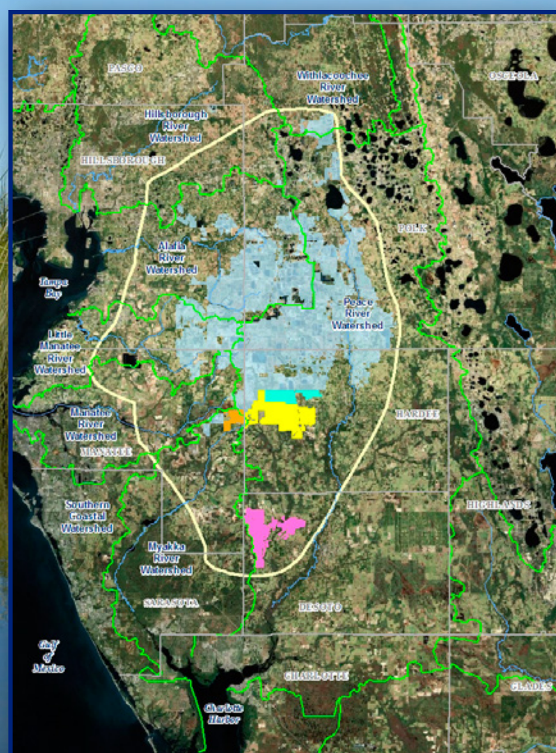
Chapter 5
Mitigation



CHAPTER 5
MITIGATION

5.1 INTRODUCTION

Pursuant to NEPA and the CEQ regulations, federal agencies must consider mitigation measures within the scope of alternatives to the proposed action (40 CFR 1508.25(b)(3); 40 CFR 1502.14(f) 40 CFR 1502.16(h)). NEPA has a broad definition of mitigation (40 CFR 1508.20), including:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action;

(b) Minimizing the impacts by limiting the degree or magnitude of the action and its implementation;

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action;

(e) Compensating for the impact by replacing or providing substitute resources or environments.

Although NEPA sets a procedural requirement for consideration of mitigation alternatives, USACE has other regulatory authorities that set substantive standards for determining the sufficiency of mitigation for adverse impacts to environmental resources under USACE's public interest review and per Section 404 of the CWA (discussed below). This chapter focuses on mitigation alternatives for phosphate mining in the CFPD under USACE's federal authorities. The State of Florida has separate mitigation and reclamation authorities over phosphate mining that are discussed in Sections 5.7 and 5.8.

5.1.1 Mitigation under the Public Interest Review

All Department of the Army permit decisions, including those pursuant to Section 404(a) of the CWA, are subject to USACE's public interest review (33 CFR § 320.4). The public interest review involves weighing the proposed action's potential benefits against its potential detriments on the public interest. Among the factors considered by USACE are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and in general, the needs and welfare of the people. USACE determines how much weight to give each factor based on its relevance to the specific proposal. USACE issues a permit only if it concludes that the proposed action is not contrary to the public interest. A proposed action is contrary to the public interest if it does not comply with the CWA Section 404(b)(1) Guidelines. One of the public interest factors considered is mitigation, including avoiding, minimizing, rectifying, reducing, or compensating for resource losses (33 CFR § 320.4(r)). USACE can require mitigation pursuant to the public interest review for significant resource losses which are specifically identifiable, reasonably likely to occur, and of importance to the human or aquatic environment, and to the extent that USACE determines mitigation to be reasonable and justified.

A discussion of mitigation under the public interest review for one public interest factor, fish and wildlife values, is provided below in Section 5.9. This section also describes compensation for impacts considered under the Endangered Species Act. Potential mitigation for additional public interest factors is discussed in Chapter 4.

5.1.2 Mitigation under the Clean Water Act

Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the U.S., including wetlands. The basic premise of the federal Section 404 program is that no discharge of dredged or fill material may be permitted if a practicable alternative exists that is less damaging to the aquatic environment, or if the nation's waters would be significantly degraded. Section 404(b)(1) requires that permit applicants show that they have, to the extent practicable, taken steps to avoid impacts to waters of the U.S., minimized potential impacts to waters of the U.S. once they have avoided impacts, and then, provide compensatory mitigation for any remaining unavoidable impacts. The Section 404 program is jointly administered by USEPA and USACE. The USACE administers the day-to-day functions of the program and is responsible for permit decisions and conducting and verifying jurisdictional determinations. The USEPA is responsible for ensuring that the Section 404(b)(1) Guidelines are complied with and for reviewing noticed permits under Section 404(q). The Section 404 review for each of the four Applicants' Preferred Alternatives will be documented in the project-specific ROD/SOF that will be prepared for each mine. A draft of the Section 404(b)(1) and public interest review analyses for each project will be made available for public review and comment.

A fundamental requirement of the Section 404 program is that authorized impacts to waters of the U.S. are offset by restored, enhanced, or created wetlands and other waters that replace those lost acres and their functions and values. In some cases, preservation of wetlands or other waters may also be used to offset losses. This objective is often referred to as "no net loss." On March 31, 2008, USEPA and USACE issued revised regulations governing compensatory mitigation for authorized impacts to wetlands, streams, and other waters of the U.S. to advance the federal objective of "no net loss" of wetlands. These regulations, known as the Compensatory Mitigation Rule or the 2008 Mitigation Rule (33 CFR Parts 325 and 332 and 40 CFR Part 230), are designed to improve the effectiveness of compensatory mitigation to offset the loss of aquatic resource area and function, and to increase the efficiency and predictability of the mitigation project review process (USEPA and USACE, 2008).

For this AEIS, USACE developed a proposed mitigation framework based on the mitigation sequence required under the Section 404(b)(1) Guidelines. This mitigation framework outlines reasonable alternatives for avoiding, minimizing, and compensating impacts to aquatic resources for the four Applicants' Preferred Alternatives. USACE's proposed mitigation framework is discussed in detail in Section 5.4. The steps in the mitigation sequence process under the Section 404(b)(1) Guidelines are described below.

5.1.2.1 Avoidance

In the first step of the mitigation sequence process required under the Section 404(b)(1) Guidelines, impacts to waters of the U.S. are required to be avoided to the extent practicable. To meet this requirement, the applicant must evaluate opportunities to use non-aquatic areas and other aquatic sites that would result in less adverse impacts. For proposed impacts to "special aquatic sites" such as wetlands, there is a presumption in the avoidance test under the Guidelines that an alternative site that is not a special aquatic site exists and a presumption that such a site will result in less adverse environmental impacts to the aquatic ecosystem unless the applicant clearly demonstrates otherwise. Reasonable alternatives for avoiding impacts to aquatic resources under the mitigation framework developed by USACE for this AEIS are discussed in Section 5.4. Alternatives identified as reasonable for purposes of this NEPA analysis are not necessarily practicable for a particular proposed project. Project-specific 404(b)(1) analyses for each of the four Applicants' Preferred Alternatives will be conducted in separate ROD/SOFs. A draft of the Section 404(b)(1) and public interest review analyses for each project will be made available for public review and comment.

5.1.2.2 Minimization

In the second step of the mitigation sequence process, impacts to waters of the U.S. are required to be minimized to the extent practicable. Per the Section 404(b)(1) Guidelines, "no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem" Subpart H of the Guidelines provides examples of how the potential dredge and fill impacts of a proposed activity can be minimized. Impact minimization measures typically involve the use of alternative project designs, construction methods, and engineering practices and controls. As with avoidance, the implementation of a given impact minimization measure must be practicable as defined under the Section 404(b)(1) Guidelines. Reasonable alternatives for minimizing impacts to aquatic resources under the mitigation framework developed by USACE for this AEIS are discussed in Section 5.4. Alternatives identified as reasonable for purposes of this NEPA analysis are not necessarily practicable for a particular proposed project. Project-specific 404(b)(1) analyses for each of the four Applicants' Preferred Alternatives will be conducted in separate ROD/SOFs. A draft of the Section 404(b)(1) and public interest review analyses for each project will be made available for public review and comment.

5.1.2.3 Compensatory Mitigation

After impacts have been avoided and minimized to the greatest extent practicable, the final step of the mitigation sequence requires compensatory mitigation to be provided for the remaining unavoidable impacts. Compensatory mitigation for impacts to waters of the U.S. is to be provided in accordance with the Compensatory Mitigation Rule (33 CFR Part 332 and 40 CFR Part 230). The following are methods of compensatory mitigation for unavoidable impacts to waters of the U.S, as defined in the Compensatory Mitigation Rule:

- Restoration: the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded aquatic resource.
- Establishment (Creation): the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site.
- Enhancement: the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s).
- Preservation: the removal of a threat to, or preventing the decline of, aquatic resources by an action in or near those aquatic resources. This term includes activities commonly associated with the protection and maintenance of aquatic resources through the implementation of appropriate legal and physical mechanisms.

Compensatory mitigation for unavoidable impacts to waters of the U.S. may be accomplished through three distinct mechanisms (USEPA and USACE, 2008):

- Permittee-responsible mitigation
- In-lieu fee mitigation
- Mitigation banking

These alternative compensatory mitigation mechanisms are discussed in detail in Section 5.5.

5.2 MITIGATION GOALS AND CONCEPTS

5.2.1 Watershed-based Approach

Federal mitigation requirements emphasize the importance of a watershed-based approach to mitigation. The Compensatory Mitigation Rule states that for wetland mitigation overall, “The primary objective of the watershed approach included in today’s rule is to maintain and improve the quantity and quality of wetlands and other aquatic resources in watersheds through strategic selection of compensatory mitigation project sites. The watershed approach accomplishes this objective by expanding the informational and analytic basis of mitigation project site selection decisions and ensuring that both authorized impacts and mitigation are considered on a watershed scale rather than only project by project.”

In recent years, USACE has required the Florida phosphate industry to conduct wetland mitigation with large-scale system connectivity and the overall watershed in mind. The current approach includes practicable avoidance and preservation of high-quality wetlands and streams; siting of most of the mining area in uplands that have been previously disturbed (e.g., agricultural areas); and mitigation designs that strive to achieve greater habitat functionality and connectivity than that which existed prior to mining. Any proposed mitigation will be coupled with a monitoring plan based on identified success criteria for soils, vegetation, and hydrology along with an adaptive management approach to ensure the success of the compensatory mitigation.

5.2.2 Use of Soils

Compensatory mitigation must result in self-sustaining wetlands. Wetlands are defined as " ….those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions…." (40 CFR § 230.3(t)) Compensatory wetland mitigation must result in soils that either can be classified as hydric (as currently defined by USDA NRCS), or that possess hydric soil indicators (as described in the November 2010 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region.

Many wetlands within the CFPD have at least several inches of muck, typically overlying thicker layers of sandy soil. Compensatory mitigation wetlands created today by the phosphate industry are constructed using sand tailings with an overlying cap of native wetland topsoil. This is done to mimic the soil profiles of the natural systems being mitigated. Muck collected from the mine site is commonly used as the topsoil in created wetlands, and is often stored in flooded mine cuts or under overburden caps to prevent it from oxidizing prior to use. Applying native wetland topsoil provides a seed source of native vegetation, and a soil medium that has the appropriate physical, hydrologic, and biochemical characteristics for the target systems. Topsoil suitability is determined based on the presence of nuisance/exotic seed sources in the soil, the availability of receptor mitigation sites, and loading, hauling, and spreading logistics. Where topsoil placement is not feasible, mitigation areas may receive a growing medium such as green manure, compost, or other suitable organic material. As noted below, in both cases, vegetation monitoring will be critical to ensure success of the compensatory mitigation. When native wetland soils are not available and alternative soil mediums are used, additional vegetative as well as soil monitoring may be critical to ensure success.

5.2.3 Vegetation Sources and Planting Methods

Compensatory mitigation must result in sustainable vegetation that meets the regulatory definition of a wetland (40 CFR § 230.3(t)). Nursery-grown plants are often used to vegetate mitigation wetlands. Muck collected from the mine site and spread over created wetlands also provides a seed source and may produce a significant portion of the wetland plants that become established. In some cases, there are opportunities to transplant vegetation from the mine site into mitigation areas. Transplanted vegetation may serve as the sole source of plantings or may supplement nursery-grown plantings.

Plant species diversity in created wetlands is designed to increase over time, through phased plantings and via natural recruitment of native plant species. The first planting phase occurs after grading and placement of muck, and typically consists of plant species that can withstand varying periods of hydration. The second planting phase typically consists of plant species with more specific hydrologic requirements and is conducted after confirmation that the desired hydroperiod is stable for at least 2 years. The third phase of plantings usually applies only to forested wetlands, and typically consists of shrub and herbaceous species that are shade-tolerant. Plant maintenance is achieved through inspections, control of undesirable plant species, and supplemental plantings. The phosphate industry uses chemical, mechanical, fire, hydrologic, and manual techniques to control nuisance and exotic plant species in mitigation areas.

After planting, vegetation monitoring is critical to ensure success of the compensatory mitigation. There is an example of vegetation monitoring included in the examples of permit conditions provided in Appendix I.

5.2.4 Development of Appropriate Hydrology

Compensatory mitigation must result in groundwater and surface water hydrology that is appropriate to sustain targeted wetland systems. The development of appropriate hydrology is of vital importance to wetland and stream mitigation. Hydrology has been and continues to be one of the most challenging aspects of wetland and stream design. Hydrologic predictions for early wetland designs were simple, full of assumptions, and often proved to be inadequate in capturing the hydrologic processes of the targeted wetland systems. Today, the phosphate industry uses sophisticated integrated surface water/groundwater modeling to predict target hydrologic conditions in mitigation wetlands and streams. Today's advanced construction technology, such as laser and GPS-guided earthmoving equipment, provides the means to precisely contour the land to achieve desired elevations and hydroperiods. Grading precision is particularly important for the design of shallow wetland systems that require subtle changes in elevation.

After construction, it is necessary to ensure that the results are consistent with the modeling predictions and that the hydrology achieved will support the target wetland type. There is an example of hydrology monitoring included in the examples of permit conditions provided in Appendix I.

5.2.5 Implementation of Best Management Practices

Mitigation measures are distinguished from best management practices (BMPs), which are practical and effective management or control practices that reduce or prevent adverse effects on resources. In some cases, BMPs may be required by regulation, and in other cases they may be implemented by a proponent as a matter of good engineering practice. Measures to control erosion, sedimentation, and turbidity, and various other BMPs are implemented during each phase of mitigation to prevent runoff of soils and other materials from directly and indirectly impacting onsite and offsite wetlands and waters.

5.2.6 Determination of Mitigation Requirements

The compensatory mitigation requirements and standards for waters of the U.S. emphasize offsetting the direct and temporal loss of functional values in addition to providing appropriate compensation for the areas of the systems impacted. Two methodologies currently used in Florida to determine the mitigation required to offset proposed impacts to waters of the U.S. are the Uniform Mitigation Assessment Method (UMAM) and the Wetland Rapid Assessment Procedure (WRAP). Both UMAM and WRAP are accepted by the USACE for regulatory evaluation of dredge and fill permit applications and associated mitigation plans. The phosphate industry has also used a modified version of WRAP, known as IMC-Agrico Company WRAP (IMC-WRAP), which was developed to better account for the landforms, vegetative cover, hydrology, and water quality issues that are specific to phosphate mining and mitigation sites in central Florida. UMAM is the more recent methodology, and outside the phosphate industry is more widely used in Florida. The USACE considers both temporal lag and risk factors when using either UMAM or WRAP/IMC-WRAP to evaluate proposed compensatory mitigation, including for phosphate mine projects. The temporal lag table used by the USACE is shown in Table 5-1.

Table 5-1. Temporal Lag Table Used by the U.S. Army Corps of Engineers

This table based on discount rate of 3%

YS = Year Start = 0 Presumes compensatory mitigation starts within the same 12 month period as the impact/credit release

YF = Year Finish = when the compensatory mitigation achieves the functional capacity that is described by the “with project” functional assessment score. After this year, the compensatory mitigation is expected to stay at or above the “with project” score either naturally or as the result of arrangements for perpetual management.

(a) If the “with project” score is achieved within the same 12 month period as the impact/credit release, then YF = 1.

(b) Otherwise, YF = YS + the number of years to reach the “with project” score (for example, if saplings are planted in the same year as the impact/credit release and the “with project” score is based on 35 years of growth, then YF = 0 + 35 = 35; but, if the saplings are planted two years prior to impact/credit release, YS = -2, then YF = (-2) + 35 = 33).

YS=	YF=	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	T=	1.000	1.0170	1.0341	1.0518	1.0696	1.0876	1.1058	1.1238	1.1431	1.1614	1.1805	1.2000	1.2197	1.2397	1.2600
YS=	YF=	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
0	T=	1.2805	1.3013	1.3224	1.3437	1.3654	1.3873	1.4096	1.4321	1.4549	1.4780	1.5015	1.5252	1.5492	1.5736	1.5983
YS=	YF=	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
0	T=	1.6233	1.6486	1.6743	1.7002	1.7265	1.7532	1.7802	1.8075	1.8352	1.8633	1.8917	1.9282	1.9577	1.9791	2.0178
YS=	YF=	46	47	48	49	50	51	52	53	54	55					
0	T=	2.0485	2.7095	2.1110	2.1322	2.1751	2.1962	2.2289	2.2619	2.2953	2.3292					

UMAM was developed by various State of Florida regulatory agencies, with input from local government and the USACE, Jacksonville District. On February 2, 2004, UMAM went into effect at the state level, and those state and local governments responsible for environmental regulation were required to begin utilizing the methodology. Prior to its implementation at the federal level, the USACE conducted a study of the method and recommended UMAM be used for federal wetland regulatory purposes starting August 1, 2005. Implementation of UMAM by the USACE included a few changes from the state rule. Specifically, the USACE uses a time lag table based on a 3 percent discount rate and the state uses a time lag table based on a 7 percent rate. Also, the USACE has more restrictions compared to the state in the amount of wetland and upland preservation credit given. The method is used to determine the amount of mitigation needed to offset adverse impacts to wetlands and other surface waters and to award and deduct mitigation bank credits. Additional information about UMAM may be found on the FDEP website (FDEP, 2012d).

WRAP was originally developed by the South Florida Water Management District (SFWMD) as a method for the regulatory evaluation of mitigation sites. Later, regulatory agencies began using it to assess wetland function in general. IMC-WRAP is an adaptation of the SFWMD WRAP that customizes the assessment procedure to better fit the landform, vegetative cover, hydrology, and water quality issues encountered when regulatory agency applications are being considered for phosphate mining and reclamation sites in central Florida. The IMC-WRAP Manual fully explains how IMC-WRAP differs from SFWMD WRAP. The manual was included as an appendix to the three Mosaic applications and is available on the AEIS website. For example, it is Appendix A-2 of the Ona application (SFWMD, 1998). Additional information about how the USACE calculates mitigation requirements using either SFWMD WRAP or IMC-WRAP, including how the temporal lag and risk factor are applied, can be found in the "Calculating Mitigation" section of the USACE Regulatory Sourcebook (USACE, 2013).

In the past, the USACE considered streams as wetland systems in determining mitigation requirements, with no stream-specific considerations. That approach evolved into mitigation efforts using stream classifications that were based largely on the physical characteristics of the stream. Today, streams are classified and characterized based on multiple attributes associated with stream hydrology, geology, morphology, and biology.

For the determination of physical characteristics, current stream evaluations often use the Rosgen Level-II morphological classification system, which classifies streams based on degree of valley entrenchment and channel shape (Rosgen, 1996). Where possible, existing streams are used as reference reaches to provide morphological design data for mitigation streams. This approach is commonly called the analogue method of stream design because the reference stream provides a morphological analogy (or template) that can be translated to other streams/drainages. When this approach is not feasible, stream design takes into account the factors that influence natural streams, such as topography and predicted surface water and groundwater flows and contributions to the stream.

Habitat assessments of streams on areas proposed for mining is typically performed using the FDEP Standard Operating Procedure (SOP) 001/01, FT 3100, Stream and River Habitat Assessment (FDEP, 2008). In this methodology, Overall habitat quality is determined by measuring eight attributes known to have potential effects on the stream biota: substrate diversity, substrate availability, water velocity, habitat smothering, artificial channelization, bank stability, riparian buffer zone width, and riparian zone vegetation quality.

Finally, biological assessments of streams can be performed using FDEP's SCI and Bioreconnaissance (or BioRecon) protocols. The SCI is the primary indicator of stream ecosystem health, identifying impairment with respect to minimally disturbed condition. The SCI was developed to evaluate perennial streams, and may not be as effective a tool for evaluating intermittent or ephemeral streams. The BioRecon is used as an initial watershed screening method to determine whether or not additional resources should be allocated to the area, such as sampling using the SCI method.

More information about the FDEP Stream and River Habitat Assessment, SCI, and BioRecon evaluation methods may be found on the FDEP website (FDEP, 2011f).

5.2.7 Assessment of Mitigation Success

For wetlands, mitigation success is measured using established success criteria for several parameters including vegetative community composition and survivorship, hydrology, exotic species abundance, and wildlife usage. For example, the vegetation success criteria for created forested wetlands typically include targets for tree density (number of trees per acre); tree species composition/diversity, shrub/understory cover, and exotic/nuisance species cover. The time required to reach mitigation success varies based on the type of wetland targeted and site conditions. Opinions vary on the time that created wetlands require to reach full functionality. Several authors, including Moreno-Mateos et al. (2012) and Brown (2005) have reported that determining full restoration success may be inconclusive in wetland systems until many decades have passed. Non-forested wetlands, such as marshes and wet prairies, reach final successional stages faster than forested wetlands. Kiefer (1991) reported that with good initial establishment and weed control, marshes reclaimed on mined land tended to reach final successional stages relatively quickly, often in less than 5 years. Forested wetlands take longer to mature, and typically require more weed management and supplemental plantings (Kiefer, 2011a; Brown and Carstenn, 2009).

The determination of mitigation success is made by regulatory agencies when a positive trend is evident based on identified regulatory success criteria, and not when the wetland reaches a stable condition. Phosphate mining companies must continue to monitor and maintain mitigation wetlands until established success criteria are met. The federal Section 404 program does not have minimum establishment periods for regulatory release of mitigation wetlands. Mitigation wetlands created to compensate impacts to waters of the U.S. are not considered for regulatory release at any specified time, only at the point when all success criteria are demonstrated to have been met.

The USACE historically did not have separate success requirements for streams. Today, stream mitigation has specific requirements, including provision of the appropriate topography and lithology in the contributing landscape, use of reference reaches as appropriate for the design of stream segments, inclusion of stream buffers, as-built surveys, assessment of habitat and biological functions and values, and performance standards based on stream hydrology, geology, morphology, and biology (USACE Permit No. SAJ-1997-4099-IP-MGH).

Given the scale and types of mitigation proposed, as well as the prospective nature of mitigation, there are levels of uncertainty associated with mitigation success. Some wetland types, such as bay swamps, have more exacting requirements for establishment and growth than do others, such as herbaceous marshes. An assessment of risk is included in the functional analyses commonly used to determine mitigation requirements for phosphate mining; however, it is still critical to have specific success criteria linked to appropriate types of monitoring in order to assess the success of the mitigation. The monitoring and results of the success criteria analysis must be linked to an adaptive management protocol to address deficiencies in the compensatory mitigation and address how the deficiencies, if they exist, can be addressed through site modifications, design changes, revisions to management plans, planting criteria, hydrological requirements and monitoring changes among other adaptive management protocols (see also Appendix I).

5.2.8 Relationships of Mining Activities and Mitigation

Impacts to wetlands and surface waters within phosphate mine sites are primarily associated with land preparation (clearing and grading), mining (ore extraction), and construction of infrastructure. Within areas proposed to be mined, wetlands are drained and cleared prior to mining. Sand tailings produced during ore recovery at the beneficiation plant are transported hydraulically through pipelines to areas where they are used to create mitigation wetlands. Wherever practicable, topsoil from wetlands to be mined is stockpiled during land clearing for use in mitigation sites.

Mining infrastructure primarily consists of the beneficiation plant, clay settling areas (CSAs), ditch and berm systems, and infrastructure corridors that connect mining areas with the beneficiation plant. To the extent practicable, infrastructure is located in upland areas to minimize wetlands impacts and in areas where historical agricultural equipment crossings exist to minimize impacts to riparian corridors. Most infrastructure disturbances occur in areas that have been or are scheduled to be mined. New mines use existing offsite CSAs whenever possible to reduce costs and allow faster mine start-ups. This approach has the added benefit of allowing any new CSAs to be constructed in mined-out areas. Phosphate mining companies minimize the footprint of CSAs to the extent practicable, which results in less land disturbance, potentially including less disturbance to aquatic systems. To minimize their footprint, CSAs may be constructed to be higher than they were in the past, or excavated deeper, and they may be stage-filled, which is a process of dewatering and filling to maximize storage per area. Mining companies also try to use contiguous CSAs so that they have a common wall to reduce the CSA footprint.

CSAs are reclaimed after they reach their clay storage capacity. At present, the phosphate industry cannot claim functional gain for wetlands and surface waters that are established on reclaimed CSAs. Some reasons for this include that CSA wetlands are hydrologically isolated and perched above the groundwater table, that there is a risk of wetlands and surface waters not forming in the proposed locations and areas, and that hydroperiods cannot be accurately predicted. They are dependent on rainfall for hydration, and evapotranspiration is the main mechanism for water to leave the system although they do also have outfall structures.

5.3 EVOLUTION OF MITIGATION

5.3.1 Wetlands

During early phosphate mining, there was no active restoration of wetland resources following mining; the land was left to restore itself over time through natural processes (FIPR Institute, 2011; Brown, 2005). Subsequently, a simplistic approach was taken in terms of establishing a vegetative cover with a few main species, with little concern toward integration of the ecosystem as a whole (Kiefer, 2011a). Since the 1990s, wetland mitigation has improved considerably and greater emphasis has been placed on wetland protection during mine planning. Significant advances in wetland design and construction methods, which include the use of integrated hydrologic modeling, muck application, and plant transplantation, coupled with a watershed approach to mitigation, have raised expectations about the likelihood of success of wetland mitigation. In addition, the 2008 Mitigation Rule has codified mitigation process and the types of compensatory mitigation allowed to comply with the Section 404(b)(1) Guidelines. Any mitigation for the Applicants' Preferred Alternatives, and future mining activities reviewed by the USEPA and the USACE, will need to comply with these requirements.

5.3.1.1 Wetland Mitigation Technology

Prior to the mid-1990s, the lack of integrated modeling capabilities and inaccurate wetland hydrology predictions often resulted in mitigation wetlands having inappropriate hydrology, such as excessively long hydroperiods. In the mid-1990s, wetland hydrology design became more accurate with the inception of integrated modeling of surface water and groundwater interactions, and USACE's hydrogeomorphic approach to wetland characterization and functional assessment (Smith et al., 1995). According to Kiefer (2011a), integrated modeling based on hydrogeomorphic principles has been used by the phosphate industry in wetland design since 1995, when CF Industries developed an integrated model for its South Pasture Mine reclamation plan. These hydrologic modeling tools allowed more accurate predictions of wetland depths, hydroperiods, and other drainage characteristics, and a greater diversity of wetland types could effectively be created. Kiefer (2011a) indicated that integrated groundwater/surface water modeling is particularly useful in designing shallower wetland systems such as headwater stream corridors, seepage swamps, wetland flatwoods, and wet prairies/zoned marshes. Laser and GPS-guided construction equipment, used by the industry since the early 1990s, has provided the means to precisely contour the land to achieve the desired elevations and hydroperiods of these shallow systems.

Over the course of improving wetland mitigation technology, alternative methods have been developed for re-establishing desired vegetative cover within mine wetland mitigation sites. Methods originally focused on transplantation of desired plant species obtained from donor sites or commercial sources. These methods were supplemented over time through experiments involving use of salvaged wetland topsoil (muck) from wetland donor sites with less focus on specific vegetative species; vegetation self-sorting occurred based on alignment with physical and chemical conditions within the site. Muck provides a natural seed bank and has the appropriate hydrologic and biochemical characteristics of the targeted wetland surface soils. Such muck material, often removed as some of the overburden prior to ore extraction, can be either transported directly to an ongoing mitigation site, or can be stored in flooded mine cuts or under overburden caps to prevent it from oxidizing pending its application to a mitigation site. Today, the application of muck and transplantation of native wetland plants from mined areas into created wetlands is standard practice. Plant transplantation serves as an alternative to nursery-grown plants, and is the preferred approach for certain herbaceous plant species, particularly those not available through commercial nurseries.

5.3.1.2 Creation of Herbaceous Wetlands

Freshwater marshes intended to be sustained as a mix between an aquatic and herbaceous-dominated wetland habitat have been the systems most easily created. Such systems generally contain some level of ponded water and a mixture of herbaceous emergent and submerged vegetation, and are typically hydrated through a combination of seasonally-reliable surface water inflows, groundwater inputs, and rainfall. More difficult to establish have been wet prairies designed to experience more variable hydroperiods, including periods of dry out conditions. Rainfall-driven wet prairie systems are particularly challenging because of the uncertainties introduced by natural climate variability. As noted previously, use of improved hydrologic modeling tools and topographic control has contributed to better creation of shallow wetland types such as wet prairies.

Regulatory success criteria for created herbaceous wetlands have evolved over time. During the early 1990s, permits issued by USACE for herbaceous wetlands created on phosphate mine sites typically included success criteria such as the following example (USACE Permit No. 199101355 targeting FLUCCS Code 641: Freshwater Marsh – September 17, 1992):

- Wetland has sustained a minimum of 85 percent obligate wetland and/or facultative wetland species (as defined by the USACE Jurisdictional Delineation Manual).
- Wetland does not contain more than 10 percent nuisance species.

By the late 1990s, success criteria for freshwater marshes created on phosphate mine sites became more specific as exemplified by the following example (USACE Permit No. 199201293, Mod. #3 – March 26, 1997):

- Herbaceous vegetation planted will cover 80 percent of those zones with 50 percent or more of this cover being plant species listed as facultative or wetter, be rooted for at least 12 months, and be reproducing naturally with no one species comprising 30 percent of the total groundcover.
- Cattail, primrose willow and other exotic vegetation shall be limited to 10 percent or less of the total cover.

In more recent permits issued for phosphate mines, success criteria for created herbaceous wetlands were further expanded to include achievement of functionality, as exemplified by the following criteria for wet prairie creation (USACE Permit No. 199500794, Mod. #6 – February 27, 2002):

- A minimum of 80 percent vegetation cover will consist of plants listed as “Typical”, “Associated”, or “Additional” species for wet prairies in *A Guide to Selected Florida Wetland Plants and Communities* published by the USACE-Jacksonville District in 1988.
- No single species shall constitute greater than 30 percent relative cover.
- Exotic/nuisance species will not exceed 10 percent relative cover.
- A minimum WRAP score of 0.60 must be attained before community release.

The above examples indicate that regulatory success criteria for created herbaceous wetlands have progressively become more focused on achieving habitat-specific structure and functionality. Advances in wetland mitigation technology have improved the potential to create herbaceous wetlands that meet target success criteria. The industry has created herbaceous systems that have met the more recent regulatory structure and functionality criteria; such systems have been released from further regulatory monitoring requirements. Although meeting the success criteria required for regulatory release does not demonstrate that the system has reached full functionality, it does provide a reasonable indication that the system is on a proper trajectory toward a functionally stable state.

Throughout the CFPD, many areas that historically consisted of freshwater marshes and wet prairies have been converted into shrub-dominated areas as a result of agricultural practices. As such, recent mitigation plans developed by the phosphate industry, such as those proposed for Mosaic’s Desoto, Ona, and Wingate East mines, emphasize the restoration of marshes and wet prairies in areas currently dominated by shrub systems (Mosaic, 2011a; Mosaic, 2011b; Mosaic, 2011c). The creation of freshwater marshes and wet prairies is aimed to restore historical wetland community composition, improve wetland diversity and functionality, and increase wildlife habitat quality within the CFPD.

5.3.1.3 Creation of Forested Wetlands

Perhaps the most controversial mitigation designs are those targeting creation of forested wetlands. In addition to requiring design considerations focused on hydrologic diversity and topographic variability, the increased range of plant species' physiological needs and associated community complexity corresponds to a higher level of uncertainty regarding achievement of the right mix of physical, chemical, and biological factor interactions supporting mitigation success. Additionally, because of the need to establish multiple canopy layers, there is a significant time lag involved between re-vegetation of a forested wetland and achievement of adequate three-dimensional structure to support wildlife use. In recognition of the fact that phosphate mining impacts include loss of forested wetlands, the phosphate industry has worked to refine technologies supporting forested wetland creation.

USACE currently requires habitat-specific success criteria for forested wetlands created on phosphate mine sites. Example success criteria for created mixed forested wetlands, hardwood swamps, and bay swamps include the following (USACE Permit No. 199500794, Mod. #6 – February 27, 2002):

- Mixed Forested Wetland:
  - A minimum of 70 percent of the trees and 80 percent of the groundcover vegetation will consist of plants listed as "Typical", "Associated", or "Additional" species for Deep Swamps in *A Guide to Selected Florida Wetland Plants and Communities* published by the USACE-Jacksonville District in 1988.
  - Tree density will be equal to 400 trees per acre with trees equal to or greater than 12 feet in height.
  - No single groundcover species will constitute greater than 30 percent relative cover.
  - Native conifers will compose between 33 percent and 67 percent of the total number of trees in the canopy.
  - Exotic/nuisance species will not exceed 10 percent relative cover in the groundcover and 10 percent of the total number of trees in the canopy.
  - A minimum WRAP score of 0.65 must be attained before community release.
- Hardwood Swamp:
  - A minimum of 70 percent of the trees and 80 percent of the groundcover vegetation will consist of plants listed as "Typical", "Associated", or "Additional" species for Deep Swamps in *A Guide to*

Selected Florida Wetland Plants and Communities published by the USACE-Jacksonville District in 1988.

- Tree density will be equal to or greater than 400 trees per acre with trees equal to or greater than 12 feet in height.
- No single groundcover species will constitute greater than 30 percent relative cover.
- Exotic/nuisance species will not exceed 10 percent relative cover in the groundcover and 10 percent of the total number of trees in the canopy.
- A minimum WRAP score of 0.65 must be attained before community release.

• Bay Swamp:

- A minimum of 70 percent of the trees and 80 percent of the groundcover vegetation will consist of plants listed as “Typical”, “Associated”, or “Additional” species for Bay Swamps in *A Guide to Selected Florida Wetland Plants and Communities* published by the USACE-Jacksonville District in 1988.
- At least one-half of the bay swamp trees will consist of some combination of sweet bay, loblolly bay, swamp tupelo, black gum, and red bay.
- Tree density will be equal to or greater than 400 trees per acre with trees equal to or greater than 12 feet in height.
- No single groundcover species will constitute greater than 30 percent relative cover.
- Exotic/nuisance species will not exceed 10 percent relative cover in the groundcover and 10 percent of the total number of trees in the canopy.
- A minimum WRAP score of 0.65 must be attained before community release.

The above examples indicate that current regulatory success criteria for created forested wetlands emphasize the achievement of habitat-specific structure and functionality. As discussed previously, created forested wetlands require a longer time to mature and reach targeted successional stages than created herbaceous wetlands.

Advances in wetland mitigation technology have improved the potential to create forested wetlands that meet target success criteria Many forested wetlands created by the industry have been released as a result of meeting all regulatory mitigation success criteria. Most of the created systems, however, are still progressing through successional stages of development, particularly those that were created within the last 15 years. Many of these more recently created forested wetlands have met certain regulatory success criteria but are too young to meet other success criteria that are indicators for more mature forested wetland structure and functionality.

Bay swamps are a specific forested wetland type considered to be inherently challenging to successfully re-create, in part because their hydration typically depends mainly on groundwater collection and rainfall. Gaines et al. (2000) reported on several forested wetland creation approaches taken by IMC-Agrico (now part of Mosaic) since the late 1970s at selected example phosphate mine mitigation sites, with specific focus on creation of bay swamps or similar forested wetland systems whose hydration is predominantly or exclusively dependent on groundwater collection (seepage wetlands) and rainfall. The sites they described, their key physical and biological characteristics, and wildlife observations are summarized in Table 5-2. Their findings suggest that these example projects reflect varied levels of success in creating systems exhibiting bay swamp features.

More recently, Curtis and Denton (2011) evaluated some of these same mitigation sites (Hardee Lakes Bay Swamp, South Prong Bay Swamp, and Alderman Creek Bay Swamp) and compared their physical and biological characteristics with three reference forested seepage swamp sites within the CFPD selected on the basis of their wetland type classification as FLUCCS Code 611 (Bay Swamp). Their findings generally were aligned with the conclusions presented by Gaines et al. (2000).They indicated that their field visits and aerial map interpretations supported the conclusion that the general topography and landscape setting created were similar to that of the reference wetland sites, and the features addressed included "…*creating a hydrologic 'high' either from an uphill water body or a sand hill".* Organic soil accumulation was indicated in the created wetlands and this produced muck was physically comparable to the muck materials of the reference wetlands. Lastly, the vegetative species composition and community zonation were comparable in the created and reference wetlands. The sites varied in relative age, and it was acknowledged that canopy closure in the natural wetlands was higher than in the created wetlands, likely reflecting the continuing succession occurring in the created wetlands,

Overall, Curtis and Denton (2011) concluded that the *"…created forested seepage wetlands appear to be functioning appropriately to their designs and developing into systems appropriate to the regional landscape. The species composition in the newer created wetlands appears appropriate to long term succession toward systems that will be similar to the natural FLUCCS 611 Bay Swamps in the region".*

Notably, these investigators confirmed that keystone tree species, including sweetbay and red maple, were clearly reproductive at the time of these field studies in both the natural and created wetland sites. These indications of vegetative community reproductive activity in the created wetlands were considered evidence of successful creation of the physical environmental conditions favoring continued vegetative community maturation. With such maturation, further increased usage of the created wetland sites by wildlife species would be expected.

Table 5-2. Physical and Biological Characteristics of Selected Forested Seepage Wetland Creation Sites

Site Name	Associated Phosphate Mine (County)	Initial Restoration (Revegetation)	Seepage Wetland Estimated Area (acres)	Primary Hydration Sources	Revegetation Approaches	Habitat Characteristics (Dominant Tree Species)	Documented Wildlife Usage (1998-1999)
Hardee Lakes Bay Swamp	Fort Green (Hardee)	1989-1991	1.5	Rainfall and groundwater seepage through sand tailing blanket leading from lake overflows to wetland	Muck application; plantings; transplantation	Sweetbay, red maple, swamp bay, and water oak.	1995-1998: 19 bird species; 3 amphibian species, 1 fish species; 1 mammal species
South Prong Bay Swamp	Big Four (Hillsborough)	1996	10	Rainfall and groundwater seepage slope along the South Prong of the Alafia River	Muck application for a portion of the site; tree plantings	Sand Tailings Only - Trees: Sweetbay, swamp bay, dahoon holly, red maple, and black gum. Muck over Sand Tailings: Sweetbay, black gum, red maple, swamp bay, loblolly bay.	1997-1998: 4 bird species; 3 amphibian species; 1 fish species
AMAX-BF-1	Big Four (Hillsborough)	1979	31	Rainfall and groundwater seepage	Herbaceous and tree plantings	Loblolly bay, red maple, bald cypress, sweet gum.	1999: 1 bird species; 4 mammal species
Alderman Creek Bay Swamp	Four Corners (Hillsborough)	1998-1999	8	Rainfall and groundwater seepage slope parallel to Alderman Creek	Donor site muck, trees, and stumps, with additional phases of selective transplantation	Sweetbay, loblolly bay, black gum, dahoon holly.	1998-1999: 30 bird species; 2 amphibian species; 1 fish species; 2 mammal species

Notes:
Information summarized from Gaines et al., 2000.

An example of a quantitative permit-defined mitigation success criterion specifically for a bay swamp creation project is the one cited by Gaines et al. (2000) as being used by the Hillsborough County Environmental Protection Commission. This example criterion defines bay swamp mitigation success as achievement of a hardwood forested swamp with at least 51 percent vegetative cover by bay trees, including sweetbay (*Magnolia virginiana*), swamp bay (*Persea palustris*), loblolly bay (*Gordonia* *lasianthus*), and swamp tupelo (*Nyssa sylvatica*). Similar but even more quantitative success criteria for bay swamp creation projects have been included in FDEP permits issued for phosphate mines, an example of which is provided below (Source: FDEP Permit #0155875-002 (PACTS #744) for IMC-FCL-AC (5), Mining Unit 10 Wetland B – Alderman Creek Bay Swamp Demonstration Project):

- A minimum of 600 trees per acre.
- A combined minimum 51 percent tree density of the following tree species: loblolly bay, sweetbay, swamp bay, and swamp tupelo.
- The remaining percentage will be comprised of species listed under 62-340.450 F.A.C. as obligate, facultative wetland, and facultative.
- The tree canopy cover shall exceed 33 percent of the total area and in no area of a half acre in size or larger shall the tree and shrub cover be less than 20 percent total cover.
- Cover by non-nuisance, non-exotic wetland species listed in 62-340.450, F.A.C., in the herbaceous and shrub layer of the forested wetland shall be at least 80 percent or greater. All desirable plant species must be reproducing naturally, either by normal vegetative spread or through seedling establishment, growth, and survival.
- Open water areas shall not exceed 15 percent of the total wetland area.

A 2012 monitoring report submitted to FDEP addressing the regulatory success status of the Alderman Creek Bay Swamp site (Kleinfelder Southeast, Inc., 2012) indicated that in 2011, the site had met all the permit-defined <u>forested</u> wetland success criteria but had not yet met the non-forested (herbaceous/shrub) species coverage required under the permit (FDEP Permit #0155875-002). Thus, monitoring results indicate that this bay swamp creation site is trending toward success but has not fully met all the success criteria required for regulatory release. It is notable that based on the cumulative site monitoring records summarized in Kleinfelder Southeast, Inc. (2012), 25 avian species, 1 reptilian species, 4 amphibian species, 1 fish species, 6 mammal species, and 2 invertebrate species have been recorded as present within this site, qualitatively indicating its demonstrated functionality as wildlife habitat.

5.3.1.4 Overall Wetland Mitigation Success

Although varying opinions have been offered on the time that is required to ascertain the success of mitigation wetlands (e.g., Moreno-Mateos, 2012; Kiefer, 2011a; Brown and Carstenn, 2009; Brown, 2005; and Kiefer, 1991), advances in mitigation technology and approaches over the years have led to greater wetland mitigation success both within and outside the phosphate industry. Current federal regulations require demonstration of mitigation success through achievement of structural and functional success criteria specified in issued Section 404 permits. The phosphate industry has demonstrated that it can create herbaceous and forested wetlands that meet the current success criteria required for regulatory release. Although meeting regulatory success criteria does not demonstrate that the system has reached full functionality, it does provide a reasonable indication that the system is on a trajectory toward a functionally stable state. This regulatory measure of mitigation success is applied nationwide to all Section 404 permit holders, including commercial mitigation banks, and therefore is not specific only to the phosphate industry.

A 2011 FDEP study that evaluated reclaimed and released wetlands on 19 phosphate mines (total of 105 sites; all released prior to July 2007) concluded that newer mines had higher UMAM scores on average than older mines (FDEP, 2011g). Although such studies provide evidence that advances in wetland construction technology have resulted in better functioning wetlands, it is generally accepted that more research is needed to better understand how constructed wetlands compare to natural undisturbed wetlands. While substantive progress has been demonstrated, methods for accelerated recovery of habitat structure as well as function clearly remain needed. It is important to note that some of the wetlands that have been impacted recently, or are currently proposed to be impacted by the phosphate industry, are in a degraded state, primarily due to disturbances from agricultural practices.

5.3.2 Streams

The techniques used by the phosphate industry to mitigate streams have evolved over time in conjunction with regulatory drivers and scientific advancements. Historically, mined streams were mitigated as part of wetland mitigation. Wetlands were constructed with the assumption that stream channels would form over time through natural hydrologic influences. This “natural” design method accounted for mitigation wetland acreages, but did not always result in consistent stream channel formation (FDEP, 2007b). Physical creation of the stream valley was another approach that relied on self-organization of hydraulic and landscape forces or “weathering” to produce a natural stream channel within the constructed valley over time. These approaches required significant amounts of time (more than 20 years) to produce stable stream channels (Kiefer, 2011b). The USACE no longer accepts such methods of stream construction as part of a mitigation plan. Today, streams must be directly contoured per design criteria and must offset the biological functions of the system lost during mining.

5.3.2.1 Stream Mitigation Technology

Recent construction techniques for streams in rural settings have typically incorporated analog design or reference reaches for establishing goals for successful mitigation. Analog design involves copying essential characteristics (dimensions, patterns, biology) from a nearby intact stream or section of the project stream to provide a template for the stream mitigation design. The design template is then scaled to match the characteristics (watershed, flows) of the area targeted for mitigation. This technique is most appropriate when local and undisturbed streams reaches with similar geology, chemistry, and physical processes are present (NRCS, 2007). Many streams within the CFPD, however, have been disturbed by agricultural practices, making the analog design approach problematic and requiring the use of regional data (reference reaches and regional curves) for design criteria (Kiefer, 2010).

Recent stream designs have used integrated surface water/groundwater models such as the USACE Hydraulic Engineering Center River Analysis System (HEC-RAS) and the FIPR Institute Hydrologic Model (FHM). These models take into account the hydrologic influences of rainfall and groundwater, and can be used to assess potential impacts or as planning tools (Kiefer, 2011b). Stream construction techniques currently used by the phosphate industry involve mechanical stream construction and hydraulic carving. Both techniques reduce the amount of time in which stable stream channel designs can be achieved compared to historically used “weathering” techniques.

Mechanical construction follows a detailed design of stream dimensions and construction is performed using heavy earthmoving equipment. Typically, the stream valley is graded to specific elevations, and then soils (sand tailings in the case of phosphate mining) are placed to create the surrounding upland landscape. The stream’s depth, width, meander, and pattern of riffle/pool sequence are physically created based on either reference reach and/or regional curve data. Other soil types (muck/mineral mixtures) appropriate for stream banks and in-stream morphological conditions (riffles and pools) are then placed. Stream banks are typically stabilized by planting native vegetation or using erosion control materials. Large woody debris such as logs and root wads are added for in-stream habitats and further erosion control. Riparian areas are then planted with native vegetation appropriate for the flooding frequency and soil type (NRCS, 2007). An example of mechanical stream construction within the CFPD is CF Industries’ construction of a segment of Doe Branch (DB-5) in Hardee County (Kiefer, 2011b).

The hydraulic carving construction technique involves pumping water through a mechanically constructed stream valley at the calculated bankfull discharge at a constant rate to produce stream channel formation. This technique employs the theory of effective discharge (the flow volume that performs the most alluvial work in a stream) to sculpt natural channel dimensions and patterns in a relatively short time (several months) that would normally be produced over long-term flow conditions. Additional stream construction components are then completed using mechanical construction techniques as described previously. These include placement of soils, riparian plantings, stream bank stabilization, and in-stream habitat improvements. A flow-return system including a sink at the project terminus is constructed to capture and recycle water used during the hydraulic carving technique. The sink also functions to contain sediment liberated during stream channel formation. Examples of hydraulic carving stream construction within the CFPD include CF Industries’ construction of a segment of Doe Branch (DB-2) and Mosaic’s South Bowlegs project (Kiefer, 2011b).

5.3.2.2 Stream Mitigation Success

Historically, success criteria for stream mitigation were based solely on vegetation monitoring data. However, vegetation data were found over time to be poor indicators of stream function. In the early

1990s, FDEP acknowledged that a more scientifically sound approach was needed to assess stream mitigation success. This was due in part to assessments that revealed that many mitigation streams that met vegetation criteria provided relatively poor overall habitat (FDEP, 2007b). Today, mitigation streams have very specific and stringent success criteria that emphasize offsetting the loss of ecological functions in the stream.

Advances in stream construction technology and approaches over the years have led to greater stream creation success in recent times. A 2007 FDEP study that compared reclaimed streams to unmined streams within the CFPD concluded that recently reclaimed streams begin to provide functions similar to those of unmined streams approximately 13 to 14 years after construction based on habitat and biological index scores, with some reclaimed streams potentially needing as long as 20 years to provide similar functions (FDEP, 2007b).

The 2007 FDEP study suggested that development of microhabitats in reclaimed streams could be expedited through higher density floodplain plantings and greater initial additions of habitat structure such as woody debris within the channel. Connecting reclaimed streams to unmined stream segments was also suggested as a means of promoting colonization of benthic macroinvertebrates and achieving higher habitat assessment scores. Recent stream mitigation efforts by the phosphate industry have involved the use of such techniques to increase habitat diversity and overall stream functionality. An example is Mosaic's Maron Run project in Polk County (Figure 5-1). The construction of this stream involved phased additions of woody debris and other natural material to develop channel morphology and stream habitats, and the stream was reconnected to state waters after sufficient development (Mosaic, 2012). BCI Engineers & Scientists, Inc. (currently AMEC Environment & Infrastructure, Inc.) reported in 2009 and 2010, respectively, that this constructed stream had diverse fish and macroinvertebrate communities, and a habitat assessment score in the optimal range (Mosaic, 2012). Additional research would provide more information into how constructed streams compare to natural undisturbed streams. However, as with wetlands, it is important to note that some of the streams that have been impacted recently and are currently proposed to be impacted by the phosphate industry are in a degraded state, primarily due to past disturbances from agricultural practices.

5.4 PROPOSED MITIGATION FRAMEWORK

5.4.1 Introduction

For this AEIS, USACE developed a proposed mitigation framework to outline reasonable alternatives for avoidance, minimization, and compensatory mitigation for the four Applicants' Preferred Alternatives. The proposed mitigation framework is based on the mitigation sequence required under the CWA Section 404(b)(1) Guidelines for mitigating potential adverse impacts to waters of the U.S., which first require impact avoidance, then impact minimization, and lastly compensatory mitigation for any remaining unavoidable impacts (see Section 5.1.2). The mitigation framework identifies priority-based impact

Source: Mosaic, 2012

Figure 5-1. Mosaic's Maron Run Stream Creation Project

avoidance and minimization alternatives identified as reasonable under NEPA. The mitigation framework will be applied after consideration of the applicable presumptions for proposed discharges of fill into special aquatic sites under the Section 404(b)(1) Guidelines – namely, that an alternative site that is not a special aquatic site exists and that such a site will result in less adverse environmental impacts to the aquatic ecosystem unless the Applicant clearly demonstrates otherwise. The proposed mitigation framework does not modify any law or regulation or the jurisdictional authority of USACE or any other agency and is intended to be consistent with the 2008 Mitigation Rule.

As discussed in Section 5.1.2, the USACE and the USEPA jointly administer the Section 404 program, including the Section 404(b)(1) Guidelines. Based on USEPA's comments concerning mitigation and other issues in its July 30, 2012 and August 23, 2012 letters, review of the mitigation sequencing for the four Applicants' Preferred Alternatives, including the application of the proposed mitigation framework, will be conducted in accordance with the 404(q) procedures. Both the USACE and the USEPA have committed to continued coordination of their reviews following this process.

5.4.2 Background and Purpose

USACE developed the proposed mitigation framework in collaboration with the AEIS cooperating and participating regulatory agencies. The need for the mitigation framework was identified based on comments on the Draft AEIS received from the public, non-governmental organizations (NGOs), and regulatory agencies, which recommended that more emphasis should be placed on impact avoidance and minimization, especially for certain aquatic system types and characteristics, and that the approaches for impact avoidance and minimization presented in the Draft AEIS be re-evaluated and improved. In response to these comments, USACE held a workshop on August 21, 2012, with USFWS, USEPA, and NMFS, and had subsequent coordination with these agencies to develop priority-based avoidance and minimization alternatives for the Final AEIS. The mitigation framework developed for this AEIS will be used by USACE to evaluate the permit applications and associated mitigation plans of the four Applicants' Preferred Alternatives. This section explains the general steps of the framework and the overall priority-based avoidance and minimization criteria and alternatives that will be considered for each Applicant's Preferred Alternative. The specific avoidance and minimization measures and approaches determined to be appropriate for each Applicant's Preferred Alternative will be detailed in the separate ROD/SOFs prepared for each Applicant's Preferred Alternative. A draft of the Section 404(b)(1) and public interest review analyses for each project will be made available for public review and comment.

5.4.3 Steps of Framework

5.4.3.1 Step 1 – Identify Priority-Based Avoidance Areas

If the Applicants demonstrate that all discharges of dredged or fill material into waters of the U.S. cannot be avoided pursuant to the Section 404(b)(1) Guidelines, then the first step of the proposed mitigation framework is to identify areas on each mine site that should be prioritized for avoidance. Such areas are to be identified primarily based on the priority-based avoidance criteria that have been developed for the framework.

Priority Avoidance Criteria

Based on public comments received on the Draft AEIS and evaluations conducted by USACE and the collaborating agencies, the following aquatic system types and characteristics were identified as priority avoidance criteria for the proposed mitigation framework:

- Perennial and intermittent streams (as defined in Section 2.2.5.2)
- Forested wetlands
- Herbaceous wetlands of high quality based on functional analyses (UMAM or WRAP)

Perennial and intermittent streams on the Applicants' Preferred Alternative sites were identified as warranting priority avoidance consideration based on the importance of their hydrological and ecological functions and values. Perennial streams are generally considered to warrant higher avoidance priority than intermittent streams based on their hydrological permanence, larger typical size, and greater overall significance to watershed drainage. However, natural intermittent streams, especially those which serve as headwaters and those which have well-functioning floodplain/riparian systems, are acknowledged as also being ecologically important. Other rationales for prioritizing the avoidance of streams include the inherent difficulty of re-creating streams and the length of time required for re-establishment of lost stream functions.

Forested wetlands were identified for priority avoidance consideration based on the habitat and wetland functions and values they provide, which include wildlife utilization, species composition and diversity, pollutant filtration, erosion/flooding control, surface water and groundwater recharge, and carbon sequestration. Forested wetlands are inherently difficult to re-create, and created forested wetlands take longer to mature and reach final successional stages than created herbaceous wetlands. Forested wetlands include the various types defined under FLUCCS Codes 6100, 6200, and 6300; however, not all of the types defined under these codes occur within the CFPD, or are otherwise applicable as priority wetlands (for example, those defined as having a plant species composition dominated by exotic species).

Lastly, herbaceous (vegetated non-forested) wetlands of high quality based on the UMAM or WRAP functional analysis methods were identified for priority avoidance consideration. Although this criterion was identified as being specific to herbaceous wetlands, the qualities of streams and forested wetlands based on UMAM or WRAP may also be considered by USACE during the Section 404(b)(1) analyses of areas for impact avoidance (further discussed below). Herbaceous wetlands include the various types defined under FLUCCS Code 6400; however, not all of the types defined under this code occur within the CFPD. UMAM and WRAP are the two methodologies currently used to assess wetland functionality and quality in Florida. Both UMAM and WRAP are accepted by USACE for regulatory evaluation of Section 404 permit applications and associated mitigation plans. The WRAP or UMAM score for a wetland is an indicator of its overall quality; in general, a higher score indicates a wetland of higher quality. For the proposed mitigation framework, herbaceous wetlands with WRAP or UMAM scores of 0.7 or higher are considered as being of high quality. This would be consistent with protecting those wetlands that fully support FDEP's designated uses that are part of their water quality standards required and approved by USEPA under Section 303 of the CWA.

Application of Avoidance Criteria

The priority avoidance criteria described previously will be used by USACE to identify areas within each mine site that should be prioritized for avoidance. USACE may evaluate areas based on individual criterion or combinations of criteria. Areas where there is an "overlap" of criteria (areas that meet more than one criterion) would typically be given higher avoidance prioritization than areas that meet only one criterion. For example, a forested wetland adjacent to a stream would typically be given higher avoidance prioritization than a forested wetland that is far from any stream, provided that the forested wetlands are comparable in other aspects of quality and function. As another example, an intermittent stream that has adjacent forested wetlands and/or high-quality herbaceous wetlands would typically be given higher avoidance prioritization than an intermittent stream that does not have any adjacent wetlands.

As priority avoidance criteria, streams and forested wetlands have not been assigned an initial "level of quality" as have herbaceous wetlands. Although the importance of all aquatic system types is acknowledged, streams and forested wetlands are recognized as being more difficult to recreate and requiring longer lengths of time to reach functional maturity than herbaceous wetlands. Under the mitigation framework, however, USACE may consider the quality/functionality of a given stream or forested wetland during avoidance evaluations, as determined through UMAM or WRAP. USACE may also consider various environmental attributes during evaluation of a given stream or forested wetland (or herbaceous wetland), including the system's location, surrounding land use, prior disturbance, connectivity, hydrology, plant species composition, and usage by wildlife or listed species. Although these attributes/variables are to a large extent factored into UMAM and WRAP, they may be evaluated by USACE separate from these functional analysis tools because their individual importance or relevance may not be adequately expressed by the UMAM or WRAP score.

In addition to applying the priority avoidance criteria described previously, USACE may support the evaluations of impact avoidance under the framework by assessing areas using other criteria. During development of the mitigation framework, USACE and the collaborating agencies identified various other criteria that could potentially be applied during impact avoidance evaluations.

These criteria include but not limited to:

- Wetlands based on CLIP priority
- Wetlands within the IHN
- 100-year floodplains

As discussed in Chapter 4, CLIP is a GIS-based tool that can be used to assess the ecological quality of a given parcel of land in Florida. Depending on the model and data layers used, CLIP can provide a broad assessment of the overall ecological quality of an area, or it can provide a more focused assessment of the quality of a specific resource within an area, such a wetlands. According to the CLIP tool, areas or specific resources that are ranked as CLIP Priority 1 or 2 are considered to have the highest priority for conservation significance (Florida Natural Areas Inventory [FNAI] et al., 2011). Under the mitigation framework, CLIP could be used by USACE as a supplemental means of assessing the quality of wetlands within a mine site. According to the CLIP tool, CLIP Priority 1 and 2 wetlands would represent wetlands of relatively high quality within the mine site. However, because CLIP is primarily based on GIS data, it does not assess wetland quality as accurately as UMAM or WRAP, which assess wetland quality based on data collected in the field. Therefore, CLIP is proposed to be used under the mitigation framework as a supplemental tool only; the assessment of wetland quality by CLIP is to be viewed in light of its potential inaccuracy.

As discussed in Chapter 3, the IHN is a conceptual network of reclaimed and natural habitat corridors inside and outside the CFPD. The IHN was developed by FDEP in part to promote creation and restoration of regional ecosystem connectivity. Within the CFPD, the IHN includes natural habitats, agricultural lands, phosphate mined lands (including those that have been reclaimed), and some areas of industrial/commercial development. Under the mitigation framework, USACE may consider wetlands within the IHN as an additional criterion in association with the identified priority criteria for the purpose of evaluating the potential benefits that avoiding such wetlands may have on the development of the IHN. Location within the IHN alone is not considered to be of high importance. However, location within the IHN may be an attribute of importance to USACE when evaluated in association with habitat type, quality, and the potential to provide habitat interconnectivity that may benefit regional water quality/quantity and wildlife populations.

Under the mitigation framework, USACE may consider the 100-year floodplain as an additional criterion in association with the identified priority criteria. Systems within floodplains and riparian zones are considered to be important because they provide habitat and corridors for wildlife, habitat interconnectivity and diversity, and natural buffers that protect stream water quality. The 100-year floodplain is represented to some extent in the priority avoidance criteria, which includes avoidance consideration for perennial and intermittent streams and adjacent forested and high-quality herbaceous wetlands. It should be noted that some Florida counties have specific regulations that require floodplain avoidance, including counties within which two of the four Applicants' Preferred Alternatives would be located. Desoto County requires avoidance of the 100-year floodplain and Manatee County requires avoidance of the 25-year floodplain. As such, the mine plan developed for the proposed Desoto mine already excludes mining within the 100-year floodplain and the mine plan developed for proposed Wingate East Mine already excludes mining within the 25-year floodplain.

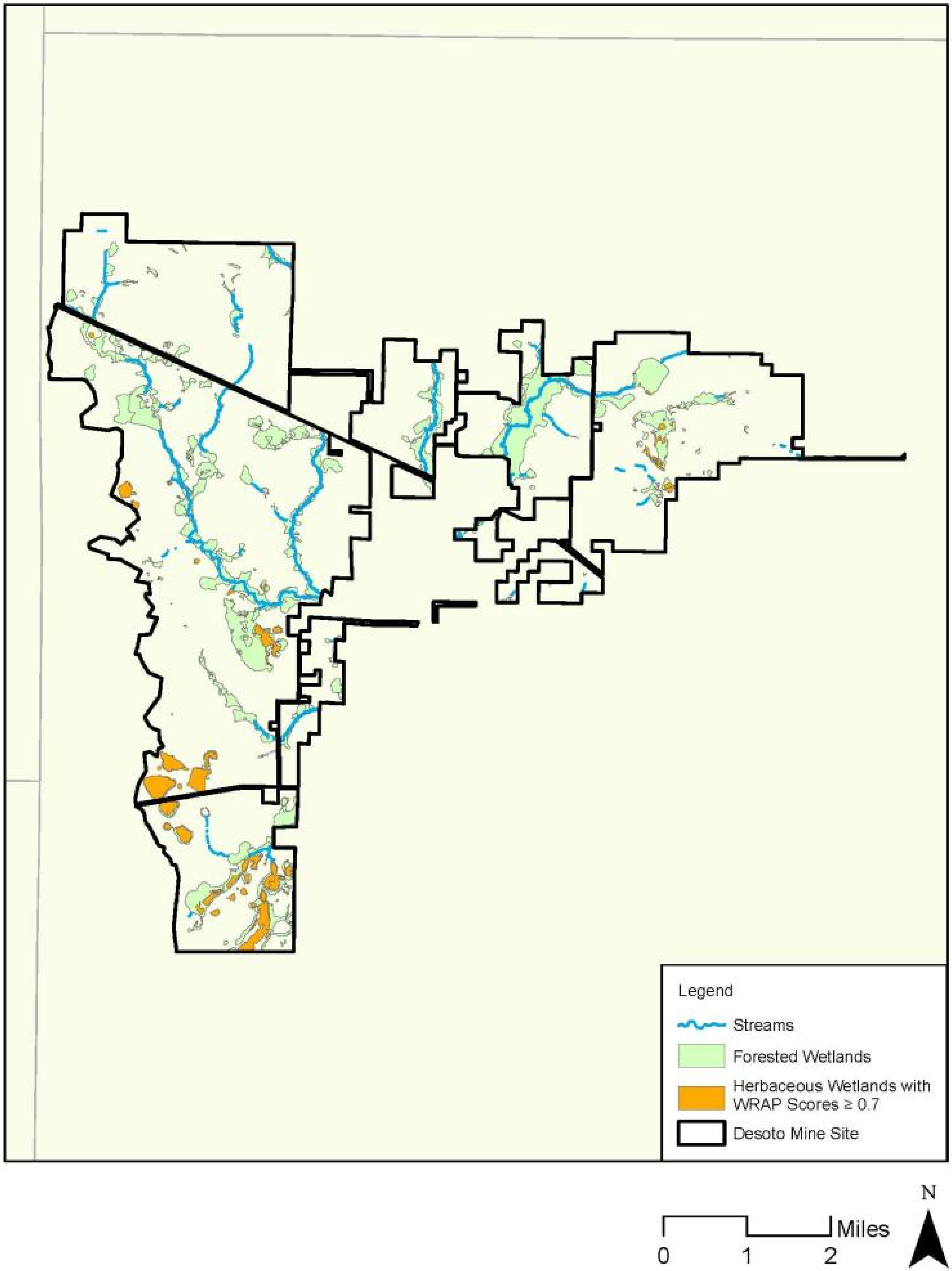
The locations of the priority avoidance criteria (streams, forested wetlands, and high-quality herbaceous wetlands) based on the USACE-approved Jurisdictional Determinations for each of the four Applicants' Preferred Alternatives are shown on Figures 5-2 through 5-5. This mapping is provided for informational purposes only and does not depict avoidance proposals from the Applicants nor a determination by USACE that such areas are practicable for avoidance. Such determinations will be made by USACE in the project-specific ROD/SOFs in cooperation with USEPA. A draft of the Section 404(b)(1) and public interest review analyses for each project will be made available for public review and comment.

5.4.3.2 Step 2 – Determine Extent of Practicable Avoidance

The second step of the proposed mitigation framework is to determine the extent of avoidance that is practicable under the Section 404(b)(1) Guidelines. Evaluations of practicable avoidance will be based on consideration of cost, existing technology, and logistics in light of overall project purposes for each Applicant's Preferred Alternative. Factors to be considered include locations and configurations of CSAs; locations of infrastructure corridors; required compliance with residential setbacks, other setbacks, and local planning goals; and other factors and requirements specified in each mine plan. USACE will determine the extent of avoidance that is practicable at each Applicant's Preferred Alternative site by evaluating these factors in concert with the priority avoidance criteria and approaches identified in Step 1. As discussed in Step 1, higher avoidance prioritization will typically be given to areas where criteria overlap. In Step 2, USACE will maximize protection of such areas to the extent practicable based on relevant mine-specific conditions and requirements. The Section 404(b)(1) Guideline analysis for each of the four Applicants' Preferred Alternatives will be conducted in a project-specific ROD/SOF.

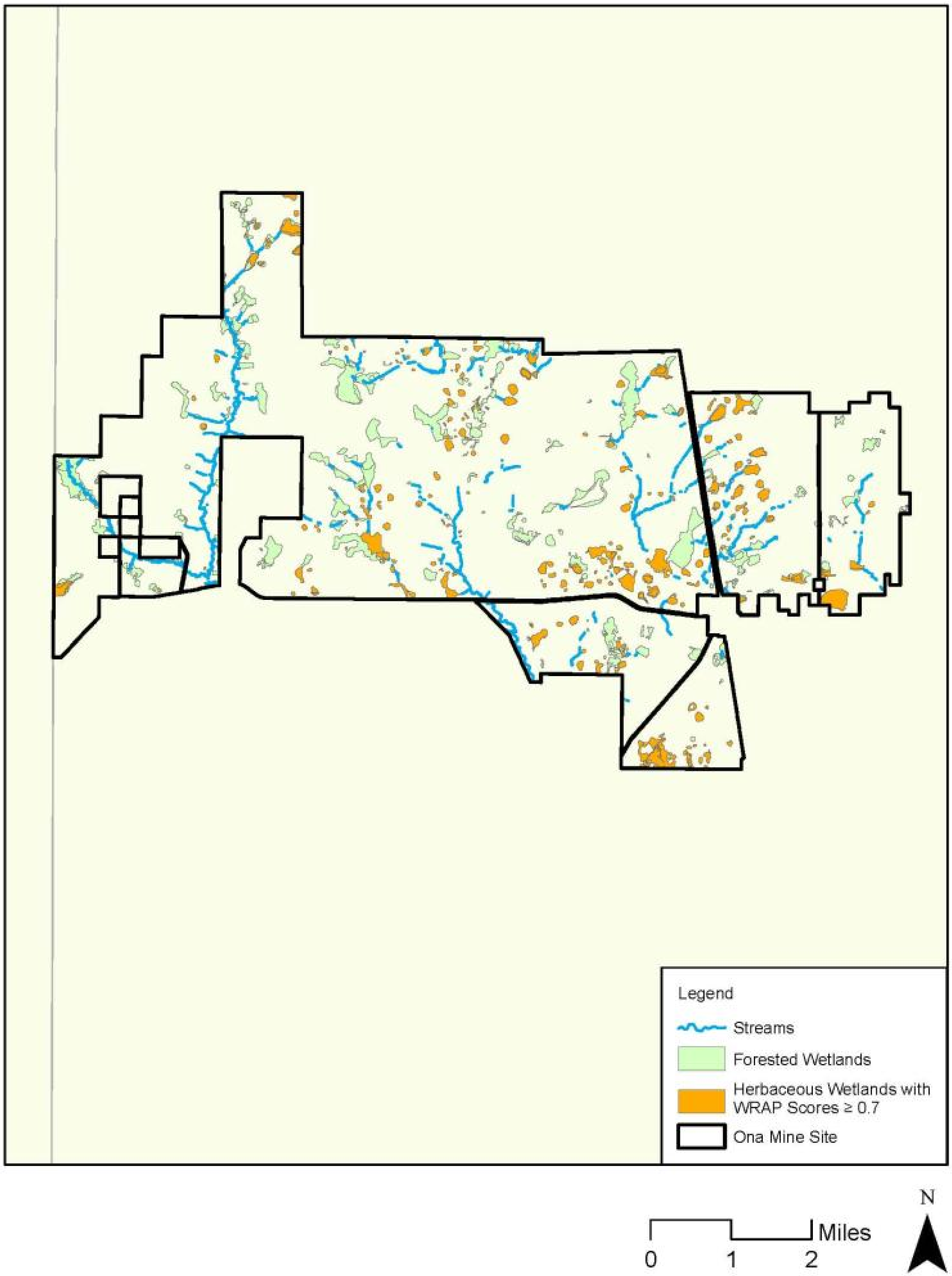
5.4.3.3 Step 3 – Evaluate Opportunities to Minimize Impacts

After impacts have been avoided to the greatest extent reasonable and practicable, the third step of the proposed mitigation framework is to evaluate opportunities to minimize impacts. Impact minimization considerations may address both physical and temporal impacts as well as direct, indirect, and cumulative impacts. Potential minimization measures include, but are not limited to, reducing the widths of infrastructure corridors; using existing CSAs and constructing contiguous CSAs so that they have a common wall; minimizing CSA footprints through design and operation methods; using existing stream crossings created for agricultural operations; sequentially reusing disturbed areas; using upland buffers; using recharge ditch systems; and maintaining habitat interconnectivity and existing wildlife corridors. As with avoidance, the Applicant must demonstrate that implementation of a given impact minimization measure is not practicable.



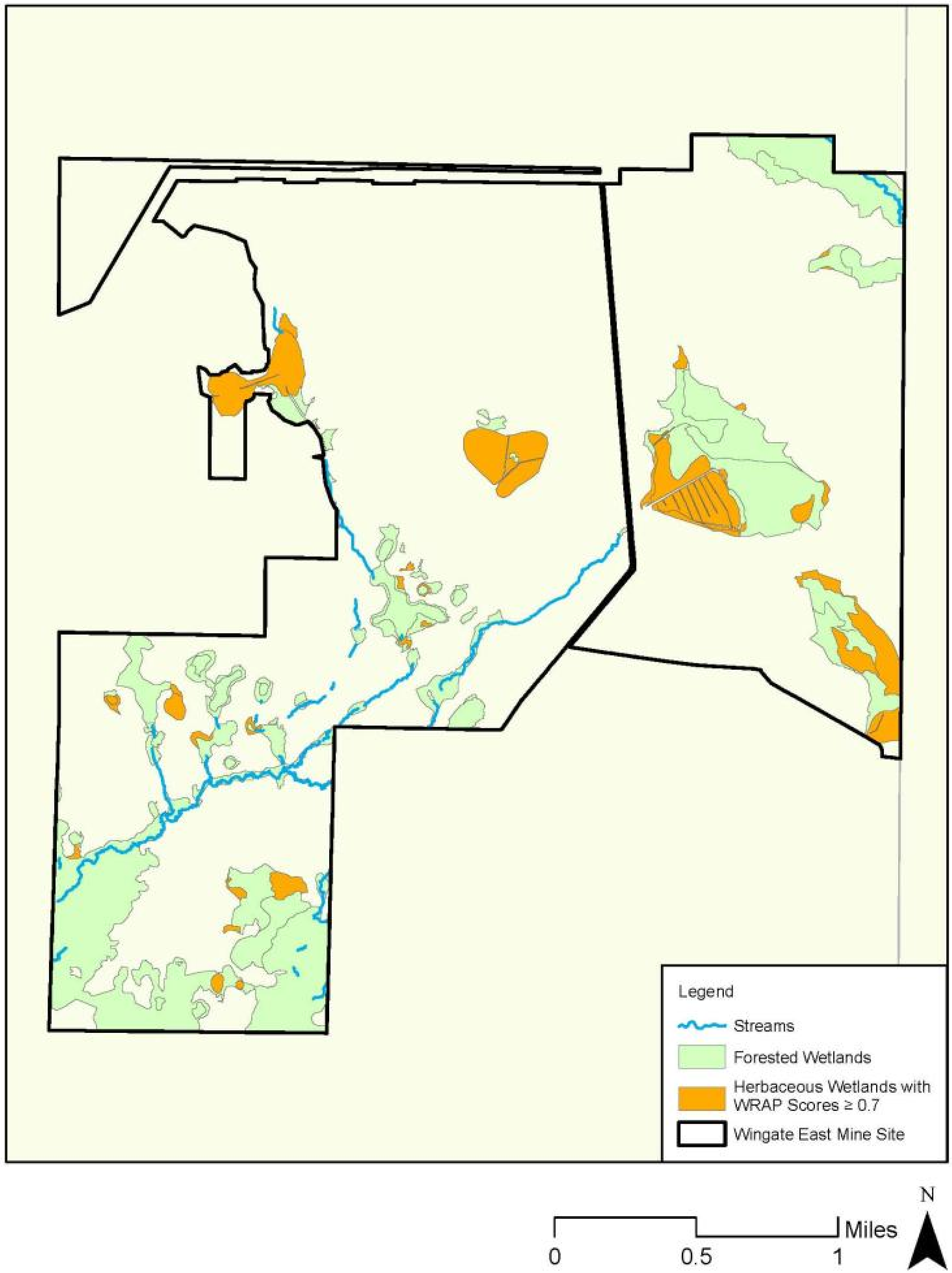
For informational purposes only – does not show final areas determined to be avoided
Based on USACE-approved Jurisdictional Determinations
WRAP = Wetland Rapid Assessment Procedure

Figure 5-2. Locations of Priority Avoidance Criteria on Mosaic's Proposed Desoto Mine Site



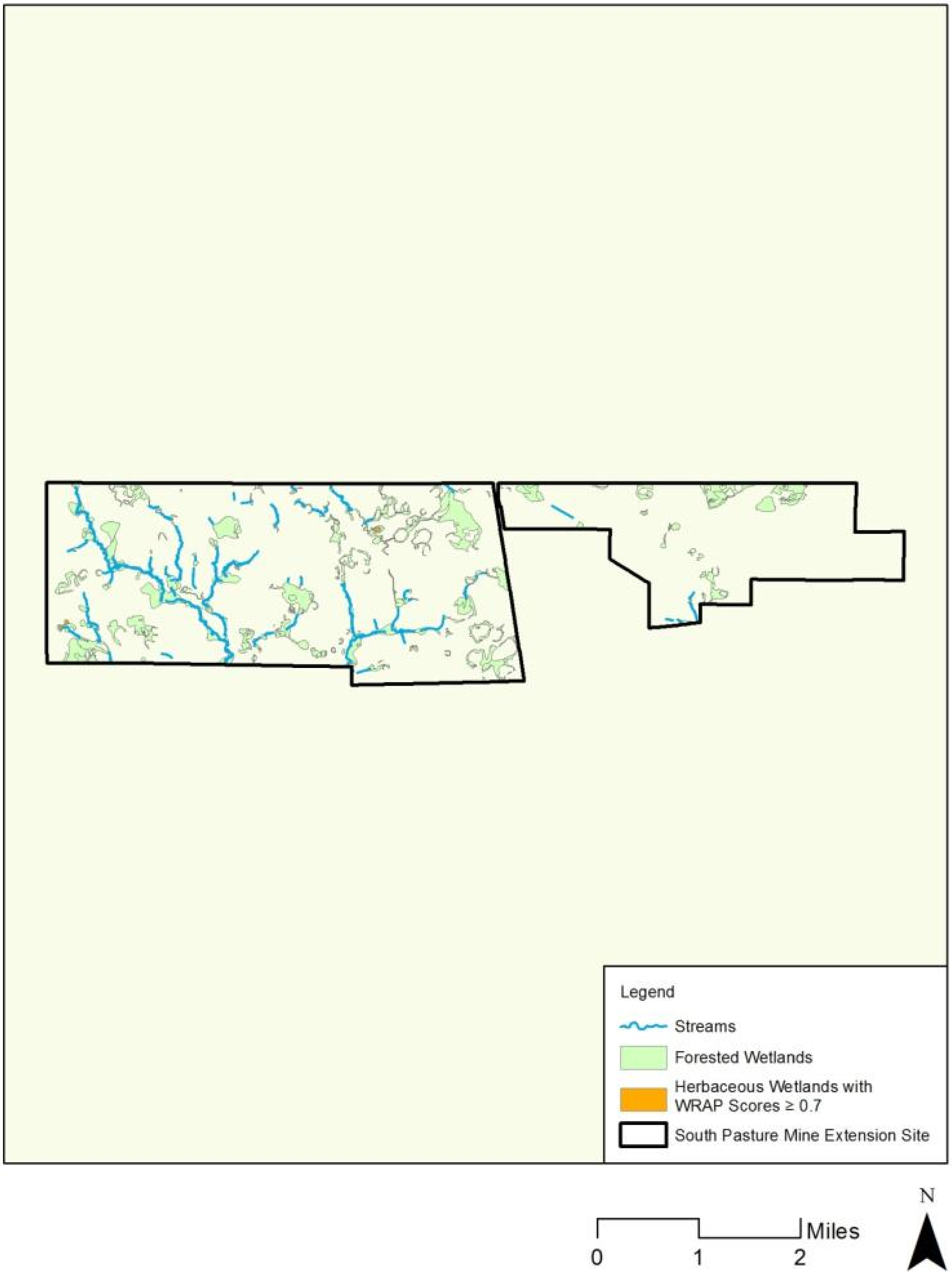
For informational purposes only – does not show final areas determined to be avoided
Based on USACE-approved Jurisdictional Determinations
WRAP = Wetland Rapid Assessment Procedure

Figure 5-3. Locations of Priority Avoidance Criteria on Mosaic's Proposed Ona Mine Site



For informational purposes only – does not show final areas determined to be avoided
Based on USACE-approved Jurisdictional Determinations
WRAP = Wetland Rapid Assessment Procedure

Figure 5-4. Locations of Priority Avoidance Criteria on Mosaic's Proposed Wingate East Mine Site



For informational purposes only – does not show final areas determined to be avoided
Based on USACE-approved Jurisdictional Determinations
UMAM = Unified Mitigation Assessment Method

Figure 5-5. Locations of Priority Avoidance Criteria on CF Industries' Proposed South Pasture Mine Extension Site

Consideration of Buffers

The onsite alternatives developed for the Draft AEIS included evaluation of the potential environmental benefits of applying buffers (mining exclusion zones) around perennial and intermittent streams and around habitats considered to be of high quality within each of the Applicants' Preferred Alternative sites. The buffers considered were based on public input received during scoping. When applied, the size of the buffers (1,500 feet, 3,000 feet, and 6,000 feet) essentially covered most or all of the areas of the four proposed actions and precluded any reasoned discussion of these buffers as reasonable or practicable alternatives. Several commenters on the Draft AEIS questioned the reasonableness of using buffer widths of such magnitude and recommended the application of narrower buffer widths that would provide greater balance between environmental protection and mining.

Based on the findings of the Draft AEIS and associated public and agency comments received, USACE re-evaluated how buffers could be more reasonably and practicably applied under the proposed mitigation framework developed for the Final AEIS, primarily as an impact minimization measure. Under the mitigation framework, buffers are proposed to be considered primarily to:

1) Minimize indirect water-quality impacts to adjacent aquatic systems through pollutant filtration, soil stabilization, and flow attenuation; and

2) Minimize impacts to wildlife by providing habitat protection and corridors for movement.

It should be noted that although CWA Section 404 jurisdiction regulating discharges of dredged or fill material into waters of the U.S. does not extend into upland areas, the USACE normally defines its scope of action for phosphate mines in the CFPD as the entire mine site, including upland areas, in order to comply with other federal environmental requirements, such as the Endangered Species Act. Thus, USACE has the regulatory authority to require vegetated upland buffers around wetlands and other waters of the U.S. for the purposes of minimizing impacts to water quality and aquatic habitats (40 CFR § 332.3(i)).

Basis for Buffers and Buffer Widths

Buffers have been used for many projects in Florida and elsewhere to provide a zone of protection between project activities and streams, wetlands, or other areas considered to benefit from buffers. The benefits of buffers vary based on the type and width of the buffer and the type and quality of the adjacent resource. By definition, a buffer is a vegetated zone located between a natural resource and adjacent areas subject to human alteration (Castelle et al., 1994). Buffers adjacent to streams and other surface water bodies can minimize water quality impacts from human activities by reducing erosion, sedimentation, and pollutant loading. Buffers adjacent to wetlands and other natural habitats can minimize wildlife impacts by providing cover and additional distance from human activities, and by serving as corridors for wildlife movement.

While there is general agreement that buffers can protect water quality and wildlife, opinions vary on what size buffers should be to achieve the desired protection. Factors that influence the width of a buffer include:

- The resource to be protected, such as water quality or wildlife
- The location of the activity in the watershed, for example, buffers for the purpose of water quality protection are typically more effective along small headwater streams than along larger rivers (Castelle et al., 1994; Fischer and Fischenich, 2000; NRCS, 2010)
- The potential that areas where cumulative impacts from multiple sources are anticipated may require larger buffers than areas anticipated to be impacted by relatively few sources
- Hydrologic influence of the activity on the system to be protected
- Slope/topography of adjacent land uses
- Erodability of soil
- Existing water quality condition of the streams and/or Waters (fully supporting, partially supporting, impaired)

Undersized buffers may be insufficient to provide protection, while buffers that are larger than needed may make some alternatives impractical for mining. Generally, larger buffers are necessary to protect high-value wetlands and streams that are adjacent to intense land-use changes, while smaller buffers may be appropriate in areas with fewer disturbances and/or when the natural resource is of low functional value. Buffers used to minimize water quality impacts are typically narrower than buffers used to minimize impacts to wildlife. Ideally, buffer widths would be established to vary along the area of interest based on the type of resource to be protected, topography, soils, and other factors. However, this approach, while potentially reasonable for a small area, can be very difficult and expensive to implement for a large area. It is also more typical for buffers to be standardized by a regulating agency to simplify planning and enforcement.

The buffer width to protect a stream is measured beginning at the top of the bank or at the level of bank-full discharge. Recommended widths for buffers to protect stream water quality have ranged from 30 feet to 150 feet, depending on the condition of the stream targeted for protection and the characteristics of the buffer (Castelle et al., 1994; Fischer and Fischenich, 2000; NRCS, 2012b). The standard buffer width used by NRCS for protection of stream water quality is 35 feet.

Recommended widths for buffers to protect wildlife have ranged from less than 100 feet to more than 1,000 feet, depending on regional ecology and the species targeted for protection. (Castelle, et al., 1994; Fischer and Fischenich, 2000; NRCS, 2012b). The maximum forested riparian buffer width used by NRCS for protection of wildlife is 150 feet.

Ditch and Berm Systems

Current phosphate mining operations in the CFPD include the use of ditch and berm systems, which are installed along the entire outer perimeter of the mine property and adjacent to streams and wetlands within the mine that are to be avoided. The ditch and berm system is designed to capture rainfall and runoff from mining and reclamation areas so it can be used in the mine's water recirculation system. In addition, the ditch and berm system is designed to prevent any runoff from mining and reclamation areas that are not yet re-vegetated from entering the streams and wetlands within the mine property that are to be avoided, as well as those outside the mine property. As such, the ditch and berm system itself serves as a buffer by providing water quality protection for streams and wetlands within and outside the mine property. The berm of the ditch and berm system is set back approximately 135 feet to 150 feet from the edge of a stream or wetland; the ditch is between the berm and the mining/reclamation area. A schematic and photograph of a typical ditch and berm system are presented as Figures 5-6 and 5-7, respectively.

Buffer Widths Proposed Under the Mitigation Framework

Under the mitigation framework, a buffer width in the range of 30 feet to 100 feet is proposed to be considered for the purpose of minimizing impacts to the water quality of perennial and intermittent streams. This buffer width range is considered adequate to provide a reasonable balance between water quality protection and mining. Wider buffers should be considered when the waters of the U.S. downstream of the mining area have been listed as impaired under CWA Section 303(d) for pollutants likely to be generated in the mining area. Figure 5-8 shows a conceptual buffer for water quality protection. As discussed previously, phosphate mine companies currently install ditch and berm systems within mine sites, adjacent to streams and wetlands that are to be avoided and along the entire outer perimeter of the mine property. For streams that are to be avoided, the water quality protection that the ditch and berm system provides will be considered by USACE during evaluation of this minimization measure. USACE may consider the potential application of the proposed buffer width for streams that are not to be avoided, potentially for some duration prior to when they are mined, as appropriate based on the location of mining operations and the overall quality of the stream. For streams that are to be avoided, USACE may consider the potential application of the proposed buffer width during construction and post-mining removal of the ditch and berm system to minimize potential water quality impacts that may otherwise result from construction activities.

Under the mitigation framework, a buffer width in the range of 100 feet to 300 feet is proposed to be considered for the purpose of minimizing impacts to wildlife. This buffer width range is considered adequate to provide a reasonable balance between wildlife protection and mining. In comparison, NRCS uses a maximum forested riparian buffer width of 150 feet for protection of wildlife.

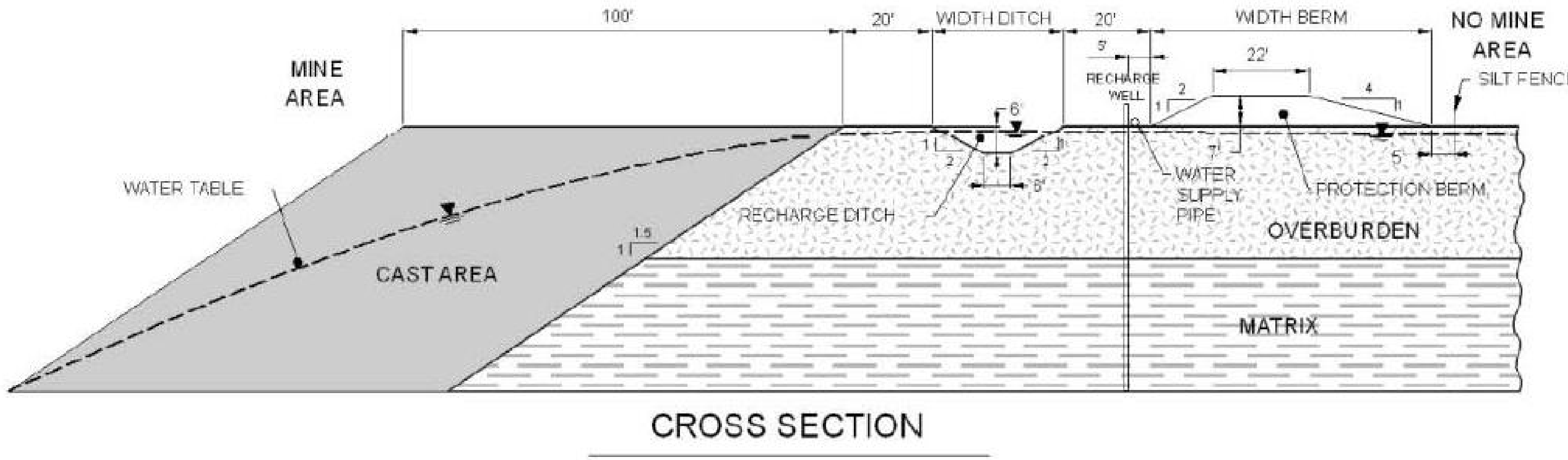


Figure 5-6. Schematic of Typical Ditch and Berm System

Figure 5-7. Photograph of Typical Ditch and Berm System

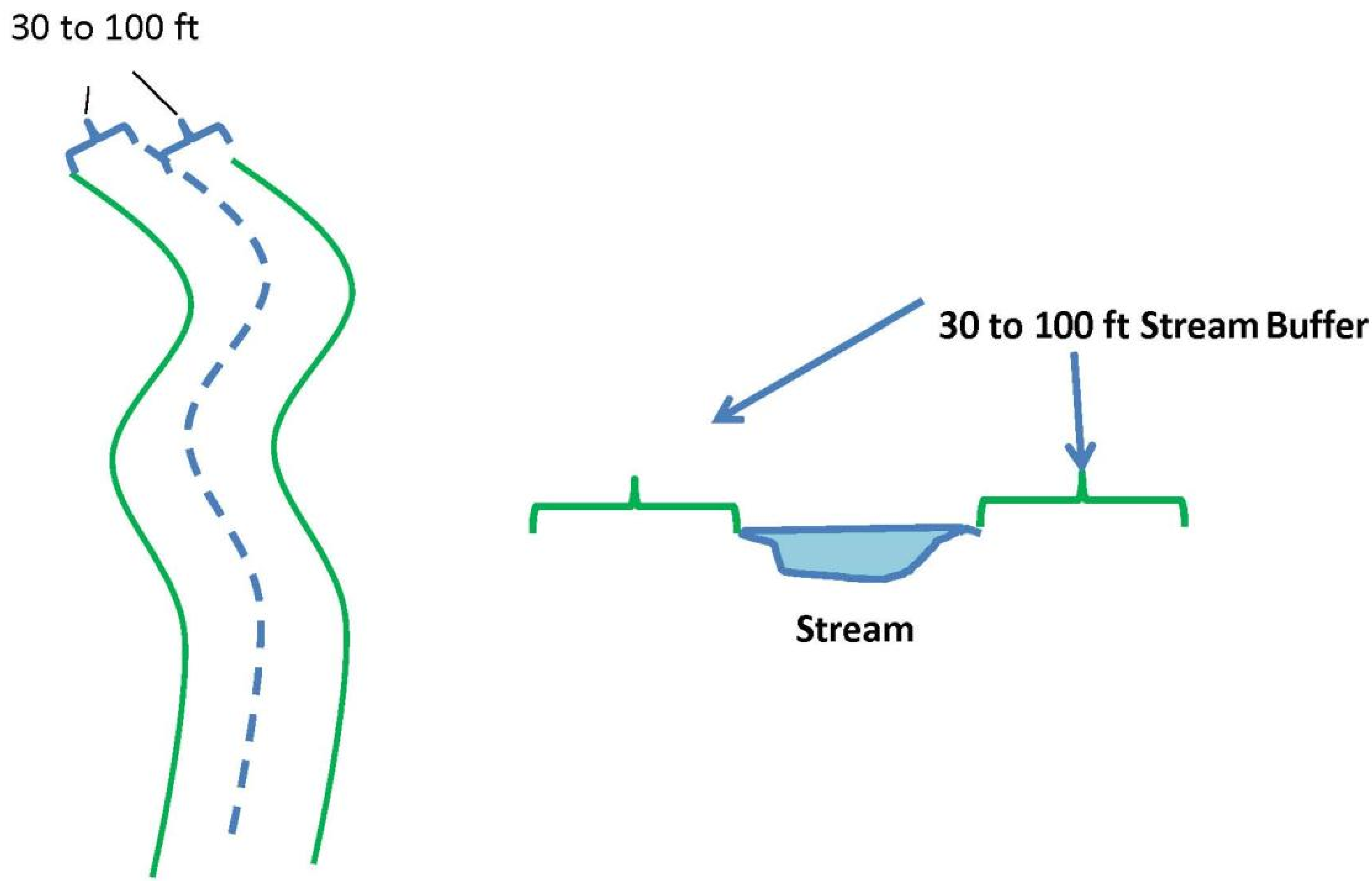


Figure 5-8. Conceptual Buffer for Water Quality Protection

Figure 5-9 shows a conceptual buffer for wildlife protection. Under the mitigation framework, the proposed buffer width range is to be considered primarily for perennial and intermittent streams, floodplain/riparian wetlands and other wetlands of high quality, especially those that are large and/or interconnected with other systems. The proposed buffer would provide protective cover and additional distance from mining activities, and serve as a corridor for wildlife movement along these targeted areas. The Section 404(b)(1) analyses for each of the four Applicants' Preferred Alternatives will consider a variety of ecological factors during evaluations of this minimization measures, including the type, quality, location, and connectivity of the aquatic systems, and information on documented usage of the aquatic systems and surrounding habitats by wildlife, including listed species.

Under the mitigation framework, the Section 404(b)(1) analyses for each of the four Applicants' Preferred Alternatives will consider the practicability of applying the proposed buffer widths based on each mine's specific conditions, characteristics, and requirements, in concert with evaluations of the type, quality, location, and other characteristics of the targeted aquatic systems. This analysis is an example of the type of adaptive management that will need to occur as the details of the mining plans are further developed to ensure that the resource agencies have the opportunity to coordinate and comment during the review of the final plans.

5.4.3.4 Step 4 – Evaluate Opportunities to Compensate for Impacts

After impacts have been avoided and minimized to the greatest extent reasonable and practicable, the fourth and final step of the proposed mitigation framework is for USACE, in consultation with USEPA, to evaluate the sufficiency of the Applicants' proposed compensatory mitigation plans for any unavoidable impacts to aquatic resources pursuant to the joint USEPA-USACE Compensatory Mitigation Rule (33 CFR Part 332 and 40 CFR Part 203, Subpart J). The various compensatory mitigation alternatives that may be proposed by the Applicants for each of the four Applicants' Preferred Alternatives are discussed in Section 5.5. Both the USACE and the USEPA have committed to coordinate their reviews of each Applicant's proposed compensatory mitigation plan. Based on USEPA's comments in its July 30, 2012 and August 23, 2012 letters concerning mitigation and other issues, USEPA, following the Section 404(q) procedures, will reserve its rights to comment on the mitigation plans once they are completed and submitted to the USACE. Permit review and special conditions will require the Applicants to modify their compensatory mitigation plans as appropriate if they are determined to not fully meet all federal compensatory mitigation requirements for offsetting impacts to waters of the U.S. The project-specific analysis of the sufficiency of the Applicants' proposed mitigation plans pursuant to the 404(b)(1) Guidelines will be conducted in the project-specific ROD/SOFs. A draft of the Section 404(b)(1) and public interest review analyses for each project will be made available for public review and comment.

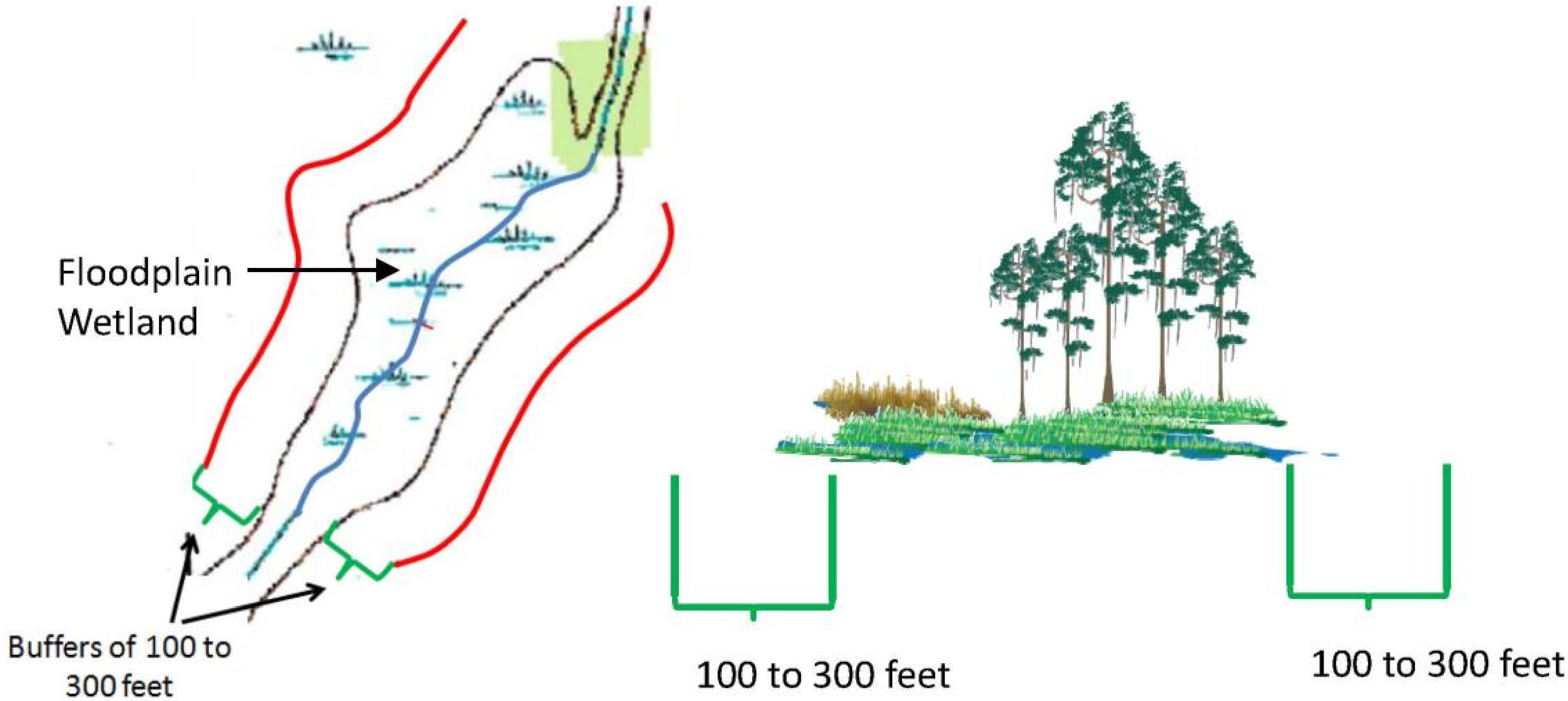


Figure 5-9. Conceptual Buffer for Wildlife Protection

5.5 COMPENSATORY MITIGATION OPTIONS

The 2008 Compensatory Mitigation Rule establishes a hierarchy of preference for the three compensatory mitigation mechanisms. Mitigation banks are the most preferred mechanism, followed by in-lieu fee programs, then permittee-responsible mitigation. However, the Rule also allows the USACE to determine what constitutes the most appropriate and practicable compensatory mitigation based on consideration of project-specific circumstances, such as the availability of mitigation banks or in-lieu fee programs, and the watershed approach. The Compensatory Mitigation Rule has a flexible preference for in-kind mitigation. In-kind mitigation means that the wetland types that are mitigated are the same as those that are impacted. Conversely, out-of-kind mitigation means that the wetland types that are mitigated differ from those that are impacted. The Rule recognizes that departure from this preference can be environmentally preferable in certain cases, for example when out-of-kind mitigation may address specific regional environmental issues or result in greater overall benefits to the watershed. The USACE does not dictate the elements of the mitigation plan to the applicant, but instead reviews the applicant's proposed plan with respect to its sufficiency under the Compensatory Mitigation Rule and the USACE's public interest review.

5.5.1 Onsite Mitigation

All of the required federal and state compensatory wetland mitigation for phosphate mines in Florida to date has been done onsite within the mine boundaries. Onsite mitigation is currently conducted with large-scale system connectivity and the overall watershed in mind. Phosphate mining companies develop mitigation plans that include a combination of mitigation approaches, including creation, restoration, enhancement and preservation. Recently permitted mines having such mitigation plans include the Four Corners Mine, Lonesome Mine, and South Fort Meade – Hardee County Mine (USACE, 2002; USACE, 2010). The proposed mitigation plans for the Applicants' Preferred Alternatives also include a combination of creation, restoration, enhancement, and preservation. This approach is intended to create new high-quality systems, restore and enhance existing disturbed systems in areas that would have the most benefits to the watershed, and preserve existing high-quality systems so their functions can continue to benefit the watershed.

5.5.2 Offsite Mitigation

Federal regulations under the 2008 Compensatory Mitigation Rule allow the option of offsite compensatory mitigation (USEPA and USACE, 2008). Offsite mitigation may be conducted directly by the permittee, or through an in-lieu fee program or mitigation bank. Established In-lieu fee programs and mitigation banks conduct mitigation on a relatively large scale based on a watershed approach, by which mitigation is conducted in a manner that provides the most watershed benefits. In-lieu fee programs and mitigation banks often involve a combination of creation, restoration, enhancement, and preservation. Offsite mitigation may be combined with onsite mitigation if the combined approach is determined to best meet watershed needs

(USEPA and USACE, 2008; USACE, 2008). Offsite mitigation in the CFPD has the potential benefits of allowing permittees to begin and possibly complete the compensatory mitigation before or concurrently with the permitted impacts.

The benefits of offsite mitigation also include, but are not limited to:

- Protection of wetland and upland systems that have an otherwise higher potential to be impacted by agriculture or urban/residential development
- Advance conservation efforts of other local agencies/organizations
- Improve impacted riverine and wetland systems in strategic locations that may have impaired aquatic resources

5.5.2.1 Permittee-Responsible Offsite Mitigation

With permittee-responsible offsite mitigation, the permittee would identify a suitable offsite property where mitigation can be conducted, and obtain ownership of the property or the right to conduct mitigation on the property. This type of mitigation would need to comply with the same requirements as onsite mitigation, including complying with the Compensatory Mitigation Rule.

Potential offsite compensatory mitigation sites may include properties currently owned by phosphate mine companies, such as reclaimed lands where further wetland/stream restoration and/or enhancement would be appropriate and ecologically beneficial. Potential offsite mitigation opportunities may also be available on old un-reclaimed lands that were either ineligible for the state's non-mandatory grant program or were eligible but did not meet the grant application deadline (see Section 5.7.2). The use of non-mandatory lands for compensatory mitigation may be complicated by their current condition/status; therefore, such lands would need to be carefully evaluated for their potential to provide appropriate compensatory mitigation to offset lost wetland or stream area and function. The Applicants could also consider acquisition of offsite parcels currently owned by other parties.

Potential benefits of this approach include the opportunity for phosphate mining companies to work together with local and regional agencies and NGOs to identify suitable land, acquire long-term control of the land through fee acquisition or through covenants or easements enacted on the land, and conduct mitigation on the land. Also, the Applicants may be able to complete the compensatory mitigation prior to the impacts and reduce time lag and risk factors used in the functional analysis of the mitigation. This is especially applicable to phosphate mining because the time from when the permit is issued and when waters of the U.S. are impacted could be a decade or more. Therefore, there should be sufficient lead time to create wetland or stream functional lift in advance of the impact and minimize any risk or time lag in mitigating the resource loss.

Challenges to this approach include the Applicant's identification and acquisition of sufficient legal interest in property that is suitable in terms of size and mitigation potential. Also, the Applicants would have to account for the time required for permitting the activities necessary to do the mitigation.

5.5.2.2 In-lieu Fee Programs

An in-lieu fee program involves the creation, restoration, enhancement, and/or preservation of regulated wetlands and waters through funds paid to an in-lieu fee sponsor (a public agency or non-profit entity). In-lieu fee programs may consist of a single mitigation project or a group of projects directed toward watershed management goals. Typically, in-lieu fee programs receive funds and then develop mitigation projects, which results in a delay between permitted impacts and mitigation. An in-lieu fee program instrument governs the use and operation of an in-lieu fee program. The in-lieu fee sponsor is responsible for the completion and success of the compensatory mitigation associated with permits that provide funds to that program (USEPA and USACE, 2008; USACE, 2008).

An in-lieu fee program is created under a formal agreement between the creating entity and the appropriate regulatory agency or agencies. This formal agreement defines the expectations of the compensatory mitigation and considers the following (Federal Register, 2000a):

- The qualifications of the in-lieu fee sponsor prior to approval.
- Operational information including the restoration locations, schedule for implementation, appropriateness of restoration on a specific site, and the financial, technical, and legal mechanisms required to reach success. Applicable state and local permits should be issued prior to the start of construction.
- Watershed planning to identify wetlands and aquatic resources previously degraded and in need of restoration.
- Selection of ecologically suitable sites to meet the goals and objectives of compensatory mitigation.
- Technical feasibility of the restoration should be self sustaining over the long term.
- Role of preservation of existing wetlands or aquatic resources when done in conjunction with other restoration, creation, or enhancement activities.
- Collected funds should pay for direct improvements to wetland functions and values and will not fund non-mitigation programs, such as education projects or research.
- Monitoring and management should be funded to operate and maintain the mitigation site.

The in-lieu fee agreement also identifies the accounting procedures and methods for determining fees and credits. An "umbrella" agreement may be established for the operation of multiple sites under the same agreement. It is possible to convert individual in-lieu fee agreements to mitigation banks, but they must meet the mitigation bank criteria (Federal Register, 2000a).

In-lieu fee programs may offer advantages over other offsite options. The entity administering an in-lieu fee program can regularly assess watershed needs and focus projects in areas of greatest need. In contrast, an established commercial bank may have less flexibility with regard to addressing watershed needs, due to banks typically being single projects. Also, a permittee may have fewer options for selection of a location to implement a private mitigation project. A disadvantage of in-lieu fee programs is that the mitigation is typically not implemented until after the impacts have occurred, which results is a time lag in offsetting loss of habitat area and function. In addition, it may not be possible to mitigate in-kind or within a relevant or desired portion of a watershed with regard to where the impacts occur. Moreover, in-lieu fee programs may not adequately address local ecological impacts that adversely affect metapopulation dynamics of species with limited dispersal capabilities.

Currently, the USACE has not issued any permits for in-lieu fee programs within the CFPD, the Peace River watershed, or the Myakka River watershed.

5.5.2.3 Mitigation Banks

Mitigation banks are areas where wetland, stream, or other aquatic resources have been created, restored, enhanced, and/or (under limited conditions) preserved for the purpose of providing compensation for unavoidable impacts to aquatic resources permitted under the federal Section 404 program or a similar state or local wetland permitting program. A mitigation bank may include terrestrial resources, such as upland riparian areas or upland buffers, which contribute to the overall ecological functions of the bank. The operator of the mitigation bank, not the permittee, is responsible for the completion and success of the compensatory mitigation associated with permits that use the mitigation bank. To address financial considerations that may be important to the development of a mitigation bank, a percentage of the total credits projected for the bank at maturity is regularly authorized for sale once adequate financial assurances are in place to guarantee completion of the mitigation bank site. These advance credits also require demonstration of a high likelihood of success (Federal Register, 1995). With a mitigation bank, most permitted impacts are mitigated in advance, with the operational bank being in place at the time of the permit application. However, this would not be the case with advance credits authorized to support initial development of a mitigation bank.

A mitigation bank is created under a formal agreement between the creating entity and the appropriate regulatory agency or agencies. Mitigation banks have four distinct components:

- The bank site, which consists of the physical acreage created, restored, enhanced, and/or preserved

- The bank instrument, which is the formal agreement between the bank owner and the regulatory authority that establishes liability, performance standards, management and monitoring requirements, and the terms of bank credit approval
- The Interagency Review Team, which is the group of regulatory agencies that provides regulatory review, approval, and oversight of the bank
- The service area, which is the geographic area in which permitted impacts can be compensated for at a given bank

Through the mitigation that is conducted, mitigation banks enhance the ecological values of the bank property, which is generally referred to as generating lift of ecological value. The amount of lift achieved determines the amount of compensatory mitigation credits available for sale by the bank. The value of a bank is defined by the compensatory mitigation credits it generates.

A mitigation bank instrument identifies the number of credits available and requires the use of ecological assessment techniques to certify that those credits provide the required ecological functions. Although most mitigation banks are designed to compensate only for impacts to various wetland types, some banks have been developed to compensate specifically for impacts to streams, while other banks may provide a combination of wetland and stream credits.

Compensatory mitigation banks may offer advantages over permittee-responsible mitigation and in-lieu fee programs. Mitigation banks typically draw on extensive financial resources, planning, and scientific expertise that is not always available to permittee-responsible compensatory mitigation efforts. Banks typically reduce uncertainty over whether the compensatory mitigation will be successful and also frequently are more cost-effective due to economies of scale. Furthermore, mitigation banks enable a more efficient use of limited agency resources in the review and compliance assessment of compensatory mitigation projects by consolidating mitigation from several projects into a single area. Mitigation banks avoid or minimize the lag between the time when the impacts occur and the time at which the loss of habitat area and functions are offset. However, it may not be possible to use mitigation banks to mitigate in-kind or within a relevant portion of the watershed with regard to where the impacts occur. Moreover, mitigation banks may not adequately address local ecological impacts that adversely affect metapopulation dynamics of species with limited dispersal capabilities.

Most of the eastern half of the CFPD is located within the Peace River watershed, which along with the Myakka River watershed is where the majority of new mining is currently proposed and where foreseeable future mining is expected to occur. At present, two commercial mitigation banks serve the Peace River watershed (Boran Ranch Mitigation Bank and Peace River Mitigation Bank) and one commercial mitigation bank serves the Myakka River watershed (Myakka Mitigation Bank) (FDEP, 2012e; National Mitigation Banking Association, 2012a).

The Boran Ranch Mitigation Bank is approved for more than 200 credits that can be purchased as compensatory mitigation for unavoidable impacts to herbaceous or forested wetlands. For this bank, credits that may be used as compensation for impacts to state-regulated wetlands were determined using UMAM, while credits available for impacts to federally regulated wetlands were determined using WRAP (National Mitigation Banking Association, 2012b).

The Peace River Mitigation Bank is approved for 138 credits that can be can be purchased as compensatory mitigation for unavoidable impacts to forested wetlands. For this bank, credits were determined using UMAM (National Mitigation Banking Association, 2012c).

The Myakka Mitigation Bank is approved for 220 credits that can be purchased as compensatory mitigation for unavoidable impacts to herbaceous or forested wetlands. For this bank, credits were determined using UMAM (National Mitigation Banking Association, 2012d).

The amount of commercial mitigation bank credits currently available for purchase by potential users within the Peace River and Myakka River watersheds would not exclusively satisfy the mitigation needs of the four Applicants' Preferred Alternatives. It is also unlikely that future commercial mitigation banks that may be developed would exclusively satisfy the mitigation needs of the currently proposed or future mines. However, the use of commercial mitigation banks in combination with other forms of mitigation (onsite and/or in-lieu fee) could be a feasible approach for the phosphate industry.

Another form of mitigation banking that could be considered for phosphate mining impact is for phosphate mining applicants to develop a single-user mitigation bank. Single-user banks are developed by commercial entities or state agencies to generate mitigation credits for their own use (USEPA, 2012b). One approach would be to develop a single-user mitigation bank that could be used only by phosphate mining companies and to conduct large-scale mitigation that would generate credits in advance of impacts. After a sufficient amount of mitigation has been completed, this approach (like a commercial mitigation bank) would have the advantage of avoiding or minimizing the lag between the time when the impacts occur and the time when the loss of habitat area and functions are offset. Challenges to developing an offsite single-user mitigation bank would include identification and acquisition of property that is suitable in terms of size and mitigation potential. The cost of purchasing the property would also need to be considered. Depending on the cost of the land itself and the mitigation that would need to be done, this approach could have greater costs than conducting onsite mitigation, or purchasing credits from an in-lieu fee program or commercial mitigation bank. The start-up time for developing a single-user bank could be significant in terms of the time required for environmental permitting and conducting the mitigation. Avoidance/minimization of time lag to offset impacts would only be realized after a considerable amount of mitigation had occurred for long enough duration to result in habitat maturity and full functionality. After this point, the credits would represent mitigation in advance of impacts.

5.5.3 Ecological Performance Standards for Mitigation

Final approved mitigation plans must contain ecological performance standards, which are "observable or measurable physical (including hydrological), chemical and/or biological attributes that are used to determine if a compensatory mitigation project meets its objectives." (33 CFR 332.2 and 332.5). Section 5.3.1 discusses how ecological performance standards for created wetlands have evolved over time and provides general examples of performance standards for created herbaceous and forested wetlands specified in permits issued in the 1990s and early 2000s. Appendix I includes examples of performance standards that can be tailored to the four similar Applicants' Preferred Alternatives if USACE were to make a favorable permitting decision, and discusses potential changes to those standards. Success criteria will be determined by USACE in coordination with USEPA. Based on USEPA's comments in its July 30, 2012 and August 23, 2012 letters concerning mitigation and other issues, the USACE and the USEPA have both committed to coordinate development of the performance standards for the four Applicants' Preferred Alternatives in accordance with the 404(q) procedures.

5.5.4 Monitoring and Adaptive Management

The goal of monitoring is to determine whether the compensatory mitigation projects are meeting their performance standards. Compensatory mitigation plans must include monitoring plans that identify the parameters to be monitored, the length of the monitoring period, the party responsible, and the frequency for submitting monitoring reports (33 CFR § 332.6). The monitoring period must be at least five years, but may be longer in the case of aquatic resources with slow development rates, for example forested wetlands. Appendix I includes examples of monitoring special conditions that can be tailored to the four similar Applicants' Preferred Alternatives if USACE were to make a favorable permitting decision. The Applicant must develop appropriate monitoring plans and ultimately, monitoring requirements will be determined by USACE in coordination with USEPA. Based on USEPA's comments in its July 30, 2012 and August 23, 2012 letters concerning mitigation and other issues, the USACE and the USEPA have both committed to coordinate development of the monitoring special conditions for the four Applicants' Preferred Alternatives in accordance with the Section 404(q) procedures. In addition to monitoring requirements, a final mitigation plan must also include an adaptive management plan (33 CFR § 332.4(c)(12)). Adaptive management is:

> *[T]he development of a management strategy that anticipates likely challenges associated with compensatory mitigation projects and provides for the implementation of actions to address those challenges, as well as unforeseen changes to those projects. It requires consideration of the risk, uncertainty, and the dynamic nature of compensatory mitigation projects and guides modification of those projects to optimize performance. It includes the selection of appropriate measures that will ensure that the aquatic resource functions are provided and involves analysis of monitoring results to identify potential*

problems of a compensatory mitigation project and the identification and implementation of measures to rectify those problems.

(33 CFR 332.2). USACE, in consultation with the Applicant, USEPA, and other agencies as appropriate, will determine appropriate measures to address deficiencies in the compensatory mitigation, such as site modifications, design changes, revisions to maintenance requirements, and revised monitoring requirements. Appendix I includes examples of adaptive management special conditions that can be tailored to the four similar Applicants' Preferred Alternatives if USACE were to make a favorable permitting decision. The Applicant must develop appropriate adaptive management plans and ultimately, adaptive management requirements will be determined by USACE in coordination with USEPA. Based on USEPA's comments in its July 30, 2012 and August 23, 2012 letters concerning mitigation and other issues, the USACE and the USEPA have both committed to coordinate development of the adaptive management special conditions for the four Applicants' Preferred Alternatives in accordance with the 404(q) procedures.

5.6 USACE EVALUATION OF APPLICANTS' PROPOSED MITIGATION

USACE will evaluate each Applicant's proposed mitigation plan, including impact avoidance, minimization and compensatory mitigation, pursuant to the requirements of CWA 404(b)(1) and the Compensatory Mitigation Rule, in the project-specific ROD/SOF. Additionally, each Applicant's mitigation plan will be evaluated in accordance with the proposed mitigation framework developed for this AEIS in the project-specific ROD/SOF. As discussed in Section 5.4, the proposed mitigation framework is based on the mitigation sequence established under the CWA Section 404(b)(1) Guidelines, which first require impact avoidance, then impact minimization, and lastly compensatory mitigation for any remaining unavoidable impacts.

USACE will apply the priority-based impact avoidance and minimization criteria and approaches identified in the mitigation framework, and will consider each mine's specific operating conditions and requirements to determine whether each Applicant has proposed to avoid and minimize impacts to waters of the U.S. to the greatest extent practicable under the Section 404(b)(1) Guidelines. If USACE determines that the Applicant has not proposed to avoid and minimize impacts to the maximum extent practicable, the Applicant will be required to modify its plan as necessary to meet this requirement of the 404(b)(1) Guidelines.

After USACE determines that impacts have been avoided and minimized to the greatest extent practicable, it will evaluate each Applicant's proposed compensatory mitigation plan for the remaining unavoidable impacts in the project-specific ROD/SOF. USACE will evaluate each Applicant's proposed plan with respect to its compliance with the Compensatory Mitigation Rule. USACE will require the Applicant to modify its compensatory mitigation plan as necessary if it is determined that the plan does not fully meet all federal compensatory mitigation requirements for offsetting impacts to waters of the U.S.

Based on the information presented in the Applicants' Section 404 permit applications, each Applicant proposes to provide permittee-responsible onsite compensatory mitigation (a combination of wetland and stream establishment [creation], restoration, and preservation) for the impacts to federal jurisdictional wetlands/waters that would result from mining operations. The Applicants' compensatory mitigation plans were still under revision at the time this AEIS was prepared due to ongoing impact avoidance and minimization discussions with USACE. The quantities of federal jurisdictional wetlands/waters that the Applicants preliminarily propose to avoid and impact are discussed in Section 4.5 for the purpose of broadly analyzing impacts to wetlands/waters for this AEIS. These data are subject to change pending final USACE review of the Applicants' mitigation plans. As discussed previously, USACE will evaluate each Applicant's proposed mitigation and monitoring plan, including impact avoidance, minimization and compensatory mitigation, pursuant to the requirements of CWA 404(b)(1) and the 2008 Compensatory Mitigation Rule, in the ROD/SOF that will be prepared for each Applicant's Preferred Alternative. A draft of the Section 404(b)(1) and public interest review analyses for each project will be made available for public review and comment.

The impact avoidance areas/habitats preliminarily proposed by each Applicant are summarized below. This information is preliminary and subject to change pending final USACE review of the Applicants' mitigation plans.

Desoto

Based on information in the Section 404 permit application, Mosaic preliminarily proposes to avoid the following areas/habitats within the proposed Desoto mine site:

- The 100-year floodplain of Horse Creek and its direct tributaries
- The forested riparian habitat of Buzzard Roost tributary south of SR 70

Ona

Based on information in the Section 404 permit application, Mosaic preliminarily proposes to avoid the following areas/habitats within the proposed Ona mine site:

- The forested riparian habitat of West Fork Horse Creek (132 acres)
- The 100-year floodway of Horse Creek (359 acres)
- The forested riparian habitat of Brushy Creek north of Sections 23 and 24, Township 34 South, Range 23 East and south of SR 64 (749 acres)
- A large, headwater forested wetland (approximately 110 acres) located primarily in Section 17, Township 34 South, Range 24 East.

Wingate East

Based on information in the Section 404 permit application, Mosaic preliminarily proposes to avoid the 25-year floodplains of the West Fork Horse Creek and Myakka River.

South Pasture Extension

Based on information in the Section 404 permit application, CF Industries preliminarily proposes to avoid nearly all the intact natural stream segments associated with Brushy, Lettis, and Troublesome Creeks. Approximately 96 percent of the bay swamp acreage within the mine site would be avoided and preserved in perpetuity. The only bay swamp proposed to be impacted is a hydrologically isolated system within a pasture. The application indicated that on average, the wetlands proposed to be avoided are of higher quality (average composite UMAM score = 0.62) than the wetlands proposed to be impacted (average composite UMAM score = 0.52).

The Section 404 application for the proposed South Pasture Extension mine included CF Industries' Section 404(b)(1) Guidelines evaluation for impact avoidance and minimization, and its review of public interest factors. The application includes discussion of the environmental, engineering, mining, and waste disposal factors that were considered during evaluation of impact avoidance and minimization.

5.7 RECLAMATION

Although reclamation is not associated with the federal wetland mitigation process, it is an important environmental component of phosphate mining that is considered relevant for discussion in this chapter.

Currently, all mining in Florida is subject to the state's reclamation requirements. FDEP's Mining and Minerals Regulation Program administers the laws and regulations related to the reclamation of all mined land in Florida. Reclamation standards are set forth in Chapter 378, F.S. Of the various types of mining conducted in Florida, phosphate mining is the most land-intensive. Currently, all the land that is mined or otherwise disturbed during phosphate mining must be reclaimed. Reclamation standards for phosphate mined lands in Florida are detailed in Chapter 62C-16, F.A.C.

5.7.1 Mandatory Reclamation

The Florida Legislature mandated reclamation of all lands mined for phosphate after July 1, 1975, with the passage of the Mandatory Phosphate Reclamation Rule (hereafter referred to as the Reclamation Rule), as defined in Chapter 62C-16, F.A.C. Until this time, phosphate mining companies had reclaimed land on a voluntary basis. FDEP's Mandatory Phosphate Program (MANPHO) is responsible for administering the Reclamation Rule. From July 1, 1975 (when the Reclamation Rule was adopted), to December 31, 2010, approximately 190,256 acres of land in Florida have been mined for phosphate.

Approximately 134,901 acres (71 percent) of this mined land have been reclaimed, and the remainder of this land is still under mining operations (FDEP, 2012c).

In accordance with Chapter 378, Part II, F.S., a conceptual reclamation plan must be prepared for a proposed phosphate mine and the plan must be approved by FDEP. Approval of the plan must be obtained before initiating reclamation activities and the reclamation activities must be consistent with the approvals. Once mining operations have ceased on a disturbance area, reclamation must be conducted in compliance with rule requirements and the approved conceptual reclamation plan.

The Reclamation Rule requires that reclaimed wetlands and surface waters (other than streams) be restored on an acre-for-acre and type-for type basis. The restoration is required to be designed to reflect the biological structure and hydrology of the wetland community that was disturbed by mining operations; however, exact replication of the pre-disturbed wetland vegetation is not required. The Reclamation Rule also requires that natural streams be restored at least via replacement of the linear footage of the stream impacted. Restoration of natural streams must be designed to at least the Rosgen Level-II channel classification (Rosgen, 1996). The design of created wetlands and water bodies is to be consistent with health and safety practices, maximize beneficial contributions within local drainage patterns, provide aquatic and wetland wildlife habitat values, and maintain downstream water quality by preventing erosion and providing nutrient uptake. Water bodies are to incorporate a variety of emergent habitats, a balance of deep and shallow water, fluctuating water levels, high ratios of shoreline length to surface area, and a variety of shoreline slopes.

The Reclamation Rule requires minimum vegetation establishment periods (after initial planting) of 3 years for reclaimed herbaceous wetlands and 5 years for reclaimed forested wetlands. Herbaceous wetlands must achieve a ground cover of at least 50 percent at the end of 1 year after planting and be protected from grazing, mowing, or other adverse land uses for 3 years after planting to allow establishment. Forested wetlands must achieve a stand density of 200 trees per acre at the end of 1 year after planting and be protected from grazing, mowing, or other adverse land uses for 5 years or until such time as the trees are 10 feet tall. If a reclaimed wetland has not met the regulatory success criteria at the end of the minimum establishment period, remedial actions must be taken until the success criteria are met.

The Reclamation Rule requires that reclaimed uplands be returned to beneficial use, but not necessarily restored type-for-type. Beneficial uses of reclaimed uplands may include undeveloped, agricultural, residential, recreational, and industrial land uses. The Reclamation Rule requires that 80 percent of all reclaimed upland areas (excluding road, groves, and row crops) be replanted and that those areas maintain ground cover for a minimum of 1 year after planting. Bare areas are required not to exceed 0.25 acre. Upland forested areas are required to be established to resemble pre-mining conditions where practical and where consistent with proposed land uses. At a minimum, 10 percent of the reclaimed upland area is required to be re-vegetated as upland forest with a variety of indigenous tree species. Reclaimed upland forests are required to be protected from grazing, mowing, or other adverse land uses to allow establishment. An area is considered to be reforested if a stand density of 200 trees per acre is achieved at the end of 1 year after planting.

The Reclamation Rule requires land reclamation to be completed in a neat, clean manner by removing or disposing of all visible debris, litter, junk, worn-out or unusable equipment or materials, as well as all footings, poles, pilings, and cables. With the exception of those structures that are of sound construction with potential use compatible with the reclamation goals, all temporary buildings, pipelines, and other man-made structures are to be removed. Slopes of any reclaimed area are to be no steeper than 4 feet horizontal to 1 foot vertical to enhance slope stabilization and provide for the safety of the general public. A perimeter greenbelt of vegetation consisting of indigenous tree and shrub species is required to be created. All waters of the state on or leaving the property under control of the operator must meet applicable FDEP water quality standards and water within all wetlands and water bodies must be of sufficient quality to maintain their designated use. All reasonable steps necessary to eliminate the risk of flooding on lands not controlled by the operator must be taken. The original drainage pattern of the area must be restored to the greatest extent possible.

5.7.2 Non-Mandatory Reclamation

Chapter 211 and Chapter 378, F.S., created a Non-Mandatory Land Reclamation Trust Fund to help reclaim lands disturbed by phosphate mining prior to July 1, 1975. The state’s non-mandatory reclamation grant program is funded with a portion of the severance tax collected on phosphate mined in Florida. Approximately 149,130 acres of land in Florida were identified in 1978 as having been mined for phosphate before July 1, 1975. Of this total, 86,624 acres were deemed eligible in 1978 to participate in the non-mandatory reclamation grant program. The remaining 62,506 acres of land mined for phosphate before July 1, 1975, consist of land that has either been voluntarily reclaimed; has been reclaimed naturally (with established vegetative cover and soil stabilization, with most land providing relatively good fish and wildlife habitat), or has been assimilated into a park or other land use.

Chapter 378.035 (7), F.S., subsequently established a deadline of January 1, 2005, for the submittal of all non-mandatory reclamation grant fund applications. Grant program applications for approximately 46,524 acres (or 54 percent) of the eligible land met the application deadline and owners of these lands have received or are eligible to receive grant funds for reclamation. Of the land for which owners received grant funds, approximately 93 percent has been reclaimed and released to date and approximately 7 percent is still undergoing reclamation. Non-mandatory mined lands that were deemed eligible for the non-mandatory grant program, but did not meet the grant application deadline, are currently being evaluated by FDEP and other stakeholders for reclamation opportunities.

5.7.3 Evolution of Reclamation

Early reclamation efforts undertaken by the phosphate industry after enactment of the Reclamation Rule in 1975 did not consider the needs of the watershed and resulted largely in a landscape of hills interspersed with ponds and lakes, commonly referred to as "land and lakes". Subsequent upland reclamation primarily involved the return of mined uplands to agricultural uses such as improved pastures, citrus, and row crops. Large areas reclaimed exclusively as pasture and/or steep-sided lakes no longer occur. Although pasture still represents a significant percentage of recently reclaimed land, these areas now include forested wildlife corridors and are designed in conjunction with other habitat types. Today, reclamation of wetland and upland habitats on lands mined for phosphate, like wetland mitigation, is conducted with large-scale system connectivity and the overall watershed in mind, in accordance with the goals of FDEP's IHN.

5.7.4 Relationships of Mining Activities and Reclamation

Reclamation of lands mined for phosphate is currently phased in sequence to follow the overall mine plan. Mining is conducted incrementally in defined areas referred to as mine blocks. Reclamation is initiated after each area is mined; therefore, reclamation is conducted concurrently with mining that occurs in other areas throughout the life of the mine. This "rolling process" of mining and reclamation results in some areas being reclaimed before other areas are impacted.

Most of the mined land is backfilled with sand tailings; small amounts of overburden are added to the sand to improve the moisture –holding capacity of the surface soils. During reclamation, overburden is primarily regraded along the perimeter of the mine where the ditch and berm systems are located, and in areas where sand backfill is not deposited, which includes reclaimed CSA dams and the edges of some reclaimed lakes. Sand tailings produced during ore recovery at the beneficiation plant are transported hydraulically through pipelines to fill mine cuts and to areas where they are used to create natural systems (uplands and wetlands) or uplands suitable for agriculture or other uses. A significant portion of the generated clay is hydraulically transported into CSAs.

Future reclamation in the Southern Extension of the CFPD is expected to primarily involve the use of sand tailings, based on the amount of sand that exists within the soil matrix in this part of the CFPD. The relative percentage of sand within the matrix in the southern part of the CFPD is approximately 52 percent compared to approximately 30 percent in the northern part of the CFPD. The conceptual reclamation plans for the proposed South Pasture Extension and Ona mines indicate that most, if not all, of the non-CSA reclamation would be sand tailings with overburden cap, or muck cap in the case of wetland reclamation. Due to their high infiltration properties, the sand tailings that would be used to fill the mine cuts during reclamation are expected to provide an active recharge and reestablishment of the surficial aquifer and associated maintenance of base flow to contiguous unmined streams and wetlands (FDEP, 2011a).

5.7.5 Reclamation of Clay Settling Areas

CSAs are reclaimed after they reach their clay storage capacity. Specialized equipment is used to facilitate the consolidation and drying of the clay, and channels are cut through the surface of the clay to promote dewatering. Once a crust has developed on the surface of the clay, the dam walls are regraded to create a gentle slope. Reclaimed CSAs today have the appearance of a subtle hill (6 m or less in height) compared to active CSAs, which are more elevated (7 to 20 m in height) and, therefore, more visibly prominent. The clay beneath the surface of a reclaimed CSA continues to settle for many years and, thereby, limits the CSA's potential to be developed. CSAs have been reclaimed by the phosphate industry for productive uses such as cattle pastures and row crop farming, and as green space containing natural upland and aquatic habitat. During CSA reclamation, the CSA wall is breached so that captured stormwater can be purposefully discharged into a wetland system for recharging of the surficial aquifer. Although the reclaimed CSA itself is a barrier to the surficial aquifer, the discharging of captured stormwater to a receiving wetland is expected to recharge the surficial aquifer and maintain base flow to connected streams and wetlands.

5.7.6 Reclamation of Native Upland Habitats

The role of uplands in an integrated landscape, and the importance of uplands in the life cycles of many plant and animal species, including state and federally listed species, became increasingly recognized over time. Efforts to create native upland habitats by the phosphate industry have increased in recent years. Most native uplands within the CFPD have at least an upper foot of fine sand. To mimic native soil profiles, most natural upland habitats created today by the phosphate industry are constructed using mine sand tailings with an overlying cap of native topsoil salvaged from mined areas. The application of topsoil has proven to be effective in promoting the successful establishment of native upland habitats such as scrub and flatwoods habitats (Cates, 1987).

Native xeric habitats in general have been identified as community types needing protection and conservation because of the high rate at which they had been lost to development. Xeric scrub habitat in particular is considered ecologically valuable because it has the potential to support a variety of listed/rare plant and animal species. The quality of xeric scrub and other native upland habitats within the CFPD varies depending on the past disturbances the habitats have experienced. Native upland habitats that are of high quality and are confirmed to support listed species are required to be avoided and preserved to the extent practicable by phosphate mine companies. Xeric habitats have been created by the phosphate industry in recent years. Examples include Mosaic's North Fork Manatee reclamation site where 150 acres of scrub habitat were created and Mosaic's West Noralyn Scrub reclamation site where 462 acres of scrub habitat were created. Both of these reclamation sites have been released by FDEP, and the West Noralyn project was awarded the Outstanding Environmental Achievement Award for habitat creation by the Tampa Bay Chapter of the Florida Association of Environmental Professionals (Mosaic, 2012).

5.7.7 Reclamation Rates and Financial Responsibility

Operators of phosphate mines must meet the rate of reclamation requirements established in Subsection 378.209(1)(b), F.S. Reclamation, for the purpose of financial responsibility, is defined as reclaimed through the initial re-vegetation as described in Rule 62C-16.0075(5)(f), F.A.C. Failure to meet financial responsibility requirements results in the imposition of financial security by the operator, pursuant to Rule 62C-16.0075, F.A.C. FDEP issues Financial Responsibility Reports for all existing mines in Florida.

5.7.8 Reclamation Compliance and Enforcement

Routine reclamation compliance inspections are conducted by FDEP for mines regulated by the MANPHO to ensure that reclamation activities comply with the requirements of the Reclamation Rule. Routine inspections are required each quarter by statute and rule for such mines per Chapter 378, F.S., and Chapter 62C-16, F.A.C. Enforcement actions are taken by FDEP for non-compliance in the form of various types of corrective actions, compensation, and penalties.

5.7.9 Reclamation Variances

In granting a reclamation variance, FDEP takes into consideration the period of time for which the variance is sought, including the social, economic, and environmental impacts on the applicant and residents of the area. Reclamation activities that require a variance are not to be initiated unless and until a variance is approved by FDEP. Variances issued for more than 5 years are reviewed by FDEP at least every 5 years to ensure that the factors justifying the issuance of the variance have not changed to an extent that would make the variance unnecessary. From April 1991 to September 2010, FDEP granted 30 variances to phosphate mines in Florida. The majority of these variances were granted under the provisions of Chapter 378, F.S., for time extensions requested to accomplish land contouring and to meet reclamation rates and standards. Operators seeking variances are required to post security for the reclamation of unreclaimed future sand tailings areas; land and lake reclamation areas (sites where existing overburden will be contoured and no sand tailings will be utilized in the reclamation); and areas that have received sand and have been contoured, but not yet re-vegetated. All land mined for phosphate after July 1, 1975, is required to be reclaimed per the Reclamation Rule regardless of any bonding requirements.

5.7.10 Regulatory Release of Reclamation Land

Once the reclamation and restoration requirements are fulfilled within a reclamation parcel, the operator may request a regulatory release of the reclamation parcel, as a whole, or as a distinct upland portion thereof. FDEP grants a release of an upland portion of a reclamation parcel only if it will not jeopardize the operator's ability to fulfill the reclamation and restoration requirements of the remainder of the parcel and if the operator retains ownership or control of the entire reclamation parcel until the remainder of the parcel is released. Regulatory release of a reclamation parcel, or upland portion thereof, does not relieve the operator of any other obligations imposed under other laws, rules, regulations, or ordinances.

FDEP has no jurisdiction regarding reclamation over an area that has been released from further obligations to perform reclamation. If the land is again mined or disturbed as part of mining operations, the area mined or disturbed will again be subject to applicable regulatory reclamation provisions. Once an area is released from reclamation obligations, it remains subject to any applicable federal Section 404 and/or state ERP obligations that may be required.

From July 1, 1975 (when the Reclamation Rule was adopted) to December 31, 2010, approximately 72,759 acres (38 percent) of land mined for phosphate in Florida have been released and approximately 62,142 acres (33 percent) have been reclaimed but not released; the remainder of the land is still under mining operations (FDEP, 2012c).

5.8 ENVIRONMENTAL RESOURCE PERMITTING

Florida implements a regulatory ERP program under the independent state authority of Part IV of Chapter 373, F.S. The ERP program is in effect statewide and is implemented jointly by the FDEP and the state's five water management districts (WMDs) under Operating Agreements that provide a division of responsibilities between the agencies. FDEP's MANPHO is responsible for administering the ERP program for phosphate mining in Florida. The ERP program operates in addition to the federal program that regulates activities in waters of the U.S. All state, local, and regional governments in Florida delineate wetlands in accordance with state methodology (Chapter 62-340, F.A.C.) instead of the federal method. While ERP applications are issued, withdrawn, or denied in accordance with state statutory and rule criteria, state agency action on an ERP application also constitutes any needed water quality certification (WQC) or waiver thereto under Section 401 of the CWA and Coastal Zone Consistency Concurrence with Florida's federally approved Coastal Zone Management program under Section 307 (Coastal Zone Management Act). In Florida the ERP and the USACE Section 404 permit is a joint application. The federal Section 404 permits cannot be issued without the State's Section 401 WQC or Coastal Zone Consistency Concurrence.

The ERP program regulates all activities in uplands, wetlands, and other waters of the State (whether publicly or privately owned [more than two owners]) that will alter the flow of surface waters. Activities regulated by the ERP program include dredging and filling in most surface waters and wetlands connected to Waters of the State and activities in uplands, such as construction, that increase impervious surfaces and stormwater runoff. The ERP program is designed to ensure that such activities do not degrade water quality (from the discharge of untreated stormwater runoff) or cause flooding (from a change in offsite runoff characteristics). Additional information about the FDEP ERP program, including FDEP's mitigation goals and requirements, may be found on the FDEP website (FDEP, 2012f)

5.9 CONSERVATION OF WILDLIFE AND LISTED SPECIES

This section presents a brief overview of the wildlife and listed species conservation practices implemented on lands mined for phosphate in Florida. The conservation of wildlife and listed species is an important environmental component of phosphate mining and includes practices to avoid, minimize, and offset potential impacts to species and their habitats. As discussed in Section 5.1.1, impacts to fish and wildlife values, among other factors, are considered during the USACE's public interest review.

The practices implemented by the phosphate industry to conserve and protect wildlife and listed species have evolved over time in concert with the advancements the industry has made in wetland mitigation and upland reclamation. The large-scale watershed-based mitigation/reclamation approaches implemented today by the industry are intended to result in greater direct and indirect benefits to wildlife and listed species than earlier approaches. As previously discussed, the industry currently conducts mitigation and reclamation in accordance with the goals of the IHN, which include the goal of increasing the amount and quality of wildlife habitats and corridors within the region through habitat replacement, protection, and connection. Given that agricultural practices within the Peace River watershed over the years have resulted in reduced wildlife abundance and diversity (PBS&J, 2007), the IHN is expected to have a positive overall impact on wildlife and listed species, if the IHN is successfully accomplished.

Specific conservation practices currently implemented by the phosphate industry for listed species include preservation, restoration, and enhancement of habitats utilized by listed species; avoidance of areas where listed species are breeding and nesting; relocations of listed species from mining areas; and creation of habitats that are suitable to support listed species that are relocated. Phosphate mining companies conduct extensive wildlife and listed species field surveys during mine planning to initially assess listed species occurrence within the mine sites. Pre-clearing wildlife and listed species surveys are then conducted within specific areas to be mined, typically 3 to 6 months before land disturbance. Additionally, each area to be mined is surveyed 1 to 3 months before clearing to identify any listed or sensitive species that may be nesting during the particular phase of the mining operation. The findings of pre-clearing surveys are used to develop the mine's Wildlife and Habitat Management Plan, which outlines the measures to be implemented to protect/manage wildlife and listed species, and their habitats during mining operations. In addition, separate species-specific habitat management plans are also prepared for certain species, as necessary.

In recent years, listed plant species and slow-moving listed animal species, such as the state-listed gopher tortoise (*Gopherus polyphemus*), that are identified during pre-clearing surveys have been relocated before land disturbance to suitable onsite preservation or reclamation areas, or to suitable offsite areas. Various slow-moving non-listed species that are encountered have also been relocated during listed species relocations. Species relocations (also referred to as restocking) are authorized through permits issued by the Florida Fish and Wildlife Conservation Commission (FFWCC) and/or federal permits issued by the U.S. Fish and Wildlife Service (USFWS). FFWCC and/or USFWS must approve the suitability of all proposed recipient sites to support the species proposed to be relocated. Recipient site surveys are conducted prior to species relocations to avoid overstocking of the recipient sites. To minimize potential impacts to more mobile species that cannot be collected and relocated, land clearing is conducted in a directional manner that allows mobile species to relocate on their own to undisturbed areas.

The protection of certain listed and sensitive species during mining operations requires implementation of species-specific impact avoidance and minimization measures. For example, active nesting sites of the federally-listed Florida scrub jay (*Aphelocoma coerulescens*), Audubon's crested caracara (*Polyborus plancus audubonii*), and woodstork (*Mycteria americana*), of the recently delisted bald eagle (*Haliaeetus leucocephalus*), and of the state-listed Southeastern American kestrel (*Falco sparverius paulus*) and Florida sandhill crane (*Grus canadensis pratensis*) are avoided, and measures are implemented to minimize potential disturbance to the sites during the nesting period. The avoidance and minimization measures implemented for such nesting species are developed based on species-specific nest-management regulations and guidelines, which include nest monitoring protocols, nest avoidance distances, work area signage, worker education/training, and agency consultation protocols. Standard protection measures have been developed for some species, such as the federally-listed Eastern indigo snake (*Drymarchon couperi*), to minimize the potential for incidental take of the species during construction activity.

The preservation and integration of high-quality habitats into the IHN benefits regional wildlife populations and various listed plant and animal species. Habitats that are typically targeted for avoidance and preservation include riverine systems and associated floodplains, large herbaceous wetlands, mature upland forests, and xeric upland habitats. Xeric scrub habitats within the CFPD have the potential to support several scrub-dependent listed species including the federally-listed Florida scrub jay, bluetail mole skink (*Eumeces egregius lividus*), sand skink (*Neoseps reynoldsi*), Florida bonamia (*Bonamia grandiflora*), Florida golden aster (*Caryopsis floridana*), and perforate reindeer lichen (*Caledonia perforate*).

The industry also implements habitat management practices within preserved and reclaimed xeric habitats, such as prescribed burning, to improve their functionality and ability to support listed species. On occasions when avoidance of xeric habitat is not feasible, the industry has compensated the loss of the habitat through financial contributions toward the acquisition and management of suitable offsite habitat. In addition to such compensation, the industry has created xeric habitats to replace those that could not be avoided and to provide suitable recipient habitat for certain listed species that are relocated from mine sites. Today, gopher tortoises and certain commensal species that utilize gopher tortoise burrows, such as the gopher frog (*Rana capito*) and Florida mouse (*Podomys floridanus*), are commonly relocated from mine sites to xeric habitats created by the industry. Research has indicated that reclaimed lands can serve as suitable recipient sites for relocated gopher tortoises. For example, Small and Mcdonald (2001) concluded that the growth and reproduction of relocated gopher tortoises were not affected by either the relocation activity or by the reclaimed sites to which they were relocated. Mosaic and CF Industries currently have numerous permitted gopher tortoise recipient sites on reclaimed land, and have restocked these sites with gopher tortoises and certain gopher tortoise commensal species for years. For example, under Mosaic's FFWCC Gopher Tortoise Relocation Permit WR07393, Mosaic had relocated a total of 1,150 gopher tortoises to 12 recipient sites as of 2010 (Mosaic, 2007; Mosaic, 2011d).

Another species for which the phosphate industry has conducted extensive conservation practices for in recent years is the federally-listed Florida scrub jay. Conservation practices implemented for this species to date by the industry have included scrub jay translocations, restoration/enhancement of existing scrub habitat, and creation of suitable habitat through reclamation. In the absence of natural fires, prescribed burning is the preferred method of improving the quality of existing Florida scrub jay habitat (USFWS, 2012). Translocations of Florida scrub jays, which were first conducted experimentally in 1989 (Mumme and Below, 1995), have been used as a management strategy for the Florida scrub jay by regulatory agencies, research institutions, and the phosphate industry since the 1990s.

Recent examples of large-scale conservation practices implemented by the phosphate industry for the Florida scrub jay include those implemented by Mosaic under its Florida Scrub Jay Habitat Management Plan developed for its Four Corners/Lonesome Regional Mine Areas. Mosaic has implemented various conservation practices for the Florida scrub jay under this plan in coordination with USFWS, FFWCC, and individual scrub jay researchers since the plan was approved in 2002 (Mosaic, 2010). The various scrub jay conservation practices implemented under this plan to date have included scrub jay translocations; restoration and enhancement of existing scrub habitats; providing supplemental food sources to increase scrub jay demographics; and monitoring the effectiveness of management activities. Restoration and enhancement of scrub habitat under this plan has included prescribed burning; reduction of pine and scrub oak heights; and creation of bare ground/open space. Based on the findings of the latest monitoring conducted, the conservation practices implemented to date in the targeted areas are meeting the objectives of the plan (Mosaic, 2010).