



West Lake Park

Master Mitigation Plan

Prepared for:
Broward County Parks and Recreation Division
950 N.W. 38th Street
Oakland Park, FL 33309

Prepared by:

Miller Legg
1800 N. Douglas Road, Suite 200
Pembroke Pines, FL 33024-3200
www.millerlegg.com

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1.0 PREAMBLE

West Lake Park is a $\pm 1,522$ acre park in Sections 25, 35, and 36 in Township 50S, Range 42E and Sections 1, 2, 11, and 12 in Township 51S, Range 42E in Broward County Florida. The Park, which is currently managed by Broward County Parks and Recreation Division (BCPRD), includes mangrove, seagrass, mud flat, upland, and open water communities, as well as community recreation facilities. The Park also currently contains ± 63.5 acres of exotic plant-dominated spoil islands and uplands of which ± 55.3 is proposed to be created into a natural habitat under this plan.

The development of this Mitigation Plan is a continuation of the previously successful mitigation efforts at West Lake Park. This plan is intended to address ecosystem-level improvements through a comprehensive plan for the entire West Lake region and the surrounding environment. The improvements are intended to allow the ecosystem to function as naturally as possible with minimal human influence.

Permits for the improvements described herein have been received by the U.S. Army Corps of Engineers (USACOE), South Florida Water Management District (SFWMD), and Broward County Environmental Protection and Growth Management Department (BCEPGMD). USACOE permit SAJ-2002-72 (IP-LAO) was issued on March 2, 2006. SFWMD permit 06-04016-P was issued on April 22, 2004 and BCEPD license DF03-1117 was issued on August 12, 2004.

Restoration and enhancement of tidal wetland functions and associated benefits to significant wildlife species should occur through the implementation of 11 key mitigation components with a focus on exotic upland spoil/vegetation removal and hydrologic/flushing improvements. These key ecological improvement concepts envisioned include:

- Creation of mangroves, mudflats, channels, tidal pools, seagrass recruitment areas, and native upland hammocks from exotic-infested spoil areas,
- Shoreline protection along the Intracoastal Waterway (ICW) and Dania Cutoff Canal (DCC),
- Improvement of flushing and circulation within the Dania Salt Marsh by the creation of a north-south flushing channel and removal of hindrances to water movement,
- Improvements to flushing throughout West Lake Park either through installation of new culverts, upsizing of existing culverts, or desilting of existing culverts to enhance and restore water flow within the Park,
- Enhanced protection for an established bird nesting, feeding, and watering area,
- Establishment of two manatee protection areas along the ICW,
- Removal of existing barges from Whiskey Creek.
- Exotic vegetation removal,
- Desilting specific existing channels,
- Installation of additional osprey nesting platforms,
- Outparcel acquisition,

1.1 Project Description

West Lake Park contains habitats that are significantly imperiled in the South Florida region. The estuarine wetlands and upland hammocks historically located on and east of the Southeast Ridge within Broward County have been mostly lost due to development. Due to its location and size, West Lake Park provides a vista of Broward County's historic mangrove environment. This important natural area provides wildlife resources, upland recreational possibilities, and sensitive estuarine wetland habitat.

Implementation of the West Lake Park Mitigation Plan should result in identifiable ecological benefits to the Park and the surrounding watershed. These benefits include:

- Removal of ±55.3 acres of exotic vegetation and associated seed source that currently degrades the natural communities in the park and adjacent areas,
- Increasing habitat diversity in the Park,
- Protecting the shoreline from continued erosion due to wave energy and storm events,
- Increasing the carrying capacity of fish habitat in the Dania Salt Marsh,
- Acquiring of private outparcels within the Park to preserve and protect the parcels as ecologically important County property in perpetuity,
- Reducing the threat of predation on birds using the bird nesting area,
- Increasing the potential for nesting success for ospreys in Broward County,
- Protecting the West Indian Manatee and submerged natural resources,
- Reducing turbidity in the Park,
- Increasing suitable areas for seagrass recruitment,
- Shoreline/substrate stabilization and associated reduction of sediment contribution
- Increasing overall floral diversity throughout the Park.

1.2 Goals

The goals of the West Lake Park Mitigation Plan are as follows:

- To establish and enhance a large unified mitigation area that provides a diverse, high quality, estuarine wetland system. This will encourage propagation of desirable invertebrates and additional use by birds, fish, amphibians, reptiles, and mammals.
- To remove exotic and invasive plant species and recruit desirable flora to provide valuable habitat for wildlife.
- To attain a minimum of 80% survivorship of planted species, and 80% coverage of desirable plant species in the mitigation areas.
- To improve an existing natural system through mitigation efforts which enhance and increase functional wetlands and uplands to benefit both wildlife and the surrounding community.

1.3 Existing Conditions

West Lake Park currently consists of approximately ± 989.9 acres of mangrove swamps, ± 246.9 acres of lakes, ± 63.5 acres of exotic plant-dominated spoil areas of which ± 55.3 are proposed to be improved per this plan with the remaining balance to be improved separately, and ± 221.7 acres of other habitats, including waterways, saltwater marsh, tidal flats, barren land, seagrass, and roads and highways. The Park is tidally influenced by direct connection to the ICW on the east and the Dania Cutoff Canal to the north. The Park is sectioned by Sheridan Street and Dania Beach Boulevard, dividing the Park into three main areas.

1.3.1 Soils

The soils map was prepared using the Soil Survey of Broward County Florida (Eastern Part), United States Soil Conservation Service (1984). A total of 10 mapped soil types are present within park boundaries. Predominant types include Terra Ceia muck, tidal (Tc) and Pennsuco silty clay, tidal (Pf). The location of each soil type within the park boundaries is listed below followed by the standard soil survey description for each soil type in italics.

Arents, organic substratum urban land complex (Ao)

Most of the acreage of this map unit is in the northeastern part of the project area near the ICW in areas that closely correspond to Spoil Areas #1-7. These areas are dominated by Australian pine (*Casuarina equisetifolia*) except at the northeastern limits of the mapped soil unit which correspond with the northeast corner of the Park, an area previously scraped down for mangrove recruitment.

This complex consists of Arents, organic substratum, in open areas and of Urban land, or areas covered by concrete and buildings. About 50 to 70 percent is Arents, organic substratum, and about 30 to 50 percent is urban land. The areas of these components are so intermixed or so small that to map them separately at the scale used is impractical. Areas are nearly level.

Arents organic substratum, are in open areas that are used for lawns, vacant lots, parks, and playgrounds, or are idle. Urban land consists of streets, sidewalks, parking lots, buildings, and other construction areas where the soil is covered and cannot be readily observed.

Thickness and color of the layers of this soil vary from place to place, but in a representative profile, the upper 38 inches is very pale brown sand that has pockets, streaks, and lenses of gray and brown sand. About 15 to 20% of the upper 12 inches is made up of gravel and cobblestones that range to 2 or 3 inches in diameter. Between depths of 38 and 52 inches is black muck that contains lenses and pockets of dark reddish-brown, fibrous muck. Dark grayish-brown

sand that has light gray and very pale brown mottles extends below the muck to a depth of 72 inches or more.

Included with this complex in mapping are small areas of soils that have a higher percentage of limestone fragments in the overburden material and scattered areas of soils that do not have organic layers in the underlying natural soil. Also included are scattered open areas that have not been developed for urban use at this time.

Depth to the water table depends on the established drainage and elevation in the area, but in most areas it is between 24 and 50 inches and averages about 40 inches. Permeability is rapid throughout these soils, though in some places the weight of the overburden has compressed the organic layer and reduced its permeability. Available water capacity is generally low in the overburden and very high in the underlying organic materials. The natural fertility is low.

Most of the Arents, the organic substratum part of this map unit, is used for lawns and ornamentals. The soil is poorly suited to most plants, but satisfactory plant growth can be achieved by spreading a layer of good topsoil over the surface and applying water and fertilizer on a regular basis.

The soils in this complex are not used for crops or improved pasture. They were created to make the land suitable for urban development and are fairly well suited for many urban uses. They are severely limited as foundations for roads or buildings. The organic substratum material is compressible under mobile or static loads. The severity of the limitation varies according to the degree of drainage provided, the thickness of the overburden, and the thickness of the underlying organic material. For major roads, the organic material should be removed. All building foundations should be placed on pilings. The determined use of this map unit for the foreseeable future is urban related.

Arents urban land complex (Ae)

This soil is located in a single location within the Park, south of Sheridan Street on the east shore of the southern lake halfway between Sheridan Street and the southern end of the Park.

This complex consists of Arents in open areas and of Urban land, or areas covered by concrete and buildings. About 50 to 70 percent is Arents, and about 30 to 50 percent is Urban land. The areas of these components are so intermixed or so small that to map them separately at the scale used was impractical. Slopes are 0 to 5 percent.

The Arents part of this map unit is in open areas that are used for lawns, vacant lots, parks, and playgrounds, or are unused. Urban land consists of streets,

sidewalks, parking lots, buildings, and other construction areas where the soil is covered and cannot be readily observed.

Arents are nearly level or gently sloping, somewhat poorly drained to moderately well drained, heterogeneous sandy materials about 20 to 50 inches thick that have been spread over the natural soils to make them suitable for urban development. The underlying natural soil can generally be identified in places where the overburden material is less than about 30 inches thick.

Depth to the water table depends on the established drainage in the area, but is generally between depths of 20 and 50 inches most of each year. The permeability is generally low. Natural fertility and organic matter content are low.

Included within this mapped complex are small areas in which the sandy overburden material rests on organic (muck) soils or silt loam (marl) soils. In some areas, the overburden material has a high percentage of coarse rock fragments. Below a depth of 2 or 3 feet in a few areas are large cells of garbage and refuse, which range in thickness from 5 to 20 feet. These areas of sanitary landfill are identified on the soil map by the words "sanitary landfill" in addition to the map symbol. Also included in this map unit are small areas of Arents in spoil mounds or other idle areas that are not being urbanized or are not in close association with urban development.

Proper management, which includes spreading a thin layer of good topsoil over the surface and timely applications of water and fertilizer, the commonly grown lawn grasses and ornamentals, can be produced successfully on the soil.

Lauderhill muck (La)

This soil is located in a single small area within the Park along the western boundary, north of Dania Beach Blvd. currently dominated by mangroves.

This is a nearly level, very poorly drained, organic soil underlain by limestone at a depth of 20 to 40 inches. It is in broad flats in the Everglades.

Included within this mapped soil complex are small areas of Dania muck and small areas of soils that have organic material 36 to 51 inches thick over limestone. Also included are small areas of Okeelanta muck.

Most of the acreage of this soil is in natural vegetation that consists of sawgrass. In some places where the sawgrass has been burned, Melaleuca has become established. A few acres are in improved pasture.

This soil is severely limited for cultivated crops by excessive wetness. Where it is properly drained, it is well suited for winter truck crops. After drainage and the initial subsidence caused by compaction, subsidence by oxidation is a continual

hazard. Thus, structures are needed that hold the water level at the proper depth for crops and permit flooding when the soil is left idle. In addition, fertilizer that is high in all plant nutrients except nitrogen should be applied frequently. Lime is needed in places.

This soil is unsuited to citrus; however, high quality pasture consisting of improved grasses or grass and clover can be produced under intensive management. A drainage system is needed for removing excess surface water and for maintaining the water table at shallow depths. Fertilizer and lime should be applied where needed. Grazing needs to be controlled.

Pennsuco silty clay loam (Pe)

This soil is located at the western edge of the recreation area within the Park and is dominated by white mangroves.

This is nearly level, poorly drained and very poorly drained, loamy soil underlain by limestone at a depth of more than 40 inches. It is primarily on coastal lowlands east of the Atlantic Coastal Ridge and extending south from Ft. Lauderdale.

Included with this soil in mapping are small areas of similar soils that have less than 20 inches of fill material on the surface, and similar soils that do not have limestone within a depth of 72 inches. Also included are small areas of Pennsuco tidal, Perrine, and Perrine Variant soils.

The natural vegetation consists of red and white mangroves, sawgrass, giant leather fern, bushy sea-oxeye daisy, and glasswort. Some areas have a dense cover of Brazilian pepper. Some areas are used for vegetable and nursery crops.

Under natural conditions, this soil is severely limited for cultivated crops by excessive wetness and other poor soil qualities. If water control, proper fertilization, and good management are used, this soil is moderately well suited to vegetable crops and other special crops.

This soil is found in areas where land use is primarily urban. This soil is severely limited for such uses unless it is adequately drained and filled with stable soil material.

Pennsuco silty clay, tidal (Pf)

The majority of West Lake Park is Pennsuco silty clay, tidal and is dominated by mangroves.

This is a nearly level, very poorly drained, loamy soil that is underlain by limestone at a depth of more than 40 inches. It is found in tidal swamps in southeastern Broward County from Port Everglades southward.

Included within this mapped soil complex are small areas of similar soils with a thin covering of organic material or gravelly sand fill material. Also included are small spots of Pennsuco, Perrine, and Perrine Variant soils.

The natural vegetation consists mainly of red mangrove, white mangrove, and scattered areas of giant leatherfern, sawgrass, bushy sea-oxeye daisy, and glasswort. Australian pine is scattered through areas that have thin coverings of fill materials.

This soil is adversely affected by daily or frequent tidal flooding and low to moderate salinity. This soil is unsuited to either agricultural or urban uses. It is best used in its natural condition as habitat for marine life and waterfowl.

Perrine variant silt loam (Pv)

This soil is located in three areas within the Park, one north of Dania Beach Blvd near the western boundary, the second north of Sheridan Street along the eastern shoreline of the lake and the third south of Sheridan Street along the ICW. Dominant vegetation in these areas is mangroves.

This is a nearly level, very poorly drained soil that has 18 to 48 inches of calcareous silt loam (marl) over well decomposed organic materials. This soil is on coastal lowlands and in swamps in the southeastern part of the county.

Included within this mapped soil complex are small areas of soils similar to Perrine Variant soils that have limestone at a depth of more than 40 inches. Also included are small areas of Pennsuco and Perrine soils.

The natural vegetation consists of red mangrove, white mangrove, giant leatherfern, bushy sea-oxeye, glasswort, and salt-tolerant grasses. Some areas of this soil have been drained and protected from flooding and are used for nursery and truck crops.

Under natural conditions, this soil is severely limited for cultivated crops by excessive wetness and alkalinity. If adequately drained and protected from flooding, and properly fertilized, this soil is moderately well suited to some vegetable crops and special crops.

Perrine silty clay loam (Ps)

This soil is located in one small area within the Park near the western boundary, just north of Dania Beach Blvd. The dominant vegetation on this soil type is mangrove.

This soil is in the coastal areas under urban development. Adequate drainage and filling with stable soil material are needed to make the soil suited to some urban

uses. This is a nearly level, poorly drained, loamy soil underlain by limestone at a depth of 20 to 40 inches. It is on coastal lowlands and in brackish swamps in the southeastern part of the survey area.

Included within this mapped soil complex are small areas of similar soils that have a thin layer of organic material on the surface or that have limestone at a depth of less than 20 inches. Also included are small areas of Pennsuco and Perrine Variant soils.

The natural vegetation includes sawgrass, sedges, reeds, various grasses, and scattered palm trees. Areas nearest the coast include red mangrove and white mangrove trees. Some areas are used for truck crops and plant nurseries.

This soil is severely limited for cultivated crops by excessive wetness and poor soil qualities. If water is adequately controlled and the soil is managed at a high level, it is moderately well suited to locally grown vegetable crops and ornamentals. This soil is poorly suited to most urban uses unless it is adequately drained and filled with stable soil materials.

Terra ceia muck, tidal (Tc)

This soil comprises the majority of the area north of Dania Beach Blvd within the Park and is dominated by mangroves.

This is a nearly level, very poorly drained organic soil in tidal mangrove swamps near the coast. This soil has organic materials more than 51 inches thick and is subject to daily or periodic tidal flooding.

Included with this soil in mapping are small areas of Arents, Pensuco, and perrine Variant soils. Also included are small areas of soils similar to Terra Ceia that have slightly less than 1 inches of organic material and soils that have 6 to 20 inches of gravelly sand fill material on the surface.

All areas of this soil remain covered by natural vegetation consisting of red mangrove, white mangrove, and, in some places, a few giant leatherfern. Some Australian pine is in fringe areas where thin layers of spoil material covers the surface.

This soil is severely limited for all uses because of tidal flooding and excessive wetness. In addition, the organic material that makes up this soil has low load-bearing capacity, which severely limits the construction of a stable foundation. This soil is best used in its natural condition as habitat for many kinds of marine life. It is a major breeding and spawning area for shellfish and other marine life.

Udorthents (Ud)

This soil is located near the east edge of the park both north and south of Sheridan Street. Mangroves dominate this soil type.

This soil consists of unconsolidated or heterogeneous geologic material removed in the excavation of ditches, canals, lakes, and ponds. It is commonly piled along banks and has slopes of 2 to 40 percent. Few, if any, other soils are included in this mapped complex. The soil is moderately well drained.

Weeds and native grasses have become established on some areas of Udorthents. Other areas have little or no vegetation. The soil material is erodible, especially where slopes are steep and where areas are bare or sparsely vegetated.

This soil is unsuited to cultivated crops, citrus, or improved pasture. It is frequently used as a source of road building material and as a source of fill for new home sites, golf courses, and other purposes.

Udorthents, marly substratum ULC (Um)

This soil is located along the ICW north of Sheridan Street, along Sheridan Street, and within the recreational area of the Park. Dominant vegetation in this soil type is Australian pine, however, the majority of this soil type has been developed for Anne Kolb Nature Center and the recreational area of the park.

About 50 to 75 percent of this complex consists of Udorthents, marly substratum, which are in open land areas; and 25 to 45 percent consists of Urban land, or areas covered by concrete and buildings. The areas of these components are so intermixed or so small that to map them separately at the scale of mapping used is impractical. Slopes are 0 to 2 percent.

The open areas of Udorthents, marly substratum, are lawns, vacant lots, parks, playgrounds, and idle areas. Urban land consists of streets, sidewalks, parking lots, and buildings or other constructions where the soil is covered and cannot be readily observed.

This map unit occurs only in the eastern part of the survey area. It is made up of a layer of mixed limestone fragments, sand, and shell about 20 to 50 inches thick over the natural soil, which is predominantly calcareous silt loam (marl). The overburden material is occasional pockets or lenses of black. The natural marl soil below is similar to that described as representative for the Perrine or Pennsuco series.

The water table depends on the established drainage in the area, but in most areas it is at a depth of about 30 to 40 inches. Commonly, depth to the water table is the same as the depth to the natural soil in any particular area. In general, the

rocky sand mixture of overburden material is rapidly permeable and the available water capacity is low. Natural fertility is also low.

Included within this mapped soil complex are small areas in which the overburden material is dominantly sand and other small areas in which the fill material overlies 12 to 48 inches of muck.

To properly establish and maintain lawns and ornamentals on the soil in this complex, a layer of good topsoil about 6 inches thick is needed. In addition, proper watering and regular applications of fertilizer are needed.

The soil is well suited to many urban uses, but has moderate to severe limitations as a foundation for roads or buildings. The marl substratum, when wet, is compressible under mobile or static loads. The severity of the limitation depends upon the degree of drainage provided and the thickness of the overburden. Areas of this unit that are inadequately drained and have less than 3 feet of fill material are poorly suited to use as foundations for major roads, buildings, or large homes.

1.3.2 Hydrologic and Water Quality Conditions

West Lake Park is tidally influenced through direct connection and through numerous secondary, tidal channels that connect the interior of the Park to the ICW. The tidal cycle in Florida is semi-diurnal, consisting of two high and low tides each day. Freshwater inputs are mainly limited to stormwater runoff and direct rainfall. In the Dania Salt Marsh, a maintenance road and remnant berms limit tidal flow.

In addition, the remains of an extensive constructed drainage system are present in the western half of the Park. Approximately 12 miles of drainage ditches and canals were created when the area was in agricultural operations in the 1950s, however, some of the smaller ditches and canals are nearly silted-in and, therefore, currently provide limited flushing. This drainage system provides a collection and channeling system for rainwater and also provides a network for tidal flushing of surface water. Both functions are necessary to provide optimum conditions for development of healthy estuarine communities. These habitats are vital as nurseries for recreationally important fishes such as the common snook (*Centropomus undecimalis*) and tarpon (*Megalops atlanticus*), and as foraging areas for wading birds and other wildlife.

Hydrologic data was recorded at 10 stations located throughout West Lake Park. Water level data was recorded at Stations 1-8 using Remote Data Systems (RDS) WL80 Automated Monitoring Wells.

Water quality parameters were collected thirteen replicate times and water level data was recorded hourly between June 21 and December 11, 2000. The placement of the monitoring wells was designed to measure tidal flow rates running north-south through the Park and east-west between the ICW and the interior of West Lake, and to determine

Mean High Water (MHW) and Mean Low Water (MLW) elevations (in feet NGVD) at various locations throughout the Park. This information was used to determine proper elevations for construction of proposed mud flats, mangrove islands, flushing channels, etc.

1.3.3 Vegetative Community Types

The dominant vegetative community within the Park is mangrove swamp; approximately 989.9 acres of mangroves currently exist within the Park. Red mangroves (*Rhizophora mangle*), black mangroves (*Avicennia germinans*), and white mangroves (*Laguncularia racemosa*) are abundant. Buttonwood (*Conocarpus erectus*) and sea oxeye daisy (*Borrchia* spp.) are also present within this community, but to a lesser extent.

Various other native species are present at Anne Kolb Nature Center and the recreational portion of the Park (south of Sheridan Street). These species include gumbo limbo (*Bursera simaruba*), cabbage palm (*Sabal palmetto*), pigeon plum (*Coccoloba diversifolia*), sea grape (*Coccoloba uvifera*), and blolly (*Guapira discolor*).

Approximately 55.3 acres of Australian pine (*Casuarina equisetifolia*) and other exotic vegetation currently exist throughout the Park. Of those ± 55.3 acres, approximately 40 acres of these Australian pine dominated areas are along the ICW and exist on spoil islands created during the historical dredging of the ICW. The remaining ± 15.3 acres are scattered inland throughout the Park. These exotic plant-dominated areas are targeted for conversion to desirable native vegetative communities through nuisance/exotic eradication.

2.0 PROPOSED HABITAT & MITIGATION IMPROVEMENTS

The proposed improvements at West Lake Park were conceived and designed to improve the overall functional values of the estuarine habitat within the Park. Numerous habitat improvements were permitted that provide mitigation credit by the proposed activity. Additional improvements are proposed that have the potential to yield mitigation credit if additional data analysis is provided at a later date. These items are described below. The currently proposed habitat improvements have been divided into nine phases as follows:

- 1) Dania Cutoff Canal to Dania Beach Boulevard,
- 2) Dania Beach Boulevard to Anne Kolb Nature Center,
- 3) Anne Kolb Nature Center to Bird Nesting Area,
- 4) Bird Nesting Area to South End of Park,
- 5) West Lake Park Recreational Area/Sheridan Street,
- 6) Dania Salt Marsh,
- 7) Park-Wide Habitat Improvements,
- 8) Dania Cutoff Canal,
- 9) Outparcel Acquisition.

These phases were divided based primarily on geographic location, i.e. all improvements in each phase are located within the same general area. The only exceptions are Phase 7, which covers park wide habitat improvements, and Phase 9 which requires administrative work rather than on-site construction.

Habitat improvements were permitted that generated mitigation credit for future use based upon the ecological lift they provided. During the permitting process, it was negotiated to use the newly adopted assessment method known as the Uniform Mitigation Assessment Methodology (UMAM). This methodology quantifies the improvements based on several factors, accounts for time lag and risk factors and yields what is termed a Functional Gain Unit. This is calculated by taking the Relative Functional Gain (RFG) (ecological lift) multiplied by the acreage of the area being improved. The resulting Functional Gain Unit becomes the trading currency to determine number of units to offset an impact or functional loss.

Based upon the different habitat types, two groups of units were defined to distinguish Functional Gain Units between Mangroves and seagrasses. The permitted functional units are as follows:

MANGROVE SUMMARY

Assessment Area	Size (Acres)	RFG	Functional Gain Units
Mangrove Creation	20.7	0.41	8.49
Mudflat-Channel Creation	15.8	0.61	9.64
Upland Creation	11.3	0.19	2.14
DCC Mangrove Creation	2.5	0.17	0.43
Riprap Crib	35.9	0.30	10.77

Dania Salt Marsh	14.9	0.21	3.13
Exotic Vegetation Control	8.4	0.10	0.84
Outparcel Acquisition	23.3	0.11	2.56
TOTAL	135.8		37.99

SEAGRASS SUMMARY

Assessment Area	Size (Acres)	RFG	Functional Gain Units
Seagrass Creation area	7.5	0.28	2.10
Whiskey Ck. Barge Remove	0.5	0.09	0.05
Manatee Protection Area	30	0.06	1.80
TOTAL	38.5		3.94

Therefore, the permitted restoration plan generates 41.93. Functional Units that can be used by Broward County.

In addition, numerous habitat improvements originally contemplated in the Master Plan were permitted as Management Items. During the permitting process it was determined that these items may not adequately demonstrate Functional Gain Units for mitigation credit purposes. However, approval was obtained to perform these activities. These are items that the BCPRD intends to do, however, mitigation credit is not being requested for these items at this time. These items may be considered and evaluated by the reviewing agencies for credit, in the future.

The following Improvements were distinguished as Management Items during the permitting process:

- Acquisition of certain outparcels
- Vacation of utility easements
- Vacation of FIND easements
- Establishment of Osprey towers
- Desilting existing culverts
- Desilting channels and ongoing maintenance dredging

2.1 Phase 1 – Dania Cut-off Canal to Dania Beach Boulevard

This phase includes the installation of new culverts to increase flushing, the creation of a manatee protection area along the ICW, the creation of mangrove, seagrass, mudflat, and channel areas from exotic plant-dominated spoil areas, protection of Florida endangered Marsh's dutchman's pipe vine (*Aristolochia pentandra* Jacq), and the installation of shoreline protection.

Flushing Improvements

Two culverts are proposed to be installed north of Dania Beach Blvd. to allow greater surface water exchange between the ICW and areas of the Park west of the maintenance

road. Insufficient water exchange can lead to stunted mangroves, stagnant water, low water quality, limited fisheries usage, and increased siltation.

Manatee Protection Areas

The West Indian manatee or sea cow (*Trichechus manatus*) is a large, herbivorous, aquatic mammal that uses a variety of habitats such as shallow coastal waters, rivers, and springs in Florida. This species is endangered throughout its range. A low reproductive rate and loss of habitat, combined with high rates of mortality from human-related causes such as boats and watercraft, are the primary threats to its future. This species is the focus of a wide range of protection efforts by federal, state, and local agencies. In addition universities, corporations, and non-profit conservation organizations are supporting efforts to protect these animals.

Based on information from the Management Plan for West Lake as well as from personal observations, manatees are occasionally observed in the shallow waters of West Lake Park, and are regularly observed in the ICW, Whiskey Creek, and the Dania Cutoff Canal adjacent to West Lake Park. These waters, except for the interior lakes, are heavily traveled by boats and personal watercraft.

Boat-related mortality is probably the greatest single threat to the manatee. Regulation of boat speeds and implementation of boat exclusion areas to reduce boat-related injuries and harassment have been difficult to enforce due to lack of staffing and large geographic areas. The effect of boats on manatee populations is particularly critical because it is mostly adults that are killed. Manatees must maintain a high adult survivorship to keep populations stable due to their low reproductive rates. In Whiskey Creek and the cove area south of Dania Beach Blvd., minimal protection from boat traffic exists for the manatee. However, manatees regularly travel through the main channel of the ICW and Whiskey Creek area and must contend with heavy boat and barge traffic.

Manatee/seagrass protection areas (MPAs) are proposed to be established at both ends of Whiskey Creek, and at the cove area south of Dania Beach Blvd. The MPAs will be designated using appropriate signage and floating buoy lines that would prohibit boats and personal watercraft from entering the protected area while still allowing manatees, fishes, and other fauna to pass.

The primary benefit is a safe retreat for manatees in areas of high boat traffic. Another benefit is the protection of seagrass beds, a known source of food for manatees, from prop scars and turbid conditions caused by boats/personal watercraft wakes. Without these barriers, manatees will remain at risk of injury within these heavily traveled areas.

Creation of Mangrove, Mudflat, Seagrass, and Channel Areas from Spoil Areas

Exotic plant-dominated upland spoil areas in this phase will be replaced by extensive wetland creation areas following practices used successfully on previous projects within West Lake Park. Exotic plant-dominated uplands will be converted into desirable, native

communities including mangrove areas, mud flats, tidal pools, seagrass beds, and native upland hammocks to encourage usage by a diversity of plant and animal species.

Mangrove Creation Areas. Mangroves provide physical habitat for many species of plants and animals that could not survive alone in the intertidal zone. Mangrove systems support a highly complex food web, with many organisms dependent upon one another for their survival. In addition, mangrove areas function as nurseries for a wide variety of recreationally and commercially important fish, crustacean, and mollusk species. These can include such well known species as snook, tarpon, snapper, shrimp, crabs, lobster, and oysters.

Upland areas within the Park that are infested with exotic vegetation will be cleared and scraped down to the proper elevation to support natural recruitment of mangroves. If necessary, these areas may also receive supplemental mangrove planting to promote their spread and establishment.

Mud Flat/Tidal Pool Creation Areas. Mud flats are important community for numerous species of invertebrates as well as shorebirds that feed on prey stranded on the flats and in exposed tidal pools.

Certain exotic plant infested uplands will be cleared and scraped down to serve as mud flats and tidal pools. Based on the current wildlife usage of the existing mud flats/tidal pools within West Lake Park, these proposed areas should serve as habitat for numerous invertebrates and provide new foraging areas for wetland dependent bird species (e.g., ibis, wood stork, herons, spoonbills, sandpipers, and knots). An osprey tower will be installed at the edge of the mud flat/tidal pool to provide a perching and nesting location.

Seagrass Creation Areas. Seagrass beds rank among the most productive ecosystems. Seagrasses currently exist in the ICW and in certain areas within West Lake itself. The dominant species present is paddle grass (*Halophila decipiens*); shoal grass (*Halodule wrightii*) and the threatened Johnson's seagrass (*Halophila johnsonii*) are also present.

Certain upland areas infested with exotic vegetation will be cleared and scraped down to serve as natural recruitment areas for seagrasses. An extensive benthic survey revealed that seagrasses were present nearly the entire length of the ICW's western half adjacent to West Lake Park (ML, 2002). The dominant seagrass was paddle grass (*Halophila decipiens*). Johnson's seagrass (*Halophila johnsonii*), a threatened species, and shoal grass (*Halodule wrightii*) were also present. These seagrasses were present as patchy beds of varying density, usually with rubble and overgrowing algae interspersed.

The seagrass creation areas will be specifically created from existing spoil islands along the ICW adjacent to existing, dense seagrass beds. A sediment analysis was performed, and it was determined that the sediment in the spoil areas was similar to the sediment in the ICW currently supporting seagrasses (Tierra, 2002), therefore seagrass is expected to naturally recruit into these newly created areas.

Shoreline Protection – Riprap crib

The purpose of shoreline protection is to halt the constant erosion occurring along the ICW caused by many factors such as boat traffic and storms. A shoreline regression analysis estimated the shoreline has eroded at a rate of $\pm 1.5'$ per year between 1957 and 2000. The placement of shoreline protection options are proposed to reduce further erosion of the shoreline and the mangrove communities.

Based on a detailed 2001 shoreline analysis for the entire length of West Lake Park:

- 1) 15% of the shoreline does not require any stabilization (channel openings, bridge right-of-way, etc.),
- 2) shoreline protection could be placed along approximately 35% of the shoreline without incurring mangrove impacts,
- 3) an additional intermittent 15% of the shoreline may have room for narrow shoreline protection,
- 4) the remaining 35% of the shoreline has virtually no separation between mangroves and seagrasses. The table below summarizes this information.

To further break down these percentages, the following table outlines the detailed conditions and constraints associated with each portion:

1) Cove (no protection needed)	$\pm$	997	linear feet	5%
Road Right-of-Way (no protection needed)	$\pm$	401	linear feet	2%
Channel openings (no protection needed)	$\pm$	952	linear feet	5%
Existing Revetment on side of maintenance road (no protection needed)	$\pm$	654	linear feet	3%
2) 7' to 15' width for shoreline protection *	$\pm$	6,744	linear feet	35%
3) $\geq 5'$ to $\pm < 7'$ width for shoreline protection *	$\pm$	2,855	linear feet	15%
4) 0 to $< 5'$ for shoreline protection *	$\pm$	6,582	linear feet	35%
Total Shoreline	$\pm$	19,185	linear feet	100%

* Separation between existing seagrasses and mangroves

Note that this shoreline length is based on the limits from the mangroves on the north side of the channel by Holland Park northward to existing riprap $\pm 1,200$ ft. south of the Dania Cut-off Canal.

The intermittent 15% of shoreline referenced in item number 3 above has only a 5 to 7 foot separation between mangroves and seagrasses. Permit conditions allow trimming of mangroves in narrow areas to accommodate placement of a continuous riprap crib structure.

The proposed shoreline protection will incorporate a riprap crib structure that has a footprint of approximately 5 feet in width. The crib will be sloped on the waterward (ICW) side at no steeper than 2 to 1. The crib will be constructed of a single series of vertical vinyl coated marine wood pilings spaced every 10 feet with horizontal

reinforcing bars on both sides. The landward side piles will reach $4.5 \pm$ MLLW NGVD and the windward piles will reach just above mean sea at $1.25 \pm$ MLLW NGVD. Riprap boulders (1.5' to 2.5' diameter) will be placed inside the crib. The base of the structure will be a geotube or equivalent stabilization. This should allow construction to occur without the use of a large barge and/or other heavy equipment.

Shoreline Protection – Enhance Existing Riprap

Supplemental riprap will be placed onto existing riprap along the ICW from the Dania Cutoff Canal southward approximately $\pm 1,500'$. This riprap will most likely be placed from a shallow-draft barge with hand guidance. Because the riprap is being placed on already existing, but poorly functioning, riprap, primary and secondary impacts are not anticipated.

2.2 Phase 2 – Dania Beach Boulevard to Anne Kolb Nature Center

This phase includes the creation of a manatee protection area along the ICW, the creation of mangrove, seagrass, mudflat, channel and upland hammock areas from exotic plant-dominated spoil areas, and installation of shoreline protection.

Upland hammock Creation Areas. Certain exotic plant-infested uplands will be cleared and planted with native upland hammock vegetation to create a complementary habitat to the surrounding wetlands. These upland hammock areas are intended to be used by faunal species for shelter, nesting/denning, and foraging. These hammocks, minimally present at West Lake Park, will add diversity and complexity to the Park's habitats.

A detailed description for the mangrove, mudflat/tidal pool, and channel improvements in this phase is discussed above in Section 2.1.

2.3 Phase 3 – Anne Kolb Nature Center to Bird Nesting Area

This phase includes the installation of a new culvert to increase flushing, the creation of mangrove, seagrass, mudflat/tidal pool, upland hammock, and channel areas from exotic plant-dominated spoil areas, and installation of shoreline protection. A detailed description for each type of improvement in this phase is discussed above in Section 2.1 and 2.2.

2.4 Phase 4 – Bird Nesting Area to South End of Park

This phase includes the creation of mangrove, mudflat, channels, and upland hammock areas from exotic plant-dominated spoil areas, and installation of shoreline protection. A detailed description for each type of improvement in this phase is discussed above in Section 2.1 and 2.2.

2.5 Phase 5 – West Lake Recreational Park/Sheridan Street

This phase includes the installation of new culverts to increase flushing, the creation of mangrove, mudflat, channel, and upland hammock areas from exotic plant-dominated spoil areas. A detailed description for each type of improvement in this phase is discussed above in Section 2.1.

2.6 Phase 6 – Dania Salt Marsh

The Dania Salt Marsh (DSM) was originally a freshwater marsh system prepared for agricultural purposes approximately 100 years ago (BCPRD, 1998). At that time, the marsh was channeled for irrigation and the fields were planted with tomatoes. Subsequent to those events, Joseph Young, a Hollywood developer, purchased most of the land in this area and sold individual lots as part of a large-scale development plan. Hurricanes and the Great Depression discouraged further development of the area at that time. The surrounding development, dredging of the ICW, and drainage led to saltwater intrusion, which ended the tomato farming in this area during the 1950s. Conditions at the site encouraged the establishment of a salt marsh sea oxeye daisy (*Borrchia* spp.) habitat that has been transitioning to a mangrove-dominated community in recent years.

Based on previous fisheries studies (Mangrove Systems, Inc. 1983, Lewis Environmental Services 1994; Roberts, 1994), and County staff observations, the western portions of West Lake Park are an important nursery habitat for commercial, recreational, and threatened fish species such as snook (*Centropomus undecimalis*), tarpon (*Megalops atlanticus*), mangrove snapper (*Lutjanus griseus*), and mangrove rivulus (*Rivulus marmoratus*) - listed as a Species of Special Concern by the Florida Fish and Wildlife Conservation Commission. The DSM has incurred physical changes throughout the years that has somewhat limited its function as a nursery habitat.

Channel Improvements

Presently, portions of the primary DSM channel (running east-west through the center of the salt marsh) contain surface water during both high and low tides. However, secondary channels contain minimal surface water during lower portions of the tidal cycle, thus limiting their availability to fish and other aquatic species.

This lack of surface water serves to limit the carrying capacity of the habitat for fisheries within portions of the DSM. Without improvements to the salt marsh's hydrology, this area will continue to be underutilized by fish species when compared to its overall size.

Certain berms that run throughout the salt marsh are eroding with the resultant material filling in the smaller channels. In addition, this area has historically received dumping of tires and debris, which also has had an effect on flushing and biological productivity.

Large fields of sea oxeye daisy (*Borrchia* spp.) became established within this area after agriculture was abandoned. The sea-oxeye daisy portions of the salt marsh are being

naturally displaced by mangrove (mainly white mangroves) and Brazilian pepper (*Schinus terebinthifolius*). Between 1980 and 2000, there was an 85% decrease of the sea oxeye daisy habitat within the DSM.

The proposed improvements for this area are to be phased, beginning with the removal of blockages that hinder water movement in the existing primary channels. The effects of blockage removal will be monitored prior to proceeding with the other listed improvements.

One existing primary east-west double channel near the center of the DSM will be cleared of material that now hinders water movement. This is intended to increase flushing and would increase the area of surface water coverage during low tide. The length of channel to be desilted will be determined in the field in order to minimize impacts to existing mangroves and reduce trimming.

Four north-south oriented channels will be excavated north of the FPL substation. The channels will be created in the footprint of existing upland spoil berms located between small secondary channels or remnant agricultural ditches that filled in due to erosion of the spoil berm.

Channel/Mudflat Creation

The creation of a primary north-south flushing channel near the western boundary of West Lake Park will increase flushing and retain surface water during low tide in an area that is normally dry; this will increase the amount of usable habitat for juvenile fish species. This work is proposed in the area of a historic haul road and dumpsite.

Certain secondary north-south channels will also be cleared of material that hinders water movement. This is intended to increase flushing and would increase the area of surface water coverage during low tide. This work is anticipated to be performed with the use of a small suction dredge and a small backhoe in a manner that will minimize impacts to existing mangrove trees. Each new channel will also create additional red mangrove habitat along its entire length.

The above habitat improvements to the salt marsh will benefit commercial, recreational, and threatened fisheries by increasing the area's carrying capacity for fishes, including snook, mangrove snapper, tarpon, and other important fishes. Enhancement/protection of the Dania Salt Marsh will also allow for the protection of *Rivulus marmoratus*., a Species of Special Concern, which has been documented by BCPRD to inhabit the Dania Salt Marsh.

2.7 Phase 7 – Park-wide Habitat Improvements

A few of the proposed habitat improvements are smaller scale changes not localized to a particular area or project Phase. These improvements include nuisance/exotic removal, channel de-siltation, and installation of additional osprey nesting towers. Certain

improvements are approved to receive mitigation credit, while others are currently listed as Management Items and have not currently been approved for mitigation credit by the permitting agencies. If significant benefits resulting from completion of Management Items become evident, these items may be reviewed and re-evaluated by the permitting agencies for mitigation credit at that time.

Nuisance/Exotic Removal

Currently, approximately 8.4 acres of exotic plant-dominated areas throughout the Park are not targeted for large scale habitat improvements requiring earthwork because of their relative small size and/or accessibility. Exotic vegetation in these areas shall be removed and replaced with understory plantings of *Borrchia frutescens* and *B. arborescens* to discourage further colonization by nuisance/exotic species. This improvement is a mitigation item and has been approved for mitigation credit.

Maintenance Dredging/Channel De-siltation

In addition, specific areas throughout the park have been selected for maintenance dredging and channel de-siltation to improve flushing capacity. Some of the proposed channel de-siltation will be addressed within other project Phases but none has been approved for mitigation credit at this time. If substantial benefits from this improvement item become apparent after its completion, it may be reviewed and re-evaluated by the permitting agencies for mitigation credit at that time.

Osprey Towers

Installation of additional osprey nest towers throughout the park is also included in this Phase. Though this work is required by one or more of the environmental permits, the associated improvements are currently designated as Management Items rather than Mitigation because no mitigation credit has been allocated in the permits. These items can potentially be reviewed and re-evaluated for mitigation credit after completion.

2.8 Phase 8 – Riprap Relocation/Mangrove Creation Along Dania Cutoff Canal

Presently, the approximate northern boundary of West Lake Park extends waterward into the Dania Cutoff Canal (DCC). The existing riprap along the DCC is proposed to be relocated north to the actual Park boundary (by Port Everglades). Approximately 2.5 acres of open water would then exist behind the riprap. These ± 2.5 acres of open water will be filled using suitable material dredged from the spoil areas to the proper elevation to support natural recruitment of mangroves, and the relocated riprap will be supplemented with additional new riprap to improve protection for this habitat comparable to what is proposed in other Phases of the project. If necessary, these areas may also receive supplemental mangrove plantings to promote their spread and establishment.

2.9 Phase 9 – Outparcel Acquisition

There are approximately 200 outparcels (± 23 acres) that, if not acquired, would prevent the completion of some key proposed mitigation improvements.

The outparcels have been prioritized in order of importance (i.e., outparcels within a proposed improvement area have greater priority) to secure the land or vacate an encumbrance(s).

2.10 Miscellaneous Improvements

Due to existing Park conditions, miscellaneous additional improvements have also been proposed for management purposes. These include such items as vacating existing utility and FIND easements and installing educational signage. Though these items may be required by one or more of the issued environmental permits, these improvements are designated as Management Items rather than Mitigation Items because neither mitigation credit (unless requested for evaluation in the future) nor physical habitat improvements will be generated by completion of these tasks.

3.0 POTENTIAL CONSTRUCTION ALTERNATIVES

This section describes environmentally sensitive construction alternatives and precautions that could be used during construction activities of this project. The contractor, however, will determine the appropriate means or methods of construction based on the environmental constraints. The contractor shall provide protection, operate temporary facilities, and conduct construction in a manner that complies with environmental regulations, minimizes the possibility that air, waterways, and subsoil may become contaminated or polluted, or result in other undesirable effects. While exact means and methods of the contractor cannot be dictated, the conceptual framework of guidelines discussed below would provide the appropriate restrictions.

Due to the environmental sensitivity of this project, the contractor and the appropriate subcontractors shall attend an environmental pre-construction meeting with appropriate owner and agency representatives.

3.1 Phase 1 – Dania Cut-off Canal to Dania Beach Boulevard

This phase includes the installation of new culverts to increase flushing, the creation of a manatee protection area along the ICW, the creation of mangrove, seagrass, mudflat, and channel areas from exotic plant-dominated spoil areas #1-5, and installation of shoreline protection. The proposed improvements for this phase could be conducted using the existing maintenance road that runs northward from Dania Beach Blvd.; therefore, the possibility of secondary impacts to adjacent resources in these areas is minimal. A potential staging and stockpiling area for this phase exists just north of Dania Beach Blvd. and west of the ICW along the existing maintenance road within and adjacent to Spoil Area #5.

3.1.1 Spoil Area #1

Spoil Area #1 is targeted for mangrove creation. Existing vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina equisetifolia*). Vegetation on the islands is proposed to be cleared, grubbed and piled using a combination of mechanical and non-mechanical means. Non-mechanical means refers to clearing by chainsaws, trimmers, etc. that do not move the soil. Mechanical equipment used to clear vegetation can access the spoil area using the existing maintenance road. Minor temporary impacts to mangroves (± 0.03 acres) are anticipated to occur in order to widen the end of the maintenance road that will be used to access the spoil area.

To avoid and minimize impacts, the spoil area/existing mangrove interface is proposed to be demarcated with erosion control, where appropriate to protect existing mangroves from damage prior to clearing and during construction. In addition, exotic vegetation should be removed by non-mechanical means to minimize disturbance where mangroves and other desirable natural vegetation is in close proximity. The resulting pile of removed vegetation could be burned or removed by truck using the existing maintenance road and

disposed of in an appropriate upland location in accordance with state and local regulations.

To provide turbidity control and containment, excavation of spoil material could proceed from the center of the spoil area outward. Material should be excavated using appropriate mechanical means, such as a small backhoe and/or bulldozer that can access the area using the existing maintenance road. Silt fencing/turbidity curtains shall be placed at the edge of mangroves prior to clearing of vegetation and shall remain until the end of construction in this area. The entire spoil area will be excavated to an elevation of between $\pm 0.9'$ and $1.4'$ NGVD as appropriate for natural mangrove recruitment with connecting (-2.0 - -0.5) channels dispersed throughout for habitat variation.

Spoil material may be used to 1) fill the geotubes discussed in Section 3.1.4; 2) create the substrate for the ± 2.5 acre mangrove creation area along the Dania Cutoff Canal that is discussed in Section 3.8 below; and/or 3) be placed on existing maintenance roads that need reinforcement (if the sediment is appropriate for such use). Excess spoil material may be removed from the construction site by dump trucks using the existing maintenance road. The contractor shall be responsible for placement of spoil on a suitable upland site to be used for public purposes unless otherwise transferred by the owner.

3.1.2 Spoil Areas #2 and #3

Spoil Areas #2 and #3 are targeted for mangrove, mud flat, tidal pools, and channel creation. Existing vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina equisetifolia*). Methods for exotic vegetation removal, sediment excavation and use/removal, staging, containment, avoidance and minimization are the same as described in Section 3.1.1. The portions of the spoil areas proposed for habitat creation will be excavated to an elevation of $\pm 0.9'$ to $1.4'$ NGVD for mangrove habitat, $\pm 0.0'$ to $0.5'$ NGVD for mud flat habitat, $\pm(-)4.0$ for tide pools, $\pm(-)2.0$ - $(-)0.5'$ NGVD for connecting channels, and lastly, the primary channel areas will be excavated to an elevation of $\pm (-)3.5'$ NGVD.

Two new 29" x 45" elliptical pipe culverts, one at Spoil Area #2 and one at #3, are proposed at the west end of the proposed channels under the existing maintenance road to increase flushing to mangroves located west of this maintenance road. Prior to installation, silt fence and turbidity screens should be installed, as appropriate, to reduce turbidity. The culverts could be installed by excavating an appropriate portion of the existing maintenance road using a small excavator. Minor mangrove trimming may be necessary to install the culverts. Culverts could then be placed in the excavated area and covered with a portion of the excavated material to achieve the same elevation as prior to installation.

3.1.3 Spoil Areas #4 and #5

Spoil Areas #4 and #5 are targeted for conversion to seagrass creation areas. Existing vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina*

equisetifolia). Methods for exotic vegetation removal and excavation are the same as described in Section 3.1.1. The entire spoil areas are proposed to be excavated to an elevation of $\pm (-)$ 2.0 for natural seagrass recruitment. Methods for exotic vegetation removal, sediment excavation and use/removal, staging, containment, avoidance and minimization are the same as described in Section 3.1.1.

3.1.4 Spoil Area #43

Spoil Area #43 linear strip adjacent to Dania Beach Blvd. right-of-way is targeted for conversion to a mangrove creation area. Existing vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina equisetifolia*). Methods for exotic vegetation removal and excavation are the same as described in Section 3.1.1. The entire spoil area will be excavated to an elevation of between $\pm 0.9'$ and $\pm 1.4'$ NGVD for natural mangrove recruitment. Methods for exotic vegetation removal, sediment excavation and use/removal, staging, containment, avoidance and minimization are the same as described in Section 3.1.1.

3.1.5 Shoreline Protection along the ICW

Shoreline protection is proposed as the primary means of erosion control along the heavily traveled ICW. A portion of the proposed shoreline protection consists of a riprap “crib” structure that is $\pm 5'$ wide, front to back, and is designed to contain riprap that will be sloped toward the channel. Other portions of the shoreline that currently have riprap protection will receive a “supplemental” layer of riprap. The proposed shoreline protection along the ICW is intended to provide protection against erosion caused primarily by wave energy generated by heavy boat traffic as well as those waves created by storm events.

Prior to installation of the riprap crib, the landward edge of the seagrass beds are to be visibly demarcated to prevent impacts. The “crib” structure is proposed to consist of a riprap container created by constructing two “railings” $\pm 5'$ apart and parallel from each other and parallel to the shoreline. Connections are made between the two fence lines at each pile set creating contiguous “cribs”. The front (windward) “railings” will be shorter than the rear (leeward) fence line allowing for the forward slope of the riprap. The vertical pile material is intended to be either vinyl coated marine grade timber piles, concrete piles, or any other material that provides equivalent lifespan and physical properties. Traditional uncoated pressure treated timber piles are not proposed. The front and back fence horizontal material (whalers) are proposed to be vinyl coated marine grade timber pieces. The top of the crib will be exposed riprap boulders sloped toward the channel at an incline no steeper than 1.5 horizontal to 1 vertical. Riprap boulders of 1.5-2.5' size are proposed to be placed within this crib. The base of the crib is proposed to be lined with a geotube to provide stabilization and erosion protection of the base of the riprap crib. This geotube will be filled with clean material excavated from the spoil areas.

Regarding a potential construction methodology, it is possible that the piles will be installed with a pile driving crane barge operating near shore, but far enough offshore to

avoid adverse impact to seagrass beds. Once these piles are installed, it is anticipated that the contractor will utilize either shore accessible temporary gang ways mounted on the piles or small floats tied off to the newly installed piles to complete the whaler and other applicable hardware installation. Once each riprap crib is complete, it is anticipated that the riprap material will be placed via a barge mounted excavator utilizing the newly installed piles as anchor points eliminating the need for spuds within the seagrass beds. In areas where water depth may be an issue, this work will be scheduled and coordinated to occur during high tide. When applicable, riprap material will be hand placed to minimize impacts on mangroves.

The design of the riprap crib structure will not block tidal flow into existing or proposed channels connecting West Lake to the ICW. Placement is proposed to follow the contours of the shoreline and wrap around the sides of the channel inlets. It is anticipated and desired that the riprap crib structure will also stabilize the position of the channels by directing tidal currents.

From the existing riprap southward to the small mangrove island east of Spoil Area #1, the riprap crib can be installed from the water, yet still avoid mangrove and seagrass impacts. The installation of the riprap crib could be performed from the geotube base and from small work boats with a maximum draft of 30", however barge use will need to maintain a minimum of 1' bottom clearance. A barge could be staged at Port Everglades to store riprap and crib piles and small work boats could load from the barge for transport to the crib installation site.

For Areas #1-5, the riprap crib can be constructed from land using the existing maintenance road and installed at the upland edge except for Areas #4 and #5. At Areas #4 and #5, mangroves are present on the eastern edge of the spoil areas. The riprap crib is proposed to be installed at the eastern edge of the mangroves in these two areas to protect them from erosion. Trimming of existing mangroves may be required for the riprap crib placement in this area to avoid seagrass impacts.

For mangrove areas between Spoil Areas #1-5, the riprap crib structure can be installed in the same manner as discussed above, working from the base and a shallow draft work boat. Select mangrove trimming may be required in these areas, however seagrasses will not be impacted during installation.

3.1.6 Manatee Protection Areas

This improvement would most likely be performed from a boat/barge along the ICW and will involve diver assistance for the installation of approximately 2,000 linear ft. of a barrier float system along Whiskey Creek. The buoy lines will be secured by anchoring them to the bottom at regular intervals and are proposed be maintained by the BCPRD.

3.1.7 Remove Barges at Whiskey Creek

This improvement includes removal of four partially submerged vessels. These vessels may be floated to the surface and attached to a vessel capable of moving them from their current location with minimal disturbance. Should the vessels no longer be able to float due to corrosion, they may also be removed in pieces by barge. This activity should occur during high tide to minimize the potential for disturbance of existing benthic communities. Any active floating barges existing in this area will be removed prior to construction.

3.2 Phase 2 –Dania Beach Blvd. to Anne Kolb Nature Center

This phase includes the habitat creation in the form of mangrove, upland hammock, seagrass, mudflat, and channel areas from exotic plant-dominated Spoil Areas #6-13, and the installation of shoreline protection.

3.2.1 Spoil Areas #6 and #7

Spoil Area #6 is targeted for conversion to a mangrove creation area and Spoil Area #7 is targeted for mudflat creation. These areas cannot be accessed by land but can be accessed from the ICW using a shallow draft boat. Seagrasses are not present in the immediate vicinity of these areas and, therefore, should not be an issue.

Spoil Area #6 can be accessed from the ICW by a small front-loading work boat that can bow up to the edge of the spoil area and offload equipment. All work vessels must maintain a minimum of 1' bottom clearance at all times.

Mangroves completely surround Spoil Area #7 and therefore approximately 0.05 acres of mangrove impacts may be necessary to access this island. This narrow impact zone is proposed to be converted to a channel to allow proper flushing into and out of the proposed mudflat. The mangroves to be impacted are proposed to be removed by non-mechanical means.

To avoid and minimize impacts, the spoil area/existing mangrove interface is proposed to be demarcated with erosion control, where appropriate to protect existing mangroves from damage prior to clearing and during construction. Exotic vegetation should be removed by non-mechanical means to minimize disturbance where mangroves and other desirable natural vegetation are in close proximity. The resulting pile of removed vegetation could be burned in accordance with state and local regulations.

Excavated Spoil material could be used to 1) fill the geotubes or base discussed in Section 3.1.4, and/or 2) create the substrate for the ± 2.0 acre mangrove creation area along the Dania Cutoff Canal that is discussed in Section 3.8. Excess spoil material could be removed from the site by suction dredge (such as a Piranha Pump) to a containment/settling area (such as the large Spoil Area #19 at the entrance to Anne Kolb Nature Center and/or Spoil Area #13). These area's could be cleared of exotic vegetation

and serve as the settling area prior to its conversion to mangroves, mud flats, and channels as discussed in Section 3.3.1 and 3.2.2. This settling area can be surrounded by a berm to contain the dredge spoils and protect adjacent mangroves from impacts. The spoils would be allowed to settle for an appropriate amount of time (per State criteria), and the return water could then be discharged via filtration and/or settlement into the ground and/or existing channels. The point of discharge of the return water would be surrounded by a turbidity curtain and/or other appropriate turbidity control measures. Sediment would then be loaded onto dump trucks for transport to a suitable upland site and used for public purposes unless otherwise appropriately addressed.

Excavation of spoil material could proceed from the center of the spoil area outward to provide turbidity control and containment. Material could be excavated using appropriate mechanical means, such as a small backhoe and/or bulldozer that can access the spoil areas from a front loading work boat. A minimum of 1' ground clearance must be maintained at all times. Silt fencing/turbidity curtains shall be placed at the edge of mangroves prior to clearing of vegetation and would remain until the end of construction in this area. Spoil Area #6 is proposed to be excavated to an elevation of $\pm 0.9'$ to $1.4'$ NGVD for natural mangrove recruitment except for a channel through the center of the area that will be excavated to an elevation of $\pm (-) 3.5'$ NGVD and some feeder channels at an elevation of $(-)0.5'$. Spoil Area #7 is proposed be excavated to an elevation of $0.0'$ NGVD for the mudflat portion, and $\pm (-) 3.5'$ NGVD for the channel connecting the ICW to the mudflat. The contractor shall be responsible for placement of spoil on a suitable upland site and the material shall remain the property of the owner unless otherwise transferred.

3.2.2 Spoil Areas #8-13

Spoil Areas #8, 9, 11, and 12 are targeted for conversion to seagrass creation areas. Spoil Area #10 is targeted for conversion to seagrass, mangrove, and upland hammock creation areas. Spoil Area #13 is targeted for conversion to mangrove, mudflat, upland hammock, and channel creation areas. Existing vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina equisetifolia*).

Vegetation on the islands is proposed to be cleared, grubbed and piled using a combination of mechanical and non-mechanical means. Non-mechanical means refers to clearing by chainsaws, trimmers, etc. that do not move the soil. Mechanical equipment used to clear vegetation could access the spoil area by a shallow draft front loading work boat that could access the areas in-line with the channel between Areas #10 and #11. The area in front of the channel itself is devoid of seagrasses; therefore, no seagrass impacts are anticipated. The boat could offload equipment onto Spoil Area #10. Temporary bridges could be erected between Spoil Area #10 and #9 and between Spoil Area #9 and #8 to allow access to those areas. To install the temporary bridges, approximately 0.02 and 0.07 acres of temporary mangrove impacts may occur between areas 10 and 9, and 9 and 8 respectively. After construction, the temporary bridges would be removed to allow natural mangrove recruitment and regeneration.

Likewise, to access Spoil Area #11-13, a small front loading work boat could access Spoil Area #13 by approaching in-line with the channel between Areas #12 and #13. The boat could offload the equipment at Spoil Area #12. Temporary bridges could be erected between Spoil Area #12 and #11, and between Spoil Areas #12 and #13 to allow access to these areas. To install the temporary bridges, approximately 0.02 and 0.03 acres of mangrove impacts may occur between areas 12 and 11, and 12 and 13 respectively. After construction, the temporary bridges would be removed to allow natural recruitment by mangroves.

To avoid and minimize impacts, the spoil area/existing mangrove interface is proposed to be demarcated with erosion control, where appropriate to protect existing mangroves from damage prior to clearing and during construction. In addition, exotic vegetation could be removed by non-mechanical means to minimize disturbance where mangroves and other desirable natural vegetation are in close proximity. The resulting removed vegetation could be burned in accordance with state and local regulations.

Excavation of spoil material is proposed to proceed from the center of the spoil area outward to provide turbidity control and containment. Material could be excavated using appropriate mechanical means, such as a small backhoe and/or bulldozer that can access the area by a front-loading workboat. Silt fencing/turbidity curtains would be placed at the edge of mangroves prior to clearing of vegetation and would remain until the end of construction in this area. The spoil areas are proposed to be excavated to elevations of $\pm 0.9'$ to $1.4'$ NGVD for natural mangrove recruitment, $\pm(-)0.2'$ NGVD for natural seagrass recruitment, $\pm(-)3.5'$ NGVD for the channels, $\pm 0.0'$ NGVD for the mudflat area and $(-)2.0' - (-)0.5'$ NGVD for the connecting channels. The upland hammock areas would not be excavated but would be graded prior to planting.

Spoil material could be used to 1) fill the geotubes or base discussed in Section 3.1.4, and/or 2) create the substrate for the ± 2.0 acre mangrove creation area along the Dania Cutoff Canal that is discussed in Section 3.8 below. Excess spoil material could be removed from the site by suction dredge (such as a Piranha Pump) to a containment/settling area (such as the large Spoil Area #19 at the entrance to Anne Kolb Nature Center). This area could be cleared of exotic vegetation and serve as the settling area prior to its conversion to mangroves, mud flats, and channels as discussed in Section 3.3.1 below. The dredge spoils would be allowed to settle for an appropriate amount of time (per State criteria), and the return water would then be discharged via filtration and/or settlement in the ground and/or marsh. The sediment would then be loaded onto dump trucks for transport to a suitable upland site and the material shall remain the property of the owner unless otherwise transferred.

If necessary, seagrasses from impact/donor sites will be transplanted to these seagrass creation areas.

3.2.3 Shoreline Protection along the ICW

Prior to installation of the riprap crib, the landward edge of the seagrass beds are to be visibly demarcated to prevent impacts. The “crib” structure is proposed to consist of a riprap container created by constructing two “railings” ± 5 apart and parallel from each other and parallel to the shoreline. Connections are made between the two fence lines at each pile set creating contiguous “cribs”. The front (windward) “railings” will be shorter than the rear (leeward) fence line allowing for the forward slope of the riprap. The top of the crib will be exposed riprap boulders sloped toward the channel at an incline no steeper than 1.5 horizontal to 1 vertical. Riprap boulders of 1.5-2.5' size are proposed to be placed within this crib. The base of the crib is proposed to be lined with a geotube to provide stabilization and erosion protection of the base of the riprap crib. This geotube will be filled with clean material excavated from the spoil areas. Construction of the riprap crib is described in Section 3.1.5. The sloped riprap crib is proposed to be installed along upland spoil areas, open water, and along the mangrove edge. Select mangrove trimming may be required in these areas; however seagrass impacts are not permitted.

3.2.4 Manatee Protection Areas

This improvement would most likely be performed from a boat/barge along the ICW and involve diver assistance for installation of approximately 3,000 linear ft. of a barrier float system along the cove area between Dania Beach Blvd. and Sheridan Street. The buoy lines could be secured by anchoring them to the bottom at regular intervals and are proposed to be maintained by the BCPRD.

3.3 Phase 3 – Anne Kolb Nature Center to Bird Nesting Area

This phase includes the creation of mangrove, upland hammock, mudflat, and channel areas from exotic plant-dominated Spoil Areas #14-30 and #40-42, and also includes installation of shoreline protection.

3.3.1 Spoil Areas #14-30 and #40-42

Spoil Areas #14-30, and #40-42 are targeted for conversion to mangrove, channel, mudflat, and upland hammock creation areas. The proposed improvement areas can be accessed from Anne Kolb Nature Center and existing maintenance roads; therefore, secondary impacts to adjacent resources are not anticipated.

Existing vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina equisetifolia*). Vegetation on the islands is proposed to be cleared, grubbed and piled using a combination of mechanical and non-mechanical means. Non-mechanical means refers to clearing by chainsaws, trimmers, etc. that do not move the soil. Mechanical equipment used to clear vegetation can access the spoil areas using the existing roads.

To avoid and minimize impacts, the spoil area/existing mangrove interface is proposed to be demarcated with erosion control, where appropriate to protect existing mangroves from damage prior to clearing and during construction. In addition, exotic vegetation could be removed by non-mechanical means to minimize disturbance where mangroves and other desirable natural vegetation are in close proximity. The resulting pile of removed vegetation could be burned or removed by truck using existing roads and disposed of in an appropriate upland location in accordance with state and local regulations.

Excavation of spoil material is proposed to proceed from the center of the spoil area outward to provide turbidity control and containment. Material could be excavated using appropriate mechanical means, such as a small backhoe and/or bulldozer that could access the area using the existing maintenance road. Silt fencing/turbidity curtains would be placed at the edge of mangroves prior to clearing of vegetation and would remain until the end of construction in this area. The spoil areas are proposed to be excavated to an elevation of $\pm 0.9'$ to $1.4'$ NGVD for natural mangrove recruitment, $\pm (-) 3.5'$ NGVD for channels, $0.0'$ NGVD for mudflats, $\pm (-) 4.0'$ for tide pools, and $\pm (-) 2.0' - (-) 0.5'$ NGVD for connecting channels. The upland hammock areas should not be excavated but would be graded prior to planting.

Spoil material could be used to 1) fill the geotubes or base discussed in Section 3.1.5, and/or 2) create the substrate for the ± 2.0 acre mangrove creation area along the Dania Cutoff Canal that is discussed in Section 3.8 below. Excess spoil material could be removed from the site by dump trucks using the existing roads. The contractor shall be responsible for placement of spoils on a suitable upland site and the material shall remain the property of the owner (public domain) unless otherwise transferred.

A small flushing channel is proposed west of Spoil Area #19 and #30 to connect existing channels to the interior lake. Approximately 0.68 acres of mangroves may be impacted and could be removed by non-mechanical means. The channels could be created by using a small suction dredge such as a Piranha Pump to a containment/settling area (such as the large Spoil Area #19 at the entrance to Anne Kolb Nature Center and Spoil Area #30 south of Sheridan Street next to the bird nesting area). This area can be cleared of exotic vegetation and serve as the settling area prior to its conversion to mangroves, mud flats, and channels. The dredge spoils would be allowed to settle for an appropriate amount of time (per State criteria) and the return water would then be discharged via filtration and/or settlement in the ground and/or existing channels. The sediment could then be loaded onto dump trucks for transport to a suitable upland site and the material shall remain the property of the owner unless otherwise transferred. The exact location of the channels will be field located to minimize mangrove impacts.

3.3.2 Enhance/Protect Bird Nesting and Feeding Habitat

This improvement can be accessed from existing maintenance roads and staged from Spoil Area #30 and the maintenance road. The existing channels could be dredged by using a small suction dredge such as a Piranha Pump. The dredge spoils could then be

relocated to a containment/settling area (such as the large Spoil Area #30 adjacent to the bird nesting area). This area can be cleared of exotic vegetation and serve as the spoil settling area prior to being converted to mangrove, mud flat, and channel habitats. The dredge spoils would be allowed to settle for an appropriate amount of time (per State criteria) and the return water would then be discharged via percolation and/or settlement into the ground through the containment area. The sediment could then be loaded onto dump trucks for transport to a suitable upland site and the material shall remain the property of the owner unless otherwise transferred.

Existing downed trees that cross the channels are proposed to be removed and trees with branches that extend far over the channel would be trimmed. The contractor shall install and be responsible for maintenance of the appropriate turbidity controls (such as silt fence and floating turbidity barriers) for the duration of the project to ensure continuous compliance with state and/or local water quality standards. Turbidity controls would be placed to protect existing mangrove areas and water bodies from silt and water-borne debris and prevent water quality degradation in surrounding surface waters or wetlands.

Enhancement of the Bird Nesting/Feeding Habitat is currently considered a Management Item and has not been approved for mitigation credit at this time. If benefits from this improvement item become apparent after its completion, it may be reviewed and re-evaluated by the permitting agencies for mitigation credit at that time.

3.3.3 Shoreline Protection along the ICW

The “crib” structure is proposed to consist of Connections are made between the two fence lines at each pile set creating contiguous “cribs”. The sloped riprap crib structure is proposed to consist of a riprap container created by constructing two “railings” ± 5 apart and parallel from each other and parallel to the shoreline. The front (windward) “railings” will be shorter than the rear (leeward) fence line allowing for the forward slope of the riprap. The top of the crib will be exposed riprap boulders sloped toward the channel at an incline no steeper than 1.5 horizontal to 1 vertical. The leeward side piles will reach $4.5 \pm$ MLLW NGVD and the windward piles will reach just above mean sea at $1.25 \pm$ MLLW NGVD. Riprap boulders of 1.5’-2.5’ diameter are proposed to be placed within this crib. The base of the crib is proposed to be lined with a geotube to provide stabilization and erosion protection of the base of the riprap crib. This geotube will be filled with clean material excavated from the spoil areas. The riprap crib can be constructed from land using the existing maintenance roads and Anne Kolb Nature Center. Where existing mangroves prohibit direct access to the shoreline for the riprap crib placement, the riprap crib could be constructed in the same manner as discussed in Section 3.1.5. The riprap crib could be installed along upland spoil areas, open water, and along mangroves. Select mangrove trimming may be required in these areas, however seagrass impacts are not permitted.

3.3.4 Culverts along Maintenance Road/De-siltation of Existing Channels

One 24" x 45" elliptical pipe culvert will be installed between Spoil Islands 30 and 29 under the existing maintenance road to increase flushing to the mangroves west of the maintenance road. Prior to installation, silt fence and turbidity screens are proposed to be installed to reduce turbidity. The culvert could be installed by excavating an appropriate portion of the existing maintenance road. The culvert could then be placed in the excavated area and covered with a portion of the excavated material to achieve the same elevation as prior to installation. The existing channels could be dredged by using a small suction dredge such as a Piranha Pump to a containment/settling area (such as the large Spoil Area #30 adjacent to the bird nesting area). Excess material may be removed from the site by truck to a suitable upland site and the material shall remain the property of the owner unless otherwise transferred.

3.4 Phase 4 – Bird Nesting Area to South End of Park

This phase includes the creation of upland hammock, and channel areas from exotic plant-dominated Spoil Areas #31-36 and installation of shoreline protection. Access to perform the improvements discussed below would be from the ICW by a shallow-draft work vessel such as a pontoon boat. Island 36 could also be accessed by maintenance road.

3.4.1 Spoil Areas #31-36

Spoil Areas #31-36 are targeted for conversion to upland hammock. A small channel is also proposed through the eastern edge of Spoil Area #36. Vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina equisetifolia*).

Vegetation on Spoil Areas #31-35 may be cleared, grubbed and piled using non-mechanical means. Non-mechanical means refers to clearing by chainsaws, trimmers, etc. that do not move the soil. Access to these areas could be by a johnboat or similar equipment; however 1' clearance from bottom must be maintained.

Vegetation on Spoil Area #36 is proposed to be cleared, grubbed and piled using a combination of mechanical and non-mechanical means. Non-mechanical means refers to clearing by chainsaws, trimmers, etc. that do not move the soil. Mechanical equipment used to clear vegetation can access the spoil area using the existing maintenance road.

To avoid and minimize impacts, the spoil area/existing mangrove interface is proposed to be demarcated with erosion control, where appropriate to protect existing mangroves from damage prior to clearing and during construction. In addition, exotic vegetation may be removed by non-mechanical means to minimize disturbance where mangroves and other desirable natural vegetation is in close proximity. The resulting removed vegetation could be burned or removed by truck using the existing maintenance road and disposed of in an appropriate upland location in accordance with state and local regulations.

3.4.2 Shoreline Protection along the ICW

In this location the presence of seagrass are closer to the mangrove edge as compared to other areas. The proposed shoreline protection will incorporate a riprap crib structure that has a footprint of approximately 5 feet in width. The crib will be sloped on the windward (ICW) side at no steeper than 2 to 1. The crib will be constructed of a single series of vertical vinyl coated marine wood pilings spaced every 10 feet with horizontal reinforcing bars on both sides. The leeward side piles will reach $4.5 \pm$ MLLW NGVD and the windward piles will reach just above mean sea at $1.25 \pm$ MLLW NGVD. Riprap boulders (1.5' to 2.5' diameter) will be placed inside the crib. The base of the structure will be a geotube or equivalent stabilization. This geotube is proposed to be filled with sand or material excavated from the spoil areas. Construction of the riprap crib can then proceed along the base, possibly eliminating the need for a barge or crane. The riprap crib could be installed in upland spoil areas and along mangroves. Select mangrove trimming or minor mangrove impacts may be required in these areas; however seagrass impacts are not permitted. The construction of the riprap crib structure should not block tidal flow into existing or proposed channels connecting West Lake to the ICW. Placement is proposed to follow the contours of the shoreline and wrap around the sides of the channel inlets. It is anticipated that the riprap crib structure will also stabilize the position of the channels by directing tidal currents. Offset openings in the riprap crib will be added at locations where the additional footprint required by the offset will not result in additional mangrove or seagrass impacts.

3.5 Phase 5 –West Lake Park Recreational Area/Sheridan Street

This phase includes the installation of new culverts to increase flushing, and the creation of mangrove, mudflat, and channel areas from exotic plant-dominated Spoil Areas #37-39. The West Lake Park Recreation Area provides access to and may serve as a suitable staging area for equipment and a construction trailer. The proposed improvement areas for this phase can be accessed from the recreation area and, therefore, secondary impacts to adjacent resources are not anticipated.

3.5.1 Spoil Areas #37-39

Spoil Areas #37-39 are targeted for conversion to mangrove, channel, mudflat, and upland hammock creation areas. Existing vegetation consists primarily of the nuisance/exotic species Australian pine (*Casuarina equisetifolia*). Vegetation on the islands is proposed to be cleared, grubbed and piled. Prior to clearing, the spoil area/existing mangrove interface is proposed to be demarcated with erosion control where appropriate to protect existing mangroves from damage prior to clearing and during construction. Exotic vegetation is proposed to be cleared and grubbed using appropriate mechanical means except where mangroves and other natural vegetation is in close proximity; in which case vegetation may be removed using non-mechanical means to minimize disturbance. The resulting removed vegetation could be burned or removed by truck and/or disposed of in an appropriate upland location in accordance with state and local regulations.

Excavation of spoil material could be phased to provide turbidity control and containment (i.e. excavation will proceed from the center of the spoil area outward). Material will be excavated using appropriate mechanical means. Material could then be loaded onto trucks for transfer to the staging area. Silt fencing/turbidity curtains would be placed at the edge of mangroves prior to clearing of vegetation and would remain until the end of construction in this area. The spoil areas are proposed to be excavated to an elevation of $\pm 0.9'$ to $1.4'$ NGVD for natural mangrove recruitment, $\pm (-) 3.5'$ NGVD for channels, $\pm 0.0'$ for mudflats, $\pm (-) 4.0'$ NGVD for tide pools, and $\pm (-) 2.0' - (-) 0.5'$ NGVD for connecting channels. The upland hammock areas would not be excavated but would be graded prior to planting. The contractor shall be responsible for placement of spoil on a suitable upland site and the material shall remain the property of the owner unless otherwise transferred.

3.5.2 Culvert under West Lake Park Entrance Road

One 24" x 45" elliptical pipe culvert shall be installed under the existing entrance road to increase flushing to the mangroves west of the road. Prior to installation, silt fence and turbidity screens should be installed to reduce turbidity. Pavement, curb, and sidewalk will be restored to previous elevations. Underground utilities are anticipated to be present in this area. However, contractor shall schedule work effort so as not to limit access to the park in this public use area.

3.6 Phase 6 – Dania Salt Marsh

This phase includes the excavation of new channels to increase flushing, creation of mudflats from exotic plant-dominated areas, de-silting of certain existing channels, and removal of any other impediments to water flow. The Florida Power & Light (FPL) substation along SE 5th Avenue could serve as a suitable staging area for this phase. The proposed improvements for this phase can be accessed from SE 5th Avenue. Minor secondary impacts to adjacent mangroves may occur but should be limited to trimming.

3.6.1 Flushing Channels from Existing Berms

The creation of new channels from existing berms would most likely be performed using a small backhoe and excavator. This equipment could access the site by laying a geogrid mat over the existing path that exists in the sea oxeye daisy fields. This mat would only be wide enough for the small excavator and backhoe. The sediment could then be placed in a small Toolcat™ (or similar) work machine for transport to the staging area. Another possibility is the use of a conveyor system that could transfer the excavated sediment directly to the staging area. These channels are proposed to be excavated to $\pm (-) 2.0'$ NGVD unless bedrock is encountered above $\pm (-) 2.0'$ NGVD in which case the channel is proposed to be excavated to bedrock elevation. The contractor shall install, and be responsible for, maintenance of turbidity controls (silt fence and floating turbidity barriers) for the duration of the project to help ensure compliance with local and state water quality standards. Turbidity controls should be placed appropriately to protect

existing mangrove areas and water bodies from silt and water-borne debris, and to prevent degradation of water quality within surrounding surface waters and/or wetlands.

3.6.2 Mudflats from Exotic Plant-Dominated Areas

This improvement would most likely be performed using a small backhoe to excavate sediment to elevation 0.0' NGVD. The existing historic haul road that is proposed for conversion to a channel could be used to access these mudflat creation areas. The channel would then be excavated from the mudflats to the historic haul road. The mudflats are proposed to be excavated to an elevation of 0.0' NGVD, $\pm(-)$ 4.0' NGVD for tide pools and $\pm(-)$ 2.0' NGVD for connecting channels.

Existing vegetation in this area consists primarily of the nuisance/exotic species Brazilian pepper (*Schinus terebinthifolius*). Vegetation may be cleared, grubbed and piled using a combination of mechanical and non-mechanical means. Non-mechanical means refers to clearing by chainsaws, trimmers, etc. that do not move the soil. Mechanical equipment used to clear vegetation can access the spoil areas using the existing haul road and trail.

3.6.3 Flushing Channel along Historic Haul Road

The creation of a flushing channel along the historic haul road is proposed to be excavated in the manner described in Section 3.6.1. An existing trail could provide access to the site with minimal mangrove trimming. This channel is proposed to start on the north at the main double east-west channel and be approximately 30 feet wide. The channel is proposed to taper to about 15 feet wide on the southern end at its terminus at the southernmost created mudflat. Prior to excavation, the proposed channel is proposed to be visibly demarcated to protect mangroves outside the footprint of the channel from damage and generally minimize the possibility of accidental mangrove impacts. Channel creation is proposed to follow the existing remains of a historic haul road. Up to 0.5 acres of white and black mangroves may, however, be impacted at the southern end of the channel to connect to the southern mudflat.

The channel is proposed to be excavated to an elevation of $\pm(-)$ 2.0' NGVD unless bedrock is encountered above $\pm(-)$ 2.0' NGVD in which case the channel is proposed to be excavated to bedrock elevation. The contractor shall install, and be responsible for, maintenance of turbidity controls (silt fence and floating turbidity barriers) for the duration of the project to help ensure compliance with water quality standards. Turbidity controls will be placed as appropriate to protect existing mangrove areas and water bodies from silt and water-borne debris; preventing degradation of the water quality to surrounding waters and/or wetlands.

3.6.4 De-silt Existing Channels

Existing channels would most likely be de-silted through use of a small hydraulic dredge, such as a Piranha Pump to excavate sediment to the specified elevation. The sediment can be sent through hoses to the transport location. These channels are proposed to be

desilted to a $\pm(-)$ 3.5' NGVD unless bedrock is encountered above $\pm(-)$ 3.5' NGVD in which case the channel will be desilted to bedrock elevation. The length of channel to be desilted will be determined in the field in order to minimize impacts to existing mangroves and reduce trimming. The contractor shall install, and be responsible for, maintenance of turbidity controls (silt fence and floating turbidity barriers) for the duration of the project to help ensure compliance with water quality standards. Turbidity controls should be placed, as appropriate, to protect existing mangrove areas and water bodies from silt and water-borne debris, preventing degradation of the water quality to surrounding waters and/or wetlands. Turbidity controls will remain in place until side slope stabilization is achieved.

3.6.5 Protect/Preserve Sea-Oxeye Daisy Fields from Exotic Invasion

The remaining sea-oxeye daisy fields in the DSM should be maintained free of exotic vegetation through quarterly monitoring and maintenance. If exotic vegetation is observed, it should be removed by hand or through chemical treatment, as appropriate.

3.7 Phase 7 – Park-Wide Habitat Improvements

A few of the proposed habitat improvements are smaller scale efforts or are not localized to a particular area or project Phase. These improvements include nuisance/exotic removal, channel de-siltation, and installation of additional osprey nesting towers. Certain park-wide improvements are approved to receive mitigation credit, while others are currently listed as Management Items and have not been approved for mitigation credit by the permitting agencies. If significant benefits resulting from completion of Management Items become evident, these items may be reviewed and re-evaluated by the permitting agencies for mitigation credit at that time.

3.7.1 Nuisance/Exotic Removal

Approximately 8.4 acres of exotic plant-dominated areas throughout the Park are not targeted for specific habitat improvements because of their relative small size and/or limited accessibility. These areas are proposed to be accessed on foot or by small vessel and exotic vegetation may be removed by non-mechanical means. Exotic vegetation shall be removed and planted with *Borrchia frutescens* and *B. arborescens*. Where removal of exotic vegetation could result in impacts to adjacent resources, exotics will be treated in-place with herbicides and remain as snags. Disposal shall be in a manner that will not encourage reinfestation by those nuisance/exotic species and must comply with applicable State and local codes and regulations. This improvement is a mitigation item and has been approved for mitigation credit.

3.7.2 Maintenance Dredging/Channel De-siltation

In addition to the areas indicated in previously discussed project Phases, specific areas throughout the park have been selected for maintenance dredging and channel de-siltation to improve flushing capacity. Existing channels would most likely be de-silted through

use of a small hydraulic dredge, such as a Piranha Pump to excavate sediment to the specified elevation. The sediment can be sent through hoses to the transport location. These channels are proposed to be de-silted to a $\pm(-)$ 3.5' NGVD unless bedrock is encountered above $\pm(-)$ 3.5' NGVD in which case the channel will be de-silted to bedrock elevation. The length of channel to be de-silted will be determined in the field in order to minimize impacts to existing mangroves and reduce trimming. The contractor shall install, and be responsible for, maintenance of turbidity controls (silt fence and floating turbidity barriers) for the duration of the project to help ensure compliance with water quality standards. Turbidity controls should be placed, as appropriate, to protect existing mangrove areas and water bodies from silt and water-borne debris, preventing degradation of the water quality to surrounding waters and/or wetlands. Turbidity controls will remain in place until side slope stabilization is achieved. Although a portion of the proposed channel de-siltation will be addressed within other project Phases, all de-siltation improvements are currently considered Management Items and have not been approved for mitigation credit at this time. If benefits from this improvement item become apparent after its completion, it may be reviewed and re-evaluated by the permitting agencies for mitigation credit at that time.

3.7.3 Osprey Towers

Installation of additional osprey nest towers throughout the park is also included in this Phase. If available, osprey nest towers that emulate dead trees rather than the familiar anthropogenic "platform" towers are preferred. Installation of these items will need to be conducted without heavy equipment and in such a manner that disturbance to adjacent resources is minimized. Prior to and during installation, turbidity control measures should be employed, as appropriate, to protect existing mangrove areas and water bodies from silt and water-borne debris, thereby preventing degradation of the water quality to surrounding surface waters and/or wetlands. Though this work is required by one or more of the environmental permits, the associated improvements are currently designated as Management Items rather than Mitigation because no mitigation credit has been allocated in the permits. These items can potentially be reviewed and re-evaluated for mitigation credit after completion.

3.8 Phase 8 – Dania Cutoff Canal

Riprap shall be placed at the West Lake Park property limits, north of the existing riprap along the Dania Cutoff Canal (DCC). This riprap could most likely be placed from a shallow-draft barge with hand guidance. Some mangroves are currently present on the existing, but poorly functioning, riprap. Therefore, any existing riprap supporting mangroves should remain in place. This relocation of the existing riprap is proposed to be permitted separately by Port Everglades activities along with potential installation of new sheet pile bulkhead to stabilize the new riprap at the edge of the deep-cut channel in the Dania Cut-off canal.

Following the proposed bulkhead and riprap installation along the DCC (performed by Port Everglades) approximately 2.5 acres are proposed to be filled with spoil island material behind the newly placed riprap to an elevation of $\pm 0.9'$ to $1.4'$ to allow for mangrove recruitment. The average elevation in this area is currently $\pm(-) 1.4'$ NGVD. Therefore, approximately $2.3'$ of fill will be required over the ± 2.5 acre area resulting in a total of 9,277 cubic yards of fill. Sediment from the spoil area excavation could be placed in this location from a barge along the Dania Cutoff Canal. The vertical sheet pile potentially installed for stability of the newly placed riprap could be extended to above the high tide line during construction to help ensure compliance with water quality standards. This may be comprised of temporary or supplemental sheet pile that will be adjusted to the appropriate final elevation. Floating turbidity curtains can be placed on the south side of this creation area to protect existing mangrove areas and water bodies from silt and waterborne debris; thereby preventing degradation of water quality to surrounding surface waters and/or wetlands.

3.9 Archaeological and Historic Resources

Based upon previous research by Florida Department of State Division of Historical Resources, it is not anticipated that historic or archaeological remains are present. However if historic or archaeological remains are discovered, the contractor shall notify the appropriate Federal and State agencies. In addition, ground disturbing work in the immediate vicinity of artifacts will be halted until the area can be further investigated by qualified, owner approved personnel.

3.10 Cleanup and Restoration

During and upon completion of the project, the contractor shall keep the project site clean. The contractor should be allowed to temporarily store equipment, surplus materials, etc., within the limits of construction only if previously approved by the project's environmental permits and BCPRD. No discarded equipment or materials, rubbish, or other refuse shall be placed outside the limits of construction.

Upon completion, the contractor shall remove from the project site and adjacent property all equipment, surplus and discarded materials, rubbish and temporary structures; the contractor shall restore, to an acceptable degree, public and private property which may have been damaged during execution of the work. Waterways shall be left clean and unobstructed upon project completion.

4.0 TURBIDITY MONITORING PLAN

4.1 Construction Turbidity Monitoring

Prior to and during waterward construction, erosion controls will be installed as necessary to prevent exceeding turbidity standards as outlined in Chapter 62-302, F.A.C. Turbidity control devices used shall remain in place until turbidity, as measured in Nephelometric Turbidity Units (NTUs), within the work areas returns to within 29 NTUs of background levels.

The contractor will be responsible for monitoring turbidity in areas where waterward construction activity occurs. Turbidity levels shall be monitored and recorded every four hours during dredging and filling. Samples shall be taken one foot below the surface and mid-depth at monitoring stations, which shall be located as follows:

- $\pm 200'$ up current of the work sites and/or outside the influence of construction activities (control).
- At 200' down current of the work site, within $\pm 50'$ down current of the work site, and within the densest portion of any visible turbidity plume.

If turbidity exceeds standards (29 NTUs above background), work may be temporarily halted until the above standard is achieved.

The following data will be recorded and presented in each daily water quality monitoring report:

- permit and permit number
- dates of sampling and analysis
- turbidity sampling results
- description of data collection methods
- a map indicating the sampling locations
- time of sampling
- depth of water
- weather conditions at time of sampling
- tidal stage and direction of flow
- wind direction and velocity
- water temperature
- a statement by the individual responsible for the implementation of the sampling program concerning the authenticity, precision, limits of detection and accuracy of the data

Reports are to be submitted to Broward County Environmental Protection Department on a weekly basis.

5.0 PLANTING SCHEDULE

UPLAND HAMMOCK CREATION - ±11.3 ACRES

Canopy/Shrub Layer

QUANTITY	SPECIES	SIZE	ELEVATION (FT NGVD)
±365 ±5%	<i>Conocarpus erectus</i> (Green buttonwood)	3 gal.	±≥1.7
±365 ±5%	<i>Conocarpus erectus</i> (Green buttonwood)	7 gal.	±≥1.7
±140 ±5%	<i>Bursera simaruba</i> (Gumbo limbo)	3 gal.	±≥3.5
±141 ±5%	<i>Bursera simaruba</i> (Gumbo limbo)	10 gal.	±≥3.5
±145 ±5%	<i>Coccoloba diversifolia</i> (Pigeon plum)	7 gal.	±≥3.5
±140 ±5%	<i>Simarouba glauca</i> (Paradise tree)	7 gal.	±≥3.5
±141 ±5%	<i>Simarouba glauca</i> (Paradise tree)	3 gal.	±≥3.5
±141 ±5%	<i>Rapanea guianensis</i> (Myrsine)	7 gal.	±≥3.5
±142 ±5%	<i>Rapanea guianensis</i> (Myrsine)	3 gal.	±≥3.5
±141 ±5%	<i>Coccoloba uvifera</i> (Sea grape)	7 gal.	±≥3.5
±141 ±5%	<i>Coccoloba uvifera</i> (Sea grape)	3 gal.	±≥3.5
±140 ±5%	<i>Chrysophyllum oliviforme</i> (Satin leaf)	7 gal.	±≥3.5
±140 ±5%	<i>Chrysophyllum oliviforme</i> (Satin leaf)	3 gal.	±≥3.5
±145 ±5%	<i>Sabal palmetto</i> (Cabbage palm)	6'C.T'	±≥3.5
±140 ±5%	<i>Capparis flexuosa</i> (Limber caper)	14"-	±≥3.5
±140 ±5%	<i>Genipa clusiifolia</i> (Seven-year apple)	15 gal.	±≥3.5
±140 ±5%	<i>Krugiodendron ferreum</i> (Black ironwood)	7 gal.	±≥3.5
±140 ±5%	<i>Krugiodendron ferreum</i> (Black ironwood)	3 gal.	±≥3.5
±140 ±5%	<i>Ocotea coriacea</i> (Lancewood)	3 gal.	±≥3.5
±140 ±5%	<i>Sideroxylon foetidissimum</i> (Mastic)	7 gal.	±≥3.5
±4472 ±5%	<i>Psychotria nervosa</i> (Wild coffee)	1 gal.	±≥3.5
±4472 ±5%	<i>Hamelia patens</i> (Firebush)	1 gal.	±≥3.5
±4472 ±5%	<i>Chrysobalanus icaco</i> (Cocoplum)	1 gal.	±≥3.5
±16,683 ±5%	TOTAL		

Ground Cover

QUANTITY	SPECIES	SIZE	ELEVATION (FT NGVD)
±2,669 ±5%	<i>Borrchia frutescens</i> (Sea oxeye)	1 gal.	±≥1.7
±2,669 ±5%	<i>Borrchia arborescens</i> (Sea oxeye)	1 gal.	±≥1.7
±5,328 ±5%	<i>Spartina alterniflora</i> (Smooth cordgrass)	1 gal.	±≥1.7 – ≥2.7
±17,913 ±5%	<i>Spartina bakeri</i> (Sand cordgrass)	1 gal.	±≥2.7
±9,061 ±5%	<i>Nephrolepis biserrata</i> (Giant Sword fern)	1 gal.	±≥2.7
±37,640 ±5%	TOTAL		

MANGROVE CREATION AREAS - ±20.7 ACRES

Canopy/Shrub layer vegetation will consist of naturally recruited mangrove species (*Rhizophora mangle*, *Avicennia germinans*, and *Laguncularia racemosa*).

EXOTIC VEGETATION REMOVAL AREAS - ±8.4 ACRES

QUANTITY		SPECIES	SIZE	ELEVATION (FT NGVD)
±8,007	±5%	<i>Borrchia frutescens</i> (sea oxeye daisy)	1 gal.	±≥1.7
±8,007	±5%	<i>Borrchia arborescens</i> (sea oxeye daisy)	1 gal.	±≥1.7
±5,328	±5%	<i>Spartina alterniflora</i> (Smooth cordgrass)	1 gal.	±≥1.7 – ≥2.7
±17,913	±5%	<i>Spartina bakeri</i> (Sand cordgrass)	1 gal.	±≥2.7
±9,061	±5%	<i>Nephrolepis biserrata</i> (Giant Sword fern)	1 gal.	±≥2.7
±48,316	±5%	TOTAL		

6.0 MONITORING PLAN

A time-zero monitoring event will be performed shortly after construction completion of creation and planted areas. The areas shall then be monitored quarterly for the required five-year period.

6.1 Seagrasses

Forty paired, one-square meter quadrats will be randomly placed within the created seagrass habitat during each monitoring event. Distribution of the forty quadrats will be divided equitably between the seven seagrass creation areas. Random, rather than fixed, quadrats will be used so that the results are without bias and can be used to generalize the condition of the entire area (Fonseca, personal communication). Random directions and distances will be chosen using a random number generator. Random directions and distances to sample quadrats will be calculated from the approximate center of each seagrass creation area.

An equivalent number of replicate quadrats will be established in the existing seagrass beds adjacent to the creation areas (at least 50' away) to serve as a control. In addition, two fixed quadrats for each seagrass recruitment area will be used to observe and approximate recruitment at a specific location between monitoring periods. The following data will be collected at each quadrat:

- water depth (relative to 0.0' NGVD)
- Time
- Species present
- Shoot counts
- Aerial coverage by photo-documentation
- Qualitative observations of natural seagrass recruitment and vegetative expansion of planting units

Survivorship rates may be assessed based on measurements within the quadrats. Abundance measurements shall be made through visual and photographic assessments of percent aerial coverage by species. The 1 m² quadrat shall be divided into a 10 cm x 10 cm grid and coverage estimated based on the number of squares containing seagrasses.

In addition, percent aerial coverage will be equated to Cover Classes based on the Braun-Blanquet technique as follows:

Cover Class	Description
0	Absent
0.1	Solitary individual ramet, less than 5% cover
0.5	Few individual ramets, less than 5% cover
1	Many individual ramets, less than 5% cover
2	5% - 25% cover
3	25% - 50% cover
4	50% - 75% cover
5	75% - 100% cover

Survivorship Success criteria:

Seagrass success criteria shall be based on:

1. By the third year, a target goal of Cover Class 1 coverage or equivalent coverage to the adjacent ICW control site, whichever is lower.
2. By the fifth year, a target goal of Cover Class 2 coverage or equivalent coverage to the adjacent ICW control site, whichever is lower.
3. Supplemental seagrass will be planted at a density of 2 m on-center if:
 - a) at the end of the third year, recruitment areas have lower than both Cover Class 1 coverage and the existing coverage in the adjacent ICW control site.
 - b) at the end of the fifth year, recruitment areas have lower than both Cover Class 2 coverage and the existing coverage in the adjacent ICW control site.

The contingency plan for supplemental seagrass planting is to obtain donor stock from the adjacent seagrass beds and transplant the seagrasses using the plug method as described in Fonseca *et. al.* (1998) *Guidelines for the Conservation and Restoration of Seagrasses in the United States and Adjacent Waters*.

If the seagrass creation areas do not become completely covered by natural seagrass recruitment, seagrass from donor site(s) may be transplanted to the seagrass creation areas in West Lake Park.

Above-water panoramic photo-stations shall be established and underwater photographic documentation of each quadrat shall also be collected.

Aquatic macrofauna (vertebrates and invertebrates) are proposed to be identified and recorded within the visible radius along 20 meter transects. This identification would be performed prior to monitoring of seagrasses to minimize a priori disturbance. Benthic fauna would be identified, however interstitial fauna shall not. The following data shall be collected for each transect:

- Identification of fauna to lowest practical taxonomic level
- Number of individuals of a given species (abundance)
- Number of species (diversity)
- Location of identified fauna (sediment surface, water column)
- Behavior of identified fauna (swimming, foraging, etc.)
- Time to complete transect

In addition, incidental faunal observations shall be recorded.

In addition to the above-listed biological data, the following physical data may also be collected for each monitoring event: tides, weather, water temperature, and wind. A staff gauge or automatic water level monitoring well shall be installed to record tide level.

6.2 Mangrove Areas

Vegetative sampling:

Establish one (1) belt transect within each individual mangrove recruitment area. These transects will be two (2) meters wide and will stretch across the approximate maximum length of each recruitment area. A one-square meter quadrat will be randomly placed along the transects at a minimum density of one (1) quadrat per 10 meters of transect (i.e., 100 meter transect will contain 10 quadrats). Though the quadrats will be randomly placed, they will not be placed within "breaks" (i.e., mud flats, pre-existing mangrove areas) in the mangrove recruitment areas. Percent aerial coverage by naturally recruited vegetative species falling within the quadrats will be visually estimated and recorded. Data from these sampling quadrats will then be extrapolated to determine overall percent coverage within each mangrove recruitment area.

Once naturally recruited mangrove trees have obtained sufficient height (± 1.5 meters) to be recorded individually, trees located within the belt transects (base of trunk within the transect) would be flagged and measured for height, spread, and diameter breast height (DBH). These measurements will be at random points along the transect at a frequency of one set of measurements per 10 meters. Measurements of these flagged trees will be repeated during subsequent monitoring events to determine growth rates and survivorship. Overall health would also be assessed.

Survivorship Success criteria:

Success criteria for mangroves and herbaceous plantings within mangrove recruitment areas will be based on percent coverage.

Percent coverage success criteria will be based on the following interim goals:

1. 10% aerial coverage by mangroves by the first year.
2. 40% aerial coverage by mangroves by the third year.
3. 80% aerial coverage by mangroves by the fifth year.

If the interim coverage mentioned above are not achieved, supplemental mangrove planting will be performed; red mangrove seedlings will be installed 3' on center in areas where coverage discrepancies and shortfalls are noted.

6.3 Mudflat/Tidal Pool Areas

Mud flat/tidal pool creation areas will be monitored for incidental wildlife use. Photo-documentation of each mudflat/tidal pool area and incidental wildlife observations will be recorded.

6.4 Upland Hammock Areas

Vegetative sampling:

Establish one (1) belt transect within each individual upland hammock area. These transects will be two (2) meters wide and will stretch across the approximate maximum length of each planting area. A one-square meter quadrat will be randomly placed along the transect at a minimum density of one (1) quadrat per 10 meters. Percent aerial coverage by installed and naturally recruited vegetative species falling within the quadrats will be visually estimated and recorded. Data from these sampling quadrats will then be extrapolated to determine overall percent coverage within each mangrove recruitment area.

Installed tree species falling within the belt transects (base of trunk within transect) will be flagged and measured for height, canopy spread, and DBH (if applicable). Measurements of these flagged trees will be repeated during subsequent monitoring events to determine growth rates and survivorship. Overall health will also be assessed for each installed tree species.

Survivorship Success criteria

Success criteria for tree/shrub species within the upland hammock areas shall be based upon survivorship rates of 80% or greater for planted species by the second annual monitoring period.

6.5 Success Criteria for Recruitment/Planting Areas

The success criterion will be 2% or less coverage by nuisance/exotic vegetative species within the recruitment/planting areas.

The following information will be included in the Time-Zero and quarterly monitoring reports:

- 1) A summary of visual field observations, including survivorship and percent coverage data obtained from the above-noted sampling activities.
- 2) Physical conditions during the monitoring event including: weather, wind direction and speed; tide cycle status and direction of flow, water temperature, salinity, and turbidity levels.
- 3) A photographic record taken from fixed photo stations.
- 4) Water level readings from automatic monitoring wells during the time period of monitoring activities.
- 5) Aquatic macrofauna sampling data and incidental fish/wildlife observations.
- 6) Evaluation of the success of the mitigation and maintenance effort.
- 7) Comments and/or recommendations for permit compliance.

7.0 MAINTENANCE PLAN

Maintenance shall be performed quarterly for a period of five (5) years by the contractor and in perpetuity by the permittee as needed. A survival rate of 80% for installed tree/shrub species in the upland hammock planting areas, 80% coverage by desirable herbaceous species in the upland hammock areas, 80% coverage for the planted species in the upland areas, and 80% coverage of desirable obligate and facultative wetland species in the aquatic and marsh areas are anticipated through implementation of this mitigation program.

The permittee is responsible for the regular removal of nuisance and exotic vegetation and debris from the mitigation area for the length of the monitoring period, and in perpetuity as needed. Exotic vegetation shall include such species as are currently listed by the Florida Exotic Pest Plant Council. Mitigation areas shall be free from exotic/nuisance vegetation immediately following maintenance periods. Total coverage of exotic and nuisance species shall not exceed 2% between maintenance activities.

Maintenance is anticipated to be conducted regularly throughout the duration of the 5-year monitoring period, and in perpetuity on an as-needed basis. Appropriate methods of control shall be used which will include, but will not necessarily be limited to, cutting, mowing, chemical treatment, hand removal, or any combination thereof.

Upon completion of the required 5-year monitoring period, BCPRD shall continue to be responsible for the perpetual maintenance and management of the mitigation areas.

8.0 SCHEDULE

Activities	Anticipated Date
Begin earthwork	TBD
Complete earthwork	TBD
Begin planting	TBD
Complete planting	TBD
Submit Time-zero Monitoring Report	TBD
Submit first Annual Monitoring Report	TBD
Submit Second Annual Monitoring Report	TBD
Submit Third Annual Monitoring Report	TBD
Submit Fourth Annual Monitoring Report	TBD
Submit Fifth Annual Monitoring Report	TBD

The above schedule is typical of similar scale habitat improvement projects. Due to unscheduled funding, the construction plans are proposed to be prepared in phases and areas that would allow bundling for an appropriate habitat improvement area. Therefore scheduling will be subject to the activities that can be performed at the time funding becomes available. It is possible not all habitat improvements would be constructed at the same time.

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