

Southeast Coast Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 2.2.04

Park-wide Assessment Water and Sediment Quality Data Summary Reporting Manual—Version 2.0

Please cite this as:

Starkey, E. N., and W. Wright. 2022. Park-wide assessment water and sediment quality data summary reporting manual—Version 2.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—2.2.04. Southeast Coast Network, Athens, Georgia.

Summary

The following standard operating procedure (SOP) outlines the format and general approach to developing data summary reports for the assessment of estuarine water and sediment quality. Natural Resource Data Series (NRDS) reports are intended for the timely release of basic data sets and data summaries. These reports provide managers with the status of water and sediment quality conditions and are not intended to synthesize multiple years of data and determine trends. In addition, this SOP may not cover all park specific exceptions and reporting needs. Reports for each park, published after 2016, serve as the template to generate subsequent reports. See [NPS Integrated Resource Management Applications Portal](#) to search for the latest SECN park-wide assessment reports.

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
1/17/2013		Citation updated	Protocol publication	1.0
08/20/2021	E. N. Starkey	Citation and procedures updated. Title changed for consistency with other SOPs. Procedures updated to reflect the latest NRDS template and SECN report preparation procedures.	Changes to data export and report preparation since original publication.	2.0

Contents

	Page
Park-wide Assessment Activities and Workflow Summary	5
Required Access and Software	6
Overview.....	6
Report Authorship	6
How to Submit Reports to Editing	6
Data Summary Report Outline.....	7
Major Sections.....	7
List of Figures and Tables	7
Data Export from SECN Water-Quality Monitoring Database	9
Main Report Tables.....	10
Table 1—Location and Site Information.....	10
Table 2—Parameter Condition Criteria.....	13
Table 3—Site and Park Condition Criteria	13
Table 4—Thresholds for Ecological Condition	14
Table 5—Sediment Quality Guideline Values	14
Table 6—Site Water-Quality Data	16
Water Clarity	16
Chlorophyll a, Dissolved Inorganic N, Dissolved Inorganic P, Total N, and Total P.....	16
Dissolved Oxygen	16
Table 8—Concentration of Select Metals	18
Table 8a—Concentrations of Contaminants (Acenaphthene – Chrysene).....	21
Table 8b—Concentrations of Contaminants (Dibenz[A,H]Anthracene – Total Polychlorinated Biphenyl [PCBs])	24
Table 9—Ecological Condition by Site.....	27

Main Report Figures	29
Figure 1—Location Map of Park	29
Figure 2—Sampling Locations Map	29
Figures 3 to 7—Parameter Specific Index Rating Maps	30
Figure 8—Water Quality Index Rating Map.....	30
Figure 9—Ecological Condition due to Sediment Contamination Map.....	30
Summary, Key Findings and Results.....	40
Other Sections of the Park-wide Assessment Data Report.....	40
Literature Cited	41
Appendix A. Example Park-wide Reports Found on IRMA	42

Park-wide Assessment Activities and Workflow Summary

An overview of park-wide assessment activities and workflow are presented in Figure 1. SOPs are presented left to right in the general order of operations for each activity. This SOP (2.2.04) pertains to the Post-Sampling activity.

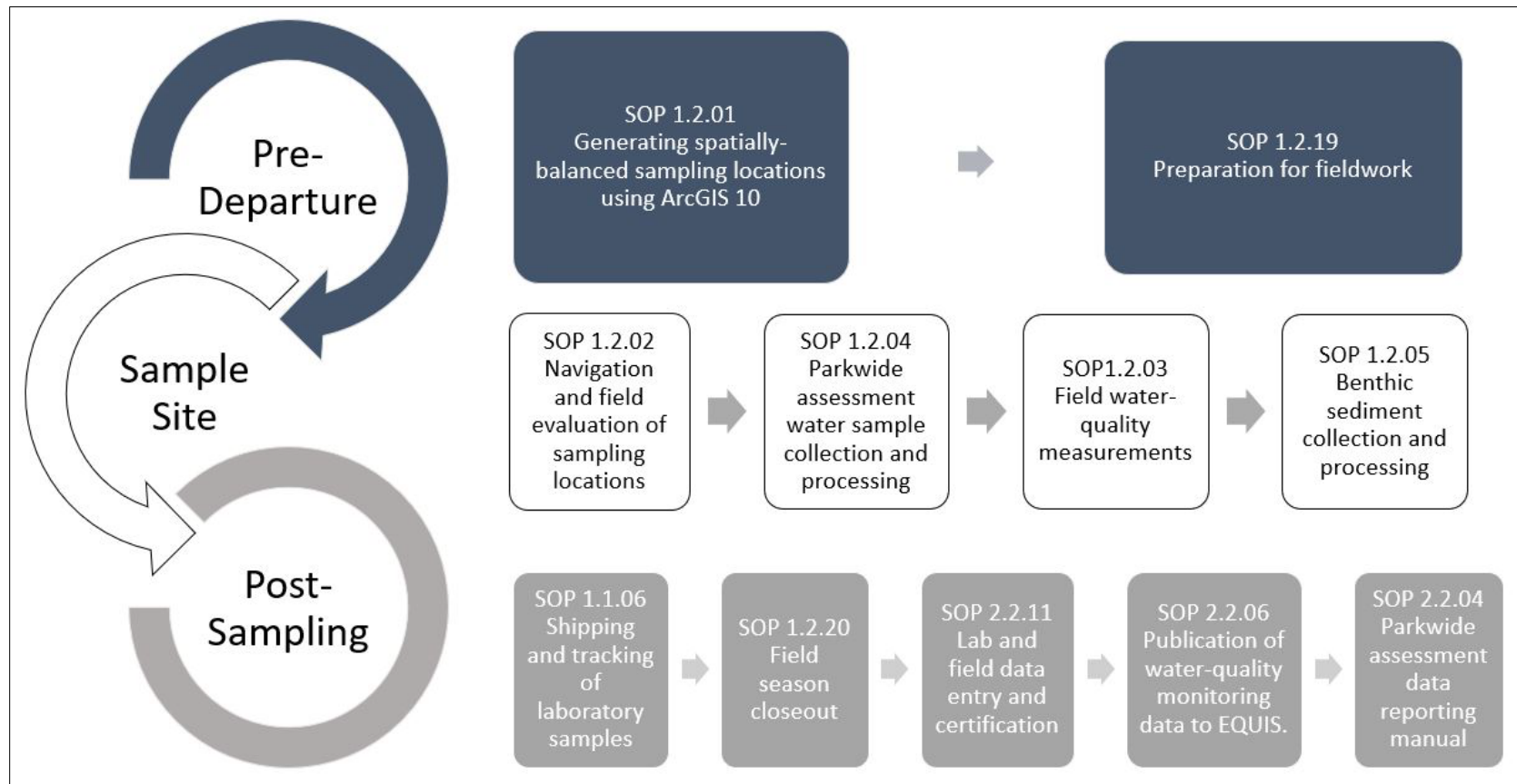


Figure 1. Park-wide assessment activities and workflow. SOPs are presented left to right in the general order of operations for each activity.

Required Access and Software

- Access to the DOI Network.
- Access to the NPS Power BI Report Server – Estuarine Water-quality Reports ([Estuarine Water Quality - Power BI Report Server](#)). For access contact SECN Data Manager Wendy Wright (wendy_wright@nps.gov).
- Microsoft Excel
- Microsoft Word
- ArcGIS 10.7 or above, with existing map templates for the park-wide assessment.

Overview

This standard operating procedure (SOP) outlines the format and general approach to developing data summary reports for the park-wide assessment of estuarine water and sediment quality. Natural Resource Data Series (NRDS) reports are intended for the timely release of basic data sets and data summaries. These reports provide managers with the status of water and sediment quality conditions and are not intended to synthesize multiple years of data and present trends. In addition, this SOP may not cover all park specific exceptions and reporting needs. Reports for each park, published after 2016, serve as the template to generate subsequent reports. See [NPS Integrated Resource Management Applications Portal](#) to search for the latest SECN park-wide assessment reports.

Prior to reporting, all data must have cleared the quality assurance and quality control procedures outlined in SOP 2.2.11 *Park-wide Assessment Data Entry, Processing, and QA/QC*—Version 1.0 (Starkey and McCay 2022; Figure 1). If, during report preparation, a data error is discovered, the SECN aquatic ecologist must work with the SECN data manager to rectify the issue within the SECN data system. All corrections need to be applied prior to report publication and release.

Report Authorship

Report authorship will follow guidelines published in the Southeast Coast Network’s SOP 2.1.03 *Southeast Coast Network Authorship Guidelines*—Version 3.0 (SECN 2019).

How to Submit Reports to Editing

Prior to preparing reports, the lead author will meet with the regional editor and discuss the preferred format for submission. As of the writing of this SOP, the acting editor prefers the following be submitted for each report.

- Text in a Microsoft Word Normal Template document, with defined headers (e.g., Heading 1, Heading 2), and placeholders indicating where each table and figure should be located.
- Tables will be submitted in a single Excel file.

- Figures will be labeled (e.g., Figure1_Sunset-over-MosquitoLagoon, Figure2_DailyMeanDO, etc.) and submitted in a single folder for the report.

Data Summary Report Outline

Data summary reports include the following major sections, figures, and tables. **The example reports in Appendix A and reports published on IRMA after 2016 should serve as templates for future reports.**

Major Sections

- Summary and Key Findings
- Introduction
- Study Area
- Methods
 - Water-quality data collection
 - Water-quality assessment criteria
 - Sediment data collection
 - Sediment Assessment Criteria
- Results
 - Parameter-based water condition assessments
 - Sediment Condition Assessments
 - Water-quality data
- Literature Cited

List of Figures and Tables

Specifics for each figure and table are discussed below. Note that *PARK*, *MONTH*, *YEAR*, and *SAMPLE DATE* change for each report.

Figures

- Figure 1. Map of fixed stations monitored by the Southeast Coast Network and significant waters in the vicinity of the *PARK*, in *YEAR*.
- Figure 2. Map showing the location of park-wide assessment sites sampled in *MONTH*, *YEAR* at *PARK*.
- Figure 3. Water clarity ratings at sampling sites at *PARK* in *MONTH*, *YEAR*

- Figure 4. Chlorophyll *a* concentrations at *PARK* in *MONTH, YEAR*.
- Figure 5. Dissolved inorganic nitrogen concentrations at sampling sites at *PARK* in *MONTH, YEAR*.
- Figure 6. Dissolved inorganic phosphorus concentrations at sampling sites at *PARK* in *MONTH, YEAR*.
- Figure 7. Dissolved oxygen concentrations at sampling sites at *PARK* in *MONTH, YEAR*.
- Figure 8. Water-quality index rating at sampling sites in the vicinity of *PARK* in *MONTH, YEAR*.
- Figure 9. Spatial distribution of sampling sites and the corresponding ratings for ecological condition based on sediment chemistry at *PARK* in *MONTH, YEAR*. (Optional if no sediment was sampled)

Tables

- Table 1. Site name, waterbody name and location, depth, coordinates, and chemical and physical attributes of sampling sites at *PARK, SAMPLE DATE*.
- Table 2. Coastal water-quality monitoring condition criteria for water-quality parameters collected by the Southeast Coast Network.
- Table 3. Condition criteria used for water-quality assessment summaries at individual sampling sites and parks.
- Table 4. Thresholds for sediment chemistry used to determine ecological condition by site (EPA 2010) [mERM-Q— mean Effects-Range Median Quotient; LRM— Logistic Regression Model; Pmax—maximum probability].
- Table 5. Sediment-quality guideline values used to calculate mERM-Q and LRM-Pmax (EPA 2016).
- Table 6. Water-quality parameter values and assessment conditions for sampling sites in the vicinity of *PARK, SAMPLE DATE*.
- Table 7. Concentrations of select metals for sites sampled at *PARK, SAMPLE DATE*. (Optional if no sediment was sampled)
- Table 8a. Organic contaminant concentrations (Acenaphthene – Chrysene) for sites sampled at *PARK, SAMPLE DATE*. (Optional if no sediment was sampled)
- Table 8b. Organic contaminant concentrations (Dibenz(A,H)Anthracene – Total Polychlorinated Biphenyl (PCBs) for sites sampled at *PARK, SAMPLE DATE*. (Optional if no sediment was sampled)

- Table 9. Ecological condition, based on sediment, for sites sampled at *PARK*, *SAMPLE DATE*. (Optional if no sediment was sampled)

Data Export from SECN Water-Quality Monitoring Database

Access the NPS Power BI Report Server (Figure 2)—Estuarine Water-quality Reports at [Estuarine Water Quality - Power BI Report Server \(doi.net\)](#). Run the following reports and export them to Word for subsequent formatting and inclusion in the data summary report.

1. Parkwide_SiteInfo (becomes report table 1)
2. Parkwide_WaterQualityConditionCriteria (reports the monitoring condition criteria for water-quality parameters (i.e., % good, fair, and poor ratings)
3. Parkwide_WaterQualityConditionSummary (reports the site water-quality index ratings shown in report figure 8)
4. Parkwide_WaterQualityParameterValueAndConditionOutput (becomes report table 6)
5. Parkwide_ConcentrationsOfSelectMetals (becomes report table 7 [do not include in years without sediment samples])
6. Parkwide_ConcentrationsOfOrganicContamination (becomes report tables 8a and 8b [do not include in years without sediment samples])

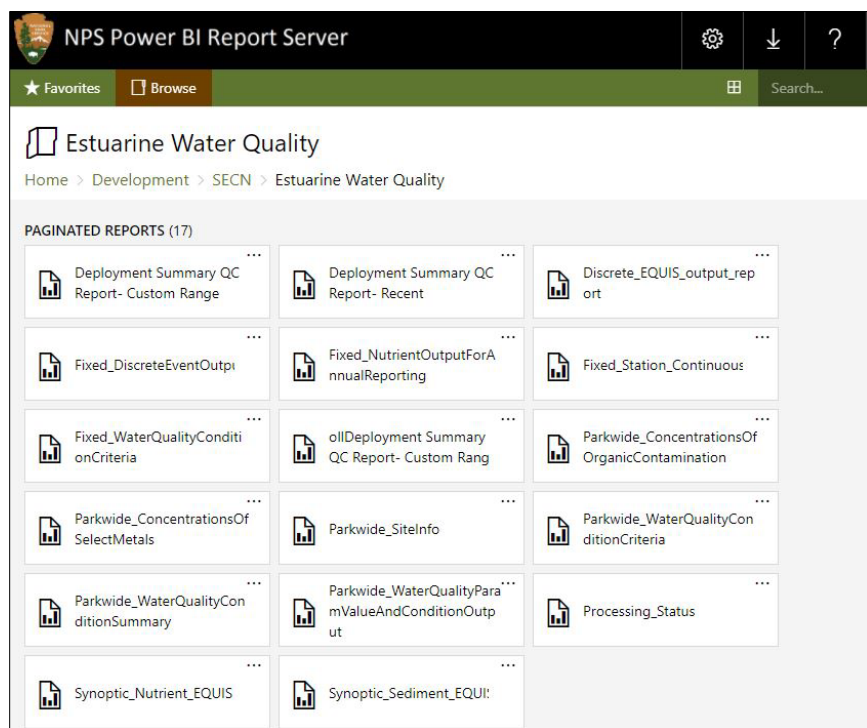


Figure 2. NPS Power BI Report Server – Estuarine Water-quality Reports.

Main Report Tables

Tables are discussed prior to figures because the table results are used to build the maps and graphs shown in the figures. For 508 compliance, all color coding for ratings of Good, Fair, and Poor use the following Red (R), Green (G), and Blue (B) colors. Good: R=164, G=252, B=168; Fair: R=255, G=255, B=153; Poor: R=241, G=153, B=135.

Table 1—Location and Site Information

This table contains site name, waterbody name, X and Y coordinates in UTM, presence/absence of submerged aquatic vegetation, presence/absence of marine debris, site depth, water temperature, pH, and salinity for all sampled sites.

The table references site names used to present data in report figure 2. All coordinates are in NAD83 Datum, in UTM zone 17 or 18. It is important to note in the table caption that salinity, pH, and water temperature were measured at a depth of 0.5 meters (1.6 feet) unless the total depth was less than 1.0 meter (3.3 feet). Ensure that all measures are reported to one decimal place. The final table in the report is landscape format.

Table 1. Example report table 1. Site name, waterbody name and location, depth, coordinates, and chemical and physical attributes of sampling sites at Canaveral National Seashore, July 15–18, 2019. The table references site names used to present data in this report (Figure 2). All coordinates are in NAD83 Datum, in UTM zone 17. Salinity, pH, and water temperature measured at a depth of 0.5 meters. [SAV—sub-aquatic vegetation; m—meters; °C—degrees Celsius; ppt—parts per thousand].

Site Name	Water Body	UTMX	UTMY	SAV	Debris	Site Depth (m)	Water Temperature (°C)	pH	Salinity (ppt)
CANA-01	Mosquito Lagoon	521653	3185902	No	No	1.6	31.7	8.3	28.4
CANA-02	Mosquito Lagoon	517833	3196418	No	No	1.4	33.6	8.2	28.4
CANA-03	Mosquito Lagoon	529268	3175914	No	No	1.6	30.3	8.3	30.5
CANA-04	Mosquito Lagoon	524877	3179052	No	No	0.8	33.8	8.4	28.1
CANA-05	Mosquito Lagoon	519573	3188273	No	No	2.5	31.9	8.3	29.2
CANA-06	Mosquito Lagoon	513237	3201407	No	No	1.9	30.7	8.0	28.2
CANA-07	Mosquito Lagoon	529312	3175019	No	No	2.6	31.5	8.3	30.4
CANA-08	Mosquito Lagoon	528624	3179685	No	No	0.7	33.2	8.3	30.8
CANA-09	Mosquito Lagoon	525874	3183261	No	No	0.5	31.4	8.3	29.0
CANA-10	Mosquito Lagoon	517400	3193079	No	No	0.8	31.8	8.2	28.9
CANA-11	Mosquito Lagoon	531364	3171694	No	No	0.6	31.1	8.2	31.1
CANA-12	Mosquito Lagoon	526761	3176273	No	No	0.5	31.7	8.3	30.5
CANA-13	Mosquito Lagoon	523465	3185061	No	No	0.9	33.3	8.4	28.1
CANA-14	Mosquito Lagoon	516481	3199121	No	No	0.4	34.6	8.3	28.1
CANA-15	Mosquito Lagoon	522788	3184458	No	No	1.8	30.9	8.2	28.3
CANA-16	Mosquito Lagoon	520010	3189641	No	No	2.4	30.8	8.3	29.1
CANA-17	Mosquito Lagoon	523558	3183045	No	No	1.9	31.5	8.3	28.0

Site Name	Water Body	UTMX	UTMY	SAV	Debris	Site Depth (m)	Water Temperature (°C)	pH	Salinity (ppt)
CANA-18	Mosquito Lagoon	520242	3193009	No	No	0.7	33.0	8.3	28.1
CANA-19	Mosquito Lagoon	530688	3173643	No	No	2.0	31.4	8.3	30.4
CANA-20	Mosquito Lagoon	526705	3179071	No	No	0.7	32.2	8.4	28.2
CANA-21	Mosquito Lagoon	518408	3189357	No	No	1.6	31.1	8.2	29.3
CANA-22	Mosquito Lagoon	516601	3192414	No	No	0.7	31.7	8.2	28.5
CANA-23	Mosquito Lagoon	529233	3178393	No	No	0.6	34.0	8.3	31.5
CANA-24	Mosquito Lagoon	526960	3180386	No	No	0.6	32.7	8.3	30.2
CANA-25	Mosquito Lagoon	521266	3188928	No	No	1.3	30.6	8.3	28.6
CANA-26	Mosquito Lagoon	519492	3191416	No	No	2.1	31.3	8.3	28.8
CANA-27	Mosquito Lagoon	533026	3171724	No	No	0.8	30.3	8.3	31.0
CANA-28	Mosquito Lagoon	520442	3185364	No	No	0.5	34.4	8.2	28.4
CANA-29	Mosquito Lagoon	522796	3185258	No	No	1.3	32.7	8.3	28.3
CANA-30	Mosquito Lagoon	518975	3195313	No	No	0.7	34.5	8.3	28.1

Table 2—Parameter Condition Criteria

This table contains coastal water-quality monitoring condition criteria for water-quality parameters collected by the Southeast Coast Network. All criteria are based on thresholds set by the EPA (2012). **Water clarity criteria are park dependent (Table 7). Criteria for other parameters remain constant across sampled parks.**

Table 2. Example report table 2. Coastal water-quality monitoring condition criteria for water-quality parameters collected by the Southeast Coast Network. Based on thresholds set by the EPA (2012) [$\mu\text{g/L}$ —micrograms per liter; mg/L —milligrams per liter].

Rating	Water Clarity (k) ¹	Chlorophyll a ($\mu\text{g/L}$)	Dissolved Inorganic Nitrogen (DIN) (mg/L)	Dissolved Inorganic Phosphorus (DIP) (mg/L)	Dissolved Oxygen (mg/L)
Good	< 0.92	< 5	< 0.1	< 0.01	> 5
Fair	0.92–1.61	5–20	0.1–0.5	0.01–0.05	2–5
Poor	> 1.61	> 20	> 0.5	> 0.05	< 2

¹Light attenuation coefficients (k) were used to assess water-clarity conditions using criteria categories in Smith et al. (2006) which are comparable to the EPA (2012) criteria for the assessed water bodies.

Table 3—Site and Park Condition Criteria

Site assessments are made using an index that combines the ratings for each parameter (Table 2) into a site-specific water-quality index rating. This index allows for general comparisons between sites, summarization of conditions throughout the park, and comparisons among parks based on the percentage of sites that fall within the good, fair, or poor categories.

Table 3. Example report table 3. Condition criteria used for water-quality assessment summaries at individual sampling sites and parks.

Rating	Site Water-Quality Index Rating ¹	Park Water-Quality Index Rating
Good	A maximum of one indicator is rated fair, and no indicators are rated poor.	Less than 10% of sites are in poor condition, and more than 50% of sites are in good condition.
Fair	One indicator is rated poor, or two or more indicators are rated fair.	10% to 20% of sites are in poor condition, or 50% or less of sites are in good condition.
Poor	Two or more of the five indicators are rated poor.	More than 20% of sites are in poor condition.
Missing	Two components of the indicator are missing and the available indicators do not suggest a fair or poor rating.	NA

¹Park and site water-quality index ratings are adapted from ratings established by the EPA (2012).

Table 4—Thresholds for Ecological Condition

The Southeast Coast Network uses Environmental Protection Agency (EPA) National Coastal Condition Assessment (NCCA) sediment quality guidelines (SQG) for estuarine waters to assess the degree of sediment contamination and ecological condition by site. Table 4 of the report indicates the cut points for ecological rankings of good, fair and poor. See EPA 2010 for more information.

Table 4. Example report table 4. Thresholds for sediment chemistry used to determine ecological condition by site (EPA 2010) [mERM-Q—mean Effects-Range Median Quotient; LRM—Logistic Regression Model; Pmax—maximum probability].

Rank	Threshold
Good	mERM-Q < 0.1 and LRM Pmax ≤ 0.5
Fair	mERM-Q ≥ 0.1 - ≤ 0.5 or LRM Pmax > 0.5 – < 0.75
Poor	mERM-Q >0.5 or LRM Pmax ≥ 0.75

Table 5—Sediment Quality Guideline Values

The Southeast Coast Network uses Environmental Protection Agency (EPA) National Coastal Condition Assessment (NCCA) sediment quality guidelines (SQG) for estuarine waters to assess the degree of sediment contamination. These SQGs include the mean Effects-Range Median Quotient (mERM-Q) and Logistic Regression Model (LRM). Together, the mERM-Q and LRM provide a holistic interpretation of sediment chemistry and its potential effects on benthic organisms. The LRM approach calculates the probability of observing a toxic effect based on individual contaminant concentrations and the maximum probability (Pmax) of observing toxicity from all contaminants in a sample (EPA 2016). Values used in the LRM-Pmax calculation (B0 and B1) can be found in Table 5.

Table 5. Example report table 5. Sediment quality guideline values used to calculate mERM-Q and LRM-Pmax (EPA 2016).

Sediment Chemicals Analyzed	Units	ERL	ERM	Used to calculate mERM-Q	B0	B1	Used to calculate LRM-Pmax
Antimony	µg/g	–	–	–	-0.9005	2.4110	X
Arsenic	µg/g	8.2	70.00	X	-4.1407	3.1674	X
Cadmium	µg/g	1.2	9.60	X	-0.3400	2.5073	X
Chromium	µg/g	81.0	370.00	X	-6.4395	2.9952	X
Copper	µg/g	34.0	270.00	X	-5.7878	2.9325	X
Lead	µg/g	46.7	218.00	X	-5.4523	2.7662	X
Mercury	µg/g	0.15	0.71	X	0.8041	2.5461	X
Nickel	µg/g	20.9	51.60	–	-4.6119	2.7658	X
Silver	µg/g	1.0	3.70	X	-0.1117	1.9684	X
Zinc	µg/g	150.0	410.00	X	-7.9834	3.3420	X
Acenaphthene	ng/g	16.0	500.00	X	-3.6165	1.7532	X
Acenaphthylene	ng/g	44.0	640.00	X	-2.9620	1.3797	X
Anthracene	ng/g	85.3	1100.00	X	-3.6574	1.4854	X
Fluorene	ng/g	19.0	540.00	X	-3.7146	1.8071	X
2-methylnapthalene	ng/g	70.0	670.00	X	-3.7579	1.7833	X
Napthalene	ng/g	160.0	2100.00	X	-3.7753	1.6152	X
Phenanthrene	ng/g	240.0	1500.00	X	-4.4576	1.6768	X
Benz(a)anthracene	ng/g	261.0	1600.00	X	-4.2013	1.5747	X
Benzo(a)pyrene	ng/g	430.0	1600.00	X	-4.3005	1.5832	X
Chrysene	ng/g	384.0	2800.00	X	-4.3241	1.5372	X
Dibenz(a,h)anthracene	ng/g	63.4	260.00	X	-3.6308	1.7692	X
Fluoranthene	ng/g	600.0	5100.00	X	-4.4574	1.4787	X
Pyrene	ng/g	665.0	2600.00	X	-4.7080	1.5854	X
Total DDT	ng/g	1.6	46.10	X	–	–	–
Total PCB congeners	ng/g	22.7	180.00	X	-3.4613	1.3488	X
Total PAHs	ng/g	4020.0	44800.00	–	–	–	–

Table 6—Site Water-Quality Data

This table summarizes site-specific water-quality data for each parameter and the associated condition rating (good, fair, or poor). Data will be reported out to the precision shown in Table 6.

Water Clarity

Water clarity is estimated at each site using a Secchi disk to determine light extinction depths, which are then converted to light attenuation coefficients (k) using the equation: $k = c / \text{Secchi depth (in meters)}$ where “c” is a constant that corresponds to the water body’s naturally occurring clarity conditions (turbidity class). The value of $c = 1.0$ for naturally turbid conditions, $c = 1.4$ for normal turbidity conditions, or $c = 1.7$ for waters supporting submerged aquatic vegetation (SAV) restoration (Smith et al. 2006; EPA 2016). The terminology used by the EPA 2016 and Smith et al. 2006 differ, yet the constants and ratings are the same. **Water clarity criteria are park dependent (Table 7). Criteria for other parameters remain constant across sampled parks.** This SOP’s (2.2.04) Table 7 is useful to crosswalk the terminology and criteria to be used in each park.

Chlorophyll a, Dissolved Inorganic N, Dissolved Inorganic P, Total N, and Total P

These parameters are reported directly from the SECN Estuarine Water-Quality Monitoring Database and mirror results from the analytical lab. Note that when results are less than or equal to the Method Detection Limit [MDL], the MDL is reported. There are no EPA condition criteria for TDN and TDP.

Note that dissolved inorganic nitrogen (DIN) is calculated as $\text{NO}_3 + \text{NH}_4$ and that DIP = PO_4 .

Dissolved Oxygen

For consistency with NCCA protocols, the Southeast Coast Network reports near bottom dissolved oxygen.

Table 6. Example report table 6. Water-quality parameter values and assessment conditions for sampling sites in the vicinity of Canaveral National Seashore from July 15–18, 2019. Water clarity was assessed using light attenuation values (k) using a constant (1.7) for estuarine waters supporting submerged aquatic vegetation (SAV) restoration (Smith et al. 2006) and assessment categories that correspond to EPA (2012). Condition of other assessed parameters is based on EPA (2012). [^aGreen—good; ^byellow—fair; ^cred—poor; *result was less than or equal to the Method Detection Limit [MDL reported]; k —light attenuation coefficient; $\mu\text{g/L}$ —micrograms per liter; N—Nitrogen; mg/L —milligrams per liter; P—Phosphorous; – —data not collected;]. Dissolved oxygen concentrations are taken near the bottom (deepest reading).

Site Name	Water Clarity (k')	Chlorophyll a ($\mu\text{g/L}$)	Dissolved Oxygen (DO, mg/L)	Dissolved Inorganic N (DIN, mg/L)	Dissolved Inorganic P (DIP, mg/L)	Total Dissolved Nitrogen ² (mg/L)	Total Dissolved Phosphorus ² (mg/L)
CANA-01	2.1 ^c	19.75 ^b	5.6 ^a	0.023 ^a	0.0034 ^{a*}	0.80	0.017
CANA-02	4.3 ^c	21.69 ^c	7.7 ^a	0.015 ^a	0.0034 ^{a*}	0.82	0.021
CANA-03	1.4 ^b	22.62 ^c	3.7 ^b	0.016 ^a	0.0034 ^{a*}	0.83	0.018
CANA-04	2.4 ^c	21.03 ^c	8.2 ^a	0.014 ^{a*}	0.0034 ^{a*}	0.84	0.016
CANA-05	1.5 ^b	9.99 ^b	5.6 ^a	0.014 ^{a*}	0.0034 ^{a*}	0.75	0.019
CANA-06	2.6 ^c	20.67 ^c	4.7 ^b	0.015 ^a	0.0034 ^{a*}	0.77	0.023
CANA-07	0.9 ^a	15.19 ^b	5.2 ^a	0.016 ^a	0.0034 ^{a*}	0.83	0.017
CANA-08	3.4 ^c	15.13 ^b	7.1 ^a	0.014 ^{a*}	0.0034 ^{a*}	0.84	0.015
CANA-09	4.3 ^c	16.67 ^b	5.1 ^a	0.014 ^{a*}	0.0034 ^{a*}	0.85	0.014
CANA-10	2.8 ^c	9.77 ^b	5.3 ^a	0.049 ^a	0.0034 ^{a*}	0.84	0.017
CANA-11	4.3 ^c	26.42 ^c	3.7 ^b	0.014 ^{a*}	0.0052 ^a	0.88	0.020
CANA-12	—	11.82 ^b	6.0 ^a	0.014 ^{a*}	0.0034 ^{a*}	0.89	0.014
CANA-13	3.1 ^c	22.54 ^c	7.9 ^a	0.014 ^{a*}	0.0034 ^{a*}	0.82	0.017
CANA-14	5.7 ^c	21.2 ^c	8.3 ^a	0.023 ^a	0.0058 ^a	0.84	0.034
CANA-15	1.7 ^c	12.69 ^b	5.1 ^a	0.025 ^a	0.0034 ^{a*}	0.81	0.017
CANA-16	2.1 ^c	14.32 ^b	5.2 ^a	0.016 ^a	0.0034 ^{a*}	0.78	0.020
CANA-17	1.9 ^c	25.02 ^c	5.4 ^a	0.022 ^a	0.0034 ^{a*}	0.84	0.020
CANA-18	3.4 ^c	21.4 ^c	7.2 ^a	0.016 ^a	0.0034 ^{a*}	0.84	0.019
CANA-19	1.0 ^b	16.41 ^b	5.3 ^a	0.015 ^a	0.0034 ^{a*}	0.82	0.015
CANA-20	—	11.57 ^b	7.1 ^a	0.014 ^a	0.0034 ^{a*}	0.83	0.018
CANA-21	1.5 ^b	12.01 ^b	3.1 ^b	0.042 ^a	0.0034 ^{a*}	0.90	0.018
CANA-22	2.8 ^c	15.38 ^b	5.8 ^a	0.016 ^a	0.0034 ^{a*}	0.74	0.021

Site Name	Water Clarity (k ¹)	Chlorophyll a (µg/L)	Dissolved Oxygen (DO, mg/L)	Dissolved Inorganic N (DIN, mg/L)	Dissolved Inorganic P (DIP, mg/L)	Total Dissolved Nitrogen ² (mg/L)	Total Dissolved Phosphorus ² (mg/L)
CANA-23	3.8 ^c	21.11 ^c	7.8 ^a	0.015 ^a	0.0034 ^{a*}	0.86	0.016
CANA-24	3.4 ^c	21.23 ^c	6.6 ^a	0.017 ^a	0.0034 ^{a*}	0.98	0.015
CANA-25	2.6 ^c	24.79 ^c	4.5 ^b	0.015 ^a	0.0043 ^a	0.83	0.026
CANA-26	1.9 ^c	10.87 ^b	6.5 ^a	0.014 ^{a*}	0.0034 ^{a*}	0.80	0.018
CANA-27	2.6 ^c	24.58 ^c	4.9 ^b	0.02 ^a	0.004 ^a	0.89	0.021
CANA-28	—	12.05 ^b	6.1 ^a	0.02 ^a	0.0034 ^{a*}	0.83	0.018
CANA-29	2.8 ^c	15.08 ^b	7.2 ^a	0.015 ^a	0.0034 ^{a*}	0.82	0.016
CANA-30	5.7 ^c	26.03 ^c	8.2 ^a	0.014 ^{a*}	0.0062 ^a	0.87	0.029

¹Light attenuation coefficients (k) were used to assess water-clarity conditions using criteria categories in Smith et al. (2006) which are comparable to the EPA (2012) criteria for the assessed water bodies.

²There are no EPA condition criteria for TDN and TDP.

Table 7. Turbidity classes, constants and light attenuation coefficients used to evaluate water clarity in each park (modified from Smith et al. 2006 and EPA 2016). SAV—sub-aquatic vegetation.

Parks ¹	Turbidity Class from EPA 2016	Turbidity Class from Smith et al. 2006	Constant (c)	Light attenuation coefficients (k) for a rating of "Good"	Light attenuation coefficients (k) for a rating of "Fair"	Light attenuation coefficients (k) for a rating of "Poor"
CUIS, FOPU	Naturally Turbid	High	1.0	<2.30	2.30-2.99	>2.99
CAHA, CALO, FOMA, TIMU	Normal Turbidity	Moderate	1.4	<1.61	1.61-2.30	>2.30
CANA	SAV Restoration	Low	1.7	<0.92	0.92-1.61	>1.61

¹ Parks in each turbidity class were confirmed by the EPA in 2018, see also EPA 2016.

Table 8—Concentration of Select Metals

This table summarizes site-specific concentrations of select metals. Data are reported out to the precision shown. Note that concentrations are flagged when the result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL) or when the result was less than the MDL.

Table 8. Example report table 7. Concentrations of select metals for sites sampled at Canaveral National Seashore, July 15–18, 2019. All results are presented in mg/kg. [*—result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL); **—result was less than the Method Detection Limit].

Site	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
CANA-01	0.78**	0.78**	0.078**	5.3*	2.80*	0.31**	0.00900	1.30	5.8
CANA-02	0.86**	0.86**	0.086**	6.1*	1.60*	0.34**	0.00730*	1.40	6.5
CANA-03	0.87**	0.91*	0.091*	6.0	1.20*	3.10	0.00890	1.60	6.5
CANA-04	0.69**	0.69**	0.069**	1.1	0.69**	0.47*	0.00096**	0.29*	1.1*
CANA-05	0.72**	0.72**	0.072**	4.0*	1.40*	0.29**	0.01000	1.00*	4.3
CANA-06	0.70**	0.70**	0.070**	1.7	0.70**	0.56*	0.00170*	0.47*	2.1*
CANA-07	1.20**	1.20**	0.140*	8.8	2.00*	3.40	0.01600	2.40	9.5
CANA-08	0.72**	0.72**	0.072**	2.1	0.72**	0.96*	0.00150*	0.49*	2.3*
CANA-09	0.91**	0.91**	0.091**	5.7*	1.90*	0.36**	0.00620*	1.70	5.7
CANA-10	0.68**	0.68**	0.068**	2.6*	0.76*	0.27**	0.00380*	0.60*	2.5*
CANA-11	0.70**	0.70**	0.070**	1.2	0.70**	0.83*	0.00089**	0.30*	1.2*
CANA-12	0.76**	0.76**	0.076**	1.8	0.82*	1.40	0.00160*	0.50*	1.9*
CANA-13	0.89**	0.89**	0.089**	3.3*	0.96*	0.36**	0.00200*	0.78*	3.4*
CANA-14	0.81**	0.81**	0.081**	8.9	2.20*	0.32**	0.00840	2.20	9.2
CANA-15	0.77**	0.77**	0.077**	4.7*	1.70*	0.31**	0.00830	1.30	5.7
CANA-16	0.73**	0.73**	0.073**	3.1	2.50*	0.29**	0.00950	0.82*	4.2
CANA-17	0.83**	0.83**	0.083**	7.0	1.70*	0.33**	0.00930	1.80	7.4
CANA-18	0.69**	0.69**	0.069**	2.5*	0.81*	0.28**	0.00340*	0.58*	2.5*
CANA-19	0.77**	1.00*	0.077**	4.6	0.95*	2.20	0.00720*	1.20*	4.8

Site	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
CANA-20	0.68**	0.68**	0.068**	1.4	0.68**	0.52*	0.00088**	0.29*	1.3*
CANA-21	0.70**	0.70**	0.070**	1.4	0.90*	0.28**	0.00360*	0.43*	1.7*
CANA-22	0.75**	0.75**	0.075**	1.8	1.70*	0.30**	0.00340*	0.47*	2.2*
CANA-23	0.79**	0.79**	0.079**	2.1	0.79**	0.31**	0.00110**	0.48*	2.1*
CANA-24	0.73**	0.73**	0.073**	2.1	0.73**	1.10*	0.00150*	0.49*	2.0*
CANA-25	0.72**	0.72**	0.072**	2.6*	0.86*	0.29**	0.00220*	0.67*	2.8*
CANA-26	0.73**	0.73**	0.073**	4.4*	1.50*	0.29**	0.01000	1.10*	4.8
CANA-27	0.67**	0.67**	0.067**	1.4	0.67**	0.53*	0.00091**	0.36*	1.3*
CANA-28	0.95**	0.95**	0.095**	3.6*	2.20*	0.38**	0.00660*	1.00*	3.9
CANA-29	0.74**	0.74**	0.074**	3.0*	0.79*	0.30**	0.00410*	0.84*	3.3
CANA-30	0.78**	0.78**	0.078**	4.4*	1.80*	0.31**	0.00490*	1.20*	5.1

Table 8a—Concentrations of Contaminants (Acenaphthene – Chrysene)

This table summarizes site-specific concentrations of contaminants (Acenaphthene – Chrysene). Data are reported out to the precision shown. Note that concentrations are flagged when the result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL) or when the result was less than the MDL.

Table 9. Example report table 8a. Organic contaminant concentrations (Acenaphthene – Chrysene) for sites sampled at Canaveral National Seashore, July 15–18, 2019. All results are presented in mg/kg. [*—result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL); **— result was less than the MDL].

Site	Acenaph- thene	Acenaph- thylene	Anthracene	Fluorene	2-Methyl- naphthalene	Naphthalene	Phenan- threne	Benzo(A) Anthracene	Benzo(A) Pyrene	Chrysene
CANA-01	0.0190**	0.0250**	0.0260**	0.0220**	0.0170**	0.0180**	0.0230**	0.0310**	0.0430**	0.0320**
CANA-02	0.0190**	0.0260**	0.0260**	0.0220**	0.0170**	0.0180**	0.0230**	0.0310**	0.0440**	0.0330**
CANA-03	0.0200**	0.0260**	0.0270**	0.0220**	0.0170**	0.0180**	0.0230**	0.0320**	0.0450**	0.0330**
CANA-04	0.0170**	0.0230**	0.0240**	0.0200**	0.0160**	0.0160**	0.0210**	0.0280**	0.0400**	0.0290**
CANA-05	0.0180**	0.0240**	0.0250**	0.0210**	0.0160**	0.0170**	0.0210**	0.0290**	0.0410**	0.0300**
CANA-06	0.0043**	0.0057**	0.0059**	0.0049**	0.0039**	0.0040**	0.0052**	0.0070**	0.0098**	0.0073**
CANA-07	0.0072**	0.0096**	0.0099**	0.0082**	0.0064**	0.0067**	0.0086**	0.0120**	0.0160**	0.0120**
CANA-08	0.0190**	0.0250**	0.0260**	0.0210**	0.0170**	0.0170**	0.0220**	0.0300**	0.0420**	0.0320**
CANA-09	0.0230**	0.0310**	0.0320**	0.0270**	0.0210**	0.0220**	0.0280**	0.0380**	0.0530**	0.0400**
CANA-10	0.0043**	0.0056**	0.0058**	0.0048**	0.0038**	0.0040**	0.0076*	0.0210	0.0290	0.0310
CANA-11	0.0044**	0.0059**	0.0061**	0.0050**	0.0039**	0.0041**	0.0053**	0.0071**	0.0100**	0.0075**
CANA-12	0.0049**	0.0065**	0.0067**	0.0056**	0.0044**	0.0046**	0.0059**	0.0079**	0.0110**	0.0083**
CANA-13	0.0230**	0.0300**	0.0310**	0.0260**	0.0200**	0.0210**	0.0270**	0.0360**	0.0510**	0.0380**
CANA-14	0.0190**	0.0260**	0.0260**	0.0220**	0.0170**	0.0180**	0.0230**	0.0310**	0.0440**	0.0330**
CANA-15	0.0190**	0.0250**	0.0260**	0.0210**	0.0170**	0.0170**	0.0220**	0.0300**	0.0420**	0.0310**

Site	Acenaph- thene	Acenaph- thylene	Anthracene	Fluorene	2-Methyl- naphthalene	Naphthalene	Phenan- threne	Benzo(A) Anthracene	Benzo(A) Pyrene	Chrysene
CANA-16	0.0180**	0.0240**	0.0250**	0.0210**	0.0160**	0.0170**	0.0220**	0.0300**	0.0420**	0.0310**
CANA-17	0.0220**	0.0290**	0.0300**	0.0250**	0.0190**	0.0200**	0.0260**	0.0350**	0.0490**	0.0370**
CANA-18	0.0044**	0.0058**	0.0060**	0.0050**	0.0039**	0.0041**	0.0052**	0.0071**	0.0100**	0.0074**
CANA-19	0.0049**	0.0065**	0.0067**	0.0056**	0.0043**	0.0045**	0.0058**	0.0078**	0.0110**	0.0082**
CANA-20	0.0170**	0.0220**	0.0230**	0.0190**	0.0150**	0.0160**	0.0200**	0.0270**	0.0380**	0.0280**
CANA-21	0.0180**	0.0240**	0.0240**	0.0200**	0.0160**	0.0170**	0.0210**	0.0290**	0.0400**	0.0300**
CANA-22	0.0047**	0.0062**	0.0064**	0.0053**	0.0041**	0.0043**	0.0056**	0.0075**	0.0110**	0.0079**
CANA-23	0.0200**	0.0260**	0.0270**	0.0230**	0.0180**	0.0180**	0.0240**	0.0320**	0.0450**	0.0330**
CANA-24	0.0190**	0.0250**	0.0260**	0.0220**	0.0170**	0.0180**	0.0230**	0.0310**	0.0403**	0.0320**
CANA-25	0.0180**	0.0240**	0.0250**	0.0210**	0.0160**	0.0170**	0.0220**	0.0300**	0.0420**	0.0310**
CANA-26	0.0045**	0.0059**	0.0061**	0.0051**	0.0040**	0.0042**	0.0053**	0.0072**	0.0100**	0.0076**
CANA-27	0.0042**	0.0056**	0.0058**	0.0048**	0.0037**	0.0039**	0.0050**	0.0068**	0.0095**	0.0071**
CANA-28	0.0230**	0.0300**	0.0310**	0.0260**	0.0200**	0.0210**	0.0270**	0.0360**	0.0510**	0.0380**
CANA-29	0.0190**	0.0250**	0.0260**	0.0210**	0.0170**	0.0170**	0.0220**	0.0300**	0.0420**	0.0320**
CANA-30	0.0200**	0.0260**	0.0270**	0.0220**	0.0170**	0.0180**	0.0230**	0.0310**	0.0440**	0.0330**

Table 8b—Concentrations of Contaminants (Dibenz[A,H]Anthracene – Total Polychlorinated Biphenyl [PCBs])

This table summarizes site-specific concentrations of contaminants (Dibenz[A,H]Anthracene – Total Polychlorinated Biphenyl [PCBs]). Data are reported out to the precision shown. Note that concentrations are flagged when the result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL) or when the result was less than the MDL.

Table 10. Example report table 8b. Organic contaminant concentrations (Dibenz[A,H]Anthracene – Total Polychlorinated Biphenyl [PCBs]) for sites sampled at Canaveral National Seashore, July 15–18, 2019. All results are presented in mg/kg. [*—result was greater than or equal to the Method Detection Limit (MDL) but below the Practical Quantitation Limit (PQL); **—result was less than the Method Detection Limit; PAH—Polycyclic Aromatic Hydrocarbon].

Site	Dibenz(A,H) Anthracene	Fluoranthene	Pyrene	Low Molecular Weight PAH	High Molecular Weight PAH	Total PAHs	P,P-DDE	P,P-DDT	Total PCBs
CANA-01	0.0260**	0.0280**	0.0300**	0.1500	0.1900	0.4810	0.0033**	0.0073**	0.049**
CANA-02	0.0260**	0.0280**	0.0310**	0.1510	0.1930	0.4870	0.0035**	0.0077**	0.052**
CANA-03	0.0260**	0.0290**	0.0310**	0.1530	0.1960	0.4950	0.0036**	0.0080**	0.054**
CANA-04	0.0230**	0.0260**	0.0280**	0.1370	0.1740	0.4410	0.0029**	0.0063**	0.042**
CANA-05	0.0240**	0.0260**	0.0290**	0.1420	0.1790	0.4540	0.0030**	0.0067**	0.045**
CANA-06	0.0058**	0.0064**	0.0069**	0.0339	0.0432	0.1093	0.0029**	0.0063**	0.042**
CANA-07	0.0097**	0.0110**	0.0110**	0.0566	0.0717	0.1819	0.0048**	0.0110**	0.071**
CANA-08	0.0250**	0.0280**	0.0300**	0.1470	0.1870	0.4730	0.0031**	0.0068**	0.046**
CANA-09	0.0310**	0.0340**	0.0370**	0.1840	0.2330	0.5910	0.0039**	0.0085**	0.057**
CANA-10	0.0065*	0.0450	0.0410	0.0359	0.1735	0.3393	0.0029**	0.0063**	0.042**
CANA-11	0.0059**	0.0065**	0.0070**	0.0347	0.0440	0.1115	0.0029**	0.0064**	0.043**
CANA-12	0.0066**	0.0072**	0.0078**	0.0386	0.0488	0.1239	0.0032**	0.0071**	0.048**
CANA-13	0.0300**	0.0330**	0.0360**	0.1780	0.2240	0.5680	0.0037**	0.0081**	0.054**
CANA-14	0.0260**	0.0280**	0.0310**	0.1510	0.1930	0.4860	0.0034**	0.0076**	0.051**
CANA-15	0.0250**	0.0270**	0.0300**	0.1470	0.1850	0.4700	0.0033**	0.0072**	0.048**
CANA-16	0.0250**	0.0270**	0.0290**	0.1430	0.1840	0.4640	0.0030**	0.0067**	0.045**
CANA-17	0.0290**	0.0320**	0.0340**	0.1710	0.2160	0.5490	0.0036**	0.0079**	0.053**

Site	Dibenz(A,H) Anthracene	Fluoranthene	Pyrene	Low Molecular Weight PAH	High Molecular Weight PAH	Total PAHs	P,P-DDE	P,P-DDT	Total PCBs
CANA-18	0.0059**	0.0065**	0.0070**	0.0344	0.0439	0.1110	0.0029**	0.0064**	0.043**
CANA-19	0.0065**	0.0072**	0.0077**	0.0383	0.0484	0.1230	0.0033**	0.0072**	0.048**
CANA-20	0.0230**	0.0250**	0.0270**	0.1320	0.1680	0.4250	0.0029**	0.0063**	0.042**
CANA-21	0.0240**	0.0260**	0.0280**	0.1400	0.1770	0.4490	0.0030**	0.0067**	0.045**
CANA-22	0.0062**	0.0068**	0.0074**	0.0366	0.0468	0.1178	0.0031**	0.0070**	0.047**
CANA-23	0.0270**	0.0290**	0.0310**	0.1560	0.1970	0.5000	0.0033**	0.0073**	0.049**
CANA-24	0.0260**	0.0280**	0.0300**	0.1500	0.1900	0.4810	0.0031**	0.0068**	0.045**
CANA-25	0.0250**	0.0270**	0.0290**	0.1430	0.1840	0.4640	0.0029**	0.0065**	0.043**
CANA-26	0.0060**	0.0066**	0.0071**	0.0351	0.0445	0.1129	0.0030**	0.0067**	0.045**
CANA-27	0.0056**	0.0062**	0.0067**	0.0330	0.0419	0.1061	0.0028**	0.0062**	0.041**
CANA-28	0.0300**	0.0330**	0.0360**	0.1780	0.2240	0.5710	0.0039**	0.0087**	0.058**
CANA-29	0.0250**	0.0280**	0.0300**	0.1470	0.1870	0.4730	0.0031**	0.0068**	0.045**
CANA-30	0.0260**	0.0290**	0.0310**	0.1530	0.1940	0.4930	0.0033**	0.0073**	0.049**

Table 9—Ecological Condition by Site

This table summarizes ecological condition by site. The condition score is determined using the criteria shown in report table 4.

Sediment Index Calculations

The Southeast Coast Network uses Environmental Protection Agency (EPA) National Coastal Condition Assessment (NCCA) sediment quality guidelines (SQG) for estuarine waters to assess the degree of sediment contamination. These SQGs include the mean Effects-Range Median Quotient (mERM-Q) and Logistic Regression Model (LRM). Together, the mERM-Q and LRM provide a holistic interpretation of sediment chemistry and its potential effects on benthic organisms.

The mERM-Q approach assesses the relative degree of sediment contamination and estimates the probability of toxicity to benthic organisms from sediment contaminants (EPA 2016). To calculate mERM-Q, each chemical concentration is divided by its corresponding ERM value. The mERM-Q is the average of the resulting ratios for a sample (EPA 2016).

The LRM approach evaluates relationships between contaminant concentrations and adverse effects of select contaminants (EPA 2016). The Pmax is the calculation of maximum probability of observing sediment toxicity taken from the set of probabilities that were calculated for each chemical in a sample (EPA 2016). Calculation of the LRM value for each chemical is done using formulas from EPA (2016).

The calculation of mERM-Q and LRM values is done outside of the SECN estuarine water-quality database using a template in Microsoft Excel. Previous examples are on the SECN share drive in folders for each park-wide assessment (e.g., S:\Monitoring\EstuarineWaterQuality\Parkwide_Assessment\Data\CANA_2019).

Previous park-wide assessments conducted by the network and the EPA used % Total Organic Carbon (TOC) as a rating factor for sediment quality. However, in 2010, the EPA updated its methods to reflect current practices and %TOC is no longer a component of the sediment quality index. As a result, %TOC is reported in report table 9 for comparison with past reports but is not used in determination of ecological condition by site.

Table 11. Example report table 9. Ecological condition, based on sediment, for sites sampled at Canaveral National Seashore, July 15–18, 2019. Ecological condition was determined using the thresholds for sediment chemistry in EPA NCCA (2010). Total Organic Carbon % is presented for comparison with previous coastal assessments [^agreen—good].

Site	Ecological Condition by Site	Total Organic Carbon %
CANA-01	Good ^a	0.170
CANA-02	Good ^a	0.160
CANA-03	Good ^a	0.240
CANA-04	Good ^a	0.058
CANA-05	Good ^a	0.110
CANA-06	Good ^a	0.034
CANA-07	Good ^a	0.380
CANA-08	Good ^a	0.210
CANA-09	Good ^a	0.370
CANA-10	Good ^a	0.022
CANA-11	Good ^a	0.180
CANA-12	Good ^a	0.160
CANA-13	Good ^a	0.098
CANA-14	Good ^a	0.190
CANA-15	Good ^a	0.270
CANA-16	Good ^a	0.510
CANA-17	Good ^a	0.160
CANA-18	Good ^a	0.042
CANA-19	Good ^a	0.190
CANA-20	Good ^a	0.044
CANA-21	Good ^a	0.013
CANA-22	Good ^a	0.320
CANA-23	Good ^a	0.110
CANA-24	Good ^a	0.160
CANA-25	Good ^a	0.050
CANA-26	Good ^a	0.095

Site	Ecological Condition by Site	Total Organic Carbon %
CANA-27	Good ^a	0.069
CANA-28	Good ^a	0.210
CANA-29	Good ^a	0.058
CANA-30	Good ^a	0.120

Main Report Figures

All report figures are created using data from tables mentioned above and from existing Arc GIS templates found on the SECN GIS drive (L:\GIS\projects\EstuarineWaterQuality\Parkwide_Assessment\CANA\2019\map documents\Data Maps AND L:\GIS\projects\EstuarineWaterQuality\SignificantWaters\map documents).

For 508 compliance, all color coding for ratings of Good, Fair, and Poor use the following Red (R), Green (G), and Blue (B) colors. Good: R=164, G=252, B=168; Fair: R=255, G=255, B=153; Poor: R=241, G=153, B=135.

Prior to publication of any map ensure that:

- The park boundary is still current and accurate.
- All coverages are the most current available (303(d), urban areas, special use areas, etc.)
- New maps created in Arc GIS have been saved as CMYK PDF or .jpeg format and are 6.5 inches (16.5 centimeters) wide (no taller than 8 inches [20.3 centimeters]) and 600 dpi for portrait maps, and 8.5 inches (21.6 centimeters) wide (no taller than 6 inches [15.2 centimeters]) and 600 dpi for landscape.

Figure 1—Location Map of Park

See the example template on the SECN GIS drive: CANA_SigWaters.mxd. Report figure 1 shows: park boundaries, SECN and collaborator fixed water-quality monitoring stations, salt marsh, impaired waters (i.e., 303(d)), urban areas, and important miscellaneous features such as restricted areas and pole/troll zones (Figure 3). Saltmarsh areas are determined using data from the United States Fish and Wildlife Service (e.g., FWS 2022). Urbanized areas are determined using data from the United States Census Bureau (e.g., USCB 2020), impaired 303(d) listed waters are determined using data from the United States Environmental Protection Agency (e.g., EPA 2022).

Figure 2—Sampling Locations Map

See the example template on the SECN GIS drive: CANA_2019_CA_Sites.mxd. Report figure 2 shows the location of all sampled sites during the park-wide assessment (Figure 4). Any site shown in report table 1 will be depicted on the figure. Do not show impaired waters, poll and troll zones or special use areas on this map. Points are labeled with the site name shown in report table 1.

Figures 3 to 7—Parameter Specific Index Rating Maps

See the example templates on the SECN GIS drive: CANA_2019_CA_WC.mxd, SECN GIS drive: CANA_2019_CA_CHLa.mxd, CANA_2019_CA_DIN.mxd, CANA_2019_CA_DIP.mxd, CANA_2019_CA_DO.mxd. These figures show the condition rating for each parameter at each site and are based on report tables 2 and 6. The marker for each site is color coded according to its rating (Good, Fair, Poor). See above for the standard 508 acceptable colors, blue indicates “No Data.” In addition, the proportion (as a percentage) of sites in each rating category (Good, Fair, Poor) is displayed in an inset pie chart (Figures 5–9).

Figure 8—Water Quality Index Rating Map

See the example template on the SECN GIS drive: CANA_2019_CA_SiteCond.mxd. The Site Water-Quality Index Rating is determined for each site based on the criteria found in report figure 3. This index considers how many indicator parameters are rated as good, fair, and poor (Figure 10). As with the parameter specific figures, the marker for each site is color coded according to its rating (Good, Fair, Poor). In addition, the proportion (as a percentage) of sites in each rating category (Good, Fair, Poor) is displayed in an inset pie chart.

Figure 9—Ecological Condition due to Sediment Contamination Map

See the example template on the SECN GIS drive: CANA_2019_CA_ECOcond.mxd. This figure may be omitted if no sediment was sampled. Report figure 9 shows the ecological condition by site as determined based on sediment-quality criteria shown in report table 4 (Figure 11). The marker for each site is color coded according to its rating (Good, Fair, Poor). See above for the standard 508 acceptable colors, blue indicates “No Data.” In addition, the proportion (as a percentage) of sites in each rating category (Good, Fair, Poor) is displayed in an inset pie chart.

Canaveral National Seashore Significant Waters

Southeast Coast Network
National Park Service
U.S. Department of the Interior

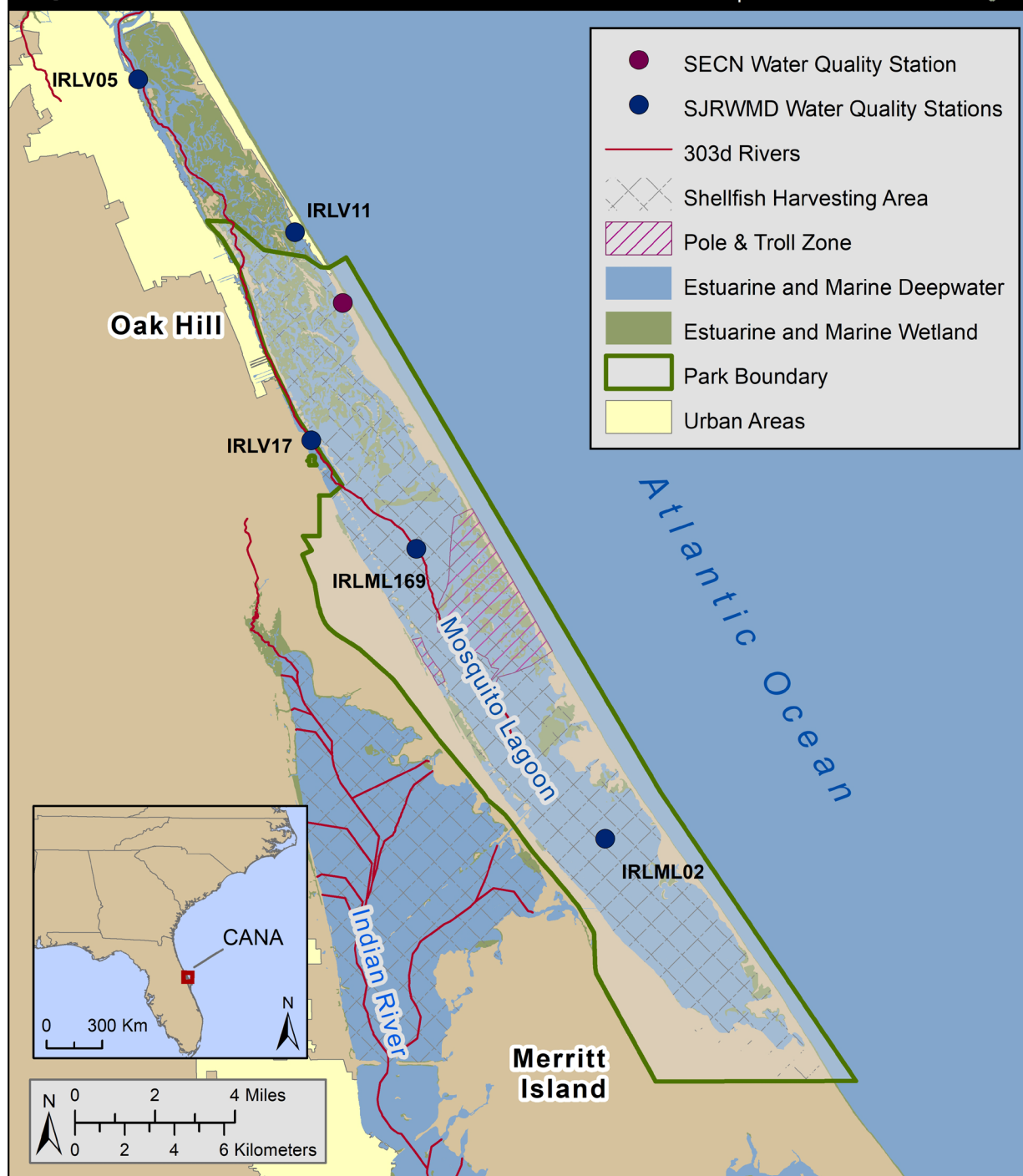


Figure 3. Example report figure 1. Map of fixed stations monitored by the Southeast Coast Network and St. Johns River Water Management District in Mosquito Lagoon, and significant waters in the vicinity of Canaveral National Seashore, in 2019. Indicated are areas of salt marsh (FWS 2022), urbanized area (United States Census Bureau 2020), 303(d) listed water bodies (Environmental Protection Agency 2019).

Canaveral National Seashore
2019 Coastal Assessment Sites

Southeast Coast Network
National Park Service
U.S. Department of the Interior

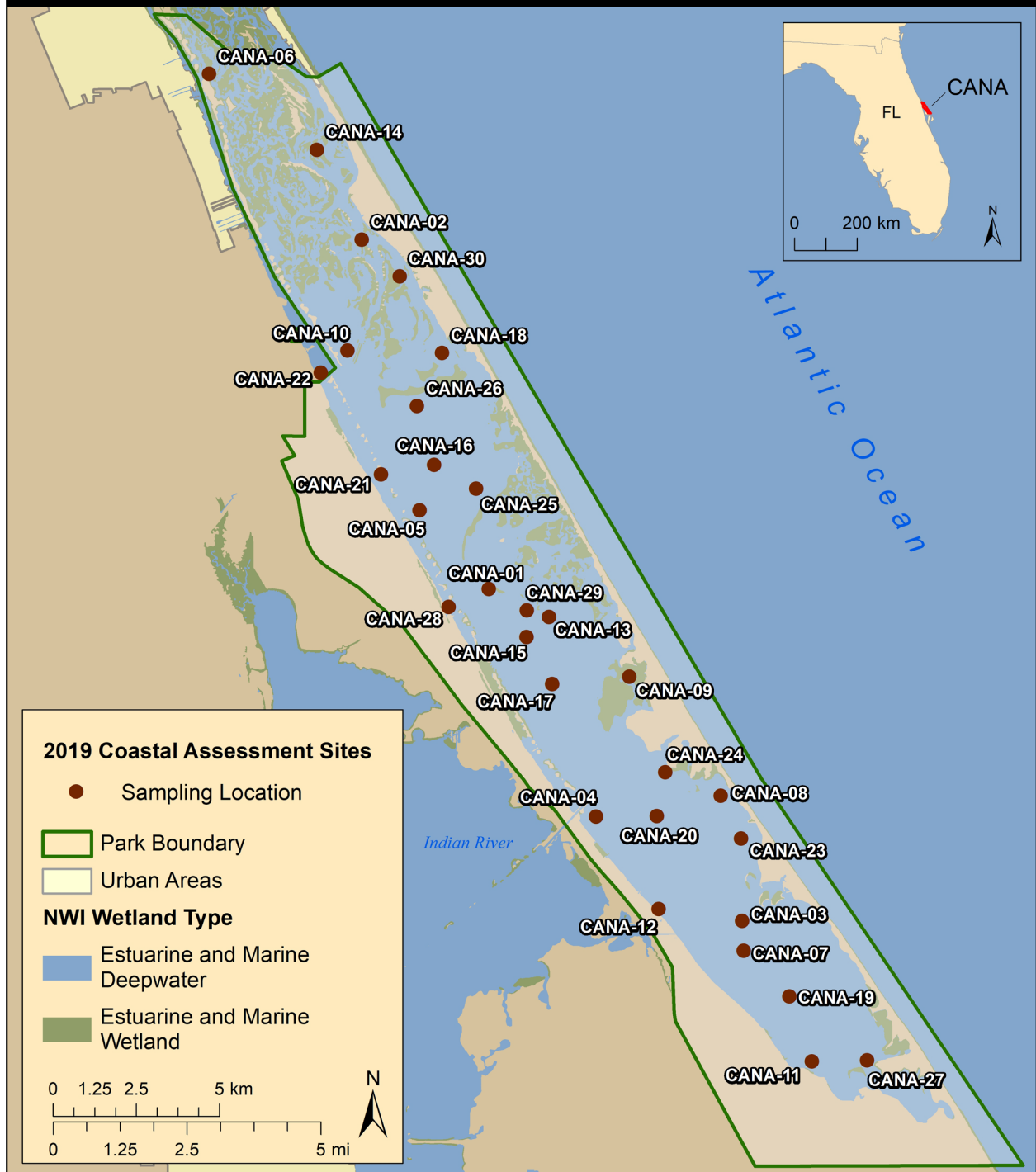


Figure 4. Example report figure 2. Map showing the location of coastal assessment sites sampled in July 2019 at Canaveral National Seashore.

Canaveral National Seashore Water Clarity (*k*)

Southeast Coast Network
National Park Service
U.S. Department of the Interior

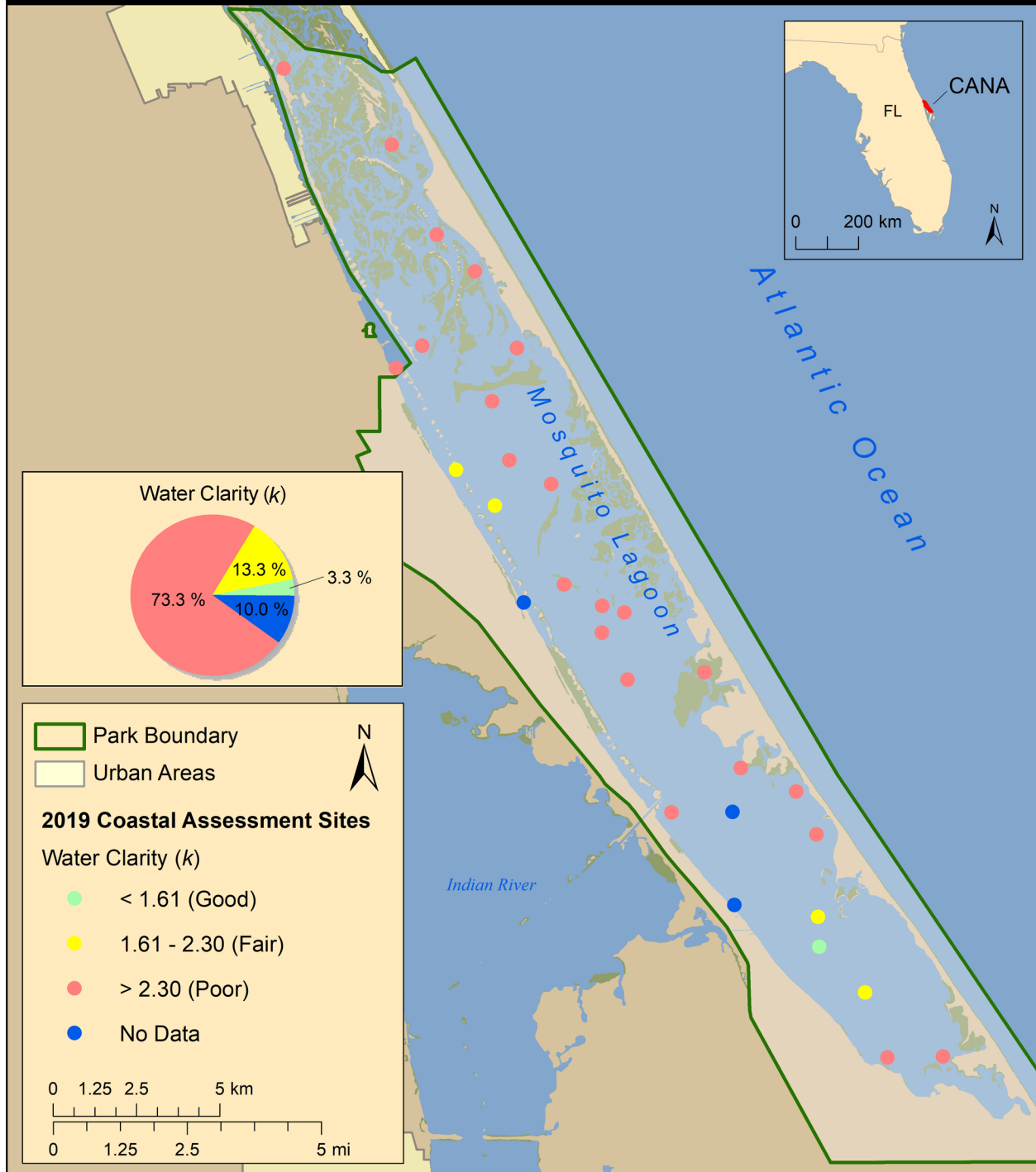


Figure 5. Example report figure 3. Water clarity ratings at sampling sites at Canaveral National Seashore in July 2019. Inset graph shows the percent of sites in each condition category [yellow—fair; red—poor; blue—n/a].

Canaveral National Seashore Chlorophyll *a*

Southeast Coast Network
National Park Service
U.S. Department of the Interior

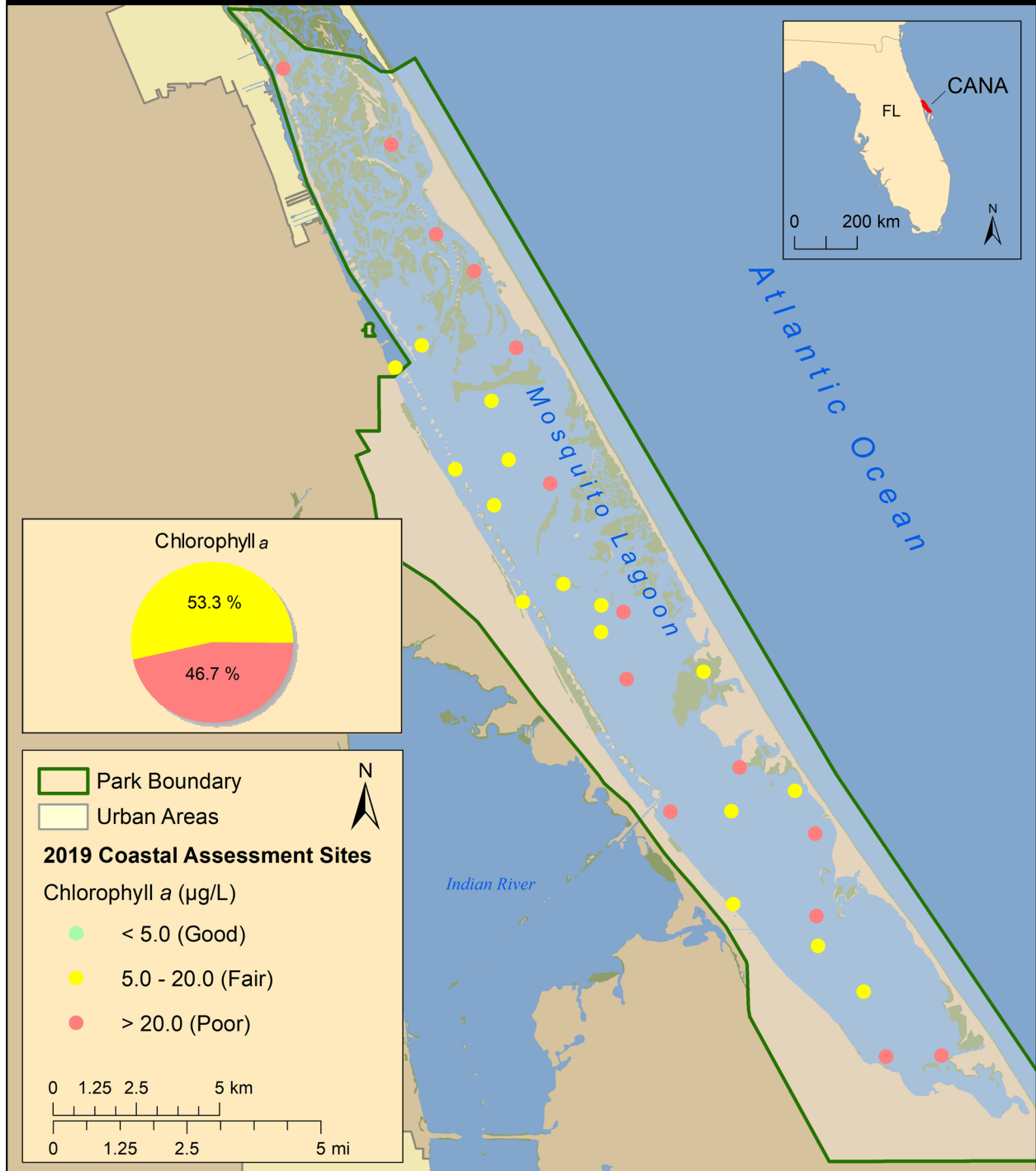


Figure 6. Example report figure 4. Chlorophyll *a* concentrations at Canaveral National Seashore in July 2019. Inset graph shows the percent of sites in each condition category [green—good; yellow—fair; red—poor].

Canaveral National Seashore Dissolved Inorganic Nitrogen

Southeast Coast Network
National Park Service
U.S. Department of the Interior

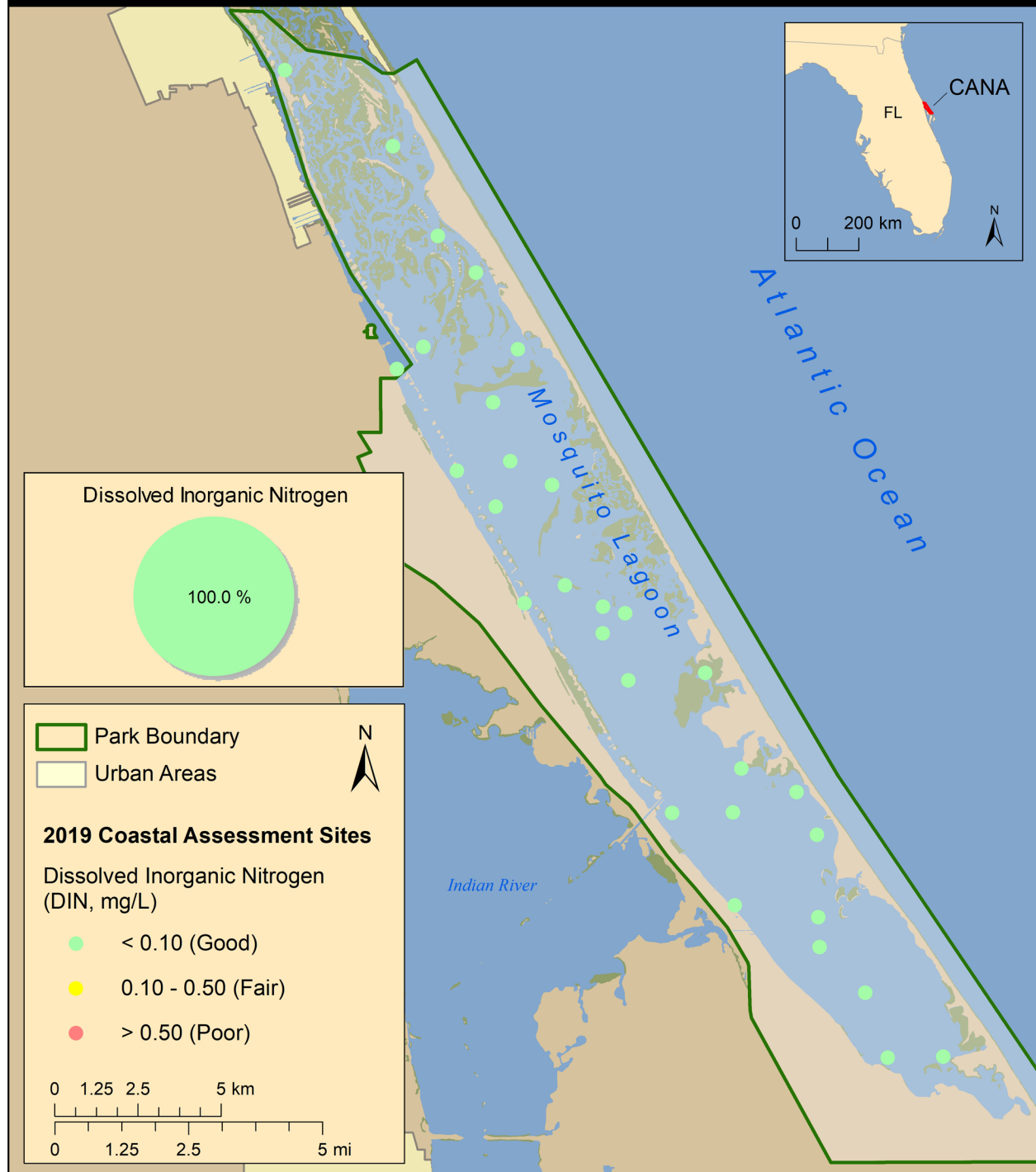


Figure 7. Example report figure 5. Dissolved inorganic nitrogen concentrations at sampling sites at Canaveral National Seashore in July 2019. Inset graph shows the percent of sites in each condition category [green—good].

Canaveral National Seashore Dissolved Inorganic Phosphorus

Southeast Coast Network
National Park Service
U.S. Department of the Interior

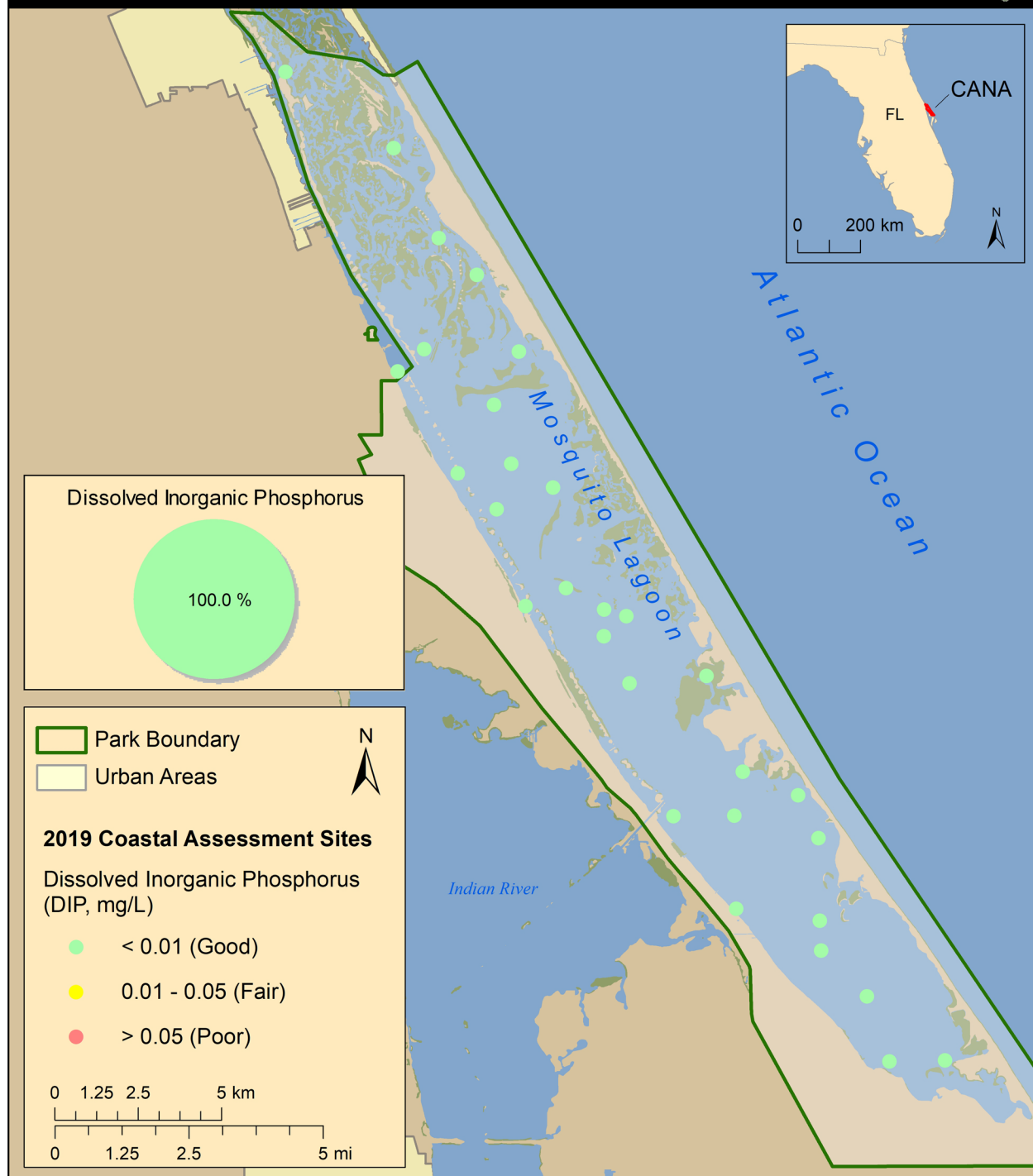


Figure 8. Example report figure 6. Dissolved inorganic phosphorus concentrations at sampling sites at Canaveral National Seashore in July 2019. Inset graph shows the percent of sites in each condition category [green—good].

Canaveral National Seashore Dissolved Oxygen

Southeast Coast Network
National Park Service
U.S. Department of the Interior

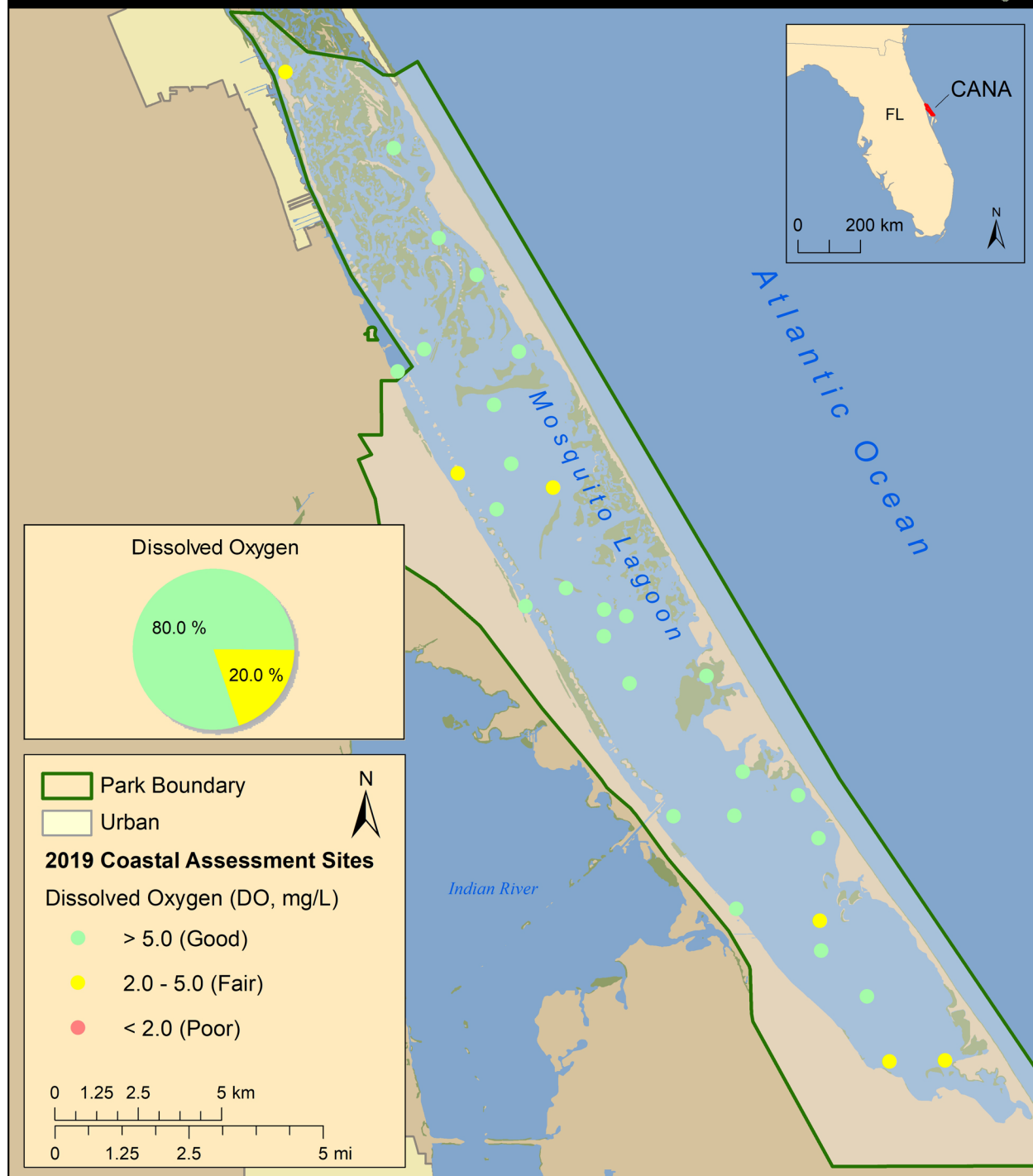


Figure 9. Example report figure 7. Dissolved oxygen concentrations at sampling sites at Canaveral National Seashore in July 2019. Inset graph shows the proportion of sites in each condition category [green—good; yellow—fair].

Canaveral National Seashore Site Water Quality Index Rating

Southeast Coast Network
National Park Service
U.S. Department of the Interior

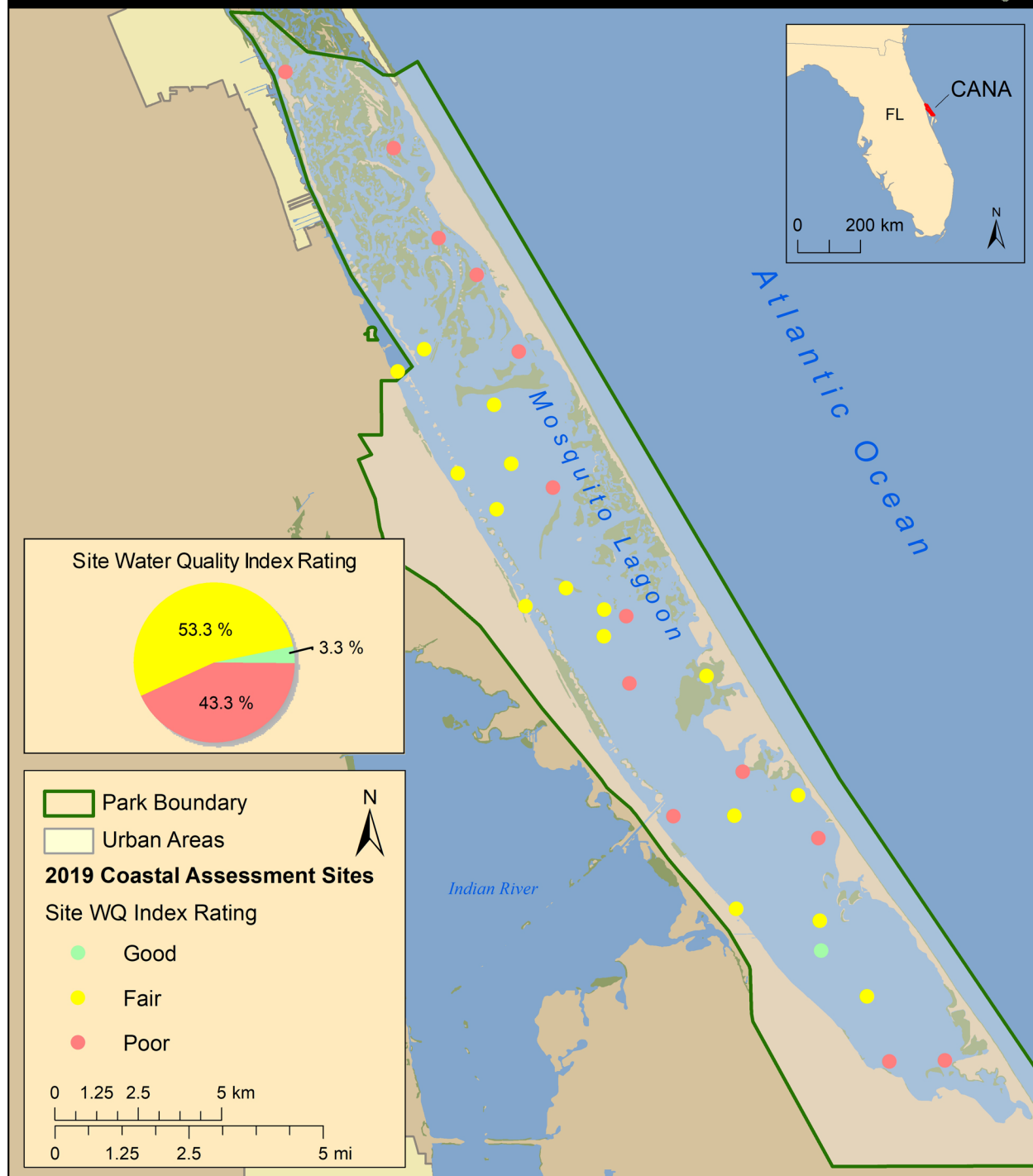


Figure 10. Example report figure 8. Water-quality index rating at sampling sites in the vicinity of Canaveral National Seashore in July 2019. Inset graph shows the proportion of sites in each condition category [green—good; yellow—fair; red—poor].

Canaveral National Seashore Ecological Condition

Southeast Coast Network
National Park Service
U.S. Department of the Interior

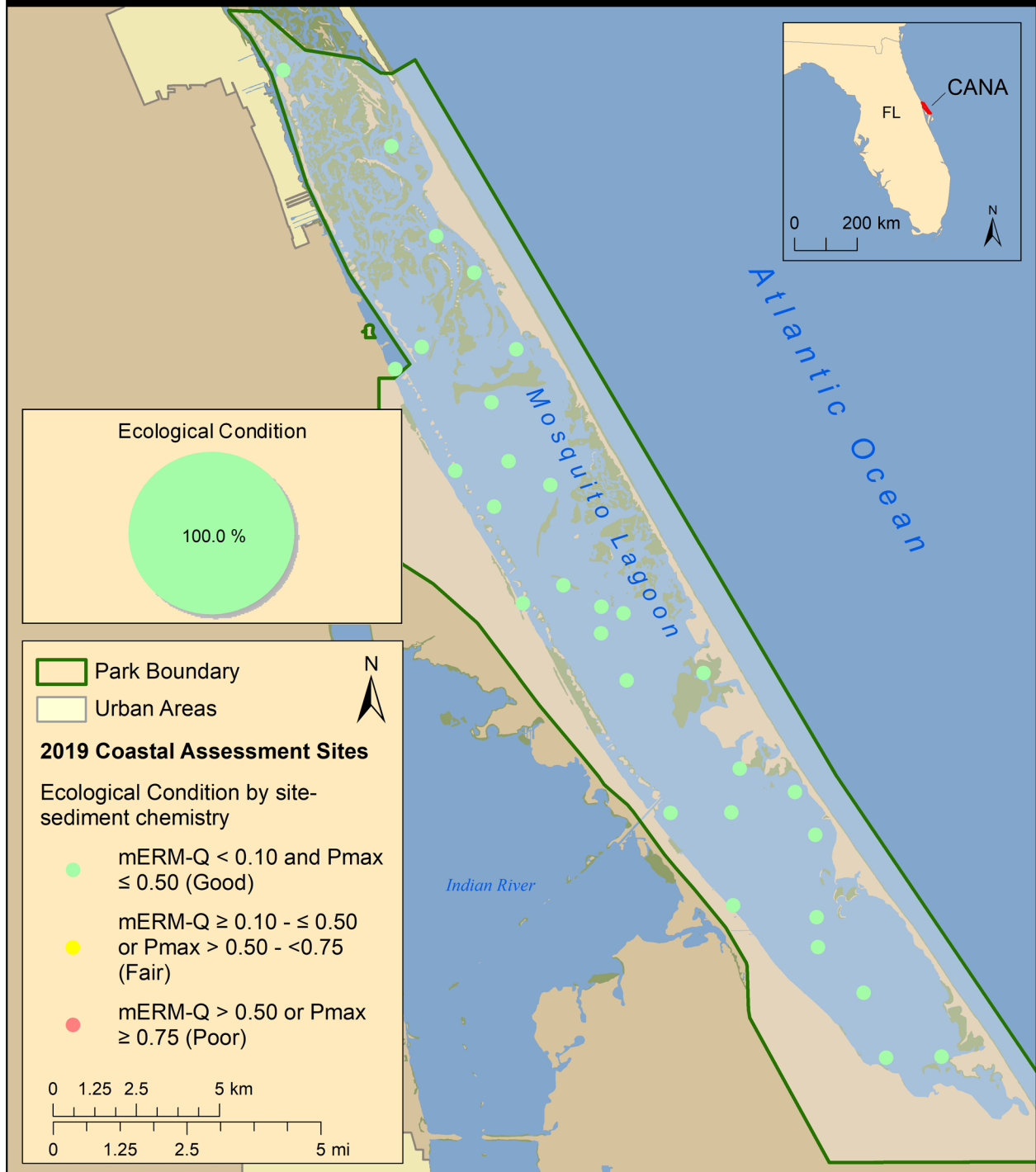


Figure 11. Example report figure 9. Spatial distribution of sampling sites and the corresponding ratings for ecological condition based on sediment chemistry at Canaveral National Seashore in July 2019. Inset graph shows the proportion of sites in each condition category [green—good].

Summary, Key Findings and Results

The summary, key findings, and results sections in the report will cover the following:

- When and where the assessment was conducted
- Key partners
- Citation of the methods
- Indication of field measures
- Summary of each field measure/parameter
 - Water clarity ratings, % sites rated as Good, Fair and Poor
 - Chlorophyll *a* ratings, % sites rated as Good, Fair and Poor
 - Dissolved inorganic nitrogen (DIN) ratings, % sites rated as Good, Fair and Poor
 - Dissolved inorganic phosphorus (DIP) ratings, % sites rated as Good, Fair and Poor
 - Bottom dissolved oxygen ratings, % sites rated as Good, Fair and Poor
- Summary of site water-quality condition scores and proportion of sites rated as Good, Fair and Poor
- Park-wide water-quality condition score (Good, Fair, Poor) based on the park water-quality index rating
- If sediment was sampled during the assessment, include a summary of the ecological condition and the proportion of sites rated as Good, Fair and Poor

It is important to remember that Natural Resource Data Series (NRDS) reports are meant to be a basic release of data and include summary statistics and findings. More detailed discussion related to findings may occur in other publications such as a Natural Resource Report (NRR) and/or directly with natural resource managers.

Other Sections of the Park-wide Assessment Data Report

Close review of the Introduction, Study Area, and Methods sections will occur as the report is assembled. While these sections do not change with frequency, they may require periodic updates.

Literature Cited

- Smith, L. M., V. D. Engle, and J. K. Summers. 2006. Assessing Water Clarity as a Component of Water Quality in Gulf of Mexico Estuaries. *Environmental Monitoring & Assessment* 115:291–305.
- Southeast Coast Network (SECN). 2019. Southeast Coast Network authorship guidelines—Version 3.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—2.1.03. Southeast Coast Network, Athens, Georgia. Available at: [DataStore - Standard Operating Procedure - \(Code: 2260360\) \(nps.gov\)](#) (last accessed June 2022).
- Starkey, E. N., and D. McCay. 2022. Park-wide assessment data entry, processing, and QA/QC — Version 1.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—2.2.11. Southeast Coast Network, Athens, Georgia. Available at: <https://irma.nps.gov/DataStore/Reference/Edit/2284600> (last accessed July 2022).
- United States Census Bureau. 2022. Census 2010 Gateway website. Available at: <http://www.census.gov/2010census/> (last accessed June 2022).
- United States Environmental Protection Agency (EPA). 2012. National Coastal Condition Report IV. EPA-842-R-10-003, Washington D.C 20460.
- United States Environmental Protection Agency (EPA). 2016. National Coastal Condition Assessment (NCCA) 2010 Technical Report. Washington, D. C. Available at: https://www.epa.gov/sites/production/files/2014-10/documents/0_nccr_4_report_508_bookmarks.pdf (last accessed June 2022).
- United States Environmental Protection Agency (EPA). 2022. Geospatial Data Downloads website. [https://www.epa.gov/waterdata#303\(d\)%20Listed%20Impaired%20Waters](https://www.epa.gov/waterdata#303(d)%20Listed%20Impaired%20Waters) (last accessed June 2022).
- U.S. Fish and Wildlife Service (FWS). 2022. National Wetlands Inventory website. Available at: <http://www.fws.gov/wetlands/> (last accessed June 2022).

Appendix A. Example Park-wide Reports Found on IRMA

2017 Park-wide assessment

Starkey, E. N., W. Wright, and S. Cooper. 2019. Assessment of estuarine water and sediment quality at Cumberland Island National Seashore: 2017 data summary. Natural Resource Data Series NPS/SECN/NRDS—2019/1223. National Park Service, Fort Collins, Colorado. Available at: [DataStore - Published Report - \(Code: 2260279\) \(nps.gov\)](#) (last accessed June 2022).

Wright, W., E. N. Starkey, and S. Cooper. 2019. Assessment of estuarine water and sediment quality at Fort Matanzas National Monuments: 2017 Data Summary. Natural Resource Data Series NPS/SECN/NRDS—2019/1202. National Park Service, Fort Collins, Colorado. Available at: [DataStore - Published Report - \(Code: 2259086\) \(nps.gov\)](#) (last accessed June 2022).

2018 Park-wide assessment

Starkey, E. N., W. Wright, and C. S. Cooper. 2019. Assessment of estuarine water and sediment quality at Fort Pulaski National Monument: 2018 data summary. Natural Resource Data Series NPS/SECN/NRDS—2019/1237. National Park Service, Fort Collins, Colorado. Available at: [DataStore - Published Report - \(Code: 2266897\) \(nps.gov\)](#) (last accessed June 2022).

Starkey, E. N., W. Wright, and C. S. Cooper. 2019. Assessment of estuarine water and sediment quality at Timucuan Ecological and Historic Preserve: 2018 data summary. Natural Resource Data Series NPS/SECN/NRDS—2019/1236. National Park Service, Fort Collins, Colorado. Available at: [DataStore - Published Report - \(Code: 2266891\) \(nps.gov\)](#) (last accessed June 2022).

2019 Park-wide assessment

Starkey, E. N., D. McCay, and C. S. Cooper. 2020. Assessment of estuarine water and sediment quality at Canaveral National Seashore: 2019 data summary. Natural Resource Data Series NPS/SECN/NRDS—2020/1285. National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/DownloadFile/644765> (last accessed September 2021).