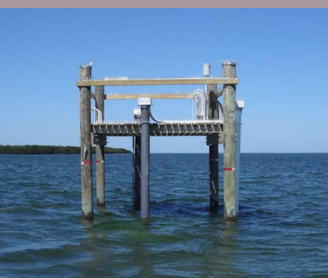
Turkey Point Plant

Annual Monitoring Report

August 2019





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ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
µS/cm	microSiemen(s) per centimeter
‰	parts per mille
Agencies	South Florida Water Management District, Miami-Dade County Department of Regulatory and Economic Resources, and the Florida Department of Environmental Protection
ANPP	Annual Net Primary Productivity
BBCA	Braun-Blanquet Cover Abundance
CA	Consent Agreement
CCS	cooling canal system
cm	centimeter(s)
C:N	carbon to nitrogen
CO	Consent Order
COC	Conditions of Certification
CSEM	Continuous Surface Electromagnetic Mapping
DO	dissolved oxygen
DQO	data quality objective
DUS	data usability summary
EDMS	Electronic Data Management System
EPA	United States Environmental Protection Agency
EPU	Extended Power Uprate
FDEP	Florida Department of Environmental Protection
FDOH-BRC	Florida Department of Health – Bureau of Radiation Control
FIU-WQMN	Florida International University Water Quality Monitoring Network
FPL	Florida Power & Light Company
ft	foot/feet
g/m^2	gram(s) per square meter

GPS	global positioning system
ID	Interceptor Ditch
LNWR	Loxahatchee National Wildlife Refuge
m	meter(s)
m^2	square meter(s)
MDC	Miami-Dade County
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mgd	million gallons per day
Monitoring Plan	Florida Power & Light Company Turkey Point Nuclear Power Plant Groundwater, Surface Water, and Ecological Monitoring Plan (2009)
mph	miles per hour
NAVD 88	North American Vertical Datum of 1988
NEXRAD	Next Generation Radar
N:P	nitrogen to phosphorus
NRC	U.S. Nuclear Regulatory Commission
OP	orthophosphate
PAR	photosynthetically active radiation
pCi/L	picocuries per liter
PSS-78	Practical Salinity Scale of 1978
PSU	practical salinity unit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RER	(Miami-Dade County) Department of Regulatory and Economic Resources
RWS	recovery well system
SAV	submerged aquatic vegetation
SFWMD	South Florida Water Management District
SWI	Shannon-Wiener Index (of diversity)
TKN	total Kjeldahl nitrogen
TN	total nitrogen

TP	total phosphorus
Turkey Point	Florida Power & Light Company Turkey Point Power Plant
UFA	Upper Floridan Aquifer
USGS	United States Geological Survey

EXECUTIVE SUMMARY

Summary

Observations from the 2018 – 2019 reporting period demonstrate that the data collection and assessment objectives of the Consent Order (CO), Consent Agreement (CA), and Fifth Supplemental Agreement are being met. The reporting period was generally drier than past years, resulting in limited progress in reducing salinity. However, groundwater, porewater, and surface water monitoring continues to confirm that the extent and movement of water that comes from the cooling canal system (CCS) is relatively well understood.

This report provides a review of the extent and factors affecting the disposition of water, salt, and nutrients in and around the Florida Power & Light Company (FPL) Turkey Point Power Plant (Turkey Point) facility.

Meteorological

Meteorologically, this was a drier year with less intense/large rainfall events as compared to historical data. The total rainfall over the CCS for the reporting period was 36.97 inches compared to the 24-year historical average of 43.67 inches, with the deficit occurring in the wet season. The highest daily rainfall total was only 3.87 inches, and the second highest was just 2.30 inches; these two events comprise the only instances of rainfall greater than 2 inches over the reporting period. The lack of a heavy single day rainfall or multi-day events in excess of 5 or 6 inches is a notable meteorological finding for the reporting period. Heavy rain events, which have occurred more frequently in most years, are important in helping lower CCS salinities; these rain events did not occur during this reporting period. Additionally, 4 months in this reporting period had average monthly air temperatures that were some of the highest over the last 23 years of record. Evaporation also exceeded rainfall in the CCS for 11 out of 12 months. As a result, over 19 million gallons per day (mgd) of freshwater left the CCS via evaporation than was added by rainfall.

Groundwater

Most of the groundwater data collected during this reporting period were consistent with values and trends measured over the entire monitoring effort. However, there were some exceptions, including the reduction of specific conductance, chloride, and sodium in several shallow wells west of, but closest to, the CCS that coincide with recovery well system (RWS) pumping. This most notably included wells TPGW-1S, TPGW-15S, and, to a lesser extent, TPGW-2S. Historically, low values in one or more of these parameters were recorded in these wells during the reporting period. No appreciable changes in salt water constituents were noted in these wells at depth. Over 4.9 billion gallons of hypersaline groundwater and over 2 billion pounds of salt have been removed from the Biscayne Aquifer and it was anticipated that these initial reductions in groundwater salt content would be first observed in shallow wells close to the CCS.

Long-term gradual increases in salinity along the base of the Biscayne Aquifer in monitoring wells west of the L-31E canal in the vicinity of Tallahassee Road (TPGW-4D, TPGW-5D, TPGW-7D, and TPGW-L21 [58 feet (ft)]) indicate saltwater is continuing to move westward; however, the rate of movement over the past several reporting periods is either waning or is occurring slowly. For example, the specific conductance at TPGW-7D increased by approximately 5% during this reporting period as compared to 10% during the previous year and over 50% in prior years. Quarterly specific conductance, chloride, and sodium values increased slightly at TPGW-21 (58 ft) during this reporting period, but this slight increase has been consistent since 2010. The highest values of specific conductance (21,034 microSiemens per centimeter [µS/cm]), chloride (7,630 milligrams per liter [mg/L]), and sodium (3,850 mg/L) were all recorded in March 2019 at TPGW-21 (58 ft), which indicate an ongoing gradual increase in saltwater at depth. Tritium concentrations are also slightly increasing in this well over time; however, values remain below 60 picocuries per liter (pCi/L). The inland migration of saltwater is consistent with the South Florida regional saltwater intrusion impacts documented by United States Geological Survey (USGS) monitoring in Palm Beach, Broward, and Miami-Dade counties.

The influence of the CCS on groundwater below Biscayne Bay/Card Sound is primarily observed in the deep wells. Groundwater at the base of the Biscayne Aquifer, as observed in two of the three wells located east of the CCS (TPGW-10D and TPGW-11D), have shown gradual increases in saltwater constituents starting in 2012/2013. However, similar to the previous reporting period, the rate of increase in specific conductance in both wells has leveled off. There is little to no sourced CCS groundwater in the shallow wells, and porewater data collected from multiple locations in the Bay do not reveal CCS sourced groundwater seeping up into the Bay.

Surface Water

Water quality and automated data from Biscayne Bay/Card Sound from this reporting period indicate no changes in trends or discernible influences from the CCS. Short-term increases in specific conductance, which indicate saltwater, have been noted in the L-31E canal, similar to prior years. Based on the assessment of data and multiple lines of evidence, the cause of saltwater increases in the L-31E canal is not from a CCS-sourced groundwater pathway.

The average specific conductance for the CCS using all seven stations combined during the reporting period (72,556 µS/cm) was almost exactly the same as the previous year (72,227 µS/cm). The average annual salinity for this year, calculated in accordance with Paragraph 29.J of the CO, was 51.1 on the Practical Salinity Scale of 1978 [PSS-78]. Upper Floridan Aquifer (UFA) freshening water was added during the reporting period (approximately 4.15 billion gallons). This non-potable, low-salinity water was instrumental in moderating CCS salinities and it offset some of the evaporative losses of water from the CCS; however, coupled with the lack of larger rainfall events, it was not enough to lower the annual average salinity in the CCS from the previous year.

Conclusion

Data collected during this reporting period continue to support the conclusion that the CCS does not have adverse water quality or ecological impacts on surrounding marsh and mangrove areas and seagrass in Biscayne Bay/Card Sound. For example, based on 9 years of twice yearly in-situ observations of seagrass in 256 plots offshore of Turkey Point (640 plots monitored from 2010 through 2012), there has been no evidence of seagrass community transition that would indicate increases in total phosphorus (TP) or impacts from the CCS. The presence and prevalence of seagrasses in the area appear to be primarily influenced by sediment depth, seasonal variability, and regional climatic events.

1. INTRODUCTION

Florida Power & Light Company (FPL) submits this Annual Monitoring Report, as required by Conditions of Certification (COC) X of Site Certification #PA 03-45 (FDEP 2008) for the FPL Turkey Point Power Plant (Turkey Point) Units 3 and 4 Nuclear Power Plant and the South Florida Water Management District (SFWMD) Fifth Supplemental Agreement (SFWMD 2009a). This monitoring report has been prepared in accordance with the FPL Turkey Point Groundwater, Surface Water, and Ecological Monitoring Plan, referred to herein as the Monitoring Plan (SFWMD 2009b) and modifications (SFWMD 2013a, b, c), as required by the SFWMD Fifth Supplemental Agreement. The 2009 Monitoring Plan requires the collection of groundwater, surface water, meteorological, and ecological data in and around Turkey Point to establish conditions before and after the uprating of the nuclear units and to determine the horizontal and vertical effects and extent of the cooling canal system (CCS) water on existing and projected surface water, groundwater and ecological conditions surrounding Turkey Point.

FPL has been conducting the above required monitoring since 2010 and has submitted reports semi-annually and annually to the SFWMD, the Miami-Dade County (MDC) Department of Regulatory and Economic Resources (RER), and the Florida Department of Environmental Protection (FDEP), collectively referred to as the Agencies. These reports summarize the extensive collection of monitoring data and provide a discussion of findings. The Comprehensive Pre-Uprate Monitoring Report (FPL 2012a) was submitted in August 2012 and the Comprehensive Post-Uprate Monitoring Report (FPL 2016a) was submitted in March 2016. This monitoring continues that reporting and is primarily associated with the requirements of the SFWMD Fifth Supplemental Agreement and COC X of the site license.

The scope of this Annual Monitoring Report is to summarize the monitoring efforts from June 1, 2018, through May 31, 2019 (herein referred to as the reporting period), to present and summarize the data, and to assess the effects and extent of CCS water on water and ecological conditions surrounding Turkey Point. Some of the information for the reporting period is compared to or shown with data collected over the previous 8 years of monitoring data (June 2010, or since startup of station monitoring, through May 2018), herein referred to as the historical period of record. This includes data previously reported in the February 2019 FPL Semi-Annual Data Delivery (FPL 2019a), the 2018 FPL Annual Monitoring Report (FPL 2018a), the 2017 FPL Annual Monitoring Report (FPL 2017a), the Comprehensive Post-Uprate Monitoring Report (FPL 2016a), and the Comprehensive Pre-Uprate Monitoring Report (FPL 2012a).

Additional monitoring is conducted as part of the FDEP Consent Order (CO), dated June 2016, and the MDC Consent Agreement (CA), dated October 2015, which are focused on restoration and remediation efforts. Data from the FDEP CO and MDC CA monitoring stations not included in the original 2009 Monitoring Plan and data from CCS freshening wells are provided in Appendix A to fulfil paragraph 31.b of the FDEP CO. This additional information may be discussed when such data are helpful and relevant in achieving the objectives of this report.

1.1 Brief Overview of Automated Monitoring Network

In accordance with the Monitoring Plan, FPL has installed an extensive automated monitoring network comprised of over 110 automated sensors to collect hourly meteorological, groundwater, and surface water data from a broad area surrounding Turkey Point (Figures 1.1-1 to 1.1-3). The methods and details of the collection protocols are outlined in Appendix B. Table 1.1-1 provides a brief summary of the well construction information; further details are provided in the JLA Geosciences, Inc. (2010) Geology and Hydrogeology Report. During the reporting period, risers were installed on the wells at well cluster TPGW-7 to prevent issues with the wells being overtopped with flood waters. The new top of casing elevations have been included in Table 1.1-1.

1.2 Quarterly Water Quality Sampling

The monitoring network for groundwater and surface water supports the collection of water samples for laboratory analysis. During the reporting period, samples were collected from the 42 groundwater wells and the 19 surface water stations, excluding TPBBSW-10 and TPBBSW-14, which are automated stations only. Samples were also collected from two depths at five existing historical wells (L-3, L-5, G-21, G-28, and G-35) as part of FPL's routine sampling for interceptor ditch (ID) operation. The samples were analyzed for a variety of laboratory and field parameters based on locations and frequency (Table 1.1-2).

Results of the quarterly monitoring conducted for the reporting period in June 2018, October 2018, December 2018, and March 2019 are included in Section 3 of this report. Analytical results prior to June 2018 can be found in the Turkey Point Plant Annual Monitoring Report (FPL 2017a and 2018a) and the Comprehensive Post-Uprate Monitoring Report (FPL 2016a).

1.3 Extent of CCS Water

FPL conducted assessments of the location and orientation of CCS groundwater conditions in the area surrounding Turkey Point and the CCS in the Comprehensive Pre-Uprate Monitoring Report (FPL 2012a) and Comprehensive Post-Uprate Monitoring Report (FPL 2016a). These assessments were completed using data collected as part of the well installation efforts, automated data and analytical results, United States Geological Survey (USGS) induction logs, and other supporting documentation. Updated information on the extent of CCS water is provided in Section 3 of this report and details will be included in the Remedial Action Annual Status Report that will be submitted to MDC in November 2019.

1.4 CCS Water and Salt Budget

FPL has worked closely with the Agencies to develop an approved methodology for calculating monthly CCS water and salt budgets. This methodology was presented in the Comprehensive

Pre-Uprate Monitoring Report (FPL 2012a), and the same methodology has been used to assess the water and salt budgets for the reporting period. Estimated monthly water budgets and salt loads from June 2018 through May 2019 are included in Section 4 of this report.

1.5 Ecological Monitoring

The Monitoring Plan and Quality Assurance Project Plan (QAPP) outline an ecological monitoring program for the wetlands and Biscayne Bay/Card Sound/Barnes Sound around the CCS that has been conducted from 2010 to present. The FPL Turkey Point ecological monitoring program collects data from marshes, mangroves, tree islands, and Biscayne Bay/Card Sound. This report presents the results of the quarterly marsh and mangrove monitoring (August 2018, November 2018, February 2019, and May 2019), and the bi-annual Biscayne Bay/Card Sound monitoring (September 2018 and May 2019). Figure 1.5-1 shows the sampling locations, and Table 1.1-2 includes the ecological parameters measured during the reporting period.

Results prior to June 2018 can be found in the Turkey Point Plant Annual Monitoring Report (FPL 2017a and 2018a) and the Comprehensive Post-Uprate Monitoring Report (FPL 2016a). Details on the transect plot set-ups, sampling methods, and materials can be found in the Comprehensive Pre-Uprate Monitoring Report (FPL 2012a). Findings from a landscape-scale, multiple-depth, porewater monitoring effort in Biscayne Bay/Card Sound and wetlands can be found in the Turkey Point Initial Ecological Characterization Report (FPL 2012c).

1.6 Interceptor Ditch Operation

The ID is located immediately west of the CCS and is designed to prevent seasonal inland movement of saltwater from the CCS into the historically fresh/upper portion of the Biscayne Aquifer. Shallow saline groundwater is intercepted by the ID and pumped back to the CCS during the dry season or during other times when the natural gradients are low and the potential for saltwater intrusion exists. FPL began following a revised plan in 2011 (FPL 2011b) that considered the effects of water density, pursuant to requirements in the Fifth Supplemental Agreement. Subsequent refinements were made in 2012 (minor change in pumping triggers) (FPL 2012b), and FPL has been following the updated version (FPL 2012b) since December 2012 (FPL 2017b).

FPL has been collecting groundwater data west of the CCS and recording the volume of water pumped from the ID as part of ID operation. Results have been included in reports that were submitted on a quarterly and annual basis to the SFWMD. With SFWMD’s concurrence, these results (beginning in 2012) are now integrated into the annual reports required as part of the Monitoring Plan and include findings for the reporting period, which is from June of one year to the end of May the next year. ID operation information/results for June 2018 through May 2019 are provided in Section 6 of this report.

1.7 Plant Operations and Remedial Activities

FPL continued to operate Nuclear Units 3 and 4 during the reporting period; an outage occurred at Unit 3 from October 1, 2018, through November 9, 2018, and at Unit 4 from March 11, 2019, to April 11, 2019 (Appendix C). Routine outages have short-term effects on specific data collected inside the CCS (such as stage and temperature) as a result of a temporary reduction in CCS circulation pumping rates and reduced thermal loading associated with the outages.

In 2016, FPL initiated freshening activities using five Upper Floridan Aquifer (UFA) wells, which continued to operate during this reporting year, adding up to 14 million gallons per day (mgd) of low salinity UFA water to the CCS. The Turkey Point groundwater recovery well system (RWS), which is required as part of the Consent Agreement with MDC (MDC 2015) and the Consent Order by FDEP (FDEP 2016), became fully operational on May 15, 2018. Information related to the startup of the RWS and its first year of operation are summarized in the RWS Startup Report (FPL 2018b) and quarterly status reports (FPL 2018c, 2019b, 2019c). Additional information related to changes in chloride concentrations in the aquifer based on analytical data and Continuous Surface Electromagnetic Mapping (CSEM) surveys and updates to the groundwater model after the first year of operation will be provided in the Remedial Action Status Report, which is scheduled for submittal to MDC in November 2019.

1.8 Data Quality Objectives and Acceptance Criteria

The monitoring program is conducted under the guidance of a detailed set of protocols outlined in the project QAPP. These protocols are a compilation of United States Environmental Protection Agency (EPA), SFWMD, and FDEP methods and processes. The QAPP is a rigorous document defining the tools and techniques used in this program, some of which have been customized for the specific challenging working conditions (e.g., hypersaline matrix) and analyses (e.g., non-standard isotopic analyses). Data Quality Objectives (DQOs) and associated goals for precision, accuracy, analytical sensitivity, completeness, representativeness, comparability, maintainability, and timeliness have also been identified in the QAPP, and FPL consistently meets these DQOs. The QAPP was developed in conjunction with the Agencies and has a number of checks and quality assurance/quality control (QA/QC) measures that are specific to the project needs and that often exceed state standards.

Data in this program are reviewed multiple times by different scientists/engineers. Qualified automated data are tracked in a qualifications master spreadsheet, while the analytical data are written up in Data Usability Summary (DUS) reports for each event. DQOs are then reported for data precision, accuracy, analytical sensitivity, completeness, representativeness, comparability, maintainability, and timeliness. The DQOs have consistently been met, with a few notable exceptions briefly described in Table 1.8-1. Further details of the procedures used to assess meeting DQOs and acceptance criteria goals can be found in the Comprehensive Post-Uprate Monitoring Report (FPL 2016a).

TABLES

Table 1.1-1. Well Construction Summary.

Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Depth to Top of Screen from TOC (ft)	Depth to Bottom of Screen from TOC (ft)	Screen Length (ft)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Elevation Screen Midpoint (ft NAVD 88)
TPGW-1S	3.82	32.0	34.0	2	-28.18	-30.18	-29.18
TPGW-1M	3.92	52.1	54.1	2	-48.18	-50.18	-49.18
TPGW-1D	4.20	85.3	89.3	4	-81.10	-85.10	-83.10
TPGW-2S[1]	4.63	28.0	32.0	4	-23.34	-27.34	-25.34
TPGW-2M[1]	4.56	53.9	55.9	2	-49.32	-51.32	-50.32
TPGW-2D[1]	4.43	88.8	90.8	2	-84.36	-86.36	-85.36
TPGW-3S[1]	4.61	30.3	34.3	4	-25.66	-29.66	-27.66
TPGW-3M[1]	4.49	58.0	62.0	4	-53.48	-57.48	-55.48
TPGW-3D[1]	4.42	89.9	91.9	2	-85.50	-87.50	-86.5
TPGW-4S	2.24	23.2	25.2	2	-20.96	-22.96	-21.96
TPGW-4M	1.82	38.1	43.1	5	-36.28	-41.28	-38.78
TPGW-4D	1.92	61.6	65.6	4	-59.68	-63.68	-61.68
TPGW-5S	5.35	28.6	32.6	4	-23.25	-27.25	-25.25
TPGW-5M	5.07	49.3	54.3	5	-44.23	-49.23	-46.73
TPGW-5D	5.22	67.0	72.0	5	-61.78	-66.78	-64.28
TPGW-6S[2]	4.35	25.1	27.1	2	-20.74	-22.74	-21.74
TPGW-6M[2]	4.43	51.6	55.6	4	-47.18	-51.18	-49.18
TPGW-6D[2]	4.39	84.7	88.7	4	-80.31	-84.31	-82.31
TPGW-7S[3]	4.28	24.7	28.7	4	-20.44	-24.44	-22.44
TPGW-7M[3]	4.33	50.8	54.8	4	-46.45	-50.45	-48.45
TPGW-7D[3]	4.31	82.8	86.8	4	-78.51	-82.51	-80.51
TPGW-8S	1.98	16.8	20.8	4	-14.82	-18.82	-16.82
TPGW-8M	2.12	34.9	36.9	2	-32.78	-34.78	-33.78
TPGW-8D	2.01	49.2	53.2	4	-47.19	-51.19	-49.19
TPGW-9S	3.63	14.9	18.9	4	-11.27	-15.27	-13.27
TPGW-9M	3.53	34.3	36.3	2	-30.77	-32.77	-31.77
TPGW-9D	3.52	47.9	49.9	2	-44.38	-46.38	-45.38
TPGW-10S*	8.3	36.4	38.4	2	-28.10	-30.10	-29.10
TPGW-10M*	8.3	60.4	64.4	4	-52.10	-56.10	-54.10
TPGW-10D*	8.3	126.5	130.5	4	-118.20	-122.20	-120.10
TPGW-11S*	8.7	39.4	43.4	4	-30.70	-34.70	-32.70

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Monitoring Well	Top of Casing Elevation (ft NAVD 88)	Depth to Top of Screen from TOC (ft)	Depth to Bottom of Screen from TOC (ft)	Screen Length (ft)	Top of Screen Elevation (ft NAVD 88)	Bottom of Screen Elevation (ft NAVD 88)	Elevation Screen Midpoint (ft NAVD 88)
TPGW-11M*	8.7	90.4	94.4	4	-81.70	-85.70	-83.70
TPGW-11D*	8.7	122.4	126.4	4	-113.70	-117.70	-115.70
TPGW-12S[1]	4.11	25.2	27.2	2	-21.08	-23.08	-22.08
TPGW-12M[1]	4.14	59.2	63.2	4	-55.07	-59.07	-57.07
TPGW-12D[1]	4.20	93.2	97.2	4	-89.04	-93.04	-91.04
TPGW-13S[1]	5.49	33.1	37.1	4	-27.61	-31.61	-29.61
TPGW-13M[1]	5.38	59.9	63.9	4	-54.57	-58.57	-56.57
TPGW-13D[1]	5.32	88.0	92.0	4	-82.72	-86.72	-84.72
TPGW-14S*	8.8	32.5	36.5	4	-23.70	-27.70	-25.70
TPGW-14M*	8.8	56.3	60.3	4	-47.50	-51.50	-49.50
TPGW-14D*	8.6	102.2	106.2	4	-93.60	-97.60	-95.60

Note:
*Offshore wells surveyed using GPS are only accurate to 0.1 foot.
[1]New risers installed in February 2016; TOC elevation and depth from TOC to top and bottom of screen revised based on well survey.
[2]New risers installed in February 2017; TOC elevation and depth from TOC to top and bottom of screen revised based on well survey.
[3]New riser installed in April 2019; TOC elevation and depth from TOC to top and bottom of screen revised based on well survey.

Key:

D = Deep.	NAVD 88 = North American Vertical Datum of 1988.
ft = Feet.	S = Shallow.
M = Intermediate.	TOC = Top of casing.

Table 1.1-2. Summary of Monitoring Efforts for Reporting Period (June 2018 - May 2019).

Monitoring Effort	Month											
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Automated Data Collection	Continuous	Continuous	Continuous	Continuous[1]	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Groundwater and Surface Water Sampling	Field parameters, TDS (GW only), sodium, chloride and tritium			Field parameters, TDS (GW only), anions, cations, silica (SW only), tritium and nutrients[1]			Field parameters, TDS (GW only), sodium, chloride, and tritium			Field parameters, TDS (GW only), anions, cations, silica (SW only), tritium and nutrients[1]		
Historic Groundwater Well Sampling (G and L series wells)	Field parameters, TDS (GW only), sodium, chloride and tritium			Field parameters, TDS (GW only), anions, cations, silica (SW only), tritium and nutrients[1]			Field parameters, TDS (GW only), sodium, chloride, and tritium			Field parameters, TDS (GW only), anions, cations, silica (SW only), tritium and nutrients[1]		
Ecological Marsh and Mangrove Monitoring			Marsh measurements			Marsh and mangrove measurements			Marsh measurements			Marsh measurements
			Marsh porewater (field parameters, sodium, chloride, and tritium)			Marsh and mangrove porewater (field parameters, sodium, chloride, tritium, and nutrients)			Marsh porewater (field parameters, sodium, chloride and tritium)			Marsh and mangrove porewater (field parameters, sodium, chloride, tritium, and nutrients)
						Marsh and mangrove vegetation (nutrients)						Marsh Vegetation (nutrients)
Ecological Bay Monitoring				Seagrass measurements Porewater (field parameters, sodium, chloride, tritium, and nutrients) Vegetation (nutrients)								Seagrass measurements Porewater (field parameters, sodium, chloride, tritium, and nutrients)
Meteorological Station	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Rainfall Collector Sampling	Tritium			Tritium			Tritium			Tritium		

Notes:
Automated data collection includes groundwater and surface water quality and stage.
[1]Nutrients sampled at all surface water stations, but in groundwater only at selected well clusters.

Table 1.8-1. Summary of Data Quality Objective Performance.

Data Quality Objective	Comment
Precision – Measure of mutual agreement (reproducibility) between duplicate or co-located measurements of the same analyte. The closer the numerical values of the measurements are to each other, the more precise the measurement.	To assess precision of the automated probes being used to collect time-series water quality and water level data, field measurements are taken during sampling events and/or during cleaning and calibration events to compare the results with the automated probe, mostly for water levels. No automated data were qualified as questionable during the reporting period due to verification failures. A certified weather station calibration validation was conducted by Locher Environmental on the meteorological station (TPM-1) on June 28, 2018, and December 26, 2018. Station measurements for air temperature, relative humidity, photosynthetically active radiation, wind speed, wind direction, rainfall and barometric pressure were made and compared to validated measurements with another instrument. All parameters met validation requirements and the station passed certification. In May 2019, Isotech Laboratories identified a deficiency in their QA/QC of the tritium samples analyzed as a decay correction factor (for half-life of 12.32 years to account for the natural decay between when the sample was collected and analyzed) had not been applied to the data issued. A revised procedure was implemented in July 2019 that revised all the tritium data analyzed by the laboratory since the start of their contract. Although these adjustments were generally minor (2-4%), previously reported results from Isotech have been corrected and are presented in Appendix B. Tritium data analyzed by the USGS and the University of Miami laboratories have been corrected for the decay so no changes are necessary. The precision of laboratory samples is established by the evaluation of field and laboratory duplicate samples. If the relative percent difference (RPD) between the sample and the duplicate result differ by more than 20%, the results for that analyte in both samples are qualified as estimated (J). While a small percentage (~5%) of sample data has been qualified due to high duplicate RPDs, overall, the analytical results are comparable to duplicate samples for those samples using the same method. These precision results indicate the sampling and analytical procedures are consistently performed and repeatable. Details are provided in the Data Usability Summary (DUS) reports issued for each sampling event.
Accuracy – Measure of bias in a measurement system. The closer the value of a measurement is to the true value, the more accurate the measurement.	Each measurement parameter has its own level of accuracy that is either defined by the instrument/manufacturer or in the case of laboratory analyses, the acceptance criteria of various quality control (QC) elements (blanks, spikes, duplicates, calibration verifications, etc.) as defined by the analytical method. Analytical data are also compared to each other, referred to as technical comparison checks, to evaluate result accuracy. The instrumentation for all the automated station instruments and field equipment during the reporting period met the requirements for accuracy per the Quality Assurance Project Plan (QAPP). All the analytical data also met the accuracy requirements of the QAPP despite a few issues outlined below. These issues resulted in some data being qualified as estimated; however, all data are considered usable for project purposes. The laboratory is continuing to further improve their processes to enhance data accuracy. To assess accuracy of the automated stations being used to collect time-series water quality data, each of the 112 probes was checked against standards of

Table 1.8-1. Summary of Data Quality Objective Performance.

Data Quality Objective	Comment
	known specific conductance values (verification) and then recalibrated, as necessary during each cleaning and calibration event. As part of the continued data improvement process and as previously reported, a slight revision was implemented to the cleaning calibration protocols in March 2018 after discussion with Florida Power & Light Company (FPL) and several trial runs. The probe undergoes calibration only when the unit fails to meet the verification requirement, similar to the U.S. Geological Survey (USGS) protocol. Consequently, if a probe passes verification post-cleaning, a calibration is not necessary before the unit is redeployed; this process has resulted in smoother data with fewer minor shifts post-calibration. Approximately 99% of the probes for the reporting period of June 2018 through May 2019 passed the verification check conducted during cleaning and calibration (verification check values within 5% of the known standards). When verification check values differ by more than 5% and less than 30% from the known standard values, the probe data are qualified as estimated. When values differ by more than 30%, the data are qualified as questionable. In both cases, data are qualified back to the previous cleaning and calibration event or, at a minimum, back to an interim point where there is an unexplained shift in the data. Specific conductance data for only one probe out of 998 total probe verification checks had to be qualified as questionable for this reason during the reporting period. Similarly, probe temperature readings are compared with a highly accurate National Institute of Standards and Technology (NIST) -certified thermometer during each cleaning and calibration event. If a temperature verification measurement on the NIST thermometer is more than 0.5 degree Celsius (°C) different from the automated probe reading, the data are qualified. During the reporting period, none of the water quality data was qualified for not meeting a field instrument temperature verification reading. Accuracy of the analytical results is evaluated using percent recoveries of analytes added (termed “spiked”) to samples (matrix spikes [MSs]) or reagents (laboratory control samples [LCSs]) and carried through the extraction and analysis procedure. Laboratory established acceptance criteria (within method requirements) are used for MS and LCS percent recoveries. The MS percent recoveries have routinely passed acceptance criteria for fluoride, sulfide, boron, strontium, and silica for TestAmerica Laboratories, Inc. (TestAmerica) and all other project analytes by FPL Central Lab, although there are sporadic instances where criteria were not met and data have been qualified. For the initial events following the lab transition in September 2017, many of the MS recoveries for cations and anions could not be evaluated due to the spiking concentration being less than 30% of the parent sample concentration. The FPL Central Lab has worked to correct this issue by increasing spiking concentrations for affected methods and the events in this reporting period have had much fewer instances compared to the initial events. Only 15 instances were noted during this reporting period where the MS recoveries could not be evaluated due to the spiking/analyte concentrations, with the vast majority attributable to sodium. In these instances, the LCS run in a batch can be used for general analytical accuracy, however matrix effects on the data cannot be evaluated. For additional details, refer to the event DUSs (Appendix F). This check, in combination with instrument calibrations, calibration

Table 1.8-1. Summary of Data Quality Objective Performance.

Data Quality Objective	Comment
	verifications, LCS recoveries, lab and field duplicate recoveries, and technical consistency checks are used to validate the accuracy of the batch run. Not achieving the MS check alone does not impugn the usability of the data; none of the analytical data has been qualified as questionable (i.e., unusable) due to accuracy; however, some of the data have other qualifiers applied per the QAPP. LCS percent recoveries have consistently passed acceptance criteria for all analyses, indicating that both laboratories' extraction and analytical procedures and materials have met method requirements. Refer to the analytical tables in Section 3 and the DUS for details on data qualifications and usability. In addition to recoveries, accuracy is evaluated using technical comparison checks, including: cation and anion charge balance; cations, anions, and TDS compared with the specific conductance; total ammonia less than total Kjeldahl nitrogen (TKN); and orthophosphate (OP) less than total phosphorus (TP). As noted in the previous report, the laboratory revised their cation internal SOP in March 2018 to have final measurements fall more in the median of the calibration range and curve rather than doing the minimum dilution. Since the modification, anion and cation results now fall more in line with historical data and are passing technical consistency checks this reporting period. Comparison of OP/TP, and ammonia/TKN were generally acceptable for the reporting period (i.e., OP should be less than 120% of TP and ammonia should be less than 120% the TKN per FDEP allowed variance limits). There were only four instances where the ammonia was reported with a concentration greater than 120% of the TKN. There were 22 instances where the OP results were greater than 120% of the TP results, primarily in the marine porewater samples. In these cases, samples are qualified as estimated; for further details, refer to the analytical tables and DUSs. The laboratory QA/QC process identified a deficiency in the TKN analytical procedure. This is related to hypersaline samples creating matrix interference during the analysis. A revised procedure was implemented in April 2019 that has minimized this effect. The review of prior samples continues in order to understand the potential impact to recorded TKN values. TN results between October and December 2017 were reported with two significant figures while the nitrate/nitrite and TKN results were reported with three, leading to cases where the true sum of nitrate/nitrite and TKN could be higher than the corresponding TN result. This was corrected in January 2018 and will be incorporated going forward. Technical consistency checks indicated that FPL Central Lab calculates the ammonium and unionized ammonia results using the Florida Department of Environmental Protection (FDEP) website calculator rather than the QAPP required FDEP standard operating procedures (SOP). The FDEP SOP uses sample temperature and pH to determine fractionation, while the FDEP website calculator uses temperature, pH, and salinity. This change has caused a slight shift in the ammonium and unionized ammonia values; this shift is more pronounced with marine samples but has not made a meaningful impact on data accuracy as the differences are well within laboratory error.

Table 1.8-1. Summary of Data Quality Objective Performance.

Data Quality Objective	Comment
	Accuracy can also be evaluated using field blanks (FBs) and method blanks (MBs), which can indicate bias in the associated analytical results. Field blank results over the course of the project and for the majority of analytes have confirmed proper sampling and handling techniques. Instances where the sample results were reported at concentrations less than 10 times the associated blank concentration (indicating potential sample contamination) are qualified as estimated. Over the past year, the MB and FB detections have been minimal and sporadic, with no periods of repeated detections for any analytes. Chloride was the most common analyte detected in FBs; however, the sample concentrations were typically greater than 10 times the blank concentration and, therefore, no qualification was necessary. Certified Reference Materials (CRMs) are another way to evaluate laboratory accuracy. CRMs are blind samples of known concentrations in seawater. FPL Central Lab analyzed a set of CRMs (two standard solutions and one custom hypersaline blend) in May 2018 and passed the acceptance criteria for each analyte.
Analytical Sensitivity – For data validation, qualification, and reporting purposes, analytical sensitivity is expressed by Method Detection Limits (MDLs). An MDL is set so that the minimum concentration of an analyte reported is within 99% confidence that the analyte is greater than zero.	Project-required MDLs are listed in Table 3.2-1 of the QAPP (FPL 2013). For the reporting period of June 2018 through May 2019, the majority of analytical detection limits have met the QAPP requirements. For the FPL Central Lab, the analytes with a laboratory MDL set above the QAPP requirement are ammonia and TP. The MDLs for bicarbonate and total dissolved solids (TDS) were modified in March 2019 to levels below the QAPP requirements. The laboratory is working to reduce the ammonia and TP MDLs to QAPP requirements. If these MDLs cannot be achieved, MDL requirements will be raised in the next revision of the QAPP to a level that meets the lab’s capability, subject to regulatory approval. In some cases, the laboratory had to dilute the saline samples to keep instruments from being overloaded with the major ionic constituents (i.e., chloride, sodium). This resulted in some data reported as not detected, but with detection limits above the QAPP requirements. Any instances where this has occurred are noted in the DUS, although data are not qualified as estimated since the accuracy is not affected.

Table 1.8-1. Summary of Data Quality Objective Performance.

Data Quality Objective	Comment
Completeness – Expressed as the percentage of valid or usable measurement to planned measurements. The higher the percentage, the more complete the measurement process.	The automated water quality and water level data are collectively 96.7% complete for groundwater and 97.4% complete for surface water for the reporting period from June 2018 through May 2019, which is above the 90% QAPP completeness goal. In the past year, there are some individual stations that have one or more parameters below the 90% goal, but many stations have data completeness in excess of 99%. The specific conductance probe at TPGW-11M had the lowest percent completeness due to data and probe issues. Probes were swapped on multiple occasions. All planned groundwater and surface water stations were sampled during the reporting period from June 2018 through May 2019. All planned porewater stations were sampled over the same period; the only exceptions were at porewater locations where conditions were too dry to extract sufficient water for analysis. No analytical data points have been qualified as questionable during the reporting period; therefore, the analytical completeness is 100% and the completeness goal is 95%. All of the planned ecological measurements have been made.
Representativeness – Qualitative parameter that expresses the degree to which data accurately and precisely represent the environmental condition.	Based on the monitoring design, the data being collected are representative of the environmental conditions, unless qualified as questionable. Estimated values are left in place as they continue to be usable and reasonably represent the environmental conditions; however, the results could be biased high or low. Some of the raw water elevation data at TPGW-2M, TPGW-3D, TPGW-9M, TPGW-13S, TPGW-13D, TPBBSW-10B, TPBBSW-14B, TPSWCCS-3, and TPSWCCS-6 was corrected slightly and qualified as calculated (G) and estimated due to obvious issues with a water level setting or probe hanger. Additionally, water elevation data at well cluster TPGW-7 had to be adjusted in late April and May 2019 to account for new top of casing elevations. The wells were also purged to remove any overlying fresher water. The corrected data now more accurately reflect the environmental conditions within the well screened interval.
Comparability – Qualitative parameter expressing the confidence with which one set of data can be compared to another.	Nearly all the analytical data, unless qualified as questionable or unusable for other reasons, are comparable. Methods of data collection and analysis have primarily remained consistent over the entire monitoring effort, including this reporting period, with the exception of a few parameters (OP, fluoride, sulfide, nitrate/nitrite) reported prior to September 2013 when different analytical methods were used (Comprehensive Post-Uprate Monitoring Report [FPL 2016a]). However, as noted above, the primary laboratory for the project was changed from TestAmerica to FPL Central Lab starting in September 2017. While the methods performed by both labs are either the same or comparable, slight variations in specific procedures, instrumentation, etc., may cause differences or shifts from data reported by the previous laboratory (as described in previous sections). With the lab transition in September 2017, a few methods have been changed from previous events. These include the unionized ammonia calculation and the OP method. As noted in the “Accuracy” section above, the FPL Central

Table 1.8-1. Summary of Data Quality Objective Performance.

Data Quality Objective	Comment
	Lab uses the FDEP website calculator to calculate unionized ammonia results, while the data prior to September 2017 were based on the FDEP SOP. The SOP only uses temperature and pH along with total ammonia to determine fractionation, while the FDEP website calculator uses the additional parameter of salinity, causing a slight difference in values reported, particularly in marine samples. However, the differences are within typical laboratory error and the results are considered comparable with previous data. Starting in September 2017, the OP method was revised to SM 4500 P F, a manual spectrophotometric method. Previous OP data have been reported using SM 4500 P E, an automated method that allows subtracting natural background fluorescence. The laboratory obtained NELAC certification for the SM 4500 P E method in June 2018 and has incorporated the background correction procedure for all events starting in August 2018. OP results between September 2017 and August 2019 could be potentially biased high due to this background fluorescence. As noted in the accuracy section above, there were 22 instances where the OP was greater than 120% of the TP results during this reporting period.
Availability – Percentage of time that a system or function is available for service, according to established criteria and the probability that the system is operating satisfactorily at any point in time, excluding times when the system is under repair.	The stations that report automated water level, water quality, and meteorological data collectively have a high degree of availability. These systems operate continuously with the exception of the stations that were vandalized or offline during system upgrades. The systems have collectively been operational over 95% of the time. There have been, and will likely continue to be, issues with individual stations that require systematic troubleshooting efforts to address oscillating and erroneous or missing data that impact the availability of data. For stations on telemetry, the data are reviewed weekly. However, in non-telemetry stations (see Section 3) the data are reviewed when the data are being qualified (8-10 weeks). The amount of time necessary to resolve the data issues is related to the complexity of the problem.
Reliability – Probability of a system performing a specified function without failure for a specified period of time. A “failure” occurs when a measurement or control action does not comply with established accuracy, completeness, or timeliness standards. This applies to automated data only.	Collectively, the stations that report automated water level, water quality, and meteorological data continue to have nearly 97% reliability in the context of data usability. Non-reliable data are identified by a qualifier and/or the presence of a data gap. The associated probes that measure and record the data meet the accuracy requirements and exhibit high percent completeness rates.
Maintainability – Ease with which a component or equipment can be modified to correct faults.	Per the QAPP, the quality guideline for completion of repairs to components or equipment is 7 days for 95% of all incidents, with the exception of remote stations accessible only by boat or airboat. However, given the size of the system, the remote locations of some stations, and the occasional need for extended troubleshooting efforts, strict compliance with the guideline is not always possible or even appropriate. The automated groundwater and surface water stations (inshore) are easier to maintain than some of the other systems. Some of the oscillation and daily reporting issues have required, and continue to require, extensive troubleshooting, which has to be conducted in a

Table 1.8-1. Summary of Data Quality Objective Performance.

Data Quality Objective	Comment
	systematic fashion.
Timeliness – Promptness of reporting a measurement after it is made, reporting deficiencies, submitting reports or other project documentation, addressing corrective actions, and reporting deviations within the timeframes specified in the QAPP or within the Monitoring Plan or the Agreement.	Automated data are typically available nightly, except for those stations not on telemetry or the occasional non-reporting station. Reporting deficiencies (e.g., failed probes resulting in lost data, stolen probes) are recorded in a master list that is included on the Electronic Data Management System (EDMS) and as an appendix in every report submitted. Preliminary lab results are posted to the EDMS (https://www.ptn-combined-monitoring.com/) and available to Agencies as soon as FPL receives them from the laboratory. All information is provided within the time period required by the Agencies.

FIGURES

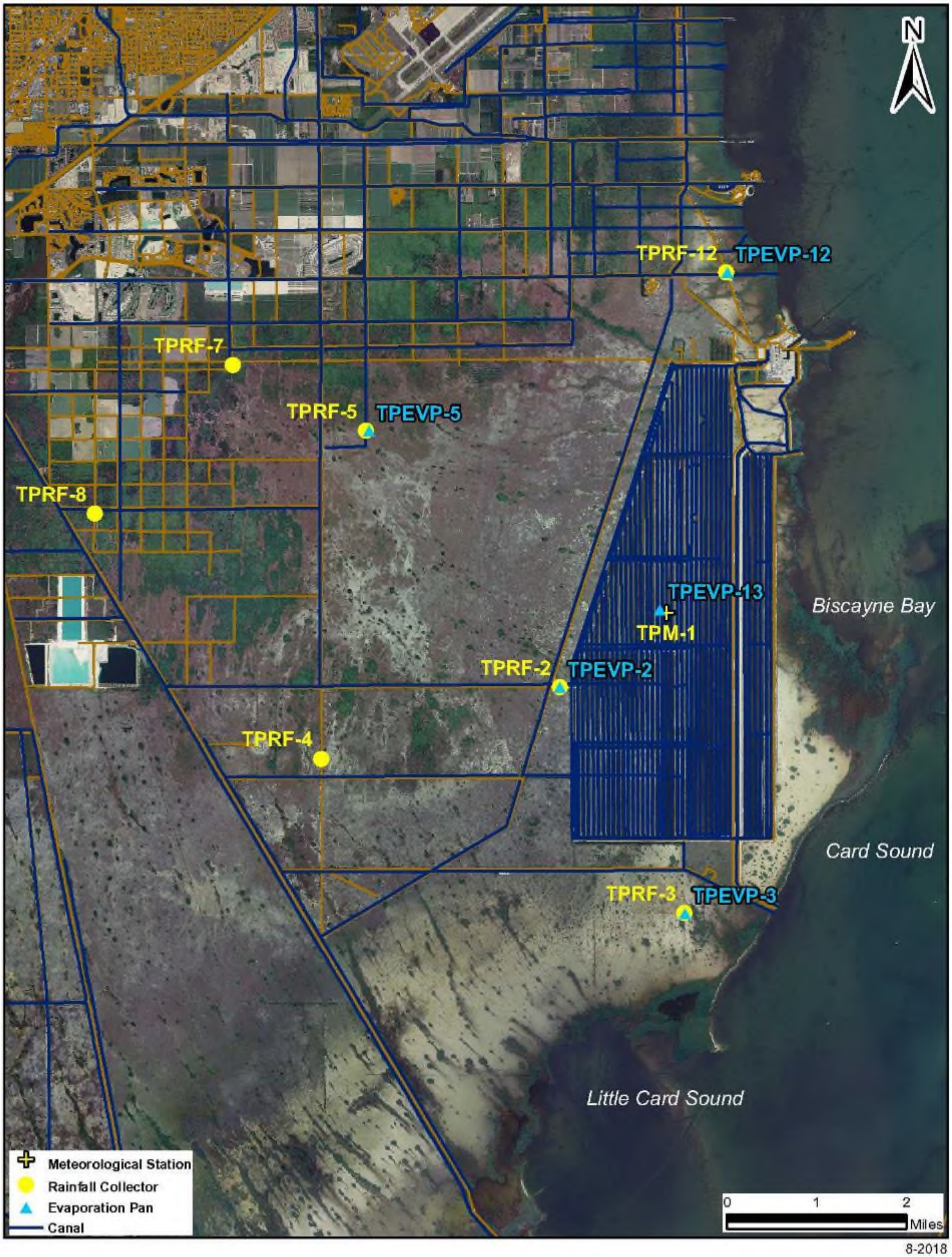


Figure 1.1-1. Locations of the Meteorological Station and Rainfall Collectors.

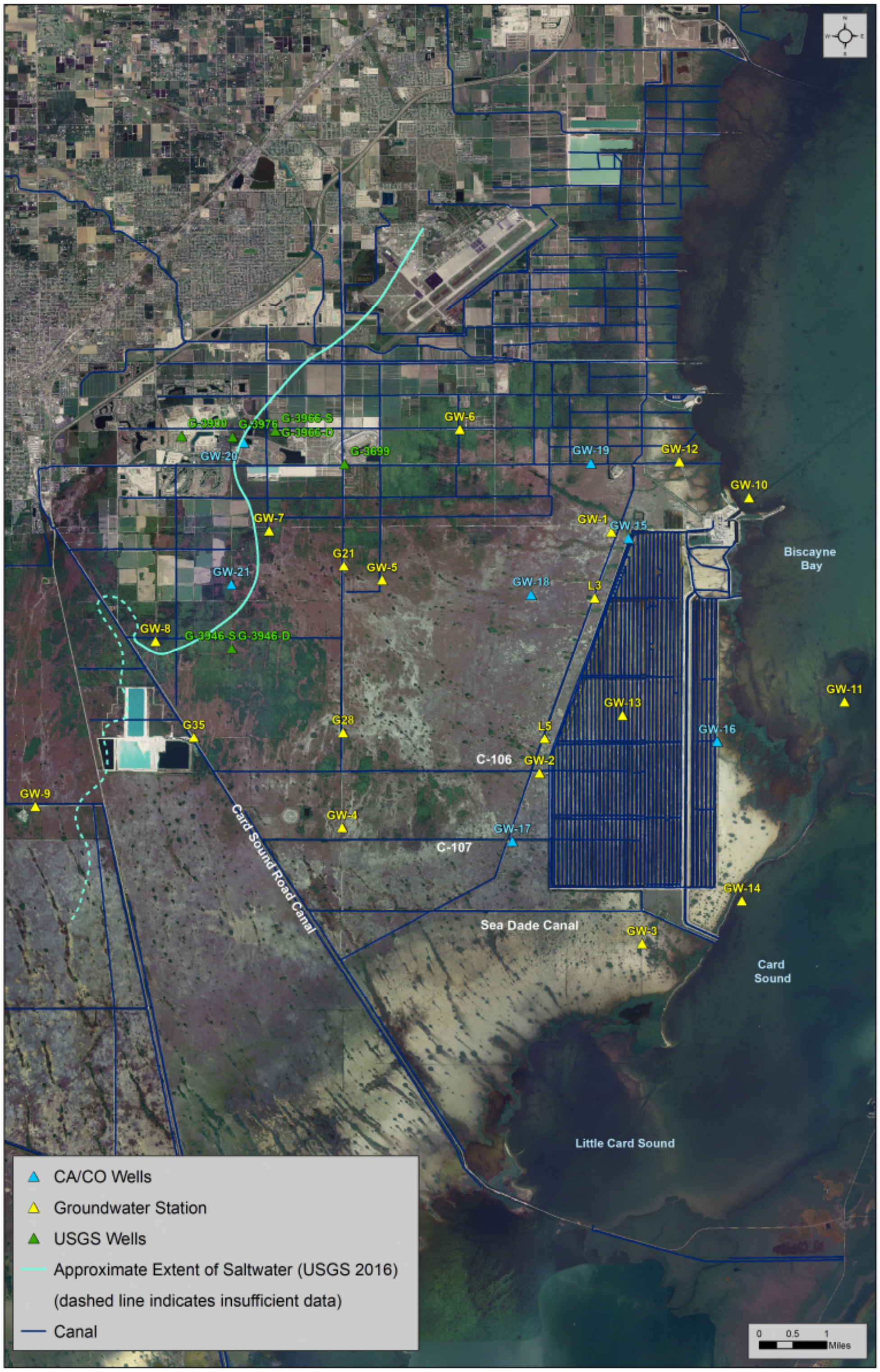
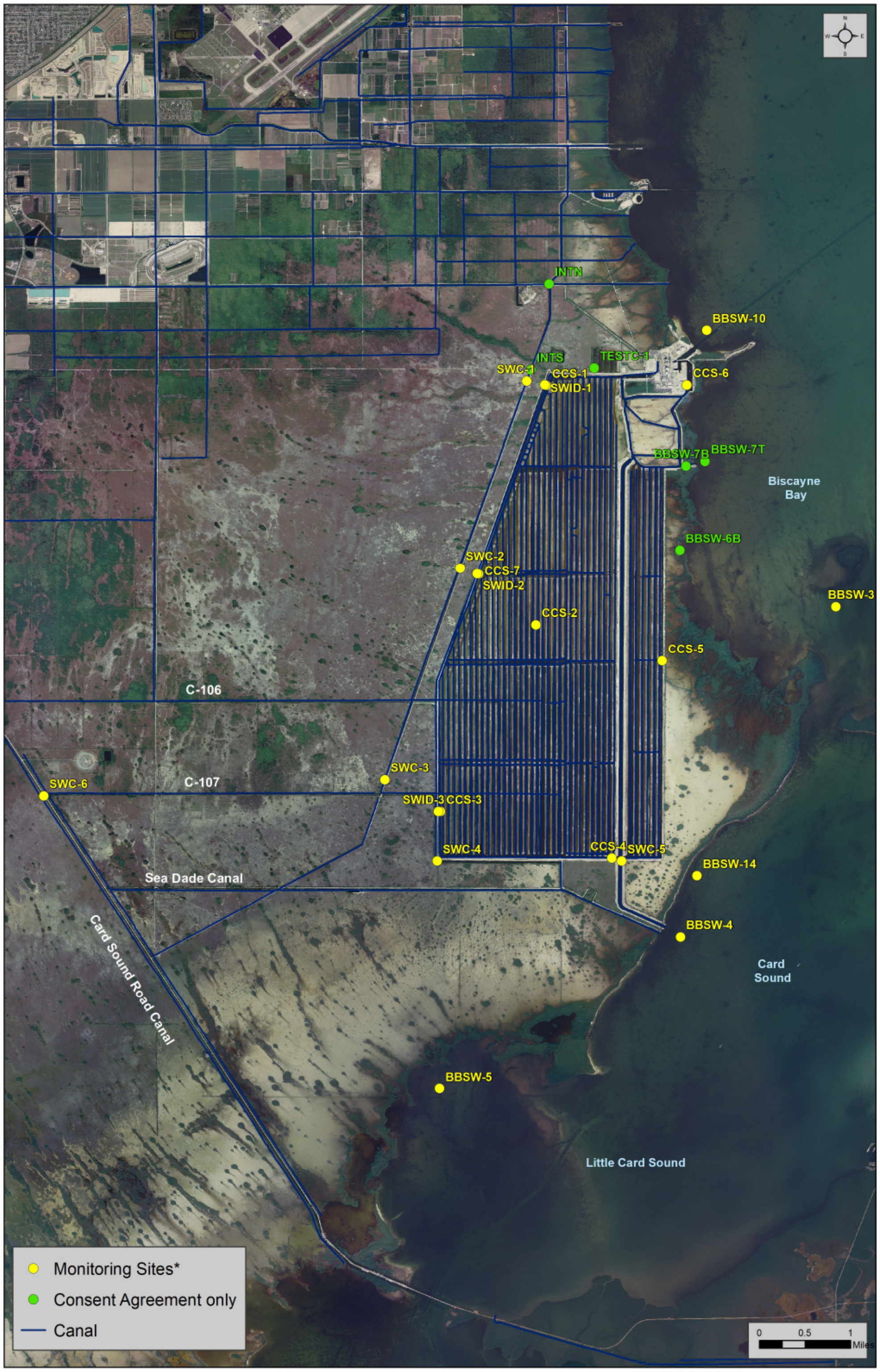


Figure 1.1-2. Locations of Groundwater Monitoring Stations.



Note: *Some of the monitoring sites are also sampled under the Consent Agreement at different frequencies.

Figure 1.1-3. Locations of Surface Water Monitoring Stations.

Figure 1.5-1. Ecological Transect Locations.

2. METEOROLOGICAL MONITORING

The 2010 FPL Monitoring Plan requires the collection of rainfall, air temperature, relative humidity, barometric pressure, photosynthetically active radiation (PAR), wind direction, and wind speed, in part, to aid in the determination of evaporative losses and water gains to the CCS, as presented in Section 4. Also, the collection and review of meteorological data, particularly precipitation and temperature, facilitates an understanding of the groundwater and surface water results presented in Section 3, and the ecological findings discussed in Section 5.

2.1 Data Collection

Rainfall data are reported from the following stations: the on-site meteorological station (TPM-1) from near the center of the CCS (Figure 2.1-1), high-resolution Next Generation Radar (NEXRAD) data from the SFWMD that encompasses the CCS, and the SFWMD long-term S20F gauge site (data from 1968 to 2019). The difference between the NEXRAD data and single-point continuous measurements made at locations such as at TPM-1 and S20F is that the NEXRAD data are being used to calculate average daily rainfall directly into the CCS while the individual stations measure rain at a single location.

Additional meteorological parameters are recorded at TPM-1 in accordance with the Monitoring Plan (Table 2.1-1). Details on these collection methods are outlined in Appendix B. Also, temperature data are obtained from Homestead Airport to facilitate comparisons between the long-term record at this location to TPM-1.

2.2 Automated Meteorological Results

Hourly rainfall, temperature, relative humidity, barometric pressure, PAR, wind direction, and wind speed measured at TPM-1 are available in the Electronic Data Management System (EDMS) for the reporting period. Daily rainfall and hourly temperature from TPM-1 are shown on Figure 2.2-1.

Results from a number of sources are presented to enable readers to see conditions within the boundaries of the CCS (TPM-1 and NEXRAD rainfall) as well as regional conditions where longer periods of historical data are available. Table 2.2-1 shows the daily rainfall measured at TPM-1 and S20F, and using NEXRAD for the reporting year. This table shows how much rain occurred on any given day and how often there was little to no rain. Rainfall measurements for these two stations and over the CCS are also provided on a monthly basis for the reporting period (Table 2.2-2). The monthly rainfall totals at S20F and NEXRAD are compared to long-term historical monthly averages; there are more than 51 years of S20F rainfall data and 23 years of NEXRAD data (Figure 2.2-2). These monthly totals show the variability from month to month during the reporting period, differences between locations and methods of collection, and differences between the historical data. As mentioned above, the NEXRAD data are calculated values over the entire CCS and are not single-point measurements like the other stations; therefore, results are not as directly comparable.

Table 2.2-3 shows the average monthly air temperatures recorded at Homestead Airport from January 1996 to May 2019 and allows a comparison of monthly temperatures for this reporting period to previous months over a longer period of record. Figure 2.2-3 compares monthly temperatures at TPM-1 to monthly air temperatures at Homestead Airport for this reporting period.

Information on wind direction and wind speed from TPM-1 is provided on Figures 2.2-4 and 2.2-5. A summary of these meteorological results is provided below.

2.3 Discussion of Results

The reporting period of 2018-2019 was a drier than average year due the relatively dry wet season, which included only one large (>3 inches) rainfall event. The lack of large rainfall event (i.e., greater than several inches/day or consecutive-rainfall events totaling 5 to 6 inches) as these types of events cause appreciable declines in CCS salinity since the rainfall inputs greatly exceed evaporative losses.

2.3.1 Rainfall

Extended dry periods can result in regionally depressed groundwater tables, lower canal stages, and higher salinities in Biscayne Bay and the CCS. Wet periods have the opposite effect, and heavy rain events (greater than several inches in a day) can cause rapid increases in groundwater, CCS, and canal levels and quickly influence surface water temperatures and salinity.

Based on NEXRAD data, annual rainfall for the reporting year was 36.97 inches, which was below the historical (1996 to 2018) average value of 43.67 inches and similar to several other recent dry reporting periods (June 2013 to May 2014, June 2014 to May 2015, and June 2016 to May 2017) (Figure 2.3-1 and Table 2.3-1). Data collected at S20F shows a similar deficit, with the annual rainfall total for the reporting period of 40.97 inches compared to the average historical annual rainfall of 46.74 inches. In addition to being a drier year on average, other observations for this reporting period include a relatively dry wet season and the lack of intense rainfall.

Based on NEXRAD data, the wet season's (June through October) rainfall total of 23.07 inches was also lower than the NEXRAD historical wet season average of 28.16 inches. The wet season total at S20F was 23.56 inches, which was below the wet season S20F historical average of 30.34 inches. This drier wet season was preceded by a notable drought, when the first quarter of 2018 (January to March) was the driest first quarter of any year over the past decade (1.69 inches total) and the second driest over the past 51 years based on records at the S20F rainfall station.

Meanwhile, the dry season for this reporting period, which typically runs from December to April, was similar to historical averages. For example, a dry season total of 9.41 inches was calculated from NEXRAD for this reporting period, while the historical average was 9.32 inches. At S20F, the dry season total for the reporting period was 11.04 inches, while the historical average was 9.40 inches.

Based on NEXRAD data, there were 9 events when rainfall totals exceeded 1 inch for this reporting period; however, there were only 2 days when more than 2 inches of rainfall was recorded. The maximum daily rainfall, per NEXRAD data, was 3.87 inches on September 3, 2018. The next highest total for the reporting period was 2.30 inches on December 4, 2018. Similar rainfall totals were noted for the S20F data—3.94 inches on September 3, 2018, and 2.70 inches on November 11, 2018.

In most years there tends to be a greater number of the larger single-day or multi-day rainfall events as compared to this reporting period. These larger rainfall events are helpful in lowering CCS salinity since freshwater inputs greatly exceed evaporative losses. For example, 4 inches of rainfall over the CCS (excluding runoff from the berms) equates to approximately 520 million gallons, while the CCS daily evaporation rate ranges from 27 to 45 million gallons during this reporting period. The average CCS evaporative loss for the entire reporting period was 35.7 mgd. The amount of salinity change in the CCS and the length of time the salinity will stay lower as a result of large rainfall inputs is a function of multiple variables including, but not limited to, air temperature, CCS temperature, humidity, barometric pressure, water level and subsequent rainfall.

Overall, average annual air temperatures during the reporting period were warmer, both at the CCS and regionally, thereby increasing temperatures in Biscayne Bay, the CCS, and other surface water bodies and also increasing evaporative losses.

2.3.2 Temperature

A review of regional air temperatures from Homestead Airport indicates that every month of the reporting period had higher average temperatures than the long-term monthly average from 1996-2018 (Figure 2.2-3). During the reporting period, 3 months exhibited some of the highest monthly average temperatures for that same month over the previous 24 years; these were:

- February 2019: second highest February temperature (22.6 degrees Celsius [°C], with the highest value the previous year);
- April 2019: third highest April temperature (24.3°C); and
- May 2019: highest May temperature (25.5°C).

At the CCS, air temperature measured at TPM-1 was warmer than the regional air temperature at Homestead Airport, with the monthly average at TPM-1 higher for all 12 months during the reporting period and the long-term monthly averages (Figure 2.2-3). The annual average air temperature for the reporting period at TPM-1 was 26.0°C, while the average air temperature for the same period at Homestead Airport was 24.9°C.

Hourly air temperatures at TPM-1 during the reporting period ranged from 9.2°C to 33.6°C (Figure 2.2-1). The average air temperature from June 2018 through May 2019 at TPM-1 was 0.6°C warmer than the previous reporting period and the historical period of record (June 2010 through May 2018).

2.3.3 Wind Direction and Speed

The prevailing wind directions (predominantly onshore, Figure 2.2-4) and average annual relative humidity (72.2%) for the reporting year were similar to previous years (FPL 2016b, 2017a, 2018a). Average wind speed for this period, measured at approximately 16 feet above the ground, was 9.9 miles per hour (mph). The lull wind speeds averaged 5.0 knots (5.7 mph), and the maximum wind gust was 40.1 knots (46.1 mph). Most of the wind speeds were between 7.0 to 11.1 knots (8.1 to 12.8 mph; 44.9% of records), followed by 4.1 to 7.0 knots (4.7 to 8.1 mph; 24.5% of records) for the reporting period (Figure 2.2-5). While the frequency for the 7.0- to 11.1-knot winds was nearly the same as the previous reporting period (i.e., 44.2%), winds in the 4.1- to 7.0-knot category were higher during this reporting period (24.5% compared to 22% previously), and winds in the 11.1- to 17.1-knot category were lower (20.7% compared to 25.1 previously). With all other factors influencing evaporation being equal, higher velocity winds will result in greater evaporative losses.

2.4 Atmospheric Deposition and Exchange of Tritium

Tritium is being used as a tracer to assess the extent to which CCS water occurs in the areas surrounding the facility. At the levels being measured, tritium is not a public health concern and is below the FDEP and EPA drinking water standard of 20,000 picocuries per liter (pCi/L) (FDEP 2012). Tritium from the CCS can migrate to adjacent surface water, porewater, and shallow groundwater by atmospheric transport (wind driven moisture, humidity/dew point, and rainfall), and can get concentrated due to evaporation. To aid in the understanding of the atmospheric transport of tritium and the degree to which it can influence water samples, FPL has collected rainfall and evaporation pan data from multiple sites surrounding the CCS for many years.

2.4.1 Sample Collection and Analysis

Rainfall is collected quarterly at seven locations (Figure 2.1-1) at intervals consistent with the groundwater/surface water quarterly sampling schedule (i.e., June 2018, September 2018, December 2018, and March 2019) and is analyzed for tritium. Details on the collection are outlined in Appendix B. Evaporation pan data were collected by FPL on a monthly basis from March 2011 to October 2015 from a series of stations located in and around the CCS (Figure 2.1-1).

2.4.2 Results and Discussion

Low-level atmospheric tritium in the vicinity of the CCS elevates background tritium levels in nearby waterbodies. Atmospheric exchange is highest around the plant (>500 pCi/L) and the values attenuate with distance from the plant; values approaching 40 pCi/L have been observed several miles west of the CCS.

Rainfall tritium values ranged from 2.0 pCi/L at TPRF-12 in June 2018 to 74.0 pCi/L at TPRF-2 in December 2018 during the reporting period (Table 2.4-1). The highest tritium values were observed southwest of the CCS at TPRF-2 (i.e., 74.0 pCi/L) (Figure 2.4-1), with tritium concentrations decreasing with increased distance from the CCS (Figure 2.4-2). These values are within the range of tritium values observed in rainfall within the CCS (2010-2018 maximum: 113 pCi/L at TPRF-2).

Over 4.5 miles west of the CCS at TPRF-7 (co-located with TPGW-7), a value of 39.9 pCi/L was recorded in December 2018, and 20.3 pCi/L was recorded in March 2019. It is important to note that tritium values in excess of 20 pCi/L do occur in rainfall at remote distances from the CCS, and these values vary among quarters at a site. These observations may be influenced by the prevailing wind patterns. Figure 2.2-4 indicates the distribution of wind speeds and directions during the reporting period and shows a predominant onshore breeze from the southeast and east.

Tritium data from the evaporation pans (Figure 2.1-1) collected from 2011-2015, as outlined in Appendix B, indicate that a combination of vapor exchange and rainfall yield higher values than rainfall alone. The pans are influenced by wind-driven CCS vapor, condensation, and concentration by evaporation. As a result of the prevailing wind direction, atmospheric influences of tritium affects areas onshore more often than offshore. The pan data show a clear declining trend in tritium concentrations with increased distance from the CCS (Figure 2.4-2). These trends are similar to those exhibited by the tritium concentrations in rainfall. The highest concentrations during the period of data collection from 2011 through 2015 (63.7 pCi/L to 1,610.1 pCi/L) were observed at TPEVP-13, which is in the center of the CCS, followed by TPEVP-2 (26.3 pCi/L to 550.0 pCi/L), which is just west of the CCS; the values at TPEVP-5, which is several miles west of the CCS, ranged from 0.0 pCi/L to 63.1 pCi/L. Values in the evaporation pans were also generally higher during the dry season as compared to the wet season, which is most likely due to higher evaporative losses and limited rainfall (FPL 2016a). The evaporation patterns and values provide an indication of the potential range of the tritium values that may be observed in the surface waters of nearby Biscayne Bay, canals, and marsh/mangrove porewaters.

In conclusion, low-level atmospheric distribution of tritium in the vicinity of the CCS is sufficient to elevate background tritium levels in surface water, porewater, and shallow groundwater without any groundwater transport of CCS water.

TABLES

Table 2.1-1. Parameters Collected at Hourly Intervals Reported by the Meteorological Station at TPM-1.

Parameter	Units	Accuracy	Resolution
Rainfall – Amount	inches	Better than 5%, weather dependent	0.001
Relative Humidity	%	± 3	0.1
Temperature	°Celsius	± 0.3	± 0.1
Barometric Pressure	mmHg	0.5	0.5
Wind Speed - Average	mph	1 ft/sec	0.3 ft/sec
Wind Speed - Gusts and Lull	mph	1 ft/sec	0.3 ft/sec
Wind Direction	degrees	± 3	1
Light Level	$\mu mol/m^2/sec$	5-10 $\mu A/100\ \mu mol/m^2/sec$	NA
Hail	Hits	1	1

Key:
ft/sec = Feet per second.
mmHg = Millimeters of mercury.
mph = Miles per hour.
NA = Not applicable.
$\mu mol/m^2/sec$ = Micromoles per square meter per second.

Table 2.2-1. Rainfall Recorded at the Meteorological Station TPM-1 and S20F, and Calculated Based on NEXRAD Data (June 2018 – May 2019).

Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)
6	1	2018	0.000	0.030	0.000	0.00
6	2	2018	0.000	0.000	0.000	0.00
6	3	2018	0.000	0.000	0.000	0.00
6	4	2018	0.000	0.000	0.000	0.00
6	5	2018	0.370	0.000	0.064	8.18
6	6	2018	0.000	0.150	0.013	1.64
6	7	2018	0.010	0.270	0.003	0.42
6	8	2018	0.120	0.010	0.105	13.36
6	9	2018	0.060	0.050	0.096	12.25
6	10	2018	0.060	0.860	0.086	10.90
6	11	2018	0.060	0.000	0.142	18.10
6	12	2018	0.010	1.020	0.014	1.80
6	13	2018	0.120	0.010	0.027	3.38
6	14	2018	0.000	0.000	0.006	0.80
6	15	2018	0.000	0.050	0.000	0.00
6	16	2018	0.000	0.000	0.000	0.00
6	17	2018	0.000	0.000	0.000	0.00
6	18	2018	0.000	0.000	0.000	0.00
6	19	2018	0.000	0.000	0.002	0.25
6	20	2018	0.000	0.000	0.002	0.25
6	21	2018	0.830	0.050	0.589	74.99
6	22	2018	0.410	0.210	0.460	58.54
6	23	2018	0.090	1.540	0.142	18.05
6	24	2018	0.030	0.410	0.018	2.35
6	25	2018	0.000	0.000	0.000	0.00
6	26	2018	0.000	0.000	0.000	0.00
6	27	2018	0.000	0.000	0.001	0.13
6	28	2018	0.820	0.000	0.065	8.33
6	29	2018	0.000	0.000	0.001	0.10
6	30	2018	0.000	0.000	0.000	0.00
7	1	2018	0.000	0.000	0.000	0.00
7	2	2018	0.000	0.000	0.001	0.10
7	3	2018	0.000	0.000	0.063	7.97
7	4	2018	0.000	0.000	0.000	0.00

Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)
7	5	2018	0.000	0.000	0.000	0.00
7	6	2018	0.020	0.000	0.133	16.96
7	7	2018	0.000	0.000	0.000	0.00
7	8	2018	0.000	0.000	0.000	0.00
7	9	2018	0.000	0.000	0.000	0.00
7	10	2018	0.000	0.000	0.222	28.20
7	11	2018	1.230	0.010	1.193	151.84
7	12	2018	0.090	1.460	0.008	0.96
7	13	2018	0.000	0.050	0.000	0.00
7	14	2018	0.000	0.000	0.000	0.00
7	15	2018	0.000	0.000	0.000	0.00
7	16	2018	0.000	0.000	0.000	0.04
7	17	2018	0.000	0.000	0.000	0.00
7	18	2018	0.520	0.000	0.632	80.37
7	19	2018	0.000	0.210	0.000	0.00
7	20	2018	0.040	0.000	0.226	28.76
7	21	2018	0.000	0.050	0.000	0.00
7	22	2018	0.290	0.000	0.245	31.13
7	23	2018	0.030	0.290	0.029	3.72
7	24	2018	0.210	0.110	0.237	30.13
7	25	2018	0.000	0.060	0.000	0.00
7	26	2018	0.000	0.000	0.123	15.65
7	27	2018	0.360	0.460	0.071	8.99
7	28	2018	0.000	0.010	0.042	5.36
7	29	2018	0.610	0.000	0.605	77.02
7	30	2018	3.160	0.350	1.662	211.47
7	31	2018	0.000	0.980	0.016	2.06
8	1	2018	0.020	0.120	0.091	11.57
8	2	2018	0.000	0.150	0.030	3.85
8	3	2018	0.420	0.020	0.292	37.14
8	4	2018	0.160	0.000	0.072	9.13
8	5	2018	0.030	0.140	0.065	8.28
8	6	2018	0.040	0.000	0.000	0.00
8	7	2018	0.070	0.010	0.154	19.62

Table 2.2-1. Rainfall Recorded at the Meteorological Station TPM-1 and S20F, and Calculated Based on NEXRAD Data (June 2018 – May 2019).

Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)
8	8	2018	0.000	0.310	0.000	0.00
8	9	2018	0.030	0.000	0.026	3.31
8	10	2018	2.190	0.000	1.360	173.01
8	11	2018	0.000	0.310	0.019	2.43
8	12	2018	1.540	0.010	0.967	123.10
8	13	2018	0.000	1.380	0.016	2.05
8	14	2018	0.100	0.000	0.237	30.20
8	15	2018	0.000	0.000	0.002	0.27
8	16	2018	0.000	0.040	0.004	0.49
8	17	2018	0.160	0.080	0.032	4.13
8	18	2018	0.150	0.040	0.317	40.37
8	19	2018	0.410	0.040	0.168	21.42
8	20	2018	0.000	0.010	0.000	0.00
8	21	2018	0.000	0.000	0.000	0.00
8	22	2018	0.000	0.000	0.000	0.00
8	23	2018	0.110	0.000	0.047	5.99
8	24	2018	0.000	0.000	0.030	3.85
8	25	2018	0.510	0.280	0.395	50.27
8	26	2018	0.000	2.140	0.010	1.22
8	27	2018	0.000	0.150	0.078	9.92
8	28	2018	0.070	0.020	0.021	2.72
8	29	2018	0.050	0.010	0.284	36.11
8	30	2018	0.320	0.100	0.291	36.97
8	31	2018	0.050	0.090	0.015	1.90
9	1	2018	0.010	0.100	0.123	15.70
9	2	2018	0.080	0.020	1.785	227.15
9	3	2018	0.380	2.040	3.870	492.45
9	4	2018	0.010	2.150	0.054	6.92
9	5	2018	0.030	0.000	0.015	1.87
9	6	2018	0.230	0.010	0.045	5.68
9	7	2018	0.050	0.010	0.162	20.63
9	8	2018	0.090	0.040	0.153	19.50
9	9	2018	2.540	1.740	1.817	231.23
9	10	2018	0.000	0.640	0.000	0.00
9	11	2018	0.000	0.000	0.000	0.00
9	12	2018	0.000	0.000	0.000	0.00
9	13	2018	0.000	0.000	0.000	0.00
9	14	2018	0.010	0.000	0.014	1.72
9	15	2018	0.000	0.000	0.001	0.08
9	16	2018	0.000	0.000	0.066	8.40
9	17	2018	0.180	0.000	0.000	0.00
9	18	2018	0.090	0.030	0.024	2.99
9	19	2018	0.000	0.000	0.037	4.76
9	20	2018	0.000	0.050	0.044	5.61
9	21	2018	0.050	0.010	0.214	27.24
9	22	2018	0.000	0.140	0.003	0.34
9	23	2018	0.020	0.000	0.019	2.37
9	24	2018	0.000	0.110	0.003	0.35
9	25	2018	0.000	0.200	0.000	0.00
9	26	2018	0.000	0.000	0.054	6.90
9	27	2018	0.050	0.000	0.047	5.95
9	28	2018	0.000	0.000	0.054	6.84
9	29	2018	0.050	0.420	0.283	35.95
9	30	2018	0.000	0.370	0.002	0.24
10	1	2018	0.130	0.000	0.033	4.20
10	2	2018	0.030	0.000	0.060	7.59
10	3	2018	0.000	0.080	0.022	2.82
10	4	2018	0.000	0.320	0.061	7.73
10	5	2018	0.000	0.020	0.010	1.23
10	6	2018	0.000	0.000	0.000	0.00
10	7	2018	0.010	0.000	0.194	24.69
10	8	2018	0.110	0.310	0.144	18.37
10	9	2018	0.000	0.000	0.014	1.79
10	10	2018	0.000	0.000	0.000	0.00
10	11	2018	0.010	0.000	0.980	124.71
10	12	2018	0.000	0.450	0.000	0.00
10	13	2018	0.280	0.070	0.109	13.88
10	14	2018	0.010	0.000	0.000	0.00

Table 2.2-1. Rainfall Recorded at the Meteorological Station TPM-1 and S20F, and Calculated Based on NEXRAD Data (June 2018 – May 2019).

Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)	Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)
10	15	2018	0.000	0.000	0.000	0.00	11	18	2018	0.000	0.000	0.000	0.00
10	16	2018	0.000	0.000	0.052	6.67	11	19	2018	0.000	0.000	0.000	0.00
10	17	2018	0.010	0.070	0.025	3.21	11	20	2018	0.000	0.000	0.000	0.00
10	18	2018	0.000	0.010	0.003	0.42	11	21	2018	0.000	0.000	0.000	0.00
10	19	2018	0.010	0.000	0.000	0.00	11	22	2018	0.000	0.000	0.000	0.00
10	20	2018	0.000	0.000	0.000	0.00	11	23	2018	0.000	0.000	0.000	0.00
10	21	2018	0.020	0.000	0.008	1.07	11	24	2018	0.000	0.000	0.000	0.00
10	22	2018	0.010	0.000	0.014	1.83	11	25	2018	0.010	0.000	0.057	7.20
10	23	2018	0.000	0.000	0.000	0.00	11	26	2018	0.000	0.000	0.000	0.00
10	24	2018	0.000	0.000	0.000	0.00	11	27	2018	0.000	0.010	0.000	0.00
10	25	2018	0.000	0.000	0.000	0.00	11	28	2018	0.000	0.000	0.000	0.00
10	26	2018	0.000	0.000	0.000	0.00	11	29	2018	0.000	0.000	0.000	0.00
10	27	2018	0.350	0.000	0.085	10.77	11	30	2018	0.000	0.000	0.003	0.40
10	28	2018	0.000	0.000	0.000	0.00	12	1	2018	0.000	0.000	0.000	0.00
10	29	2018	0.000	0.000	0.000	0.00	12	2	2018	0.000	0.000	0.000	0.00
10	30	2018	0.000	0.000	0.000	0.00	12	3	2018	0.000	0.000	0.000	0.00
10	31	2018	0.000	0.000	0.000	0.00	12	4	2018	2.510	0.000	2.301	292.73
11	1	2018	0.000	0.000	0.000	0.00	12	5	2018	0.000	1.820	0.000	0.00
11	2	2018	0.280	0.000	0.425	54.13	12	6	2018	0.000	0.000	0.000	0.00
11	3	2018	0.120	0.210	0.000	0.00	12	7	2018	0.000	0.000	0.000	0.00
11	4	2018	0.010	0.000	0.008	1.07	12	8	2018	0.000	0.000	0.000	0.00
11	5	2018	0.000	0.000	0.000	0.04	12	9	2018	0.170	0.000	0.187	23.81
11	6	2018	0.000	0.050	0.005	0.60	12	10	2018	0.000	0.040	0.000	0.00
11	7	2018	0.000	0.010	0.046	5.84	12	11	2018	0.000	0.000	0.000	0.00
11	8	2018	0.030	0.670	0.027	3.46	12	12	2018	0.000	0.000	0.000	0.00
11	9	2018	0.000	0.000	0.000	0.00	12	13	2018	0.000	0.000	0.000	0.00
11	10	2018	0.000	0.000	0.000	0.00	12	14	2018	0.000	0.000	0.000	0.00
11	11	2018	0.420	2.520	1.812	230.56	12	15	2018	0.090	0.000	0.093	11.83
11	12	2018	0.000	0.180	0.049	6.21	12	16	2018	0.030	0.230	0.000	0.00
11	13	2018	0.000	0.020	0.075	9.50	12	17	2018	0.000	0.000	0.000	0.00
11	14	2018	0.000	0.010	0.027	3.41	12	18	2018	0.000	0.000	0.000	0.00
11	15	2018	0.130	0.400	0.153	19.53	12	19	2018	0.000	0.010	0.000	0.00
11	16	2018	0.000	0.090	0.000	0.00	12	20	2018	0.480	0.000	0.549	69.86
11	17	2018	0.000	0.000	0.000	0.00	12	21	2018	0.000	0.960	0.000	0.00

Table 2.2-1. Rainfall Recorded at the Meteorological Station TPM-1 and S20F, and Calculated Based on NEXRAD Data (June 2018 – May 2019).

Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)	Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)
12	22	2018	0.000	0.000	0.000	0.00	1	25	2019	0.050	1.340	0.004	0.47
12	23	2018	0.000	0.000	0.000	0.00	1	26	2019	0.250	0.050	0.157	20.04
12	24	2018	0.000	0.000	0.000	0.00	1	27	2019	0.560	0.350	0.558	70.95
12	25	2018	0.000	0.000	0.000	0.00	1	28	2019	0.050	0.550	0.020	2.51
12	26	2018	0.860	0.000	0.000	0.00	1	29	2019	0.000	0.000	0.000	0.00
12	27	2018	0.000	0.000	0.000	0.04	1	30	2019	0.000	0.000	0.000	0.00
12	28	2018	0.000	0.000	0.000	0.00	1	31	2019	0.030	0.000	0.080	10.19
12	29	2018	0.000	0.000	0.000	0.00	2	1	2019	0.000	0.000	0.000	0.00
12	30	2018	0.000	0.000	0.000	0.00	2	2	2019	0.000	0.000	0.000	0.00
12	31	2018	0.000	0.000	0.000	0.00	2	3	2019	0.000	0.000	0.000	0.00
1	1	2019	0.000	0.000	0.000	0.00	2	4	2019	0.000	0.010	0.000	0.00
1	2	2019	0.000	0.000	0.000	0.00	2	5	2019	0.000	0.000	0.000	0.00
1	3	2019	0.000	0.000	0.004	0.55	2	6	2019	0.000	0.000	0.000	0.00
1	4	2019	0.000	0.000	0.000	0.00	2	7	2019	0.000	0.000	0.000	0.00
1	5	2019	0.000	0.000	0.000	0.00	2	8	2019	0.000	0.000	0.000	0.00
1	6	2019	0.000	0.010	0.000	0.00	2	9	2019	0.000	0.000	0.023	2.90
1	7	2019	0.000	0.000	0.000	0.00	2	10	2019	0.000	0.140	0.000	0.00
1	8	2019	0.000	0.000	0.000	0.00	2	11	2019	0.060	0.000	0.090	11.43
1	9	2019	0.000	0.000	0.000	0.00	2	12	2019	0.000	0.220	0.000	0.00
1	10	2019	0.000	0.000	0.000	0.00	2	13	2019	0.630	0.000	0.532	67.70
1	11	2019	0.000	0.000	0.000	0.00	2	14	2019	0.000	0.730	0.000	0.00
1	12	2019	0.000	0.000	0.000	0.00	2	15	2019	0.000	0.000	0.000	0.00
1	13	2019	0.000	0.000	0.000	0.00	2	16	2019	0.000	0.010	0.000	0.00
1	14	2019	0.000	0.000	0.000	0.00	2	17	2019	0.000	0.000	0.000	0.00
1	15	2019	0.000	0.000	0.000	0.00	2	18	2019	0.000	0.000	0.000	0.00
1	16	2019	0.000	0.000	0.000	0.00	2	19	2019	0.010	0.000	0.025	3.15
1	17	2019	0.000	0.000	0.000	0.00	2	20	2019	0.000	0.050	0.001	0.15
1	18	2019	0.000	0.000	0.000	0.00	2	21	2019	0.000	0.000	0.000	0.00
1	19	2019	0.000	0.000	0.000	0.00	2	22	2019	0.000	0.000	0.000	0.00
1	20	2019	0.580	0.000	0.524	66.70	2	23	2019	0.000	0.000	0.006	0.80
1	21	2019	0.000	0.630	0.000	0.00	2	24	2019	0.000	0.000	0.000	0.00
1	22	2019	0.000	0.000	0.000	0.00	2	25	2019	0.000	0.000	0.000	0.00
1	23	2019	0.000	0.000	0.000	0.00	2	26	2019	0.000	0.010	0.022	2.79
1	24	2019	0.370	0.000	0.564	71.78	2	27	2019	0.010	0.010	0.000	0.00

Table 2.2-1. Rainfall Recorded at the Meteorological Station TPM-1 and S20F, and Calculated Based on NEXRAD Data (June 2018 – May 2019).

Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD	
					(inch)	(MG)
2	28	2019	0.000	0.000	0.000	0.00
3	1	2019	0.000	0.000	0.000	0.00
3	2	2019	0.000	0.000	0.000	0.00
3	3	2019	0.000	0.070	0.039	4.95
3	4	2019	0.000	0.250	0.000	0.00
3	5	2019	0.000	0.000	0.000	0.00
3	6	2019	0.000	0.000	0.000	0.00
3	7	2019	0.000	0.000	0.000	0.00
3	8	2019	0.000	0.000	0.001	0.08
3	9	2019	0.000	0.000	0.000	0.04
3	10	2019	0.000	0.000	0.000	0.00
3	11	2019	0.000	0.000	0.000	0.00
3	12	2019	0.000	0.000	0.000	0.00
3	13	2019	0.000	0.100	0.000	0.00
3	14	2019	0.000	0.000	0.000	0.00
3	15	2019	0.000	0.000	0.000	0.00
3	16	2019	0.000	0.000	0.000	0.00
3	17	2019	0.090	0.000	0.133	16.91
3	18	2019	0.000	0.000	0.010	1.25
3	19	2019	1.500	0.470	1.497	190.45
3	20	2019	0.080	1.120	0.123	15.60
3	21	2019	0.000	0.010	0.000	0.00
3	22	2019	0.000	0.000	0.000	0.00
3	23	2019	0.000	0.000	0.000	0.00
3	24	2019	0.000	0.000	0.000	0.00
3	25	2019	0.000	0.000	0.000	0.00
3	26	2019	0.000	0.000	0.000	0.00
3	27	2019	0.000	0.000	0.000	0.00
3	28	2019	0.000	0.000	0.038	4.87
3	29	2019	0.030	0.020	0.015	1.86
3	30	2019	0.000	0.030	0.001	0.18
3	31	2019	0.060	0.000	0.005	0.64
4	1	2019	0.000	0.000	0.000	0.00
4	2	2019	0.000	0.000	0.000	0.00
4	3	2019	0.000	0.000	0.010	1.23
4	4	2019	0.100	0.020	0.046	5.86
4	5	2019	0.000	0.010	0.000	0.04
4	6	2019	0.000	0.000	0.000	0.00
4	7	2019	0.000	0.000	0.010	1.28
4	8	2019	0.000	0.000	0.000	0.00
4	9	2019	0.860	0.000	0.861	109.61
4	10	2019	0.000	1.290	0.000	0.00
4	11	2019	0.000	0.000	0.000	0.00
4	12	2019	0.000	0.000	0.000	0.00
4	13	2019	0.000	0.000	0.000	0.03
4	14	2019	0.000	0.000	0.000	0.00
4	15	2019	0.000	0.000	0.039	4.98
4	16	2019	0.000	0.000	0.000	0.00
4	17	2019	0.000	0.000	0.000	0.00
4	18	2019	0.000	0.000	0.000	0.00
4	19	2019	0.570	0.010	0.821	104.44
4	20	2019	0.020	0.450	0.000	0.00
4	21	2019	0.000	0.000	0.000	0.00
4	22	2019	0.000	0.000	0.000	0.00
4	23	2019	0.000	0.000	0.000	0.00
4	24	2019	0.000	0.000	0.000	0.00
4	25	2019	0.000	0.000	0.000	0.00
4	26	2019	0.000	0.000	0.000	0.00
4	27	2019	0.000	0.000	0.000	0.00
4	28	2019	0.000	0.000	0.001	0.16
4	29	2019	0.000	0.020	0.000	0.00
4	30	2019	0.030	0.000	0.018	2.27
5	1	2019	0.090	0.000	0.066	8.39
5	2	2019	0.020	0.280	0.010	1.23
5	3	2019	0.000	0.000	0.000	0.00
5	4	2019	0.000	0.090	0.000	0.00
5	5	2019	0.000	0.000	0.000	0.00
5	6	2019	0.000	0.230	0.033	4.20

Table 2.2-1. Rainfall Recorded at the Meteorological Station TPM-1 and S20F, and Calculated Based on NEXRAD Data (June 2018 – May 2019).

Month	Date	Year	TPM-1 (inch)	S20F (inch)	NEXRAD (inch)	NEXRAD (MG)
5	7	2019	0.390	0.050	0.378	48.05
5	8	2019	0.010	0.500	0.000	0.00
5	9	2019	0.000	0.050	0.000	0.00
5	10	2019	0.060	0.000	0.160	20.38
5	11	2019	0.000	0.000	0.062	7.89
5	12	2019	0.000	0.000	0.000	0.00
5	13	2019	0.130	0.000	0.083	10.56
5	14	2019	0.560	0.170	0.358	45.50
5	15	2019	0.110	0.320	0.058	7.36
5	16	2019	0.370	0.400	0.472	60.03
5	17	2019	0.000	0.110	0.000	0.00
5	18	2019	0.030	0.000	0.087	11.07
5	19	2019	0.000	0.000	0.000	0.00
5	20	2019	0.000	0.000	0.007	0.85
5	21	2019	0.000	0.000	0.000	0.00
5	22	2019	0.000	0.000	0.000	0.00
5	23	2019	0.000	0.000	0.001	0.10
5	24	2019	0.000	0.000	0.000	0.00
5	25	2019	0.000	0.000	0.000	0.00
5	26	2019	0.000	0.000	0.000	0.00
5	27	2019	0.000	0.000	0.000	0.00
5	28	2019	0.000	0.000	0.000	0.00
5	29	2019	0.000	0.000	0.000	0.00
5	30	2019	0.000	0.000	0.020	2.61
5	31	2019	0.000	0.000	0.002	0.25

Key:
MG = Millions of gallons.

Table 2.2-2. Total Monthly Rainfall in and around the CCS (June 2018 – May 2019).

Month	NEXRAD* (inches)	TPM-1 (inches)	S20F (inches)
Jun-18	1.84	2.99	4.66
Jul-18	5.51	6.56	4.04
Aug-18	5.02	6.43**	5.45
Sep-18	8.89	3.87**	8.08
Oct-18	1.82	0.98**	1.33
Nov-18	2.69	1.00**	4.17
Dec-18	3.13	4.14**	3.06
Jan-19	1.91	1.89	2.93
Feb-19	0.70	0.71	1.18
Mar-19	1.86	1.76	2.07
Apr-19	1.81	1.58	1.80
May-19	1.80	1.77	2.20
TOTAL	36.97	33.68	40.97

Notes:
* NEXRAD data, averaged over the whole CCS.
**Battery issue may have resulted in under reporting rainfall (data or a total of 309 hours from August 2018 through December not available)

Table 2.2-3. Average Monthly Air Temperature in Homestead Airport, Florida (1996 – 2019).

Year	Temperature (°C)												
	Annual Average	January	February	March	April	May	June	July	August	September	October	November	December
1996	23.7	18.9	18.1	20.0	23.0	26.4	27.0	28.1	27.7	27.7	25.2	22.7	20.0
1997	23.9	19.2	22.4	23.3	24.1	26.0	27.3	27.8	NA	NA	25.3	NA	20.0
1998	24.7	20.8	20.7	20.4	23.6	26.3	28.9	28.6	28.7	27.7	26.0	23.2	21.6
1999	23.7	20.1	19.5	19.7	23.9	24.8	26.4	27.5	28.1	27.0	25.2	22.2	20.0
2000	23.3	18.9	19.3	22.2	22.8	25.3	26.6	27.6	NA	27.5	24.5	21.7	19.5
2001	23.8	16.2	22.2	21.9	23.0	23.9	26.9	27.3	27.9	26.7	25.5	22.2	21.4
2002	23.8	19.9	20.2	22.8	24.2	25.7	NA	27.4	27.8	27.4	25.8	21.2	19.7
2003	23.7	15.6	20.6	24.3	22.3	26.1	27.0	27.7	27.2	27.4	25.6	23.2	17.6
2004	23.4	17.9	19.9	21.1	21.6	24.8	27.6	27.2	27.8	27.3	24.9	22.2	18.7
2005	23.0	18.3	18.7	20.2	21.1	24.6	26.7	28.3	28.4	NA	25.3	22.4	18.9
2006	23.4	18.7	17.8	19.9	22.8	24.3	26.7	26.9	27.9	27.4	25.2	21.3	22.2
2007	24.1	20.8	18.6	21.6	22.1	24.4	26.8	28.9	28.6	27.3	26.8	22.2	21.6
2008	23.8	19.2	21.4	21.5	22.8	25.6	27.4	27.4	28.2	27.5	24.6	20.2	20.2
2009	23.9	18.1	17.3	20.5	23.1	25.5	27.4	28.2	28.4	27.8	26.2	22.8	21.0
2010	16.5	15.7	16.2	17.6	NA	NA	NA	NA	NA	NA	NA	NA	NA
2011	24.0	17.7	19.9	21.0	24.4	25.3	26.7	28.0	28.4	27.8	25.2	22.9	20.9
2012	24.0	18.5	21.3	22.2	22.6	25.8	27.2	27.4	27.9	27.8	25.8	20.3	21.0
2013	24.6	21.4	20.7	18.2	23.9	24.8	27.5	27.6	28.6	28.6	26.4	24.7	23.2
2014	24.4	18.8	22.5	21.6	23.7	25.8	26.9	28.6	29.1	27.9	25.8	21.7	20.5
2015	25.5	20.6	18.3	23.7	25.7	25.8	27.7	28.7	28.8	28.7	26.9	25.8	25.3
2016	24.9	19.4	18.7	23.7	23.8	26.2	28.7	29.1	29.1	28.4	26.4	22.3	23.5
2017	24.3	20.1	21.1	21.1	23.7	26.4	27.9	28.9	28.8	NA	26.3	23.2	19.9
2018	24.7	18.2	23.1	20.2	23.9	25.4	27.8	28.7	28.6	28.2	27.1	23.8	20.9
2019	NA	18.9	22.6	22.0	24.3	26.5	NA	NA	NA	NA	NA	NA	NA

Key:

°C = Degrees Celcius.

NA = No data available.

Table 2.3-1. Comparison of Historical NEXRAD Rainfall (inches) Over CCS (January 1996 – May 2019).

Reporting Year	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Reporting Period Total (Jun-May)
1995/1996								0.42	0.16	0.37	1.02	2.64	
1996/1997	4.10	1.44	2.26	4.17	3.95	0.22	0.31	3.17	0.75	0.81	1.33	2.27	24.77
1997/1998	11.92	2.64	3.84	6.86	1.21	2.47	7.87	1.68	5.68	4.46	0.07	3.14	51.83
1998/1999	1.35	2.04	3.02	8.49	3.79	8.32	0.93	1.82	0.37	0.64	0.48	3.56	34.82
1999/2000	9.55	2.96	8.55	7.01	11.94	2.22	0.43	0.85	0.58	1.46	2.75	1.59	49.88
2000/2001	4.98	4.30	5.66	6.60	12.45	0.16	4.46	0.51	0.09	2.97	NA	3.19	45.36
2001/2002	5.52	6.16	5.95	14.67	8.27	1.54	1.13	0.18	1.12	2.56	0.16	4.04	51.30
2002/2003	12.23	7.08	4.02	3.81	1.03	3.79	3.24	0.35	0.61	5.56	3.21	3.95	48.86
2003/2004	4.55	1.24	5.95	9.39	0.84	4.91	1.22	2.55	1.66	0.39	1.41	1.12	35.23
2004/2005	1.74	4.86	4.63	3.18	5.11	1.34	0.40	0.43	0.28	2.10	1.81	3.00	28.87
2005/2006	14.26	6.16	9.27	7.44	4.57	1.59	0.74	0.63	1.39	0.90	2.02	4.65	53.61
2006/2007	3.63	11.64	5.63	7.93	2.14	2.30	2.75	0.30	1.81	0.45	4.35	6.17	49.10
2007/2008	11.64	7.62	2.43	8.48	8.47	0.11	0.78	0.64	1.51	2.64	1.77	2.17	48.26
2008/2009	4.88	3.20	7.33	2.59	4.45	0.44	0.22	0.13	0.29	2.28	0.55	10.47	36.83
2009/2010	9.48	3.47	3.91	9.99	0.76	4.64	3.52	1.18	3.12	2.27	4.16	4.45	50.95
2010/2011	5.33	4.25	7.69	12.96	2.28	4.59	0.60	3.34	0.12	1.19	1.84	1.18	45.37
2011/2012	1.28	7.85	6.54	6.15	8.99	0.20	0.30	0.50	5.79	0.39	8.55	6.32	52.86
2012/2013	5.02	5.06	6.87	4.96	2.53	0.30	0.35	0.18	0.84	0.84	3.89	8.24	39.08
2013/2014	3.03	8.39	4.75	4.49	1.27	5.49	0.75	1.44	1.57	1.17	0.38	1.20	33.93
2014/2015	4.18	5.31	2.70	3.22	5.62	0.35	2.16	1.85	1.00	1.82	5.95	0.76	34.92
2015/2016	1.21	3.35	5.01	8.64	5.08	5.89	14.94	4.68	2.34	1.98	2.70	5.68	61.50
2016/2017	4.25	2.27	8.67	7.43	4.73	0.26	4.03	1.18	0.92	2.04	1.13	1.38	38.29
2017/2018	6.12	6.10	6.51	8.33	4.34	0.71	0.59	0.96	0.43	0.32	2.40	8.31	45.12
2018/2019	1.84	5.51	5.02	8.89	1.82	2.69	3.13	1.91	0.70	1.86	1.81	1.80	36.97
Historical	**5.92**	**4.88**	**5.51**	**7.13**	**4.72**	**2.36**	**2.35**	**1.30**	**1.47**	**1.78**	**2.42**	**3.95**	**43.67**

Notes:

1. Per SFWMD, data since 2008 may be more accurate due to improvements in technology and processing of data.
2. Historical based on data from 1996/1997 to 2017/2018 reporting period.

Table 2.4-1. Rainfall Tritium Results.

Rainfall Station	Sample Date	Concentration (pCi/L)		
		Value	1-Sigma	MDL
TPRF-2	6/7/2018	18.4	7.2	6.4
TPRF-3	6/11/2018	16.3	4.6	6.4
TPRF-4	6/7/2018	8.3	5.7	6.4
TPRF-5	6/14/2018	17.5	8.3	6.4
TPRF-7	6/7/2018	18.7	7.3	6.4
TPRF-8	6/14/2018	14.5	7.3	6.4
TPRF-12	6/14/2018	2	6.5	6.4
TPRF-2	9/17/2018	39.3	6.1	6.4
TPRF-3	9/13/2018	5.9	4.4	6.4
TPRF-4	9/18/2018	12.7	8	6.4
TPRF-5	9/11/2018	17.6	5.3	6.4
TPRF-7	9/12/2018	8.3	5.2	6.4
TPRF-8	NA	NA	NA	NA
TPRF-12	9/12/2018	12.9	6.9	6.4
TPRF-2	12/6/2018	74	6.9	6.4
TPRF-3	12/6/2018	7.5	7.5	6.4
TPRF-4	12/6/2018	36.8	8.2	6.4
TPRF-5	12/13/2018	53.7	8.9	6.4
TPRF-7	12/10/2018	39.9	7	6.4
TPRF-8	12/13/2018	15.1	7	6.4
TPRF-12	12/11/2018	12.9	7.2	6.4
TPRF-2	3/5/2019	24.1	5.6	6.4
TPRF-3	3/6/2019	20.7	6.9	6.4
TPRF-4	3/13/2019	20.2	6.5	6.4
TPRF-5	3/4/2019	12.5	3.5	6.4
TPRF-7	3/5/2019	20.3	5.0	6.4
TPRF-8	3/14/2019	34.0	9.6	6.4
TPRF-12	3/5/2019	19.2	5.0	6.4

Key:
pCi/L = picoCuries per liter.
MDL = Minimum detection limit.
TPRF = Rainfall.
NA = Not available; filter on collector clogged.

FIGURES

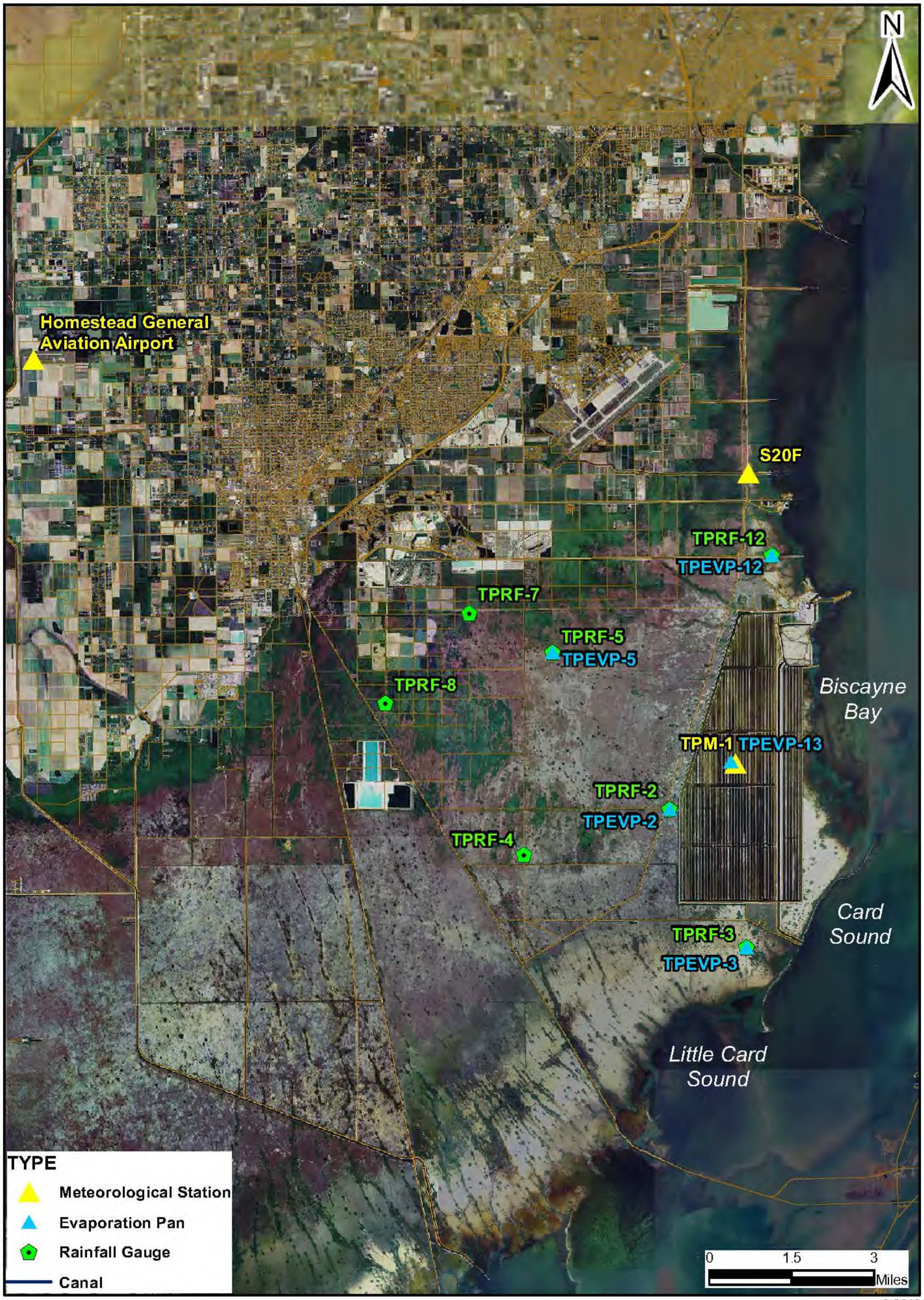
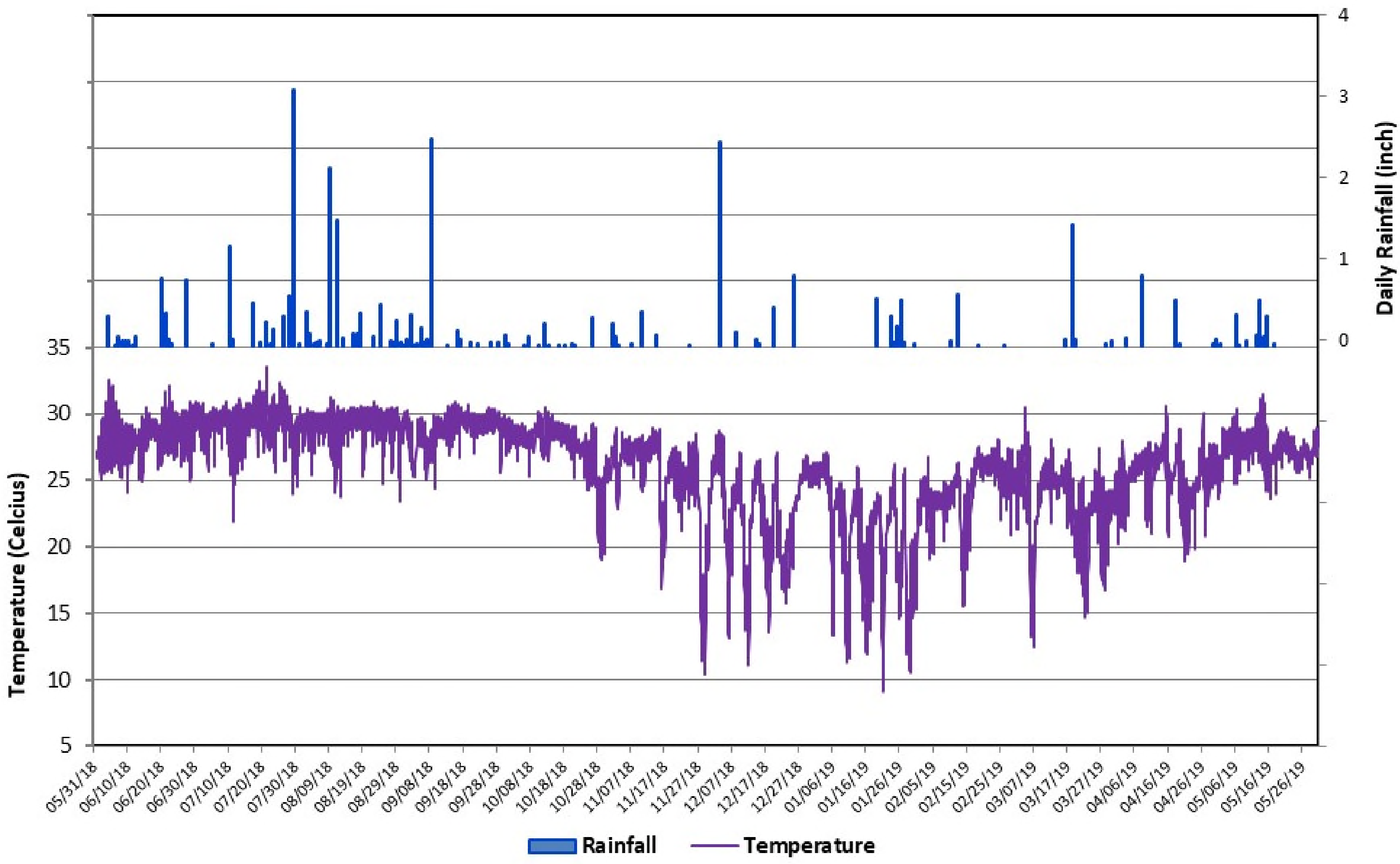


Figure 2.1-1. Locations of Rainfall Stations in and around the CCS.



Note: Rainfall data may be under-reported from late-August to mid-December 2018.

Figure 2.2-1. Daily Rainfall and Hourly Temperature at TPM-1 for Reporting Period.

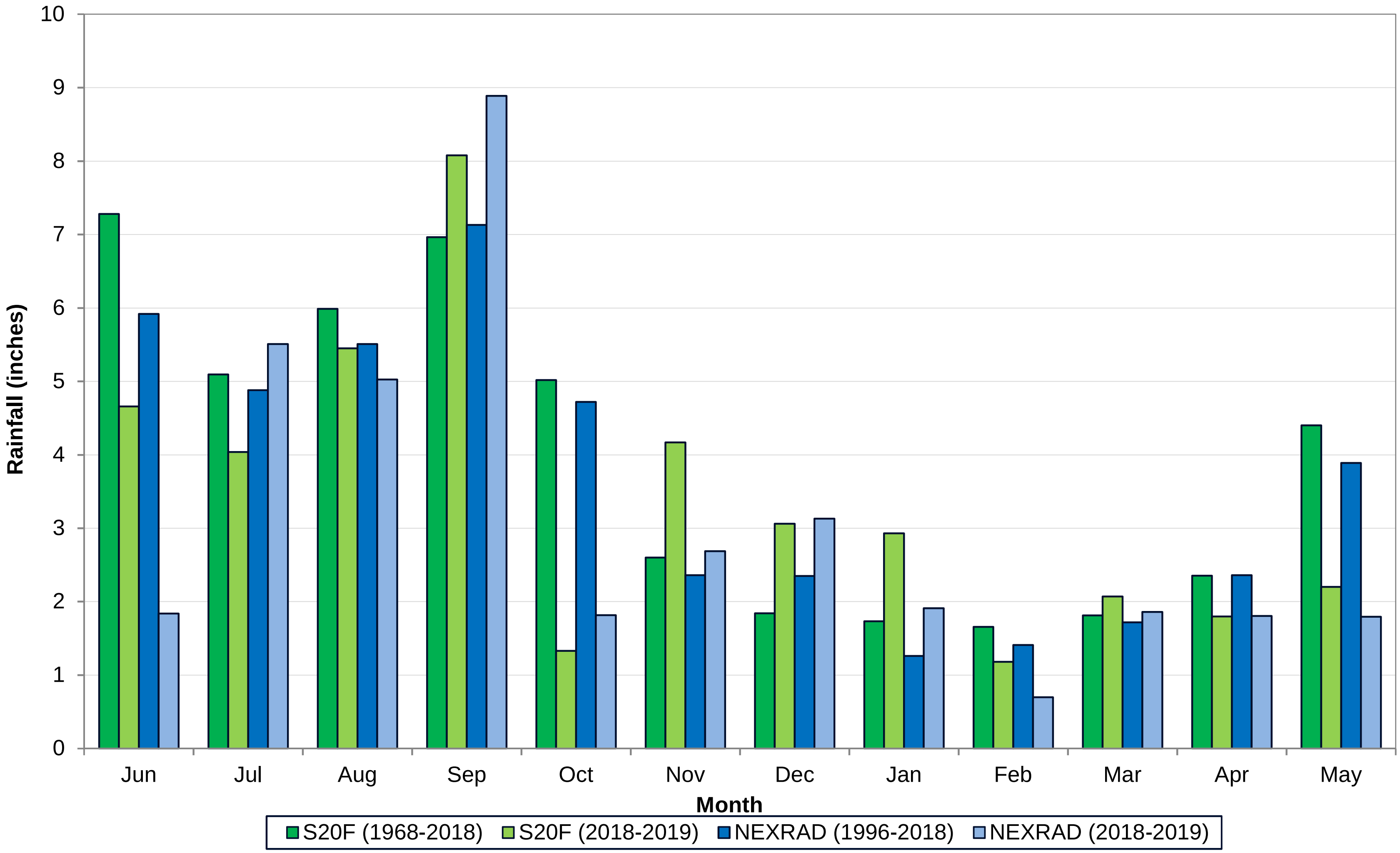


Figure 2.2-2. Monthly Rainfall Comparisons to Average Historical Data.

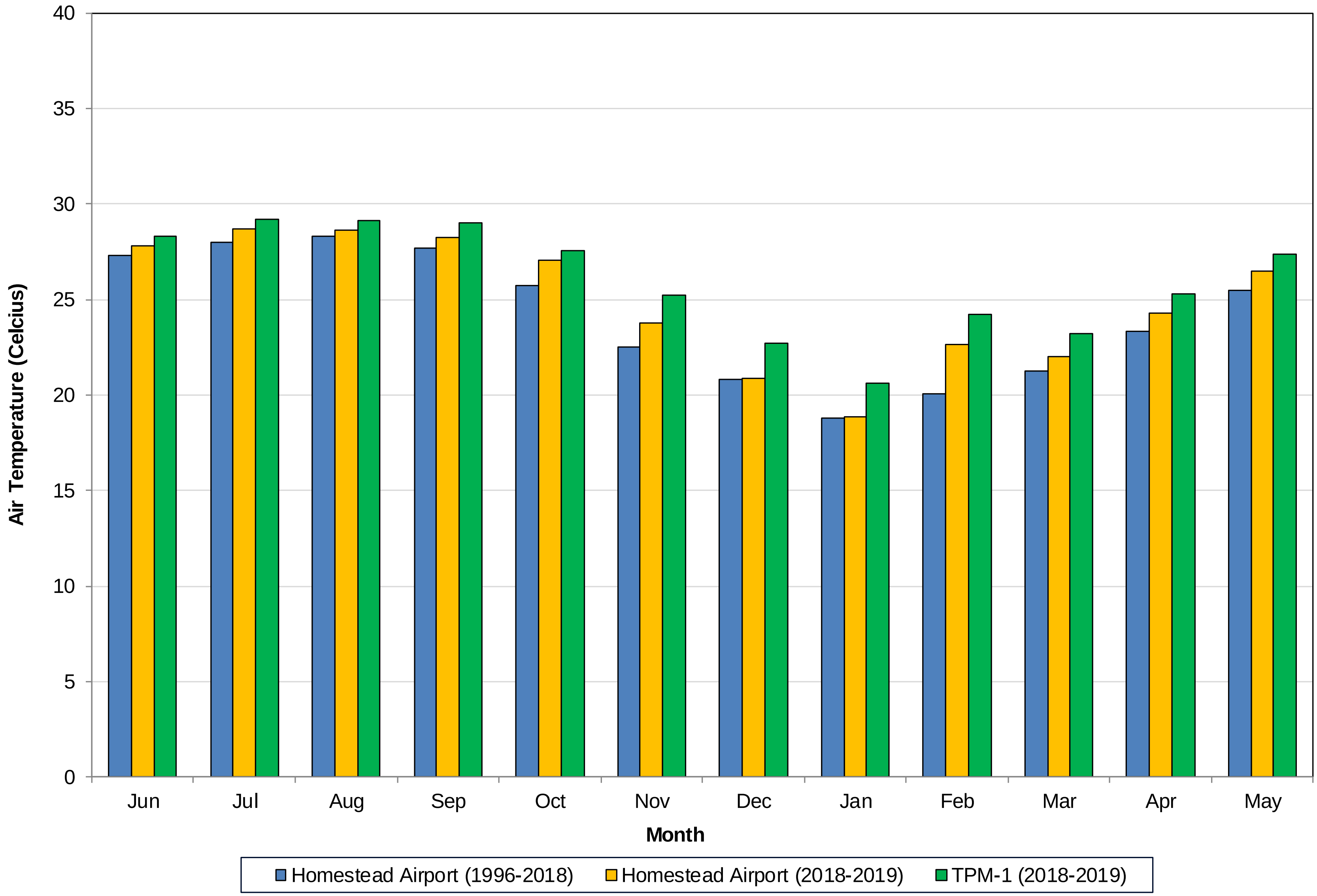


Figure 2.2-3. Monthly Temperature Comparisons to Average Historical Data

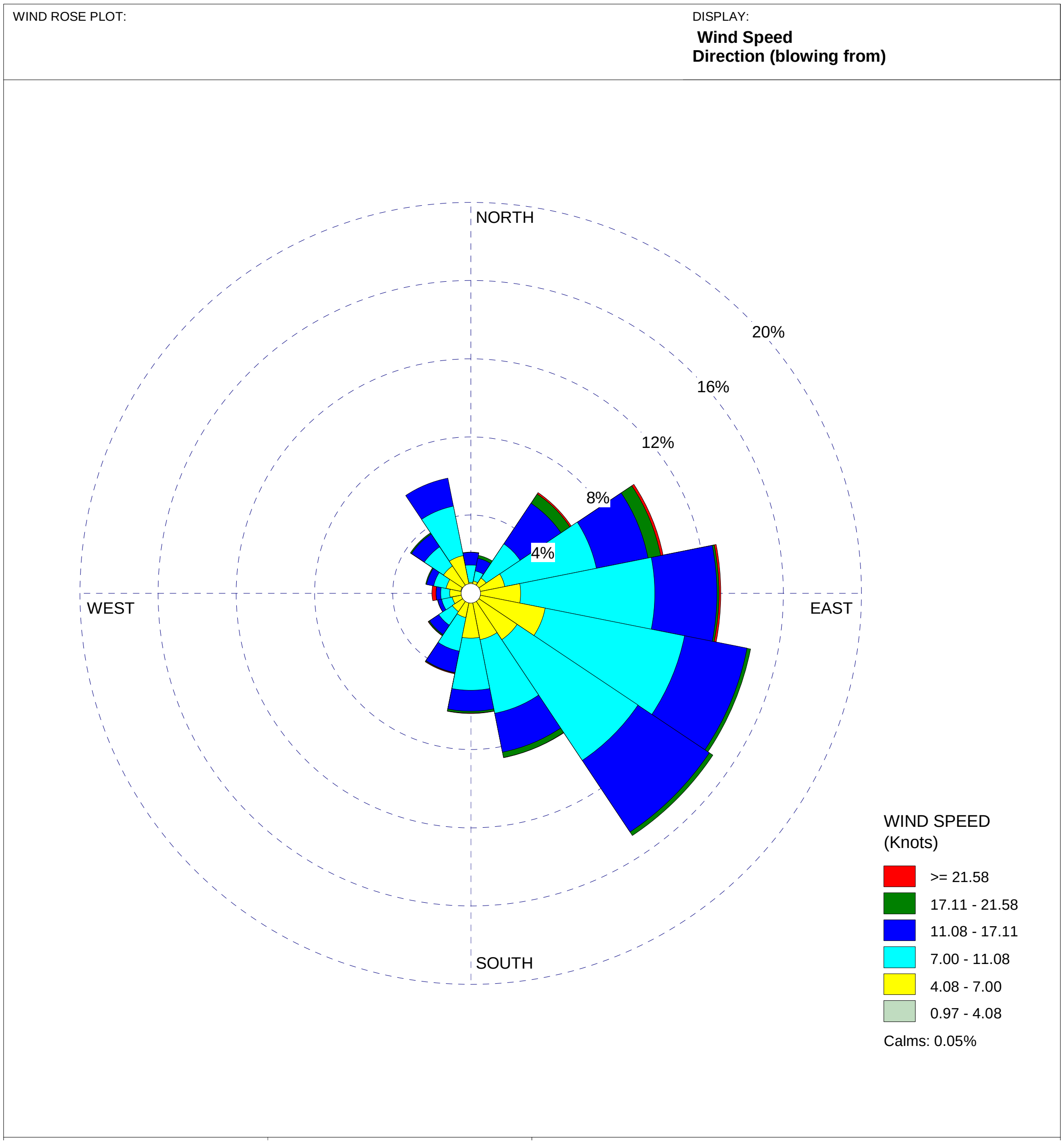
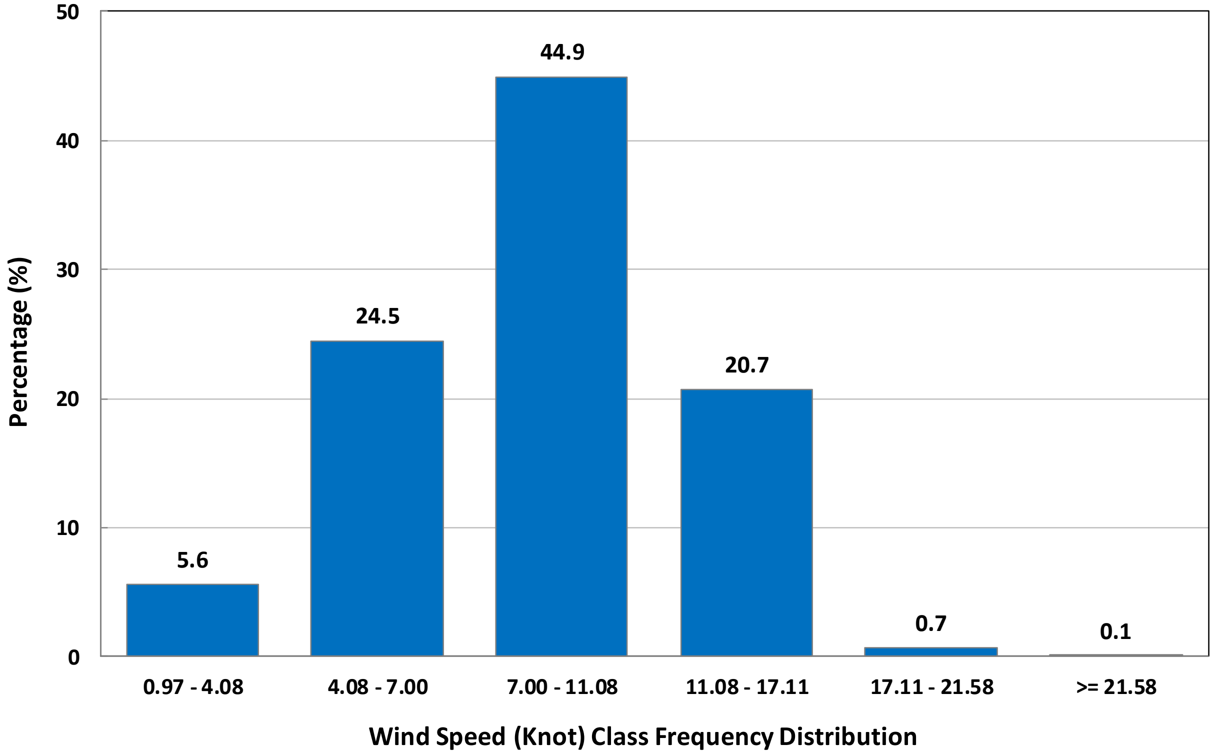
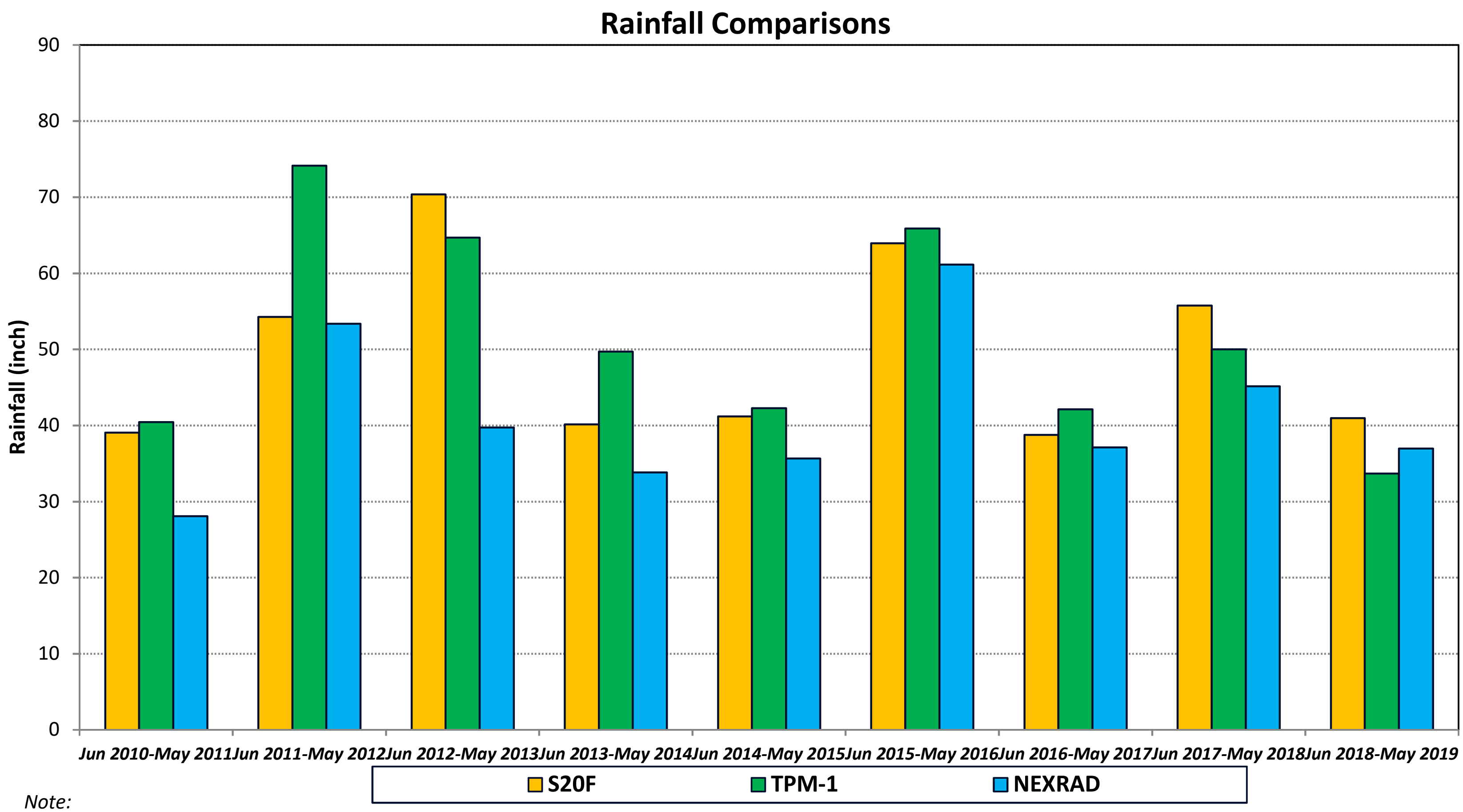


Figure 2.2-4. Wind Rose Plots Indicating Wind Speed and Direction at TPM-1 for the Reporting Period (June 2018 – May 2019).



Note: 3.54% of values missing due to periodic battery failure.

Figure 2.2-5. Wind Speed (Class) Frequency Distribution at TPM-1 for the Reporting Period (June 2018 – May 2019).



Note:

1. June and July 2010 data are missing at TPM-1. Rainfall data may also be under-reported from late-August to mid-December 2018.

2. Historical S20F (1967-2018) rainfall = 46.74 inches; historical NEXRAD (1996-2018) rainfall = 43.61 inches.

Figure 2.3-1. Annual Rainfall Totals from 2010-2019.

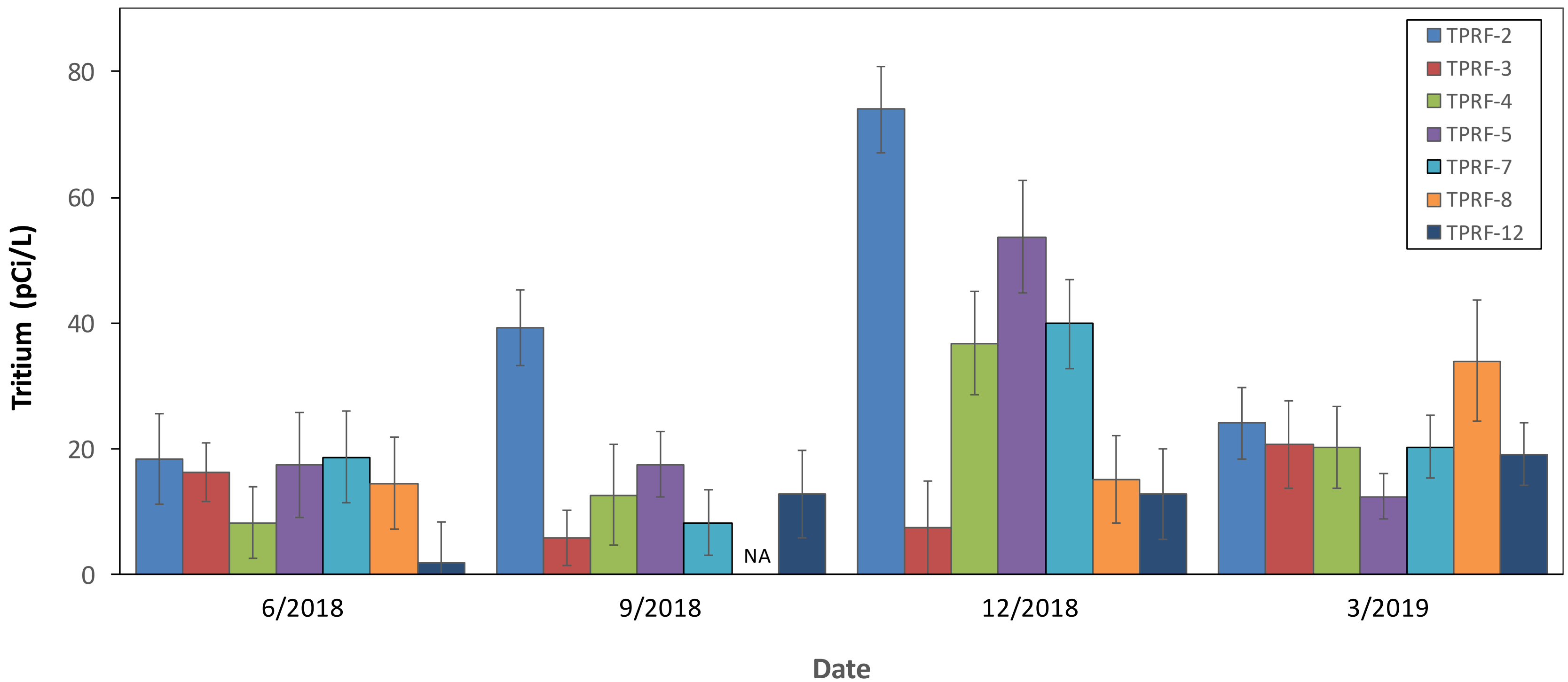
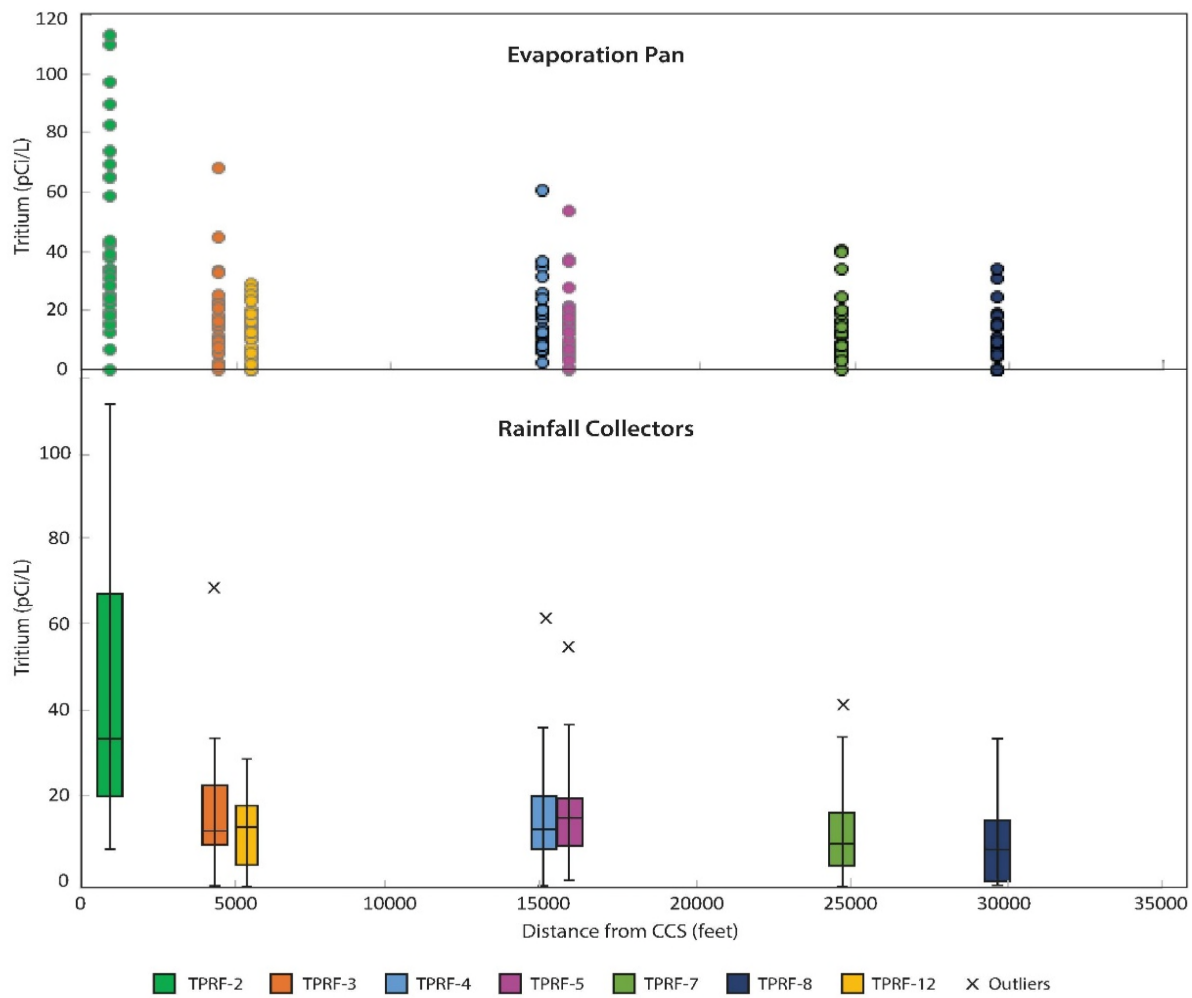


Figure 2.4-1. Tritium (± 1σ) Values in Rainfall (July 2018 – March 2019).



Note: 509 pCi/L value (6/14/2016) at TPRF-2 omitted to allow display of the lower values at the other sites.

Figure 2.4-2. Tritium Values in Rainfall and Evaporation Pans with Distance from the CCS.

3. GROUNDWATER AND SURFACE WATER MONITORING

Over 4.5 million automated and analytical data points values were collected during the 2018-2019 reporting period. These data points were collected, processed, validated, and reported consistent with the procedures and protocols outlined in the extensive Agencies' approved Data Quality Objectives, as outlined in the project Quality Assurance Project Plan.

The monitoring network includes 14 groundwater well clusters, five historical single wells, and 20 surface water stations where water quality and/or water level data are recorded by automated probes (Table 3.0-1). Figures 1.1-2 and 1.1-3 (presented in Section 1) show the locations of these stations. Automated data are collected hourly while water quality samples are collected quarterly, with some parameters analyzed quarterly and other parameters analyzed semi-annually (Table 3.0-2). Automated and analytical data parameters, sampling frequencies, sampling methods and processing protocols are outlined in Appendix B and detailed in the QAPP (FPL, 2013).

3.1 Groundwater Quality

3.1.1 Data Collection

There were no changes made to the EPU Monitoring Plan during the reporting period. The only notable monitoring station modification was made to change for monitoring well cluster TPGW-7 which was converted from flush-mounted wells in a vault to riser construction to eliminate over-topping issues caused by flooding. While the vault provided more protection from vandalism, overtopping was impacting the representativeness of water level elevations in the deep well. Water quality results were not impacted. Other wells that were originally constructed as flush-mounted but have been converted to riser construction over the years to address overtopping include TPGW-2, TPGW-3, TPGW-6, and TPGW-12, and TPGW-13.

3.1.2 Automated Data Results

Figures 3.1-1 through 3.1-14 are time-series graphs of groundwater specific conductance and temperature at each well. The graphs depict validated data and exclude data that have been qualified as "questionable." The time-series graphs show data from the beginning of station reporting in 2010 (various dates depending on station startup) through May 2019 to enable viewing of trends over time. This entire time-series display also allows for a comparison between the reporting period (June 2018 through May 2019) and the historical period of record (June 2010, or as stations became operational, to May 2018). This report includes the validated time-series data in separate Excel files (provided as Section 3 electronic data files as part of this reporting package) to facilitate closer review of the results by the Agencies and to allow the adjustment of graphic scales presented herein and/or to focus on specific time intervals. The validated data Excel files are also available for download on the FPL EDMS.

Tables 3.1-1, 3.1-2, and 3.1-3 show statistical summaries for time-series automated groundwater specific conductance, salinity, and temperature data, respectively. The tables include monthly average values for each monitoring well, the minimum, maximum, average, and standard deviation for the reporting period (data from June 2018 through May 2019), and the minimum, maximum, average, and standard deviation for the historical period of record (data from station startup through May 2018); these summaries were calculated when at least 21 days of data were available during the month. The calculations have been included in separate Excel files along with this report. The salinity values are also presented since readers often relate more directly to salinity than to specific conductance. The standard deviation for some of the salinity and temperature values is shown as zero, but that is a function of rounding/significant digits. Figures 3.1-15, 3.1-16, and 3.1-17 show the annual average and standard deviation values for specific conductance, salinity, and temperature, respectively, at each groundwater station.

3.1.3 Analytical Data Results

Tables 3.1-4 through 3.1-7 provide a summary of the groundwater analytical results from the June 2018 through March 2019 sampling events for well clusters TPGW-1 through TPGW-14 and historical monitoring wells TPGW-L3, TPGW-L5, TPGW-G21, TPGW-G28, and TPGW-G35 (18-foot [ft] and 58-ft sample horizons). Table 3.1-8 includes a summary showing the range of ion and nutrient concentrations. Figures 3.1-18, 3.1-19, and 3.1-20 show the quarterly concentrations for chloride, sodium, and tritium, respectively, along with the historical range in values for all the above-mentioned monitoring wells. Figure 3.1-21 shows semi-annual concentrations for total nitrogen (TN), ammonia, and total phosphorus (TP), along with historical values for a smaller set of monitoring well clusters located in or near the CCS (TPGW-1, TPGW-2, TPGW-10, TPGW-13, and TPGW-14). Per the Monitoring Plan (FDEP 2009), nutrients are collected only semi-annually at these five well clusters.

For the historical monitoring wells (TPGW-L3, TPGW-L5, TPGW-G21, TPGW-G28 and TPGW-35), Figures 3.1-22 through 3.1-31 show the vertical profiles of chloride and temperature. These figures provide detailed information on the changes in these two parameters from the surface down to the bottom of the well with measurements reported at 1-ft intervals.

Groundwater sampling logs from the June 2018 to March 2019 sampling events are provided in Appendix F of this report. DUS reports for all events are provided in Appendix G, and the detailed Level IV laboratory reports are included in Appendix H. Note that the laboratory reported analytical results to three digits at the request of the Agencies in 2013. However, the third digit is not considered significant by the laboratory and can be misconstrued as indicating a false level of accuracy. Analytical outliers are included in Appendix I.

3.1.4 Discussion of Results

The following discussion focuses on tritium, specific conductance, chloride, sodium, nutrients, and temperature in groundwater and surface water. Other parameters (Table 3.0-2) are collected, but most are primarily used for QA/QC consistency checks with information presented in DUSs; therefore, no further discussion of these other parameters is provided below.

3.1.4.1 Groundwater Salt Constituents and Tritium

> Tritium concentrations are a function of atmospheric exchange and groundwater transport. Both phenomena must be considered when evaluating tritium data and groundwater pathways.

Cooling water containing low levels of non-hazardous wastes (including tritium) are collected during routine power plant maintenance and are allowed to be discharged to the CCS in accordance with U.S. Nuclear Regulatory Commission (NRC) regulations and oversight as prescribed in the NRC site license for Turkey Point. These discharges are managed to ensure tritium levels in the CCS do not exceed federal safe drinking water standards, even though the CCS and the groundwater beneath it are designated as non-drinking water sources. Due to the periodic nature of maintenance activities and the resulting discharges, the tritium levels in the CCS fluctuate. The variations in CCS tritium levels are reflected more dynamically in the CCS canals and evaporative waters than in groundwater beneath the CCS where tritium levels are less variable. As a result, tritium levels in surface water, porewater, and shallow groundwater monitoring sites located close to the CCS exhibit higher degrees of variability during the year than groundwater sites.

Tritium is being used along with specific conductance to help distinguish CCS water from ambient marine sourced saline surface and groundwater. However, the use of this isotope of water for quantitative assessments of CCS water does have its limitations. Tritium is present in the CCS at concentrations higher than the surrounding environment (see Section 2). In waters outside of the CCS, particularly in samples near the CCS that exhibit low tritium concentrations (less than 200 pCi/L, but can be higher in certain circumstances), determination of the method by which tritium was transported to the location is complicated, particularly in surface water and porewater but also in shallow groundwater. Determining the mode of transport of tritiated CCS water is important, as the means of transport affects the chemical make-up of the water transported. For example, tritiated water originating from the CCS as evaporation that is deposited on the landscape via rainfall or condensation will be depleted in salts and nutrients as compared to the ionic ratios of water derived from the canals. Similarly, some CCS canal water constituents, such as nitrogen and phosphorus, are reactive to canal sediments, biological processes, and/or aquifer materials that can attenuate the transport of some constituents differently than others as water moves out of the CCS via a groundwater path. Atmospheric transport of tritium has been documented in areas surrounding the CCS based on evaporation pan data collected from 2011 through 2015 (FPL 2016a) and rainfall data collected from 2010 through present. The highest tritium concentrations in rainfall and evaporation pans are reported closest to the CCS and diminish with distance from the CCS. Tritium concentrations in evaporation pans near TPGW-2/L-31E canal were often in excess of 100 pCi/L to 200 pCi/L, while concentrations in evaporation pans near TPGW-5 were consistently less than 50 pCi/L; however, a maximum value of 63.1 pCi/L has been recorded at that site.

In addition, tritium has a relatively short half-life (12.28 years/half-life), further complicating the determination of contribution of CCS water at sample locations farther from the CCS when the travel times are uncertain. It is important to note that, under this Monitoring Plan, tritium is being measured only as a chemical tracer in order to determine the potential movement of CCS water. At the levels being measured, tritium is not a public health concern and is below the FDEP drinking water standard of 20,000 pCi/L (FDEP 2012). Tritium is also monitored in the CCS by the Florida Department of Health – Bureau of Radiation Control (FDOH-BRC) under a monitoring condition of the Nuclear Regulatory Commission operation license for Turkey Point Units 3 and 4. This information can be found in the FPL EDMS (https://www.ptn-combined-monitoring.com).

> Saltwater intrusion in the aquifer underneath and west of Turkey Point has been documented over 4 miles inland prior to the construction of the CCS. The water in this region of the Biscayne Aquifer was (at that time and continues to be) non-potable.

As previously reported (FPL 2011, 2012a, 2016a, 2018), the presence of saltwater in the aquifer west of Turkey Point pre-dates the CCS and was documented well inland in the 1950s (Klein 1957). A more detailed determination of the location and orientation of saline groundwater prior to the construction of the CCS was documented by Golder Associates Inc. (2011b) utilizing over 50 monitoring wells completed to 20-, 40-, and 60-ft-deep zones; this analysis showed saltwater from Biscayne Bay over 4 miles inland from the coast in 1971/1972. The saltwater/freshwater interface and orientation can differ from year to year and responds to changes in rainfall/drought conditions, drainage, land use changes, consumptive use of water, climate changes, storm surges, and sea level rise. Accordingly, distinguishing saltwater originating from Biscayne Bay from saltwater originating from the CCS is complex, and the use of tritium concentrations along with chloride and specific conductance data are helpful in determining the origin of the saltwater.

Chloride and tritium concentrations were highest in the shallow well at TPGW-13S (located within the CCS), with average concentrations of 33,300 milligrams per liter (mg/L) and 6,306 pCi/L, respectively, during the reporting period. Water quality data from this well are more reflective of CCS water compared to the other monitoring wells. Both salinity and tritium concentrations decline significantly laterally from the CCS as hypersaline groundwater moves downward towards the base of the aquifer due to the higher fluid density of the hypersaline CCS water. Laterally, CCS sourced groundwater mixes with fresher non-CCS water, resulting in reductions in both salinity and tritium in the upper portion of the aquifer. This phenomenon is demonstrated by CA monitoring wells TPGW-15S (located at the north western edge of the CCS) and TPGW-16S (located along the south eastern edge of the CCS) which had average chloride and tritium levels for the reporting period of 10,983 mg/L, 463 pCi/L and 22,000 mg/L, 352 pCi/L respectively. Reductions in CCS water constituents occur with distance from the center of the CCS at depths of over 25 feet indicate limited lateral movement of CCS canal water via groundwater paths in shallow portions of the aquifer.

Outermost well clusters (TPGW-8 and TPGW-9) had average chloride concentrations less than 40 mg/L and average tritium values less than 20 pCi/L. All shallow wells throughout the monitoring network with the exception of TPGW-13S, tend to have lower specific conductance, chloride, sodium, and tritium values, as saline water is denser than freshwater.

Groundwater quality in most wells has changed very little since the start of monitoring, and groundwater quality, with a few exceptions, is buffered against daily and short-term seasonal meteorological conditions, particularly in the intermediate and deep wells. This is still true for the reporting period and is consistent with previous reports (FPL 2016a, 2017a, 2018a).

Specific conductance in most wells varied less than a few percentage points during the reporting period; most of the variability was associated with probe calibration events. For the majority of wells (nearly 90%) during the reporting period, the standard deviations for specific conductance at each individual well were very low (within 5% of the average value). Average specific conductance values from this reporting period were also within 10% (higher or lower) of the historical average values for nearly 75% of the wells, indicating that the values typically have been stable. The same can be said for chloride, sodium, and tritium concentrations, as most concentrations during the reporting period were within 10 mg/L, 10 pCi/L or 10% of historical average values, whichever was higher. However, there are a few notable exceptions, as mentioned below.

Groundwater salt concentrations have remained consistent in the majority of wells; however, there are some exceptions, including notable declines in salt water constituents in shallow western wells close to the CCS that are consistent with the initiation of RWS pumping.

During the reporting period, three wells (TPGW-1S, TPGW-2S, and TPGW-15S) exhibited sustained decreases in specific conductance based on the continuous automated data and quarterly analytical results. Specific conductance at TPGW-1S decreased from slightly over 50,000 microSiemens per centimeter (µS/cm) at the start of the reporting period to around 41,000 µS/cm by the end of the reporting period (Figure 3.1-1); a low automated value of 35,191 µS/cm was recorded in December 2018. What makes this current trend different from previous fluctuations is that the specific conductance decreased continuously, despite a dry wet season, and exhibited less rebound in values during the 2019 dry season. The average concentrations of both chloride and

While variable, there is a net decline in shallow wells west of the RWS system.

sodium for the reporting period were over 45% lower than the previous reporting period and historical period of record. For example, the average chloride concentration for the 2018/2019 reporting period was 12,810 mg/L, while the historical period of record value is 18,597 mg/L. The lowest chloride and sodium concentrations on record for TPGW-1S were recorded in December 2018 (9,040 mg/L and 4,730 mg/L respectively). The average tritium concentration at TPGW-1S during the reporting period (492 pCi/L) was over 100% lower than the previous year (1,101 pCi/L) and historical period of record (1,047 pCi/L). The findings at TPGW-1S for this reporting period are similar to what was observed in the FPL-MDC CA monitoring well TPGW-15S (Appendix A), located on the western edge of the CCS, as the decreases in salt constituents and tritium at these two wells appear to be likely influenced by operations of the FPL groundwater remediation system extraction wells which began withdrawing hypersaline groundwater from the base of the Biscayne Aquifer on May 15, 2018 (FPL 2018b). No notable changes were observed in the intermediate and deep wells, other than some decline in tritium concentrations from the previous reporting period and historical period of record at TPGW-1M (9% and 20%, respectively) and TPGW-1D (8% and 13%, respectively), indicating a potential reduction in CCS-sourced groundwater.

The observations at TPGW-2S are more complicated, as a small sustained decrease (approximately 5%) was observed in the automated specific conductance data throughout the entire reporting period, including the dry season (Figure 3.1-2). While this well has historically exhibited fluctuations ranging from around 77,000 to 60,000 µS/cm, the values have never stayed in the low 60,000 µS/cm for an entire year, such as for this reporting period. Average chloride and sodium values were also more than 10% lower during this reporting period compared to the historical period of record. The lowest chloride and sodium values recorded at TPGW-2S (22,800 mg/L and 11,800 mg/L, respectively) were observed during this reporting period. Despite the concentration of salt constituents decreasing, tritium values at TPGW-2S were higher during the reporting period compared to the previous year and historical period of record. The average tritium value for the reporting period (3,715 pCi/L) was 45% higher than the previous reporting period (2,043 pCi/L) and 29% higher than average for the historical period of record. The relationship between salinity and tritium at this station appears to have changed; tritium and chloride values from this station will continue to be monitored closely.

There are several other wells in proximity to the CCS where notable reductions in specific conductance, chloride, and sodium were recorded at shallow depths during the reporting period. These include historical wells TPGW-L3 and TPGW-L5, which are located approximately 0.2 mile west of the CCS and sampled quarterly at depths of 18 ft and 58 ft below top of well casing for laboratory analysis. Specific conductance is recorded at 1-ft intervals in these wells and converted to chloride values to provide a vertical profile each quarter (Figures 3.1-22 through 3.1-26). The vertical profiles show a sharp transition from slightly brackish/brackish groundwater to hypersaline groundwater, with the hypersaline groundwater below the 18-ft depth. Over the years, the shallow sample zone has exhibited a moderate amount of variability. For example, specific conductance values at TPGW-L3 have ranged from 657 µS/cm to 18,499 µS/cm over the period of record, depending on the depth of the fresh water/saltwater interface. During the reporting period, the average specific conductance values at TPGW-L3 (18 ft) and TPGW-L5 (18 ft) were 2,654 mg/L and 1,387 mg/L, respectively, which were over 100% lower than the previous reporting period but within the range of the historical period of record.

Chloride and sodium followed similar trends, with the average chloride concentrations during the reporting period at TPGW-L3 (18 ft) and TPGW-L5 (18 ft) being 713 mg/L and 313 mg/L, respectively, which were well below the previous reporting period values of 1,862 mg/L and 1,059 mg/L, respectively, and 690 mg/L and 380 mg/L, respectively, for the historical period of record. Average tritium values of 96 pCi/L at TPGW-L3 (18 ft) and 75 pCi/L at TPGW-L5 during the reporting period were within 20 pCi/L of both the previous reporting period and historical period of record values; the lack of change in tritium values coupled with substantial changes in specific conductance indicate there is limited influence of the CCS in this upper shallow zone. It is unclear how much of the freshening in the upper 15 ft of the aquifer was due to normal fluctuations versus the RWS pumping.

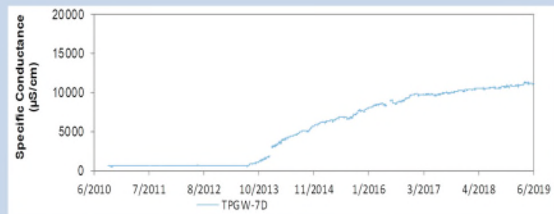
A few additional wells (TPGW-12M, -17M, and -19M) also exhibited small declines that warrant continued observations and could be related to the RWS pumping.

> Previously reported increases in saltwater constituents and/or induction log reading in deep wells located several miles west of the CCS in the vicinity of Tallahassee Road (TPGW-4D, TPGW-5D, and TPGW-7D) have slowed over the past several years, including this reporting period. Wells farther west (clusters TPGW-8 and TPGW-9) are still fresh at all depths.

FPL previously reported (2016a, 2018a) that there was some sustained inland movement of brackish water several miles west of the CCS in the vicinity of Tallahassee Road. This was demonstrated by increases in bulk conductivity at depths below the lower monitoring well screen interval in TPGW-4D and TPGW-5D and increasing salt water constituents in wells TPGW-7D, and TPGW-G21 (58-ft interval). The rate of increase appears to be limited and/or diminishing over the past few years—a trend that continued during this reporting period (Section 2, Figures 2.1-4, 2.1-5, and 2.1-7).

While the analytical results at TPGW-4D and TPGW-5D do not show any sustained increases in specific conductance, chloride, sodium, or tritium values, induction log data collected at depths below the deep monitoring interval suggest a small but diminishing increase in bulk conductivity. Annual induction logs, conducted in March-April 2019, from the deep well at each of the groundwater monitoring sites are included in Appendix J. Per the Monitoring Plan, groundwater induction log data from the monitoring wells are collected annually; the USGS conducts this effort and reports it as part of their regional assessment of coastal saltwater intrusion in South Florida (Valderrama 2017). Periodic induction log data collected from monitoring wells located east of the USGS freshwater-saltwater interface in Palm Beach, Broward, and Miami-Dade counties from the late 1990s through 2016 show continuous increases in bulk resistivity/salinity along the base on the Biscayne Aquifer (e.g., PB-1195, PB-1723, G-2478, G-2965, G-3602, G-3604, G-3605, G-3612, G-36-15, G-3699, and G-3887A) (Valderrama 2017). These regional trends are the same as those measured in FPL monitoring wells in the Model Lands basin. Saltwater has intruded inland in Florida coastal areas due to various factors including the reduction in groundwater levels caused by water supply withdrawals, excessive drainage, reductions in precipitation, and/or increases in sea level (Prinos 2016). While westward migration of hypersaline groundwater from the CCS is a contributing cause of saltwater intrusion beneath the model lands over the past decades, westward saltwater intrusion can be expected to continue after the CCS hypersaline plume is remediated due to depressed groundwater levels consistent with urban development, droughts, and rising sea levels.

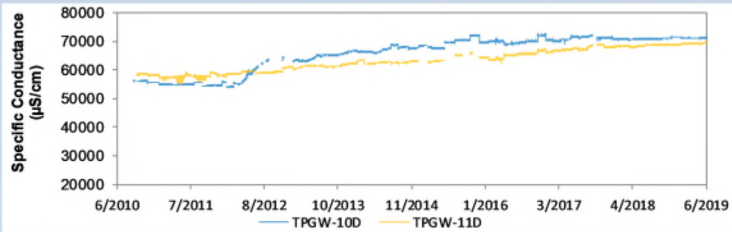
Well TPGW-7D continued to have increases in specific conductance, chloride, and sodium; this was first noted in 2013 and documented in previous reports (FPL 2016a, 2017a, 2018a). The bulk conductivity from induction logs also show an ongoing increasing trend (Appendix J); however, the rate of increase continues to slow. At the beginning of this reporting period, specific conductance in TPGW-7D was around 10,500 µS/cm based on the automated data; however, by the end of the reporting period (May 2018), the value had risen to slightly over 11,000 µS/cm (Figure 3.1-7), or an approximate 5% increase. The previous reporting period (2017/2018) had a 10% increase in specific conductance value and some of the prior annual reporting periods had specific conductance increases of well over 50%. The average chloride and sodium values for this reporting period are slightly higher than the previous reporting period; however, similar to specific conductance, the rate of increase has declined in recent years. The average tritium value for this reporting period at TPGW-7D was low (19.2 pCi/L) and similar to the previous reporting period average (22.2 pCi/L).



The rate of salinity increase in TPGW-7D has declined over the past two years.

At TPGW-G21 (58-ft sample depth), located approximately 3.7 miles west of the CCS, the 8-year period of record's gradual increase in quarterly specific conductance, chloride, and sodium values continued with a small increase over the reporting period. Tritium values also slightly increased during this reporting period (58.2 pCi/L) compared to the previous year (42.6 pCi/L). Continued monitoring will determine whether the changes in tritium observed at this station during this reporting period are temporary or indicate a longer-term change.

As previously reported (FPL 2018a), shallow groundwater in the vicinity of well TPGW-4S, which is located nearly 3 miles west of the CCS, was impacted by Hurricane Irma in September 2017, as evidenced by immediate increases in salt water constituents during the passage of the storm. Despite purging during the reporting period, groundwater had not returned to pre-storm conditions. Prior to the hurricane, automated specific conductance readings indicated values were consistently around 2,000 µS/cm, with short-term non-CCS-related increases of 5,000 µS/cm to 6,000 µS/cm during some dry seasons. Following the hurricane, specific conductance values above 6,000 µS/cm were recorded for prolonged periods (Figure 3.1-4). In May 2019, specific conductance values at TPGW-4S were around 10,000 µS/cm. Meanwhile, the average tritium concentration for the reporting period was 16.6 pCi/L, which indicates that these increases in saltwater at TPGW-4S are not related to groundwater influenced by the CCS.



Rates of salinity increase at depth in TPGW-10D and -11D have leveled off. There is little to no CCS sourced groundwater in the shallow wells at these sites.

Groundwater at the base of the Biscayne Aquifer, as monitored in two monitoring stations located east of the CCS (TPGW-10 and TPGW-11), has experienced gradual increases in saltwater constituents since 2012/2013. However, similar to the previous reporting period, the rate of increase in specific conductance at TPGW-10D and TPGW-11D has leveled off. Automated specific conductance values throughout the entire reporting period are essentially the same. The 2019 induction logs actually show a slight decrease in bulk resistivity compared to the previous year. The average chloride concentration for the reporting period was 28,325 mg/L, which is similar to values reported over the two previous years, aside from a historically low value reported in June 2017 (19,900 mg/L). Tritium values were virtually identical to the previous year's values in these two wells. The primary influence of the CCS on groundwater below Biscayne Bay is observed at the deep wells with sample intervals greater than 100 feet below the bottom of the Bay. There is little to no CCS sourced groundwater in the shallow TPGW-10S and TPGW-11S wells based on the tritium data.

One other well cluster of note is TPGW-3, which is located south of the CCS near Biscayne Bay and generally has specific conductance values over 59,000 µS/cm at all three depths for the duration of monitoring. While the saltwater constituents have not drastically changed and there is no apparent trend in saltwater concentration changes, tritium values in all three wells have declined since monitoring began. Tritium values in the deep and intermediate zones were around 2,000 pCi/L in June 2010 and steadily declined to around 1,250 pCi/L by March 2019. The shallow zone has experienced an even more dramatic long-term decline in terms of percentage, as tritium values in 2010 were over 800 pCi/L and the concentration in March 2019 was 88 pCi/L. This indicates that there may be an ongoing reduction in the influence of CCS water at this location, although the groundwater is still somewhat hypersaline.

3.1.4.2 Groundwater Nutrients

With regard to nutrients in the five wells clusters in and around the CCS (TPGW-1, TPGW-2, TPGW-10, TPGW-13 and TPGW-14), the concentrations tend to be more variable from quarter to quarter and annually than the other parameters such as specific conductance, chloride, and sodium. Most of the TN in these wells is in the form of ammonia, with the exception of the two shallow wells, TPGW-10S and TPGW-14S, where roughly 60 to 70% of the TN is organic nitrogen. As noted in Table 1.8-1, TKN in hypersaline samples may be biased low, thus underestimating TN values. Historically, ammonia is highest at depth, with the exception of TPGW-13 where the highest ammonia values are consistently observed in the shallow well. During the reporting period, all the wells at well cluster TPGW-13 exhibited the highest ammonia values to date. Mann-Kendall statistical analyses were conducted on the five well clusters for the entire period of record to further assess trends for ammonia. While the results showed some increasing trends at TPGW-13 (all depths) and in the other wells at depth, all of the shallow wells showed no trend or stable results. The only exception was TPGW-1S, which showed a "probable increasing ammonia trend;" however, the tritium data do not support that the trend is linked to the CCS as the Mann-Kendall statistical analysis at TPGW-1S showed no trend for tritium and a regression analysis showed no statistical relationship between tritium and ammonia.

> During the reporting period, TP concentrations at the five well clusters in or close to the CCS were similar to well TPGW-11S in Biscayne Bay, which is a well not influenced by the CCS.

TP concentrations in the majority of monitoring well clusters beneath and near the CCS ranged from 0.0146 mg/L to 0.0886 mg/L for the reporting period. Well TPGW-11S in Biscayne Bay had a TP concentration within that range (i.e., 0.0609 mg/L) but a tritium value of only 6.2 pCi/L in October 2017; this value was higher than what was recorded in most of the CCS influenced wells. The highest value for the reporting year was observed at TPGW-14M (0.219 mg/L) in September 2018; this is a statistical outlier and well above concentrations recorded at any groundwater well since monitoring began. The March 2019 value was 0.057 mg/L which is more aligned with the data record for this station.

3.1.4.3 Groundwater Temperature

Well cluster TPGW-13 continues to exhibit the highest average automated groundwater temperatures (reporting period average of 29.5°C shallow, 29.4°C intermediate, and 29.0°C deep, with a maximum of 29.6°C). Wells TPGW-2M and TPGW-2D, which are in proximity to the CCS, had the second-highest well cluster average temperatures (reporting period averages of 26.8°C and 26.9°C, respectively). Similar to previous findings, the groundwater temperatures in all of the other the shallow wells appear to be more seasonally driven, while temperatures in the deep and intermediate wells tend to be stable and lower overall. The exceptions are wells closest to the CCS (TPGW-1 and TPGW-2), which consistently have warmer temperatures at depth. The vertical profiles for temperature from the historical wells TPGW-L3, TPGW-L5, TPGW-G21, TPGW-G28, and TPGW-L35 (Figures 3.1-27 through 3.1-31) show that groundwater temperatures are more variable and seasonally influenced in the upper 20 to 30 feet of the aquifer than at depth where the temperature is more stable. Aside from the variability in temperature right at the surface, the groundwater temperature at TPGW-L3 and TPGW-L5 typically tends to be higher (1°C to 2°C) at depth. Other than a possible slight influence on temperatures under the CCS and at depth in a few wells closest to the CCS, the effects of temperature on groundwater is inconsequential or non-existent.

3.2 Surface Water Quality

3.2.1 Data Collection

Automated and analytical sampling methods and protocols for surface water are outlined in Appendix B and the QAPP (FPL 2013). Most stations are on telemetry, with the exception of Biscayne Bay/Card Sound stations TPBBSW-4 and TPBBSW-5. Table 3.2-1 summarizes the probes currently used at each surface water station and the parameters measured; these are the same as those reported for the previous reporting period.

During this reporting period, surface water quality samples were collected quarterly (June 2018, September 2018, December 2018, and March 2019) for laboratory analyses from 19 stations (28 surface water samples per event, plus QA/QC samples) (Table 3.0-1). Further details are provided in Appendix B.

3.2.2 Automated Data Results

The automated surface water data are qualified and validated in the same manner as the automated groundwater data. Appendix D shows the water quality field verification/calibration logs. Appendix E presents the data that were qualified and provides general explanations for the qualifications.

Figures 3.2-1 to 3.2-20 show time-series graphs of specific conductance and temperature at each surface water station. The time-series graphs show data from the beginning of station reporting (various dates depending on station startup) through May 2019 to enable viewing changes over time; validated time-series data are in separate Microsoft Excel files (provided as Section 3 electronic data files as part of this reporting package). The validated data Excel files are also available for download on the FPL EDMS.

Tables 3.2-2 through 3.2-4 show statistical summaries of the time-series data for specific conductance, salinity, and temperature, respectively. The tables include monthly average values for each monitoring station, the minimum, maximum, average, and standard deviations for the reporting period (data from June 2018 through May 2019), and the minimum, maximum, average, and standard deviations for the historical period of record. Summaries were calculated when at least 21 days of data were available during the month. The salinity values are presented, since readers often relate more directly to salinity than to specific conductance. Figures 3.2-21, 3.2-22, and 3.2-23 show the annual average and standard deviation values for specific conductance, salinity, and temperature, respectively, at each surface water station.

3.2.3 Analytical Data Results

Tables 3.2-5 through 3.2-8 provide a summary of the surface water analytical results from June 2018 through March 2019. Table 3.2-9 includes a summary showing the range of ion and nutrient concentrations. Surface water sampling logs from the June 2018 through March 2019 sampling events are provided in Appendix F of this report. DUS reports for each event are provided in Appendix G, and detailed Level IV laboratory reports are included in Appendix H.

Note that the laboratory reports analytical results to three digits, per a request by the Agencies in 2013. However, the third digit is not considered significant by the laboratory and can be misconstrued as indicating a false level of accuracy. Analytical outliers are included in Appendix I.

Figures 3.2-24, 3.2-25, and 3.2-26 show the quarterly concentrations of chloride, sodium, and tritium, respectively, along with the historical range in values for surface water stations (TPSWCCS-1 through TPSWCCS-7, TPSWID-1 through TPSWID-3, TPSWC-1 through TPSWC-6, and TPBBSW-3 through TPBBSW-5). Figure 3.2-27 shows semi-annual concentrations for TN and ammonia along with historical values, while Figure 3.2-28 shows the same information for TP.

3.2.4 Discussion of Results

Waters in the study area ranged from fresh to hypersaline, based on location and time of year, with many of the stations exhibiting conditions similar to those observed in previous years. Compared with the groundwater time-series graphs, the surface water time-series graphs show greater variability, most of which are related to seasonal and meteorological conditions. Figures 3.2-21, 3.2-22, and 3.2-23 show the average and standard deviations for specific conductance, salinity, and temperature, respectively, for all surface water stations. Note that the standard deviations for many of the stations are an order of magnitude greater than the groundwater stations.

Seasonally, most stations are more saline during the dry season and less saline during the wet season. A heavy rainfall event or tropical system can cause dramatic changes in specific conductance, chloride, and sodium concentrations in less than a day or in the weeks following an event. Nutrient concentrations can also be affected by stormwater runoff and/or discharges from area flood control canals.

Overall, water quality at stations in the CCS, Biscayne Bay/Card Sound, marine canal stations (TPSWC-4 and TPSWC-5), and the ID were within historical ranges for specific conductance, chloride, and sodium; however, above average tritium values in the CCS in December 2018 appear to have influenced December 2018 tritium values (higher concentrations) in nearby surface water stations as a result of atmospheric exchange. The data do not support a conclusion that higher tritium values are the result of a groundwater pathway from the CCS, as discussed below.

3.2.4.1 CCS Stations

Multiple factors resulted in little to no decrease in the average annual CCS salinity calculated for this reporting period as compared to the previous year. The principal factor was an overall drier than average year and evaporative losses that averaged 35.7 MGD.

The CCS is characterized as having hypersaline water, with specific conductance, density, chloride, and sodium values consistently being higher in the CCS than the surrounding water. High salinity and associated elevated fluid density will result in CCS water "sinking" through the aquifer system to the base of the aquifer and then spreading out laterally instead of flowing out horizontally at shallow depth. During the reporting period, average daily specific conductance values typically ranged between approximately 60,000 µS/cm to 90,000 µS/cm. The highest values occurred at the end of the reporting period in May 2019, at the end of the dry season. The lowest values were reported in September 2018 following heavy rainfall on September 3, 2018. During the dry season in 2019, station TPSWCCS-7 exhibited the most variability since this station was influenced by interceptor ditch discharges, which are fresher than the CCS and cause a localized short-term decrease in specific conductance. While there are some short-term fluctuations in values at all stations in response to rainfall and/or freshening and ID operations, there has been a general increase in specific conductance values from mid-September 2018 to the end of the reporting period on May 31, 2019. The average automated specific conductance for the CCS using all seven stations combined during the reporting period was 72,556 µS/cm. This was almost exactly the same as the previous reporting period average specific conductance value of 72,532 µS/cm. The annual average salinity in the CCS, calculated in accordance with Paragraph 29.J of the CO for the reporting period, was 51.1 on the Practical Salinity Scale of 1978 [PSS-78]. The chloride and sodium data support the automated data, with the average chloride and sodium concentrations of the CCS being 28,932 mg/L and 14,711 mg/L, respectively, during the reporting period. These values are within a few percent of the previous reporting period, indicating the addition of UFA water is instrumental in moderating CCS salinities and can offset some of the evaporative losses; however, the drier than normal year and evaporative losses prevented reductions in CCS salinity this reporting period.

Tritium concentrations in the CCS ranged from 1,265 pCi/L to 18,529 pCi/L during the reporting period, with an average CCS tritium concentration of 17,469 pCi/L in December 2018. The surface water tritium concentrations in the CCS are more variable than the groundwater concentrations at TPGW-13, as the surface water is more directly affected by plant operations and meteorological conditions. Variations in tritium concentrations in the CCS can result in variable tritium concentrations in nearby surface water and pore water as a result of atmospheric transport. Higher December 2018 tritium values were also recorded in Biscayne Bay, L-31E, and porewater, concurrently (see Sections 3.2.4.2 and 3.2.4.3 and Section 5). Regardless, all tritium values were below the FDEP and EPA drinking water standard of 20,000 pCi/L (FDEP 2012).

Nutrient samples were collected in September 2018 and March 2019 in the CCS. The average CCS TN and TP concentrations were 3.58 mg/L and 0.029 mg/L, respectively, during the September 2018 sampling event and 2.50 mg/L and 0.046 mg/L, respectively, during the March 2019 sampling event. Most of the TN in the CCS surface water is in the form of organic nitrogen, and ammonia values are much lower than TN. CCS ammonia concentrations were below 0.200 mg/L and averaged 0.095 mg/L for the reporting period, which was less than the average reporting period ammonia value of 0.115 mg/L in the Biscayne Bay/Card Sound reference station BBSW-5. As noted in Table 1.8-1, TKN in hypersaline samples may be biased low, thus underestimating TN values.

During this reporting period, the best sustained cooling efficiency was achieved in the CCS since the start of EPU monitoring.

The highest water temperatures at all surface water stations are found in the CCS, as expected. The average CCS surface water temperature for the reporting period was 31.2°C, which is 0.7°C warmer than the previous reporting period but 2.3°C degrees cooler than the 2014/2015 reporting period when CCS temperatures were the highest. The temperature in the CCS is not only affected by plant operations and the cooling efficiency of the CCS but also by meteorological conditions. The air temperatures were warmer during this reporting year than the previous reporting year by approximately 0.5°C and, thus, the reason for the increase in average CCS water temperature. Within the CCS, the water temperature varies based on location, with the warmest temperatures closest to the plant discharge into the CCS at TPSWCCS-1 and the coolest temperatures near the return canal intake on the east side of the plant at TPSWCCS-6. During the reporting period, the average temperatures were 37.9°C at TPSWCCS-1 and 28.6°C at TPSWCCS-6. This equates to an average temperature reduction of 9.3°C between TPSWCCS-1 and TPSWCCS-6, which is a slight increase over the previous reporting period and the best performance since the start of EPU monitoring. Figure 3.2-29 shows the average annual temperature difference between TPSWCCS-1 and TPSWCCS-6 starting in June 2011, when a full reporting period of data was available, through this reporting period.

3.2.4.2 Biscayne Bay and Card Sound Stations

There continues to be no adverse impact of CCS water on the Biscayne Bay/Card Sound monitoring sites based on water quality, nutrient quality, and temperature data; values observed were within naturally occurring ranges for the Bay.

Water quality and temperature data from the three Biscayne Bay/Card Sound stations (TPBBSW-3, TPBBSW-4, and TPBBSW-5) that are sampled quarterly and have automated probes deployed continue to indicate there is no influence from the CCS. Tritium concentrations at the Biscayne Bay/Card Sound stations were all low, ranging from 3.0 pCi/L to 35.4 pCi/L (annual average of 17.5 pCi/L), with all three stations having their highest (or one of their highest) values in December 2018 when the CCS tritium values were higher, which is consistent with atmospheric exchange. Concentrations of saltwater constituents followed naturally occurring seasonal trends (including naturally occurring hypersaline conditions). The other two Bay stations (TPBBSW-10 and TPBBSW-14) are not sampled quarterly per the Monitoring Plan but have automated water quality probes that also do not indicate an influence from the CCS.

The highest specific conductance, chloride, and sodium values in Biscayne Bay/Card Sound for the reporting period occurred during the dry season, mostly in March 2019, while the lowest values were observed during the wet season, mostly in September 2018. Based on the continuous automated data, the highest specific conductance values for the reporting period were reached at all of the Bay stations (TPBBSW-3, TPBBSW-4, and TPBBSW-5, TPBBSW-10, and

TPBBSW-14) toward the end of the dry season in May 2019. Maximum specific conductance values in the Bay stations approached or slightly exceeded 60,000 µS/cm (salinities approaching or exceeding 40 in the PSS-78 scale), indicating hypersaline conditions that have also naturally occurred in other dry seasons (i.e., 2011, 2014, 2015, 2017, and 2018) (FPL 2018a). Salinities approaching or exceeding 40 on the PSS 78 scale have been observed in the dry season throughout Biscayne Bay for a number of years (Lohmann et al. 2012). Thus, the findings at FPL monitoring stations are consistent with findings at other locations in the Bay.

The average specific conductance for the five current automated Bay stations combined for the reporting period was 51,600 µS/cm (average salinity of 34.5 PSS-78). This is higher than the average value for the historical period of record of 47,973µS/cm (31.8 PSS-78) for the same stations in part due to fewer large regional rainfall events, which lowered the Bay's salinity. TPBBSW-10 still exhibits substantial variability in specific conductance, since this northernmost station is influenced by surface water drainage canals north of Turkey Point, with short-term drops from a few days to a few weeks that can exceed 20,000 µS/cm. While the CO target for the CCS is 34 practical salinity units (PSU) or PSS-78, the Biscayne Bay average does exceed that value seasonally and, for some years, annually, such as for this reporting period.

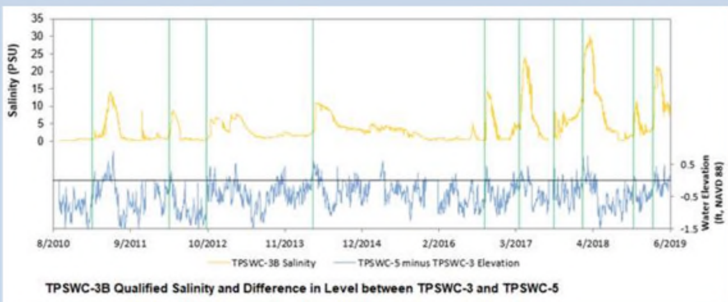
Chloride concentrations ranged from 16,300 mg/L to 23,100 mg/L, while sodium concentrations ranged from 8,460 mg/L to 11,200 mg/L; all were within historical ranges. For comparison, the average chloride concentration for seawater at 3.5% salinity is 19,600 mg/L (Turekian 1968). Average sodium levels in seawater are 11,050 mg/L at a salinity of 35 on the PSS-78 scale (Millero 1996), but can approach 14,000 mg/L in Biscayne Bay, depending on the location and time of year (Reich et al. 2006). In most years, dry season chloride concentrations in Biscayne Bay/Card Sound naturally exceed 21,000 mg/L. Over the entire monitoring effort, with quarterly data from June 2010 through March 2019, the average chloride and sodium concentrations were approximately 19,200 mg/L and 10,100 mg/L, respectively, and consistent with data reported by others (e.g., Reich et al. 2006; Turekian 1968; Millero 1996).

Biscayne Bay/Card Sound stations consistently had the lowest surface water TN concentrations, ranging from 0.53 mg/L to 0.91 mg/L during the reporting period. The majority of nitrogen at each station is organic nitrogen. These Bay stations had low ammonia concentrations, ranging from 0.03 mg/L to 0.20 mg/L during the reporting period, with the highest value at the background station TPBBSW-5. TP at all of the Biscayne Bay/Card Sound stations was non-detect based on a detection limit of 0.005 mg/L or 0.009 mg/L, which is below or near historical values reported in the Bay. The Florida International University Water Quality Monitoring Network (FIU-WQMN) reported an average value of <0.01 mg/L over a 13-year period (1993 to 2005) at a sample location offshore and southeast of Turkey Point (Site 122).

Water temperatures in the Bay followed historic annual trends/patterns and were driven by meteorological conditions. The average annual combined temperature for the reporting period (27.1°C) was 0.9°C warmer than the previous reporting period and 0.6°C warmer than the historical period of record. Compared to the average annual CCS temperature for this reporting period, the combined Bay stations were 4.1°C cooler.

3.2.4.3 L-31E Canal Stations

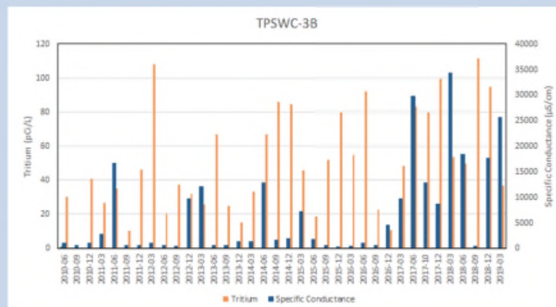
Sharp increases in saltwater constituents are observed at the L-31E canal every year, including this reporting period; however, review of multiple factors indicate that saltwater entering the canal is Biscayne Bay marine groundwater and is not linked to the CCS



Salinity changes in TPSWC-3B with water level changes at TPSWC-5B. See Figure 3.2-31 for details.

In the L-31E canal stations which are located due west of the CCS (TPSWC-1, TPSWC-2, and TPSWC-3), the water historically ranges from fresh to brackish, depending on the time of year. Specific conductance values in the upper zone of the water column in the L-31E canal (1 ft below the surface) are consistently lower than the bottom station (Figure 3.2-30). Historically, increases in specific conductance have been observed whenever tidal water elevations exceed the water levels in the L-31E canal. This occasionally occurs during the dry season and at other times of the year when there are exceptionally high tides (i.e., king tides). Figure 3.2-31 and the inserted graphic show the L-31E canal's response in specific conductance when saline tidal water levels are higher than L-31E canal water levels. Elevated specific conductance events in the L-31E canal are typically observed first in the TPSWC-3B station, with increases measured at TPSWC-2B shortly after, although to a much lower degree. Increases in specific conductance at TPSWC-1B in response to tidal high water events are more temporally delayed and more muted compared with TPSWC-2B and 3B. Both the frequency and magnitude of the tidal high water events and the associated elevated specific conductance levels appear to be on the rise. Specific conductance values from the three L-31E bottom monitoring stations from September 2010 through May 2019 are shown on Figure 3.2-30. There were five elevated specific conductance events that exceeded 10,000 µS/cm from September 2010 through September 2016, with a maximum value of 22,400 µS/cm (May 26, 2011), while there were five from October 2016 through May 2019 (a sixth was associated with Hurricane Irma), four of which had specific conductance values between 23, 000 µS/cm and 44,000 µS/cm.

In order to further evaluate the potential for CCS influence on the elevated specific conductance events, water elevations between monitoring stations TPSWC-3T and TPSWCCS-3B were compared to determine whether there was a prevailing westward gradient from the CCS toward the L-31 monitoring stations (refer to transect E Figure 6.3-6). These data show an eastward gradient from the L-31E canal toward the CCS, with water levels in the L-31E canal consistently on the order of at least 0.5 ft higher than concurrent levels in the CCS. Next, tritium data collected at the time of the high salinity events were examined. The available data show tritium values in the L-31E canal are within the ranges observed from atmospheric deposition and do not respond commensurately and consistently with changes in specific conductance which otherwise would be expected if there was a CCS sourced groundwater pathway (see graphic on right). While increases in specific conductance values at theTPSWC-3B station are typically several times to an order of magnitude greater than the values in the other L-31E canal monitoring stations, this station consistently has the lowest tritium concentrations. In addition, quarterly vertical specific conductance profiles from monitoring wells located adjacent to the L-31E canal (TPGW-L3 and TPGW-L5; Figures 3.1-22 and 3.1-23) indicate the sharp interface between the fresher/slightly brackish groundwater and saline/hypersaline groundwater is roughly 10 ft deeper than the bottom of L-31E canal.



There is no relationship between tritium and salinity at TPSWC-3B in the L-31E Canal ($p>0.10$; $R^2 = 0.006$).

These data demonstrate the intermittent elevated salinity events measured are caused by high tidal events in which Biscayne Bay/Card Sound water levels exceed the stages in the L-31E canal, allowing coastal saline water to seep into the bottom of the deep canal cuts through porous rock. It is anticipated that, as sea levels continue to gradually increase, the frequency, duration, and salinity of these events will increase.

Increases in saltwater constituents in the L-31E canal seem to consistently occur during the few times a year when saline Biscayne Bay influenced water levels are higher than fresher water levels in the L-31E canal.

The automated data for this reporting period support the above findings. Specific conductance, chloride, and sodium values are within historical limits and exhibit similar trends. Increased specific conductance values were noted several times during the reporting period, including in June 2018, December 2018, and March/April 2019, and were most notable at TPSWC-3, which is the farthest L-31E station west of the CCS (Figure 3.2-31). For example, specific conductance values at TPSWC-3B (bottom) began to increase in late November 2018 and reached a peak value of 18,824 µS/cm on December 7, 2018, before waning in early January 2019. A larger increase occurred in early March 2019 and peaked on March 20, 2019 (33,662 µS/cm, based on automated data) and then declined over the next several months. Meanwhile, tritium values in December 2018 and March 2019 at the bottom of TPSWC-3 were 94.9 pCi/L and 36.9 pCi/L, respectively, which were lower than tritium values at the other stations despite those stations having much lower specific conductance values. If there was a groundwater source of tritium from the CCS, then one would expect that the station with much higher specific conductance values would also have much higher tritium values and stations with lower tritium would have lower specific conductance; however, this is not the case.

> Increases in nutrients in the L-31E canal cannot be explained by a CCS groundwater pathway due, in part, to low tritium values.

TP values during the reporting period ranged from non-detect to 0.023 mg/L and were within historical limits. TN values ranged from 0.069 mg/L to 1.54 mg/L during the reporting period and also were within historical limits. Most of the TN recorded for this reporting period, as well as historically, is in the form of organic nitrogen. This may be a result of the biological decomposition of algae and aquatic vegetation at the bottom of the canal. On a few occasions, dissolved oxygen (DO) levels drop at a few stations and a larger percentage of the TN is in the form of ammonia. In March 2019, ammonia at TPSWC-3 was 0.63 mg/L. As discussed above, the tritium value in March 2019 was only 36.9 pCi/L, which does not support a supposition that the source of ammonia or any appreciable contribution is from CCS groundwater.

Water temperatures in the L-31E canal vary among stations but were collectively, on average, 0.8°C warmer than the previous reporting period's average. Coincidentally, the average water temperature of the five Bay/Sound monitoring stations for this reporting period was also 0.8°C warmer as compared with the previous reporting period's average and equal to the L-31E canal bottom average annual temperatures of 26.3°C during the 2017-2018 reporting period, and 27.1°C for this reporting period. As discussed in Section 2, regional air temperatures during the 2018-2019 reporting period exhibited some of the highest monthly values recorded over the previous 24 years. Average L-31E canal temperatures measured near the canal surface during the reporting period were 0.6°C warmer than the canal bottom temperatures, thereby indicating air temperature influences. Similarities between L-31E canal bottom and Bay/Sound bottom temperatures combined with average cooler canal bottom temperatures than shallow canal temperatures do not support the supposition that warmer hypersaline waters from the CCS are influencing the elevated salinity excursions in the L-31E canal.

3.2.4.4 S-20 Discharge Canal and Card Sound Canal

Station TPSWC-4 is located in the S-20 discharge canal, and TPSWC-5 is located in the Card Sound canal. Periodically, both stations experience limited flushing, which can result in poorer water quality, particularly at the bottom, as compared to the Biscayne Bay stations.

While TPSWC-4 can be affected by releases from the S-20 structure and can transition quickly from saline to fresh or brackish conditions, as observed in September 2018 when it appears the S-20 gate was open, the water is oftentimes stagnant. A weir structure constructed in early 2014 restricts water exchange upstream and downstream of the weir. As a result, saline tidal waters can get trapped upstream of the weir during high tides and become concentrated by evaporation over extended dry periods. The water temperatures also get warmer. Depending on water elevations in Biscayne Bay, there may or may not be an exchange of water with the Bay. There are a series of culverts in the former Sea-Dade canal that allow high flows to discharge more naturally as sheet flow to Card Sound but also allow high flood tides to reach the S-20 discharge canal on occasion, adding salinity to the area. Chloride and sodium values at TPSWC-4 were within historical ranges during the reporting period, with the highest concentrations in December 2018 at the bottom (20,900 mg/L and 11,000 mg/L, respectively); these values were typical values and similar to those reported in Biscayne Bay. The automated data indicate that specific conductance values have risen steadily at TPSWC-4 during the dry season, with values by the end of the reporting period in excess of 63,000 µS/cm, which was over 3,000 µS/cm higher than nearby Biscayne Bay stations. All tritium values at TPSWC-4 were within historical limits and within ranges associated with atmospheric influences. The highest concentration during the reporting period (269 pCi/L) was measured at the surface and occurred in December 2018 when the CCS had higher tritium values. These above average tritium values in the CCS appear to have influenced December 2018 tritium values in nearby surface water stations as a result of atmospheric exchange.

TPSWC-5 is located in a remnant canal that is over 20 ft deep. This station reflects marine conditions and, during the reporting period, appeared to generally follow specific conductance of the nearby Card Sound station TPBBSW-4B. There were several periods (a few weeks up to several months) when there was a notable increase in specific conductance at the bottom station where specific conductance values were higher than those observed in Biscayne Bay. One such increase, based on automated data, was noted in early May 2018 and extended into the reporting period through early July 2018, which was longer than typical (Figure 3.2-32). Sampling results from June 2018 showed chloride and sodium concentrations at the bottom of TPSWC-5 were 24,400 mg/L and 13,600 mg/L, respectively, while values at the nearby Biscayne Bay station TPBBSW-4 were over 20% lower. Tritium values were well within historical limits and consistent with values reflecting atmospheric influences. The highest tritium value at TPSWC-5 for the reporting period was measured in June 2018 (107.8 pCi/L) at the bottom sample depth when tritium in Biscayne Bay was 8.0 pCi/L at TPBBSW-4B.

3.2.4.5 ID Stations

Findings in this reporting period are similar to previous reporting periods. The ID specific conductance, chloride, and sodium values are affected by the amount of water pumped from the ID. During non-pumping periods, water in the ID is fresh to brackish; however, during periods of heavy pumping, the water becomes saline and tritium increases in the pumped segments. These increases are expected since the ID is intercepting CCS groundwater when there is an inland gradient. Specific conductance values in the ID are always below the values in the CCS and reflect a mix of fresh and saline groundwater.

Similar to observation at other surface water stations, the tritium values were highest in the ID in December 2018 when the CCS tritium levels were highest. Higher CCS tritium levels increase the tritium concentration associated with atmospheric influences. ID pumping did not occur until several weeks after the sampling event; therefore, the higher tritium levels were not the result of pumping. The highest tritium value observed in the ID was at TPSWID-1 at the top station (322.3 pCi/L), which is within the range observed from atmospheric deposition adjacent to the CCS. For additional details on operations of the ID pumps during the reporting period, refer to Section 6 and Appendix N.

3.3 Water Levels

3.3.1 Data Collection

Water levels provide insight into groundwater hydrology as well as groundwater and surface water interactions; levels are collected at all groundwater stations and most surface water stations for the monitoring effort. Currently, only two automated water quality stations in Biscayne Bay (TPBBSW-4 and TPBBSW-5) do not have stage recorders.

3.3.2 Groundwater and Surface Water Level Results

Data validation and qualification of the automated water level data is a multi-step process, and details can be found in the Comprehensive Pre-Uprate Monitoring Report (FPL 2012a) and the QAPP (FPL 2013). Over 99% of the automated water level data for the reporting period were deemed valid and usable.

The accuracy of the land-based station survey is typically within hundredths of a foot. Groundwater and stilling well locations in Biscayne Bay and Card Sound may have a lower level of accuracy because those stations could only be surveyed with global positioning system (GPS) units. Thus, the survey accuracy limits should be considered when interpreting the results to hundredths of a foot or, in the case of the Biscayne Bay wells, to several tenths of a foot.

Changes in the salinity at the well screen interval, leakage of rainwater, or groundwater at or near the surface can result in stratification in the well casing, which can influence the representativeness of water levels. While the impact to the data is minimal for the reporting period, there are a few wells, such as TPGW-14D, where the water levels have been estimated since there appears to be leakage of Biscayne Bay water into the well casing. This leakage is causing stratification, which appears to impact water levels by several tenths of a foot (water levels slightly higher); therefore, care should be taken when interpreting the results.

Figures 3.3-1 through 3.3-14 are time-series graphs of water elevations at all automated groundwater stations, and Figures 3.3-15 through 3.3-32 are time-series graphs of surface water station elevations. The graphs depict validated data and exclude data that have been qualified as “questionable.” The time-series graphs show data from the beginning of station reporting (various dates depending on station startup) through May 2019 to enable viewing changes over time; validated time-series data are in separate Microsoft Excel files (provided as Section 3 electronic data files as part of this reporting package). The validated data Excel files are also available for download on the FPL EDMS.

3.3.3 Discussion of Results

3.3.3.1 Groundwater

Water levels in TPGW-1S and -2S were slightly higher than their corresponding intermediate (M) and deep (D) wells due to the shallow zone becoming less saline, likely due to RWS pumping.

During the reporting period, there was nothing atypical about the groundwater levels, other than measured water levels at TPGW-1S and TPGW-2S becoming slightly higher relative to the intermediate and deep water levels (Figures 3.3-1 and 3.3-2). This is likely in response to the shallow zone becoming less saline, potentially as a result of RWS pumping. Other findings in the Comprehensive Post-Uprate Monitoring Report (FPL 2016a) remain valid for this reporting period. These findings are listed below:

- Water levels change very quickly in response to rainfall events. This is most evident in stations not significantly influenced by tides (TPGW-1, TPGW-2, TPGW-4 through TPGW-9, and TPGW-13). Typically, when there is a spike in water levels on the time-series graphs, there is a corresponding rainfall event.

- At each well cluster, fluctuations in stage for all three depth intervals track closely, indicating good hydrologic connection between intervals.

- Water levels at stations in or immediately adjacent to Biscayne Bay (TPGW-3, TPGW-10, TPGW-11, TPGW-12, and TPGW-14) exhibited tidal influence at all three depths. The amplitude of the tidal changes decreases across the landscape from north to south. Thus, TPGW-10 has a larger range of water levels than TPGW-14.

- The stations that are freshest and located farthest from the coast (TPGW-8 and TPGW-9) exhibit fewer water level differences among the shallow, intermediate, and deep wells. The differences in water levels among the shallow, intermediate, and deep wells at other locations are influenced by the density differences in the formation water.

- Wells located between the westernmost wells and the CCS, such as TPGW-4 and TPGW-5, have brackish water in the intermediate and deep zones overlain by much fresher water in the shallow zone. The shallow zone water elevations in these wells are always higher than the deep zone.

To provide insight into the differences in groundwater elevations over the landscape, time-series plots from selected stations are illustrated on Figures 3.3-33 and 3.3-34. Each figure represents a transect or group of well clusters. The water levels for the stations in Biscayne Bay (TPGW-10 and TPGW-11) are shown as daily averages since their hourly tidal fluctuations obscure comparisons with other non-tidal stations. It is important to note that all time-series data reflect actual measured water levels and have not been converted to freshwater head equivalents. Water elevations are typically higher in stations to the west and are lower in stations near the coast.

Groundwater levels in the Biscayne Bay wells fluctuate notably with tides. During high tide, the Bay groundwater levels are higher than groundwater levels in land-based nearshore wells; at low tide, the opposite is true.

Figure 3.3-35 shows a time-series plot stage at TPSWCCS-2B and TPGW-13S, which are located near the center of the CCS. For the reporting period, the results indicate that the CCS water levels at TPSWCCS-2B were higher than the groundwater elevation at TPGW-13S, suggesting that a downward gradient generally occurs at this location.

3.3.3.2 Surface Water

The CCS and the L-31E canal exhibit limited tidal response to conditions in Biscayne Bay, indicating a less direct hydrologic connectivity.

Findings regarding surface water levels presented in the Comprehensive Post-Uprate Monitoring Report (FPL 2016a) remain valid. These findings include the following:

- Diurnal water level variations were observed at all tidally influenced stations, including those located in Biscayne Bay (north to south: TPBBSW-10, TPBBSW-3, and TPBBSW-14) and tidal canal station TPSWC-5. The tidal range declines across the landscape from north to south. At TPBBSW-10, tide ranges during spring tide and neap tide can be more than 2.0 ft and less than 1.0 ft, respectively.

- The effect of rainfall on water levels is masked in most tidal stations. Rainfall effects are evident on all onshore surface water stations where water level increases have been observed following significant rainfall events in the L-31E canal, CCS, and ID.

- Water levels in the CCS vary spatially, depending on whether the station is located on the plant discharge side or intake side of the CCS. Water levels on the plant discharge side have lower ranges in variability (typically less than 1 ft at TPSWCCS-1) than stations on the intake side (up to approximately 2 ft at TPSWCCS-6). Water levels on the discharge side of the CCS are also typically at least 0.5 ft higher than those on the CCS intake side. Following heavy rain events, during the rainy season, and during outages, the difference in water levels between TPSWCCS-1 and TPSWCCS-6 is less than at other times of the year.

- Water levels in the CCS and L-31E canal exhibit little response to tidal influences in Biscayne Bay surface water.

3.4 Extent of CCS Water

Data collected during this reporting period show no significant changes to the orientation and extent of CCS water, with the exception of several groundwater wells near the western boundary of the CCS which are becoming less saline. Based on tritium data for the reporting period, the outer limit for potential CCS groundwater (20 pCi/L isopleth) at depth continues to be approximately 4.5 miles west of the CCS.

As discussed in the 2018 Annual Monitoring report (FPL 2018a), saltwater from Biscayne Bay was reported well inland prior to construction and operation of the CCS (Prinos et al. 2014; Golder 2011a; Parker et al.1955; Klein 1957). The CCS is a source of saline water; that water has intermixed with historical Bay marine groundwater and has migrated inland. There are multiple factors influencing saltwater movement, including groundwater hydraulic gradients, drainage, evaporation, precipitation, groundwater withdrawals, hurricanes, regional development, and changes in sea levels. Based on tritium data for the reporting period, the outer limit for potential CCS groundwater (20 pCi/L isopleth) at depth is approximately 4.5 miles west of the CCS, which has not changed since the previous reporting year. This water consists of ambient saline groundwater and may contain very small (not discernible) amounts of CCS water. Closer to the CCS, the amount of CCS water mixed with ambient saline groundwater is much higher and is reflected by higher tritium and chloride concentrations. Groundwater near the base of the Biscayne Aquifer, 1.5 to 2.5 miles west of the CCS, is hypersaline, and chloride concentrations have not changed appreciably at depth over the entire period of monitoring. Further discussion is provided below, along with figures that show the approximate western extent of CCS groundwater influences (outer limits of CCS influenced groundwater).

Figures 3.4-1, 3.4-2, and 3.4-3 show transect locations and cross-sectional tritium isopleths based on the average concentrations for the reporting period. Tritium concentrations from June 2012 through March 2013 are also included on Figures 3.4-2 and 3.4-3 for comparative purposes. All isopleths represent estimated locations of tritium contours and were developed based on linear interpolation methods and best professional judgment using tritium data collected for this reporting period. Data from other wells, such as TPGW-15 through TPGW-18, have been reviewed to determine the appropriateness of the contours. With a few exceptions, some of which were discussed in Section 3.1.4, the majority of the groundwater tritium values are very similar when comparing values for the same wells for the two reporting periods. While the values at a specific station will vary and may be higher or lower in any given year, the majority of values tend to fluctuate within a fairly consistent range reflective of each well. Thus far, there have been no large-scale changes in the tritium isopleths from one reporting period to another.

Other than the influences from atmospheric exchange, there are was no evidence during the reporting period of CCS sourced groundwater adversely impacting Biscayne Bay/Card Sound, other surface water bodies, or surrounding wetlands.

With regard to the extent of saline and hypersaline groundwater west of the CCS, similar cross-sectional maps have been prepared for chloride (Figures 3.4-4 and 3.4-5) and are of interest, as the progress of some remediation efforts will be based on chloride. MDC and FPL have agreed that hypersaline groundwater is represented by chloride concentrations above 19,000 mg/L (MDC 2015). Figures 3.4-4 and 3.4-5 also include chloride concentrations for the period from June 2012 through March 2013. Similar to the tritium maps, the chloride values at each well are similar over time, with a few exceptions, as noted in Section 3.1.4.

It is anticipated that, as a result of RWS withdrawals of hypersaline groundwater, chloride concentrations will gradually lower west of the CCS as the hypersaline plume is gradually retracted back toward the CCS. This change will be first observed in wells closest to the CCS in the shallow zone, such as TPGW-1S and TPGW-2S, which are near the hypersaline groundwater interface. Reductions of chloride in intermediate and deep wells, such as at TPGW-1M, TPGW-1D, TPGW-2M, and TPGW-2D, will take longer, given the mass of hypersaline groundwater to be retracted at depth. Further information related to RWS operation and effectiveness will be included in annual Remedial Action Reports submitted to MDC.

TABLES

Table 3.0-1. Groundwater and Surface Water Monitoring at Each Station.

Monitoring	Stations	Media
Automated Water Quality	TPGW – 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	GW
	TPBBSW – 3, 4, 5, 10, 14, TPSWC – 1, 2, 3, 4, 5 TPSWID – 1, 2, 3 CCS – 1, 2, 3, 4, 5, 6, 7	SW
Automated Water Level	TPGW–1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	GW
	TPBBSW – 3, 10, 14 TPSWC – 1, 2, 3, 4, 5 TPSWID – 1, 2, 3 CCS – 1, 2, 3, 4, 5, 6, 7	SW
Quarterly[1]	TPGW–1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, L-3, L-5, G-21, G-28, G-35	GW
	TPBBSW – 3, 4, 5 TPSWC – 1, 2, 3, 4, 5, 6 TPSWID – 1, 2, 3 TPSWCCS – 1, 2, 3, 4, 5, 6, 7	SW
Semi-annual[1]	TPGW–3, 4, 5, 6, 7, 8, 9, 11, 13, L-3, L-5, G-21, G-28, G-35	GW (excludes nutrients)
	TPGW – 1, 2, 10, 13, 14	GW (includes nutrients)
	TPBBSW – 3, 4, 5 TPSWC – 1, 2, 3, 4, 5, 6 TPSWID – 1, 2, 3 TPSWCCS – 1, 2, 3, 4, 5, 6, 7	SW

Notes:
[1] = Analytes from Table 3.0-2 plus field parameters (temperature, specific conductivity, DO, percent oxygen saturation, pH, oxidation reduction potential, and salinity) at all stations.

Key:
CCS = Cooling Canal System.
GW = Groundwater.
SW = Surface Water.

Table 3.0-2. Analytes Measured in Groundwater, Surface Water, and the Cooling Canal System.

Analyte	Monitoring Plan Analyte Category	GW	SW	CCS
Chloride (Cl^-)	Ions	Q	Q	Q
Sodium (Na^+)	Ions	Q	Q	Q
Other Anions (SO_4^{2-}, F^-, Br^-)	Ions	SA	SA	SA
Other Cations (Ca^{2+}, Mg^{2+}, K^+, Sr^{2+}, B^+)	Ions	SA	SA	SA
Alkalinity	Ions	SA	SA	SA
Total Ammonia	Nutrients	SA	SA	SA
Ammonium + unionized ammonia	Nutrients	SA	SA	SA
Nitrate/Nitrite	Nutrients	SA	SA	SA
Total Kjeldahl Nitrogen	Nutrients	SA	SA	SA
Total Phosphorus	Nutrients	SA	SA	SA
Ortho-Phosphate	Nutrients	SA	SA	SA
Silica	Nutrients	-	-	SA
Sulfides	Ions	SA	SA	SA
TDS	Other	Q	-	-
Chlorophyll	Other	-	-	-
Tritium	Tracer	Q	Q	Q

Key:
- = Not applicable.
BB = Biscayne Bay.
B^+ = Boron.
Br^- = Bromide.
Ca^{2+} = Calcium.
CCS = Cooling Canal System.
F^- = Fluoride.
GW = Groundwater.
K^+ = Potassium.
Mg^{2+} = Magnesium.
Q = Quarterly event.
SA = Semi-annual event.
SO_4^{2-} = Sulfate.
Sr^{2+} = Strontium.
SW = Surface water.

Table 3.1-1. Statistical Summary of Automated Groundwater Specific Conductance (µS/cm).

	2018							2019					Reporting Period				Historical Period of Record			
Well	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPGW-1S_AT	49988	47983	45560	43850	40986	37819	35817	39217	39407	40294	38698	39770	35191	50815	41622	4214	34379	66059	53895	6790
TPGW-1M_AT	69457	69510	69515	69644	69615	69631	69609	69511	69492	69442	69330	69150	68835	70301	69492	172	66640	75369	71429	1060
TPGW-1D_AT	71672	71834	71884	71872	71534	71477	71648	71718	71603	71538	71330	70887	68326	72048	71593	303	69525	73258	71206	614
TPGW-2S_AT	61917	61273	60681	60522	60174	60537	60571	60547	60419	61126	61164	60487	59802	63654	60784	553	59193	77321	70835	3331
TPGW-2M_AT	74428	73841	73705	73748	73947	74176	74348	74521	74453	74784	75628	75718	73352	77930	74424	685	72648	78584	75208	853
TPGW-2D_AT	77036	77000	76942	76898	76686	76503	76780	76853	76720	76708	76659	76600	76341	77348	76783	181	72128	78233	75795	705
TPGW-3S_AT	60656	60625	60561	60491	60400	60367	60546	60412	60321	60199	59964	59760	59570	60786	60362	262	54694	65637	62656	1560
TPGW-3M_AT	68008	68081	67997	67904	67957	67944	67903	67860	67893	67846	67869	67801	67622	68483	67923	101	65756	70236	68233	818
TPGW-3D_AT	67953	67939	67925	67822	67738	67695	67714	67684	67575	67498	68493	69518	67323	70102	67832	418	65468	72418	68908	771
TPGW-4S_AT	5645	4541	4199	3606	3824	4849	4633	5365	5327	6009	7761	8559	3326	10116	5358	1530	1105	16267	2503	1286
TPGW-4M_AT	41459	41446	41524	41253	41491	41728	41595	41811	41507	41653	41767	41900	40813	42281	41595	226	35988	42023	38363	1181
TPGW-4D_AT	42808	42824	42852	42792	42875	42807	42636	42542	42489	42025	42130	42879	40968	43283	42639	331	41045	44803	42825	553
TPGW-5S_AT	920	907	897	881	870	861	862	894	899	871	855	851	835	952	881	26	496	1947	1107	257
TPGW-5M_AT	33937	33854	33783	33653	33604	33728	33966	34008	33918	33797	33657	33412	33211	34084	33776	176	29494	35694	31853	1087
TPGW-5D_AT	36159	36131	36137	35910	35991	36175	36238	36282	36274	36306	36276	36045	35789	36491	36160	136	31234	37376	34102	1083
TPGW-6S_AT	1317	1383	1442	1433	1482	1502	1485	1507	1475	1520	1506	1602	1268	1637	1471	73	496	1552	1166	113
TPGW-6M_AT	23112	23044	23093	23363	23377	23377	23424	23416	23405	23392	23429	23480	22914	23564	23325	155	20731	23434	22512	420
TPGW-6D_AT	24205	24210	24202	24204	24236	24266	24381	24371	24392	24387	24382	24382	23486	24483	24301	92	22444	24729	23606	278
TPGW-7S_AT	498	490	488	491	493	488	483	483	481	486	497	508	443	582	490	8	421	906	551	33
TPGW-7M_AT	552	535	549	529	509	515	509	516	587	599	599	624	468	750	547	42	445	814	608	49
TPGW-7D_AT	10505	10618	10601	10568	10771	10745	10834	10839	10879	11056	11193	11156	10413	11328	10805	226	418	10573	2699	3471
TPGW-8S_AT	654	657	657	650	658	657	649	656	627	616	652	666	525	669	650	17	343	3681	2169	868
TPGW-8M_AT	652	653	653	654	655	654	655	655	655	*	*	*	631	658	654	1	606	671	638	11
TPGW-8D_AT	665	670	662	662	667	677	671	661	661	663	662	670	594	685	666	9	183	714	670	24
TPGW-9S_AT	593	594	591	602	601	605	598	595	598	596	593	596	585	618	597	5	60	659	590	42
TPGW-9M_AT	603	599	601	615	614	608	609	609	617	608	601	602	582	627	607	7	490	752	628	28
TPGW-9D_AT	606	604	611	614	611	610	610		608	*	607	604	596	625	608	5	592	791	632	15
TPGW-10S_AT	55012	55123	55090	55092	55142	55156	55145	55003	54965	55072	55096	54984	54778	55339	55077	92	50000	55605	52517	1263
TPGW-10M_AT	56305	56479	57260	58171	59372	58865	57467	57752	57109	56768	56505	56491	56075	60920	57407	1132	53629	68230	55606	2050
TPGW-10D_AT	70873	70910	70874	70918	70977	71222	71434	71215	71113	71033	71041	71175	70627	71641	71063	196	53918	72720	61013	6694

Table 3.1-1. Statistical Summary of Automated Groundwater Specific Conductance (µS/cm) (continued).

	2018							2019					Reporting Period				Historical Period of Record			
Well	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPGW-11S_AT	55800	55764	55808	55752	55663	55763	55784	55892	56027	55795	55757	55960	54234	56984	55810	145	53242	56838	54864	705
TPGW-11M_AT	56599	*	*	*	*	*	53428	54504	54933	51772	51130	48938	48617	56725	52805	2500	54895	59680	56548	787
TPGW-11D_AT	68387	68619	68686	68822	68900	68816	68746	69025	69153	69211	69329	69370	68079	69623	68913	301	55275	69143	60540	3235
TPGW-12S_AT	41336	42760	44395	41827	40304	40320	41484	43525	44124	46931	48948	51472	22023	58860	43889	6304	19579	56674	42223	3465
TPGW-12M_AT	64265	64120	64387	64610	64753	63943	62413	62806	62386	61189	59340	59139	58858	65084	62780	1920	56264	66924	63453	1755
TPGW-12D_AT	66014	65988	66340	66460	66484	66511	66462	66481	66563	66576	66200	65579	64542	68655	66307	331	61509	67675	64377	996
TPGW-13S_AT	83130	83075	83001	82979	82939	82895	82871	82869	82777	82785	82742	82648	82419	83395	82890	157	80937	92012	84215	1810
TPGW-13M_AT	81437	81158	81822	82028	81910	81780	81947	81691	81479	80306	80970	81567	79134	84630	81534	697	72747	85519	80322	1453
TPGW-13D_AT	82684	82577	82396	82497	82474	82137	82150	81707	81388	81284	81307	81364	80920	83443	82002	552	77542	89551	82412	2017
TPGW-14S_AT	57910	58101	58242	58261	58301	58166	58103	58127	58070	57771	57469	57401	57200	58768	57995	306	54695	61461	57755	831
TPGW-14M_AT	60764	60546	60632	60805	60603	60575	60637	60496	60455	60503	60586	60556	60296	61558	60597	185	58050	67002	62536	1369
TPGW-14D_AT	72635	72665	72639	72637	72625	72554	72597	72383	72266	72503	72536	72960	72014	73888	72563	185	70754	75918	73722	789

Key:

Avg = Average. Historical Period of Record = Start-up of monitoring through May 2018.

Min = Minimum. Reporting Period = June 2018 through May 2019.

Max = Maximum. Std Dev = Standard Deviation.

* = Less than 21 days of data are available, so no monthly average is included. However all available hourly data included in annual min, max, ave, and STDDEV

Table 3.1-2. Statistical Summary of Automated Groundwater Salinity (in PSS-78 scale).

	2018							2019					Reporting Period				Historical Period of Record			
Well	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPGW-1S_AT	33.3	31.8	30.0	28.7	26.6	24.4	22.9	25.4	25.5	26.2	25.0	25.8	22.5	33.9	27.1	3.1	21.9	45.6	36.3	5.1
TPGW-1M_AT	48.3	48.4	48.4	48.5	48.4	48.5	48.4	48.4	48.3	48.3	48.2	48.1	47.8	49.0	48.3	0.1	46.1	53.1	49.9	0.8
TPGW-1D_AT	50.1	50.2	50.3	50.3	50.0	49.9	50.1	50.1	50.0	50.0	49.8	49.5	47.4	50.4	50.0	0.2	48.4	51.4	49.7	0.5
TPGW-2S_AT	42.4	41.9	41.4	41.3	41.0	41.3	41.3	41.3	41.2	41.8	41.8	41.3	40.8	43.8	41.5	0.4	40.3	54.7	49.5	2.7
TPGW-2M_AT	52.4	51.9	51.8	51.8	52.0	52.2	52.3	52.4	52.4	52.7	53.4	53.4	51.5	55.2	52.4	0.6	50.9	55.8	53.0	0.7
TPGW-2D_AT	54.5	54.5	54.4	54.4	54.2	54.1	54.3	54.4	54.2	54.2	54.2	54.1	53.9	54.8	54.3	0.1	50.5	55.5	53.5	0.6
TPGW-3S_AT	41.4	41.4	41.3	41.3	41.2	41.2	41.3	41.2	41.2	41.1	40.9	40.7	40.6	41.5	41.2	0.2	36.8	45.3	43.0	1.2
TPGW-3M_AT	47.2	47.2	47.2	47.1	47.1	47.1	47.1	47.1	47.1	47.0	47.1	47.0	46.9	47.5	47.1	0.1	45.4	49.0	47.3	0.7
TPGW-3D_AT	47.1	47.1	47.1	47.0	46.9	46.9	46.9	46.9	46.8	46.8	47.5	48.4	46.6	48.8	47.0	0.3	45.2	50.7	47.9	0.6
TPGW-4S_AT	3.1	2.5	2.3	1.9	2.0	2.6	2.5	2.9	2.9	3.3	4.4	4.8	1.8	5.8	2.9	0.9	0.6	9.7	1.3	0.7
TPGW-4M_AT	27.0	27.0	27.0	26.8	27.0	27.2	27.1	27.2	27.0	27.1	27.2	27.3	26.5	27.6	27.1	0.2	23.1	27.4	24.7	0.8
TPGW-4D_AT	28.0	28.0	28.0	27.9	28.0	28.0	27.8	27.8	27.7	27.4	27.5	28.0	26.6	28.3	27.8	0.2	26.7	29.4	28.0	0.4
TPGW-5S_AT	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.0	0.2	1.0	0.6	0.1
TPGW-5M_AT	21.6	21.5	21.5	21.4	21.4	21.4	21.6	21.6	21.6	21.5	21.4	21.2	21.1	21.7	21.5	0.1	18.5	22.8	20.1	0.8
TPGW-5D_AT	23.2	23.1	23.1	23.0	23.0	23.2	23.2	23.2	23.2	23.3	23.2	23.1	22.9	23.4	23.2	0.1	19.7	24.0	21.7	0.8
TPGW-6S_AT	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.6	0.8	0.7	0.0	0.2	0.8	0.6	0.1
TPGW-6M_AT	14.2	14.1	14.1	14.3	14.3	14.3	14.4	14.4	14.4	14.3	14.4	14.4	14.0	14.5	14.3	0.1	12.6	14.4	13.8	0.3
TPGW-6D_AT	14.9	14.9	14.9	14.9	14.9	14.9	15.0	15.0	15.0	15.0	15.0	15.0	14.4	15.1	15.0	0.1	13.7	15.2	14.5	0.2
TPGW-7S_AT	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.0	0.2	0.4	0.3	0.0
TPGW-7M_AT	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.4	0.3	0.0	0.2	0.4	0.3	0.0
TPGW-7D_AT	6.0	6.1	6.1	6.1	6.2	6.2	6.2	6.2	6.3	6.4	6.4	6.4	6.0	6.5	6.2	0.1	0.2	6.1	1.5	2.0
TPGW-8S_AT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.2	2.0	1.1	0.5
TPGW-8M_AT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	*	*	*	0.3	0.3	0.3	0.0	0.3	0.3	0.3	0.0
TPGW-8D_AT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.1	0.4	0.3	0.0
TPGW-9S_AT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.3	0.3	0.0
TPGW-9M_AT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.2	0.4	0.3	0.0
TPGW-9D_AT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	*	0.3	*	0.3	0.3	0.3	0.3	0.3	0.0	0.3	0.4	0.3	0.0
TPGW-10S_AT	37.1	37.2	37.1	37.1	37.2	37.2	37.2	37.1	37.1	37.1	37.1	37.1	36.9	37.3	37.1	0.1	33.3	37.5	35.2	1.0
TPGW-10M_AT	38.1	38.2	38.8	39.5	40.4	40.0	38.9	39.2	38.7	38.4	38.2	38.2	37.9	41.6	38.9	0.9	36.0	47.4	37.5	1.6
TPGW-10D_AT	49.4	49.5	49.4	49.5	49.5	49.7	49.9	49.7	49.6	49.6	49.6	49.7	49.2	50.1	49.6	0.2	36.2	50.9	41.7	5.2

Table 3.1-2. Statistical Summary of Automated Groundwater Salinity (in PSS-78 scale) (continued).

	2018							2019					Reporting Period				Historical Period of Record			
Well	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPGW-11S_AT	37.7	37.6	37.7	37.6	37.6	37.6	37.7	37.7	37.8	37.7	37.6	37.8	36.5	38.6	37.7	0.1	35.7	38.5	36.9	0.5
TPGW-11M_AT	38.3	*	*	*	*	*	35.9	36.7	37.0	34.6	34.1	32.5	32.2	38.4	35.4	1.9	37.0	40.6	38.2	0.6
TPGW-11D_AT	47.4	47.6	47.7	47.8	47.8	47.8	47.7	47.9	48.1	48.1	48.2	48.2	47.2	48.4	47.9	0.2	37.2	48.0	41.3	2.5
TPGW-12S_AT	27.1	28.0	29.2	27.3	26.3	26.2	27.0	28.5	29.0	31.0	32.5	34.4	13.5	40.0	28.8	4.6	11.8	38.4	27.6	2.5
TPGW-12M_AT	44.2	44.1	44.3	44.5	44.6	44.0	42.8	43.1	42.7	41.8	40.4	40.2	40.0	44.9	43.1	1.5	38.0	46.3	43.6	1.4
TPGW-12D_AT	45.6	45.6	45.8	45.9	46.0	46.0	45.9	46.0	46.0	46.0	45.7	45.2	44.4	47.7	45.8	0.3	42.1	46.9	44.3	0.8
TPGW-13S_AT	59.7	59.6	59.6	59.5	59.5	59.5	59.5	59.5	59.4	59.4	59.4	59.3	59.1	59.9	59.5	0.1	57.9	67.3	60.6	1.5
TPGW-13M_AT	58.3	58.0	58.6	58.8	58.7	58.5	58.7	58.5	58.3	57.3	57.9	58.4	56.3	60.9	58.3	0.6	51.1	61.7	57.3	1.2
TPGW-13D_AT	59.3	59.2	59.0	59.1	59.1	58.8	58.8	58.5	58.2	58.1	58.1	58.2	57.8	59.9	58.7	0.5	55.0	65.1	59.1	1.7
TPGW-14S_AT	39.3	39.4	39.5	39.6	39.6	39.5	39.5	39.5	39.4	39.2	38.9	38.9	38.7	40.0	39.4	0.2	36.8	42.0	39.2	0.6
TPGW-14M_AT	41.5	41.3	41.4	41.5	41.4	41.4	41.4	41.3	41.3	41.3	41.4	41.3	41.1	42.1	41.4	0.1	39.4	46.2	42.9	1.1
TPGW-14D_AT	50.9	50.9	50.9	50.9	50.9	50.8	50.9	50.7	50.6	50.8	50.8	51.2	50.4	51.9	50.8	0.1	49.4	53.6	51.8	0.6

Key:

Avg = Average. Historical Period of Record = Start-up of monitoring through May 2018.

Min = Minimum. Reporting Period = June 2018 through May 2019.

Max = Maximum. Std Dev = Standard Deviation.

* = Less than 21 days of data are available, so no monthly average is included. However all available hourly data included in annual min, max, ave, and STDDEV

Table 3.1-3. Statistical Summary of Automated Groundwater Temperature (°C).

	2018							2019					Reporting Period				Historical Period of Record			
Well	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPGW-1S_AT	25.7	25.6	25.5	25.5	25.4	25.5	25.5	25.6	25.6	25.8	25.8	25.8	25.4	25.8	25.6	0.1	25.4	26.3	25.7	0.2
TPGW-1M_AT	25.8	25.8	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.8	25.7	25.9	25.7	0.0	25.8	26.2	25.9	0.1
TPGW-1D_AT	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.7	25.8	25.8	0.0	25.7	26.2	26.0	0.1
TPGW-2S_AT	26.2	26.1	26.1	26.1	26.1	26.2	26.3	26.3	26.4	26.4	26.4	26.4	26.1	26.6	26.2	0.1	25.6	27.5	26.4	0.4
TPGW-2M_AT	27.0	26.9	26.8	26.8	26.8	26.8	26.8	26.8	26.7	26.8	26.9	26.9	26.7	27.1	26.8	0.1	26.6	27.4	27.0	0.2
TPGW-2D_AT	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.9	0.0	26.8	27.6	27.2	0.2
TPGW-3S_AT	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.2	26.2	26.1	26.1	26.1	26.1	26.2	26.1	0.0	25.6	26.7	26.0	0.2
TPGW-3M_AT	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9	0.0	25.8	26.0	25.9	0.0
TPGW-3D_AT	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	0.0	25.6	25.8	25.7	0.0
TPGW-4S_AT	25.3	25.2	25.1	25.1	25.2	25.3	25.3	25.4	25.4	25.3	25.2	25.1	25.1	25.4	25.3	0.1	24.2	26.1	25.0	0.4
TPGW-4M_AT	25.1	25.1	25.1	25.1	25.1	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.1	25.1	0.0	24.4	25.1	24.6	0.1
TPGW-4D_AT	24.6	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.6	24.8	24.7	0.0	24.3	24.6	24.4	0.1
TPGW-5S_AT	24.0	24.1	24.1	24.1	24.1	24.2	24.3	24.4	24.4	24.4	24.3	24.3	24.0	24.4	24.2	0.1	23.3	24.1	23.6	0.2
TPGW-5M_AT	23.9	23.9	23.9	23.9	23.9	23.9	23.9	24.0	24.0	24.0	24.0	24.0	23.9	24.1	23.9	0.0	23.5	23.9	23.6	0.1
TPGW-5D_AT	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.7	23.8	23.8	0.0	23.6	23.7	23.7	0.0
TPGW-6S_AT	23.4	23.4	23.4	23.4	23.5	23.6	23.7	23.7	23.7	23.7	23.6	23.6	23.3	23.7	23.6	0.1	23.0	23.8	23.5	0.2
TPGW-6M_AT	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	0.0	23.3	23.7	23.5	0.1
TPGW-6D_AT	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	0.0	23.3	23.6	23.5	0.1
TPGW-7S_AT	24.4	24.4	24.4	24.5	24.6	24.6	24.7	24.8	24.8	24.7	24.6	24.5	24.3	24.8	24.6	0.1	23.6	24.6	23.8	0.2
TPGW-7M_AT	24.1	24.2	24.2	24.2	24.2	24.2	24.2	24.3	24.3	24.3	24.3	24.2	24.1	24.4	24.2	0.0	23.7	24.6	23.8	0.1
TPGW-7D_AT	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9	24.0	23.9	24.0	23.9	0.0	23.8	23.9	23.8	0.0
TPGW-8S_AT	23.7	23.7	23.7	23.8	23.9	24.0	24.1	24.1	23.9	23.8	23.8	23.8	23.7	24.2	23.9	0.1	23.3	24.3	23.8	0.2
TPGW-8M_AT	23.7	23.6	23.6	23.6	23.7	23.7	23.7	23.7	23.7	*	*	*	23.6	23.8	23.7	0.0	23.6	23.8	23.7	0.1
TPGW-8D_AT	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.8	23.7	0.0	23.5	24.6	23.7	0.0
TPGW-9S_AT	24.3	24.4	24.5	24.5	24.7	24.8	24.9	24.8	24.7	24.4	24.4	24.3	24.3	24.9	24.6	0.2	24.1	25.3	24.7	0.3
TPGW-9M_AT	23.8	23.7	23.7	23.8	23.8	23.8	23.8	23.8	23.9	23.9	23.9	23.8	23.7	23.9	23.8	0.1	23.6	24.2	23.9	0.1
TPGW-9D_AT	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.9	23.9	23.8	23.9	23.8	0.0	23.8	24.1	24.0	0.1
TPGW-10S_AT	26.3	26.3	26.4	26.4	26.6	26.7	26.8	26.8	26.7	26.6	26.5	26.4	26.3	26.9	26.5	0.2	25.5	27.3	26.2	0.4
TPGW-10M_AT	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.3	26.3	26.2	26.3	26.2	0.0	25.8	26.3	25.9	0.1
TPGW-10D_AT	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.7	25.6	0.0	25.6	25.7	25.6	0.0

Table 3.1-3. Statistical Summary of Automated Groundwater Temperature (°C) (continued).

	2018							2019					Reporting Period				Historical Period of Record			
Well	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPGW-11S_AT	25.7	25.7	25.7	25.7	25.7	25.8	25.9	26.0	25.9	25.8	25.8	25.8	25.7	26.0	25.8	0.1	25.0	26.1	25.4	0.2
TPGW-11M_AT	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	0.0	25.2	25.4	25.3	0.0
TPGW-11D_AT	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	0.0	25.2	25.3	25.3	0.0
TPGW-12S_AT	26.1	26.2	26.1	26.1	26.1	26.2	26.3	26.3	26.2	26.2	26.1	26.1	25.9	27.1	26.2	0.1	22.4	30.8	26.1	0.5
TPGW-12M_AT	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	25.9	25.9	25.9	25.9	25.9	26.0	26.0	0.0	25.9	26.2	26.0	0.1
TPGW-12D_AT	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.7	25.7	25.9	25.8	0.0	25.8	26.2	26.0	0.1
TPGW-13S_AT	29.5	29.5	29.5	29.5	29.5	29.5	29.5	29.6	29.6	29.6	29.6	29.6	29.5	29.6	29.5	0.0	29.3	30.8	29.9	0.4
TPGW-13M_AT	29.6	29.5	29.5	29.5	29.4	29.4	29.4	29.4	29.4	29.3	29.4	29.4	29.3	29.6	29.4	0.1	29.2	29.8	29.5	0.1
TPGW-13D_AT	29.1	29.1	29.1	29.1	29.1	29.0	29.0	29.0	29.0	29.0	29.0	29.0	28.9	29.1	29.0	0.0	29.0	29.9	29.4	0.2
TPGW-14S_AT	26.0	26.0	26.2	26.3	26.5	26.7	26.7	26.7	26.6	26.2	26.0	26.0	25.9	26.8	26.3	0.3	25.5	26.9	26.2	0.3
TPGW-14M_AT	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	0.0	26.0	26.4	26.2	0.1
TPGW-14D_AT	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.4	26.4	26.3	26.3	26.3	26.2	26.4	26.3	0.0	26.3	26.4	26.3	0.0

Key:

Avg = Average. Historical Period of Record = Start-up of monitoring through May 2018.

Min = Minimum. Reporting Period = June 2017 through May 2018.

Max = Maximum. Std Dev = Standard Deviation.

* = Less than 21 days of data are available, so no monthly average is included. However all available hourly data included in annual min, max, ave, and STDDEV

Table 3.1-4. Summary of Groundwater Analytical Results from the June 2018 Sampling Event.

Parameter	Units	TPGW-1S 06/14/2018	TPGW-1M 06/14/2018	TPGW-1D 06/14/2018	TPGW-2S 06/06/2018	TPGW-2M 06/06/2018	TPGW-2D 06/06/2018	TPGW-3S 06/11/2018	TPGW-3M 06/11/2018	TPGW-3D 06/11/2018	DUP1 06/11/2018	TPGW-4S 06/07/2018	TPGW-4M 06/07/2018
Temperature	°C	26.8	26.9	26.6	27.5	27.6	27.6	27	26.8	26.6		25.8	25.7
pH	SU	7.05	7.11	7.06	7.34	6.96	6.94	6.62	6.85	6.83		6.98	6.98
Dissolved Oxygen	mg/L	0.19	0.18	0.25	0.12	0.12	0.38	0.29	0.15	0.14		0.17	0.15
Specific Conductance	µS/cm	45343	70256	70898	61984	74183	74624	59375	66328	67512		6017	40206
Turbidity	NTU	0.18	0.34	0.22	0.24	0.15	0.27	0.19	0.49	0.39		0.37	0.41
Sodium	mg/L	8810	14600	14700	12700	15400	16100	12400	13900	15000	14500	880	7760
Chloride	mg/L	17300	28300	28400	24300	30400	31500	23300	26500	27600	27100	1810	14700
Total Dissolved Solids	mg/L	28200	47000	52200	44200	55000	60800	41200	44600	48000	45600	4020	26600
Salinity	*	29.3	48.07	48.58	41.64	51.15	51.5	39.67	45.01	45.94		3.27	25.65
Tritium	pCi/L (1σ)	775 (26.6)	1961 (62.6)	2227 (62.0)	4605 (165)	2986 (109)	3071 (113)	69.5 (4.4) J	900 (29.9)	997 (31.9)	1228 (42.4)	25.9 (3.9) J	308 (12.3)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
060518-DUP1 was collected at 060518-TPGW-7M
061118-DUP1 was collected at 061118-TPGW-3D
061318-DUP1 was collected at 061318-TPGW-12S
Key:
°C = Degrees Celsius.
mg/L = Milligram(s) per Liter.
µS/cm = MicroSiemen(s) per Centimeter.
NTU = Nephelometric Turbidity Units(s).
σ = Sigma (Standard Deviation).
pCi/L = PicoCuries per Liter.
DUP = Duplicate.
SU = Standard Unit(s).
EB = Equipment Blank.
U = Analyzed for but not detected at the reported value.
FB = Field Blank.
J = Estimated (+/- indicate bias).

Table 3.1-4. Summary of Groundwater Analytical Results from the June 2018 Sampling Event (continued).

Parameter	Units	TPGW-4D	TPGW-5S	TPGW-5M	TPGW-5D	TPGW-6S	TPGW-6M	TPGW-6D	TPGW-7S	TPGW-7M	DUP1	TPGW-7D	TPGW-8S-NEW
		06/07/2018	06/14/2018	06/14/2018	06/14/2018	06/05/2018	06/05/2018	06/05/2018	06/05/2018	06/05/2018	06/05/2018	06/05/2018	06/12/2018
Temperature	°C	25.6	25.1	25	24.8	24.8	25.1	25.0	25.1	24.8		24.6	24.9
pH	SU	7.02	7.41	6.9	6.92	7.06	6.97	6.97	7.46	7.42		6.83	7.09
Dissolved Oxygen	mg/L	0.21	0.21	0.26	0.41	0.33	0.13	0.15	0.13	0.14		0.21	0.26
Specific Conductance	µS/cm	42387	947	33829	36381	1303	23521	24307	515	548		10425	668
Turbidity	NTU	0.16	0.24	0.3	0.36	0.38	0.26	0.93	0.42	0.29		0.39	0.25
Sodium	mg/L	8390	74.6	6400	6920	117	4250	4460	21.1	23.4	22.8	1640	15.7
Chloride	mg/L	15800	146	12500	13600	224	8210	8530	35.7	40.7	40.8	3400	28.8
Total Dissolved Solids	mg/L	29600	502	20800	22000	720	13600	13800	310	302	312	6180	402
Salinity	*	27.21	0.46 J	21.2	22.99	0.65 J	14.22	14.74	0.25 J	0.26 J		5.89	0.32 J
Tritium	pCi/L (1σ)	381 (14.6)	11.8 (4.0)	241 (10.2)	287 (11.0)	6.3 (6.1)	11.0 (6.0)	8.8 (6.2)	7.4 (6.1)	-2.3 (5.9) UJ	6.5 (6.1)	24.6 (6.5)	4.8 (3.8) J

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
060518-DUP1 was collected at 060518-TPGW-7M
061118-DUP1 was collected at 061118-TPGW-3D
061318-DUP1 was collected at 061318-TPGW-12S
Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per Centimeter.
σ = Sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per Liter.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per Liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-4. Summary of Groundwater Analytical Results from the June 2018 Sampling Event (continued).

		TPGW-8M		TPGW-8D		TPGW-9S		TPGW-9M		TPGW-9D		TPGW-10S		TPGW-10M		TPGW-10D		TPGW-11S		TPGW-11M		TPGW-11D		TPGW-12S	
Parameter	Units	06/12/2018		06/12/2018		06/12/2018		06/12/2018		06/12/2018		06/19/2018		06/19/2018		06/19/2018		06/19/2018		06/19/2018		06/19/2018		06/13/2018	
Temperature	°C	24.4		24.4		25.6		25.4		25.1		27.6		27.5		27.5		27.0		26.7		26.8		27.7	
pH	SU	7.04		7.03		6.85		6.81		6.7		7.33		7.24		7.06		7.00		6.85		6.94		6.8	
Dissolved Oxygen	mg/L	0.17		0.26		0.17		0.19		0.23		0.22		0.32		0.27		0.43		0.61		0.35		0.28	
Specific Conductance	µS/cm	667		687		614		609		625		54249		54577		69917		54244		57545		66478		36772	
Turbidity	NTU	0.34		0.31		0.09		0.8		0.1		0.25		0.21		0.24		0.35		0.45		0.20		0.19	
Sodium	mg/L	15.0		22.8		14.4		14.5		14.9		10400		10600		13800		10500		11200		13200		7150	
Chloride	mg/L	28.0		39.4		23.9		23.6		24.4		21100		21300		28600		21300		22900		26800		13200	
Total Dissolved Solids	mg/L	396		408		346		342		346		39800		40000		48400		37400		38200		44400		22600	
Salinity	*	0.32	J	0.33	J	0.30	J	0.29	J	0.30	J	35.81		36.05		47.79		35.82		38.29		45.1		23.19	
Tritium	pCi/L (1σ)	8.2 (3.0)	J	6.4 (3.0)	J	2.5 (3.7)	UJ	7.8 (3.9)	J	3.5 (3.9)	UJ	70.5 (4.3)	J	194 (7.4)		1723 (48.8)		4.6 (3.0)	J	281 (9.7)		1133 (33.1)		33.2 (4.4)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
060518-DUP1 was collected at 060518-TPGW-7M
061118-DUP1 was collected at 061118-TPGW-3D
061318-DUP1 was collected at 061318-TPGW-12S

Key:
°C = Degrees Celsius.
mg/L = Milligram(s) per Liter.
µS/cm = MicroSiemen(s) per Centimeter.
NTU = Nephelometric Turbidity Units(s).
σ = Sigma (Standard Deviation).
pCi/L = PicoCuries per Liter.
DUP = Duplicate.
SU = Standard Unit(s).
EB = Equipment Blank.
U = Analyzed for but not detected at the reported value.
FB = Field Blank.
J = Estimated (+/- indicate bias).

Table 3.1-4. Summary of Groundwater Analytical Results from the June 2018 Sampling Event (continued).

Parameter	Units	DUP1 06/13/2018	TPGW-12M 06/13/2018	TPGW-12D 06/13/2018	TPGW-13S 06/13/2018	TPGW-13M 06/13/2018	TPGW-13D 06/13/2018	TPGW-14S 06/19/2018	TPGW-14M 06/19/2018	TPGW-14D 06/19/2018	TPGW-L3-18 06/06/2018	TPGW-L3-58 06/06/2018	TPGW-L5-18 06/06/2018
Temperature	°C		27	27	29.1	29.0	29.1	27.3	27.5	27.3	27.5	27.8	28.7
pH	SU		6.91	7.11	6.71	6.82	6.83	6.93	6.80	6.85	7.39	6.94	7.36
Dissolved Oxygen	mg/L		0.18	0.22	0.22	0.96	0.16	0.28	0.62	0.26	0.24	0.25	0.43
Specific Conductance	µS/cm		62736	65647	80936	81146	82099	56996	58993	71429	1743	76608	1472
Turbidity	NTU		0.15	0.23	0.21	0.65	0.13	0.26	0.22	0.26	0.74	0.26	0.38
Sodium	mg/L	7190	12500	13300	18700	16800	19400	11100	12100	14100	211	16500	174
Chloride	mg/L	13500	24600	25900	33100	33100	33900	22200	23300	29300	400	31900	311
Total Dissolved Solids	mg/L	23600	43000	42600	55800	55200	58800	41200	43000	47400	990	54000	880
Salinity	*		42.24	44.48	56.52	56.70	57.47	37.87	39.36	48.98	0.88 J	53.08	0.73 J
Tritium	pCi/L (1σ)	39.7 (4.5)	1136 (40.3)	1282 (44.5)	6057 (189)	2615 (84.0)	3102 (105)	109 (6.8)	178 (7.0)	1928 (54.8)	41.9 (4.3)	2743 (92.1)	25.4 (4.0)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
060518-DUP1 was collected at 060518-TPGW-7M
061118-DUP1 was collected at 061118-TPGW-3D
061318-DUP1 was collected at 061318-TPGW-12S
Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per Centimeter.
σ = Sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per Liter.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per Liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-4. Summary of Groundwater Analytical Results from the June 2018 Sampling Event (continued).

Parameter	Units	TPGW-L5-58 06/06/2018	TPGW-G21-18 06/05/2018	TPGW-G21-58 06/05/2018	TPGW-G28-18 06/07/2018	TPGW-G28-58 06/07/2018	TPGW-G35-18 06/12/2018	TPGW-G35-58 06/12/2018	FB1 06/05/2018	FB1 06/06/2018	FB1 06/07/2018	FB1 6/11/2018	FB1 06/12/2018	FB1 06/13/2018	FB1 06/14/2018	FB1 6/19/2018	FB2 6/19/2018
Temperature	**°C**	28	25.8	25.6	26.1	25.2	25.5	25.7									
pH	**SU**	6.93	7.15	6.72	7.76	6.96	7.35	7.17									
Dissolved Oxygen	**mg/L**	0.24	0.27	0.36	0.27	0.27	0.24	0.25									
Specific Conductance	**µS/cm**	73783	644	20844 J	2395 J	39734 J	706	18495									
Turbidity	**NTU**	0.38	0.69	0.23	4.84	1.57	0.01	0.08									
Sodium	**mg/L**	15600	39.4	3670	339	7760	50.2	3290	0.0650 U	0.0650 U	0.0650 U				0.0650 U	0.0650 U	0.0650 U
Chloride	**mg/L**	30200	77.7	7400	625	14600	94.0	6170	0.221 U	0.221 U	0.221 U				0.221 U	0.221 U	0.221 U
Total Dissolved Solids	**mg/L**	56200	364	7600 J	1440	26400	406	10400	15.0 U	15.0 U	15.0 U	9.47 U	9.47 U	15.0 U	15.0 U	15.0 U	15.0 U
Salinity	*****	50.82	0.31 J	12.46 J	1.23 J	25.3 J	0.340 J	10.93									
Tritium	**pCi/L (1σ)**	2481 (83.9)	14.1 (6.3)	55.5 (7.3)	19.4 (3.9) J	338 (13.3)	8.9 (3.9) J	-5.7 (3.7) UJ	4.0 (6.0) UJ	-1.5 (6.0) UJ	4.3 (3.5)	15.8 (3.7)	8.4 (3.0)	-1.5 (3.7) UJ	2.8 (3.8) UJ	8.1 (3.9)	8.5 (3.9)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
060518-DUP1 was collected at 060518-TPGW-7M
061118-DUP1 was collected at 061118-TPGW-3D
061318-DUP1 was collected at 061318-TPGW-12S
Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per Centimeter.
σ = Sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per Liter.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per Liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-5. Summary of Groundwater Analytical Results from the September 2018 Sampling Event.

Parameter	Units	TPGW-1S 09/11/2018	TPGW-1M 09/11/2018	TPGW-1D 09/11/2018	TPGW-2S 09/17/2018	TPGW-2M 09/17/2018	TPGW-2D 09/17/2018	TPGW-3S 09/13/2018	TPGW-3M 09/13/2018	TPGW-3D 09/13/2018	TPGW-4S 09/18/2018	TPGW-4M 09/18/2018	TPGW-4D 09/18/2018	TPGW-5S 09/11/2018	TPGW-5M 09/11/2018
Temperature	°C	26.8	26.6	26.7	26.9	27.2	27.3	27.7	27.5	27.4	27	26.6	27.1	25.6	25.5
pH	SU	7.08	7.13	7.06	7.23	6.96	6.91	6.7	6.96	6.95	7.04	7.05	7.08	7.37	6.99
Dissolved Oxygen	mg/L	0.24	0.4	0.91	0.26	0.67	0.7	0.19	0.17	0.19	0.33	0.19	0.25	0.71	1.04
Specific Conductance	µS/cm	37102	70268	70881	60081	74078	76107	59188	65999	67307	3535	40246	42586	906	33569
Turbidity	NTU	0.36	0.08	0.04	0.09	0.05	0.12	0.33	0.28	0.28	0.18	0.11	0.16	0.08	0.22
Calcium	mg/L	449	638	630	948	681	690	618	635	621	193	550	541	99.3	592
Magnesium	mg/L	930	1920	1900	1310	1930	1970	1470	1700	1680	36.4	921	1010	7.55	771
Potassium	mg/L	268	567	564	466	590	613	447	515	511	10.5	195	237	6.20	154
Sodium	mg/L	7380	15700	15600	12600	16000	16400	12000	14000	13900	456	7660	8280	73.9	6420
Boron	mg/L	2.62	5.7	5.65	4.56	6.00	6.21	4.73	5.22	5.34	0.0777	1.53	1.88	0.0490 I	1.08
Strontium	mg/L	7.34	11.7	11.5	11.4	13.8	13.6	9.86	11.5	11.9	1.79	7.82	7.80	0.935	7.22
Bromide	mg/L	43.6	90.8	92.5	73.6	94.6	97.4	72.8	82.6	84.8	2.99	47.6	52.4	0.507	39.9
Chloride	mg/L	13900	28500	28900	22800	29200	30500	22300	25900	26700	953	15200	16700	146	12700
Fluoride	mg/L	0.230	0.270 J-	0.280 J	0.190	0.260	0.240	0.210	0.190	0.200	0.100	0.130	0.150	0.130	0.130
Sulfate	mg/L	1680	3540	3610	2920	3510	3660	2760	3130	3240	45.1	1750	1960	20.1	1330
Ammonia	mg/L as N	1.11	1.71	1.76	1.84	2.52 J+	2.54 J								
Ammonium ion (NH_4^+)	mg/L	1.43	2.20	2.26	2.37	3.25 J	3.28 J								
Unionized NH_3	mg/L	0.00881	0.0125	0.0110	0.0183	0.0128 J	0.0114 J								
Nitrate/Nitrite	mg/L as N	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U								
TKN	mg/L	1.65	1.85 J-	1.79 J	3.47	3.35	3.52								
TN	mg/L	1.65	1.85 J	1.79 J	3.47	3.35	3.52								
ortho-Phosphate	mg/L as P	0.0473	0.0511	0.0146 I	0.0179 I	0.0567	0.0762								
Total Phosphorus (P)	mg/L	0.0283	0.0365	0.0429	0.00900 U	0.0645	0.0553								
Alkalinityas $CaCO_3$	mg/L	325	207	208	126	224	233	522	284	265	322	219	228	217	254
Bicarbonate as HCO_3	mg/L	397	252	253	154	273	284	636	347	324	393	267	278	264	309
Sulfide	mg/L	0.0760 I	0.715	1.55	0.285 U	0.285 U	0.285 U	0.868	0.570 U	0.0760 I	0.722	0.0570 U	0.0570 U	0.0570 U	0.285 U
Total Dissolved Solids	mg/L	25400	47400	47000	39800	47000	56800	37800	45400	40800	2020	25400	26800	492	24800
Salinity	*	23.44	48.09	48.57	40.21	51.08	52.7	39.51	44.74	45.75	1.85 J	25.66	27.31	0.440 J	21.01
Tritium	pCi/L (1σ)	519 (14.1)	2141 (23.2)	2100 (27.9)	3648 (37.5)	2977 (30.8)	3049 (29.0)	111 (7.9)	1086 (19.6)	1256 (22.3)	9.6 (7.2)	305 (11.0)	371 (14.2)	21 (7.2)	245 (10.6)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
091218-DUP1 is a field duplicate of 091218-TPGW-12M
091318-DUP1 is a field duplicate of 091318-TPGW-9D
092018-DUP1 is a field duplicate of 092018-TPGW-11S
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.1-5. Summary of Groundwater Analytical Results from the September 2018 Sampling Event (continued).

Parameter	Units	TPGW-5D 09/11/2018	TPGW-6S 09/12/2018	TPGW-6M 09/12/2018	TPGW-6D 09/12/2018	TPGW-7S 09/12/2018	TPGW-7M 09/12/2018	TPGW-7D 09/12/2018	TPGW-8S-NEW 09/11/2018	TPGW-8M 09/11/2018	TPGW-8D 09/11/2018	TPGW-9S 09/13/2018	TPGW-9M 09/13/2018	TPGW-9D 09/13/2018
Temperature	°C	25.5	25.1	24.9	24.8	25.4	26.4	24.9	25.7	25	25.1	25.7	25.5	25.5
pH	SU	7.02	7.17	7.03	7.01	7.48	7.09	6.89	7.14	7.11	7.11	6.96	6.96	6.97
Dissolved Oxygen	mg/L	1.15	0.26	0.21	0.41	0.26	0.37	0.25	0.37	0.66	0.46	0.21	0.26	0.56
Specific Conductance	µS/cm	36312	1439	23525	24355	499	455.2	10532	659	664	678	625	616	616
Turbidity	NTU	0.23	0.42	0.25	0.29	0.08	0.5	0.06	0.21	0.23	0.33	0.31	0.33	0.28
Calcium	mg/L	588	137	512	513	74.4	80.6	499	114	117	110	110	113	111
Magnesium	mg/L	864	14.5	504	507	3.77	3.53	97.9	4.59	4.75	6.44	2.62	2.83	3.23
Potassium	mg/L	190	4.84	106	107	7.60	3.84	11.1	14.5	16.1	12.4	4.37	5.23	4.15
Sodium	mg/L	7070	137	4290	4390	20.7	14.2	1600	15.5	15.7	22.0	13.7	14.1	15.1
Boron	mg/L	1.5	0.0541	0.756	0.794	0.0487 I	0.0303 I	0.0738	0.0662	0.0672	0.067	0.0404 I	0.0429 I	0.0477 I
Strontium	mg/L	8.1	1.27	7.77	8.30	0.734	0.700	5.48	1.13	1.14	1.03	0.899	0.889	1.08
Bromide	mg/L	42.4	0.966	26.6	27.5	0.154	0.179	11.8	0.190	0.196	0.222	0.186	0.180	0.246
Chloride	mg/L	13600	279	8120	8500	34.6	18.8	3580	28.4	28.6	37.3	26.4	23.3	23.5
Fluoride	mg/L	0.140	0.130	0.140	0.150	0.150	0.170	0.0900 I	0.100	0.100	0.100	0.100	0.100	0.0900 I
Sulfate	mg/L	1500	7.78	803	844	44.1	1.40	79.0	67.2	70.6	67.9	2.28	5.48	19.7
Ammonia	mg/L as N													
Ammonium ion (NH_4^+)	mg/L													
Unionized NH_3	mg/L													
Nitrate/Nitrite	mg/L as N													
TKN	mg/L													
TN	mg/L													
ortho-Phosphate	mg/L as P													
Total Phosphorus (P)	mg/L													
Alkalinityas $CaCO_3$	mg/L	227	301	225	225	164	206	188	233	233	225	285	293	274
Bicarbonate as HCO_3	mg/L	277	368	275	274	200	251	230	285	285	275	347	357	334
Sulfide	mg/L	0.285 U	0.110	0.0570 U	0.285 U	0.0570 U	0.315 I	0.285 U	0.0570 U	0.0570 U	0.0570 U	0.362	0.149	0.0570 U
Total Dissolved Solids	mg/L	21600	812	14600	15300	292	296	6400	416	428	416	366	356	364
Salinity	*	22.92	0.72 J	14.23	14.78	0.24 J	0.22 J	5.95	0.32 J	0.32 J	0.33 J	0.30 J	0.30 J	0.30 J
Tritium	pCi/L (1σ)	342 (11.4)	16.8 (4.9)	13.6 (6.1)	12.3 (4.1)	7.9 (7.0)	18.4 (7.5)	19.0 (6.3)	13.4 (8.1)	4.5 (5.3) UJ	6.1 (4.1)	28.3 (5.6)	1.1 (5.4) UJ	5.3 (5.2)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
091218-DUP1 is a field duplicate of 091218-TPGW-12M
091318-DUP1 is a field duplicate of 091318-TPGW-9D
092018-DUP1 is a field duplicate of 092018-TPGW-11S
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.
Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.1-5. Summary of Groundwater Analytical Results from the September 2018 Sampling Event (continued).

Parameter	Units	DUP1 09/13/2018	TPGW-10S 09/20/2018	TPGW-10M 09/20/2018	TPGW-10D 09/20/2018	TPGW-11S 09/20/2018	DUP1 09/20/2018	TPGW-11M 09/20/2018	TPGW-11D 09/20/2018	TPGW-12S 09/12/2018	TPGW-12M 09/12/2018	DUP1 09/12/2018	TPGW-12D 09/12/2018	TPGW-13S 09/10/2018
Temperature	°C		28.2	28.0	27.8	28.0		27.8	27.9	28	27.8		27.8	30.2
pH	SU		7.34	7.13	7.05	7.03		6.90	7.00	6.69	6.95		7.15	6.81
Dissolved Oxygen	mg/L		0.20	0.22	0.24	0.18		0.18	0.22	0.22	0.25		0.22	0.25
Specific Conductance	µS/cm		55039	58205	71500	55643		59390	67981	48806	62858		66081	81241
Turbidity	NTU		0.15	0.17	0.33	0.36		0.09	0.54	0.19	0.11		0.48	0.17
Calcium	mg/L	111	458	510	619	495	485	593	616	530	646	713	654	738
Magnesium	mg/L	3.25	1400	1500	1900	1380	1350	1580	1740	1240	1760	1960	1860	2180
Potassium	mg/L	4.17	416	451	566	417	409	462	505	367	506	568	537	658
Sodium	mg/L	15.1	11100	11900	15200	11100	10800	12600	13800	9780	13900	15500	14500	17900
Boron	mg/L	0.0495 I	4.53	4.84	5.74	4.9	4.76	4.77	5.30	3.47	4.62	4.44	4.88	7.94
Strontium	mg/L	1.09	8.40	9.40	11.1	8.72	8.47	9.79	11.2	7.21	10.2	9.28	10.3	16.0
Bromide	mg/L	0.251	68.4	73.2	92.9	69.4	69.2	74.7	87.4	57.8	78.0	78.2	82.7	107
Chloride	mg/L	24.0	21000	22500	28700	21400	21500	23000	27300	18100	24400	24500	25800	33500
Fluoride	mg/L	0.0900 I	0.740	0.590	0.250	0.830	0.850	0.570	0.670	0.450	0.290	0.290	0.280	0.440 J-
Sulfate	mg/L	20.0	2680	2850	3580	2740	2750	2840	3390	2190	3060	3070	3230	4230
Ammonia	mg/L as N		0.401	0.713	1.49									6.55 J
Ammonium ion (NH_4^+)	mg/L		0.516	0.918	1.93									8.44 J
Unionized NH_3	mg/L		0.00578	0.00617	0.00982									0.0277 J
Nitrate/Nitrite	mg/L as N		0.0140 U	0.0140 U	0.0140 U									0.0140 U
TKN	mg/L		1.24	0.772 I	1.96 I J-									7.61 J
TN	mg/L		1.24	0.772	1.96 J									7.61 J
ortho-Phosphate	mg/L as P		0.0100 U	0.0100 U	0.0500 U J-									0.0100 U
Total Phosphorus (P)	mg/L		0.0183 I	0.0324	0.0417									0.0886
Alkalinityas $CaCO_3$	mg/L	283	156	200	202	353	323	337	257	549	288	285	208	362
Bicarbonate as HCO_3	mg/L	345	191	244	246	431	394	412	314	670	351	348	254	442
Sulfide	mg/L	0.0570 U	4.93	7.15	9.06	10.8	10.0	8.45	6.02	2.33	2.74 J	3.59	1.09	3.42
Total Dissolved Solids	mg/L	354	32800	38000	49000	34200	38000	39200	48600	29200	41400	43200	48400	52200
Salinity	*		36.38	38.76	49.02	36.83		39.66	46.26	31.78	42.3		44.79	56.72
Tritium	pCi/L (1σ)	12.0 (5.3)	70.7 (6.9)	423 (15.1)	1745 (25.0)	7.8 (8.8)		284 (10.1)	1179 (21.8)	81.1 (6.6)	1111 (18.9)	-4.4 (4.5) UJ	1355 (22.9)	6647 (57.6)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
091218-DUP1 is a field duplicate of 091218-TPGW-12M
091318-DUP1 is a field duplicate of 091318-TPGW-9D
092018-DUP1 is a field duplicate of 092018-TPGW-11S
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.1-5. Summary of Groundwater Analytical Results from the September 2018 Sampling Event (continued).

Parameter	Units	TPGW-13M		TPGW-13D		TPGW-14S		TPGW-14M		TPGW-14D		TPGW-L3-18		TPGW-L3-58		TPGW-L5-18		TPGW-L5-58		TPGW-G21-18		TPGW-G21-58		TPGW-G28-18		TPGW-G28-58	
		09/10/2018		09/10/2018		09/20/2018		09/20/2018		09/20/2018		09/17/2018		09/17/2018		09/17/2018		09/17/2018		09/18/2018		09/18/2018		09/18/2018		09/18/2018	
Temperature	°C	29.9		30.0		28.3		28.5		28.6		29.3		29.1		29		28.9		27.1		26.8		26.6		26.6	
pH	SU	6.88		6.95		6.95		6.87		6.92		7.21		7.02		7.53		6.99		7.24		6.81		7.91		7.01	
Dissolved Oxygen	mg/L	0.22		0.20		0.25		0.21		0.17		0.59		0.29		0.54		0.46		0.38		0.53		0.35		0.38	
Specific Conductance	µS/cm	81325		82271		58489		60566		71947		3464		76829		543		73310		510		20573		2122		40017	
Turbidity	NTU	0.11		0.09		0.49		0.37		0.63		0.43		0.11		0.68		0.36		0.9		0.64		0.85		2.08	
Calcium	mg/L	731		725		544		553		633		123		675		42.9		695		72.6		638		115		582	
Magnesium	mg/L	2180		2210		1510		1520		1880		44.6		1970		9.28		1910		4.03		312		33.8		956	
Potassium	mg/L	641		647		446		448		560		17.9		617		3.32		584		4.26		30.4		10.5		211	
Sodium	mg/L	17800		17800		12100		12000		14800		473		16500		45.6		15900		27.7		3530		334		7970	
Boron	mg/L	7.32		7.44		4.91		5.08		6.08		0.178		6.41		0.0649		5.87		0.0424		0.161		0.121		1.56	
Strontium	mg/L	16.0		15.5		9.42		9.82		12.5		1.23		12.9		0.403		14.6		0.721		7.29		1.14		8.15	
Bromide	mg/L	105		111		73.2		76.9		95.0		2.84		99.0		0.328		95.6		0.192		23.3		1.88		47.3	
Chloride	mg/L	32600		34400		22600		23900		29500		976		31100		78.9		29800		47.7		7400		561		15000	
Fluoride	mg/L	0.200	J-	0.220	J	0.530		0.440	J-	0.400		0.130		0.300		0.100		0.220		0.130		0.100		0.0800	I	0.140	
Sulfate	mg/L	3990		4200		2880		3010		3690		82.1		3860		0.626		3620		4.14		334		79.9		1710	
Ammonia	mg/L as N	3.31	J+	3.33	J	0.498		0.775		2.18																	
Ammonium ion (NH_4^+)	mg/L	4.26	J	4.29	J	0.641		1.00		2.81																	
Unionized NH_3	mg/L	0.0161	J	0.0190	J	0.00291		0.00378		0.0112																	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U																
TKN	mg/L	4.48	J-	5.27	J	1.26		1.49	J	3.09	J																
TN	mg/L	4.48	J	5.27	J	1.26		1.49	J	3.09	J																
ortho-Phosphate	mg/L as P	0.0520		0.0151	I	0.0100	U	0.0100	U J	0.0100	U J																
Total Phosphorus (P)	mg/L	0.0575		0.0566		0.0550		0.219		0.0527																	
Alkalinityas $CaCO_3$	mg/L	265		269		335		368		274		219		198		150		212		177		220		184		220	
Bicarbonate as HCO_3	mg/L	323		328		409		449		334		268		242		183		259		216		269		225		269	
Sulfide	mg/L	1.50		4.17		8.71		9.97		5.32		1.16		0.285	U	0.0570	U	0.285	U	0.471		0.0570	U	0.480		0.0570	U
Total Dissolved Solids	mg/L	55000		54200		41400		39800		50800		2070		50600		298		52200		288		13200		1300		26000	
Salinity	*	56.80		57.57		38.96		40.53		49.35		1.8	J	53.21		0.26	J	50.41		0.24	J	12.26		1.08	J	25.5	
Tritium	pCi/L (1σ)	3049 (34.3)		3222 (29.8)		128 (8.9)		208 (11.4)		2044 (28.9)		59.7 (7.3)	J	2897 (31.0)		57.2 (9.1)	J	2573 (31.3)		19.6 (7.8)		67.4 (7.3)		1.3 (7.8)	UJ	349 (11.8)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
091218-DUP1 is a field duplicate of 091218-TPGW-12M
091318-DUP1 is a field duplicate of 091318-TPGW-9D
092018-DUP1 is a field duplicate of 092018-TPGW-11S
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.1-5. Summary of Groundwater Analytical Results from the September 2018 Sampling Event (continued).

Parameter	Units	TPGW-G35-18 09/13/2018		TPGW-G35-58 09/13/2018		FB1 9/10/2018		FB1 09/11/2018		FB1 09/12/2018		FB1 09/13/2018		FB1 09/17/2018		FB1 09/18/2018		FB1 09/20/2018		FB2 09/20/2018	
Temperature	°C	27.2		26																	
pH	SU	7.39		7.27																	
Dissolved Oxygen	mg/L	0.45		0.33																	
Specific Conductance	µS/cm	619		17919																	
Turbidity	NTU	0.64		0.3																	
Calcium	mg/L	73.9		295		0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U
Magnesium	mg/L	6.43		339		0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U
Potassium	mg/L	12.6		103		0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U
Sodium	mg/L	36.1		3030		0.0650	U	0.0650	U	0.0650	U	0.0650	U	0.0650	U	0.0650	U	0.0650	U	0.110	I
Boron	mg/L	0.0785		1.50		0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U
Strontium	mg/L	0.957		4.83		0.00100	U	0.00100	U	0.00100	U	0.00100	U	0.00100	U	0.00100	U	0.00100	U	0.00100	U
Bromide	mg/L	0.366		18.9		0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
Chloride	mg/L	66.2		5800		0.221	U	0.221	U	0.221	U	0.221	U	0.221	U	0.221	U	0.221	U	0.221	U
Fluoride	mg/L	0.150		0.170		0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U
Sulfate	mg/L	59.9		901		0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.0920	U
Ammonia	mg/L as N					0.0398	U	0.0749	I			0.0398	U	0.0398	U			0.0398	U	0.0398	U
Ammonium ion (NH_4^+)	mg/L					0.128	U													0.129	U
Unionized NH_3	mg/L																				
Nitrate/Nitrite	mg/L as N					0.0140	U	0.0140	U			0.014	U	0.018	I			0.0140	U	0.0140	U
TKN	mg/L					0.126	U	0.126	U			0.126	U	0.126	U			0.126	U	0.126	U
TN	mg/L					0.140	U	0.140	U			0.0140	U	0.0180	I			0.140	U	0.140	U
ortho-Phosphate	mg/L as P					0.0100	U	0.0100	U			0.0100	U	0.0100	U			0.0100	U	0.0100	U
Total Phosphorus (P)	mg/L					0.00900	U	0.00900	U			0.00900	U	0.00900	U			0.00900	U	0.00900	U
Alkalinityas $CaCO_3$	mg/L	167		176		1.78		1.78		1.39		1.19		1.78		1.78		2.18		2.18	
Bicarbonate as HCO_3	mg/L	204		215		2.17		2.17		1.69		1.45		2.17		2.17		2.66		2.66	
Sulfide	mg/L	0.124		0.0570	U	0.570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U
Total Dissolved Solids	mg/L	360		10500		15.0	U	15.0	U	15.0	U	15.0	U	15.0	U	15.0	U	15.0	U	15.0	U
Salinity	*	0.300	J	10.56																	
Tritium	pCi/L (1σ)	8.0 (4.5)		6.4 (5.0)		10.8 (7)		0.4 (5.3)	UJ	-2.5 (7.2)	UJ	-2.5 (7.2)	UJ	11.0 (5.5)		6.8 (7.3)	UJ	38.3 (6.8)		1133 (17.0)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
091218-DUP1 is a field duplicate of 091218-TPGW-12M
091318-DUP1 is a field duplicate of 091318-TPGW-9D
092018-DUP1 is a field duplicate of 092018-TPGW-11S
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.1-6. Summary of Groundwater Analytical Results from the December 2018 Sampling Event.

Parameter	Units	TPGW-1S 12/13/2018		TPGW-1M 12/13/2018		TPGW-1D 12/13/2018		TPGW-2S 12/05/2018		DUP1 12/05/2018		TPGW-2M 12/05/2018		TPGW-2D 12/05/2018		TPGW-3S 12/05/2018		TPGW-3M 12/04/2018		TPGW-3D 12/04/2018		TPGW-4S 12/06/2018		TPGW-4M 12/06/2018	
Temperature	°C	25.2		25.7		25.8		26				26.1		26.2		25.6		26.5		26.8		25.6		25.3	
pH	SU	7.08		7.03		7.03		7.25				6.97		7.00		6.66		7.01		7.01		6.92		6.98	
Dissolved Oxygen	mg/L	0.2		0.53		0.39		0.19				0.16		0.89		0.29		0.6		0.26		0.19		0.18	
Specific Conductance	µS/cm	26011		71737		70609		60336				74090		75839		59423		66054		67301		5006		40435	
Turbidity	NTU	0.18		0.34		0.16		0.22				0.23		0.23		0.29		0.08		0.28		0.08		0.16	
Sodium	mg/L	4730		14100		14100		11800		11900		14800		15200		11800		12800		13200		697		7680	
Chloride	mg/L	9040		27000		27400		22800		22600		29200		29900		22500		25300		25800		1410		14600	
Total Dissolved Solids	mg/L	17600		50800		51800		39800		38200		50200		51000		40200		42800		45400		2860		27200	
Salinity	*	15.87		49.27		48.38		40.43				51.12		52.52		39.75		44.81		45.77		2.68		25.82	
Tritium	pCi/L (1σ)	300 (11.4)		2051 (26.3)		2214 (24.9)		3372 (30.2)		3708 (37.3)		2922 (26.3)		2955 (33.8)		87.6 (7.8)		1199 (18.4)		1275 (16.8)		30.7 (7.3)		289 (12.1)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120518-DUP1 was collected at TPGW-2S
120518 DUP2 was collected at TPGW-12M
121318 DUP1 was collected at TPGW-8D
Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
I = Value between the MDL and PQL.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-6. Summary of Groundwater Analytical Results from the December 2018 Sampling Event (continued).

Parameter	Units	TPGW-4D		TPGW-5S		TPGW-5M		TPGW-5D		TPGW-6S		TPGW-6M		TPGW-6D		TPGW-7S		TPGW-7M		TPGW-7D		TPGW-8S-NEW		TPGW-8M	
		12/06/2018		12/13/2018		12/13/2018		12/13/2018		12/10/2018		12/10/2018		12/10/2018		12/10/2018		12/10/2018		12/10/2018		12/13/2018		12/13/2018	
Temperature	**°C**	25.3		24.5		24.3		24.3		24.3		24.3		24.0		25.0		24.8		24.5		24.8		24.6	
pH	**SU**	7		7.27		6.77		6.96		7.07		6.97		6.95		7.51		7.38		6.85		7.29		7.33	
Dissolved Oxygen	**mg/L**	0.21		0.47		0.45		0.39		0.19		0.22		0.23		0.17		0.18		0.25		0.4		0.45	
Specific Conductance	**µS/cm**	42304		888		34085		36617		1497		23415		24385		496		527		10866		678		685	
Turbidity	**NTU**	0.11		0.42		0.46		0.36		0.37		0.43		0.16		0.18		0.83		0.79		0.56		0.24	
Sodium	**mg/L**	8130		70.0		6280		6900		146		4230		4380		21.4		21.7		1600		15.3		15.2	
Chloride	**mg/L**	15400		133		11900		13000		286		7900		8240		33.0		35.6		3580		28.0		27.9	
Total Dissolved Solids	**mg/L**	29800		480		22600		24800		772		14500		14200		284		318		6280		390		380	
Salinity	*****	27.15		0.440	J	21.39		23.15		0.75	J	14.16		14.81		0.24	J	0.25	J	6.16		0.33	J	0.33	J
Tritium	**pCi/L (1σ)**	401 (12.6)		7.5 (8.2)	UJ	268 (12.6)		345 (12.3)		12.9 (5.9)	J	1.4 (6.9)	UJ	2.2 (4.9)	UJ	16.5 (6.1)	J	12.7 (7.6)	J	22.7 (8.3)	J	7.0 (4.6)		7.2 (5.8)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120518-DUP1 was collected at TPGW-2S
120518 DUP2 was collected at TPGW-12M
121318 DUP1 was collected at TPGW-8D

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
I = Value between the MDL and PQL.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-6. Summary of Groundwater Analytical Results from the December 2018 Sampling Event (continued).

Parameter	Units	TPGW-8D 12/13/2018	DUP1 12/13/2018	TPGW-9S 12/11/2018	TPGW-9M 12/11/2018	TPGW-9D 12/11/2018	TPGW-10S 12/12/2018	TPGW-10M 12/12/2018	TPGW-10D 12/12/2018	TPGW-11S 12/12/2018	TPGW-11M 12/12/2018	TPGW-11D 12/12/2018	TPGW-12S 12/05/2018
Temperature	°C	24.7		24.7	23.5	23.8	24.9	24.9	24.4	23.6	23.6	23.6	26.2
pH	SU	7.22		7.01	6.55	7.05	7.25	7.17	7.04	7.00	6.84	6.94	6.91
Dissolved Oxygen	mg/L	0.36		0.52	0.77	0.29	0.34	0.37	0.20	0.21	0.42	0.22	0.22
Specific Conductance	µS/cm	721		617	623	618	55231	57311	70434	55045	58732	67134	42988
Turbidity	NTU	0.44		1.65	0.77	0.228	0.10	0.37	0.03	0.14	0.67	0.34	0.22
Sodium	mg/L	24.2	24.2	14.7	15.8	15.8	11000	11300	14400	11000	11700	13700	8140
Chloride	mg/L	42.4	42.4	25.2	25.8	24.5	19900	20600	27000	20100	21700	25600	15200
Total Dissolved Solids	mg/L	370	430	350	346	354	38000	35800	51200	38200	37000	48000	26800
Salinity	*	0.35 J		0.30 J	0.30 J	0.30 J	36.61	38.17	48.28	36.50	39.27	45.71	27.62
Tritium	pCi/L (1σ)	42.8 (8.7)	0.0 (8.0) UJ	3.9 (8.4) UJ	14.0 (7.7)	3.2 (5.4) UJ	68.2 (7.3)	289 (13.2)	1754 (25.8)	10.7 (5.7)	309 (12.1)	1152 (19.7)	43.6 (7.3)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120518-DUP1 was collected at TPGW-2S
120518 DUP2 was collected at TPGW-12M
121318 DUP1 was collected at TPGW-8D

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
I = Value between the MDL and PQL.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-6. Summary of Groundwater Analytical Results from the December 2018 Sampling Event (continued).

Parameter	Units	TPGW-12M		DUP2		TPGW-12D		TPGW-13S		TPGW-13M		TPGW-13D		TPGW-14S		TPGW-14M		TPGW-14D		TPGW-L3-18		TPGW-L3-58		TPGW-L5-18	
		12/05/2018		12/05/2018		12/05/2018		12/04/2018		12/04/2018		12/04/2018		12/12/2018		12/12/2018		12/12/2018		12/10/2018		12/10/2018		12/05/2018	
Temperature	**°C**	26.4				26.3		29.4		29.4		29.2		23.6		23.8		24.3		24.4		25.4		26.3	
pH	**SU**	6.86				7.16		6.86		6.91		6.99		6.90		6.81		6.89		7.37		6.99		7.61	
Dissolved Oxygen	**mg/L**	0.18				0.18		0.18		0.16		0.83		0.36		0.31		0.23		0.14		0.34		1.97	
Specific Conductance	**µS/cm**	59927				65848		81025		81263		82375		57517		59579		71094		2278		76531		972	
Turbidity	**NTU**	0.04				0.45		0.20		0.16		0.19		0.79		0.47		0.42		0.79		0.3		6.72	
Sodium	**mg/L**	11500		11800		13000		16400		16400		16700		11900		12100		14700		318		16200		99.6	
Chloride	**mg/L**	22600		22500		25800		32600		32500		32500		21200		22400		27500		603		29900		186	
Total Dissolved Solids	**mg/L**	38200		38200		45000		54400		59800		61600		38200		40200		50200		1210		52000		600	
Salinity	*****	40.11				44.63		56.59		56.78		57.69		38.35		38.91		48.80		1.17	J	53.1		0.48	J
Tritium	**pCi/L (1σ)**	913 (15.2)		899 (14.5)		1329 (17.0)		6448 (47.4)		3004 (33.2)		3197 (36.2)		105 (8.2)		174 (9.2)		1921 (24.9)		138 (9.3)	J	2774 (36)		125 (7.7)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120518-DUP1 was collected at TPGW-2S
120518 DUP2 was collected at TPGW-12M
121318 DUP1 was collected at TPGW-8D

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
I = Value between the MDL and PQL.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-6. Summary of Groundwater Analytical Results from the December 2018 Sampling Event (continued).

Parameter	Units	TPGW-L5-58 12/05/2018	TPGW-G21-18 12/06/2018	TPGW-G21-58 12/06/2018	TPGW-G28-18 12/06/2018	TPGW-G28-58 12/06/2018	TPGW-G35-18 12/11/2018	TPGW-G35-58 12/11/2018	FB1 12/04/2018	FB1 12/05/2018	FB1 12/06/2018	FB1 12/10/2018	FB1 12/11/2018	FB1 12/12/2018	FB1 12/13/2018	FB2 12/13/2018
Temperature	**°C**	26	24.7	24.3	25.3	25	25.6	25.4								
pH	**SU**	7.01	7.26	6.79	7.63	6.98	7.54	7.21								
Dissolved Oxygen	**mg/L**	0.32	0.44	0.48	0.36	0.35	0.64	0.335								
Specific Conductance	**µS/cm**	73099	615	20554	2314	39994	756	18548								
Turbidity	**NTU**	1.64	0.51	0.83	1.02	1.53	1.83	0.3								
Sodium	**mg/L**	14900	28.8	3530	329	7660	62.7	3290	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U	0.0650 U
Chloride	**mg/L**	28600	52.0	7010	588	14500	116	6000	0.221 U	0.221 U	0.221 U	0.221 U	0.221 U	0.189 U	0.189 U	0.189 U
Total Dissolved Solids	**mg/L**	47000	328	13800	1350	24000	418	11600	15.0 U	18.0 I	15.0 U	15.0 U	15.0 U	15.0 U	10.0 U	10.0 U
Salinity	*****	50.34	0.30 J	12.28	1.18 J	25.5	0.37 J	10.97								
Tritium	**pCi/L (1σ)**	2523 (31.5)	14.7 (7.8)	51.8 (6.4)	4.8 (5.6) UJ	370 (10.7)	45.8 (6.5)	2.1 (4.4) UJ	15.3 (5.2)	-5.5 (7.4) UJ	-11.3 (6.5) UJ	15.5 (5.4)	-1.6 (4.5) UJ	-8.3 (6.1) UJ	0.2 (4.5) UJ	11.5 (5.9)

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120518-DUP1 was collected at TPGW-2S
120518 DUP2 was collected at TPGW-12M
121318 DUP1 was collected at TPGW-8D

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
I = Value between the MDL and PQL.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.1-7. Summary of Groundwater Analytical Results from the March 2019 Sampling Event.

Parameter	Units	TPGW-1S		TPGW-1M		TPGW-1D		DUP1		TPGW-2S		TPGW-2M		TPGW-2D		TPGW-3S		TPGW-3M		TPGW-3D		TPGW-4S		TPGW-4M	
		03/04/2019		03/04/2019		03/04/2019		03/04/2019		03/05/2019		03/05/2019		03/05/2019		03/06/2019		03/06/2019		03/06/2019		03/13/2019		03/13/2019	
Temperature	**°C**	26.4		26.4		26.5				26.6		26.8		26.9		25.4		25.5		25.1		25.7		25.3	
pH	**SU**	7.04		7.09		7.01				7.16		6.93		6.90		6.66		6.9		6.92		6.85		6.96	
Dissolved Oxygen	**mg/L**	0.34		0.17		0.24				0.19		0.23		0.13		0.37		0.13		0.28		0.32		0.19	
Specific Conductance	**µS/cm**	30353		70980		71402				60080		74326		76347		59722		66739		68110		5517	J	41139	
Turbidity	**NTU**	0.35		1.45		0.34				0.23		0.34		0.27		0.39		0.91		0.21		0.12		14.03	
Calcium	**mg/L**	361		571		579		613		812		661		636		617		621		627		257		554	
Magnesium	**mg/L**	669		1780		1800		1830		1370		2050		2000		1570		1760		1800		68.5		970	
Potassium	**mg/L**	195		532		526		543		437		577		571		468		514		524		16.2		219	
Sodium	**mg/L**	5350		14400		14400		13700		11800	J	15400	J	15700	J-	12000		13500		13700		741		7900	
Boron	**mg/L**	2.17		6.10		6.31		5.85		4.95	I	5.97		6.44		4.96	I	5.36		5.72		0.115		1.69	
Strontium	**mg/L**	5.89		11.2		11.3		11.5		11.4		13.6		14.3		10.4		12.3		12.7		2.38		7.78	
Bromide	**mg/L**	34.1	J	91.9		90.9		91.7		75.6		98.7		102		77.3		88.6		90.3		5.23		50.0	
Chloride	**mg/L**	11000	J	28300		29100		29000		23800		30600		31800		24000		27300		28100		1640		15200	
Fluoride	**mg/L**	0.220	J	0.250		0.260		0.260		0.190		0.260	J	0.230	J-	0.200	J	0.170		0.190		0.0900	I J	0.120	J-
Sulfate	**mg/L**	1320	J	3380		3460		3450		2950		3580		3730		2930		3280		3380		101		1760	
Ammonia	**mg/L as N**	1.05		1.67		1.90		1.88		1.91	J	2.89	J	2.70	J-										
Ammonium ion (NH_4^+)	**mg/L**	1.35		2.15		2.45		2.42		2.47	J	3.73	J	3.48	J										
Unionized NH_3	**mg/L**	0.00764		0.0110		0.0104				0.0159	J	0.0133	J	0.0115	J										
Nitrate/Nitrite	**mg/L as N**	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.204		0.0140	U	0.0140	U										
TKN	**mg/L**	1.52		1.82		2.23		2.18		2.20		2.67		2.51											
TN	**mg/L**	1.52		1.82		2.23		2.18		2.41		2.67		2.51											
ortho-Phosphate	**mg/L as P**	0.0259	I J	0.0265	I	0.0222	I	0.0235	I	0.0191	I	0.0412		0.0613											
Total Phosphorus (P)	**mg/L**	0.0209	I J	0.0349	I	0.0404	I	0.0405	I	0.0426	J V	0.0442	J V	0.0541	J V										
Alkalinity as $CaCO_3$	**mg/L**	328	J	197		195		197		138		242		236		517		272		262		319		211	
Bicarbonate as HCO_3	**mg/L**	400	J	241		238		241		168		295		288		631		332		320		389		257	
Sulfide	**mg/L**	0.321		1.18		2.13		2.05		1.55		1.17	J	0.232	J-	16.5		0.0570	U	0.111		0.117		0.0570	U
Total Dissolved Solids	**mg/L**	20300		49800		50800		47800		42600		52800		52200		41000		47400		46400		3040	I	23400	
Salinity	*****	18.79		48.66		48.99				40.22		51.29		52.9		39.98		45.37		46.44		2.97		26.32	
Tritium	**pCi/L (1σ)**	374 (13.0)		2033 (26.9)		2111 (27.8)		2177 (26.5)		3237 (52.4)		2959 (28.4)		2987 (35.6)		81.0 (9.4)		1145 (18.2)		1320 (23.0)		0.3 (7.7)		304 (12.6)	

Notes:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is unitless.

030419-DUP1 is a field duplicate of 030419-TPGW-1D

031419-DUP1 is a field duplicate of 031419-TPGW-9S

032119-DUP1 is a field duplicate of 032119-TPGW-13D

Key:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Detected in method blank.

Table 3.1-7. Summary of Groundwater Analytical Results from the March 2019 Sampling Event (continued).

Parameter	Units	TPGW-4D		TPGW-5S		TPGW-5M		TPGW-5D		TPGW-6S		TPGW-6M		TPGW-6D		TPGW-7S		TPGW-7M		TPGW-7D		TPGW-8S-NEW		TPGW-8M	
		03/13/2019		03/04/2019		03/04/2019		03/04/2019		03/06/2019		03/06/2019		03/06/2019		03/05/2019		03/05/2019		03/05/2019		03/14/2019		03/14/2019	
Temperature	°C	25.2		25.7		25.2		25.2		23.8		23.8		23.9		24.7		24.5		24.3		24.2		24.1	
pH	SU	6.97		7.21		6.91		6.93		7.07		6.98		6.96		7.40		7.3		6.83		7.06		7.03	
Dissolved Oxygen	mg/L	0.19		0.16		0.21		0.2		0.19		0.15		0.33		0.28		0.15		0.19		0.47		0.2	
Specific Conductance	µS/cm	42289		900		33332		36851		1538		23459		24586		505		533		10983		677		677	
Turbidity	NTU	0.19		0.29		0.51		0.23		1.17		0.20		0.19		0.08		0.24		0.32		13.02		0.12	
Calcium	mg/L	529		92.7		542		537		139		470		472		72.6		77.1		493		122		113	
Magnesium	mg/L	1000		6.97		673		784		14.8		437		455		3.94		3.95		103		4.65		4.59	
Potassium	mg/L	242		5.73		137		178		4.98		95.7		100		8.07		7.29		11.4		15.0		15.7	
Sodium	mg/L	8100		65.0		5880		6530		141		3920		4210		21.8		22.6		1580		16.9		15.7	
Boron	mg/L	2.03		0.0497	I	1.12		1.56		0.0573		0.807		0.834		0.0521		0.0516		0.0868		0.0715		0.0730	
Strontium	mg/L	8.24		0.920		7.33		7.41		1.39		8.53		8.73		0.740		0.784		6.20		1.21		1.20	
Bromide	mg/L	51.7		0.460		37.7	J	42.6	J	1.09		26.9		27.7	J	0.144		0.155		12.4		0.192		0.209	
Chloride	mg/L	16000		142		12300	J	13600	J	331		8260		8970	J	36.8		40.4		3780		31.2		29.9	
Fluoride	mg/L	0.140	J	0.130		0.120	J	0.140	J	0.120		0.130		0.140	J	0.140		0.130		0.0900	I	0.100		0.0900	I
Sulfate	mg/L	1910		18.6		1220	J	1470	J	9.87		792		869	J	47.3		36.50		80.4		68.3		72.4	
Ammonia	mg/L as N																								
Ammonium ion (NH_4^+)	mg/L																								
Unionized NH_3	mg/L																								
Nitrate/Nitrite	mg/L as N																								
TKN	mg/L																								
TN	mg/L																								
ortho-Phosphate	mg/L as P																								
Total Phosphorus (P)	mg/L																								
Alkalinity as $CaCO_3$	mg/L	208		224		236	J	225	J	290		218		228	J	149		170		190		244		236	
Bicarbonate as HCO_3	mg/L	254		273		288	J	275	J	353		266		278	J	181		207		232		297		287	
Sulfide	mg/L	0.0570	U	0.119		0.0570	U	0.0570	U	0.0934	I	0.0570	U	0.0570	U	0.0570	U	0.114		0.0570	U	0.0570	U	0.0570	U
Total Dissolved Solids	mg/L	27000		496		20800		21600		890		16200		15800		284		306		6520		392		390	
Salinity	*	27.14		0.440	J	20.85		23.3		0.77	J	14.2		14.94		0.24	J	0.26	J	6.23		0.33	J	0.33	J
Tritium	pCi/L (1σ)	417 (14.1)		25.4 (5.6)		240 (13.1)		381 (12.2)		19.0 (7.4)		10.7 (8.0)		25.3 (9.5)		23.9 (7.7)		8.6 (4.5)		10.5 (6.8)		8.1 (6.1)		1.1 (8.0)	

Notes:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is unitless.

030419-DUP1 is a field duplicate of 030419-TPGW-1D

031419-DUP1 is a field duplicate of 031419-TPGW-9S

032119-DUP1 is a field duplicate of 032119-TPGW-13D

Key:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Detected in method blank.

Table 3.1-7. Summary of Groundwater Analytical Results from the March 2019 Sampling Event (continued).

Parameter	Units	TPGW-8D		TPGW-9S		DUP1		TPGW-9M		TPGW-9D		TPGW-10S		TPGW-10M		TPGW-10D		TPGW-11S		TPGW-11M		TPGW-11D		TPGW-12S	
		03/14/2019		03/14/2019		03/14/2019		03/14/2019		03/14/2019		03/07/2019		03/07/2019		03/07/2019		03/07/2019		03/07/2019		03/07/2019		03/05/2019	
Temperature	°C	24.1		24.5				24.1		24		25.3		25.1		25.2		24.6		24.4		24.4		27.2	
pH	SU	7.04		6.94				6.93		6.93		7.31		7.29		7.03		7.00		6.83		6.93		6.65	
Dissolved Oxygen	mg/L	0.58		0.31				0.22		0.28		0.17		0.07		0.29		0.16		0.37		0.15		0.27	
Specific Conductance	µS/cm	683		627				622		628		55160		56288		70636		56034		58805		68809		48305	
Turbidity	NTU	1.01		0.31				0.37		0.3		0.50		0.38		0.64		0.82		0.52		0.40		0.03	
Calcium	mg/L	109		113		112		111		114		448		454		604		493		554		623		494	
Magnesium	mg/L	6.06		3.00		2.95		3.09		3.47		1370		1380		1860		1390		1490		1790		1210	
Potassium	mg/L	13.0		4.94		4.89		4.84		3.96		407		410		544		414		433		515		350	
Sodium	mg/L	21.2		15.6		15.5		15.8		15.5		10600		10700		14900		11300		11400		13500		9370	
Boron	mg/L	0.0754		0.0443	I	0.0457	I	0.0468	I	0.0507		4.60	I	4.73	I	5.90		4.64	I	4.67	I	5.30		3.73	
Strontium	mg/L	1.12		0.916		0.903		0.942		1.12		8.38		9.00		11.7		8.50		9.51		11.3		7.79	
Bromide	mg/L	0.220		0.193		0.195		0.195		0.241		69.6		71.3		95.0		70.0		76.0		90.4		58.0	
Chloride	mg/L	37.1		26.1		26.2		26.5		25.2		20800		21500		29000		22100		22800		27000		18900	
Fluoride	mg/L	0.0900	I	0.0900	I	0.0900	I	0.0900	I	0.0900	I	0.660	J	0.580	J-	0.220		0.750		0.520	J	0.610		0.480	
Sulfate	mg/L	71.8		3.94		4.07		5.29		20.6		26.0		2680		3580		2700		2770		3260		2320	
Ammonia	mg/L as N											0.338		0.677		1.49	J								
Ammonium ion (NH_4^+)	mg/L											0.435		0.872		1.92	J								
Unionized NH_3	mg/L											0.00371		0.00696		0.00786	J								
Nitrate/Nitrite	mg/L as N											0.0140	U	0.0140	U	0.0140	U								
TKN	mg/L											1.09	J+	0.898	J-	1.83									
TN	mg/L											1.09	J	0.898	J	1.83									
ortho-Phosphate	mg/L as P											0.0216	I J	0.0216	I J	0.0123	I								
Total Phosphorus (P)	mg/L											0.0146	I J	0.0159	I J	0.0434									
Alkalinity as $CaCO_3$	mg/L	230		287		289		281		266		149		157		202		310		344		245		503	
Bicarbonate as HCO_3	mg/L	281		350		353		342		325		182		192		246		378		420		299		614	
Sulfide	mg/L	0.0980	I	0.389	J	0.124		0.187		0.0570	U	3.87	I	4.72	I	12.6		11.0		8.50		6.14		9.81	
Total Dissolved Solids	mg/L	392		356		352		354		346		36400		37400		52200		37400		39600		47800		31600	
Salinity	*	0.33	J	0.30	J			0.30	J	0.30	J	36.55		37.40		48.42		37.22		39.10		47.09		31.44	
Tritium	pCi/L (1σ)	4.7 (7.3)		8.3 (4.6)		-7.6 (5.9)		11.4 (6.0)		1.3 (4.6)		61.4 (6.7)		197 (8.9)		1776 (25.3)		26.6 (5.6)		290 (11.5)		1249 (20.4)		54.8 (6.9)	

Notes:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is unitless.

030419-DUP1 is a field duplicate of 030419-TPGW-1D

031419-DUP1 is a field duplicate of 031419-TPGW-9S

032119-DUP1 is a field duplicate of 032119-TPGW-13D

Key:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Detected in method blank.

Table 3.1-7. Summary of Groundwater Analytical Results from the March 2019 Sampling Event (continued).

Parameter	Units	TPGW-12M		TPGW-12D		TPGW-13S		TPGW-13M		TPGW-13D		DUP1		TPGW-14S		TPGW-14M		TPGW-14D		TPGW-L3-18		TPGW-L3-58		TPGW-L5-18		TPGW-L5-58	
		03/05/2019		03/05/2019		03/21/2019		03/21/2019		03/21/2019		03/21/2019		03/07/2019		03/07/2019		03/07/2019		03/12/2019		03/12/2019		03/12/2019		03/12/2019	
Temperature	**°C**	27		26.9		29.2		28.9		28.5				24.6		25.2		25.1		26.4		27.1		26.4		26.8	
pH	**SU**	6.8		7.07		6.76		6.82		6.91				6.93		6.79		6.87		7.18		6.98		7.17		6.95	
Dissolved Oxygen	**mg/L**	0.12		0.12		0.19		0.14		0.37				0.22		0.30		0.19		0.56		0.38		0.4		0.39	
Specific Conductance	**µS/cm**	59787		66007		81185		81062		81890				58457		60350		72372		3133		78801		2560		73976	
Turbidity	**NTU**	0.08		0.18		0.17		0.16		0.12				0.45		0.39		0.21		0.77		0.08		0.31		0.45	
Calcium	**mg/L**	580		594		644		643		659		644		515		556		624		117		634		115		655	
Magnesium	**mg/L**	1610		1780		1900		1920		1980		1960		1460		1530		1890		39.4		1970		31.7		1860	
Potassium	**mg/L**	458		502		591		591		602		599		430		448		554		13.4		595		11.1		546	
Sodium	**mg/L**	11900		13400		21900		18800		18000		18600		11200		12400		15400		442		16800		328		14600	
Boron	**mg/L**	4.87	I	5.19		7.71		7.21		7.27		7.20		4.93	I	5.25		6.27		0.138		7.07		0.111		5.76	
Strontium	**mg/L**	9.97		10.8		16.1		16.1		16.6		16.4		9.17		9.90		12.6		1.16		14.0		1.22		14.3	
Bromide	**mg/L**	75.3		84.2		111		112		113		113		74.7		77.6		96.0		2.54		106		2.09		98.6	
Chloride	**mg/L**	24200		26600		34000		33700		34800		34500		22700		23700		29500		874		32000		677		29300	
Fluoride	**mg/L**	0.260		0.250	J	0.400	J	0.200	J-	0.210		0.200		0.480	J	0.410	J	0.360		0.0900	I	0.250		0.0900	I	0.200	
Sulfate	**mg/L**	2910		3200		4320		4150		4280		4220		2820		2920		3560		54.5		3890		23.7		3480	
Ammonia	**mg/L as N**					7.03		3.56		3.67		3.68		0.587		0.651		2.49	J								
Ammonium ion (NH_4^+)	**mg/L**					9.05		4.58		4.72		4.74		0.756		0.839		3.21	J								
Unionized NH_3	**mg/L**					0.0248		0.0141		0.0173				0.00253		0.00210		0.00894	J								
Nitrate/Nitrite	**mg/L as N**					0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U								
TKN	**mg/L**					7.01		3.88		3.85		3.98		1.32	J+	1.24	J	2.55									
TN	**mg/L**					7.01		3.88		3.85		3.98		1.32	J	1.24	J	2.55									
ortho-Phosphate	**mg/L as P**					0.0100	U J	0.0313	V	0.0250	V J	0.0219	I V	0.0358	I	0.0206	I	0.0269	I								
Total Phosphorus (P)	**mg/L**					0.0523		0.0743		0.0679		0.0661		0.0624		0.0574		0.0564									
Alkalinity as $CaCO_3$	**mg/L**	351		200		350		264		266		266		301		399		277		212		200		250		212	
Bicarbonate as HCO_3	**mg/L**	428		244		427		322		324		325		367		486		338		258		244		305		258	
Sulfide	**mg/L**	6.37		1.16	J	18.9	Q	1.92	Q	1.95	Q	1.98	Q	8.99		13.0		6.84		2.65	J	0.0890	I	5.73	J-	0.520	
Total Dissolved Solids	**mg/L**	40800		47800		60000		59800		59800		60200		40400		42000		51800		1660		54400		1330		52000	
Salinity	*****	39.99		44.76		56.73		56.64		57.34				39.04		40.46		49.79		1.63	J	54.87		1.37	J	51.01	
Tritium	**pCi/L (1σ)**	793 (17.5)		1281 (19.0)		6071 (47.3)		3042 (31.4)		3084 (35.8)		3040 (29.3)		109 (8.3)		150 (10.4)		1972 (22.8)		146 (9.0)		2931 (30.0)		91.0 (10.3)		2446 (28.5)	

Notes:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is unitless.

030419-DUP1 is a field duplicate of 030419-TPGW-1D

031419-DUP1 is a field duplicate of 031419-TPGW-9S

032119-DUP1 is a field duplicate of 032119-TPGW-13D

Key:

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HCO_3 = Bicarbonate.
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N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Detected in method blank.

Table 3.1-7. Summary of Groundwater Analytical Results from the March 2019 Sampling Event (continued).

Parameter	Units	TPGW-G21-18 03/21/2019	TPGW-G21-58 03/21/2019	TPGW-G28-18 03/13/2019	TPGW-G28-58 03/13/2019	TPGW-G35-18 03/14/2019	TPGW-G35-58 03/14/2019	EB1 03/04/2019	FB1 03/05/2019	FB1 3/6/2019	FB1 03/07/2019	FB1 03/12/2019	FB1 3/13/2019	FB1 03/14/2019	FB1 03/21/2019	FB2 03/21/2019
Temperature	°C	25.5	25.1	25.9	25.3	26.5	26.1									
pH	SU	7.3	6.78	7.34	7	7.47	7.19									
Dissolved Oxygen	mg/L	0.89	0.33	0.52	0.4	0.28	0.4									
Specific Conductance	µS/cm	640	21034	2456	40525	806	18844									
Turbidity	NTU	0.5	0.32	0.39	1.66	4.06	0.73									
Calcium	mg/L	78.1	568	130	571	70.0	316	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U	0.0760 U
Magnesium	mg/L	3.77	283	42.2	960	9.08	396	0.0320 U	0.0320 U	0.0320 U	0.0320 U	0.0320 U	0.0320 U	0.0320 U	0.0320 U	0.0320 U
Potassium	mg/L	5.51	27.5	10.7	216	13.0	112	0.0490 U	0.0490 U	0.0490 U	0.0490 U	0.0490 U	0.0490 U	0.0490 U	0.0490 U	0.0490 U
Sodium	mg/L	30.0	3850	336	7700	71.7	3260	0.119 I	0.0650 U	0.0650 U	0.0650 U	0.147 I	0.0742 I	0.0650 U	0.0650 U	0.0650 U
Boron	mg/L	0.0453 I	0.176 I	0.143 I	1.53	0.0878	1.59	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U
Strontium	mg/L	0.919	7.64	1.35	7.51	1.05	4.88	0.00100 U	0.00100 U	0.00100 U	0.00579 U	0.00100 U	0.00100 U	0.00100 U	0.00100 U	0.00100 U
Bromide	mg/L	0.216	24.0	2.22	49.6	0.581	22.2	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U
Chloride	mg/L	57.0	7630	631	15500	137	6260	0.273 I	0.189 U	0.189 U	0.189 U	0.189 U	0.189 U	0.189 U	0.189 U	0.189 U
Fluoride	mg/L	0.130	0.100	0.0800 I J	0.140 J	0.140	0.170	0.0320 U	0.0320 U	0.0320 U	0.0320 U	0.0320 U	0.330	0.0320 U	0.0320 U	0.0320 U
Sulfate	mg/L	23.5	398	79.8	1790	63.3	1010	0.0924 I	0.0920 U	0.0920 U	0.0920 U	0.0920 U	0.0920 U	0.0920 U	0.0920 U	0.101 I
Ammonia	mg/L as N							0.0339 U	0.0339 U	0.0339 U	0.0339 U	0.0339 U	0.0339 U		0.0339 U	0.0339 U
Ammonium ion (NH_4^+)	mg/L							0.0437 U	0.0437 U	0.0437 U	0.0437 U	0.0437 U	0.0437 U		0.0437 U	0.0437 U
Unionized NH_3	mg/L															
Nitrate/Nitrite	mg/L as N							0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U	0.0140 U		0.0140 U	0.0140 U
TKN	mg/L							0.124 U	0.124 U	0.124 U	0.124 U	0.124 U	0.124 U		0.124 U	0.124 U
TN	mg/L							0.138 U	0.138 U	0.138 U	0.138 U	0.0140 U	0.138 U		0.0140 U	0.0140 U
ortho-Phosphate	mg/L as P							0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U		0.0100 U	0.0100 U
Total Phosphorus (P)	mg/L							0.00500 U	0.00660 I	0.00500 U	0.00500 U	0.00500 U	0.00500 U		0.00500 U	0.00500 U
Alkalinity as $CaCO_3$	mg/L	203	221	252	216	129	175	1.24 V	0.830 I V	1.24	1.04 V	1.66 V	2.06	1.44	2.88 V	2.05 V
Bicarbonate as HCO_3	mg/L	247	270	308	264	157	214	1.51 V	1.01 I V	1.52	1.27 V	2.02 V	2.52	1.76	3.51 V	2.51 V
Sulfide	mg/L	0.0570 U	0.0570 U Q	0.108	0.0570 U	0.0570 U	0.0570 U	0.0570 U	0.0570 U	0.0570 U	0.0570 U	0.0570 U	0.0570 U	0.0570 U	0.0570 U Q	0.0570 U Q
Total Dissolved Solids	mg/L	334	12800	1350	26000	400	11200	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Salinity	*	0.31 J	12.59	1.26 J	25.9	0.39 J	11.15									
Tritium	pCi/L (1σ)	2.8 (5.1)	56.6 (6.4)	7.2 (5.1)	339 (10.5)	13.5 (5.4)	6.1 (7.1)	0.6 (5.7)	-6.6 (7.2)	3.7 (4.9)	-11.4 (6.6)	6.7 (4.2)	-1.0 (4.7)	-19.7 (7.4)	-17.7 (6.2)	12.0 (8.5)

Notes:

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Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Detected in method blank.

Table 3.1-8. Range of Ion and Nutrient Concentrations in Groundwater.

Paramter	Units	Marine								Fresh/Brackish								TPGW-13							
		Historical Period of Record				Reporting Period				Historical Period of Record				Reporting Period				Historical Period of Record				Reporting Period			
		Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev
Temperature	°C	18.32	31.35	26.08	1.44	23.60	28.60	26.14	1.31	22.05	32.10	25.12	1.22	23.50	29.30	25.40	1.11	27.00	31.20	29.57	0.71	28.50	30.20	28.92	0.80
pH	SU	6.45	7.64	6.93	0.19	6.62	7.34	6.98	0.14	6.52	12.10	7.29	0.90	6.55	7.91	7.15	0.26	6.52	7.25	6.87	0.16	6.71	6.99	6.78	0.10
Dissolved Oxygen	mg/L	-0.07	1.93	0.29	0.22	0.07	1.15	0.29	0.18	0.03	4.58	0.38	0.36	0.13	1.97	0.36	0.24	0.02	1.10	0.27	0.22	0.14	0.96	0.41	0.23
Specific Conductance	µS/cm	20594	79893	56329	15370	23415	76347	55769	15175	305	41949	4985	9422	455	40525	5497	9837	72393	93579	82462	2955	80936	83311	81826	1022
Turbidity	NTU	0.00	8.50	0.46	0.81	0.03	14.03	0.43	1.33	0.00	105.40	2.35	8.01	0.01	13.02	0.85	1.70	0.00	5.62	0.36	0.65	0.09	0.65	0.30	0.17
Calcium	mg/L	259	1700	588	107	361	948	578	91.4	15.0	980	176	160	42.9	638	187	166	633	878	741	51.0	643	738	690	41.8
Magnesium	mg/L	300	2200	1350	450	437	2050	1417	453	0.0200	910	76.1	188	2.62	960	97.1	220	1670	2500	2144	189	1900	2210	2062	131
Potassium	mg/L	91.0	780	436	170	95.7	613	407	152	2.30	440	24.00	51.1	3.32	216	25.35	48.44	600	932	723	65.2	591	658	622	27.7
Sodium	mg/L	3340	18900	11338	3554	3920	16400	11200	3409	6.00	8300	763	1716	13.7	7970	911	1883	14700	20100	17381	1092	16400	21900	18567	1498
Boron	mg/L	0.580	7.78	4.30	1.85	0.807	6.96	4.47	1.88	0.0250	1.70	0.213	0.435	0.0316	1.75	0.234	0.460	6.50	9.20	7.51	0.598	7.14	7.95	7.44	0.291
Strontium	mg/L	3.96	15.0	10.0	2.16	5.89	15.3	10.3	2.10	0.521	8.80	1.93	2.04	0.429	8.23	2.24	2.32	13.4	18.9	14.9	1.03	15.4	16.6	15.9	0.438
Bromide	mg/L	23.0	180	77.5	27.4	26.6	102	70.8	21.4	0.0100	62.0	5.29	11.9	0.144	49.6	5.93	11.9	49.0	174	114	16.7	105	113	110	2.85
Chloride	mg/L	6400	36900	21998	6902	7900	31800	21665	6566	10.0	16300	1561	3451	18.8	15500	1790	3642	26000	39800	34371	2168	32500	34800	33217	739
Fluoride	mg/L	0.0100	3.30	0.444	0.459	0.120	0.830	0.320	0.190	0.0200	2.00	0.135	0.147	0.0800	0.170	0.114	0.0260	0.0200	3.60	0.629	0.775	0.200	0.440	0.278	0.101
Sulfate	mg/L	650	5760	2854	1030	792	3730	2662	858	0.472	2230	172	406	0.626	1790	190	415	3700	6330	4450	496	3990	4320	4195	107
Total Ammonia	mg/L as N	0.220	3.14	1.31	0.666	0.338	2.89	1.50	0.786	NA	NA	NA	NA	NA	NA	NA	NA	0.0610	5.58	2.42	1.05	3.31	7.03	4.58	1.58
Ammonium ion	mg/L	0.280	4.01	1.67	0.859	0.435	3.73	1.93	1.01	NA	NA	NA	NA	NA	NA	NA	NA	0.0780	7.15	3.08	1.35	4.26	9.05	5.89	2.03
Unionized ammonia	mg/L	0.00152	0.0423	0.00964	0.00534	0.00210	0.0183	0.00901	0.00415	NA	NA	NA	NA	NA	NA	NA	NA	0.000718	0.184	0.0190	0.0248	0.0141	0.0277	0.0198	0.00484
Nitrate/Nitrite	mg/L as N	0.00470	1.20	0.0340	0.112	0.0140	0.204	0.0219	0.0380	NA	NA	NA	NA	NA	NA	NA	NA	0.00470	0.34	0.05175	0.0600	0.0140	0.0140	0.0140	0.00
Total Kjeldahl Nitrogen	mg/L	0.260	3.50	1.78	0.841	0.772	3.52	1.97	0.791	NA	NA	NA	NA	NA	NA	NA	NA	1.50	5.40	3.34	1.00	3.85	7.61	5.35	1.47
Total Nitrogen	mg/L	0.260	3.51	1.80	0.848	0.772	3.52	1.98	0.795	NA	NA	NA	NA	NA	NA	NA	NA	1.50	5.43	3.41	1.01	3.85	7.61	5.35	1.47
Orthophosphate	mg/L	0.00140	0.100	0.0375	0.0192	0.0100	0.0762	0.0291	0.0185	NA	NA	NA	NA	NA	NA	NA	NA	0.00140	0.0854	0.0417	0.0258	0.0100	0.0520	0.0239	0.0148
Total Phosphorus	mg/L	0.00220	0.0845	0.0366	0.0185	0.00900	0.219	0.0476	0.0390	NA	NA	NA	NA	NA	NA	NA	NA	0.00220	0.152	0.0509	0.0259	0.0523	0.0886	0.0662	0.0125
Alkalinity	mg/L	70.0	590	234	84.7	126	549	268	93.5	30.0	580	223	66.0	129	322	225	48.2	116	381	207	54.0	264	362	296	42.6
Bicarbonate Alkalinity	mg/L as HCO_3	70.0	720	254	100	154	670	326	114	30.0	417	236	61.72	157	393	274	58.8	116	465	228	79.5	322	442	361	52.2
Sulfide	mg/L	0.0140	22.0	3.36	4.17	0.0570	16.5	3.68	4.34	0.0140	19.0	0.891	1.22	0.0570	5.73	0.373	0.966	0.100	39.1	7.53	9.13	1.50	18.9	5.31	6.15
Total Dissolved Solids	mg/L	7700	71900	36354	11939	13600	60800	37844	11545	160	27300	2829	5630	284	26400	3255	6185	41100	75000	57290	6008	52200	62800	58267	3796
Salinity (PSS-78)	*	12.30	57.88	37.68	11.32	14.16	52.90	37.26	11.13	0.14	26.93	2.94	5.92	0.22	25.89	3.25	6.18	49.41	66.97	57.80	2.43	56.52	58.48	57.26	0.84
Tritium	pCi/L	-11.8	3770	1065	1077	1.4	4605	973	1053	-21.6	440	34.5	83.1	-5.7	370	39.3	78.2	2133	6390	3825	665	2615	6647	4067	1295

Notes:

1. Marine wells include: TPGW-1S, -1M, -1D, -2S, -2M, -2D, -3S, -3M, -3D, -4M, -4D, -5M, -5D, -6M, -6D, -10S, -10M, -10D, -11S, -11M, -11D, -12S, -12M, -12D, -14S, -14M, -14D.
2. Fresh/Brackish wells include: TPGW-4S, -5S, -6S, -7S, -7M, -7D, -8S, -8M, -8D, -9S, -9M, -9D, -L3-18, -L5-18, -G21-18, -G21-58, -G28-18, -G28-58, -G35-18, -G35-58

Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

*PSS-78 salinity is unitless.

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
HCO_3 = Bicarbonate.
Max = Maximum.
mg/L = Milligram(s) per liter.
Min = Minimum.
N = Nitrogen.
NA = Not applicable, analyte not collected/required for location/event.
NH3 = Ammonia.
NH4+ = Ammonium ion.
NTU = Nephelometric Turbidity Unit(s).
pCi/L = PicoCuries per liter.
Std Dev = Standard deviation.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.

Table 3.2.1. Probe Types/Automated Measurements at Surface Water Stations for the Reporting Period.

Surface Water Site	Probe	Parameters Measured
TPSWC-1T	AT200	Water Quality, Stage
TPSWC-1B	AT100	Water Quality
TPSWC-2T	AT200	Water Quality, Stage
TPSWC-2B	AT100	Water Quality
TPSWC-3T	AT200	Water Quality, Stage
TPSWC-3B	AT100	Water Quality
TPSWC-4T	AT200	Water Quality, Stage
TPSWC-4B	AT100	Water Quality
TPSWC-5T	AT200	Water Quality, Stage
TPSWC-5B	AT100	Water Quality
TPSWID-1T	AT200	Water Quality, Stage
TPSWID-1B	AT100	Water Quality
TPSWID-2T	AT200	Water Quality, Stage
TPSWID-2B	AT100	Water Quality
TPSWID-3T	AT100	Water Quality
TPSWID-3B	AT200	Water Quality, Stage
TPSWCCS-1B	AT200	Water Quality, Stage
TPSWCCS-2B	AT200	Water Quality, Stage
TPSWCCS-3B	AT200	Water Quality, Stage
TPSWCCS-4T	AT200	Water Quality, Stage
TPSWCCS-5T	AT200	Water Quality, Stage
TPSWCCS-6T	AT200	Water Quality, Stage
TPSWCCS-7B	AT200	Water Quality, Stage
TPBBSW-3B	AT200	Water Quality, Stage
TPBBSW-4B	AT100	Water Quality
TPBBSW-5B	AT100	Water Quality
TPBBSW-10B	AT200	Water Quality, Stage
TPBBSW-14B	AT200	Water Quality, Stage

Key:
AT = Aqua TROLL®.
B = Bottom.
T = Top.

Table 3.2-2. Statistical Summary of Automated Surface Water Specific Conductance (µS/cm).

	2018							2019					Reporting Period				Historical Period of Record			
Station	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPBBSW-3B_AT	53799	52711	52984	48986	49392	49218	50787	53187	51332	54113	53812	61098	37337	62814	52624	3676	18655	63371	49351	6981
TPBBSW-4B_AT	52934	52718	51264	48708	48028	51900	54293	54978	54972	57723	57867	58813	44461	60085	53682	3564	33490	61897	50612	5440
TPBBSW-5B_AT	47767	49644	46249	44282	48916	51843	53022	53691	54981	57454	58651	60522	38477	62650	52251	5115	29312	69581	48485	7022
TPBBSW-10B_AT	46928	44942	49027	38318	38721	42810	45235	48308	44749	48389	52660	55972	13542	60132	46364	6911	9593	64623	45985	9163
TPBBSW-14B_AT	53136	52544	51904	49265	50954	52807	53201	53632	52499	55491	54353	57268	45059	60168	53080	2460	31935	60805	45434	6679
TPSWC-1T_AT	2512	3420	1612	726	682	867	1660	1721	2138	3232	6589	6303	442	7146	2625	1966	315	10428	1139	1416
TPSWC-1B_AT	4651	4277	2168	1130	706	917	1813	1757	2529	4104	7416	6528	563	8166	3166	2224	387	25089	1545	2650
TPSWC-2T_AT	3426	3837	2145	627	843	2232	2289	2981	4528	7177	10434	12453	403	14279	4416	3714	256	21805	1695	2830
TPSWC-2B_AT	8227	5040	3671	695	924	2381	2771	3223	4786	10093	11469	13101	397	15832	5534	4308	267	26383	2154	3240
TPSWC-3T_AT	3119	4864	2774	719	1171	2613	2818	3811	4703	7291	10564	12832	408	13799	4705	3651	265	21717	1875	2764
TPSWC-3B_AT	14561	6434	4955	853	2085	4932	12365	5170	5736	23769	26749	16166	406	33662	10335	9044	265	46008	5410	6863
TPSWC-4T_AT	34057	32457	24035	12532	32420	42602	42446	36926	40124	52121	57124	54715	1005	60808	39048	12994	378	65333	31905	16945
TPSWC-4B_AT	36512	36119	29456	19578	38729	45887	45443	40854	44358	51903	58200	57931	1001	64061	42081	12116	388	66755	35853	17115
TPSWC-5T_AT	51810	51061	48076	45940	50360	52509	53218	54334	53727	55822	55927	58499	35437	59674	52609	3756	27741	62477	49341	6415
TPSWC-5B_AT	58362	53981	52877	50627	51989	53845	54028	54627	54409	56775	56983	59979	48425	62896	54875	2823	39376	71282	55094	5117
TPSWCCS-1B_AT	75201	79472	76548	66889	69532	69322	69105	72128	72243	76351	77837	82132	61443	86993	73997	5004	44133	128358	79684	14571
TPSWCCS-2B_AT	75995	78629	75436	65307	68961	70344	69253	72431	72206	73479	71931	88935	57964	91428	72603	4761	47717	129541	83689	13269
TPSWCCS-3B_AT	68671	71279	68847	60712	60812	64586	64877	67011	68188	69084	74284	76763	55806	81625	68028	5117	49131	128283	78557	13911
TPSWCCS-4T_AT	75023	78777	74148	64323	65529	65949	70144	74195	75817	77705	79711	83180	58414	86301	73718	6036	49572	126549	81391	13655
TPSWCCS-5T_AT	76000	79482	76653	66251	69696	70147	69585	71381	74974	77257	78804	83707	60202	89598	74495	5203	49973	125101	79570	13834
TPSWCCS-6T_AT	74040	78171	75296	65719	68296	68660	68191	71798	73807	79131	80212	86666	60938	90389	74011	6231	42852	126500	79384	12627
TPSWCCS-7B_AT	73453	76737	73581	64475	66291	66966	66831	68944	71758	71929	73693	77675	59845	81858	71037	4634	41390	129230	77260	14605
TPSWID-1T_AT	10670	8667	7038	5639	5076	5152	5192	5793	5758	6173	6124	9655	4614	17332	6746	1962	1605	45621	8474	7579
TPSWID-1B_AT	11042	8640	7099	5733	5121	5154	5199	6964	5897	9038	9149	15800	4713	24079	7926	3301	1594	48037	12932	10158
TPSWID-2T_AT	7487	6695	5435	4477	4381	4543	4393	4472	4153	4260	4696	5226	2896	8445	5023	1042	1308	55392	6536	7673
TPSWID-2B_AT	12541	*	7320	6212	5648	4578	4415	4507	4203	4239	4782	6243	3849	13587	5440	1720	2146	68416	18466	18929
TPSWID-3T_AT	7213	6892	5462	3468	3886	4833	4940	4851	4757	6056	7733	7048	2710	8713	5599	1406	1177	62140	6318	8454
TPSWID-3B_AT	7251	6613	5242	3949	5790	8381	6514	5063	5546	20961	25259	9488	3199	38994	9177	7603	1211	66206	11086	15175

Key:

Avg = Average. Historical Period of Record = Start-up of monitoring through May 2018.
Min = Minimum. Reporting Period = June 2018 through May 2019.
Max = Maximum. Std Dev = Standard Deviation.

* = Less than 21 days of data are available, so no monthly average is included. However all available hourly data included in annual min, max, ave, and STDDEV

3.2-3. Statistical Summary of Automated Surface Water Salinity (in PSS-78 Scale).

	2018							2019					Reporting Period				Historical Period of Record			
Station	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPBBSW-3B_AT	36.2	35.4	35.6	32.6	32.9	32.7	33.7	35.5	34.2	36.3	36.2	41.8	24.1	43.2	35.3	2.8	11.2	43.7	32.8	5.2
TPBBSW-4B_AT	35.6	35.4	34.3	32.4	31.9	34.7	36.4	36.9	37.0	39.1	39.3	40.0	29.2	41.0	36.1	2.7	21.3	42.5	33.8	4.1
TPBBSW-5B_AT	31.7	33.1	30.6	29.1	32.5	34.7	35.4	35.9	37.0	38.9	39.9	41.4	24.9	43.1	35.0	3.8	18.4	48.5	32.2	5.2
TPBBSW-10B_AT	31.1	29.6	32.7	24.9	25.2	28.0	29.7	31.9	29.4	32.1	35.3	37.9	7.9	41.1	30.7	5.1	5.5	44.5	30.4	6.7
TPBBSW-14B_AT	35.7	35.3	34.8	32.8	34.1	35.4	35.6	35.9	35.1	37.4	36.6	38.9	29.7	41.1	35.6	1.8	20.2	41.6	30.0	5.0
TPSWC-1T_AT	1.3	1.8	0.8	0.4	0.3	0.4	0.8	0.9	1.1	1.7	3.7	3.5	0.2	4.0	1.4	1.1	0.2	6.0	0.6	0.8
TPSWC-1B_AT	2.5	2.3	1.1	0.6	0.3	0.5	0.9	0.9	1.3	2.2	4.1	3.6	0.3	4.6	1.7	1.3	0.2	15.5	0.8	1.6
TPSWC-2T_AT	1.8	2.1	1.1	0.3	0.4	1.2	1.2	1.6	2.4	4.0	6.0	7.2	0.2	8.4	2.4	2.2	0.1	13.3	0.9	1.7
TPSWC-2B_AT	4.7	2.7	2.0	0.3	0.5	1.2	1.5	1.7	2.6	5.8	6.6	7.7	0.2	9.4	3.1	2.6	0.1	16.4	1.2	1.9
TPSWC-3T_AT	1.7	2.6	1.5	0.4	0.6	1.4	1.5	2.0	2.6	4.1	6.1	7.5	0.2	8.1	2.6	2.2	0.1	13.2	1.0	1.6
TPSWC-3B_AT	8.6	3.6	2.7	0.4	1.1	2.7	7.2	2.8	3.1	14.8	16.7	9.6	0.2	21.4	6.1	5.8	0.1	30.3	3.1	4.3
TPSWC-4T_AT	21.8	20.6	14.9	7.6	20.7	27.9	27.7	23.7	26.0	34.9	38.7	36.9	0.5	41.5	25.5	9.2	0.2	45.1	20.7	11.5
TPSWC-4B_AT	23.5	23.2	18.6	12.2	25.1	30.3	29.9	26.5	29.1	34.7	39.6	39.4	0.5	44.2	27.7	8.6	0.2	46.2	23.4	11.7
TPSWC-5T_AT	34.7	34.2	31.9	30.3	33.6	35.2	35.6	36.4	36.1	37.7	37.8	39.8	22.7	40.8	35.3	2.8	17.5	42.9	32.8	4.8
TPSWC-5B_AT	39.7	36.4	35.5	33.8	34.8	36.2	36.2	36.6	36.5	38.4	38.6	40.9	32.2	43.2	37.0	2.2	25.5	49.1	37.2	3.9
TPSWCCS-1B_AT	53.3	56.8	54.4	46.5	48.6	48.5	48.3	50.7	50.8	54.2	55.4	59.1	42.2	63.2	52.3	4.1	29.0	101.4	57.3	12.5
TPSWCCS-2B_AT	53.9	56.1	53.4	45.2	48.1	49.2	48.2	50.7	50.7	51.6	50.4	64.7	39.5	66.9	51.0	3.9	31.7	101.9	60.4	11.5
TPSWCCS-3B_AT	47.9	50.0	48.0	41.6	41.6	44.6	44.7	46.3	47.4	48.1	52.3	54.4	37.7	58.5	47.3	4.1	32.6	100.9	56.1	12.0
TPSWCCS-4T_AT	53.1	56.2	52.3	44.4	45.3	45.6	48.8	52.0	53.5	55.0	56.8	59.8	39.8	62.5	51.9	4.9	32.9	99.3	58.4	11.7
TPSWCCS-5T_AT	53.9	56.8	54.4	46.0	48.6	48.9	48.4	49.7	52.8	54.6	56.0	60.2	41.2	65.3	52.5	4.3	33.2	97.8	56.9	11.8
TPSWCCS-6T_AT	52.2	55.7	53.3	45.5	47.5	47.7	47.2	50.1	51.8	56.2	57.2	62.7	41.7	66.0	52.1	5.1	28.0	99.3	56.7	10.8
TPSWCCS-7B_AT	51.8	54.5	51.9	44.6	46.0	46.5	46.4	48.0	50.4	50.4	51.9	55.3	40.9	58.8	49.8	3.8	27.0	102.2	55.2	12.5
TPSWID-1T_AT	6.1	4.9	3.9	3.1	2.8	2.8	2.8	3.2	3.2	3.4	3.4	5.5	2.5	10.4	3.8	1.2	0.8	30.1	4.9	4.9
TPSWID-1B_AT	6.4	4.9	4.0	3.1	2.8	2.8	2.8	3.9	3.2	5.1	5.2	9.4	2.6	14.8	4.5	2.0	0.8	31.9	7.8	6.6
TPSWID-2T_AT	4.2	3.7	3.0	2.4	2.4	2.5	2.4	2.4	2.2	2.3	2.5	2.9	1.5	4.8	2.7	0.6	0.7	37.4	3.8	5.0
TPSWID-2B_AT	7.3	*	4.1	3.4	3.1	2.5	2.4	2.4	2.3	2.3	2.6	3.4	2.1	8.0	3.0	1.0	1.1	47.6	11.7	13.1
TPSWID-3T_AT	4.0	3.8	3.0	1.8	2.1	2.6	2.7	2.6	2.6	3.3	4.3	3.9	1.4	4.9	3.1	0.8	0.6	42.7	3.7	5.6
TPSWID-3B_AT	4.0	3.7	2.9	2.1	3.2	4.8	3.7	2.8	3.0	12.9	15.8	5.4	1.7	25.2	5.4	4.9	0.6	45.9	7.0	10.4

Key:

Avg = Average. Historical Period of Record = Start-up of monitoring through May 2018.

Min = Minimum. Reporting Period = June 2018 through May 2019.

Max = Maximum. Std Dev = Standard Deviation.

* = Less than 21 days of data are available, so no monthly average is included.
However all available hourly data included in annual min, max, ave, and STDDEV

Table 3.2-4. Statistical Summary of Automated Surface Water Temperature (ºC).

	2018							2019					Reporting Period				Historical Period of Record			
Station	2018-06	2018-07	2018-08	2018-09	2018-10	2018-11	2018-12	2019-01	2019-02	2019-03	2019-04	2019-05	MIN	MAX	AVG	STDDEV	MIN	MAX	AVG	STDDEV
TPBBSW-3B_AT	30.6	31.7	30.8	30.2	28.0	25.6	21.9	21.1	24.3	24.5	26.6	28.6	15.2	34.0	27.0	3.8	9.5	35.4	25.7	4.1
TPBBSW-4B_AT	30.4	31.7	30.8	30.2	28.2	25.9	22.1	21.7	23.8	24.5	26.6	28.6	19.0	33.3	27.0	3.5	15.9	35.1	26.4	3.7
TPBBSW-5B_AT	30.9	31.8	30.8	30.6	28.1	25.9	22.5	21.7	24.4	24.9	27.0	28.9	18.2	33.7	27.3	3.6	15.1	35.9	26.7	3.7
TPBBSW-10B_AT	30.7	31.8	30.9	30.4	28.0	25.7	21.9	21.3	24.4	24.6	26.7	28.7	17.1	34.6	27.1	3.8	13.9	35.4	26.6	3.7
TPBBSW-14B_AT	30.5	31.7	30.8	30.3	28.2	25.9	22.3	21.8	24.3	24.9	26.7	28.6	18.9	33.1	27.2	3.5	15.6	34.4	26.5	3.6
TPSWC-1T_AT	30.4	31.8	30.8	30.3	28.6	26.3	22.7	22.2	24.6	25.6	27.7	29.6	19.5	34.1	27.6	3.3	14.5	34.4	26.4	3.6
TPSWC-1B_AT	29.5	31.2	30.3	29.2	28.0	25.8	21.9	21.5	23.5	25.4	27.2	28.9	19.4	32.2	26.9	3.3	14.7	32.2	25.4	3.4
TPSWC-2T_AT	31.0	31.7	31.0	30.6	28.6	26.2	22.7	22.1	24.5	25.5	27.9	30.1	19.4	34.2	27.7	3.5	14.1	34.8	26.3	3.8
TPSWC-2B_AT	30.2	31.2	30.9	29.7	28.2	25.9	22.0	21.5	23.7	26.0	27.5	29.8	19.4	32.6	27.2	3.5	14.0	32.7	25.6	3.7
TPSWC-3T_AT	30.7	31.9	31.1	30.8	28.8	26.3	22.7	22.4	24.5	25.2	27.9	29.9	19.9	34.4	27.8	3.5	15.1	34.3	26.6	3.7
TPSWC-3B_AT	29.2	30.7	31.1	30.2	28.4	26.0	22.9	21.7	23.2	26.0	27.3	29.5	19.9	32.9	27.2	3.2	15.0	33.1	26.2	3.7
TPSWC-4T_AT	30.8	33.2	32.3	30.1	29.1	27.3	24.4	22.5	25.2	26.0	28.4	30.2	18.6	36.0	28.3	3.5	15.2	37.4	27.3	3.2
TPSWC-4B_AT	30.7	33.4	32.5	29.4	29.0	27.0	24.1	23.0	25.8	25.8	28.3	30.5	16.6	36.1	28.3	3.5	15.4	36.5	27.4	3.1
TPSWC-5T_AT	31.0	32.4	31.4	30.8	28.6	26.4	22.8	22.1	25.1	25.4	27.8	29.7	19.3	35.1	27.8	3.6	13.8	36.2	26.8	3.8
TPSWC-5B_AT	29.1	31.8	30.8	29.8	27.8	25.5	21.9	21.5	23.4	24.3	26.4	28.3	19.2	33.0	26.8	3.5	16.2	34.9	27.1	3.5
TPSWCCS-1B_AT	41.8	42.5	41.6	41.0	37.4	35.9	33.5	32.8	36.0	34.9	36.4	39.4	28.3	44.4	37.9	3.6	18.0	46.3	35.6	4.2
TPSWCCS-2B_AT	35.1	35.6	34.7	34.2	29.5	29.5	27.3	26.4	29.4	27.6	30.0	32.6	20.0	39.9	31.0	3.9	14.4	45.0	30.5	4.2
TPSWCCS-3B_AT	33.0	33.7	33.0	32.1	29.0	28.6	25.2	24.7	27.6	26.7	29.0	31.2	18.5	37.4	29.5	3.6	14.8	42.2	29.9	4.2
TPSWCCS-4T_AT	32.8	33.4	32.8	32.1	28.7	27.6	25.0	24.1	27.2	26.2	28.5	30.8	18.1	36.8	29.1	3.7	12.4	40.8	28.7	4.2
TPSWCCS-5T_AT	32.8	33.4	32.8	32.1	28.7	27.5	24.9	24.0	27.1	26.3	28.5	30.7	19.0	35.9	29.1	3.6	12.8	40.1	28.4	4.1
TPSWCCS-6T_AT	32.2	33.0	32.3	31.6	28.6	27.1	24.2	23.4	26.5	26.0	28.0	30.3	19.2	35.3	28.6	3.6	12.5	38.8	28.1	4.0
TPSWCCS-7B_AT	37.4	38.1	36.7	36.3	31.4	31.7	29.8	29.0	31.5	29.7	32.1	34.5	21.6	42.1	33.2	3.8	11.5	45.7	32.3	4.3
TPSWID-1T_AT	31.2	32.2	31.5	30.4	28.7	26.7	23.7	23.1	25.2	26.0	27.8	29.4	20.9	34.2	28.0	3.2	16.8	36.3	27.2	3.4
TPSWID-1B_AT	30.5	31.8	31.0	29.9	28.3	26.3	23.2	23.5	24.5	26.8	28.1	28.2	20.7	33.4	27.7	2.9	16.8	36.4	27.5	3.1
TPSWID-2T_AT	29.3	30.4	29.9	28.9	28.2	26.5	24.0	23.5	25.3	25.7	27.2	28.6	21.7	32.9	27.3	2.4	17.9	33.9	27.0	2.9
TPSWID-2B_AT	26.9	26.9	26.7	26.7	27.1	25.5	23.8	23.2	24.9	25.2	26.5	27.4	21.6	29.5	25.8	1.5	18.8	32.5	27.0	2.2
TPSWID-3T_AT	30.5	31.2	30.7	30.4	28.8	26.5	23.6	23.1	25.2	25.7	27.6	29.6	20.8	32.8	27.8	2.9	17.9	34.4	27.0	3.1
TPSWID-3B_AT	29.2	29.7	29.3	29.1	28.1	26.9	23.6	22.8	24.3	26.7	27.3	28.7	20.7	30.6	27.1	2.4	17.7	33.8	26.7	2.7

Key:

Avg = Average. Historical Period of Record = Start-up of monitoring through May 2018.

Min = Minimum. Reporting Period = June 2018 through May 2019.

Max = Maximum. Std Dev = Standard Deviation.

* = Less than 21 days of data are available, so no monthly average is included.
However all available hourly data included in annual min, max, ave, and STDDEV

Table 3.2-5. Summary of Surface Water Analytical Results from the June 2018 Sampling Event.

Parameter	Units	TPBBSW-3B		TPBBSW-4B		TPBBSW-5B		DUP1		TPSWC-1T		TPSWC-1B		TPSWC-2T		DUP1		TPSWC-2B		TPSWC-3T		TPSWC-3B		TPSWC-4T	
		06/19/2018		06/19/2018		06/19/2018		06/19/2018		06/11/2018		06/11/2018		06/12/2018		06/12/2018		06/12/2018		06/11/2018		06/11/2018		06/04/2018	
Temperature	°C	30.2		30.1		30.6				29.6		29.4		29.9				30.2		29.7		29.1		33.0	
pH	SU	8.40		8.16		7.95				7.8		7.40		7.68				7.45		8.06		7.7		7.34	
Dissolved Oxygen	mg/L	5.53		5.34		4.7				4.47		0.15		4.18				2.13		4.72		0.14		3.93	
Specific Conductance	µS/cm	54912		54121		50710				1943		3890		3480				6950		1928		18457		39741	
Turbidity	NTU	0.75		0.00		0.98				7.8		6.19		1.59				2.63		1.15		19.05		12.69	
Sodium	mg/L	10300		9860		9620		8920		256		572		515		518		1130		254		3290		7700	
Chloride	mg/L	21100		20900		19300		19300		478		1090		1020		1030		2390		464		6190		14500	
Salinity	*	36.21		35.63		33.11				0.98	J	2.04		1.81	J			3.78		0.97	J	10.86		25.12	
Tritium	pCi/L (1σ)	5.8 (4.0)	J	8.1 (3.0)	J	8.5 (3.0)	J	27.1 (3.4)		31.3 (3.5)	J	39.7 (3.7)	J	28.7 (4.3)	J	8.5 (3.9)		18.0 (4.1)	J	20.0 (3.2)	J	49.5 (3.9)		83.7 (7.2)	J

Notes:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is unitless.

061218-DUP1 was collected at 061218-TPSWC-2T

061918-DUP1 was collected at 061918-TPBBSW-5B

Key:

°C = Degrees Celsius.

µS/cm = MicroSiemen(s) per centimeter.

σ = sigma (Standard Deviation).

DUP = Duplicate.

EB = Equipment Blank.

FB = Field Blank.

I = Value between the MDL and PQL.

J = Estimated.

mg/L = Milligram(s) per liter.

NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples

NTU = Nephelometric Turbidity Units(s).

pCi/L = PicoCuries per liter.

SU = Standard Unit(s).

U = Analyzed for but not detected at the reported value.

Table 3.2-5. Summary of Surface Water Analytical Results from the June 2018 Sampling Event (continued).

Parameter	Units	TPSWC-4B		TPSWC-5T		TPSWC-5B		TPSWC-6T		TPSWC-6B		TPSWID-1T		TPSWID-1B		TPSWID-2T		TPSWID-2B		TPSWID-3T		TPSWID-3B		TPSWCCS-1B	
		06/04/2018		06/11/2018		06/11/2018		06/07/2018		06/07/2018		06/04/2018		06/04/2018		06/04/2018		06/04/2018		06/04/2018		06/04/2018		06/04/2018	
Temperature	°C	30.0		30.7		29.6		27.1		27.5		31.2		29.9		30.6		28.1		31.4		29.6		41.7	
pH	SU	7.20		7.99		7.52		7.28		7.31		8.06		7.42		7.87		7.02		7.78		7.74		8.18	
Dissolved Oxygen	mg/L	0.25		5.15		0.26		1.28		1.35		5.67		5.14		5.11		0.11		4.61		4.14		2.29	
Specific Conductance	µS/cm	40903		52585		61903		1088		1058		11995	J	13006		6080		11519		6779	J	8058		73060	
Turbidity	NTU	37.8		1.73		10.72		0.71		0.87		0.75		3.65		1.33		6.02		0.68		1.05		72.47	
Sodium	mg/L	8040		10900		13600		88.3		96.4		2000		2220		935		1910		1070		1280		15100	
Chloride	mg/L	15000		20100		24400		159		173		4840	J	4900		2200		4230		2500	J	2750		29400	
Salinity	*	26.04		34.47		41.51		0.54	J	0.52	J	6.79	J	7.42		3.27		6.53		3.67	J	4.43		49.53	
Tritium	pCi/L (1σ)	99.5 (7.7)	J	10.8 (3.0)	J	108 (5.5)		14.3 (3.7)		12.6 (3.7)		242 (11.9)		285 (13.1)		118 (8.4)		148 (9.1)		102 (7.4)		126 (8.4)		1388 (47.6)	

Notes:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is unitless.

061218-DUP1 was collected at 061218-TPSWC-2T

061918-DUP1 was collected at 061918-TPBBSW-5B

Key:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
I = Value between the MDL and PQL.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.2-5. Summary of Surface Water Analytical Results from the June 2018 Sampling Event (continued).

Parameter	Units	TPSWCCS-2B		TPSWCCS-3B		TPSWCCS-4T		TPSWCCS-5T		TPSWCCS-6T		TPSWCCS-7B		EB1		FB1		FB1		FB1		FB1		FB2	
		06/13/2018		06/04/2018		06/11/2018		06/04/2018		06/04/2018		06/04/2018		06/04/2018		06/11/2018		06/12/2018		6/13/2018		06/19/2018		06/19/2018	
Temperature	°C	32.2		32.5		31.6		33.3		32.8		38.4													
pH	SU	8.08		8.31		8.23		8.34		8.29		8.28													
Dissolved Oxygen	mg/L	2.07		4.39		2.71		3.86		2.86		4.08													
Specific Conductance	µS/cm	75609		68236		75071		73321		72878		72446													
Turbidity	NTU	75.57		69.96		77.27		78.07		77.77		72.88													
Sodium	mg/L	15700		13800		15800		15300		15300		15200		0.0650	U	0.0650	U	0.0650	U	0.0650	U	0.0650	U	0.0650	U
Chloride	mg/L	30600		27200		30200		29100		29700		29300		0.288	I	0.221	U	0.221	U	0.221	U	0.221	U	0.221	U
Salinity	*	52.09		46.27		51.69		50.22		49.89		49.25													
Tritium	pCi/L (1σ)	1266 (41.6)		1388 (47.7)		1265 (41.2)		1376 (48.0)		1388 (47.7)		1423 (48.4)		10.5 (5.3)		4.3 (3.5)		15.8 (3.7)		8.4 (3.0)		-1.5 (3.7)	UJ	8.1 (3.9)	

Notes:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is unitless.

061218-DUP1 was collected at 061218-TPSWC-2T

061918-DUP1 was collected at 061918-TPBBSW-5B

Key:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
I = Value between the MDL and PQL.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.2-6. Summary of Surface Water Analytical Results from the September 2018 Sampling Event.

Parameter	Units	TPBBSW-3B 09/19/2018		TPBBSW-4B 09/19/2018		TPBBSW-5B 09/19/2018		TPSWC-1T 09/06/2018		TPSWC-1B 09/06/2018		TPSWC-2T 09/06/2018		TPSWC-2B 09/06/2018		TPSWC-3T 09/06/2018		TPSWC-3B 09/06/2018		TPSWC-4T 09/05/2018		TPSWC-4B 09/05/2018		DUP1 09/05/2018		TPSWC-5T 09/05/2018	
Temperature	°C	30.7		30.9		31.2		29.6		28.4		30.3		29.2		31.1		30.5		31.1		29.9				28.3	
pH	SU	8.21		8.08		7.99		7.4		7.57		7.87		7.66		7.89		7.88		7.93		7.58				7.96	
Dissolved Oxygen	mg/L	4.30		4.58		3.84		4.11		3.21		6.16		4.06		6.48		4.71		4.67		2.8				4.19	
Specific Conductance	µS/cm	50969		48010		42840		702		1572		480		625		525		521		2703		25069				46864	
Turbidity	NTU	0.95		0.54		0.87		0.88		2.89		0.63		2.26		0.83		0.84		1.19		7.09				2.3	
Copper	mg/L							0.00188	I													0.0435	U	0.0435	U		
Silica, dissolved	mg/L																							2.10	I		
Calcium	mg/L	410		407		342		32.0		49.9		26.0		29.7		29.0		30.3		43.9	J	213		219		366	
Magnesium	mg/L	1290		1260		1040		9.82		21.9		7.12		9.29		7.33		7.36		43.7	J	545		568		1140	
Potassium	mg/L	388		376		317		3.41		8.61		2.79		3.77		3.18		3.22		15.0	J	169		176		359	
Sodium	mg/L	10300		10300		8460		79.9		215		49.9		74.8		57.1		58.6		383	J	4550		4670		9540	
Boron	mg/L	4.41		3.93		3.54		0.0703		0.111		0.0567		0.0650		0.0518		0.0518		0.235	I	2.09		2.10		4.30	
Strontium	mg/L	7.78		7.07		6.28		0.323		0.508		0.297		0.314		0.319		0.321		0.647		4.09		4.02		7.35	
Bromide	mg/L	61.7		57.8		51.2		0.270		1.12		0.133		0.261		0.156		0.156		2.22	J	28.0		29.8		56.5	
Chloride	mg/L	19300		18100		16300		141		415		80.2		128		97.1		98.5		775	J	8100		8700		17000	
Fluoride	mg/L	0.910	J	0.860	J-	0.810	J	0.0700	I	0.0900	I	0.0800	I	0.0800	I	0.0700	I	0.0700	I	0.120		0.520		0.520		0.830	
Sulfate	mg/L	2530		2370		2110		4.52		23.2		1.94		3.90		2.37		2.36		80.6	J	1140	I	1180		2210	
Ammonia	mg/L as N	0.0503	I	0.0794	I	0.197		0.158		0.258	J+	0.127		0.146		0.139		0.156		0.173		0.180		0.181		0.0893	I
Ammonium ion (NH_4^+)	mg/L	0.128	I	0.128	I	0.252		0.202		0.331	J	0.163		0.187		0.178		0.199		0.222		0.231		0.231		0.128	I
Unionized NH_3	mg/L	0.00597		0.00737		0.0158		0.00368		0.00811	J	0.00882		0.00594		0.0106		0.0112		0.0143		0.00582				0.00543	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0290	I J-	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	0.910	J	0.704	J+	0.776	J	0.972		1.23		0.879		0.970		0.936		0.863		0.836		1.07		1.01		0.894	
TN	mg/L	0.910	J	0.704	J	0.776	J	0.972		1.26	J	0.879		0.970		0.936		0.863		0.836		1.07		1.01		0.894	
Orthophosphate as P	mg/L	0.0112	I J	0.0111	I J	0.0105	I	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0124	I J	0.0135	I	0.0100	U
Total Phosphorus (P)	mg/L	0.00900	U J	0.00900	U J	0.00900	U	0.0114	I	0.0228	I	0.00900	U	0.00900	I	0.0116	I	0.0101	I	0.0117	I	0.00900	U J	0.00900	U	0.00900	U
Alkalinity	mg/L	148		139		154		85.9		105		84.7		92.1		92.1		85.3		85.3	J	148		138		134	
Bicarbonate Alkalinity	mg/L	180		170		188		105		128		103		112		112		104		104	J	181		168		164	
Sulfide	mg/L	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.570	U	0.0570	U	0.570	U	0.570	U
Total Dissolved Solids	mg/L			31800																							
Dissolved Inorganic Carbon	mg/L																										
Salinity	*	33.28		31.11		27.38		0.34	J	0.79	J	0.23	J	0.30	J	0.25	J	0.25	J	1.38	J	15.17				30.33	
Tritium	pCi/L (1σ)	21.3 (5.8)		3.8 (9.5)	UJ	14.8 (4.7)		109 (7.1)		62.0 (6.4)		127 (8.4)		124 (8.1)		103 (6.7)		112 (10.0)		107 (9.8)		67.2 (7.1)		87.8 (6.0)		21.2 (6.4)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
090518-DUP1 is a duplicate of -TPSWC-4B
090618-DUP1 is a duplicate of TPSWID-3T
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.2-6. Summary of Surface Water Analytical Results from the September 2018 Sampling Event (continued).

Parameter	Units	TPSWC-5B		TPSWC-6T		TPSWC-6B		TPSWID-1T		TPSWID-1B		TPSWID-2T		TPSWID-2B		TPSWID-3T		DUP1		TPSWID-3B		TPSWCCS-1B		TPSWCCS-2B		TPSWCCS-3B	
		09/05/2018		09/13/2018		09/13/2018		09/06/2018		09/06/2018		09/06/2018		09/06/2018		09/06/2018		09/06/2018		09/06/2018		09/05/2018		09/10/2018		09/06/2018	
Temperature	°C	29.2		28.2		28.2		30.7		29.5		30.6		28.6		30.8				28.4		37.6		33.4		31.7	
pH	SU	7.84		7.28		7.25		7.99		7.91		7.81		7.08		7.93				7.56		8.18		8.26		8.31	
Dissolved Oxygen	mg/L	1.7		1.20		0.95		5.43		5.32		5.26		0.34		5.94				4.55		4.67		2.16		5.67	
Specific Conductance	µS/cm	53413		770		777		6187		6259		4478		6312		3583				4651		65668		66595		61204	
Turbidity	NTU	3.12		0.97		1.00		1.53		1.81		1.61		119.20		1.11				2.27		69.94		72.99		69.36	
Copper	mg/L	0.0435	U							0.0843				0.0174	U			0.0174	U	0.0174	U	0.0723	I				
Silica, dissolved	mg/L																	2.94				15.7		16.2		15.4	
Calcium	mg/L	411		89.0		88.3		155	J	155	J	138		199		115		114		152		576		612		593	
Magnesium	mg/L	1300		9.35		9.43		102	J	105	J	65.2		96.9		50.6		49.8		66.2		1620		1670		1590	
Potassium	mg/L	410		8.71		8.58		32.1	J	32.7	J	22.9		32.9		17.4		17.4		22.1		512		515		493	
Sodium	mg/L	10800		53.4		55.3		913	J	932	J	645		949		518		512		676		13500		13800		13100	
Boron	mg/L	5.16		0.0664		0.0650		0.335	I	0.310	I	0.222	I	0.299	I	0.184	I	0.185	I	0.209	I	7.18		6.34		5.62	
Strontium	mg/L	8.79		0.951		0.942		1.92		1.70		1.47		2.32		1.25		1.22		1.80		16.3		14.7		13.0	
Bromide	mg/L	64.1		0.436		0.450		5.64	J	5.74	J	3.83		5.86		2.92		2.92		4.13		81.4		86.0		74.5	
Chloride	mg/L	19300		99.4		103		1920	J	1930	J	1320		1930		1040		1030		1400		25200		26800		23800	
Fluoride	mg/L	0.880		0.110		0.110		0.150		0.150		0.140		0.160		0.120		0.140		0.130		1.32		1.35		1.28	J-
Sulfate	mg/L	2500		19.7		19.8		190	J	192	J	121		187		85.8		85.1		116		3460		3690		3230	
Ammonia	mg/L as N	0.134		0.0899	I	0.0778	I	0.185		0.140		0.317		0.875		0.161		0.161		0.255		0.141		0.151		0.160	
Ammonium ion (NH_4^+)	mg/L	0.172		0.128	I	0.128	I	0.237		0.180		0.406		1.12		0.206		0.206		0.327		0.180		0.193		0.205	
Unionized NH_3	mg/L	0.00643		0.00145	I	0.00117	I	0.0167		0.00987		0.0194		0.00903		0.0130				0.00775		0.0222		0.0217		0.0236	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.143		0.122		0.211		0.0140	U	0.248		0.243		0.152		0.0500		0.0140	U	0.0140	U
TKN	mg/L	1.00		0.622		0.518		0.750		0.795		0.908		1.59		0.814		0.707		0.839		3.56		2.84		3.89	
TN	mg/L	1.00		0.622		0.518		0.893		0.917		1.12		1.59		1.06		0.950		0.991		3.61		2.84		3.89	
Orthophosphate as P	mg/L	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0130	I	0.0176	I	0.0100	U J-
Total Phosphorus (P)	mg/L	0.00900	U	0.00900	U	0.00900	U	0.00900	U	0.00900	U	0.00900	U	0.0256		0.00970	I	0.00900	U	0.00900	U	0.0250		0.0319		0.0274	
Alkalinity	mg/L	146		210		216		256	J	261	J	230		292		183		183		226		173		185		198	
Bicarbonate Alkalinity	mg/L	178		257		263		312	J	319	J	281		356		223		224		275		211		226		221	
Sulfide	mg/L	0.570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	4.92		0.0570	U	0.0570	U	0.0570	U	0.570	U	0.570	U	0.570	U
Total Dissolved Solids	mg/L																										
Dissolved Inorganic Carbon	mg/L																										
Salinity	*	35.13		0.37	J	0.38	J	3.34		3.38		2.36		3.42		1.87	J			2.47		44.02		44.95		40.89	
Tritium	pCi/L (1σ)	25.4 (5.4)		14.2 (4.2)		12.3 (7.9)		200 (10.2)		202 (9.5)		145 (8.5)		73.4 (6.3)		148 (9.2)		136 (7.9)		99.0 (7.2)		6023 (44.5)		6151 (46.8)		5539 (45.6)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
090518-DUP1 is a duplicate of -TPSWC-4B
090618-DUP1 is a duplicate of TPSWID-3T
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank
FB = Field Blank.
HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
J = Estimated (+/- indica
mg/L = Milligram(s) per li
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.2-6. Summary of Surface Water Analytical Results from the September 2018 Sampling Event (continued).

Parameter	Units	TPSWCCS-4T 09/05/2018		TPSWCCS-5T 09/10/2018		TPSWCCS-6T 09/05/2018		TPSWCCS-7B 09/06/2018		EB1 09/05/2018		FB1 09/06/2018		FB1 09/10/2018		FB1 9/13/2018		FB1 09/19/2018	
Temperature	°C	30.1		31.2		30.3		34.8											
pH	SU	8.34		8.39		8.27		8.40											
Dissolved Oxygen	mg/L	4.60		3.86		4.57		6.60											
Specific Conductance	µS/cm	68536		64192		67129		66245											
Turbidity	NTU	81.59		76.96		78.11		77.14											
Copper	mg/L					0.0664	I			0.00174	U	0.00174	U	0.00174	U				
Silica, dissolved	mg/L	16.3		15.7		15.8		16.5		0.0936	I	0.0430	U	0.0430	U				
Calcium	mg/L	619		586		605		656		0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U
Magnesium	mg/L	1750		1590		1710		1800		0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U
Potassium	mg/L	558		491		536		558		0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U
Sodium	mg/L	14500		13100		14000		14900		0.0650	U	0.0650	U	0.0650	U	0.0650	U	0.0650	U
Boron	mg/L	7.17		6.35		7.13		6.31		0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U
Strontium	mg/L	16.8		14.5		16.8		14.3		0.00100	U	0.00100	U	0.00100	U	0.00100	U	0.00100	U
Bromide	mg/L	87.3		79.6		84.2		82.1		0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
Chloride	mg/L	26700		24700		25900		26300		0.221	U	0.221	U	0.221	U	0.221	U	0.221	U
Fluoride	mg/L	1.35		1.32		1.30		1.35	J	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U
Sulfate	mg/L	3740		3400		3570		3590		0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.0920	U
Ammonia	mg/L as N	0.144		0.155		0.156		0.146		0.0398	U	0.0398	U	0.0398	U	0.0398	U	0.0398	U
Ammonium ion (NH_4^+)	mg/L	0.185		0.198		0.199		0.187		0.128	U			0.128	U				
Unionized NH_3	mg/L	0.0197		0.0257		0.0189		0.0300											
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	4.49		3.15		3.45		3.62		0.126	U	0.126	U	0.126	U	0.126	U	0.126	U
TN	mg/L	4.49		3.15		3.45		3.62		0.140	U	0.140	U	0.140	U	0.140	U	0.140	U
Orthophosphate as P	mg/L	0.0150	I	0.0100	U	0.0140	I	0.0100	U J	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U
Total Phosphorus (P)	mg/L	0.0240	I	0.0313		0.0267		0.0350		0.00900	U	0.00900	U	0.00900	U	0.00900	U	0.00900	U
Alkalinity	mg/L	181		190		177		188		1.40		1.59		1.78		1.19		2.58	
Bicarbonate Alkalinity	mg/L	209		232		216		189		1.71		1.94		2.17		1.45		3.14	
Sulfide	mg/L	0.570	U	0.570	U	0.570	U	0.930	I	0.0570	U	0.0570	U	0.570	U	0.0570	U	0.0570	U
Total Dissolved Solids	mg/L											15.0	U	15.0	U	15.0	U	15.0	U
Dissolved Inorganic Carbon	mg/L																		
Salinity	*	46.61		43.20		45.51		44.61											
Tritium	pCi/L (1σ)	7275 (42.8)		5533 (42.2)		6480 (53.9)		6378 (48.5)		4.0 (5.5)	UJ	-0.30 (5.8)	UJ	6.8 (5.9)				4.0 (6.6)	UJ

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
090518-DUP1 is a duplicate of -TPSWC-4B
090618-DUP1 is a duplicate of TPSWID-3T
Text in blue are revised from the February 2019 Semi-Annual Data Delivery.

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
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DUP = Duplicate.
EB = Equipment Blank
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HCO_3 = Bicarbonate.
I = Value between the MDL and PQL.
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mg/L = Milligram(s) per li
N = Nitrogen
NH_3 = Ammonia.
NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.2-7. Summary of Surface Water Analytical Results from the December 2018 Sampling Event.

Parameter	Units	TPBBSW-3B		TPBBSW-4B		TPBBSW-5B		TPSWC-1T		TPSWC-1B		TPSWC-2T		TPSWC-2B		TPSWC-3T		TPSWC-3B		TPSWC-4T		TPSWC-4B		TPSWC-5T	
		12/12/2018		12/12/2018		12/12/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/04/2018		12/04/2018		12/04/2018	
Temperature	**°C**	17.9		20.1		19.1		26.1		24.3		26.4		24.1		25.9		24.7		25.7		25.3		26.8	
pH	**SU**	8.12		7.84		7.68		8.1		7.76		8.11		7.85		7.90		7.52		7.86		7.86		7.99	
Dissolved Oxygen	**mg/L**	7.23		6.29		6.98		6.62		4.81		6.21		4.8		4.94		0.55		3.84		3.41		5.28	
Specific Conductance	**µS/cm**	51470		55171		53712		1341		1173		3151		2870		4119		17648		53721		56040		55870	
Turbidity	**NTU**	0.94		0.69		0.33		1.05		5.56		1.03		2.49		0.94		1.63		0.54		2.61		0.77	
Sodium	**mg/L**	10100		11200		11000		176		152		457		423		596		3070		10400		11000		11000	
Chloride	**mg/L**	18500		20200		19400		325		274		907		806		1220		5630		19600		20900		20600	
Salinity	*****	33.88		36.66		35.54		0.67	J	0.58	J	1.64	J	1.49	J	2.18		10.4		35.47		37.21		37.04	
Tritium	**pCi/L (1σ)**	33.7 (6.6)		28.9 (5.7)		27.0 (5.9)		189 (8.7)		221 (9.9)		166 (9.0)		154 (8.2)		118 (9.1)	J	94.9 (6.4)	J	269 (11.0)		161 (9.2)	J	50.4 (6.5)	J

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120318-DUP1 was collected at 120318-TPSWID-2B
120418-DUP1 was collected at 120418-TPSWCCS-5T
Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.2-7. Summary of Surface Water Analytical Results from the December 2018 Sampling Event (continued).

Parameter	Units	TPSWC-5B		TPSWC-6T		TPSWC-6B		TPSWID-1T		TPSWID-1B		TPSWID-2T		TPSWID-2B		DUP1		TPSWID-3T		TPSWID-3B		TPSWCCS-1B		TPSWCCS-2B	
		12/04/2018		12/11/2018		12/11/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/03/2018		12/04/2018	
Temperature	**°C**	24.6		21.7		21.7		25.8		25.3		25.7		25.0				26.2		27.2		35.5		30.8	
pH	**SU**	7.91		7.35		7.35		7.92		7.71		7.56		7.49				7.94		7.04		8.11		8.11	
Dissolved Oxygen	**mg/L**	4.23		2.65		2.86		6.19		5.30		4.16		2.68				6.60		0.29		2.64		1.33	
Specific Conductance	**µS/cm**	55899		962		1033		5248		5366		4691		4785				5875		21270		72133		72838	
Turbidity	**NTU**	0.8		0.68		0.99		0.39		1.04		0.42		0.68				0.36		24.18		79.91		78.75	
Sodium	**mg/L**	10900		82.9		93.1		753		759		640		672		676		837		3610		14700		14300	
Chloride	**mg/L**	20700		159		180		1510		1540		1330		1350		1390		1790		6870		27900		28400	
Salinity	*****	37.12		0.47	J	0.51	J	2.82		2.89		2.50		2.56				3.18		12.71		49.17		49.95	
Tritium	**pCi/L (1σ)**	55.2 (9)	J	8.4 (6.4)		12.4 (5.2)		322 (13.4)		315 (9.4)		165 (6.7)		119 (6.5)		145.6 (10.5)		174 (7.5)		178 (8.6)		16496 (145)		17945 (84.0)	

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120318-DUP1 was collected at 120318-TPSWID-2B
120418-DUP1 was collected at 120418-TPSWCCS-5T

Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.2-7. Summary of Surface Water Analytical Results from the December 2018 Sampling Event (continued).

Parameter	Units	TPSWCCS-3B		TPSWCCS-4T		TPSWCCS-5T		DUP1		TPSWCCS-6T		TPSWCCS-7B		EB1		FB1		FB1		FB1	
		12/03/2018		12/04/2018		12/04/2018		12/04/2018		12/03/2018		12/03/2018		12/03/2018		12/4/2018		12/11/2018		12/12/2018	
Temperature	°C	29.5		28.9		29.1				26.7		32.2									
pH	SU	8.22		8.26		8.22				8.13		8.22									
Dissolved Oxygen	mg/L	4.99		3.98		3.47				2.38		5.33									
Specific Conductance	µS/cm	68107		72625		72628				72873		71755									
Turbidity	NTU	76.84		82.40		83.30				84.37		77.61									
Sodium	mg/L	13500		14600		14000		14400		15100		14200		0.0650	U	0.0650	U	0.0650	U	0.0650	U
Chloride	mg/L	25900		28200		28300		28300		28600		28100		0.221	U	0.221	U	0.221	U	0.189	U
Salinity	*	46.30		49.87		49.86				50.14		49.03									
Tritium	pCi/L (1σ)	15703 (77.0)		18176 (78.0)		17379 (77.0)		17277 (80)		18529 (86.0)		18054 (77.0)		12.8 (6.1)		15.3 (5.2)		-1.6 (4.5)	UJ	-8.1 (6.3)	UJ

Notes:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is unitless.
120318-DUP1 was collected at 120318-TPSWID-2B
120418-DUP1 was collected at 120418-TPSWCCS-5T
Key:
°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
DUP = Duplicate.
EB = Equipment Blank.
FB = Field Blank.
J = Estimated.
mg/L = Milligram(s) per liter.
NA = Not applicable; field parameters and calculated values not collected/reported for duplicate and blank samples
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
SU = Standard Unit(s).
U = Analyzed for but not detected at the reported value.

Table 3.2-8. Summary of Surface Water Analytical Results from the March 2019 Sampling Event.

Parameter	Units	TPBBSW-3B		TPBBSW-4B		TPBBSW-5B		TPSWC-1T		TPSWC-1B		TPSWC-2T		TPSWC-2B		TPSWC-3T		TPSWC-3B		TPSWC-4T		TPSWC-4B		TPSWC-5T	
		03/07/2019		03/07/2019		03/07/2019		03/12/2019		03/12/2019		03/12/2019		03/12/2019		03/12/2019		03/12/2019		03/06/2019		03/06/2019		03/06/2019	
Temperature	°C	22.1		23.2		22.1		28.4		26.3		26.5		26.2		27.3		26.4		24.9		24.9		24.5	
pH	SU	7.16		8.24		8.21		8.08		7.88		8.18		7.49		8.10		7.23		7.77		7.75		7.85	
Dissolved Oxygen	mg/L	6.97		7.18		7.21		5.93		4.87		6.4		2.99		6.57		0.28		3.62		3.59		2.74	
Specific Conductance	µS/cm	56201		55660		56694		2819		2976		5377		9005		6131		25646		46192		46170		56968	
Turbidity	NTU	1.52		0.98		0.79		1.6		3.46		0.79		1.81		0.74		6.62		2.96		5.6		1.91	
Silica, dissolved	mg/L																								
Calcium	mg/L	449		449		465		78.7		80.4		119		189		136		304	J-	410		414		470	
Magnesium	mg/L	1420		1430		1460		36.9		39.6		74.6		140		87.0		527		1140		1140		1470	
Potassium	mg/L	429		430		440		13.1		14.0		25.0		40.9		28.4		156		349		346		446	
Sodium	mg/L	11000		11000		11200		399	J-	424	J	820		1460		948		4650		9160		8980		11500	
Boron	mg/L	4.81	I	4.86	I	4.68	I	0.143		0.148		0.214		0.354		0.244		1.70		3.22	I	3.82	I	4.87	I
Strontium	mg/L	8.17		8.15		7.94		0.905		0.949		1.35		2.33		1.64		4.75		5.81		6.95		8.10	
Bromide	mg/L	73.0	J	73.8	J	73.5	J	2.21		2.47		4.62		9.00		5.460		28.8		57.7		57.1		73.9	
Chloride	mg/L	22600	J	23100	J	22900	J	795		845		1680		2940		1940		9100		18400		18000		22800	
Fluoride	mg/L	0.840	J	0.860	J	0.860	J-	0.100		0.100		0.110		0.120		0.110		0.380		0.710		0.710		0.840	
Sulfate	mg/L	2820	J	2880	J	2820	J	35.6		38.4		69.4		191		81.5		1000		2350		2280		2830	
Ammonia	mg/L as N	0.0349	I	0.0339	U	0.0339	U	0.0890	I	0.161		0.144		0.452		0.210		0.628		0.130		0.129		0.0972	I
Ammonium ion (NH_4^+)	mg/L	0.0450	I	0.0437	U	0.0437	U	0.115	I	0.208		0.185		0.583		0.271		0.810		0.167		0.166		0.125	I
Unionized NH_3	mg/L	0.000400	U	0.000547	I	0.00152	I	0.00852		0.00871		0.0150		0.00993		0.0193		0.00721		0.00413		0.00392		0.00340	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0160	I	0.0140	I	0.0490	I	0.0520		0.0690		0.0770		0.0810		0.0140	U	0.0330	I	0.0310	I	0.0150	I
TKN	mg/L	0.531		0.585		0.809		1.06		1.07		0.124	U	1.44		1.26		1.54		0.944		0.967		0.776	
TN	mg/L	0.531	J	0.601	J	0.825		1.11		1.12		0.0193		1.51		1.34		1.54		0.977		1.00		0.791	J
Orthophosphate as P	mg/L	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U
Total Phosphorus (P)	mg/L	0.00500	U	0.00500	U	0.00500	U	0.0211		0.0223		0.0132	I	0.0119	I	0.0106	I	0.0107	I	0.00500	U	0.00500	U	0.00500	U
Alkalinity	mg/L	139	J	142	J	157	J	164		164		187		239		202		239		199		198		162	
Bicarbonate Alkalinity	mg/L	170	J	174	J	192	J	191		200		215		292		236		291		242		241		198	
Sulfide	mg/L	0.0570	U J	0.0570	U J	0.0570	U J-	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U
Salinity	*	37.38		36.94		37.75		1.45	J	1.54	J	2.89		5.02		3.32		15.61		29.96		29.94		37.92	
Tritium	pCi/L (1σ)	3.0 (7.1)		35.4 (7.0)		20.0 (5.4)		161 (9.5)		169 (9.6)		90.2 (9.1)		50.0 (9.5)		79.6 (6.0)		36.9 (5.5)		98.2 (7.1)		89.9 (9.6)		34.0 (6.1)	

NOTES:

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* PSS-78 salinity is unitless.

031819-DUP1 is a duplicate of -TPSWCCS-1B

031819-DUP2 is a duplicate of -TPSWID-1T

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HCO_3 = Bicarbonate.
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NH_4^+ = Ammonium ion.
NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.2-8. Summary of Surface Water Analytical Results from the March 2019 Sampling Event (continued).

Parameter	Units	TPSWC-5B		TPSWC-6T		TPSWC-6B		TPSWID-1T		DUP2		TPSWID-1B		TPSWID-2T		TPSWID-2B		TPSWID-3T		TPSWID-3B		TPSWCCS-1B		DUP1	
		03/06/2019		03/13/2019		03/13/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019	
Temperature	°C	24.6		24.7		24.7		26.1				27.3		26.5		26.1		26.8		26.7		34.0			
pH	SU	7.84		7.18		7.25		7.98				7.04		7.66		7.41		7.76		7.18		8.09			
Dissolved Oxygen	mg/L	2.39		2.34		2.22		6.31				0.47		5.07		2.45		5.15		0.20		2.61			
Specific Conductance	µS/cm	57080		829		829		6013				12415		4262		4228		5792		39160		82028			
Turbidity	NTU	2.47		0.76		1.04		0.82				19.93		0.61		1.00		1.08		19.41		87.00			
Silica, dissolved	mg/L																					15.2		16.3	
Calcium	mg/L	461		84.2		82.6		148		152		180		149		148		170		358		723		735	
Magnesium	mg/L	1450		10.2		10.0		97.0		98.7		230		54.5		53.6		78.0		878		2110		2130	
Potassium	mg/L	441		12.5		12.3		34.1		34.5		83.5		19.2		18.8		25.6		268		672		673	
Sodium	mg/L	11500		66.0		65.9		984		877		1870		653		655		935		8120		15800		15900	
Boron	mg/L	4.85	I	0.0752		0.0800		0.396	I	0.392	I	0.963		0.191	I	0.187	I	0.222	I	2.83	I	8.75		8.67	
Strontium	mg/L	8.14		1.09		1.14		2.03		2.06		2.81		1.80		1.78		2.06		6.58		20.5		20.6	
Bromide	mg/L	73.7		0.538		0.537		5.40		5.38		13.4	J	3.99		3.99		5.38		47.7		113	J	114	
Chloride	mg/L	23200		134		127		1820		1810		3960	J	1210		1210		1770		14700		33600	J	34100	
Fluoride	mg/L	0.840		0.110	J	0.110	J	0.160		0.160		0.230	J	0.130		0.120		0.130		0.310		1.52	J	1.52	
Sulfate	mg/L	2880		56.1		53.2		191		189		476	J	103		99.3		140		1810		4760	J	4800	
Ammonia	mg/L as N	0.0845	I	0.0339	U	0.0339	U	0.173		0.188		0.989		0.349		0.419		0.257		0.539		0.0339	U	0.0339	U
Ammonium ion (NH_4^+)	mg/L	0.109	I	0.0437	U	0.0437	U	0.223		0.242		1.26		0.449		0.539		0.331		0.694		0.0437	U	0.0437	U
Unionized NH_3	mg/L	0.00290		0.000400	U	0.000401	I	0.0114				0.00159		0.0117		0.00777		0.0109		0.00528		0.00326			
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0350	I	0.0400	I	0.0910		0.0880		0.0140	U	0.127		0.0920		0.120		0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	0.900		0.287	I	0.223	I	0.867		0.791		1.92		0.812		0.944		0.828		1.18		2.87		3.00	
TN	mg/L	0.900	J	0.322		0.263		0.958		0.879		1.92		0.940		1.04		0.948		1.18		2.87		3.00	
Orthophosphate as P	mg/L	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U J	0.0100	U	0.0100	U
Total Phosphorus (P)	mg/L	0.00500	U	0.0128	I	0.0143	I	0.00500	U	0.00500	U	0.0106	I	0.00500	U	0.00500	U	0.00500	U	0.00630	I J	0.0470	I	0.0470	I
Alkalinity	mg/L	162		172		170		301		298		401	J	273		275		254		227		275	J	277	
Bicarbonate Alkalinity	mg/L	197		210		208		367		364		490	J	333		335		310		276		336	J	338	
Sulfide	mg/L	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.853	J	0.294	J	0.297	J	0.297	J	0.0570	U	0.292	J	0.0570	U
Salinity	*	38		0.40		0.40	J	3.26				7.08		2.26		2.24		3.13		24.89		57.17			
Tritium	pCi/L (1σ)	46.2 (7.4)		20.7 (5.5)		26.0 (7.4)		202 (9.2)		220 (12.5)		173 (9.6)		92.5 (10.2)		74.6 (9.1)		80.1 (8.1)		230 (10.1)		8808 (54.1)		8875 (54.5)	

NOTES:

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031819-DUP1 is a duplicate of -TPSWCCS-1B

031819-DUP2 is a duplicate of -TPSWID-1T

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HCO_3 = Bicarbonate.
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NTU = Nephelometric Turbidity Units(s).
pCi/L = PicoCuries per liter.
Q = Holding time exceeded.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 3.2-8. Summary of Surface Water Analytical Results from the March 2019 Sampling Event (continued).

Parameter	Units	TPSWCCS-2B		TPSWCCS-3B		TPSWCCS-4T		TPSWCCS-5T		TPSWCCS-6T		TPSWCCS-7B		FB1		FB1		FB1		FB1		FB1		FB1		FB2	
		03/21/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019		03/18/2019		03/06/2019		3/7/2019		3/12/2019		03/13/2019		03/18/2019		3/21/2019		3/21/2019	
Temperature	**°C**	24.2		27.1		26.6		27.3		26.2		30.5															
pH	**SU**	8.15		8.14		8.20		8.17		8.07		8.12															
Dissolved Oxygen	**mg/L**	5.25		4.53		5.48		4.06		1.5		4.65															
Specific Conductance	**µS/cm**	79077		71505		79709		80580		82089		80599															
Turbidity	**NTU**	79.06		83.75		87.09		83.19		85.38		86.00															
Silica, dissolved	**mg/L**	14.0		14.7		14.1		16.3		13.6		14.9										0.0500	U				
Calcium	**mg/L**	708		638		703		705		736		691		0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U	0.0760	U
Magnesium	**mg/L**	1900		1790		2040		2050		2150		2010		0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U	0.0320	U
Potassium	**mg/L**	603		574		645		649		683		645		0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U	0.0490	U
Sodium	**mg/L**	16300		13700		15200		15500		16600		15300		0.0650	U	0.0650	U	0.147	I	0.0742	I	0.0650	U	0.0650	U	0.0650	U
Boron	**mg/L**	8.31		7.38		8.40		8.51		8.50		8.38		0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U
Strontium	**mg/L**	20.2		18.0		20.1		20.3		20.4		20.1		0.00100	U	0.00579	U	0.00100	U	0.00100	U	0.00100	U	0.00100	U	0.00100	U
Bromide	**mg/L**	108	J	96.4	J	112	J	113	J	114	J	112	J	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
Chloride	**mg/L**	33400	J	28700	J	33100	J	33600	J	34400	J	33000	J	0.189	U	0.189	U	0.189	U	0.189	U	0.189	U	0.189	U	0.189	U
Fluoride	**mg/L**	1.52	J	1.41	J	1.50	J	1.52	J	1.50	J	1.50	J	0.0320	U	0.0320	U	0.0320	U	0.330		0.0320	U	0.0320	U	0.0320	U
Sulfate	**mg/L**	4620	J	3990	J	4660	J	4730	J	4870	J	4630	J	0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.0920	U	0.101	I
Ammonia	**mg/L as N**	0.0339	U	0.0752	I	0.0339	U	0.0339	U	0.0339	U	0.0339	U	0.0339	U	0.0339	U			0.0339	U	0.0339	U	0.0339	U	0.0339	U
Ammonium ion (NH_4^+)	**mg/L**	0.0437	U	0.0969	I	0.0437	U	0.0437	U	0.0437	U	0.0437	U	0.0437	U	0.0437	U			0.0437	U	0.0437	U	0.0437	U	0.0437	U
Unionized NH_3	**mg/L**	0.00199		0.00548		0.00260		0.00253		0.00188		0.00281															
Nitrate/Nitrite	**mg/L as N**	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U			0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	**mg/L**	3.28		2.78		2.01		1.86		3.01		1.71		0.124	U	0.124	U			0.124	U	0.124	U	0.124	U	0.124	U
TN	**mg/L**	3.28		2.78		2.01		1.86		3.01		1.71		0.138	U	0.138	U			0.138	U	0.138	U	0.138	U	0.138	U
Orthophosphate as P	**mg/L**	0.0100	U	0.0100	U	0.0100	U	0.0102	I	0.0100	U	0.0100	U	0.0100	U	0.0100	U			0.0100	U	0.0100	U	0.0100	U	0.0100	U
Total Phosphorus (P)	**mg/L**	0.0535		0.0382	I	0.0419	I	0.0499	I	0.0443	I	0.0467	I	0.00500	U	0.00500	U			0.00500	U	0.00500	U	0.00500	U	0.00500	U
Alkalinity	**mg/L**	267	J	272	J	271	J	277	J	282	J	281	J	1.24	V	1.04	V	1.66	V	2.06		1.45	V	2.88	V	2.05	V
Bicarbonate Alkalinity	**mg/L**	326	J	332	J	330	J	338	J	344	J	343	J	1.52	V	1.27	V	2.02	V	2.52		1.77	V	3.51	V	2.51	V
Sulfide	**mg/L**	0.0606	I Q	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.860	J	0.0570	U	0.0570	U	0.0570	U	0.0570	U	0.282		0.0570	U Q	0.0570	U Q
Salinity	*****	55.18		49.05		55.62		56.56		57.57		56.19															
Tritium	**pCi/L (1σ)**	10282 (55.3)		7314 (53.0)		8802 (57.7)		8643 (45.2)		9580 (52.3)		7995 (48.2)		3.7 (4.9)		-11.4 (6.6)		6.7 (4.2)		-1.0 (4.7)		3.0 (4.7)		12.0 (8.5)		-17.7 (6.2)	

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Table 3.2-9. Range of Ion and Nutrient Concentrations in Surface Water.

Parameter	Units	Biscayne Bay								Interceptor Ditch							
		Historical Period of Record				Reporting Period				Historical Period of Record				Reporting Period			
		Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev
Temperature	°C	17.02	31.98	26.08	4.01	17.90	31.20	25.68	5.11	18.85	32.48	27.66	2.98	25.00	31.40	28.09	2.07
pH	SU	7.68	8.57	8.14	0.20	7.16	8.40	8.00	0.31	5.39	8.52	7.48	0.39	7.02	8.06	7.62	0.33
Dissolved Oxygen	mg/L	2.34	8.99	6.17	1.26	3.84	7.23	5.85	1.22	0.04	9.14	4.04	2.36	0.11	6.60	4.02	2.14
Specific Conductance	µS/cm	37725	64512	50676	6371	42840	56694	52539	3856	1759	66251	9064	10336	3583	39160	8667	7483
Turbidity	NTU	0.17	8.62	1.24	1.12	0.00	1.52	0.78	0.36	0.07	136.12	4.20	12.68	0.36	119.20	8.79	23.97
Silica, dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	mg/L	330	500	429	44.9	330	464	391	53.4	68.0	610	174	102	84.2	230	133	45.6
Magnesium	mg/L	870	1700	1235	181	916	1300	1095	158	27.0	1700	188	318	51.1	205	92.2	49.6
Potassium	mg/L	280	590	423	68.4	312	520	406	87.8	11.0	560	64.7	103	19.8	78.8	36.2	20.1
Sodium	mg/L	7200	14000	10149	1346	11100	12800	11933	657	230	14000	1506	2579	541	3870	1364	993
Boron	mg/L	3.10	5.40	4.46	0.573	3.22	5.49	4.29	0.953	0.0535	5.30	0.630	1.00	0.194	0.763	0.348	0.186
Strontium	mg/L	5.40	9.50	7.43	0.905	5.93	9.12	7.33	1.30	0.80	11.00	2.25	1.88	0.98	3.21	1.70	0.69
Bromide	mg/L	44.0	95.0	68.3	11.0	47.6	77.9	62.4	12.2	0.258	85.0	9.62	15.2	3.08	15.8	6.09	3.90
Chloride	mg/L	14000	26000	19094	2646	21200	22500	21850	475	110	27000	2825	4915	1130	8180	2738	2030
Fluoride	mg/L	0.100	1.20	0.716	0.284	0.571	1.03	0.799	0.212	0.0270	3.20	0.241	0.332	0.0730	0.184	0.137	0.0257
Sulfate	mg/L	2000	3700	2644	366	2040	3110	2530	449	30.0	2900	324	512	90.9	431	187	116
Ammonia	mg/L as N	0.0260	0.915	0.131	0.142	0.0339	0.197	0.0716	0.0584	0.0272	1.90	0.423	0.326	0.140	0.989	0.388	0.268
Ammonium ion (NH_4^+)	mg/L	0.0343	1.08	0.154	0.180	0.0437	0.197	0.0765	0.0553	0.0500	2.40	0.524	0.408	0.140	3.31	0.623	0.839
Unionized NH_3	mg/L	0.0000170	0.116	0.0148	0.0220	0.000400	0.0158	0.00527	0.00541	0.0000170	0.0654	0.0117	0.0122	0.00528	0.0216	0.0120	0.00471
Nitrate Nitrite	mg/L as N	0.00470	0.164	0.0213	0.0248	0.0140	0.0160	0.0144	0.000731	0.00470	0.210	0.0547	0.0488	0.0140	0.248	0.112	0.0712
TKN	mg/L	0.110	1.30	0.529	0.270	0.531	0.910	0.719	0.130	0.200	2.40	1.00	0.402	0.750	1.92	1.02	0.351
TN	mg/L	0.205	1.30	0.560	0.267	0.531	1.11	0.772	0.194	0.200	2.40	1.07	0.384	0.893	1.92	1.13	0.299
Orthophosphate as P	mg/L	0.00140	0.0609	0.00466	0.00921	0.0100	0.0112	0.0105	0.000515	0.00140	0.0410	0.00656	0.00861	0.0100	0.0100	0.0100	0.00
Total Phosphorus (P)	mg/L	0.00220	0.112	0.0121	0.0177	0.00500	0.00900	0.00700	0.00200	0.00220	0.0400	0.00711	0.00622	0.00500	0.0256	0.00902	0.00540
Alkalinity	mg/L	58.0	170	130	20.7	131	145	140	6.05	120	448	251	60.9	176	310	220	39.6
Bicarbonate Alkalinity	mg/L	57.0	184	132	25.3	128	177	163	18.4	120	511	258	68.9	208	378	263	48.9
Sulfide	mg/L	0.100	1.00	0.909	0.250	0.0360	0.360	0.198	0.162	0.0517	13.0	1.45	1.95	0.0360	4.56	0.668	1.27
Salinity	*	23.96	43.43	33.24	4.66	27.38	37.75	34.57	2.90	0.20	44.82	5.27	6.80	1.87	24.89	4.94	4.80
Tritium	pCi/L (1σ)	-20.0	34.5	11.2	9.5	3.0	35.4	17.5	11.3	48.8	5677	302	599	73.4	322	167	70.8

Notes:

1. TPSWC-4T, TPSWC-4B, TPSWC-5T, TPSWC-5B, TPSWC-6T, and TPSWC-6B sites are located either in a marine system or not along the L-31E canal and are therefore not included in these calculations.

Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

*PSS-78 salinity is unitless.

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
HCO_3 = Bicarbonate.
Max = Maximum.
mg/L = Milligram(s) per liter.
Min = Minimum.
N = Nitrogen.
NA = Not applicable, analyte not collected/required for location/event.
NH3 = Ammonia.
NH4+ = Ammonium ion.
NTU = Nephelometric Turbidity Unit(s).
pCi/L = PicoCuries per liter.
Std Dev = Standard deviation.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.

Table 3.2-9. Range of Ion and Nutrient Concentrations in Surface Water (continued).

Parameter	Units	L-31								Cooling Canals							
		Historical Period of Record				Reporting Period				Historical Period of Record				Reporting Period			
		Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev	Min	Max	Average	Std Dev
Temperature	°C	19.64	33.68	26.80	3.32	21.70	33.00	27.43	2.55	18.60	40.56	30.91	4.96	24.20	41.70	31.44	3.87
pH	SU	6.53	8.83	7.67	0.36	7.18	8.18	7.69	0.29	7.35	9.47	8.19	0.38	8.07	8.40	8.22	0.09
Dissolved Oxygen	mg/L	0.11	10.05	4.41	2.42	0.14	6.62	3.47	1.90	0.07	12.30	4.52	2.04	1.33	6.60	3.81	1.34
Specific Conductance	µS/cm	271	63421	16077	21612	480	61903	18371	22353	47883	128411	84823	17935	61204	82089	72455	5436
Turbidity	NTU	0.00	107.80	3.40	7.47	0.54	37.80	3.66	6.11	1.26	1100.00	52.90	82.32	69.36	87.09	78.74	5.10
Silica, dissolved	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	0.140	14.4	6.06	4.13	13.6	16.5	15.3	0.901
Calcium	mg/L	44.0	740	182	167	44.3	473	162	154	570	1170	808	148	539	962	698	155
Magnesium	mg/L	5.40	1800	350	533	5.65	1330	304	477	1600	3200	2242	349	1360	2440	1765	400
Potassium	mg/L	2.00	610	122	182	2.27	457	106	163	560	1420	780	193	440	964	670	235
Sodium	mg/L	27.0	14000	2867	4359	31.9	12500	3841	4988	13000	24500	17505	2319	26000	28500	27342	862
Boron	mg/L	0.0250	5.70	1.24	1.85	0.0191	5.03	1.17	1.81	6.00	14.3	8.32	2.05	5.54	10.9	7.79	2.12
Strontium	mg/L	0.41	9.60	2.68	2.95	0.47	8.65	2.59	2.95	11.00	24.90	15.51	3.60	10.70	20.80	14.81	3.94
Bromide	mg/L	0.0270	110	19.4	29.8	0.0250	92.1	17.6	28.7	0.270	252	122	35.7	14.3	177	102	43.2
Chloride	mg/L	39.0	28000	5529	8413	59.2	22900	7105	9150	13000	48900	34335	5640	51700	54600	53617	860
Fluoride	mg/L	0.0200	2.00	0.328	0.393	0.0500	0.992	0.276	0.314	0.0200	94.0	2.18	9.08	0.715	1.07	0.982	0.0839
Sulfate	mg/L	0.713	4000	746	1125	0.916	3740	718	1153	1900	7740	4831	1244	2860	6090	4273	1319
Ammonia	mg/L as N	0.0260	3.87	0.260	0.337	0.0339	0.628	0.163	0.127	0.0552	4.42	0.328	0.532	0.0339	0.160	0.0951	0.0564
Ammonium ion (NH_4^+)	mg/L	0.0300	4.95	0.338	0.429	0.0437	0.810	0.190	0.166	0.0500	5.36	0.380	0.661	0.0437	0.160	0.101	0.0515
Unionized NH_3	mg/L	0.0000170	0.0798	0.0106	0.0126	0.000400	0.0193	0.00695	0.00471	0.0000170	0.323	0.0349	0.0416	0.00188	0.0300	0.0130	0.0104
Nitrate Nitrite	mg/L as N	0.00470	0.550	0.0398	0.0658	0.0140	0.0810	0.0289	0.0212	0.00470	1.00	0.0364	0.101	0.0140	0.0500	0.0166	0.00927
TKN	mg/L	0.180	4.94	0.898	0.528	0.124	1.54	0.891	0.337	1.50	17.7	5.88	3.71	1.71	4.49	3.04	0.757
TN	mg/L	0.200	4.90	0.933	0.535	0.193	1.54	0.912	0.338	0.870	17.7	5.78	3.60	1.71	4.49	3.04	0.760
Orthophosphate as P	mg/L	0.00140	0.0736	0.00336	0.00586	0.0100	0.0124	0.0101	0.000480	0.00140	0.0870	0.0132	0.0211	0.0100	0.0176	0.0114	0.00239
Total Phosphorus (P)	mg/L	0.00220	0.140	0.0119	0.0158	0.00500	0.0228	0.0111	0.00484	0.00440	0.106	0.0393	0.0239	0.0240	0.0535	0.0373	0.00958
Alkalinity	mg/L	42.0	310	160	42.2	109	241	160	47.8	73.0	250	155.8	34.7	193	216	208	8.70
Bicarbonate Alkalinity	mg/L	42.0	310	164	44.4	133	292	194	57.9	15.0	277	142	62.2	235	264	255	10.2
Sulfide	mg/L	0.0360	3.90	0.901	0.380	0.0360	0.455	0.215	0.166	0.00	2.40	0.919	0.310	0.0360	2.52	0.795	0.930
Salinity	*	0.13	42.60	10.30	14.28	0.23	41.51	11.77	14.85	31.20	98.34	60.10	14.87	40.89	57.57	49.66	4.37
Tritium	pCi/L (1σ)	-4.4	1636	97.6	194	8.4	269	79.2	61.2	358	16538	6496	3724	1265	18529	8449	5892

Notes:

1. TPSWC-4T, TPSWC-4B, TPSWC-5T, TPSWC-5B, TPSWC-6T, and TPSWC-6B sites are located either in a marine system or not along the L-31E canal and are therefore not included in these calculations.

Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

*PSS-78 salinity is unitless.

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
HCO_3 = Bicarbonate.
Max = Maximum.
mg/L = Milligram(s) per liter.
Min = Minimum.
N = Nitrogen.
NA = Not applicable, analyte not collected/required for location/event.
NH3 = Ammonia.
NH4+ = Ammonium ion.
NTU = Nephelometric Turbidity Unit(s).
pCi/L = PicoCuries per liter.
Std Dev = Standard deviation.
SU = Standard Unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.

FIGURES

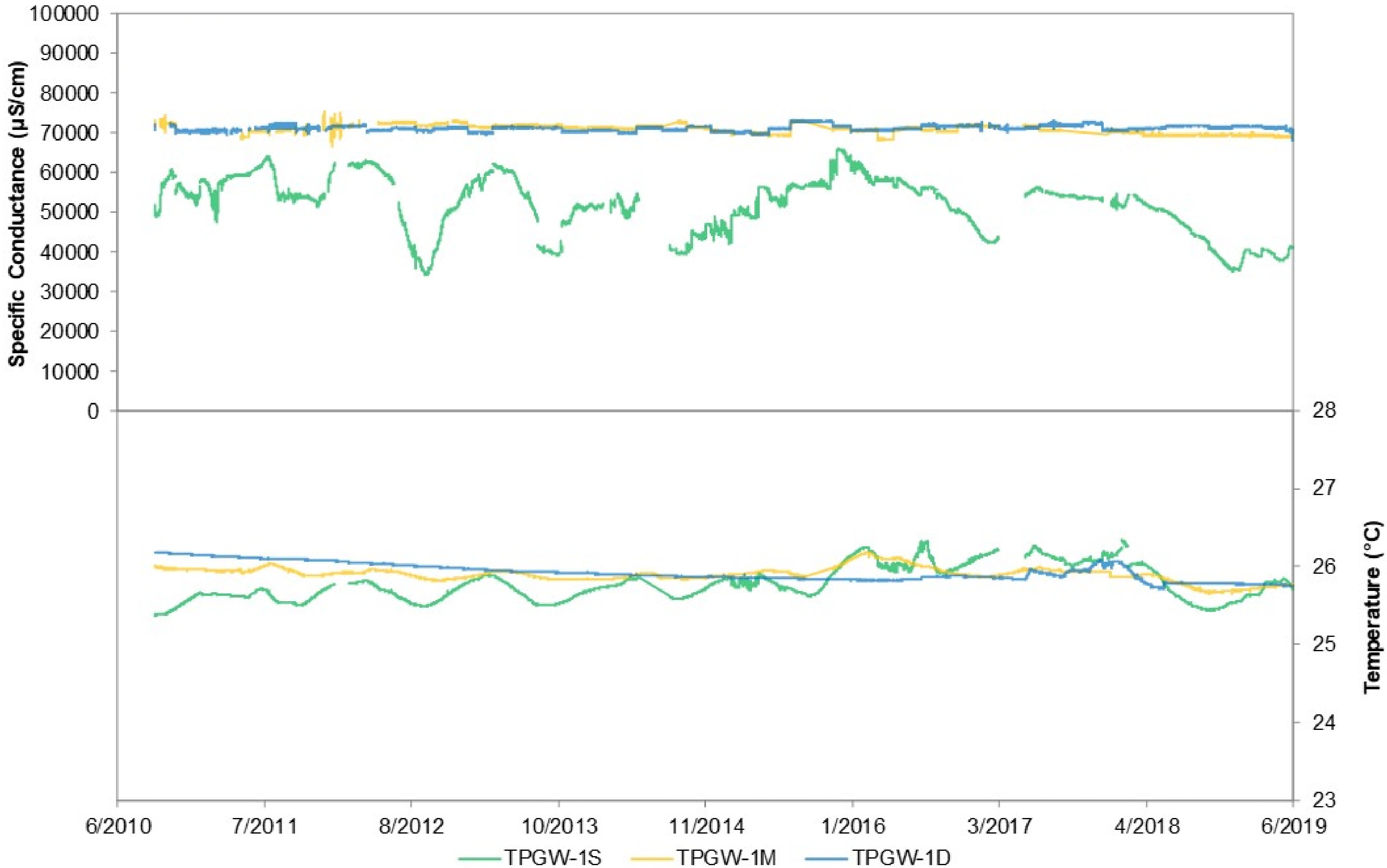


Figure 3.1-1. TPGW-1 Specific Conductance and Temperature.

Figure 3.1-2. TPGW-2 Specific Conductance and Temperature.

Figure 3.1-3. TPGW-3 Specific Conductance and Temperature.

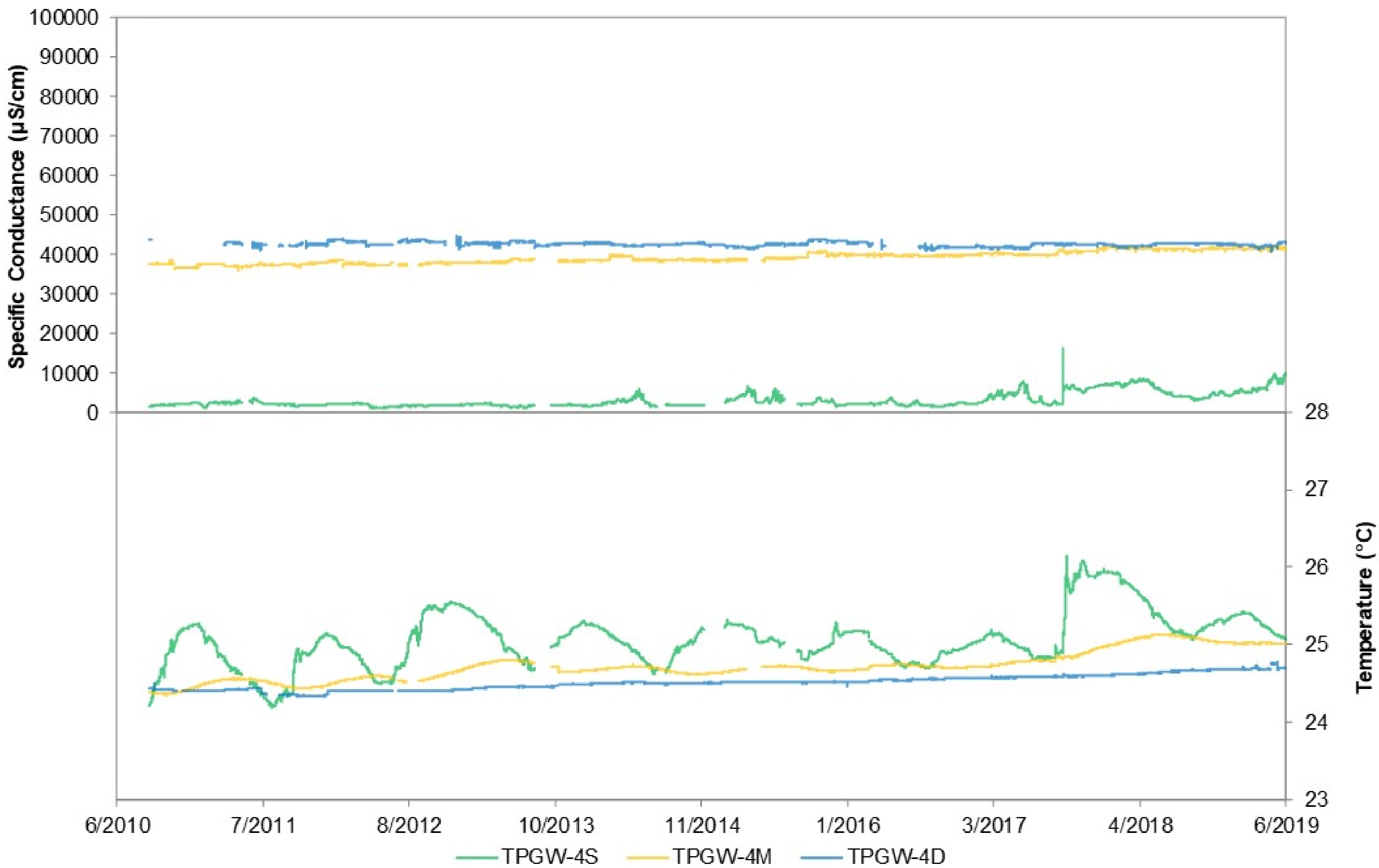


Figure 3.1-4. TPGW-4 Specific Conductance and Temperature.

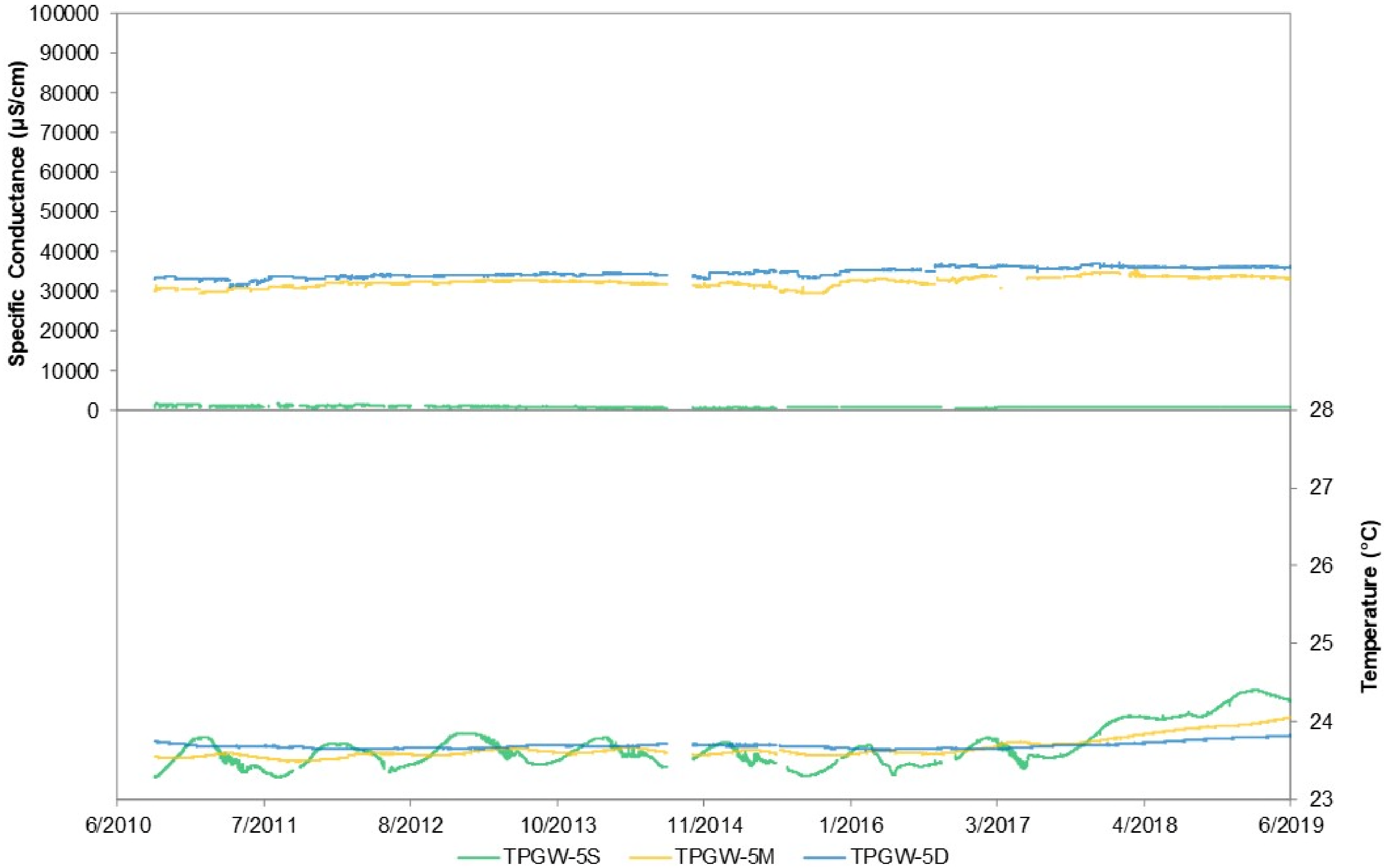


Figure 3.1-5. TPGW-5 Specific Conductance and Temperature.

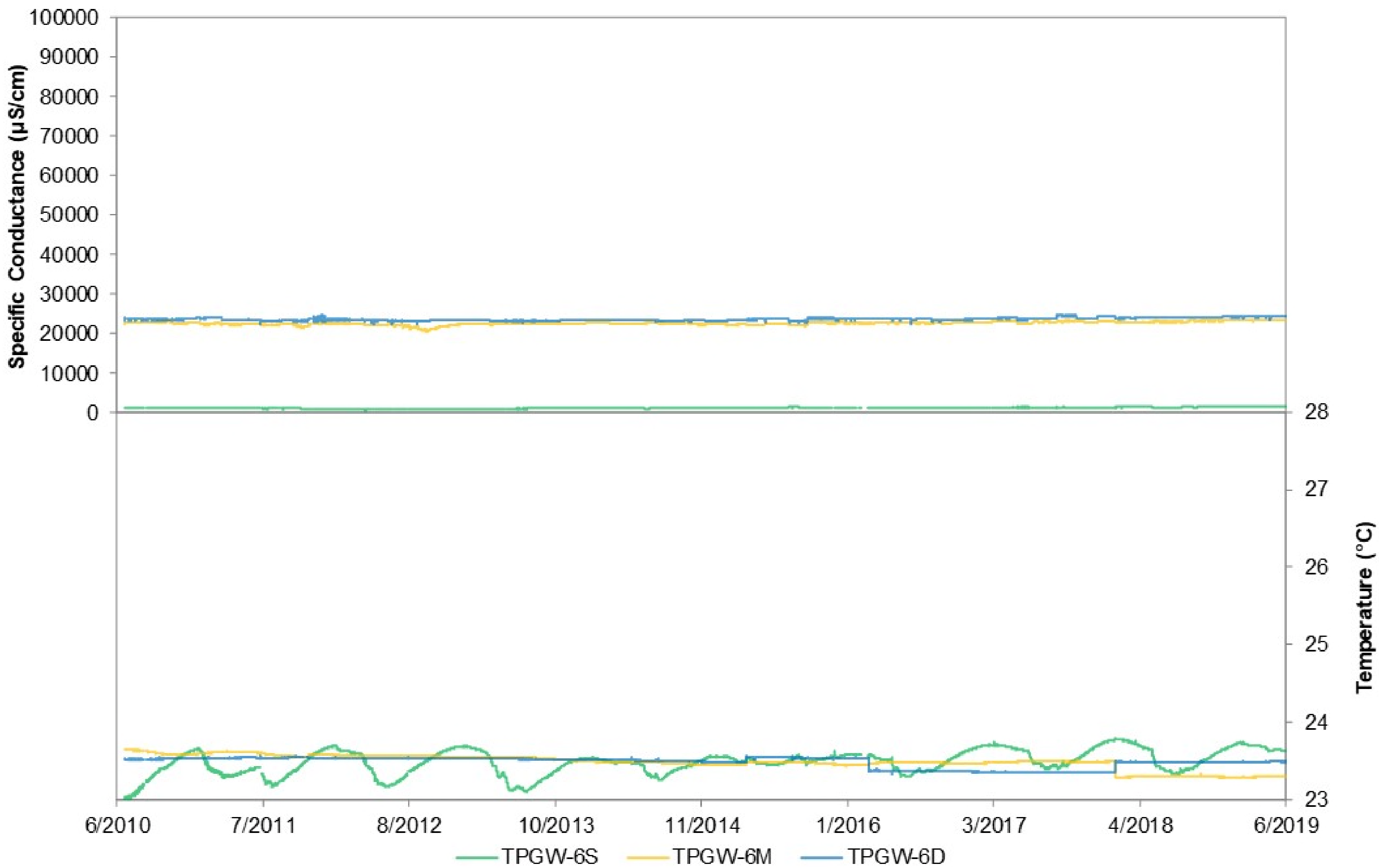


Figure 3.1-6. TPGW-6 Specific Conductance and Temperature.

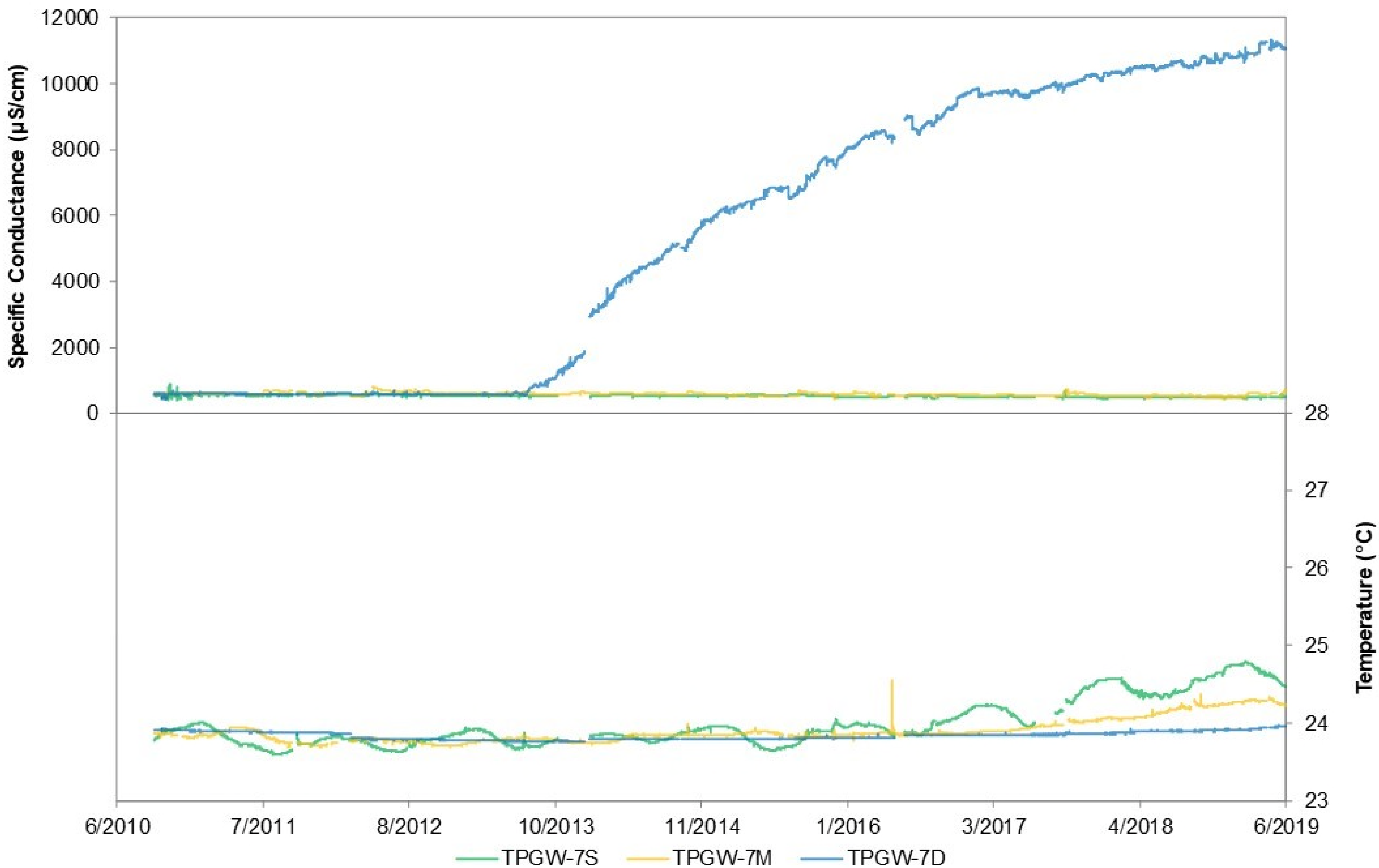


Figure 3.1-7. TPGW-7 Specific Conductance and Temperature.

Figure 3.1-8. TPGW-8 Specific Conductance and Temperature.

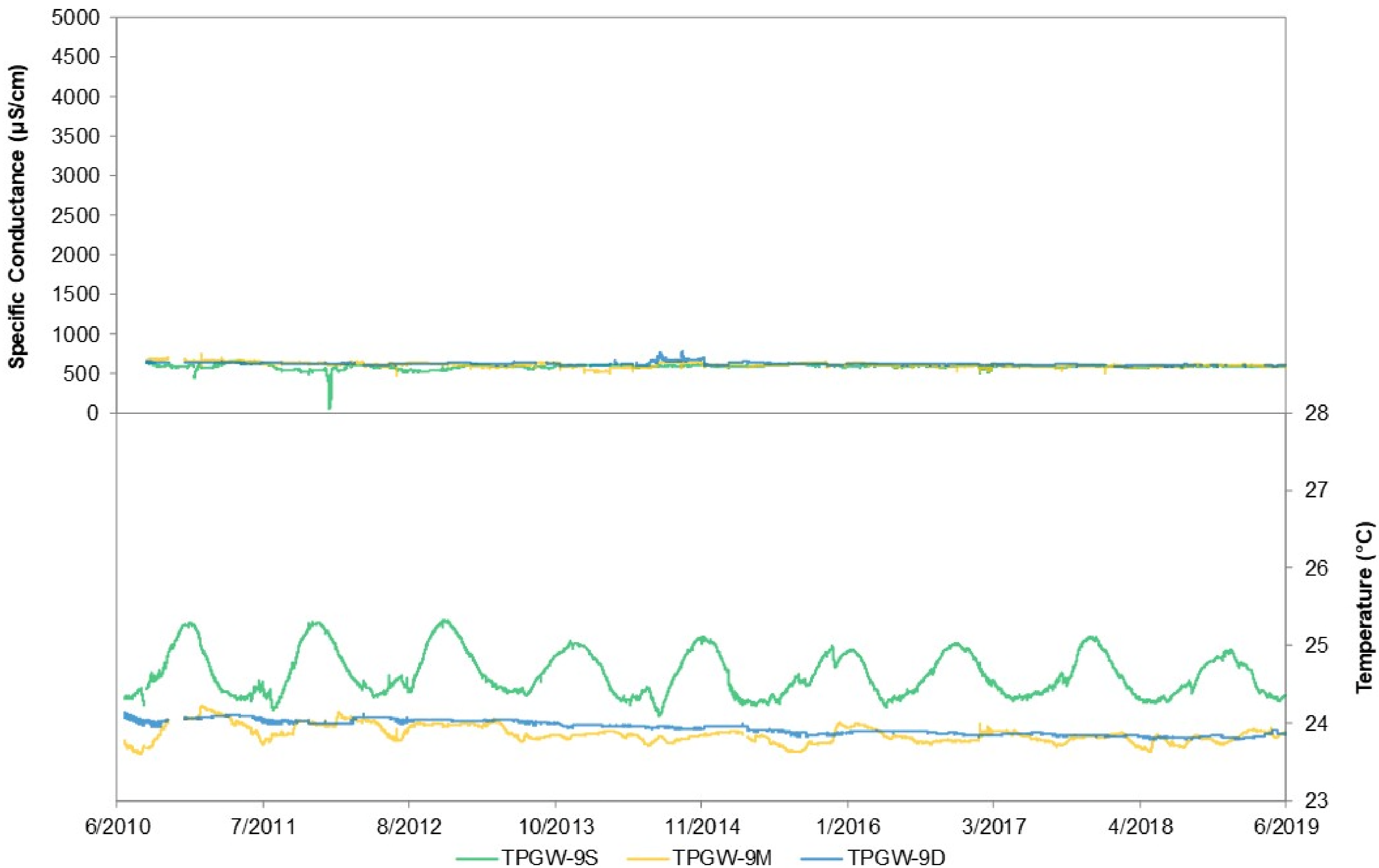


Figure 3.1-9. TPGW-9 Specific Conductance and Temperature.

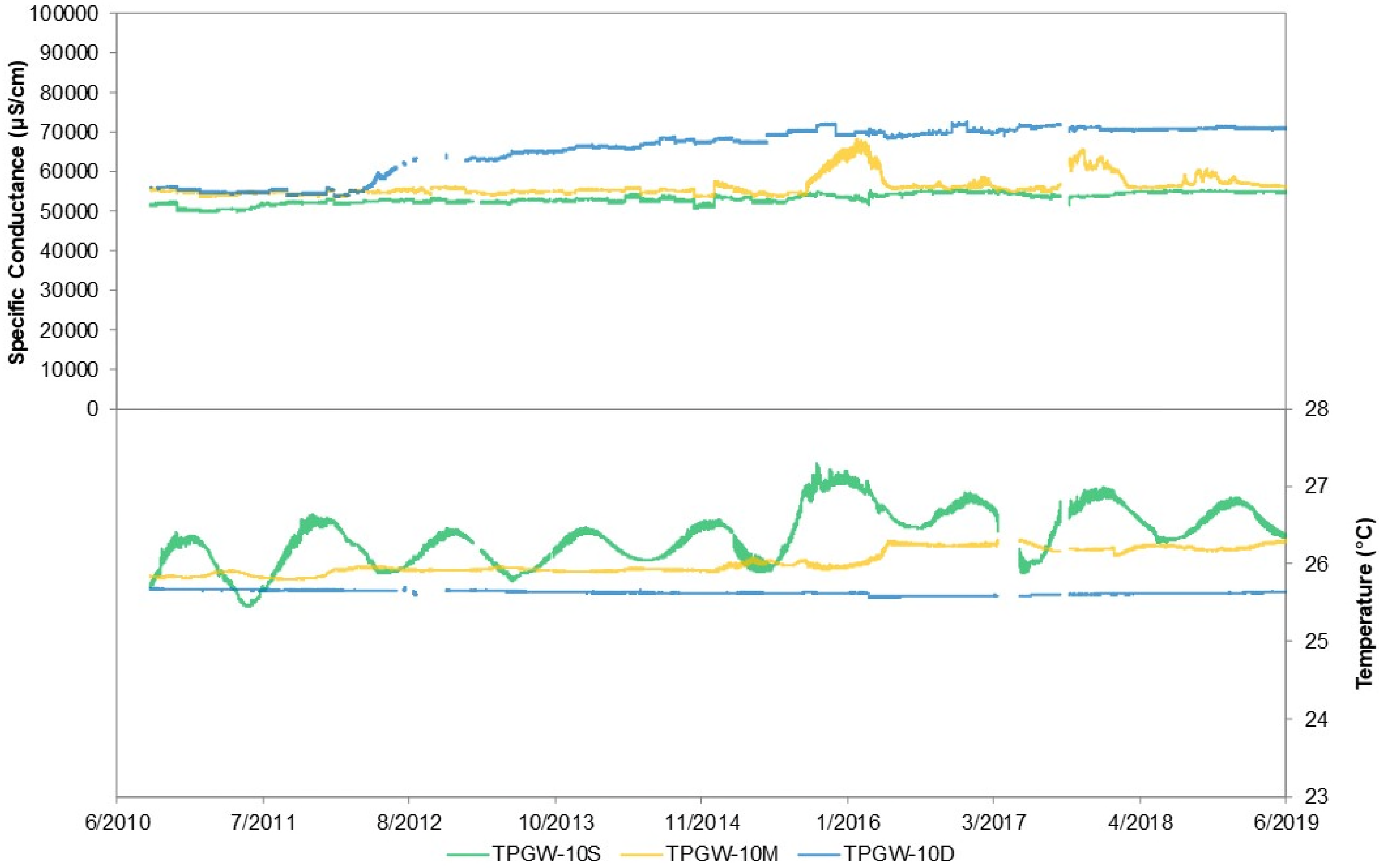


Figure 3.1-10. TPGW-10 Specific Conductance and Temperature.

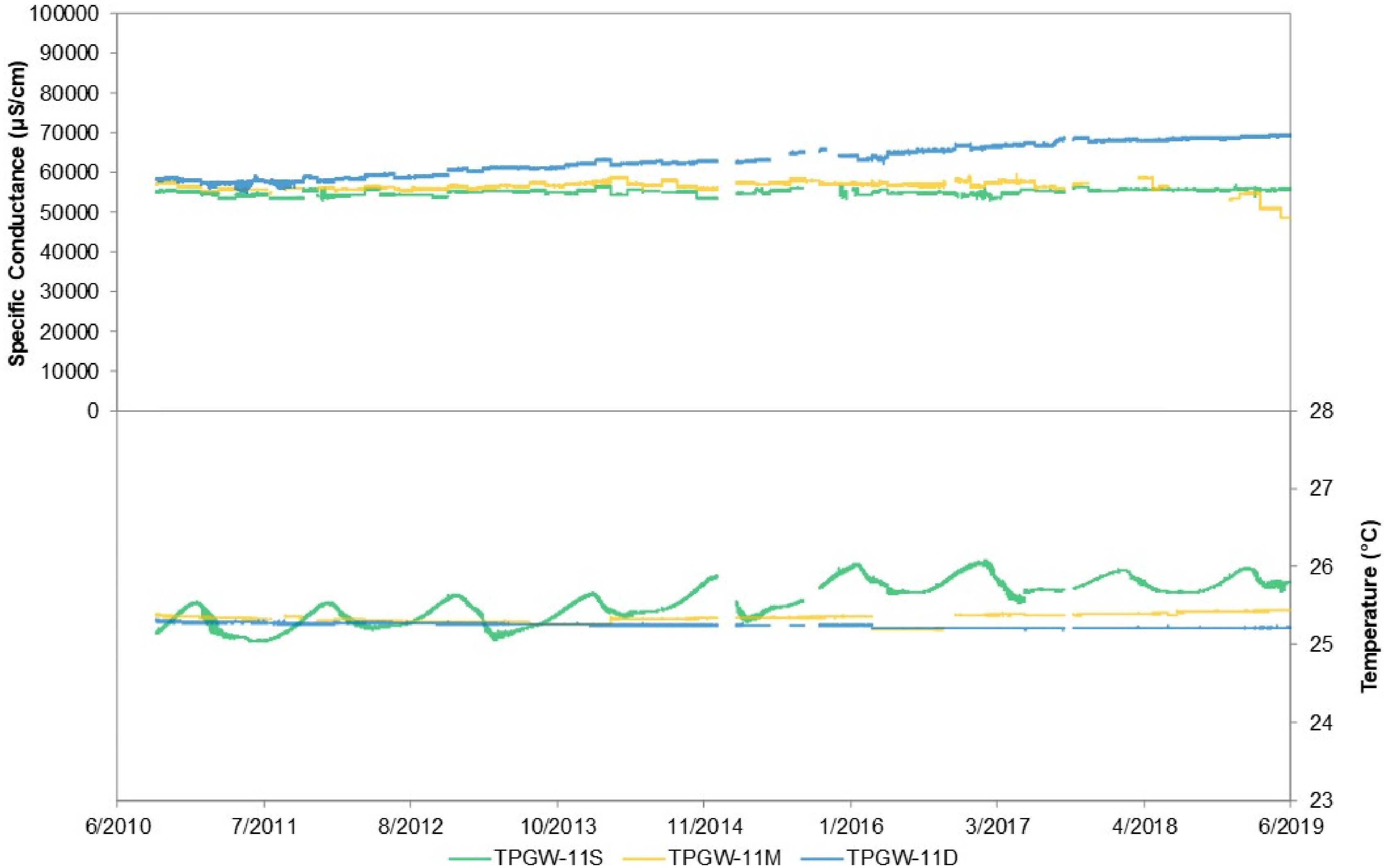


Figure 3.1-11. TPGW-11 Specific Conductance and Temperature.

Figure 3.1-12. TPGW-12 Specific Conductance and Temperature.

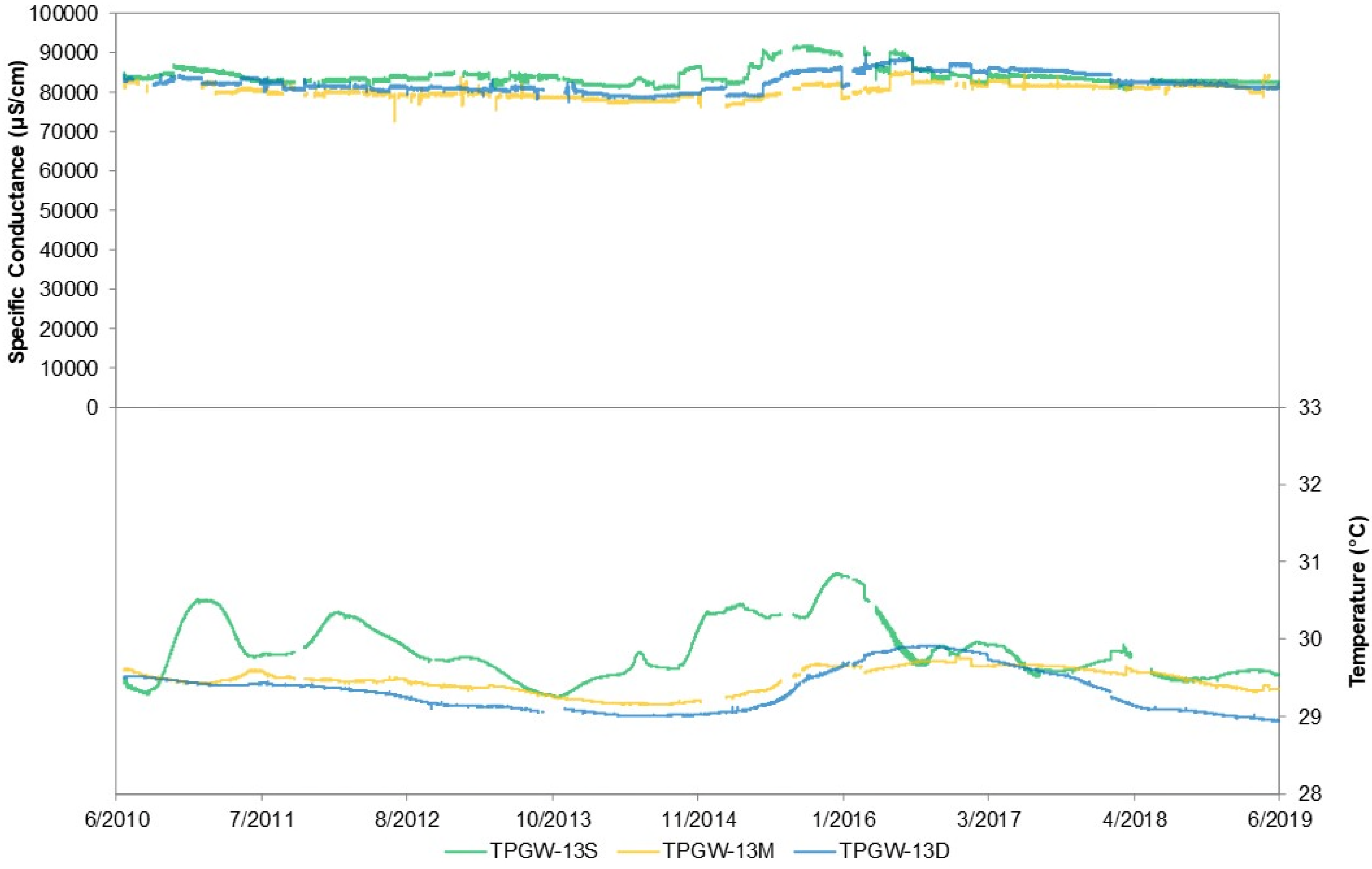


Figure 3.1-13. TPGW-13 Specific Conductance and Temperature.

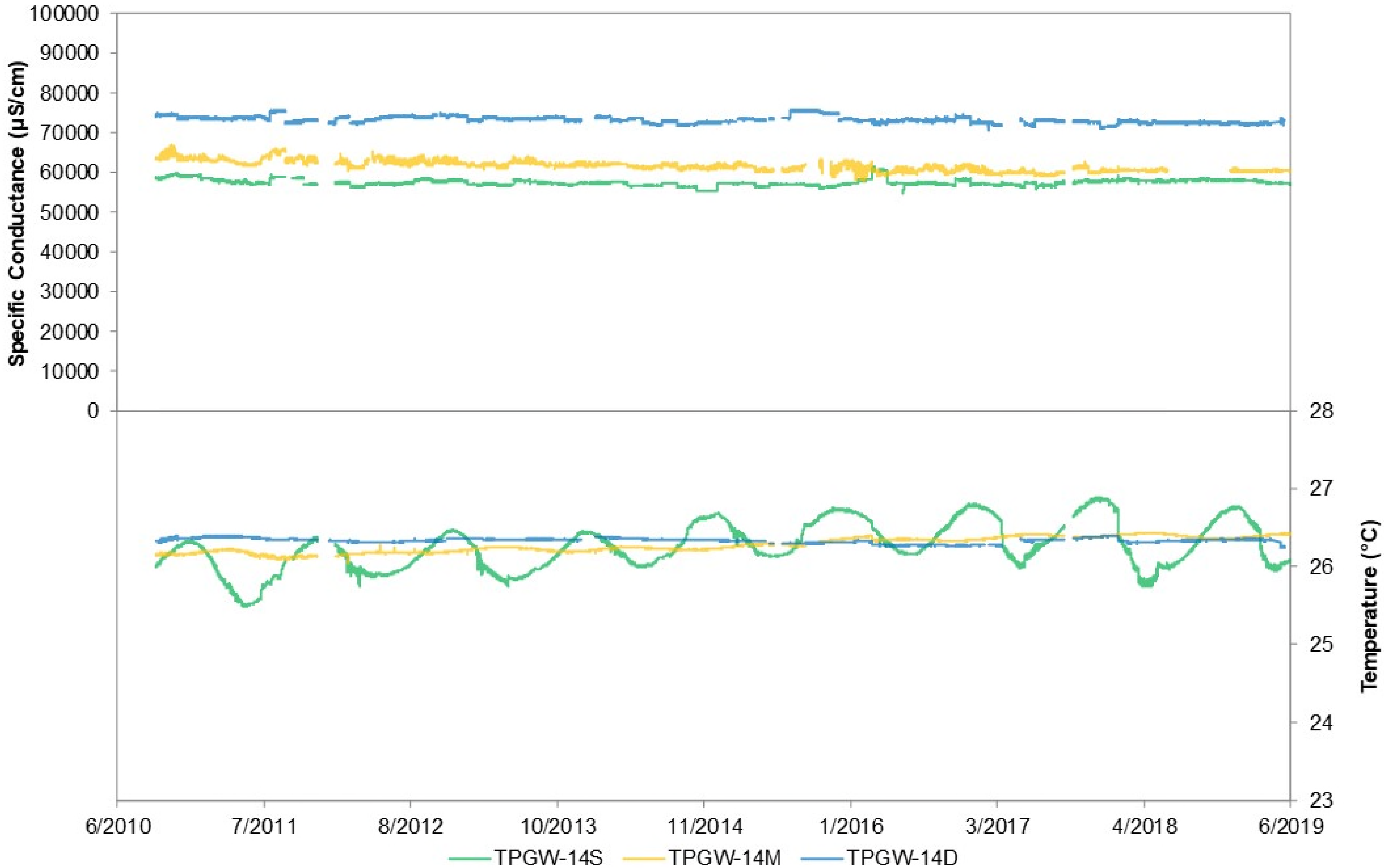
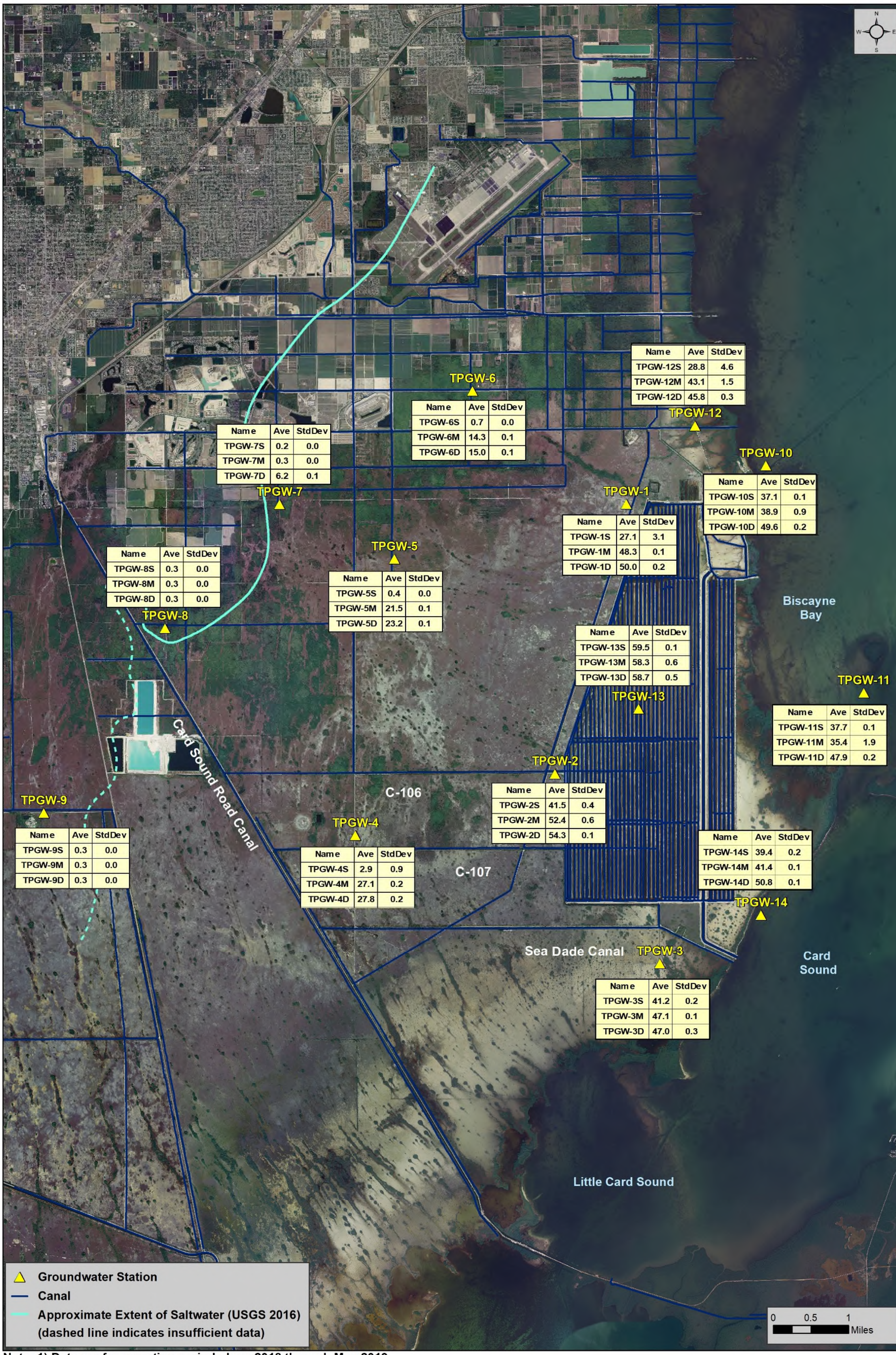


Figure 3.1-14. TPGW-14 Specific Conductance and Temperature.

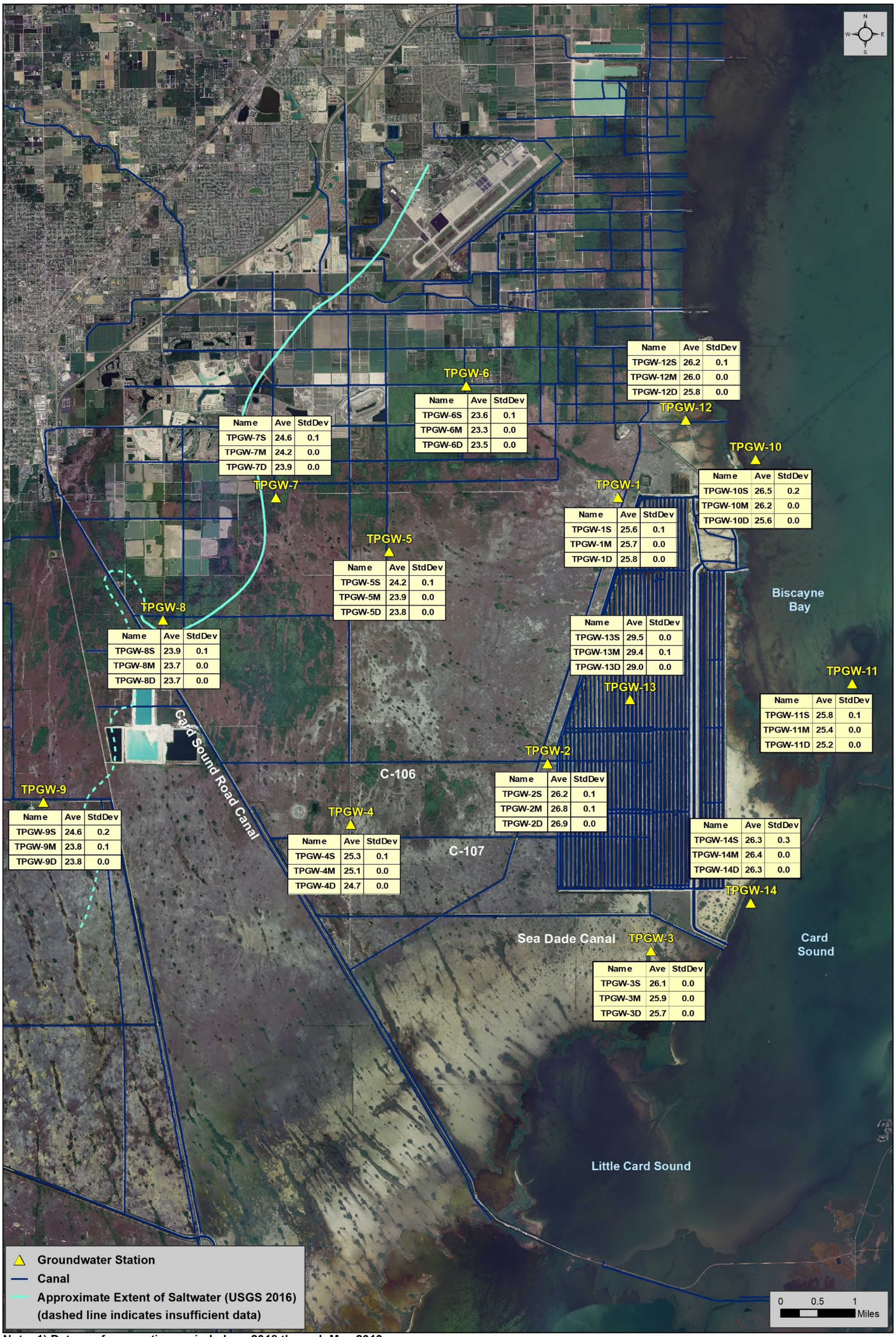
Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Ave=Average.
3) StdDev=Standard Deviation.
4) Samples Collected at 3 Depths (S: shallow; M: intermediate; D: deep).

Figure 3.1-15. Average and Standard Deviation of Specific Conductance Values (µS/cm) for Groundwater Stations.



Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Ave=Average.
3) StdDev=Standard Deviation.
4) Samples Collected at 3 Depths (S: shallow; M: intermediate; D: deep).

Figure 3.1-16. Average and Standard Deviation of Salinity (PSS-78) for Groundwater Stations.



Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Ave=Average.
3) StdDev=Standard Deviation.
4) Samples Collected at 3 Depths (S: shallow; M: intermediate; D: deep).

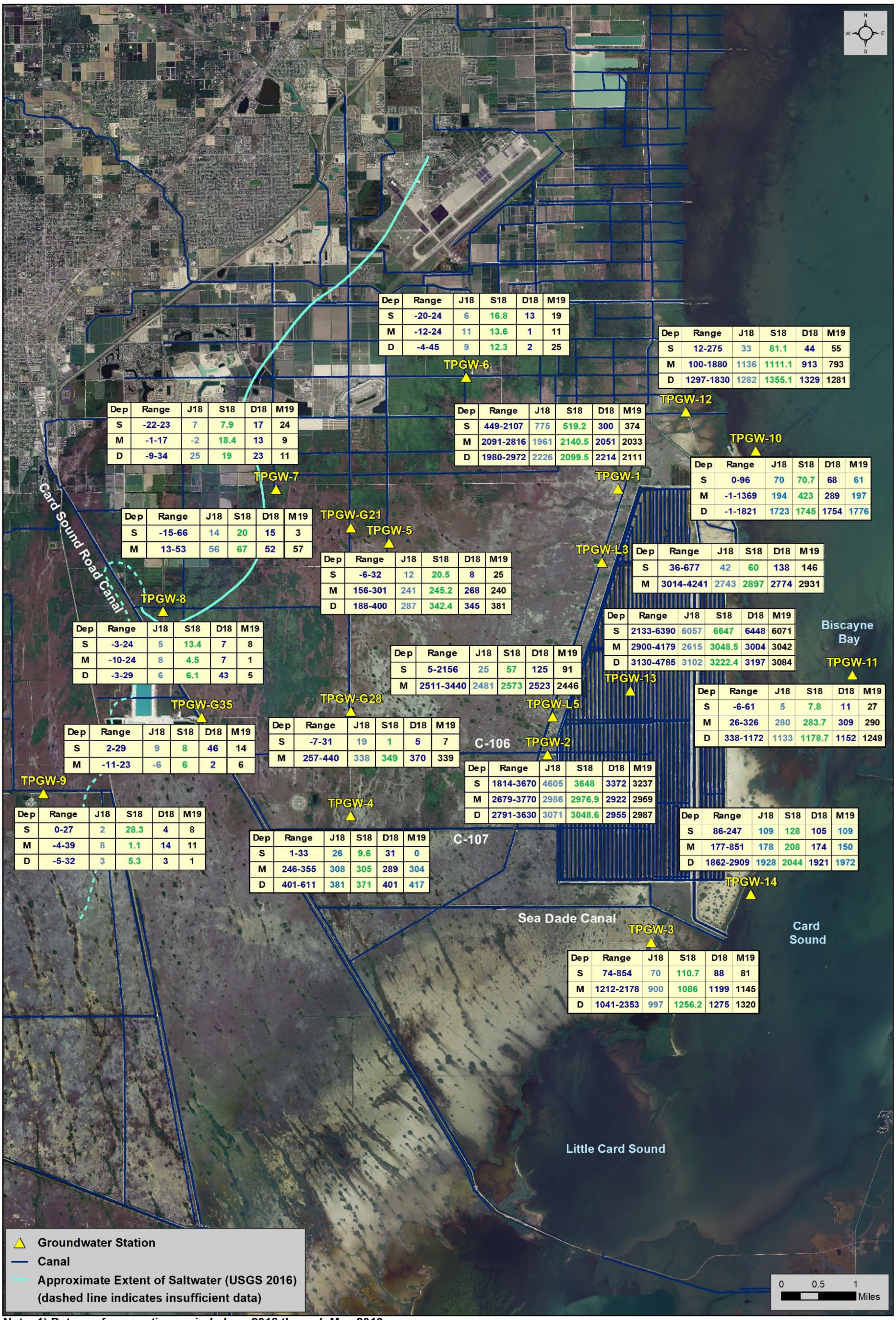
Figure 3.1-17. Average and Standard Deviation of Temperature (°C) for Groundwater Stations.

Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples Collected at 3 Depths (S: shallow; M: intermediate; D: deep).
3) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
4) J18: Jun 2018; S18: Sep 2018; D18: Dec 2018; Mar19: Mar 2019.
5) Samples for wells L-3, L-5, G-21, G-28, and G-35 were taken at depths of 18 and 58 ft.
6) Please see Appendix I for a list of values that were removed from this analysis and the rational for their removal.

Figure 3.1-18. Historical Range and Reporting Period Quarterly Groundwater Chloride (mg/L) Results.

Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples Collected at 3 Depths (S: shallow; M: intermediate; D: deep).
3) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
4) J18: Jun 2018; S18: Sep 2018; D18: Dec 2018; Mar19: Mar 2019.
5) Samples for wells L-3, L-5, G-21, G-28, and G-35 were taken at depths of 18 and 58 ft.
6) Please see Appendix I for a list of values that were removed from this analysis and the rational for their removal.

Figure 3.1-19. Historical Range and Reporting Period Quarterly Groundwater Sodium (mg/L) Results.



Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples Collected at 3 Depths (S: shallow; M: intermediate; D: deep).
3) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
4) J18: Jun 2018; S18: Sep 2018; D18: Dec 2018; M19: Mar 2019.
5) Samples for wells L-3, L-5, G-21, G-28, and G-35 were taken at depths of 18 and 58 ft.
6) Please see Appendix I for a list of values that were removed from this analysis and the rational for their removal.

Figure 3.1-20. Historical Range and Reporting Period Quarterly Groundwater Tritium (pCi/L) Results.

TPGW-1		NH3	TN	TP
Range	S	0.38-1.29	1.40-1.91	0.004-0.046
	M	1.10-1.90	1.70-3.41	0.002-0.059
	D	1.30-2.04	1.24-2.78	0.008-0.057
S18	S	1.11	1.65	0.028
	M	1.71	1.85	0.037
	D	1.76	1.79	0.043
M19	S	1.05	1.52	0.021
	M	1.67	1.82	0.035
	D	1.90	2.23	0.040

TPGW-10		NH3	TN	TP
Range	S	0.32-0.92	0.31-1.10	0.002-0.035
	M	0.24-1.08	0.26-1.49	0.002-0.053
	D	0.22-1.41	0.33-1.83	0.004-0.051
S18	S	0.40	1.24	0.018
	M	0.71	0.77	0.032
	D	1.49	1.96	0.042
M19	S	0.34	1.09	0.015
	M	0.68	0.90	0.016
	D	1.49	1.83	0.043

TPGW-13		NH3	TN	TP
Range	S	0.61-3.90	2.60-5.19	0.004-0.067
	M	0.76-2.60	1.50-3.13	0.004-0.070
	D	0.06-3.00	1.70-5.43	0.002-0.077
S18	S	6.55	7.61	0.089
	M	3.31	4.48	0.058
	D	3.33	5.27	0.057
M19	S	7.03	7.01	0.052
	M	3.56	3.88	0.074
	D	3.67	3.85	0.068

TPGW-14		NH3	TN	TP
Range	S	0.41-1.15	0.71-1.70	0.002-0.071
	M	0.72-1.55	1.08-1.91	0.003-0.068
	D	1.05-2.42	2.30-3.51	0.004-0.078
S18	S	0.50	1.26	0.055
	M	0.78	1.49	0.219
	D	2.18	3.09	0.053
M19	S	0.59	1.32	0.062
	M	0.65	1.24	0.057
	D	2.49	2.55	0.056

TPGW-2		NH3	TN	TP
Range	S	1.49-2.90	1.80-3.01	0.002-0.043
	M	1.50-2.46	1.90-3.31	0.013-0.082
	D	0.35-2.48	2.00-3.19	0.007-0.062
S18	S	1.84	3.47	0.009
	M	2.52	3.35	0.065
	D	2.54	3.52	0.055
M19	S	1.91	2.41	0.043
	M	2.89	2.67	0.044
	D	2.70	2.51	0.054

Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples Collected at 3 Depths (S: shallow; M: intermediate; D: deep).
3) NH3: Total Ammonia (mg/L as N); TN: Total Nitrogen (mg/L); TP: Total Phosphorus (mg/L).
4) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
5) S18: Sep 2018; Mar19: Mar 2019.
6) Please see Appendix I for a list of values that were removed from this analysis and the rational for their removal.

Figure 3.1-21. Historical Range and Reporting Period Semi-Annual Groundwater Nutrient (mg/L) Results.

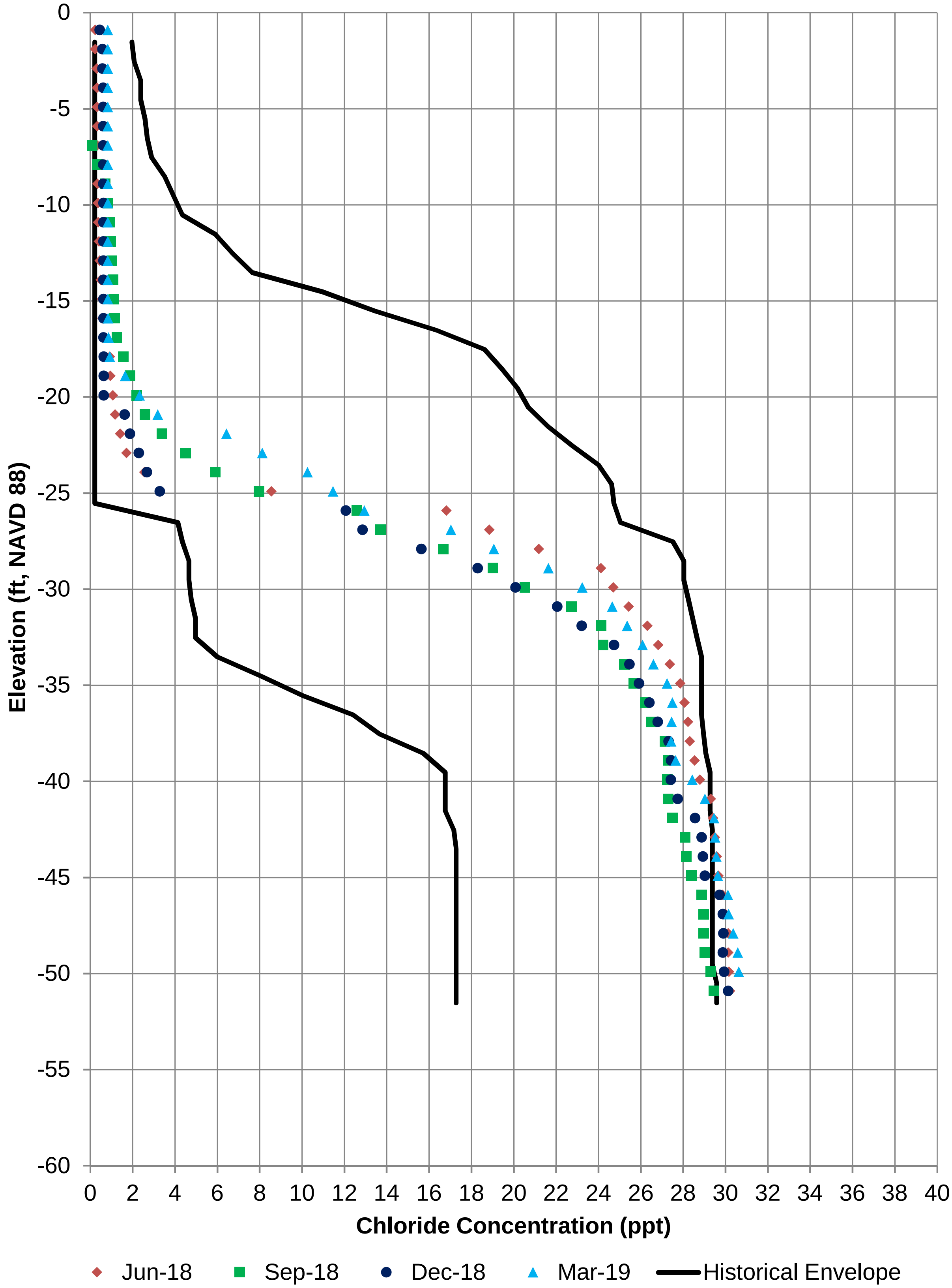


Figure 3.1-22. L-3 Vertical Chloride Profile June 2018 through March 2019.

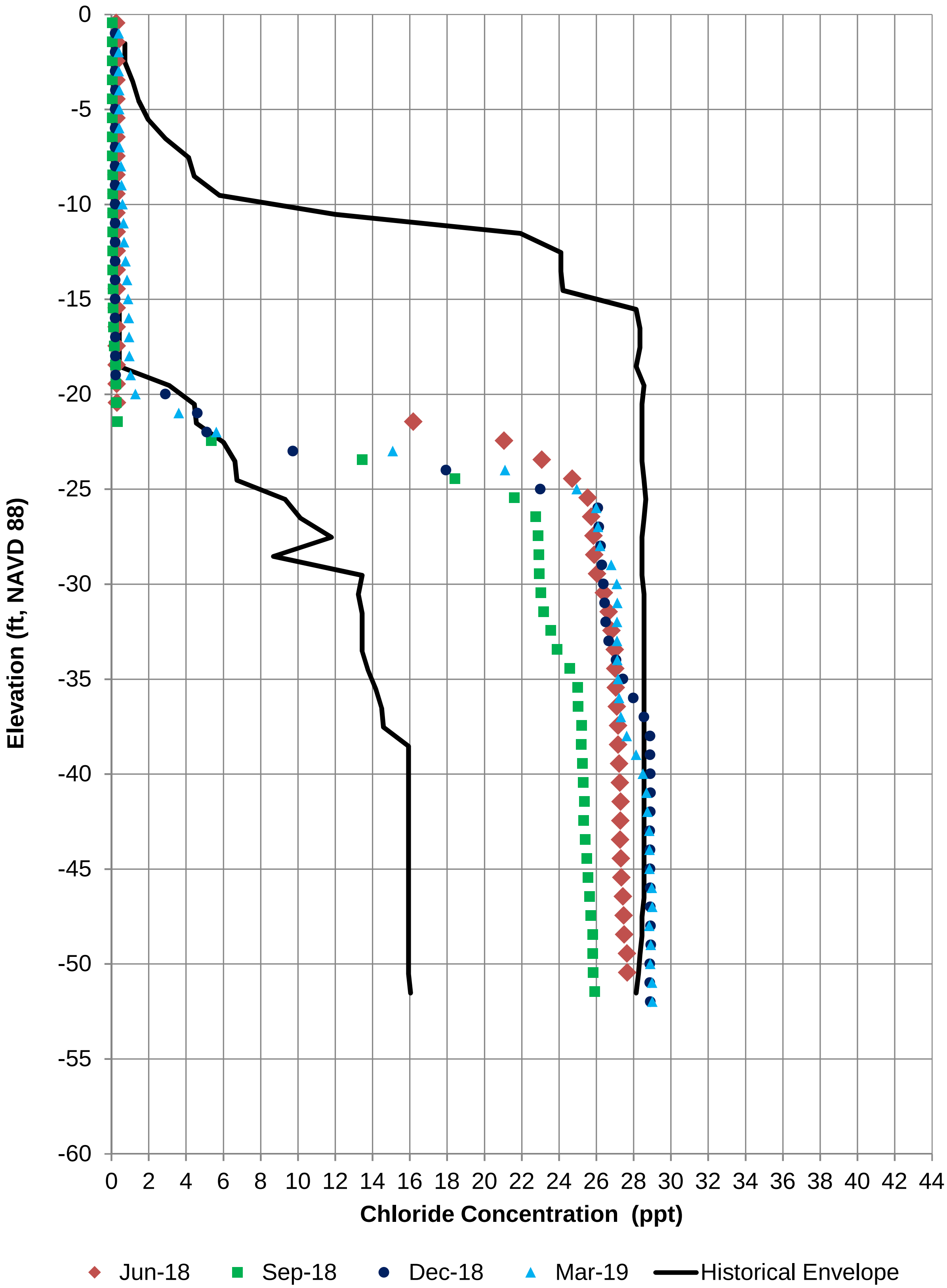


Figure 3.1-23. L-5 Vertical Chloride Profile June 2018 through March 2019.

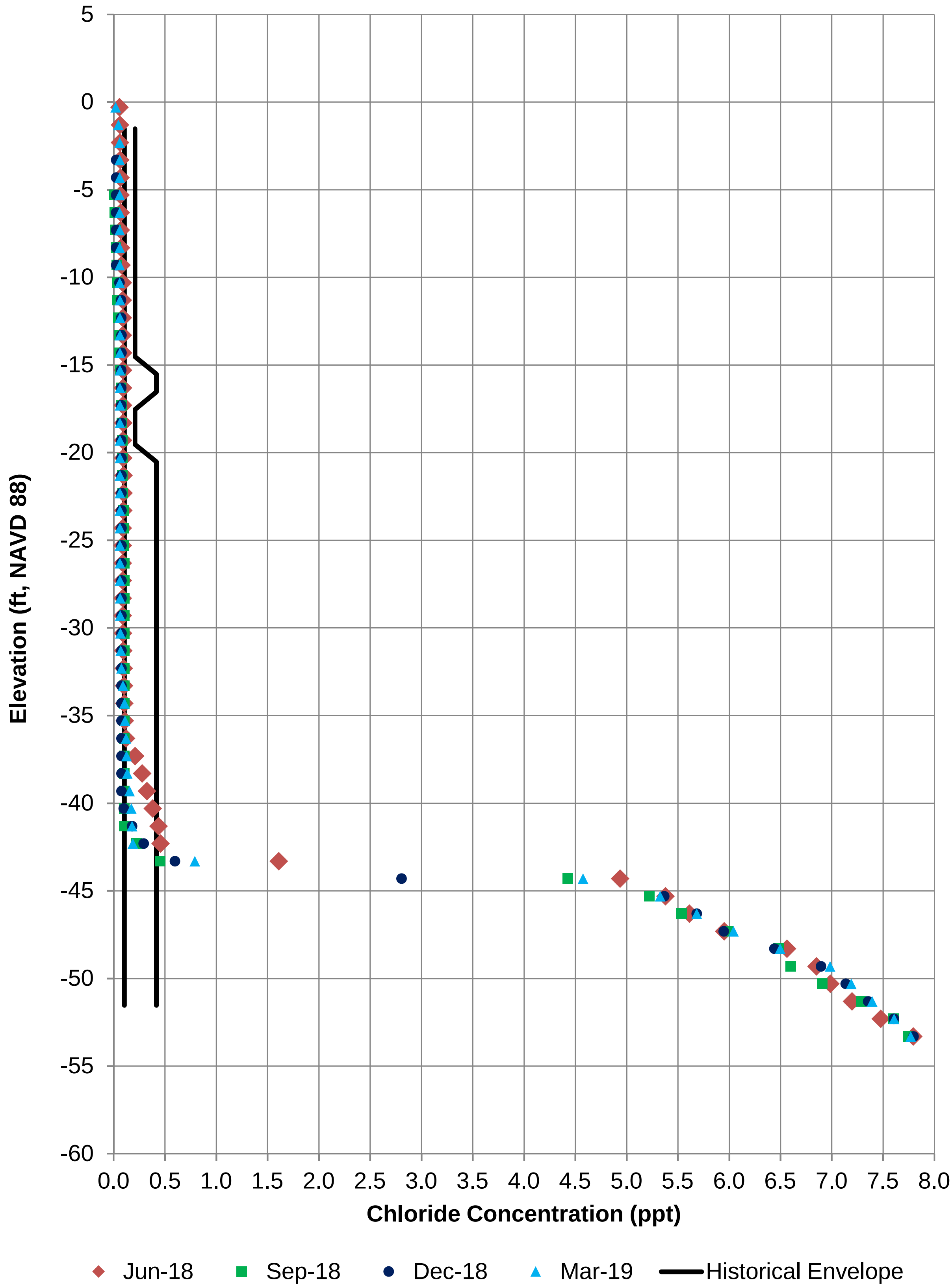


Figure 3.1-24. G-21 Vertical Chloride Profile June 2018 through March 2019.

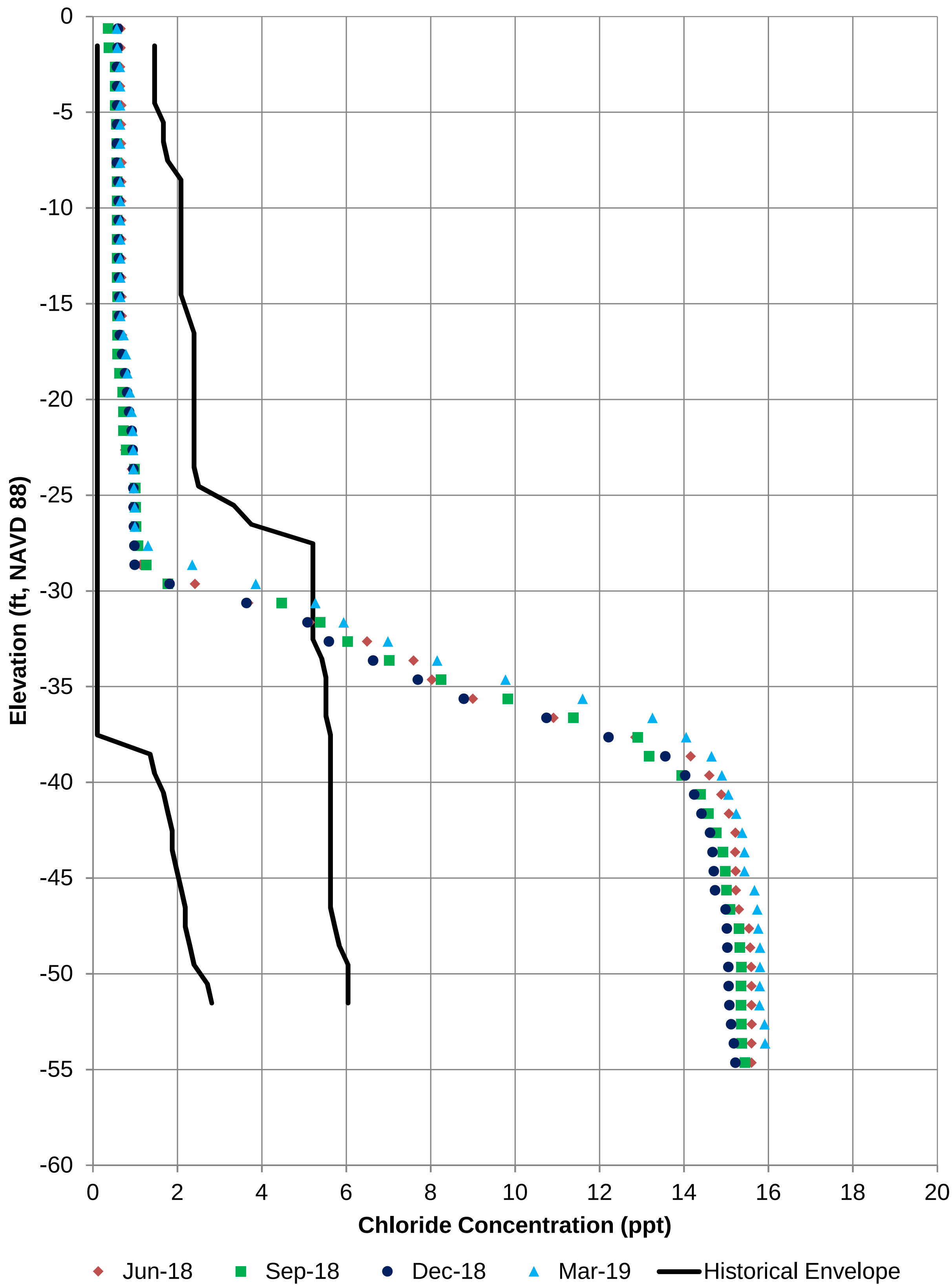


Figure 3.1-25. G-28 Vertical Chloride Profile June 2018 through March 2019.

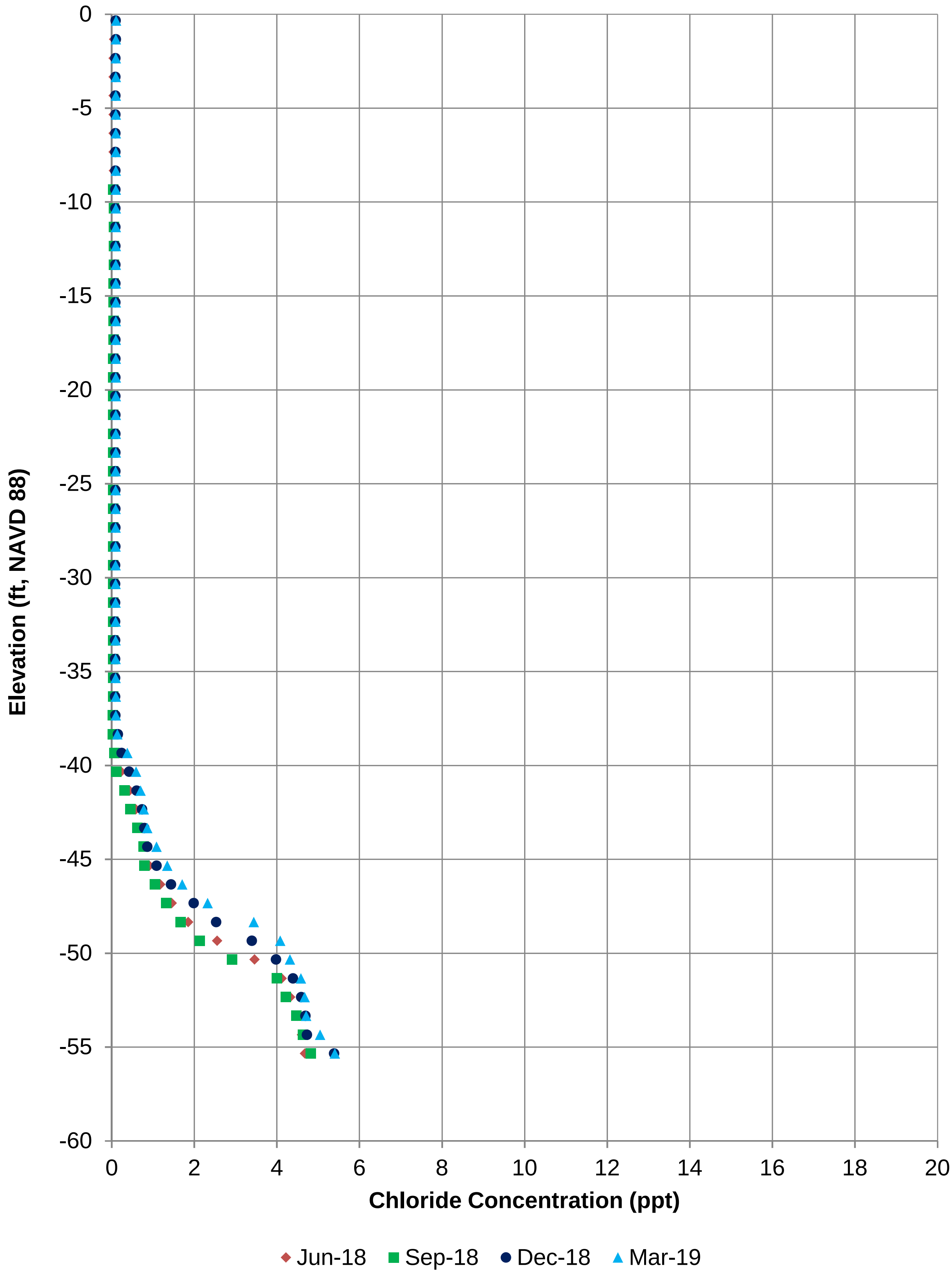


Figure 3.1-26. G-35 Vertical Chloride Profile June 2018 through March 2019.

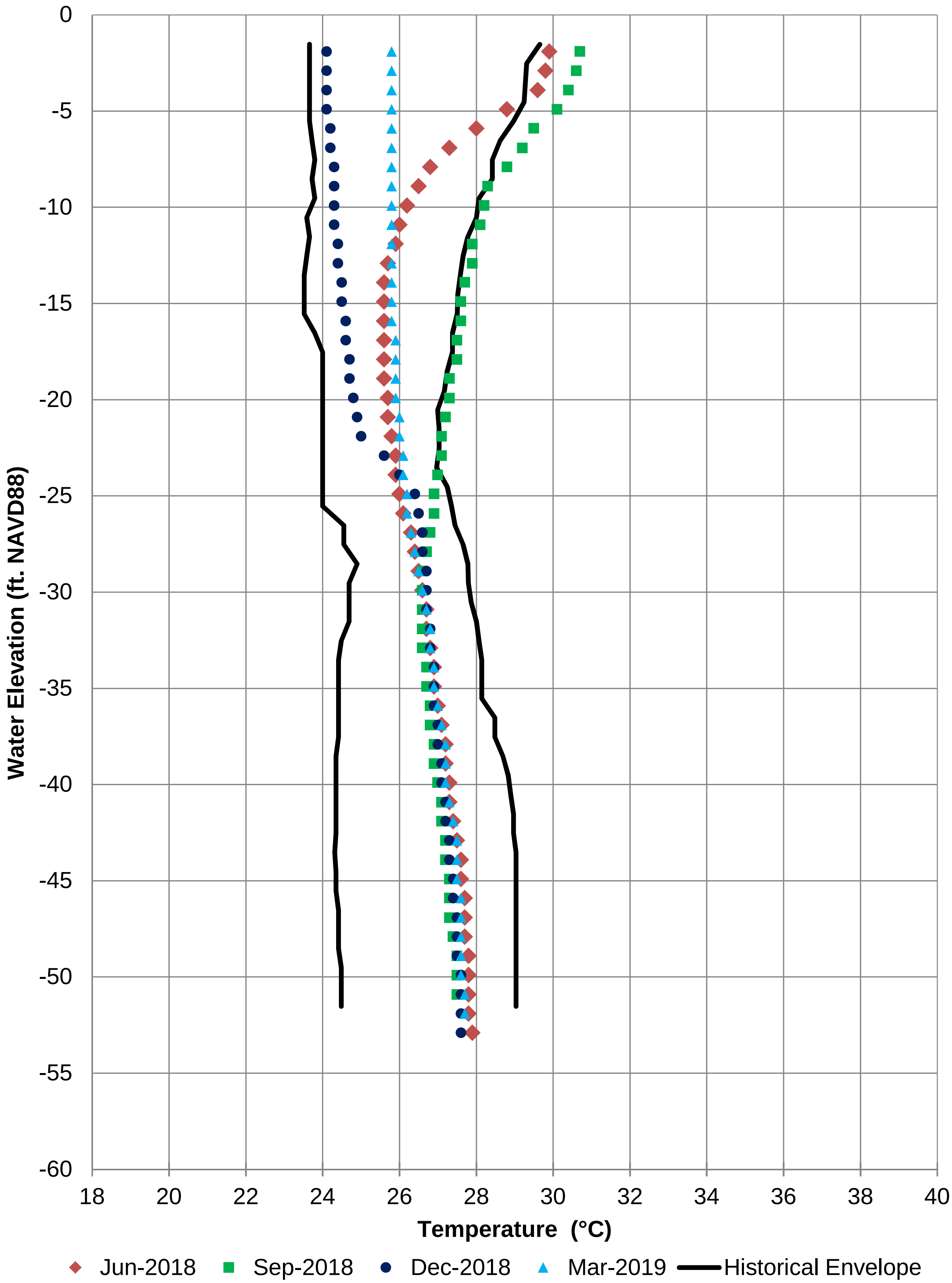


Figure 3.1-27. L-3 Vertical Temperature Profile June 2018 through March 2019.

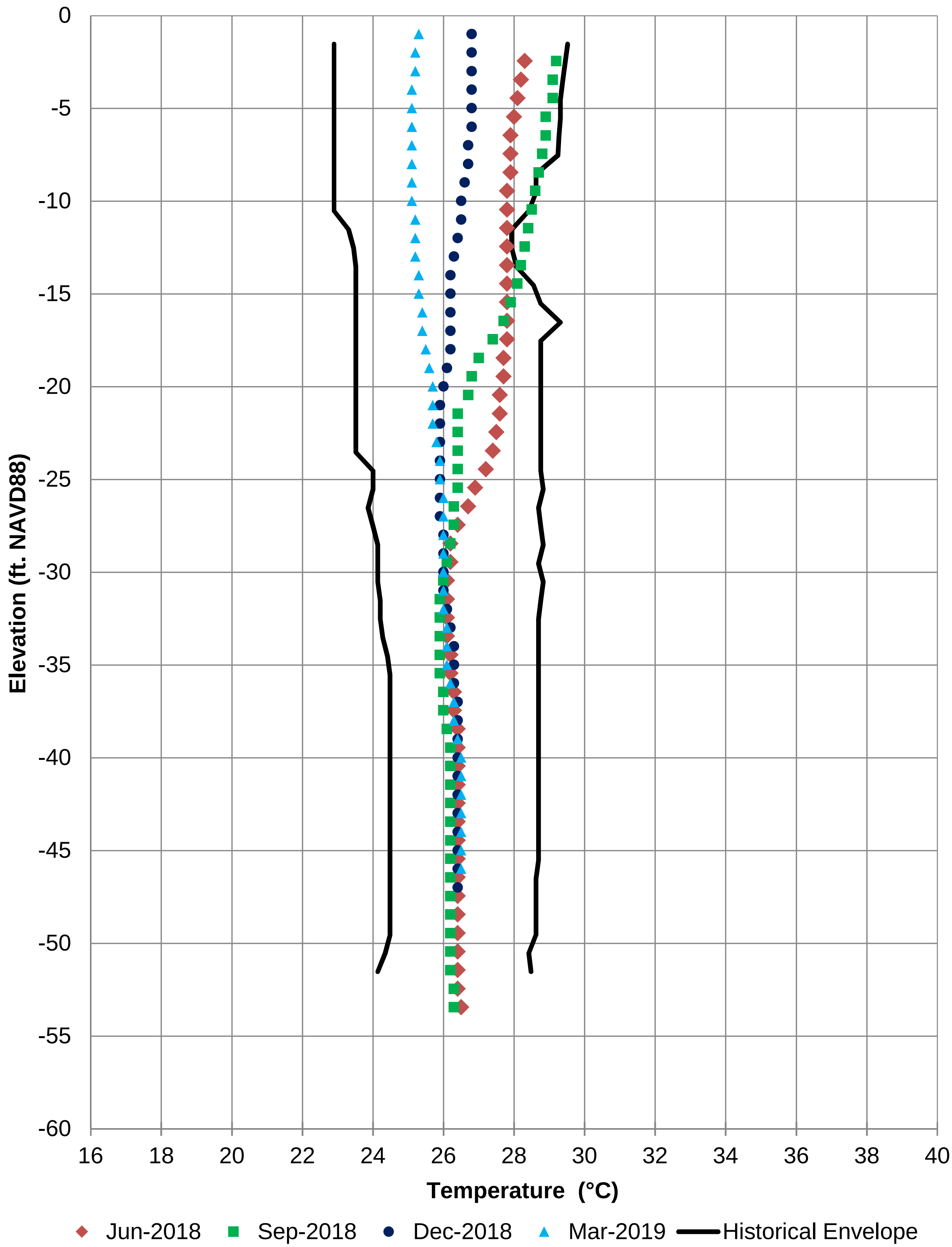


Figure 3.1-28. L-5 Vertical Temperature Profile June 2018 through March 2019.

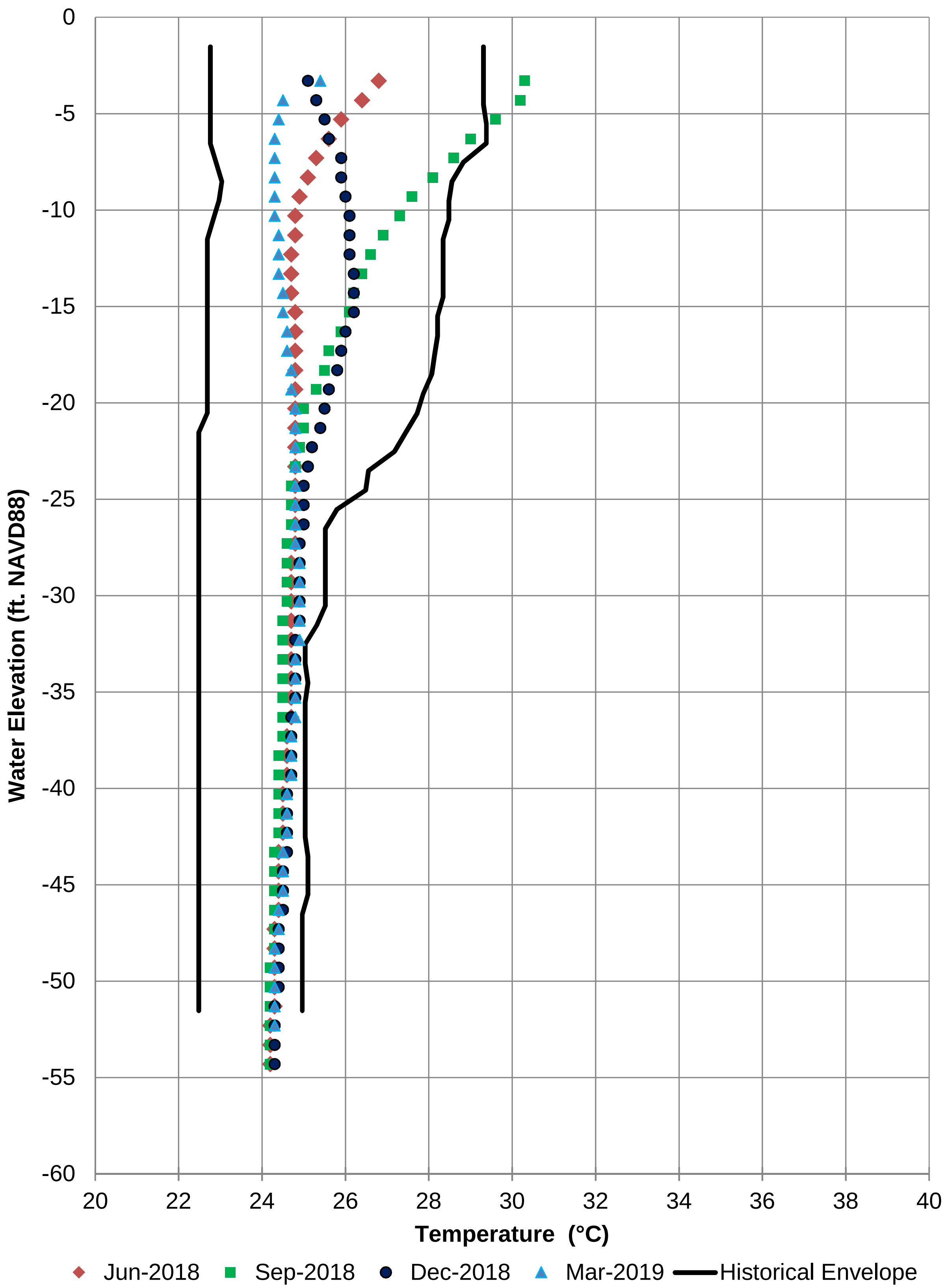


Figure 3.1-29. G-21 Vertical Temperature Profile June 2018 through March 2019.

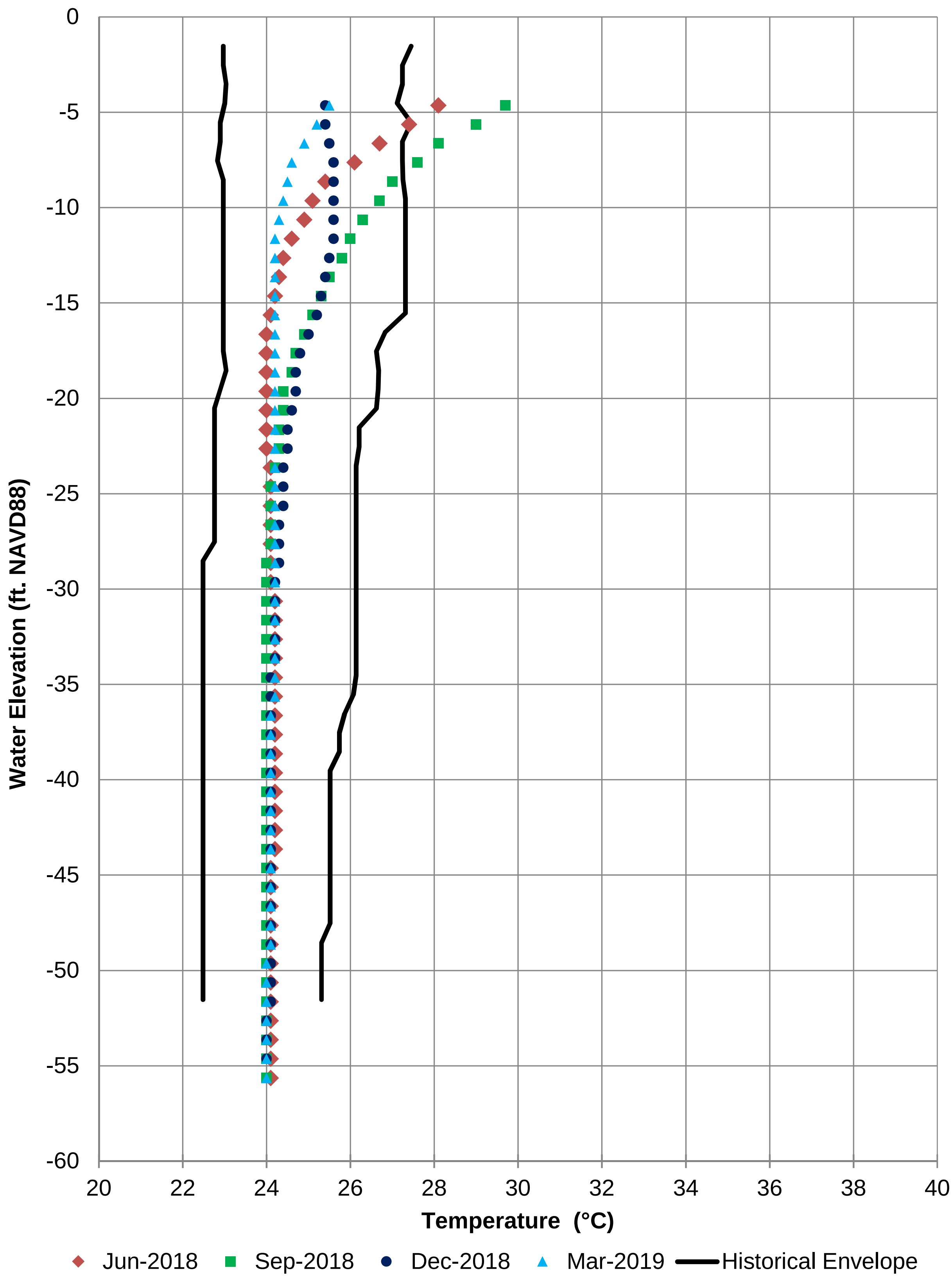


Figure 3.1-30. G-28 Vertical Temperature Profile June 2018 through March 2019.

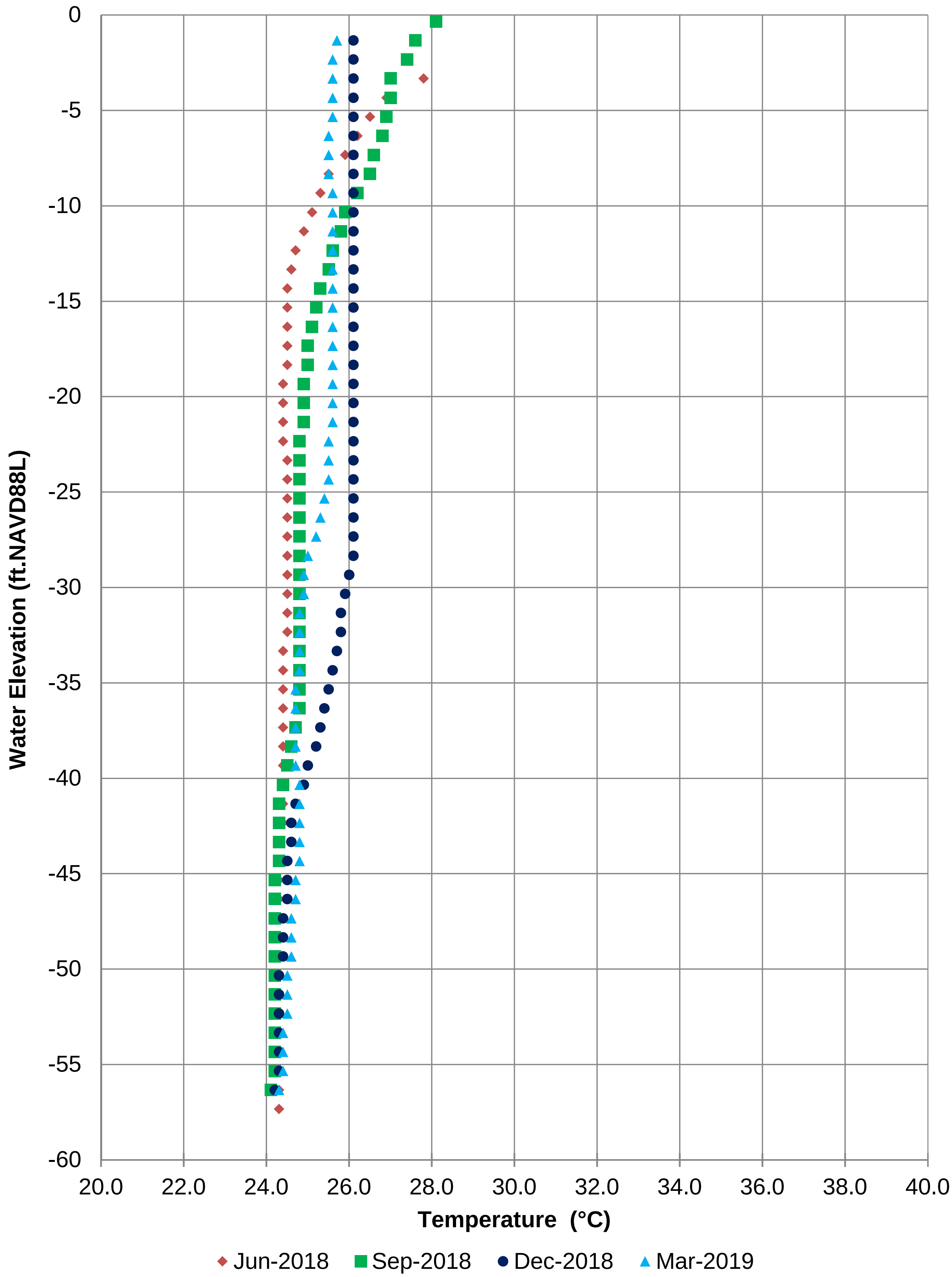


Figure 3.1-31. G-35 Vertical Temperature Profile June 2018 through March 2019.

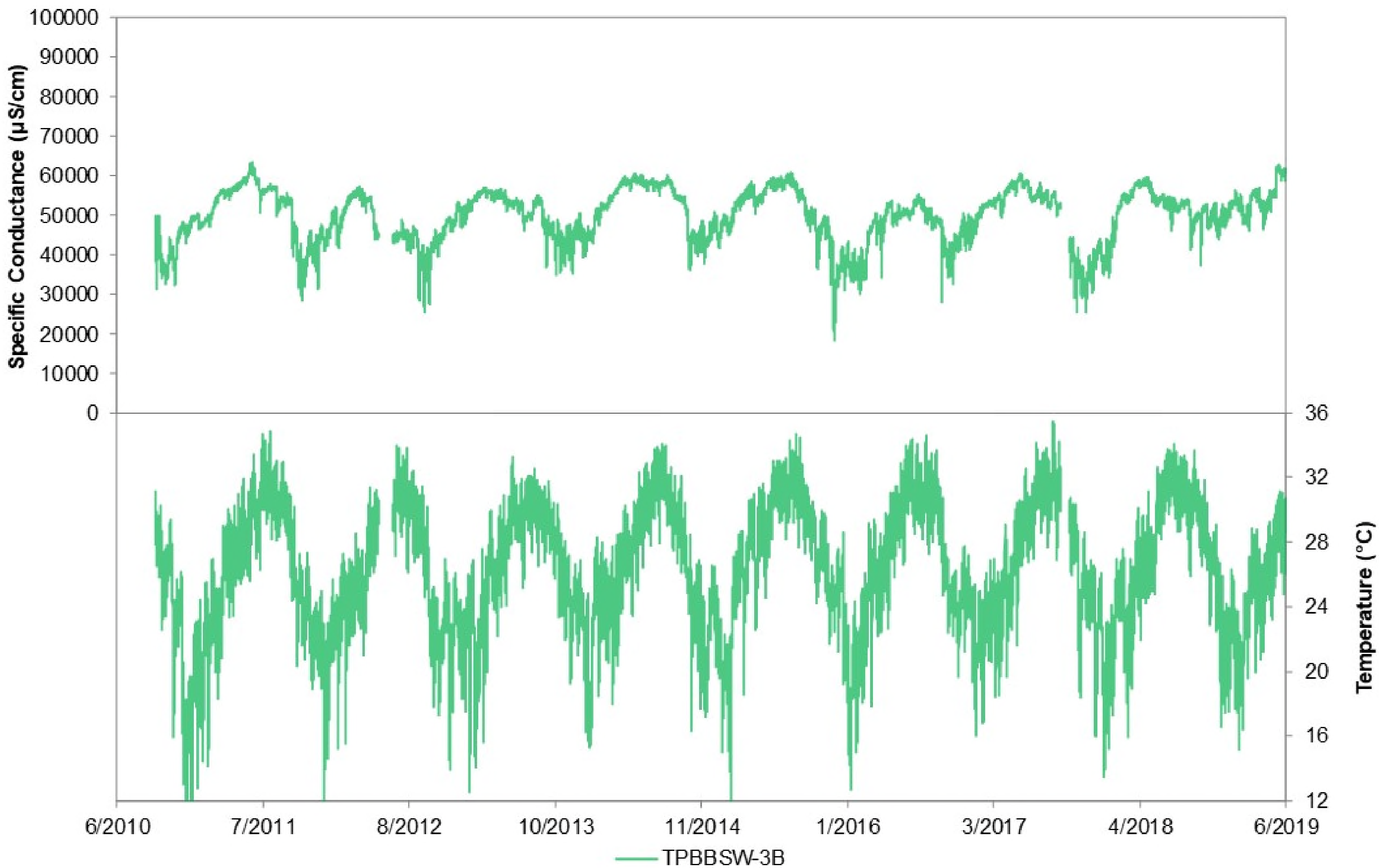


Figure 3.2-1. TPBBSW-3 Specific Conductance and Temperature.

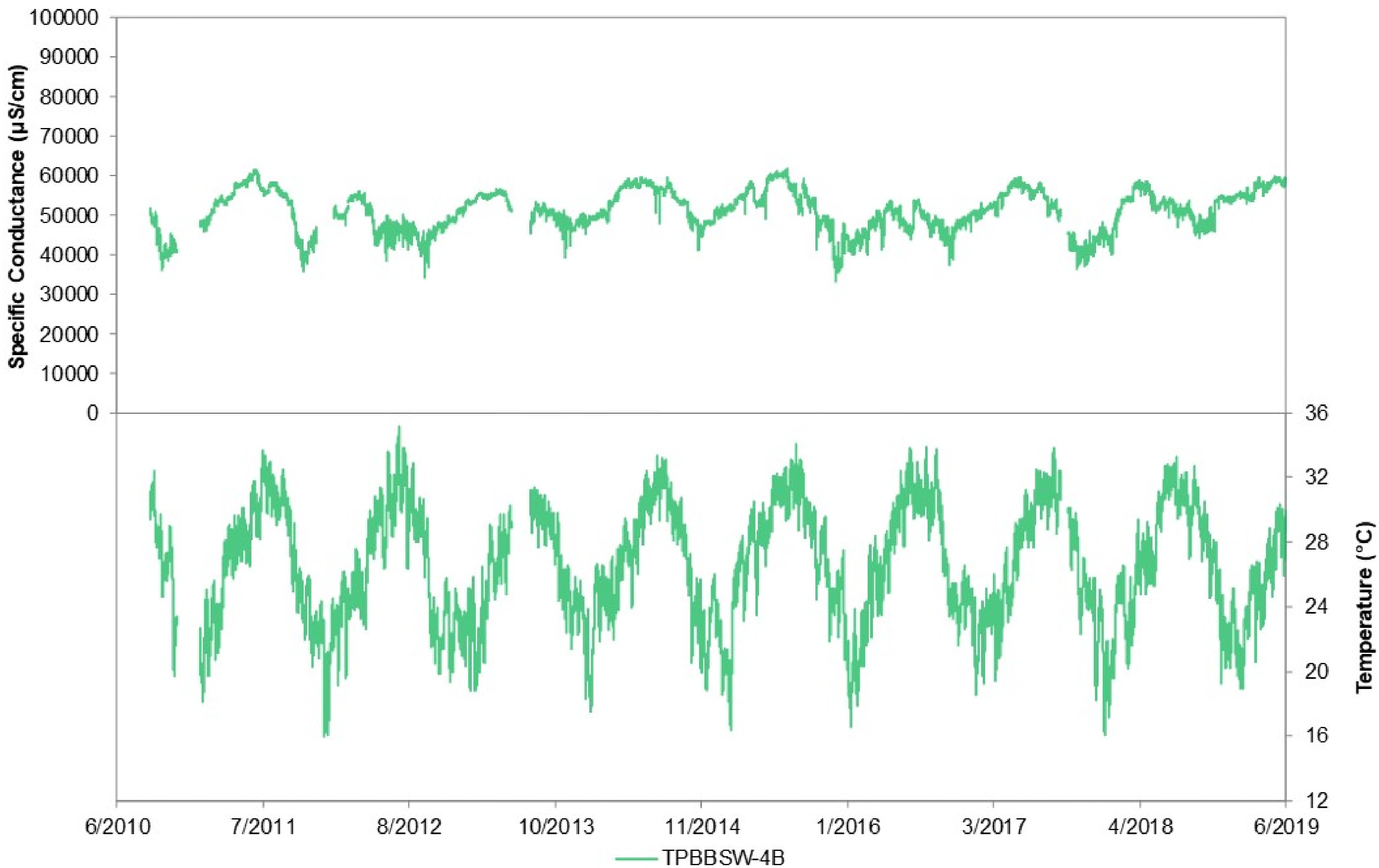


Figure 3.2-2. TPBBSW-4 Specific Conductance and Temperature.

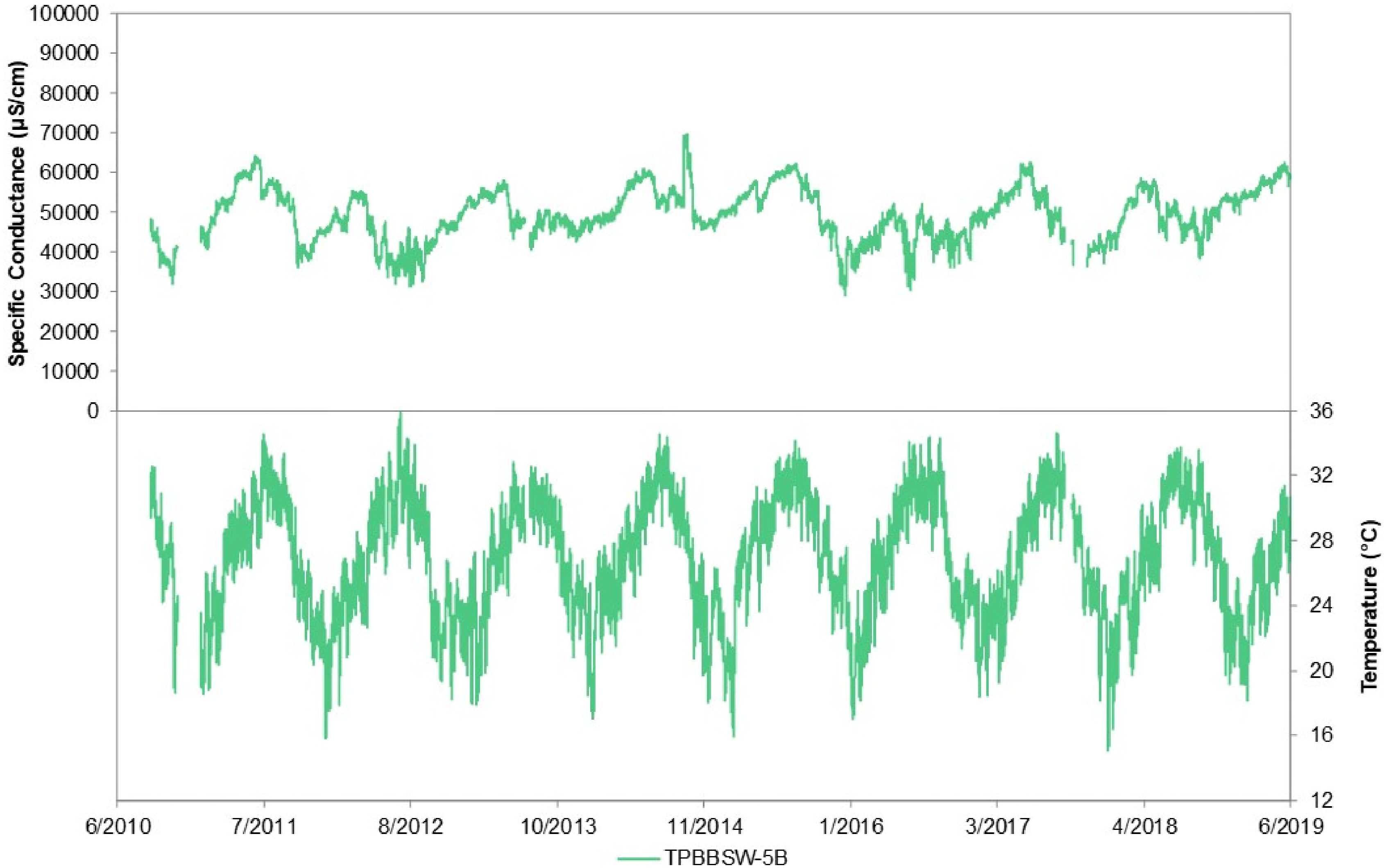


Figure 3.2-3. TPBBSW-5 Specific Conductance and Temperature.

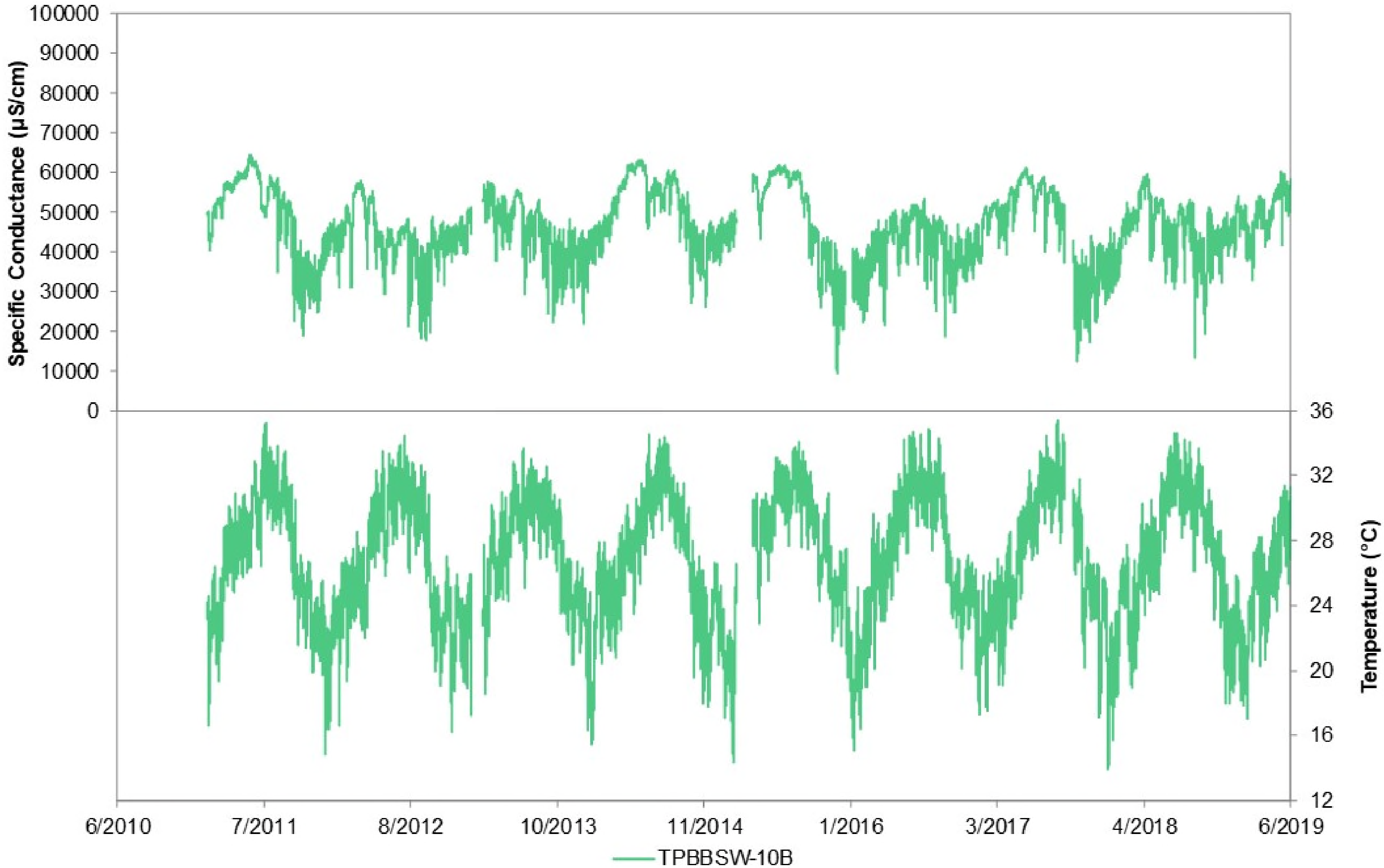


Figure 3.2-4. TPBBSW-10 Specific Conductance and Temperature.

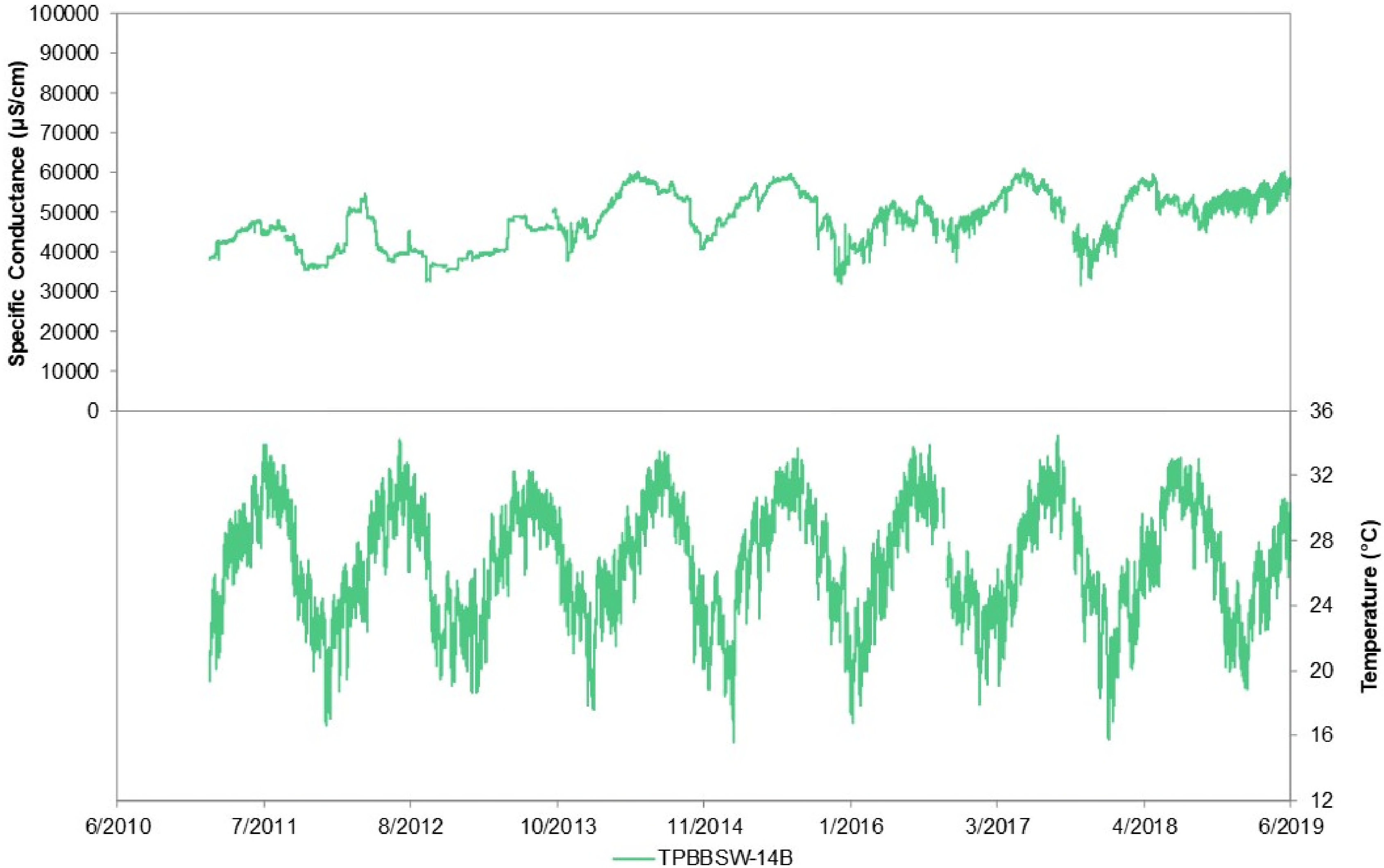


Figure 3.2-5. TPBBSW-14 Specific Conductance and Temperature.

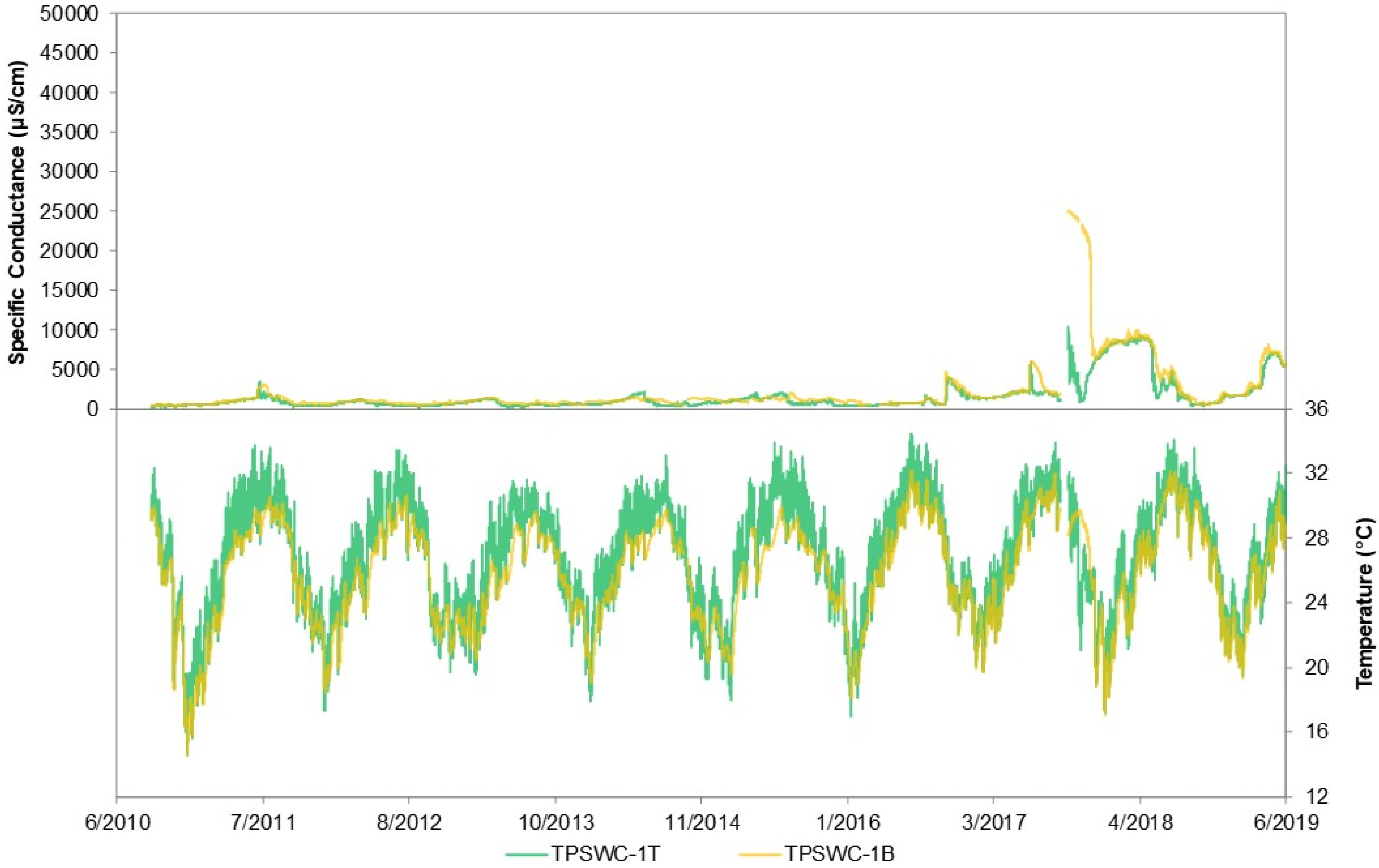


Figure 3.2-6. TPSWC-1 Specific Conductance and Temperature.

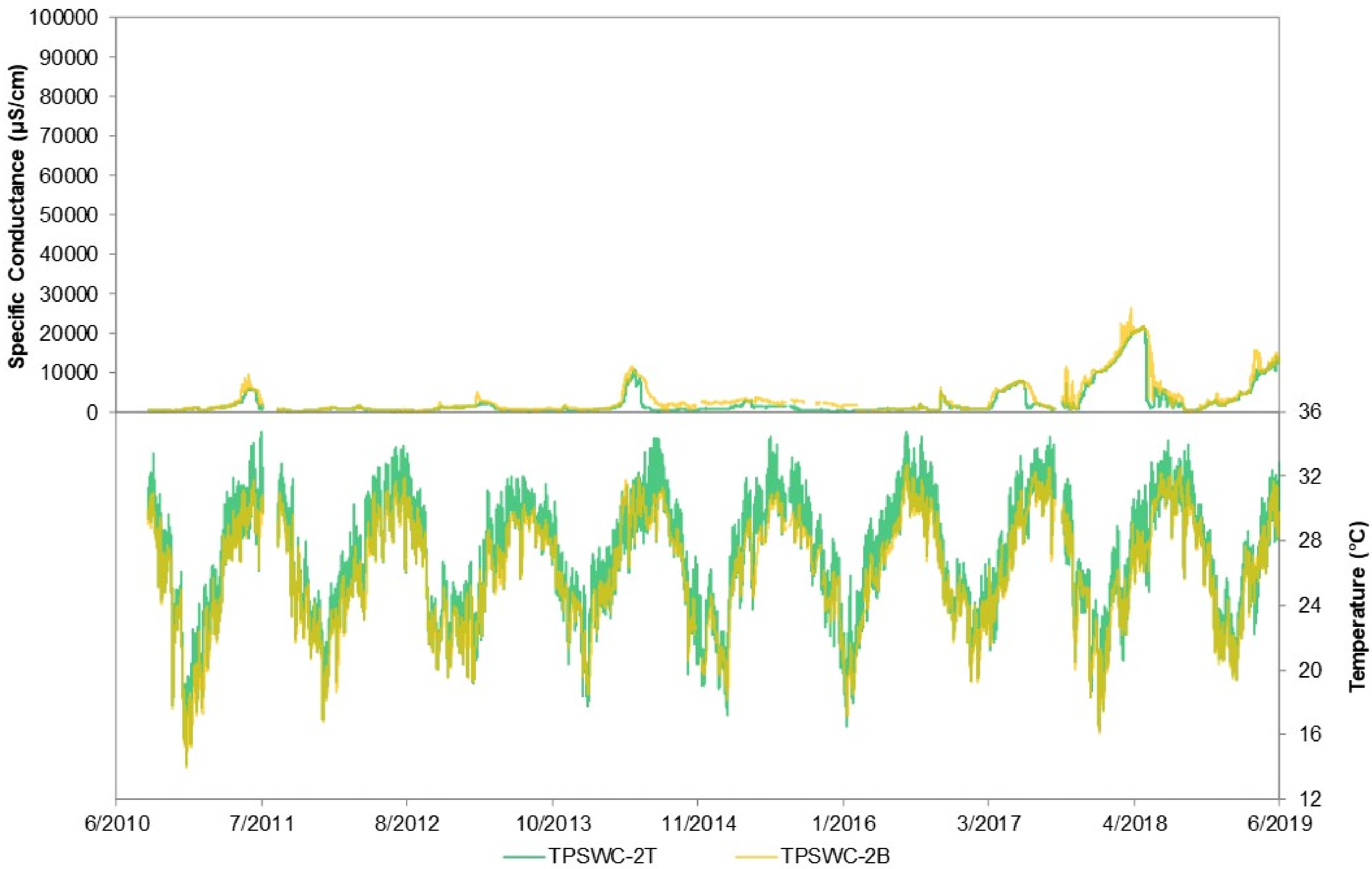


Figure 3.2-7. TPSWC-2 Specific Conductance and Temperature.

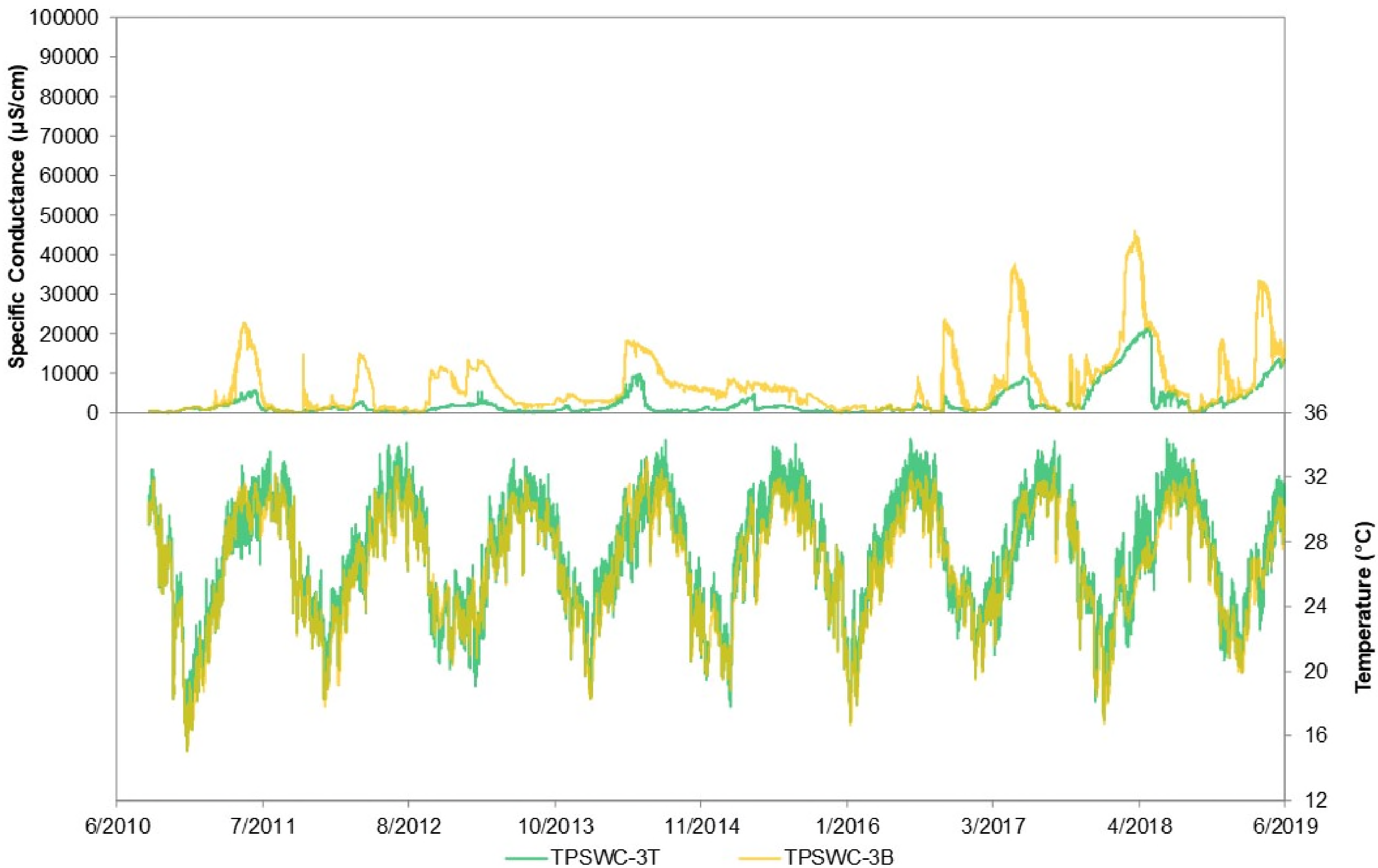


Figure 3.2-8. TPSWC-3 Specific Conductance and Temperature.

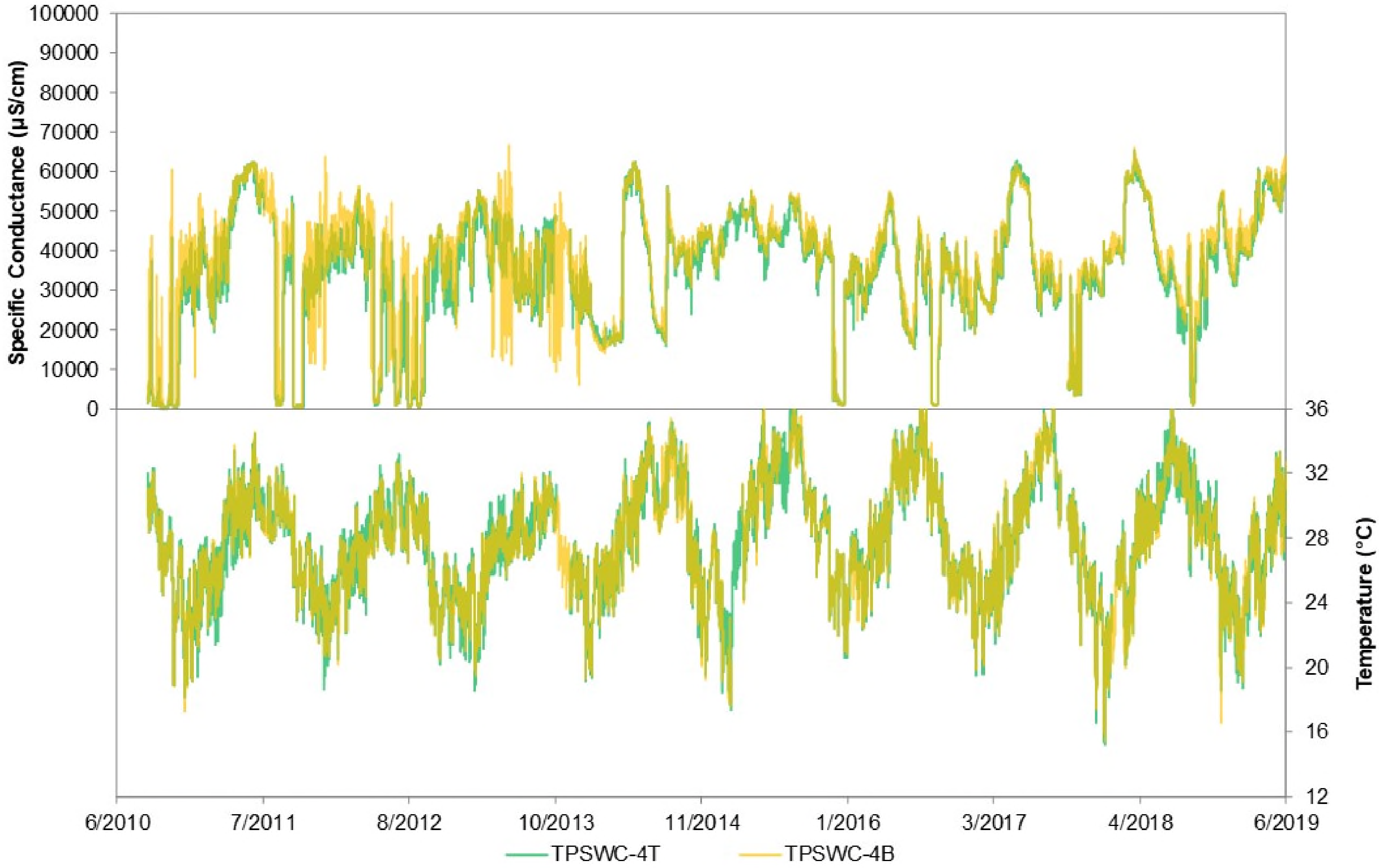


Figure 3.2-9. TPSWC-4 Specific Conductance and Temperature.

Figure 3.2-10. TPSWC-5 Specific Conductance and Temperature.

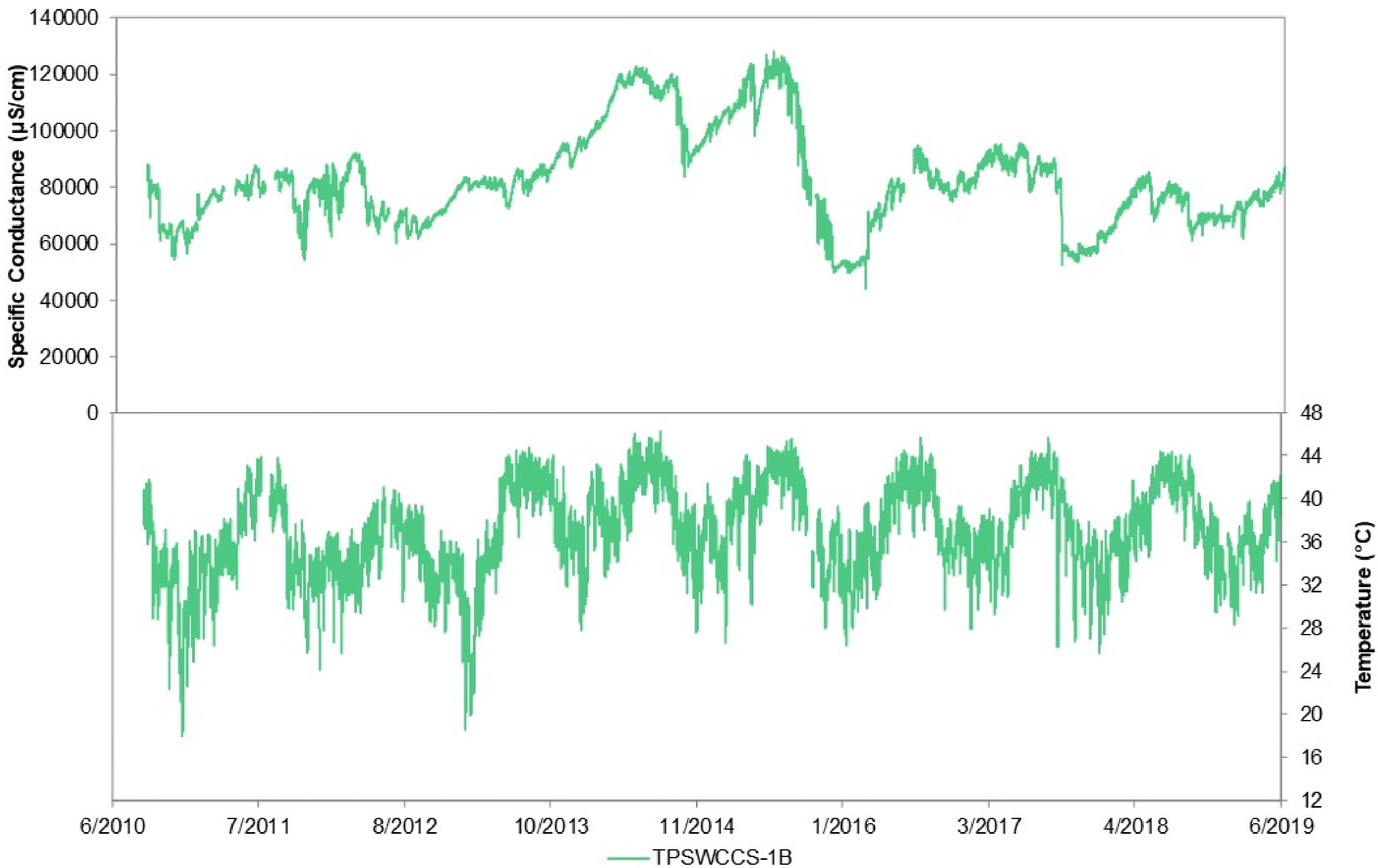


Figure 3.2-11. TPSWCCS-1 Specific Conductance and Temperature.

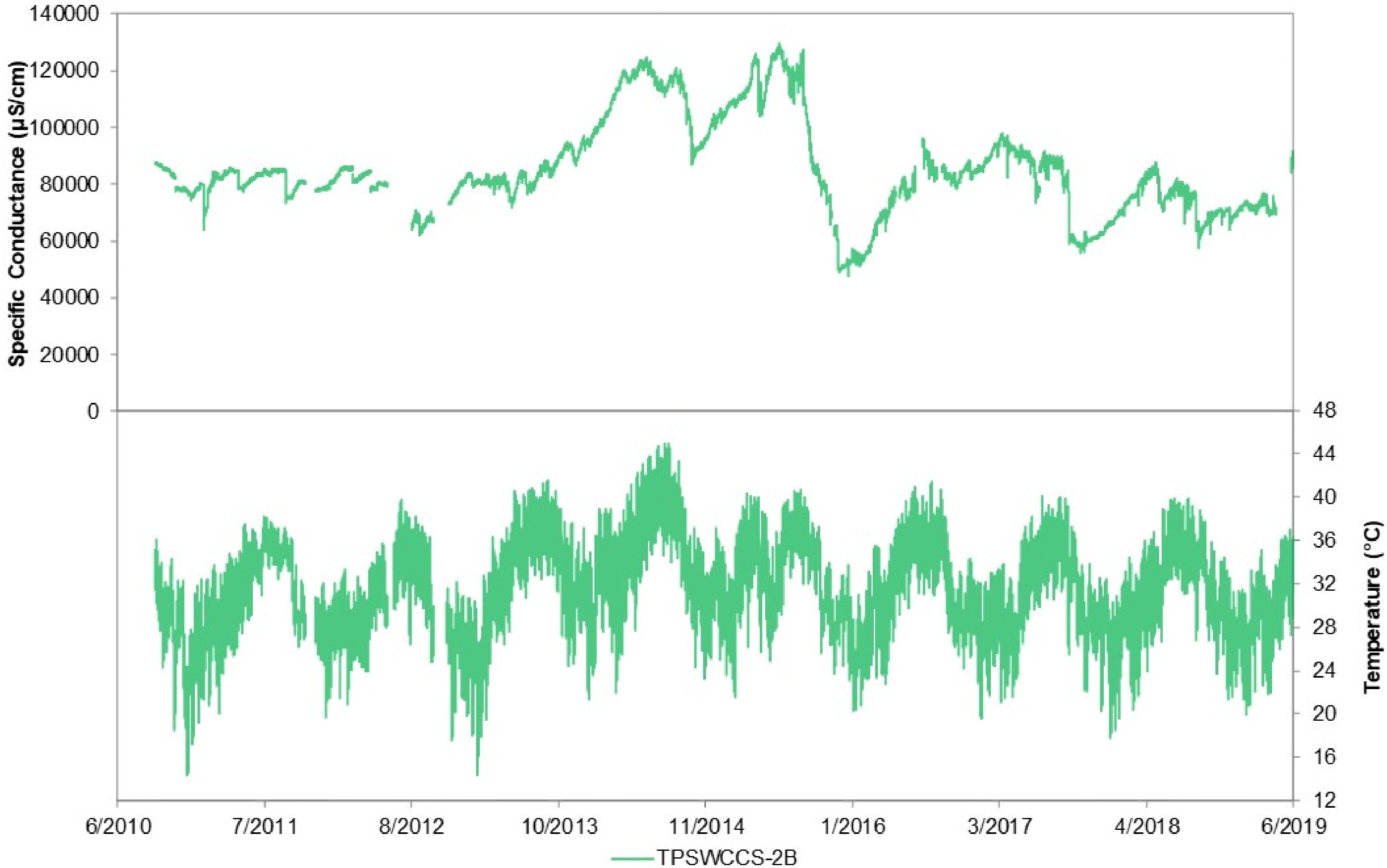


Figure 3.2-12. TPSWCCS-2 Specific Conductance and Temperature.

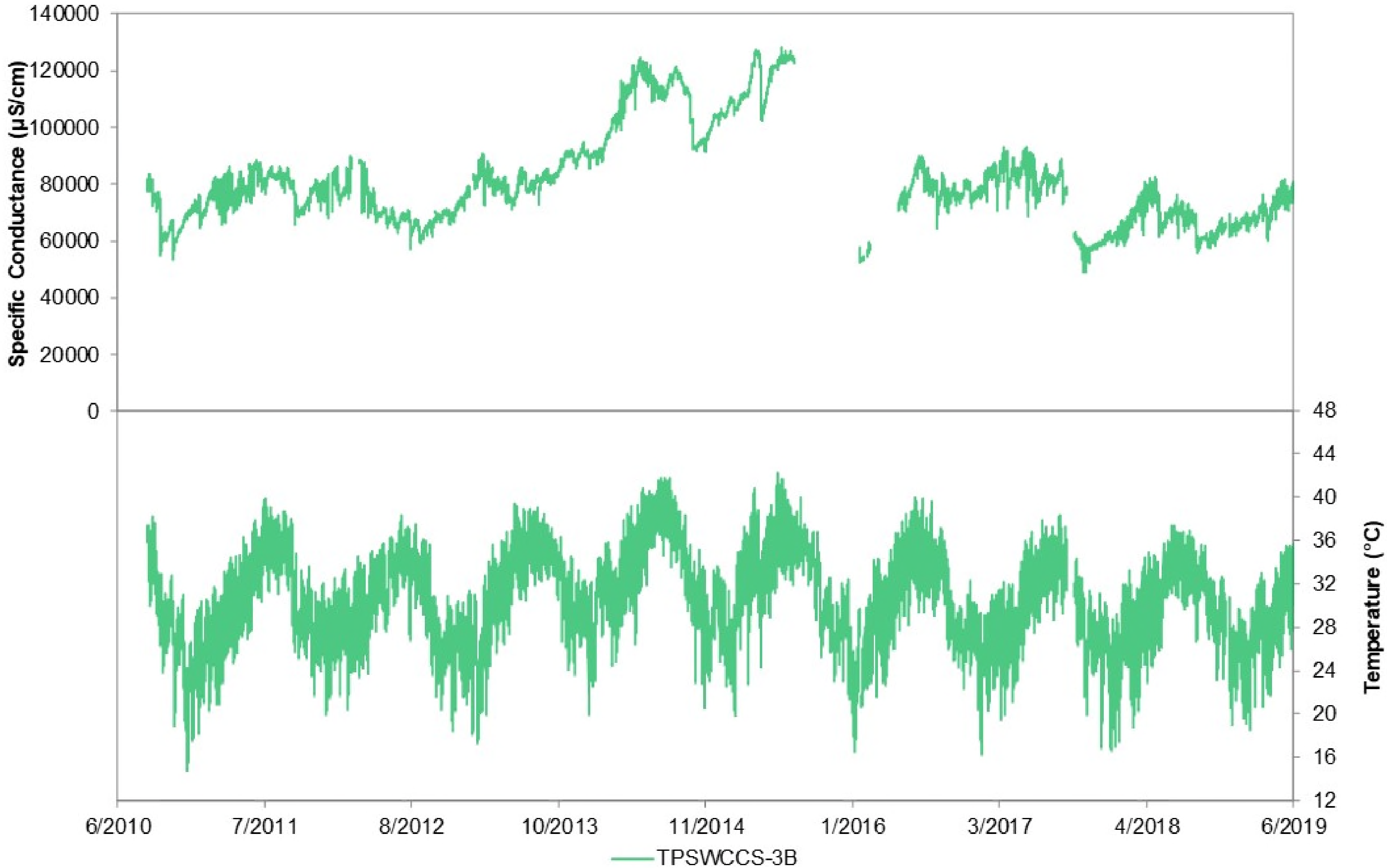


Figure 3.2-13. TPSWCCS-3 Specific Conductance and Temperature.

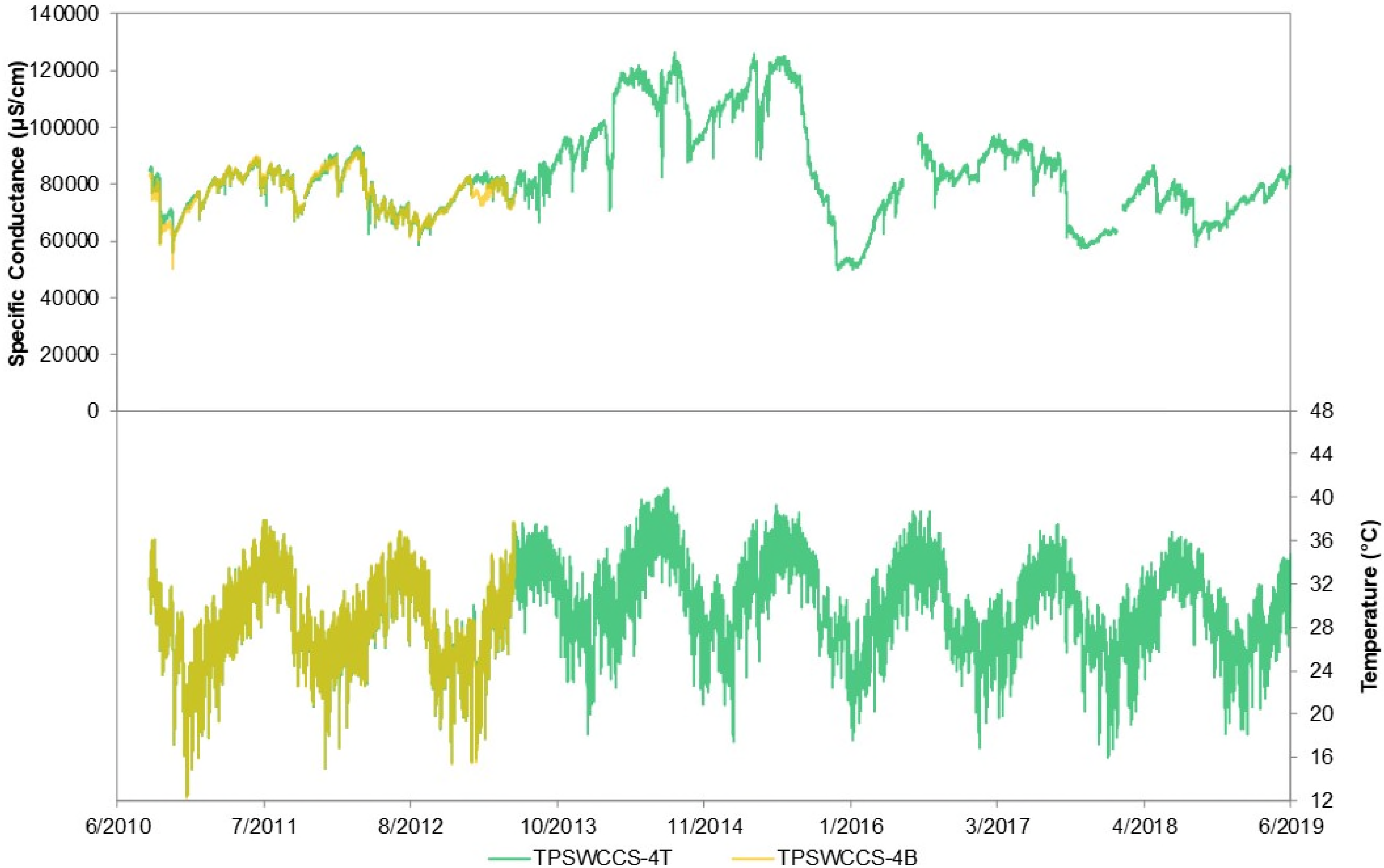


Figure 3.2-14. TPSWCCS-4 Specific Conductance and Temperature.

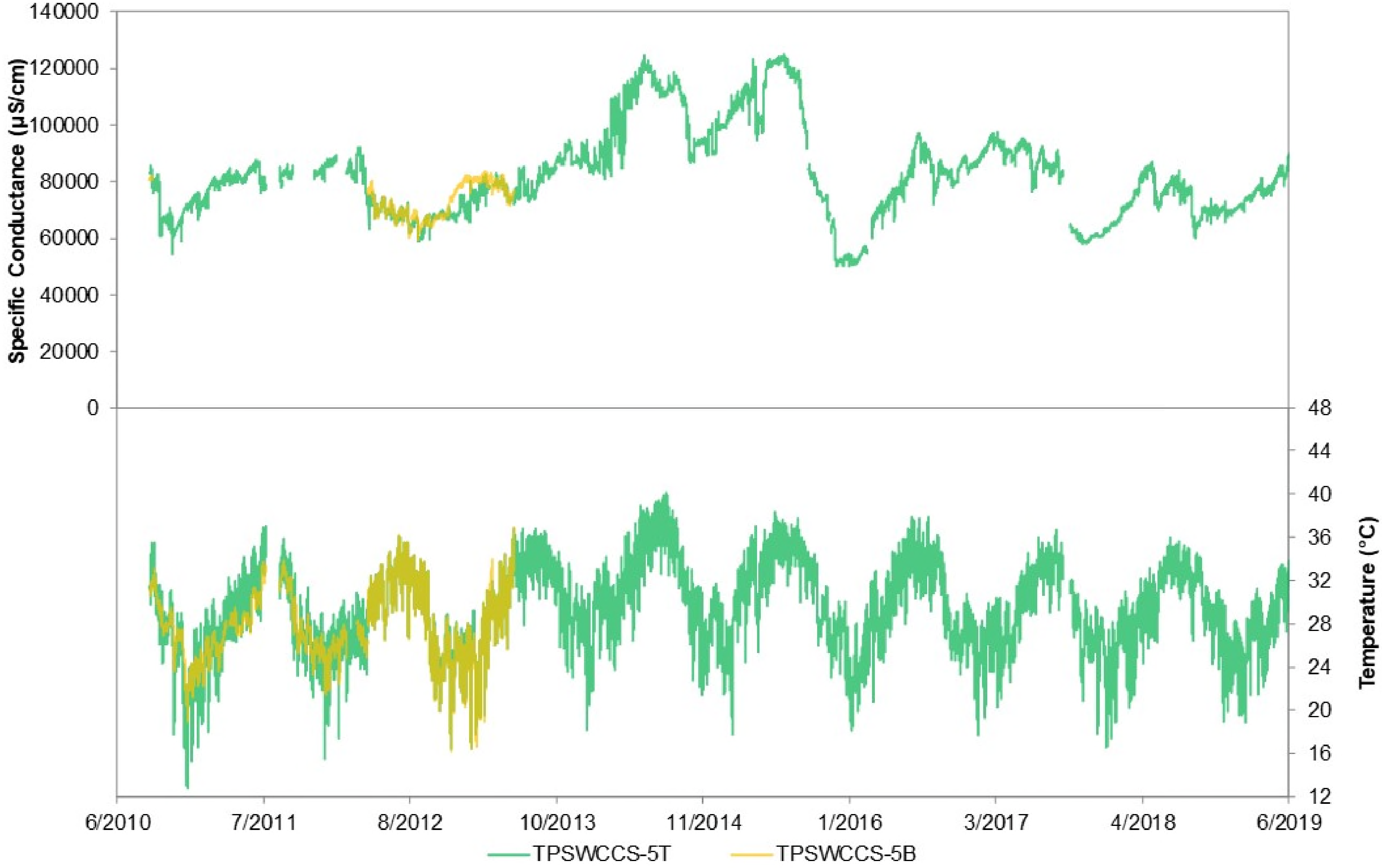


Figure 3.2-15. TPSWCCS-5 Specific Conductance and Temperature.

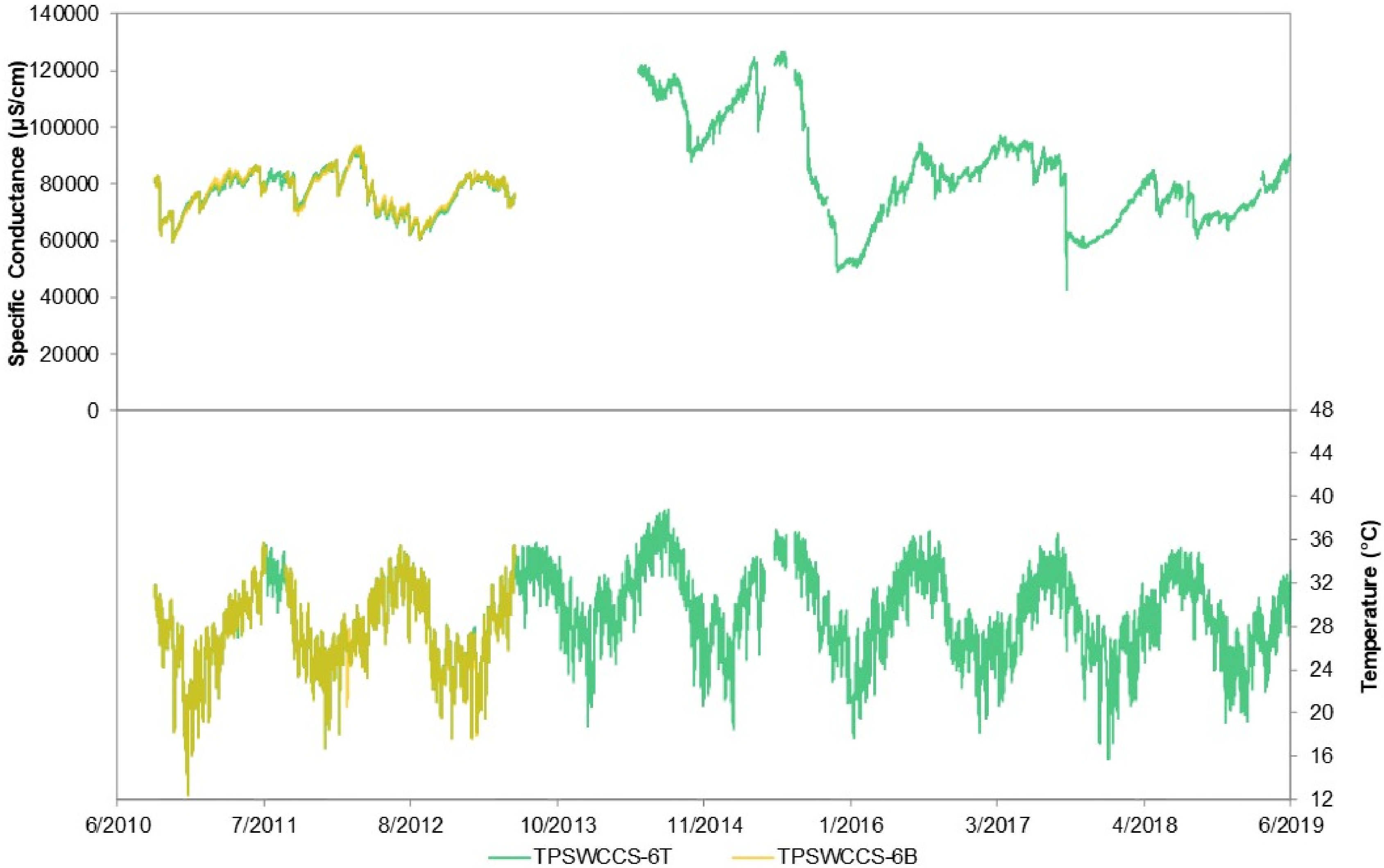


Figure 3.2-16. TPSWCCS-6 Specific Conductance and Temperature.

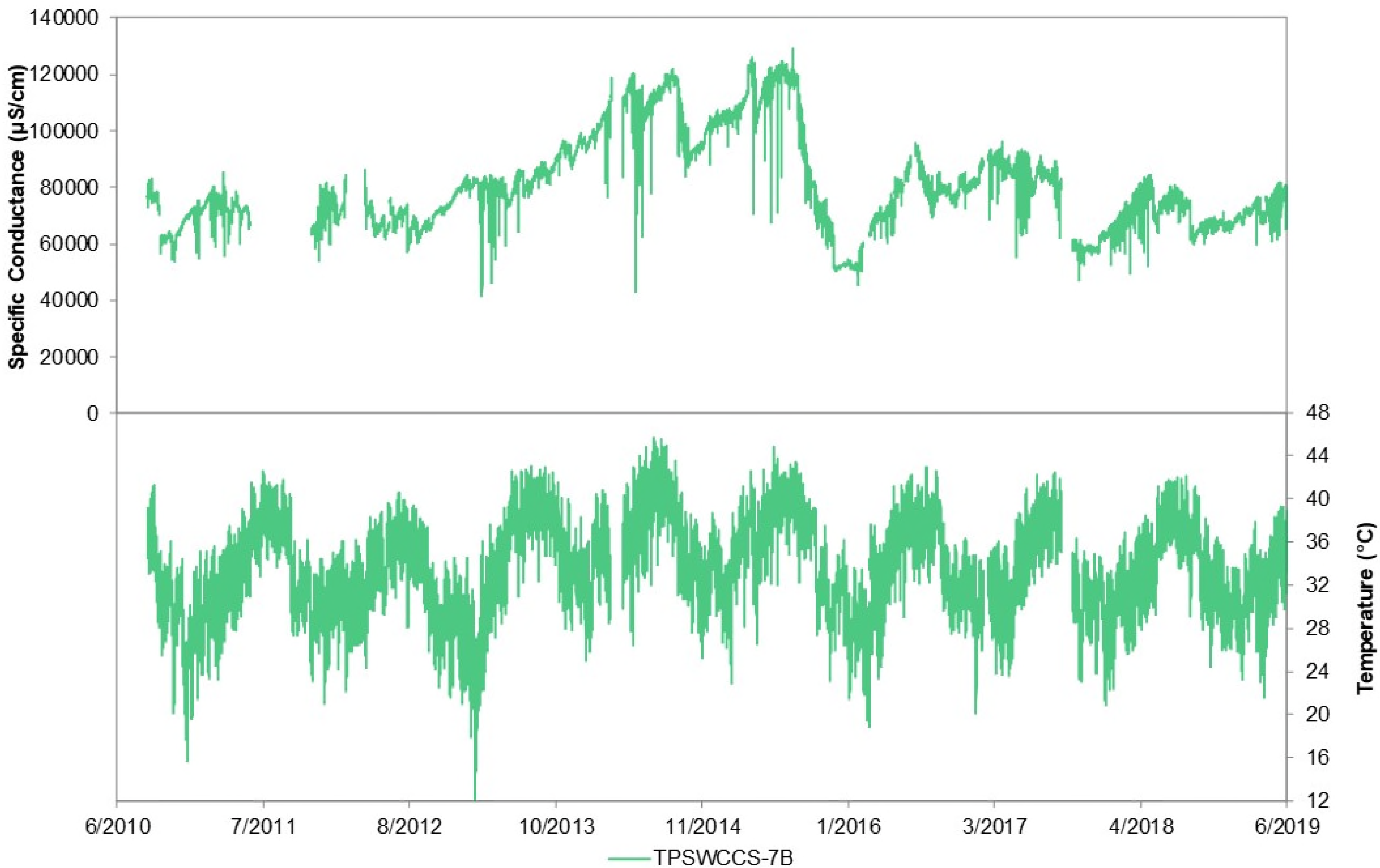


Figure 3.2-17. TPSWCCS-7 Specific Conductance and Temperature.

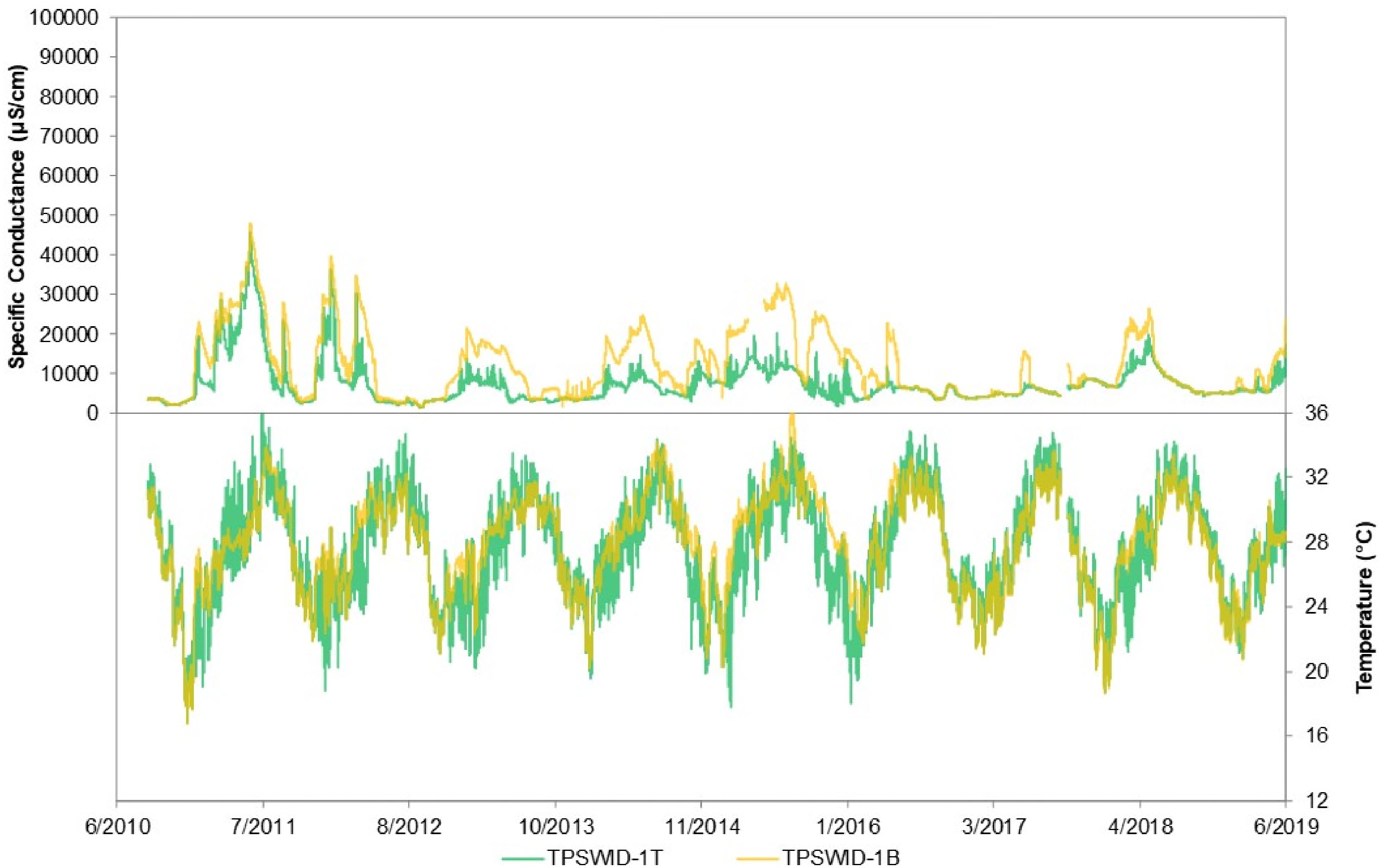


Figure 3.2-18. TPSWID-1 Specific Conductance and Temperature.

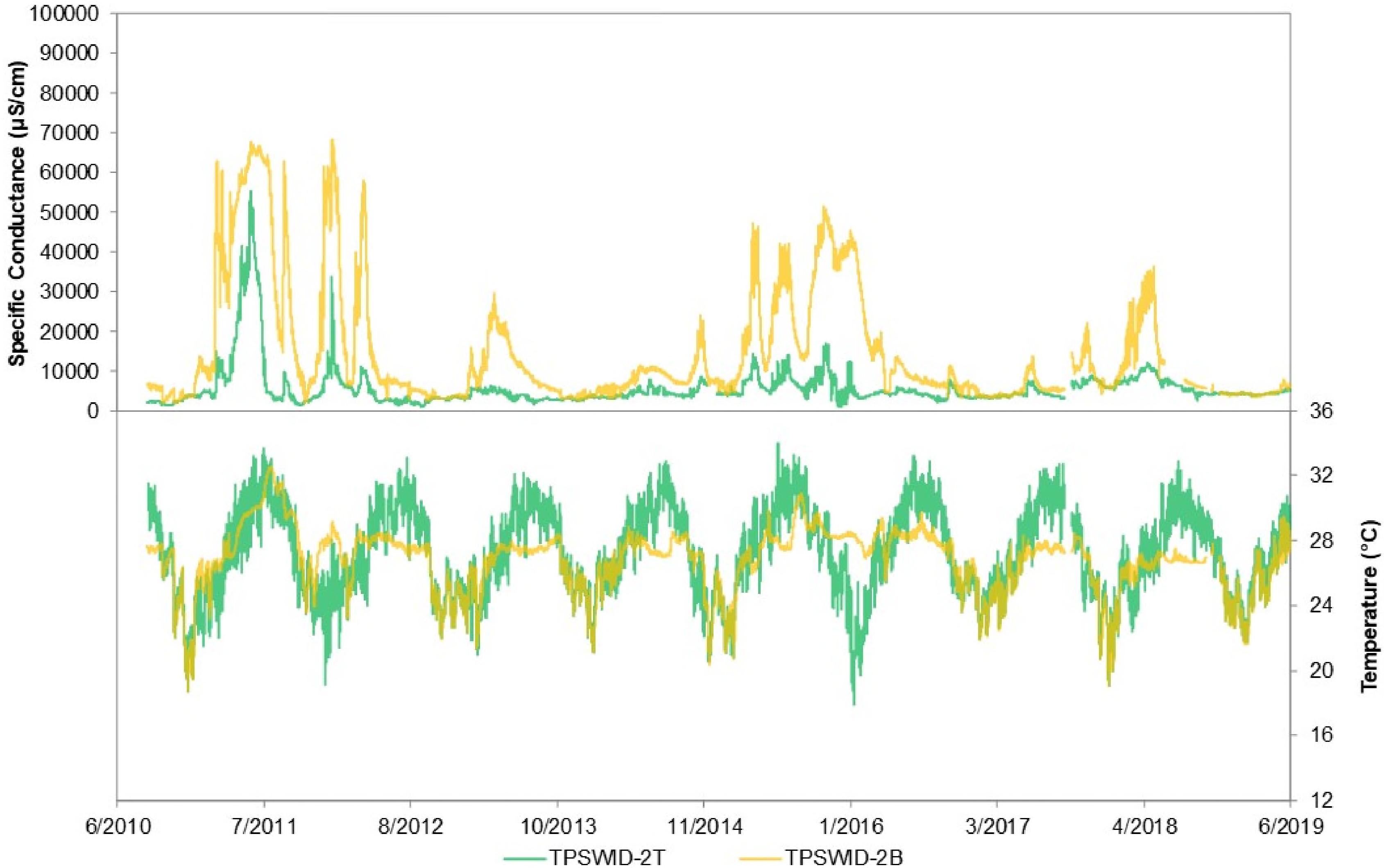


Figure 3.2-19. TPSWID-2 Specific Conductance and Temperature.

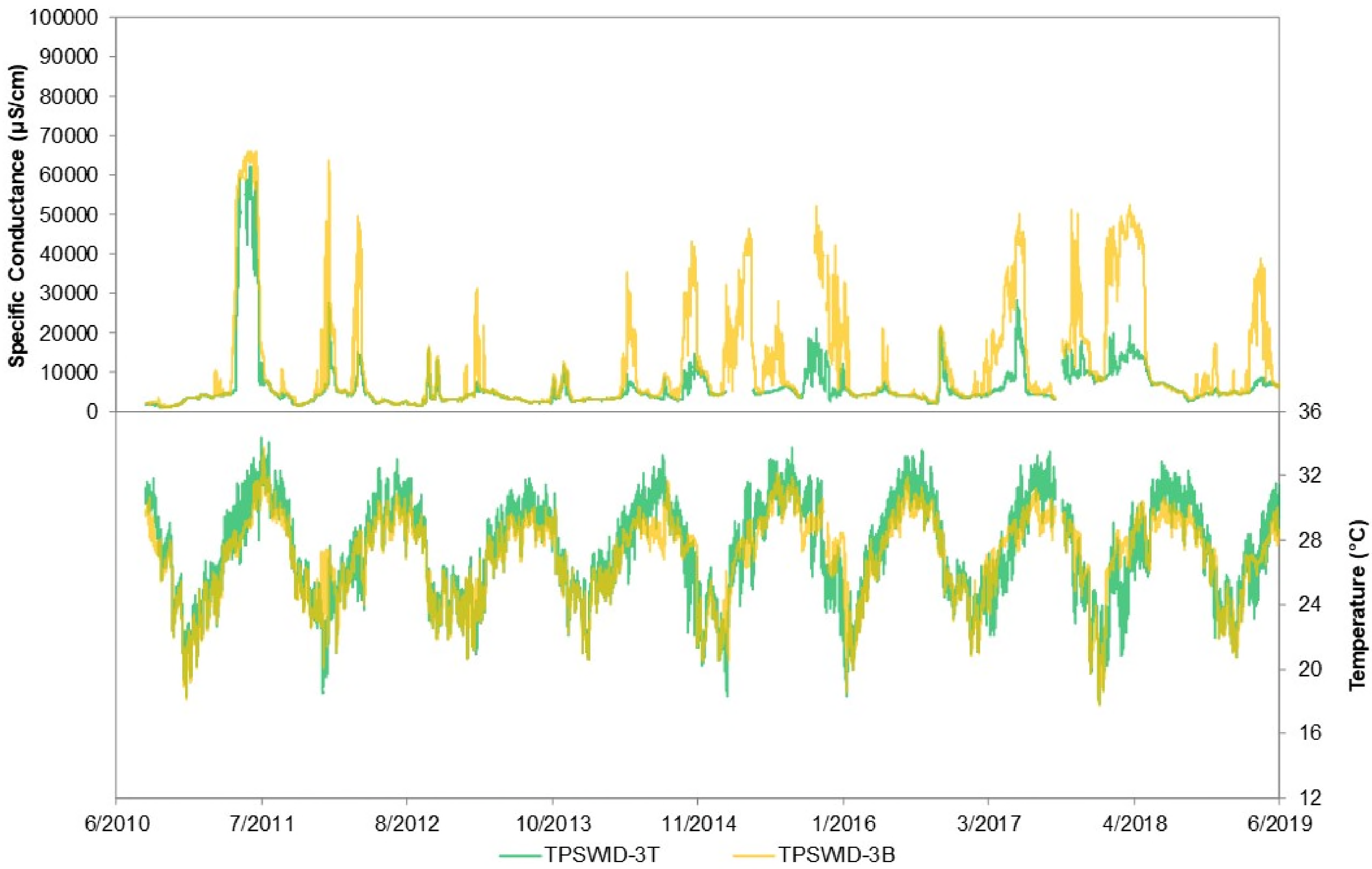
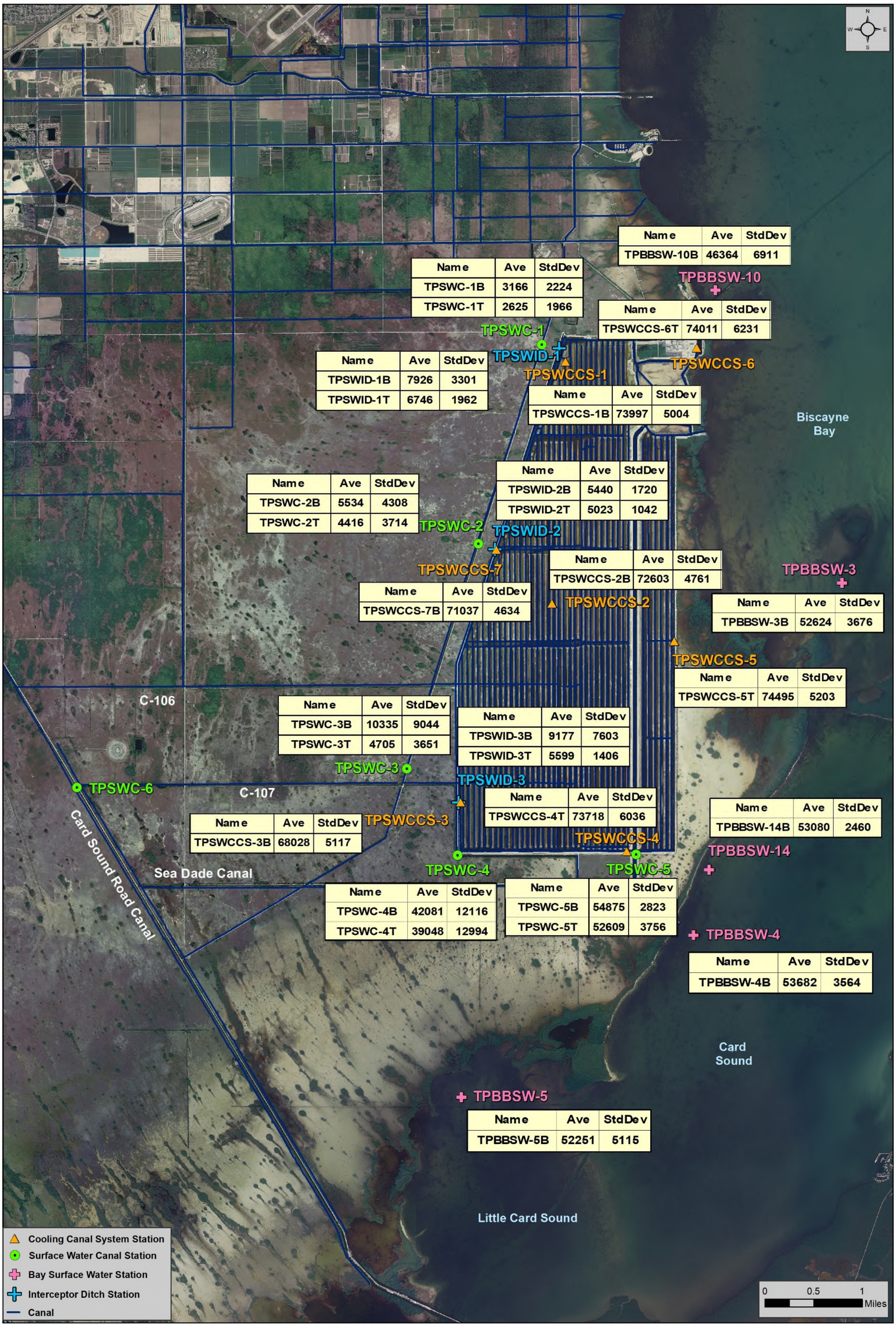
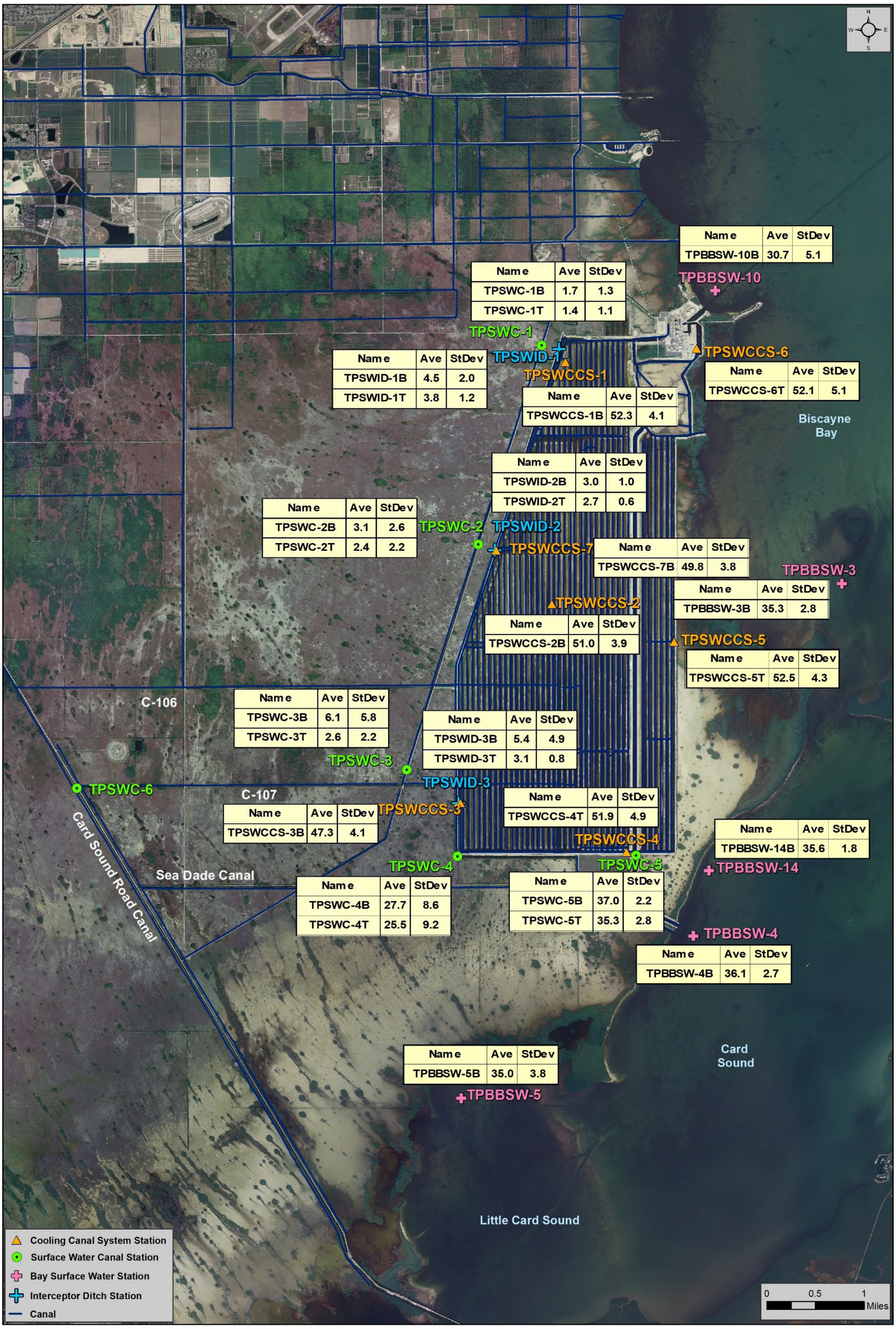


Figure 3.2-20. TPSWID-3 Specific Conductance and Temperature.



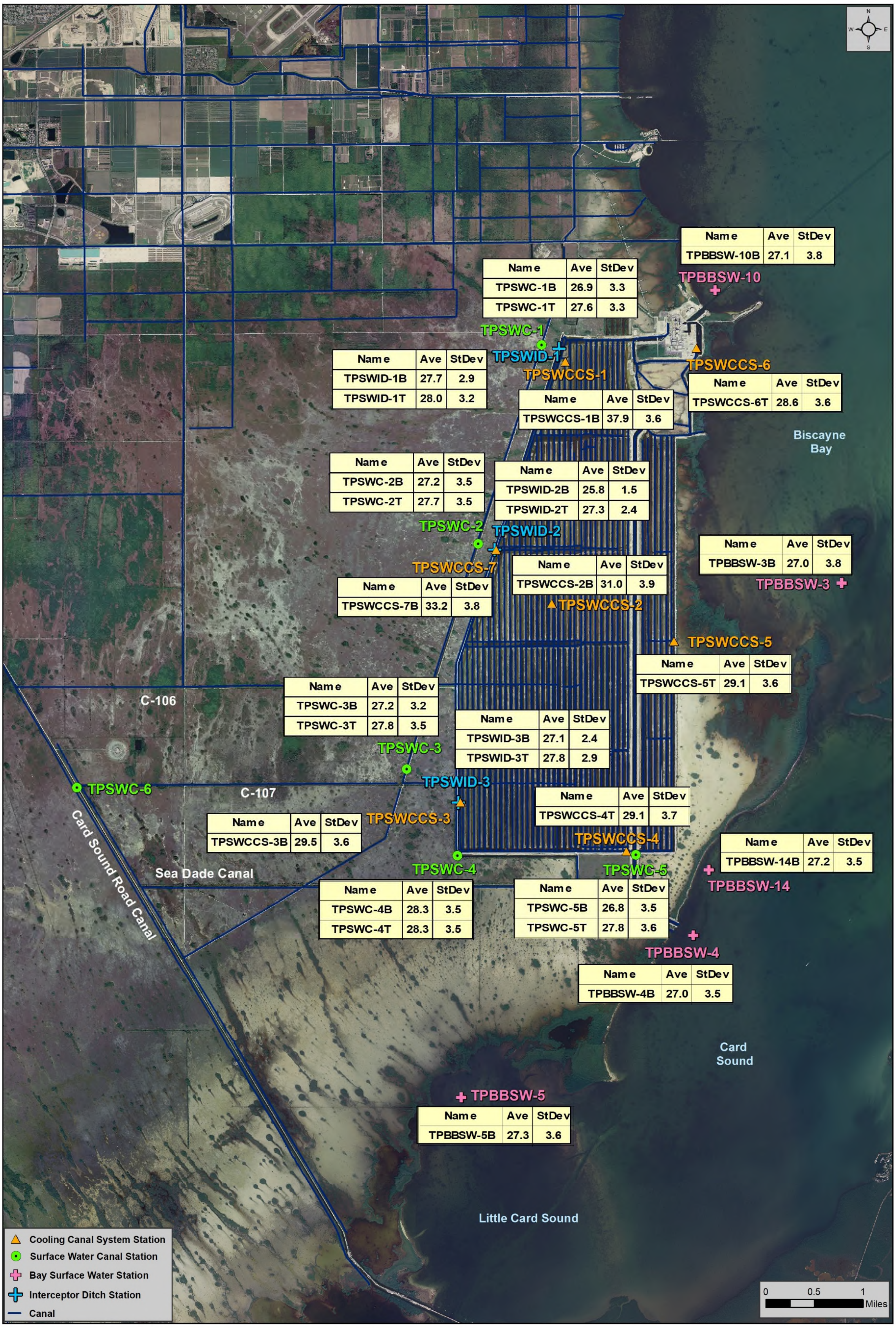
Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Ave=Average.
3) StdDev=Standard Deviation.
4) Samples Collected at 1 or 2 Depths (B: bottom; T: top).

Figure 3.2-21. Average and Standard Deviation of Specific Conductance (µS/cm) for Surface Water Stations.



Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Ave=Average.
3) StdDev=Standard Deviation.
4) Samples Collected at 1 or 2 Depths (B: bottom; T: top).

Figure 3.2-22. Average and Standard Deviation of Salinity (PSS-78) for Surface Water Stations.



Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Ave=Average.
3) StdDev=Standard Deviation.
4) Samples Collected at 1 or 2 Depths (B: bottom; T: top).

Figure 3.2-23. Average and Standard Deviation of Temperature (°C) for Surface Water Stations.

Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples collected at 1 foot from the top (T) and/or 1 foot from the bottom (B).
3) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
4) J18: Jun 2018; S18: Sep 2018; D18: Dec 2018; Mar19: Mar 2019.
5) Please see Appendix I for a list of values that were removed from this analysis and the rational for their removal.

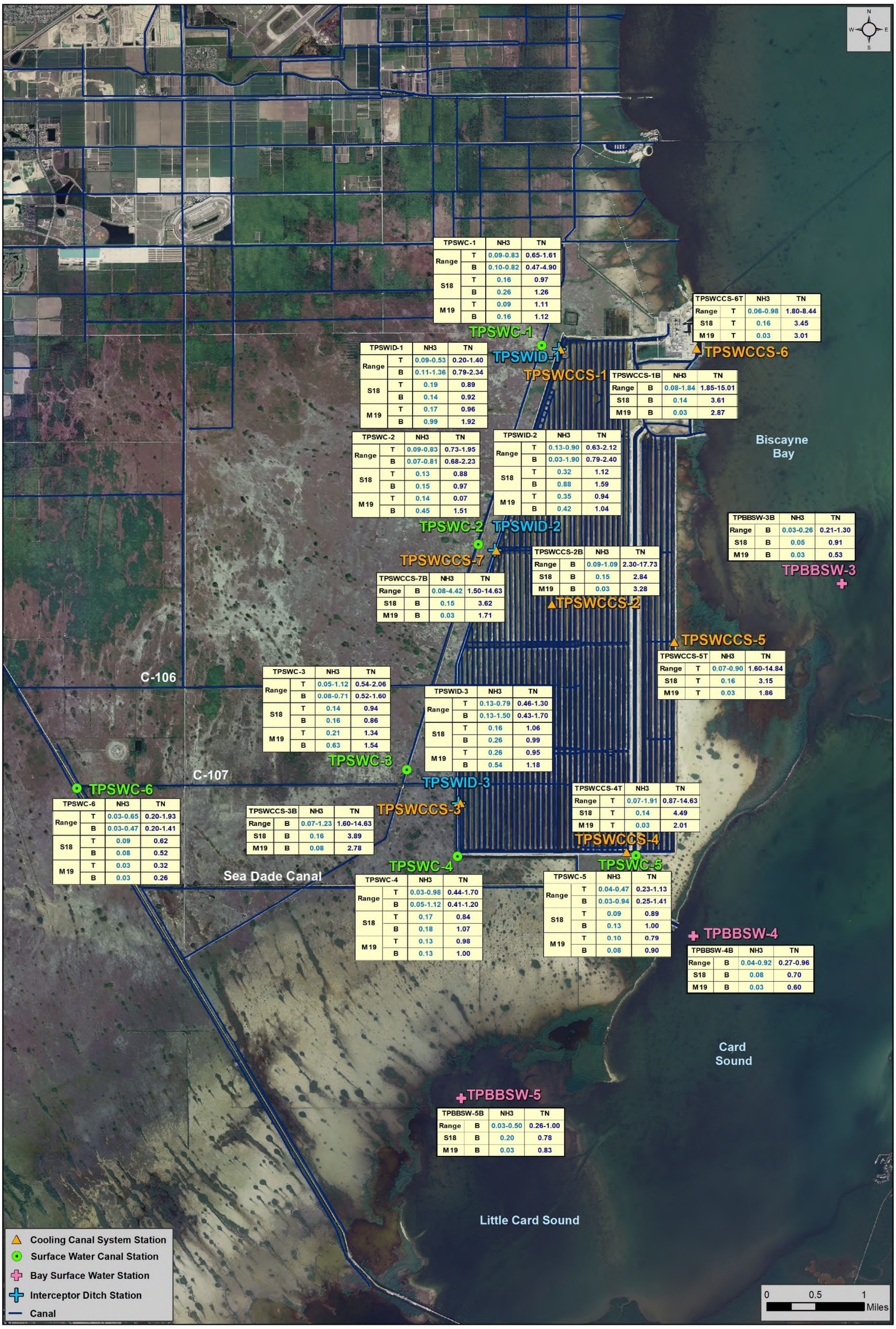
Figure 3.2-24. Historical Range and Reporting Period Quarterly Surface Water Chloride (mg/L) Results.

Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples collected at 1 foot from the top (T) and/or 1 foot from the bottom (B).
3) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
4) J18: Jun 2018; S18: Sep 2018; D18: Dec 2018; Mar19: Mar 2019.

Figure 3.2-25. Historical Range and Reporting Period Quarterly Surface Water Sodium (mg/L) Results.

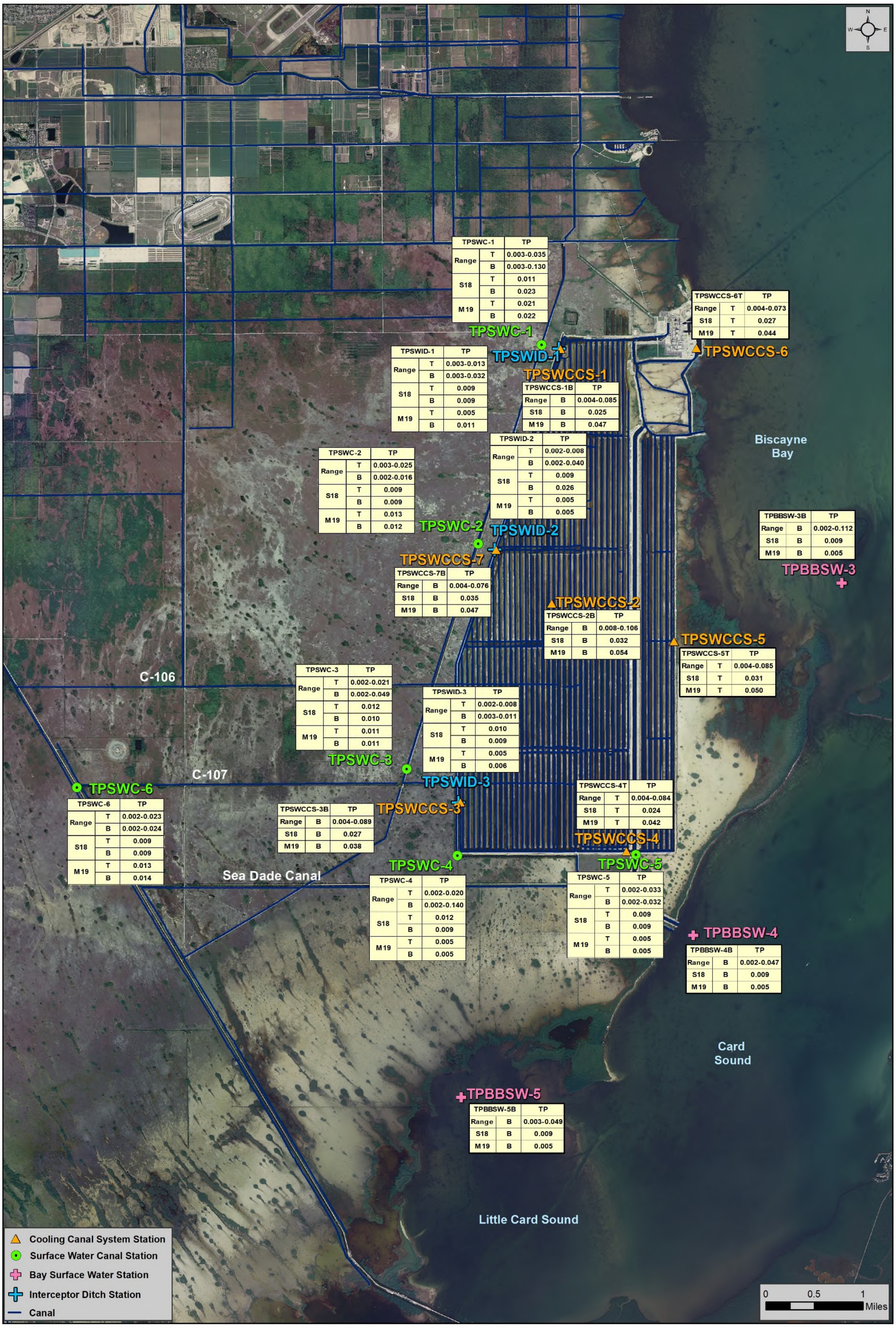
Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples collected at 1 foot from the top (T) and/or 1 foot from the bottom (B).
3) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
4) J18: Jun 2018; S18: Sep 2018; D18: Dec 2018; M19: Mar 2019.
5) Please see Appendix I for a list of values that were removed from this analysis and the rational for their removal.

Figure 3.2-26. Historical Range and Reporting Period Quarterly Surface Water Tritium (pCi/L) Results.



Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples collected at 1 foot from the top (T) and/or 1 foot from the bottom (B).
3) NH3: Total Ammonia (mg/L as N); TN: Total Nitrogen (mg/L).
4) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
5) S18: Sep 2018; Mar19: Mar 2019.
6) Please see Appendix I for a list of values that were removed from this analysis and the rational for their removal.

Figure 3.2-27. Reporting Period Semi-Annual Surface Water TN (mg/L) and NH_3 (mg/L as N) Results with Historical Period of Record Range.



Note: 1) Data are for reporting period: June 2018 through May 2019.
2) Samples collected at 1 foot from the top (T) and/or 1 foot from the bottom (B).
3) TP: Total Phosphorus (mg/L).
4) Range: Data range (min-max) for the samples collected in the Historical Period of Record (June 2010 to March 2018).
5) S18: Sep 2018; Mar19: Mar 2019.

Figure 3.2-28. Reporting Period Semi-Annual Surface Water TP (mg/L) Results with Historical Period of Record Range.

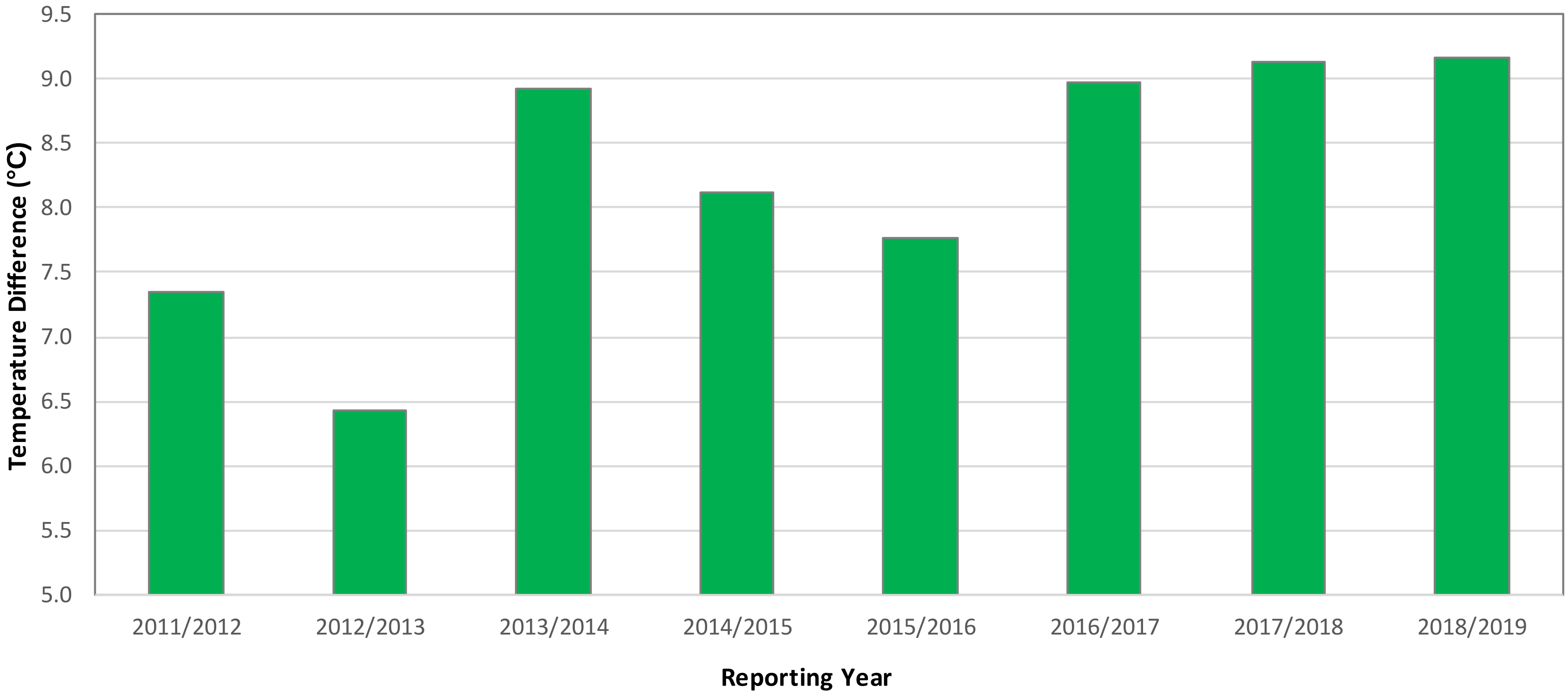


Figure 3.2-29. Temperature Difference between TPSWCCS-6 and TPSWCCS-1/Cooling in the CCS.

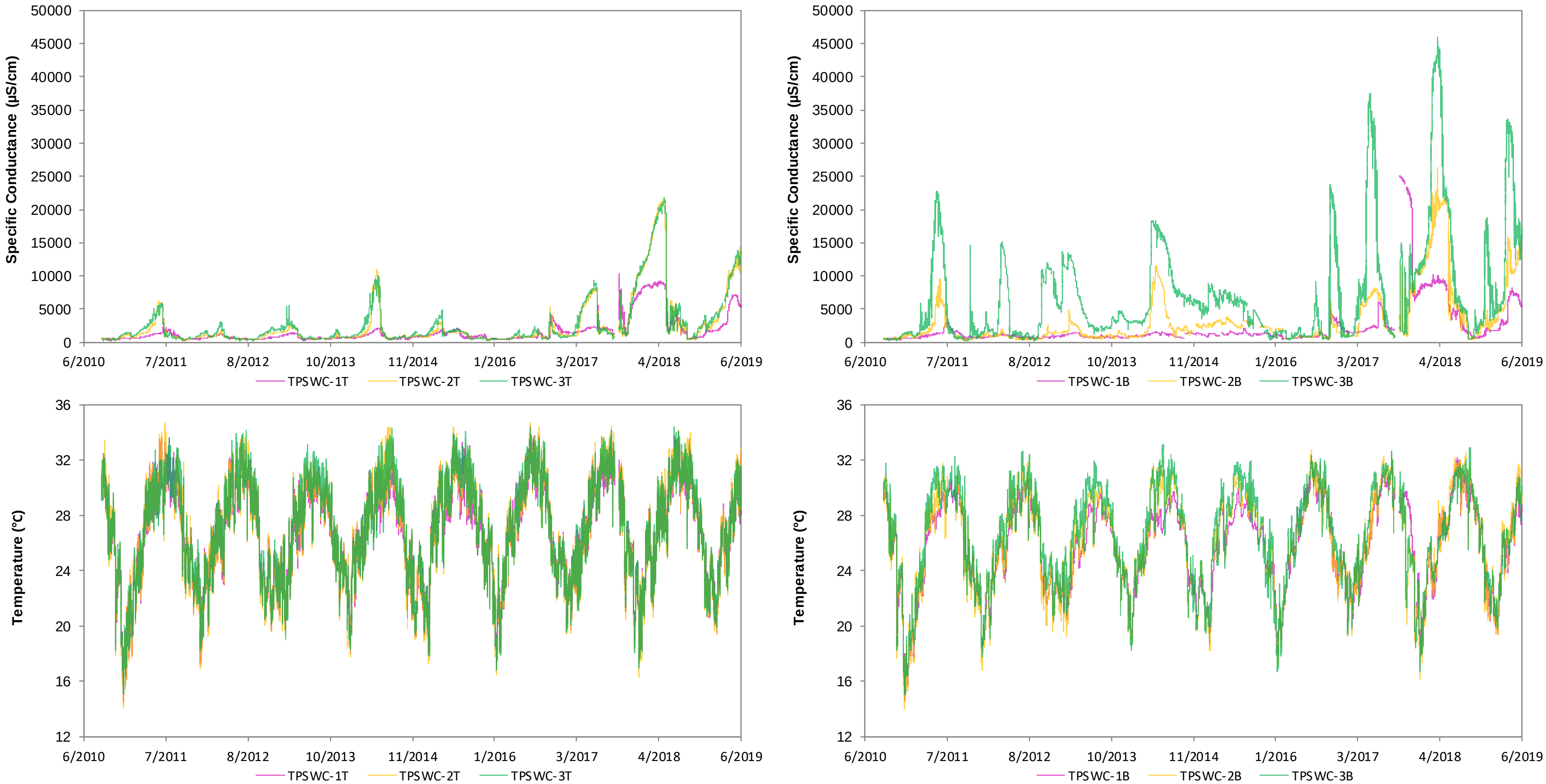


Figure 3.2-30. Comparison of Specific Conductance and Temperature in the L-31E Canal for Top and Bottom Locations.

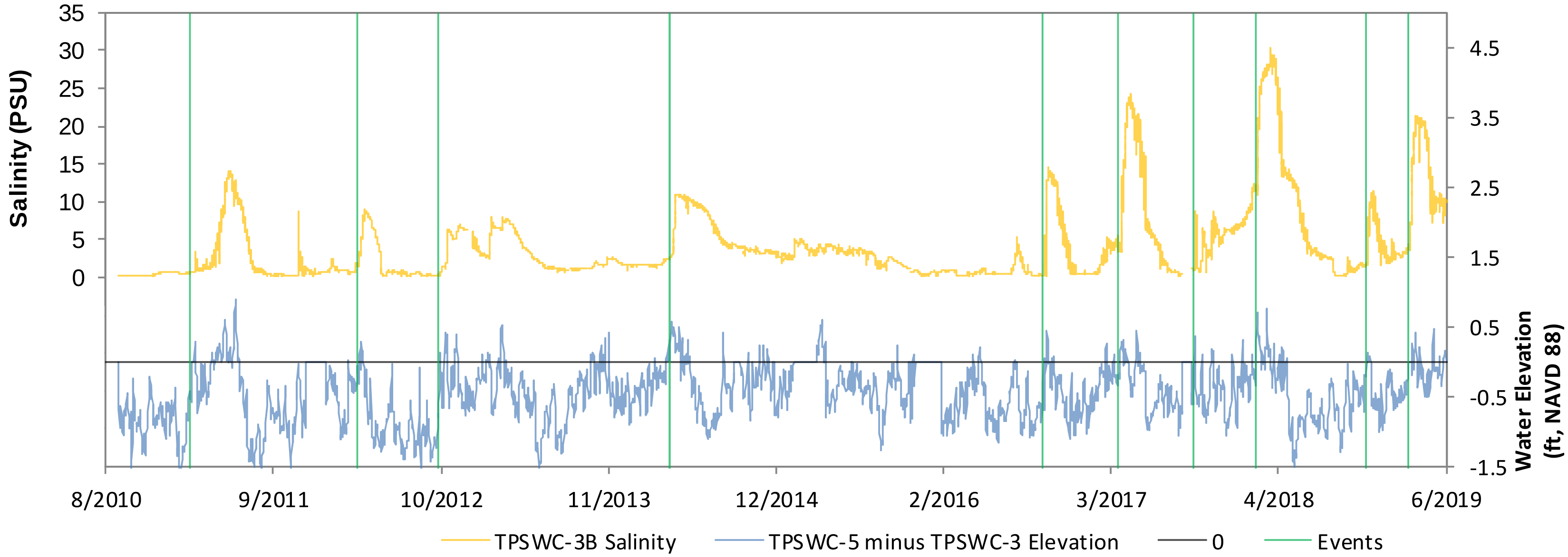


Figure 3.2-31. TPSWC-3B Qualified Salinity and Difference in Level between TPSWC-3 and TPSWC-5.

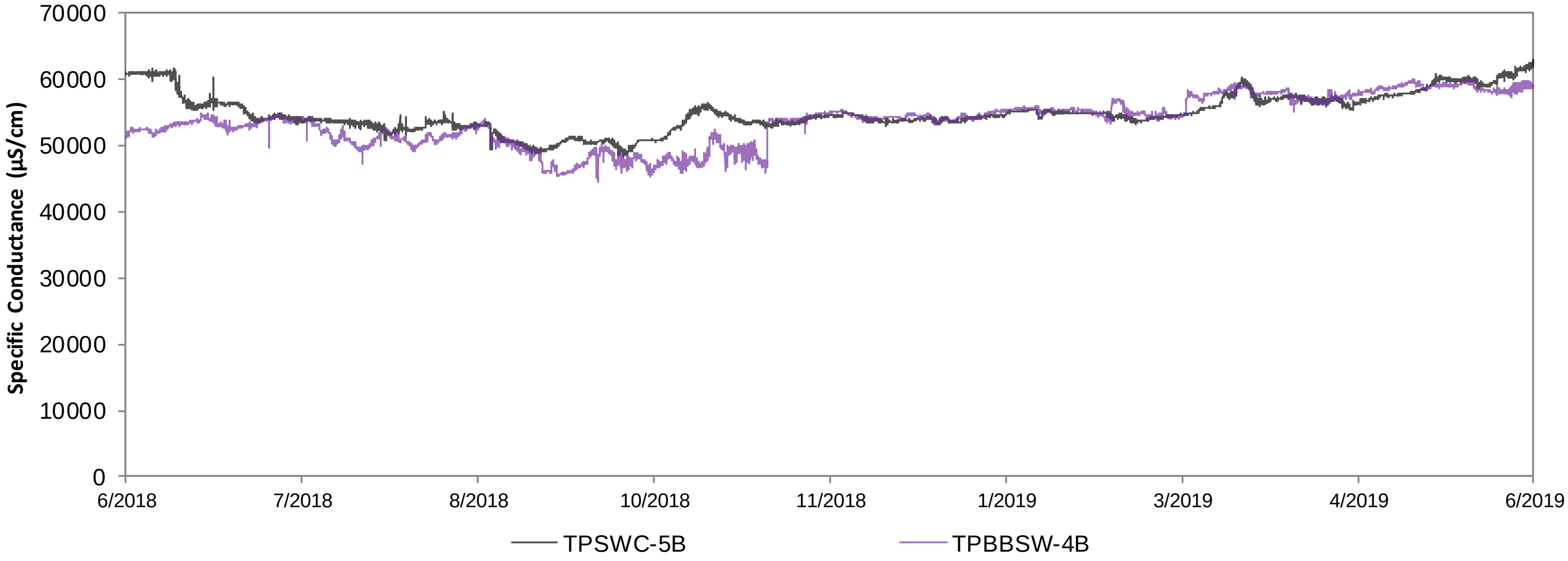


Figure 3.2-32. Comparison of Specific Conductance at TPSWC-5 and TPBBSW-4.

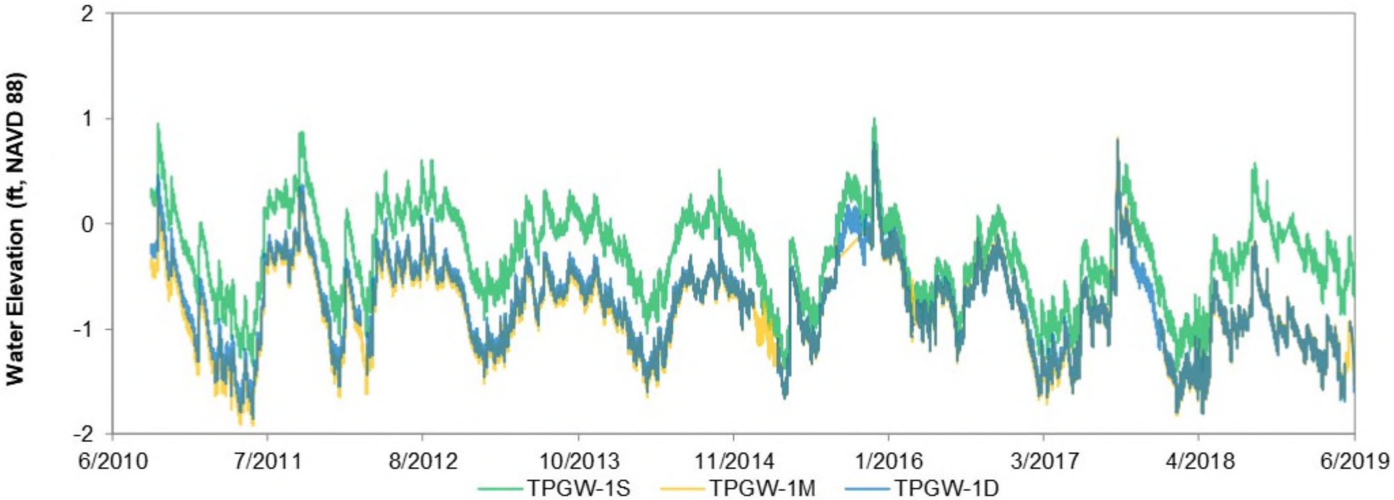


Figure 3.3-1. TPGW-1 Water Elevations.

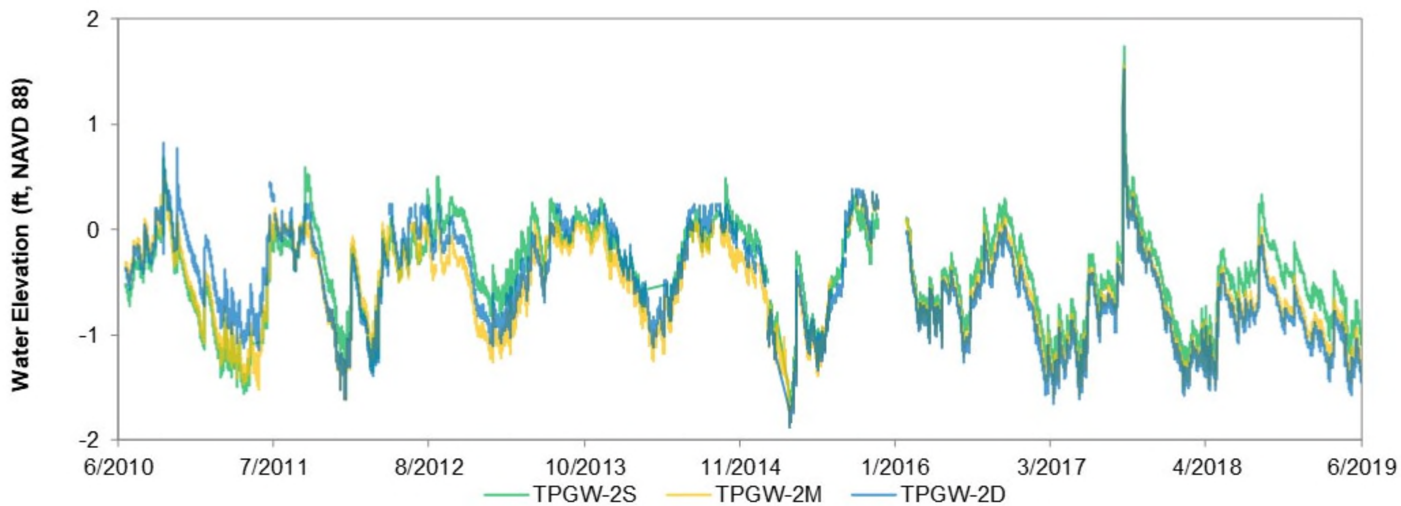


Figure 3.3-2. TPGW-2 Water Elevations.

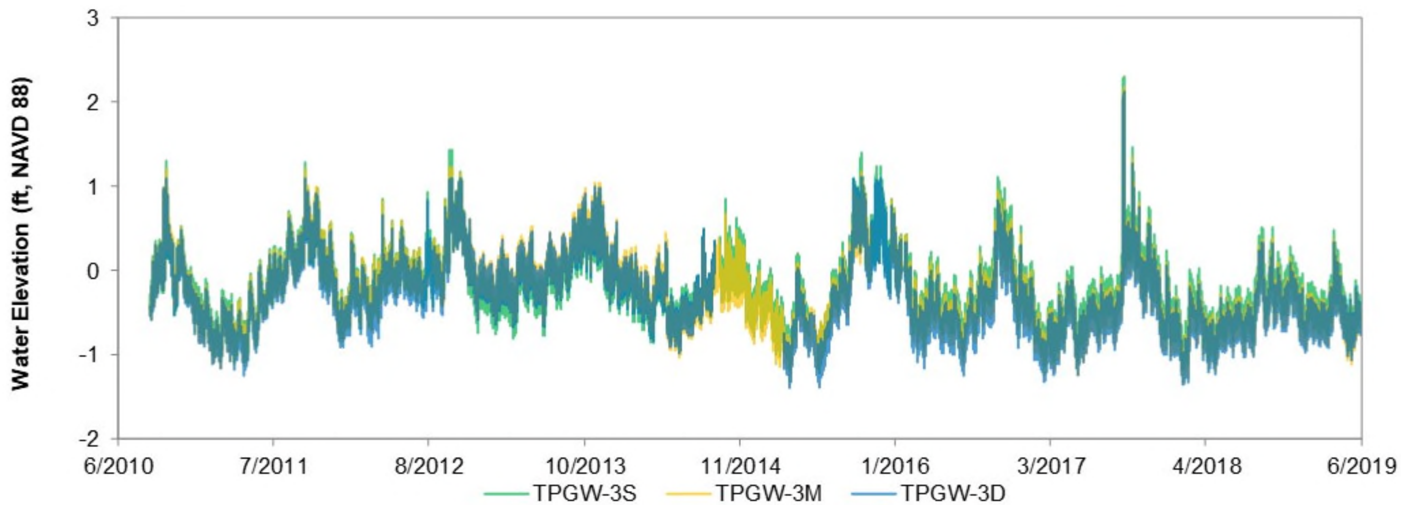


Figure 3.3-3. TPGW-3 Water Elevations.

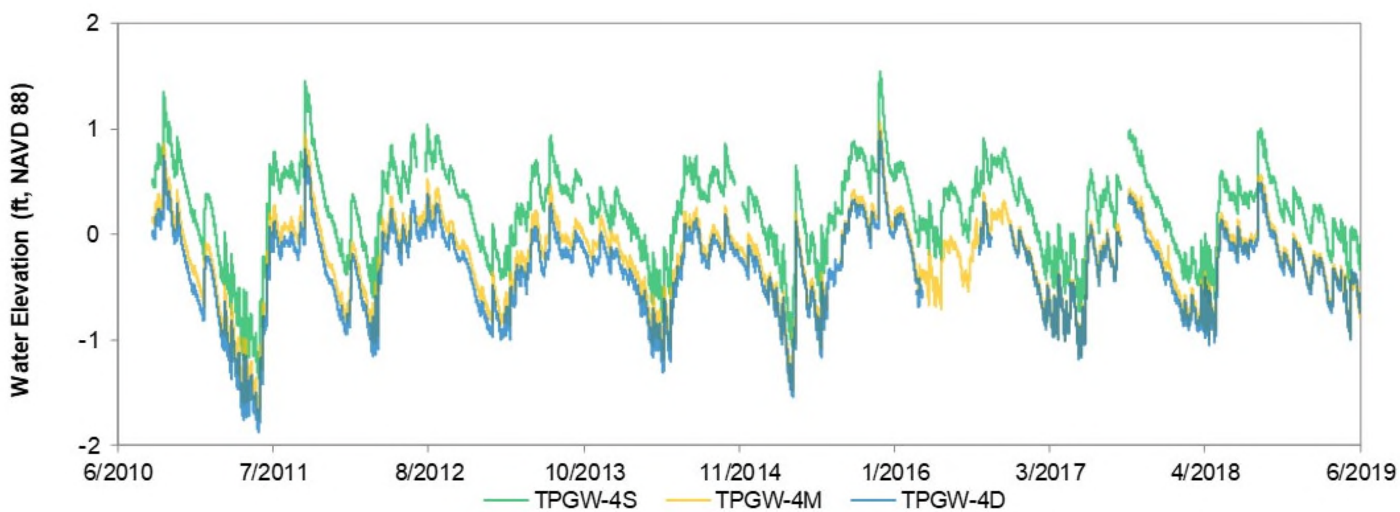


Figure 3.3-4. TPGW-4 Water Elevations.

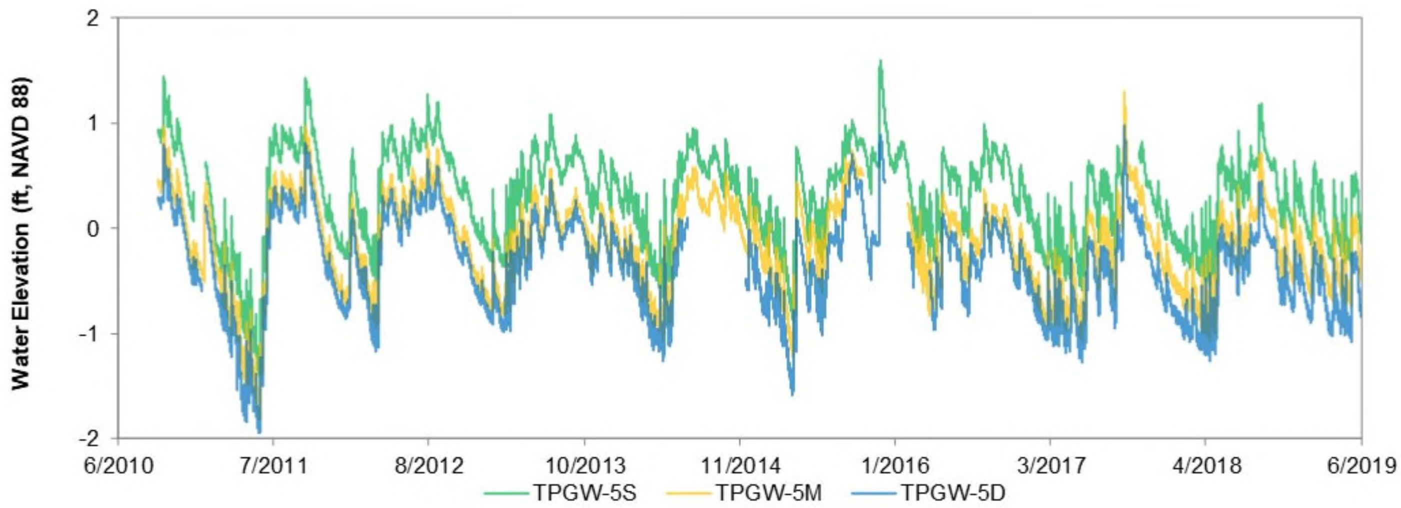


Figure 3.3-5. TPGW-5 Water Elevations.

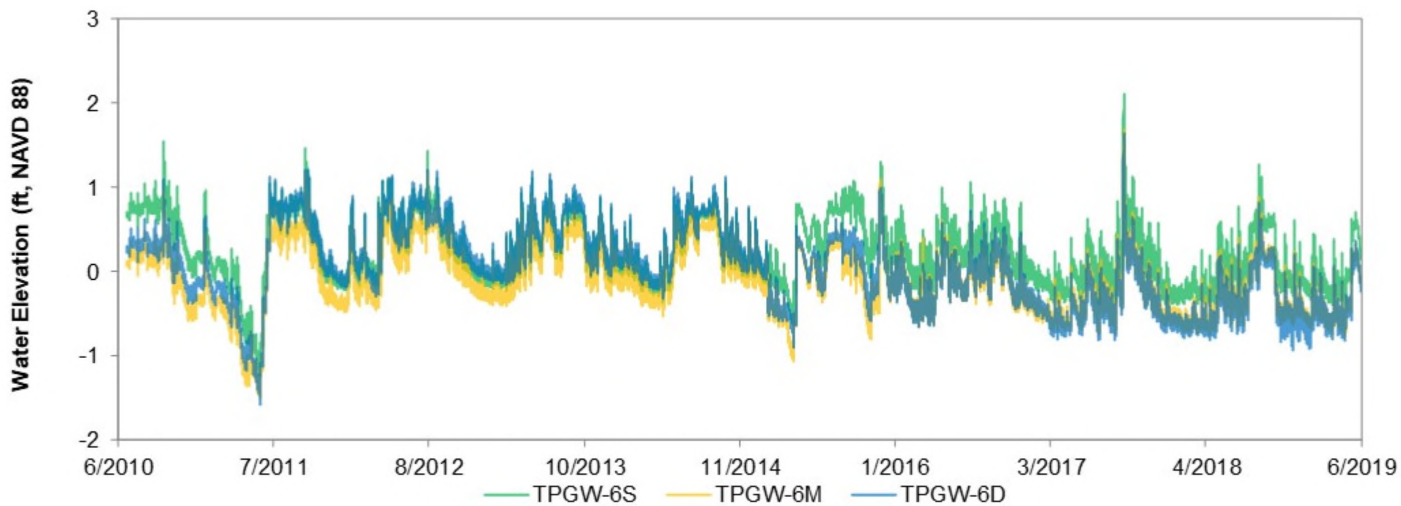


Figure 3.3-6. TPGW-6 Water Elevations.

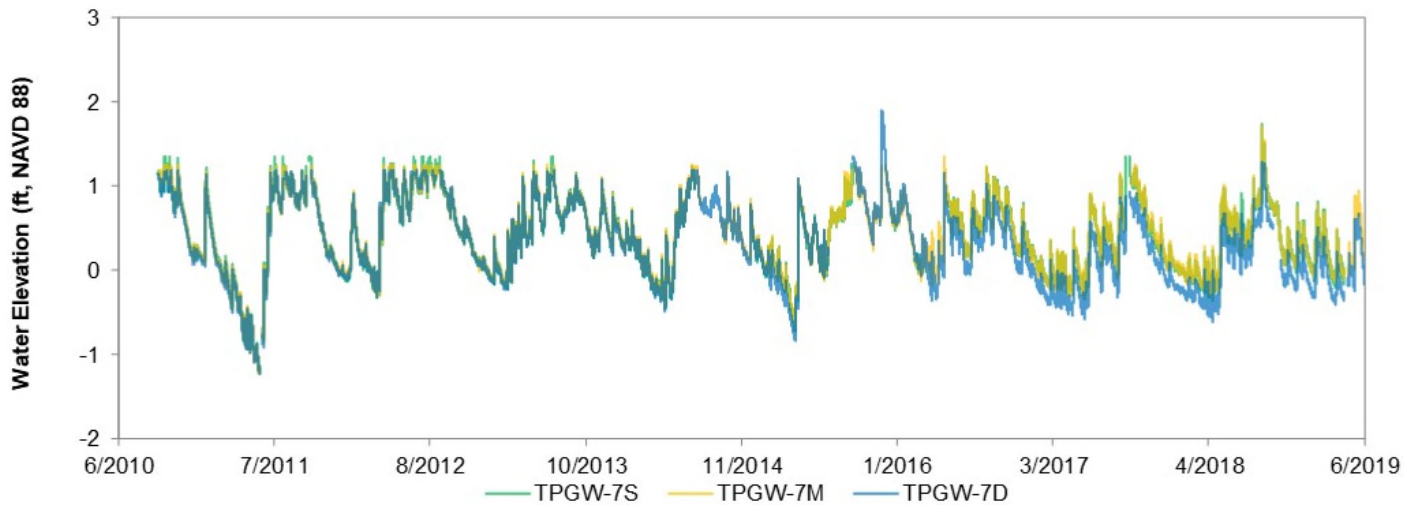


Figure 3.3-7. TPGW-7 Water Elevations.

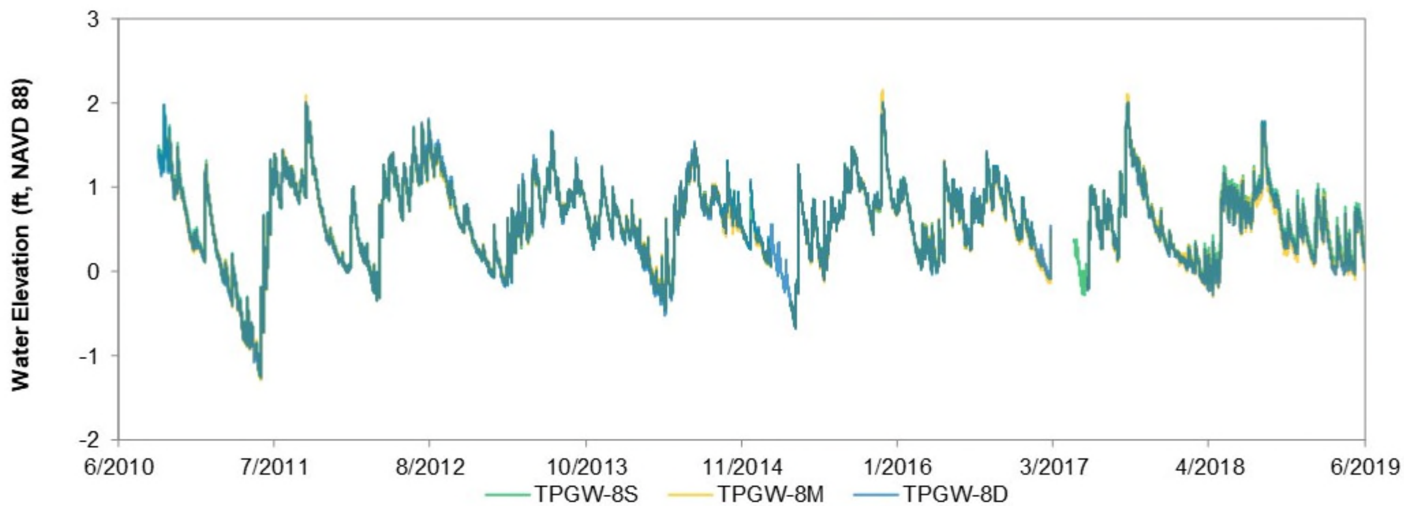


Figure 3.3-8. TPGW-8 Water Elevations.

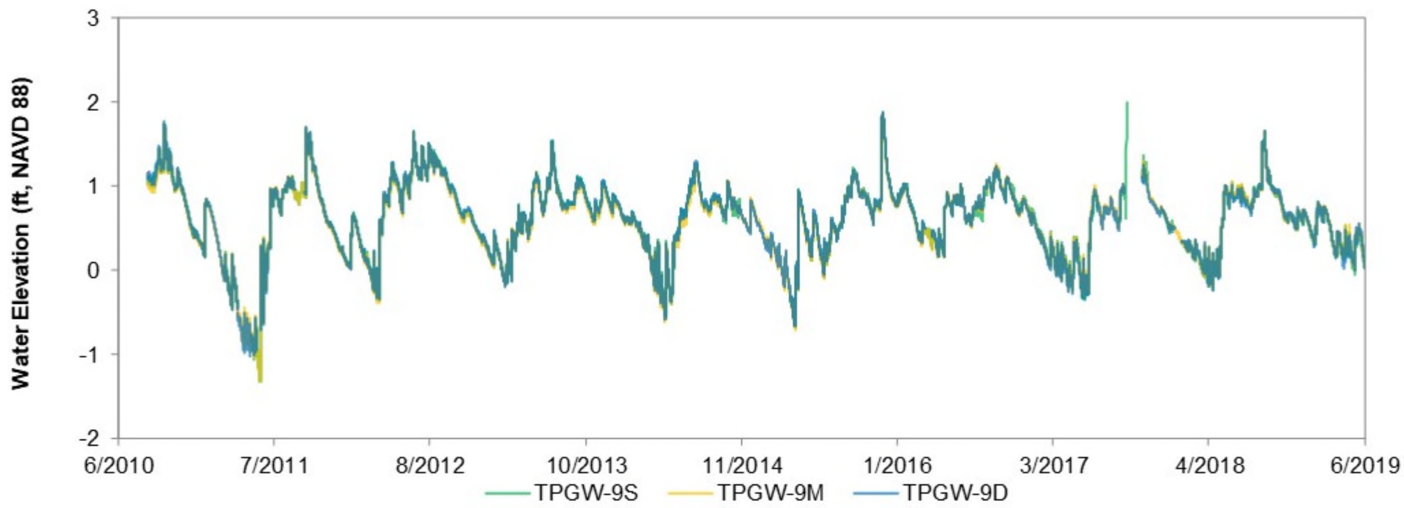


Figure 3.3-9. TPGW-9 Water Elevations.

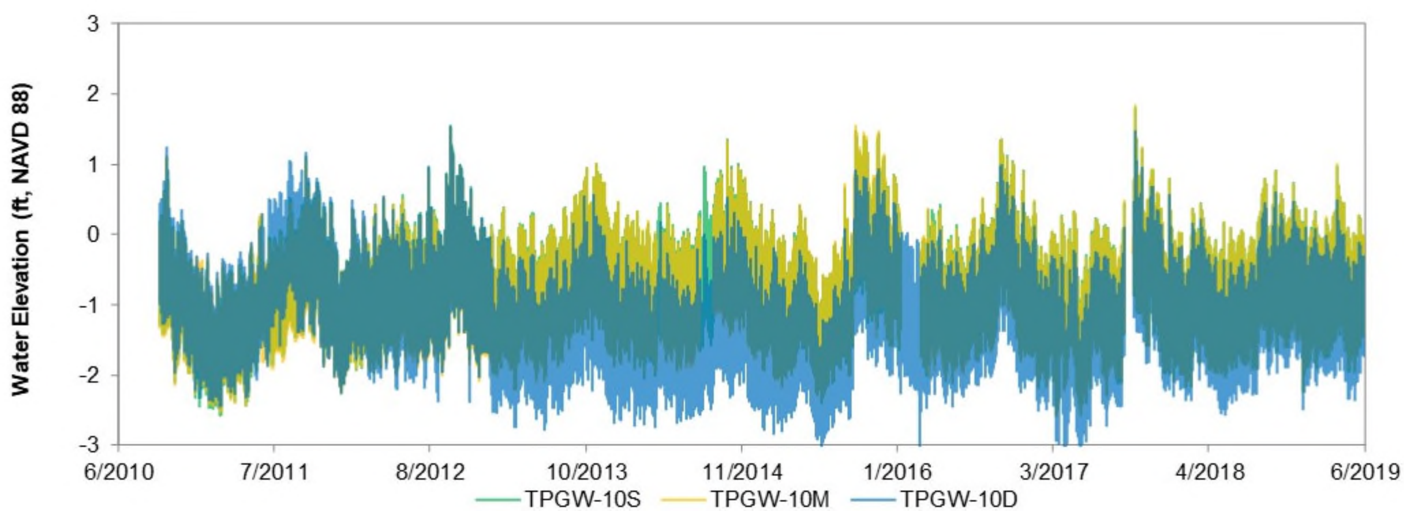


Figure 3.3-10. TPGW-10 Water Elevations.

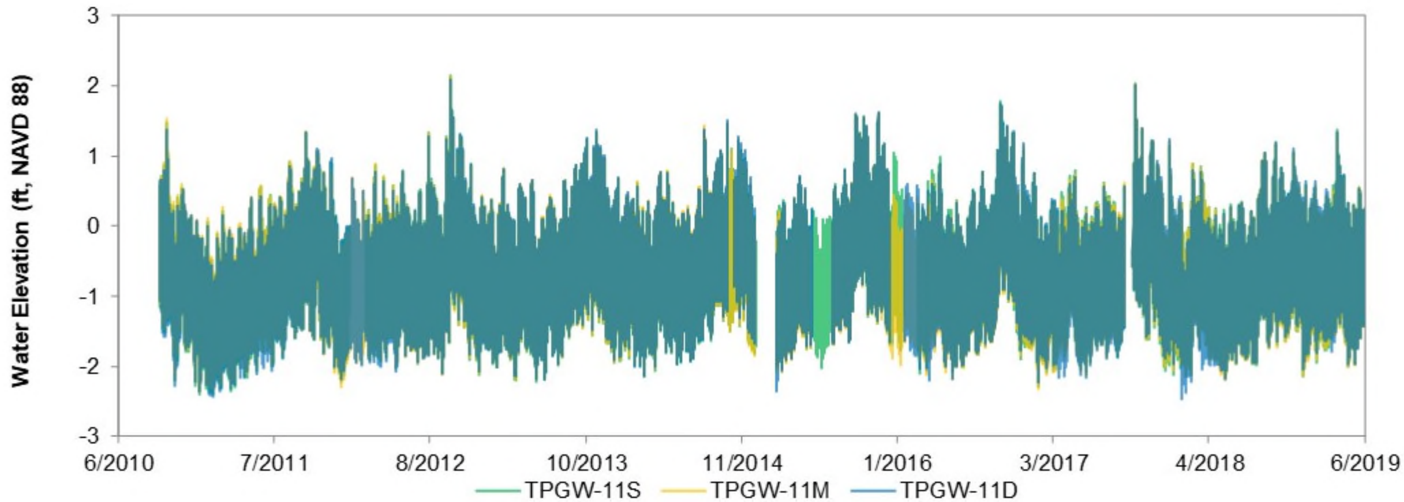


Figure 3.3-11. TPGW-11 Water Elevations.

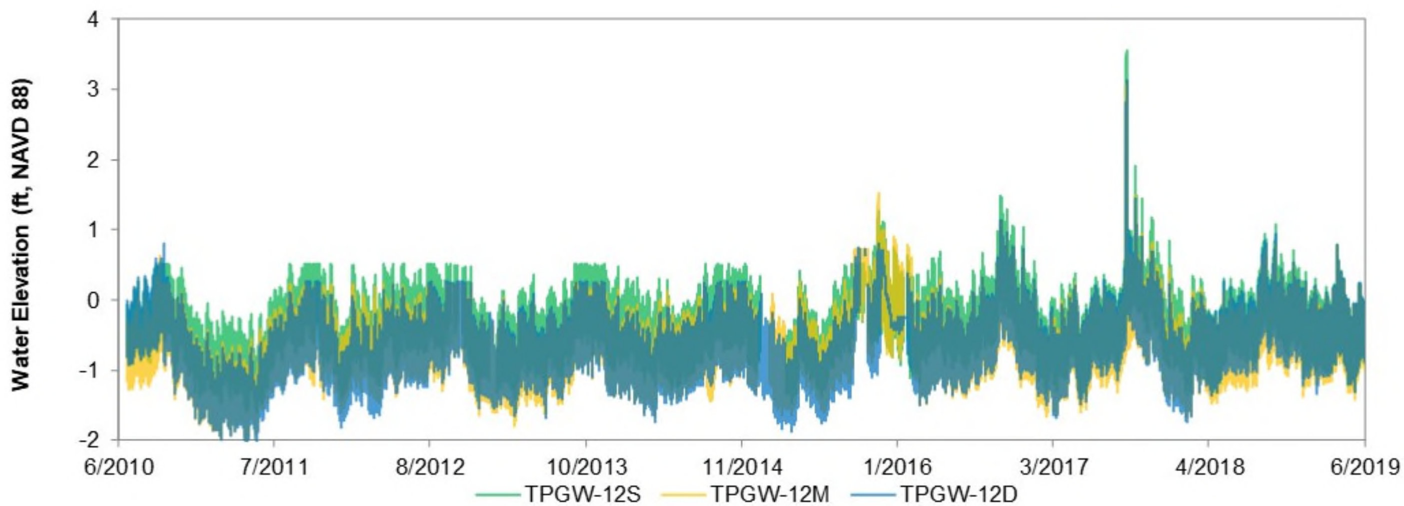


Figure 3.3-12. TPGW-12 Water Elevations.

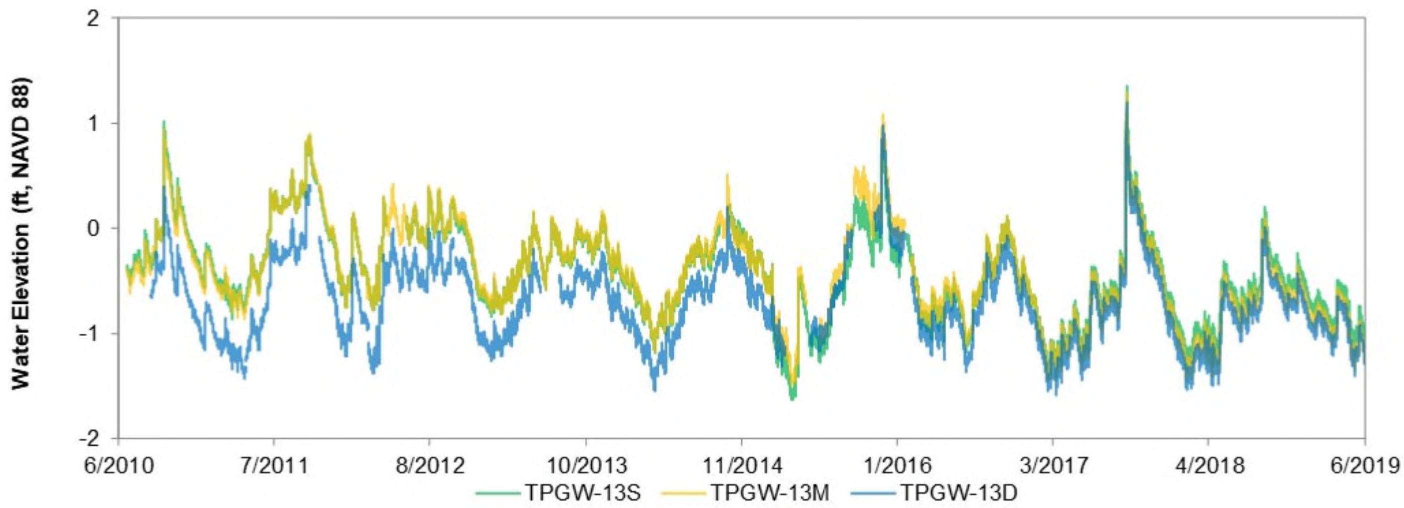


Figure 3.3-13. TPGW-13 Water Elevations.

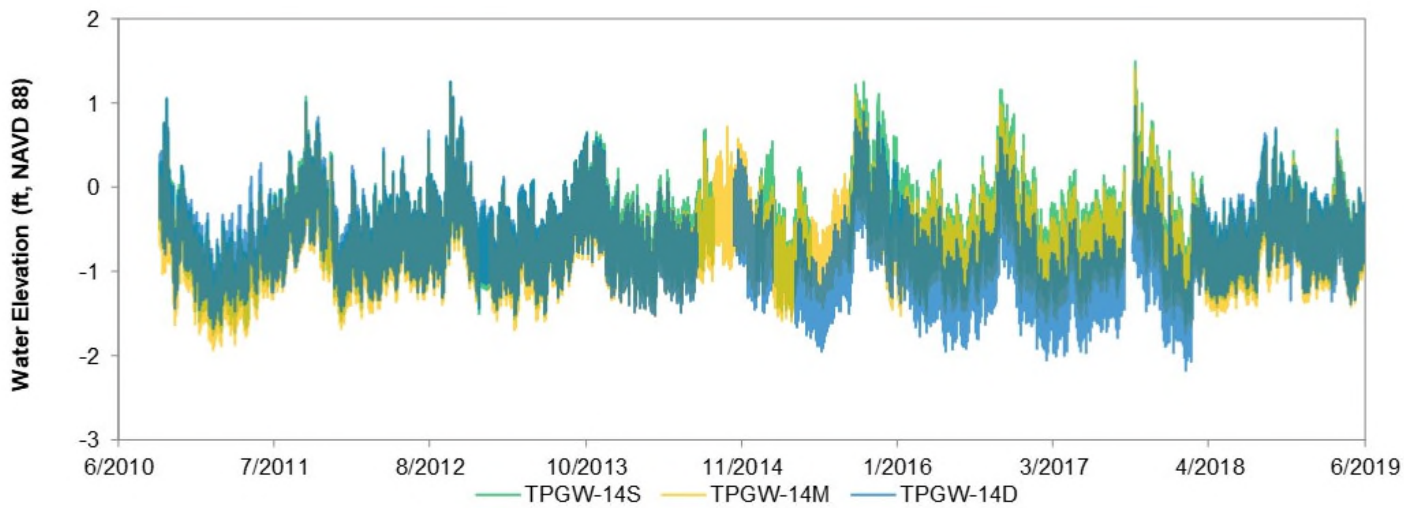


Figure 3.3-14. TPGW-14 Water Elevations.

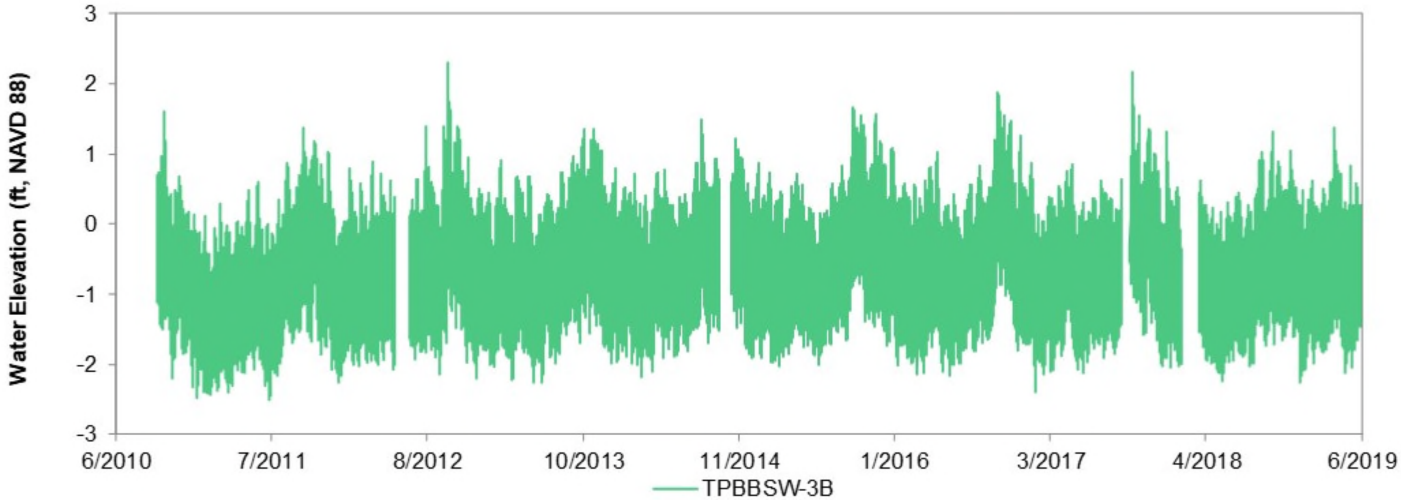


Figure 3.3-15. TPBBSW-3 Water Elevations.

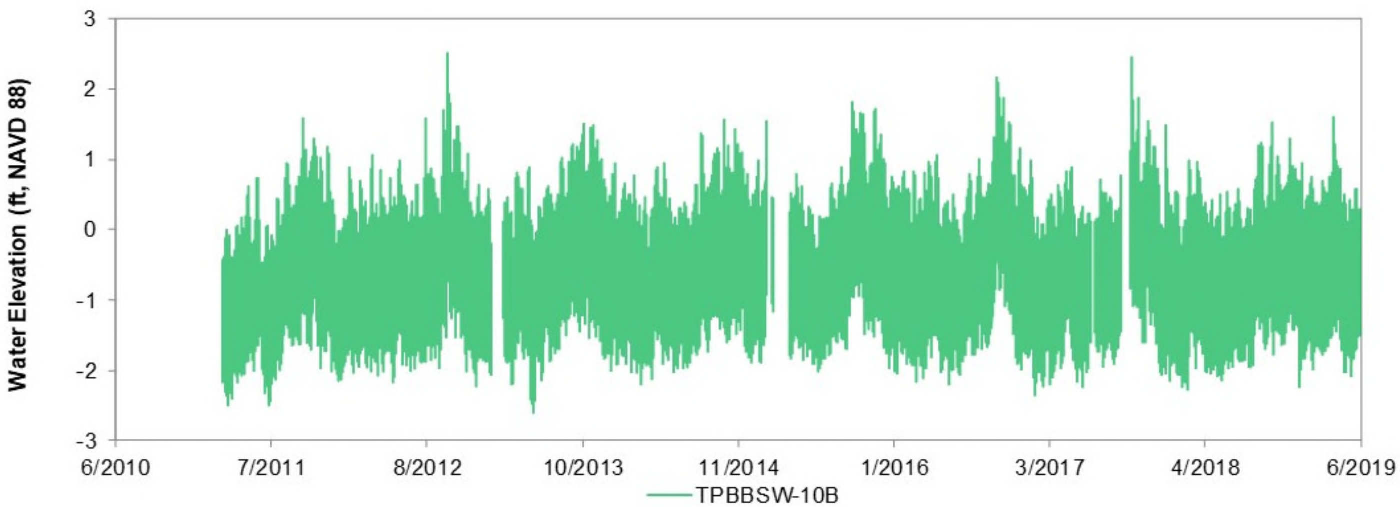


Figure 3.3-16. TPBBSW-10 Water Elevations.

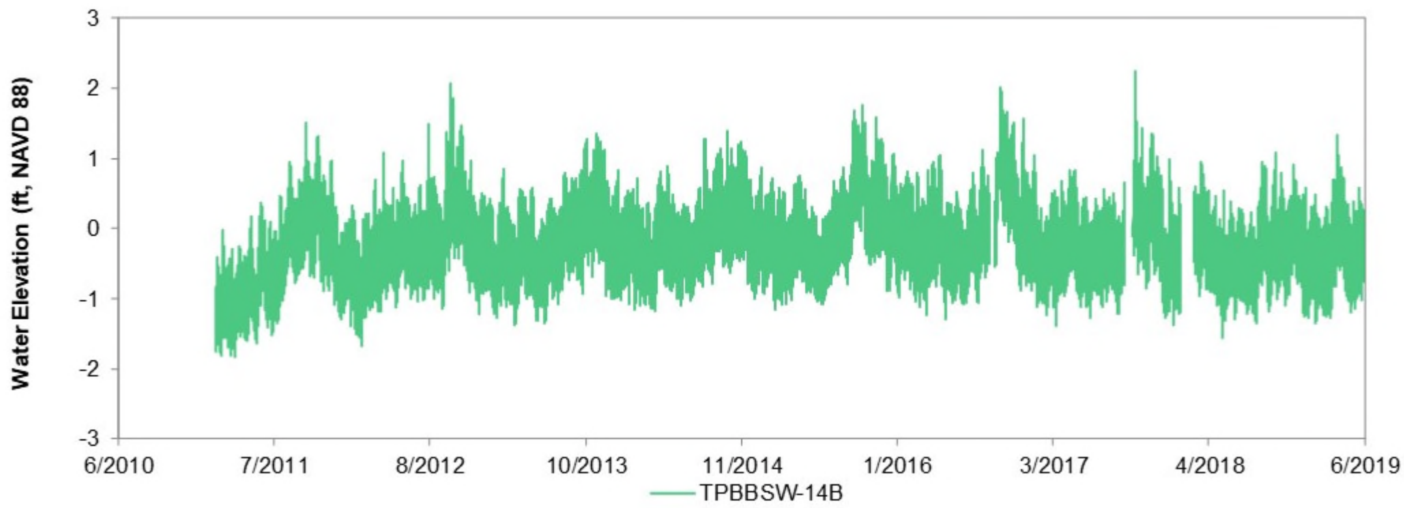


Figure 3.3-17. TPBBSW-14 Water Elevations.

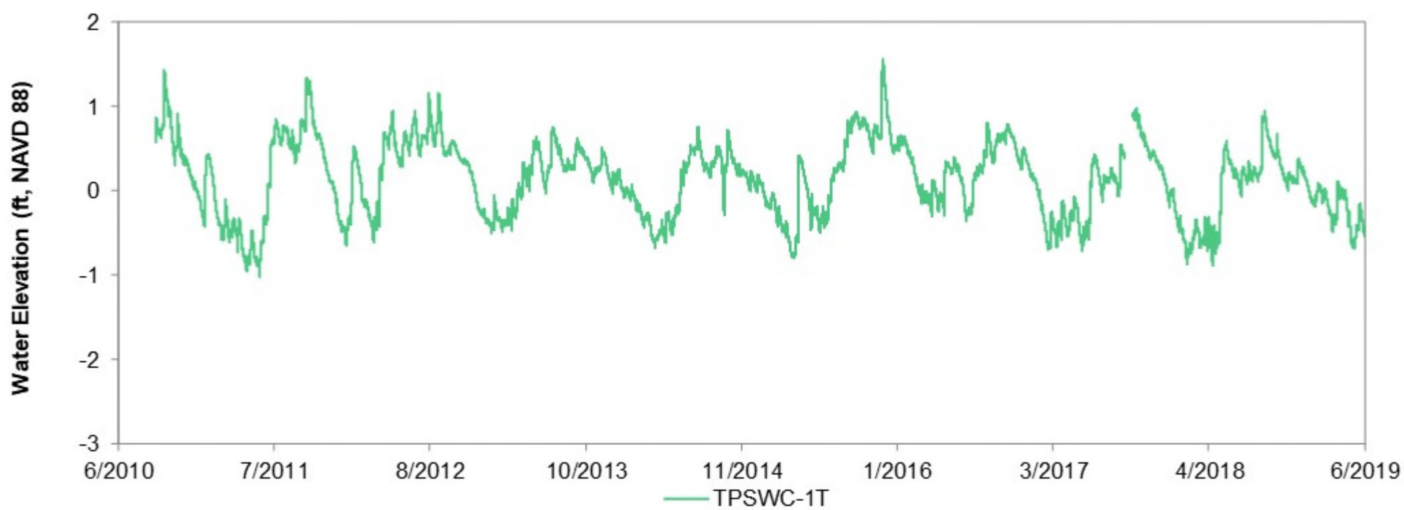


Figure 3.3-18. TPSWC-1 Water Elevations.

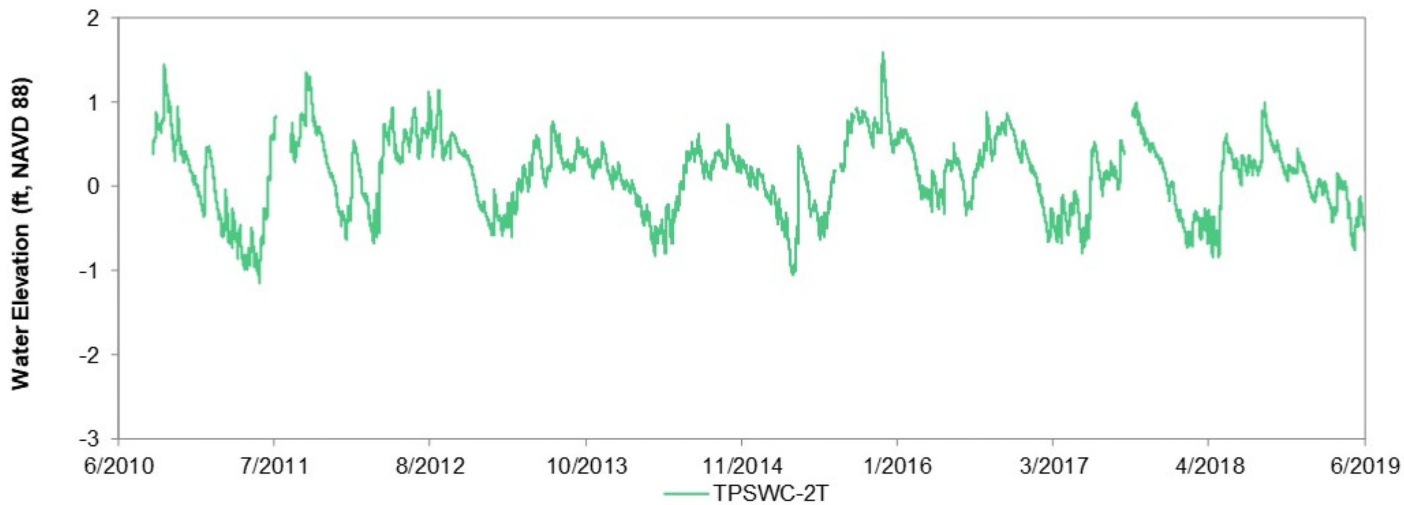


Figure 3.3-19. TPSWC-2 Water Elevations.

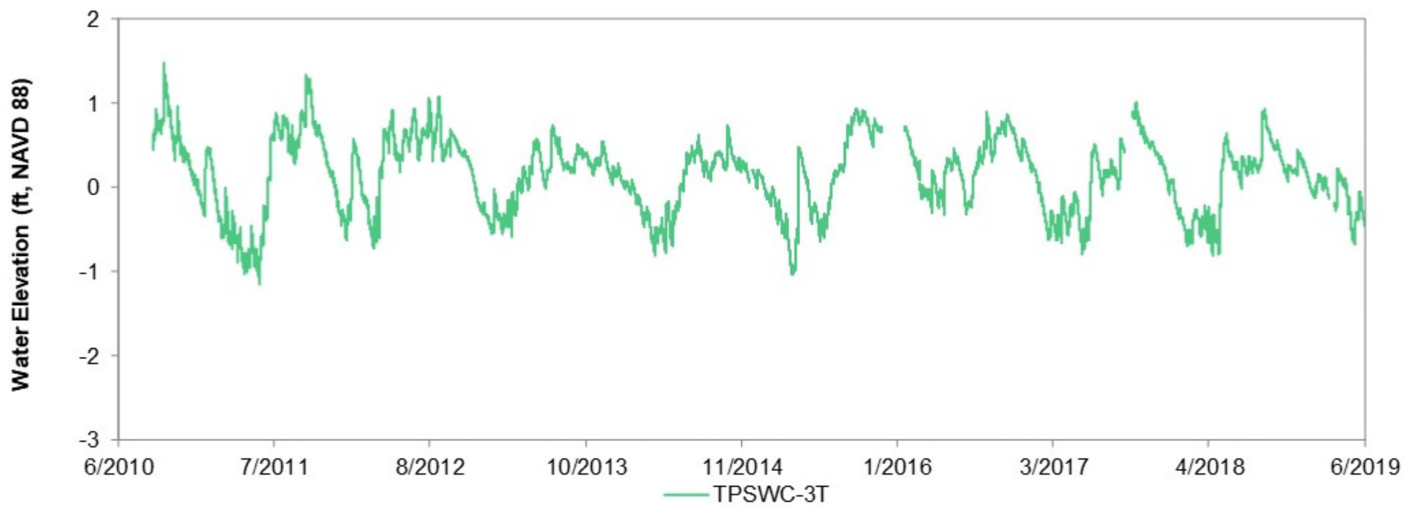


Figure 3.3-20. TPSWC-3 Water Elevations.

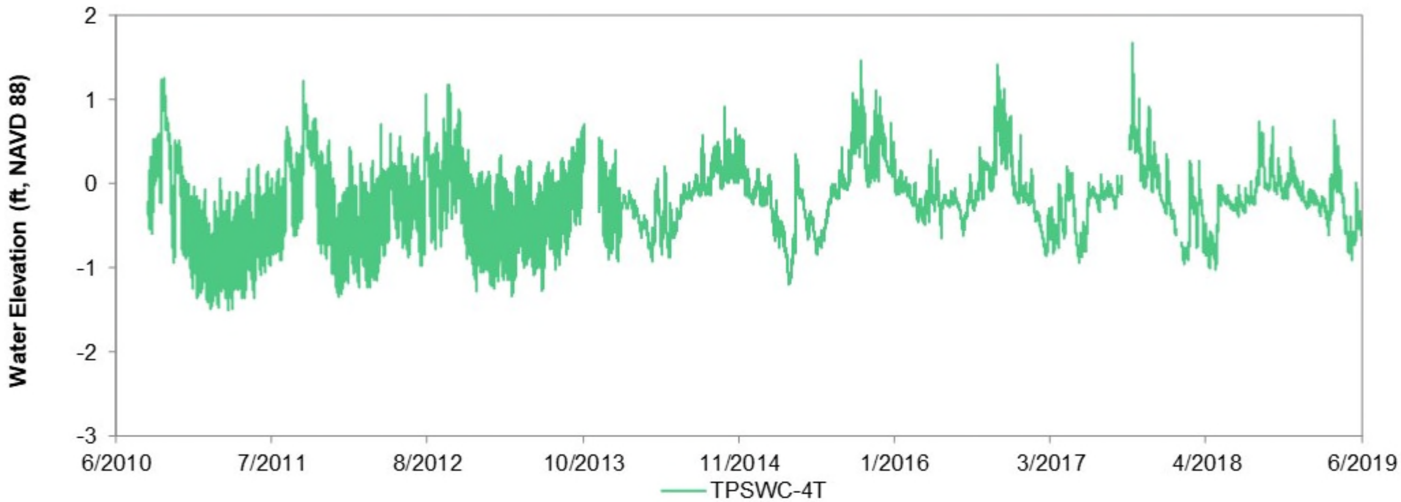


Figure 3.3-21. TPSWC-4 Water Elevations.

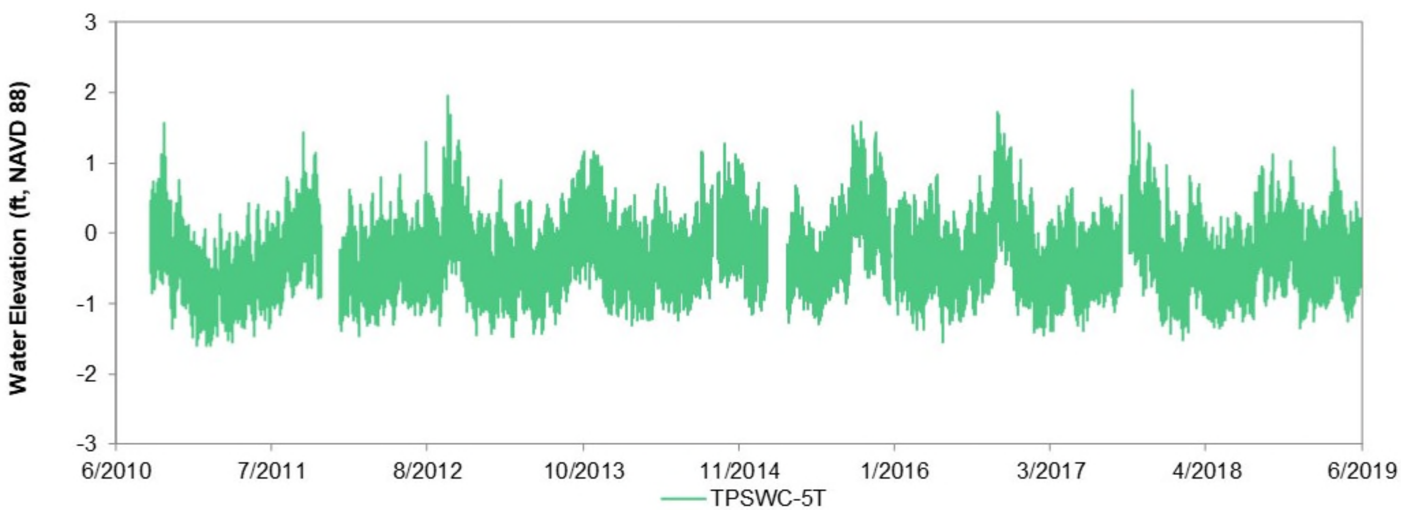


Figure 3.3-22. TPSWC-5 Water Elevations.

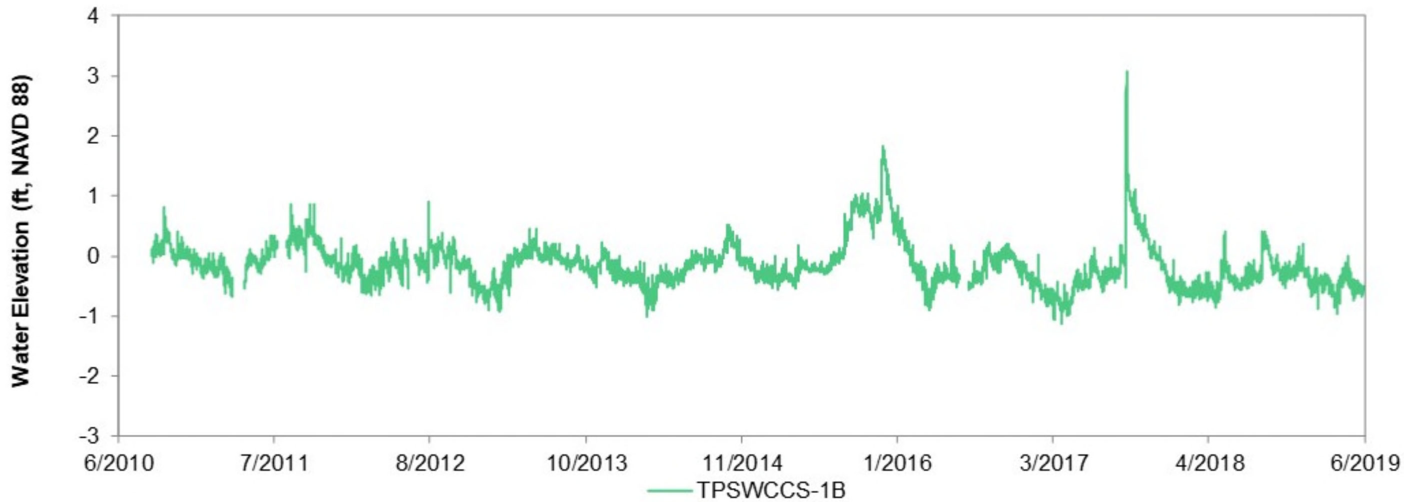


Figure 3.3-23. TPSWCCS-1 Water Elevations.

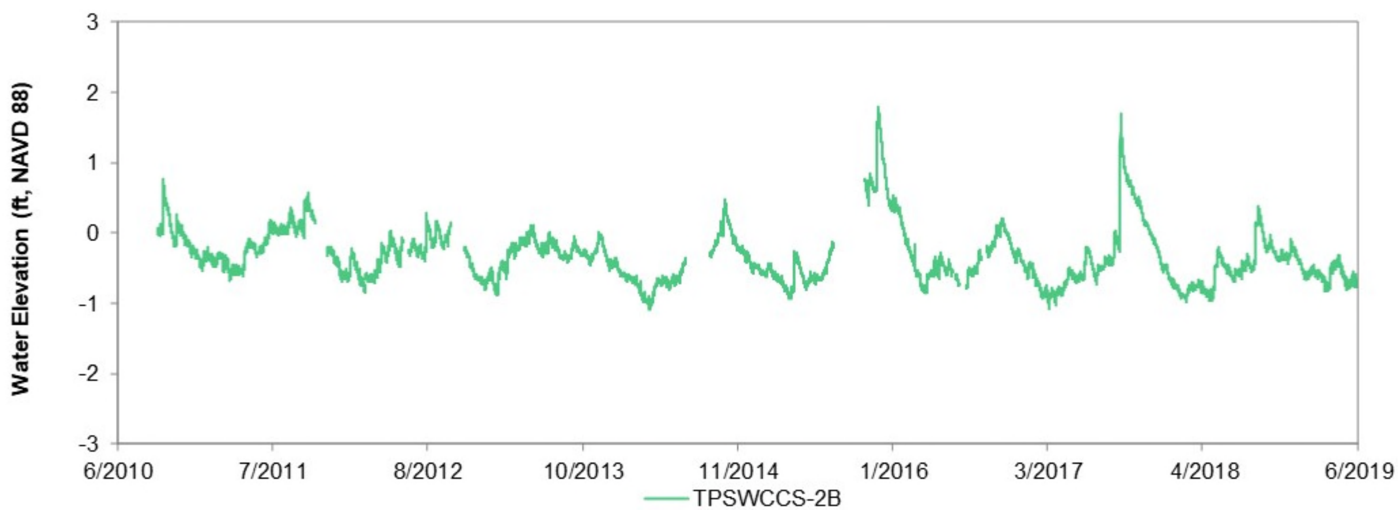


Figure 3.3-24. TPSWCCS-2 Water Elevations.

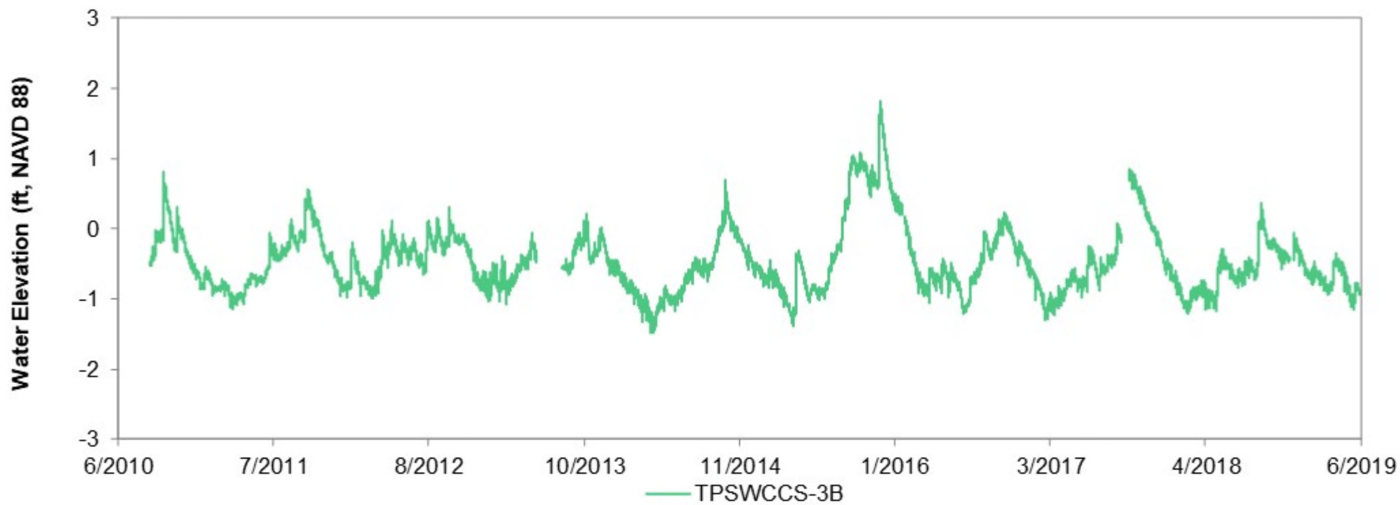


Figure 3.3-25. TPSWCCS-3 Water Elevations.

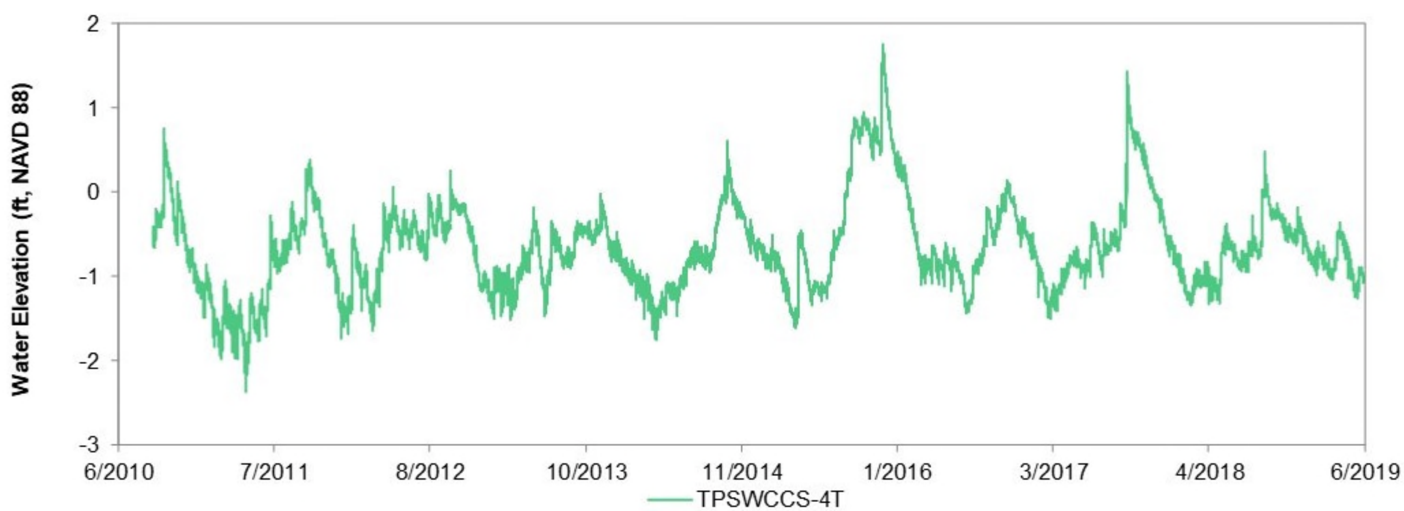


Figure 3.3-26. TPSWCCS-4 Water Elevations.

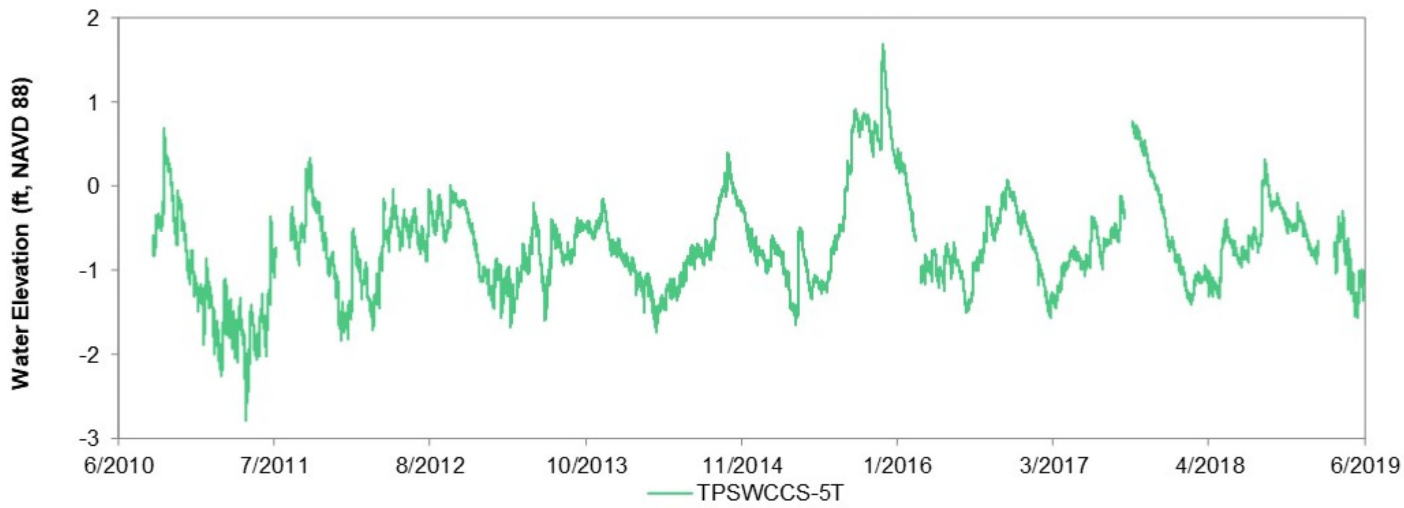


Figure 3.3-27. TPSWCCS-5 Water Elevations.

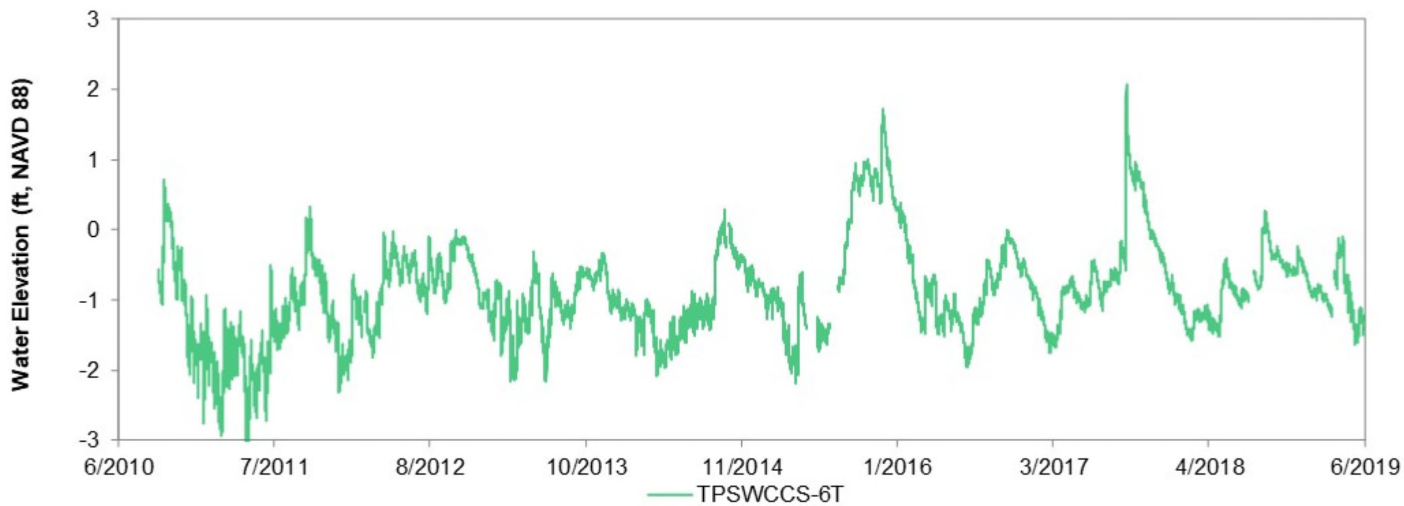


Figure 3.3-28. TPSWCCS-6 Water Elevations.

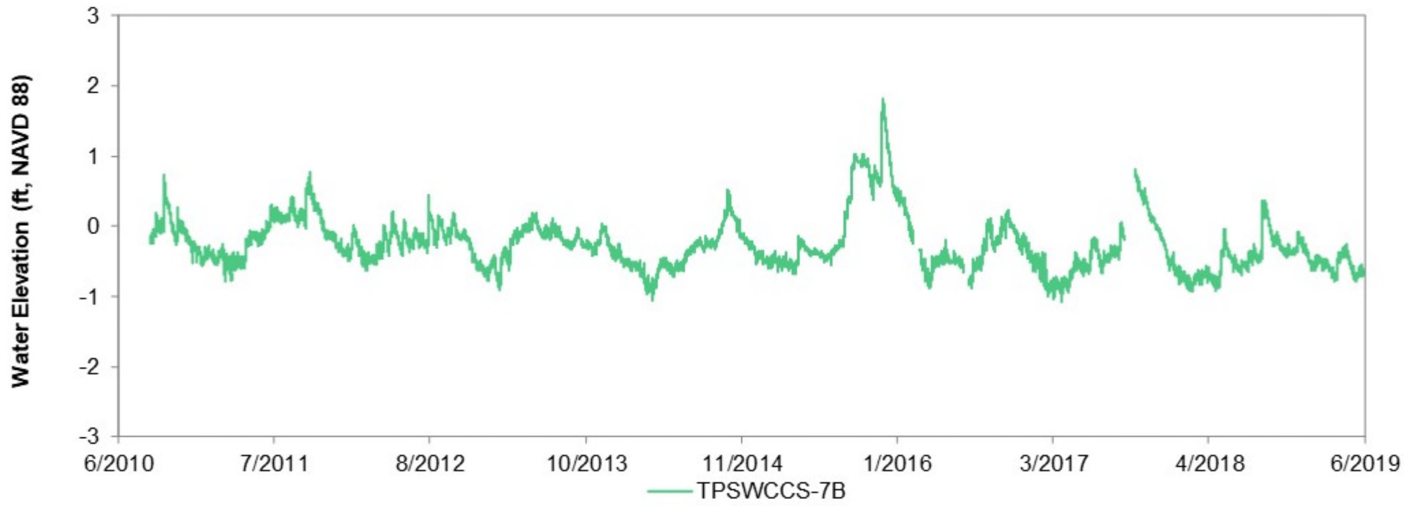


Figure 3.3-29. TPSWCCS-7 Water Elevations.

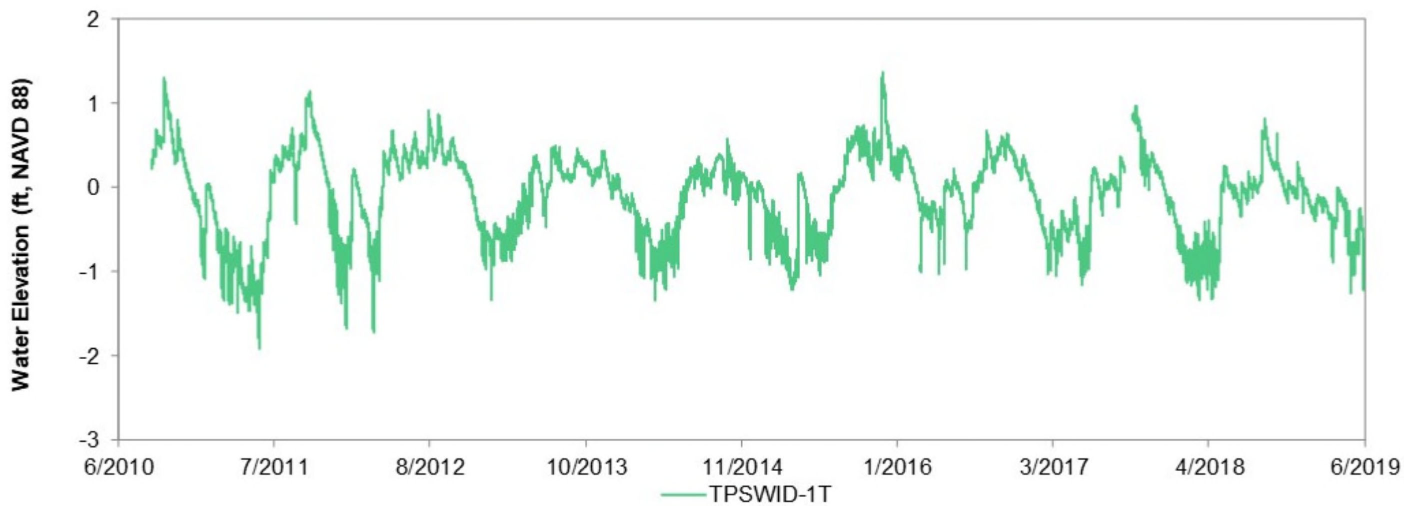


Figure 3.3-30. TPSWID-1 Water Elevations.

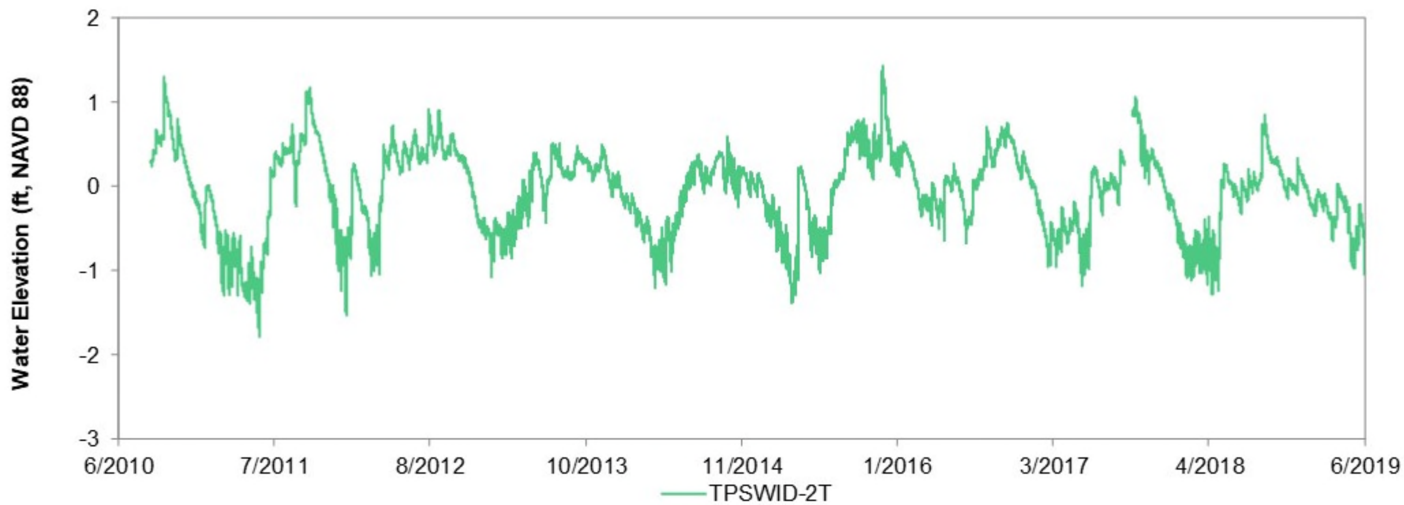


Figure 3.3-31. TPSWID-2 Water Elevations.

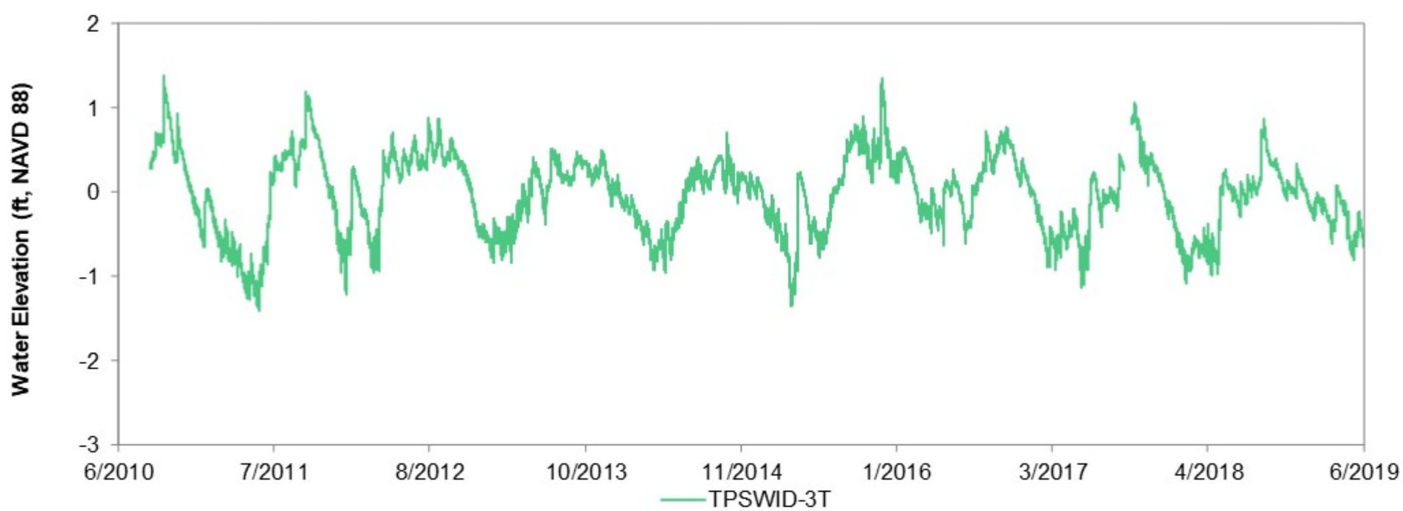


Figure 3.3-32. TPSWID-3 Water Elevations.

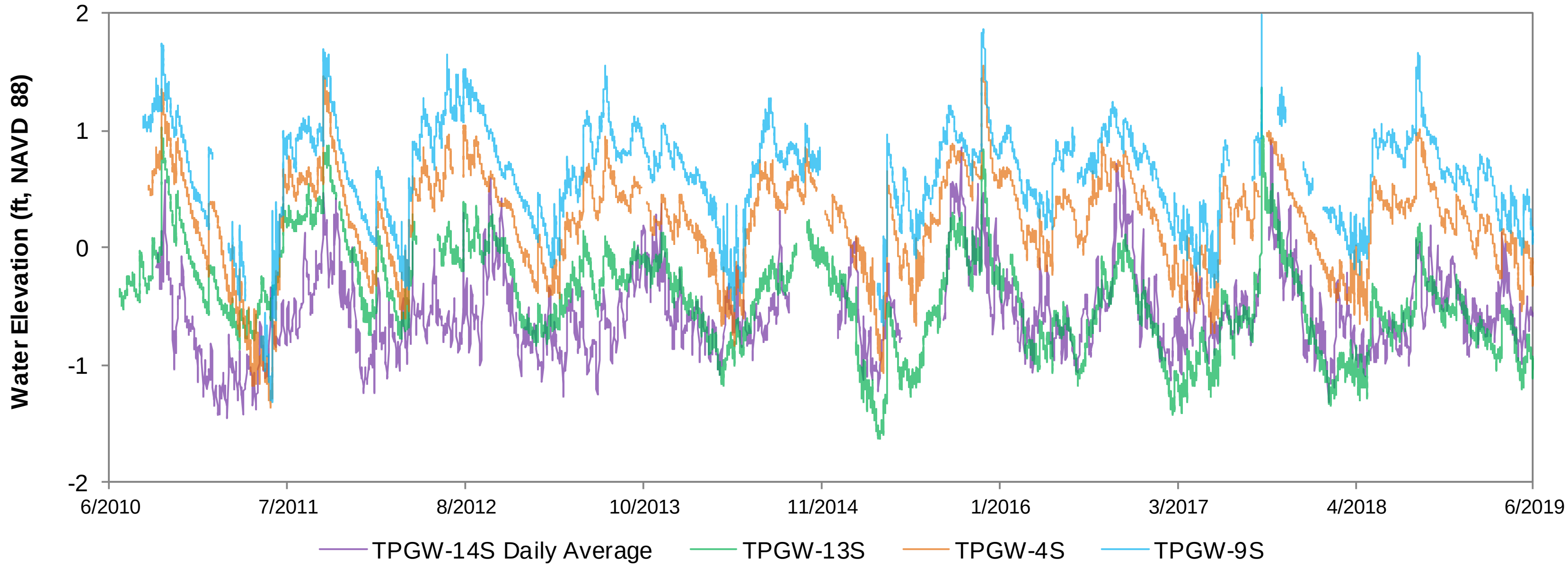


Figure 3.3-33. Comparison of Time-Series Groundwater Elevations across the Landscape at TPGW-14, TPGW-13, TPGW-4, and TPGW-9.

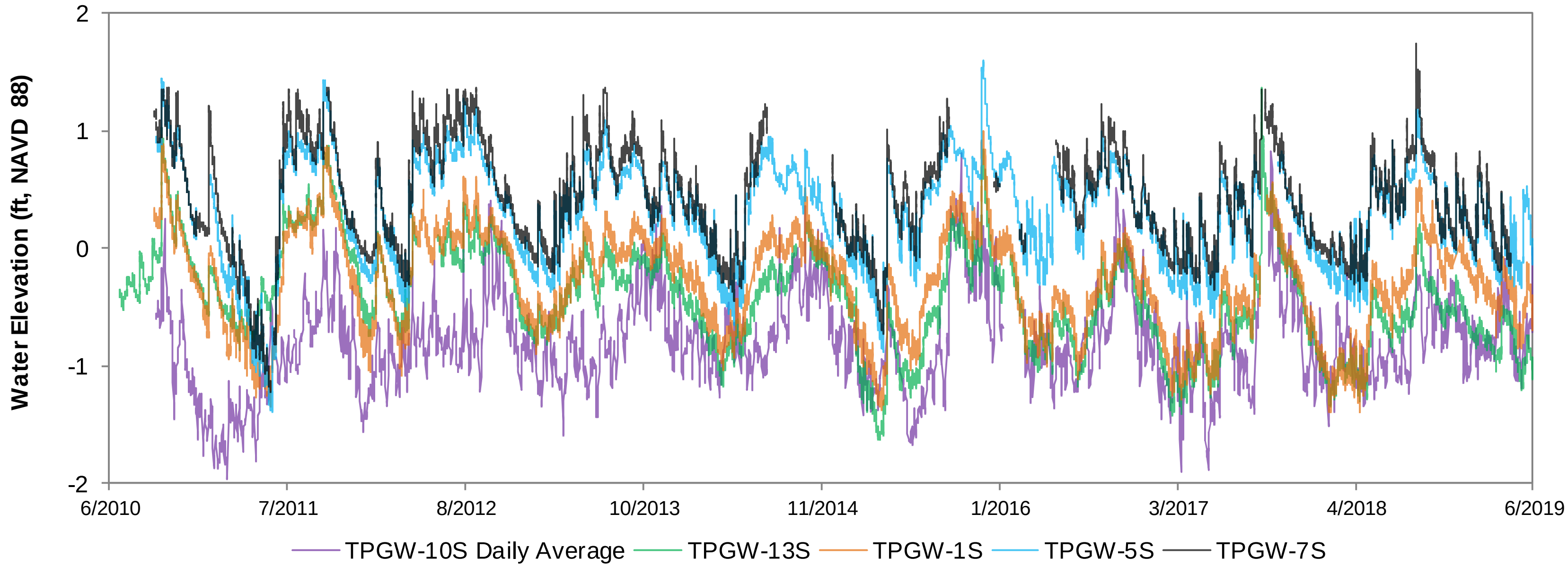


Figure 3.3-34. Comparison of Time-Series Groundwater Elevations across the Landscape at TPGW-10, TPGW-13, TPGW-1, TPGW-5, and TPGW-7.

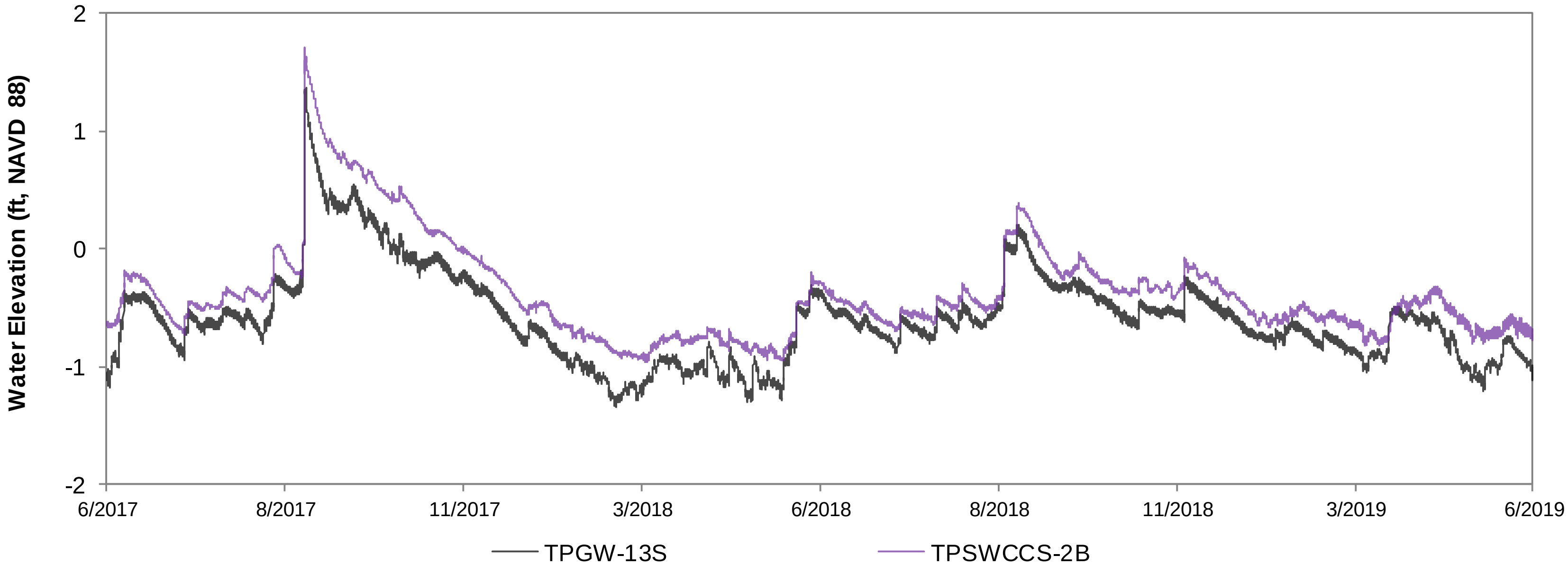


Figure 3.3-35. Comparison of Time-Series Groundwater Elevations at TPGW-13S and CCS Surface Water Elevations at TPSWCCS-2.

Figure 3.4-1. Locations of Tritium and Chloride Cross-Sections.

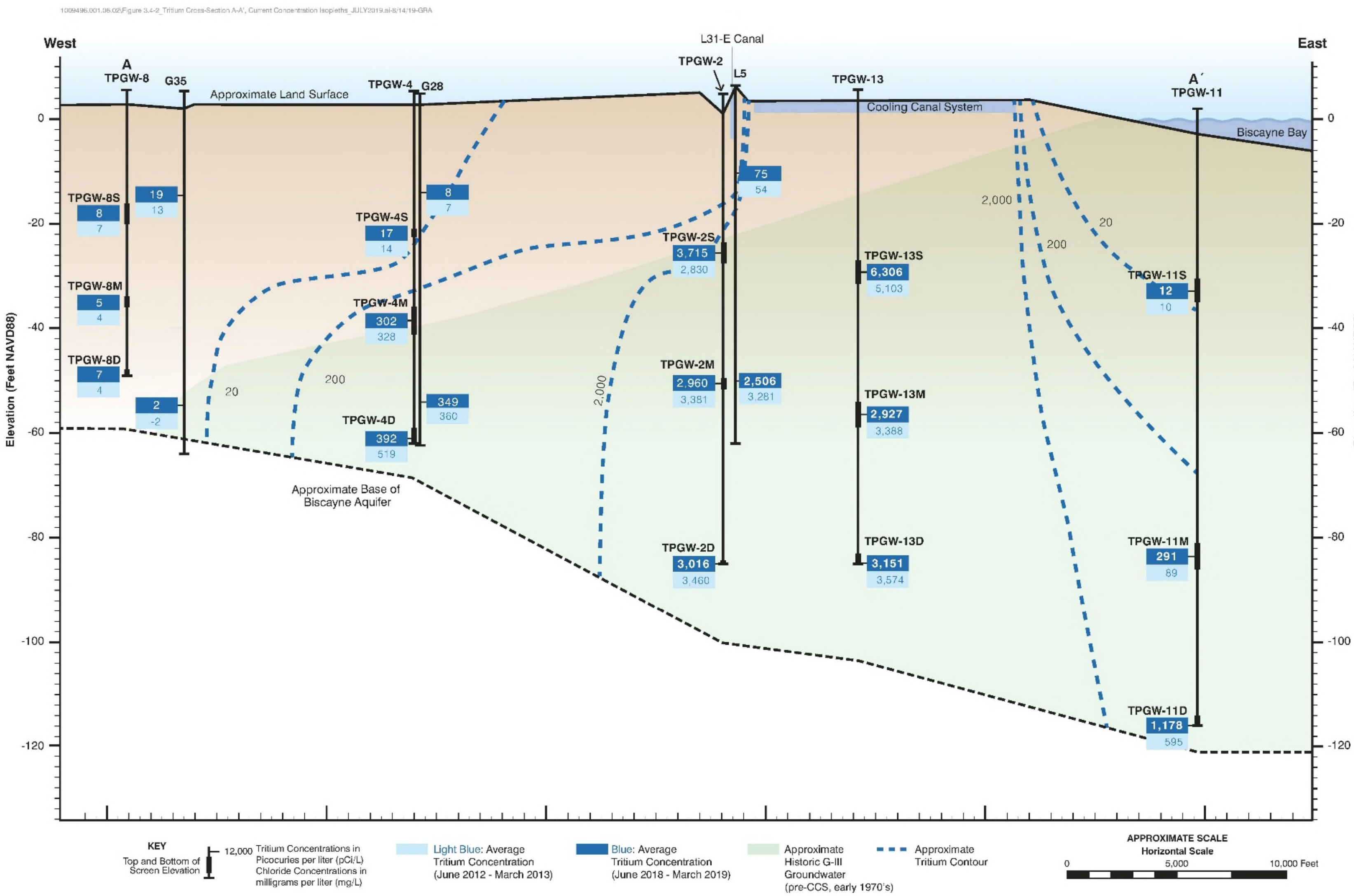


Figure 3.4-2. Tritium Cross-Section A-A', Current Concentration Isopleths.

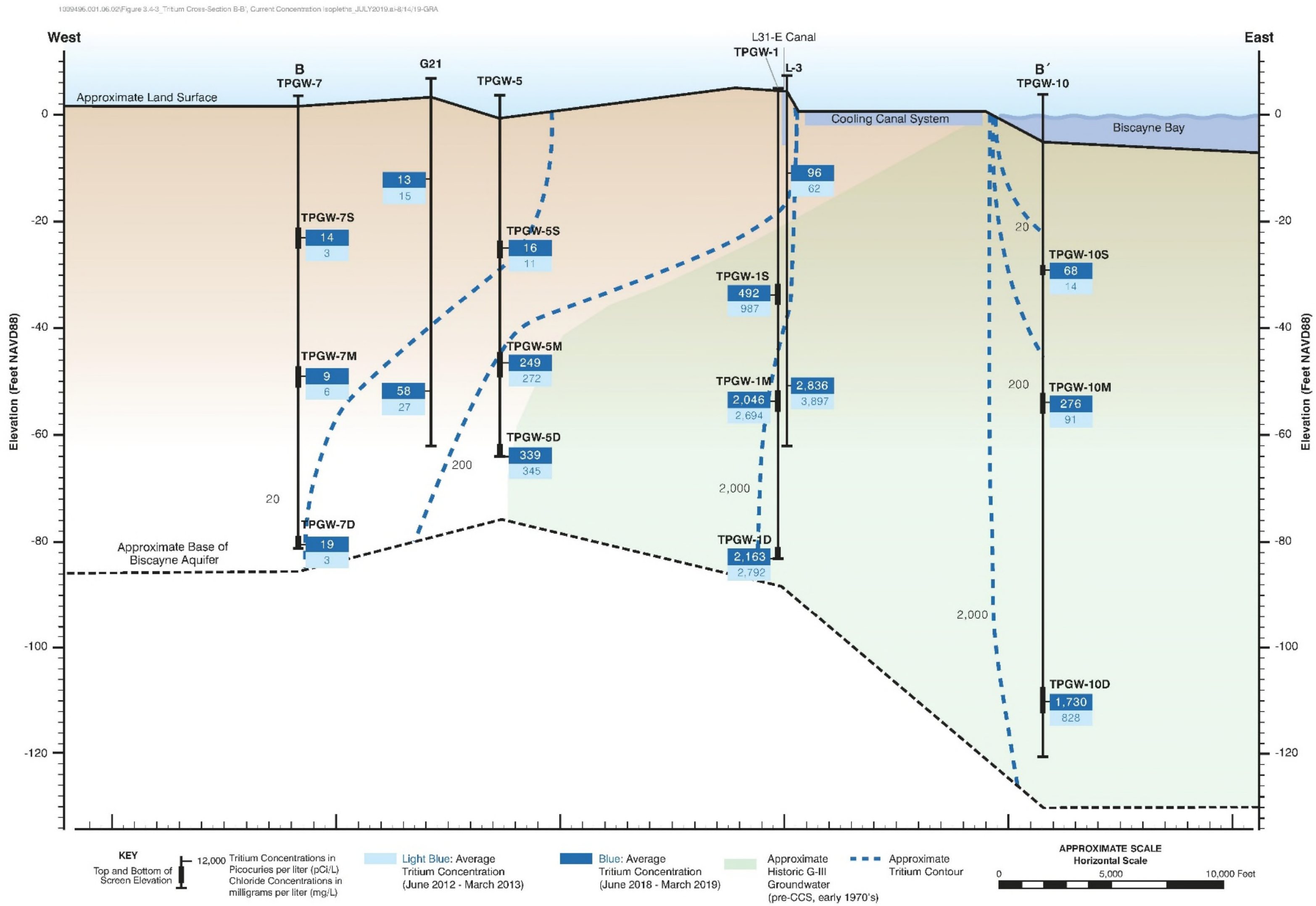


Figure 3.4-3. Tritium Cross-Section B-B', Current Concentration Isopleths.

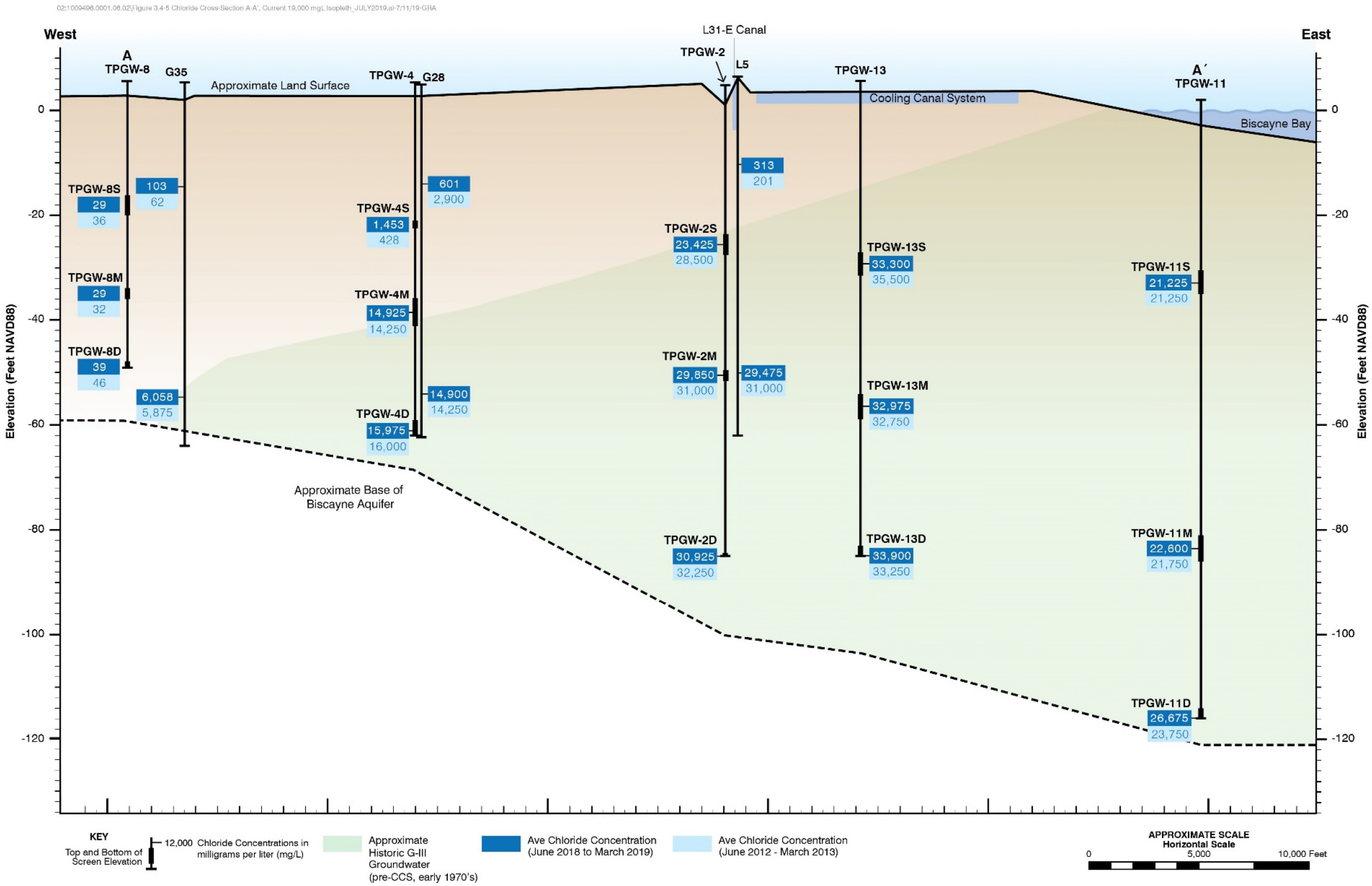


Figure 3.4-4. Chloride Cross Section A-A'.

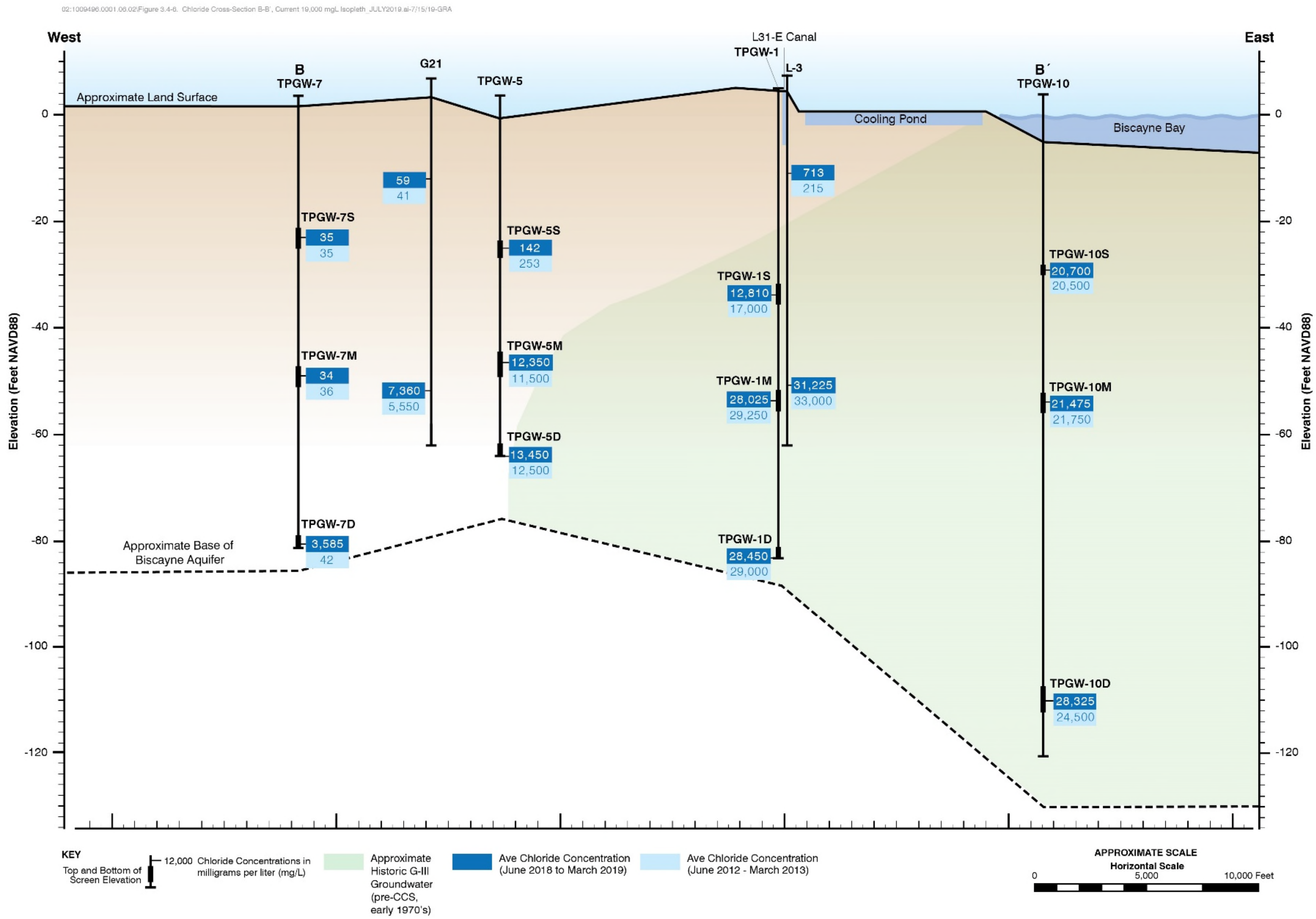


Figure 3.4-5. Chloride Cross Section B-B'.

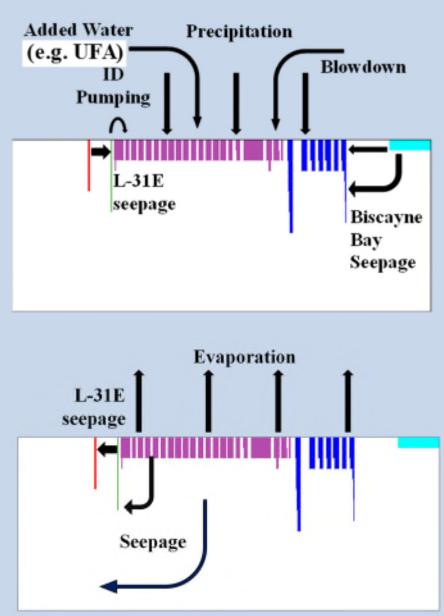
4. CCS WATER AND SALT BUDGET

A requirement of the Monitoring Plan is for FPL to provide a monthly water and salt balance budget for the CCS. The purpose of the budget model is to quantify the volume of water and mass of salt entering and exiting the CCS over a 12-month period. Details of this Excel-based model, the underlying conceptualization of the relationship between the CCS and the surrounding environmental systems, key calculations, and results were provided in the Comprehensive Pre-Uprate Monitoring Report (FPL 2012a). That version of the model simulated water and salt flow to and from the CCS for the period between September 2010 and June 2012. In the Comprehensive Post-Uprate Monitoring Report, refinements to the model were made and water and salt flow to and from the CCS was simulated for the period between September 2010 and May 2015. Subsequent updates to the model simulated semi-annual and annual periods between June 2016 and May 2018. For this annual report, the modeled period encompasses the reporting period (June 2018 through May 2019).

The conceptual model and associated calculations are predominantly unchanged since last presented in the 2012 Comprehensive Pre-Uprate Monitoring Report (FPL 2012a). As such, only a brief summary of the model is provided below. Model results and corresponding conclusions regarding the operation of the CCS are based on the current calibrated water and salt balance model and are provided herein.

4.1 Model Summary

As depicted on Figure 4.1-1 and the inserted schematic, the water balance for the proposed control volume for this reporting period is comprised of seepage (lateral through the sides and vertical through the bottom), blowdown (additional water pumped from other units to the CCS), added water (pumped from the UFA and/or shallow groundwater and the ID), precipitation (including runoff from earth berms between canals), and evaporation. Aside from evaporation and precipitation, these are the same mechanisms by which salt flows into and out of the CCS. The means by which water and/or salt is transferred (e.g., seepage, evaporation) are calculated using various equations provided in the 2012 Comprehensive Pre-Uprate Monitoring Report (FPL 2012a). Calculations were performed during the 12-month reporting period, and average flows of water and salt into and out of the control volume were calculated for each day of this period using hydrologic, water quality, and meteorological data measured within, beneath, and adjacent to the CCS. The



Conceptual diagram showing inflows (top) and outflows (bottom). See Figure 4.1-1 for details.

average daily flows were summed to estimate the amount of water and salt that enters or exits the control volume (i.e., the CCS) during each month and the entire 12-month reporting period. These calculations demonstrate and validate the conceptual model of the CCS and, in so doing, illustrate the hydrologic mechanisms by which the CCS functions.

Calculated water flows are reported in mgd. The mass flux into or out of the control volume is calculated by multiplying the volumetric flow by the salinity of the body of water from which the water is flowing. Salinity was monitored at all groundwater and surface water stations employed in the ensuing calculations and was reported in the practical salinity scale (PSS-78), which is equivalent to grams per liter. Calculated mass fluxes are reported in thousands of pounds per day (lb x 1,000/day).

The gain/loss of water and salt mass within the control volume during some period of time results in a change in the control volume's water and salt mass storage. Increased water storage, for instance, occurs when more water enters the control volume (i.e., the CCS) than exits. Storage then can be estimated by summing all of the components of the water (and salt) balance. When the net flow is positive (into the control volume) during a specified period of time, the storage of the control volume increases. Conversely, a net negative (out of the control volume) flow implies a decrease in storage during a specified time period. Whereas an increase or decrease in water storage results in a rise or drop, respectively, of CCS water elevation, the same is not universally true for salt storage. An increase in salt storage can be coincident with a decrease in salinity as long as the volume of water in which the salt is dissolved increases sufficiently over the same time period.

Water elevations and salinity are monitored at seven locations throughout the CCS. Thus, another manner in which a change in storage can be estimated relies on these direct measurements of water elevations and salinities within the control volume. A change in water elevation within the control volume can be calculated as a difference between water elevations at the beginning and end of a specified time period. The product of this change in water elevations and the surface area of the control volume provide an estimate of the change in the volume of water contained in the control volume during that period of time. Estimates of daily storage changes derived from this method are used to further calibrate the water and salt balance model to ensure an accurate simulation of temporal trends for CCS water elevation and salinity.

For the most part, inflows and outflows of water and salt to/from the CCS are natural and can be predicted based on differences in water levels and meteorological conditions. However, some inflows to the CCS are anthropogenic. During the 12-month simulated period, UFA water was continuously added to the CCS at rates between approximately 10 mgd and 14 mgd as a salinity abatement measure. Additionally, water from the ID, located immediately west of the CCS, was intermittently pumped into the CCS as a part of normal ID operations meant to prevent westward migration of CCS groundwater. Plant operations contribute other sources of water to the CCS (i.e., added water from Units 3, 4, and 5). Water pumped from and back into the CCS from the plant intake and discharge pumps are assumed to be equivalent in magnitude and cancel each other out; as such, these flows are not simulated as a part of the CCS water and salt balance model.

4.2 Model Calibration, Results, and Discussion

The individual components of the water and salt balance were simulated daily and summed for each month individually from June 2018 through May 2019, for the semi-annual period between June 2018 and November 2018, and for the 12-month reporting period in its entirety. The individual components of flow are summed in order to calculate a simulated change in volume for each month and for the 12-month reporting period. These simulated changes in storage were compared to observed changes in CCS water and salt storage on a monthly, semi-annual, and annual basis. Errors between the simulated and observed storage changes were minimized by adjusting key variables associated with the flow balance model; this process is called calibration. The calibration process ensures that the model can accurately reflect the average changes in CCS storage over a 12-month period while also effectively capturing day-to-day changes in CCS water and mass storage. Calibration of the water and salt balance model was achieved by adjusting hydraulic conductivities of the aquifer materials adjacent to and beneath the CCS that factor into the calculation of seepage to/from groundwater and Biscayne Bay. Additional adjustable parameters include the coefficients in the wind function (FPL 2012a), the amount of runoff that enters the control volume as percentage of precipitation, the amount of Unit 5 cooling tower water that is lost to evaporation before entering the CCS, and the salinity of the Unit 5 blowdown as a percentage of seawater. Adjustments were also made to the amount of influence that different observed groundwater levels beneath and adjacent to the CCS contributed to the appropriate representation of the exchange of flow between the CCS and the Biscayne Aquifer. The calibrated model parameter values are provided in Table 4.2-1.

4.2.1 Parameter Adjustments

The horizontal hydraulic conductivities of the side (north, south, east, west) walls of the CCS were calibrated to range between 100 ft/day (west and north CCS walls) and 450 ft/day (south CCS wall). The calibrated vertical conductivities of the bottom of the CCS ranged from 0.1 ft/day (middle portion of discharge canals, southern portion of discharge and return canals) to 5.4 ft/day (northern discharge canals); the vertical hydraulic conductivity of the middle of the discharge canals were 0.12 ft/day, and that of the middle and northern portions of the return canals were calibrated to 2.0 ft/day. The variability in these vertical hydraulic conductivities is attributable to the non-uniform depth of a shallow high flow zone that is variably intersected by deeper CCS canals. A separate factor of 1.2 was multiplied by the vertical hydraulic conductivities of the discharge canals that were a part of sediment removal activities in early 2015 to reflect a greater connectivity with the Biscayne Aquifer. The magnitude of and variability in vertical hydraulic conductivities are approximately on the same order of magnitude as those in the prior model (which simulated the period from June 2018 through November 2018 for the Semi-Annual Data Delivery), when vertical hydraulic conductivity ranged from 0.1 to 6.0 ft/day. Horizontal hydraulic conductivities calibrated in this model are, for the most part, on the same order of magnitude and range of values as those calibrated in the prior model, which was simulated through November 2018. The minor exception to this is the hydraulic conductivity of the eastern wall of the CCS, which was previously set to 1,000 ft/day. The reduction in this hydraulic conductivity value was effective at matching the rise in salinity observed between March and May 2019. Overall, the adjustments to hydraulic conductivity were relatively minor but were necessary to maintain a reasonably accurate match to observed CCS water levels and salinities throughout the 12-month reporting period.

In addition to changes in hydraulic conductivities, revisions were also made to evaporation. The equation for evaporation (FPL 2012a) includes an empirical factor. This factor was increased from 0.63 to 0.635 (a minor adjustment) to calibrate the model to the 12-month reporting period. By increasing this factor, the simulated evaporative losses from the CCS were consequently increased. As in the case of the east CCS wall's hydraulic conductivity, this was necessary to match the moderate rate of salinity increase observed throughout the modeled timeframe.

The percentage of additional precipitation-based inflow due to runoff from canal berms is an adjustable model parameter. This parameter is time-invariant and increases precipitation-based inflow for all precipitation events; as the precipitation increases, additional runoff inflow also increases. Since precipitation is a key inflow to the CCS for moderating salinity, the balance model is sensitive to this parameter. This parameter is defined to be 27% of direct precipitation inflow. This is an increase relative to the prior 6-month model (16%). There is considerable uncertainty in this parameter, and it is more impactful to the simulation of water level and salinity changes during greater rainfalls. However, the significant rain events during the simulated 12-month timeframe were few, and the average of non-zero daily rainfalls was approximately 0.2 inch.

The impact of the parameter changes, particularly the adjustments made to the evaporation parameters, is a relatively accurate simulation of the monthly flow balance and simulated daily CCS conditions during the reporting period. The effect of these parameter adjustments on the historical period of record (September 2010 through May 2018), which were previously simulated by earlier versions of the water and salt balance model, were not evaluated as a part of this modeling effort.

4.2.2 Flow Balance Comparisons

Results of the calibrated 12-month water and salt balance model are provided in Tables 4.2-2 and 4.2-3, respectively. The modeled net flow of water, as calculated by summing the components of the water balance for the 12-month calibration period, is denoted as the "Modeled Change in CCS Storage" and was calculated to be an average outflow of 2.18 mgd over the 12-month calibration period (i.e., on average, over the 12-month period, the volume of water in the CCS decreased at a rate of 2.18 mgd). The observed change in storage, which is the difference in the volume of water in the CCS between the final and first days of the calibration period, divided by the number of days in the period, was observed to be a decrease in storage at a rate of 2.14 mgd. Though the model over-estimated the decrease in storage, the residual error between the simulated and observed flow was only 0.04 mgd. This error is small (0.11%) relative to the variability in monthly net observed flows, which range from a net inflow of 15.1 mgd (March 2019) and a net outflow of 20.2 mgd (April 2019). These monthly net flows are provided in the calibrated water and salt balance model included as Appendix M.

The model simulated a net gain of salt over the 12-month reporting period that equates to 348,000 pounds per day.

The model simulated a net gain (net inflow) of salt over the 12-month reporting period at a rate of 348 (lb x 1,000)/day. The corresponding observed rate of salt outflow was calculated by multiplying the average observed salinity in the CCS (based on salinities measured at monitoring stations TPSWCCS-1, -2, -4, -5, and -6) on the final and first day of the calibration period by the corresponding CCS volumes on those days. The difference between these two products divided by the number of days in the calibration period provides the observed net inflow of salt, 539 (lb x 1,000)/day. Thus, the model under-estimates the salt inflow by approximately 191 (lb x 1,000)/day. As in the case of water balance simulation, the magnitude of this over-estimation is small (1.5%) relative to the range in monthly average salt inflows; the observed monthly net mass fluxes range from an outflow of 5,426 (lb x 1,000)/day (April 2019) to an inflow of 7,478 (lb x 1,000)/day (March 2019).

Figures 4.2-1 and 4.2-2 show the monthly change in water and salt mass flows and illustrate the model's ability to match the magnitude and direction of net monthly flows of water and salt, respectively, over the 12-month period. With a few exceptions, the model accurately simulated the direction of monthly averaged water and salt flows into and out of the CCS. In Figure 4.2-1, it is evident that the wet season (June to October) is marked by a mix of inflow (July, August, and September) and outflow (June and October). In the latter two months, rainfall was relatively low and precipitation inflows were dwarfed by evaporative losses. The dry season (December to April and including the transitional months of May and November) is marked by a fairly consistent outflow of water from the CCS, with isolated months of net inflow (March and May). Consistent with these general trends in net water flow, water elevations during the wet season were relatively steady, with isolated peaks; water elevations generally decreased during the dry season, except for a short-term increase in March 2019.

Modeled and measured water (left diagram) and salt (right diagram) inflows and outflows. See Figures 4.2-1 and 4.2-2 for details.

Figure 4.2-2 compares observed and modeled net monthly flows of salt into and out of the CCS. Unlike the flows of water in Figure 4.2-1, net salt storage was muted during the wet seasons, except in September 2018, when the loss of salt was more pronounced. Net salt storage changes during the dry season alternated between losses and gains, though the latter are more notable. Like the modeled water flows, modeled salt mass fluxes generally match observed fluxes, albeit with less accuracy than the match to water flows. One month in particular (July 2018) illustrated a marked deviation between the modeled and observed changes in magnitude and direction of net storage; the model simulates a nearly 4,000 (lb x 1,000)/day increase in salt mass compared to the approximately 400 (lb x 1,000)/day decrease in salt storage. The cause of this is likely one or both of the following: (1) too high a ratio of inflowing salt mass through the bottom and/or east faces of the CCS to outflowing salt mass; and/or (2) a short-term deviation from the hydrology. Nevertheless, this is an isolated condition and changes to CCS water and salt storage are adequately simulated the remainder of the year. As such, this model error does not signify a deficiency in the monitoring network in and around the CCS.

4.2.3 Simulated CCS Water Levels and Salt

The model generally predicts water level and salt changes fairly well; however, there are some months when the water levels tend to be underestimated and this can cause salinity to be overestimated.

Implicit in the model's ability to simulate monthly net water and salt mass flows is the accurate simulation of daily flows to and from the CCS. Because the model is able to characterize the daily flows of water and salt, the model estimates the daily changes in CCS water and salt storage. As previously mentioned, these changes in storage are associated with daily changes in CCS water levels and salinity. Figure 4.2-3 shows the model-calculated water level in the CCS, which varies over the reporting period. These modeled water levels range between approximately -1.0 ft North American Vertical Datum of 1988 (NAVD 88) and 0.2 ft NAVD 88 and are an average of water levels throughout the entire CCS. Also shown in this figure are the observed CCS water levels over time; the observed values reflect the mean of daily-averaged water elevations across the five sensors in the CCS (TPSWCCS-1, -2, -4, -5, -6). The model generally matches the seasonal trends in CCS water level changes (reductions during the dry season and increases during the wet season). However, from July to October 2018, the model under-simulates the CCS stage. Changes to the model intended to mitigate these residuals resulted in a degradation in the quality of the match to CCS salinity and CCS water levels during other periods of the simulated timeframe.

Changes in salt mass storage within the CCS can be used to calculate average CCS salinity changes over time. The simulated daily net flow of salt is divided by the simulated volume of water in the CCS, which results in a change in salinity. This change in salinity is added to the simulated salinity calculated for the previous day to produce a simulated salinity for the current day. Like the simulated CCS water level, the modeled salinity reflects a representative daily salinity throughout the CCS. Figure 4.2-4 compares the simulated salinities to those observed in the CCS over the period of record. Observed salinities are the mean of daily averaged salinities measured in the CCS monitoring stations (TPSWCCS-1, -2, -4, -5, and -6). The model generally matches the observed temporal trends in salinity. Periods of salinity over-simulation are generally consistent with periods of under-simulation of water elevations. This is not coincidental, since an underestimation of the volume of water in the CCS can lead to an over-simulation of salt concentrations. However, it is important to note that the most notable period of salinity over-simulation begins in July 2018, which is the same month that modeled and observed changes in salt storage had markedly deviated.

4.3 Conclusions

The accurate simulation of changing CCS inflows, outflows, water elevations, and salinities is complex due to the different components of the balance model and their varying impacts on CCS water and salt storage. For instance, vertical flows into and out of the control volume are generally larger than horizontal flows and have a comparatively greater impact. However, the salinity of inflowing water can vary depending on the source of the water. For example, water pumped from the UFA into the CCS is relatively low in salinity and, as such, serves to reduce and/or moderate CCS salinity; vertical flow from groundwater beneath portions of the discharge canals to the CCS is saline to hyper-saline and generally increases the salinity of the CCS. The correct balance of both water and salt mass flow is difficult to estimate in the model. In addition, observed CCS water temperatures varied by approximately 23.9°C (from approximately 19.6°C at TPSWCCS-5 in November 2018 to 43.5°C at TPSWCCS-1 in July 2018) during the simulated timeframe. The model addresses associated impacts to the CCS by explicitly simulating the effects of water/air temperature gradients on evaporation. Whereas numerous sources and sinks of water, varying salinities, and changes in water temperature do increase model complexity, the need to accurately simulate these different components of CCS operation constrains the number of possible solutions.

Though the model is able to simulate the complex dynamics associated with the CCS over a 12-month timeframe with reasonable accuracy, there are periods when the simulated flows of water and salt do not accurately reflect observed conditions. Consequently, the simulated water levels and salinities in the CCS deviate from those that have been observed at various times in the simulation period. However, the overall performance of the model reinforces its utility as a tool for understanding how the CCS has and will operate under varying meteorological, hydrological, and operational conditions. This is best demonstrated by the fact that the same conceptual model employed to characterize changes in CCS storage of water and salt during the reporting period was used to explain changes in storage during the prior approximately 8-year historical period of record. This is notable since the same conceptual model is able to effectively characterize CCS water level and salinity responses to average conditions as well as numerous hydrologic, meteorological, and anthropogenic conditions, including hurricanes, droughts, added water, and sediment removal.

The robustness and accuracy in the model underpins FPL's informed understanding of processes that control the CCS and the manner in which the CCS interacts with the surrounding environment. This accuracy in simulating the historical changes within the CCS bolsters confidence in the model's utility as a tool to evaluate the sensitivity of CCS operations to certain factors, such as changes in operation, drought conditions, storm events, salinity abatement activities, and other potential environmental stresses. Additionally, the model quality validates the fact that the most appropriate data are being collected to effectively capture CCS operations, identify interactions between the CCS and the surrounding environment, and support FPL's comprehension of historical and future operations of the CCS. Continued application and updating of this model is recommended to improve the quality with which it simulates historical conditions and, thereby, bolster user confidence when making future decisions regarding CCS operations.

TABLES

Table 4.2-1. Calibration Parameters.

Parameter Name	Calibrated Value	Units
Vertical Hydraulic Conductivity (Zone A)	4.5	ft/day
Vertical Hydraulic Conductivity (Zone B)	0.1	ft/day
Vertical Hydraulic Conductivity (Zone C)	0.1	ft/day
Vertical Hydraulic Conductivity (Zone D)	2.0	ft/day
West Face Hydraulic Conductivity	200.0	ft/day
East Face Hydraulic Conductivity	400.0	ft/day
North Face Hydraulic Conductivity	100.0	ft/day
South Face Hydraulic Conductivity	450.0	ft/day
Evaporation Modifier (Factor Multiplier)	0.64	
Runoff Modifier (as % of Precipitation)	27%	
Blowdown Evaporation Factor	25%	
Blowdown Concentration (as % of Seawater)	0.85	

Table 4.2-2. Calculated Fluid Flows from Water Budget Components for the Period of Record (June 2018 through May 2019).

June 2018 to May 2019			
Water Budget Component		**Flow (MGD)**	**Volume (gal x 10^6)**
Into CCS	W. Seepage	0.17	63.16
	E. Seepage	2.52	918.09
	N. Seepage	0.01	2.81
	S. Seepage	2.09	761.98
	Bot Seepage	5.45	1988.03
	Precipitation and Runoff	16.35	5967.59
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.58	211.22
	Unit 5 Blowdown	1.73	630.93
	ID Pumping	1.21	440.46
	Added Water	11.36	4146.75
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**41.45**	**15131.02**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-1.97	-717.24
	N. Seepage	0.00	-1.81
	S. Seepage	0.00	0.00
	Bot Seepage	-5.97	-2178.61
	Precipitation and Runoff	0.00	0.00
	Evaporation	-35.71	-13034.29
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-43.65**	**-15931.95**
Modeled Change in CCS Storage:		**-2.19**	**-800.93**
Observed Change		**-2.14**	**-780.15**

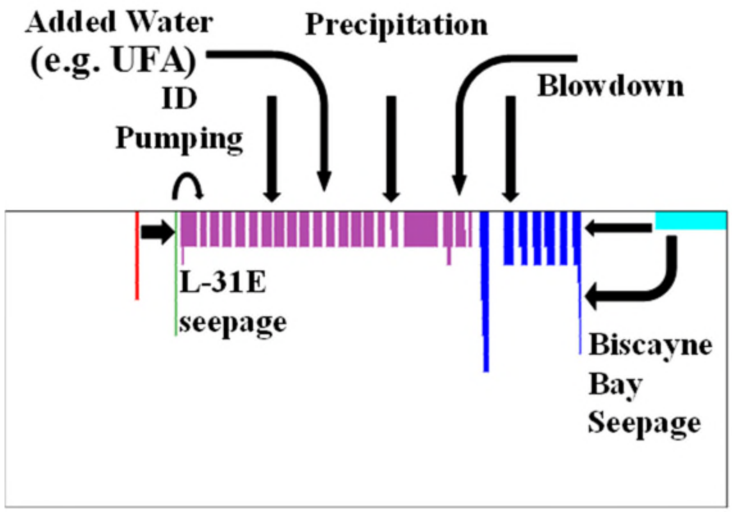
Key:
CCS = Cooling Canal System.
gal = Gallon.
ID = Interceptor Ditch.
MGD = Million gallons per day.

Table 4.2-3. Calculated Mass Flows from Salt Budget Components for the Period of Record (June 2018 through May 2019).

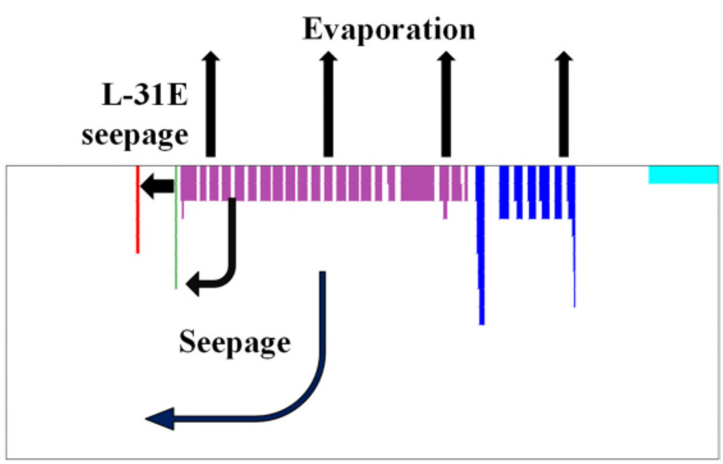
June 2018 to May 2019			
Mass Budget Component		lb/day (x1000)	Mass (lb x 1000)
Into CCS	W. Seepage	3.82	1392.51
	E. Seepage	695.00	254037.03
	N. Seepage	0.00	0.00
	S. Seepage	469.58	171394.90
	Bot Seepage	1927.76	703633.02
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	429.16	156643.67
	ID Pumped Water	51.74	18883.70
	Added Water	230.39	84093.29
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total In:	**3808.43**	**1390078.12**
Out of CCS	W. Seepage	0.00	0.00
	E. Seepage	-823.86	-300708.99
	N. Seepage	-2.56	-934.50
	S. Seepage	0.00	0.00
	Bot Seepage	-2558.71	-933928.94
	Precipitation and Runoff	0.00	0.00
	Evaporation	0.00	0.00
	Unit 3, 4 Added Water	0.00	0.00
	Unit 5 Blowdown	0.00	0.00
	ID Pumping	0.00	0.00
	Plant Outflow	Equal to Intake	
	Plant Intake	Equal to Outflow	
	Total Out:	**-3385.13**	**-1235572.43**
Modeled Change in CCS Storage:		**423.30**	**154505.69**
Observed Change		**539.43**	**196892.09**

Key:
CCS = Cooling Canal System.
ID = Interceptor Ditch.
lb = Pound(s).

FIGURES



(A)



(B)

Key: Red line = L-31E canal; green line = Interceptor Ditch; purple lines = CCS southbound canals; thick blue line = CCS Grand Canal; short blue line = CCS northbound canals; thin blue line = CCS return canal; light blue bar = Biscayne Bay

Figure 4.1-1. Flow into (A) and out of (B) the CCS, Shown in Cross-Section.

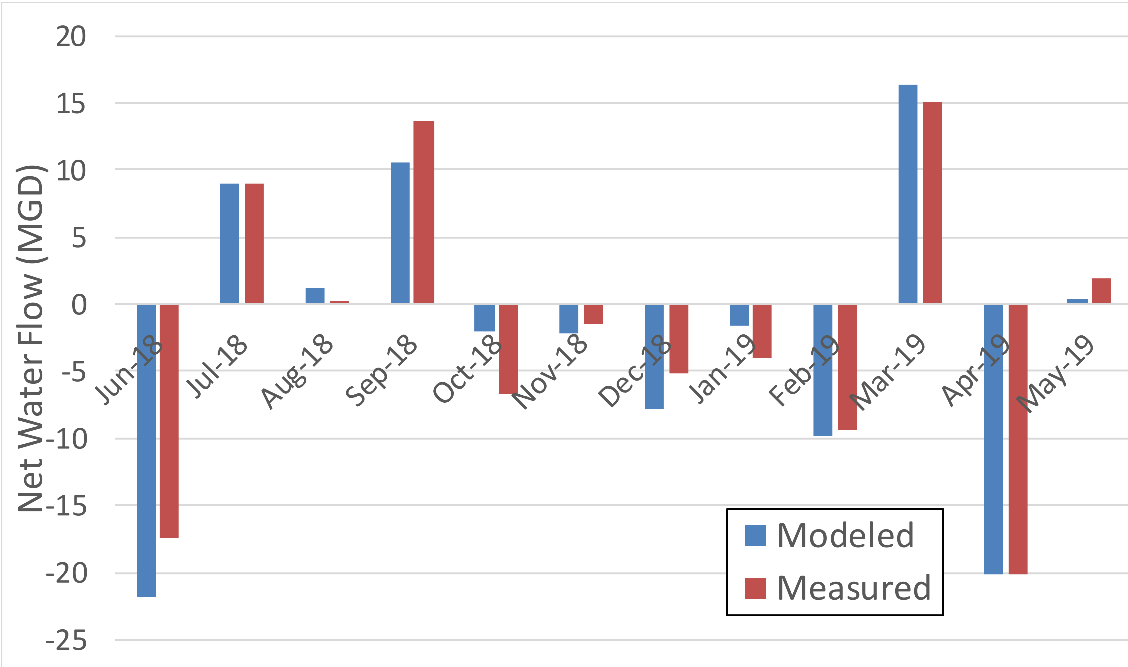


Figure 4.2-1. Modeled versus Measured Net Monthly Flows of Water for the CCS during the Period from June 2018 - May 2019.

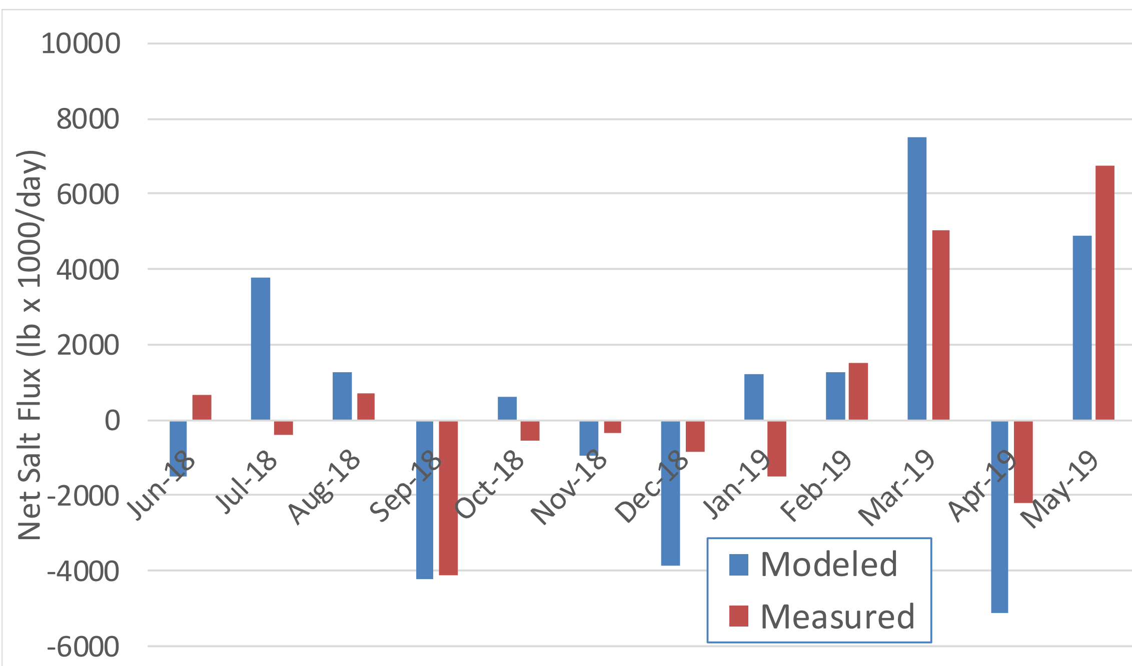


Figure 4.2-2. Modeled versus Measured Net Monthly Flux of Salt Mass for the CCS during the Period from June 2018 - May 2019.

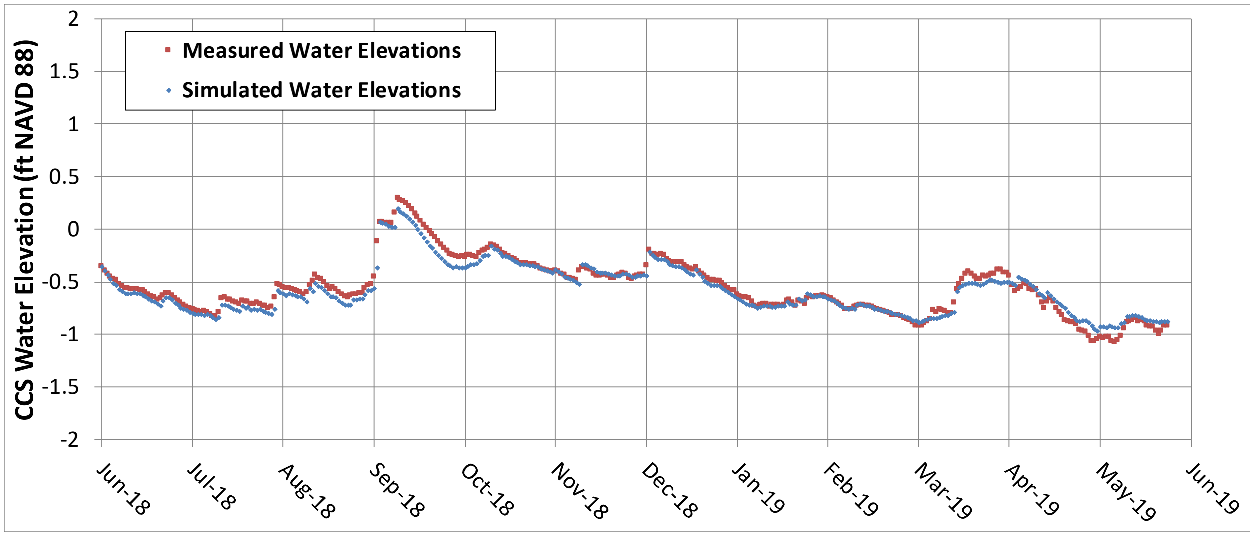


Figure 4.2-3. Modeled versus Measured Water Elevations (NAVD 88) in the CCS during the Reporting Period; Used to Validate the Conceptual Model and Calibrate the Water Balance Model to Temporal Trends in Water Elevation.

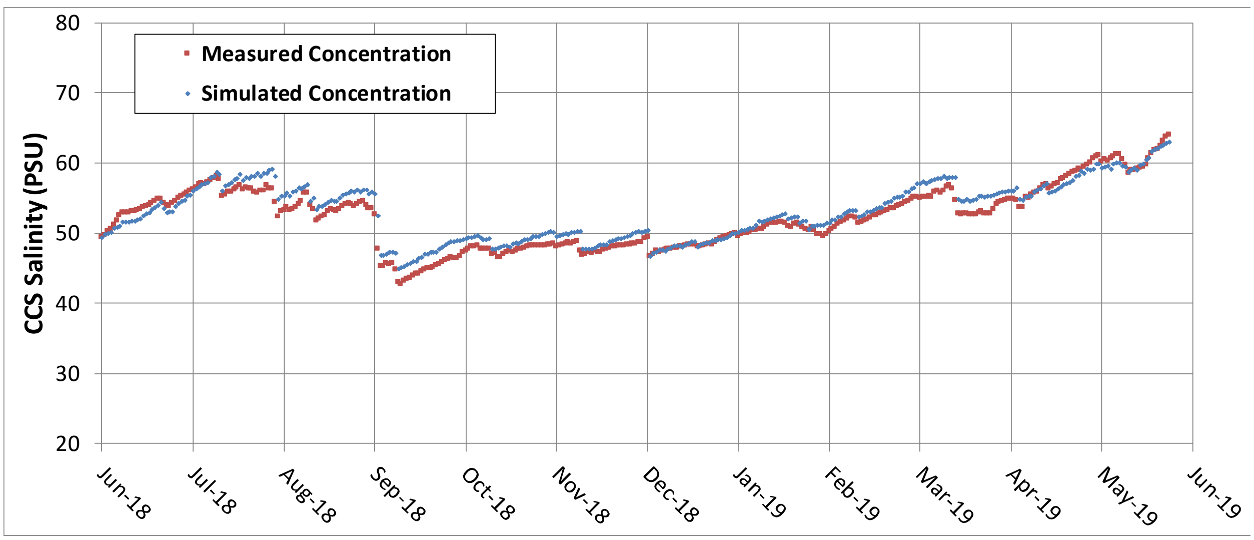


Figure 4.2-4. Modeled versus Measured Salinity in the CCS during the Reporting Period; Used to Validate the Conceptual Model and Calibrate the Water Balance Model to Temporal Trends in Salinity.

5. ECOLOGICAL MONITORING

The ecological monitoring plan was designed to characterize the plant communities in the marsh, mangrove, and bay ecosystems adjacent to Turkey Point and to determine the influence, if any, of the CCS on these communities via a groundwater pathway. The ecological significance of each type of ecological data collected under this monitoring program and their significance in identifying potential CCS influences are summarized in Table 5.0-1.

This section encompasses data collected from marsh and mangrove wetlands adjacent to the CCS and submerged aquatic vegetation (SAV) in Biscayne Bay and Card Sound proximal to Turkey Point for the reporting period. An overview of the ecological conditions for the historical period of record (October 2010 through May 2018) is also provided in this section as a comparison with the reporting period data. Background of the sites monitored, plot setup, sampling frequency, and parameters measured are detailed in Appendix B. Appendix K provides a detailed explanation of all terrestrial ecological calculations.

The most impactful event over the last 9 years of monitoring has been Hurricane Irma (September 10, 2017). Immediately after the hurricane, the effects of storm surge and high winds could be seen in many of the marsh and mangrove plots. The impacts continue to be evident in a handful of marsh and mangrove plots and will be discussed in the sections below.

5.1 Marsh, Mangroves, and Tree Islands

Details of the plot establishment, monitoring setup, and parameters measured are provided in detail in Appendix B, while Table 5.0-1 outlines all of the types of data collected and their significance to the monitoring program.

5.1.1 Results and Discussion

5.1.1.1 Community Description

Vegetation patterns have not changed significantly over the past 9 years; the biggest impact to the system has been due to climatic events (e.g., Hurricane Irma) and regional meteorological conditions.

As described in detail below, in general, the overall trends in species diversity and evenness have remained consistent throughout the entire period of record. The key vegetation communities in each of the general habitats are provided in Table 5.1-1, and a complete list of species is provided in Appendix L. The vegetation community remains consistent, as described in previous years (FPL 2018; Table 5.1-2).

Eleven total species of woody and herbaceous plants were documented in the northeast corners of the plots during the November 2018 sampling event (Table 5.1-3). In the freshwater F-plots (F2, F3, F4, and F6), sawgrass and spikerush (*Eleocharis cellulosa*) were the two species encountered most often. In the mangrove plots, red mangrove was the most common species. Diversity ranged from one to five species within a plot and from one to six species along a transect, which is consistent with observations from the historical period of record (Table 5.1-3).

The Shannon-Weiner Index (SWI) of diversity is a measure of the probability that a randomly sampled individual will be a particular species. For instance, an SWI value of 0 indicates that only one species is present, with no uncertainty as to what species a randomly sampled individual will be. Values can range from 0 to 4.5, with the smallest values representing low diversity and the larger values representing high diversity. Shifts in these values over time can indicate a change in the vegetative community (fewer species or more species present). During the November 2018 monitoring event, the SWI was low at all plots, and each transect had SWI values of less than 1 (Table 5.1-4). In the marsh plots, diversity was lowest in the F2 plots (SWI = 0.425), as plots along the transect were dominated by a single species (sawgrass), with spikerush only sparsely present. In comparison, diversity was highest in the freshwater marsh at transect F3 during the November 2018 sampling event (SWI = 0.647). All values in November 2018, including those from the F6 reference plots, were similar to those observed during the historical period of record. Overall, the relatively low SWI values indicate low species diversity and low abundance of non-dominant species (i.e., most plots are dominated by sawgrass, with spikerush sparsely present), which is typical of Everglades sawgrass marshes (Gunderson 1997).

Low species diversity and low abundance of non-dominant species (i.e., most plots are dominated by sawgrass, with spikerush sparsely present), as seen in the monitoring plots, are typical of Everglades sawgrass marsh and mangrove habitats.

The SWI diversity was also low in the mangrove plots, which were dominated by red mangrove, with white and black mangrove (*Avicennia germinans*) sparsely present. Low diversity is expected in scrub mangrove ecosystems, as few plants can tolerate the harsh conditions that naturally occur in these areas (Lugo and Snedaker 1974). M5-1 was the most diverse mangrove plot, with four species present (Table 5.1-3). The community with the highest diversity was the marsh-mangrove mix, which had three (F1) and six (F5) species along each transect. F5 was the most diverse transect, as it was composed of a mix of woody and non-woody species within the different plots. Although the SWI values have fluctuated over the years, the overall trends have remained consistent throughout the entire period of record. These data from both the “M” and “F” plots indicate a stable system, with species diversity consistent with similar ecosystems (Lugo and Snedaker 1974; Gunderson 1997).

Species evenness is a measure of how evenly distributed (numerically) each species is at a site. A species evenness of 1 means an equal number of individuals of each species is present. The low evenness values of the mangrove plots indicate one highly dominant species (e.g., red mangrove) with other species sparsely intermixed (Table 5.1-4). Higher evenness values indicate that at plots such as F3-1, F4-2, and F6-2 most species present are well represented. Many of the plots along the F6 and M6 reference transects are represented by only one species and, therefore, could not be evaluated for species evenness (plot F6-2 excluded). The mangrove plots had the lowest species evenness, while the marsh sites had the highest (Table 5.1-4). These trends have remained consistent throughout the entire monitoring period, indicating a stable system.

5.1.1.2 Freshwater Marsh Sampling

> The marsh community is reflective of the "sparse sawgrass" community type (i.e., low cover and productivity). Productivity is a function of soil nutrient conditions and hydrology that is influenced by regional meteorological conditions and climatic events. Porewater tritium concentrations have been low at all of the marsh sites throughout the entire period of record and are consistent with atmospheric deposition concentrations. Plot differences are likely due to inherent hydrologic and biogeochemical interactions within each plot and not because of CCS groundwater influence.

To focus on landscape trends, the following discussion is limited to sawgrass, which is the primary herbaceous species measured in the marsh plots. Prior to Hurricane Irma, the sawgrass at plot F1-1 consistently had the third or fourth highest biomass of all marsh plots. However, this plot experienced a complete die-off of sawgrass after the hurricane, likely caused by increased salinity from the storm surge associated with the hurricane and not because of a groundwater pathway from the CCS (based on porewater chloride and tritium values). While some regrowth has occurred, there are only three sawgrass individuals present in the plot. Therefore, plot F1-1 will be largely omitted from the vegetation discussion below.

Sawgrass percent cover at sites other than F1-1 have remained consistent during the entire period of record. During the reporting period, percent cover categories remained consistent in most plots, with only small seasonal changes observed (Table 5.1-5). Throughout the entire period of record, sawgrass cover was consistently ≤25%, and average vegetation height for each sampling event never exceeded 1.35 meters (m) (Tables 5.1-5 and 5.1-6, respectively). These vegetation patterns are consistent with the "sparse sawgrass" community commonly observed in Florida (Olmsted and Armentano 1997). Ross et al. (2003) determined that the "sparse sawgrass" habitat was the most common marsh cover type in Shark Slough within Everglades National Park, consisting of >50% of the transects studied.

Sawgrass is tallest at plots F4-1 and F1-2, while plants in F3-1 and F3-2 are the shortest (Table 5.1-6). Comparisons among transects show that sawgrass in F3, F2, and F6 (reference transect) have always been shorter relative to F1 and F4. These patterns have remained consistent throughout the entire period of record and there have been no differences in the rank order of vegetation heights over the last 6 years. In the reporting period, height in each plot was generally lowest during the early wet season (August 2018) or late dry season (May 2019) monitoring events and was highest during the November 2018 monitoring event. Because porewater tritium concentrations have been low and consistent with atmospheric deposition concentrations at all of the marsh sites throughout the entire period of record, these differences are likely due to inherent hydrologic and biogeochemical interactions within each plot and not because of CCS influence.

Both live and total sawgrass biomass were calculated using the equations presented in Table 5.1-7. These equations were derived from semi-annual plant harvests conducted in accordance with the Monitoring Plan (SFWMD 2009b) using the methodology established by Daoust and Childers (1998). Both live and total biomass follow the same general patterns across the landscape, with F4-1 and F1-2 having the highest values and F3-1 and F6-2 having the lowest values (Tables 5.1-8 and 5.1-9). Most plots experienced a decline in both live and total biomass during the wet season sampling events (August and November), followed by a noticeable increase during the dry season events (February and May). This is consistent with the Childers et al. (2006) findings that sawgrass becomes less productive with increased water depth and hydroperiod. This overall trend has remained consistent during the entire period of record.

The Model Lands Marsh adjacent to Turkey Point has similar hydrology and community composition as the C-111 Basin and Taylor Slough (Childers et al. 2006). Although the Model Lands Marsh is smaller in size than both the C-111 Basin and Taylor Slough, these landscapes are similarly characterized by sawgrass marshes, tree islands, and hydrology driven by rain, canal overflow, and surface water runoff (Childers et al. 2006). Historical live biomass data at study sites in the C-111 Basin and Taylor Slough (located west of the study area) generally range from 100 to 300 grams per square meter (g/m^2) annually (Childers et al. 2006). Average live biomass during the reporting period was within the range observed by Childers et al. (2006) for seven of the 14 sawgrass plots; the other half of the sawgrass plots had biomass <100 g/m^2, including plot F1-1 (die-off from Hurricane Irma) and one of the three plots along reference transect F6. This is consistent with the average live biomass observed for most of the plots for the entire period of record. The values observed in the reporting period are within or above the range of values historically observed.

Annual net primary productivity (ANPP) is collected for sawgrass in order to represent how much aboveground biomass is produced and lost during a given year. It is often used as an annual indicator of vegetative community health. Within the reporting period, ANPP values ranged from 77.0 to 347.0 g/m^2, excluding plot F1-1. Productivity at plots F1-2 and F4-1 were the highest this reporting period, while F6-2, a reference plot, was the lowest. Average transect ANPP rank order this reporting period was F4>F2>F6>F3, consistent with the historical period of record (Table 5.1-10). Slight variability is observed among years, attributable to localized hydrologic variations and meteorological conditions. Annual mean productivity from the C-111 Basin typically ranges from about 200 to 500 g/m^2, while mean productivity at Taylor Slough in Everglades National Park is typically less than 300 g/m^2 (Childers et al. 2006); the values from this reporting period are consistent with the values observed at Taylor Slough.

Sclerophylly is a measure of leaf hardness or toughness that reflects growing conditions and external stressors, such as climate, meteorological conditions, and nutrient availability. Low sclerophylly values (i.e., thinner, less dense/tough leaves) represent better growing conditions compared to high sclerophylly values. During the reporting period, sclerophylly values were lower in November 2018 than in May 2019 at all 10 of the marsh plots that had data for both events (Table 5.1-11). This indicates better growing conditions at the end of the wet season compared to the dry season. All reporting period values were within historical ranges.

Summaries of sawgrass leaf nutrients and stable isotopes are presented in Tables 5.1-12 through 5.1-18. Leaf carbon concentrations in November 2018 and May 2019 were within the historical period of record range for all 13 sawgrass plots. Leaf nitrogen concentrations followed a similar trend at 10 of the 13 plots, but were lower than historical values at F2-2 and F4-3 in November 2018 and at F6-1 in May 2019. Leaf phosphorous values were within the historical range at 12 of the 13 plots, but were below the historical range at F2-1 in May 2019.

Leaf isotopic and nutrient composition are indicators of plant and community health; values observed in the study area were consistent with values found in similar ecosystems throughout southern Florida. C3 photosynthetic plants (e.g., sawgrass) can have carbon isotope values between -34 parts per mille (‰) and -22‰ (Smith and Epstein 1971), where -22‰ is representative of plants from desert conditions and -34‰ is indicative of tropical rainforest vegetation (Kohn 2010). Chang et al. (2009) found that carbon isotopes from sawgrass in the Loxahatchee National Wildlife Refuge (LNWR) ranged from -30.1‰ to -24.5‰. Carbon isotopes from sawgrass collected during the reporting period ranged from -27.8‰ (F1-1 in November 2018) to -25.1‰ (F6-2 in November 2018), which is within range of the plant community in the LNWR and historical period of record data (Table 5.1-15). The nitrogen isotopes ($\delta^{15}N$) found in sawgrass from the LNWR ranged from -5.3‰ to 7.7‰, while sawgrass adjacent to Turkey Point had an average range of -5.0‰ (F4-1 in November 2018) to 0.21‰ (F1-2 in May 2019) during the reporting period (Table 5.1-16). The molar ratio of carbon to nitrogen (C:N) never fell below 47:1, which is representative of mature plants with high lignin content (Table 5.1-17). Terrestrial environments are considered nitrogen-limited when the nitrogen to phosphorus (N:P) ratio is below 14 (31 molar ratio) and phosphorous-limited when the N:P ratio is above 16 (36 molar ratio) (Verhoeven et al. 1996). Interestingly, the N:P ratio at plot F1-1 in November 2018 indicated that the sawgrass plants re-growing at the site post-hurricane were nitrogen-limited instead of phosphorous-limited; this may be a consequence of greater short-term phosphorus availability post-hurricane with increased detrital/organic matter decomposition. The plants shifted back to being phosphorous-limited in May 2019. Besides F1-1 in November 2018, the N:P ratios in this reporting period ranged from 49:1 to 124:1, indicating a P-limited system (Table 5.1-18). This pattern is consistent with previous data from the historical period.

The specific conductance and temperature of porewater collected from the 30-centimeter (cm) depth within the sediment are presented in Tables 5.1-19 and 5.1-20, respectively. Porewater analytical data for August 2018 through May 2019 are presented in Tables 5.1-21 through 5.1-24 and Figures 5.1-1 through 5.1-6. The historical period of record and reporting period averages for each analyte at each “F” site habitat type (marsh, tree island, marsh/mangrove mix) are presented in Table 5.1-25 for comparison.

Porewater specific conductance values at transects F3, F4, and F6 (reference transect) all noticeably increased following Hurricane Irma, although not as much as observed at F1-1. None of the vegetation in the F3, F4, or F6 plots experienced any notable die-off. While the specific conductance values along the F4 transect have since returned to pre-hurricane levels, porewater specific conductance along the F3 and F6 (reference) transects were still elevated during this reporting period. Sodium and chloride values mirrored specific conductance, with the highest marsh values observed along transects F3 and F6. The F6 plots are located along the reference transect, which is located outside of any potential influence from the CCS, indicating that the high specific conductance values are not the result of plant operations. Additionally, the high specific conductance values do not coincide with high porewater tritium concentrations. The combination of these two factors indicate that the high specific conductance values were likely caused by storm surge associated with Hurricane Irma and are not the result of groundwater migration of CCS water.

Transect F5 is located in an area south of Turkey Point that had been previously hydrologically isolated but was reconnected to the surrounding marsh to the west in 2015, as part of an FPL Everglades Mitigation Bank restoration effort, and reconnected to the mangroves to the south in 2017. This restoration of hydrologic connectivity in the area has resulted in plot F5-1, which had historically lower specific conductance values (2010-2015 range: 2,290 to 44,370 µS/cm), having consistently higher porewater values in the last 2 years (2017-2019 range: 25,554 to 59,133 µS/cm).

> Total ammonia was higher at the end of the wet season relative to the dry season for most of the plots. Naturally occurring ammonia at the reference plots was higher than in the monitoring plots around the CCS, possibly due to delayed impacts on vegetation from Hurricane Irma.

In the reporting period, marsh porewater nutrients (TN, total ammonia, and TP) showed no consistent trends with distance from the CCS (Figures 5.1-3, 5.1-4, and 5.1-5), demonstrating a wide range of natural variability across the landscape. Marsh TN and TP showed no consistent seasonal patterns in porewater nutrient concentrations during the reporting period. Marsh TN values ranged from 1.96 mg/L (F4-1 in November 2018) to 15.7 mg/L (F2-1 in May 2019), with an average of 5.26 mg/L during the reporting period. Marsh porewater TP ranged from 0.0090 mg/L (F6-1 and F6-2 in November 2018) to 0.252 (F2-1 in May 2019), with an average of 0.0602 mg/L in the marsh sites during the reporting period. Total ammonia concentrations were higher in November 2018 than in May 2019 at all marsh plots, with the exception of F4-2. Total ammonia values observed in the reporting period ranged from 0.23 mg/L to 2.54 mg/L in the monitoring plots around the CCS, with an average of 1.54 mg/L. Naturally occurring values in the F6 reference plots (0.68 to 2.97 mg/L) were higher than those observed around the CCS. Ammonia values (>0.5 mg/L) have been observed in Everglades National Park and are a natural occurrence in sawgrass marsh ecosystems (Ilami et al. 2003), likely due to organic matter decomposition.

Porewater tritium values around the CCS were highly variable across the landscape during the reporting period and appeared to be influenced by the atmospheric concentration of tritium (Figure 5.1-6). Reporting period tritium values in the marsh around the CCS were lowest in August 2018 relative to the other three quarters. However, despite the offset in marsh sampling periods (November, February, and May) relative to the CCS sampling periods (September, December, and March), the ”F” sites closest to the CCS (i.e., F2-1, F3-1, F4-1, and F5-1) seemed to broadly reflect an atmospheric influence of CCS tritium concentrations when values in the CCS were higher (see Section 3.2). Most of the values at “F” sites closest to the CCS were >100pCi/L when the tritium concentration within the CCS was between an average of 6,197 to 17,469 pCi/L. The observation of an atmospheric exchange with the CCS, however, seemed to dissipate rapidly with distance from the CCS, with much lower values observed in the plots farther from the CCS within each transect. Values in the reference transect, F6, did not exhibit any pattern and remained <15 pCi/L at all sites for all sampling events. Higher tritium values in the "F" sites nearest the CCS were not accompanied by high salinity values; the majority of sites (except F3-1 in August and F1-1 exhibiting residual Hurricane Irma impacts) had salinity values of <4 (in PSS-78 scale). Consequently, the data do not indicate any influence from the CCS via a groundwater pathway.

The structure and composition of the sawgrass marsh communities within the study area have remained stable throughout the entire monitoring effort. Plot F1-1 continues to show gradual recovery after Hurricane Irma. Many of the fluctuations observed are likely due to seasonal and meteorological conditions. Overall, the vegetation characteristics summarized above (i.e., live biomass, productivity, leaf nutrient concentration), porewater chemistry, and community composition are representative of the hydrologically modified marshes found throughout southern Florida, as described in Childers et al. 2006.

5.1.1.3 Mangrove Sampling

> The scrub mangrove forest study sites have remained fairly consistent structurally over the past 9 years, with the exception of the reference transect, which had some delayed mortality during this reporting period (not uncommon) from the impact of Hurricane Irma.

Reporting period annual vegetation sampling at the "M" sites occurred during the November 2018 sampling, while porewater was sampled in November 2018 and May 2019. Data collected in May and November throughout the historical period of record are presented as ranges in each table to aid in comparisons with the reporting period. As red mangrove is the primary woody species measured in the mangrove plots, to focus on landscape trends, discussion of the woody vegetation is limited to this species.

Percent cover values are reported as percentage categories per the QAPP (FPL 2013). Average red mangrove percent cover has remained consistent throughout the entire period of record, indicating that no rapid decline or growth has occurred at any of the mangrove plots at most of the "M" plots, with the exception of M6-2 (Table 5.1-26). Significant die-off was observed at the fringe reference plot M6-2 during the November 2018 sampling event, where four of the 12 tagged trees within the plot were either dead or lost. The M6 reference transect is located outside of the influence of Turkey Point in an area with no protective fringe mangrove forest, and plot M6-2 is in proximity to Barnes Sound (within approximately 500 m). It is likely that wind and storm surge from Hurricane Irma significantly impacted the mangroves in plot M6-2. The effects of the hurricane on plot M6-2 were more notable in November 2018 than they were immediately after the storm in November 2017. This is not uncommon; mangrove research in the Everglades (Smith et al. 1994; Barr et al. 2012) has shown that mangrove tree damage and mortality can continue to occur 2 to 3 years after a storm.

Data on height is collected to help determine how the trees are growing and if there is any die-back. Lugo and Snedaker (1974) classified a scrub mangrove forest as having trees that are less than 1.5 m (150 cm) tall. Trees measured within the study area are consistent with this classification (Table 5.1-27). With the exception of reference transect M6, average height values from November 2018 are slightly higher than, or are within the upper range values of, the historical period of record, suggesting that the dwarf mangrove populations within the study area are slow-growing and that no considerable die-off has occurred. Slow growth is expected in dwarf mangrove ecosystems because of the concurrent stressors (phosphorous nutrient limitations and naturally higher salinities due to less tidal flushing) that create difficult growing conditions in these areas (McKee et al. 2002).

Red mangrove biomass was calculated using the allometric equation presented in Coronado-Molina et al. (2004). The average biomass values for this reporting period at all sites were lower than other studies from either Florida (Coronado-Molina et al. 2004) and Biscayne Bays (Lugo and Snedaker 1974, Ross et al. 2001). Biomass was highest at M3 and lowest at reference transect M6 (Table 5.1-28). Inter-annual variations have been observed, but for most "M" sites there are no consistent increasing or decreasing trends over time (Table 5.1-28). This suggests that, while red mangrove biomass can fluctuate between events, there has been no considerable change in the red mangrove community during the entire monitoring period. However, several plots in November 2018 had biomass values lower than the historical period of record. Biomass at plots M3-1 and M5-2 were only slightly below their historical ranges. Biomass at plot M1-2, however, has been steadily decreasing for the past 4 years although there has been no noticeable die-off at this site (as indicated by the percent cover and height values). A decrease in height and biomass was observed at the two reference transect plots M6-1 and M6-2 during the November 2018 event, likely as a delayed response to Hurricane Irma.

Biomass varies spatially from plot to plot, but these variations are not directly indicative of plot health. For instance, the highest biomass values in the reporting period were found at plots M1-1 and M2-2, not because of the height or robustness of the trees (Table 5.1-27), but because of the density at which the trees are growing (~1,000 individuals per 25 square meters [m^2]) (Table 5.1-3). Conversely, plot M6-1, which has relatively tall trees compared to most plots, had the third lowest biomass of the "M" plots during the reporting period because of low tree density (29 individuals per 25 m^2) (Table 5.1-3). These differences do not indicate that one plot is healthier than another but, instead, highlight the natural variability present in the scrub mangrove ecosystems being monitored.

Sclerophylly is a measure of leaf hardness or toughness that reflects growing conditions and external stressors, such as climate, meteorological conditions, and nutrient availability. Low sclerophylly values represent better growing conditions compared to high sclerophylly values. Data from Belize show that typical scrub red mangroves have sclerophylly somewhere between 200 to 300 g/m^2 (Feller 1995). All of the plots had average sclerophylly values within this typical range in November 2018, although M2-1 and M4-1 (Table 5.1-29) had values that were slightly higher than their historical period of record. Average sclerophylly at the monitoring sites were lower than the reference M6 plots, which may be a reflection of the hurricane response in the M6 plots.

Mangrove leaf nutrients, stable isotopes, and molar ratios for the November 2018 event are presented in Tables 5.1-30 through 5.1-36. Carbon isotope data were within the normal range of C3 plants (-34‰ to -22‰, from Smith and Epstein 1971), ranging from -27.3‰ at F2-2 to -24.2‰ at M3-2. The overall carbon isotope average in November 2018 was -25.5‰, which is similar to data from scrub red mangroves in Belize (-25.3‰, from Smallwood et al. 2003; and -26.4‰, from McKee et al. 2002). Red mangrove $\delta^{15}N$ ranged from -11.3‰ to 1.00‰ and averaged -4.7‰ (Table 5.1-34). McKee et al. (2002) found average $\delta^{15}N$ values of -5.38‰ in similar scrub mangrove habitats. Low $\delta^{15}N$ values are a consequence of the slow growth patterns and the resulting low nitrogen demand associated with scrub mangrove forests (McKee et al. 2002). The November 2018 leaf nutrient and isotope values are consistent with the historical data and are within the ranges established in the literature for similar dwarf mangrove plant communities (Smallwood et al. 2003; McKee et al. 2002). The N:P molar ratios observed at plots M2-1, M3-1, M6-1, and M6-2 were all below 36:1, indicating a nitrogen limitation for the first time in the entire period of record at these plots. This shift to N-limitation may be a consequence of greater short-term phosphorus availability post-hurricane with increased detrital/organic matter decomposition within the mangroves, especially in the M6 plots where whole-tree mortality has been observed. The N:P molar ratios of the leaves at the remaining "M" sites ranged from 36:1 to 67:1, indicating that these mangrove sites are still P-limited (Table 5.1-36). Leaf chemistry of these sites will continue to be monitored closely to determine if this switch to N-limitation is a continued phenomenon or just a short-term observation.

Porewater monitoring during the reporting period occurred in November 2018 and May 2019. For comparison purposes, the historical ranges presented in Tables 5.1-19 and 5.1-20 include data from past November and May events only so that the values represent similar seasons to the reporting period. Values from both sampling events were within the historical ranges of each site. The highest specific conductance value observed in either sampling period was measured at M5-1 in May 2019 (63,006 µS/cm) but was still within the range of the values historically encountered at this site. Several tidal creeks on the north side of the Card Sound canal were re-opened as part of an FPL mitigation effort in 2017. The creeks have provided tidal flushing to plots M4-1 and M4-2, which is helping to minimize the seasonal fluctuations in porewater specific conductance and temperature at these sites throughout the reporting period. This may be beneficial to plant growth patterns in the long-term.

Table 5.1-37 shows the range of porewater field parameters and ionic and nutrient concentrations at the "M" plots for both the historical period of record and the reporting period. The historical period of record includes data from past November and May events only, so the values represent similar seasons to the reporting period. Reporting period sodium and chloride values were within historical ranges at all "M" sites and were consistently higher in May 2019 than November 2018 (Figures 5.1-1 and 5.1-2). The highest sodium and chloride values observed during the reporting period occurred at M5-1 (13,100 mg/L and 24,100 mg/L, respectively) in May 2019, coincident with the highest specific conductance value (63,006 µS/cm). The values observed at M5-1 were within the historical range for this site.

Porewater total ammonia was generally higher in November 2018 than May 2019 and all the porewater values are consistently higher than in the overlying Biscayne Bay/Card Sound waters. Ammonia values at reference plots M6-1 and M6-2 were generally higher than all other "M" plots, with ammonia at M6-2 doubling after Hurricane Irma (from 1.48 mg/L in May 2017 to 3.07 mg/L in November 2017) and remaining high after that, potentially indicating tree damage and the resultant delayed mortality in one-third of the measured trees. Porewater TP and TN values varied both spatially and seasonally, demonstrating a wide range of natural variability across the landscape (Figures 5.1-3 and 5.1-5). When averaged across all “M” sites, nutrient values observed during the reporting period were generally higher than historical averages (Table 5.1-37).

Tritium values varied both spatially and temporally at all “M” sites, with sites closer to the CCS (i.e., M1-1, M2-1, M4-1, M5-1) generally having values higher than the sites farther away (Figure 5.1-6). The tritium values at all “M” sites during the reporting period were less than 90 pCi/L, which is consistent with atmospheric influence from the CCS. Wet season (November 2018) values were lower than the dry season (May 2019) values, but all the tritium concentrations were within the range of their historical ranges.

The structure and composition of the scrub mangrove communities within the study area have remained stable throughout the entire monitoring effort. The system is driven by multiple factors, including nutrient deficiency, high salinities, tropical storms, and saturated soil. The vegetation characteristics of the study area are consistent with scrub mangrove forests that Lugo and Snedaker (1972) documented along the coastal fringe of south Florida and the Florida Keys. There are no indications of impacts from the CCS on coastal mangroves.

5.2 Biscayne Bay/Card Sound

On-going ecological monitoring has been conducted on a semi-annual basis since September 2010, with the entire period of record extending through May 2019. This annual reporting period encompasses September 2018 (fall) and May 2019 (spring) events. Results of this reporting period are compared with corresponding results from the historical period of record (September 2010 through May 2018).

The purpose of monitoring is to document benthic biota (SAV, benthic and epibenthic fauna), salinity, and tritium to determine the extent of CCS connectivity to the conditions of Biscayne Bay/Card Sound (SFWMD 2009b). Table 5.0-1 outlines the types of data collected and their significance to the monitoring program. Background of the sites monitored, sampling frequency, and parameters measured are detailed in Appendix B. The sampling point locations are provided in Table 5.2-1, and the Braun-Blanquet categories can be found in Table 5.2-2.

5.2.1 Results and Discussion

5.2.1.1 Water Depth and Sediment Conditions

> Physical conditions (water quality and clarity) in the study site are consistent with previously observed conditions in past years.

Sampling was conducted over all tidal cycles, and the data presented herein are actual depths at the time of sampling, unadjusted for tides. BB1 had the shallowest mean depth, while BB3 was the deepest (Table 5.2-3). Water depths in all areas were within the range of historical mean minimums and maximums. The basins encompassing each study area are geologically and hydrologically stable, and significant changes to depth beyond the normal tidal range are not expected, short of the changes caused by Hurricane Irma.

Sediment types sampled during the reporting period were consistent with observations reported during the historical period of record and confirm prior observed variability within and among the four study areas (Table 5.2-4). During the fall 2018 and spring 2019 sampling periods, most of the sampling points within BB1, BB2, and BB3 had a substrate comprised of sand and shell hash. Similar to previous years, BB4 had a higher percentage of sampling points with a rubble component compared with the other three areas during both sampling periods. Only BB1 and BB4 had sampling points with a silty component. These findings are consistent with observations reported during the historical period of record and demonstrate that sediment conditions in BB4 (the reference area, which is located south of the study area within Barnes Sound) continue to be somewhat different from the other three areas.

5.2.1.2 Surface Water Quality

Light attenuation, temperature, turbidity, DO, salinity, and other water quality variables in Biscayne Bay are highly dynamic and reflect prevailing conditions at the time of sampling, including time of day (air temperature and sunlight), tidal stage, currents, cloud cover, wind, waves, rainfall, and recent extent of freshwater runoff. All of these factors, both independently and collectively, create considerable natural spatial and temporal variability within the system.

Light attenuation varied over space and time during field sampling events, which is to be expected, given the variability in those factors (e.g., winds, waves, currents, rainfall, etc.) that collectively contribute to water clarity (Table 5.2-5). Water clarity was relatively high during this reporting period, as reflected by the very low (largely undetectable) surface and bottom turbidity values throughout the entire study area (Tables 5.2-6 and 5.2-7). Overall, the values of light attenuation indicated that the water was quite clear and that light is not a limiting factor in seagrass distribution in either the study area or the reference area.

Surface water temperature data, collected over a period of 4 to 5 days, primarily reflect the temporal variability in water temperatures based on prevailing weather conditions (sunny vs. cloudy, clear vs. rainy, etc.). Values recorded during the fall 2018 and spring 2019 sampling events are within the range of values recorded over the historical period of record, with the exception of BB1 (higher mean surface and bottom temperatures than the historical period of record for both transects) and BB2 (transect *a* in fall 2018 and transect *b* for the surface water measurement only in spring 2019). Few differences were observed between the mean surface and bottom water temperatures along any transect during the reporting period; the greatest difference was a 3.2°C warmer surface water than bottom temperature in area BB2 transect *b* in the spring 2019 event. The shallow (1 to 3 m; Table 5.2-3) basins (especially BB-1 which is the shallowest area) containing the four study areas are well-mixed by wind action, in general; water temperatures are, therefore, reflective of prevailing air temperatures.

Overall, the long-term automated data (see Section 3) indicate that reporting period average (27.1°C) was 0.9°C warmer than the previous reporting period (26.2°C) and 0.6°C warmer than the historical period of record. These higher Bay temperatures are a reflection of the higher overall air temperatures observed regionally. Additionally, as these sites are fairly shallow, especially BB-1, the surface water temperatures observed may even be higher than the automated Biscayne Bay/Card Sound surface water stations, at times. Due to the shallow conditions within the Bay and the drier reporting period, these observations may contribute to higher evaporative rates and result in continued hypersaline conditions that may become less conducive to the growth of seagrass over time. These changes are driven by broader-scale events and are not a result of CCS operations.

Specific conductance, salinity, DO, and pH over the historical period of record have generally been lower in the wet season compared to the dry season (Tables 5.2-6 and 5.2-7). Additionally, specific conductance, DO, pH, and temperature between the top and bottom of the water columns further indicate that the Biscayne Bay/Card Sound transect sites are fairly well mixed vertically. Mean bottom specific conductance and salinity data for all transects and study areas were similar to surface water values during both the reporting period and over the historical period of record, which is suggestive of a well-mixed water column. Consequently, trends reported above for surface waters were also evident near the bottom. Mean bottom values in all four study areas were higher during the spring 2019 sampling event than during the fall 2018 event (Table 5.2-7); this is consistent with observations in the Bay surface waters (see Section 3). Both the mean surface and bottom water specific conductance for control area BB4 for the spring 2019 event were above the historical period of record's maximum mean for the area.

Spring hypersaline conditions were not unexpected, as the study area has become hypersaline at the end of the dry season in previous years (see Section 3). Hypersaline conditions have been previously reported not only in Biscayne Bay but also in nearby Florida Bay (FIU-WQMN; http://serc.fiu.edu/wqmnetwork/SFWMD-CD/index.htm). For this reporting period, hypersaline (salinity >35.0 PSS-78; Lohmann et al. 2012) conditions were observed in all four study areas during spring 2019 sampling, with the highest mean value (42.2 PSS-78) recorded in reference area BB4 at both the surface and bottom. Although mean salinity values for BB2, BB3, and BB4 were hypersaline during the spring 2019 sampling event, most of the surface mean values fell below area maximums from the historical period of record. It should be noted that higher salinity values recorded during both the reporting period and over the historical period of record are lower than the maximum values reported for regions of Florida Bay and are within the healthy upper range for turtle grass (*Thalassia testudinum*) (Zieman et al. 1999). The primary driver of salinity in Biscayne Bay is freshwater flow from canals on the western shore (Caccia and Boyer 2005). The drier reporting period (see Section 2) and especially the dry wet season are likely the primary contributors to the hypersaline conditions observed during spring 2019 within Biscayne Bay (e.g., at BBCW-10 north of Turkey Point). Two MDC RER monitoring sites located in Barnes Sound (BB50 and BB51) have had salinity values greater than 42 PSS-78 dating back to 1990, even though this area is well outside the influence of Turkey Point Units 3 and 4. Barnes Sound is an enclosed system that experiences limited water circulation compared to Biscayne Bay (Lohmann et al. 2012). Consequently, pulses of freshwater that enter Barnes Sound during the wet season (summer) have a long residency time and result in extended periods of low salinity. Conversely, when drought conditions limit input of freshwater into Barnes Sound, salinities can rise to hypersaline (>35 in PSS-78) conditions (Lohmann et al. 2012).

Due to the shallow conditions within Biscayne Bay and the drier reporting period, these observations may contribute to higher evaporative rates and result in continued hypersaline conditions that may become less conducive to the growth of seagrass over time. These changes are driven by broader-scale events and are not necessarily a result of CCS operations.

5.2.1.3 Porewater Quality

> Porewater conditions are generally comparable to the historical period of record values, reflective of the overlying surface water conditions, and are not influenced by the CCS via a groundwater pathway.

Porewater temperatures were relatively consistent between transects and among areas for fall 2018 and spring 2019, with a maximum difference of mean values between areas of 0.3°C and 0.5°C, respectively. Mean values within each study area ranged from 30.6°C in BB3 and BB4 to 30.9°C in BB1 and BB4 during the fall 2018 sampling event, and from 28.3°C in BB4 to 28.8°C in BB2 during the spring 2019 sampling event. During the reporting period, average porewater temperatures for each transect were within the range observed for the historical period of record (Table 5.2-8).

Porewater in Biscayne Bay transects do not appear to have any linkage to CCS temperatures, as porewater temperatures were cooler than the overlying Bay surface water by 0.1 to 0.8°C; the only exception was in reference area BB4 where the porewater was slightly (0.2°C) warmer (Table 5.2-8). The shallow automated wells in Biscayne Bay were also cooler than the overlying surface water and porewater. Both the bedrock and sediments have an insulating effect and, thus, changes in porewater temperatures sometimes lag behind changes in overlying water column temperatures. For example, as water column temperatures increase, porewater temperatures tend to remain slightly cooler; the opposite effect is observed when water column temperatures decrease.

Porewater specific conductance and associated salinity values were substantially higher during the spring 2019 sampling event than during the preceding fall event and are reflective of sampling at the end of the dry and wet seasons, respectively (Table 5.2-8). The greatest seasonal differences occurred in BB4, where the mean specific conductance value during the spring was 11,950 µS/cm higher than the corresponding fall value. When sampling areas are compared, BB4 had the lowest mean porewater specific conductance during the fall 2018 sampling event (45,394 µS/cm), while BB1 had the lowest value during the spring 2019 sampling event (56,831 µS/cm). BB3 had the highest mean specific conductance values in fall 2018 event (50,206 µS/cm) and spring 2019 event (58,156 µS/cm). Over the historical period of record, there has been considerable variability in the data, with values ranging from 40,700 µS/cm at BB4 to 59,775 µS/cm at BB1. All mean transect values for porewater specific conductance during the reporting period were within their respective historical ranges, except for BB3 during the spring 2019 sampling event, which was within the range of historical maximum.

Porewater specific conductance is largely a reflection of the conductance in the overlying water column. However, unlike temperature, specific conductance for porewater and the water column differed considerably among study areas and between seasons (Table 5.2-8). For example, during the fall 2018 sampling event, mean porewater conductance was 1,983 to 7,194 µS/cm higher than bottom water column values in all areas, while mean porewater values during the spring 2019 event ranged from 1,890 to 5,107 µS/cm lower than bottom water column values. These differences are likely from lag-time sediment-surface water seepage and exchange.

During the reporting period, mean sodium concentrations in porewater within each study area ranged from 9,145 (BB4) to 10,600 mg/L (BB2) during the fall and from 12,200 (BB1) to 12,400 mg/L (BB3 and BB4) during the spring (Table 5.2-9; Figure 5.2-1). Sodium concentrations were lower in the fall than in the spring. All transect values and area means were within the range of comparable values documented over the historical period of record for the fall event. During the spring, area means were slightly above the historical period of record in BB1, BB2, and BB3. In the spring, transect values ranged from 200 mg/L (BB1-*b*) to 500 mg/L (BB3-*a*) higher than the historical period of record.

Mean chloride concentrations in porewater ranged from 17,400 mg/L (BB4) to 19,050 mg/L (BB2) during the fall 2018 sampling event, and from 23,100 mg/L (BB2) to 24,100 mg/L (BB1) during the spring 2019 sampling event (Table 5.2-9; Figure 5.2-2). Mean chloride concentrations were lower in the fall than in the spring. The greatest variance in seasonal means was found in BB1 and BB4; both sites had average chloride concentrations of 6,200 mg/L greater in the spring than in the fall. The area mean for BB1 during the spring 2019 sampling event was 300 mg/L higher than the historical period of record, while the other area means were within the range of comparable values over the historical period of record. Transect values were higher than the historical period of record at BB1-*a* and BB4-*a* during the spring, while fall values were all within the historical range.

Porewater nutrient concentrations for TN, total ammonia, and TP are provided in Figures 5.2-3 through 5.2-5. Mean total Kjeldahl nitrogen (TKN) concentrations in porewater ranged from 0.732 mg/L (BB2) to 1.72 mg/L (BB4) during the fall 2018 sampling event and from 0.931 mg/L (BB2) to 1.09 mg/L (BB4) during the spring 2019 event (Table 5.2-9). The greatest variance in seasonal means was found in BB4, which had a TKN concentration 0.635 mg/L greater in the fall than in the spring. All area means were within the range of comparable values over the historical period of record.

Unionized ammonia concentrations in porewater were low during both the fall 2018 and spring 2019 sampling events, with a maximum mean area value of 0.006 mg/L found in BB1 during fall 2018 (Table 5.2-9). All ammonia values during the reporting period were within the range of comparable values reported over the historical period of record; average porewater values over the 9 years have been higher than the average surface water ammonia values for the monitoring sites over the historical period.

TP, orthophosphate (OP), and nitrate/nitrite porewater concentrations during the reporting period were mostly non-detect, with the exception of an OP value at BB2-*a* (0.0115 mg/L) and a TP reported value of 0.0298 mg/L in the reference site at BB4-*a* in fall 2018. These low phosphorus values indicate that the monitoring transects are phosphorus-limited, consistent with other studies from South Florida (Brand 1988). The porewater does not appear to be a source of phosphorus into the Bay.

Mean tritium values for the reporting period were 7.5 pCi/L in fall 2018 and 8.5 pCi/L in spring 2019 in the monitoring transects BB-1 to BB-3, while the reference transect means were 4.6 pCi/L and 7.5 pCi/L for the same periods. These slight differences are not significant, as these comparative values are within the 1-sigma (σ) of approximately 6.5 for these values. Plot values ranged from effectively zero (-6.4 pCi/L reported) at BB2-*b* to 28.2 pCi/L at BB1-*a* (Table 5.2-9; Figure 5.2-6). All values were <15 pCi/L, with the exception of BB1-*a* in May 2019. This 28.2 pCi/L value from BB1-*a* is not unexpected, as this is the shallowest transect and this value is within the 1-sigma error of dry season values from previous years (e.g., September 2013 [25.1 pCi/L], May 2017 [24.3 pCi/L]).

5.2.1.4 Submerged Aquatic Vegetation

The seagrass community continues to be healthy and dominated by turtle grass, reflective of stable growing conditions. Percent coverage of macrophytes has been consistent over the 9-year monitoring effort, and the turtle grass TN/TP ratios continue to indicate a phosphorus-limited system with ratios similar to, and often more limiting than, the reference area in Barnes Sound.

Study Area Characterization

All four study areas have different physical and hydrologic attributes that contribute to the vegetation patterns observed. For example, study area BB1 can generally be described as a sheltered embayment compared to the other study areas because portions are located west of the Arsenicker Islands and south of the Turkey Point peninsula (Figure 1.5-1). BB1 is also the shallowest of the study areas, with a mean depth of 1.6 m (Table 5.2-3). This site also had the most consistent layer of sediment. Turtle grass was present in >90% of the quadrats. Shoal grass (*Halodule wrightii*) was also present in BB1, but was less widespread than turtle grass. This species was present in about one-third of the quadrats. The percentage of quadrats containing either turtle grass or shoal grass during both seasonal sampling events was within the range of comparable values previously reported for BB1.

Study area BB2 contained turtle grass in approximately one-third of the quadrats (Table 5.2-10). Shoal grass was present in approximately 20% of the quadrats in BB2. The percentage of quadrats in BB2 containing the two species during both seasonal sampling events was within the range of comparable values previously reported. Study area BB3 is the deepest of the four study areas, with a mean water depth of 2.8 m (Table 5.2-3). During this reporting period, turtle grass was present in approximately 70% of the quadrats (Table 5.2-10) while shoal grass occurred in 9% of the fall 2018 and spring 2019 quadrats, although it was completely absent in BB3-*b* during this reporting period. Shoal grass is sparsely and patchily distributed in the study areas where it occurs; it may still be in the study area, but was not captured in the randomized quadrat placement.

Turtle grass was present in >70% in the BB4 reference transects during this reporting period (Table 5.2-10). Shoal grass was scarce and present in <10% of the quadrats, and completely absent from BB4-*b* in spring 2019. The percentage of quadrats containing turtle grass or shoal grass this reporting period were within historical range, with the exception of turtle grass in spring 2019, which was lower (81%) than the historical period of record minimum (84%).

There have been no changes in the dominant seagrass species in the transects over the years, although the cover may vary from year to year. Seagrass coverage within the study area primarily consists of turtle grass, which is the dominant species in oligotrophic tropical and sub-tropical coastal waters. This is because turtle grass is able to tightly recycle phosphate in carbonate sediments with low phosphate availability (Fourqurean et al. 1992) and promote phosphorus releases from sediments (Long et al. 2008). Robblee and Browder (2007) generally found turtle grass to be the most abundant seagrass present at their monitoring locations in both Biscayne Bay and Florida Bay (frequency of occurrence ranged from 80 to 98%). High cover and a low-standing crop of seagrass is typical in Biscayne Bay and has been attributed to the shallow depth of sediments. As the turtle grass rhizosphere typically extends 25 to 40 cm into the substrate (Enriquez et al. 2001; Robblee and Browder 2007), this grass cannot effectively colonize and grow in areas where only a thin veneer of substrate exists over the hardbottom. Overall, higher levels of salinity favor growth of turtle grass and shoal grass (Lirman et al. 2014).

During the reporting period, mean sediment depths at SAV sampling points ranged from 5.1 cm (BB4-*b* in spring 2019) to 26.8 cm (BB1-*a* in fall 2018), with BB1 having the greatest mean depth of any study area during both seasonal events (Table 5.2-11). Thus, it is not surprising that BB1 typically has the greatest coverage of turtle grass of any study area. However, sediment depths are not uniform. Mean sediments only exceeded 20.0 cm in depth on the nearshore transect in BB1 in spring 2019. The maximum mean sediment depth on the offshore transect in BB1 was only 9.4 cm (BB1-*b* in spring 2019). Variability in sediment depths between seasonal sampling events reflects the random nature of quadrat placement. This variability is the reason depth to hardbottom was recorded at five points within each quadrat. The five-point measurement with each depth recorded was first conducted in the spring 2017 event. Previously (spring 2013 through fall 2016), a diver would probe the four corners and record an approximate average on the datasheet. Actual depths for each probe were not recorded. The historical period of record minimum and maximum depths to hardbottom reflect the data collected from spring 2013 through spring 2018. All mean depths to hardbottom in all areas for the current reporting period are within the range of minimum and maximum depths recorded for the historical period of record.

Calcareous algae, such as *Penicillus*, *Halimeda*, and *Acetabularia*, were ubiquitous throughout the study area during this reporting period (Table 5.2-12); this has remained consistent for the historical period of record. During the spring 2019 event, 100% of all sampling points scored the presence of calcareous algae as “many,” while the percentage of sampling points with “many” calcareous algae during the fall 2018 event ranged from 94% (BB1) to 100% (BB2, BB3, and BB4). The Braun-Blanquet scores for macroalgae over the historical period of record ranged from 1.0 to 3.3, and the range for fall 2018 and spring 2019 (1.5 to 2.3 for both sampling periods) fell squarely in the middle of this range.

Drift algae was present at all sampling points during both the fall 2018 and spring 2019 sampling events, although most of the sampling points were scored as having only sparse or sparse to moderate coverage (Table 5.2-12). Coverage was generally greater during the fall event than during the spring event.

Batophora, a tropical green macroalgae loosely affixed to the substrate, was widespread in all study areas throughout this reporting period, with coverage ranging from sparse to moderate/dense. However, it was generally more abundant during the fall 2018 event than during the spring 2019 event (Table 5.2-12). The presence and seasonal prevalence of this species is comparable to previous years. *Batophora* coverage varies across the historical period of record, although it is ubiquitous in the monitoring areas; it is a common species in Biscayne Bay and its presence is seasonal, being more prevalent during the warmer summer months relative to the fall and spring (Collado-Vides et al. 2011).

Sponges and stony corals were found in all the study areas during this reporting period, although they were encountered less frequently in BB1 than at the other transects (Table 5.2-12). Gorgonians (i.e., soft corals) were relatively abundant in BB2 and BB3 during this reporting period, but were completely absent from BB1 and BB4. In a reversal of the relationship between seagrasses and sediments, the relative abundance of both stony and soft corals within the study area is positively related to the amount of exposed hardbottom present. Those areas with relatively large amounts of unconsolidated sediments, such as BB1, have fewer corals than areas where exposed hardbottom is more expansive.

Macrophyte Coverage

Braun-Blanquet Cover Abundance (BBCA) scores for SAV (i.e., total macrophytes, total seagrass, and total algae) are semi-quantitative, as each score represents a range of values (1 = <5% coverage, 2 = 5% to 25% coverage, 3 = 25% to 50%, 4 = 50% to 75%, and 5 = >75%), and the numerical ranges vary among scores (5%, 20%, and 25%, respectively). This can skew results when scores are averaged. Nevertheless, the means do provide a reasonable gauge for assessing relative coverage.

During this reporting period, mean total macrophyte (seagrass and attached macroalgae after drift red algae has been removed) BBCA scores ranged from an average of 1.5 (BB2 in spring 2019) to 2.4 (BB1 in fall 2018, and BB3 in spring 2019; Table 5.2-13). Some of the variation in total macrophyte BBCA values can be attributed to the very patchy nature of many of the SAV species within the study area and the randomness of quadrat placement around sampling points.

Mean total seagrass BBCA scores during this reporting period ranged from 0.4 (BB2 in fall and spring) to 1.1 (BB1 in fall and spring; Table 5.2-13). The fall sampling event occurs at the end of the seagrass growing season. Soon thereafter, the grasses enter a period of senescence when leaves are shed and aboveground coverage declines. Thus, seagrass coverage at a particular location would be expected to be greater in the fall than in the spring, which is at the end of this quiescent period. However, it should be noted that BBCA scores encompass a broad range of SAV coverage, and an increase in coverage might not always be reflected by a higher score. For example, a doubling of coverage from 10% to 20% would not change the BBCA score, which is 2 (5% to 25%). Overall, all mean seagrass BBCA scores within each study area were within the range of values reported over the historical period of record.

A better assessment of SAV conditions is a comparison of the attached seagrass and macroalgae community. Mean total attached macroalgae (i.e., all species exclusive of drift algae) BBCA scores during this reporting period ranged from 1.5 (BB2 in spring 2019) to 2.3 (BB1 in fall 2018 and BB3 in spring 2019), all of which were within the range for the historical period of record (Table 5.2-13). Average total attached macroalgae for the historical period of record ranged from 1.0 in BB1 to 3.0 in BB2. In short, the BBCA scores for the 2018 and 2019 sampling events were no higher or lower than the historic range for macrophyte coverage. The SAV patterns and composition of the seagrass at the monitoring sites have remained consistent over the period of record and do not appear to be transitioning to a different community type.

5.2.1.5 Seagrass Leaf Nutrients

Mean TP values ranged from 566.5 milligrams per kilogram (mg/kg) in BB3 to 717.5 mg/kg in BB1 for the reporting period. Area means were within historical ranges for all areas (Table 5.2-14). For the 2010-2018 reporting period, TP in seagrass leaves appears to be trending higher (Mann-Kendall Test, phosphorus and N:P ratios). However, the trend was apparent at all sites (including reference sites), which suggests that phosphorous enrichment may be a regional phenomenon. Regionally, the monitoring sites in Biscayne Bay and Card Sound have turtle grass leaves that are more phosphorous-limited than the average of Florida Bay *T. testudinum* leaves (Fourqurean and Zieman 1992). In a long-term study of seagrass nutrients, Fourqurean and Zieman (2002) found that leaf phosphorus accounted for between 0.048% to 0.243% (mean = 0.113%) of the dry weight of turtle grass leaves collected over a broad geographic area of the Florida Keys. In Florida Bay, the dry weight of turtle grass leaf TP ranged from a high of 0.161% close to a bird rookery with substantial phosphate inputs, to a low of 0.078% at 120 m from the rookery that the authors considered to be oligotrophic (Fourqurean et al. 1992). Mean TP values obtained for each study area during the fall 2018 sampling event ranged from 0.059% in BB3 to 0.066% in BB1 (Table 5.2-14). Thus, leaf nutrient values for TP obtained during this reporting period are within the range of values reported for turtle grass in similar areas of South Florida.

Seagrass leaf nutrient ratios for Fall 2018 are within or below values reported for the historical period of record. The molar N:P ratios for turtle grass indicate phosphorus limitation in their growth. The N:P ratios for the monitoring sites (e.g., BB1, BB2, and BB3) were slightly lower than the reference BB4 transect, and indicate that these sites are less phosphorus-limited than the control site. Furthermore, molar N:P ratios reported from 2010 to 2018 ranged from 57.58 to 206.78, which testify to the phosphorus-limited sediments found in the study areas. In 2010, Dewsbury (2013) sampled turtle grass at three sites in southern Biscayne Bay, including a site near Turkey Point, and reported average N:P ratios of 31.4 to 71.2. The N:P ratios found near

Turkey Point ranged higher than the Dewsbury (2013) data set, and indicate lower TP levels in *T. testudinum* blades. The N:P ratios at all sampling sites are within the range of values reported for the shoreline sampling sites (<50 m from shore) for western Biscayne Bay in 2008, but lower (i.e., less phosphorus-limited) than nearshore or offshore sampling sites sampled in 2011 (Lirman et al. 2014).

Nutrients within the water column can be highly variable, both spatially and temporally, making it difficult to accurately characterize prevailing conditions. However, over time, nutrients present in the water column become sequestered in sediment porewater where they are used by seagrasses for growth. Therefore, nutrient concentrations in leaf tissue provide a reliable indicator of limiting nutrients within the ecosystem. Seagrass leaf nutrients were measured during fall sampling events as an integration of the growing season. The data over the past 9 years have remained consistent, and the porewater patterns at the monitoring sites, coupled with the leaf data, indicate that the system continues to be a phosphorus-limited system that is stable and dominated by turtle grass.

TABLES

Table 5.0-1. Summary of all Ecological Data Collected and Significance to the Project.

Type of Ecological Data Collected	Marsh	Mangrove	Biscayne Bay	Significance
Community Description	X	X	X	Indicates if the vegetative community in a given area has changed over time. Shifts in the vegetative community could be an indication of outside influence such as mitigation efforts, major storm events, or regional meteorological conditions. It could also be an indication of potential CCS influence via a groundwater pathway if a sudden change in the vegetative community coincides with higher-than normal porewater specific conductance, chloride, sodium, and tritium values.
Shannon-Weiner Index	X	X		An indicator of species diversity. Shifts in the Shannon-Weiner Index value of a plot over time can indicate a change in the vegetative community (fewer species or more species), the cause of which can be a naturally occurring influence such as droughts/floods or storm events. It could also be caused by potential CCS influence via a groundwater pathway if a sudden change in the vegetative community coincides with higher-than normal porewater specific conductance, chloride, sodium, and tritium values.
Species Evenness	X	X		Measures how evenly distributed (numerically) each species is at a site. Sudden changes in species evenness can indicate shifts in the vegetative community caused by outside influences.
Vegetation Height	X	X		Changes in vegetation height over time indicates growth and/or die-off. Changes in height are most commonly caused by seasonal effects, meteorological conditions, or storm events, but could potentially be caused by CCS influence via a groundwater pathway if a sudden change in height coincides with higher-than-normal porewater specific conductance, chloride, sodium, and tritium values.

Table 5.0-1. Summary of all Ecological Data Collected and Significance to the Project.

Type of Ecological Data Collected	Marsh	Mangrove	Biscayne Bay	Significance
Vegetation Percent Cover	X	X	X	Changes in vegetation percent cover over time indicates growth and/or die-off. Changes in percent cover are most commonly caused by seasonal effects, meteorological conditions, or storm events, but could potentially be caused by CCS influence via a groundwater pathway if a dramatic change in percent cover coincides with higher-than-normal porewater specific conductance, chloride, sodium, and tritium values.
Vegetation Biomass	X	X		Biomass values can be compared to published values in similar habitats as an indicator of vegetative community health. Biomass values can also be monitored for changes over time, which can indicate the effects of outside influences. Changes in biomass are most commonly caused by seasonal effects, meteorological conditions, or storm events, but could potentially be caused by CCS influence via a groundwater pathway if a sudden change in biomass coincides with higher-than-normal porewater specific conductance, chloride, sodium, and tritium values.
Vegetation Productivity	X	X		Productivity values can be compared to published values in similar habitats as an indicator of vegetative community health. Productivity values can also be monitored for changes over time, which can indicate outside influences. Changes in productivity are most commonly caused by seasonal effects, meteorological conditions, or storm events, but could potentially be caused by CCS influence via a groundwater pathway if a sudden change in productivity coincides with higher-than-normal porewater specific conductance, chloride, sodium, and tritium values.
Leaf Sclerophylly	X	X		Sclerophylly is a measure of leaf hardness or toughness that reflects a plant's response to climate and nutrient availability. Better growing conditions will result in lower sclerophylly values. These values can be monitored for changes over time or compared to published values to indicate potential stressors on the vegetative community.

Table 5.0-1. Summary of all Ecological Data Collected and Significance to the Project.

Type of Ecological Data Collected	Marsh	Mangrove	Biscayne Bay	Significance
Leaf Nutrient Concentrations	X	X	X	Describes the carbon, nitrogen, and phosphorous content of the vegetation. These values can be used to determine nutrient limitations and can be compared over time to identify shifts in nutrient availability caused by outside influences.
Leaf Isotopic Values	X	X	X	These values can be compared to published values from similar habitats as an indicator of vegetative community health. Values that fall well outside the range of published values for a particular habitat can reflect abnormal environmental conditions. Large changes in leaf isotopic values can indicate a significant environmental change.
Porewater Specific Conductance and Temperature	X	X	X	Collected from the sediment at 0, 30, and 60 cm depths (terrestrial only). CCS water is characterized by specific conductance and temperature values that are higher than those found in the ecosystems adjacent to TPP. High porewater specific conductance and temperature values can indicate a potential CCS groundwater pathway if they coincide with high sodium, chloride, and tritium values.
Porewater Chloride and Sodium Concentrations	X	X	X	Porewater chloride and sodium samples are collected from the root zone (30 cm depth) on a quarterly basis. These values reflect salt concentrations in the porewater. High values of sodium and chloride can indicate potential CCS influence if they coincide with high specific conductance and tritium values.
Porewater Nutrient Concentrations (TN, TP, Total Ammonia)	X	X	X	Porewater nutrient samples are collected from the root zone (30 cm depth) on a semi-annual basis. These values can help explain vegetation biomass and productivity patterns on a landscape scale. They can also indicate nutrient cycling patterns and phosphorous availability in the marsh and mangrove ecosystems. CCS water can contain high concentrations of nutrients at certain times of the year. If high nutrient values are present at an ecological monitoring site and those values coincide with high specific conductance, sodium, chloride, and tritium values, this may indicate CCS influence via a groundwater pathway.

Table 5.0-1. Summary of all Ecological Data Collected and Significance to the Project.

Type of Ecological Data Collected	Marsh	Mangrove	Biscayne Bay	Significance
Porewater Tritium Concentrations	X	X	X	Porewater tritium samples are collected from the root zone (30 cm depth) on a quarterly basis. CCS water is characterized by high tritium concentrations (ranging from 1,000 to 19,000 pCi/L). Groundwater migration of CCS water would be characterized by tritium concentrations similar to those observed in the CCS, and would coincide with higher specific conductance, temperature, sodium, chloride, and possibly nutrient values. It should be noted that atmospheric deposition of tritium does occur in the areas adjacent to TPP. Tritium concentrations from atmospheric deposition are generally above background levels (>20 pCi/L) but are still considered low level and would not coincide with higher specific conductance, chloride, and sodium values.

Table 5.1-1. Data and Samples Collected from August 2018 through May 2019.

Measurements	August 2018	November 2018	February 2019	May 2019
Measure herbaceous plants in 1x1m subplots	X	X	X	X
Measure woody plants in 5x5m subplots		X		
Collect herbaceous leaf samples for mass and nutrient analysis		X		X
Collect woody leaf samples for mass and nutrient analysis		X		
Estimate herbaceous plant cover in 1x1m subplots	X	X	X	X
Estimate woody plant cover in 5x5m subplots		X		
Collect porewater samples for nutrient analysis		X		X
Collect porewater samples for tracer suite analysis	X	X	X	X

Key:
m = meter(s).

Table 5.1-2. Plot Location, Community Description, Dominant Vegetation in Subplots.

Location		Northeast Subplot (decimal degrees)					Set Up (meters)	
Transect	Plot	Latitude	Longitude	Community	Herbaceous Dominant Species	Woody Dominant Species	1 x 1	5 x 5
F1	1	25.43503	-80.34692	Marsh/Mangrove	*Cladium jamaicense*	*Rhizophora mangle*	Y	Y
F1	2	25.44027	-80.34042	Freshwater marsh	*C. jamaicense*	*R. mangle*	Y	Y
F2	1	25.43310	-80.35403	Freshwater marsh	*C. jamaicense*	None	Y	N
F2	2	25.43286	-80.35864	Freshwater marsh	*C. jamaicense*	*R. mangle*	Y	Y
F2	3	25.43328	-80.36346	Freshwater marsh	*C. jamaicense*	None	Y	N
F3	1	25.40840	-80.36248	Freshwater marsh	*C. jamaicense*	None	Y	N
F3	2	25.40815	-80.36722	Freshwater marsh	*C. jamaicense*	None	Y	N
F3	3	25.40806	-80.37231	Freshwater marsh	*C. jamaicense*	None	Y	N
F4	1	25.38657	-80.37074	Freshwater marsh	*C. jamaicense*	*R. mangle* *Conocarpus erectus* *Myrica cerifera*	Y	N
F4	2	25.38669	-80.37492	Freshwater marsh	*C. jamaicense*	None	Y	N
F4	3	25.38655	-80.37908	Freshwater marsh	*C. jamaicense*	None	Y	N
F5	1	25.3557	-80.36692	Scrub mangrove	None	*Laguncularia racemosa* *R. mangle*	Y	Y
F5	2	25.35304	-80.35600	Scrub mangrove	*D. spicata* *Juncus roemerianus*	*R. mangle*	Y	Y
F6	1	25.35469	-80.43848	Freshwater marsh	*C. jamaicense*	None	Y	N
F6	2	25.34966	-80.43619	Freshwater marsh	*C. jamaicense*	None	Y	N
F6	3	25.34413	-80.43097	Freshwater marsh	*C. jamaicense*	None	Y	N
M1	1	25.44296	-80.33598	Scrub mangrove	None	*R. mangle*	N	Y
M1	2	25.44716	-80.33269	Scrub mangrove	None	*R. mangle*	N	Y

Table 5.1-2. Plot Location, Community Description, Dominant Vegetation in Subplots.

Location		Northeast Subplot (decimal degrees)		Community	Herbaceous Dominant Species	Woody Dominant Species	Set Up (meters)	
Transect	Plot	Latitude	Longitude				1 x 1	5 x 5
M2	1	25.40535	-80.33070	Scrub mangrove	None	*R. mangle*	N	Y
M2	2	25.40521	-80.32990	Scrub mangrove	None	*R. mangle*	N	Y
M3	1	25.38628	-80.33083	Scrub mangrove	None	*R. mangle*	N	Y
M3	2	25.38450	-80.32794	Scrub mangrove	None	*R. mangle*	N	Y
M4	1	25.35630	-80.33138	Scrub mangrove	None	*R. mangle*	N	Y
M4	2	25.35468	-80.32911	Scrub mangrove	None	*R. mangle*	N	Y
M5	1	25.35186	-80.35543	Scrub mangrove	*D. spicata*	*R. mangle* *Avicennia germinans*	Y	Y
M5	2	25.34507	-80.33381	Scrub mangrove	None	*R. mangle*	Y	Y
M6	1	25.29448	-80.39633	Scrub mangrove	None	*R. mangle*	N	Y
M6	2	25.29305	-80.39538	Scrub mangrove	None	*R. mangle*	N	Y

Table 5.1-3. Species and Individuals Counted in Subplots for Shannon-Wiener Index of Diversity Calculations in November 2018.

Community Type *	Plot	November 2018	
		Species Present	# of Individuals
Marsh	F2-1	*C. jamaicense*	47
		E. cellulosa	4
	F2-2	*C. jamaicense*	45
		E. cellulosa	6
		R. mangle	2
	F2-3	*C. jamaicense*	50
		E. cellulosa	9
	F3-1	*C. jamaicense*	34
		E. cellulosa	30
	F3-2	*C. jamaicense*	36
		Aster sp.	3
	F3-3	*C. jamaicense*	44
		E. cellulosa	8
		Aster sp.	1
	F4-1	*C. jamaicense*	64
		R. mangle	1
		Myrica cerifera	1
		Chrysobalanus icaco	1
		Unknown sp.	1
	F4-2	*C. jamaicense*	42
		E. cellulosa	35
	F4-3	*C. jamaicense*	32
	F6-1	*C. jamaicense*	61
	F6-2	*C. jamaicense*	18
		E. cellulosa	81
	F6-3	*C. jamaicense*	73
Marsh/Mangrove	F1-1	*C. jamaicense*	3
		R. mangle	60
	F1-2	*C. jamaicense*	86
		R. mangle	11
		Conocarpus erectus	1
	F5-1	*R. mangle*	427
		L. racemosa	51
		C. erectus	4
	F5-2	*D. spicata*	3

Table 5.1-3. Species and Individuals Counted in Subplots for Shannon-Wiener Index of Diversity Calculations in November 2018.

Community Type *	Plot	November 2018	
		Species Present	# of Individuals
		J. romerianus	7
		R. mangle	401
		L. racemosa	17
		A. germinans	1
Mangrove	M1-1	*R. mangle*	1024
		A. germinans	7
	M1-2	*R. mangle*	233
		A. germinans	2
	M2-1	*R. mangle*	26
		A. germinans	2
	M2-2	*R. mangle*	984
		A. germinans	4
	M3-1	*R. mangle*	82
	M3-2	*R. mangle*	61
	M4-1	*R. mangle*	372
		A. germinans	2
	M4-2	*R. mangle*	87
	M5-1	*D. spicata*	1
		R. mangle	714
		A. germinans	12
		L. racemosa	8
	M5-2	*R. mangle*	77
		A. germinans	1
	M6-1	*R. mangle*	29
	M6-2	*R. mangle*	24

Note:

* Calculations are conducted once per year in November. For herbaceous vegetation, all plants were counted in the northeast 1x1 (1 m^2) subplot; similarly woody species were counted in the northeast 5x5 (25 m^2).

Table 5.1-4. Shannon-Wiener Index Calculated Values for Plots and Transects in November 2018 with Historical Period of Record Range.

Location		*Historical Period of Record Range				November 2018			
		Shannon Wiener Index		Species Evenness		Shannon Wiener Index		Species Evenness	
Transect	Plot	Plot	Transect	Plot	Transect	Plot	Transect	Plot	Transect
F1	1	0.0 - 0.693	0.532 - 0.728	N/A - 0.999	0.484 - 0.843	0.191	0.720	0.276	0.656
	2	0.393 - 0.510		0.358 - 0.464		0.407		0.370	
F2	1	0.113 - 0.473	0.192 - 0.670	0.162 - 0.682	0.175 - 0.609	0.275	0.425	0.397	0.387
	2	0.195 - 0.850		0.281 - 0.774		0.509		0.464	
	3	0.0 - 0.580		N/A - 0.837		0.427		0.616	
F3	1	0.130 - 0.693	0.243 - 0.762	0.187 - 1.00	0.221 - 0.982	0.691	0.647	0.997	0.589
	2	0.0 - 0.292		N/A - 0.391		0.271		0.391	
	3	0.325 - 0.684		0.469 - 0.986		0.429		0.619	
F4	1	0.0 - 0.0	0.0 - 0.512	N/A	0.496 - 0.739	0.305	0.632	0.190	0.303
	2	0.0 - 0.693		N/A - 1.00		0.689		0.994	
	3	0.0 - 0.0		N/A		0.0		N/A	
F5	1	0.469 - 0.841	0.494 - 1.17	0.427 - 0.765	0.276 - 0.715	0.385	0.368	0.350	0.205
	2	0.243 - 0.943		0.221 - 0.680		0.307		0.191	
F6	1	0.0 – 0.0	0.458 - 0.656	N/A	0.661 - 0.946	0.0	0.646	N/A	0.932
	2	0.555 - 0.687		N/A - 0.991		0.474		0.684	
	3	0.0 - 0.0		N/A		0.0		N/A	
M1	1	0.0 - 0.0280	0.0 - 0.0760	N/A - 0.0410	0.00200 - 0.109	0.041	0.042	0.059	0.061
	2	0.0 - 0.255		0.0570 - 0.369		0.049		0.071	
M2	1	0.0 - 0.168	0.0120 - 0.116	N/A - 0.242	0.0180 - 0.168	0.257	0.036	0.371	0.052
	2	0.0130 - 0.122		0.0180 - 0.176		0.026		0.038	
M3	1	0.0 - 0.0	0.0 - 0.0	N/A	N/A	0.0	0.0	N/A	N/A
	2	0.0 - 0.0		N/A		0.0		N/A	
M4	1	0.0 - 0.0920	0.0 - 0.0840	N/A - 0.133	0.0130 - 0.121	0.005	0.028	0.008	0.040
	2	0.0 - 0.0790		N/A - 0.563		0.0		N/A	
M5	1	0.156 - 0.649	0.141 - 0.584	0.113 - 0.468	0.0490 - 0.421	0.154	0.147	0.111	0.106
	2	0.0 - 0.212		N/A - 0.306		0.069		0.099	
M6	1	0.0 - 0.0	0.0 - 0.0	N/A	N/A	0.0	0.0	N/A	N/A
	2	0.0 - 0.0		N/A		0.0		N/A	

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.

Key:

N/A = Not applicable. Species evenness cannot be calculated when only one species is present.

Table 5.1-5. Average Sawgrass Coverage per Plot and Transect during the Reporting Period with Historical Period of Record Average.

		Percent Cover									
		Historical Period of Record Average*		August 2018		November 2018		February 2019		May 2019	
Transect	Plot	Plot	Transect	Plot	Transect	Plot	Transect	Plot	Transect	Plot	Transect
F1	1	6-25%	6-25%	0-1%	6-25%	0-1%	6-25%	0-1%	6-25%	0-1%	6-25%
	2	6-25%		6-25%		6-25%		6-25%		6-25%	
F2	1	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%
	2	2-5%		6-25%		6-25%		6-25%		6-25%	
	3	6-25%		6-25%		2-5%		6-25%		6-25%	
F3	1	2-5%	2-5%	2-5%	2-5%	2-5%	2-5%	6-25%	6-25%	6-25%	6-25%
	2	2-5%		2-5%		2-5%		6-25%		2-5%	
	3	6-25%		6-25%		6-25%		6-25%		6-25%	
F4	1	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%	6-25%
	2	2-5%		6-25%		6-25%		6-25%		6-25%	
	3	2-5%		6-25%		6-25%		6-25%		6-25%	
F6	1	2-5%	2-5%	6-25%	2-5%	6-25%	2-5%	6-25%	2-5%	6-25%	2-5%
	2	2-5%		2-5%		2-5%		2-5%		2-5%	
	3	2-5%		2-5%		2-5%		6-25%		2-5%	

Notes:
Percent cover based on cover classes (e.g. 0-1; 2-5; 6-25; 26-50; 51-75; 76-100).
*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Table 5.1-6. Average Sawgrass Height per Plot and Transect in the Reporting Period with Historical Period of Record Range.

		Average Height ± Standard Error (cm)																	
		Historical Period of Record Range*		August 2018				November 2018				February 2019				May 2019			
Transect	Plot	Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	68.2 - 117.5	82.0 - 106.0	128.0	12.3	93.3	2.1	128.5	26.2	98.8	2.2	113.0	43.3	94.6	2.5	131.8	21.4	91.4	2.2
	2	89.7 - 114.5		91.6	2.0			97.8	2.0			94.0	2.2			90.1	2.1		
F2	1	67.1 - 96.3	65.4 - 88.7	66.1	1.5	67.4	1.0	71.5	1.5	70.7	1.1	70.2	1.9	70.5	1.2	68.3	1.5	66.0	1.1
	2	62.7 - 89.6		68.5	2.0			72.7	2.1			71.5	2.2			64.6	2.2		
	3	59.3 - 80.4		67.7	1.8			67.9	2.1			70.0	2.0			64.9	1.8		
F3	1	50.3 - 68.1	57.7 - 79.4	56.8	1.5	61.2	1.1	63.1	1.9	63.7	1.3	58.9	2.0	63.5	1.4	54.4	1.7	58.9	1.1
	2	53.2 - 73.0		61.4	2.0			66.0	2.3			61.8	2.2			54.9	2.0		
	3	65.8 - 101.6		65.2	2.3			69.2	2.3			70.3	2.7			65.1	1.9		
F4	1	86.6 - 123.9	71.0 - 96.2	89.0	2.4	74.8	1.5	96.3	2.1	79.9	1.5	91.1	3.0	77.1	1.7	90.8	2.3	75.2	1.5
	2	57.9 - 79.9		59.8	1.7			66.4	1.8			62.9	1.9			62.4	1.7		
	3	59.6 - 89.1		70.0	1.8			74.3	1.8			74.8	2.2			69.7	2.1		
F6	1	75.2 - 99.3	66.9 - 89.3	88.5	2.6	77.7	1.4	82.2	2.7	79.5	1.4	78.6	2.5	77.4	1.3	82.0	1.9	75.3	1.1
	2	61.7 - 87.0		75.8	1.7			81.3	2.4			77.4	2.4			72.0	1.7		
	3	59.6 - 81.5		69.3	2.0			75.2	1.9			76.2	1.9			71.3	1.8		

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.

Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

cm = Centimeters.

Table 5.1-7. Corrected Live and Total Sawgrass Biomass Equations for Previous and Current Reporting Period Events.

Season	Model	R^2	p-Value	N
Total Biomass Equations				
Wet Season 2018	Total Biomass = -2.92276 + 0.000186 $(LLL)^2$ + 0.04193 $(NoLL)^2$ + 0.36254 (NoDL) + 3.76860 (Cdb1)	0.8474	<0.0001	143
Dry Season 2019	Total Biomass = -1.14201 + 0.0002934 $(LLL)^2$ + 0.01542 $(NoLL)^2$ + 0.15366 (NoDL) + 2.61598 (Cdb1)	0.8645	<0.0001	120
Live Biomass Equations				
Wet Season 2018	Live Biomass = -0.97047 + 0.0001596 $(LLL)^2$ + 0.05041 $(NoLL)^2$ + 1.53759 $(Cdb1)^2$ - 0.01453 $(NoDL)^2$	0.8315	<0.0001	143
Dry Season 2019	Live Biomass = -1.53489 + 0.0001919 (LLL)2 + 0.03257 $(NoLL)^2$ + 2.49648 $(Cdb1)^2$ - 0.02271 $(NoDL)^2$	0.8153	<0.0001	120

Key:

Cdb1 = Culm diameter at base 1.

Cdb2 = Culm diameter at base 2.

LLL = Longest live
leaf.

NoDead = Number of dead leaves.

NoLL = Number of live leaves.

N = Sample size.

Table 5.1-8. Average Sawgrass Live Biomass per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	Live Biomass (g/m²)																	
		Historical Period of Record Range*		August 2018				November 2018				February 2019				May 2019			
		Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	0.0 - 193.0	102.8 - 205.8	7.8	7.8	142.0	58.7	5.2	5.2	110.5	45.1	5.9	5.9	126.0	50.8	5.7	5.7	139.1	57.1
	2	122 - 313.0		276.1	63.2			215.7	45.4			246.1	48.7			272.4	57.6		
F2	1	59.6 - 208.8	56.0 - 122.2	92.7	11.9	88.0	11.1	88.0	12.1	80.4	7.1	120.8	10.5	98.4	9.5	124.3	8.8	101.7	8.2
	2	36.4 - 91.8		64.9	8.7			68.6	7.9			79.3	16.0			82.1	5.6		
	3	38.9 - 112.6		106.4	28.8			84.5	16.7			95.1	17.9			98.7	18.3		
F3	1	29.1 - 91.2	40.8 - 84.8	53.4	7.4	75.9	9.8	57.8	11.7	70.0	8.3	66.6	14.7	70.4	10.7	53.2	12.3	70.4	10.7
	2	25.5 - 71.8		68.4	14.9			61.3	11.4			64.3	13.2			56.6	17.7		
	3	67.2 - 141.9		105.8	16.9			90.9	16.7			105.5	18.4			101.5	17.6		
F4	1	124.9 - 327	68.7 - 172.3	275.3	55.0	146.3	33.0	157.7	29.7	101.8	16.8	275.5	48.3	153.8	30.9	376.3	49.8	196.7	42.0
	2	36.4 - 89.9		68.0	9.7			56.1	6.0			80.9	14.3			94.5	10.8		
	3	37.8 - 100.0		95.8	20.0			91.5	20.6			105.1	22.0			119.2	24.5		
F6	1	48.7 - 156.0	47.7 - 92.1	79.6	35.3	62.6	18.2	90.9	36.6	72.2	20.6	109.2	48.5	89.5	25.0	131.2	58.9	116.4	34.2
	2	18.6 - 84.8		37.5	18.1			38.4	14.8			55.2	22.6			74.0	30.7		
	3	39.5 - 100.8		70.5	42.0			87.3	50.3			104.0	58.6			144.0	86.9		

Notes:
*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:
SE = Standard error.
g/m^2 = Grams per square meter.

Table 5.1-9. Average Sawgrass Total Biomass per Plot and Transect during the Reporting Period with Historical Period of Record Range.

		Total Biomass (g/m^2)																	
		Historical Period of Record Range*		August 2018				November 2018				February 2019				May 2019			
Transect	Plot	Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	0.0 - 354.1		7.9	7.9			6.7	6.7			11.6	11.6			8.4	8.4		
	2	167.7 - 507.6	129.4 - 329.7	309.0	66.0	158.5	64.7	277.2	56.7	141.9	57.5	341.6	64.2	176.6	69.3	384.0	70.1	196.2	78.2
F2	1	78.9 - 366.3		116.8	17.9			106.0	5.4			155.0	13.7			150.7	11.7		
	2	58.3 - 163.8		94.8	9.8			91.4	8.1			109.8	25.5			102.1	9.6		
	3	66.7 - 157.9	74.4 - 216.9	132.2	31.5	114.6	12.2	129.3	25.6	108.9	9.5	124.5	25.8	129.8	13.0	118.9	25.6	123.9	10.8
F3	1	28.5 - 112.7		66.3	8.7			71.6	12.3			81.2	19.5			70.3	16.1		
	2	33.1 - 138.2		86.4	19.0			92.0	19.0			86.0	18.6			64.5	18.3		
	3	90.0 - 285.2	54.0 - 169.0	125.2	21.7	92.7	11.7	120.3	20.1	94.6	10.9	126.0	33.8	95.2	13.3	132.2	22.1	89.0	13.6
F4	1	172.6 - 661.8		332.0	58.1			217.6	30.2			391.9	77.7			498.3	80.2		
	2	52.0 - 161.7		89.5	10.8			77.3	9.0			104.8	24.0			113.6	16.8		
	3	51.0 - 206.0	92.7 - 325.9	124.0	25.0	181.8	37.6	114.4	25.4	136.4	21.7	155.2	30.4	217.3	45.9	164.6	36.1	258.8	58.1
F6	1	67.3 - 219.2		101.2	44.2			128.2	51.0			159.5	70.1			172.5	78.9		
	2	24.6 - 205.8		44.9	19.4			59.0	23.6			72.8	26.8			87.0	37.4		
	3	47.7 - 253.7	63.5 - 226.9	85.6	53.3	77.2	22.8	101.7	55.3	96.3	25.3	150.4	91.9	127.6	37.6	208.0	129.7	155.8	49.6

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.

Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

g/m^2 = grams per square meter.

Table 5.1-10. Annual Net Primary Productivity for the Reporting Period with Historical Period of Record Range.

Transect	Plot	ANPP (g/m^2/yr)	
		Historical Period of Record Range*	November 2017 to November 2018
F1	1	-17.6 - 253.8	8.5
	2	220.2 - 326.3	347.0
F2	1	105.5 - 229.7	167.9
	2	68.5 - 125.8	160.9
	3	86.2 - 134.4	163.9
F3	1	40.1 - 101.7	84.1
	2	51.7 - 102.5	115.4
	3	110.0 - 158.3	171.8
F4	1	208.7 - 440.1	256.9
	2	67.3 - 129.7	126.2
	3	67.8 - 107.9	179.3
F6	1	82.9 - 190.1	190.3
	2	41.1 - 104.8	77.0
	3	76.4 - 161.8	154.1

Notes:
*Historical Period of Record includes the October 2010 through November 2017 ecological sampling events.
Mean productivity at Taylor Slough in Everglades National Park is typically less than 300 g/m^2/yr (Childers et al. 2006)
Key:
ANPP = Annual net primary productivity.
g/m^2/yr = grams per square meter per year.

Table 5.1-11. Sawgrass Leaf Sclerophylly per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	Sclerophylly (g/m^2)									
		Historical Period of Record Range*		November 2018				May 2019			
		Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	101.2 - 241.5	126.1 - 249.7	155.2	10.1	172.4	6.7	229.8	16.6	215.0	9.6
	2	89.7 - 296.9		176.7	7.6			211.2	11.3		
F2	1	111.6 - 279.9	125.3 - 269.6	**	**	191.2	6.8	196.9	9.3	205.3	7.7
	2	130.6 - 276.9		205.5	8.2			224.4	13.4		
	3	125.9 - 263.4		176.9	9.3			194.6	15.7		
F3	1	128.6 - 304.2	130.0 - 272.3	185.6	11.3	172.6	5.6	***	***	***	***
	2	134.0 - 254.0		168.0	6.9			***	***		
	3	121.7 - 269.9		164.3	10.2			***	***		
F4	1	102.6 - 228.2	133.0 - 272.6	173.8	7.8	175.7	6.5	227.8	15.4	227.5	8.5
	2	138.5 - 279.4		176.7	13.4			209.7	12.1		
	3	149.3 - 320.0		176.5	12.6			244.9	15.6		
F6	1	112.9 - 281.0	125.1 - 273.1	180.2	5.7	192.0	4.7	217.7	11.7	226.3	7.0
	2	129.2 - 263.2		202.1	8.4			209.5	11.7		
	3	118.9 - 312.9		193.8	9.0			251.7	10.0		

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.

** Data from F2-1 was lost.

*** Data from the F3 transect was lost due to transcription error.

Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

g/m^2 = Grams per square meter.

Table 5.1-12. Average Leaf Carbon for Sawgrass per Plot and Transect during the Reporting Historical Period with Historical Period of Record Range.

Transect	Plot	*C. jamaicense* Total Carbon (mg/g)									
		Historical Period of Record Range*		November 2018				May 2019			
		Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	419 - 519	434 - 512	451	NA	461	3.65	452	NA	461	2.47
	2	449 - 510		463	3.46			463	1.41		
F2	1	445 - 549	445 - 523	468	3.89	469	1.40	463	1.56	461	1.65
	2	429 - 499		470	1.84			463	3.18		
	3	446 - 522		470	1.24			458	3.47		
F3	1	438 - 513	440 - 507	462	2.92	464	1.20	468	3.32	460	3.27
	2	436 - 505		466	1.79			452	7.69		
	3	432 - 525		464	1.45			459	2.18		
F4	1	439 - 495	436 - 510	466	1.19	468	2.62	459	1.49	462	1.08
	2	428 - 491		474	7.51			464	0.86		
	3	436 - 549		465	1.80			463	2.27		
F6	1	425 - 512	427 - 511	464	2.73	465	2.25	465	1.93	465	1.15
	2	421 - 508		472	2.50			465	2.68		
	3	432 - 511		459	3.91			465	1.88		

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

mg/g = milligrams per gram.

NA = Not applicable.

Table 5.1-13. Average Leaf Total Nitrogen for Sawgrass per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	*C. jamaicense* Total Nitrogen (mg/g)									
		Historical Period of Record Range*		November 2018				May 2019			
		Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	5.20 - 10.7	4.80 - 10.4	5.80	NA	6.50	0.61	6.60	NA	7.20	0.51
	2	4.40 - 10.8		6.68	0.76			7.35	0.62		
F2	1	4.60 - 11.0	5.40 - 11.1	6.58	0.25	6.00	0.28	8.70	0.44	8.51	0.29
	2	6.00 - 11.0		5.13	0.50			8.90	0.50		
	3	4.70 - 11.8		6.30	0.37			7.93	0.53		
F3	1	5.00 - 10.0	5.90 - 9.90	6.80	0.51	6.82	0.42	8.25	0.15	7.44	0.25
	2	6.00 - 10.4		6.55	0.83			6.83	0.28		
	3	5.30 - 10.0		7.10	0.95			7.25	0.47		
F4	1	5.70 - 10.0	5.50 - 10.2	6.28	0.19	5.89	0.23	7.63	0.84	6.82	0.44
	2	5.00 - 9.50		5.90	0.49			6.98	0.38		
	3	5.70 - 11.0		5.50	0.42			5.85	0.83		
F6	1	5.60 - 10.5	5.30 - 10.9	6.53	0.69	6.31	0.23	5.45	0.26	5.90	0.17
	2	5.20 - 12.0		6.48	0.14			6.40	0.19		
	3	4.60 - 10.3		5.93	0.15			5.85	0.23		

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

mg/g = milligrams per gram.

NA = Not applicable.

Table 5.1-14. Average Leaf Total Phosphorous for Sawgrass per Plot and Transect During the Reporting Period with Historical Period of Record Range.

Transect	Plot	*C. jamaicense* Total Phosphorous (mg/kg)									
		Historical Period of Record Range*		November 2018				May 2019			
		Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	144 - 296	136 - 304	465	NA	255	53.2	195	NA	206	8.3
	2	127 - 313		203	11.4			208	10.2		
F2	1	163 - 255	143 - 284	174	8.80	178	7.45	155	23.1	171	17.38
	2	160 - 285		161	13.4			188	15.2		
	3	92.8 - 313		199	9.87			170	48.8		
F3	1	120 - 327	134 - 261	154	26.2	169	14.0	203	36.2	181	12.4
	2	120 - 258		156	32.5			170	8.60		
	3	123 - 282		197	5.40			170	8.77		
F4	1	117 - 324	147 - 312	227	26.2	193	11.9	232	10.4	203	9.3
	2	92.7 - 292		172	9.60			183	10.9		
	3	169 - 318		181	14.1			195	17.4		
F6	1	159 - 336	159 - 328	298	21.5	243	14.8	227	22.0	200	11.2
	2	155 - 358		231	9.16			190	22.0		
	3	130 - 288		200	14.2			184	7.49		

Notes:
*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

mg/g = milligrams per gram.

NA = Not applicable.

Table 5.1-15. Average Leaf Carbon Isotopes for Sawgrass per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	*C. jamaicense* Carbon Isotopes (‰)									
		Historical Period of Record Range*		November 2018				May 2019			
		Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	-28.3 to -25.5	-27.8 to -25.6	-27.8	NA	-26.2	0.51	-27.6	NA	-26.9	0.37
	2	-27.5 to -24.3		-25.8	0.42			-26.8	0.42		
F2	1	-27.0 to -25.4	-27.0 to -25.4	-25.9	0.22	-26.1	0.12	-26.3	0.12	-26.5	0.14
	2	-27.0 to -25.2		-26.3	0.20			-26.7	0.34		
	3	-27.1 to -25.6		-26.1	0.21			-26.4	0.24		
F3	1	-26.7 to -25.2	-26.7 to -25.1	-25.9	0.23	-25.7	0.13	-26.1	0.10	-26.3	0.15
	2	-27.0 to -25.1		-25.8	0.20			-26.6	0.31		
	3	-26.7 to -25.1		-25.5	0.28			-26.1	0.27		
F4	1	-27.5 to -24.9	-27.4 to -25.0	-26.1	0.10	-25.9	0.14	-26.6	0.35	-26.3	0.16
	2	-27.8 to -25.2		-26.0	0.18			-26.3	0.31		
	3	-26.9 to -25.4		-25.5	0.31			-26.1	0.13		
F6	1	-27.6 to -24.8	-27.4 to -21.5	-25.2	0.07	-25.3	0.10	-26.8	0.26	-26.7	0.17
	2	-27.0 to -18.1		-25.1	0.11			-26.1	0.18		
	3	-27.6 to -20.2		-25.6	0.18			-27.1	0.10		

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

mg/g = milligrams per gram.

NA = Not applicable.

Table 5.1-16. Average Leaf Nitrogen Isotopes for Sawgrass per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	*C. jamaicense* Nitrogen Isotopes (‰) Historical Period of Record Range*		November 2018				May 2019			
		Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE
F1	1	-3.4 to 2.8	-3.6 to 2.8	-0.04	NA	-1.6	0.46	-0.37	NA	0.10	0.37
	2	-3.8 to 2.8		-2.0	0.31			0.21	0.46		
F2	1	-3.2 to 0.70	-3.7 to 0.70	-2.6	0.47	-2.4	0.29	-3.6	0.65	-2.5	0.33
	2	-4.6 to 0.80		-1.7	0.63			-2.0	0.23		
	3	-3.6 to 1.3		-2.9	0.18			-1.9	0.32		
F3	1	-5.8 to 0.30	-5.3 to -0.50	-3.6	0.92	-4.2	0.42	-3.5	0.72	-3.6	0.45
	2	-5.2 to -0.30		-4.4	0.60			-3.5	0.89		
	3	-5.0 to -0.50		-4.6	0.75			-3.8	0.93		
F4	1	-5.2 to 2.7	-5.8 to 0.10	-5.0	0.42	-4.9	0.33	-3.5	0.65	-3.6	0.41
	2	-7.8 to -1.8		-4.8	0.95			-2.7	0.73		
	3	-5.9 to -0.60		-5.0	0.38			-4.6	0.54		
F6	1	-4.6 to -0.90	-4.3 to -1.0	-2.2	0.76	-3.1	0.44	-4.3	0.38	-3.8	0.58
	2	-3.7 to -0.60		-3.3	0.27			-3.8	1.3		
	3	-5.1 to -0.50		-3.7	1.1			-3.3	1.3		

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

SE = Standard error.

mg/g = milligrams per gram.

NA = Not applicable.

Table 5.1-17. Sawgrass Leaf C:N Molar Ratio per Plot and Transect in the Reporting Period.

Transect	Plot	*C. jamaicense* C:N Molar Ratio			
		November 2018		May 2019	
		Plot	Transect	Plot	Transect
F1	1	91:1	83:1	80:1	75:1
	2	81:1		73:1	
F2	1	83:1	91:1	62:1	63:1
	2	107:1		61:1	
	3	87:1		67:1	
F3	1	79:1	79:1	66:1	72:1
	2	83:1		77:1	
	3	76:1		74:1	
F4	1	87:1	93:1	70:1	79:1
	2	94:1		78:1	
	3	99:1		92:1	
F6	1	83:1	86:1	99:1	92:1
	2	85:1		85:1	
	3	90:1		93:1	

Notes:
*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

C = Carbon.

N = Nitrogen.

Table 5.1-18. Sawgrass Leaf N:P Molar Ratio per Plot and Transect in the Reporting Period.

		C. jamaicense N:P Ratio			
		November 2018		May 2019	
Transect	Plot	Plot	Transect	Plot	Transect
F1	1	28:1	56:1	75:1	78:1
	2	73:1		78:1	
F2	1	84:1	75:1	124:1	110:1
	2	71:1		105:1	
	3	70:1		103:1	
F3	1	98:1	89:1	90:1	91:1
	2	93:1		89:1	
	3	80:1		95:1	
F4	1	61:1	68:1	73:1	74:1
	2	76:1		84:1	
	3	67:1		67:1	
F6	1	49:1	57:1	53:1	65:1
	2	62:1		75:1	
	3	66:1		70:1	

Notes:
*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.
Hurricane Irma (9/10/17) resulted in the mortality of all sawgrass plants in F1-1. Some regrowth was observed at the northeast corner subplot during the reporting period.

Key:

N = Nitrogen.
P = Phosphorous.

Table 5.1-19. Average Specific Conductance (µS/cm) of Porewater at 30 cm Depth for the Reporting Period with Historical Period of Record Range.

		Porewater Specific Conductance at 30 cm Depth (µS/cm)																	
		Historical Period of Record Range*		August 2018				November 2018				February 2019				May 2019			
Transect	Plot	Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE
	1	1045 - 16146		12153	1517			5623	1271			4561	601			7555	1303		
F1	2	1076 - 4112	1360 - 9597	3428	95	7790	2594	3241	45	4432	862	2900	145	3730	542	3329	98	5442	1332
	1	847 - 6751		3812	504			1982	584			2296	75			3056	303		
	2	1153 - 2718		1988	334			1604	74			1259	31			2184	76		
	3	1827 - 2745		2027	50			2093	62			2055	110			2419	40		
F2	4	670 - 2274	1194 - 3489	NA	NA	2609	412	802	172	1621	224	NA	NA	1870	201	1425	307	2271	236
	1	1191 - 10141		7664	382			5875	212			4995	204			5254	37		
	2	1314 - 7509		6670	573			5828	137			5243	21			5317	65		
	3	1984 - 7764		5874	11			5615	297			4602	76			4465	3		
F3	4	381 - 3440	1351 - 7810	NA	NA	6736	373	1374	13	4673	725	NA	NA	4946	131	2225	161	4315	475
	1	651 - 9089		994	47			999	10			1273	2			1357	5		
	2	512 - 2318		1017	301			1017	13			1064	4			1143	24		
	3	790 - 5865		1569	484			1454	304			1478	49			1499	58		
F4	4	874 - 5051	667 - 5268	NA	NA	1193	189	2958	199	1877	311	NA	NA	1272	77	3299	464	2119	365
	1	6660 - 59133		26819	6953			34808	364			39535	146			56925	3409		
F5	2	19904 - 76679	20114 - 60246	51097	2376	38958	7623	47951	464	41380	3802	51828	711	45681	3561	61377	654	59151	1913
	1	889 - 9412		7262	212			6503	617			5252	35			5118	117		
	2	1070 - 4336		4177	673			3353	631			3433	619			3178	258		
	3	2438 - 11017		7935	1178			8285	406			6406	1153			6881	735		
F6	4	645 - 3517	1124 - 7055	NA	NA	6458	813	1620	111	4940	1002	NA	NA	5030	643	1581	28	4190	769
	1	40039 - 64315		NA	NA			44388	284			NA	NA			46988	271		
M1	2	41105 - 63885	41584 - 59212	NA	NA	NA	NA	44796	1041	44592	456	NA	NA	NA	NA	48400	1101	47694	617
	1	42239 - 62516		NA	NA			50187	78			NA	NA			54101	1666		
M2	2	45387 - 64093	43813 - 62374	NA	NA	NA	NA	55258	260	52722	1468	NA	NA	NA	NA	56259	1003	55180	1009
	1	42949 - 67368		NA	NA			52644	284			NA	NA			54061	634		
M3	2	40886 - 64914	41918 - 63560	NA	NA	NA	NA	50885	88	51764	522	NA	NA	NA	NA	56553	451	55307	786
	1	38237 - 79856		NA	NA			51981	421			NA	NA			59724	918		
M4	2	40031 - 85880	38465 - 78953	NA	NA	NA	NA	53515	852	52748	589	NA	NA	NA	NA	56055	959	57890	1190
	1	39633 - 81751		NA	NA			50938	734			NA	NA			63006	734		
M5	2	41322 - 58486	43648 - 66605	NA	NA	NA	NA	53422	676	52180	825	NA	NA	NA	NA	54826	761	58916	2400
	1	40409 - 51057		NA	NA			44695	512			NA	NA			46204	251		
M6	2	32397 - 51909	37620 - 50682	NA	NA	NA	NA	46271	339	45483	519	NA	NA	NA	NA	46112	1069	46158	449

Notes:

*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.

Key:

µS/cm = Microsiemens per centimeter.

NA = Not applicable.

SE = Standard Error.

Table 5.1-20. Average Temperature (°C) of Porewater at 30 cm Depth for the Reporting Period with Historical Period of Record Range.

		Porewater Temperature at 30 cm Depth (°C)																	
		Historical Period of Record Range*		August 2018				November 2018				February 2019				May 2019			
Transect	Plot	Plot	Transect	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE	Plot	SE	Transect	SE
	1	21.2 - 36.9		31.6	0.1			27.7	0.1			26.2	0.2			26.9	0.0		
F1	2	20.0 - 30.8	21.7 - 33.9	28.1	0.1	29.9	1.0	26.4	0.0	27.1	0.4	25.6	0.8	25.9	0.4	26.5	0.2	26.7	0.1
	1	22.3 - 31.0		28.8	0.1			29.3	1.1			23.3	0.9			28.1	0.1		
	2	21.0 - 31.5		30.7	1.0			27.9	1.0			23.1	0.4			29.3	0.7		
	3	20.7 - 31.4		31.5	1.5			23.2	0.7			25.8	0.6			28.3	0.4		
F2	4	22.3 - 30.0	21.6 - 30.7	NA	NA	30.4	0.7	27.5	0.3	27.0	0.9	NA	NA	24.1	0.6	29.8	0.0	28.9	0.3
	1	19.0 - 31.0		33.0	2.5			28.9	0.8			25.6	1.0			28.3	0.6		
	2	17.5 - 31.5		31.3	1.3			28.8	0.9			26.2	1.0			28.5	0.5		
	3	17.3 - 32.6		29.5	0.4			27.3	0.5			25.7	0.9			29.0	1.1		
F3	4	23.1 - 28.7	18.0 - 30.5	NA	NA	31.3	1.0	28.7	1.1	28.4	0.4	NA	NA	25.8	0.5	27.2	0.3	28.2	0.4
	1	18.9 - 30.2		30.6	0.5			28.2	0.5			25.9	0.7			28.5	0.9		
	2	19.9 - 32.0		29.5	0.1			28.1	0.5			25.7	0.4			29.3	0.8		
	3	21.4 - 32.1		30.6	0.6			27.9	0.4			25.2	0.2			28.6	0.9		
F4	4	23.5 - 29.0	20.1 - 31.0	NA	NA	30.2	0.3	29.0	1.0	28.4	0.4	NA	NA	25.6	0.2	26.7	0.3	27.9	0.4
	1	21.7 - 34.5		31.5	0.2			23.4	0.7			25.6	0.1			28.3	0.1		
F5	2	22.4 - 34.1	22.1 - 33.0	30.8	0.3	31.2	0.2	25.3	0.3	24.4	0.6	24.7	0.7	25.2	0.4	30.6	0.5	29.4	0.7
	1	18.8 - 31.6		30.6	0.3			27.3	0.5			21.5	0.1			28.8	0.5		
	2	19.3 - 30.6		29.7	0.1			27.8	0.8			23.1	0.0			29.8	1.3		
	3	20.8 - 30.2		29.0	0.1			26.9	0.0			23.2	1.0			27.8	0.4		
F6	4	21.4 - 27.5	19.6 - 30.5	NA	NA	29.8	0.3	27.1	0.7	27.3	0.3	NA	NA	22.6	0.4	29.9	1.0	29.1	0.5
	1	22.1 - 31.9		NA	NA			28.3	0.6			NA	NA			30.2	0.7		
M1	2	23.4 - 31.1	22.8 - 31.2	NA	NA	NA	NA	29.0	0.2	28.7	0.3	NA	NA	NA	NA	26.2	0.3	28.2	1.2
	1	22.4 - 32.6		NA	NA			27.5	0.4			NA	NA			26.6	0.0		
M2	2	23.2 - 32.5	22.7 - 32.5	NA	NA	NA	NA	27.4	0.1	27.5	0.2	NA	NA	NA	NA	23.6	3.5	25.1	1.7
	1	22.1 - 31.3		NA	NA			28.3	0.6			NA	NA			28.0	0.3		
M3	2	20.9 - 31.0	21.7 - 30.9	NA	NA	NA	NA	27.6	0.2	27.9	0.3	NA	NA	NA	NA	28.4	0.4	28.2	0.2
	1	23.0 - 33.5		NA	NA			27.7	0.1			NA	NA			26.2	0.1		
M4	2	20.5 - 32.7	22.3 - 33.7	NA	NA	NA	NA	29.2	0.1	28.4	0.4	NA	NA	NA	NA	29.3	0.3	27.8	0.9
	1	23.8 - 32.8		NA	NA			25.3	0.0			NA	NA			30.3	0.3		
M5	2	18.4 - 31.2	21.4 - 32.5	NA	NA	NA	NA	28.1	0.3	26.7	0.8	NA	NA	NA	NA	28.9	0.3	29.6	0.5
	1	22.5 - 31.5		NA	NA			28.1	0.0			NA	NA			28.4	0.4		
M6	2	23.3 - 32.5	22.9 - 32.1	NA	NA	NA	NA	28.1	0.4	28.1	0.1	NA	NA	NA	NA	28.0	0.3	28.2	0.3

Notes:
*Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.

Key:
C = Celcius.
cm = Centimeter.
NA = Not Applicable.
SE = Standard Error.

Table 5.1-21. Marsh Analytical Porewater Results August 2018.

Parameter	Units	PW-F1-1		PW-F1-2		PW-F2-1		PW-F2-2		PW-F2-3		PW-F3-1		PW-F3-2		PW-F3-3		PW-F4-1	
		08/01/2018		08/01/2018		08/07/2018		08/07/2018		08/07/2018		08/13/2018		08/13/2018		08/13/2018		08/14/2018	
Temperature	°C	31.64		28.09		28.85		30.75		31.49		31.81		31.32		29.54		30.64	
pH	SU	6.93		7.01		6.88		6.96		7.03		6.91		6.87		6.93		6.98	
Specific Conductance	µS/cm	12153		3427		3812		1988		2027		7664		6670		5874		994	
Sodium	mg/L	1980		476		584		224		236		1220		1000		867		118	
Chloride	mg/L	3500		939		1130		459		476		2520		2050		1780		175	
Salinity	*	7.07		1.82	J	2.02		1.02	J	1.04	J	4.29		3.70		3.23		0.50	J
Tritium	pCi/L (1σ)	147 (7.7)		33.9 (7.1)		20.0 (6.7)		39.8 (5.0)		29.9 (6.8)		71.2 (7.7)		56.4 (7.0)		34.7 (5.6)		29.3 (6.0)	

NOTES:

Laboratory anion and cation results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius. mg/L = Milligram(s) per liter.

µS/cm = MicroSiemen(s) per centimeter. pCi/L = PicoCuries per liter.

σ = sigma (Standard Deviation). PSS-78 = Practical Salinity Scale of 1978.

I = Value between the MDL and PQL. PW = Porewater.

J = Estimated (+/- indicate bias). U = Analyzed for but not detected at the reported value.

Table 5.1-21. Marsh Analytical Porewater Results August 2018 (continued).

Parameter	Units	PW-F4-2		PW-F4-3		PW-F5-1		PW-F5-2		PW-F6-1		PW-F6-2		PW-F6-3		PW-EB1		PW-FB1	
		08/14/2018		08/14/2018		08/06/2018		08/06/2018		08/15/2018		08/15/2018		08/15/2018		08/01/2018		08/15/2018	
Temperature	°C	29.52		30.56		31.54		30.84		30.56		29.71		29.00					
pH	SU	6.97		6.84		6.82		6.88		6.86		6.76		6.80					
Specific Conductance	µS/cm	1017		1569		26819		51097		7262		4177		7935					
Sodium	mg/L	113		202		5400		10800		1050		581		1280		0.155	I	0.0650	U
Chloride	mg/L	190		339		10300		20600		2630		1280		2670		0.221	U	0.221	U
Salinity	*	0.51	J	0.80	J	16.77		31.20		4.05		2.25		4.46					
Tritium	pCi/L (1σ)	23.9 (7.5)		25.8 (7.3)		45.0 (8.1)		23.6 (6.9)		12.4 (5.8)		2.5 (6.0)	UJ	4.9 (8.5)	UJ	21.8 (7.1)		-4.0 (10.1)	UJ

NOTES:

Laboratory anion and cation results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius. mg/L = Milligram(s) per liter.

µS/cm = MicroSiemen(s) per centimeter. pCi/L = PicoCuries per liter.

σ = sigma (Standard Deviation). PSS-78 = Practical Salinity Scale of 1978.

I = Value between the MDL and PQL. PW = Porewater.

J = Estimated (+/- indicate bias). U = Analyzed for but not detected at the reported value.

Table 5.1-22. Marsh and Mangrove Analytical Porewater Results November 2018.

Parameter	Units	PW-F1-1		PW-F1-2		PW-F2-1		PW-F2-2		PW-F2-3		PW-F2-4		PW-F3-1		PW-F3-2		PW-F3-3	
		11/26/2018		11/26/2018		11/05/2018		11/05/2018		11/29/2018		11/13/2018		11/07/2018		11/07/2018		11/07/2018	
Temperature	°C	27.74		26.43		28.86		27.87		23.41		27.53		28.89		28.84		27.27	
pH	SU	7.07		6.80		6.88		6.94		6.91		6.36		6.90		6.86		6.98	
Specific Conductance	µS/cm	5623		3241		1982		1604		2093		802		5875		5828		5615	
Sodium	mg/L	889		407		260		177		219		113		930		859		825	
Chloride	mg/L	1540		757		393		318		422		129		1770		1730		1700	
Ammonia	mg/L as N	1.27		0.889		1.91		1.90		2.11		0.711		2.54		2.35		2.28	
Ammonium ion (NH_4^+)	mg/L	1.63		1.15		2.45		2.45		2.72		0.915		3.27		3.03		2.94	
Unionized NH_3	mg/L	0.0121		0.00420		0.0129		0.0138		0.0104		0.00133	I	0.0177		0.0149		0.0171	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	4.00		6.06		3.77		4.72		5.30		3.07		5.20		4.87		4.24	
TN	mg/L	4.00		6.06		3.77		4.72		5.30		3.07		5.20		4.87		4.24	
ortho-Phosphate	mg/L	0.0111	I	0.0100	U	0.0107	I	0.0100	U	0.0104	I	0.0119	I	0.0168	I J	0.0153	I J-	0.0162	I J
Total Phosphorous (P)	mg/L	0.0297		0.106		0.225		0.180		0.0449		0.0209	I	0.0169	I	0.0175	I	0.0172	I
Salinity	*	3.09		1.72	J	1.02	J	0.81	J	1.07	J	0.39	J	3.23		3.20		3.08	
Tritium	pCi/L (1σ)	190 (9.3)		49.1 (6.8)		129 (10.1)		48.5 (9.0)		53.7 (7.6)		46.2 (8.2)		105 (7.9)		49.0 (5.7)		50.8 (5.9)	

NOTES:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

Text in blue are revised from the 2019 Semi-Annual Data Delivery.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.
SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 5.1-22. Marsh and Mangrove Analytical Porewater Results November 2018 (continued).

Parameter	Units	PW-F3-4		PW-F4-1		PW-F4-2		PW-F4-3		PW-F4-4		PW-F5-1		PW-F5-2		PW-F6-1		PW-F6-2	
		11/13/2018		11/06/2018		11/06/2018		11/06/2018		11/06/2018		11/27/2018		11/27/2018		11/12/2018		11/12/2018	
Temperature	°C	28.70		28.19		28.10		27.91		28.98		23.42		25.33		27.28		27.84	
pH	SU	6.44		7.05		7.10		7.02		6.67		6.85		7.21		6.74		6.78	
Specific Conductance	µS/cm	1374		999		1017		1454		3208		34808		47952		6503		3353	
Sodium	mg/L	252		83.4		94.0		146		357		6520		9570		920		436	
Chloride	mg/L	286		151		176		255		734		12300		17700		1950		930	
Ammonia	mg/L as N	0.410		0.912	J	1.47	J+	2.10		0.434		0.378		0.233		2.97		2.02	
Ammonium ion (NH_4^+)	mg/L	0.529		1.17	J	1.90	J	2.71		0.559		0.487		0.300		3.82		2.61	
Unionized NH_3	mg/L	0.00100	I	0.00871	J	0.0156	J	0.0183		0.00182		0.00141	I	0.00212		0.0128		0.0101	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0700	U	0.0140	U	0.0140	U	0.0700	U	0.0700	U	0.0140	U
TKN	mg/L	2.97		1.96	J	2.76	J-	3.55		2.88		2.21		3.51		5.38		2.67	
TN	mg/L	2.97		1.96	J	2.76	J	3.55		2.88		2.21		3.51		5.38		2.67	
ortho-Phosphate	mg/L	0.0130	I	0.0168	I	0.0144	I	0.0138	I	0.0183	I	0.0136	I	0.0100	U J	0.0110	I J	0.0127	I J
Total Phosphorous (P)	mg/L	0.0248	I	0.0235	I	0.0282		0.111		0.111		0.0131	I	0.0993		0.00900	U J	0.00900	U J
Salinity	*	0.69	J	0.50	J	0.51	J	0.74	J	1.55	J	22.20		31.74		3.60		1.78	J
Tritium	pCi/L (1σ)	45.8 (7.5)		139 (10.6)		132 (9.4)		59.7 (7.7)		49.4 (6.2)		149 (9.8)		111 (9.6)		5.8 (6.6)		14.7 (8.1)	

NOTES:

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* PSS-78 salinity is untiless

KEY:

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σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.
SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 5.1-22. Marsh and Mangrove Analytical Porewater Results November 2018 (continued).

Parameter	Units	PW-F6-3		PW-F6-4		PW-M1-1		PW-M1-2		PW-M2-1		PW-M2-2		PW-M3-1		PW-M3-2	
		11/12/2018		11/12/2018		11/15/2018		11/14/2018		11/19/2018		11/19/2018		11/20/2018		11/19/2018	
Temperature	°C	26.90		27.14		28.28		29.04		27.51		27.44		27.15		27.57	
pH	SU	6.78		6.67		6.83		6.84		7.10		6.64		6.86		7.10	
Specific Conductance	µS/cm	8285		1620		44388		44796		50187		55258		52644		50885	
Sodium	mg/L	1250		222		8460		8840		10100		10900		10300		9950	
Chloride	mg/L	2550		217		15900		16500		18200		20000		19400		18900	
Ammonia	mg/L as N	1.30	J-	0.533		0.186		0.0671	I	0.820		0.135		0.869		0.671	
Ammonium ion (NH_4^+)	mg/L	1.68	J	0.687		0.239		0.0864	I	1.06		0.173		1.12		0.864	
Unionized NH_3	mg/L	0.00595	J	0.00198		0.000886	I	0.000400	U	0.00667		0.000400	U	0.00392		0.00546	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	4.53		4.32		1.68	J	1.52		1.61	J	1.13	J	1.86	J	1.65	J
TN	mg/L	4.53		4.32		1.68	J	1.52		1.61	J	1.13	J	1.86	J	1.65	J
ortho-Phosphate	mg/L	0.0179	I J	0.0275	I	0.0122	I	0.0100	U J	0.0160	I	0.0161	I	0.0136	I J	0.0128	I
Total Phosphorous (P)	mg/L	0.0147	I J	0.0423		0.0320		0.0169	I	0.0205	I	0.0780		0.00900	U J	0.0283	
Salinity	*	4.66		0.82	J	29.17		29.48		33.46		37.29		35.32		33.98	
Tritium	pCi/L (1σ)	-6.6 (6.3)		20.4 (6.4)		17.9 (6.5)		3.9 (7.8)		11.6 (7.4)		28.7 (7.4)		24.6 (7.0)		58.1 (7.8)	

NOTES:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

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J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.
SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 5.1-22. Marsh and Mangrove Analytical Porewater Results November 2018 (continued).

Parameter	Units	PW-M4-1		PW-M4-2		PW-M5-1		PW-M5-2		PW-M6-1		PW-M6-2		PW-EB1		PW-FB1	
		11/20/2018		11/14/2018		11/27/2018		11/14/2018		11/15/2018		11/15/2018		11/05/2018		11/29/2018	
Temperature	°C	27.72		29.17		25.33		28.14		28.10		28.06					
pH	SU	6.94		6.88		6.82		6.98		6.85		6.86					
Specific Conductance	µS/cm	51981		53515		50938		53422		44695		46271					
Sodium	mg/L	10300		11100		10400		11100		8390		8720		0.0968	I	0.0650	U
Chloride	mg/L	19000		19800		18900		19600		16100		16600		0.221	U	0.221	U
Ammonia	mg/L as N	1.13		1.50		0.126		1.65		2.67		3.66		0.0775	I	0.0339	U
Ammonium ion (NH_4^+)	mg/L	1.46		1.94		0.162		2.13		3.43		4.72		0.100	I	0.0437	U
Unionized NH_3	mg/L	0.00639		0.00810		0.000462	I	0.0104		0.0131		0.0182					
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0700	U	0.0140	U	0.0140	U
TKN	mg/L	1.97	J-	2.41		2.60		2.75		3.33	J	3.79	J	0.126	U	0.124	U
TN	mg/L	1.97	J	2.41		2.60		2.75		3.33	J	3.79	J	0.140	U	0.140	U
ortho-Phosphate	mg/L	0.0500	U J-	0.0100	U J	0.0131	I J	0.0500	U J-	0.0154	I J	0.0119	I	0.0100	U	0.0100	U
Total Phosphorous (P)	mg/L	0.00900	U	0.00900	U	0.0293		0.0168	I J	0.00920	I J	0.0293		0.00900	U	0.00900	U
Salinity	*	34.81		36.00		33.67		35.91		29.39		30.55					
Tritium	pCi/L (1σ)	38.9 (7.2)		17.8 (7.0)		74.4 (6.4)		-5.1 (7.3)		14.9 (4.8)		9.6 (5.1)		3.0 (6.7)		-1.5 (7.2)	

NOTES:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

Text in blue are revised from the 2019 Semi-Annual Data Delivery.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.

N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.

PW = Porewater.
SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.

Table 5.1-23. Marsh Analytical Porewater Results February 2019.

Parameter	Units	PW-F1-1		PW-F1-2		PW-F2-1		PW-F2-2		PW-F2-3		PW-F3-1		PW-F3-2		PW-F3-3		PW-F4-1	
		2/6/2019		2/6/2019		2/7/2019		2/7/2019		2/25/2019		2/20/2019		2/20/2019		2/20/2019		2/25/2019	
Temperature	°C	26.18		25.55		23.30		23.10		25.79		25.62		26.23		25.70		25.94	
pH	SU	7.06		6.87		6.95		6.98		7.00		7.04		6.98		7.02		6.94	
Specific Conductance	µS/cm	4561		2900		2296		1259		2055		4995		5243		4602		1273	
Sodium	mg/L	686		360		339		131		231		778		804		682		124	
Chloride	mg/L	1240		700		551		229		454		1490		1570		1390		249	J-
Salinity	*	2.47		1.53	J	1.19	J	0.65	J	1.06	J	2.72		2.86		2.49		0.64	J
Tritium	pCi/L (1σ)	225 (19.5)		71.7 (16.0)		164 (16.6)		89.6 (16.3)		48.0 (1.9)		170 (17.0)		81.9 (15.7)		73.9 (15.7)		165 (16.6)	

NOTES:

Laboratory anion and cation results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.
U = Analyzed for but not detected at the reported value.

Table 5.1-23. Marsh Analytical Porewater Results February 2019 (continued).

Parameter	Units	PW-F4-2 2/25/2019		PW-F4-3 2/25/2019		PW-F5-1 2/4/2019		PW-F5-2 2/6/2019		PW-F6-1 2/14/2019		PW-F6-2 2/14/2019		PW-F6-3 2/14/2019		PW-EB-1 2/4/2019	
Temperature	°C	25.20		25.30		25.59		24.72		21.49		23.03		23.17			
pH	SU	7.18		7.08		6.70		7.04		6.79		6.72		6.78			
Specific Conductance	µS/cm	1064		1478		39535		51828		5252		3433		6406			
Sodium	mg/L	110		170		7670		10300		776		457		1040		0.173	I
Chloride	mg/L	202	J	271	J	15500		19600		1570		960		2150		0.210	I
Salinity	*	0.53	J	0.75	J	25.60		34.63		2.86		1.83	J	3.55			
Tritium	pCi/L (1σ)	156 (16.3)		76.2 (17.0)		152 (18.2)		73.9 (13.8)		11.4 (2.2)		3.4 (2.3)		13.3 (2.3)		-17.8 (9.3)	UJ

NOTES:

Laboratory anion and cation results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius.
mg/L = Milligram(s) per liter.
µS/cm = MicroSiemen(s) per centimeter.
pCi/L = PicoCuries per liter.
σ = sigma (Standard Deviation).
PSS-78 = Practical Salinity Scale of 1978.
I = Value between the MDL and PQL.
PW = Porewater.
J = Estimated (+/- indicate bias).
U = Analyzed for but not detected at the reported value.

Table 5.1-24. Marsh and Mangrove Analytical Porewater Results May 2019.

Parameter	Units	PW-F1-1		PW-F1-2		PW-F2-1		PW-F2-2		PW-F2-3		PW-F2-4		PW-F3-1		PW-F3-2	
		05/07/2019		05/16/2019		05/09/2019		05/09/2019		05/09/2019		05/13/2019		05/13/2019		05/13/2019	
Temperature	°C	26.93		26.52		28.06		29.30		28.29		29.83		28.30		28.46	
pH	SU	6.90		6.86		7.36		7.01		6.94		6.87		6.96		6.94	
Specific Conductance	µS/cm	7555		3329		4736		2184		2419		1425		5254		5317	
Sodium	mg/L	1130		244		413		243		277		163		840		808	
Chloride	mg/L	2230		850		689		462		508		330		1610		1620	
Ammonia	mg/L as N	0.508		0.507		0.876		1.41		1.22		0.527		1.97		2.08	
Ammonium ion (NH_4^+)	mg/L	0.655		0.653		1.13		1.82		1.57		0.679		2.54		2.69	
Unionized NH_3	mg/L	0.00308		0.00277		0.0167		0.0132		0.00907		0.00372		0.0152		0.0155	
Nitrate/Nitrite	mg/L as N	0.0850		0.141		0.0140	U	0.0220	I	0.0200	I	0.0150	I J	0.0140	U	0.0140	U
TKN	mg/L	2.79		3.88		15.7		6.57		8.27		5.31		5.59		6.46	
TN	mg/L	2.87		4.02		15.7		6.59		8.29		5.32	J	5.59		6.46	
ortho-Phosphate	mg/L	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U
Total Phosphorous (P)	mg/L	0.0875		0.0505		0.252		0.0800		0.0663		0.0366		0.0471		0.0419	
Salinity	*	4.23		1.77	J	1.61	J	1.13	J	1.26	J	0.72	J	2.86		2.94	
Tritium	pCi/L (1σ)	186 (17.0)		32.3 (4.5)		114 (11.2)		55.4 (15.4)		34.2 (4.5)		32.3 (15.0)		117 (16.0)		49.0 (15.0)	

NOTES:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.

N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.

SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Analyte detected in the sample and the associated preparation blank.

Table 5.1-24. Marsh and Mangrove Analytical Porewater Results May 2019 (continued).

Parameter	Units	PW-F3-3		PW-F3-4		PW-F4-1		PW-F4-2		PW-F4-3		PW-F4-4		PW-F5-1		PW-F5-2	
		05/13/2019		05/13/2019		05/15/2019		05/15/2019		05/15/2019		05/15/2019		05/07/2019		05/08/2019	
Temperature	°C	29.03		27.22		28.68		29.28		28.60		26.68		28.25		30.64	
pH	SU	6.92		6.52		6.79		6.92		6.78		6.54		6.76		7.20	
Specific Conductance	µS/cm	4465		2225		1357		1727		1499		3299		56925		61372	
Sodium	mg/L	694		363		124		111		158		385		11600		13800	
Chloride	mg/L	1350		612		273		215		299		911		21400		25100	
Ammonia	mg/L as N	1.21		0.141		0.496		2.08		1.69		0.490		0.529		0.428	
Ammonium ion (NH_4^+)	mg/L	1.56		0.181		0.639		2.68		2.18		0.630		0.681		0.551	
Unionized NH_3	mg/L	0.00897		0.000400	U	0.00270		0.0159		0.00893		0.00130	I	0.00200		0.00509	
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0170	I	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	2.84		2.88		2.71		4.57		5.37		3.98		2.04		6.45	J-
TN	mg/L	2.84		2.90		2.71		4.57		5.37		3.98		2.04		6.45	J
ortho-Phosphate	mg/L	0.0100	U	0.0106	I	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U J	0.0100	U
Total Phosphorous (P)	mg/L	0.0212		0.0245		0.0191	I	0.0296		0.0617		0.0688		0.00750	I J	0.0537	
Salinity	*	2.41		1.15	J	0.68	J	0.57	J	0.76	J	1.74	J	38.60		42.08	
Tritium	pCi/L (1σ)	92.8 (15.7)		31.5 (3.3)		182 (17.0)		107 (15.7)		87.7 (15.7)		50.2 (15.4)		71.7 (10.9)		66.6 (3.2)	

NOTES:
Laboratory results are reported with 3 digits although only the first 2 are significant figures.
* PSS-78 salinity is untiless
KEY:
°C = Degrees Celsius.
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σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.
SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Analyte detected in the sample and the associated preparation blank.

Table 5.1-24. Marsh and Mangrove Analytical Porewater Results May 2019 (continued).

Parameter	Units	PW-F6-1		PW-F6-2		PW-F6-3		PW-F6-4		PW-M1-1		PW-M1-2		PW-M2-1		PW-M2-2		PW-M3-1	
		05/14/2019		05/14/2019		05/14/2019		05/14/2019		05/08/2019		05/02/2019		05/01/2019		05/01/2019		05/01/2019	
Temperature	°C	28.83		29.85		27.77		29.93		30.23		26.16		26.56		26.57		28.03	
pH	SU	6.76		6.72		6.74		6.67		6.80		6.48		7.18		6.53		6.94	
Specific Conductance	µS/cm	5118		3178		6881		1581		46988		48400		54101		56259		54061	
Sodium	mg/L	741		424		1080		205		9930		10000		11400		12000		11300	
Chloride	mg/L	1630		922		2270		332		18000		17400		20600		21900		20100	
Ammonia	mg/L as N	2.33		1.77		0.679		0.350		0.0558	I	0.0466	I	0.582		0.0349	I	0.625	
Ammonium ion (NH_4^+)	mg/L	3.00		2.28		0.874		0.451		0.0719	I	0.0600	I	0.750		0.0450	I	0.805	
Unionized NH_3	mg/L	0.0118		0.00882		0.00303		0.00157	I	0.000400	U	0.000400	U	0.00520		0.000400	U	0.00357	
Nitrate/Nitrite	mg/L as N	0.0170	I	0.0150	I	0.0290	I	0.0160	I J-	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	6.50	J+	3.66		8.84		6.99		1.18	V	1.90	J	2.07	J-	1.56	J	1.92	J
TN	mg/L	6.52	J	3.68		8.87		7.01	J	1.18	J	1.90	J	2.07	J	1.56	J	1.92	J
ortho-Phosphate	mg/L	0.0100	U	0.0100	U	0.0100	U J-	0.0100	U	0.0124	I J-	0.0100	U	0.0100	U J	0.0100	U J	0.0100	U J
Total Phosphorous (P)	mg/L	0.0217		0.0299		0.0773		0.114		0.00500	U J	0.0290		0.0172	I	0.0109	I	0.00600	I J
Salinity	*	2.79		1.68	J	3.83		0.80	J	32.61		34.60		36.39		38.03		36.36	
Tritium	pCi/L (1σ)	12.8 (2.5)		9.8 (2.8)		9.6 (4.0)		19.0 (2.5)		18.1 (3.8)		7.3 (3.6)		62.1 (15.0)		24.0 (2.4)		61.4 (4.8)	

NOTES:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is untiless

KEY:

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σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.

N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.

SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Analyte detected in the sample and the associated preparation blank.

Table 5.1-24. Marsh and Mangrove Analytical Porewater Results May 2019 (continued).

Parameter	Units	PW-M3-2		PW-M4-1		PW-M4-2		PW-M5-1		PW-M5-2		PW-M6-1		PW-M6-2		PW-EB1		PW-FB1	
		05/01/2019		05/01/2019		05/02/2019		05/07/2019		05/02/2019		05/02/2019		05/02/2019		05/01/2019		05/16/2019	
Temperature	°C	28.45		26.18		29.34		30.33		28.88		28.36		27.95					
pH	SU	7.02		6.68		6.71		6.94		6.96		6.70		6.67					
Specific Conductance	µS/cm	56553		59724		56055		63006		54826		46204		46076					
Sodium	mg/L	11500		12600		11900		13100		11700		9480		9250		0.183	I	0.0650	U
Chloride	mg/L	21100		23600		22600		24100		21400		17400		17400		0.248	I	0.108	U
Ammonia	mg/L as N	0.555		0.282		1.03		0.0339	U	0.346		3.70		3.04		0.0339	U	0.0339	U
Ammonium ion (NH_4^+)	mg/L	0.715		0.363		1.33		0.0437	U	0.446		4.76		3.92		0.0437	U	0.0437	U
Unionized NH_3	mg/L	0.00387		0.000755	I	0.00376		0.000400	U	0.00219		0.0132		0.00971					
Nitrate/Nitrite	mg/L as N	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U	0.0140	U
TKN	mg/L	3.71	J	1.34	J	1.83		6.48		1.17		4.48	J	4.33	J-	0.141	I	0.124	U
TN	mg/L	3.71	J	1.34	J	1.83		6.48		1.17		4.48	J	4.33	J	0.141		0.138	U
ortho-Phosphate	mg/L	0.0100	U J	0.0500	U J-	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U J	0.0100	U	0.0100	U
Total Phosphorous (P)	mg/L	0.0627		0.00500	U	0.00500	U	0.108		0.00500	U	0.00500	U	0.00650	I J	0.00500	U	0.00500	U
Salinity	*	38.31		40.69		37.94		43.35		36.99		30.50		30.44					
Tritium	pCi/L (1σ)	81.6 (15.4)		66.9 (15.0)		51.2 (15.4)		57.0 (4.2)		14.8 (4.0)		8.6 (3.4)		8.6 (3.6)		2.2 (14.4)	UJ	9.9 (14.7)	UJ

NOTES:

Laboratory results are reported with 3 digits although only the first 2 are significant figures.

* PSS-78 salinity is untiless

KEY:

°C = Degrees Celsius.
µS/cm = MicroSiemen(s) per centimeter.
σ = sigma (Standard Deviation).
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligram(s) per liter.
N = Nitrogen.
NH_3 = Ammonia.
NH_4^+ = Ammonum ion.
pCi/L = PicoCuries per liter.
PSS-78 = Practical Salinity Scale of 1978.
PW = Porewater.
SU = Standard unit(s).
TKN = Total Kjeldahl nitrogen.
TN = Total nitrogen.
U = Analyzed for but not detected at the reported value.
V = Analyte detected in the sample and the associated preparation blank.

Table 5.1-25. Range of Porewater Field Parameters and Ionic and Nutrient Concentrations at the Marsh, Brackish, and Tree Island Plots during the Historical Period of Record and Reporting Period.

		[1]Marsh								[2]Fresh/Brackish								[3]Tree Islands							
		[4]Historical Period of Record				Reporting Period				[4]Historical Period of Record				Reporting Period				[4]Historical Period of Record				Reporting Period			
Parameter	Units	Min	Max	Average	Standard Deviation	Min	Max	Average	Standard Deviation	Min	Max	Average	Standard Deviation	Min	Max	Average	Standard Deviation	Min	Max	Average	Standard Deviation	Min	Max	Average	Standard Deviation
Temperature	°C	17.34	32.55	26.43	2.79	21.49	31.81	27.78	2.45	20.03	34.45	27.55	2.94	23.42	31.64	27.46	2.53	21.40	30.01	25.26	1.75	26.68	29.93	28.25	1.27
pH	SU	6.41	7.78	6.86	0.261	6.36	7.36	6.89	0.18	6.43	7.80	6.84	0.28	6.76	7.21	6.96	0.18	5.71	6.83	6.41	0.26	6.36	6.87	6.59	0.16
Specific Conductance	µS/cm	541	11017	2041	1666	994	8285	3731	2244	1045	76679	21366	21533	2900	62600	25897	22830	381	5051	1371	880	802	3299	1942	898
Sodium	mg/n	35	1800	216	267	83	1280	526	374	72.1	16000	4023	4366	244	13800	5115	4888	21	568	128	119	113	385	258	101
Chloride	mg/n	54	3860	451	606	151	2670	1062	801	101	31000	7763	8523	700	25100	9641	9107	35	1480	250	271	129	911	444	276
Total Ammonia	mg/L as N	0.0260	2.90	1.21	0.730	0.496	2.97	1.74	0.621	0.0260	2.150	0.602	0.445	0.233	1.27	0.593	0.331	0.0260	2.00	0.636	0.458	0.141	0.711	0.450	0.165
TKN	mg/L	1.40	21.0	4.03	2.50	1.96	15.70	5.25	1.97	0.7740	6.60	2.74	1.21	2.04	6.45	3.87	1.64	1.40	15.00	3.85	2.63	2.88	7.0	4.05	1.47
TN	mg/L	1.41	17.5	4.10	2.31	1.96	15.70	5.26	2.82	0.8240	6.60	2.91	1.25	2.04	6.45	3.90	1.64	1.42	15.00	4.03	2.72	2.88	7.0	4.06	1.48
TP	mg/L	0.00220	0.260	0.0336	0.0385	0.0090	0.252	0.0602	0.0673	0.00220	0.170	0.0291	0.0353	0.00750	0.106	0.0559	0.0383	0.00220	0.260	0.0476	0.0513	0.0209	0.114	0.0554	0.0384
Salinity	*	0.25	6.74	1.08	0.98	0.50	4.66	2.00	1.28	0.50	54.40	14.00	14.70	1.53	42.08	16.66	15.33	0.30	2.75	0.72	0.49	0.39	1.74	0.98	0.46
Tritium	pCi/L	-17.6	143	42.0	30.0	-6.6	181.76	63.6	52.4	0.20	240	76.0	46.8	23.6	225	102	64.40	-8.8	102	27.3	19.4	19.0	50.2	36.9	12.8

Notes:

[1]Marsh = F2-1, F2-2, F2-3, F3-1, F3-2, F3-3, F4-1, F4-2, F4-3, F6-1, F6-2, and F6-3.

[2]Fresh/Brackish = F1-1, F1-2, F5-1, and F5-2.

[3]Tree Islands = F2-4, F3-4, F4-4, and F6-4.

[4]Historical Period of Record includes the October 2010 through May 2018 ecological sampling events.

Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Key:

°C = Degrees Celsius.
* = Unitless.
µS/cm = MicroSiemens per centimeter.
Max = Maximum.
Min = Minimum.
mg/L = Milligram(s) per liter.
N = Nitrogen.
pCi/L = Picocuries per Liter.
SU = Standard Units.
TKN = Total Kjeldahl Nitrogen.
TN = Total Nitrogen.
TP = Total Phosphorous.

Table 5.1-26. Percent Cover of Red Mangroves per Plot and Transect for the Reporting Period with Historical Period of Record Average.

Transect	Plot	Percent (%) Cover			
		Historical Period of Record Average*		November 2018	
		Plot	Transect	Plot	Transect
F1	1	6-25%	6-25%	6-25%	6-25%
	2	2-5%		2-5%	
F2	1	0-1%	0-1%	0-1%	0-1%
	2	0-1%		0-1%	
	3	0-1%		0-1%	
F5	1	6-25%	6-25%	6-25%	6-25%
	2	6-25%		6-25%	
M1	1	26-50%	26-50%	26-50%	26-50%
	2	26-50%		26-50%	
M2	1	6-25%	6-25%	6-25%	6-25%
	2	26-50%		26-50%	
M3	1	6-25%	6-25%	6-25%	6-25%
	2	6-25%		6-25%	
M4	1	6-25%	6-25%	6-25%	6-25%
	2	6-25%		6-25%	
M5	1	6-25%	6-25%	6-25%	6-25%
	2	6-25%		6-25%	
M6	1	6-25%	6-25%	6-25%	6-25%
	2	6-25%		2-5%	

Notes:

Percent cover based on cover classes (e.g. 0-1; 2-5; 6-25; 26-50; 51-75; 76-100).

*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Table 5.1-27. Average Red Mangrove Height per Plot and Transect for the Reporting Period with Historical Period of Record Range.

		Height ± Standard Error (cm)					
		Historical Period of Record Range*		November 2018			
Transect	Plot	Plot	Transect	Plot	SE	Transect	SE
F1	1	112.8 - 119.2	100.2 - 107.5	108.6	7.6	104.7	4.5
	2	83.7 - 99.6		100.1	3.8		
F2	2	42.3 - 55.0	.	49.8	6.4	49.8	6.4
F5	1	77.1 - 96.4	64.7 - 76.6	97.4	17.4	77.5	6.9
	2	59.3 - 69.0		69.2	5.6		
M1	1	71.7 - 77.8	78.1 - 86.5	77.8	2.2	84.1	3.4
	2	84.6 - 95.3		90.4	6.1		
M2	1	87.4 - 94.8	78.2 - 85	95.2	4.1	82.1	4.5
	2	68.9 - 75.2		69.1	5.9		
M3	1	81.8 - 89.7	89.1 - 95.8	90.3	4.0	95.8	3.5
	2	96.4 - 101.8		101.3	5.5		
M4	1	78.6 - 95.6	80.5 - 94.9	96.8	5.2	96.0	4.0
	2	82.3 - 94.2		95.2	6.2		
M5	1	58.7 - 67.7	86.1 - 94.3	62.5	6.7	93.4	7.6
	2	109.1 - 118.6		121.8	5.5		
M6	1	99.8 - 109.2	95.2 - 103.5	98.7	7.7	92.7	5.7
	2	90.2 - 98.3		86.8	8.4		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:
SE = Standard error.
cm = Centimeters.

Table 5.1-28. Average Red Mangrove Biomass per Plot and Transect for the Reporting Period with Historical Period of Record Range.

Transect	Plot	Biomass ± Standard Error (g/m²)					
		Historical Period of Record Range*		November 2018			
		Plot	Transect	Plot	SE	Transect	SE
F1	1	220.2 - 262.8	128.5 - 158.3	210.8	65.8	134.2	42.8
	2	36.5 - 55.6		57.6	17.1		
F2	1	0.0 - 0.0	2.4 - 4.6	0.0	0.0	5.1	2.3
	2	7.2 - 13.7		15.2	2.3		
	3	0.0 - 0.0		0.0	0.0		
F5	1	112.8 - 185.3	176.3 - 251.5	215.4	87.1	242.0	45.7
	2	239.7 - 317.8		268.7	41.1		
M1	1	702.3 - 849.7	663.2 - 766.9	731.7	70.9	666.2	43.1
	2	611.7 - 691.2		600.7	27.6		
M2	1	89.1 - 263.5	329.4 - 481.0	107.7	24.4	384.1	112.6
	2	569.6 - 708.1		660.6	87.5		
M3	1	383.2 - 400.8	269.6 - 322.4	379.2	31.5	271.5	43.8
	2	155.9 - 252.8		163.7	15.0		
M4	1	196.2 - 226.2	259.6 - 307.0	231.8	30.2	294.6	38.9
	2	323.1 - 387.9		357.3	59.2		
M5	1	251.6 - 322.7	262.3 - 370.6	262.8	53.9	265.4	27.5
	2	271.6 - 418.6		267.9	25.1		
M6	1	145.8 - 168.4	147.8 - 169.9	121.3	14.9	102.8	12.5
	2	141.0 - 176.4		84.4	16.8		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:

SE = Standard error.
g/m^2 = grams per square meter.

Table 5.1-29. Red Mangrove Sclerophylly per Plot and Transect for the Reporting Period with Historical Period of Record Range.

Transect	Plot	Sclerophylly (g/m^2)					
		Historical Period of Record Average*		November 2018			
		Plot	Transect	Plot	SE	Transect	SE
F1	1	214.5 - 269.8	220.7 - 255.5	262.5	5.3	255.0	4.3
	2	223.9 - 241.2		247.4	6.4		
F2	2	191.8 - 273.5	.	260.9	7.7	.	.
F5	1	155.5 - 342.0	181.2 - 308.6	238.2	6.2	244.4	4.7
	2	200.9 - 283.5		255.1	6.3		
M1	1	210.2 - 306.6	211.2 - 261.7	238.0	7.7	243.8	5.0
	2	198.5 - 269.6		249.6	6.5		
M2	1	239.5 - 281.1	225.0 - 273.3	281.8	5.9	259.6	7.2
	2	210.4 - 265.5		237.4	9.7		
M3	1	204.5 - 263.3	214.4 - 258.5	255.9	9.1	261.5	5.9
	2	223.1 - 274.5		267.1	7.6		
M4	1	212.7 - 237.7	215.6 - 255.4	256.7	7.3	243.0	5.8
	2	212.2 - 273.1		229.2	7.3		
M5	1	192.8 - 267.9	201.8 - 259.4	244.1	5.9	242.5	4.5
	2	210.8 - 267.1		240.4	7.2		
M6	1	230.9 - 340.0	230.9 - 327.0	270.8	7.8	267.4	5.8
	2	231.0 - 314.0		264.0	8.8		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:

SE = Standard error.

g/m^2 = Grams per square meter.

Table 5.1-30. Average Leaf Carbon for Red Mangrove per Plot and Transect during the Reporting Period with Historical Period with Historical Period of Record Range.

Transect	Plot	***R. mangle*** **Total Carbon (mg/g)**					
		Historical Period of Record Average*		November 2018			
		Plot	Transect	Plot	SE	Transect	SE
F1	1	414 - 490	419 - 490	438	2.72	439	3.26
	2	424 - 491		440	6.47		
F2	2	435 - 471	NA	445	2.06	NA	NA
F5	1	412 - 465	411 - 471	445	4.71	443	3.37
	2	410 - 477		442	5.28		
M1	1	394 - 493	399 - 497	436	3.27	428	6.91
	2	404 - 501		421	13.2		
M2	1	397 - 471	412 - 463	410	22.1	422	11.2
	2	392 - 467		433	3.41		
M3	1	395 - 545	396 - 486	440	1.38	437	1.96
	2	395 - 452		435	3.57		
M4	1	429 - 587	416 - 512	447	2.91	444	3.50
	2	395 - 461		441	6.54		
M5	1	398 - 457	407 - 461	434	18.4	434	8.58
	2	404 - 466		435	2.46		
M6	1	380 - 444	377 - 443	418	6.92	415	4.61
	2	373 - 444		411	6.59		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:

SE = Standard error.
mg/g = milligrams per gram.

Table 5.1-31. Average Leaf Total Nitrogen for Red Mangrove per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	*R. mangle* Total Nitrogen (mg/g)					
		Historical Period of Record Average*		November 2018			
		Plot	Transect	Plot	SE	Transect	SE
F1	1	8.31 - 16.0	9.38 - 16.5	11.5	0.18	11.7	0.28
	2	10.5 - 16.9		11.9	0.55		
F2	2	8.11 - 14.5	-	9.20	0.70	NA	NA
F5	1	9.97 - 19.3	10.0 - 16.4	11.5	0.59	10.7	0.39
	2	9.62 - 15.0		10.1	0.29		
M1	1	10.2 - 15.5	10.4 - 15.9	10.0	0.29	9.50	0.41
	2	10.5 - 16.3		8.98	0.73		
M2	1	8.84 - 14.2	9.67 - 13.7	6.58	0.20	7.95	0.64
	2	9.78 - 13.3		9.33	0.77		
M3	1	8.70 - 13.9	9.01 - 13.4	8.43	0.53	8.24	0.34
	2	8.62 - 12.8		8.05	0.48		
M4	1	11.2 - 20.5	10.9 - 17.7	9.73	0.42	10.3	0.31
	2	10.6 - 15.0		10.9	0.18		
M5	1	10.6 - 18.5	10.2 - 16.9	15.1	4.31	12.3	2.27
	2	9.92 - 15.3		9.43	0.31		
M6	1	8.49 - 11.8	8.62 - 11.8	6.73	0.30	7.31	0.33
	2	8.79 - 11.8		7.90	0.41		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:

SE = Standard error.
mg/g = milligrams per gram.

Table 5.1-32. Average Leaf Total Phosphorus for Red Mangrove per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	*R. mangle* Total Phosphorous (mg/kg)					
		Historical Period of Record Average*		November 2018			
		Plot	Transect	Plot	SE	Transect	SE
F1	1	305 - 583	365 - 603	335	91.1	333	66.6
	2	425 - 623		331	111		
F2	2	305 - 740	NA	467	15.1	NA	NA
F5	1	316 - 885	360 - 755	538	38.3	578	19.5
	2	383 - 641		492	16.9		
M1	1	470 - 640	475 - 639	563	21.1	535	17.4
	2	480 - 638		507	21.0		
M2	1	430 - 713	439 - 726	526	23.3	547	25.8
	2	448 - 740		569	47.5		
M3	1	233 - 760	344 - 719	555	26.4	525	19.2
	2	455 - 678		495	20.6		
M4	1	365 - 707	371 - 674	522	28.2	531	19.2
	2	378 - 680		540	29.7		
M5	1	345 - 601	401 - 599	502	14.4	529	16.7
	2	323 - 598		557	24.3		
M6	1	446 - 645	469 - 636	470	36.7	511	27.7
	2	457 - 628		552	33.1		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:

SE = Standard error.

mg/kg = milligrams per kilogram.

Table 5.1-33. Average Leaf Carbon Isotopes for Red Mangrove per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	*R. mangle* Carbon Isotopes (‰)					
		Historical Period of Record Average*		November 2018			
		Plot	Transect	Plot	SE	Transect	SE
F1	1	-27.9 to -25.8	-27.6 to -25.7	-26.6	0.12	-26.6	0.1
	2	-27.5 to -25.7		-26.5	0.15		
F2	2	-28.3 to -26.1	NA	-27.3	0.30	NA	NA
F5	1	-28.0 to -25.9	-26.9 to -25.7	-27.0	0.41	-26.2	0.3
	2	-26.1 to -24.8		-25.6	0.14		
M1	1	-26.1 to -24.4	-26.1 to -18.4	-25.6	0.29	-25.6	0.1
	2	-26.2 to -11.8		-25.6	0.13		
M2	1	-25.4 to -22.6	-25.4 to -17.2	-24.7	0.18	-24.8	0.3
	2	-25.6 to -11.9		-24.9	0.58		
M3	1	-25.4 to -24.1	-25.4 to -24.1	-24.6	0.16	-24.4	0.1
	2	-25.3 to -23.9		-24.2	0.14		
M4	1	-25.8 to -23.4	-26.1 to -24.3	-24.8	0.18	-25.0	0.1
	2	-26.5 to -24.3		-25.2	0.17		
M5	1	-26.1 to -22.8	-26.1 to -22.9	-25.8	0.46	-25.6	0.2
	2	-26.1 to -22.9		-25.4	0.12		
M6	1	-25.7 to -24.7	-25.9 to -24.6	-24.8	0.11	-24.8	0.1
	2	-26.1 to -24.4		-24.8	0.20		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:

SE = Standard error.
‰ = parts per mille.

Table 5.1-34. Average Leaf Nitrogen Isotopes for Red Mangrove per Plot and Transect during the Reporting Period with Historical Period of Record Range.

Transect	Plot	*R. mangle* Nitrogen Isotopes (‰)					
		Historical Period of Record Average*		November 2018			
		Plot	Transect	Plot	SE	Transect	SE
F1	1	-2.44 to -0.10	-4.47 to -1.62	-3.90	0.30	-4.88	0.53
	2	-6.51 to -2.96		-5.86	0.76		
F2	2	-2.05 to 0.50	NA	-2.11	0.80	NA	NA
F5	1	-2.74 to 0.58	-2.58 to -1.40	1.00	0.52	-2.08	1.19
	2	-4.41 to -1.64		-4.39	0.81		
M1	1	-2.40 to 1.23	0.35 to 2.19	-0.12	1.54	-0.63	1.42
	2	1.38 to 4.17		-1.13	2.61		
M2	1	-11.4 to -8.58	-6.76 to -5.00	-10.5	0.70	-6.10	1.80
	2	-2.64 to 0.47		-1.69	1.33		
M3	1	-9.03 to -4.07	-7.79 to -5.81	-6.02	1.49	-7.62	0.98
	2	-10.3 to -5.55		-9.22	0.73		
M4	1	-6.80 to -3.92	-5.99 to -4.17	-6.66	0.57	-5.95	0.41
	2	-7.55 to -3.70		-5.24	0.33		
M5	1	-1.57 to 3.58	-3.94 to -1.13	0.54	1.31	-2.17	1.73
	2	-9.05 to -2.33		-4.88	2.70		
M6	1	-7.24 to -6.13	-9.08 to -6.63	-8.36	0.43	-9.83	0.59
	2	-11.2 to -7.13		-11.3	0.10		

Notes:
*Historical Period of Record includes the November ecological sampling events from October 2010 through November 2017.

Key:

SE = Standard error.
‰ = parts per mille.

Table 5.1-35. Red Mangrove Leaf C:N Molar Ratio per Plot and Transect in the Reporting Period.

Transect	Plot	R. mangle C:N Molar Ratio November 2018 Plot	R. mangle C:N Molar Ratio November 2018 Transect
F1	1	45:1	44:1
	2	43:1	
F2	2	56:1	-
F5	1	45:1	48:1
	2	51:1	
M1	1	51:1	53:1
	2	55:1	
M2	1	73:1	62:1
	2	54:1	
M3	1	61:1	62:1
	2	63:1	
M4	1	54:1	50:1
	2	47:1	
M5	1	33:1	41:1
	2	54:1	
M6	1	73:1	66:1
	2	61:1	

Key:

C = Carbon.

N = Nitrogen.

Table 5.1-36. Red Mangrove Leaf N:P Molar Ratio per Plot and Transect in the Reporting Period.

Transect	Plot	R. mangle N:P Ratio November 2018 Plot	R. mangle N:P Ratio November 2018 Transect
F1	1	76:1	78:1
	2	80:1	
F2	2	44:1	-
F5	1	47:1	41:1
	2	45:1	
M1	1	39:1	39:1
	2	39:1	
M2	1	28:1	32:1
	2	36:1	
M3	1	34:1	35:1
	2	36:1	
M4	1	41:1	43:1
	2	45:1	
M5	1	67:1	51:1
	2	37:1	
M6	1	32:1	32:1
	2	32:1	

Key:

N = Nitrogen.

P = Phosphorous.

Table 5.1-37. Range of Porewater Field Parameters, and Ionic and Nutrient Concentrations at Mangrove Plots in the Historic Period of Record and Reporting Period.

Parameter	Units	[1]Mangrove							
		[2]Historical Period of Record				Reporting Period			
		Min	Max	Average	Standard Deviation	Min	Max	Average	Standard Deviation
Temperature	°C	22.50	32.35	27.29	1.67	25.33	30.33	27.94	1.24
pH	SU	6.18	7.68	6.82	0.24	6.48	7.18	6.85	0.18
Specific Conductance	µS/cm	38237	78743	52422	7486	44388	63006	51718	4998
Sodium	mg/L	7300	17200	10280	1689	8390	13100	10530	1292
Chloride	mg/L	14000	32000	19875	3286	15900	24100	19354	2294
Total Ammonia	mg/L as N	0.0260	3.64	0.787	0.742	0.0339	3.70	0.992	1.148
TKN	mg/L	0.150	5.56	1.77	0.984	1.130	6.48	2.43	1.313
TN	mg/L	0.222	5.59	1.88	1.03	1.130	6.48	2.43	1.313
TP	mg/L	0.00220	0.124	0.0186	0.0201	0.00500	0.1080	0.0230	0.02577
Salinity	*	24.27	54.74	34.93	5.67	29.17	43.35	34.80	3.69
Tritium	pCi/L	-1.1	99.9	30.2	22.1	-5.1	81.6	31.5	25.6

Notes:

[1]Mangrove sites include M1-1, M1-2, M2-1, M2-2, M3-1, M3-2, M4-1, M4-2, M5-1, M5-2, M6-1, and M6-2.

[2]Historical Period of Record includes the semi-annual sampling events (November and May only) between October/November 2010 through May 2018.

Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Key:

°C = Degrees Celsius.

* = Unitless.

µS/cm = MicroSiemens per centimeter.

Max = Maximum.

Min = Minimum.

mg/L = Milligram(s) per liter.

N = Nitrogen.

SU = Standard Units

Table 5.2-1. Latitude and Longitude of Biscayne Bay, Card Sound, and Barnes Sound Ecological Sampling Points.

Point	Latitude	Longitude	Point	Latitude	Longitude
BB1-a-1	25.42632	80.32344	BB3-a-1	25.35211	80.32451
BB1-a-2	25.42355	80.32348	BB3-a-2	25.35034	80.32586
BB1-a-3	25.42296	80.32346	BB3-a-3	25.34834	80.32731
BB1-a-4	25.41888	80.32347	BB3-a-4	25.34671	80.32854
BB1-a-5	25.41664	80.32343	BB3-a-5	25.34400	80.33055
BB1-a-6	25.41644	80.32344	BB3-a-6	25.34172	80.33224
BB1-a-7	25.41217	80.32345	BB3-a-7	25.34089	80.33284
BB1-a-8	25.41074	80.32344	BB3-a-8	25.33927	80.33405
BB1-b-1	25.42769	80.32095	BB3-b-1	25.35051	80.32288
BB1-b-2	25.42335	80.32097	BB3-b-2	25.34832	80.32450
BB1-b-3	25.42116	80.32096	BB3-b-3	25.34663	80.32575
BB1-b-4	25.42049	80.32096	BB3-b-4	25.34426	80.32749
BB1-b-5	25.41750	80.32094	BB3-b-5	25.34346	80.32808
BB1-b-6	25.41514	80.32094	BB3-b-6	25.34202	80.32914
BB1-b-7	25.41306	80.32094	BB3-b-7	25.33996	80.33068
BB1-b-8	25.41130	80.32095	BB3-b-8	25.33817	80.33199
BB2-a-1	25.37277	80.30706	BB4-a-1	25.28361	80.38995
BB2-a-2	25.37171	80.30782	BB4-a-2	25.28203	80.39109
BB2-a-3	25.37021	80.30888	BB4-a-3	25.28096	80.39186
BB2-a-4	25.36822	80.31030	BB4-a-4	25.27843	80.39368
BB2-a-5	25.36692	80.31122	BB4-a-5	25.27762	80.39426
BB2-a-6	25.36490	80.31265	BB4-a-6	25.27576	80.39561
BB2-a-7	25.36334	80.31375	BB4-a-7	25.27357	80.39718
BB2-a-8	25.36009	80.31604	BB4-a-8	25.27135	80.39879
BB2-b-1	25.37296	80.30388	BB4-b-1	25.28255	80.38793
BB2-b-2	25.37088	80.30538	BB4-b-2	25.28035	80.38951
BB2-b-3	25.36808	80.30740	BB4-b-3	25.27996	80.38978
BB2-b-4	25.36702	80.30816	BB4-b-4	25.27821	80.39103
BB2-b-5	25.36481	80.30966	BB4-b-5	25.27587	80.39272
BB2-b-6	25.36344	80.31065	BB4-b-6	25.27476	80.39350
BB2-b-7	25.36159	80.31196	BB4-b-7	25.27293	80.39482
BB2-b-8	25.35886	80.31391	BB4-b-8	25.27068	80.39641

Table 5.2-2. Categories of Submerged Aquatic Vegetation Scored Using Braun-Blanquet Cover Abundance Index Method at Each Ecological Sampling Point for Reporting Period Fall 2018 to Spring 2019.

Totals	Algae	Seagrasses	Calcareous Algae	Fleshy Green Algae	Corals/ Sponges[1]
Total Macrophytes	Total Macroalgae	*Thalassia testudinum*	*Penicillus*	*Batophora/ Dasycladus*	Corals
Total Drift Red	Total Calcareous	*Halodule wrightii*	*Rhipocephalus*	*Anadyomene*	Gorgonians/ Soft Corals
Total Macrophytes Minus Drift Red	Total Green Other (Fleshy)	*Syringodium filiforme*	*Halimeda*	*Caulerpa paspaloides*	Sponges
Total Seagrass	Total Red Other		*Udotea*		
	Total Brown		*Acetabularia*		

Notes:
[1] Presence/absence only

Table 5.2-3. Mean Water Depth, ± One Standard Error, by Transect, Season, and Study Area during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented during the Historical Period of Record [Fall 2010 - Spring 2018]).

Area	Transect	Historical Period of Record		Fall 2018		Spring 2019	
		Min	Max	Mean	± SE	Mean	± SE
BB1	**a**	1.3	1.8	1.4	0.07	1.6	0.05
	b	1.4	2.0	1.6	0.06	1.6	0.04
	Total	**1.4**	**1.9**	**1.5**	**0.04**	**1.6**	**0.04**
BB2	**a**	2.0	2.5	2.1	0.08	2.1	0.06
	b	2.3	2.7	2.6	0.12	2.4	0.13
	Total	**2.2**	**2.6**	**2.4**	**0.10**	**2.3**	**0.09**
BB3	**a**	2.6	3.0	2.7	0.06	2.7	0.05
	b	2.8	3.1	3.0	0.03	2.9	0.06
	Total	**2.7**	**3.0**	**2.8**	**0.03**	**2.8**	**0.03**
BB4	**a**	1.8	2.3	2.0	0.02	2.0	0.04
	b	1.9	2.4	2.1	0.02	2.0	0.03
	Total	**1.8**	**2.3**	**2.1**	**0.02**	**2.0**	**0.02**
All Areas		**2.0**	**2.4**	**2.2**	**0.09**	**2.2**	**0.08**

Key:

m = meter(s)

SE = Standard Error

Table 5.2-4. Substrate Type by Transect, Season, and Study Area during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented during the Historical Period of Record [Fall 2010 - Spring 2018]).

Substrate Type	Historical Period of Record							
	BB1		BB2		BB3		BB4	
	Min	Max	Min	Max	Min	Max	Min	Max
Sandy and Rubble	0%	6%	0%	0%	0%	0%	0%	6%
Sandy and Shell Hash	38%	100%	75%	100%	75%	100%	0%	50%
Sandy, Shell Hash, Rubble	0%	19%	0%	0%	0%	19%	0%	56%
Sandy, Silty, Shell Hash, Rubble	0%	6%	0%	0%	0%	0%	0%	44%
Silty	0%	0%	0%	0%	0%	0%	0%	19%
Silty and Rubble	0%	0%	0%	0%	0%	0%	0%	38%
Silty and Sandy	0%	13%	0%	6%	0%	0%	0%	6%
Silty and Shell Hash	0%	0%	0%	0%	0%	0%	0%	6%
Silty, Sandy, and Shell Hash	0%	44%	0%	6%	0%	13%	0%	44%
Silty, Sandy, Rubble	0%	0%	0%	0%	0%	0%	0%	25%
Silty, Shell Hash, Rubble	0%	0%	0%	0%	0%	0%	0%	31%
Not Recorded	0%	6%	0%	19%	0%	19%	0%	0%

Substrate Type	Fall 2018			
	BB1	BB2	BB3	BB4
	Total	Total	Total	Total
Sandy and Rubble	0%	0%	0%	0%
Sandy and Shell Hash	88%	100%	100%	0%
Sandy, Shell Hash, Rubble	0%	0%	0%	81%
Sandy, Silty, Shell Hash, Rubble	0%	0%	0%	19%
Silty	0%	0%	0%	0%
Silty and Rubble	0%	0%	0%	0%
Silty and Sandy	0%	0%	0%	0%
Silty and Shell Hash	0%	0%	0%	0%
Silty, Sandy, and Shell Hash	13%	0%	0%	0%
Silty, Sandy, Rubble	0%	0%	0%	0%
Silty, Shell Hash, Rubble	0%	0%	0%	0%
Not Recorded	0%	0%	0%	0%

Substrate Type	Spring 2019			
	BB1	BB2	BB3	BB4
	Total	Total	Total	Total
Sandy and Rubble	0%	0%	0%	0%
Sandy and Shell Hash	100%	100%	100%	19%
Sandy, Shell Hash, Rubble	0%	0%	0%	69%
Sandy, Silty, Shell Hash, Rubble	0%	0%	0%	13%
Silty	0%	0%	0%	0%
Silty and Rubble	0%	0%	0%	0%
Silty and Sandy	0%	0%	0%	0%
Silty and Shell Hash	0%	0%	0%	0%
Silty, Sandy, and Shell Hash	0%	0%	0%	0%
Silty, Sandy, Rubble	0%	0%	0%	0%
Silty, Shell Hash, Rubble	0%	0%	0%	0%
Not Recorded	0%	0%	0%	0%

Table 5.2-5. Percent (%) Light Attenuation Based on Readings (µmols/m2/sec) Taken Simultaneously in Air and Water in Half Meter Increments at One Point Along Each Transect during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

Rounded Depth (m)	Historical Period of Record																							
	BB1						BB2						BB3						BB4					
	a		b		Total		a		b		Total		a		b		Total		a		b		Total	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
0.3 (Surface)	2%	34%	-2%	29%	**-2%**	**34%**	0%	33%	2%	28%	**0%**	**33%**	2%	49%	3%	40%	**2%**	**49%**	1%	26%	1%	37%	**1%**	**37%**
0.5	15%	38%	9%	47%	**9%**	**47%**	3%	54%	11%	51%	**3%**	**54%**	38%	38%	*	*	**38%**	**38%**	7%	53%	1%	43%	**1%**	**53%**
1.0	8%	55%	14%	46%	**8%**	**55%**	16%	55%	21%	59%	**16%**	**59%**	12%	52%	14%	79%	**12%**	**79%**	20%	62%	13%	54%	**13%**	**62%**
1.5	44%	54%	24%	51%	**24%**	**54%**	28%	64%	28%	64%	**28%**	**64%**	27%	62%	24%	66%	**24%**	**66%**	28%	67%	23%	64%	**23%**	**67%**
2.0							35%	66%	-25%	74%	**-25%**	**74%**	48%	73%	40%	74%	**40%**	**74%**	66%	66%	80%	80%	**66%**	**80%**
2.5													54%	73%	49%	90%	**49%**	**90%**						

Rounded Depth (m)	Fall 2018											
	BB1			BB2			BB3			BB4		
	a	b	Total	a	b	Total	a	b	Total	a	b	Total
Surface (0.3 m)	10%	5%	**7%**	10%	12%	**11%**	10%	12%	**11%**	14%	12%	**13%**
0.5 m	23%	19%	**21%**	27%	30%	**28%**	*	*	*	37%	36%	**37%**
1.0 m	32%	34%	**34%**	45%	41%	**43%**	41%	26%	**34%**	40%	42%	**41%**
1.5 m				47%	50%	**48%**	52%	50%	**51%**	59%	52%	**54%**
2.0 m					58%	**58%**	66%	65%	**65%**			
2.5 m								68%	**68%**			

Rounded Depth (m)	Spring 2019											
	BB1			BB2			BB3			BB4		
	a	b	Total	a	b	Total	a	b	Total	a	b	Total
0.3 (Surface)	-4%	-7%	**-6%**	-3%	-1%	**-1%**	-1%	-2%	**-1%**	-1%	-11%	**-5%**
0.5	10%	12%	**11%**	19%	20%	**19%**	*	*	*	18%	8%	**13%**
1.0	23%	21%	**22%**	33%	31%	**32%**	21%	20%	**21%**	31%	24%	**29%**
1.5	28%	26%	**27%**	45%	38%	**40%**	36%	31%	**33%**	38%	45%	**40%**
2.0					46%	**46%**	45%	38%	**41%**			
2.5							49%	49%	**49%**			

Key:

m = meter(s).

* Sample depths are based on water depth and taking five readings equally spaced out from 0.3 m below the surface and 0.3m above the bottom. No 0.5 m equivalent depth sampled.

Grayed out areas represent depths deeper than found at the sampling point

Table 5.2-6. Mean Surface Water Quality Variables, ± One Standard Error, by Transect, Season, and Study Area during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

		Historical Period of Record																							
		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Temperature	°C	22.1	31.3	24.0	31.3	**22.1**	**31.3**	23.5	31.0	24.4	31.5	**23.5**	**31.5**	24.9	31.4	25.3	31.8	**24.9**	**31.8**	23.9	31.3	24.4	31.3	**23.9**	**31.3**
Specific Conductance	µS/cm	23,987	60,337	23,712	60,638	**23,712**	**60,638**	36,063	59,863	39,825	59,613	**36,063**	**59,863**	34,800	61,238	37,225	60,825	**34,800**	**61,238**	33,950	60,287	34,688	60,287	**33,950**	**60,287**
Salinity	PSU	14.6	40.6	14.4	40.8	**14.4**	**40.8**	22.8	40.3	25.4	40.1	**22.8**	**40.3**	22.7	41.3	23.5	41.0	**22.7**	**41.3**	21.5	40.0	21.9	40.0	**21.5**	**40.0**
Dissolved Oxygen	mg/L	4.5	7.0	4.6	6.9	**4.5**	**7.0**	4.3	7.1	4.8	7.0	**4.3**	**7.1**	4.7	6.6	4.8	8.0	**4.7**	**8.0**	4.3	6.4	4.5	6.4	**4.3**	**6.4**
pH	-	7.4	8.6	6.8	8.5	**6.8**	**8.6**	7.3	8.5	7.2	8.6	**7.2**	**8.6**	7.2	8.4	7.3	8.3	**7.2**	**8.4**	7.6	8.2	7.4	8.2	**7.4**	**8.2**
Turbidity	NTU	0.0	4.5	0.0	4.5	**0.0**	**4.5**	0.0	1.5	0.0	0.0	**0.0**	**1.5**	0.0	0.9	0.0	0.0	**0.0**	**0.9**	0.0	11.6	0.0	11.6	**0.0**	**11.6**
ORP	mV	14.38	376.88	26.25	357.88	**14.38**	**376.88**	52.13	347.50	20.75	346.00	**20.75**	**347.50**	25.13	354.38	20.75	345.25	**20.75**	**354.38**	46.63	348.75	65.50	348.75	**46.63**	**348.75**

		Fall 2018																							
		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE
Temperature	°C	31.6	0.26	31.4	0.23	**31.5**	**0.17**	31.5	0.16	30.2	0.06	**30.9**	**0.19**	31.1	0.29	30.5	0.06	**30.8**	**0.16**	30.5	0.13	30.9	0.04	**30.7**	**0.08**
Specific Conductance	µS/cm	42,888	176	44,900	288	**43,894**	**307**	46,250	256	46,437	65	**46,344**	**130**	45,425	356	45,413	23	**45,419**	**172**	36,738	543	37,600	204	**37,169**	**302**
Salinity	PSU	27.8	0.12	29.3	0.19	**28.5**	**0.22**	30.2	0.22	30.3	0.05	**30.3**	**0.11**	29.6	0.25	29.6	0.01	**29.6**	**0.12**	23.3	0.39	24.0	0.13	**23.7**	**0.22**
Dissolved Oxygen	mg/L	5.1	0.16	5.1	0.31	**5.1**	**0.17**	5.3	0.27	5.0	0.06	**5.1**	**0.14**	4.7	0.08	5.1	0.03	**4.9**	**0.07**	4.7	0.16	5.6	0.04	**5.2**	**0.14**
pH	-	7.7	0.05	8.0	0.03	**7.8**	**0.05**	7.7	0.12	8.0	0.01	**7.8**	**0.06**	7.8	0.04	8.0	0.00	**7.9**	**0.03**	7.8	0.04	8.0	0.01	**7.9**	**0.02**
Turbidity	NTU	0.5	0.29	0.0	0.00	**0.2**	**0.15**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**
ORP	mV	332.13	13.26	256.50	12.24	**294.31**	**13.09**	261.38	18.13	281.38	15.22	**271.38**	**11.72**	274.13	27.72	264.25	8.02	**269.19**	**14.00**	242.00	19.44	245.00	10.06	**243.50**	**10.58**

		Spring 2019																							
		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE
Temperature	°C	29.7	0.11	29.3	0.08	**29.5**	**0.08**	29.1	0.09	33.4	3.73	**31.3**	**1.89**	29.0	0.06	29.6	0.05	**29.3**	**0.09**	29.0	0.04	29.8	0.03	**29.4**	**0.11**
Specific Conductance	µS/cm	59,375	133	60,000	46	**59,687**	**106**	59,775	49	58,937	78	**59,356**	**117**	59,687	77	60,987	35	**60,337**	**173**	61,950	265	62,612	199	**62,281**	**181**
Salinity	PSU	40.0	0.10	40.5	0.03	**40.2**	**0.08**	40.3	0.03	39.7	0.06	**40.0**	**0.08**	40.2	0.06	41.2	0.03	**40.7**	**0.13**	41.9	0.20	42.5	0.15	**42.2**	**0.14**
Dissolved Oxygen	mg/L	6.0	0.16	4.9	0.04	**5.4**	**0.16**	4.8	0.23	5.6	0.07	**5.2**	**0.16**	5.5	0.02	5.9	0.05	**5.7**	**0.06**	5.2	0.12	5.9	0.07	**5.5**	**0.11**
pH	-	8.0	0.05	8.2	0.01	**8.1**	**0.04**	8.2	0.02	8.2	0.01	**8.2**	**0.01**	8.2	0.00	8.1	0.01	**8.1**	**0.00**	7.9	0.11	8.1	0.02	**8.0**	**0.06**
Turbidity	NTU	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**
ORP	mV	223.00	8.03	255.50	15.73	**239.25**	**9.51**	247.50	14.86	213.88	5.03	**230.69**	**8.73**	260.13	18.83	212.25	4.51	**236.19**	**11.21**	260.25	16.51	238.38	8.47	**249.31**	**9.40**

Notes:
* PSS-78 salinity is unitless.

Key:
°C = Degrees Celcius.
mg/L = Milligram per liter.
µS/cm = Microsiemens per centimeter.
mV = Millivolts.
NTU = Nephelometric turbidity units.
ORP = Oxidation reduction potential.
SE = Standard error.

Table 5.2-7. Mean Bottom Water Quality Variables, ± One Standard Error, by Transect, Season, and Study Area during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

		Historical Period of Record																							
		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Temperature	°C	22.1	31.3	24.0	31.3	**22.1**	**31.3**	23.5	31.0	24.4	31.6	**23.5**	**31.6**	24.8	31.3	25.3	31.8	**24.8**	**31.8**	23.9	31.5	24.4	31.8	**23.9**	**31.8**
Specific Conductance	µS/cm	24,950	60,375	27,712	60,713	**24,950**	**60,713**	39,725	59,950	41,200	59,613	**39,725**	**59,950**	40,025	61,225	41,225	60,838	**40,025**	**61,225**	36,375	60,875	35,387	61,162	**35,387**	**61,162**
Salinity	PSU	15.2	40.6	17.4	40.9	**15.2**	**40.9**	25.3	40.4	26.3	40.1	**25.3**	**40.4**	26.2	41.3	26.3	41.0	**26.2**	**41.3**	23.0	41.3	22.4	41.5	**22.4**	**41.5**
Dissolved Oxygen	mg/L	4.4	6.8	4.6	6.8	**4.4**	**6.8**	4.1	6.9	4.8	6.7	**4.1**	**6.9**	4.9	6.5	4.9	6.2	**4.9**	**6.5**	4.1	6.2	4.8	6.4	**4.1**	**6.4**
pH	-	7.6	8.6	6.9	8.6	**6.9**	**8.6**	7.6	8.5	7.7	8.6	**7.6**	**8.6**	7.7	8.4	7.7	8.4	**7.7**	**8.4**	7.6	8.2	7.7	8.2	**7.6**	**8.2**
Turbidity	NTU	0.0	3.9	0.0	4.9	**0.0**	**4.9**	0.0	0.1	0.0	0.0	**0.0**	**0.1**	0.0	1.4	0.0	0.0	**0.0**	**1.4**	0.0	10.1	0.0	5.1	**0.0**	**10.1**
ORP	mV	12.13	368.00	23.75	346.50	**12.13**	**368.00**	41.75	339.88	13.13	334.38	**13.13**	**339.88**	26.38	345.75	30.38	333.0	**26.38**	**345.75**	51.38	338.25	59.38	354.13	**51.38**	**354.13**

		Fall 2018																							
		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE
Temperature	°C	31.6	0.26	31.5	0.19	**31.5**	**0.15**	31.6	0.14	30.2	0.06	**30.9**	**0.19**	30.9	0.21	30.5	0.06	**30.7**	**0.12**	30.9	0.14	31.0	0.10	**31.0**	**0.08**
Specific Conductance	µS/cm	42,862	194	45,450	392	**44,156**	**395**	46,787	169	46,487	74	**46,637**	**97**	46,075	219	45,213	261	**45,644**	**199**	38,200	132	38,200	60	**38,200**	**70**
Salinity	PSU	27.8	0.12	29.7	0.27	**28.7**	**0.28**	30.6	0.11	30.4	0.06	**30.5**	**0.07**	30.1	0.17	29.6	0.02	**29.9**	**0.10**	24.4	0.06	24.5	0.04	**24.4**	**0.04**
Dissolved Oxygen	mg/L	4.9	0.16	5.1	0.34	**5.0**	**0.18**	5.5	0.29	4.8	0.08	**5.1**	**0.17**	4.6	0.06	5.1	0.06	**4.9**	**0.08**	4.1	0.12	5.6	0.18	**4.8**	**0.22**
pH	-	7.9	0.01	8.1	0.03	**8.0**	**0.02**	7.9	0.04	8.0	0.01	**8.0**	**0.02**	7.9	0.02	8.0	0.00	**8.0**	**0.02**	7.9	0.01	8.0	0.02	**7.9**	**0.02**
Turbidity	NTU	0.7	0.43	0.0	0.00	**0.4**	**0.23**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**
ORP	mV	319.25	14.37	255.50	11.87	**287.38**	**12.20**	259.50	16.70	283.00	14.11	**271.25**	**10.99**	271.88	25.39	261.88	7.54	**266.88**	**12.86**	242.25	19.01	251.13	8.59	**246.69**	**10.14**

		Spring 2019																							
		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE	Mean	± SE
Temperature	°C	29.7	0.12	29.3	0.08	**29.5**	**0.08**	29.1	0.09	29.7	0.03	**29.4**	**0.09**	29.0	0.06	29.6	0.05	**29.3**	**0.08**	29.0	0.04	27.3	2.49	**28.1**	**1.22**
Specific Conductance	µS/cm	59,375	122	59,987	44	**59,681**	**101**	59,775	49	58,912	81	**59,344**	**120**	59,675	75	60,700	259	**60,188**	**186**	61,912	261	62,590	184	**62,251**	**177**
Salinity	PSU	40.0	0.10	40.6	0.11	**40.3**	**0.10**	40.3	0.02	39.7	0.06	**40.0**	**0.09**	40.2	0.06	41.2	0.03	**40.7**	**0.14**	41.9	0.20	42.5	0.15	**42.2**	**0.14**
Dissolved Oxygen	mg/L	6.1	0.11	4.8	0.04	**5.5**	**0.18**	4.8	0.23	5.7	0.07	**5.3**	**0.16**	5.5	0.04	5.9	0.05	**5.7**	**0.06**	5.1	0.14	5.9	0.09	**5.5**	**0.13**
pH	-	8.1	0.02	8.2	0.01	**8.2**	**0.02**	8.2	0.01	8.2	0.01	**8.2**	**0.01**	8.2	0.00	8.2	0.00	**8.2**	**0.00**	8.0	0.04	8.1	0.01	**8.1**	**0.02**
Turbidity	NTU	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**	0.0	0.00	0.0	0.00	**0.0**	**0.00**
ORP	mV	220.00	7.48	257.00	15.48	**238.50**	**9.58**	247.63	14.28	215.88	4.98	**231.75**	**8.38**	260.63	18.55	213.75	4.35	**237.19**	**11.02**	256.75	14.64	240.38	8.03	**248.56**	**8.34**

Notes:
* PSS-78 salinity is unitless.
Key:
°C = Degrees Celcius.
mg/L = Milligram per liter.
µS/cm = Microsiemens per centimeter.
mV = Millivolts.
NTU = Nephelometric turbidity units.
ORP = Oxidation reduction potential.
SE = Standard error.

Table 5.2-8. Comparison of Mean Porewater and Bottom Water Column Temperatures, Salinity, and Specific Conductance by Transect, Season, and Study Area during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

Historical Period of Record — BB1

		a				b				Area			
		Porewater		Bottom		Porewater		Bottom		Porewater		Bottom	
Parameter	Units	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Temperature	°C	24.7	30.9	22.1	31.3	24.4	30.8	24.0	31.3	24.4	30.9	22.1	31.3
Specific Conductance	µS/cm	42,750	58,362	24,950	60,375	43,200	59,775	27,713	60,713	42,750	59,775	24,950	60,713
Salinity	PSS	27.6	39.3	15.2	40.6	27.8	40.2	17.4	40.9	27.6	40.2	15.2	40.9

Historical Period of Record — BB2

		a				b				Area			
		Porewater		Bottom		Porewater		Bottom		Porewater		Bottom	
Parameter	Units	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Temperature	°C	24.3	31.0	23.5	31.0	24.7	31.0	24.4	31.6	24.3	31.0	23.5	31.6
Specific Conductance	µS/cm	45,612	58,600	39,725	59,950	46,125	58,213	41,200	59,613	45,612	58,600	39,725	59,950
Salinity	PSS	29.7	39.4	25.3	40.4	30.0	39.1	26.3	40.1	29.7	39.4	25.3	40.4

Historical Period of Record — BB3

		a				b				Area			
		Porewater		Bottom		Porewater		Bottom		Porewater		Bottom	
Parameter	Units	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Temperature	°C	24.8	30.9	24.8	31.3	24.8	30.8	25.3	31.8	24.8	30.9	24.8	31.8
Specific Conductance	µS/cm	44,175	56,875	40,025	61,225	48,412	58,088	41,225	60,838	44,175	58,088	40,025	61,225
Salinity	PSS	28.3	38.0	26.2	41.3	31.6	39.0	26.3	41.0	28.3	39.0	26.2	41.3

Historical Period of Record — BB4

		a				b				Area			
		Porewater		Bottom		Porewater		Bottom		Porewater		Bottom	
Parameter	Units	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Temperature	°C	24.9	31.3	23.9	31.5	24.9	32.3	24.4	31.8	24.9	32.3	23.9	31.8
Specific Conductance	µS/cm	40,700	57,925	36,375	60,875	43,575	57,888	35,388	61,162	40,700	57,925	35,388	61,162
Salinity	PSS	26.1	39.0	23.0	41.3	28.2	41.5	22.4	41.5	26.1	41.5	22.4	41.5

Fall 2018

		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom
Temperature	°C	30.9	31.6	30.9	31.4	30.9	31.5	30.9	31.6	30.4	30.2	30.7	30.9	30.7	30.9	30.6	30.5	30.6	30.7	31.0	30.9	30.8	31.0	30.9	31.0
Specific Conductance	µS/cm	46,800	42,862	45,878	45,633	46,312	44,329	49,575	46,787	48,175	46,487	48,875	46,637	50,400	46,075	50,012	45,213	50,206	45,644	45,550	38,200	45,238	38,200	45,394	38,200
Salinity	PSS	30.5	27.8	30.0	29.8	30.3	28.9	32.7	30.6	31.6	30.4	32.2	30.5	33.3	30.1	33.0	29.6	33.2	29.9	29.6	24.4	29.5	24.5	29.5	24.4

Spring 2019

		BB1						BB2						BB3						BB4					
		a		b		Area		a		b		Area		a		b		Area		a		b		Area	
Parameter	Units	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom	Porewater	Bottom
Temperature	°C	28.5	29.7	28.8	29.3	28.7	29.5	28.8	29.1	28.7	29.7	28.8	29.4	*	29.0	*	29.6	*	29.3	28.3	29.0	28.2	27.3	28.3	28.1
Specific Conductance	µS/cm	56,225	59,375	57,438	59,987	56,831	59,681	58,075	59,775	56,813	58,912	57,444	59,344	57,425	59,675	58,887	60,700	58,156	60,188	55,750	61,912	58,537	62,590	57,144	62,251
Salinity	PSS	37.7	40.0	38.5	40.6	38.1	40.3	38.4	40.3	38.1	39.7	38.2	40.0	38.4	40.2	39.6	41.2	39.0	40.7	37.2	41.9	39.3	42.5	38.2	42.2

Notes:
* PSS-78 salinity is unitless.

Key:
°C = Degrees Celcius.
µS/cm = Microsiemens per centimeter.

Table 5.2-9. Porewater Nutrient Concentrations by Transect, Season, and Study Area during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

		Historical Period of Record											
		BB1			BB2			BB3			BB4		
		a	b	Area	a	b	Area	a	b	Area	a	b	Area
Parameter	Units	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range
Sodium	(mg/L)	6,200 - 13,000	6,100 - 11,900	6,100 - 11,900	8,300 - 11,900	9,000 - 11,800	8,300 - 11,900	8,600 - 12,100	9,100 - 12,200	8,600 - 12,200	6,700 - 13,100	7,000 - 13,100	6,700 - 13,100
Chloride	(mg/L)	12,200 - 23,300	11,800 - 23,800	11,800 - 23,800	16,600 - 39,300	17,300 - 22,900	16,600 - 39,300	17,000 - 25,000	17,800 - 26,500	17,000 - 26,500	13,000 - 23,200	14,300 - 25,000	13,000 - 25,000
Nitrate/ Nitrite	(mg/L) as N	0.005 - 0.500	0.005 - 0.500	0.005 - 0.500	0.005 - 0.500	0.005 - 0.786	0.005 - 0.786	0.005 - 0.500	0.005 - 0.500	0.005 - 0.500	0.005 - 0.500	0.005 - 0.500	0.005 - 0.500
Unionized Ammonia	mg/L	0.000017 - 0.0224	0.000017 - 0.0223	0.000017 - 0.0224	0.000017 - 0.0241	0.000017- 0.0116	0.000017 - 0.0241	0.000017 - 0.0216	0.000017 - 0.0388	0.000017 - 0.0388	0.0011 - 0.0191	0.000017 - 0.0185	0.000017 - 0.0191
Total Kjeldahl Nitrogen	(mg/L)	0.1500 - 1.1500	0.1500 - 8.8000	0.1500 - 8.8000	0.1500 - 1.1500	0.1500 - 2.600	0.1500 - 2.6000	0.2000 - 1.1500	0.1500 - 1.6600	0.1500 - 1.6600	0.4600 - 15.100	0.2000 - 8.1600	0.2000 - 15.1000
ortho-Phosphate	(mg/L)	0.0014 - 0.0181	0.0014 - 0.0118	0.0014 - 0.0181	0.0014 - 0.1960	0.0014 - 0.0288	0.0014 - 0.1960	0.0014 - 0.0262	0.0014 - 0.0342	0.0014 - 0.0342	0.0014 - 0.0093	0.0014 - 0.0093	0.0014 - 0.0093
Phosphorus	(mg/L)	0.0022 - 0.0150	0.0022 - 0.0941	0.0022 - 0.0941	0.0022 - 0.0220	0.0022 - 0.0420	0.0022 - 0.0420	0.0022 - 0.0233	0.0022 - 0.0416	0.0022 - 0.0416	0.0022 - 0.1400	0.0003 - 0.1790	0.0003 - 0.1790
Tritium	pCi/L (1σ)	0.30 - 25.10	-2.50 - 25.80	-2.50 - 25.80	-6.50 - 19.30	-4.90 - 18.30	6.50 - 19.30	-0.90 - 21.60	-2.00 - 27.20	-2.00 - 27.20	-2.10 - 19.50	-0.40 - 19.50	-2.10 - 19.50

		Fall 2018																							
		BB1						BB2						BB3						BB4					
		a		b		Area Mean		a		b		Area Mean		a		b		Area Mean		a		b		Area Mean	
Parameter	Units	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier
Sodium	(mg/L)	9,610		10,300		9,955		10,900		10,300		10,600		10,400		9,640		10,020		8,930		9,360		9,145	
Chloride	(mg/L)	17,100		18,700		17,900		19,600		18,500		19,050		19,300		18,100		18,700		17,500		1,730		9,615	
Nitrate/ Nitrite	(mg/L) as N	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J	0.014	U J
Unionized Ammonia	mg/L	0.00596	J	0.00655	J	0.00626	J	0.00098	I J	0.00085	I J	0.00092	I J	0.00076	I J	0.00625	J	0.00350	J I	0.00573	J	0.00103	I J	0.00338	I J
Total Kjeldahl Nitrogen	(mg/L)	0.9230		1.0000		0.9615		0.6480		0.8160		0.7320		0.7460		1.1900		0.9680		2.2200		1.2200		1.7200	
ortho-Phosphate	(mg/L)	0.0100	U	0.0100	U	0.0100	U J	0.0115	I J	0.0100	U	0.0108	I U J	0.0100	U J	0.0100	U J	0.0100	U J	0.0500	U J	0.0100	U J	0.0300	U J
Phosphorus	(mg/L)	0.0090	U	0.0090	U	0.0090	U J	0.0090	U J	0.0090	U	0.0090	U J	0.0090	U	0.0090	U	0.0090	U	0.0298	J	0.0090	U	0.0194	U J
Tritium	pCi/L (1σ)	28.20		10.30	J	19.25	J	12.10	J	-6.40	U J	2.85	J U	-1.30	U J	2.10	U J	0.40	U J	2.20	U J	7.00	J	4.60	U J

		Spring 2019																							
		BB1						BB2						BB3						BB4					
		a		b		Area Mean		a		b		Area Mean		a		b		Area Mean		a		b		Area Mean	
Parameter	Units	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier	Value	Quali-fier
Sodium	(mg/L)	12,300		12,100		12,200		127,000		11,800		69,400		12,600		12,200		12,400		12,800		12,000		12,400	
Chloride	(mg/L)	24,400		23,800		24,100		23,400		22,800		23,100		23,900		23,500		23,700		24,500		22,700		23,600	
Nitrate/ Nitrite	(mg/L) as N	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U	0.014	U
Unionized Ammonia	mg/L	0.00425		0.00814		0.00620		0.00261		0.00040	U	0.00151	U	0.00327		0.00051	I	0.00189	I	0.00945		0.00186		0.00566	
Total Kjeldahl Nitrogen	(mg/L)	0.9920		1.0100		1.0010		0.9180		0.9440		0.9310		1.1300		0.8800		1.0050		1.0900		1.0800		1.0850	
ortho-Phosphate	(mg/L)	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.0100	U	0.1000	U	0.0550	U
Phosphorus	(mg/L)	0.0050	U	0.0050	U	0.0050	U	0.0050	U	0.0050	U	0.0050	U	0.0072	U	0.0050	U	0.0061	U	0.0050	U	0.0050	U	0.0050	U
Tritium	pCi/L (1σ)	9.63		7.14		8.39		6.53		9.18		7.86		10.72		7.97		9.35		5.44		9.57		7.51	

Key:
°C = Degrees Celcius.
I = Value between the MDL and PQL.
J = Estimated (+/- indicate bias).
mg/L = Milligrams per liter.
N = Nitrogen.
U = Analyzed for but not detected at the reported value.

Table 5.2-10. Percentage (%) of Quadrats Along Each Transect (n=32) Containing *Thalassia testudinum* (TT) and/or *Halodule wrightii* (HW) by Study Area (n=64) and Season during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

Area	Transect	Historical Period of Record				Fall 2018		Spring 2019	
		TT[1]		HW[2]					
		Min	Max	Min	Max	TT	HW	TT	HW
BB1	a	88%	100%	3%	47%	88%	25%	94%	34%
	b	84%	100%	0%	72%	97%	38%	88%	30%
	Total	**84%**	**100%**	**0%**	**72%**	**92%**	**31%**	**91%**	**32%**
BB2	a	9%	78%	25%	50%	25%	38%	34%	28%
	b	31%	72%	3%	38%	34%	13%	38%	6%
	Total	**9%**	**78%**	**3%**	**50%**	**30%**	**25%**	**36%**	**17%**
BB3	a	72%	94%	0%	22%	78%	19%	78%	19%
	b	63%	84%	0%	16%	66%	0%	59%	0%
	Total	**63%**	**94%**	**0%**	**22%**	**72%**	**9%**	**69%**	**9%**
BB4	a	84%	100%	0%	13%	84%	9%	81%	6%
	b	59%	91%	0%	19%	63%	3%	75%	0%
	Total	**59%**	**100%**	**0%**	**19%**	**73%**	**6%**	**78%**	**3%**

Table 5.2-11. Mean Hardbottom Depth (cm), ± One Standard Error (SE), by Transect, Season, and Study Area During Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented during the Historical Period of Record [Fall 2013 - Spring 2018]).

Area	Transect	Historical Period of Record*		Fall 2018		Spring 2019	
		Min	Max	Mean	± SE	Mean	± SE
BB1	a	16.8	28.4	26.8	4.73	25.2	4.48
	b	8.5	17.9	9.6	1.61	9.4	1.65
	Total	12.9	21.1	18.2	2.71	17.3	2.57
BB2	a	4.2	10.6	6.3	1.32	5.2	0.91
	b	8.6	12.8	11.1	3.29	10.9	2.70
	Total	6.7	11.2	8.7	1.79	8.1	1.46
BB3	a	7.9	16.6	12.3	2.76	13.8	2.57
	b	4.8	12.8	7.7	0.82	5.3	0.65
	Total	7.3	12.9	10.0	1.46	9.6	1.42
BB4	a	6.4	16.1	6.7	1.16	8.1	1.26
	b	4.5	12.7	5.8	1.42	5.1	1.01
	Total	6.2	14.4	6.2	1.29	6.6	0.82
All Areas		9.0	14.8	10.8	0.95	10.4	0.88

Key:

m = meter(s)
SE = Standard Error

Notes:

* Depth to hardbottom data for the four corners and center of each quadrat was first collected in the Fall 2017 event. Previously (spring 2013 through fall 2016) a diver probed the four corners and center and recorded the estimated average depth to hardbottom. The individual corner/center measurements for each quadrat were not recorded.

Table 5.2-12. Percentage (%) of Sampling Points within Each Study Area (n=16) Having Specific Bottom Conditions during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

Category	Coverage / Presence	BB1				BB2				BB3				BB4			
		Historical Period		Fall 2018	Spring 2019	Historical Period		Fall 2018	Spring 2019	Historical Period		Fall 2018	Spring 2019	Historical Period		Fall 2018	Spring 2019
		Min	Max			Min	Max			Min	Max			Min	Max		
Overall	Open	0%	0%	0%	0%	0%	31%	38%	0%	0%	13%	0%	0%	0%	6%	0%	0%
	Fairly Open	6%	75%	19%	56%	38%	81%	56%	88%	19%	69%	31%	13%	31%	94%	44%	13%
	Moderately Open	6%	69%	50%	19%	6%	44%	6%	0%	6%	69%	38%	44%	0%	56%	19%	25%
	Mostly Covered	6%	38%	31%	25%	0%	25%	0%	13%	0%	63%	31%	44%	0%	25%	38%	63%
	Uniform	0%	19%	0%	0%	0%	25%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%
Seagrass	Sparse	25%	81%	75%	69%	75%	94%	88%	75%	44%	94%	50%	63%	69%	100%	81%	75%
	Sparse to Moderate	6%	63%	19%	25%	6%	25%	6%	19%	6%	56%	50%	38%	0%	31%	19%	25%
	Moderate	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Moderate to Dense	0%	19%	6%	6%	0%	6%	6%	6%	0%	19%	0%	0%	0%	0%	0%	0%
Drift Algae	Sparse	44%	100%	94%	31%	0%	100%	69%	50%	13%	100%	81%	31%	0%	100%	13%	6%
	Sparse to Moderate	0%	50%	6%	69%	0%	69%	25%	44%	0%	63%	19%	44%	0%	69%	63%	38%
	Moderate	0%	0%	0%	0%	0%	6%	6%	6%	0%	0%	0%	0%	0%	0%	0%	0%
	Moderate to Dense	0%	13%	0%	0%	0%	25%	6%	6%	0%	38%	0%	25%	0%	50%	25%	56%
	None	0%	31%	0%	0%	0%	100%	0%	0%	0%	88%	0%	0%	0%	100%	0%	0%
Batophora	Sparse	0%	81%	0%	50%	0%	94%	25%	44%	19%	100%	13%	88%	6%	100%	13%	75%
	Sparse to Moderate	19%	88%	69%	44%	6%	81%	75%	56%	0%	69%	50%	13%	0%	75%	75%	25%
	Moderate	0%	6%	0%	0%	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Moderate to Dense	0%	38%	31%	0%	0%	38%	0%	0%	0%	25%	38%	0%	0%	31%	13%	0%
	None	0%	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Calcareous Algae	None	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	Few	0%	81%	6%	0%	0%	38%	0%	0%	0%	19%	0%	0%	0%	6%	0%	0%
	Many	19%	100%	94%	100%	63%	100%	100%	100%	81%	100%	100%	100%	94%	100%	100%	100%
Sponges	None	0%	6%	0%	0%	0%	6%	0%	0%	0%	0%	0%	0%	0%	13%	0%	0%
	Few	19%	88%	44%	19%	0%	25%	0%	6%	0%	56%	0%	0%	6%	69%	6%	6%
	Many	6%	81%	56%	81%	69%	100%	100%	94%	44%	100%	100%	100%	25%	94%	94%	94%
Corals	None	13%	69%	13%	38%	0%	19%	0%	0%	0%	25%	0%	0%	0%	19%	0%	0%
	Few	31%	69%	69%	44%	6%	50%	19%	31%	19%	56%	13%	38%	6%	63%	6%	19%
	Many	0%	38%	19%	19%	38%	81%	81%	69%	38%	81%	88%	63%	31%	94%	94%	81%
Gorgonians	None	100%	100%	100%	100%	19%	31%	25%	25%	13%	50%	19%	13%	69%	100%	100%	100%
	Few	0%	0%	0%	0%	0%	13%	6%	13%	6%	50%	19%	25%	0%	31%	0%	0%
	Many	0%	0%	0%	0%	63%	81%	69%	63%	31%	75%	63%	63%	0%	0%	0%	0%

Table 5.2-13. Mean Braun-Blanquet Coverage Abundance (BBCA) Scores, ± One Standard Error, for Total Macrophyte Coverage (Excluding Drift Red Algae), Total Seagrass, and Total Macroalgae, by Transect and Study Area during Fall 2018 and Spring 2019. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2018]).

Area	Transect	Total Macrophytes[1]						Total Seagrass[2]						Total Macroalgae					
		Historical Period of Record		Fall 2018		Spring 2019		Historical Period of Record		Fall 2018		Spring 2019		Historical Period of Record		Fall 2018		Spring 2019	
		Min	Max	Mean	SE	Mean	SE	Min	Max	Mean	SE	Mean	SE	Min	Max	Mean	SE	Mean	SE
BB1	a	0.0	2.7	2.6	0.32	1.8	0.17	1.1	1.8	1.3	0.18	1.3	0.23	1.0	2.2	2.3	0.33	1.5	0.15
	b	0.1	2.6	2.3	0.12	1.8	0.14	0.8	1.6	1.0	0.04	1.0	0.16	1.0	2.5	2.3	0.12	1.6	0.15
	Total	**0.0**	**2.7**	**2.4**	**0.17**	**1.8**	**0.11**	**1.1**	**1.5**	**1.1**	**0.10**	**1.1**	**0.14**	**1.0**	**2.4**	**2.3**	**0.17**	**1.6**	**0.10**
BB2	a	0.0	3.3	1.6	0.31	1.5	0.21	0.4	1.1	0.4	0.16	0.4	0.11	1.2	3.3	1.6	0.31	1.5	0.21
	b	0.0	2.8	1.6	0.21	1.6	0.26	0.4	0.9	0.5	0.24	0.5	0.27	1.1	2.8	1.5	0.17	1.5	0.22
	Total	**0.0**	**3.0**	**1.6**	**0.18**	**1.5**	**0.16**	**0.4**	**1.0**	**0.4**	**0.14**	**0.4**	**0.14**	**1.2**	**3.0**	**1.6**	**0.17**	**1.5**	**0.15**
BB3	a	0.0	2.5	2.6	0.37	2.6	0.31	0.8	1.8	0.9	0.22	1.1	0.26	1.1	2.3	2.6	0.40	2.4	0.34
	b	0.0	2.4	1.9	0.18	2.1	0.23	0.6	1.1	0.6	0.17	0.5	0.15	1.1	2.4	1.9	0.19	2.1	0.23
	Total	**0.0**	**2.5**	**2.3**	**0.22**	**2.4**	**0.19**	**0.7**	**1.2**	**0.8**	**0.14**	**0.8**	**0.16**	**1.1**	**2.3**	**2.2**	**0.23**	**2.3**	**0.20**
BB4	a	0.0	2.6	2.3	0.10	1.8	0.14	0.8	1.3	0.9	0.11	0.9	0.09	1.1	2.6	2.3	0.10	1.8	0.15
	b	0.0	2.5	2.0	0.17	1.8	0.17	0.5	1.0	0.6	0.12	0.8	0.17	1.1	2.8	1.9	0.22	1.7	0.20
	Total	**0.0**	**2.5**	**2.2**	**0.11**	**1.8**	**0.11**	**0.8**	**1.1**	**0.8**	**0.09**	**0.9**	**0.09**	**1.2**	**2.7**	**2.1**	**0.13**	**1.8**	**0.12**

[1] Total macrophyte cover after drift red algae has been removed from the quadrat

[2] Total seagrass cover for all seagrass species combined

[3] Total macroalgae cover for all attached red, brown, calcareous, and fleshy green algaes combined

Notes:

BBCA score <1 represents total coverage less than 5%

BBCA score >1 to 2 represents total coverage between 5% and 25%

BBCA score >2 to 3 represents total coverage between 25% and 50%

Table 5.2-14. Seagrass Leaf Nutrient Concentrations during Reporting Period Fall 2018. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Fall 2017[1]]).

Method		353.2 & 351.2				365.4				U of M				U of M			U of M		
Parameter		Total Nitrogen				Total Phosphorus				Total Carbon				d13C			d16N		
Sample Period		Historical Period of Record		Fall 2018		Historical Period of Record [1]		Fall 2018		Historical Period of Record		Fall 2018		Historical Period of Record		Fall 2018	Historical Period of Record		Fall 2018
Area	Transect	Min wt (%)	Max wt (%)	wt (%)	mg/kg	Min wt (%)	Max wt (%)	wt (%)	mg/kg	Min wt (%)	Max wt (%)	wt (%)	mg/kg	Min (‰)	Max (‰)	‰	Min (‰)	Max (‰)	‰
BB1	a	1.85	2.82	1.99	19900	0.047	0.064	0.072	717.5	26.40	45.80	34.45	344450	-12.99	-8.60	-10.31	4.70	7.11	4.97
	b	1.74	2.77	1.90	18950	0.026	0.059	0.061	612.0	26.25	43.52	34.86	348550	-12.19	-8.00	-9.37	3.40	5.71	3.79
	Total	**1.80**	**2.80**	**1.94**	**19425**	**0.036**	**0.062**	**0.066**	**664.8**	**26.33**	**44.66**	**34.65**	**346500**	**-12.59**	**-8.30**	**-9.84**	**4.05**	**6.41**	**4.38**
BB2	a	1.80	2.54	1.82	18150	0.047	0.064	0.064	644.5	25.80	42.40	34.23	342250	-11.15	-7.50	-9.03	0.56	4.40	2.00
	b	1.70	2.69	1.72	17200	0.054	0.062	0.065	651.0	27.60	43.47	33.04	330400	-11.00	-8.40	-10.47	2.34	3.80	3.03
	Total	**1.75**	**2.62**	**1.77**	**17675**	**0.051**	**0.063**	**0.065**	**647.8**	**26.70**	**42.94**	**33.63**	**336325**	**-11.07**	**-7.95**	**-9.75**	**1.45**	**4.10**	**2.51**
BB3	a	1.77	5.14	1.77	17700	0.041	0.069	0.061	609.5	27.45	94.86	33.83	338300	-11.91	-8.90	-11.46	3.00	5.04	3.93
	b	1.67	5.23	1.67	16650	0.036	0.064	0.057	566.5	27.10	91.24	33.48	334800	-11.47	-8.60	-11.57	3.00	5.14	4.17
	Total	**1.72**	**5.19**	**1.72**	**17175**	**0.039**	**0.067**	**0.059**	**588.0**	**27.28**	**93.05**	**33.66**	**336550**	**-11.69**	**-8.75**	**-11.52**	**3.00**	**5.09**	**4.05**
BB4	a	1.72	2.46	1.84	18400	0.038	0.084	0.061	613.5	28.95	43.77	33.89	338850	-12.46	-10.10	-11.80	3.10	5.67	3.56
	b	1.68	2.48	2.06	20550	0.040	0.073	0.063	628.5	26.95	44.69	36.02	360150	-12.15	-9.10	-10.84	3.00	5.60	3.98
	Total	**1.70**	**2.47**	**1.95**	**19475**	**0.039**	**0.078**	**0.062**	**621.0**	**27.95**	**44.23**	**34.95**	**349500**	**-12.30**	**-9.60**	**-11.32**	**3.05**	**5.63**	**3.77**

Notes:
[1]Total Phosphorus in the Historical Period Record minimum and maximum values only include data from Fall 2010, Fall 2013, Fall 2015, Fall 2016 and Fall 2017 sampling.
Methods 353.2, 351.2 and 365.4 refer to the corresponding EPA methods.
Key:
‰ = Parts per mille
wt% = Percent weight
mg/kg = Milligrams per kilogram
U of M = University of Miami

Table 5.2-15. Comparison of Seagrass Leaf Nutrient Molar Ratios during Reporting Period Fall 2018. (For Comparative Purposes, Minimum and Maximum Values are Also Presented for the Historical Period of Record [Fall 2010 - Spring 2017]).

Area	Transect	C:N (molar)			C:P (molar)			N:P (molar)		
		Historical Period of Record		Fall 2018	Historical Period of Record		Fall 2018	Historical Period of Record		Fall 2018
		Min	Max		Min	Max		Min	Max	
BB1	a	16.2	20.5	20.2	1,246.8	1,983.2	1,238.1	73.8	96.4	61.3
	b	15.8	21.5	21.5	1,238.5	3182.3	1,473.4	73.0	168.4	68.6
	Total	**16.0**	**21.0**	**20.8**	**1,242.7**	**2582.8**	**1,355.8**	**73.4**	**132.4**	**65.0**
BB2	a	16.7	24.4	22.1	1,082.9	2,200.3	1,369.8	61.8	109.5	62.3
	b	15.9	23.1	22.4	1,148.5	1,963.5	1,312.1	65.6	99.4	58.5
	Total	**16.3**	**23.7**	**22.3**	**1,115.7**	**2,081.9**	**1,341.0**	**63.7**	**104.5**	**60.4**
BB3	a	17.0	24.0	22.3	1,053.6	3,695.7	1,477.4	57.8	174.6	66.0
	b	16.9	24.0	23.6	1130.6	4,325.0	1,534.3	57.6	206.8	65.0
	Total	**16.9**	**24.0**	**23.0**	**1,092.1**	**4,010.4**	**1,505.9**	**57.7**	**190.7**	**65.5**
BB4	a	15.4	24.6	21.5	989.8	2,819.1	1,425.4	60.2	132.1	66.3
	b	15.8	23.7	20.5	1,080.6	2,690.8	1,476.7	64.7	128.1	72.2
	Total	**15.6**	**24.1**	**21.0**	**1,035.2**	**2,755.0**	**1,451.1**	**62.4**	**130.1**	**69.2**

Notes:

[1] Seagrass leaves for nutrient analysis are only collected during the fall sampling period.

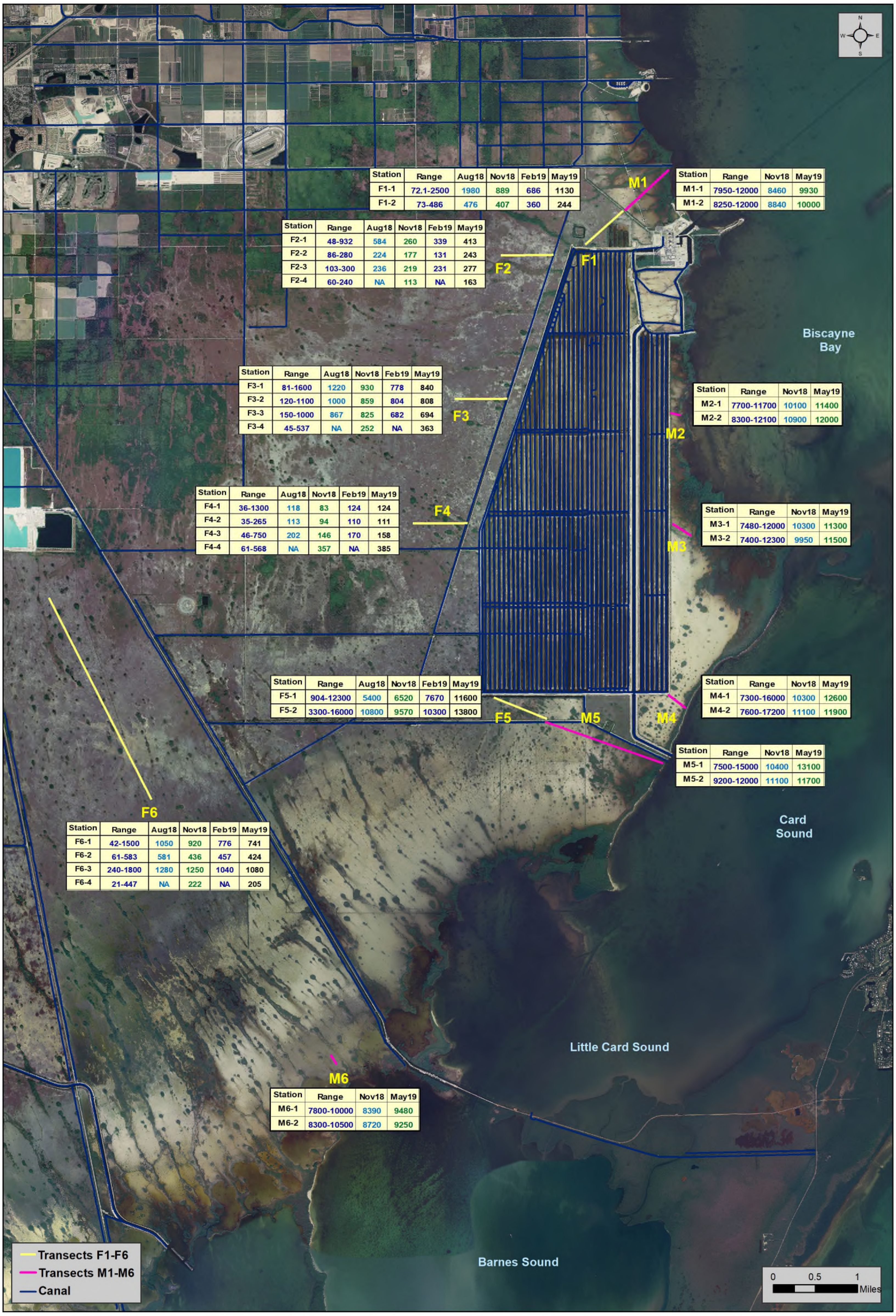
Key:

C = Carbon

N = Nitrogen

P = Phosphorus

FIGURES



Station	Range	Aug18	Nov18	Feb19	May19
F1-1	72.1-2500	1980	889	686	1130
F1-2	73-486	476	407	360	244

Station	Range	Nov18	May19
M1-1	7950-12000	8460	9930
M1-2	8250-12000	8840	10000

Station	Range	Aug18	Nov18	Feb19	May19
F2-1	48-932	584	260	339	413
F2-2	86-280	224	177	131	243
F2-3	103-300	236	219	231	277
F2-4	60-240	NA	113	NA	163

Station	Range	Aug18	Nov18	Feb19	May19
F3-1	81-1600	1220	930	778	840
F3-2	120-1100	1000	859	804	808
F3-3	150-1000	867	825	682	694
F3-4	45-537	NA	252	NA	363

Station	Range	Nov18	May19
M2-1	7700-11700	10100	11400
M2-2	8300-12100	10900	12000

Station	Range	Aug18	Nov18	Feb19	May19
F4-1	36-1300	118	83	124	124
F4-2	35-265	113	94	110	111
F4-3	46-750	202	146	170	158
F4-4	61-568	NA	357	NA	385

Station	Range	Nov18	May19
M3-1	7480-12000	10300	11300
M3-2	7400-12300	9950	11500

Station	Range	Aug18	Nov18	Feb19	May19
F5-1	904-12300	5400	6520	7670	11600
F5-2	3300-16000	10800	9570	10300	13800

Station	Range	Nov18	May19
M4-1	7300-16000	10300	12600
M4-2	7600-17200	11100	11900

Station	Range	Nov18	May19
M5-1	7500-15000	10400	13100
M5-2	9200-12000	11100	11700

Station	Range	Aug18	Nov18	Feb19	May19
F6-1	42-1500	1050	920	776	741
F6-2	61-583	581	436	457	424
F6-3	240-1800	1280	1250	1040	1080
F6-4	21-447	NA	222	NA	205

Station	Range	Nov18	May19
M6-1	7800-10000	8390	9480
M6-2	8300-10500	8720	9250

Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Aug18: August 2018; Nov18: November 2018; Feb19: February 2019; May19: May 2019.
3) NA: Not Available.
4) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.1-1. Reporting Period Porewater Sodium (mg/L) Results with Historical Period of Record Ranges.

Station	Range	Aug18	Nov18	Feb19	May19
F1-1	101-6000	3500	1540	1240	2230
F1-2	107-1010	939	757	700	850

Station	Range	Aug18	Nov18	Feb19	May19
F2-1	78-2050	1130	393	551	689
F2-2	61-629	459	318	229	462
F2-3	120-650	476	422	454	508
F2-4	100-529	NA	129	NA	330

Station	Range	Aug18	Nov18	Feb19	May19
F3-1	170-3640	2520	1770	1490	1610
F3-2	230-2480	2050	1730	1570	1620
F3-3	300-2710	1780	1700	1390	1350
F3-4	66-918	NA	286	NA	612

Station	Range	Aug18	Nov18	Feb19	May19
F4-1	66-3170	175	151	249	273
F4-2	65-574	190	176	202	215
F4-3	78-1670	339	255	271	299
F4-4	94-1480	NA	734	NA	911

Station	Range	Aug18	Nov18	Feb19	May19
F5-1	1650-24900	10300	12300	15500	21400
F5-2	5600-31000	20600	17700	19600	25100

Station	Range	Aug18	Nov18	Feb19	May19
F6-1	54-3250	2630	1950	1570	1630
F6-2	120-1340	1280	930	960	922
F6-3	480-3860	2670	2550	2150	2270
F6-4	35-968	NA	217	NA	332

Station	Range	Nov18	May19
M1-1	15900-22000	15900	18000
M1-2	15000-24000	16500	17400

Station	Range	Nov18	May19
M2-1	15000-22700	18200	20600
M2-2	16000-25000	20000	21900

Station	Range	Nov18	May19
M3-1	15000-26000	19400	20100
M3-2	14000-24300	18900	21100

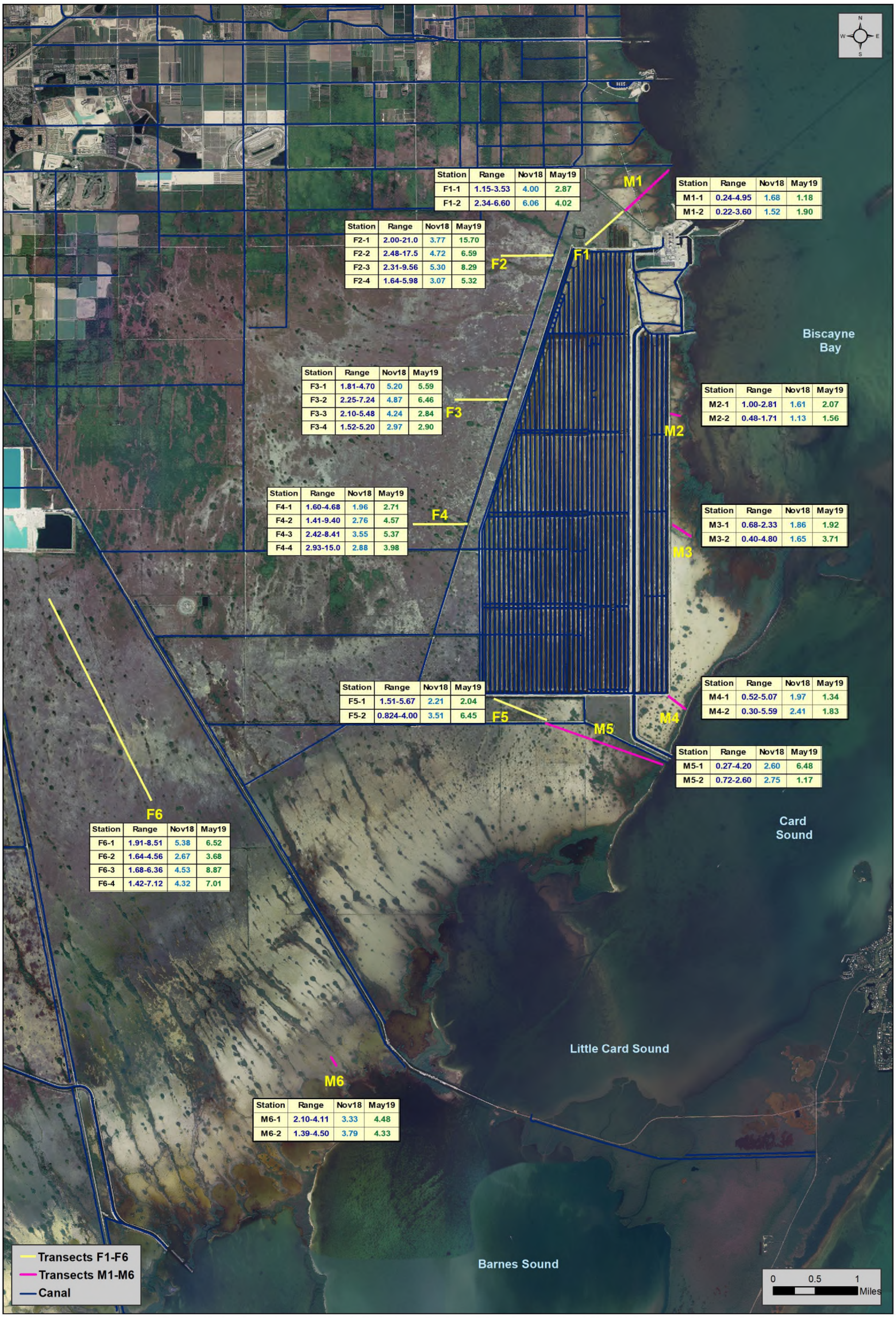
Station	Range	Nov18	May19
M4-1	14000-32000	19000	23600
M4-2	15000-32000	19800	22600

Station	Range	Nov18	May19
M5-1	14000-28200	18900	24100
M5-2	18000-22200	19600	21400

Station	Range	Nov18	May19
M6-1	15000-19000	16100	17400
M6-2	16000-20200	16600	17400

Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Aug18: August 2018; Nov18: November 2018; Feb19: February 2019; May19: May 2019.
3) NA: Not Available.
4) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.1-2. Reporting Period Porewater Chloride (mg/L) Results with Historical Period of Record Ranges.



Station	Range	Nov18	May19
F1-1	1.15-3.53	4.00	2.87
F1-2	2.34-6.60	6.06	4.02

Station	Range	Nov18	May19
M1-1	0.24-4.95	1.68	1.18
M1-2	0.22-3.60	1.52	1.90

Station	Range	Nov18	May19
F2-1	2.00-21.0	3.77	15.70
F2-2	2.48-17.5	4.72	6.59
F2-3	2.31-9.56	5.30	8.29
F2-4	1.64-5.98	3.07	5.32

Station	Range	Nov18	May19
F3-1	1.81-4.70	5.20	5.59
F3-2	2.25-7.24	4.87	6.46
F3-3	2.10-5.48	4.24	2.84
F3-4	1.52-5.20	2.97	2.90

Station	Range	Nov18	May19
M2-1	1.00-2.81	1.61	2.07
M2-2	0.48-1.71	1.13	1.56

Station	Range	Nov18	May19
F4-1	1.60-4.68	1.96	2.71
F4-2	1.41-9.40	2.76	4.57
F4-3	2.42-8.41	3.55	5.37
F4-4	2.93-15.0	2.88	3.98

Station	Range	Nov18	May19
M3-1	0.68-2.33	1.86	1.92
M3-2	0.40-4.80	1.65	3.71

Station	Range	Nov18	May19
F5-1	1.51-5.67	2.21	2.04
F5-2	0.824-4.00	3.51	6.45

Station	Range	Nov18	May19
M4-1	0.52-5.07	1.97	1.34
M4-2	0.30-5.59	2.41	1.83

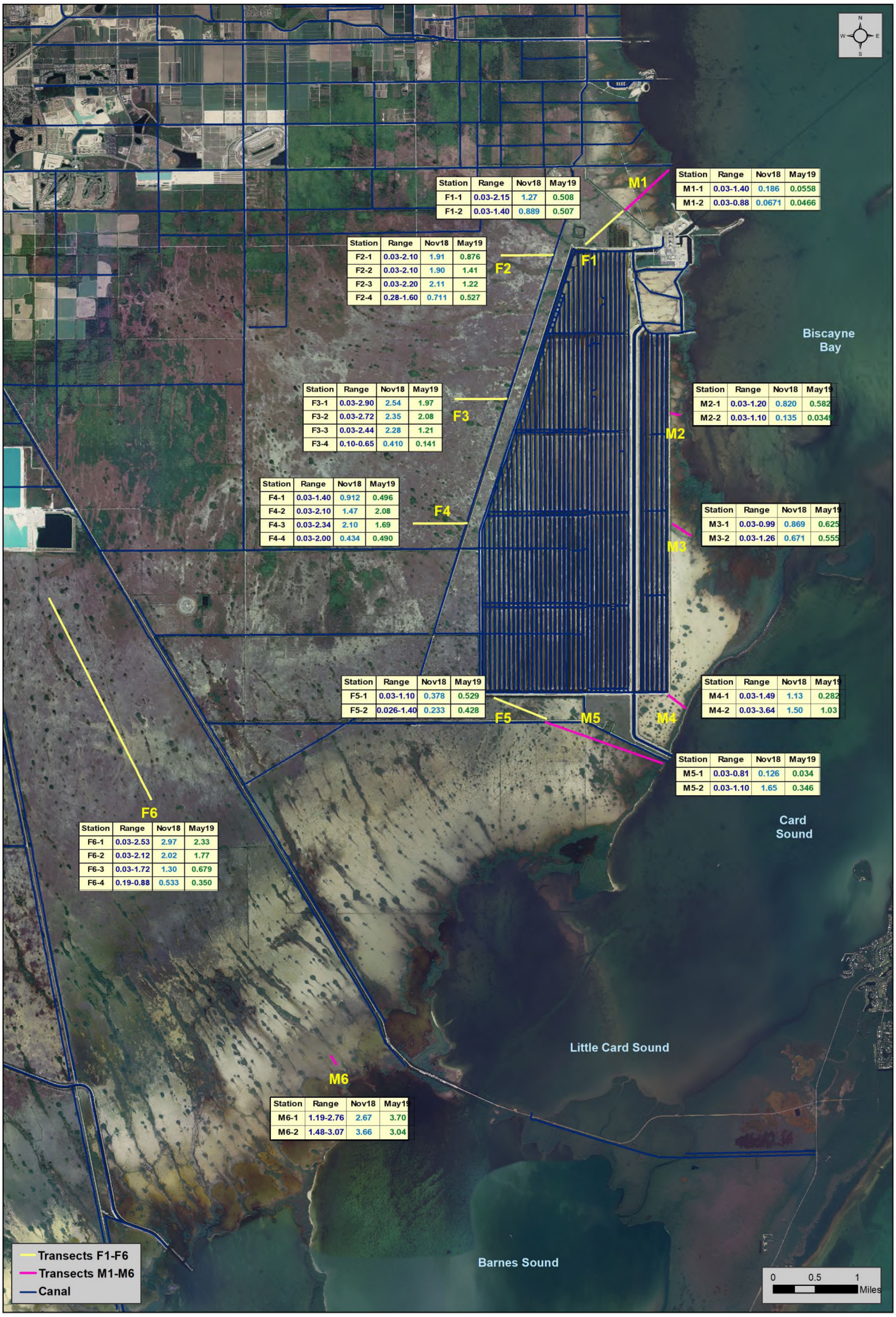
Station	Range	Nov18	May19
M5-1	0.27-4.20	2.60	6.48
M5-2	0.72-2.60	2.75	1.17

Station	Range	Nov18	May19
F6-1	1.91-8.51	5.38	6.52
F6-2	1.64-4.56	2.67	3.68
F6-3	1.68-6.36	4.53	8.87
F6-4	1.42-7.12	4.32	7.01

Station	Range	Nov18	May19
M6-1	2.10-4.11	3.33	4.48
M6-2	1.39-4.50	3.79	4.33

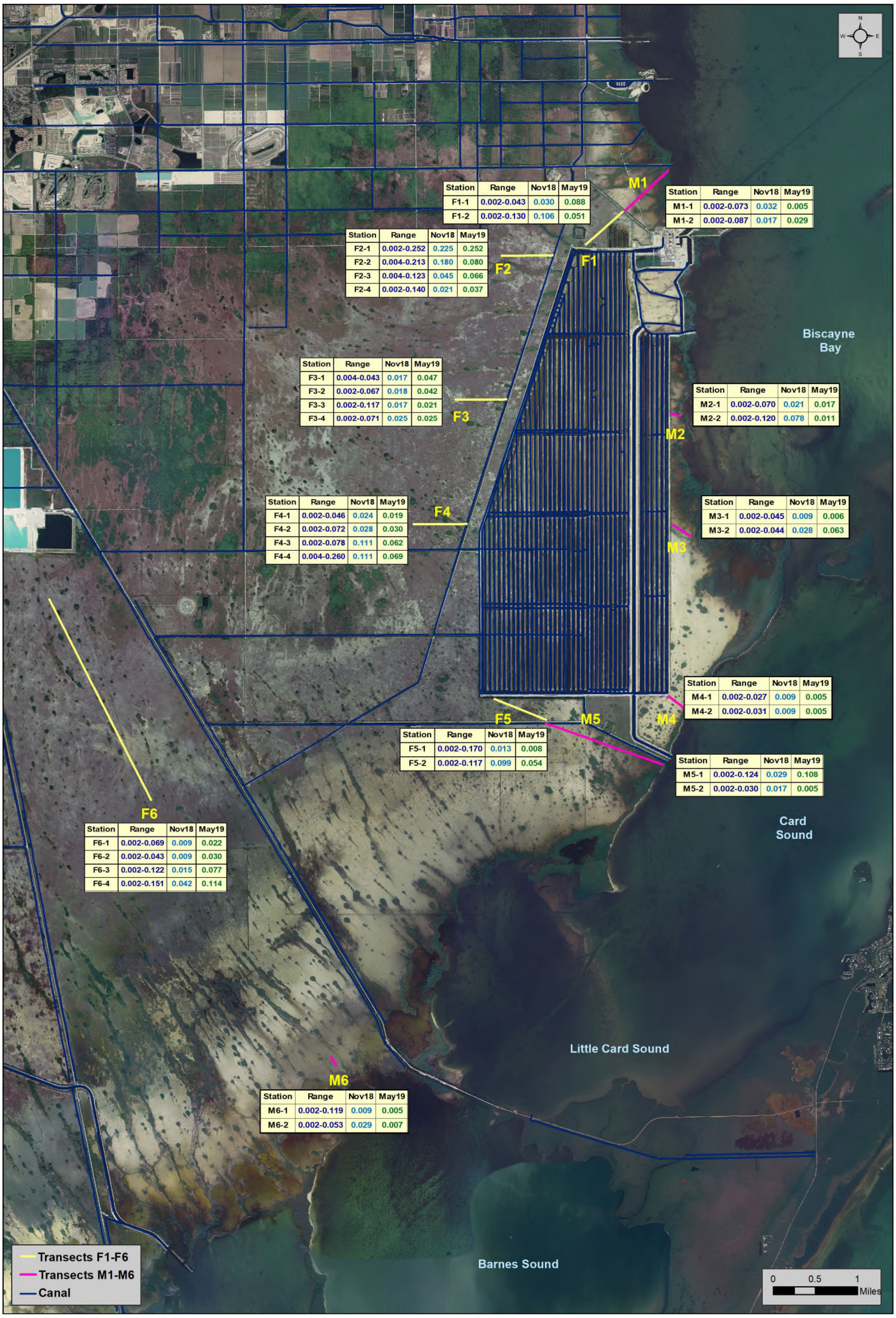
Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Nov18: November 2018; May19: May 2019.
3) NA: Not Available.
4) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.1-3. Reporting Period Semi-Annual Porewater Total Nitrogen (mg/L) Results with Historical Period of Record Ranges.



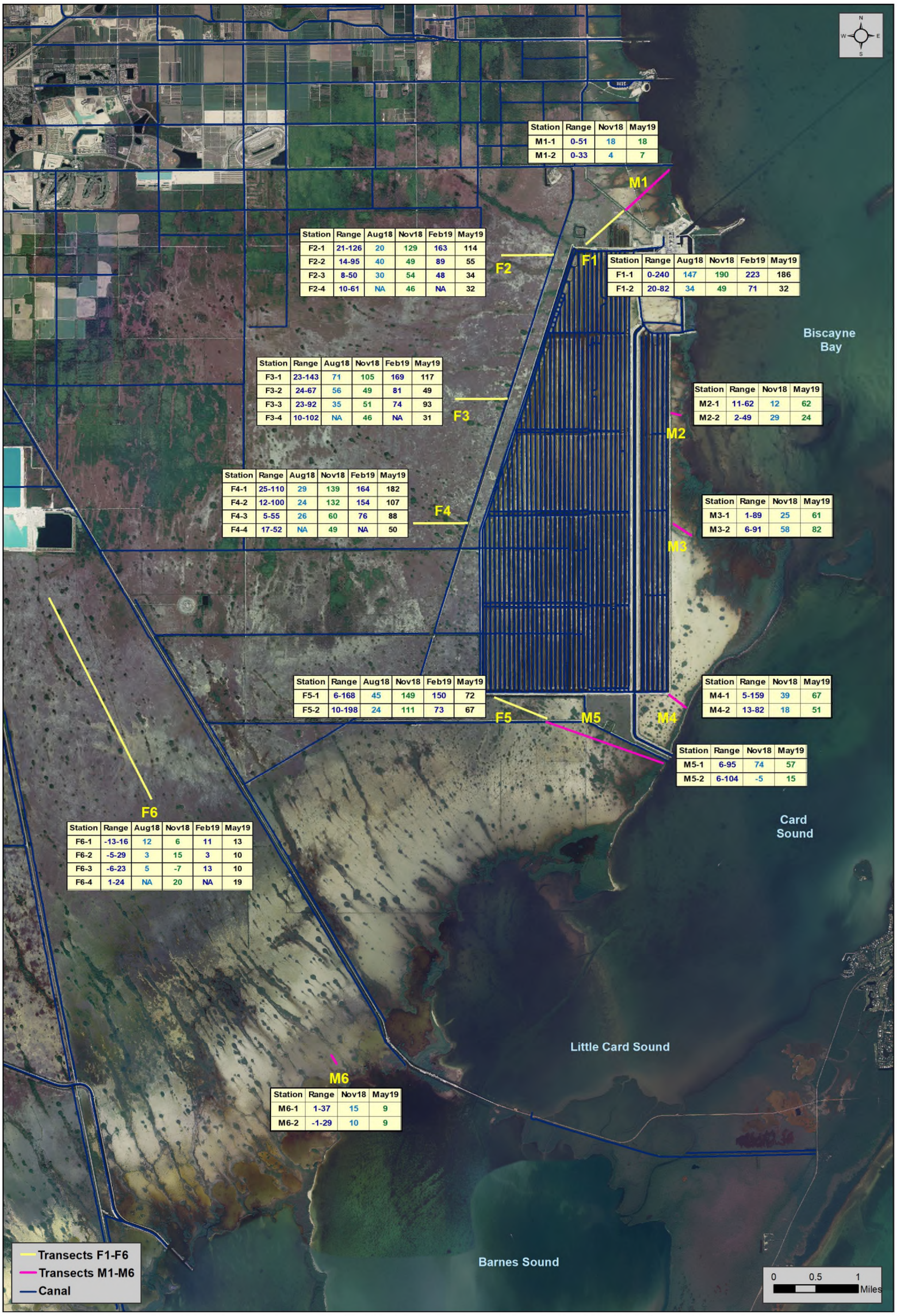
Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Nov18: November 2018; May19: May 2019.
3) NA: Not Available.
4) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.1-4. Reporting Period Semi-Annual Porewater Total Ammonia (mg/L) Results with Historical Period of Record Ranges.



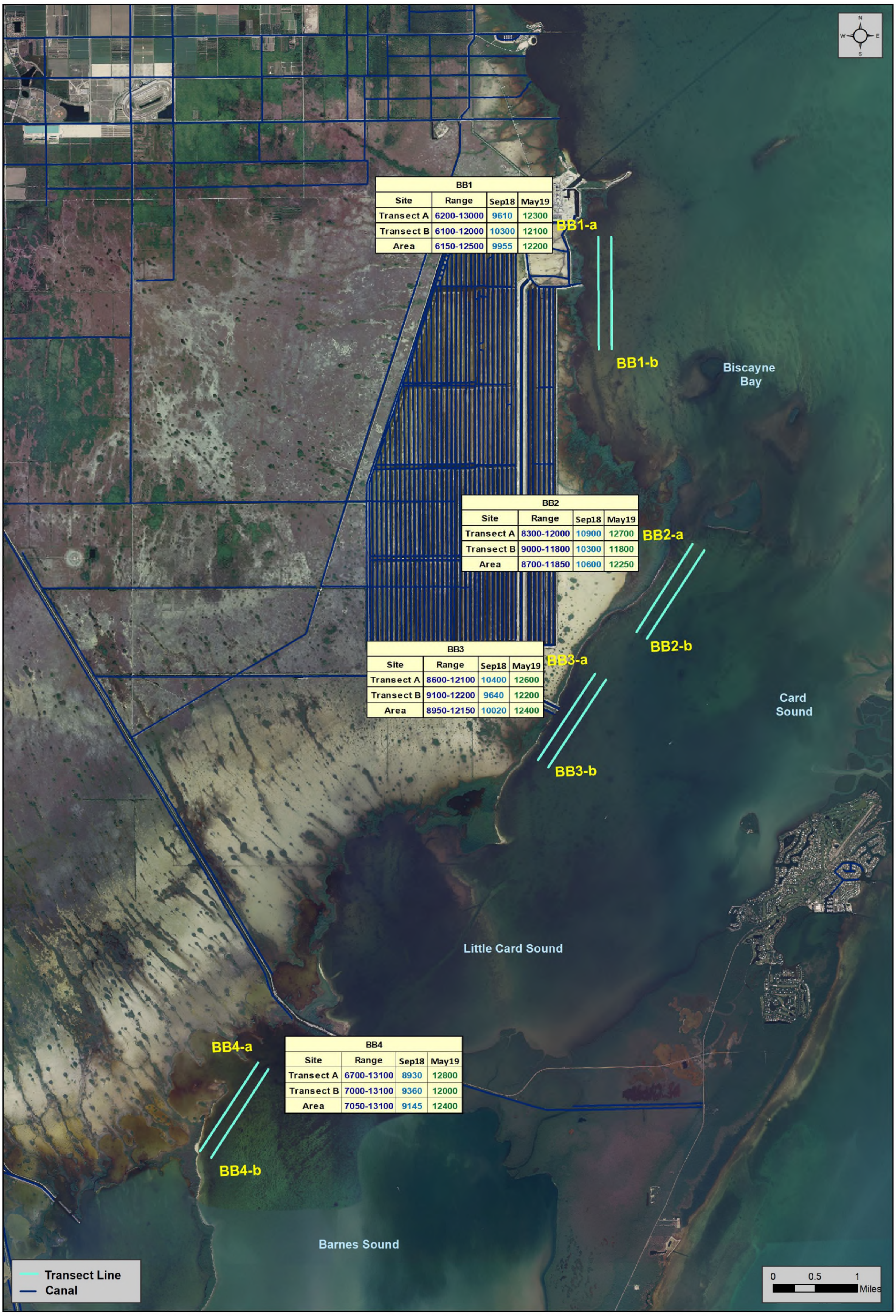
Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Nov18: November 2018; May19: May 2019.
3) NA: Not Available.
4) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.1-5. Reporting Period Semi-Annual Porewater Total Phosphorous (mg/L) Results with Historical Period of Record Ranges.



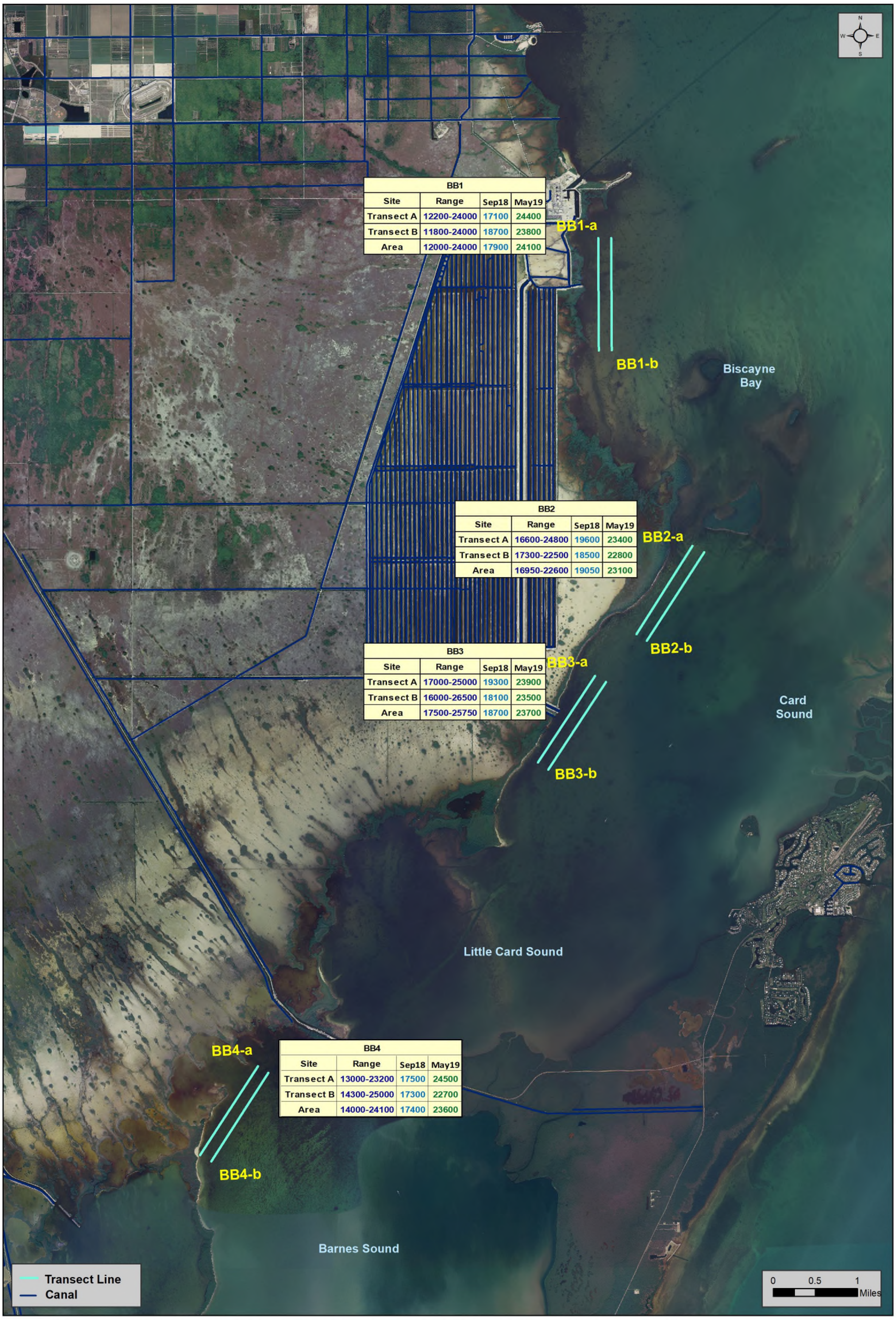
Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Aug18: August 2018; Nov18: November 2018; Feb19: February 2019; May19: May 2019.
3) NA: Not Available.
4) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.1-6. Reporting Period Porewater Tritium (pCi/L) Results with Historical Period of Record Ranges.



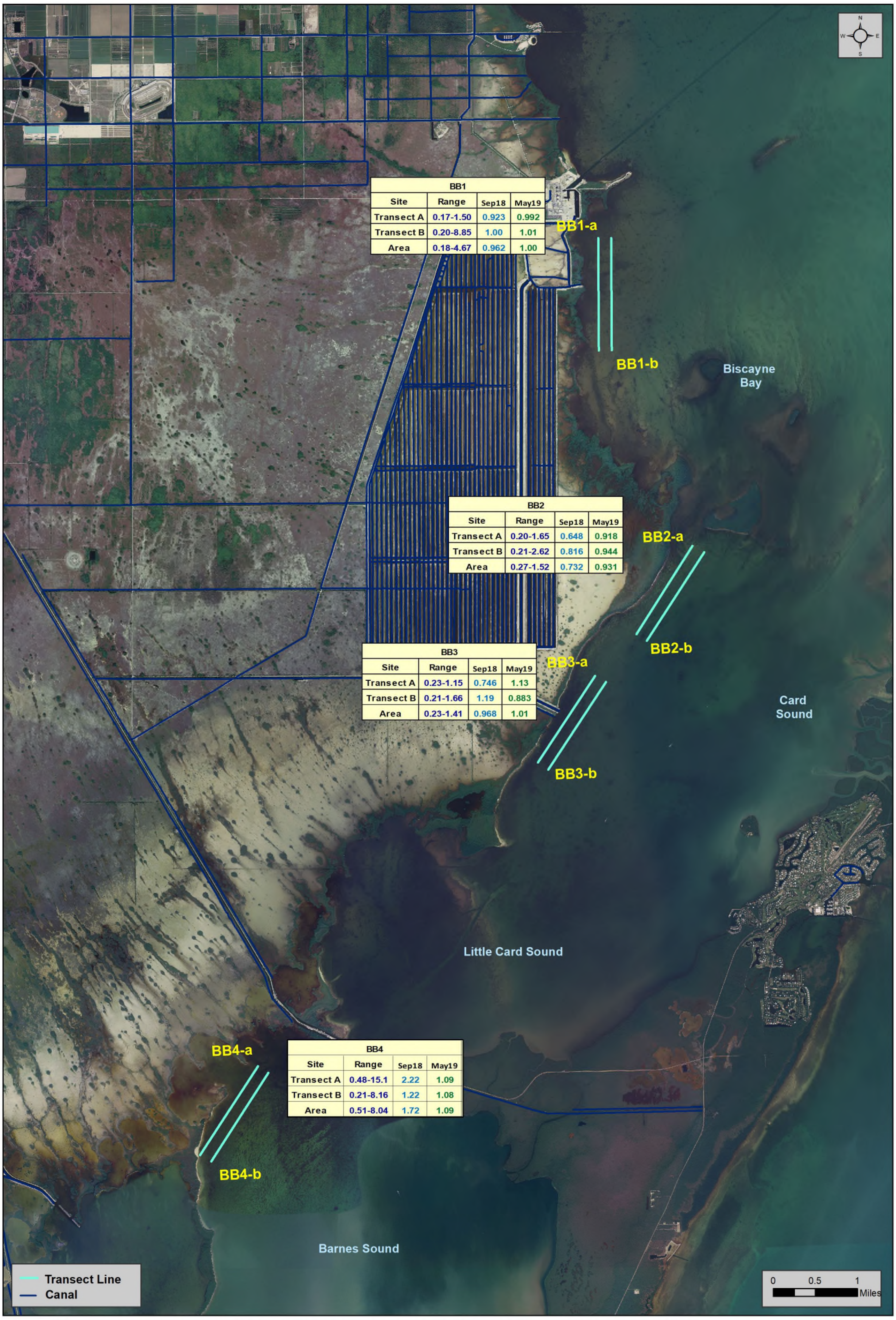
Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Sep18: Sept 2018; May19: May 2019
3) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.2-1. Reporting Period Bay Porewater Sodium (mg/L) Results with Historical Period of Record Ranges.



Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Sep18: Sept 2018; May19: May 2019
3) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.2-2. Reporting Period Bay Porewater Chloride (mg/L) Results with Historical Period of Record Ranges.



BB1

Site	Range	Sep18	May19
Transect A	0.17-1.50	0.923	0.992
Transect B	0.20-8.85	1.00	1.01
Area	0.18-4.67	0.962	1.00

BB2

Site	Range	Sep18	May19
Transect A	0.20-1.65	0.648	0.918
Transect B	0.21-2.62	0.816	0.944
Area	0.27-1.52	0.732	0.931

BB3

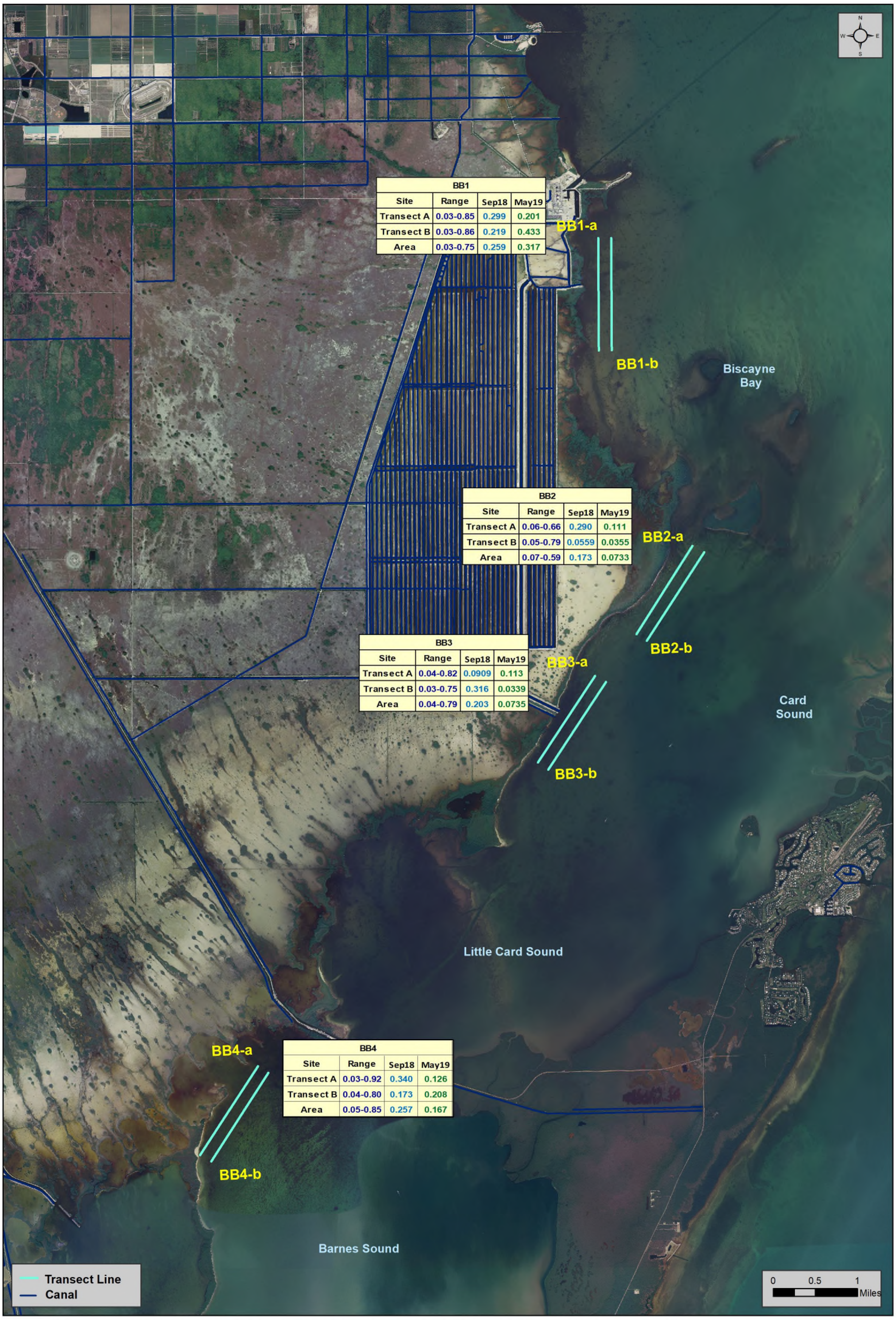
Site	Range	Sep18	May19
Transect A	0.23-1.15	0.746	1.13
Transect B	0.21-1.66	1.19	0.883
Area	0.23-1.41	0.968	1.01

BB4

Site	Range	Sep18	May19
Transect A	0.48-15.1	2.22	1.09
Transect B	0.21-8.16	1.22	1.08
Area	0.51-8.04	1.72	1.09

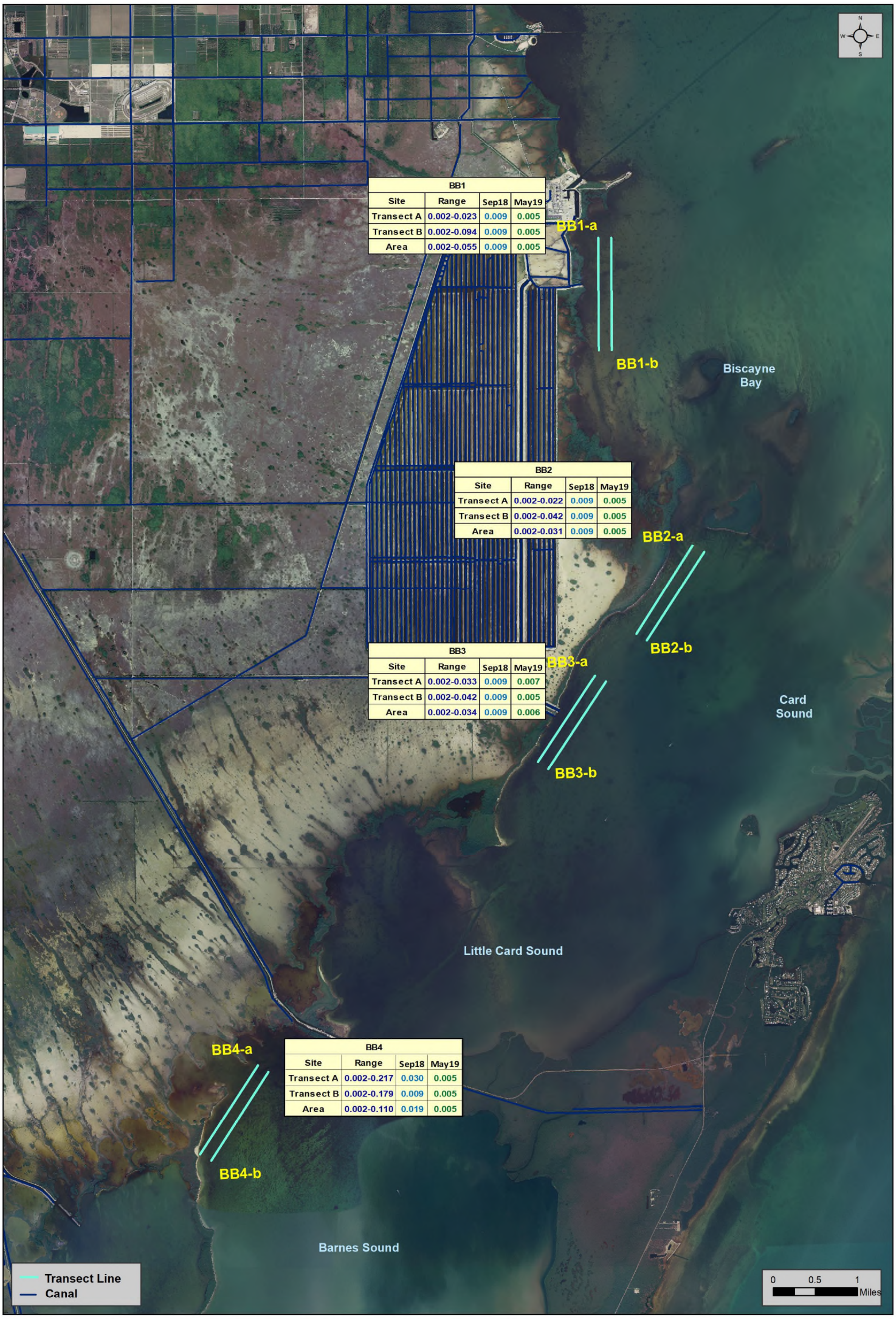
Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Sep18: Sept 2018; May19: May 2019
3) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.2-3. Reporting Period Bay Porewater Total Nitrogen (mg/L) Results with Historical Period of Record Ranges.



Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Sep18: Sept 2018; May19: May 2019
3) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.2-4. Reporting Period Bay Porewater Total Ammonia (mg/L) Results with Historical Period of Record Ranges.



BB1			
Site	Range	Sep18	May19
Transect A	0.002-0.023	0.009	0.005
Transect B	0.002-0.094	0.009	0.005
Area	0.002-0.055	0.009	0.005

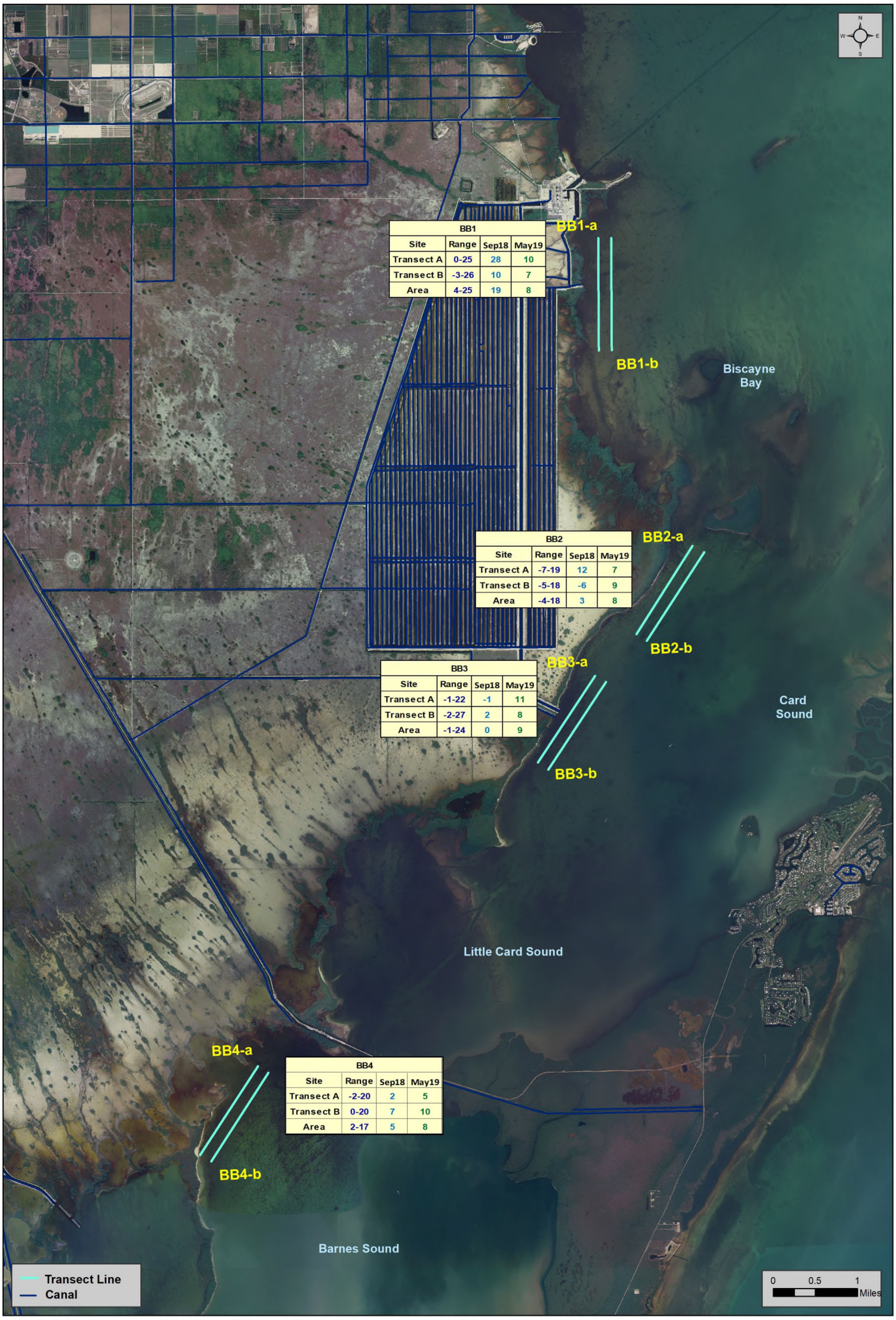
BB2			
Site	Range	Sep18	May19
Transect A	0.002-0.022	0.009	0.005
Transect B	0.002-0.042	0.009	0.005
Area	0.002-0.031	0.009	0.005

BB3			
Site	Range	Sep18	May19
Transect A	0.002-0.033	0.009	0.007
Transect B	0.002-0.042	0.009	0.005
Area	0.002-0.034	0.009	0.006

BB4			
Site	Range	Sep18	May19
Transect A	0.002-0.217	0.030	0.005
Transect B	0.002-0.179	0.009	0.005
Area	0.002-0.110	0.019	0.005

Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Sep18: Sept 2018; May19: May 2019
3) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.2-5. Reporting Period Bay Porewater Total Phosphorous (mg/L) Results with Historical Period of Record Ranges.



BB1			
Site	Range	Sep18	May19
Transect A	0-25	28	10
Transect B	-3-26	10	7
Area	4-25	19	8

BB2			
Site	Range	Sep18	May19
Transect A	-7-19	12	7
Transect B	-5-18	-6	9
Area	-4-18	3	8

BB3			
Site	Range	Sep18	May19
Transect A	-1-22	-1	11
Transect B	-2-27	2	8
Area	-1-24	0	9

BB4			
Site	Range	Sep18	May19
Transect A	-2-20	2	5
Transect B	0-20	7	10
Area	2-17	5	8

Notes: 1) Range: Data range (min-max) for the samples collected in the Historical Period of Record (Oct 2010 to May 2018).
2) Sep18: Sept 2018; May19: May 2019
3) Please see Appendix I for a list of values that were removed from this analysis and the rationale for their removal.

Figure 5.2-6. Reporting Period Bay Porewater Tritium (pCi/L) Results with Historical Period of Record Ranges.

6. INTERCEPTOR DITCH OPERATION

6.1 Introduction

The ID system is operated pursuant to Section II (A)(1) of the Fifth Supplemental Agreement between the SFWMD and FPL, dated October 16, 2009, "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" (SFWMD 2009a). When a "seaward gradient" between the L-31E canal and the CCS, as defined in the Turkey Point Plant Interceptor Ditch Operation Procedure (FPL 2017b), temporarily ceases to exist, the water level in the ID is lowered by pumping water from the ID into the CCS, thereby creating a hydraulic divide in groundwater that acts to restrict the westward migration of groundwater. The information presented in this section pertains to the operation of the ID from June 1, 2018, through May 31, 2019 (the reporting period).

The ID system is part of the original CCS design and has been in operation since the early 1970s. Original analog modeling used in the design of the system identified that the hydraulic divide established by operation of the ID pumps would be effective in restricting westward flow of groundwater throughout the thickness of the Biscayne Aquifer. However, naturally occurring variability of vertical permeabilities within the Biscayne Aquifer combined with the effects of increased specific gravity of saline and hypersaline waters limit the effectiveness of the ID to the upper zones of the aquifer. Surface water, groundwater, and porewater quality data combined with marsh ecological data demonstrate that the ID system effectively restricts inland movement of saline CCS water in the upper zones of the aquifer.

6.2 Operational or Structural Changes

Operation of the ID system was conducted in accordance with the SFWMD-approved ID Operations Plan (FPL 2017b). There have been no changes in the operating procedures or structural changes in the ID during the reporting period. The current ID Operations Plan can be found in the Public Resources folder of the FPL EDMS (https://ptn-combined-monitoring.com).

On May 15, 2018, FPL began operating the 15-mgd groundwater RWS to extract hypersaline groundwater from 10 wells constructed at the base of the Biscayne Aquifer. These extraction wells are located on the CCS perimeter berm road immediately west of the ID canal over the entire length of the CCS and north to the daycare center. Modeling of the RWS system suggests that operation of the extraction wells may induce small drawdowns along the ID and western edge of the CCS that could reduce the frequency and duration of ID pump operation. While the amount of ID pumping was three times lower during this reporting period when compared to the previous year, it is not clear at this time the extent to which RWS operations had on this reduction, if any, as RWS induced drawdown in the CCS or ID is very small and difficult to discern given the daily and seasonal fluctuations in surface water.

6.3 Interceptor Ditch Operation and Transect Surface Water Levels

Surface water levels are measured in the L-31E canal, the ID, and C-32 (CCS) on a routine basis along five transects (Figure 6.3-1) in order to assess whether a seaward gradient is maintained. In the event the gradient criteria are not met and such conditions are confirmed in the field by manual readings, the ID pump operations are activated as prescribed in the ID operation procedures. Water levels recorded during the reporting period are presented on Figures 6.3-2 through 6.3-6. The data for these figures are based on the manual readings by FPL staff at all five transect locations.

Except for a few short periods (order of days), the L-31E canal water level was higher than the CCS at all five transects during the reporting period. With a few exceptions, the water levels in the L-31E canal were also higher than in the ID. The water level in the ID is usually higher than the CCS. In instances when the differences in water levels between the CCS and the L 31E canal triggered pumping, the ID water levels dropped below CCS water levels, such as in transects A, B, and C during the period from March through May 2019. Table 6.3-1 shows the range in head differences between the L-31E canal and C-32 and the range in head differences between the L-31E canal and ID at each transect based on weekly field measurements.

Operation of the ID pumps is shown on Figure 6.3-7, along with the NEXRAD rainfall data from the SFWMD. Much of the pumping occurred in March through May 2019 during periods with little rainfall, as is typical during the dry season. Table 6.3-2 shows the number of hours each pump operated every month, along with the volume of water pumped. During the reporting period, pumping was limited to the northern ID pump station, as seaward gradient criteria were met without the need to operate the southern ID pump station.

During the reporting period, the system operated 36 days, with a combined total of 492 hours of pumping. The total volume pumped during the year was 460 million gallons. Data in Table 6.3-3 identify when pumping was required by the field measured water levels and when such pumping actually occurred. While the individual ID pumps have the ability to withdraw over 20 mgd each from the ID, the associated drawdown at nearby monitoring wells TPGW-1S and TPGW-2S is only on the order of 0.1 to 0.2 ft; this drawdown further diminishes with distance from the CCS. Accordingly, the area of influence of ID operations is mostly limited to the area between the L-31E canal and the CCS. During pumping, a large percentage of the water removed from the ID comes from the adjacent CCS as demonstrated by short-term increased salinity in the ID reach that accompanies the pumping events (refer to Section 3). The low amount of groundwater drawdown combined with the short duration of the withdrawals (typically on the order of 1 to 3 days) are insufficient to harm wetlands west of the CCS.

As part of the historic assessment of the effectiveness of ID operations on restricting westward migration of CCS groundwater, temperature and specific conductance are measured on a quarterly basis at 1-ft intervals throughout the water column in wells TPGW-L3, TPGW-L5, TPGW-G21, TPGW-G28, and TPGW-G35. The data consistently show a predominately fresh groundwater lens (approximately 20 ft thick) near the L-31E canal that increases in thickness with distance to the west. The ID helps maintain this lens. During the reporting period, the predominantly fresh groundwater extended to elevations of -18 ft to -23 ft NAVD 88 (Figures 3.1-22 and 3.1-23). As the depth of the L-31E canal is approximately 9 to 10 ft below land surface (approximately elevation of -10 ft NAVD 88), it is apparent that the saline/freshwater interface occurs below the bottom of the L-31E canal.

TABLES

Table 6.3-1. Range in Surface Water Head Differences.

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
6/5/18	0.77	0.40	0.72	0.29	0.87	0.33	0.98	0.39	0.91	0.32
6/14/18	0.83	0.45	0.90	0.40	0.95	0.45	1.05	0.47	1.03	0.38
6/21/18	0.57	0.32	0.53	0.18	0.70	0.30	0.72	0.12	0.82	0.20
6/25/18	0.64	0.30	0.61	0.22	0.78	0.26	0.90	0.27	0.90	0.26
7/6/18	0.55	0.29	0.56	0.24	0.72	0.26	0.86	0.26	0.82	0.17
7/12/18	0.56	0.28	0.52	0.12	0.75	0.25	0.95	0.27	0.92	0.20
7/19/18	0.60	0.26	0.63	0.23	0.75	0.25	0.93	0.30	0.95	0.27
7/24/18	0.57	0.19	0.70	0.15	0.80	0.19	0.90	0.20	0.95	0.22
8/1/18	0.52	0.24	0.71	0.21	0.75	0.20	0.88	0.28	0.82	0.22
8/9/18	0.58	0.23	0.60	0.15	0.65	0.14	0.80	0.20	0.78	0.08
8/13/18	0.50	0.22	0.50	0.18	0.65	0.20	0.76	0.26	0.72	0.20
8/20/18	0.50	0.20	0.55	0.18	0.65	0.16	0.81	0.28	0.74	0.10
9/5/18	1.10	0.25	1.10	0.25	1.10	0.25	1.22	0.34	1.08	0.22
9/12/18	1.22	0.20	1.27	0.12	1.13	0.15	1.06	0.08	1.12	0.02
9/18/18	0.88	0.22	0.88	0.03	0.88	0.18	0.86	0.24	0.80	0.17
9/27/18	0.68	0.26	0.64	0.15	0.67	0.14	0.77	0.24	0.73	0.20
10/4/18	0.70	0.20	0.65	0.04	0.72	0.12	0.75	0.12	0.68	0.10
10/9/18	0.55	0.17	0.62	0.14	0.72	0.19	0.72	0.13	0.68	0.10
10/19/18	0.62	0.12	0.63	0.00	0.68	0.06	0.70	0.08	0.60	0.01
10/24/18	0.58	0.16	0.60	0.03	0.64	0.07	0.64	0.07	0.57	0.10
11/1/18	0.50	0.15	0.46	0.15	0.56	0.10	0.67	0.23	0.58	0.18
11/6/18	0.48	0.05	0.46	0.07	0.57	0.04	0.57	0.14	0.52	0.12
11/13/18	0.42	0.12	0.51	0.16	0.53	0.10	NA	NA	0.57	0.22
11/21/18	0.47	-0.05	0.54	0.13	0.58	0.18	0.58	0.16	0.58	0.14
11/29/18	0.50	-0.03	0.47	-0.05	0.59	0.15	0.58	0.17	0.54	0.17
12/6/18	0.52	0.07	0.49	0.11	0.53	0.10	0.57	0.10	0.51	0.08
12/13/18	0.43	0.20	0.40	0.12	0.57	0.15	0.69	0.25	0.61	0.16
12/20/18	0.08	0.12	0.12	0.10	0.45	0.11	0.63	0.10	0.74	0.10
12/21/18	0.46	0.32	0.74	0.34	0.62	0.14	0.75	0.10	0.72	0.12

Table 6.3-1. Range in Surface Water Head Differences.

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
12/26/18	0.50	0.18	0.46	0.12	0.57	0.15	0.60	0.12	0.56	0.14
1/4/19	0.32	0.12	0.32	0.10	0.48	0.12	0.66	0.10	0.68	0.10
1/8/19	0.38	0.06	0.38	0.08	0.51	0.11	0.63	0.12	0.60	0.10
1/15/19	0.38	0.13	0.36	0.13	0.49	0.16	0.62	0.08	0.54	0.14
1/23/19	0.23	0.12	0.21	0.13	0.44	0.15	NA	NA	0.59	0.15
1/24/19	0.21	0.15	0.25	0.16	0.44	0.20	NA	NA	0.62	0.17
1/30/19	0.52	0.20	0.49	0.14	0.60	0.17	0.72	0.14	0.66	0.16
2/7/19	0.43	0.21	0.45	0.18	0.57	0.19	0.69	0.13	0.64	0.20
2/12/19	0.28	0.21	0.30	0.14	0.59	0.19	0.70	0.14	0.67	0.20
2/21/19	0.33	0.19	0.38	0.14	0.55	0.21	0.70	0.14	0.68	0.14
2/25/19	0.41	0.21	0.34	0.12	0.47	0.15	0.62	0.13	0.45	0.02
3/4/19	0.25	0.17	0.28	0.10	0.47	0.09	0.67	0.11	0.58	0.06
3/5/19	0.23	0.21	0.24	0.13	0.44	0.17	0.63	0.12	0.60	0.14
3/6/19	0.25	0.43	0.22	0.38	0.33	0.21	0.50	0.18	0.39	0.17
3/7/19	0.23	0.13	0.19	0.10	0.34	0.11	0.52	0.08	0.44	0.05
3/8/19	0.09	0.37	0.11	0.33	0.35	0.20	0.44	0.04	0.42	-0.02
3/11/19	0.38	0.17	0.35	0.11	0.46	0.13	0.60	0.06	0.56	0.10
3/18/19	0.45	0.13	0.50	0.10	0.49	0.09	0.53	-0.01	0.46	0.08
3/25/19	0.52	0.15	0.49	0.11	0.54	0.10	0.64	0.08	0.59	0.14
4/1/19	0.50	0.20	0.47	0.13	0.51	0.16	0.58	0.10	0.52	0.14
4/8/19	0.25	0.22	0.26	0.19	0.40	0.19	0.53	0.19	0.50	0.20
4/9/19	0.09	0.21	0.08	0.18	0.33	0.22	0.49	0.21	0.54	0.19
4/10/19	0.31	0.37	0.31	0.33	0.44	0.35	0.54	0.22	0.50	0.17
4/11/19	0.24	0.15	0.27	0.09	0.38	0.12	0.49	0.15	0.44	0.10
4/12/19	0.22	0.56	0.24	0.51	0.40	0.21	0.50	0.23	0.45	0.14
4/15/19	0.27	0.17	0.25	0.13	0.40	0.14	0.57	0.22	0.43	0.10
4/16/19	0.25	0.13	0.23	0.11	0.30	0.10	0.39	0.11	0.38	0.08
4/17/19	0.16	0.42	0.16	0.36	0.27	0.19	0.34	0.11	0.30	0.14
4/18/19	0.03	0.09	0.08	0.06	0.18	0.06	0.34	0.00	0.35	0.04

Table 6.3-1. Range in Surface Water Head Differences.

Date	Line A		Line B		Line C		Line D		Line E	
	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID	L31-C32	L31-ID
4/19/19	-0.17	0.31	-0.04	0.26	0.09	0.19	0.29	0.11	0.30	0.12
4/19/19	0.22	0.10	0.20	0.07	NA	NA	NA	NA	NA	NA
4/23/19	0.14	0.34	0.09	0.27	0.23	0.22	0.30	0.09	0.29	0.11
4/24/19	0.08	0.36	0.04	0.24	0.20	0.34	0.46	0.22	0.30	0.18
4/25/19	-0.04	0.34	-0.02	0.26	0.12	0.30	0.42	0.20	0.32	0.18
4/26/19	-0.16	0.22	-0.10	0.14	0.08	0.34	0.42	0.20	0.30	0.10
4/26/19	-0.11	0.69	-0.09	0.64	NA	NA	NA	NA	NA	NA
4/29/19	0.08	0.14	0.03	0.08	0.17	0.07	0.30	-0.02	0.28	0.04
5/1/19	0.01	0.36	0.02	0.31	0.20	0.34	0.26	0.06	0.26	0.06
5/2/19	0.06	0.12	0.06	0.07	0.18	0.07	0.36	-0.03	0.38	0.00
5/3/19	-0.10	0.37	-0.08	0.33	0.10	0.31	0.30	0.06	0.37	0.10
5/6/19	0.00	0.12	-0.01	0.05	0.14	0.02	0.33	-0.03	0.39	0.03
5/8/19	0.21	0.35	0.20	0.30	0.35	0.30	0.51	0.07	0.52	0.13
5/9/19	0.20	0.15	0.26	0.08	0.41	0.11	0.56	0.02	0.56	0.09
5/10/19	0.15	0.36	0.14	0.30	0.36	0.33	0.54	0.02	0.52	0.08
5/13/19	0.11	0.12	0.13	0.10	0.38	0.12	0.61	0.06	0.64	0.12
5/15/19	0.21	0.40	0.22	0.33	0.36	0.26	0.49	0.02	0.52	0.10
5/16/19	0.37	0.18	0.36	0.13	0.39	0.04	0.58	0.03	0.58	0.08
5/17/19	0.42	0.16	0.42	0.09	0.56	0.12	0.70	0.06	0.63	0.10
5/23/19	0.38	0.18	0.40	0.11	0.44	0.12	0.53	0.07	0.51	0.12
5/28/19	0.22	0.18	0.20	0.12	0.32	0.09	0.48	0.03	0.48	0.09
5/29/19	0.12	0.72	0.10	0.68	0.28	0.08	0.42	-0.02	0.41	0.06
5/30/19	0.16	0.24	0.18	0.16	0.32	0.08	0.44	-0.02	0.44	0.05
5/31/19	0.13	0.50	0.24	0.22	0.22	0.50	0.38	0.08	0.38	0.12
5/31/19	0.08	0.66	0.09	0.61	NA	NA	NA	NA	NA	NA

Key:
NA = Not applicable

Table 6.3-2. Hours and Volumes of ID Pump Operation per Month (June 2018 through May 2019).

ID	2018							2019				
Pumped Hours	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
N1	0	0	0	0	0	0	11	0	0	51	134	120
N2	0	0	0	0	0	0	0	0	0	0	75	92
S1	0	0	0	0	0	0	0	0	0	0	0	0
S2	0	0	0	0	0	0	0	0	0	0	0	0
Pumped Volume (MG)												
N1	0	0	0	0	0	0	10	0	0	47	125	112
N2	0	0	0	0	0	0	0	0	0	0	70	85
S1	0	0	0	0	0	0	0	0	0	0	0	0
S2	0	0	0	0	0	0	0	0	0	0	0	0

Key:
MG = Million gallons
N = North
S = South

Table 6.3-3. Pumping Summary.

Date	N1	N2	S1	S2	Performed Pumping
12/20/2018	Yes				x
12/21/2018	Yes				x
3/5/2019	Yes				x
3/6/2019	Yes				x
3/7/2019	Yes				x
3/8/2019	Yes				x
4/9/2019		Yes			x
4/10/2019		Yes			x
4/11/2019	Yes				x
4/12/2019	Yes				x
4/16/2019	Yes				x
4/17/2019	Yes				x
4/18/2019	Yes				x
4/19/2019	Yes				x
4/22/2019	Yes				x
4/23/2019	Yes				x
4/24/2019	Yes				x
4/25/2019	Yes	Yes			x
4/26/2019	Yes	Yes			x
4/29/2019		Yes			x
4/30/2019		Yes			x
5/1/149		Yes			x
5/2/2019		Yes			x
5/3/2019		Yes			x
5/6/2019		Yes			x
5/7/2019		Yes			x
5/8/2019		Yes			x
5/9/2019	Yes				x
5/10/2019	Yes				x
5/13/2019	Yes				x
5/14/2019	Yes				x
5/15/2019	Yes				x
5/28/2019	Yes				x
5/29/2019	Yes				x
5/30/2019	Yes				x
5/31/2019	Yes	Yes			x

Key:
N = North
S = South

FIGURES

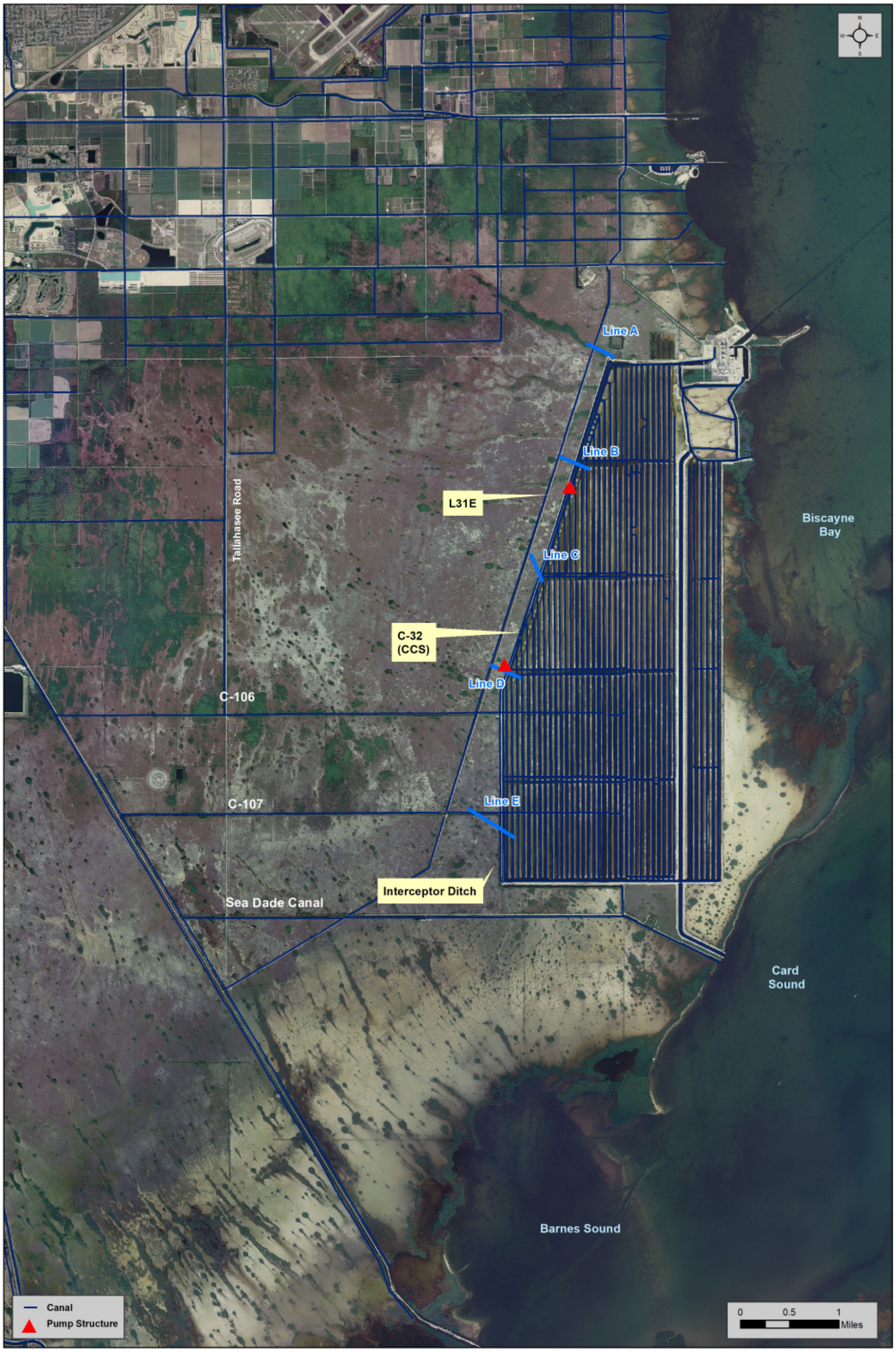


Figure 6.3-1. Historical ID Monitoring Wells and Transects.

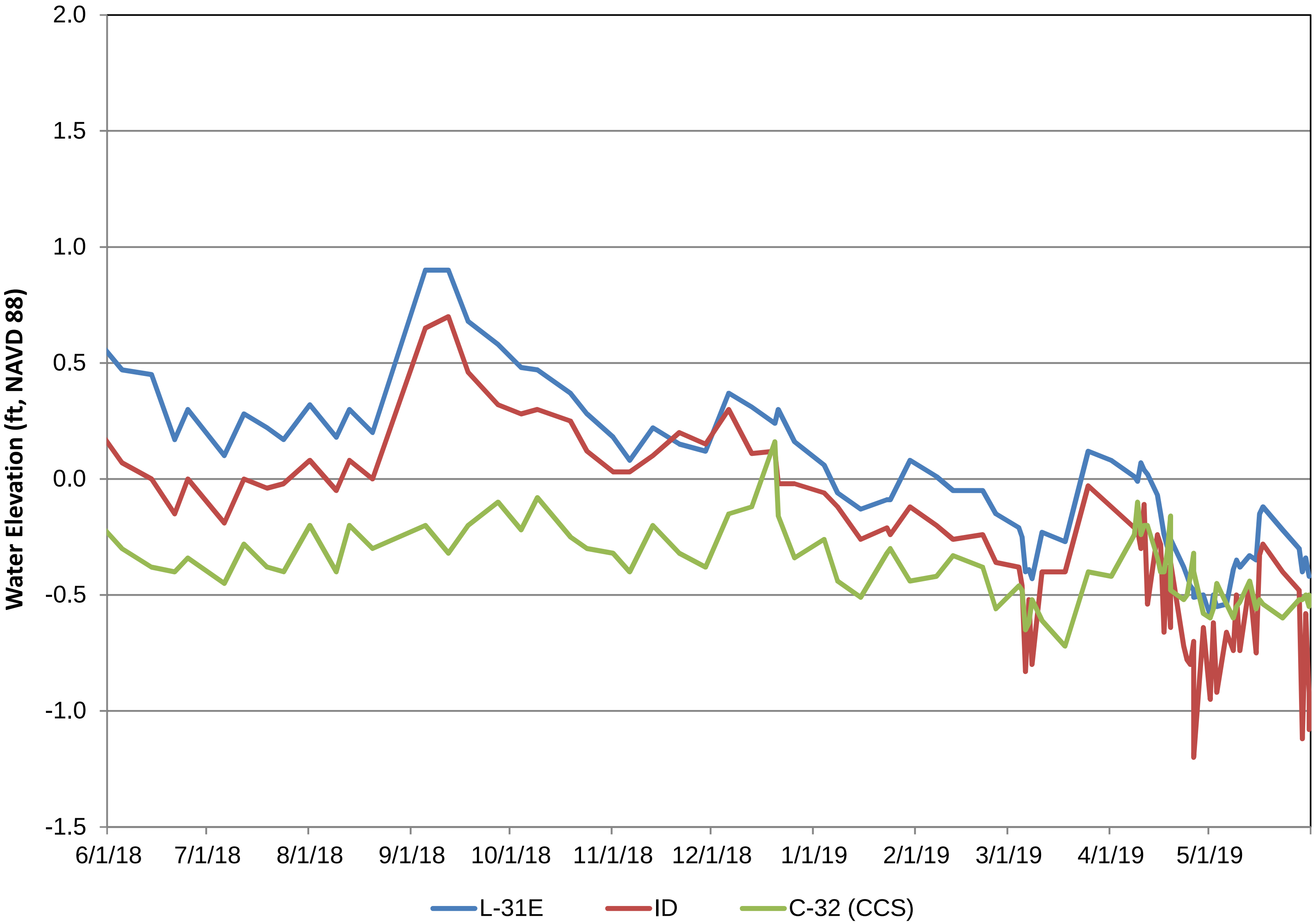


Figure 6.3-2. Transect A Field-Recorded Water Levels June 2018 through May 2019.

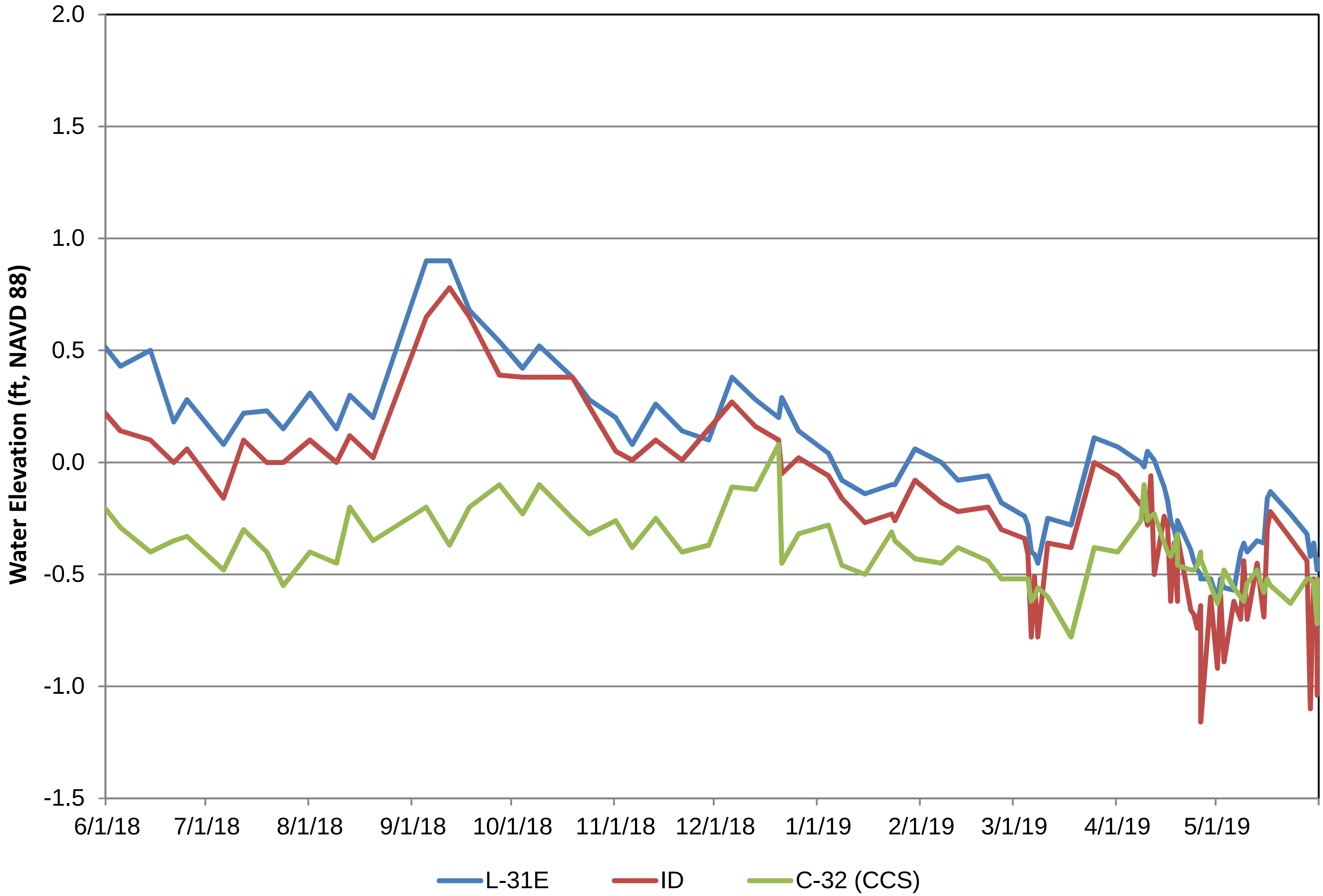


Figure 6.3-3. Transect B Field-Recorded Water Levels June 2018 through May 2019.

Figure 6.3-4. Transect C Field-Recorded Water Levels June 2018 through May 2019.

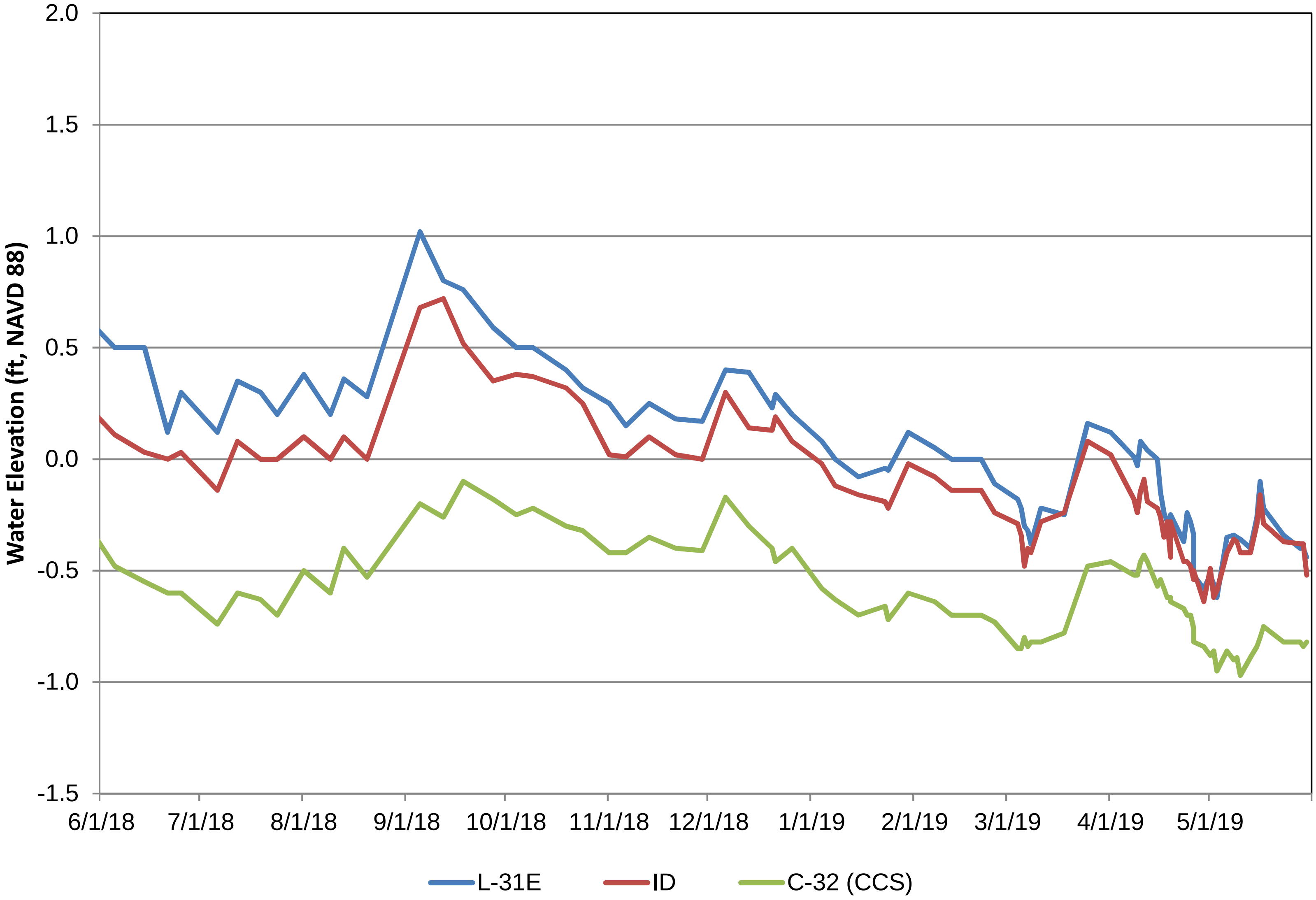


Figure 6.3-5. Transect D Field-Recorded Water Levels June 2018 through May 2019.

Figure 6.3-6. Transect E Field-Recorded Water Levels June 2018 through May 2019.

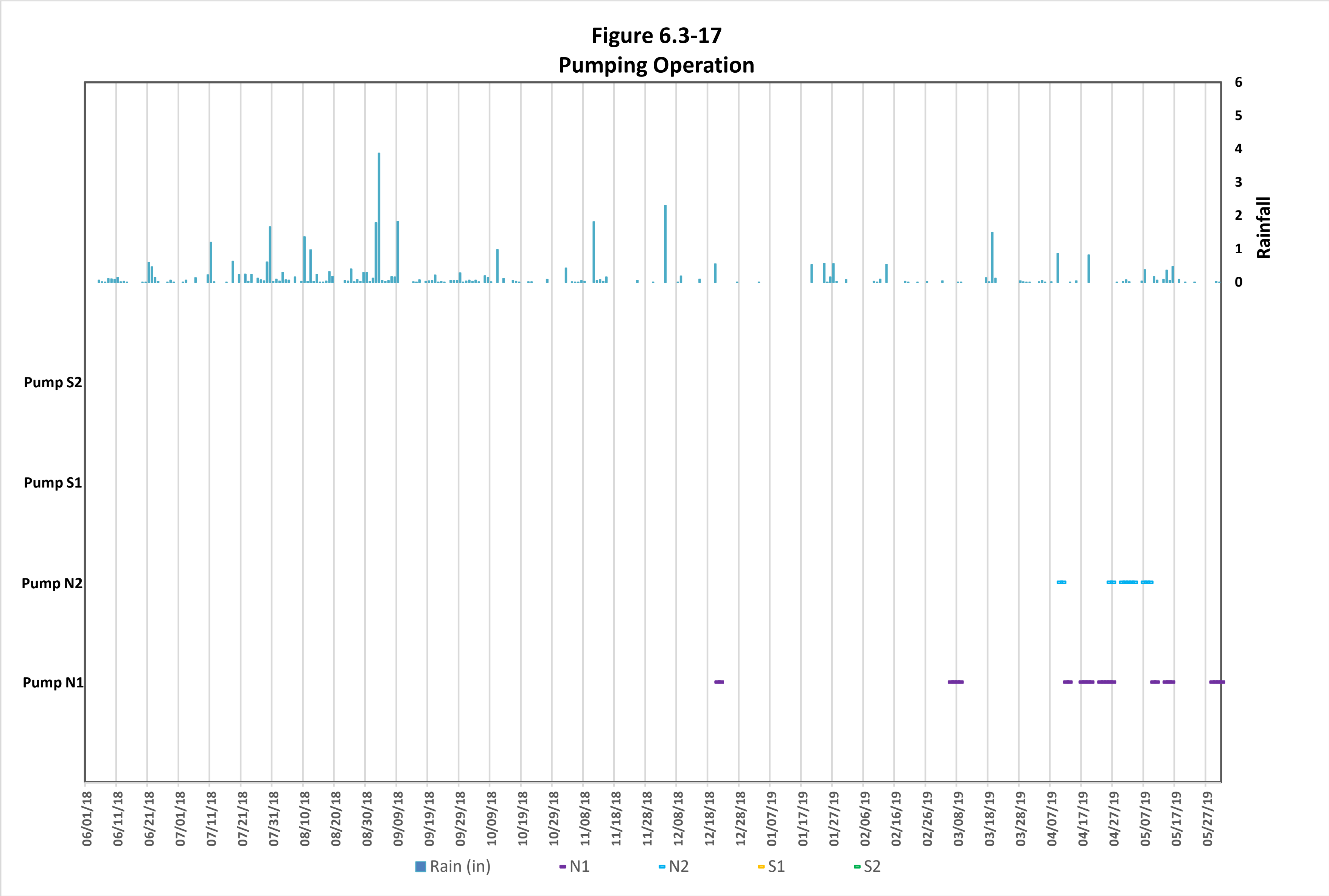


Figure 6.3-7. Interceptor Ditch Pump Operation and Rainfall.

7. SUMMARY AND INTERPRETATIONS

In accordance with the Turkey Point Monitoring Plan (SFWMD 2009a) and the Fifth Supplemental Agreement (SFWMD 2009b), FPL is required to collect groundwater, surface water, meteorological, and ecological data in and around Turkey Point to establish conditions before and after the uprating of the nuclear units and to determine the horizontal and vertical effects and extent of CCS water on existing and projected surface water, groundwater, and ecological conditions. FPL has been conducting the above-required monitoring since 2010 and has submitted reports semi-annually and annually to the Agencies, pursuant to the requirements of the SFWMD Fifth Supplemental Agreement and referenced Monitoring Plan. This report summarizes the monitoring efforts from June 1, 2018, through May 31, 2019 (referred to as the reporting period) and compares the data from the reporting period to the historical period of record (June 2010 to May 2018) to determine whether there are any recent changes to the historical record. The results in this report are based on:

- Automated water quality and water level data (over 4,500,000 data points) and analytical results for a wide array of parameters from 47 groundwater wells and 20 surface water stations (plus one additional non-automated surface water station) located in and around Turkey Point;

- Ecological field and analytical data, including plant productivity and community characteristics, leaf characteristics, nutrient content in leaves, and porewater quality from marshes, mangroves, and trees islands over a broad area around the CCS and control sites;

- Biscayne Bay field and analytical data for SAV, coral, and sponge community composition and cover, nutrient content in seagrass leaves, light attenuation, and porewater quality;

- Automated meteorological data, including rainfall, wind speed and direction, temperature, and other parameters;

- Rainfall and evaporation pan tritium data;

- Monthly water and salt budget results for the CCS;

- Borehole geophysical data from USGS annual induction logging in 14 deep wells;

- Applicable data collected from other sources referenced in the report; and

- Results from the Comprehensive Pre-Uprate Monitoring Report (FPL 2012a), Comprehensive Post-Uprate Monitoring Report (FPL 2016a), and Annual Monitoring Reports (FPL 2017a and 2018a).

Many of the current findings are similar to those previously reported in the Comprehensive Pre-Uprate Monitoring Report (FPL 2012a) and Comprehensive Post-Uprate Monitoring Report (FPL 2016a) and for the last several years' Annual Monitoring Reports (FPL 2017a, 2018a).

During this reporting period, the operation of the UFA freshening wells has continued, adding an average of 11.17 mgd of low salinity UFA water to the CCS. Turkey Point groundwater RWS construction was completed and the system became fully operational on May 15, 2018 and operated 90% of the time during the reporting period. There are some early indications of reductions in salinity in shallow wells closest to the CCS, most likely due to RWS operation.

7.1 Meteorological

Major Findings

- Total rainfall over the CCS estimated from NEXRAD during the reporting period was 36.97 inches, while the average historical value is 43.67 inches, with the deficiency occurring during the wet season. Wet season rainfall was only 23.07 inches, compared to the wet season historical average of 28.16 inches.

- The drier 2018 wet season was preceded by a below average dry season in the previous reporting period, with the total rainfall for the months of January through March 2018 being the second driest, based on 51 years of records from the S-20F rainfall station.

- There was only one large rainfall event greater than 3 inches and only two rainfall events greater than 2 inches during the reporting period. This lack of large rainfall events (i.e., greater than several inches/day or consecutive-rainfall events totaling 5 to 6 inches) was a notable meteorological finding for the reporting period. In most years there are two to four events in excess of 3 or 4 inches and one or two multi-day periods of much higher rainfall totals. These types of events cause appreciable declines in CCS salinity since the rainfall inputs greatly exceed evaporative losses; in this reporting period, these rainfall events did not occur as often as in previous years.

- Temperature was overall warmer this reporting year, both regionally and over the CCS, contributing to higher evaporative losses.

- Atmospheric tritium in the vicinity of the CCS elevates background tritium levels in the nearby waterbodies. Atmospheric exchange is highest around the plant (>500 pCi/L), although the values attenuate with distance from the plant, with values approaching 40 pCi/L observed several miles west of the CCS.

7.2 Groundwater

Major Findings

- There continues to be hypersaline groundwater (greater than 19,000 mg/L chloride) under and adjacent to the CCS, with diminishing concentrations at depth farther from the CCS. The extent of this hypersaline water, based on chloride data, has not appreciably changed compared to the historical period of record.

- Data for this reporting period show no significant changes to the orientation and extent of CCS groundwater. Based on tritium data for the reporting period, the outer limit for potential CCS groundwater (20 pCi/L isopleth) at depth continues to be approximately 4.5 miles west of the CCS.

- The farthest wells, over 5.5 to 6 miles west of the CCS (TPGW-8 and TPGW-9, respectively), continue to be fresh at all depths, as are the shallow and intermediate depth wells at TPGW-7.

- Based on water quality results, vertical profiling, and induction logging, a fresher groundwater lens was present within the upper 18 to 20 ft of the aquifer just west of the CCS. The lens thickens/increases in depth to over 50 ft at TPGW-7 (over 4.5 miles west of the CCS) and encompasses the full extent of the Biscayne Aquifer farther west. The thickness of this fresher groundwater lens varies slightly from year to year due to seasonal meteorological influences.

- Groundwater specific conductance, chloride, sodium, and tritium values were generally consistent for the majority of wells throughout the entire monitoring effort. However, there are exceptions, as discussed below.

    - Declines in saltwater constituents were recorded in several of the groundwater monitoring wells located west of and closest to the CCS. This notably includes TPGW-1S, TPGW-2S, and TPGW-15S, where historically low specific conductance, chloride, and/or sodium values were recorded and automated data show a clear downward trend that coincides with RWS hypersaline groundwater extraction pumping.

    - Quarterly specific conductance, chloride, and sodium data in the shallow zone at TPGW-L3 (18 ft) and TPGW-L5 (18 ft) show declines in values compared to the previous reporting period when the shallow zone was influenced (made saltier) by Hurricane Irma.

    - There have been increases in specific conductance, chloride, sodium, and/or bulk resistivity in the vicinity of Tallahassee Road in the deep zone of the Biscayne Aquifer (TPGW-4, TPGW-5, TPGW-7D, and TPGW-G21 [58-ft interval]). The rate of inland movement of saltwater has diminished during the reporting period relative to previous years.

- At TPGW-G21 (58 ft), quarterly specific conductance, chloride, and sodium values continued to increase slightly during this reporting period. The tritium concentrations have also been gradually increasing, but are still relatively low; the average for the reporting period was 57.8 pCi/L.

- Groundwater at the base of the Biscayne Aquifer, over 100 ft below the bottom of Biscayne Bay, has experienced gradual increases in saltwater constituents since 2012/2013 (TPGW-10D and TPGW-11D), but this has leveled off. Automated specific conductance values throughout the reporting period are nearly unchanged. The 2019 induction logs for these sites actually show a slight decrease in bulk resistivity compared to the previous year.

- The primary influence of the CCS on groundwater below Biscayne Bay is observed in the deep wells. There is little to no sourced CCS groundwater in the shallow wells, and porewater data collected from multiple locations in the Bay do not reveal CCS sourced groundwater seeping up into the Bay.

- From May 15, 2018, through May 31, 2019, over 4.9 billion gallons of hypersaline groundwater and over 2 billion pounds of salt were removed from the Biscayne Aquifer in the vicinity of the CCS via the operation of the RWS.

7.3 Surface Water

Major Findings

- The majority of conclusions regarding surface water quality and stage from this reporting period are similar to the values reported in the Pre- and Post-Uprate Comprehensive Monitoring Reports (FPL 2012a, 2016a) and previous Annual Monitoring Report (FPL 2017a, 2018a) findings.

- The average specific conductance for the CCS using all seven stations combined during the reporting period (72,556 µS/cm) was almost exactly the same as the previous year (72,227 µS/cm). The average annual salinity for this year, calculated in accordance with Paragraph 29.J of the Consent Order, was 51.1 on the PSS-78 scale. The average CCS surface water temperature for the monitoring reporting period was 31.2°C, which is 0.7°C warmer than the previous reporting period due to commensurately warmer air temperatures, but still 2.3°C cooler than the 2014/2015 reporting period when CCS temperatures were the highest.

- Tritium concentrations in surface waters surrounding the CCS are influenced by atmospheric deposition and vary based on tritium levels in the CCS, wind, rainfall, and distance. December 2018 canal and Biscayne Bay values were elevated commensurate with higher tritium levels in the CCS at that sampling period. The data do not support that the source of tritium was from a groundwater pathway.

- The average temperature drop from near the plant discharge into the CCS at TPSWCCS-1 to the intake near TPSWCCS-6 was 9.3°C. This change in temperature reflects the amount of cooling that occurred across the CCS and reflects the best cooling performance since monitoring began.

- The L-31E canal exhibited notable increases in specific conductance several times during the reporting period, indicating a saltwater influence. These elevated salinity events have been observed every reporting period when coastal tidal water elevations exceed water levels in the L-31E canal. Based on multiple lines of evidence (i.e., groundwater gradients, depth of hypersaline groundwater below the bottom of the L-31E canal, tritium concentrations, tritium-specific conductance relationships), the source of the saltwater entering the canal is Biscayne Bay marine groundwater and is not linked to the CCS.

- Water quality and automated data from Biscayne Bay for this reporting period indicate no changes in trends or discernible influences from the CCS on adjacent surface waterbodies.

- Total phosphorous samples at all of the Biscayne Bay/Card Sound stations were non-detect based on detection limits of 0.00582 mg/L and 0.009 mg/L, which are below or near historical values reported in the Bay.

- UFA freshening water was added during the report period (approximately 4.15 billion gallons). This non-potable, low salinity water was instrumental in moderating CCS salinities and offset some of the evaporative losses of water from the CCS; however, it was not enough to offset the over 19 mgd deficit between precipitation and evaporation that occurred during the reporting period.

7.4 Water Budget

Major Findings

- The water and salt budget model has been fairly robust in informing understanding of processes that control the CCS and the manner in which the CCS interacts with the adjacent aquifer and waterbodies.

- The average monthly difference in rainfall versus evaporation was 589 million gallons, meaning that during the reporting period, on average, over 19.36 mgd of freshwater left the CCS by evaporation than was added by rainfall.

- The modeled net flow of water was calculated to be an average inflow of 2.19 mgd over the 12-month calibration period, while the net gain (inflow) of salt over the same time period was 423 (lb x 1,000)/day.

7.5 Ecological

Major Findings

- The marsh and mangrove areas are representative of communities found along the coastal fringe of South Florida, are hydrologically modified and/or nutrient limited systems, and have remained consistent over the historical period of record.

- Marsh and mangrove productivity is a function of hydrological and biogeochemical interactions within each plot and is affected by regional meteorological conditions and climatic events (e.g., Hurricane Irma).

- The data collected during the reporting period continue to support the conclusion that the CCS does not have an ecological impact on the surrounding areas and there is no clear evidence of CCS water in the surrounding marsh and mangrove areas from a groundwater pathway. Ecological changes observed during this reporting period are more seasonally and meteorologically driven.

- Based on 9 years of twice yearly in-situ observations of seagrass in Biscayne Bay and Card Sound, there has been no indication of seagrass community transition that would indicate increases in TP or impacts from the CCS. While some changes in density or vegetation composition have been documented seasonally or annually, there is no trend to those changes. The location and growth of seagrasses in the area appear to be primarily a function of sediment depth.

- TN/TP ratios in seagrass vary from year to year and still indicate a phosphorus-limited system with ratios similar to, and often more limiting than, the control/background station in Barnes Sound.

7.6 Interceptor Ditch

Major Findings

- ID operational criteria triggered the use of the ID pumps for a total of 36 days during the reporting period, with a combined total of 492 hours of pumping. The total volume pumped from June 1, 2018, through May 31, 2019, was 460 million gallons, which was approximately 3.5 times lower than the previous reporting period.

- The ID was successful in restricting a net westward migration of CCS groundwater in the upper portion of the Biscayne Aquifer, as evidenced by the continued presence of a freshwater lens west of the ID.

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