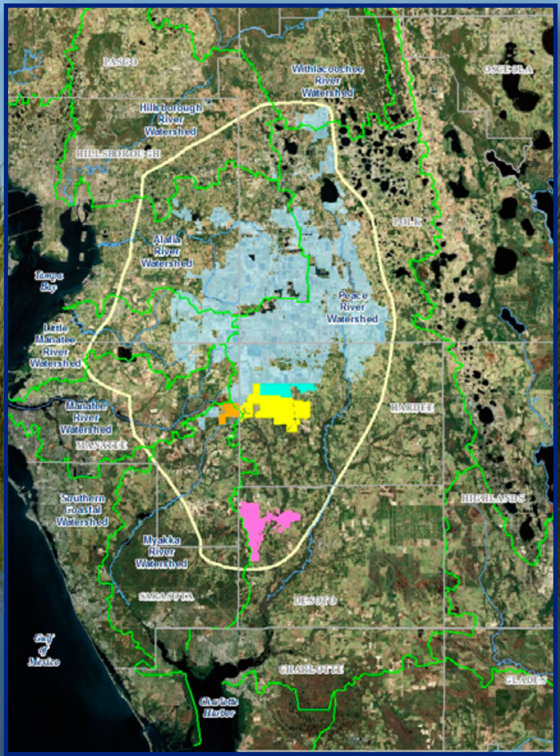
# Chapter 4
# Environmental Consequences




# CHAPTER 4
# ENVIRONMENTAL CONSEQUENCES

## 4.1 INTRODUCTION

### 4.1.1 Scope of the Effect Assessment

This chapter evaluates the direct, indirect, and cumulative effects of implementing the Applicants' Preferred Alternatives, the four alternative mine sites, and the No Action Alternative as described in Chapter 2. The geographic scope of analysis for direct and indirect effects of the proposed actions and the alternatives varies with the resource as described in the following sections. The temporal scope of the analysis for direct and indirect effects of the proposed actions and the alternatives is based on the expected operational periods of the Applicants' Preferred Alternatives and the Offsite Alternatives to those actions. The temporal scope extends forward until the year 2060, which is after all physical mining, reclamation, and mitigation efforts on the four Applicants' Preferred Alternatives are projected to be completed (about 2060). The geographic and temporal scope of analysis for the cumulative effects of the proposed actions and alternatives are described in Section 4.12.1. The Scope of Action is described in Section 1.3.1 of Chapter 1 and the Scope of Alternatives is described in Chapter 2 (offsite and functional alternatives) and Chapter 5 (onsite and mitigation alternatives).

### 4.1.2 Direct versus Indirect Effects

The terms impact and effect are synonymous as used in this AEIS. Effects may be beneficial or adverse and could apply to the full range of natural, social, cultural, and economic resources of the CFPD and the surrounding area. Definitions and examples of direct and indirect effects as used in this document are as follows:

- ***Direct Effect.*** A direct effect is caused by implementing one of the alternatives and would occur at the same time and place.
- ***Indirect Effect.*** Indirect effects are caused by implementing one of the alternatives and would occur later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects could include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
- ***Relationship of Direct versus Indirect Effects.*** For direct effects to occur, a resource must be present. For example, if highly erodible soils were disturbed as a direct result of the use of heavy equipment during construction of a development, there could be a direct effect on soils due to erosion. This could further indirectly affect water quality if stormwater runoff containing sediment from the construction site enters adjacent water bodies.

### 4.1.3 Short-term versus Long-term Effects

Effects are also expressed in terms of duration. The duration of short-term effects is considered to be 1 year or less. For example, the construction of a building would likely expose soil in the immediate area of construction. However, this effect would be considered short-term because it would be expected that vegetation would be reestablished on the disturbed area within a year of the disturbance. Long-term effects are described as lasting beyond 1 year. They can potentially continue into perpetuity, in which case they would also be described as permanent.

### 4.1.4 Cumulative Effects

Evidence is increasing that the most severe environmental consequences do not result from the direct impacts of any particular action, but from the combination of impacts of multiple, independent actions over time. As defined in 40 CFR 1508.7 (CEQ Regulations), a cumulative impact is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." Principles of cumulative effects analysis, as described in the CEQ guide *Considering Cumulative Effects under the National Environmental Policy Act*, are presented in Table 4-1.

| **Table 4-1. Principles of Cumulative Impacts Analysis** |
|---|
| Cumulative impacts are caused by the aggregate of past, present, and reasonably foreseeable future actions. |
| Cumulative impacts are the total impacts, including both direct and indirect impacts, on a given resource, ecosystem, and human community of all actions taken, no matter who (federal, nonfederal, or private) has taken the actions. |
| Cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected. |
| It is not practical to analyze the cumulative impacts of an action on the universe; the list of environmental impacts must focus on those that are truly meaningful. |
| Cumulative impacts on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries. |
| Cumulative impacts could result from the accumulation of similar impacts or the synergistic interaction of different impacts. |
| Cumulative impacts could last for many years beyond the life of the action that caused the impacts. |
| Each affected resource, ecosystem, and human community must be analyzed in terms of the capacity to accommodate additional impacts, based on its own time and space parameters. |
| Source: CEQ, 2013. |

### 4.1.5 Intensity of Effects

Intensity refers to the severity, or degree, of effect. Factors that have been used to define the intensity of effects include the magnitude, geographic extent, duration, and frequency of the effects. The following terms are used to describe the degree of direct and indirect effects, whether they are adverse or beneficial:

- No Effect or Minor Effect - the effect is either non-detectable (no effect) or slight but detectable (minor)
- Moderate – the effect is readily apparent.
- Major – the effect is severely adverse or exceptionally beneficial.

The descriptor "major" does not imply a significant effect (see below) unless specifically stated. Section 4.1.6 provides a discussion of significance.

It is important to note that adverse effects can be reduced in intensity by mitigation. Mitigation in this context refers to measures taken to avoid, minimize, or offset adverse effects. For example, dust emissions generated during mining operations, whether directly caused by the movement of heavy equipment or indirectly caused by unvegetated soils exposed to wind, have the potential to cause a major effect that decreases as distance from the mine increases. When Best Management Practices (BMPs) are implemented, usually in response to local or county ordinances, the BMPs mitigate the effect of the dust by controlling fugitive dust emissions and reducing the intensity (magnitude, geographic extent, and frequency) of the effect to a moderate or minor level.

Each resource category (i.e. wetlands, water quality, etc) examined in this chapter has issue-specific criteria for determining degree of effects. The description of the effects associated with each Action Alternative will indicate if the degree of effect determination was made with or without mitigative measures and will describe how such measures may be implemented either by regulation or by standard mine operating procedures. Chapter 5 provides additional information on how the USACE considers mitigation under NEPA, its public interest review, and under the 404(b)(1) Guidelines, along with details about mitigation for effects to waters of the U.S.

### 4.1.6 **Significance**

In accordance with CEQ regulations and implementing guidance, effects are also evaluated in terms of their significance. The term *significant*, as defined in 40 CFR 1508.27, part of the CEQ regulations for implementing NEPA, requires considerations of both context and intensity. The issues that the USACE determined were potentially significant were identified during the scoping process (see Chapter 2).

Context means that the significance of an action must be analyzed in several settings, such as society as a whole, the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed actions. For instance, in the case of a site-specific action, significance would usually depend on the effects on the locale rather than on the world as a whole. Both short- and long-term effects are relevant to the consideration of the significance of an effect.

Intensity refers to the severity of effect and includes the ratings described in Section 4.1.5 (i.e., no effect or minor through major). Factors contributing to the evaluation of the intensity of an effect for significance include, but are not limited to, the following:

- The balance of beneficial and adverse effects, in a situation where an activity has both.
- The degree to which the action affects public health or safety.
- The unique characteristics of the geographic area where the action is proposed, such as proximity to parklands, historic or cultural resources, wetlands, prime farmlands, wild and scenic rivers, and ecologically critical areas.
- The degree to which the effects on the quality of the human environment are likely to be controversial.
- The degree to which the effects of the action on the quality of the human environment are likely to be highly uncertain or involve unique or unknown risks.
- The degree to which the action might establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- Whether the action is related to other actions with individually insignificant but cumulatively significant effects. Significance exists if it is reasonable to anticipate a cumulatively significant effect on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
- The degree to which the action might adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the NRHP or might cause loss or destruction of significant scientific, cultural, or historical resources.
- The degree to which the action might adversely affect an endangered or threatened species or habitat that has been determined to be critical under the Endangered Species Act of 1973.
- Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

As the intensity of an adverse effect may be reduced by mitigation as described in Section 4.1.5, the determination of significance may also be changed by the implementation of mitigative measures.

Therefore, the significance determination made for each Action Alternative will indicate whether that determination was made with or without mitigation.

### 4.1.7 Detail of Analyses

The level of documentation provided in this chapter for each resource category is consistent with the significance of the effect on the resource category, where significance includes the severity, nature, and extent of environmental effect and the potential for controversy. As stated in the CEQ regulations (1501.1):

“following scoping, the preparing agency should:

Determine the scope (Sec. 1508.25) and the significant issues to be analyzed in depth in the environmental effect statement. Identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3), narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere.”

### 4.1.8 Issues Which Are Not Significant

This portion of the AEIS addresses general or specific impacts which were not considered significant, and therefore were not considered in depth in this AEIS. The following provides a brief presentation of why these issues will not have a significant effect on the human environment and do not require detailed evaluation.

#### 4.1.8.1 Air Quality

The replacement and/or expansion of existing operations are not expected to result in changes in current emissions. Therefore, no significant impacts are expected to occur to air quality that would result from mining in any of the proposed locations. Equipment used in land clearing and preparation, and routine vehicular traffic on and around these proposed mine sites would contribute to fuel-burning emissions, but the effects would be small in spatial extent and not stationary. Fugitive dust would be associated with mining activities, primarily localized in the vicinity of the electric dragline operations and in areas where earthmoving and truck movement occur. Generally these impacts would be localized and, as required by local ordinances, BMPs such as watering down roads would be used as necessary to control or mitigate the impacts. Because the area is not in a non-attainment area for any air quality standards and these emissions are minor or, in the case of fugitive dust, mitigated, the impacts of the alternatives will not have a significant effect on the human environment.

#### 4.1.8.2 Noise

Site preparation for mining activities typically involves the use of earthmoving equipment such as scrapers, bulldozers, and front-end loaders, which characteristically have peak noise levels of 84 dBA, 82 dBA, and 79 dBA, respectively, 50 feet from the equipment (FHWA, 2006). Mining activities also involve the use of various heavy mobile equipment and electric draglines. Noise levels for dragline vary with the type of equipment but studies have found that generally these have peak levels from 75 to 85 dBA measured at 50 feet from the source (Ping, 1996). This noise level would be roughly equivalent to heavy traffic or a noisy restaurant. Noise sources along mine property boundaries would include the use of mobile construction equipment to construct ditch and berm systems; matrix extraction using draglines or dredges supported by electrically powered pumps and mobile construction equipment; and construction equipment to reclaim the sites following mining. Electrically powered pumps used to transport slurries, of water and matrix or sand, are generally located in the internal portions of the mining areas. A portion of this earthmoving equipment, such as draglines, dredges, and slurry pumps, would operate 7 days a week and 24 hours a day. The remainder of the earthmoving equipment would normally be operated during the day for 8 to 12 hours.

Most of the Applicants' Preferred Alternatives and offsite alternatives are in rural areas where agriculture and pastureland are the primary land uses. Mining activities would increase noise levels in immediately adjacent areas, but because noise levels dissipate quickly with distance (6-dBA reduction with every doubling of distance [FHWA, 2012]), significant negative impacts as a result of increased noise levels are not projected for any proposed boundary. The placement of berms around the mined areas also reduces the noise levels by as much as 5 to 15 dBA (Ohio DOT, 2013). Active mining would be at a distance of a minimum of 200 feet from anyone who might otherwise hear these noise levels.

The US Department of Housing and Urban Development considers 65 dBA to be a normally unacceptable noise level in populated areas (24 CFR 51B). Noise levels in Hardee County are limited by the Hardee County Development Code, Section 2.15.07, and Section 3.14.02, which specifically addresses noise from mining operations with a maximum noise limit of 65 dBA from 6 AM to 9 PM, and 60 dBA from 9 PM to 6 AM at the mining property line if the adjoining uses are agricultural or residential. If the adjoining uses commercial or industrial, the maximum noise limit is 75 dBA at the mining property line. Noise within DeSoto County is regulated by DeSoto County Code of Ordinances, Chapter 11, Article V, and specific regulations for noise associated with phosphate mining are prescribed in the DeSoto County Land development regulations, Phosphate Mining and Reclamation Activities, Section 14600, although there are no specific numeric noise limitations listed. Manatee County Code in Chapter II, Article II sets standards that are based on levels at the property line and type of receiving land. For sound generated where the receiving land is commercial, the limit is 65 dBA, where the receiving land is Industrial it is 80 dBA, and for other lands, the limits are 60 dBA during the day and 55 dBA at night between 10 PM and 7 AM.

Assuming that at a distance of 200 feet the noise level were reduced by at least 12 dBA (6 dBA reduction for each doubling from 50 feet to 200 feet) and the berms would reduce the noise by at least another 10 dBA, the total reduction would be 22 dBA or result in a maximum noise level of about 62 dBA, the impacts of noise may be expected to be minor. The noise impacts of the alternatives will not have a significant effect on the human environment.

#### 4.1.8.3 Climate and Sea Level Rise

The regional climate would not change as a result of mining. The overall area of active mining stays about constant in the future under the foreseeable conditions (see Section 4.14). Since the greenhouse gas (GHG) emissions from the mining are primarily associated with the equipment used, no change in air quality on a regional scale is expected (see Section 4.1.8.1 above). CEQ guidance on climate change in decision-making (CEQ, 2010) suggests an indicator of significant greenhouse gases (GHG) would be at a level of 25,000 metric tons of CO2. There is no expectation that any or all of the Applicants' Preferred Alternatives would attain these levels of GHG. Therefore, the impact of these or any alternatives would not be significant.

The literature suggests that long-term average precipitation would change only slightly in Florida with future climate change; perhaps a slightly lower average annual rainfall resulting from higher temperatures, but precipitation would definitely become more variable with an increase in storm intensity (Fernald and Purdum, 1998b; Karl, Melillo, and Peterson, 2009). The onsite stormwater storage at the mines would dampen the effects of more intense rainfall, especially compared to the natural landscape, and the mines would still need to maintain the surficial aquifer system (SAS) water levels around the active mines as required by permit. Consequently, if there is an impact to biota or flows from these potential climate changes, it would not be related to impacts from the mining.

Similarly, mining would have no measureable influence on sea level rise over time. As sea level rises, however, changes are projected for the Gulf of Mexico and its coastal embayments including Charlotte Harbor. It is possible that such changes in gulf water levels over the next 50 to 60 years could influence landward shifting of the tidally affected zones within the Peace and Myakka Rivers. At this time, review of sea level rise projections conducted on behalf of the Charlotte Harbor National Estuary Program (CHNEP) suggests that the zone of potential sea level rise influence does not penetrate the rivers in segments that might be influenced by any of the Alternatives (CHNEP, 2010). Therefore, no significant change in sea level rise is expected from continued mining. No alternative would have a significant effect on climate or sea level rise.

#### 4.1.8.4 Floodplains

The ERP Basis of Review adopted by the FDEP by reference states that no net encroachment into the floodplain, up to that encompassed by the 100-year event, would be allowed unless equivalent compensating storage is provided between the seasonal high water level and the 100-year flood level. Therefore, a new mine would not be permitted by the state unless floodplains are fully protected or mitigated. Additionally, floodplains are considered included in the evaluations of potential effects on ecological resources as described in this chapter.

#### 4.1.8.5 Aesthetics

The effects of phosphate mining on the landscape are often characterized as unavoidable and negative. The physical description of the landscape and the location of viewsheds from which the public may see the mining activities are common concerns in areas where mining occurs, and even more so in areas with low topography and expanses of flat open land such as is typical of central Florida and the CFPD.

While all of the mining operations plan to facilitate re-vegetation and landscaping to follow state and federal requirements, the ongoing plans for 20 or more years of mining would affect the viewshed for passersby driving along major highways in the vicinity of the mines, including loss of trees that might otherwise shield these views. Berms would be established along the highways that would shield most of the operations from view. From an area perspective, there would be aesthetic impacts to the region for extended periods of time. Reclamation would be required in accordance with state regulations, but it must be acknowledged that reclamation efforts to the conditions shown in mine reclamation plans require decades to achieve.

Minimal aesthetic impact concerns are anticipated for any of the Action Alternatives as long as adequate berms and setbacks or buffers are maintained. The aesthetic quality of the mining area is defined primarily by land use and land cover, vegetation, and historic resources, and the effects of this alternative are described in the context of those resource categories. The Wingate East site, however, is adjacent to the Duette Preserve and the mine operations would be visible from the southeast corner of the park. None of the areas proposed for mining are designated as outstanding scenic areas, and no designated wild and scenic waterways would be affected visually by the proposed activities. Therefore, no significant impacts to aesthetics are expected to result from mining by any of the Applicants' Preferred Alternatives or the Offsite Alternatives.

#### 4.1.8.6 Transportation

As described in Section 3.1.1, phosphate mining operations require development and maintenance of infrastructure corridors connecting the active mine cut areas to the beneficiation plant to which the mined matrix is conveyed via pipeline and hydraulic pumping of slurried materials. These corridors include access roadways and dragline walking paths. Thus, internally within the subject mines, a transportation plan is part of the overall mining and reclamation plan. Most of the roadway networks in the mines consist of dirt or shellrock roads.

Crossings of privately owned infrastructure corridors are controlled by contract agreements between the mines and the operators of the infrastructure. Mining operations may also abut and cross over existing county or state highways. Under those situations, close industry coordination with the applicable county or regional transportation planning and management agencies is required. Crossings requiring disruption of existing vehicular traffic patterns are minimized to the extent practicable; local and regional transportation impacts from the mining operations themselves are not viewed as a major issue. Specific mine crossings that may affect the infrastructure corridors range from a width of 150 feet for most pipelines and related equipment to 400 feet for dragline crossings. Crossings can take from 1 to 3 days but often are completed within 24 hours.

Where new mining operations are planned that are relatively independent of past mining activities, changes in local and regional traffic patterns and vehicle trip totals will occur. In some cases, new phosphate mines will require siting, design, and construction of new railroad connections to allow effective transport of phosphate rock generated through beneficiation out of the area to the applicable fertilizer manufacturing facilities.

None of the Action Alternatives is expected to have more than a minor effect on transportation, considering the required level of permitting and coordination with applicable transportation planning and management agencies. No significant impacts to transportation are expected to result from mining by any of the Applicants' Preferred Alternatives or the Offsite Alternatives.

#### 4.1.8.7 Recreation

Parks and other recreational facilities maintained by local, regional, and state agencies are important elements of the human environment that could potentially be affected by phosphate mining activities. Direct impacts on recreation are unlikely because mine siting and mine planning normally avoid mine footprint contact with existing recreational facilities. However, indirect impacts could occur, where mines are in the vicinity of recreational facilities. Indirect recreational effects could also occur if mining activities' effects on resource categories such as water quality and surface water hydrology led to impacts in downstream waters such as Charlotte Harbor.

The following Florida Geographic Data Library (FGDL) databases (FGDL, 2013) were reviewed to identify the recreational facilities that currently exist within the vicinities (1-mile radius) of the Applicants' Preferred phosphate mines and/or the Offsite Alternatives:

- Golf Courses 2009 (par_golf_09)
- Florida Parks and Recreational Facilities 2009 (gc_parks_mar09)
- FFWCC Management Areas (fwcmas_2010)
- Florida Managed Areas – June 2011 (flma_jun11)
- Existing Recreational Trails in Florida – February 2012 (existing_trails_feb12)

Based on these databases, no recreational facilities of any kind currently exist within 1 mile of the proposed Desoto Mine, Ona Mine, or South Pasture Extension sites. The database review indicated that there are three recreational facilities (Duette Park, Duette Park Trail, and the Manson-Jenkins

Conservation Easement Florida Managed Area) within 1 mile of the proposed Wingate East Mine site. There is the Myakka Prairie Conservation Easement within 1 mile of Pine Level/Keys Tract, and the South Fort Meade Hardee County Conservation Easement within 1 mile of Site A-2. There is Peace River State Canoe Trail within 1 mile of Pioneer Tract. There are three parks (Crane Park, Myakka Community Park, and Flatford Swamp Preserve and an unnamed recreational trail within 1 mile of Site A-2.

Typically, post-mining reclamation in the CFPD has included large acreages of open water lakes. Some of these lakes have been made available for public use, while others may be restricted for other ongoing mine or industrial uses. The ore has increased sand tailings in the southern extension of the CFPD, and areas impacted by the proposed new mines would have relatively few acres of lakes – open water bodies – relative to the acres mined and reclaimed in the northern CFPD.

As an element of its community service programs, Mosaic has worked on integrating land and lake reclamation strategies into recreational facilities valued by the counties. In a number of cases, these arrangements have resulted in positive outcomes where the industry reclamation objectives are met concurrently with development of lakes and associated park facilities supporting local and regional community use of the sites.

Examples of mine reclamation efforts leading to development of parks and recreational facilities are summarized below:

- Hardee Lakes Park: This is a 732-acre park in Sections 1, 2, 11, 12, and 13; Township 33S, Range 23E in Hardee County. The area was mined from 1989 to 1992. Site contouring, grading, and revegetation occurred in 1992 and the reclamation project was released by the USACE and FDEP in 2000. The lands were donated to Hardee County as a recreational area, with a conservation easement placed on the wetlands adjoining the floodplain. The site includes two lakes totaling approximately 205 acres; boat ramps and nature paths/boardwalks were incorporated into the facility design to promote recreational uses.

- Bunker Hill Community Park: This project site occupies approximately 75 acres of reclaimed phosphate mine lands. The site is in Sections 23 and 25, Township 33S, Range 21E in Manatee County. The site was mined in 2003, the reclamation efforts were completed in 2005, and the reclamation project was released by FDEP and the county in 2010. Bunker Hill Park was designed in collaboration with the county Parks and Recreation Department to provide park facilities to the Duette Community. Facilities incorporated into the final design included a baseball field, soccer/open play field, a 19-acre lake, canoe launch and dock area, picnic areas, parking/paved driveway, restroom facilities, and an irrigation system to support the landscaping and sports field maintenance.

- Edward Medard Park: This park is the result of a non-mandatory phosphate mine reclamation currently owned and managed by Hillsborough County and SWFWMD. This recreational park consists of 1,284 acres, with a water control structure/reservoir that is available for canoeing, boating, and catch and release fishing. It also provides flood protection along the Alafia River.

- Alafia River State Park: This state park in Hillsborough County is owned by the state and managed by the Florida Park Service. It consists of more than 6,000 acres of both mandatory and non-mandatory reclaimed phosphate mine lands that offer off-road bicycling trails as well as equestrian and hiking trails. The park also offers picnic pavilions, a playground, horseshoe pit, volleyball court, and a full-facility campground for both primitive and recreational vehicle (RV) camping.

Any impacts to recreational uses in the vicinity of mining activities are related to the proximity of the recreational land use to the mining activity and the magnitude of impacts, such as noise, air quality, and traffic interruption, may be the result of mining. In most of the Action Alternatives, recreational uses are limited that would be affected by mining operations. Even in areas where there may be some proximity of mining operations to a recreational site, such as Wingate East and A-2, noted above, it may be expected that standard mitigation practices to minimize fugitive dust and mitigate noise, plus the likelihood that these impacts would be transitory and not last over the life of the mines, would lead to minimal adverse effect on recreation. Any potential public recreational opportunities that would come from any of the Action Alternatives would have a positive effect on recreation.

Based on the analyses of the direct and indirect effects of the Action Alternatives on water quality, surface water resources, and other resource categories, as described in this chapter, none of those alternatives would have more than a minor indirect effect on recreation in Charlotte Harbor. The results of the cumulative impact analyses indicate that the same is true of the current and reasonably foreseeable mining actions, when considered along with other past, present, and reasonably foreseeable future actions.

#### 4.1.8.8 Waste Management

Typically, phosphate mines are not large generators of solid waste, with the amount generated disposed of by commercial vendors and transported to local landfills. Sand and clay beneficiation by-products are used as part of the land reclamation process and scrap metals and other non-hazardous materials are sold for recycling. Other materials produced are typically recycled or burned offsite at an approved facility (USACE, 2007). Final decisions on quantities and types of solid waste to be generated would be reviewed with the state.

Phosphate rock can be used to produce fertilizer and animal feed. The byproducts of this process are phosphogypsum and phosphogypsum stacks. As described in Chapter 1, the USACE does not consider fertilizer production to be within the scope of action for AEIS, as the Applicants' Preferred Alternatives have independent utility from the existing fertilizer plants such that the mining operations are single and complete projects. Thus, the AEIS does not study the direct and indirect impacts of fertilizer plants, to include phosphogypsum and phosphogypsum stacks. However, the cumulative impacts of phosphogypsum and phosphogypsum stacks on resources within the geographic and temporal scope of the cumulative impacts analysis are considered within the scope of analysis. In addition, phosphogypsum is regulated by other agencies, including USEPA and FDEP.

#### 4.1.8.9 Land Use

Table 4-2 provides summaries of the current and projected land uses for the Applicants' Preferred Alternatives, as described in the applications for the four projects. Table 4-3 provides summaries of the current land uses for the Offsite Alternatives, as taken from SWFWMD 2009 FLUCCS data (SWFWMD, 2011c). Section 3.3.7.4 has additional information about existing land uses in the CFPD.

**Table 4-2. Summary of Current and Projected Land Uses for Each of the Applicants' Preferred Alternatives**

| | 2—Desoto Mine | | 3-Ona Mine | | 4-Wingate East Mine | | 5—South Pasture Extension Mine | |
|---|---|---|---|---|---|---|---|---|
| | Current Land Use | Proposed Future Land Use | Current Land Use | Proposed Future Land Use | Current Land Use | Proposed Future Land Use | Current Land Use | Proposed Future Land Use |
| Residential/ Urban (acres) | 7 | 0 | 8 | 1 | 50 | 0 | 0 | 0 |
| Rangeland (acres) | 740 | 898 | 3,095 | 1,812 | 664 | 743 | 683 | 666 |
| Upland Forest (acres) | 1,970 | 5,321 | 5,063 | 4,829 | 884 | 797 | 1,295 | 1,459 |
| Pastureland (acres) | 8,566 | 7,539 | 9,266 | 8,926 | 1,037 | 1,003 | 2,776 | 3,240 |
| Wetlands (acres) | 4,034 | 4,497 | 5,389 | 7,091 | 940 | 1,105 | 1,769 | 2,026 |
| Streams (linear ft) | 128,639 | 129,926 | 208,366 | 240,481 | 32,210 | 33,109 | 87,662 | 98,359 |

**Table 4-3. Summary of Current Land Uses for Each of the Offsite Alternatives**

| | 6-Pine Level/ Keys Tract | 7-Pioneer | 8-A-2 | 9-W-2 |
|---|---|---|---|---|
| | **Current Land Use** | **Current Land Use** | **Current Land Use** | **Current Land Use** |
| Residential/ Urban (acres) | 471 | 60 | 0 | 0 |
| Rangeland (acres) | 3,400 | 1,855 | 150 | 1,455 |
| Upland Forest (acres) | 2,700 | 1,352 | 203 | 1,241 |
| Pastureland (acres) | 11,849 | 12,975 | 6,462 | 4,406 |
| Wetlands (acres) | 6,273 | 8,973 | 1,361 | 2,538 |
| Streams (linear ft) | 129516 | 288054 | 90356 | 71561 |

Effects due to changes in land use are directly related to the processes required for preparing the sites for mining, operations of extraction and transport of rock, and reclamation to similar land uses from pre-mining or conversion to other land uses based on agreed to state and local reclamation planning and federal mitigation requirements. These effects are limited overall to the boundaries of the mine site; however, as explained in Section 3.1.1, active mining does not occur over the entire mine site at one time, but rather in specific units, called mining blocks. The duration of the effects depends on the length of time needed for mining and reclamation. Section 5.7.1 provides information about mandatory phosphate mine reclamation as required by FDEP, including goals and timelines.

Indirect land use effects include changes in the runoff characteristics of the mined area after mining and reclamation are completed. Section 4.2 and Appendix G explain how these changes were considered in the surface water resources analyses for the Final AEIS, and what the predicted effects are. Effects on specific land uses such as wetlands and wildlife habitat are analyzed in Section 4.5. Mitigation of the effects on wetlands is described in Chapter 5.

Future land uses following mining are typically shaped in part of the Comprehensive Plans of the respective county. In some cases rezoning may be considered where the projected land use by the county is not aligned with that proposed by the mining company. Along major highway, local counties may have future land use plans that include expanded industrial or mixed use development, and timing of the mining reclamation has been included in some mine plans.

As described in Section 5.7.1, FDEP requires that reclaimed wetlands and surface waters (other than streams) be restored on an acre-for-acre and type-for type basis, and that reclaimed uplands be returned to a beneficial use, although not necessarily restored type-for-type, with a minimum 10 percent of the upland area reclaimed as upland forest. Some of the area may also be used to provide compensatory mitigation in accordance with USACE or FDEP permitting requirements, as also described in Chapter 5.

Based on the FDEP reclamation requirements, the USACE and FDEP requirements for mitigation of effects on wetlands, the lack of significant effects related to land use changes, with mitigation, in other resource categories, and the local and regional authority over current and future land use changes, none of the alternatives would have a significant land use effect related to phosphate mining.

### 4.1.9 **No Action Alternative Scenarios**

Under the No Action Alternative as described in Chapter 2, the mining that has already been authorized in the CFPD would continue as scheduled under currently approved state and federal permits, and the USACE would not issue Section 404 permits for the Applicants' Preferred Alternatives on those four parcels. The Applicants would have the option to pursue mining that does not involve the discharge of dredged or fill material into waters of the U.S., and such projects would be subject to state ERP and mine permitting, NPDES permitting, state and federal wildlife regulations, and any other applicable local, state, and federal requirements. This scenario is hereafter referred to as the No Action Alternative – Upland Only Mining and will be used to differentiate when a quantitative analysis of the No Action Alternative was able to take into account the possibility of upland only mining.

For some of the evaluations of effects described below, it was not possible to do a quantitative analysis under the 'Upland Only Mining' scenario due to the lack of information on how solely mining in the uplands and non-Waters of the US would actually take place. Instead, for these resource categories the No Action Alternative was considered under a scenario in which existing permitted mining would continue to completion, including all required mitigation and reclamation, but there would be no mining at all on the four Applicants' Preferred Alternatives parcels. This scenario is hereafter referred to as the No Action Alternative – No Mining and will be used to differentiate when a quantitative analysis of the No Action Alternative was not available. In these cases, a qualitative assessment of the effects of the No Action Alternative will be provided.

## 4.2 SURFACE WATER RESOURCES

The geographic scope of the evaluation of the direct and indirect effects on surface water resources is predominantly the subwatersheds where the individual alternatives are located as listed in Table 4-4, with consideration of any direct and indirect effects on the Peace and Myakka River watersheds and Charlotte Harbor as well. Appendix G *Surface Water Hydrologic Impact Analysis for the Final AEIS on Phosphate Mining in the CFPD* and Appendix J provide more information about the analyses, including the assumptions and approaches that were used. Section 3.3.1 describes the affected environment related to surface water hydrology, and Section 3.3.9.6 provides information on regional water supply and its relation to surface water hydrology.

The degree of intensity of effects for surface water resources was determined using the following criteria:

- No Effect to Minor: Mining would affect surface water budget on the mine site in the land areas included within the perimeter ditch and berm system. No measurable effects on downstream water delivery are expected over a 3- to 5-year period of record (a typical minimum wet to dry rainfall cycle in central Florida). Effects are likely to occur concurrent with the mining and be managed under normal operating procedures and rules.

- Moderate: Mining would affect the quantity of water delivered downstream from the mine boundaries at the subwatershed level. Effects would be measurable over a 3- to 5-year period of record, but would not substantially contribute to violating Minimum Flows and Levels (MFL) goals. Additional monitoring and measures may be required to protect downstream resources, including downstream water users.

- Major: Mining would affect regional surface water flows at the subwatershed level, resulting in long term (greater than 5 years) to permanent hydrologic system impact effects in downstream reaches beyond the mine boundaries and within the watershed. These effects would substantially contribute to violating MFL goals, and downstream users of surface water would be affected.

Direct impacts from the active mining were estimated two ways. One method was by removing all of the actively mined land from the subwatershed (a 100 percent capture scenario), which is the maximum reduction of downstream flow, and a less conservative 50 percent capture scenario where half of the stormwater onsite is retained for reuse. Direct onsite impacts are normally abated at the mine's boundaries by maintaining the SAS groundwater levels with the ditch and berm system; through managed discharges from the Applicants' NPDES outfall where flooding is controlled and water quality is monitored (water quality is discussed in Section 4.6); and by seepage to adjacent streams and wetlands supplied indirectly by hydration of the SAS through the mine's ditches. Downstream indirect impacts estimated quantitatively for future flows were predicted 5 times at 10-year increments, until 2060 which is the end of the AEIS 50-year time frame. Appendix G provides a detailed presentation of the results, including tables with actual flow rates listed and graphs that are provided to illustrate the differences and the future flows.

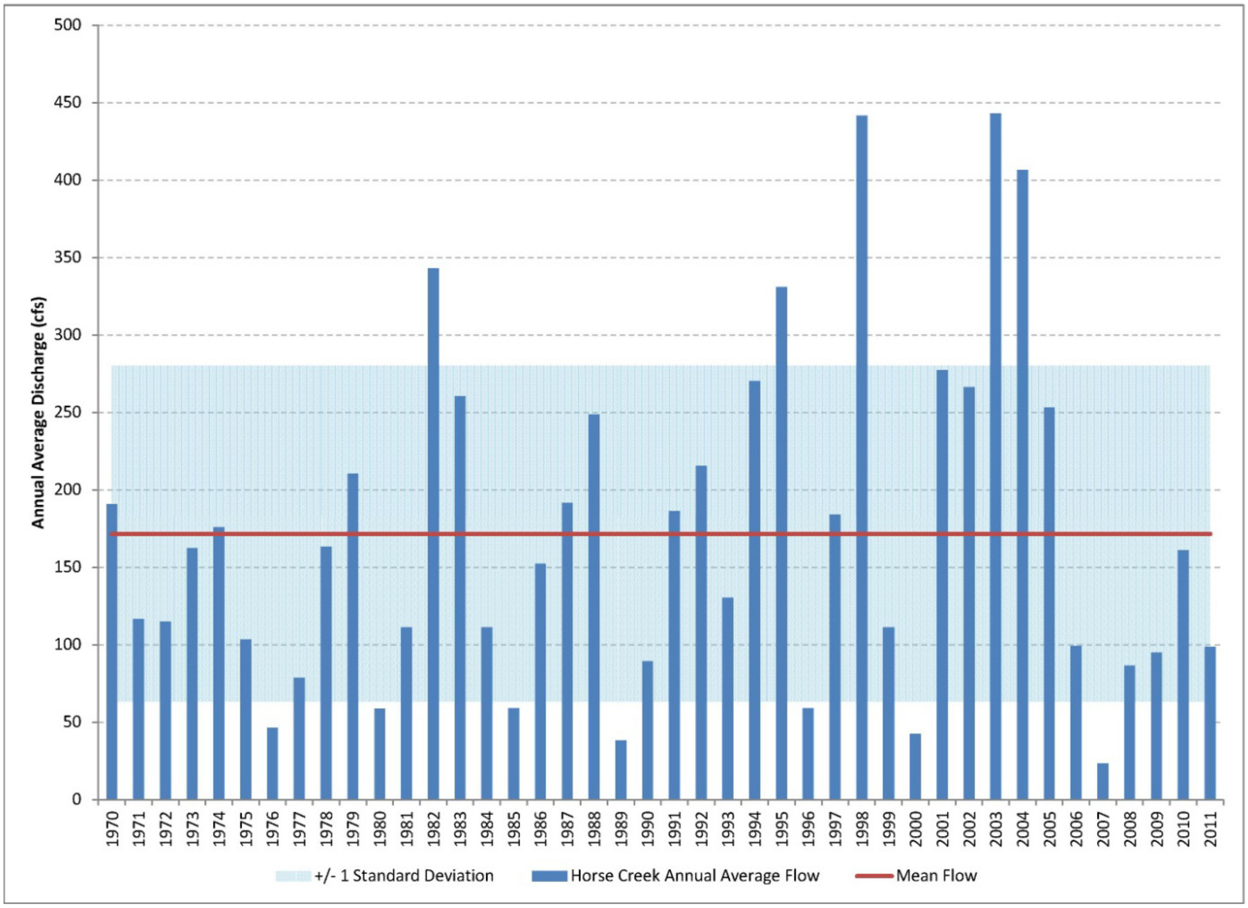
The four Applicants' Preferred Alternatives are located primarily in the Horse Creek and Upper Myakka River subwatersheds, with small portions of the projects draining to the Peace River at Arcadia subwatershed. On the basis of USGS gage records of flow from 1970 to 2010, mean discharge from Horse Creek to the Peace River was approximately 175 cubic feet per second (cfs) (Figure 4-1). For the

Upper Myakka River subwatershed over the comparable period of record, the mean discharge to the lower portion of the Myakka River watershed was approximately 240 cfs (Figure 4-2).

**Table 4-4. Area of Action Alternatives in Watersheds and Subwatersheds as Mapped on GIS Coverage**

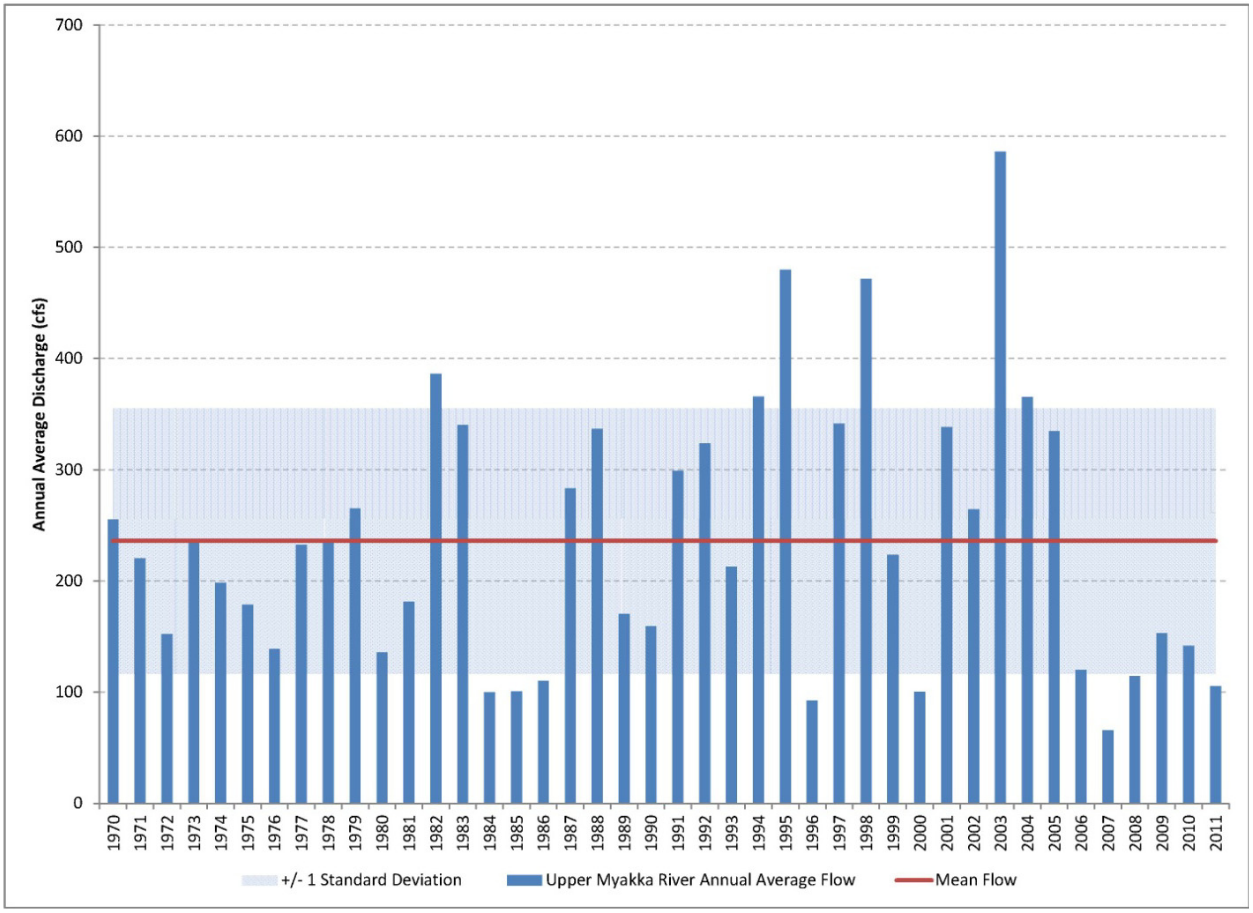
| Alternative | Watershed | Subwatershed | Acreage |
|---|---|---|---|
| **Desoto Mine** | **Myakka River** | Lower Myakka/Big Slough | 375 |
| | **Peace River** | Horse Creek | 15,993 |
| | | Peace at Arcadia | 1,919 |
| | | **Total Acreage** | 18,287 |
| **Ona Mine** | **Myakka River** | Upper Myakka River | 269 |
| | **Peace River** | Horse Creek | 17,242 |
| | | Peace at Arcadia | 4,808 |
| | | **Total Acreage** | 22,320 |
| **Wingate East Mine Extension** | **Myakka River** | Upper Myakka River | 3,280 |
| | **Peace River** | Horse Creek | 355 |
| | | **Total Acreage** | 3,635 |
| **South Pasture Extension Mine** | **Peace River** | Horse Creek | 5,324 |
| | | Payne Creek | 409 |
| | | Peace at Arcadia | 1,781 |
| | | **Total Acreage** | 7,514 |
| **Pine Level/Keys Tract** | **Myakka River** | Lower Myakka/Big Slough | 20,727 |
| | | Upper Myakka River | 499 |
| | **Peace River** | Horse Creek | 3,484 |
| | | **Total Acreage** | 24,711 |
| **Pioneer Tract** | **Myakka River** | Upper Myakka River | 9 |
| | **Peace River** | Horse Creek | 10,824 |
| | | Peace at Arcadia | 14,426 |
| | | **Total Acreage** | 25,259 |
| **Site A-2** | **Peace River** | Charlie Creek | 64 |
| | | Peace at Zolfo Springs | 8,125 |
| | | **Total Acreage** | 8,189 |
| **Site W-2** | **Myakka River** | Upper Myakka River | 9,719 |
| | | **Total Acreage** | 9,719 |

Basin Boundary Source: Hydrologic Unit Maps from USDA (2013)




*Data Source: USGS, Accessed March 2012. http://waterdata.usgs.gov/fl/nwis/dv/?referred_module=sw*

**Figure 4-1. Annual Average Flows for USGS Gage Station, Horse Creek (Station ID 02297310)**




*Data Source: USGS, Accessed March 2012. [http://waterdata.usgs.gov/fl/nwis/dv/?referred_module=sw](http://waterdata.usgs.gov/fl/nwis/dv/?referred_module=sw)*

**Figure 4-2. Annual Average Flows for USGS Gage Station, Upper Myakka River near Sarasota (Station ID 02298830)**

During the period of record (1970 through 2011), significant flow variations occurred at each of these stream gauging locations. The periods of low and high flow correlate well between these gages and also correlate well with the rainfall totals for those years. This illustrates that these streams can be considered predominantly rainfall-driven systems, as others have also indicated (Basso, 2003; HGL, 2012a). One standard deviation above and below historical mean flow is presented to show a reasonable range of historical variation in stream flow (note the shaded blue band). A standard deviation range contains approximately 67 percent of the observations in a normal distribution. A log-transformation was examined to determine whether it would yield a different result, which it did not in this case. One standard deviation was selected to use in the plots to show a relative range of flow because larger statistical ranges often reported (e.g., 90 or 95 percent) are so large; the plots would just appear to have a blue background.

Under the No Action Alternative, similar variability in season–to-season and year-to-year flows would be anticipated in response to rainfall patterns. To reflect a range of conditions, an average and a low rainfall year were used to estimate surface water flows. As discussed in the methodology discussion

(Appendix J), a dry and wet season value was also estimated based on the typical rainfall patterns in central Florida. Normally, about 40 percent of the annual rainfall occurs between October and May and 60 percent occurs from June through September, even though the range of monthly rainfall is also wide (that is, a wet month could occur almost anytime during a year; see Appendix G for rainfall data summaries).

### 4.2.1 Alternative 1: No Action Alternative

The stream flow in the Peace River, as well as in all subwatersheds in west-central Florida, is highly variable and dependent on rainfall. The USGS has studied the yield of surface water in several subwatersheds and determined that there are periods of time when stream flow can be very low or cease flowing when the groundwater levels are low. However, this occurs primarily in river segments north of Fort Meade (Metz and Lewelling, 2009). In general, both the Peace and Myakka River watersheds are much larger than the area that would be affected by the Applicants' Preferred Alternatives or offsite alternatives, either individually or combined. The Upper Myakka River and Lower Myakka River subwatersheds are defined to be separated at the USGS gage near Sarasota. The Big Slough Basin is a subwatershed in the Lower Myakka River watershed and is the only waterbody in this watershed affected by any of the alternatives considered. Therefore these are identified together in this section as the Lower Myakka/Big Slough subwatershed. The Lower Myakka/Big Slough subwatershed drains toward the City of North Port and Myakkahatchee Creek, which joins the Myakka River very near where it flows into Charlotte Harbor. Therefore, this mine's drainage area would not influence flows in the Myakka River except as they contribute to Charlotte Harbor.

A quantitative surface water hydrology evaluation was conducted for the No Action Alternative – No Mining scenario. The estimated No Action Alternative flow conditions for an average annual rainfall year are presented for the Lower Peace River subwatersheds (Table 4-5), the Myakka River subwatersheds (Table 4-6) and the watersheds combined (Table 4-7) The average rainfall for the Peace River watershed and the Myakka watershed is 50 and 53 inches, respectively, based on long-term rainfall records (the low rainfall value was the same for both Peace and Myakka River watersheds - see Appendix G). Each prediction of the surface water hydrology change was based on runoff coefficients allocated to the soil type and land use as described previously in Section 2.3 of Appendix G. The flow conditions are provided for both wet and dry seasons and for the annual average stream flow at each 10-year increment. These data were used to compare the mining alternatives discussed in the remainder of this section and they are plotted alongside each alternative presented. Estimated flow conditions were also based on predictions of land use changes derived from historic trends and changes in land use of the existing mining areas to predominantly agricultural land uses and wetlands after reclamation and mitigation on the mine sites.

The predicted changes resulted in an increase in downstream flow rates in most subwatersheds (based on average rainfall) as follows:

- Lower Peace River, 11.1 percent increase
- Peace River at Arcadia, 9.8 percent increase
- Joshua Creek, 18 percent increase
- Horse Creek, 3.5 percent increase
- Prairie Creek, 22 percent increase
- Myakka River watershed, 5.3 percent increase
- Upper Myakka River, 14.8 percent increase
- Lower Myakka River, 0 percent increase

The Peace River at Arcadia subwatershed makes up approximately two-thirds of the flow of the entire Lower Peace River watershed. There is a 9.8 percent increase in the Peace River at Arcadia subwatershed and an 11.1 percent increase for the whole Lower Peace River. For all subwatersheds the percent change was slightly lower for the dry season and slightly higher in the wet season. As detailed in Appendix G, by using a long-term adjustment factor as a calibration factor, the runoff coefficient water balance approach yielded reasonable results when compared to measured flow records. The mean error associated with this approach for estimating annual average flow in the Horse Creek, Peace River at Arcadia, and Upper Myakka River subwatersheds for the periods of record analyzed ranged from 5 to 20 percent. Therefore, changes within this range must be viewed as informative, but should not be considered conclusive.

The increase in flow was highest in the Upper Myakka River subwatershed because the historical trend of land use changes to more urbanization within that subwatershed has been higher. No change was observed in the Lower Myakka/Big Slough subwatershed because there are no existing mines in this subwatershed and the urban development here is clustered around a canal system near Charlotte Harbor. Growth in this subwatershed will occur, but it is unknown how the drainage patterns through the canals will affect flow near Myakkahatchee Creek. The SWFWMD has delayed developing an MFL study on Myakkahatchee Creek because of the complicated flow patterns and lack of available data. Consequently, the No Action Alternative for Lower Myakka/Big Slough subwatershed assumed constant conditions.

**Table 4-5. No Action Alternative – Predicted Peace River No Action Alternative Conditions for Average Rainfall Year**

| | Peace River at Arcadia | | | Joshua Creek | | | Horse Creek | | | Prairie Creek | | | Lower Peace River to Charlotte Harbor | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** |
| 2009 | 713 | 328 | 1,657 | 90 | 40 | 222 | 171 | 78 | 404 | 145 | 65 | 348 | 1,119 | 510 | 2,631 |
| 2020 | 726 | 332 | 1,702 | 95 | 43 | 232 | 173 | 78 | 413 | 151 | 68 | 362 | 1,145 | 520 | 2,709 |
| 2030 | 738 | 336 | 1,743 | 99 | 44 | 239 | 173 | 78 | 416 | 158 | 71 | 375 | 1,168 | 529 | 2,774 |
| 2040 | 754 | 343 | 1,785 | 102 | 46 | 246 | 174 | 78 | 419 | 164 | 75 | 389 | 1,195 | 541 | 2,840 |
| 2050 | 772 | 351 | 1,829 | 105 | 47 | 252 | 175 | 79 | 422 | 171 | 78 | 403 | 1,223 | 554 | 2,906 |
| 2060 | 783 | 355 | 1,858 | 107 | 48 | 257 | 177 | 79 | 424 | 177 | 81 | 416 | 1,244 | 564 | 2,955 |

Notes:
Wet season is from June through September, and the dry season is the rest of the year. Annual flow is average value for given annual precipitation total.
Rainfall is based on long term monthly averages.

**Table 4-6. No Action Alternative – Predicted Myakka River No Action Alternative Conditions for Average Rainfall Year**

| | Upper Myakka River | | | Lower Myakka/Big Slough Subwatershed | | | Lower Myakka River (incl. Lower Myakka/Big Slough Subwatershed) | | | Myakka River to Charlotte Harbor | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** |
| 2009 | 243 | 109 | 589 | 217 | 117 | 629 | 432 | 128 | 664 | 675 | 237 | 1,253 |
| 2020 | 252 | 113 | 608 | 217 | 117 | 629 | 432 | 128 | 664 | 684 | 241 | 1,272 |
| 2030 | 259 | 116 | 624 | 217 | 117 | 629 | 432 | 128 | 664 | 690 | 244 | 1,288 |
| 2040 | 265 | 119 | 640 | 217 | 117 | 629 | 432 | 128 | 664 | 697 | 247 | 1,304 |
| 2050 | 272 | 122 | 655 | 217 | 117 | 629 | 432 | 128 | 664 | 704 | 250 | 1,319 |
| 2060 | 279 | 125 | 671 | 217 | 117 | 629 | 432 | 128 | 664 | 711 | 253 | 1,335 |

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**Table 4-7. No Action Alternative – Predicted Charlotte Harbor No Action Alternative Conditions for Average Rainfall Year**

| | Charlotte Harbor Average Year Annual | | | Charlotte Harbor Average Year Dry Season | | | Charlotte Harbor Average Year Wet Season | | |
|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Lower Peace River (cfs)** | **Myakka River (cfs)** | **Total (cfs)** | **Lower Peace River (cfs)** | **Myakka River (cfs)** | **Total (cfs)** | **Lower Peace River (cfs)** | **Myakka River (cfs)** | **Total (cfs)** |
| 2009 | 1,119 | 675 | 1,794 | 510 | 237 | 747 | 2,631 | 1,253 | 3,884 |
| 2020 | 1,145 | 684 | 1,829 | 520 | 241 | 761 | 2,709 | 1,272 | 3,981 |
| 2030 | 1,168 | 690 | 1,858 | 529 | 244 | 773 | 2,774 | 1,288 | 4,062 |
| 2040 | 1,195 | 697 | 1,892 | 541 | 247 | 788 | 2,840 | 1,304 | 4,143 |
| 2050 | 1,223 | 704 | 1,928 | 554 | 250 | 805 | 2,906 | 1,319 | 4,225 |
| 2060 | 1,244 | 711 | 1,955 | 564 | 253 | 817 | 2,955 | 1,335 | 4,290 |

The estimated No Action Alternative flow conditions for a low rainfall year are presented in Tables 4-8 through 4-10. The low rainfall calculation used 43 inches of rainfall per year for both watersheds (see Appendix G). The flow conditions are provided for both wet and dry seasons and for the annual average flow at each 10-year increment. These data were used to compare the mining alternatives discussed in the remainder of this section and they are plotted alongside each alternative presented.

The predicted changes resulted in an increase in downstream flow rates in most subwatersheds (based on low rainfall) as follows:

- Lower Peace River, 12.0 percent increase
- Peace River at Arcadia, 10 percent increase
- Joshua Creek, 20 percent increase
- Horse Creek, 3.5 percent increase
- Prairie Creek, 22.5 percent increase
- Entire Myakka River watershed, 4.0 percent increase
- Upper Myakka River, 10.8 percent increase
- Lower Myakka River, 0 percent increase

Overall, during a low rainfall year, the comparative increase is flow is very similar for the Lower Peace River subwatersheds and slightly less for the Upper Myakka. There was no percent change in the flow rates in the Horse Creek subwatershed for the low rainfall year compared to the average rainfall year.

**Table 4-8. No Action Alternative – Predicted Lower Peace River No Action Alternative Conditions for Low Rainfall Year**

| | Peace River at Arcadia | | | Joshua Creek | | | Horse Creek | | | Prairie Creek | | | Lower Peace River to Charlotte Harbor | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** |
| 2009 | 330 | 152 | 766 | 60 | 27 | 148 | 84 | 38 | 199 | 93 | 42 | 225 | 568 | 259 | 1,338 |
| 2020 | 337 | 154 | 787 | 64 | 28 | 155 | 85 | 38 | 203 | 97 | 44 | 233 | 583 | 264 | 1,379 |
| 2030 | 342 | 156 | 807 | 66 | 30 | 160 | 85 | 38 | 205 | 102 | 46 | 242 | 595 | 270 | 1,414 |
| 2040 | 350 | 159 | 827 | 68 | 31 | 164 | 86 | 39 | 206 | 106 | 48 | 251 | 610 | 276 | 1,449 |
| 2050 | 358 | 163 | 848 | 70 | 32 | 169 | 86 | 39 | 207 | 110 | 50 | 260 | 625 | 283 | 1,484 |
| 2060 | 363 | 165 | 862 | 72 | 32 | 172 | 87 | 39 | 209 | 114 | 52 | 268 | 636 | 288 | 1,511 |

Notes:
Wet season is from June through September, and the dry season is the rest of the year. Annual flow is average value for given annual precipitation total.
Rainfall is based on the lowest 20th percentile of long term annual averages, which is similar to SWFWMD permitting basis for irrigation use.

| Table 4-9. No Action Alternative – Predicted Myakka River No Action Alternative Conditions for Low Rainfall Year | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Myakka River | | | Lower Myakka/Big Slough Subwatershed | | | Lower Myakka River (incl. Lower Myakka/Big Slough Subwatershed) | | | Myakka River to Charlotte Harbor | | |
| **Year** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** | **Qannual (cfs)** | **Qdry (cfs)** | **Qwet (cfs)** |
| 2009 | 204 | 91 | 493 | 176 | 95 | 511 | 350 | 104 | 539 | 555 | 195 | 1,032 |
| 2020 | 204 | 91 | 493 | 176 | 95 | 511 | 350 | 104 | 539 | 555 | 195 | 1,032 |
| 2030 | 210 | 94 | 506 | 176 | 95 | 511 | 350 | 104 | 539 | 560 | 198 | 1,045 |
| 2040 | 215 | 97 | 519 | 176 | 95 | 511 | 350 | 104 | 539 | 566 | 200 | 1,058 |
| 2050 | 221 | 99 | 532 | 176 | 95 | 511 | 350 | 104 | 539 | 571 | 203 | 1,070 |
| 2060 | 226 | 102 | 544 | 176 | 95 | 511 | 350 | 104 | 539 | 577 | 206 | 1,083 |

**Table 4-10. No Action Alternative – Predicted Charlotte Harbor No Action Alternative Conditions for Low Rainfall Year**

| | Charlotte Harbor Average Year Annual | | | Charlotte Harbor Average Year Dry Season | | | Charlotte Harbor Average Year Wet Season | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Lower Peace River (cfs) | Myakka River (cfs) | Total (cfs) | Lower Peace River (cfs) | Myakka River (cfs) | Total (cfs) | Lower Peace River (cfs) | Myakka River (cfs) | Total (cfs) |
| 2009 | 568 | 555 | 1,122 | 259 | 195 | 454 | 1,338 | 1,032 | 2,369 |
| 2020 | 583 | 555 | 1,137 | 264 | 195 | 460 | 1,379 | 1,032 | 2,411 |
| 2030 | 595 | 560 | 1,155 | 270 | 198 | 467 | 1,414 | 1,045 | 2,458 |
| 2040 | 610 | 566 | 1,175 | 276 | 200 | 477 | 1,449 | 1,058 | 2,507 |
| 2050 | 625 | 571 | 1,196 | 283 | 203 | 486 | 1,484 | 1,070 | 2,554 |
| 2060 | 636 | 577 | 1,213 | 288 | 206 | 494 | 1,511 | 1,083 | 2,593 |

#### 4.2.1.1 No Action Alternative: Degree and Significance of Surface Water Resource Effects

Under the No Action Alternative - No Mining scenario, as shown above, increases in flow in all subwatersheds and watersheds are illustrative of the increased flow caused by changing land use through urbanization. This scenario will be used for comparative purposes for the rest of this Chapter.

Under the No Action Alternative - Upland Mining Only scenario, the capture areas associated with the mines on the four parcels would be smaller than under the Applicants' Preferred Alternatives as the mines within upland areas alone would presumably be smaller than mines that would also impact wetlands or waters, and the effect of the capture area would reduce the downstream flows compared to the 'no mining' scenario, which assumes no capture areas. The degree of effect for the No Action Alternative - Upland Only scenario would vary by mine and by subwatershed, as is the case for the alternatives described below. At most, the degree of the effect would be less than any of the degree of effects documented below as the Upland Mining Only scenario would be a subset of mining proposed. As for all phosphate mines, under local and state permitting requirements the applicants would be required to implement mitigation measures such as recharge ditches or wells, and monitor base flows in potentially affected waterways. Mitigation would lower the degree of effect and make any effects not significant.

### 4.2.2 Alternative 2: Desoto Mine

The proposed Desoto Mine is located mostly in the Horse Creek subwatershed (88% - 15,993 acres), but a portion is in the Peace River at Arcadia subwatershed (10% - 1,919 acres) and the Lower Myakka/Big Slough subwatershed (2% - 375 acres). Mosaic proposes to construct an initial clay settling area (CSA), a beneficiation plant, and initial mine infrastructure corridors. The Desoto Mine anticipated schedule has mining to continue for the first 13 years of the mine life, and reclamation to continue to mine year 23. Mosaic anticipates beginning mining at the Desoto Mine in 2021; therefore, mining should be complete by 2034 and reclamation by 2044.

The capture area graph for the Desoto Mine is presented in Figure 4-3. Because of the four draglines proposed matrix excavation, mining effects would occur in the subwatersheds at different times and to varying levels of impact. As indicated in Figure 4-3, mining activities would affect the two main subwatersheds concurrently for much of this mine's life cycle. The capture area would increase for the first portion of the life cycle as more and more of the land is incorporated into the mine's operations. Past a certain point in any given mine's life cycle, the capture area curve descends--reflecting the stage at which gradual reclamation and land release is occurring from the mine operations. This results in a proportionate amount of the land area returning to contribute runoff to the pre-mining conditions. Where the mine's footprint affects multiple subwatersheds within a larger watershed, the runoff analysis accounts for the capture area for that portion of the mine's footprint associated with each subwatershed. Thus, in terms of understanding what the mining effects are, where they occur (i.e., what streams are affected), when the effects begin, and how long they last, it is essential to consider these changes in time and space as part of the impact assessment.

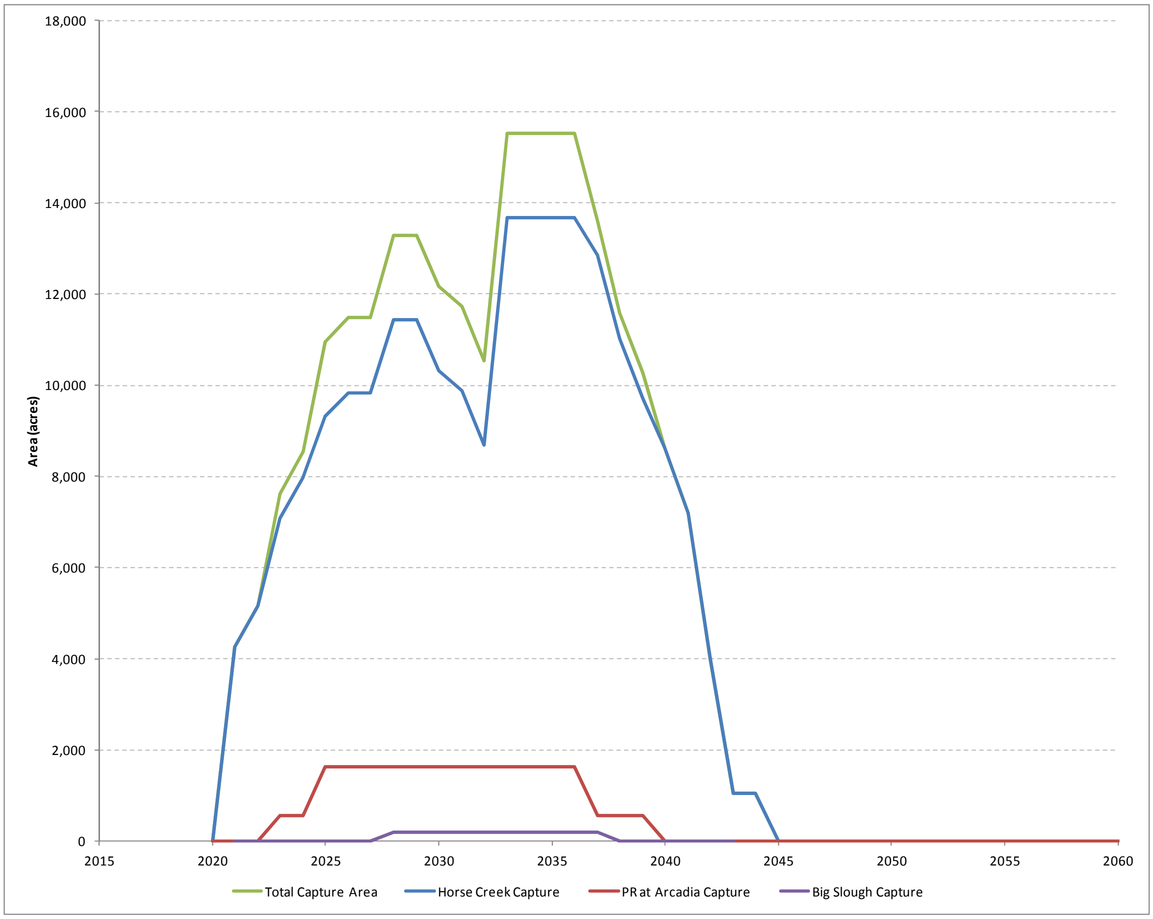


**Figure 4-3. Desoto Mine Stormwater Capture Area Graph**

The capture of stormwater in an active mine was evaluated for the most conservative bounding condition, where 100 percent of the stormwater (i.e., excess precipitation, as defined in Appendix J) is captured. Evaluations were also performed using a 50 percent-capture condition, which the Applicants indicated is still a high estimate of their standard practices. To illustrate the effect on stream flow at these subwatersheds under annual average rainfall conditions, 50 inches per year was applied for the surface water calculations in the Peace River watershed. The evaluation was repeated under low rainfall conditions (43 inches per year). This low rainfall value was selected because SWFWMD permits irrigation water use for similar low rainfall conditions. Forty-three inches per year is also about the lowest 20th percentile of the long-term average rainfall in the region. The detailed results are presented in Appendix G for this and all alternatives.

#### 4.2.2.1 Desoto Mine Effects on Horse Creek

Tables 4-11 and 4-12 present the annual average and seasonal flow rates calculated for an average rainfall year for Horse Creek with the Desoto Mine for the 100 percent and 50 percent stormwater capture, respectively. Tables 4-13 and 4-14 present the annual average and seasonal flow rates calculated in a low rainfall year for Horse Creek with the Desoto Mine for the 100 percent and 50 percent stormwater capture, respectively.

The largest influence on streamflow from the Horse Creek subwatershed from the mining capture areas of the Desoto Mine was predicted to occur around 2035. To ensure that the peak impact was represented, an extra computation was conducted for 2035 for this alternative. When considering the condition of 100 percent capture of stormwater in the mining capture area of the Desoto Mine, Horse Creek may have an average annual flow of approximately 173 cfs without the Desoto Mine, and approximately 157 cfs with the Desoto Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 16 cfs, or 9 percent below the No Action Alternative conditions; and a decrease in flow of approximately 14 cfs, or 8 percent of the calculated 2009 average annual flow of 171 cfs. When considering the 50 percent stormwater capture condition, the annual average flow in Horse Creek may be approximately 165 cfs with the Desoto Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 8 cfs, or 5 percent below the No Action Alternative conditions; and a decrease in flow of approximately 6 cfs, or 3 percent below the calculated 2009 average annual flow.

**Table 4-11. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the Desoto Mine**

| Year | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 173 | 1% | 78 | 0% | 413 | 2% |
| 2030 | 161 | -6% | 72 | -7% | 387 | -4% |
| 2035 | 157 | -8% | 71 | -9% | 378 | -6% |
| 2040 | 164 | -4% | 74 | -5% | 394 | -2% |
| 2050 | 175 | 3% | 79 | 2% | 422 | 4% |
| 2060 | 177 | 3% | 79 | 2% | 424 | 5% |

**Table 4-12. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the Desoto Mine**

| Year | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 173 | 1% | 75 | -4% | 413 | 2% |
| 2030 | 168 | -2% | 73 | -5% | 403 | 0% |
| 2035 | 165 | -3% | 73 | -6% | 397 | -2% |
| 2040 | 169 | -1% | 74 | -5% | 407 | 1% |
| 2050 | 175 | 2% | 75 | -3% | 420 | 4% |
| 2060 | 176 | 3% | 76 | -2% | 423 | 5% |

The same evaluation was performed for a low rainfall year with similar results. Tables 4-13 and 4-14 present the annual average flows and seasonal flow rates calculated for a low rainfall year for Horse Creek subwatershed with the Desoto Mine for the 100 percent and 50 percent stormwater capture scenario, respectively. When considering the condition of 100 percent capture of stormwater in the mining capture area of the Desoto Mine, Horse Creek may have an average annual flow of approximately 85 cfs without the Desoto Mine, and approximately 77 cfs with the Desoto Mine during low rainfall conditions. This corresponds to a decrease in flow of approximately 9 percent below the No Action Alternative conditions; and a decrease in flow of approximately 7 cfs, or 8 percent of the calculated 2009 average annual flow of 84 cfs. When considering the 50 percent stormwater capture condition, the annual average flow in Horse Creek was reduced by a proportional percentage (about half the impact).

**Table 4-13. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the Desoto Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 85 | 1% | 38 | 0% | 203 | 2% |
| 2030 | 79 | -6%- | 36 | -7% | 190 | -4% |
| 2035 | 77 | -8% | 35 | -9% | 186 | -6% |
| 2040 | 81 | -4% | 36 | -5% | 194 | -2% |
| 2050 | 86 | 3% | 39 | 2% | 207 | 4% |
| 2060 | 87 | 3% | 39 | 2% | 209 | 5% |

**Table 4-14. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the Desoto Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 84 | 1% | 35 | -7% | 202 | 2% |
| 2030 | 82 | -2% | 35 | -8% | 197 | -1% |
| 2035 | 81 | -3% | 35 | -8% | 195 | -2% |
| 2040 | 83 | -1% | 35 | -7% | 200 | 1% |
| 2050 | 86 | 2% | 36 | -6% | 206 | 4% |
| 2060 | 86 | 3% | 36 | -5% | 208 | 4% |

Note: Variations in percentages with similar flow values is related to rounding nuances.
Desoto Mine Effects on Peace River at Arcadia

Tables 4-15 and 4-16 present the annual average flows and seasonal flow rates calculated in an average rainfall year for Peace River at Arcadia gage stations with the Desoto Mine for the 100 percent and 50 percent stormwater capture, respectively. Tables 4-17 and 4-18 present the annual average flows and seasonal flow rates calculated in a low rainfall year for Peace River at Arcadia gage stations with the Desoto Mine for the 100 percent and 50 percent stormwater capture, respectively.

The largest influence on streamflow from the Peace River at Arcadia subwatershed from the mining capture areas of the Desoto Mine was predicted to occur in 2030. When considering the more conservative stormwater capture condition, 100 percent capture within the mining capture area of the Desoto Mine, Peace River at Arcadia may have an average annual flow of approximately 738 cfs without the Desoto Mine in 2030, and approximately 737 cfs with the Desoto Mine during average rainfall conditions in the same year. This corresponds to a decrease in flow of approximately 1 cfs, or less than 1 percent below the No Action Alternative conditions. There is an increase in flow of approximately 24 cfs, or 3 percent above the calculated 2009 average annual flow of 713 cfs because of the predicted land use shifts in the watershed toward urbanization. When considering the 50 percent stormwater capture condition the annual average flow in Peace River at Arcadia may be approximately 738 cfs with the Desoto Mine during average rainfall conditions. This corresponds to a negligible decrease in flow below the No Action Alternative, but an increase in flow of approximately 25 cfs, or 3 percent above the calculated 2009 average annual flow. Flow increases from the 2009 levels can also be attributed to predicted changes in land uses from urbanization and the release of reclaimed land of existing mines in areas upstream of this subwatershed. The effect on annual average flow from the Peace River at Arcadia subwatershed during average rainfall conditions is indistinguishable from the No Action Alternative.

**Table 4-15. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the Desoto Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 726 | 2% | 332 | 1% | 1,702 | 3% |
| 2030 | 737 | 3% | 335 | 2% | 1,740 | 5% |
| 2040 | 754 | 6% | 343 | 5% | 1,785 | 8% |
| 2050 | 772 | 8% | 351 | 7% | 1,829 | 10% |
| 2060 | 783 | 10% | 355 | 8% | 1,858 | 12% |

| Table 4-16. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the Desoto Mine | | | | | | |
|---|---|---|---|---|---|---|
| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 726 | 2% | 332 | 1% | 1,702 | 3% |
| 2030 | 738 | 3% | 336 | 2% | 1,741 | 5% |
| 2040 | 755 | 6% | 343 | 5% | 1,786 | 8% |
| 2050 | 772 | 8% | 351 | 7% | 1,829 | 10% |
| 2060 | 783 | 10% | 355 | 8% | 1,858 | 12% |

Tables 4-17 and 4-18 present the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 and 50 percent capture of stormwater, respectively. Changes in flows are indistinguishable from the No Action Alternative.

| Table 4-17. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the Desoto Mine | | | | | | |
|---|---|---|---|---|---|---|
| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 337 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 342 | 4% | 156 | 2% | 806 | 5% |
| 2040 | 350 | 6% | 159 | 5% | 827 | 8% |
| 2050 | 358 | 9% | 163 | 7% | 848 | 11% |
| 2060 | 363 | 10% | 165 | 9% | 862 | 13% |

**Table 4-18. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the Desoto Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 336 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 342 | 4% | 156 | 3% | 806 | 5% |
| 2040 | 350 | 6% | 159 | 5% | 827 | 8% |
| 2050 | 358 | 9% | 163 | 7% | 848 | 11% |
| 2060 | 363 | 10% | 165 | 9% | 862 | 13% |

#### 4.2.2.2 Desoto Mine Effects on Lower Myakka/Big Slough Subwatershed

An analysis was not conducted for the effect of the mining of 375 acres within the Myakka River subwatershed. The Lower Myakka/Big Slough subwatershed has approximately 127 percent of the stream flow as the Horse Creek subwatershed, but the mining area proposed in that watershed is 2 percent of the size mining area compared to the Desoto Mine area proposed in the Horse Creek. After reviewing the effects on the Horse Creek stream flow (reductions that are less than 10 percent when the stream flow is less and the area of mining is 42 times greater), any effect on the stream flow within the Lower Myakka/Big Slough subwatershed was determined to be insubstantial.

#### 4.2.2.3 Desoto Mine: Degree and Significance of Surface Water Resource Effects

While the Horse Creek flow rate from mining is projected to decrease up to 9 percent during a low rainfall year in the dry season with a 50 percent capture area, the decrease in flow rates falls within the error range for this analysis, which is based on extremely variable parameter (rainfall). The reduction in flows within Horse Creek may be indicative of a change at the Horse Creek subwatershed level; therefore, the effect cannot be considered minor. For a major effect, there must be an extended effect on surface water flows at least at the subwatershed level that also leads to a violation of the MFLs for the subwatershed. In addition to the potential reductions being within one order of significant figures, there are no SWFWMD MFLs established for Horse Creek to which flow reductions can be compared. For this reason (no contribution to a violation of MFLs for Horse Creek and a change in stream flow rates that falls within the expected error range), the effect on surface water flows within Horse Creek cannot be considered to have a major effect. The apparent reduction in flow is indicative of a change beyond the boundaries of the mine within the Horse Creek subwatershed even though the degree may be within the realm of natural variation. Therefore, the effects would be moderate without mitigation within the Horse Creek subwatershed and minor with mitigation. Given the moderate level of an effect for this mine within the watershed, the effect is expected to be significant without mitigation and not significant when mitigation is considered.

Possible measures that would reduce the moderate degree of effect, mitigate the intensity factors, and potentially make the effect not significant include recharge ditches and wells to maintain base flow in Horse Creek and its tributaries, or reducing the capture area. There are also monitoring program and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to the creek, the Applicants would need to address those impacts.

The effects within the Peace River at Arcadia and Lower Myakka/Big Slough subwatersheds are none to minor and are not considered significant.

The individual effect of the Desoto Mine on the Peace River watershed and on Charlotte Harbor is none to minor, which is not significant. The moderate (without mitigation) degree of effect on Horse Creek and minor degree of effect on the Peace River at Arcadia are overwhelmed at this scale by the contributions of other tributaries, and over time by the predicted increases in flow due to changes in land use. These effects are described further in the No Action Alternative section above (4.2.1) and in the surface water resources cumulative effects section (4.12.2).

### 4.2.3 **Alternative 3: Ona Mine**

The proposed Ona Mine is located mostly in the Horse Creek subwatershed (77% - 17,242 acres), but includes some small portions in the Peace River at Arcadia subwatershed (22% - 4,808 acres) and the Upper Myakka River subwatershed (1% - 269 acres). Mosaic proposes to use the CSAs in two existing mines to support the initial stages of mining at the Ona Mine. This would allow mining to begin without having to construct a new CSA on unmined ground. The use of existing CSAs would also allow the use of mine corridors in these two existing mines, reduce the CSA footprint in the new mine, and reduce overall surface water capture time and acres for this mine. The Ona Mine anticipated schedule has mining to continue for the first 29 years of the mine operations, and reclamation to continue to mine year 45. Mosaic anticipates beginning mining at the Ona Mine site in 2020; therefore, reclamation should be complete by 2065.

The capture area curve for the Ona Mine site is presented In Figure 4-4 and reflects the gradual increase in acreage included in the recirculation system boundary over the roughly 29-year period of active mining, with a gradual return of lands to contribute to downstream flows as reclamation rates exceed the mining rates and result in a net decrease in the capture area acreages. On the basis of this analysis, the peak years of capture are predicted to occur toward the end of the period of matrix extraction, after which reclamation and land release would gradually return the full mine footprint to contributing runoff to downstream waters.

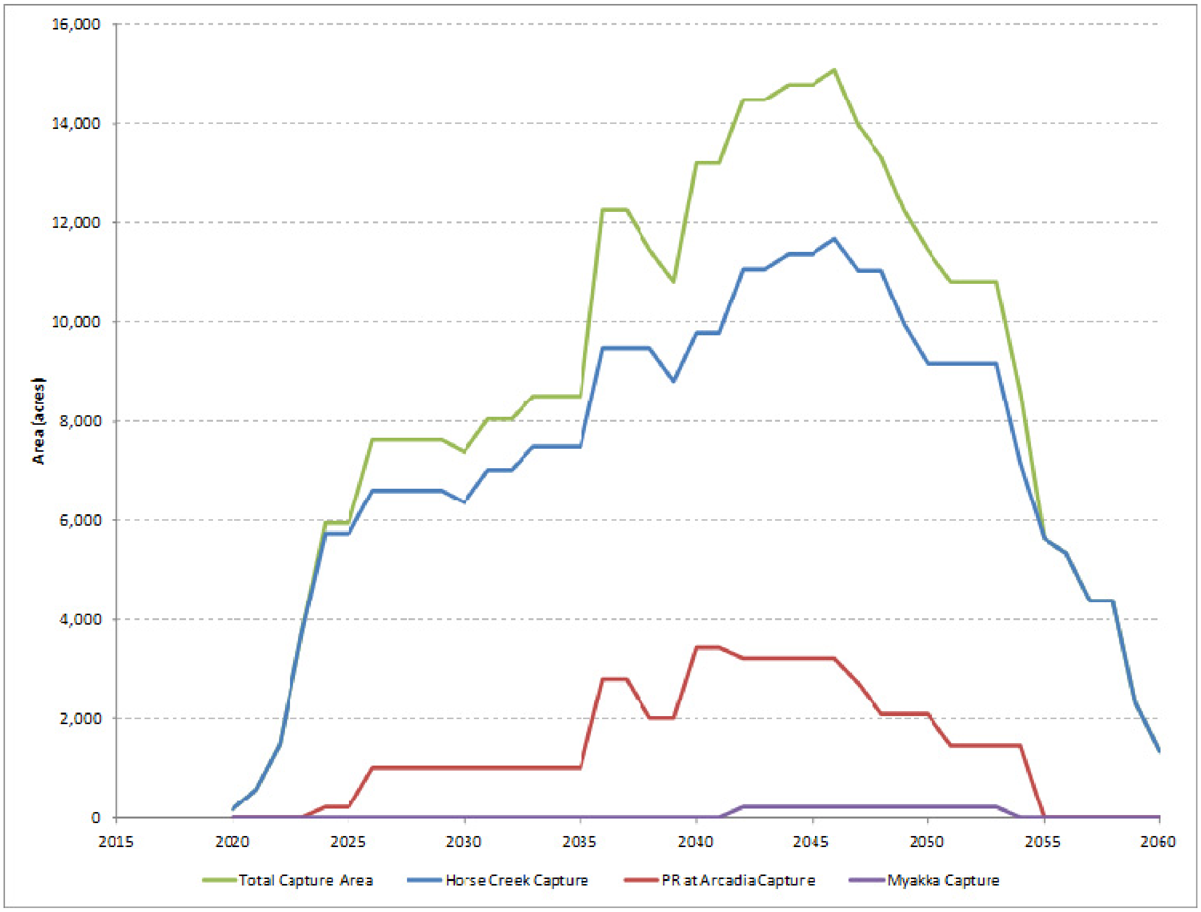


**Figure 4-4. Ona Mine Stormwater Capture Area Graph**

The mining sequence indicates that for approximately the first 15 years of mine operations, mining would occur only in the Horse Creek subwatershed, with no mining during that period in the Peace River at Arcadia and Upper Myakka River subwatersheds. The acreages of proposed mining in these two subwatersheds are relatively small in their respective subwatersheds, and the duration of influence much shorter than the likely influence on the Horse Creek subwatershed.

#### 4.2.3.1 Ona Mine Effects on Upper Myakka River

An analysis was not conducted for the effect of the mining of 269 acres within the Myakka River subwatershed. The Myakka River subwatershed has approximately 142 percent of the stream flow as the Horse Creek subwatershed, but the mining area proposed in that watershed is 1 percent of the size mining area compared to the Ona Mine area proposed in the Horse Creek. After reviewing the effects on the Horse Creek stream flow (reductions that are less than 10% when the stream flow is less and the area of mining is 100 times greater), any effect on the stream flow within the Myakka River subwatershed was determined to be insubstantial.

#### 4.2.3.2 Ona Mine Effects on Horse Creek

Tables 4-19 and 4-20 present the annual average flows and seasonal flow rates calculated for an average annual rainfall for Horse Creek with the Ona Mine for the 100 percent and 50 percent stormwater capture scenario, respectively. Tables 4-21 and 4-22 present the annual average flows and seasonal flow rates calculated for an average low rainfall year for Horse Creek with the Ona Mine for the 100 percent and 50 percent stormwater capture scenario, respectively.

The largest influence on streamflow from the Horse Creek subwatershed from the mining capture areas of the Ona Mine was predicted to occur from 2040 to 2045. To ensure that the peak impact was represented, an extra computation was conducted for 2045 for this alternative. When considering the condition of 100 percent capture, Horse Creek may have an average annual flow of approximately 173 to 174 cfs without the Ona Mine, and approximately 161 to 162 cfs with the Ona Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 11 to 13 cfs, or 6 to 8 percent below the No Action Alternative conditions; and a decrease in flow of approximately 9to 10 cfs, or 5 to 6 percent below the calculated 2009 average annual flow of 171 cfs. When considering the 50 percent capture condition, the annual average flow in Horse Creek may be approximately 166 to 168 cfs with the Ona Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 5 to 7 cfs, or 3 to 4 percent below the No Action Alternative conditions; and a decrease in flow of approximately 3 to 5 cfs, or 2 to 3 percent below the calculated 2009 average annual flow.

**Table 4-19. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 172 | 1% | 78 | 0% | 413 | 2% |
| 2030 | 166 | -3% | 74 | -4% | 398 | -2% |
| 2040 | 162 | -5% | 73 | -6% | 391 | -3% |
| 2045 | 161 | -6% | 72 | -7% | 387 | -4% |
| 2050 | 161 | -4% | 74 | -5% | 395 | -2% |
| 2060 | 175 | 2% | 79 | 1% | 420 | 4% |

**Table 4-20 Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 171 | 0% | 74 | -4% | 409 | 1% |
| 2030 | 168 | -2% | 73 | -5% | 404 | 0% |
| 2040 | 166 | -3% | 72 | -7% | 401 | -1% |
| 2045 | 168 | -2% | 73 | -6% | 404 | 0% |
| 2050 | 169 | -1% | 73 | -6% | 404 | 0% |
| 2060 | 174 | 2% | 75 | -3% | 419 | 4% |

The same evaluation was performed for a low rainfall year with similar results. Table 4-21 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 percent capture of stormwater in the capture area of the Ona Mine at the Horse Creek flow station. When considering the condition of 100 percent capture of stormwater in the mining capture area of the Ona Mine, Horse Creek may have an average annual flow of approximately 86 cfs without the Ona Mine, and approximately 79 cfs with the Ona Mine during low rainfall conditions. This corresponds to a decrease in flow of approximately 8 percent below the No Action Alternative conditions; and a decrease in flow of approximately 5 cfs, or 6 percent of the calculated 2009 average annual flow of 84 cfs. When considering the 50 percent stormwater capture condition (Table 4-22), the annual average flow in Horse Creek was reduced by a proportional percentage (about one half the impact).

**Table 4-21. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 85 | 1% | 38 | 0% | 203 | 2% |
| 2030 | 81 | -3% | 37 | -4% | 195 | -2% |
| 2040 | 80 | -5% | 36 | -6% | 192 | -3% |
| 2045 | 79 | -6% | 36 | -7% | 190 | -4% |
| 2050 | 81 | -4% | 36 | -5% | 194 | -2% |
| 2060 | 86 | 2% | 39 | 1% | 207 | 4% |

**Table 4-22. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 85 | 1% | 35 | -8% | 203 | 2% |
| 2030 | 83 | -2% | 35 | -9% | 199 | 0% |
| 2040 | 82 | -3% | 35 | -9% | 197 | -1% |
| 2045 | 83 | -1% | 35 | -8% | 199 | 0% |
| 2050 | 83 | -1% | 35 | -8% | 199 | 0% |
| 2060 | 86 | 2% | 36 | -6% | 207 | 4% |

#### 4.2.3.3 Ona Mine Effects on Peace River at Arcadia

Tables 4-23 and 4-24 present the annual average flows and seasonal flow rates calculated for an average annual rainfall year for Peace River at Arcadia with the Ona Mine for the 100 percent and 50 percent stormwater capture scenario, respectively. Tables 4-25 and 4-26 present the annual average flows and seasonal flow rates calculated for a low rainfall year for Peace River at Arcadia with the Ona Mine for the 100 percent and 50 percent stormwater capture scenario, respectively.

The largest influence on streamflow from the Peace River at Arcadia subwatershed from the mining capture areas of the Ona Mine was predicted to occur in 2040. However, the effect on annual average flow from the Peace River at Arcadia subwatershed during average rainfall conditions was expected to be minimal and likely would not be detected because of the comparatively small area being impacted in the Peace River at Arcadia subwatershed (i.e., one would not be able to determine a change in the monitoring data). When considering the more conservative stormwater capture condition, 100 percent capture within the mining capture area of the Ona Mine, Peace River at Arcadia may have an average annual flow of approximately 754 cfs without the Ona Mine in 2040, and approximately 750 cfs with the Ona Mine during average rainfall conditions in the same year. This corresponds to a decrease in flow of approximately 4 cfs, or less than 1 percent below the No Action Alternative conditions; however, there is an increase in flow of approximately 37 cfs, or 5 percent above the calculated 2009 average annual flow of 713 cfs because of other predicted land use changes in the watershed. When considering the 50 percent stormwater capture condition the annual average flow in Peace River at Arcadia may be approximately 752 cfs with the Ona Mine during average rainfall conditions. This is nearly the same effect as the 100 percent capture area. Both of these effects are so small as to be inconsequential. Flow increases from the 2009 levels can be attributed to predicted changes in land uses from urbanization and the release of reclaimed land of existing mines in areas upstream of this subwatershed.

**Table 4-23. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 726 | 2% | 332 | 1% | 1,701 | 3% |
| 2030 | 736 | 3% | 335 | 2% | 1,741 | 5% |
| 2040 | 750 | 5% | 340 | 4% | 1,780 | 7% |
| 2050 | 769 | 8% | 349 | 6% | 1,825 | 10% |
| 2060 | 782 | 10% | 354 | 8% | 1,858 | 12% |

**Table 4-24. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 724 | 2% | 331 | 1% | 1,697 | 2% |
| 2030 | 736 | 3% | 335 | 2% | 1,737 | 5% |
| 2040 | 752 | 6% | 342 | 4% | 1,779 | 7% |
| 2050 | 770 | 8% | 350 | 7% | 1,823 | 10% |
| 2060 | 781 | 10% | 354 | 8% | 1,853 | 12% |

The same evaluation was performed for a low rainfall year. Tables 4-25 and 4-26 present the annual average flows and seasonal flow rates calculated for a low rainfall year for Peace River at Arcadia with the Ona Mine for the 100 percent and 50 percent stormwater capture scenario, respectively. Changes in flows are indistinguishable from the No Action Alternative.

**Table 4-25. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 336 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 341 | 3% | 155 | 2% | 806 | 5% |
| 2040 | 348 | 5% | 158 | 4% | 825 | 8% |
| 2050 | 357 | 8% | 162 | 7% | 847 | 11% |
| 2060 | 363 | 10% | 164 | 8% | 862 | 13% |

**Table 4-26. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the Ona Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 335 | 2% | 153 | 1% | 785 | 2% |
| 2030 | 341 | 3% | 155 | 2% | 804 | 5% |
| 2040 | 349 | 6% | 158 | 4% | 824 | 8% |
| 2050 | 357 | 8% | 162 | 7% | 845 | 10% |
| 2060 | 362 | 10% | 164 | 8% | 859 | 12% |

#### 4.2.3.4 Ona Mine: Degree and Significance of Surface Water Resource Effects

While the Horse Creek flow rate from mining is projected to decrease up to 9 percent during a low rainfall year in the dry season with a 100 percent capture area, the decrease in flow rates falls within the error range for this analysis which is based on an extremely variable parameter (rainfall). The reduction in flows within Horse Creek may be indicative of a change at the Horse Creek subwatershed level; therefore, the effect cannot be considered minor. For a major effect, there must be an extended effect on surface water flows at least at the subwatershed level that also leads to a violation of the MFLs for the subwatershed. In addition to the potential reductions being within one order of significant figures, there are no SWFWMD MFLs established for Horse Creek to which the flow reduction can be compared. For this reason (no contribution to a violation of MFLs for Horse Creek and a change in stream flow rates that falls within the expected error range), the effect on surface water flows within Horse Creek cannot be considered to have a major effect. The apparent reduction in flow is indicative of a change beyond the boundaries of the mine within the Horse Creek subwatershed even though the degree may be within the realm of natural variation. Therefore, the effects would be moderate without mitigation and minor with mitigation within the Horse Creek subwatershed. Given the moderate level of an effect for this mine within the watershed, the effect is expected to be significant without mitigation but not significant with mitigation considered.

Possible measures that would reduce the moderate degree of effect, mitigate the intensity factors, and potentially make the effects not significant include recharge ditches and wells to maintain base flow in Horse Creek and its tributaries, or reducing the capture area. There are also monitoring program and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to the creek, the Applicants would need to address those impacts.

The effects within the Peace River at Arcadia and Upper Myakka River subwatersheds are minor to no effect and are not considered significant.

The individual effect of the Ona Mine on the Myakka and Peace River watersheds and on Charlotte Harbor is none to minor, which is not significant. The moderate (without mitigation) degree of effect on Horse Creek and minor degree of effect on the Peace River at Arcadia and Upper Myakka River are overwhelmed at this scale by the contributions of other tributaries, and over time by the predicted increases in flow due to changes in land use. These effects are described further in the No Action Alternative section above (4.2.1) and in the surface water resources cumulative effects section (4.12.2).

### 4.2.4 **Alternative 4: Wingate East Mine**

The proposed Wingate East Mine is located primarily in the Upper Myakka River subwatershed (90% - 3,280 acres) with an additional portion in the Horse Creek subwatershed (10% - 355 acres). The Wingate East Mine expansion is one-fifth the size of the Desoto Mine and one-sixth the size of the Ona Mine by comparison. This mine as proposed would use the CSAs, beneficiation plant, and mine infrastructure corridors of the existing Wingate Creek Mine. The Wingate East Mine anticipated schedule has mining to continue for the first 28 years of the mine operations, and reclamation to continue to mine year 41. Mosaic proposes to begin mining in this site in 2020; therefore, mining should be complete by 2048 and reclamation should be complete by 2061.

The capture area curve for the Wingate East Mine site is presented in Figure 4-5 and reflects the gradual increase in acreage included in the recirculation system boundary over the roughly 28-year period of active mining, with a gradual return of lands to contribute to downstream flows as reclamation rates exceed the mining rates and result in a net decrease in the capture area acreages. On the basis of this analysis, the peak years of capture are predicted to occur over most of the period of matrix extraction, after which reclamation and land release would gradually return the full mine footprint to contributing runoff to downstream waters. Approximately two-thirds of this mine is proposed to be mined using a dredge and the other third to be mined by draglines. Because the wet dredge process does not facilitate the storage of additional water onsite (because the pits are already full of water), it was assumed that only half as much capture of stormwater would occur with this alternative. Reductions in surface water from the mine capture were only applied at half the area shown on the capture curve for this mine, so effectively this alternative was analyzed at 25 and 50 percent capture, but the naming convention was not changed for discussion consistency in the AEIS. Like the dragline mines, the wet dredge scenarios with this changed assumption capture a much higher percentage of stormwater than the Applicants indicate that they would use in practice.

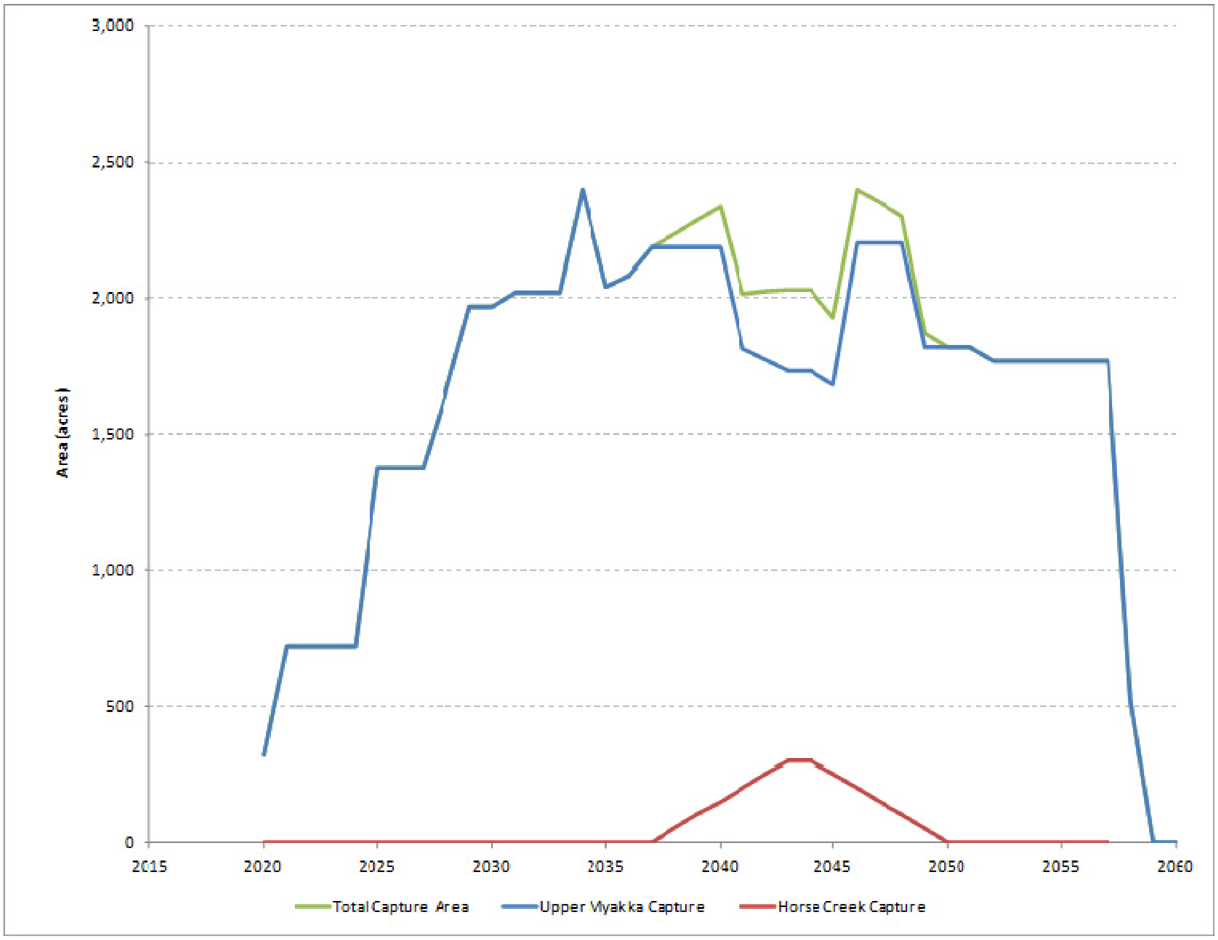


**Figure 4-5. Wingate East Mine Stormwater Capture Area Graph**

The mining sequence is reflected in the capture area and indicates that from 2025 to 2055, mining would occur in the Upper Myakka River subwatershed.

#### 4.2.4.1 Wingate East Mine Effects on Horse Creek

The Wingate East Mine's potential impacts on the Horse Creek subwatershed were not calculated because of the very small size of the mine in this subwatershed. Approximately 355 acres of the Wingate East Mine are within the Horse Creek subwatershed. It is not expected that mining this relatively small percentage of the overall subwatershed would have a measurable effect on flows within the subwatershed.

#### 4.2.4.2 Wingate East Mine Effects on Upper Myakka River

Tables 4-27 and 4-28 present the annual average and seasonal flows calculated for an average annual rainfall year for the Myakka River near Sarasota gage station with the Wingate East Mine for the 100 percent and 50 percent stormwater capture, respectively. Tables 4-29 and 4-30 present the annual average and seasonal flows calculated for a low rainfall year for the Myakka River near Sarasota gage station with the Wingate East Mine for the 100 percent and 50 percent stormwater capture, respectively.

The largest influence on streamflow from the Upper Myakka River subwatershed from the mining capture areas of the Wingate East Mine was predicted to occur from 2030 to 2050. When considering the condition of 100 percent capture, the Myakka River near Sarasota gage station may show an average annual flow of approximately 259 to 272 cfs without the Wingate East Mine, and approximately 257 to 271 cfs with the Wingate East Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 1 to 2 cfs, or less than 1 percent below the No Action Alternative conditions; and an increase in flow of approximately 14 to 28 cfs, or 6 to 11 percent above the calculated 2009 average annual flow of 243 cfs. When considering the 50 percent stormwater capture condition, the annual average flow from the Upper Myakka River subwatershed may be approximately 258 to 271 cfs with the Wingate East Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 1 cfs, less than 1 percent below the No Action Alternative conditions; and an increase in flow of approximately 14 to 28 cfs, or 6 to 11 percent above the calculated 2009 average annual flow. Flow increases from the 2009 levels can be attributed to predicted changes in land uses in this subwatershed. Changes to annual average flow from the Upper Myakka River subwatershed during average rainfall conditions were minimal and not likely detectable because of the relatively small area being mined in the Upper Myakka River subwatershed.

**Table 4-27. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Upper Myakka Flow Station with the Wingate East Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 243 | 0% | 109 | 0% | 589 | 0% |
| 2020 | 251 | 3% | 113 | 3% | 607 | 3% |
| 2030 | 257 | 6% | 115 | 6% | 620 | 5% |
| 2040 | 264 | 8% | 118 | 9% | 635 | 8% |
| 2050 | 271 | 11% | 122 | 12% | 652 | 11% |
| 2060 | 279 | 15% | 125 | 15% | 671 | 14% |

**Table 4-28. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Upper Myakka River Flow Station with the Wingate East Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 243 | 0% | 113 | 0% | 589 | 0% |
| 2020 | 251 | 3% | 113 | 0% | 607 | 3% |
| 2030 | 258 | 6% | 116 | 2% | 622 | 6% |
| 2040 | 265 | 9% | 119 | 5% | 638 | 8% |
| 2050 | 271 | 11% | 122 | 8% | 654 | 11% |
| 2060 | 279 | 15% | 125 | 11% | 671 | 14% |

The same evaluation was performed for a low rainfall year with similar results. Table 4-29 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 percent capture of stormwater in the capture area of the Myakka River near Sarasota gage station. When considering the condition of 100 percent capture of stormwater in the mining capture area of the Wingate East Mine from 2030 to 2050, the Upper Myakka River may have an average annual flow between approximately 210 and 221 cfs without the Wingate East Mine, and approximately 208 to 220 cfs with the Wingate East Mine during low rainfall conditions. This corresponds to a decrease in flow of less than one percent below the No Action Alternative conditions; and an increase in flow of approximately 11 to 23 cfs, or 6 to 11 percent of the calculated 2009 average annual flow of 197 cfs. When considering the 50 percent stormwater capture condition (Table 4-30), the difference in the effect to the annual average flow in the Upper Myakka River subwatershed was insubstantial.

**Table 4-29. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Upper Myakka River Flow Station with the Wingate East Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 197 | 0% | 88 | 0% | 478 | 0% |
| 2020 | 204 | 3% | 91 | 3% | 492 | 3% |
| 2030 | 208 | 6% | 93 | 6% | 503 | 5% |
| 2040 | 214 | 8% | 96 | 8% | 516 | 8% |
| 2050 | 220 | 11% | 99 | 11% | 529 | 11% |
| 2060 | 226 | 15% | 102 | 15% | 544 | 14% |

**Table 4-30. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Upper Myakka River Flow Station with the Wingate East Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 197 | 0% | 88 | 0% | 478 | 0% |
| 2020 | 204 | 3% | 91 | 3% | 492 | 3% |
| 2030 | 209 | 6% | 94 | 6% | 505 | 6% |
| 2040 | 215 | 9% | 96 | 9% | 517 | 8% |
| 2050 | 220 | 12% | 99 | 12% | 530 | 11% |
| 2060 | 226 | 15% | 102 | 15% | 544 | 14% |

#### 4.2.4.3 Wingate East Mine: Degree and Significance of Surface Water Resource Effects

There is in effect no reduction to the stream flow resulting from the mining of Wingate East either on the Upper Myakka River subwatershed, the Myakka River watershed, or Charlotte Harbor, and no significant impact on the Horse Creek subwatershed. Therefore, the effect of this Alternative on streamflow within the subwatershed and watersheds is minor and is not significant.

### 4.2.5 Alternative 5: South Pasture Extension Mine

The proposed South Pasture Extension Mine is mostly in the Horse Creek subwatershed (71% - 5,324 acres), with additional areas in the Peace River at Arcadia (24% - 1,781 acres) and Payne Creek (5% - 409 acres) subwatersheds. CF Industries proposes to initially use the CSAs and mine infrastructure corridors of the South Pasture Mine. CF Industries proposes to begin mining into this extension in 2020 (although earlier completion of the existing mine would move this date forward). The South Pasture Extension Mine anticipated schedule describes mining to continue for the first 14 to 15 years of the mine operations, and reclamation to continue to mine year 26. CF Industries anticipates beginning mining at the South Pasture Extension Mine site in 2020; therefore, mining should be complete by 2034 and reclamation should be complete by 2046.

The capture area graph for the South Pasture Extension Mine is presented in Figure 4-6. CF and reflects the gradual increase in acreage included in the recirculation system boundary over the roughly 14-year period of active mining, with a gradual return of lands to contribute to downstream flows as reclamation rates exceed the mining rates and result in a net decrease in the capture area acreages. On the basis of this analysis, the peak years of capture are predicted to occur toward the end of the period of matrix extraction, after which reclamation and land release would gradually return the full mine footprint to contributing runoff to downstream waters.

#### 4.2.5.1 South Pasture Extension Mine Effects on Payne Creek

An analysis was not conducted for the effect of the mining of 409 acres within the Payne Creek subwatershed. The Payne Creek subwatershed is 125 square miles in size, and on a percentage basis (about 64% of total subwatershed) is already the most heavily mined subwatershed in the Lower Peace River watershed. The Payne Creek watershed is similar sized to the Joshua Creek subwatershed and apparently discharges more water during low flows than would be anticipated for a watershed of its size based on a comparison with other Peace River subwatersheds (SWFWMD, 2005; Schreuder, 2006). Because of the relative size of the South Pasture Extension Mine proposed in Payne Creek subwatershed, it is not expected that mining this relatively small percentage of the overall subwatershed would have a measurable additional effect on flows within the subwatershed.

The mining sequence indicates that for the first 20 years of mining operations, mining would occur in the Horse Creek and Peace River at Arcadia subwatersheds concurrently.

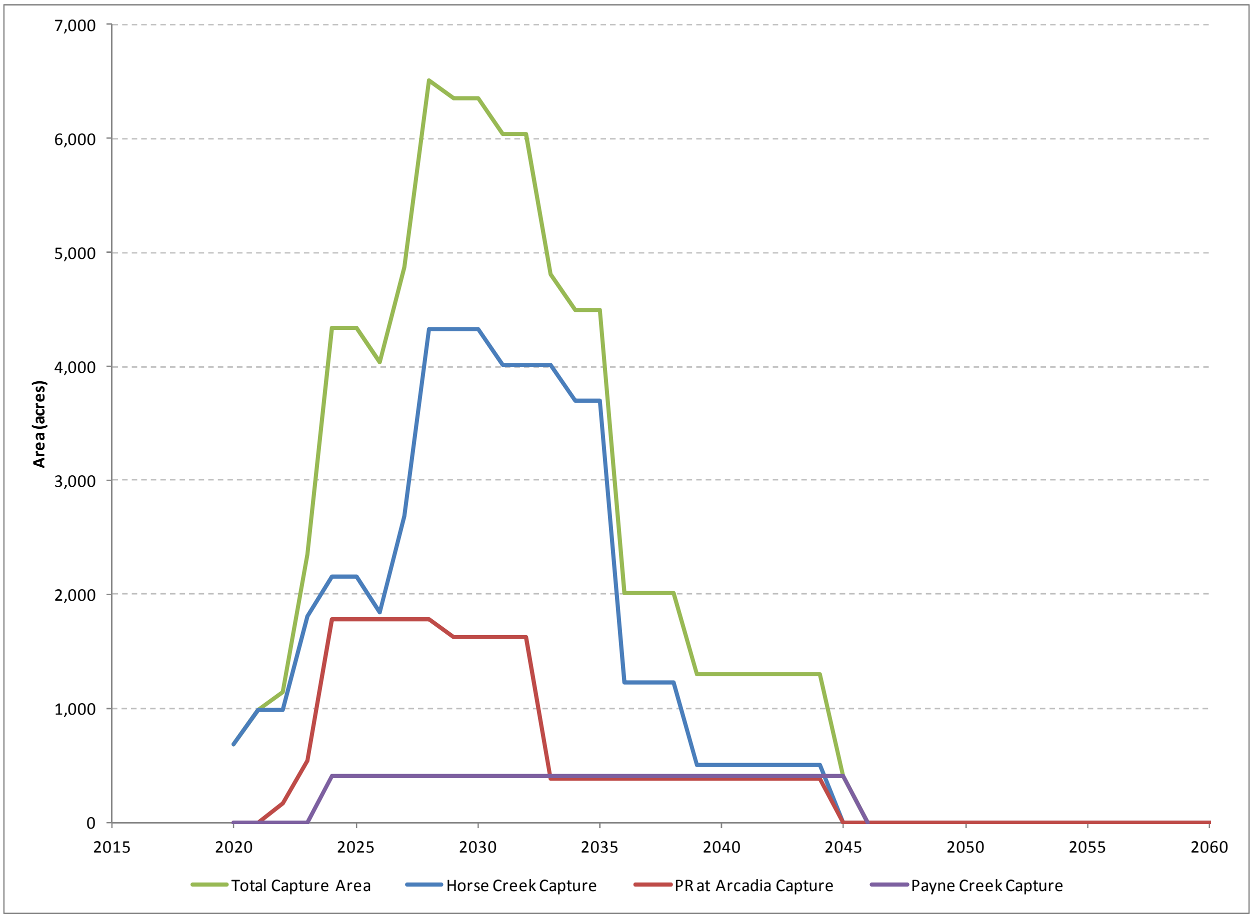


**Figure 4-6. South Pasture Extension Mine Stormwater Capture Area Graph**

#### 4.2.5.2 South Pasture Extension Mine Effects on Horse Creek

Tables 4-31 and 4-32 present the annual average flows and seasonal flows calculated for Horse Creek for an average annual rainfall year with the South Pasture Extension Mine for the 100 percent and 50 percent stormwater capture, respectively. Tables 4-33 and 4-34 present the annual average flows and seasonal flows calculated for a low rainfall year for Horse Creek gage stations with the South Pasture Extension Mine for the 100 percent and 50 percent capture, respectively, for low rainfall conditions.

The largest influence on streamflow from the Horse Creek subwatershed from the mining capture areas of the South Pasture Extension Mine was predicted to show on the graphics in 2030. When considering the condition of 100 percent stormwater capture in 2030, Horse Creek may have an average annual flow of approximately 173 cfs without the South Pasture Extension Mine, and approximately 167 cfs with the South Pasture Extension Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 6 cfs, or 4 percent below the No Action Alternative conditions; and a decrease in flow of approximately 4 cfs, or 3 percent below the calculated 2009 average annual flow of 171 cfs. When considering the 50 percent stormwater capture condition, the annual average flow in Horse Creek may be approximately 168 cfs with the

South Pasture Extension Mine during average rainfall conditions. This corresponds to a decrease in flow of approximately 5 cfs, or 3 percent below the No Action Alternative conditions; and a decrease in flow of approximately 3 cfs, or 2 percent below the calculated 2009 average annual flow.

**Table 4-31. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 172 | 0% | 77 | 0% | 411 | 2% |
| 2030 | 167 | -3% | 75 | -3% | 401 | -1% |
| 2040 | 174 | 2% | 78 | 1% | 418 | 3% |
| 2050 | 175 | 3% | 79 | 2% | 422 | 4% |
| 2060 | 177 | 3% | 79 | 2% | 424 | 5% |

**Table 4-32. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 169 | -1% | 76 | -2% | 404 | 0% |
| 2030 | 168 | -2% | 75 | -3% | 403 | 0% |
| 2040 | 170 | 0% | 77 | -1% | 410 | 1% |
| 2050 | 172 | 1% | 77 | -1% | 413 | 2% |
| 2060 | 173 | 1% | 78 | 0% | 416 | 3% |

The same evaluation was performed for a low rainfall year. Tables 4-33 and 4-34 present the annual average flows and seasonal flows calculated for Horse Creek with the South Pasture Extension Mine for the 100 percent and 50 percent stormwater capture, respectively. When considering the condition of 100 percent capture of stormwater in the mining capture area of the South Pasture Extension Mine, Horse Creek may have an average annual flow of approximately 86 cfs without the South Pasture Extension Mine, and approximately 82 cfs with the South Pasture Extension Mine during low rainfall conditions. This corresponds to a decrease in flow of approximately 5 percent below the No Action Alternative conditions; and a decrease in flow of approximately 2 cfs, or 2 percent of the calculated 2009 average annual flow of 84 cfs. When considering the 50 percent stormwater capture condition (Table 4-34), the annual average flow in Horse Creek was reduced by a proportional percentage.

**Table 4-33. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 84 | 0% | 38 | 0% | 202 | 2% |
| 2030 | 82 | -2% | 37 | -3% | 197 | -1% |
| 2040 | 85 | 2% | 38 | 1% | 205 | 3% |
| 2050 | 86 | 3% | 39 | 2% | 207 | 4% |
| 2060 | 87 | 3% | 39 | 2% | 209 | 5% |

**Table 4-34. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 84 | 0% | 38 | -1% | 202 | 2% |
| 2030 | 83 | -1% | 37 | -2% | 201 | 1% |
| 2040 | 85 | 1% | 38 | 0% | 205 | 3% |
| 2050 | 86 | 2% | 38 | 1% | 206 | 4% |
| 2060 | 86 | 3% | 39 | 1% | 208 | 4% |

### 4.2.5.3 South Pasture Extension Mine Effects on Peace River at Arcadia

Tables 4-35 and 4-36 present the annual average flows and seasonal flows calculated for Peace River at Arcadia with the South Pasture Extension Mine for the 100 percent and 50 percent stormwater capture, respectively.

The largest influence on streamflow from the Peace River at Arcadia subwatershed from the mining capture areas of the South Pasture Extension Mine was predicted to occur around 2030. However, the impact to annual average flow from the Peace River at Arcadia subwatershed during average rainfall conditions was minimal and likely not detectable because of the small area being impacted in the Peace River at Arcadia subwatershed. When considering the condition of 100 percent capture of stormwater in the mining capture area of the South Pasture Extension Mine, Peace River at Arcadia may have an average annual flow of approximately 738 cfs without the South Pasture Extension Mine in 2030, and approximately the same flow with the South Pasture Extension Mine during average rainfall conditions in the same years. These are identical to the flows predicted for the No Action Alternative. This predicted flow is an increase in flow of approximately 25 cfs, or 3 percent above the calculated 2009 average annual flow of 713 cfs. Flow increases from the 2009 levels can be attributed to predicted changes in land uses in this subwatershed. The 50 percent capture scenario also has a negligible effect in this subwatershed.

**Table 4-35. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 726 | 2% | 332 | 1% | 1,702 | 3% |
| 2030 | 738 | 3% | 336 | 3% | 1,740 | 5% |
| 2040 | 754 | 6% | 343 | 5% | 1,785 | 8% |
| 2050 | 772 | 8% | 351 | 7% | 1,829 | 10% |
| 2060 | 783 | 10% | 355 | 8% | 1,858 | 12% |

**Table 4-36. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 725 | 2% | 332 | 1% | 1,700 | 3% |
| 2030 | 737 | 3% | 335 | 2% | 1,741 | 5% |
| 2040 | 754 | 6% | 342 | 5% | 1,784 | 8% |
| 2050 | 771 | 8% | 350 | 7% | 1,827 | 10% |
| 2060 | 782 | 10% | 355 | 8% | 1,856 | 12% |

The same evaluation was performed for a low rainfall year. Tables 4-37 and 4-38 present the annual average flows and seasonal flows calculated for a low rainfall year with the South Pasture Extension Mine for the 100 percent and 50 percent stormwater capture, respectively. Changes in flows are indistinguishable from the No Action Alternative.

**Table 4-37. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 337 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 342 | 4% | 156 | 3% | 806 | 5% |
| 2040 | 350 | 6% | 159 | 5% | 827 | 8% |
| 2050 | 358 | 9% | 163 | 7% | 848 | 11% |
| 2060 | 363 | 10% | 165 | 9% | 862 | 13% |

**Table 4-38. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the South Pasture Extension Mine**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 336 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 342 | 4% | 156 | 2% | 806 | 5% |
| 2040 | 350 | 6% | 159 | 5% | 827 | 8% |
| 2050 | 358 | 8% | 163 | 7% | 847 | 11% |
| 2060 | 363 | 10% | 165 | 8% | 861 | 12% |

#### 4.2.5.4 South Pasture Extension Mine: Degree and Significance of Surface Water Resource Effects

While the flow rate from mining is projected to decrease up to 3 percent for the Horse Creek subwatershed during an average rainfall year or a low rainfall year in the dry season with a 100 percent capture area, the decrease in flow rates falls within the accuracy range for this analysis which is based on an extremely variable parameter (rainfall). The reduction in flows within Horse Creek may be indicative of a change at the Horse Creek subwatershed level; therefore, the effect cannot be considered minor. For a major effect, there must be an extended effect on surface water flows at least at the subwatershed level that also leads to a violation of the MFLs for the subwatershed. In addition to the potential reductions being within one order of significant figures, there are no SWFWMD MFLs established for Horse Creek to which the flow reduction can be compared. For this reason (no contribution to a violation of MFLs for Horse Creek and a change in stream flow rates that falls within the accuracy range), the effect on surface water flows within Horse Creek cannot be considered to have a major effect. The apparent reduction in flow is indicative of a change beyond the boundaries of the mine within the Horse Creek subwatershed even though the degree may be within the realm of natural variation. Therefore, the effects would be moderate without mitigation within the Horse Creek subwatershed but reduced to minor with mitigation. Given the moderate level of an effect for this mine within the watershed, the effect is expected to be significant without mitigation and not significant with mitigation.

Possible measures that would reduce the moderate degree of effect, mitigate the intensity factors, and potentially make the effects not significant include recharge ditches and wells to maintain base flow in Horse Creek and its tributaries, or reducing the capture area. There are also monitoring program and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to the creek, the Applicants would need to address those impacts.

The effects within the Payne Creek and Peace River at Arcadia subwatersheds are minor to no effect and are not considered significant.

The individual effect of the South Pasture Extension Mine on the Peace River watershed and on Charlotte Harbor is none to minor, which is not significant. The moderate (without mitigation) degree of effect on Horse Creek and minor degree of effect on the Peace River at Arcadia and Payne Creek are overwhelmed at this scale by the contributions of other tributaries, and over time by the predicted increases in flow due to changes in land use. These effects are described further in the No Action Alternative section above (4.2.1) and in the surface water resources cumulative effects section (4.12.2).

### 4.2.6 Alternative 6: Pine Level/Keys Tract

The Pine Level/Keys Tract is in the Lower Myakka/Big Slough subwatershed (84% - 20,727 acres) of the Lower Myakka River watershed, the Upper Myakka River subwatershed (2% - 499 acres), and the Horse Creek subwatershed (14% - 3,484 acres). This site was identified by Mosaic as a future mine extension to the Desoto Mine; however, this mine is also a potential offsite alternative to the Applicants' Preferred Alternatives and was evaluated as an individual alternative in this section. Under cumulative impact analysis presented in Section 4.12.2, the Pine Level/Keys Tract is considered a reasonably foreseeable action. For the purpose of the description of impacts presented in this section, where the Pine Level/Keys Tract is a stand-alone alternative to the Applicants' Preferred Alternatives, this mine would require construction of an initial CSA, a beneficiation plant, and initial mine infrastructure corridors. The start date of mining was assumed to be 2025, mining would continue into mine year 32 (2057) and reclamation would continue until approximately mine year 40 (2065).

The capture area curve for the Pine Level/Keys Tract Mine site is presented in Figure 4-7 and reflects the gradual increase in acreage included in the recirculation system boundary over the roughly 32-year period of active mining, with a gradual return of lands to contribute to downstream flows as reclamation rates exceed the mining rates and result in a net decrease in the capture area acreages. On the basis of this analysis, the peak years of capture are predicted to occur toward the end of the period of matrix extraction, after which reclamation and land release would gradually return the full mine footprint to contributing runoff to downstream waters. The Lower Myakka/Big Slough subwatershed drains toward the City of North Port and Myakkahatchee Creek, which joins the Myakka River very near where it flows into Charlotte Harbor. Therefore, this mine's drainage area would not influence flows in the Myakka River except as they contribute to Charlotte Harbor (for the cumulative effect analysis in Section 4.12).

#### 4.2.6.1 Pine Level/Keys Tract Effects on Upper Myakka River

The Pine Level/Keys Tract's potential impacts on the Upper Myakka River subwatershed were not calculated because of the very small size of the mine (approximately 499 acres) in this subwatershed. It is not expected that mining this relatively small percentage of the overall subwatershed would have a measurable effect on flows within the subwatershed.

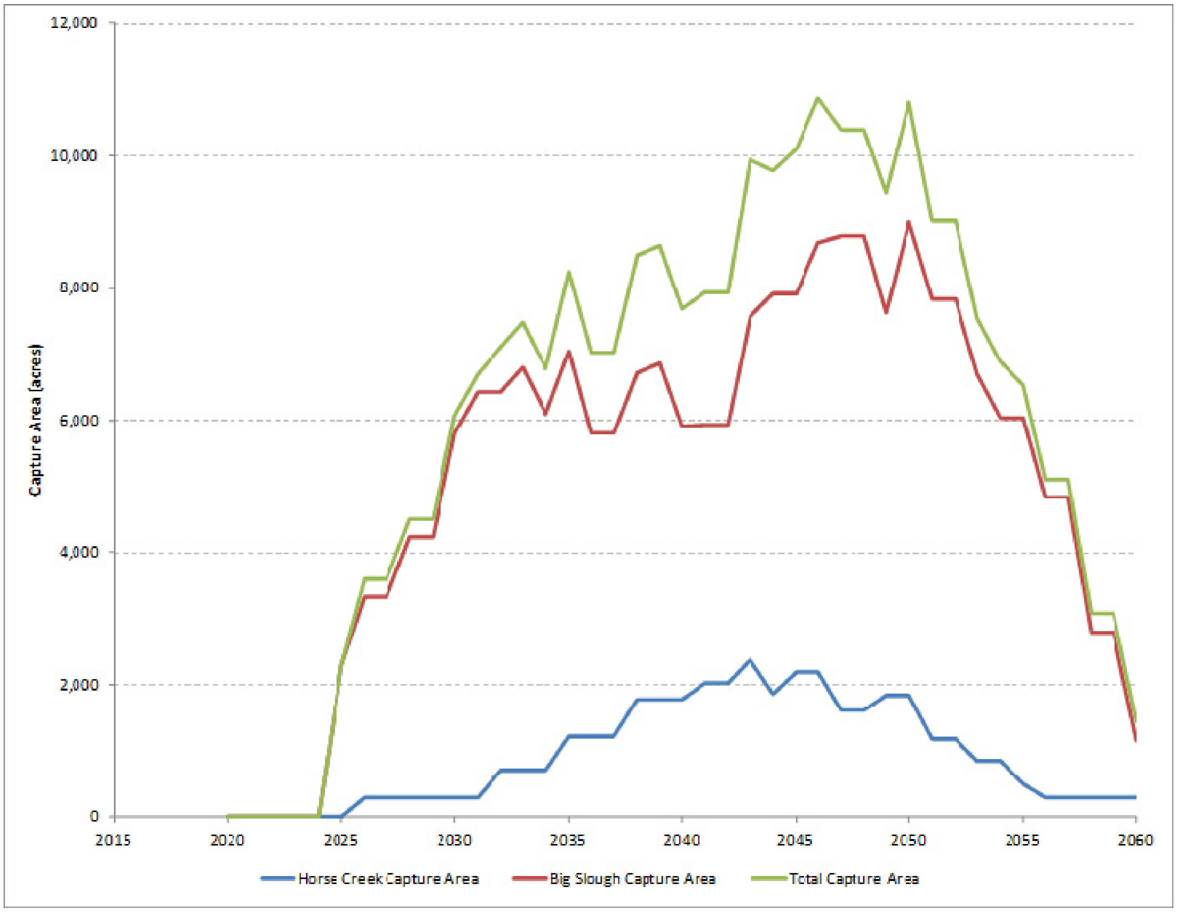


**Figure 4-7. Pine Level/Keys Tract Mine Stormwater Capture Area Graph**

#### 4.2.6.2 Pine Level/Keys Tract Effects on Lower Myakka/Big Slough

Tables 4-39 and 4-40 present the annual average and seasonal flow rates calculated for an average annual rainfall for the Lower Myakka/Big Slough subwatershed with the Pine Level/Keys Tract for the 100 percent and 50 percent stormwater capture, respectively. Tables 4-41 and 4-42 present the annual average and seasonal flow rates calculated for a low annual rainfall for the Lower Myakka/Big Slough subwatershed with the Pine Level/Keys Tract for the 100 percent and 50 percent stormwater capture, respectively.

The largest influence on streamflow on the Lower Myakka/Big Slough subwatershed from the mining capture areas of the Pine Level/Keys Tract alternative was predicted to occur in approximately 2050 based on the capture graph. When considering the most conservative capture condition, 100 percent stormwater capture, the Lower Myakka/Big Slough subwatershed may have an average annual flow of approximately 217 cfs without the Pine Level/Keys Tract, and approximately 203 cfs with the Pine Level/Keys Tract during average rainfall conditions. This corresponds to a decrease in flow of approximately 14 cfs, or 6 percent below the No Action Alternative conditions as well as the calculated 2009 average annual flow of 217 cfs. When considering the 50 percent capture condition, the annual average flow from the Upper Myakka River subwatershed may be approximately 210 cfs with the Pine Level/Keys Tract during average rainfall conditions. This corresponds to a decrease in flow of approximately 7 cfs, or 3 percent below the No Action Alternative conditions as well as the calculated 2009 average annual flow. Unlike the other alternatives studied, there is no change in the annual flow rates predicted over time in Lower Myakka/Big Slough in this analysis because, unlike the other subwatersheds, there were no resulting changes to future land use. There was no projected increase in urbanization or other mines that would be reclaimed in the upper reaches of the subwatershed. As the mines are reclaimed, the flows return to near pre-mining conditions.

**Table 4-39. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture in Lower Myakka/Big Slough Watershed with the Pine Level/Keys Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 217 | 0% | 117 | 0% | 629 | 0% |
| 2020 | 217 | 0% | 117 | 0% | 629 | 0% |
| 2030 | 206 | -5% | 111 | -5% | 596 | -5% |
| 2040 | 207 | -5% | 111 | -5% | 599 | -5% |
| 2050 | 203 | -6% | 109 | -7% | 589 | -6% |
| 2060 | 215 | -1% | 116 | -1% | 623 | -1% |

**Table 4-40. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture in Lower Myakka/Big Slough Subwatershed with the Pine Level/Keys Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 217 | 0% | 117 | 0% | 629 | 0% |
| 2020 | 217 | 0% | 117 | 0% | 629 | 0% |
| 2030 | 212 | -3% | 114 | -3% | 614 | -3% |
| 2040 | 212 | -2% | 113 | -3% | 609 | -2% |
| 2050 | 210 | -3% | 112 | -4% | 601 | -3% |
| 2060 | 216 | <-1% | 116 | <-1% | 626 | <-1% |

The same evaluation was performed for a low rainfall year with similar results. Table 4-41 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 percent capture of stormwater in the capture area of the Pine Level/Keys Tract. Table 4-42 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 50 percent capture of stormwater in the capture area of the Pine Level/Keys Tract. The maximum influence is predicted to occur in approximately 2050 based on the capture analysis. When considering the condition of 100 percent capture of stormwater in the mining capture area of the Pine Level/Keys Tract Mine, Lower Myakka/Big Slough may have an average annual flow of approximately 176 cfs without the Pine Level/Keys Tract Mine, and approximately 165 cfs with the Pine Level/Keys Tract during low rainfall conditions. This corresponds to a decrease by approximately 6 percent by 2050 from the No Action Alternative. When considering the 50 percent stormwater capture condition (Table 4-42), the annual average flow decreases by approximately 2 percent by 2050, less than half of the 100 percent capture scenario from the No Action Alternative or from the 2009 levels.

| Table 4-41. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture in Lower Myakka/Big Slough Subwatershed with the Pine Level/Keys Tract | | | | | | |
|---|---|---|---|---|---|---|
| | **Annual Average Flow (cfs)** | **Annual Average Percent Change from 2009 Flows** | **Dry Season Average Flow (cfs)** | **Dry Season Percent Change from 2009 Flows** | **Wet Season Average Flow (cfs)** | **Wet Season Percent Change from 2009 Flows** |
| 2009 | 176 | 0% | 95 | 0% | 511 | 0% |
| 2020 | 176 | 0% | 95 | 0% | 511 | 0% |
| 2030 | 167 | -5% | 90 | -5% | 484 | -5% |
| 2040 | 168 | -5% | 90 | -5% | 486 | -5% |
| 2050 | 165 | -6% | 89 | -7% | 478 | -6% |
| 2060 | 175 | -1% | 94 | -1% | 506 | -1% |

| Table 4-42. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Lower Myakka/Big Slough Subwatershed with the Pine Level/Keys Tract | | | | | | |
|---|---|---|---|---|---|---|
| | **Annual Average Flow (cfs)** | **Annual Average Percent Change from 2009 Flows** | **Dry Season Average Flow (cfs)** | **Dry Season Percent Change from 2009 Flows** | **Wet Season Average Flow (cfs)** | **Wet Season Percent Change from 2009 Flows** |
| 2009 | 176 | 0% | 95 | 0% | 511 | 0% |
| 2020 | 176 | 0% | 95 | 0% | 511 | 0% |
| 2030 | 172 | -3% | 92 | -3% | 497 | -3% |
| 2040 | 172 | -2% | 92 | -2% | 498 | -2% |
| 2050 | 169 | -4% | 91 | -3% | 494 | -3% |
| 2060 | 175 | -1% | 94 | <-1% | 508 | <-1% |

#### 4.2.6.3 Pine Level/Keys Tract Effect on Horse Creek

Tables 4-43 and 4-44 present the annual average flows and seasonal flows calculated for an average rainfall year with the Pine Level/Keys Tract for the 100 percent and 50 percent stormwater capture, respectively. The largest influence on streamflow on the Horse Creek subwatershed from the mining capture areas of the Pine Level/Keys Tract alternative was predicted to occur between 2040 and 2050 based on the capture graph. When considering the condition of 100 percent stormwater capture between 2040 and 2050, Horse Creek may have an average annual flow of approximately 174 cfs without the Pine

Level/Keys Tract, and approximately 173 cfs with the Pine Level/Keys Tract during average rainfall conditions. This corresponds to a decrease in flow of approximately 1 cfs, or less than 1 percent below the No Action Alternative conditions; and an increase in flow of approximately 2 cfs, or 1 percent above the calculated 2009 average annual flow of 171 cfs. Flow increases from the 2009 levels can be attributed to predicted changes in land uses in this subwatershed. The 50 percent capture scenario also has a negligible effect in this subwatershed.

**Table 4-43. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture in Horse Creek with the Pine Level/Keys Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 173 | 1% | 78 | 0% | 413 | 2% |
| 2030 | 173 | 1% | 78 | 0% | 416 | 3% |
| 2040 | 172 | 1% | 77 | <1% | 414 | 2% |
| 2050 | 173 | 1% | 78 | 0% | 417 | 3% |
| 2060 | 176 | 3% | 79 | 2% | 424 | 5% |

**Table 4-44. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture in Horse Creek with the Pine Level/Keys Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 173 | 1% | 78 | 0% | 413 | 2% |
| 2030 | 173 | 1% | 78 | 0% | 416 | 3% |
| 2040 | 173 | 1% | 78 | 0% | 417 | 3% |
| 2050 | 174 | 2% | 78 | <1% | 419 | 4% |
| 2060 | 176 | 3% | 79 | 2% | 424 | 5% |

The same evaluation was performed for a low rainfall year. Tables 4-45 and 4-46 present the annual average flows and seasonal flows calculated for a low rainfall year with the Pine Level/Keys Tract for the 100 percent and 50 percent stormwater capture, respectively. Changes in flows are insignificantly different from the No Action Alternative (1 cfs or less).

**Table 4-45. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture in Horse Creek with the Pine Level/Keys Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 85 | 1% | 38 | 0% | 203 | 2% |
| 2030 | 85 | 1% | 38 | 0% | 204 | 3% |
| 2040 | 85 | 1% | 38 | 0% | 204 | 2% |
| 2050 | 85 | 1% | 38 | 0% | 205 | 3% |
| 2060 | 87 | 3% | 39 | 2% | 208 | 5% |

**Table 4-46. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent in Horse Creek with the Pine Level/Keys Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 85 | 1% | 38 | 0% | 203 | 2% |
| 2030 | 85 | 1% | 38 | 0% | 204 | 3% |
| 2040 | 85 | 1% | 38 | 0% | 205 | 3% |
| 2050 | 86 | 2% | 39 | 1% | 206 | 4% |
| 2060 | 87 | 3% | 39 | 2% | 208 | 5% |

#### 4.2.6.4 Pine Level/Keys Tract: Degree and Significance of Surface Water Resource Effects

Within the Lower Myakka/Big Slough subwatershed, while the flow rate from mining is projected to decrease up to 7 percent in 2050 during the dry seasonal flow with a 100 percent capture area regardless of the rainfall levels, the decrease in flow rates falls within the error range for this analysis which is based on an extremely variable parameter (rainfall). The reduction in flows within Lower Myakka/Big Slough subwatershed may be indicative of a change at the Lower Myakka/Big Slough subwatershed level; therefore, the effect cannot be considered minor. For a major effect, there must be an extended effect on surface water flows at least at the subwatershed level that also leads to a violation of the MFLs for the subwatershed. In addition to the potential reductions being within one order of significant figures, there are no SWFWMD MFLs established for Lower Myakka/Big Slough subwatershed to which flow reductions can be compared. For this reason (no contribution to a violation of MFLs for Lower Myakka/Big Slough and a change in stream flow rates that falls within the expected error range), the effect on surface water flows within Lower Myakka/Big Slough subwatershed cannot be considered to have a major effect. The apparent reduction in flow is indicative of a change beyond the boundaries of the mine within the Lower Myakka/Big Slough subwatershed even though the degree may be within the realm of natural variation. Therefore, the effects would be moderate without mitigation within the Lower Myakka/Big Slough subwatershed. Given the moderate level of an effect for this mine within the watershed, the effect is expected to be significant.

For the Horse Creek subwatershed, the maximum predicted impacts on flow rate from mining are decreases of less than 1 percent in 2040 during the dry seasonal flow in an average rainfall year with a 100 percent capture area, and less than 1 percent in 2050 during the dry seasonal flow in an average rainfall year with a 50 percent capture area. Flow increases from the 2009 levels predicted at the end of the temporal scope of the analysis can be attributed to predicted changes in land uses in this subwatershed and they exceed reductions predicted for this alternative's impact in Horse Creek. Although measurable, the adverse effects are at a very low level, and therefore are determined to be minor and not significant

The effect within the Upper Myakka subwatershed is a minor to no effect and is not considered significant. The individual effect of mining the Pine Level/Keys Tract on the Myakka River and Peace River watersheds and on Charlotte Harbor is none to minor, which is not significant. The moderate (without mitigation) degree of effect on Lower Myakka/Big Slough and Horse Creek and minor degree of effect on the Upper Myakka River are overwhelmed at this scale by the contributions of other tributaries, and over time by the predicted increases in flow due to changes in land use. These effects are described further in the No Action Alternative section above (4.2.1) and in the surface water resources cumulative effects section (Section 4.12.2).

Possible measures that would reduce the moderate degree of effect, mitigate the intensity factors, and potentially make the effects not significant include recharge ditches and wells to maintain base flow in the Lower Myakka/Big Slough and Horse Creek subwatersheds and their tributaries, or reducing the capture area within the two subwatersheds. There are also monitoring programs and other provisions in FDEP mining permits. If it were determined through monitoring that there were unanticipated impacts in either subwatershed, the Applicants would need to address those impacts.

### 4.2.7 Alternative 7: Pioneer Tract

The Pioneer Tract is in the Horse Creek subwatershed (43% - 10,824 acres) and the Peace River at Arcadia subwatershed (57% - 14,426 acres). This site was identified by Mosaic as a future mine extension to the Ona Mine; however, this mine is also a reasonable alternative to the Applicants' Preferred Alternatives and will be evaluated as an individual alternative in this section. Under cumulative impact analysis presented in Section 4.12, the Pioneer Tract is considered a reasonably foreseeable action. For the purpose of the description of impacts presented in this section, where the Pioneer Tract is a standalone alternative to the Applicants' Preferred Alternatives, this mine would require construction of an initial CSA, a beneficiation plant, and initial mine infrastructure corridors. The start date of mining was assumed to be 2025, mining would continue into mine year 32 (2057) and reclamation would continue until approximately mine year 40 (2065).

The capture area curve for the Pioneer Tract Mine site is presented In Figure 4-8 and reflects the gradual increase in acreage included in the recirculation system boundary over the roughly 32-year period of active mining, with a gradual return of lands to contribute to downstream flows as reclamation rates exceed the mining rates and result in a net decrease in the capture area acreages. As with the previous alternatives where the footprint lies in different subwatersheds, the analysis provides the results by subwatershed. The impacts of this alternative on surface water runoff potential were calculated by evaluating the change to the runoff coefficients in the Horse Creek and the Peace River at Arcadia subwatersheds. On the basis of this analysis, the peak years of capture are predicted to occur toward the end of the period of matrix extraction, after which reclamation and land release would gradually return the full mine footprint to contributing runoff to downstream waters.

#### 4.2.7.1 Pioneer Tract Effects on Horse Creek

Tables 4-47 and 4-48 present the annual average and seasonal flow rates calculated for Horse Creek with Pioneer Mine for an average rainfall year for the 100 percent and 50 percent stormwater capture, respectively. Tables 4-49 and 4-50 present the annual average and seasonal flow rates calculated for Horse Creek with Pioneer Mine for a low rainfall year for the 100 percent and 50 percent stormwater capture, respectively.

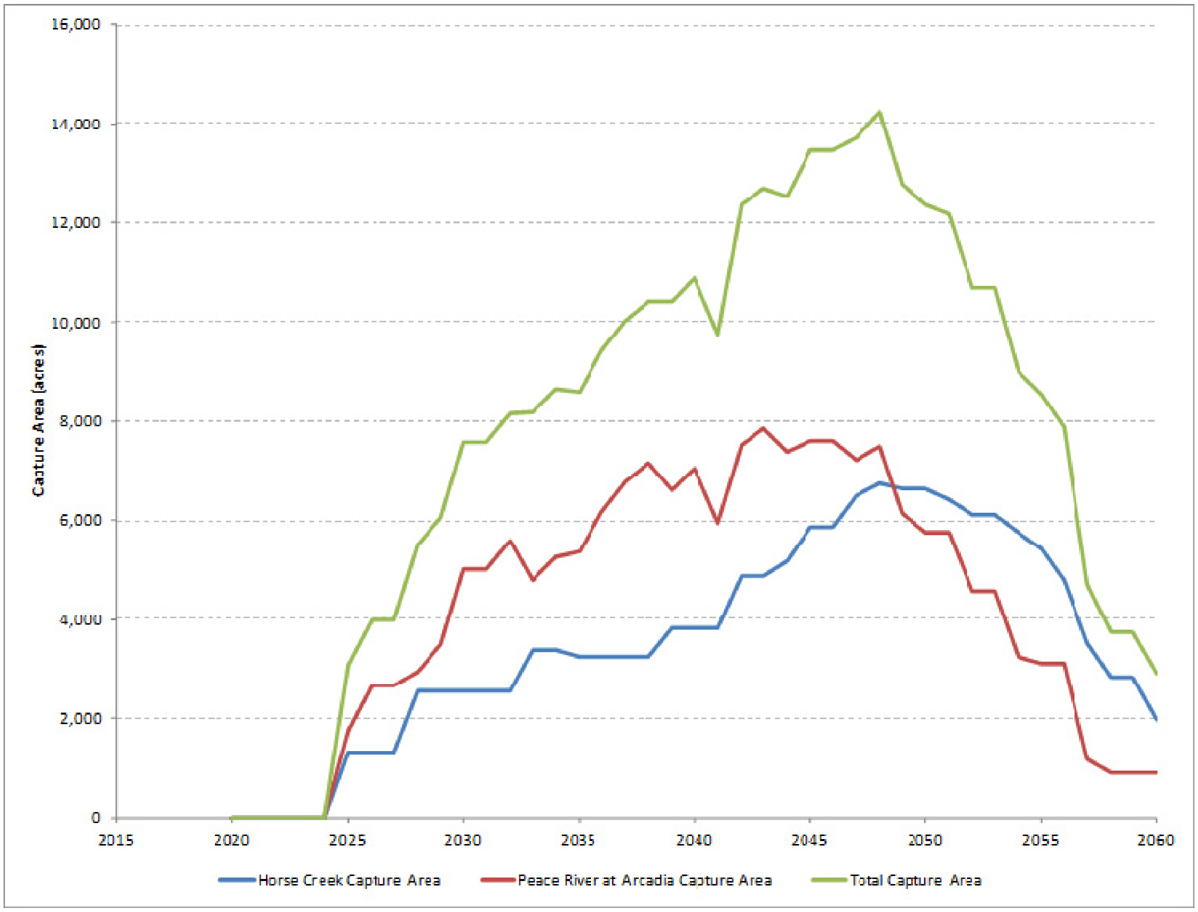


**Figure 4-8. Stormwater Capture Area Graph for a Conceptual Pioneer Tract**

| Table 4-47. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the Pioneer Tract | | | | | | |
|---|---|---|---|---|---|---|
| | **Annual Average Flow (cfs)** | **Annual Average Percent Change from 2009 Flows** | **Dry Season Average Flow (cfs)** | **Dry Season Average Percent Change from 2009 Flows** | **Wet Season Average Flow (cfs)** | **Wet Season Average Percent Change from 2009 Flows** |
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 173 | 1% | 78 | 0% | 413 | 2% |
| 2030 | 170 | -1% | 76 | -2% | 408 | 1% |
| 2040 | 169 | -1% | 76 | -2% | 407 | 1% |
| 2050 | 165 | -3% | 74 | -4% | 400 | -1% |
| 2060 | 174 | 2% | 78 | 1% | 418 | 3% |

**Table 4-48. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the Pioneer Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 173 | 1% | 78 | 0% | 413 | 2% |
| 2030 | 172 | <1% | 77 | -1% | 412 | 2% |
| 2040 | 172 | 1% | 77 | -1% | 413 | 2% |
| 2050 | 171 | 0% | 77 | -1% | 411 | 2% |
| 2060 | 175 | 2% | 79 | 1% | 421 | 4% |

**Table 4-49. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with the Pioneer Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 85 | 1% | 38 | 0% | 203 | 2% |
| 2030 | 83 | -1% | 38 | -2% | 201 | 1% |
| 2040 | 83 | -1% | 37 | -2% | 200 | 1% |
| 2050 | 82 | -3% | 37 | -4% | 197 | -1% |
| 2060 | 85 | 2% | 38 | 1% | 205 | 3% |

**Table 4-50. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with the Pioneer Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 85 | 1% | 38 | 0% | 203 | 2% |
| 2030 | 84 | 0% | 38 | <-1% | 203 | 2% |
| 2040 | 84 | <1% | 38 | <-1% | 203 | 2% |
| 2050 | 84 | 0% | 38 | <-1% | 202 | 2% |
| 2060 | 86 | 2% | 39 | 1% | 207 | 4% |

The largest influence on streamflow from the Horse Creek subwatershed from the mining capture areas of the Pioneer Tract in the Horse Creek subwatershed was predicted to occur in approximately 2050 based on the capture graph. When considering the most conservative runoff capture condition, 100 percent stormwater capture, in 2050 Horse Creek may have an average annual flow of approximately 175 cfs without the Pioneer Tract, and approximately 165 cfs with the Pioneer Tract during average rainfall conditions. This corresponds to a decrease in flow of approximately 10 cfs, or 6 percent below the No Action Alternative conditions; and a decrease in flow of approximately 6 cfs, or 3 percent below the calculated 2009 average annual flow of 171 cfs. When considering the 50 percent stormwater capture condition, the annual average flow in Horse Creek may be approximately 171 cfs with the Pioneer Tract during average rainfall conditions. This corresponds to a decrease in flow of approximately 4 cfs, or 2 percent below the No Action Alternative conditions; and about the same flow as the calculated 2009 average annual flow. Flow increases from the 2009 levels can be attributed to predicted changes in land uses in areas of this subwatershed. Flow is expected to return to near No Action Alternative conditions by 2060 and is slightly higher than 2009 flow because changes to land use outweigh the effects of mining.

The same evaluation was performed for a low rainfall year. Tables 4-49 and 4-50 present the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 and 50 percent capture of stormwater in the capture area of the Pioneer Tract at the Horse Creek flow station, respectively. Similar to the average rainfall conditions evaluation, annual average flow does not change by much. The average annual flow for the 100 percent capture scenario with an average annual rainfall decreases by approximately 3 percent by 2050 when compared to 2009 flows. The flows recover after 2050 to a level that is higher than the 2009 levels resulting from land use change. All differences in this case are only a few cfs. Considering the low rainfall year with a capture area of 50 percent and the changes are negligible.

#### 4.2.7.2 Pioneer Tract Effects on Peace River at Arcadia

Tables 4-51 and 4-52 present the annual average flows and seasonal flow rates calculated in an average rainfall year for Peace River at Arcadia gage stations with the Desoto Mine for the 100 percent and 50 percent stormwater capture, respectively. Tables 4-53 and 4-54 present the annual average flows and seasonal flow rates calculated in a low rainfall year for Peace River at Arcadia gage stations with the Desoto Mine for the 100 percent and 50 percent stormwater capture, respectively.

The largest influence on streamflow from the Peace River at Arcadia subwatershed from the mining capture areas of the Pioneer Tract was predicted to occur on 2040. When considering the condition of 100 percent stormwater capture, Peace River at Arcadia may have an average annual flow of approximately 754 cfs without the Pioneer Tract in 2040, and approximately 749 cfs with the Pioneer Tract during average rainfall conditions in the same year (Table 4-36). This corresponds to a decrease in flow of approximately 5 cfs, or less than 1 percent below the No Action Alternative conditions; and an increase in flow of approximately 36 cfs, or 5 percent above the calculated 2009 average annual flow. When considering the 50 percent stormwater capture condition, the results are very similar to those estimated under the 100 percent capture conditions (Table 4-37). The impact to annual average flow from the Peace River at Arcadia subwatershed during average rainfall conditions was minimal and likely not detectable because although the acreage of the mining (over 14,000 acres) within the subwatershed is large, a comparatively small area of the subwatershed is impacted and the flow within the subwatershed is high. Comparing this mine to the Desoto Mine in the Horse Creek subwatershed illustrates that point. The Desoto Mine has a similar acreage (15,993 versus 14,426), while the subwatershed flow in the Horse Creek is 171 cfs compared to 713 cfs for Peace River at Arcadia based on the 2009 levels, yet the Desoto Mine had no more than about a 9 cfs change. Based on land use changes within the subwatershed and upstream subwatersheds, flows are predicted to increase during the Pioneer Tract mining period in excess of the effect observed by mining.

**Table 4-51. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the Pioneer Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 726 | 2% | 332 | 1% | 1,702 | 3% |
| 2030 | 734 | 3% | 334 | 2% | 1,734 | 5% |
| 2040 | 749 | 5% | 340 | 4% | 1,773 | 7% |
| 2050 | 768 | 8% | 348 | 6% | 1,818 | 10% |
| 2060 | 782 | 10% | 355 | 8% | 1,856 | 12% |

**Table 4-52. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the Pioneer Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 726 | 2% | 332 | 1% | 1,702 | 3% |
| 2030 | 736 | 3% | 335 | 2% | 1,738 | 5% |
| 2040 | 752 | 5% | 341 | 4% | 1,779 | 7% |
| 2050 | 770 | 8% | 349 | 7% | 1,824 | 10% |
| 2060 | 783 | 10% | 355 | 8% | 1,857 | 12% |

The same evaluation was performed for a low rainfall year. Flows are predicted to decrease by less than one percent from the No Action Alternative by 2040. Annual average flow increases by approximately 5 percent by 2040 from 2009 levels. Under the 50 percent capture scenario, the difference from the 100 percent results is inconsequential.

**Table 4-53. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with the Pioneer Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 337 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 340 | 3% | 155 | 2% | 803 | 5% |
| 2040 | 347 | 5% | 158 | 4% | 822 | 7% |
| 2050 | 357 | 8% | 162 | 7% | 845 | 10% |
| 2060 | 363 | 10% | 165 | 8% | 861 | 12% |

**Table 4-54. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with the Pioneer Tract**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 337 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 341 | 3% | 155 | 2% | 805 | 5% |
| 2040 | 349 | 6% | 158 | 4% | 825 | 8% |
| 2050 | 358 | 8% | 162 | 7% | 846 | 11% |
| 2060 | 363 | 10% | 165 | 9% | 861 | 12% |

#### 4.2.7.3 Pioneer Tract: Degree and Significance of Surface Water Resource Effects

While the flow rate from mining in the Horse Creek subwatershed is projected to decrease up to 4 percent in 2050 from the seasonal dry flows with a 100 percent capture area for the average annual rainfall, the decrease in flow rates falls within the error range for this analysis which is based on an extremely variable parameter (rainfall). The reduction in flows within Horse Creek may be indicative of a change at the Horse Creek subwatershed level; therefore, the effect cannot be considered minor. For a major effect, there must be an extended effect on surface water flows at least at the subwatershed level that also leads to a violation of the MFLs for the subwatershed. In addition to the potential reductions being within one order of significant figures, there are no SWFWMD MFLs established for Horse Creek to which flow reductions can be compared. For this reason (no contribution to a violation of MFLs for Horse Creek and a change in stream flow rates that falls within the expected error range), the effect on surface water flows within Horse Creek cannot be considered to have a major effect. The apparent reduction in flow is indicative of a change beyond the boundaries of the mine within the Horse Creek subwatershed even though the degree may be within the realm of natural variation. Therefore, the effects would be moderate without mitigation within the Horse Creek subwatershed and minor with mitigation. Given the moderate level of an effect for this mine within the watershed, the effect is expected to be significant without mitigation but not significant with mitigation.

Possible measures that would reduce the moderate degree of effect, mitigate the intensity factors, and potentially make the effects not significant include recharge ditches and wells to maintain base flow in Horse Creek and its tributaries, or reducing the capture area. There are also monitoring program and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to the creek, the Applicants would need to address those impacts.

The effects within the Peace River at Arcadia subwatershed are minor to no effect and are not considered significant.

The individual effect of mining the Pioneer Tract on the Peace River watershed and on Charlotte Harbor is none to minor, which is not significant. The moderate (without mitigation) degree of effect on Horse Creek and minor degree of effect on the Peace River at Arcadia are overwhelmed at this scale by the contributions of other tributaries, and over time by the predicted increases in flow due to changes in land use. These effects are described further in the No Action Alternative section above (4.2.1) and in the surface water resources cumulative effects section (Section 4.12.2).

### 4.2.8 **Alternative 8: Site A-2**

Approximately 8,125 acres of Site A-2 is mapped within the Peace River at Zolfo Springs subwatershed. An additional 64 acres is mapped within the Charlie Creek subwatershed. The area mapped within the Charlie Creek subwatershed may be attributed to mapping inaccuracy, so the entire parcel will be considered within the Peace River at Zolfo Springs subwatershed. This section qualitatively describes the potential impact associated with mining Site A-2, based on the parcel having conditions affecting surface water contributions that are similar to those existing on the other offsite alternative parcels. No applicant has proposed mining Site A-2, and therefore there is not enough information available to perform a quantitative analysis.

The area of Site A-2 within the Peace River at Zolfo Springs subwatershed lies within the size range of other alternatives' acreages within the Horse Creek subwatershed, with the exception of the small portion of Wingate East within that subwatershed. As described in the sections above, each of those alternatives (except Wingate East) were predicted to have an adverse effect on flows in Horse Creek, with degrees of impact being moderate.

#### 4.2.8.1 Site A-2: Degree and Significance of Surface Water Resource Effects

Based on the above analysis, it is reasonable to predict that mining Site A-2 would have at least a moderate adverse effect on the Peace River at Zolfo Springs subwatershed without mitigation and minor with mitigation. Given the moderate level of an effect for this mine within the watershed, the effect is expected to be significant without mitigation and not significant when mitigation is considered.

Possible measures that would reduce the moderate degree of effect, mitigate the intensity factors, and potentially make the effects not significant include recharge ditches and wells to maintain base flow in the Peace River at Zolfo Springs and its tributaries, or reducing the capture area. There are also monitoring program and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to the streams, the Applicants would need to address those impacts.

The individual effect of mining Site A-2 on the Peace River watershed and on Charlotte Harbor is none to minor, which is not significant. The moderate (without mitigation) degree of effect on the Peace River at Zolfo Springs is overwhelmed at this scale by the contributions of other tributaries, and over time by the predicted increases in flow due to changes in land use. These effects are described further in the No Action Alternative section above (4.2.1) and in the surface water resources cumulative effects section (4.12.2).

### 4.2.9 Alternative 9: Site W-2

Approximately 9,719 acres of Site W-2 is mapped within Upper Myakka River subwatershed. This section qualitatively describes the potential impact associated with mining Site W-2, based on the parcel having conditions affecting surface water contributions that are similar to those existing on the other offsite alternative parcels. No applicant has proposed mining Site W-2, and therefore there is not enough information available to perform a quantitative analysis.

The area of Site W-2 within the Upper Myakka River subwatershed is roughly half the size of the Ona Mine (17,242 acres) within the Horse Creek subwatershed and is nearly three times as large as the Wingate East Extension (3,280 acres) within the Upper Myakka River Watershed. The Upper Myakka River subwatershed has approximately 142 percent of the stream flow as the Horse Creek subwatershed.

#### 4.2.9.1 Site W-2: Degree and Significance of Surface Water Resource Effects

The larger Ona Mine in the smaller Horse Creek subwatershed was predicted to have at most a 13 cfs decrease in flow based on the most conservative analysis resulting in a moderate impact without mitigation. The effect of the Wingate East Extension to downstream flow was considered to have little change. Therefore, it is reasonable to predict that the Site W-2 would have a minor effect, but could at most have a moderate effect on the Upper Myakka River subwatershed by reducing downstream flows without mitigation. If an application was submitted to mine Site W-2, a more detailed analysis would need to be performed to determine the actual potential level of effect.

Possible measures that would reduce the moderate degree of effect, mitigate the intensity factors, and potentially make the effects not significant include recharge ditches and wells to maintain base flow in the Upper Myakka River and its tributaries, or reducing the capture area. There are also monitoring program and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to the streams, the Applicants would need to address those impacts.

The individual effect of mining Site W-2 on the Myakka River watershed and on Charlotte Harbor is none to minor, which is not significant. A moderate (without mitigation) degree of effect on the Upper Myakka River is overwhelmed at this scale by the contributions of other tributaries, and over time by the predicted increases in flow due to changes in land use. These effects are described further in the No Action Alternative section above (4.2.1) and in the surface water resources cumulative effects section (4.12;2).

## 4.3 GROUNDWATER RESOURCES

The geographic scope of the evaluation of the direct and indirect impacts on groundwater resources is regional, extending beyond the boundaries of the individual alternatives and in some cases even beyond the boundaries of the CFPD, as shown in the modeling results presented in this chapter. The potential environmental consequences from phosphate mining must examine potential impacts to the surficial, intermediate, and Floridan aquifers. Chapter 3 provides a discussion of aquifer systems. The mining industry's groundwater withdrawals cause drawdown of the FAS, which could result in impacts in the form of increased saltwater intrusion, reduced groundwater contributions to regional river flows, and associated net impacts on regional water supply interests of potable water suppliers or others reliant on the Floridan aquifer for water supply purposes. These effects could be direct or indirect effects associated with a single mine, or cumulative effects associated with multiple mines, or multiple mines plus other water users.

A groundwater flow model was developed to support AEIS evaluations of the potential water level changes resulting from the No Action alternative and the Applicants' Preferred Alternatives. The model simulates the effects of pumping the Floridan aquifer on groundwater levels in the surficial aquifer system (SAS), permeable Zone 1 of the Intermediate Aquifer System (IAS Zone 1), permeable Zone 2 of the

Intermediate Aquifer System (IAS Zone 2), and Upper Floridan aquifer (UFA). The model was based on the SWFWMD District-Wide Regulatory Model Version 2.1 (DWRM2.1), which is a MODFLOW model (Harbaugh et al., 2000) used by SWFWMD to conduct groundwater resource evaluations and specifically support its water supply permitting and planning decisions. The simulated water level change is presented using 85 Regional Observation Monitoring Well Program (ROMP) monitor wells that are within the model domain and represent a good distribution across the study area in each of the aquifer zones of interest (i.e. SAS, IAS, and UFA).

The SWFWMD has established a Saltwater Intrusion Minimum Aquifer Level (SWIMAL) for the Southern Water Use Caution Area (SWUCA) (SWFWMD, 2002). This level is the "*minimum aquifer level necessary to prevent significant harm caused by saltwater intrusion in the UFA in the SWUCA*." The SWIMAL is calculated each year based on the 10-year average water level in 10 specific SWFWMD monitoring wells in the SWUCA. Each well is assigned a weight based on a GIS analysis performed by the SWFWMD. Because this study evaluated simulated drawdown rather than aquifer levels, the simulated drawdown at each observation well was multiplied by the adjusted SWIMAL weight to obtain a weighted drawdown for the well.

For the No Action Alternative (Alternative 1) and the Applicants' Preferred Alternatives (Alternatives 2, 3, 4, and 5) and for each simulation year analyzed, two predictions were run. For all simulations, water level changes were determined in the SAS, IAS Zone 1, IAS Zone 2, and the UFA ROMP wells. Model simulations were conducted using the permitted drought year annual average allocation rates rather than any projected actual UFA pumpages. The drought year pumping rate is determined using the 2 in 10-year drought event, as defined by SWFWMD. The drought year average was chosen to provide a conservative estimate of water level changes. Agricultural uses remained unchanged for these simulations. A second set of simulations was run for the same conditions except with the 50 million gallons per day (mgd) agricultural reduction included. The offsite alternatives were not included in the modeling because no water supply plans are available.

A more detailed description of model development and the simulations conducted supporting this AEIS is presented in Appendix F. Appendix J provides more information about the evaluation methods for groundwater resource effects. Section 3.3.2 describes the affected environment related to groundwater hydrology, and Section 3.3.7.6 provides information on regional water supply and its relation to groundwater hydrology.

The degree of intensity of impacts for groundwater resources was determined using the following criteria:

- No Impact to Minor: Mine-related dewatering would lower SAS levels on the mine site in the land areas included within the perimeter ditch and berm system. Any impacts to the surficial aquifer would be short-term (months). Water supply withdrawals from the Floridan aquifer would result in insignificant changes to groundwater levels beyond the property boundary at other well users or regulatory monitoring wells.

- Moderate: Mine-related dewatering would lower SAS levels outside of the mine site past the perimeter ditch and berm system. Water level changes in the surficial aquifer must be great enough to change the hydroperiod of nearby wetlands. Any wetland impacts outside of the mine property would be minor and recoverable. Water supply withdrawals from the Floridan aquifer would measurably change the groundwater levels beyond the mine boundaries in other users' wells and would contribute a minor amount of drawdown at any SWUCA monitoring well.
- Major: Mine-related dewatering would lower SAS levels outside of the mine site past the perimeter ditch and berm system. Water level changes in the surficial aquifer must be great enough to change the hydroperiod of nearby wetlands. Impacts are likely to be long-term (5 or more years) leading to changes in both wetland hydroperiod and ecology. Water supply withdrawals from the Floridan aquifer would lower water levels in the aquifer a significant amount, resulting in potential water level changes at any SWUCA monitoring well large enough to impact regional availability of water supply resources.

Without mitigation, the effects of any actions that involve groundwater withdrawals, including the phosphate mining Action Alternatives considered in the Final AEIS, would likely be adverse, have up to a major degree of effect, and be significant. However, permitted groundwater withdrawals are required to avoid, minimize, and offset impacts to groundwater. Also, the analyses of the Action Alternatives' effects on groundwater in this section rely on permitted pumping rates as described above and in Appendixes F and J. Therefore, it would be speculative to try and do a quantitative analysis of these alternatives' effects on groundwater without mitigation. The determinations for the degree of impact and significance for the Action Alternatives as described below are considered to be 'with mitigation' to avoid and minimize adverse effects.

### 4.3.1 Alternative 1: No Action Alternative

Under the No Action – No Mining Alternative the mining companies would continue to use the FAS to supplement the mine circulation systems at the existing mines as allowed by their water use permits from SWFWMD. Operations at the existing phosphate mines would continue until the mineable reserves were depleted. Mine reclamation would require continued sand tailings conveyance to support delivery to reclamation sites; there would be the need for water supply augmentation for up to a decade beyond the end of active rock excavation periods but the demand would be reduced and over time this demand for supplemental water to support the remaining activities on phosphate mines would drop to zero. Under the No Action – Upland Mining scenario where mining was to occur in uplands, the groundwater withdrawals would be substantially less for shorter periods of time although without a mine plan it would not be possible to quantify the direct and indirect impacts of this alternative. Impacts to groundwater would be less than under the condition of any of the Preferred or Offsite Alternatives.

It is expected that populations in the AEIS study area would continue to increase. BEBR (2011) estimates for 2030 project a population of approximately 4 million people compared to the 2010 census figures for the AEIS study area counties of 3.3 million people. Growth in demand for potable water would continue. Per the SWFWMD's SWUCA recovery strategy, only limited new water supply allocations from the Floridan aquifer would be allowed while the SWFWMD seeks concurrent offsets of reduced allocations for existing permitted water users. Future water supplies may include development of alternative water supply sources and/or strategies, including expanded use of surface waters as potable water sources, greater emphasis on reuse of wastewater, and conservation measures. If no further authorization of new phosphate mines were to occur, SWFWMD would be likely to allow the FAS to rebound while maintaining its strategy of limiting increased withdrawals throughout the SWUCA.

Model simulations were prepared for two different conditions:

The No Action Alternative, Existing Mining Only simulations include all other groundwater users at 2010 rates and the mining withdrawals that change over time. The reduction in agricultural withdrawals predicted in the SWUCA Recovery Plan is not included in this set of simulations, so they clearly represent the aquifer responses directly attributable to mining withdrawals.

The second set of model simulations are for No Action Alternative - All Users. These simulations include all other groundwater users at 2010 rates and the mining withdrawals that change over time. The reductions anticipated in the SWUCA Recovery Plan in agricultural withdrawals are included; therefore, these simulations also show the cumulative impacts of all users and their predicted changes in the future.

For the No Action Alternative, the results of the Existing Mining Only simulations are presented in this section. The results for the No Action Alternative - All Users simulations are presented in the Cumulative Impacts section of this chapter, Section 4.12. Appendix F includes additional information about the No Action Alternative, both Existing Mining Only and All Users simulations, including figures and tables showing water level changes in each aquifer.

Under the No Action Alternative there would be no additional Floridan aquifer withdrawals for phosphate mining beyond those of existing mines. The projected drought year withdrawal rates for the currently operating mines that will operate through 2030 are summarized in Table 1 of Appendix J and Table 8 of Appendix F. Tables 4-55 through 4-58 show the predicted changes in SAS, IAS Zones 1 and 2, and FAS water levels due solely to simulated drought year phosphate mining withdrawals for the years 2015, 2020, 2025, and 2030 as compared to the baseline conditions in the year 2010. These tables show the water level change at all of the selected SWFWMD ROMP wells for each aquifer and time step. In all cases, the water levels remain unchanged or rise over the duration of the No Action Alternative. The SWIMAL value is included at the bottom of Table 4-58 for each year evaluated. It provides the predicted change in Floridan aquifer water level in relation to 2010 conditions at each of the wells included in the SWIMAL. For all of the ROMP wells included in the SWIMAL group, there was an increase in water levels resulting from the reduction in mining withdrawals.

These simulation results indicated that over the life of the existing mines, the gradual reduction in phosphate mining use of water from the Floridan aquifer would result in increased SAS, IAS Zones 1 and 2, and UFA water levels compared to 2010 conditions. This is a beneficial impact that results in water level rises in regional ROMP monitoring wells and local groundwater users' wells.

The difference in SAS/UFA water levels is shown in hydrographs from monitoring well clusters in the study area. Figure 4-9 shows the locations of six well clusters that monitor the SAS, IAS, and UFA. Details of the well clusters follow:

- In Regional Observation Monitoring-Well Program (ROMP) 85, the northernmost well cluster, the SAS and UFA water levels have approximately 15 feet of water level difference. ROMP 70, approximately 25 miles to the southeast of ROMP 85, exhibits approximately 80 feet of water level difference between the SAS and UFA.
- At ROMP 40, approximately 30 miles to the south of ROMP 70, the water levels in the two aquifers are separated by approximately 100 feet. The IAS Zone 1 aquifer level is approximately 10 feet less than the SAS at ROMP 40.
- At ROMP 25, approximately 20 miles to the south of ROMP 40, the water level in the IAS Zone 1 monitor well is about 20 feet less than the SAS and shows increased fluctuations as compared to the SAS. The water level in the UFA is approximately another 40 feet below the IAS Zone 1 and shows additional increased fluctuation.
- ROMP 30 is approximately 15 miles northeast of ROMP 25. The IAS Zone 1, IAS Zone 2, and UFA monitor well water levels are all virtually identical and the fluctuations consistently track one another. These water levels are about 30 feet lower than the SAS and have much greater variation in water level.
- ROMP 13, about 30 miles southeast of ROMP 30, shows a similar pattern. The IAS Zone 1, IAS Zone 2, and UFA monitor wells track one another with water levels about 15 feet below the SAS. All of the wells in the ROMP 13 have similar variation in the water level.

Figures 4-10 through 4-15 depict hydrographs from the six well pair clusters. Two additional wells in the IAS Zone 2, ROMP 14 and ROMP TR-9, were included because only two of the six well clusters included data for the IAS Zone 2 aquifer. The range in water level for these monitor wells is presented in Table 4-59.

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| Table 4-55. Simulated SAS Monitor Well Water Level Change Relative to 2010, No Action Alternative (Existing Mining Only without Agricultural Reduction) Layer 1 | | | | | |
|---|---|---|---|---|---|
| | | Mining Only Simulated Water Level Change Relative to 2010 (ft) [b] | | | |
| **Well** | **SWIMAL Weight[a]** | **2015** | **2020** | **2025** | **2030** |
| ENGLEWOOD 14 DEEP | NA | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP 10 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP 16 SURF AQ MONITOR | NA | 0.00 | 0.01 | 0.01 | 0.01 |
| ROMP 19X SURF AQ MONITOR | NA | 0.00 | 0.03 | 0.04 | 0.04 |
| ROMP 28X SURF AQ MONITOR | NA | 0.00 | 0.01 | 0.01 | 0.02 |
| ROMP 30 SURF AQ MONITOR | NA | 0.01 | 0.04 | 0.07 | 0.08 |
| ROMP 32 HTRN AS MONITOR | NA | 0.00 | 0.05 | 0.06 | 0.08 |
| ROMP 35 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP 40 SURF AQ MONITOR | NA | 0.05 | 0.52 | 0.61 | 0.72 |
| ROMP 43 SURF AQ MONITOR REPL | NA | 0.17 | 0.58 | 1.45 | 1.69 |
| ROMP 45.5 HTRN CU MONITOR | NA | 0.06 | 0.18 | 0.29 | 0.35 |
| ROMP 58 SURF AQ MONITOR | NA | 0.05 | 0.17 | 0.30 | 0.36 |
| ROMP 60X (PRIM SC06) SURF AQ MONITOR | NA | 0.25 | 0.96 | 1.34 | 1.54 |
| ROMP TR 10-2 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP TR 8-1 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP TR SA-1 SURF | NA | 0.00 | 0.01 | 0.01 | 0.01 |

[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculate simulated change in SWIMAL
[b] Positive numbers mean an increase in water level

**Table 4-56. Simulated IAS Zone 1 Monitor Well Water Level Change Relative to 2010, No Action Alternative (Existing Mining Only without Agricultural Reduction) Layer 2**

| | | Mining Only Simulated Water Level Change Relative to 2010 (ft) [b] | | | |
|---|---|---|---|---|---|
| **Well** | **SWIMAL Weight[a]** | **2015** | **2020** | **2025** | **2030** |
| CL-3 HTRN AS MONITOR | NA | 0.10 | 0.34 | 0.80 | 0.93 |
| KUSHMER INT | NA | 0.02 | 0.23 | 0.26 | 0.29 |
| ROMP 10 U ARCA AQ MONITOR 2 | NA | 0.01 | 0.09 | 0.12 | 0.14 |
| ROMP 13 U ARCA AQ MONITOR | NA | 0.02 | 0.19 | 0.26 | 0.32 |
| ROMP 17 U ARCA AQ MONITOR | NA | 0.03 | 0.25 | 0.34 | 0.40 |
| ROMP 20 U ARCA AQ MONITOR | NA | 0.02 | 0.37 | 0.42 | 0.48 |
| ROMP 25 U ARCA AQ MONITOR | NA | 0.02 | 0.15 | 0.20 | 0.25 |
| ROMP 26 U ARCA AQ MONITOR | NA | 0.05 | 0.38 | 0.54 | 0.66 |
| ROMP 30 U ARCA AQ MONITOR | NA | 0.16 | 0.84 | 1.45 | 1.82 |
| ROMP 39 HTRN AS MONITOR | NA | 0.01 | 0.19 | 0.21 | 0.24 |
| ROMP 41 SURF AQ MONITOR | NA | 0.23 | 0.91 | 1.62 | 2.11 |
| ROMP 43 U ARCA AQ MONITOR | NA | 0.21 | 0.72 | 1.83 | 2.13 |
| ROMP 5 U ARCA AQ MONITOR | NA | 0.03 | 0.23 | 0.31 | 0.38 |
| ROMP 59 HTRN AS MONITOR 1 | NA | 0.37 | 1.32 | 1.98 | 2.32 |
| ROMP 8 U ARCA AQ MONITOR | NA | 0.02 | 0.23 | 0.28 | 0.33 |
| ROMP TR 7-2 U ARCA AQ MONITOR | NA | 0.00 | 0.04 | 0.04 | 0.05 |
| VERNA TEST 0-1 | NA | 0.10 | 1.85 | 2.08 | 2.34 |

[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculate simulated change in SWIMAL
[b] Positive numbers mean an increase in water level

**Table 4-57. Simulated IAS Zone 2 Monitor Well Water Level Change Relative to 2010, No Action Alternative (Existing Mining Only without Agricultural Reduction) Layer 3**

| | | Mining Only Simulated Water Level Change Relative to 2010 (ft) [b] | | | |
|---|---|---|---|---|---|
| **Well** | **SWIMAL Weight[a]** | **2015** | **2020** | **2025** | **2030** |
| CL-2 DEEP SURF AQ MONITOR | NA | 0.08 | 0.25 | 0.59 | 0.68 |
| FORT GREEN SPRINGS INT | NA | 0.71 | 2.86 | 4.19 | 5.12 |
| ROMP 12 U ARCA AQ MONITOR | NA | 0.03 | 0.26 | 0.36 | 0.44 |
| ROMP 14 L ARCA AQ MONITOR | NA | 0.01 | 0.05 | 0.07 | 0.08 |
| ROMP 16 L ARCA AQ MONITOR | NA | 0.03 | 0.30 | 0.42 | 0.50 |
| ROMP 26 L ARCA AQ MONITOR | NA | 0.05 | 0.38 | 0.54 | 0.66 |
| ROMP 28 HTRN | NA | 0.01 | 0.08 | 0.14 | 0.16 |
| ROMP 30 L ARCA AQ MONITOR | NA | 0.18 | 0.91 | 1.59 | 1.98 |
| ROMP 43 L ARCA AQ MONITOR | NA | 0.21 | 0.73 | 1.85 | 2.16 |
| ROMP 5 L ARCA AQ MONITOR | NA | 0.03 | 0.23 | 0.32 | 0.38 |
| ROMP 59 HTRN AS MONITOR 2 | NA | 0.41 | 1.49 | 2.24 | 2.63 |
| ROMP 9.5 L ARCA AQ MONITOR (MW-2) | NA | 0.03 | 0.34 | 0.44 | 0.53 |
| ROMP TR 1-2 L ARCA AQ MONITOR | NA | 0.01 | 0.06 | 0.09 | 0.10 |
| ROMP TR 3-1 L ARCA AQ MONITOR 2 | NA | 0.02 | 0.27 | 0.34 | 0.41 |
| ROMP TR 5-1 L ARCA AQ MONITOR | NA | 0.02 | 0.32 | 0.37 | 0.42 |
| ROMP TR 7-1 L ARCA AQ INTERFACE MONITOR | 8.84% | 0.04 | 0.68 | 0.76 | 0.86 |
| ROMP TR 9-2 L ARCA AQ MONITOR | NA | 0.02 | 0.27 | 0.31 | 0.34 |
| SARASOTA 9 DEEP | 8.66% | 0.07 | 1.28 | 1.44 | 1.63 |

[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculate simulated change in SWIMAL
[b] Positive numbers mean an increase in water level

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| Table 4-58. Simulated FAS Monitor Well Water Level Change Relative to 2010, No Action Alternative (Existing Mining Only without Agricultural Reduction) Layer 4 | | | | | |
|---|---|---|---|---|---|
| | | Mining Only Simulated Water Level Change Relative to 2010 (ft) [b] | | | |
| **Well** | **SWIMAL Weight[a]** | **2015** | **2020** | **2025** | **2030** |
| COLEY DEEP | NA | 0.09 | 0.30 | 0.71 | 0.83 |
| FLORIDA POWER FLDN AT PINEY POINT | NA | 0.05 | 0.91 | 1.03 | 1.15 |
| KIBLER DEEP | 14.01% | 0.14 | 2.61 | 2.92 | 3.28 |
| LAKE ALFRED DEEP AT LAKE ALFRED | NA | 0.03 | 0.12 | 0.18 | 0.21 |
| ROMP 12 AVPK PZ MONITOR | NA | 0.03 | 0.26 | 0.36 | 0.44 |
| ROMP 123 HTRN AS/U FLDN AQ MONITOR | 9.55% | 0.19 | 3.34 | 3.72 | 4.11 |
| ROMP 13 AVPK PZ MONITOR | NA | 0.02 | 0.19 | 0.27 | 0.33 |
| ROMP 14 U FLDN AQ MONITOR (AVPK) | NA | 0.01 | 0.05 | 0.07 | 0.08 |
| ROMP 15 U FLDN AQ MONITOR MOD | NA | 0.03 | 0.28 | 0.39 | 0.48 |
| ROMP 17 U FLDN AQ MONITOR (AVPK) | NA | 0.04 | 0.34 | 0.45 | 0.54 |
| ROMP 19X U FLDN AQ MONITOR (SWNN) | NA | 0.04 | 0.51 | 0.62 | 0.72 |
| ROMP 20 U FLDN AQ MONITOR (OCAL) | NA | 0.03 | 0.55 | 0.62 | 0.71 |
| ROMP 25 U FLDN AQ MONITOR | NA | 0.12 | 1.73 | 2.04 | 2.41 |
| ROMP 28 AVPK | NA | 0.02 | 0.08 | 0.14 | 0.17 |
| ROMP 30 U FLDN AQ MONITOR | NA | 0.18 | 0.91 | 1.59 | 1.98 |
| ROMP 31 U FLDN AQ MONITOR | NA | 0.19 | 1.56 | 2.11 | 2.73 |
| ROMP 32 U FLDN AQ MONITOR (AVPK) | NA | 0.24 | 4.00 | 4.56 | 5.38 |
| ROMP 39 AVPK PZ MONITOR | NA | 0.16 | 3.03 | 3.37 | 3.75 |

**Table 4-58. Simulated FAS Monitor Well Water Level Change Relative to 2010, No Action Alternative (Existing Mining Only without Agricultural Reduction) Layer 4**

| | | Mining Only Simulated Water Level Change Relative to 2010 (ft) [b] | | | |
|---|---|---|---|---|---|
| **Well** | **SWIMAL Weight[a]** | **2015** | **2020** | **2025** | **2030** |
| ROMP 40 U FLDN AQ MONITOR | NA | 0.44 | 5.66 | 6.55 | 7.53 |
| ROMP 41 AVPK PZ MONITOR | NA | 0.62 | 2.26 | 4.16 | 5.29 |
| ROMP 43XX U FLDN AQ MONITOR | NA | 0.06 | 0.23 | 0.54 | 0.63 |
| ROMP 45 U FLDN AQ MONITOR (AVPK) | NA | 0.69 | 2.08 | 3.98 | 4.75 |
| ROMP 5 U FLDN AQ MONITOR (SWNN) | NA | 0.03 | 0.23 | 0.32 | 0.38 |
| ROMP 50 U FLDN AQ MONITOR (SWNN) | 13.25% | 0.12 | 1.94 | 2.17 | 2.41 |
| ROMP 57 U FLDN AQ MONITOR | NA | 0.12 | 0.38 | 0.70 | 0.83 |
| ROMP 59 U FLDN AQ INTERFACE MONITOR | NA | 0.47 | 1.68 | 2.52 | 2.95 |
| ROMP 60X U FLDN AQ MONITOR | NA | 0.41 | 1.61 | 2.32 | 2.70 |
| ROMP TR 10-2 L ARCA AQ MONITOR | 5.41% | 0.05 | 0.55 | 0.64 | 0.71 |
| ROMP TR 4-1 U FLDN AQ INTERFACE MONITOR | NA | 0.02 | 0.36 | 0.42 | 0.48 |
| ROMP TR 7-4 U FLDN AQ MONITOR (SWNN) | 13.54% | 0.06 | 1.14 | 1.28 | 1.44 |
| ROMP TR 8-1 AVPK PZ MONITOR | 14.08% | 0.05 | 0.81 | 0.91 | 1.02 |
| ROMP TR 9-3 U FLDN AQ MONITOR (SWNN) | 7.17% | 0.08 | 1.22 | 1.37 | 1.53 |
| SMITH DEEP | NA | 0.18 | 0.66 | 1.59 | 1.88 |
| VERNA TEST 0-4 | 5.50% | 0.08 | 1.55 | 1.74 | 1.97 |
| Simulated Change in SWIMAL, feet | | 0.09 | 1.58 | 1.77 | 1.98 |

[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculate simulated change in SWIMAL
[b] Positive numbers mean an increase in water level

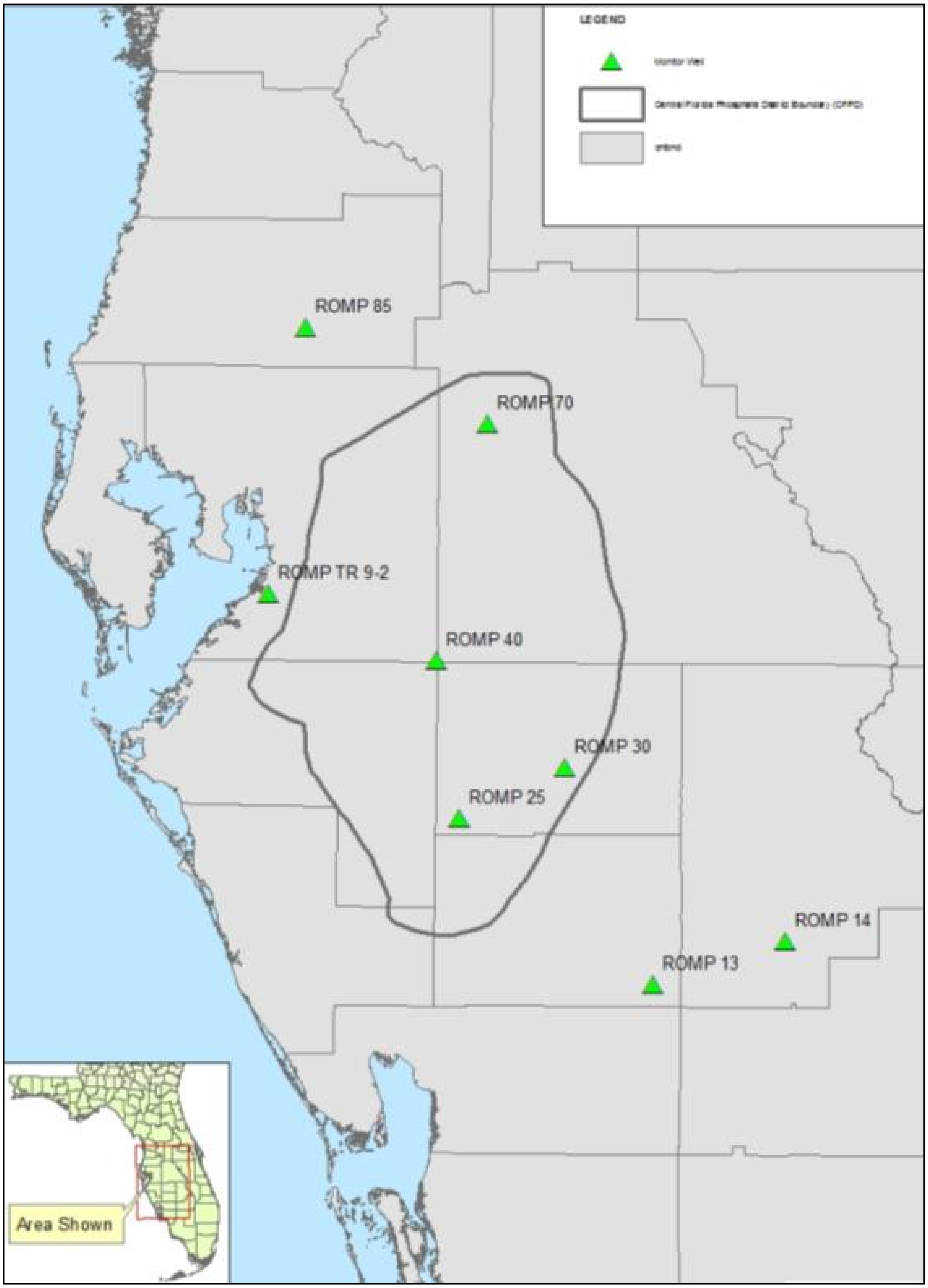



**Figure 4-9. Locations of Selected Paired Shallow and Deep Monitoring Wells in the AEIS Study Area**

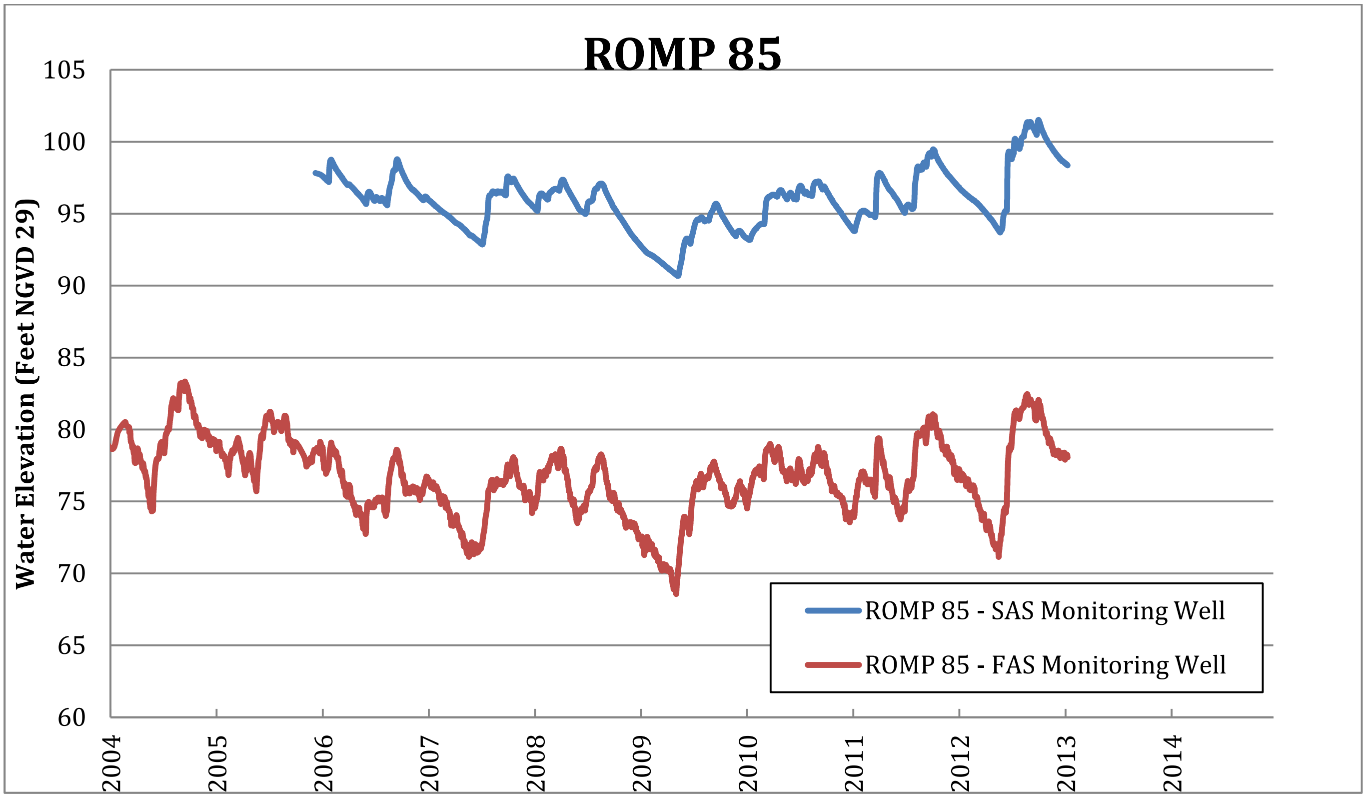
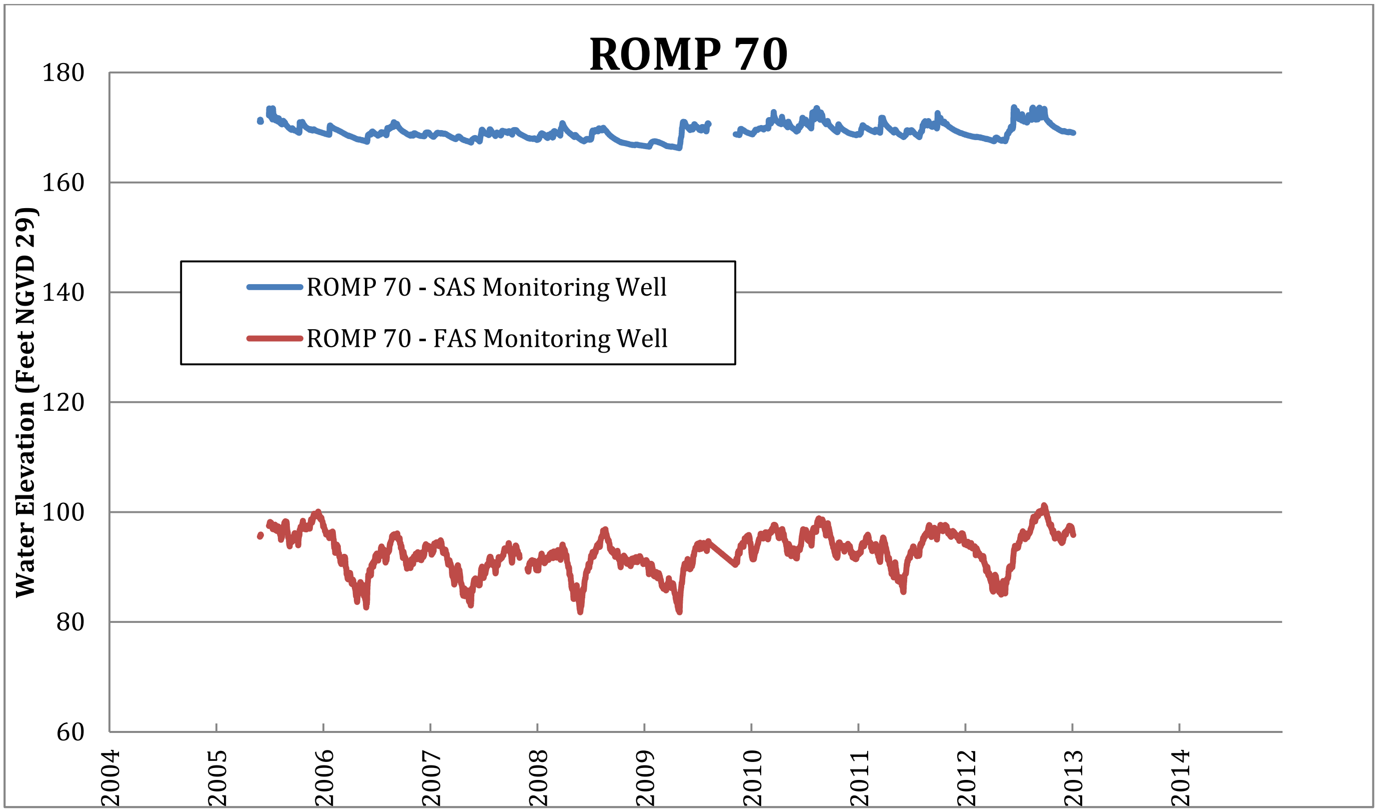



**Figure 4-10. UFA, IAS, and SAS Monitoring Well Clusters, ROMP 85**

1




2

3 **Figure 4-11. UFA, IAS, and SAS Monitoring Well Clusters, ROMP 70**

4

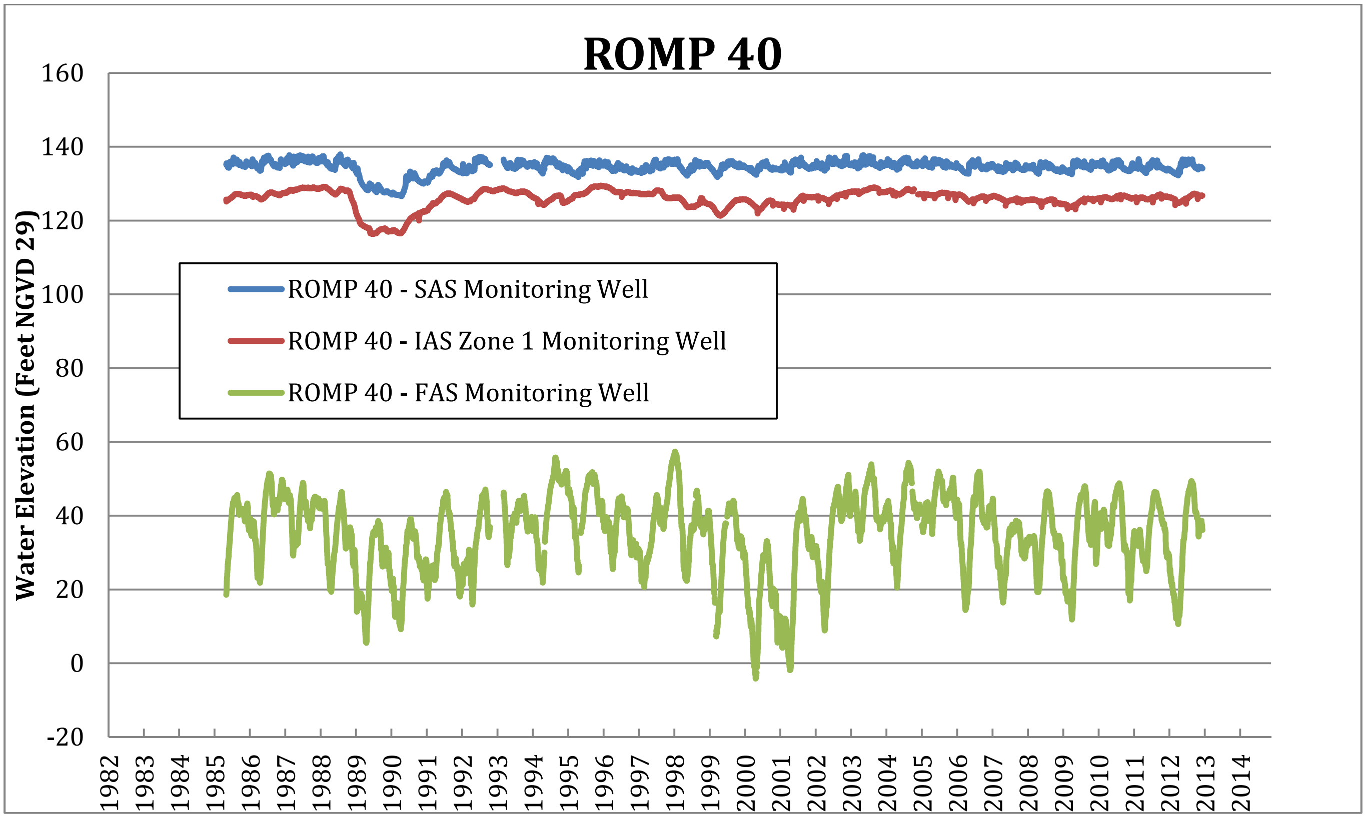



**Figure 4-12. UFA, IAS, and SAS Monitoring Well Clusters, ROMP 40**

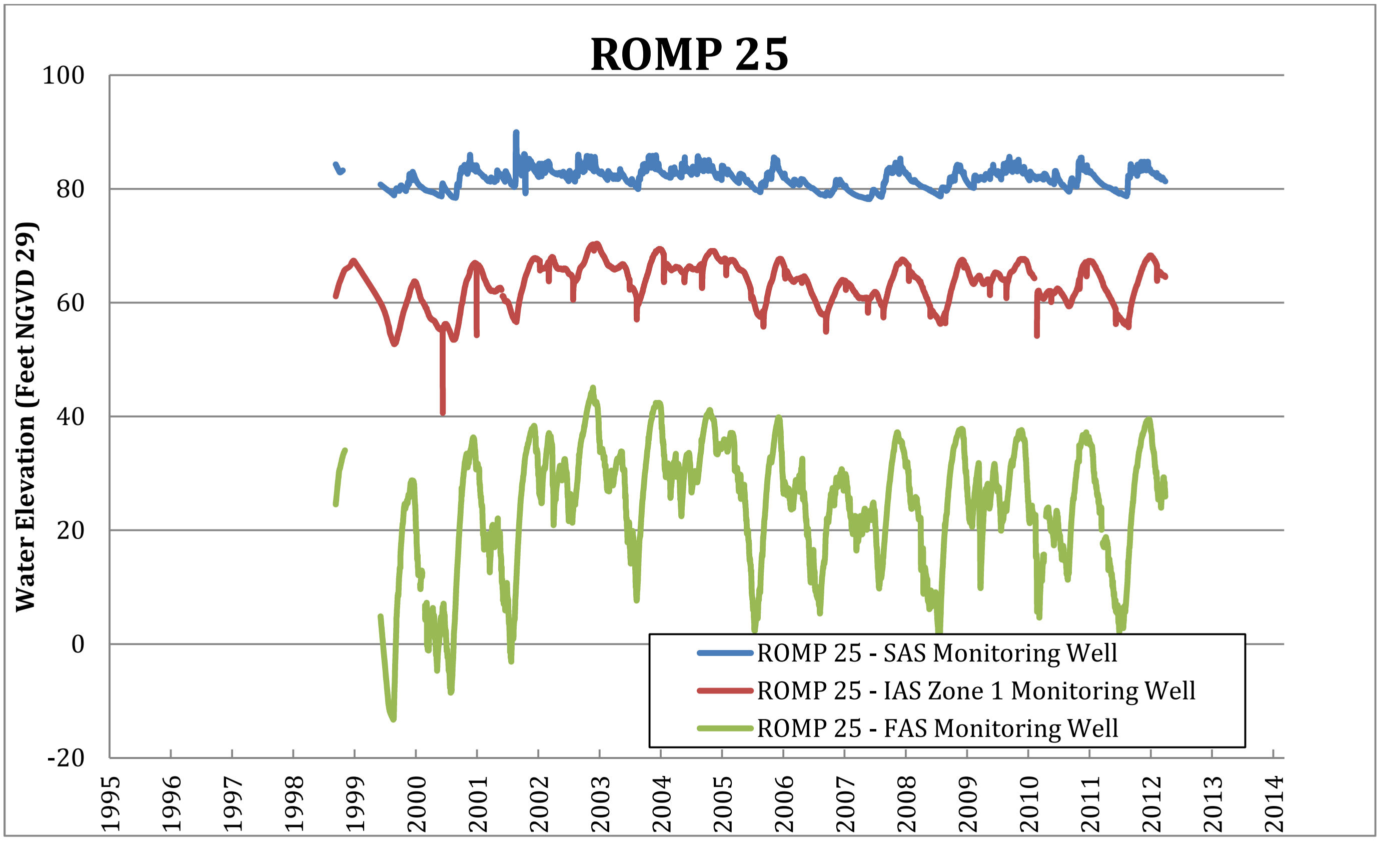



**Figure 4-13. UFA, IAS, and SAS Monitoring Well Clusters, ROMP 25**

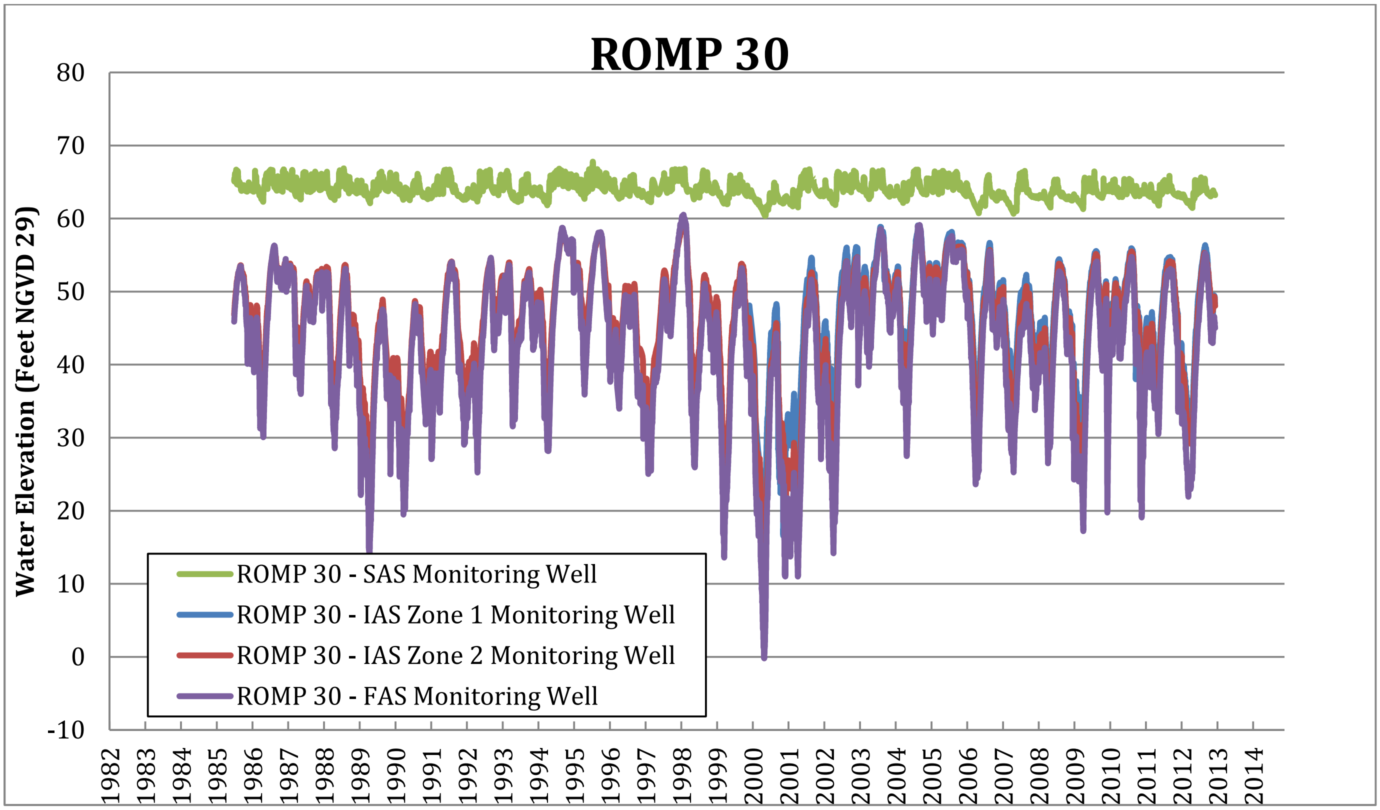



**Figure 4-14. UFA, IAS, and SAS Monitoring Well Clusters, ROMP 30**

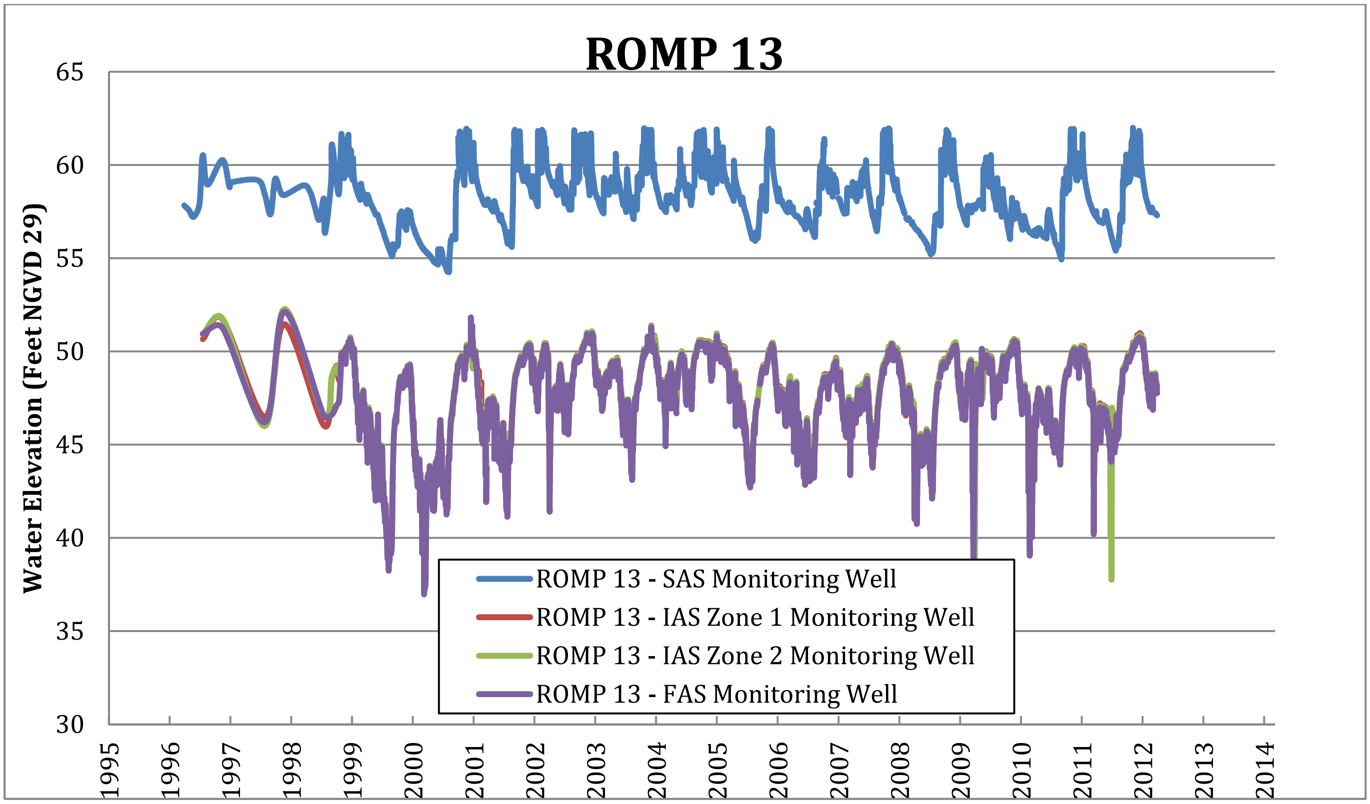



**Figure 4-15. UFA, IAS, and SAS Monitoring Well Clusters, ROMP 13**

**Table 4-59. Historical Groundwater Elevation [a]**

| Monitoring Well | Aquifer | Maximum Water Elevation (ft) | Minimum Water Elevation (ft) | Change in Water Elevation (ft) | Dates of Monitor Data |
|---|---|---|---|---|---|
| ROMP 13 SURF AQ MONITOR | SAS | 61.99 | 54.26 | 7.73 | 1/23/1997 to 1/18/2013 |
| ROMP 25 SURF AQ MONITOR | SAS | 89.93 | 78.22 | 11.71 | 7/7/1999 to 1/18/2013 |
| ROMP 30 SURF AQ MONITOR | SAS | 67.8 | 60.37 | 7.43 | 8/14/1995 to 1/18/2013 |
| ROMP 40 SURF AQ MONITOR | SAS | 137.93 | 126.62 | 11.31 | 6/18/1995 to 1/18/2013 |
| ROMP 70 SURF AQ MONITOR | SAS | 173.68 | 166.24 | 7.44 | 6/10/2005 to 1/14/2013 |
| ROMP 85 SURF AQ MONITOR | SAS | 101.51 | 90.68 | 10.83 | 12/19/2005 to 1/18/2013 |
| ROMP 13 U ARCA AQ MONITOR | IAS Zone 1 | 51.73 | 38.79 | 12.94 | 5/15/1997 to 1/18/2013 |
| ROMP 25 U ARCA AQ MONITOR | IAS Zone 1 | 70.35 | 40.6 | 29.75 | 7/7/1999 to 1/18/2013 |
| ROMP 30 U ARCA AQ MONITOR | IAS Zone 1 | 59.06 | 16.71 | 42.35 | 1/10/2000 to 1/18/2013 |
| ROMP 43 U ARCA AQ MONITOR | IAS Zone 1 | 93.89 | 80.57 | 13.32 | 9/19/2006 to 1/17/2013 |
| ROMP 13 L ARCA AQ MONITOR | IAS Zone 2 | 52.27 | 34.99 | 17.28 | 5/14/1997 to 1/18/2013 |
| ROMP 14 L ARCA AQ MONITOR | IAS Zone 2 | 117.09 | 104.17 | 12.92 | 9/12/1995 to 1/18/2013 |
| ROMP 30 L ARCA AQ MONITOR | IAS Zone 2 | 58.98 | 9.27 | 49.71 | 8/14/1985 to 1/18/2013 |
| ROMP TR 9-2 L ARCA AQ MONITOR | IAS Zone 2 | 14.79 | -5.28 | 20.07 | 4/2/1992 to 1/18/2013 |
| ROMP 13 U FLDN AQ MONITOR (SWNN) | UFA | 52.13 | 36.97 | 15.16 | 5/14/1997 to 1/18/2013 |
| ROMP 25 U FLDN AQ MONITOR | UFA | 45.06 | -13.28 | 58.34 | 7/7/1999 to 1/18/2013 |
| ROMP 30 U FLDN AQ MONITOR | UFA | 60.52 | -0.2 | 60.72 | 8/14/1985 to 1/18/2013 |
| ROMP 40 U FLDN AQ MONITOR | UFA | 57.37 | -4.15 | 61.52 | 6/18/1995 to 1/18/2013 |
| ROMP 70 U FLDN AQ MONITOR | UFA | 101.24 | 81.75 | 19.49 | 6/10/2005 to 1/14/2013 |
| ROMP 85 U FLDN AQ MONITOR (AVPK) | UFA | 83.78 | 66.98 | 16.8 | 7/1/1985 to 1/18/2013 |

[a] In feet National Geodetic Vertical Datum of 1929 (ft NGVD 29)

The SAS monitor well water levels range from 7.43 to 11.71 ft. The IAS Zone 1 monitor well water levels range from 12.94 to 42.35 ft. The IAS Zone 2 monitor well water levels range from 12.92 to 49.71 ft. The UFA monitor well water levels range from 15.16 to 61.52 ft. Generally, the deeper the aquifer, the greater the variation is in its water level. The water level variations shown are over a 10- to 25-year duration. Annual seasonal water level variation is expected to be somewhat smaller.

The model results for No Action Alternative Existing Mining indicate that the simulated water level in all aquifer layers will increase throughout the model domain as existing mines cease operations and overall water use in the SWUCA decreases. If only water level changes from phosphate mining are considered, the 2030 simulated water level rise at ROMP targets of interest is up to 1.69 feet in the SAS, 2.34 feet in the IAS (Zone 1), 5.12 feet in the IAS (Zone 2), and 7.53 feet in the UFA. Based on these results, the No Action Alternative would have minor and beneficial impacts.

Under the 'upland only' mining scenario for the No Action Alternative, the groundwater usage would be at a rate similar to that for the Applicants' Preferred Alternatives; however, it would be for a shorter time. Therefore, the No Action Alternative – Upland Only would have a minor and beneficial degree of impact, which would not be significant.

### 4.3.2 Alternative 2: Desoto Mine

The proposed Desoto Mine is expected to operate for 15 years (including reclamation) beginning in 2021. The Desoto Mine is located in an area where the UFA is expected to contain naturally occurring brackish water. This water is not suitable for the recirculation system; therefore, a water supply for this mine will be provided by pumping the existing wells at the Fort Green facility and conveyance via pipeline to the Desoto Mine location. No new supply wells will be constructed to support this new mine. The analysis for the Desoto Mine used a drought year annual average pumping rate of up to 10.7 mgd.

Tables 18 through 21 and Figures 25 through 28 in Appendix F show the predicted impacts of the Applicants' Preferred Alternatives, including the Desoto Mine, on the SAS, IAS Zone 1, IAS Zone 2, and UFA. These tables and figures do not include the agricultural withdrawal reduction anticipated by the SWUCA Recovery Strategy so this analysis represents a conservative evaluation of potential water level changes. The Desoto Mine is predicted to have a minor impact on the SAS with only local mining activities potentially impacting the SAS since the circulating water system supply will be conveyed from the Fort Green mine wellfield. The SAS impacts would not be significant. Monitoring of the water levels in wetlands adjacent to the wellfield at Fort Green is a mitigative measure that should be considered, however, to address potential indirect impacts at the Desoto Mine. The Desoto Mine would cause a minor impact on the IAS Zones 1 and 2 since the IAS is separated from the SAS by semiconfining material. Any impact would be an increase in water levels as a result of additional recharge. These water level increases could be long-term. These impacts would not be significant. The Desoto Mine would also have a minor impact on the UFA with no drawdown expected in the vicinity of the mine since there will be no UFA wellfield located at the mine. This impact would not be significant. Drawdown impacts to other groundwater users are expected to be minor since there will be no new wellfield at the Desoto Mine.

### 4.3.3 **Alternative 3: Ona Mine**

The proposed Ona Mine is expected to operate for 28 years (including reclamation) beginning in 2020. The Ona Mine includes new UFA withdrawal locations and the UFA allocation is included in Mosaic's SWFWMD WUP. The analysis for the Ona Mine used a drought year annual average pumping rate of up to 11.9 mgd.

Tables 18 through 21 and Figures 25 through 28 in Appendix F show the predicted impacts of the Applicants' Preferred Alternatives, including the Ona Mine, on the SAS, IAS Zone 1, IAS Zone 2, and UFA. These tables and figures do not include the agricultural withdrawal reduction anticipated by the SWUCA Recovery Strategy so this analysis represents a conservative evaluation of potential water level changes. The Ona Mine is predicted to have a minor impact on the SAS, with no drawdown of the SAS outside of the wellfield, although the water level changes may last longer than a few months. This impact would not be significant. Monitoring of the water levels in wetlands adjacent to the wellfield is a mitigative measure that is required by the CUP; therefore, this monitoring network should address potential indirect impacts.

Based on the modeling results, the Ona Mine would cause potential drawdowns of 3 to 8 feet outside of the mine property in the IAS Zones 1 and 2.. The mine would also cause drawdown as much as 8 to 10 feet beyond the mine property in the UFA, also as based on the modeling. These drawdowns would be long-term (10 to 20 years), although they would recover.

In determining the degree of effect to the IAS Zones 1 and 2 and the UFA, it is necessary to consider that these impacts are consistent with the variability of the aquifer levels discussed in Section 4.3.1, that these impacts would not be expected to affect other users of any of these three aquifers, as discussed in Appendix F, that this predicted impact does not take into account other actions which reduce groundwater pumping as discussed in Section 4.3.1, on cumulative impacts, and that in order to comply with the SWFWMD WUP, the actual water usage would likely be substantially lower than what was used in this analysis. Therefore, although a moderate degree of effect based on the modeling, it is expected that this degree of effect would be reduced to a minor degree of effect with mitigation. The effects on the IAS Zones 1 and 2 and the UFA would not be significant.

### 4.3.4 Alternative 4: Wingate East Mine

The proposed Wingate East Mine is an extension of the Wingate Creek Mine, and therefore no new supply wells will be constructed to support this alternative. Mining and reclamation will extend out to 2046. The analysis for the Wingate East Mine used a drought year annual average pumping rate of up to 5.8 mgd.

Tables 18 through 21 and Figures 25 through 28 in Appendix F show the predicted impacts of the Applicants' Preferred Alternatives, including the Wingate East Mine, on the SAS, IAS Zone 1, IAS Zone 2, and UFA. These tables and figures do not include the agricultural withdrawal reduction anticipated by the SWUCA Recovery Strategy so this analysis represents a conservative evaluation of potential water level changes. The Wingate East Mine is predicted to have a minor impact on the SAS, with no drawdown of the SAS outside of the wellfield, although the drawdown may last longer than a few months. This impact would not be significant. Monitoring of the water levels in wetlands adjacent to the wellfield is a mitigative measure that is required by the CUP; therefore, this monitoring network should address potential indirect impacts. The Wingate East Mine would have a minor impact on the IAS Zones 1 and 2, with no changes in water levels since the wellfield has been in operation for the Wingate Mine for years. These impacts would not be significant. The Wingate East Mine would also have a minor impact on the UFA by extending the time of pumping but not changing the magnitude. Although the water levels are existing and long-term, the levels would be recoverable. This impact would not be significant. Drawdown impacts to other groundwater users are expected to be minor since there will be no new wellfield at the Wingate East Mine.

### 4.3.5 Alternative 5: South Pasture Extension Mine

The proposed South Pasture Extension Mine is an extension of the South Pasture Mine, and therefore no new supply wells will be constructed to support this alternative. Mining and reclamation will extend out to 2037. The analysis for the South Pasture Extension Mine used a drought year annual average pumping rate of up to 6.39 mgd.

Tables 18 through 21 and Figures 25 through 28 in Appendix F show the predicted impacts of the Applicants' Preferred Alternatives, including the South Pasture Extension Mine, on the SAS, IAS Zone 1, IAS Zone 2, and UFA. These tables and figures do not include the agricultural withdrawal reduction anticipated by the SWUCA Recovery Strategy so this analysis represents a conservative evaluation of potential water level changes. The South Pasture Extension Mine is predicted to have a minor impact on the SAS, with no drawdown of the SAS outside of the wellfield, although the drawdown may last longer than a few months. This impact would not be significant. Monitoring of the water levels in wetlands adjacent to the wellfield is a mitigative measure required by the CUP; therefore, this monitoring network should address potential indirect impacts. The South Pasture Extension Mine would have a minor impact on the IAS Zones 1 and 2, with no changes in water levels since the wellfield has been in operation for the South Pasture Mine for years. The South Pasture Extension Mine would extend the pumping for a longer period of time and the water levels would be recoverable. These impacts would not be significant. The South Pasture Extension Mine would also have a minor impact on the UFA with no changes in water levels since the wellfield has been in operation for the South Pasture Mine for years. The South Pasture Extension Mine would extend the pumping for a longer period of time and the water levels would be recoverable. This impact would not be significant. Drawdown impacts to other groundwater users are expected to be minor since there will be no new wellfield at the South Pasture Extension Mine.

### 4.3.6 Alternative 6: Pine Level/Keys Tract

The Pine Level/Keys Tract is located in an area where the UFA is expected to contain naturally occurring brackish water. This water is not suitable for the recirculation system; therefore, a water supply wellfield for this mine would have to be located to the north. This analysis assumes that as with the Desoto Mine immediately to the east, a water supply for the Pine Level/Keys Tract could be provided by pumping the existing wells at the Fort Green facility and conveyance via pipeline to the Pine Level/Keys Tract. No new supply wells will be constructed to support this new mine.

Because the two alternatives are subject to similar conditions, the predicted effects of mining the Pine Level/Keys Tract can be extrapolated from those predicted for the Desoto Mine. Mining the Pine Level/Keys Tract is predicted to have a minor impact on the SAS with only local mining activities potentially impacting the SAS since the circulating water system supply will be conveyed from the Fort Green mine wellfield. The SAS impacts would not be significant. Monitoring of the water levels in wetlands adjacent to the wellfield at Fort Green is a mitigative measure that should be considered, however, to address potential indirect impacts at the Pine Level/Keys Tract. Mining the Pine Level/Keys Tract would cause a minor impact on the IAS Zones 1 and 2 since the IAS is separated from the SAS by semi-confining material. Any impact would be an increase in water levels as a result of additional recharge. These water level increases could be long-term. These impacts would not be significant. Mining the Pine Level/Keys Tract would also have a minor impact on the UFA with no drawdown expected in the vicinity of the mine since there will be no UFA wellfield located at the mine. This impact would not be significant. Drawdown impacts to other groundwater users are expected to be minor since there will be no new wellfield at the Pine Level/Keys Tract.

### 4.3.7 Alternative 7: Pioneer Tract

The Pioneer Tract is located south of the Ona Mine. Because the two alternatives are subject to similar conditions, the predicted effects of mining the Pioneer Tract can be extrapolated from those predicted for the Ona Mine.

Mining the Pioneer Tract is predicted to have a minor impact on the SAS, with no drawdown of the SAS outside of the wellfield, although the water level changes may last longer than a few months. This impact would not be significant. Monitoring of the water levels in wetlands adjacent to the Ona Mine wellfield is a mitigative measure that is required by the CUP. It is likely that a similar measure would be required for a mine at the Pioneer Tract, and would address potential indirect impacts. As described for the Ona Mine, with mitigation, it is not expected that the Pioneer Tract would have more than a minor effect on the IAS Zones 1 and 2 or the UFA. Taking the degree of effect and the mitigation into consideration, the IAS Zones 1 and 2 and the UFA impacts would not be significant.

### 4.3.8 **Alternative 8: Site A-2**

Alternative 8 (A-2) is located along the eastern edge of the CFPD. This location is adjacent to the South Fort Meade Mine. Given this proximity, the most practical source of water would be the existing South Fort Meade Mine wellfield. Therefore, it is assumed that there would be minor impacts to the SAS, IAS Zones 1 and 2, and the UFA at the A-2 Mine. Since the South Fort Meade Mine is planned to be completed in 2020, if the A-2 Mine began operation in 2021, the water level impacts that already exist at the South Fort Meade Mine would be extended for a longer period of time but would not change in magnitude since the wellfield would just continue operations. If the A-2 Mine began operation at a later time, the water level recovery resulting from ceasing withdrawals at South Fort Meade Mine would be reversed. It is reasonable to assume the water levels would return to their existing levels so the duration of those water level impacts would change but the magnitude of impacts would be the same. The water levels in the SAS would be managed with the ditch and berm system and monitoring of the water levels in wetlands adjacent to the mine is a mitigative measure required by the CUP; therefore, this monitoring network should address potential indirect impacts to the SAS. These impacts would not be significant. The A-2 Mine would have a minor impact on the IAS Zones 1 and 2, with minor changes in water levels expected from changes in recharge resulting from mining. Drawdown impacts to other groundwater users are expected to be minor since there will be no new wellfield at the A-2 Mine.

### 4.3.9 **Alternative 9: Site W-2**

Alternative 9 (W-2) is in an area where drawdowns in the UFA have more potential to impact the SWIMAL water levels. If a UFA wellfield were developed at this site, there could be moderate to major impacts to the SWIMAL. A mitigation measure would be to use a wellfield at one of the existing or proposed mines located further east from the SWIMAL wells. Given this proximity, the most practical source of water would be the existing Wingate Creek Mine wellfield. Therefore, it is assumed that there would be minor impacts to the SAS, IAS Zones 1 and 2, and the UFA at the W-2 Mine if the water supply came from the Wingate Creek Mine. The water level impacts that already exist at the Wingate Creek Mine would be extended for a longer period of time but would not change in magnitude since the wellfield would just continue operations. The water levels in the SAS would be managed with the ditch and berm system and monitoring of the water levels in wetlands adjacent to the mine is a mitigative measure required by the CUP; therefore, this monitoring network should address potential indirect impacts to the SAS. These impacts would not be significant. The W-2 Mine would have a minor impact on the IAS Zones 1 and 2, with minor changes in water levels expected from changes in recharge resulting from mining. Drawdown impacts to other groundwater users are expected to be minor since there will be no new wellfield at the W-2 Mine.

## 4.4 WATER QUALITY

The geographic scope of the evaluation of the direct and indirect impacts on surface water quality is the subwatersheds listed in Table 4-4 where individual alternatives are located, with consideration of the direct and indirect effects on Charlotte Harbor as well. The geographic scope of the evaluation of impacts to groundwater quality is the mine boundaries and the immediately surrounding area. Appendix D provides more information about the analyses, including the assumptions and approaches that were used. Section 3.3.3 provides general water quality information, Section 3.3.3.1 provides information about surface water quality in the CFPD and about regulatory water quality factors such as Numeric Nutrient Criteria (NNC), and Section 3.3.3.2 provides information about groundwater quality in the CFPD.

The degree of intensity of impacts for water quality was determined using the following criteria:

- No Impact to Minor: Mining would impact surface and/or groundwater quality only within or very near the mine boundaries. Effects are likely to be temporary or sporadic, and limited to selected water quality parameters with only localized impact on aquatic communities.
- Moderate: Mining would impact surface and/or groundwater quality in water systems extending beyond the mine boundaries but below watershed-level scale. Effects likely to be frequent, seasonally important, and include a fairly broad range of water quality parameters influencing downstream aquatic communities and/or potable water supplies.
- Major: Mining would impact surface and/or groundwater quality over a broad area of the watershed streams. Effects likely to be permanent, seasonally important, and include a broad range of water quality parameters influencing downstream aquatic communities. Event-based impacts likely to have acute effects on aquatic communities and/or potable water supplies. Watersheds are defined here as the main creeks and river segments defined in the analysis.

### 4.4.1 Alternative 1: No Action Alternative

Under the No Mining scenario, with population growth, urbanization of portions of the AEIS study area would occur. A study conducted on behalf of 1000 Friends of Florida by the University of Florida (Zwick and Carr, 2006) projected that urbanization into rural land areas similar to those in the CFPD would likely follow the highway corridors. Projected urbanization in the study area was described briefly in Chapter 3 (see Section 3.3.7). Increased urbanization shifts land use from undeveloped agricultural and rangelands to various forms of developed areas including more intensively managed agricultural, residential, commercial, and perhaps light industrial land uses. The urban uses typically have higher coverage of impermeable surfaces and can lead to higher rates of stormwater runoff along with increased nonpoint source pollutant loads, where row crops or similar improved agricultural uses also can have higher runoff (return flows from irrigation and drainage) and pollutant loads (SWFWMD, 2001; PBS&J, 2007). Without mitigation, these land use changes would tend to adversely impact surface water quality and groundwater quality. In the Upland Only scenario, without mitigation again it is expected that runoff from mining in uplands and non-USACE-jurisdictional wetlands and surface waters would have a similar adverse impact.

However, under both scenarios, water quality regulations, basin management plans associated with TMDLs, aquifer protection plans, and restoration projects would be likely to offset some of the impacts of future land use changes. Therefore, with mitigation the degree of effect for either scenario of the No Action Alternative would be expected to be minor, with no appreciable change or improvement in surface water quality and groundwater quality conditions, which would not be significant.

## 4.4.2 Impacts Common to All Action Alternatives

The Action Alternatives' effects on surface water were evaluated by reviewing monitoring results for inactive and active phosphate mines. These mines are referred to as "reference mines" in this section. This approach is based on the expectation that the mining technologies and practices in these reference mines and the measures implemented to comply with current water quality regulations would at least remain the same in the mining considered in the Action Alternatives, if not improve in terms of reducing adverse effects on water quality. It is important to note that the determinations for the degree of impact and significance for the Action Alternatives are therefore considered to be 'with mitigation' to avoid and minimize adverse effects.

This section provides information about the monitoring results used to make the degree of effect and significance determinations for the Action Alternatives, and information about additional factors such as the implementation of NNC that may affect water quality compliance for the Action Alternatives.

### 4.4.2.1 Surface Water Quality

Although the quality of discharges from future mines would likely be similar to current mine discharges, water quality conditions in receiving streams may be different in the future. The NPDES and ERP permitting process for future mines will include evaluations of the potential for discharges to affect compliance with water quality standards in the receiving streams and their ability to support designated uses. These permitting processes are described briefly in Section 3.3.3. More detailed information is available at the following websites:

- NPDES: http://www.dep.state.fl.us/water/wastewater/permitting.htm#npdes
- NPDES: http://cfpub.epa.gov/npdes/regs.cfm?program_id=0

- ERP: http://www.dep.state.fl.us/water/wetlands/erp/index.htm
- ERP (Section 401 Certification): http://water.epa.gov/lawsregs/guidance/cwa/waterquality_index.cfm

For the reference mines comparison, data were summarized for a total of five mines, three of which are actively involved in rock production, beneficiation, and reclamation, and two of which are inactive in terms of rock production and beneficiation but are still engaged in mine reclamation activities. The reference mines are identified as follows:

- Active Mines: Four Corners/Lonesome, Wingate Creek, and South Pasture
- Inactive Mines: Fort Green and Kingsford

Monitoring results from these mines are the basis for the following characterization of potential environmental effects of mining on surface water quality. The primary focus is on assessing the potential direct impacts as reflected by water quality characteristics in offsite discharges. However, the potential for indirect effects also is addressed in terms of indications of aquatic biological community response to offsite discharges.

**NPDES Discharge Data**

Operating permits issued by FDEP for phosphate mines contain specific conditions which include requirements for hydrologic isolation of a mine’s water management system from waters of the state, with all discharges from the water management system limited to those passing through specific permitted outfalls defined in the permits. Typically, monitoring of water quality is required for any month during which a discharge occurs. While the analytical parameters called for in the various permits reviewed were not always consistent, they often included most of the following:

- pH
- Specific Conductance
- Temperature
- Turbidity
- Dissolved oxygen
- Total suspended solids
- Fixed suspended solids
- Total phosphorus

- Total nitrogen
- Fluoride
- Sulfate
- Chlorophyll a
- Total radium
- Gross alpha

Discharge compliance with the applicable surface water quality standards is required by these FDEP-specified permit conditions.

The NPDES outfall monitoring data for 2005 through 2010 were summarized for five currently active outfalls at three Mosaic phosphate mines that are required to monitor discharges: the Four Corners Mine (two outfalls), Wingate Creek Mine (two outfalls), and South Fort Meade Mine (one outfall). Monitoring data for discharges from the two permitted outfalls at the CF Industries South Pasture Mine were also summarized for the same period of record. Parameter averages for 2005 through 2010 summarized in Table 4-60 indicate that the various mine discharges generally have similar water quality and that the discharges generally comply with the applicable Class III surface water quality criteria. Comparable records were compiled for two inactive Mosaic mines which remain engaged in reclamation activities only (no active rock extraction or beneficiation); these mean values are summarized in Table 4-60. For nearly all parameters, the values shown for the inactive mines were comparable to those for the active mines. Sulfate mean values were substantively lower for the inactive mine outfalls. Tables 4-62 through 4-65 include the number of exceedances of Class III criteria observed at the active and inactive outfalls for specific conductance, pH, DO, and turbidity.

**Table 4-60. Phosphate Mine Discharge Mean Water Quality Values for Selected Active Mine NPDES Outfalls (Averages for Period of Record 2005 – 2010)**

| Parameter | Units | Class III Criteria | Outfall | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | FCO D001 | FCO D002 | WIN D001 | WIN D002 | SFM D001 | SP D004 | SP D005 |
| pH | SU | 6.0 - 8.5 | 7.2 | 7.4 | 6.6 | 7.0 | 7.6 | 7.5 | 7.4 |
| Specific Conductance | µmho/cm | 1,275 | 569 | 653 | 408 | 600 | 782 | 781 | 651 |
| Temperature | °C | -- | 26.9 | 23.4 | 27.9 | 35.2 | 24.9 | 23.1 | 27.5 |
| Turbidity | NTU | Bkgd + 29 | 15.7 | 7.0 | 5.1 | 6.2 | 5.6 | 6.7 | 8.1 |
| Dissolved Oxygen | mg/L | 5.0 | 6.0 | 7.8 | 6.9 | 8.0 | 7.7 | 7.5 | 6.9 |
| Total Suspended Solids | mg/L | -- | 11.8 | 5.0 | 3.6 | 4.7 | 5.1 | 6.5 | 6.6 |
| Fixed Suspended Solids | mg/L | -- | 7.2 | 2.3 | 2.2 | 2.4 | 1.8 | 3.2 | 3.5 |
| Total Phosphorus | mg/L | -- | 1.10 | 1.23 | 1.00 | 1.51 | 1.44 | 1.13 | 0.87 |
| Total Nitrogen | mg/L | -- | 0.88 | 0.93 | 0.95 | 0.99 | 0.97 | 0.98 | 1.23 |
| Fluoride | mg/L | 10.0 | 1.4 | 1.7 | ND | 0.88 | 2.1 | 2.1 | 2.4 |
| Sulfate | mg/L | -- | 98 | 204 | 204 | 273 | 278 | 222 | 204 |
| Chlorophyll a | µg/L | -- | 6.7 | 14.8 | 5.8 | 13.2 | 13.5 | 15.3 | 10.0 |
| Total Radium | pCi/L | 5 | 2.93 | 2.20 | 1.52 | 1.57 | ND | ND | ND |
| Gross Alpha | pCi/L | 15 | 10.30 | 9.50 | 2.22 | 3.22 | ND | 11.60 | 12.27 |

Notes:
FCO = Mosaic Four Corners Outfall
WIN = Mosaic Wingate Creek Outfall
SFM = Mosaic South Fort Meade Outfall
SP = CF Industries South Pasture Outfall
pCi/L = picocuries per liter

**Table 4-61. Phosphate Mine Discharge Mean Water Quality Values for Selected Inactive Mine NPDES Outfalls**

| Parameter | Units | Class III Criteria | Outfall | |
|---|---|---|---|---|
| | | | Fort Green 005 | Kingsford 005 |
| pH | SU | 6.0 – 8.5 | 7.2 | 7.8 |
| Specific Conductance | µmho/cm | 1,275 | 508 | 465 |
| Temperature | °C | -- | 23.2 | 25.1 |
| Turbidity | NTU | Bkgd + 29 | 5.5 | 7.6 |
| Dissolved Oxygen | mg/L | 5 | -- | 7.8 |
| Total Suspended Solids | mg/L | -- | 7.7 | 9.7 |
| Fixed Suspended Solids | mg/L | -- | 0.9 | 2.9 |
| Total Phosphorus | mg/L | -- | 1.03 | 0.72 |
| Total Nitrogen | mg/L | -- | 1.60 | 1.43 |
| Fluoride | mg/L | 10 | 1.32 | 1.44 |
| Sulfate | mg/L | -- | 62 | 42 |
| Chlorophyll a | µg/L | -- | 12.6 | 38.4 |
| Total Radium | pCi/L | 5 | -- | -- |
| Gross Alpha | pCi/L | 15 | -- | 3.01 |

Fort Green (2006-2011)
Kingsford (2008-2011)

**Table 4-62. Summary Statistics for Specific Conductance at Background, Outfall and Downstream Stations (Exceedances Based on Values Greater than 1,275 µmho/cm)**

| Mine/Location | | Specific Conductance (µmho/cm) | | Number of Samples | Number of Criteria Exceedances |
|---|---|---|---|---|---|
| | | Mean | Median | | |
| South Pasture | | | | | |
| | Outfall 4 | 781 | 817 | 55 | 0 |
| | Outfall 5 | 651 | 729 | 25 | 0 |
| Four Corners 1 | | | | | |
| | Upstream | 277 | 284 | 70 | 0 |
| | Outfall | 569 | 564 | 28 | 0 |
| | Downstream | 462 | 422 | 78 | 0 |
| Four Corners 2 | | | | | |
| | Upstream | 204 | 210 | 55 | 0 |
| | Outfall | 653 | 623 | 53 | 0 |
| | Downstream | 550 | 574 | 33 | 0 |
| Ft. Green | | | | | |
| | Upstream | 442 | 464 | 59 | 0 |
| | Outfall | 509 | 505 | 232 | 0 |
| | Downstream | 465 | 476 | 128 | 0 |
| Kingsford | | | | | |
| | Upstream | 236 | 232 | 53 | 0 |
| | Outfall | 465 | 476 | 128 | 0 |
| | Downstream | 361 | 368 | 52 | 0 |
| Wingate 1 | | | | | |
| | Upstream | 186 | 174 | 60 | 0 |
| | Outfall | 408 | 384 | 14 | 0 |
| | Downstream | 367 | 337 | 6 | 0 |
| Wingate 2 | | | | | |
| | Upstream | 321 | 293 | 51 | 0 |
| | Outfall | 600 | 609 | 89 | 0 |
| | Downstream | 623 | 665 | 51 | 0 |

**Table 4-63. Summary Statistics for pH at Background, Outfall and Downstream Stations (Exceedances Based on Values Greater than 8.0 SU and Less than 6.5 SU)**

| Mine/Location | | pH (SU) | | Number of Samples | Number of Criteria Exceedances |
|---|---|---|---|---|---|
| | | Mean | Median | | |
| South Pasture | | | | | |
| | Outfall 4 | 7.7 | 7.8 | 57 | 0 |
| | Outfall 5 | 7.7 | 7.7 | 26 | 0 |
| Four Corners 1 | | | | | |
| | Upstream | 7.1 | 7.1 | 70 | 1 |
| | Outfall | 7.3 | 7.3 | 59 | 0 |
| | Downstream | 7.3 | 7.3 | 78 | 0 |
| Four Corners 2 | | | | | |
| | Upstream | 6.8 | 6.9 | 55 | 0 |
| | Outfall | 7.6 | 7.5 | 108 | 0 |
| | Downstream | 7.0 | 7.0 | 33 | 0 |
| Ft. Green | | | | | |
| | Upstream | 7.4 | 7.4 | 59 | 0 |
| | Outfall | 7.2 | 7.2 | 244 | 1 |
| | Downstream | 7.8 | 7.8 | 56 | 0 |
| Kingsford | | | | | |
| | Upstream | 7.2 | 7.2 | 53 | 0 |
| | Outfall | 7.8 | 7.8 | 153 | 1 |
| | Downstream | 7.5 | 7.5 | 52 | 0 |
| Wingate 1 | | | | | |
| | Upstream | 6.8 | 6.8 | 63 | 1 |
| | Outfall | 7.0 | 6.8 | 18 | 0 |
| | Downstream | 6.8 | 6.9 | 13 | 0 |
| Wingate 2 | | | | | |
| | Upstream | 7.0 | 7.0 | 72 | 0 |
| | Outfall | 7.3 | 7.3 | 127 | 0 |
| | Downstream | 7.3 | 7.3 | 71 | 0 |

**Table 4-64. Summary Statistics for Dissolved Oxygen at Background, Outfall and Downstream Stations (Exceedances Based on Values Greater than 5 mg/L)**

| Mine/Location | | Dissolved Oxygen (mg/L) | | Number of Samples | Number of Criteria Exceedances |
|---|---|---|---|---|---|
| | | Mean | Median | | |
| South Pasture | | | | | |
| | Outfall 4 | 7.5 | 7.5 | 55 | 0 |
| | Outfall 5 | 6.9 | 7.0 | 25 | 3 |
| Four Corners 1 | | | | | |
| | Upstream | 5.6 | 5.6 | 70 | 23 |
| | Outfall | 6.1 | 5.6 | 28 | 0 |
| | Downstream | 7.3 | 7.2 | 78 | 1 |
| Four Corners 2 | | | | | |
| | Upstream | 3.7 | 3.6 | 55 | 40 |
| | Outfall | 7.8 | 7.8 | 53 | 0 |
| | Downstream | 5.7 | 5.5 | 33 | 10 |
| Ft. Green | | | | | |
| | Upstream | 6.5 | 6.5 | 59 | 8 |
| | Outfall | N/A | N/A | 0 | 0 |
| | Downstream | 7.8 | 7.4 | 129 | 1 |
| Kingsford | | | | | |
| | Upstream | 6.1 | 6.1 | 52 | 2 |
| | Outfall | 7.8 | 7.4 | 129 | 1 |
| | Downstream | 5.3 | 5.1 | 51 | 22 |
| Wingate 1 | | | | | |
| | Upstream | 5.6 | 5.6 | 59 | 22 |
| | Outfall | 6.9 | 5.8 | 13 | 0 |
| | Downstream | 7.6 | 7.3 | 4 | 0 |
| Wingate 2 | | | | | |
| | Upstream | 5.3 | 5.4 | 42 | 18 |
| | Outfall | 8.0 | 7.8 | 90 | 0 |
| | Downstream | 7.0 | 7.2 | 43 | 2 |

**Table 4-65. Summary Statistics for Turbidity at Background, Outfall and Downstream Stations (Exceedances Based on Values Greater than 29 NTU)**

| Mine/Location | | Turbidity (NTU) | | Number of Samples | Number of Criteria Exceedances |
|---|---|---|---|---|---|
| | | Mean | Median | | |
| South Pasture | | | | | |
| | Outfall 4 | 6.7 | 5.4 | 55 | 0 |
| | Outfall 5 | 8.1 | 7.4 | 25 | 0 |
| Four Corners 1 | | | | | |
| | Upstream | 3.3 | 2.8 | 66 | 0 |
| | Outfall | 16 | 16 | 32 | 0 |
| | Downstream | 3.9 | 2.7 | 73 | 0 |
| Four Corners 2 | | | | | |
| | Upstream | 3.2 | 2.9 | 34 | 0 |
| | Outfall | 7.0 | 5.8 | 42 | 0 |
| | Downstream | 3.3 | 2.5 | 11 | 0 |
| Ft. Green | | | | | |
| | Upstream | 5.9 | 4.4 | 59 | 0 |
| | Outfall | 3.7 | 3.2 | 231 | 0 |
| | Downstream | 7.6 | 6.7 | 124 | 0 |
| Kingsford | | | | | |
| | Upstream | 14 | 11 | 52 | 4 |
| | Outfall | 7.6 | 6.7 | 124 | 0 |
| | Downstream | 7.6 | 6.2 | 51 | 1 |
| Wingate 1 | | | | | |
| | Upstream | 5.4 | 4.4 | 63 | 0 |
| | Outfall | 5.1 | 4.5 | 15 | 0 |
| | Downstream | 1.8 | 1.7 | 7 | 0 |
| Wingate 2 | | | | | |
| | Upstream | 5.5 | 4.5 | 63 | 1 |
| | Outfall | 6.1 | 4.9 | 92 | 1 |
| | Downstream | 6.2 | 5.6 | 42 | 0 |

#### 4.4.2.2 Upstream and Downstream Monitoring Records

The Mosaic outfall monitoring program requirements for the Four Corners and Wingate Creek Mines included monitoring of receiving water locations upstream (background) and downstream of each NPDES point of discharge for a subset of the water quality parameters monitored in the discharge samples. Comparable monitoring requirements exist for the Fort Green and Kingsford Mines. Table 4-66 describes the locations of those stations, <u>and Figures 12, 13, 14, and 15 in Appendix D show the station locations</u>.

**Table 4-66. Locations of Upstream and Downstream Monitoring Stations**

| Mine/Outfall | Upstream | Downstream |
|---|---|---|
| Four Corners/001 | Little Manatee River at Taylor Gill Rd. | Alderman Creek at Taylor Gill Rd. |
| Four Corners/002 | Payne Creek Inlet | Payne Creek at pipe crossing in Section 49 |
| Wingate Creek/001 | Myakka River at State Rd. 64 | Wingate Creek at S.R. 64 |
| Wingate Creek/002 | Johnson Creek at Logue Rd. | Johnson Creek at S.R. 64 |
| Kingsford/005 | Upper Lake Branch | Lake Branch at Lonesome Mine Rd. |
| Fort Green/005 | Tributary to Little Payne Creek at County Line Rd. | Payne Creek at U.S. Highway 17 |

Appendix D provides detailed information for the monitoring results from the outfalls summarized in Tables 4-60 and 4-61, and from corresponding upstream and downstream locations except at the South Pasture Mine outfalls, where upstream and downstream locations were not monitored. Box and whisker plots in Appendix D display the median values and distribution of values for the following parameters, and they also indicate the total number of observations and the number of exceedances of surface water criteria where applicable:

- Specific conductance
- pH
- Dissolved oxygen
- Turbidity
- Total phosphorus
- Total nitrogen
- Chlorophyll a

Upstream stations were compared to the corresponding outfall and downstream stations for the parameters above using only data from dates when all three stations were sampled. Table 4-67 indicates which station in each pair was determined to have significantly higher concentrations for each parameter, if there was no significant difference, or if there were less than 10 data pairs. For all the mines with more than 10 data pairs, the outfall stations had higher values of specific conductance, DO, and total phosphorus than the corresponding upstream stations. The active mine outfalls (Four Corners Mine and Wingate Creek Mine) also generally had higher values of pH and turbidity than the upstream stations; however, for the upstream-outfall pairs for the inactive mines (Fort Green Mine and Kingsford Mine), pH was higher at one outfall and one upstream station; turbidity was higher at both upstream stations than at the closed mine outfalls. Total nitrogen was higher at the upstream stations than at the outfalls except at Wingate Creek Mine Outfall 2, where no significant difference was observed. For chlorophyll a, two active mine outfalls were higher than the upstream stations but one showed no significant difference. The downstream stations generally showed the same relationships to the upstream stations as the outfalls.

Tables 4-62 through 4-65 provide summary statistics and frequency of exceedances for the parameters that have numerical surface water quality criteria (specific conductance, pH, DO, and turbidity). Mean and median values of specific conductance were generally higher at outfall and downstream stations than at corresponding upstream stations (Table 4-62). Similar findings were seen in the box and whisker plot (Figure 17 in Appendix D) and the paired comparison test results in Table 4-67. No exceedances of the Class III surface water quality criterion (1,275 micromhos per centimeter [µmho/cm]), were observed at any of the stations during the monitoring period.

For pH, the mean and median values at outfall, upstream, and downstream stations were within the acceptable range of 6.0 to 8.5, although one exceedance of criteria was observed at each of two upstream stations and two outfalls; no exceedances were reported at the downstream stations (Table 4-63). Many DO values were less than the 5.0 milligram per liter (mg/L) minimum but the low values occurred most frequently at upstream stations than at outfall or downstream stations (Table 4-64). Very few exceedances of the 29 nephelometric turbidity units (NTU) turbidity maximum were reported, and mean and median values were all lower than 29 NTU (Table 4-65). The Wingate 2 outfall station had one turbidity exceedance and the upstream station also had one exceedance.

**Table 4-67. Water Quality Comparisons for Outfall, Upstream, and Downstream Stations at Mine NPDES Outfalls**

| Station Pairs | Conductivity | Dissolved Oxygen | pH | Turbidity | Total Nitrogen | Total Phosphorus | Chlorophyll a |
|---|---|---|---|---|---|---|---|
| Four Corners Mine Outfall 1 | | | | | | | |
| Upstream vs Outfall | Outfall | Outfall | Outfall | Outfall | Upstream | Outfall | Outfall |
| Upstream vs Downstream | Downstream | Downstream | Downstream | NSD | Downstream | Upstream | NSD |
| Four Corners Mine Outfall 2 | | | | | | | |
| Upstream vs Outfall | Outfall | Outfall | Outfall | — | Upstream | Outfall | NSD |
| Upstream vs Downstream | Downstream | Downstream | Downstream | NSD | Upstream | Downstream | NSD |
| Wingate Mine Outfall 1 | | | | | | | |
| Upstream vs Outfall | — | — | NSD | NSD | — | — | — |
| Upstream vs Downstream | — | — | NSD | — | — | — | — |
| Wingate Mine Outfall 2 | | | | | | | |
| Upstream vs Outfall | Outfall | Outfall | Outfall | Outfall | NSD | Outfall | Outfall |
| Upstream vs Downstream | Downstream | Downstream | Downstream | NSD | NSD | Downstream | Downstream |
| Fort Green Mine | | | | | | | |
| Upstream vs Outfall | Outfall | — | Upstream | Upstream | — | Outfall | — |
| Upstream vs Downstream | NSD | — | Downstream | NSD | Upstream | Upstream | — |
| Kingsford Mine | | | | | | | |
| Upstream vs Outfall | Outfall | Outfall | Outfall | Upstream | Upstream | Outfall | — |
| Upstream vs Downstream | Downstream | Upstream | Downstream | Upstream | Upstream | Downstream | — |

Table indicates which station in pair has significantly higher values based on Wilcoxon Signed Rank Test ($\alpha = 0.05$)
Wilcoxon Signed Rank Test used only data from dates when all three stations (outfall, upstream, and downstream) were sampled.

Notes:
NSD = No significant difference
— = Less than 10 data pairs, no statistical analysis

**Numeric Nutrient Criteria**

As described in Section 3.3.3 and Appendix D, both FDEP and USEPA are working to develop water quality standards to prevent nutrient pollution in Florida rivers, perennial streams, lakes and to estuaries from Tampa Bay to Biscayne Bay, including Charlotte Harbor. These standards are called numeric nutrient criteria (NNC) and establish levels for nitrogen and phosphorus. FDEP's standards also include biological conditions that must be met to protect healthy waterways.

At this time, the only NNC that have taken full effect are those portions of USEPA's Inland Rule applicable to lakes and springs and FDEP's estuary criteria, which cover some state estuaries. The estuary criteria are set out in Section 62-302.532, F.A.C. For flowing waters and the remainder of the state's marine waters, the applicable water quality standards remain the state narrative criteria set out in subsection 62-302.530(47), F.A.C., as well as any established restoration goals in the form of TMDLs.

Tables 16 through 18 in Appendix D show the results of sampling for total phosphorus, total nitrogen, and chlorophyll *a* for several mine outfalls, plus upstream and downstream locations, from 2001 through 2011, expressed as annual geometric mean values. It is important to note that these data are provided for informational purposes only. The sampling procedures used to produce these data, and the sampling procedures that may be required to determine NNC compliance, may differ. The NNC limits for total phosphorus and total nitrogen shown are taken from Section 62-302.532, F.A.C.; the standard described in that statute allows for no more than one exceedance in any three calendar year period.

The outfall and downstream station annual means consistently exceeded the total phosphorus limit more than once in a consecutive 3-year period, as did many of the upstream locations. Many annual geometric mean total nitrogen values could not be calculated because less than four data points were available for those years. For the years with valid geometric values, exceedances of the NNC total nitrogen limit were more frequent for upstream stations. In contrast, annual geometric mean total nitrogen values complied with the limit at all of the outfall stations and all but one of the downstream stations. Annual geometric mean chlorophyll *a* concentrations were less than the screening value at all outfall, upstream, and downstream stations except at the Kingsford Mine outfall. It was not possible to compare the Kingsford Mine outfall chlorophyll *a* values with upstream and downstream stations because valid geometric means were not available for those stations.

The preceding data summaries document that discharges from phosphate mines may have elevated specific conductance, total phosphorus, turbidity, and chlorophyll *a* values compared to the corresponding background locations. In some but not all cases, downstream values were also correspondingly higher than the background levels, reflecting an instream influence of the discharge. However, the criteria exceedances apparently associated with outfall discharges were infrequent. For most outfall and downstream monitoring locations, total nitrogen concentrations were lower than at the corresponding background stations. Outfalls at inactive mines undergoing reclamation did not generally show the same relationships to upstream stations.

**Aquatic Biological Monitoring**

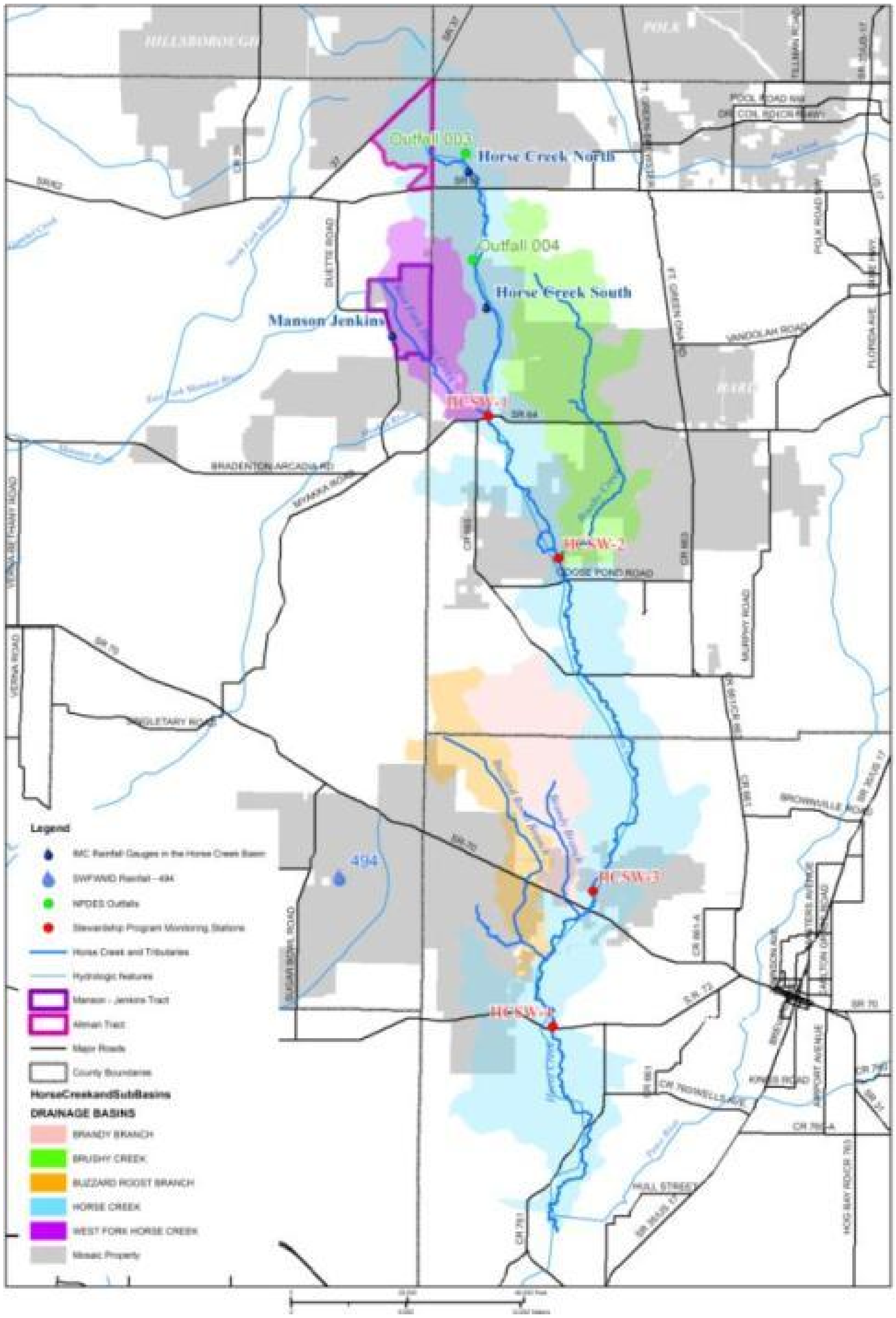
Indirect effects of phosphate mine discharges on downstream reaches of the receiving water body may be difficult to detect solely through water quality monitoring because of low frequency of mine discharges, and the variable nature of streamflow. Discharges generally only occur when rainfall accumulations lead to the recirculation systems being full, due to seasonal accumulations, or because of extended durations and/or multiple large storm events. Thus, mine discharges are most likely to occur when stream baseflows are elevated because of the same drivers – large storms, extended durations of rainfall, or gradual seasonal buildup of watershed storage and baseflow. Under such scenarios, water quality effects of mine discharges may be quickly diluted by stream baseflow, making them difficult to document. However, these same conditions may make it less likely that the discharges would affect on the aquatic biological communities associated with the water body.

For these reasons, aquatic biological monitoring is often used to provide an indirect measure of potential water quality effects of a discharge on the receiving stream. Macroinvertebrate monitoring results, expressed as Stream Condition Index (SCI), are also important in evaluating compliance with NNC. The results from two biological monitoring programs are described below.

***Horse Creek Stewardship Program Aquatic Biological Studies***

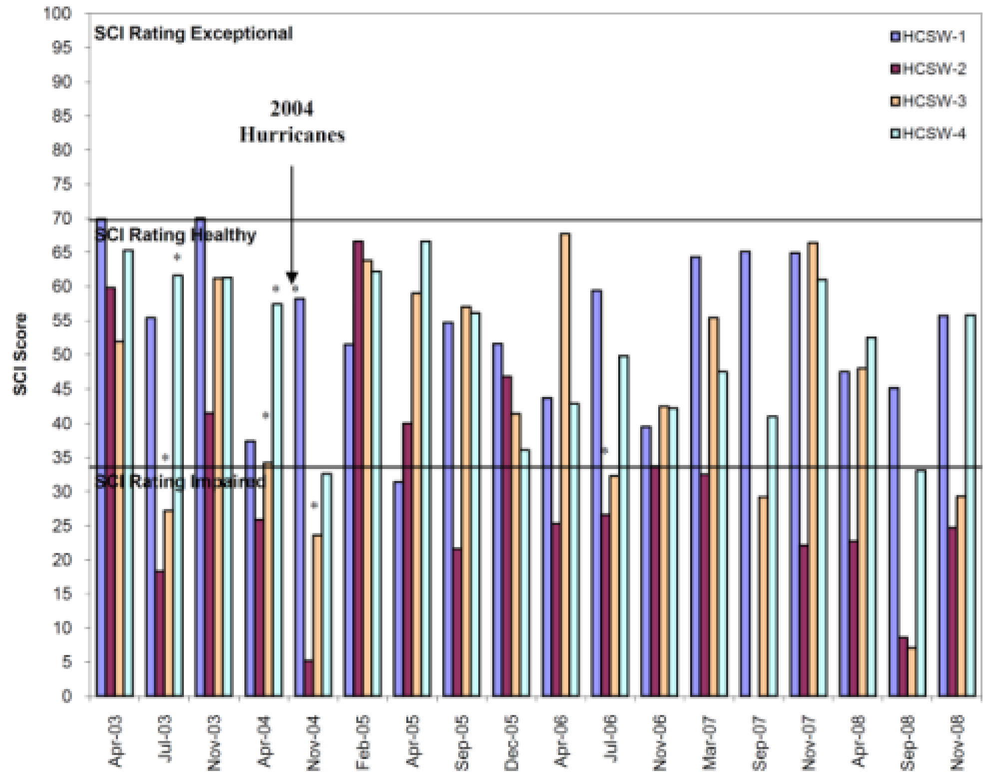
Of the widely varied studies of fish and macroinvertebrate communities in the AEIS study area pertinent to review of phosphate mining effects, one of the most relevant is the long-term monitoring of these communities conducted under the Horse Creek Stewardship Program -- an environmental monitoring program established through the collaborative efforts of Mosaic and the PRMRWSA to monitor for mining-related effects on Horse Creek that could affect PRMRWSA's withdrawal of raw water for potable water supply purposes.

Under this program, monitoring of fish and macroinvertebrate communities at fixed locations in Horse Creek has been conducted since 2003. The monitoring program includes assessment of fish and macroinvertebrate communities three times per year (March-April, July-September, and October-December) at the four sites shown in Figure 4-16, all of which are along the main stem of Horse Creek (Entrix, 2010a). The upstream station (HCSW1) is slightly less than 8 miles downstream of the nearest phosphate mine outfall (Fort Green Outfall 004). Monitoring of macroinvertebrates is conducted in accordance with FDEP-approved procedures for SCI analyses. Figure 4-17 summarizes SCI scores for each of the four stations for monitoring years 2003 through 2008. SCI scores for the upstream station remained in the "healthy" range for this entire study period, as did those for the most downstream station.




Source: Entrix, 2010a

**Figure 4-16. Aquatic Biological Monitoring Stations in Horse Creek, Horse Creek Stewardship Program**



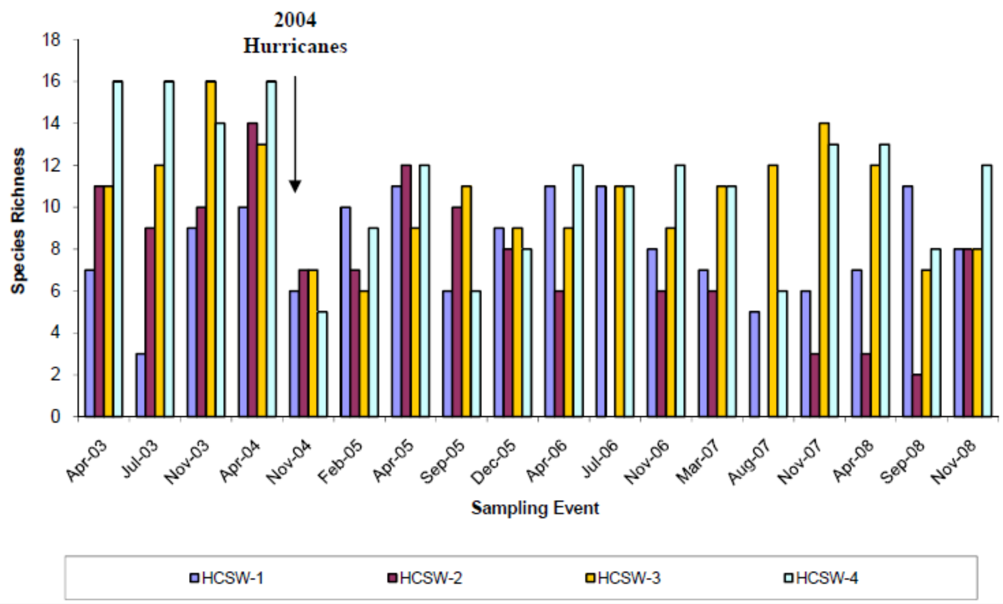

*Source: Entrix, 2010a*

**Figure 4-17. Macroinvertebrate Community Assessment Results (SCI Scores), 2003 - 2008, Horse Creek Stewardship Program**

Station HCSW2 fairly consistently was characterized as "impaired" based on its low SCI scores; these were attributed to a large wetland system adjacent to this monitoring location, which influenced the prevailing flow and water quality conditions. The third monitoring location, HCSW3, variably reflected SCI scores in either the impaired or healthy range. For all four stations, considerable season to season and year to year variability was reflected. None of these patterns appear related to phosphate mining discharges from the two outfalls from the Fort Green Mine in the upper portion of the Horse Creek watershed.

BRA (2006a) presented an overview of historical macroinvertebrate monitoring data in the Horse Creek watershed, including data collected prior to HCSP sampling. On the basis of that review, BRA concluded that macroinvertebrate abundance and richness in this creek is greater during the dry season than during the wet season. The lower abundance and richness during the wet season was attributed to macroinvertebrates being flushed out and/or being diluted by greater streamflows during the wet season (BRA, 2006a). These relationships may be relevant as future mining effects are evaluated for individual mines and/or for combinations of mines which may have overlapping operational periods affecting lands in the Horse Creek watershed.

Monitoring of fish species present at these same four stations from 2003 through 2008 produced the species richness (number of species per station) information summarized in Figure 4-18 (Entrix, 2010a). Through 2008, investigators collected 41 fish species from these four sampling sites. The number of fish species found at the upstream locations was generally lower than at the locations further downstream, perhaps reflecting the increased opportunity for fish movements up into the watershed from the lower reaches of the system as well as increased habitat diversity in higher-order stream reaches.




*Source: Entrix, 2010a*

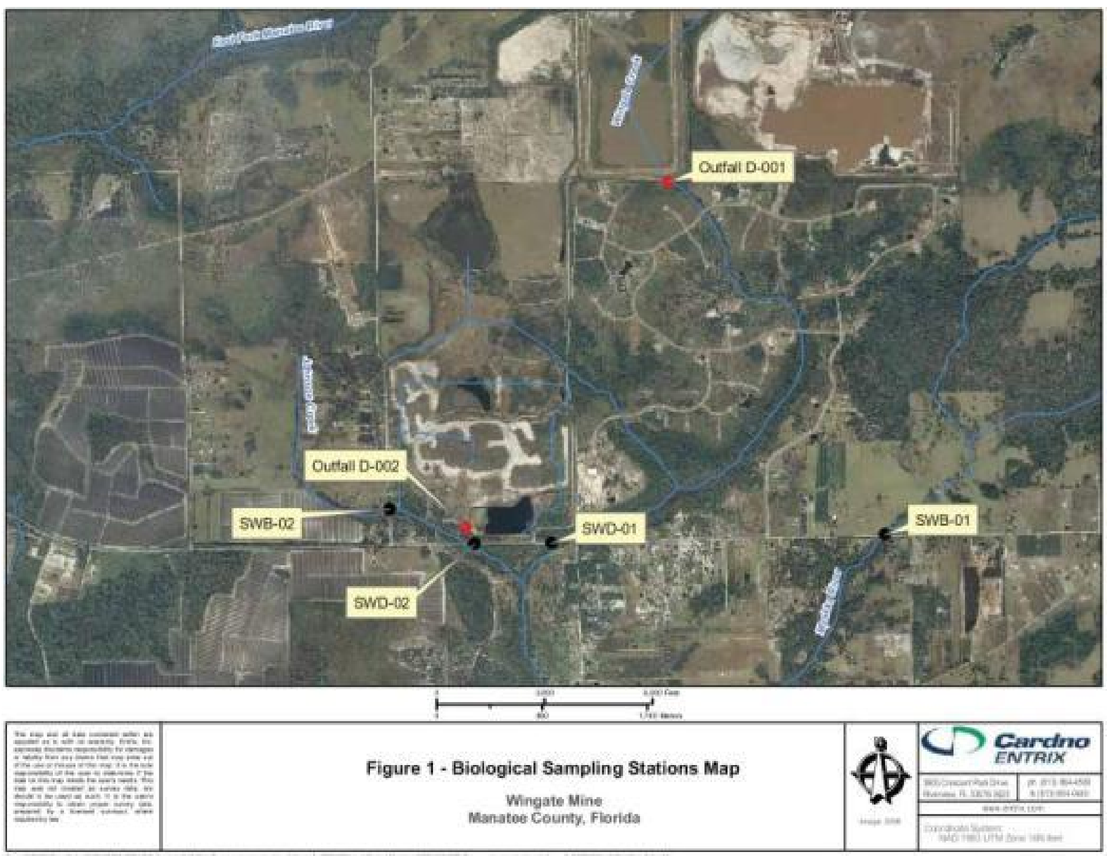
**Figure 4-18. Fish Community Assessment Results (Species Richness), 2003 - 2008, Horse Creek Stewardship Program**

Entrix (2010a) indicated that prior to 2004 when Hurricane Charley caused substantial impacts across this watershed, species richness as well as diversity were lowest at the upstream site and highest at the location furthest downstream in the study area, reporting that “this pattern of longitudinal zonation of increasing species diversity with increasing stream order is typical of stream systems (Harrel et al., 1967, Whiteside and McNatt, 1972, Sheldon, 1988).” Fish community species richness and diversity were not viewed as related to mining activities in the uppermost reaches of the creek watershed during this period of monitoring. Recovery from Hurricane Charley effects has been suggested by the more recent years of monitoring.

***Wingate Creek Mine Discharge Monitoring for Effects on Macroinvertebrates***

The existing Wingate Creek Mine’s industrial operations permit issued by FDEP is unique in that it includes a requirement for an annual wet season evaluation of macroinvertebrate communities upstream and downstream from each of the two NPDES permit-authorized outfalls from this mine. The permit conditions call for monitoring if any outflow through the specific outfall occurs in the 12 months prior to that year’s wet season (August – October); monitoring is conducted following FDEP's standard operating procedure DEP-SOP-001/01 FS 7420 Stream Condition Index (D-Frame Dipnet) Sampling. The permit conditions stipulate that "At the time of sampling, the appropriate outfall shall be discharging effluent to the receiving stream."

The two permitted outfalls, D-001 and D-002, discharge to Wingate Creek and Johnson Creek, respectively; both are tributaries of the Myakka River. For Outfall D-002, the upstream and downstream reaches monitored are in Johnson Creek with each reach defined as a 100-meter zone of the creek. Outfall D-001 discharges to Wingate Creek, and for this site the downstream station is just upstream of the junction of Wingate Creek with Johnson Creek. No upstream portion of Wingate Creek was suitable as an upstream reference site so the background monitoring station is actually in the Myakka River at a location considered as comparable in habitat characteristics as possible to the downstream monitoring station in Wingate Creek. Each monitoring location also is represented by a 100-meter zone of the applicable water body. The station locations are shown in Figure 4-19.




*Source: ENTRIX, 2010a*

**Figure 4-19. Macroinvertebrate Monitoring Stations for the Wingate Creek Mine (NPDES Permit No. FL0032522)**

The monitoring records available for 2008, 2009, and 2010 are summarized in Table 4-68. No discharges from Outfall D-001 occurred during this 3-year period; thus, the limited data reported relevant to this site may be useful for future reference but are not interpretable for assessing potential effects of mine-related discharges. For Outfall D-002, discharges occurred during each year with discharge rates ranging from near zero to a peak rate of up to approximately 19 mgd. Macroinvertebrate monitoring only occurred during an actual period of discharge for the first year (2008). For both 2009 and 2010, the macroinvertebrate surveys were conducted during periods when no effluent was being released, and in both years the most recent discharge had occurred several weeks prior to the stream monitoring effort. SCI scores for those years may not have complied with the FDEP requirement for antecedent streamflow conditions. The Standard Operating Procedure for SCI evaluations specifies that the stream must discharge continuously for 180 consecutive days prior to sampling, and that flows must be within an acceptable range for 28 days prior to testing.

**Table 4-68. Stream Condition Index Scores for Wingate Creek Mine's Outfalls D-001 and D-002**

| | | Outfall D-001 | | Outfall D-002 | |
|---|---|---|---|---|---|
| **Year** | | **Reference** | **Downstream** | **Upstream** | **Downstream** |
| 2008 | Flow Condition | No Discharge in Prior Year; No monitoring | | High rate of effluent flow (>10 mgd) | |
| | SCI Score | NA | NA | 50 | 32 |
| 2009 | Flow Condition | No Discharge in Prior Year; Monitored Per Permit Condition | | No Effluent Flow During Sampling, but Monitored | |
| | SCI Score | Inadequate Flow; No Sampling | 46 | 29 | 28 |
| 2010 | Flow Condition | No Discharge in Prior Year; No monitoring | | No Effluent Flow During Sampling, but Monitored | |
| | SCI Score | NA | NA | 36 | 42 |

Notes:
For these scores, evaluations were as follows per the FDEP SOP specifications: SCI scores of 71-100 = Exceptional; SCI scores of 35-70 = Healthy; SCI scores of 0-34 = Impaired. FDEP has recommended using an SCI score threshold of 40 to differentiate healthy vs. impaired stream habitats.

(Sources: BRA, 2008; Entrix, 2010a)

In 2009, both upstream and downstream SCI scores relevant to Outfall D-002 suggested an impaired stream condition, in contrast to the 2010 results which suggested a healthy stream condition. The 2008 monitoring results (healthy upstream but impaired downstream conditions) indicate that there may be short-term invertebrate community response to high rates of mine discharge. Where such communities are numerically dominated by insect larval forms with short-duration reproductive strategies, recolonization rates may be high enough to cause a rapid recovery to community characteristics similar to those of upstream reference habitats. What may be most relevant is that during both 2009 and 2010, the upstream and downstream values were comparable; this suggests no substantive differences in the macroinvertebrate communities approximately 3 weeks after the last mine discharge from Outfall D-002. If there were short-term effects on the macroinvertebrate communities, recovery had occurred over a very short time.

On the basis of these monitoring records, there were no definitive indications of phosphate mine-related indirect water quality impacts on the aquatic biological communities monitored downstream of the Wingate Creek Mine and Fort Green Mine discharge locations.

#### 4.4.2.3 Groundwater Quality

Interactions between surface waters and the shallow water table can be dynamic and complex depending on both short-term and long-term antecedent weather conditions, and the physical and chemical characteristics of the soils and geological features of the aquifer. Some rainfall on undisturbed natural land surfaces infiltrates through the soil horizons, with the contribution of both water and leached constituents to the water table aquifer. Depending on the soil characteristics and level of saturation, some portion of the rainfall runs off to the nearest wetland or surface water body, where again some portion can infiltrate while the remainder can flow to downstream reaches. Conversely, where the water table elevation is above the surface water body's stage, groundwater exfiltration to the surface water body can occur. Evaluation of the effects of phosphate mining on water table water quality, thus, is not a simple exercise.

For assessment of mining effects on the water table, however, the most likely means of assessing direct effects is monitoring of shallow groundwater quality at mine infrastructure units most likely to result in infiltration. CSAs are the infrastructure units of greatest concern because of two key factors:

- CSAs receive the clay slurries produced from the beneficiation process. This process involves both physical and chemical treatments to separate the phosphate-rich fractions from the clays and sands also contained in the incoming matrix. A variety of chemicals are used in the beneficiation process, and some of these are believed to be carried into the CSAs associated with the clay materials. A potential consequence of water infiltration from CSAs would be introduction of residual beneficiation reagents into the water table.

- Under typical operational scenarios, the water level in an actively operating CSA is substantively above the ground elevations around the CSA. Thus, water seepage through the CSA berms and into the groundwater beneath the CSA would occur. Seepage collection ditches at the outer toe of the berms are used to collect the shallow seepage through the berms but some of the water infiltrates to the water table. This route of potential constituent conveyance is the most likely path for constituents in the recirculation system waters to reach the water table both due to the hydraulic gradients present and the higher probability of mining-related constituents to be present.

For these reasons, the AEIS evaluations regarding potential phosphate mining effects on water table water quality were focused on groundwater monitoring records for CSAs. Historical investigations conducted by industry representatives working with the (current) FDEP led to the conclusion that groundwater quality at phosphate mine sites typically remained in compliance with the primary and secondary drinking water standards used by the FDEP to ensure adequate protection of GII aquifers (Gordon F. Palm and Associates, 1984). However, in some permits groundwater monitoring has been required. Review of these types of groundwater monitoring data for wells on the perimeter of CSAs was conducted to provide this AEIS with a review of relevant monitoring records.

***Groundwater Quality Effects for South Pasture Mine***

For the South Pasture Mine, the FDEP-issued operations permit requires monitoring of four monitoring wells installed in the SAS (three compliance wells and one background well) to monitor groundwater levels and quality. The three compliance wells are on the south, west, and east sides of Clay Settling Area (CSA) 1; the background well is on the north side of CSA 1. Groundwater samples are collected quarterly from these four wells and analyzed for the physical and water quality parameters listed in Table 4-69. Assessment of compliance with primary (groundwater maximum contaminant levels [MCLs]) and secondary (SMCL) drinking water standards for representative parameters is used by FDEP to monitor the risk of adverse effects on the water table aquifer.

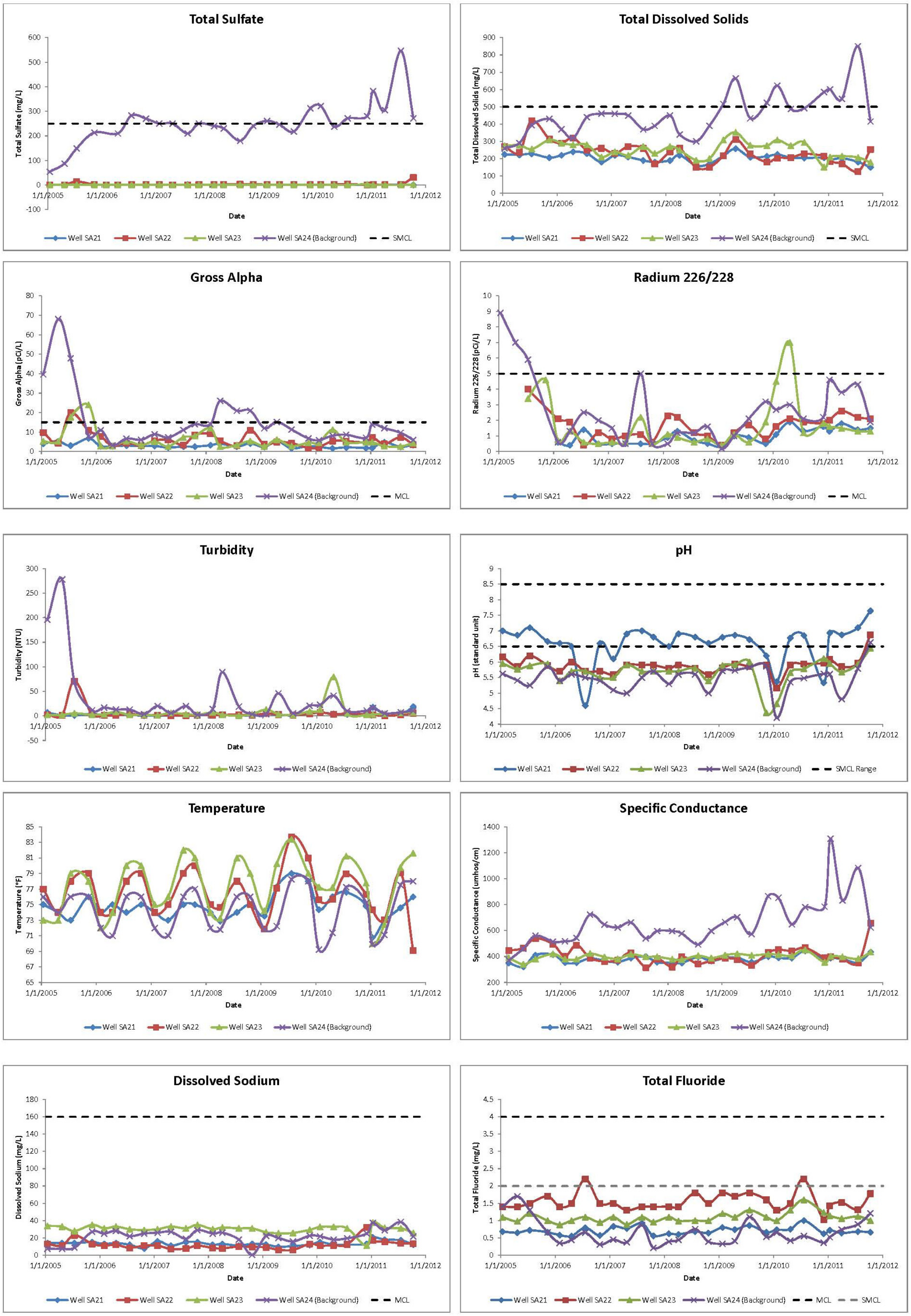
The results of the South Pasture Mine quarterly groundwater monitoring from 2005 through 2010 were summarized; and Figure 4-20 provides a graphical summary of the data. Increasing trends in total dissolved solids, specific conductance, and sulfate have been observed at the background well. Higher concentrations of total dissolved solids, specific conductance, turbidity, sulfate, gross alpha, and radium-226/228 have generally been observed at the background well than at the compliance wells.

**Table 4-69. Groundwater Monitoring Parameters, South Pasture Mine, Hardee County**

| Parameter | Groundwater MCL/SMCL |
|---|---|
| Water Level | NA |
| Turbidity | NA |
| pH | 6.5 – 8.5 standard units (SMCL) |
| Water Temperature | NA |
| Specific Conductance | NA |
| Dissolved Sodium | 160 mg/L (MCL) |
| Total Fluoride | 4 / 2 mg/L |
| Total Sulfate | 250 mg/L (SMCL) |
| Total Dissolved Solids | 500 mg/L (SMCL) |
| Gross Alpha | 15 pCi/L (MCL) |
| Radium 226 and Radium 228 | 5 pCi/L (MCL) |

Where the natural background concentration is greater than the associated groundwater MCL, the background groundwater concentration is used as the prevailing standard.

Notes:
MCL = Maximum contaminant level
SMCL = Secondary maximum contaminant level
NA = Not applicable




*Source: CF Industries, 2012b*

**Figure 4-20. South Pasture Mine Groundwater Monitoring Water Quality Records, 2005-2010**

Based on these results, the groundwater quality at the compliance wells rarely exceeded the MCL and SMCL, and the background well water quality frequently exceeded the MCL and SMCL. The exception to this is seen in the results for pH, which show that two of the three compliance wells and the background well routinely had a pH below the lower limit for the SMCL, and one compliance well frequently was above that lower limit, within the acceptable range. The FDEP Ground Water Quality Monitoring Network Summary 1994-1997 (Silvanima et al., 2013) provides context for these results, indicating that statewide, pH values in the SA ranged from 4.13 to 9.06, with a median value of 6.08. pH values in the area that includes the South Pasture Mine ranged from 4.13 to 7.76, with a median value of 5.84. Viewed in context, it is apparent that the pH values reported in the monitoring results, although typically below the SMCL, are within a normal range of values for the state and the local area.

### 4.4.3 **Alternative 2: Desoto Mine**

The Desoto Mine would be expected to have impacts similar to those discussed above on surface water quality and groundwater quality in the Horse Creek subwatershed, the Peace River at Arcadia subwatershed, and the Peace River watershed. Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to cause exceedances of primary and secondary regulatory criteria.

Based on these expected water quality conditions, the Desoto Mine would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations. If this happens during the project-specific CWA Section 404(b)(1) analysis for the Desoto Mine, then as described in Chapter 1, the USACE is committed to working with the appropriate parties to find a resolution to the issue of the degree and significance of the Desoto Mine's impact on water quality.

### 4.4.4 **Alternative 3: Ona Mine**

The Ona Mine would be expected to have impacts similar to those discussed above on surface water quality and groundwater quality in the Horse Creek subwatershed, the Peace River subwatershed at Arcadia, the Upper Myakka subwatershed, and the Peace and Myakka River watersheds. Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to cause exceedances of primary and secondary regulatory criteria.

Based on these expected water quality conditions, the Ona Mine would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations. If this happens during the project-specific CWA Section 404(b)(1) analysis for the Ona Mine, then as described in Chapter 1, the USACE is committed to working with the appropriate parties to find a resolution to the issue of the degree and significance of the Ona Mines' impact on water quality.

### 4.4.5 Alternative 4: Wingate East Mine

The Wingate East Mine would be expected to have impacts similar to those discussed above on surface water quality and groundwater quality in the Upper Myakka subwatershed and the Myakka River watershed, but should not impact the Horse Creek subwatershed or Peace River watershed because of the small amount of area in that subwatershed and watershed. Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to have a significant impact or to cause exceedances of primary and secondary regulatory criteria.

Based on these expected water quality conditions, the Wingate East Mine would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations. If this happens during the project-specific CWA Section 404(b)(1) analysis for the Wingate East Mine, then as described in Chapter 1, the USACE is committed to working with the appropriate parties to find a resolution to the issue of the degree and significance of the Wingate East Mines' impact on water quality.

### 4.4.6 Alternative 5: South Pasture Extension Mine

The South Pasture Extension Mine would be expected to have impacts similar to those discussed above on surface water quality and groundwater quality in the Horse Creek subwatershed and Peace River at Arcadia subwatershed, and the Peace River watershed. Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to have a significant impact or to cause exceedances of primary and secondary regulatory criteria.

Based on these expected water quality conditions, the South Pasture Extension Mine would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations. If this happens during the project-specific CWA Section 404(b)(1) analysis for the South Pasture Extension Mine, then as described in Chapter 1, the USACE is committed to working with the appropriate parties to find a resolution to the issue of the degree and significance of the South Pasture Extension Mines' impact on water quality.

### 4.4.7 Alternative 6: Pine Level/Keys Tract

Discharges from the Pine Level/Keys Tract extension would likely be to a portion of the Big Slough subwatershed of the Lower Myakka River watershed. This alternative would be expected to have similar impacts as those discussed above on surface water quality and groundwater quality. Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to have a significant impact or to cause exceedances of primary and secondary regulatory criteria.

Based on these expected water quality conditions, mining the Pine Level/Keys Tract would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations.

### 4.4.8 Alternative 7: Pioneer Tract

The Pioneer Tract alternative would discharge to the Horse Creek subwatershed, Peace River subwatershed at Arcadia, and Upper Myakka subwatershed. It would likely have water quality characteristics similar to those discussed above. Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to have a significant impact or to cause exceedances of primary and secondary regulatory criteria.

Based on these expected water quality conditions, mining the Pioneer Tract would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations.

### 4.4.9 Alternative 8: Site A-2

Site A-2 would discharge to the Buckhorn Creek, Lake Dale Branch, Little Charlie Creek, and Max Creek subwatersheds, all in the Peace River watershed. Water quality impacts of discharges would be expected to be similar to those discussed above. Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to have a significant impact or to cause exceedances of primary and secondary criteria.

Based on these expected water quality conditions, mining Site A-2 would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations.

### 4.4.10 Alternative 9: Site W-2

Discharges from the Site W-2 alternative would be to the Boggy Creek, Coker Creek, Myakka River, Ogleby Creek, and Tatum Sawgrass Slough subwatersheds of the Myakka River watershed. This alternative would be expected to have similar impacts as those discussed above on surface water quality and groundwater quality, Surface water quality downstream from outfalls would likely see increases in specific conductance, DO, pH, and total phosphorus, while turbidity, total nitrogen and chlorophyll *a* would remain relatively unimpacted by discharges. Discharge exceedances of criteria for pH, DO, and turbidity would be very infrequent and of short duration. Specific conductance would be expected to be in compliance with regulatory standards. Compliance with future surface water quality criteria like NNC will need to be evaluated using the appropriate methodologies. CSA operations and discharges may cause observable changes in groundwater quality at downgradient locations but would not be expected to have a significant impact or to cause exceedances of primary and secondary regulatory criteria.

Based on these expected water quality conditions, mining Site W-2 would have a minor to moderate degree of effect of surface water and groundwater quality. Because these effects would not affect public health or safety, can be reasonably predicted based on existing monitoring data, and are not expected to violate water quality standards, they would not be considered significant. New information, or changes in regulatory requirements, may lead to the USACE reconsidering these determinations.

## 4.5 ECOLOGICAL RESOURCES

This section is divided into four subsections - aquatic biological communities, wetlands, wildlife habitat, and listed species. The geographic scope of the ecological resources analyses includes the area inside the boundaries of each alternative and the downstream area that receives surface water drainage from each alternative, including the Charlotte Harbor estuary.

The criteria for determining the degree of impact are provided for each subsection.

### 4.5.1 Aquatic Biological Communities

The analysis of potential effects on aquatic biological communities is primarily focused on faunal communities in open waters such as streams, rivers (freshwater and estuarine reaches), and the Charlotte Harbor estuary. Section 3.3.4 contains additional information about aquatic biological communities within the AEIS study area.

Factors considered in the determination of the intensity of impacts and significance include the level of direct impacts, and an alternative’s effects on surface water hydrology and water quality. The degree of intensity of impacts on aquatic biological communities was determined using the following criteria:

- No Impact to Minor: All disturbances to aquatic biota on the mine site would be short-term or would result in little to no loss of aquatic biota. Aquatic biological communities outside the mine property would not be impacted in any manner.
- Moderate: Some disturbances to aquatic biota on the mine site would be long-term. A moderate amount of aquatic biota on the mine site would be eliminated over a short term. Aquatic biological communities outside the mine property would not be impacted in any manner.
- Major: Most disturbances to aquatic biota on the mine site would be long-term. A large amount of aquatic biota on the mine site would be eliminated short-term. Aquatic biological communities outside the mine property may be impacted but would not have to be impacted for a major impact to occur.

#### 4.5.1.1 Alternative 1: No Action Alternative

Under the No Action Alternative – No Mining scenario, there would be no impacts to aquatic biological communities associated with phosphate mining within the four parcels that make up the Applicants' Preferred Alternatives. The upland and wetland habitats and their biota on these lands would not undergo large-scale disturbance from mining operations; however, they would continue to be impacted by ongoing agricultural activities and likely by gradual increases in residential/commercial development in the area.

Under the No Action Alternative – Upland Only scenario, there would be minor direct impacts to aquatic biological communities in isolated open water bodies not considered waters of the U.S., and minor indirect impacts to streams on the four parcels as the adjacent uplands and non-waters of the U.S. wetlands were mined.

Under both scenarios, any potential beneficial effect resulting from enhancement and restoration of streams that were historically impacted by ditching and other practices would not occur.

As described in Section 4.2.1, either scenario of the No Action Alternative would have a minor effect on downstream water flows, and therefore either scenario would have no effect to a minor effect on aquatic biological communities in the estuarine reaches of the Peace and Myakka Rivers and Charlotte Harbor.

Based on the low level of impacts, the No Action Alternative would not be considered significant.

#### 4.5.1.2 Alternative 2: Desoto Mine

As described in the June 1, 2012, public notice, there are 64,474 linear feet of direct stream impacts proposed for the Desoto Mine, which is approximately 50% of the stream linear footage onsite.

Without mitigation, these direct impacts would not be compensated for or reclaimed; 64,474 linear feet, or approximately half of the stream linear footage onsite, would be eliminated, long-term. In addition, the 'without mitigation' scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a major degree of adverse effect, which would be significant.

It is expected, however, that as the project moves through the mitigation sequencing process (as described in Chapter 5), there will be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures will address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation the Desoto Mine would have at most a moderate effect on aquatic biological communities, which would not be significant.

The Desoto Mine would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace River or in Charlotte Harbor. The USACE will coordinate this determination with the NMFS in its individual permit review for the Desoto Mine.

#### 4.5.1.3 Alternative 3: Ona Mine

As described in the June 1, 2012, public notice, there are 136,731 linear feet of direct stream impacts proposed for the Ona Mine, which is approximately 66 percent of the stream linear footage onsite.

Without mitigation, these direct impacts would not be compensated for or reclaimed; 136,731 linear feet, or approximately 66 percent of the stream linear footage onsite, would be eliminated, long-term. In addition, the ‘without mitigation’ scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a major degree of adverse effect, which would be significant.

It is expected, however, that as the project moves through the mitigation sequencing process (as described in Chapter 5), there will be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures will address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation the Ona Mine would have at most a moderate effect on aquatic biological communities, which would not be significant.

The Ona Mine would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace or Myakka Rivers or in Charlotte Harbor. The USACE will coordinate this determination with the NMFS in its individual permit review for the Ona Mine.

#### 4.5.1.4 Alternative 4: Wingate East Mine

As described in the June 1, 2012, public notice, there are 27,287 linear feet of direct stream impacts proposed for the Wingate East Mine, which is approximately 85 percent of the stream linear footage onsite.

Without mitigation, these direct impacts would not be compensated for or reclaimed; 27,287 linear feet, or approximately 85 percent of the stream linear footage onsite, would be eliminated, long-term. In addition, the ‘without mitigation’ scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a major degree of adverse effect, which would be significant.

It is expected, however, that as the project moves through the mitigation sequencing process (as described in Chapter 5), there will be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures will address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation the Wingate East Mine would have at most a moderate effect on aquatic biological communities, which would not be significant.

The Wingate East Mine would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace or Myakka Rivers or in Charlotte Harbor. The USACE will coordinate this determination with the NMFS in its individual permit review for the Wingate East Mine.

#### 4.5.1.5 Alternative 5: South Pasture Extension Mine

As described in the June 1, 2012, public notice, there are 32,161 linear feet of direct stream impacts proposed for the South Pasture Extension Mine, which is approximately 37% of the stream linear footage onsite.

Without mitigation, these direct impacts would not be compensated for or reclaimed; 32,161 linear feet, or approximately 37 percent of the stream linear footage onsite, would be eliminated, long-term. In addition, the ‘without mitigation’ scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a moderate to major degree of adverse effect, which would be significant.

It is expected, however, that as the project moves through the mitigation sequencing process (as described in Chapter 5), there will be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures will address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation the South Pasture Extension Mine would have at most a moderate effect on aquatic biological communities, which would not be significant.

The South Pasture Extension Mine would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace River or in Charlotte Harbor. The USACE will coordinate this determination with the NMFS in its individual permit review for the South Pasture Extension Mine.

#### 4.5.1.6 Alternative 6: Pine Level/Keys Tract

The Pine Level/Keys Tract contains approximately 209,949 linear feet of streams based on NHD data (USGS, 2013b). Although no mining is currently proposed for Pine Level/Keys Tract, this analysis assumes that a percentage of stream impacts similar to what is proposed for the Applicants' Preferred Alternatives would be proposed for this alternative.

Without mitigation, streams on the Pine Level/Keys Tract would be eliminated, long-term, and not be compensated for or reclaimed. Applying the 37 percent to 85 percent range of impact for the Applicants' Preferred Alternatives to the Pine Level Keys Tract, this would mean direct impacts to between approximately 77,681 linear feet and 178,456 linear feet of streams onsite. In addition, the 'without mitigation' scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a moderate to major degree of adverse effect, which would be significant.

It is expected, however, that as the project would move through the mitigation sequencing process (as described in Chapter 5), there would be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures would address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation mining the Pine Level/Keys Tract would have at most a moderate effect on aquatic biological communities, which would not be significant.

Mining the Pine Level/Keys Tract would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace River, Myakka River, or in Charlotte Harbor.

#### 4.5.1.7 Alternative 7: Pioneer Tract

The Pioneer Tract contains approximately 330,526 linear feet of streams based on NHD data (USGS, 2013b). Although no mining is currently proposed for Pioneer Tract, this analysis assumes that a percentage of stream impacts similar to what is proposed for the Applicants' Preferred Alternative would be proposed for this alternative.

Without mitigation, streams on the Pioneer Tract would be eliminated, long-term, and not be compensated for or reclaimed. Applying the 37 percent to 85 percent range of impact for the Applicants' Preferred Alternatives to the Pioneer Tract, this would mean direct impacts to between approximately 122,294 linear feet and 280,947 linear feet of streams onsite. In addition, the 'without mitigation' scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in

Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a moderate to major degree of adverse effect, which would be significant.

It is expected, however, that as the project would move through the mitigation sequencing process (as described in Chapter 5), there would be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures would address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation mining the Pioneer Tract would have at most a moderate effect on aquatic biological communities, which would not be significant.

Mining the Pioneer Tract would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace River, Myakka River, or in Charlotte Harbor.

#### 4.5.1.8 Alternative 8: Site A-2

Site A-2 contains approximately 108,226 linear feet of streams based on NHD data (USGS, 2013b). Although no mining is currently proposed for Site A-2, this analysis assumes that a percentage of stream impacts similar to what is proposed for the Applicants' Preferred Alternative would be proposed for this alternative.

Without mitigation, streams on Site A-2 would be eliminated, long-term, and not be compensated for or reclaimed. Applying the 37 percent to 85 percent range of impact for the Applicants' Preferred Alternatives to Site A-2, this would mean direct impacts to between approximately 40,044 linear feet and 91,992 linear feet of streams onsite. In addition, the 'without mitigation' scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a moderate to major degree of adverse effect, which would be significant.

It is expected, however, that as the project would move through the mitigation sequencing process (as described in Chapter 5), there would be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures would address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation mining Site A-2 would have at most a moderate effect on aquatic biological communities, which would not be significant.

Mining Site A-2 would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace River, Myakka River, or in Charlotte Harbor.

#### 4.5.1.9 Alternative 9: Site W-2

Site W-2 contains approximately 108,280 linear feet of streams based on NHD data (USGS, 2013b). Although no mining is currently proposed for Site W-2, this analysis assumes that a percentage of stream impacts similar to what is proposed for the Applicants' Preferred Alternative would be proposed for this alternative.

Without mitigation, streams on Site W-2 would be eliminated, long-term, and not be compensated for or reclaimed. Applying the 37 percent to 85 percent range of impact for the Applicants' Preferred Alternatives to Site W-2, this would mean direct impacts to between approximately 40,064 linear feet and 92,038 linear feet of streams onsite. In addition, the 'without mitigation' scenarios for surface water hydrology (as described in Section 4.2) and for water quality (as described in Section 4.4) effects would also occur, leading to indirect effects on the aquatic biota in the remaining stream areas onsite and potentially offsite as well. These direct and indirect effects would have a moderate to major degree of adverse effect, which would be significant.

It is expected, however, that as the project would move through the mitigation sequencing process (as described in Chapter 5), there would be a potential reduction in the linear footage of stream impacts and a necessary offset of any remaining unavoidable impacts with compensatory mitigation. It is also expected that mitigative measures would address the potential effects on surface water hydrology and water quality. Based on this expectation, with mitigation mining Site W-2 would have at most a moderate effect on aquatic biological communities, which would not be significant.

Mining Site W-2 would not be considered to have an adverse effect on essential fish habitat (EFH) in the estuarine reaches of the Peace River, Myakka River, or in Charlotte Harbor.

### 4.5.2 Wetlands

Each alternative would result in, or have the potential to result in, direct impacts, and potentially indirect impacts, to wetlands and surface waters. Direct impacts would primarily result from mining and associated land clearing, with additional direct impacts resulting from construction of mine infrastructure. Wetlands and waters in designated avoidance areas on each mine site would not be directly impacted by mining operations. Potential indirect impacts to wetlands and waters in avoidance areas can be minimized through implementation of BMPs and impact minimization measures/features. Indirect water quality and dewatering impacts on wetlands to be avoided on each mine site can be minimized by the use of ditch and berm systems and recharge ditches/wells, respectively. In addition to capturing rainfall and runoff for the mine's water recirculation system, ditch and berm systems are designed to prevent any runoff from mining and reclamation areas that are not yet re-vegetated from entering the wetlands and surface waters on the mine property that are to be avoided, as well as those outside the mine property.

Associated recharge ditches and groundwater wells can prevent dewatering of wetlands and waters adjacent to mining operations when conditions indicate that such measures are necessary.

The timeframe for the loss of wetlands and waters on each mine site spans the period when the systems are impacted to when the impacts are offset through compensatory mitigation. This timeframe, or temporal lag, is considered in the USACE's functional assessment of compensatory mitigation. Wetlands and waters on each mine site are proposed to be mined and mitigated in phases in separate mine blocks over the life of each mine; therefore, the onsite systems would not all be impacted at once. All wetlands and waters mitigated under the federal CWA Section 404 program by the Applicants would be required to meet specific permit-defined success criteria for offsetting loss of wetland/water area and function. Regulatory success criteria would vary based on wetland/water type and would focus on achievement of habitat-specific structure and functionality. The timeframes required for created wetlands/waters to meet regulatory success criteria would vary based on the type of system created. Forested wetlands and streams would require longer periods of time to reach targeted succession stages than would non-forested wetlands; therefore, impacts to forested wetlands and streams would have greater temporal impacts than impacts to non-forested wetlands. Compensatory wetland mitigation is further discussed in Chapter 5.

The potential impacts that each Applicant's Preferred Alternative would have on wetlands/waters are discussed below. Surface waters are discussed below as either streams or non-stream surface waters. Streams include natural streams and/or ditched natural streams. Non-stream surface waters primarily include upland-cut ditches, wetland-cut ditches, cattle ponds, and lakes.

Data obtained from the permit applications for the Applicants' Preferred Alternatives, and from the Applicants, was used in the analysis of potential impacts associated with those four alternatives. In lieu of field data, GIS-based data/tools, including FLUCCS data, NHD data, and the CLIP tool were used in this AEIS to support the analysis of potential impacts that each Offsite Alternative would have on wetlands and streams. The FLUCCS and NHD data were used to estimate the current wetland cover and stream length, respectively, on each Offsite Alternative. The CLIP tool was used to estimate the quality of the wetlands on each offsite alternative. The comprehensive FLUCCS, NHD, and CLIP data for the offsite alternatives are provided in Appendix E. It should be noted that these data have not been ground-trotted or otherwise verified at the site-specific level, and they are not considered to be as accurate as the information used in the evaluations of the Applicants' Preferred Alternatives.

Section 3.3.5 contains additional information about existing wetland conditions within the AEIS study area.

The degree of intensity of impacts on wetlands was determined using the following criteria:

- No Impact to Minor: All disturbances to wetlands on the mine site would be short-term or would result in little to no loss of wetland area or functions. Wetlands outside the mine property would not be impacted in any manner.
- Moderate: Some disturbances to wetlands on the mine site would be long-term. A moderate amount of wetland area and functions on the mine site would be eliminated. Wetlands outside the mine property would not be impacted in any manner.
- Major: Most disturbances to wetlands on the mine site would be long-term. A large amount of wetland area and functions on the mine site would be eliminated. Wetlands outside the mine property may be impacted but would not have to be impacted for a major impact to occur.

#### 4.5.2.1 No Action Alternative

Under the No Action Alternative – No Mining scenario, there would be no mining-related direct impacts to wetlands on any of the four Applicants' Preferred Alternatives parcels. Impacts to wetlands resulting from other activities, such as current agricultural practices or future development, may occur. Any wetland impacts requiring authorization from the USACE would be subject to applicable regulations requiring avoidance, minimization, and compensatory mitigation. Impacts to wetlands on existing mines would continue, and would be subject to USACE and FDEP permit requirements, including for mitigation.

Under the No Action Alternative – Upland Only scenario, there would be no mining-related direct impacts to waters of the U.S., including jurisdictional wetlands, on any of the four Applicants' Preferred Alternatives parcels. Impacts to non-USACE-jurisdictional wetlands associated with mining, as potentially authorized by FDEP, would occur. Wetland impacts resulting from other activities, such as current agricultural practices or future development, may occur. Any wetland impacts requiring authorization from the USACE would be subject to applicable regulations requiring avoidance, minimization, and compensatory mitigation.

For either scenario, it is expected that impacts to wetlands would be required to be mitigated, with a replacement of lost functions. Based on this expectation, the No Action Alternative would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.2 Alternative 2: Desoto Mine

The preliminary quantities of federal jurisdictional wetlands/waters existing, and proposed to be avoided or impacted, on the Desoto Mine site are summarized in Table 4-70. The avoidance and impact numbers presented in Table 4-70 reflect the plans shown in the June 1, 2012, public notice for the Desoto Mine. These avoidance and impact values are subject to change as the project moves through the mitigation sequencing process of avoidance, minimization, and compensatory mitigation as required by the 404(b)1

Guidelines. This process is described in further detail in Chapter 5. The values in this table are based on the information contained in the approved Jurisdictional Determination package for this project.

**Table 4-70. Current Summary of Avoidance of and Impacts to Waters of the United States for Desoto Mine[a]**

| | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) |
|---|---|---|---|
| All Wetlands and Waters (acres) | 4,034 (22%) | 781 (19%) | 3,253 (81%) |
| Forested Wetlands (acres) | 2,334 (13%) | 739 (32%) | 1,595 (68%) |
| Non-forested Wetlands (acres) | 1,575 (9%) | 41 (3%) | 1,535 (97%) |
| Non-stream Surface Waters (acres) | 125 (<1%) | 2 (2%) | 123 (98%) |
| Streams (linear feet) | 128,639 | 64,164 (50%) | 64,474 (50%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.

Under the current plan for the Desoto Mine, approximately 3,253 acres of USACE-jurisdictional wetlands/waters and approximately 64,474 linear feet of USACE-jurisdictional streams are proposed to be impacted. Approximately 68 percent (1,595 acres) of the total forested wetland area on the site is proposed to be impacted. The forested wetland impacts include approximately 145 acres of bay swamp, which is 54 percent of the total bay swamp area on the site. Approximately 97 percent (1,535 acres) of the total non-forested wetland area, 98 percent (123 acres) of the total non-stream surface water area, and 50 percent of the total stream length on the site are proposed to be impacted.

Without mitigation, these impacts would not have to be avoided, minimized, or compensated for by the Applicant. The impact could even be higher, as the numbers presented represent a first step in the mitigation sequencing process. These impacts would have a major degree of effect, which would be significant.

However, as stated in the opening paragraph, it is necessary to understand that these proposed impacts are subject to change as the 404(b)(1) mitigation sequencing requirements are applied to the project. Also, the impacts that cannot be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

WRAP analyses conducted for the Desoto Mine site indicate that onsite wetlands overall are of moderate quality (average WRAP score for all wetlands = 0.50). It should be noted that these WRAP analyses are still being verified by the USACE; therefore, they are preliminary and subject to change. The WRAP analyses indicate that forested wetlands on the Desoto Mine site overall are of moderate to moderately high quality (average WRAP score = 0.62) and are of higher quality than non-forested wetlands (average WRAP score = 0.45). The WRAP analyses indicate that existing onsite wetlands overall are functionally viable but have been directly and/or indirectly impacted to varying degrees by past land use practices. Wetlands on the Desoto Mine site are expected to have been impacted mostly by agriculture given that agriculture is the dominant land use on the site.

Forested wetlands, high-quality herbaceous wetlands (based on UMAM or WRAP functional assessments), and perennial and intermittent streams are identified as priority avoidance criteria for the Applicants' Preferred Alternatives under the proposed mitigation framework developed for this AEIS (see Chapter 5). The specific areas on the Desoto Mine site that Mosaic preliminarily proposes to avoid are discussed in Section 5.6. The wetlands and streams in the proposed avoidance areas and the wetlands and streams proposed to be impacted outside the avoidance areas on the Desoto Mine site will be evaluated by USACE and USEPA in accordance with the CWA Section 404(b)(1) Guidelines and the impact avoidance and minimization alternatives proposed under the mitigation framework. USACE and USEPA will also evaluate the compensatory mitigation proposed for the Desoto Mine with respect to its ability to offset unavoidable wetland impacts in compliance with the 2008 Compensatory Mitigation Rule. The findings of these evaluations and the impact analysis conducted for this AEIS will be used to prepare the ROD/SOF for the Desoto Mine, which will serve as the basis for subsequent USACE permit decisions on final wetland impact avoidance, minimization, and compensatory mitigation for the mine. Permit review and special conditions will require Mosaic to modify its mitigation plan if the plan does not avoid and minimize wetland impacts to the greatest extent practicable under the Section 404(b)(1) Guidelines, or does not fully meet all federal compensatory mitigation requirements for offsetting unavoidable impacts to wetlands.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., the Desoto Mine would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.3 Alternative 3: Ona Mine

The preliminary quantities of federal jurisdictional wetlands/waters existing, and proposed to be avoided or impacted, on the Ona Mine site are summarized in Table 4-71. The avoidance and impact numbers presented in Table 4-71 reflect the plans shown in the June 1, 2012, public notice for the Ona Mine. These avoidance and impact values are subject to change as the project moves through the mitigation sequencing process of avoidance, minimization, and compensatory mitigation as required by the

404(b)(1) Guidelines. This process is described in further detail in Chapter 5. The values in this table are based on the information contained in the approved Jurisdictional Determination package for this project.

**Table 4-71. Current Summary of Avoidance of and Impacts to Waters of the United States for Ona Mine[a]**

| | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) |
|---|---|---|---|
| All Wetlands and Waters (acres) | 5,389 (24%) | 774 (14%) | 4,615 (86%) |
| Forested Wetlands (acres) | 2,463 (11%) | 639 (26%) | 1,824 (74%) |
| Non-forested Wetlands (acres) | 2,904 (13%) | 134 (5%) | 2,770 (95%) |
| Non-stream Surface Waters (acres) | 22 (<1%) | <1 (<1%) | 22 (>99%) |
| Streams (linear feet) | 208,366 | 71,635 (34%) | 136,731 (66%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.

Under the current plan for the Ona Mine, approximately 4,615 acres of USACE-jurisdictional wetlands/waters and approximately 136,731 linear feet of USACE-jurisdictional streams are proposed to be impacted. Approximately 74 percent (1,824 acres) of the total forested wetland area on the site is proposed to be impacted. The forested wetland impacts include approximately 123 acres of bay swamp, which is 96 percent of the total bay swamp area on the site. Approximately 95 percent (2,770 acres) of the total non-forested wetland area, greater than 99 percent (22 acres) of the total non-stream surface water area, and 66 percent of the total stream length on the site are proposed to be impacted.

Without mitigation, these impacts would not have to be avoided, minimized, or compensated for by the Applicant. The impact could even be higher, as the numbers presented represent a first step in the mitigation sequencing process. These impacts would have a major degree of effect, which would be significant.

However, as stated in the opening paragraph, it is necessary to understand that these proposed impacts are subject to change as the 404(b)(1) mitigation sequencing requirements are applied to the project. Also, the impacts that cannot be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

WRAP analyses conducted for the Ona Mine site indicate that onsite wetlands overall are of moderate quality (average WRAP score for all wetlands = 0.61). It should be noted that these WRAP analyses are still being verified by the USACE; therefore, they are preliminary and subject to change. The WRAP analyses indicate that forested wetlands on the Ona Mine site overall are of moderate to moderately high quality (average WRAP score = 0.64) and are of higher quality than non-forested wetlands (average WRAP score = 0.59). The WRAP analyses indicate that existing onsite wetlands overall are functionally viable but have been directly and/or indirectly impacted to varying degrees by past land use practices. Wetlands on the Ona Mine site are expected to have been impacted mostly by agriculture given that agriculture is the dominant land use on the site.

Forested wetlands, high-quality herbaceous wetlands (based on UMAM or WRAP functional assessments), and perennial and intermittent streams are identified as priority avoidance criteria for the Applicants' Preferred Alternatives under the proposed mitigation framework developed for this AEIS (see Chapter 5). The specific areas on the Ona Mine site that Mosaic preliminarily proposes to avoid are discussed in Section 5.6. The wetlands and streams in the proposed avoidance areas and the wetlands and streams proposed to be impacted outside the avoidance areas on the Ona Mine site will be evaluated by USACE and USEPA in accordance with the CWA Section 404(b)(1) Guidelines and the impact avoidance and minimization alternatives proposed under the mitigation framework. USACE and USEPA will also evaluate the compensatory mitigation proposed for the Ona Mine with respect to its ability to offset unavoidable wetland impacts in compliance with the 2008 Compensatory Mitigation Rule. The findings of these evaluations and the impact analysis conducted for this AEIS will be used to prepare the ROD/SOF for the Ona Mine, which will serve as the basis for subsequent USACE permit decisions on final wetland impact avoidance, minimization, and compensatory mitigation for the mine. Permit review and special conditions will require Mosaic to modify its mitigation plan if the plan does not avoid and minimize wetland impacts to the greatest extent practicable under the Section 404(b)(1) Guidelines, or does not fully meet all federal compensatory mitigation requirements for offsetting unavoidable impacts to wetlands.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., the Ona Mine would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.4 Alternative 4: Wingate East Mine

The preliminary quantities of federal jurisdictional wetlands/waters existing, and proposed to be avoided or impacted, on the Wingate East Mine site are summarized in Table 4-72. The avoidance and impact numbers presented in Table 4-72 reflect the plans shown in the June 1, 2012, public notice for the Wingate East Mine. These avoidance and impact values are subject to change as the project moves through the mitigation sequencing process of avoidance, minimization, and compensatory mitigation as required by the 404(b)(1) Guidelines. This process is described in further detail in Chapter 5. The values in this table are based on the information contained in the approved Jurisdictional Determination package for this project.

**Table 4-72. Current Summary of Avoidance of and Impacts to Waters of the United States for Wingate East Mine[a]**

| | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) |
|---|---|---|---|
| All Wetlands and Waters (acres) | 940 (26%) | 162 (17%) | 784 (83%) |
| Forested Wetlands (acres) | 568 (16%) | 157 (27%) | 413 (73%) |
| Non-forested Wetlands (acres) | 349 (10%) | 5 (1%) | 348 (99%) |
| Non-stream Surface Waters (acres) | 23 (<1%) | 1 (<1%) | 23 (>99%) |
| Streams (linear feet) | 68,138b | 5,196 (15%) | 27,287 (85%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.
[b] Jurisdictional tributaries (including ditches and streams).

Under the current plan for the Wingate East Mine, approximately 784 acres of USACE-jurisdictional wetlands/waters and approximately 27,287 linear feet of USACE-jurisdictional streams are proposed to be impacted. Approximately 73 percent (413 acres) of the total forested wetland area on the site is proposed to be impacted. The forested wetland impacts include approximately 22 acres of bay swamp, which is all of the bay swamp area on the site. Approximately 99 percent (348 acres) of the total non-forested wetland area, greater than 99 percent (23 acres) of the total non-stream surface water area, and 85 percent of the total stream length on the site are proposed to be impacted.

Without mitigation, these impacts would not have to be avoided, minimized, or compensated for by the Applicant. The impact could even be higher, as the numbers presented represent a first step in the mitigation sequencing process. These impacts would have a major degree of effect, which would be significant.

However, as stated in the opening paragraph, it is necessary to understand that these proposed impacts are subject to change as the 404(b)(1) mitigation sequencing requirements are applied to the project. Also, the impacts that cannot be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

WRAP analyses conducted for the Wingate East Mine site indicate that onsite wetlands overall are of moderate quality (average WRAP score for all wetlands = 0.67). It should be noted that these WRAP analyses are still being verified by the USACE; therefore, they are preliminary and subject to change. The WRAP analyses indicate that forested wetlands on the Wingate East Mine site overall are of moderate to moderately high quality (average WRAP score = 0.70) and are of higher quality than non-forested wetlands (average WRAP score = 0.64). The WRAP analyses indicate that existing onsite wetlands overall are functionally viable but have been directly and/or indirectly impacted to varying degrees by past land use practices. Wetlands on the Wingate East Mine site are expected to have been impacted mostly by agriculture given that agriculture is the dominant land use on the site.

Forested wetlands, high-quality herbaceous wetlands (based on UMAM or WRAP functional assessments), and perennial and intermittent streams are identified as priority avoidance criteria for the Applicants' Preferred Alternatives under the proposed mitigation framework developed for this AEIS (see Chapter 5). The specific areas on the Wingate East Mine site that Mosaic preliminarily proposes to avoid are discussed in Section 5.6. The wetlands and streams in the proposed avoidance areas and the wetlands and streams proposed to be impacted outside the avoidance areas on the Wingate East Mine site will be evaluated by USACE and USEPA in accordance with the CWA Section 404(b)(1) Guidelines and the impact avoidance and minimization alternatives proposed under the mitigation framework. USACE and USEPA will also evaluate the compensatory mitigation proposed for the Wingate East Mine with respect to its ability to offset unavoidable wetland impacts in compliance with the 2008 Compensatory Mitigation Rule. The findings of these evaluations and the impact analysis conducted for this AEIS will be used to prepare the ROD/SOF for the Wingate East Mine, which will serve as the basis for subsequent USACE permit decisions on final wetland impact avoidance, minimization, and compensatory mitigation for the mine. Permit review and special conditions will require Mosaic to modify its mitigation plan if the plan does not avoid and minimize wetland impacts to the greatest extent practicable under the Section 404(b)(1) Guidelines, or does not fully meet all federal compensatory mitigation requirements for offsetting unavoidable impacts to wetlands.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., the Wingate East Mine would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.5 Alternative 5: South Pasture Extension Mine

The preliminary quantities of federal jurisdictional wetlands/waters existing, and proposed to be avoided or impacted, on the South Pasture Extension Mine site are summarized in Table 4-73. The avoidance and impact numbers presented in Table 4-73 reflect the plans shown in the June 1, 2012, public notice for the South Pasture Extension Mine. These avoidance and impact values are subject to change as the project moves through the mitigation sequencing process of avoidance, minimization, and compensatory mitigation as required by the 404(b)(1) Guidelines. This process is described in further detail in Chapter 5. The values in this table are based on the information contained in the approved Jurisdictional Determination package for this project.

**Table 4-73. Current Summary of Avoidance of and Impacts to Waters of the United States for South Pasture Extension Mine[a]**

| | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) |
|---|---|---|---|
| All Wetlands and Waters (acres) | 1,699[b] (23%) | 500 (29%) | 1,218 (71%) |
| Forested Wetlands (acres) | 796 (11%) | 338 (42%) | 458 (58%) |
| Non-forested Wetlands (acres) | 872 (12%) | 145 (17%) | 727 (83%) |
| Non-stream Surface Waters (acres) | 33 (<1%) | 6 (18%) | 27 (82%) |
| Streams (linear feet) | 92,809[c] | 55,501 (63%) | 32,161 (37%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.
[b] Does not include non-stream surface waters.
[c] Jurisdictional tributaries (including ditches and streams).

Under the current plan for the South Pasture Extension Mine, approximately 1,218 acres of USACE-jurisdictional wetlands/waters and approximately 32,161 linear feet of USACE-jurisdictional streams are proposed to be impacted. Approximately 58 percent (458 acres) of the total forested wetland area on the site is proposed to be impacted. The forested wetland impacts include approximately 1 acre of bay swamp, which is 4 percent of the total bay swamp area on the site. Approximately 83 percent (727 acres) of the total non-forested wetland area, 82 percent (27 acres) of the total non-stream surface water area, and 37 percent of the total stream length on the site are proposed to be impacted.

Without mitigation, these impacts would not have to be avoided, minimized, or compensated for by the Applicant. The impact could even be higher, as the numbers presented represent a first step in the mitigation sequencing process. These impacts would have a major degree of effect, which would be significant.

However, as stated in the opening paragraph, it is necessary to understand that these proposed impacts are subject to change as the 404(b)(1) mitigation sequencing requirements are applied to the project. Also, the impacts that cannot be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

UMAM analyses conducted for the South Pasture Extension Mine site indicate that onsite wetlands overall are of moderate quality. It should be noted that these UMAM analyses are still being verified by the USACE; therefore, they are preliminary and subject to change. The average UMAM score for all wetlands proposed to be avoided was reported to be 6.2 and the average UMAM score for all wetlands proposed to be impacted was reported to be 5.2. The UMAM analyses indicate that existing onsite wetlands overall are functionally viable but have been directly and/or indirectly impacted to varying degrees by past land use practices. Wetlands on the South Pasture Extension Mine site are expected to have been impacted mostly by agriculture given that agriculture is the dominant land use on the site.

Forested wetlands, high-quality herbaceous wetlands (based on UMAM or WRAP functional assessments), and perennial and intermittent streams are identified as priority avoidance criteria for the Applicants' Preferred Alternatives under the proposed mitigation framework developed for this AEIS (see Chapter 5). The specific areas on the South Pasture Extension Mine site that CF Industries preliminarily proposes to avoid are discussed in Section 5.6. The wetlands and streams in the proposed avoidance areas and the wetlands and streams proposed to be impacted outside the avoidance areas on the South Pasture Extension Mine site will be evaluated by USACE and USEPA in accordance with the CWA Section 404(b)(1) Guidelines and the impact avoidance and minimization alternatives proposed under the mitigation framework. USACE and USEPA will also evaluate the compensatory mitigation proposed for the South Pasture Extension Mine with respect to its ability to offset unavoidable wetland impacts in compliance with the 2008 Compensatory Mitigation Rule. The findings of these evaluations and the impact analysis conducted for this AEIS will be used to prepare the ROD/SOF for the South Pasture Extension Mine, which will serve as the basis for subsequent USACE permit decisions on final wetland impact avoidance, minimization, and compensatory mitigation for the mine. Permit review and special conditions will require CF Industries to modify its mitigation plan if the plan does not avoid and minimize wetland impacts to the greatest extent practicable under the Section 404(b)(1) Guidelines, or does not fully meet all federal compensatory mitigation requirements for offsetting unavoidable impacts to wetlands.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., the South Pasture Extension Mine would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.6 Alternative 6: Pine Level/Keys Tract

Table 4-74 presents the acreages of wetlands and non-stream surface waters (including systems that may not be under USACE's regulatory jurisdiction) on the Pine Level/Keys Tract site based on FLUCCS data (SWFWMD, 2009a) and the linear feet of streams on the Pine Level/Keys Tract site based on NHD data (USGS, 2013b).

**Table 4-74. Wetlands/Waters Summary for Pine Level/Keys Tract Offsite Alternative**

| Offsite Alternative | All Wetlands and Waters[a] – acres (% of Site) | Forested Wetlands[a] – acres (% of Site) | Non-forested Wetlands[a] - acres (% of Site) | Non-stream Surface Waters[a] – acres (% of Site) | Streams[b] - linear feet |
|---|---|---|---|---|---|
| Pine Level/ Keys Tract | 6,273 (25%) | 2,269 (9%) | 4,004 (16%) | 18 (<1%) | 209,949 |

[a] Source: SWFWMD, 2009a
[b] Source: USGS, 2013b

As indicated in Table 4-74, the Pine Level/Keys Tract site contains approximately 6,273 acres of wetlands/waters (excluding streams) and 209,949 linear feet of streams, based on FLUCCS and NHD data, respectively. Wetlands/waters (excluding streams) represent approximately 25 percent of the total area of the Pine Level/Keys Tract site. Forested wetlands, non-forested (herbaceous or shrub) wetlands, and non-stream surface waters represent approximately 9 percent, 16 percent, and less than 1 percent of the total area of the site, respectively. The wetland acreages on the Pine Level/Keys Tract site cannot be directly compared to the wetland acreages on the Applicants' Preferred Alternative sites presented previously because the FLUCCS data include wetlands that may not be federally jurisdictional (not under USACE's jurisdiction) and the Applicants' data include only wetlands that are federally jurisdictional. The relative percentages of total wetlands/waters, forested wetlands, non-forested wetlands, and non-stream surface waters on the Pine Level/Keys Tract site are comparable to those on each Applicant's Preferred Alternative site. The total stream length on the Pine Level/Keys Tract site is comparable to that on the Ona Mine site.

Based on the FLUCCS data, bottomland swamp, freshwater marsh, and reservoir are the dominant forested wetland type, non-forested wetland type, and non-stream surface water type, respectively on the Pine Level/ Keys Tract site. The FLUCCS data indicate that no bay swamps exist on the Pine Level/Keys Tract site. Because FLUCCS data are primarily derived from aerial photography and airborne/satellite imaging systems, it may not accurately reflect the wetland community composition of the Pine Level/Keys Tract site. Therefore, it is acknowledged that the Pine Level/Keys Tract site may contain bay swamps and may have a different composition of wetland types than that indicated by the FLUCCS data.

Table 4-75 presents the percentages of wetlands ranked as CLIP Priority 1 and 2 (high-quality wetlands), wetlands ranked as CLIP Priority 3 and 4 (moderate-quality wetlands), and wetlands ranked as CLIP Priority 5 and 6 (low-quality wetlands) on the Pine Level/Keys Tract site.

**Table 4-75. Estimated Wetland Quality Based on CLIP for Pine Level/Keys Tract Offsite Alternative**

| Offsite Alternative | High Quality (% of Wetlands Ranked as CLIP Priority 1 and 2) | Moderate Quality (% of Wetlands Ranked as CLIP Priority 3 and 4) | Low Quality (% of Wetlands Ranked as CLIP Priority 5 and 6) |
|---|---|---|---|
| Pine Level/ Keys Tract | 27% | 63% | 10% |
| Source: FNAI et al., 2011 | | | |

As indicated in Table 4-75, approximately 27 percent of the wetlands on the Pine Level/Keys Tract site are of high quality, 63 percent are of moderate quality, and 10 percent are of low quality based on CLIP data. As discussed previously, wetlands overall on each Applicant's Preferred Alternative site are of moderate quality based on WRAP/UMAM data. Although wetland quality based on CLIP data cannot be equated to wetland quality based on WRAP/UMAM data, the CLIP data suggest that overall wetland quality on the Pine Level/Keys Tract site is comparable to that on each Applicants' Preferred Alternative site. This is a generalized comparison and it is acknowledged that WRAP/UMAM analyses that may be conducted for the Pine Level/Keys Tract site may indicate that wetland quality on the site is different than that indicated by the CLIP data. The CLIP data suggest that many of the wetlands on the Pine Level/Keys Tract site have been impacted by past land use practices. Wetlands on the Pine Level/Keys Tract site are expected to have been disturbed mostly by agriculture given that agriculture is the dominant land use on the site based on FLUCCS data (48 percent of total area).

The overall quantity and quality of wetlands/waters that would be impacted on the Pine Level/Keys Tract site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred Alternative sites. This is a generalization and it is acknowledged that detailed assessments of wetland quantity/quality based on field data may indicate differences in wetland quantity/quality between the Pine Level/Keys Tract site and the Applicants' Preferred Alternative sites not indicated by the GIS-based data/tools used in this AEIS.

Without mitigation, impacts to waters of the U.S. associated with mining the Pine Level/Keys Tract would not have to be avoided, minimized, or compensated for by an Applicant. These impacts would have a major degree of effect, which would be significant.

However, it is necessary to understand that an Applicant would have to demonstrate avoidance, minimization, and compensation of impacts as the 404(b)(1) mitigation sequencing requirements are applied to the project. The impacts that could not be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., mining the Pine Level/Keys Tract would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.7 Alternative 7: Pioneer Tract

Table 4-76 presents the acreages of wetlands and non-stream surface waters (including systems that may not be under USACE's regulatory jurisdiction) on the Pioneer Tract site based on FLUCCS data (SWFWMD, 2009a) and the linear feet of streams on the Pioneer Tract site based on NHD data (USGS, 2013b).

**Table 4-76. Wetlands/Waters Summary for Pioneer Tract Offsite Alternative**

| Offsite Alternative | All Wetlands and Waters[a] – acres (% of Site) | Forested Wetlands[a] – acres (% of Site) | Non-forested Wetlands[a] - acres (% of Site) | Non-stream Surface Waters[a] – acres (% of Site) | Streams[b] (linear feet) |
|---|---|---|---|---|---|
| Pioneer Tract | 8,973 (36%) | 6,274 (25%) | 2,699 (11%) | 92 (<1%) | 330,526 |

[a] Source: SWFWMD, 2009a
[b] Source: USGS, 2013b

As indicated in Table 4-76, the Pioneer Tract site contains approximately 8,973 acres of wetlands/waters (excluding streams) and 330,526 linear feet of streams, based on FLUCCS and NHD data, respectively. Wetlands/waters (excluding streams) represent approximately 36 percent of the total area of the Pioneer Tract site. Forested wetlands, non-forested (herbaceous or shrub) wetlands, and non-stream surface waters represent approximately 25 percent, 11 percent, and less than 1 percent of the total area of the site, respectively. The wetland acreages on the Pioneer Tract site cannot be directly compared to the wetland acreages on the Applicants' Preferred Alternative sites presented previously because the FLUCCS data include wetlands that may not be federally jurisdictional (not under USACE's jurisdiction) and the Applicants' data include only wetlands that are federally jurisdictional. The relative percentages of total wetlands/waters and forested wetlands on the Pioneer Tract site are considerably greater than those on each Applicant's Preferred Alternative site. The relative percentages of non-forested wetlands and non-stream surface waters on the Pioneer Tract site are comparable to those on each Applicant's Preferred Alternative site. The total stream length on the Pioneer Tract site is considerably greater than that on each Applicant's Preferred Alternative site.

Based on the FLUCCS data, bottomland swamp, freshwater marsh, and lake are the dominant forested wetland type, non-forested wetland type, and non-stream surface water type, respectively on the Pioneer Tract site. The FLUCCS data indicate that no bay swamps exist on the Pioneer Tract site. Because

FLUCCS data are primarily derived from aerial photography and airborne/satellite imaging systems, it may not accurately reflect the wetland community composition of the Pioneer Tract site. Therefore, it is acknowledged that the Pioneer Tract site may contain bay swamps and may have a different composition of wetland types than that indicated by the FLUCCS data.

Table 4-77 presents the percentages of wetlands ranked as CLIP Priority 1 and 2 (high-quality wetlands), wetlands ranked as CLIP Priority 3 and 4 (moderate-quality wetlands), and wetlands ranked as CLIP Priority 5 and 6 (low-quality wetlands) on the Pioneer Tract site.

**Table 4-77. Estimated Wetland Quality Based on CLIP for Pioneer Tract Offsite Alternative**

| Offsite Alternative | High Quality (% of Wetlands Ranked as CLIP Priority 1 and 2) | Moderate Quality (% of Wetlands Ranked as CLIP Priority 3 and 4) | Low Quality (% of Wetlands Ranked as CLIP Priority 5 and 6) |
|---|---|---|---|
| Pioneer Tract | 45% | 46% | 8% |

Source: FNAI et al., 2011

As indicated in Table 4-77, approximately 45 percent of the wetlands on the Pine Level/Keys Tract site are of high quality, 46 percent are of moderate quality, and 8 percent are of low quality based on CLIP data. As discussed previously, wetlands overall on each Applicant's Preferred Alternative site are of moderate quality based on WRAP/UMAM data. Although wetland quality based on CLIP data cannot be equated to wetland quality based on WRAP/UMAM data, the CLIP data suggest that overall wetland quality on the Pioneer Tract site is comparable (and potentially higher) to that on each Applicant's Preferred Alternative site. This is a generalized comparison and it is acknowledged that WRAP/UMAM analyses that may be conducted for the Pioneer Tract site may indicate that wetland quality on the site is different than that indicated by the CLIP data. The CLIP data suggest that many of the wetlands on the Pioneer Tract site have been impacted by past land use practices. Wetlands on the Pioneer Tract site are expected to have been disturbed mostly by agriculture given that agriculture is the dominant land use on the site based on FLUCCS data (51 percent of total area).

The overall quantity and quality of wetlands/waters that would be impacted on the Pioneer Tract site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred Alternative sites. This is a generalization and it is acknowledged that detailed assessments of wetland quantity/quality based on field data may indicate differences in wetland quantity/quality between the Pioneer Tract site and the Applicants' Preferred Alternative sites not indicated by the GIS-based data/tools used in this AEIS.

Without mitigation, impacts to waters of the U.S. associated with mining the Pioneer Tract would not have to be avoided, minimized, or compensated for by an Applicant. These impacts would have a major degree of effect, which would be significant.

However, it is necessary to understand that an Applicant would have to demonstrate avoidance, minimization, and compensation of impacts as the 404(b)(1) mitigation sequencing requirements are applied to the project. The impacts that could not be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., mining the Pioneer Tract would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.8 Alternative 8: Site A-2

Table 4-78 presents the acreages of wetlands and non-stream surface waters (including systems that may not be under USACE's regulatory jurisdiction) on the A-2 site based on FLUCCS data (SWFWMD, 2009a) and the linear feet of streams on the A-2 site based on NHD data (USGS, 2013b).

**Table 4-78. Wetlands/Waters Summary for A-2 Offsite Alternative**

| Offsite Alternative | All Wetlands and Waters[a] – acres (% of Site) | Forested Wetlands[a] – acres (% of Site) | Non-forested Wetlands[a] – acres (% of Site) | Non-stream Surface Waters[a] – acres (% of Site) | Streams[b] - linear feet |
|---|---|---|---|---|---|
| A-2 | 1,361 (17%) | 492 (6%) | 869 (11%) | 19 (<1%) | 108,226 |

[a] Source: SWFWMD, 2009a
[b] Source: USGS, 2013b

As indicated in Table 4-78, the A-2 site contains approximately 1,361 acres of wetlands/waters (excluding streams) and 108,226 linear feet of streams, based on FLUCCS and NHD data, respectively. Wetlands/waters (excluding streams) represent approximately 17 percent of the total area of the A-2 site. Forested wetlands, non-forested (herbaceous or shrub) wetlands, and non-stream surface waters represent approximately 6 percent, 11 percent, and less than 1 percent of the total area of the site, respectively. The wetland acreages on the A-2 site cannot be directly compared to the wetland acreages on the Applicants' Preferred Alternative sites presented previously because the FLUCCS data include wetlands that may not be federally jurisdictional (not under USACE's jurisdiction) and the Applicants' data include only wetlands that are federally jurisdictional. The relative percentages of total wetlands/waters and forested wetlands on the A-2 site are somewhat smaller than those on each Applicant's Preferred

Alternative site. The relative percentages of non-forested wetlands and non-stream surface waters on the A-2 site are comparable to those on each Applicant's Preferred Alternative site. The total stream length on the A-2 site is comparable to that on the Desoto Mine site.

Based on the FLUCCS data, bottomland swamp, freshwater marsh, and reservoir are the dominant forested wetland type, non-forested wetland type, and non-stream surface water type, respectively on the A-2 site. The FLUCCS data indicate that no bay swamps exist on the A-2 site. Because FLUCCS data are primarily derived from aerial photography and airborne/satellite imaging systems, it may not accurately reflect the wetland community composition of the A-2 site. Therefore, it is acknowledged that the A-2 site may contain bay swamps and may have a different composition of wetland types than that indicated by the FLUCCS data.

Table 4-79 presents the percentages of wetlands ranked as CLIP Priority 1 and 2 (high-quality wetlands), wetlands ranked as CLIP Priority 3 and 4 (moderate-quality wetlands), and wetlands ranked as CLIP Priority 5 and 6 (low-quality wetlands) on the A-2 site.

**Table 4-79. Estimated Wetland Quality Based on CLIP for A-2 Offsite Alternative**

| Offsite Alternative | High Quality (% of Wetlands Ranked as CLIP Priority 1 and 2) | Moderate Quality (% of Wetlands Ranked as CLIP Priority 3 and 4) | Low Quality (% of Wetlands Ranked as CLIP Priority 5 and 6) |
|---|---|---|---|
| A-2 | 9% | 40% | 51% |

Source: FNAI et al., 2011

As indicated in Table 4-79, approximately 9 percent of the wetlands on the A-2 site are of high quality, 40 percent are of moderate quality, and 51 percent are of low quality based on CLIP data. As discussed previously, wetlands overall on each Applicant's Preferred Alternative site are of moderate quality based on WRAP/UMAM data. Although wetland quality based on CLIP data cannot be equated to wetland quality based on WRAP/UMAM data, the CLIP data suggest that overall wetland quality on the A-2 site is comparable (and potentially lower) to that on each Applicant's Preferred Alternative site. This is a generalized comparison and it is acknowledged that WRAP/UMAM analyses that may be conducted for the A-2 site may indicate that wetland quality on the site is different than that indicated by the CLIP data. The CLIP data suggest that many of the wetlands on the A-2 site have been impacted by past land use practices. Wetlands on the A-2 site are expected to have been disturbed mostly by agriculture given that agriculture is the dominant land use on the site based on FLUCCS data (79 percent of total area).

The overall quantity and quality of wetlands/waters that would be impacted on the A-2 site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred

Alternative sites. This is a generalization and it is acknowledged that detailed assessments of wetland quantity/quality based on field data may indicate differences in wetland quantity/quality between the A-2 site and the Applicants' Preferred Alternative sites not indicated by the GIS-based data/tools used in this AEIS.

Without mitigation, impacts to waters of the U.S. associated with mining Site A-2 would not have to be avoided, minimized, or compensated for by an Applicant. These impacts would have a major degree of effect, which would be significant.

However, it is necessary to understand that an Applicant would have to demonstrate avoidance, minimization, and compensation of impacts as the 404(b)(1) mitigation sequencing requirements are applied to the project. The impacts that could not be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., mining Site A-2 would have no impact to a minor impact on wetlands. This impact would not be significant.

#### 4.5.2.9 Alternative 9: Site W-2

Table 4-80 presents the acreages of wetlands and non-stream surface waters (including systems that may not be under USACE's regulatory jurisdiction) on the W-2 site based on FLUCCS data (SWFWMD, 2009a) and the linear feet of streams on the W-2 site based on NHD data (USGS, 2013b).

**Table 4-80. Wetlands/Waters Summary for W-2 Offsite Alternative**

| Offsite Alternative | All Wetlands and Waters[a] – acres (% of Site) | Forested Wetlands[a] – acres (% of Site) | Non-forested Wetlands[a] – acres (% of Site) | Non-stream Surface Waters[a] – acres (% of Site) | Streams[b] - linear feet |
|---|---|---|---|---|---|
| W-2 | 2,538 (26%) | 826 (8%) | 1,711 (18%) | 10 (<1%) | 108,280 |

[a] Source: SWFWMD, 2009a
[b] Source: USGS, 2013b

As indicated in Table 4-80, the W-2 site contains approximately 2,538 acres of wetlands/waters (excluding streams) and 108,280 linear feet of streams, based on FLUCCS and NHD data, respectively. Wetlands/waters (excluding streams) represent approximately 26 percent of the total area of the W-2 site. Forested wetlands, non-forested (herbaceous or shrub) wetlands, and non-stream surface waters represent approximately 8 percent, 18 percent, and less than 1 percent of the total area of the site, respectively. The wetland acreages on the W-2 site cannot be directly compared to the wetland acreages on the Applicants' Preferred Alternative sites presented previously because the FLUCCS data include wetlands that may not be federally jurisdictional (not under USACE's jurisdiction) and the Applicants' data include only wetlands that are federally jurisdictional. The relative percentages of total wetlands/waters and non-stream surface waters on the W-2 site are comparable to those on each Applicant's Preferred Alternative site. The relative percentage of forested wetlands is somewhat smaller and the relative percentage of non-forested wetlands is somewhat greater on the W-2 site than those on each Applicant's Preferred Alternative site. The total stream length on the W-2 site is comparable to that on the Desoto Mine site.

Based on the FLUCCS data, bottomland swamp, freshwater marsh, and reservoir are the dominant forested wetland type, non-forested wetland type, and non-stream surface water type, respectively on the W-2 site. The FLUCCS data indicate that no bay swamps exist on the W-2 site. Because FLUCCS data are primarily derived from aerial photography and airborne/satellite imaging systems, it may not accurately reflect the wetland community composition of the W-2 site. Therefore, it is acknowledged that the W-2 site may contain bay swamps and may have a different composition of wetland types than that indicated by the FLUCCS data.

Table 4-81 presents the percentages of wetlands ranked as CLIP Priority 1 and 2 (high-quality wetlands), wetlands ranked as CLIP Priority 3 and 4 (moderate-quality wetlands), and wetlands ranked as CLIP Priority 5 and 6 (low-quality wetlands) on the W-2 site.

**Table 4-81. Estimated Wetland Quality Based on CLIP for W-2 Offsite Alternative**

| Offsite Alternative | High Quality (% of Wetlands Ranked as CLIP Priority 1 and 2) | Moderate Quality (% of Wetlands Ranked as CLIP Priority 3 and 4) | Low Quality (% of Wetlands Ranked as CLIP Priority 5 and 6) |
|---|---|---|---|
| W-2 | 20% | 74% | 6% |

Source: FNAI et al., 2011

As indicated in Table 4-81, approximately 20 percent of the wetlands on the W-2 site are of high quality, 74 percent are of moderate quality, and 6 percent are of low quality based on CLIP data. As discussed previously, wetlands overall on each Applicant's Preferred Alternative site are of moderate quality based on WRAP/UMAM data. Although wetland quality based on CLIP data cannot be equated to wetland quality based on WRAP/UMAM data, the CLIP data suggest that overall wetland quality on the W-2 site is comparable to that on each Applicant's Preferred Alternative site. This is a generalized comparison and it is acknowledged that WRAP/UMAM analyses that may be conducted for the W-2 site may indicate that wetland quality on the site is different than that indicated by the CLIP data. The CLIP data suggest that many of the wetlands on the W-2 site have been impacted by past land use practices. Wetlands on the W-2 site are expected to have been disturbed mostly by agriculture given that agriculture is the dominant land use on the site based on FLUCCS data (45 percent of total area).

The overall quantity and quality of wetlands/waters that would be impacted on the W-2 site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred Alternative sites. This is a generalization and it is acknowledged that detailed assessments of wetland quantity/quality based on field data may indicate differences in wetland quantity/quality between the W-2 site and the Applicants' Preferred Alternative sites not indicated by the GIS-based data/tools used in this AEIS.

Without mitigation, impacts to waters of the U.S. associated with mining Site W-2 would not have to be avoided, minimized, or compensated for by an Applicant. These impacts would have a major degree of effect, which would be significant.

However, it is necessary to understand that an Applicant would have to demonstrate avoidance, minimization, and compensation of impacts as the 404(b)(1) mitigation sequencing requirements are applied to the project. The impacts that could not be practicably avoided or minimized would be required to be mitigated in compliance with the 2008 Compensatory Mitigation Rule. FDEP has similar requirements for reducing and offsetting impacts in its ERP permit process.

Based on the expected, required offset of lost functions associated with the impacts to waters of the U.S., mining Site W-2 would have no impact to a minor impact on wetlands. This impact would not be significant.

### 4.5.3 Wildlife Habitat

This section discusses the potential impacts that each alternative would have on wildlife habitat. The analyses in this section focus on terrestrial biota/habitats. Each alternative would result in direct impacts, and potentially indirect impacts, to onsite wildlife habitat. The timeframe for the loss of wildlife habitat on each mine site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands). Wildlife habitat within each mine site will be mined and then mitigated for or reclaimed in phases in separate mine blocks over the life of the each mine; therefore, the onsite habitats would not all be impacted at once. Compensatory mitigation and reclamation are further discussed in Chapter 5.

A Wildlife and Habitat Management Plan will be prepared for each Applicant's Preferred Alternative to outline the measures to be implemented to protect/manage wildlife during mining operations. Similar plans would be prepared for the offsite alternatives if they were to be proposed for mining. Each mine's Wildlife and Habitat Management Plan is updated as necessary based on the findings of pre-clearing surveys. The findings of the planning-level and pre-clearing surveys are used to develop specific wildlife/listed species and habitat conservation measures to be implemented prior to, during, and after mining operations. Conservation of wildlife and listed species is further discussed in Chapter 5.

Data obtained from the permit applications for the Applicants' Preferred Alternatives, and from the Applicants, was used in the analysis of potential impacts associated with those four alternatives. In lieu of field data, GIS-based data/tools, including FLUCCS data, NHD data, and the CLIP tool were used in this AEIS to support the analysis of potential impacts that each Offsite Alternative would have on wildlife habitat. The comprehensive FLUCCS, NHD, and CLIP data for the Offsite Alternatives are provided in Appendix E. It should be noted that these data have not been ground-trotted or otherwise verified at the site-specific level, and they are not considered to be as accurate as the information used in the evaluations of the Applicants' Preferred Alternatives.

Section 3.3.6 provides additional information about wildlife habitat within the CFPD.

The degree of intensity of impacts on wildlife habitat was determined using the following criteria:

- No Impact to Minor: All disturbances to wildlife habitat on the mine site would be short-term or would result in little to no loss of wildlife habitat area or functions. Impacts on wildlife would be negligible and largely associated with noise generated during mining activities. Habitat and wildlife outside the mine property would not be impacted in any manner.
- Moderate: Some disturbances to wildlife habitat on the mine site would be long-term. A moderate amount of wildlife habitat area and functions on the mine site would be eliminated. Impacts to wildlife would include noise/activity disturbance and loss of moderate amounts of habitat. Habitat and wildlife outside the mine property would not be impacted in any manner.
- Major: Most disturbances to wildlife habitat on the mine site would be long-term. A large amount of wildlife habitat area and functions on the mine site would be eliminated. Impacts to wildlife would include noise/activity disturbance and loss of large amounts of habitat. Habitat and wildlife outside the mine property may be impacted but would not have to be impacted for a major impact to occur.

#### 4.5.3.1 No Action Alternative

Under the No Action Alternative – No Mining scenario, there would be no mining-related impacts to wildlife habitat on any of the four Applicants' Preferred Alternatives parcels. Impacts to habitat resulting from other activities, such as current agricultural practices or future development, may occur. Impacts to habitat on existing mines would continue, and would be subject to the requirements of previous authorizations including but not limited to USACE and FDEP permits.

Under the No Action Alternative – Upland Only scenario, there would be no mining-related impacts to habitat associated with waters of the U.S., including jurisdictional wetlands, on any of the four Applicants'

Preferred Alternatives parcels. Mining-related impacts to habitat associated with non-USACE-jurisdictional wetlands and on uplands would occur. Habitat impacts resulting from other activities, such as current agricultural practices or future development, may occur.

For the No Mining scenario, it is unknown what type of compensation for habitat impacts on the four parcels would be required. Based on this uncertainty, the No Action Alternative – No Mining would have moderate to major impact on habitat, which would be significant. For the Upland Only scenario, it is expected that FDEP reclamation requirements would lead to a restoration of habitat on the four parcels. Based on this expectation, the No Action Alternative – Upland Only scenario would have minor to moderate impact on habitat. This impact would not be significant.

#### 4.5.3.2 Alternative 2: Desoto Mine

The preliminary quantities of upland wildlife habitat proposed to be avoided, impacted, and reclaimed on the Desoto Mine site are summarized in Table 4-82. The data presented in Table 4-82 reflect the plans shown in the June 1, 2012, public notice for the Desoto Mine, and are subject to change prior to potential issuance of the federal 404 permit, and for reclamation, the FDEP mine permit.

**Table 4-82. Current Summary of Upland Wildlife Habitat Avoidance, Impact, and Reclamation for Desoto Mine[a]**

| Habitat Type | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) | Reclaim[b] | Post-Mining | Amount Change (% Change) |
|---|---|---|---|---|---|---|
| Rangeland | 740 (4%) | 1 (<1%) | 739 (>99%) | 897 | 898 | +158 (+21%) |
| Upland Forest | 1,970 (11%) | 44 (2%) | 1,926 (98%) | 5,277 | 5,321 | +3,351 (+170%) |
| Pastureland | 8,566 (47%) | 168 (2%) | 8,398 (98%) | 7,371 | 7,539 | -1027 (-12%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.
[b] Not under the USACE's authority.

Notes:
Values = acres

As indicated in Table 4-82, pastureland is the most abundant upland wildlife habitat type on the Desoto Mine site, representing approximately 47 percent of the total area of the site. Upland forest is the second most abundant upland wildlife habitat on the mine site (approximately 11 percent of the total site) and rangeland is the least abundant upland wildlife habitat on the mine site (approximately 4 percent of the total site). Most of the rangeland, upland forest, and pastureland on the Desoto Mine site is proposed to be impacted. More rangeland and upland forest is proposed to be reclaimed than impacted and less pastureland is proposed to be reclaimed than impacted. When coupled with the amount of existing upland wildlife habitat proposed to be avoided, the post-reclamation condition on the Desoto Mine site would result in a 21 percent increase in rangeland, 170 percent increase in upland forest, and 12 percent decrease in pastureland.

Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. Based on Mosaic's federal 404 permit application, most pasturelands on the Desoto Mine site are improved pasture. Improved pasture is generally defined as land that has been cleared, tilled, and reseeded with specific grass types and periodically improved with brush control and fertilizer application. All agricultural lands, including pasturelands, represent approximately 62 percent of the total area of the Desoto Mine site.

The overall wildlife habitat quality of upland forests and rangelands on the Desoto Mine site is expected to be higher than that of pasturelands, particularly improved pasture, on the mine site. The wildlife habitat quality of upland forest and rangeland communities on the Desoto Mine site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the Desoto Mine site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

The specific areas on the Desoto Mine site that Mosaic preliminarily proposes to avoid are discussed in Section 5.6. The wildlife habitats in the proposed avoidance areas consist primarily of forested wetlands and streams; a relatively small percentage of the wildlife habitat is uplands (primarily pastureland). Under the mitigation framework developed for this AEIS, USACE proposes to consider a buffer width in the range of 100 feet to 300 feet for the purpose of minimizing impacts to wildlife on the Desoto Mine site (see Section 5.4). USACE would consider the reasonableness and practicability of applying buffers for wildlife protection based on the mine's operational requirements in concert with evaluations of the type, quality, location, and other characteristics of the targeted aquatic systems. Buffers for wildlife protection are proposed to be considered primarily for 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.

Mining operations on the Desoto Mine site would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the mine site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the mine site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands). During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is proposed to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are proposed to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.2, at a minimum the habitat acreages described in Table 4-82 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, the Desoto Mine would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

#### 4.5.3.3 Alternative 3: Ona Mine

The preliminary quantities of upland wildlife habitat proposed to be avoided, impacted, and reclaimed on the Ona Mine site are summarized in Table 4-83. The data presented in Table 4-83 reflect the plans shown in the June 1, 2012, public notice for the Ona Mine, and are subject to change prior to potential issuance of the federal 404 permit, and for reclamation, the FDEP mine permit.

**Table 4-83. Current Summary of Upland Wildlife Habitat Avoidance, Impact, and Reclamation for Ona Mine[a]**

| Habitat Type | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) | Reclaim[b] | Post-Mining | Amount Change (% Change) |
|---|---|---|---|---|---|---|
| Rangeland | 3,095 (14%) | 36 (1%) | 3,059 (99%) | 1,776 | 1,812 | -1,283 (-41%) |
| Upland Forest | 5,063 (23%) | 720 (14%) | 4,342 (86%) | 4,109 | 4,829 | -234 (-5%) |
| Pastureland | 9,266 (41%) | 269 (3%) | 8,998 (97%) | 8,657 | 8,926 | -340 (-4%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.
[b] Not under the USACE's authority.
Notes:
Values = acres

As indicated in Table 4-83, pastureland is the most abundant upland wildlife habitat type on the Ona Mine site, representing approximately 41 percent of the total area of the site. Upland forest is the second most abundant upland wildlife habitat on the mine site (approximately 23 percent of the total site) and rangeland is the least abundant upland wildlife habitat on the mine site (approximately 14 percent of the total site). Most of the rangeland, upland forest, and pastureland on the Ona Mine site is proposed to be impacted; upland forest is proposed to be impacted to a lesser relative extent than rangeland and pastureland. Less pastureland, upland forest, and rangeland is proposed to be reclaimed than impacted. When coupled with the amount of existing upland wildlife habitat proposed to be avoided, the post-reclamation condition on the Ona Mine site would result in a 4 percent decrease in pastureland, 5 percent decrease in upland forest, and 41 percent decrease in rangeland.

Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. Based on Mosaic's federal 404 permit application, most pasturelands on the Ona Mine site are improved pasture. Improved pasture is generally defined as land that has been cleared, tilled, and reseeded with specific grass types and periodically improved with brush control and fertilizer application. All agricultural lands, including pasturelands, represent approximately 43 percent of the total area of the Ona Mine site.

The overall wildlife habitat quality of upland forests and rangelands on the Ona Mine site is expected to be higher than that of pasturelands, particularly improved pasture, on the mine site. The wildlife habitat quality of upland forest and rangeland communities on the Ona Mine site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the Ona Mine site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

The specific areas on the Ona Mine site that Mosaic preliminarily proposes to avoid are discussed in Section 5.6. The wildlife habitats in the proposed avoidance areas consist primarily of wetlands (primarily forested wetlands), streams, upland forests, and pasturelands. Under the mitigation framework developed for this AEIS, USACE proposes to consider a buffer width in the range of 100 feet to 300 feet for the purpose of minimizing impacts to wildlife on the Ona Mine site (see Section 5.4). USACE would consider the reasonableness and practicability of applying buffers for wildlife protection based on the mine's operational requirements in concert with evaluations of the type, quality, location, and other characteristics of the targeted aquatic systems. Buffers for wildlife protection are proposed to be considered primarily for 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.

Mining operations on the Ona Mine would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the mine site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the mine site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands).During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is proposed to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are proposed to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.3, at a minimum the habitat acreages described in Table 4-83 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, the Ona Mine would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

#### 4.5.3.4 Alternative 4: Wingate East Mine

The preliminary quantities of upland wildlife habitat proposed to be avoided, impacted, and reclaimed on the Wingate East Mine site are summarized in Table 4-84. The data presented in Table 4-84 reflect the plans shown in the June 1, 2012, public notice for the Wingate East Mine, and are subject to change prior to potential issuance of the federal 404 permit, and for reclamation, the FDEP mine permit.

**Table 4-84. Current Summary of Upland Wildlife Habitat Avoidance, Impact, and Reclamation for Wingate East Mine[a]**

| Habitat Type | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) | Reclaim[b] | Post-Mining | Amount Change (% Change) |
|---|---|---|---|---|---|---|
| Rangeland | 664 (18%) | 13 (<1%) | 651 (>99%) | 730 | 743 | +79 (+12%) |
| Upland Forest | 884 (24%) | 48 (5%) | 835 (95%) | 749 | 797 | -87 (-10%) |
| Pastureland | 1,037 (28%) | 25 (2%) | 1,013 (98%) | 978 | 1,003 | -34 (-3%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.
[b] Not under the USACE's authority.

Notes:
Values = acres

As indicated in Table 4-84, pastureland is the most abundant upland wildlife habitat type on the Wingate East Mine site, representing approximately 28 percent of the total area of the site. Upland forest is the second most abundant upland wildlife habitat on the mine site (approximately 24 percent of the total site) and rangeland is the least abundant upland wildlife habitat on the mine site (approximately 18 percent of the total site). Most of the rangeland, upland forest, and pastureland on the Wingate East Mine site is proposed to be impacted. More rangeland is proposed to be reclaimed than impacted and less upland forest and pastureland is proposed to be reclaimed than impacted. When coupled with the amount of existing upland wildlife habitat proposed to be avoided, the post-reclamation condition on the Wingate East Mine site would result in a 12 percent increase in rangeland, 10 percent decrease in upland forest, and 3 percent decrease in pastureland.

Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. Based on Mosaic's federal 404 permit application, most pasturelands on the Wingate East Mine site are improved pasture. Improved pasture is generally defined as land that has been cleared, tilled, and reseeded with specific grass types and periodically improved with brush control and fertilizer application. Agricultural land use on the Wingate East Mine site consists only of pasturelands.

The overall wildlife habitat quality of upland forests and rangelands on the Wingate East Mine site is expected to be higher than that of pasturelands, particularly improved pasture, on the mine site. The wildlife habitat quality of upland forest and rangeland communities on the Wingate East Mine site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the Wingate East Mine site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

The specific areas on the Wingate East Mine site that Mosaic preliminarily proposes to avoid are discussed in Section 5.6. The wildlife habitats in the proposed avoidance areas consist primarily of forested wetlands and streams; a relatively small percentage of the total avoidance area is uplands (primarily upland forest). Under the mitigation framework developed for this AEIS, USACE proposes to consider a buffer width in the range of 100 feet to 300 feet for the purpose of minimizing impacts to wildlife on the Wingate East Mine site (see Section 5.4). USACE would consider the reasonableness and practicability of applying buffers for wildlife protection based on the mine's operational requirements in concert with evaluations of the type, quality, location, and other characteristics of the targeted aquatic systems. Buffers for wildlife protection are proposed to be considered primarily for 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.

Mining operations on the Wingate East Mine would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the mine site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the mine site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands).During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is proposed to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are proposed to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.4, at a minimum the habitat acreages described in Table 4-84 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, the Wingate East Mine would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

#### 4.5.3.5 Alternative 5: South Pasture Extension Mine

The preliminary quantities of upland wildlife habitat proposed to be avoided, impacted, and reclaimed on the South Pasture Extension Mine site are summarized in Table 4-85. The data presented in Table 4-85 reflect the plans shown in the June 1, 2012, public notice for the South Pasture Extension Mine, and are subject to change prior to potential issuance of the federal 404 permit, and for reclamation, the FDEP mine permit.

**Table 4-85. Current Summary of Upland Wildlife Habitat Avoidance, Impact, and Reclamation for South Pasture Extension Mine[a]**

| Habitat Type | Existing (% of Mine Site) | Avoid (% of Total) | Impact (% of Total) | Reclaim[b] | Post-Mining | Amount Change (% Change) |
|---|---|---|---|---|---|---|
| Rangeland | 683 (9%) | 54 (8%) | 629 (92%) | 612 | 666 | -17 (-2%) |
| Upland Forest | 1,295 (17%) | 434 (34%) | 861 (66%) | 1,025 | 1,459 | +164 (+13%) |
| Pastureland | 2,776 (37%) | 76 (3%) | 2,700 (97%) | 3,225 | 3,240 | +464 (+17%) |

[a] Based on the June 1, 2012, public notice. Values subject to change.
[b] Not under the USACE's authority.

Notes:
Values = acres

As indicated in Table 4-85, pastureland is the most abundant upland wildlife habitat type on the South Pasture Extension Mine site, representing approximately 37 percent of the total area of the site. Upland forest is the second most abundant upland wildlife habitat on the mine site (approximately 17 percent of the total site) and rangeland is the least abundant upland wildlife habitat on the mine site (approximately 9 percent of the total site). Most of the rangeland, upland forest, and pastureland on the South Pasture Extension Mine site is proposed to be impacted; upland forest is proposed to be impacted to a lesser relative extent than rangeland and pastureland. More upland forest and pastureland is proposed to be reclaimed than impacted and slightly less rangeland is proposed to be reclaimed than impacted. When coupled with the amount of existing upland wildlife habitat proposed to be avoided, the post-reclamation condition on the South Pasture Extension Mine site would result in a 2 percent decrease in rangeland, 13 percent increase in upland forest, and 17 percent increase in pastureland.

Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. Based on CF Industries' federal 404 permit application, most pasturelands on the proposed South Pasture Extension Mine site are improved pasture. Improved pasture is generally defined as land that has been cleared, tilled, and reseeded with specific grass types and periodically improved with brush control and fertilizer application. All agricultural lands, including pasturelands, represent approximately 46 percent of the total area of the South Pasture Extension Mine site.

The overall wildlife habitat quality of upland forests and rangelands on the South Pasture Extension Mine site is expected to be higher than that of pasturelands, particularly improved pasture, on the mine site. The wildlife habitat quality of upland forest and rangeland communities on the South Pasture Extension Mine site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the South Pasture Extension Mine site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

The specific areas on the South Pasture Extension Mine site that CF Industries preliminarily proposes to avoid are discussed in Section 5.6. The wildlife habitats in the proposed avoidance areas consist primarily of forested wetlands, non-forested wetlands, streams, and upland forests. All avoidance areas on the South Pasture Extension Mine site are proposed to be preserved by CF Industries through a conservation easement and some habitats in the avoidance areas are proposed to be enhanced. Under the mitigation framework developed for this AEIS, USACE proposes to consider a buffer width in the range of 100 feet to 300 feet for the purpose of minimizing impacts to wildlife on the South Pasture Extension Mine site (see Section 5.4). USACE would consider the reasonableness and practicability of applying buffers for wildlife protection based on the mine's operational requirements in concert with evaluations of the type, quality, location, and other characteristics of the targeted aquatic systems. Buffers for wildlife protection are proposed to be considered primarily for 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.

Mining operations on the South Pasture Extension Mine would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the mine site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the mine site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands). During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is proposed to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are proposed to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.5, at a minimum the habitat acreages described in Table 4-85 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, the South Pasture Extension Mine would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

#### 4.5.3.6 Alternative 6: Pine Level/Keys Tract

Table 4-86 presents the acreages of upland wildlife habitat on the Pine Level/Keys Tract site based on FLUCCS data (SWFWMD, 2009a).

**Table 4-86. Upland Wildlife Habitat Summary for Pine Level/Keys Tract Offsite Alternative**

| Offsite Alternative | Rangeland (% of Site) | Upland Forest (% of Site) | Pastureland (% of Site) |
|---|---|---|---|
| Pine Level/ Keys Tract | 3,400 (14%) | 2,700 (11%) | 6,460 (26%) |

Notes:
Values = acres

Source: SWFWMD, 2009a

As indicated in Table 4-86, pastureland is the most abundant upland wildlife habitat type on the Pine Level/Keys Tract site, representing approximately 26 percent of the total area of the site. Rangeland is the second most abundant upland wildlife habitat on the site (approximately 14 percent of the total site) and upland forest is the least abundant upland wildlife habitat on the site (approximately 11 percent of the total site). Based on the FLUCCS data, all agricultural lands, including pasturelands, represent approximately 48 percent of the total area of the Pine Level/Keys Tract site.

The acreages of rangeland, upland forest, and pastureland on the Pine Level/Keys Tract site are within the overall ranges of those on the Applicants' Preferred Alternative sites. It should be noted that there is considerable variability among the Applicants' Preferred Alternative sites in their acreages (and relative percentages) of upland wildlife habitat. As on all of the Applicants' Preferred Alternative sites, pastureland is the dominant upland wildlife habitat and agriculture is the dominant land use on the Pine Level/Keys Tract site. Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. The quality of wildlife habitat provided by the various upland types on the Pine Level/Keys Tract site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the Pine Level/Keys Tract site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

Based on the GIS-based data/tools used, the overall quantity and quality of wildlife habitat that would be impacted by mining on the Pine Level/Keys Tract site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred Alternative sites.

Mining operations on the Pine Level/Keys Tract site would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands). During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is expected to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are expected to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.6, at a minimum the habitat acreages described in Table 4-86 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, mining the Pine Level/Keys Tract would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

#### 4.5.3.7 Alternative 7: Pioneer Tract

Table 4-87 presents the acreages of upland wildlife habitat on the Pioneer Tract site based on FLUCCS data (SWFWMD, 2009a).

**Table 4-87. Upland Wildlife Habitat Summary for Pioneer Tract Offsite Alternative**

| Offsite Alternative | Rangeland (% of Site) | Upland Forest (% of Site) | Pastureland (% of Site) |
|---|---|---|---|
| Pioneer Tract | 1,855 (7%) | 1,352 (5%) | 7,022 (28%) |

Notes:
Values = acres
Source: SWFWMD, 2009a

As indicated in Table 4-87, pastureland is the most abundant upland wildlife habitat type on the Pioneer Tract site, representing approximately 28 percent of the total area of the site. Rangeland is the second most abundant upland wildlife habitat on the site (approximately 7 percent of the total site) and upland forest is the least abundant upland wildlife habitat on the site (approximately 5 percent of the total site). Based on the FLUCCS data, all agricultural lands, including pasturelands, represent approximately 51 percent of the total area of the Pioneer Tract site.

The acreages of rangeland, upland forest, and pastureland on the Pioneer Tract site are within the overall ranges of those on the Applicants' Preferred Alternative sites. It should be noted that there is considerable variability among the Applicants' Preferred Alternative sites in their acreages (and relative percentages) of upland wildlife habitat. As on all of the Applicants' Preferred Alternative sites, pastureland is the dominant upland wildlife habitat and agriculture is the dominant land use on the Pioneer Tract site. Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. The quality of wildlife habitat provided by the various upland types on the Pioneer Tract site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the Pioneer Tract site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

Based on the GIS-based data/tools used, the overall quantity and quality of wildlife habitat that would be impacted by mining on the Pioneer Tract site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred Alternative sites.

Mining operations on the Pioneer Tract site would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands). During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is expected to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are expected to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.7, at a minimum the habitat acreages described in Table 4-87 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, mining the Pioneer Tract would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

#### 4.5.3.8 Alternative 8: Site A-2

Table 4-88 presents the acreages of upland wildlife habitat on the A-2 site based on FLUCCS data (SWFWMD, 2009a).

**Table 4-88. Upland Wildlife Habitat Summary for A-2 Offsite Alternative**

| Offsite Alternative | Rangeland (% of Site) | Upland Forest (% of Site) | Pastureland (% of Site) |
|---|---|---|---|
| A-2 | 150<br>(2%) | 203<br>(2%) | 4,146<br>(51%) |

Notes:
Values = acres

Source: SWFWMD, 2009a

As indicated in Table 4-88, pastureland is the most abundant upland wildlife habitat type on the A-2 site, representing approximately 28 percent of the total area of the site. Rangeland and upland forest cover on the A-2 site are comparable and considerably less than pastureland cover (each represent approximately 2 percent of the total area of the site). Based on the FLUCCS data, all agricultural lands, including pasturelands, represent approximately 79 percent of the total area of the A-2 site.

The acreage of pastureland on the A-2 site is within the overall range of pastureland acreages on the Applicants' Preferred Alternative sites; the A-2 site has less upland forest and rangeland than any of the Applicants' Preferred Alternative sites. It should be noted that there is considerable variability among the Applicants' Preferred Alternative sites in their acreages (and relative percentages) of upland wildlife habitat. As on all the Applicants' Preferred Alternative sites, pastureland is the dominant upland wildlife habitat and agriculture is the dominant land use on the A-2 site. Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. The quality of wildlife habitat provided by the various upland types on the A-2 site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the A-2 site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

Based on the GIS-based data/tools used, the overall quantity and quality of wildlife habitat that would be impacted by mining on the A-2 site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred Alternative sites.

Mining operations on the A-2 site would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands). During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is expected to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are expected to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.8, at a minimum the habitat acreages described in Table 4-88 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, mining Site A-2 would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

#### 4.5.3.9 Alternative 9: Site W-2

Table 4-89 presents the acreages of upland wildlife habitat on the W-2 site based on FLUCCS data (SWFWMD, 2009a).

**Table 4-89. Upland Wildlife Habitat Summary for W-2 Offsite Alternative**

| Offsite Alternative | Rangeland (% of Site) | Upland Forest (% of Site) | Pastureland (% of Site) |
|---|---|---|---|
| W-2 | 1,455 (15%) | 1,241 (13%) | 1,470 (15%) |

Notes:
Values = acres

Source: SWFWMD, 2009a

As indicated in Table 4-89, the amounts of pastureland and rangeland on the W-2 site are similar (each represent approximately 15 percent of the total area of the site). Upland forest represents approximately 13 percent of the total area of the site. Based on the FLUCCS data, all agricultural lands, including pasturelands, represent approximately 45 percent of the total area of the W-2 site.

The acreages of rangeland, upland forest, and pastureland on the W-2 site are within the overall ranges of those on the Applicants' Preferred Alternative sites. It should be noted that there is considerable variability among the Applicants' Preferred Alternative sites in their acreages (and relative percentages) of upland wildlife habitat. As on all the Applicants' Preferred Alternative sites, agriculture is the dominant land use on the W-2 site. The relative percentage of pastureland (relative to other onsite upland types) on the W-2 site is less than that on the Applicants' Preferred Alternative sites. Pasturelands are agricultural land uses that serve as habitat for certain wildlife species; however, the overall wildlife habitat quality of pasturelands, particularly improved pasture, is typically lower than that of rangelands and upland forests, which are native upland habitat types. The quality of wildlife habitat provided by the various upland types on the W-2 site is expected to vary based on the ecological characteristics and condition of each community. Upland communities on the W-2 site, like wetlands/waters, are expected to have been directly and/or indirectly impacted to varying degrees by agricultural practices given that agriculture is the dominant land use on the site.

Based on the GIS-based data/tools used, the overall quantity and quality of wildlife habitat that would be impacted by mining on the W-2 site are expected to be comparable to those proposed to be impacted on one or more of the Applicants' Preferred Alternative sites.

Mining operations on the W-2 site would have a temporary adverse impact on non-listed wildlife species. Wildlife species that occur on the site would be temporarily impacted by loss of habitat and by noise generated during mining activities. The timeframe for the loss of wildlife habitat on the site spans the period when the habitat is impacted to when the impacts are offset through compensatory mitigation (wetlands) or reclamation (uplands and wetlands). During land clearing, mobile wildlife species would relocate to undisturbed areas; land clearing is expected to be conducted in a directional manner to allow mobile species to more easily relocate to adjacent habitats. Wildlife species that are displaced by land clearing are expected to re-occupy mined areas after they are reclaimed. Based on the findings of past studies, wildlife use of reclaimed areas is expected to be comparable to wildlife use of unmined areas (see Section 3.3.6.1). Some slow-moving wildlife species may not be able to relocate to undisturbed areas and, therefore, may be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations. Certain slow-moving non-listed animal species that are encountered during pre-clearing surveys are expected to be relocated before land disturbance (along with listed plant species and slow-moving listed animal species) to suitable onsite avoidance or reclamation areas or to suitable sites outside the mine property.

Without mitigation, none of the measures that would protect wildlife habitat, such as buffers and reclamation as required by the FDEP, would be implemented. As with the discussion of wetland impacts in Section 4.5.3.9, at a minimum the habitat acreages described in Table 4-89 above would be eliminated, with no replacement of acreage or function. This would have a major degree of effect, which would be significant.

With mitigation, however, based on the expected, required consideration and reclamation of lost wildlife habitat during the USACE and FDEP permit review processes, mining Site W-2 would have no impact to a minor impact on wildlife habitat. This impact would not be significant.

### 4.5.4 Listed Species

The analysis of impacts to listed species focuses on federally listed species, which are species that are required to be considered under Section 7 or Section 10 of the Endangered Species Act (ESA). Potential impacts to state-listed species are also briefly addressed. The American alligator, which is federally listed solely because of its resemblance to the American crocodile, is excluded from the impact analysis on federally listed species; impacts to the American alligator are addressed generically as part of the analysis of impacts to general wildlife species.

Each alternative would potentially result in direct and indirect impacts to listed species, including direct disturbance and loss of habitat. The timeframe for listed species impacts on each alternative site spans the life of the mine, through final reclamation and mitigation. Each mine site would be mined, and then mitigated or reclaimed in phases in separate mine blocks over the life of the each mine; therefore, the listed species would not all be impacted at once.

A species-specific habitat management plans would be prepared for each alternative to outline the measures to be implemented to protect/manage listed species during mining operations. Listed species field surveys have been conducted during the planning phase of each Applicant’s Preferred Alternative to initially assess listed species occurrence on the mine site (discussed further below), and would be conducted for the offsite alternatives if they were to be mined. In addition to these planning-level surveys, pre-clearing surveys would be conducted in each mine block to be mined on each mine site prior to land disturbance. Each mine's species-specific habitat management plans would be updated as necessary based on the findings of these pre-clearing surveys. The findings of the planning-level and pre-clearing surveys would be used to develop the specific wildlife/listed species and habitat conservation measures to be implemented prior to, during, and after mining operations on each mine site. Conservation of wildlife and listed species is further discussed in Chapter 5.

Section 3.3.6 provides more information about listed species within the AEIS study area and on the Applicants' Preferred Alternatives parcels.

The degree of intensity of impacts on listed species was determined using the following criteria:

- No Impact to Minor: All disturbances to federally listed species on the mine site would be short-term or would result in little to no loss of listed species habitat area or functions. Impacts on listed species would be negligible and largely associated with noise generated during mining activities. Listed species outside the mine property would not be impacted in any manner.
- Moderate: Some disturbances to federally listed species on the mine site would be long-term. A moderate amount of listed species habitat area and functions on the mine site would be eliminated temporarily, and then replaced. Impacts to listed species would include noise/activity disturbance and loss of moderate amounts of habitat. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property would not be impacted in any manner.
- Major: Most disturbances to federally listed species on the mine site would be long-term. A large amount of listed species habitat area and functions on the mine site would be eliminated temporarily, and then replaced. Impacts to listed species would include noise/activity disturbance and loss of large amounts of habitat. The potential for listed species to be harmed or killed would be relatively high. Listed species outside the mine property may be impacted but would not have to be impacted for a major impact to occur.

#### 4.5.4.1 No Action Alternative

Under the No Action Alternative – No Mining scenario, there would be no mining-related impacts to listed species on any of the four Applicants' Preferred Alternatives parcels. Impacts to listed species resulting from other activities, such as current agricultural practices or future development, may occur. Impacts to listed species on existing mines would continue, and would be subject to the requirements of previous authorizations including but not limited to USACE and FDEP permits.

Under the No Action Alternative – Upland Only scenario, there would be no mining-related impacts to listed species associated with waters of the U.S., including jurisdictional wetlands, on any of the four

Applicants' Preferred Alternatives parcels. Mining-related impacts to listed species associated with non-USACE-jurisdictional wetlands and on uplands would occur. Listed species impacts resulting from other activities, such as current agricultural practices or future development, may occur.

For the No Mining scenario, it is unknown what type of compensation for listed species impacts on the four parcels would be required. Based on this uncertainty, the No Action Alternative – No Mining would have moderate to major impact on listed species, which would be significant. For the Upland Only scenario, it is expected that FDEP permitting requirements, and USFWS requirements under Section 10 of the ESA, would address listed species impacts on the four parcels. Based on this expectation, the No Action Alternative – Upland Only scenario would have minor to moderate impact on listed species. This impact would not be significant.

#### 4.5.4.2 Alternative 2: Desoto Mine

The findings of listed species field surveys conducted on the Desoto Mine site are discussed in detail in Section 3.3.6.3. The federally listed species confirmed onsite include the threatened eastern indigo snake *(Drymarchon couperi)*, the threatened Northern crested caracara *(Polyborus plancus audubonii),* and the endangered wood stork *(Mycteria americana)*. The project is within an 18.6-mile radius of at least one wood stork nesting colony. No caracara nests were observed onsite; however, there is a communal roost on the property, and a nest on an adjacent property. The project has suitable habitat and is within the consultation area for the threatened Florida scrub jay *(Aphelocoma coerulescens)*; however, no scrub jays were detected during species-specific surveys. The project is also within the consultation area for the endangered Florida grasshopper sparrow *(Ammodramus savannarum floridanus);* however, no Florida grasshopper sparrow habitat was identified onsite. Portions of the project are within 2 miles of a Florida panther *(Puma concolor coryi)* road crossing and a panther dispersal pathway.

Impacts to the wood stork, eastern indigo snake, and Audubon's crested caracara would primarily be from direct disturbance and from temporary loss of habitat. These species may be disturbed by noise generated during mining activities; however, the overall noise disturbance would be temporary and is expected to be negligible. Adult and juvenile wood storks and crested caracaras are expected to be able to move away from land-clearing and mining equipment; therefore, the potential for the adults and juveniles of these species to be harmed or killed by mining activities is considered to be relatively low. Indigo snakes are less able to avoid heavy equipment, and therefore the potential for indigo snakes to be impacted by land-clearing or mining equipment is relatively high.

The timeframe for the loss of habitats used by wood storks (primarily herbaceous wetlands and shallow surface waters), indigo snakes (variety of habitats, including gopher tortoise burrows), and crested caracaras (primarily pasturelands and rangelands) spans the period from when the habitats are impacted to when the habitats that are replaced through compensatory wetland mitigation or wetland/upland reclamation have reached a similar level of function as the original habitat. The habitats used by these species are proposed to be impacted and replaced in phases in separate mine blocks over the life of the mine; therefore, the habitats would not all be impacted at once. These species would be able to use undisturbed areas on the Desoto Mine site and are expected to re-occupy mined areas after they are mitigated and reclaimed.

The potential impacts to listed species are proposed to be avoided, minimized, or compensated for in several different ways. Wood stork and crested caracara nest protection measures are proposed to prevent disturbances around the nest or nesting colony likely to result in impacts to eggs or young still occupying nests. Indigo nesting habits are not well known; therefore, indigo snake nests would be difficult to identify on the Desoto Mine site. Standardized protection measures developed by USFWS for the indigo snake are proposed to be implemented to minimize the likelihood for incidental take of indigo snakes during mining operations. Specific measures are proposed to be implemented to avoid and minimize impacts to any indigo snakes encountered in gopher tortoise burrows during gopher tortoise relocations; indigo snakes that are encountered during gopher tortoise relocations are proposed to be allowed to disperse from the area on their own. Compensation for the loss of suitable foraging habitat for wood storks would be required. The amount of compensation would be determined with a core foraging model assessment to determine how much suitable foraging habitat is present, and the amount and types (based on hydroperiods) of wetlands needed to replace the lost wood stork foraging habitat.

The Wildlife and Habitat Management Plan proposed to be prepared for the Desoto Mine would outline the general measures to be implemented to protect/manage wood storks, indigo snakes, and crested caracaras during mining operations. A species-specific habitat management plan is proposed to be prepared for each of these species to identify the specific conservation measures and protocols to be implemented for the species. These plans would be required to be approved by USFWS prior to implementation and they are proposed to be updated as necessary based on the findings of pre-clearing surveys proposed to be conducted in each mine block to be mined prior to land disturbance.

Potential impacts to the Florida panther and the Florida scrub jay would be from the loss of habitat, although as noted above and in the application for the project, there are no reports of panthers or scrub jays on the project site. As also noted above and in the application, there is neither suitable habitat for the Florida grasshopper sparrow, nor actual reports of Florida grasshopper sparrows, on the project site.

As described in the June 1, 2012, public notice for the Desoto Mine project, the USACE made effect determinations of ‘may affect’ for the Florida panther, the eastern indigo snake, the caracara, and the wood stork, and ‘may affect, not likely to adversely affect’ for the scrub jay and Florida grasshopper sparrow, and is coordinating these determinations with the USFWS pursuant to the requirements of Section 7 of the ESA.

Public and regulatory agency comments received during the AEIS scoping and Draft AEIS review periods recommended that the analysis of ecological impacts on the Charlotte Harbor estuary include consideration of the potential effect of mining on the smalltooth sawfish pursuant to Section 7 of the ESA. The surface water quality and hydrology analyses conducted and discussed in this chapter show that the Desoto Mine, individually and cumulatively with other past, present, and reasonably foreseeable actions, may affect, but would not adversely affect, the smalltooth sawfish. The USACE will include this assessment of the potential effect of the Desoto Mine on the smalltooth sawfish in its coordination with NMFS pursuant to Section 7 of the ESA.

No other federally listed species have been identified on the Desoto Mine site, are expected to have a high probability of occurrence on the mine site based on the findings of past surveys and the types and qualities of the habitats that exist on the mine site, or are expected to be directly, indirectly, or cumulatively impacted by the proposed actions. In the event of changes such as new species being listed or a change in status for currently-listed species, additional listed species being documented on the project site or as being impacted, or additional rule making under Section 7 of the ESA, appropriate coordination with USFWS or NMFS would be initiated.

Two species that are state-listed as Threatened (gopher tortoise and Florida sandhill crane) and six species that are listed as Species of Special Concern were observed during field surveys conducted on the Desoto Mine site (see Section 3.3.6.3). Impacts to these species would primarily be from direct disturbance and from temporary loss of habitat. Conservation measures for these species are proposed to be developed and implemented in coordination with FFWCC. Conservation measures for state-listed species may include, but are not limited to, preservation, restoration, and/or enhancement of onsite habitats; avoidance of breeding/nesting areas; relocation of plants and slow-moving animal species; and creation of suitable habitats for relocated species. Gopher tortoises (and certain commensal species that use gopher tortoise burrows) that occur in areas proposed to be mined on the Desoto Mine site are proposed to be relocated to suitable onsite avoidance/preservation or reclamation areas or to suitable sites outside the mine property. Past studies have indicated that reclaimed lands can serve as suitable recipient sites for relocated gopher tortoises and that gopher tortoises can be relocated without adverse effects to their growth or reproduction (see Chapter 5). Mosaic currently has numerous permitted gopher tortoise recipient sites on reclaimed land, and has restocked these sites with gopher tortoises and certain gopher tortoise commensal species for years (see Chapter 5).

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented. This would have a major degree of effect, which would be significant.

With mitigation, the various species-specific measures that are described above or reasonably expected to result from formal or informal consultation under Section 7 of the ESA and from the FDEP permit review process would be implemented. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging within the property. The functions provided by the Desoto Mine site that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis the Desoto Mine would have a moderate to major degree of impact Considering the avoidance, minimization, and compensation measures, the impacts on listed species associated with the Desoto Mine would not be significant.

#### 4.5.4.3 Alternative 3: Ona Mine

The findings of listed species field surveys conducted on the Ona Mine site are discussed in detail in Section 3.3.6.3. Audubon's crested caracara (*Polyborus plancus*), wood storks (*Mycteria americana*), and eastern indigo snakes (*Drymarchon couperi*) have been confirmed onsite. The project is within an 18.6-mile radius of at least one wood stork nesting colony. There is one nesting pair of caracara currently located within the subject property. The project has suitable habitat and is within the consultation area for the Florida grasshopper sparrow (*Ammodramus savannarum floridanus)*. The project has suitable habitat for the Florida panther (*Puma concolor coryi)* and is outside of the Panther Focus Area. The project has suitable habitat for the Florida scrub jay (*Aphelocoma coerulescens*); however, no scrub jays were detected during species specific surveys.

Impacts to the wood stork, eastern indigo snake, and Audubon's crested caracara would primarily be from direct disturbance and from temporary loss of habitat. These species may be disturbed by noise generated during mining activities; however, the overall noise disturbance would be temporary and is expected to be negligible. Adult and juvenile wood storks and crested caracaras are expected to be able to move away from land-clearing and mining equipment; therefore, the potential for the adults and juveniles of these species to be harmed or killed by mining activities is considered to be relatively low. Indigo snakes are less able to avoid heavy equipment, and therefore the potential for indigo snakes to be impacted by land-clearing or mining equipment is relatively high.

The timeframe for the loss of habitats used by wood storks (primarily herbaceous wetlands and shallow surface waters), indigo snakes (variety of habitats, including gopher tortoise burrows), and crested caracaras (primarily pasturelands and rangelands) spans the period from when the habitats are impacted to when the habitats that are replaced through compensatory wetland mitigation or wetland/upland reclamation have reached a similar level of function as the original habitat. The habitats used by these species are proposed to be impacted and replaced in phases in separate mine blocks over the life of the mine; therefore, the habitats would not all be impacted at once. These species would be able to use undisturbed areas on the Ona Mine site and are expected to re-occupy mined areas after they are mitigated and reclaimed.

The potential impacts to listed species are proposed to be avoided, minimized, or compensated for in several different ways. Wood stork and crested caracara nest protection measures are proposed to prevent disturbances around the nest or nesting colony likely to result in impacts to eggs or young still occupying nests. Indigo nesting habits are not well known; therefore, indigo snake nests would be difficult to identify on the Ona Mine site. Standardized protection measures developed by USFWS for the indigo snake are proposed to be implemented to minimize the likelihood for incidental take of indigo snakes during mining operations. Specific measures are proposed to be implemented to avoid and minimize impacts to any indigo snakes encountered in gopher tortoise burrows during gopher tortoise relocations; indigo snakes that are encountered during gopher tortoise relocations are proposed to be allowed to disperse from the area on their own. Compensation for the loss of suitable foraging habitat for wood storks would be required. The amount of compensation would be determined with a core foraging model assessment to determine how much suitable foraging habitat is present, and the amount and types (based on hydroperiods) of wetlands needed to replace the lost wood stork foraging habitat.

The Wildlife and Habitat Management Plan proposed to be prepared for the Ona Mine would outline the general measures to be implemented to protect/manage wood storks, indigo snakes, and crested caracaras during mining operations. A species-specific habitat management plan is proposed to be prepared for each of these species to identify the specific conservation measures and protocols to be implemented for the species. These plans would be required to be approved by USFWS prior to implementation and they are proposed to be updated as necessary based on the findings of pre-clearing surveys proposed to be conducted in each mine block to be mined prior to land disturbance.

Potential impacts to the Florida panther and the Florida scrub jay would be from the loss of habitat, although as noted above and in the application for the project, there are no reports of panthers or scrub jays on the project site. As also noted above and in the application, although there is suitable habitat for the Florida grasshopper sparrow, there are no reports of Florida grasshopper sparrows on the project site.

As described in the June 1, 2012, public notice for the Ona Mine project, the USACE made effect determinations of ‘may affect’ for the caracara, the eastern indigo snake, and the wood stork, and ‘may affect, not likely to adversely affect’ for the Florida panther, scrub jay and Florida grasshopper sparrow, and is coordinating these determinations with the USFWS pursuant to the requirements of Section 7 of the ESA.

Public and regulatory agency comments received during the AEIS scoping and Draft AEIS review periods recommended that the analysis of ecological impacts on the Charlotte Harbor estuary include consideration of the potential effect of mining on the smalltooth sawfish pursuant to Section 7 of the ESA. The surface water quality and hydrology analyses conducted and discussed in this chapter show that the Ona Mine, individually and cumulatively with other past, present, and reasonably foreseeable actions, may affect, but would not adversely affect, the smalltooth sawfish. The USACE will include this assessment of the potential effect of the Ona Mine on the smalltooth sawfish in its coordination with NMFS pursuant to Section 7 of the ESA.

No other federally listed species have been identified on the Ona Mine site, are expected to have a high probability of occurrence on the mine site based on the findings of past surveys and the types and qualities of the habitats that exist on the mine site, or are expected to be directly, indirectly, or cumulatively impacted by the proposed actions. In the event of changes such as new species being listed or a change in status for currently-listed species, additional listed species being documented on the project site or as being impacted, or additional rulemaking under Section 7 of the ESA, appropriate coordination with USFWS or NMFS would be initiated.

Three species that are state-listed as Threatened (gopher tortoise, Southeastern American kestrel, and Florida sandhill crane) and nine species that are listed as Species of Special Concern were observed during field surveys conducted on the Ona Mine site (see Section 3.3.6.3). Impacts to these species would primarily be from direct disturbance and from temporary loss of habitat. Conservation measures for these species are proposed to be developed and implemented in coordination with FFWCC. Conservation measures for state-listed species may include, but are not limited to, preservation, restoration, and/or enhancement of onsite habitats; avoidance of breeding/nesting areas; relocation of plants and slow-moving animal species; and creation of suitable habitats for relocated species. Gopher tortoises (and certain commensal species that use gopher tortoise burrows) that occur in areas proposed to be mined on the Ona Mine site are proposed to be relocated to suitable onsite avoidance/preservation or reclamation areas or to suitable sites outside the mine property. Past studies have indicated that reclaimed lands can serve as suitable recipient sites for relocated gopher tortoises and that gopher tortoises can be relocated without adverse effects to their growth or reproduction (see Chapter 5). Mosaic currently has numerous permitted gopher tortoise recipient sites on reclaimed land, and has restocked these sites with gopher tortoises and certain gopher tortoise commensal species for years (see Chapter 5).

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented. This would have a major degree of effect, which would be significant.

With mitigation, the various species-specific measures that are described above or reasonably expected to result from formal or informal consultation under Section 7 of the ESA and from the FDEP permit review process would be implemented. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging within the property. The functions provided by the Ona Mine site that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis the Ona Mine would have a moderate to major degree of impact. Considering the avoidance, minimization, and compensation measures, the impacts on listed species associated with the Ona Mine would not be significant.

#### 4.5.4.4 Alternative 4: Wingate East Mine

The findings of listed species field surveys conducted on the Wingate East Mine site are discussed in detail in Section 3.3.6.3. Audubon's crested caracara (*Polyborus plancus*), wood storks (*Mycteria americana*), Florida scrub jays, and eastern indigo snakes (*Drymarchon couperi*) have been confirmed onsite. The project is within a 15-mile radius of at least one wood stork nesting colony. The project has suitable habitat and is within the consultation area for the Florida grasshopper sparrow (*Ammodramus savannarum floridanus)*. The project has suitable habitat for the Florida panther (*Puma concolor coryi)* and is outside of the Panther Focus Area.

Impacts to the wood stork, eastern indigo snake, and Audubon's crested caracara would primarily be from direct disturbance and from temporary loss of habitat. These species may be disturbed by noise generated during mining activities; however, the overall noise disturbance would be temporary and is expected to be negligible. Adult and juvenile wood storks, and crested caracaras are expected to be able to move away from land-clearing and mining equipment; therefore, the potential for the adults and juveniles of these species to be harmed or killed by mining activities is considered to be relatively low. Indigo snakes are less able to avoid heavy equipment, and therefore the potential for indigo snakes to be impacted by land-clearing or mining equipment is relatively high.

The timeframe for the loss of habitats used by wood storks (primarily herbaceous wetlands and shallow surface waters), indigo snakes (variety of habitats, including gopher tortoise burrows), and crested caracaras (primarily pasturelands and rangelands) spans the period from when the habitats are impacted to when the habitats that are replaced through compensatory wetland mitigation or wetland/upland reclamation have reached a similar level of function as the original habitat. The habitats used by these species are proposed to be impacted and replaced in phases in separate mine blocks over the life of the mine; therefore, the habitats would not all be impacted at once. These species would be able to use undisturbed areas on the Wingate East Mine site and are expected to re-occupy mined areas after they are mitigated and reclaimed.

The potential impacts to listed species are proposed to be avoided, minimized, or compensated for in several different ways. Wood stork and crested caracara nest protection measures are proposed to prevent disturbances around the nest or nesting colony likely to result in impacts to eggs or young still occupying nests. Indigo nesting habits are not well known; therefore, indigo snake nests would be difficult to identify on the Wingate East Mine site. Standardized protection measures developed by USFWS for the indigo snake are proposed to be implemented to minimize the likelihood for incidental take of indigo snakes during mining operations. Specific measures are proposed to be implemented to avoid and minimize impacts to any indigo snakes encountered in gopher tortoise burrows during gopher tortoise relocations; indigo snakes that are encountered during gopher tortoise relocations are proposed to be allowed to disperse from the area on their own. Compensation for the loss of suitable foraging habitat for wood storks would be required. The amount of compensation would be determined with a core foraging model assessment to determine how much suitable foraging habitat is present, and the amount and types (based on hydroperiods) of wetlands needed to replace the lost wood stork foraging habitat.

The Wildlife and Habitat Management Plan proposed to be prepared for the Wingate East Mine would outline the general measures to be implemented to protect/manage wood storks, indigo snakes, and crested caracaras during mining operations. A species-specific habitat management plan is proposed to be prepared for each of these species to identify the specific conservation measures and protocols to be implemented for the species. These plans would be required to be approved by USFWS prior to implementation and they are proposed to be updated as necessary based on the findings of pre-clearing surveys proposed to be conducted in each mine block to be mined prior to land disturbance.

One Florida scrub jay territory was identified on the Wingate East Mine site and five scrub jays were observed occupying the territory during the field surveys; no scrub jay nests were found during the field surveys. In 2011, Mosaic relocated a total of 10 scrub jays from the Wingate East Mine site to Mosaic's 150-acre Wellfield scrub jay recipient site. The additional five scrub jays that were relocated were confirmed to be the offspring of the five scrub jays identified during the earlier field surveys. The scrub jay relocations were conducted under Mosaic's Habitat Conservation Plan/Incidental Take Permit for Wingate East scrub jays (USFWS Permit # TE 236128-0). Mosaic's Wellfield scrub jay recipient site is part of Mosaic's larger Four Corners/Lonesome scrub jay management site (see Chapter 5). Mosaic's management plan and permit for the Four Corners/Lonesome site were amended to include the Wellfield scrub jay recipient site and the scrub jays relocated from the Wingate East Mine site. A total of 84 scrub jays (including the 10 scrub jays relocated from the Wingate East Mine site) currently occupy the Four Corners/Lonesome site. The various conservation practices that Mosaic implements for scrub jays on its Four Corners/Lonesome management site are discussed in Chapter 5.

Potential impacts to the Florida panther would be from the loss of habitat, although as noted above and in the application for the project, there are no reports of panthers on the project site.

As described in the June 1, 2012, public notice for the Wingate East Mine project, the USACE made effect determinations of 'may affect' for the Florida grasshopper sparrow, the eastern indigo snake, and the wood stork, and 'may affect, not likely to adversely affect' for the Florida panther and the caracara, and is coordinating these determinations with the USFWS pursuant to the requirements of Section 7 of the ESA. Mosaic completed consultation for the Florida scrub jay under Section 10 of the ESA with the USFWS, and therefore no additional consultation is required.

Public and regulatory agency comments received during the AEIS scoping and Draft AEIS review periods recommended that the analysis of ecological impacts on the Charlotte Harbor estuary include consideration of the potential effect of mining on the smalltooth sawfish pursuant to Section 7 of the ESA. The surface water quality and hydrology analyses conducted and discussed in this chapter show that the Wingate East Mine, individually and cumulatively with other past, present, and reasonably foreseeable actions, would not have an effect on the smalltooth sawfish. The USACE will include this assessment of the potential effect of the Wingate East Mine on the smalltooth sawfish in its coordination with NMFS pursuant to Section 7 of the ESA.

No other federally listed species have been identified on the Wingate East Mine site, are expected to have a high probability of occurrence on the mine site based on the findings of past surveys and the types and qualities of the habitats that exist on the mine site, or are expected to be directly, indirectly, or cumulatively impacted by the proposed actions. In the event of changes such as new species being listed or a change in status for currently-listed species, additional listed species being documented on the project site or as being impacted, or additional rulemaking under Section 7 of the ESA, appropriate coordination with USFWS or NMFS would be initiated.

Four species that are state-listed as Threatened (Catesby's lily, gopher tortoise, Southeastern American kestrel, and Florida sandhill crane) and eight species that are listed as Species of Special Concern were observed during field surveys conducted on the Wingate East Mine site (see Section 3.3.6.3). Impacts to these species would primarily be from direct disturbance and from temporary loss of habitat. Conservation measures for these species are proposed to be developed and implemented in coordination with FFWCC. Conservation measures for state-listed species may include, but are not limited to, preservation, restoration, and/or enhancement of onsite habitats; avoidance of breeding/nesting areas; relocation of plants and slow-moving animal species; and creation of suitable habitats for relocated species. Gopher tortoises (and certain commensal species that use gopher tortoise burrows) that occur in areas proposed to be mined on the Wingate East Mine site are proposed to be relocated to suitable onsite avoidance/preservation or reclamation areas or to suitable sites outside the mine property. Past studies have indicated that reclaimed lands can serve as suitable recipient sites for relocated gopher tortoises and that gopher tortoises can be relocated without adverse effects to their growth or reproduction (see Chapter 5). Mosaic currently has numerous permitted gopher tortoise recipient sites on reclaimed land, and has restocked these sites with gopher tortoises and certain gopher tortoise commensal species for years (see Chapter 5).

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented. This would have a major degree of effect, which would be significant.

With mitigation, the various species-specific measures described that are above or reasonably expected to result from formal or informal consultation under Section 7 of the ESA and from the FDEP permit review process would be implemented. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging within the property. The functions provided by the Wingate East Mine site that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis the Wingate East Mine would have a moderate to major degree of impact. Considering the avoidance, minimization, and compensation measures, the impacts on listed species associated with the Wingate East Mine would not be significant.

#### 4.5.4.5 Alternative 5: South Pasture Extension Mine

The findings of listed species field surveys conducted on the South Pasture Extension Mine site are discussed in detail in Section 3.3.6.3. Audubon's crested caracara (*Polyborus plancus*), wood storks (*Mycteria americana*), and eastern indigo snakes (*Drymarchon couperi*) have been confirmed onsite. The project is within an 18.6-mile radius of at least one wood stork nesting colony. The project has suitable habitat and is within the consultation area for the Florida grasshopper sparrow (*Ammodramus savannarum floridanus)*. The project has suitable habitat for the Florida panther (*Puma concolor coryi)* and is outside of the Panther Focus Area. The project has a small area of potentially suitable habitat for the Florida scrub jay (*Aphelocoma coerulescens*); however, no scrub jays have been observed during listed species surveys.

Impacts to the wood stork, eastern indigo snake, and Audubon's crested caracara would primarily be from direct disturbance and from temporary loss of habitat. These species may be disturbed by noise generated during mining activities; however, the overall noise disturbance would be temporary and is expected to be negligible. Adult and juvenile wood storks, and crested caracaras are expected to be able to move away from land-clearing and mining equipment; therefore, the potential for the adults and juveniles of these species to be harmed or killed by mining activities is considered to be relatively low.

Indigo snakes are less able to avoid heavy equipment, and therefore the potential for indigo snakes to be impacted by land-clearing or mining equipment is relatively high.

The timeframe for the loss of habitats used by wood storks (primarily herbaceous wetlands and shallow surface waters), indigo snakes (variety of habitats, including gopher tortoise burrows), and crested caracaras (primarily pasturelands and rangelands) spans the period from when the habitats are impacted to when the habitats that are replaced through compensatory wetland mitigation or wetland/upland reclamation have reached a similar level of function as the original habitat. The habitats used by these species are proposed to be impacted and replaced in phases in separate mine blocks over the life of the mine; therefore, the habitats would not all be impacted at once. These species would be able to use undisturbed areas on the South Pasture Extension Mine site and are expected to re-occupy mined areas after they are mitigated and reclaimed.

The potential impacts to listed species are proposed to be avoided, minimized, or compensated for in several different ways. Wood stork and crested caracara nest protection measures are proposed to prevent disturbances around the nest or nesting colony likely to result in impacts to eggs or young still occupying nests. Indigo nesting habits are not well known; therefore, indigo snake nests would be difficult to identify on the South Pasture Extension Mine site. Standardized protection measures developed by USFWS for the indigo snake are proposed to be implemented to minimize the likelihood for incidental take of indigo snakes during mining operations. Specific measures are proposed to be implemented to avoid and minimize impacts to any indigo snakes encountered in gopher tortoise burrows during gopher tortoise relocations; indigo snakes that are encountered during gopher tortoise relocations are proposed to be allowed to disperse from the area on their own. Compensation for the loss of suitable foraging habitat for wood storks would be required. The amount of compensation would be determined with a core foraging model assessment to determine how much foraging suitable foraging habitat is present, and the amount and types (based on hydroperiods) of wetlands needed to replace the lost wood stork foraging habitat.

The Wildlife and Habitat Management Plan proposed to be prepared for the South Pasture Extension Mine would outline the general measures to be implemented to protect/manage wood storks, indigo snakes, and crested caracaras during mining operations. A species-specific habitat management plan also is proposed to be prepared for each of these species to identify the specific conservation measures and protocols to be implemented for the species. These plans would be required to be approved by USFWS prior to implementation and they are proposed to be updated as necessary based on the findings of pre-clearing surveys proposed to be conducted in each mine block to be mined prior to land disturbance.

Potential impacts to the Florida panther, Florida scrub jay, and the Florida grasshopper sparrow would be from the loss of habitat, although as noted above and in the application for the project, there are no reports of panthers, scrub jays, or grasshopper sparrows on the project site.

As described in the June 1, 2012, public notice for the South Pasture Extension Mine project, the USACE made effect determinations of ‘may affect’ for the caracara, the eastern indigo snake, and the wood stork, and ‘may affect, not likely to adversely affect’ for the Florida panther, Florida scrub jay, and the Florida grasshopper sparrow, and is coordinating these determinations with the USFWS pursuant to the requirements of Section 7 of the ESA.

Public and regulatory agency comments received during the AEIS scoping and Draft AEIS review periods recommended that the analysis of ecological impacts on the Charlotte Harbor estuary include consideration of the potential effect of mining on the smalltooth sawfish pursuant to Section 7 of the ESA. The surface water quality and hydrology analyses conducted and discussed in this chapter show that the South Pasture Extension Mine, individually and cumulatively with other past, present, and reasonably foreseeable actions, would not have an effect on the smalltooth sawfish. The USACE will include this assessment of the potential effect of the South Pasture Extension Mine on the smalltooth sawfish in its coordination with NMFS pursuant to Section 7 of the ESA.

No other federally listed species have been identified on the South Pasture Extension Mine site, are expected to have a high probability of occurrence on the mine site based on the findings of past surveys and the types and qualities of the habitats that exist on the mine site, or are expected to be directly, indirectly, or cumulatively impacted by the proposed actions. In the event of changes such as new species being listed or a change in status for currently-listed species, additional listed species being documented on the project site or as being impacted, or additional rulemaking under Section 7 of the ESA, appropriate coordination with USFWS or NMFS would be initiated.

Three species that are state-listed as Endangered (many-flowered grass-pink, common wild pine, and giant wild pine), two species that are state-listed as Threatened (gopher tortoise and Florida sandhill crane), and seven species that are listed as Species of Special Concern were observed during field surveys conducted on the South Pasture Extension Mine site (see Section 3.3.6.3). Impacts to these species would primarily be from direct disturbance and from temporary loss of habitat. Conservation measures for these species are proposed to be developed and implemented in coordination with FFWCC. Conservation measures for state-listed species may include, but are not limited to, preservation, restoration, and/or enhancement of onsite habitats; avoidance of breeding/nesting areas; relocation of plants and slow-moving animal species; and creation of suitable habitats for relocated species. Gopher tortoises (and certain commensal species that use gopher tortoise burrows) that occur in areas proposed to be mined on the South Pasture Extension Mine site are proposed to be relocated to suitable onsite avoidance/preservation or reclamation areas or to suitable sites outside the mine property. Past studies have indicated that reclaimed lands can serve as suitable recipient sites for relocated gopher tortoises and that gopher tortoises can be relocated without adverse effects to their growth or reproduction (see Chapter 5). CF Industries currently has numerous permitted gopher tortoise recipient sites on reclaimed land, and has restocked these sites with gopher tortoises and certain gopher tortoise commensal species for years (see Chapter 5).

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented. This would have a major degree of effect, which would be significant.

With mitigation, the various species-specific measures that are described above or reasonably expected to result from formal or informal consultation under Section 7 of the ESA and from the FDEP permit review process would be implemented. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging within the property. The functions provided by the South Pasture Extension Mine site that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis the South Pasture Extension Mine would have a moderate to major degree of impact. Considering the avoidance, minimization, and compensation measures, the impacts on listed species associated with the South Pasture Extension Mine would not be significant.

#### 4.5.4.6 Alternative 6: Pine Level/Keys Tract

The evaluation of listed species impacts for Pine Level/Keys Tract relies on reviews of available GIS data and other information sources such as FNAI occurrence data (FNAI, 2013).

The southern part of the Pine Level/Keys Tract parcel overlaps a panther dispersal pathway. Caracara nests have been previously documented outside the parcel, just north of the northwest section. Pine Level/Keys Tract is within 18.6 miles of at least one wood stork colony. It is expected that eastern indigo snakes would be found on the property, along with several of the state-listed species described in Chapter 3.

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented on the Pine Level/Keys Tract. This would have a major degree of effect, which would be significant.

With mitigation, any proposal for mining the Pine Level/Keys Tract would go through the ESA coordination procedures described in Section 4.5.4 and in the Applicants' Preferred Alternatives sections above. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging he property. The functions provided by the Pine Level/Keys Tract site that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis mining the Pine Level/Keys Tract would have a moderate to major degree of impact. Considering the expected avoidance, minimization, and compensation measures, the impacts on listed species associated with mining the Pine Level/Keys Tract would not be significant.

#### 4.5.4.7 Alternative 7: Pioneer Tract

The evaluation of listed species impacts for Pioneer Tract relies on reviews of available GIS data and other information sources such as FNAI occurrence data (FNAI, 2013).

A caracara nest has been previously documented outside the parcel, just outside the northeast corner. The Pioneer Tract is within 18.6 miles of at least one wood stork colony. It is expected that eastern indigo snakes would be found on the property, along with several of the state-listed species described in Chapter 3.

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented on the Pioneer Tract. This would have a major degree of effect, which would be significant.

With mitigation, any proposal for mining the Pioneer Tract would go through the ESA coordination procedures described in Section 4.5.4 and in the Applicants' Preferred Alternatives sections above. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging within the property. The functions provided by the Pioneer Tract site that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis mining the Pioneer Tract would have a moderate to major degree of impact. Considering the expected avoidance, minimization, and compensation measures, the impacts on listed species associated with mining the Pioneer Tract would not be significant.

#### 4.5.4.8 Alternative 8: Site A-2

The evaluation of listed species impacts for Site A-2 relies on reviews of available GIS data and other information sources such as FNAI occurrence data (FNAI, 2013).

There are several telemetry points indicating the presence of Florida panthers east of the parcel, along the west side of the Lake Wales Ridge. Site A-2 is within 18.6 miles of at least one wood stork colony. It is expected that eastern indigo snakes would be found on the property, along with several of the state-listed species described in Chapter 3.

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented on Site A-2. This would have a major degree of effect, which would be significant.

With mitigation, any proposal for mining Site A-2 would go through the ESA coordination procedures described in Section 4.5.4 and in the Applicants' Preferred Alternatives sections above. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging within the property. The functions provided by Site A-2 that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis mining Site A-2 would have a moderate to major degree of impact. Considering the expected avoidance, minimization, and compensation measures, the impacts on listed species associated with mining Site A-2 would not be significant.

#### 4.5.4.9 Alternative 9: Site W-2

The evaluation of listed species impacts for Site W-2 relies on reviews of available GIS data and other information sources such as FNAI occurrence data (FNAI, 2013).

There are documented scrub jay occurrences at two points on the south end of Site W-2, and suitable scrub jay habitat at several places within the parcel. Site W-2 is not within15 miles of any wood stork colonies. It is expected that eastern indigo snakes would be found on the property, along with several of the state-listed species described in Chapter 3.

Without mitigation, none of the expected required measures that would protect listed species, such as pre-clearing surveys for eastern indigo snakes, compensation for loss of wood stork habitat, or replacement of wildlife habitat through mitigation or reclamation, would be implemented on Site W-2. This would have a major degree of effect, which would be significant.

With mitigation, any proposal for mining Site W-2 would go through the ESA coordination procedures described in Section 4.5.4 and in the Applicants' Preferred Alternatives sections above. The potential for listed species to be harmed or killed would be relatively low. Listed species outside the mine property may be affected, such as wood storks nesting outside the property and foraging within the property. The functions provided by Site W-2 that these species depend on would be replaced by compensation. However, even with mitigation, mining this alternative would result in long-term disturbances to listed species, and the temporary elimination of a large amount of listed species habitat area and functions on the mine site. Therefore, based on this analysis mining Site W-2 would have a moderate to major degree of impact. Considering the expected avoidance, minimization, and compensation measures, the impacts on listed species associated with mining Site W-2 would not be significant.

## 4.6 ECONOMIC RESOURCES

The geographic scope of the economic analysis of the alternatives' direct and indirect effects is primarily the counties where each alternative is located (DeSoto, Hardee, and/or Manatee). Quantitative analyses are provided for the four Applicants' Preferred Alternatives and two of the Offsite Alternatives, Pine Level/Keys Tract and Pioneer Tract. The other two Offsite Alternatives, Site A-2 and W-2, are considered qualitatively. Section 3.3.7.1 includes an overview of the economic conditions within the AEIS study area. Section 3.3.7.5 has more specific information about existing agricultural and phosphate mining influences on the local and regional economy.

The degree of intensity of impacts for economic resources was determined using the following criteria:

- No Impact to Minor: Mining would have only a negative impact on economic interests in areas adjacent or near to the mine boundaries such as a local business. Direct and indirect beneficial impacts would be limited to less than 1 percent of county employment or income in the county or counties affected. These effects would be short-term with little residual impact beyond reclamation.

- Moderate: Mining would impact the economic interests adjacent to and beyond the mine boundaries extending as far as the county lines within which the mines are located. Direct and indirect beneficial impacts would be limited to greater than 1 percent but less than 3 percent of total employment or income within the county or counties affected. There would be some noticeable residual impacts beyond reclamation.

- Major: Mining would impact the region with large and/or long-term impacts to economic interests throughout the region affecting greater than 3 percent of total employment and income for the county or counties affected. Residual effects with long-term impacts on future economic activities would extend greater than 5 years past reclamation.

## 4.6.1 Alternative 1: No Action Alternative

The quantitative analysis was done using the No Action Alternative – No Mining Scenario. Under this scenario, operations of existing mines that currently have approved permits would continue to operate until their reserves were fully depleted. Approved reclamation plans would proceed as scheduled including approved mitigation and restoration as defined by existing permits. As existing mines reach the end of their life cycles, there would be a gradual shift in the applicable local and regional economy, currently based in part on mining, to other economic drivers such as transportation, industrial development, and/or agriculture. The potential effects of the No Action Alternative would be the loss or reduction of jobs available for those who depend on mining as a profession as the current mining operations complete their planned schedules for ore extraction. While some employees would relocate to other regions of Florida or the U.S., the indirect impacts from secondary economic benefits would affect local businesses and suppliers with limited opportunity for replacement of the lost income. Table 4-90 presents a summary of the existing mines in the CFPD, their currently projected schedules for completion of mining, and the county or counties where each mine is located.

**Table 4-90. Existing CFPD Phosphate Mines, Anticipated Mining Periods, and Directly Affected Counties**

| Mine | Mining Period | Counties |
|---|---|---|
| Four Corners | Present - 2019 | Hillsborough, Manatee, Polk, and Hardee Counties |
| Hookers Prairie | Present - 2013 | Polk County |
| South Fort Meade | Present - 2020 | Hardee County |
| Wingate Creek | Present - 2013 | Manatee County |
| Wingate Extension | 2013-2018 | Manatee County |
| South Pasture | Present – 2035 | Hardee County |

This approach provided an economic “base case” for each county where Applicants’ Preferred Alternatives and the Pioneer Tract and Pine Level Keys Offsite Alternatives would be located, for the quantitative analyses of those alternatives.

### 4.6.1.1 DeSoto County

The direct output and local government revenue impacts for each decade in the 50-year forecast period under the No Action Alternative for DeSoto County are presented in Table 4-91. There are no existing mines in DeSoto County, so the No Action Alternative does not show any mining output or severance taxes. The No Action Alternative includes forecast agricultural activities on the Desoto Mine site, assuming that this proposed mine is not permitted. Total agricultural output is projected to be $3.3 million in each decade.

Counties receive revenues from property taxes, and the state distributes a portion of the severance tax revenues that it collects from the mines to the counties with operating mines. The projected property tax revenues presented below ($10.0 million for each decade) are based on an analysis of the property taxes being paid by the individual parcels comprising the Desoto Mine site. The list of parcels comprising the mine site was provided by the Applicants, and the annual property tax payments for those parcels were obtained from county tax assessor records. For the No Action Alternative analysis of the Desoto Mine site, the anticipated land use would not change over the study period, so the property tax revenues generated by the use of the land on this site would not change during the study period. While the assessed property values and property tax revenues generated by the mine properties actually are likely to fluctuate with the use of the land and possibly due to changes in tax rates over time, insufficient information was available to allow this 50-year projection of economic effects to account for these factors with sufficient reliability for inclusion in this analysis.

**Table 4-91. DeSoto County No Action Alternative Forecast Direct Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $0 | $0 | $0 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $3,300,000 | $3,300,000 | $3,300,000 | $3,300,000 | $3,300,000 |
| **Total** | $3,300,000 | $3,300,000 | $3,300,000 | $3,300,000 | $3,300,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $10,000,000 | $10,000,000 | $10,000,000 | $10,000,000 | $10,000,000 |
| Severance Taxes | $0 | $0 | $0 | $0 | $0 |
| **Total** | $10,000,000 | $10,000,000 | $10,000,000 | $10,000,000 | $10,000,000 |

Note: Figures are totals for each 10-year period.

Appendix H includes detailed tabular summaries of the direct, indirect, induced and total employment, labor income, value added, and output metrics by decade for the No Action Alternative for DeSoto County. The appendix also presents the calculation of the present value of the labor income, value added, and output impacts over the 50-year forecast period.

#### 4.6.1.2 Manatee County

The direct output and local government revenue impacts for each decade in the 50-year forecast period under the No Action Alternative for Manatee County are presented in Table 4-92. The No Action Alternative includes forecast mining activities associated with the existing mines in Manatee County

(Wingate Creek, Wingate Extension, and a portion of Four Corners), and agricultural activities on these existing mine sites and on the Wingate East Alternative mine site, assuming that the Wingate East Mine Alternative is not permitted. The table shows that reserves in the existing mines would be exhausted in the first decade of the analysis. Agricultural output would decline to about 93 percent of its first decade level of output in the second and subsequent decades. The phosphate mine-related property tax revenues for this county was projected to be $15.5 million in the first decade and is then projected to decline to $14.2 million in the second decade, before rising in each of the subsequent decades, reaching $14.7 million in the 5th decade.

The direct, indirect, induced and total employment, labor income, value added, and output metrics by decade for the No Action Alternative for Manatee County are presented in Appendix H. The calculation of the present value of the labor income, value added, and output impacts of the No Action Alternative for Manatee County over the 50-year forecast period are also summarized in Appendix H.

**Table 4-92. Manatee County No Action Alternative Forecast Direct Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $2,454,100,000 | $0 | $0 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $22,300,000 | $20,800,000 | $20,800,000 | $20,800,000 | $20,800,000 |
| **Total** | $2,476,400,000 | $20,800,000 | $20,800,000 | $20,800,000 | $20,800,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $15,600,000 | $14,200,000 | $14,600,000 | $14,700,000 | $14,700,000 |
| Severance Taxes | $5,600,000 | $0 | $0 | $0 | $0 |
| **Total** | $21,200,000 | $14,200,000 | $14,600,000 | $14,700,000 | $14,700,000 |

Note: Figures are totals for each 10-year period.

#### 4.6.1.3 Hardee County

Table 4-93 presents the direct output for each decade in the 50-year forecast period under the No Action Alternative for Hardee County. The No Action Alternative includes forecast mining activities associated with the existing mines in Hardee County (South Pasture, South Fort Meade, and a portion of Four Corners), agricultural activities on these existing mine sites, and agricultural production on the Ona, and South Pasture Extension Alternatives and Pioneer Tract mine sites, assuming that these alternatives are not permitted. The table shows that total income is projected to decline by 80 percent between the first and second decades. Most of this reduction in output would be in mining. Agricultural output is projected to decline by 18 percent from the first to the third decades, before stabilizing in the following decades. Appendix H presents the direct, indirect, induced and total employment, labor income, value added, and output metrics by decade for the No Action Alternative for Hardee County, and the calculation of the present value of the labor income, value added, and output impacts of the No Action Alternative for Hardee County over the 50-year forecast period. Table 4-93 also presents the County's projected property tax revenues on the Mosaic and CF Industries lands, and the projected portion of the state's severance tax revenues distributed to Hardee County.

**Table 4-93. Hardee County No Action Alternative Forecast Direct Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $8,508,400,000 | $1,634,000,000 | $1,470,600,000 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $47,300,000 | $41,200,000 | $39,700,000 | $38,900,000 | $38,900,000 |
| **Total** | $8,555,700,000 | $1,675,200,000 | $1,510,300,000 | $38,900,000 | $38,900,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $39,400,000 | $32,100,000 | $32,600,000 | $31,900,000 | $32,100,000 |
| Severance Taxes | $34,400,000 | $7,400,000 | $6,700,000 | $0 | $0 |
| **Total** | $73,800,000 | $39,500,000 | $39,300,000 | $31,900,000 | $32,100,000 |

Note: Figures are totals for each 10-year period.

#### 4.6.1.4 DeSoto and Manatee Counties Combined

Table 4-94 summarizes the direct output and local government revenue impacts of the No Action Alternative for DeSoto and Manatee Counties combined. These counties were analyzed together as a special scenario to support the economic analysis of the Pine Level/Keys Tract, because its potential operations would be expected to have direct impacts on both counties. The Pine Level/Keys Tract is in Manatee County; however, Manatee County has passed an ordinance prohibiting the construction of a beneficiation plant in this county. It was therefore assumed that the beneficiation plant for this alternative would be in DeSoto County. Thus the output, employment, and other direct impacts of the Pine Level/Keys Tract would be expected to accrue to both counties.

The No Action Alternative includes forecast mining activities associated with the existing mines in Manatee County (Wingate Creek, Wingate Extension, and a portion of Four Corners), agricultural activities on these existing mine sites, and agricultural production on the proposed Desoto and Wingate East Alternative mine sites, as well as the Pine Level/Keys Tract, assuming that these alternatives are not permitted. Total agricultural output is projected to be $25.6 million in the first decade, and is then projected to decline to $24.1 million in the subsequent decades. Annual property tax revenues generated from the mine sites are expected to be an average of $25.6 million in the first decade, and about $24.5 million throughout the remainder of the forecast period.

Calculations of the direct, indirect, induced and total employment, labor income, value added, and output metrics by decade for the No Action Alternative for DeSoto and Manatee Counties are presented in Appendix H. The appendix also presents the calculation of the present value of the labor income, value added, and output impacts of the No Action Alternative for DeSoto and Manatee Counties over the 50-year forecast period.

**Table 4-94. DeSoto and Manatee Counties Combined No Action Alternative Forecast Direct Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $2,454,100,000 | $0 | $0 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $25,600,000 | $24,100,000 | $24,100,000 | $24,100,000 | $24,100,000 |
| **Total** | $2,479,700,000 | $24,100,000 | $24,100,000 | $24,100,000 | $24,100,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $25,600,000 | $24,200,000 | $24,500,000 | $24,500,000 | $24,500,000 |
| Severance Taxes | $5,600,000 | $0 | $0 | $0 | $0 |
| **Total** | $31,200,000 | $24,200,000 | $24,500,000 | $24,500,000 | $24,500,000 |

Note: Figures are totals for each 10-year period.

When compared to the Action Alternatives, as quantitatively analyzed in Sections 4.6.2 through 4.6.7, and qualitatively analyzed in Sections 4.6.8 and 4.6.9, the No Action Alternative – No Mining scenario would result in a major decline in output and employment in the region. It can be expected that, as the existing mines operating in Polk, Hillsborough, Hardee, and Manatee Counties are exhausted, there will be a major decline in employment, income, and severance tax revenues to local governments in these counties and the region as a whole. Based on this analysis, the No Action Alternative - No Mining scenario, as compared to existing conditions, would have a major adverse effect on Hardee County and a moderate adverse impact on Manatee County, which would be significant.[1] There would be only a minor, insignificant impact on DeSoto County, as compared to existing conditions, as there currently is no mining activity in this county, and the No Action Alternative would not result in any reduction in mining employment and income in this county, nor change in the level of agricultural employment and income.

Although not analyzed quantitatively, it is reasonable to expect that the No Action Alternative – Upland Only scenario would have some of the economic benefits of the Action Alternatives. As the area that would be mined is unknown, it would be speculative to try and determine the significance of the impacts.

### 4.6.2 **Alternative 2: Desoto Mine**

Table 4-95 presents the direct output and local government revenue over the 50-year forecast period assuming that a permit to construct and operate the Desoto Mine is issued. These direct impacts would consist of forecast mining activities on the Desoto Mine, construction of a beneficiation plant, and agricultural activities on the proposed mine site. The table shows that mining operations would occur in the second and third decades.

**Table 4-95. DeSoto County with Desoto Mine Forecast Direct Impacts by Decade**

| | Years 1-10 a | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $0 | $4,902,100,000 | $3,812,800,000 | $0 | $0 |
| Beneficiation Plant Construction | $1,000,000,000 | | | | |
| Income/Revenue attributed to Agriculture | $3,300,000 | $2,200,000 | $1,000,000 | $1,200,000 | $1,400,000 |
| **Total** | $1,003,300,000 | $4,904,300,000 | $3,813,800,000 | $1,200,000 | $1,400,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $16,700,000 | $40,600,000 | $32,700,000 | $9,000,000 | $9,900,000 |
| Severance Taxes | $0 | $22,300,000 | $17,300,000 | $0 | $0 |
| **Total** | $16,700,000 | $62,900,000 | $50,000,000 | $9,000,000 | $9,900,000 |

[a] Includes $1 billion for construction of a beneficiation plant.

Note: Figures are totals for each 10-year period.

[1] Alternative A-2 is in Hardee County. The No Action Alternative for Hardee County would have a major adverse impact on this County which would be significant. Alternative W-2 is in Manatee County. The No Action alternative for Manatee County would have a moderate adverse impact on Manatee County, which would be significant.

The net impacts of permitting the Desoto Mine on DeSoto County are summarized in Table 4-96. The net present value of the difference in income, and employee compensation or labor income, in DeSoto County between the Desoto Mine and the No Action Alternative would be $7.9 billion and $2.3 billion, respectively. The Desoto Mine is forecast to increase employment in DeSoto County by 717 jobs over the 50-year study period, compared to the No Action Alternative. The direct, indirect, induced, and total impact by decade for DeSoto County for the Desoto Mine and the calculation of the present value of the impacts of the with mining alternatives are also presented in Appendix H.

**Table 4-96. Net Impacts of Desoto Mine as Compared to No Action Alternative on DeSoto County**

| | No Action | Desoto | Difference |
|---|---|---|---|
| Average Annual Employment | 7 | 724 | 717 |
| Present Value Labor Income | $4,500,000 | $2,333,800,000 | $2,329,300,000 |
| Present Value Added | $16,000,000 | $4,705,000,000 | $4,689,000,000 |
| Present Value Output | $27,400,000 | $7,954,700,000 | $7,927,300,000 |

Unlike the other Alternatives, the Desoto Mine is located in DeSoto County, which does not have any operating mines in the County. Therefore, this alternative would result in a significant increase in employment and income in the county, unlike the other alternatives that would likely just avoid the decline in employment and income that would be experienced in those counties under the No Action Alternative. Based on this analysis, the Desoto Mine would have a major, beneficial effect on DeSoto County, which would be significant as compared to either the No Action Alternative or current conditions.

### 4.6.3 Alternative 3: Ona Mine

Table 4-97 presents the direct output and local government revenue impacts over the 50-year forecast period assuming that a permit to construct and operate the Ona Mine is issued. These direct impacts would include forecast mining activities on the existing mines operating in the county and the Ona Mine, construction of a beneficiation plant, and agricultural activities on the existing and Applicants' Preferred Alternatives (including agricultural activities on the South Pasture Extension), and the Pioneer Tract. This analysis assumes that permits for constructing and operating the South Pasture Extension and Pioneer Tract are not issued (the impacts of issuing a permit for the South Pasture Extension Mine and for issuing a permit for the Pioneer Tract are presented later in this analysis.

The table shows that with only the proposed Ona Mine, mining activities would continue in the county through the fifth decade, but at a much reduced level compared to current activities. Income from mining is forecast to decline from $8.5 billion in the first decade, to $7.1 billion in the second decade and $6.9 billion in the third decade. Property tax revenues to Hardee County range from a high of $67.5 million in the second decade to a low of $25.6 million in the fifth decade.

**Table 4-97. Hardee County With Ona Mine Forecast Direct Impacts by Decade**

| | Years 1-10[a] | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $8,508,400,000 | $7,080,800,000 | $6,917,400,000 | $5,446,800,000 | $544,700,000 |
| Beneficiation Plant Construction | $1,000,000,000 | | | | |
| Income/Revenue attributed to Agriculture | $47,300,000 | $38,500,000 | $31,200,000 | $23,600,000 | $20,000,000 |
| **Total** | $9,555,700,000 | $7,119,300,000 | $6,948,600,000 | $5,470,400,000 | $564,700,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $39,400,000 | $67,500,000 | $65,200,000 | $60,900,000 | $25,600,000 |
| Severance Taxes | $34,400,000 | $32,200,000 | $31,400,000 | $24,800,000 | $2,500,000 |
| **Total** | $73,800,000 | $99,700,000 | $96,600,000 | $85,700,000 | $28,100,000 |

[a] Includes $1 billion for construction of a beneficiation plant.

Note: Figures are totals for each 10-year period.

The net impacts of permitting the Ona Mine on Hardee County are summarized in Table 4-98. The net present value of the difference in output, and employee compensation, in Hardee County between the Ona Mine and No Action Alternative would be $12.9 billion and $3.7 billion, respectively. The Ona Mine is forecast to provide 1,233 jobs more jobs than the No Action Alternative in Hardee County, over the 50-year study period. It should be noted that the additional jobs and output presented in Table 4-98 represent jobs and output that would not be lost as compared to the No Action Alternative for the county, not an increase in jobs compared to existing employment and output. The direct, indirect, induced, and total impacts by decade for Hardee County, for the Ona Mine are presented in Appendix H. In addition, the calculation of the present value of the impacts of the Ona Mine is also presented in Appendix H.

| Table 4-98. Net Impacts With Ona Mine as Compared to No Action Alternative on Hardee County | | | |
|---|---|---|---|
| | **No Action** | **Ona** | **Difference** |
| Average Annual Employment | 840 | 2,073 | 1,233 |
| Present Value Labor Income | $3,296,500,000 | $7,039,700,000 | $3,743,200,000 |
| Present Value Added | $6,798,600,000 | $14,457,600,000 | $7,659,000,000 |
| Present Value Output | $11,459,900,000 | $24,359,100,000 | $12,899,200,000 |

Based on this analysis, the Ona Mine would have a major beneficial effect on economic resources for Hardee County as compared to the No Action Alternative, which would be significant. The impacts relative to current conditions would be minor or insignificant, as this alternative would simply offset jobs losses that would be experienced under the No Action Alternative, with little net gain or loss compared to existing conditions.

### 4.6.4 Alternative 4: Wingate East Mine

Table 4-99 presents the direct output and local government property tax and severance tax revenue impacts over the 50-year forecast period assuming that a permit to construct and operate the Wingate East Mine is issued. These direct impacts would include forecast mining activities on the existing mines operating in the county and the Wingate East Mine. Agricultural activities on the existing mines, Wingate East Mine and Pine Level Keys Mine, assuming that a permit for operating the Pine Level/Keys Tract is not issued are also included in the economic impacts. The combined impacts on Manatee County of issuing permits for construction and operation of the Wingate East Mine and the Pine Level/Keys Tract are presented in Section 4.12.6. Table 4-99 shows mining production into the fifth decade.

| Table 4-99. Manatee County With Wingate East Mine Forecast Direct Impacts by Decade | | | | | |
|---|---|---|---|---|---|
| | **Years 1-10** | **Years 11-20** | **Years 21-30** | **Years 31-40** | **Years 41-50** |
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $2,573,200,000 | $1,191,000,000 | $1,191,000,000 | $1,191,000,000 | $238,200,000 |
| Income/Revenue attributed to Agriculture | $38,900,000 | $37,300,000 | $34,100,000 | $27,900,000 | $22,100,000 |
| **Total** | $2,612,100,000 | $1,228,300,000 | $1,225,100,000 | $1,218,900,000 | $260,300,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $16,400,000 | $15,700,000 | $16,000,000 | $15,300,000 | $13,300,000 |
| Severance Taxes | $5,800,000 | $3,000,000 | $3,000,000 | $3,000,000 | $600,000 |
| **Total** | $22,200,000 | $18,700,000 | $19,000,000 | $18,300,000 | $13,900,000 |
| Note: Figures are totals for each 10-year period. | | | | | |

The net impacts of permitting the Wingate East Mine on Manatee County are summarized in Table 4-100. The net present value of the difference in output, value added, jobs, and employee compensation in Manatee County between the Wingate East Mine and the No Action Alternative would be $2.9 billion and $867 million, respectively. The Wingate East Mine is forecast to increase employment in Manatee County by 332 jobs over the 50-year study period, as compared to the No Action Alternative. The No Action Alternative is expected to result in a notable decline in employment and output in the County, while the Wingate East Mine is expected to save about 332 jobs that would otherwise be lost; these are not additional jobs when compared to the existing levels of economic activity in the county. Appendix H presents the direct, indirect, induced, and total impacts by decade for Manatee County, for the Wingate East Mine. The calculation of the present value of the Wingate East Alternative on Manatee County is also presented in Appendix H.

| Table 4-100. Net Impacts of the Wingate East Mine as Compared to the No Action Alternative on Manatee County | | | |
|---|---|---|---|
| | **No Action** | **Wingate East** | **Difference** |
| Average Annual Employment | 233 | 565 | 332 |
| Present Value Labor Income | $809,100,000 | $1,675,800,000 | $866,700,000 |
| Present Value Added | $1,605,600,000 | $3,322,800,000 | $1,717,200,000 |
| Present Value Output | $2,741,500,000 | $5,674,700,000 | $2,933,200,000 |

Based on this analysis, the Wingate East Mine would have a minor beneficial effect on economic resources in Manatee County, as compared to the No Action Alternative, which would not be significant. The impacts as compared to existing conditions would also be minor or insignificant, as this alternative would simply offset jobs losses that would be experienced under the No Action Alternative, with little net gain or loss compared to existing conditions.

### 4.6.5 Alternative 5: South Pasture Extension Mine

Table 4-101 presents the direct output, property tax revenue and severance tax revenue distributed to the county by decade over the 50-year forecast period assuming that a permit to construct and operate the South Pasture Extension Mine is issued. These direct impacts would include forecast mining activities on the existing mines operating in the county and the South Pasture Extension, and agricultural activities on the existing and proposed mine sites (including agricultural activities on the Ona and Pioneer Tract mine sites). This analysis assumes that a permit for constructing and operating the Ona and Pioneer Tract alternatives is not issued; the impacts of issuing a permit for the Ona Mine were discussed above, and the impacts of issuing a permit for the Pioneer Tract are discussed in Section 4.6.7. The combined impacts on Hardee County of issuing permits for construction and operation of the Ona Mine, South Pasture Extension, and Pioneer Tract are presented in Section 4.12.6. Table 4-101 shows that the South Pasture Extension is expected to provide mining output until part-way through the third decade.

**Table 4-101. Hardee County South Pasture Extension Mine Forecast Direct Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $8,508,400,000 | $3,268,100,000 | $1,960,800,000 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $47,300,000 | $39,900,000 | $35,800,000 | $33,700,000 | $34,000,000 |
| **Total** | $8,555,700,000 | $3,308,000,000 | $1,996,600,000 | $33,700,000 | $34,000,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $39,400,000 | $42,700,000 | $34,800,000 | $29,900,000 | $30,600,000 |
| Severance Taxes | $34,400,000 | $14,900,000 | $8,900,000 | $0 | $0 |
| **Total** | $73,800,000 | $57,600,000 | $43,700,000 | $29,900,000 | $30,600,000 |

Note: Figures are totals for each 10-year period.

As shown in Table 4-102, the South Pasture Extension Mine (as compared to the Hardee County No Action Alternative) would increase average employment in the county over the 50-year period by 145 jobs. The net present value of the total output in the county would increase by $1.7 billion and labor compensation by $504 million, as compared to the No Action Alternative. Appendix H presents the calculation of the impacts by decade for the South Pasture Extension Alternative, and the calculation on the present value of the impacts of South Pasture Extension. Appendix H also presents the direct, indirect, induced, and total impacts by decade for Hardee County, for the With South Pasture Extension Alternative, and the calculation of the present value of the South Pasture Extension Alternative on Manatee County.

**Table 4-102. Net Impacts South Pasture Extension Mine as Compared to No Action Alternative on Hardee County**

| | No Action | South Pasture Extension | Difference |
|---|---|---|---|
| Average Annual Employment | 840 | 985 | 145 |
| Present Value Labor Income | $3,296,500,000 | $3,800,600,000 | $504,100,000 |
| Present Value Added | $6,798,600,000 | $7,828,300,000 | $1,029,700,000 |
| Present Value Output | $11,459,900,000 | $13,193,700,000 | $1,733,800,000 |

Based on this analysis, the South Pasture Extension Mine would have a moderate beneficial effect on economic resources in Hardee County as compared to the No Action Alternative, which would be significant. The impact on the County, as compared to existing conditions would be minor or insignificant, as this alternative would offset job losses that would occur under the No Action Alternative, with little net change in employment and income as compared to current conditions.

### 4.6.6 Alternative 6: Pine Level/Keys Tract

Table 4-103 presents the direct economic impact of the potential Pine Level/Keys Alternative on DeSoto and Manatee Counties. Mining activities are expected to occur in both counties, and for the purposes of the analysis the beneficiation plant would be located in DeSoto County.[2] The direct impacts include forecast mining activities on the existing mines operating in Manatee County (Wingate Creek and Wingate Extension), the operation in both counties of the Pine Level/Keys Tract, construction of a beneficiation plant, and agricultural activities on the proposed mine site. This analysis assumes that a

[2] The Pine Level/Keys Alternative would be in Manatee County. However the County has adopted an ordinance prohibiting the siting of new beneficiation plants in the County. Thus it was assumed for this analysis, that the beneficiation plant for this alternative would be located in DeSoto County.

permit for constructing and operating the Wingate East and Desoto Alternatives are not issued (the impacts of issuing a permit for the Wingate East Alternative on Manatee County and of issuing a permit to operate the Desoto alternative on DeSoto County were presented earlier in this analysis, and the impacts on DeSoto and Manatee Counties combined of issuing permits for construction and operation of all three alternatives: Desoto, Wingate East, and Pine Level/Key Alternatives are presented later in this analysis). The data show agricultural production on the Applicants' Preferred and offsite alternative mine sites declining each decade of the forecast period.

The existing mines (Wingate Creek and Wingate Extension) end rock production in the first decade of the analysis, and the potential Pine Level/Keys mine would start operations at the beginning of the second decade (2020), with rock production ending in 2045. This schedule assumes that the Pine Level/Keys Tract would replace the production of those existing mines in Manatee County. This assumption is consistent with the Applicants' approach of having new mines replace older mines as stated in the descriptions of the Applicants' Preferred Alternatives in Chapter 1 and elsewhere in the Final AEIS. A beneficiation plant to serve the Pine Level/Keys Alternative would be constructed in the second decade of the analysis as well.

**Table 4-103. Forecast Direct Impacts by Decade on Manatee-DeSoto Counties With Pine Level/Keys Alternative**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $2,454,100,000 | $7,337,700,000 | $7,337,700,000 | $7,337,700,000 | $3,668,900,000 |
| Beneficiation Plant Construction | $0 | $1,000,000,000 | $0 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $42,200,000 | $37,000,000 | $28,600,000 | $19,300,000 | $12,400,000 |
| **Total** | $2,496,300,000 | $8,374,700,000 | $7,366,300,000 | $7,357,000,000 | $3,681,300,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $25,600,000 | $24,800,000 | $36,900,000 | $44,800,000 | $49,600,000 |
| Severance Taxes | $5,600,000 | $18,700,000 | $18,700,000 | $18,700,000 | $9,400,000 |
| **Total** | $31,200,000 | $43,500,000 | $55,600,000 | $63,500,000 | $59,000,000 |

Note: Figures are totals for each 10-year period.

The net impacts of permitting the Pine Level/Keys Alternative on DeSoto and Manatee Counties are summarized in Table 4-104. The net present value of the difference in output and labor income in DeSoto and Manatee Counties between the Pine Level/Keys Alternative and No Action Alternative, amounts to $19.0 billion, and $5.6 billion, respectively. The Pine Level/Keys Mine is forecast to increase employment in DeSoto and Manatee Counties by an average of 2,136 jobs over the 50-year forecast period. The direct, indirect, induced, and total impacts by decade for DeSoto and Manatee Counties combined, for the Pine Level/Keys Alternative is presented in Appendix H. In addition, the calculation of the present value of the impacts of the Pine Level/Keys Alternative is also presented in Appendix H.

**Table 4-104. Net Impacts on Manatee-DeSoto Counties With Pine Level Keys Extension Alternative**

| | No Action | With Mines | Difference |
|---|---|---|---|
| Average Annual Employment | 232 | 2,368 | 2,136 |
| Present Value Labor Income | $809,700,000 | $6,427,500,000 | $5,617,800,000 |
| Present Value - Value Added | $1,613,900,000 | $12,718,900,000 | $11,105,000,000 |
| Present Value Output | $2,756,900,000 | $21,741,500,000 | $18,984,600,000 |

Based on this analysis, mining the Pine Level/Keys Tract would have a moderate beneficial effect on economic resources of Manatee and DeSoto Counties, as compared to the No Action Alternative, which would be significant. The impacts compared to existing conditions would be minor, which would not be significant.

### 4.6.7 Alternative 7: Pioneer Tract

Table 4-105 presents the direct output by decade within Hardee County over the 50-year forecast period assuming that a permit to construct and operate the Pioneer Alternative is issued. These direct impacts include forecast mining activities on the existing mines operating in Hardee County and the Pioneer Alternative, and agricultural activities on the existing and Applicants' Preferred and offsite alternatives (including agricultural activities on the Ona and South Pasture Mine Extension Alternatives). This analysis assumes that permits for constructing and operating the Ona and South Pasture Mine Extension Alternatives are not issued; the impacts of issuing a permit for the Ona Alternative and South Pasture Mine Extension Alternative were discussed previously, and the impacts on Hardee County of issuing permits for construction and operation of three alternatives (Ona, South Pasture Mine Extension, and Pioneer Tract) are presented in Section 4.12.64.

This analysis assumes that mining activities on the Pioneer Tract will begin in 2023, and that mining output begins in the second decade of the analysis. As with the analysis of the Desoto Mine above, this is consistent with the Applicants' approach of having new mines replace older mines as stated in the descriptions of the Applicants' Preferred Alternatives in Chapter 1 and elsewhere in the Final AEIS. A beneficiation plant would be constructed in the second decade under this analysis as well. The Pioneer Alternative has an estimated life of 27 years. By starting the mine operations in 2023, rock production would be complete by 2050.

As shown in Table 4-106, the With Pioneer Alternative, as compared to the Hardee County No Action Alternative, would increase average employment in the county over the 50-year period by an average of 1,310 jobs. The net present value of the total income in the county would increase by $13.4 billion and labor compensation by $3.9 billion, as compared to the No Action Alternative. Appendix H presents the calculation of the impact by decade for the Pioneer Mine Alternative, and the calculation on the present value of the Pioneer Mine Alternative.

**Table 4-105. Forecast Direct Impacts by Decade on Hardee County With Pioneer Alternative**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $8,508,400,000 | $6,308,800,000 | $8,148,900,000 | $6,678,300,000 | $0 |
| Beneficiation Plant Construction | $0 | $1,000,000,000 | $0 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $47,300,000 | $37,800,000 | $28,700,000 | $19,600,000 | $16,100,000 |
| **Total** | $8,555,700,000 | $7,346,600,000 | $8,177,600,000 | $6,697,900,000 | $16,100,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $39,400,000 | $32,800,000 | $30,200,000 | $25,300,000 | $55,700,000 |
| Severance Taxes | $34,400,000 | $28,700,000 | $37,000,000 | $30,400,000 | $0 |
| **Total** | $73,800,000 | $61,500,000 | $67,200,000 | $55,700,000 | $55,700,000 |

Note: Figures are totals for each 10-year period.

| Table 4-106. Net Impacts on Hardee County With Pioneer Alternative | | | |
|---|---|---|---|
| | No Action | With Mines | Difference |
| Average Annual Employment | 840 | 2,151 | 1,310 |
| Present Value Labor Income | $3,296,500,000 | $7,174,600,000 | $3,878,100,000 |
| Present Value - Value Added | $6,798,600,000 | $14,731,700,000 | $7,933,100,000 |
| Present Value Output | $11,459,900,000 | $24,821,200,000 | $13,361,300,000 |

Based on this analysis, mining the Pioneer Tract would have a major beneficial effect on economic resources in Hardee County, which would be significant. However, as compared to current conditions, the impact would be minor, or insignificant, as the net jobs shown would be replacements for jobs that would be lost with the closing of existing mines.

### 4.6.8 Alternative 8: A-2 Alternative

Site A-2 is located in Hardee County, east of the existing South Fort Meade – Hardee County Mine. This alternative is within the size range of the other alternatives considered above (as shown in Table 2-4), and its annual phosphate production is assumed to be within the range of those alternatives as well. Therefore, it is reasonable to predict qualitatively that the economic impacts on Hardee County of mining this site would be similar to the other alternatives within that county analyzed above, specifically Ona Mine (Section 4.6.3), South Pasture Extension Mine (Section 4.6.5), and Pioneer Tract (Section 4.6.7). Based on this analysis, mining Site A-2 would have a major beneficial effect on economic resources in Hardee County, as compared to the No Action Alternative, which would be significant. Impacts as compared to existing conditions would be minor and insignificant.

### 4.6.9 Alternative 9: W-2 Alternative

Site W-2 is located in Manatee County, southwest of the existing Wingate Creek Mine. This alternative is within the size range of the other alternatives considered above (as shown in Table 2-4), and its annual phosphate production is assumed to be within the range of those alternatives as well. Therefore, it is reasonable to predict qualitatively that the economic impacts on Manatee County of mining this site would be similar to the other alternatives within that county analyzed above, specifically Wingate East Mine (Section 4.6.4) and Pine Level/Keys Tract (Section 4.6.6). Based on this analysis, mining Site W-2 would have a minor beneficial effect on economic resources in Manatee County, which would not be significant. Impacts as compared to existing conditions would also be minor and insignificant.

## 4.7 ENVIRONMENTAL JUSTICE

The geographic scope of the evaluation of the direct and indirect impacts on minority or low income includes the mine parcels and their adjacent areas, and extends out to the county boundaries. Section 3.3.7.3 has additional information on environmental justice, including identification of census block groups that have minority populations greater than the reference populations or have greater than 20 percent of the population living below the poverty level and that the Action Alternatives may affect.

The degree of intensity of environmental justice impacts was determined using the following criteria:

- No Impact to Minor: Mining would not disproportionately affect minority or economically disadvantaged communities currently living adjacent to the mine boundaries. Effects, if any, would be short-term; no residual effects would extend beyond planned mine reclamation.

- Moderate: Mining would disproportionately affect minority and economically disadvantaged communities currently living within the affected county. Effects would be primarily during periods of active mining to communities in the immediate area. Benefits would be afforded some local communities within the county. Some long-term residual effects beyond planned mine reclamation may occur but less than 5 years.

- Major: Mining would disproportionately affect minority and economically disadvantaged communities currently living within and outside the affected county. Effects would be long-term in duration and would affect communities throughout the region. Residual effects beyond mine reclamation would have noticeable sustained impacts on these communities in the region extending greater than 5 years beyond planned reclamation.

### 4.7.1 **Alternative 1: No Action Alternative**

Under the No Action Alternative – No Mining scenario, operations of existing mines that currently have approved permits would continue. As described in Section 4.6, as existing mines reach the end of their life cycles the impact of the No Action Alternative would be the loss or reduction of jobs available for those who depend on mining as a profession, with a gradual a shift in the applicable local and regional economy, currently based in part on mining, to other economic drivers.

The greatest effects would occur in the counties with active mines—Manatee and Hardee Counties—with a reduction in mining-related income and tax revenues. On a county-wide basis, disproportionate impacts to minority populations are not expected. Hardee County has the largest percentage of minority residents, 28 percent, as determined by the non-white/Caucasian population. On an individual block group basis, Tract 9703000, Block Group 5, which contains the Hardee County Correctional Institution and coincides with the Ona and South Pasture Mine Extension Sites (while being adjacent to the Wingate East Mine), could experience a major adverse socioeconomic impact to minority and low-income populations that is expected to be significant. That impact would likely be less than the data indicate (see Table 3-28), since the prison population (1,600 individuals) contributes to the minority population of that block group. In addition, the loss of mining-related jobs would not directly affect the imprisoned portion of the population. Any inmates who remain Hardee County residents after they are released would likely experience additional difficulty in finding employment, however.

On a county-wide basis, disproportionate impacts to populations living below the poverty level are expected in Hardee Counties, with respectively, 26.9 and 26.1 percent of the populations living below the poverty level. In Hardee County, the effect would be somewhat less than indicated, as a result of Hardee County Correctional Institution's likely contribution to the economically disadvantaged population.

These impacts are expected to mirror general economic impacts and result in a minor to moderate adverse impact to populations living below the poverty level that are expected to be significant. Impacts associated with the No Action Alternative – No Mining scenario could be mitigated to result in minor impacts, in part, with efforts by county government to encourage economic development and to provide job training, as part of efforts to transition these mine workers to other professions.

Under the No Action Alternative – Upland Only scenario, the degree of effect and significance would be similar to the effect and significance associated with the Applicants' Preferred Alternatives, with potentially less employment opportunity based on the shorter lives of the mines.

### 4.7.2 Alternative 2: Desoto Mine

The Desoto Mine parcel does not contain, and is not adjacent to, block groups having minority populations greater than the reference populations and greater than 20 percent of the population living below the poverty level; therefore, adversely high or disproportionate environmental justice impacts to such groups would not occur.

Based on this information, the Desoto Mine would have no effect on environmental justice, and this would not be significant.

### 4.7.3 Alternative 3: Ona Mine

The Ona Mine overlaps with block groups having minority populations greater than the reference populations and greater than 20 percent of the population living below the poverty level.

Potential adverse effects on these populations associated with the Ona Mine include air quality, water quality, noise, or radiation-related public health. As described in other sections of this chapter, with mitigation the Ona Mine will either have no or minor direct or indirect effects related to air quality (Section 4.1.8.1), noise (Section 4.1.8.2), or radiation (Section 4.8), and at most a potential moderate direct or indirect effect related to water quality (Section 4.4). None of these effects are expected to be significant, with mitigation. Potential beneficial effects on these populations associated with the Ona Mine include economic opportunities. The beneficial effect would be minor compared to current conditions, and not significant, as described in Section 4.6.

It is expected that with mitigation, the adverse effects associated with the Ona Mine would not disproportionately impact the populations of environmental justice concern in the area, leading to a minor degree of adverse effect. The beneficial economic effects associated with the Ona Mine may disproportionately affect the populations of environmental justice concern during the period of active mining, leading to a moderate degree of effect. Based on this information, overall the Ona Mine would have a minor beneficial effect on environmental justice, which would not be significant.

### 4.7.4 Alternative 4: Wingate East Mine

The Wingate East Mine is adjacent to a block group having minority populations greater than the reference populations and adjacent to the east of a block group with greater than 20 percent of the population living below the poverty level. Potential adverse effects on these populations associated with the Wingate East Mine include air quality, water quality, noise, or radiation-related public health. As described in other sections of this chapter, with mitigation the Wingate East Mine will either have no or minor direct or indirect effects related to air quality (Section 4.1.8.1), noise (Section 4.1.8.2), or radiation (Section 4.8), and at most a potential moderate direct or indirect effect related to water quality (Section 4.4). None of these effects are expected to be significant, with mitigation. Potential beneficial effects on these populations associated with the Wingate East Mine include economic opportunities. The beneficial effect would be minor compared to current conditions, and not significant, as described in Section 4.6.

It is expected that with mitigation, the adverse effects associated with the Wingate East Mine would not disproportionately impact the populations of environmental justice concern in the area, leading to a minor degree of adverse effect. The beneficial economic effects associated with the Wingate East Mine may disproportionately affect the populations of environmental justice concern during the period of active mining, leading to a moderate degree of effect. Based on this information, overall the Wingate East Mine would have a minor beneficial effect on environmental justice, which would not be significant.

### 4.7.5 Alternative 5: South Pasture Extension Mine

The South Pasture Extension Mine overlaps with block groups having minority populations greater than the reference populations and greater than 20 percent of the population living below the poverty level. Potential adverse effects on these populations associated with the South Pasture Extension Mine include air quality, water quality, noise, or radiation-related public health. As described in other sections of this chapter, with mitigation the South Pasture Extension Mine will either have no or minor direct or indirect effects related to air quality (Section 4.1.8.1), noise (Section 4.1.8.2), or radiation (Section 4.8), and at most a potential moderate direct or indirect effect related to water quality (Section 4.4). None of these effects are expected to be significant, with mitigation. Potential beneficial effects on these populations associated with the South Pasture Extension Mine include economic opportunities. The beneficial effect would be minor compared to current conditions, and not significant, as described in Section 4.6.

It is expected that with mitigation, the adverse effects associated with the South Pasture Extension Mine would not disproportionately impact the populations of environmental justice concern in the area, leading to a minor degree of adverse effect. The beneficial economic effects associated with the South Pasture Extension Mine may disproportionately affect the populations of environmental justice concern during the period of active mining, leading to a moderate degree of effect. Based on this information, overall the South Pasture Extension Mine would have a minor beneficial effect on environmental justice, which would not be significant.

### 4.7.6 Alternative 6: Pine Level/Keys Tract

The Pine Level/Keys Tract parcel does not contain, and is not adjacent to, block groups having minority populations greater than the reference populations and greater than 20 percent of the population living below the poverty level; therefore, adversely high or disproportionate environmental justice impacts to such groups would not occur.

Based on this information, mining the Pine Level/Keys Tract would have no effect on environmental justice, and this would not be significant.

### 4.7.7 Alternative 7: Pioneer Tract

The Pioneer Mine parcel does not contain, and is not adjacent to, block groups having minority populations greater than the reference populations and greater than 20 percent of the population living below the poverty level; therefore, adversely high or disproportionate environmental justice impacts to such groups would not occur.

Based on this information, mining the Pioneer Tract would have no effect on environmental justice, and this would not be significant.

### 4.7.8 Alternative 8: Site A-2

The Site A-2 parcel does not contain, and is not adjacent to, block groups having minority populations greater than the reference populations and greater than 20 percent of the population living below the poverty level; therefore, adversely high or disproportionate environmental justice impacts to such groups would not occur.

Based on this information, mining Site A-2 would have no effect on environmental justice, and this would not be significant.

### 4.7.9 Alternative 9: Site W-2

The Site W-2 parcel does not contain, and is not adjacent to, block groups having minority populations greater than the reference populations and greater than 20 percent of the population living below the poverty level; therefore, adversely high or disproportionate environmental justice impacts to such groups would not occur.

Based on this information, mining Site W-2 would have no effect on environmental justice, and this would not be significant.

## 4.8 RADIATION

The geographic scope of the evaluation of the direct and indirect impacts related to radiation includes the mine parcels and their adjacent areas. Section 3.3.7.7 provides information about the natural background radiation levels found in the study area and how those levels are changed by phosphate ore extraction and subsequent CSAs and mine cut reclamation with clay and sand generated during ore beneficiation.

The degree of intensity of impacts related to radiation was determined using the following criteria:

- No Impact to Minor: Mining would increase ambient radiation levels within the mine boundaries but at levels posing no human health risks. Any effects would be short-term, with no effects after mining has been completed, and/or limited to selected areas of mining activity.

- Moderate: Mining would increase ambient radiation levels on lands adjacent to the mine beyond levels having low to moderate human health risks. Effects would be moderate in duration, limited to no more than the period of time required for reclamation. Some minor risk of regional public health effects could occur.
- Major: Mining would increase ambient radiation levels to areas that extend well beyond the vicinity of the mine to levels posing potential risk to human health. Effects would be long-term in duration. Measurable long-term public health effects likely.

### 4.8.1 Alternative 1: No Action Alternative

The No Action Alternative – No Mining scenario would result in no additional impacts related to radiation beyond any caused by the existing operations. The Upland Only scenario would have impacts similar to those of the Applicants' Preferred Alternatives.

### 4.8.2 Alternatives 2 through 9

It is widely accepted that most of the radioactive materials in phosphate ore and in various products and byproducts of the beneficiation process tend to remain with the rock and the clay wastes. The radium also tends to remain bound to the particles in these materials and does not dissolve readily. Therefore, it is not likely that the mining activities or the reclaimed mined areas would cause more than a minor increase in radiation levels above background. However, the expected concentrations of radiation on the CSAs after reclamation would be higher than the existing conditions and other reclaimed areas of the site. CSAs are not conducive to construction of buildings or other structures. Although the prospect of buildings being constructed on CSAs is low, buildings constructed on reclaimed settling ponds could potentially have higher indoor radon levels than normally encountered in this area. If needed, radon-resistant construction techniques that are used in other parts of the country, such as those developed by the USEPA and BRC, could be used to protect homes and buildings from indoor radon hazard.

All of the Action Alternatives – Desoto Mine, Ona Mine, Wingate East Mine, South Pasture Mine Extension, Pine Level/Keys Tract, Pioneer Mine, Site A-2, and Site W-2, would have impacts similar to those discussed above related to radiation in the vicinity of the mine. Based on available information, all of these alternatives would have no impact to a minor degree of impact related to radiation, which would not be significant.

## 4.9 CULTURAL RESOURCES AND HISTORIC PROPERTIES

The geographic scope of the evaluation of the direct and indirect effects on cultural resources and historic properties (collectively referred to as "historic properties") includes the boundaries of the alternatives.

A screening evaluation of information regarding presence and condition of historic properties on the alternatives was conducted by a review of GIS information available through the Florida Geographic Data

Library. The results of this research are found in Chapter 3. However, not all areas of each alternative have been completely surveyed and in some instances, areas that have been subjected to a previous cultural resource assessment survey (CRAS), may require additional research.

For the purpose of the AEIS analysis, the degree of intensity of impacts for cultural and historic resources was determined using the following criteria:

- No Impact to Minor: Mining would impact culturally or historically important resource sites within the mine boundary or adjacent areas. The effect would be measurable or perceptible, but would be slight and would not affect the overall integrity that qualifies a site, district, building, or cultural landscape for inclusion in the National Register of Historic Places (NRHP).
- Moderate: Mining would impact culturally or historically important resource sites within the mine boundary or adjacent areas. The effect would be measurable or perceptible, and would change one or more of the characteristics that qualify a site, district, building, or cultural landscape for inclusion in the NRHP. As a result, it diminishes the integrity of the site(s), but does not jeopardize the National Register eligibility of the site(s).
- Major: Mining would impact culturally or historically important resource sites within the mine boundary or adjacent areas. The effect on a site, district, building, or cultural landscape would be substantial, noticeable, and permanent. The action would severely change one or more characteristics that qualify the site(s) for inclusion in the NRHP, diminishing the integrity of the site(s) to such an extent that it is no longer eligible for listing in the NRHP.

It is important to understand that these determinations of effect in no way override federal or state regulations for determination of effects to historic properties, and that the determinations in the following subsections are intended only to allow a reasoned choice among alternatives. The USACE will follow all appropriate regulations in consultation with the SHPO pursuant to the National Historic Preservation Act (NHPA). These determinations will be included in the project-specific Record of Decision/Statement of Findings for each project.

Initially eligibility to the NRHP is determined by the State Historic Preservation Officer (SHPO) and 4 criteria outlined National Register Bulletin #15:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- That are associated with events that have made a significant contribution to the broad patterns of our history; or

- That are associated with the lives of significant persons in or past; or
- That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- That have yielded or may be likely to yield, information important in history or prehistory.

For the Applicants' Preferred Alternatives, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, is determined by 33 CFR 325: Appendix C (7):

- Applying the Criteria of Effect and Adverse Effect[3]. During the public notice comment period or within 30 days after the determination or discovery of a designated history property the district engineer will coordinate with the State Historic Preservation Office (SHPO) and determine if there is an effect and if so, assess the effect.
- No Effect. If the SHPO concurs with the district engineer's determination of no effect or fails to respond within 15 days of the district engineer's notice to the SHPO of a no effect determination, then the district engineer may proceed with the final decision.
- No Adverse Effect. If the district engineer, based on his coordination with the SHPO, determines that an effect is not adverse, the district engineer will notify the Advisory Council on Historic Preservation (ACHP) and request the comments of the ACHP. The district engineer's notice will include a description of both the project and the designated historic property; both the district engineer's and the SHPO's views, as well as any views of affected local governments, Indian tribes, Federal agencies, and the public, on the no adverse effect determination; and a description of the efforts to identify historic properties and solicit the views of those above. The district engineer may conclude the permit decision if the ACHP does not object to the district engineer's determination or if the district engineer accepts any conditions requested by the ACHP for a no adverse effect determination, or the ACHP fails to respond within 30 days of the district engineer's notice to the ACHP. If the ACHP objects or the district engineer does not accept the conditions proposed by the ACHP, then the effect shall be considered as adverse.

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[3] Adverse Effects will be determined per 36 CFR 800.5 (1): *Criteria of adverse effect*.

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

- Adverse Effect. If an adverse effect on designated historic properties is found, the district engineer will notify the ACHP and coordinate with the SHPO to seek ways to avoid or reduce effects on designated historic properties. Either the district engineer or the SHPO may request the ACHP to participate. At its discretion, the ACHP may participate without such a request. The district engineer, the SHPO or the ACHP may state that further coordination will not be productive. The district engineer shall then request the ACHP's comments.

The consultation process described above may determine that it is necessary to mitigate adverse effects to historic properties, and there are a number of measures that can be implemented. The first priority is avoidance; this can take the form of redesigning the proposed project to avoid adverse impacts to the historic property, or realign the project. The second measure is minimizing the adverse effect; this would involve redesigning the project to reduce the impacts to the historic property. The last measure would be documenting the loss (for archeological sites this would be data recovery excavations; for historic structures it would involve detailed photo and architectural documentation as required by Historic American Building Survey/Historic American engineering Record). This is the least desirable and is both expensive and time consuming.

Another option for the Applicants and USACE to use to define the process for planning, construction, mining, and mitigation measures, would be to develop a Programmatic Agreement (PA) in accordance with the National Historic Preservation Act and its implementing authority, 36 CFR 800, in consultation with SHPO and other concerned parties. Elements of the PA would include, but not be limited to: survey methodology, site evaluation and determination of eligibility to NRHP, avoidance, and mitigation measures. Mitigation measures would include, but would not be limited to: approved setback distances, buffer options, monitoring, data recovery, and documentation. The PA would define when additional research and investigations would be conducted prior to the initiation of mining activities. For example, the PA may require surveys be conducted a minimum of 1 year prior to initiation of mining activities to allow for sufficient time to determine whether historic properties are present in the project area and if those resources would be eligible for listing on the NRHP. Sites known to contain human remain remains will be protected as if eligible, or potentially eligible, to the NRHP.

Regardless of the options chosen, the USACE will consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA.

### 4.9.1 Effects of No Action Alternative on Cultural Resources

There would be limited adverse effects to historic properties associated with the No Action Alternative. Previously approved mining activities would continue, and any effects associated with actions permitted under the No Action Alternative would have been previously defined and mitigated prior to issuance of the permit.

### 4.9.2 Alternative 2: Desoto Mine

Previous surveys on portions of the proposed Desoto Mine identified 2 sites with human remains, 25 archaeological sites whose eligibility for listing on the NRHP has not been determined by SHPO, and 1 site determined ineligible for listing on the NRHP. Historic structures surveys were conducted and no resources were found eligible for listing in the NRHP.

Prior to construction, for those areas of the Desoto Mine that have not been previously surveyed, new cultural resource assessment surveys will be required to be conducted to determine whether unidentified historic properties are present. If historic properties are determined to be eligible, or potentially eligible for listing in the NRHP are found, effects will be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects will be required to be mitigated. The USACE is coordinating the potential effects of this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

Adverse effects to the 25 identified historic properties and any additional eligible historic properties identified by new cultural assessment surveys will be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE will consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties are mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for the Desoto Mine, the historic properties that have already been identified and any additional eligible historic properties would be eliminated by the proposed mining. This impact would have a major degree of effect, which would be significant. It is important to note that Mosaic has not proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

For the Desoto Mine, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, will be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE will consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with the Desoto Mine are determined for the purpose of this AEIS analysis to be minor to moderate, and not significant. This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

### 4.9.3 Alternative 3: Ona Mine

Previous surveys identified 8 archaeological sites that have not been evaluated by SHPO as to their eligibility to the NRHP and 1 site that determined ineligible for listing on the NRHP. Historic structures surveys were conducted and no resources were found to be eligible for listing in the NRHP.

Prior to construction, for those areas of the Ona Mine that have not been previously surveyed, new cultural resource assessment surveys will be required to be conducted to determine whether unidentified historic properties are present. If historic properties are determined to be eligible, or potentially eligible for listing on the NRHP are found, effects will be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects will be required to be mitigated. The USACE is coordinating the potential effects of this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

Adverse effects to the identified historic properties and any additional eligible historic properties identified by new cultural assessment surveys will be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE will consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties are mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for the Ona Mine, the historic properties that have already been identified and any additional eligible historic properties would be eliminated by the proposed mining. This impact would have a major degree of effect, which would be significant. It is important to note that Mosaic has not proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

For the Ona Mine, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, will be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE will consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with the Ona Mine are determined for the purpose of this AEIS analysis to be minor to moderate, and not significant. This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

### 4.9.4 Alternative 4: Wingate East Mine

Previous surveys identified historical resources within the Wingate East boundaries. The SHPO stated in a letter dated January 23, 2008, that none of resources identified appeared eligible for listing on the NRHP, and that it was their opinion that Wingate East was unlikely to affect cultural resources (Gaske, 2008). The SHPO also stated in a letter dated June 14, 2012, that their review of the Florida Master Site File indicated that there no historical properties recorded within the project area, and that because of the location and/or nature of the project it is unlikely that historic properties will be affected. If necessary, prior to construction additional cultural resource assessments will be conducted to determine eligibility (Kammerer, 2012). If a site is determined eligible, or potentially eligible, effects to historic properties would be avoided or mitigated. Historic structures surveys were conducted and no resources were found eligible for listing in the NRHP. Prior to construction, for any areas of the Wingate East Mine that have not been previously surveyed, new cultural resource assessment surveys will be required to be conducted to determine whether unidentified historic properties are present. If historic properties are determined to be eligible, or potentially eligible for listing on the NRHP are found, effects will be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects will be required to be mitigated. The USACE is coordinating the potential effects of this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

Adverse effects to the identified historic properties and any additional eligible historic properties identified by new cultural assessment surveys will be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE will consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties are mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for the Wingate East Mine, the historic properties that have already been identified and any additional eligible historic properties would be eliminated by the proposed mining. This impact would have a major degree of effect, which would be significant. It is important to note that Mosaic has not proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

For the Wingate East Mine, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, will be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE will consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with the Wingate East Mine are determined for the purpose of this AEIS analysis to be minor, and not significant. This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

### 4.9.5 **Alternative 5: South Pasture Extension Mine**

Previous surveys of the South Pasture Extension Mine found no archaeological sites eligible for listing in the NRHP; however, the entire mining area has not been surveyed. Historic structures surveys were conducted and no resources were found eligible for listing in the NRHP.

Prior to construction, for those areas of the South Pasture Extension Mine that have not been previously surveyed, new cultural resource assessment surveys will be required to be conducted to determine whether unidentified historic properties are present. If historic properties are determined to be eligible, or potentially eligible for listing on the NRHP are found, effects will be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects will be required to be mitigated. The USACE is coordinating the potential effects of this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

Adverse effects to any historic properties identified by new cultural assessment surveys will be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE will consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties are mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for the South Pasture Extension Mine, any eligible historic properties would be eliminated by the proposed mining. This impact would have a major degree of effect, which would be significant. It is important to note that CF Industries has not proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

For the South Pasture Extension Mine, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, will be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE will consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with the South Pasture Extension Mine are determined for the purpose of this AEIS analysis to be minor to moderate, and not significant. This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation will be documented in the project-specific ROD-SOF, if a permit issuance decision is made.

### 4.9.6 **Alternative 6: Pine Level/Keys Tract**

Previous surveys identified 6 archaeological sites eligible for listing in the NRHP. To reduce effects to these resources, the sites will be avoided or mitigated. Historic structures surveys were conducted and no resources were found eligible for listing in the NRHP.

Prior to construction, for those areas of the Pine Level/Keys Tract that have not been previously surveyed, new cultural resource assessment surveys would be required to be conducted to determine whether unidentified historic properties are present. If historic properties were determined to be eligible, or potentially eligible for listing on the NRHP are found, effects would be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects would be required to be mitigated. The USACE would coordinate the potential effects of mining this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination would be documented in the project-specific ROD-SOF, if a permit issuance decision were made.

Adverse effects to any historic properties identified by new cultural assessment surveys would be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE would consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties would be mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for the Pine Level/Keys Tract, any eligible historic properties would be eliminated by the potential mining. This impact would have a major degree of effect, which would be significant. It is important to note that no applicant or property owner has proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

In the review of a USACE application to mine the Pine Level/Keys Tract, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, would be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE would consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with mining the Pine Level/Keys Tract are determined for the purpose of this AEIS analysis to be minor to moderate, and not significant. This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation would be documented in a project-specific ROD-SOF, if a permit issuance decision were to be made.

### 4.9.7 **Alternative 7: Pioneer Tract**

Previous cultural resource surveys have been conducted in the eastern half of the Pioneer Tract. These surveys found no resources considered eligible for listing on the NRHP; however, the western portion of the alternative has not been surveyed.

Prior to construction, for those areas of the Pioneer Tract that have not been previously surveyed, new cultural resource assessment surveys would be required to be conducted to determine whether unidentified historic properties are present. If historic properties were determined to be eligible, or potentially eligible for listing on the NRHP are found, effects would be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects would be required to be mitigated. The USACE would coordinate the potential effects of mining this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination would be documented in the project-specific ROD-SOF, if a permit issuance decision were made.

Adverse effects to any historic properties identified by new cultural assessment surveys would be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE would consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties would be mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for the Pioneer Tract, any eligible historic properties would be eliminated by the potential mining. This impact would have a major degree of effect, which would be significant. It is important to note that no applicant or property owner has proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

In the review of a USACE application to mine the Pioneer Tract, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, would be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE would consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with mining the Pioneer Tract are determined for the purpose of this AEIS analysis to be minor to moderate, and not significant. This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation would be documented in a project-specific ROD-SOF, if a permit issuance decision were to be made.

### 4.9.8 **Alternative 8: A-2**

No cultural resource surveys have been conducted on this parcel.

Prior to construction, new cultural resource assessment surveys would be required to be conducted to determine whether unidentified historic properties are present. If historic properties were determined to be eligible, or potentially eligible for listing on the NRHP are found, effects would be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects would be required to be mitigated. The USACE would coordinate the potential effects of mining this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination would be documented in the project-specific ROD-SOF, if a permit issuance decision were made.

Adverse effects to any historic properties identified by new cultural assessment surveys would be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE would consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties would be mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for Site A-2, any eligible historic properties would be eliminated by potential mining. This impact would have a major degree of effect, which would be significant. It is important to note that no applicant or property owner has proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

In the review of a USACE application to mine Site A-2, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, would be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE would consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with mining the Site A-2 are determined for the purpose of this AEIS analysis to be minor to moderate, and not significant.

This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation would be documented in a project-specific ROD-SOF, if a permit issuance decision were to be made.

### 4.9.9 Alternative 9: W-2

No cultural resource surveys have been conducted on this parcel.

Prior to construction, new cultural resource assessment surveys would be required to be conducted to determine whether unidentified historic properties are present. If historic properties were determined to be eligible, or potentially eligible for listing on the NRHP are found, effects would be avoided, minimized, or mitigated pursuant to the NHPA. Unavoidable adverse effects would be required to be mitigated. The USACE would coordinate the potential effects of mining this alternative with the federally recognized Native American Tribes' Tribal Historic Preservation Office (THPO) and the SHPO. Any necessary mitigative measures identified by that coordination would be documented in the project-specific ROD-SOF, if a permit issuance decision were made.

Adverse effects to any historic properties identified by new cultural assessment surveys would be required to be avoided, minimized, or mitigated pursuant to the NHPA. USACE would consult with the SHPO, federally recognized tribes and other appropriate parties, in accordance with the NHPA, to ensure that unavoidable adverse effects to eligible historic properties would be mitigated.

Without the mitigation measures described in the introduction to this section and in this effect analysis for Site W-2, any eligible historic properties would be eliminated by potential mining. This impact would have a major degree of effect, which would be significant. It is important to note that no applicant or property owner has proposed proceeding without considering historic properties in this manner; this is a hypothetical 'without mitigation' determination of significance and degree of effect.

In the review of a USACE application to mine Site W-2, as with any other regulatory action considered by the USACE, the degree of effects to sites determined to be eligible, or potentially eligible, would be determined by 33 CFR 325: Appendix C (7), as stated in the introduction to this section.

The USACE would consult with the SHPO and other appropriate parties to avoid, minimize, and mitigate adverse effects to historic properties pursuant to the NHPA. Based on the expected outcome of such consultation, with mitigation the impacts to cultural and historic resources associated with mining the Site W-2 are determined for the purpose of this AEIS analysis to be minor to moderate, and not significant. This determination is made only for the purpose of comparing alternatives in the AEIS. The results of the actual consultation would be documented in a project-specific ROD-SOF, if a permit issuance decision were to be made.

## 4.10 SURFICIAL GEOLOGY AND SOILS

The geographic scope of the evaluation of the direct and indirect impacts to surficial geology and soils includes the mine parcels. Additional information about surficial geology and soils within the CFPD is located in Section 3.3.1.

The degree of intensity of impacts for surficial geology and soils was determined using the following criteria:

- No Impact to Minor: Effects on surficial geology and soils would be short-term and reversed following mine reclamation.
- Moderate: Effects on surficial geology and soils would be moderate in duration; reversal would require extended periods following mine reclamation.
- Major: Effects on surficial geology and soils would be long-term in duration; extended effects would occur to the agricultural and natural productivity of the affected area, as well as other functions.

### 4.10.1 Alternative 1: No Action Alternative

The No Action Alternative – No Mining scenario would result in no additional impacts related to mining beyond any caused by the existing operations. Current land uses, such as agriculture and pastureland, would continue to modify these soils as in the past for their current and ongoing future needs. With population growth, urbanization of portions of the AEIS study area would occur and would shift land use from undeveloped agricultural and rangelands to various forms of developed areas including more intensively managed agricultural, residential, commercial, and perhaps light industrial land uses. By themselves, these land use changes would tend to be considered minor and presumably would align with local county land-use planning.

The Upland Only scenario would have impacts similar to those of the Applicants' Preferred Alternatives, although of a reduced scale.

### 4.10.2 Alternatives 2 through 9

Phosphate mining involves extensive earthwork and will substantially alter the nature of the existing soils in the areas of extraction and, to a somewhat lesser extent, in areas that are not mined but are disturbed for other mine activities. The existing soil profiles within the mining areas will be lost in the surface horizons, affecting the layers of either subsurface overburden or waste materials. The removal of the overburden or any soils overlying the ore (matrix) would result in the unavoidable disturbance of soils in the mined area, including any unique farmland or hydric soils. The soil character would be altered to varying extents depending on the approach used for returning overburden, sand, and/or clays to previously mined areas. Clearing of areas prior to mining will result in windblown and eroded surface soils and these losses will continue until the areas are reclaimed and stabilized by revegetation.

Byproducts of the beneficiation process, waste clays, will be deposited in settling areas as clays or sand-clay mixtures, and surrounded by earthen embankments which will be constructed from the overburden in the mine cuts that are enclosed within the CSA footprint. The CSAs represent permanent disturbances of the soil profile within the footprints of the CSAs. Other parts of the mining activities, including disturbances such as construction of roads, pipeline corridors, and ditches and berms, will also involve a slight modification to the soil profiles in those areas, analogous to other non-mining road or utility disturbances.

Mining also would result in impacts to the near-surface geology down through the matrix. Mineral resource impacts from the mining would include the removal of commercially valuable phosphate rock as well as the relocation of other mineral components within these stratigraphic units. Due to the nature of the mining activity, mineral resource impacts would be unavoidable and relate to both the sand tailings that would be used to fill the mine cuts prior to beginning the reclamation process and the clays, as indicated above, which are pumped to CSAs for disposal, consolidation, and then reclamation.

Land use losses would be offset through reclamation, although soil character would differ from existing conditions and will result in new soil types with distinct agricultural engineering properties that relate to post-reclamation land use potential. Reclaimed upland soils may be expected to provide good inherent fertility as a result of a sandy-clay overburden cap, as is typical in reclamation in the southern extension of the CFPD. This overburden cap overlies the tailing sands that are pumped to the mine pits and then covered with these overburden soils. Tillage and aeration characteristics of these soils due to the high content of sand in the soils should be good and probably better than the clay soils found in the CSAs.

The primary mitigation for the loss of soils for agriculture will be recovery of the soils back to productive land uses as soon as possible after mining. To encourage development of organic matter within soils, rapid establishment of an extensive vegetative cover is needed, as required in the reclamation of uplands.

In wetland reclamation and mitigation, the tailings sand pumped to the wetland reclamation and mitigation parcels provide a good base for the recontouring of overburden. When available, wetland muck is transferred from wetlands prior to mining, is used to inoculate the reclaimed or mitigated wetland, and provides a base soil for establishment of native wetland plants. With reclamation conducted in accordance with state requirements, the effects are expected to be primarily localized to the footprint of the mine for durations allowed under the current regulatory program's provisions.

The CSAs have a high clay content, which provides good moisture and nutrient retention, although initially the soil may have poor tillage and aeration characteristics due to the limited establishment of desiccation cracking needed for improved surface drainage. Areas containing CSAs provide good conditions for agricultural use (pasture and improved pasture) when the CSAs are properly consolidated during the dewatering process prior to final reclamation. Because of the physical characteristics of CSAs, however, building within the CSA has severe limitations which must be considered, whereas building on the reclaimed earthen embankments is less limited.

To support mitigation, wetlands within mined areas will be drained, cleared, and mined. Wherever practicable, topsoil from wetlands, as well as xeric areas, to be mined will be removed as part of the land clearing for use in reclamation. Sand tailings in the southern extension of the CFPD would be primarily used for reclamation by pumping the sand tailings to the mine pit, or in some cases stockpiling the sand tailings. Based on the return of these surficial soils to the mine site and their use to support prior mining activities, these impacts are considered minor and not significant.

The use of native topsoil in reclamation of native upland and wetland communities would provide a natural seed source roughly equivalent to the diversity present at the donor site as well as soil bulk density and nutrient levels benefits. The topsoil would be directly transferred from the donor site to the recipient reclamation/mitigation site with good expectation for inoculation of native plants through the available seed source. The top soil stockpiled for later use may tend to lose some of its active native seed source, but may retain its organic content. Provided the Applicants' proposed mining technologies and BMPs are the same as or better than those found at the Applicants' existing active mines, future mining would be expected to have characteristics similar to those of the existing mines.

All of the Action Alternatives – Desoto Mine, Ona Mine, Wingate East Mine, South Pasture Extension Mine, Pine Level/Keys Tract, Pioneer Mine, Site A-2, and Site W-2, would have impacts similar to those discussed above related to surficial geology and soils within the mine boundaries. Based on available information, all of these alternatives would have a moderate to major degree of effect. Without mitigation, these impacts would be significant. However, it is expected that the Applicants, and any applicants for the Offsite Alternatives, would be required to implement the described reclamation and actions by their various state, local and USACE permits and authorizations, including assurance that the reclaimed areas were returned to a beneficial use, and that the mitigation would be successful. The degree of effect would be reduced to moderate, based on the expected decrease in time needed to return agricultural and natural productivity to the affected areas, and with the mitigative measures it would not be significant.

Other sections of this chapter provide additional considerations of the effect of mining on soils related to wetlands, land use, and potential effects of runoff and water quality. There also is a discussion at the end of this chapter on the unavoidable loss of minerals related directly to the process of extracting phosphate rock. Chapter 5 includes a discussion of the importance of soils in reclamation and restoration activities after mining.

## 4.11 SUMMARY OF DIRECT AND INDIRECT EFFECTS

Table 4-107 summarizes the degrees of direct and indirect effects of the No Action Alternative, the four Applicants' Preferred Alternatives, and the four Offsite Alternatives on the resource categories that were analyzed in depth for the Final AEIS. Where the analysis identified a range of potential effect, for example minor to moderate, the summary table shows the higher degree of effect. Table 4-108 summarizes the significance determinations for the No Action Alternative, the four Applicants' Preferred Alternatives, and the four Offsite Alternatives for each resource category analyzed in depth. The degrees and significance of the effects for the No Action Alternative show the determinations for the No Mining and Upland Only scenarios. The degrees and significance of the effects for the Action Alternatives are presented without and with mitigation, as applicable. The analyses and effect determinations, including the definitions of the degrees of effect for each resource category, are explained in greater detail in Sections 4.2 through 4.10.

**Table 4-107. Degree of Effect of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Surface Water Resources Including Water Supply (Section 4.2)** | | | | | | | | | | | | | | | | | | |
| **Horse Creek** | ● | ○ | ◍ | ○ | ◍ | ○ | ○ | ○ | ◍ | ○ | ◍ | ○ | ◍ | ○ | N/A | N/A | N/A | N/A |
| **Peace River at Arcadia** | ● | ○ | ○ | ○ | ○ | ○ | N/A | N/A | ○ | ○ | N/A | N/A | ○ | ○ | N/A | N/A | N/A | N/A |
| **Payne Creek** | ● | ○ | N/A | N/A | N/A | N/A | N/A | N/A | ○ | ○ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Peace River at Zolfo Springs** | ● | ○ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | ◍ | ○ | N/A | N/A |
| **Upper Myakka River** | ● | ○ | N/A | N/A | ○ | ○ | ○ | ○ | N/A | N/A | ○ | ○ | N/A | N/A | N/A | N/A | ◍ | ○ |
| **Lower Myakka/Big Slough** | ● | ◍ | ○ | ○ | N/A | N/A | N/A | N/A | N/A | N/A | ◍ | ○ | N/A | N/A | N/A | N/A | N/A | N/A |
| **Peace River** | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Myakka River** | ◍ | ○ | N/A | N/A | ○ | ○ | ○ | ○ | N/A | N/A | ○ | ○ | N/A | N/A | N/A | N/A | ○ | ○ |

**Table 4-107. Degree of Effect of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Charlotte Harbor** | ● | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Groundwater Resources Including Water Supply (Section 4.3)** | | | | | | | | | | | | | | | | | | |
| Surficial Aquifer | ● [b] | ● [b] | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ |
| Intermediate Aquifer Zone 1 and 2 | ● [b] | ● [b] | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ |
| Upper Floridan Aquifer | ● [b] | ● [b] | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ | N/A [c] | ○ |
| **Water Quality (Section 4.4)[d]** | | | | | | | | | | | | | | | | | | |
| **Surface Water Quality** | ○ | ○ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ |
| **Groundwater Quality** | ○ | ○ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ | N/A [c] | ◍ |

**Table 4-107. Degree of Effect of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Ecological Resources (Section 4.5)** | | | | | | | | | | | | | | | | | | |
| Aquatic Biological Communities | ○ | ○ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ |
| Wetlands | ○ | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ |
| Wildlife Habitat | ● | ◍ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ |
| Listed Species (Threatened or Endangered) | ● | ◍ | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| **Economic Resources (Section 4.6)[e]** | | | | | | | | | | | | | | | | | | |
| DeSoto County | ○ | N/A | ●[b] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Hardee County | ● | N/A | N/A | N/A | ●[b] | N/A | N/A | N/A | ◍[b] | N/A | N/A | N/A | ●[b] | N/A | ●[b] | N/A | N/A | N/A |
| Manatee County | ◍ | N/A | N/A | N/A | N/A | N/A | ○[b] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | ○[b] | N/A |
| DeSoto and Manatee Counties | ◍ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | ◍[b] | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Table 4-107. Degree of Effect of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Environmental Justice (Section 4.7)** | | | | | | | | | | | | | | | | | | |
| DeSoto County | ○ | ○ | ○ | ○ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Hardee County | ◍ | N/A[c] | N/A | N/A | N/A[c] | ○[b] | N/A | N/A | N/A[c] | ○[b] | N/A | N/A | ○ | ○ | ○ | ○ | N/A | N/A |
| Manatee County | ○ | N/A[c] | N/A | N/A | N/A | N/A | N/A[c] | ○[b] | N/A | N/A | ○ | ○ | N/A | N/A | N/A | N/A | ○ | ○ |
| **Radiation (Section 4.8)** | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **Cultural and Historic Resources (Section 4.9)** | ○ | ● | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ○ | ● | ◍ | ● | ◍ |
| **Surficial Geology and Soils (Section 4.10)** | ○ | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ | ● | ◍ |

**Table 4-107. Degree of Effect of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |

Legend:
+ Beneficial impact
Minor or no impact.
Moderate impact.
Major impact.

N/A Not Applicable

Notes:
[a] Impacts associated with the No Action Alternative include mitigation that may have been included as part of existing permitted activities.
[b] Impacts are beneficial
[c] N/A means not applicable because of inadequate data to conduct analysis
[d] The water quality analyses were all performed "with mitigation"
[e] The economic effects are as compared to the No Action Alternative

**Table 4-108. Significance Determination of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Surface Water Resources Including Water Supply (Section 4.2)** | | | | | | | | | | | | | | | | | | |
| **Horse Creek** | S | N | S | N | S | N | N | N | S | N | S | N | S | N | N/A | N/A | N/A | N/A |
| **Peace River at Arcadia** | S | N | N | N | N | N | — | — | N | N | — | — | N | N | N/A | N/A | N/A | N/A |
| **Payne Creek** | — | — | — | — | — | — | — | — | N | N | — | — | — | — | — | — | — | — |
| **Peace River at Zolfo Springs** | S | N | — | — | — | — | — | — | — | — | — | — | — | — | S | N | — | — |
| **Upper Myakka River** | S | N | — | — | N | N | N | N | — | — | N | N | — | — | — | — | S | N |
| **Lower Myakka River/Big Slough** | S | N | N | N | — | — | — | — | — | — | S | N | — | — | — | — | — | — |
| **Peace River** | S | N | N | N | N | N | — | — | N | N | N | N | N | N | N | N | — | — |
| **Myakka River** | S | N | — | — | N | N | N | N | — | — | N | N | — | — | — | — | N | N |

**Table 4-108. Significance Determination of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Charlotte Harbor** | **S** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** | **N** |
| **Groundwater Resources Including Water Supply (Section 4.3)** | | | | | | | | | | | | | | | | | | |
| Surficial Aquifer | **N** | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** |
| Intermediate Aquifer Zone 1 and 2 | **N** | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** |
| Upper Floridan Aquifer | **N** | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** |
| **Water Quality (Section 4.4)** | | | | | | | | | | | | | | | | | | |
| **Surface Water Quality** | **N** | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** |
| **Groundwater Quality** | **N** | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** | – | **N** |

**Table 4-108. Significance Determination of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Ecological Resources (Section 4.5)** | | | | | | | | | | | | | | | | | | |
| Aquatic Biological Communities | N | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N |
| Wetlands | N | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N |
| Wildlife Habitat | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N |
| Listed Species (Threatened or Endangered) | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N |
| **Economic Resources (Section 4.6)** | | | | | | | | | | | | | | | | | | |
| DeSoto County | N | — | S | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| Hardee County | S | — | — | — | S | — | — | — | S | — | — | — | S | — | S | — | — | — |
| Manatee County | S | — | — | — | — | — | N | — | — | — | — | — | — | — | — | — | N | — |
| DeSoto and Manatee Counties | S | — | — | — | — | — | — | — | — | — | S | — | — | — | — | — | — | — |
| **Environmental Justice (Section 4.7)** | S | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |

**Table 4-108. Significance Determination of the No Action, Applicants' Preferred, and Offsite Alternatives**

| Resource Category | 1: No Action[a] | | 2: Desoto Mine | | 3: Ona Mine | | 4: Wingate East Mine | | 5: South Pasture Extension Mine | | 6: Pine Level/ Keys Tract | | 7: Pioneer Tract | | 8: Site A-2 | | 9: Site W-2 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No Mining | Upland Only | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation | Without Mitigation | With Mitigation |
| **Radiation (Section 4.8)** | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N | N |
| **Cultural and Historic Resources (Section 4.9)** | N | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N |
| **Surficial Geology and Soils (Section 4.10)** | N | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N | S | N |

Legend:
S = significant
N = not significant

Note:
[a] Impacts associated with the No Action Alternative include mitigation that may have been included as part of existing permitted activities.

# 4.12 CUMULATIVE IMPACTS ANALYSIS

## 4.12.1 Introduction

NEPA requires federal agencies to analyze the cumulative impacts of their actions on the environment. Cumulative impacts are defined in the CEQ regulations implementing provisions of NEPA as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (CEQ 1508.7)

For the AEIS cumulative impact analysis, there are four present, or current, actions – Desoto Mine, Ona Mine, Wingate East Mine, and South Pasture Extension Mine (referenced elsewhere in the AEIS as the Applicants' Preferred Alternatives), and two reasonably foreseeable mining actions – Pine Level/Key Tract and Pioneer Tract (as discussed further below) The goal of the AEIS cumulative impact analysis is to evaluate the effects of four current actions, in combination with the effects of other past, present, and reasonably foreseeable actions, both mining-related and non-mining-related.

### 4.12.1.1 Significant Cumulative Impacts

In accordance with CEQ guidance (CEQ, 1997), the analysis of cumulative effects in the AEIS is focused on those resource categories determined to be significant. Identification of the resource categories for which there are significant cumulative effects began with defining the direct and indirect effects of the current and reasonably foreseeable mining actions. These direct and indirect effects are described above in Sections 4.2 through 4,10. Next, the resources, ecosystems, and human communities that may be affected were defined. Chapter 3 describes the affected environment considered in the AEIS. Finally, the resource categories were considered in terms of their importance nationally, regionally, and locally. For this determination, the AEIS relied on comments received during scoping and on the Draft AEIS.

Based on this process, the resource categories determined to have significant potential cumulative impacts are:

- Surface Water Resources
- Groundwater Resources
- Surface Water Quality
- Ecological Resources (Wetlands/Surface Waters and Upland Habitat)
- Economic Resources

Although environmental justice, radiation, cultural and historical resources, surficial geology and soils, groundwater quality (as part of water quality overall), aquatic biological communities, including downstream estuarine areas such as Charlotte Harbor (as part of ecological resources), and listed species (also as part of ecological resources) were considered in detail for direct and indirect effects, they are not part of the cumulative effects analysis in this section. This decision was based on the factors described above, including the degree and significance of the direct and indirect effects, the resources, ecosystems, and human communities that may be affected, and the relative importance of the issues.

The current and reasonably foreseeable actions' direct and indirect effects on most of these resource categories were predicted to have no effect or to have a minor degree of effect, or at most a moderate degree of effect. The only major degree of effect was associated with listed species. None of these effects were significant. Most were relatively limited in extent, with the categories' effects confined within the boundaries of the action. The primary exception to this was environmental justice, and for that resource category the current and reasonably foreseeable actions were expected to have a minor, beneficial, and non-disproportionate effect. Finally, although all of these resource categories generated interest during scoping and comments on the Draft AEIS, this factor alone was not sufficient to elevate any of the categories to the level of the significant cumulative impact issues.

#### 4.12.1.2 Geographic Scope

The four current and two reasonably foreseeable mining actions are all located within the Peace River and Myakka River watersheds. Therefore the evaluations presented in this section focus primarily on past, present, and reasonably foreseeable actions that contribute to cumulative impacts in those two watersheds. Where there are cumulative impacts issues that have potential for direct or indirect impacts that extend beyond the Peace and Myakka River watersheds, these are defined as having regional impacts.

The geographic scopes of the significant cumulative impacts are described as follows:

- Surface Water Resources: The cumulative impacts on surface water resources would occur within the watersheds of the evaluated actions and in receiving waters. Present and reasonably foreseeable surface water resource cumulative impacts would be observed downstream of the proposed impacts. However, these evaluations consider past, current, and reasonably foreseeable future actions' impacts upstream as well to capture those impacts' contribution to the cumulative effects.

- Groundwater Resources: The cumulative impacts to Floridan aquifer levels would occur on a regional level, across watershed and county boundaries. As shown in this section, information used in this evaluation included information from all permitted users of the Floridan aquifer across the study area.

- Surface Water Quality: The cumulative impacts on surface water quality would occur within the watersheds of the evaluated actions and in receiving waters. Present and reasonably foreseeable surface water resource cumulative impacts would be observed downstream of the proposed impacts.

However, these evaluations consider past, current, and reasonably foreseeable future actions' impacts upstream as well to capture those impacts' contribution to the cumulative effects.

- Ecological Resources (Wetlands/Waters and Upland Habitat): The cumulative impacts on ecological resources would occur on a scale from the individual projects out to both the Peace and Myakka River watersheds and in some cases Charlotte Harbor.
- Economic Resources: The cumulative economic impacts would occur on a regional level, which extends out across eight counties - Hillsborough, Polk, Hardee, Manatee, Sarasota, DeSoto, Charlotte, and Lee Counties.

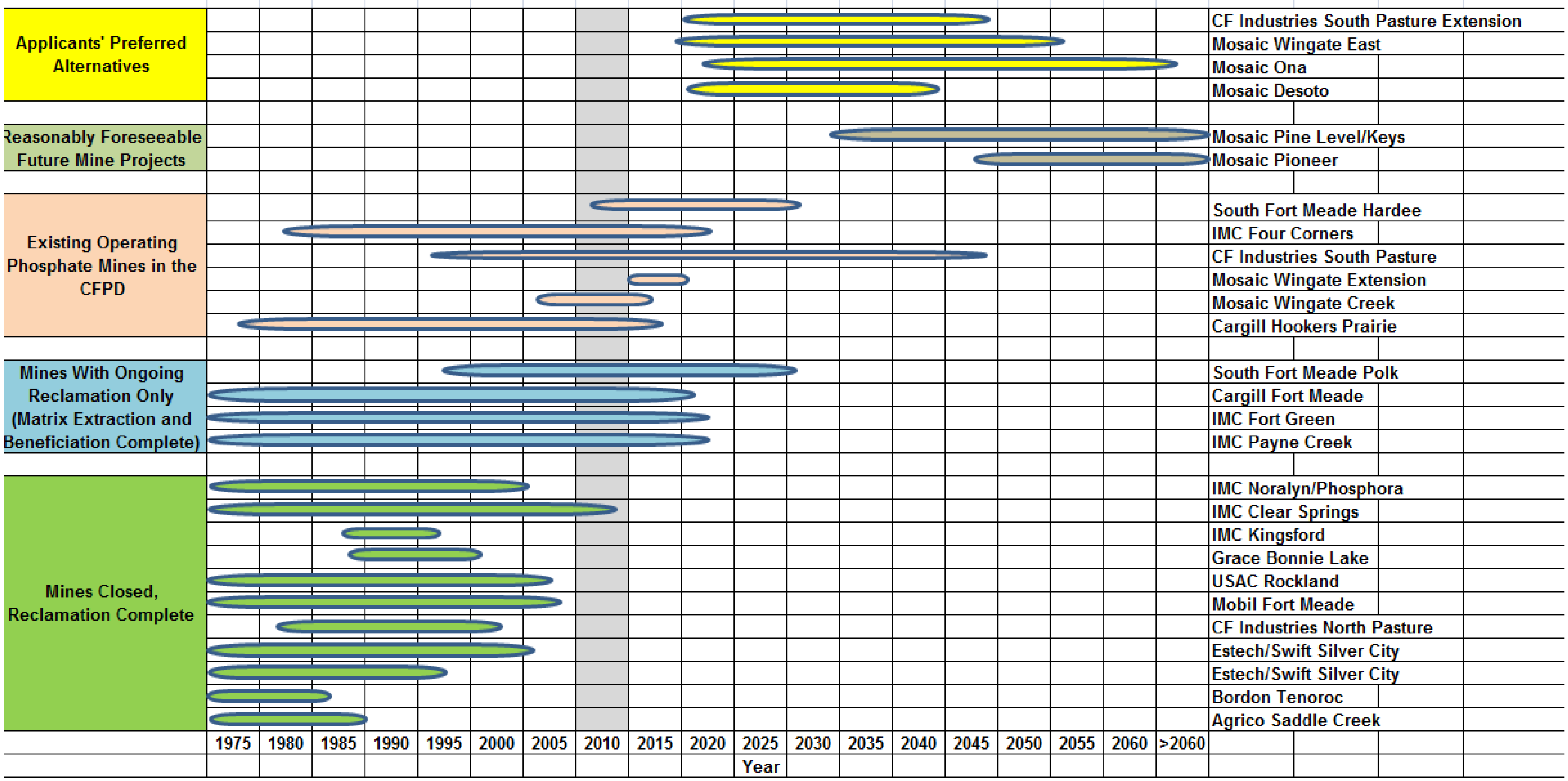
#### 4.12.1.3 Temporal Scope

The temporal scope of the cumulative impact analysis is from 1975 out to the year 2060. The temporal relationships between the past (mines authorized between 1975 and now), present (the Applicants' Preferred Alternatives), and the two reasonably foreseeable future mining actions which could contribute to cumulative effects on resources within the Peace River and Myakka River watersheds, are illustrated in Figure 4-21.

**Past Actions**

Most of the detailed information about past actions comes from after 1975, when state mandatory reclamation regulations were introduced, leading to more information being collected by public agencies or private entities about phosphate mining and mining impacts, especially at a mine specific level. More information also began to be collected in the late 1960s and early 1970s as other applicable environmental laws came into effect, such as NEPA, the Clean Water Act, and the Endangered Species Act. The contribution to cumulative impacts from actions before 1975, including prior phosphate mining activities, is taken into account as part of the characterization of the current conditions. As stated in CEQ's 2005 guidance memorandum on cumulative effects analysis,

"Generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions" (CEQ, 2005).




*Notes:*
*1. Wingate Creek mine actually started in 1981, although it has not run continuously and has transferred ownership several times since that time. Wingate Mine can be seen as a continuation of Wingate Creek - Wingate Extension - Wingate East.*
*2. The dates are approximate for the "Currently Proposed New Mine Projects" and the "Foreseeable Future Mine Projects" due to changes in mine plans based on market conditions, matrix quality, and final state and federal permit conditions.*
*3. The dates for the "Existing Operating Phosphate Mines" are based on current mine plan projects and can also change due to changes in mine plans based on market conditions, matrix quality, and final state and federal permit conditions.*

**Figure 4-21. Past, Present, and Reasonably Foreseeable Future Phosphate Mine Projects**

**Baseline**

The potential cumulative impacts of present and reasonably foreseeable future actions are measured against a baseline of current conditions. For the AEIS, 2010 is the baseline year, in which the conditions of the resource categories evaluated represent the total cumulative impacts of all prior actions, including phosphate mining, agricultural activities, and urban, industrial, commercial, and recreational development up to 2010. This year was chosen because in February 2011, when the AEIS preparation began, 2010 was the latest year for which annual summary information was compiled by various source agencies.

**Future Actions**

2060 is the end boundary of the temporal scope because that is when all physical mining, reclamation, and mitigation efforts on the four Applicants' Preferred Alternatives will be completed, based on available information. The temporal scope (50 years - 2010 through 2060) includes overlap with the start of the mining period of the two reasonably foreseeable mining actions. By 2060, it is expected that any remaining effects of the Applicants' Preferred Alternatives, when combined with effects of other actions, including the two reasonably foreseeable mining actions, would not result in significant cumulative impacts. Therefore, in accordance with CEQ guidance, the analysis of the cumulative impacts of Pine Level/Keys Tract and Pioneer Tract does not extend past 2060.

For information about future effects that was not available for this entire timeframe, the analyses used existing information, trends, and credible scientific evidence.

#### 4.12.1.4 Past, Present, and Reasonably Foreseeable Future Actions

**Past Actions**

***Past Phosphate Mining Actions***

Commercial exploration and phosphate mining in Florida began in the early 1880s with the mining of phosphate pebbles from the Peace River near Fort Meade, in Polk County. Technological improvements and mining economics allowed phosphate miners to move from the river-pebble to the land-pebble and hard-rock phosphates, and then to mining the fine-grained phosphate "matrix" that occurs in the CFPD. The earliest mining activities were concentrated in Hillsborough and Polk Counties, with mining operations shifting to the south and west as the older mines depleted their accessible reserves. Starting in the late 1970s, phosphate companies operating in the CFPD began moving their mining operations into the "southern extension," located in parts of DeSoto, Hardee, and Manatee Counties (Jones and Randazzo, 1997; Woolwine, 2004). Chapter 1 provides additional information about the history of phosphate mining in Florida, including the CFPD (Section 1.1.5).

Phosphate mining in the CFPD which occurred prior to 1975 pre-dated implementation of the State of Florida's Mandatory Reclamation Regulations and that period is referred to as the Non-Mandatory Reclamation period. Mining since 1975 is referred to as occurring during the Mandatory Reclamation period. Figure 4-22 shows the extent of reasonably well-defined mined lands within the CFPD where mining has occurred during both periods, although some old mined lands are difficult to define and map. Of these watersheds, the Peace River system is the watershed with the greatest extent of lands that were mined both before and after 1975. This watershed includes approximately 204,000 acres of land that have either been mined or are currently permitted for mining. In the Myakka River watershed, approximately 2,900 acres have been affected by mining during the Mandatory Reclamation period.

The specific phosphate mines that have been permitted under state and federal regulatory programs are shown in Figure 4-23. Mines that historically operated within the Peace River watershed but which are now closed included the following:

- Bonny Lake (partial)
- Clear Springs
- Fort Meade (Mosaic)
- Fort Meade (Mobil)
- Noralyn Phosphoria (partial)
- North Pasture
    - Silver City (partial)
    - Watson Mine
    - Rockland
    - Payne Creek

Past actions also include mines that were operating prior to the 2010 baseline year and remain operating now. Mines within the Peace River watershed that remain operating are as follows:

- Fort Green (Closed for mining but still being used for CSA)
- Hookers Prairie
- South Fort Meade – Polk and Hardee County Extension

- South Pasture
- Four Corners/Lonesome Mine (partial)

The only mine located in the Myakka River watershed is the Wingate Creek Mine, which is currently operating.

These past actions have contributed to the cumulative effects of phosphate mining on the Peace and Myakka River watersheds. On the basis of the amount of mining in terms of acreage and number of mines, the influence of phosphate mining on the Myakka River watershed's human and environmental resources to date would be considered minor. In contrast, based on the same criteria, one would consider that past phosphate mining has had a major influence on the environmental conditions in the Peace River watershed.

***Other Past Actions***

Trends in land use changes associated with urban and industrial development, creation or expansion of recreational facilities, and the conversion of natural land areas into pastureland, groves, and row crop cultivation areas can be used to represent past effects on the significant issues considered in the AEIS cumulative impact analysis. These land conversions impact natural habitats and the surface water hydrology within the affected watersheds. Impacts to aquatic resources can occur where water drawdowns or other factors that reduce stream flows may affect fish passage or form isolated pools which can develop low oxygen concentrations affecting aquatic biota. Water drawdowns also cause a reduction in the wetted perimeter (the distance along the stream bed and banks where there is contact with water) which also affects the suitability for these habitats to support a diverse biological community. Land clearing activities that reduce the woody canopy along surface waters have other effects by affecting temperature and reducing the external sources of energy sources, such as leaf litter, that might provide nutrients for these communities. Urbanization and agricultural development can also influence the use of water drawn from the Floridan aquifer. The 2009 land use data was used here because it was the most recent dataset available when this trends analysis was prepared.

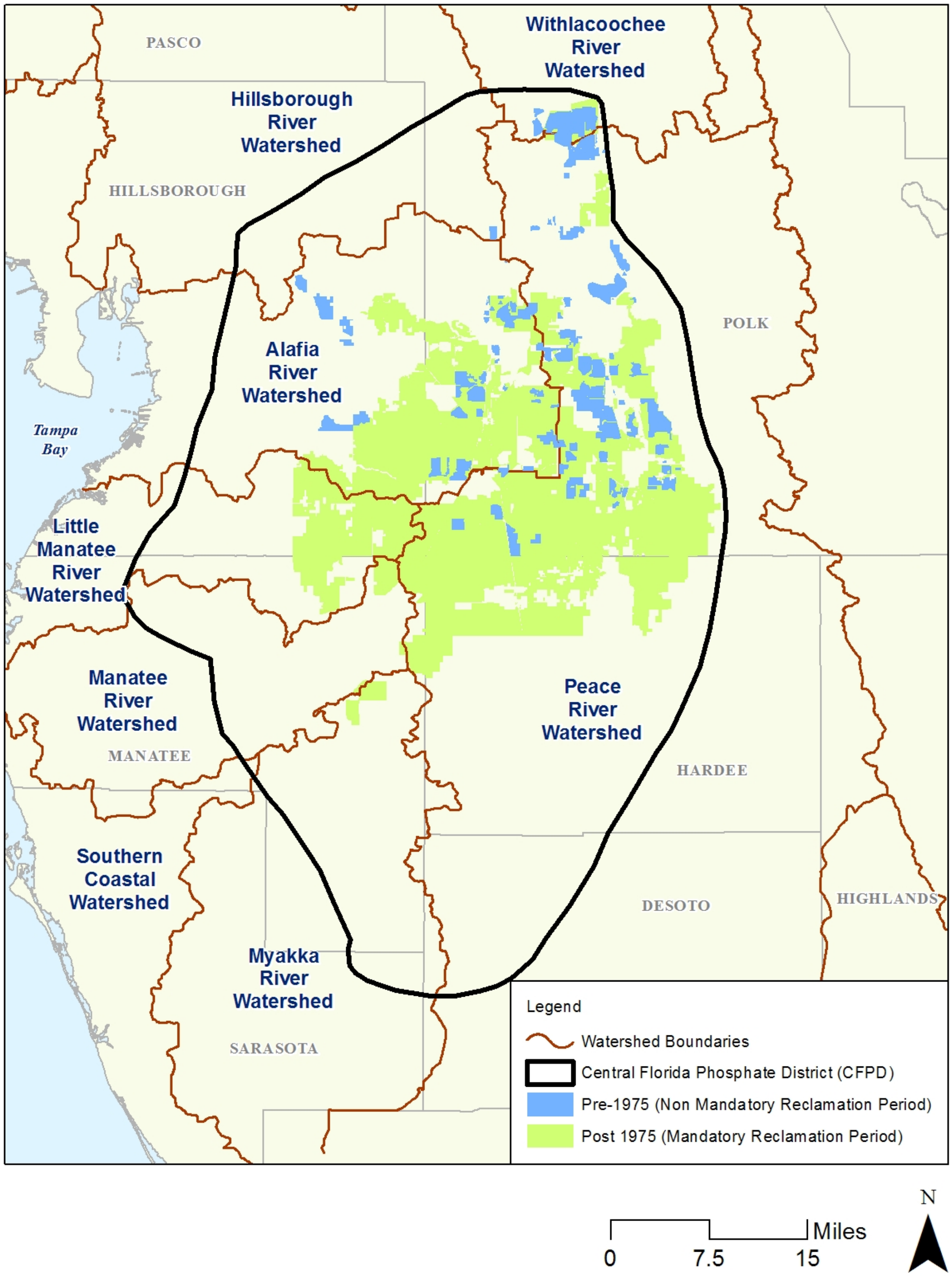
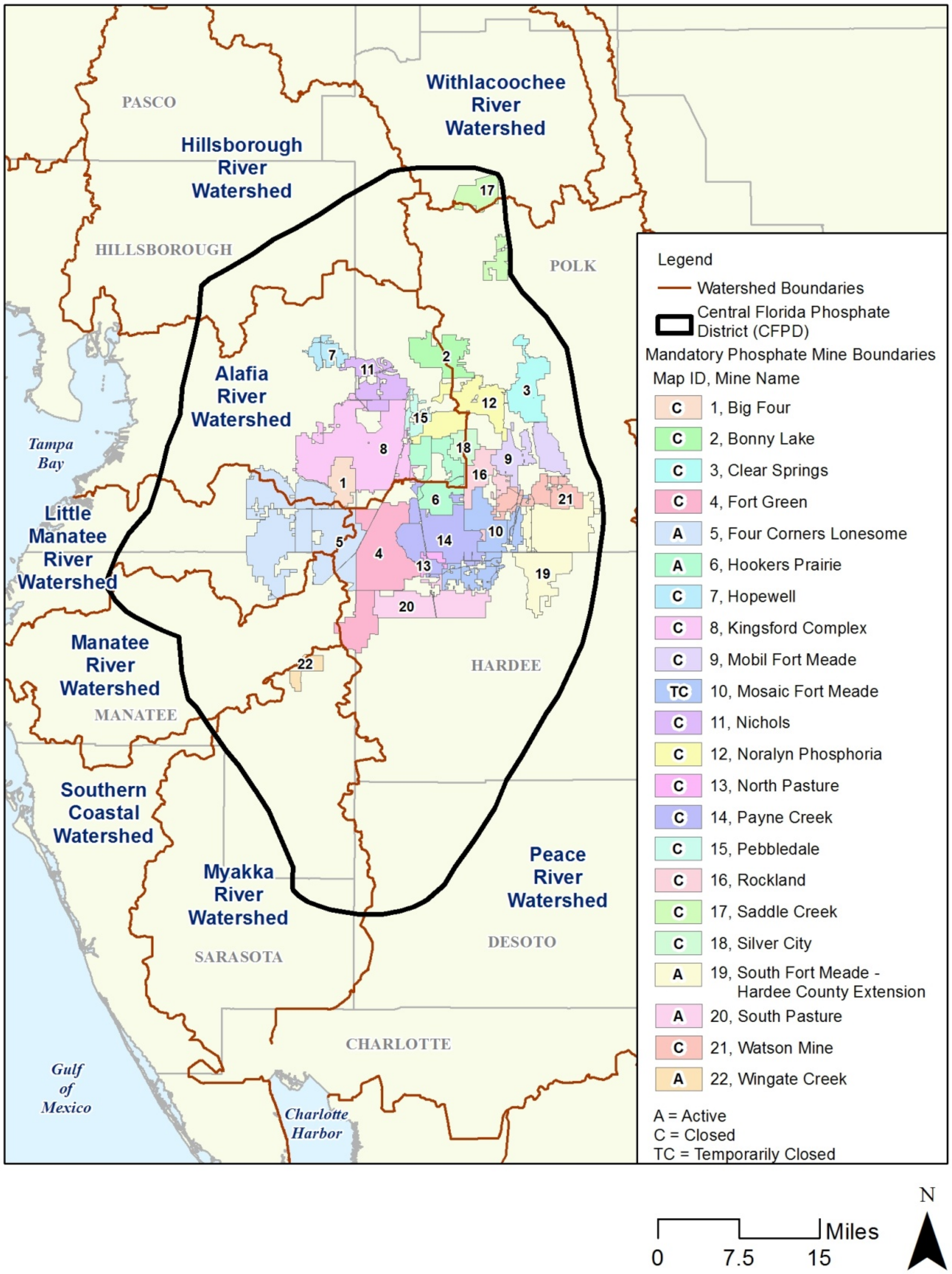



**Figure 4-22. CFPD Lands Mined During the Non-Mandatory Reclamation Period (Pre-1975) and the Mandatory Reclamation Period (Post-1975)**




*Source: FDEP, Bureau of Mining and Minerals Regulation, 2007c; Updated per Mosaic, 2012*

**Figure 4-23. Past and Present Phosphate Mines in the CFPD**

The present unmined Florida landscape within the overall phosphate mining region is fragmented by a variety of past human activities, with agricultural uses being dominant (Erwin et al., 1997). Cumulative impacts to vegetation, wildlife resources, and threatened or endangered species that have resulted from regional development include habitat loss, displacement of fish and wildlife, and reduction in protected populations. In Florida, the conversion of wetlands to agriculture and other uses was on average 72,000 acres per year from the 1950s to the 1970s. This was reduced to 23,700 acres per year from the 1970s to the mid 1980s, and further reduced in the period from 1985 to 1996 to about 4,700 acres per year. Most of these losses were due to urban development and agricultural conversion. An estimated 35 percent of the historical acreage of uplands in central Florida had been lost by 1981 (Mushinsky et al., 1996). The cumulative impacts to vegetation, wildlife, and listed species through urbanization are significant, since development of urban areas is a permanent alteration and displacement of wildlife that occurs and typically requires no mitigation for the loss of uplands. Conversion of these upland habitats to agricultural and range lands also has reduced the functional value of much of these areas for wildlife use.

In the analysis that follows, data are reviewed that illustrate land use changes that have occurred in the Peace River and Myakka River watersheds.

***General Land Use Trends in the Peace River and Myakka River Watersheds***

**Agricultural Land Uses***:* According to the SWFWMD, the principal land use within the Peace River watershed in 1975 was agricultural, especially when native cover (including rangeland) is included (SWFWMD, 2004b). Agricultural and native cover land use categories were also dominant within the Myakka River watershed in 1975 with urban and built up lands also representing a large percentage of the watershed. It should be noted that agricultural land owners use native uplands and wetlands for cattle grazing, in addition to land converted to pasture. Improved pasture is the predominant land use, with citrus the second largest use. All other agricultural uses occupy only a small percentage of the watershed. Citrus production in the Myakka River watershed is substantially less than is found in the Peace River watershed. The increase in row-crop acreage in the Peace River watershed reflects shifts in tomato production inland from coastal Hillsborough and Manatee Counties resulting from urbanization of the coastal counties.

Agricultural uses decreased by almost one-third in these two watersheds since 1975 even with the re-classification of open space to the equivalent of pasture. The acreage of citrus dropped by almost two-thirds during this period. Citrus is being grown on reclaimed land by Mosaic and CF Industries. However, the freezes in the 1980s caused many growers, including those on phosphate lands, to shift to other land uses in Polk County as more acreage was planted in citrus in southern counties less susceptible to hard freezes.

**Urban Land Uses***:* Urban or built-up land accounts for a smaller part of the land use in these watersheds. In the Peace River watershed, urban land uses have historically dominated the upper and lower coastal sub-watersheds. The Lakeland/Winter Haven/Bartow metropolitan area is located in the upper sub-watershed and the North Port/Punta Gorda/Port Charlotte developed area almost entirely surrounds the Peace River riparian corridor in Charlotte County. Along the riparian corridor, Bartow, Fort Meade, Bowling Green, Wauchula, Zolfo Springs, and Arcadia each form urban areas. The only other sizeable urban area is located along the eastern watershed boundary where urban growth west of Sebring now occupies a sizeable portion of the watershed. Commercial development is limited to corridors along main thoroughfares, especially U.S. 41, the Tamiami Trail.

Trends since 1975 have shown over a doubling of urban growth related to the boom of the 1980s, past actions that have added to the changes in land use affecting cumulative impacts for those areas where mining had occurred and is still underway.

Urban expansion typically does not occur on prior mined lands but rather along the linear corridors and highways that are adjacent to these former mines. The USDA mapped 1,445 acres of low density, 249 acres of medium density, and 118 acres of high density development on the phosphate lands in 2001. These areas are principally located in and around Lakeland, Bartow, Fort Meade, and Bowling Green on very old mine tracts.

With reclassification of pasture lands as agricultural land use, less than 4,000 acres of urban development had occurred on the phosphate mine lands as of 2009 in these two watersheds. The decrease in urban use between 1975 and 2009 reflects closure and removal of phosphate ore separation/beneficiation plants.

**Native Cover***:* Native cover acreages overall have decreased in the watershed between 1975 and 2009.

**Extractive***:* Phosphate mining in 1975 accounted for the smallest land use of the four land uses summarized. Mining and most urban use is concentrated in the upper third of the watershed. The 9,968 acres of barren land reported by the USDA reflects ongoing mining and reclamation as of 2001. Over the period from 1975 through 2009 there has been a continuing trend of increased areas considered extractive land use accompanied by similar trends in reclaimed lands.

***Land Use Changes in the Myakka River and Peace River Watersheds in the CFPD***

The land use changes that have occurred in the CFPD are summarized in this section and in Table 4-109. The data sources for these data vary because of availability of the specific time periods needed. The 1974 data used were from the USGS and the 2009 data were provided by SWFWMD FLUCCS data sources.

| Table 4-109. Summary of Land Use Changes Between 1974 and 2009 in the Myakka River and Peace River Watersheds in the CFPD | | | | | | |
|---|---|---|---|---|---|---|
| **Watershed** | **Land Use** | **1974[a]** | | **2009** | | |
| | | **Acreage** | **% of Total** | **Acreage** | **% of Total** | **Change in Acreage** |
| MYAKKA RIVER WATERSHED | | | | | | |
| | Urban and Built Up | 96 | 0.1 | 8100 | 6.2 | 8004 |
| | Extractive | | | 2163 | 1.6 | 2163 |
| | Reclaimed Land | | | 226 | 0.2 | 226 |
| | Agriculture | 56453 | 42.9 | 62456 | 47.4 | 6003 |
| | Native Cover | 75087 | 57.0 | 58545 | 44.5 | -16542 |
| | Disturbed Land | | | 66 | 0.1 | 66 |
| | Transportation / Communication / Utility | | | 79 | 0.1 | 79 |
| Total Acreage | | 131635 | | 131635 | | |
| | | | | | | |
| PEACE RIVER WATERSHED | | | | | | |
| | Urban and Built Up | 34842 | 5.7 | 61600 | 10.1 | 26758 |
| | Extractive | 50265 | 8.2 | 70773 | 11.6 | 20508 |
| | Reclaimed Land | | | 80655 | 13.2 | 80655 |
| | Agriculture | 256495 | 42.1 | 201394 | 33.0 | -55101 |
| | Native Cover | 266708 | 43.8 | 187810 | 30.8 | -78898 |
| | Disturbed Land | 101 | 0.0 | 222 | 0.0 | 121 |
| | Transportation / Communication / Utility | 1188 | 0.2 | 7146 | 1.2 | 5958 |
| Total Acreage | | 609600 | | 609600 | | |

[a] In 1974, the USGS land use classification was different in the approach used to lump various categories than was used in 2009 by the SWFWMD. Therefore exact acreage transformations between these two data sets are not always precisely comparable.

The Extractive category in FLUCCS primarily represents phosphate-mined lands; however, it also includes some reclaimed areas. As such, the 2009 SWFWMD FLUCCS overestimates the coverage of phosphate-mined land and underestimates land uses/habitats that have been created through reclamation.

This table documents the changes in land use that have occurred between 1974, one year before the beginning of the mandatory reclamation period and 2009, the year for which land use information was available at the onset of the AEIS study period. Examination of the change in land uses in these watersheds over this period of record documents the cumulative influence of such development during the approximate overlapping period for which phosphate mining has been actively developed within the CFPD.

As these data indicate, the dominant land use characteristics for both watersheds throughout the period has been and continues to be primarily agricultural lands, which are mainly pasture lands, and native cover, which includes a broad range of natural vegetation. The Myakka River watershed shows a trend in increasing urban and built up, extractive, and agricultural land use, while the Peace River watershed shows increases in urban and built up, extractive, reclaimed, and transportation/communication/utility land uses, and a decrease in agricultural land use. Both show declines in native cover.

The AEIS cumulative impact analysis also looks at the contribution to cumulative impacts from past actions as part of the characterization of the current conditions, as described in the discussion of temporal scope above in Section 4.12.1.3.

For example, historical records through 2010 regarding Peace and Myakka River subwatershed and watershed discharges documented by USGS gauging station data reflect the cumulative effects to date of all prior man-induced land use changes influencing runoff accumulations to surface water streams and rivers within the AEIS study area. The historical discharge records up through 2010 also account for long-term changes in rainfall patterns influencing natural variability as well as trends in water delivery from the Peace River and Myakka River watersheds to Charlotte Harbor.

Similarly, the use of 2010 as the nominal baseline year for AEIS impact evaluations regarding Floridan aquifer water levels was the approach adopted to provide that “…the current aggregate effects of past actions…” was used in the AEIS’ cumulative effects review. Modeling of the current FAS water supply allocations to all users of the regional Floridan aquifer set the baseline reflecting the influences of all such users, including past users, and future changes from this baseline would reflect the cumulative impacts of the future scenarios of water supply uses by the various water supply categories. For the groundwater modeling analyses, the nominal 2010 condition actually represents the baseline FAS water supply allocations permitted by the SWFWMD through 2006. Use of this baseline year for comparative purposes is the procedure applied by the water management district in assessing the potential effects of proposed change in existing FAS water supply allocations, and the approach was adopted to support the AEIS to remain as consistent as possible with how the cumulative impacts of all user categories on the Floridan aquifer water levels would be evaluated by that agency.

***Reclamation and Reclaimed Land Re-Use on Prior Mined Lands***

*CARL/Florida Forever:* In 1979, Florida established the Conservation and Recreational Lands (CARL) Program, subsequently replaced in 1999 by the Florida Forever Act, which used taxes collected on each ton of phosphate rock mined to help pay for the reclamation and conservation of previously mined areas. (FIPR, 2013). Under Florida Statute Title XIV, Chapter 211.3103, this tax is maintained at a rate of $1.61 per ton severed until the period from January 1, 2015 through December 31, 2022 when the tax rate will be $1.81 per ton. The statute allocated for the fiscal year 2011 to 2012 25.5 percent of this tax to the credit of CARL, but this will be reduced to 22.8 percent during the period from 2015 to 2022 noted above. While this was used primarily for acquisition of lands for conservation in the past, the program has been refocused primarily to management because of budgetary issues. Thus, the funding dropped from $300 MM a year from 1998 to 2008 to only $15 MM for 2010 and 2011 (Conservation Trust, 2013). Nonetheless, these funds represent a substantial impact on changes in land uses during the time they have been, and to a lesser extent, continue to be available.

*Peace River Watershed:* Independent of the vegetative cover mapped by USDA, numerous large areas of reclaimed land are being used for purposes other than agriculture in the Peace River watershed. These include:

- The Tenoroc fish management area operated by the Florida Fish and Wildlife Conservation Commission occupies over 5,000 acres of the former Borden Tenoroc mine.
- SWFWMD has purchased over 3,000 acres of the U.S. Agrichemicals (USAC) land adjacent to Lake Hancock as part of the restoration program designed to restore flows in the Upper Peace River.
- Peace River Park was donated to Polk County by IMC-Agrico.
- Progress Energy has converted approximately 8,200 acres of land mined by IMC, Estech, and USAC into the Hines Energy Center.
- Tampa Electric has converted over 4,000 acres mined by Agrico into the Polk Power Station.
- Seminole Electric Co-operative has converted over 1,200 acres into the Hardee Power Station.
- Mosaic donated 1,260 acres to Hardee County to form Hardee Lakes Park.

**Present Phosphate Mining Actions**

Sections 4.2 through 4.10 describe the direct and indirect impacts that would occur as a result of the four current actions, along with two different scenarios of a No Action Alternative, plus four offsite alternatives. The geographic boundaries of the direct and indirect impacts vary by the area being evaluated and are described in the individual sections.

**Reasonably Foreseeable Future Actions**

***Reasonably Foreseeable Future Mining Actions***

The USACE has determined that Pine Level/Keys Tract and Pioneer Tract (which for the AEIS includes the area shown on many maps as “West Pioneer”) are reasonably foreseeable future mining sites. These two actions are also identified in Chapter 2 as offsite alternatives, and their direct and indirect effects considered above in this chapter. Mosaic has identified both of these areas as proposed future mines. Mosaic also requested a jurisdictional determination for a portion of the Pine Level/Keys Tract. In addition, Pioneer Tract (Alternative 7) shares a boundary with Ona (Alternative 3) to the north, Pine Level/Keys (Alternative 6) shares a boundary with Desoto (Alternative 2) to the east, and both would be in the vicinity of those mines’ beneficiation plants. The locations of these two potential future mines are shown in Figure 2-8.

It is reasonable to expect that the Applicants will continue to acquire land parcels immediately adjacent to their currently operating and proposed mines if such parcels become available at economically attractive prices, either as new mines, mine extensions, or infill parcels (as defined in Section 1.3.1). Two known infill parcels, G&D Farms and Lambe Tract, are discussed in Section 1.3.3. As stated in that section, those two infill parcels are part of the cumulative impact analysis.

Neither of the Applicants has disclosed specific plans to acquire properties to form potential future new mines, mine extensions, or infill parcels other than those identified above. Therefore, although such new phosphate mining activities within the CFPD cannot be dismissed, such actions are considered speculative, not reasonably foreseeable, and therefore not considered in this cumulative impact analysis.

***Reasonably Foreseeable Future Non-Mining Actions***

**Urban Development**: Whether population growth will approach the rates experienced during the 2003-2007 housing “bubble” in Florida, and especially within the Peace River and Myakka River watersheds, is the subject of debate amongst economists nationally and statewide. Urban growth land use changes from 1999 to 2009 have gone from 1,303 acres to 3,630 acres, a rate of development of about 1.2 percent. In the Myakka River watershed, over this same period, urban land use has grown from 4,586 acres to 13,603 acres, a rate of about 1.4 percent. Zwick and Carr (2006) estimated population growth in Florida through the year 2060. They predicted a large amount of new development in Hardee and DeSoto Counties, projecting that these counties (along with Osceola County) would experience the greatest transformation among Florida counties, as they shifted from rural to urban counties, with 14 times more urban development in 2060 than in 2006. However, throughout Charlotte County and in south central Hardee and DeSoto Counties, developers had applications pending in 2008 to convert tens of thousands of acres of rural lands east of the Peace River into new urban areas. Most of these projects have since been cancelled. In the 2009 Florida Statistical Abstract, the University of Florida reports that housing markets are slowing down across all Florida MSAs, but especially in the southwest and southeast coastal areas. In the second quarter of 2006, sales of homes dropped 27 percent compared to a year earlier, and this rate is slower than the US housing market as a whole. The percent change in population has followed similar trends with the growth rate dropping from about 33 percent in 1990 to less than 10 percent in 2004 (Montes-Rojas et al., 2007). Absent immigration of retirees from northern states, no economic driver exists to create significant additional residential housing demand in either the Peace River or the Myakka River watershed.

***Specific Projects****:* In the Payne Creek watershed in southern Polk County, Mosaic has constructed Streamsong, a self-contained 16,000-acre destination ecotourism facility including two golf courses, which opened in December 2012, and a resort facility scheduled to open in the fall of 2013. The area is generally bounded by CR 630 on the north, CR 663 on the west, the Hardee County Line on the south, and District Line Road on the east. Located on lands mined as part of the Hookers Prairie and Payne Creek Mine, the resort focuses on fishing and other recreational uses. Elsewhere in Polk County, the County Commission has begun land re-use comprehensive planning efforts.

Construction of the Florida Polytechnic campus, located at the southwest corner of Interstate 4 and the east end of the Polk Parkway is underway. The new university may lead to additional development in the area, as was seen with Florida Gulf Coast University in Lee County.

**Transportation**: The Florida Department of Transportation (FDOT) is currently funding a study of the proposed Heartland Parkway, which would extend from Interstate 4, west of Orlando, south to State Road 82 or State Road 29 in the Immokalee area, perhaps joining with Alligator Alley. FDOT is also studying the proposed Central Polk Parkway, one leg of which would connect the Polk Parkway with State Road 60, and the other leg of which would start a few miles east of State Road 60 and run north, parallel to US 27, to Interstate 4. FDOT has plans for upgrading and improvements on Highway 17 in Hardee County.

**Electric Utilities**: Reasonably foreseeable electric utility growth in the Peace River watershed also has been affected by the housing collapse. Ten year site plans (2010-2019) filed recently with the Public Service Commission projected one limited expansion in the Peace River watershed. The Tampa Electric Company plans to convert three combustion turbines into a combined cycle unit at the Polk Power Station in 2019. Also, upgrading of existing transmission corridors is envisioned by several utilities; however, no new corridors are proposed. Florida Power & Light has recently completed a solar plant in DeSoto County about 6 miles east of the proposed Desoto Mine and another potential photovoltaic site is located about 5 miles east of Parrish, Florida.

**Water Utilities**: Several water resource developments are reasonably foreseeable and would reduce stress on the Floridan aquifer and the Peace River. These projects are in addition to the initiatives being undertaken by SWFWMD as described previously.

Two projects are planned to reduce stress on the Floridan aquifer. First, Tampa Electric, the City of Lakeland, and SWFWMD have begun a cooperative project to convert the Polk Power Station to reclaimed water cooling. By doing so, Tampa Electric would re-allocate its Water Use Permit to the City of Lakeland in exchange for a reclaimed water supply. The City would retire a portion of the allocation and use the remainder to support the anticipated growth described above, resulting in a net reduction in total aquifer withdrawals. In addition, CF Industries is implementing a deep well injection project at its South Pasture Mine. Currently, FDEP has permitted an injection test well and associated monitoring wells, and CF Industries is testing the surface water treatment system before constructing the test well. The system is designed to treat and inject 2 mgd and can be expanded in the future up to 4 mgd.

Two projects are underway to reduce stress on the Lower Peace River. First, PRMRWSA has constructed a larger reservoir and increased the capacity of its intake structure. As a result, PRMRWSA should not have to continue to request variances from SWFWMD to allow withdrawals during extremely low-flow periods. In addition, Manatee County has begun efforts to permit an injection well to facilitate the future development of a reserve reverse osmosis potable water supply plant in the vicinity of Port Manatee. Development of this alternative source would reduce future PRMRWSA demands on the river and decrease the amount of water transferred out of the watershed. Finally, SWFWMD continues to evaluate alternative water supply sources in Manatee and Sarasota Counties to yield the same benefits as the Manatee County initiative.

**Agriculture**: Large-scale conversion of native habitat or improved pastureland into row-crop or citrus production is not reasonably foreseeable for several reasons. First, SWFWMD has essentially capped water withdrawals from the Floridan aquifer, thereby requiring re-allocation of existing permitted quantities for any new users. Some transfers of permits from the coastal counties to other areas could occur; however, urban development pressures would have to resume to create the economic conditions necessary to move coastal farmers inland. With respect to citrus, declining demand in the United States and Europe, combined with disease issues, makes it unlikely that the growers in the Peace River watershed will expand citrus acreage significantly in the future. USGS and SWFWMD data document that citrus acreage has decreased between 1999 and 2008.

Conversion of native habitat to support increased cattle production also is not reasonably foreseeable. Declining national per capita consumption of beef has resulted in less demand. Further, no economic advantages are emerging that would lead to an increase in production. The inventory of cattle and calves in DeSoto, Hardee, Hillsborough, Manatee, and Polk Counties declined from 385,000 animals in 2002 to 346,000 animals in 2011 (FDACS, 2011). Commercial citrus acreage also dropped between 2002 and 2010 in those six counties, from 272,184 acres to 220, 977 acres (UF-IFAS, 2009). There is evidence throughout the watershed that citrus groves in poor health have been converted into pasture land. USGS and SWFWMD data show that pasture acreage decreased between 1999 and 2008.

#### 4.12.1.5 Affected Environment

Chapter 3 provides descriptions of mining activities and key natural and human resources of concern. This section of Chapter 4 focuses on those aspects of the environment related to the significant cumulative impact issues listed in Section 4.12.1.1.

**General Ecosystem Conditions, Stresses, and Responses**

FDEP's and SWFWMD's Peace River Cumulative Impact Study (PRCIS) and Charlotte Harbor National Estuary Program's (CHNEP) Comprehensive Conservation and Management Plan (CCMP) provide watershed-wide descriptions of the affected environment, data summarizing the status of natural and human resources, identification of stress factors that have caused cumulative impacts historically, assessment of trends over time through analysis of historical data, and descriptions of the regulatory programs being implemented to reverse historical impacts and prevent impacts of past, present, and reasonably foreseeable future actions from accumulating on a watershed-wide basis. These recent analyses also provide the background necessary to assess whether cumulative effects are reasonably foreseeable based upon the developments expected to occur within the Peace River watershed.

According to FDEP's and SWFWMD's PRCIS, published in 2007, historical impacts to the aquatic ecosystem that may be, at least in part, attributable to phosphate mining include:

- Approximately 343 miles of streams and associated floodplains were lost in the basin during the study period from the 1940s through 1999.
- During the same period, the basin sustained a 38.5 percent reduction in wetland acres, a loss of about 136,000 of the original 355,000 acres.
- Approximately 31,000 wetland acres were lost after 1979 despite the existence of more stringent regulations
- Native upland habitats declined from more than 834,000 acres in the 1940s to fewer than 243,000 acres in 1999, a 71 percent decrease.
- Floridan aquifer levels in the area have declined by 20 to 50 feet.

- The impacts of phosphate mining on landform and hydrology are found in the four sub-basins in the northern basin where mining occurred historically.

It should be noted that neither FDEP nor the USACE had authority over isolated wetlands until the mid- to late-1980s (and the USACE currently does not have authority over hydrologically isolated wetlands), while reclamation of mined lands became mandatory after July 1, 1975. Also, the PRCIS methodology for defining wetlands and streams consisted of photo interpretation of historical aerial photographs to develop land use/land cover maps for the 1940s, 1979, and 1999 eras; therefore, the acreages referenced do not correspond to USACE or FDEP regulatory definitions of wetlands.

Similar watershed comprehensive planning is underway following the guidance and goal of the Myakka River Watershed Initiative and Comprehensive Management Plan proposed by SWFWMD (2004a).

One measure of past and present effects of mining on land is the characterization of the amount of land mined and then reclaimed in accordance with state regulations. Mining physically disrupts the land surface while reclamation standards for phosphate lands under Chapter 62C-16, F.A.C., require contouring to safe slopes, providing for acceptable water quality and quantity, revegetation, and the return of wetlands and streams to premining type, nature, function, and acreage. Figure 4-24 shows a summary of acreage within the CFPD of historical phosphate mines that have been mined but not reclaimed or mitigated (Past Mines) as well as the reclamation status of current operating mines (Present Mines), the four Applicant Preferred mines described in this AEIS (Applicants' Preferred Alternatives), and the two foreseeable future mines (Reasonably Foreseeable Future Mines). This figure shows that the unreclaimed acreage for each category rises and falls, and the overall unreclaimed acreage follows the same general pattern as new mines replace old mines with an eventual reclamation of all mined lands. At its peak in 1993, approximately 39,000 acres of land had been mined but not yet reclaimed or mitigated. In 2009, the unreclaimed or mitigated mined land totaled approximately 25,000 acres, a 35 percent reduction from 1993 levels. The projected unreclaimed or mitigated mined lands for 2020 total just over 15,000 acres, a 60 percent reduction from 1993 levels. As the proposed and foreseeable future mines come on line in the 2015 through 2020 time period, and again in the 2035 time frame, with reclamation scheduled to continue into 2060 (and beyond) for future mines, the number of acres of unreclaimed lands rises as it did in the period following 1975, reaching a high of approximately 35,000 acres. But as reclamation continues following mandatory reclamation schedules, these numbers also drop steadily over the life of the mines, with a projected estimate of about 20,000 acres of unreclaimed lands by 2060 that will be followed by a continued drop as the proposed and future mines complete reclamation and release.

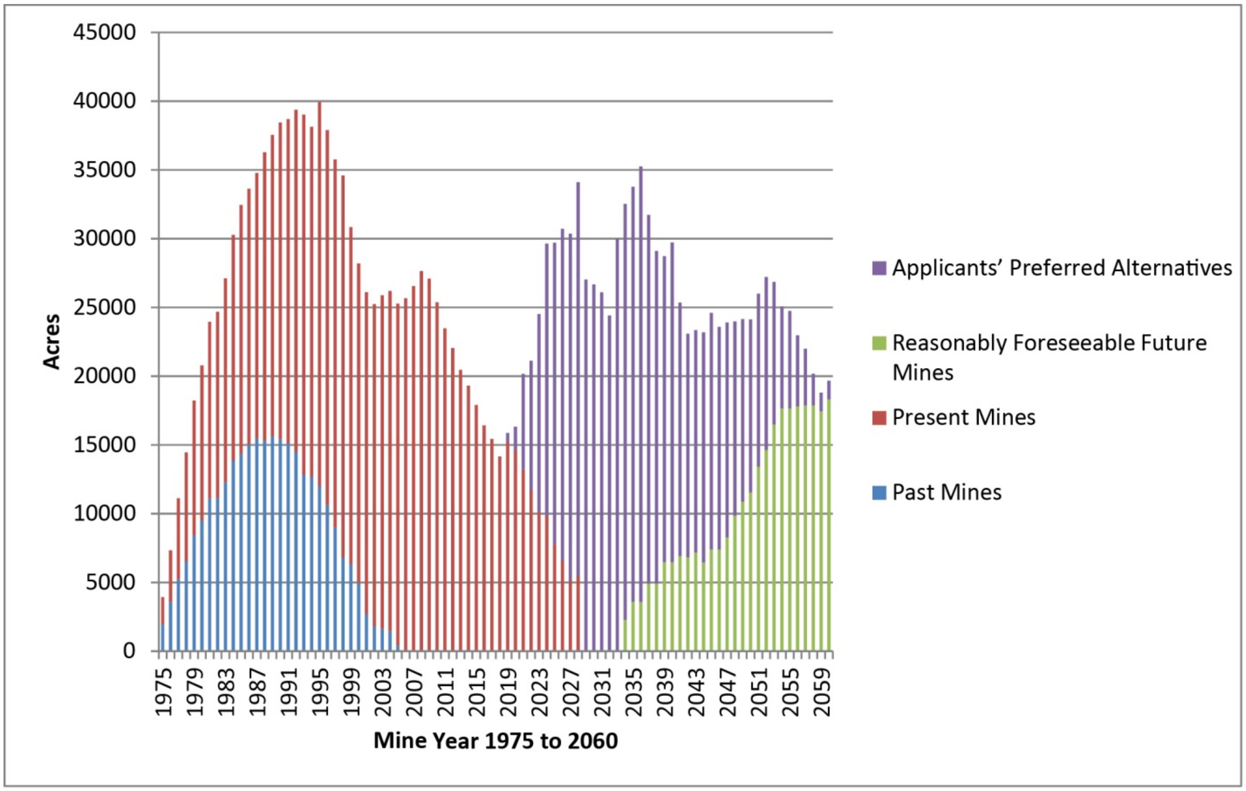



**Figure 4-24. Phosphate Lands Mined and Not Yet Reclaimed**

Other land development projects within the subject watersheds will no doubt also occur during these time frames. While no specific information is available which could be used to define precise acreages, it is reasonable to view the rate of land use change over time leading up to 2010, the current baseline year used for most of this AEIS, and to project what the future changes will likely consist of. Other reviews of change over time also are useful for informing agency decisions regarding what the future may hold, and where applicable these have been reviewed and referenced.

**Surface Water Resources**

Florida law (Chapter 373.042, Florida Statutes) requires the state water management districts to establish Minimum Flows and Levels (MFLs) for aquifers, surface watercourses, and other surface water bodies to identify the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. SWFWMD has been developing MFLs for prioritized water bodies within its jurisdictional area; the status of MFL development for rivers within the AEIS study area is reviewed in detail in Chapter 3. Additional future withdrawals of surface water or near-surface groundwater from all users will be evaluated by the SWFWMD to ensure compliance with water recovery goals in these watersheds. Future demand for water must be supplied by some combination of projects that will develop surface water, reclaimed water, and brackish groundwater, and through non-agricultural water conservation (SWFWMD, 2010b). Essentially, if water deliveries are impacted cumulatively by land development practices leading to reduced flows during critical seasons, the water management district's MFL guidelines would be implemented to reverse such impacts.

In 2004, SWFWMD published its comprehensive analysis entitled "Florida River Flow Patterns and the Atlantic Multidecadal Oscillation." In this report, SWFWMD researchers compared Peace River flow records to those of other rivers in Florida. SWFWMD concluded that a principal cause of reduced flows in the Peace River is the effect of the Atlantic Multidecadal Oscillation on rainfall patterns rather than phosphate mining or other anthropogenic activities. This 20- to 40-year step-function cycle has affected conclusions related to surface water declines in west-central Florida. As discussed in Section 4.1.8.3, long-term climate change impacts to the precipitation in this region are expected to be small on average, although variability in precipitation would increase. The record of rainfall in the region is already highly variable (Appendix G, Attachment A) so natural biota are adapted to a wide range of flow patterns.

In the upper Peace River segment between Bartow and Fort Meade, where flow declines are most significant, SWFWMD has concluded the principal anthropogenic contribution is reductions in the potentiometric (confining) surface of the Floridan aquifer combined with stream flow losses through karst features. In an article published in February 2010, USGS stated:

> "The progressive, long-term decline of stream flow in the upper Peace River began as early as the 1950s, with intensive groundwater withdrawals for phosphate mining. In 1975, when groundwater use for phosphate-mining processes was at its maximum, groundwater levels were as much as 50 feet below the riverbed elevation along the upper Peace River. Since then, there has been a reduction in the use of groundwater for mining processing, and aquifer levels have risen."

In the Myakka River watershed, significant declining trends in flows in the Myakka River have not been documented (SWFWMD, 2005b). During the course of this AEIS, review of the documentation regarding the SWFWMD MFLs program occurred. The review confirmed that MFL development for the Manatee River was scheduled for 2012. MFL development for the Little Manatee River by SWFWMD is underway; a draft report on proposed MFL criteria was released in November 2011. MFLs have been developed for at least some reaches of both the Peace and Myakka Rivers. Development of MFLs confirms that the SWFWMD is working toward defining levels that will trigger management efforts or recovery strategies to achieve compliance with ecologically focused flow metrics.

**Groundwater Resources**

The AEIS study area includes three hydrostratigraphic units:

- The Surficial Aquifer System (SAS)

- The Intermediate Aquifer System / Intermediate Confining Unit (IAS/ICU)
- The Floridan Aquifer System (FAS), including the Upper Floridan Aquifer (UFA)

These aquifers have been described as "…not uniformly permeable throughout their thickness. Each aquifer contains zones of higher permeability (flow zones) that are partially separated from one another by semi-confining, lower permeability zones. The aquifers are also hydrologically separated from each other by confining beds that strongly restrict movement between the aquifers" (SWFWMD, 1993). Despite these confining beds which help differentiate the three aquifers from each other, there is vertical water movement through the system, with recharge of the SAS by infiltration of rainfall accumulated on the land surface, and variable interaction between the SAS and the underlying aquifers depending on the geological formation characteristics and prevailing pressure gradients within a given area.

Land use changes and surface water management actions affecting the interactions between surface waters and the water table can lead to surficial aquifer drawdown impacts, which in the extreme can translate to impacts to associated wetlands and streams should the drawdowns reduce groundwater contributions to the surface water systems. Changes to these surface and groundwater system interactions can occur because of water supply well systems of potable water users, agriculture, or industry, and in fact have been a source of historic problems in the upper Peace River and adjacent areas where karst geologic formations provide ready connections for such impacts to be experienced. To varying degrees, such interactions can translate to effects on the intermediate aquifer and/or to the Upper Floridan aquifer.

The Upper Floridan aquifer is a principal source of water in the SWFWMD used for major industrial, mining, public supply, domestic use, and agricultural irrigation (SWFWMD, 2009b). Other withdrawals include use of the pumped water to support brackish water desalination in some coastal communities. Historical heavy reliance on the FAS to support these water supply uses by all of the user categories listed above resulted in substantial cumulative aquifer level drawdown in the northern Peace River watershed and adjacent areas within the overall AEIS study area in central Florida. In this subwatershed of the Peace River system, and adjacent land areas, karst geologic features are prominent and FAS drawdown contributed to impacts on surface water bodies in the form of decreases in lake levels, spring discharges, and groundwater contributions to Peace River baseflows.

Along the Gulf Coast, FAS drawdown impacts led to increased magnitude and spatial extent of saltwater intrusion into the freshwater portions of the aquifer, and increasing risk of permanent impacts to the usability of coastal water supply wellfields. To address this, a Most Impacted Area (MIA) was defined along the coastal portion of this study area where the cumulative effects in terms of saltwater intrusion have been the greatest to date, and where the risk of further impacts is also the highest without effective reversal of FAS water level drawdown in this area.

Today, Floridan aquifer water levels in the Upper Peace River watershed have recovered substantially from the levels observed in the 1960s and 1970s which were as much as 50 feet below the Peace River bed elevation. By 2007, potentiometric surface maps indicate UFA water levels remain about 30 feet below the upper Peace River bed elevation suggesting nearly 20 feet of recovery (Metz and Lewelling, 2009). Reduced reliance on the UFA for water supply by the phosphate mining industry has contributed to this recovery. Further water level recovery in the Upper Peace River watershed has occurred as a result of the progressive movement of active mining centers to the south in the CFPD. UFA pumping in this area has less effect on the SAS because the two aquifer systems have greater hydraulic separation due to the presence and thickness of the IAS. However, heavy reliance on the UFA for agricultural irrigation and freeze protection continues, as do large withdrawals to support public water supply.

As a result of investigations by SWFWMD and other governmental agencies, the Southern Water Use Caution Area (SWUCA) was defined as a geographic region in need of focused strategies for reversal of the historical cumulative groundwater drawdown impacts. As described elsewhere in this AEIS, the SWUCA Recovery Strategy was developed and implemented to manage collective efforts toward that goal.

As described by SWFWMD in a 2002 report on saltwater intrusion (SWFWMD, 2002b):

> "Major uses of ground water have historically been for agricultural irrigation and mining of phosphate ore. Locations of agricultural withdrawals tend to be distributed throughout the basin, whereas, phosphate mining has been concentrated in the areas of southeast Hillsborough, southwest Polk and northern Hardee counties. Since the 1970s, there has been a shift in water use from the mining industry to other water use types in other areas of the basin. As described in Beach et al (2002b), the 1990s was a period of water level recovery in the northern portion of the basin and continued water level decline in southern portions of the basin. This, in large part, was due to the migration of agriculture into the area. Decreased water use in the northern portion of the basin was largely due to increased water conservation practices by the phosphate mining industry since the 1970s and other changes within the industry that occurred."

Table 4-110 summarizes the FAS water use allocations in permits issued by SWFWMD, as of 2009; these values were reported in the water management district's estimated water use report for that year completed in June 2011 (SWFWMD, 2011b). Agricultural allocations represented 57.4 percent of the total allocations within the SWUCA planning area. The aggregate of all public water supply users represented 22.3 percent of the total. The industrial/commercial and mining/dewatering categories represented 8.1 and 8.5 percent of the total, respectively. Recreational/aesthetic water users (golf courses, parks, etc.) represented the smallest user group at 3.8 percent of the total. While actual water usage totals are variable depending on the interaction of factors such as antecedent rainfall, variations in market conditions affecting industrial/commercial/mining operational levels, and varying population levels and use of conservation methods, these relative allocation levels generally reflect the historical usage relationships between the user categories.

| Table 4-110. 2009 FAS Water Allocations for All Water User Categories in the SWUCA | | |
|---|---|---|
| **Water Use Category** | **2009 FAS Water Use Allocation, in mgd** | **% of Total Allocations** |
| Agriculture | 575 | 57.4% |
| Industrial/Commercial | 81 | 8.1% |
| Mining/Dewatering | 85 | 8.5% |
| Public Supply | 223 | 22.3% |
| Recreational/Aesthetic | 38 | 3.8% |
| Totals | 1,002 | 100.0% |
| (Source: SWFWMD, 2011b) | | |

From a water management district-wide perspective, review of historical usage trends compared to the 2009 FAS allocations demonstrates the relative relationships between allocations and actual usage. From 2001 through 2009, actual water use from the FAS for the various user categories has been relatively consistent for the agricultural, industrial/commercial, public supply, and recreational/aesthetic user categories (Table 4-111). The collective mining/dewatering user category use has shown a decreasing trend over this time period.

| Table 4-111. Comparison of 2009 FAS Water Allocations and Historical Water Use for All Water User Categories District-Wide | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Category** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2009 Total** |
| | **Reported Pumpage (mgd)** | | | | | | | | | **2009 Total Permitted Quantity for All Permits (mgd)** |
| Agriculture | 318 | 273 | 227 | 246 | 199 | 298 | 273 | 240 | 291 | 773 |
| Industrial/Commercial | 66 | 69 | 64 | 55 | 51 | 61 | 57 | 57 | 57 | 160 |
| Mining/Dewatering | 65 | 47 | 58 | 64 | 46 | 37 | 45 | 37 | 31 | 103 |
| Public Supply | 503 | 497 | 481 | 513 | 562 | 522 | 472 | 492 | 522 | 771 |
| Recreational/Aesthetic | 32 | 32 | 28 | 33 | 28 | 37 | 33 | 30 | 33 | 124 |
| **District Total** | **984** | **918** | **859** | **912** | **886** | **955** | **880** | **857** | **933** | **1,930** |
| Source: SWFWMD, 2011b | | | | | | | | | | |

Impacts on the FAS associated with historical phosphate mining-related water withdrawals within the CFPD have been substantially reduced compared to the types of impacts which occurred in the 1970s and 1980s. Phosphate mining operations continue to use the UFA to provide supplemental water to meet mine recirculation functions. However, the industry has increased its reliance on surface water runoff capture and storage/reuse in the mine capture area in the ditch and berm perimeter of the active mines as a water source. As a result, routine reliance on UFA withdrawals has been significantly reduced compared to the water consumption rates documented for the industry prior to the 1990s.

**Surface Water Quality**

Change in land uses can contribute to altered runoff quality as well as quantity. Agricultural activities can modify surface runoff quality in a number of ways. Use of fertilizers to promote cultivation productivity can lead to elevated levels of nutrients and various minerals during runoff contributions to local and regional streams and rivers. Further, one phenomenon that has been documented within the subwatersheds of the Peace River is elevation of dissolved solids and related parameters in waters draining from watersheds within which agricultural irrigation is practiced using Floridan aquifer wells as a water supply (PBS&J, 2007). The elevated dissolved solids collect in waters running off of the irrigated lands, and have been shown to contribute to cumulative impacts of water quality degradation in the applicable watersheds.

Historically, phosphate mine surface water discharges have contributed to elevated concentrations of some parameters, including dissolved solids and related parameters. Since 1970, phosphate mine operators have made three changes in the mining and reclamation process that have beneficially improved water quality in the receiving streams:

- Eliminating the use of ammonia in the ore separation (i.e., beneficiation) process, thereby reducing the nutrient (nitrogen) load in any water discharged
- Increasing the water re-use rate, principally to address the hydrologic alterations discussed below, with the secondary benefit of reduced effluent volumes and loadings being released to the receiving streams
- Installing sharp-crested weirs instead of discharge canals, which results in aeration at the point of discharge and increased DO levels downstream

In addition, improved floatation process control technology provides not only improved ore recovery and economic efficiency, but also water quality benefits as measured in units of flotation reagents applied per ton of phosphate rock recovered.

FDEP and SWFWMD, through their collective efforts as described in the Peace River Watershed Studies and SWFWMD Peace River Watershed Initiatives, have collaborated to develop a comprehensive water quality restoration program for the Upper Peace River watershed in response to agricultural, urban, and historic phosphate mining land uses combining to create an impaired waterway. WRAP restoration actions currently being undertaken by FDEP and SWFWMD include: Lake Hancock Water Quality Treatment Project; Peace Creek Restoration Program; and Upper Peace River/Saddle Creek Restoration Project (SWFWMD, 2013).

Together with the flow restoration programs described below and the FDEP TMDL program implementation, these efforts can reasonably be expected to mitigate the historical water quality impacts associated with anthropogenic activities, including phosphate mining, in the Upper Peace River watershed. Similar water quality improvement initiatives implemented regionally will improved water quality in the other watersheds as well.

Water quality in the Myakka River is generally considered good, although a variety of human activities have impacted the river. As a result, areas of the river are classified as having only “fair” water quality. An increase in loadings of the nutrients nitrogen and phosphorus remains the greatest potential threat to water quality. SWFWMD has undertaken the Myakka River Watershed Initiative to develop and implement a strategy to restore the environmental damage that has occurred in the watershed. The initiative is designed to ultimately restore water quality and natural systems, and address floodplain impacts in the watershed in ways that can also provide a benefit to water supplies in the SWUCA.

The effects on water quality of evolving NNC as related to phosphate mining in the CFPD are described in Sections 3.3.3 and 4.4.2.1, and in Appendix D.

**Ecological Resources (Wetlands/Waters and Upland Habitat)**

A review of change in wetlands coverage within the Peace River and Myakka River watersheds was conducted using land use coverage data for 1990, 1999, and 2009. Table 4-112 summarizes these records of change in wetland coverage. Substantive increased areal coverage of wetland cover categories in the year 2009 for both the Myakka and Peace River watersheds when compared with the corresponding estimates for 1990 and 1999 are not readily explained, but it is possible that at least some of this increase may be associated with more intensive reclamation or habitat creation as mitigation for wetland losses within the subject basins.

**Table 4-112. Wetlands Acreage in Peace and Myakka River Watersheds, 1990, 1999, and 2009**

| Watershed | 1990 | 1999 | 2009 |
|---|---|---|---|
| Myakka | 82,190 | 82,039 | 86,701 |
| Peace | 248,117 | 245,638 | 298,998 |
| **Totals** | **330,307** | **327,677** | **385,699** |

Source: SWFWMD, 2009a

Table 4-109 provides additional information on land use changes within the Peace River and Myakka River watersheds that relates back to wetlands and upland habitat.

Information on historical impacts to the aquatic ecosystem that may be, at least in part, attributable to phosphate mining from FDEP's and SWFWMD's PRCIS is provided above in this section.

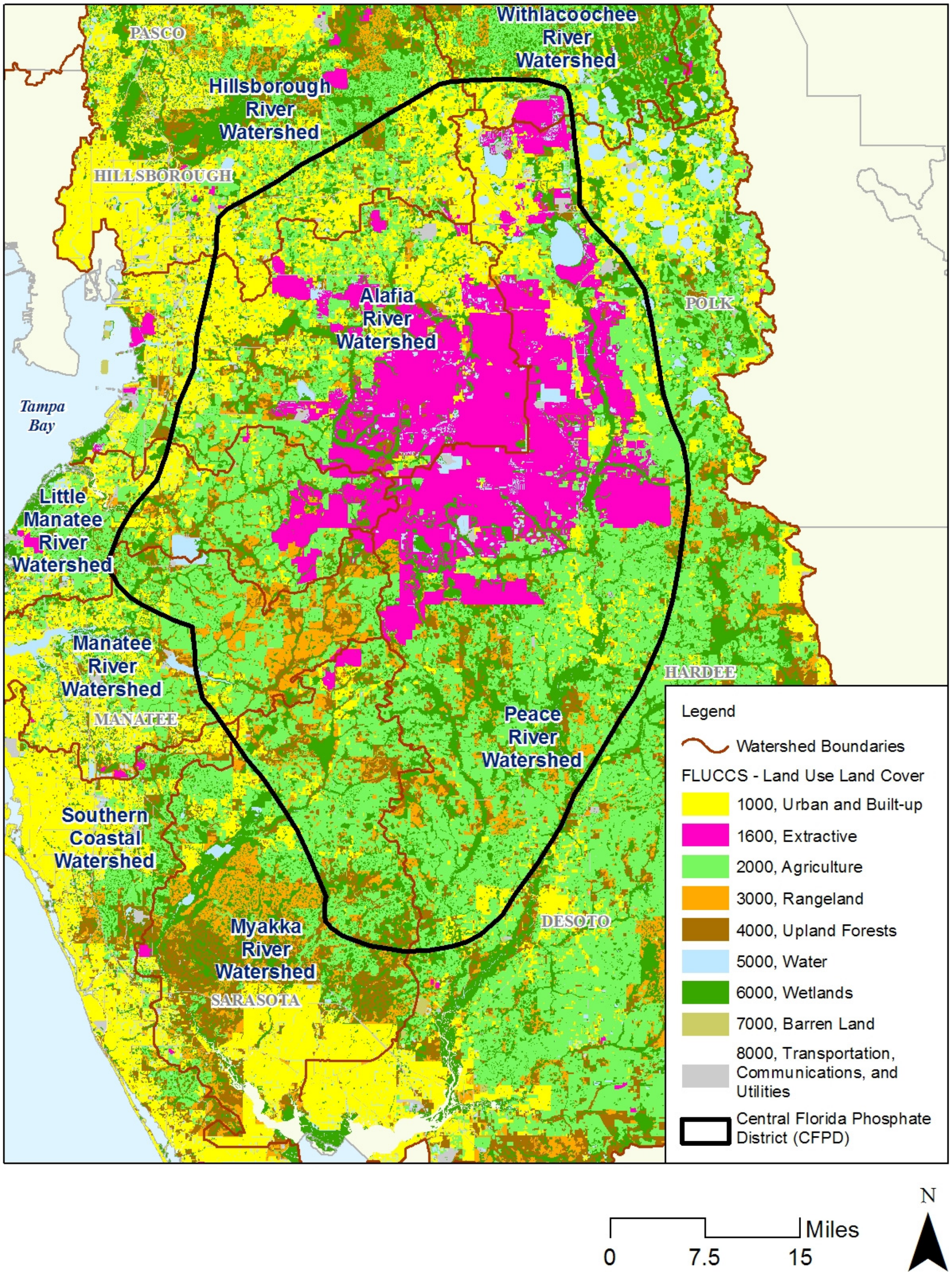
**Economic Resources**

Regional influences on the economy within the AEIS study area counties are reflected in the SWFWMD's land use coverage database summarized for 2009 in Figure 4-25. Phosphate mining has had a major influence on the economies of Hillsborough, Polk, Hardee, and Manatee Counties. Similarly, agricultural land uses are prevalent throughout the study area, with much of the lands currently categorized as extractive slated to be returned to low intensity agricultural production in the form of pastureland. Lands within the southern extension of the CFPD are strongly dominated by agricultural land use categories.

Employment within the region is reflective of the land use patterns. In a study conducted by the University of Florida's Institute of Food and Agricultural Sciences, it was concluded that there were a total of 428,087 agriculture-related jobs within the AEIS study area counties, and that collectively the revenue generated by agriculture-based industries totaled nearly $26 billion (UF-IFAS, 2009).

Urban land uses are most prevalent within the study area along the Gulf Coast and to the north generally aligned between the Tampa – Orlando corridor. Particularly along the coastal corridor, tourism is a substantive driver behind the local economy, and accordingly a high level of emphasis is awarded to protection of the environment against the cumulative effects of land conversion from natural land uses to those associated with agriculture, mining or other industrial activities, and urban or residential development. Environmental quality is a key factor in promoting seasonal or shorter-term tourism-based economic productivity.

Evaluations regarding the potential impacts of the Applicants' Preferred Alternatives, as well as continued agricultural production and associated indirect or induced effects of these two major economic drivers, are included in the baseline analysis of economic conditions without any new phosphate mines being developed on the subject properties. Under this projection, existing agricultural activities on the lands within the study area counties are presumed to continue, and the existing phosphate mines currently permitted would continue operations through to their depletion of mineable reserves.




*Note: Extractive lands in this FLUCCS data set includes reclaimed lands and therefore underestimates actual post-mining lands returned to other uses.*

**Figure 4-25. 2009 Land Use Information for the AEIS Study Area**

The economic conditions associated with this future scenario are addressed in this cumulative effects analysis, and they represent the cumulative effects to date of these major economic drivers on the regional economy. The evaluations reflect the cumulative land use changes and associated economic production from all past actions as summarized through the 2010 baseline condition. The "without new phosphate mines" analyses characterize the predicted county and regional economic conditions against which the future predicted conditions may be compared. Application of the IMPLAN model addresses the relative influence of all supporting industries associated with both agriculture and phosphate mining, and the induced economic productivity resulting regionally as all elements of the economy interact over the period of the analysis conducted, which in this case included predictions out through 2060.

#### 4.12.1.6 Cumulative Effects

This section describes the cumulative cause and effect relationships between the four current mining actions and the two reasonably foreseeable mining actions, plus other past mining actions and other past, present, and reasonably foreseeable non-mining actions, on the significant resource categories identified above in Section 4.12.1. Each of the following subsections will also provide a determination of the magnitude and significance of the potential cumulative impacts (as determined by the resource-specific analyses), the potential mitigation measures for avoiding, minimizing, and offsetting the cumulative impacts, and potential adaptive management and monitoring procedures that may be applicable to each resource category.

### 4.12.2 Surface Water Resources

The geographic scope of the surface water resource cumulative impact analysis was described above in Section 4.2. The cumulative effects of past actions were considered as part of the baseline conditions. The discharge records for USGS flow gages in the CFPD reflect the net balance of rainfall-generated runoff from natural lands and that from lands affected by the past development of urban, agricultural, industrial, commercial, mining, recreational uses, and other facilities or infrastructure in the study area.

The analysis of the cumulative effects of present and reasonably foreseeable future actions on surface water resources considered predicted land use changes through 2060, and how those changes might affect runoff coefficients and therefore cumulative surface water deliveries. Appendix J provides details on how this methodology was applied, including how it was applied to the current actions. Changes to future surface water withdrawals for public supply or other uses were not included in this analysis because any change to future surface water withdrawal for public supply would come under current allocations included in the MFL assessments. The analytical methods detailed in Appendix J were applied to quantify the flows for the individual alternatives.

Evaluations of the four current and two reasonably foreseeable mining actions quantified the likely reductions in subwatershed and watershed water deliveries to downstream reaches of the affected rivers and to the Charlotte Harbor estuary, as a result of the capture of rainfall in the mined areas. This additive effect was then considered along with the effects of the reasonably foreseeable land use changes to determine the cumulative effect. Although schedules would overlap, not all mines would operate concurrently; especially the Pioneer and Pine Level/Keys Tracts, which would foreseeably follow the completion of Ona and Desoto Mines, respectively. As in Section 4.2, the No Action Alternative is the estimated flow from the No Action, No Mining Alternative.

#### 4.12.2.1 Cumulative Effect on Horse Creek Subwatershed

The impacts from three of the current actions (Desoto Mine, Ona Mine, and South Pasture Extension Mine) and two reasonably foreseeable actions (Pioneer and Pine Level/Keys Tracts) that would operate with overlapping schedules in the Horse Creek subwatershed were calculated by summing the impacts from the individual alternatives. The analysis was conducted for wet and dry seasons during an average rainfall year and for wet and dry seasons during a low rainfall year based on all of the stormwater in the capture area (i.e., active mine blocks) being retained (100 percent capture) and based on half of the net stormwater in the capture area being retained (50 percent capture). To illustrate the potential typical effect on streamflow, an average rainfall of 50 in/yr was applied as the average annual rainfall for the Peace River watershed.

Table 4-113 presents the flow and percent change from 2009 average annual and seasonal flows during an average rainfall year with 100 percent capture of stormwater in the capture areas of the three current actions and two reasonably foreseeable actions in this subwatershed. Table 4-114 presents the flow and percent change from 2009 average annual and seasonal flows during an average rainfall year with 50 percent capture of stormwater in the capture areas of the three current actions and two reasonably foreseeable actions in this subwatershed. The maximum influence was predicted to occur around 2035 according to the capture analysis and flow results.

When considering the condition of 100 percent capture of stormwater in the mining capture area of the five mines, Horse Creek may have an annual average flow of approximately 174 cfs without the mines and approximately 142 cfs with the mines during an average annual rainfall conditions. This corresponds to a decrease in flow of approximately 32 cfs, or 18 percent below the No Action Alternative conditions; and a decrease in flow of approximately 29 cfs, or 17 percent of the calculated 2009 average annual flow of 171 cfs. When considering the 50 percent stormwater capture condition, the annual average flow in Horse Creek may be approximately 154 cfs with the mines during average annual rainfall conditions. This corresponds to a decrease in flow of approximately 20 cfs, or 11 percent below the No Action Alternative conditions; and a decrease in flow of approximately 17 cfs, or 10 percent below the calculated 2009 average annual flow.

The seasonal flows with 100 percent capture for an average rainfall year decreases by approximately 18 percent from the 2009 levels for the dry season and by 15 percent from 2009 levels for the wet season. This corresponds to an 18 percent decrease from the No Action Alternative for both the wet and dry seasons. However, by 2060 annual average flows approach the approximate levels predicted for 2009, with a 2 percent decrease for the dry season and a 1 percent increase for the wet season, but lower than the No Action Alternative by 4 percent (both dry and wet seasons).

The seasonal flows with 50 percent capture for an average rainfall year decrease by approximately 17 percent in the dry season and by approximately 8 percent in the wet season from 2009 levels. This corresponds to a 16 percent decrease from the No Action Alternative for the dry season and an 11 percent decrease for the wet season. However, by 2060 annual average flows start to approach the approximate levels predicted for 2009, with a 12 percent decrease for the dry season and a 1 percent decrease for the wet season, but lower than the No Action Alternative by 13 percent for the dry season and lower by 5 percent in the wet season. As described in Appendix G, the 50 percent capture analysis used a different method to compute runoff (excess precipitation) at the current actions and it varied from the runoff coefficient approach by about 3 cfs (average annual) for the No Action Alternative at South Pasture Extension Mine, and to a lesser extent at the other alternatives. This deviation is why the 50 percent capture analysis shows lower flows in the future than the 100 percent capture case--because the deviations are also additive. Regardless of the higher percent differences for the 50 percent capture case, the actual flow differences between capture amounts are small in magnitude when considering the natural flow variability and measurement precision.

**Table 4-113. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with Three Current Actions and Two Reasonably Foreseeable Actions in the Horse Creek Subwatershed**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 171 | 0% | 77 | 0% | 410 | 1% |
| 2030 | 147 | -14% | 66 | -15% | 353 | -13% |
| 2035 | 142 | -17% | 64 | -18% | 343 | -15% |
| 2040 | 151 | -12% | 68 | -13% | 363 | -10% |
| 2050 | 160 | -6% | 72 | -7% | 385 | -5% |
| 2060 | 169 | -1% | 76 | -2% | 406 | 1% |

| Table 4-114. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with Three Current Actions and Two Reasonably Foreseeable Actions in the Horse Creek Subwatershed | | | | | | |
|---|---|---|---|---|---|---|
| | **Annual Average Flow (cfs)** | **Annual Average Percent Change from 2009 Flows** | **Dry Season Average Flow (cfs)** | **Dry Season Average Percent Change from 2009 Flows** | **Wet Season Average Flow (cfs)** | **Wet Season Average Percent Change from 2009 Flows** |
| 2009 | 171 | 0% | 78 | 0% | 404 | 0% |
| 2020 | 166 | -3% | 68 | -12% | 398 | -2% |
| 2030 | 155 | -9% | 65 | -16% | 374 | -7% |
| 2035 | 154 | -10% | 65 | -17% | 371 | -8% |
| 2040 | 156 | -9% | 66 | -16% | 375 | -7% |
| 2050 | 161 | -6% | 67 | -14% | 389 | -4% |
| 2060 | 167 | -2% | 68 | -12% | 402 | -1% |

The same evaluation was performed for a low rainfall year. Low rainfall conditions were estimated as the 20th percentile of the annual rainfall totals for the period of record (i.e., 80 percent of the years had higher rainfall). For the Horse Creek cumulative analysis, this low rainfall calculation used 43 inches of rainfall per year. Table 4-115 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 percent capture of stormwater in the capture area of the three current actions and two reasonably foreseeable actions in the Horse Creek subwatershed. Table 4-116 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 50 percent capture of stormwater in the capture area of the three current actions and two reasonably foreseeable actions in the Horse Creek subwatershed. The maximum influence was predicted to occur around 2035 according to the capture analysis and flow results.

Similar to the average rainfall scenarios, based on land use changes in the subwatershed and upstream subwatersheds, when considering the condition of 100 percent capture of stormwater in the mining capture area of the five mines, Horse Creek may have an annual average flow of approximately 85 cfs without the mines and approximately 70 cfs with the mines during a low rainfall year. This corresponds to a decrease in flow of approximately 15 cfs, or 18 percent below the No Action Alternative conditions and a decrease in flow of approximately 14 cfs, or 17 percent of the calculated 2009 average annual flow of 84 cfs. When considering the 50 percent stormwater capture condition, the annual average flow in Horse Creek may be approximately 77 cfs with the mines during average rainfall conditions. This corresponds to a decrease in flow of approximately 8 cfs, or 8 percent below the No Action Alternative conditions and a decrease in flow of approximately 7 cfs, or 8 percent below the calculated 2009 average annual flow.

The seasonal flows with 100 percent capture for an average rainfall year decrease by approximately 18 percent from the 2009 levels for the dry season and by 15 percent from 2009 levels for the wet season. This corresponds to an 18 percent decrease from the No Action Alternative for both the wet and dry seasons. However, with the three current actions reclaimed by 2060, and only the two reasonably foreseeable actions continuing to operate, flows return to the approximate 2009 levels, which are 3 to 5 percent lower than the No Action Alternative.

The seasonal flows with 50 percent capture for an average rainfall year decreases by approximately 19 percent in the dry season and by approximately 7 percent in the wet season flow from 2009 levels. This corresponds to an 18 percent decrease from the No Action Alternative for the dry season and a 9 percent decrease for the wet season. By 2060 annual average flows start to approach the approximate levels predicted for 2009, with a 16 percent decrease for the dry season and a 1 percent increase for the wet season, but lower than the No Action Alternative by 16 percent for the dry season and lower by 3 percent in the wet season.

**Table 4-115. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Horse Creek Flow Station with Three Current Actions and Two Reasonably Foreseeable Actions in the Horse Creek Subwatershed**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 84 | 0% | 38 | 0% | 200 | 1% |
| 2030 | 72 | -14% | 32 | -15% | 172 | -13% |
| 2035 | 70 | -17% | 31 | -18% | 168 | -15% |
| 2040 | 74 | -12% | 33 | -13% | 178 | -10% |
| 2050 | 79 | -6% | 35 | -7% | 189 | -5% |
| 2060 | 83 | -1% | 37 | -2% | 200 | 1% |

**Table 4-116. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Horse Creek Flow Station with Three Current Actions and Two Reasonably Foreseeable Actions in the Horse Creek Subwatershed**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 84 | 0% | 38 | 0% | 199 | 0% |
| 2020 | 84 | 0% | 32 | -16% | 201 | 1% |
| 2030 | 77 | -8% | 31 | -20% | 186 | -6% |
| 2035 | 77 | -8% | 31 | -19% | 186 | -7% |
| 2040 | 78 | -7% | 31 | -18% | 188 | -5% |
| 2050 | 81 | -4% | 31 | -17% | 195 | -2% |
| 2060 | 84 | 0% | 32 | -16% | 202 | 1% |

#### 4.12.2.2 Cumulative Effect on Peace River at Arcadia Subwatershed

The impact from three current actions (Desoto Mine, Ona Mine, and South Pasture Extension Mine) and one reasonably foreseeable action (Pioneer Tract) was calculated by evaluating the cumulative effects on the runoff coefficients in the Peace River at Arcadia subwatershed using the same process used for Horse Creek. The analysis was conducted for wet and dry seasons during an average rainfall year and for wet and dry seasons during a low rainfall year based on all of the runoff in the capture area being captured (100 percent capture) and based on half of the runoff in the capture area being captured (50 percent capture). Site A-2 also contributes runoff in this subwatershed, but it is much further upstream (not directly in the Peace River at Arcadia subwatershed) and is not considered a reasonably foreseeable project, although it is a potential alternative. To illustrate the potential impacts on streamflow, an average rainfall of 50 in/yr was applied as the average annual rainfall for the Peace River watershed.

Table 4-117 presents the flow and percent change from 2009 average annual and seasonal flows during an average rainfall year with 100 percent capture of stormwater in the capture areas of the three current actions and one reasonably foreseeable action in this watershed. Table 4-118 presents the flow and percent change from 2009 average annual and seasonal flows during an average rainfall year with 50 percent capture of stormwater in the capture areas of the three current actions and one foreseeable action in this watershed. The maximum influence was predicted to occur around 2065 according to the capture analysis, so the 2060 values are compared.

When considering the condition of 100 percent capture of stormwater in the mining capture area of the four mines, Peace River at Arcadia subwatershed may have an annual average flow of approximately 783 cfs without the mines and approximately 777 cfs with the mines by 2060 during an annual average rainfall conditions. This corresponds to a decrease in flow of up to 6 cfs, or about one percent below the No Action Alternative conditions; and an increase in flow of up to 64 cfs, or 9 percent of the calculated 2009 average annual flow of 713 cfs. When considering the 50 percent stormwater capture condition, the annual average flow in Peace River at Arcadia subwatershed is expected to be similar to the 100 percent capture simulation. When considering the three current actions and one foreseeable action in the Peace River at Arcadia subwatershed, projected land use changes in this subwatershed and upstream subwatersheds outweigh the impact of mining and result in an overall increase in flow. The change as compared to the No Action Alternative observed in the wet and dry season calculations for average rainfall conditions with mining in the Peace River at Arcadia subwatershed for either a 100 or 50 percent capture area is insubstantial, less than 1 percent decrease in flow for annual and both seasons.

**Table 4-117. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with Three Current Actions and One Reasonably Foreseeable Action in Peace River at Arcadia**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 726 | 2% | 332 | 1% | 1,701 | 3% |
| 2030 | 735 | 3% | 334 | 2% | 1,735 | 5% |
| 2040 | 750 | 5% | 340 | 4% | 1,779 | 7% |
| 2050 | 769 | 8% | 348 | 6% | 1,820 | 10% |
| 2060 | 777 | 9% | 352 | 7% | 1,846 | 11% |

**Table 4-118. Projected Flows and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with Three Current Actions and One Reasonably Foreseeable Action in Peace River at Arcadia**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 713 | 0% | 328 | 0% | 1,657 | 0% |
| 2020 | 724 | 2% | 331 | 1% | 1,696 | 2% |
| 2030 | 734 | 3% | 334 | 2% | 1,733 | 5% |
| 2040 | 751 | 5% | 341 | 4% | 1,777 | 7% |
| 2050 | 768 | 8% | 349 | 7% | 1,818 | 10% |
| 2060 | 777 | 9% | 353 | 8% | 1,846 | 11% |

The same evaluation was performed for a low rainfall year (43 inches per year). Table 4-119 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 percent capture of stormwater in the capture area of the three current actions and one reasonably foreseeable action in the Peace River at Arcadia subwatershed. Table 4-120 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 50 percent capture of stormwater in the capture area of the three current actions and one foreseeable action in the Peace River at Arcadia subwatershed. The maximum influence was predicted to occur just after 2060 according to the capture analysis and flow results.

Similar to the average rainfall scenarios, based on projected land use changes in the subwatershed and upstream subwatersheds, annual average flow increases by approximately 9 percent by 2060, dry season flow increases by approximately 8 percent, and wet season flow increases by approximately 12 percent from 2009 levels. The changes as compared to the No Action Alternative annual or for the wet and dry season calculations for low rainfall conditions with mining in the Peace River at Arcadia subwatershed for either a 100 or 50 percent capture area are insubstantial.

**Table 4-119. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture at the Peace River at Arcadia Flow Station with Three Current Actions and One Reasonably Foreseeable Action in Peace River at Arcadia**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 336 | 2% | 154 | 1% | 787 | 3% |
| 2030 | 341 | 3% | 155 | 2% | 804 | 5% |
| 2040 | 348 | 5% | 158 | 4% | 825 | 8% |
| 2050 | 356 | 8% | 162 | 6% | 845 | 10% |
| 2060 | 361 | 9% | 163 | 8% | 856 | 12% |

**Table 4-120. Projected Flows and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture at the Peace River at Arcadia Flow Station with Three Current Actions and One Reasonably Foreseeable Action in Peace River at Arcadia**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 330 | 0% | 152 | 0% | 766 | 0% |
| 2020 | 335 | 2% | 154 | 1% | 784 | 2% |
| 2030 | 340 | 3% | 155 | 2% | 802 | 5% |
| 2040 | 348 | 6% | 159 | 4% | 823 | 8% |
| 2050 | 356 | 8% | 162 | 7% | 843 | 10% |
| 2060 | 361 | 9% | 164 | 8% | 855 | 12% |

#### 4.12.2.3 Cumulative Effect on Upper Myakka River and Lower Myakka/Big Slough Subwatersheds

The Wingate East Mine is the only mine in the Upper Myakka River subwatershed being included in the cumulative effect analysis. The Ona Mine had an insignificant overlap over the watershed boundary. The direct and indirect effects of the Wingate East Mine on the Upper Myakka River subwatershed are described in Section 4.2 above. This analysis takes into account past actions (in the baseline) and other present and reasonably foreseeable actions (in the consideration of those other actions' effects on surface water flows). Therefore, that analysis may also be considered as the cumulative effects analysis for surface water resources in the Upper Myakka River subwatershed alone.

The Pine Level/Keys Tract is the only offsite alternative proposed in the Lower Myakka/Big Slough subwatershed (the Desoto Mine had an insignificant overlap over the watershed boundary), which is a subset of the Lower Myakka River subwatershed. The direct and indirect effects of the Pine Level/Keys Tract as an independent, offsite alternative on this subwatershed are described in Section 4.2 above. This analysis takes into account past actions (in the baseline) and other present and reasonably foreseeable actions (in the consideration of those other actions' effects on surface water flows). Therefore, that analysis may also be considered the cumulative effects analysis for surface water resources in the Lower Myakka/Big Slough subwatershed alone.

Because these two Myakka River subwatersheds and the Peace River subwatersheds flow into Charlotte Harbor, reduction in flows in these subwatersheds may have a cumulative effect on Charlotte Harbor. Therefore, cumulative effects of the current action (Wingate East Mine) and the reasonably foreseeable action (Pine Level/Keys Tract) on the Myakka River watershed and Charlotte Harbor are considered below.

#### 4.12.2.4 Cumulative Effect on Charlotte Harbor

The deliveries of flow to the upper Charlotte Harbor estuary from both the Peace River and Myakka River watersheds were projected by applying the runoff coefficient approach to the river watersheds at subwatersheds defined primarily by USGS monitoring stations. The flows from these rivers are not the only contributors to Charlotte Harbor;  there are some additional contributing uplands downstream of these gages that also contribute flow to the estuary. The flow listed in this subsection is therefore not an estimate of the total flow, but only the flow from those freshwater sources that are discussed in the analysis: the Peace River subwatersheds, including the following primary subwatersheds: Peace River at Arcadia (and contributing areas upstream), Horse Creek, Joshua Creek, and Prairie Creek (includes Shell Creek), and the Myakka River subwatersheds, including the following primary subwatersheds: Lower Myakka River (with the Big Slough Basin) and Upper Myakka River subwatershed (USGS gage near Sarasota). The lower Charlotte Harbor estuary area (near Fort Myers) is more heavily influenced by the Caloosahatchee River and is not included here because it is not in the surface water impacts expected in the AEIS. Consequently, the flows presented here are estimates of "most" of the flow from the respective watershed. Percent changes reported are only for the areas contributing to the estuary in the computations as represented in Table 4-7 for an average rainfall year and Table 4-10 for a low rainfall year.

The impacts to flow from the four current actions and the two reasonably foreseeable actions were estimated by summing the capture areas for the subwatershed. This assessment was applied for cases of 100 percent capture of stormwater in the mine capture areas and for 50 percent capture of stormwater in the mine capture areas. Estimates were performed seasonally and for annual average flows for average rainfall conditions and for low rainfall conditions.

Table 4-121 presents the total of the Myakka River and Peace River subwatersheds estimated (i.e., most of these watersheds' area) contributions to the upper Charlotte Harbor estuary and percent change from 2009 annual and average seasonal flows for the 100 percent capture of stormwater under average annual rainfall conditions. Table 4-122 presents the total of the Myakka River and Peace River subwatersheds estimated contributions to the upper Charlotte Harbor estuary and percent change from 2009 annual average and seasonal flows for the 50 percent capture of stormwater under average annual rainfall conditions. The maximum influence was predicted to occur between 2030 and 2040 according to the capture analysis.

When considering the condition of 100 percent capture of stormwater in the mining capture area of the four current actions and the two reasonably foreseeable actions, flow to the upper Charlotte Harbor may have an annual average flow from 1,858 to 1,892 cfs without the mines and approximately 1,825 and 1,851 with the mines during annual average rainfall conditions. This corresponds to a decrease in flow of approximately 33 to 41 cfs, or about 2 percent below the No Action Alternative conditions and an increase in flow of approximately 31 to 57 cfs, or 3 percent of the calculated 2009 average annual flow of 1,794 cfs. Even when considering the four current actions and the two reasonably foreseeable actions in the Myakka and Peace River watersheds, projected land use changes in these watersheds result in increases in flow to the upper Charlotte Harbor that exceed the conservatively calculated negative effects caused by mining. By 2060, most of the four current actions would be reclaimed. The projected flows by 2060 on average increase by 7 percent, less than a 2 percent difference from the No Action Alternative.

When considering the 50 percent stormwater capture condition, the annual average flow from the combined basin to the upper Charlotte Harbor may be approximately 1,836 to 1,864 cfs with the mines during average rainfall conditions. This corresponds to an increase in flow of approximately 2 to 4 percent from 2009 conditions.

Dry season flows for both 100 and 50 percent capture areas increase by approximately 3 percent, and wet season flow increases between approximately 3 and 5 percent when compared to 2009 levels. The change as compared to the No Action Alternative annual or for the wet and dry season calculations for average rainfall conditions with mining in the upper Charlotte Harbor for either a 100 or 50 percent capture area are insubstantial (less than 1 or 2 percent).

| Table 4-121. Projected Contributions to the Charlotte Harbor Estuary and Percent Change from 2009 Flows during Average Rainfall Year and 100 Percent Capture with All Four Current Actions and the Two Foreseeable Actions in the Myakka and Peace River Watersheds | | | | | | |
|---|---|---|---|---|---|---|
| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
| 2009 | 1,794 | 0% | 747 | 0% | 3,884 | 0% |
| 2020 | 1,827 | 2% | 760 | 2% | 3,976 | 2% |
| 2030 | 1,825 | 2% | 758 | 2% | 3,984 | 3% |
| 2040 | 1,851 | 3% | 768 | 3% | 4,043 | 4% |
| 2050 | 1,895 | 6% | 788 | 5% | 4,145 | 7% |
| 2060 | 1,921 | 7% | 800 | 7% | 4,205 | 8% |

| Table 4-122. Projected Contributions to the Charlotte Harbor Estuary and Percent Change from 2009 Flows during Average Rainfall Year and 50 Percent Capture with All Four Current Actions and the Two Foreseeable Actions in the Myakka and Peace River Watersheds | | | | | | |
|---|---|---|---|---|---|---|
| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
| 2009 | 1,794 | 0% | 747 | 0% | 3,884 | 0% |
| 2020 | 1,821 | 2% | 750 | 1% | 3,958 | 2% |
| 2030 | 1,836 | 2% | 758 | 2% | 4,008 | 3% |
| 2040 | 1,864 | 4% | 771 | 3% | 4,072 | 5% |
| 2050 | 1,903 | 6% | 788 | 5% | 4,164 | 7% |
| 2060 | 1,928 | 7% | 798 | 7% | 4,223 | 9% |

The same evaluation was performed for a low rainfall year. Table 4-123 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 100 percent capture of stormwater in the capture area of the four current actions and the two foreseeable actions in the Myakka and Peace River watersheds. Table 4-124 presents the flow and percent change from 2009 average annual and seasonal flows during a low rainfall year with 50 percent capture of stormwater in the capture area of the four current actions and the two foreseeable actions in the Myakka and Peace River watersheds. The maximum influence was predicted to occur between 2030 and 2040 according to the capture analysis.

Similar to the average rainfall scenarios, based on land use changes in the subwatershed and upstream subwatersheds, annual average flow increases by approximately up to 4 percent during the period from 2030 to 2040, dry season flow increases by up to 3 percent, and wet season flow increases by approximately up to 5 percent from 2009 levels. By 2060, the projected annual average flow increases by 7 percent, with an increase of 7 percent in the dry season and an increase of 9 percent in the wet season when compared to 2009 flows. The change as compared to the No Action Alternative calculations for low rainfall conditions during annual, wet season, and dry season with mining in the upper Charlotte Harbor, for either a 100 or 50 percent capture area, are insubstantial (2.5 percent or less). As in the average rainfall analysis, the projected changes in land use have a far larger positive effect on flow than the negative effect that might be caused by the mining.

**Table 4-123. Projected Contributions to the Charlotte Harbor Estuary and Percent Change from 2009 Flows during Low Rainfall Year and 100 Percent Capture with All Four Current Actions and the Two Foreseeable Actions in the Myakka and Peace River Watersheds**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 1,116 | 0% | 451 | 0% | 2,354 | 0% |
| 2020 | 1,136 | 2% | 459 | 2% | 2,408 | 2% |
| 2030 | 1,139 | 2% | 460 | 2% | 2,420 | 3% |
| 2040 | 1,151 | 3% | 465 | 3% | 2,446 | 4% |
| 2050 | 1,177 | 5% | 476 | 6% | 2,505 | 6% |
| 2060 | 1,190 | 7% | 484 | 7% | 2,535 | 8% |

**Table 4-124. Projected Contributions to the Charlotte Harbor Estuary and Percent Change from 2009 Flows during Low Rainfall Year and 50 Percent Capture with All Four Current Actions and the Two Foreseeable Actions in the Myakka and Peace River Watersheds**

| | Annual Average Flow (cfs) | Annual Average Percent Change from 2009 Flows | Dry Season Average Flow (cfs) | Dry Season Average Percent Change from 2009 Flows | Wet Season Average Flow (cfs) | Wet Season Average Percent Change from 2009 Flows |
|---|---|---|---|---|---|---|
| 2009 | 1,116 | 0% | 451 | 0% | 2,354 | 0% |
| 2020 | 1,134 | 2% | 453 | 0% | 2,404 | 2% |
| 2030 | 1,145 | 3% | 459 | 1% | 2,434 | 3% |
| 2040 | 1,161 | 4% | 466 | 3% | 2,470 | 5% |
| 2050 | 1,184 | 6% | 476 | 5% | 2,523 | 7% |
| 2060 | 1,198 | 7% | 481 | 7% | 2,555 | 9% |

#### 4.12.2.5 Cumulative Impacts on Water Supply Withdrawals in the Lower Peace and Myakka Rivers

This AEIS includes a relative estimate of the extent to which surface water flows might be reduced during low flow days for regional water supply wells by using observed data (see Appendix G, Section 6.0 for additional details). The Peace River Manasota Regional Water Supply Authority (PRMRWSA) has the only public water supply freshwater withdrawal (intake) in the Lower Peace River subwatershed (south of the Zolfo Springs gage). The PRMRWSA intake is near the downstream end of the Peace River, before the salinity in the estuary influences the water quality to a point that may affect treatment requirements.

The PRMRWSA withdrawal is limited to higher flow rates and the utility has an aboveground reservoir and aquifer storage-recovery system (a type of underground reservoir) to extend their supply through dry periods. The SWFWMD determined from an empirical analysis that a low flow threshold of 130 cfs for the sum of the monitored flows at three USGS gages (Peace River at Arcadia, Joshua Creek at Nocatee, and Horse Creek near Arcadia) would maintain freshwater at the PRMRWSA treatment plant intake location. The PRMRWSA withdrawal rate is based on a percentage of the previous day's flow and the pumping rate cannot exceed the difference between the sum of the monitored flow less the 130 cfs MFL. According to the SWFWMD Regional Water Supply Plan (SWFWMD, 2010b), the Peace River at the PRMRWSA plant has available water about 320 days per year, with a range between 152 and 365 days per year. SWFWMD listed the current permit average annual limit as 32.8 mgd or 50.7 cfs, but only about 14.9 mgd (23.1 cfs) is being used.

Several limitations affect evaluation of the future effects. These limitations include:

- The high variability in flows and weather
- The fact that existing active mining area is not increasing
- The uncertainty associated with projections of future land uses

By using observed data, no allowance is provided for existing effects of surface water captured at the current mine operations. Effects from existing mines on flows are considered minor because the utility already deals with them in their design; It is possible that reductions could a reflection of other practices such as irrigation use and agricultural return flow (PBS&J, 2007). Depending on the period of record used in the AEIS analysis of observed data (Appendix G), the average number of days when water could not be withdrawn at the PRMRWSA intake under current water withdrawal scenarios ranged from 35 to 77 days per year.

The AEIS estimates the maximum potential impact of the current and foreseeable actions by reducing the total observed flow record by 3.8 percent, which is the is the maximum amount of contributing land south of Zolfo Springs, adjusted for southern proximity. The result of this reduction indicates that the number of days water is not available at the PRMRWSA intake increases by about 2 to 5 additional days per year if the current actions were operating with 100 percent capture of stormwater. This also corresponds to about a 1.3 percent reduction in the volume available to be withdrawn when the PRMRWSA current permit withdrawal schedule is applied.

The observed data include some existing mining impact in the flow, and the total area projected to be mined in the future remains about the same. However, the surface water delivery to PRMRWSA's withdrawal point from the southern tributaries is expected to be higher than in the more northern reaches of the Peace River watershed; about 22 percent higher than an unweighted area-based average. Therefore, while it is possible that a greater relative effect could occur as the area being mined moves further south in the Lower Peace River watershed. The portion of the reduction that could be attributed to the southerly location would be small (about 22 percent of the maximum of 5 days attributed to the southerly location, or a 1 day per year increase).

Despite the difficulty in discerning changes to low flows in the record, given the variability of potential low flow days and ignoring the potential for increased surface water from land use changes, this analysis indicates that the maximum impact (100 percent capture) by the current and reasonably foreseeable actions would be small (2 to 5 days, or less). The SWFWMD reported in its 2010 water supply plan that there is substantial available water (about 80 mgd) in the Peace River (SWFWMD, 2011c) if enough storage can be developed to accommodate the extraction during periods of high flows for use in the drier periods. The expected effect of land use changes on surface water delivery is predicted to increase by the time of maximum mining disturbance (2030 to 2040) by 1 to 4 percent over the existing 2009 annual dry season flow. The future flow analysis included the capture of surface water, so the change in land uses would likely offset measureable changes in the number of low flow days from the current actions. Additional baseflow may be available for water users as the groundwater table recovers in the future.

The City of North Port water supply facility is the only permitted public water supply surface water withdrawal in the Myakka River watershed. North Port can withdraw surface water from Myakkahatchee Creek and the Cocoplum Waterway, but Myakkahatchee Creek is the primary water source (near U.S. 41) with the Cocoplum Waterway used only as a back-up source (SWFWMD, 2011c). North Port's facility is linked to the water supply system of the PRMRWSA and the City can receive treated potable water from the PRMRWSA or transfer treated water to PRMRWSA. During times of low flow, the City discontinues withdrawals from Myakkahatchee Creek because of reduced water quality (sulfates) in the creek and receives treated water from the PRMRWSA. The City's withdrawals from Myakkahatchee Creek cannot exceed an annual average rate of 4.4 mgd and a peak month average rate of 6.6 mgd, which are equivalent to flow rates of 6.8 and 10.2 cfs, respectively. The City's 2006 permit required that maximum daily withdrawal rates be linked to the rate of flow in the creek. Daily withdrawals cannot exceed 2.08 mgd (3.2 cfs) when flows at the diversion structure are less than 10 cfs, 4 mgd (6.2 cfs) when flows are between 10 cfs and 30 cfs, and 6 mgd (9.3 cfs) when flows are greater than 30 cfs.

There is no MFL for Myakkahatchee Creek because of a lack of historical monitoring data. For practical purposes, the threshold low flow limit for North Port's intake is 10 cfs. As predicted earlier (Section 4.2.1), the low rainfall year (lowest 20$^{th}$ percentile) estimated average annual flow on the order of 176 cfs with a dry season flow around 100 cfs. The potential impact from a conceptual mine plan for the Pine Level/Keys Tract offsite alternative was about 5 to 6 cfs, so the flow impacts here are expected to be minor. However, because of the lack of observed data, MFLs, and mine plans, there is greater uncertainty about potential impacts at this location.

#### 4.12.2.6 Surface Water Resources: Cumulative Impact Magnitude and Significance

Cumulative adverse impacts were predicted for the four subwatersheds where the four current and the two reasonably foreseeable actions are located: Peace River at Arcadia, Horse Creek, Upper Myakka River, and Big Slough. The Upper Myakka River subwatershed impacts were assessed previously in Section 4.2 and are not discussed again here because there are no reasonably foreseeable actions in this subwatershed that would be additive to that assessment.

For Peace River at Arcadia, there is no significant reduction of flow identified through cumulative effects analysis, although the maximum reduction in annual flow, if it were to occur, would be expected to occur in 2060 under average annual rainfall conditions, with 100 percent capture. However, the maximum reduction was estimated to be up to 12 cfs out of 1,858 cfs under the No Action Alternative with either the 100 or 50 percent capture in the wet season of an average rainfall year. At less than 1 percent change, this is an inconsequential change. The decrease in flow rates falls within the error range for this analysis, which is based on an extremely variable parameter (rainfall). The cumulative effects in the Peace River at Arcadia subwatershed are minor to no effect and are considered insignificant.

For Horse Creek, the maximum reduction in annual flow occurs in 2035 under average annual rainfall conditions with 100 percent capture. The average annual flow is predicted to be approximately 142 cfs, or 18 percent, below the predicted flow of 174 cfs without mining. A similar percent decrease was predicted for both 50 percent and 100 percent capture of stormwater of the three current and two reasonably foreseeable actions. When compared to the No Action Alternative, a consistent reduction of approximately 18 percent is seen for the 100 percent capture area for almost all categories regardless of the season (average annual, dry season, and wet season) and independent of whether annual average rainfall or low rainfall is used. Reducing the capture area does not appear to affect the dry season effects much, but does reduce the impacts during the wet season.

The reduction in flows in Horse Creek may be indicative of a change at the Horse Creek subwatershed level; therefore, the effect cannot be considered minor. For a major effect, there must be an extended effect on surface water flows at least at the subwatershed level that also leads to a violation of the MFLs for the subwatershed. Even though the potential reductions are two orders of significant figures, the natural variability of flow is also large. There are no SWFWMD MFLs established for Horse Creek to which flow reductions can be compared. For this reason (no contribution to a violation of MFLs for Horse Creek and a change in streamflow rates that falls in the expected error range), the effect on surface water flows in Horse Creek cannot be considered to have a major effect as defined above. The apparent reduction in flows is indicative of a change beyond the boundaries of the mine in the Horse Creek subwatershed even though the degree may be in the realm of natural variation. Therefore, the cumulative effects would be moderate without mitigation in the Horse Creek subwatershed, which is expected to be significant.

For Big Slough, the maximum reduction in annual flow occurs in 2055, when the Pine Level/Keys Tract was considered as an independent alternative. The average annual flow is predicted to decrease up to 7 percent in 2055 from the average annual flow as well as from the seasonal flows with a 100 percent capture area regardless of the rainfall levels. If the Pine Level/Keys Tract is implemented later in time, then this impact would be delayed also. Because of the uncertainties associated with this action and this subwatershed, future land use growth was not estimated; therefore, it is possible that there may be future land use changes that affect future runoff values. The decrease in flow rates falls within the error range for this analysis based on rainfall, an extremely variable parameter. The reduction in flows in the Lower Myakka/Big Slough subwatershed may be indicative of a change at the Lower Myakka/Big Slough subwatershed level; therefore, the effect cannot be considered minor. For a major effect, there must be an extended effect on surface water flows at least at the subwatershed level that also leads to a violation of the MFLs for the subwatershed. In addition to the potential reductions being within one order of significant figures, there are no SWFWMD MFLs established for the Lower Myakka/Big Slough subwatershed to which flow reductions can be compared. For this reason (no contribution to a violation of MFLs for the Lower Myakka/Big Slough subwatershed and a change in streamflow rates that falls within the expected error range), the effect on surface water flows in the Lower Myakka/Big Slough subwatershed cannot be considered to have a major effect. The apparent reduction in flows is indicative of a change beyond the boundaries of the mine within the Lower Myakka/Big Slough subwatershed even though the degree may be within the realm of natural variation. Therefore, the cumulative effects would be moderate without mitigation in the Lower Myakka/Big Slough subwatershed. Given the moderate level of an effect for this mine within the watershed, the effect is expected to be significant.

Possible measures that would reduce the degree of a moderate effect, mitigate the intensity factors, and potentially make the effect not significant include recharge ditches and wells to maintain baseflows in Horse Creek and Big Slough and their tributaries, or reducing the capture area. There are also monitoring programs and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to Horse Creek or Big Slough, the Applicants would need to address those impacts.

The four current actions and the two reasonably foreseeable actions, considered along with land use changes associated with other past, present, and reasonably foreseeable actions, will not affect Peace and Myakka River discharge volumes sufficiently to reduce existing flows to Charlotte Harbor and, therefore, are not expected to negatively affect the salinity regimes in the tidal portions of these rivers or the Charlotte Harbor estuary. The watershed-level water systems are rainfall-driven, and short-term seasonal and annual rainfall variability results in highly variable flow conditions. SWFWMD has evaluated salinity and habitat conditions as part of its MFL studies and determined that 16 percent of the water in the Peace River could be withdrawn for water supply (SWFWMD, 2011c). All differences calculated for the four current actions and the two reasonably foreseeable actions were small in magnitude at the watershed level. Future land use changes resulting from urbanization or agricultural use are expected to cause an increase in surface water delivery when compared to the baseline condition. This increase will outweigh the effects of mining, especially at the most downstream reaches of the two rivers' watersheds. The cumulative impact of the four current actions and the two reasonably foreseeable actions on surface water resources at the watershed and Charlotte Harbor level would not be significant.

The cumulative effect of mining on water supply withdrawals for the local water supply authorities is minor to no effect and is not considered significant.

#### 4.12.2.7 Surface Water Resources: Cumulative Impact Mitigation, Monitoring, and Adaptive Management

Based on the determination in the magnitude and significance section above, mitigation would be needed for the cumulative surface water impacts to the Horse Creek and Lower Myakka/Big Slough subwatersheds. Possible measures that would reduce the degree of a moderate effect, mitigate the intensity factors, and potentially make the effect not significant include recharge ditches and wells to maintain baseflow in Horse Creek and Big Slough and their tributaries or reducing the capture areas of mines. There are also monitoring programs and other provisions in FDEP mining permits. If it is determined through monitoring that there is an unanticipated impact to the creeks, the Applicants would need to address those impacts.

For Horse Creek, the mitigation required would be addressed as part of the Horse Creek Stewardship Program (HCSP), with focused monitoring and adaptive management actions developed under the auspices of an FDEP permit. Given the increased level of interest in Horse Creek, it is expected that changes could be implemented to avoid, minimize, or offset the predicted impacts.

Because of the relative size of the Pine Level/Keys Tract in the Lower Myakka/Big Slough subwatershed, the speculative nature of a mine plan for the parcel, and the lack of existing flow data for Big Slough, there is also uncertainty about what type of mitigation, monitoring, and adaptive management could be implemented. At a minimum, those measures typically identified for other mining operations can be considered.

### 4.12.3 Groundwater Resources

The geographic scope of the groundwater resource cumulative impact analysis is described above in Section 4.3. The cumulative impacts of all users on aquifer levels within the study area have resulted from the various combinations of water withdrawals from all user categories in the past. The current allocations, and the associated drawdown effects, represent the cumulative effects of all historical users as balanced against aquifer recovery over time due to greater regulatory controls imposed by SWFWMD coupled with the above types of conservation and water management strategy development over time. As detailed elsewhere in this chapter, the baseline condition reflecting the current allocations to all users reflects the worst-case quantification of the cumulative effects to date of all such water users that have relied on the FAS for water supply purposes.

The quantitative analysis of the cumulative effects of present actions on groundwater resources included predicted Floridan aquifer withdrawals for the existing phosphate mines, for the four current actions, and for other groundwater users. The quantitative analysis considered reasonably foreseeable actions associated with other groundwater users. The methods applied are outlined in Appendix J and specific details provided in Appendix F.

The two reasonably foreseeable mining actions were not considered in the quantitative analysis due to the lack of available information. The cumulative effects of these two actions will be considered qualitatively.

Annual projected UFA drought year demands were provided by the Applicants for the existing and proposed projects, as shown in Appendix J, Tables 1 and 2. Using these drought year withdrawal rates for steady-state modeling is a highly conservative approach; these model scenarios represent worst-case conditions that are highly unlikely to occur. It is more likely that these rates would be used for a few months during the dry season, with withdrawals returning to a more normal annual rate thereafter.

Three of the existing mines (Four Corners, Hookers Prairie, and South Fort Meade) and one of the current actions (Ona) also have permitted flexible withdrawal rate limits that exceed the drought year aquifer demand. These pumping rates would occur only for short time periods, most likely several days or a few weeks. If one mine pumps at the flexible rate limits, the remaining operating (Mosaic) mines have to reduce their pumping so that the total pumping for all of the mines does not exceed the sum of their drought year annual average pumping rate. Alternative pumping scenarios were developed to evaluate possible combinations of a flexible pumping rate at one mine and reduced pumping rates at the other mines.

The FAS water allocations associated with the existing mines and the four current actions are summarized as follows:

- Four Corners Mine – FAS water use at the existing Four Corners Mine is projected to be up to a drought year annual average of 15.6 mgd through the end of active mining in 2019. The Four Corners Mine also has a flexible permit withdrawal limit of 20 mgd. Scenarios 2015B and 2019B show the impacts of the Four Corners Mine using its flexible permit withdrawal limit and the other Mosaic owned operating mines adjusting their pumpage so that the total withdrawal does not exceed the sum of the drought year withdrawal for all operating mines.

- Hookers Prairie Mine – The Hookers Prairie Mine is an existing mine that is projected to withdraw a drought year annual average of 4.2 mgd through the end of mining in 2014.

- Hopewell Mine – The existing Hopewell Mine is projected to use a drought year annual average of up to 0.5 mgd through 2015.

- Ona Mine – The proposed Ona Mine is expected to withdraw up to a drought year annual average of 11.9 mgd beginning in 2020. It is assumed that active mining will continue through approximately 2048. The Ona Mine is the only current action that includes new FAS withdrawal locations and allocations beyond the current levels of water supply for phosphate mining in the CFPD. The Ona Mine has a flexible permit withdrawal limit of 15 mgd. Scenarios 2020B, 2025B, 2036B, and 2047B show the impacts of Ona Mine using its flexible permit withdrawal limit and the other Mosaic owned operating mines adjusting their pumpage so that the total withdrawal does not exceed the sum of the drought year withdrawal for all operating mines.

- Desoto Mine – The proposed Desoto Mine is expected to operate for 15 years beginning in 2021, and withdraw groundwater from the FAS at a drought year annual average rate of up to 10.7 mgd. It was assumed for this analysis that water demands during reclamation would be equivalent to those during active mining. FAS groundwater for the Desoto Mine would be provided by pumpage of existing wells at the Fort Green facility and conveyance via pipeline to the Desoto Mine location. No new supply wells would be constructed to support this new mine.

- South Fort Meade Mine – The existing South Fort Meade Mine is projected to withdraw groundwater from the FAS at a drought year annual average rate of 11.3 mgd through 2020. The South Fort Meade Mine also has a flexible permit withdrawal rate limit of 15.4 mgd. Scenarios 2015C, 2019C, and 2020B show the impacts of the South Fort Meade Mine using its flexible permit withdrawal limit and the other Mosaic owned mines adjusting their pumpage so that the total withdrawal does not exceed the sum of the drought year withdrawal for all operating mines.

- Wingate Creek/Wingate East – The existing Wingate Creek Mine and the proposed Wingate East mine would withdraw FAS groundwater at a rate of up to a drought year annual average of 5.8 mgd for 36 years through 2046.

- South Pasture/South Pasture Extension – The South Pasture/South Pasture Extension Mine combined would withdraw FAS groundwater up to its SWFWMD-permitted drought year annual average rate of 6.39 mgd through 2037.

Appendix J, Table 2 summarizes the simulated withdrawal rates for the currently operating and proposed mines that will operate through 2050. Highlighted rows indicate years for which model simulations were run and output was generated. The monthly peaking factors used in transient modeling (discussed later in this section) are provided at the bottom of the table. On the basis of these annual average allocations and the projected operational periods of all of the existing and projected phosphate mines, the maximal mining usage of the FAS would occur in the period ranging from approximately 2010 to 2019. Thus, from a worst-case (most conservative) perspective, the simulations for the 2015 and 2019 periods represent the maximal cumulative effects analyses. By 2025, only the four current actions would be operating. By 2036, only three of these projects would remain in operation. By 2047, only one of the current actions would remain in operation. These simulations provide perspectives on the relative influence of each of these current actions on SAS, IAS, and UFA water level changes.

#### 4.12.3.1 2015 Scenarios: Effects from 2010 to 2015

In all 2015 scenarios, agricultural pumping is reduced to 93 percent of the 2010 rates, in line with the SWUCA recovery strategy.

In Scenario 2015A, Four Corners Mine will continue to operate at its 2010 drought year pumping rate of 15.6 mgd; Hookers Prairie Mine will cease operating; and Hopewell, South Fort Meade, Wingate, and South Pasture Mines will continue pumping at their 2010 drought year rates of 0.5, 11.3, 5.8, and 6.39 mgd, respectively.

In Scenario 2015B, Four Corners Mine will pump at its flexible permit rate limit of 20 mgd and South Fort Meade and Wingate Mines will pump slightly less, so that the sum of the Mosaic mines does not exceed the total drought year annual permit capacity of 37.4 mgd.

In Scenario 2015C, South Fort Meade Mine will pump at its flexible permit rate limit of 15.4 mgd and Four Corners Mine may pump slightly more, so that the sum of the Mosaic mines does not exceed the total drought year annual permit capacity of 37.4 mgd.

#### 4.12.3.2 2019 Scenarios: Effects from 2010 to 2019

In all 2019 scenarios, agricultural pumping is reduced to 90 percent of the 2010 rate, in line with the SWUCA recovery strategy.

In Scenario 2019A, Four Corners Mine will continue to operate at its 2010 rate of 15.6 mgd; Hookers Prairie and Hopewell Mines will cease operating; and South Fort Meade, Wingate, and South Pasture Mines, will continue pumping at their 2010 rates of 11.3, 5.8, and 6.39 mgd, respectively.

In Scenario 2019B, Four Corners Mine will pump at its flexible permit rate limit of 20 mgd and South Fort Meade Mine will pump slightly more, so that the sum of the Mosaic mines does not exceed the total drought year annual permit capacity of 37.4 mgd.

In Scenario 2019C, South Fort Meade Mine will pump at its flexible permit rate of 15.4 mgd and Four Corners Mine will use some of its flexible permit capacity, so that the sum of the Mosaic mines does not exceed the total drought year annual permit capacity of 37.4 mgd.

#### 4.12.3.3 2020 Scenarios: Effects from 2010 to 2020

In all 2020 scenarios, agricultural pumping is reduced to 89 percent of the 2010 rate, in line with the SWUCA recovery strategy.

In Scenario 2020A Four Corners, Hookers Prairie, and Hopewell Mines will cease operating; Ona Mine will pump at its permitted drought year withdrawal rate of 11.9 mgd; and South Fort Meade, Wingate East, and South Pasture Mines will continue pumping at their 2010 rates of 11.3, 5.8, and 6.39 mgd, respectively.

In Scenario 2020B, Ona and South Fort Meade Mines will pump at their flexible permit rate limits of 15 mgd and 15.4 mgd, respectively, which does not exceed the total drought year annual permit capacity of 36.2 mgd for the three Mosaic mines.

#### 4.12.3.4 2025 Scenarios: Effects from 2010 to 2025

In all 2025 scenarios, agricultural pumping is reduced by 50 mgd, in line with the SWUCA recovery strategy.

In Scenario 2025A, South Fort Meade Mine will cease operating; Desoto Mine will pump at its drought annual average rate of 10.7 mgd; and Ona, Wingate East, and South Pasture Mines will continue pumping at their drought year annual average rates of 11.9, 5.8, and 6.39 mgd, respectively.

In Scenario 2025B, Ona Mine will pump at its flexible permit rate of 15 mgd, while the other mines remain at their drought year annual rates.

#### 4.12.3.5 2036 Scenarios: Effects from 2010 to 2036

In all 2036 scenarios, agriculture pumping is maintained at 2025 levels, per the SWUCA recovery strategy.

In Scenario 2036A, Desoto Mine will cease operating and Ona, Wingate East, and South Pasture Mines will continue pumping at their drought year annual average rates of 11.9, 5.8, and 6.39 mgd, respectively.

In Scenario 2036B, Ona Mine will pump at its flexible permit rate limit of 15 mgd, while the other mines remain at their drought year annual pumpage rates.

#### 4.12.3.6 2047 Scenarios: Effects from 2010 to 2047

For the 2047 scenarios, agriculture withdrawals are maintained at their 2025 levels, per the SWUCA recovery strategy.

In Scenario 2047A, Wingate East and South Pasture Mines will cease operating and Ona Mine will continue pumping at the drought year annual average rate of 11.9 mgd.

In Scenario 2047B, Ona Mine will pump at its flexible permit rate limit of 15 mgd.

#### 4.12.3.7 2049 Scenarios: Effects from 2010 to 2049

For 2049, it is projected that all mines will have ceased operating.

#### 4.12.3.8 Aquifer Level Changes from Cumulative Effects

Tables 4-125 through 4-128 show the water level changes in each aquifer (SAS, IAS Zone 1, IAS Zone 2, and UFA) that result from the pumping by all users, including the agricultural withdrawal reduction and the mining withdrawals. The water level change is presented at each of the ROMP wells for each of the future years in the four aquifers, all compared to 2010 baseline water levels.

In Table 4-125, the water level change in the ROMP SAS wells is estimated to range from -0.16 to +2.68 feet for the non-flexible pumping model simulations. The range is -0.17 to + 2.27 feet for several of the flexible pumping “B” and “C” scenarios. These modeling results show that the current actions, cumulatively with other reasonably foreseeable non-mining actions, have a positive cumulative effect on the water level in the SAS.

The water level change in the ROMP IAS Zone 1 wells is estimated to range from +0.001 to + 4.26 feet for the non-flexible pumping model simulations. The range is +0.02 to + 3.44 feet for several of the flexible pumping “B” and “C” scenarios. IAS Zone 1 is not directly pumped, but reflects the changes in water level, mostly from pumping the UFA. These modeling results show that the current actions, cumulatively with other reasonably foreseeable non-mining actions, have a positive cumulative effect on the water level in the IAS Zone 1.

The water level change in the ROMP IAS Zone 2 wells is estimated to range from +0.11 to + 6.44 feet for the non-flexible pumping model simulations. The range is +0.05 to +5.09 feet for several of the flexible pumping “B” and “C” scenarios. IAS Zone 2 is not directly pumped, but reflects the changes in water level, mostly from pumping the UFA. These modeling results show that the current actions, cumulatively with other reasonably foreseeable non-mining actions, have a positive cumulative effect on the water level in the IAS Zone 2.

The water level change in the ROMP UFA wells is estimated to range from -0.82 to +9.32 feet for the non-flexible pumping model simulations. The range is -1.79 to +7.32 feet for several of the flexible pumping “B” and “C” scenarios. These ranges of water level change are small compared to the range of water level change that occurs seasonally in the UFA as described in Appendix F. These simulation results indicated that over the period of time addressed through these model runs, the relocation of a portion of the existing withdrawals from the FAS to meet the needs of the four current actions would result in minor changes in water level in the SAS, IAS Zones 1 and 2, and FAS compared to 2010 conditions. More detailed discussion regarding the groundwater modeling simulation results is provided in Appendix F.

The SWIMAL value is included at the bottom of Table 4-128 for each year evaluated. This value provides the predicted change in FAS water level in relation to 2010 conditions at each of the wells included in the SWIMAL. When all of the water level changes are considered for the non-flexible pumping model simulations, the water level ranges from a minimum of +0.58 to +3.40 feet higher than the 2010 value.

## Table 4-125. Simulated ROMP SAS Monitor Well Water Level Change Relative to 2010, Alternatives 2, 3, 4, and 5 (All Users with Agricultural Reduction)

| Well | SWIMAL weight[a] | All Users Simulated Water Level Change Relative to 2010 (ft) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015A | 2015B | 2015C | 2019A | 2019B | 2019C | 2020A | 2020B | 2025A | 2025B | 2036A | 2036B | 2047A | 2047B | 2049 |
| ENGLEWOOD 14 DEEP | NA | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP 10 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP 16 SURF AQ MONITOR | NA | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 |
| ROMP 19X SURF AQ MONITOR | NA | 0.02 | 0.01 | 0.02 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.05 | 0.04 | 0.06 | 0.05 | 0.07 | 0.07 | 0.09 |
| ROMP 28X SURF AQ MONITOR | NA | 0.03 | 0.02 | 0.02 | 0.05 | 0.04 | 0.04 | 0.05 | 0.04 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 |
| ROMP 30 SURF AQ MONITOR | NA | 0.03 | 0.02 | 0.02 | 0.05 | 0.04 | 0.04 | 0.03 | 0.00 | 0.06 | 0.05 | 0.08 | 0.07 | 0.11 | 0.10 | 0.15 |
| ROMP 32 HTRN AS MONITOR | NA | 0.01 | 0.01 | 0.01 | -0.16 | -0.17 | -0.16 | 0.55 | 0.53 | 0.37 | 0.36 | 1.45 | 1.44 | 1.78 | 1.77 | 1.27 |
| ROMP 35 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.20 | 0.31 | 0.31 | 0.00 | 0.00 | 0.01 |
| ROMP 40 SURF AQ MONITOR | NA | 0.11 | 0.00 | 0.07 | 0.15 | 0.05 | 0.10 | 0.38 | 0.30 | 0.20 | 0.16 | 0.54 | 0.50 | 0.74 | 0.70 | 0.89 |
| ROMP 43 SURF AQ MONITOR REPL | NA | 0.49 | 0.42 | 0.17 | 0.75 | 0.65 | 0.42 | 0.79 | 0.38 | 1.70 | 1.62 | 1.99 | 1.91 | 2.35 | 2.27 | 2.68 |
| ROMP 45.5 HTRN CU MONITOR | NA | 0.09 | 0.07 | 0.05 | 0.12 | 0.09 | 0.08 | 0.16 | 0.10 | 0.21 | 0.20 | 0.30 | 0.29 | 0.38 | 0.37 | 0.45 |
| ROMP 58 SURF AQ MONITOR | NA | 0.23 | 0.21 | 0.18 | 0.38 | 0.35 | 0.33 | 0.44 | 0.37 | 0.66 | 0.65 | 0.74 | 0.73 | 0.82 | 0.80 | 0.88 |
| ROMP 60X (PRIM SC06) SURF AQ MONITOR | NA | 0.43 | 0.27 | 0.26 | 0.59 | 0.41 | 0.41 | 0.89 | 0.67 | 1.02 | 0.95 | 1.43 | 1.36 | 1.73 | 1.67 | 1.96 |
| ROMP TR 10-2 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP TR 8-1 SURF AQ MONITOR | NA | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ROMP TR SA-1 SURF | NA | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 |

Notes:
[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculated simulated change in SWIMAL

## Table 4-126. Simulated ROMP IAS Zone 1 Target Water Level Change Relative to 2010, Alternatives 2, 3, 4, and 5 (All Users with Agricultural Reduction)

| Well | SWIMAL Weight[a] | All Users Simulated Water Level Change Relative to 2010 (ft) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015A | 2015B | 2015C | 2019A | 2019B | 2019C | 2020A | 2020B | 2025A | 2025B | 2036A | 2036B | 2047A | 2047B | 2049 |
| CL-3 HTRN AS MONITOR | NA | 0.36 | 0.31 | 0.19 | 0.56 | 0.50 | 0.39 | 0.63 | 0.42 | 1.18 | 1.14 | 1.35 | 1.31 | 1.54 | 1.50 | 1.70 |
| KUSHMER INT | NA | 0.09 | 0.04 | 0.07 | 0.15 | 0.10 | 0.13 | 0.26 | 0.24 | 0.30 | 0.29 | 0.37 | 0.35 | 0.44 | 0.43 | 0.50 |
| ROMP 10 U ARCA AQ MONITOR 2 | NA | 0.09 | 0.07 | 0.07 | 0.15 | 0.13 | 0.14 | 0.14 | 0.11 | 0.22 | 0.20 | 0.25 | 0.24 | 0.30 | 0.29 | 0.37 |
| ROMP 13 U ARCA AQ MONITOR | NA | 0.23 | 0.20 | 0.20 | 0.39 | 0.36 | 0.36 | 0.36 | 0.29 | 0.58 | 0.54 | 0.65 | 0.60 | 0.77 | 0.73 | 0.94 |
| ROMP 17 U ARCA AQ MONITOR | NA | 0.25 | 0.21 | 0.22 | 0.43 | 0.39 | 0.39 | 0.40 | 0.31 | 0.73 | 0.67 | 0.84 | 0.79 | 0.88 | 0.83 | 1.09 |
| ROMP 20 U ARCA AQ MONITOR | NA | 0.18 | 0.12 | 0.16 | 0.31 | 0.25 | 0.28 | 0.41 | 0.35 | 0.52 | 0.49 | 0.62 | 0.58 | 0.82 | 0.78 | 0.96 |
| ROMP 25 U ARCA AQ MONITOR | NA | 0.10 | 0.08 | 0.08 | 0.17 | 0.14 | 0.15 | 0.07 | 0.00 | 0.24 | 0.19 | 0.34 | 0.29 | 0.35 | 0.30 | 0.54 |
| ROMP 26 U ARCA AQ MONITOR | NA | 0.40 | 0.34 | 0.33 | 0.67 | 0.61 | 0.61 | 0.56 | 0.40 | 0.95 | 0.85 | 1.10 | 0.99 | 1.35 | 1.25 | 1.74 |
| ROMP 30 U ARCA AQ MONITOR | NA | 0.60 | 0.48 | 0.37 | 0.95 | 0.80 | 0.71 | 0.51 | 0.03 | 1.24 | 0.98 | 1.62 | 1.36 | 2.24 | 1.99 | 3.20 |
| ROMP 39 HTRN AS MONITOR | NA | 0.07 | 0.04 | 0.06 | 0.12 | 0.09 | 0.11 | 0.19 | 0.17 | 0.23 | 0.21 | 0.28 | 0.26 | 0.37 | 0.35 | 0.43 |
| ROMP 41 SURF AQ MONITOR | NA | 0.44 | 0.31 | 0.17 | 0.58 | 0.42 | 0.30 | 0.46 | 0.00 | 1.09 | 0.91 | 1.34 | 1.15 | 2.14 | 1.96 | 2.81 |
| ROMP 43 U ARCA AQ MONITOR | NA | 0.62 | 0.52 | 0.21 | 0.95 | 0.81 | 0.53 | 0.99 | 0.48 | 2.14 | 2.03 | 2.51 | 2.40 | 2.96 | 2.85 | 3.37 |
| ROMP 5 U ARCA AQ MONITOR | NA | 0.25 | 0.22 | 0.22 | 0.43 | 0.39 | 0.40 | 0.40 | 0.31 | 0.64 | 0.59 | 0.72 | 0.67 | 0.87 | 0.82 | 1.07 |
| ROMP 59 HTRN AS MONITOR 1 | NA | 0.61 | 0.41 | 0.36 | 0.83 | 0.60 | 0.56 | 1.21 | 0.86 | 1.49 | 1.38 | 2.13 | 2.02 | 2.65 | 2.55 | 3.06 |
| ROMP 8 U ARCA AQ MONITOR | NA | 0.16 | 0.12 | 0.14 | 0.27 | 0.23 | 0.25 | 0.29 | 0.24 | 0.42 | 0.39 | 0.49 | 0.46 | 0.62 | 0.59 | 0.75 |
| ROMP TR 7-2 U ARCA AQ MONITOR | NA | 0.02 | 0.01 | 0.01 | 0.03 | 0.02 | 0.02 | 0.04 | 0.03 | 0.05 | 0.04 | 0.06 | 0.05 | 0.07 | 0.07 | 0.09 |
| VERNA TEST 0-1 | NA | 0.73 | 0.45 | 0.64 | 1.24 | 0.95 | 1.12 | 1.72 | 1.47 | 2.12 | 1.95 | 2.60 | 2.42 | 3.61 | 3.44 | 4.26 |

Notes:
[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculated simulated change in SWIMAL

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**Table 4-127. Simulated ROMP IAS Zone 2 Target Water Level Change Relative to 2010, Alternatives 2, 3, 4, and 5 (All Users with Agricultural Reduction)**

| Well | SWIMAL Weight[a] | All Users Simulated Water Level Change Relative to 2010 (ft) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015A | 2015B | 2015C | 2019A | 2019B | 2019C | 2020A | 2020B | 2025A | 2025B | 2036A | 2036B | 2047A | 2047B | 2049 |
| CL-2 DEEP SURF AQ MONITOR | NA | 0.38 | 0.34 | 0.25 | 0.62 | 0.57 | 0.49 | 0.69 | 0.54 | 1.20 | 1.17 | 1.33 | 1.30 | 1.47 | 1.44 | 1.58 |
| FORT GREEN SPRINGS INT | NA | 1.14 | 0.68 | 0.64 | 1.50 | 0.99 | 0.95 | 2.17 | 1.40 | 1.86 | 1.58 | 3.95 | 3.67 | 5.37 | 5.09 | 6.44 |
| ROMP 12 U ARCA AQ MONITOR | NA | 0.30 | 0.26 | 0.26 | 0.51 | 0.47 | 0.47 | 0.47 | 0.37 | 0.76 | 0.70 | 0.85 | 0.79 | 1.02 | 0.96 | 1.26 |
| ROMP 14 L ARCA AQ MONITOR | NA | 0.07 | 0.07 | 0.07 | 0.13 | 0.12 | 0.12 | 0.12 | 0.10 | 0.20 | 0.19 | 0.21 | 0.20 | 0.25 | 0.24 | 0.29 |
| ROMP 16 L ARCA AQ MONITOR | NA | 0.33 | 0.29 | 0.29 | 0.57 | 0.53 | 0.52 | 0.51 | 0.40 | 0.84 | 0.77 | 0.95 | 0.88 | 1.14 | 1.07 | 1.42 |
| ROMP 26 L ARCA AQ MONITOR | NA | 0.40 | 0.34 | 0.33 | 0.67 | 0.61 | 0.61 | 0.56 | 0.40 | 0.95 | 0.85 | 1.10 | 0.99 | 1.35 | 1.25 | 1.73 |
| ROMP 28 HTRN | NA | 0.13 | 0.12 | 0.10 | 0.22 | 0.20 | 0.19 | 0.22 | 0.18 | 0.37 | 0.35 | 0.40 | 0.38 | 0.45 | 0.43 | 0.50 |
| ROMP 30 L ARCA AQ MONITOR | NA | 0.65 | 0.52 | 0.40 | 1.03 | 0.87 | 0.76 | 0.58 | 0.06 | 1.37 | 1.10 | 1.79 | 1.52 | 2.46 | 2.19 | 3.48 |
| ROMP 43 L ARCA AQ MONITOR | NA | 0.62 | 0.53 | 0.21 | 0.96 | 0.82 | 0.54 | 1.00 | 0.48 | 2.16 | 2.05 | 2.54 | 2.43 | 2.99 | 2.88 | 3.41 |
| ROMP 5 L ARCA AQ MONITOR | NA | 0.25 | 0.22 | 0.22 | 0.43 | 0.40 | 0.40 | 0.40 | 0.32 | 0.64 | 0.59 | 0.73 | 0.67 | 0.88 | 0.82 | 1.08 |
| ROMP 59 HTRN AS MONITOR 2 | NA | 0.69 | 0.46 | 0.41 | 0.94 | 0.68 | 0.63 | 1.37 | 0.98 | 1.68 | 1.56 | 2.41 | 2.29 | 3.00 | 2.88 | 3.46 |
| ROMP 9.5 L ARCA AQ MONITOR (MW-2) | NA | 0.32 | 0.28 | 0.28 | 0.56 | 0.50 | 0.51 | 0.53 | 0.42 | 0.83 | 0.76 | 0.94 | 0.87 | 1.15 | 1.09 | 1.42 |
| ROMP TR 1-2 L ARCA AQ MONITOR | NA | 0.06 | 0.05 | 0.06 | 0.11 | 0.10 | 0.10 | 0.10 | 0.08 | 0.16 | 0.15 | 0.19 | 0.17 | 0.23 | 0.21 | 0.28 |
| ROMP TR 3-1 L ARCA AQ MONITOR 2 | NA | 0.23 | 0.19 | 0.20 | 0.40 | 0.35 | 0.36 | 0.39 | 0.32 | 0.60 | 0.55 | 0.69 | 0.64 | 0.85 | 0.80 | 1.03 |
| ROMP TR 5-1 L ARCA AQ MONITOR | NA | 0.17 | 0.12 | 0.15 | 0.28 | 0.23 | 0.26 | 0.36 | 0.31 | 0.47 | 0.44 | 0.56 | 0.53 | 0.73 | 0.70 | 0.87 |
| ROMP TR 7-1 L ARCA AQ INTERFACE MONITOR | 8.84% | 0.29 | 0.18 | 0.26 | 0.50 | 0.38 | 0.45 | 0.74 | 0.66 | 0.91 | 0.86 | 1.09 | 1.03 | 1.42 | 1.36 | 1.63 |
| ROMP TR 9-2 L ARCA AQ MONITOR | NA | 0.11 | 0.06 | 0.10 | 0.19 | 0.13 | 0.17 | 0.33 | 0.30 | 0.38 | 0.36 | 0.46 | 0.44 | 0.56 | 0.54 | 0.63 |
| SARASOTA 9 DEEP | 8.66% | 0.55 | 0.35 | 0.49 | 0.94 | 0.73 | 0.85 | 1.31 | 1.13 | 1.63 | 1.51 | 1.96 | 1.85 | 2.64 | 2.52 | 3.09 |

Notes:
[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculated simulated change in SWIMAL

**Table 4-128. Simulated ROMP UFA Target Water Level Change Relative to 2010, Alternatives 2, 3, 4, and 5 (All Users with Agricultural Reduction) Layer 4**

| Well | SWIMAL Weight[a] | All Users Simulated Water Level Change Relative to 2010 (ft) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015A | 2015B | 2015C | 2019A | 2019B | 2019C | 2020A | 2020B | 2025A | 2025B | 2036A | 2036B | 2047A | 2047B | 2049 |
| COLEY DEEP | NA | 0.41 | 0.37 | 0.26 | 0.66 | 0.61 | 0.51 | 0.74 | 0.56 | 1.32 | 1.28 | 1.47 | 1.44 | 1.64 | 1.60 | 1.78 |
| FLORIDA POWER FLDN AT PINEY POINT | NA | 0.40 | 0.24 | 0.36 | 0.69 | 0.52 | 0.62 | 1.08 | 0.98 | 1.31 | 1.24 | 1.55 | 1.48 | 1.95 | 1.88 | 2.21 |
| KIBLER DEEP | 14.01% | 0.92 | 0.53 | 0.80 | 1.56 | 1.14 | 1.39 | 2.28 | 1.94 | 2.73 | 2.50 | 3.39 | 3.16 | 4.81 | 4.58 | 5.68 |
| LAKE ALFRED DEEP AT LAKE ALFRED | NA | 0.12 | 0.11 | 0.10 | 0.20 | 0.18 | 0.17 | 0.25 | 0.21 | 0.34 | 0.33 | 0.40 | 0.39 | 0.44 | 0.43 | 0.48 |
| ROMP 12 AVPK PZ MONITOR | NA | 0.30 | 0.26 | 0.26 | 0.51 | 0.47 | 0.47 | 0.47 | 0.37 | 0.76 | 0.70 | 0.85 | 0.79 | 1.03 | 0.96 | 1.26 |
| ROMP 123 HTRN AS/U FLDN AQ MONITOR | 9.55% | 0.90 | 0.22 | 0.75 | 1.49 | 0.78 | 1.25 | 3.38 | 3.05 | 3.59 | 3.40 | 4.49 | 4.30 | 5.54 | 5.35 | 6.27 |
| ROMP 13 AVPK PZ MONITOR | NA | 0.23 | 0.21 | 0.20 | 0.40 | 0.37 | 0.37 | 0.37 | 0.29 | 0.60 | 0.55 | 0.67 | 0.62 | 0.80 | 0.75 | 0.97 |
| ROMP 14 U FLDN AQ MONITOR (AVPK) | NA | 0.07 | 0.07 | 0.07 | 0.13 | 0.12 | 0.12 | 0.12 | 0.10 | 0.20 | 0.19 | 0.21 | 0.20 | 0.25 | 0.24 | 0.29 |
| ROMP 15 U FLDN AQ MONITOR MOD | NA | 0.34 | 0.30 | 0.29 | 0.58 | 0.54 | 0.53 | 0.52 | 0.41 | 0.86 | 0.79 | 0.96 | 0.89 | 1.14 | 1.08 | 1.40 |
| ROMP 17 U FLDN AQ MONITOR (AVPK) | NA | 0.34 | 0.29 | 0.30 | 0.59 | 0.53 | 0.54 | 0.54 | 0.42 | 0.86 | 0.79 | 0.98 | 0.91 | 1.19 | 1.12 | 1.48 |
| ROMP 19X U FLDN AQ MONITOR (SWNN) | NA | 0.35 | 0.28 | 0.31 | 0.61 | 0.53 | 0.56 | 0.65 | 0.53 | 0.94 | 0.86 | 1.09 | 1.01 | 1.39 | 1.32 | 1.68 |
| ROMP 20 U FLDN AQ MONITOR (OCAL) | NA | 0.27 | 0.18 | 0.24 | 0.46 | 0.37 | 0.42 | 0.60 | 0.52 | 0.77 | 0.72 | 0.92 | 0.86 | 1.21 | 1.16 | 1.42 |
| ROMP 25 U FLDN AQ MONITOR | NA | 0.84 | 0.60 | 0.72 | 1.41 | 1.16 | 1.27 | 1.15 | 0.70 | 1.72 | 1.39 | 2.23 | 1.89 | 3.36 | 3.02 | 4.63 |
| ROMP 28 AVPK | NA | 0.13 | 0.12 | 0.11 | 0.22 | 0.21 | 0.20 | 0.23 | 0.19 | 0.38 | 0.36 | 0.41 | 0.40 | 0.46 | 0.45 | 0.52 |
| ROMP 30 U FLDN AQ MONITOR | NA | 0.65 | 0.52 | 0.40 | 1.03 | 0.87 | 0.76 | 0.58 | 0.06 | 1.38 | 1.11 | 1.79 | 1.52 | 2.46 | 2.19 | 3.49 |
| ROMP 31 U FLDN AQ MONITOR | NA | 0.73 | 0.51 | 0.52 | 1.16 | 0.91 | 0.93 | -0.82 | -1.79 | -0.20 | -0.97 | 0.44 | -0.32 | 1.68 | 0.91 | 4.58 |
| ROMP 32 U FLDN AQ MONITOR (AVPK) | NA | 1.01 | 0.50 | 0.78 | 1.63 | 1.07 | 1.35 | 1.31 | 0.47 | 1.57 | 0.94 | 2.70 | 2.08 | 5.41 | 4.79 | 7.78 |

## Table 4-128. Simulated ROMP UFA Target Water Level Change Relative to 2010, Alternatives 2, 3, 4, and 5 (All Users with Agricultural Reduction) Layer 4

| Well | SWIMAL Weight[a] | All Users Simulated Water Level Change Relative to 2010 (ft) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015A | 2015B | 2015C | 2019A | 2019B | 2019C | 2020A | 2020B | 2025A | 2025B | 2036A | 2036B | 2047A | 2047B | 2049 |
| ROMP 39 AVPK PZ MONITOR | NA | 0.95 | 0.40 | 0.81 | 1.58 | 1.01 | 1.38 | 2.91 | 2.57 | 3.25 | 3.04 | 4.05 | 3.84 | 5.32 | 5.11 | 6.14 |
| ROMP 40 U FLDN AQ MONITOR | NA | 1.01 | -0.17 | 0.66 | 1.49 | 0.27 | 1.00 | 4.26 | 3.51 | 2.80 | 2.39 | 5.76 | 5.34 | 7.74 | 7.32 | 9.32 |
| ROMP 41 AVPK PZ MONITOR | NA | 1.11 | 0.80 | 0.41 | 1.52 | 1.12 | 0.78 | 1.52 | 0.48 | 2.72 | 2.37 | 3.95 | 3.60 | 5.53 | 5.19 | 6.83 |
| ROMP 43XX U FLDN AQ MONITOR | NA | 0.43 | 0.40 | 0.31 | 0.72 | 0.68 | 0.60 | 0.79 | 0.64 | 1.35 | 1.32 | 1.47 | 1.43 | 1.60 | 1.57 | 1.73 |
| ROMP 45 U FLDN AQ MONITOR (AVPK) | NA | 1.13 | 0.86 | 0.43 | 1.50 | 1.15 | 0.76 | 1.78 | 0.86 | 3.08 | 2.86 | 4.15 | 3.92 | 5.25 | 5.03 | 6.11 |
| ROMP 5 U FLDN AQ MONITOR (SWNN) | NA | 0.25 | 0.22 | 0.22 | 0.43 | 0.40 | 0.40 | 0.40 | 0.32 | 0.65 | 0.59 | 0.73 | 0.67 | 0.88 | 0.82 | 1.08 |
| ROMP 50 U FLDN AQ MONITOR (SWNN) | 13.25% | 0.70 | 0.32 | 0.60 | 1.18 | 0.79 | 1.04 | 2.19 | 1.98 | 2.48 | 2.36 | 3.01 | 2.89 | 3.71 | 3.58 | 4.17 |
| ROMP 57 U FLDN AQ MONITOR | NA | 0.40 | 0.35 | 0.28 | 0.63 | 0.56 | 0.51 | 0.75 | 0.59 | 1.16 | 1.12 | 1.34 | 1.31 | 1.53 | 1.49 | 1.67 |
| ROMP 59 U FLDN AQ INTERFACE MONITOR | NA | 0.77 | 0.52 | 0.46 | 1.05 | 0.76 | 0.71 | 1.54 | 1.10 | 1.89 | 1.75 | 2.70 | 2.57 | 3.37 | 3.24 | 3.89 |
| ROMP 60X U FLDN AQ MONITOR | NA | 0.70 | 0.44 | 0.43 | 0.96 | 0.68 | 0.66 | 1.49 | 1.10 | 1.71 | 1.59 | 2.49 | 2.37 | 3.10 | 2.98 | 3.57 |
| ROMP TR 10-2 L ARCA AQ MONITOR | 5.41% | 0.18 | 0.07 | 0.15 | 0.30 | 0.19 | 0.25 | 0.60 | 0.54 | 0.65 | 0.62 | 0.83 | 0.79 | 0.99 | 0.96 | 1.11 |
| ROMP TR 4-1 U FLDN AQ INTERFACE MONITOR | NA | 0.20 | 0.14 | 0.17 | 0.33 | 0.28 | 0.31 | 0.42 | 0.35 | 0.55 | 0.51 | 0.65 | 0.61 | 0.85 | 0.81 | 1.00 |
| ROMP TR 7-4 U FLDN AQ MONITOR (SWNN) | 13.54% | 0.48 | 0.30 | 0.43 | 0.82 | 0.63 | 0.75 | 1.21 | 1.06 | 1.48 | 1.38 | 1.77 | 1.68 | 2.34 | 2.25 | 2.71 |
| ROMP TR 8-1 AVPK PZ MONITOR | 14.08% | 0.35 | 0.21 | 0.31 | 0.60 | 0.46 | 0.55 | 0.94 | 0.84 | 1.14 | 1.07 | 1.35 | 1.29 | 1.71 | 1.65 | 1.95 |
| ROMP TR 9-3 U FLDN AQ MONITOR (SWNN) | 7.17% | 0.50 | 0.26 | 0.43 | 0.84 | 0.60 | 0.75 | 1.46 | 1.32 | 1.70 | 1.62 | 2.04 | 1.96 | 2.49 | 2.41 | 2.80 |
| SMITH DEEP | NA | 0.58 | 0.50 | 0.24 | 0.91 | 0.78 | 0.56 | 0.92 | 0.47 | 1.92 | 1.81 | 2.25 | 2.14 | 2.68 | 2.57 | 3.09 |

**Table 4-128. Simulated ROMP UFA Target Water Level Change Relative to 2010, Alternatives 2, 3, 4, and 5 (All Users with Agricultural Reduction) Layer 4**

| Well | SWIMAL Weight[a] | All Users Simulated Water Level Change Relative to 2010 (ft) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2015A | 2015B | 2015C | 2019A | 2019B | 2019C | 2020A | 2020B | 2025A | 2025B | 2036A | 2036B | 2047A | 2047B | 2049 |
| VERNA TEST 0-4 | 5.50% | 0.65 | 0.42 | 0.58 | 1.12 | 0.87 | 1.01 | 1.54 | 1.33 | 1.92 | 1.78 | 2.32 | 2.18 | 3.16 | 3.01 | 3.71 |
| Simulated Change in SWIMAL, ft | | 0.58 | 0.30 | 0.50 | 0.98 | 0.69 | 0.87 | 1.63 | 1.44 | 1.90 | 1.78 | 2.32 | 2.20 | 3.01 | 2.89 | 3.46 |

Notes:
[a] If well is used for SWIMAL calculation, the SWIMAL weight is used to calculated simulated change in SWIMAL

If the flexible pumping amounts are used, for example in several "B" and "C" scenarios, the change in SWIMAL water levels ranges from +0.30 to +2.89 feet. This indicates that even with the flexible pumping simulations there is no increased potential for accelerated rates of saltwater intrusion.

#### 4.12.3.9 Impacts of Aquifer Water Level Changes on Spring Discharge and Sinkholes

The model results show that regardless of the phosphate mining scenarios simulated, regional water levels in all aquifer layers will increase over most of the model domain as agricultural water use in the SWUCA is curtailed by SWFWMD restrictions. As currently operating mines cease withdrawing groundwater from the FAS, localized water level rebound will occur. Localized drawdown (lowering) of the FAS will occur as the pumpage from individual mines is increased or new mines come on-line (for example, the Ona Mine). Overall, the net change is positive over the majority of the model domain.

As spring discharges depend on the potentiometric surface of the IAS and/or the FAS, an increase in the potentiometric surface of the IAS and/or FAS can be expected to result in additional spring flow if the spring already flows and is in an area near the mine wellfields where more than a few feet of change is estimated to occur. If the spring does not flow, or is in an area of a few feet or less of water level change associated with the mining withdrawals, no change in flow of those particular springs will occur. There are springs, however, that are not expected to recover even if all withdrawals for mining were to cease. For example, an analysis conducted by the SWFWMD in 2006 as part of its SWUCA recovery strategy estimated that groundwater withdrawals would have to decrease by as much as 450 mgd (or 69 percent of the 650-mgd SWUCA goal) before Kissengen Spring would flow again.

Springs outside of the mined areas (including Warm Mineral Springs near North Port) should not be affected by continued mining operations because that area is not disturbed by mining. If there are any underlying karst conduits that may be associated with such springs, they are in the underlying Upper FAS and contribute to the high transmissivity of the aquifer system. High transmissivity has the effect of reducing the amount of drawdown necessary to convey water to a water supply well, which means that there is a smaller change in the water level over a larger area. And, because mining occurs above the IAS and there is a confining layer between the mining and Upper FAS in the area of the existing and proposed mines, only the FAS withdrawal's effect is relevant.

Mining would have a similar effect on sinkholes. Lowered water level due to groundwater pumping is one potential triggering mechanism for sinkhole collapse (FDEP, 2013e). As explained above, although there may be some drawdown from mining, it is predicted to be localized. If there are any karst conduits connecting these areas of drawdown associated with the mines with other areas further away from the mines, then the level of drawdown will be lower, as the well will be drawing from a larger volume of water.

Based on the groundwater effects modeling done for the Final AEIS, there will be no cumulative effects from the four current actions and the two reasonably foreseeable actions on springs or sinkholes.

#### 4.12.3.10 Impacts to Surface Waters Used for Public Water Supply

The 2010 SWFWMD Water Supply Plan summarizes the surface water available to help meet public supply demand for each watershed. An evaluation of the changes in available surface water quantity was performed using permitted withdrawals from surface waters and the estimated available quantities, both provided by SWFWMD in the 2010 Water Supply Plan. SWFWMD estimates that there is an additional 80 mgd available from the Peace River, 18 mgd from the Alafia, 41 mgd from the Myakka, and 93 mgd from the Withlacoochee Rivers. Table 4-129 shows the river flow, permitted withdrawals, actual use, and potentially available withdrawals obtained from the SWFWMD.

Using the results of the surface water analysis described in Section 4.2 and Appendix G and the changes in flow from River cells in the DWRM2.1 model for the four current actions plus other past, present and reasonably foreseeable non-mining actions, an estimate of the combined changes resulting from mining was prepared. Changes in surface water flow were determined for the Peace and Myakka Rivers and take into account runoff changes resulting from future land use changes throughout the river watersheds. Changes in groundwater contribution were calculated for all of the river watersheds. The last column in Table 4-129 shows the sum of the two calculations which, in every case where values were determined, the river flow increased as a result of mining. The streamflow contribution increases by 77.21 mgd in the Peace River and 19.25 mgd in the Myakka River from 2009 to 2050, which will substantially increase the amount of surface water available for public supply.

#### 4.12.3.11 Transient Modeling to Evaluate Seasonal Mining Impacts

Seasonal variability in withdrawal rates typically results in regional lowering of aquifer levels during the spring dry season, and recovery of water levels in the winter. Simulation of monthly changes in water levels required that the DWRM2.1 model be run in transient mode instead of steady state used for all other simulations. Transient mode allows the recharge to change monthly to more accurately simulate seasonal conditions. Pumping can also be varied by month to simulate changes in demand. Both recharge and pumping were varied by month for a hypothetical year, in this case the 2025B No Action Alternative and Applicants' Preferred Alternatives "All Users" with and without Agricultural Reduction. The methodology and results are presented in Appendix F.

The results illustrate the seasonal variability of the water levels in the SAS, IAS, and UFA in tables and figures in Appendix F. Figure 4-26 presents the IAS Zone 1 ROMP monitoring well water level differences compared to the 2010 base scenario. Figure 4-26 shows that the water levels are lower in the spring dry season, but recover in the late summer, fall, and winter. The change in water level fluctuation varies by as much as 8 feet above and below the 2010 base conditions but as the chart illustrates, the annual average water level remains stable.

**Table 4-129. Surface Water Available to Meet Public Supply Demand**

| | SWFWMD Water Supply Plan | | | | | Watershed-Wide Mining Operation Impacts from 2009 to 2050 | | |
|---|---|---|---|---|---|---|---|---|
| | Adjusted Annual Average Flow[a] | Permitted Average Withdrawal[a] | 2003 to 2007 Withdrawal[a] | 2003 to 2007 Unused Permitted Withdrawal[a] | Unpermitted Potentially Available Withdrawal, mgd[a] | Change in Surface Water Runoff[b] | Change in Streamflow Contribution from Groundwater[c] | Total Change in Streamflow Contribution[d] |
| **Watershed** | **mgd** | **mgd** | **mgd** | **mgd** | **mgd** | **mgd** | **mgd** | **mgd** |
| Peace River | 813.0 | 32.8 | 14.9 | 17.9 | 80.4 | 62.69 | 14.52 | 77.21 |
| Hillsborough River | 255.0 | 113 | 91.6 | 21.4 | TBD | NC | 2.78 | NC |
| Alafia River | 261.0 | 23.6 | 15.7 | 7.9 | 18.5 | NC | 3.02 | NC |
| Manatee River | 117.0 | 35 | 30 | 5 | 2.2 | NC | 0.25 | NC |
| Little Manatee River | 98.6 | 8.7 | 3.7 | 5 | 0.2 | NC | 0.36 | NC |
| Myakka River | 163.5 | 0 | 0 | 0 | 41.7 | 18.10 | 1.15 | 19.25 |
| Withlacoochee River | 1002.0 | 0.5 | 0.01 | 0.49 | 93.2 | NC | 0.96 | NC |
| Total | 2710.1 | 213.6 | 155.91 | 57.69 | 236.2 | 80.8 | 23.0 | 96.5 |

[a] Values are from SWFWMD 2010 Water Supply Plan (SWFWMD, 2011c)
[b] Values are from Surface Water Analysis, Appendix G (Only the Peace and Myakka River Watersheds were assessed for future changes to flow resulting from land use change in the AEIS)
[c] Values are from Groundwater Modeling River Cells for No Action and Applicants' Preferred Alternatives with Agricultural Reduction
[d] Sum of Change in Surface Water Runoff and Change in Streamflow Contribution from Groundwater

Notes:
NC = Not Calculated

**Water Level (ft)**

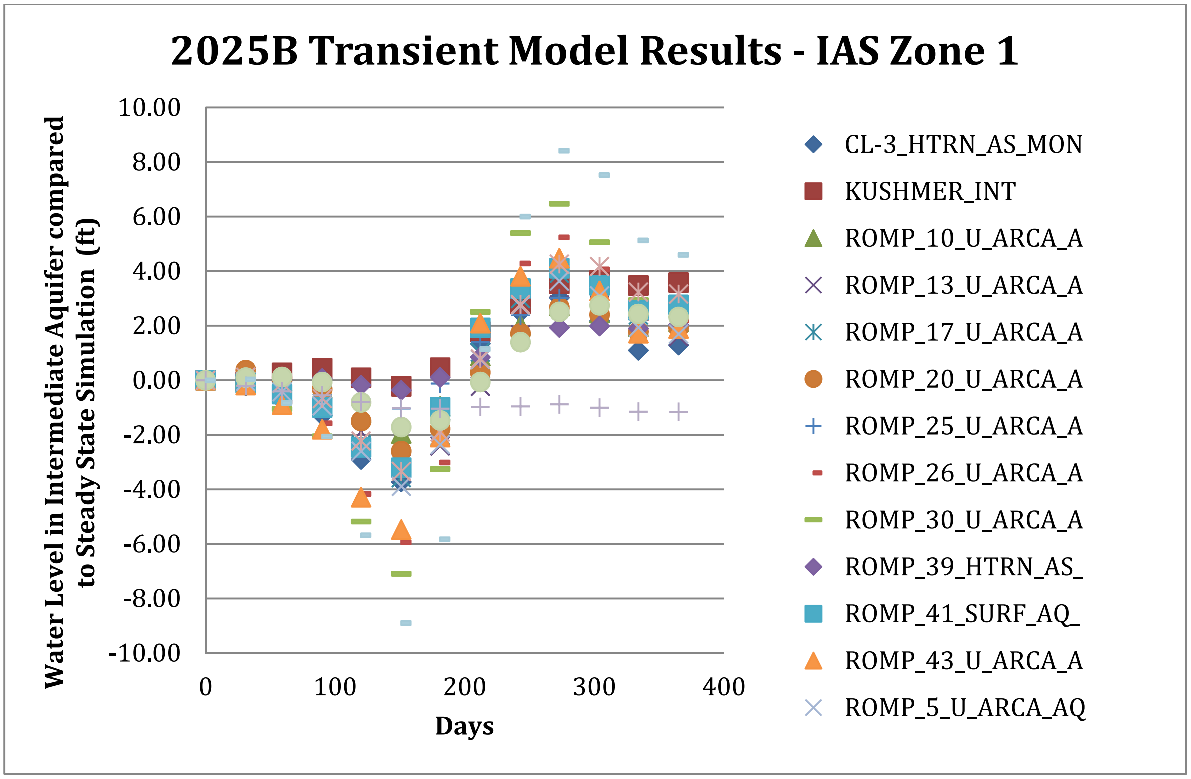



**Figure 4-26. Transient 2025B Model Simulated Water Change in the IAS Zone 1**

Figure 4-27 presents the IAS Zone 2 ROMP monitoring well water level differences compared to the 2010 base scenario. Figure 4-27 shows that the water levels are lower in the spring dry season, but recover in the late summer, fall, and winter. The change in water level fluctuation varies by as much as 7 feet above and below the 2010 base conditions but as the chart illustrates, the annual average water level remains stable.

**Water Level (ft)**

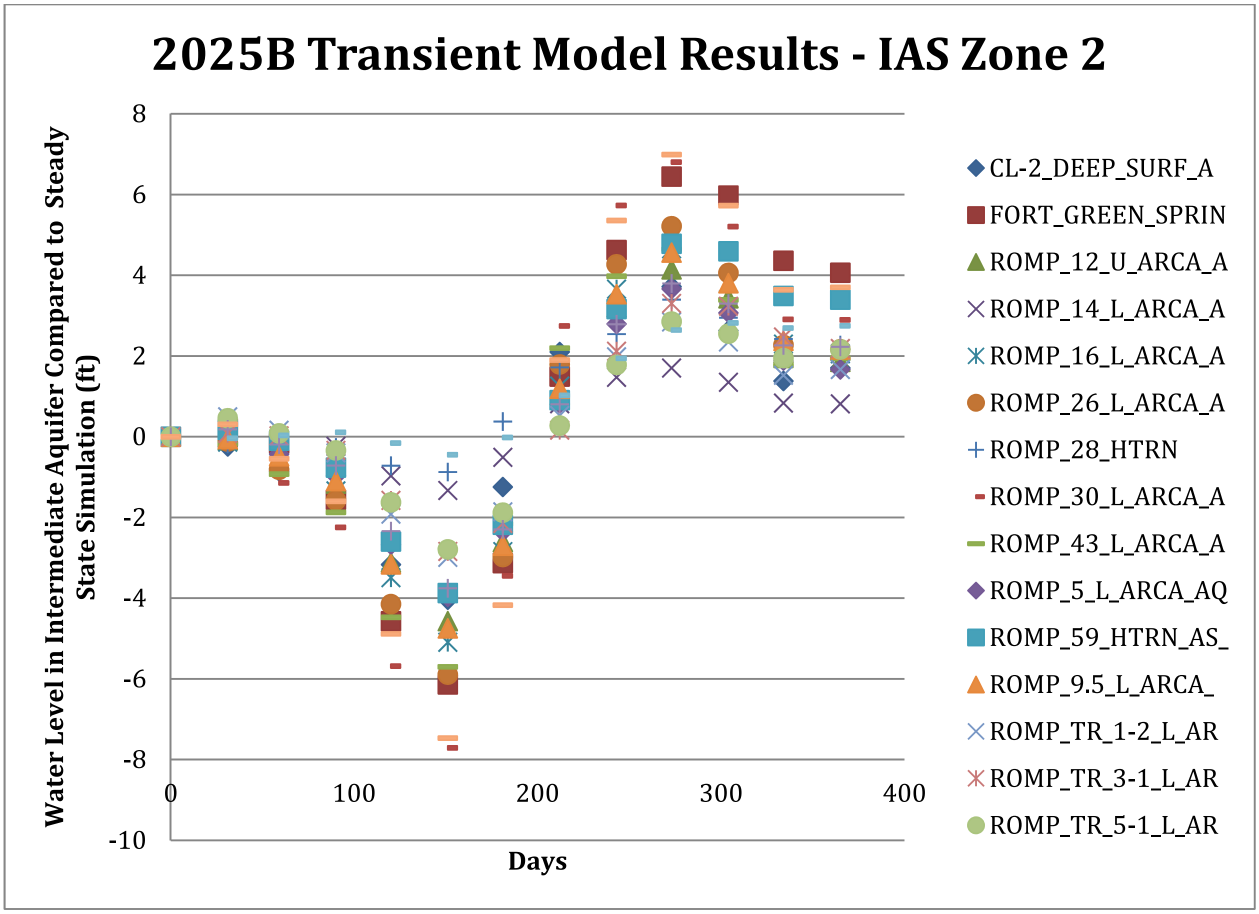



**Figure 4-27. Transient 2025B Model Simulated Water Change in the IAS Zone 2**

Figure 4-28 presents the UFA ROMP monitoring well water level differences compared to the 2010 base scenario. Figure 4-28 shows that the water levels are lower in the spring dry season, but recover in the late summer, fall, and winter. The change in water level fluctuation varies by as much as 12 feet above and below the 2010 base conditions but as the chart illustrates, the annual average water level remains stable.

**Water Level (ft)**

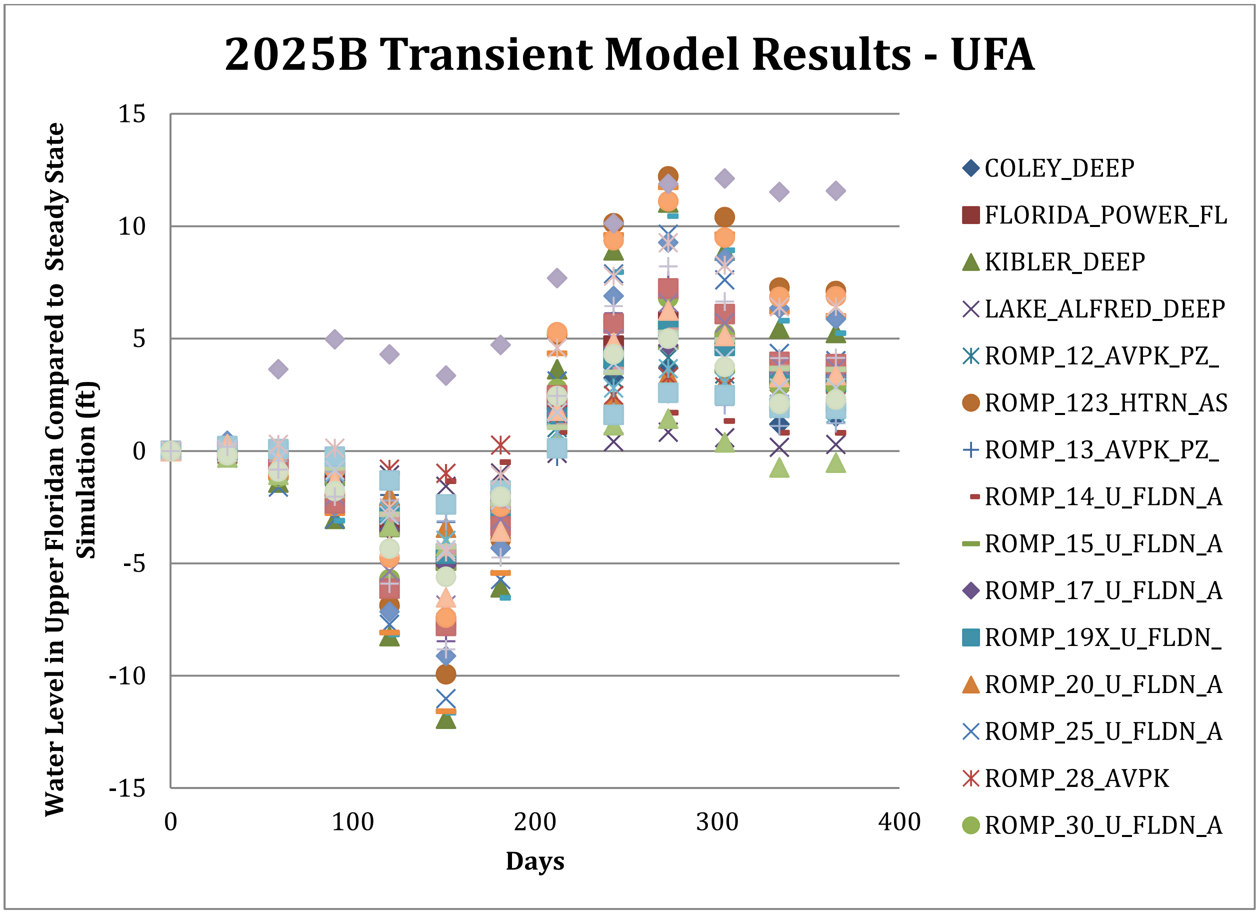



**Figure 4-28. Transient 2025B Model Simulated Water Change in the UFA**

#### 4.12.3.12 Groundwater Resources: Cumulative Impact Magnitude and Significance

In general, the cumulative groundwater modeling predicts that improved groundwater levels in the UFA should occur based on the interactions of agricultural allocation reductions, changes in phosphate mining water allocations during the temporal scope analyzed, and SWFWMD's implementation of the SWUCA Recovery Strategy goal of maintaining annual average allocations to the total of 600 mgd beyond the year 2025. The magnitude of the cumulative effects modeled was modest, and positive, overall, which is significant.

**Surficial Aquifer Impacts**

Model results for the SAS at a regional scale (the southern part of the CFPD) are approximate because the SAS is more directly affected by local recharge and discharge features, proximity to surface waters, local runoff conditions, and land use than by regional pumping of the UFA. Based on the modeling results, groundwater pumping would have a minimal magnitude on the SAS, which would not be significant.

**Intermediate Aquifer Impacts**

No significant changes in water levels were found in the ROMP wells selected for this evaluation in either Zone 1 or 2 of the IAS. The simulated changes in water level would not likely affect other users of the IAS; therefore, mining should have no detrimental impact on the IAS. This magnitude of effect is not significant.

**Upper Floridan Aquifer Impacts**

All the UFA modeling indicates that changes resulting from existing and proposed mines would be minor at the ROMP wells used to calculate the SWIMAL and at the other ROMP wells selected for this study. However, the modeling scenarios that do not incorporate flexible pumping quantities generally have less impact on the regulatory ROMP wells than those that use flexible pumping amounts. Because it is unlikely that pumping at this rate would occur for long periods, and assuming that the agricultural withdrawal reduction will occur, there would be no impact to the SWIMAL water levels

The potential exception is that pumping Ona Mine at the permitted drought year rate for extended periods could result in drawdown at ROMP 31. This is considered a moderate potential impact, as the SWUCA Recovery Strategy seeks recovery of the UFA water levels and the ROMP well water levels are used to measure success. Based on the potential effects on the SWUCA, this impact would be significant.

**Reasonably Foreseeable Actions**

For the cumulative impact analysis, the Pine Level/Keys Tract and Pioneer Tract replace the Desoto and Ona Mines, respectively. As explained in Section 4.12.1, their cumulative impacts are considered only for a period where they overlap with the current actions' impacts, towards the end of the current actions' mining periods.

As both reasonably foreseeable actions are located in areas of similar geologic and other conditions as the current actions, then it is reasonable to expect a similar lack of impact or minor impact on the SAS or the two zones of the IAS from UFA pumping as was modeled for the current actions, during the period that the cumulative impacts of the reasonably foreseeable actions are considered.

For the UFA impacts, there is no specific information about plans for groundwater usage. Therefore, it is assumed that the Pine Level/Keys Tract would use the same wellfield as the Desoto Mine immediately to the east (i.e., the Fort Green wellfield), and the Pioneer Tract would use the same wellfield as the Ona Mine immediately to the north.

The cumulative impacts on the UFA considering the Desoto Mine groundwater pumping were determined to be of a minor magnitude, and not significant. Similar results would be expected for the cumulative effect of mining the Pine Level/Keys Tract. However, it is possible that the cumulative impacts on the UFA associated with mining the Pioneer Tract would be moderate and would have a significant effect, as would the cumulative impacts associated with the Ona Mine.

#### 4.12.3.13 Groundwater Resources: Cumulative Impact Mitigation, Monitoring, and Adaptive Management

SAS dewatering is performed at some mine areas depending on the local conditions encountered for a given mine block or set of mine blocks. On the basis of the findings of site-specific hydrogeologic investigations called for under the Environmental Management Plans as incorporated into Water Use Permits (WUPs) issued by SWFWMD, phosphate mines must initiate appropriate SAS drawdown mitigation actions if deemed necessary to prevent dewatering impacts on nearby sensitive ecological habitats and/or shallow water aquifer conditions beyond the mine's property boundaries (unless appropriate waivers are executed with adjacent landowners). Definition of site-specific Hydrologic Impact Distance (HID) metrics is now required by SWFWMD to clarify when and where installation of ditch systems with specific groundwater recharge features is to be integrated into the mine block planning. These evaluations are now required along all property boundaries and along all areas identified as "no mine" preservation zones within the mines.

These provisions have been added to recent WUPs by SWFWMD in recognition of the need to be proactive in identifying risks of dewatering impacts on adjacent natural areas and/or property owners' ability to use the water table on their lands within the legal bounds regulated by the state. Adherence to these provisions is required under SWFWMD's WUPs, and it is anticipated that these provisions would provide adequate protection from direct or indirect hydrologic impacts.

There have been notable impacts associated with past mining practices. However, if the current and reasonably foreseeable actions meet their WUP conditions for design, construction, monitoring, and operation of the ditch and berm system, the impacts to the SAS should be minor. Changes in operational impacts on SAS water levels should be detected within weeks or months, so corrective measures can be taken to restore acceptable water levels. Compliance with the WUP conditions would provide reasonable assurance that SAS water level changes would be minor and of short duration.

For the moderate, significant cumulative impact to the UFA associated with the Ona Mine, potential mitigation measures would be to reduce pumping to rates approaching the drought year quantities by managing recirculation water storage in the mine. Managing the recirculation system storage and minimizing long-term drought year and flexible rate pumping would result in only minor impacts. This same mitigation would also apply to the Pioneer Tract.

### 4.12.4 Surface Water Quality

The geographic scope of the surface water quality cumulative impact analysis is described above in Section 4.12.1.

#### 4.12.4.1 Cumulative Effects on the Peace River and Myakka River Watersheds and Charlotte Harbor

Three of the current actions (Desoto, Ona, and South Pasture Extension) and one of the reasonably foreseeable actions, (Pioneer Tract), would operate concurrently in the Peace River watershed during the temporal scope of the AEIS. One current action (Wingate East Mine) would operate concurrently in the Myakka River watershed; the Wingate East mine is located in the upper portion of the watershed and the Pine/Level Keys Tract is in the lower watershed. One reasonably foreseeable action (Pine Level/Keys Tract) would operate in both the Peace and Myakka River watersheds.

In addition to past, present, and reasonably foreseeable phosphate mines, other actions that may affect water quality within the areas considered are agriculture and urban development. These past, present, and reasonably foreseeable actions are described further in Section 4.12.1

The cumulative effects from all sources of surface water, including mining, agriculture, and urban development, is reflected in the analysis and reporting by FDEP for both the 303(d) and impaired waters reports (see Section 3.3.3.1). These reports list impairments that include waterbody segments in the Peace and Myakka River watersheds that have parameters of concern not associated solely with mining. The evaluation of the direct and indirect effects on surface water quality associated with phosphate mining (in Section 4.4) did not identify water quality impacts from mining discharges that caused non-compliance with existing numerical water quality standards. However, the review of monitoring records did show that some parameters are consistently elevated in mine site discharges when compared to upstream or background concentrations. These include total phosphorus, total dissolved solids, conductivity, sulfate, and fluoride. Long-term biological monitoring studies of locations along Horse Creek under the Horse Creek Stewardship Program have not shown an indirect or cumulative effect of phosphate mine discharges. Similarly, other study area tributaries that have received phosphate mine discharges for long durations have not demonstrated trends leading to impairment over time.

#### 4.12.4.2 Surface Water Quality: Cumulative Impact Magnitude and Significance

Along with the current and reasonably foreseeable mining actions, potential impacts from continued or reduced agricultural activity and increased urbanization and associated stormwater-related pollutant loading may be expected. Without mitigation, monitoring, and adaptive management, the cumulative impact of all of the past, present, and reasonably foreseeable actions on water quality within the Peace River watershed, the Myakka River watershed, and Charlotte Harbor would be of a high magnitude, and would be significant. However, it is reasonable to expect that the current and reasonably foreseeable phosphate mine actions, along with most other current and reasonably foreseeable actions, will be subject to some level of regulation, including mitigation, monitoring, and adaptive management. Therefore, it has been determined that the four current and two reasonably foreseeable phosphate mine actions would not be expected to contribute to cumulative impacts to water quality in a manner inconsistent with water quality standards established by state and USEPA regulations.

#### 4.12.4.3 Surface Water Quality: Cumulative Impact Mitigation, Monitoring, and Adaptive Management

Pollutant reduction strategies are being implemented through a combination of regulatory and voluntary programs. Stormwater BMPs are being developed and implemented in urban settings and agricultural practices that reduce the effects of fertilization and irrigation are also being more widely implemented. Wastewater reuse strategies are being developed to avoid surface discharge of effluent and more effectively capture pollutants through land application, wetland treatment systems, or groundwater recharge systems. Those actions help to achieve pollutant load reduction goals for surface waters. These surface water improvement strategies are being integrated into Basin Management Action Plans (BMAPs) coming out of TMDL studies.

With respect to agriculture, irrigation and fertilization practices are the principal actions that can cause nutrients and dissolved solids levels to increase cumulatively in groundwater and surface water. The SWFWMD FARMS program principally targets dissolved solids. The FDEP TMDL BMAPs target nutrients. Based upon these programs and the projection of small, if any, increases in intensive agriculture acreages in the future, the total dissolved solids and nutrient loadings generated by agriculture can reasonably be expected to remain constant or decrease. FDEP is addressing bio-accumulative pollutants such as mercury in fish on a state-wide basis. Phosphate mine discharges do not contain detectable levels of mercury or other known bio-accumulative substances. The evaluations of phosphate mining influence on surface water quality in the Peace and Myakka River watersheds are relevant to other watersheds, and can be used to predict the cumulative impacts of future phosphate mining in other AEIS study area watersheds.

Along with these measures, continued monitoring of water quality is clearly warranted, especially as stricter water quality standards are implemented in the future for parameters such as nutrients and conductivity. The effects of evolving NNC on phosphate mining are described in Section 3.3.3.1.

### 4.12.5 Ecological Resources (Wetlands/Waters and Upland Habitat)

The geographic scope of the ecological resources cumulative impact analysis is described above in Section 4.12.1. The primary past, present, and foreseeable actions considered for this cumulative impacts analysis are phosphate mining, agriculture, and urban development in the Peace and Myakka River watersheds. The cumulative effects of all land use practices that have impacted wetlands, surface waters, and upland habitat within the geographic scope considered are reflected in the current (baseline) condition. The potential direct and indirect ecological impacts of the four current actions (Wingate East, Desoto, Ona, and South Pasture Mine Extension) and the two reasonably foreseeable mines (Pine Level/Keys Tract and Pioneer Tract) are discussed in Section 4.5.

Evaluating historical impacts on ecological resources provides perspective on the extent and temporal trends of impacts that have occurred over time. Historical agriculture, phosphate mining, and urban development in the CFPD have collectively resulted in substantial impacts to wetlands, surface waters, and native uplands. Aquatic systems that have been impacted in the CFPD include various types of forested wetlands (such as cypress swamps, hydric pine flatwoods, and bay swamps), non-forested wetlands (such as wet prairies, freshwater marshes, and shrub wetlands), and surface waters (such as rivers, streams, and lakes). Native uplands that have been impacted include various types of rangelands (such as palmetto prairies, shrub and brushlands, and mixed rangelands) and upland forests (such as live oak forests, pine flatwoods, and mixed hardwood-conifer forests). Impacts to natural habitats in the CFPD include loss or diminishment of their associated functions. For example, wetlands provide valuable functions such as flood prevention, ground water recharge, recreation, breeding and feeding grounds for fish, shellfish, birds, and mammals, protection of surface water quality, and many others. As such, the loss of wetlands in the CFPD from past land use practices has impacted various other environmental resources as well as the human environment.

In the northern half of the CFPD, habitats and associated biota have been historically impacted by a mix of agriculture, mining, and urban development, while in the southern half of the CFPD impacts have resulted primarily from agriculture. Based on historical and current land use data, ecological resources in the CFPD portion of the Peace River watershed have been impacted primarily by agriculture and mining (see Sections 3.3.7.4 and 4.1.8.3). In comparison, agricultural practices alone have resulted in most of the impacts to ecological resources in the CFPD portion of the Myakka River watershed; only about 2 percent of the Myakka River watershed in the CFPD has been mined for phosphate.

The net loss of wetlands/waters and native uplands in the CFPD portions of the Peace and Myakka River watersheds has steadily decreased since the late 1970s as a result of federal and state environmental regulations and policies, most notably the federal CWA Section 404 program and the state mandatory phosphate reclamation program (as described in Sections 5.1.2 and 5.7.1). Comparisons of historical and current land use data indicate that net loss of habitats in the Peace and Myakka River watersheds has declined considerably since the early 1990s. For example, SWFWMD FLUCCS data indicate that wetland coverage in both the Peace and Myakka River watersheds was relatively stable during the period between 1990 and 2009, and increased in both watersheds during the period between 1999 and 2009 (see Section 3.3.5). The relative stability in wetland coverage in the Peace River watershed during the period between 1990 and 2009, despite the steady rate of phosphate mining in the watershed during the same period, is likely in part associated with more intensive wetland mitigation and reclamation conducted by the phosphate industry during and prior to this period.

#### 4.12.5.1 Cumulative Effects

Table 4-130 presents the combined quantities of wetlands, streams, native uplands, and upland wildlife habitat currently proposed to be impacted by the four current actions. The data presented in Table 4-130 reflect the plans shown in the June 1, 2012, public notices for the Applicants' Preferred Alternatives. The proposed wetland and stream impact values shown in the table are subject to change as the projects move through the mitigation sequencing process of avoidance, minimization, and compensatory mitigation as required by the 404(b)(1) Guidelines. This mitigation sequencing process is described in further detail in Chapter 5. The wetland and stream data are based on the information contained in the approved Jurisdictional Determination packages for the projects.

**Table 4-130. Combined Currently Proposed Impacts of Applicants' Preferred Alternatives on Ecological Resources[a]**

| Ecological Resource | Existing | Impacted |
|---|---|---|
| Total Wetlands[b] (acres) | 12,062 | 9,870 |
| Total Stream Length[b] (linear feet) | 497,952 | 260,653 |
| Total Native Uplands[c] (acres) | 14,394 | 13,078 |
| Total Upland Wildlife Habitat[d] (acres) | 36,039 | 34,187 |

Notes:
[a] Based on the June 1, 2012, public notice. Values subject to change.
[b] USACE-jurisdictional (portion of stream length includes ditches)
[c] Rangelands and Upland Forests
[d] Native Uplands and Pasturelands

As indicated in Table 4-130, the four current actions, combined, currently propose to impact approximately 9,870 acres of USACE-jurisdictional wetlands, 260,653 linear feet of USACE-jurisdictional streams (portion of stream length includes ditches), 3,078 acres of native uplands (rangelands and upland forests), and 34,187 acres of upland wildlife habitat (native uplands and pasturelands). The wetlands, streams, and uplands on each site are proposed to be impacted, mitigated, and reclaimed in phases in separate mine blocks over the life of each mine; therefore, the impacts would occur in phases and would be temporary. Collectively, the natural systems would be impacted, mitigated, and reclaimed incrementally over a period of approximately 40 years, from about 2020 (collective mine startup) to about 2060 (final reclamation phase of Ona Mine). As discussed in Sections 4.5.2 and 4.5.3, the wetlands and uplands on each site are of variable quality and many of the systems are expected to have been impacted by past land use practices (primarily agriculture). Proposed impacts to wildlife and listed species that occur on each mine site would primarily be from direct disturbance and from temporary loss of habitat. Conservation measures for listed species would be required to be implemented in coordination with USFWS and FFWCC.

The rate of urban/residential development began to decrease in the Peace and Myakka River watersheds in 2007 as a result of overall economic slowdown. Although urban/residential growth in the Peace and Myakka River watersheds has been relatively stable since 2007, urban/residential land use in these watersheds is anticipated to increase during the AEIS study period from 2010 through 2060. During this same period, agricultural land use within these watersheds is anticipated to decrease, as some of the land currently used for agriculture is converted to urban uses (see Appendix H for further discussion of economic development assumptions for the region). The decrease in overall agricultural acres is also anticipated in the SWUCA goals for reduction of groundwater withdrawals, primarily from the agricultural sector (see Section 4.3).

Ecological resources would be impacted in areas where future urban/residential development occurs in the Peace and Myakka River watersheds. Based on current land use projections, overall ecological impacts from urban/residential development are expected to be less extensive and occur more gradually through the foreseeable future in the watersheds than those expected to result from phosphate mining. As with phosphate mining, impacts to waters of the U.S. from urban/residential development would be required to be avoided and minimized to the greatest extent practicable, and unavoidable impacts would be required to be offset through compensatory mitigation. However, native upland habitats that are displaced by urban/residential development would not be required to be reclaimed as those impacted by phosphate mining. Overall ecological impacts associated with agricultural activity in the Peace and Myakka River watersheds are expected to gradually decrease through the foreseeable future. However, lands that remain in agricultural use would continue to have certain types of ongoing ecological impacts. For example, agricultural ditches/canals have the potential to continuously impact the hydrology of nearby wetlands and streams. The ecological impacts expected to result from existing agricultural activities in the watersheds would undoubtedly be less direct and lesser in magnitude than those expected to result from phosphate mining.

Based on FDEP Bureau of Mining and Minerals Regulation *Annual Rate of Reclamation Reports 2000 – 2010* (FDEP, 2012c), there are currently four active mines in the Peace River watershed and one active mine in the Myakka River watershed that require further land clearing to complete their mining operations. Combined, these mines would disturb a total of approximately 26,287 acres of land from the 2010 baseline year to 2034 (mine-out year of youngest mine). The total land disturbance from these mines in the Peace and Myakka River watersheds would be less than 26,287 acres because two of the mines are partially in other watersheds. The remaining wetlands, streams, and uplands on these existing active mine sites are expected to be impacted, mitigated, and reclaimed in phases in separate mine blocks over the life of each mine; therefore, the impacts are expected to occur in phases and be temporary. All remaining permitted impacts to waters of the U.S. would be required to be offset through compensatory mitigation in accordance with the specific requirements in each active mine's federal Section 404 permit. Based on the hydrologic modeling and water quality impact analyses conducted for this AEIS, these active mines are not expected to result in reductions in freshwater flows or water quality alterations that would adversely impact downstream estuarine biological communities. Remaining impacts to wildlife and listed species are expected to be minimized through measures specified in existing habitat/species management plans.

Based on the estimated amounts and qualities of habitats on the Pine Level/Keys Tract site and Pioneer Tract site, the overall ecological impacts of each of the two reasonably foreseeable actions are expected to be comparable to those of each of the current actions (see Sections 4.5.2 and 4.5.3. This is a generalization, and it is acknowledged that detailed field surveys may indicate greater ecological differences between these reasonably foreseeable actions and the current actions. The wetlands, streams, and uplands on these foreseeable mine sites are expected to be impacted, mitigated, and reclaimed in phases in separate mine blocks over the life of each mine; therefore, the impacts are expected to occur in phases and be temporary. Impacts to waters of the U.S. on each site would be required to be avoided and minimized to the greatest extent practicable and compensatory mitigation would be required to offset unavoidable impacts. Impacts to wildlife and listed species that occur on each site are expected to primarily be from direct disturbance and from temporary loss of habitat. Conservation measures for listed species would be required to be implemented in coordination with USFWS and FFWCC.

Cumulatively, past mining actions, the four current mining actions, the two reasonably foreseeable mining actions, and other past, present, and reasonably foreseeable non-mining do cause major ecological impacts, including to wetlands and to upland habitat. These cumulative ecological impacts are geographically extensive in terms of the amount of wetlands, streams, and uplands that would be impacted. However, the loss of functions of these natural systems is not permanent, as the lost functions are required to be replaced in equal or greater amounts through compensatory mitigation (jurisdictional wetlands) and reclamation (uplands and wetlands).

The timeframes required for created wetlands/waters and uplands to meet regulatory success criteria vary based on the type of system created (see Chapter 5). For example, forested wetlands and streams require longer periods of time to mature and achieve regulatory success criteria than non-forested wetlands; therefore, impacts to forested wetlands and streams have a greater bearing on overall cumulative temporal impacts. Cumulative impacts on natural systems, in terms of both quantitative and temporal habitat loss, would result in overall greater potential impacts to wildlife and listed species.

However, the overall magnitude of impact on wildlife and listed species would likely not increase substantially as a result of the wildlife and listed species conservation measures that are required to be implemented during phosphate mining.

The large-scale watershed-based reclamation approaches currently implemented by the phosphate industry are intended to result in greater direct and indirect benefits to wildlife and listed species than earlier approaches. The industry currently conducts reclamation in accordance with the goals of the IHN, which include the goal of increasing the amount and quality of wildlife habitats and corridors in the region through habitat replacement, protection, and connection.

Cumulative ecological impacts would likely be magnified during periods when multiple mines are operating concurrently. Concurrent mining would not alter the overall quantitative extent of the ecological impacts that would occur over the combined lives of the mines, but would increase the overall rate of ecological impacts during the period when concurrent mining occurs. The four current actions would come on-line during the 2015 – 2020 period (see Figure 4-21). Although the mines would have different onsets of ecological impacts, the mines would eventually impact ecological resources concurrently. Ecological impacts on each mine would primarily result from land clearing, which would occur in phases in separate mine blocks during the period between mine startup and final reclamation. Based on the Applicants' mine plans, all four of the current actions would concurrently conduct land clearing over a period of approximately 15 years from about 2020 (collective mine startup) to about 2035 (mine-out of Desoto Mine). Although the start-up of the two reasonably foreseeable mines would add to this cleared acreage, as each of the current actions reaches its final reclamation phase the amount of concurrent land clearing would gradually decrease.

Based on FDEP Mining and Minerals Regulation *Annual Rate of Reclamation Reports 2000 – 2010* (FDEP, 2012c), all but one of the existing active mines in the Peace and Myakka River watersheds would be mined out before 2020 – Mosaic's South Pasture mine in the Peace River watershed. The South Pasture mine is projected to be mined out in 2034; therefore, it would conduct land clearing during the period when all four current actions are conducting land clearing, but not beyond this period. Land clearing on the Pine Level/Keys Tract site and Pioneer Tract site would begin around 2035 and 2045, respectively. Land clearing on these mines would primarily overlap with land clearing on the Ona and Wingate East Mines.

Based on the projected timelines of the past mining actions (the existing active mines), the four current actions, and the two reasonably foreseeable actions, the greatest amount of concurrent land clearing would occur during an approximately 15-year period from about 2020 to about 2035. A considerable, but overall lesser, amount of concurrent land clearing would occur during an approximately 15-year period from about 2040 to about 2055. The overall rate of habitat loss would increase during these periods; therefore, these periods would result in greater cumulative temporal impacts on ecological resources.

The cumulative ecological impacts would be greater in the Peace River watershed than in the Myakka River watershed based on where and when concurrent land clearing is expected to occur. The increased rate of habitat loss and associated impacts on wildlife and aquatic biota during periods of concurrent mining would likely not have major long-term adverse ecological impacts, as the lost natural systems would be required to be offset over time through mitigation and reclamation. Concurrent mining may result in greater overall impacts to certain wildlife species; however, it would likely not have major adverse impacts on regional wildlife populations because of the spatial and temporal phasing of mining over the entire mine life and the wildlife conservation measures expected to be implemented.

#### 4.12.5.2 Magnitude and Significance

Based on the analysis conducted for this AEIS, without mitigation and reclamation the four current actions, cumulatively with the two reasonably foreseeable actions and with other past, present, and reasonably foreseeable future actions, would have major cumulative impacts on wetlands, and wetland and upland wildlife habitat. Impacts to these ecological resources, based on their expected nature and extent, would be significant. These major, significant cumulative impacts would be reduced to a minor level of magnitude and would become non-significant by the compensatory wetland mitigation, wetland/upland reclamation, and wildlife management expected to be provided by the Applicants based on regulatory requirements.

#### 4.12.5.3 Ecological Resources: Cumulative Impact Mitigation, Monitoring, and Adaptive Management

Chapter 5 describes mitigation as considered by the USACE, including compensatory mitigation for impacts to waters of the U.S. under Section 404(b)(1) of the Clean Water Act, with additional information on the FDEP's mitigation and reclamation programs, and on offsetting impacts to wildlife and listed species. Examples of permit conditions addressing mitigation success goals, monitoring requirements, and adaptive management are described in Chapter 5 and in Appendix I.

### 4.12.6 Economic Resources

Several of the Applicants' Preferred Alternatives are in a single county, or their direct impacts are split between two counties. In addition, the combined impacts of the four current actions (Desoto, Ona, Wingate East, and South Pasture Extension) and the two reasonably foreseeable actions (Pioneer Tract and Pine Level/Keys Tract) on the region are expected to exceed the effects on their host counties, as many of the indirect and induced effects will accrue to other counties in the 8-county area that are included in the study area. As a result, the following cumulative impact analyses were conducted:

- Combined impacts of two current actions (Desoto and Wingate East) and one reasonably foreseeable action (Pine Level/Keys Tract) on DeSoto and Manatee Counties

- Combined impacts of two current actions (Ona and South Pasture Extension) and one reasonably foreseeable action (Pioneer Tract) on Hardee County
- Combined impacts of the four current actions and two reasonably foreseeable actions on the 8-County region

For these analyses, the economic impacts were evaluated assuming no change in the economy over this period, except for changes associated with the four current actions and two reasonably foreseeable actions.

The following analyses include the predicted economic conditions over the temporal scope without the current actions or the reasonably foreseeable actions in Manatee and DeSoto Counties combined, Hardee County alone, and all 8 counties combined. The purpose of these No Action Alternative cumulative impact analyses is to provide a point of reference for the economic cumulative impact analyses described above, as opposed to just comparing the predicted conditions against the 2010 baseline. The No Action Alternative considered here is the 'No Mining' scenario, as described in Section 4.6.1.

#### 4.12.6.1 Cumulative Effects

**No Action Alternative – Manatee and DeSoto Counties**

The effect under the No Action Alternative for Manatee and DeSoto Counties is the same as the direct and indirect effect for the No Action Alternative as presented in 4.6.1. The results of the analysis are shown here in Table 4-131.

**Table 4-131. DeSoto and Manatee Counties Combined No Action Alternative Forecast Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $2,454,100,000 | $0 | $0 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $25,600,000 | $24,100,000 | $24,100,000 | $24,100,000 | $24,100,000 |
| **Total** | $2,479,700,000 | $24,100,000 | $24,100,000 | $24,100,000 | $24,100,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $25,600,000 | $24,200,000 | $24,500,000 | $24,500,000 | $24,500,000 |
| Severance Taxes | $5,600,000 | $0 | $0 | $0 | $0 |
| **Total** | $31,200,000 | $24,200,000 | $24,500,000 | $24,500,000 | $24,500,000 |

Note: Figures are totals for each 10-year period.

**No Action Alternative – Hardee County**

The effect under the No Action Alternative for Hardee County is the same as the direct and indirect effect for the No Action Alternative as presented in Section 4.6.1. The results of the analysis are shown here in Table 4-132.

**Table 4-132. Hardee County No Action Alternative Forecast Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $8,508,400,000 | $1,634,000,000 | $1,470,600,000 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $47,300,000 | $41,200,000 | $39,700,000 | $38,900,000 | $38,900,000 |
| **Total** | $8,555,700,000 | $1,675,200,000 | $1,510,300,000 | $38,900,000 | $38,900,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $39,400,000 | $32,100,000 | $32,600,000 | $31,900,000 | $32,100,000 |
| Severance Taxes | $34,400,000 | $7,400,000 | $6,700,000 | $0 | $0 |
| **Total** | $73,800,000 | $39,500,000 | $39,300,000 | $31,900,000 | $32,100,000 |

Note: Figures are totals for each 10-year period.

**No Action Alternative - All Eight Counties Combined**

The projected combined direct impacts of the No Action Alternative by decade for the eight-county study area are presented in Table 4-133. The table reflects that most of the existing mines would reach the end of rock production within the first decade of the analysis, with the South Pasture Mine continuing operations into the third decade. As a result, income from mining and reclamation activities would decline dramatically in the second decade, from $14.4 billion in the first decade to $1.6 billion in the second decade, and $1.5 billion in the third decade, with no direct mining output in the fourth decade and beyond, because no additional mining or reclamation activities would be forecast for the CFPD under the No Action Alternative. The level of agricultural activity on the mine sites would also decline from the first to the second decades, as some of the land on the existing mine sites currently used for agriculture would be mined. The level of agricultural activity would then stabilize in the third decade and remains at a similar level for the remainder of the study period. The direct, indirect, induced and total employment, labor income, value added, and output metrics by decade for the No Action Alternative for the eight-county region combined, and the calculation of the present value of the labor income, value added, and output impacts of the No Action Alternative for these counties over the 50-year forecast period, are presented in Appendix H.

As noted above, the counties receive revenues from property taxes and the state distributes a portion of the severance tax revenues it collects from the mines. For this evaluation, the aggregated property tax paid by the mine companies to the three counties (Hardee, DeSoto, and Manatee) was based on the county-specific levels projected for each county's No Action Alternative analysis. Severance tax revenues distributed to the counties would be expected to decline along with the level of mining activity in the region. The severance tax revenues are forecast to decline from $57.9 million in the first decade to zero by the fourth decade.

**Table 4-133. No Action Alternative Cumulative Analysis Projected Impacts by Decade**

| | Years 1-10 | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $14,407,100,000 | $1,634,000,000 | $1,470,600,000 | $0 | $0 |
| Income/Revenue attributed to Agriculture | $92,600,000 | $82,900,000 | $81,500,000 | $80,800,000 | $80,800,000 |
| **Total** | $14,499,700,000 | $1,716,900,000 | $1,552,100,000 | $80,800,000 | $80,800,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $62,800,000 | $53,300,000 | $54,400,000 | $53,600,000 | $53,700,000 |
| Severance Taxes | $57,900,000 | $7,400,000 | $6,700,000 | $0 | $0 |
| **Total** | $120,700,000 | $60,700,000 | $61,100,000 | $53,600,000 | $53,700,000 |

Note: Figures are totals for each 10-year period.

**Desoto, Wingate East, and Pine Level/Keys Tract - DeSoto and Manatee Counties**

The estimated combined direct economic impact of the two current actions and one reasonably foreseeable action is presented in Table 4-134. The data show that total income generated by these alternatives, the construction of the beneficiation plant, and the agricultural activities on the alternative mine sites in Manatee and DeSoto Counties would increase from $3.6 billion in the first decade to $6.1 billion in the second decade to $10.9 billion in the third decade, before falling in to $8.2 billion in the fourth decade and $7.8 billion in the fifth decade.

**Table 4-134. Forecast Impacts by Decade for DeSoto and Manatee Counties Combined based on Desoto and Wingate East Mines and the Pine Level/Keys Tract**

| | Years 1-10[a] | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $2,573,200,000 | $6,093,200,000 | $10,864,300,000 | $8,151,500,000 | $7,805,800,000 |
| Beneficiation Plant Construction | $1,000,000,000 | | | | |
| Income/Revenue attributed to Agriculture | $42,200,000 | $39,500,000 | $33,200,000 | $22,600,000 | $12,000,000 |
| **Total** | $3,615,400,000 | $6,132,700,000 | $10,897,500,000 | $8,174,100,000 | $7,817,800,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $26,400,000 | $52,300,000 | $56,100,000 | $42,700,000 | $38,800,000 |
| Severance Taxes | $5,800,000 | $25,300,000 | $35,300,000 | $20,800,000 | $19,900,000 |
| **Total** | $32,200,000 | $77,600,000 | $91,400,000 | $63,500,000 | $58,700,000 |

[a] Includes $1 billion for construction of a beneficiation plant.

Note: Figures are totals for each 10-year period.

Table 4-135 shows that the net present value output/income associated with the two current actions and one reasonably foreseeable action in DeSoto and Manatee Counties would increase by $22.2 billion with permitting of the mines. The net present value of labor income is similarly forecast to increase by $6.6 billion. Average annual employment over the 50-year period associated with permitting the mines is projected to amount to 2,647 jobs, as compared to the No Action Alternative. The direct, indirect, induced, and total effects by decade for DeSoto and Manatee Counties for the two current actions and one reasonably foreseeable action are presented in Appendix H. Appendix H also presents the calculation of the present value of the total output, labor compensation, and value added effects for this mine development/operation combination.

| Table 4-135. Net Impacts for DeSoto and Manatee Counties Combined Based on Desoto and Wingate East Mines and the Pine Level/Keys Tract | | | |
|---|---|---|---|
| | **No Action** | **With Mines** | **Difference** |
| Average Annual Employment | 232 | 2,879 | 2,647 |
| Present Value Labor Income | $809,713,334 | $7,383,600,000 | $6,573,886,666 |
| Present Value, Value Added | $1,613,930,298 | $14,609,500,000 | $12,995,569,702 |
| Present Value Output/Income | $2,756,938,523 | $24,972,700,000 | $22,215,761,477 |

**Ona, South Pasture Extension, and Pioneer Tract - Hardee County**

The estimated combined direct economic impact of the two current actions and one reasonably foreseeable action is presented in Table 4-136. The data show that total income generated by these mines, the construction of the beneficiation plant, and the agricultural activities on the mine sites in Hardee County would decline from $9.6 billion in the first decade to $8.8 billion in the second decade. Income declines in the subsequent decades to $7.4 billion in the third decade, $5.5 billion in the fourth decade, and $5.2 billion in the fifth decade.

| Table 4-136. Forecast Impacts by Decade on Hardee County based on Ona and South Pasture Extension Mines and the Pioneer Tract | | | | | |
|---|---|---|---|---|---|
| | **Years 1-10[a]** | **Years 11-20** | **Years 21-30** | **Years 31-40** | **Years 41-50** |
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $8,508,400,000 | $8,714,900,000 | $7,407,600,000 | $5,446,800,000 | $5,172,300,000 |
| Beneficiation Plant Construction | $1,000,000,000 | | | | |
| Income/Revenue attributed to Agriculture | $47,300,000 | $37,700,000 | $28,700,000 | $20,200,000 | $13,800,000 |
| **Total** | $9,555,700,000 | $8,752,600,000 | $7,436,300,000 | $5,467,000,000 | $5,186,100,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $39,400,000 | $46,500,000 | $35,800,000 | $58,900,000 | $59,900,000 |
| Severance Taxes | $34,400,000 | $39,600,000 | $33,700,000 | $24,800,000 | $23,500,000 |
| **Total** | $73,800,000 | $86,100,000 | $69,500,000 | $83,700,000 | $83,400,000 |

[a] Includes $1 billion for construction of a beneficiation plant.

Note: Figures are totals for each 10-year period.

Table 4-137 shows that the net present value output/income associated with the two current actions and one reasonably foreseeable action in Hardee County would increase by $16.8 billion with permitting of the mines. The net present value of labor income is similarly forecast to increase by $4.9 billion. Average annual employment over the 50-year period associated with permitting the mines is projected to amount to 1,699 jobs, as compared to the No Action Alternative. The direct, indirect, induced, and total effects by decade for Hardee County for the two current actions and one reasonably foreseeable action are presented in Appendix H. Appendix H also presents the calculation of the present value of the total output, labor compensation, and value added effects for this mine development/operation combination.

**Table 4-137. Net Impacts for Hardee County with Ona and South Pasture Extension Mines and the Pioneer Tract**

| | No Action | With Mines | Difference |
|---|---|---|---|
| Average Annual Employment | 840 | 2,539 | 1,699 |
| Present Value Labor Income | $3,296,500,000 | $8,177,800,000 | $4,881,300,000 |
| Present Value, Value Added | $6,798,600,000 | $16,786,400,000 | $9,987,800,000 |
| Present Value Output | $11,459,900,000 | $28,281,500,000 | $16,821,600,000 |

**Desoto, Ona, South Pasture Extension, Pine Level/Keys Tract and Pioneer Tract – All 8 Counties**

Table 4-138 presents the projected direct output/income by decade over the forecast 50-year period, and property taxes and the portion of the state's severance tax revenues distributed to the local governments in the 8-county region, assuming that all four current actions and both reasonably foreseeable actions receive permits and begin mining. Under this scenario, total mining activity is expected to increase in the second decade from $14.5 billion in the first decade to $14.8 billion in the second decade, increase to $18.3 billion in the third decade, and then decline in the subsequent decades. Agricultural production declines each decade as lands are removed from agricultural production to be used for mining. The forecast also shows $2 billion in expenditures for constructing two beneficiation plants (one each for the Ona and Desoto Mines) during the first decade of the analysis. Local government revenues amount to $150.0 million in the first decade, but are expected to increase to $218.4 million in the second decade, before declining to 165.9 million by the fifth decade.

**Table 4-138. Forecast Impacts by Decade based on Desoto, Wingate East, South Pasture Extension, and Ona Mines and the Pine Level/Keys and Pioneer Tracts**

| | Years 1-10[a] | Years 11-20 | Years 21-30 | Years 31-40 | Years 41-50 |
|---|---|---|---|---|---|
| **Income** | | | | | |
| Income/Revenue attributed to Mining | $14,526,300,000 | $14,808,000,000 | $18,271,900,000 | $13,598,300,000 | $12,978,100,000 |
| Beneficiation Plant Construction | $2,000,000,000 | | | | |
| Income/Revenue attributed to Agriculture | $109,200,000 | $94,900,000 | $79,700,000 | $60,600,000 | $43,600,000 |
| **Total** | $16,635,500,000 | $14,902,900,000 | $18,351,600,000 | $13,658,900,000 | $13,021,700,000 |
| **Local Government Revenues** | | | | | |
| Property Taxes | $91,900,000 | $153,500,000 | $147,300,000 | $125,500,000 | $122,500,000 |
| Severance Taxes | $58,400,000 | $64,900,000 | $69,000,000 | $45,500,000 | $43,400,000 |
| **Total** | $150,300,000 | $218,400,000 | $216,300,000 | $171,000,000 | $165,900,000 |

[a] Includes $2 billion for construction of two beneficiation plants.

Note: Figures are totals for each 10-year period.

Table 4-139 presents a calculation of the present value of the net effects of the four current actions and two reasonably foreseeable actions' development and operation as compared to the No Action Alternative. The net present value of the difference in output between these alternatives amounts to $50.1 billion. The net present value of the difference in employee compensation or labor income between the two cases is estimated at $14.8 billion. The permitting of all four current actions and two reasonably foreseeable actions is forecast to increase employment by an average of 6,340 jobs per year over the 50-year study period as compared to the No Action Alternative. Most of the output and employment generated by phosphate rock production is ongoing; therefore, the projected increase in employment, labor income, value added, and output represents jobs and output that would not be lost when compared to the No Action Alternative. It is not an increase in employment or output in comparison to current levels. Appendix H presents the estimates of the direct, indirect, induced, and total effects by decade for full mine development alternative; the present value estimates for this alternative are presented in Table 4-139.

**Table 4-139. Net Impacts based on Desoto, Wingate East, South Pasture Extension, and Ona Mines plus the Pine Level/Keys and Pioneer Tracts Compared to the No Action Alternative**

| | No Action | With Mines | Difference |
|---|---|---|---|
| Average Annual Employment | 2,053 | 8,393 | 6,340 |
| Present Value Labor Income | $6,706,500,000 | $21,546,800,000 | $14,840,300,000 |
| Present Value, Value Added | $13,180,900,000 | $42,292,000,000 | $29,111,100,000 |
| Present Value Output | $22,704,500,000 | $72,835,500,000 | $50,131,000,000 |

It should be noted that the results presented in Table 4-139 assume that all four current actions and two reasonably foreseeable actions are permitted. If some, but not all, of these mines are permitted, the effects on the 8-county region can be expected to fall somewhere between the results for the individual alternatives and the development of all four current actions and both reasonably foreseeable actions for the 8-county region. Where these effects fall within this range will depend on which alternatives are permitted. It should also be noted that the summation of the individual county effects will be less than the effects for the 8-county region, because of the direct, indirect, and induced effects that accrue to the counties in the region that are not hosting the specific mines.

#### 4.12.6.2 Economic Resources: Cumulative Impact Magnitude and Significance

As described in Section 4.12.6, phosphate mining and agriculture have both had major influences on the economy of the region, especially in Hillsborough, Polk, Hardee, and Manatee Counties. Although phosphate mining has not occurred in the past in DeSoto County, its economy has been heavily influenced by agriculture; therefore, both phosphate mining and agriculture have had a significant, positive effect on the regional economy.

When the cumulative effects of the various proposed projects are considered, the net economic benefits to the AEIS study area are substantial. While the economic effects would have the greatest individual effect on Hardee, DeSoto, and Manatee Counties, in that order, all eight counties included in this evaluation, and the region as a whole, would experience some level of economic benefits because of the indirect and induced effects of the four current actions and the two reasonably foreseeable actions that are envisioned.

Because mining activities are a major component of the economic base of the AEIS study area, the effect of not permitting the four current actions and two reasonably foreseeable actions would result in a substantial decline in economic output and employment in this region. As noted above, permitting the four current actions and both reasonably foreseeable actions is not expected to increase employment and output in the region compared to current levels of activity, but rather reduce or offset the decline in employment and output that would otherwise occur as the current operating mines are closed.

Based on the economic analysis performed for this AEIS, the four current actions and two reasonably foreseeable actions would have a positive effect on the regional economy compared to the No Action Alternative. The four current actions and two reasonably foreseeable actions would largely avoid the loss in mining income and employment that would be experienced under the No Action Alternative; however, as compared to the current levels of employment and income in the region, the impact would be relatively moderate.

In summary, the economic analysis shows a substantial negative economic impact that would occur with the No Action Alternative as compared to current mining levels. The cumulative impacts with the mining alternatives, as compared to current conditions, can be considered to be minor, as the levels of employment and income are expected to largely avoid the negative effects that would occur under the No Action Alternative rather than increase these economic factors. The negative impact associated with the No Action Alternative on the region would be considered significant, but the positive impact associated with the proposed alternatives would be considered minor and insignificant compared to current conditions. The reason is that the additional 6,340 jobs associated with the cumulative impact of the four proposed mining alternatives and two reasonably foreseeable tracts represents about 0.5 percent of the total employment in the 8-county region, and are considered minor. The cumulative effect of mining and non-mining current and reasonably foreseeable actions is expected to be additive, but relatively small.

#### 4.12.6.3 Economic Resources: Cumulative Impact Mitigation, Monitoring, and Adaptive Management

Some of the negative effects of the No Action Alternative described above would be offset by changes in land use for the four current actions and two reasonably foreseeable actions' parcels that would lead to greater economic opportunity. For example, projects similar to those built or proposed to be built on reclaimed lands, as described above in Section 4.12.1, may be proposed for these parcels. Such decisions would be up to current and future landowners, along with local, state, and federal agencies that may have jurisdiction over such land uses. As the four current actions and two reasonably foreseeable actions are predicted to have a positive effect, no mitigation is necessary.

## 4.13 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF THE APPLICANTS' PREFERRED ALTERNATIVES

The following sections provide a summary of the adverse environmental impacts that cannot be avoided by any reasonable means during the construction and operation of the proposed projects. The degree and significance of these impacts are discussed in preceding sections of this chapter.

## 4.13.1 Air Quality and Noise

### 4.13.1.1 Air Quality

A temporary increase in particulate matter (PM) levels is anticipated in the vicinity of the mining activities. PM emissions would consist principally of fugitive dust generated during land clearing, mining, and reclamation recontouring of mined land when the land surface is temporarily barren, and by vehicular travel on unpaved roads. Air emissions would also be generated in small amounts by the combustion of gasoline and diesel motor fuels in cars, trucks, trains, and earthmoving equipment. PM levels should be reduced when mining activities are completed in an area, however, and would return to areawide background levels when reclamation is completed. No exceedances of any ambient air quality standard or long-term impacts to regional ambient air quality are anticipated.

### 4.13.1.2 Noise

Noise contributions from mining operations would be considered an unavoidable adverse impact related to the 24-hour per day operations of draglines, trucks, and other mining vehicles and operations. These are expected to be below the USEPA suggested short-term thresholds for residential areas, and will not exceed local county noise ordinances.

## 4.13.2 Geology and Soils

The acreage needed for the CSAs will provide a final settled elevation of land that would be approximately 20 feet above grade. Although the changes in topography would cause the drainage area boundaries and sizes to be altered slightly from existing conditions, in general, the site would be returned to the same relatively flat topography as currently exists. The characteristics of the existing soils would be changed by the reclaimed soils, which include tailings with overburden cap, settled clay, tailings, and overburden. During mining, soil erosion from water and wind are anticipated in unvegetated areas. The runoff is captured into the mine recirculation system which is isolated from the surrounding streams by the NPDES discharge points. The NPDES discharge points are regulated for water quality and are expected to prevent internal mine erosion from degrading local water quality in streams. Most of the mining activity is with wet soils; however, providing setbacks at property boundaries would further minimize potential offsite impacts from wind erosion.

## 4.13.3 Water Resources

### 4.13.3.1 Groundwater

Groundwater impacts from mining include lowering the SAS onsite during mining. The impacts of SAS water level reductions will mostly affect surface water contributions because groundwater outflow from the mined area to protected areas would be maintained by keeping a high level of water in the ditch adjacent to the protected areas. These areas include protected streams and wetlands, which would maintain surface water base flows in unmined creeks as discussed above. Lowering the SAS onsite does not impact seepage directly below the mine because the SAS is contained by relatively impermeable soil and onsite water stored in the CSAs and ditches contribute to recharge to the lower aquifers. Groundwater recharge during active mining was computed and included in the direct impact assessment (Section 4.3).

Groundwater potentiometric levels in the UFA would be reduced near the wells pumping water for plant operations. This is evaluated as a direct and indirect impact in the AEIS at a scale typically used to study aquifer levels. This scale may is too coarse to evaluate localized impacts at individual wetlands or small lakes. However, the SWFWMD monitors representative resources in west-central Florida and depends on these results to gauge impacts on a regional basis.

#### 4.13.3.2 Surface Water Quality

Water quality impacts from the clearing of vegetation from the land should be avoided because runoff from these areas would be captured in the mine water management system which will be in place prior to disturbance. However, there will be some land along the outside of the containment that is disturbed during construction and this area will be controlled using typical construction best management practices (BMPs) to limit offsite erosion and dust until ground surfaces are stabilized.

The quality of water discharged from the NPDES outfalls is not expected to adversely affect the water quality in adjacent streams; therefore, the impacts to stream water quality are expected to be minimal. The direct and indirect impacts of downstream resources were evaluated in Section 4.3.

#### 4.13.3.3 Surface Water Quantity

As a result of dewatering the mine pits, SAS water levels are lowered in the vicinity of the mine cuts. These impacts would be temporary and local except where noted elsewhere in the AEIS. The ditch and berm system mitigates most of these impacts but on occasion they have not worked well at certain locations. Monitoring is required to determine if modifications or other types of controls are needed. These SAS impacts when the ditch and berm systems do not work are considered isolated and temporary until the problems are fixed.

Unavoidable environmental impacts on surface water flows would result from some areas of land periodically being removed from the natural drainage systems. Runoff would be reduced in stream segments because some areas would be isolated from the natural drainage basins and would not contribute runoff to their flow. Rain falling within the mining and disposal areas is captured in the mine recirculation system for use in the mining operations. However, the stream base flows along floodplains or wetlands left undisturbed that are near an excavated open mine cut, are maintained during mining by seepage from the surrounding ditches or by discharge from NPDES outfalls. This BMP appears to offset impacts to natural low flows in most areas beyond the mine boundaries according to recent monitoring results (see Appendixes D and G). In addition, NPDES discharges offset some of the reduction from the capture of surface water during higher flow periods. Discharge of captured water during mining will contribute flow in streams below the discharge points and will likely reduce the duration of natural periods of no flow in some small streams. Current regulations require streams to be restored to match predevelopment conditions. Although it may take some time for significant ecological restoration, the flows appear to return to near pre-mining conditions (Section 3.3.2.3). As demonstrated in Section 4.2, indirect downstream impacts are expected to return closer to natural levels after reclamation.

### 4.13.4 **Ecological Resources**

Land clearing necessary for mining results in unavoidable impacts to wetlands, surface waters, and native uplands, and the biota they support. The timeframe for unavoidable losses of wetlands/waters and native uplands spans the period when these resources are impacted to when the impacts are offset through compensatory wetland mitigation and wetland/upland reclamation. Upland habitats are replaced through reclamation in accordance with the requirements of the Mandatory Reclamation Rule under the authority of the FDEP. Impacts to waters of the U.S. are required to be avoided and minimized to the greatest extent practicable, and compensatory mitigation performed pursuant to the 2008 Compensatory Mitigation Rule is required to offset unavoidable impacts. Impacts to wildlife (including listed species) during mining operations are minimized through implementation of the Wildlife and Habitat Management Plan and species-specific management plans prepared for the mine. Plans that address federally listed species are required to be approved by the USFWS prior to implementation. The post-reclamation landscape would approximate the pre-mining landscape in terms of upland/wetland types and coverage. Current mine reclamation is watershed based and emphasizes restoration of historical habitat interconnectivity to improve watershed ecological functions including wildlife use.

### 4.13.5 **Socioeconomics**

A slight increase in traffic levels on local roads and highways is expected to be caused by the mining activities. No adverse social or economic impacts are expected except where noted elsewhere in this AEIS. There are no unavoidable adverse economic impacts associated with this project; however, once the mining operations are concluded, the mining jobs and tax revenue would be lost.

### 4.13.6 **Radiation**

It is widely accepted that most of the radioactive materials in phosphate ore and in various products and byproducts of the beneficiation process tend to remain with the rock and the clay wastes. The radium also tends to remain bound to the particles in these materials and does not dissolve readily. Therefore, the expected concentrations of radiation on the CSAs after reclamation would be higher than the existing conditions and other reclaimed areas of the site. CSAs are not conducive to construction of buildings or other structures. Although the prospect of buildings being constructed on CSAs is low, buildings constructed on reclaimed settling ponds could potentially have higher indoor radon levels. If needed, radon-resistant construction techniques, such as those developed by the USEPA and BRC, could be used to protect homes and buildings from indoor radon hazard.

## 4.14 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

NEPA requires consideration of the relationship between short-term uses of the environment and long-term productivity associated with the Applicants' Preferred Alternatives. Open-pit mining of phosphate ore will be the short-term use within the proposed project boundaries. Recovery of this non-renewable mineral resource would necessitate the disruption of existing land uses and natural habitats. These disruptions would occur gradually for each mine block over a period of years within each boundary. Reclamation under the regulatory requirements of the FDEP would be designed, as noted earlier, to include contouring to safe slopes, providing for acceptable water quality and quantity, revegetation, and the return of wetlands to premining type, nature, function, and acreage. Expectations are that as part of the coordination with county planning and zoning; these lands would be returned to use for subsequent appropriate commercial uses, such as agriculture and silviculture, and to restore replacement of biotic communities. Restoration would follow the permit requirements following the compensatory mitigation rule and a goal for no net loss of jurisdictional waters of the U.S. There would be no long-term risk to human health and safety from the mine continuation. Specific resources where these effects would occur are in overall land use, ecological resources, water resources, and socioeconomics.

### 4.14.1 Air Quality

During the period of plant construction and phosphate mining and beneficiation, there would be increased emissions of gases and particulates to the atmosphere. These emissions and the resulting ambient concentrations would not exceed established state or federal standards. At the conclusion of mining operations, emissions would cease and no long-term effect on atmospheric resources is projected.

### 4.14.2 Water Resources

Average flows and flood flows would be reduced during mining due to a reduction in the drainage areas being captured in the mine recirculation system. However, base flows would be maintained by keeping a high level of water in ditch systems constructed adjacent to the protected areas. The contributing drainage basin areas will be altered during the life of the mine (20 or more years), but these changes vary spatially and temporally as the mining progresses across the site and mine blocks are reclaimed and released. Long-term changes that may affect surface water resources include alterations to topography, land cover, and soils characteristics. The runoff quantities from reclaimed CSAs would increase because of lower infiltration rates; however, reclaimed areas within the mine would offset these quantities because they are comprised of sand tailings typically with higher hydraulic conductivity. Flow is also regulated from the CSAs, thereby reducing the peak flow during storms. The water balances presented in Section 3.3.2.3 and Appendix G indicate that the overall water delivery is expected to remain similar between pre- and post-reclamation, but direct runoff will be somewhat lower with greater SAS recharge and baseflow in the future. Recharge to deeper aquifers may change by minor amounts because the confining layers beneath the SAS are not disturbed.

### 4.14.3 Ecology

The long-term productivity of reclaimed uplands is expected to be similar to the productivity of existing onsite uplands; reclaimed upland forests would require more time to reach mature succession stages than would rangelands and pasturelands. Current regulatory success criteria for created wetlands/waters require achievement of lost habitat functions, including wildlife use of wetlands and fish and aquatic macroinvertebrate compositions of streams. The ecological productivity of created wetlands and streams are therefore expected to approximate those of existing systems once they have reached maturity. The post reclamation coverage of habitats would be comparable to the pre mining coverage of habitats. Current reclamation is conducted in accordance with the goals of the IHN, which include the long-term goal of increasing the amount and quality of wildlife habitats and corridors within the region through habitat replacement, protection, and connection.

### 4.14.4 Economics

Under the Applicants' Preferred Alternatives, mining would provide continued employment for personnel and would sustain local and regional economic contribution to the long-term economic growth of affected counties.

### 4.14.5 Land Use

Table 4-140 summarizes the approximate land areas affected by each mine, and the total time frame over which these lands will be occupied, although the specific land disturbance occurs sequentially over mining blocks throughout the life of the mine. The specific land use changes for these projects are provided in Section 4.1.8.9. Prior to clearing these lands, their current uses are generally maintained. Reclamation and restoration of these land areas, as described in Section 4.1.8.9 also progresses sequentially. County-wide, the approximate percentage of preemptive land use by mining is also summarized in Table 4-140. Land uses generally return to pre-mining conditions except for the areas dedicated for an extended period for CSAs.

**Table 4-140. Comparison of Land Areas Allocated for Mine Use and Operations**

| Mine | Mine Life (years) | Total Area (acres) | Total Disturbed (acres) | Total Mined (acres) | County Area (acres) | % of Total County Area |
|---|---|---|---|---|---|---|
| Desoto | 14 | 18,287 | 17,260 | 13,948 | DeSoto (318,080) | 4 |
| Ona | 28 | 22,320 | 20,863 | 18,930 | Hardee (408,320) | 5 |
| Wingate East | 31 | 3,685 | 3,411 | 3,070 | Manatee (571,620) | 0.50 |
| South Pasture Extension | 17 | 7,513 | | 6,416 | Hardee (408,320) | 1.60 |
| **Totals** | | **51,805** | **41,534** | **42,364** | | |

## 4.15 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

**Irreversible commitments** are decisions affecting renewable resources, such as soils and wetlands or other categories of resources. Decisions such as these are considered irreversible because their implementation would affect a resource that has deteriorated to the point that renewal can only occur over a long period of time or at great expense, or because they would cause the resource to be destroyed or removed.

**Irretrievable commitment** of natural resources means loss of production or use of non-renewable resources as a result of a decision. It represents opportunities missed for the period of time that a resource cannot be used. Irretrievable refers to the permanent loss of a resource including production, harvest, or use of natural resources. Those resources irreversibly altered or irretrievably committed by the implementation of the project boundaries are summarized in the following paragraphs.

### 4.15.1 Soils and Geology

Overburden removal would cause the destruction of existing stratigraphy, resulting in the soil surface character being irreversibly altered. Table 4-141 summarizes the estimated quantities of phosphate rock that would be removed and the approximate quantities of phosphate ore represented by this removal over the respective life of each mine. There are also typically byproducts of the milling process used for the construction of road beds, dikes, or other support features that are considered as an irretrievable commitment of resources.

| Table 4-141. Estimated Extraction of Rock and Ore over Life of Mine | | |
|---|---|---|
| **Mine** | **Total Rock Extracted (tons)** | **Total Ore Extracted** |
| Desoto | 84,000,000 | 90,006,444 |
| Ona | 168,000,000 | 173,001,270 |
| Wingate East | 168,000,000 | 35,998,820 |
| South Pasture Extension | 403,000,000 | 51,552,560 |
| **Totals** | **823,000,000** | **350,559,094** |

## 4.15.2 Ecological Resources

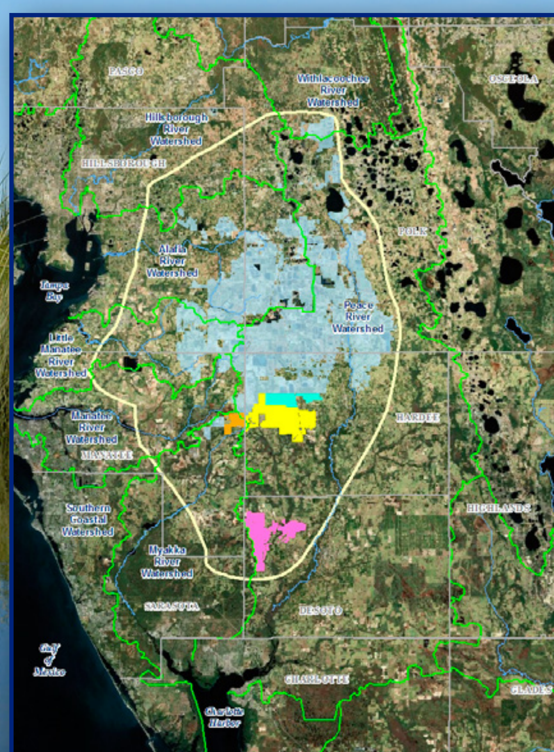
The Applicants' Preferred Alternatives would result in relatively few permanent losses of ecological resources. Certain upland habitats may not be replaced type-for type through reclamation. Some slow-moving wildlife species may not be able to relocate to undisturbed areas and may therefore be injured or killed during land clearing. The potential for incidental animal mortality occurring during land clearing exists but is considered to be relatively low and any losses would have a negligible effect on regional wildlife populations.

## 4.15.3 Energy Use

The project would require energy for construction, mining, product transport, land reclamation and restoration, and other purposes throughout the mine life. These expenditures are estimated in Table 4-142. The energy used would not be retrievable and would represent a decrease in energy available for future use.

| Table 4-142. Estimated Energy Use for Each Project | | | |
|---|---|---|---|
| | **Electricity (megawatt average)** | **Gasoline (gallons/year)** | **Diesel (gallons/year)** |
| Desoto | 75 | 95,000 | 75,000 |
| Ona | 75 | 95,000 | 75,000 |
| Wingate East | 19 | 30,000 | 12,000 |
| South Pasture Extension | 65 | 60,000 | 24,000 |
| **Totals** | | **280,000** | **186,000** |

# 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 Star**t = 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.

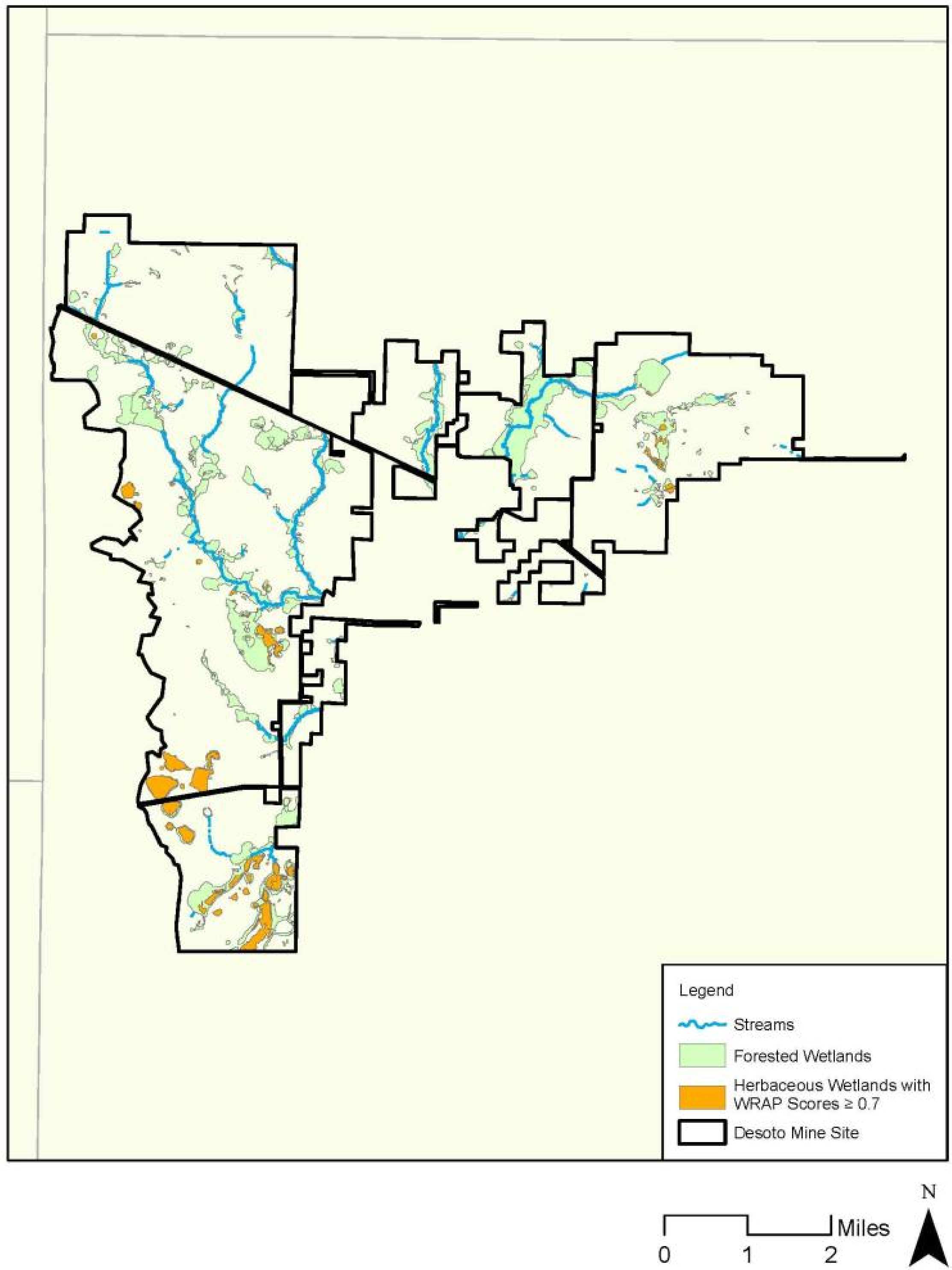
The locations of the priority avoidance criteria (streams, forested wetlands, and high-quality herbaceous wetlands) based on the USACE-approved Jurisdictional Determinations for each of the four Applicants' Preferred Alternatives are shown on Figures 5-2 through 5-5. This mapping is provided for informational 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.

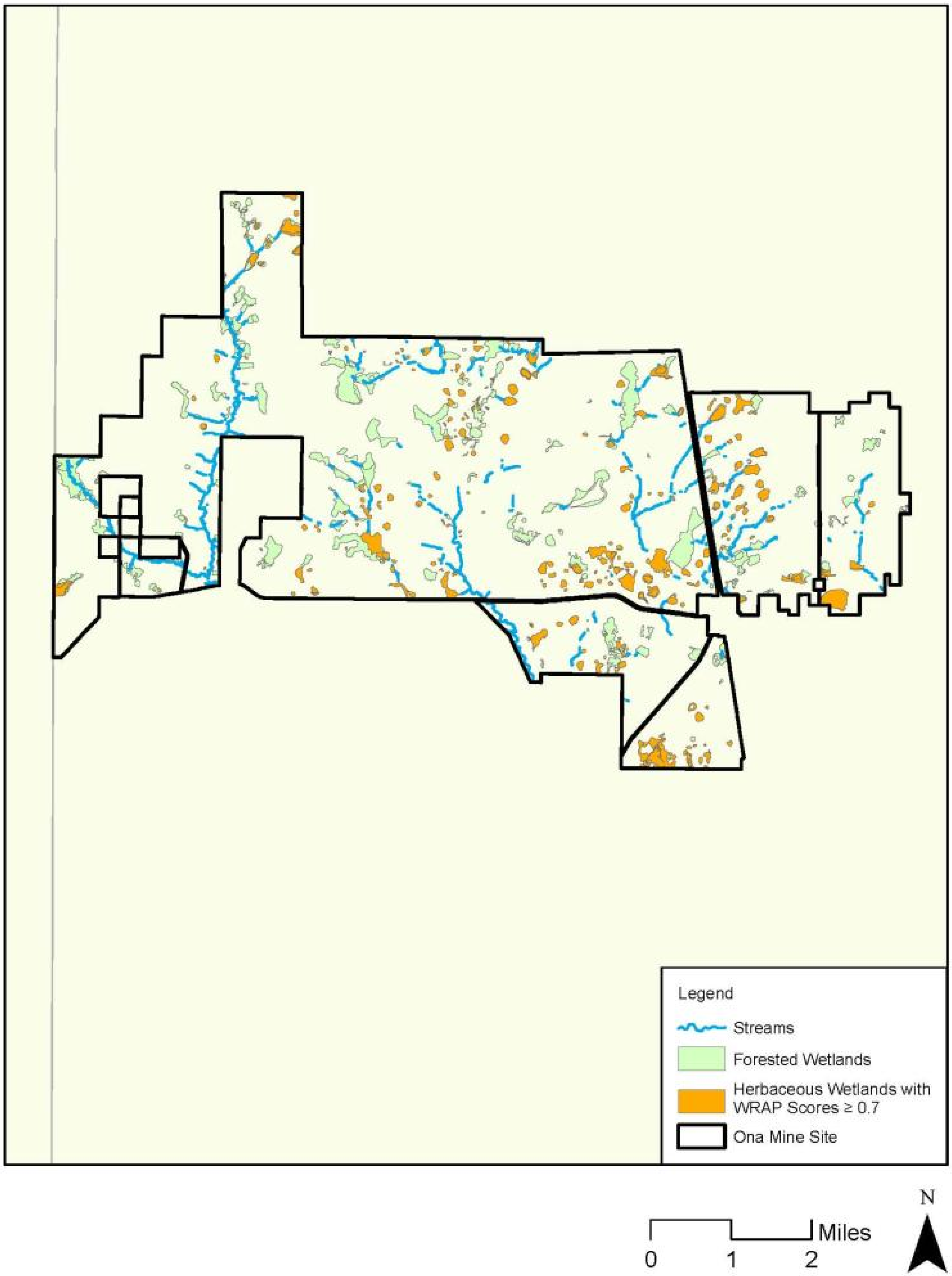
#### 5.4.3.3 Step 3 – Evaluate Opportunities to Minimize Impacts

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.



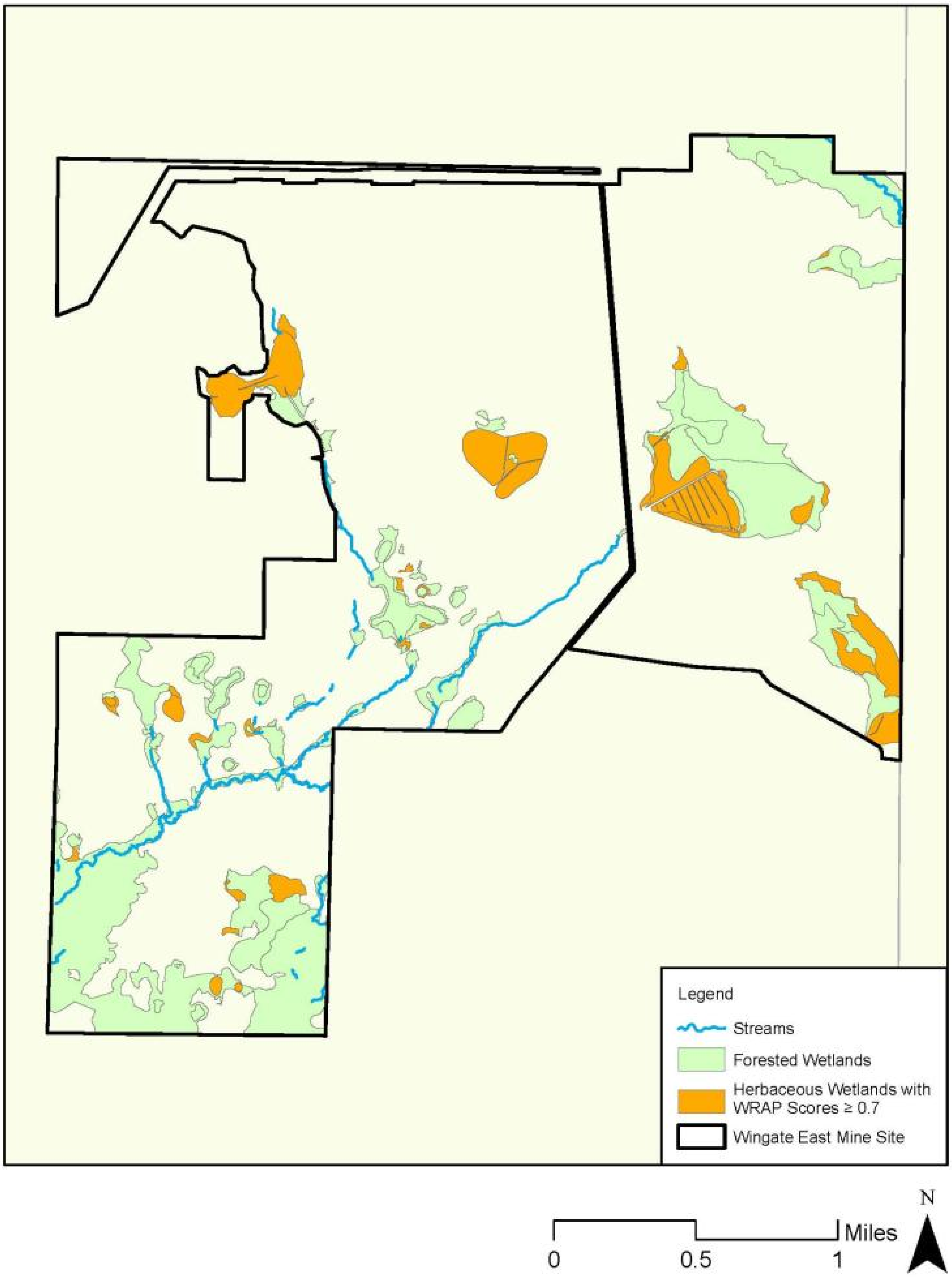

*For informational purposes only – does not show final areas determined to be avoided*
*Based on USACE-approved Jurisdictional Determinations*
*WRAP = Wetland Rapid Assessment Procedure*

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



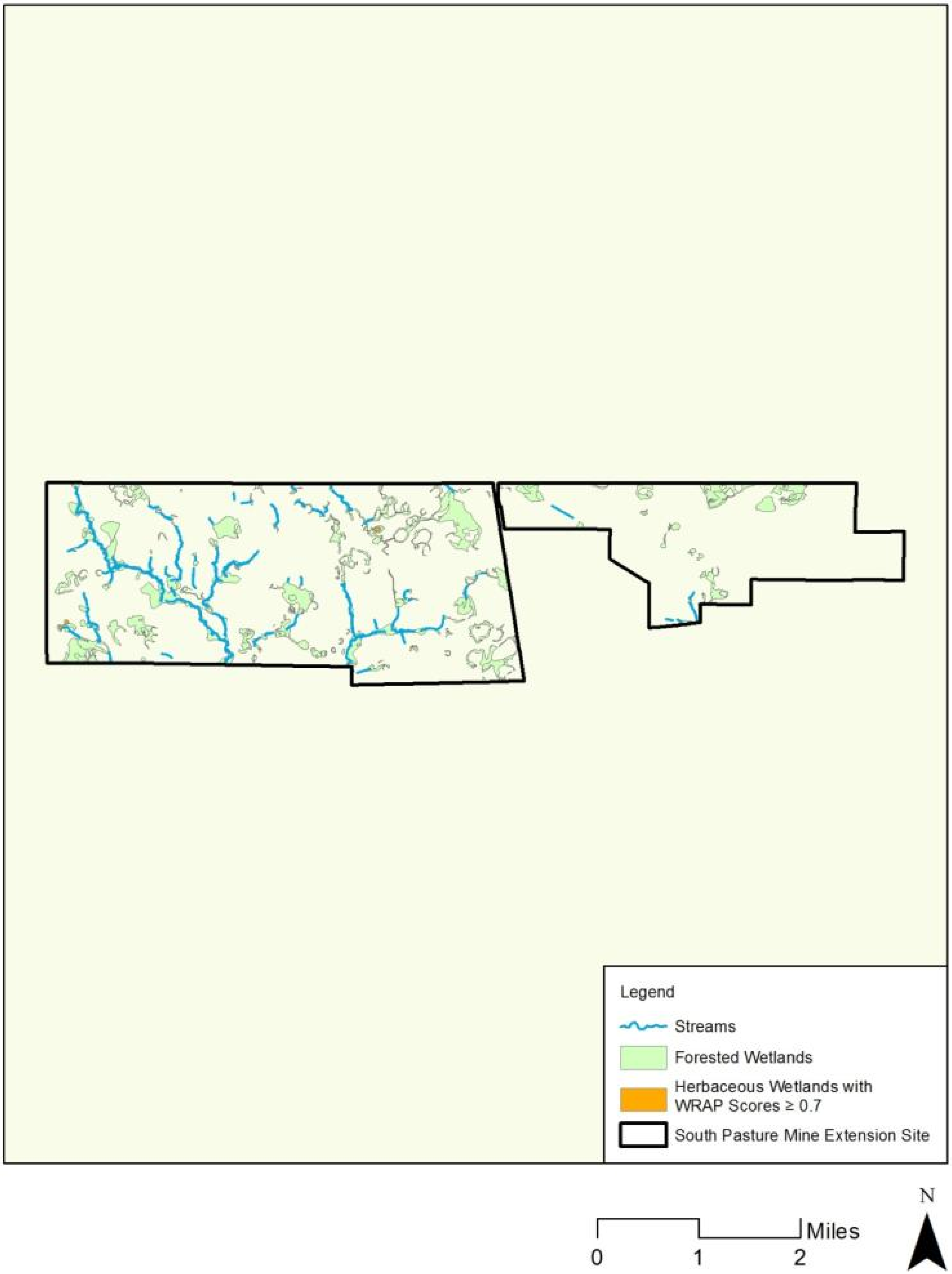

*For informational purposes only – does not show final areas determined to be avoided*
*Based on USACE-approved Jurisdictional Determinations*
*WRAP = Wetland Rapid Assessment Procedure*

**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.

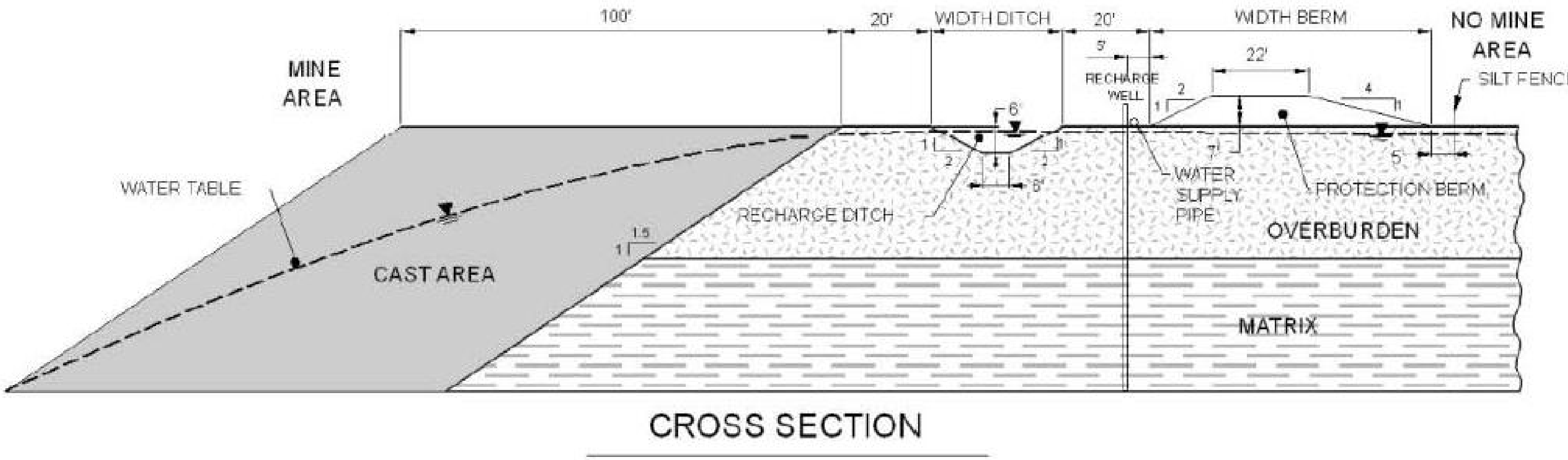



**Figure 5-6. Schematic of Typical Ditch and Berm System**


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

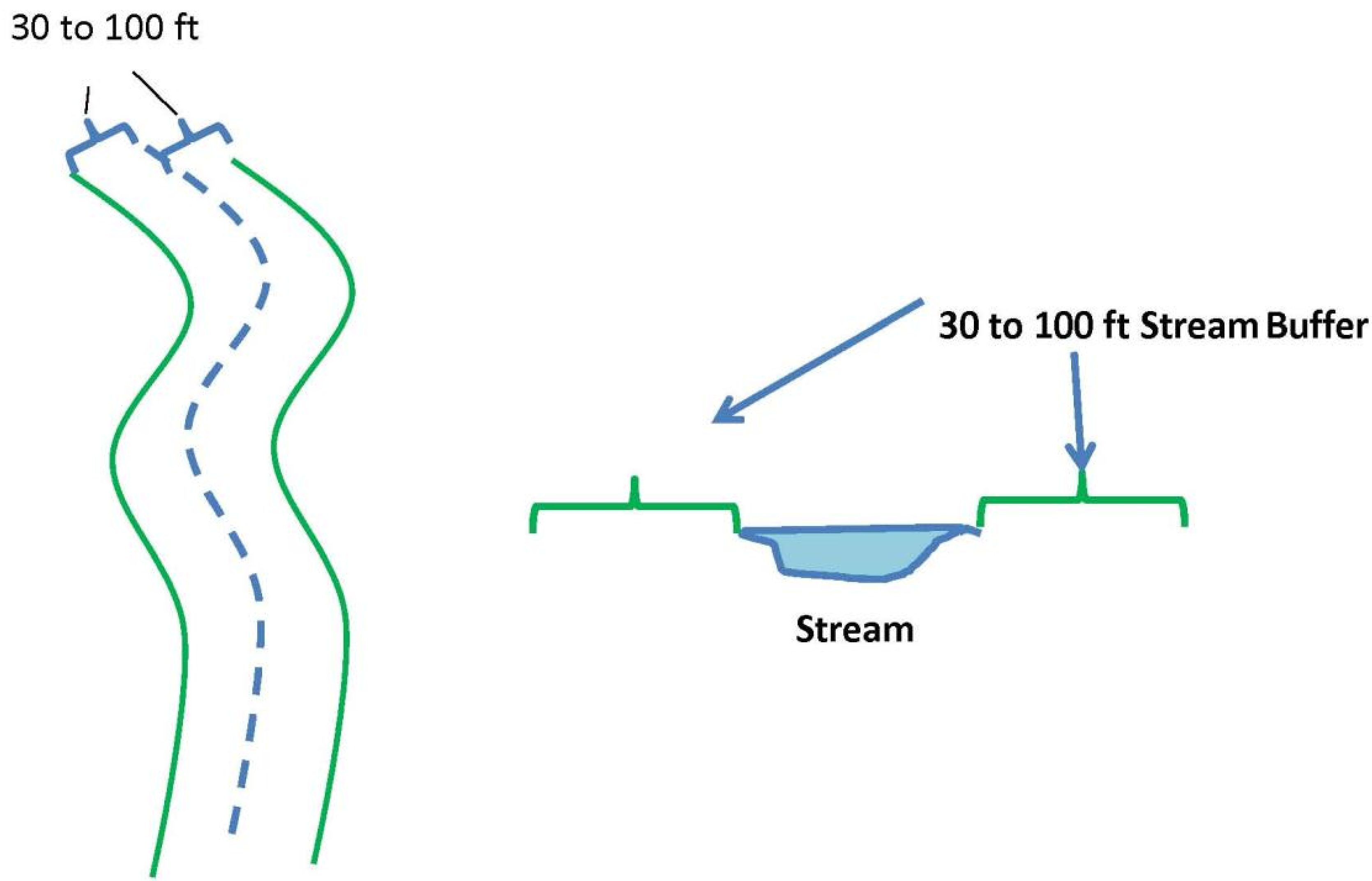



**Figure 5-8. Conceptual Buffer for Water Quality Protection**

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.

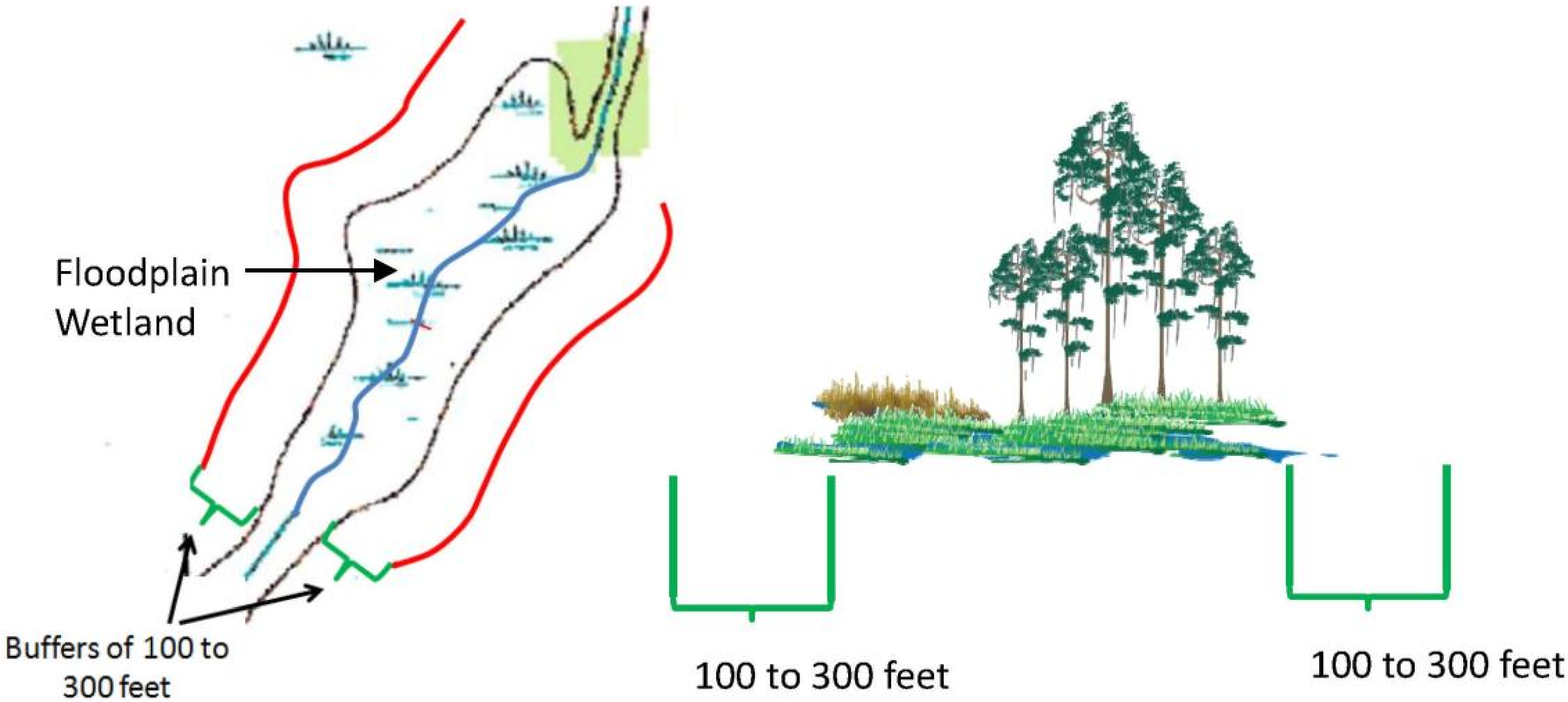



**Figure 5-9. Conceptual Buffer for Wildlife Protection**

## 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.

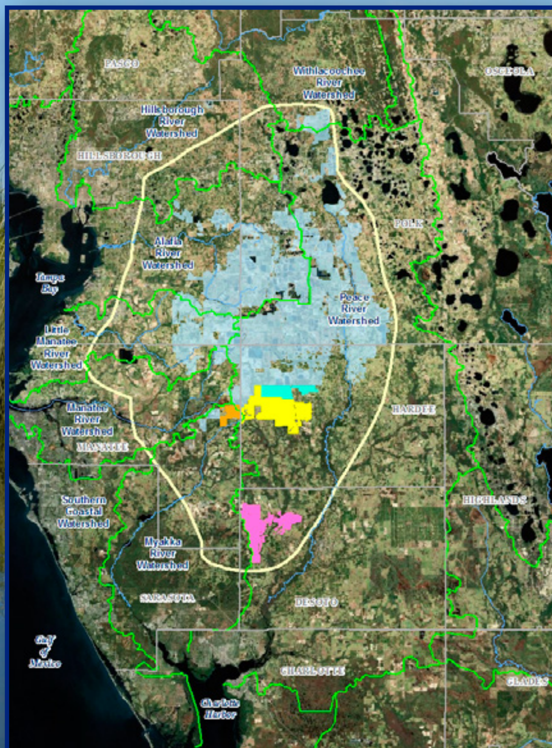
The preservation and integration of high-quality habitats into the IHN benefits regional wildlife populations and various listed plant and animal species. Habitats that are typically targeted for avoidance and preservation include riverine systems and associated floodplains, large herbaceous wetlands, 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).

# Chapter 6
# Compliance with Environmental Requirements



# CHAPTER 6
# COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

This chapter documents the major federal regulations and executive orders (EOs) that may apply to the various alternatives evaluated in this Draft AEIS on phosphate mining in central Florida. Compliance activities are described as they relate to proposed activities that may be associated with each of the proposed mine locations.

## 6.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

The purposes of NEPA (42 U.S.C. 4321 et seq.), as amended, are to: (1) declare a national policy that will encourage productive and enjoyable harmony between man and his environment, (2) promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, (3) enrich the understanding of the ecological systems and natural resources important to the nation, and (4) establish a CEQ. NEPA establishes a national policy requiring that federal agencies consider the environmental impacts of major federal actions significantly affecting the quality of the human environment before making decisions and taking actions to implement those decisions. Implementation of NEPA requirements in accordance with CEQ regulations (40 CFR 1500–1508) can result in a Categorical Exclusion, an environmental assessment, a Finding of No Significant Impact, or an EIS. This Final AEIS has been prepared in accordance with NEPA requirements, CEQ regulations (40 CFR 1500 et seq.), and USACE provisions for implementing the procedural requirements of NEPA (33 CFR 230, USACE Engineering Regulation ER 200-2-2). It discusses reasonable alternatives and their potential environmental consequences.

## 6.2 ENDANGERED SPECIES ACT OF 1973

The Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.) declares the intention of the Congress to conserve threatened and endangered species and the ecosystems on which those species depend. The ESA requires that federal agencies, in consultation with the USFWS and the NMFS, use their authorities in furtherance of its purposes by carrying out programs for the conservation of endangered or threatened species, and by taking such action necessary to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of such endangered or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary of the Interior or Commerce, as appropriate, to be critical (see 50 CFR Part 17 and 50 CFR Part 402).

Surveys for federally-protected species have been conducted and coordination with the USFWS is an ongoing activity by the Applicants. The USFWS provided comments on the Draft AEIS as part of their coordination role in the Final AEIS. These comments have been addressed in this Final AEIS.

## 6.3 NATIONAL HISTORIC PRESERVATION ACT OF 1966

The National Historic Preservation Act of 1966 (16 U.S.C. 470) created the Advisory Council on Historic Preservation to advise the President and Congress on matters involving historic preservation. In performing its function the Council is authorized to review and comment upon activities licensed by the federal government which will have an effect upon properties listed in the NRHP, or eligible for such listing. The concern of Congress for the preservation of significant historical sites is also expressed in the Preservation of Historical and Archeological Data Act of 1974 (16 U.S.C. 469 et seq.), which amends the Act of June 27, 1960. By this Act, whenever a federal construction project or federally licensed project, activity, or program alters any terrain such that significant historical or archeological data are threatened, the Secretary of the Interior may take action necessary to recover and preserve the data prior to the commencement of the project.

Prior to initiation of ground disturbing activities, systematic archeological surveys should be performed. Such surveys will be completed and the results reviewed prior to issuance of the permits under this document. The purpose of the surveys will be to locate and assess the significance of historic properties and determine if activities proposed under the permit will adversely affect these properties. If it is determined that significant historic properties will be adversely affected by the project, a plan will be developed, in consultation with the State Historic Preservation Officer, to avoid, minimize, or mitigate effects to historic properties. Actions under the plan will be completed prior to initiation of ground disturbing activities. All work will be conducted in compliance with the National Historic Preservation Act of 1966, as amended (Public Law 89-655) and the Archeological and Historic Preservation Act, as amended (Public Law 93-291). Chapter 3 of this Final AEIS includes information on surveys previously performed, and Chapter 4 contains an analysis of potential impacts associated with cultural and historical resources.

## 6.4 CLEAN WATER ACT OF 1972

The CWA (33 U.S.C. 1251 et seq.) was enacted to “restore and maintain the chemical, physical, and biological integrity of the Nation’s water.” The CWA prohibits the “discharge of toxic pollutants in toxic amounts” to navigable waters of the U.S. Section 404 of the CWA established a program to regulate the discharge of dredged and fill material into waters of the U.S., including wetlands. Activities regulated under this program include fill for development, water resource projects (e.g., dams and levees), infrastructure development (e.g., highways and airports), and conversion of wetlands to uplands for farming and forestry.

Section 402 of the CWA authorizes USEPA to issue permits under procedures established to implement the NPDES program. The administration of this program has been delegated to the State of Florida.

In 1990, the USEPA developed permitting regulations under the NPDES program to control stormwater discharges associated with 11 categories of industrial activity, including mineral mining.

Section 401 of the CWA (33 U.S.C. 1341) requires any applicant for a federal license or permit that conducts any activity that may result in a discharge of a pollutant into waters of the United States to obtain a certification from the state in which the discharge originates or would originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the affected waters. The jurisdiction is determined at the point where the discharge originates or would originate, and the discharge is required to comply with the applicable effluent limitations and water quality standards. A certification obtained for the construction of any facility must also pertain to the subsequent operation of the facility.

CWA compliance was initiated through the Section 404 permit applications submitted to the USACE by CF Industries on April 28, 2010, and by Mosaic on June 29 and 30, 2011. This Final AEIS addresses potential impacts to waters of the U.S. by the Applicants' Preferred Alternatives, alternatives considered to minimize those impacts, and management practices to further minimize impacts and mitigation. Public notices of the Section 404 applications were released in parallel with the NOA for the Draft AEIS. Section 401 certification is being evaluated concurrently as part of the Section 404 permit application reviews. Decisions on NPDES permits by FDEP will be completed before any mining operation begins. As a cooperating agency, FDEP has provided input throughout the development of the Draft and Final AEIS.

## 6.5 CLEAN AIR ACT OF 1972

The CAA (42 U.S.C. 7401 et seq.) is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the CAA (42 U.S.C. 7418) requires that each federal agency with jurisdiction over any property or facility engaged in any activity that might result in the discharge of air pollutants comply with "all Federal, state, interstate, and local requirements" with regard to the control and abatement of air pollution.

Section 109 of the CAA (42 U.S.C. 7409 et seq.) directs USEPA to set NAAQS for criteria pollutants. USEPA has identified and set NAAQS under 40 CFR Part 50, for the following criteria pollutants: particulate matter, sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, and lead. Section 111 of the CAA (42 U.S.C. 7411) requires establishment of national standards of performance for new or modified stationary sources of atmospheric pollutants. Section 160 of the CAA (42 U.S.C. 7470 et seq.) requires that specific emission increases be evaluated prior to permit approval to prevent significant deterioration of air quality. Section 112 of the CAA (42 U.S.C. 7412) requires specific standards for releases of hazardous air pollutants (including radionuclides).

Air permits in Florida are issued by the FDEP. The state regulations are implemented to control emissions of air pollutants such that the requirements of the CAA (including NAAQS and emission limits) are met. An analysis of the potential impacts of the activities associated with the Applicants' Preferred Alternatives in terms of their impact on air quality was completed for this Final AEIS in Chapter 4. It is the Applicants' responsibility to obtain the necessary air permits and ensure compliance with the CAA.

## 6.6 COASTAL ZONE MANAGEMENT ACT OF 1972

Section 307(c) of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1456(c)), requires federal agencies conducting activities, including development projects, directly affecting a state's coastal zone, to comply to the maximum extent practicable with an approved state coastal zone management program. The Act also requires any non-federal applicant for a federal license or permit to conduct an activity affecting land or water uses in the state's coastal zone to furnish a certification that the proposed activity will comply with the state's coastal zone management program. Generally, no permit will be issued until the state has concurred with the non-federal applicant's certification. This provision becomes effective upon approval by the Secretary of Commerce of the state's coastal zone management program (see 15 CFR Part 930).

The Florida Coastal Management Program (FCMP) was approved in September 1981, and includes the entire state in Florida's "coastal zone." Within FDEP, the Office of Intergovernmental Programs coordinates state review on the consistency of federal projects and federally-funded activities relative to state policies and regulations. A federal consistency determination in accordance with 15 CFR Part 930 Subpart C will be conducted as part of the review process for the individual projects. State consistency review will also be performed during the agency coordination of the individual projects to ensure consistency with the FCMP.

## 6.7 FARMLAND PROTECTION POLICY ACT OF 1981

The Farmland Protection Policy Act of 1981 (7 U.S.C. 4201) attempts to minimize the effects federally funded programs have on the conversion of farmland to non-agricultural uses. The act specifically targets the urban sprawl resulting from the conversion and the associated waste of resources and energy.

According to 7 CFR, Section 658.2(c)(1)(i) of the Farmland Protection Policy Act, federal permitting, licensing, or rate approval programs for activities on private or non-federal lands are not governed by this act. Therefore, mining activities occurring in the CFPD are not subject to this act.

## 6.8 SOLID WASTE DISPOSAL ACT OF 1965

The Solid Waste Disposal Act of 1965, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA) and the Hazardous and Solid Waste Amendments of 1984 (42 U.S.C. 6901 et seq.), as amended, governs the transportation, treatment, storage, and disposal of hazardous waste and nonhazardous waste (that is, municipal solid waste). Under RCRA, USEPA defines and identifies hazardous waste; establishes standards for its transportation, treatment, storage, and disposal; and requires permits for persons engaged in hazardous waste activities. Regulations imposed on a generator or on a treatment, storage, or disposal facility vary according to the type and quantity of hazardous waste generated, treated, stored, or disposed of, and the methods of treatment, storage, and disposal. Florida has adopted by reference portions of the federal regulations into Chapter 62-730, F.A.C. An analysis of issues related to the generation and disposal of hazardous wastes associated with the Applicants' Preferred Alternatives is included in Chapter 4 of this Final AEIS.

## 6.9 ESTUARY PROTECTION ACT OF 1968

The Estuary Protection Act of 1968 ((16 U.S.C. 1221-1226; P.L. 90-454; 82 Stat 625) was passed to highlight the values of estuaries and the need to conserve their natural resources while providing a means to achieve a balance between protection of resources and development. It authorized the Secretary of the Interior to take a variety of actions, including study and inventory of estuaries of the U.S., in cooperation with other federal agencies and the states.

An adjunct to the Estuary Protection Act was the creation of the NEP in 1987, through amendments to the CWA. The NEP was designed to identify, restore, and protect nationally-significant estuaries of the U.S., which are included in the program through a designation process. The USEPA administers the program, with committees consisting of local government officials, private citizens, and representatives from other federal agencies, academic institutions, industry, and estuary user-groups managing program decisions and activities.

Charlotte Harbor was designated as part of the NEP on July 6, 1995. As described in Chapter 3, the watersheds of the Peace, Myakka, and Caloosahatchee Rivers (nearly 4,500 square miles) feed freshwater into the coastal area, which serves as a home, feeding ground and/or nursery area for more than 270 species of resident, migrant, and commercial fishes of the Gulf of Mexico (CHNEP, 2005). This estuarine system and its watershed are both directly and indirectly vitally important economic assets to Florida (USEPA, 2007b).

Problems facing the Charlotte Harbor NEP include hydrologic changes, degradation of water quality, the loss of fish and wildlife habitat, and land use change. The population in the watershed continues to grow based on current trends, with a 33 percent increase between 2000 and 2020 (CHNEP, 2000).

All of the proposed mine locations fall within the CHNEP boundaries. There has been, and continues to be, coordination with the partners to the CHNEP, including the counties, FDEP, SWFWMD, USACE, USFWS, and the USEPA. This coordination has continued throughout the preparation of this Final AEIS and therefore is in compliance with the Estuary Protection Act.

## 6.10 NATIONAL WILD AND SCENIC RIVERS ACT

Section 7(a) of the Wild and Scenic Rivers Act (16 U.S.C. 1278 et seq.) provides that no department or agency of the United States shall assist by loan, grant, license, or otherwise in the construction of any water resources project that would have a direct and adverse effect on the values for which such river was established, as determined by the Secretary charged with its administration.

A portion of the Myakka River is a designated Wild and Scenic River in Sarasota County between the county line and SR 780. Based on the analyses in the Final AEIS there are not expected to be any impacts from the Applicants' Preferred Alternatives to the Wild and Scenic portion of the Myakka River.

## 6.11 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Act of 1956 (16 U.S.C. 742a, et seq.), the Migratory Marine Game–Fish Act (16 U.S.C. 760c–760g), the Fish and Wildlife Coordination Act (16 U.S.C. 661–666c) and other acts express the will of Congress to protect the quality of the aquatic environment as it affects the conservation, improvement and enjoyment of fish and wildlife resources. Reorganization Plan No. 4 of 1970 transferred certain functions, including certain fish and wildlife-water resources coordination responsibilities, from the Secretary of the Interior to the Secretary of Commerce. Under the Fish and Wildlife Coordination Act and Reorganization Plan No. 4, any federal agency that proposes to control or modify any body of water must first consult with the USFWS or the NMFS, as appropriate, and with the head of the appropriate state agency exercising administration over the wildlife resources of the affected state.

Although the Act is not directly applicable to the projects that make up the Applicants' Preferred Alternatives, which are not water-resources development projects, coordination with federal and state resource agencies has been conducted throughout the preparation of the Draft AEIS and comments to this document relative to fish and wildlife coordination are included in this Final AEIS. Additional coordination is ongoing as requested by resource agencies.

## 6.12 MIGRATORY BIRD TREATY ACT OF 1918 AND THE MIGRATORY BIRD CONSERVATION ACT OF 1929

The Migratory Bird Treaty Act (16 U.S.C. 703-712, July 3, 1918, as amended 1936 et seq.) implements various treaties and conventions between the U.S. and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, it is unlawful to take, kill, or possess migratory birds, or attempt the preceding actions. The Act also makes it unlawful to possess, sell, barter, purchase, deliver, ship, import, export, or offer the preceding; or to receive any migratory bird, part, nest, egg, or product unless allowed by permit. Permitting decisions may be based on temperature zones, distribution, abundance, economic value, breeding habits, and flight patterns of migratory birds. The Migratory Bird Conservation Act (16 U.S.C. 715-715d, 715e, 715f-715r) of February 18, 1929 (45 Stat. 1222) established a commission to approve areas of land or water recommended by the Secretary of the Interior for acquisition as reservations for migratory birds.

Although migratory birds use the areas proposed for mines at various times of the year, the Applicants' Preferred Alternatives are not likely to result in violation of either of these acts. To avoid affecting migratory waterfowl nesting, pre-clearing will be conducted by pedestrian transect surveys prior to clearing any forested wetlands. Migratory winter species will also be recorded. If pre-clearing surveys reveal active nesting, clearing activities will be restricted until the young have fledged and mining activities would be rescheduled accordingly. Clearing of any nests will require consultation with the FFWCC and a nest removal permit. This coordination will be conducted independently of the USACE Section 404 permitting process.

## 6.13 BALD AND GOLDEN EAGLE PROTECTION ACT OF 1940, AS AMENDED

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940 and amended several times since then, prohibits anyone without a permit issued by the Secretary of the Interior from "taking" bald or golden eagles, including their parts, nests, or eggs. In addition to immediate impacts, this definition also covers impacts that could result from human-induced alterations around a previously used nest site during a time when eagles are not present, if the alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment when it returns.

Although bald eagles were removed from the endangered species list in June 2007, they are still protected under this act as well as the Migratory Bird Treaty Act and the 1900 Lacey Act which protects bald eagles by making it a federal offense to take, possess, transport, sell, import, or export their nests, eggs and parts that are taken in violation of any state, tribal, or U.S. law. When the bald eagle was delisted, USFWS established regulations (50 CFR 22.26, 22.27, and 22.28) creating a permit program to authorize limited incidental take of bald eagles and golden eagles, with tighter restrictions for golden eagles. Under the new regulations, permits associated with bald eagles can authorize disturbances associated with development activities, with decisions made based on regional populations of eagles among other factors.

Bald eagles and their nests have been reported on and around the proposed mine locations. Prior to mining near active nests, the applicants will coordinate with the USFWS to obtain any necessary clearances prior to mining near active nests. This coordination will be conducted independently of the USACE Section 404 permitting process.

## 6.14 EXECUTIVE ORDER 11988 – FLOODPLAIN MANAGEMENT

EO 11988 requires federal agencies to avoid, to the extent possible, the long-term and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. To meet these goals, agencies are required to take action to reduce the risk of flood loss, to minimize the effect of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial functions of floodplains. The EO applies to federal actions that involve:

- Acquiring, managing, and disposing of federal lands and facilities
- Taking direct federal action or federal financing and assisting with construction and improvements to nonfederal facilities
- Land use, including but not limited to water and related land resources planning, regulation, and licensing activities

Compliance with EO 11988 has been initiated through the Section 404 permit applications submitted to the USACE by CF Industries on April 28, 2010, and by Mosaic on June 29 and 30, 2011. This Final AEIS addresses potential impacts to floodplains (Chapter 4) and management practices to further minimize and mitigate potential impacts (Chapter 5). Current plans for avoiding or minimizing impacts to floodplains as currently proposed include combinations of setbacks and avoidance of perennial and some intermittent streams by the applicants. Additionally, industry optimization of design of ditch and berm systems is now required by SWFWMD in Water Use Permit conditions in order to accomplish increased surficial aquifer recharge where deemed necessary to help protect sensitive natural resources in floodplains or other preservation areas.

## 6.15 EXECUTIVE ORDER 11990 – PROTECTION OF WETLANDS

EO 11990*,* adopted on May 24,1977, and amended by EO 12608, directs federal agencies to preserve and enhance the natural and beneficial values of wetlands and to avoid, to the extent possible, the long-term and short-term adverse impacts associated with the destruction or modification of wetlands. Federal agencies also are directed to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative, and to provide opportunities for early public review of any plans or proposals for new construction in wetlands (Section 2(b)). EO 11990 does not apply to the permits, licenses, or allocations issued by federal agencies to private parties for activities involving wetlands on non-federal property.

Despite this limit to the applicability of EO 11990, the Applicants' Preferred Alternatives comply with the intent of the EO as documented through the Section 404 permit applications submitted to the USACE by CF Industries on April 28, 2010, and by Mosaic on June29 and 30, 2011. Chapter 5 of the Final AEIS addresses avoidance and minimization of impacts to waters of the U.S., including wetlands, and compensatory mitigation for unavoidable impacts.

## 6.16 EXECUTIVE ORDER 12898 – FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW INCOME POPULATIONS

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 11, 1994), requires each federal agency to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. EO 12898 requires the federal government to review the effects of their programs and actions on minorities and low-income communities.

An environmental justice analysis was completed on the Applicants' Preferred Alternatives and the offsite alternatives and is included in Chapter 4 of this Final AEIS.

## 6.17 EXECUTIVE ORDER 13112 – INVASIVE SPECIES

EO 13112 defines invasive species as "…an alien (or non-native) species whose introduction does, or is likely to cause economic or environmental harm or harm to human health" and requires federal agencies to prevent the introduction of invasive species, to provide for their control, and to minimize their economic, ecological, and human health impacts (*Federal Register*, 1999). The National Invasive Species Council (NISC) was established by EO 13112 to ensure that federal programs and activities to prevent and control invasive species are coordinated, effective, and efficient. NISC comprises the secretaries and administrators of 13 federal departments and agencies to provide high-level coordination on invasive species and is co-chaired by the secretaries of Commerce, Agriculture, and the Interior.

Compliance with EO 13112 is documented by the applications provided by the Applicants including identification of invasive species in the proposed mining locations. Protocols for management and control are documented in the Final AEIS.

## 6.18 RIVERS AND HARBORS ACT OF 1899

Section 9 of the Rivers and Harbors Act, approved March 3, 1899 (33 U.S.C. 401), prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Section 9 also pertains to bridges and causeways but the authority of the Secretary of the Army and Chief of Engineers with respect to bridges and causeways was transferred to the Secretary of Transportation under the Department of Transportation Act of October 15, 1966 (49 U.S.C. 1155g(6)(A)).

Section 10 of the Rivers and Harbors Act approved March 3, 1899, (33 U.S.C. 403) (hereinafter referred to as Section 10), prohibits the unauthorized obstruction or alteration of any navigable water of the United States. The construction of any structure in or over any navigable water of the United States, the excavating from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army.

Neither Section 9 nor Section 10 of the Act is applicable since the activities associated with the Applicants' Preferred Alternatives are not located in navigable waters.

## 6.19 EXECUTIVE ORDER 13045 – PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH RISKS AND SAFETY RISKS

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, was originally signed in 1997 and amended in 2001 by EO 13229 and in 2003 by EO 13296. This EO orders that each federal agency make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. Risks to health or to safety are attributable to products or substances that a child is likely to come in contact with or ingest (such as air, food that a child consumes, water consumed or used for recreation, soil, and products a child uses or is exposed to).

Compliance with EO 13045 is documented in Chapter 4.9 of the Final AEIS, Land Use, which discusses the lack of special population land uses such as schools and daycares near the Applicants' Preferred Alternatives.

## 6.20 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT/FISHERY CONSERVATION AND MANAGEMENT ACT OF 1976

The purposes of these Acts are to conserve and manage fishery resources off the U.S. coasts as well as U.S. anadromous species and Continental Shelf fishery resources; support implementation and enforcement of international fishery agreements for the conservation and management of highly migratory species; promote domestic commercial and recreational fishing under sound conservation and management principles; provide for preparing and implementing fishery management plans to achieve and maintain the optimum yield of each fishery on a continuing basis; establish Regional Fishery Management Councils to protect fishery resources by preparing, monitoring, and revising plans that allow for participation of states, fishing industry, consumer and environmental organizations; and to encourage the development of underutilized U.S. fisheries. Congress amended the Magnusen-Stevens Fishery Conservation and Management Act extensively when it passed the Sustainable Fisheries Act (SFA) in 1996.

The SFA promotes the protection of essential fish habitat. Essential fish habitat is defined as those waters and substrate necessary to fish for spawning, breeding, feeding or growing to maturity. Although Charlotte Harbor and the lower Peace River may be essential fish habitat, given the distance of the proposed projects from these areas and the lack of adverse impacts to the Peace River or Charlotte Harbor from the projects, the Applicants' Preferred Alternatives would have no adverse impact on essential fish habitat. Therefore, the Applicants' Preferred Alternatives is in compliance with this Act.