

APPENDIX C-1 TABLE

HABITAT RESTORATION AND ENHANCEMENT PROJECTS SUMMARY

| Project # Priority ¹ Action Plan | Project Name | Project Type | Status | Project Area | Comments* | Project Cost |
|---|---|--|--|--|--|--|
| 1 Low SE-3 | Little Lake Worth | -Filling/Capping | Dredged hole, anoxic sediments, no littoral area | 40 acre submerged dredge hole (approx. 500,000 cy capacity) | Substrate and habitat to support SAV, stone crab, fisheries and water quality improvements. Low maintenance/monitoring. | \$5,500,000 to \$10,000,000 fill costs-depend on sand source |
| 2 Low HE-5, SE-3 | Monastery Dredge Hole | -Filling/Capping -Artificial Reef | ~9 acres of the 26 acres submerged dredged hole were filled (100,000 cu. yds.) to -8ft NGVD in 1993. | 17 acres of submerged dredged hole remains to be filled (150,000cy) 2 acre artificial reef | Substrate and habitat to support SAV, stone crab, fisheries and water quality improvements. Low maintenance/monitoring. | \$2,400,000 to \$3,000,000/ fill costs-depend on sand source \$400,000 / reef |
| 3 High HE-2, HE-6 | Singer Island Seagrass Sanctuary | -Acquisition -Conservation -Mangrove/spartina | Previous attempts have been made to acquire this land with no success to date. | Up to 154 acres of land for acquisition (147 submerged acres, 7 upland acres), 6,100 ft. shoreline. | This submerged area contains the densest and healthiest seagrass beds in the Lake Worth Lagoon. | Acquisition -TBD |
| 4 High HE-2 | Little Munyon Island | -Acquisition -Mangrove/spartina -Coastal hammock | Site is targeted to mitigate SAV impacts from dredging Spencer/Rybovich Marina. Not available for restoration at this time. | ~18 acres of land for acquisition (15 submerged acres, 3 upland acres), 2.5 acres mangrove and , 0.5 acres coastal hammock | After completion of mitigation, site is to be transferred to John D. MacArthur Beach State Park for management. | Mitigation Note: To be completed by others |
| 5 Med HE-5 | Sugar Sands/Palm Beach Isles Artificial Reef Site | -Artificial reef | 10 acre dredged hole (~ 2000' x 200'), 25'deep. Reef materials have been place within 7 acres of the site. | 3 acres remain for future reef projects. The current artificial reef is very successful. | Site is successful & highly utilized by marine fauna due to close proximity to inlet. Low maintenance, primarily monitoring. | \$600,000 |

¹ High = anticipated to be approved, permitted and constructed within the next 5yrs
 Med = anticipated to be designed, approved & initiate permitting within the next 5yrs, construction 2yrs post permitting.
 Low = anticipated to receive conceptual approval within the next 5yrs

Please note: all projects are conceptual until proper approvals and permitting have been received. The projected timeline for construction is subject to time delays associated with permitting and available funding.

*Listed Agencies have not committed funds and are subject to Agencies' budget approvals

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| 6 Med HE-5 | Kelsey Park Artificial Reef | -Artificial reef | 6 acres dredged hole is 10' deep. ~2,000 ton of limestone rock has been placed to date. | Up to 4 acres of submerged area remains for future reef projects. | Site is successful & highly utilized by marine fauna due to close proximity to inlet. Low maintenance, primarily monitoring. | \$800,000 |
| 7 Low HE-2, HE5 | Phil Foster Park | -Artificial reef -Riprap/mangrove | The park was refurbished by PBC Parks & Recreation Department (2006). Parks proposes a 221 slip marina. | Artificial reef site ~0.2 acres Rip rap/mangrove planters ~1300 lf. | Artificial reef site located off of west seawall. Riprap/Mangrove planter to be constructed off seawall as part of proposed marina project. | Artificial reef - \$50,000 Mangrove Planter \$400,000 |
| 8 Low HE-4, HE-5 | Peanut Island shoal | -Seagrass Habitat -Artificial Reef -Water Quality | Identify area to receive sand for restoration purposes. Requires public support | ~30 acres shoal, remove ~100,000 cu. yds. of sand, add reef habitat | May improve tidal flushing to northern LWL; provides habitat and recreational opportunities. Sand will be used to fill dredged hole sites for additional SAV enhancement. | \$1,100,000 |
| 9 Med HE-5 | Rybovich Artificial Reef Site | -Artificial Reef | 3 acres of the 5 acres site have been filled with reef structures. | ~2 acres remain to be filled with reef materials. | Reef is successful and highly utilized by marine fauna due to close proximity to inlet. Low maintenance, primarily monitoring. | \$400,000 |
| 10 Low HE-2 | PB Country Club Mangroves | -Mangrove Planter | Will require an agreement with the golf course landowner | 1500 linear ft. of shoreline | Mangrove planters will stabilize shoreline and provide habitat | \$450,000 |
| 11 Low HE-2 | West Palm Beach Currie Park | -Mangrove Planter -Riprap | Reef placement under the pier & prototype mangrove planter, completed in 2002. | 2000 linear ft. | Mangrove planters/riprap will be constructed waterward of seawall. Project will attenuate waves/wakes. | Riprap for mangrove planters - \$600,000 |

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| 12 High HE-1, HE-2, HE-5, SE-3 | City of West Palm Beach South Cove Waterfront Restoration | -Filling -Mangrove Is/Spartina -Seagrass Habitat -Riprap/Oyster Habitat -Artificial Reef | Requires an Interlocal Agreement with the City Identify sand source: Peanut Island or ICW shoal dredging | 1.8 acres mangroves/ spartina 3.5 acres seagrass ~1 acre artificial reef ~1650 lf oyster reef ~2480 linear ft riprap | Enhancement of this site by filling anoxic dredged holes and placing rock will provide vital habitat in an urban setting. Substrate and habitat improvements will provide water quality improvements. | \$4,400,000 |
| 13 High HE-1, HE-2, HE-4, SE-3, | Palm Beach Atlantic Univ. Mangroves | -Mangrove Planter -Filling/Capping -Seagrass/Oyster | Requires Interlocal Agreement with PBAU | <3 acre area ~0.5 ac mangrove/spartina | Mangrove planter will provide habitat and wave attenuation. Filling/capping mucks will provide substrate for SAV. | \$300,000 / fill \$400,000 oyster/mangrove |
| 14 Med HE-1, HE-2 | Bradley Park- Town of Palm Beach | -Mangrove Planter -Riprap | Interlocal Agreement signed (May 2007) by Town of Palm Beach and Palm Beach County to initiate project | 450 linear ft. | Mangrove planter will be constructed waterward of seawall | \$200,000 |
| 15 Med HE-5 | Royal Park Bridge- Hole | -Artificial reef | May be coordinated with FDOT improvements to other local bridges | Approximately 1 acre project. | Location is isolated from other resource areas and inlets. Proximity to channel and/or bridge may result in concerns and objections. | \$200,000 |
| 16 Low HE-1 | Everglades Island Country Club | -Riprap | Needs approval by land owners | 4000 linear ft. | Riprap can be placed at the toe of the existing bulkhead with equipment on a barge. | \$1,200,000 |
| 17 Med HE-1, HE-2, HE-4 | Town of Palm Beach Mangrove Islands and Oyster Reefs | -Mangrove Islands -Oyster Reef -Seagrass Habitat -Capping/Filling | Interlocal Agreement signed by Town of Palm Beach and Palm Beach County May 2007. | 4 acre area of primarily submerged habitat between Southern Blvd north to Everglades Island. 2 acre oyster/mangrove | Increased oyster, mangrove and seagrass habitat will benefit water quality, bird and fisheries resources. | \$500,000 / fill \$400,000/oyst mangrove |
| 18 Med HE-5 | Southern Boulevard Bridge - Hole | -Artificial reef | Small dredged hole | Undetermined project area. | Located in the vicinity of significant resources but away from inlets. | \$100,000 |

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| 19 High HE-1, HE-2 | Bingham/ Audubon Islands | -Exotic vegetation removal -Mangrove/Oyster habitat | Requires an agreement with landowners Preservation/restoration | 7 acre area of primarily 50% submerged and 50% existing high quality mangrove habitat. | Increased oyster, mangrove and seagrass habitat will benefit water quality, bird and fisheries resources. Located in an area of significant resources. | \$800,000 |
| 20 High HE-1 | John's Island | -Oyster Habitat | A pilot oyster project that will be utilized to expand oyster habitat throughout the LWL | 6.0 acres | Near C-51 canal freshwater discharge creating salinities favorable for oyster habitat. Shallow water area. | \$1,200,000 |
| 21 High HE-1, HE-2 SE-3 | Palm Beach Ibis Isle Restoration | -Mangrove/Spartina -Filling/capping -Oyster | Interlocal signed with Town of Palm Beach and Palm Beach County May 2005. | 8 acre site 2 ac mangrove/spartina 6 ac oyster/seagrasses | Cap muck sediments to provide, mangrove, seagrass & oyster habitat to benefit water quality, bird and fisheries resources. | \$1,000,000 |
| 22 Med HE-1, HE-4, SE-3 | Snook Islands (Phase II) | -Filling and minor capping -Mangrove Island(s) -Oyster/Seagrasses | A continuation of the Snook Islands Natural Area | Approximately 80-100 acres | Utilize fill material on site and Bring elevations up to support SAV. Rock placement to provide oyster habitat and mangrove islands. | \$10,000,000 |
| 23 High SE-3, HE-1, HE-2, HE-4 | Bryant Park Islands | -Filling/Capping -Mangrove/oyster -Seagrass | Requires an Interlocal Agreement with City of Lake Worth | 30 acre site ~5-10 ac mangroves | Fill would need to come from offsite. Continuation from Snook Islands Project. Increased oyster, mangrove and seagrass habitat will benefit water quality, bird and fisheries resources. | \$9,000,000 |

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|--------------------------------------|--|---|--|--|---|--|
| 24 Low HE-2 | Lake Worth/ A1A Spartina Wetlands | -Riprap -Spartina Planter | City Owned, under private lease. Requires Interlocal Agreement | 1000 linear ft. | Exotic plant removal, install native plants. Riprap will provide habitat. | \$300,000 |
| 25 Med HE-1, HE-2, SW-3 | City of Lake Worth South Palm Park and Road Right of Ways | -Spartina Planter -Oyster Reef/riprap -Stormwater treatment | Needs an Interlocal Agreement with the City. | 250 linear ft. | Moderate energy shoreline. Some submerged areas along the shoreline can be filled to form planting areas. | \$75,000 riprap Stormwater treatment \$50,000 |
| 26 Low HE-2 | Lantana Nature Preserve | -Mangrove/Spartina -Exotic removal -Enhanced Flushing | Needs an Interlocal Agreement with the Town. Requires Project Scoping | 2 acre mangrove area | Mangrove planting, exotic removal. Excavate sediments in mosquito ditches to increase flushing to mangroves. | \$75,000 exotic removal & planting \$50,000 enhance flushing |
| 27 Med HE-2, SW-3 | Lantana Pocket Parks | -Spartina/mangrove planters -Water Quality Imp. | Requires Interlocal Agreement with Town | 300 linear ft. | Isolated planters will provide habitat and stormwater treatment | \$100,000 planters \$150,000 stormwater |
| 28 High HE-2 | Mangrove Preserves Palm Beach County/ Ocean Ridge & Boynton Bch property | -Land acquisition -Riprap -Exotic vegetation control Public Boardwalk | PBC is expected to acquire the Ocean Grand site and install riprap & boardwalk along the shore. Will require Interlocal Agreement with Town | Approximately 40 acres PBC - approximately 12 acres of Ocean Grand mitigation tract - Private - 20 acres | Selective exotic vegetation removal. Riprap to protect eroding shoreline | Acquisition - \$200,000 Mangrove enhancement and creation - \$300,000 |
| 29 Med HE-2 | Island Drive Riprap | Riprap | Vertical seawall on public road ROW | 700 linear ft | Install 1500 tons of riprap to reduce wave energy & provide habitat | \$210,000 |

APPENDIX C-2 TABLE

STUDIES AND MONITORING PROJECTS SUMMARY

| Project #/ Priority Action Plan | Project Name | Project Type | Status | Project Area | Comments* | Project Cost |
|---------------------------------------|---|--------------|--|--|---|-------------------------------|
| 1 High EM-1 | Implement Sea Turtle Monitoring Goals for LWL | Monitoring | The netting survey has been ongoing since March 2005. Additional sampling events will be scheduled quarterly for the next four years as funding is made available. | All three segments of the Lake Worth Lagoon | Monitor the health of the seaturtle population utilizing LWL by continuing to perform quarterly netting events for 5 years. | \$35,000/yr \$175,000/5yr |
| 2 High EM-2 | Develop a Fishery Monitoring Program | Monitoring | To be implemented. Develop a long-term, comprehensive database on fish and selected invertebrate species inhabiting the LWL. | All three segments of the Lake Worth Lagoon | FWC/FWRI will contribute \$75,000 in staff & services. The remaining \$75,000 is contingent upon grant funds. | \$150,000/yr \$750,000/5yr |
| 3 High EM-3 | Develop a SAV Monitoring Program | Monitoring | To be implemented. Develop a long-term, comprehensive SAV monitoring program for LWL. | All three segments of the Lake Worth Lagoon. | Develop a monitoring protocol capable of detecting SAV changes in both short- and long term spatial and temporal scales. The current monitoring protocol utilized by PBCERM will be modified when a standardized monitoring protocol is developed by the RECOVER Northern Estuaries SAV sub-team. | \$140,000/yr \$700,000/5yr |
| 4 High EM-4 | Monitor Oyster Reef Habitat in LWL | Monitoring | The establishment of a baseline for oysters in the lagoon is currently ongoing through a long-term monitoring program headed by the Florida Fish and Wildlife Conservation Commission (FWC). FWC has been conducting a comprehensive study in LWL under the RECOVER Monitoring and Assessment Plan since January 2005. | All three segments of the Lake Worth Lagoon. | The goal is to increase monitoring of the oyster population in LWL and on artificial substrate (walls, pilings, rock). | \$100,000/yr \$500,000/5yr |
| 5 High HE-1, HE-2, HE-4 | Post Construction Project Monitoring | Monitoring | Establish monitoring program to determine success of constructed restoration/enhancement projects. | All three segments of the Lake Worth Lagoon. | Monitor the project success and re-establishment of resources. | \$100,000/yr \$500,000/5yr |

TABLE C-3 TABLE

WATER AND SEDIMENT QUALITY PROGRAM

| Project Name | Project No. & Priority | Activity or Product | ESTIMATED COST | POTENTIAL* PARTNERS | STATUS |
|-----------------------|------------------------|--|---|--|---|
| WATER QUALITY | WQ - 1 High | Implement Water Quality Monitoring for Lake Worth Lagoon. Monitor the health of the Lake Worth Lagoon and trend analysis by increasing the number of water quality stations from 10 to 22. | \$134,000/yr \$670,000/5yr | PBCERM, SFWMD, FDEP, Local governments | This is part of the new proposed monitoring network in cooperation with SFWMD |
| | WQ - 2 Med | Reduce the occurrence of municipal sewer overflows to the Lake Worth lagoon. | TBD | EPA Region 4, FDEP, Local governments, PBCERM | To be implemented |
| | WQ - 3 Low | Install Additional Sewage Pump-out Facilities for Recreational Boaters and Live-aboard Vessels. | Stationary or portable pump-out unite range from approximately \$2,000 to \$6,000. Costs for a portable toilet waste station may vary from \$1,100 to \$1,800. | FDEP, Local governments, PBCERM | To be implemented |
| | WQ - 4 Low | Improve Fueling and Bilge-Pumping Practices Among Recreational Boaters. | TBD | FDEP, U.S. Coast Guard Auxiliary, PBCERM, Lagoon Keepers, Local Municipalities | To be implemented |
| | WQ-5 Low | Provide sewage removal from vessels within the Lake Worth Lagoon (LWL) to live-aboard vessels through a pump-out boat. | Costs vary depending on type of pump-out boat selected and the size. The annual cost to run this program is \$70,000/year. This amount includes a full-time employee to run the service, and the associated costs for docking fees. | FDEP, Florida's Clean Vessel Act grant program, Florida's Clean Marina program, PBC Boater Registration, FIND grant program. | To be implemented |
| WASTE WATER TREATMENT | WW - 1 High | Identify Septic systems and Municipal Wastewater Loading to Lake Worth Lagoon and associated watershed. Implement bacteriological assessment to identify problem areas associated with septic loading. | \$125,000 | PBC Board of County Commissioners, FDEP, PBC DOH, EPA, NOAA FACE Program, Local Municipalities | To be implemented |
| | WW - 2 Med | Provide Additional Sanitary Sewer Connections to Priority Areas of Lake Worth Lagoon. | TBD | PBC Board of County Commissioners, FDEP, Palm Beach County Health Unit, EPA, NOAA FACE Program, Local Municipalities, SFWMD | To be implemented |

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| TABLE C-3 TABLE | | | | | |
|------------------------------------|------------------------|---|--|--|---|
| WATER AND SEDIMENT QUALITY PROGRAM | | | | | |
| Project Name | Project No. & Priority | Activity or Product | ESTIMATED COST | POTENTIAL* PARTNERS | STATUS |
| STORMWATER TREATMENT | SW – 1 High | Reduce Discharge of Freshwater and Total Suspended Solids in the Lake Worth Lagoon through the C-51 Canal. | NPBC-1 Project with all its components is \$425,079,000; however, the allocated sum for the C-51 dredging project is currently \$2.7 million/year. | SFWMD,USACE, PBCERM, FDEP | The C-51 Project is currently on-going. |
| | SW – 2 High | Implement Best Management Practices on Golf Courses near the Lake Worth Lagoon. | TBD | FDEP, SFWMD, IFAS, Environmental Education Centers, Lagoon Keepers | To be implemented |
| | SW – 3 High | Identify and Increase stormwater retrofit projects by identifying and collect ArcGis data to create map for project prioritization. | \$50,000 | SFWMD,PBCERM, FDEP, Municipalities, PBC NPDES Program | To be implemented |
| SEDIMENT QUALITY | SE – 1 Med | Substrate Characterization in Lake Worth Lagoon | \$125,000 | RECOVER, SFWMD, FWC, FIND, FDEP | To be implemented |
| | SE – 2 High | C-51 Basin and Lake Worth Lagoon Sourcing Study | \$150,000 | SFWMD, FDEP, PBCERM, LWDD | To be implemented |
| | SE – 3 Med | Capping Sediments in Lake Worth Lagoon | \$2,000,000 | SFWMD, USFWS, EPA, USACOE, PBC, LWLPGP, FIND | To be implemented |

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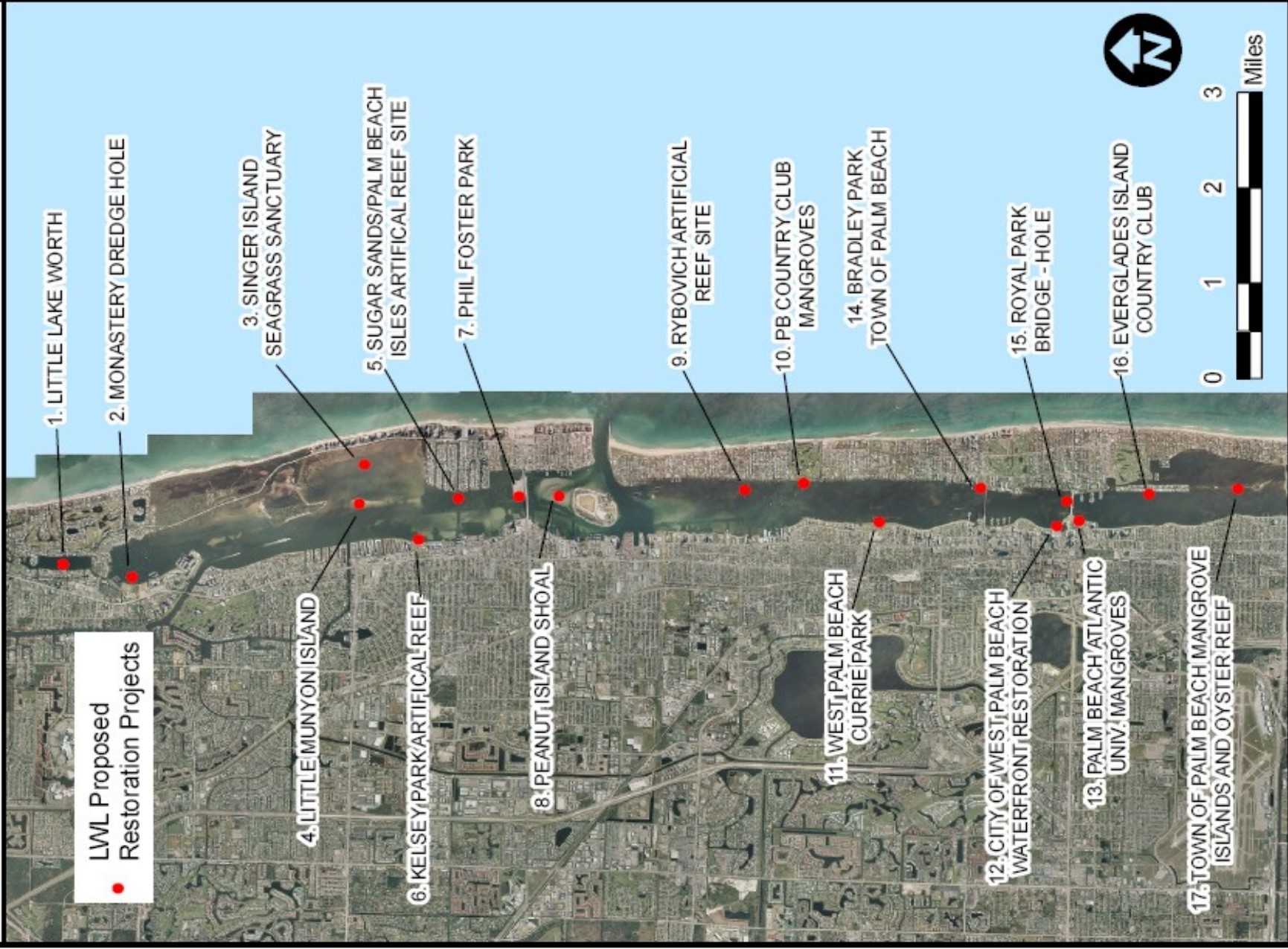
TABLE C-4 TABLE

PUBLIC USE AND OUTREACH PROGRAM – FUNDING PROGRAM

| Project Name | Project No. & Priority | Activity or Product | ESTIMATED COST | POTENTIAL* PARTNERS | STATUS |
|-------------------------|------------------------|--|---|---|-------------------|
| PUBLIC USE AND OUTREACH | PO – 1 Med | Established the LWL Initiative to facilities stakeholders partnerships and seek funding assistance | Average appropriations for the since 1998 has been \$1.7 million | LWL Stakeholders | To be implemented |
| | PO – 2 High | Promote Public Outreach in Lagoon Restoration and protection through education and citizens' involvement | Annual costs for staff are estimated at approximately \$75,000/yr, plus costs for DVDs and other educational materials | LWL OAC, PBCERM, IFAS, SFWMD, FDEP, Environmental Education Centers, Lagoon Keepers | To be implemented |
| | PO – 3 Med | Implement Pollution Prevention Initiatives and the Florida Yards & Neighborhoods Program | Annual costs for staff and other educational materials are estimated at approximately \$100,000/yr | IFAS, SFWMD, SWWMD, FDEP, PBCERM, Local Governments, Mounts Botanical Gardens, Bush Wildlife Sanctuary | To be implemented |
| | PO – 4 High | Identify and construct areas around the Lake Worth Lagoon (LWL) for public access features dedicated to non-motorized vessels such as kayaks and canoes, and features promoting birding, fishing, etc. | Siting and construction of public access facilities is contingent upon the type of facilities selected at each location | PBCERM, PBC Parks & Recreation, SFWMD, FDEP, Municipalities | To be implemented |
| FUNDING | FD – 1 High | Increase Funding and Partnerships for the Lake Worth Lagoon Partnership Grant program | Annual costs for staff, database development, and grant writing are estimated at approximately \$75,000/yr | PBCERM, FDEP, SFWMD, FFWCC, USFWS, NOAA/NMFS, FIND, Local Municipalities | To be implemented |
| FUNDING | FD – 2 High | Increase funding directed toward LWL management through Federal, State and local government grants and partnerships, private-public partnerships with non-governmental organizations (NGOs), grants from privately managed trusts and direct funding from the public | Annual costs for staff and grant writing are estimated at approximately \$134,000 per year | PBCERM, SFWMD, FWC, USFWS NOAA / NMFS, FDEP, FIND, Tourism Development Council, Municipalities, Marine Industries Association | To be implemented |

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Lake Worth Lagoon Proposed Restoration Projects - North



Lake Worth Lagoon Proposed Restoration Projects - South

