Tampa Bay Dredged Hole Habitat Assessment:

Status of Benthic Macrofauna and Sediment Contaminants

Final Report

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Abstract

Eleven dredged holes in Tampa Bay were sampled to evaluate their benthic habitat status and provide data for future management decisions. Samples were collected in August 2016 (fall) and March/April 2017 (spring). Sediment grab samples were collected from three sites within each dredged hole and from one reference site outside of the dredged hole during each season. Samples were analyzed for benthic infauna, sediment composition and sediment contaminants (fall only).

Results indicated that four of the eleven dredged holes had clean or only low levels of sediment contaminants and supported a healthy benthic community. These included the Skyway Causeway North and South dredged holes in Lower Tampa Bay, The Venetian Isles dredged hole in Middle Tampa Bay and the Georgetown dredged hole in Old Tampa Bay. The Culbreath Bayou North dredged hole in Old Tampa Bay had moderate levels of sediment contaminants but still supported a relatively healthy benthic community. These five dredged holes are recommended to be maintained in their current state.

The Culbreath Bayou South, MacDill AFB Beach and MacDill AFB Docks dredged holes all had moderate to high levels of some sediment contaminants and a poor benthic community during the fall season. The Ft. Desoto and Bay Point dredged holes had the lowest rankings due to low bottom dissolved oxygen concentrations and degraded benthic communities. The Bay Point dredged hole in Old Tampa Bay had the lowest ranking overall and may be a good candidate for mitigation.

Results from the restored McKay Bay dredged hole indicated that the benthic infaunal community has improved with higher species richness and composition, abundance and higher Tampa Bay Benthic Index scores then during the pre-restoration period. However, low bottom dissolved oxygen during the fall and elevated sediment concentrations of several contaminants including lead, PAH’s and DDT were evident. Periodic monitoring in the future is recommended to continue to evaluate the recovery of this site.

Table of Contents

List of Figures

List of Tables

Introduction

Dredged holes are submerged depressions that are the result of human activity, most often from the dredging of bottom sediments to be used as fill or land creation for shoreline development or for the creation of navigation channels. These holes are typically several meters deeper than the surrounding natural bay bottom and often act as deposition areas for finer grained sediments and as sinks for anthropogenic contaminants such as heavy metals, pesticides and hydrocarbons. Since these holes are often isolated they can have poor water exchange with the surrounding environment resulting in stratification of the water column and hypoxic conditions in the bottom water. This can further negatively affect the benthic macroinvertebrate community living in the bottom sediments.

In 2003 the Tampa Bay Estuary Program (TBEP) received a wetlands development grant from the U.S. Environmental Protection Agency, Region 4 to evaluate the fisheries, benthic habitat and sediment quality in 11 dredged holes throughout Tampa Bay and make management recommendations (TBEP 2005). The TBEP partnered with the Florida Fish and Wildlife Conservation Commission – Fish and Wildlife Research Institute (FWC-FWRI), the Environmental Protection Commission of Hillsborough County (EPCHC), and the U.S. Army Corp of Engineers (USACOE) on this project, forming the Tampa Bay Dredged Hole Habitat Assessment Advisory Team. The final report was published in 2005 (TBEP 2005) along with a technical report on benthic community and sediment contaminant results (Grabe et al. 2005). This study found that most of the dredged holes had more species and higher abundances of fish as well as commercially important shellfish such as blue crabs and pink shrimp than the surrounding shallow areas, and that the dredged holes were also being utilized by commercial and recreational fisherman. Benthic communities were seasonally more diverse during the spring than in the fall both within the dredged hole and in the surrounding shallow areas. The bottom dissolved oxygen in most of the 11 holes was generally good (>4 mg/L) and some level of sediment contamination was observed in each hole.

The final recommendations from the 2003 study suggested that seven of the 11 dredged holes were providing suitable habitat for fish and benthic communities and should be maintained as they were. The remaining four holes however could be improved through partial or complete filling to the surrounding depth. The McKay Bay dredged hole in particular was identified in this study as having the most degraded benthic and fisheries habitat and the highest level of sediment contamination. Subsequently, the Southwest Florida Water Management District (SWFWMD) obtained funding to partially fill the McKay Bay dredged hole in 2010 and the project was completed in 2014. The EPCHC was contracted to conduct pre and post restoration benthic surveys of the McKay Bay dredged hole site. Results from those surveys indicated that filling the dredged hole was successful in improving the benthic community and bottom water quality conditions to a comparable level as the surrounding shallow water habitat (Karlen 2012, Karlen et al. 2012, Karlen et al. 2015).

The 2003 study further recommended that since the characteristics of individual dredged holes in that study were unique they may not be comparable to other holes and therefore any future management decisions for other dredged holes in Tampa Bay would require additional sampling and analysis (TBEP 2005). To this extent, the TBEP, in addition to the use of annual work plan funding, obtained grant funding from the SWFWMD and the Tampa Bay Environmental Restoration Fund (TBERF) in 2015 to conduct the current study of ten additional dredged holes in Tampa Bay. Additional funding to study the McKay Bay dredged hole was obtained from the EPCHC's Pollution Recovery Fund (PRF). Results from the benthic macroinvertebrate community and sediment chemistry analysis are presented in this report.

Methods

Sample Locations

Eleven dredged holes were selected throughout Tampa Bay for this study (Figure 1). The sampling dates and sample GPS coordinates are presented in Appendix A.

Four of the dredged holes were located in Old Tampa Bay. These were the Bay Point dredged hole located near the northeast end of the Courtney Campbell Causeway, the Culbreath Bayou North and South dredged holes located near the southeast end of the Howard Frankland Bridge and the Georgetown dredged hole located on the east site of the bay north of the Gandy Bridge.

Two sites were located around MacDill Air Force Base on the Interbay Peninsula: The MacDill AFB Docks dredged hole on the east side of the peninsula in Hillsborough Bay, and the MacDill AFB Beach dredged hole on the south end of the peninsula in Middle Tampa Bay. The Venetian Isles dredged hole was also located in Middle Tampa Bay on the west shore near St. Petersburg.

McKay Bay is a small embayment located at the northeastern tip of Hillsborough Bay that was formed by the construction of the 22nd Street Causeway. McKay Bay is adjacent to the East Bay section of Port Tampa Bay to the south and the Palm River to the east (Figure 1). A peninsula on the north end bisects the bay and is the site of the City of Tampa's Refuse-To-Energy Facility and McKay Bay Nature Park. The location of the McKay Bay dredged hole is directly south of the peninsula although most of the hole's footprint has been filled in as part of the SWFWMD's restoration efforts.

Two sites were located in Lower Tampa Bay, Skyway Causeway North and South dredged holes, located on the east side of the bay on either side of the Skyway Bridge approach, and one site, the Ft. De Soto (St. Antoine Key) dredged hole, was in Boca Ciega Bay.

Field Sampling

Samples were collected at each dredged hole during two seasonal sampling events in August, 2016 (fall) and March/April, 2017 (spring). Sediment grab samples and surface and bottom hydrographic measurements were collected at three locations within the dredged hole (center, left, right) and at one reference location outside of the dredged hole during each season. The same sampling coordinates (approximately) were sampled during both seasons. A hydrographic profile was taken at each site using a Hydrolab® Quanta multi-probe sonde. Measurements were taken from the surface (0.1 meters) and bottom for temperature, salinity, pH, and dissolved oxygen.

Sediment samples for benthic infauna community analysis were collected using a Young-Modified Van Veen grab sampler to a sediment depth of 15 cm and covered an area of 0.04 m^2. Samples were field sieved through a 0.5 mm mesh sieve and the retained sediment fraction was transferred to plastic sample jars and fixed in NOTOXhisto (Scientific Device Laboratory, Inc.) for a minimum of 72 hours and then transferred to 70% isopropanol with Rose Bengal stain for storage until processing.

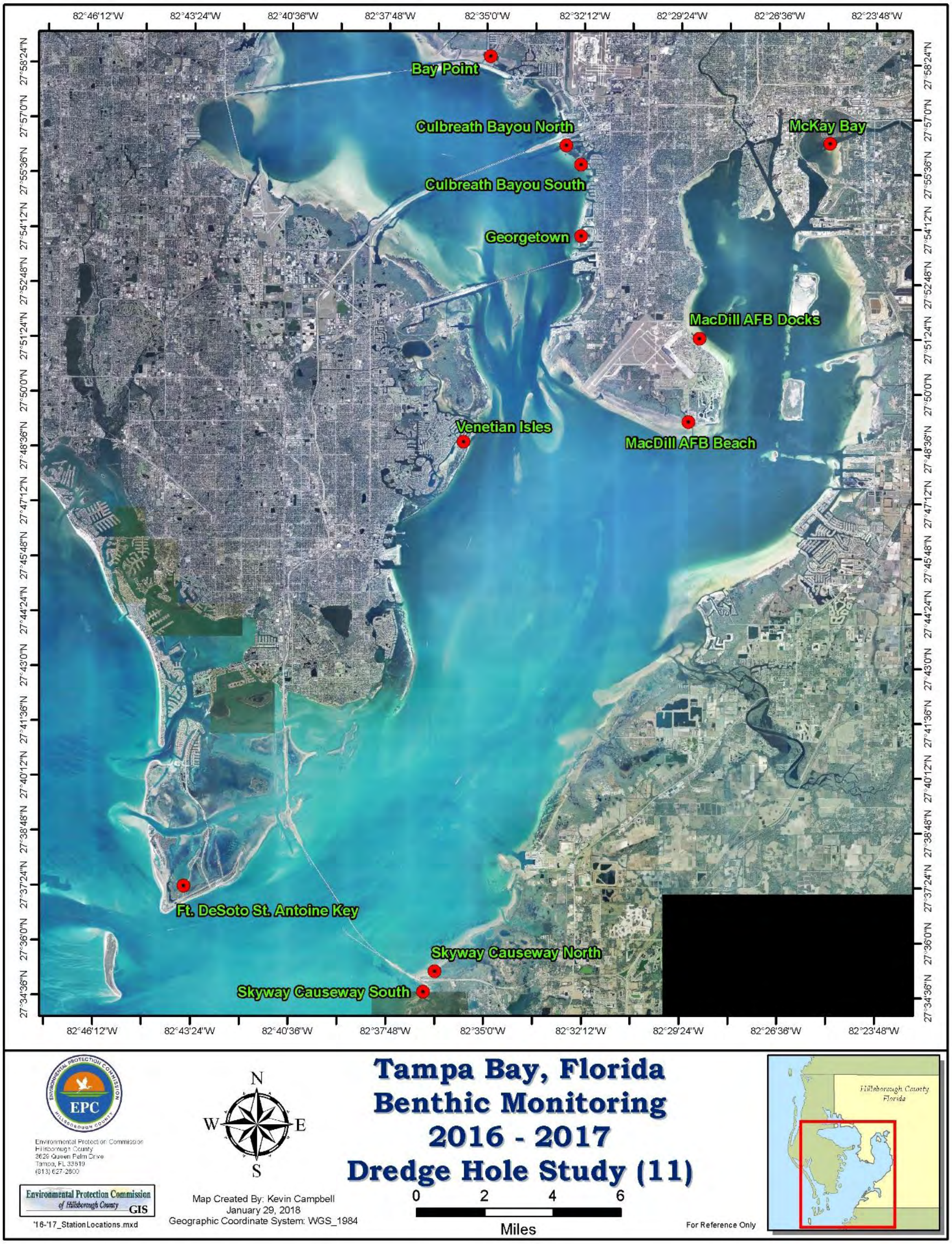

Figure 1. Tampa Bay dredged hole locations.

A second grab sample was taken at each site for sediment composition (% silt+clay), Total organic carbon (TOC) and sediment contaminant analysis. TOC and sediment contaminant samples were only collected during the fall sampling event and sediment composition samples were collected during both seasons. Samples were stored on ice for transport back to the lab and then stored in a -20°C laboratory freezer until processing.

Laboratory Analysis

Benthic sediment samples were rough sorted under a dissecting microscope into general taxonomic categories (annelids, mollusks, crustaceans, and miscellaneous taxa). Resorting was done on 10% of the samples completed by each technician for QA/QC. The sorted animals were identified to the lowest practical taxonomic level (species level when possible) and counted. Taxonomic identifications were conducted using available identification keys and primary scientific literature. All identification and count data were recorded on laboratory bench sheets and entered into a Microsoft Access® database maintained by the EPCHC.

The silt+clay analysis followed procedures outlined in Versar, 1993. The sediment total organic carbon (TOC) content was measured using a Shimadzu TOC-VCPH instrument equipped with a solid sample module, SSM-500A and a non-dispersive infrared detector (NDIR). The sediment metal samples were processed using a total digestion method with hydrofluoric acid using a CEM MARS Xpress microwave digester. Analysis was performed on a Perkin Elmer Optima 2000 Optical Emission Spectrometer according to EPA Method 200.7. The organic contaminant samples were extracted using EPA Method 3545A (Accelerated Solvent Extraction), followed by the cleanup methods, EPA 3630C (Silica gel) and EPA 3660B (copper). Analysis was completed using EPA Method 8081 (organochlorine pesticides) and EPA Method 8082 (PCB congeners) on a gas chromatograph equipped with dual Electron Capture Detectors (ECDs). Polycyclic aromatic hydrocarbons (PAHs) were analyzed using EPA Method 8270c on a mass spectrometer.

Data Classification and Analysis

Basic ecological community metrics (Species Richness, Abundance, Shannon Diversity) and the Tampa Bay Benthic Index were calculated using in house SQL routines incorporated in the EPCHC Benthic Database and basic summary statistics and sample rankings were calculated using Microsoft Excel (Microsoft Office Professional Plus 2016). Potential toxicity levels for sediment contaminants followed the sediment quality guidelines established for Florida coastal waters and utilized the Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) established for individual contaminants and the PEL Quotient as a measure of overall sediment contamination at a given site (MacDonald 1994; MacDonald et al. 1996). The Tampa Bay Benthic Index (TBBI) was calculated for each site following the methods established in Janicki Environmental (2005) and Malloy et al. (2007). The TBBI threshold scores for “Degraded” (< 73), “Intermediate” (between 73 to 87) and “Healthy” (> 87) benthic habitats were established by Janicki Environmental (2005) and Malloy et al. (2007). Dissolved oxygen concentrations and percent saturations were evaluated against Florida state water quality criteria.

Maps were generated by the EPCHC using ArcGIS 10.3 (ESRI 2015).

Results and Discussion

Bay Point

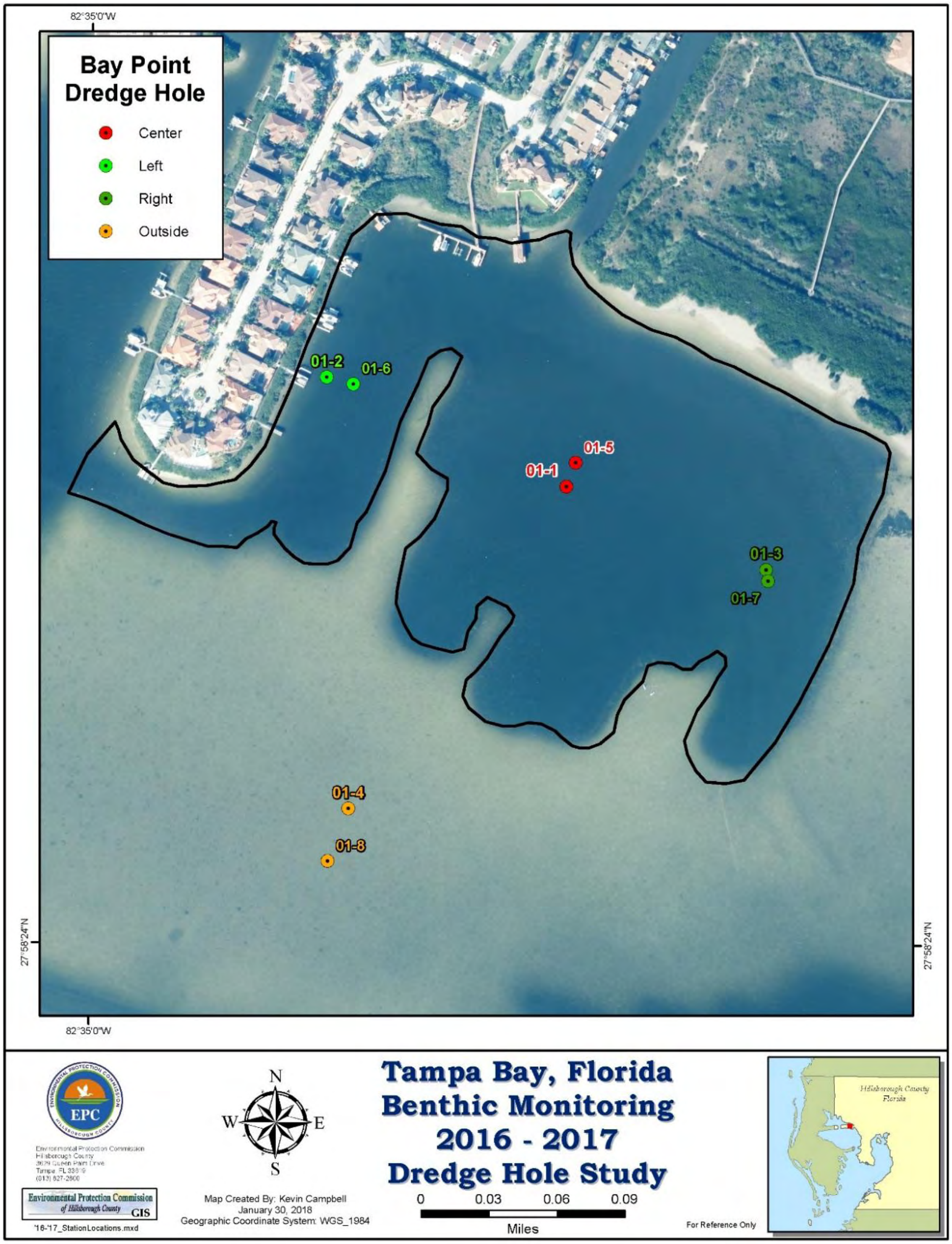

Figure 2. Fall 2016 and spring 2017 Bay Point dredged hole and reference sample locations.

The bottom hydrographic measurements at the Bay Point dredged hole sample sites (Figure 2) and outside reference site are summarized in Tables 1 and 2 for the fall and spring samples respectively. The mean values for temperature, salinity and pH within the dredged hole were similar to the reference site during both seasons. The Bay Point dredged hole had a mean depth of 2.2 meters in the fall and 2.1 meters in the spring with the deepest readings at the center. Salinities were in the high mesohaline range in the fall with a mean of 16.68 psu and were polyhaline in the spring (mean = 27.42 psu). Bottom dissolved oxygen within the dredged hole was suboptimal to hypoxic during the fall with a mean of 1.97 mg/l and 28.7% saturation while the reference site exhibited healthy dissolved oxygen concentrations. Bottom dissolved oxygen was above 4 mg/l and > 60% saturation at all sites during the spring (Table 2).

Table 1. Fall Bay Point dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH01-1	16DH01-2	16DH01-3	DH	16DH01-4
	Center	Left	Right	Mean	Ref
Depth (m)	2.4	2.1	2.1	2.2	0.8
Temperature (°C)	30.1	29.64	30.12	29.95	30.2
Salinity (psu)	15.15	17.24	17.65	16.68	18.89
pH	7.34	7.93	7.84	7.70	8.36
Dissolved Oxygen (mg/l)	0.19	3.53	2.19	1.97	6.92
D.O. Saturation (%)	2.7	51.2	32.1	28.7	102.4

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 2. Spring Bay Point dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH01-5	17DH01-6	17DH01-7	DH	16DH01-8
	Center	Left	Right	Mean	Ref
Depth (m)	2.2	2.0	2.0	2.1	0.5
Temperature (°C)	23.52	23.51	23.34	23.46	23.89
Salinity (psu)	27.52	27.37	27.37	27.42	27.53
pH	7.92	7.89	7.85	7.89	8.06
Dissolved Oxygen (mg/l)	4.83	4.99	4.46	4.76	6.18
D.O. Saturation (%)	66.7	68.8	61.4	65.6	85.8

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

A total of 30 taxa were identified within the Bay Point dredged hole in the fall; however, the center and right samples only had two taxa present and were also characterized by low abundances, diversity and "Degraded" TBBI scores (Table 3). The fall reference site had 44 taxa present and relatively high abundance, diversity and an overall "Healthy" TBBI score. Compared to fall samples, the dredged hole samples taken during the spring had a lower species richness (22 taxa total) but there were more taxa found at the center and right sample sites, while only 3 taxa were present at the left sample site (compared to 27 in the fall). The average spring dredged hole TBBI was lower and indicated a "Degraded" benthic habitat. The spring reference sample had more taxa (57 total) and higher abundance than in the fall but the overall TBBI score was lower (Table 4).

Table 3. Fall Bay Point dredged hole benthic community metrics.

	Fall 2016				
	16DH01-1	16DH01-2	16DH01-3	DH	16DH01-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	2	27	2	10.33 (30)	44
Abundance (#/m^2)	50	6700	175	2308.33	15225
Shannon Diversity	0.69	2.57	0.68	1.31	2.71
TBBI	65.16	89.4	53.19	69.25	91.23
TBBI Category	Degraded	Healthy	Degraded	Degraded	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

Table 4. Spring Bay Point dredged hole benthic community metrics.

	Spring 2017				
	17DH01-5	17DH01-6	17DH01-7	DH	16DH01-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	12	3	12	9 (22)	57
Abundance (#/m^2)	1250	75	1425	916.67	19702
Shannon Diversity	1.18	1.1	1.23	1.17	2.6
TBBI	75.06	4.03	78.86	52.65	83.31
TBBI Category	Intermediate	Degraded	Intermediate	Degraded	Intermediate

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall dredged hole samples were dominated by the cirratulid polychaete *Kirkegaardia* sp. and the tubificid oligochaete *Tubificoides wasselli* along with the gastropod *Bittiolum varium* and amphipod *Ampelisca abdita* cumulatively comprised over half of the infaunal abundance (Table 5). The fall reference site was dominated by the amphipods *Grandidierella bonnieroides* and *Ampelisca abdita* which accounted for 42% of the cumulative abundance (Table 5).

The spring dredged hole sites were strongly dominated by crustaceans with the amphipod *Ampelisca abdita* and cumacean *Cyclaspis varians* accounting for nearly 75% of the cumulative abundance (Table 6). The congeneric amphipods *Ampelisca holmesi* and *A. abdita* dominated the spring reference site comprising over 50% of the spring abundance (Table 6).

Table 5. Fall Bay Point ranked taxa abundance (top 10).

Bay Point Dredged Hole (Fall)				Bay Point Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Kirkegaardia sp.	383.33	16.60%	16.60%	*Grandidierella bonnieroides*	4000	26.27%	26.27%
Tubificoides wasselli	358.33	15.52%	32.13%	*Ampelisca abdita*	2400	15.76%	42.04%
Bittiolum varium	258.33	11.19%	43.32%	*Aricidea philbinae*	1475	9.69%	51.72%
Ampelisca abdita	250.00	10.83%	54.14%	Tubificinae	1100	7.22%	58.95%
Tubificinae	183.33	7.94%	62.08%	*Ampelisca spp.*	650	4.27%	63.22%
Spiochaetopterus costarum	175.00	7.58%	69.67%	*Hypereteone heteropoda*	600	3.94%	67.16%
Scoloplos (Scoloplos) rubra	141.67	6.14%	75.80%	*Lyonsia floridana*	575	3.78%	70.94%
Ampelisca spp.	100.00	4.33%	80.13%	*Cyclaspis varians*	500	3.28%	74.22%
Ampelisca holmesi	91.67	3.97%	84.10%	*Pectinaria gouldii*	475	3.12%	77.34%
Glycinde solitaria	66.67	2.89%	86.99%	*Laeonereis culveri*	400	2.63%	79.97%

Table 6. Spring Bay Point ranked taxa abundance (top 10).

Bay Point Dredged Hole (Spring)				Bay Point Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Ampelisca abdita	650.00	70.91%	70.91%	*Ampelisca holmesi*	7800	39.59%	39.59%
Cyclaspis varians	33.33	3.64%	74.55%	*Ampelisca abdita*	2100	10.66%	50.25%
Ampelisca spp.	25.00	2.73%	77.27%	*Clymenella mucosa*	1075	5.46%	55.71%
Mysella planulata	25.00	2.73%	80.00%	Tubificinae	1075	5.46%	61.16%
Haminoea succinea	16.67	1.82%	81.82%	*Aricidea philbinae*	875	4.44%	65.60%
Paracaprella tenuis	16.67	1.82%	83.64%	*Rudilemboides naglei*	600	3.05%	68.65%
Streblospio spp.	16.67	1.82%	85.45%	*Capitella capitata complex*	575	2.92%	71.57%
Tellinidae	16.67	1.82%	87.27%	Fabriciidae	575	2.92%	74.48%
Brania nitidula	8.33	0.91%	88.18%	*Cymadusa compta*	500	2.54%	77.02%
Capitella capitata complex	8.33	0.91%	89.09%	*Capitella jonesi*	475	2.41%	79.43%

The Bay Point dredged hole sediments were muddy with an average silt+clay content of 53.87% in the fall and 60.17% in the spring and a total organic carbon (TOC) content of 3.47%. The reference site by comparison had sandier sediments with a silt+clay content of 5.3% in the fall and 1.4% in the spring and TOC of 0.50% (Table 7). The dredged hole sediments had elevated concentrations of several contaminates and were above the TEL threshold for Cr, Cu, Pb, Ni, the low molecular weight PAH Acenaphthylene and for all high molecular weight PAHs (Table 7). Cadmium is shown to be above its TEL, however the reported concentration is below the minimum detection limit (MDL) for the analysis (Table 7). The overall PEL Quotient for the dredged hole sediments was 0.10. The Bay Point reference site as well as one of the dredged hole replicates had relatively low levels of sediment contaminates with no measured SQG exceedances and a PEL Quotient of 0.02 (Table 7).

Table 7. Bay Point sediment contaminants and composition.

Bay Point										
	Formula	MW	MDL	TEL	PEL	16DH01-1 (Center)	16DH01-2 (Left)	16DH01-3 (Right)	16DH01 (Mean)	16DH01-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			60225.80	5820.48	62215.79	42754.02	3888.79
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	0.00
Cadmium	Cd	112.41	2.280	0.676	4.210	0.68	0.35	0.53	0.52	0.44
Chromium	Cr	52.00	1.210	52.300	160.000	98.73	16.76	100.04	71.84	12.18
Copper	Cu	63.55	0.450	18.700	108.000	22.61	2.27	24.41	16.43	0.78
Iron	Fe	55.85	69.200			26820.58	2477.94	27574.75	18957.76	1481.93
Lead	Pb	207.20	5.220	30.200	112.000	32.20	22.11	32.73	29.01	21.94
Manganese	Mn	54.94	4.490			56.07	15.26	53.15	41.49	9.33
Nickel	Ni	58.69	0.710	15.900	42.800	17.57	4.73	17.80	13.37	4.14
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.00	0.00	0.00	0.00	0.50
Zinc	Zn	65.38	1.890	124.000	271.000	83.82	11.83	89.16	61.60	8.28
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.03	0.00	0.05	0.03	0.03
β BHC	$C_6H_6Cl_6$	290.83	0.730			1.54	0.15	2.97	1.55	1.31
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.03	0.04	0.05	0.04	0.05
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.03	0.01	0.04	0.03	0.02
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.04	0.00	0.09	0.04	0.01
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.00	0.00	0.00	0.09
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.04	0.00	0.09	0.04	0.10
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.02	0.01	0.10	0.04	0.10
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.06	0.02	0.16	0.08	0.00
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.01	0.00	0.22	0.08	0.00
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.13	0.01	0.18	0.11	0.03
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.06	0.00	0.67	0.24	0.03
Total DDT				3.890	51.700	0.20	0.01	1.07	0.43	0.06

Bay Point										
	Formula	MW	MDL	TEL	PEL	16DH01-1 (Center)	16DH01-2 (Left)	16DH01-3 (Right)	16DH01 (Mean)	16DH01-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.02	0.00	0.03	0.02	0.02
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.00	0.00	0.00	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.00	0.00	0.10	0.03	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.01	0.00	0.03	0.01	0.01
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	0.00	0.00	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.00	0.00	0.00	0.00	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.02	0.00	0.12	0.05	0.03
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.00	0.00	0.11	0.04	0.03
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.08	0.06	0.10	0.08	0.01
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.00	0.00	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.01	0.00	0.01	0.01	0.09
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.01	0.00	0.09	0.03	0.02
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.02	0.00	0.73	0.25	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.02	0.00	0.00	0.01	0.00
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			1.18	0.82	0.60	0.87	1.30
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.13	0.00	0.14	0.09	0.01
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.02	0.00	0.01	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.01	0.00	2.73	0.91	1.84
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.06	0.02	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.18	0.00	0.37	0.18	1.86
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.19	0.12	0.00	0.10	1.46
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.49	0.00	0.02	0.17	0.24
Total PCBs				21.600	189.000	2.24	0.96	4.75	2.65	6.82
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	10.91	0.00	0.00	3.64	0.00
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	13.46	2.65	0.00	5.37	0.00

Bay Point										
	Formula	MW	MDL	TEL	PEL	16DH01-1 (Center)	16DH01-2 (Left)	16DH01-3 (Right)	16DH01 (Mean)	16DH01-4 (Ref)
Fluorene	$C_{13}H_{10}$	166.22	4.670	21.200	144.000	11.26	0.00	0.00	3.75	0.00
Naphthalene	$C_{10}H_8$	128.17	7.890	34.600	391.000	10.09	0.00	0.00	3.36	1.69
Phenanthrene	$C_{14}H_{10}$	178.23	5.070	86.700	544.000	37.53	7.56	27.45	24.18	5.22
Total LMW PAHs				312.000	1440.000	83.25	10.21	27.45	40.30	6.91
Benzo(a)anthracene	$C_{18}H_{12}$	228.29	5.030	74.800	693.000	82.89	15.90	121.95	73.58	7.69
Benzo(a)pyrene	$C_{20}H_{12}$	252.31	3.160	88.800	763.000	170.95	42.19	310.29	174.48	32.64
Chrysene	$C_{18}H_{12}$	228.29	5.010	108.000	846.000	168.80	34.16	242.92	148.63	21.97
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	278.35	5.770	6.220	135.000	55.89	0.00	77.13	44.34	0.00
Fluoranthene	$C_{16}H_{10}$	202.25	2.520	113.000	1494.000	202.04	35.92	292.98	176.98	23.00
Pyrene	$C_{16}H_{10}$	202.25	5.630	153.000	1398.000	207.10	34.79	289.42	177.10	23.34
Total HMW PAHs				655.000	6680.000	887.67	162.96	1334.69	795.11	108.64
Total PAHs				1680.000	16800.000	970.92	173.17	1362.14	835.41	115.55
PEL Quotient						**0.13**	**0.03**	**0.15**	**0.10**	**0.02**
Benzo(b)fluoranthene	$C_{20}H_{12}$	252.31	4.400			228.79	51.48	399.33	226.53	37.97
Benzo(g,h,i)perylene	$C_{22}H_{12}$	276.33	5.580			191.20	43.71	243.88	159.60	29.94
Benzo(k)fluoranthene	$C_{20}H_{12}$	252.31	7.230			179.30	37.38	348.11	188.26	30.45
Coronene	$C_{24}H_{12}$	300.35	8.810			80.27	24.81	51.30	52.13	0.00
Indeno(1,2,3-c,d)pyrene	$C_{22}H_{12}$	276.33	6.000			189.62	38.62	237.64	155.29	20.20
Retene	$C_{18}H_{18}$	234.34	4.170			21.89	0.00	18.35	13.41	3.26
Sediment composition (%)										
% Silt+Clay (%) –Fall/Spring						72.80/78.30	8.50/23.3	80.30/78.9	53.87/60.17	5.30/1.40
% Total Carbon (Solids)						4.80	0.60	5.30	3.57	0.50
% Total Inorganic Carbon (Solids)						0.20	0.10	0.10	0.13	0.10
% Total Organic Carbon (Solids)						4.7	0.5	5.2	3.47	0.50

Yellow >TEL; Red>PEL

Culbreath Bayou North

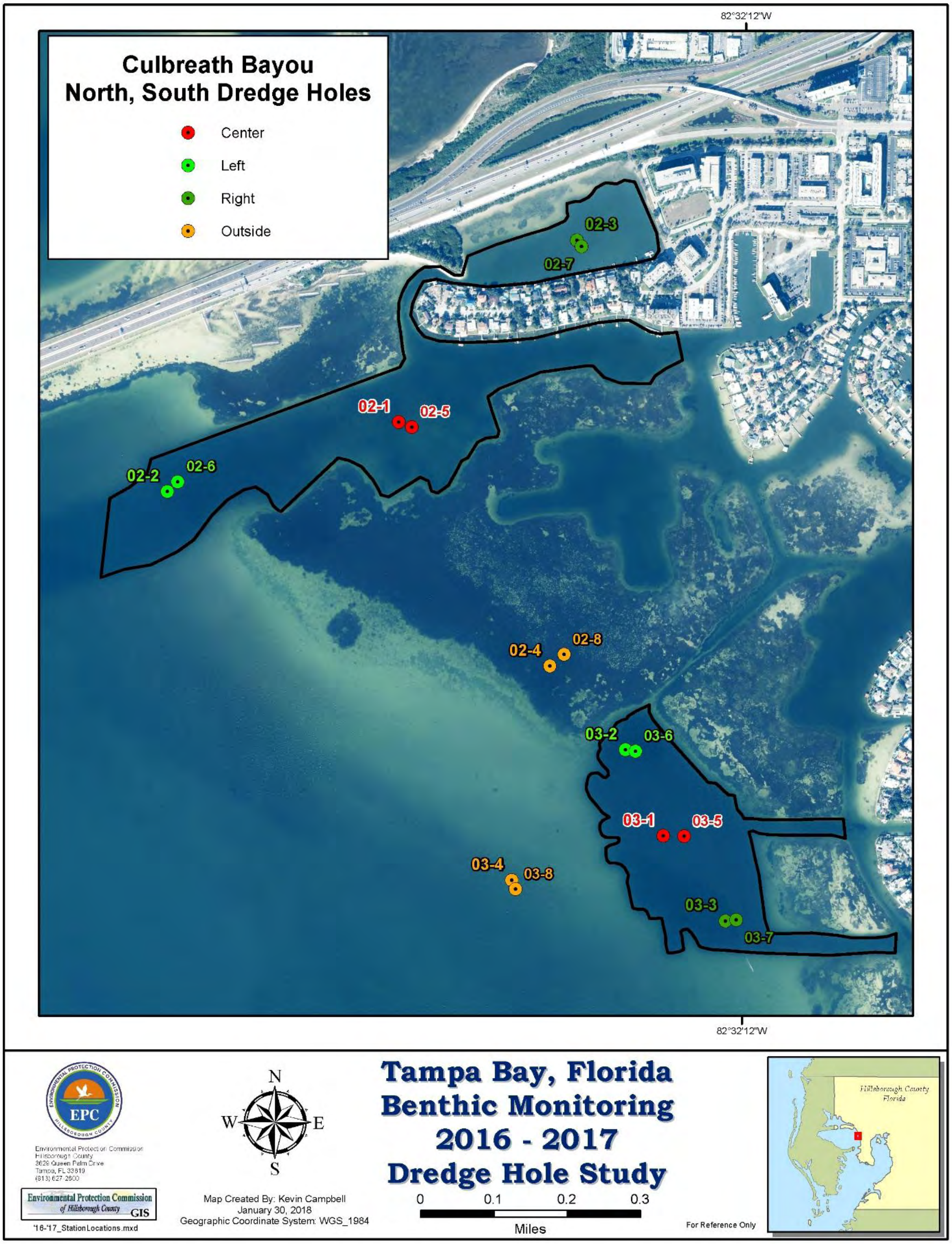

Figure 3. Fall 2016 and spring 2017 Culbreath Bayou North and South dredged hole and reference sample locations.

The bottom hydrographic measurements for the Culbreath Bayou North dredged hole and reference samples for the fall and spring sampling are summarized in Tables 8 and 9. The fall dredge hole samples had a mean depth of 3.7 meters with a maximum depth of 4.9 meters while the spring samples had a mean depth of 3.0 meters with a maximum depth of 4.1 meters. The reference sample sites were shallower with depths of 1.5 and 1.1 meters in the fall and spring respectively. Bottom temperatures were higher in the fall and comparable to the reference site during both seasons. Fall bottom salinities were lower than in the spring and also comparable to the reference site. The mean bottom dissolved oxygen and percent saturation within the dredge hole was above the state water quality standards during both seasons, with the exception of one fall replicate (16DH02-3) which had a slightly low D.O. reading (Table 8). The fall reference site had an extremely high dissolved oxygen concentration (14.16 mg/l) and a D.O. saturation of over 215%. (highlighted in orange in Table 8) This was indicative of a late summer bloom of the dinoflagellate *Pyrodinium bahamense* that was occurring in Old Tampa Bay during the sample collections.

Table 8. Fall Culbreath Bayou North dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH02-1	16DH02-2	16DH02-3	DH	16DH02-4
	Center	Left	Right	Mean	Ref
Depth (m)	3.5	4.9	2.7	3.7	1.5
Temperature (°C)	30.21	29.69	30.12	30.01	30.88
Salinity (psu)	21.73	21.65	21.52	21.63	21.75
pH	8.24	8.17	8.14	8.18	8.39
Dissolved Oxygen (mg/l)	5.98	5.26	3.20	4.81	14.16
D.O. Saturation (%)	90.1	78.4	48.0	72.2	215.4

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 9. Spring Culbreath Bayou North dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH02-5	17DH02-6	17DH02-7	DH	17DH02-8
	Center	Left	Right	Mean	Ref
Depth (m)	2.5	4.1	2.3	3.0	1.1
Temperature (°C)	23.35	23.35	23.44	23.38	24.58
Salinity (psu)	28.22	28.22	28.09	28.18	28.28
pH	7.98	7.98	7.96	7.97	8.14
Dissolved Oxygen (mg/l)	4.74	4.84	4.70	4.76	6.87
D.O. Saturation (%)	65.4	66.8	65.0	65.7	97.0

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

A total of 65 taxa were identified in the fall dredged hole samples with a mean of 34 taxa, a mean abundance of 5,598 individuals/m^2, and a high "Intermediate" TBBI score of 85.45 (Table 10). The fall reference sample was similar with 37 taxa but had a slightly higher abundance and "Healthy" TBBI score (Table 10).

Table 10. Fall Culbreath Bayou North dredged hole benthic community metrics.

	Fall 2016				
	16DH02-1	16DH02-2	16DH02-3	DH	16DH02-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	35	49	18	34 (65)	37
Abundance (#/m^2)	3025	10325	4525	5958.33	8278
Shannon Diversity	3.26	3.00	1.38	2.55	2.42
TBBI	83.1	89.83	83.41	85.45	90.9
TBBI Category	Intermediate	Healthy	Intermediate	Intermediate	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring dredged hole benthic macrofauna community had higher species richness than in the fall with a total of 116 taxa present and a mean of 60 taxa per sample. The mean benthic abundance was nearly 4 times greater in the spring than in the fall but the overall TBBI did not change between seasons (Table 10 & 11). The spring reference sample had more taxa present and a higher abundance than in the fall, but actually had fewer taxa and lower abundance than the spring dredge hole sample mean. The spring reference site had a TBBI score in the "Degraded" range due to a relatively high abundance of capitellid polychaetes.

Table 11. Spring Culbreath Bayou North dredged hole benthic community metrics.

	Spring 2017				
	17DH02-5	17DH02-6	17DH02-7	DH	17DH02-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	85	65	30	60 (116)	44
Abundance (#/m^2)	44426	16850	4675	21983.67	17150
Shannon Diversity	3.15	3.34	2.03	2.84	2.43
TBBI	90.28	79.3	86.79	85.46	70.21
TBBI Category	Healthy	Intermediate	Intermediate	Intermediate	Degraded

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall dredged hole was dominated by the polychaetes *Kirkegaardia* sp., *Spiochaetopterous costarum* and *Prionospio perkinsi* which cumulatively made up nearly 42% of the benthic abundance while the reference sample was dominated by the gastropod *Bittiolum varium* and the oligochaete *Tubificoides brownie* which together accounted for 47% of the abundance (Table 12).

Table 12. Fall Culbreath Bayou North ranked taxa abundance (top 10).

Culbreath Bayou North Dredged Hole (Fall)				Culbreath Bayou North Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Kirkegaardia sp.	1216.67	20.42%	20.42%	*Bittiolum varium*	2700	32.62%	32.62%
Spiochaetopterus costarum	866.67	14.55%	34.97%	*Tubificoides brownae*	1175	14.19%	46.81%
Prionospio perkinsi	416.67	6.99%	41.96%	*Aricidea philbinae*	925	11.17%	57.99%
Ampelisca holmesi	400.00	6.71%	48.67%	*Crepidula ustulatulina*	800	9.66%	67.65%
Macoma tenta	391.67	6.57%	55.24%	*Acteocina canaliculata*	375	4.53%	72.18%
Orobitella floridana	325.00	5.45%	60.70%	Tubificinae	375	4.53%	76.71%
Ampelisca abdita	241.67	4.06%	64.76%	*Prunum apicinum*	300	3.62%	80.33%
Scoloplos (Scoloplos) rubra	133.33	2.24%	66.99%	*Prionospio heterobranchia*	225	2.72%	83.05%
Tubificoides wasselli	125.00	2.10%	69.09%	*Turbonilla cf. arnoldoi*	175	2.11%	85.17%
Acteocina canaliculata	108.33	1.82%	70.91%	*Ampelisca holmesi*	150	1.81%	86.98%

The most abundant taxa in the spring dredged hole samples included unidentified sabellid polychaetes (Fabriciidae) which comprised 16% of the total abundance (Table 13). Other dominant taxa included the polychaetes *Kirkegaardia* sp. and *Spiochaetopterus costarum*, and the amphipod *Rudilemboides naglei* (Table 13). *Rudilemboides naglei* and the polychaete *Aricidea philbinae* accounted for approximately 55% of the benthic abundance at the spring reference site (Table 13).

Table 13. Spring Culbreath Bayou North ranked taxa abundance (top 10).

Culbreath Bayou North Dredged Hole (Spring)				Culbreath Bayou North Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Fabriciidae	3516.67	16.00%	16.00%	*Rudilemboides naglei*	6125	35.71%	35.71%
Kirkegaardia sp.	2741.67	12.47%	28.47%	*Aricidea philbinae*	3275	19.10%	54.81%
Rudilemboides naglei	1566.67	7.13%	35.59%	*Capitella capitata complex*	1300	7.58%	62.39%
Spiochaetopterus costarum	1425.00	6.48%	42.08%	*Ampelisca holmesi*	1175	6.85%	69.24%
Macoma tenta	958.33	4.36%	46.44%	*Leitoscoloplos sp.*	500	2.92%	72.16%
Aricidea philbinae	950.00	4.32%	50.76%	*Capitella aciculata*	450	2.62%	74.78%
Monocorophium acherusicum	766.67	3.49%	54.24%	*Listriella barnardi*	350	2.04%	76.82%
Tubificoides wasselli	708.33	3.22%	57.47%	*Spio pettiboneae*	325	1.90%	78.72%
Mediomastus sp.	700.00	3.18%	60.65%	*Tubificoides wasselli*	300	1.75%	80.47%
Fabricinuda trilobata	533.33	2.43%	63.08%	*Acteocina canaliculata*	275	1.60%	82.07%

The sediments within the dredged hole had a higher silt+clay and TOC content than at the reference site (Table 14). The dredge hole samples showed elevated concentrations above the TEL for all of the high molecular weight PAHs and for the low molecular weight PAH phenanthrene, while the only elevated sediment contaminant observed at the reference site was dibenzo (a,h) anthracene which was above its TEL (Table 14). The PEL Quotient for the dredged hole sediments was 0.06 while the reference site had a PEL Quotient of 0.01.

Table 14. Culbreath Bayou North sediment contaminants and composition.

Culbreath Bayou North										
	Formula	MW	MDL	TEL	PEL	16DH02-1 (Center)	16DH02-2 (Left)	16DH02-3 (Right)	16DH02 (Mean)	16DH02-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			4546.60	6936.19	14771.50	8751.43	935.54
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	3.25
Cadmium	Cd	112.41	2.280	0.676	4.210	0.00	0.13	0.49	0.21	0.00
Chromium	Cr	52.00	1.210	52.300	160.000	13.00	17.34	39.43	23.26	5.22
Copper	Cu	63.55	0.450	18.700	108.000	1.14	1.75	9.31	4.07	0.00
Iron	Fe	55.85	69.200			1580.46	2567.64	5711.22	3286.44	352.23
Lead	Pb	207.20	5.220	30.200	112.000	22.46	21.53	27.84	23.94	19.82
Manganese	Mn	54.94	4.490			11.86	13.97	18.70	14.84	5.24
Nickel	Ni	58.69	0.710	15.900	42.800	4.21	4.70	8.01	5.64	3.08
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.00	0.00	0.00	0.00	0.73
Zinc	Zn	65.38	1.890	124.000	271.000	8.51	14.13	19.82	14.15	2.27
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.00	0.00	0.02	0.01	0.00
β BHC	$C_6H_6Cl_6$	290.83	0.730			1.25	1.16	3.00	1.80	0.91
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.00	0.00	2.72	0.91	0.00
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.00	0.00	0.23	0.08	0.00
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.01	0.00	0.00	0.00	0.00
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.00	0.89	0.30	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.01	0.00	0.89	0.30	0.00
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.00	0.00	0.01	0.00	0.05
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.00	0.01	0.46	0.16	0.00
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.00	0.00	0.90	0.30	0.03
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.02	0.00	0.06	0.03	0.00
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.00	0.00	0.23	0.08	0.00
Total DDT				3.890	51.700	0.02	0.00	1.19	0.40	0.03

Culbreath Bayou North										
	Formula	MW	MDL	TEL	PEL	16DH02-1 (Center)	16DH02-2 (Left)	16DH02-3 (Right)	16DH02 (Mean)	16DH02-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.01	0.00	0.00	0.00
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.01	0.00	0.00	0.00	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.00	0.00	0.31	0.10	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.00	0.13	0.04	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	1.71	0.57	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.01	0.00	0.08	0.03	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.00	0.01	0.05	0.02	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.00	0.00	0.11	0.04	0.00
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.00	0.00	1.67	0.56	0.00
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.02	0.01	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.00	0.33	0.11	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.00	0.00	0.11	0.04	0.00
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.78	0.26	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.00	0.00	0.00	0.01
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			0.00	0.00	0.41	0.14	0.00
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.00	0.00	0.11	0.04	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.04	0.01	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.02	0.06	1.14	0.41	0.00
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.01	0.00	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.42	2.03	0.00	0.82	0.00
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.03	0.00	0.00	0.01	0.00
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.01	0.47	0.76	0.41	0.09
Total PCBs				21.600	189.000	0.48	2.56	3.71	2.25	0.10
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	5.02	1.67	0.00

Culbreath Bayou North										
	Formula	MW	MDL	TEL	PEL	16DH02-1 (Center)	16DH02-2 (Left)	16DH02-3 (Right)	16DH02 (Mean)	16DH02-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	0.00	0.00	9.58	3.19	0.00
Fluorene	$C_{13}H_{10}$	166.22	4.670	21.200	144.000	0.00	0.00	1.03	0.34	0.00
Naphthalene	$C_{10}H_8$	128.17	7.890	34.600	391.000	1.19	1.20	0.00	0.80	0.00
Phenanthrene	$C_{14}H_{10}$	178.23	5.070	86.700	544.000	4.44	0.00	107.01	37.15	1.14
Total LMW PAHs				312.000	1440.000	5.63	1.20	122.64	43.16	1.14
Benzo(a)anthracene	$C_{18}H_{12}$	228.29	5.030	74.800	693.000	9.73	0.00	204.87	71.53	1.25
Benzo(a)pyrene	$C_{20}H_{12}$	252.31	3.160	88.800	763.000	33.09	0.00	322.32	118.47	0.00
Chrysene	$C_{18}H_{12}$	228.29	5.010	108.000	846.000	23.17	0.00	341.45	121.54	0.00
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	278.35	5.770	6.220	135.000	15.44	0.00	62.63	26.02	8.39
Fluoranthene	$C_{16}H_{10}$	202.25	2.520	113.000	1494.000	23.28	0.00	183.79	69.02	2.17
Pyrene	$C_{16}H_{10}$	202.25	5.630	153.000	1398.000	22.58	0.00	480.56	167.71	0.00
Total HMW PAHs				655.000	6680.000	127.29	0.00	1595.62	574.30	11.81
Total PAHs				1680.000	16800.000	132.92	1.20	1718.26	617.46	12.95
PEL Quotient						**0.02**	**0.02**	**0.14**	**0.06**	**0.01**
Benzo(b)fluoranthene	$C_{20}H_{12}$	252.31	4.400			34.31	0.00	421.29	151.87	0.00
Benzo(g,h,i)perylene	$C_{22}H_{12}$	276.33	5.580			30.23	0.00	173.16	67.80	0.00
Benzo(k)fluoranthene	$C_{20}H_{12}$	252.31	7.230			31.38	0.00	327.75	119.71	0.00
Coronene	$C_{24}H_{12}$	300.35	8.810			0.00	0.00	22.24	7.41	0.00
Indeno(1,2,3-c,d)pyrene	$C_{22}H_{12}$	276.33	6.000			21.24	0.00	182.84	68.03	0.00
Retene	$C_{18}H_{18}$	234.34	4.170			0.00	0.00	26.92	8.97	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						6.00/5.00	10.20/9.30	20.70/16.2	12.30/10.17	1.60/2.20
% Total Carbon (Solids)						0.30	0.70	1.20	0.73	0.10
% Total Inorganic Carbon (Solids)						0.10	0.10	0.10	0.10	0.10
% Total Organic Carbon (Solids)						0.3	0.6	1.10	0.67	0.10

Yellow >TEL; Red>PEL

Culbreath Bayou South

The Culbreath Bayou South dredged hole samples (Figure 3) had a mean depth of 5.1 meters in the fall and 4.9 meters in the spring while the depth at the reference sites were 2.4 and 1.9 meters respectively (Tables 15 & 16). The other bottom hydrographic parameters are summarized in Tables 15 and 16 for the fall and spring sampling events respectively. The bottom dissolved oxygen and D.O. saturation was relatively high in both seasons and above the state water quality standards.

Table 15. Fall Culbreath Bayou South dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH03-1	16DH03-2	16DH03-3	DH	16DH03-4
	Center	Left	Right	Mean	Ref
Depth (m)	5.0	5.0	5.2	5.1	2.4
Temperature (°C)	29.98	29.89	30.06	29.98	30.24
Salinity (psu)	21.86	21.72	21.87	21.82	21.73
pH	8.10	8.15	7.97	8.07	8.21
Dissolved Oxygen (mg/l)	4.95	5.33	5.66	5.31	6.36
D.O. Saturation (%)	74.4	80.0	85.2	79.9	95.8

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 16. Spring Culbreath Bayou South dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH03-5	17DH03-6	17DH03-7	DH	17DH03-8
	Center	Left	Right	Mean	Ref
Depth (m)	4.5	4.7	4.9	4.7	1.9
Temperature (°C)	19.22	19.23	19.27	19.24	19.42
Salinity (psu)	26.77	26.70	26.77	26.75	26.85
pH	8.18	8.20	8.18	8.19	8.17
Dissolved Oxygen (mg/l)	6.84	6.86	6.74	6.81	6.88
D.O. Saturation (%)	86.5	86.7	85.4	86.2	87.3

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

The fall benthic community within the dredged hole was classified as "Degraded" with a low mean TBBI score and only 9 taxa recorded with a mean of 4 taxa per sample (Table 17). The fall reference site in contrast had 48 taxa and an overall "Healthy" TBBI score (Table 17).

Table 17. Fall Culbreath Bayou South dredged hole benthic community metrics.

	Fall 2016				
	16DH03-1	16DH03-2	16DH03-3	DH	16DH03-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	4	1	7	4 (9)	48
Abundance (#/m^2)	925	25	200	383.33	9200
Shannon Diversity	0.37	0	1.91	0.76	3.06
TBBI	70.38	29.44	75.41	58.41	92.21
TBBI Category	Degraded	Degraded	Intermediate	Degraded	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring dredged hole samples had a total of 27 taxa identified and a mean TBBI score of 77.98 falling within the “Intermediate” range (Table 18). The spring reference sample was similar to the fall with 44 taxa and an overall “Healthy” TBBI (Table 18).

Table 18. Spring Culbreath Bayou South dredged hole benthic community metrics.

	Spring 2017				
	17DH03-5	17DH03-6	17DH03-7	DH	17DH03-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	7	9	20	12 (27)	44
Abundance (#/m^2)	800	700	1951	1150.33	11975
Shannon Diversity	0.98	1.63	2.49	1.70	2.06
TBBI	74.36	76.65	82.93	77.98	91.4
TBBI Category	Intermediate	Intermediate	Intermediate	Intermediate	Healthy

TBBI: Green = “Healthy”; Yellow = “Intermediate”; Red = “Degraded”; Dark Red = “Empty”

The fall dredged hole benthic community was dominated by *Spiochaetopterus costarum* which accounted for over 78% of the abundance (Table 19), although the overall abundance was low during that season. The polychaetes *Aricidea philbinae* and *Clymenella mucosa* were dominant at the reference site along with the cephalochordate *Branchiostoma floridae*, amphipod *Ampelisca holmesi* and gastropod *Haminoea succinea* comprised over 52% of the cumulative abundance (Table 19).

Table 19. Fall Culbreath Bayou South ranked taxa abundance (top 10).

Culbreath Bayou South Dredged Hole (Fall)				**Culbreath Bayou South Reference (Fall)**			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Spiochaetopterus costarum	300.00	78.26%	78.26%	*Aricidea philbinae*	1950	21.20%	21.20%
Podarkeopsis levifuscina	16.67	4.35%	82.61%	*Clymenella mucosa*	1025	11.14%	32.34%
Sabaco elongata	16.67	4.35%	86.96%	*Branchiostoma floridae*	800	8.70%	41.03%
Cyclostremiscus pentagonus	8.33	2.17%	89.13%	*Ampelisca holmesi*	600	6.52%	47.55%
Macoma tenta	8.33	2.17%	91.30%	*Haminoea succinea*	425	4.62%	52.17%
Paramphinome sp. B of Gathof, 1984	8.33	2.17%	93.48%	*Cyclaspis varians*	400	4.35%	56.52%
Prionospio heterobranchia	8.33	2.17%	95.65%	*Pectinaria gouldii*	350	3.80%	60.33%
Prunum apicinum	8.33	2.17%	97.83%	*Scoloplos (Scoloplos) rubra*	325	3.53%	63.86%
Sigambra tentaculata	8.33	2.17%	100.00%	*Oxyurostylis smithi*	300	3.26%	67.12%
				Eudevenopus honduranus	275	2.99%	70.11%

Spiochaetopterus costarum was also dominate during the spring dredged hole samples along with the amphipod *Ampelisca abdita* and polychaete *Aricidea philbinae* accounted for over 55% of the abundance (Table 20). The amphipod *Rudilemboides naglei* was the most abundant macrofauna at the spring reference site and represented over 57% of the abundance (Table 20).

Table 20. Spring Culbreath Bayou South ranked taxa abundance (top 10).

Culbreath Bayou South Dredged Hole (Spring)				Culbreath Bayou South Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Spiochaetopterus costarum	483.33	42.02%	42.02%	*Rudilemboides naglei*	6875	57.41%	57.41%
Ampelisca abdita	83.33	7.24%	49.26%	*Fabricinuda trilobata*	575	4.80%	62.21%
Aricidea philbinae	75.00	6.52%	55.78%	*Listriella barnardi*	500	4.18%	66.39%
Acteocina canaliculata	50.00	4.35%	60.13%	*Macoma tenta*	450	3.76%	70.15%
Limapontiidae	50.00	4.35%	64.47%	*Ampelisca holmesi*	400	3.34%	73.49%
Bivalvia	41.67	3.62%	68.10%	*Orbinia riseri*	300	2.51%	75.99%
Paraprionospio pinnata	41.67	3.62%	71.72%	*Angulus cf. versicolor*	250	2.09%	78.08%
Cymadusa compta	33.33	2.90%	74.62%	*Amakusanthura magnifica*	225	1.88%	79.96%
Harrieta faxoni	33.33	2.90%	77.51%	*Acteocina canaliculata*	200	1.67%	81.63%
Nassarius vibex	33.33	2.90%	80.41%	*Metharpinia floridana*	200	1.67%	83.30%

The dredged hole sediments had a high silt+clay content (51.47% and 58.17%) and a TOC content of 2.9% while the reference site sediments had only a 3.1% and 1.8% silt+clay content and were the same for TOC (Table 21). The dredged hole sediments exceeded the TEL for several metals (Cr, Cu, Ni) and most of the heavy molecular weight PAHs while there were no sediment quality exceedances at the reference site (Table 21). The dredged hole PEL Quotient was 0.10 while the reference site was 0.02.

Table 21. Culbreath Bayou South sediment contaminants and composition.

Culbreath Bayou South										
	Formula	MW	MDL	TEL	PEL	16DH03-1 (Center)	16DH03-2 (Left)	16DH03-3 (Right)	16DH03 (Mean)	16DH03-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			24426.19	40944.48	30776.96	32049.21	1760.94
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	0.76
Cadmium	Cd	112.41	2.280	0.676	4.210	0.57	0.38	0.09	0.35	0.00
Chromium	Cr	52.00	1.210	52.300	160.000	57.28	90.01	69.96	72.42	7.17
Copper	Cu	63.55	0.450	18.700	108.000	11.02	20.88	14.46	15.45	0.00
Iron	Fe	55.85	69.200			10204.10	15604.20	11875.11	12561.14	685.97
Lead	Pb	207.20	5.220	30.200	112.000	26.59	30.04	28.05	28.23	20.60
Manganese	Mn	54.94	4.490			35.44	48.20	38.28	40.64	8.03
Nickel	Ni	58.69	0.710	15.900	42.800	11.20	16.95	13.39	13.85	3.37
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.00	0.00	0.00	0.00	0.48
Zinc	Zn	65.38	1.890	124.000	271.000	56.45	88.34	68.36	71.05	3.13
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.06	0.08	0.06	0.07	0.07
β BHC	$C_6H_6Cl_6$	290.83	0.730			0.00	3.35	0.05	1.13	0.06
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.00	0.01	0.17	0.06	0.10
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.01	0.01	0.06	0.03	0.12
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.01	0.00	0.00	0.00	0.03
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.62	0.34	0.27	0.41	0.01
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.63	0.34	0.27	0.41	0.04
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.00	0.07	0.08	0.05	0.04
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.00	0.01	0.06	0.02	0.04
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.05	0.19	0.08	0.11	0.00
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.02	0.06	0.17	0.08	0.05
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.02	0.50	0.00	0.17	0.18
Total DDT				3.890	51.700	0.09	0.75	0.25	0.36	0.23

Culbreath Bayou South										
	Formula	MW	MDL	TEL	PEL	16DH03-1 (Center)	16DH03-2 (Left)	16DH03-3 (Right)	16DH03 (Mean)	16DH03-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.03	0.01	0.01	0.02
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.03	0.02	0.02	0.01
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.24	0.29	0.10	0.21	0.07
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.10	0.09	0.06	0.01
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			1.21	0.63	0.54	0.79	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.05	0.07	0.07	0.06	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.00	0.08	0.00	0.03	0.05
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.03	0.11	0.13	0.09	0.17
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.17	0.03	0.53	0.24	0.68
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.08	0.00	0.00	0.03	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.31	0.00	0.00	0.10	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.09	0.00	0.03	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.04	0.25	0.36	0.22	0.02
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.03	0.01	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.00	0.00	0.00	0.01
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			0.07	1.08	1.67	0.94	0.01
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.11	0.26	0.19	0.19	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.02	0.02	0.01	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.01	0.00	0.01	0.01	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.32	2.19	0.10	0.87	0.00
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.02	0.01	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.00	0.20	0.00	0.07	1.91
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.06	0.05	0.34	0.15	0.01
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.83	0.36	1.63	0.94	0.38
Total PCBs				21.600	189.000	1.75	4.50	4.37	3.54	2.34
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	0.00	0.00	0.00

Culbreath Bayou South										
	Formula	MW	MDL	TEL	PEL	16DH03-1 (Center)	16DH03-2 (Left)	16DH03-3 (Right)	16DH03 (Mean)	16DH03-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	0.00	0.13	0.00	0.04	0.00
Fluorene	C13H10	166.22	4.670	21.200	144.000	0.00	0.00	0.00	0.00	0.00
Naphthalene	C10H8	128.17	7.890	34.600	391.000	0.00	0.00	0.00	0.00	0.00
Phenanthrene	C14H10	178.23	5.070	86.700	544.000	19.83	32.65	22.44	24.97	0.00
Total LMW PAHs				312.000	1440.000	19.83	32.78	22.44	25.02	0.00
Benzo(a)anthracene	C18H12	228.29	5.030	74.800	693.000	67.88	96.03	75.20	79.70	0.00
Benzo(a)pyrene	C20H12	252.31	3.160	88.800	763.000	169.17	256.77	180.68	202.21	0.00
Chrysene	C18H12	228.29	5.010	108.000	846.000	127.80	212.12	135.58	158.50	15.94
Dibenzo(a,h)anthracene	C22H14	278.35	5.770	6.220	135.000	38.03	67.01	43.50	49.51	0.00
Fluoranthene	C16H10	202.25	2.520	113.000	1494.000	82.76	112.60	85.31	93.56	0.00
Pyrene	C16H10	202.25	5.630	153.000	1398.000	148.76	234.03	161.96	181.58	9.09
Total HMW PAHs				655.000	6680.000	634.40	978.56	682.23	765.06	25.03
Total PAHs				1680.000	16800.000	654.23	1011.34	704.67	790.08	25.03
PEL Quotient						**0.08**	**0.12**	**0.09**	**0.10**	**0.02**
Benzo(b)fluoranthene	C20H12	252.31	4.400			226.70	382.87	255.41	288.33	0.00
Benzo(g,h,i)perylene	C22H12	276.33	5.580			137.38	210.81	151.23	166.47	15.67
Benzo(k)fluoranthene	C20H12	252.31	7.230			181.05	294.61	196.91	224.19	0.00
Coronene	C24H12	300.35	8.810			31.37	41.20	30.58	34.38	0.00
Indeno(1,2,3-c,d)pyrene	C22H12	276.33	6.000			129.11	194.73	135.76	153.20	0.00
Retene	C18H18	234.34	4.170			0.00	0.00	0.00	0.00	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						40.0/48.70	65.90/69.10	48.5/56.7	51.47/58.17	3.1/1.8
% Total Carbon (Solids)						2.50	4.20	3.10	3.27	0.10
% Total Inorganic Carbon (Solids)						0.30	0.40	0.30	0.33	0.10
% Total Organic Carbon (Solids)						2.2	3.8	2.7	2.9	0.10

Yellow >TEL; Red>PEL

Georgetown

Figure 4. Fall 2016 and spring 2017 Georgetown dredged hole and reference sample locations.

The Georgetown dredged hole (Figure 4) bottom hydrographic readings are summarized in Tables 22 and 23 for the fall and spring sampling events respectively. The mean sample depth within the dredged hole was 5.1 meters during both seasons and ranged from 2.4 – 7.0 meters in the fall and from 4.0-6.3 meters in the spring. The reference sites had sample depths of 2.8 in the fall and 2.3 in the spring. Bottom temperature, salinity and pH measurements were similar between the dredged hole and reference sites within each season, and bottom dissolved oxygen and D.O. saturation measurements were all normal.

Table 22. Fall Georgetown dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH05-1	16DH05-2	16DH05-3	DH	16DH05-4
	Center	Left	Right	Mean	Ref
Depth (m)	6.0	7.0	2.4	5.1	2.8
Temperature (°C)	30.47	30.54	30.20	30.40	30.67
Salinity (psu)	22.37	22.44	22.22	22.34	22.51
pH	8.14	8.13	8.11	8.13	8.15
Dissolved Oxygen (mg/l)	5.78	5.87	5.06	5.57	6.32
D.O. Saturation (%)	87.8	89.3	76.3	84.5	96.4

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 23. Spring Georgetown dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH05-5	17DH05-6	17DH05-7	DH	17DH05-8
	Center	Left	Right	Mean	Ref
Depth (m)	4.9	6.3	4.0	5.1	2.3
Temperature (°C)	19.44	19.51	19.45	19.47	20.05
Salinity (psu)	26.85	26.93	26.78	26.85	26.95
pH	8.16	8.16	8.19	8.17	8.20
Dissolved Oxygen (mg/l)	6.36	6.51	6.43	6.43	7.20
D.O. Saturation (%)	80.8	82.9	81.7	81.8	92.6

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

The fall dredged hole benthic community had a total of 82 taxa with a mean of 41 taxa per sample, 8,650 individuals/m^2 and a high "Intermediate" TBBI score of 85.79 (Table 24). The fall reference sample by comparison had 45 taxa with an abundance of 18,225 individuals/m^2 and a high TBBI score of 92.44 indicating a "Healthy" benthic habitat (Table 24).

Table 24. Fall Georgetown dredged hole benthic community metrics.

	Fall 2016				
	16DH05-1	16DH05-2	16DH05-3	DH	16DH05-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	16	54	54	41.33 (82)	45
Abundance (#/m^2)	2325	13075	10550	8650.00	18225
Shannon Diversity	2.39	2.02	3.09	2.50	2.26
TBBI	78.75	94.18	84.45	85.79	92.44
TBBI Category	Intermediate	Healthy	Intermediate	Intermediate	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring dredged hole benthic community was similar to the fall with a total of 86 taxa identified and mean of 45 taxa per sample while the spring reference site had a lower species richness with 29 taxa present (Table 25). Abundance was higher in the spring both within the dredged hole and at the reference site. The mean TBBI score for the spring dredged hole was in the upper "Intermediate" range, although two of the three dredged hole samples had "Healthy" TBBI scores while the reference site was also in the "Healthy" TBBI range (Table 25).

Table 25. Spring Georgetown dredged hole benthic community metrics.

	Spring 2017				
	17DH05-5	17DH05-6	17DH05-7	DH	17DH05-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	64	40	32	45.33 (86)	29
Abundance (#/m^2)	18700	13050	2550	11433.33	23375
Shannon Diversity	3.2	2.67	2.91	2.93	1.41
TBBI	87.69	87.27	78.13	84.36	87.69
TBBI Category	Healthy	Healthy	Intermediate	Intermediate	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall dredged hole benthic community was dominated by the polychaete *Kirkegaardia* sp. and amphipod *Ampelisca holmesi* which together comprised over 43% of the abundance (Table 26). The amphipod *Rudilemboides naglei* and cephalochordate *Branchiostoma floridae* were the dominant taxa at the spring reference site and accounted for nearly 62% of the abundance (Table 26).

Table 26. Fall Georgetown ranked taxa abundance (top 10).

Georgetown Dredged Hole (Fall)				**Georgetown Reference (Fall)**			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Kirkegaardia sp.	2850.00	32.95%	32.95%	*Rudilemboides naglei*	7175	39.37%	39.37%
Ampelisca holmesi	925.00	10.69%	43.64%	*Branchiostoma floridae*	4075	22.36%	61.73%
Spiochaetopterus costarum	741.67	8.57%	52.22%	*Prionospio heterobranchia*	1125	6.17%	67.90%
Tubificoides brownae	441.67	5.11%	57.32%	*Metharpinia floridana*	800	4.39%	72.29%
Tubificinae	433.33	5.01%	62.33%	*Ampelisca holmesi*	600	3.29%	75.58%
Tubificoides wasselli	283.33	3.28%	65.61%	*Ampelisca sp. C of LeCroy, 2002*	400	2.19%	77.78%
Nassarius vibex	183.33	2.12%	67.73%	*Ampelisca abdita*	375	2.06%	79.84%
Mediomastus sp.	175.00	2.02%	69.75%	*Listriella barnardi*	375	2.06%	81.89%
Pagurus maclaughlinae	175.00	2.02%	71.77%	*Amakusanthura magnifica*	350	1.92%	83.81%
Ampelisca abdita	166.67	1.93%	73.70%	*Eudevenopus honduranus*	325	1.78%	85.60%

The spring dredged hole benthic macrofauna were dominated by unidentified oligochatetes (Tubificinae), the bivalve *Mysella planulata*, and the polychates *Spiochaetopterus costarum*, *Lysilla* sp. and *Lysilla sp. A of EPC* which cumulatively comprised 49% of the abundance (Table 27). The spring reference sample was dominated by amphipods with *Rudilemboides naglei* accounting for 67% of the abundance and the top five taxa (all amphipods) cumulatively making up over 90% of the total abundance at that site (Table 27).

Table 27. Spring Georgetown ranked taxa abundance (top 10).

Georgetown Dredged Hole (Spring)				Georgetown Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Tubificinae	1916.67	16.76%	16.76%	*Rudilemboides naglei*	15725	67.27%	67.27%
Mysella planulata	1158.33	10.13%	26.90%	*Metharpinia floridana*	2125	9.09%	76.36%
Spiochaetopterus costarum	1075.00	9.40%	36.30%	*Ampelisca holmesi*	1475	6.31%	82.67%
Lysilla sp.	791.67	6.92%	43.22%	*Listriella barnardi*	1200	5.13%	87.81%
Lysilla sp. A of EPC	675.00	5.90%	49.13%	*Eudevenopus honduranus*	550	2.35%	90.16%
Prionospio perkinsi	500.00	4.37%	53.50%	*Travisia hobsonae*	400	1.71%	91.87%
Kirkegaardia sp.	425.00	3.72%	57.22%	*Transennella conradina*	200	0.86%	92.73%
Polycirrinae	425.00	3.72%	60.93%	*Haminoea succinea*	175	0.75%	93.48%
Limnodriloides barnardi	391.67	3.43%	64.36%	*Ericthonius brasiliensis*	150	0.64%	94.12%
Tubificoides wasselli	383.33	3.35%	67.71%	*Prunum apicinum*	150	0.64%	94.76%

The dredged hole sediments had a mean silt+clay content of 11.87% in the fall and 18.43% in the spring compared to 2.7% and 1.9% at the reference site and the TOC was low in both the dredged hole and reference site sediments (Table 28). Most of the measured sediment contaminants were low in the dredged hole sediments with the exception of the high molecular weight PAHs benzo (a) pyrene which was above the TEL in one dredged hole sample and dibenzo (a,h,) anthracene which exceeded the TEL in all three dredged hole samples (Table 28). There were no measured sediment quality exceedances at the reference site (Table 28). The overall PEL Quotient for the dredged hole was 0.04 and the reference site was 0.02.

Table 28. Georgetown sediment contaminants and composition.

Georgetown										
	Formula	MW	MDL	TEL	PEL	16DH05-1 (Center)	16DH05-2 (Left)	16DH05-3 (Right)	16DH05 (Mean)	16DH05-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			11926.63	9496.12	2359.53	7927.43	1445.70
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	1.87	0.62	2.91
Cadmium	Cd	112.41	2.280	0.676	4.210	0.00	0.33	0.27	0.20	0.18
Chromium	Cr	52.00	1.210	52.300	160.000	28.99	24.79	8.33	20.70	6.39
Copper	Cu	63.55	0.450	18.700	108.000	6.20	4.84	0.81	3.95	0.00
Iron	Fe	55.85	69.200			4806.01	3875.74	921.18	3200.98	639.70
Lead	Pb	207.20	5.220	30.200	112.000	22.46	22.47	19.95	21.63	19.79
Manganese	Mn	54.94	4.490			19.21	15.38	6.01	13.53	8.28
Nickel	Ni	58.69	0.710	15.900	42.800	6.96	6.20	3.69	5.62	3.39
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.00	0.00	0.53	0.18	0.66
Zinc	Zn	65.38	1.890	124.000	271.000	35.43	28.25	7.36	23.68	3.92
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.02	0.01	0.00	0.01	0.01
β BHC	$C_6H_6Cl_6$	290.83	0.730			2.33	1.88	0.54	1.58	0.07
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.15	0.11	0.00	0.09	0.01
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.07	0.07	0.00	0.05	0.12
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.00	0.00	0.01	0.00	0.00
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.00	0.00	0.00	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.00	0.00	0.01	0.00	0.00
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.02	0.03	0.00	0.02	0.01
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.05	0.02	0.00	0.02	0.01
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.00	0.00	0.00	0.00	0.00
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.10	0.06	0.00	0.05	0.00
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.01	0.00	0.02	0.01	0.04
Total DDT				3.890	51.700	0.11	0.06	0.02	0.06	0.04

Georgetown										
	Formula	MW	MDL	TEL	PEL	16DH05-1 (Center)	16DH05-2 (Left)	16DH05-3 (Right)	16DH05 (Mean)	16DH05-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.00	0.00	0.00	0.00
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.00	0.00	0.00	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.00	0.00	0.00	0.00	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.01	0.00	0.00	0.00	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	0.00	0.00	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.00	0.00	0.00	0.00	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.00	0.01	0.00	0.00	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.01	0.00	0.00	0.00	0.05
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.06	0.04	0.02	0.04	0.81
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.00	0.00	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.00	0.00	0.00	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.01	0.02	0.00	0.01	0.03
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.00	0.00	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.00	0.00	0.00	0.01
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			0.00	0.00	0.37	0.12	0.00
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.05	0.02	0.00	0.02	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.00	0.00	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.33	0.25	0.00	0.19	0.10
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.00	0.00	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			2.19	2.12	0.00	1.44	1.72
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.17	0.00	0.56	0.24	0.03
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.00	0.01	0.01	0.01	0.26
Total PCBs				21.600	189.000	2.75	2.42	0.94	2.04	2.15
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	0.00	0.00	0.00

Georgetown

	Formula	MW	MDL	TEL	PEL	16DH05-1 (Center)	16DH05-2 (Left)	16DH05-3 (Right)	16DH05 (Mean)	16DH05-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	7.97	5.45	0.00	4.47	0.00
Fluorene	$C_{13}H_{10}$	166.22	4.670	21.200	144.000	7.36	4.81	0.00	4.06	0.00
Naphthalene	$C_{10}H_8$	128.17	7.890	34.600	391.000	0.00	0.00	0.00	0.00	0.00
Phenanthrene	$C1_4H_{10}$	178.23	5.070	86.700	544.000	23.58	16.49	0.00	13.36	0.00
Total LMW PAHs				312.000	1440.000	38.91	26.75	0.00	21.89	0.00
Benzo(a)anthracene	$C_{18}H_{12}$	228.29	5.030	74.800	693.000	54.99	32.45	0.47	29.30	3.21
Benzo(a)pyrene	$C_{20}H_{12}$	252.31	3.160	88.800	763.000	102.81	66.80	15.50	61.70	10.84
Chrysene	$C_{18}H_{12}$	228.29	5.010	108.000	846.000	95.99	62.59	10.61	56.40	11.68
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	278.35	5.770	6.220	135.000	37.59	24.40	9.99	23.99	0.00
Fluoranthene	$C_{16}H_{10}$	202.25	2.520	113.000	1494.000	65.95	39.12	11.84	38.97	3.49
Pyrene	$C_{16}H_{10}$	202.25	5.630	153.000	1398.000	106.80	66.19	20.23	64.41	4.27
Total HMW PAHs				655.000	6680.000	464.13	291.55	68.64	274.77	33.49
Total PAHs				1680.000	16800.000	503.04	318.30	68.64	296.66	33.49
PEL Quotient						**0.06**	**0.05**	**0.02**	**0.04**	**0.02**
Benzo(b)fluoranthene	$C_{20}H_{12}$	252.31	4.400			120.32	77.45	21.38	73.05	0.00
Benzo(g,h,i)perylene	$C_{22}H_{12}$	276.33	5.580			88.69	55.36	21.79	55.28	0.00
Benzo(k)fluoranthene	$C_{20}H_{12}$	252.31	7.230			102.93	68.97	15.14	62.35	14.29
Coronene	$C_{24}H_{12}$	300.35	8.810			35.38	0.00	15.60	16.99	0.00
Indeno(1,2,3-c,d)pyrene	$C_{22}H_{12}$	276.33	6.000			83.92	50.29	18.24	50.82	19.14
Retene	$C_{18}H_{18}$	234.34	4.170			10.96	7.68	0.00	6.21	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						17.6/11.8	15.3/17.5	2.7/26.0	11.87/18.43	2.7/1.9
% Total Carbon (Solids)						1.40	1.10	0.30	0.93	0.10
% Total Inorganic Carbon (Solids)						0.20	0.20	0.10	0.17	0.10
% Total Organic Carbon (Solids)						1.2	0.9	0.2	0.77	0.10

Yellow >TEL; Red>PEL

MacDill AFB Docks

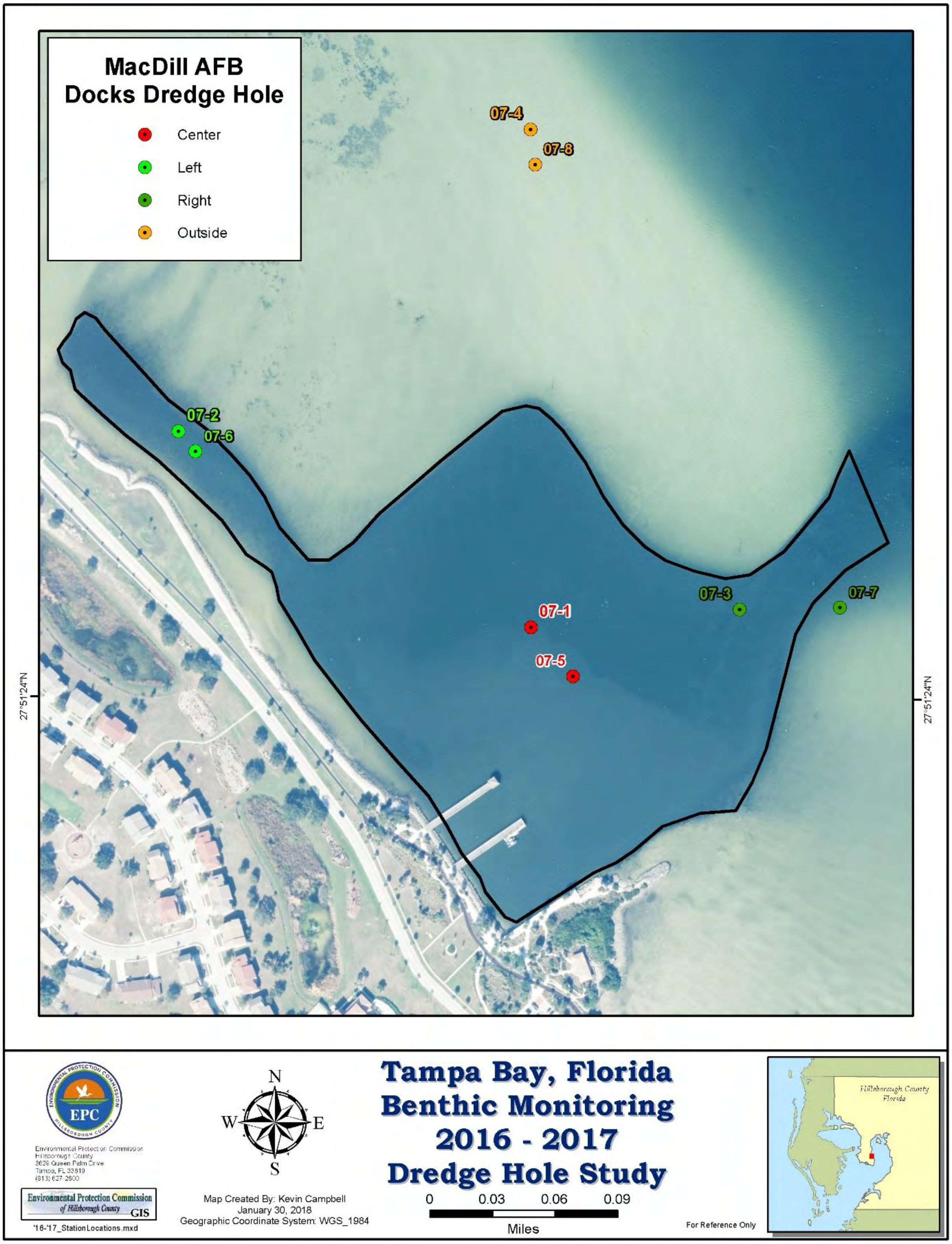

Figure 5. Fall 2016 and spring 2017 MacDill AFB Docks dredged hole and reference sample locations.

The MacDill Air Force Base Docks dredged hole (Figure 5) bottom hydrographic measurements are summarized in Table 29 for the fall sampling and Table 30 for the spring sampling. The mean fall sample depth within the dredged hole was 2.3 meters in the fall and 1.7 meters in the spring while the reference sites depth varied from 1.2 meters in the fall to 0.9 meters in the spring. Bottom temperatures, salinities and pH values within each season were similar between the dredged hole and reference sites and all dissolved oxygen and D.O. saturation measurements were above state water quality thresholds with the exception of one fall dredged hole reading that was slightly low at 3.64 mg/l (Table 29).

Table 29. Fall MacDill AFB Docks dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH07-1	16DH07-2	16DH07-3	DH	16DH07-4
	Center	Left	Right	Mean	Ref
Depth (m)	2.4	1.5	2.9	2.3	1.2
Temperature (°C)	28.44	29.29	28.62	28.78	29.99
Salinity (psu)	17.76	16.69	17.90	17.45	17.18
pH	7.87	7.89	7.87	7.88	8.11
Dissolved Oxygen (mg/l)	4.45	3.64	4.46	4.18	6.05
D.O. Saturation (%)	63.4	52.4	63.8	59.9	88.3

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 30. Spring MacDill AFB Docks dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH07-5	17DH07-6	17DH07-7	DH	17DH07-8
	Center	Left	Right	Mean	Ref
Depth (m)	2.2	1.5	1.5	1.7	0.9
Temperature (°C)	19.80	19.86	20.08	19.91	20.20
Salinity (psu)	27.50	27.51	27.59	27.53	27.52
pH	8.02	8.03	8.04	8.03	8.04
Dissolved Oxygen (mg/l)	6.71	6.99	7.54	7.08	7.21
D.O. Saturation (%)	86.5	90.2	97.8	91.5	93.7

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

The fall dredged hole benthic macrofauna community had a total of 30 taxa with a mean of 12.67 taxa per sample and mean abundance of 791.67/m^2 (Table 31). The fall reference sample had 44 taxa present and an abundance of 32,375 individuals/m^2. The mean TBBI score for the dredged hole samples was 80.11 within the "Intermediate" range while the reference site had a "Healthy" benthic community with a TBBI score of 94.45.

Table 31. Fall MacDill AFB Docks dredged hole benthic community metrics.

	Fall 2016				
	16DH07-1	16DH07-2	16DH07-3	DH	16DH07-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	22	6	10	12.67 (30)	44
Abundance (#/m^2)	1800	225	350	791.67	32375
Shannon Diversity	2.35	1.68	2.24	2.09	2.22
TBBI	87.65	74.57	78.12	80.11	94.45
TBBI Category	Healthy	Intermediate	Intermediate	Intermediate	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring dredged hole samples had more taxa than in the fall and also than the spring reference sample with a total of 58 taxa and a mean of 28.67 taxa/sample (Table 32). The dredged hole abundance was also higher in the spring. The spring reference site in contrast had few taxa (24) and low abundance. Despite the higher counts within the dredged hole, two of the three samples had "Degraded" TBBI scores and the overall mean TBBI fell within the "Degraded" range while the reference site TBBI score was higher and indicated an "Intermediate" benthic community (Table 32). This was due to a higher abundance of capitellid polychates at the dredged hole sites lowering the TBBI scores.

Table 32. Spring MacDill AFB Docks dredged hole benthic community metrics.

	Spring 2017				
	17DH07-5	17DH07-6	17DH07-7	DH	17DH07-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	7	38	41	28.67 (58)	24
Abundance (#/m^2)	250	8627	6402	5093	2900
Shannon Diversity	1.83	2.32	2.89	2.35	2.54
TBBI	74.26	58.78	69.09	67.38	82.84
TBBI Category	Intermediate	Degraded	Degraded	Degraded	Intermediate

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall dredged hole benthic community was dominated by the gastropods *Bittiolum varium* and *Astyris lunata* which comprised 40% of the abundance (Table 33). The fall reference site was dominated by the amphipods *Rudilemboides naglei* and *Ampelisca holmesi* with cumulatively accounted for over 61% of the abundance at that site (Table 33).

Table 33. Fall MacDill AFB Docks ranked taxa abundance (top 10).

MacDill AFB Docks Dredged Hole (Fall)				MacDill AFB Docks Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Bittiolum varium	166.67	21.05%	21.05%	*Rudilemboides naglei*	13400	41.39%	41.39%
Astyris lunata	150.00	18.95%	40.00%	*Ampelisca holmesi*	6475	20.00%	61.39%
Tubificoides brownae	58.33	7.37%	47.37%	Tubificinae	1700	5.25%	66.64%
Anadara transversa	33.33	4.21%	51.58%	*Branchiostoma floridae*	1625	5.02%	71.66%
Cymadusa compta	33.33	4.21%	55.79%	*Amygdalum papyrium*	1375	4.25%	75.91%
Ampelisca abdita	25.00	3.16%	58.95%	*Alitta succinea*	975	3.01%	78.92%
Ericthonius brasiliensis	25.00	3.16%	62.11%	*Mysella planulata*	775	2.39%	81.31%
Grandidierella bonnieroides	25.00	3.16%	65.26%	*Paraonis fulgens*	775	2.39%	83.71%
Prunum apicinum	25.00	3.16%	68.42%	*Eobrolgus spinosus*	550	1.70%	85.41%
Sigambra tentaculata	25.00	3.16%	71.58%	*Prunum apicinum*	500	1.54%	86.95%

The spring dredged hole benthic macrofauna community was dominated by annelids including the spionid polychaete *Streblospio* spp. and the oligochaetes *Tubificoides brownae* and unidentified Tubificinae which together made up over 45% of the abundance (Table 34). Also among the top ranked taxa in the dredged hole samples were the capitellid polychaetes *Capitella jonesi* and *Capitella capitata* spp. complex which contributed to the lower spring TBBI scores at the dredged hole sites. The spring reference site was dominated by crustaceans including the amphipods *Eobrolgus spinosus* and *Ampelisca holmesi* and the isopod *Amakusanthura magnifica* which cumulatively accounted for over 52% of the abundance in the reference sample (Table 34).

Table 34. Spring MacDill AFB Docks ranked taxa abundance (top 10).

MacDill AFB Docks Dredged Hole (Spring)				MacDill AFB Docks Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Streblospio spp.	1425.00	27.98%	27.98%	*Eobrolgus spinosus*	775	26.72%	26.72%
Tubificoides brownae	466.67	9.16%	37.14%	*Ampelisca holmesi*	525	18.10%	44.83%
Tubificinae	433.33	8.51%	45.65%	*Amakusanthura magnifica*	225	7.76%	52.59%
Grandidierella bonnieroides	391.67	7.69%	53.34%	*Prionospio perkinsi*	200	6.90%	59.48%
Capitella jonesi	300.00	5.89%	59.23%	*Mysella planulata*	150	5.17%	64.66%
Alitta succinea	225.00	4.42%	63.65%	*Paraonis fulgens*	125	4.31%	68.97%
Streblospio gynobranchiata	166.67	3.27%	66.92%	*Angulus cf. versicolor*	100	3.45%	72.41%
Capitella capitata complex	141.67	2.78%	69.70%	*Aricidea philbinae*	100	3.45%	75.86%
Aricidea philbinae	133.33	2.62%	72.32%	*Olivella pusilla*	100	3.45%	79.31%
Paracaprella pusilla	133.33	2.62%	74.94%	*Acteocina canaliculata*	75	2.59%	81.90%

The dredged hole sediments had a high silt+clay content (54.47% fall and 30.5% spring) and a relatively high TOC content of 3.07% while the reference site sediments were sandier (silt+clay = 2.2% and 1.3%) and a low TOC content (Table 35). The lower spring mean silt+clay was due to one sample (right) which fell near the boundary of the hole and was shallower than the corresponding fall sample. The dredged hole sediments had several TEL exceedances for metals including Cd, Cr, Cu and Pb and for all of the measured high molecular weight PAHs and total PAHs while there were no sediment quality exceedances at the reference site (Table 35). This dredged hole had the highest PEL Quotient (0.17) of the ten holes evaluated while the reference site had a low PEL Quotient of 0.02.

Table 35. MacDill AFB Docks sediment contaminants and composition.

MacDill AFB Docks										
	Formula	MW	MDL	TEL	PEL	16DH07-1 (Center)	16DH07-2 (Left)	16DH07-3 (Right)	16DH07 (Mean)	16DH07-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			24654.55	14376.21	25981.90	21670.89	1384.41
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	1.85
Cadmium	Cd	112.41	2.280	0.676	4.210	0.44	0.48	0.89	0.60	0.18
Chromium	Cr	52.00	1.210	52.300	160.000	70.52	38.31	79.57	62.80	5.85
Copper	Cu	63.55	0.450	18.700	108.000	21.11	12.12	23.97	19.07	0.13
Iron	Fe	55.85	69.200			17331.81	9465.77	19443.59	15413.72	843.22
Lead	Pb	207.20	5.220	30.200	112.000	37.49	29.04	39.86	35.46	19.17
Manganese	Mn	54.94	4.490			62.42	40.54	59.57	54.18	10.51
Nickel	Ni	58.69	0.710	15.900	42.800	12.48	7.85	14.60	11.64	2.91
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.00	0.00	0.00	0.00	0.39
Zinc	Zn	65.38	1.890	124.000	271.000	104.44	61.02	119.68	95.05	5.21
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.04	0.16	0.00	0.07	0.01
β BHC	$C_6H_6Cl_6$	290.83	0.730			0.92	3.02	0.02	1.32	0.00
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.02	0.57	0.59	0.39	0.02
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.01	0.09	0.00	0.03	0.04
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.00	0.10	0.01	0.04	0.01
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			1.12	0.00	1.04	0.72	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	1.12	0.10	1.05	0.76	0.01
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.01	0.21	0.01	0.08	0.00
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.00	0.07	0.05	0.04	0.00
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.04	0.43	0.03	0.17	0.01
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.05	0.53	0.08	0.22	0.01
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.16	0.51	0.01	0.23	0.00
Total DDT				3.890	51.700	0.25	1.47	0.12	0.61	0.02

MacDill AFB Docks										
	Formula	MW	MDL	TEL	PEL	16DH07-1 (Center)	16DH07-2 (Left)	16DH07-3 (Right)	16DH07 (Mean)	16DH07-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.02	0.00	0.01	0.01
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.04	0.00	0.07	0.04	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.01	0.00	0.02	0.01	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.03	0.10	0.01	0.05	0.01
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			1.04	0.02	0.82	0.63	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.43	0.03	0.23	0.23	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.02	0.20	0.00	0.07	0.01
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.07	0.11	0.04	0.07	0.10
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			4.12	0.28	3.61	2.67	0.06
Mirex	$C_{10}Cl_{12}$	545.54	0.160			2.08	0.00	0.00	0.69	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.12	0.00	0.01	0.04	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.07	0.00	0.02	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.26	0.00	0.28	0.18	0.03
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.00	0.00	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.00	0.30	0.10	0.01
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			0.02	2.54	0.01	0.86	0.05
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.02	8.41	0.00	2.81	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.06	0.02	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.07	0.00	0.15	0.07	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.03	1.18	0.34	0.52	0.00
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.81	0.25	0.06	0.37	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.00	5.14	0.00	1.71	1.18
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.11	0.04	9.10	3.08	0.23
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			1.39	0.06	0.51	0.65	0.04
Total PCBs				21.600	189.000	2.83	17.69	10.82	10.45	1.54
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	5.16	0.00	0.00	1.72	0.00

MacDill AFB Docks										
	Formula	MW	MDL	TEL	PEL	16DH07-1 (Center)	16DH07-2 (Left)	16DH07-3 (Right)	16DH07 (Mean)	16DH07-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	17.26	0.00	0.00	5.75	0.00
Fluorene	$C_{13}H_{10}$	166.22	4.670	21.200	144.000	4.32	0.00	0.00	1.44	0.00
Naphthalene	$C_{10}H_8$	128.17	7.890	34.600	391.000	0.00	0.00	0.00	0.00	0.38
Phenanthrene	$C_{14}H_{10}$	178.23	5.070	86.700	544.000	119.30	22.53	80.43	74.09	0.00
Total LMW PAHs				312.000	1440.000	146.04	22.53	80.43	83.00	0.38
Benzo(a)anthracene	$C_{18}H_{12}$	228.29	5.030	74.800	693.000	265.27	229.36	243.11	245.91	0.00
Benzo(a)pyrene	$C_{20}H_{12}$	252.31	3.160	88.800	763.000	449.87	506.90	581.84	512.87	9.58
Chrysene	$C_{18}H_{12}$	228.29	5.010	108.000	846.000	434.06	415.16	448.95	432.72	10.85
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	278.35	5.770	6.220	135.000	92.09	0.00	129.17	73.75	0.00
Fluoranthene	$C_{16}H_{10}$	202.25	2.520	113.000	1494.000	310.99	465.70	446.33	407.67	3.39
Pyrene	$C_{16}H_{10}$	202.25	5.630	153.000	1398.000	513.92	480.92	538.35	511.06	4.13
Total HMW PAHs				655.000	6680.000	2066.20	2098.04	2387.75	2184.00	27.95
Total PAHs				1680.000	16800.000	2212.24	2120.57	2468.18	2267.00	28.33
PEL Quotient						**0.18**	**0.14**	**0.21**	**0.17**	**0.02**
Benzo(b)fluoranthene	$C_{20}H_{12}$	252.31	4.400			485.86	467.58	685.57	546.34	6.26
Benzo(g,h,i)perylene	$C_{22}H_{12}$	276.33	5.580			262.50	270.36	405.30	312.72	10.45
Benzo(k)fluoranthene	$C_{20}H_{12}$	252.31	7.230			459.32	480.22	597.70	512.41	0.00
Coronene	$C_{24}H_{12}$	300.35	8.810			42.15	0.00	91.18	44.44	0.00
Indeno(1,2,3-c,d)pyrene	$C_{22}H_{12}$	276.33	6.000			239.27	268.14	393.78	300.40	16.92
Retene	$C_{18}H_{18}$	234.34	4.170			27.96	8.70	6.60	14.42	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						64.3/63.0	33.3/24.0	65.8/4.5	54.47/30.5	2.2/1.3
% Total Carbon (Solids)						3.90	2.20	4.70	3.60	0.20
% Total Inorganic Carbon (Solids)						0.70	0.30	0.60	0.53	0.10
% Total Organic Carbon (Solids)						3.2	1.9	4.1	3.07	0.2

Yellow >TEL; Red>PEL

MacDill AFB Beach

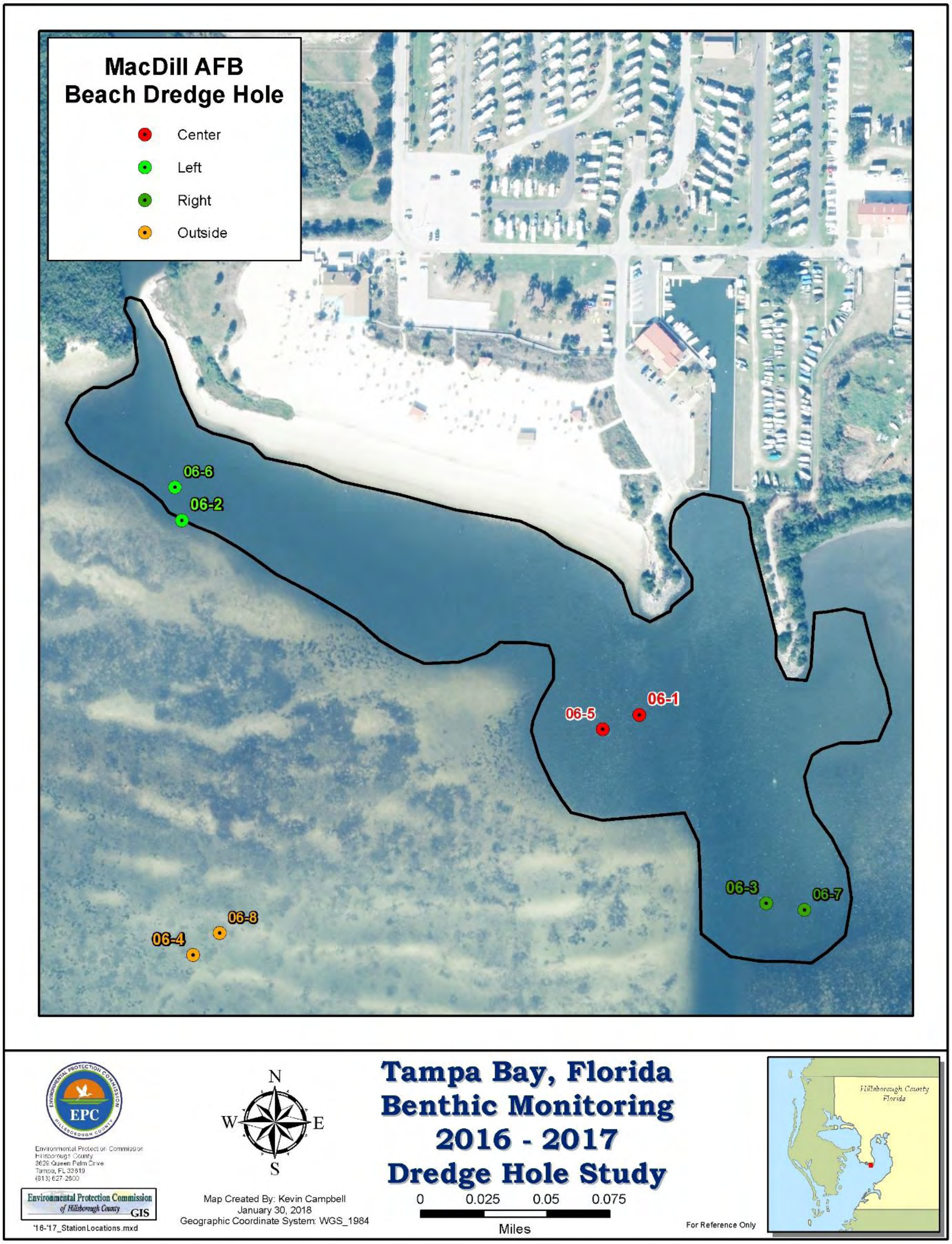

Figure 6. Fall 2016 and spring 2017 MacDill AFB Beach dredged hole and reference sample locations.

The MacDill Air Force Base Beach dredged hole (Figure 6) bottom hydrographic measurements are summarized in Table 36 for the fall and Table 37 for the spring sampling events. The mean fall sampling depth within the dredged hole was 1.5 meters and 1.3 meters in the spring while the reference site depths were 0.9 and 0.4 meters in the fall and spring. The mean bottom temperature, salinity and pH were comparable between the dredged hole and the reference site within each season. The bottom dissolved oxygen was lower in the fall within the dredged hole, particularly at the center where it was hypoxic (1.26 mg/l and 18.6% saturation; Table 36). The spring dissolved oxygen and D.O. saturation was above the state water quality standards at all sampling sites (Table 37).

Table 36. Fall MacDill AFB Beach dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH06-1	16DH06-2	16DH06-3	DH	16DH06-4
	Center	Left	Right	Mean	Ref
Depth (m)	1.8	0.9	1.7	1.5	0.9
Temperature (°C)	29.53	29.83	29.48	29.61	30.24
Salinity (psu)	20.32	18.81	20.04	19.72	19.99
pH	7.63	8.08	7.88	7.86	8.20
Dissolved Oxygen (mg/l)	1.26	6.72	3.79	3.92	7.53
D.O. Saturation (%)	18.6	98.8	55.8	57.7	112.1

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 37. Spring MacDill AFB Beach dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH06-5	17DH06-6	17DH06-7	DH	17DH06-8
	Center	Left	Right	Mean	Ref
Depth (m)	1.4	1.3	1.3	1.3	0.4
Temperature (°C)	21.53	21.66	22.26	21.82	22.71
Salinity (psu)	28.50	28.87	28.46	28.61	28.56
pH	8.11	8.20	8.12	8.14	8.11
Dissolved Oxygen (mg/l)	5.74	6.44	6.66	6.28	6.88
D.O. Saturation (%)	76.9	86.8	90.5	84.7	94.2

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

The fall dredged hole benthic community had a total of 40 taxa present with a mean of 13.67 taxa/sample (Table 38). Most of the species richness was at only one of the three replicate samples (16DH06-2 = left sample) which had 39 taxa. This sample was also the shallowest (0.9 meters) and had a much higher dissolved oxygen concentration than the other two fall dredged hole samples. In contrast, the center sample was completely depauperate and the right sample only had two taxa present (Table 38). As a result, the center and right fall dredged hole samples had low TBBI scores and were classified as “Degraded” which also was reflected in the overall mean TBBI score (Table 38). The fall reference sample had 44 taxa present, with a higher abundance, diversity and TBBI score than the dredged hole (Table 38).

Table 38. Fall MacDill AFB Beach dredged hole benthic community metrics.

	Fall 2016				
	16DH06-1	16DH06-2	16DH06-3	DH	16DH06-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	0	39	2	13.67 (40)	44
Abundance (#/m^2)	0	9526	125	3217	30351
Shannon Diversity	0	2.54	0.5	1.01	2.15
TBBI	0	82.25	65.11	49.12	84.11
TBBI Category	Empty	Intermediate	Degraded	Degraded	Intermediate

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

Compared to fall samples, the spring dredged hole benthic community had a higher mean and total species richness (24.33 taxa/sample and 46 taxa total) as well as higher abundances, diversity and TBBI scores. The increase in taxa was most notable at the center and right dredged hole samples, while the left sample had fewer taxa than in the fall, but higher abundance (Table 39). The TBBI scores within the dredged hole ranged from "Intermediate" to "Healthy" with an overall mean TBBI of 84.88 within the high "Intermediate" range (Table 39). The spring reference sample also had higher species richness (59 taxa), abundance and Shannon diversity, and a TBBI score in the "Healthy" range (Table 39).

Table 39. Spring MacDill AFB Beach dredged hole benthic community metrics.

	Spring 2017				
	17DH06-5	17DH06-6	17DH06-7	DH	17DH06-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	25	31	17	24.33 (46)	59
Abundance (#/m^2)	2275	11075	4225	5858.33	21676
Shannon Diversity	2.3	1.6	1.81	1.90	2.28
TBBI	85.4	88.01	81.24	84.88	90.92
TBBI Category	Intermediate	Healthy	Intermediate	Intermediate	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall dredged hole was dominated by the polychaetes *Prionospio heterobranchia* and *Laeonereis culveri* and the amphipod *Cymadusa compta* which together comprised 57% of the benthic abundance (Table 40). The fall reference site was dominated by annelids *Aricidea philbinae*, unidentified oligochaetes (Tubificinae) and *Prionospio heterobranchia* accounting for over 70% of the cumulative abundance (Table 40).

Table 40. Fall MacDill AFB Beach ranked taxa abundance (top 10).

MacDill AFB Beach Dredged Hole (Fall)				MacDill AFB Beach Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Prionospio heterobranchia	675.00	20.98%	20.98%	*Aricidea philbinae*	11600	38.22%	38.22%
Laeonereis culveri	591.67	18.39%	39.37%	Tubificinae	5450	17.96%	56.18%
Cymadusa compta	566.67	17.61%	56.99%	*Prionospio heterobranchia*	4400	14.50%	70.67%
Tubificinae	341.67	10.62%	67.61%	*Cymadusa compta*	2500	8.24%	78.91%
Grandidierella bonnieroides	141.67	4.40%	72.01%	*Limnodriloides baculatus*	1000	3.29%	82.20%
Capitella capitata complex	116.67	3.63%	75.64%	*Capitella capitata complex*	950	3.13%	85.33%
Stenoninereis martini	75.00	2.33%	77.97%	*Prunum apicinum*	425	1.40%	86.74%
Tubificoides brownae	66.67	2.07%	80.04%	*Alitta succinea*	400	1.32%	88.05%
Diopatra cuprea	58.33	1.81%	81.86%	*Polydora cornuta*	300	0.99%	89.04%
Panopeidae	58.33	1.81%	83.67%	*Tubificoides brownae*	300	0.99%	90.03%

The spring dredged hole macrofauna community was dominated by the amphipod *Ampelisca abdita* and the bivalve *Mysella planulata* which made up 57% of the total abundance (Table 41). The spring reference sample was dominated by the amphipods *Ampelisca holmesi* and *Rudilemboides naglei* which comprised nearly 60% of the benthic abundance (Table 41).

Table 41. Spring MacDill AFB Beach ranked taxa abundance (top 10).

MacDill AFB Beach Dredged Hole (Spring)				MacDill AFB Beach Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Ampelisca abdita	2416.67	41.25%	41.25%	*Ampelisca holmesi*	9750	44.98%	44.98%
Mysella planulata	925.00	15.79%	57.04%	*Rudilemboides naglei*	3200	14.76%	59.74%
Mulinia lateralis	716.67	12.23%	69.27%	*Mysella planulata*	2050	9.46%	69.20%
Cyclaspis varians	666.67	11.38%	80.65%	Tubificinae	1050	4.84%	74.05%
Grandidierella bonnieroides	150.00	2.56%	83.21%	*Aricidea philbinae*	700	3.23%	77.27%
Ampelisca spp.	116.67	1.99%	85.21%	*Oxyurostylis smithi*	550	2.54%	79.81%
Angulus cf. tampaensis	83.33	1.42%	86.63%	*Cymadusa compta*	325	1.50%	81.31%
Melinna maculata	75.00	1.28%	87.91%	*Capitella capitata complex*	275	1.27%	82.58%
Deutella incerta	66.67	1.14%	89.05%	*Prionospio heterobranchia*	275	1.27%	83.85%
Amygdalum papyrium	58.33	1.00%	90.04%	*Ensis minor*	250	1.15%	85.00%

The sediment within the dredged hole had a mean silt+clay content of 20.97% in the fall and 30.37% in the spring and a TOC of 1.33% compared to a silt+clay content of 6.9% in the fall and 2.4% in the spring and a TOC of 0.6% in the reference sample sediments (Table 42). The pesticide γ- BHC (Lindane) was above the Probable Effects Level (PEL) in one of the dredged hole samples and the overall mean dredged hole concentration was above the TEL as was the reference site (Table 42). The dredged hole sediments also had TEL exceedances for DDT, Total PCBs and dibenzo (a,h) anthracene (Table 42). The overall dredged hole PEL Quotient was 0.06 and the reference site was 0.05, which was the highest of the ten reference samples collected.

Table 42. MacDill AFB Beach sediment contaminants and composition.

MacDill AFB Beach										
	Formula	MW	MDL	TEL	PEL	16DH06-1 (Center)	16DH06-2 (Left)	16DH06-3 (Right)	16DH06 (Mean)	16DH06-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			11869.64	4174.95	8339.43	8128.01	3598.00
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	0.00
Cadmium	Cd	112.41	2.280	0.676	4.210	0.64	0.00	0.45	0.36	0.19
Chromium	Cr	52.00	1.210	52.300	160.000	34.13	13.35	25.46	24.31	12.12
Copper	Cu	63.55	0.450	18.700	108.000	9.86	2.81	6.49	6.39	2.38
Iron	Fe	55.85	69.200			6272.24	2008.96	4299.15	4193.45	1716.32
Lead	Pb	207.20	5.220	30.200	112.000	24.77	20.85	21.58	22.40	19.88
Manganese	Mn	54.94	4.490			27.85	10.42	19.44	19.24	11.01
Nickel	Ni	58.69	0.710	15.900	42.800	8.08	4.64	6.59	6.44	4.38
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.00	0.00	0.00	0.00	0.00
Zinc	Zn	65.38	1.890	124.000	271.000	47.18	14.04	32.48	31.23	12.16
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.00	0.04	0.13	0.06	0.06
β BHC	$C_6H_6Cl_6$	290.83	0.730			1.63	1.49	1.47	1.53	1.16
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.02	0.92	1.67	0.87	0.00
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.01	0.07	1.52	0.53	0.95
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.00	0.01	0.00	0.00	0.00
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.08	0.00	0.03	0.18
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.00	0.09	0.00	0.03	0.18
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.00	0.07	0.26	0.11	0.13
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.00	0.01	0.00	0.00	0.00
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.01	0.16	0.07	0.08	0.02
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.16	0.46	1.12	0.58	0.00
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.05	0.02	1.35	0.47	0.00
Total DDT				3.890	51.700	0.22	0.64	2.54	1.13	0.02

MacDill AFB Beach										
	Formula	MW	MDL	TEL	PEL	16DH06-1 (Center)	16DH06-2 (Left)	16DH06-3 (Right)	16DH06 (Mean)	16DH06-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.03	0.00	0.01	0.00
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.00	0.12	0.04	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.02	0.04	0.20	0.09	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.03	0.07	0.03	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	0.06	0.02	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.00	0.01	0.00	0.00	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.00	0.12	0.52	0.21	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.00	0.00	0.00	0.00	0.00
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.03	0.03	0.17	0.08	0.04
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.00	0.00	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.05	0.14	0.06	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.00	0.05	0.33	0.13	0.00
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.29	0.10	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.01	0.00	0.00	0.00
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			0.00	0.00	2.11	0.70	3.06
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.00	0.58	1.62	0.73	0.02
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.01	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.01	0.00	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.02	1.02	0.00	0.35	0.00
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.00	0.00	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.34	4.11	0.00	1.48	0.00
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.09	1.88	5.49	2.49	0.00
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.00	18.61	0.09	6.23	1.43
Total PCBs				21.600	189.000	0.45	26.32	10.08	12.28	4.51
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	0.00	0.00	0.00

MacDill AFB Beach										
	Formula	MW	MDL	TEL	PEL	16DH06-1 (Center)	16DH06-2 (Left)	16DH06-3 (Right)	16DH06 (Mean)	16DH06-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	0.00	3.27	2.61	1.96	0.00
Fluorene	C13H10	166.22	4.670	21.200	144.000	1.20	3.95	0.00	1.72	0.00
Naphthalene	C10H8	128.17	7.890	34.600	391.000	0.00	1.17	0.00	0.39	0.00
Phenanthrene	C14H10	178.23	5.070	86.700	544.000	4.42	6.50	8.21	6.38	4.79
Total LMW PAHs				312.000	1440.000	5.62	14.89	10.82	10.44	4.79
Benzo(a)anthracene	C18H12	228.29	5.030	74.800	693.000	7.13	11.37	10.78	9.76	0.00
Benzo(a)pyrene	C20H12	252.31	3.160	88.800	763.000	23.86	26.83	29.54	26.74	21.39
Chrysene	C18H12	228.29	5.010	108.000	846.000	13.21	17.88	25.72	18.94	7.42
Dibenzo(a,h)anthracene	C22H14	278.35	5.770	6.220	135.000	0.00	17.09	8.80	8.63	0.00
Fluoranthene	C16H10	202.25	2.520	113.000	1494.000	14.45	15.86	33.77	21.36	7.92
Pyrene	C16H10	202.25	5.630	153.000	1398.000	15.29	18.64	26.91	20.28	9.24
Total HMW PAHs				655.000	6680.000	73.94	107.67	135.52	105.71	45.97
Total PAHs				1680.000	16800.000	79.56	122.56	146.34	116.15	50.76
PEL Quotient						**0.04**	**0.03**	**0.10**	**0.06**	**0.05**
Benzo(b)fluoranthene	C20H12	252.31	4.400			24.00	28.58	32.90	28.49	21.53
Benzo(g,h,i)perylene	C22H12	276.33	5.580			18.19	23.23	26.59	22.67	0.00
Benzo(k)fluoranthene	C20H12	252.31	7.230			19.45	23.43	27.53	23.47	16.31
Coronene	C24H12	300.35	8.810			0.00	20.02	0.00	6.67	0.00
Indeno(1,2,3-c,d)pyrene	C22H12	276.33	6.000			11.24	16.85	5.84	11.31	0.00
Retene	C18H18	234.34	4.170			1.44	6.78	7.72	5.31	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						36.3/29.0	8.2/24.7	18.4/37.4	20.97/30.37	6.9/2.4
% Total Carbon (Solids)						2.00	0.90	1.70	1.53	0.60
% Total Inorganic Carbon (Solids)						0.20	0.10	0.30	0.20	0.10
% Total Organic Carbon (Solids)						1.8	0.8	1.4	1.33	0.6

Yellow >TEL; Red>PEL

Venetian Isles

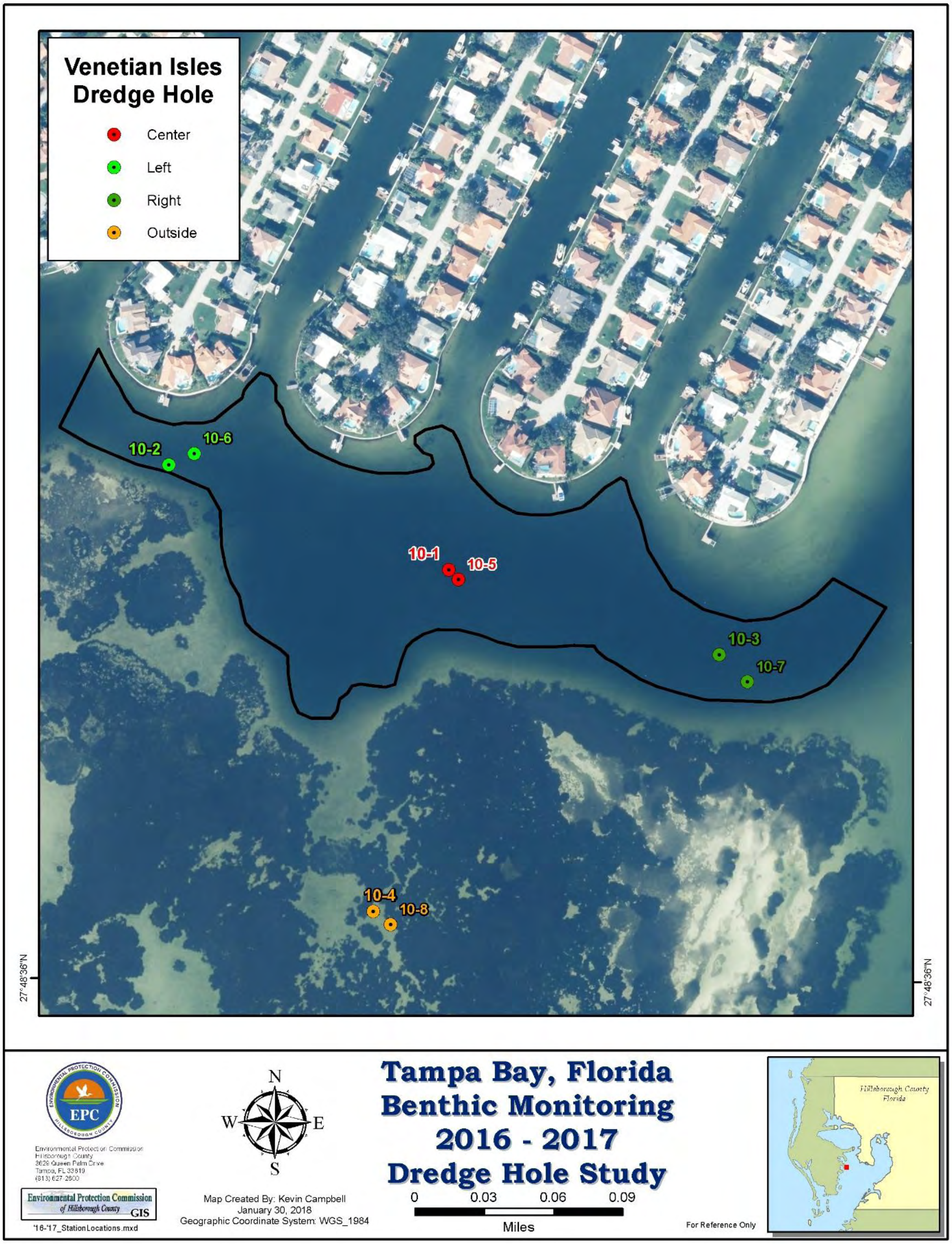

Figure 7. Fall 2016 and spring 2017 Venetian Isles dredged hole and reference sample locations.

The Venetian Isles dredged hole (Figure 7) bottom hydrographic measurements for the fall sampling are presented in Table 43 and for the spring sampling in Table 44. The mean fall sample depth within the dredged hole was 3.5 meters and ranged from 2.2 to 4.5 meters while the fall reference site was 0.9 meters (Table 43). The mean dredged hole sample depth in the spring was 3.6 meters and ranged from 2.9 to 3.9 meters and the spring reference site was 0.5 meters (Table 44). The bottom temperature and salinity were comparable between the dredged hole and reference sites within each season. The bottom pH was lower in the dredged hole than at the reference site during both seasons. The bottom dissolved oxygen and D.O. saturation was above state water quality standards during both seasons within the dredged hole and at the reference sites (Tables 43 and 44).

Table 43. Fall Venetian Isles dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH10-1	16DH10-2	16DH10-3	DH	16DH10-4
	Center	Left	Right	Mean (Total)	Ref
Depth (m)	3.9	2.2	4.5	3.5	0.9
Temperature (°C)	30.14	30.10	30.20	30.15	30.32
Salinity (psu)	23.13	22.99	23.13	23.08	23.07
pH	7.99	7.89	7.98	7.95	8.06
Dissolved Oxygen (mg/l)	4.93	4.24	4.81	4.66	5.80
D.O. Saturation (%)	74.8	64.1	73.0	70.6	88.3

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 44. Spring Venetian Isles dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH10-5	17DH10-6	17DH10-7	DH	17DH10-8
	Center	Left	Right	Mean (Total)	Ref
Depth (m)	3.9	2.9	3.9	3.6	0.5
Temperature (°C)	20.56	20.96	20.68	20.73	21.11
Salinity (psu)	28.75	28.55	28.75	28.68	28.56
pH	7.92	7.91	7.94	7.92	8.04
Dissolved Oxygen (mg/l)	6.63	6.65	6.81	6.70	8.26
D.O. Saturation (%)	87.6	88.4	90.2	88.7	110.1

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

The fall dredged hole benthic community had a total of 161 taxa with a mean of 84.33 taxa/sample compared to 27 taxa identified at the fall reference site (Table 45). The fall dredged hole had a higher abundance, diversity and a higher TBBI score relative to the fall reference site. The fall dredged hole benthic community was rated as “Healthy” with a TBBI score of 91.88 while the fall reference site had a slightly lower TBBI score of 86.05, just below the “Healthy” threshold (Table 45).

Table 45. Fall Venetian Isles dredged hole benthic community metrics.

	Fall 2016				
	16DH10-1	16DH10-2	16DH10-3	DH	16DH10-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	94	75	84	84.33 (161)	27
Abundance (#/m^2)	46450	84877	21800	51042.33	4650
Shannon Diversity	2.84	1.85	3.27	2.65	2.28
TBBI	91.94	93.76	89.95	91.88	86.05
TBBI Category	Healthy	Healthy	Healthy	Healthy	Intermediate

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring dredged hole species richness was lower than in the fall with a total of 115 taxa and a mean of 67.67 taxa/sample (Table 46). The spring reference site had a higher species richness and abundance than in the fall with a total of 46 taxa and 23,175 individuals/m^2 (Table 46). Both the overall mean dredged hole and reference site had TBBI scores in the "Healthy" range, although the center dredged hole sample was considerably lower (80.6) in the "Intermediate" category (Table 46).

Table 46. Spring Venetian Isles dredged hole benthic community metrics.

	Spring 2017				
	17DH10-5	17DH10-6	17DH10-7	DH	17DH10-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	83	71	49	67.67 (115)	46
Abundance (#/m^2)	15776	15351	25301	18809.33	23175
Shannon Diversity	3.71	3.04	2.53	3.09	1.95
TBBI	80.6	95.02	92.6	89.41	91.89
TBBI Category	Intermediate	Healthy	Healthy	Healthy	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall dredged hole benthic community was dominated by the tanaid crustacean *Mesokalliapseudes macsweenyi*, the amphipod *Ampelisca abdita* and the sabellid polychaete *Fabricinuda trilobata* which comprised over 54.22% of the cumulative abundance (Table 47). The fall reference site was dominated by the amphipod *Acanthohaustorius uncinus*, the cephalochordate *Branchiostoma floridae*, and the nereid polychaete *Laeonereis culveri* which accounted for 62.37% of the cumulative abundance (Table 47).

Table 47. Fall Venetian Isles ranked taxa abundance (top 10).

Venetian Isles Dredged Hole (Fall)				Venetian Isles Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Mesokalliapseudes macsweenyi	18791.67	36.82%	36.82%	*Acanthohaustorius uncinus*	1550	33.33%	33.33%
Ampelisca abdita	4983.33	9.76%	46.58%	*Branchiostoma floridae*	725	15.59%	48.92%
Fabricinuda trilobata	3900.00	7.64%	54.22%	*Laeonereis culveri*	625	13.44%	62.37%
Caecum pulchellum	2441.67	4.78%	59.00%	*Aricidea philbinae*	575	12.37%	74.73%
Ampelisca holmesi	2208.33	4.33%	63.33%	*Paraonis fulgens*	150	3.23%	77.96%
Prionospio perkinsi	1766.67	3.46%	66.79%	*Grania monospermatheca*	100	2.15%	80.11%
Mediomastus sp.	1291.67	2.53%	69.32%	*Angulus nr. tampaensis*	75	1.61%	81.72%
Kirkegaardia sp.	1125.00	2.20%	71.53%	*Mesokalliapseudes macsweenyi*	75	1.61%	83.33%
Rudilemboides naglei	1083.33	2.12%	73.65%	*Neanthes acuminata*	75	1.61%	84.95%
Mysella planulata	1000.00	1.96%	75.61%	*Scolelepis (Scolelepis) texana*	75	1.61%	86.56%

The spring dredged hole benthic community was largely dominated by amphipod species and the seven top ranked taxa made up 53.52% of the cumulative abundance. The top ranked species was *Rudilemboides naglei* which accounted for 17.68% of the abundance (Table 48). The spring reference site was largely dominated by the tanaid *Mesokalliapseudes macsweenyi* which comprised 43.8% of the abundance (Table 48).

Table 48. Spring Venetian Isles ranked taxa abundance (top 10).

Venetian Isles Dredged Hole (Spring)				Venetian Isles Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Rudilemboides naglei	3325.00	17.68%	17.68%	*Mesokalliapseudes macsweenyi*	10150	43.80%	43.80%
Ampelisca abdita	1616.67	8.60%	26.27%	*Clymenella mucosa*	4975	21.47%	65.26%
Metharpinia floridana	1400.00	7.44%	33.72%	*Acanthohaustorius uncinus*	2925	12.62%	77.89%
Ampelisca holmesi	991.67	5.27%	38.99%	*Travisia hobsonae*	1100	4.75%	82.63%
Nebalia sp.	933.33	4.96%	43.95%	*Rudilemboides naglei*	725	3.13%	85.76%
Ampelisca sp. C of LeCroy, 2002	925.00	4.92%	48.87%	*Olivella pusilla*	350	1.51%	87.27%
Listriella barnardi	875.00	4.65%	53.52%	*Listriella barnardi*	275	1.19%	88.46%
Eudevenopus honduranus	741.67	3.94%	57.46%	*Mysella planulata*	275	1.19%	89.64%
Prionospio perkinsi	716.67	3.81%	61.27%	*Metharpinia floridana*	250	1.08%	90.72%
Travisia hobsonae	675.00	3.59%	64.86%	*Granulina hadria*	225	0.97%	91.69%

The dredged hole sediments had a relatively low mean silt+clay content of 3.6% in the fall and 4.4% in the spring and a TOC content of 1.23%. The reference site sediments had a lower silt+clay content of 1.2% and TOC of 0.1% (Table 49).

Sediment contaminant concentrations were low in both the dredged hole and reference site sediments with no observed sediment quality exceedances (Table 49). The overall PEL Quotient for the dredged hole sediments was low (0.02) as was the PEL Quotient for the reference site sediments (0.01).

Table 49. Venetian Isles sediment contaminants and composition.

Venetian Isles										
	Formula	MW	MDL	TEL	PEL	16DH10-1 (Center)	16DH10-2 (Left)	16DH10-3 (Right)	16DH10 (Mean)	16DH10-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			2722.59	1166.12	1926.90	1938.54	474.11
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	2.25	1.16	1.14	3.43
Cadmium	Cd	112.41	2.280	0.676	4.210	0.22	0.00	0.12	0.11	0.19
Chromium	Cr	52.00	1.210	52.300	160.000	9.55	5.46	10.45	8.49	3.63
Copper	Cu	63.55	0.450	18.700	108.000	1.15	0.00	0.65	0.60	0.00
Iron	Fe	55.85	69.200			1178.42	520.54	814.98	837.98	178.45
Lead	Pb	207.20	5.220	30.200	112.000	21.02	20.49	21.04	20.85	20.98
Manganese	Mn	54.94	4.490			6.05	5.27	4.36	5.23	2.05
Nickel	Ni	58.69	0.710	15.900	42.800	4.39	3.55	5.15	4.36	3.29
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			1.26	1.05	0.82	1.04	1.53
Zinc	Zn	65.38	1.890	124.000	271.000	5.78	1.91	4.13	3.94	0.67
Pesticides (μg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.01	0.02	0.00	0.01	0.00
β BHC	$C_6H_6Cl_6$	290.83	0.730			0.01	0.04	2.28	0.78	0.25
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.61	0.03	0.06	0.23	0.02
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.00	0.09	0.02	0.04	0.00
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.01	0.00	0.01	0.01	0.00
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.02	0.00	0.00	0.01	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.03	0.00	0.01	0.01	0.00
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.03	0.01	0.02	0.02	0.00
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.00	0.01	0.01	0.01	0.00
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.00	0.00	0.05	0.02	0.00
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.00	0.01	0.00	0.00	0.02
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.01	0.03	0.06	0.03	0.05
Total DDT				3.890	51.700	0.01	0.04	0.11	0.05	0.07

Venetian Isles										
	Formula	MW	MDL	TEL	PEL	16DH10-1 (Center)	16DH10-2 (Left)	16DH10-3 (Right)	16DH10 (Mean)	16DH10-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.01	0.00	0.00	0.00
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.00	0.00	0.00	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.00	0.03	0.00	0.01	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.00	0.00	0.00	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	0.00	0.00	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.00	0.00	0.00	0.00	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.29	0.01	0.00	0.10	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.00	0.04	0.00	0.01	0.15
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.18	0.03	0.48	0.23	0.06
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.00	0.00	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.00	0.01	0.00	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.00	0.01	0.00	0.00	0.00
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.00	0.00	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.00	0.00	0.00	0.00
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			2.15	0.00	0.00	0.72	0.89
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.01	0.00	0.00	0.00	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.00	0.00	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.00	0.00	0.16	0.05	0.21
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.01	0.00	0.04
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			1.04	1.40	0.28	0.91	0.00
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			1.57	0.00	0.05	0.54	1.77
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.06	0.06	0.17	0.10	0.03
Total PCBs				21.600	189.000	4.83	1.47	0.68	2.33	2.94
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	0.00	0.00	0.00

Venetian Isles										
	Formula	MW	MDL	TEL	PEL	16DH10-1 (Center)	16DH10-2 (Left)	16DH10-3 (Right)	16DH10 (Mean)	16DH10-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	0.00	0.00	0.00	0.00	0.00
Fluorene	$C_{13}H_{10}$	166.22	4.670	21.200	144.000	0.00	0.00	0.00	0.00	0.00
Naphthalene	$C_{10}H_8$	128.17	7.890	34.600	391.000	0.00	0.00	0.00	0.00	0.00
Phenanthrene	$C_{14}H_{10}$	178.23	5.070	86.700	544.000	0.00	0.00	2.91	0.97	0.00
Total LMW PAHs				312.000	1440.000	0.00	0.00	2.91	0.97	0.00
Benzo(a)anthracene	$C_{18}H_{12}$	228.29	5.030	74.800	693.000	2.43	2.72	0.00	1.72	0.00
Benzo(a)pyrene	$C_{20}H_{12}$	252.31	3.160	88.800	763.000	12.71	0.00	21.44	11.38	0.00
Chrysene	$C_{18}H_{12}$	228.29	5.010	108.000	846.000	8.23	13.06	7.81	9.70	0.00
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	278.35	5.770	6.220	135.000	0.00	0.00	0.00	0.00	0.00
Fluoranthene	$C_{16}H_{10}$	202.25	2.520	113.000	1494.000	4.85	3.84	8.58	5.76	0.00
Pyrene	$C_{16}H_{10}$	202.25	5.630	153.000	1398.000	13.48	5.62	9.01	9.37	0.00
Total HMW PAHs				655.000	6680.000	41.70	25.24	46.84	37.93	0.00
Total PAHs				1680.000	16800.000	41.70	25.24	49.75	38.90	0.00
PEL Quotient						**0.02**	**0.02**	**0.02**	**0.02**	**0.01**
Benzo(b)fluoranthene	$C_{20}H_{12}$	252.31	4.400			17.80	0.00	21.92	13.24	0.00
Benzo(g,h,i)perylene	$C_{22}H_{12}$	276.33	5.580			15.81	12.57	15.90	14.76	2.90
Benzo(k)fluoranthene	$C_{20}H_{12}$	252.31	7.230			10.24	0.00	17.06	9.10	0.00
Coronene	$C_{24}H_{12}$	300.35	8.810			0.00	0.00	0.00	0.00	0.00
Indeno(1,2,3-c,d)pyrene	$C_{22}H_{12}$	276.33	6.000			15.08	20.99	9.30	15.12	0.00
Retene	$C_{18}H_{18}$	234.34	4.170			0.00	0.00	3.86	1.29	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						5.0/6.1	2.1/2.9	3.7/4.2	3.6/4.4	1.4/2.0
% Total Carbon (Solids)						0.50	3.30	0.40	1.40	0.10
% Total Inorganic Carbon (Solids)						0.10	0.40	0.10	0.20	0.10
% Total Organic Carbon (Solids)						0.5	2.9	0.3	1.23	0.1

Yellow >TEL; Red>PEL

Ft. De Soto (St. Antoine Key)

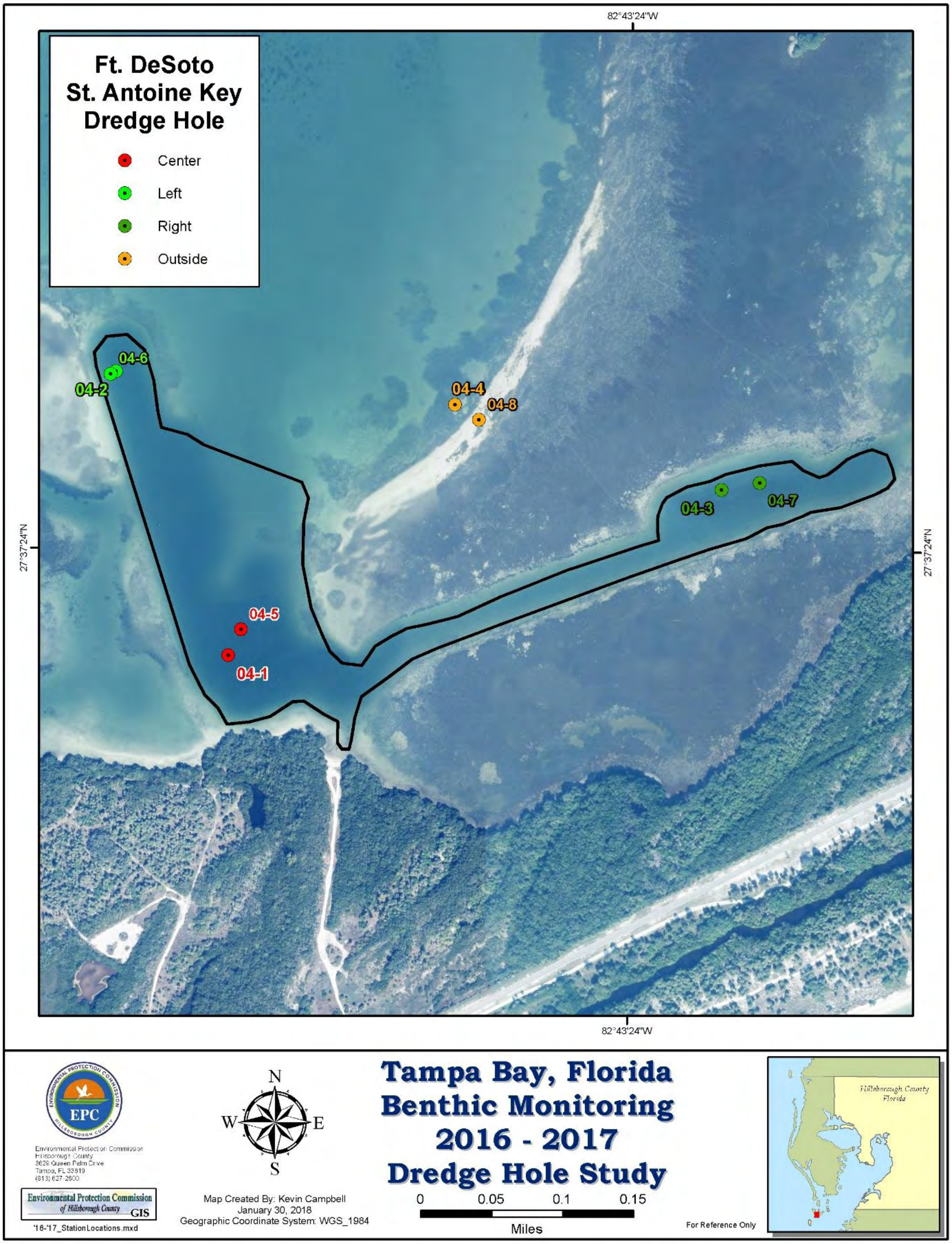

Figure 8. Fall 2016 and spring 2017 Ft. De Soto (St. Antoine Key) dredged hole and reference sample locations.

The Ft. De Soto dredged hole (Figure 8) bottom hydrographic measurements are summarized in Table 50 for the fall sampling and Table 51 for the spring sampling. The mean fall sample depth within the dredged hole was 3.0 meters and the spring mean depth was 3.3 meters. The reference site depths were 0.7 and 0.3 meters in the fall and spring respectively. The bottom temperature, salinity and pH were comparable between the dredged hole and reference site within each season. The bottom dissolved oxygen at the dredged hole sites were below the state standard of 4 mg/l during the fall, but met the standard for D.O. saturation (>42%) except at the center of the dredged hole which was slightly below (Table 50). Bottom dissolved oxygen concentrations and D.O. saturations were above the state water quality standards at all sites in the spring (Table 51).

Table 50. Fall Ft. De Soto dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH04-1	16DH04-2	16DH04-3	DH	16DH04-4
	Center	Left	Right	Mean	Ref
Depth (m)	3.4	3.0	2.5	3.0	0.7
Temperature (°C)	31.50	31.49	31.63	31.54	32.55
Salinity (psu)	31.18	31.11	31.19	31.16	31.23
pH	8.13	8.21	8.25	8.20	8.41
Dissolved Oxygen (mg/l)	2.58	2.79	3.17	2.85	7.11
D.O. Saturation (%)	41.9	45.3	51.6	46.3	117.6

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 51. Spring Ft. De Soto dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH04-5	17DH04-6	17DH04-7	DH	17DH04-8
	Center	Left	Right	Mean	Ref
Depth (m)	3.4	3.4	3.2	3.3	0.3
Temperature (°C)	24.13	24.13	24.09	24.12	24.67
Salinity (psu)	33.78	33.63	33.85	33.75	33.59
pH	8.10	8.14	8.09	8.11	8.17
Dissolved Oxygen (mg/l)	5.20	5.60	4.07	4.96	6.33
D.O. Saturation (%)	75.7	81.6	59.1	72.1	93.0

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

A total of 37 taxa were identified within the dredged hole during the fall sampling period with a mean of 16.67 taxa/sample. The center sample however was depauperate and the overall mean TBBI score was in the "Degraded" range (Table 52). The fall reference sample had 36 taxa and higher abundance, diversity and a high TBBI score indicating a "Healthy" benthic community (Table 52).

Table 52. Fall Ft. De Soto dredged hole benthic community metrics.

	Fall 2016				
	16DH04-1	16DH04-2	16DH04-3	DH	16DH04-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	0	25	25	16.67 (37)	36
Abundance (#/m^2)	0	2325	2575	1633.33	3025
Shannon Diversity	0	2.64	2.8	1.81	3.04
TBBI	0	75.54	66.15	47.23	89.15
TBBI Category	Empty	Intermediate	Degraded	Degraded	Healthy

TBBI: Green = “Healthy”; Yellow = “Intermediate”; Red = “Degraded”; Dark Red = “Empty”

The spring dredged hole benthic community had a total 96 taxa with a mean of 45.67 taxa/sample and the spring reference sample had 45 taxa (Table 53). Abundances were lower in the dredged hole relative to the reference site, but the Shannon diversity index was higher. The overall mean TBBI for the dredged hole was in the “Degraded” range however two of the three dredged hole samples had “Intermediate” TBBI scores (Table 53). The spring reference site had a higher TBBI score that indicated a “Healthy” benthic community (Table 53).

Table 53. Spring Ft. De Soto dredged hole benthic community metrics.

	Spring 2017				
	17DH04-5	17DH04-6	17DH04-7	DH	17DH04-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	15	69	53	45.67 (96)	45
Abundance (#/m^2)	1875	6853	6126	4951.33	8725
Shannon Diversity	2.26	3.63	3.39	3.09	2.6
TBBI	47.42	77.86	79.65	68.31	90.2
TBBI Category	Degraded	Intermediate	Intermediate	Degraded	Healthy

TBBI: Green = “Healthy”; Yellow = “Intermediate”; Red = “Degraded”; Dark Red = “Empty”

The fall dredged hole community was dominated by annelids including the spionid polychaete *Paraprionospio pinnata*, unidentified oligochaetes (Tubificinae) and the polychaete *Aricidea suecica*. Also among the top five dominant taxa werethe amphipods *Listriella barnardi* and *Ampelisca abdita* which cumulatively accounted for 52.04% of the total abundance (Table 54). The fall reference site was largely dominated by annelids and mollusks including unidentified oligochaetes (Tubificinae), the bivalve *Parastarte triquetra*, the gastropod *Jaspidella blanesi* and the polychaete *Paradoneis cf. lyra* which along with the cephalochordate *Branchiostoma floridae* comprised 51.24% of the cumulative abundance (Table 54).

Table 54. Fall Ft. De Soto ranked taxa abundance (top 10).

Ft. De Soto Dredged Hole (Fall)				Ft. De Soto Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Paraprionospio pinnata	400.00	24.49%	24.49%	Tubificinae	525	17.36%	17.36%
Tubificinae	141.67	8.67%	33.16%	*Parastarte triquetra*	375	12.40%	29.75%
Aricidea suecica	116.67	7.14%	40.31%	*Jaspidella blanesi*	300	9.92%	39.67%
Listriella barnardi	100.00	6.12%	46.43%	*Paradoneis cf. lyra*	200	6.61%	46.28%
Ampelisca abdita	91.67	5.61%	52.04%	*Branchiostoma floridae*	150	4.96%	51.24%
Tubificoides brownae	91.67	5.61%	57.65%	*Clymenella mucosa*	125	4.13%	55.37%
Prionospio heterobranchia	83.33	5.10%	62.76%	*Neanthes acuminata*	125	4.13%	59.50%
Tubificoides wasselli	75.00	4.59%	67.35%	*Phoronis sp.*	125	4.13%	63.64%
Phoronis sp.	58.33	3.57%	70.92%	*Branchiomma cf. bairdi*	100	3.31%	66.94%
Neanthes acuminata	50.00	3.06%	73.98%	*Palaeonemertea sp. A of EPC*	100	3.31%	70.25%

The top ten ranked macrofauna taxa in the spring dredged hole accounted for only 44.10% of the total benthic abundance while the top ten taxa comprised 80.52% of the abundance at the reference site (Table 55). The top five taxa from the dredged hole included juvenile bivalve clams in the subfamily Tellininae, the caprellid amphipod *Deutella incerta*, the tellin clam *Angulus cf. versicolor*, the spionid polychaete *Paraprionospio pinnata* and the holothuroidean echinoderm (sea cucumber) *Leptosynapta cf. tenuis*. Cumulatively, these five taxa made up 26.26% of the benthic abundance in the dredged hole (Table 55). Annelids dominated at the spring reference site and the top ranked taxa include the polychaetes *Clymenella mucosa*, *Mooreonuphis pallidula*, and unidentified oligochaetes (Tubificinae) which cumulatively accounted for 56.73% of the benthic abundance (Table 55).

Table 55. Spring Ft. De Soto ranked taxa abundance (top 10).

Ft. De Soto Dredged Hole (Spring)				Ft. De Soto Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Tellininae	341.67	6.90%	6.90%	*Clymenella mucosa*	3050	34.96%	34.96%
Deutella incerta	291.67	5.89%	12.79%	*Mooreonuphis pallidula*	1300	14.90%	49.86%
Angulus cf. versicolor	233.33	4.71%	17.50%	Tubificinae	600	6.88%	56.73%
Paraprionospio pinnata	233.33	4.71%	22.22%	*Kinbergonuphis simoni*	500	5.73%	62.46%
Leptosynapta cf. tenuis	200.00	4.04%	26.26%	*Gammarus cf. tigrinus*	350	4.01%	66.48%
Streblosoma hartmanae	191.67	3.87%	30.13%	*Scoletoma tenuis*	300	3.44%	69.91%
Tubificinae	191.67	3.87%	34.00%	*Neanthes acuminata*	275	3.15%	73.07%
Capitella capitata complex	183.33	3.70%	37.70%	*Brania nitidula*	250	2.87%	75.93%
Cymadusa compta	158.33	3.20%	40.90%	*Paradoneis cf. lyra*	250	2.87%	78.80%
Listriella barnardi	158.33	3.20%	44.10%	*Amakusanthura magnifica*	150	1.72%	80.52%

The dredged hole sediments had a mean silt+clay content of 7.37% in the fall and 13.23% in the spring and a TOC content of 0.37% while the reference sites had a silt+clay content of 2.40% in the fall and 2.0% in the spring and a TOC content of 0.30%. None of the measured sediment contaminants were above the state sediment quality guidelines in either the dredged hole or reference sediments (Table 56) and both the dredged hole and reference sediments had a low PEL Quotient of 0.01.

Table 56. Ft. De Soto sediment contaminants and composition.

Ft. De Soto (St. Antoine Key) Dredged Hole										
	Formula	MW	MDL	TEL	PEL	16DH04-1 (Center)	16DH04-2 (Left)	16DH04-3 (Right)	16DH04 (Mean)	16DH04-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			1566.95	4223.62	6217.79	4002.79	1716.85
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	2.53	0.00	0.00	0.84	3.50
Cadmium	Cd	112.41	2.280	0.676	4.210	0.17	0.15	0.16	0.16	0.21
Chromium	Cr	52.00	1.210	52.300	160.000	4.53	8.91	13.84	9.09	4.74
Copper	Cu	63.55	0.450	18.700	108.000	0.00	0.41	1.62	0.68	0.00
Iron	Fe	55.85	69.200			350.58	1152.76	2059.22	1187.52	361.73
Lead	Pb	207.20	5.220	30.200	112.000	20.16	21.13	21.23	20.84	19.34
Manganese	Mn	54.94	4.490			4.59	7.72	15.39	9.23	4.73
Nickel	Ni	58.69	0.710	15.900	42.800	3.02	3.57	4.21	3.60	3.04
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			2.06	1.32	0.60	1.33	1.13
Zinc	Zn	65.38	1.890	124.000	271.000	1.29	3.69	5.88	3.62	1.05
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.00	0.00	0.00	0.00	0.20
β BHC	$C_6H_6Cl_6$	290.83	0.730			0.00	0.17	0.06	0.08	0.00
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.46	0.02	0.03	0.17	0.11
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.00	0.01	0.03	0.01	0.01
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.00	0.00	0.01	0.00	0.00
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.00	0.00	0.00	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.00	0.00	0.01	0.00	0.00
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.01	0.00	0.00	0.00	0.00
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.00	0.00	0.00	0.00	0.00
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.00	0.00	0.00	0.00	0.00
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.00	0.00	0.00	0.00	0.00
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.00	0.08	0.14	0.07	0.01
Total DDT				3.890	51.700	0.00	0.08	0.14	0.07	0.01

Ft. De Soto (St. Antoine Key) Dredged Hole										
	Formula	MW	MDL	TEL	PEL	16DH04-1 (Center)	16DH04-2 (Left)	16DH04-3 (Right)	16DH04 (Mean)	16DH04-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.00	0.00	0.00	0.00
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.00	0.00	0.00	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.00	0.00	0.00	0.00	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.00	0.00	0.00	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	0.00	0.00	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.00	0.00	0.00	0.00	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.18	0.00	0.00	0.06	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.06	0.00	0.00	0.02	0.08
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.07	0.00	0.00	0.02	0.00
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.00	0.00	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.00	0.00	0.00	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.00	0.00	0.00	0.00	0.00
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.00	0.00	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.00	0.00	0.00	0.00
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			1.74	0.00	0.50	0.75	1.84
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.00	0.00	0.05	0.02	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.00	0.00	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.00	0.00	0.00	0.00	0.30
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.00	0.00	0.02
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.00	0.03	0.00	0.01	1.41
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			2.42	1.52	1.02	1.65	0.47
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.00	0.33	0.38	0.24	0.75
Total PCBs				21.600	189.000	4.16	1.88	1.95	2.66	4.79
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	0.00	0.00	0.00

Ft. De Soto (St. Antoine Key) Dredged Hole										
	Formula	MW	MDL	TEL	PEL	16DH04-1 (Center)	16DH04-2 (Left)	16DH04-3 (Right)	16DH04 (Mean)	16DH04-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	0.00	0.00	0.00	0.00	0.00
Fluorene	C13H10	166.22	4.670	21.200	144.000	0.00	0.00	0.00	0.00	0.00
Naphthalene	C10H8	128.17	7.890	34.600	391.000	0.00	0.00	0.00	0.00	0.00
Phenanthrene	C14H10	178.23	5.070	86.700	544.000	0.00	0.00	0.00	0.00	0.00
Total LMW PAHs				312.000	1440.000	0.00	0.00	0.00	0.00	0.00
Benzo(a)anthracene	C18H12	228.29	5.030	74.800	693.000	0.00	0.00	0.00	0.00	0.00
Benzo(a)pyrene	C20H12	252.31	3.160	88.800	763.000	0.00	0.00	0.00	0.00	0.00
Chrysene	C18H12	228.29	5.010	108.000	846.000	0.00	0.00	0.00	0.00	0.00
Dibenzo(a,h)anthracene	C22H14	278.35	5.770	6.220	135.000	0.00	0.00	0.00	0.00	0.00
Fluoranthene	C16H10	202.25	2.520	113.000	1494.000	0.00	0.00	0.00	0.00	0.00
Pyrene	C16H10	202.25	5.630	153.000	1398.000	2.76	4.83	6.78	4.79	3.25
Total HMW PAHs				655.000	6680.000	2.76	4.83	6.78	4.79	3.25
Total PAHs				1680.000	16800.000	2.76	4.83	6.78	4.79	3.25
PEL Quotient						**0.01**	**0.01**	**0.02**	**0.01**	**0.01**
Benzo(b)fluoranthene	C20H12	252.31	4.400			0.00	0.00	0.00	0.00	0.00
Benzo(g,h,i)perylene	C22H12	276.33	5.580			2.24	4.32	5.72	4.09	2.80
Benzo(k)fluoranthene	C20H12	252.31	7.230			0.00	0.00	0.00	0.00	0.00
Coronene	C24H12	300.35	8.810			0.00	0.00	0.00	0.00	0.00
Indeno(1,2,3-c,d)pyrene	C22H12	276.33	6.000			0.00	0.00	0.00	0.00	0.00
Retene	C18H18	234.34	4.170			0.00	0.00	0.00	0.00	0.00
Sediment composition (%)										
% Silt+Clay (%)						2.5/27.6	7.7/2.9	11.9/9.2	7.37/13.23	2.4/2.0
% Total Carbon (Solids)						0.40	1.10	2.10	1.20	0.50
% Total Inorganic Carbon (Solids)						0.30	0.50	1.70	0.83	0.10
% Total Organic Carbon (Solids)						0.1	0.7	0.3	0.37	0.3

Yellow >TEL; Red>PEL

Skyway Causeway North

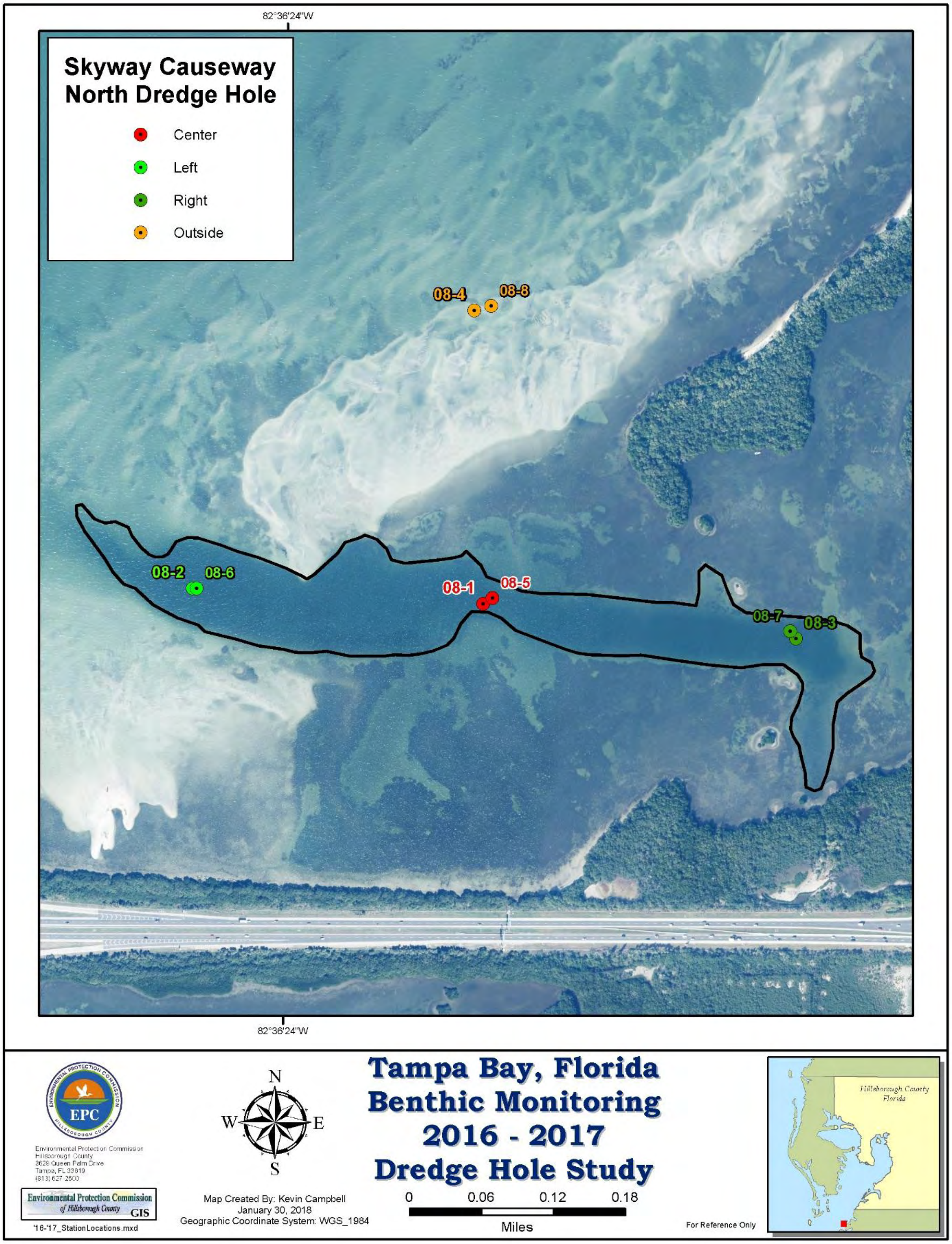

Figure 9. Fall 2016 and spring 2017 Skyway Causeway North dredged hole and reference sample locations.

The Skyway Causeway North dredged hole (Figure 9) bottom hydrographic field measurements are summarized in Table 57 for the fall and Table 58 for the spring sampling events. The mean depth within the dredged hole was 3.5 meters in the fall and 3.0 meters in the spring and the depth at the reference sites were 0.4 and 0.6 meters in the fall and spring respectively. Bottom temperature, salinity and pH were generally comparable between the dredged hole and reference site within each season although the fall bottom temperatures at the dredge hole sites were lower than at the fall reference site (Table 57). The fall bottom dissolved oxygen and D.O. saturation within the dredged hole was lower than at the reference site but two of the three dredged hole samples and the overall dredge hole means were above the state water quality standards (Table 57). The right dredged hole sample however had a low dissolved oxygen concentration and a D.O. saturation of only 38.3% (Table 57). This corresponded to the deepest area of the dredged hole at 4.0 meters. The spring bottom dissolved oxygen and D.O. saturation measurements were above the state water quality standards at all of the dredged hole and the reference sites (Table 58).

Table 57. Fall Skyway Causeway North dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH08-1	16DH08-2	16DH08-3	DH	16DH08-4
	Center	Left	Right	Mean (Total)	Ref
Depth (m)	2.9	3.5	4.0	3.5	0.4
Temperature (°C)	31.33	32.34	30.97	31.55	33.20
Salinity (psu)	28.83	29.24	28.75	28.94	28.83
pH	7.99	8.00	7.88	7.96	8.16
Dissolved Oxygen (mg/l)	4.44	5.82	2.41	4.22	7.84
D.O. Saturation (%)	70.9	94.8	38.3	68.0	129.2

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 58. Spring Skyway Causeway North dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH08-5	17DH08-6	17DH08-7	DH	17DH08-8
	Center	Left	Right	Mean (Total)	Ref
Depth (m)	2.5	3.5	3.0	3.0	0.6
Temperature (°C)	23.04	22.74	23.14	22.97	23.56
Salinity (psu)	31.97	32.10	32.12	32.06	31.85
pH	8.12	8.07	8.11	8.10	8.19
Dissolved Oxygen (mg/l)	5.87	6.30	5.50	5.89	6.79
D.O. Saturation (%)	82.7	88.4	77.7	82.9	96.6

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

A total of 100 taxa were identified within the dredged hole during the fall sampling with a mean of 58.33 taxa/sample while 47 taxa were present at the reference site (Table 59). The dredged hole samples had lower abundances but higher diversities than the reference site. The TBBI scores for both the dredged hole and the reference site indicated “Healthy” benthic communities overall, although the right dredged hole sample had a lower TBBI score in the “Intermediate” category (Table 59) and may reflect the lower dissolved oxygen recorded at that site.

Table 59. Fall Skyway Causeway North dredged hole benthic community metrics.

	Fall 2016				
	16DH08-1	16DH08-2	16DH08-3	DH	16DH08-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	58	72	45	58.33 (100)	47
Abundance (#/m^2)	15475	12202	17525	15067.33	29050
Shannon Diversity	2.77	3.27	1.99	2.68	1.97
TBBI	91.78	87.45	83.14	87.46	91.7
TBBI Category	Healthy	Healthy	Intermediate	Healthy	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring dredged hole samples had a total of 113 taxa with a mean of 66.67 taxa/sample compared to 36 taxa identified at the reference site (Table 60). Abundances were lower within the dredged hole but Shannon diversity was higher than at the reference site. Both the dredged hole and the reference site had high TBBI scores indicating "Healthy" benthic communities (Table 60).

Table 60. Spring Skyway Causeway North dredged hole benthic community metrics.

	Spring 2017				
	17DH08-5	17DH08-6	17DH08-7	DH	17DH08-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	62	74	64	66.67 (113)	36
Abundance (#/m^2)	16275	17725	16900	16966.67	29401
Shannon Diversity	3.03	3.33	3.07	3.14	1.33
TBBI	94.21	85.03	87.99	89.08	89.78
TBBI Category	Healthy	Intermediate	Healthy	Healthy	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall dredged hole benthic community was dominated by the amphipod *Ampelisca abdita*, the sipunculid *Phascolion caupo* and the bivalve *Mysella planulata* which cumulatively accounted for 51.38% of the abundance (Table 61). The reference site was dominated by the gastropod *Caecum imbricatum* which comprised 51.72% of the total benthic abundance (Table 61). Other top ranked taxa at the spring reference site included the polychaete *Clymenella mucosa* and the cephalochordate *Branchiostoma floridae* which together with *C. imbracatum* accounted for 74.18% of the cumulative abundance (Table 61).

The top ten ranked taxa comprised 54.91% of the cumulative abundance in the spring dredged hole samples (Table 62). The three most abundant taxa included the congeneric amphipods *Ampelisca holmesi* and *A. abdita* and the polychaete *Travisia hobsonae* which together made up 25.98% of the spring dredged hole benthic abundance (Table 62). The gastropod *Caecum imbricatum* was dominant at the spring reference site accounting for 68.79% of the benthic abundance at that site and having a total abundance of 20,225 individuals/m^2 (Table 62). Other top ranked taxa at the reference site included the amphipod *Metharpinia floridana* and the polychaete *Clymenella mucosa*.

Table 61. Fall Skyway Causeway North ranked taxa abundance (top 10).

Skyway Causeway North Dredged Hole (Fall)				Skyway Causeway North Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Ampelisca abdita	5450.00	36.17%	36.17%	*Caecum imbricatum*	15025	51.72%	51.72%
Phascolion caupo	1266.67	8.41%	44.58%	*Clymenella mucosa*	4750	16.35%	68.07%
Mysella planulata	1025.00	6.80%	51.38%	*Branchiostoma floridae*	1775	6.11%	74.18%
Ampelisca holmesi	858.33	5.70%	57.08%	*Metharpinia floridana*	1175	4.04%	78.23%
Nucula proxima	858.33	5.70%	62.77%	*Spio pettiboneae*	575	1.98%	80.21%
Angulus cf. versicolor	625.00	4.15%	66.92%	*Syllis cornuta*	550	1.89%	82.10%
Mesokalliapseudes macsweenyi	300.00	1.99%	68.91%	*Mesokalliapseudes macsweenyi*	475	1.64%	83.73%
Phascolion cryptum	291.67	1.94%	70.85%	*Travisia hobsonae*	450	1.55%	85.28%
Neanthes acuminata	283.33	1.88%	72.73%	*Eudevenopus honduranus*	400	1.38%	86.66%
Eudevenopus honduranus	258.33	1.71%	74.44%	*Phascolion caupo*	400	1.38%	88.04%

Table 62. Spring Skyway Causeway North ranked taxa abundance (top 10).

Skyway Causeway North Dredged Hole (Spring)				Skyway Causeway North Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Ampelisca holmesi	1675.00	9.87%	9.87%	*Caecum imbricatum*	20225	68.79%	68.79%
Travisia hobsonae	1675.00	9.87%	19.74%	*Metharpinia floridana*	3875	13.18%	81.97%
Ampelisca abdita	1058.33	6.24%	25.98%	*Clymenella mucosa*	1200	4.08%	86.05%
Microprotopus raneyi	1050.00	6.19%	32.17%	*Acanthohaustorius uncinus*	650	2.21%	88.26%
Listriella barnardi	758.33	4.47%	36.64%	*Travisia hobsonae*	450	1.53%	89.79%
Cyclaspis varians	708.33	4.17%	40.82%	*Caecum pulchellum*	400	1.36%	91.15%
Clymenella mucosa	658.33	3.88%	44.70%	*Transennella conradina*	400	1.36%	92.51%
Deutella incerta	641.67	3.78%	48.48%	*Branchiostoma floridae*	325	1.11%	93.62%
Tubificinae	608.33	3.59%	52.06%	*Eudevenopus honduranus*	250	0.85%	94.47%
Nucula proxima	483.33	2.85%	54.91%	*Phascolion caupo*	225	0.77%	95.23%

The dredged hole sediments had a mean silt+clay content of 5.97% in the fall and 4.53% in the spring and a TOC content of 0.43%. The reference site sediments had a silt+clay and TOC content of 0.9% and 2.5% respectively in the fall and a spring silt+clay content of 1.5% (Table 63).

None of the measured sediment contaminates were above the state sediment quality guidelines in any of the dredged hole samples or at the reference site (Table 63) and the PEL Quotient was 0.01 for both the dredged hole and reference site sediments.

Table 63. Skyway Causeway North sediment contaminants and composition.

Skyway Causeway North										
	Formula	MW	MDL	TEL	PEL	16DH08-1 (Center)	16DH08-2 (Left)	16DH08-3 (Right)	16DH08 (Mean)	16DH08-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			5212.57	5060.34	5128.64	5133.85	1089.32
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	0.00
Cadmium	Cd	112.41	2.280	0.676	4.210	0.26	0.00	0.31	0.19	0.00
Chromium	Cr	52.00	1.210	52.300	160.000	7.52	8.44	7.60	7.85	4.82
Copper	Cu	63.55	0.450	18.700	108.000	0.00	0.69	0.00	0.23	0.00
Iron	Fe	55.85	69.200			1012.27	1383.99	1037.13	1144.46	1071.72
Lead	Pb	207.20	5.220	30.200	112.000	15.79	16.77	16.29	16.28	12.58
Manganese	Mn	54.94	4.490			24.82	26.47	25.58	25.62	21.68
Nickel	Ni	58.69	0.710	15.900	42.800	2.25	2.54	2.33	2.37	1.59
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.72	0.71	0.69	0.71	1.11
Zinc	Zn	65.38	1.890	124.000	271.000	4.28	5.45	4.20	4.64	2.54
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.01	0.01	0.00	0.01	0.00
β BHC	$C_6H_6Cl_6$	290.83	0.730			0.05	4.30	0.48	1.61	0.35
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.59	0.03	0.07	0.23	0.00
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.00	0.07	0.09	0.05	0.00
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.15	0.01	0.00	0.05	0.01
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.00	0.00	0.00	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.15	0.01	0.00	0.05	0.01
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.02	0.03	0.00	0.02	0.00
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.01	0.01	0.00	0.01	0.02
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.00	0.00	0.00	0.00	0.00
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.00	0.01	0.00	0.00	0.00
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.00	0.00	0.06	0.02	0.01
Total DDT				3.890	51.700	0.00	0.01	0.06	0.02	0.01

Skyway Causeway North										
	Formula	MW	MDL	TEL	PEL	16DH08-1 (Center)	16DH08-2 (Left)	16DH08-3 (Right)	16DH08 (Mean)	16DH08-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.01	0.00	0.00	0.00
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.00	0.00	0.00	0.01
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.00	0.00	0.00	0.00	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.01	0.00	0.00	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	0.00	0.00	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.00	0.00	0.00	0.00	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.29	0.01	0.00	0.10	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.01	0.00	0.00	0.00	0.01
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.18	0.36	0.00	0.18	0.39
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.02
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.00	0.00	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.01	0.00	0.00	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.00	0.00	0.00	0.00	0.03
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.00	0.00	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.00	0.00	0.00	0.00	0.00
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			0.16	0.00	0.20	0.12	0.00
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.00	0.00	0.00	0.00	0.02
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.00	0.00	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.00	0.15	0.08	0.08	0.00
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.05	0.02	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.22	1.61	0.58	0.80	1.67
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.00	0.11	0.94	0.35	0.16
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.00	0.00	0.39	0.13	0.03
Total PCBs				21.600	189.000	0.38	1.88	2.24	1.50	1.91
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	0.00	0.00	0.00

Skyway Causeway North										
	Formula	MW	MDL	TEL	PEL	16DH08-1 (Center)	16DH08-2 (Left)	16DH08-3 (Right)	16DH08 (Mean)	16DH08-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	0.00	0.00	0.00	0.00	0.00
Fluorene	$C_{13}H_{10}$	166.22	4.670	21.200	144.000	0.00	0.00	0.00	0.00	0.00
Naphthalene	$C_{10}H_8$	128.17	7.890	34.600	391.000	0.00	0.00	0.00	0.00	0.00
Phenanthrene	$C_{14}H_{10}$	178.23	5.070	86.700	544.000	0.00	3.66	0.00	1.22	0.00
Total LMW PAHs				312.000	1440.000	0.00	3.66	0.00	1.22	0.00
Benzo(a)anthracene	$C_{18}H_{12}$	228.29	5.030	74.800	693.000	0.00	0.00	0.00	0.00	0.00
Benzo(a)pyrene	$C_{20}H_{12}$	252.31	3.160	88.800	763.000	0.00	0.00	0.00	0.00	0.00
Chrysene	$C_{18}H_{12}$	228.29	5.010	108.000	846.000	0.00	5.39	0.00	1.80	0.00
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	278.35	5.770	6.220	135.000	0.00	0.00	0.00	0.00	0.00
Fluoranthene	$C_{16}H_{10}$	202.25	2.520	113.000	1494.000	0.00	5.43	0.00	1.81	0.00
Pyrene	$C_{16}H_{10}$	202.25	5.630	153.000	1398.000	3.60	6.08	3.68	4.45	0.00
Total HMW PAHs				655.000	6680.000	3.60	16.90	3.68	8.06	0.00
Total PAHs				1680.000	16800.000	3.60	20.56	3.68	9.28	0.00
PEL Quotient						**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Benzo(b)fluoranthene	$C_{20}H_{12}$	252.31	4.400			0.00	0.00	0.00	0.00	0.00
Benzo(g,h,i)perylene	$C_{22}H_{12}$	276.33	5.580			3.24	0.00	3.08	2.11	2.31
Benzo(k)fluoranthene	$C_{20}H_{12}$	252.31	7.230			0.00	0.00	0.00	0.00	0.00
Coronene	$C_{24}H_{12}$	300.35	8.810			0.00	0.00	0.00	0.00	0.00
Indeno(1,2,3-c,d)pyrene	$C_{22}H_{12}$	276.33	6.000			4.05	0.00	0.00	1.35	0.00
Retene	$C_{18}H_{18}$	234.34	4.170			0.00	0.00	0.00	0.00	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						5.3/3.0	7.6/4.7	5.0/5.9	5.97/4.53	0.9/1.5
% Total Carbon (Solids)						0.70	1.30	0.60	0.87	2.90
% Total Inorganic Carbon (Solids)						0.30	0.70	0.30	0.43	0.40
% Total Organic Carbon (Solids)						0.40	0.60	0.30	0.43	2.50

Yellow >TEL; Red>PEL

Skyway Causeway South

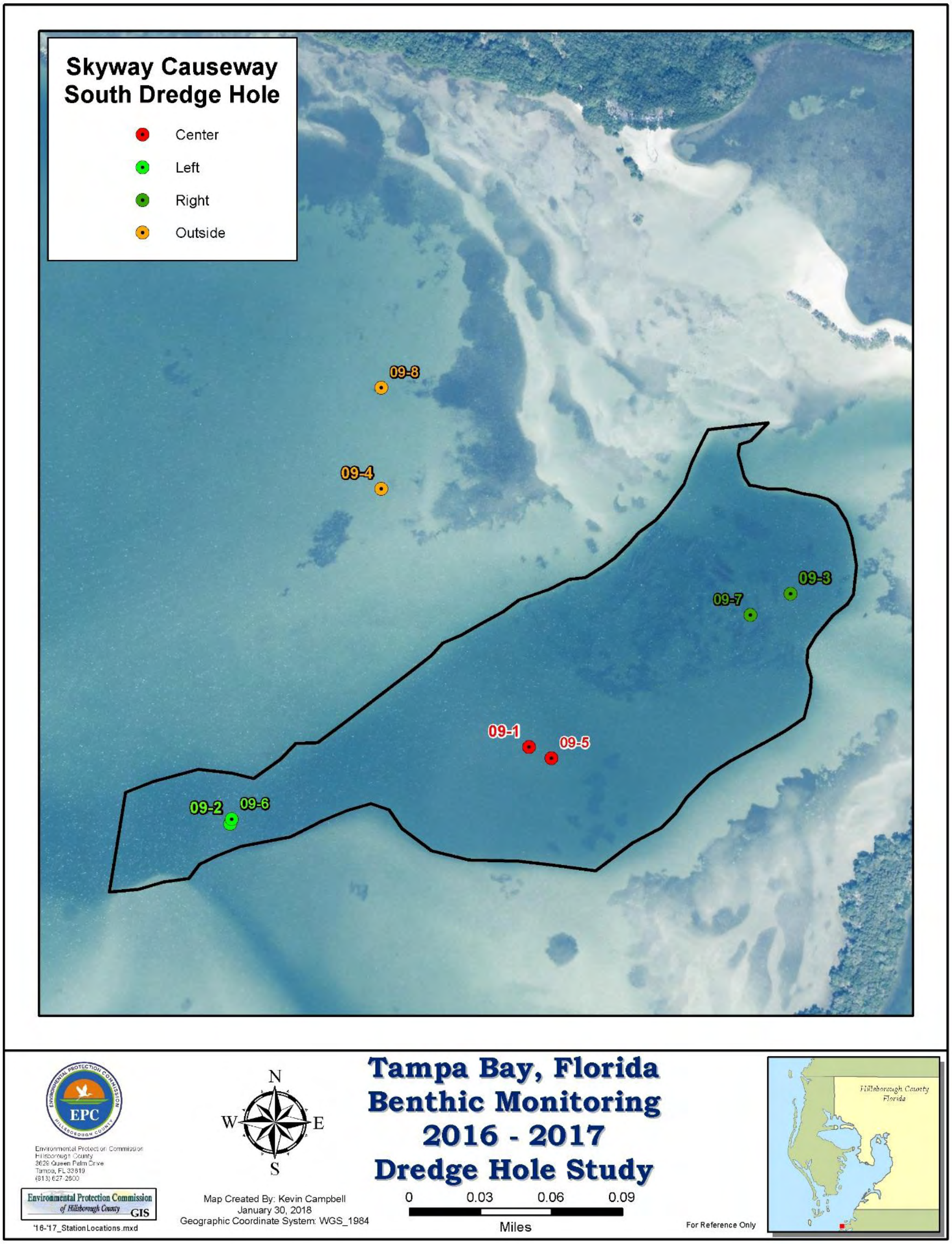

Figure 10. Fall 2016 and spring 2017 Skyway Causeway South dredged hole and reference sample locations.

The Skyway Causeway South dredged hole (Figure 10) bottom hydrographic field measurements are summarized in Table 64 for the fall and Table 65 for the spring sampling events. The mean sample depth within the dredged hole was 2.1 meters in the fall and 2.7 meters in the spring and the reference sites had sample depths of 0.7 meters in the fall and 1.2 meters in the spring. Bottom temperature, salinity and pH were similar between the dredged hole and reference site within each season. The fall bottom dissolved oxygen was below the 4 mg/l water quality standard at all sites but the D.O. saturation was above the water quality standard of 42% (Table 64). The spring dissolved oxygen and D.O. saturation measurements were above state water quality standards at all sites (Table 65).

Table 64. Fall Skyway Causeway South dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH09-1	16DH09-2	16DH09-3	DH	16DH09-4
	Center	Left	Right	Mean	Ref
Depth (m)	1.5	2.7	2.0	2.1	0.7
Temperature (°C)	31.44	31.23	31.54	31.40	31.44
Salinity (psu)	29.27	29.34	29.28	29.30	29.35
pH	7.90	7.86	7.91	7.89	7.91
Dissolved Oxygen (mg/l)	3.85	3.42	3.88	3.72	3.83
D.O. Saturation (%)	61.8	54.7	62.4	59.6	61.7

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

Table 65. Spring Skyway Causeway South dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH09-5	17DH09-6	17DH09-7	DH	17DH09-8
	Center	Left	Right	Mean	Ref
Depth (m)	2.0	3.5	2.7	2.7	1.2
Temperature (°C)	23.65	23.41	23.78	23.61	23.79
Salinity (psu)	32.36	32.28	32.44	32.36	32.30
pH	8.16	8.13	8.16	8.15	8.13
Dissolved Oxygen (mg/l)	6.50	6.47	6.83	6.60	6.54
D.O. Saturation (%)	92.8	91.9	97.8	94.2	93.6

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

The fall dredged hole had a total of 139 taxa with a mean of 82 taxa/sample and the fall reference site had 58 taxa (Table 66). The abundance was lower within the dredged hole, but diversity was higher. All of the dredged hole samples and the reference sample had high TBBI scores >90 indicating a "Healthy" benthic community (Table 66).

Table 66. Fall Skyway Causeway South dredged hole benthic community metrics.

	Fall 2016				
	16DH09-1	16DH09-2	16DH09-3	DH	16DH09-4
	Center	Left	Right	Mean (Total)	Ref
Species Richness	106	66	74	82 (139)	58
Abundance (#/m^2)	30902	16901	12075	19959.33	41800
Shannon Diversity	3.31	2.84	3.58	3.24	2.21
TBBI	98.67	93.77	91.84	94.76	93.68
TBBI Category	Healthy	Healthy	Healthy	Healthy	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring dredged hole benthic community had a total of 193 taxa with a mean of 108.67 taxa/sample while the spring reference site had a total of 51 taxa (Table 67). The abundance was lower at the dredged hole sites but Shannon diversity was higher relative to the reference site. All of the dredged hole sites and the reference site had high TBBI scores reflecting a "Healthy" benthic community.

Table 67. Spring Skyway Causeway South dredged hole benthic community metrics.

	Spring 2017				
	17DH09-5	17DH09-6	17DH09-7	DH	17DH09-8
	Center	Left	Right	Mean (Total)	Ref
Species Richness	85	135	106	108.67 (193)	51
Abundance (#/m^2)	35051	28401	22026	28492.67	62950
Shannon Diversity	3.22	3.95	3.82	3.66	2.21
TBBI	98.39	97.97	88.53	94.96	93.39
TBBI Category	Healthy	Healthy	Healthy	Healthy	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The top ten ranked benthic taxa in the fall dredged hole accounted for 63.96% of the cumulative abundance and was dominated by the gastropods *Caecum pulchellum* and *Caecum cf. bipartitum* and polychaete *Clymenella mucosa* which together comprised 35% of the abundance (Table 68). The fall reference site was dominated by the gastropod *Caecum imbricatum* which alone made up 48.09% of the abundance while the top ten taxa cumulatively accounted for 84.39% of the abundance (Table 68).

Table 68. Fall Skyway Causeway South ranked taxa abundance (top 10).

Skyway Causeway South Dredged Hole (Fall)				Skyway Causeway South Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Caecum pulchellum	3008.33	15.07%	15.07%	*Caecum imbricatum*	20100	48.09%	48.09%
Clymenella mucosa	2783.33	13.95%	29.02%	*Clymenella mucosa*	5750	13.76%	61.84%
Caecum cf. bipartitum	1191.67	5.97%	34.99%	*Eudevenopus honduranus*	2200	5.26%	67.11%
Nucula proxima	1083.33	5.43%	40.42%	*Caecum pulchellum*	2050	4.90%	72.01%
Jaspidella blanesi	908.33	4.55%	44.97%	*Branchiostoma floridae*	1850	4.43%	76.44%
Caecum imbricatum	891.67	4.47%	49.43%	*Metharpinia floridana*	925	2.21%	78.65%
Phascolion caupo	850.00	4.26%	53.69%	*Phascolion caupo*	725	1.73%	80.38%
Mysella planulata	800.00	4.01%	57.70%	*Syllis cornuta*	625	1.50%	81.88%
Branchiostoma floridae	741.67	3.72%	61.42%	*Caryocorbula caribaea*	525	1.26%	83.13%
Listriella barnardi	508.33	2.55%	63.96%	*Pleuromeris tridentata*	525	1.26%	84.39%

The top ten ranked benthic taxa comprised 46.82% of the spring dredged hole abundance (Table 69). The top ranked taxa included the amphipod *Rudilemboides naglei*, the polychaete *Clymenella mucosa* and the bivalve *Nucula proxima* which together comprised 23.69% of the abundance (Table 69). The spring reference site was dominated by the gastropod *Caecum imbricatum* which represented 44.92% of the total abundance at that site. The top ten taxa cumulatively accounted for 86.38% of the abundance (Table 69).

Table 69. Spring Skyway Causeway South ranked taxa abundance (top 10).

Skyway Causeway South Dredged Hole (Spring)				Skyway Causeway South Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Rudilemboides naglei	3283.33	11.52%	11.52%	*Caecum imbricatum*	28275	44.92%	44.92%
Clymenella mucosa	2208.33	7.75%	19.27%	*Pleuromeris tridentata*	7500	11.91%	56.83%
Nucula proxima	1258.33	4.42%	23.69%	*Metharpinia floridana*	6525	10.37%	67.20%
Deutella incerta	1216.67	4.27%	27.96%	*Caecum pulchellum*	3625	5.76%	72.95%
Travisia hobsonae	1200.00	4.21%	32.17%	*Pitar simpsoni*	1900	3.02%	75.97%
Metharpinia floridana	1175.00	4.12%	36.30%	*Cyclaspis varians*	1875	2.98%	78.95%
Caecum pulchellum	975.00	3.42%	39.72%	*Travisia hobsonae*	1450	2.30%	81.25%
Phascolion caupo	725.00	2.54%	42.26%	*Clymenella mucosa*	1200	1.91%	83.16%
Shoemakerella cubensis	675.00	2.37%	44.63%	*Eudevenopus honduranus*	1025	1.63%	84.79%
Cymadusa compta	625.00	2.19%	46.82%	*Phascolion caupo*	1000	1.59%	86.38%

The dredged hole sediments had a mean silt+clay content of 4.0% in the fall and 3.97% in the spring and a mean TOC content of 0.27%. The reference site sediments had a silt+clay content of 2.0% in the fall and 1.9% in the spring and a higher TOC content of 3.5% (Table 70). The center dredged hole sample was above the TEL for total PCBs but no other sediment quality exceedances were found within the dredged hole or at the reference site (Table 70). The overall PEL Quotient for the dredged hole sediments was 0.02 and the reference site sediments had a PEL Quotient of 0.01.

Table 70. Skyway Causeway South sediment contaminants and composition.

Skyway Causeway South										
	Formula	MW	MDL	TEL	PEL	16DH09-1 (Center)	16DH09-2 (Left)	16DH09-3 (Right)	16DH09 (Mean)	16DH09-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			4017.99	5616.32	4519.66	4717.99	2847.26
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	0.00
Cadmium	Cd	112.41	2.280	0.676	4.210	0.00	0.00	0.19	0.06	0.00
Chromium	Cr	52.00	1.210	52.300	160.000	5.89	7.18	6.21	6.43	5.99
Copper	Cu	63.55	0.450	18.700	108.000	0.53	0.00	0.00	0.18	0.00
Iron	Fe	55.85	69.200			780.92	861.47	804.63	815.67	754.80
Lead	Pb	207.20	5.220	30.200	112.000	16.98	16.37	17.52	16.96	14.76
Manganese	Mn	54.94	4.490			22.52	24.01	20.34	22.29	24.22
Nickel	Ni	58.69	0.710	15.900	42.800	2.18	2.69	2.68	2.52	2.42
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.68	0.59	1.22	0.83	0.62
Zinc	Zn	65.38	1.890	124.000	271.000	3.50	2.78	2.42	2.90	2.10
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.02	0.00	0.01	0.01	0.00
β BHC	$C_6H_6Cl_6$	290.83	0.730			10.66	2.45	0.00	4.37	0.16
δ BHC	$C_6H_6Cl_6$	290.83	0.050			9.07	0.00	0.01	3.03	0.00
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.30	0.01	0.00	0.10	0.10
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			2.15	0.01	0.00	0.72	0.00
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.00	0.00	0.00	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	2.15	0.01	0.00	0.72	0.00
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			2.81	0.04	0.05	0.97	0.01
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.00	0.02	0.00	0.01	0.04
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.00	0.00	0.00	0.00	0.06
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	0.00	0.00	0.00	0.00	0.00
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.00	0.01	0.21	0.07	0.00
Total DDT				3.890	51.700	0.00	0.01	0.21	0.07	0.06

Skyway Causeway South										
	Formula	MW	MDL	TEL	PEL	16DH09-1 (Center)	16DH09-2 (Left)	16DH09-3 (Right)	16DH09 (Mean)	16DH09-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.00	0.00	0.00	0.03
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.00	0.00	0.00	0.00	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.00	0.01	0.00	0.00	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.00	0.00	0.00	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.00	0.00	0.00	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.02	0.01	0.00	0.01	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			5.23	0.00	0.00	1.74	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			3.25	0.00	0.00	1.08	0.00
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			0.07	0.61	0.08	0.25	0.00
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.00	0.00	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.00	0.00	0.00	0.00	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.00	0.00	0.00	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.13	0.00	0.00	0.04	0.00
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.00	0.00	0.00	0.00	0.00
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.01	0.00	0.00	0.00	0.05
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			1.00	0.00	1.68	0.89	0.21
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.00	0.00	0.00	0.00	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.00	0.00	0.00	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.00	0.00	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			10.17	0.14	0.39	3.57	0.03
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.00	0.00	0.00	0.00	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			27.08	0.03	0.14	9.08	0.01
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			11.59	0.03	1.27	4.30	0.00
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.11	0.10	0.16	0.12	0.41
Total PCBs				21.600	189.000	50.09	0.30	3.64	18.01	0.71
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	0.00	0.00	0.00	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	0.00	0.00	0.00	0.00	0.00

Skyway Causeway South										
	Formula	MW	MDL	TEL	PEL	16DH09-1 (Center)	16DH09-2 (Left)	16DH09-3 (Right)	16DH09 (Mean)	16DH09-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	0.00	2.79	0.00	0.93	0.00
Fluorene	$C_{13}H_{10}$	166.22	4.670	21.200	144.000	0.00	0.00	0.00	0.00	0.00
Naphthalene	$C_{10}H_8$	128.17	7.890	34.600	391.000	0.00	0.00	0.00	0.00	0.00
Phenanthrene	C14H10	178.23	5.070	86.700	544.000	0.00	7.53	0.00	2.51	0.00
Total LMW PAHs				312.000	1440.000	0.00	10.32	0.00	3.44	0.00
Benzo(a)anthracene	$C_{18}H_{12}$	228.29	5.030	74.800	693.000	1.74	14.41	0.00	5.38	2.99
Benzo(a)pyrene	$C_{20}H_{12}$	252.31	3.160	88.800	763.000	0.00	39.75	2.22	13.99	0.00
Chrysene	$C_{18}H_{12}$	228.29	5.010	108.000	846.000	0.00	30.71	0.00	10.24	2.46
Dibenzo(a,h)anthracene	$C_{22}H_{14}$	278.35	5.770	6.220	135.000	0.00	0.00	0.00	0.00	0.00
Fluoranthene	$C_{16}H_{10}$	202.25	2.520	113.000	1494.000	0.00	29.55	0.00	9.85	2.01
Pyrene	$C_{16}H_{10}$	202.25	5.630	153.000	1398.000	2.46	32.15	12.84	15.82	2.46
Total HMW PAHs				655.000	6680.000	4.20	146.57	15.06	55.28	9.92
Total PAHs				1680.000	16800.000	4.20	156.89	15.06	58.72	9.92
PEL Quotient						**0.04**	**0.02**	**0.01**	**0.02**	**0.01**
Benzo(b)fluoranthene	$C_{20}H_{12}$	252.31	4.400			0.00	44.40	0.00	14.80	0.00
Benzo(g,h,i)perylene	$C_{22}H_{12}$	276.33	5.580			0.00	34.36	4.42	12.93	0.00
Benzo(k)fluoranthene	$C_{20}H_{12}$	252.31	7.230			0.00	35.07	0.00	11.69	10.53
Coronene	$C_{24}H_{12}$	300.35	8.810			9.59	0.00	0.00	3.20	0.00
Indeno(1,2,3-c,d)pyrene	$C_{22}H_{12}$	276.33	6.000			0.00	25.36	0.00	8.45	0.00
Retene	$C_{18}H_{18}$	234.34	4.170			0.00	0.00	0.00	0.00	1.50
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						4.4/3.4	3.7/6.4	3.9/2.1	4.0/3.97	2.0/1.9
% Total Carbon (Solids)						0.70	0.70	0.70	0.70	4.00
% Total Inorganic Carbon (Solids)						0.60	0.30	0.40	0.43	0.50
% Total Organic Carbon (Solids)						0.2	0.4	0.2	0.27	3.5

o Yellow >TEL; Red>PEL

McKay Bay

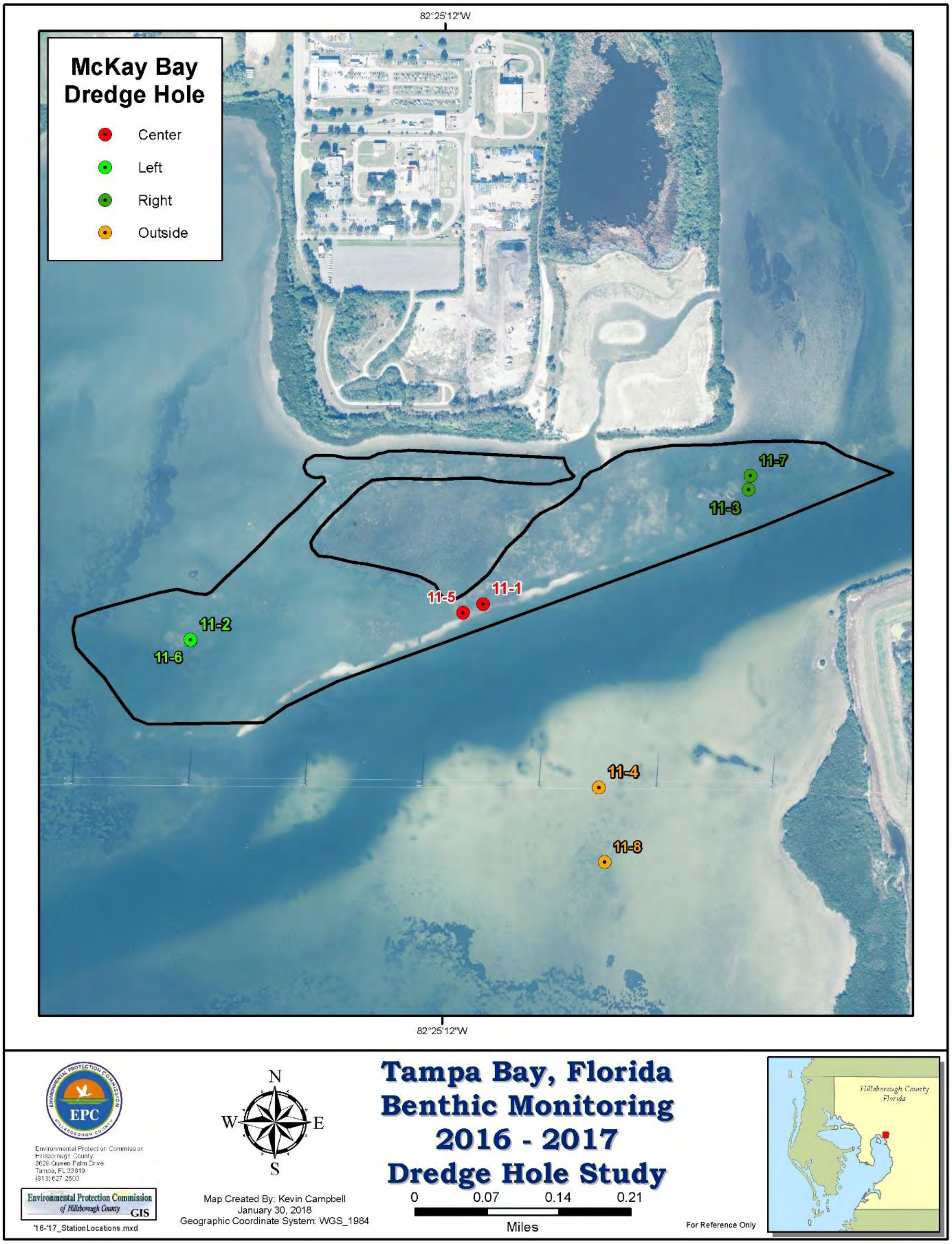

Figure 11. Fall 2016 and spring 2017 McKay Bay dredged hole and reference sample locations.

The mean fall sampling depth within the McKay Bay dredged hole was 1.3 meters and ranged from 1.0 – 1.5 meters while the corresponding reference sample was 0.5 meters (Table 71). The mean bottom temperature in the dredged hole sites was 31.34°C and mean bottom salinity was 21.62 psu. The deepest dredged hole site (1.5 meters) had a slightly higher bottom salinity of 22.25 psu and lower pH. The mean bottom dissolved oxygen within the dredged hole was low with the deepest site in the hypoxic range (<2 mg/l) and also having a low D.O. saturation of 20.6%. By comparison, the reference site had a bottom dissolved oxygen level of 4.52 mg/l and D.O. saturation of 69.4%.

Table 71. Fall McKay Bay dredged hole bottom hydrographic measurements.

	Fall 2016				
	16DH11-1 Center	16DH11-2 Left	16DH11-3 Right	Dredge Hole Mean	16DH11-4 (Reference)
Depth (m)	1.0	1.3	1.5	1.3	0.5
Temperature (°C)	31.35	31.26	31.41	31.34	31.55
Salinity (psu)	21.06	21.97	22.25	21.76	21.21
pH	7.73	7.64	7.49	7.62	7.77
Dissolved Oxygen (mg/l)	4.13	3.11	1.34	2.86	4.52
D.O. Saturation (%)	63.1	47.7	20.6	43.8	69.4

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

The mean spring sampling depth within the McKay Bay dredged hole was 0.6 meters and ranged from 0.2 to 0.8 meters while the reference site was also 0.6 meters (Table 72). Bottom temperatures were lower (mean = 23.17°C) and bottom salinities higher (mean = 27.24 psu) in the spring than in the fall and comparable between the dredged hole and reference site. The mean dredged hole pH was also the same as at the reference site. The bottom dissolved oxygen and D.O. saturation was above the state water quality standards of 4 mg/l and 42% at all of the sample sites.

Table 72. Spring McKay Bay dredged hole bottom hydrographic measurements.

	Spring 2017				
	17DH11-5 Center	17DH11-6 Left	17DH11-7 Right	DH Mean (Total)	17DH11-8 Ref
Depth (m)	0.2	0.8	0.8	0.6	0.6
Temperature (°C)	23.19	22.75	23.56	23.17	23.77
Salinity (psu)	27.58	27.13	27.02	27.24	27.38
pH	8.10	8.09	8.15	8.11	8.11
Dissolved Oxygen (mg/l)	5.26	5.47	6.04	5.59	6.02
D.O. Saturation (%)	72.1	74.5	83.5	76.7	83.3

Green = normal D.O.; Yellow = low D.O.; Red = hypoxic D.O. (< 2 mg/l; <42% saturation).

A total of 51 taxa (mean = 30.33 taxa/sample) were identified in the fall McKay Bay dredged hole samples and 35 taxa were identified at the reference site during Fall 2016 (Table 73). The mean abundance within the dredged hole area was lower than at the reference site however while the mean Shannon diversity was about the same between the dredged hole and reference sites. The mean dredged hole TBBI was 86.03 which was just below the “Healthy” threshold of 87 while the reference site has a “Healthy” TBBI score.

Table 73. Fall McKay Bay dredged hole benthic community metrics.

	Fall 2016				
	16DH11-1 Center	16DH11-2 Left	16DH11-3 Right	Dredge Hole Mean (Total)	16DH11-4 (Reference)
Species Richness	31	37	23	30.33 (51)	35
Abundance (#/m^2)	6400	5600	3825	5275	14000
Shannon Diversity	2.83	3.22	2.47	2.84	2.82
TBBI	85.45	87.42	85.21	86.03	91.67
TBBI Category	Intermediate	Healthy	Intermediate	Intermediate	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

Species richness within the dredged hole was higher in the Spring 2017 than in the Fall 2016 with a total of 71 taxa and a mean of 42.67 taxa/sample (Table 74). The number of taxa at the reference site was about the same between the seasons and was lower than at two of the three dredged hole sites during the spring. Spring abundance was higher than the fall at both the dredged hole and reference sites while Shannon diversity was lower. All of the spring samples had "Healthy" TBBI scores.

Table 74. Spring McKay Bay dredged hole benthic community metrics.

	Spring 2017				
	17DH11-5 Center	17DH11-6 Left	17DH11-7 Right	Dredge Hole Mean (Total)	17DH11-8 (Reference)
Species Richness	41	53	34	42.67 (71)	37
Abundance (#/m^2)	97100	97125	52150	82125	101650
Shannon Diversity	1.55	2.02	1.27	1.61	1.27
TBBI	87.98	92.85	87.61	89.48	89.54
TBBI Category	Healthy	Healthy	Healthy	Healthy	Healthy

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

Mollusks and polychaetes dominated the Fall 2016 McKay Bay dredged hole community. The bivalves *Macoma cf. phenax*, *Mysella planulata*, *Amygdalum papyrium*, the gastropod *Acteocina canalicualata* and the polychaetes *Paraprionospio pinnata* and *Alitta succinea* accounted for 50.55% of the total abundance within the dredged hole (Table 75). The Fall 2016 reference site was dominated by the amphipod *Ampelisca abdita*, the bivalves *Mulinia lateralis* and *Mysella planulata,* and the gastropod *Littoridinops* sp., which cumulatively made up 50% of the total abundance.

Table 75. Fall McKay Bay ranked taxa abundance (top 10).

McKay Bay Dredged Hole (Fall)				McKay Bay Reference (Fall)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Macoma cf. phenax	691.67	13.11%	13.11%	*Ampelisca abdita*	2825	20.18%	20.18%
Mysella planulata	625.00	11.85%	24.96%	*Mulinia lateralis*	2000	14.29%	34.46%
Paraprionospio pinnata	408.33	7.74%	32.70%	*Mysella planulata*	1200	8.57%	43.04%
Alitta succinea	375.00	7.11%	39.81%	*Littoridinops sp.*	975	6.96%	50.00%
Acteocina canaliculata	291.67	5.53%	45.34%	*Xenanthura brevitelson*	925	6.61%	56.61%
Amygdalum papyrium	275.00	5.21%	50.55%	*Pectinaria gouldii*	700	5.00%	61.61%
Pectinaria gouldii	258.33	4.90%	55.45%	*Leitoscoloplos sp.*	675	4.82%	66.43%
Glycinde solitaria	233.33	4.42%	59.87%	*Macoma cf. phenax*	650	4.64%	71.07%
Mulinia lateralis	200.00	3.79%	63.67%	*Acteocina canaliculata*	575	4.11%	75.18%
Cyathura polita	158.33	3.00%	66.67%	*Laeonereis culveri*	375	2.68%	77.86%

Crustaceans dominated both the dredged hole and the reference sites in Spring 2017 with the amphipod *Ampelisca abdita* comprising 58.84% of the abundance in the dredged hole and 66.4% of the abundance at the reference site (Table 76). Nine of the top ten taxa in the dredged hole samples and all of the top ten taxa at the reference site were crustaceans.

Table 76. Spring McKay Bay ranked taxa abundance (top 10).

McKay Bay Dredged Hole (Spring)				McKay Bay Reference (Spring)			
Taxon	**Mean Abund.**	**Rel. Abund.**	**Cumulative Abund.**	**NAME**	**Total Abund.**	**Rel. Abund.**	**Cumulative Abund.**
Ampelisca abdita	48325.00	58.84%	58.84%	*Ampelisca abdita*	67500	66.40%	66.40%
Monocorophium acherusicum	6000.00	7.31%	66.15%	*Grandidierella bonnieroides*	17875	17.58%	83.99%
Grandidierella bonnieroides	5141.67	6.26%	72.41%	*Gammarus cf. tigrinus*	3150	3.10%	87.09%
Deutella incerta	4841.67	5.90%	78.31%	*Cyathura polita*	2750	2.71%	89.79%
Ampelisca spp.	2700.00	3.29%	81.59%	*Gammarus mucronatus*	2600	2.56%	92.35%
Cyathura polita	2508.33	3.05%	84.65%	*Xenanthura brevitelson*	1800	1.77%	94.12%
Macoma cf. phenax	2183.33	2.66%	87.31%	*Ampelisca holmesi*	1275	1.25%	95.38%
Ampelisca holmesi	2025.00	2.47%	89.77%	*Ampelisca spp.*	975	0.96%	96.34%
Gammarus mucronatus	1350.00	1.64%	91.42%	*Monocorophium acherusicum*	525	0.52%	96.85%
Xenanthura brevitelson	666.67	0.81%	92.23%	*Cyclaspis varians*	450	0.44%	97.29%

The sediments within the dredged hole were very fine to muddy with a mean silt+clay content of 24.8% in the fall and 13.8% in the spring and a mean TOC of 1.4% (Table 77). The reference site was characterized by medium-grained sediments with a silt+clay content of 2.0% and 4.2% in the fall and spring respectively and a mean TOC of 0.1%. Some individual dredged hole samples and some means (as highlighted in Table 77) were above the TEL for lead; the pesticides DDD, DDE, DDT and total DDT; the low molecular weight PAHs acenaphthene and acenaphthlene; all six high molecular weight PAHs; and total high molecular weight PAH's and total PAHs (Table 8). One of the dredged hole samples (Right) also exceeded the PEL for DDT. The overall PEL Quotient for the McKay Bay dredged hole was 0.16. In contrast, the reference sample had no sediment quality exceedances.

Table 77. McKay Bay sediment contaminants and composition.

McKay Bay										
	Formula	MW	MDL	TEL	PEL	16DH11-1 (Center)	16DH11-2 (Left)	16DH11-3 (Right)	16DH11 (Mean)	16DH11-4 (Ref)
Metals (mg/kg)										
Aluminum	Al	26.98	112.990			4069.23	13311.80	9814.69	9065.24	1228.56
Antimony	Sb	121.76	2.650			0.00	0.00	0.00	0.00	0.00
Arsenic	As	74.92	6.800	7.240	41.600	0.00	0.00	0.00	0.00	2.73
Cadmium	Cd	112.41	2.280	0.676	4.210	0.31	0.60	0.49	0.47	0.00
Chromium	Cr	52.00	1.210	52.300	160.000	13.53	43.70	30.30	29.18	5.05
Copper	Cu	63.55	0.450	18.700	108.000	2.60	13.15	11.02	8.92	0.35
Iron	Fe	55.85	69.200			1908.50	7174.18	5049.66	4710.78	532.71
Lead	Pb	207.20	5.220	30.200	112.000	31.12	46.69	45.69	41.17	20.84
Manganese	Mn	54.94	4.490			16.96	38.34	35.29	30.20	8.13
Nickel	Ni	58.69	0.710	15.900	42.800	3.89	7.74	6.46	6.03	2.57
Selenium	Se	78.96	2.210			0.00	0.00	0.00	0.00	0.00
Silver	Ag	107.87	0.570	0.733	1.770	0.00	0.00	0.00	0.00	0.00
Tin	Sn	118.71	2.070			0.43	3.18	3.02	2.21	0.73
Zinc	Zn	65.38	1.890	124.000	271.000	31.39	82.69	79.81	64.63	6.85
Pesticides (µg/kg)										
α BHC	$C_6H_6Cl_6$	290.83	0.070			0.00	0.10	0.05	0.05	0.00
β BHC	$C_6H_6Cl_6$	290.83	0.730			0.78	0.10	7.73	2.87	0.20
δ BHC	$C_6H_6Cl_6$	290.83	0.050			0.00	0.08	0.01	0.03	0.00
γ BHC (Lindane)	$C_6H_6Cl_6$	290.83	0.030	0.320	0.990	0.00	0.06	0.03	0.03	0.00
α Chlordane	$C_{10}H_6Cl_8$	409.78	0.040			0.00	0.00	0.22	0.07	0.00
γ Chlordane	$C_{10}H_6Cl_8$	409.78	0.280			0.00	0.00	0.34	0.11	0.00
Total Chlordane	$C_{10}H_6Cl_8$	409.78		2.300	4.800	0.00	0.00	0.56	0.19	0.00
Aldrin	$C_{12}H_8Cl_6$	364.91	0.070			0.00	0.00	0.05	0.02	0.00
Dieldrin	$C_{12}H_8Cl_6O$	380.91	0.100	0.715	4.300	0.03	0.35	0.38	0.25	0.00
DDD	$C_{14}H_{10}Cl_4$	320.04	0.130	1.220	7.810	0.47	1.15	1.67	1.10	0.00
DDE	$C_{14}H_8Cl_4$	318.02	0.050	2.070	37.400	1.48	3.25	0.00	1.58	0.03
DDT	$C_{14}H_9Cl_5$	354.49	0.020	1.190	4.770	0.54	1.41	9.14	3.70	0.05
Total DDT				3.890	51.700	2.49	5.81	10.81	6.37	0.08

McKay Bay										
	Formula	MW	MDL	TEL	PEL	16DH11-1 (Center)	16DH11-2 (Left)	16DH11-3 (Right)	16DH11 (Mean)	16DH11-4 (Ref)
Endosulfan I	$C_6H_6Cl_6SO_3$	406.93	0.070			0.00	0.00	0.00	0.00	0.00
Endosulfan II	$C_6H_6Cl_6SO_3$	406.93	0.160			0.01	0.00	0.00	0.00	0.00
Endosulfan SO_4	$C_6H_6Cl_6SO_4$	422.92	0.190			0.01	0.12	0.15	0.09	0.00
Endrin	$C_{12}H_8Cl_6O$	380.91	0.170			0.00	0.04	0.14	0.06	0.00
Endrin Aldehyde	$C_{12}H_8Cl_6O$	380.91	0.260			0.00	0.99	0.45	0.48	0.00
Endrin Ketone	$C_{12}H_8Cl_6O$	380.91	0.230			0.00	0.05	0.13	0.06	0.00
Heptachlor	$C_{10}H_5Cl_7$	373.32	0.050			0.00	0.00	0.04	0.01	0.00
Heptachlor Epoxide	$C_{10}H_5Cl_7O$	389.32	0.050			0.04	0.03	0.05	0.04	0.00
Methoxychlor	$C_{16}H_{15}Cl_3O_2$	345.65	0.300			1.97	0.01	1.19	1.06	0.01
Mirex	$C_{10}Cl_{12}$	545.54	0.160			0.00	0.00	0.49	0.16	0.00
Polychlorinated Biphenyls (µg/kg)										
PCB 101	$C_{12}H_5Cl_5$	326.43	0.240			0.14	0.01	0.00	0.05	0.00
PCB 105	$C_{12}H_5Cl_5$	326.43	0.050			0.00	0.41	0.63	0.35	0.00
PCB 118	$C_{12}H_5Cl_5$	326.43	0.080			0.43	1.19	1.19	0.94	0.01
PCB 153	$C_{12}H_4Cl_6$	360.88	0.060			0.30	0.77	0.96	0.68	0.01
PCB 170	$C_{12}H_3Cl_7$	395.32	0.060			0.09	0.33	0.06	0.16	0.00
PCB 18	$C_{12}H_7Cl_3$	257.54	0.190			0.35	0.71	0.35	0.47	0.01
PCB 180	$C_{12}H_3Cl_7$	395.32	0.050			0.22	0.55	0.00	0.26	0.00
PCB 195	$C_{12}H_2Cl_8$	429.77	0.080			0.00	0.16	0.05	0.07	0.00
PCB 206	$C_{12}HCl_9$	464.21	0.040			0.00	0.00	0.00	0.00	0.00
PCB 28	$C_{12}H_7Cl_3$	257.54	0.820			0.07	1.64	1.15	0.95	0.04
PCB 44	$C_{12}H_6Cl_4$	291.99	0.130			0.23	0.50	0.49	0.41	0.00
PCB 52	$C_{12}H_6Cl_4$	291.99	0.370			0.00	0.00	0.00	0.00	1.14
PCB 66	$C_{12}H_6Cl_4$	291.99	0.040			0.66	1.36	1.04	1.02	0.13
PCB 8	$C_{12}H_8Cl_2$	223.10	0.720			0.05	0.00	0.00	0.02	0.00
Total PCBs				21.600	189.000	2.54	7.63	5.92	5.36	1.34
Polyaromatic Hydrocarbons (µg/kg)										
Acenaphthene	$C_{12}H_{10}$	154.22	7.350	6.700	88.900	0.00	16.20	4.97	7.06	0.00
Acenaphthylene	$C_{12}H_8$	152.19	5.300	5.870	128.000	5.32	30.76	12.59	16.22	0.00

McKay Bay										
	Formula	MW	MDL	TEL	PEL	16DH11-1 (Center)	16DH11-2 (Left)	16DH11-3 (Right)	16DH11 (Mean)	16DH11-4 (Ref)
Anthracene	$C_{14}H_{10}$	178.23	4.490	46.900	245.000	1.17	29.00	14.22	14.80	0.00
Fluorene	C13H10	166.22	4.670	21.200	144.000	0.00	12.66	10.37	7.68	0.00
Naphthalene	C10H8	128.17	7.890	34.600	391.000	0.00	1.31	3.42	1.58	0.00
Phenanthrene	C14H10	178.23	5.070	86.700	544.000	27.18	83.90	72.00	61.03	0.00
Total LMW PAHs				312.000	1440.000	33.67	173.83	117.57	108.36	0.00
Benzo(a)anthracene	C18H12	228.29	5.030	74.800	693.000	61.87	256.95	162.76	160.53	0.00
Benzo(a)pyrene	C20H12	252.31	3.160	88.800	763.000	106.34	423.34	289.43	273.04	1.44
Chrysene	C18H12	228.29	5.010	108.000	846.000	75.83	290.25	230.41	198.83	0.00
Dibenzo(a,h)anthracene	C22H14	278.35	5.770	6.220	135.000	31.30	102.59	74.38	69.42	0.00
Fluoranthene	C16H10	202.25	2.520	113.000	1494.000	103.00	348.20	277.12	242.77	0.11
Pyrene	C16H10	202.25	5.630	153.000	1398.000	150.99	533.14	399.66	361.26	6.88
Total HMW PAHs				655.000	6680.000	529.33	1954.47	1433.76	1305.85	8.43
Total PAHs				1680.000	16800.000	563.00	2128.30	1551.33	1414.21	8.43
PEL Quotient						**0.06**	**0.20**	**0.21**	**0.16**	**0.01**
Benzo(b)fluoranthene	C20H12	252.31	4.400			87.05	390.36	315.37	264.26	4.10
Benzo(g,h,i)perylene	C22H12	276.33	5.580			81.37	294.42	40.76	138.85	7.89
Benzo(k)fluoranthene	C20H12	252.31	7.230			87.57	341.43	255.04	228.01	1.12
Coronene	C24H12	300.35	8.810			43.86	74.49	86.45	68.27	0.00
Indeno(1,2,3-c,d)pyrene	C22H12	276.33	6.000			74.39	269.77	183.55	175.90	7.76
Retene	C18H18	234.34	4.170			7.92	44.17	20.09	24.06	0.00
Sediment composition (%)										
% Silt+Clay (%) Fall/Spring						10.0/2.9	39.3/16.1	25.1/22.3	24.8/13.8	2.0/4.2
% Total Carbon (Solids)						0.90	2.40	2.50	1.93	0.20
% Total Inorganic Carbon (Solids)						0.30	0.10	1.20	0.53	0.10
% Total Organic Carbon (Solids)						0.6	2.3	1.4	1.4	0.1

Yellow >TEL; Red>PEL

Dredged Hole Ranking

In order to evaluate the overall status of the 11 dredged holes in this study they were sorted and ranked based on several parameters: The PEL Quotient (PEL_Q) as an overall measure of the sediment contamination levels (MacDonald et al. 1996); the fall and spring TBBI scores as a measure of the health of the benthic macroinvertebrate communities within each season (Janicki Environmental 2005); and the fall and spring bottom dissolved oxygen concentrations as a measure of water quality. Final ranks were done based on the average rankings of these five measures.

The PEL Quotient rankings are presented in Table 78, tied PEL_Q scores were assigned the same rank. Lower PEL_Q values reflect lower levels of sediment contaminants. The Skyway Causeway North and Ft. De Soto dredged holes tied for the top ranking and the Venetian Isles and Skyway Causeway South tied for the second rankings. The MacDill AFB Docks dredged hole ranked last (#7), having the highest level of sediment contaminants among the 10 holes, and McKay Bay ranked 6th with a PEL_Q of 0.16. Culbreath Bayou South and Bay Point dredged holes also had relatively higher levels of sediment contaminants with a PEL_Q of 0.10.

Table 78. Dredged Hole rankings based on PEL Quotients.

Dredge Hole	PEL Quotient	PEL_Q Rank
Skyway Causeway North	0.01	1
Ft. De Soto	0.01	1
Venetian Isles	0.02	2
Skyway Causeway South	0.02	2
Georgetown	0.04	3
MacDill AFB Beach	0.06	4
Culbreath Bayou North	0.06	4
Culbreath Bayou South	0.10	5
Bay Point	0.10	5
McKay Bay	0.16	6
MacDill AFB Docks	0.17	7

The fall TBBI rankings are presented in Table 79. TBBI scores in the “Healthy” range were assigned a rank of “1”, scores in the “Intermediate” range were assigned a rank of “2” and scores in the “Degraded” range were ranked sequentially from “3”. The Skyway Causeway South, Venetian Isles and Skyway Causeway North dredged holes all had “Healthy” TBBI scores while the Bay Point, Culbreath Bayou South, MacDill AFB Beach and Ft. Desoto dredged holes all were below the “Degraded” TBBI threshold. The Ft. Desoto dredged hole ranked the lowest based on the fall TBBI scores despite having low sediment contaminants.

Table 79. Dredged Hole rankings based on fall mean Tampa Bay Benthic Index scores.

Dredge Hole	TBBI Fall	Rank
Skyway Causeway South	94.76	1
Venetian Isles	91.88	1
Skyway Causeway North	87.46	1
McKay Bay	86.03	2
Georgetown	85.79	2
Culbreath Bayou North	85.45	2
MacDill AFB Docks	80.11	2
Bay Point	69.25	3
Culbreath Bayou South	58.41	4
MacDill AFB Beach	49.12	5
Ft. De Soto	47.23	6

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The spring TBBI rankings are presented in Table 80. The Skyway Causeway South, Venetian Isles, McKay Bay and Skyway Causeway North dredged holes were assigned the top rank in the spring while the Bay Point dredge hole had the lowest ranking TBBI score. The Ft. Desoto and MacDill AFB Docks dredged holes also ranked low with "Degraded" TBBI scores.

Table 80. Dredged Hole rankings based on spring mean Tampa Bay Benthic Index scores.

Dredge Hole	TBBI Spring	Rank
Skyway Causeway South	94.96	1
Venetian Isles	89.41	1
McKay Bay	89.48	1
Skyway Causeway North	89.08	1
Culbreath Bayou North	85.46	2
MacDill AFB Beach	84.88	2
Georgetown	84.36	2
Culbreath Bayou South	77.98	2
Ft. De Soto	68.31	3
MacDill AFB Docks	67.38	4
Bay Point	52.65	5

TBBI: Green = "Healthy"; Yellow = "Intermediate"; Red = "Degraded"; Dark Red = "Empty"

The fall bottom dissolved oxygen rankings are presented in Table 81. Dissolved oxygen concentrations above the state water quality standard of 4 mg/l were assigned a rank of "1", and concentrations below 4 mg/l were assigned ranks sequentially from "2" on down. Six of the dredged holes had bottom dissolved oxygen measurements above 4 mg/l and tied for the top ranking. The Bay Point dredged hole had the lowest dissolved oxygen concentration, falling within the hypoxic range of below 2 mg/l. The MacDill AFB Beach, Skyway Causeway South, McKay Bay, and Ft. Desoto dredged holes also had relatively low bottom dissolved oxygen levels below the 4 mg/l threshold.

Table 81. Dredged Hole rankings based on fall mean bottom dissolved oxygen (mg/l).

Dredge Hole	DO Fall	Rank
Georgetown	5.57	1
Culbreath Bayou South	5.31	1
Culbreath Bayou North	4.81	1
Venetian Isles	4.66	1
Skyway Causeway North	4.22	1
MacDill AFB Docks	4.18	1
MacDill AFB Beach	3.92	2
Skyway Causeway South	3.72	3
McKay Bay	2.86	4
Ft. De Soto	2.85	5
Bay Point	1.97	6

Green = normal; Yellow = low.; Red = hypoxic

The spring bottom dissolved oxygen rankings are presented in Table 82. All of the dredged holes were above the 4 mg/l water quality standard and were all assigned a rank of "1".

Table 82. Dredged Hole rankings based on spring mean bottom dissolved oxygen (mg/l).

Dredge Hole	DO Spring	Rank
MacDill AFB Docks	7.08	1
Culbreath Bayou South	6.81	1
Venetian Isles	6.70	1
Skyway Causeway South	6.60	1
Georgetown	6.43	1
MacDill AFB Beach	6.28	1
Skyway Causeway North	5.89	1
McKay Bay	5.59	1
Ft. De Soto	4.96	1
Culbreath Bayou North	4.76	1
Bay Point	4.76	1

Green = normal; Yellow = low.; Red = hypoxic

The overall dredged hole rankings based on the average of the PEL Quotient, seasonal mean TBBI and mean bottom dissolved oxygen rankings are presented in Table 83. The Skyway Causeway North dredged hole had the top score with an average rank of 1.0. This was followed by the Venetian Isles, Skyway Causeway South and Georgetown dredged holes which had average rankings ranging from 1.2 – 1.8 and also tended to have relatively high TBBI scores and bottom dissolved oxygen levels and relatively low PEL quotients. The Culbreath Bayou North and South dredged holes had intermediate average rankings (2.0 and 2.6

respectively) and tended to have "Intermediate" to "Degraded" TBBI scores and relatively higher levels of sediment contaminants. The MacDill AFB Beach and McKay Bay dredged holes had a tied average ranking of 2.8 and tended to have relatively higher levels of sediment contaminants having the highest PEL_Q of the holes evaluated in this study and MacDill AFB Beach also exhibited "Intermediate" or "Degraded" TBBI scores. The MacDill Docks and Ft. Desoto dredged holes' low rankings (3.0 and 3.2 respectively) were characterized by "Intermediate" or "Degraded" TBBI scores. The Bay Point dredged hole ranked last overall (with an average ranking of 4.0) and generally had "Degraded" TBBI scores, low dissolved oxygen in the fall and relatively high sediment contaminants.

Table 83. Overall Dredged Hole rankings based on average for PEL_Q, TBBI and bottom D.O. ranks.

Dredge Hole	Average Rank
Skyway Causeway North	1.0
Venetian Isles	1.2
Skyway Causeway South	1.6
Georgetown	1.8
Culbreath Bayou North	2.0
Culbreath Bayou South	2.6
McKay Bay	2.8
MacDill AFB Beach	2.8
MacDill AFB Docks	3.0
Ft. De Soto	3.2
Bay Point	4.0

McKay Bay Discussion

The 2002/2003 dredged hole study identified the McKay Bay dredged hole as the most degraded of the 11 holes evaluated due to hypoxic conditions during the fall, elevated sediment metals and a degraded benthic community (Grabe et al. 2005; TBEP 2005). Prior to restoration efforts, the McKay Bay dredge hole had median depth of 2.6 meters with a maximum of 4.2 meters (Karlen 2012), compared to a historical mean depth of 1.5 meters for McKay Bay based on samples collected from 1999-2010 by EPCHC (Karlen et al. 2012). The current survey had sampling depths ranging from 0.2 – 1.5 meters within the dredged hole area and 0.5-0.6 meters at reference locations.

McKay Bay historically has had slightly low bottom dissolved oxygen levels, primarily in the deeper dredged areas, with a historical mean of 3.7 mg/l (Karlen et al. 2012). Within the dredged hole prior to its restoration, median bottom dissolved oxygen was hypoxic at 1.9 mg/l and median D.O. saturation was 30.6 %, below the 42% state water quality standard (Karlen 2012, Karlen et al. 2015). The post-restoration monitoring did show improvements in the bottom water quality with a median dissolved oxygen of 5.2 mg/l and median D.O. saturation of 77.3% (Karlen et al. 2015). This current study did indicate that bottom hypoxia is still an issue seasonally in the fall despite the shallower depths within the dredged hole footprint. This was likely due to seasonal higher water temperatures.

Prior to the restoration efforts the benthic community within the McKay Bay dredged hole was severely degraded. The first dredged hole study reported a mean species richness of <1 taxa per sample within the dredged hole with a single species, the bivalve *Dosinia discus,* accounting for 100% of the fall abundance and the spionid polychaete *Streblospio gynobranchiata* accounting for 100% of the spring abundance (Grabe et al. 2005; TBEP 2005). The pre-restoration benthic survey also only found a median species richness of 2 taxa and the community was dominated by the cirratulid polychaete *Kirkegaardia sp.* (originally identified as *Monticellina cf. dorsobranchialis*) and the amphipod *Ampelisca abdita* (Karlen 2012; Karlen et al. 2015). In contrast, the historical baseline species richness for McKay Bay had an average of 27.7 taxa (Karlen et al. 2012). The post-restoration dredged hole samples were closer to the McKay Bay historical average with a median species richness of 28 taxa and was dominated by *Ampelisca abdita*. The current study was also about the same as the historical average in the fall with a mean of 30.33 taxa and was higher in the spring with a mean of 42.67 taxa. The fall community was dominated by mollusks and a few polychaete species, while the spring was primarily dominated by crustaceans, and this may reflect seasonal recruitment patterns. The observed shift in the species richness and composition since the original study and pre-restoration period is a good indication that the past restoration efforts have been successful in restoring the benthic community within the former dredged hole area. Improvements in the TBBI scores also support this. The historical mean TBBI score for McKay Bay is 76.65 (“Intermediate”) while the pre-restoration dredged hole samples had a “Degraded” benthic habitat with a mean TBBI score of 64.5 (Karlen 2012; Karlen et al. 2012). The post-restoration benthic survey results had an “Intermediate” median TBBI of 80.4 (Karlen et al. 2015) and the current study had TBBI scores above or just below the “Healthy” range with all of the spring samples having a “Healthy” benthic community.

The sediments in McKay Bay have historically been very fine to silty sands and muds, particularly in the deeper dredged areas with an overall mean silt+clay content of 20.1% (Karlen et al. 2012). Within the dredge hole area, the sediments had a median silt+clay content of 26.0 % prior to restoration and there was no significant change in the sediment composition post-restoration with an actual increase in the median silt+clay content (38.9%) despite the fill material having a courser composition (Karlen 2012; Karlen et al. 2015). The results of this current study showed a more variable sediment composition between the seasons with siltier sediments found in the fall and more fine sands in the spring. There was a wide variability among the three dredged hole samples within each season and these results may largely be an artifact of the small sample size. Overall however, the sediments within the former dredged hole area were still finer than the surrounding shallow reference area.

Sediment contaminants were relatively high within the McKay Bay dredged hole during the original (2002/2003) study with a PEL Quotient of 0.21. Several metals were found to be above their TEL concentrations including cadmium, chromium, copper, lead and zinc as well as the chlorinated pesticide Lindane (Grabe et al. 2005; TBEP 2005). Sediment contamination was still evident in the current study with the dredged hole sediments having a PEL Quotient of 0.16 which was lower than in the original study but still relatively high compared to other dredged holes. The currently observed high PEL Quotient was attributed to a different suite of contaminants than in the original dredged hole study. The only metal that was above the TEL in the current study was lead while PAH’s and the pesticide DDT and its degradation compounds (DDD and DDE) were elevated with DDT exceeding the PEL concentration at one of the dredged hole sites. The reason for the observed shift in contaminants is not immediately clear.

Conclusions and Management Recommendations

The two Skyway Causeway dredged holes along with the Venetian Isles and Georgetown dredged holes had good water quality, no or very low levels of sediment contamination and appeared to support healthy benthic communities. It is recommended that these four holes be maintained in their current condition. The Culbreath Bayou North dredged hole had some intermediate levels of sediment contamination from PAHs but had good water quality and relatively high TBBI scores and species richness. It is recommended that this dredged hole is maintained in its current state as well.

The Culbreath Bayou South dredged hole had good water quality but had moderate levels of sediment contamination for several metals and PAH's, and had a poor benthic community particularly in the fall. This dredged hole may be a candidate for possible filling, at least in the central and northern portions of the hole that exhibited the lowest TBBI scores.

The MacDill AFB Beach dredged hole had relatively high sediment contamination for the pesticide lindane and moderate contamination for DDT and total PCB's as well as a degraded benthic community particularly in the center and right (east) sides of the hole. The MacDill AFB Docks dredged hole also had moderate levels of sediment contamination for several metals and PAHs and a degraded benthic community during the spring. Both of these holes may be considered as possible candidates for partial filling in portions of the holes that won't interfere with existing boating channels.

The Ft. De Soto dredged hole had no sediment contamination but the center area of the hole had a degraded benthic community and low dissolved oxygen in the fall. Portions of this hole may be a candidate for partial filling to a shallower depth to help improve the benthic habitat but still maintain depth for recreational fishing.

The Bay Point dredged hole ranked the lowest of the 10 dredged holes and exhibited near anoxic conditions at the center of the hole in the fall, a degraded benthic community, and moderate levels of sediment contamination for several metals and PAHs. This hole would be a good candidate for filling to the surrounding depth (approximately 0.5 – 1 meters), particularly the central and eastern sides of the hole which are away from existing boating channels.

The benthic community within the former McKay Bay dredged hole area has shown signs of recovery since the completion of the restoration activities in 2014 as reflected in the higher species richness and abundance observed in this study along with increased TBBI scores. Low bottom dissolved oxygen during the fall season and sediment contamination from PAHs and pesticides continues to be present at the dredged hole sites but hasn't appeared to negatively impact the recovery of the benthic infauna community. Periodic monitoring of the benthic community and analysis of sediment contaminants in the future would be useful for evaluating long-term recovery of this site.

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Appendix A: Dredged Hole Sample Locations and Sampling Dates

Dredged Hole	Season	Sample	Location	Date	Latitude	Longitude
Bay Point	Fall	16DH01-1	Center	15-Aug-16	27.976263	-82.579883
		16DH01-2	Left	15-Aug-16	27.976955	-82.581616
		16DH01-3	Right	15-Aug-16	27.975735	-82.578439
		16DH01-4	Reference	15-Aug-16	27.974198	-82.581445
	Spring	17DH01-5	Center	17-Apr-17	27.976414	-82.579818
		17DH01-6	Left	17-Apr-17	27.976912	-82.581424
		17DH01-7	Right	17-Apr-17	27.975664	-82.578426
		17DH01-8	Reference	17-Apr-17	27.973861	-82.581594
Culbreath Bayou North	Fall	16DH02-1	Center	15-Aug-16	27.939	-82.54435
		16DH02-2	Left	15-Aug-16	27.93765	-82.549467
		16DH02-3	Right	15-Aug-16	27.942619	-82.540397
		16DH02-4	Reference	15-Aug-16	27.93418	-82.540957
	Spring	17DH02-5	Center	17-Apr-17	27.938905	-82.54406
		17DH02-6	Left	17-Apr-17	27.937797	-82.549273
		17DH02-7	Right	17-Apr-17	27.942492	-82.54029
		17DH02-8	Reference	17-Apr-17	27.934415	-82.540642
Culbreath Bayou South	Fall	16DH03-1	Center	16-Aug-16	27.930828	-82.53841
		16DH03-2	Left	16-Aug-16	27.932532	-82.53926
		16DH03-3	Right	16-Aug-16	27.929152	-82.537015
		16DH03-4	Reference	16-Aug-16	27.929939	-82.541784
	Spring	17DH03-5	Center	21-Mar-17	27.930823	-82.537942
		17DH03-6	Left	21-Mar-17	27.932503	-82.539038
		17DH03-7	Right	21-Mar-17	27.929169	-82.536777
		17DH03-8	Reference	21-Mar-17	27.929768	-82.541702
Georgetown	Fall	16DH05-1	Center	16-Aug-16	27.901437	-82.538041
		16DH05-2	Left	16-Aug-16	27.898182	-82.538474
		16DH05-3	Right	16-Aug-16	27.904415	-82.533303
		16DH05-4	Reference	16-Aug-16	27.903712	-82.540787
	Spring	17DH05-5	Center	21-Mar-17	27.901531	-82.537783
		17DH05-6	Left	21-Mar-17	27.898399	-82.538264
		17DH05-7	Right	21-Mar-17	27.90431	-82.533199
		17DH05-8	Reference	21-Mar-17	27.903788	-82.54068

Dredged Hole	Season	Sample	Location	Date	Latitude	Longitude
MacDill AFB Docks	Fall	16DH07-1	Center	17-Aug-16	27.857161	-82.481345
		16DH07-2	Left	17-Aug-16	27.858514	-82.484111
		16DH07-3	Right	17-Aug-16	27.857289	-82.47971
		16DH07-4	Reference	17-Aug-16	27.860624	-82.481362
	Spring	17DH07-5	Center	22-Mar-17	27.85682	-82.481014
		17DH07-6	Left	22-Mar-17	27.858374	-82.483976
		17DH07-7	Right	22-Mar-17	27.857304	-82.478924
		17DH07-8	Reference	22-Mar-17	27.860379	-82.481326
MacDill AFB Beach	Fall	16DH06-1	Center	17-Aug-16	27.820825	-82.484674
		16DH06-2	Left	17-Aug-16	27.821934	-82.487641
		16DH06-3	Right	17-Aug-16	27.819744	-82.483846
		16DH06-4	Reference	17-Aug-16	27.819433	-82.487557
	Spring	17DH06-5	Center	22-Mar-17	27.820743	-82.48491
		17DH06-6	Left	22-Mar-17	27.822125	-82.487685
		17DH06-7	Right	22-Mar-17	27.819708	-82.483599
		17DH06-8	Reference	22-Mar-17	27.819561	-82.487384
Venetian Isles	Fall	16DH10-1	Center	18-Aug-16	27.812578	-82.593497
		16DH10-2	Left	18-Aug-16	27.81323	-82.595479
		16DH10-3	Right	18-Aug-16	27.812052	-82.591579
		16DH10-4	Reference	18-Aug-16	27.81043	-82.594017
	Spring	17DH10-5	Center	23-Mar-17	27.812518	-82.593426
		17DH10-6	Left	23-Mar-17	27.813301	-82.5953
		17DH10-7	Right	23-Mar-17	27.811883	-82.591379
		17DH10-8	Reference	23-Mar-17	27.810348	-82.593895
Ft. De Soto (St. Antoine Key)	Fall	16DH04-1	Center	23-Aug-16	27.622246	-82.727907
		16DH04-2	Left	23-Aug-16	27.625141	-82.729214
		16DH04-3	Right	23-Aug-16	27.623963	-82.722257
		16DH04-4	Reference	23-Aug-16	27.624816	-82.725322
	Spring	17DH04-5	Center	28-Mar-17	27.622511	-82.727766
		17DH04-6	Left	28-Mar-17	27.625114	-82.729278
		17DH04-7	Right	28-Mar-17	27.624035	-82.72182
		17DH04-8	Reference	28-Mar-17	27.624665	-82.725046

Dredged Hole	Season	Sample	Location	Date	Latitude	Longitude
Skyway Causeway North	Fall	16DH08-1	Center	22-Aug-16	27.587448	-82.603955
		16DH08-2	Left	22-Aug-16	27.587617	-82.607904
		16DH08-3	Right	22-Aug-16	27.587042	-82.599706
		16DH08-4	Reference	22-Aug-16	27.590995	-82.604097
	Spring	17DH08-5	Center	27-Mar-17	27.587516	-82.603833
		17DH08-6	Left	27-Mar-17	27.587616	-82.60785
		17DH08-7	Right	27-Mar-17	27.587133	-82.599783
		17DH08-8	Reference	27-Mar-17	27.59105	-82.603866
Skyway Causeway South	Fall	16DH09-1	Center	22-Aug-16	27.578533	-82.611588
		16DH09-2	Left	22-Aug-16	27.578055	-82.613642
		16DH09-3	Right	22-Aug-16	27.57948	-82.609792
		16DH09-4	Reference	22-Aug-16	27.580111	-82.612612
	Spring	17DH09-5	Center	27-Mar-17	27.578466	-82.611433
		17DH09-6	Left	27-Mar-17	27.578083	-82.613633
		17DH09-7	Right	27-Mar-17	27.57935	-82.610066
		17DH09-8	Reference	27-Mar-17	27.580733	-82.612616
McKay Bay	Fall	16DH11-1	Center	24-Aug-16	27.940568	-82.419349
		16DH11-2	Left	24-Aug-16	27.940042	-82.423998
		16DH11-3	Right	24-Aug-16	27.942202	-82.415133
		16DH11-4	Reference	24-Aug-16	27.937983	-82.417500
	Spring	17DH11-5	Center	10-Apr-17	27.940449	-82.419665
		17DH11-6	Left	10-Apr-17	27.940051	-82.424007
		17DH11-7	Right	10-Apr-17	27.942395	-82.415102
		17DH11-8	Reference	10-Apr-17	27.936931	-82.417401