental Protection (DEP) and which would be supported by the present language of a draft Joint Partnership Agreement between Miami Dade County and Florida Power and Light will exacerbate existing impacts on the Biscayne Aquifer and Biscayne Bay caused by the Turkey Point Facility's cooling canal system.

Based on the analysis of our experts, shown in the underlying report, we propose the following actions that will improve remediation efforts already being taken to address problems with the cooling canals and mitigate unintended consequences of the proposed changes in their operation.

For the State of Florida:

Immediately, begin working with all regulators and stakeholders to resolve conflicts with Everglades Restoration and impacts on water supplies, Biscayne National Park and Florida Keys Marine Sanctuary. Because of the 5th Supplemental Agreement we suggest that the SFWMD governing Board invite all stakeholders and regulators to the upcoming May 2020 Governing Board Workshop for a discussion and hopeful cooperation among regulators on a path forward that resolves the existing conflicts. This should occur before any new agreement or permit is issued to FPL or any final project is determined for C-111 and Biscayne Bay Coastal Wetlands.

For Miami Dade County:

Amend the draft Joint Partnership Agreement with FPL to address concerns in the following areas. In each of these areas our experts identify a number of issues in the full text of the attached letter.

Changes required to address legal liability

Changes required by compliance with the Consent Agreement

Changes required to address increased nutrient loading

Changes required to address changes in the water budget

Changes required to address conflicts with Everglades Restoration

The ecological health and vitality of Biscayne Bay and its coastal wetlands are a matter of critical importance to the many stakeholders which derive their health, wealth, and well-being from the use of these resources. DEP, SFWMD and Miami Dade County must consider all the information available when supporting operational changes which will affect us economically.

Despite three years of remediation efforts, the contaminated groundwater plume has continued to advance westward and the requirement to lower salinity in the cooling canals has not been met. Furthermore, hydro-geological modeling shows that FPL's chosen strategy of diluting and flushing out cooling canal system water will result in additional westward movement of the

hypersaline plume and negative impacts on surrounding water quality. The current approach to remediating the plume should be reevaluated.

The threats posed to the remaining potable water users in the area, adjacent land owners, federal and State ecosystem restoration objectives, and the Miami Dade and Florida Keys residents who rely upon the wellfields threatened by the Turkey Point Cooling Canal System salt-front must be addressed through both prevention of further harm and mitigation of existing harm.

We hope the detailed information we have taken the time to provide will encourage all parties to work together to resolve these issues and that you will take this information and these suggestions into consideration in drafting final language for the Joint Partnership Agreement between Miami Dade County and the Florida Power and Light Company and in the pending draft NPDES permit that DEP is still reviewing. In additional we are hopeful that the terms of the 5th Supplemental Agreement are enforced to ensure there are no conflicts with Everglades Restoration or lower east coast water supply.

This is a complicated issue that impacts all of us greatly and it is imperative that all of us work together. We look forward to working with you to help resolve our concerns.

Sincerely,

Steve Friedman;

Commodore, Florida Keys Fishing Guides Association

_____

Thomas Walker;

Executive Director, Florida Keys Aqueduct Authority

April 8th, 2020

Secretary Noah Valenstein
Florida Department of Environmental Protection
3900 Commonwealth Boulevard M.S. 49
Tallahassee, FL 32399
Noah.valenstein@dep.state.fl.us

Director Kevin Lynskey
Miami Dade County Water and Sewer Department
3071 SW 38th Ave, Miami, FL 33146
Kevin.Lynskey@miamidade.gov

RE: Comments regarding the recent changes to the Power Plant Siting Act (PPSA) and proposed draft Joint Partnership Agreement (JPA) between Miami Dade County and Florida Power and Light

Dear Secretary Noah Valenstein and Director Kevin Lynskey,

We are taking the opportunity to submit comments to both the State which has approved FPL's recent post-certification amendment to their site certification under the Power Plant Siting Act (PPSA) and Miami Dade County on the prospective Joint Partnership Agreement (JPA) between Miami Dade County and the Florida Power & Light Company (FPL). These comments are submitted on behalf of the Florida Keys Aqueduct Authority and the Florida Keys Fishing Guides Association and reflect concerns shared by multiple stakeholders and user groups. The continued operations of the cooling canal system impact the success of Everglades Restoration efforts, the lower east coast water supply, saltwater intrusion into the Biscayne Aquifer and the ecological health and well-being of Biscayne National Park and the Florida Keys Marine Sanctuary.

The purpose of this letter is to raise concerns resulting from the proposed changes in operations at Turkey Point recently approved in the PPSA that would allow the re-allocation of more than 14 MGD of Floridian water currently permitted for use in unit 5. We have analyzed the impacts of these prospective changes and have proposed conditions to improve the overall operations that would help to mitigate for impacts associated with the continued operations of the cooling canal system moving forward.

On October 29th, 2019 FPL requested a post-certification amendment to their Site Certification Application for FPL's Turkey Point Clean Energy Center under the Power Plant Siting Act (F.S. 403.501-.518) which would grant approval for the installation of a water conveyance pipeline, a portion of which would fall within the certified boundary. FPL states that the purpose of this pipeline would be to 'convey the unutilized portion of the 14.06 million gallons per day allocated for cooling water for Unit 5 and process water Units 1-5 to the cooling

canals systems to aid in salinity reduction"[1]. This requested amendment did not include a request for additional water by FPL, as the company anticipates the Floridan aquifer water currently in use in Natural Gas Unit 5 will be liberated for use in the canals as a result of the JPA currently under consideration. The path of this proposed pipeline is shown below in Figure 1. This would allow upwards of 14 MGD to be rerouted to the cooling canal system for 'freshening', i.e., the process of adding water with lower chloride content into the cooling canal system in order to reduce the average salinity in the cooling canal system as required by the Florida Department of Environmental Protection (FDEP) 2015 Consent Order.

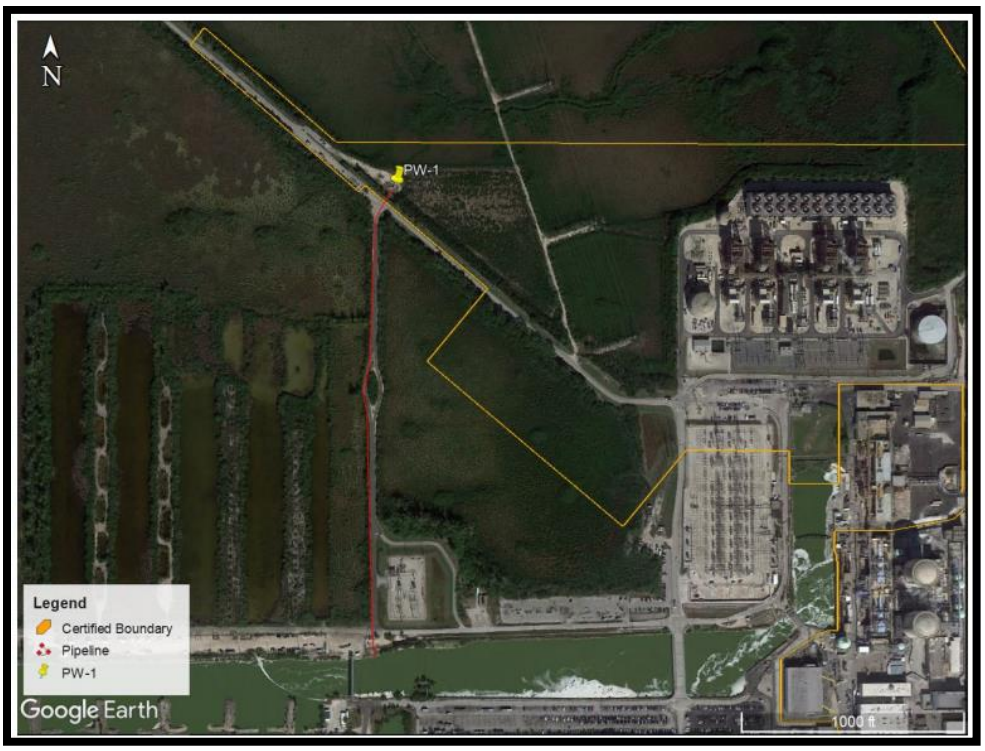

Figure 1. Unit 5 Upper Floridan aquifer well PW-1 with proposed pipeline route cooling canal system

Over the past 3 years FPL has failed to meet the mandates required under this Consent Order. The first objective of the consent order was for FPL to "cease discharges from the cooling canal system that impair the reasonable and beneficial use of the adjacent G-II ground waters to the west of the cooling canal system … accomplish this first objective by undertaking freshening activities as authorized in the Turkey Point site certification, by eliminating cooling canal system contribution to the hypersaline plume, by maintaining the average salinity of the cooling canal system at or below 34 Practical Salinity Units(PSU), by halting westward migration of hypersaline water from the cooling canal system, and by reducing the westward extend of the hypersaline plume to the L-31E within 10 years"[2].

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[1] Danielle Hall, P.E., Florida Power and Light, Email to SCO RE: FPL Turkey Point Unit 5 (PA 03-45) Amendment Request, October 30th, 2019.

[2] State of Florida Department of Environmental Protection V. Florida Power & Light Company, OGC File No. 16-0241, Consent Order

The underlying strategy behind FPL's 'freshening' strategy is best described as 'feed and bleed'. The mechanism for a reduction in cooling canal system salinity under this strategy is to dilute the cooling canal system water with fresher water while simultaneously flushing the canal's saline and nutrient loaded pollution into the surrounding area. This will worsen conditions in the area surrounding the cooling canal system and conflicts with the Consent Order's mandates to halt westward migration of the hypersaline plume.

By providing an alternative source of water for Unit 5, the JPA will allow FPL to double the amount of water from the Floridan aquifer currently added to the cooling canal system. Our collective data analysis and modeling shows that this process will have significant consequences that will impact the natural resources utilized by stakeholders in the region. We support the beneficial use of wastewater and recognize that Miami Dade County is obligated to treat and reuse 117.5 MGD of wastewater under the 2008 Ocean Outfalls Act. However, we cannot ignore the scientific evidence that FPL's plans to use reuse water at their Turkey Point plant will negatively impact the region's freshwater and ecological resources.

Under the JPA Miami Dade County would share costs on the development of wastewater treatment capacity at the South Dade Wastewater treatment center and promise delivery of Miami Dade County treated wastewater to FPL for use in their Turkey Point Facility. Upon its passage, the JPA will serve as a legal document enforceable by injunction, will commit the county to multiple obligations, and will forge a longstanding and mutually dependent relationship between Miami Dade County and FPL. Therefore, the terms of the agreement should at a minimum ensure that Florida Power and Light meet existing obligations to Miami-Dade County, specifically those mandated under the 2015 Consent Agreement, that are intended to mitigate the environmental impacts of the cooling canal system.

In its current form, i.e. the draft language as of October 18th 2019, the JPA does not protect Miami Dade County and its citizens and is not in the county's best interest. Our concerns with the present language of the draft agreement are as follows:

1. The present language of the agreement is incompatible with previous positions taken by the Miami Dade County Board of County Commissioners to seek the eventual decommissioning and replacement of the Turkey Point Nuclear Generating Station's unlined cooling canal system.
2. The present language of the agreement fails to adequately ensure that Florida Power and Light meet existing obligations to Miami-Dade County, specifically those mandated under the 2015 Consent Agreement.
3. The present language of the agreement will result in additional nutrient loading in the Surface Waters of Biscayne Bay, and no effort to mitigate this has been proposed.
4. The present language of the agreement would alter the cooling canal system water budget in a manner which modeling determines will have ecologically deleterious effects upon the surrounding ecosystem and no effort to mitigate this has been proposed.
5. The present language of the agreement stands in conflict with the goals of the Comprehensive Everglades Restoration Plan, specifically the C-111 Canal Project and the Biscayne Bay Coastal Wetlands Project.

This Joint Partnership Agreement should establish a mutually beneficial arrangement which will require Florida Power and Light to meet their obligations under state and local mandates, is aligned with existing legal positions Miami Dade county has established, and shows a commitment towards Everglades Restoration and mitigation of the pollution plume that is exacerbating the movement of the salt front in the Biscayne aquifer. This is necessary to ensure that goals for environmental restoration are met and to reassure threatened landowners and current water users in the vicinity of the Turkey Point Nuclear Facility. The language of this agreement should be amended to reflect these goals. We explore our concerns at length and provide examples of amendments which would address them in the following sections.

1. **The present language of the agreement omits crucial context and is incompatible with previous positions taken by the Miami Dade County Board of County Commissioners to seek the eventual decommissioning and replacement of the Turkey Point Nuclear Generating Station's unlined cooling canal system.**

The Turkey Point Facility's cooling canal system is composed of 5,900 acres of unlined cooling canals which are in open communication with both the groundwater of the surrounding class G-II potable aquifer and the surface waters of Biscayne Bay via subterranean channels[3,4,5]. The operation of this open cooling system has resulted in the formation of a hypersaline and nutrient rich plume of pollution, which was discovered by the South Florida Water Management District in 2012 as a result of an expanded monitoring program initiated in the 2009 Fifth Supplemental Agreement[6]. This pollution plume has extended into both the G-II designated potable aquifer to the West and the surface waters of Biscayne Bay to the East. The hydrologic connection in question is demonstrated in Figure 2.

The language of the JPA fails to include crucial context regarding the nature of the water budget and the uses which the agreement would support, nor does it provide any context on the legal and policy relationship between Miami Dade County and FPL regarding operation of the cooling canal system.

The 15 MGD treated water produced and directed to FPL for use in the cooling tower of Natural Gas Unit 5 under this agreement will replace Floridan aquifer water currently being directed towards this purpose. FPL will then direct the Floridan aquifer water in question into the

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[3] Reynolds, L. Fourqurean, J. Nuttle, W.K. Future Impacts on Biscayne Bay of Extended Operation of Turkey Point Cooling Canals [online: https://www.researchgate.net/publication/333717294_Future_Impacts_on_Biscayne_Bay_of_Extended_Operation_of_Turkey_Point_Cooling_Canals ; accessed 3 Mar 2020]

[4] The Cooling-Canal System at the FPL Turkey Point Power Station, Chin, 2015, University of Miami

[5] Miami-Dade County Report on Biscayne Bay Water Quality Observations associated with the Turkey Point cooling canal system Operations, March 7, 2016, Memorandum from Carlos A. Giménez, Mayor, to Chairman Jean Monestime and Members, Board of County Commissions, p. 4.

[6] FPL Turkey Point Power Plant Groundwater, Surface Water, and Ecological Monitoring Plan, South Florida Water Management District Florida Department of Environmental Protection Miami-Dade County Department of Environmental Resource Management, October 14, 2009

cooling canal system to assist in the process of diluting the saltwater content of the canals and flushing excess pollutants out of the cooling canal system and into the surrounding area. FPL hopes that this strategy will allow them to meet their state mandate to reduce the salinity of the cooling canal system to 34 PSU from its current level of 51 PSU, as per their obligations under the Florida Department of Environmental Protection's (FDEP) 2015 consent order. FPL has referred to this process as 'freshening'.

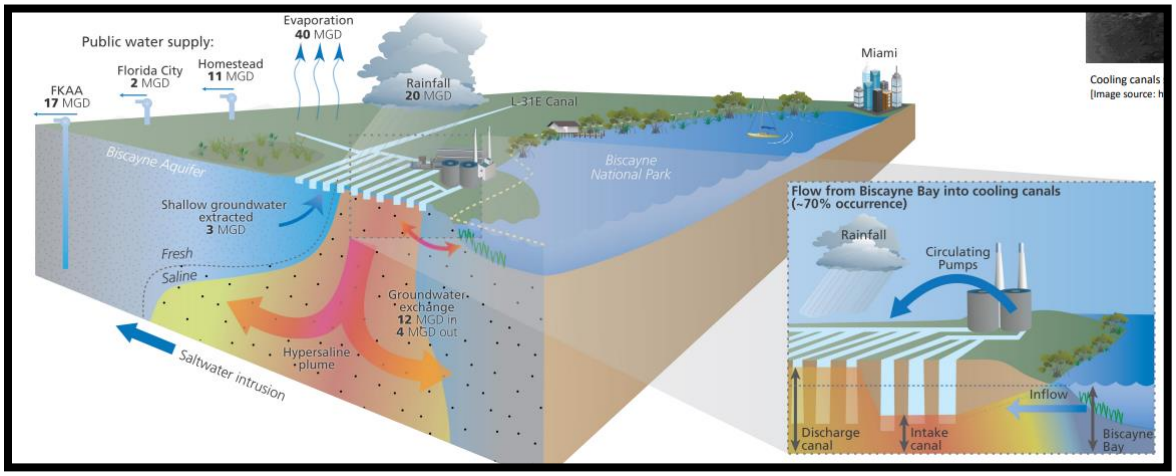

Figure 2. Hydrological Connection between the cooling canal system and Surrounding Waters

Out of recognition for the failure of the cooling canal system to function as a closed system, as per the 1971 Federal Consent Decree[7], the Miami Dade County Board of County Commissioners passed a resolution on July 19th, 2016 urging Miami Dade County Mayor Carlos Gimenez to seek a commitment from FPL to decommission the Turkey Point cooling canal system by 2033 and replace the outdated and failing technology with a modern alternative such as mechanical updraft cooling towers[8] (See attachment 1). The replacement of the cooling canal system with mechanical updraft cooling towers can be achieved in a cost effective manner that will not put undue financial burden on the residents of Miami Dade County, as demonstrated by the feasibility assessment developed by Powers Engineering on behalf of the Southern Alliance for Clean Energy[9]. This commitment is more important than ever, as Turkey Point Nuclear Generating Units 3 & 4 have received a subsequent license renewal from the Nuclear Regulatory Commission which would extend their lifetime of operation to 2052 and 2053 respectively[10].

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[7] United States of America v. Florida Power and Light Company. Civ. A. No. 70-328, September 10th, 1971

[8] Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

[9] Closed Cycle Cooling Tower Feasibility Assessment for Turkey Point Nuclear Units 3 and 4. Powers Engineering, San Diego, California. July 11th, 2016.

[10] ISSUANCE OF SUBSEQUENT RENEWED FACILITY OPERATING LICENSE NOS. DPR-31 AND DPR-41 FOR TURKEY POINT NUCLEAR GENERATING UNIT NOS. 3 AND 4 (EPID L-2018-RNW-0002), United States Nuclear Regulatory Commission, Washington, D.C. 20555-0001, December 4th, 2019

The JPA language also contains no reference to the many ways in which established county policy and objectives conflict with continued operation of the cooling canal system and operation of the recovery well system. The county has communicated these concerns regarding water losses associated with the operation of the Interceptor Ditch and their impacts upon county conservation lands and ecological restoration objectives to the Florida Department of Environmental Protection[11] (See attachment 2).

The conflict between FPL's operation of the cooling canal system with county objectives is noted in both the county's resolution urging the decommissioning of the cooling canal system[12] and through county communications to other regulatory authorities. Through omission of these important details, the JPA appears to validate the use of the cooling canal system. This agreement and the language therein should be considered within the full context of how it will affect future operations of the cooling canal system and how the operations of the cooling canal system impact county interests.

The JPA would allow FPL to significantly increase the volume of water employed in its dilution and flushing strategy for achieving compliance with state mandates, and yet the current language of the agreement completely ignores the context of this ongoing FPL initiative. As such, the language of this agreement could be construed as providing tacit support for the current cooling canal system "freshening" and recovery well system operations beyond 2033.

It is particularly important that the county and its various departments take a unified stance on the strategy of diluting and flushing out the saline content of the canals which FPL refers to as "freshening". FPL is currently in the process of seeking to "freshen" its cooling canal system to 34 PSU in order to comply with the mandates of the 2015 Florida Department of Environmental Protection Consent Order. This activity, while it has been accepted by the State as a solution, is misleading and merely represents a dilution of the pollution plume that has been created over 40 years of operations. We do not agree that this dilution and flushing activity is the correct way to solve this problem, The FPL recovery well system (RWS) does not represent an effective means of recovering contaminated water west of the cooling canal system. Modeling produced by the firm Earthfx using models developed and used by FPL show that this dilution and flushing strategy will result in additional saline pollution being pushed towards the model lands and wellfields to the west of the facility[13]. We elaborate upon this modeling and its implications in section 3 of this letter.

Now that the permitted operational lifetime of Turkey Point nuclear generating units 3 and 4 has been confirmed, it is important for the county to step back and articulate a clear and coherent set of objectives regarding its policy on the canals and its approach to negotiation with

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[11] Crandall, Lea. Rach, Timothy. Memo RE: Request of Time in accordance with Section 120.57, Florida Statutes, July 18th, 2018

[12] Miami Dade County Board of County Commissioners, Miami Dade County Board of County Commissioners, Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

[13] Earthfx modeling

FPL which may extend to the agreements and decisions made across all departments. There are viable alternative strategies for achieving compliance which Miami Dade County can and should push for, such as a technological upgrade of the plant to include additional cooling towers, which would require no additional salt and nutrients be loaded into the upper aquifer[14]. However, if this is not going to be required, there are other operational changes and improved mitigation requirements that can improve the situation markedly.

This concern can be addressed through the inclusion of a textual amendment recognizing that the Turkey Point cooling canal system is in open communication with surrounding groundwater and surface waters and as such changes in operations, updating the technology, or both would be required to mitigate the impacts of continued operations. Alternatively, Miami Dade County should clarify its current stance on the continued operation of the cooling canal system beyond 2033, and require actual progress on mitigation from the impacts of the current freshening strategy and recovery well system as required by both the Florida Department of Environmental Protection Consent Order and the Miami Dade County 2015 Consent Agreement.

In order to better align this agreement with positions taken by the county and current county objectives in the region as well as limit liability and ensure stronger oversight, the following changes should be made to the JPA language:

- The agreement should include "County as sovereign" language.
- The agreement should stipulate that FPL must appropriately maintain pipe infrastructure, assumes liability for malfunctions and can be held to county standards as opposed to state/federal
- The County must maintain strong regulatory oversight and control of the processes to be established under this agreement. In particular, the county must maintain control over the water supply and maintain the right to cease deliveries at its discretion.
- In light of the additional seepage that will occur from doubling the amount of water allocated to freshen the cooling canal system and the contamination risks associated with this process, one of the most critical operational changes which can be made to mitigate the impacts of the cooling canal system's continued operation is to review and modify or potentially discontinue use of the interceptor ditch pumps.
- The interceptor ditch pumps withdraw an average of 3 MGD of fresh water from the Biscayne Aquifer. Removing or scaling down the use of these pumps would liberate additional fresh water for productive use and slow saltwater intrusion
- Reuse water produced under this agreement should meet Biscayne bay anti-degradation target standards established by the Biscayne Bay Coastal Wetlands project delivery term.

[14] Closed Cycle Cooling Tower Feasibility Assessment for Turkey Point Nuclear Units 3 and 4. Powers Engineering, San Diego, California. July 11th, 2016.

2. **The present language of the agreement fails to adequately ensure that Florida Power and Light meet existing obligations to Miami-Dade County, specifically those mandated under the 2015 Consent Agreement.**

Shortly after the discovery of the hypersaline plume emanating from the Turkey Point cooling canal system, Miami Dade County placed Florida Power and Light under a Consent Agreement in 2015 stipulating that FPL must retract and eventually arrest discharges as well as engage in a variety of activities meant to monitor further pollution and mitigate the impacts of their operations[15]. To date, many of these mandates remain unfulfilled or only partially completed. What is worse is that after years of remediation the plume is still moving at the same rate to the west and the addition of water for to the cooling canal system for freshening will only increase the seepage rate generally.

It is inappropriate for the county to enter into any major new agreement with FPL regarding the operations of their Turkey Point Facility which does not address these existing obligations on the part of FPL. Some of these obligations which remain unfulfilled are as follows:

- Conduct a review of the interceptor ditch operations to determine if current design and or operations can be practicably modified to improve its function.
- The alternative water sources and modifications to ID design or operation shall be authorized through appropriate regulatory processes and shall demonstrate to not create adverse impacts to surface waters, GW, wetland or other resources.
- Raise control elevations in the FPL model lands to a minimum of 2.2 feet
- Fill portions of the Model Lands North Canal within the Everglades Mitigation Bank
- Acknowledge the benefits of hydrologic restoration projects contemplated by the Comprehensive Everglades Restoration Project ("CERP"), as well as other government entities, adjacent and to the west of the cooling canal system in controlling movement of hypersaline and saline waters in the Biscayne Aquifer, and commit to working with state, local and federal agencies to facilitate implementation of these projects to promote improved hydrologic conditions.
- FPL shall add three groundwater monitoring clusters (shallow, mid and deep) to monitor groundwater conditions in the model lands basin.
- The Miami Dade County Department of Environmental Resources Management and Florida Power and Light should expand monitoring operations and provide quarterly and annual reports on cooling canal system water and the environmental aspects of the project.

This concern may be addressed via an amendment to the JPA language which incorporates the amendment called for by Commissioner Rebecca Sosa at the April 10th 2018 Board of County Commissioners meeting discussing the draft JPA agreement stating that FPL must comply with the mandates of the Miami Dade County Consent Agreement within one year and prompting re-visitation of the agreement upon failure to meet county objectives within that time.

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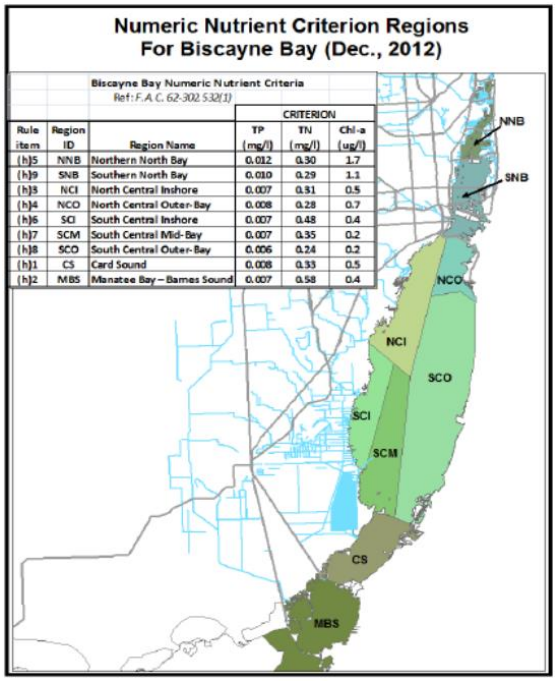
[15] Miami Dade County through its Department of Regulatory and Economic Resources, Division of Environmental Resources, Division of Environmental Resources Management v Florida Power and Light, Consent Agreement, October 6th, 2015.

3. The present language of the agreement will result in additional nutrient loading to Biscayne National Park and the Florida Keys Marine Sanctuary

Nutrient pollution is a dire problem in Biscayne Bay. A recent study published in the journal 'Estuaries and Coasts' focusing on rates of change in chlorophyll-a and nutrient concentrations at 48 stations throughout Biscayne Bay over a 20 year period determined that pollution emanating from Biscayne Bay's nearshore waters (i.e., from landward sources) have brought the bay to the precipice of a phase shift characterized by rapid eutrophication and seagrass die-offs which would change the character of the bay for decades to come[16].

Nutrient concentrations associated with the cooling canal system already exceed applicable criteria[17]. Figure 3 shows the criteria for total Nitrogen, total phosphorus, and chlorophyll-a established for the Bay's various regions under F.A.C 62-302 532(1). Figure 4 shows the best current estimate of the extent of the phosphorus loading to the East of the facility as measured via N:P concentrations in seagrass samples taken in July 2019.



Rule item	Region ID	Region Name	CRITERION TP (mg/l)	TN (mg/l)	Chl-a (ug/l)
(h)5	NNB	Northern North Bay	0.012	0.30	1.7
(h)9	SNB	Southern North Bay	0.010	0.29	1.1
(h)3	NCI	North Central Inshore	0.007	0.31	0.5
(h)4	NCO	North Central Outer-Bay	0.008	0.28	0.7
(h)6	SCI	South Central Inshore	0.007	0.48	0.4
(h)7	SCM	South Central Mid-Bay	0.007	0.35	0.2
(h)8	SCO	South Central Outer-Bay	0.006	0.24	0.2
(h)1	CS	Card Sound	0.008	0.33	0.5
(h)2	MBS	Manatee Bay – Barnes Sound	0.007	0.58	0.4

Figure 3. Seagrass N:P NNC for Biscayne Bay

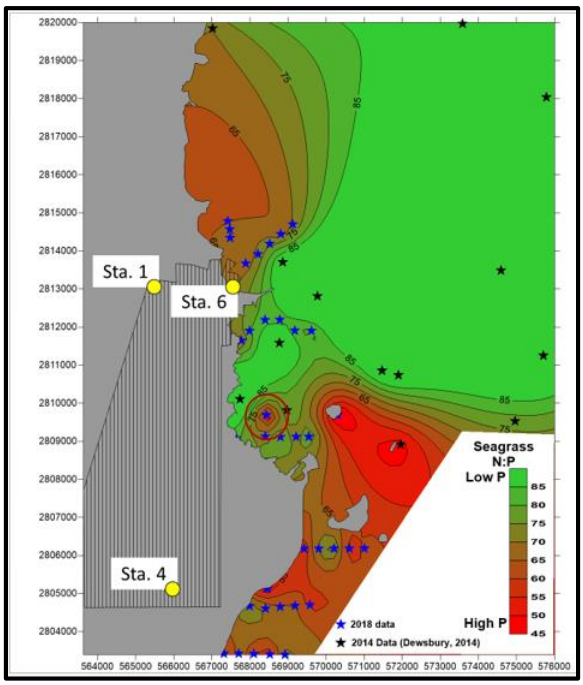


Figure 4. Nutrient Sampling Results, July 2019

Without significant amendments to the JPA, the operational changes which would result from its implementation will make nutrient loading even worse. Miami Dade County recognizes that the cooling canal system is an outdated technology in open communication with the

[16] Millette, N.C., Kelble, C., Linhoss, A. *et al.* Using Spatial Variability in the Rate of Change of Chlorophyll *a* to Improve Water Quality Management in a Subtropical Oligotrophic Estuary. *Estuaries and Coasts* **42,** 1792–1803 (2019). https://doi.org/10.1007/s12237-019-00610-5

[17] Review of Nutrient Treatment Target Levels, RER-DERM Water Resources Coordination Division, Final Report by Black and Veatch, October 30, 2018.

surrounding groundwater and surface waters of Biscayne Bay[18]. Out of recognition for this hydrological connection, Miami Dade County has long insisted that water used in the cooling canal system must meet Biscayne Bay Non-Degradation Standards[19]. There are several avenues by which the language of the JPA as currently written threatens to exacerbate the issue of nutrient loading and pollution emanating from the cooling canal system.

Increasing the input of water from the Floridan aquifer into the cooling canal system will increase the inputs of nutrients (nitrogen and phosphorous). Unless compensatory actions are taken, for example by instituting measures that will actively remove nutrients from the cooling canal system, nutrient concentrations in the cooling canal system can be expected to increase, and the associated impacts of those discharges will also increase. The proposed action to reallocate 15 MGD of Floridan aquifer water from Unit 5 for discharge into the cooling canal system will double the nitrogen and phosphorous inputs from the Floridan aquifer, which are currently estimated to be 977 pounds per month nitrogen and 23 pounds per month phosphorous. This would make inputs from the Floridan aquifer the fourth largest input of nitrogen, comparable to inputs from the interceptor ditch, and the largest source of phosphorous to the cooling canal system[20](See attachment 3). Figures 5 and 6 below from the report prepared for Miami Dade County by Black and Veatch demonstrate the additional loading which may be anticipated.

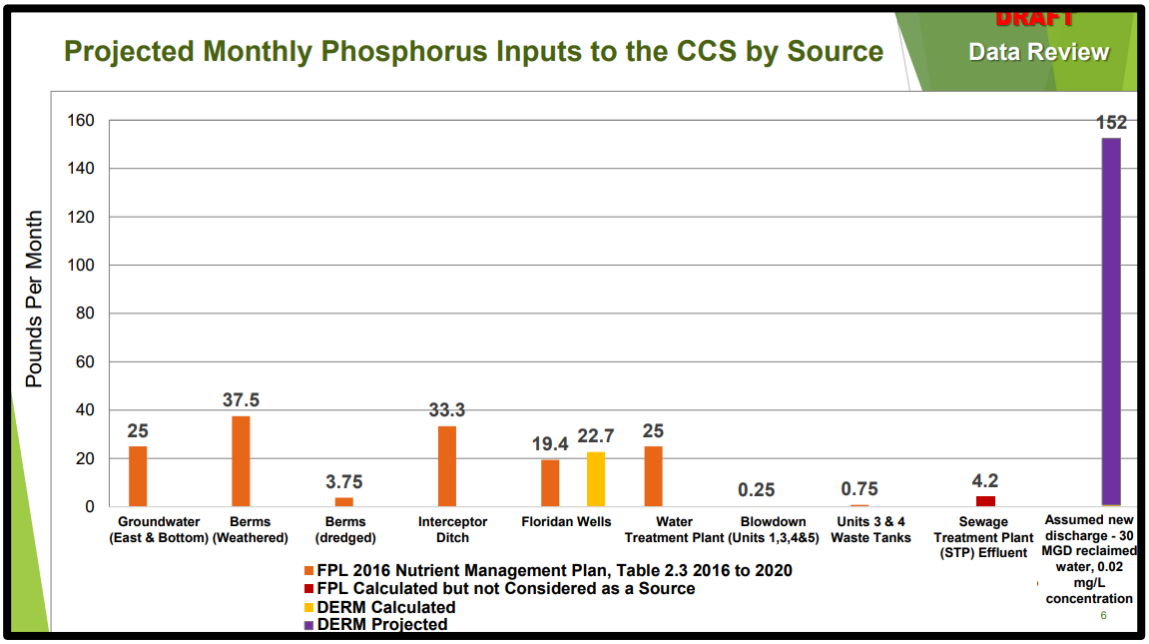


Figure 5. Projected Monthly Phosphorus inputs to the CCS by Source, Black & Veatch

[18] Miami Dade County Board of County Commissioners, Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

[19] CHAPTER 6-302: SURFACE WATER QUALITY STANDARDS Effective May 19, 2015

[20] Review of Nutrient Treatment Target Levels, RER-DERM Water Resources Coordination Division, Final Report by Black and Veatch, October 30, 2018.

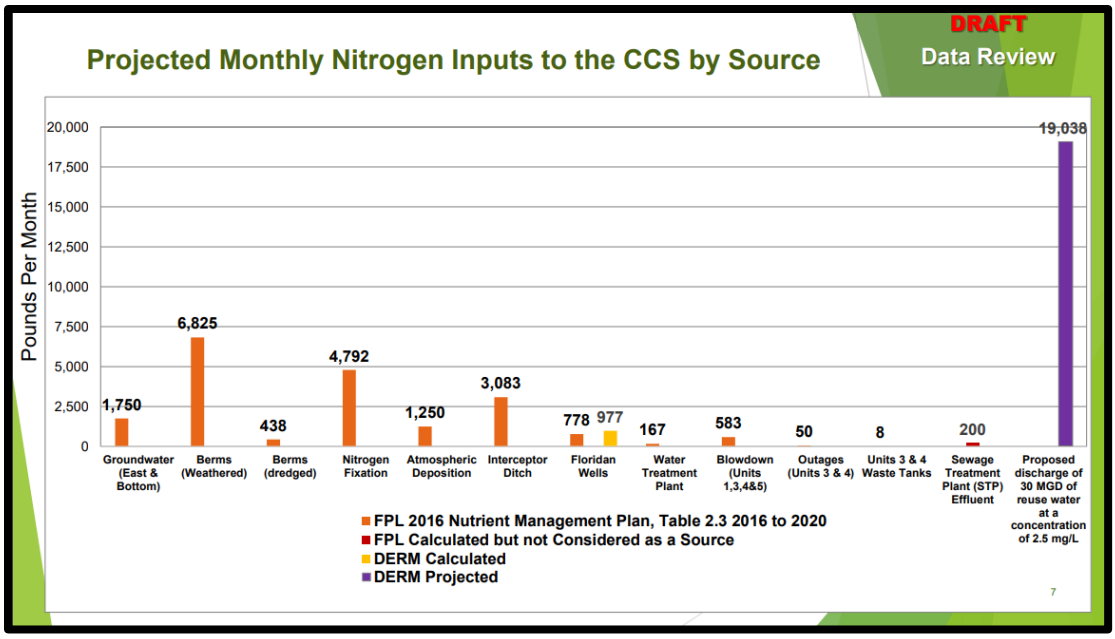


Figure 6. Projected Monthly Phosphorus inputs to the CCS by Source, Black & Veatch

In addition, while the use of wastewater for the cooling of unit 5 is theoretically safe, the JPA language fails to address what will come of the byproduct of nutrient rich 'blowdown' water produced when water is purged from the condenser to remove impurities. At present there is nothing preventing FPL from discharging this nutrient rich water into the hydrologically open cooling canal system.

The work of Dr. James Fourqurean demonstrates the impacts of such nutrient loading on the seagrass beds which form the basis of Biscayne Bay's marine ecosystem. An increase in nutrient loading, specifically phosphorus, encourages proliferation of organisms, particularly certain types of seaweed. When nutrient concentrations increase, seagrass beds are choked out by this "fast-growing, noxious" seaweed. At the most concentrated nutrient levels, seaweeds and microalgae replace the naturally occurring seagrass beds, and overgrowth of these organisms blocks access to sunlight—leading to losses of coral as well as seagrass. P concentrations in the deeper canals offshore of the cooling canal system and in caves offshore of Turkey Point are 10-20 times higher than the median concentrations (0.03 µM) of inorganic phosphorus in Biscayne Bay waters[21].

Nutrient delivery can be increased through higher concentrations of nutrients in discharges, but it can also be increased by increasing the volume of water containing nutrients, "even at very low concentrations that would pass drinking water quality standards over a long period of time". Phosphorus is the nutrient responsible for decreased water clarity, as well as the density and species composition of the seagrasses of southern Biscayne Bay. As phosphorus levels increase, a loss of seagrasses occurs. Disrupting populations of aquatic flora and fauna through nutrient

[21] Expert Report of James Fourqurean, Southern Alliance for Clean Energy, Tropical Audubon Society Incorporated, & Friends of the Everglades, Inc. v. Florida Power and Light Company. J.W. Fourqurean. May 14th, 2017.

pollution violates Florida's surface water quality statutes. The resulting harms to fish and wildlife will negatively affect activities like fishing and bird watching which stakeholders derive value from.

F.A.C. 62-302.520(48)(b) dictates that "in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna." F.A.C. 62-302(48)(a) declares that, "Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Rules 62-302.300, 62-302.700, and 62-4.242, F.A.C." Since Biscayne Bay is considered Outstanding Florida Waters by statute 62-302.700, nutrient pollution from the cooling canal system is considered degradation and is thus prohibited.

Dr. Fourqurean testified in Case No.: 1:16-cv-23017-DPG that the cooling canal system has "carried phosphorus-polluted groundwater to near-shore surface waters through the highly porous bedrock" and "dissolved carbonates in that bedrock, releasing additional phosphorus… As this phosphorus reaches the seagrass meadows offshore in Biscayne Bay, it will continue to degrade the ecosystem".

These concerns may be addressed via the inclusion of amendments to the JPA language stipulating the following:

- All blowdown water produced via the use of treated wastewater for the cooling of natural gas unit 5 must be deep-well injected and not disposed of in the open cooling canal system to prevent further contamination of Biscayne Bay. All solid waste produced via this process must be landfilled.
- Acceptance of the agreement must entail a corresponding mandate to update to the Turkey Point Nutrient Management Plan meant to take into account the proposed additional 15 MGD of Floridan aquifer water into the cooling canal system as well as other changes resultant from the JPA.
- Require annual reporting of the mass budgets for total nitrogen and total phosphorous to better track progress towards goals of reducing nutrient concentrations and controlling algal blooms, as called for in the Miami Dade County Consent Agreement.
- A TMDL should be set with the help of Dr. James Fourqurean, as seagrass death is already occurring in the nearshore of the Turkey Point Facility; ongoing research suggests the source is emanating from the cooling canal system[22].

[22] Reynolds, L. Fourqurean, J. Nuttle, W.K. Future Impacts on Biscayne Bay of Extended Operation of Turkey Point Cooling Canals [online: https://www.researchgate.net/publication/333717294_Future_Impacts_on_Biscayne_Bay_of_Extended_Operation_of_Turkey_Point_Cooling_Canals ; accessed 3 Mar 2020]

4. **The present language of the agreement will impact the water budgets in an ecologically deleterious manner which must be mitigated and calls for insufficient use of treated waste-water for beneficial purposes**

The coastal wetlands surrounding the Turkey Point Facility are already imperiled by saltwater intrusion[23]. To date; the spread of the saltwater plume further west from the cooling canal system has not been halted. In his 2018 update on the position of the saline water interface, Prinos calculated the movement of the saline water interface in the area of USGS Monitoring Wells G-1264 and G-3164 at approximately 470 feet per year[24] Figure 7 demonstrates the extent of this saltwater intrusion to the west as measured by USGS. It is also the only area in the county where significant change in the position of the saltwater front has occurred in the last 10 years.

Well data collected by the Florida Keys Aqueduct Authority (FKAA) indicates the hypersaline plume is moving westward at an even more alarming rate. The Florida Keys Aqueduct Authority constructed additional monitoring wells in 2017 where the saline water interface had passed existing monitoring wells making them obsolete. Analysis of that data indicated a very similar rate to the Prinos calculations which we rounded to approximately 500 feet per year. The locations of the FKAAs wells are shown in Figure 8.

Figure 7. Miami Dade County Salt Intrusion Extent, Prinos 2019 **Figure 8.** Location of FKAA Monitoring Wells

Continued monitoring of the new wells into 2019 showed further saline water migration in the area of new monitoring wells FKS-14 and G-3999 at a calculated rate of over 800 feet per year. The chloride concentrations at these wells over time are shown in Figure 9. The westward movement of the plume has been observed by additional stakeholders as well. The firm SDI, which operates a mining site west of the Turkey Point facility, measures specific conductivity at

[23] Miami Dade County, Crandall, 'Communication RE Request for an Extension of Time in accordance with section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Phase II Modification and Credit Release…', Miami Dade County Division of Environmental Resources Management, July 18th 2018.

[24] Map of the Approximate Inland Extent of Saltwater at the Base of the Biscayne Aquifer in the Model Land Area of Miami-Dade County, Florida, 2016

a series of monitoring wells located around their site. The locations of these wells are shown in Figure 10. The specific conductivity at the bottom of MW-05 continues to increase from the levels detected in previous surveys. This is indicative of a continued inland movement of the saltwater front at this location. The maximum specific conductance observed in February was 4,633 µS/cm, or about 1,494 mg/L equivalent chloride concentration based on relationship developed using past on-site water quality data. The specific conductance profile at MW-05 and at bottom over time are shown in Figures 11 and 12 respectively. The risk is sufficient that the owners of the property have begun preliminary design and cost estimates for the installation of a physical seepage barrier to block the salt front from migrating into the mining area[25].

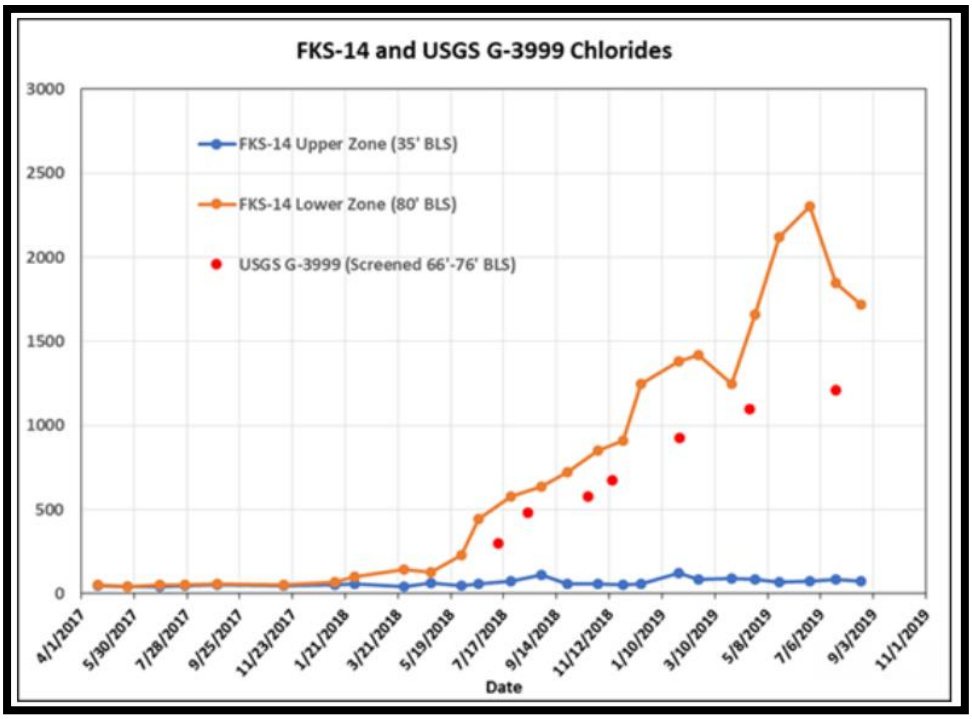


Figure 9. Chloride Concentration over Time at FKS-14 and USGA-3999

At a fundamental level, the nature of density-driven groundwater flow, hydrodynamic dispersion, and diffusion will continue to move chloride molecules from regions of higher concentration to areas of lower concentration. Thus, the plume will still move west by diffusion until equilibrium is achieved.

[25] MW-05 WATER QUALITY UPDATE for Permit No. MMR_226005-009. SDI Mine in Miami-Dade County, MacVicar Consulting, Inc. 4524 West Gun Club Road, Suite 201, West Palm Beach FL 33415, February 2019

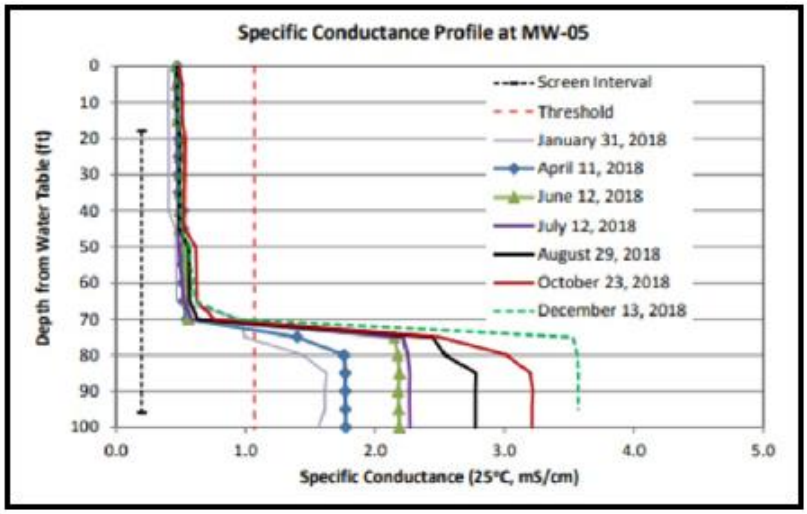


Figure 10. Location of SDI Monitoring Wells

Figure 11. Specific Conductance Profile at MW-05

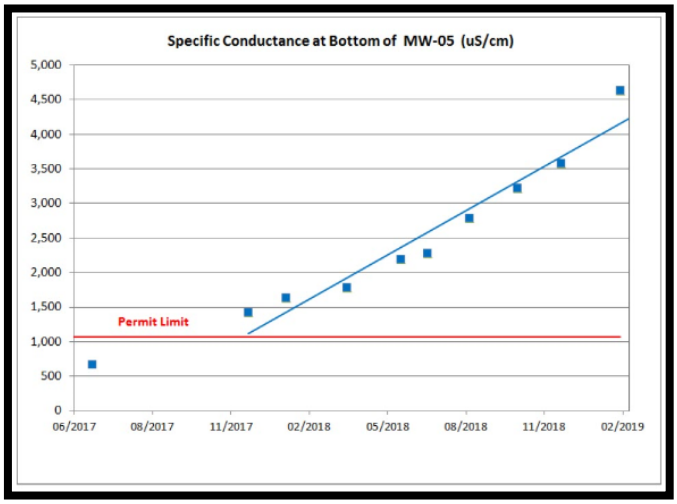


Figure 12. Specific Conductance at Bottom of MW-05 over Time

By allowing FPL to reallocate 15 MGD of Floridan aquifer water currently being used for the cooling of Natural Gas Unit 5 towards the freshening of the cooling canal system, the Power Plant Siting Act post-certification amendment links Miami-Dade County to the freshening activities. Expert analysis performed by Dr. William Nuttle demonstrates that this process which FPL calls "freshening" is really dilution, in which FPL adds water inputs of lower salinity value to replace freshwater evaporated from the cooling canal system (thereby reducing overall salinity) exacerbates cooling canal system discharges. When one compares discharge rates from prior to the beginning of these activities to the current operational period, a clear pattern emerges which demonstrates that net outflow from the cooling canal system has increased in direct correspondence to new inputs[26].

[26] Expert Report of Dr. William Nuttle, Case No.: 1:16-cv-23017-DPG, May 14, 2018

Increasing the amount of water added to the cooling canal system will raise water levels in the cooling canals. Multiple stakeholders have raised concerns that this will cause the further movement of the hypersaline ground water beyond the boundaries of the cooling canal system.

FPLs own water balance models demonstrate that their 'freshening' activities have pushed the plume further East into the surface waters of Biscayne Bay (see figure 13). This is supported by modeling performed by the firm Earthfx.

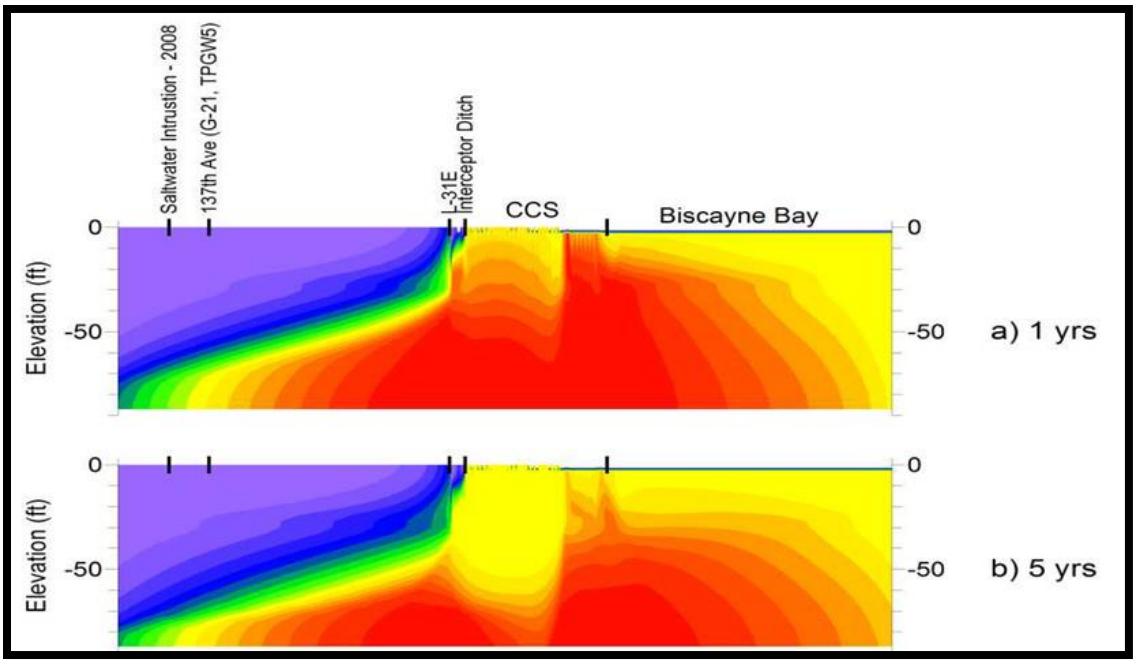


Figure 13. FPL Water Balance Model under 'freshening'

The firm Earthfx utilized the FPL 2018 Model to assess the movement of the saline groundwater under the conditions of adding an additional 15 MGD of Floridan aquifer water. Earthfx took a two-step approach to this modeling. First, they replicated the original analysis of the RWS under baseline conditions. Second, they assessed the change in groundwater salinity with the addition of 30 MGD to the cooling canal system.

It is important to note that the FPL 2018 model results are based on two assumptions:

1) The concentration of water in model Layer 1 representing the cooling canal system was set to 34 PSU at the start of the simulation, assuming that the cooling canal system had been "freshened" instantly and uniformly across the cooling canal system.

2) The elevation of the water in the cooling canal system has been raised by 0.1 ft. uniformly to represent the change in water levels caused by the addition of the Upper Floridan water.

Figure 14 shows the starting concentrations in Layer 8 of the 2018 FPL model at the start of remediation. The top of layer 8 ranges between 40 and 50 ft. below sea level in the Model Land Area. These results show that salinity levels in Layer 8 beneath the cooling canal system

are between 56 to 66 PSU and are higher than in Layer 1 (The cooling canal system) and show the western extent of FPL's hypersaline pollution plume extending into the Biscayne Aquifer past 137th Avenue, close to the extent of the saltwater interface mapped by the USGS. These conditions are borne out by other entities.

Figure 15 shows the simulated concentrations at the end of 10 years of pumping, operating the recovery well system (RWS), and "freshening" the cooling canal system at 30 MGD. Notice the very high salinity levels to the east as well as hypersaline contamination still remaining to the west. These results are consistent with those previously presented by FPL. Model results for Layer 8 shows a drop in simulated salinity values in the Biscayne Aquifer beneath the cooling canal system compared to the baseline simulation. However, salinity values west of the cooling canal system are higher as more saline water is pushed out into the Model Lands area due to the higher water levels in the cooling canal system and the reduced effectiveness of the RWS.

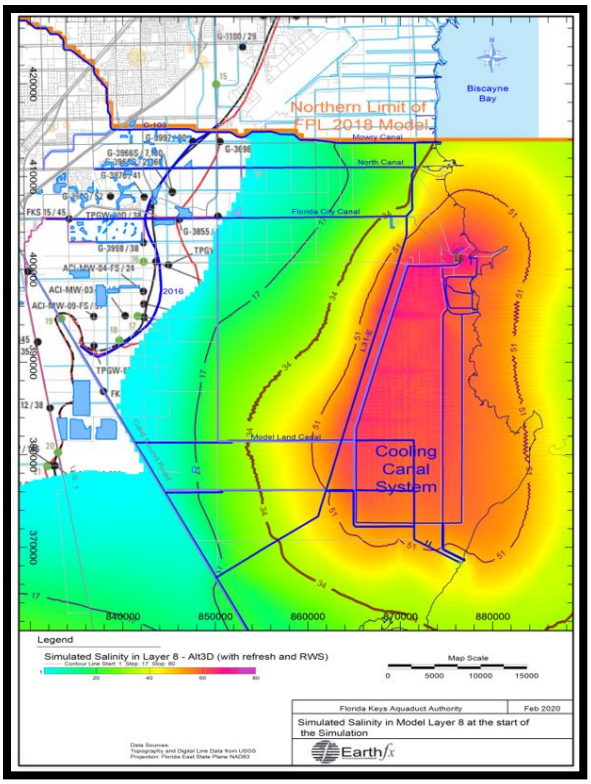


Figure 14. Simulated concentrations in Layer 8 at a depth of approx. 60 feet of the 2018 FPL Model at the start of the redial simulation.

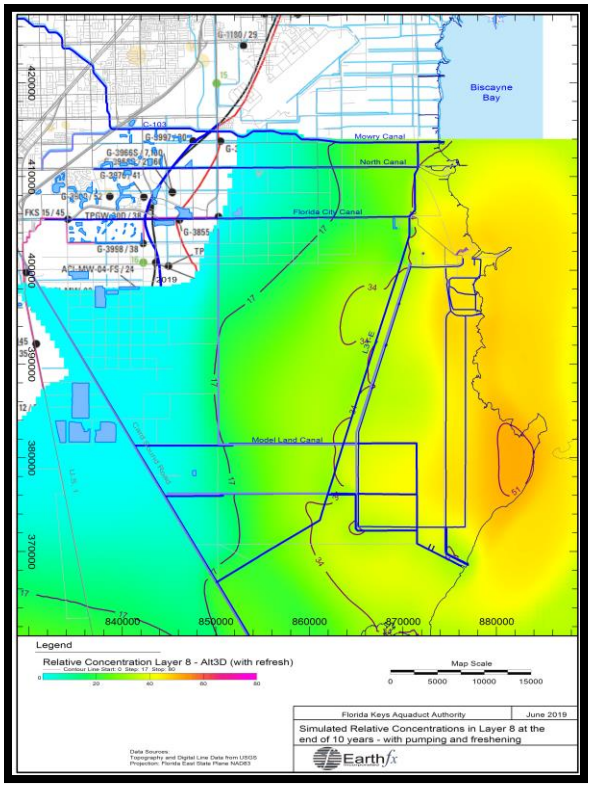


Figure 15. Simulated concentrations in Layer 8 or approx. 60 feet at the end of the 10-year remediation simulation with freshening of the cooling canal system at 30 MGD and RWS pumping.

FPL claims that these results justify that the recovery well system can achieve pullback of the hypersaline plume. However, upon closer examination one can see that only a portion of the saline plume is retracted under this model. The combination of dilution or "freshening" the cooling canal system and operating the RWS reduces the concentrations to below seawater salinity in only a portion of the Model Land area, leaving behind a large body of contaminated groundwater in the Model Lands area which could continue to migrate and threaten both wellfields and wetlands.

The simulations shown in the figures above serve as the baseline for assessing the effects of nearly doubling the volume of water in the cooling canal system. To estimate the effects of doubling the volume on the movement of saline water in the cooling canal system vicinity, two conditions must be set, the initial concentration of water in the cooling canal system at the start of remediation and water levels in the cooling canal system.

Although data is limited, injection of the 14MGD of freshwater into the cooling canal system was able to reduce salinities to between 50.9 and 51.1 PSU in 2018 and 2019, falling short of the 34 PSU target. FPL assumes it is reasonable that doubling the volume of freshwater inputs would achieve the goal of bringing cooling canal system saline concentrations to 34 PSU, as well as raising the water level by 0.1 feet across the cooling canal system. That assumption was used in this simulation.

The results of this modeling show that while saline concentrations within the cooling canal system fall more rapidly under higher volumes of freshwater input, concentrations of chloride outside the cooling canal system also rose as more chloride is pushed out into the Model Lands area due to the higher heads in the cooling canal system. The interceptor ditch and recovery well system have proven insufficient to address this issue. Our model shows an expanded area of hypersaline water (above 34 PSU) up to 7000 ft. from the cooling canal system under the condition of adding 30 MGD of freshwater to the cooling system. The two smaller closed 34 PSU contours are areas where the RWS has reduced concentrations. No significant change occurs in the vicinity of SW 137th Street and on the east side of the cooling canal system. Figure 15 above demonstrates this condition.

This agreement would allow for 15 MGD of nutrient-loaded Floridan aquifer water to be added to the cooling canal system for 'freshening' purposes, and would result in a similar level of exacerbation of cooling canal system discharges. As such, provisions should be included to counteract the impacts which this change will have on surrounding waters. Under the South Florida Water Management District's Fifth Supplemental Agreement with Florida Power and Light, FPL was mandated to 'operate the interceptor ditch system to restrict movement of saline water from the cooling water system westward of the Levee 31E adjacent to the cooling canal system to those amounts which would occur without the existence of the cooling canal system"[27] (See attachment 4). They have clearly failed in this objective, and the very viability of the Interceptor Ditch as a means of abating westward migration of polluted water has been proven

[27] Fifth Supplemental Agreement Between the South Florida Water Management District and Florida Power and Light Company, October 16th, 2009

lacking. Miami Dade County's Consent Agreement with Florida Power and Light states that an objective of the agreement is to "reduce the rate of, and, as an ultimate goal, arrest migration of hypersaline groundwater". As such, it would be inappropriate to sign on to an agreement which would result in additional saline pollution being extruded into the Model Lands. Thus, the agreement should contain language meant to minimize and mitigate the impacts of freshening operations.

In light of the additional seepage and head elevation that will occur from doubling the amount of water added to the cooling canal system, the agreement should be amended to include the following:

- Language stating that the use of the interceptor ditch pumps should be modified or discontinued to preserve upwards of 3MGD of freshwater to help prevent advancing the salt water intrusion front, pumps should be removed.

- Seek a higher and better use for the remaining 102 MGD than simply deep well injection that includes replacing some of the water damaged in the model lands by treating it to anti degradation standards and restoring the freshwater lens in this area to combat salt water intrusion.

5. The present language of the agreement stands in conflict with the goals of the Comprehensive Everglades Restoration Plan, specifically the C-111 Canal Project and the Biscayne Bay Coastal Wetlands Project.

Miami Dade County has a substantial interest in ensuring that the Comprehensive Everglades Restoration Plan, and specifically the C-111 Canal Project and the Biscayne Bay Coastal Wetlands Project which aim to improve the quality and quantity of freshwater entering Biscayne Bay are implemented successfully. Out of recognition for the importance of the project and the positive impacts it would have on county resources, in April of 2016 Miami Dade County passed a resolution urging the US Army Corps of Engineers and South Florida Water Management District to Expedite Phase II of the Biscayne Bay Coastal Wetlands project so that planning for Phase II may commence as soon as possible[28].

In their 2015 consent agreement with Miami Dade County, FPL agreed to acknowledge the benefits of hydrologic restoration projects contemplated by the Comprehensive Everglades Restoration Project ("CERP"), as well as other government entities, adjacent and to the west of the cooling canal system in controlling movement of hypersaline and saline waters in the Biscayne Aquifer, and commit to working with state, local and federal agencies to facilitate implementation of these projects to promote improved hydrologic conditions. And yet, the

[28] Miami Dade County RTSOTIITTONNO R-32s-r_6 RESOLUTION URGING THE U.S. ARMY CORPS OF ENGINEERS, THE T'LORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION AND THE SOUTH ELORIDA WATER MANAGEMENT DISTRICT TO EXPEDITE PHASE II OF THE BISCAYNE BAY COASTAL WETLANDS PROJECT SO THAT PLANNING FOR PHASE II MAY COMMENCE AS SOON AS POSSIBLE AND TO TAKE ALL NECESSARY ACTONS TO COMPLETE PHASE I OF THE BISCAYNE BAY COASTAL WETLANDS PROJECT, April 16th 2016

language of this JPA would validate the alteration of cooling canal system water budgets in a manner that would undermine the goals of both of these CERP projects. Furthermore, in the Fifth Supplemental Agreement, FPL is obligated to "immediately begin consultation with the district in order to identify measures to mitigate, abate or remediate impacts from the cooling canal system" upon any determination by the South Florida Water Management District that impacts of the cooling canal system are found "inconsistent with the goals and objectives of the CERP Biscayne Bay Coastal Wetlands project"[29].

The Biscayne Bay Coastal Wetlands projects aims to address nearshore hyper-salinity in Biscayne Bay and restore mesohaline conditions along the nearshore south/central bay in order to improve ecological conditions, specifically aiming to increase the duration and spatial coverage of mesohaline conditions of 5-20 PSU out to 250 m during the dry season and 500 m during the wet season[30] These targets are not currently being met[31]. A map detailing these targets can be seen in Figure 16.

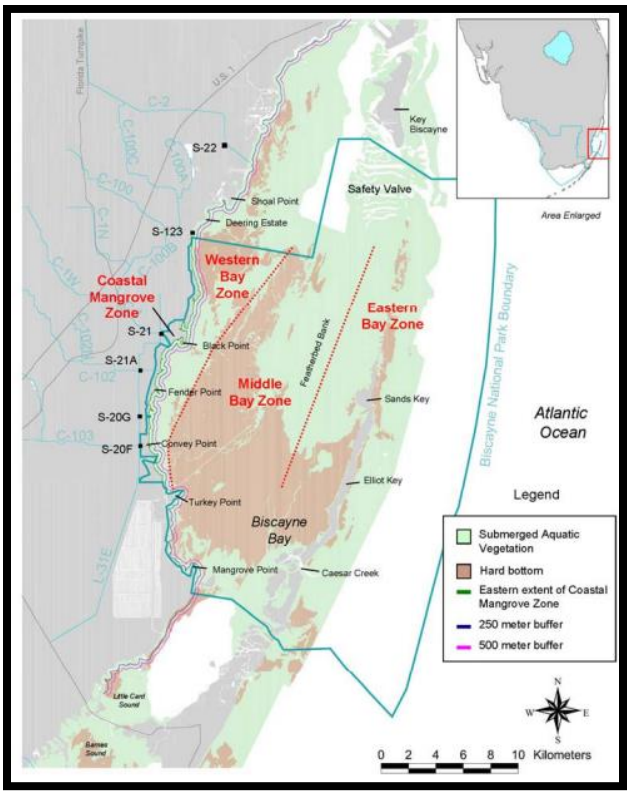


Figure 16. Biscayne National Park Western Bay Zone current and potential distribution of submerged aquatic vegetation on the bay bottom under restored conditions

[29] Fifth Supplemental Agreement Between the South Florida Water Management District and Florida Power and Light Company, October 16th, 2009

[30] Estimates of Flows to Meet Salinity Targets for Western Biscayne National Park, National Park Service, SFNRC Technical Series 2008: 2

[31] Erik Stabenau* and Donatto Surrat, Biscayne Bay: Current Conditions and CERP Objectives, National Park Service, http://nas-sites.org/cisrerp/files/2019/08/1335-NPS__BiscayneBay_Conditon_and_CERP_Objectives_2019-Stabenau.pdf

Saltwater intrusion imperils the coastal wetlands surrounding Turkey Point including the model lands and wetlands targeted for improvement under the C-111 canal and Biscayne Bay Coastal Wetlands Everglades Restoration projects. This was borne out in a letter sent by the director of the division of Environmental Resources Management to the Miami Dade County Office of General Counsel regarding a requested Everglades Mitigation Bank Phase II Modification delivered on July 18th, 2018[32]. FPL reports[33] that extreme high tides related to increased sea level are causing saltwater to encroach into the L31 canal. Data collected by the South Florida Water Management District shows that there has been a marked increase over the past 10 years in the number of days that water levels in the L31 canal are lower than water levels in Biscayne Bay[34]. This data is graphed in Figure 17. In 2019, conditions of lower water level in the L31 canal favored the encroachment of saline water on one out of every 6 days.

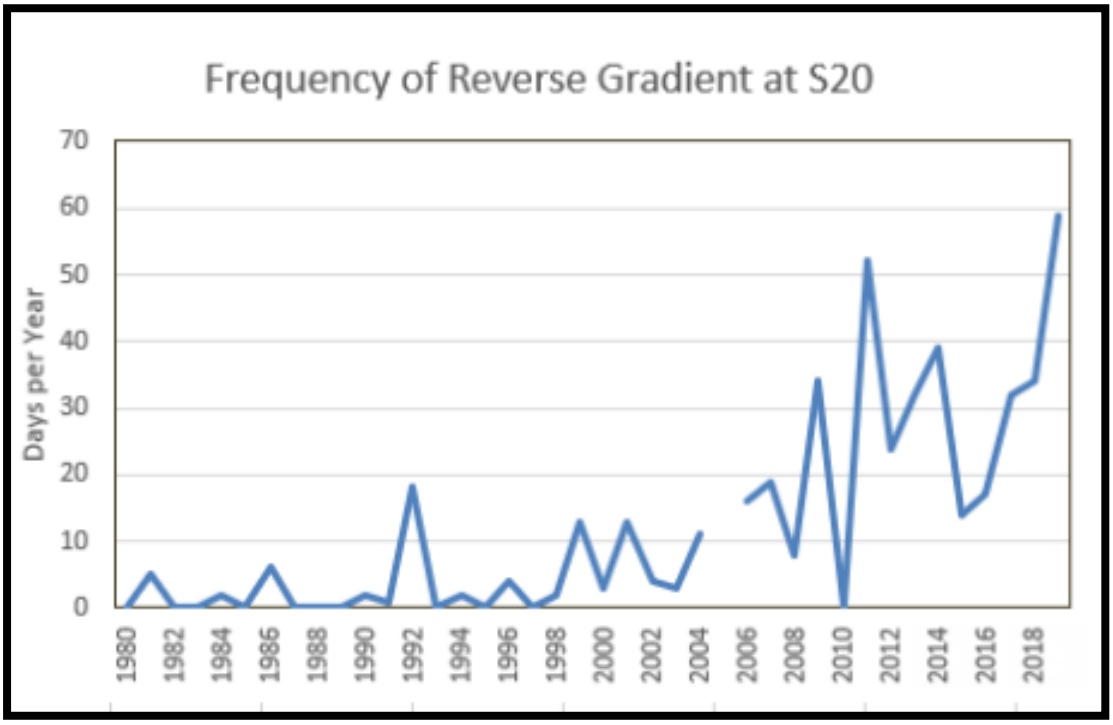


Figure 17: Frequency that average daily water levels in Biscayne Bay exceed water levels in the L31 canal at the S20 structure, which drives the encroachment of saline water into the surface water of the Model Lands Basin

Figures 18 and 19 demonstrate the unhealthy conditions which exist within the FPL Model Lands adjacent to the Turkey Point facility and were provided to FDEP by DERM on July 18th, 2018 in a letter for an extention of time peguarding FPL's Mitigation bank permit.

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[32] Letter RE Request for an Extension of Time in accordance with section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Phase II Modification and Credit Release, Miami Dade County Division of Environmental Resources Management, July 18th 2018.

[33] Turkey Point Annual Monitoring Report 2019

[34] Based on water level data collected at the S20 structure, located near the southwest corner of the Turkey Point cooling canal system,

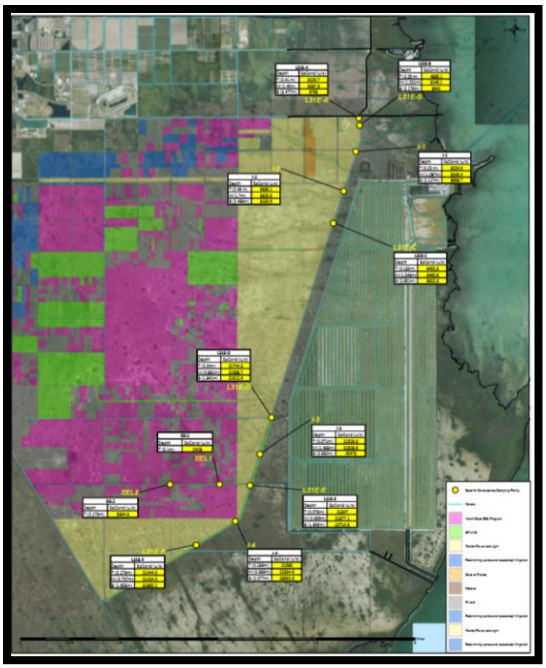

Figure18. Model Lands Surface Water Specific Conductance L-31E borrow canal and Model Lands South canal April 2018, showing surface water contamination in what was a freshwater wetland.

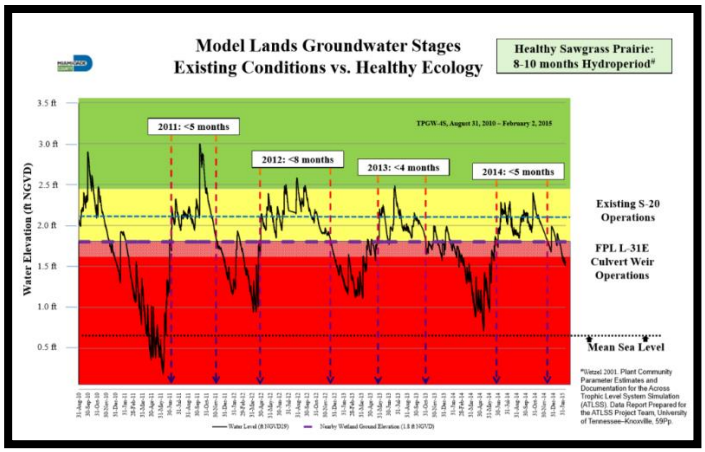

Figure19. Model Lands Groundwater Stages Existing Conditions vs. Healthy Ecology

The Earthfx modeling described above demonstrates that this JPA as currently written would run counter to the commitment to restore mesohaline conditions in this area, and undermine critical Everglades restoration projects meant to improve the health of Biscayne Bay and its coastal wetlands.

Additional land and water is needed for ecosystem restoration by the Biscayne Bay Coastal Wetlands Project and to mitigate the impacts on Biscayne National Park and the Florida Keys Marine sanctuary from continued operation of the cooling canal system via salt loading and nutrient loading. At the same time, the current version of the JPA would put far less treated water towards productive re-use than previous versions[35], and calls for only a fraction of the water re-use which Miami Dade County must provide. Previous versions of this agreement would have called for upwards of 90 MGD of treated wastewater to be reused in the Turkey Point facility. The 15 Million Gallons per day called for under this agreement does not adequately advance Miami Dade County obligations to reuse 117.5 MGD by 2025.

In light of the current threats to the wetlands surrounding the Turkey Point facility and the role which the JPA may play in exacerbating these threats, a greater emphasis should be placed on producing and using treated water for environmental restoration purposes as opposed

[35] Miami Dade County Water and Sewer Department, 5-Year Progress Report: Progress from 2008 through 2019, Section 403.086(9)(f), Florida Statutes, Task Authorization 49, December 2019.

to wasting this valuable resource through deep-well injection. This can be achieved through the inclusion of the following textual amendments:

- Because of the known conflicts with the C-111 CERP project, additional water storage should be realized in the model lands' 21,000 acres, sufficient to raise the freshwater head elevation from 1.8 feet to 2.2 feet at a minimum, as called for in the Miami Dade County Consent Agreement.

- Because the continued operations are in conflict with the BBCW CERP project the agreement should call for a future guaranteed amount of freshwater to be recycled for restoration purposes, potentially recharging the Bird Drive Basin area to seek a higher and better use for the remaining 102 MGD than simply deep well injection. Creating a recharge basin will help recharge the aquifer and ensure there is a driving head to the coastal structures.

- The additional contamination associated with this freshening effort calls for increase monitoring in Biscayne Bay and backfilling of the known areas where the greatest contamination has been shown to occur. Backfilling should be completed to where Mangrove restoration can occur at -1.5 feet to better benefit wildlife and restoration efforts.

Summary of Suggested Amendments

In light of the information presented above, we propose the following amendments to the JPA language:

For the State of Florida:

Work in partnership with all regulators and stakeholder; hold a public workshop with all of those impacted by these changes in operations to resolve conflicts with Everglades Restoration, water supply and impacts to Biscayne National Park and Florida Keys Marine Sanctuary. The venue for this could possibly be the May 2020 SFWMD Governing Board meeting, where board members can also consider their role under the Fifth Supplemental Agreement. The outcome of this meeting should drive required joint conditions to continued operations at Turkey Point that mitigate for impacts of the changes to the PPSA, JPA agreement and continued operations of the cooling canal system generally. This should occur before any new agreement or permit is issued to FPL.

For Miami Dade to Address Legal Liability:

- The agreement should include "County as sovereign" language.
- The agreement should stipulate that FPL must appropriately maintain pipe infrastructure, assumes liability for malfunctions and can be held to county standards as opposed to state/federal

- The agreement should include a textual amendment recognizing that the Turkey Point cooling canal system is in open communication with surrounding ground and waters and as such changes in operations are required or updating the technology would be required for continued operations to mitigate impacts.
- Alternatively, Miami Dade County should clarify its current stance on the continued operation of the cooling canal system beyond 2033, and require actual progress on mitigation from the impacts of the current freshening strategy and recovery well system as required by the consent Order and Consent Agreement.

To Address the Consent Agreement:

- FPL must comply with the mandates of the Miami Dade County Consent Agreement within one year. The County should also take the opportunity to strengthen the language of FPL's obligations in light of the new evidence surrounding the impacts of the cooling canal system "freshening" process.
- Alternatively, this agreement should incorporate the amendment called for by Commissioner Rebecca Sosa at the April 10th 2018 Board of County Commissioners meeting discussing the draft JPA agreement, which called for re-visitation of the agreement upon failure to meet county objectives within one year.

To Address Nutrient Loading:

- All 'Blowdown' water produced via the use of treated wastewater for the cooling of natural gas unit 5 must be deep-well injected and not disposed of in the open cooling canal system to prevent further contamination of Biscayne Bay. All solid waste produced via this process must be landfilled.
- Acceptance of the agreement must entail a corresponding mandate to update to the Turkey Point Nutrient Management Plan meant to take into account the proposed additional 15 MGD of Floridan aquifer water into the cooling canal system as well as other changes resultant from the JPA.
- Require annual reporting of the mass budgets for total nitrogen and total phosphorous to better track progress towards goals of reducing nutrient concentrations and controlling algal blooms, as called for in the Miami Dade County Consent Agreement.
- A TMDL should be set with the help of Dr. James Fourqurean, as seagrass death is already occurring in the nearshore of the Turkey Point Facility; ongoing research suggests the source is emanating from the cooling canal system[36].

To Address the Water Budget:

[36]Reynolds, L. Fourqurean, J. Nuttle, W.K. Future Impacts on Biscayne Bay of Extended Operation of Turkey Point Cooling Canals [online: https://www.researchgate.net/publication/333717294_Future_Impacts_on_Biscayne_Bay_of_Extended_Operation_of_Turkey_Point_Cooling_Canals ; accessed 3 Mar 2020]

- Language stating that the use of the interceptor ditch pumps should be modified or discontinued to preserve upwards of 3MGD of freshwater to help prevent advancing the salt water intrusion front.
- Seek a higher and better use for the remaining 102 MGD than simply deep well injection that includes replacing some of the water damaged in the model lands by treating it to anti degradation standards and restoring the freshwater lens in this area to combat salt water intrusion.

To Address Conflicts with Everglades Restoration:

- Because of the known conflicts with the C-111 CERP project, additional water storage should be realized in the model lands 21,000 acres, sufficient to raise the freshwater head elevation from 1.8 feet to 2.2 feet at a minimum, as called for in the Miami Dade County Consent Agreement.
- Because the continued operations are in conflict with the BBCW CERP project the agreement should call for a future guaranteed amount of freshwater to be recycled for restoration purposes, potentially recharging the Bird Drive Basin area to seek a higher and better use for the remaining 102 MGD than simply deep well injection. Creating a recharge basin will help recharge the aquifer and ensure there is a driving head to the coastal structures.
- The additional contamination associated with this freshening effort calls for increase monitoring in Biscayne Bay and backfilling of the known areas where the greatest contamination has been shown to occur. Backfilling should be completed to where Mangrove restoration can occur at -1.5 feet to better benefit wildlife and restoration efforts.

The ecological health and vitality of Biscayne Bay and its coastal wetlands are a matter of critical importance to the many stakeholders which derive their health, wealth, and well-being from the use of these resources. Because of the advancement of the plume despite 3 years of remediation efforts these conditions to protect the remaining potable water in the area, to protect adjacent land owners and Miami Dade and the Florida Keys drinking water supply must be addressed. We hope this information will encourage all regulators to work together to resolve these issues and that each of you will take this information and these suggestions into consideration in drafting final language for the Joint Partnership Agreement between Miami Dade County and the Florida Power and Light Company and in the pending draft NPDES permit. If you feel these negotiations with FPL will fail, then our suggestion is to suspend entering into any new agreement or issuance of any new permit with FPL until full compliance with the consent order and consent agreement is achieved and FPL has successfully shown what it continues to claim it can achieve through this remediation.

We look forward to providing you with any information we can and would be glad to address the SFWMD governing board at an upcoming workshop to address these conflicts. This analysis and report was produced for your consideration by the undersigned scientists on behalf of the Florida Keys Aqueduct Authority and the Florida Keys Fishing Guides Association.

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Appendix:

Attachment 1:

Miami Dade County Board of County Commissioners, Miami Dade County Board of County Commissioners, Resolution supporting the County Mayor in efforts to seek a commitment from Florida Power and Light Company to discontinue use of the cooling canal system at the Turkey Point Power Plant, Miami Dade County Board of County Commissioners, July 19, 2016.

Attachment 2:

Miami Dade County, Crandall, 'Communication RE Request for an Extension of Time in accordance with section 120.57, Florida Statutes regarding Florida Power & Light (FPL) Permit No. 0193232-182, Everglades Phase II Modification and Credit Release…', Miami Dade County Division of Environmental Resources Management, July 18th 2018.

Attachment 3:

Review of Nutrient Treatment Target Levels, RER-DERM Water Resources Coordination Division, Final Report by Black and Veatch, October 30, 2018.

Attachment 4:

Fifth Supplemental Agreement Between the South Florida Water Management District and Florida Power and Light Company, October 16th, 2009

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