Northwest Florida Water Management District

Live Oak Point Living Shorelines
Walton County, Florida

NWFWMD In-Lieu Fee Program (SAJ-2011-00287 TMF)

February 2021

To offset unavoidable wetland impacts associated with transportation infrastructure upgrades, the Florida Department of Transportation (FDOT) anticipates a need for estuarine emergent wetland mitigation credits in the Choctawhatchee Bay watershed and elsewhere in northwest Florida. Although private mitigation banks currently service approximately 1/3 of northwest Florida, none located in the Florida Panhandle have associated estuarine emergent credit.[1] Under section 373.4137, Florida Statutes (FS), the Northwest Florida Water Management District (NWFWMD) provides mitigation options to FDOT when private mitigation banks are not able to provide appropriate, offsetting mitigation as determined by federal or state permitters.

This project will develop estuarine emergent credits for the sole use of FDOT via implementation of living shorelines within the Choctawhatchee Bay at Live Oak Point in Walton County. Inclusion of this project into the NWFWMD In-Lieu Fee (ILF) program, as a complement to an existing ILF project,[2] will enable FDOT to move forward with necessary transportation upgrades without having to rely on riskier, permittee-responsible "postage stamp" mitigation. By providing an in-lieu fee option for the offset of minor estuarine emergent impacts, federal and state permitters will also be aided in streamlining the permitting process while being afforded a higher degree of confidence that the mitigation will be successful.

[1] The Florida Gulf Coast Mitigation Bank (FGCMB), located in north central Florida near Cedar Key, is permitted to provide estuarine emergent credits within a narrow, coastal strip extending approximately 200 miles from Ochlockonee Bay in the Big Bend region of northwest Florida to Tarpon Springs to the south (near Tampa).

[2] The existing Live Oak Peninsula ILF mitigation project, a component of the NWFWMD ILF Final Instrument approved by the USACE on 3/18/2015, generated 3.98 mitigation credits (all credits have been depleted for FDOT road projects; no credits remain and there is no potential for additional credits). The proposed Live Oak Point Living Shorelines project is one mile north of the Live Oak Peninsula ILF project area.

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Scope

Salt marsh habitat will be protected, enhanced, and restored along approximately 5,245 feet of the northern edge of Live Oak Point via implementation of a living shoreline. Initial mitigation credits generated by this project will be used to offset estuarine emergent wetland functional loss associated with FDOT replacement of the US 98 Brooks Bridge (FPID 415474-2[3]) in Okaloosa County. Functional credit generated and not needed for the US 98 Brooks Bridge will be reserved for future FDOT use via incorporation into the ILF program.

Background

Live Oak Point contains the largest salt marsh system (approximately 1,000 acres) in Choctawhatchee Bay. Dominated by black needlerush (*Juncus roemerianus*), other prominent species include smooth cordgrass (*Spartina alterniflora*), bulrush (*Scirpus* spp.) and big cordgrass (*Spartina cynosuroides*). Scattered pines and other transitional species occur on hammocks and relict spoil piles. The salt marsh is buffered to the east by hydric pine flatwoods, although single-family housing units are encroaching. A large network of mosquito control ditches, constructed between 1969 and 1972 (as determined from historic aerials), exists throughout much of the northern half of this marsh. Primary productivity in salt marsh is among the highest of any ecosystem in the world. Direct benefits of the Live Oak Point peninsula salt marsh to Choctawhatchee Bay include nursery habitat for fish and crustaceans, habitat for migrating birds, water quality enhancement via filtering of stormwater runoff, floodwater storage, and wave attenuation to protect adjacent hydric pine flatwoods and uplands.

Historic aerial photography dating to 1941 indicates that substantial erosion and the resultant loss of salt marsh habitat is occurring at Live Oak Point peninsula.[4] Analysis of historic aerial photography from 1972 – 2016 suggests an average shoreline/salt marsh retreat of approximately 3½ feet per year along the northern edge of the marsh. Salt marsh habitat loss from 1972 – 2016 for the entire Live Oak Point peninsula is estimated at 56 acres.[5] Analysis of digital orthophotos of Phase 1 (2007 – 2016) indicates that the retreat of the northern shoreline has increased to an average of 4.2 feet per year since 2007. Shoreline retreat along the western edge of the Live Oak Point peninsula is less pronounced, estimated at an average of 0.88 feet per year from 1972 – 2016.[6]

In 2011, three fossil oyster shell breakwaters with accompanying plantings of salt marsh species (*Spartina patens, Juncus roemarianus,* and *Spartina alterniflora*) were installed by the Choctawhatchee Basin Alliance (CBA) on NWFWMD lands along approximately 550 feet of the Live Oak Point as a living shoreline demonstration project. This demonstration project was

[3] FDOT Financial Project Identification number.
[4] Analysis of historic aerials indicates that the salt marsh along the northern portions of Live Oak Point has retreated up to 300 feet since 1941.
[5] Although the earliest aerials available date to 1941, challenges in georeferencing aerials obtained prior to 1972 make acreage loss estimates problematic. The presence of ditching and spoil piles in the salt marsh in the historic aerials from 1972 onward allows for higher georeferencing accuracy and greater confidence in habitat loss estimates.
[6] Because of the presence of extensive seagrass beds along the western edge of Live Oak Point, implementation of living shorelines are not planned for this portion of the Live Oak Point peninsula.

successful: shoreline/salt marsh loss has been halted where breakwaters were installed; strips of additional marsh protected by the breakwaters have been created and are expanding; and oyster spat is colonizing the breakwaters. However, the entire Live Oak Point peninsula salt marsh shoreline (northern, western and southern sides of the peninsula) is approximately 40,000 feet. This current project aims to build upon the success of the 2011 demonstration project by protecting, restoring and enhancing approximately 5,245 feet of shoreline/salt marsh owned by the NWFWMD.

Development of this plan is guided by compliance with the 12 components of a compensatory mitigation plan as outlined in 33 CFR §332.4(c)(2)(14) of the 2008 EPA Final Rule (Compensatory Mitigation for Losses of Aquatic Resources).

Mitigation Plan

1—Objectives [§332.4(c)(2)]

The objectives of this project are 1) to halt ongoing loss of salt marsh habitat at Live Oak Point along approximately 5,245 feet of shoreline, 2) restore and create new salt marsh habitat along an approximately 25-foot wide strip parallel to the current shoreline while avoiding impacts to any existing seagrass beds, and 3) enhance exiting salt marsh habitat via buffer restoration. This will be accomplished via implementation of living shorelines, which will entail construction of shallow limerock breakwaters and plantings of salt marsh species (e.g., *Spartina patens, Juncus roemarianus, Spartina alterniflora*). Other wave attenuation methods such as coir logs may also be used where appropriate, especially where existing salt marsh is being undercut. Hardened structures such as revetments or bulkheads will not be used. Implementation of this project will address ongoing degradation and loss of salt marsh habitat in the Choctawhatchee Bay watershed. Without implementation, current rates of erosion strongly indicate that the northern edge of the Live Oak Point salt marsh will retreat approximately 100 feet over the next 25-30 years and be replaced by open, shallow water.

Specific, measurable outcomes of mitigation activities that can be used to demonstrate whether objectives are being met may include 1) monitoring of the edge of the salt marsh to determine if habitat is expanding, is in stasis, or is continuing to be lost; 2) monitoring of planted vegetation in creation/restoration areas for survivorship, density, recruitment, composition, health, and other criteria; 3) monitoring of sediment accretion or loss; and 4) monitoring of breakwater condition for stability and oyster spat establishment.

Linear Feet	Creation/Restoration			Enhancement		Total Acres
	Pre-FLUCCS[7]	Post-FLUCCS	Acres	Pre- & Post-FLUCCS	Acres	
5,245	540	642	2.24	642	8.42	10.66

Table 1. Live Oak Point Living Shoreline Project Area (Linear Feet, Pre & Post FLUCCS, Acres)

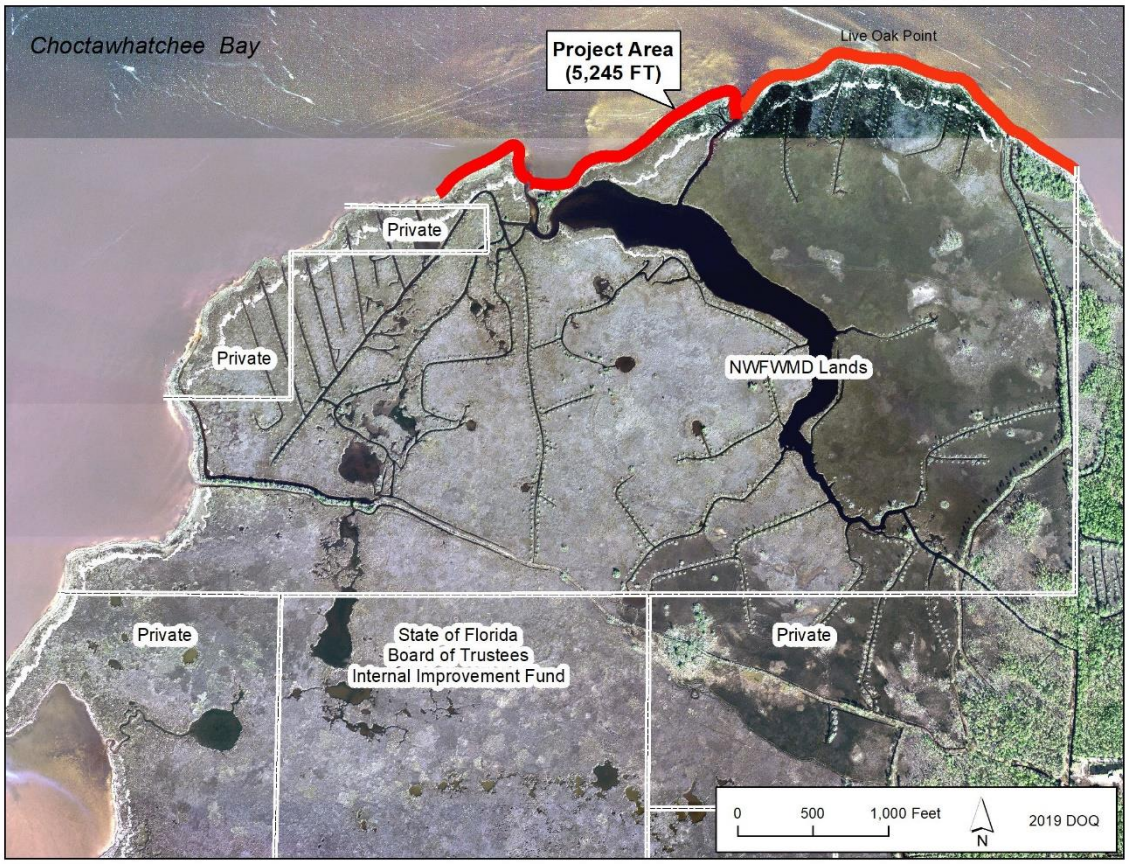


Figure 1. Live Oak Point Living Shorelines Project Area

[7] "Florida Land Use, Cover and Forms Classification System," January 1999 FDOT Handbook; 540 = Open water; 642 = Salt marsh; 625 = Hydric pine flatwoods.

2—Site Selection Criteria [§332.4(c)(3)]

Estuarine emergent wetlands within the Choctawhatchee Bay watershed provide important environmental services including flood attenuation, water quality protection, cycling of energy and nutrients, and nursery habitat for fish and crustaceans. Site selection justification for placement of mitigation at Live Oak Point is described in the earlier Live Oak Peninsula ILF mitigation plan approved by the USACE in 2015 (available at https://www.nwfwater.com/Water-Resources/Regional-Wetland-Mitigation-Program/In-Lieu-Fee-Program; hardcopy available upon request).

This project also implements ecological needs identified in the Choctawhatchee SWIM Plan ["Choctawhatchee River and Bay Surface Water Improvement and Management Plan" (NWFWMD, Program Development Series 17-05, October 2017[8])] and increases protection of the largest salt marsh system in Choctawhatchee Bay. Section 4.1.2 Ecological Restoration (beginning on Page 28 of the Choctawhatchee SWIM Plan) identifies shoreline restoration such as "living shorelines" as an ecological need for Choctawhatchee Bay. Section 4.3 Priority Projects (beginning on Page 36 of the Choctawhatchee SWIM Plan) identifies estuarine emergent habitat restoration as a watershed priority. The subsection Estuarine emergent Habitat Restoration (Pages 45-46) further describes ecological needs that would be addressed by the Live Oak Point project including restoration of estuarine emergent habitat.

When complete, the mitigation at Live Oak Point is anticipated to be self-sustaining. All project phases will be owned fee-simple and managed for ecological integrity in perpetuity by the NWFWMD.

3—Site Protection Instrument [§332.4(c)(4)]

Title to this site (fee-simple) will be held in perpetuity by the NWFWMD. All environmental benefits gained from implementation of this project will be managed in a natural condition and protected in perpetuity by the NWFWMD as conservation lands.

The EPA 2008 Final Rule (§332.7(a)(1)) states that mitigation sites may be protected by various means including "transfer of title" to a state resource agency. As a state resource agency, the mission of the NWFWMD, as defined by Chapter 373, Florida Statutes, includes protecting and improving natural systems in Northwest Florida through land acquisition, management, and ecosystem restoration activities. The Live Oak Point Living Shorelines project area is owned outright by the NWFWMD and would not be subject to any consideration for surplus by the State of Florida Board of Trustees (which holds title to other lands such as state parks and state forests).

[8] The "Choctawhatchee River and Bay Surface Water Improvement and Management Plan" (NWFWMD, Program Development Series 17-05, October 2017) is available at: https://www.nwfwater.com/Water-Resources/Surface-Water-Improvement-and-Management (hardcopy available upon request). Development of Surface Water Improvement and Management (SWIM) plans are mandated by the Florida legislature to address, on a watershed basis, cumulative anthropogenic impacts to water quality and aquatic habitats and to incorporate comprehensive strategies to both restore and to protect watershed resources.

No reasonable scenario has been identified in which these lands would be considered for surplus. In the highly unlikely event that this salt marsh was suggested for surplus, the existence of federal and state permits with legally-binding requirements tying FDOT mitigation to this site would preclude such action from moving forward.

The NWFWMD, a governmental entity created by the Florida Water Resources Act of 1972 (section 373.069, Florida Statutes), given taxing authority by a Florida constitutional amendment in 1973 and with jurisdictional boundaries covering 16 counties, manages over 211,000 acres in the Florida Panhandle for water resources protection and ecosystem integrity. Section 373.1391, Florida Statutes, mandates ecological management of NWFWMD lands, although allowing for multiple uses such as hunting and passive recreation when such uses do not conflict with ecological management goals.

4—Baseline Information [§332.4(c)(5)]

As stated in the Background section above, the Live Oak Point peninsula contains the largest salt marsh system in Choctawhatchee Bay (approximately 1,000 acres) and is dominated by black needlerush (*Juncus roemerianus*). Historic aerials indicate substantial and ongoing shoreline erosion and loss of estuarine emergent wetlands since at least the 1940s (earliest known aerial photos of the site date to 1941).

DSAS 4.0 (Digital Shoreline Analysis System), an ArcMap tool developed by the US Geological Survey to assess shoreline erosion, was used to estimate shoreline loss at Live Oak Point using georeferenced 1941, 1972, and 2016 aerial imagery. Since 1941, the shoreline/marsh has retreated an average of some 250 FT along the northern edge of Live Oak Point (MIN 66 FT; MAX 432 FT). Estimated erosion rates from 1972 – 2016 was approximately 3½ feet per year.[9]

[9] Erosions rates for the 1972 – 2016 data range are reported here because of higher confidence in georeferencing of the 1972 and 2016 imagery.

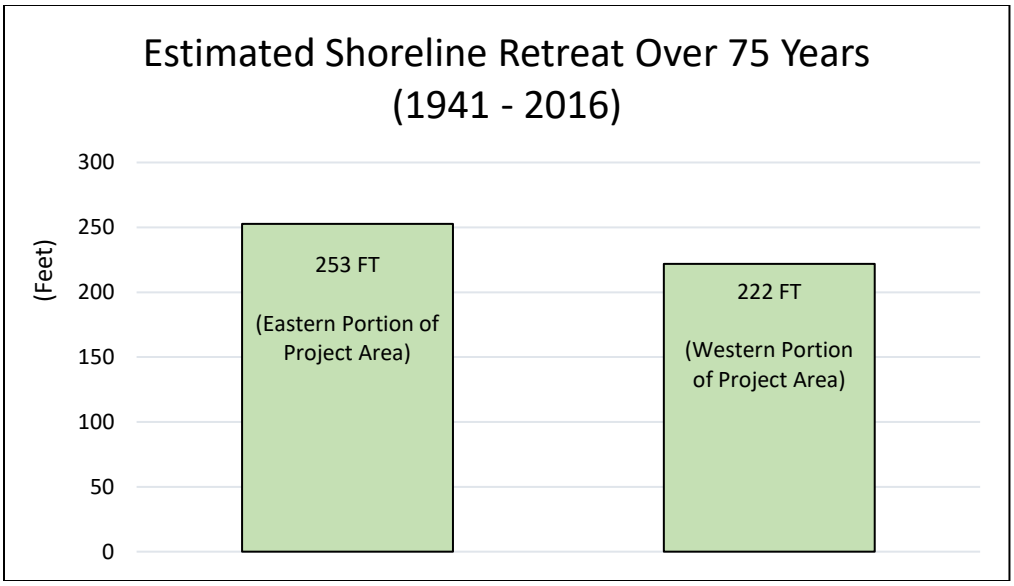


Figure 2. Average Shoreline Retreat 1941 – 2016

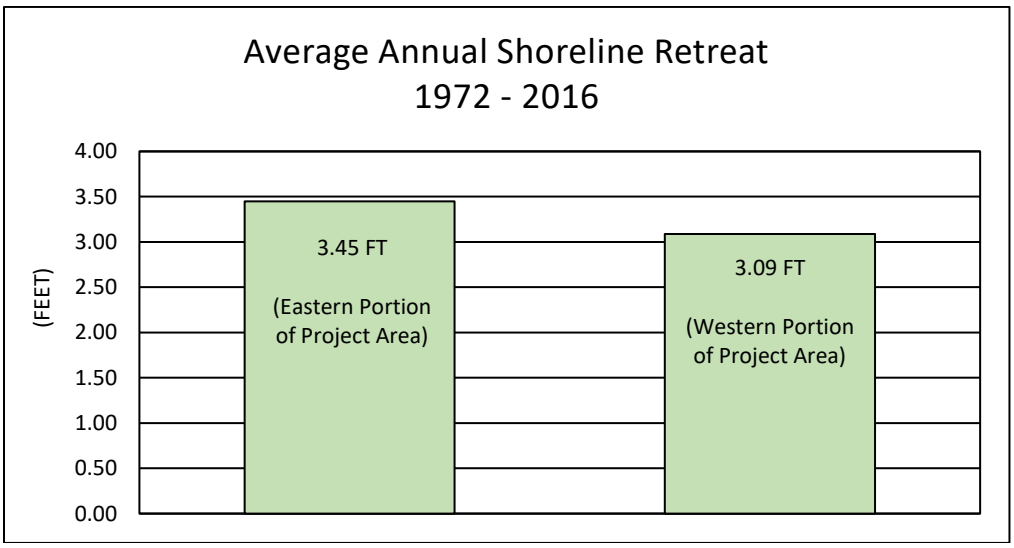


Figure 3. Average Annual Rate of Shoreline Retreat 1972 - 2016

The normal tidal range within Choctawhatchee Bay is estimated at approximately 0.5 FT.[10] This estimate is consistent with observed conditions at Live Oak Point, although tides will vary somewhat based on the presence of neap tides, spring tides, current weather, and shoreline geometry.

No federally listed species are known to be present within any project phase.

Although Chinese tallow (*Sapium sebiferum*) has previously been identified on several relict spoil piles associated with mosquito control ditching implemented at the Live Oak Point salt marsh in

[10] Personal communication from MRD Associates, Inc. cited in Marsh Shoreline Protection and Wetland Mitigation Plan, November 2006, a report prepared for the NWFWMD by Biological Research Associates, Inc.

the late 1960s or early 1970s, none is known to be present within any of the proposed project areas associated with this plan. No other exotic and/or nuisance vegetation is known to occur within the Live Oak Point salt marsh. All project areas will be closely monitored for any establishment of exotic and/or nuisance vegetation. In the event exotic and/or nuisance vegetation becomes established in any project area, eradication methods will be implemented.

The current edge of the salt marsh within and adjacent to the project area has been recorded using GPS by NWFWMD staff and is shown on an attached map (GPS survey conducted July - September 2019). This survey will be repeated at future dates as part of a monitoring program.

The soils at the Live Oak Point are mapped by the US Department of Agriculture, Natural Resources Conservation Service as "Direго Muck, Frequently Flooded" and "Duckston Muck, Frequently Flooded."[11] These mucky soils are typical of brackish tidal marshes underlain by stratified sandy sediments. The general composition of the nearshore substrate consists of a friable peat layer near the existing marsh shelf that transitions into fine bay sand in deeper waters further from the shoreline.[12] The majority of the bay bottom within 300 feet of shore occurs at a depth less than 2 feet relative to sea level (0.0 ft. NGVD 1929).[13] Generally, mucky areas are thin and underlain by hard, sandy substrates.

Seagrass (overwhelmingly *Halodule wrightii* with minor occurrences of *Ruppia maritima*) is present near portions of the project area, with extensive occurrences on the western side of the Live Oak Point salt marsh. In accordance with USACE guidance, these seagrass areas were surveyed and mapped between June 1st and September 30th of 2020 (see attached report). Breakwater footprints and salt marsh creation/restoration areas will be placed a minimum of 3 FT from any extant seagrass. Best Management Practices (BMPs) will be implemented to ensure that seagrass beds are not impacted during project implementation.

Additional baseline information is provided on maps and figures included in this plan, and in other background documents included as attachments.

5—Determination of Credits [§332.4(c)(6)]

Estimated mitigation credits for this project are derived using the Uniform Mitigation Assessment Method (UMAM).[14] Assessments by NWFWMD staff (scores vetted by USACE on 4/24/2020) indicate a total of 2.61 estuarine emergent UMAM credits may be generated by implementation of this project. Calculated from UMAM scores and project area, this value (2.61 credits) may be subject to slight upward or downward adjustment if field conditions require minor shifts in the planned breakwater or UMAM polygon footprints.

[11] Soil Survey of Walton County, Florida. US Department of Agriculture, Soil Conservation Service (renamed Natural Resources Conservation Service in 1994).
[12] Marsh Shoreline Protection and Wetland Mitigation Plan, November 2006, a report prepared for the NWFWMD by Biological Research Associates, Inc.
[13] Marsh Shoreline Protection and Wetland Mitigation Plan, November 2006, a report prepared for the NWFWMD by Biological Research Associates, Inc.
[14] Section 373.414(18), Florida Statutes; Rule Number 62-345, Florida Administrative Code (FAC).

For estimation of UMAM credit, the project design delineates three types of map polygons:

- BREAKWATER. The most waterward polygon type will be the footprint of the rock breakwater. Nominal design is for 7 FT wide at the base of the breakwater, 2 FT wide at the top, with 5 FT gaps every 20-50 FT along the shoreline. Elevation of the top of the breakwater may extend approximately ½ FT above the Mean Highwater Line (MHWL). The 20-50 FT breakwater segments will be curved in an alternating concave / convex pattern ("scallop pattern") to facilitate appropriate flushing of water between breakwater gaps and establishment of salt marsh. The waterward edge of the breakwater footprint may extend up to 32 FT from the nominal edge of the extant salt marsh; the marshward edge of the breakwater footprint may extend up to 25 FT from the nominal edge of the extant salt marsh. Although oyster spat is expected to colonize the limerock breakwater and salt marsh vegetation may become established within portions of the breakwater footprint, no UMAM credit will be generated or claimed within the breakwater footprint or within gaps between breakwater segments.
- SALT MARSH CREATION / RESTORATION. This polygon type is where salt marsh will be actively created and restored via sediment accretion and supplemental plantings of appropriate species. It will extend a maximum of 25 FT from the marshward base of the breakwater to the nominal edge of the extant salt marsh. UMAM credit will be generated via creation / restoration of salt marsh habitat.
- SALT MARSH ENHANCEMENT. Salt marsh habitat within this polygon type will be enhanced via restored buffers and protection from ongoing erosion.[15] This polygon type will extend from the edge of reestablished salt marsh inland for no more than 100 FT; it will not extend beyond any existing mosquito ditches, onto private property, and will not include large open water areas and non-estuarine emergent wetland areas. A 2015 USACE Jacksonville District guidance document[16] for assessing indirect effects on wetlands "decided that a 300-foot maximum distance would be a reasonable and conservative" approach that "would not result in over-estimation of wetland" function associated with indirect effects. Although a 300 FT buffer is commonly used by federal authorities when assessing indirect impacts to wetland functions and is commonly accepted by federal authorities when assessing benefits to wetlands from improvements to buffer habitat, best professional judgement suggests that using a maximum 100 FT buffer in this situation would be more appropriate for calculating UMAM credit.

A UMAM summary table, UMAM worksheets, and maps of UMAM polygons are included as an attachment to this plan.

[15] Historic erosion rates derived from 1972 – 2016 imagery (DSAS analysis) suggest that without implementation of mitigation, by 2048 (approximately 30 years out) the salt marsh edge of the eastern portion of the project area will retreat an additional 100 feet, whereas the edge of the western portion of the project area will retreat an additional 90 feet. Preliminary analyses limited to the 2007 – 2016 imagery for the eastern project area, coupled with anticipated sea level rise, suggest actual shoreline retreat will be greater than that estimated from the 1972 – 2016 average.

[16] "Jacksonville District, Regulatory Division Guidance for the Assessment of Indirect Effects and Impacts in Wetlands for Compensatory Mitigation under the National Environmental Policy Act and Section 404 of the Clean Water Act of 1972" (2015).

6—Detailed Work Plan [§332.4(c)(7)]

Although fossilized oyster shell was used to construct three pilot breakwaters at Live Oak Point in 2011, because of the relatively high energy environment and current difficulty in obtaining fossilized oyster shell in the Walton County area, it has been determined that the use of limerock for breakwater construction will be an appropriate alternative. The planting of salt marsh vegetation will be a key component and integral part of each project phase.

The proposed design dimensions for the breakwaters to be installed are 20-50 FT sections with a 7 FT base and a 2 FT crown, with 5 FT gaps. Each 20-50 FT section will be arced and may alternate between convex and concave sections relative to the shoreline.

The NWFWMD will contract with the Choctawhatchee Basin Alliance (CBA) to implement this project.[17] CBA, established in 1996 and associated with Northwest Florida State College, has extensive experience researching, improving methodologies, and implementing living shorelines in Choctawhatchee Bay. The pilot living shoreline project at Live Oak Point, inspected and appraised positively by USACE representatives in October 2018, was implemented by CBA in 2011. An interactive map and additional information on past CBA living shoreline projects is available for viewing at http://basinalliance.org/what-we-do/in-our-waterways/living-shorelines/.

Best Management Practices (BMPs) for turbidity, sedimentation and erosion control may be implemented during construction to prevent siltation and turbid discharges into waters of the state and water quality violations of Chapter 62-302, F.A.C.

Locations of existing seagrass in relation to the work area have been surveyed (September 2020) and mapped. Impacts to seagrass beds will be avoided. It is anticipated that a shallow-draft pontoon boat will be used to transport materials and personnel to and from the site during implementation. Materials will not be stored within any wetland area.

Each breakwater segment will be completed before construction of additional segments are begun. The breakwater will consist of gabion sized limerock placed according the plan drawings. The limerock will be placed in the water at the proper design location for each segment with successive rock layers added until the design elevation has been reached. It is anticipated that breakwater construction will be completed in 2022.

Vegetation to be planted will include:

- *Spartina patens* (Salt meadow cordgrass)
- *Spartina alterniflora* (Smooth cordgrass)

Plants will be planted on approximately 1-foot centers (43,560 plants per acre) along the current shoreline. The width of the planting area will not exceed 6 FT. The anticipated planting method will use 1 FT x 2 FT burlap bags, filled with site-appropriate sand, and containing three plants per bag. Rows of burlap bagged plants will be planted parallel to the current shoreline. Alternative

[17] The Choctawhatchee Basin Alliance, a non-profit organization affiliated with Northwest Florida State College, has extensive experience implementing successful living shorelines within Choctawhatchee Bay. Any contracting with CBA for implementation of this project will stipulate that no volunteer labor or materials may be used.

planting methods and densities may also be used if determined to be more appropriate by experienced restoration ecologists and approved by the USACE.

No grading of the site will occur.

Although manatees are not known to occur near the project area, this project will comply with the "Standard Manatee Conditions for In-Water Work" (US Fish and Wildlife Service, 2009). Likewise, if applicable, this project shall also comply with the "Sea Turtle and Smalltooth Sawfish Construction Conditions" (US National Marine Fisheries Service, 2006).

The current rate of global sea level rise (December 2017) is estimated by the NASA Goddard Space Flight Center as 3.2 mm per year; this rate is expected to increase with time. Rates specific to Choctawhatchee Bay are not available. However, the National Oceanic and Atmospheric Administration (NOAA) reports that the relative sea level rise trend at Panama City (2017) is 2.29 mm per year (equivalent to a change of 0.75 feet in 100 years). The corresponding relative sea level rise trend at Pensacola is 2.36 mm per year (equivalent to a change of 0.77 feet in 100 years). Successful implementation of extensive living shorelines at Live Oak Point peninsula may aid accretion processes of the existing salt marsh and potentially allow it to keep pace with gradual increases in sea level.

7—Maintenance Plan [§332.4(c)(8)]

After initial implementation, this project is anticipated to be self-sustaining. To ensure project success, all planted vegetation, breakwaters, accretion or erosion of salt marsh, and any seagrass beds within the project area will be closely monitored (see attached monitoring plan). Planted vegetation will be closely monitored for survivorship, density, recruitment, and health. Breakwaters will be inspected for potential maintenance issues, especially after major storms.

The project area will be maintained in perpetuity by the NWFWMD as part of the Choctawhatchee River and Bay WMA (Water Management Area). After all success criteria are and final credit releases are obtained, monitoring will continue at least annually for the life of the ILF program. Replantings of salt marsh species, rehabilitation of rock breakwaters or other wave attenuation techniques, and eradication of exotic plant species, should they occur, will be conducted when necessary.

8—Performance Standards [§332.4(c)(9)]

Credit release schedules, based on ecologically-based and performance-based criteria in accordance with USACE guidance, have been developed for this project (see "Schedule of Credit Release" attachment). In addition to initial credit release criteria including USACE-approval of the compensatory mitigation plan, submittal of a baseline monitoring report, establishing financial

guarantees, construction of breakwaters, and plantings of approved salt marsh species, the following standards are proposed:

- Exotic vegetation is <1% cover.
- Nuisance vegetation <5% cover.
- Planted vegetation is at appropriate densities and in a thriving condition. Minimum cover of planted vegetation to meet success criteria to be decided in consultation with the USACE and IRT (see Credit Release Schedule attachment).
- All installed breakwaters are intact and functioning as designed.
- Sediment accretion is ≥2.29 mm per year as measured by sediment accretion plates installed 0.5 meters marshward of the current shoreline.
- Salt marsh vegetation recruitment is occurring.
- Any other performance standards required by the USACE and IRT.

9—Monitoring [§332.4(c)(10)]

Monitoring protocols have been developed to ensure that the restoration is successful (see attached monitoring plan). It is anticipated that quantitative monitoring will be conducted at least annually for a minimum of five years from the start of mitigation activities (USACE permit conditions may require more frequent or longer-duration monitoring). Quantitative vegetation will occur twice during the first year of project implementation. Monitoring will be performed by NWFWMD staff, qualified consulting firms, or other entities (e.g., Choctawhatchee Basin Alliance). The project will be inspected for damage within a reasonable time, as conditions allow, after any major storm. Corrective measures will be taken as necessary. Monitoring will include, at a minimum, annual qualitative and quantitative measurements. A "Baseline Monitoring Report" will be conducted and provided to the USACE and IRT to serve as a basis for the development of project specific success criteria. Qualitative monitoring and inspections will continue for the life of the ILF project.

Monitoring may include measuring survivorship of planted vegetation, vegetation densities, oyster colonization of breakwater materials, marsh surface aggradation measurements, shoreline loss or accretion rates, presence or absence of exotic and/or nuisance vegetation, and photo-monitoring.

All monitoring reports will be posted at https://www.nwfwater.com/Water-Resources/Regional-Wetland-Mitigation-Program. Annual monitoring will be prepared and submitted to the USACE each year by January 31st for the previous calendar year. These reports will include the information collected during the semi-annual monitoring events such as measuring survivorship of planted vegetation, vegetation densities, oyster colonization of breakwater materials, marsh surface aggradation measurements, shoreline loss or accretion rates, and photo-monitoring, along with qualitative information regarding the ecological performance of the habitats within the Live Oak Point Living Shorelines project area and the activities necessary to maintain the ecological function in perpetuity.

Monitoring to be conducted after initial mitigation activities through the achievement of final success and release of all credits, will consist of a qualitative monitoring event in the spring and a

quantitative monitoring event in the fall. It is anticipated that quantitative monitoring will be conducted for not less than five years or as directed by the USACE. A longer monitoring period may be required for aquatic resources with slow development rates to attain final success. After final credit release, long-term qualitative monitoring will be conducted annually for the life of the ILF program. The long-term (perpetual) monitoring, which documents the monitoring activities once the project has achieved final success criteria, will consist of qualitative data collection. The long-term management report will serve to demonstrate how the project is continuing to meet the goals and objectives of the ILF mitigation plan and will include a log and aerial showing the location of all maintenance activities undertaken during the preceding year. Quantitative monitoring may be required if the project is failing to maintain full success standards. The long-term monitoring period does not begin until written concurrence is provided by the USACE.

Monitoring will be conducted to document the progression of enhancement activities in each assessment area. Qualitative monitoring information to be included in the annual reports will consist of:

- an overall assessment of the enhancement areas,
- estimation of the percent cover and dominant species in each community,
- shoreline loss or accretion rates,
- wildlife utilization,
- general biological integrity of each assessed community; and
- all the necessary information to demonstrate success criteria are being achieved.

Quantitative vegetation data will be collected along transects established through each assessment area where vegetative changes are anticipated. The geographic coordinates for the locations of all sampling locations and photo stations will be identified on a monitoring map and included in the monitoring plan.

10—Long-term Management [§332.4(c)(11)]

Long-term management will commence after the achievement of final success and sale or relinquishment of all available credits from the entire project area.

Restored salt marsh habitat and associated breakwaters will be managed in perpetuity by the NWFWMD.

Monitoring of restored salt marsh and associated breakwaters will be conducted as part of the long-term management plan. If necessary, planted species may be augmented when and where needed. Exotic or nuisance plant species, if they gain a foothold or become established, will be treated and eradicated.

Maintenance and/or repair, as necessary, of the breakwater structures will be part of the long-term management plan. The structural integrity of the limerock breakwaters will be closely monitored, especially after major storms and will be repaired as necessary.

Shoreline loss or accretion rates will be monitored as part of the long-term management plan.

Funds (tentatively $50,000) will be held in reserve in case remedial actions are required.

Annual monitoring before obtainment of final success criteria is estimated at $10,000 (subject to modification as the planning process proceeds). Long-term management monitoring is anticipated to be much lower, currently estimated at $2,500 per year.

11—Adaptive Management Plan [§332.4(c)(12)]

As required by §332.4(c)(12) of the EPA 2008 Final Rule, the adaptive management plan is a management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. It will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success. If changes in the implementation of this mitigation plan become necessary due to the stochastic nature of ecological processes or for any other reasons, the NWFWMD will first obtain approvals from the USACE in consultation with the Interagency Review Team (IRT).

Adaptive Management. In the event either the USACE, in consultation with the IRT, or the NWFWMD determines that either (1) the Live Oak Point Living Shorelines ILF project is not achieving the performance standards identified in Success Criteria; or (2) the Live Oak Point Living Shorelines ILF project has failed to meet or will no longer meet a function, value or component of the mitigation project; or (3) an unanticipated event (natural or human-caused) has adversely affected the Live Oak Point Living Shorelines ILF project; a Notice of Deficiency shall be prepared by the entity making the determination. Within 15 days of submittal to the USACE or receipt from the USACE of a Notice of Deficiency, the NWFWMD will either submit to the USACE a proposed adaptive management plan to address the deficiency or provide a timeframe for submitting the proposed plan. The proposed adaptive management plan will be reviewed by the USACE in accordance with 33 CFR 332.4(c)(12) and 33 CFR 332.7(c). The approved Adaptive Management Plan shall be implemented by the NWFWMD to address the deficiency. The Adaptive Management Plan will identify specific measures to be taken and a timetable to complete the work to correct deficiencies. After the work is completed, and the time defined in the Adaptive Management Plan has passed, if the USACE, in consultation with the IRT, determines that Live Oak Point Living Shorelines ILF project is still not performing in accordance with the Adaptive Management Plan, modifications to the Adaptive Management Plan may be required and credit sales may be suspended until the NWFWMD has performed the necessary remedial work. If the USACE, in consultation with the IRT suspends credit sales, the transfer of credits will not resume until the NWFWMD has successfully performed additional adaptive management/remedial work or until the USACE, in consultation with the IRT, decides to adjust the total amount of credits and the credit release schedule based on the current condition of the Live Oak Point Living Shorelines ILF project.

Failure of NWFWMD. If the NWFWMD fails to implement the Adaptive Management Plan to address any failure in meeting the performance standards within the timeframe specified in the

Adaptive Management Plan, the USACE, in consultation with the IRT, will issue a Notice of Deficiency to call on the Financial Assurance. The Financial Assurance will be utilized to correct the issue identified in the Notice of Deficiency, and the USACE, in consultation with the IRT will determine the number of credits that the ILF Project will generate. Any deficit in the number of credits the ILF Project has generated in relation to the number of credits sold will be the responsibility of the NWFWMD to recover. The perpetual protection will remain in place on the Property to protect accrued credits.

Natural or Human-caused Disasters. When a disaster (natural or human-caused) adversely affects the Live Oak Point Living Shorelines ILF project, the NWFWMD shall provide a Notice of Deficiency to the USACE of such circumstance within two (2) weeks of the event. The NWFWMD will provide details of the deficiency and propose a course of action to correct deficiencies in accordance the Adaptive Management requirements discussed in this section. In the event substantial damage to the Live Oak Point Livings Shorelines ILF project is caused by a natural disaster or a deliberate or unlawful act by a 3rd party that is not the NWFWMD or Owner, and the USACE, in consultation with the NWFWMD and IRT, determines that the disaster was beyond the control of the NWFWMD, its agents, contractors, or consultants to prevent, or mitigate, the NWFWMD may request, and the USACE in consultation with the IRT, may approve changes to the construction, operation, project milestones, or performance standards. In addition, should a disaster occur which causes substantial damage to the Live Oak Point Living Shorelines ILF project, the use of the Live Oak Point Living Shorelines ILF project will be temporarily suspended pending determination of the degree of impacts and measures necessary to remediate identified impacts.

12—Financial Assurances [§332.4(c)(13)]

The NWFWMD is a governmental entity created by the Florida Water Resources Act of 1972 with the mission of protecting water resources protection and ecosystem integrity. Funds are specifically earmarked to implement and maintain mitigation.

As of 12/31/2020, the NWFWMD had $15,933,637.64 in a dedicated wetlands mitigation fund. This fund was established to receive mitigation funds from FDOT for the implementation and long-term management of mitigation sites, in accordance with 62-342.850 Florida Administrative Code (FAC).

Fees for credit sales from the Live Oak Point Living Shorelines ILF project to FDOT, in accordance with the USACE-approved NWFWMD ILF Final Instrument, are governed by section 373.4137, Florida Statutes. All mitigation funds received, plus earned interest, remain in the dedicated mitigation fund.

Based on estimates from CBA, limerock breakwaters can be installed at Live Oak Point at a rate of $84.20 per liner foot. Vegetation can be planted, using the burlap bag technique, at a rate of $10.11 per square foot (use of bare-root plants would be cheaper, though they would have a lower survival rate and would be less effective in stabilizing erosion). Using these estimates, project cost

is estimated at approximately $680,000 ($285,000 for breakwater construction; $395,000 for revegetation).[18]

Other Information [§332.4(c)(14)]

The NWFWMD will provide any other information on this project as requested by the USACE.

Mitigation Service Area

In accordance with the 2008 EPA Final Rule governing delineation of service areas, the Live Oak Point Living Shorelines ILF Mitigation Service Area (MSA) was developed using a watershed and ecoregion-based rationale. It covers approximately 383 mi^2. A detailed description of the MSA is attached to this plan.

[18] NWFWMD staff hours for project oversight not included; size of area planned for revegetation (0.65 acres) may be adjusted upward or downward depending on site-specific conditions.

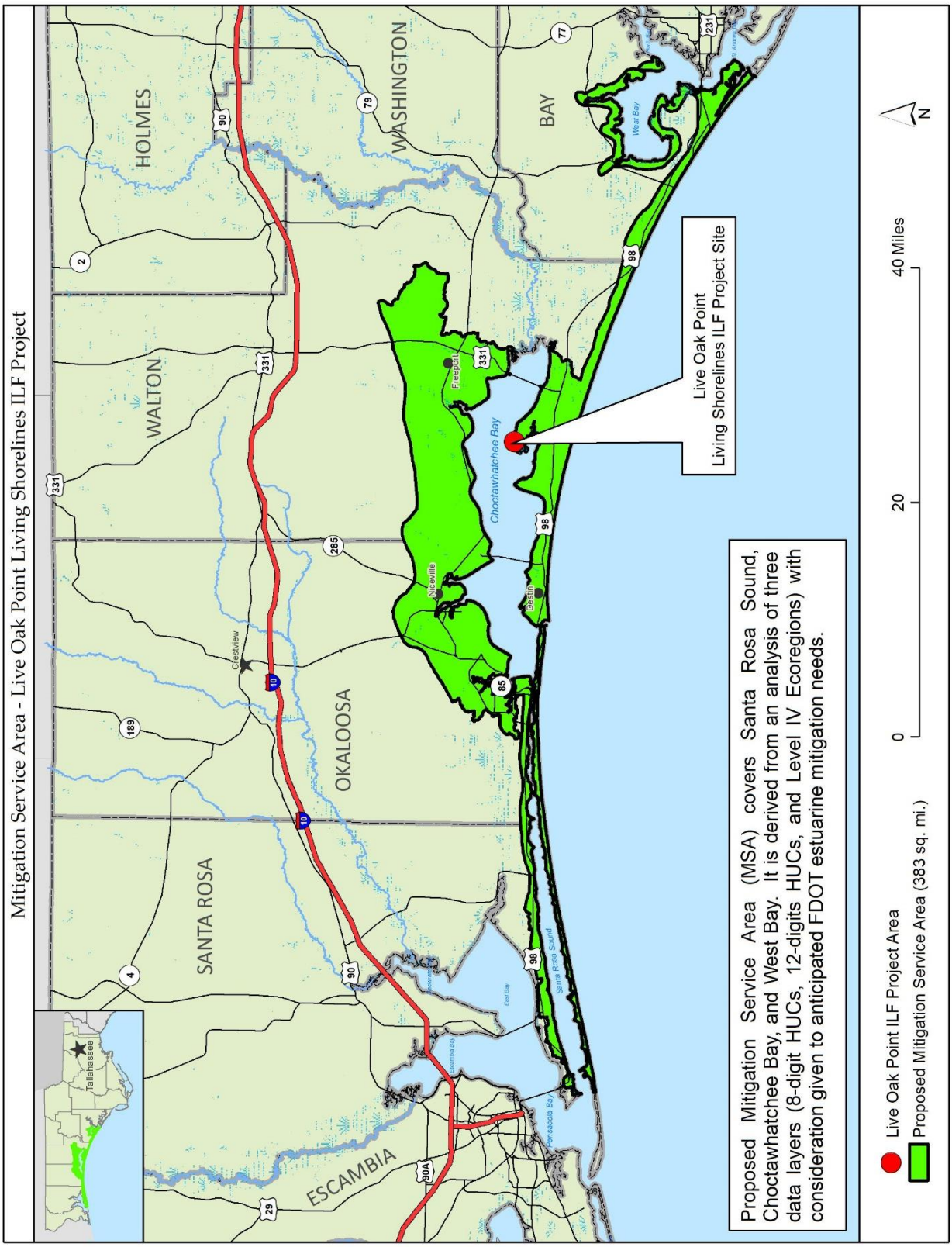


Figure 4. Live Oak Point Mitigation Service Area (MSA)

Figure 5. Location Map (Live Oak Point Living Shorelines)

Figure 6. Estimated Shoreline Loss (1972 - 2016)

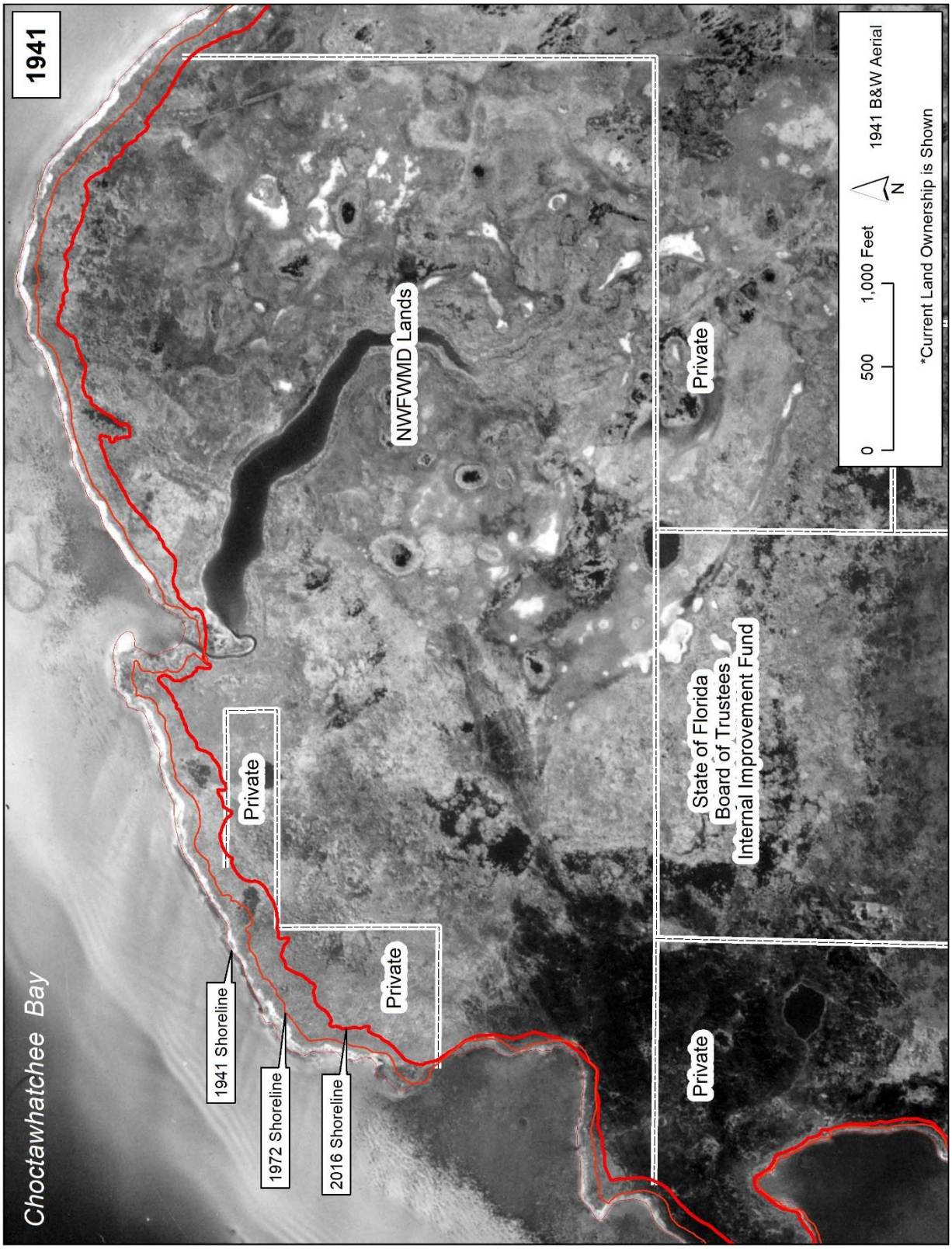


Figure 7. Live Oak Point Living Shorelines Project Area 1941

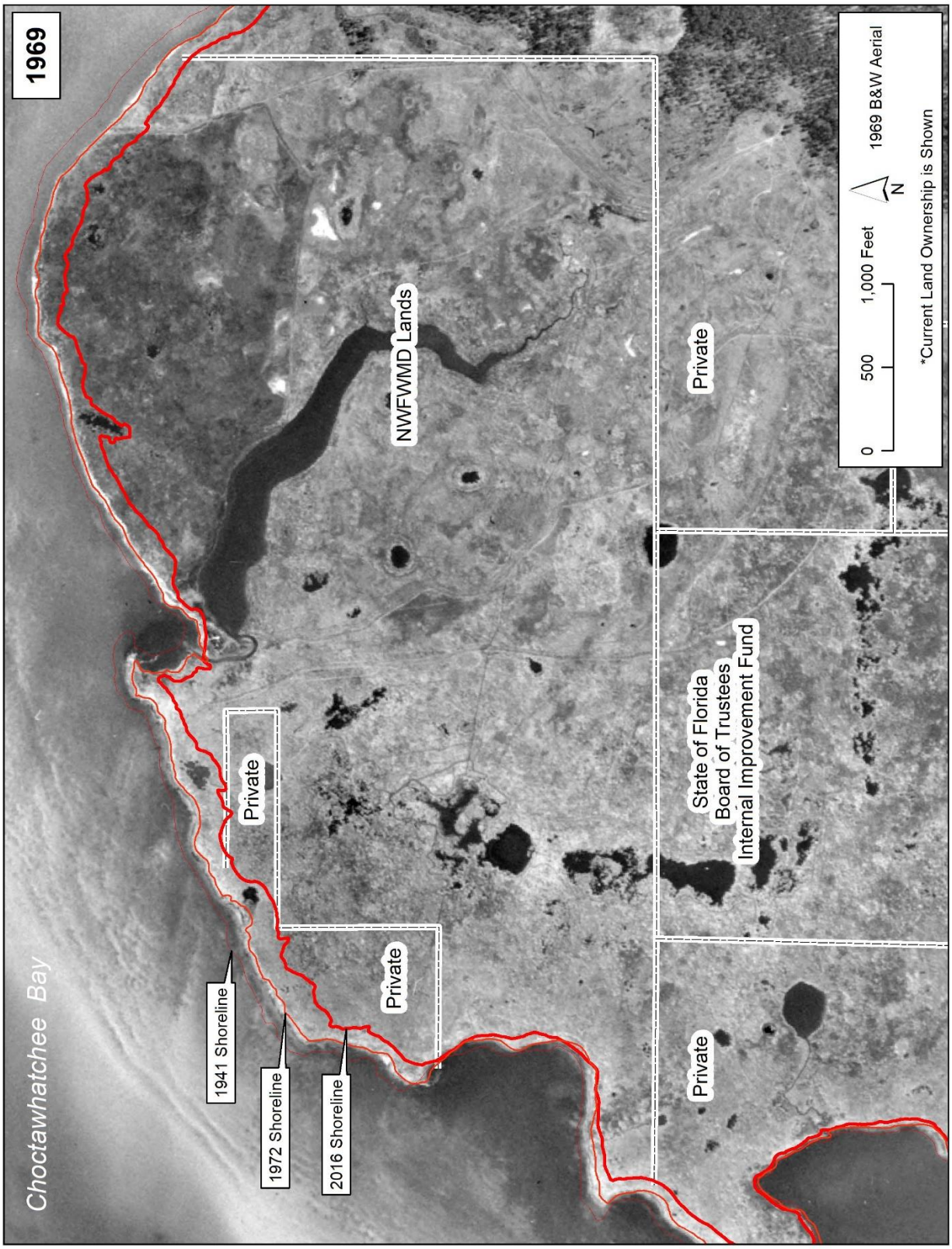


Figure 8. Live Oak Point Living Shorelines Project Area 1969

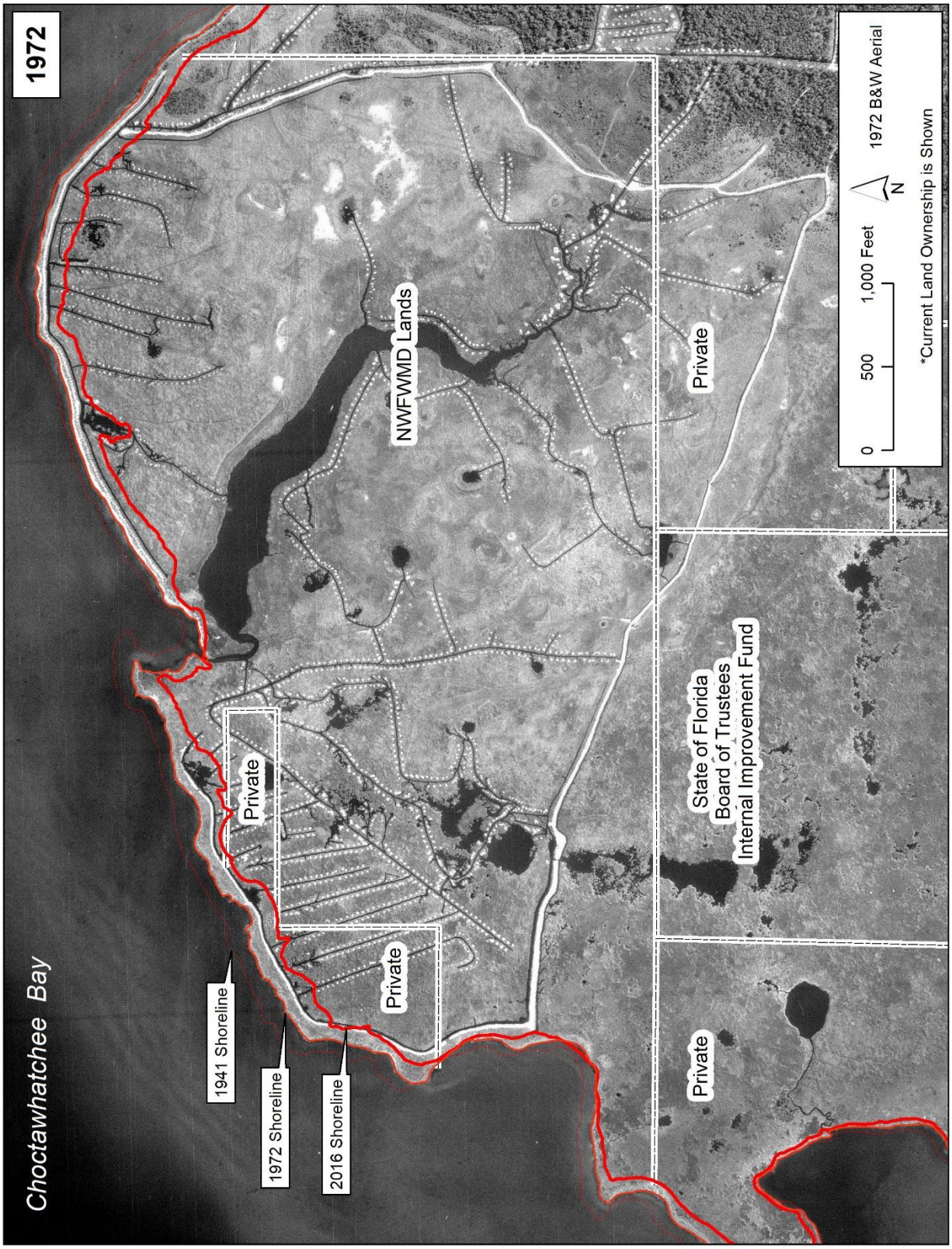


Figure 9. Live Oak Point Living Shorelines Project Area 1972

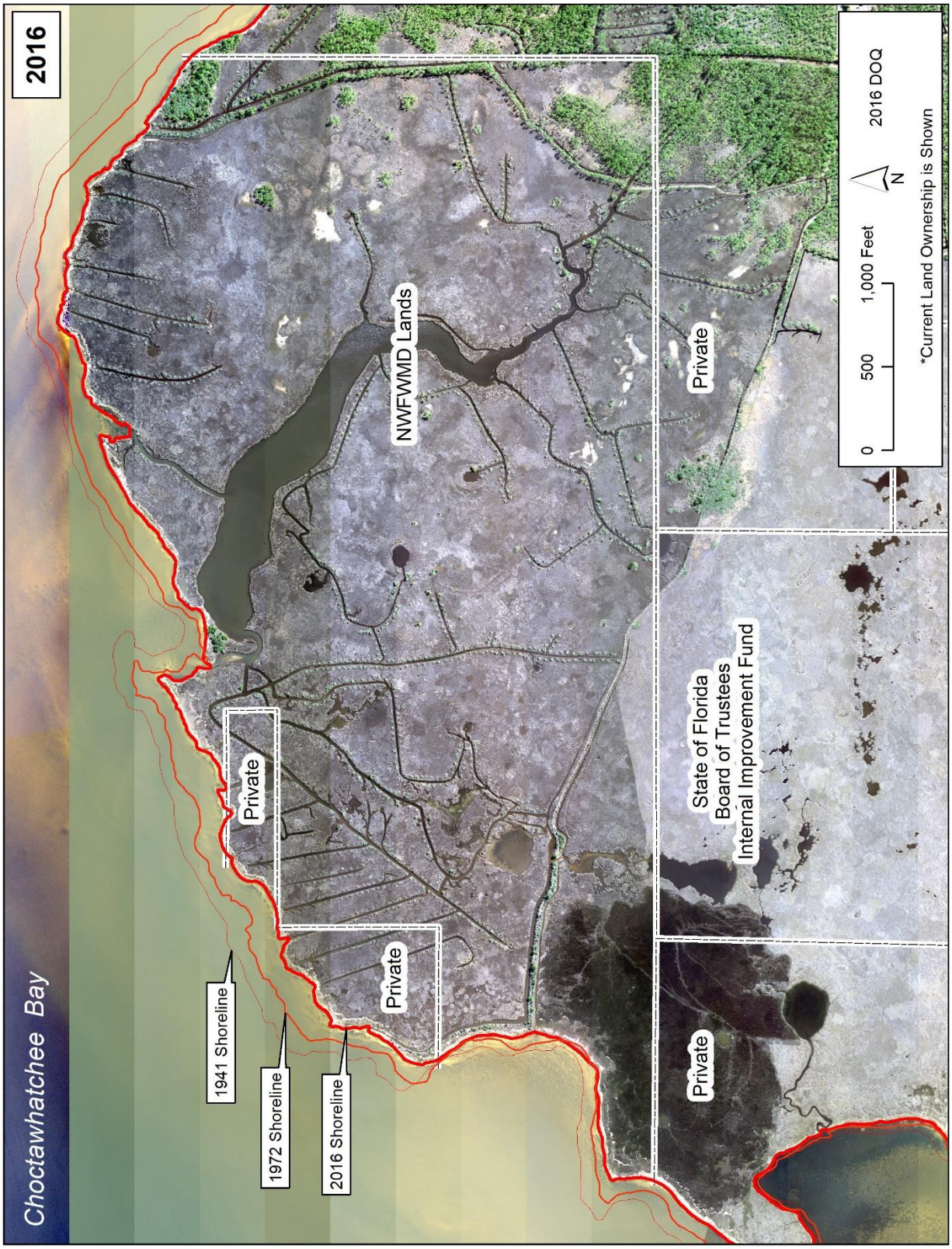


Figure 10. Live Oak Point Living Shorelines Project Area 2016

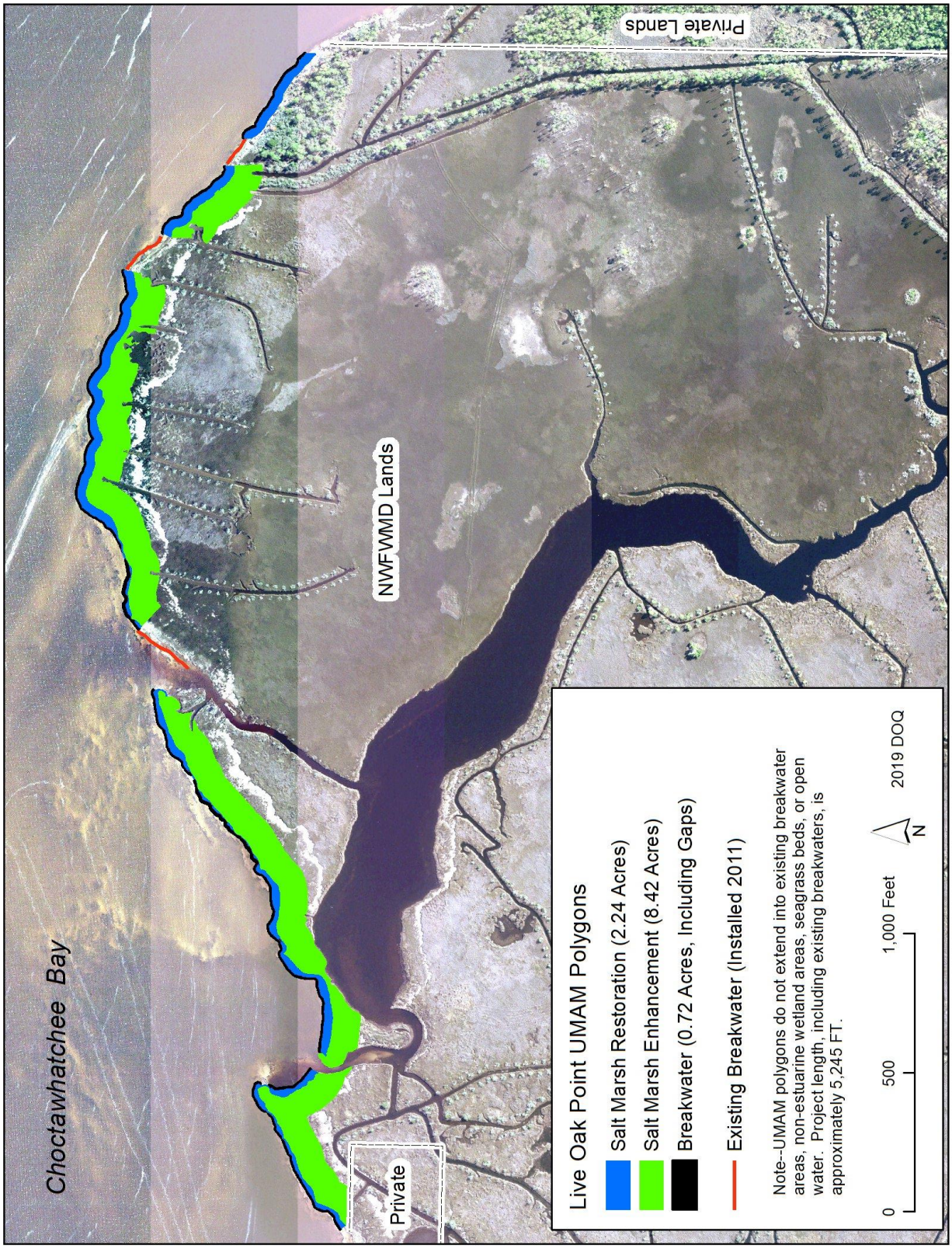


Figure 11. Live Oak Point Living Shorelines UMAM Polygons Overview

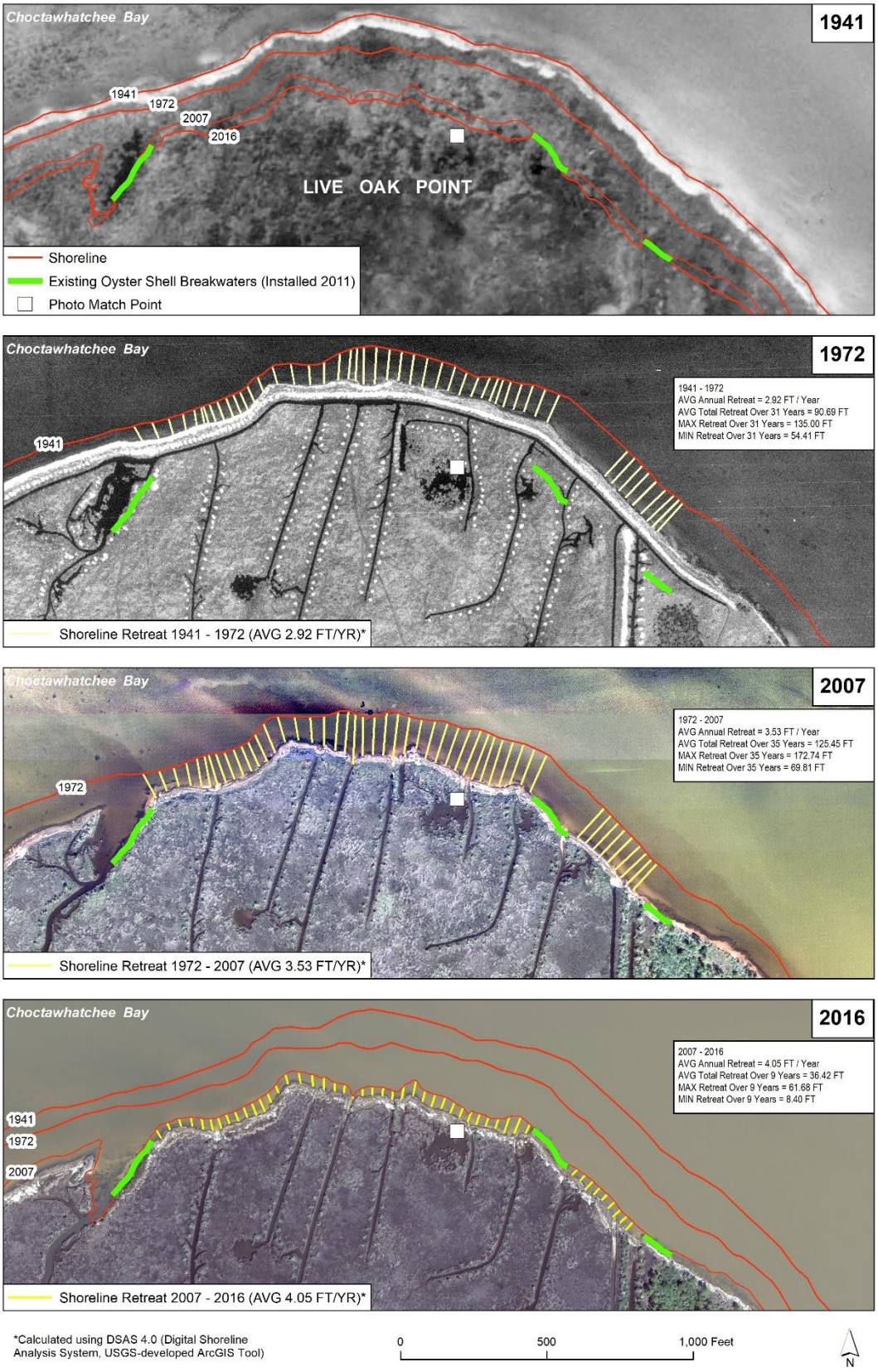


Figure 12. Area 1 Shoreline Retreat (1941 - 2016)

Figure 13. Area 1 Shoreline Retreat (2007 - 2016)

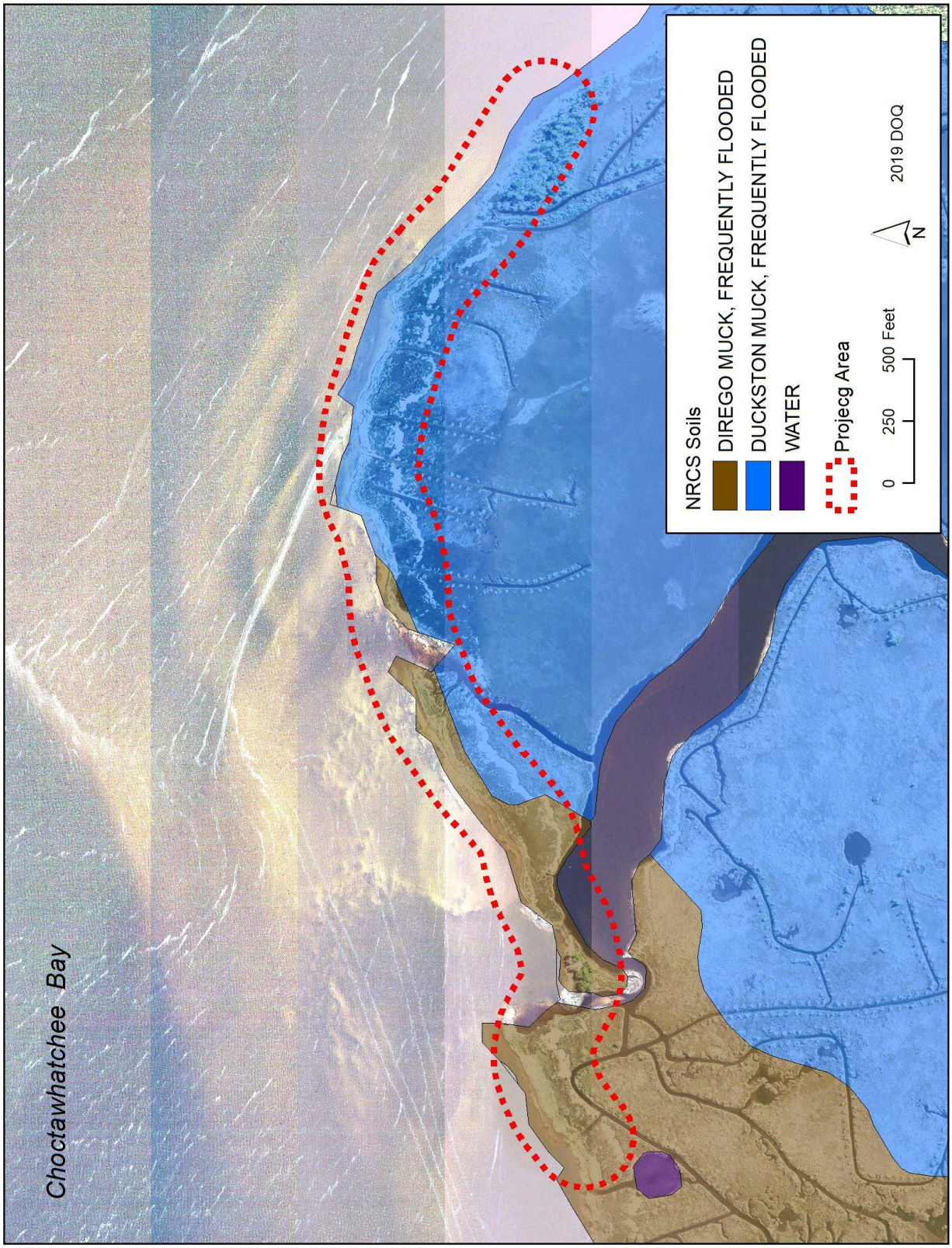


Figure 14. Soils at Live Oak Point (Natural Resources Conservation Service, US Department of Agriculture)

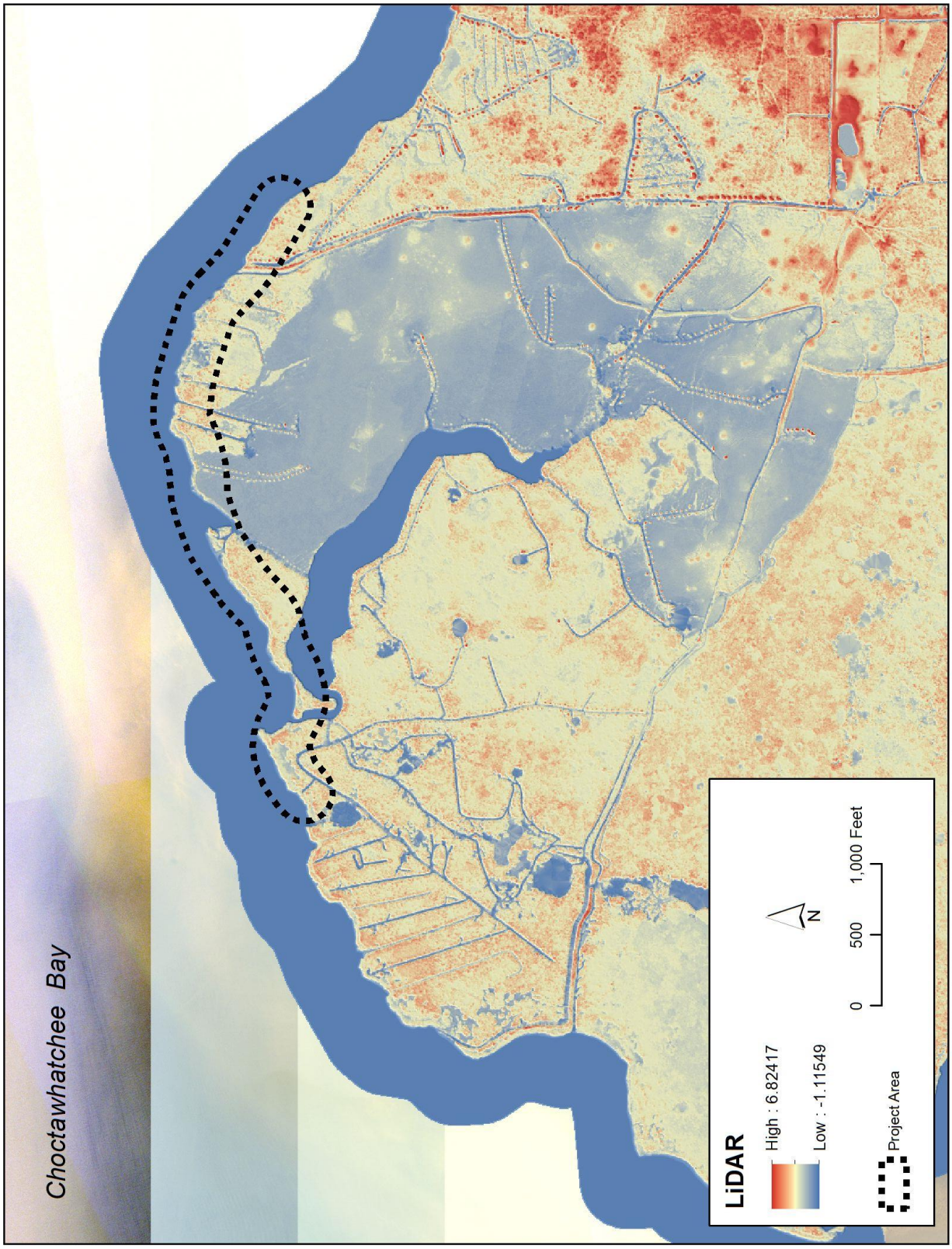


Figure 15. LiDAR (Light Detection and Ranging)

Figure 16. Live Oak Point, Existing Breakwater No. 2, Looking West (11/8/2011)

Figure 17. Live Oak Point peninsula, Existing Breakwater No. 2, Looking East (8/9/2017)

Figure 18. Live Oak Point, Existing Breakwater No. 1, Looking West (8/9/2017)

Figure 19. Live Oak Point, Oyster Spat Colonization (8/9/2017)

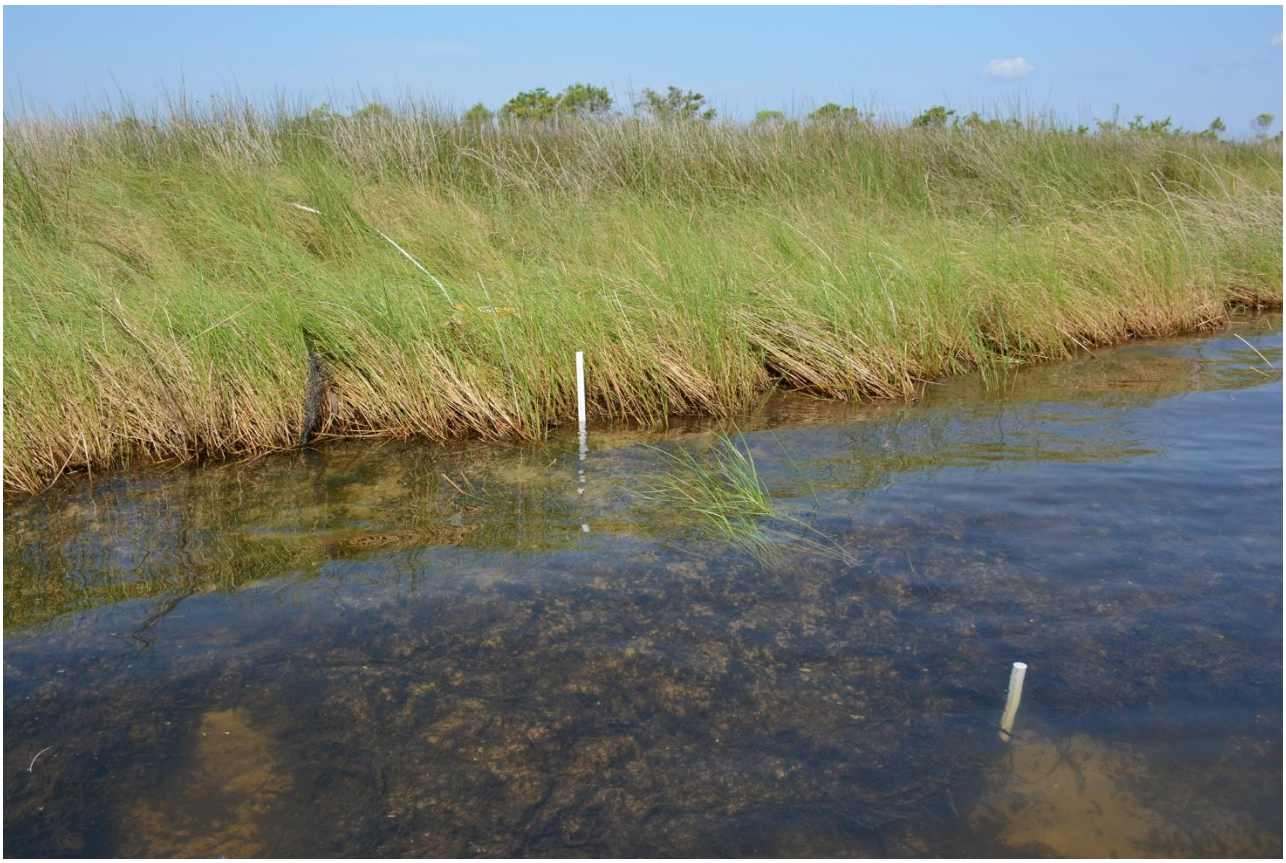


Figure 20. Undercutting of Salt Marsh (6/12/2019)

Figure 21. Live Oak Point, Undercutting of Salt Marsh (8/9/2017)

Figure 22. Live Oak Point, Undercutting of Salt Marsh (2/9/2001)

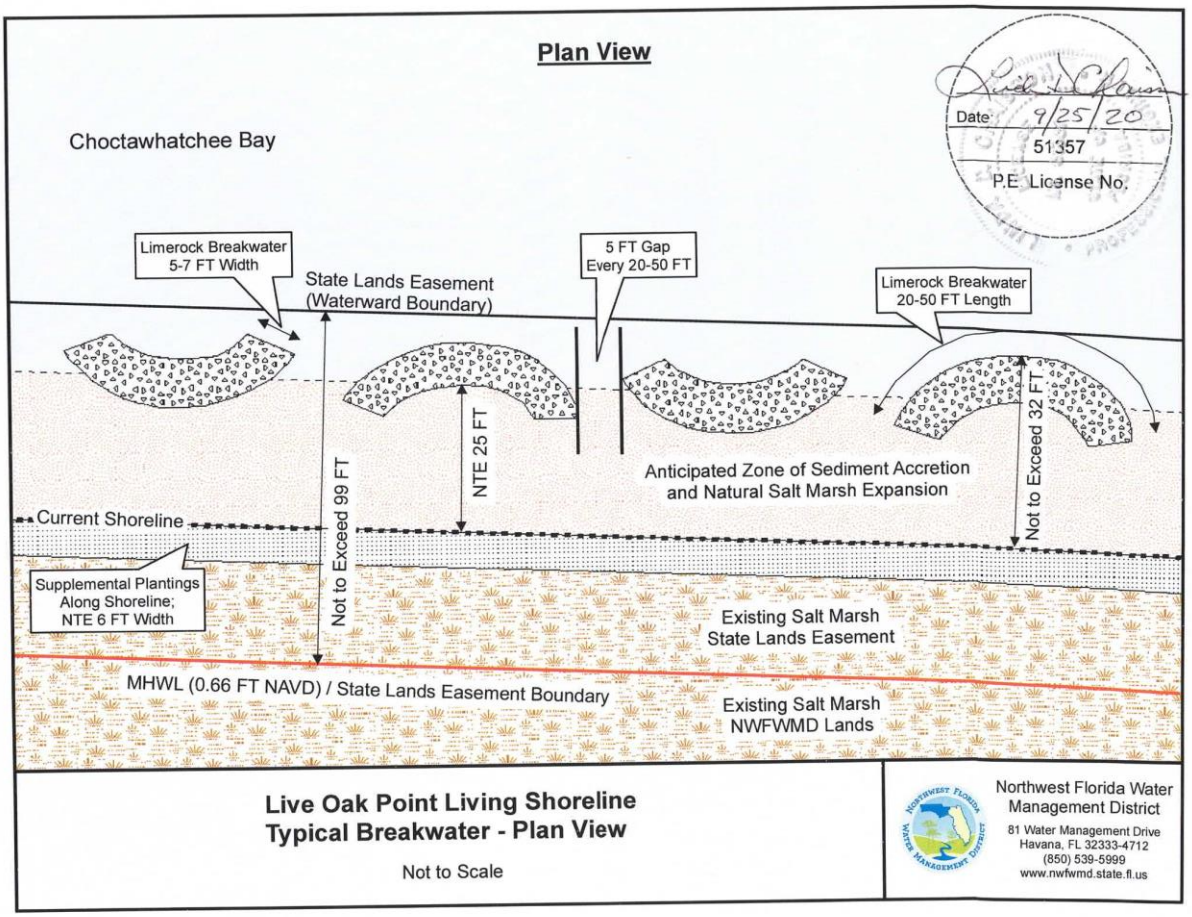


Figure 23. Breakwater Plan View Typical

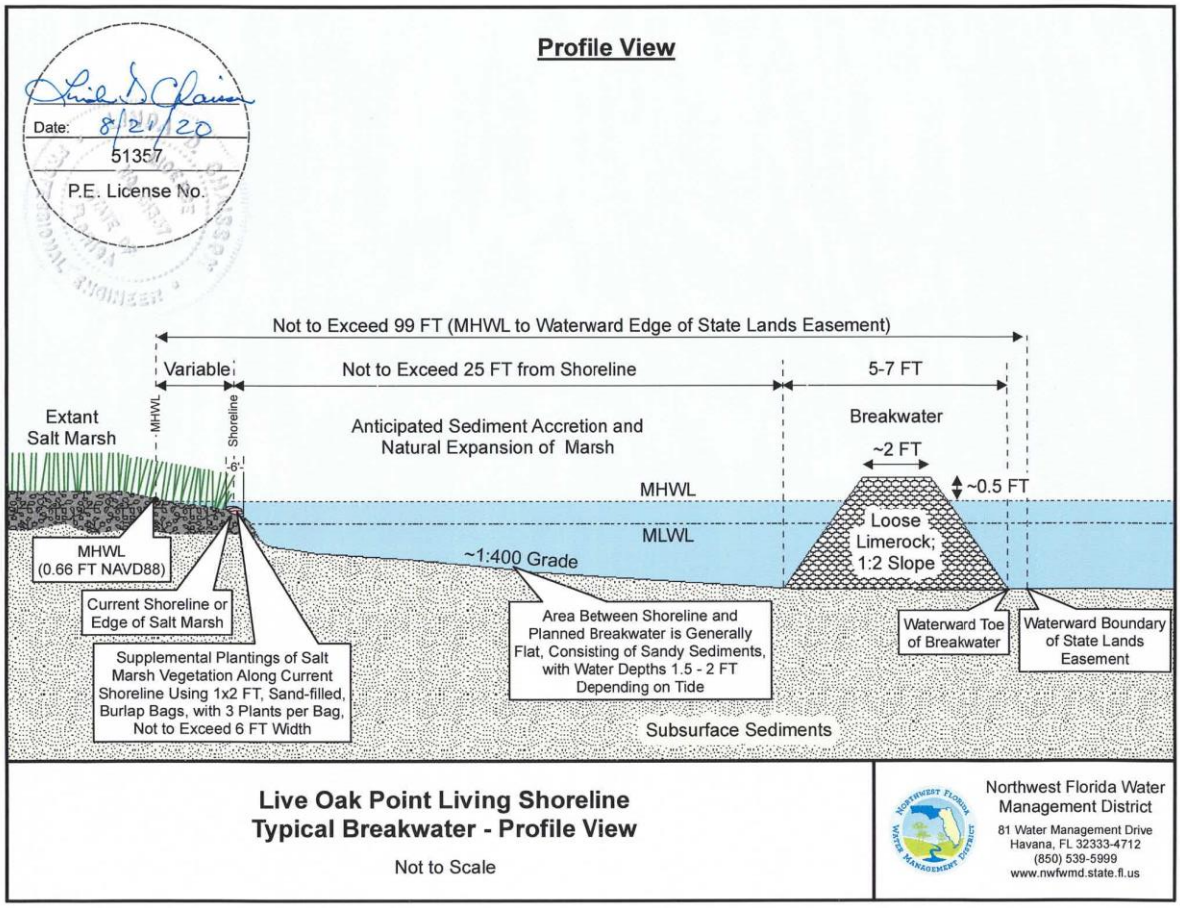


Figure 24. Breakwater Profile View Typical (CBA-provided Graphic)

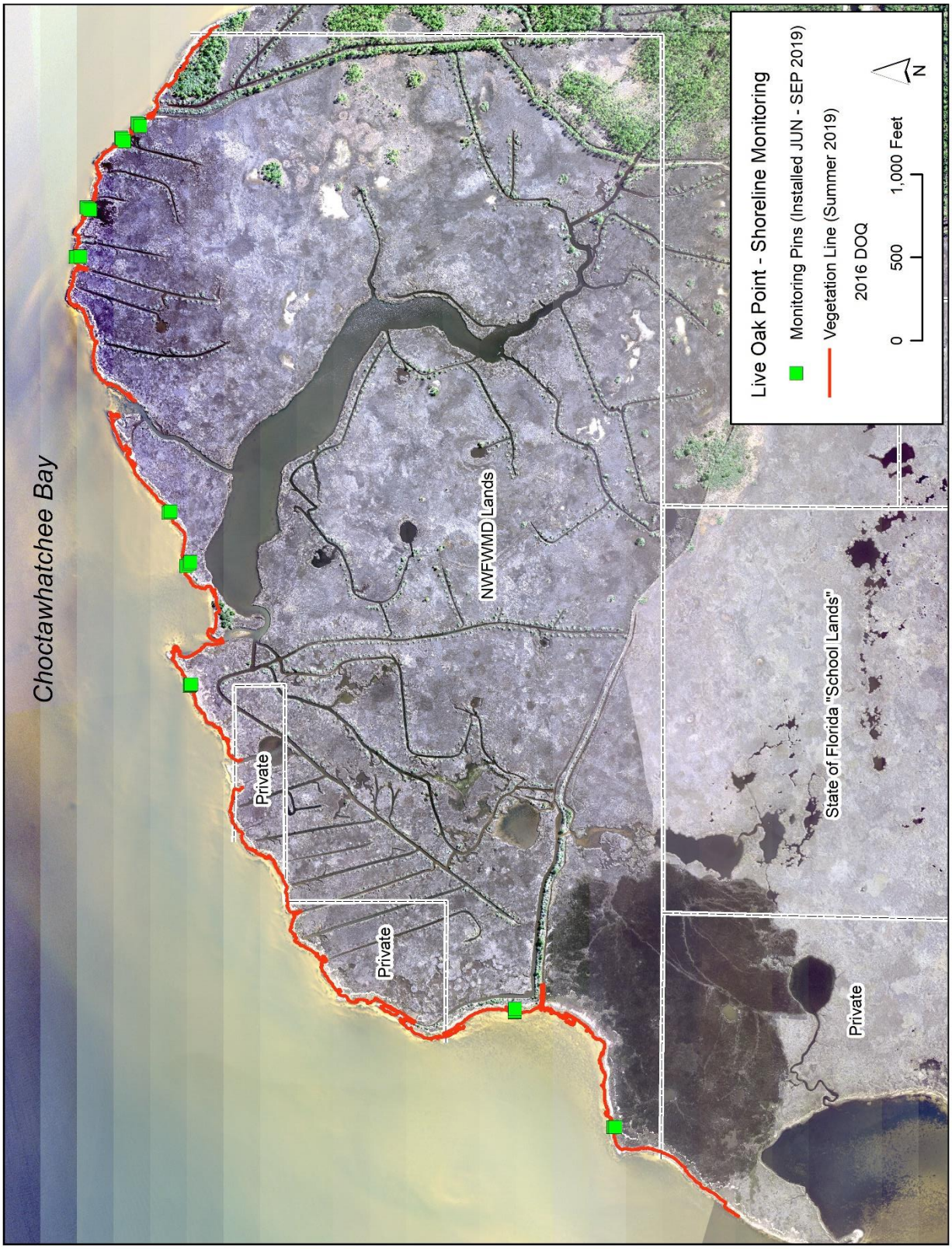


Figure 25. Vegetation Line (GPS 2019) and Shoreline Erosion Markers

Attachments

Monitoring Plan

Live Oak Point Living Shorelines ILF Project
Monitoring Plan
29 June 2020

Annual quantitative monitoring will be conducted by NWFWMD staff and/or qualified environmental consultants until site release or as directed by USACE permit conditions. Quantitative monitoring of vegetation will be conducted twice during the first year of the project (spring and fall), and then annually thereafter each fall. Qualitative monitoring and inspections of the site will continue for the life of the ILF program. Reports will be submitted electronically to the USACE and posted at the NWFWMD website (www.nwfwater.com).

Background on "Soft" Shoreline Enhancement

Increasing shoreline loss and sea level rise has increased the global demand to protect coastal systems and saltmarshes (Gittman et al., 2016). In contrast to natural shorelines, hardened structures do not absorb wave energy (O'Connell, 2010) and alter sediment transport (Nordstrom et al., 2009). Hardened structures inhibit natural process and negatively impact the surrounding ecosystem (Gerber-Williams 2017). They also replace native vegetation and associated habitat, removing important food webs and habitat for fish and invertebrate species (Gittman et al., 2015; Gittman et al., 2016; Lawless & Seitz, 2014). Alternatively, hybrid shoreline stabilization methods, referred to as "living shorelines," use a mix native vegetation, hard structure, such as oyster shell limerock, and natural organic materials such as coconut fiber mats or coir logs, that do not sever the connection between the aquatic and terrestrial environment (Gerber-Williams 2017; Sutton-Grier et al., 2015. These "soft" designs absorb wave energy which hardened shorelines do not and allow the deposition of organic and inorganic sediment as well as providing a substrate for vegetation to thrive. Wave reducing vegetation enhances the protected shoreline and restores natural processes (Craft and Sacco, 2003). In addition, it has been demonstrated that breakwater vegetation generates belowground biomass and enhances marsh bank stabilization (Bilkovic & Roggero, 2008).

Reference Wetlands Site

The success of the saltmarsh restoration will be evaluated in relationship to a reference saltmarsh occurring on NWFWMD-owned lands at Live Oak Point approximately 3,000 FT southwest of the Living Shorelines project area (Figure 1). The reference site has similar geomorphology, tidal range, elevations, and vegetation community structure relative to the project area and will be used to guide the development of restoration targets and measurable performance standards.

Figure 1. Reference Wetlands Site in Relation to Project Area

Vegetation Monitoring

Performance standards will be established to measure project success and guide credit releases.

Vegetation Performance Standards:

- Nuisance vegetation ≤ 5% cover per acre.
- Exotic vegetation ≤ 1% cover per acre.
- Monitoring protocols necessary to ensure effective preservation, enhancement, restoration, and management will be conducted annually for a minimum of five years from the start of mitigation activities. Quantitative monitoring of vegetation will be conducted twice (spring and fall) during the first year of project implementation, and thereafter in the fall of each year. Monitoring will be performed by NWFWMD staff or qualified consulting firms. Annual reports will be generated, sent to the USACE and posted at www.nwfwater.com (or any successor website).
- Panoramic photo points will be established within the reference and restoration sites (Figure 2).

Quantitative vegetation transects will be established that extend from the landward toe of the breakwater into the high marsh and will generally cover three vegetation zones: low marsh dominated by smooth cordgrass (*Spartina alterniflora*), the mid-marsh dominated by saltmarsh cordgrass (*Spartina patens*), and the high marsh dominated by black needle rush (*Juncus roemerianus*). Transects will be established in both the reference site and the restoration site. Because the low marsh, mid-marsh, and high marsh zones are of variable width, nested quadrats within each zone will be utilized. Quantitative monitoring will consist of three transects within the reference site and six transects within the restoration project site.

Transects will be marked at each end with PVC or metal t-posts. Four nested 0.5-meter square quadrats will be randomly placed within each of the low marsh, mid-marsh and high marsh zones associated with each transect (Figure 3). Data recorded in each quadrat will consist of visually estimated percent cover of each plant species, including individuals rooted in the quadrat as well as overhanging. Bare ground will be estimated in each quadrat as a percentage of ground not obscured by plant cover or large woody debris. Qualitative monitoring will consist of recording the species and vegetation structure observed along meandering pedestrian transects through each of the three vegetation zones (i.e., low marsh, mid-marsh, and high marsh).

At establishment, the restoration site will meet or exceed 45% cover of the low marsh, mid-marsh, and high marsh vegetation with respect to the reference site. At year one, the restoration site will meet or exceed 55% cover of the reference site. At year two, the restoration site will meet or exceed 65% percent of the reference saltmarsh. At year three, the restoration site will meet or exceed 75% of the reference site. By year four, the restoration site will meet or exceed 85% of the reference site. At year five or release, the restoration site will meet or exceed 95% of the reference site.

Vegetation species coverage statistics will be recorded. The percent coverage for each species will be generated by adding all quadrat observations separately for the low, mid-marsh and high marsh. The vegetation cover will be summed within each zone separately and divided by the total cover for each species. This represents a modified Daubenmire cover scale where vegetation species statistics are used to determine the percent cover by species.

A similarity index will be used to compare the reference and restored saltmarshes annually

$Sim = \frac{2 \sum nc}{\sum n1 + \sum n2}$	Where: *nc* = number of common species between sites *this number is the lowest value among the compared sites* *n1* = number of individuals of site 1 *n2* = number of individuals of site 2

Figure 2. Vegetation Transects, Panoramic Photo Points, Shoreline Erosion Pins

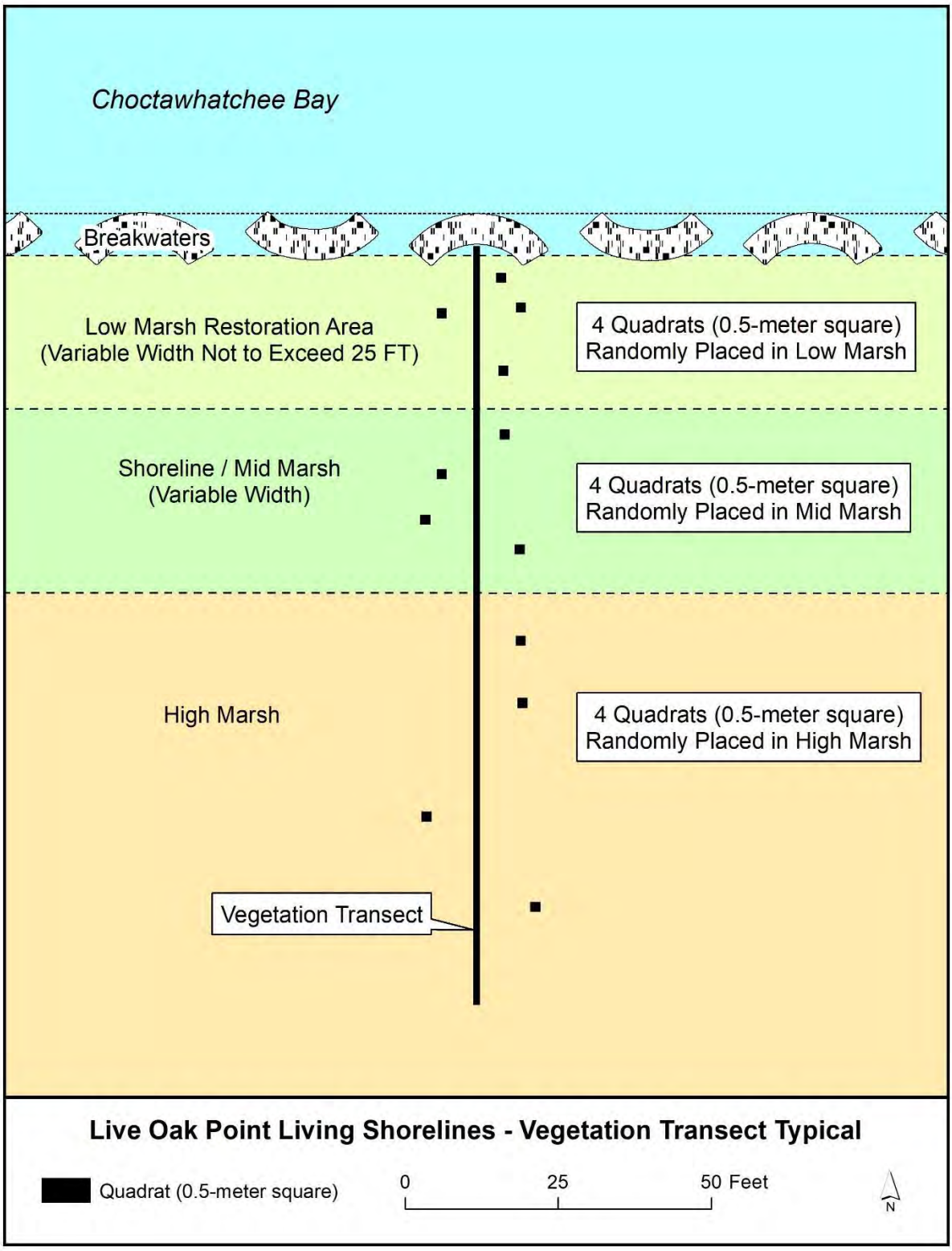


Figure 3. Quantitative Vegetation Transect Sample Design (Typical)

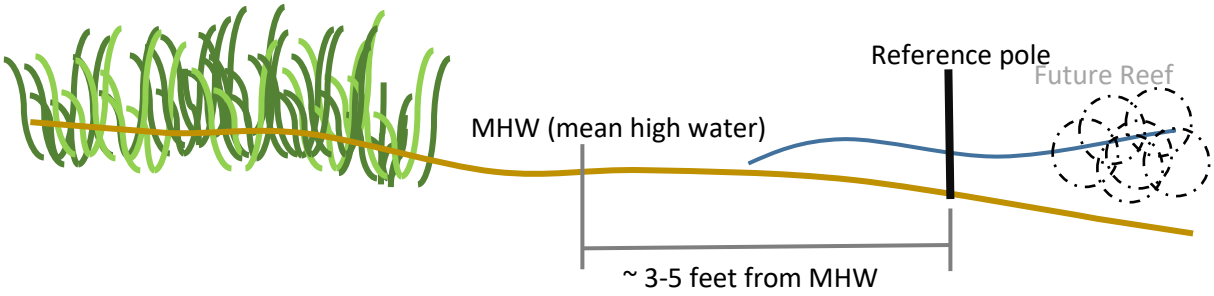
Oyster Monitoring Protocol

Established oyster reefs provide shoreline protection and stability, promote native oysters' growth and reproduction, improve water quality, and enhance habitat for species of the Choctawhatchee Bay and Gulf of Mexico. The success of oyster reefs is assessed through monitoring procedures that measure sediment accretion/erosion, number and size range of live oysters, species diversity and water quality variables.

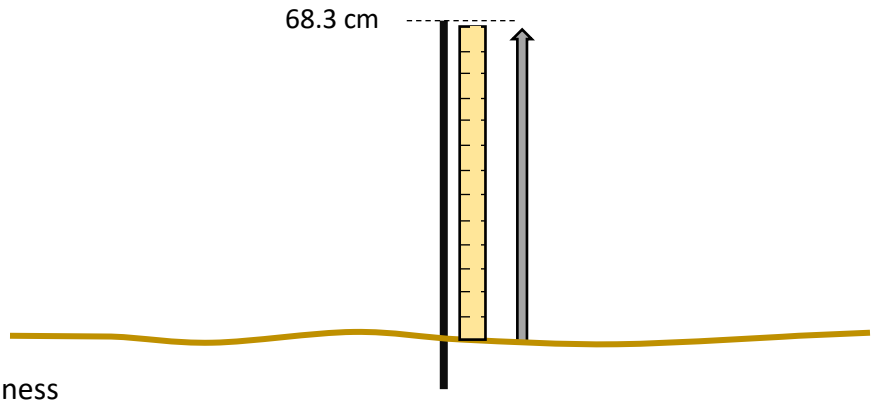
1. Pre-Construction Monitoring

1.1 Shoreline Sediment Height

Prior to reef construction, multiple PVC or rebar poles are placed roughly 3 to 5 feet water-ward of the mean high water, approximately just behind the future footprint of a reef sections. Depending on projected total reef length, 2-4 poles may be spaced out along the length of the shoreline. The reference poles are used as a baseline sediment height assessment measuring tool for pre-construction and reef sites.



Using a metric measuring tape, measuring from the top of the sediment to the top of the reference pole, to the nearest 0.1 centimeter.



1.2 Species Richness

A seine net is used to capture fish species diversity prior to reef construction

I. Siene two times at each reference pole, if applicable seine in front of and behind reef footprint

II. Identify fish species and record number of species caught.

Fish Species (Example)	Total (Example)
Silverside	10
Croaker	5

1.3 Water Quality

A Hydrolab Datasonde will be used during annual monitoring to record hydrologic conditions near reef locations at approximately a 0.5-meter depth.

I. Use Hydrolab datasonde to record water quality variables: temperature, specific conductivity, dissolved oxygen, pH, depth, salinity, dissolved oxygen percent saturation, and turbidity at approximately 0.5-meter depth.

Water Quality Variable	Sample Values
Temperature (˚F)	82.0
Specific Conductivity (mS/cm)	25.5
Dissolved Oxygen (mg/L)	7.35
pH	7.10
Depth (Feet)	1.0
Salinity (PPS/PPT)	20.23
Dissolved Oxygen Saturation (%)	75.5
Turbidity (NTU)	0.0

2. Post-Construction Oyster Reef Monitoring

2.1 Reef Height and Slope

To calculate reef height, using string and a string (line) level, run the string straight out from the highest point on reef a stadia rod or marked PVC pipe positioned at the reef perimeter. Place the string level on the line and adjust the vertical position of the string until level. Measure the height of the reef by measuring the distance from the string to the base of the pole.

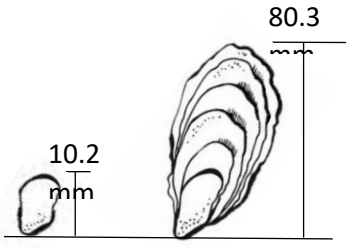
2.2 Oyster Recruitment and Size Range

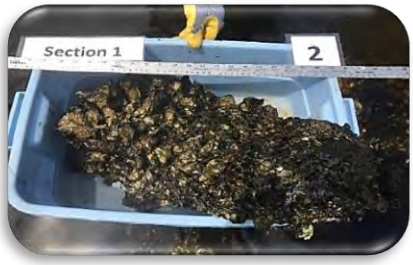
The total number of live oysters will be measured by averaging five 0.5-meter square quadrats placed at random along the oyster reef to estimate the total number of oysters per meter square.

Choose representative oyster sampling sites at random.

Count number of live oysters within one-square foot quadrat.

Measure the smallest and the largest hinge-lip distance of live oysters visible on bag or within quad to nearest 0.1 mm





Document oyster quadrat by taking a photo with a scale reference (meter stick) and with appropriate reef section location.

"Section 1 – PVC 2"

2.3 Species Diversity

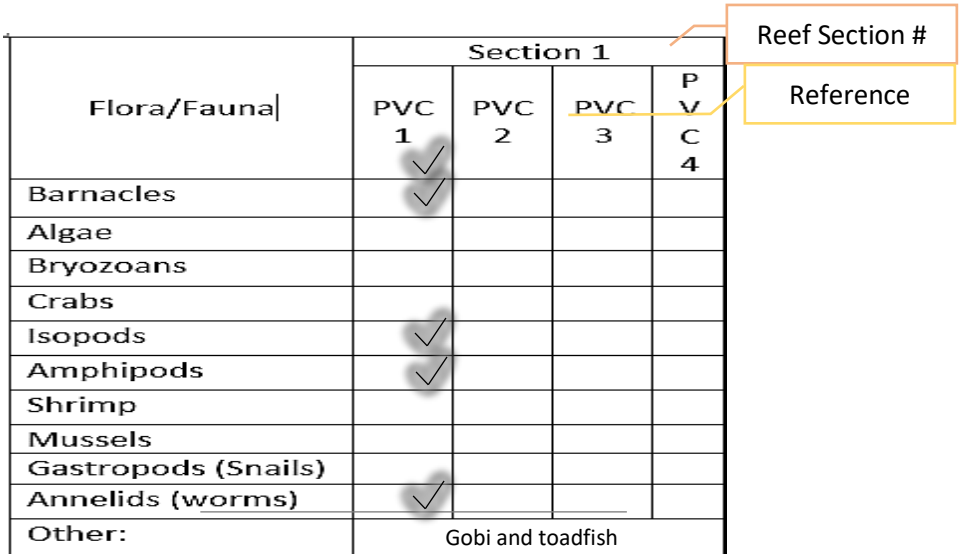
Each representative quadrat will be examined for species richness. All species within five, 0.5-meter quadrats will be identified. In addition, two seine sweeps will be at each reference pole. Associated Fauna: In each 0.25 m x 0.25 m quadrat, record the total number of sessile invertebrates by taxa (barnacles, mussels, solitary and clonal ascidians, etc.) encountered in a tally for the quadrat on data sheet. From the basket, record the tally number of motile invertebrates (porcelain crabs, quahog clams, oyster drills, and other species) to the lowest taxon level possible) on data sheet. For mussels, clams, and oyster drills, record each shell length in mm in space provided on data sheet for the first ten individuals of each species. For porcelain crabs, record carapace width in mm for first 10 crabs removed from basket. Make a

special note and collect known invasive species on oyster reefs: pink barnacles, green mussels, black charru mussel (no ribs). Place invasive mussels and barnacles in alcohol and label jar by location and submit for DNA extractions.

Crown conchs and other mollusks: Within the 0.5 m X 0.5 m quadrat, record the total number of crown conch shells visible on data sheet. For each individual, record the shell length from tip to maximum extent of the aperture in mm using digital calipers. Additionally, record if shell contains a conch, hermit crab or appears to be empty on data sheet. Collect the same data for any other large mollusks in quadrat (tulip shells, horse conch, whelks, etc.). Note the number of egg cases for mollusks within each quadrat on data sheet.

Species will be identified and recorded on a data sheet for each sampling location.

Example Table



Flora/Fauna	Section 1			
	PVC 1	PVC 2	PVC 3	PVC 4
Barnacles	✓			
Algae				
Bryozoans				
Crabs				
Isopods	✓			
Amphipods	✓			
Shrimp				
Mussels				
Gastropods (Snails)				
Annelids (worms)	✓			
Other:	Gobi and toadfish			

Benthic Monitoring

Adapted from Gerber-Williams 2017

Rader et al. (1984) determined that the greatest benthic diversity occurred within the culms of *S. alterniflora*. The mid-marsh dominated by *S. patens* had fewer benthic organisms compared to the areas dominated by *S. alterniflora* (Rader 1984). Bare sediments just off the shoreline had the fewest benthic organisms due to constant disturbance (Rader 1984). A sediment core (6.5 cm diameter, 14 cm long) will be used to determine species abundance and biomass. Cores will be collected in late summer haphazardly within 50 cm either side of replicate four meter-long transects (perpendicular to the shoreline) at zero meters (edge of shoreline), two meters, and four meters. Each sample will be washed over a 250 µm mesh sieve in the field. All material retained on the screen will be stored in a labeled plastic 0.5 L container and preserved with 70% isopropyl alcohol and 30% water with rose Bengal added. Organisms will be removed from the sediment under a stereomicroscope to the lowest practical taxonomic level. Total density (individuals / m2) and biomass (g / m2) were calculated as the mean of the two replicate cores collected within each treatment (site) (n = 6 / site) for the breakwater sites and two within the reference site. Shannon-Weiner Diversity Index (H'=-SUM[(pi) x ln(pi)] $H' = -\sum[pi \times \ln pi]$ where pi is the proportion of total sample represented by species i) and species richness (S) was calculated for each core.

Species collected will be placed into feeding guilds (filter feeder, deposit feeder, scavenger, omnivore, carnivore, and herbivore). Mean abundance within guilds at each of the site will be used to determine differences between breakwater and reference benthic community.

Sediment Accretion Monitoring

Compared to a mud flat, more than 80% of wave attenuation was ascribed to the presence of vegetation (Yang et al. 2012). Sediment accretion rates vary greatly depending on vegetation type and where they are sampled. *Spartina alterniflora* has been observed to trap the greatest amount of sediment compared to other species Li and Yang 2009 and can trap greater than 10% sediment observed annually. Low marshes dominated by S. alterniflora trap significant amounts of sediment. Within the *Spartina alterniflora* canopy, approximately 50% of the initial mean velocity and is reduced within 5 m of the canopy edge (Leonard and Croft 2006). Sediment trapping rates of the low marsh exceeded current sea level rise estimates by 1.5-1.7% (Brickerson-Orso et al. 1989). Estimates of accretion for low marsh dominated by *Spartina alterniflora* had accretion rates of 6.5 – 10.5 cm a year whereas the mid-marsh dominated by *Spartina patens* had accretion rates of 1.5 to 1.7 cm per year (Hopkins et al. 2018).

The goal of the saltmarsh restoration is to demonstrate the restored marsh is similar to a reference marsh while stabilization of the shoreline, establishing a low and mid-marsh and enhancing the high marsh. In addition, the restoration will demonstrate accretion rates greater than sea level rise. Scientific studies have monitored accretion rates in the area between the

breakwater and shoreline, just above the shoreline and within the mid-marsh and upper marsh. The area in-between the breakwater and shoreline accrete and scours. At least initially there is no vegetation within this area to trap the sediment and accretion is due to larger sized sand particles dropping out of the water column due to reduced wave action. This area had the lowest accretion rates of any of the areas sampled. The mid-marsh dominated by *Spartina patens* only intermittently receives way action and has less ability to trap sediment while the high marsh traps the least amount of sediment of the vegetated areas (Li and Yang 2009). The low marsh trapped the greatest amount of sediment if *Spartina alterniflora* occurred (Li and Yang 2009). On average established areas with Spartina *alterniflora* can trap up to 0.6 – 10.5 cm of sediment a year depending on location and sediment type. Accretion rates will be measured in the low marsh dominated *Spartina alterniflora*.

Sedimentation plates

In an evaluation of different sediment monitoring techniques, Notle et al. 2012) determined that sediment plates were the most accurate in determining sediment accretion rates in shorelines with heavier wave action. Sediment plates will be installed at one half meter from the shoreline planted with *Spartina alterniflora* and one meter in from the reference shoreline. A total of six sediment plates will be installed within the created breakwater area and three within the reference. With the sedimentation plate method, the marker horizon consists of a perforated plate made of metal or plastic that allow natural percolation of water (Watson 2008; Stokes et al. 2010). The plate is buried in the soil just below the rooting zone under a carefully extracted block of marsh turf, which is then placed back on top of the sedimentation plate (French and Burningham 2003). Thus, vegetation disturbance is kept to a minimum. Small holes drilled into the plate reduce the influence of the plate on drainage conditions and plant rooting. The plates should be placed in a perfectly horizontal position to allow for reliable repeated measurements. After burial, the location of the plate is marked with a PVC pipe to be easily located during sampling. The plates need to settle for at least 1 month before the first measurement can be taken (Stokes et al. 2010). To measure sediment accretion, a thin metal pin is pushed into the sediment until it hits the plate, and its length above the sediment is determined.

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Monitoring Parameters (Project Site and Reference Site)

- Vegetation transects.
    - Percent cover for each species and bare ground.
    - Percent cover of nuisance vegetation, if any.
    - Percent cover of exotic vegetation, if any.
    - Planted vegetation mortality (project site only).
    - General assessments of overall vegetation health.
- Benthic macroinvertebrate transects (species diversity and abundance).
- Utilization by faunal species.
    - Fish species richness.
    - Other faunal usage.
- Sediment accretion and/or erosion rates.
- Water quality (via Hydrolab Datasonde).
    - Temperature (^{o}F).
    - Specific conductivity (mS/cm).
    - Dissolved oxygen (mg/L).
    - pH.
    - Water depth (FT).
    - Salinity (PPS/PPT).
    - Dissolved oxygen saturation (%).
    - Turbidity (NTU).
- Limerock breakwater.
    - Overall condition.
    - Height.
    - Width.
    - Slope.
- Oyster spat recruitment on breakwater.
- Photo monitoring.
    - Panoramic photos at established points.
    - Other photo-documentation.

UMAM Summary Table and Scoring Worksheets

Live Oak Point Living Shorelines

UMAM Estimate (USACE Vetted 4/24/2020)

Polygon	UMAM Acres	Mit. Type	L1	L2	W1	W1	C1	C2	W/Out	With	Raw Delta	Time Lag	P Factor	Risk	Adjusted Delta	UMAM Credits	UMAM Credits by Phase
Area 1-A	2.24	Creation / Restoration	0	8	0	8	0	8	0.00	0.80	0.80	1.07	1	1.25	0.60	1.344	2.61
Area 1-B	8.42	Enhancement	7	8	4	8	4	8	0.50	0.80	0.30	1.598	1	1.25	0.15	1.263	
	10.66	**(Total Estuarine Wetland Acreage)**													**(Total UMAM Credit)**	**2.607**	

Explanation of Credit Summary Table Column Headings:

Polygon - Assessment polygon identification.
UMAM Acres - Area of assessment polygon.
Mit. Type - Mitigation type (Creation / Restoration or Enhancement)
L1 - Location and Landscape Support score (Pre-Mitigation).
L2 - Location and Landscape Support score (Post-Mitigation).
W1 - Water Environment score (Pre-Mitigation).
W2 - Water Environment score (Post-Mitigation).
C1 - Community Structure score (Pre-Mitigation).
C2 - Community Structure score (Post-Mitigation).
W/Out - UMAM Functional Value Pre-Mitigation (0 = No Value, 1 = 100% Functional Value).
With - UMAM Functional Value Post-Mitigation (0 = No Value, 1 = 100% Functional Value).
Raw Delta - "With" minus "W/Out" (the raw functional lift from implementation of the mitigation).
Time Lag - Lag between when mitigation is implemented and when target ecological conditions are achieved (USACE Time Lag Values).
P Factor - Preservation Factor (0 = no preservation value; 1 = optimal preservation value).
Risk - Risk that mitigation project will fail (1 = no risk; 3 = high risk).
Adjusted Delta - Functional lift of mitigation project adjusted for Time Lag, Risk, and Preservation Factor.
UMAM Credits - Functional UMAM Credits generated from mitigation project.

PART I – Qualitative Description
(See Section 62-345.400, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Live Oak Point Living Shorelines	**Not Applicable**	**1-A (Creation / Restoration)**

FLUCCS code	Further classification (optional)	Impact or Mitigation Site?	Assessment Area Size
540 Current; 642 Target	**---**	**Mitigation**	**2.24 Acres**

Basin/Watershed Name/Number	Affected Waterbody (Class)	Special Classification (i.e.OFW, AP, other local/state/federal designation of importance)
Choctawhatchee Bay SWIM	**III**	**---**

Geographic relationship to and hydrologic connection with wetlands, other surface water, uplands

Former salt marsh habitat (now open shallow water) that is contiguous with extant salt marsh at Live Oak Point (largest remaining salt marsh in Choctawhatchee Bay).

Assessment area description

This assessment area (25 FT wide strip) was historically (approximately within the last 10 years) salt marsh habitat that has converted to shallow (generally <1 FT deep depending on tide conditions) open water because of ongoing erosion and shoreline/salt marsh retreat.

Significant nearby features	Uniqueness (considering the relative rarity in relation to the regional landscape.)
Choctawhatchee Bay; Hogtown Bayou; Live Oak Point salt marsh.	**Not unique, although threatened by sea level rise, possible increased storm intensity associated with global climate change, and continuing coastal development.**

Functions	Mitigation for previous permit/other historic use
Water storage; water quality; floral and faunal habitat; buffer protection for nearby hydric pine flatwoods and residential areas.	**None**

Anticipated Wildlife Utilization Based on Literature Review (List of species that are representative of the assessment area and reasonably expected to be found)	Anticipated Utilization by Listed Species (List species, their legal classification (E, T, SSC), type of use, and intensity of use of the assessment area)
Wading birds and other avian fauna; oysters; crabs; invertebrates; juvenile fish; mammals such as raccoon, marsh rabbit, and cotton mouse.	**Little blue heron (SSC) foraging.**

Observed Evidence of Wildlife Utilization (List species directly observed, or other signs such as tracks, droppings, casings, nests, etc.)

Various wading birds and other avian fauna; blue crab; juvenile fish.

Additional relevant factors

This project will restore salt marsh habitat lost to erosion over the previous 10 years and enhance extant salt marsh by buffer improvement and protection from ongoing erosion.

Assessment conducted by	Assessment date(s)
NWFWMD Staff	**11/4/2019**

PART II – Quantification of Assessment Area (impact or mitigation)
(See Sections 62-345.500 and .600, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Live Oak Point Living Shorelines	**Not Applicable**	**Area 1-A**
Impact or Mitigation	Assessment conducted by:	Assessment date:
Mitigation	**NWFWMD Staff**	**11/4/2019**

Scoring Guidance	Optimal (10)	Moderate(7)	Minimal (4)	Not Present (0)
The scoring of each indicator is based on what would be suitable for the type of wetland or surface water assessed	Condition is optimal and fully supports wetland/surface water functions	Condition is less than optimal, but sufficient to maintain most wetland/surface waterfunctions	Minimal level of support of wetland/surface water functions	Condition is insufficient to provide wetland/surface water functions

	w/out mit	w/mit	
.500(6)(a) Location and Landscape Support	0	8	**Without Mitigation** - Assessment area (former salt marsh habitat) has been converted to open water and no longer provides any salt marsh habitat functions; erosion and loss of salt marsh habitat continues (estimated retreat of salt marsh for this assessment area is >4 FT per year). **With Mitigation** - Salt marsh habitat is reestablished with contiguous connectivity to a large extant salt marsh; ongoing loss of salt marsh habitat is halted; buffer to extant salt marsh exhibits improved water quality, vegetation and wildlife habitat functions.
.500(6)(b)Water Environment (N/A for Uplands)	0	8	**Without Mitigation** - Continued open water with no salt marsh habitat function. **With Mitigation** - Salt marsh is reestablished.
.500(6)(c)Community structure Vegetation and/or Benthic Community	0	8	**Without Mitigation** - Former salt marsh habitat continues as open water; continued loss of salt marsh habitat from ongoing erosion. **With Mitigation** - Salt marsh habitat is reestablished.

Score = sum of above scores/30 (if uplands, divide by 20)	w/out mit	w/mit
	0.00	0.80

Raw Delta = [w/mit - w/out mit]
0.80

Preservation Adjustment Factor (PF) =	**1**
5-Yr Fed Time Lag Factor =	**1.0696**
Risk Factor =	**1.25**
Adjusted Delta [(Raw Delta * PF) / (T * R)] =	**0.60**

UMAM Functional Assessment	
Polygon Acreage =	**2.24**
Functional Gain w/Mitigation (Adjusted Delta * Acres) =	**1.34**

PART I – Qualitative Description
(See Section 62-345.400, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Live Oak Point Living Shorelines	**Not Applicable**	**1-B (Enhancement)**

FLUCCS code	Further classification (optional)	Impact or Mitigation Site?	Assessment Area Size
642	**---**	**Mitigation**	**8.42 Acres**

Basin/Watershed Name/Number	Affected Waterbody (Class)	Special Classification (i.e.OFW, AP, other local/state/federal designation of importance)
Choctawhatchee Bay SWIM	**III**	**---**

Geographic relationship to and hydrologic connection with wetlands, other surface water, uplands

Salt marsh habitat that is part of the largest remaining salt marsh system in Choctawhatchee Bay.

Assessment area description

High-quality salt marsh (dominated by *Juncus roemerianus*) impacted by loss of adjacent salt marsh and ongoing erosion. Polygon delineation based on marshward area (not exceeding 100 FT marshward and not including ditches, non-contiguous salt marsh, and non-salt marsh habitat) reasonably expected to be enhanced by restoration of waterward salt marsh areas (USACE-Jacksonville guidance suggests allowance of up to 300 FT distance for indirect assessments).

Significant nearby features	Uniqueness (considering the relative rarity in relation to the regional landscape.)
Choctawhatchee Bay; Hogtown Bayou; Live Oak Point salt marsh.	**Not unique, although threatened by sea level rise, possible increased storm intensity associated with global climate change, and continuing coastal development.**

Functions	Mitigation for previous permit/other historic use
Water storage; water quality; floral and faunal habitat; buffer protection for nearby hydric pine flatwoods and residential areas.	**None**

Anticipated Wildlife Utilization Based on Literature Review (List of species that are representative of the assessment area and reasonably expected to be found)	Anticipated Utilization by Listed Species (List species, their legal classification (E, T, SSC), type of use, and intensity of use of the assessment area)
Wading birds and other avian fauna; oysters; crabs; invertebrates; juvenile fish; mammals such as raccoon, marsh rabbit, and cotton mouse.	**Little blue heron (SSC) foraging.**

Observed Evidence of Wildlife Utilization (List species directly observed, or other signs such as tracks, droppings, casings, nests, etc.)

Various wading birds and other avian fauna; blue crab; juvenile fish.

Additional relevant factors

This project will restore salt marsh habitat lost to erosion over the previous 10 years and enhance extant salt marsh by buffer improvement and protection from ongoing erosion.

Assessment conducted by	Assessment date(s)
NWFWMD Staff	**11/4/2019**

PART II – Quantification of Assessment Area (impact or mitigation)
(See Sections 62-345.500 and .600, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Live Oak Point Living Shorelines	**Not Applicable**	**Area 1-B**
Impact or Mitigation	Assessment conducted by:	Assessment date:
Mitigation	**NWFWMD Staff**	**11/4/2019**

Scoring Guidance	Optimal (10)	Moderate(7)	Minimal (4)	Not Present (0)
The scoring of each indicator is based on what would be suitable for the type of wetland or surface water assessed	Condition is optimal and fully supports wetland/surface water functions	Condition is less than optimal, but sufficient to maintain most wetland/surface waterfunctions	Minimal level of support of wetland/surface water functions	Condition is insufficient to provide wetland/surface water functions

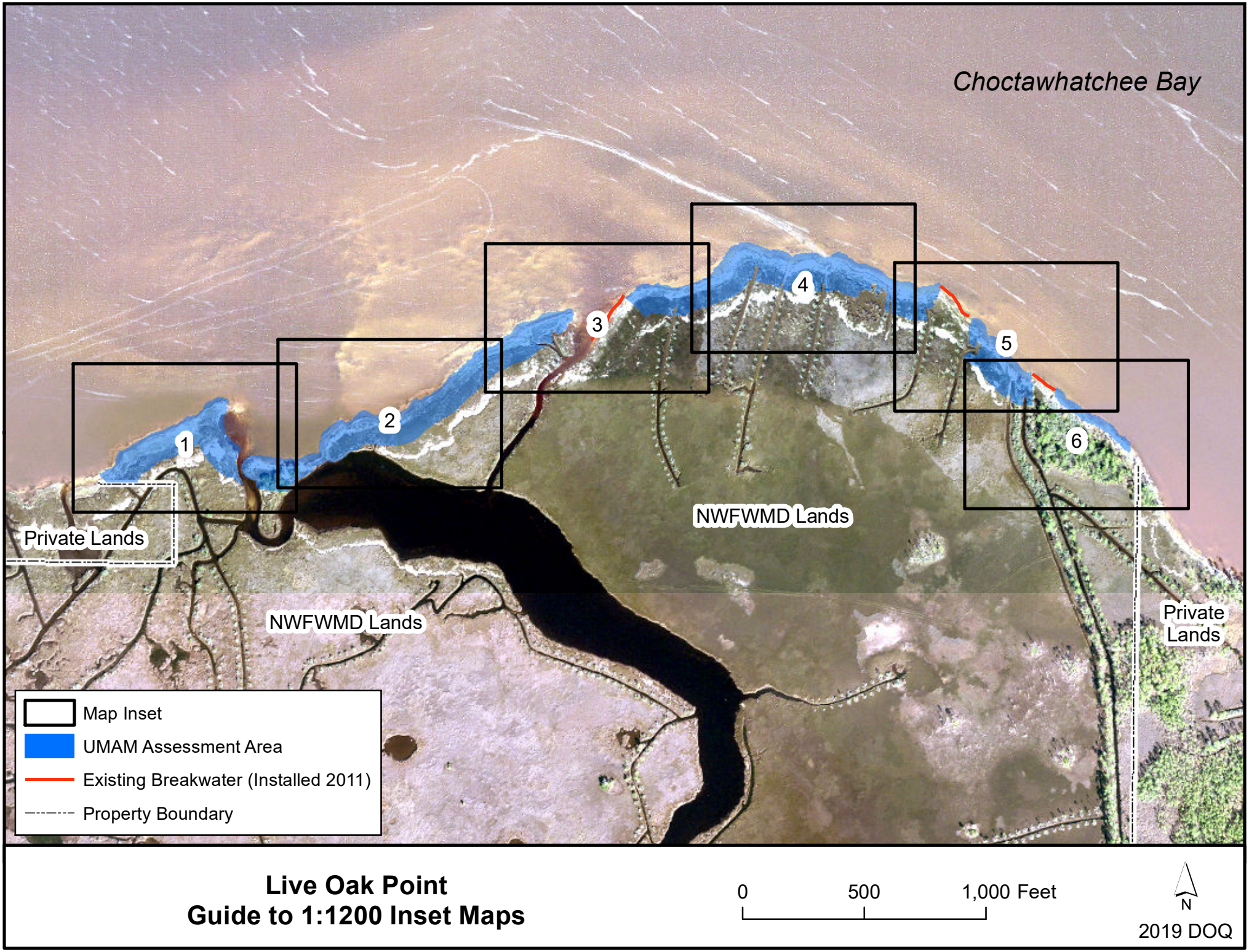
	w/out mit	w/mit	
.500(6)(a) Location and Landscape Support	7	8	**Without Mitigation** - Extant salt marsh continues to be degraded by ongoing loss of adjacent salt marsh habitat and loss of concomitant fuctional benefits of buffer wetlands (wave and erosion protection; water quality; buffer habitat). **With Mitigation** - Salt marsh buffer habitat is reestablished with concomitant benefits associated with wetland buffers.
.500(6)(b)Water Environment (N/A for Uplands)	4	8	**Without Mitigation** - Water Environment fully supports wetland functions, although ongoing erosion will convert extant salt marsh to open water. **With Mitigation** - Water Environment fully supports wetland functions.
.500(6)(c)Community structure Vegetation and/or Benthic Community	4	8	**Without Mitigation** - Because of ongoing erosion, high-quality salt marsh continues to be converted to open water. **With Mitigation** - Extant salt marsh is maintained fully intact.

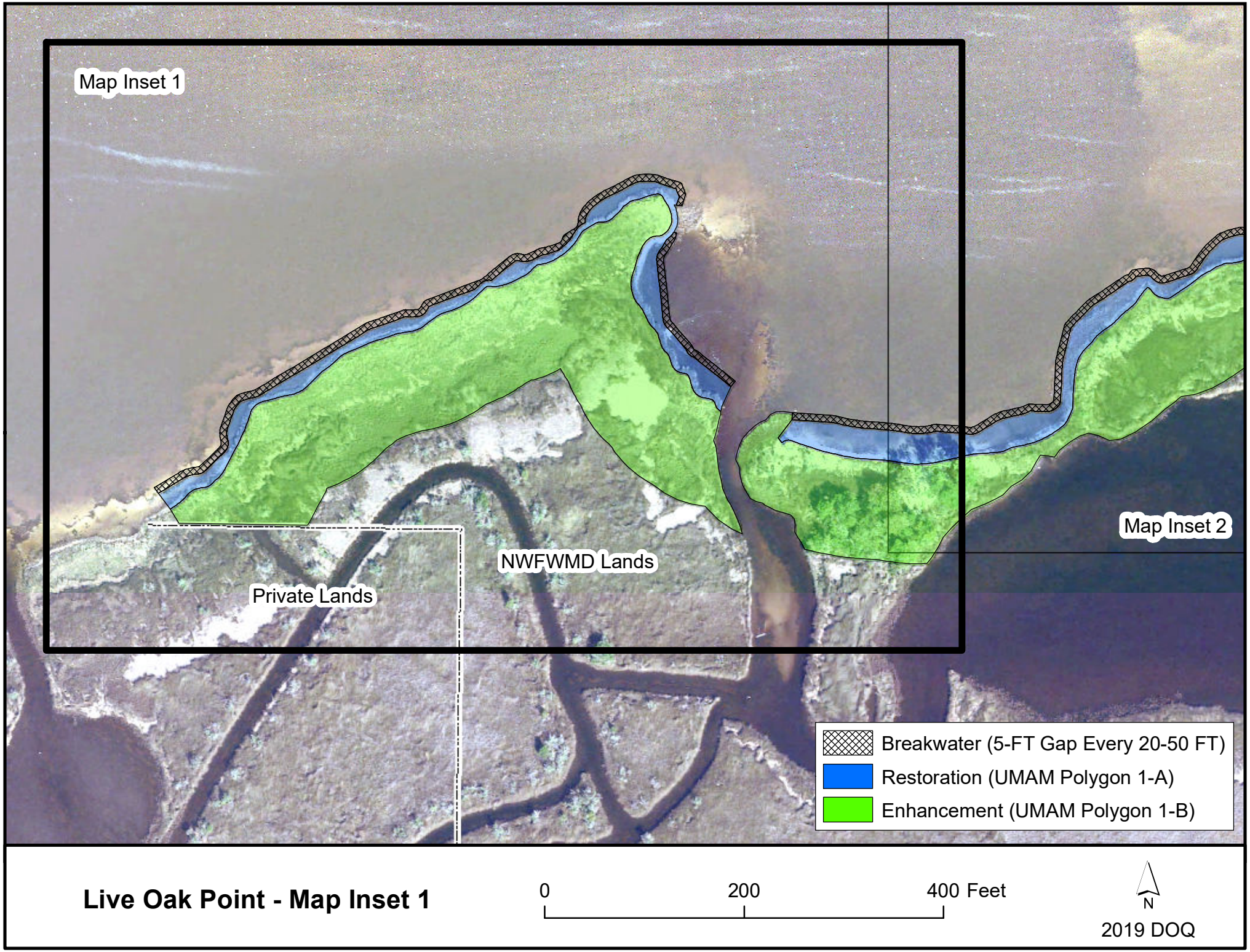
Score = sum of above scores/30 (if uplands, divide by 20)	w/out mit	w/mit
	0.50	0.80

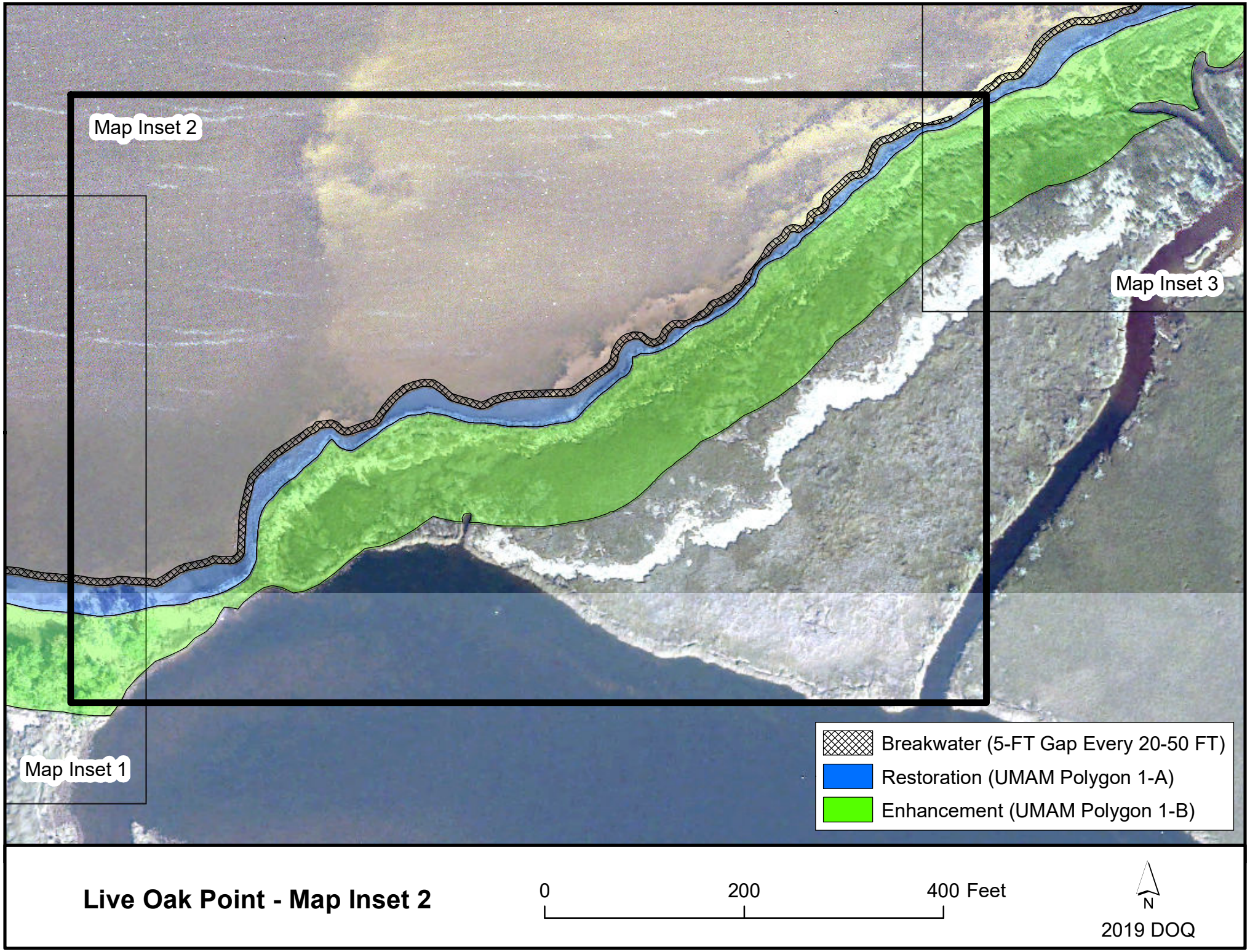
Raw Delta = [w/mit - w/out mit]
0.30

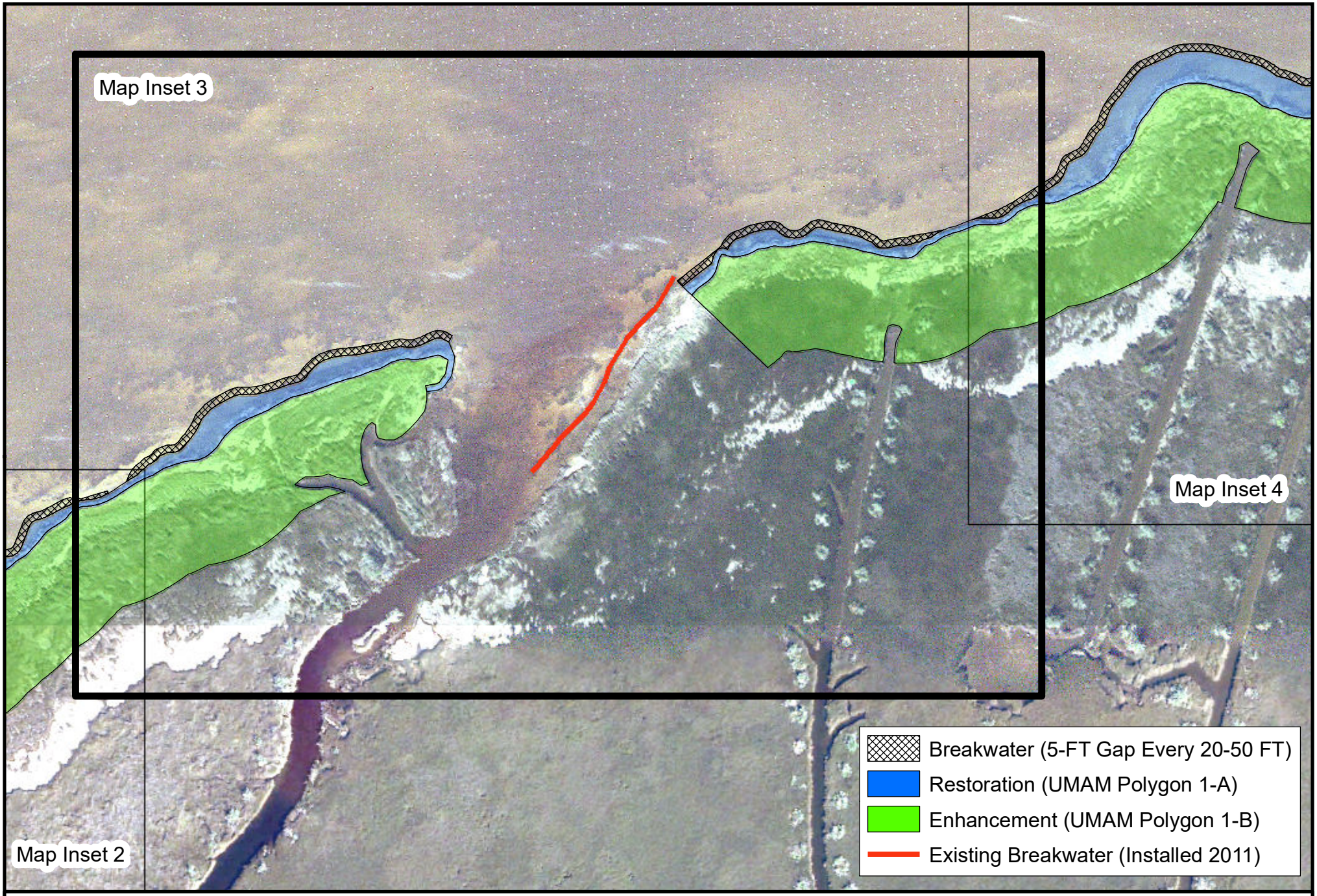
Preservation Adjustment Factor (PF) =	**1**
30-Yr Fed Time Lag Factor =	**1.5983**
Risk Factor =	**1.25**
Adjusted Delta [(Raw Delta * PF) / (T * R)] =	**0.15**

UMAM Functional Assessment	
Polygon Acreage =	**8.42**
Functional Gain w/Mitigation (Adjusted Delta * Acres) =	**1.26**


Choctawhatchee Bay
1
2
3
4
5
6
Private Lands
NWFWMD Lands
NWFWMD Lands
Private Lands
Map Inset
UMAM Assessment Area
Existing Breakwater (Installed 2011)
Property Boundary
Live Oak Point
Guide to 1:1200 Inset Maps
0
500
1,000 Feet
N
2019 DOQ


Map Inset 1
Map Inset 2
NWFWMD Lands
Private Lands
Breakwater (5-FT Gap Every 20-50 FT)
Restoration (UMAM Polygon 1-A)
Enhancement (UMAM Polygon 1-B)
Live Oak Point - Map Inset 1
0
200
400 Feet
N
2019 DOQ


Map Inset 2
Map Inset 3
Map Inset 1
Breakwater (5-FT Gap Every 20-50 FT)
Restoration (UMAM Polygon 1-A)
Enhancement (UMAM Polygon 1-B)
Live Oak Point - Map Inset 2
0
200
400 Feet
N
2019 DOQ

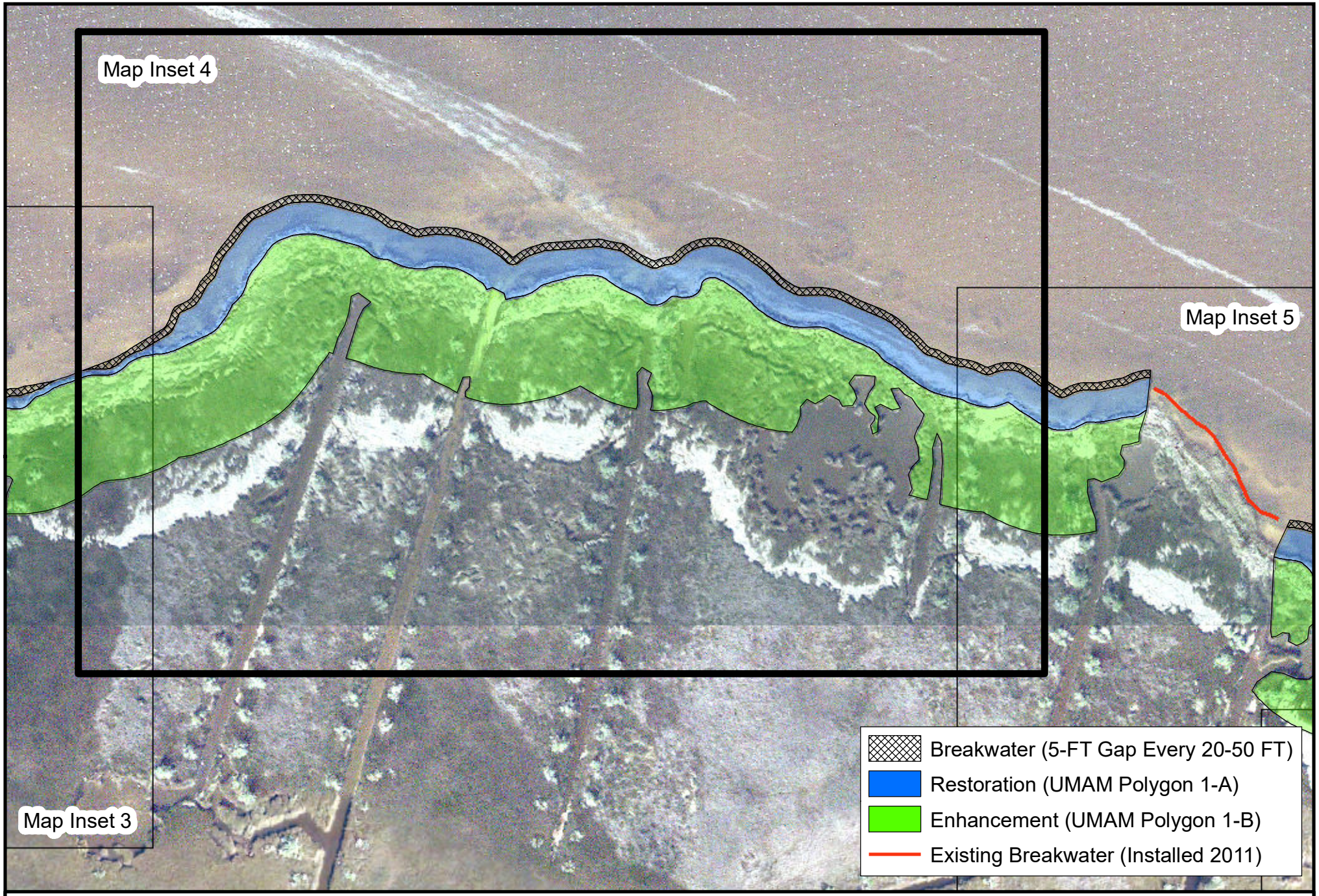


Live Oak Point - Map Inset 3

0 200 400 Feet

N

2019 DOQ

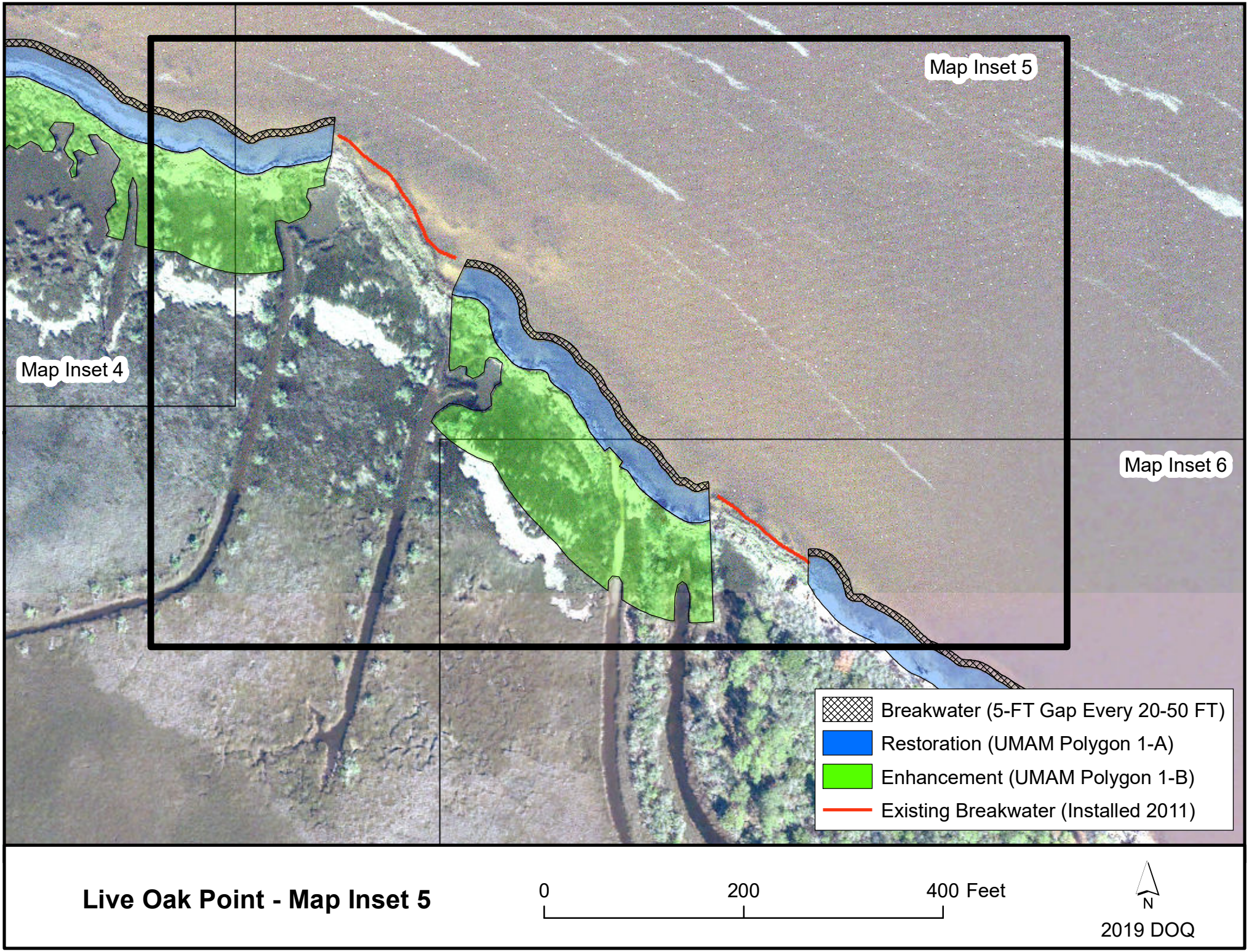


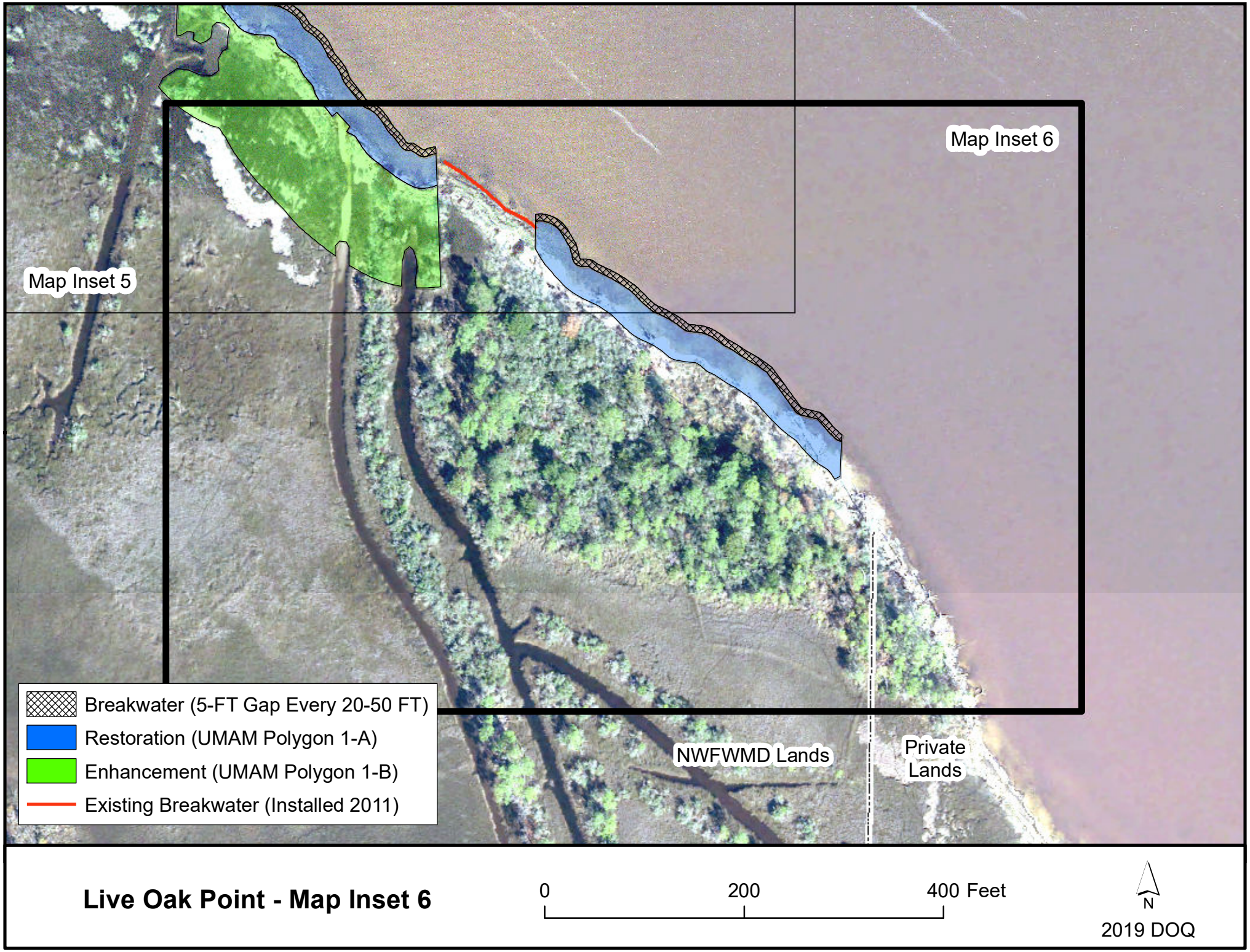
Live Oak Point - Map Inset 4

0 200 400 Feet

N

2019 DOQ


Map Inset 5
Map Inset 4
Map Inset 6
Breakwater (5-FT Gap Every 20-50 FT)
Restoration (UMAM Polygon 1-A)
Enhancement (UMAM Polygon 1-B)
Existing Breakwater (Installed 2011)
Live Oak Point - Map Inset 5
0
200
400 Feet
N
2019 DOQ


Map Inset 6
Map Inset 5
Breakwater (5-FT Gap Every 20-50 FT)
Restoration (UMAM Polygon 1-A)
Enhancement (UMAM Polygon 1-B)
Existing Breakwater (Installed 2011)
NWFWMD Lands
Private Lands
Live Oak Point - Map Inset 6
0
200
400 Feet
N
2019 DOQ

Mitigation Service Area (MSA) Description

Mitigation Service Area

The Live Oak Point Living Shorelines ILF Mitigation Service Area (MSA) has been developed in accordance with 33 CFR Part 332—Compensatory Mitigation for Losses of Aquatic Resources (2008 US EPA Final Rule) and the USACE Jacksonville District "Guidance for the Establishment of Service Areas for Mitigation Bank and In-Lieu-Fee Programs in the Jacksonville District" (March 10, 2020). Development of this project is funded by the Florida Department of Transportation (FDOT), which will be the sole purchaser of associated credits. Credits generated from the restoration and enhancement of salt marsh habitat at Live Oak Point will be used to offset minor, unavoidable impacts to estuarine wetlands associated with linear transportation projects.

Focused on the USGS 8-digit Hydrologic Unit Code (HUC) for Choctawhatchee Bay and analysis of US EPA Level IV Ecoregions, portions of 12-digit HUCs in adjacent watersheds are also included in the MSA. Though not meant to be a driving force, the 2008 EPA Final Rule and 2020 USACE Jacksonville District guidance allow for consideration of economic viability when determining an MSA. By extending the MSA into portions of several adjoining 12-digit HUCs, the economic viability of this project will be ensured and "type-for-type" mitigation options will be available for minor estuarine impacts that may result from upcoming transportation projects.

Consisting primarily of the EPA Level IV "Gulf Barrier Islands and Coastal Marshes" and "Gulf Coast Flatwoods" areas within the Choctawhatchee Bay 8-digit HUC 03140102 (the 8-digit HUC in which the mitigation project is located), the proposed MSA also includes portions of Level IV "Gulf Barrier Islands and Coastal Marshes" that extend westward into Santa Rosa Sound (part of the Pensacola Bay 8-digit HUC 03140105) and eastward to West Bay (part of the St. Andrew-St. Joseph Bays 8-digit HUC 03140102).

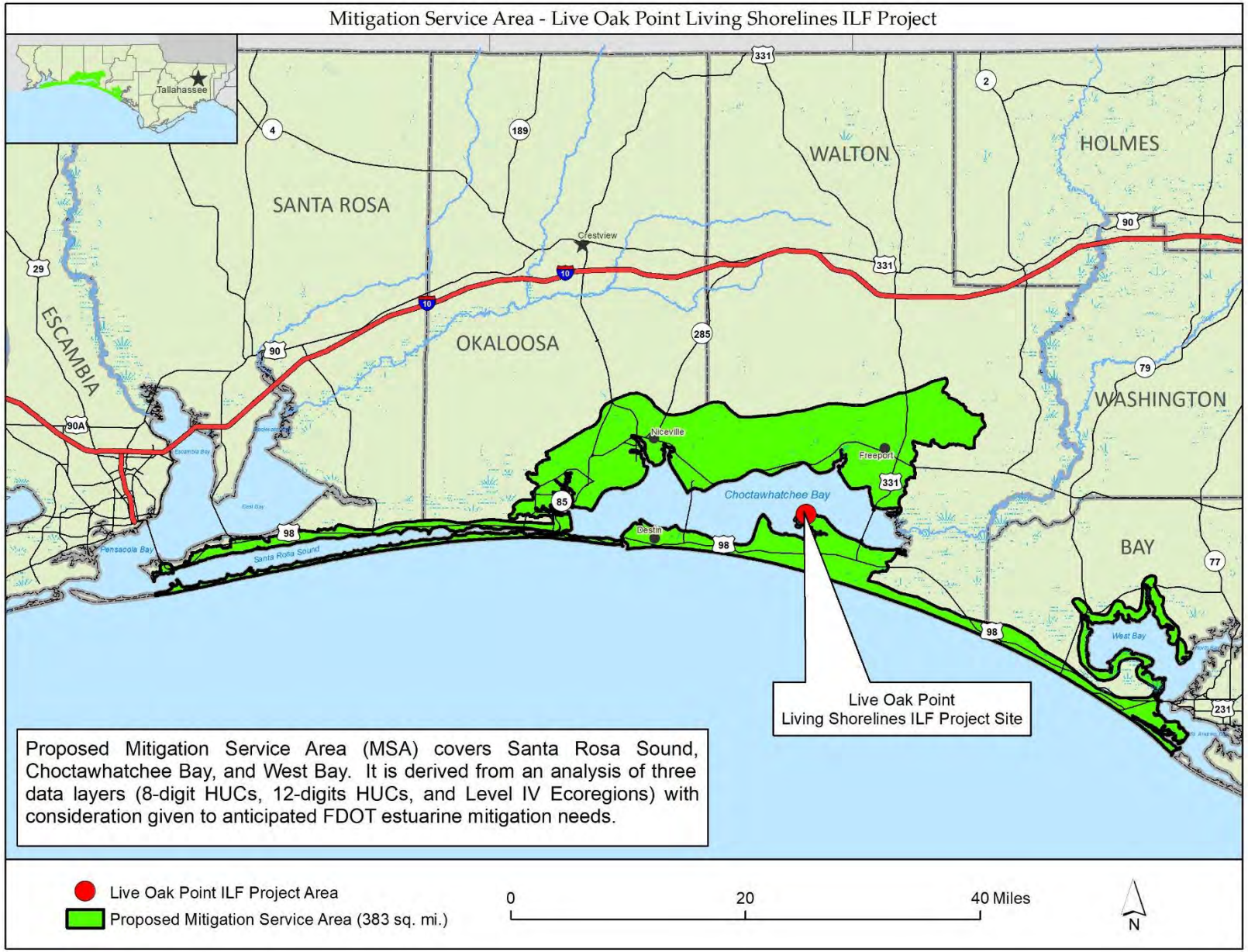
Total area of the proposed MSA is 383 mi^2. Approximately 75% (286 mi^2) of the MSA is within the Choctawhatchee Bay 8-digit HUC). About 10% (39 mi^2) of the MSA is within the Pensacola Bay 8-digit HUC, and about 15% (58 mi^2) of the MSA is within the St. Andrew-St. Joseph Bays HUC.

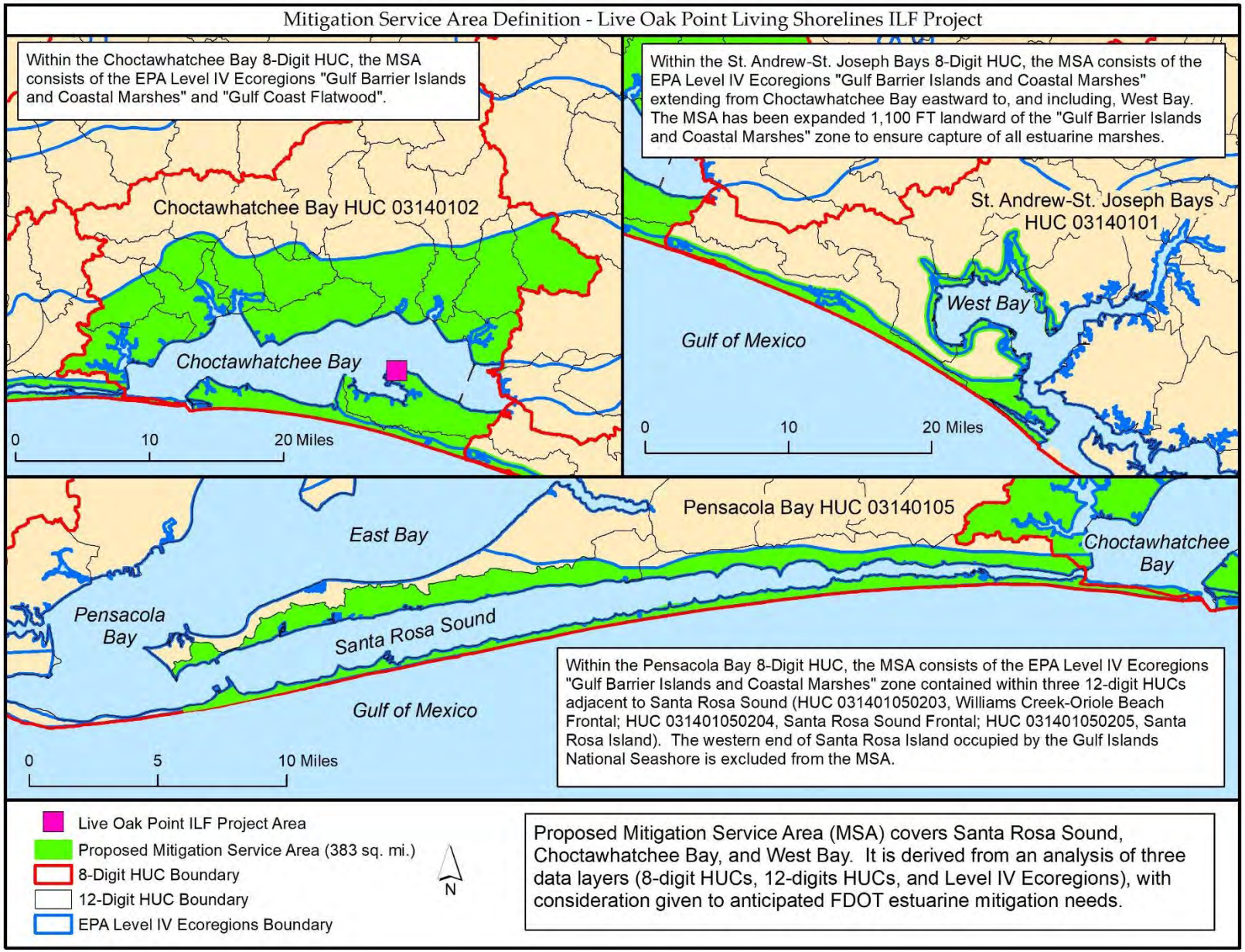
Proposed Mitigation Service Area (MSA) – 383 mi^2		
MSA Component	Size of MSA Component (mi^2)	Percent of MSA
Portion within Pensacola Bay (HUC 03140105)	39	10%
Portion within Choctawhatchee Bay (HUC 03140102)	286	75%
Portion within St. Andrew-St. Joseph Bays (HUC 03140101)	58	15%
	383 mi^2	100%

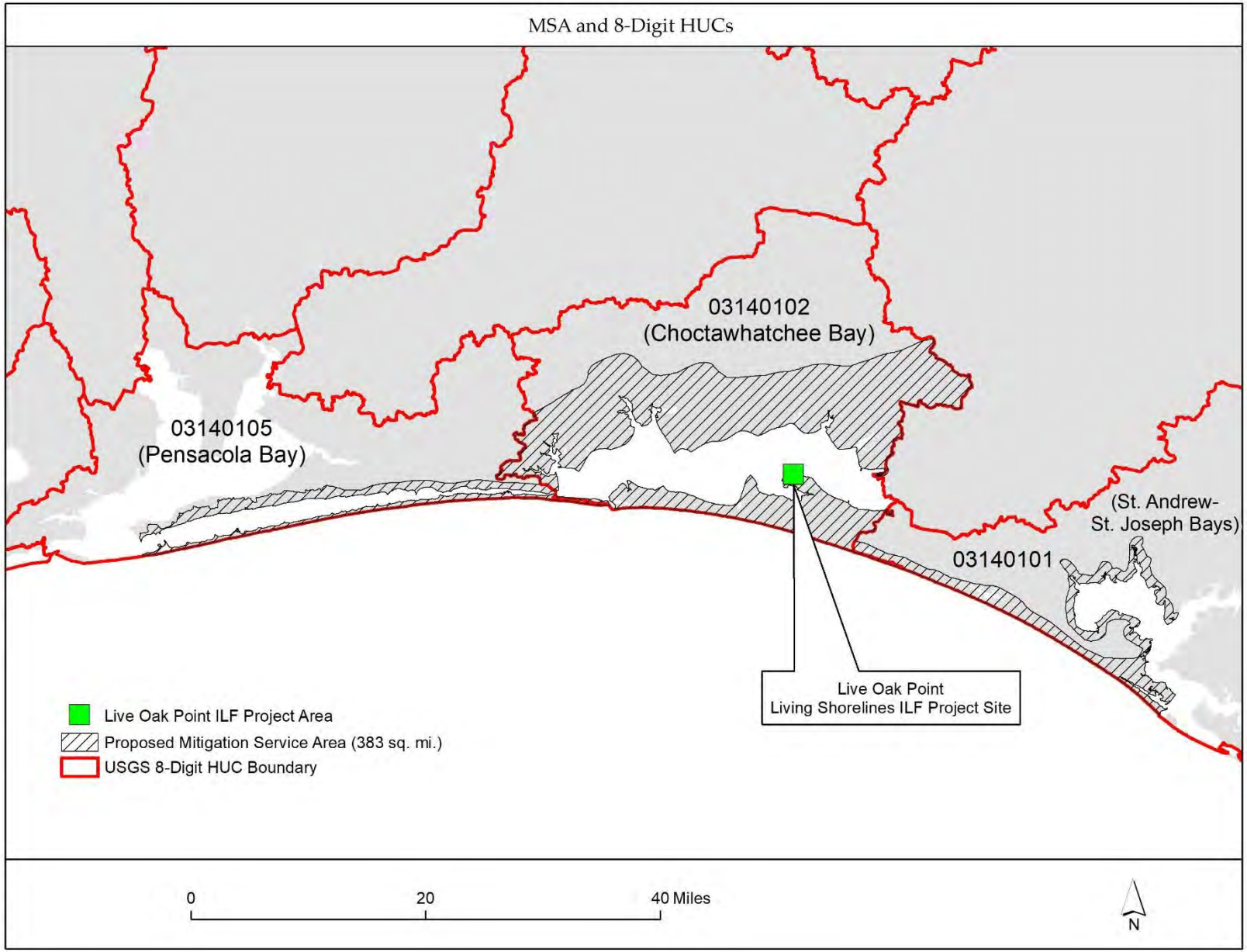
The portion of the MSA within the St. Andrew-St. Joseph Bays 8-digit HUC consists of the Level IV "Gulf Barrier Islands and Coastal Marshes" zone extending from Choctawhatchee Bay east to, and including, West Bay (i.e., the Level IV "Barrier Islands and Coastal Marshes" zone located within the following 12-digit HUCs: Burnt Mill Creek-Doyle Bayou Frontal, HUC 031401010602; Eastern Lake-Phillips Inlet Frontal, HUC 031401011004; Intercoastal Waterway-West Bay, HUC 031401011002; Alligator Bayou-Botheration Bay Frontal, HUC 03141011003; Fannin Bayou-Warren Bayou Frontal, HUC 031401010604; and Crooked Creek-West Bay, HUC 031401010603).

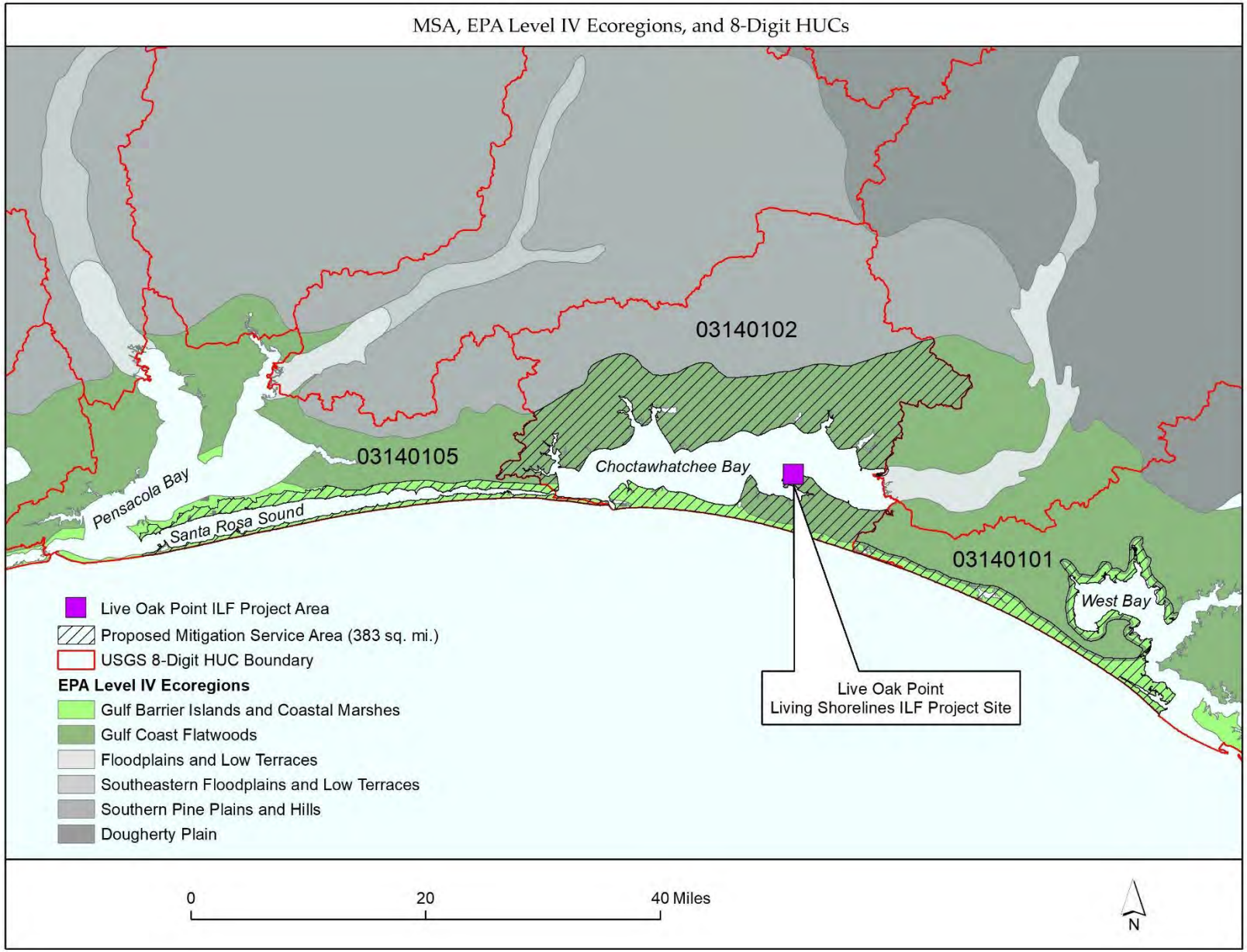
Within the St. Andrew-St. Joseph Bays 8-digit HUC, the MSA has been expanded 1,100 FT landward of the EPA Level IV "Gulf Barrier Islands and Coastal Marshes" to ensure capture of all coastal marshes. Extending the MSA eastward to West Bay will enable minor FDOT impacts to estuarine wetlands that may result from widening of SR 388 at Burnt Mill Creek and Crooked Creek to be offset "type-for-type." No mitigation bank provides estuarine credits in the West Bay watershed. "Permittee-responsible" mitigation projects, especially small-scale, estuarine wetland projects, are difficult to develop, costly, often result in "postage-stamp" projects that are challenging to ensure perpetual management and have high risk of failure.

Within the Pensacola Bay 8-digit HUC, the MSA consists of the EPA Level IV Ecoregions "Gulf Barrier Islands and Coastal Marshes" zone contained within the 12-digit HUCs adjacent to Santa Rosa Sound (i.e., Williams Creek-Oriole Beach Frontal, HUC 031401050203; Santa Rosa Sound Frontal, HUC 03141050204; and Santa Rosa Island, HUC 03141050205, minus the western portion of the island contained within the Gulf Islands National Seashore). The 8-digit HUC boundary that separates Santa Rosa Sound from Choctawhatchee Bay is arbitrary; extending the MSA into Santa Rosa Sound maintains the ecological continuity of the MSA and will allow a "type-for-type" mitigation option for the upcoming replacement of the US 98 Brooks Bridge at Fort Walton Beach and possible future FDOT projects.


Mitigation Service Area - Live Oak Point Living Shorelines ILF Project
Tallahassee
SANTA ROSA
WALTON
HOLMES
OKALOOSA
WASHINGTON
BAY
ESCAMBIA
Crestview
Niceville
Freeport
Destin
Choctawhatchee Bay
Pensacola Bay
Santa Rosa Sound
West Bay
Live Oak Point
Living Shorelines ILF Project Site
Proposed Mitigation Service Area (MSA) covers Santa Rosa Sound, Choctawhatchee Bay, and West Bay. It is derived from an analysis of three data layers (8-digit HUCs, 12-digits HUCs, and Level IV Ecoregions) with consideration given to anticipated FDOT estuarine mitigation needs.
Live Oak Point ILF Project Area
Proposed Mitigation Service Area (383 sq. mi.)
0
20
40 Miles
N


Mitigation Service Area Definition - Live Oak Point Living Shorelines ILF Project
Within the Choctawhatchee Bay 8-Digit HUC, the MSA consists of the EPA Level IV Ecoregions "Gulf Barrier Islands and Coastal Marshes" and "Gulf Coast Flatwood".
Choctawhatchee Bay HUC 03140102
Choctawhatchee Bay
0
10
20 Miles
Within the St. Andrew-St. Joseph Bays 8-Digit HUC, the MSA consists of the EPA Level IV Ecoregions "Gulf Barrier Islands and Coastal Marshes" extending from Choctawhatchee Bay eastward to, and including, West Bay. The MSA has been expanded 1,100 FT landward of the "Gulf Barrier Islands and Coastal Marshes" zone to ensure capture of all estuarine marshes.
St. Andrew-St. Joseph Bays HUC 03140101
West Bay
Gulf of Mexico
0
10
20 Miles
Pensacola Bay HUC 03140105
East Bay
Choctawhatchee Bay
Pensacola Bay
Santa Rosa Sound
Gulf of Mexico
0
5
10 Miles
Within the Pensacola Bay 8-Digit HUC, the MSA consists of the EPA Level IV Ecoregions "Gulf Barrier Islands and Coastal Marshes" zone contained within three 12-digit HUCs adjacent to Santa Rosa Sound (HUC 031401050203, Williams Creek-Oriole Beach Frontal; HUC 031401050204, Santa Rosa Sound Frontal; HUC 031401050205, Santa Rosa Island). The western end of Santa Rosa Island occupied by the Gulf Islands National Seashore is excluded from the MSA.
Live Oak Point ILF Project Area
Proposed Mitigation Service Area (383 sq. mi.)
8-Digit HUC Boundary
12-Digit HUC Boundary
EPA Level IV Ecoregions Boundary
N
Proposed Mitigation Service Area (MSA) covers Santa Rosa Sound, Choctawhatchee Bay, and West Bay. It is derived from an analysis of three data layers (8-digit HUCs, 12-digits HUCs, and Level IV Ecoregions), with consideration given to anticipated FDOT estuarine mitigation needs.


MSA and 8-Digit HUCs
03140102
(Choctawhatchee Bay)
03140105
(Pensacola Bay)
(St. Andrew-
St. Joseph Bays)
03140101
Live Oak Point
Living Shorelines ILF Project Site
Live Oak Point ILF Project Area
Proposed Mitigation Service Area (383 sq. mi.)
USGS 8-Digit HUC Boundary
0
20
40 Miles
N


MSA, EPA Level IV Ecoregions, and 8-Digit HUCs
03140102
03140105
03140101
Choctawhatchee Bay
Pensacola Bay
Santa Rosa Sound
West Bay
Live Oak Point
Living Shorelines ILF Project Site
Live Oak Point ILF Project Area
Proposed Mitigation Service Area (383 sq. mi.)
USGS 8-Digit HUC Boundary
EPA Level IV Ecoregions
Gulf Barrier Islands and Coastal Marshes
Gulf Coast Flatwoods
Floodplains and Low Terraces
Southeastern Floodplains and Low Terraces
Southern Pine Plains and Hills
Dougherty Plain
0
20
40 Miles
N

Credit Release Schedule

Schedule of Credit Release Live Oak Point Breakwater Total Potential Credits = 2.61			
Task No.	**Performance-based Milestone**	**% Credit Release**	**Number of Credits**
--	Advanced Credits	--	0.52
1	First Interim Success Criteria – • Breakwaters have been installed and are functioning as designed. • Revegetation areas have been planted as described in approved restoration plan. • Baseline monitoring has been completed for both reference and restoration sites and submitted to the USACE. • Marsh vegetation similarity index ≥ 50% of the reference site. • Benthic diversity similarity index ≥ 35% similar of the reference site. • Sediment accretion rate ≥ 2.29 mm per year. • Nuisance vegetation < 5% cover. • Exotic vegetation < 1% cover.	20%	0.52
2	Second Interim Success Criteria – • Breakwaters intact and functioning as designed. • Planted vegetation density averages at least 55% cover per meter square of the reference site • Oyster density and faunal species richness appear healthy and is greater than baseline. • Marsh vegetation similarity index ≥ 60% of the reference site. • Benthic diversity similarity index ≥ 45% similar of the reference site. • Sediment accretion rate ≥ 2.29 mm per year. • Nuisance vegetation < 5% cover. • Exotic vegetation < 1% cover.	20%	0.52
3	Third Interim Success Criteria – • Breakwaters intact and functioning as designed. • Planted vegetation density averages at least 75% cover per meter square of the reference site • Oyster density and faunal species richness is increasing and appears healthy. • Marsh vegetation similarity index ≥ 70% of the reference site. • Benthic diversity similarity index ≥ 55% similar of the reference site. • Sediment accretion rate ≥ 2.29 mm per year. • Nuisance vegetation < 5% cover. • Exotic vegetation < 1% cover.	20%	0.52
4	Fourth Interim Success Criteria – • Breakwaters intact and functioning as designed. • Planted vegetation density averages at least 85% cover per meter square of the reference site • Oyster density and faunal species richness is increasing or maintaining diversity and appears healthy. • Marsh vegetation similarity index ≥ 80% of the reference site. • Benthic diversity similarity index ≥ 65% similar of the reference site. • Sediment accretion rate ≥ 2.29 mm per year. • Nuisance vegetation < 5% cover. • Exotic vegetation < 1% cover.	20%	0.52
5	Final Success Criteria – • Breakwaters intact and functioning as designed. • Planted vegetation density averages at least 90% cover per meter square of the reference site • Oyster density and faunal species richness is increasing or maintaining diversity and appears healthy • Marsh vegetation similarity index ≥ 90% of the reference site. • Benthic diversity similarity index ≥ 75% similar of the reference site. • Sediment accretion rate ≥ 2.29 mm per year. • Nuisance vegetation < 5% cover. • Exotic vegetation < 1% cover.	20%	0.53
		100%	2.61