Coastal Habitat and Water Quality (“C-HAWQ”) Initiative Unsolicited Public-Private Partnership Proposal

To the City of Marco Island Vice Chairman and Council Members
Monday, March 17th, 2025

I. Introduction

Earthwerks Land Improvement and Development Corp. (“Earthwerks”), ENCAP, Inc. (“ENCAP”) along with the Naples Botanical Gardens, is pleased to present the Coastal Habitat and Water Quality Initiative (“C-HAWQ Initiative”) and its proposal for inshore reuse dredging of the Marco Island canals with construction of natively vegetated marshes and small islands throughout the City’s canals in the form of an unsolicited public private partnership (the “Project”). This proposal includes but is not limited to full design, permitting, grant solicitation, construction, planting, and maintenance services on behalf of Marco Island.

II. Problem

The inland waterways and canals of Marco Island are a hallmark of the small island community. The canals, extending over 100 miles in total, connect the island’s residential communities providing access to adjacent waters and Gulf of Mexico. In 2019, the waterways of Marco Island were listed as impaired by the Florida Department of Environmental Protection (“FDEP”) after exceeding allowable Nitrogen limits in both 2017 and 2018. Further, areas southeast of Marco Island have been listed as impaired for total nitrogen, total phosphorus and fecal coliform (ERD 2021, p. ES-1). Some of the activities considered a primary draw for the island community (boating, fishing and other forms of more passive, wildlife-centric recreation) are being hindered by this degradation in water quality which is likely to continue to decline in the absence of intervention.

The 2021 Marco Island Nutrient Source Evaluation Project Final Report indicated primary sources of nitrogen entering the Marco Island waterway system are derived from sediment release (61-77% of annual nitrogen loadings) and groundwater seepage (15-30% of annual nitrogen loadings) (ERD 2021, p. ES-5). The City of Marco Island has sought 4e designation from the FDEP, outlining a series of mitigation measures recommended by the 2021 report. These efforts are summarized primarily as follows:

1. Stormwater Best Management Practices (“BMPs”)
2. Reclaimed water management/ Reuse irrigation
3. Circulation improvement to canals
4. Continued water quality monitoring, and
5. Septic system management/ phase-out

These initiatives are important steps to help reduce various point and nonpoint sources of nutrient loading into Marco Island's waterways, though there are limitations to these options. Improved circulation within the canals through culvert improvements will provide significant benefits to key areas; however, even with all proposed improvements, there are some areas still left stagnant, especially within the northwest portion of the island (Winslow 2024, Figures 10-12). Further, considering nitrogen is a limiting nutrient in marine environments for algal growth (Howarth & Marino 2006), these initiatives do not address the primary source of nitrogen into the island's estuarine waterways in the form of sediments that have been building up since the canals' construction in the 1960's. In Monroe County, Florida, located 100 miles southeast of Marco Island, a 2020 study by Florida International University compared several demonstrated technologies for water quality improvements (air curtains, aerators, organic removal, culverts and backfilling) among various residential channels in the Florida Keys. Compared to controls and baseline data, backfilling and removal of organic matter provided the most immediate and drastic improvements in water quality and environmental conditions overall (Wilson et al., 2020). Considering the similarly degraded adjacent waters outside of Marco Island's jurisdiction, maintaining Marco Island's categorization as a Class II waters (Shellfish Propagation and Harvesting), will likely necessitate additional measures from those proposed in Marco's 4e plan to meet the accompanying stringent water quality standards.

The effects of deteriorating water quality are far-reaching. Empirical evidence for the reduction in water quality has been reported by residents for years, evident in the accumulation of algae, increased water turbidity, and a reduction in once prevalent wildlife observations. Boating, fishing, and other forms of passive recreation that have drawn many people to the area are dependent on the overall health of surrounding water resources. The economy in Southwest Florida is so strongly tied to water quality, that in the case of harmful algal blooms, billions of dollars of economic loss could be at stake for Collier County alone (Greene 2023).

III. Proposal - The C-HAWQ Initiative

The C-HAWQ Initiative intends to address the primary source of water quality impairment that lies within the accumulation of nutrient rich sediments along the channel bottoms. The project proposes to mechanically dredge all sediments from the bottom of the channels to achieve uniform depths and utilize the dredged sediments to construct a series of islands within the inland channels and bays. These islands would be planted with native mangrove and salt marsh species to introduce beneficial biological systems into Marco Island's waterways. Encapsulating the sediments within the island areas is intended to reduce nitrogen loading into the canal system while introducing native vegetation will provide a means to denitrification through microbial processes and to a lesser extent, uptake into plant tissues. The island structures themselves will provide substrate for bivalve establishment, providing yet another avenue of sediment and nutrient filtration in the water column.

While beneficial reuse of dredged sediment projects have been executed successfully both nationally and internationally, this project provides a unique solution in regard to layout, scale, and intent to improve water quality in the long-term. Despite being an innovative solution, a multitude of reference projects, pertinent research and water quality studies indicate that this project proposal is not only scientifically sound but represents a viable long-term solution to water quality issues (See Section X. Proposed Project Elements and Water Quality Improvements for

references). The plight of deteriorating water quality at the interface of human development and the natural environment can be addressed by reintroducing biological structure into the system.

Once established, these islands and associated oyster bed areas will be teeming with life-providing improved overall water quality as well as critical habitat for fish, birds and other wildlife that are deeply valued by the Marco Island community.

A. Creating Green-Blue Infrastructure on Marco Island

The C-HAWQ Initiative proposes to improve the impaired water quality in the canals of the City of Marco Island through the use of nature-based restoration solutions. Nature based or green-blue infrastructure solutions utilize natural ecological processes rather than solely technological, mechanical, or chemical based processes to improve water quality. Research has shown these methods to be the most effective and provide the widest variety of benefits when addressing water quality and stormwater management for the lowest overall costs (See Section X. Proposed Project Elements and Water Quality Improvements). Green-Blue infrastructure solutions are hybrid systems that provide a multitude of benefits including economic, societal, and environmental improvements around land and watercourses. These systems take a multi-disciplined approach to addressing complex and inter-related problems, often taking innovative and creative non-traditional approaches. They are deployed at different scales, most frequently where human development interacts with natural areas, waterways, and water bodies and serve to utilize ecosystem services to provide an adaptive system that benefits both human well-being and biodiversity. Green-Blue infrastructure also incorporates and focuses on sustainability as a component of design solutions, thereby creating long-lasting and resilient systems that require less long-term maintenance efforts and costs than traditional infrastructure solutions. This philosophy is a cornerstone of the C-HAWQ Initiative's proposal for addressing water quality and habitat issues in the canals of Marco Island and inspired the effort to secure Naples Botanical Garden as the C-HAWQ Initiative's horticultural consultant.

The C-HAWQ Initiative proposes to address two of the most significant factors contributing to water quality impairment in the canals, the dredging of nutrient rich sediments and sands from the bottom of the canals, and the introduction of habitat and structure for mangrove islands with native vegetation. The dredging and removal of these sediments was the primary recommended solution for the water quality issues in the canals but was deemed infeasible at that time due to high costs (ERD 2021, Table 7-18). The C-HAWQ Initiative proposes to drastically reduce these costs, by dredging this material through the use of mechanical rather than hydraulic methods and placing the sand and sediment into contained habitat islands that can be vegetated with native mangroves, salt marsh grasses, and other native plants. Dredging of sediments from the canals removes a significant source of nutrients from the canal bottoms, while beneficial reuse of the sediment and sand to create habitat islands eliminates exorbitant disposal and trucking costs. In turn these man-made, naturalized islands will offer a mechanism for long-term water quality improvements by introducing biological processes into the canals, providing additional nutrient reduction and water filtration (Brix 1997, Cheng & White 2022, Comer-Warner et al. 2022, Jitthaisong et al. 2012, Lam et al. 2023, Reef et al. 2010).

IV. Contract Structure and Financials

A. Qualification of Project

The Project qualifies under the P3 Statute in several categories because it is infrastructure that will be used by the public at large and because it is related infrastructure for surface water management.

For reference, “Qualifying project” means:

> 1. A facility or project that serves a public purpose, including, but not limited to, any ferry or mass transit facility, vehicle parking facility, airport or seaport facility, rail facility or project, fuel supply facility, oil or gas pipeline, medical or nursing care facility, recreational facility, sporting or cultural facility, or educational facility or other building or facility that is used or will be used by a public educational institution, or any other public facility or infrastructure that is used or will be used by the public at large or in support of an accepted public purpose or activity;
>
> 2. An improvement, including equipment, of a building that will be principally used by a public entity or the public at large or that supports a service delivery system in the public sector;
>
> 3. A water, wastewater, or surface water management facility or other related infrastructure; or
>
> 4. Notwithstanding any provision of this section, for projects that involve a facility owned or operated by the governing board of a county, district, or municipal hospital or health care system, or projects that involve a facility owned or operated by a municipal electric utility, only those projects that the governing board designates as qualifying projects pursuant to this section.

B. Public Interest Determination

Pursuant to Florida law, the City may proceed with this unsolicited proposal without a public bidding process provided the CIty holds a duly noticed public meeting at which the proposal is presented and affected public entities and members of the public are able to provide comment and, at a second duly noticed public meeting, determines that the proposal is in the public’s interest. § 255.065(3)(c), Fla. Stat.

In making the public interest determination, the responsible public entity must consider all of the following factors:

1. **The benefits to the public.**

In addition to the direct environmental benefit to the waterways of the City and the surrounding wildlands and state and federal park land, as detailed in the City’s to date, because the proposal includes not just the project, but funding, and permitting work, the proposal has many benefits to the public because it allows the project to be vetted and funding pursued without financial risk to the City. This avoids a common scenario in which a project is designed, but then cannot be built.

2. **The financial structure of and the economic efficiencies achieved by the proposal.**

There are significant economic efficiencies resulting from the financial structure stemming primarily from the fact that Earthwerks proposes to take risk to obtain permitting and partial funding. Additionally, contractor-led projects benefit from direct procurement of necessary subcontractors.

3. The qualifications and experience of the private entity that submitted the proposal and such entity's ability to perform the project.

The Project involves an in-shore dredging approach combined with a habitat creation element that both Earthwerks and ENCAP are uniquely experienced in.

4. The project's compatibility with regional infrastructure plans.

The project is directly compatible with the existing canal system.

5. Public comments submitted at the meeting. The responsible public entity must provide a statement that explains why the proposal should proceed and addresses such comments.

To be determined.

This proposal requests the City proceed pursuant to the above.

C. Overall Financial and Contractual Approach

It is proposed Earthwerks Land Development ("Earthwerks") and the City will enter into a comprehensive agreement establishing a public private partnership pursuant to section 255.065, Florida Statutes, that addresses the following structure:

1. Contractor Led Process and Overall Structure:
    a. **Pre-Development Activities**: Earthwerks will undertake the Pre-Development Activities, including applying for grants for Pre-Development Activities, applying for permits, and applying for funding in a commercially reasonable manner, and the City will cooperate and provide input and support.
    b. **Project**: Earthwerks will undertake the Project as defined in the Comprehensive Agreement in a commercially reasonable manner, and the City will cooperate and provide input and support.
    c. Post-Project: Earthwerks will undertake the Post-Project Activities, as defined in the Comprehensive Agreement, in a commercially reasonable manner, and the City will cooperate and provide input and support.
    d. **Selection of Third Parties**: Earthwerks shall be fully responsible for the selection, coordination, and contractual engagement of the Design Professionals, general contractors, vendors, suppliers and other professional consultants involved in the conduct of the Pre-Development Activities, the Project, and the Post-Project Activities.
    e. **Funding**: Earthwerks will, on behalf of the City, directly coordinate with State, Federal, and other relevant organizations, in the sole discretion of Earthwerks, to secure capital sufficient to fund all aspects of this

proposal including Pre-Development Activities up to the agreed-upon match amount (the Match Point defined herein). This will include but is not limited to grant preparation, drafting, submission with the assistance and authorizations of City staff, and required ongoing documentation and progress reports.

f. **Contact:** A single point of contact shall be established for both Earthwerks and the City.

2. Financial Structure:
    a. **At Risk Costs**: Earthwerks will at its own cost and risk design, permit, and obtain funding for the Qualifying Project (the "Pre-Development Activities").
    b. **Agreed Upon Match and Project Start**: The City, provided Earthwerks is able to obtain an agreed upon amount (agreed upon in the Comprehensive Agreement) (the "Match Point") in funding from grants, donations, and appropriations, will budget for and provide the balance of the funding and execute a Notice to Proceed which will initiate the Contract Progress Payments, which will include the Project Costs ("Total Costs").
        i. Earthwerks will pursue the entire Project Amount in funding from outside sources regardless of the Match Point
    c. **Pre-Development Activity Payments**: If any grants are obtained for Pre-Development Activities, those monies shall be paid for the work when the work is done and shall be in addition to the Total Costs.
    d. **Project Costs Payment**: The Project Costs shall be paid in a percentage basis with an agreed upon mobilization payment up front at Notice of Commencement, then on a percentage of completion basis from the Projected Budget starting at Notice to Commencement and based on the linear feet completed out of the total linear feet, less 1% retention due upon final completion.
        i. For purposes of calculating percentage of completion of the Project, the total linear feet of canals shall be used. Currently, that number is assumed to be 368,250 [linear feet], subject to final surveying.
    e. **Performance Bond**: Consistent with Florida law, Earthwerks shall post a performance bond prior to commencing the work.
    f. **Not-to-Exceed Total Costs:** The Total Costs shall not exceed a total principal amount of $60,000,000 (the "Projected Budget").

3. Principles Guiding the Project:
    a. Pre-Notice of Commencement:
        i. Design (see V.A. below),
        ii. Permitting and Property Rights Authorization (see V.B. below),
        iii. funding work (see V.C. below)
    b. The Project adheres to the vision and all other material provisions as set forth in this Proposal.
        i. Including surveying, construction
        ii. No impeding navigation (See Exhibit D)
        iii. No dredging within Riparian Envelopes

iv. Estimated project time from Notice to Proceed: 2 years for island completion, 1 year for island vegetation

c. Post-Final Completion:

i. Maintenance and Monitor: Earthwerks will provide 3-year maintenance and monitoring with a maintenance bond.

ii. The islands will be designed to qualify for sale of Carbon Credits, see below, to provide revenue to pay for any maintenance after the Maintenance and Monitor Period.

4. Notes on Carbon Credits

Earthwerks will use dredged sediment to build mangrove islands, so the Project could actively contribute to carbon sequestration. Mangrove ecosystems are known for their ability to absorb significant amounts of carbon dioxide from the atmosphere, thus providing a potential source of carbon credits that can be sold in the voluntary carbon market by the City, at the City's option.

To effectively integrate carbon credits into the project, baseline surveys on carbon stocks must be conducted at the Project's inception. These surveys will establish the initial carbon sequestration levels in the area and assess the carbon potential of the mangrove restoration. This data will form the foundation for calculating the expected carbon credits that can be generated over time that the City could use should it decide to pursue the sale of Carbon Credits.

Following the baseline surveys, regular, ongoing carbon monitoring and verification surveys will be required to track the growth of the mangroves and the continued sequestration of carbon. These surveys will need to be conducted by the City at regular intervals, typically annually or biennially, to ensure that carbon credits are issued in accordance with established carbon standards. Accurate reporting and third-party verification will be essential to maintain compliance with carbon credit programs, ensuring that the project can generate and sell carbon credits as a sustainable revenue stream throughout the project's lifespan and beyond.

V. Project Components & Phases

The Project consists of the following:

A. Design

Earthwerks will plan and model the demonstrated proposed topography of islands including location and size and provide a planting plan. Determination of these requirements are essential for permitting and to facilitate GPS-guided machines during construction to leverage state-of-the-art accuracy.

The proposal is intended to facilitate the City's decision on areas where habitat "islands" will be created by providing informed options using necessary survey data and public feedback collected.

B. Permitting and Authorization

Earthwerks will directly coordinate with permitting authorities and/or agencies to provide the necessary documentation and forms required. Anticipated agencies and general permitting takeaways are summarized below.

1. Federal Permitting: USACE – Section 401 and 404 Permits Application Process

a. The U.S. Army Corps of Engineers (USACE) is currently the only entity in the State of Florida with authority to issue permits under Section 404 of the Clean Water Act. Applications are received online through the Regulatory Request System (RRS).

b. Endangered Species Act Section 7 Consultation Information – U.S. Fish and Wildlife Service (USFWS). Consultation and coordination with the USFWS will be conducted during the permitting phase of this project.

   i. Florida Bonneted Bat – likely no issues
   ii. Florida Panther – likely no issues
   iii. Puma – likely no issues
   iv. Tricolored Bat – likely no issues
   v. West Indian Manatee – will need further consultation, and maybe additional consultation with the Marine Mammal Protection Act, Florida Fish and Wildlife Conservation Commission (FWC), and Florida Manatee Sanctuary Act
   vi. Crested Caracara – likely no issues
   vii. Eastern Black Rail – may need further consultation due to its habitat being primarily salt, brackish, and freshwater marshes
   viii. Everglade Snail Kite – likely no issues
   ix. Piping Plover – will need further consultation as Marco Island contains critical habitat for this bird species.
   x. Rufa Red Knot – will need further consultation as Marco Island contains critical habitat for this bird species.
   xi. American Alligator – may not be an issue
   xii. American Crocodile – may not be an issue
   xiii. Eastern Indigo Snake – likely no issues
   xiv. Green Sea Turtle – likely no issues. Important feeding areas in Florida include the Indian River Lagoon, the Florida Keys, Florida Bay, the Dry Tortugas, Homosassa, Crystal River, Cedar Key, and St. Joseph Bay.
   xv. Loggerhead Sea Turtle – likely no issues
   xvi. Gulf Sturgeon – likely no issues
   xvii. Miami Blue Butterfly – likely no issues
   xviii. Florida Prairie Clover – likely no issues
   xix. Garber's Spurge – likely no issues

c. National Historic Preservation Act – Section 106: likely not an issue but will need a discussion with the USACE to ensure there are no historic properties or artifacts in the canals.

d. National Marine Fisheries Service – may need coordination with this office as well.

2. State Permitting and Authorizations
    a. FDEP
        i. Earthwerks has had introductory pre-application meetings with the Florida DEP regarding permitting for the project on a state level in which the DEP personnel have been supportive and have helped outline the path to secure permits for the Project.
        ii. The Submerged Lands Environmental Resource Coordination ("SLERC") regulates activities involving the alteration of surface water flows. This includes new activities in uplands that generate stormwater runoff from upland construction, as well as dredging and filling in wetlands and other surface waters. Environmental Resource Permit applications are processed by either the department or one of the state's water management districts, in accordance with the division of responsibilities specified in operating agreements between the department and the water management districts. The SLERC Program is in effect throughout the state.
        iii. Projects over submerged lands include those waterward of the mean high water line or ordinary high water line such as docks, marinas, piers, boat ramps and some shoreline stabilization projects. Most navigable waters in Florida are state-owned submerged lands. Some land beneath navigable waters have been deeded to others, and some have been artificially created and are not State-owned. FDEP will request a title determination from the Division of State Lands upon receiving a request for an environmental resource permit or exemption verification, if required. Work on state-owned submerged lands requires additional authorizations.
    b. South Florida Water Management District
        i. In Collier County, the authority of the FDEP for stormwater management regulation and permitting is delegated to the South Florida Water Management District ("SFWMD").
        ii. In general, SFWMD reviews, approves, inspects and permits projects over 40 acres, County-owned projects, or projects impacting wetlands.
        iii. As no upland work is proposed by the project, it is not expected that formal approval under this agency will be required, though consultation is likely.
3. Marco Island
    a. A development approval addressing various approvals including:
        i. Section 18-143, Code of Ordinances: Prior to submission of any permit application, the applicant must survey 100 percent of the affected property for the most commonly found listed species on Marco Island: the Burrowing Owl (*Athene cunicularia floridana*), the Gopher Tortoise (*Gopherus polyphemus*), American Osprey (*Pandion haliaetus*), beach-nesting and migratory coastal bird species, including American Oystercatcher (*Haemotapus palliates*), Black Skimmer (*Rynchops niger*), Least Tern (*Sternula*

antillarum), Piping Plover (*Charadrius melodus*), Red Knot (*Calidris canutus rufa*), Snowy Plover (*Charadrius nirosus*), Reddish Egret (*Egretta rufescens*), Roseate Spoonbill (*Platalea ajaja*), Tricolored Heron (*Egretta tricolor*), and Little Blue Heron (*Egretta caerulea*), and Bald Eagle (*Haliaeetus leucocephalus*). If a listed species is on the property, the appropriate state and/or federal agency will be contacted for management guidelines, and compliance with all agency permits and protections is required.

ii. A development approval addressing section 26-97, Code of Ordinance:

a. General requirements for other development. All development, including man made changes to improved or unimproved real estate for which specific provisions are not specified in this ordinance or the Florida Building Code, shall:

1. Be located and constructed to minimize flood damage;
2. Reserved;
3. Be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design flood;
4. Be constructed of flood damage-resistant materials; and
5. Have mechanical, plumbing, and electrical systems above the design flood elevation or meet the requirements of ASCE 24, whichever is greater, except that minimum electric service required to address life safety and electric code requirements is permitted below the design flood elevation provided it conforms to the provisions of the electrical part of building code for wet locations.

4. Authorizations

a. For islands not located on sovereignty submerged lands (for which authorization will be sought as stated above), the islands will be located in canals that have been dedicated to the public through the various plats on Marco Island. Dedicated canals are treated as rights of way. *Travis Co. v. Coral Gables*, 153 So. 2d 750, 751-52 (Fla. 3d DCA 1963). Provided the islands do not block navigation or unreasonably block water flow, the City may authorize the construction of islands. *Lamb v. Dade Cty.*, 159 So. 2d 477, 478 (Fla. 3d DCA 1964). This is the same concept as landscaped medians which are impassable objects within dedicated public rights of way, but that do not completely obstruct the right of way.

C. Funding

Earthwerks has already retained David Childs and the Vogel Group, a renowned state and federal lobbying team, to assist in developing a strategy to obtain funding to meet and exceed the Match Point.

D. Environmental Baseline Conditions Survey

A wealth of information is currently available regarding the water quality of Marco Island's canals and adjacent waterways through regular water quality testing and various studies performed in the past. These studies will be referenced and utilized along with several publicly available databases to create a comprehensive picture of the targeted work areas.

As part of the planning, permitting and design process, the C-HAWQ team will conduct a series of surveys and initial assessments to build on this existing data. The surveys will help establish baseline conditions for the proposed project areas and better model proposed conditions of the finalized project plans. Anticipated surveys and analyses include but are not limited to:

- Sediment sampling within the canals for nutrient composition and construction suitability
- Water quality and sediment sampling near adjacent mangrove islands for comparative analysis
- Assessment of habitat suitability and/or presence of any Federally listed species, state-listed species, and species of concern within the Marco Island Municipal Code
- Floristic inventory of existing island areas and proposed work locations

E. As Constructed Surveying

Earthwerks will accurately establish existing topography and limits as necessary for permitting prior to construction. Data will be localized horizontally to current State Plane Coordinate System for Florida's East projection, as computed from current National Geodetic Survey data. Project Localization will reference no fewer than four horizontal Monuments. Vertical localization will be localized to the latest North American Vertical Datum, 1988. Project Localization will reference no fewer than four vertical NAVD88 monuments. Earthwerks staff are well trained and licensed with these systems and implement them daily.

During the construction operation excavation machinery will be integrated with the industry standard GPS equipment. Precise horizontal and vertical data will be collected with each pass the machinery takes during excavation and final grading of deposited materials. This As-Built data will be collected, stored, processed, and sorted into a CAD file showing the precise depth and volume of materials excavated and deposited. This will ensure accuracy and accountability for the tracking of construction progress.

F. Construction

1. Canal Dredging Specifications

Earthwerks will provide all necessary equipment, labor, and materials for the inshore dredging of the canals and identified, authorized waterways. Every canal

will be sampled and assessed and our findings will direct the design of the canal dredging to one of four conditions:

1. Existing canal requires little to no excavation: canals exhibiting this condition will receive up to one (1) vertical foot of excavation; the minimum channel depth for navigability will be achieved and sediments will be eliminated, maximizing benefit without necessitating further excavation;
2. Existing canal requires minimal excavation: canals exhibiting this condition will receive a minimum of one (1) vertical foot of excavation;
3. Existing canal exhibits a greater quantity of impacted sediment: the depth of excavation in these canals will match the depth of impacted sediment; or
4. Existing canal found to be shallow: excavate to restore a minimum water depth as agreed to with the City in the Comprehensive Agreement.

When determining canal conditions, industry BMPs will be followed to contain and minimize turbidity resulting from construction activities. For example, utilizing turbidity curtains to contain in-the-wet work zones.

Initial and ensuing operations (excavation and island structure) will require heavy construction equipment. Those operations will be completed using:

- Three (3) *Case* 210 long-reach excavators mounted on REMU big float E 22 undercarriages
    - Two (2) of these floating excavators will load and unload barges to transport dredged materials
    - The third excavator will place boulders and manage the installation of the sheet piling to create the island structure
- One (1) *Case* 240 long reach excavator on shore to load materials (boulders, sheet piling, plants, etc.) onto barges for the island and habitat creation operations
- Five (5) self-propelled work barges, each with a work deck of 12 feet by 40 feet, and capable of carrying 20-ton payloads
- One (1) sheet pile barge backed by two (2) work boats

2. Island Building Specifications

Earthwerks will provide all necessary equipment, labor, and materials for the island creation which primarily consists of transporting and depositing sand collected from each canal to be used for creating and shaping island areas.The City will have final approval on each island's location and size provided that sufficient locations are available to complete the project successfully as designed. Proposed locations will be thoughtfully selected based on specific criteria, which will be a part of the comprehensive agreement:

a. Areas will not impede the navigability of the canals
b. Specifically, minimum area of navigability will be preserved all around the islands

- All islands will be constructed in a body of water at least one hundred (100) feet wide.
- All islands will leave a body of water at least twenty five (25) feet wide on both sides of the island
    i. Nearly all proposed islands maintain 50'-100' of canal on all sides
- Water surrounding islands will meet or exceed the minimum depth selected for canal dredging
- Island depths will vary, depending on the locations selected. The shallowest locations are currently partially emergent, and the deepest areas will be approaching 25 feet of water

c. Spoils will be transported to each island strategically, minimizing transportation distance. The typical loads will be transported less than 1,000 feet. The longest transportation routes could be up to 1.5 miles, but those loads will be minimized.

The perimeter of each island will be defined and contained using vinyl or plastic sheet piling walls, which are further reinforced using limestone boulders. The sheet piling, limestone, and sand will unite to create the foundational island structure. The structure of each island will incorporate drainage layers to handle tidal loads.

This operation is distinct from the excavation but will occur entirely in tandem with the initial operation. Excavated materials will not be stockpiled. The material will be deposited on the islands immediately.

The same industry BMPs will be followed until the excavated materials are stabilized and resilient:

- **Long Term** - referencing *Best Management Practices for South Florida Urban Stormwater Management Systems Manual* - the project solution will function as a combination of Structural Retention Systems. Suspended Sediments, Total Phosphorus, Total Nitrogen, Heavy Metals, Oxygen Demanding Substances, Trace Metals and Bacteria will all be targeted as tides wash the canal waters through the deposited sand and rock, filtering and capturing the pollutants. Biological uptake through aquatic and mollusk growth will actively convert and deplete the captured pollutants naturally, limiting human labor input especially in comparison to mechanical or manmade chemical systems. The island structure will combine elements from structural BMPs including Exfiltration Trenches, Vegetated Filter Strips, Grassed Swales, Wet Detention Ponds, and Constructed Wetlands.

- **Short Term -** during construction activities, pollutants will be physically contained using sediment curtains. These isolating and containing structures separate the work area from the surrounding waterway to minimize spreading of contaminants / pollutants disturbed as equipment digs and deposits materials in the waterways. Implementing this BMP will 'corral' the excavation equipment entirely, around all sides. This

physically separates and isolates the work area from the surrounding clean water.

3. Island Vegetation Specifications

Earthwerks will provide all necessary equipment, labor, and materials to establish habitat refuges on the islands. The manmade structure will mimic natural areas accelerating the growth of bivalve mollusks, benthic macroinvertebrates, and ultimately generating oyster reef structure.

Native grasses, forbs, rushes, shrubs, and trees will be grown and procured to provide sufficient vegetative materials to stabilize the constructed islands and sediments and provide long-term native sustainable habitat in the professional judgment of the C-HAWQ Initiative. Native vegetation will be installed appropriately on each island based on best established restoration methods and for habitat regimes designed based on the construction of each island.

Earthwerks will provide ongoing monitoring and maintenance of the native ecosystems generated for three years from initial planting to ensure mature establishment. Monitoring activities will include surveys of the island for structural stability, successful native species establishment, habitat structure for target species, and observation of desired native aquatic and terrestrial species utilizing the islands. Maintenance activities include the removal of invasive, adventive, and non-native herbaceous species and replanting of areas as may be necessary to ensure a sustainable habitat.

The above (habitat establishment including planting, maintenance, and monitoring) will require labor and light construction equipment. Those operations will be completed using:

- One small self-propelled work barge with a work deck of 12 feet by 25 feet for the transportation of materials to and from newly created islands.
- Vessels and associated crew transporting technical specialist labor to and from newly created islands.
    - During the initial establishment period, more frequent trips will be required to each island.
    - As the habitats establish themselves naturally, and with assistance from specialist crews, frequency of visits will taper off.

VI. Supporting Exhibits

Exhibit A - Island Construction Engineering Typical Section

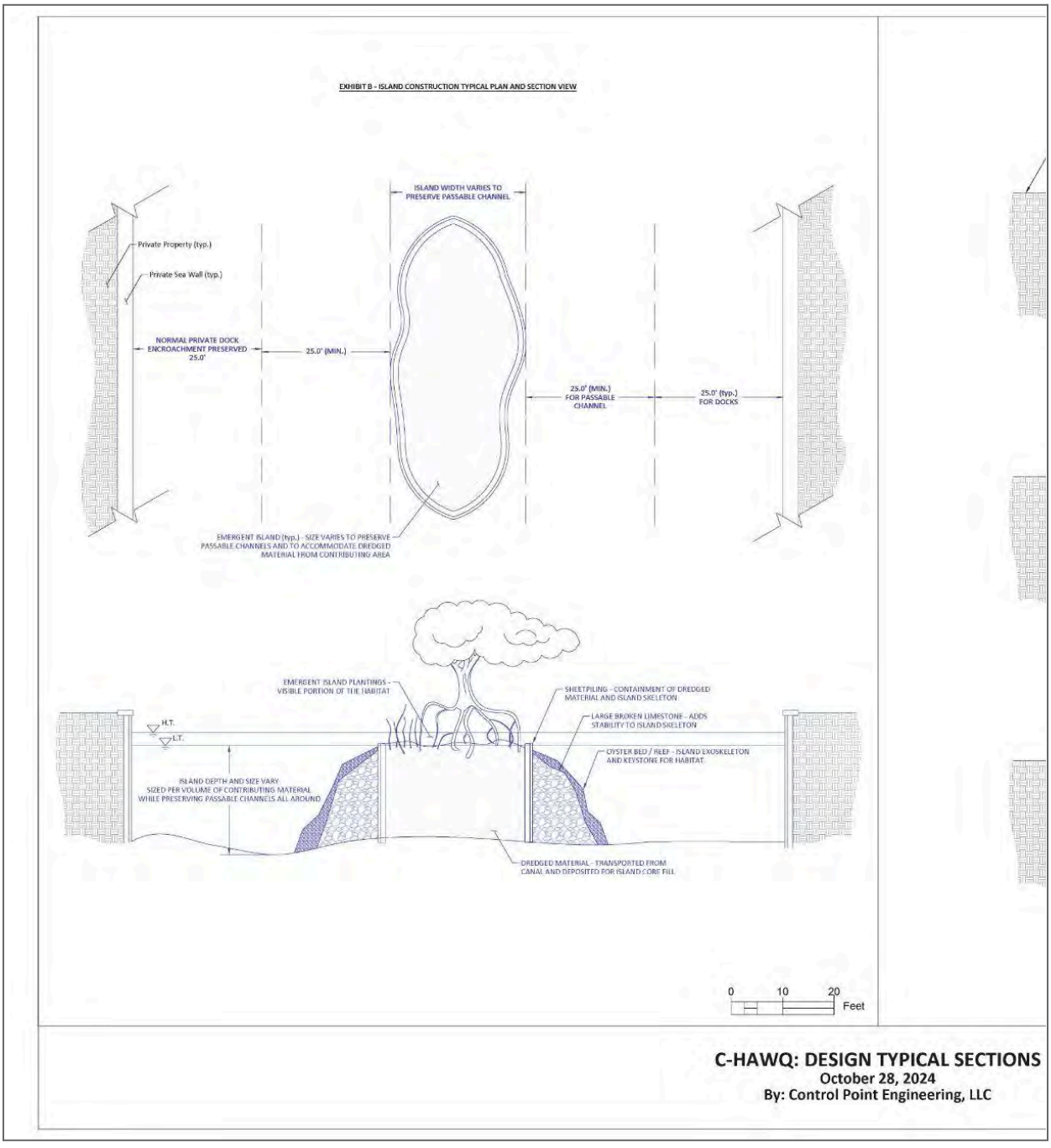


Exhibit B – Canal Dredging Engineering Typical Section

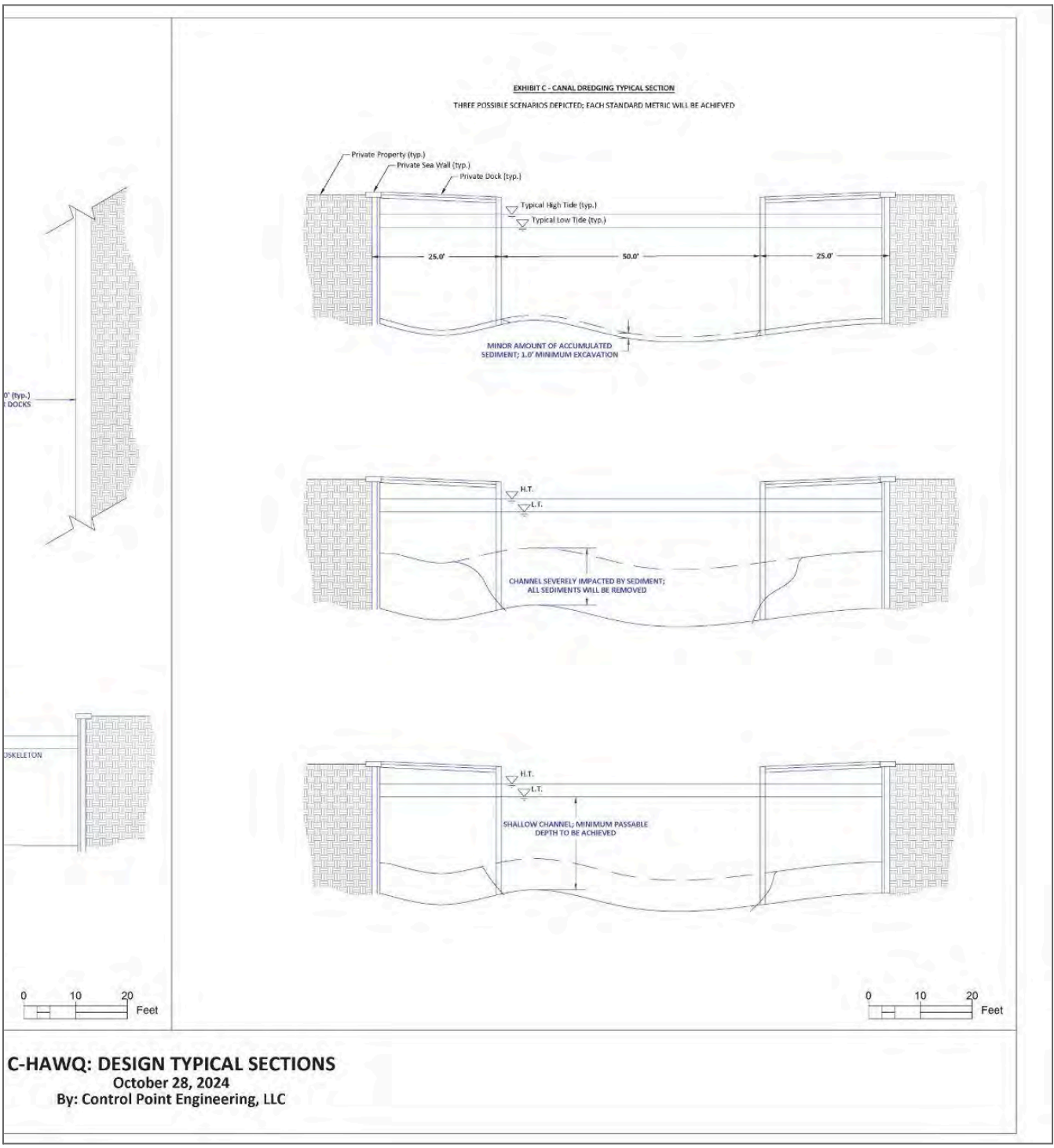
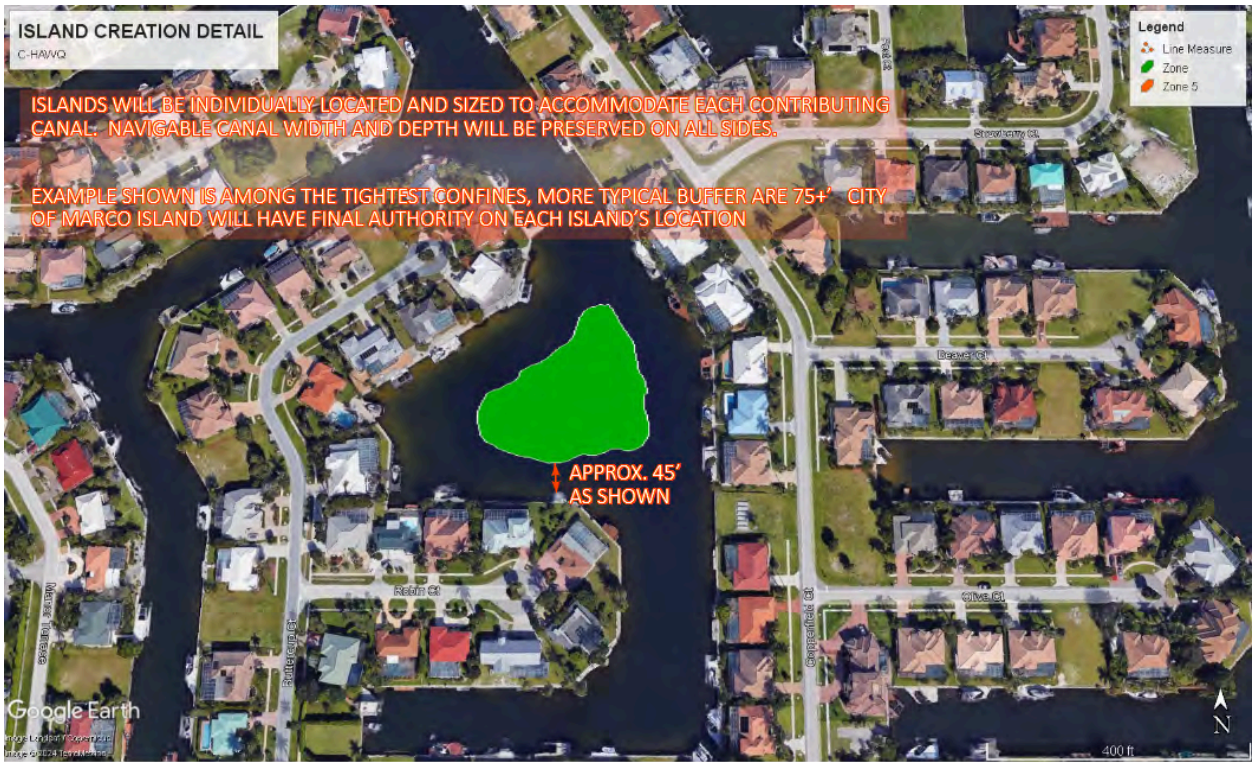
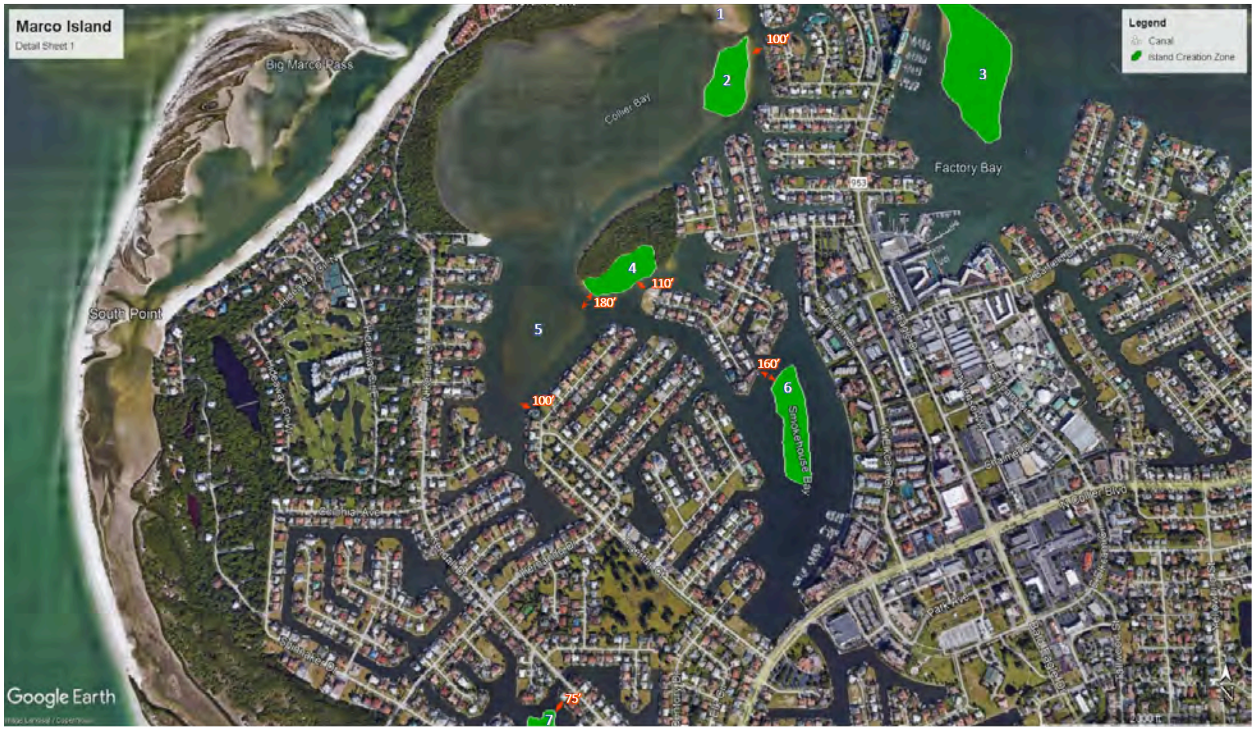
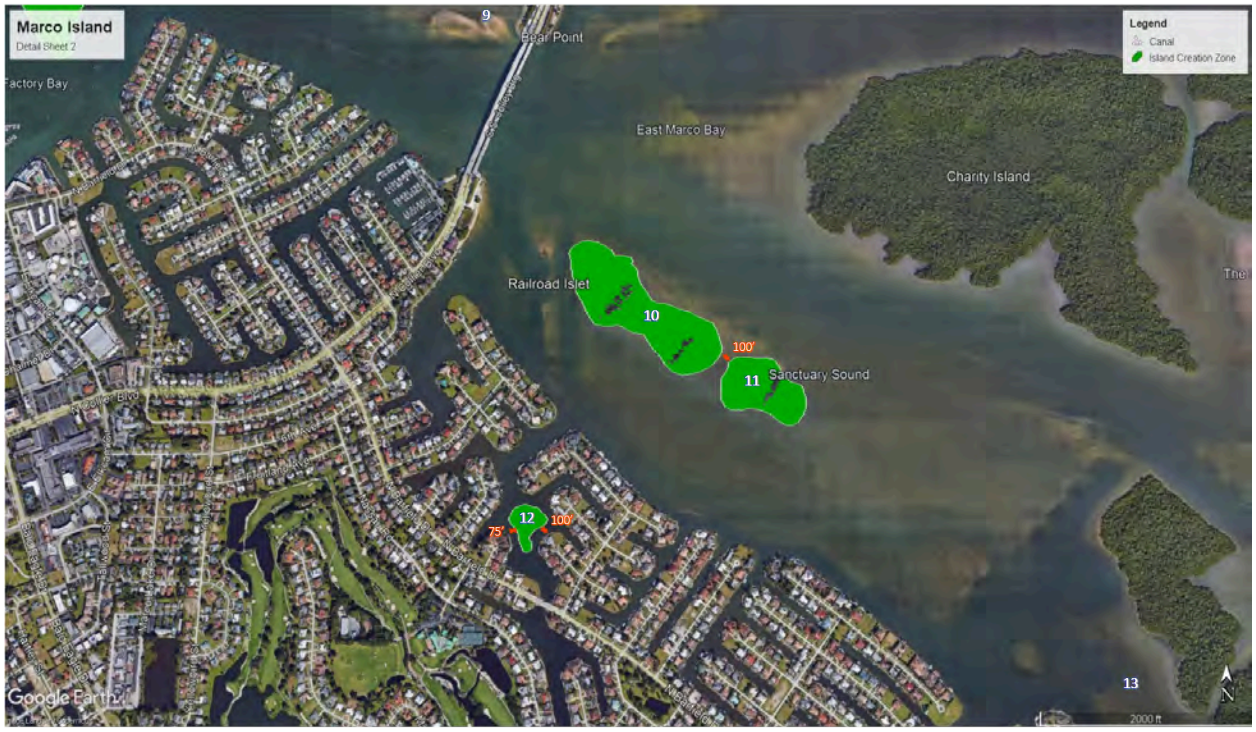


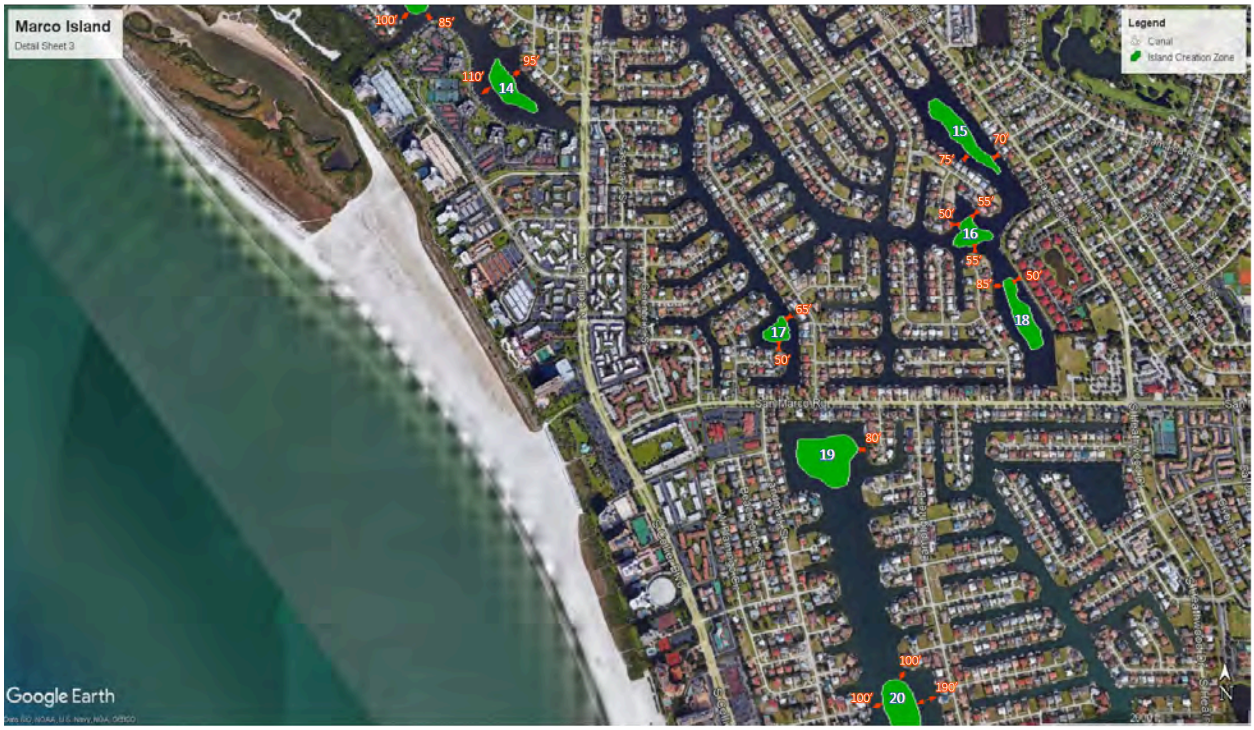
Exhibit C – Preliminary Plans

Draft plans detailing possible locations and shapes of habitat islands. These potential locations primarily focus on areas either currently un-navigable or easily navigated around, as demonstrated in the Island Creation Detail.




Marco Island
Detail Sheet 1
Legend
Canal
Island Creation Zone
Big Marco Pass
Collier Bay
Factory Bay
South Point
1
2
3
4
5
6
7
100'
110'
180'
160'
100'
75'
Google Earth


Marco Island
Detail Sheet 2
Legend
Canal
Island Creation Zone
9
Bear Point
Factory Bay
East Marco Bay
Charity Island
Railroad Islet
10
11
Sanctuary Sound
12
13
100'
75'
100'
Google Earth
2000 ft


Marco Island
Detail Sheet 3
Legend
Canal
Island Creation Zone
100'
85'
110'
95'
14
15
70'
75'
50'
55'
16
55'
85'
50'
18
65'
17
50'
80'
19
100'
100'
190'
20
San Marco Rd
Google Earth

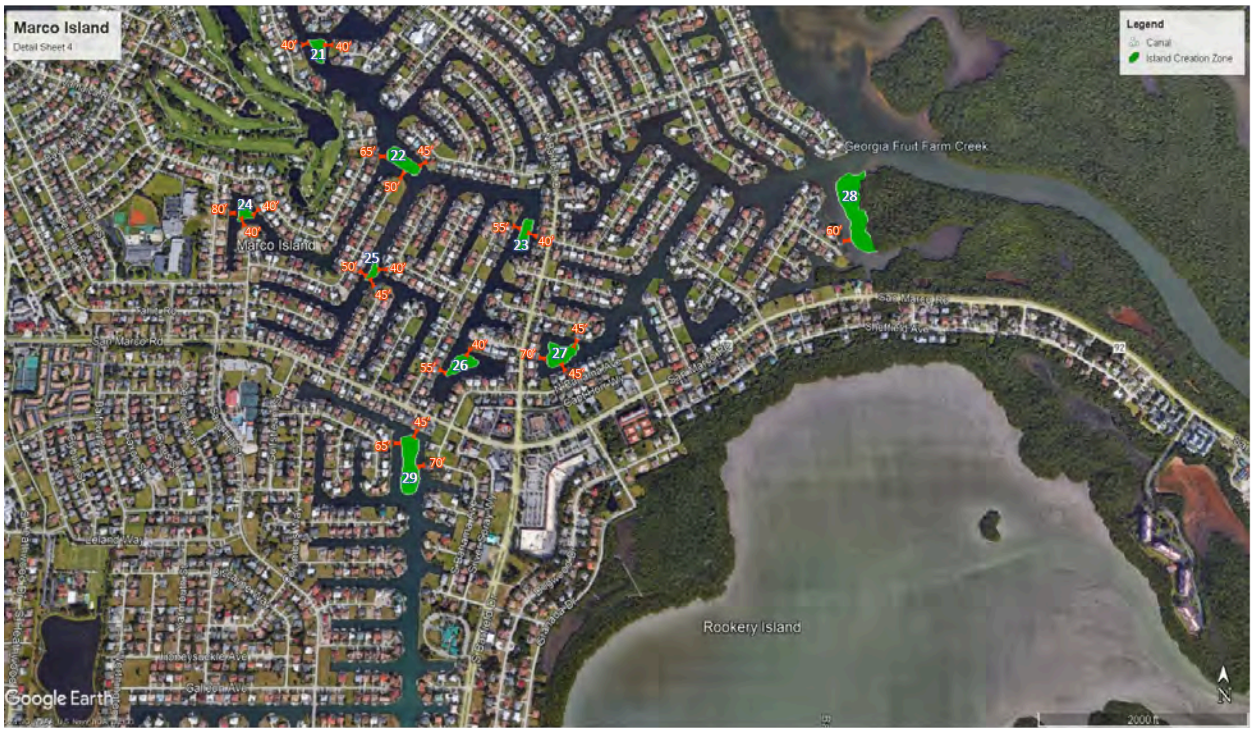

Marco Island
Detail Sheet 4
Legend
Canal
Island Creation Zone
40'
40'
21
65'
22
45'
50'
80'
24
40'
40'
Marco Island
55'
23
40'
50'
25
40'
45'
Georgia Fruit Farm Creek
28
60'
San Marco Rd
45'
40'
70'
27
55'
26
45'
45'
65'
70'
29
Rookery Island
Google Earth

Exhibit D - Preliminary Project Specifications and Special Provisions

A. GEOSYNTHETIC FABRIC FOR DRAINAGE APPLICATIONS SECTION 514

Reference: FDOT Standard Specifications for Road and Bridge Construction (SSRBC) Section 514

514-1 Description.
This Section specifies the construction requirements for geosynthetics used in drainage, slope protection, and material separation applications.

514-2 Material.
Meet the following requirements:

Geosynthetic materials* .....Section 985

Store geosynthetic materials in accordance with the manufacturer's instructions ensuring to protect the geosynthetic material from physical damage, debris, and temperatures greater than 140° F. Prevent mud, fluid concrete, asphalt, or other deleterious materials from coming in contact with the geosynthetic materials that could impact the performance of the geosynthetic material. Replace geosynthetic materials with defects, tears, punctures, flaws, deterioration, or other damage at no additional cost.

514-3 Construction Methods.

514-3.1 Geosynthetic Materials for Drainage Applications: Select a geosynthetic material meeting the appropriate application as specified in 985-3. Place and install the geosynthetic material at the proper elevation, location and orientation as shown in the Plans and in accordance with the manufacturer's instructions. Place the geosynthetic material on areas with a uniform slope that are reasonably smooth, free from mounds, windrows, and any debris or projections which might damage the geosynthetic material. When overlapping is necessary, the Contractor may sew the seams to reduce overlaps as specified in 985-2.6.

After placement of the geosynthetic material, do not exceed the manufacturer's recommendations for exposure to ultraviolet light or five days, whichever is less. If the exposure time is exceeded, remove and replace the geosynthetic material.

514-3.2 Subsurface Drainage Applications: When indicated in the Plans, place the geosynthetic material with the long dimension parallel to the trench. Place and install the geosynthetic material to provide a minimum 12-inch overlap for each joint or in accordance with the manufacturer's recommendation, whichever is greater. Do not drop coarse aggregate materials from heights greater than 3 feet.

514-3.3 Revetment System Applications: Overlap adjacent strips of geosynthetic material at a minimum of 24 inches and in accordance with the manufacturer's recommendations, whichever is greater. Anchor the geosynthetic materials with securing pins inserted through both strips of geosynthetic material along a line through the midpoint of the overlap and to the extent necessary to prevent movement of the geosynthetic material.

Place the geosynthetic material so that the upstream (upper) strip of geosynthetic material overlaps the downstream (lower) strip. Stagger vertical laps a minimum of 5 feet. Use full rolls of geosynthetic material whenever possible to reduce the number of vertical laps. Do not drop bedding stone or riprap from heights greater than 3 feet onto the geosynthetic material.

514-3.4 Repairs: Replace geosynthetic material damaged during or after installation at no additional cost. Repair geosynthetics damaged during or after installation only after the manufacturer establishes that the intended use and stability is not affected and after obtaining the Engineer's approval. Make such repairs as follows:

Remove materials placed within the damaged geosynthetic area plus an additional 4 feet in all directions beyond the limits of the damage. Place a patch consisting of the same material as the geosynthetic material over the damaged area in accordance with the manufacturer's recommendation. Overlap the undamaged geosynthetic material with the patch at a minimum of 3 feet in all directions. Place backfill material on the geosynthetic material in accordance with the Plans after repairs have been completed.

For repairs of Geosynthetic material placed on slopes adjacent to water, place geosynthetic material so that the upstream (upper) strip of geosynthetic material overlaps the downstream (lower) strip.

514-5 Basis of Payment.

No separate payment will be made for the work specified in this Section. The cost of furnishing, placing, and sewing or overlapping the fabric will be included in the Contract price for the items to which it is incidental.

B. GEOSYNTHETIC FABRIC FOR DRAINAGE APPLICATIONS SECTION 985

Reference: FDOT Standard Specifications for Road and Bridge Construction (SSRBC) Section 985

985-1 Description.
Geosynthetic materials are used for nonstructural and structural applications and shall be either geotextiles (woven or non-woven) or geogrids (woven or extruded) that are used for drainage, erosion control, reinforcement, separation or stabilization.

985-2 General Requirements.

985-2.1 Product Acceptance: Geotexiltes implemented will not require structural approval because they will be filtering not structural.

985-2.2 Material Application: In addition to the general requirements, meet the following physical requirements:

Drainage 985-3
Erosion Control 985-4
Structural 985-5

985-2.3 Materials: The geosynthetic material shall be a woven, non-woven or extruded material consisting of long-chain polymeric filaments or yarns such as polypropylene, polyethylene, polyester, polyamides or polyvinylidene chloride formed into a stable network such that the filaments or yarns retain their relative position to each other. The base plastic shall contain stabilizers and/or inhibitors to make the filaments resistant to deterioration due to ultraviolet light, heat exposure and potential chemically damaging environment. The edges of the material shall be salvaged or otherwise finished to prevent the outer yarn from pulling away from the material and shall be free of any treatment which may significantly alter its physical properties.

985-2.4 Physical Requirements: Each geosynthetic material shall be tested by an independent third party in accordance with the methods shown. All testing and reported values, except Apparent Opening Size (AOS), are to be minimum average roll values in the weakest principal direction, unless indicated otherwise in this Section. Values for AOS are maximum average roll values.

985-2.5 Packaging and Labeling: Geosynthetics shall be packaged in a protective covering sufficient to protect the material from temperatures greater than 140 F, sunlight, dirt, and other debris during shipment and storage. The manufacturer’s name, product name, style number, roll dimensions and LOT numbers must be clearly labeled on all packaging.

985-2.6 Overlaps and Seams: Overlaps shall be in accordance with the manufacturer's recommendations, unless specified otherwise in the Plans for a particular application. To reduce overlaps, the geosynthetic material may be sewn together in accordance with the manufacturer's recommendations. Sew the seams with thread meeting the chemical requirements and minimum seam strength requirements for the application.

985-3 Drainage.

985-3.1 Application: Geotextile materials selected for the project will be Type D-3 for Sheet Piling Filter and/or Type D-2 for Riprap, as found in the following SSRBC table:

Table 1: SSRBC Table 985-1 Drainage Applications

Table 985-1 Drainage Applications		
Geotextile Type	Description	Standard Plans Index
D-1	Revetment (Special)	
	Rock, Rubble without bedding stone	
	Ditch Pavement (Rubble Riprap) without bedding stone	524-001
D-2	Revetment (Standard)	
	Articulating Block	
	Gabions	524-001
	Rock, Rubble, and Broken Concrete with bedding stone	
	Ditch Pavement (Rubble Riprap) with bedding stone	524-001
	Joint Cover for Mechanically Stabilized Retaining Wall with Coarse Aggregate Backfill	
	Joint Cover for Mechanically Stabilized Retaining Wall Supporting Spread Footing Foundations	
D-3	Underdrain: Types II, III, and V	440-001
	French Drain	443-001
	Sheet Piling Filter	
	Filter Fabric Jacket (Culvert)	430-001
	Box Culvert Joints	400-289 and 400-291
	Concrete Pavement Subdrainage	446-001
	Joint Cover for Mechanically Stabilized Retaining Wall with Sand or Limerock Backfill	
D-4	Slope Pavement	
	Ditch Pavement (Sand-Cement Riprap or Concrete)	524-001

Table 2: SSRBC Table 985-2 Geotextile Selection

Table 985-2 Geotextile Selection	
In-situ Soil Type or Drainage Application	Class for Type D1, D2, D3 Materials
< 15% passing a No. 200 Sieve*	a
15% to 50% passing a No. 200 Sieve*	b
> 50% passing a No. 200 Sieve*	c
> 50% passing a No. 200 Sieve* with Plastic Index >7	d
MSE Joint Cover for Sand or Limerock Backfill	e
MSE Joint Cover for Coarse Aggregate Backfill	f
*as per AASHTO T88.	

985-3.2 Physical Requirements: Materials for drainage applications must be tested in accordance with and meet the following physical requirements:

Table 3: SSRBC Table 985-3 Geotextile Selection Test Methods and Requirements for Types D-1, D-2 and D-3

Table 985-3 Drainage Geotextiles Test Methods and Requirements for Types D-1, D-2 and D-3			
Property/Test Method	D-1	D-2	D-3
Limitation	Woven Monofilament Geotextiles only	Woven Geotextiles only. No Slit Film Geotextiles	No Slit Film Geotextiles
Minimum Permittivity (Sec - 1) per ASTM D4491	D-1a = 0.7 D-1b = 0.2 D-1c = 0.1 D-1d = 0.1 D-1e = 0.25 D-1f = 1.5	D-2a = 0.7 D-2b = 0.2 D-2c = 0.1 D-2d = 0.1 D-2e = 0.25 D-2f = 1.5	D-3a = 0.5 D-3b = 0.2 D-3c = 0.1 D-3d = 0.1 D-3e = 0.7
Maximum AOS (mm, US Sieve No.) per ASTM D4751	D-1a = 0.425 (40) D-1b = 0.250 (60) D-1c = 0.212 (70) D-1d = 0.300 (50) D-1e = 0.212 (70) D-1f = 0.600 (30)	D-2a = 0.425 (40) D-2b = 0.250 (60) D-2c = 0.212 (70) D-2d = 0.300 (50) D-2e = 0.212 (70) D-2f = 0.600 (30)	D-3a = 0.425 (40) D-3b = 0.250 (60) D-3c = 0.212 (70) D-3d = 0.300 (50) D-3e = 0.212 (70)
Minimum Grab Tensile Strength (lbs) per ASTM D4632	315	Woven Monofilament = 248 Other Woven Geotextiles = 315	Elongation <50% = 248 Elongation ≥50% = 158
Mass per Unit Area (oz/sy) per ASTM D5261	Provide Test Result	Provide Test Result	Provide Test Result
Minimum Puncture Strength (lbs) per ASTM D6241	618	Woven Monofilament = 495 Other Woven Geotextiles = 618	Elongation <50% = 495 Elongation ≥50% = 309
Minimum Trapezoidal Tear (lbs) per ASTM D4533	113	Woven Monofilament = 57 Other Woven Geotextiles: = 113	Woven Monofilament = 57 Other Geotextiles: Elongation <50% = 90 Elongation ≥50% = 57
Minimum UV Resistance per ASTM D4355 (% Retained Strength)	50% @500 hours	50% @500 hours	50% @500 hours

C. SOIL LAYERS MATERIALS SECTION 987

987-1 Description.
All material shall be suitable for plant growth. Soil materials used for island fill operations will be reprised from channel excavation operations. Furnishing of of-fsite soil materials will not be necessary. The organic matter content of soil layers will vary according to island type. Mixing of excavated soils will target a minimum of 2.5%, a maximum of 10%, in accordance with FM 1-T267 and will target a pH value of 5.5 or greater and less than or equal to 7.0 as determined in accordance with FM 5-550. The organic matter content shall be created using any of the following materials.

987-2 Materials.
Soil layer materials may be obtained from either, or a combination of, the following sources:

1. Excavation within the limits of construction on the project. Such material may be stockpiled or windrowed on the project in areas approved by the Engineer.
2. Designated borrow pits for the project will not be necessary.
3. Other sources of organic soil materials provided by the Contractor are not expected.

987-2.1 Organic Soil: This may consist of muck, mucky peat and peat and shall have an organic matter content of 30% or more if the mineral fraction is more than 50% clay, or more than 20% organic matter if the mineral fraction has no clay.

987-2.2 Blanket Material: Meet the material classification shown in the Plans and Standard Plans, Index 120-001.

987-2.3 Compost: Meet the requirements of Florida Department of Environmental Protection Rule 62.709.550 Type Y (yard waste), Type YM (yard waste and manure), Type A (municipal solid waste compost) or Rule 62.640.850 Type AA (composted biosolids) and have unrestricted distribution.

987-2.3.1 Compost for use as a Soil Amendment: If the electrical conductivity (EC) value of the compost exceeds 4.0dS (mmhos/cm) based on the saturated paste extract method, the compost shall be leached with water prior to application.

987-2.3.2 Compost for use as a Mulch: The compost shall contain no foreign matter, such as glass, plastic or metal shards. The compost shall be slightly coarse to coarse in nature (over half of the solids shall be from particles 1/2 inches in size and no greater than 6 inches). Preference shall be given to compost or mulch made from uncontaminated woody waste materials.

987-2.4 Landscape Soil: Landscape soil must be sandy loam or loamy sand with properties of AASHTO classification A-2-4 or A-4. The soil must have an organic matter content of 5 to 10% using the loss on ignition (LOI) test in accordance with FM 1-T267. Laboratory testing of soils is discretionary and not expected to be necessary. Soil must be free of litter and deleterious substances such as cans, debris, and particles greater than 2.50 inches.

Soil must be free of noxious plants or propagules of plants listed in Florida Rule 5B-57.007, and invasive exotic plants listed under Category I Florida Exotic Plant Pest Council.

Where shown in the Plans or when approved by the Engineer, existing soil may be amended with compost or biosolids to meet the requirements of this Section. Use compost in accordance with FDEP Rule 62.709.550 and 62.709.600. Use biosolids in accordance with Florida Rule 62.640.850.

D. REVETMENT SYSTEMS SECTION 530

530-1 Description.

530-1.1 Riprap: Construct riprap composed of sand-cement or rubble (consisting of broken stone or broken concrete) as shown in the Standard Plans and in the Plans.

530-2 Materials.

530-2.1 Riprap:

530-2.1.1 Filter Fabric: Meet the following requirements:

Type D-2 Geotextile Fabric* .....Section 985

Schedule work so that covering the fabric with the specified material does not exceed the manufacturer’s recommendations for exposure to ultraviolet light for five days, whichever is less. If the Engineer determines the exposure time was exceeded, the Contractor shall replace the fabric at no additional expense.

Place the filter fabric (fabric) at locations as shown in the Plans, in accordance with the manufacturer’s directions. Place the fabric on areas with a uniform slope that are reasonably smooth, free from mounds, windrows, and any debris or projections which might damage the fabric.

Loosely lay the material. Do not stretch the material. Replace or repair any fabric damaged or displaced before or during placement of overlying layers. Repair in accordance with the manufacturer's instructions.

The Contractor may sew the seams to reduce overlaps as specified in 985-3. Follow the manufacturer’s instructions for all seams and overlaps.

530-2.1.3 Rubble:

530-2.1.3.1 Rubble (Bank and Shore Protection): Provide sound, hard, durable rubble, free of open or incipient cracks, soft seams, or other structural defects, consisting of broken stone with a bulk specific gravity of at least 2.20. Ensure that stones are rough and angular.

For this application, use broken stone meeting the following gradation and thickness requirements:

Table 4: 530-2.1.3.1 Rubble (Bank and Shore Protection) Gradation and Thickness Requirements

Weight Maximum Pounds	Weight 50% Pounds	Weight Minimum Pounds	Minimum Blanket Thickness in Feet
670	290	60	2.5
Ensure that at least 97% of the material by weight is smaller than Weight Maximum pounds]. Ensure that at least 50% of the material by weight is greater than Weight 50% pounds]. Ensure that at least 85% of the material by weight is greater than Weight Minimum pounds.			

530-2.1.3.2 Rubble (Ditch Lining): Use sound, hard, durable rubble, free of open or incipient cracks, soft seams, or other structural defects, consisting of broken stone or broken concrete with a bulk specific gravity of at least 1.90. Ensure that stones or broken concrete are rough and angular.

Use broken stone or broken concrete meeting the following gradation and thickness requirements:

Table 5: 530-2.1.3.2 Rubble (Ditch Lining) Gradation and Thickness Requirements

Weight Maximum Pounds	Weight 50% Pounds	Weight Minimum Pounds	Minimum Blanket Thickness in Feet
75	30	4	1.5
Ensure that at least 97% of the material by weight is smaller than Weight Maximum pounds. Ensure that at least 50% of the material by weight is greater than Weight 50% pounds]. Ensure that at least 90% of the material by weight is greater than Weight Minimum pounds].			

530-2.1.3.3 Physical Requirements of Broken Stone and Broken Concrete: Use broken stone and broken concrete meeting the following physical requirements:

Table 6: 530-2.1.3.3 Physical Requirements of Broken Stone and Broken Concrete

Absorption (FM 1-T 85)	Maximum 5%
Los Angeles Abrasion (ASTM C535)	Maximum loss 45%*
Soundness (Sodium Sulphate) (AASHTO T 104)	Maximum loss 12%** (after five cycles)
Flat and elongated pieces	Materials with least dimension less than one third of greatest dimension not exceeding 10% by weight.
Dirt and Fines	Materials less than 1/2 inch in maximum dimension accumulated from interledge layers, blasting or handling operations not exceeding 5% by weight.
Drop Test***(EM 1110-2-2302)	No new cracks developed, or no existing crack widened additional 0.1 inch, or final largest dimension greater than or equal to 90% original largest dimension of dropped piece.
* Ensure that granite does not have a loss greater than 55% and that broken concrete does not have a loss greater than 45%. ** The Engineer may accept rubble exceeding the soundness loss limitation if performance history shows that the material will be acceptable for the intended use. The Engineer will waive the soundness specification for rubble riprap (broken stone) when project documents indicate it will be placed in or adjacent to water or soil with a sulfate content less than 150 parts per million and a pH greater than 5.0. Soundness is not required for broken concrete. *** The Engineer will waive the Drop Test unless required to ensure structural integrity. Provide all equipment, labor and testing at no expense to the Department. EM refers to the US Army Corps of Engineer's Specification Engineering Method.	

530-2.1.3.4 Source Approval and Project Control: The Engineer will approve construction aggregate sources.

1. The Engineer may perform Independent Verification tests on all materials placed on the project.
2. The Engineer will check the gradation of the riprap by visual inspection at the project site. Resolve any difference of opinion with the Engineer in accordance with the method provided in FM 5-538. Provide all equipment, labor, and the sorting site at no additional expense.
3. The Engineer may test components in a blend of rubble processed from different geologic formations, members, groups, units, layers or seams. The Engineer may select components based on like color, surface texture, porosity, or hardness. The Engineer may reject any blend if a component that makes up at least five percent by volume of the blend does not meet these specifications.

530-2.1.4 Bedding Stone: Use Bedding Stone of either a durable quality limestone or other quarry run stone, with a bulk specific gravity of not less than 1.90 and that is reasonably free from thin, flat and elongated pieces. Ensure that the bedding stone is also reasonably free from organic matter and soft, friable particles. Meet the following gradation limits:

Table 7: 530-2.1.4 Bedding Stone

Standard Sieve Sizes - Inches	Individual Percentage by Weight Passing
12 inches	100
10 inches	70 to 100
6 inches	60 to 80
3 inches	30 to 50
1 inch	0 to 15

The Engineer will conduct source approval and project control of bedding stone as specified in 530-2.1.3.4. In lieu of limestone or other quarry run stone, the Contractor may substitute non-reinforced concrete from existing pavement that is to be removed and which meets the above requirements for commercial bedding stone.

530-2.3.5 Miscellaneous Components: Miscellaneous components for gabion installations must meet the following requirements:

Type D-2 Geotextile Fabric* ..... Section 985
Granular Underlay ..... Section 901
Anchors .... Section 451 or manufacturer's recommendations

530-3 Construction and Installation.

530-3.1 Geotextile Fabric: Overlap adjacent strips of fabric, and anchor them with securing pins as recommended by the manufacturer. Anchors should be inserted

through both strips of fabric along a line through the midpoint of the overlap and to the extent necessary to prevent displacement of the fabric.

Place the fabric so that the upstream (upper) strip of fabric overlaps the downstream (lower) strip. Stagger vertical laps as recommended by the manufacturer. Use full rolls of fabric whenever possible in order to reduce the number of vertical laps. Do not drop bedding stone or riprap from heights greater than 3 feet onto the fabric.

530-3.3 Rubble: Dump rubble in place forming a compact layer conforming to the neat lines and thickness specified in the Plans. Ensure that rubble does not segregate so that smaller pieces evenly fill the voids between the larger pieces.

530-3.4 Bedding Stone: Place a minimum 4 inch thick layer of bedding stone under rubble riprap without puncturing or tearing the geotextile fabric when directed by the Engineer. The Engineer will allow an in place thickness tolerance of plus or minus one inch.

Remove and replace geotextile fabric damaged as a result of operations at no additional expense.

530-4 Method of Measurement.

530-4.2 Rubble and Bedding Stone: The quantities will not be measured separately for payment. Payment will be incidental to the Channel Excavation and Island Creation project quantity.

530-5 Basis of Payment.

530-5.2 Rubble: Price and payment will be full compensation for all work specified in this Section, including all materials, hauling, excavation, and backfill. Include the cost of dressing and shaping the existing fills (or subgrade) for placing riprap in the Contract unit price for Channel Excavation and Island Creation.

530-5.3 Bedding Stone: Price and payment will be full compensation for all work specified in this Section, including all materials and hauling.

Include the cost of dressing and shaping the existing fills (or subgrade) for placing bedding stone in the Contract unit price for Channel Excavation and Island Creation.

530-5.4 Geotextile Fabric: Include the cost of materials and installation of the geotextile fabric, including any repairs or replacement, in the Contract unit price for Channel Excavation and Island Creation.

E. MAINTENANCE OF TRAFFIC SECTION 102

(REV 8-17-22) (10-22)

ARTICLE 102-3 is deleted and the following substituted:

102-3 Specific Requirements.

102-3.1 Beginning Date of Contractor's Responsibility: Maintain traffic starting the day work begins on the project or on the first day Contract Time is charged, whichever is earlier.

102-3.2 Worksite Traffic Supervisor: Provide a Worksite Traffic Supervisor who is responsible for initiating, installing, and maintaining all temporary traffic control devices as described in this Section and the Plans. Provide all equipment and materials needed to set up, take down, maintain traffic control, and handle traffic-related situations. Provide the Worksite Traffic Supervisor or designee with a tablet or smartphone with internet access. Use approved alternate Worksite Traffic Supervisors when necessary.

The Worksite Traffic Supervisor must be aware of the specialties necessary for navigating, temporarily restricting, and rerouting naval traffic throughout the project's channel system. Nearly all Maintenance of Traffic duties will be on the project's canal system. There will be minimal if any disruption to on-shore, roadway vehicular traffic operations.

The Worksite Traffic Supervisor is to perform the following duties:

1. On site direction of all temporary traffic control on the project.
2. Immediately corrects all safety deficiencies and corrects minor deficiencies that are not immediate safety hazards within 24 hours.
3. Is available on a 24 hour per day basis and present at the site within 45 minutes after notification of an emergency situation and is prepared to respond to maintain temporary traffic control or to provide alternate traffic arrangements.

Advise the project personnel of the schedule of any inspections and give them the opportunity to join in the inspection as deemed necessary.

A Worksite Traffic Supervisor who fails to comply with the provisions of this Section may be removed from the project role. The Municipality may temporarily suspend all activities, except traffic, erosion control and such other activities that are necessary for project maintenance and safety, for failure to comply with these provisions.

102-3.3 Channel Closures: Channel closures, mobile operations, and traffic pacing operations shall routinely be conveyed to The Municipality in advance of planned channel closures, mobile operations, and traffic pacing operations. For unforeseen events that require cancelling or rescheduling channel closures, mobile operations, and traffic pacing operations, notice will be provided to The Municipality as soon as possible.

102-3.3.1 Traffic Pacing: In addition to dates and locations, include a pacing plan outlining the expected equipment and number of traffic control officers required, the proposed traffic pacing lengths and durations, the available existing egresses in the event of an emergency, and a contingency plan in the event of an equipment failure.

Existing properties in work areas are to be provided with adequate entrances for naval traffic during work hours.

F. MOBILIZATION SECTION 101

(REV 2-17-14) (FA 7-2-14) (FY 2025-26)

SECTION 101 is deleted and the following substituted:

SECTION 101 MOBILIZATION

101-1 Description.

Perform preparatory work and operations in mobilizing for beginning work on the project, including, but not limited to, those operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site and for the establishment of temporary offices, buildings, safety equipment and first aid supplies, and sanitary and other facilities.

Include the costs of bonds and any required insurance and any other pre-construction expenses necessary for the start of the work, excluding the cost of construction materials.

101-2 Basis of Payment.

101-2.1 General: The work and incidental costs specified as being covered under this Section will be paid for at the lump sum prices for the items of Mobilization included in the Schedule of Values.

101-2.2 Partial Payments: When the Notice to Proceed has been issued, partial payments will be made in accordance with the following:

Partial payment will be made at 25% of the Mobilization amount shown in the Schedule of Values per month for the first four months until 100% of the Mobilization amount shown in the Schedule of Values is paid. In no event shall more than 50% of the Mobilization amount shown in the Schedule of Values be paid prior to commencing construction on the project site.

Total partial payments for Mobilization on any project, including when more than one project or job is included in the Contract, will be limited to 10% of the original Contract amount for that project. Any remaining amount will be paid upon completion of all work on the Contract.

Retainage, as specified in 9-5, will be applied to all partial payments.

Partial payments made on this item will in no way act to preclude or limit any of the provisions for partial payments otherwise provided for by the Contract.

120-7.2.2 Placing in Unstable Areas: When depositing the material in water, or in low swampy ground that will not support the weight of hauling equipment, construct the embankment by dumping successive loads in a uniformly distributed layer of a thickness not greater than necessary to support the hauling equipment while placing subsequent layers. Once sufficient material has been placed so that the hauling equipment can be supported, construct the remaining portion of the embankment in layers in accordance with the applicable provisions of 120-9.2.3 and 120-9.2.6.

120-8.3.4 Backfill Under Wet Conditions: Where wet conditions are such that dewatering by normal pumping methods would not be effective, the procedure outlined below may be used when specifically authorized by the Engineer in writing.

The Engineer may permit the use of granular material below the elevation at which mechanical tampers would be effective, but only material classified as A-3. Place and compact the material using timbers or hand tampers until the backfill reaches an elevation such that its moisture content will permit the use of mechanical tampers. When the backfill has reached such elevation, use normally acceptable backfill material. Compact the material using mechanical tampers in such a manner and to such extent as to transfer the compacting force into the material previously tamped by hand.

The Engineer may permit the use of coarse aggregate below the elevation at which mechanical tampers would be effective. Use coarse aggregate from approved sources for Aggregate Size Number 89, 8, 78, 7, 68, 6, or 57. Place the coarse aggregate such that it will be stable and firm. Fully wrap the aggregate with a layer of Type D4 geosynthetic as specified by the Engineer. Do not place coarse aggregate within 4 feet of the ends of the trench or ditch. Use normally accepted backfill material at the ends.

120-9 Compaction Requirements.

120-9.1 Moisture Content: Compact the materials at a moisture content such that the specified density can be attained. If necessary, add water to the material, or lower the moisture content by manipulating the material or allowing it to dry, as is appropriate, to attain the specified density.

120-9.2 Compaction of Embankments:

120-9.2.1 Earthwork Category 1 and 2 Density Requirements: The Engineer will accept a minimum density of 95% of the maximum density as determined by FM 1-T099 for all earthwork items requiring densities.

120-9.2.2 Earthwork Category 3 Density Requirements: The Engineer will accept a minimum of 100% of the maximum density as determined by FM 1-T099 for all densities required under category 3. Except for embankments constructed by the hydraulic method as specified in 120-7.3, and for the material placed outside the standard minimum slope as specified in 120-7.2.4, and for other areas specifically excluded herein, compact each layer of the material used in the formation of embankments to the required density stated above. Uniformly compact each layer using equipment that will achieve the required

density, and as compaction operations progress, shape and manipulate each layer as necessary to ensure uniform density throughout the embankment.

120-9.2.3 Compaction Over Unstable Foundations: Where the embankment material is deposited in water or on low swampy ground, and in a layer thicker than 12 inches (as provided in 120-7.2.2), compact the top 6 inches (compacted thickness) of such layer to the density as specified in 120-10.5.

120-13 Method of Measurement.

120-13.1 Excavation: Excavation will be paid for by **linear foot of Canal Excavation.** The progress will be measured by field survey or by photogrammetric means as designated by the Engineer. Measurement for payment will include all excavation of unsuitable material, lateral ditch excavation, canal excavation, and excavation for structures and pipe. Payment will not be made for excavation or embankment beyond the limits shown in the plans or authorized by the Engineer.

120-13.2 Embankment / Island Creation: Measurement will not be made separately. Embankment / Island Creation will be incidental to Canal Excavation unit price. Payment will not be made for embankment beyond the limits shown in the plans or authorized by the Engineer.

120-14 Basis of Payment.

120-14.1 General: Prices and payments for the work items included in this Section will be full compensation for all work described herein, including excavating, dredging, pumping, hauling, placing, and compacting; dressing the surface of the earthwork; and maintaining and protecting the complete earthwork.

120-14.2 Excavation: The total quantity of all excavation specified under this Section will be paid for at the Contract unit price for Canal Excavation. No payment will be made for the excavation of any materials which are used for purposes other than those shown in the plans or designated by the Engineer. No payment will be made for materials excavated outside the lines and grades given by the Engineer, unless specifically authorized by the Engineer.

120-14.3 Embankment / Island Creation: The total quantity of embankment specified in this Section will be paid for under Canal Excavation unit price. No payment will be made for materials which are used for purposes other than those shown in the plans or designated by the Engineer. No payment will be made for materials placed outside the lines and grades given by the Engineer.

H. SHEET PILING CONTAINMENT WALLS

1. Materials.

1.1 Vinyl Sheet Piling

1.1.1 Acceptable Manufacturers: Sheet piling supplied for the project shall be manufactured by the following entity, with proven experience, quality control, availability,

production capability, and unencumbered by licensing and patent restrictions:

Pietrucha ESC Inc
2185 Salisbury HWY
Statesville, NC 28677
Phone: 980-689-4388

1.1.2 Physical Characteristics: Sheet piling supplied for the project shall meet or exceed all
required physical characteristics as defined below:

1.1.2.1 Sheet Pile Material: All sheet piling shall be manufactured entirely from a rigid, high impact, UV-inhibited, weatherable vinyl compound. All exposed surfaces of the sheet piling shall be UV resistant, and composed of virgin material with a minimum ASTM D4216 Cell Classification of 1-41444-33 to ensure reliable performance and color consistency. If mono-extrusion technology is used, the entire sheet pile must be made of virgin material with a minimum ASTM D4216 Cell Classification of 1-41444-33.

1.1.2.2 Section Modulus: The section modulus of the sheet piling shall be no less than **_17.4_** in^3 per linear foot of wall.

1.1.2.3 Moment of Inertia: The moment of inertia of the sheet piling shall be no less than **_80.9_** in^4 per linear foot of wall.

1.1.2.4 Thickness: The sheet piling must have a minimum thickness of **_0.30_** inches.

1.1.2.5 Depth: The sheet piling must have a maximum section depth of **_9_** inches to prevent web buckling.

1.1.2.6 Coverage & Interlocks: The sheet piling must have a minimum width of **_24_** inches per sheet resulting in a maximum of **_0.5_** interlocks per linear foot of wall.

1.1.2.7 Surface Finish/Appearance: The sheet piling must be **_white_** in color. Color samples to be approved by the engineer.

1.1.3 Approved Equals: Alternate products or manufacturers may be used, provided they have products in service for applications similar in scope and function to this project that meet or exceed all the performance requirements of this specification.

Alternate manufacturers shall provide no less than five (5) references for projects similar in scope and function and which have been in service for no less than one (1) year, which shall include the following:

- Detailed project description & location
- Completion Date
- Name and address of owner

Alternate manufacturers must submit all documentation (references, spec sheets, etc.) and one (1) physical sample for each product requested for approval no less than ten

(10) days prior to bid. Alternate manufacturers shall be approved, in writing, and exclusively by Engineer.

Exhibit E - Island Types and Species Assemblages

Island Types and Species Assemblages

The project design is planning for three separate plant community archetypes that generally cover distinct site situations. Island Types A and B are anticipated to be constructed from vinyl pylons with distinct borders. These island types will be reserved for more space-constricted canal areas where island borders will need to be more defined. Specific plant communities and planting ratios for these constructed islands will vary based on final grade and observed sediment composition. Island Type C will consist of naturally bordered islands resulting from built-up shallow areas that are currently inundated or existing exposed sandbars. These islands will be larger in size with a more naturally sloping grade, and thus be able to accommodate a more varying topography and diverse species communities with different hydrologic/tidal regimes. Plant communities have been developed in coordination with the Naples Botanical Garden and may change depending on availability and final design grade. A general summary of each proposed island model is below (Figure 1).

Figure 1: Summary of proposed island types.

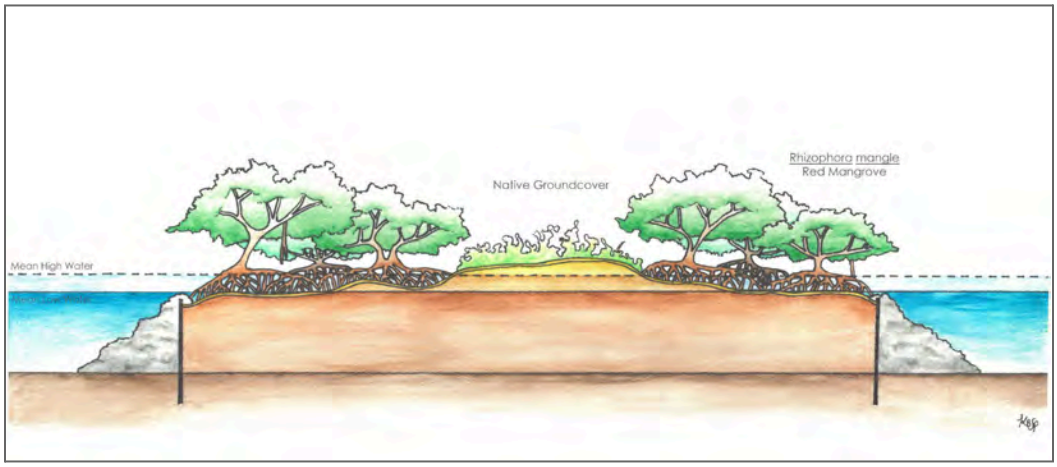
Table 8: Salt-tolerant species and proposed planting method, organized by island type

Common Name	Species	Island Type A	Island Type B	Island Type C	Planting Type*
Golden leather fern	*Acrostichum aureum*			X	P
Giant leather fern	*Acrostichum danaeifolium*			X	P
Black Mangrove	*Avicennia germinans*	X	X	X	C, V
Saltwort	*Batis maritima*			X	P
Green sea-oxeye-daisy	*Borrichia arborescens*			X	C
Bushy seaside oxeye	*Borrichia frutescens*			X	P
Buttonwood	*Conocarpus erectus*			X	C
Saltgrass	*Distichlis spicata*		X	X	P
Mangrove spiderlily	*Hymenocallis latifolia*		X	X	B
Black Needlerush	*Juncus roemerianus*		X	X	P
White Mangrove	*Laguncularia racemosa*			X	P, V, C
Christmasberry	*Lycium carolinianum*			X	P, C
Seashore Paspalum	*Paspalum vaginatum*		X	X	S, P
Red Mangrove	*Rhizophora mangle*	X	X	X	P, V, C
Perennial glasswort	*Sarcocornia perennis*			X	P

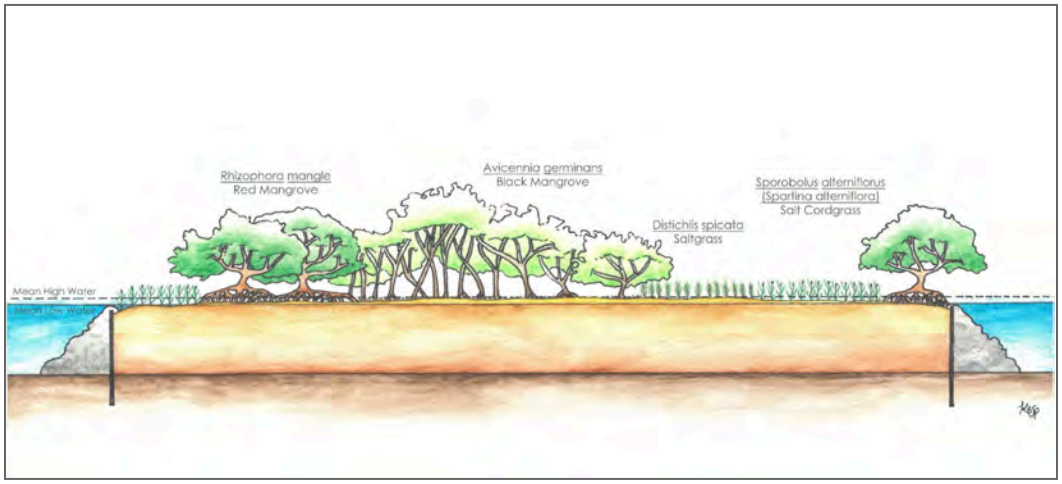
Mangrove rubbervine	*Rhabdadenia biflora*		X	X	P
Sea purslane	*Sesuvium portulacastrum*	X	X	X	P, S
Salt Cordgrass	*Spartina alterniflora*	X	X	X	P
Marsh hay cordgrass	*Spartina patens*			X	P
Seashore dropseed	*Sporobolus virginicus*		X	X	P

*C=Container, P= Plug/Plant, V= Vegetative cutting/propagule, B= Bulb

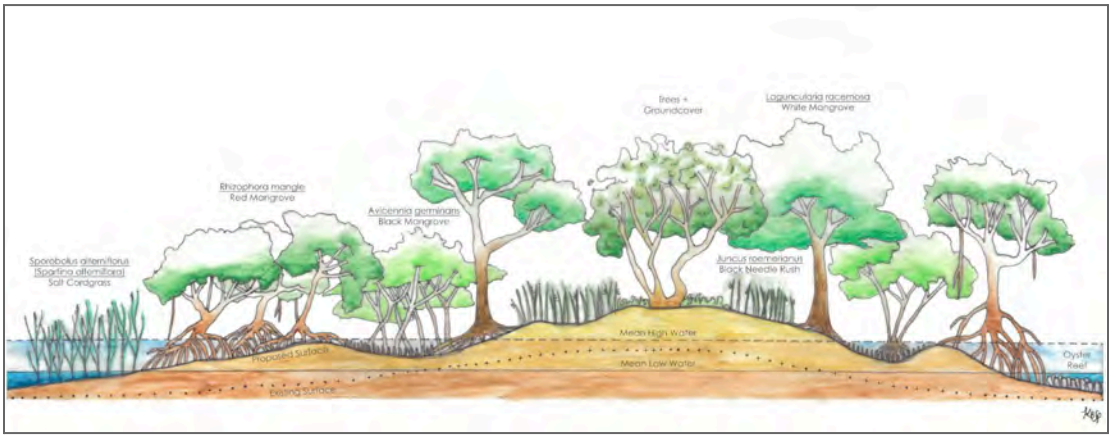
Island Type A Illustration



Island Type B Illustration



Island Type C Illustration



VII. Experience

The C-HAWQ Initiative is a collaboration of businesses specializing in natural infrastructure designs, builds, and maintenance. Leading the initiative is Earthwerks Land Improvement & Development Corp. in addition to ENCAP, Inc all based out of the greater Chicagoland area. These businesses have over 65 years of experience with specializations in inland dredging, sediment control, storm resilience, field engineering, and native vegetation planting and maintenance. The majority of their work has been publicly funded projects for municipality, county, state, and federal governments.

A. Noteworthy Projects

West Branch DuPage River Hydraulic Improvements & Restoration Project
Client: DuPage County Stormwater Management
Budget: $3,502,404.00
Location: Warrenville, IL

The approximate 1.8 mile section of the West Branch DuPage River targeted for this project flows through DuPage County, Illinois and DuPage County Forest Preserve District property. The subject reach had become hydrologically disconnected from the surrounding floodplain, diminishing potential habitat and function.

Earthwerks was the prime contractor on the West Branch project and performed all earthwork and heavy construction activities, with ENCAP subcontracted to perform all restoration, native plantings, and ecological maintenance work. The heavy construction was performed utilizing long reach tracked excavators, mid-sized excavators, wide tracked dozers, tracked haul trucks, and tracked skid steers. All construction was performed in the wet including dredging, floodplain shaping, grading, and riffle construction. Seeding and placement of 100% biodegradable erosion control blanket was completed immediately upon final grading to protect from erosion and begin establishment of the native plantings.

ENCAP was ultimately responsible for the installation and management of native communities along a 1.8 mile stretch of the West Branch of the DuPage River. Restoration activities included native planting and ecological management of 3 constructed backwater/ floodplain wetlands and adjacent wet meadow, sedge meadow, mesic prairie, shady floodplain and mesic savanna plant communities. To improve vegetative diversity and habitat complexity, ENCAP also installed 500 native trees and shrubs, as well as ~50,000 native plugs throughout the restoration areas.

The ultimate result of the project was a raised river profile within the reach to more frequently flood the lower floodplain and thus improve floodplain function and habitat. After a final prescribed burn, ENCAP successfully closed out the project meeting all final performance criteria and formal approval from DuPage County, Illinois, and the Chicago District USACE.

McDowell Grove/West Branch River Restoration Project
Client: DuPage County Stormwater Management
Contract Value: $787,878.00
Location: Naperville, IL

The McDowell Grove / West Branch River Restoration was constructed as a riparian ecosystem restoration and enhancement project. The purpose of this project was to restore natural ecological functions and the processes of a free flowing river. The initial work for the project included the removal of a dam constructed by the Civilian Conservation Corps and the remediation of thorium contamination in the river caused by previous industrial activities.

Earthwerks was the prime contractor on the project and performed all earthwork and heavy construction activities, with ENCAP subcontracted to perform all restoration, native plantings, and ecological maintenance work. The heavy construction was performed utilizing long reach tracked excavators, mid-sized excavators, wide tracked dozers, tracked haul trucks, and tracked skid steers. All construction was performed in the wet including dredging, floodplain shaping, grading, and riffle construction. Seeding and placement of 100% biodegradable erosion control blanket was completed immediately upon final grading to protect from erosion and begin establishment of the native plantings.

The contracted work performed by ENCAP involved the removal of invasive species, installation of significant riverine plantings, restoration seeding, and 3 years of ecological maintenance of these areas. The project also included 3 years of vegetation monitoring and reporting. The four main tasks the project entailed included: planting enhancements in West Branch DuPage River channel and associated maintenance and monitoring activities, river corridor restoration which involves herbicide applications, extensive tree clearing activities, controlled burning of natural areas, associated seeding activities, ecological management of specified areas including selective herbicide application, mowing, and other management activities as needed, and monitoring and reporting of specified areas.

Valley View Pond Project

Client: Village of Downers Grove
Contract Value: $750,000.00
Location: Downers Grove, IL

Valley View Pond was an on-line detention basin that previously consisted of eroded banks, a heavily sedimented bottom, and experienced frequent flooding issues. The shoreline surrounding the pond featured degraded rock toe and vegetative dominance by invasive species; primarily purple loosestrife and sandbar willow.

For this design-build project, ENCAP worked collaboratively with Earthwerks to develop a naturalization plan for the Village of Downers Grove to help reduce flooding and improve water quality conditions for the surrounding residents and downstream areas. ENCAP performed the initial wetland delineation and permitting through federal and local agencies, and formulated planting lists and specifications. Earthwerks performed the excavation and site construction despite difficult soil conditions, deep sediment, and limited access. ENCAP then installed all native seed, plugs, trees and shrubs for the project. The previously shallow basin now features an extensive wetland shelf, deep water pockets, a bypass channel with a spillway and a gentle shoreline all planted with high-quality native species. ENCAP performed all management and monitoring until final performance criteria were met.

Valley View Pond now exhibits improved resiliency during rain events and provides improved wildlife habitat for the many shorebirds, waterfowl and other species observed within its boundaries. The area will continue to be an added value to the surrounding community.

Nippersink Creek, Section 206 Ecosystem Restoration Project

Clients: U.S. Army Corps of Engineers, Chicago District
McHenry County Conservation District
Contract Value: $4,503,000.00
Location: Glacial Park Conservation Area, Ringwood, IL

The Nippersink Creek Section 206 Aquatic Ecosystem Restoration Project is a long-term on-going project which included work with streambank grading, riparian corridor restoration and in-stream structure construction. This complicated stream restoration project consisted of over 8,000 Linear Feet of streambank grading and seven in-stream riffles and habitat structures. The goal of the project was to re-establish the natural floodplain hydrology in order to hydrate side channel and off-bank wetlands, as well as historic oxbow habitats while allowing the existing channel to reconnect to the historic floodplain and migrate naturally within the riparian corridor.

The project involved over 38,000 CY of excavation and hauling under difficult conditions throughout the winter in order to achieve the project goals. The project was performed by ENCAP with excavation activities subcontracted to Earthwerks. Existing vertical cut banks were graded to 10:1 slopes in exterior bends to 20:1 slopes in interior bends to provide increased flood capacity as well as connectivity to the floodplain from the stream and existing tributaries.

The riffle construction included approximately 800 tons of sand, glacial cobble, and boulders which were placed to create a gentle 20:1 back slope from the riffle crest on each of the seven in-stream riffle structures. All work was performed in the wet including demolition and riffle construction along with bank grading in the areas across the entire upstream 8,000 feet of streambank. The work was performed utilizing a combination of a long reach wide tracked excavator, low ground compression excavator, as well as two other mid-size excavators, six low ground compression tracked haul trucks, two low compression dozers, and two tracked skid steers.

Directly following excavation and grading, preparation work for native seeding began. This work included over 188 acres of invasive woody clearing via hand crews, FECON mowing, and Feller Bunchers. Native seeding encompassed 350 total acres in a variety of unique ecosystems including sedge meadow, riparian, wet mesic, marsh, fen, dry mesic, and oak savanna, among others. Maintenance activities, mainly consisting of herbicide application and mowing of invasive species, continued throughout the project duration. Several sensitive and endangered plant and animal species were present throughout these areas. Therefore, special precautions were taken to ensure their protection throughout the restoration process, including the ongoing maintenance and development of advanced plant identification skills held by staff . The project met and exceeded all performance criteria and received formal approval from the USACE and McHenry County, Illinois.

Morton Arboretum, Section 206 Ecosystem Restoration Project

Clients: U.S. Army Corps of Engineers, Chicago District
The Morton Arboretum
Contract Value: $2,909,270.00
Location: Lisle, IL

The Morton Arboretum Ecosystem Restoration is an ongoing 93 acre habitat enhancement project funded by the USACE and Morton Arboretum in Lisle, Illinois. The project includes restoration tasks including, but not limited to: 64 acres of selective invasive tree and shrub removal, earthwork and grading of the banks of 1.1 miles of the East Branch DuPage River, creating stone riffles, 80 boulder clusters, in-stream woody habitat structures, invasive species removal, installation of native seed and plugs, and stewardship of the project site including mechanical and herbicide management of invasive species as well as prescribed burning.

The heavy construction, completed by Earthwerks, included 16,000 cubic yards of material being removed from the banks of the river to reduce the near vertical banks to a more gentle slope from 3:1 to 15:1. During the grading, woody habitat structures composed of logs saved from the invasive tree removal were installed on the banks of the river to improve stream complexity. In addition to the woody structures, boulder clusters comprising more than 600 6” to 5’ glacial boulders were placed along the northern length of the river to improve diversity of habitat. To date, the structures have attracted an additional 6 fish species to this stretch of river since installation. Finally, at the upstream end of the project a 50’ wide riffle was constructed of glacial cobble and stone to thoroughly mix and aerate the water flowing into the project from a channelized stretch of river.

ENCAP completed natural area restoration, planting, stewardship, and maintenance for this project. The upland habitat was treated for invasive species for the entirety of the first year in preparation for seed and plug installation that occurred on year 2 of the project. 90 acres of native genotype seed and 51,000 live plugs were installed throughout the project.

Deep River Rock Riffle Improvements Project

Clients: Lake County Parks Department
Little Calumet River Basin Development Commission
Contract Value: $4,433,000.00
Location: Lake Station, IN

The Project consisted of demolition of existing structures, followed by construction of a rock riffle with four (4) cascading pools, the partial removal of an existing sheet pile dam, the construction of two (2) parking lots, one boat launch, earth embankments, installation of one pedestrian bridge, construction of bituminous and Portland cement concrete paths, utility relocations, site restoration and revegetation, and ancillary improvements along Deep River in Lake Station, Indiana.

Armstrong Park Flood Control Reservoir Project

Clients: DuPage County
Contract Value: $7,785,000.00
Location: Carol Stream, IL

The Project consisted of excavation, removal, and disposal of all trees, pavements, and foundation, storm sewers, removal of sidewalks, bike paths, lighting systems, water mains, sanitary sewers and other appurtenant items necessary to clear the grounds for the construction of a Pump Station Reservoir and Gravity Reservoir. The work at the site also included the installation of temporary construction fencing around the work site, construction of new embankments, bike paths, storm sewer systems, drainage weirs, pedestrian bridges and the complete restoration of the site. Restoration included final grading of the site, the placement of

topsoil, riprap, revetment mats, trees, shrubs, plantings, seeding and erosion control blanket, the removal of all temporary construction fences, and all incidental and collateral work necessary to complete the project.

Addison Creek Wetland Restoration
Clients: Cook County
Leyden Township
City of Northlake
Contract Value: $4,544,000.00
Location: North Lake, IL

The Project consisted of channel excavation, tree removal, removal of two low-flow dam, and topsoil stripping / stockpiling. The constructed improvements included rip-rap, culvert end sections, native landscaping, tree and shrub plantings, park exercise equipment relocation, bituminous path restoration, and wood chip trail landscape restoration. Other work included temporary bypass pumping, temporary cofferdams, sediment and erosion control best management practices, maintenance of traffic (including vehicular, pedestrian, and bicycle), maintenance of a lighting system, and all incidental and collateral work necessary to complete the project. The project included in-stream work, and impacted wetlands and Waters of the United States.

North Pond at Lincoln Park, North Pond Restoration Project
Clients: Lincoln Park Conservancy
Chicago Park District
Contract Value: $6,793,000.00
Location: Lincoln Park, Chicago, IL

The North Pond Restoration Project is located at 2610 N. Cannon Drive, Chicago, IL. The Chicago Park District received funding from the Lincoln Park Conservancy (LPC) for this project to improve the ecological health of the aquatic and adjacent landscape and associated public amenities as part of LPC's Master Plan.

The main project components included: mobilization and demobilization, temporary tree and plant protection, construction waste management, protection of existing surrounding structures such as natural areas, existing trails, trees, and all other associated features to remain, providing temporary measures including temporary facilities, utilities, fencing, erosion and sediment control, excavation support and protection, signage, and safety measures for park patrons, restoration of the aquatic, shoreline, and upland habitat in and around North Pond, upland restoration at Big Marsh, turf restoration, tree removal and planting, and other landscape restoration as necessary, grading and drainage, erosion and sediment control, operations and maintenance, dredging and excavation of the pond, sealing of the pond bottom, grading the pond edge, drainage improvements, shoreline stabilization via plantings, coordination with CPD for concrete foundations of electrical enclosures, the abandonment of the existing water supply well, the installation of new multi-use asphalt paths, a drinking fountain, new aerators, and an automated water management system, and the grading and stabilization of excess material at Big Marsh.

Earthwerks completed the heavy construction for this project utilizing long reach tracked excavators, mid-sized excavators, wide tracked dozers, tracked haul trucks, and tracked skid steers. All construction was performed in the wet including dredging, pond shaping, grading, and

shoreline stabilization. ENCAP completed the natural area restoration, planting, and stewardship for this project, including 20,000 native plugs and 56 native trees.

B. Project Team

- Earthwerks Land Improvement and Development Corporation
    - ***Dan Davies, Project Executive & Construction Design Lead***
      Dan is the owner and operator of award-winning general contractor and construction firm, Earthwerks Land Improvement & Development, out of Lisle, Illinois. Dan has over 30 years of experience designing, building, and consulting on publicly funded projects in the greater Chicagoland area. These projects are specialized in natural infrastructure including inland dredging, river restoration, storm mitigation, and dam removal. Dan has been a part-time resident of Marco Island for the last 25 years.
    - ***Nick Tremmel, Project Engineer***
      Nick is a professional Engineer licensed and practicing in Illinois and in process in Florida with 15 years of experience, specializing in field engineering for public-sector construction projects. Nick is experienced with both administering public contracts as a Consultant Engineer, and field engineering as a Contractor.
- ENCAP, Incorporated
    - ***Jonathan Koepke, Environmental Design Lead***
      Jonathan is the owner and President of environmental design and construction firm, ENCAP, Inc. out of DeKalb, Illinois. Jonathan has 22 years of experience designing, executing, building, and managing environmental designs for public and private projects. These projects are specialized in stream restoration, soil erosion & sediment control, and native vegetation planting and maintenance. Jonathan also volunteers as a board member of the Great Lakes Chapter of the International Erosion Control Association.
    - ***Susan Rowley, Environmental Consulting Specialist***
      Susan is the Assistant Vice President and Ecological Consulting Director of environmental design and construction firm, ENCAP, Inc. out of DeKalb, Illinois. Susan has over 20 years of experience delineating, permitting, designing, monitoring, researching, surveying, and managing environmental projects. These projects are specialized in wetlands, streams, prairies, woodlands, shoreline habitats, mitigation banks, and native restoration/ maintenance. Susan is a Professional Wetland Scientist (PWS), a Certified Arborist, a Certified Prescribed Burn Manager, and is LEED AP Certified.
    - ***Samantha “Sam” DeDina, Project Ecologist***
      Sam is an Ecological Restoration Superintendent at environmental design and construction firm, ENCAP, Inc. located in DeKalb, Illinois. Sam has over 12 years of experience with natural areas management, invasive species management plans, plant community monitoring, wildlife monitoring, wetland delineation, permitting, and habitat planning. Sam’s work has encompassed a range of restoring severely degraded habitats to stewardship and land planning for sensitive ecosystems with

conservative and/or rare species. Sam is an ISA Certified Arborist, a Certified Prescribed Burn Manager and is PADI certified.

- The Vogel Group

  The Vogel Group is supporting the C-HAWQ Initiative with its veteran Tallahassee-based attorneys and lobbyists. The Vogel Group has a proven track record of success in the halls of the Florida Capitol. They bring decades of significant experience and deep relationships in Florida, which will be critical to clients as Florida continues to become a major hub for commerce, business, and politics.

- Naples Botanical Garden
  - ***Chad Washburn, Horticultural Consultant***

    Chad is the Vice President of Conservation at Naples Botanical Garden and is responsible for the development of the Garden's plant conservation strategy and implementation of the program. He leads the Conservation and Natural Resources team, focusing on projects that ensure the long-term survival of the flora and ecosystems of South Florida and the Caribbean region through integrated plant conservation efforts. These efforts include natural resource management, seed banking, conservation plant collections development, threat assessments, restoration and resiliency projects, and capacity building in the region.

- Woodward, Pires & Lombardo, P.A.
  - ***Zachary "Zach" Lombardo, Attorney***

    Zach is an associate attorney at Woodward, Pires & Lombardo, P.A. He is a Board Certified Specialist in City, County & Local Government Law by The Florida Bar and is the City Attorney for Everglades City. He frequently appears before the Marco Island Planning Board, the Marco Island City Council, the Collier County Planning Commission, the Collier County Hearing Examiner, and the Board of County Commissioners of Collier County. He is an experienced litigator in state and federal court both at a trial court level and on appeal. Zach is a Southwest Florida native and current full-time resident in Fort Myers.

- ***Emily Begin, Project Executive***

  Project executive and public relations, Emily is responsible for providing management oversight for the project progress with over 8 years of experience. She specializes in business operations consulting, change management, and marketing for business entities.

- ***Ryan Begin, Marketing Director***

  Ryan is the marketing director specialized in video & photo production and marketing strategy for a variety of client industries including but not limited to construction, corporations, and home remodelers. Ryan is responsible for project digital assets, video, photos, testimonials, and overall execution of digital & physical marketing.

- ***Logan Davies, Project Specialist***

  Logan has been a machine operator for Earthwerks over the last 5 years, has deep expertise in wildlife and habitats of Illinois & Florida, and with passion for social media marketing & brand management. Logan brings his variety of expertise to the team as a project specialist.

- Luetkehans, Brady, Garner & Armstrong

- ***Phil Luetkehans, Attorney***
  Phil is managing partner of Luetkehans, Brady, Garner & Armstrong since 1997 out of West Chicago, Illinois. Phil is a highly accomplished, licensed attorney with deep experience in working with construction projects, municipalities and government at every level. Phil is licensed to practice in Illinois and before all of the federal courts in Illinois, the Seventh Circuit Court of Appeals and the United States Supreme Court. He is a member of the Trial Bar for the Northern District of Illinois and has also practiced before courts in Texas, Pennsylvania, New Jersey and Indiana. Phil has been a part-time resident of Marco Island for the last 30 years.

VIII. Community Benefits

Improving the water quality in Marco Island brings numerous community benefits, both for its residents and the broader ecosystem. As a coastal community, Marco relies heavily on its water resources for tourism, fishing, and recreation. Clean water is essential for maintaining the vibrant ecosystems that support local wildlife and marine life, such as manatees, dolphins, and a variety of fish species. This boosts eco-tourism, which is a key driver of the local economy, by attracting tourists who want to experience pristine beaches and healthy, biodiverse waters. In addition, water quality improvements can help protect the island's shoreline from erosion, ensuring that the natural beauty and habitats of Marco Island are preserved for future generations.

Cleaner water contributes directly to the health and well-being of the local community. Reducing pollutants and harmful algal blooms helps prevent waterborne diseases and ensures safer conditions for fishing and other recreational activities. Enhanced water quality can increase property values, as buyers and renters are often attracted to homes near clean, scenic water bodies. With a strong emphasis on sustainability, Marco Island can cultivate a more resilient, eco-conscious community, one that thrives both economically and socially, while preserving its natural resources for future generations.

A. Engagement Strategy

Public approval and support are absolutely critical for a project of this scale, particularly when it comes to water quality improvements in a community like Marco which have been a passionate and controversial topic. Such initiatives often require substantial funding, long-term planning, and widespread collaboration among local government agencies, environmental & conservation organizations, businesses and local residents. Without the backing of the community, these efforts can face significant hurdles, including resistance to necessary changes, risk to funding and credibility. Public approval ensures that the project aligns with the values and needs of local residents, creating a sense of ownership and responsibility toward the outcomes. When the community is engaged and supportive, it is more likely to participate in conservation efforts, advocate for continued investment in the project, and hold stakeholders accountable for maintaining progress. Ultimately, strong public support can be the difference between a successful, sustainable water quality improvement project and one that struggles to gain traction or achieve long-term goals.

The project team of the C-HAWQ Initiative has already begun engaging with the community on water quality issues to understand the criticisms and feedback they may have about the project proposal. We have hosted an information booth at Farmers Market events and sponsored environmentally focused conferences in the region to reach the public and local NGOs to get local and expert opinions including Naples Botanical Garden, Sanibel-Captiva Conservation Foundation, and Conservancy of Southwest Florida.

Table 9: Methods of Engagement and Marketing the C-HAWQ Team Has Used

Content	Organization Outreach	Community Outreach	PR	Events
- Facebook - Instagram - NextDoor - Blog Posts - Website	- City Sponsored Committees - Local Groups - NGOs - Networking	- Neighborhood Meetings/Forums - Community Events - C-HAWQ Sponsored Events - Surveys	- Press Releases - Interviews - Comments Sections	- Conferences - Workshops

IX. Beneficial Reuse of Dredged Material Case Studies

A. Peanut Island - Palm Beach County, Florida

Peanut Island, located in the Lake Worth Lagoon, Florida, was initially created in 1918 and has evolved from a spoil storage site to a public park offering a variety of recreational facilities (Engineering with Nature 2021) The island spans 86 acres and features beaches, camping areas, trails, picnic spots, and several marine enhancements, such as four reef sites, breakwaters, and a snorkel reef. Over the years, various habitat restoration efforts have been made, including the construction of artificial reefs, shoreline stabilization, and improvements to tidal flow and water quality. These efforts have enhanced both the island's ecological health and its recreational appeal, supporting marine life and providing opportunities for fishing, snorkeling, and other outdoor activities. The project is part of ongoing environmental restoration efforts supported by the U.S. Army Corps of Engineers and local agencies to preserve habitats and reduce erosion in the region.

B. Poplar Island - Chesapeake Bay

Poplar Island, once a thriving community in the Chesapeake Bay, had largely eroded by the 1990s, reducing the island to just four acres (Maryland Environmental Services 2017). However, the island's restoration began in 2001 as part of an effort to reclaim lost habitat in the Bay, using dredged material from the Port of Baltimore. The restoration aims to recreate the island's 1847 footprint, ultimately restoring over 1,700 acres of diverse habitats, including wetlands, uplands, and bird nesting islands. The project has been successful in attracting wildlife, such as ospreys, herons, and terrapins, and has improved water quality through the development of wetlands. The expansion of the

project, authorized in 2007, includes a new 110-acre open water embayment and plans for the creation of additional upland habitats to support a broader range of species. Poplar Island's restoration is part of a larger regional effort to address habitat loss and the environmental challenges facing the Chesapeake Bay.

C. Marker Wadden - Markermeer, Netherlands

The Marker Wadden project, led by Natuurmonumenten and Rijkswaterstaat, aims to restore the ecological health of Lake Markermeer in the Netherlands by constructing an artificial archipelago using dredged sediments (Natuurmonumenten). This large-scale project addresses the lake's deteriorating ecosystem, caused by silt accumulation, lack of natural shores, and reduced water quality. The restoration will create diverse habitats, including wetlands, mudflats, and shallow zones, boosting biodiversity and providing crucial support for endangered plant and animal species. Migratory birds, fish, and other wildlife will benefit from the new spawning areas and natural habitats. The project also highlights innovative water engineering techniques, with a focus on "building with nature" to sustainably manage water quality, sediment, and flood risks. The restored islands will be an attractive destination for birdwatchers and nature lovers, contributing to the national ecological network while enhancing the region's biodiversity and recreational appeal.

X. Proposed Project Elements and Water Quality Improvements

A. Water Quality Improvements in Mangrove and Coastal Marsh Systems

Hydrophytes, or water-dwelling plants, are becoming more widely used for remediation of surface waters due to their ability to host microbial activity that expedites nutrient removal, in addition to a slough of accompanying ecological benefits (Brix 1997, Land et al. 2016, Wang et al. 2009). Among these, mangrove systems are among the most productive and biologically complex ecosystems on the planet. Their unique and dense root systems serve to slow water flowing across them, trapping sediments and other suspended contaminants such as heavy metals and nutrients. Studies have indicated that mangrove forests may filter out 80-90% of nitrates, phosphates, and suspended solids in water flowing through them (Jitthaisong et al. 2012). Further, rates of denitrification in surface waters were found to be higher in mangrove systems compared to other systems, coupled with lower greenhouse gas emissions and demonstrated carbon sequestration ability (Comer-Warner et al. 2021).

Similarly, establishment of salt marsh communities, particularly utilizing dredged sediments, have been demonstrated throughout the U.S. as well as internationally. In Chesapeake Bay, *Spartina* plantings, similar species to what is proposed in our project, were identified as a major nutrient sink, and internal cycling helped retain nitrogen within the marsh instead of being exported from the planted areas (Staver et al. 2021). In essence, the nutrients within the dredged sediments used for marsh restoration were retained within the planted marsh and treated in-situ. In Louisiana, the ability of marshes created from dredged sediments showed improved denitrification rates even when compared to existing marsh control areas (Cheng & White 2022).

The anoxic, water-logged soil and sediment within coastal plant communities provide an ideal environment for natural chemical and biological processes that break down and immobilize pollutants, nutrients, and organic matter (Wood et al. 2017). Natural bacteria and microbes found within salt marsh and mangrove plant communities convert nitrates in the water to nitrogen gas while heavy metals and particulates are captured in the soil and rendered less bioavailable (Zhu et al. 2022). Additionally, microbial action in the soils captures sediment and degrades hydrocarbons making them less available in the water column (Wood et al. 2017). These dynamic microbial communities associated with mangrove habitats are the primary mechanism for nutrient uptake and removal, and have the ability to adapt to a variety of conditions based on adjacent land uses (Ghose et al. 2024). Significant amounts of research, not all of which is summarized herein, demonstrate the ability of mangrove and coastal marsh habitats to provide comprehensive water quality and habitat benefits. Introduction of these systems into Marco Island waterways have the capacity to provide significant water quality improvements via transformation of excess nutrients into non-harmful components through microbial activity and providing biological structure for sediment trapping and removal from the water column.

B. Oyster reef construction, fish habitat, and associated ecological services

The inland canals and surrounding waters of Marco Island are classified as Class II waters, designated for shellfish propagation and harvesting. This classification comes with stringent water quality standards, the violation of which landed Marco Island on the impaired waters list. The relics of this classification are still evident throughout the canals, as various bivalves and barnacles cling to any substrate exposed to the tide. The limestone and coral utilized as ballast for the proposed island structures will provide an ideal substrate for oyster colonization, which can significantly increase denitrification rates and enhance nutrient sequestration. In Maryland, restored oyster reefs were found to increase denitrification rates by at least one order of magnitude compared to control sites, as well as store a significant amount of nitrogen and phosphorus through assimilation into their shells (Kellogg et al. 2013). In the same study, the restored oyster reef provided habitat for 24,585 other macrobenthic organisms per square meter compared to 2,265 per square meter at the control site. This diversity lays the groundwork for improved habitat function and marine habitat that supports fisheries and those who depend on them. Further, the vertical nature of the proposed structures for oyster establishment provides multiple zones on the tidal continuum that foster an improved ability for oysters and other bivalves to shift and respond to changing conditions (Bartol et al. 1998, McFarland et al. 2022).

In addition to substantial water quality benefits, introducing these naturalized island structures into the waterways of Marco Island will provide significantly improved fishery habitat. Ecologically engineered shoreline habitats have been found to have significant increases in nekton biomass, abundance and richness even when compared to natural shorelines in some cases (Smith et al. 2024), and this was especially so on project areas that elected to use stone sills for substrate materials. The macroinvertebrate richness supported by oyster reefs provide the trophic base for healthy fish communities (Kellogg et al. 2013). This fish habitat function is further bolstered by establishment of mangrove

communities which are found to foster ideal habitat for juvenile fish, especially desirable commercial species (Laegdsgaard & Johnson 1995).

C. Sand capping of high organic matter sediments to prevent resuspension

Once the secured pylon island structures are filled with the nutrient-rich sediment dredged from the channels, the islands will be capped with a layer of fine sand. This capping is intended to prevent resuspension of organic materials into the surrounding water column during tidal fluctuations, reducing nutrient loading and providing erosion control. Large scale sand capping has proven successful in reducing turbidity and stabilizing mud in China and Denmark (Flindt et al., 2021; Jiao et a., 2019; Oncken et al., 2022; Steinfurth et al, 2024). In one study, capping of high organic sediments with 10cm of sand was found to reduce resuspension and improve benthic light conditions up to 22%, with the mud-sand interface experiencing minimal mixing even after one year (Oncken et al., 2022). When compared to uncapped sediments, percentage of total nitrogen and nitrate concentrations were significantly reduced with 50% coverage of fine sand (Jiao et al., 2019), demonstrating the capacity for this amendment to provide yet another level of attenuation for the high-nutrient sediments utilized for island construction. Moreover, sand capping of muddy sediments is found to improve erosion thresholds, reduce suspended solids and potentially improve the anchoring capacity of rooted vegetation (Flindt et al. 2021).

Additionally, the combination of fine sand and high nutrient organic matter will provide an ideal substrate for plant growth for the target restoration species which are often nitrogen-limited (Nellis, 1994, Reef et al. 2010). Final island topography and organic matter/sand depth and composition can be used to determine species zonation within the restored islands.

XI. Appendix

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B. Documentation