



**FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION**

**Imperiled Species Management Plan (ISMP)**

**Economic Impacts Assessment:**

**Florida Sandhill Crane and Wood Stork**

**Purchase Order# 7750 JLacey FY15/16 Balmoral Group CSunquist HSC**



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## Acronyms

BMP — Best Management Practice

DACS — Florida Department of Agriculture and Consumer Services

DEP — Florida Department of Environmental Protection

EQIP — Environmental Quality Incentives Program

FAC — Florida Administrative Code

FWC — Florida Fish and Wildlife Conservation Commission

GIS — Geographic Information System

ISMP — Imperiled Species Management Plan

NGO — Non-Governmental Organization

NOI — Notice of Intent

SAP — Species Action Plan

WMD — Water Management District

## Executive Summary

The Economic Impacts Assessment estimates the costs of complying with the Imperiled Species Management Plan for the Florida Sandhill Crane (*Grus canadensis pratensis*). The Sandhill Crane Management Plan provides the framework for conserving and managing the sandhill crane in Florida. Approximately 3.8 million acres of potential sandhill crane habitat has been identified in Florida, but only about 400 adult sandhill cranes have been documented as of 2014 in the peninsula<sup>1</sup>.

**Statutory Authority:** Rule 68A-27.0012 of the Florida Administrative Code (F.A.C.) specifies that “No person shall take, possess, or sell any of the endangered or threatened species included in this subsection, or parts thereof or their nests or eggs except as allowed by specific federal or state permit or authorization.” Florida sandhill cranes, active nests, eggs, and young also are protected under the Federal Migratory Bird Treaty Act, Rule 68A-16.001, F.A.C., and Rule 68A-4.001, F.A.C. Intentional feeding of sandhill cranes is prohibited under Rule 68A-4.001(5), F.A.C.

**Proposed Guidelines:** The proposed guidelines include survey protocols, conservation protocols, and a variety of property management measures. Management approaches include avoidance measures, Forestry and Agricultural Best Management Practices (BMPs), minimization options, and aversive conditioning.

It is important to note that the Environmental Resource Permit (ERP) process serves as a multi-species option for sandhill cranes and other species that use shallow herbaceous wetlands. In many circumstances, mitigation provided through the ERP process is sufficient to cover sandhill cranes and other state-Threatened wetland dependent species. Since the ERP process is already required, and the costs incurred whether or not the sandhill crane is germane, the costs are incremental. The incremental change in processing costs is relatively small.

The total Estimated Regulatory Costs associated with the Imperiled Species Management Plan for the sandhill crane are \$508,661 annually. Over 5 years, the estimate is \$2,543,305. FFWC anticipates an increase in the number of permits issued annually, which is incorporated into the estimates.

The cost estimates are conservative, given that almost all experts interviewed for the analysis indicated that it was difficult to separate costs of sandhill crane guideline compliance from existing costs to comply with freshwater wetland protection rules. As such, this estimate can be considered an upper bound.

**Table 1. Estimated Annual Compliance Costs, Sandhill Crane ISMP**

<b>Sandhill Crane ISMP Costs</b>	<b>Annual Cost</b>
Annual Private Sector	\$455,176
Annual Administrative/ FFWC	\$53,485
<b>Annual, Sandhill Crane</b>	<b>\$508,661</b>

<sup>1</sup> From FFWC 2014 : Based on their range and available habitat, staff established 12 routes totaling roughly 640 miles through 16 counties and surveyed twice during the fall. The 2014 recruitment survey documented 404 adults, 89 young, and 42 birds of undetermined age.

FFWC is interested in evaluating the wood stork as a benchmark for comparison of compliance costs for the sandhill crane. Similar to the sandhill crane, many of the practices associated with regulations regarding the wood stork that affect property owners are already incorporated into ERP processes. However, specific requirements that are triggered for certain criteria trigger additional costs. The annual costs associated with the wood stork are \$518,762; virtually all of which is attributable to mitigation credits. Over 5 years, the estimate is \$2,593,808. A summary of the annual total costs for wood stork compliance costs are provided in **Table 2**.

**Table 2. Estimated Annual Compliance Costs, Wood Stork**

<b>Wood Stork Compliance Costs</b>	<b>Annual Cost</b>
Annual Private Sector/Property Owner Impacts	\$518,762
Annual Administrative/ USFWS	Nil
<b>Annual, Wood Stork</b>	<b>\$518,762</b>

A breakout of cost by item is provided in **Table 3**. Detailed tables are included in the Appendix.

Table 3. Summary of Overall Costs

## Florida Fish and Wildlife Conservation Commission Report Summary

### Imperiled Species Management Plan

	No. of affected Permittees Annually	Annual Private Sector Costs	Annual Administrative/ FWC Costs	Annual Total Cost	Total Cost Over Five Years
<b>Sandhill Crane</b>					
<b>Surveys</b>					
Project Planning Surveys	150	\$ 41,077	\$ 41,762	\$ 82,840	\$ 414,199
Pre-Clearing Surveys	150	\$ 33,189	\$ 21,732	\$ 54,921	\$ 274,603
Total	150	\$ 74,266	\$ 63,494	\$ 137,760	\$ 688,802
<b>Sandhill Crane Avoidance Measures</b>					
Total	-	\$ -	\$ -	\$ -	\$ -
<b>Sandhill Crane Minimization Measures</b>					
Total	-	\$ 167,569	\$ -	\$ 167,569	\$ 837,845
<b>Mitigation</b>					
Habitat Acquisition	5	\$ 79,950	\$ -	\$ 79,950	\$ 399,750
Enhancements to Degraded Habitat	1	\$ 3,721	\$ -	\$ 3,721	\$ 18,606
Seasonal / Annual Monitoring of Nesting Areas	150	\$ 93,462	\$ -	\$ 93,462	\$ 467,308
Total	156	\$ 177,133	\$ -	\$ 177,133	\$ 885,664
<b>Sandhill Crane Aversive Conditioning Measures</b>					
Total	-	\$ 1,008	\$ (1,042)	\$ (34)	\$ (168)
<b>Sandhill Crane Single Use Nest Removal Policy</b>					
Total	-	\$ 35,200	\$ (8,967)	\$ 26,233	\$ 131,163
<b>Total Sandhill Crane</b>	<b>-</b>	<b>\$ 455,176</b>	<b>\$ 53,485</b>	<b>\$ 508,661</b>	<b>\$ 2,543,305</b>
<b>Woodstork</b>					
<b>Woodstork Survey Costs</b>					
USFWS recommended methodologies	Total	\$ 66,862	\$ -	\$ 66,862	\$ 334,308
<b>Woodstork Avoidance &amp; Minimization Measures</b>					
2500 feet of an active colony site, suitable foraging habitat, Core Foraging Areas					
1000 feet from nesting colony, Seasonal avoidance and minimization variable by region					
Total	-	\$ 8,800	\$ -	\$ 8,800	\$ 44,000
<b>Mitigation</b>					
Cost of Wood Stork Credits, added cost/value to wetland mitigation banks					
Total	-	\$ 437,000	\$ 6,100	\$ 443,100	\$ 2,215,500
<b>Total Woodstork</b>	<b>-</b>	<b>\$ 512,662</b>	<b>\$ -</b>	<b>\$ 518,762</b>	<b>\$ 2,593,808</b>

## Summary of the Proposed Guidelines for the Sandhill Crane

The following describes the guidelines proposed by the FWC.

### Background

The Florida Fish and Wildlife Conservation Commission (FWC) is implementing revised management plans relating to Imperiled Species, including the sandhill crane.<sup>2</sup> Activities to improve conditions for the Sandhill Crane derive in large part from the Species Action Plan (SAP), the goal of which is to increase the number of Florida sandhill cranes so that the species is secure within its range and will not again need to be listed.<sup>3</sup> The SAP recommended the creation of habitat management guidelines for public and private land, and its conclusions are to be incorporated into the Imperiled Species Management Plan (ISMP), in satisfaction of the requirements of Chapter 68A-27, Florida Administrative Code, Rules Relating to Endangered or Threatened Species.

The Draft Guidelines were released in November, 2015.<sup>4</sup> The Guidelines are intended to achieve the conservation goals of improving the status of the crane to a point that it can be removed from the Endangered and Threatened Species List and not need to be listed again in future.

The proposed guidelines identify conservation approaches that include:

- Increasing the amount of suitable habitat through restoring hydrology and managing open habitats
- Reducing mortality and ensuring quality habitat is sufficient to support population growth
- Ensuring that species needs are considered in conservation and incentive programs
- Filling information gaps through research and monitoring on public and private land
- Educating targeted audiences to minimize threats to crane survival, reduce nuisance crane issues, and promotes practices compatible with wildlife.

### General Approach to the Economic Assessment

The new guidelines recognize that existing rules of the Florida Department of Environmental Protection (DEP) relating to the Environmental Resource Permit (ERP) process form a basis for many of the conservation, mitigation and permitting guidelines recommended for sandhill crane conservation. As such, many of the costs to both the regulated community and the regulating agencies themselves are expected to be nominal. The economic assessment was directed at the incremental costs attributable to duly implementing the guidelines for sandhill cranes, and not at the more general costs of the rules within which the guidelines operate or the programs that they may complement. For example, while the costs of conducting surveys of other listed species as part of an ERP were identified and analyzed, the entirety of these costs were not attributed to the guidelines except where crane survey protocols exceed those used for other species.

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<sup>2</sup> Florida Fish and Wildlife Conservation Commission, Draft Florida's Imperiled Species Management Plan, October 12, 2015.

<sup>3</sup> Florida Fish and Wildlife Conservation Commission, A Species Action Plan for the Florida Sandhill Crane, *Grus canadensis pratensis*, Final Draft, November 1, 2013

<sup>4</sup> Florida Fish and Wildlife Conservation Commission, Draft Species Conservation Measures and Permitting Guidelines, Florida Sandhill Crane (*Grus canadensis pratensis*).

The approach used to assess the costs of implementing the guidelines included direct input from the FWC regarding numbers of permit by category and staff costs, data acquisition from state agencies and on-line resources, and extensive interviews with the private, regulated sector (property owners, mines, utilities, mitigation banks, and consultants), regulators (the water management districts, DEP), and non-governmental organizations that are engaged with sandhill crane conservation and protection.

The economic assessment integrated the following elements:

- a) the units and measures associated with each class of activity (e.g., hours of labor, acres subject to the activity, feet of flagging or fencing, etc.);
- b) the per unit costs for each item reviewed (e.g., the various rates for categories of labor, dollars per foot of fence, dollars per mitigation credit, dollars per bird diverter, etc.);
- c) the numbers of units associated with each permit per the comment letters provided by the FWC;
- d) the frequency of activities to be conducted consistent with FWC comments and recommendations; and
- e) the numbers of sandhill crane comment letters and permits issued per year.

The above data were used to estimate the (incremental) annual cost per individual permit and the expected total costs (aggregated for all permits reviewed) for each activity under the guidelines. Aggregated annual costs were projected for a period of five years, reflecting an increase in the annual number of permits anticipated.<sup>5</sup>

**Affected Properties:** In addition to the per unit costs for implementing the specific guidelines, costs were aggregated at the land use or state-wide levels. The species ranges in peninsular Florida, from east of Jefferson County to southern Miami-Dade County. To more clearly identify the locations of where the guidelines would likely apply, The Balmoral Group converted a raster GIS file of potential sandhill crane habitat that was provided by the FWC into a vector (shape) file (output shown as **Figure 1**). The area of potential sandhill crane habitat was then evaluated against other spatial data files:

- i. Golf courses, the location and extent of which had been determined by aerial imagery and property appraiser records and verified by the St Johns River Water Management District<sup>6</sup> (**Figure 2**);
- ii. Agricultural lands, the location and extent of which had been determined by aerial imagery, property appraiser records, and water management district consumptive use permits and verified by the Florida Department of Agriculture and Consumer Services<sup>7</sup> (**Figure 3**);
- iii. Agricultural lands that had executed a Notice of Intent (NOI) to implement Best Management Practices (BMPs), the location and extent of which had been determined by aerial imagery,

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<sup>5</sup> FWC has estimated an increase between 15% and 25% during the next five years.

<sup>6</sup> Golf course location and delineation per Additional Improvements to Water Use Estimates, Contract #27848, SJRWMD, September 2015.

<sup>7</sup> Agricultural properties per Florida Statewide Agricultural Irrigation Demand (FSAID), PO No. POEC 1121, FDACS, January 2015.

property appraiser records, and program records from the Florida Department of Agriculture and Consumer Services<sup>8</sup> (**Figure 4**).

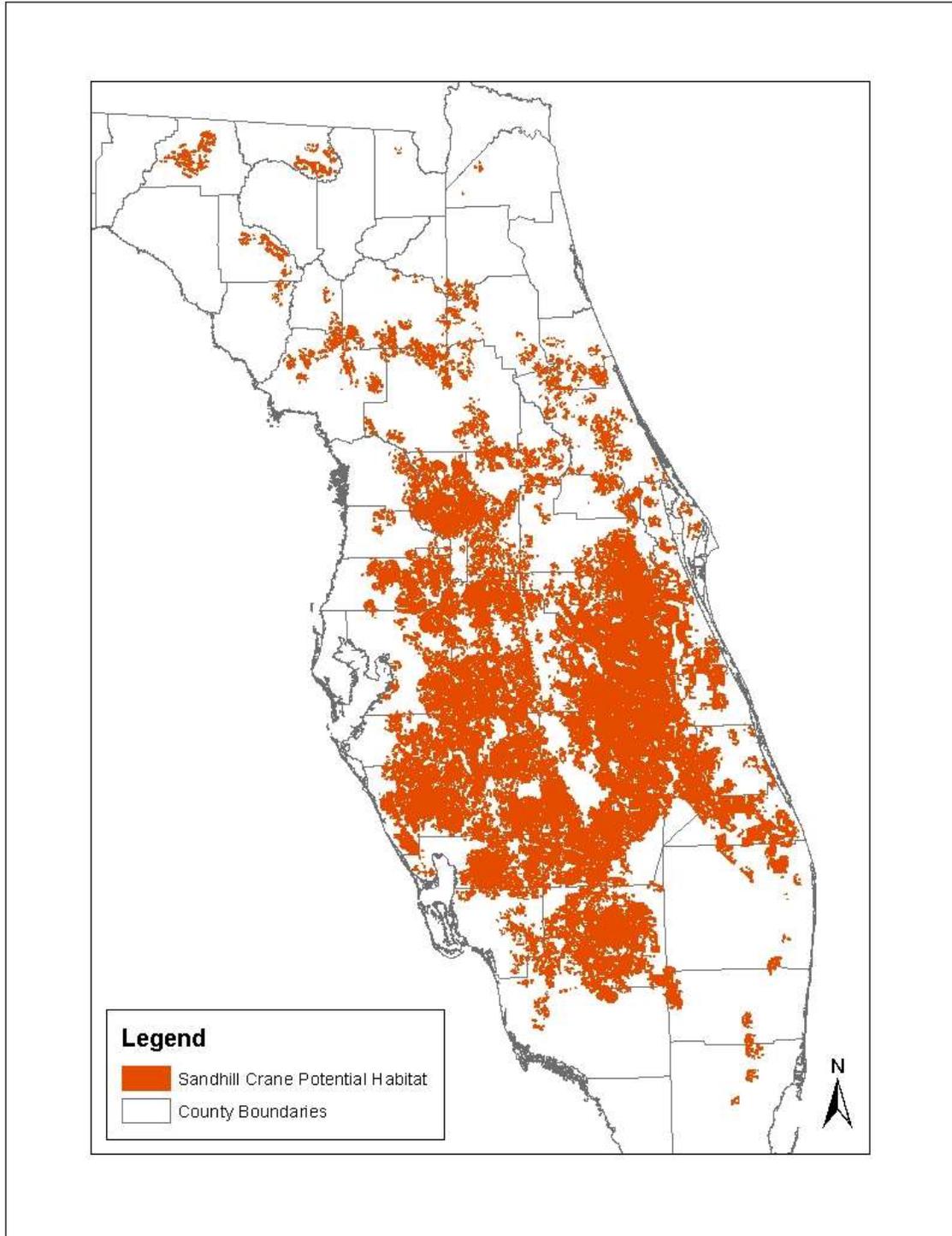
- iv. Agricultural lands without a NOI or commitment to implement BMPs (**Figure 5**). The area of these properties was determined using GIS to reverse the select of agricultural lands that have NOIs; and
- v. Estimates of areas of urban growth (land use conversion) for the periods 2015-2020 (**Figure 6**) and 2015-2025.<sup>9</sup>

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<sup>8</sup> Ibid.

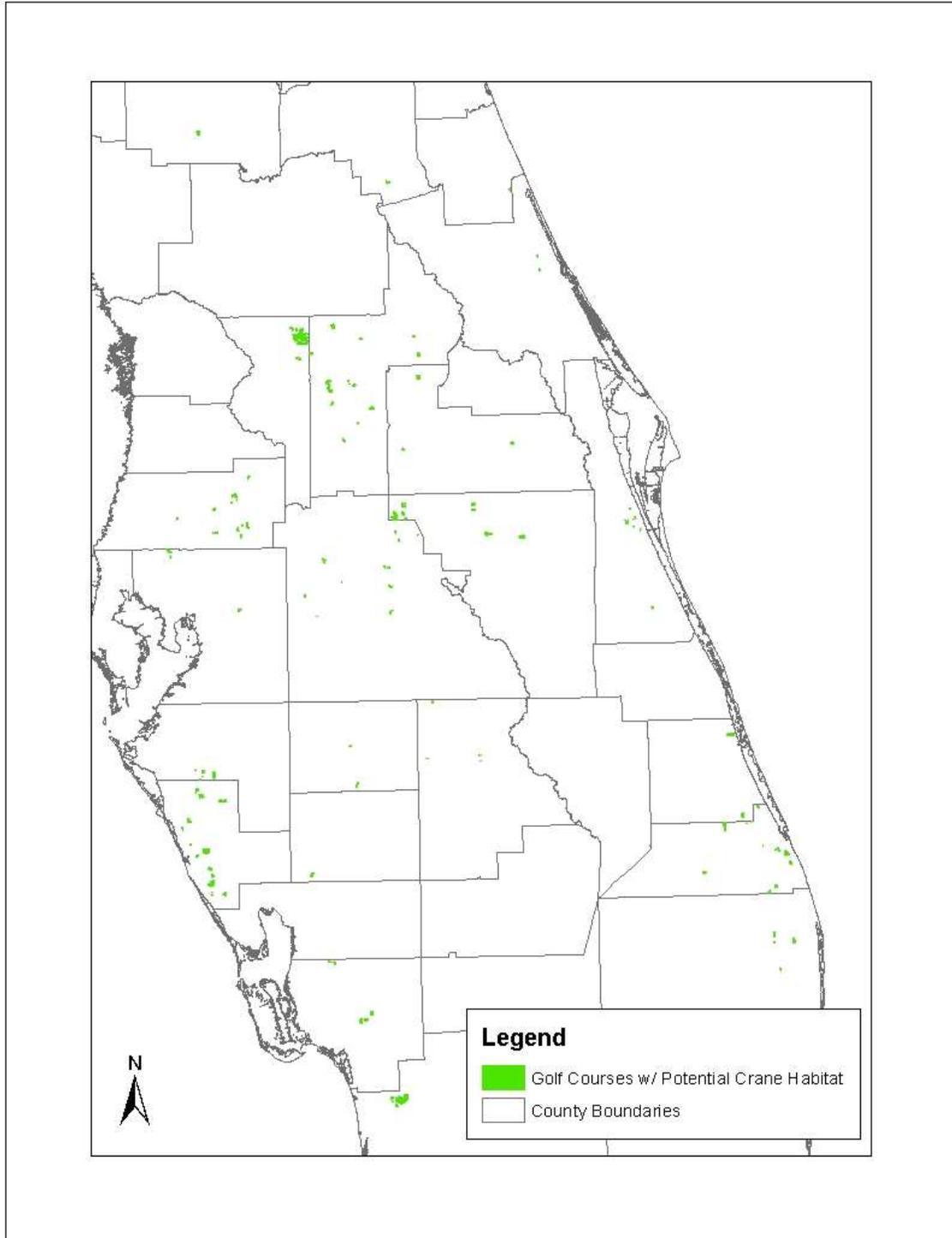
<sup>9</sup> Ibid.

Figure 1. Potential Sandhill Crane Habitat



Source: FFWCC, Raster File

Figure 2. Golf Courses with Potential Sandhill Crane Habitat



Source: FFWCC; SJRWMD

Figure 3. Agricultural Lands with Potential Sandhill Crane Habitat

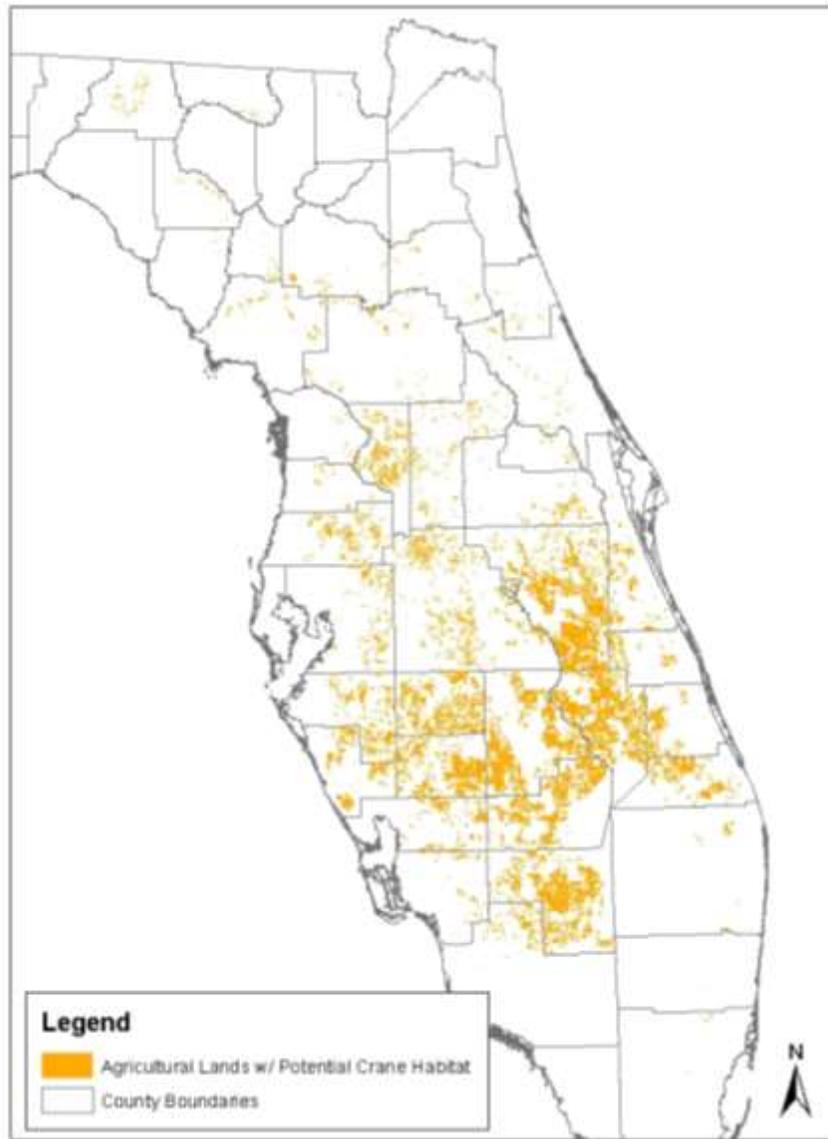
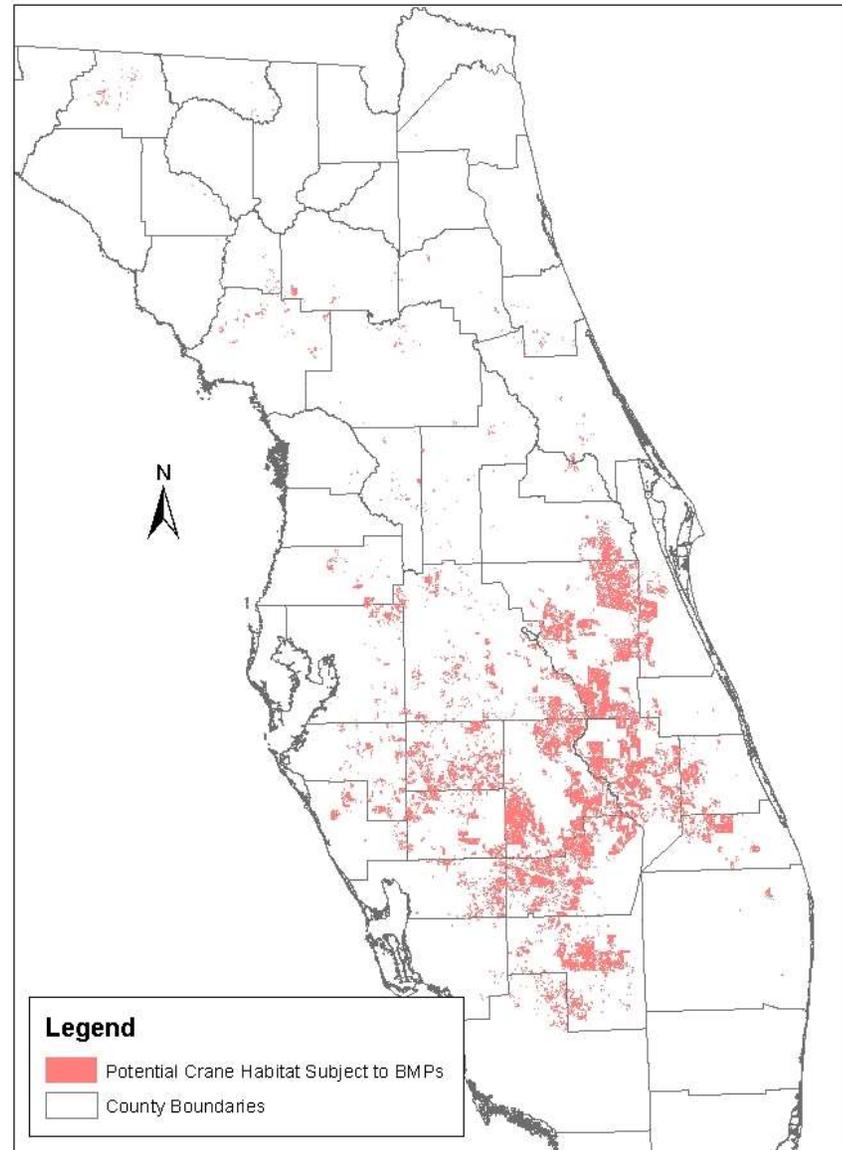


Figure 4. Agricultural Lands with Potential Sandhill Crane Habitat that have Executed Notices of Intent



Source: FFWCC; FDACS

Figure 5. Agricultural Lands without a NOI and Commitment to Implement BMPs

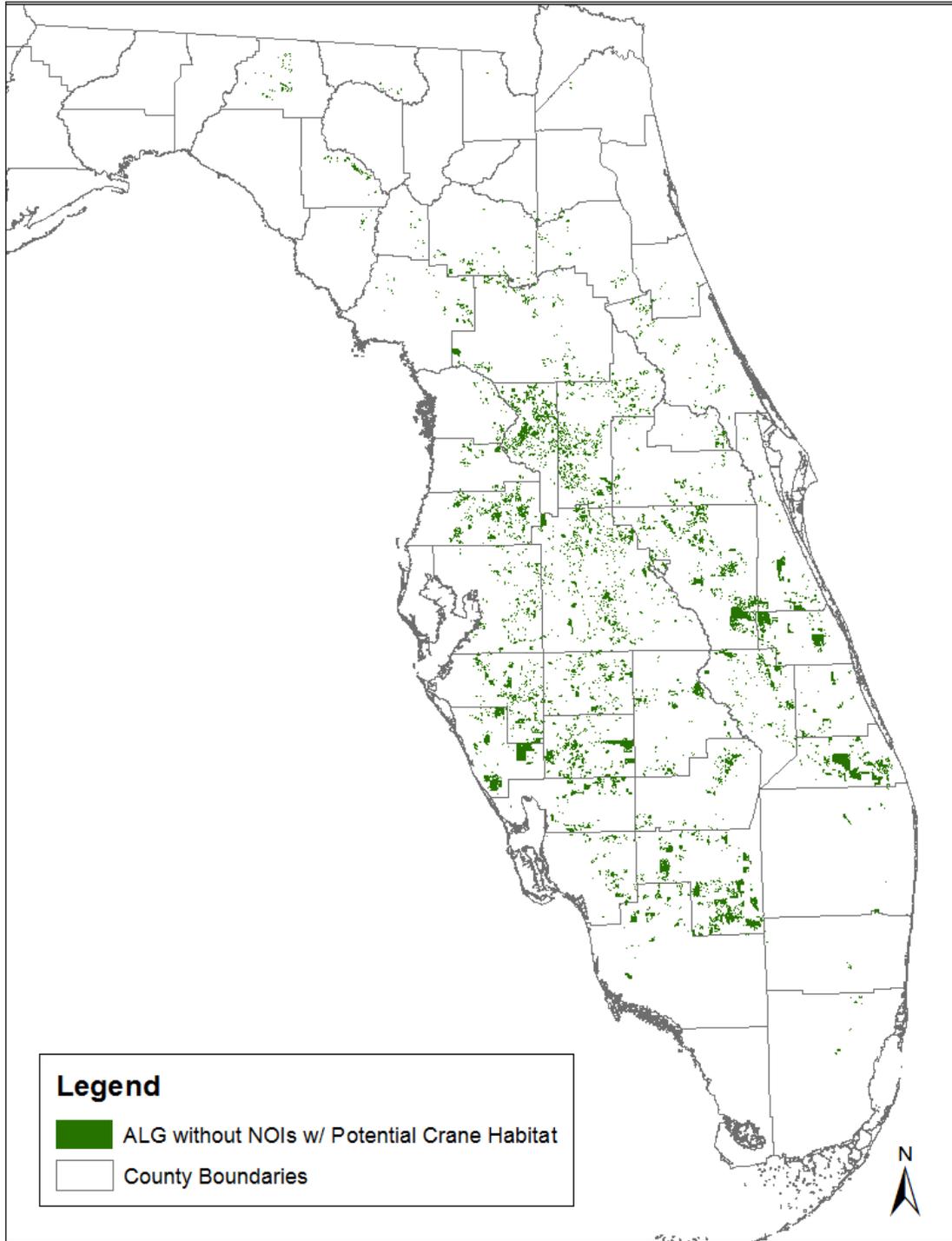
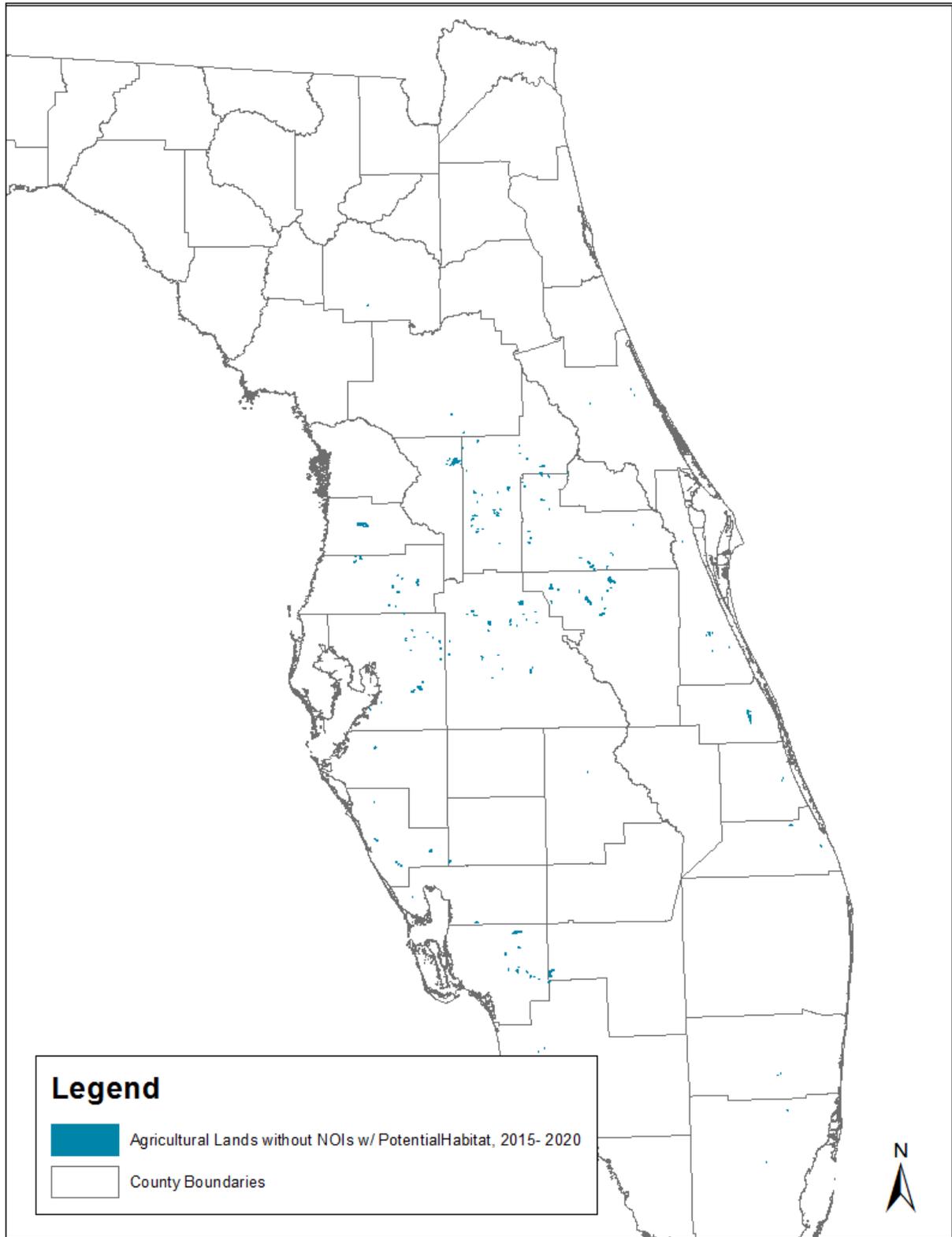


Figure 6. Projected Urban Growth (2015-2020) with Potential Sandhill Crane Habitat



Source: FFWCC; TBG

The areas of projected urban growth were generated for metropolitan statistical areas and based upon projected population increases, the average household size, and the necessary acres to accommodate the predicted growth. Specifically, growth data from the 2010 Census Urban and Rural Classification and spatial data from the 2010 U.S. Census Urban Areas and Cluster were assembled for the urban areas (populations of 50,000 or more) that are within the regions of potential sandhill crane habitat. The average rates of growth for each were calculated for the period between 1990 and 2010. Growth was assumed to increase linearly for the forecasts of the successive five-year intervals. A spatial buffer to accommodate the expected population growth for each urban area was then generated within GIS for the 2015-2020 and 2020-2015 five-year intervals. To determine the projected paths for growth, each buffer was intersected with unirrigated agricultural land polygons from the Florida Statewide Agricultural Irrigation Demand (FSAID) database.<sup>10</sup>

**Table 4** summarizes the total acres of all parcels containing potential sandhill crane habitat across Florida, by various category. Agricultural land provides the bulk of existing sandhill crane habitat, at 4 million acres. Of this, 2.8 million have BMPs in place (Best Management Practices) and are considered compliant with FFWC rules for sandhill crane habitat. 1.1 million acres of agricultural land are not covered by BMP's, of which 42,041 acres are expected to convert to urban land in the next five years. In addition, another 16,672 acres of golf course provide habitat to sandhill cranes.

**Table 4. Summary of Acreage with Potential Sand Hill Crane Habitat in Florida, By Category**

Land Use Category	Acres
Expected Loss of Sandhill Crane to Urban Development, next five years	42,041
Agricultural Lands with Sandhill Crane Habitat	4,016,044
Agricultural Lands with BMPs (NOI)	2,883,945
Golf Courses <sup>11</sup>	16,672

## Survey Costs

The proposed survey methodology posits that a survey conducted in accordance with the recommended methodology can forego FWC review.<sup>12</sup> Aerial transects are recommended. Surveys are recommended in both the project planning phase and in the pre-clearing phase.

## Project Planning Surveys

To identify nesting areas and guide avoidance, minimization or mitigation actions, the Guidelines propose that three surveys be conducted, at least 3 weeks apart during the breeding season (e.g., early March, early April, and early May).

## Pre-Clearing Surveys

To avoid, minimize or mitigate the taking of active nests or flightless young, the Guidelines propose that pre-activity surveys occur within thirty days of initiation of activities and should include either one aerial

<sup>10</sup> Irrigated lands were assumed to reflect investment to forestall conversion during the next 5-10 years.

<sup>11</sup> The entire area of golf courses is included as sandhill cranes frequently use tees and greens that may not have been identified as potential sandhill crane habitat.

<sup>12</sup> Per the Guidelines, "Surveys are not required but if conducted in accordance with the methodology described below and the species are not detected, no FWC review is needed."

survey (covering 100% of suitable nesting habitat, at a minimum height of 250') or two ground surveys using observation points or transects that account for limits on visibility imposed by the vegetation and terrain. However, ground surveys must be conducted as to avoid disturbance and flushing of nesting cranes.

Standard requirements under ERP language for wetland conservation or restoration tend to cover most of the issues associated with sandhill crane management techniques, and interviews of both regulators (DEP and water management district staff) and consultants for permit applicants confirm that existing practice would be largely unaffected by compliance with the guidelines.

The average number of permits was provided by FFWC; at 150 annually. Based on the distribution of property sizes with potential sandhill crane habitat likely to develop, 35 are estimated to require aerial survey, 32 ground surveys of less than one day and 83 requiring an average of two full days. However, based on discussion with the consultant and regulators, it is estimated that only 10-20% of the permits will require additional effort over and above already schedule ERP effort. A 15% probability has been assigned to the per permit costs.

### **Property Owner Impacts**

In discussions with practitioners, the new survey protocols are untested. For purposes of estimating the time to complete the survey effort, listed species surveys associated with existing ERP permitting protocols total about 200 hours. However, this number can vary significantly based on the scale of project, geography, vegetation type and density, and quality of property access, among other factors.

From interviews with consultants, aerial surveys are preferred for sandhill crane nest identification, and are generally cost effective for larger projects. Costs for aerial surveys depend on choice of craft. Fixed wing craft typically rent for between \$175 and \$200 per hour. Helicopters typically rent for about \$600 per hour, but do not necessitate travel time to public or private airfields and staff conducting the survey can simply meet the craft at nearby open areas. Helicopters also were identified as being able to achieve lower altitudes and thereby provide opportunity for more accurate identification of nests.

### **Administrative Impacts**

Internal costs include FWC staff time for monitoring, implementation assurance, pre-application meeting attendance. Survey costs for FWC staff are a function of mode of transport and size of area. Costs are based on an average of 2 hours of Field Biologist work on ground survey and 3 hours in aerial survey.

Internal costs to the Florida Department of Environmental Regulation to address comments about sandhill crane habitat and activities for species protection were considered to be zero for power plant siting applications<sup>13</sup> and nominal (less than two hours) for ERPs.<sup>14</sup> The agency makes no distinctions regarding the subject of the comments (surveys, avoidance, minimization, etc.). In the case of the former class of review, FWC comments are part of the licensing process, regardless of the specifics of the comments provided. The costs for monitoring are borne by the applicant and review for compliance is the responsibility of FWC. In the case of the latter, DEP expends limited staff time forwarding agency

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<sup>13</sup> Personal communication, Ann Seiler (DEP), May 12, 2016.

<sup>14</sup> Personal communication, Alan Whitehouse (DEP), May 12, 2016.

comments to applicants, if they are received. Monitoring of compliance with conditions typically extends five years or more and reports are generally received biennially. Staff time is required to review the reports.

**Table 5. Survey Costs, Sandhill Crane**

Survey	Permits per Year	Annual Cost
Survey Costs – Project Planning	150	\$41,077
Survey Costs – Pre-Clearing	150	\$33,189
Total		
<b>Survey - Administrative Costs</b>		<b>Annual Cost</b>
FFWC Administrative Costs		\$63,494

### Avoidance Measures

Avoidance measures include the establishment of protection zones or buffers, and accepting temporary losses of use or delays in project timing. Avoidance measures are temporary, and due to the seasonal nature of sandhill crane nesting activity. Since locations vary year to year based on weather and other conditions, avoidance is geared toward avoiding disruption to nesting and juvenile bird activity. Specifically, avoidance includes:

- Avoiding impacts to natural wetlands used by sandhill cranes for breeding, feeding, or sheltering;
- Avoiding activities within 400 feet of an active nest during the nesting season (generally February through April); and
- If flightless young are present in a wetland, avoiding land use conversion in suitable upland habitat within 1,500 feet of the nest until after young are capable of sustained flight.

### Property Owner Impacts

Based on samples of FWC comment letters, avoidance is generally recommended in its review of ERPs affecting potential sandhill crane habitat, i.e., it is a guideline affecting most developments.

Avoiding activities within 400 feet of an active nest can be assisted with appropriate flagging or posting (see Minimization Measures). A 400’ radius governs about 11.5 acres of property and about 2,512 feet (nearly 0.5 miles) of perimeter. On larger projects (100’s to 1000’s of acres) the acreage avoided represents a nominal share, and generally involves wetlands that would be avoided for other reasons, including agricultural best management practices (BMPs) and the protection of other wetland-dependent listed species. It should be noted that ecologists interviewed for data collection questioned whether 400’ was sufficient, although equal comments were received as to whether 400’ was appropriate or inappropriate.

In sum, the economic impacts of avoidance were deemed nominal.

Avoidance of wetlands with flightless young affects significantly more property: more than 162 acres and nearly 1.8 miles of perimeter. However, the time required for young to fully fledge runs no more than 70 days. Discussion with practitioners indicates that project delays of 4-6 weeks are typical.



The guideline to avoid uplands land use conversion within 1500 feet of a nest until young are fully fledged translates into more than 160 acres of property<sup>15</sup> on which development should not occur. Avoidance conditions could persist for 70 days (2.3 months). However, there was consensus among the several consultants contacted that such delays are generally easy to work around and that components or phases of most developments can be staggered or re-sequenced to minimize the financial impacts of localized delays due to nesting; only one consultant could recall an instance of actual delay, and the instance ultimately did not affect project costs (although it affected developer's preference).<sup>16</sup>

### Administrative Impacts

ERP regulatory staff with DEP and the four water management districts with potential sandhill crane habitat indicated that while the specification of avoidance measures for flightless young in particular is more impactful than current standards, there is no effect on staff time for permit review and processing. Project delays or temporary displacements of use have no effect on agency resources.

Table 6. Costs of Avoidance Measures, Sandhill Crane

Avoidance Measures	Permits per Year	Annual Cost
Protection Zones during construction	5	\$0
<b>Administrative Costs - Avoidance Measures</b>		<b>Annual Cost</b>
FWWC Administrative Costs		\$0

### Minimization Measures

Minimization measures also are common management tools for the sandhill crane. For example, permeable fencing is an option for ranchers, and the large utilities (Florida Power & Light and Duke Energy) have applied minimization measures. Minimization includes a broad range of activities:

- Minimizing the amount of suitable foraging habitat converted to other land uses;
- Designing projects to minimize changes in timing, quantity, or quality of water that could degrade suitable sandhill crane nesting habitat;
- Designing projects to avoid or minimize fertilizer, herbicide, and pesticide runoff into wetlands;
- Designing new ponds with shallow shelves vegetated with native herbaceous wetland species to provide breeding, roosting, and foraging opportunities;
- Avoiding placement of impermeable surfaces adjacent to wetlands used by nesting cranes;
- Incorporating culverts into road designs that will allow for maintenance and/or restoration of natural hydrology;
- Design roads away from suitable wetlands to minimize road mortality.
- Using silt fencing and other methods to minimize impacts to water quality in shallow wetlands.
- During power line installation, adding power line markers to increase visibility to flying cranes.
- Where vehicle-caused mortality is likely to occur, posting signs in areas frequented by cranes to alert motorists.

<sup>15</sup> 1500' squared times  $\pi$  divided by 43,560 sq ft per acre.

<sup>16</sup> One consultant reported one instance (over the past decade) of avoidance causing an actual delay in a project because the property's primary access was affected by nest location (Zev Cohen & Associates); however, no costs were reported as other areas of the project were simply worked on instead.

- Using fencing that is more permeable when constructing fences in or around nesting wetlands and associated uplands.

### Property Owner Impacts

Each minimization activity will have unique costs and selection will depend on the site and characteristics of development.

**Littoral Zones:** The costs for the construction of shallow ponds with littoral zones to improve foraging and nesting will vary based on the planting regime, in turn related to the soils on site. Minimum costs have been tabulated to be \$2,763 per acre on very poorly drained soils, but may be as much as \$29,040 per acre on moderately well drained soils. The average costs of six different designs (vegetation combinations and densities) on diverse soils was \$10,069 per acre (Lotspeich, 2012). Typical costs are about \$11,750 per acre. The spatial extent to be planted will vary by project or permit. Littoral zones are commonly planted with a grade of 8:1 (or less).<sup>17</sup> The guidelines do not specify a minimum area; however, enhancing the edge of a one-acre pond with a 20-foot wide littoral shelf requires less than one-third of an acre, or about \$3,100 per acre of pond to be enhanced.

**Power Line Markers:** Power line markers have been documented to reduce bird collisions.<sup>18</sup> At the typical price of \$51 per marker<sup>19</sup> and a preferred distance of 5 meter spacing, material costs are about \$3,394 for a typical 0.2 mile span (includes \$130 for an installation tool.) Labor adds \$960 per mile (at \$60/hour, including vehicle costs, for two employees).

**Signage:** Signage costs vary by size and material. Custom signs (e.g., with a silhouette of a crane) can be purchased at a 30-35% premium for uploading the graphic. For comparison, 12"x12" (pre-printed) metal signs for duck crossings can be purchased for as little as \$16 each.<sup>20, 21</sup> Larger products (24"x24") can cost as little as \$34.95 in bulk, \$47.95 individually.<sup>22</sup> A typical cost was estimated at \$70 per unit. Labor costs will be approximately \$60 per installation, assuming a total of one hour including travel.

**Flagging:** Flagging or marking areas around nests identifies property to avoid (see Avoidance Measures) and is a means to help reduce the impacts of nearby activities (by serving as a warning to workers and equipment operators). Flagging is a one-time cost per nesting season and the costs for flagging a 400' radius, including labor, are less than \$100 per nest. Multiple nests, within several hundred feet of each other would result in a larger marked area but without a significant increase in costs for flagging.

**Permeable Fencing:** Due to the reduced numbers of strands used, permeable fencing may cost approximately one-half of traditional fencing to protect areas.<sup>23, 24</sup> However, common practice for birds is to include reflectors and "lay-down" fencing, where practical. These two options increase the per unit costs to be roughly that of traditional fencing. At about \$23,760 per mile, a 400' buffer would cost about

<sup>17</sup> <http://www.colliergov.net/your-government/divisions-f-r/natural-resources/littoral-zones>

<sup>18</sup> Yee, 2008.

<sup>19</sup> Firefly Bird Diverter, [www.pr-tech.com](http://www.pr-tech.com)

<sup>20</sup> <http://www.roadtrafficsigns.com/custom-crossing-signs>

<sup>21</sup> [http://store.hallsigns.com/18-HW16-1-Duck-Crossing-\\_p\\_2940.html?gclid=CML61\\_q25MwCFddahgod8l0OXg](http://store.hallsigns.com/18-HW16-1-Duck-Crossing-_p_2940.html?gclid=CML61_q25MwCFddahgod8l0OXg)

<sup>22</sup> <http://www.safetysign.com/animal-crossing-signs>

<sup>23</sup> <http://www.landcarerresearch.co.nz/publications/innovation-stories/2014-stories/pest-fencing>

<sup>24</sup> Sonoma Ecology Center, 2003.

\$11,300. However, such fencing would be usable for multiple seasons and is appropriate for the protection of other wetland-dependent species. Lay-down fencing also provides the option for use of the protected areas after the nesting season.

### Administrative Impacts

ERP regulatory staff with DEP and the water management districts indicated that the inclusion of minimization measures would have no measurable or quantifiable incremental effect on staff time for permit review and processing or for monitoring and compliance.

### Total Minimization Costs

Total minimization costs are summarized in **Table 7**.

**Table 7. Summary of Minimization Costs, Sandhill Crane**

<b>Minimization Costs – Sandhill Crane</b>	<b>Permits per Year</b>	<b>Annual Cost</b>
Planting Nesting Vegetation on Littoral Shelves	10	\$38,775
Adding Powerline Markers to Increase Visibility	1	\$4,354
Posting Signs in Nesting Areas	10	\$2,600
Flagging Nests	100	\$8,800
Permeable Fencing	10	\$113,040
<b>Total Minimization Costs</b>		<b>\$167,569</b>
<b>Administrative Costs Minimization- Sandhill Crane</b>		<b>Total</b>
FWWC Administrative Costs		\$0

### Mitigation Measures

Mitigation for sandhill cranes would be largely accomplished through existing wetland mitigation measures. No species-specific mitigation management rules currently exist.

Beyond conventional on-site mitigation and the use of wetland mitigation banks, other mitigation measures may be undertaken:

- Options that provide scientific benefit, including
  - Funding for multi-year implementation of FWC’s statewide monitoring for sandhill cranes.
  - A study using radio or satellite telemetry to examine movements, home range size, productivity, and survival in urban and suburban areas.
- Options that address habitat
  - Wetland mitigation through the ERP program. The management option includes wetland restoration or creation through the ERP program
- Options that address information gaps
  - Supporting research consistent with the State Action Plan;
  - Multi-year monitoring that contributes to a statewide survey;
  - To complement ERP mitigation that does not satisfy the FWC’s definition of conservation benefit for sandhill cranes.



### Habitat Acquisition

Land can be acquired via fee simple acquisition or conservation easements, but generally mitigation credits would be used to satisfy permitting requirements. No transactions are anticipated exclusively for sandhill crane purposes. 1 credit annually attributable strictly to sandhill cranes is included in the estimate, using a combination of UMAM and non-UMAM prices.

### Habitat Enhancement

Onsite mitigation allows the landowner to perform enhancements to degraded habitat onsite, to compensate for impacts to habitat. Estimates from EQIP project budgets were used to calculate the costs of additional plantings, prescribe fire, and removing woody vegetation for a variety of differently-sized sites. In discussion with consultants, only the largest permits would be affected with about 2-5% of the acreage impacted. A midpoint of 3.5% was used in the calculations. The distribution of acreage sizes across sites was based on information provided by FFWC from prior permits.

### Property Owner Impacts

Much of the suitable habitat for sandhill crane management is located on private property, and specifically cow-calf operations, which tend to have the same habitat needs. Since many agricultural operations are covered by BMPs, and are presumed compliant, the mitigation measures will not affect many farms or acreage.

Table 8. Costs for Sandhill Crane Mitigation Measures, Sandhill Crane

Mitigation Measures Costs– Sandhill Crane	Permits per Year	Annual Cost
Habitat Acquisition- Fee Simple Acquisition	0	\$0
Habitat Acquisition- Conservation Easement	0	\$0
Habitat Acquisition- Mitigation Banking Credits	1	\$79,950
Habitat Enhancement	1	\$3,721
Seasonal/Annual Monitoring of Nesting Areas	10	\$93,462
<b>Total Mitigation Costs</b>		<b>\$177,133</b>
<b>Administrative Costs Mitigation Measures – Sandhill Crane</b>		<b>Total</b>
FWWC Administrative Costs		\$0

### FFWC Administrative Impacts

ERP regulatory staff with DEP and the water management districts indicated that the inclusion of mitigation measures would have no measurable or quantifiable incremental net effect on staff time for permit review and processing or for monitoring and compliance of mitigation activities.

### Aversive Conditioning Measures

Aversive conditioning is a management tool to effectively deter sandhill cranes from using land that is incompatible with habitat due to human uses, or to address the presence of nuisance cranes. Examples include damage caused to crop land by sandhill cranes pulling up drip tape irrigation systems and damage to golf course greens and tees caused by sandhill cranes pecking for mole crickets and similar food. Golf courses have been the majority of special purpose permit applicants. While the FWC fields roughly 115



calls annually for assistance regarding nuisance sandhill cranes, the FWC has issued a total of just three such “Special Purpose” permits in the last two years.<sup>25</sup> The agency provides technical assistance to educate individuals and businesses to help reduce the impacts of cranes to their properties and, indirectly, to limit the number of permits to be administered.

### Property Owner Impacts

Costs to golf courses for aversive conditioning are based on reports from golf course superintendents and club managers. A frequent response was the use of golf carts to approach and intimidate sandhill cranes.<sup>26</sup> Course maintenance workers earning about \$14/hr may be expected to expend up to 2-4 hours per week addressing sandhill cranes during the two-month breeding season when they are more active (and interfere with peak tourist season golfing). Consequently, the six-month (maximum) seasonal labor costs for aversive conditioning may be expected to be about \$670 per course. All (6) courses contacted randomly statewide affirmed the presence of cranes on-site, but only two indicated they employ aversive conditioning (the remainder just absorb the labor and green/tee restoration costs as needed). There are 122 golf courses in Florida within the areas determined to have potential sandhill crane habitat (as shown in **Figure 2**).

### Administrative Impacts

The majority of instances are addressed with technical assistance. Based on FWC records, fewer than two special purpose permits are issued per year for aversive conditioning. Processing the permits has required up to 21 hours of administrative staff time (2% of annual hours) and support of no more than 8 hours (combined) of biologist and senior staff (permit coordinator) time.<sup>27</sup>

At about \$602 per permit (with overhead), the annual cost for the average number of aversive conditioning permits has been about \$1,000. Implementation of the guidelines will result in a savings of this staff time and may be re-allocated to other agency needs.

Special Use Permits for Aversive Conditioning create no incremental demands on staff time of other agencies.

**Table 9. Aversive Conditioning Costs-Sandhill Crane**

<b>Aversive Conditioning Costs- Sandhill Crane</b>	<b>Permits per Year</b>	<b>Annual Cost</b>
Landowner Staff Time	2	\$1,008
<b>Total Aversive Conditioning Costs</b>		<b>\$1,008</b>
<b>Administrative Costs - Aversive Conditioning - Sandhill Crane</b>		<b>Total</b>
FWWC Administrative Costs		\$(1,042)

<sup>25</sup> Per FWC memo, 5/15/2016

<sup>26</sup> An FWC special purpose permit authorized the approach of carts, noise (air horns or pyrotechnics), and the spraying of water. However, there is no record of the two latter means being employed at the facility that received the permit.

<sup>27</sup> Per FWC memo, 5/26/16.



## Single-nest Use Removal Policy

Rights of way (FDOT and utilities) are the majority of nest removal special purpose permit applicants. Nest removal permits authorize the relocation and replacement of nests and require the use of a licensed wildlife rehabilitator to treat chicks and monitor the response of the adult birds. The permits also require annual reporting about nest locations and presence of eggs and flightless young.

### Property Owner Impacts

Based on a permit issued to an agent working on behalf of FDOT, the use of a licensed wildlife rehabilitator costs at least \$3,200 for the hours required to manage a nest relocation, in this case an osprey.<sup>28</sup> Costs may be higher elsewhere in the State, however, as the referenced permit made use of a nearby conservation non-profit. In this particular case, volunteers were used to conduct monitoring (twice weekly) of nest and conditions of eggs and young. Based on in-kind service valued at \$20 per hour, the costs of a single nest removal permit are about \$3,520 each.

### Administrative Impacts

Based on FWC records, as many as ten Migratory Bird Nest Removal (special purpose) permits have been issued per year for nest removal. Processing the permits has required an estimated 312 hours of administrative staff time (15% of annual hours), or an average of about 31 hours per permit, plus the support of no more than 8 hours (combined) of biologist and senior staff (permit coordinator) time.<sup>29</sup>

At about \$900 per permit (with overhead), the annual cost for ten nest removal special purpose permits has been about \$8,967. Implementation of the guidelines will result in a savings of most of this staff time and may be re-allocated to other agency needs.

**Table 10. Total Costs – Single Use Nest Removal, Sandhill Crane**

<b>Costs - Single Use Nest Removal, Sandhill Crane</b>	<b>Permits per Year</b>	<b>Annual Cost</b>
Monitoring	10	\$3,200
Nest Removal	10	\$32,000
<b>Total Single Nest Removal &amp; Nest Monitoring Costs</b>		<b>\$35,200</b>
<b>Administrative Costs - Single Use Nest Removal, Sandhill Crane</b>		<b>Total</b>
FFWC Administrative Costs		\$(8,967)

## Conservation Practices

The Guidelines recommend (but do not require) various conservation practices, such as the following (among others):

- Incorporating culverts into new road designs that maintain or restore natural hydrology.
- Avoiding the placement of impermeable surfaces adjacent to wetlands suitable for nesting cranes, reducing the chance of flooding nests.
- Minimizing fertilizer, herbicide, and pesticide runoff into wetlands.

<sup>28</sup> Permit Number: LSNR-15-00139, November 2015.

<sup>29</sup> Per FWC memo, 5/26/16.

- Posting signs in areas frequented by cranes to alert motorists.
- Developing a prescribed fire regime that minimizes woody encroachment into wetlands and uplands.
- Maintaining open areas for foraging through grazing or mowing.
- Using permeable fencing in or around wetlands and associated uplands suitable for sandhill cranes.

### **Property Owner Impacts**

As the conservation practices are recommended and not required there are no inherent costs imposed by the Guidelines. However, depending on the activity, entities that implement the recommendations may incur operational savings or costs. For example, installing culverts to improve hydrology (reducing flooding depth on the upstream side of a road while expanding areas subject to inundation below the culvert) may represent an increase in construction costs. Conversely, using barbed wire rather than woven wire or chain link fence around wetlands may represent a cost savings in materials. Modifying a site design to avoid placing impermeable areas, such as parking lots, next to wetlands may represent no costs to a development.

### **FFWC Administrative Impacts**

As there is no required review of the recommended activities, there are no administrative costs to the agency.

### **Other External Costs**

Indirect costs of implementing the ISMP guidelines for the sandhill crane include the costs of review of development proposals, permits, and monitoring / compliance reports by a variety of non-governmental organizations. As an example, staff of the Conservancy of Southwest Florida, Defenders of Wildlife and Audubon Florida invested an estimated 1,248 hours (combined) in participating in the development of the draft guidelines for the ISMP (for all species).<sup>30</sup> In addition to active review of permit conditions for the protection of sandhill cranes, NGO staff also review other permitting for wetland impacts which may involve sandhill crane foraging habitat. The organizations are selective as to which permits they review (size, known nexus with other natural resources of interest, proximity, etc., are among the factors); however, were all permits receiving crane-related comments from FWC to be reviewed (at an average of four hours total each) then external costs would be equivalent to about \$19,200 per year. Some reviews are shared between organizations; only one review party is considered in this estimated cost.

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<sup>30</sup> Excluding support staff, three professionals at an average of 10% FTE for two years. Florida Wildlife Federation and Collier County Audubon (Audubon of the Western Everglades) also indicate commitment of staff time relating to the development of the ISMP guidelines and ongoing review of permits.

## Analysis of Wood Stork Permitting

The Wood Stork is a federally protected species, classified as Threatened and considered a wetland dependent species. On June 30, 2014, the U.S. Fish and Wildlife Service reclassified the United States (U.S.) breeding population of the wood stork from Endangered to Threatened under the Endangered Species Act of 1973, as amended (Act). The Ruling also established the U.S. breeding population in Alabama, Florida, Georgia, North Carolina, Mississippi, and South Carolina as a distinct population segment (DPS). The action was based on a review of the best available scientific and commercial data, which indicated that the U.S. wood stork DPS was not presently in danger of extinction across its range.

Given its federal protection status notwithstanding the recent ruling, FFWC is interested in evaluating the costs of compliance with federal protection status for the Wood Stork as a benchmark for comparison of compliance costs for the sandhill crane. The tasks of evaluation include the costs to survey, costs of avoidance, and costs of mitigation measures.

**Figure 7** provides a map of the Wood Stork Core Foraging Areas, (provided by the USFWS). **Table 11** summarizes the estimated acres of wood stork core foraging areas within several categories of land use. Agricultural lands that overlap wood stork habitat total 4.7 million acres, of which 3 million have BMPs in place. Of the 1.7 million remaining acres without BMPs, 8,152 acres are likely to be lost within the next five years to urbanization. Another 33,456 of non-agricultural land that overlaps wood stork habitat is expected to urbanize in the next five years. Maps depicting the areas described below are shown in **Figures 8 - 12**.

**Table 11. Summary of Wood Stork Core Foraging Area Florida Acreage**

Land Use with Wood Stork Core Foraging Area	Acres
Undeveloped land with wood stork core foraging area	506,319
Estimated loss in Undeveloped land with wood stork habitat, 2015-2020	33,465
Agricultural Land with wood stork core foraging area	4,762,122
Agricultural Land with BMPs (NOI) and wood stork habitat	3,021,403
Estimated loss in agricultural land with wood stork habitat, 2015-2020	8,152
Golf course acreage with wood stork core foraging area	124,717

Figure 7. USFWS Wood Stork Core Feeding Areas

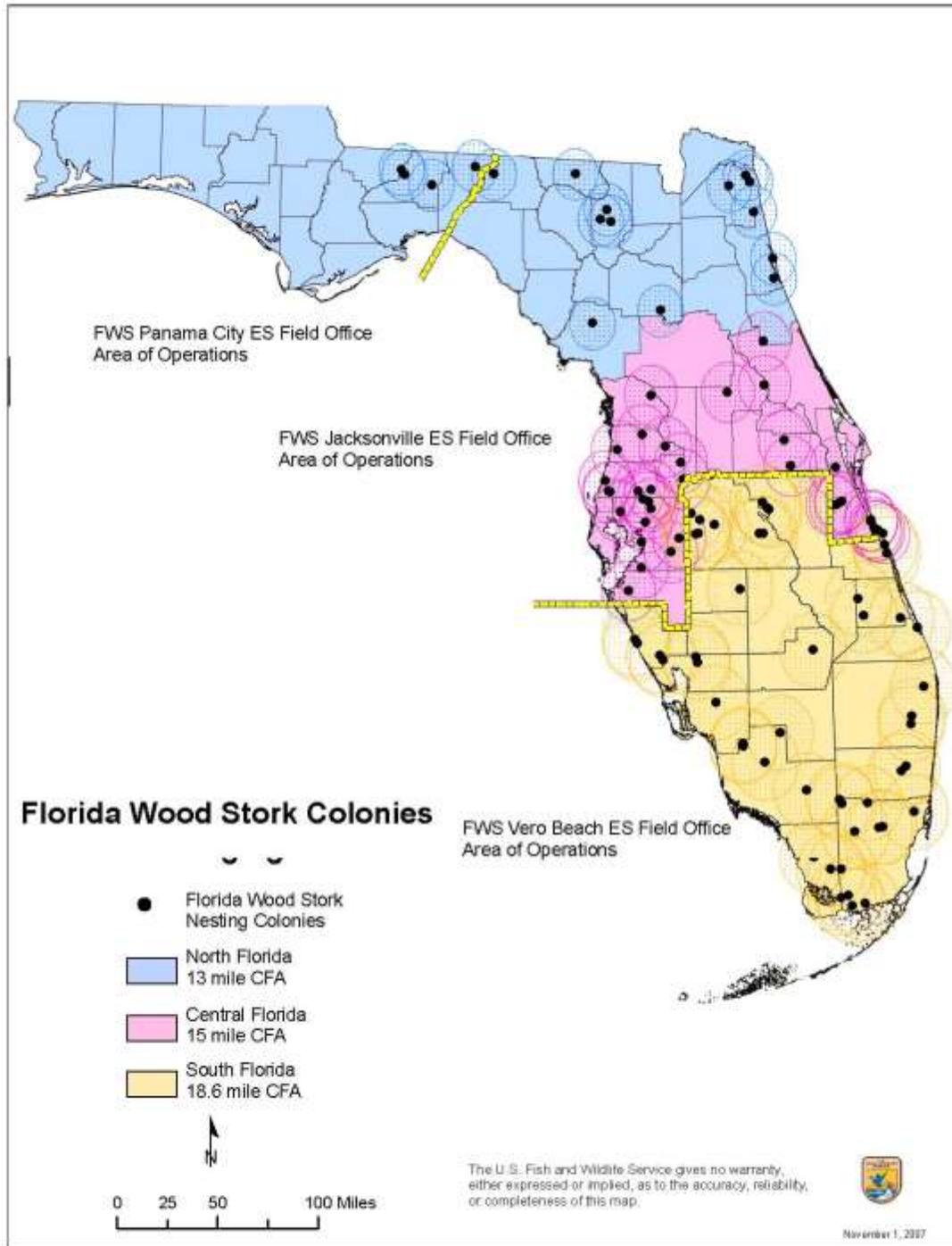


Figure 8. Golf Courses with Potential Wood Stork Habitat

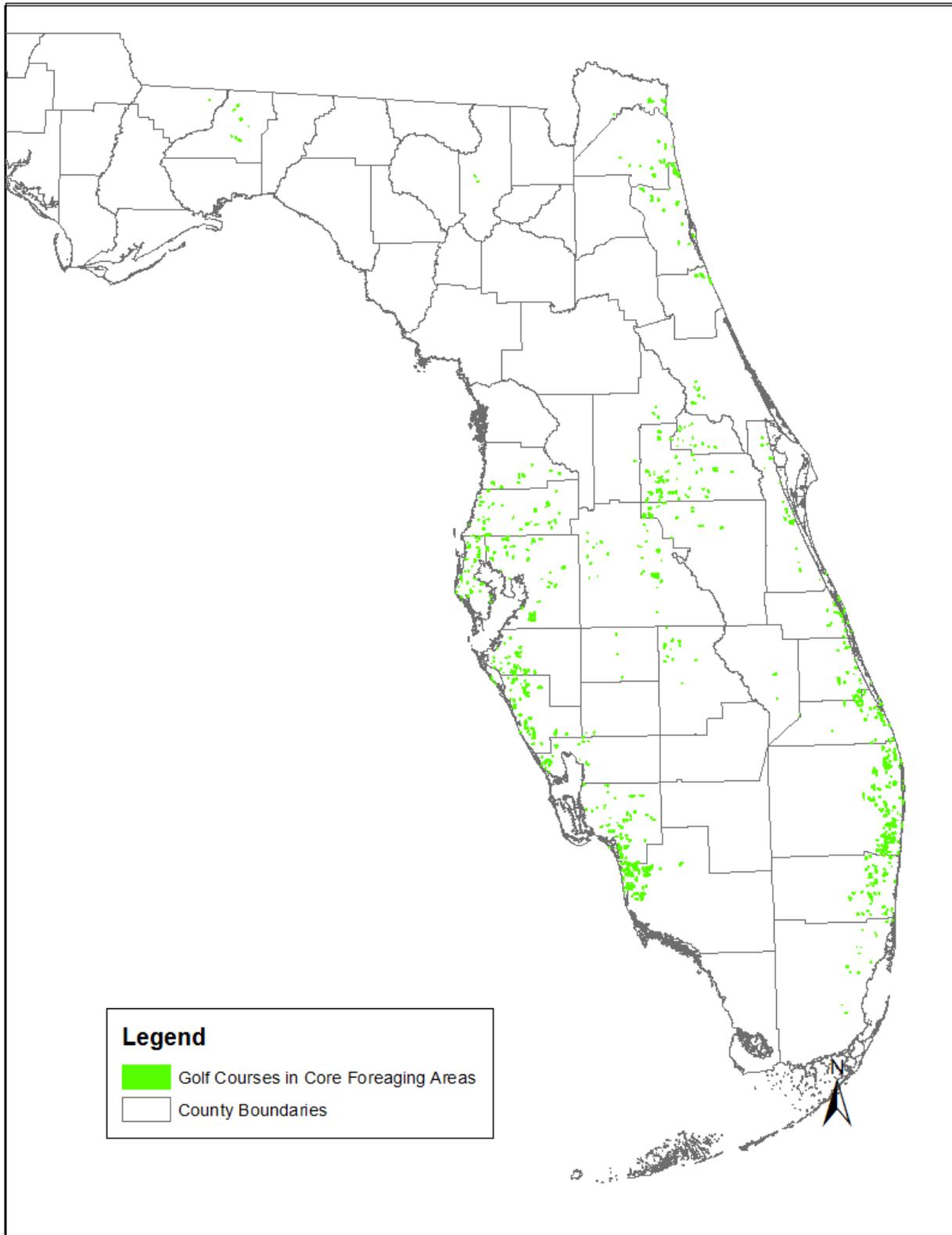


Figure 9. Agricultural Lands with Potential Wood Stork Habitat

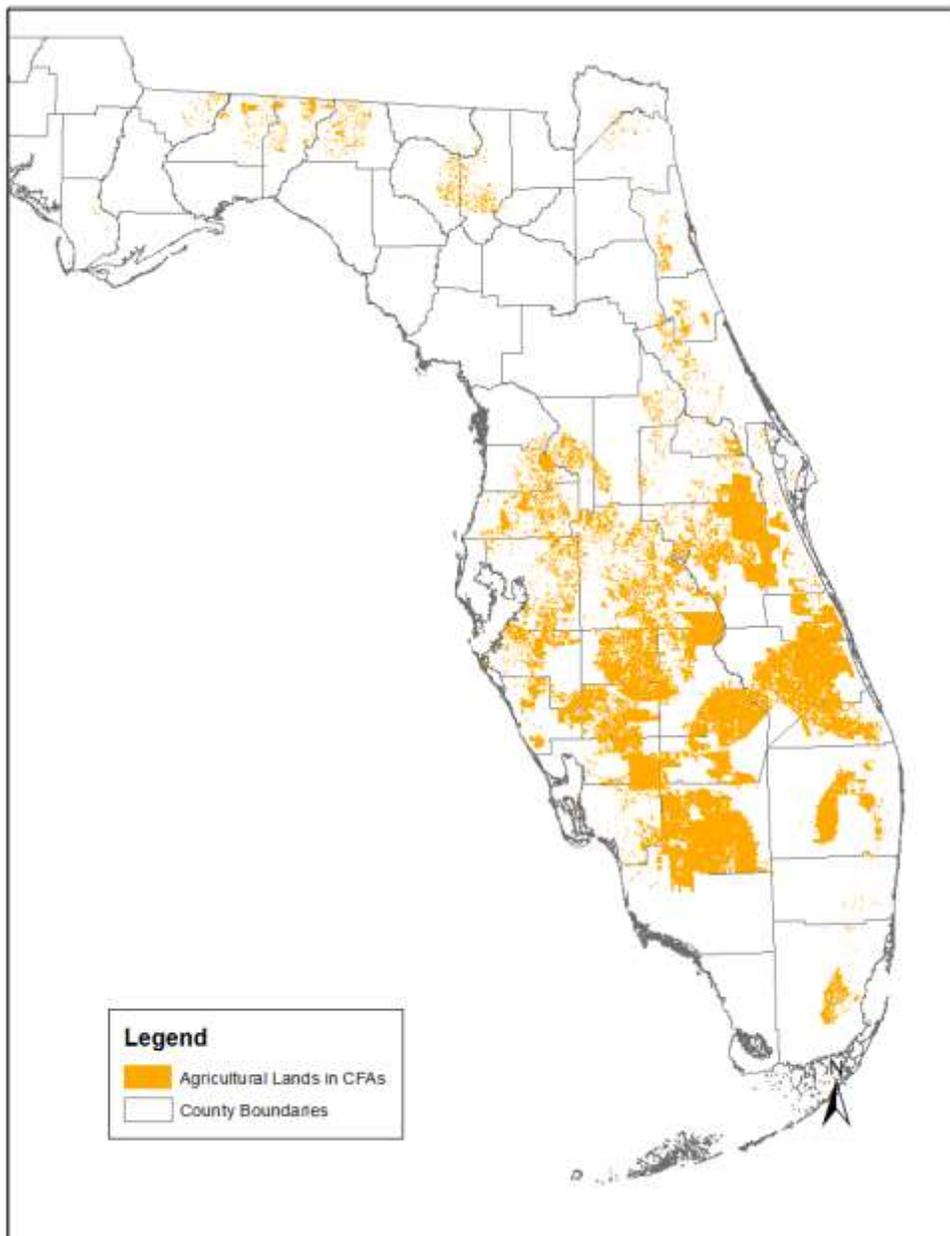


Figure 10. Agricultural Lands with Potential Wood Stork Habitat that have Executed Notices of Intent

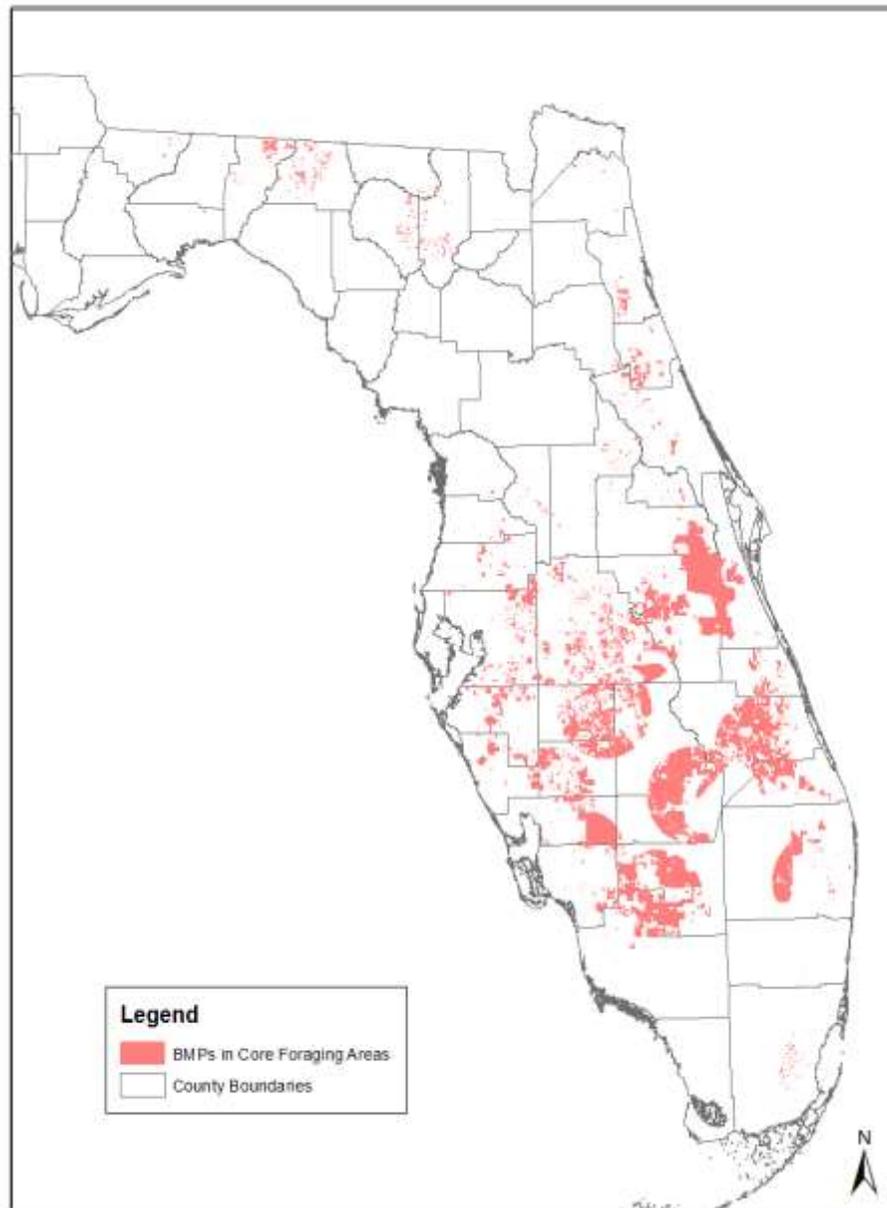


Figure 11. Agricultural Lands without a NOI and Commitment to Implement BMPs

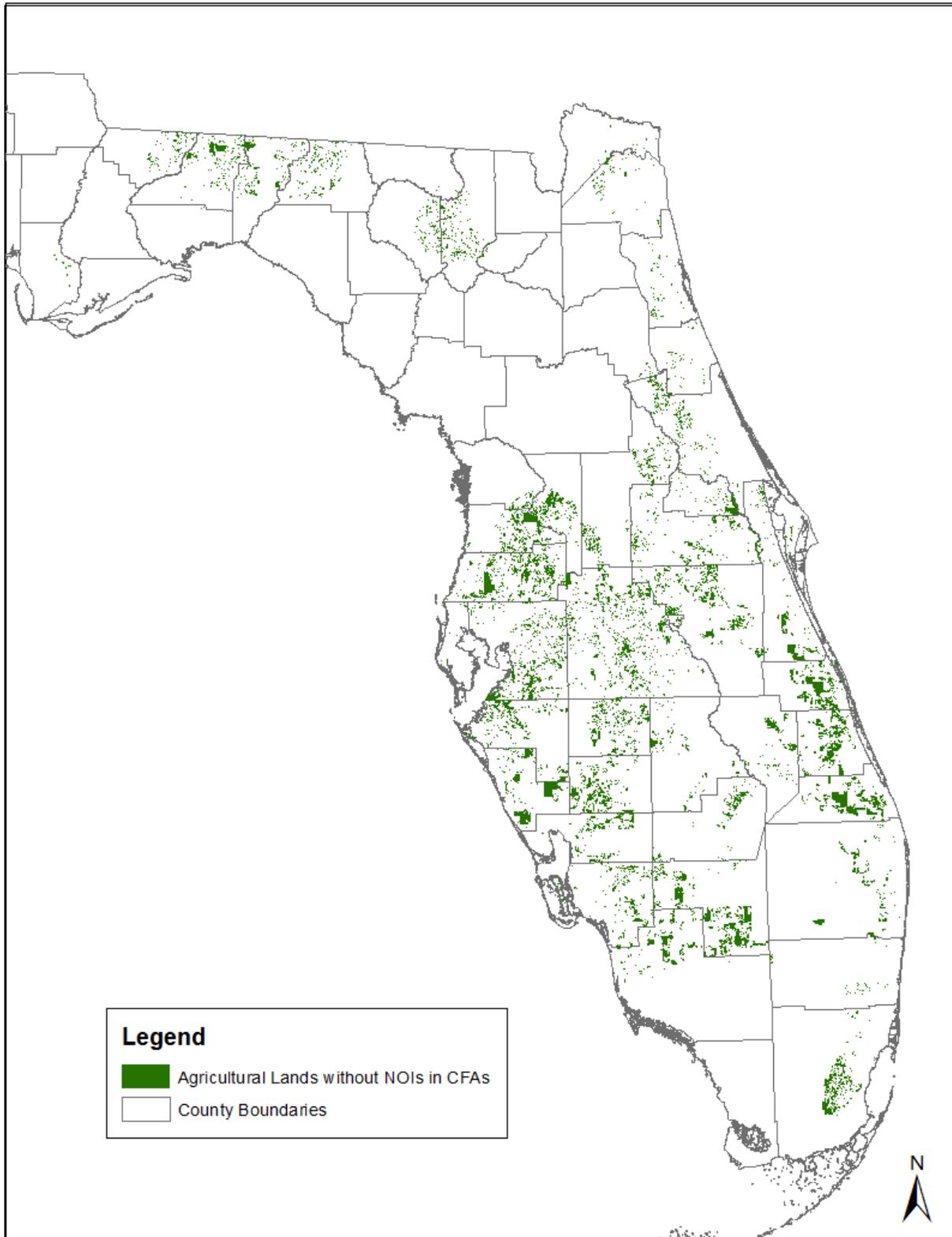
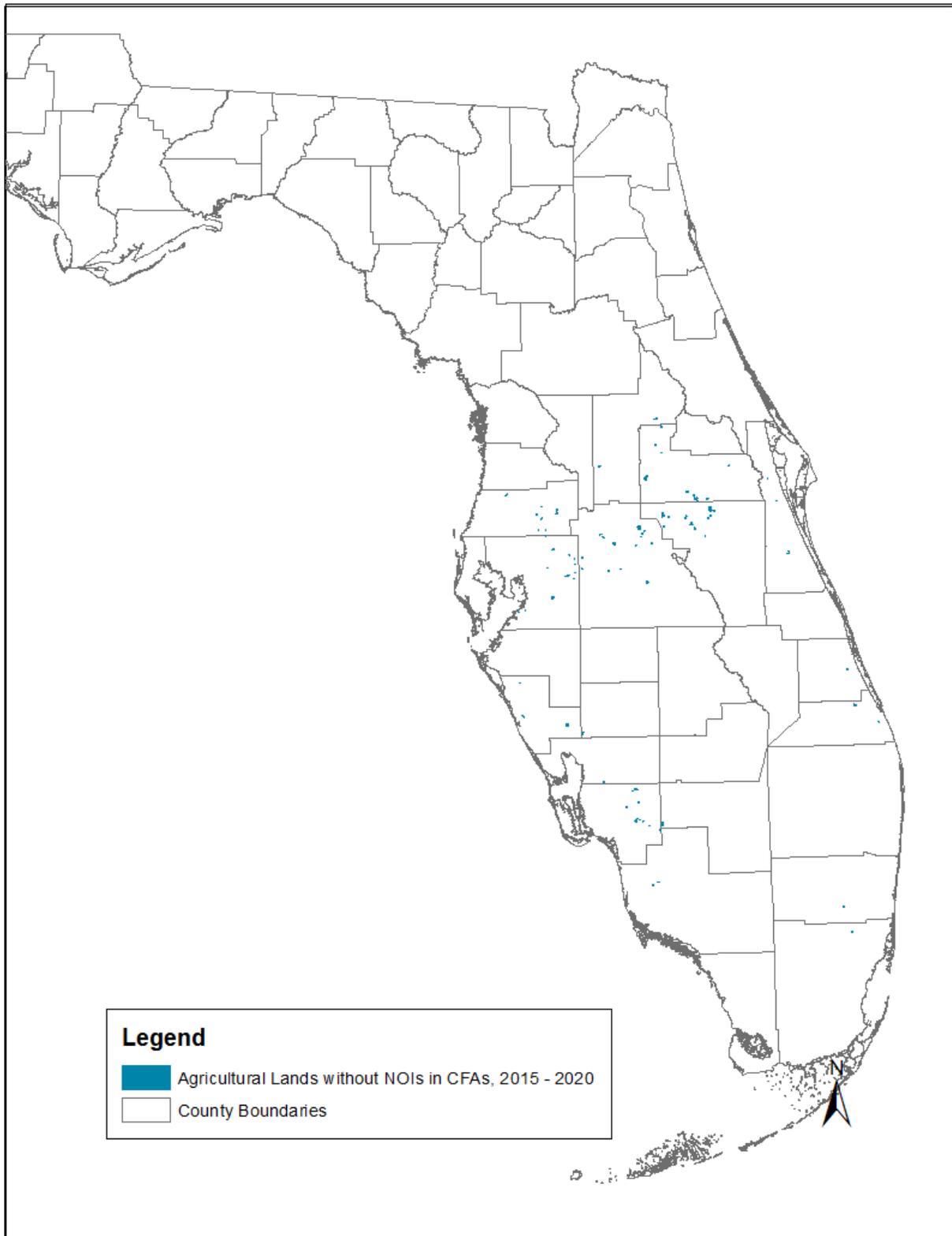


Figure 12. Projected Urban Growth (2015-2020) with Potential Wood Stork Habitat



## Costs to Survey

The costs to surveys for wood storks, due to the overlap with other wetland-dependent species that require an ERP, are perceived to be included in activities associated with the ERP. Consultants interviewed for the research indicated that on small projects, the impact would be minimal. On large projects with large acreages and/or difficult access, compliance with wood stork regulations could have a larger impact, primarily due to seasonal differences.

In some aspects, wood stork surveying is straightforward, from the landowner and ecologist/consultant perspective. The consultant performs a desktop assessment to determine if the proposed project is within a specified radius (2000') of an identified Wood Stork rookery, which dictates whether mitigation or other measures are required. The desktop assessment takes minutes and is a standard practice in project planning, according to the consultants interviewed for the research.

If the assessment identifies that wood storks may be impacted, the survey can become more complicated. The consultant will perform an expanded biomass assessment of the foraging habitat, and determine if the project will create anticipated loss of crayfish, frogs, and related dietary content, the hydrologic regime governing the habitat, annual extent of submerged habitat, and other factors. The expanded biomass assessment may add 4-8 hours for consultant work. If the project is in an already urban area, the process is bypassed since the habitat is incompatible.

Approximately 13,800 acres of wood stork core foraging areas have been identified as land likely to become urbanized within the next five years that is currently undeveloped. Of this, roughly half is bordered by already urbanized areas and considered unlikely to require the expanded biomass assessment. Information from USFWS was unavailable to directly determine the number of permits that are issued annually, but using analogous numbers from crane permits, it is estimated that approximately 144 permits could be required, of which about one-third require the expanded biomass assessment.

Table 12. Survey Costs, Wood Stork

Property Owner Impacts	Permits per Year	Annual Cost
Ground Surveys	11	\$22,000
Expanded Assessment	48	\$44,862
<b>Total Costs</b>		\$66,862
<b>USFWS Administrative Costs</b>		Nil

## Avoidance & Minimization Costs

Per the USFWS "Habitat Management Guidelines for the Wood Stork in the Southeast Region", activities that may disturb feeding should be avoided within 300' where vegetation screening exists, or 750' where it does not. Similarly, for nesting areas activities should be avoided within 500' and 1000' respectively (primary zone). Activities such as lumbering, clearing or hydrological alteration are assumed to be detrimental to colonies. Irregular behaviors and increases in ongoing activities are assumed to be detrimental when colonies are active. The secondary zone extends 2500' from the edge of the colony.



Activities that should be avoided in the secondary zone include loss of more than 20% of wetlands or changes in hydrology that may impact the primary zone.

For purposes of estimating total costs, the unit costs for flagging sandhill crane nests were used and applied to the estimated annual number of permits for the wood stork.

In interviews with consultants and landowners, incremental avoidance costs were considered minimal. Once desktop assessments were identified, issues associated with freshwater wetland avoidance would already be covered through ERP permitting. The presence of wood storks was considered a relatively inconsequential issue for non-mitigation purposes. Permitting may require an additional Biological Assessment Report, which could add delays.

Typically, permit applicants will be required to rebut the presumption that a proposed project cannot be located in a non-wetland location, because the wetland is not required to achieve the basic project purpose. In addition, there is a presumption that alternative sites exist which would have less adverse impact on the wetland or aquatic environment. Besides addressing the least damaging alternative site issue, the applicant’s minimization efforts must include taking steps including site access options that would reduce impact to onsite wetlands. In discussion with consultants, the permit would be modified so that the project could avoid impacts.

The cost of incorporating modifications and the Biological Assessment Report was estimated at 18-24 hours of consulting time, in total. Since wood storks were generally identified with other species, in nearly every instance the wood stork avoidance efforts involved multi-species plans which would have been required by wetland permitting processes already underway. Consultants cited no project delays that were specifically tied to the presence of wood storks, once a project was started. Accordingly, no additional costs have been assessed for avoidance and minimization.

**Table 13. Avoidance and Minimization Costs, Wood Stork**

<b>Avoidance &amp; Minimization Costs - Wood stork</b>	<b>Permits per Year</b>	<b>Annual Cost</b>
Avoidance costs	100	\$8,800
Minimization costs	48	\$0
	<b>Total Costs</b>	<b>\$8,800</b>

## Mitigation

The biomass assessment may determine that freshwater mitigation credits are required. If the intended mitigation bank is within a specified radius of the wood stork rookery and its core foraging habitat, wood stork credits may be sufficient. If not, the landowner would be required to purchase additional credits or do onsite mitigation. Time delays may occur, as additional agency reviews are required, including the Army Corps of Engineers (ACOE), which in turn solicits comments from sister agencies.

Once proposed mitigation has been approved, the permit is issued. The entire process entails approximately 160 hours of consultant time, however, the time is primarily associated with ERP criteria, of which wood stork requirements are one component. A review of average costs for biological permitting



across a number of FDOT projects without wood storks but with standard ERP processing and mitigation proposals indicates that 160 hours is approximately the amount of time for a regular assessment. As such, no additional consultant or delay time is attributed to the wood stork mitigation credit process.

The cost of the mitigation is estimated at \$43,700 based on the average of federal credit costs in Florida. Based on discussion with mitigation bankers, the number of annual credits is estimated at 10.

### Administrative Impacts

Internal costs for USFWS specific to the wood stork were defined to be negligible and considered to be part of the agency’s general commenting on Section 404 permits. There is a presumption by the USFWS that other agencies’ reviews on wetland impacts ((including those by DEP and the water management districts) address most considerations for species protection, although additional scrutiny is provided within distances of active colony sites per the specifications within the Effects Determination Key.<sup>31</sup> For purposes of this estimation, costs are presumed to be comparable to FWC staff time for oversight of mitigation efforts, which total about \$610 per permit.

**Table 14. Mitigation- Administrative Costs, Wood Stork**

	Permits per Year	Annual Cost
Mitigation credits	10	\$437,000
USFWS Staff costs associated with Mitigation credits	10	\$6,100
	<b>Total Costs</b>	<b>\$443,100</b>

### Total Wood Stork Costs

The total cost of compliance attributed solely to wood stork permitting, avoidance measures, and mitigation credits within the State of Florida is relatively small, given the federal status. In discussion with mitigation bankers and consultants, while initial assessments may indicate mitigation efforts or expanded assessments are required, the eventual outcome is rarely a requirement for additional cost or effort – due to the fact the needs overlap other species. One mitigation banker described it as “for every four calls we receive about wood stork credits, only one will eventually require them – in the other cases, the regulatory decision determines that other efforts expended under existing permitting negated the need.”

The total costs over five years are estimated at \$2,549,810. **Table 15** provides a breakdown.

**Table 15. Total Costs – Wood Stork**

	Permits per Year	Total Costs over 5 years
Surveys	59	\$334,308
Avoidance costs	100	\$44,000
Minimization costs	48	\$0
Mitigation costs	10	\$2,215,500
	<b>Total Costs Over 5 Years</b>	<b>\$2,593,808</b>

<sup>31</sup> Personal communication, Heath Rauschenberger, Deputy Field Supervisor, U.S. Fish and Wildlife Service, 7/8/16



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# Appendix

Table 16. Sandhill Crane Summary – Labor Costs to Private Sector

## Florida Fish and Wildlife Conservation Commission Report Summary

### Imperiled Species Management Plan

	No. of affected Permittees Annually	Total Annual Cost	Comments
<b>Sandhill Crane</b>			
<b>Surveys</b>			
Project Planning Surveys	150	\$ 41,077	
Pre-Clearing Surveys	150	\$ 33,189	
Total	150	\$ 74,266	
<b>Sandhill Crane Avoidance Measures</b>			
Total	-	\$ -	
<b>Sandhill Crane Minimization Measures</b>			
Total	-	\$ 167,569	
<b>Mitigation</b>			
Habitat Acquisition	5	\$ 79,950	
Enhancements to Degraded Habitat	1	\$ 3,721	
Seasonal / Annual Monitoring of Nesting Areas	150	\$ 93,462	
Total	156	\$ 177,133	
<b>Sandhill Crane Aversive Conditioning Measures</b>			
Total	2	\$ 1,008	One Hr, Twice per week, Four weeks, Four months
<b>Sandhill Crane Single Use Nest Removal Policy</b>			
Total	10	\$ 35,200	Volunteers, weekly monitoring, 12 weeks
<b>Sandhill Crane Total</b>		<b>318</b>	<b>\$ 455,176</b>
<b>Woodstork</b>			
<b>Surveys</b>			
USFWS recommended methodologies			
Total	-	\$ 66,862	
<b>Avoidance</b>			
2500 feet of an active colony site, suitable foraging habitat, Core Foraging Areas			
Total	-	\$ 8,800	
<b>Minimization</b>			
1000 feet from nesting colony, Seasonal avoidance and minimization variable by region			
Total	-	\$ -	
<b>Mitigation</b>			
Cost of Wood Stork Credits, added cost/value to wetland mitigation banks			
Total	-	\$ 437,000	
<b>Woodstork Total</b>		<b>-</b>	<b>\$ 512,662</b>

Table 17. Sandhill Crane Summary –Direct Costs to FWC

Florida Fish and Wildlife Conservation Commission Report Summary

Imperiled Species Management Plan

Monday, July 18, 2016

	Field Biologist Hours	Admin. Assistant	Project Manager Hours	Estimated man hour costs associated with each affected permit	No. of affected Permittees Annually	Annual Cost	Total Cost Over Five Years
<b>Sandhill Crane</b>							
<b>Surveys</b>							
Project Planning Surveys	4	-	2	\$ 208	150	\$ 31,195	\$ 155,976
Project Planning Surveys, fieldwork; ground	2	-	-	\$ 63	115	\$ 7,255	\$ 36,276
Project Planning Surveys, fieldwork; aerial	3	-	-	\$ 95	35	\$ 3,312	\$ 16,561
Pre-Clearing Surveys	2	-	2	\$ 145	150	\$ 21,732	\$ 108,660
Total	11	-	4	\$ 511	150	\$ 63,494	\$ 317,472
<b>Sandhill Crane Avoidance Measures</b>							
Total	-	-	-	\$ -	150	\$ -	\$ -
<b>Sandhill Crane Minimization Measures</b>							
Total	-	-	-	\$ -	150	\$ -	\$ -
<b>Mitigation</b>							
Habitat Acquisition	-	-	-	\$ -	5	\$ -	\$ -
Enhancements to Degraded Habitat	-	-	-	\$ -	1	\$ -	\$ -
Seasonal / Annual Monitoring of Nesting Areas	-	-	-	\$ -	150	\$ -	\$ -
Total	-	-	-	\$ -	156	\$ -	\$ -
<b>Sandhill Crane Aversive Conditioning Measures</b>							
Total	4	21	4	\$ 694	2	\$ (1,042)	\$ (5,208)
<b>Sandhill Crane Single Use Nest Removal Policy</b>							
Total	4	31	4	\$ 897	10	\$ (8,967)	\$ (44,837)
<b>Sandhill Crane Total</b>	<b>19</b>	<b>52</b>	<b>12</b>	<b>\$ 2,102</b>	<b>150</b>	<b>\$ 53,485</b>	<b>\$ 267,427</b>
<b>Woodstork</b>							
<b>Surveys</b>							
USFWS recommended methodologies							
Total	-	-	-	\$ -	-	\$ -	\$ -
<b>Avoidance</b>							
2500 feet of an active colony site, suitable foraging habitat, Core Foraging Areas							
Total	-	-	-	\$ -	-	\$ -	\$ -
<b>Minimization</b>							
1000 feet from nesting colony, Seasonal avoidance and minimization variable by region							
Total	-	-	-	\$ -	-	\$ -	\$ -
<b>Mitigation</b>							
Cost of Wood Stork Credits, added cost/value to wetland mitigation banks							
Total	-	-	-	\$ -	-	\$ -	\$ -
<b>Woodstork Total</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>\$ -</b>	<b>-</b>	<b>\$ -</b>	<b>\$ -</b>



Table 18. Sandhill Crane Summary - Survey Costs-Project Planning Surveys

<b>Sandhill Crane Survey Costs</b>								
FWC recommended methodologies								
<b>Project Planning Surveys</b>								
Materials & Equipment costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Aerial Surveys	Hours	\$ 188	2	3	\$ 1,125	35	\$ 1,969	Flighttime only, average cost; share of 150 ltrs per yr. that relate to sites > 250 Ac; 5% probability
Ground Surveys <20 Acres								
Ground Surveys 20-1000 Acres								
<b>Direct Cost Sub-Total:</b>							\$ 1,969	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Aerial Surveys	Hours	\$ 100	4	3	\$ 1,196	35	\$ 2,092	Sr. Biologists; Includes all preparation and writeups; 5% probability
Ground Surveys <20 Acres	Hours	\$ 78	16	3	\$ 3,738	32	\$ 5,976	Average of Sr Biologist and Tech; one day; Includes all preparation and writeups; 5% probability
Ground Surveys 20-1000 Acres	Hours	\$ 78	32	3	\$ 7,477	83	\$ 31,040	Average of Sr Biologist and Tech; two days; Includes all preparation and writeups; 5% probability
<b>Labor Cost Sub-Total:</b>							\$ 39,109	
<b>Costs Total:</b>							\$ 41,077	
FFWC Administrative Costs							\$ 41,762	

Table 19. Sandhill Crane Summary - Survey Costs-Pre-Clearing Surveys

<b>Sandhill Crane Survey Costs</b>								
FWC recommended methodologies								
<b>Pre-Clearing Surveys</b>								
Materials & Equipment costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Aerial Surveys	Hours	\$ 188	2	3	\$ 1,125	35	\$ 1,969	Flighttime only, average cost; share of 150 ltrs per yr. that relate to sites > 250 Ac; 5% probability
Ground Surveys <20 Acres	Each							
Ground Surveys 20-1000 Acres	Each							
<b>Direct Cost Sub-Total:</b>							\$ 1,969	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Aerial Surveys	Hours	\$ 78	16	3	\$ 3,738	35	\$ 6,542	Average of Sr Biologist and Tech; one day; Includes all preparation and writeups; 5% probability
Ground Surveys <20 Acres	Hours	\$ 78	16	2	\$ 2,492	32	\$ 3,984	Average of Sr Biologist and Tech; one day; Includes all preparation and writeups; 5% probability
Ground Surveys 20-1000 Acres	Hours	\$ 78	32	2	\$ 4,985	83	\$ 20,694	Average of Sr Biologist and Tech; two days; Includes all preparation and writeups; 5% probability
<b>Labor Cost Sub-Total:</b>							\$ 31,220	
<b>Costs Total:</b>							\$ 33,189	
FFWC Administrative Costs							\$ 21,732	

Table 20. Sandhill Crane Summary- Avoidance Measures

## Sandhill Crane Avoidance Measures

Protection Zones or Buffers; Temporary Loss of Use; Delays in Project Timing

Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Protection Zones or Buffers during construction	Acre							
<b>Direct Cost Sub-Total:</b>							\$ -	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Protection Zones or Buffers during construction	Hours							
<b>Labor Cost Sub-Total:</b>							\$ -	
<b>Costs Total:</b>							\$ -	
FFWC Administrative Costs							\$ -	

Table 21. Sandhill Crane Summary- Minimization Measures

## Sandhill Crane Minimization Measures

Planting Vegetation on Littoral Shelves; Adding Powerline Markers to Increase Visibility; Posting Signs in Nesting Areas; Using More Permeable Fencing Options

Materials & Equipment costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Planting Nesting Vegetation on Littoral Shelves	Acre	\$ 11,750	0.33	1	\$ 3,878	10	\$ 38,775	Recommended 0.33 acre littoral shelf; source: Lotspeich (2012); Supported by quote of \$10,000 per acre from Mosaic
Adding Powerline Markers to Increase Visibility	Each	\$ 51	64	1	\$ 3,394	1	\$ 3,394	5m intervals, 64 markers per 0.2 mile span; plus clamp mounting tool
Posting Signs in Nesting Areas	Each	\$ 70	2	1	\$ 140	10	\$ 1,400	One sign each direction; One posting per nest / nest cluster
Flagging Nests	1000' Roll	\$ 24	2	1	\$ 48	100	\$ 4,800	Same Price in Bulk (100 100' rolls at \$205)
Permeable Fencing	Mile	\$ 23,760	0.5	1	\$ 11,304	10	\$ 113,040	Based on 400' buffer; reduced cost per foot (3-strand vs 4-strand) offset by use of reflectors and laydown fencing (requiring extra supports) for off-season use
<b>Direct Cost Sub-Total:</b>							\$ 161,409	
Professional Staff costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Planting Nesting Vegetation on Littoral Shelves	Hours							
Adding Powerline Markers to Increase Visibility	Hours	\$ 120	8	1	\$ 960	1	\$ 960	Labor and Equipment
Posting Signs in Nesting Areas	Hours	\$ 60	2	1	\$ 120	10	\$ 1,200	For 2 signs per nest
Flagging Nests	Hours	\$ 40	1	1	\$ 40	100	\$ 4,000	Up to 1200' of flagging (400 radius)
Permeable Fencing	Hours							
<b>Indirect Cost Sub-Total:</b>							\$ 6,160	
<b>Costs Total:</b>							\$ 167,569	
FFWC Administrative Costs							\$ -	

Table 22. Sandhill Crane Summary- Mitigation Measures-Habitat Acquisition

<h2 style="margin: 0;">Sandhill Crane Mitigation Measures</h2> <p style="margin: 0;">Fee Simple Acquisition, Conservation Easements, Wetland Mitigation banking</p> <h3 style="margin: 0;">Habitat Acquisition</h3>								
Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Fee Simple Acquisition	Acres							
Conservation Easements	Acres							
Wetland Mitigation Banking - UMAM	Credit	\$ 140,000	1	1	\$ 140,000	0.5	\$ 70,000	Average of costs for 18 banks; , ranging from \$45,000 to \$180,000 per credit
Wetland Mitigation Banking - non-UMAM	Credit	\$ 17,500	1	1	\$ 17,500	0.5	\$ 8,750	Average of older site costs, \$10K and \$25K
<b>Direct Cost Sub-Total:</b>							<b>\$ 78,750</b>	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Fee Simple Acquisition	Hours							
Conservation Easements	Hours							
Wetland Mitigation Banking - UMAM	Hours	\$ 60	24	1	\$ 1,440	1	\$ 720	Permit administration
Wetland Mitigation Banking - non-UMAM	Hours	\$ 40	24	1	\$ 960	1	\$ 480	Permit administration
<b>Indirect Cost Sub-Total:</b>							<b>\$ 1,200</b>	
<b>Costs Total:</b>							<b>\$ 79,950</b>	
FFWC Administrative Costs							\$ -	

Table 23. Sandhill Crane Summary- Mitigation Measures-Enhancements to Degraded Habitat

<h2 style="margin: 0;">Sandhill Crane Mitigation Measures</h2> <p style="margin: 0;">Additional Plantings; Land Management; Prescribed Fire; Removing Woody Vegetation, costs on a per acre/functional unit basis that could be applied</p> <h3 style="margin: 0;">Enhancements to Degraded Habitat</h3>								
Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Additional Plantings	Acres	\$ 112	13	1	\$ 1,470	1	\$ 1,470.13	2 - 5%; EQIP; Conservation Cover - Native Grasses, average of local and non-local sources; Average size of parcels to be restored
Land Management	Acres	\$ 43	13	2	\$ 1,141	1	\$ 1,141	EQIP; Restoration Management
Prescribed Fire < 20 Acres	Acres							
Prescribed Fire < 250 Acres	Acres							
Prescribed Fire > 250 Acres	Acres	\$ 22	13	2	\$ 579	1	\$ 579	average of two acreage classes, 2-5% of typical 375 acre site; EQIP; Includes cost for Management Plan; average of three acreage classes
Removing Woody Vegetation	Acres	\$ 40	13	1	\$ 531	1	\$ 530.64	EQIP; Bush-hog, Roller Chopper
<b>Direct Cost Sub-Total:</b>							<b>\$ 3,721</b>	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Additional Plantings	Hours							
Land Management	Hours							
Prescribed Fire < 20 Acres	Hours							
Prescribed Fire < 250 Acres	Hours							
Prescribed Fire > 250 Acres	Hours							
Removing Woody Vegetation	Hours							
<b>Indirect Cost Sub-Total:</b>							<b>\$ -</b>	
<b>Costs Total:</b>							<b>\$ 3,721</b>	
FFWC Administrative Costs							\$ -	

Table 24. Sandhill Crane Summary- Mitigation Measures-Seasonal/Annual Monitoring of Nesting Areas

<b>Sandhill Crane Mitigation Measures</b>								
<b>Seasonal / Annual Monitoring of Nesting Areas</b>								
Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Seasonal / Annual Monitoring of Nesting Areas	Each							
<b>Direct Cost Sub-Total:</b>							\$ -	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Seasonal / Annual Monitoring of Nesting Areas	Hours	\$ 78	8	1	\$ 623	150	\$ 93,462	Includes travel, preparation and writeups; generally one person, one day
<b>Indirect Cost Sub-Total:</b>							\$ 93,462	
<b>Costs Total:</b>							\$ 93,462	
FFWC Administrative Costs							\$ -	

Table 25. Sandhill Crane Summary- Aversive Conditioning Measures

<b>Sandhill Crane Aversive Conditioning Measures</b>								
Cost savings associated with no permit requirement for use of specified aversive conditioning techniques								
Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Aversive Conditioning (Approach; Noise; Water)	Hours							
<b>Direct Cost Sub-Total:</b>							\$ -	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Aversive Conditioning (Approach; Noise; Water)	Hours	\$ 14	1	48	\$ 672	2	\$ 1,008	Twice weekly, four weeks, maximum season of six months; Course field staff (quoted salary from superintendent)
<b>Indirect Cost Sub-Total:</b>							\$ 1,008	
<b>Costs Total:</b>							\$ 1,008	
FFWC Administrative Costs							\$ (1,042)	

Table 26. Sandhill Crane Summary- Single Use Nest Removal Policy

<b>Sandhill Crane Single Use Nest Removal Policy</b>								
Cost savings associated with no permit required to remove inactive Florida Sandhill Crane Nests								
Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Monitoring								
Nest Removal								
<b>Direct Cost Sub-Total:</b>							\$ -	
Professional Staff Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Monitoring	Hours	\$ 20	1	16	\$ 320	10	\$ 3,200	Monitoring 2x/week or 2 months; actual number of permits per FWC, 5/17/16; Value of Volunteer Time per Hour
Nest Removal	Hours	\$ 100	1	32	\$ 3,200	10	\$ 32,000	Professional to remove nest; oversight of volunteer monitoring (weekly record keeping)
<b>Indirect Cost Sub-Total:</b>							\$ 35,200	
<b>Costs Total:</b>							\$ 35,200	
FFWC Administrative Costs							\$ (8,967)	



Table 27. Wood Stork Summary- Survey Cost-Project Planning Survey

<h2>Woodstork Survey Costs</h2> <p>USFWS recommended methodologies Project Planning Surveys</p>								
Materials & Equipment costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Ground Surveys	Hours							
Expanded Assessment	Hours							
<b>Direct Cost Sub-Total:</b>							\$ -	
Professional Staff costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Ground Surveys	Hours	\$ 100	10	2	\$ 2,000	11	\$ 22,000	Two people, ten hour days field work
Expanded Assessment	Hours	\$ 156	6	1	\$ 935	48	\$ 44,862	Sr Biologist; average 6 hours
<b>Labor Cost Sub-Total:</b>							\$ 66,862	
<b>Costs Total:</b>							\$ 66,862	

Table 28. Wood Stork Summary- Avoidance and Minimization Measures

<h2>Woodstork Avoidance Measures</h2> <p>2500 feet of an active colony site, suitable foraging habitat, Core Foraging Areas</p>								
Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Additional Assessments and Project Adjustments	Acre							
Flagging Nests	1000' Roll	\$ 24	2	1	\$ 48	100	\$ 4,800	Same Price in Bulk (100 100' rolls at \$205)
<b>Direct Cost Sub-Total:</b>							\$ 4,800	
Labor Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Additional Assessments and Project Adjustments	Hours							
Flagging Nests	Hours	\$ 40	1	1	\$ 40	100	\$ 4,000	Up to 1200' of flagging (400 radius)
<b>Labor Cost Sub-Total:</b>							\$ 4,000	
<b>Costs Total:</b>							\$ 8,800	

Table 29. Wood Stork Summary- Mitigation Measures

<h2>Woodstork Mitigation Measures</h2> <p>Cost of Wood Stork Credits, added cost/value to wetland mitigation banks</p>								
Direct Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Cost for Wood Stork Credits	Credit	\$ 43,700	1	1	\$ 43,700	10	\$ 437,000	Average of Federal Credit Costs in FL; assumes
Added Cost/Value to Mitigation Banks	Credit							
<b>Direct Cost Sub-Total:</b>							\$ 437,000	
Labor Costs	Units	Cost per Unit	Units per Event	Frequency per Permit	Total Cost per Permit	Permits per Year	Annual Cost	Comments
Cost for Wood Stork Credits	Hour							
Added Cost/Value to Mitigation Banks	Hour							
<b>Indirect Cost Sub-Total:</b>							\$ -	
<b>Costs Total:</b>							\$ 437,000	