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February 8, 2019

Mr. Isaac Brownman
Town of Longboat Key Public Works
600 General Harris Street
Longboat Key, FL 34228

Subject: Subaqueous Force Main Environmental Assessment – Final Report

Dear Mr. Brownman:

Carollo and its subconsultant (ESA) have prepared the subject report to address the feasibility of permitting the construction of a new subaqueous wastewater transmission force main across Sarasota Bay using an open cut construction method. The report outlines the results of bathymetric, seagrass, and sediment surveys and discusses permitting considerations for a new open cut pipeline.

Based on this evaluation, it is our collective opinion (Carollo and ESA) that the proposed open cut pipeline project could be permitted and constructed, if it can be shown in the alternatives analysis that it is the least environmentally damaging alternative, regardless of cost.

The next steps recommended are to complete an update to the seagrass survey in April/May 2019 and to attend additional pre-application meetings with USACE and FDEP. We look forward to continuing to work with the Town on this important project.

Sincerely,

CAROLLO ENGINEERS, INC.

Laura Baumberger

Laura Baumberger, P.E.

cc:
Mike Fleury, Carollo
Scott Richards, Carollo
Doug Robison, ESA
Julie Sullivan, ESA

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Final Report

LONGBOAT KEY SUBAQUEOUS FORCE MAIN

Environmental Assessment Report

Prepared for
Carollo Engineers and the
Town of Longboat Key

February 2019

Final Report

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Environmental Assessment Report

Section 1
Introduction

1.1 Background

This report addresses of the feasibility of permitting the construction of a new subaqueous domestic wastewater transmission force main across Sarasota Bay using an open cut construction method. As proposed by the Town of Longboat Key (Town), the new force main would be constructed parallel to an existing 20-inch force main, within the previous impact corridor, and at the same approximate depth.

The existing iron ductile force main is approximately 50 years old, and its physical integrity is expected to further degrade over time, thus making it susceptible to leaks or failure in the future. The new force main would provide redundant reliability, as well as the potential to use the old force main for return reclaimed water from the Manatee County Southwest Water Reclamation Facility (SWWRF). The alignment of the existing and proposed redundant force main is shown in **Figure 1** below.

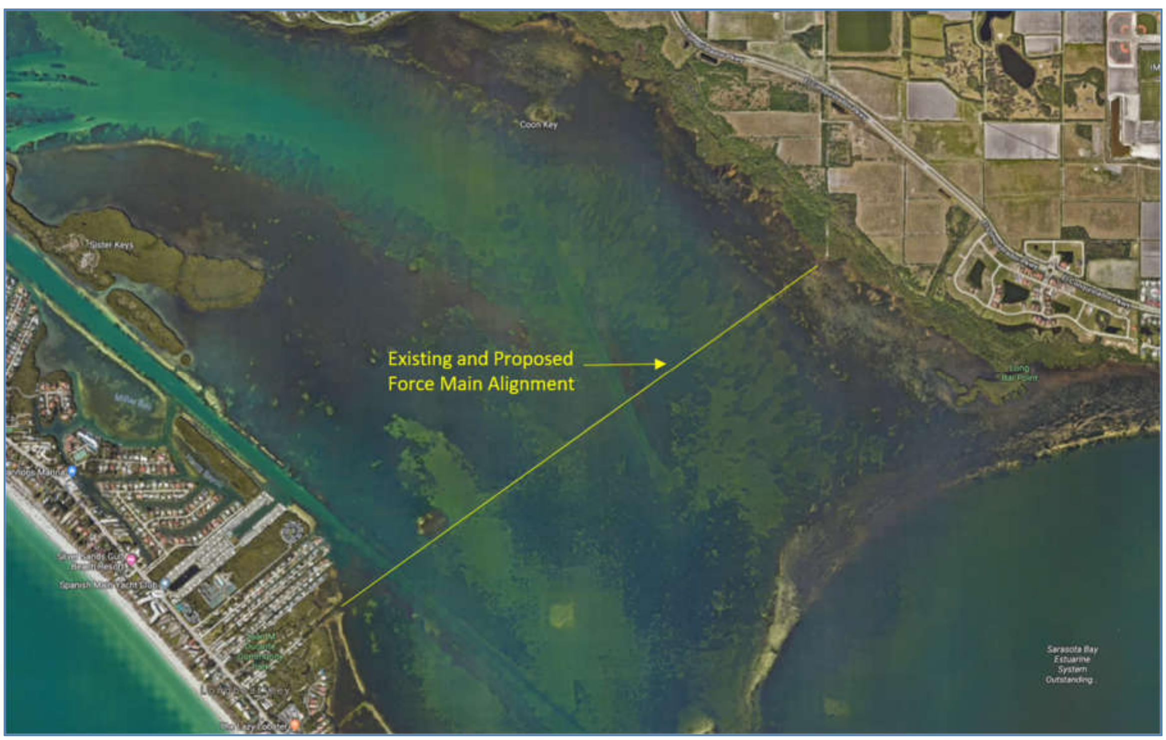

Figure 1 – Existing and Proposed Force Main Alignment

This report addresses applicable environmental regulations, impact assessment and project documentation requirements, agency coordination, and mitigation that will likely be necessary should the Town commit to project implementation. The conclusions and recommendations provided herein are based on pre-application meetings conducted with the Florida Department of Environmental Protection (FDEP) and the U.S. Army Corps of Engineers (USACE) in 2017, environmental assessment field work conducted during the summer of 2018, and experience of senior ESA staff.

1.2 Scope of Work

Under a subconsultant agreement with Carollo Engineers (Carollo), Environmental Science Associates (ESA) was retained in 2017 to initiate preliminary environmental planning and assessment work in support of the permitting of the proposed new force main.

1.2.1 Pre-Application Meetings

The first task assignment issued to ESA under the agreement was to arrange and conduct permit pre-application meetings with the key state and federal regulatory agencies. Separate pre-application meetings were conducted with the FDEP and the USACE in Tampa on March 14, 2017. At both meetings, representatives from the Town, Carollo, and ESA presented a summary of the current situation and various project alternatives, and then elicited comments from agency personnel. Detailed summaries of these meetings were previously provided to Carollo and the Town as separate deliverables.

1.2.2 Environmental Assessment Fieldwork

The second task assignment issued to ESA under agreement was to collect baseline environmental assessment information in the proposed project impact corridor, and to prepare this summary report.

Task 1 - Bathymetric Survey

A bathymetric survey and contour map was prepared for the proposed impact corridor. Survey data was developed using a single-beam Odom survey-grade fathometer linked to Hypack Survey software and referenced to the appropriate local tidal datum and benchmarks using a Trimble Real-time Kinematic Global Positioning System (RTK-GPS). The bathymetric survey was supplemented with side scan sonar and magnetometer survey data collection to locate other utilities or objects that may obstruct the proposed trench alignment. The proposed impact corridor was surveyed via boat by transecting the centerline and the two outer boundaries. The resulting data was translated into survey documents that included both spot depths as well as depth contours, referenced to the North American Vertical Datum of 1988 (NAVD 88) with a vertical resolution of 0.1 feet.

Task 2 - Seagrass Survey

Seagrass spatial polygonal data developed by the Southwest Florida Water Management District for Sarasota Bay in 2016 was integrated onto base maps of the proposed impact corridor. A rectified square meter grid comprised of $1m^2$ quadrats was prepared for the impact corridor and overlain on SWFWMD seagrass polygons. Approximately one-percent of the square meters (~500 m^2 quadrats) were randomly selected for field sampling. The randomly selected quadrats were located in the field using GPS, inspected by divers, and assessed for percent cover by seagrass species. A detailed seagrass survey and map series was developed for the entire proposed impact corridor showing seagrass density and distribution by species. This survey was utilized to calculate likely construction impacts and potential mitigation requirements.

Task 3 - Sediment Survey

Concurrent with the seagrass survey, 100 of the $1m^2$ quadrats were randomly selected for sediment sampling in the field. The randomly selected quadrats were located using GPS, and sampled using a sediment piston-core device. The piston-core was manually pushed into bottom sediments to the depth of resistance and then withdrawn. The collected sediment sample was ejected and composited in a bucket; and a 500 ml subsample was collected from the composited material, placed in a jar, and immediately delivered to Mote Marine Laboratory grain size distribution and percent organic matter analysis. From the 100 initial sediment sampling sites, 20 select sites were sampled again using the same collection methods and delivered to Mote Marine Laboratory (MML) for hydrogen sulfide (H_2S) analysis. The 20 H_2S samples were collected from the quadrats with the highest percent organic matter (quadrats with >1.75 percent volatile solids), as sulfide concentrations can reach levels that are toxic to seagrass in areas with high organic matter deposition. In addition to the laboratory analyses, a color-coded map showing the location of the sediment sampling sites and sediment characteristics within the project corridor was prepared.

Task 4 – Environmental Assessment Report

This Environmental Assessment Report was prepared to address the following objectives: 1) synthesize work products from the regulatory pre-application meetings and the environmental assessment fieldwork; 2) provide a narrative description of existing ecological conditions within the proposed impact corridor; 3) quantify potential project impacts; 4) recommend construction methods for minimizing seagrass impacts; and, 5) propose mitigation alternatives within the project area.

Section 2
Results and Discussion

This section summarizes the findings and conclusions derived from the scope of work described above.

2.1 Regulatory Pre-Application Meetings

Detailed summaries of the two regulatory pre-application meetings were previously provided to the Town and Carollo as separate deliverables under the first ESA task assignment. The following key points were derived from these deliverables.

- The project will require an Environmental Resource Permit (ERP), and FDEP will be the lead State agency in the review and processing of that permit.

- FDEP staff acknowledged that the project need was reasonably justified by the potential risks of the existing force main failure, and the safety benefits of a redundant wastewater conveyance. In addition, the potential to return reclaimed water to the Town was considered by FDEP to be another significant project benefit.

- FDEP staff stated that project alternatives to the open-cut trench will need to be presented and evaluated in the permit application, and seagrass impact avoidance and minimization will need to be demonstrated. If the project is permitted, mitigation for seagrass impacts at a 2:1 or greater ratio could be required to compensate for temporal loss and risk.

- USACE staff stated that the proposed project will require an Individual Permit (IP), but that the requirement for an Environmental Impact Statement (EIS) is unlikely, as the USACE only requires an EIS on about 1 percent of Individual Permits.

- USACE staff stated that the IP application must clearly define the project “Purpose and Need” and present an “Alternatives Analysis” including both on-site and off-site alternatives.

- The USACE will only issue a permit for the “least environmentally damaging practicable alternative” as determined through a rigorous alternatives analysis and screening process. While cost is a factor, it cannot be used as the sole deciding factor. To be eliminated, alternatives must be shown to be “not feasible” for engineering and/or environmental reasons, not just cost.

- In the alternatives analysis, the applicant must clearly demonstrate and describe why certain alternatives are to be eliminated from further consideration. The shorter subaqueous crossing alternatives, and the non-subaqueous alternatives (e.g., north and then over the Cortez Bridge) will need to be screened out based upon environmental impacts and engineering constraints first, and then cost can be considered.

- Once the preferred alternative is selected the IP application will need to demonstrate how project impacts will be avoided and minimized, before compensatory mitigation will be considered. USACE staff stated that they rarely authorize impacts to seagrass, or compensatory mitigation for seagrass impacts, because the technology to restore significant areas of seagrass has not been shown to be successful on a broad scale. However, there are many local precedents of the USACE permitting impacts and mitigation for seagrass impacts in an already impacted corridor.

- There is no marine mitigation bank within the project impact basin, therefore, actual mitigation construction will likely need to be conducted on-site or on adjacent areas owned or leased by the applicant.

- The IP application for this project will be subject to review and consultation by other federal agencies including:
    - National Marine Fisheries Service – impacts to Essential Fish Habitat (EFH);
    - U.S. Fish & Wildlife Service – impacts to listed species and their habitats;
    - U.S. Coast Guard / USACE Navigation section would review for navigational compatibility.

- In addition, the project will be subject to review under the National Historic Preservation Act (NHPA) whereby the USACE coordinates a review with the State Historic Preservation Officer (SHPO). Recent permit reviews for projects in the Sarasota Bay area have revealed significant cultural resources and antiquities in the nearshore areas (described by the USACE in the Cortez area).

- The project will be subject to a public interest evaluation and USACE staff strongly recommended that the applicant implement a public outreach program as part of the permitting process.

In summary, both regulatory agencies indicated that the proposed construction of a new force main using an open-cut trench method located immediately adjacent to the existing force main easement will present significant permitting challenges. The FDEP acknowledged that there are strong public-interest justifications for the project, including: 1) redundant wastewater conveyance in the event of a failure of the existing force main; and, 2) potential use of the existing 20-inch force main for the return of reclaimed water. Unfortunately, the USACE typically does not recognize such public-interest benefits, and will focus their review on ecological and cultural resource impacts.

In addition, both agencies acknowledged that the project impacts will occur within an already impacted corridor, and that environmental lift and mitigation opportunities may exist within the existing force main easement. However, the USACE typically will not even consider mitigation until avoidance and/or minimization of seagrass impacts have been demonstrated.

The permitting challenges presented by this project can likely be overcome through: 1) a thorough and decisive alternatives analysis; 2) a proposed construction method that minimizes seagrass impacts; 3) a comprehensive and proven mitigation strategy; 4) a well-prepared permit application with credible technical information; and, 5) close coordination with environmental agencies and stakeholders in advance of, and throughout, the permit review process.

Of the steps listed above, the most significant hurdle will likely be the alternatives analysis prepared for the USACE. This document will need to show that the proposed subaqueous crossing is not only the most cost-effective alternative, but also the least environmentally damaging alternative.

2.2 Bathymetric Survey

ESA coordinated with the marine survey firm of Morgan & Eklund, Inc. in the preparation of a topographic and bathymetric survey of project corridor. A plan set of the survey was prepared showing both spot elevations and elevation contours. The topographic and bathymetric survey plan set is provided herein as **Appendix 1**. The summary statistics for the survey include the following:

- Corridor length = 10,991 feet (2.08 miles)
- Corridor width = 1,000 feet approximate (~500 feet on both sides of the centerline)
- Survey area = 6,724,873.70 square feet (154.38 Acres)
- Total survey points = 13,150
- Maximum elevation = 3.36 feet NAVD 88 (on western terminus)
- Minimum elevation = -12.36 feet NAVD 88
- Mean elevation = -5.92 feet NAVD 88.

It should be noted that the recorded easement for the existing force main is 30 feet in width, while the bathymetric survey corridor is approximately 1,000 feet wide. Bathymetric data was collected within a much wider corridor to provide data for future design activities, including barge access and staging areas on the perimeter of project construction. The alignment of the new force main is anticipated to be within approximately 5 meters of the existing force main to minimize project impacts.

The project corridor extends 2.08 miles, from Longboat Key on the west to the eastern shoreline of Sarasota Bay to east, along an approximate ENE alignment. This alignment crosses the existing Intracoastal Waterway (ICW) on the west and the historic ICW on the east. Those channels have been dredged to an elevation of approximately -12 feet NAVD 88, and are significantly deeper than the surrounding areas. However, the depths recorded along the existing force main alignment are also greater than the surrounding area, suggesting a deficit of sediment cover following the placement of the force main, or erosion of sediments subsequent to the placement of the force main.

2.3 Seagrass Survey

ESA prepared a map series of the project corridor showing both the observed percent seagrass occurrence and the observed dominant species of seagrasses in each sampled 1m^2 quadrat. This map series is provided herein as **Appendix 2**.

It should be noted that the width and surface area of the project corridor assessed for seagrass was less than that covered by the topographic/bathymetric survey as the latter survey was developed to support design scenarios and potential staging areas. The seagrass assessment area extended 7 meters on either side of the existing pipeline along the entire corridor, or a total width of 14 meters.

The sampling methodology for quantifying seagrass cover in the seagrass assessment area involved the placement of a 1 m^2 grid pattern over the seagrass assessment area in GIS. The grid pattern included 47,023 1m^2 cells, covering an area of 11.62 acres. A total of 516 1m^2 cells were randomly selected for sampling using a stratified random sampling design. This total encompassed slightly over 1 percent of the total quadrats within the seagrass assessment area. GPS coordinates for each randomly selected cell were derived from the GIS. In the field, ESA scientists navigated to the GPS coordinates of each of the selected cells, and a 1m^2 PVC quadrat were dropped on the bottom and then visually inspected by divers. For each quadrat, the percent cover by seagrass, and the dominant species of seagrass, were recorded. The percent cover was recorded in five ranges: 0%, 1-25%, 25-50%, 50-75%, and 75-100%.

To estimate the surface area of seagrass in the seagrass assessment area, for the percent cover ranges and total seagrass (sum of all quadrats that had any seagrass), a simple ratio formula was applied:

$$\textit{Surface Area} = (\textit{Sampled } m^2 \textit{ x Total } m^2)/\textit{Total Sampled } m^2$$

The results of the seagrass survey analysis are shown in **Table 1** below. The second column shows the number of quadrats sampled, and how the total number was partitioned across the seagrass cover ranges. The third and fourth columns show the extrapolated surface areas for the entire seagrass assessment area. These results indicate that the total surface area of the entire seagrass assessment area is 11.62 acres, of which 3.92 acres have some or complete seagrass cover, and 7.70 acres have no seagrass cover.

It should be noted that the total area with seagrass (3.92 acres) does not fairly represent the potential acres of seagrass impacts associated with the proposed new force main. While the design approach has not yet been developed it is reasonable to assume that an open cut trench impact area could be limited to approximately 2 meters in width. A trench cut of 2 meters would impact about 14 percent of the seagrass assessment area (2m/14m = 0.14); therefore, the potential seagrass impact associated with a 2-meter trench cut across the entire project corridor would be approximately 0.56 acres. This total would vary depending on the exact alignment of the new pipeline cut, but impacts under 1 acre can be reasonably expected for any alignment within the seagrass assessment area.

Table 1 – Results of the Seagrass Survey

Area of Interest	Sampled 1m^2 Quadrats	Extrapolated m^2	Extrapolated Acres
Total Seagrass Assessment	516	47,023.00	11.62
Seagrass Cover = 0%	342	31,166.41	7.70
Seagrass Cover = 1-25%	33	3,007.28	0.74
Seagrass Cover = 25-50%	19	1,731.47	0.43
Seagrass Cover = 50-75%	14	1,275.82	0.32
Seagrass Cover = 75-100%	108	9,842.02	2.43
Total Area with Seagrass	174	15,856.59	3.92

The bay bottom within the seagrass assessment area is characterized by a patchy distribution of seagrass intermixed with areas of exposed sediments with no submerged aquatic vegetation. The majority of the seagrass assessment area, 7.70 acres (34%), was characterized as bare bottom with no seagrass. The next most dominant range category was dense seagrass (percent cover = 75-100%), with a total area of 2.43 acres. The most dominant species in the corridor, by far, is *Syringodium filiforme*, commonly known as manatee grass. Other observed species included *Thallassia testudinum* (turtle grass) and *Halodule wrightii* (shoal grass). These three species were observed in monotypic stands as well as composite mixtures of the various species. Generally, manatee grass is considered to be the most sensitive species with regard to physical disturbance and water quality degradation.

2.4 Sediment Survey

The patchy distribution of seagrass in the project corridor was generally known before the seagrass survey was conducted based on a cursory review of historical aerial photography of the area. In particular, the alignment of the existing force main can be clearly seen in aerial photography as a discontinuous line of non-vegetated bottom sediments. This is in contrast to immediately adjacent areas that were bare in the 1970’s but are now covered with dense seagrass.

To develop a science-based permitting and mitigation strategy for the proposed new force main, ESA thought it was critical to understand why seagrass has not fully recovered along the existing force main alignment. Two hypothesis were proposed before fieldwork was initiated: 1) seagrass recovery was limited by water depth; and, 2) seagrass recovery was limited by hostile substrate characteristics, and/or poor sediment quality. With regard to the latter, the presence of exposed rock or rubble sediments, as well as excessive organic matter deposition and associated sulfide levels, could potentially preclude seagrass recovery. The sediment survey was conducted to address these questions.

As summarized in Section 1.2.2 above, a total of 120 sediment samples were collected from randomly selected quadrats within the seagrass assessment area. The first 100 samples were analyzed for grain size distribution and percent organic matter. The 20 quadrats with the highest measured percent organic matter (quadrats with >1.75 percent volatile solids) were then subsequently sampled by ESA, and analyzed by MML for hydrogen sulfide (H_2S) concentrations. The results of these analyses, as well as a color-coded map series showing the location of the sediment sampling sites and sediment characteristics within project corridor, are herein provided in **Appendix 3**.

Other than the two dredged ICW channels, the seagrass assessment area is generally characterized by fine sands with moderate amounts of organic matter. Sediments at the bottom of the eastern ICW channel have finer grain sizes and greater percent organic matter. This is expected as deeper areas are less efficiently flushed with tidal exchange, and are thus areas of fine sediment deposition. In general, the eastern end of the corridor is characterized by slightly larger grain sizes, with sporadic rock outcrops and oyster clumps; while the western end of the corridor is characterized by finer grain sizes with little or no rock outcrops. However, there is an adequate overburden of soft unconsolidated sediments to support seagrass throughout the entire seagrass assessment area.

As expected, the measured percent organic matter (% volatile solids) is inversely correlated with grain size (% sand). This relationship is shown in **Figure 2** below.

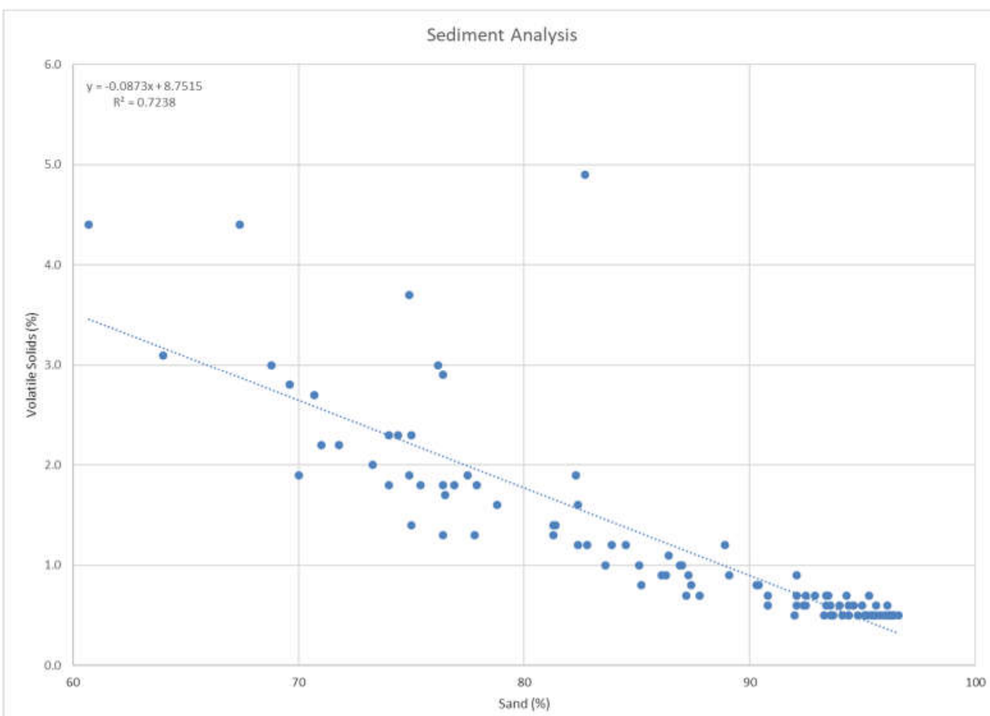

Figure 2 – Relationship Between % Volatile Solids and % Sand

Sediment samples were analyzed for H_2S because H_2S at concentrations >35 mg/l (~1mM) are potentially toxic to several seagrass species. The results of this study indicate that the highest concentration of H_2S was measured at station 525 with a value of 120 mg/l. This value wa approximately 75 mg/l higher than the next highest station (station 493). Only two other stations had H_2S concentrations greater than 35 mg/l (stations 493 and 183). There were two stations where H_2S was not detected at all (stations 466 and 216). The average H_2S sediment porewater concentration from all 20 samples was 16.71 mg/l ± 27.62 (mean ± SD).

MML opined that the higher concentrations measured at the three stations noted above may have been related to excessive organic decomposition associated with the red tide bloom that occurred in the project area for most of the summer of 2018. Nonetheless, based on a review of literature from Florida and elsewhere, MML concluded that measured H_2S porewater concentrations in the seagrass assessment area are generally well below levels that could be toxic to seagrass, or preclude seagrass recovery.

Section 3

Conclusions and Recommendations

This section presents summary conclusions and recommendations derived from the work described above.

3.1 Existing Seagrass Distribution

From a cursory review of aerial photographs of the project area dating back to the mid-1970s, is is clearly evident that seagrasses have increased substantially in both areal coverage as well as density. These findings are supported by quantitative analysis conducted by the Southwest Florida Water Management District and the Sarasota Bay National Estuary Program. However, the historical impact corridor of the existing force main is somewhat of an outlier as significant portions of this area have not recovered seagrass coverage comparable to nearby areas.

Based on the results of the environmental assessment fieldwork described above, ESA has concluded that the lack of seagrass recovery in the existing force main alignment is due solely to bathymetric elevation (e.g., water depth). No evidence was derived from the sediment survey and associated laboratory analyses that seagrass recovery was precluded by hostile substrate conditions or poor sediment quality.

Table 2 below shows a comparison of bathymetric elevation and seagrass cover. The "counts" represent the number of quadrats that were sampled within each of 12 elevation ranges. The total number of counts includes the 516 quadrats sampled within the seagrass assessment area plus an additional 21 quadrats that were assessed outside the seagrass assessment area as controls. The maximum, mean, and median values represent the percent seagrass cover in the quadrats sampled within each elevation range.

Table 2 – Comparison of Bottom Elevation and Seagrass Occurrence

	Elevations in feet (NAVD 88)											
	-12 to -11	-11 to -10	-10 to -9	-9 to -8	-8 to -7	-7 to -6	-6 to -5	-5 to -4	-4 to -3	-3 to -2	-2 to -1	-1 to 0
count	1	27	113	107	85	63	36	30	46	21	6	2
min	0	0	0	0	0	0	0	0	0	0	35	0
max	0	0	100	100	100	100	100	100	100	100	100	0
mean	0.0	0.0	12.8	17.2	21.6	33.8	43.1	59.8	54.7	45.9	74.8	0.0
median	0.0	0.0	0.0	0.0	0.0	0.0	6.0	81.0	71.5	22.0	82.0	0.0
% sites	0.2	5.0	21.0	19.9	15.8	11.7	6.7	5.6	8.6	3.9	1.1	0.4

From Table 2 it is clearly evident that seagrass occurrence is inversely related to water depth. The greatest seagrass densities occur in the elevation range of -2 to -1 feet NAVD 88. Furthermore, no seagrass occurs below -10 feet NAVD 88.

Seagrasses are flowering vascular plants that require adequate light to conduct photosynthesis to support growth and reproduction. Therefore, the distributions of seagrass occurrence and densities in the seagrass assessment area can be explained solely on the basis of elevation. As water depth increases so does light attenuation, and the point at which light becomes limiting to plant survival is referred to as the photic zone. In this portion of Sarasota Bay, the depth range most suitable for seagrass is -2 to -1 feet NAVD 88; whereas, the photic zone apparently extends to approximately -10 feet NAVD 88. Shallow water depths are clearly more conducive to seagrass growth; however, if it is too shallow seagrass cannot flourish due to periodic desiccation during extreme low tides.

It is not clear why large sections of the existing force main alignment are deeper than the surrounding area. It is possible that during construction of the existing force main some of the overburden was removed and not totally replaced once the pipe was buried. However, it more likely that the overburden replaced over the buried force main simply eroded away due to physical disturbance and “loosening” of the sediment matrix within the alignment.

3.2 Seagrass Survey Update

It is our understanding that the Town has chosen to delay the initiation of regulatory permitting until late 2019 due to funding constraints. This delay will necessitate an update to the seagrass survey, as the regulatory agencies only accept results within one year of permit application submittal. However, an update of the seagrass survey is likely to be favorable to the Town with respect to potential mitigation requirements.

During the summer of 2018 Sarasota Bay experienced a very severe and long-lasting red tide bloom. Water clarity was significantly reduced for months, and there is much anecdotal evidence that the spatial distribution and densities of seagrasses in the project area were substantially impacted. In the process of collecting sediment H_2S samples in the late summer, ESA divers went back to quadrats that had dense seagrass cover in the early summer. In the late summer many of these quadrats were found to have no seagrass or greatly reduced seagrass densities. For these reasons, ESA strongly recommends that, if the Town plans to initiate permitting in late 2019, the seagrass survey be updated as early as April 2019 to document the changed conditions in the project area, and use these changed conditions as the new baseline.

3.3 Regulatory Permitting Considerations

As discussed in Section 2.1, any impacts to seagrasses creates a significant permitting challenge in Florida. While the design approach has not yet been developed it is reasonable to assume that an open cut trench cut impact area could be limited to approximately 2 meters in width. The results of the seagrass survey indicate that the potential seagrass impact area associated with a 2-

meter trench cut across the entire project corridor would be approximately 0.56 acres. While this total impact area would vary somewhat depending on the exact alignment of the new force main cut, an impact area under 1-acre can be reasonably expected for any alignment within the seagrass assessment area. The impact area would increase linearly with any increase in the width of the trench cut.

While it is likely that the regulatory agencies will consider a 0.56-acre seagrass impact to be significant, it is not a large enough impact to be insurmountable in the regulatory permitting process. Furthermore, it should be noted that all seagrass impacts associated with the proposed project would be "temporary" impacts only. Seagrass resources will be temporarily lost during the construction of the new force main, but all affected areas will still remain jurisdictional submerged wetlands after project construction is completed, and can still support seagrass resources in the future. These temporary impacts can be contrasted with permanent impacts such as those associated with filling seagrasses to create upland development, or dredging seagrasses to construct a deep navigation channel. In both instances, the alteration results in a total loss of the resource.

The findings discussed in Section 3.1 above have ramifications to the proposed project. In the process of laying the new force main, the areas within the existing force main alignment that do not currently support seagrass because they are too deep could be raised in elevation with suitable fill material to bring them into the optimal photic range for seagrass recovery. There would be a time lag until seagrass recruited to these areas, and these areas would need to be protected from erosion. However, it is likely that the regulatory agencies would consider this approach to be an environmental lift that could result in significant mitigation "credits."

Mitigation for seagrass impacts at a 2:1 or greater ratio (e.g., 2 acres of mitigation for every 1 acre of impacts) could be required to compensate for the temporal loss of seagrass resources within the impact area, and the risk that natural seagrass recovery will not take place. With an estimated direct impact area of 0.56 acres, a mitigation ratio of 2:1 would equate to 1.12 acres. The findings of this work indicate that there are deeper areas in the immediate project area - both within the existing force main alignment and immediately adjacent areas (e.g., the abandoned ICW channel on the east end of the project corridor) – far in excess of 1.12 acres that could potentially be backfilled to provide the necessary mitigation. It is estimated that there are at least 5 acres of deep, non-vegetated bay bottom within the immediate project area that could be effectively backfilled for seagrass transplanting and/or natural recovery.

ESA recommends an enhanced construction approach whereby seagrasses are physically extracted from the trench cut impact area in advance of the impacts (e.g., ahead of the barge), and transplanted in the areas that have already been impacted (e.g., behind the barge). Seagrass "plugs" can be physically extracted using an 18-inch diameter vacuum-sealed coring device developed specifically for seagrass transplanting. This is a proven methodology that has been used on much larger projects nationwide. While it may not be feasible to relocate and transplant all seagrass within the impact zone in this manner, a significant percentage of the affected seagrass resources could be transplanted, thus protecting the impact areas from erosion and accelerating natural seagrass recovery. This approach would greatly reduce the temporary impacts of the project, and the associated mitigation requirements.

As an alternative or a supplement to the construction approach described above, there are other areas in the project vicinity that offer exceptional mitigation opportunities. The abandoned ICW channel on the east side of the project corridor has extensive deeper areas (e.g., below -10 feet NAVD 88) that could be backfilled to the optimal elevation for seagrass recovery. Backfilled areas could also be recipient sites for transplanted seagrass plugs to reduce erosion and accelerate seagrass recovery. This latter approach, as well as the backfilling of deep areas in the existing force main alignment, will require a source of clean fill material that is consistent with that in the surrounding areas. It is recommended that the Town consider coordinating its ongoing residential dredging project with the proposed force main project as the dredged material could be beneficially reused as part of the force main project mitigation approach.

In summary, it is ESA’s conclusion that the proposed project is both permitable and constructable - if it can be shown in the alternatives analysis that the proposed open-cut trench approach is the least environmentally damaging alternative, regardless of cost. Accordingly, the alternatives analysis, and coordination with USACE, will likely be the most challenging aspects of the regulatory permitting process. In addition, finding a suitable source of fill material for backfilling the new force main cut, and for other mitigation, may constitute a significant obstacle to project implementation.

APPENDICES

Appendix 1. Topographic and Bathymetric Survey Plan

Appendix 2. Seagrass Survey Map Series

Appendix 3. Sediment Sampling and Characteristic Map Series

Note: Appendices are compiled in a separate document