Technical Memorandum

To: Mac Hatcher, PM Collier County

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Date: December 9, 2010

Re: Watershed Model Update and Plan Development
Contract 08-5122, PO 4500106318
Element 1, Task 3.2 Functional Assessment
Element 3, Task 7 Natural Systems Performance Measures

1.0 Objective

This Technical Memorandum addresses Element 1, Task 3.2: Functional Assessment and partially addresses Element 3, Task 7: Natural Systems Performance Measures. The primary objective of this task is to described the methodology used to assess the natural systems existing conditions in the six Collier County watersheds:

- Cocohatchee-Corkscrew
- Golden Gate-Naples Bay
- Rookery Bay
- Faka Union
- Okaloacoochee/SR 29
- Fakahatchee

In addition to ecological functional assessment, this task includes analysis of potential hydrological storage on undeveloped lands and summary of non-native invasive vegetation coverage in these watersheds.

2.0 Introduction

This Technical Memorandum summarizes the development and application of a landscape-level functional assessment method that will be used to determine the ecological value of existing conditions in the six County watersheds. This method will also be utilized as ecological-based performance measures for the evaluation of proposed restoration projects. In addition to the development and application of an ecological functional assessment method, this memorandum presents two additional analyses: estimated ecological capacity for additional water storage on undeveloped lands, and coverage of non-native invasive species. These additional data sets, though not utilized directly for the functional assessment method, provide related information that may be used to further assess watershed conditions. Results of the functional assessment and the other two sets of data include an overview of the watersheds' existing functional value and identification of areas within each watershed where projects are most likely to result in improved functional values.

3.0 Methodology

The Uniform Mitigation Assessment Method (UMAM, Chapter 62-345 Florida Administrative Code) served as a template from which to design the functional assessment method for this project, due to the widespread use and acceptability of UMAM for ecological assessment. Modifications from UMAM were necessary in order to implement the functional assessment at the watershed level for this project, rather than the site-specific level for which UMAM was designed. The overall concepts and design, however, remain similar to UMAM. The methods of analysis for the other items (hydrological storage and non-native invasive vegetation) are described after the functional assessment methodology.

Similar to UMAM, the optimal condition for this functional assessment is defined in terms of the landscape position, vegetation, and hydrology of the ecological community in a targeted reference condition. Scores are assigned via indices based on the degree of ecological change between the reference condition and existing condition. In accordance with UMAM procedures, a score of 10 for existing condition is appropriate where a site retains optimal value (100 percent of the value compared to the reference condition), 7 for moderate value (70 percent of the value compared to the reference condition), 4 for minimal value (40 percent of the value compared to the reference condition), 0 for no value, and other whole-number scores between 1 and 9 as appropriate.

Due to the overall goal of developing a method primarily applicable at the watershed level, as well as the regional characteristics of this analysis, the method exclusively relies on available GIS data to determine functional value. The results presented herein should therefore be utilized only for watershed-level assessment rather than as a substitute for on-site analysis typically required for permitting purposes. Towards the objective of watershed-based assessment consistent with MIKE SHE modeling, this functional assessment is applied to 1500 x 1500 ft cells based on their predominant land use.

An initial element of the functional assessment method consisted of establishing reference conditions, similar to the Part I "frame of reference" proscribed in UMAM. Discussions with Collier County staff, other agencies, and non-profit conservation organizations led to the conclusion that the data set which best defines the reference condition for this project area is the pre-development vegetation map (PDVM) developed for the Southwest Florida Feasibility Study (Duever, 2004). This data layer, more thoroughly described in the Technical Memorandum for Reference Period Comparison (Element 1 Task 3.1), consists of a seamless five-county map (including Collier County) of fifteen vegetation associations defined by common vegetative composition and hydrological characteristics, in approximately the locations where they would have occurred prior to development.

The functional assessment method developed for this project consists of three independent indices, each of which includes a specific method for evaluating the current condition of a cell in comparison to its reference condition:

- Vegetation Score
- Hydrological Score
- Landscape Suitability Index (LSI)

The vegetation score evaluates the ecological functions of the cells' current vegetation species, stratum (e.g., forested vs. herbaceous), and type of ecosystem (e.g., upland vs. wetland) in comparison to the PDVM community previously present in that cell. UMAM evaluates this set of characteristics in a parameter known as Community Structure. The vegetation scoring method developed for this project evaluates these characteristics via comparison between 2007 FLUCCS data and the PDVM. The Technical Memorandum for Task 3.1 (Reference Period Comparison) included analysis of land use changes, and the results of that analysis are incorporated into the vegetation scoring method for this project. The vegetation scoring method is described in greater detail in Section 3.1 below.

The hydrology score evaluates the ecological effects of depth and duration (hydroperiod) of inundation. The hydrological scoring method developed for this project assigns values by comparing existing modeled hydrology and PDVM conditions. Areas whose existing hydrological conditions are within the normal range of the pre-development vegetation community in that location receive high hydrology scores, while areas dryer than PDVM conditions receive lower scores. The hydrology scoring method is further described in Section 3.2 below.

The LSI, unlike the hydrology and vegetation scores, measures the ecological effects of adjacent lands rather than conditions within the site itself. The LSI represents the degree to which adjacent lands provide or inhibit ecological connectivity, buffers, and corridors. Higher scores occur in areas surrounded by natural lands or other lands conducive to wildlife passage, while lower LSI scores occur in areas surrounded by land uses that serve as barriers. For instance, even a natural preserve area would receive a low LSI score if surrounded by commercial land uses, while a parcel with otherwise poor ecological conditions could receive a high LSI score if surrounded by pasture or natural areas. The LSI is based on peer-reviewed work published by researchers at the University of Florida during the development of UMAM. The LSI is described in greater detail in Section 3.3 below.

3.1 Vegetation

Vegetation scoring generally represents the functional value of a parcel of land based on the degree to which the parcel retains natural vegetation. A cell that has experienced large change from pre-development vegetation (i.e., to a developed land use) would receive low scores, while little or no change in vegetation cover (i.e., same as pre-development, or shift to another natural vegetation classification) would result in a high score. The vegetation scoring method also reflects the value of certain developed land uses for local sensitive wildlife species (e.g., relatively high score for pasture due to utilization by Florida panther, burrowing owl, gopher tortoise, and Audubon's crested caracara).

The vegetation scoring method is summarized in the following bullets and **Table 1**:

- Polygons whose existing FLUCCS designation indicates the same dominant vegetation or natural water body as in the PDVM (e.g., hydric flatwoods pre-development and existing) received a score of 10;
- Polygons that retained the same dominant stratum and ecosystem type (e.g., freshwater forested wetland to freshwater forested wetland) also received a score of 10;
- Polygons that shifted from one dominant stratum to another but retained the same ecosystem type (e.g., freshwater forested wetland to herbaceous freshwater wetland) received a score of 8;
- A shift between mesic to hydric flatwoods or vice-versa received a score of 8;
- Vegetation that shifted between natural ecosystem types and stratum (e.g., herbaceous freshwater wetland to forested native upland or natural water body) received a score of 8;
- Polygons that have been converted to an artificial water body received a score of 6;
- A natural system that has been converted to a developed land use class is scored as shown in **Table 1**.

Table 1. Vegetation Score for Developed Lands

Model Land Use Type	MIKE SHE Model Code	FLUCCS Code	Vegetation Score
Citrus	1	221, 222, 223	4
Pasture	2	211, 212, 213, 251, 260, 261, 832	6
Pasture	2	190,192, 193 (urban abandoned)	1
Sugar Cane & Sod	3	2156, 242	4
Truck (Row) Crops	5	214, 215, 216	4
Golf Course	6	180, 182	1
Bare Ground	7	161, 162, 163, 164, 181, 231, 740, 743, 744, 8113, 8115, 835	0
Urban Low Density	41	110, 111, 112, 113, 119, 148, 185, 240, 241, 243, 250	1
Rural Residential Low Density	41	118	3
Urban Medium Density	42	120, 121, 122, 123, 129, 176, 834	1
Urban High Density	43	130, 131, 132, 133, 134, 135, 139, 140, 1411, 1423, 146, 149, 154, 155, 156, 170, 171, 183, 184, 187, 252, 810, 811, 814, 820, 831, 833	0

Results of the vegetation scoring methodology are displayed graphically in **Figure 1**, and numerically by WBID in **Table 5**.

3.2 Hydrology

Similar to the approach used for assessing the vegetation functional value, hydrology scoring represents the functional value of a parcel of land based on the degree to which the parcel retains the same hydrological characteristics as its pre-development reference condition. Pre-development hydrological conditions are estimated based on the typical range of depth and duration (hydroperiod) of inundation of the vegetation community present on the PDVM per **Table 2**. No change from pre-development would result in a score of 10, while total loss of hydrology (e.g., a cell dominated by a pre-development wetland or open water body but which now experiences no inundation) would result in a score of 0. Current average depth and hydroperiod were determined from the MIKE SHE/ MIKE 11 model developed for this project. As with the vegetation scoring method, the hydrology score was applied to the 1500 x 1500 ft model cells.

The hydrology score for a parcel is based on the ratio of the existing depth and duration in comparison to the reference condition, adjusted to a scale of 0 to 10. For instance, a site whose reference hydrological condition is an average hydroperiod of 6 months and an average inundation of 12 inches, but which currently is inundated for only 2 months at an average depth of 4 inches (i.e., the site currently experiences one-third of the depth and duration of the reference condition for that site), would receive a hydrology score of 3.3.

The reference condition for hydrological scoring is dependent on whether the existing plant community remains in the same plant/hydrological class as in the PDVM, per **Table 2**. Where the plant community currently dominating a cell is different than it was in the PDVM, the hydrological reference condition is the minimum depth and hydroperiod typical of the PDVM plant community. In cells with the same existing vegetation class as PDVM, the hydrological reference condition is the maximum depth and hydroperiod typical of the plant community. The hydrology score is the average of the depth and hydroperiod scores.

Due to a wide range of hydroperiod and depth of inundation for mangroves and salt marshes, no specific standards were established for these systems in **Table 2,** but a hydrology score of 8 was globally assigned.

The overall hydrology scoring approach allows for a single score to be developed for each cell. Also for its use as a performance measure for proposed project evaluations, it differentiates between the hydrologic "lift" associated with projects that could enhance a particular wetland type without altering it (e.g., hydric flatwoods that will become wetter through project implementation) versus projects that would likely convert the site's vegetation to achieve the PDVM vegetation community (e.g. wet prairie that would be rehydrated to achieve pre-development freshwater marsh hydrology).

The basic formulae used in calculating the hydrology scores are:

- If PDVM vegetation = FLUCCS vegetation, then Score = (Model Hydro/Max PDVM Hydro)*10
- If PDVM vegetation <> FLUCCS vegetation, then Score = (Model Hydro/Min PDVM Hydro)*10
- Tidal marshes and mangroves = 8
- Combined Hydrology Score = (hydroperiod + depth)/2
- Recognizing that a score of 10 represents target conditions, all scores greater than 10 were set to 10. In these formulae,

Where:

"Model Hydro" is a cell's average depth or hydroperiod in the MIKE SHE/MIKE 11 model;

"Max PDVM Hydro" or "Min PDVM Hydro" is the top or bottom value, respectively, of the typical average range of depth or hydroperiod for a vegetation community, as estimated in **Table 2**.

Figure 2 and **Table 6** display the results of the hydrology scoring method.

Table 2. Hydrologic Regimes of Major Southwest Florida Plant Communities (from Duever, pers. comm.)

SW Florida Plant Communities	Hydroperiod (months)	Seasonal Water Level (inches)	
		Wet	Dry (1,10)*
Xeric Flatwood	0	≤-24	-60, -90
Xeric Hammock			
Mesic Flatwood	≤1	≤2	-46, -76
Mesic Hammock			
Hydric Flatwood	1 - 2	2 – 6	-30, -60
Hydric Hammock			
Wet Prairie	2 - 6	6 – 12	-24, -54
Dwarf Cypress			
Freshwater Marsh	6 - 10	12 - 24	-6, -46
Cypress	6 - 8	12 - 18	-16, -46
Swamp Forest	8 - 10	18 - 24	-6, -36
Open Water	>10	≥24	< 24, -6
Tidal Marsh	Tidal	Tidal	Tidal
Mangrove			
Beach			
* 1 = average year low water 10 = 1 in 10 year drought			July 2002

3.3 Landscape Suitability Index (LSI)

The scoring system used for this project to assign value to landscape position is known as the Landscape Suitability Index (LSI), developed by the Center for Wetlands at the University of Florida (UF) (Bardi et al; Reiss et al, 2009; Brown and Vivas, 2005). As mentioned previously, the LSI represents the degree to which a parcel supports the ecological functions of adjacent parcels. For instance, high-density urban development surrounding a parcel would substantially inhibit wildlife access and utilization, resulting in a low LSI score; while natural or agricultural lands surrounding that same parcel would provide access corridors and buffers for a variety of species, resulting in a high LSI score.

Initially, each 1500 x 1500 ft cell was assigned a dominant vegetation FLUCCS code. Each FLUCCS code was then assigned an LSI coefficient representing the degree to which that land use supports the ecological functions of adjacent lands, per **Table 3**. (In some instances, this required interpretation to determine which land use/land cover description in **Table 3** best matches a FLUCCS code).

The LSI score for each cell was calculated as the average LSI coefficient of the eight adjoining cells. The land use within a cell itself does not enter in the calculation of its LSI score because the focus of this index is to determine the effects of adjacent land uses, rather than internal characteristics. Results are presented graphically in **Figure 3** and summarized numerically by WBID in **Table 7**. Due to the focus on identifying and evaluating potential projects, no LSI scores were generated for cells dominated by urban land uses.

Table 3. Landscape Suitability Index Coefficients for Land Use/Land Cover Classes in Florida (from K. Reiss, pers. comm.)

Land Use/Land Cover	LSI Coefficients
Natural System	10.00
Natural Open water	10.00
Pine Plantation	9.36
Recreational / Open Space (Low-intensity)	9.08
Woodland Pasture (with livestock)	8.87
Pasture (without livestock)	8.03
Low Intensity Pasture (with livestock)	7.32
Citrus	7.02
High Intensity Pasture (with livestock)	6.96
Row crops	6.07
Single Family Residential (Low-density)	3.57
Recreational / Open Space (High-intensity)	3.42
High Intensity Agriculture (Dairy farm)	3.33
Single Family Residential (Med-density)	2.81
Single Family Residential (High-density)	2.72
Mobile Home (Medium density)	2.56
Highway (2 lane)	2.43
Low Intensity Commercial	2.22
Institutional	2.14
Highway (4 lane)	1.91
Mobile Home (High density)	1.90
Industrial	1.87
Multi-family Residential (Low rise)	1.49
High Intensity Commercial	0.91
Multi-family Residential (High rise)	0.90
Central Business District (Average 2 stories)	0.64
Central Business District (Average 4 stories)	0.00

4.0 Results and Discussion

The functional assessment scores for the three parameters are summarized in **Figures 1 through 3. Table 4** summarizes the overall acreage-weighted average functional value of non-urban lands within each watershed, by parameter. **Tables 5 through 7** show detail vegetation, hydrology and LSI scores by watershed. **Tables 8 through 10** show corresponding scores by WBID.

The overall average results indicate that the eastern watersheds (FakaUnion/Okaloacoochee SR29/Fakahatchee) retain the highest functional value, followed by Rookery Bay, then Cocohatchee-Corkscrew, with the Golden Gate-Naples watershed retaining the least ecological functional value. More-detailed analyses of the results for each watershed are provided in Sections 4.1 through 4.4 below.

Table 4. Average Functional Values of Non-Urban Lands, by Watershed

Watershed	Non-Urban Acres	Average Vegetation Score	Average Hydro Score	Average LSI Score
Cocohatchee-Corkscrew	111,250	7	7	8
Golden Gate-Naples	36,627	5	6	6
Rookery Bay	83,105	8	6	9
FakaUnion/ Okaloacoochee SR29/ Fakahatchee	431,414	9	6	9

Hydrological storage capacity and coverage of non-native invasive species are summarized in **Figures 4 through 7** and **Tables 9 and 10**.

4.1 Cocohatchee-Corkscrew Watershed

The functional assessment of the non-urban portions of the Cocohatchee-Corkscrew Watershed (see **Figures 1 through 3**) reveals trends in two distinct areas: the central part of the watershed just east of Corkscrew Swamp system maintains a high functional value in all three parameters, while the northern and eastern portions dominated by non-pasture agricultural lands retain relatively high hydrology and LSI scores and moderate vegetation scores. The LSI remains high (seven or greater) throughout the non-urban portion of the watershed due to natural and agricultural land uses. Vegetation and hydrology scores are somewhat lower due to conversion to agricultural uses.

The distribution of vegetation scores (**Figure 1**) reflects conversion of natural habitat other than within the Corkscrew Swamp system. Just over 30 percent (over 36,000 acres) of this watershed has a vegetation score of 4 or less, resulting primarily from the loss of most of the mesic and hydric flatwoods (as documented in the Technical Memorandum for Task 3.1 Reference Period Comparison). WBID 3278F (Corkscrew Marsh) retains the highest vegetation scores, with nearly 65 percent (just under 34,000 acres) of total area of that WBID scoring 8 or higher. At the low end, just 5 percent of WBID 3259Z (Little Hickory Bay) is comprised of non-urban land with a vegetation score of 8 or higher (**Table 5**), and over 15 percent of WBID 3278D (Cocohatchee – Inland Slough) has a vegetation score of 3 or lower.

Hydrology scores in the Cocohatchee-Corkscrew Watershed reflect existing conditions similar to PDVM depth and duration throughout much of the agricultural lands, and dryer-than-PDVM conditions in the vicinity of Corkscrew Swamp. For example over 55 percent (nearly 5,000 acres) of WBID 3278L (Immokalee Basin) has a hydrology score of 10, while only 35 percent (just under 5,000 acres) of WBID 3278F scores that high (**Table 6**). The lowest hydrology scores occur in WBID 3278D, with nearly 65 percent (over 9,000 acres) of the non-urban portion of that WBID comprised of lands scoring 5 or less.

LSI scores (**Table 7**) reflect natural lands surrounding Corkscrew Marsh, Lake Trafford, and coastal mangroves. Nearly 80 percent (nearly 80,000 acres) of the non-urban portion of Cocohatchee-Corkscrew Watershed has an LSI of 8 or greater. The largest portion of this high-LSI area (over 40,000 acres) occurs in WBID 3278F (Corkscrew Marsh). The lowest-scoring area, WBID 3278L (Immokalee Basin), is dominated by agricultural lands with moderately-high LSI values, with over 3500 acres (approximately 40 percent) scoring 6 or 7, and most of the rest scoring higher.

Reviewing the results, the greatest opportunities for improvement of ecological value occur within WBIDs 3278D and 3278F. These portions of the watershed contain over 10,000 acres with a hydrology score of 4 or lower, indicating significant potential for ecological improvement due to hydrological restoration. WBID 3278F, with a relatively higher extent of compatible land uses based on LSI and vegetation scores, presents greater potential opportunity for wildlife to benefit from hydrological restoration.

The western portion of this watershed was not evaluated for restoration potential, due to the prevalence of urban lands that restrict the feasibility of ecological benefit from hydrological restoration projects.

4.2 Golden Gate-Naples Bay Watershed

Nearly 60 percent (over 50,000 acres) of the Golden Gate-Naples Bay watershed is urban land not suitable for ecological restoration (**Tables 5-7**). The analysis of current condition and restoration projects is focused on the remaining non-urban portion of this watershed. Overall, even the non-urban areas have relatively low ecological value, with an average vegetation score of 5 and hydrology and LSI scores of 6 (**Table 4**).

The area with the highest relative functional value is WBID 3278S (Northern Golden Gate Estates). Reflecting the relatively less-developed land uses in this portion of the watershed, just over 20 percent of this WBID (approximately 15,000 acres) has vegetation scores of 8 or higher, 15 percent (11,000 acres) has a hydrology score of 10, and just over 25 percent (approximately 19,500 acres) has an LSI score between 5 and 7.

Overall, this watershed presents relatively few opportunities for large-scale improvement in ecological value. Urban and suburban development throughout the watershed limits the degree to which restoration projects would improve functional values beyond the footprint of the project itself. In relation to other portions of the watershed, the eastern portion of WBID 3278S (Northern Golden Gate Estates) presents the greatest opportunity for ecological restoration. The relatively less-developed land uses in this portion of the watershed may allow restoration projects to improve ecological values on a wider scale.

4.3 Rookery Bay Watershed

The functional assessment values of this watershed reflect low scores in the portions of the watershed surrounding Belle Meade and Tamiami Trail, but overall relatively higher functional values than in the other two primary watersheds, with a watershed-wide average LSI score of 9 and average vegetation score of 8 (**Table 4**). This is primarily because less than 30 percent of the watershed has been converted to urban or agricultural uses, as reported in the Technical Memorandum for Task 3.1 (Reference Period Comparison). Within the watershed, the Belle Meade area scores the lowest, with low to moderate scores in all three parameters.

Vegetation score distribution (**Figure 1** and **Table 5**) reflects the relatively high proportion of undeveloped lands in this watershed other than the Belle Meade area and Tamiami Trail corridor. Over 65 percent (65,000 acres) of this watershed has a vegetation score of 8 or higher. Among WBIDs (**Table 5**), 3278Y (Rookery Bay—Inland West Slough) has the lowest vegetation score, with almost 25 percent (approximately 3,500 acres), scoring 3 or lower. The highest-scoring area is WBID 3278U (Rookery Bay – Coastal Slough), with vegetation scores of 8 or higher for almost 85 percent (22,000 acres) of this WBID.

The overall hydrology scores (**Figure 2** and **Table 6**) indicate existing dryer conditions throughout the watershed in comparison to PDVM conditions. Comparing the PDVM to current FLUCCS data shown in the Technical Memorandum for Task 3.1 (Reference Period Comparison), large portions of the watershed once supported swamp forest but are now dominated by shorter-hydroperiod hydric flatwoods. As a result of this shift, over 40 percent (over 21,500 acres) of WBID 3278V (Rookery Bay – Inland East Slough) has a hydrology score of 3 or lower.

LSI scores in the Rookery Bay Watershed (**Figure 3** and **Table 7**) reflect moderate ecological value in the Belle Meade agricultural area, but otherwise high value throughout the watershed. The non-urban portion of WBID 3278Y includes approximately 5,000 acres of lands (30 percent of the WBID) with a moderate LSI score (between 5 and 7), and WBID 3278V contains approximately 10,200 acres (just under 20 percent) in that same scoring range. At the high end, over 75 percent (approximately 20,000 acres) of WBID 3278U have an LSI score of 9 or higher.

The large extent of undeveloped and agricultural lands in this watershed provides opportunities for ecological restoration, while the functional values indicate opportunities for improvements via hydrological restoration throughout these lands.

4.4 Faka Union, Okaloacoochee/SR 29, and Fakahatchee Watersheds

These watersheds, individually and as a whole, retain relatively high functional value, with average Vegetation and LSI scores of 9, and hydrological score average of 6 (**Table 4**). The mapped scores (**Figures 1 through 3**) indicate higher vegetation and LSI scores south of I-75 than north, and the opposite trend among the hydrology scores (i.e., higher hydrology scores in the north than in the south).

Vegetation scores (**Figures 1 and Table 5**) reflect the prevalence of agricultural lands in the northern portion of these watersheds, with highest scores in the preserved natural lands in the southern and eastern portions of the watersheds. WBID 3259M (Ten Thousand Islands) has the highest vegetation score, with nearly 100 percent of this WBID scoring 8 or higher. WBID 3278H (Faka Union – North Segment) has the lowest vegetation value, with 30 percent (approximately 8,100 acres) of this WBID scoring 3 or lower. The overall average vegetation score of 9 throughout these watersheds, however, indicates significant ecological value including near the agricultural lands.

The modest hydrological scores throughout these watersheds (**Figure 2** and **Table 6**) reflect the effects of regional drainage canals, with the highest scores occurring in the northern and eastern portions of the Okaloacoochee-SR 29 Watershed and the lowest scores in the Faka Union Watershed. No primary drainage canals serve the northern Okaloacoochee-SR 29 Watershed, while the Faka Union is currently drained by several. Over 33,000 acres (over 60 percent) of WBID 3278W (Silver Strand) have a hydrology score of 10, in contrast to WBID 3278I (Faka Union – South Segment), of which nearly 30,000 acres (over 50 percent) have a hydrological score of 2 or less.

Over 70 percent (325,000 acres) of the land in these watersheds has an LSI value of 9 or higher. The relatively lowest-LSI value WBID is 3278H (Faka Union North Segment), with just under 40 percent of that WBID having an LSI between 5 and 7. These modest scores reflect low-density rural development north of Alligator Alley in the eastern portion of Golden Gate Estates. Each of the other WBIDs have LSI scores of 8 or higher for at least 65 percent of their area.

Based on the scores for these three watersheds, the greatest opportunity for measurable improvement in functional value would occur through hydrological restoration. The ongoing restoration of Picayune Strand, as an example, is well-positioned to deliver hydrological and ecological benefits to the Faka Union Watershed.

Figure 1. Vegetation Functional Assessment Values

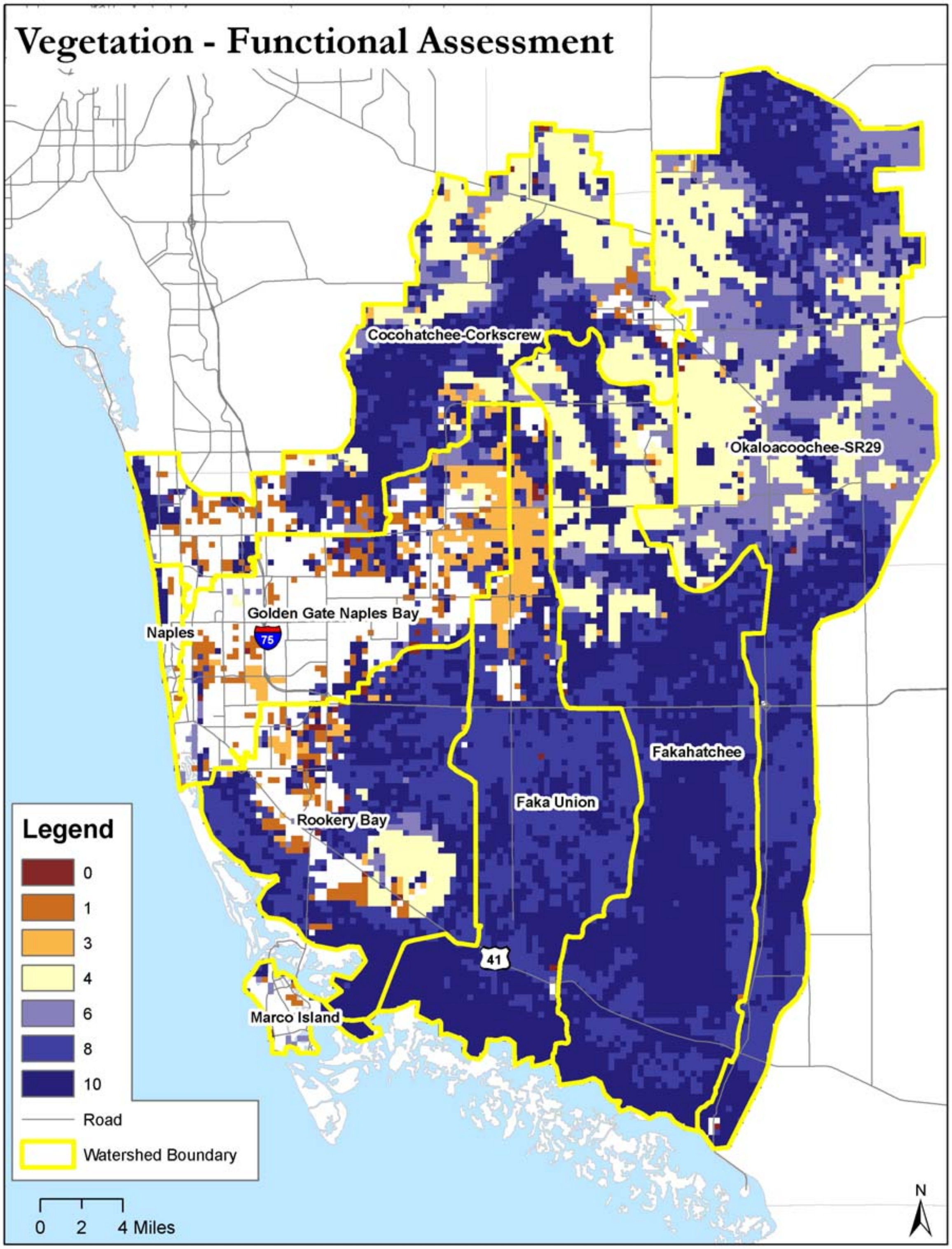


Figure 2. Hydrology Functional Assessment Values

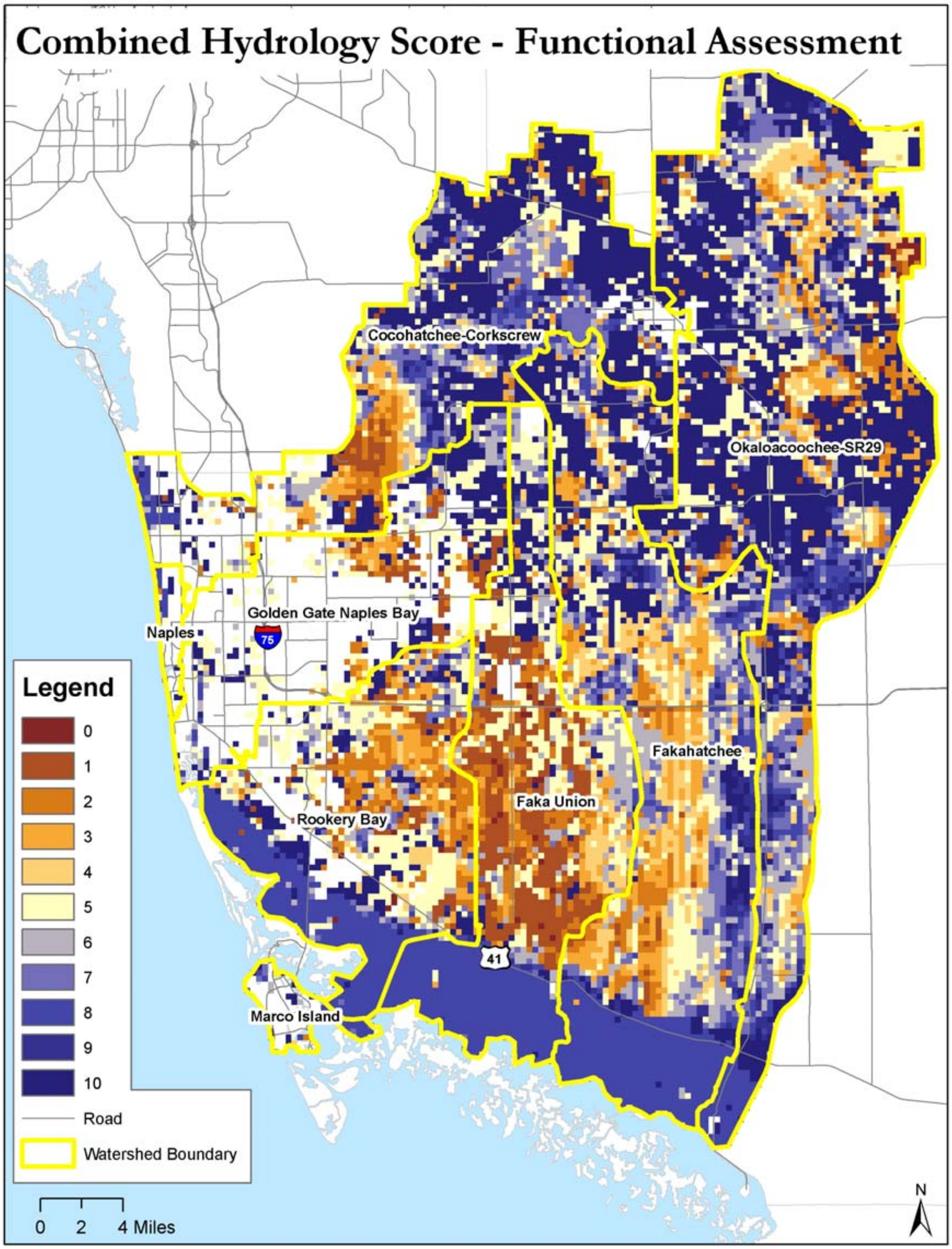


Figure 3. LSI Functional Assessment Values

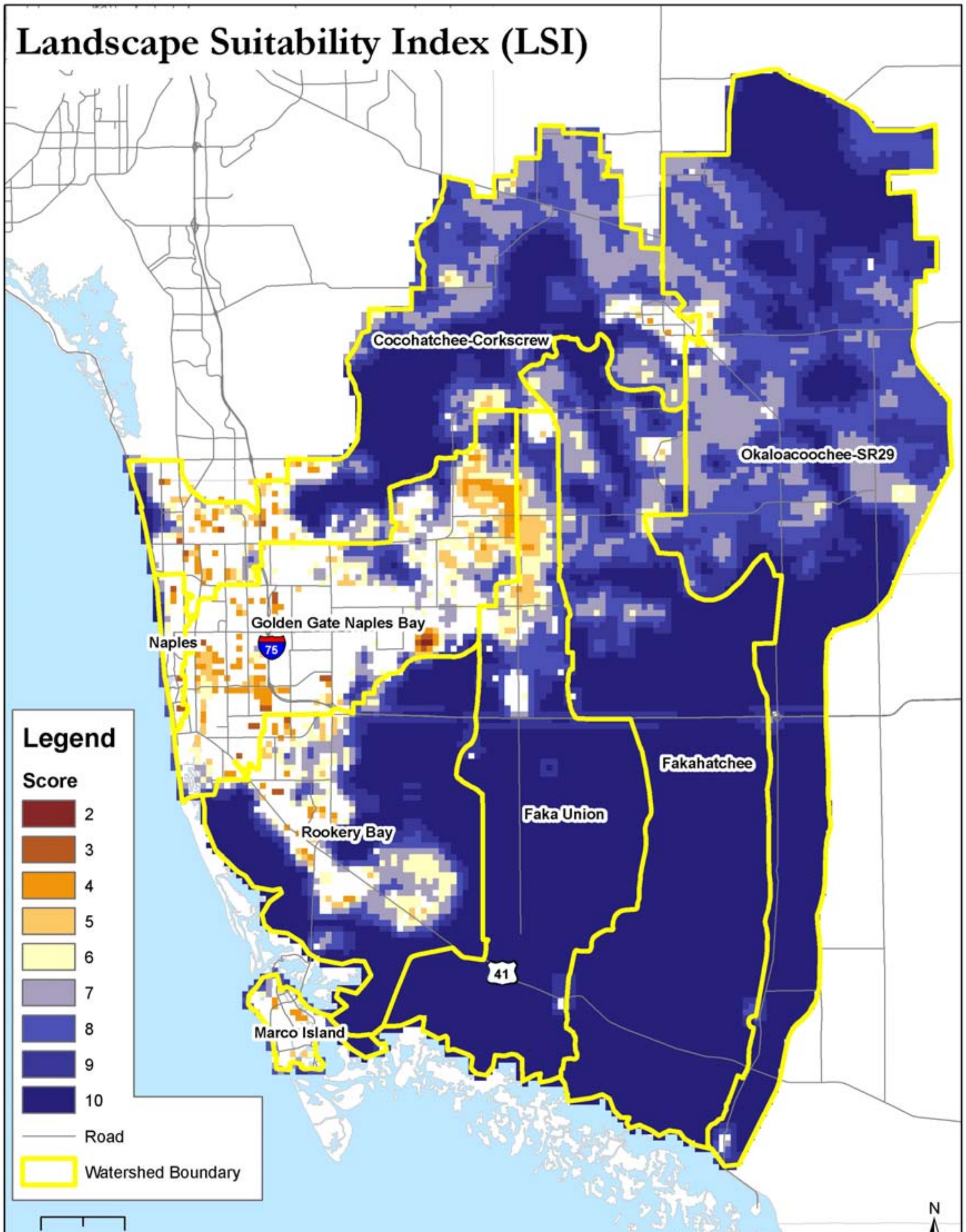


Table 5. Detailed Vegetation Scores by Watershed

	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		FakaUnion/SR29/Fakahatchee	
Vegetation Score	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**
0	563	0.44	579	0.66	1,229	1.29	821	0.20
1	4,954	3.86	7,594	8.68	4,937	5.18	1,061	0.26
3	2,306	1.80	8,299	9.48	2,266	2.38	8,461	2.11
4	33,165	25.87	979	1.12	7,260	7.62	68,427	17.03
6	11,395	8.89	3,203	3.66	1,920	2.02	56,759	14.12
8	19,795	15.44	8,159	9.32	32,344	33.97	119,205	29.66
10	39,072	30.47	7,815	8.93	33,148	34.81	138,017	34.34
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	9,122	2.27
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**401,873**	**100.00**

Table 6a. Detailed Hydroperiod Scores by Watershed

	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		FakaUnion/SR29/Fakahatchee	
Hydroperiod Score	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed
1	98	0.08	0	0.00	620	0.65	2,251	0.46
2	1,092	0.85	2,318	2.65	1,983	2.08	15,353	3.11
3	2,772	2.16	1,672	1.91	3,600	3.78	15,596	3.16
4	3,429	2.67	1,603	1.83	8,894	9.34	20,807	4.21
5	4,696	3.66	1,061	1.21	7,891	8.29	27,381	5.54
6	3,933	3.07	1,876	2.14	1,898	1.99	30,950	6.26
7	2,463	1.92	491	0.56	1,431	1.50	28,320	5.73
8	4,524	3.53	638	0.73	18,043	18.95	65,386	13.23
9	3,718	2.90	301	0.34	1,601	1.68	15,982	3.23
10	84,525	65.92	26,667	30.47	37,144	39.01	264,503	53.52
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	7,684	1.55
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**494,212**	**100.00**

Table 6b. Detailed Hydroperiod Scores by Watershed

	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		FakaUnion/SR29/Fakahatchee	
Water Depth Score	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**
0	15,690	12.24	13,187	15.07	21,964	23.07	75,097	17.97
1	12,378	9.65	4,606	5.26	18,731	19.67	59,940	14.34
2	7,221	5.63	2,577	2.94	5,381	5.65	54,066	12.94
3	7,278	5.68	1,669	1.91	2,659	2.79	43,078	10.31
4	6,578	5.13	550	0.63	1,829	1.92	29,872	7.15
5	7,031	5.48	416	0.48	1,037	1.09	18,827	4.51
6	3,314	2.59	323	0.37	1,161	1.22	11,855	2.84
7	2,083	1.62	246	0.28	302	0.32	8,909	2.13
8	2,802	2.19	483	0.55	17,921	18.82	52,849	12.65
9	743	0.58	155	0.18	207	0.22	4,879	1.17
10	46,131	35.98	12,415	14.19	11,912	12.51	127,156	30.43
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	6,469	1.55
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**417,901**	**100.00**

Table 6c. Detailed Combined Hydrology Scores by Watershed

	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		FakaUnion/SR29/Fakahatchee	
Combined Hydrology Score	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**	**Area (acres)**	**Percent of Watershed**
0	98	0.08	0	0.00	413	0.43	2,251	0.46
1	3,765	2.94	3,783	4.32	4,789	5.03	28,854	5.88
2	5,069	3.95	2,245	2.57	10,030	10.53	27,060	5.51
3	5,791	4.52	1,997	2.28	8,113	8.52	34,722	7.08
4	3,663	2.86	1,004	1.15	3,002	3.15	34,905	7.11
5	15,700	12.25	9,761	11.15	17,467	18.34	68,205	13.90
6	10,790	8.42	3,404	3.89	5,851	6.14	53,131	10.83
7	11,398	8.89	1,018	1.16	3,061	3.21	33,574	6.84
8	6,838	5.33	939	1.07	19,490	20.47	66,896	13.63
9	2,100	1.64	268	0.31	671	0.71	10,871	2.22
10	46,037	35.91	12,209	13.95	10,219	10.73	126,061	25.69
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	6,469	1.32
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**99.57**	**490,747**	**100.00**

Table 7. Detailed LSI Scores by Watershed

	Cocohatchee-Corkscrew		Golden Gate/Naples Bay		Rookery Bay		FakaUnion/SR29/Fakahatchee	
LSI Score	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed	Area (acres)	Percent of Watershed
2	0	0.00	103	0.12	0	0.00	0	0.00
3	258	0.20	732	0.84	155	0.16	0	0.00
4	1,664	1.30	4,605	5.26	930	0.98	250	0.05
5	2,067	1.61	5,916	6.76	1,623	1.70	2,964	0.60
6	4,943	3.86	7,403	8.46	6,119	6.43	6,475	1.31
7	23,987	18.71	8,426	9.63	9,369	9.84	41,479	8.39
8	28,443	22.18	5,399	6.17	6,755	7.09	79,878	16.16
9	16,547	12.91	3,331	3.81	10,678	11.21	66,977	13.55
10	33,341	26.00	713	0.81	47,477	49.86	288,504	58.38
N/A - Urban	16,965	13.23	50,882	58.14	12,112	12.72	7,684	1.55
Total:	**128,215**	**100.00**	**87,509**	**100.00**	**95,218**	**100.00**	**494,212**	**100.00**

Table 8. Vegetation Functional Assessment Values by WBID

Veg. Score	Cocohatchee-Corkscrew																		Golden Gate-Naples					
	3259A		3259B		3259W		3259Z		3278C		3278D		3278E		3278F		3278L		3278K		3278R		3278S	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	43	1	44	0	0	0	0	0	63	3	103	0	0	0	207	0	103	1	33	1	19	0	527	1
1	16	1	0	0	0	0	52	8	52	2	4,008	16	753	6	0	0	73	1	1,154	21	401	4	6,039	8
3	0	0	923	4	7	0	0	0	16	1	231	1	200	2	878	2	52	1	103	2	41	0	8,154	11
4	0	0	9,623	45	0	0	0	0	0	0	833	3	3,099	26	15,544	29	4,066	47	0	0	0	0	979	1
6	109	4	4,440	21	0	0	0	0	0	0	847	3	3,162	27	2,123	4	714	8	0	0	723	8	2,480	3
8	413	13	3,934	18	94	6	22	3	475	22	2,804	11	1,985	17	8,868	17	1,200	14	258	5	229	2	7,672	11
10	1,787	58	2,500	12	1,388	93	16	2	110	5	6,000	23	1,582	13	24,984	47	703	8	203	4	455	5	7,157	10
Urban	720	23	112	1	0	0	545	86	1,438	67	11,012	43	996	8	309	1	1,832	21	3,660	68	7,446	80	39,776	55
Acres	3,088		21,576		1,490		635		2,155		25,837		11,777		52,914		8,745		5,412		9,313		72,784	

Veg. Score	Rookery Bay						FakaUnion/Okaoacoochee SR 29/Fakahatchee															
	3278U		3278V		3278Y		3259I		3259M		3261C		3278G		3278H		3278I		3278T		3278W	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	45	0	814	2	371	2	103	0	52	0	0	0	18	0	310	1	137	0	0	0	155	0
1	1,724	7	1,024	2	2,189	15	59	0	0	0	0	0	52	0	744	3	0	0	52	0	155	0
3	139	1	1,074	2	1,054	7	636	1	0	0	0	0	14	0	7,103	26	6	0	300	0	399	1
4	314	1	6,895	13	51	0	19,823	36	0	0	0	0	343	0	123	0	0	0	24,254	19	24,227	45
6	52	0	1,662	3	207	1	4,331	8	52	0	110	0	148	0	639	2	93	0	35,745	28	15,789	29
8	8,953	34	21,410	40	1,981	13	10,896	20	8,611	20	22,450	67	26,550	28	7,483	27	37,680	63	25,539	20	6,071	11
10	13,074	50	17,947	33	2,128	14	19,266	35	34,726	79	10,447	31	67,371	71	7,295	27	21,463	36	38,875	31	5,834	11
Urban	1,872	7	3,166	6	7,075	47	591	1	497	1	358	1	0	0	3,752	14	69	0	1,215	1	1,201	2
Acres	26,171		53,991		15,055		55,706		43,938		33,365		94,494		27,449		59,450		125,980		53,830	

Table 9. Hydrology Functional Assessment Values by WBID

Hydro Score	Cocohatchee-Corkscrew																		Golden Gate - Naples					
	3259A		3259B		3259W		3259Z		3278C		3278D		3278E		3278F		3278L		3278K		3278R		3278S	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	46	1	0	0	0	0	0	0	0	0	0	0	0	0	52	0	0	0	0	0	0	0	0	0
1	4	0	103	0	0	0	0	0	52	2	1,669	6	50	0	1,784	3	103	1	0	0	27	0	3,756	5
2	0	0	269	1	0	0	0	0	0	0	1,774	7	72	1	2,894	5	59	1	0	0	0	0	2,245	3
3	0	0	614	3	0	0	0	0	0	0	1,686	7	275	2	3,106	6	109	1	0	0	0	0	1,997	3
4	0	0	237	1	0	0	0	0	7	0	611	2	352	3	2,382	5	73	1	52	1	0	0	952	1
5	202	7	3,261	15	1	0	0	0	64	3	3,606	14	1,039	9	6,664	13	864	10	677	13	241	3	8,843	12
6	258	8	2,348	11	108	7	0	0	0	0	1,758	7	428	4	5,672	11	218	2	177	3	516	6	2,711	4
7	267	9	1,584	7	1,218	82	0	0	0	0	310	1	885	8	6,756	13	378	4	52	1	127	1	840	1
8	1,398	45	813	4	33	2	37	6	52	2	231	1	741	6	3,327	6	207	2	136	3	437	5	366	1
9	52	2	371	2	48	3	0	0	0	0	207	1	146	1	1,271	2	5	0	0	0	0	0	268	0
10	141	5	11,864	55	82	6	52	8	542	25	2,973	12	6,791	58	18,694	35	4,897	56	659	12	519	6	11,031	15
Urban	720	23	112	1	0	0	545	86	1,438	67	11,012	43	996	8	309	1	1,832	21	3,660	68	7,446	80	39,776	55
Acres	3,088		21,576		1,490		635		2,155		25,837		11,777		52,914		8,745		5,412		9,313		72,784	

Hydro Score	Rookery Bay						FakaUnion/Okaloacoochee SR 29/Fakahatchee															
	3278U		3278V		3278Y		3259I		3259M		3261C		3278G		3278H		3278I		3278T		3278W	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
0	109	0	304	1	0	0	52	0	0	0	0	0	0	0	166	1	867	1	1,114	1	52	0
1	62	0	4,365	8	362	2	293	1	0	0	52	0	1,528	2	3,648	13	20,199	34	2,304	2	831	2
2	110	0	9,547	18	373	2	1,797	3	0	0	956	3	6,724	7	1,770	6	8,587	14	6,434	5	792	1
3	38	0	7,809	14	266	2	4,093	7	96	0	1,727	5	13,367	14	375	1	4,155	7	9,304	7	1,604	3
4	127	0	2,563	5	312	2	5,444	10	0	0	2,030	6	12,206	13	335	1	3,798	6	10,021	8	1,071	2
5	1,099	4	12,748	24	3,619	24	10,284	18	211	0	2,788	8	12,575	13	6,638	24	10,103	17	16,978	13	8,627	16
6	871	3	4,047	7	932	6	5,159	9	280	1	8,637	26	14,486	15	3,240	12	5,439	9	13,425	11	2,464	5
7	657	3	2,197	4	207	1	3,946	7	288	1	6,313	19	10,694	11	1,044	4	1,789	3	7,823	6	1,677	3
8	18,169	69	1,076	2	245	2	2,191	4	40,160	91	3,489	10	11,411	12	166	1	2,676	5	5,255	4	1,548	3
9	52	0	568	1	52	0	889	2	214	0	1,911	6	3,877	4	146	1	310	1	2,753	2	771	1
10	3,005	11	5,601	10	1,613	11	20,968	38	2,191	5	5,106	15	7,627	8	6,168	22	1,458	2	49,353	39	33,191	62
Urban	1,872	7	3,166	6	7,075	47	591	1	497	1	358	1	0	0	3,752	14	69	0	1,215	1	1,201	2
Acres	26,171		53,991		15,055		55,706		43,938		33,365		94,494		27,449		59,450		125,980		53,830	

Table 10. LSI Functional Values by WBID

LSI Score	Cocohatchee-Corkscrew																		Golden Gate-Naples					
	3259A		3259B		3259W		3259Z		3278C		3278D		3278E		3278F		3278L		3278K		3278R		3278S	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	103	0
3	0	0	0	0	0	0	51	8	1	0	207	1	0	0	0	0	0	0	61	1	155	2	517	1
4	0	0	0	0	0	0	1	0	51	2	1,509	6	8	0	0	0	95	1	599	11	207	2	3,799	5
5	18	1	95	0	0	0	0	0	209	10	1,449	6	52	0	163	0	80	1	756	14	299	3	4,861	7
6	43	1	891	4	0	0	0	0	229	11	2,041	8	283	2	965	2	491	6	335	6	401	4	6,667	9
7	506	16	5,964	28	0	0	37	6	177	8	2,664	10	3,430	29	8,180	15	3,027	35	0	0	481	5	7,945	11
8	504	16	9,250	43	7	0	0	0	17	1	1,941	8	2,812	24	11,885	22	2,027	23	0	0	196	2	5,203	7
9	732	24	3,970	18	64	4	0	0	32	1	1,902	7	2,693	23	6,031	11	1,121	13	0	0	129	1	3,202	4
10	563	18	1,294	6	1,419	95	0	0	0	0	3,112	12	1,502	13	25,380	48	71	1	0	0	0	0	712	1
Urban	720	23	112	1	0	0	545	86	1,438	67	11,012	43	996	8	309	1	1,832	21	3,660	68	7,446	80	39,776	55
Acres	3,088		21,576		1,490		635		2,155		25,837		11,777		52,914		8,745		5,412		9,313		72,784	

LSI Score	Rookery Bay						FakaUnion/Okaloacoochee SR 29/Fakahatchee													
	3278U		3278V		3278Y		3259I		3259M		3261C		3278G		3278H		3278I		3278T		3278W	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	155	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	116	0	78	0	736	5	0	0	0	0	0	0	0	0	250	1	0	0	0	0	0	0
5	231	1	422	1	969	6	78	0	0	0	0	0	0	0	2,708	10	0	0	0	0	178	0
6	431	2	3,822	7	1,867	12	1,644	3	0	0	0	0	0	0	3,197	12	0	0	591	0	1,043	2
7	1,359	5	6,011	11	2,000	13	9,789	18	52	0	38	0	13	0	4,160	15	0	0	12,257	10	15,171	28
8	2,093	8	3,933	7	728	5	13,991	25	428	1	261	1	430	0	6,407	23	14	0	36,921	29	21,427	40
9	2,535	10	7,533	14	610	4	13,433	24	969	2	1,455	4	2,712	3	4,967	18	3,271	6	29,406	23	10,764	20
10	17,534	67	29,027	54	916	6	16,180	29	41,991	96	31,253	94	91,340	97	2,007	7	56,096	94	45,591	36	4,046	8
Urban	1,872	7	3,166	6	7,075	47	591	1	497	1	358	1	0	0	3,752	14	69	0	1,215	1	1,201	2
Acres	26,171		53,991		15,055		55,706		43,938		33,365		94,494		27,449		59,450		125,980		53,830	

4.5 Ecological Capacity for Additional Water Storage Methodology and Results

The potential for hydrological storage provides information useful for evaluating watershed conditions and restoration opportunities. Restoration of an area that is currently an upland but was previously a wetland, for instance, would require development of storage capacity to a depth and duration typical of the pre-development wetland. Storing water in restored wetlands could also cleanse and attenuate freshwater flows to downstream estuaries, depending on the location and morphology of those wetlands. This section describes both the methodology and results of calculating potential water storage.

The difference between the existing depth and duration of inundation (based on FLUCCS vegetation type) and the pre-development depth and duration of inundation (based on PDVM vegetation type) may be considered as the ecological capacity for additional water storage. Adding water beyond this amount would potentially exceed the hydrological tolerance of the pre-development vegetation community and result in a transition to a different type of wetland or open water system that was not previously present on that site. For example, adding too much water for too much time to a current upland site that was a wet prairie could result in creation of a deepwater marsh or unvegetated pond rather than restoration of the pre-development wet prairie. This scenario would be ecologically and logistically difficult to justify or accomplish.

For the purposes of this project, the change in depth of inundation is estimated in inches based on comparisons between the typical water levels of existing vegetation and PDVM vegetation. **Table 11** provides input data for the equation used for this portion of the technical analysis. The calculation developed for this purpose of defining the available ecological capacity for additional storage is:

$$\text{Capacity for Additional Storage} = WSWL_{PDVM} - WSWL_{2007},$$

where WSWL is the long-range average wet season water level typical for the type of ecological community.

Similarly, the change in duration of inundation between PDVM and current FLUCCS vegetation is calculated in months, based on the hydroperiods duration per **Table 2**. Due to the close relationship between vegetation community and hydrology, the results of the calculations for depth and duration of inundation are displayed and summarized together. **Table 12** summarizes the application of the equations.

A comparison of the hydrological characteristics of pre-development and 2007 vegetation communities (**Figure 4**) suggests areas for potential additional wet season water storage (**Figure 5**). Overall, approximately 44,000 acres of undeveloped lands (including over 10,000 acres in Rookery Bay watershed) have capacity for additional wet season storage of at least 0.5 feet up to over 2.5 feet (**Table 12**).

The largest opportunity for storage, based strictly on the difference in hydrological characteristics between pre-development and 2007 vegetation communities, is the portion of the Rookery Bay watershed north of Belle Meade. Restoration of hydrology in these areas, in combination with ecological restoration within the northern portion of Belle Meade itself, could lead to large-scale improvements in both functional value and hydrological storage. Not included in this assessment is the potential benefit to downstream estuaries as a result of attenuating freshwater flows. To the extent that improved storage in northern Belle Meade would restore healthier salinity regimes in downstream estuaries, this would further contribute to the ecological value of such projects.

Table 11. Ecological Capacity for Additional Storage

PDVM	Existing (2007) FLUCCS	Additional Storage Capacity
Open Water	Freshwater marsh, cypress, or swamp forest	≥ 1 foot
Open Water	Wet prairie, dwarf/scrub cypress	≥ 1.5 feet
Open Water	Hydric flatwood, hydric hammock	≥ 2 feet
Open Water	Mesic flatwood, mesic hammock	≥ 2.5 feet
Open Water	Xeric flatwood, xeric hammock	≥ 4 feet
Any	Developed	0
Freshwater Marsh, Cypress, or Swamp Forest	Wet prairie, dwarf cypress	0.5-1 foot
Freshwater Marsh, Cypress, or Swamp Forest	Hydric flatwood, hydric hammock	1-1.5 feet
Freshwater Marsh, Cypress, or Swamp Forest	Mesic flatwood, mesic hammock	1-2 feet
Freshwater Marsh, Cypress, or Swamp Forest	Xeric flatwood, xeric hammock	≥ 3 feet
Any natural system	Same system	0

Table 12. Ecological Capacity for Additional Water Storage

Potential Additional Storage	Cocohatchee - Corkscrew	Golden Gate Naples Bay	Rookery	Other Watersheds	Total
0.5 - 1 foot	277	75	694	2,042	3,087
0.5-1 ft	285	7	42	1,919	2,254
0.5 - 1 ft	571	14	84	3,839	4,508
1 - 1.5 feet	2,071	2,026	7,673	8,612	20,381
1 - 2 feet	677	472	1,611	3,935	6,695
<=0.5 ft	292	21	219	6,304	6,837
>=1 foot	7	2	5	80	94
>=2 feet	1	0	0	0	1
>=2.5 feet	0	1	5	3	10
n/a (developed)	50,200	55,029	21,619	74,047	209,030

4.6 Non-Native Invasive Vegetation—Methodology and Results

The presence of non-native invasive vegetation can significantly degrade wildlife habitat functions, as documented by many studies, including studies specific to southwestern Florida (e.g., Myers, 1975). Due to the potentially significant impact of non-native invasive species at a watershed level, several data sources, government agencies, and non-profit organizations were consulted to determine the availability of comprehensive, County-wide, accurate GIS coverages of non-native exotic vegetation. However, no GIS data layers were found that provide a sufficiently comprehensive and accurate coverage of the six watersheds to incorporate these into the functional assessment methodology. The two best sources of identified data are the Florida Natural Areas Inventory (FNAI) Florida Invasive Plants Geodatabase (FLInv) for public lands and the Early Detection and Distribution Mapping System (EDDMapS) for private lands. Due to the limited extent of both of these data layers, non-native invasive vegetation was not included in the calculation of watershed-wide functional values. Instead, data from these two sources are mapped and discussed separately from the functional assessment, as well as suggestions for obtaining additional GIS data for this purpose.

The data presented in **Table 13** and **Figures 6 and 7** represent the most up-to-date and accurate GIS sources available at this time. Due to the lack of comprehensive non-native invasive species data on private lands, the most suitable use of these GIS data sources is to evaluate the ecological effects of non-native invasive species on publicly managed lands, in combination with the other factors described earlier in this Technical Memorandum.

The public lands with the greatest extent of non-native invasive species on these maps are the Belle Meade and western Corkscrew Swamp areas. Comparing the non-native invasive species maps to the functional assessment and hydrological storage data for these two areas, the greatest opportunity for multi-function improvement on public lands occurs in northern Belle Meade. Projects in this area would achieve improvements in overall functional value (particularly if coupled with restoration of adjacent private lands), large potential improvements in hydrological storage, and improvements in natural vegetation communities.

A more thorough analysis and comparison that incorporates non-native invasive species coverage is only possible with the development of additional GIS coverages over private lands. The primary options include remote sensing via multi-spectral imagery coupled with unsupervised classification and a more detailed mapping via hyperspectral imagery, LiDAR, and supervised classification based on existing known non-native invasive vegetation data points. Multispectral imagery and unsupervised classifications can be expected to achieve overall accuracy of 60 – 70 percent. A more detailed and accurate mapping of non-native invasive vegetation can be acquired through use of hyperspectral imagery, LiDAR and supervised classifications.

Table 13. Gross Acres of Non-native Invasive Species on Publicly Managed Lands (Source: FNAI)

Watershed	Brazilian Pepper	Cogon Grass	Downy Rose-Myrtle	Melaleuca	Old World Climbing Fern
Cocohatchee-Corkscrew	16,052	3,041	3,747	13,246	11,942
Golden Gate Naples Bay	985		37	828	829
Rookery Bay	1,674	1	166	8,438	421
Faka Union, Fakahatchee, Okaloacoochee-SR29	6,415	271	0	206	106
Total Area	25,125	3,313	3,950	22,719	13,298

Figure 4. Hydrology of Pre-Development and 2007 Vegetation (Source Data from M. Duever and SFWMD)

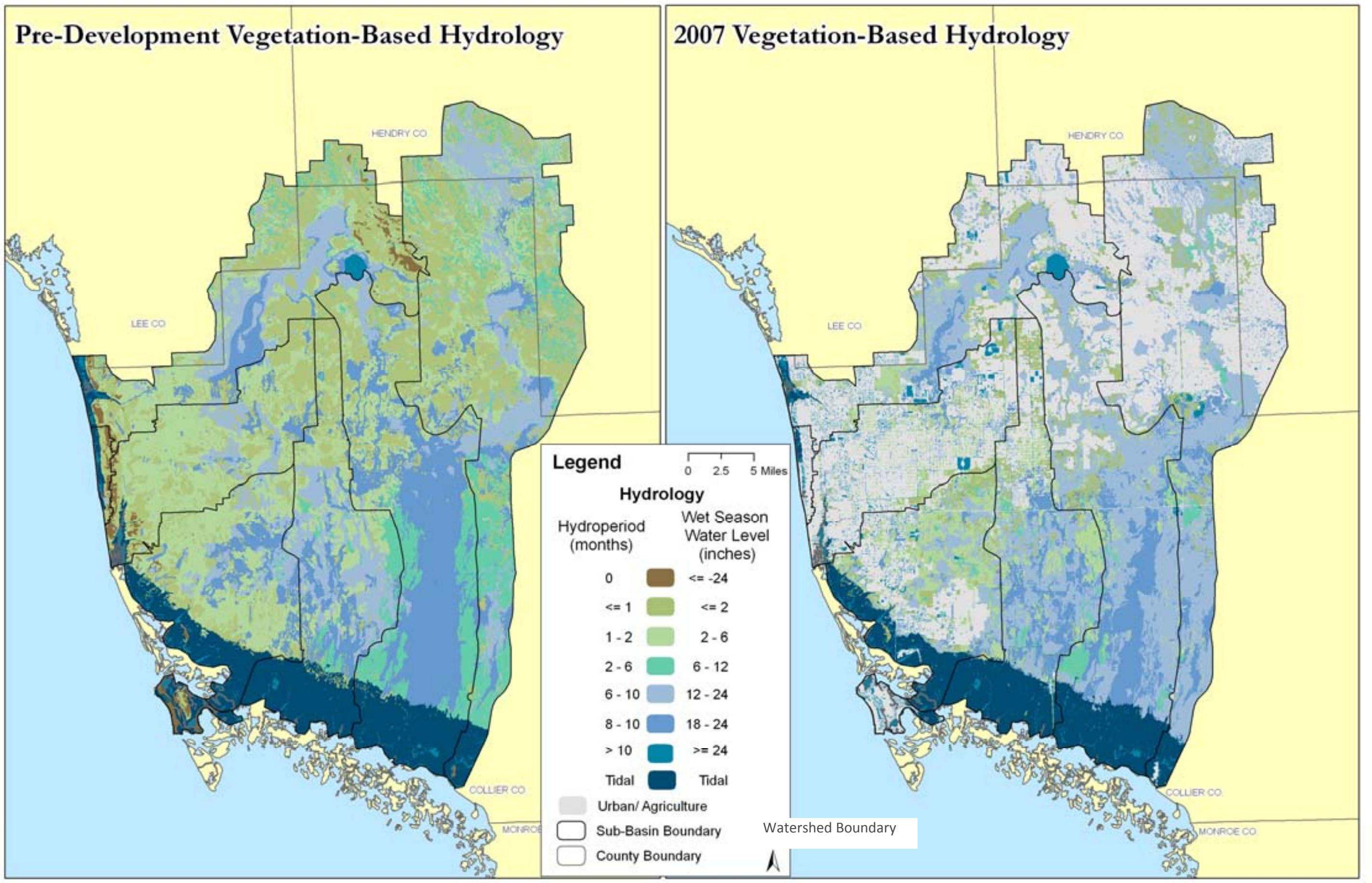


Figure 5. Ecological Systems' Wet Season Water Storage Potential

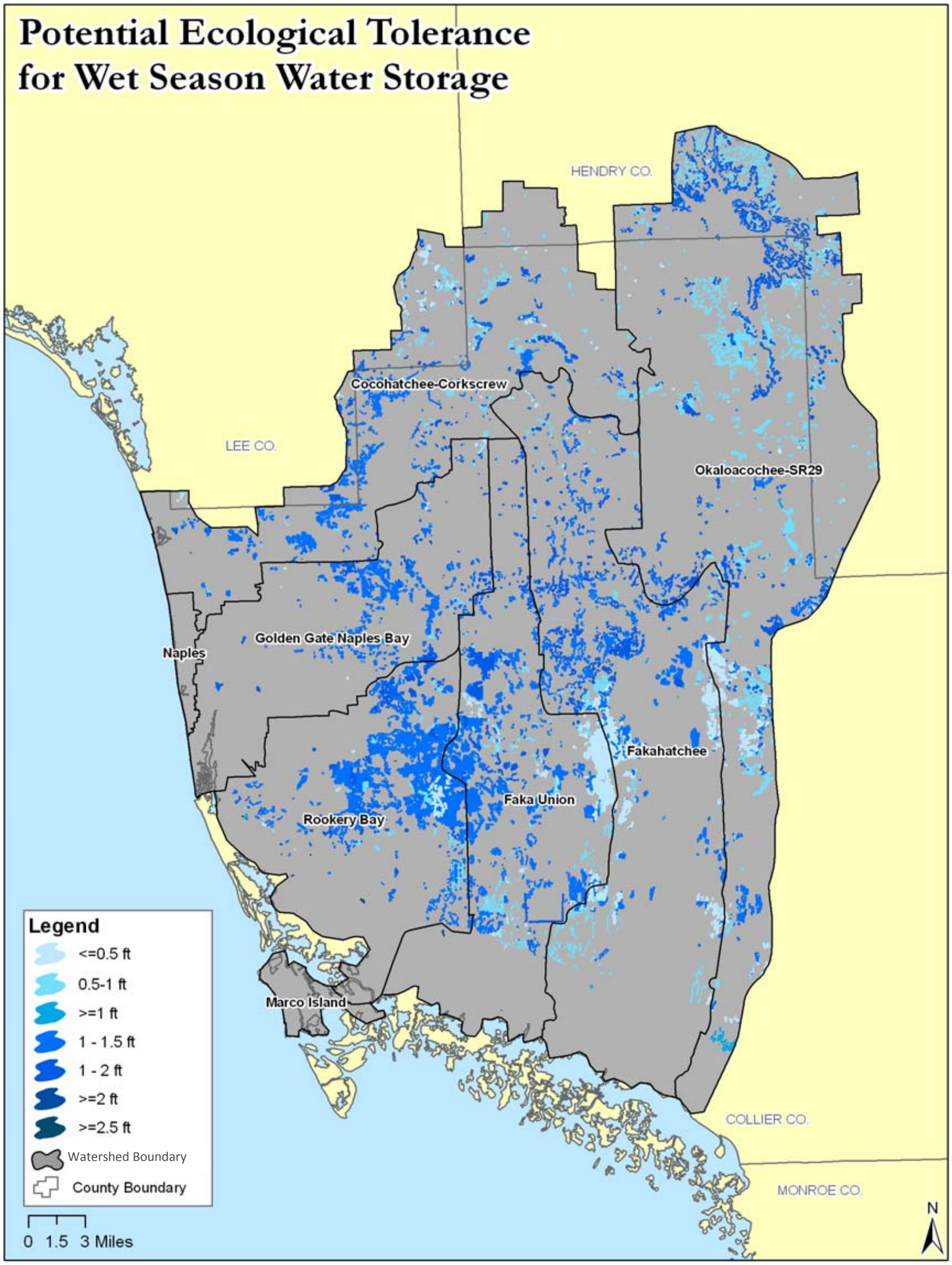


Figure 6. Non-native invasive Species on Public Lands (Source: FNAI)

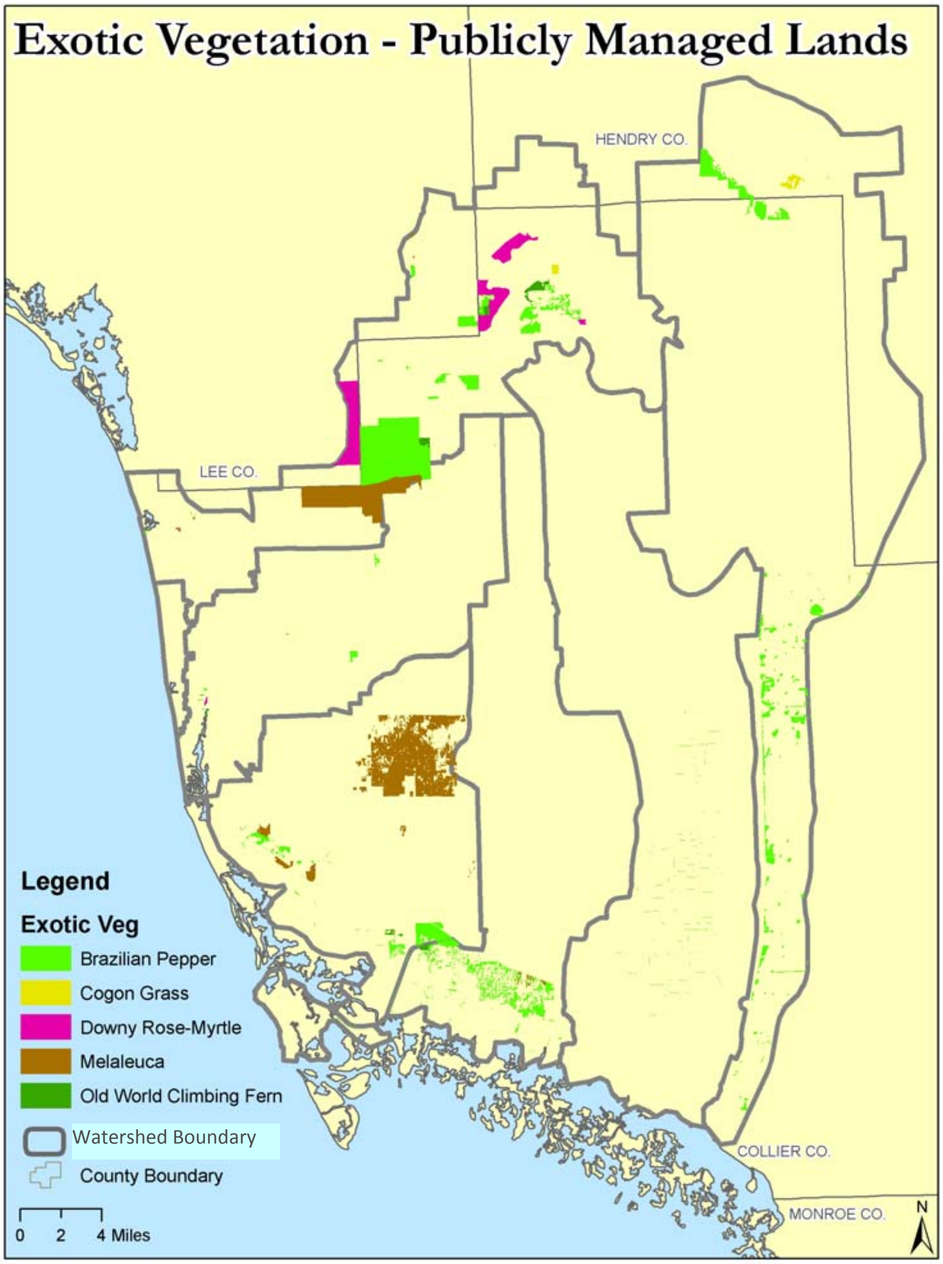
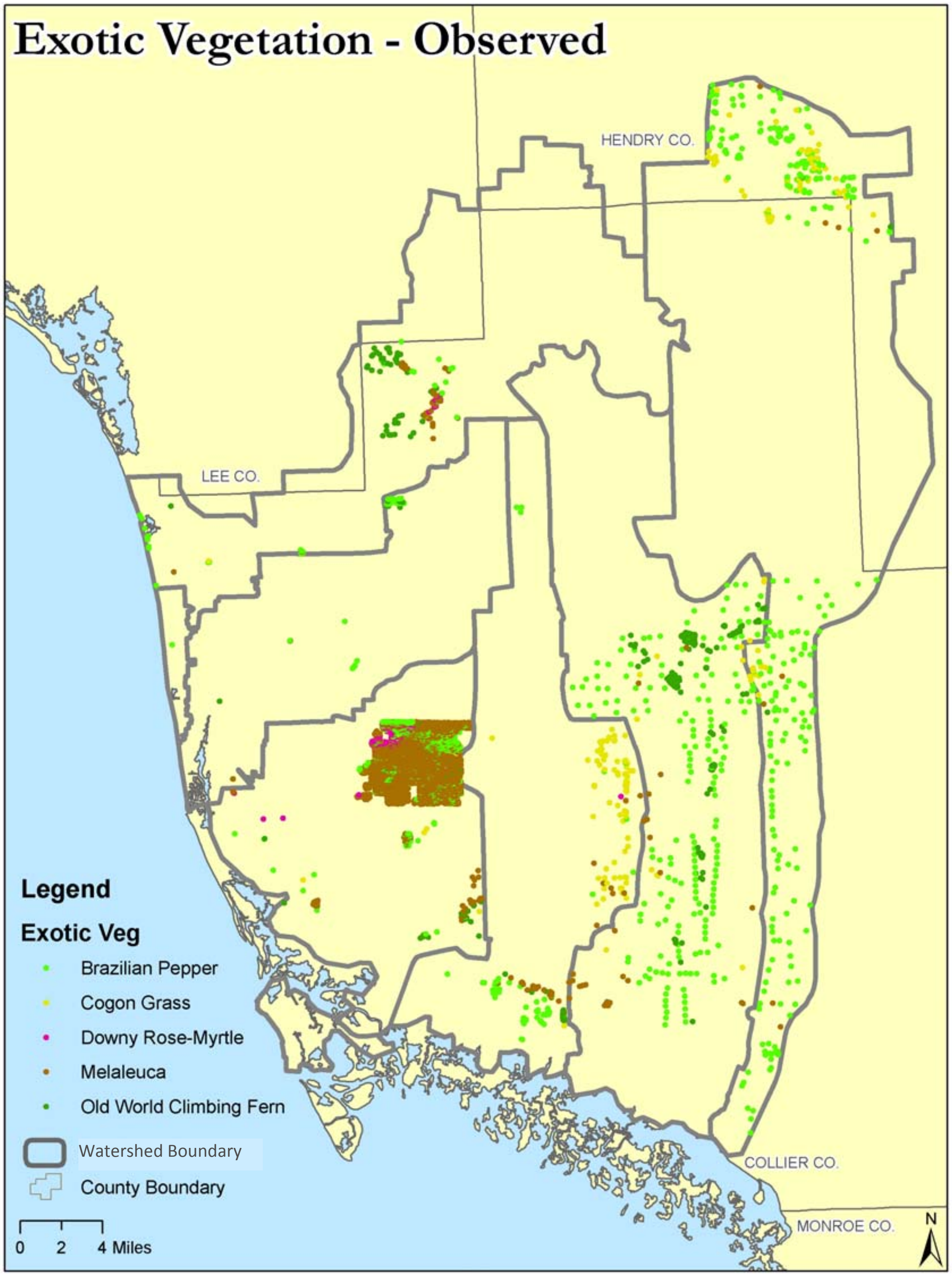


Figure 7. Non-native invasive Species Observation—Point Data (Source: EDDMapS)



5.0. Ecologically Valuable Lands

The results of the functional assessment indicate degradation of ecological values in the Golden Gate-Naples Bay Watershed, as well as the western Cocohatchee-Corkscrew Watershed, and Belle Meade portion of Rookery Bay watershed. In these watersheds, the relatively lower functional value of these areas is due to conversion of natural lands to development or agricultural land uses. Degraded ecological values in the Faka Union Watershed, on the other hand, are primarily related to regional drainage. However, Collier County and the SFWMD have put in place programs to preserve areas of high ecological value and to partially reverse the adverse effects of regional drainage.

The results of the watershed-specific analyses conducted as part of this project are being used to identify several potential areas for restoration projects, based on relatively low functional scores on lands that are well-located for widespread ecological improvement. In addition, another application of the functional assessment analysis is the identification of ecologically valuable lands, such that comparisons can be made with areas currently included in the County's or the SFWMD's preserved lands and supportive agricultural lands programs.

Ecologically valuable and supportive lands were identified throughout the study area via consideration of LSI and vegetation scores. The hydrology score was not considered in this analysis, due to focus on natural and passive land use management rather than identification of hydrological restoration projects. The three sets of LSI and vegetation scoring ranges listed below were considered, reflecting their degree of compatibility with preserved lands. All three categories support ecological functions.

- The highest value natural areas are those showing an LSI score of 10 and a vegetation score of 8 or higher. These areas are labeled "Ecologically Valuable Lands" on **Figure 8** and **Figure 9**.

- Additional supportive lands, with a vegetation score of 6 to less than 8 and LSI score of 8 to less than 10, indicate pasture and similar passive land uses. These lands are labeled "Ecologically Supportive Lands" on **Figure 9**.

- Other agricultural lands, with a vegetation score of 4 to less than 6 and LSI score of 6 to less than 8, are shown as "Agricultural Supportive Lands" on **Figure 9.**

Results of this analysis indicate that, although much of the preserved lands occur on areas where the vegetation and location conditions provide high-value ecological functions, significant areas within and adjacent to the preserves also contain supportive land uses. Continued or improved management of these areas' passive land uses provide opportunities for additional ecological improvement.

Figure 8. Ecologically Valuable Lands

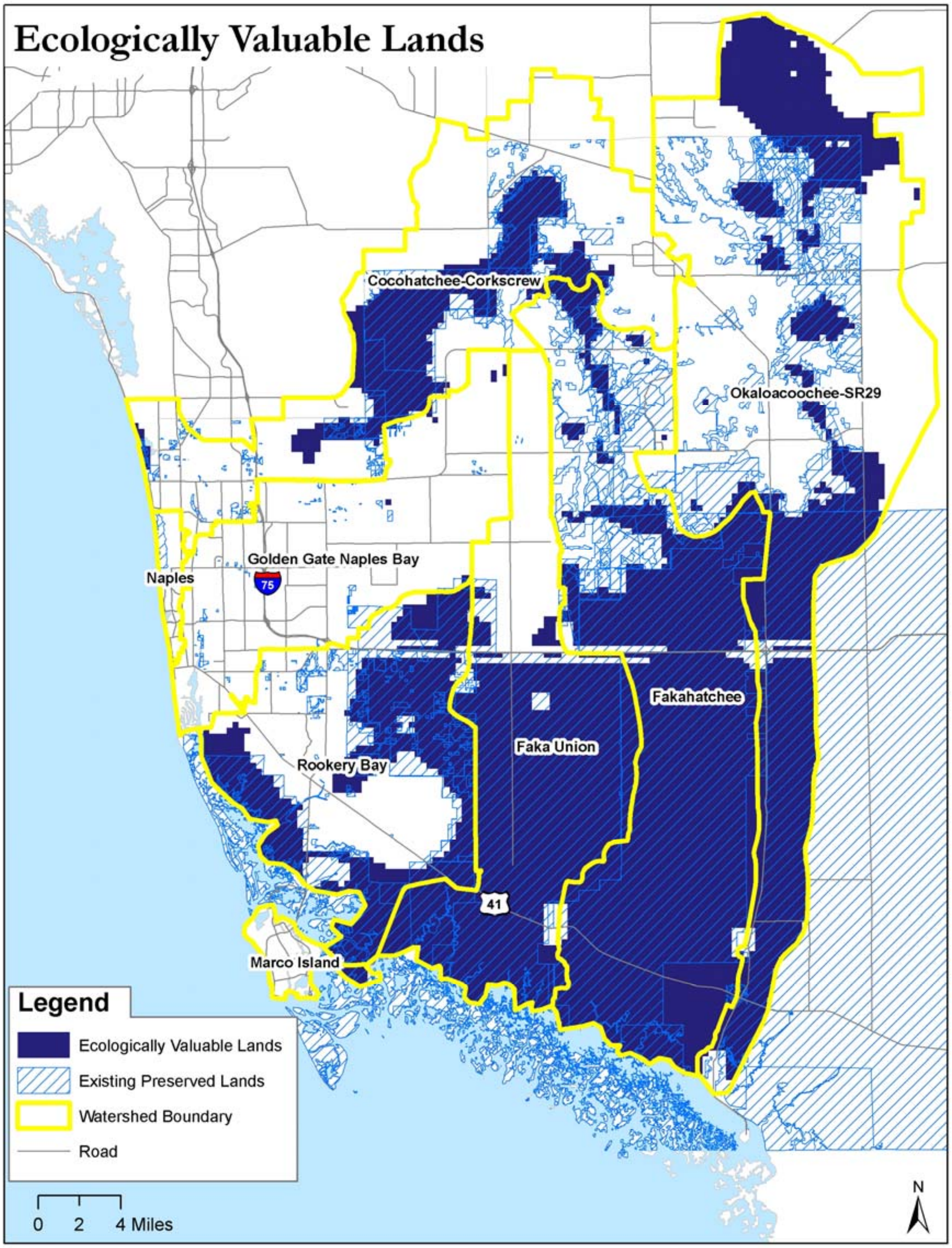
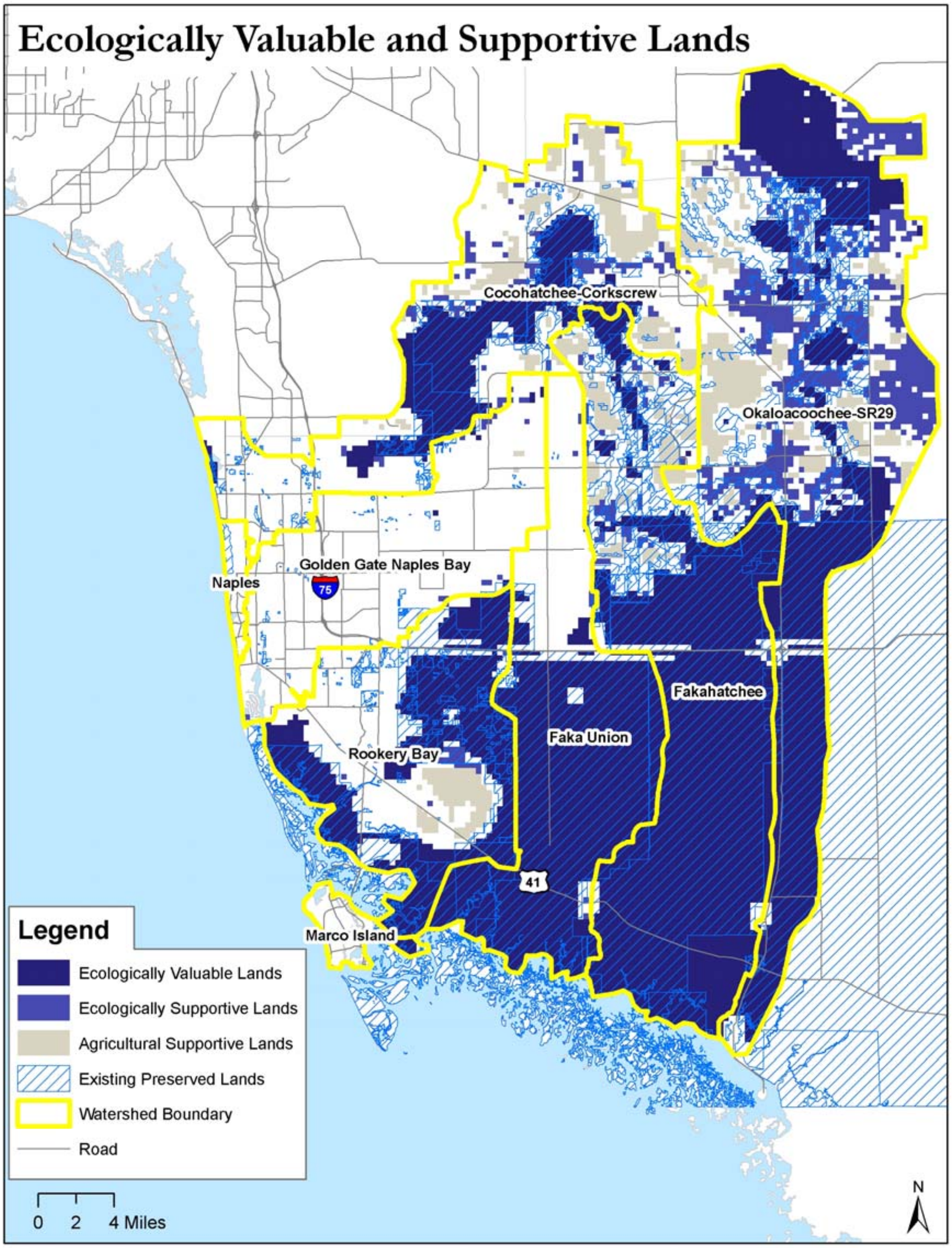


Figure 9. Ecologically Valuable Lands and Other Supportive Lands Uses



6.0 Performance Measures

The methodologies and results described in this memorandum, in addition to describing existing conditions, will also serve as ecological performance measures. The LSI and hydrological scoring index each provide existing baseline data, as well as numerical methods for evaluating and comparing the effects of proposed projects. The vegetation score is not as applicable for evaluating the results of hydrological restoration projects, as the projects generally will not focus on active vegetation management (although shifts in vegetation are expected to occur over time, as an adaptation to hydrological restoration).

These measurements are suitable for small-scale site-level assessment (i.e., for projects that don't affect the score of a 1500 x 1500 ft cell) or modeled for larger-scale projects. The functional value of proposed projects will be assessed according to the standard equation used in UMAM and other functional assessment methods:

Functional Value = [(Anticipated Score– Existing Score)/Maximum Score] * Acres

As an example: a 500-acre proposed project area has a current hydrology score of 6, and rehydration of the site via ditch-filling is reasonably expected to result in a hydrology score of 8. The hydrological functional value of this project would be 100 (i.e., [(8-6)/10] x 500). Likewise, LSI functional values would improve within and adjacent to projects that include restoration to more-natural conditions, conservation easements, transfers of development rights, or other similar means of improving the degree of ecological support to adjacent areas.

6.0. Bibliography

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