TECHNICAL MEMORANDUM
WETLANDS AND FLOWWAYS BASELINE INVENTORY FOR THE BELLE MEADE MASTER STORMWATER MANAGEMENT PLAN

Revised August 2006

SFWMD Contract No. C-15776

PREPARED FOR

Collier County

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

FLORIDA

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1.0 Introduction

Wetlands and flowway corridors were mapped and described as part of the baseline inventory of resource information for use in developing the Belle Meade Master Stormwater Management Plan (SFWMD Contract No. C-15776). Planning-level jurisdictional delineations of existing wetlands were performed while both existing and historic flowway corridors were identified. The Belle Meade Area and Main Study Area (**Figure 1**) formed the boundaries for the wetland and flowway corridor inventory. In addition to spatial extent, wetlands and flowway corridors were also characterized in terms of ecological quality, hydrological requirements and restoration potential.

Existing data collection was performed and, for each dataset obtained, its suitability of use in establishing a baseline inventory for study purposes was identified. The data collection scope required the identification of all wetlands in the Belle Meade Area greater than 0.5 acre and would include the type of wetland, size, land use code, delineation line acceptable to meet both State and Federal regulations, determination of water elevations (recent high/low, long term high/low, desirable but practical high/low), hydro period (recent, historical, desirable but practical), degree of stress, extent of invasive or nuisance species infestation, opportunities for enhancement or restoration, ownership, and status of encumbrance under any development permit restriction or preservation/conservation easement (Main Study Area).

The baseline inventory for wetlands and flowways corridors provides information required to develop and evaluate alternative design scenarios for regional stormwater management including potential flowway corridor restoration. Once design scenarios are established, a more refined analysis of the baseline inventory database would be undertaken in order to provide an evaluation of alternatives and complete environmental regulatory permitting required for stormwater management plan implementation.

Insert Figure 1

2.0 Wetland Inventory

2.1 Methods for Planning-level Jurisdictional Delineations

The methodology used to establish planning-level jurisdictional delineations included a combination of Geographical Information System (GIS) overlay analysis using land use database and aerial photo-interpretation (PI). The delineations were furthered refined through field verification.

2.2 Overlay Analysis

Preliminary wetland boundaries for the 1999-2000 Florida Land Use Cover and Forms Classification System (FLUCCS) - Section 4 (SFWMD 2004) which covers the Belle Meade Area just north of Sabal Palm Road in Collier County were generated by merging the 5000 (water) & 6000 (wetland) classes in ESRI ARCMAP ver. 8.3. The merged 5000/6000 polygons were then overlaid onto 1999 National Wetlands Inventory (NWI) maps and compared to State and Federal hydric soils data. Discrepancies of wetland spatial extent between the two were noted and a characteristic subset of anomalies (21 checkpoints) was generated for subsequent field verification.

Due to the rapid development presently occurring in Collier County and the age of the FLUCCS (1999-2000), large areas mapped as natural plant communities were already developed by the time of checkpoint verification in the fall of 2004. In addition, field verification of the checkpoints indicated some inaccuracies of wetland jurisdictional limits in the 1999-2000 FLUCCS and NWI.

As a result, the initial overlay analysis was not performed on the Section 5 FLUCCS data that covers a portion of the Belle Meade Area south of Sabal Palm Road. Primarily, the 2003 CC aerials were used to determine the spatial extent of wetland boundaries and other wetland characteristics while the other aerial sets were used collaboratively. In all, eight database layers were utilized to determine wetland boundaries/character and include:

- Natural Resources Conservation Service soil survey of Collier County;
- 1999 National Wetlands Inventory;
- 1999-2000 FLUCCS data;
- 2000 Light Detection and Ranging (LiDAR) topographical maps;
- 2003 True color one-half foot resolution aerials of Collier County (2003 CC);
- 1999 False-color infrared one-meter (some tiles were 3-meter resolution);
- Digital ortho quarter-quadrangles (1999 DOQQ); and
- 1940 (unknown resolution) Black and white aerials of Collier County (1940 CC).

A greater emphasis was placed on the spatial extent of jurisdictional wetlands and surface waters above species composition in most of the mapped area. This emphasis was essential in order to identify the primary objective of selecting a flowway or flowways designed to convey and treat

stormwater from the Belle Meade Area through the Main Study Area to the outfalls in Rookery Bay. Clearly identifying jurisdictional limits will assist the permitting process, identify those areas in need of restoration (e.g., uplands previously coded as wetland), and better approximate existing hydrologic connections through the Belle Meade Area. Estimating canopy coverage code thresholds through photointerpretation may be subjective (for purposes of refining FLUCCS to level 3 or higher), unless the different plant communities express well-defined breaks. Such was not the case throughout most of the Belle Meade Area where gradation between canopy species such as slash pine (*Pinus elliottii*) and pond cypress (*Taxodium ascendens*) was protracted. In most of the area, where these two species were present in wetlands, they were coded as Wetland Coniferous Forest (FLUCCS 6200), a Level 2 FLUCCS. However, when either of these species achieved areal coverage of near homogeneity they were mapped to Level 3 or Level 4 FLUCCS due to differing hydro levels and hydroperiods. Therefore, any further separation of these vegetation types would be achieved through site-specific evaluation of alternative design scenarios for stormwater and flowway restoration in subsequent study tasks including permitting, where applicable. Limited accessibility and uncertainty to exact species composition required some areas in the southeast quadrant of the MPA to be mapped as FLUCCS 6200 although the canopies may exceed the thresholds areal cover sufficient to be classified as FLUCCS 6300 (Wetland Forested Mixed).

2.3 Field Survey Verification

Field verification for Section 4 FLUCCS involved generating longitude and latitude coordinates for 21 checkpoints. Navigation to each checkpoint was performed using a WAAS-enabled Garmin 76map Global Positioning System (GPS), which has been found to be accurate to within approximately 15 feet. Each checkpoint and adjacent plant community was evaluated for composition of plant species in the various strata, biological and physical indicators of hydrology, and if lacking obvious hydrologic indicators, the soil to a depth of six inches was inspected to determine its hydric characteristics. Adjacent areas were also evaluated using meandering transects in order to determine if the specific point was characteristic of the general locale. General observations and the wetland jurisdictional status of the inspected area were recorded on aerial maps plotted for this purpose. In addition, digital photographs and digital video were taken at some of the checkpoints.

Due to the fact that the current deliverable is for planning purpose, relatively limited field verification occurred during this initial mapping effort for the approximately 70,000 acres of the GPA. After the initial (preliminary) selection of flowways occurs a more rigorous field characterization must be performed. Initial field verification efforts identified a number of access constraints to subsequent verification efforts, these may include:

- Vast areas of undeveloped landscape without a road or jeep trail network
- Deep water
- Heavy underbrush or significant tree density inhibits access
- Uninterrupted stretches of ditches/canals
- Private property with significant trespass signage (contact information and escort coordination usually required)

- Construction areas (residential and commercial development) (contact information and escort coordination usually required)

Most of the GIS data sources have been determined to provide reliable information. However, metadata is not always available. To an extent, these data gaps have been corrected using readily accessible information.

2.4 Aerial Photo-interpretation

Three (3) sets of aerial photograph sets were used in determining the extent of the project wetlands; 2003 true color one-half foot resolution aerials of Collier County (2003 CC), 1999 false-color infrared one-meter (some tiles were 3-meter resolution) digital ortho quarter-quadrangles (1999 DOQQ), and the 1940 of unknown resolution black and white aerials of Collier County (1940 CC). Primarily, the 2003 CC aerials were used to determine the extent of project area wetland boundaries and other wetland characteristics while the other aerial sets were used collaboratively.

2.5 Referenced Metadata

Each of the GIS shapefiles has an associated metadata file that defines and describes the information contained in the GIS shapefile. Details may include how the information was generated, the purpose of the data, the coordinate system, useful period, update frequency, source of information, etc. **Appendix A** provides a hard copy of each metadata file and also includes metadata not associated with wetlands and flowways and/or the collateral files used to create a comprehensive baseline inventory for use in subsequent study tasks. Internet downloads provided most of this data. Accuracy of the data, if provided in the source information, is referenced in the metadata files. Information sources included:

- Florida Fish and Wildlife Conservation Commission;
- Florida Department of Environmental Protection's Land and Boundary Information System;
- United States Fish and Wildlife Service; and
- University of Florida's Florida Geographic Data Library (FGDL).

2.6 Data Collection

The wetland data collection was to identify all wetlands in the GPA greater than 0.5 acre and shall include the type of wetland, size, FLUCCS identification, delineation line acceptable to meet both State and Federal regulations, determination of water elevations (recent high/low, long term high/low, desirable but practical high/low), hydro period (recent, historical, desirable but practical), degree of stress, extent of invasive or nuisance species infestation, opportunities for enhancement or restoration, ownership, status of encumbrance under any development permit restriction or preservation/conservation easement for the Main Study Area.

The current deliverables provide the necessary planning information to develop an alternatives analysis for the several selected flowways necessary for the conceptual regional stormwater

master plan. Once several flowways are selected a more refined analysis of the preliminary effort must be undertaken in order to provide the detailed information necessary for project permitting.

Historic landscape information and its assemblage of plant communities are provided for generalized comparisons to current conditions. One must consider that historic mapping efforts were curtailed to the time period resources, and that the resulting depiction of plant communities, their extent, and their location was gleaned from landscape maps of the entire state. For example, the Davis vegetative map identifies three (3) major plant communities consisting of three (3) polygons for the entire Belle Meade Watershed. Contrast this to the current FLUCCS map that identifies 22 plant communities divided into more than 1,700 polygons for the same area. Further, historic documentation objectives often differed from the current focus. More often than not, information from yesteryear was acquired to exploit natural resources rather than for their protection. Nonetheless, this historic perspective does provide an optimistic restoration target for select areas.

Targeting 1940s vegetative communities as a restoration goal does not consider long-term hydrologic cycles that affected Florida and its vegetative communities over the last several thousand years. Preliminary soil core sample studies evaluating paleontological data by the U.S. Geologic Survey indicate that some Belle Meade Area locations and plant communities have been relatively stable over the millennia while others may be significantly different than even the 1940s information.

3.0 Wetland Inventory Results

3.1 Geographic Location and Spatial Extent

Figure 2 provides a composite of wetland resources in the Belle Meade Area. **Figures 3.1 to 3.4** identify wetland resources in the Main Study Area divided into four sheets (NW-NE-SW-SE) with 2003 CC aerial background to illustrate the relationship of these resources to present-day rapid development of the area. An estimated 57 percent of the approximately 70,000 acres that comprise the Belle Meade Area consists of wetlands. Open water features (canals, ditches, borrow pit lakes, etc.) cover approximately 2 percent of the Belle Meade Area. These areas have been categorized into 6 open water and 14 wetland land use cover codes.

The wetland plant communities within the Belle Meade Area consist of mangrove swamps, mixed wetland hardwoods, cabbage palm savannahs, wetland coniferous forest (cypress and hydric pine flatwoods), cypress/pine/cabbage palm wetlands, hardwood/coniferous mix wetlands, freshwater marshes, wet grass prairies, mixed shrub wetlands, and invasive species wetlands. A description of wetland plant community types as referenced by FLUCCS and NWI and their typical hydroperiods are listed in **Table 1**.

Very few field verified wetlands or uplands communities within the Belle Meade Area remain entirely free of nonnative invasive species. In general, the level of infestation of Main Study Area wetlands was greater than the same wetland type in the Belle Meade Area. Although there were examples of extensive Brazilian pepper (*Schinus terebinthifolius*) monoculture in the southern upland areas of the Main Study Area, there were few other areas of nonnative, invasive species monoculture observed. The densest infestations appear to be concentrated in lands in and adjacent to urban (FLUCCS 1000), agricultural (FLUCCS 2000), linear waterway (FLUCCS 5120), and transportation (FLUCCS 8000) land use codes. Based on the 1999-2000 FLUCCS data approximately 508 acres of nonnative invasive species may be found in the Main Study Area and 2,121 acres of nonnative invasive species occur in the Belle Meade Area. As shown on Figure 2 and Figures 3.1 to 3.4.

The Main Study Area wetlands are primarily located on the north, east, and west portions, while a regional perspective places the wetlands in the central, east central, and west central portions of the Belle Meade Area. **Table 2** identifies the spatial extent of wetland and open water habitats in the Belle Meade Area and Main Study Area.

Figure 2

Figure 3.1

Figure 3.2

Figure 3.3

Figure 3.4

Table 1 Vegetated Communities Classification Cross Reference Table

FLUCCS	DESCRIPTION	NWI	DESCRIPTION	COMMENTS	DURATION/HIGH WATER (HYDROPERIOD)
5120	Channelized River, Stream, Waterway	R5OW	Riverine, unknown perennial, unconsolidated bottom		12 months/varies
5200	Lakes	L1OW	Lacustrine, limnetic, open water	> 6.6 feet in depth, > 19.8 acres	12 months/varies but > 6.6 feet
		L2OW	Lacustrine, littoral, open water	< 6.6 feet in depth, > 19.8 acres	12 months/varies but < 6.6 feet
5300	Reservoirs	POWx	Palustrine, open water, excavated	< 19.8 acres	12 months/varies but > 2 feet
		L1OW	Lacustrine, limnetic, open water	> 6.6 feet in depth, > 19.8 acres	12 months/varies but > 6.6 feet
		L2OW	Lacustrine, littoral, open water	< 6.6 feet in depth, > 19.8 acres	12 months/varies but < 6.6 feet
6120	Mangrove Swamps	M2FL6	Marine, intertidal, flat, vegetated		12 months, intermittent/< 3 feet
6170	Mixed Wetland Hardwoods	PFO1/3	Palustrine, forested, broad-leaved deciduous/broad-leaved, evergreen		1-2 months/2-6 inches
6172	Mixed Shrubs	PSS1/3	Palustrine, scrub/shrub, broad-leaved, deciduous/broad-leaved, evergreen		1-2 months/2-6 inches
618	Cabbage Palm Savannah	PFO3	Palustrine, forested, broad-leaved, evergreen		1-2 months/2-6 inches
6191	Wet Melaleuca	PFO3	Palustrine, forested, broad-leaved, evergreen		1-2 months/2-6 inches
620	Wetland Coniferous Forest	PFO2/3	Palustrine, forested, needle-leaved deciduous/ Palustrine, forested, needle-leaved, evergreen		2-6 months/2-12 inches
6210	Cypress	PFO2	Palustrine, forested, needle-leaved deciduous		6-8 months/12-24 inches
6215	Cypress Dome	PFO2	Palustrine, forested, needle-leaved deciduous		6-8 months/12-24 inches
6216	Cypress-Mixed Hardwoods	PFO2/1	Palustrine, forested, needle-leaved deciduous/ broad-leaved, deciduous		1-2 months/2-6 inches
		PFO2/3	Palustrine, forested, needle-leaved deciduous/ broad-leaved, evergreen		8-10 months/18-24 inches

FLUCCS	DESCRIPTION	NWI	DESCRIPTION	COMMENTS	DURATION/HIGH WATER (HYDROPERIOD)
6240	Cypress-Pine-Cabbage Palm	PFO2/4/7	Palustrine, forested, needle-leaved deciduous/needle-leaved nondeciduous/evergreen		1-2 months/2-6 inches
6250	Wet Pinelands	PFO3	Palustrine, forested, needle-leaved, evergreen		1-2 months/2-6 inches
6260	Pine Savannah	PFO3	Palustrine, forested, needle-leaved, evergreen		1-2 months/2-6 inches
6300	Wetland Forest Mixed	PFO1/2/3/4/7	Palustrine, forested, broadleaved deciduous/needle-leaved deciduous/broad-leaved evergreen/needle-leaved evergreen/evergreen		1-2 months/2-6 inches
6410	Freshwater Marsh/Graminoid Prairie-Marsh	PEMg	Palustrine, emergent, intermittently exposed		6-10 months/12-24 inches
6420	Saltwater Marsh/Halophytic Herbaceous Prairie	M2FL6	Marine, intertidal, flat, vegetated		12 months, intermittent/< 2 feet
6430	Wet Prairies	PEMs	Palustrine, emergent, seasonal		1-6 months/6-12 inches
6440	Emergent Aquatic Vegetation	PEMh	Palustrine, emergent, permanent		>10 months/> 2 feet

Table 2 Spatial Extent of Existing Wetlands and Open Water in the Belle Meade Area

FLUCCS	DESCRIPTION	Acres in the Main Study Area	Total Acres in the Belle Meade Area
5120	Channelized River, Stream, Waterway	345.47	617.43
5200	Lakes	19.86	23.01
5300	Reservoirs	541.72	1411.49
6120	Mangrove Swamps	68.01	1270.41
6170	Mixed Wetland Hardwoods		3.63
6172	Mixed Shrubs	1157.57	1230.39
6180	Cabbage Palm Savannah		384.77
6191	Wet Melaleuca	63.34	223.46
6200	Wetland Coniferous Forest	5850.71	30082.03
6210	Cypress	1881.72	4037.54
6216	Cypress-Mixed Hardwoods	27.24	121.19
6240	Cypress-Pine-Cabbage Palm	11.54	421.75
6250	Wet Pinelands	312.54	620.99
6260	Pine Savannah	202.20	202.20
6300	Wetland Forest Mixed		64.23
6410	Freshwater Marsh/Graminoid Prairie-Marsh	274.21	377.23
6430	Wet Prairies		8.15

3.2 Historical Conditions

Historic conditions for this study were limited to the earliest available collateral information that could provide useful environmental information for the entire project area. The earliest source that provided this information was the 1940s black and white aerial photographs and the Davis vegetation map of 1943. Based on this information and other collateral data such as the Pre-Development Vegetation Map (SFWMD 2004, **Figure 4**) approximately 86 percent of the Belle Meade Area was historically classified as wetland. Of the approximately 70,000 acres in the project area only approximately 11,000 acres of this was upland, mostly mesic pine flatwoods with lesser extents of hardwood hammocks. The remaining 59,000 acres was wetland dominated with wetland coniferous forest (~42,000 acres), hardwood swamp forest (~13,500 acres), tidal marsh (~1,100 acres), mangrove swamp (~650 acres), and wet prairie (~600 acres). **Table 3** provides a summary of the spatial extent of wetland communities under pre-development conditions.

Table 3 Spatial Extent of Pre-Development Wetlands and Open Water in the Belle Meade Area

PDVM DESCRIPTION	Acres in the Main Study Area	Total Acres in the Belle Meade Area
Cypress	2,493.67	13,023.39
Hydric Flatwood	13,072.64	29,936.52
Mangrove	54.01	651.64
Marsh	3.87	24.16
Mesic Flatwood	3,307.88	10,035.50
Mesic Hammock	793.15	970.78
Swamp Forest	3,543.34	13,426.73
Tidal Marsh	459.33	1,119.42
Water	9.01	38.26
Wet Prairie	140.71	657.18
Scrub Cypress	73.27	89.96

Historic hydroperiods of the various wetland plant communities within the Belle Meade and Main Study Areas are provided in **Table 1**. When the table is used in conjunction with the SFWMD Pre-Development Vegetation data, an approximation of the rainy period hydrology may be described. Generally, a north to south and southwest sheet flow occurred in the entire Belle Meade Area. The water would be 2-6 inches deep across the hydric flatwoods and 1-2 feet deep in the cypress swamps. Only several large areas of mesic flatwoods (upland) community interrupted the continuous sheet flow. During periods of heavy rainfall even these upland islands were likely to be inundated. As water levels started to drop during the fall and winter, this sheet flow would then become discontinuous and flows would stop, although deeper areas would retain standing water through the dry season depending how deep they were, how extensive they were, and how dry the season may have been.

The most significant hydrologic alteration of the Belle Meade Area and Main Study Area involves the existing, extensive network of canals, ditches, and pumps. Under the existing conditions of surface water management and the extensive development (including roads), there probably are no flowways that extend across the Belle Meade Area or Main Study Area except maybe for short periods after exceptional rainfall events. This hydrologic alteration begins with the interception of surface water flows at the Golden Gate Canal along the north end of the Belle Meade Area which intercepts and diverts flows around the entire Belle Meade Area using the Miller Canal on the east side and the Henderson Creek Canal on the west side of the project area. Rainfall within the Belle Meade Area north of I-75 does eventually accumulate which provides sheet flow in a north to south direction. What sheet flows not captured and directed east or west by numerous ditches is then delivered to the canal north and parallel to I-75.

Figure 4.

water either flows east or west, or south through the culverts under I-75. These culverts are spaced at several thousand-foot intervals and they deliver the surface water to the parallel canal south of I-75. The southern canal next distributes water to the wetland plant communities south of I-75, and to the Miller and Henderson Creek Canals.

With few exceptions, primarily the cypress swamp systems (FLUCFCS 6210 and 6216), the freshwater marshes (FLUCFCS 6410), and the tidal wetlands (mangrove swamps FLUCFCS 6120 and saltwater marshes FLUCFCS 6420) that are south of I-75, wetland communities are experiencing moderate to severe reduced hydroperiods. Some of these alterations have resulted in vegetative shifts such as the significant increase in native, more upland species. This is apparent in the north central portions of the Belle Meade Area where cabbage palm (*Sabal palmetto*) has all but replaced slash pine (*Pinus elliottii*) as the dominant canopy species. Increases in nonnative nuisance species such as Brazilian pepper (*Schinus terebinthifolius*) and punktree (*Melaleuca quinquenervia*) in both the hydric pine and cypress swamp communities throughout the Belle Meade Area are also apparent.

Perhaps even more detrimental to wetland plant communities has been the elimination of attenuated surface water flows that historically occurred during the dry season. Water delivered during the rainy season was previously stored in semi-confining basins throughout the area, whether surficial limerock outcrops that slowly seeped their water reservoir as the surrounding surface waters dropped or depressions with constrained outfalls which allowed the water to trickle from the basin over an extended period, to the sheer frictional forces of extensive vegetation that slowed the sheet flow across the landscape. A major feature of the Belle Meade area is subdued topographic relief. The difference between jurisdictional wetland and the adjacent upland or between characteristic plant communities may be an elevational change of only 2-3 inches. When considering this lack of topographical relief, relatively minor increases in water elevation for restoration purposes may have dramatic ramifications in the upstream areas.

Typically, wetland restoration involves reestablishing historic or normal hydroperiods. On one hand, the low topographic relief allows widespread hydroperiod re-establishment with minor topographical restoration scenarios to points (or non-point areas) that allow water to channel through the landscape, such as ditch-blocks. On the other hand, this same characteristic acts detrimentally by flooding development upstream of the restorative alteration. As previously mentioned, most wetlands in the Belle Meade Area and Main Study Area would benefit from additional water delivery. The most practical restoration efforts may be to target those wetlands requiring the least water depths such as hydric pine FLUCCS 6250/6260, wet prairie FLUCCS 6430 and/or cabbage palm savannah FLUCCS 6180 (that could be restored to hydric pine).

Except for the cypress wetlands in public ownership south of I-75, most of the wetlands within the project area can be described as moderately to heavily-impacted compared to accounts of the same systems prior to the construction of the 1960s drainage network. Yet, many of the remaining wetlands when evaluated against those found in the more urbanized areas of Collier County would still be considered to be high quality. Even so, few wetland or uplands within the Belle Meade Area remain entirely free of nonnative invasive species despite the efforts by public

entities to eliminate such species. Regardless, few wetlands within the Belle Meade Area and Main Study Area are entirely beyond restoration or enhancement except those lost to permanent development. Permanent development would not include land uses typically associated with mining, agricultural, or other uses that do not include the creation of impervious surfaces.

3.3 Protected Species in the Belle Meade Area

In order to evaluate the occurrence of protected flora and fauna within the Belle Meade Area, the following data sources were reviewed:

- Florida Natural Areas Inventory (FNAI) element occurrence records
- Florida Panther Multi-Species/Ecosystem Recovery Implementation Team (MERIT)
- FWC habitat maps
- Florida Atlas of Breeding Sites for Herons and their Allies
- South Florida Multi-Species Recovery Plan
- 2003 southern bald eagle nest records
- FWC and FNAI wildlife observation records
- FWC panther/bear telemetry and mortality data

While research did not indicate any critical habitat within the project area, a number of protected species are known or expected to inhabit the project area. Protected wildlife species known to inhabit Collier County are listed in **Table 4**. Of the 41 protected wildlife species, 34 of these species may be present or have suitable habitat within the Belle Meade Area. Protected plant species known to inhabit Collier County area listed in **Table 5**. Of the 62 protected plant species, 58 may be present or have suitable habitat within the Belle Meade Area. **Figure 5** illustrates the location of known occurrences of protected species within the Belle Meade Area and Main Study Area and **Appendix B** provides brief descriptions of protected wildlife species and their habitat requirements that may be affected by the proposed project and are likely to receive attention during permit application reviews:

Table 4. Collier County Protected Wildlife Species Likely to Occur in the Belle Meade Area

Scientific Name	Common Name	1 Designated Status		2 Comment
		State	Federal	
INVERTEBRATES				
Liguus fasciatus	Florida Tree Snail	SSC		
FISH				
Centropomus undecimalis	Common Snook	SSC		
3.2 Rivulus marmoratus	Mangrove rivulus	SSC		
AMPHIBIANS				
Rana areolata	Gopher (=crawfish) frog	SSC		Habitat requirements not likely in project area
REPTILES				
3.2 Alligator mississippiensis	American alligator	SSC	T-SA	
Caretta caretta	Atlantic loggerhead turtle	T	T	Habitat requirements not likely in project area
Chelonia mydas mydas	Atlantic green turtle	E	E	Habitat requirements not likely in project area
Crocodylus acutus	American crocodile	E	E	
Dermochelys coriacea	Leatherback turtle	E	E	Habitat requirements not likely in project area
Drymarchon corais couperi	Eastern indigo snake	T	T	
Gopherus polyphemus	Gopher tortoise	SSC		Habitat requirements not likely in project area
Lepidochelys kempi	Atlantic ridley turtle	E	E	Habitat requirements not likely in project area
BIRDS				
Ajaia ajaja	Roseate Spoonbill	SSC		
Aphelocoma coerulescens	Florida Scrub jay	T	T	Habitat requirements not likely in project area
Aramus guarauna	Limpkin	SSC		
Athene cunicularia	Burrowing owl	SSC		
Charadrius alexandrinus tenuirostris	Southern snowy plover	T	T	
Charadrius melodus	Piping plover	T		
Egretta caerulea	Little blue heron	SSC		
Egretta rufescens	Reddish egret	SSC		
Egretta thula	Snowy egret	SSC		
Egretta tricolor	Tricolored (=Louisiana) heron	SSC		
Eudocimus albus	White ibis	SSC		
Falco peregrinus tundrius	Arctic peregrine falcon	E		

Scientific Name	Common Name	1 Designated Status		2 Comment
		State	Federal	
Falco sparverius paulus	Southeastern American kestrel	T		
Grus canadensis pratensis	Florida sandhill crane	T		
Haematopus palliatus	American oystercatcher	SSC		
Haliaeetus leucocephalus	Southern bald eagle	T	T	
Mycteria americana	Wood stork	E	E	
Pelecanus occidentalis	Brown pelican	SSC		
Picoides borealis	Red-cockaded woodpecker	T	E	
Polyborus plancus audubonii	Audubon's crested caracara	T	T	Habitat requirements not likely in project area
Rynchops niger	Black skimmer	SSC		
Sterna antillarum	Least tern	T		
Sterna dougallii	Roseate tern	T	T	
MAMMALS				
Eumops glaucinus floridanus	Florida mastiff bat	E		
Felis concolor coryi	Florida panther	E	E	
Mustela vison evergladensis	Everglades mink	T		
Podomys floridanus	Florida mouse	SSC		
Sciurus niger avicennia	Big Cypress (=mangrove) fox squirrel	T		
Trichechus manatus	West Indian (=Florida) manatee	E	E	
Ursus americanus floridanus	Florida black bear	T		

Key to Listed Species Designated Status

E = Endangered
T = Threatened
T(E) = Threatened on State listing, Endangered on Federal listing
T-SA = Threatened due to similarity of appearance
SSC = Species of special concern
Source: *Official Lists of Florida's Endangered Species, Threatened Species, and Species of Special Concern.* Florida Fish and Wildlife Conservation Commission. January 17, 2004.

Table 5. Collier County Protected Plant Species Likely to Occur in the Belle Meade Area

SCIENTIFIC NAME	COMMON NAME	STATE STATUS *	COMMENTS
Acrostichum aureum	Golden Leather Fern	T	
Aeschynomene pratensis	Meadow Jointvetch	E	
Andropogon arctatus	Pine-woods Bluestem	T	
Asplenium erosum	Auricled Spleenwort	E	
Asplenium serratum	American Bird's Nest Fern	E	
Burmannia flava	Fakahatchee Burmannia	E	
Calopogon multiflorus	Many-flowered Grass-pink	E	
Campylocentrum pachyrrhizum	Ribbon Orchid	E	
Campyloneurum angustifolium	Narrow-leaved Strap Fern	E	
Campyloneurum costatum	Tailed Strap Fern	E	
Catopsis berteroniana	Powdery Catopsis	E	
Catopsis floribunda	Many-flowered Catopsis	E	
Catopsis nutans	Nodding Catopsis	E	
Celtis iguanaea	Iguana Hackberry	E	
Chamaesyce cumulicola	Sand-dune Spurge	E	Dune species – not likely present
Cheilanthes microphylla	Southern Lip Fern	E	
Ctenitis sloanei	Florida Tree Fern	E	
Cyrtopodium punctatum	Cowhorn Orchid	E	
Encyclia cochleata var. triandra (now *Prosthechea cocleata)*	Clamshell Orchid	E	
Encyclia pygmaea (now *Proshechea pygmae)*	Dwarf Butterfly Orchid	E	
Epidendrum acunae (now *E. blancheanum)*	Acuna's Star Orchid	E	
Epidendrum nocturnum	Night-scented Orchid	E	
Epidendrum strobiliferum	Pendant Epidendrum	E	
Glandularia maritime	Coastal Vervain	E	
Glandularia tampensis	Tampa Vervain	E	
Gossypium hirsutum	Wild Cotton	E	
Guzmania monostachia	Fakahatchee Guzmania	E	
Huperzia dichotoma	Hanging Clubmoss	E	
*Indigofera mucronata (*now *Indigofera trita subsp. scabra)*	Florida Keys Indigo	E	
Ionopsis utricularioides	Delicate Ionopsis	E	

SCIENTIFIC NAME	COMMON NAME	STATE STATUS *	COMMENTS
Jacquemontia curtissii	Pineland Jacquemontia	T	
Jacquemontia pentanthos	Skyblue Clustervine	E	
Lechea cernua	Nodding Pinweed	T	Scrub species – not likely present
Lechea lakelae	Lakela's Pinweed	E	Scrub species – not likely present
Lepanthopsis melanantha	Tiny Orchid	E	
Linum carteri var. smallii	Carter's Large-flowered Flax	E	
Maxillaria crassifolia	Hidden Orchid	E	
Microgramma heterophylla	Climbing Vine Fern	E	
*Oncidium bahamensis (*now *Tolumnia bahamensis)*	Dancing-lady Orchid	E	
*Oncidium floridanum (*now *Oncidium unsatum)*	Florida Dancing-lady Orchid	E	
Oncidium undulatum	Mule Ear Orchid	E	
Ophioglossum palmatum	Hand Fern	E	
Passiflora pallens	Pinelands passionflower	E	
*Pecluma ptilodon (*var*. daespitosa)*	Swamp plume polypody	E	
Peperomia glabella	Cypress Peperomia	E	
Peperomia humilis	Low Peperomia	E	
Peperomia obtusifolia	Blunt-leaved Peperomia	E	
Pleurothallis gelida	Frost-flower Orchid	E	
*Polyrrhiza lindenii (*now *Dendrophylax lindenii)*	Ghost Orchid	E	
Pteroglossaspis ecristata	Giant Orchid	T	Scrub species – not likely present
*Roystonea elata (*now *R. regia)*	Florida Royal Palm	E	
*Sacoila lanceolata(*includes *S. l.* var*. paludicola)*	Leafy-beaked Ladies'-tresses	T	
Schizaea pennula	Ray Fern	E	
Spiranthes torta	Southern Ladies'-tresses	E	
Stylisma abdita	Scrub Stylisma	E	
Thelypteris reticulata	Lattice-vein Fern	E	Endemic to Collier County in USA
Tillandsia flexuosa	Banded Wild-pine	T	
Tillandsia pruinosa	Fuzzy-wuzzy Air-plant	E	
Trichomanes holopterum	Entire-winged Bristle Fern	E	
Tripsacum floridanum	Florida Gama Grass	T	
Vanilla phaeantha	Leafy Vanilla	E	
Zephyranthes simpsonii	Simpson's Zephyrlily	T	

Sources: Chapter 5B-40.0055, Florida Administrative Code
Notes on Florida's Endangered and Threatened Plants 4th Edition, 2003
Guide to the Vascular Plants of Florida 2nd Edition, 2003

E = Endangered
T = Threatened

* No Federal listing

Figure 5

3.4 Constraints and Potential Opportunities for Resource Management

The location of public lands and conservation easements within the Belle Meade and Main Study Area are shown on **Figure 6**. The following are a list of constraints to resource management of wetland communities within the Belle Meade and Main Study Area that may be considered in the evaluation of alternative design scenarios and regulatory permitting activities for implementation of the Belle Meade Master Stormwater Management Plan:

3.4.1 Constraints

Prescribed burns

Historically, fire was common occurrence in a variety of plant communities. Over the millennia, periodic 'wildfire' and the various plant communities subjected to repeated 'wildfire' have adapted to the cycle, and some species are even dependent on fire for seed propagation and periodic renewal, as is the wildlife that depend on the plant communities for food and shelter. Examples of fire-dependent plant communities may include the pine flatwoods, cypress swamp, and wet prairie (Ewel 1991, FNAI 1990).

The fire-hydrological cycle in south Florida is complex. In response to these complex and variable conditions, a diversity of plant and animal communities has developed, that within themselves are in a constant state of flux as they respond to the changing environment. In order to maintain this diversity periodic fires are necessary, but because of surrounding development, the historic, naturally occurring 'wildfires' is no longer acceptable as a safe management practice. The alternative is a planned or prescribed fire.

Prescribed fire is a valuable management tool. Applied at appropriate times and locations, prescribed fire can enhance and promote recovery and sustainability of desirable fire-dependent species and their habitat. Prescribed fires are carefully planned to burn under the right conditions (fuel moisture, fuel load, temperature, humidity, season, and wind) to produce the desired results whether it is fuel reduction, removal of nuisance plant species, promotion of desired species, or stimulating new growth.

The use of fire, however, entails responsibility for any problems caused by the smoke produced, as well as for the fire itself. Smoke from prescribed fires has caused many serious accidents resulting in property damage, serious injuries, and fatalities. Numerous lawsuits have been initiated as the result of these accidents. Settlements across the state are easily estimated in the millions of dollars. However, good planning and management can reduce the risk of wildfire and smoke. Alternative strategies to prescribed burns may include chemical, mechanical, or grazing methodologies. Each method has benefits and problems associated with it.

Invasive Species Control Efforts

The Florida Exotic Pest Plant Council currently lists 67 species on their Category I Invasive Plant List. Category I plants according to the FEPPC are "Invasive exotics that are altering

native plant communities by displacing native species, changing community structures or ecological functions, or hybridizing with natives." (FEPPC, 2005) During cursory inspections at least 24 of the Category I species have been observed in the Belle Meade watershed in noteworthy quantities.

Limited monetary resources are typically allotted for the control of nuisance species. The limited resources are further diluted by:

- Inability to alter the environmental conditions that favor the nuisance species;
- Long-term viability of nuisance species seeds or ease of plant fragments to propagate new individuals;
- Avifaunal or water-transport seed dispersal mechanisms;
- Constrained access that limits control efforts which may include difficult terrain or private lands surrounding public property;
- Extensive areas of infiltration by the nuisance species;
- Treatment and post-treatment disturbances that favor reinfestation; and,
- Unmanaged lands may act as a nuisance species seed bank for dispersal into adjacent, managed lands

Large Predator Management

Management to promote stable populations of large predatory mammal species without meeting sufficient high quality habitat and range requirements and, coupled with sprawling urban development intruding up to the borders of these managed areas, has and will lead to further human/wildlife interaction. Some of these interactions are negative such as nuisance Florida black bear complaints that are common throughout the state where ever the Florida black bear is found in proximal to human habitation. Regularly, these nuisance complaints are associated with 'dumpster diving' in which the bear has found an alternative food source in the form of refuse. Another important negative impact for the Florida black bear and Florida panther are vehicular strikes that are typified by high speed highways that intersect wildlife habitat, wildlife corridors, or other areas of habitual wildlife congregation.

Multiple Use Conflicts

Public lands are purchased and maintained by public monies, frequently with adamant support from the public-at-large. Yet, public expectations and interests for their public lands may not always be limited to environmental preservation or passive recreation. Many groups seek active recreational activities for these lands such as:

- Hunting
- Fishing
- Paintball
- Off-road recreational vehicles
- Boating
- Horseback riding
- Trail (mountain) bicycling

While yet others view public lands as a place to site regional public facilities such as jails, waste water treatment plants, solid waste disposal facilities, and team sport facilities.

Though many passive recreational activities may be compatible with the strategy outlined in this report some of the activities listed above may not. A holistic management approach and the identification of a "Watershed Facilitator/Coordinator" may be necessary to establish short-term and the long-range goals of the Belle Meade watershed. Initial coordination for this collaborative process would be to develop informal outreach events, public meetings, workshops, advisory committees, formal negotiations, and fact finding task forces.

3.4.2 Opportunities

Mitigation and Restoration
Opportunities are extensive and benefits can be designed to be multi-purpose including; water treatment, water storage, flood attenuation, wildlife habitat, and natural resource-based recreation. These opportunities may include:

Creation

- Traditional excavation and contour grading of low quality uplands, such as fallow agricultural fields; and
- Pump and perched – above grade reservoir filled during rainy season and allowed to bleed down during dry season.

Restoration

- Traditional excavation and contour grading of low quality wetlands; and
- Hydrologic - Ditch blocks/berms installation, berm removal – throughout the Belle Meade Area and Main Study Area. The magnitude of impact on wetland spatial extent and quality would be dependent on upstream development.

Enhancement

- Invasive species eradication; and
- Enhancement planting.
-

Other

- Less than fee simple dedication to agencies or not-for-profit conservation groups;
- Strategic Habitat Conservation Plans;
- Conservation Easements;
- Contributions (money, services, other resources) to Land Acquisition or Restoration Programs;
- Mitigation Banks; and
- Co-location of mitigation areas with private development.

Figure 6

3.4.3 Existing Permit Encumbrances

Most of these encumbrances will be the direct result of issuance of a local, State, or Federal permit and are typically within the platted boundaries of an existing or proposed development. **Figure 7** identifies the Environmental Resource Permit (ERP) and Dredge and Fill sites within the Belle Meade Area and Main Study Area. Existing permits (including required mitigation) conditions and the associated approved plans may be modified to accommodate new development and/or mitigation design and restoration proposals. The Rookery Bay Advanced Identification of Wetlands Technical Summary Document recommended the use of the Hydrogeomorphic Functional Assessment Methodology (or equivalent assessment methodology) to evaluate impacts to Category I Wetlands during the Federal permitting process. Wetlands in the Belle Meade Area are predominantly Category I Wetlands. Currently, the State requires the use of the Unified Mitigation Assessment Method for all wetland impacts associated with regulatory permitting. The USACE has also adopted this methodology for purposes of Section 404 permitting.

Figure 7

4.0 WETLAND FLOWWAYS INVENTORY

Historic, Pre-Development and currently existing flowways were identified in the Belle Meade Area and Main study Area. Existing flowway corridors are overlaid on aerial photographs in **Figures 3.1 to 3.4**. The identification of flowway 'channels' or 'corridors' rather than flowway 'basins' through the landscape affords an opportunity compare and contrast the north to south migration of water through the historic and current, altered landscape. Further, it provides a path by which existing remnants of historic basins may be reconnected.

4.1 Methods for Planning-level Wetland Flowway Identification

The methodology used to establish historic and existing flowway corridor locations in the Belle Meade and Main Study Area included a combination of GIS overlay analysis using land use and other databases and aerial photo-interpretation. The flowway corridor locations were furthered refined through field verification.

4.2 Overlay Analysis

The historic flowway corridor in the project vicinity was a near continuous sheet flow across almost the entire Belle Meade Area. Mapping the historic flowway would result in a single polygon stretching from project boundary to project boundary with perhaps several upland islands of mesic flatwoods. Even these islands had multiple, smaller flows cut through them. Given present-day land use trends, re-establishment of the expansive, historic flowway is not likely. The term flowway corridor was established to identify the deeper, discrete portions of the historic flowway.

The identification of flowway corridors rather than flowway basins through the landscape affords an opportunity to compare and contrast the north to south migration of water through the historic and current, altered landscape. Further, it provides a path by which existing remnants of historic basins may be reconnected.

Composite layers of available resources were evaluated in various combinations to create historic flowway corridors including: hydric soil map units, the 1943 *Vegetation Map of Southern Florida* by John Davis, the *Pre-Development Vegetation Map of Lee and Collier Counties*, the 1996 *Rookery Bay Advanced Identification of Wetlands Project* (ADID), and historic accounts of area hydrology. These resources, alone or in combination, were determined to be inadequate to depict the corridor concept. During background research for the project 1940 black and white aerial imagery of Collier County that was encountered. It was concluded that in conjunction with hydric soil maps, this aerial imagery was the ideal information to depict historic flowway corridors. As indicated previously, this effort portrays the approximate centerline of the deeper, more obvious sheet flow signatures.

The existing or current flowway corridors were established with the 2003 Collier County color aerial imagery and collaborated with hydric soil maps, the 1940 aerial imagery, the 1999 DOQQs, and Collier County drainage maps.

4.3 Aerial Photo-interpretation

The 1940 imagery initially required georeferencing, which was performed in ArcMap ver. 8.3 using the US 41/Henderson Creek intersection as a reference point that was present in both existing and historic imagery. Once the approximate location of 1940 image was established using this reference point it was further refined (rubber sheeted) by correlating the boundaries of plant community aerial signatures on the aerial to the same outline produced by the digitized soil map polygons. Subsequent aerial images were pasted to the first using the same rubber sheet method to create the final mosaic.

Dark aerial signatures are usually synonymous with wet areas and these signatures were the basis of identifying both the historic and existing flowway corridors. Due to the low resolution of the 1940 imagery this typical signature did require verification with soil maps to ensure the dark signature of a heavily forested upland area was not mistakenly mapped as a flowway. Flowways for the historic and existing condition were mapped starting at the discharge point and working upstream. In some current situations the flowway was lost in the altered or developed landscape. In these situations the upstream flowways were mapped southward in order to meet somewhere in the middle. For ambiguous flowway corridors, any combination of the 1940 aerials, LiDAR maps, and soil maps may have been used to create logical connections. To maximize opportunities for flowways identification and restoration, a number of ditches/canals were mapped as flowway corridors in the existing condition. An emphasis was placed on those ditches/canals that were, or adjacent to a mapped historic flowway channel. As was sometimes the case, this situation was not always present and flowway corridor was mapped through historic/existing uplands in order to make a connection.

4.4 Field Survey Verification

Most of the field verification involved identifying connection points (culverts) for flowway corridor continuity. A subset of these field verification points was not created.

4.5 Referenced Metadata

Each of the GIS shapefiles has an associated metadata file that defines and describes the information contained in the GIS shape file. **Appendix A** includes the metadata and accuracy, where available, for the inventory of historic and existing flowway corridors in the Belle Meade Area and Main Study Area; however, it also includes metadata not associated with wetlands and flowways or the collateral files used to create the wetland/flowway shape files, but are a part of the overall project deliverables. Sources may have included the FWC, Florida Department of Environmental Protection's Land and Boundary Information System, United States Fish and Wildlife Service, and the University of Florida's Florida Geographic Data Library (FGDL). Accuracy of the data, if provided, is referenced in the metadata files.

5.0 Wetland Flowways Results

5.1 Geographic Location

In the Main Study Area (**Figures 3.1 to 3.4**), only two significant flowway corridors remain in the existing condition: 1) the contiguous corridor that runs southwesterly from the south side of I-75 to the Henderson Creek/CR 951 bridge junction (West Main Study Area), and 2) the disjunctive basin with a south-southeast flow stretching from the east side of Sabal Palm Road to southeast corner of the Main Study Area (East Main Study Area Flowway Corridor). There are no contiguous flowway corridors from the north to south end of the Belle Meade Area.

5.2 Opportunities for Flowway Corridor Enhancement and/or Restoration

Besides the two existing flowway corridors described above, one noteworthy flowway corridor was identified (Central MPA Flowway, CMPAF). Although a large number of other feasible corridors remain, the CMPAF consists of a large, north-south canal/ditch bisecting the extensive agricultural area of the Main Study Area. A portion of this existing flowway corridor includes adjacent existing wetland communities and is interconnected at several of the east-west agricultural ditch networks.

REFERENCES

Climate

Winsberg, Morton, D. 1990. Florida Weather. University of Central Florida Press. Orlando, Florida. 171 Pp.

Soils

Brown, Randall B., Earl L. Stone, and Victor W. Carlisle. 1991. "Soils." Ecosystems of Florida. Orlando: University of Central Florida Press. Pages 35-69.

Carlisle, V. W., et al. 1995. Hydric Soils of Florida Handbook. Florida Association of Environmental Soil Scientists, Gainesville, Florida. 409 Pp.

Luidahl, K., D. J. Belz, L. Carey, R. W. Drew, S. Fisher, and R. Pate. 1998. Soil Survey of Collier County Area, Florida. USDA Natural Resources Conservation Service. 152 Pp.

Vegetation

Chafin, L. G., J. C. Putnam Hancock, G. Nelson. 2000. Field Guide to the Rare Plants of Florida. Walsworth Publishing Company, Brookfield, Missouri. 448 Pp.

Duever, M.J. 1984. Environmental factors controlling plant communities of the Big Cypress Swamp. Pages 127-137 in Environments of South Florida: Past and Present II. P.J. Gleason (Ed.). Miami Geological Society, Coral Gables, Florida.

Florida Department of Agriculture and Consumer Services. 2003. Notes on Florida's Endangered and Threatened Plants, 4th Edition. 122 Pp.

Florida Department of Transportation. 1999. Florida Land Use, Cover and Forms Classification System, Third Edition. 91 Pp.

Godfrey, Robert K. and Jean W. Wooten. 1979 Aquatic and Wetland Plants of Southeastern United States Monocotoledons. The University of Georgia Press Athens, Georgia.

Godfrey, Robert K. and Jean W. Wooten. 1979. Aquatic and Wetland Plants of Southeastern United States Dicotoledons. The University of Georgia Press. Athens, Georgia.

Myers, R.L. and J. J. Ewel. 1991. Ecosystems of Florida. University of Central Florida Press. Orlando, Florida. 765 Pp.

Rookery Bay National Estuarine Research Reserve. 1996. Rookery Bay Advance Identification of Wetlands Project. 217 Pp.

SFWMD. 1999-2000. Florida Land Use, Cover and Forms Classification System. Internet resources (http://www.sfwmd.baymont.com).

SFWMD. 2003. Southern Golden Gate Estates Watershed Planning Assistance Cooperative Study. 84 Pp.

SFWMD. 2004. Pre-Development Vegetation Map (shapefile database, developed by Mike Duever)

U.S. Fish and Wildlife Service. 1999. South Florida Multi-species Recovery Plan. Atlanta, Georgia. 2172 Pp.

Wunderlin, Richard P. 2003. Guide to the Vascular Plants of Florida, 2nd Edition. University Press of Florida. Gainesville, Florida. 787 Pp.

Wunderlin, R. P., and B. F. Hansen. "Atlas of Florida Vascular Plants" 2003. Internet resources (http://www.plantatlas.usf.edu).

Wildlife

Florida Fish and Wildlife Conservation Commission. January 2004. Florida's Endangered Species, Threatened Species and SSC, official lists. 6 Pp.

Florida Fish and Wildlife Conservation Commission. 2002. Selected GIS Data Layers. Compact Disk.

Florida Geographic Data Library. 2003. Download Links. Internet Resource (http;//www.fgdl.org).

Hipes, D., D. R. Jackson, K NeSmith, D, Printiss, K. Brandt. 2001. Field Guide to the Rare Animals of Florida. Walsworth Publishing Company, Brookfield, Missouri. 213 Pp.

APPENDIX A

APPENDIX B

Protected Wildlife Species in the Belle Meade Area

Florida panther (*Felis concolor coryi*)
The Florida panther is listed as an endangered species by both the FWS and the FWC. The Belle Meade Area and Main Study Area are located within the Florida Panther Standard Local Operation Procedures (SLOPES) panther consultation area as well as in identified Primary Panther Zone habitat. Extensive forested and non-forested habitats exist in the project boundaries and are contiguous to critical panther habitats east of the project. Panther telemetry data obtained from the FWC GIS database for the time period between 1990 and 2003 indicates panther activity has occurred in both the Belle Meade Area and Main Study Area. A documented panther/vehicle incident occurred near Sabal Palm Drive and CR 951. The female panther was injured, but not killed in this incident.

Everglades mink (*Mustela vison evergladensis*)
The Everglades mink is listed by the FWC as threatened. It is not currently listed by the FWS. According to readily available resources this species has not been documented in the Belle Meade Area, but suitable habitat may exist.

Big Cypress fox squirrel (*Sciurus niger avicennia*)
The Big Cypress fox squirrel is listed by the FWC as threatened. It is not currently listed by the FWS but is under review for federal listing, including designated critical habitat. According to readily available resources this species has not been documented in the Belle Meade Area, but suitable habitat may exist.

Florida manatee (*Trichechus manatus latirostris*)
The Florida manatee is listed as endangered by both the FWS and the FWC. Although unlikely to be directly impacted by the proposed project, any alteration to the quantity, quality, or timing of water delivery to areas proximal to manatee habitat will be evaluated by wildlife regulatory agencies. There have been seven manatee deaths documented in Henderson Creek upstream of the CR 951 bridge in the last 20 years (2000 data).

Florida black bear (*Ursus americanus florid*anus)
The Florida black bear is designated as threatened by the FWC, but is not federally listed. Information on the occurrence of Florida black bears in the project area provided by the Bear Management Section of the FWC between 1976 and 2003 indicates activity throughout the Belle Meade Area. Bear nuisance complaints are sporadic throughout the urbanizing portions of the area. Nine black bear road kills have occurred on I-75 within the boundaries of the Belle Meade Area.

Wading birds
The limpkin (*Aramus guarana*), white ibis (*Eudocimus albus*), little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*), and the tricolored heron (*Egretta tricolor*) are not listed as protected by the USFWS, but are listed by the FWC as species of special concern. The

nearest recorded wading bird rookery is approximately 3 miles west of the Main Study Area in the Rookery Bay National Estuarine Research Preserve (RBNERP). Adverse project impacts to these species are not anticipated due to the very minor extent of anticipated impacts to the habitat, abundant adjacent habitat, and the high motility of these species.

Southeastern American kestrel (*Falco sparverius paulus*)
The Southeastern American kestrel is a small raptor currently listed as threatened by the FWC. While no documented nests exist within the project, suitable foraging and nesting habitat exist within the Belle Meade Area. Adverse project impacts to this species are not anticipated due to the very minor extent of anticipated impacts to the habitat, abundant adjacent habitat, and the high motility of the species.

Florida sandhill crane (*Grus canadensis pratensis*)
The Florida sandhill crane is listed as threatened by the FWC, but remains unlisted by USFWS. While no documented Florida sandhill crane nests exist within the project, suitable foraging and nesting habitat exist within the Belle Meade Area. Adverse project impacts to this species are not anticipated due to the very minor extent of anticipated impacts to the habitat, abundant adjacent habitat, and the high motility of the species.

Southern bald eagle (*Haliaeetus leucocephalus*)
The southern bald eagle is listed as threatened by both the FWS and the FWC. Data obtained from the FWC 2003 Eagle Nest GIS Database indicates that the closest documented active bald eagle nest to the Main Study Area is located approximately 1500 feet south (Nest #CO013 in Section 19, Township 51 South, Range 27 East [2003 FWC data]). Another active nest is located approximately 3 miles north of the Main Stud Area in Section 6, Township 50 South, and Range 27 East.

Wood stork (*Mycteria americana*)
The wood stork is listed as endangered by both the FWS and the FWC. There is no documented wood stork nesting colonies located within the Belle Meade Area or Main Study Area. However, the project is within the core foraging area (CFA) of these colonies (18.6 miles) and wetland habitats impacted by the project potentially utilized by this species for foraging will require provisions to reduce or minimize impacts to the greatest practicable extent. One wood stork colony is located approximately 13 miles north east of the Main Study Area, another two (2) colonies are located approximately 10 miles and 11 miles north of the Belle Meade Area.

Red-cockaded woodpecker (*Picoides borealis*)
The red-cockaded woodpecker (RCW) is currently listed as endangered by the FWS and species of special concern by the FWC. One important note is that the status of the RCW has been recently down listed by the FWC from threatened to a species of special concern. Available foraging habitat includes older pine habitats and in South Florida, hydric pine flatwoods contiguous to and within a 0.5-mile radius of the center of a colony. One observation (not a colony) has been documented in the MPA adjacent to CR 951 approximately 4,000 feet south of Sabal Palm Drive. Eight more sightings have been documented in an area of flatwoods north of

Blackburn Road and east of Inez Road. Another three observations have been documented approximately 1 mile east of CR 951 just north of I-75.

Everglade snail kite (*Rosthrhamus sociabilis plumbeus*)
The snail kite is listed as endangered by both the USFWS and FWC. The primary food source of snail kites is the Florida apple snail (*Pomacea paludosa*). Limited natural snail habitat exists within the Belle Meade Area. However, sections of all canals and ditches within any proposed impact area should be evaluated for the presence of apple snails during the planning and permitting process.

American alligator (*Alligator mississipiensis*)
The American alligator is listed by the FWS as threatened due to its similarity of appearance to the American crocodile and listed by the FWC as a species of special concern. Adverse project impacts to this species are not anticipated due to the very minor extent of anticipated impacts to the habitat, abundant adjacent habitat, and the high motility of the species.

American crocodile (*Crocodylus acutus*)
The American crocodile is listed as endangered by both the FWS and the FWC. Although the crocodile is a species often associated with saline and oligohaline waters this reptile may be found in freshwater areas several miles inland and may occur in the Main Study Area.

Eastern indigo snake (*Drymarchon corais couperi*)
The eastern indigo snake is listed by both the FWS and the FWC as threatened. Although the eastern indigo snake has not been documented in the Belle Meade Area, suitable habitat exists and therefore, it could potentially occur. Adverse project impacts to this species are not anticipated due to the very minor extent of anticipated impacts to the habitat, abundant adjacent habitat, and the high motility of the species.