# 3.0 AFFECTED ENVIRONMENT

The Affected Environment section describes the existing environmental resources of the areas that would be affected if any of the alternatives were implemented. This section describes only those environmental resources that are relevant to the decision to be made. It does not describe the entire existing environment, but only those environmental resources that would affect or that would be affected by the alternatives if they were implemented. This section, in conjunction with the description of the "no-action" alternative forms the base line conditions for determining the environmental impacts of the proposed action and reasonable alternatives.

## 3.1 GENERAL ENVIRONMENTAL SETTING

Hardee County, which encompasses the proposed Ona site, is located within southwest Florida approximately 40 miles inland from the Gulf of Mexico. Except for a small area in the northeast and southwest corners, the entire county drains to the Peace River, which flows south and empties into Charlotte Harbor (IMC, 2002). The climate of Hardee County is subtropical characterized by warm weather, generally ample precipitation and usually light but persistent winds. Each of these climatic elements has its own influence on the occurrence and availability of water and other physical characteristics in the area. The vegetation in the region consists primarily of a mixture of improved pasture and agricultural areas surrounded by native vegetation in the form of rangeland, upland forests, and herbaceous and forested wetlands. In addition, there is an existing area of phosphate mining north of the proposed Ona site.

The recorded mean annual temperature for a recent 30-year period in the region is approximately 73 degrees (°) Fahrenheit (F) with monthly average temperature varying from a low of approximately 62°F during January to a high of approximately 82°F during August. Based on records at five monitoring stations for the past 60 years, the long-term average precipitation for this area is approximately 52 inches per year (in/yr), with a range from approximately 36 to 75 in/yr (Ardaman & Associates, 2002). Sixty percent of the rainfall in this area occurs mainly in the rainy season during thunderstorms (June through September). The remaining 40 percent is mostly associated with widespread frontal storms that generally sweep into Florida from the north or northwest during the fall, winter, and early spring. Hurricanes, which sometimes occur during the period from June through November, may produce ten or more inches of rain in a day. Such heavy rainfalls may create destructive floods.

Stream flow monitoring in the region indicates a wide range of values during the year. A comparison between rainfall and discharge measurements indicates the stream flow hydrographs are closely related to the rainfall patterns in the area. Peak runoff rates coincide with the high intensity rainfall periods typically associated with thunderstorms.

The long-term average flow in the Peace River basin for a sixty-year period is the equivalent of approximately 12 in/yr of runoff over the entire drainage basin (US Geological Survey [USGS], 2001). However, this runoff amount varies from year to year depending on the seasonal rainfall patterns.

The groundwater system consists of three aquifer systems in the region, namely, the SAS (water table aquifer), the IAS, and the FAS. The rainfall typically increases the water levels in the SAS, which results in increased groundwater outflow to streams over an extended period as water levels slowly decline. The SAS is separated from the FAS hundreds of feet of confining beds in this region. This results in a low recharge rate to the FAS estimated to be zero to two in/yr (SWFWMD, 2000b).

In the Peace River Basin and surrounding areas, lower groundwater levels and large declines in stream flow usually occur in early spring. Dry season conditions often require large-scale irrigation for agricultural production. This greatly increases withdrawals from deep wells tapping the UFA. In addition, southern Florida has been undergoing a period of rainfall that is less than the historic norm. For example, the lowest annual rainfall for the sixty-year period occurred in 2000 (IMC, 2002)

The geology at the Ona site and in Hardee County consists of thick sequences of carbonate rock overlain by sand, gravel and clay deposits, which control the movement and occurrence of groundwater. In general, the various rock units dip to the south and form a wedge of water-bearing units that thicken to the southwest beneath Hardee County.

The undifferentiated surficial deposits of Pleistocene to recent age consist of sand, silty sand, clayey sand, some hardpan, and organic soils. The general lithology is mostly fine sand, inter-bedded with clayey and silty sands, marl, and shell. The thickness of the surficial soils varies from 20 to 45 feet.

## 3.2 VEGETATION

### 3.2.1 Regional Description

Natural vegetative communities of the region include upland forest and rangeland, herbaceous and forested wetlands, numerous creeks and streams, and xeric scrub. Vegetative communities of the region have been altered during the past two centuries, as forests and wetlands throughout Florida were cleared and drained to provide acreage for agricultural and urban uses. Large tracts of longleaf pine-turkey oak and xeric scrub habitats were converted to citrus and cattle farms. The impacts of historical land conversion in the region remain as large areas of improved pasture, extensive citrus groves and croplands, and networks of drainage canals.

Historically, natural communities in Florida occurred as continual tracts of land containing many different habitats corresponding to variations in moisture, fire frequency, soil fertility, and land-use history (Myers and Ewel, 1990). As a result of land clearing and subsequent development, the natural environmental gradient leading from one community type to another is often not present. The current landscape consists of a patchy distribution of natural communities interspersed between pastures, agricultural areas, and developed areas.

### 3.2.2 Site-Specific Description

The Ona site is currently vegetated with a mixture of improved pasture surrounded by native vegetation in the form of rangeland, upland forests, and herbaceous and forested wetlands. Approximately 40 percent of the land has been improved to support agricultural operations and 20 percent is covered with wetland vegetation, leaving about 40 percent of the land as native uplands.

Based upon drainage and vegetation features, the Ona site can be segregated into three sections for discussion purposes. The eastern one-third is characterized by numerous depressional marshes and swamps with large areas of remnant pine flatwoods. The major drainage feature is Oak Creek draining lands from the northeast to the south, ultimately flowing into the Peace River offsite. Troublesome and Hickory Creeks, located to the east of Oak Creek, also provide drainage for small areas of the site and discharge into the Peace River.

Brushy Creek and its expansive floodplain dominate the central portion of the site. For much of its length on the Ona site, Brushy Creek is a well-incised or channelized stream. As with most well incised streams in central Florida, the surrounding floodplain forest is primarily mesic or hydric oak hammock interspersed with depressional or backwater areas supporting marsh or pop ash swamp communities. Uplands in the central portion have mostly been cleared for use as pasture. Many of the isolated marshes and minor forested conveyances into Brushy Creek remain but ditching and cattle grazing have been impacted some, sometimes severely.

Horse Creek, West Fork Horse Creek, Brushy Creek, and Brady Branch drain the western two-thirds of the Ona site. The floodplain along Horse Creek is very narrow, suggesting this incised stream overflows infrequently. Vegetation consists primarily of oak forest with a saw palmetto understory. Although depressional marsh and swamp forest communities are present, they are not as abundant as in the eastern two-thirds of the Ona site. Historically, pine flatwoods and palmetto prairie were predominant. Of particular interest is the presence of several white sand scrub "islands" vegetated by sand live oak and sand pine/sand live oak associations. Most of these on-site xeric ecosystems are located west of Brushy Creek and have been impacted to various degrees by cattle grazing. The herbaceous stratum, usually sparse in an undisturbed scrub ecosystem, has been virtually eliminated by grazing in some of the scrub sites. Scrublands often harbor a disproportionate number of endemic and/or listed plant and animal species as compared to other upland communities such as pine flatwoods. Intense grazing may have displaced many listed species had they been present prior to agricultural conversion of surrounding areas.

#### *3.2.2.1 Methods*

Vegetative communities on the Ona site were mapped and classified using level III of the FDOT 1985 FLUCFCS during field studies conducted between 1997 and 1999 in association with the field studies for preparation of the CDA. The results of this mapping effort are presented on Figure 3.2-1 and discussed in Sections 3.2.3 and 3.2.4.

Each upland vegetative community was given a unique identification number and the percent cover of dominant species in each strata (canopy, subcanopy, shrubs, and ground cover) was recorded (Table 3.2-1).

Estimated wetland jurisdictional boundaries were established in the field and entered into a Geographic Information System (GIS) wetland boundary database between 1996-1998 by employing the procedures described in Chapter 62-343, F.A.C. (1998) and the 1987 Corps of Engineers Wetlands Delineation Manual. Jurisdictional boundaries were field-verified by FDEP and USACE personnel during 1998 and 1999 (see USACE letter dated December 3, 1999 in Appendix C). After adjusting boundary lines according to agency recommendations and subsequent confirmation of the precision and accuracy of the GIS wetland boundary database, the USACE and FDEP issued formal jurisdictional determinations Numbers 199802067(JF-ES) and FD-25-0125915-3, B, respectively. In addition to FLUCFCS habitat classifications, each wetland community was assigned a unique identification number and analyzed using the IMC Wetland Rapid Assessment Procedure (WRAP) (an adaptation of the South Florida Water Management District [SFWMD] Wetland Rapid Assessment Procedure). A complete description of the IMC WRAP and results are found in Appendix D.

These methods for vegetative community classification and wetland assessment were approved by the FDEP and USACE, and no additional sampling was required for the third party EIS. In December 2000 a limited field reconnaissance was conducted as part of the EIS effort, to review the vegetative classifications and community delineations. The December 2000 field review confirmed that the vegetative cover maps produced between 1997 and 1999 are accurate and applicable.

In June 2002, IMC updated their Section 404 application to reflect changes requested by FDEP and the Ecosystem Management Team, and to take into account the court rulings regarding USACE jurisdiction over isolated wetlands. A USACE representative conducted field visits with IMC in August and November of 2001 and IMC used this experience to identify isolated wetlands on the site. To identify isolated wetlands, IMC used the criteria that a wetland is considered isolated if:

1. The wetland is not adjacent to "Navigable Waters" (greater than 200 feet from a connected system), and;

2. The wetland is not connected to a system by a newly reviewed USACE jurisdictional ditch.

Based on the revised assessment, 477.9 acres of the 5,378.9 acres of wetlands on the property meet the isolated wetland definition. Therefore, the 4,901 acres of USACE jurisdictional wetlands described in this EIS do not include these isolated wetlands. However, these isolated wetlands are taken into consideration by the USACE when assessing secondary and cumulative impacts, especially relative to their position in the habitat corridor and their use by migratory waterfowl.

### 3.2.3 Upland Vegetative Communities

Upland vegetation on the Ona site includes the following community types: improved pasture (FLUCFCS code 211), unimproved pasture (212), woodland pasture (213), field crops (215), citrus groves (221), herbaceous rangeland (310), shrub and brushland (320), palmetto prairies (321), other shrubs and brush (329), mixed rangeland (330), pine flatwoods (411), sand pine (413), pine-mesic oak (414), temperate hardwood (425), live oak (427), sand live oak (432), hardwood-conifer mixed (434), mixed hardwoods (438), and spoil areas (743). Descriptions and acreage of each community type (FLUCFCS code in parentheses) are found below:

#### *3.2.3.1 Improved Pasture (211)*

The Ona site currently contains 7,306.3 acres classified as improved pasture. Improved pastures are lands that have been cleared and seeded with pasture grasses or allowed to naturally revegetate with native grasses and forbs. Improved pasture is maintained or actively grazed pasture dominated by cultivated pasture grasses such as bahia grass (*Paspalum notatum*) and limpograss (*Hemarthria altissima*) and may support the growth of native grasses and other herbaceous plants such as broomsedge (*Andropogon virginicus*), slender goldenrod (*Euthamia caroliniana*), dog fennel (*Eupatorium capillifolium*), Bermuda grass (*Cynodon dactylon*), and common carpet grass (*Axonopus fissifolius*). Other pasture herbs include sagotia beggarweed (*Desmodium triflorum*), coinwort (*Centella asiatica*), buffalo capeweed (*Phyla nodiflora*), crabgrass (*Digitaria serotina*), tick-trefoil (*Desmodium paniculatum*), flatsedge (*Cyperus retrorsus, C. tenuifolius*), and fringe rushes (*Fimbristylis spp.*). Shrubs and/or trees may also occur sporadically in improved pastures.

### *3.2.3.2 Unimproved Pasture (212)*

Currently, 145.7 acres on the Ona site are classified as unimproved pasture. Unimproved pasture encompasses acreage previously cleared for grazing that has become overgrown by native grasses, forbs, and occasional shrubs due to lack of maintenance or removal of cattle. Characteristic vegetation includes bahia grass, dog fennel, common carpet grass, goldenrod (*Solidago fistulosa*), dichanthelium grasses (*Dichanthelium spp.*), blackroot (*Pterocaulon virgatum*), broomsedge, sand blackberry (*Rubus cuneifolius*), and Caesar's weed (*Urena lobata*). Characteristic shrubs include wax myrtle (*Myrica cerifera*) and groundsel tree (*Baccharis halimifolia*).

### *3.2.3.3 Woodland Pasture (213)*

Woodland pasture comprises 637.4 acres of the Ona site. These are forested areas (generally oak hammocks) heavily grazed by cattle or where the understory has been cleared for use by cattle. Oaks including live oak (*Quercus virginiana*), laurel oak (*Quercus laurifolia*), and occasionally sand live oak (*Quercus geminata*) usually dominate the canopy. Shrubs or shrub like plants include scattered clumps of saw palmetto (*Serenoa repens*), wax myrtle, Caesar's weed, and John Charles or bushmint (*Hyptis verticillata*). Grasses and forbs, as previously described for improved and unimproved pastures, dominate the herbaceous stratum.

### *3.2.3.4 Field Crops (215)*

Lands classified as field crops cover 119.3 acres on the Ona site. This land use designates areas cultivated for hay. Bahia grass and limpograss fields are harvested for hay on the site.

### *3.2.3.5 Citrus Groves (221)*

Citrus groves comprise 209.2 acres of the Ona site, and occur mostly in the western portion of the site on well-drained soils. Orange varieties are the most common types of citrus produced.

### *3.2.3.6 Herbaceous Rangeland (310)*

Currently, 19.8 acres of the Ona site are classified as herbaceous rangeland. This grassland category includes grasses and other forbs that grow on the upland margins of wetlands, and are periodically inundated by water. In wetter areas, a variety of vegetation occurs such as big carpet grass (*Axonopus furcatus*), maidencane (*Panicum hemitomon*), water-primrose (*Ludwigia palustris*), coinwort, sedge (*Cyperus retrorsus*), dog fennel, and spikerush (*Eleocharis baldwinii*).

Also included in this category are pineland swales, which are also known as dry prairie. Pineland swales are dry grassland areas dominated by upland, native grasses such as wiregrasses (*Aristida spp.*) with occasional saw palmetto present. Other species present in the dry prairie areas include deer's tongue (*Carphephorous corymbosus, C. paniculatus*), flat-topped goldenrod, rabbit tobacco (*Gnaphalium obtusifolium*), indiangrasses (*Sorghastrum spp.*), and broomsedges (*Andropogon spp.*).

### *3.2.3.7 Shrub and Brushland (320)*

Currently, the Ona site contains 0.5 acre classified as shrub and brushland. These areas include a mixture of saw palmetto, gallberry (*Llex glabra*), wax myrtle, and other shrubs. It is distinguished from palmetto prairie (321) in that saw palmetto is not the dominant shrub in this classification.

### *3.2.3.8 Palmetto Prairie (321)*

A total of 2,898 acres of the Ona site is classified as palmetto prairie. Palmetto prairie is a type of rangeland characterized by a dense cover of saw palmetto with no tree cover, and the occurrence of only widely scattered pines and/or oaks. In addition to saw palmetto, other shrub layer species include gallberry, muscadine grape (*Vitis rotundifolia*), and winged sumac (*Rhus copallina*). Wiregrass (*Aristida stricta*) is the most common ground layer species. Other ground layer components include dichanthelium grasses, flat-topped goldenrod, sedge (*Cyperus retrorsus*), and chalky bluestem (*Andropogon virginicus var. glaucus*). Typically, the herbaceous cover associated with palmetto rangeland occurs within the open areas where saw palmetto is not growing. These open areas are dry prairie (described under 310), which were too small to be mapped as a separate community.

### *3.2.3.9 Other Shrubs and Brush (329)*

Shrub and brush vegetative cover occurs in both upland and jurisdictional wetland areas, comprising a total of 105.4 acres of the Ona site. In wetlands, this cover type is often found in the disturbed areas adjacent to wetland forests and marshes, or represent a successional series in marshlands that have not burned over in some time. At the Ona site, the wetland areas classified as other shrubs and brush are typically characterized by the presence of wax myrtle. Other shrubs commonly encountered are groundsel tree, elderberry (*Sambucus canadensis*), gallberry, and occasionally, tropical bushmint (*Hyptis mutabilis*). Common herbs include dog fennel, broomsedge, coinwort, and carpet grasses (*Axonopus spp.*). Muscadine grape is a common vine.

Upland areas of the Ona site classified as other shrubs and brush are also typically dominated by wax myrtle with varying coverage by gallberry and saw palmetto. Commonly observed herbs include bahia grass, common carpet grass, wiregrass, broomsedge, and slender goldenrod.

### *3.2.3.10 Mixed Rangeland (330)*

The Ona site contains 30.2 acres classified as mixed rangeland. This cover type describes areas with more than one-third intermixture of grassland or shrubland species. Areas of this type claimed as wetlands are typically dominated by wax myrtle and/or groundsel tree with a significant herb component including carpet grasses, bahia grass, dog fennel, broomsedge, bushy broomsedge (*Andropogon glomeratus*), coinwort, musky mint (*Hyptis alata*), goldenrod, and meadow beauty (*Rhexia mariana*). Upland areas classified as mixed rangeland are dominated by saw palmetto, gallberry, and dwarf live oak (*Quercus minima*). Conspicuous herbs include wiregrass, broomsedge, and slender goldenrod.

### *3.2.3.11 Pine Flatwoods (411)*

Currently, 1,479.6 acres of the Ona site are classified as pine flatwoods. Pine flatwoods are found in areas with a low, flat topography on poorly drained, acidic soils characteristically low in nutrients. Structurally, these communities are open woodland with an overstory dominated by slash pine (*Pinus elliottii*) on poorly drained sites with soils often exhibiting a hardpan two to three feet below ground surface (bgs). Longleaf pine (*Pinus palustris*) predominates on sandier, well-drained sites.

On pine flatwood sites with a soil profile of sand overlying a hardpan layer, extreme hydrological variability results. During the wet, summer months, standing water is often evident, particularly in the grassy swales (dry prairies). Conversely, in the dry winter season, hardpan limits water movement from lower soil horizons resulting in drought conditions. Historically, frequent fires maintained the structural integrity of the pine flatwoods by killing the invading oak hardwoods. In the absence of fire, hardwood trees, particularly oaks, will dominate the canopy over time resulting in a hammock community. The shrub understory is usually dense and dominated by saw palmetto with lesser abundance of gallberry, fetterbush (*Lyonia lucida*), coastal plain staggerbush (*Lyonia fruticosa*), wax myrtle and dwarf live oak.

In flatwoods on sandy soils lacking a hardpan, scrub oaks are characteristic, including Chapman's oak (*Quercus chapmanii*), myrtle oak (*Q. myrtifolia*), and sand live oak. Grasses are the predominant feature of the herb stratum. Usually, herbs are found in "swales" interspersed among the usually dense saw palmetto understory. Wiregrass, bottlebrush three-awn (*A. spiciformis*), arrowfeather (*Aristida purpurascens*), broomsedge, and lovegrasses (*Eragrostis spp.*) are abundant grasses. Yellow-eyed grass (*Xyris caroliniana*), thoroughwort (*Eupatorium mohrii*), elephant's foot (*Elephantopus elatus*), purple cudweed (*Gnaphalium purpureum*), and narrowleaf silkgrass (*Pityopsis graminifolia*) are common forbs.

### *3.2.3.12 Sand Pine (413)*

One sand pine community comprising 23.7 acres exists at the Ona site in Section 30, Township 34 South, Range 23 East. It exhibits a closed canopy dominated by sand pine (*Pinus clausa*). Scrub live oak (*Quercus geminata*) is conspicuous in the canopy but does not exceed one-third of the total canopy cover. It is, however, the predominant species in a well-defined subcanopy. A sparse shrub stratum is comprised of sapling scrub live oak, myrtle oak, and less commonly Chapman's oak. Herbs are sparse but include wiregrass, silk grass, broomsedge, and patches of ground lichen. Floristically and structurally, this sand pine scrub is similar to xeric oak communities in which pines (sand, longleaf, and/or slash pines) do not comprise at least 33 percent canopy cover. These communities, in which scrub live oak comprises more than two-thirds of the canopy are classified as Hardwood-Conifer Mixed (FLUCFCS 434) and are described below.

### *3.2.3.13 Pine-Mesic Oak (414)*

A relatively small amount (5.7 acres) of pine-mesic oak community is present on the Ona site. This category is a combination of slash and loblolly pine in association with a variety of mesic oaks and other hardwood species. Gallberry, wax myrtle, and saw palmetto are among the common understory species.

### *3.2.3.14 Temperate Hardwood (425)*

Temperate hardwoods cover 756.5 acres of the Ona site. This vegetative cover category is present within jurisdictional wetland and upland areas at Ona. Jurisdictional wetland areas are dominated by laurel oak. In addition to laurel oak, live oak, slash pine, water oak (*Quercus nigra*), red maple (*Acer rubrum*), American elm (*Ulmus americana*), cabbage palm (*Sabal palmetto*), swamp red bay (*Persea palustris*), and sweetbay (*Magnolia virginiana*) are common components of the canopy in various combinations and coverages dictated by hydrology. Common shrubs are wax myrtle with occasional saw palmetto and black haw (*Viburnum obovatum*). Herbs include redtop panicum (*Panicum rigidulum*), sour paspalum (*Paspalum conjugatum*), broomsedge, coinwort, and carpet grasses. Saw greenbrier (*Smilax bona-nox*) is often present.

Upland areas classified as temperate hardwood are dominated by laurel oak. Other canopy trees such as cabbage palm, slash pine, longleaf pine, live oak, and water oak are often present in various combinations and coverages. Wax myrtle and gallberry are common shrubs in this upland phase. Herbs include broomsedge, bahia grass, goldenrod, carpet grass, Baldwin's eryngo (*Eryngium baldwinii*), and innocence (*Hedyotis procumbens*).

### *3.2.3.15 Live Oak (427)*

A total of 1,242.2 acres of live oak hammock are found on the Ona site. Live oak hammock is dominated by mature live oak in the canopy, often mixed with other oaks such as laurel oak and water oak. Typically, this category of hammock has a dense to moderate cover of saw palmetto in the understory.

### *3.2.3.16 Sand Live Oak (432)*

The Ona site contains 404.2 acres classified as sand live oak. This category describes xeric oak scrub dominated by sand live oak. The canopy is dense and ranges from 15 to 25 feet in height. Rusty staggerbush (*lyonia ferruginea*), saw palmetto, myrtle oak, and coastal plain staggerbush are common shrub components. The shrub layer is usually dense, except where overtopped by scrub oaks. Herbs are sparse and include wiregrasses (*Aristida spp.*), broomsedge, pricklypear (*Opuntia compressa*), milk pea (*Galactia elliottii*), and narrowleaf silkgrass.

### *3.2.3.17 Hardwood-Conifer Mixed (434)*

This cover type occurs on both upland and jurisdictional wetland areas on the Ona site, totaling 1,058.0 acres. In areas claimed as wetlands, the canopy is characterized by the presence of live oak, laurel oak, slash pine, and cabbage palm. Common shrubs are silverling (*Baccharis glomeruliflora*), wax myrtle, saw palmetto, and beauty-berry (*Callicarpa americana*). Herbs include bahia grass, carpet grasses, broomsedge, Virginia chain fern (*Woodwardia virginica*), dichanthelium grasses, saw greenbrier, coinwort, cinnamon fern (*Osmunda cinnamomea*), shield fern (*Thelypteris kunthii*), maidencane, redtop panicum, and soft rush (*Juncus effusus*).

Upland areas often contain live oak, laurel oak, slash pine or longleaf pine, and cabbage palm in the canopy. Shrubs or shrub elements include immature cabbage palm, saw palmetto, and wax myrtle. Commonly encountered herbs are bahia grass, needlepod rush (*Juncus scirpoides*), broomsedge, dichanthelium grasses, Caesar's weed, and carpet grasses. Often seen vines include saw greenbrier and muscadine grape.

Two xeric communities are included in this FLUCFCS classification where the canopy is predominantly sand live oak mixed with sand and longleaf pine. Neither the oaks nor the pines achieve 66 percent crown canopy dominance. The subcanopy is similar to the canopy, while the understory is dominated by saw palmetto, fetterbush, and rosemary (*Ceratiola ericoides*). Sparse individuals of wiregrass, broomsedge, yucca (*Yucca flacide*), goldenrod, and bahia grass dominate the herb layer. This community is similar to FLUCFCS classification 432 (Sand Live Oak). Most FLUCFCS 434 communities, however, consist of mixtures of slash or long-leaf pines and live or laurel oaks. Therefore, the only FLUCFCS classification that fits is 434.

#### *3.2.3.18 Mixed Hardwoods (438)*

Areas classified as mixed hardwoods comprise 28.8 acres of the Ona site. This category is similar to temperate hardwood (425), except for the prevalence of water oak in the canopy. In addition, sweet gum (*Liquidambar styraciflua*) and sweetbay are often conspicuous canopy elements. The shrub and herb strata are similar in composition to those described under the classification of 425.

#### *3.2.3.19 Spoil Areas (743)*

The Ona site contains 13.3 acres of spoil piles surrounding excavated cattle ponds. These piles are classified as spoil areas. Species within these areas are primarily weedy herbs, such as bahia grass, broomsedges (*Andropogon sp.*), dog fennel, ragweed (*Ambrosia artemisiifolia*), and groundsel tree. Due to their disturbed nature, these areas have little inherent ecological value as habitat for plants or wildlife.

### 3.2.4 Open Water (500)

Open water (FLUCFCS 500) comprises 115.7 acres of the Ona site, approximately 0.6 percent of the entire property, primarily in the form of man-made ditches and cattle ponds (reservoirs <10 acres). These excavated areas do not provide critical habitat for wildlife or listed species. Ditches on the Ona site vary in size, depth, and duration of inundation. Those ditches that are infrequently inundated are vegetated with pasture grasses, while the wetter ditches and the edges of some cattle ponds support common herbaceous wetland species including cattails (*Typha latifolia* and *T. domingensis*), soft rush (*Juncus effuses*), pickerelweed (*Pontederia cordata*), and primrose willow (*Ludiwigia peruviana* and L. *repens*).

### 3.2.5 Wetland Vegetative Communities

The following wetland vegetation community types are found on the property: bay swamp (FLUCFCS code 611), gum swamp (613), stream and lake swamp (615), inland ponds and sloughs (616), mixed wetland hardwoods (617), wetland coniferous forest (620), wetland forested mix (630), freshwater marsh (641), wet prairie (643), emergent aquatic vegetation (644), and shrub swamp (646). The USACE jurisdictional boundaries also include wetland areas occurring within primarily upland community types. These include portions of lands classified as single family homes (111), improved pasture (211), unimproved pasture (212), woodland pasture (213), herbaceous rangeland (310), palmetto prairie (321), other shrubs and brush (329), mixed rangeland (330), pine flatwoods (411), temperate hardwoods (425), live oak (427), hardwood-conifer mixed (434), mixed hardwoods (438), and spoil areas (743). The majority of these upland communities were described in Section 3.2.3, therefore only the wetlands and vegetation communities within these upland areas are described, in addition to the swamp, marsh, and stream communities within FLUCFCS 600+.

The wetland boundaries delineated under FDEP and USACE procedures are different. This difference is primarily attributable to the fact that plant species categorized as facultative are considered neutral by FDEP, and as hydrophytic by USACE when evaluating dominance of vegetation. In addition, some species are classified differently by the FDEP and USACE with respect to their probability of occurrence in wetlands. For example, the FDEP considers slash pine (*Pinus elliotii*) to be an upland species, whereas the USACE lists slash pine as facultative wet. This in some cases results in the classification of slash pine flatwoods as wetland by the USACE and as upland by the FDEP. Additionally, FDEP classifies all lands below the mean annual flood elevation as wetlands, independent of vegetative community type. The following descriptions of wetland habitats and their extent are based upon the USACE jurisdictional determinations.

Descriptions and USACE jurisdictional acreage (Table 3.2-2) of each wetland community type (FLUCFCS code in parentheses) are found below:

### *3.2.5.1 Bay Swamp (611)*

The Ona site contains 96.2 acres of USACE jurisdictional wetlands classified as bay swamps. Bay swamps or bayheads refer to forested wetland communities where the canopy is dominated by sweetbay, swamp red bay, dahoon holly (*Llex cassine*), and occasionally, loblolly bay (*Gordonia lasianthus*). In addition, swamp tupelo (*Nyssa sylvatica var. biflora*) and red maple are often present. The shrub layer consists of wax myrtle, fetterbush, Virginia willow (*Ltea virginica*), highbush blueberry (*Vaccinium corymbosum*), and in wetter areas, buttonbush (*Cephalanthus occidentalis*). The herb stratum is often dense, especially the fern flora. Ferns include cinnamon fern, royal fern (*Osmunda regalis*), swamp fern (*Blechnum serrulatum*), Virginia chain fern, and netted chain fern (*Woodwardia areolata*). Other herbs characteristic of bay swamps are pickerelweed (*Pontederia cordata*), smartweeds (*Polygenum spp.*), lizard's tail (*Saururus cernuus*), water hoarhound (*Lycopus rubellus*), beakrushes (*Rhynchospora spp.*), arrow arum (*Peltandra virginica*), and false nettle (*Boehmeria cylindrica*).

### *3.2.5.2 Gum Swamp (613)*

Jurisdictional wetlands classified as gum swamp comprise 25.6 acres of the Ona site. This forest community is characterized by the dominance of swamp tupelo (also known as blackgum) in the canopy. Other common canopy trees are red maple, laurel oak, sweetbay, and occasional pond cypress (*Taxodium ascendens*). At the Ona site, the typical shrubs in gum swamps are wax myrtle and primrose willow. The predominance of primrose willow is due to moderate to high levels of grazing by cattle. Herbs are varied, including maidencane, redtop panicum, smartweeds, dayflower (*Commelina diffusa*), lizard's tail, pickerelweed, beakrushes, and pennywort (*Hydrocotyle umbellata*). In heavily grazed gum swamps, soft rush is conspicuous. In general, gum swamps retain surface water for longer periods than other forested wetlands, except cypress swamps, and usually contain a substantial muck component in the soils (three to six inches).

#### *3.2.5.3 Stream and Lake Swamp (615)*

This cover classification was applied to wetland forests associated with streams where the annual and 25-year floodplain was formally mapped (e.g., West Fork of Horse Creek, Horse Creek, Brushy Creek and Oak Creek). A total of 64.8 acres of stream and lake swamp occur on the Ona site.

Canopy is dominated by a variety of hardwoods, and while pond cypress and bald cypress (*Taxodium distichum*) are often present, these species usually do not comprise more than one- third of the canopy cover. Common trees include laurel oak, red maple, sweetbay, live oak, American elm, dahoon holly, and cypress. Wax myrtle, black haw, Virginia willow, and highbush blueberry are common shrubs. Occasionally, dwarf palmetto (*Sabal minor*) is present. Herbs include cinnamon fern, shield fern, Virginia chain fern, lizard's tail, redtop panicum, iris (*Iris hexagon*), pennywort, and Caesar's weed. Greenbriar (*Smilax spp.*) and poison ivy (*Toxicodendron radicans*) are common vines. Species composition of bottomland forests is determined by duration and depth of flooding, which in turn, is partially controlled by stream morphology.

#### *3.2.5.4 Inland Ponds and Sloughs (616)*

Inland ponds and sloughs comprise 2.9 acres of the Ona site. This cover type describes deepwater habitats usually located within the interior of large forested wetland systems. Trees grow around the perimeter of the deep water and include pop ash (*Fraxinus caroliniana*), pond cypress, laurel oak, willow, red maple, and swamp tupelo. Common shrubs are sapling southern willow (*Salix caroliniana*), wax myrtle, primrose willow, and buttonbush. Fireflag (*Thalia geniculata*) and pickerelweed are conspicuous herbs surrounding deepwater areas. Climbing aster (*Aster carolinianus*) is often present growing over shrubs and up tree trunks. This is an uncommon community at the Ona site.

#### *3.2.5.5 Mixed Wetland Hardwoods (617)*

Mixed wetland hardwoods are found on 1,035.5 acres of the Ona site. This swamp category occurs in lower elevations within smaller stream floodplains not mapped as stream and lake swamp (615), and as depressions in upland areas. These forests are usually flooded each summer through October/November and red maple is a common canopy species. Other species in the canopy include laurel oak, pond cypress, live oak, sweetbay, and American elm. Sugarberry (*Celtis laevigata*), dahoon holly, and swamp tupelo may be present. Shrubs are scattered and include primrose willow, wax myrtle, buttonbush, and sapling canopy species. Herbs include soft rush, fireflag, lizard's tail, pickerelweed, sawgrass (*Cladium jamaicense*), pennywort, smartweeds, and false nettle.

Ferns are usually present in the herb stratum, and in some forests form a dense ground cover. Common ferns include swamp fern, hottentot fern (*Thelypteris interrupta*), shield fern, cinnamon fern, Virginia chain fern, royal fern, and netted chain fern.

### *3.2.5.6 Wetland Coniferous Forest (620)*

Wetlands classified as wetland coniferous forest comprise 28.7 acres of the Ona site. This cover type describes wet pine savannas. Wetland coniferous forest communities at the Ona site are limited in extent, and are usually found as an upper transition zone around a few fresh water marshes. Slash pine is the dominant tree with wax myrtle usually present, and occasionally cabbage palm and laurel oak. The shrub layer is usually sparse and consists of wax myrtle, sapling slash pine, saw palmetto, or St. John's Wort (*Hypericum fasciculatum*). Herbs are usually dense and include maidencane, sand cordgrass (*Spartina bakeri*), smartweeds, broomsedge, carpet grasses, beak rushes (*Rhynchospora spp.*), bushy broomsedge, and camphorweeds (*pluchea spp.*). The composition of the shrub and herb strata is dictated by amount and duration of inundation.

### *3.2.5.7 Wetland Mixed Hardwood-Coniferous Forest (630)*

The Ona site contains 137.1 acres of USACE jurisdictional wetlands classified as mixed hardwood-coniferous forest. This forest cover type is similar to mixed wetland hardwoods (617) except that cypress is a conspicuous canopy element comprising at least one-third of the canopy cover. Hardwood canopy species, and shrub and herb composition and physiognomy are similar to that described for mixed wetland hardwoods.

### *3.2.5.8 Freshwater Marsh (641)*

Freshwater marsh associations are the most abundant wetland type at the Ona site in terms of area, comprising a total of 1,159.6 acres. These marshes are heterogeneous in terms of structure and species diversity. The type of marsh and/or quality is dictated by position in the landscape, depth of water, frequency of fire, substrate, and degree of human induced disturbance such as cattle grazing and drainage. Generally, marshes exhibit at least two zones of vegetation based upon hydrology. Deepwater marshes that are rarely grazed, are not drained and burn periodically, may exhibit as many as five vegetation zones. Typical marsh herbs include pickerelweed, maidencane, beakrushes, yellow-eyed grasses (*Xyris spp.*), sand cordgrass, smartweeds, soft rush, buttonweed (*Diodia virginiana*), coinwort, Ludwigia spp., herb-of-grace, lemon bacopa (*Bacopa caroliniana*), carpet grasses, broom sedges, pennywort, and Baldwin's eryngo. In deepwater marshes where the center may contain over three feet of water in the rainy season, true aquatics, such as fragrant water lily (*Nymphaea odorata*), and bladderworts (*Utricularia spp.*), may be found. A common shrub in the transition zone of relatively undisturbed marshes is St. John's wort. In heavily grazed or drained marshes, primrose willow often becomes dominant, excluding the more desirable, native marsh herbs and shrubs. Grazing and/or drainage have degraded a majority of the marshes on the Ona site.

### *3.2.5.9 Wet Prairie (643)*

Several plant associations dominated by herbs were collectively designated wet prairie to illustrate their regulatory status as wetlands. Three vegetative associations commonly encountered at the Ona site are designated as wet prairie: pineland swales, grass-dominated upper transitional zones near freshwater marshes or forested wetlands, and wet pastures. Areas classified as wet prairie comprise 340.0 acres of the Ona site.

Pineland swales are irregularly shaped herb-dominated areas within pine flatwoods or palmetto prairie. They are characterized by the lack of saw palmetto and the prevalence of wiregrass, bottlebrush threeawn, beakrushes, needlepod rush, meadow beauty, and dichanthelium grasses. Generally, those swales claimed as wetlands do not support extensive areas of dwarf live oak.

The outer transition zones near many isolated marshes and forested wetlands are dominated by a variety of grasses and other herbs. Typically, broomsedge, bushy broomsedge, meadow beauty, beakrushes, bahia grass, slender goldenrod, soft rush, carpet grasses, sand cordgrass, and redtop panicum are found in these areas in differing combinations and coverages. This association is most common at the edges of those forested and herbaceous wetlands where the historic perimeter of pineland or palmetto prairie has been cleared for use as pasture.

Wet pastures usually occur on gentle slopes adjacent to forested or herbaceous wetlands in intensely grazed or maintained pastures. Typical species are bahia grass, carpet grasses, soft rush, savanna false pimpernel (*Lindernia grandiflora*), and Baldwin's eryngo.

Alternatively, the above-described associations could be categorized under 310 (herbaceous Rangeland) since they are not classic natural prairies. The Kissimmee prairies, coastal prairies, sand prairies, and pine savannas of the Panhandle by contrast can harbor a bounty of endemic or rare plant species.

### *3.2.5.10 Emergent Aquatic Vegetation (644)*

Wetland areas distinguished by an abundance of emergent and floating vegetation comprise 1.2 acres of the Ona site. This cover type includes deep water areas within swamps vegetated by cattail (*Typha spp.*), water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*), pickerelweed, and maidencane.

### *3.2.5.11 Shrub Swamp (646)*

A total of 696.5 acres of the Ona site is classified as shrub swamp. This classification is a Level III vegetative cover type and has been created by a team of IMC biologists to differentiate wetlands that contain a distinct shrub layer stratum from forested or herbaceous wetlands since FLUCFCS does not classify wetlands dominated by shrubs. This cover type is abundant at the Ona site. Shrub swamps can be further classified by the dominant shrub species: primrose willow, southern willow, and buttonbush. Most shrub swamps dominated by primrose willow and southern willow are communities resulting from drainage alterations, heavy grazing of fresh water marsh communities, or the prevention of periodic fires that stop the shrubs from dominating fresh water marshes. Buttonbush-dominated shrub swamps are the most rare of the shrub swamp types observed on the site. Buttonbush rarely becomes dense enough to shade out herbs, so these shrub swamps tend to be more diverse and provide better wildlife habitat than the primrose willow or southern willow dominated associations.

### *3.2.5.12 USACE Wetlands Occurring Within Predominantly Upland Land Classifications*

As mentioned previously, some of the USACE jurisdictional boundaries include wetland areas that occur in predominantly upland areas. Many of the upland classifications were described in Section 3.2.3. Therefore, only the wetlands that occur within these upland areas are described in the following paragraphs.

#### 3.2.5.12.1 Single Family Homes (111)

According to USACE wetland boundaries, a small amount of lands classified as single-family homes are considered wetlands. Lands classified as single family homes on the Ona site are hunting cabins, which may include depressions within the surrounding maintained areas that contain facultative vegetation and water at or near the surface for a portion of the year. Of the 5.3 acres classified as single-family homes, 0.4 acres are considered jurisdictional wetlands by the USACE.

#### 3.2.5.12.2 Improved Pasture (211)

Of the 7,306.2 acres classified as improved pasture, 62.6 acres are considered jurisdictional wetlands by the USACE.

#### 3.2.5.12.3 Unimproved Pasture (212)

Of the 145.7 acres of unimproved pasture on the Ona site, 0.9 acres are considered wetlands by the USACE.

#### 3.2.5.12.4 Woodland Pasture (213)

Of the 637.4 acres classified as woodland pasture, 90.5 acres are considered wetlands by the USACE.

#### 3.2.5.12.5 Herbaceous Rangeland (310)

The Ona site contains 19.8 acres classified as herbaceous rangeland, of which 5.3 acres are considered jurisdictional wetlands by the USACE.

#### 3.2.5.12.6 Palmetto Prairie (321)

Of the 2,897.9 acres classified as palmetto prairie, 9.2 acres are considered jurisdictional wetlands by the USACE.

#### 3.2.5.12.7 Other Shrubs and Brush (329)

Lands that are classified as other shrubs and brush comprise 105.4 acres of the Ona site. The USACE wetland boundaries include 18.9 acres of this classification.

#### 3.2.5.12.8 Mixed Rangeland (330)

The Ona site contains 30.2 acres classified as mixed rangeland, 9.9 acres of which are considered wetlands by the USACE.

#### 3.2.5.12.9 Pine Flatwoods (411)

The USACE considers 96.8 acres of the 1,479.6 acres classified as pine flatwoods, to be jurisdictional wetlands.

#### 3.2.5.12.10 Temperate Hardwoods (425)

Of the 756.5 acres on the Ona site classified as temperate hardwoods, 416.4 acres are considered wetlands by the USACE. Both upland and wetland temperate hardwoods on the Ona site are dominated by laurel oak. Areas classified as wetlands contain red maple (*Acer rubrum*), American elm (*Ulmus americana*), swamp red bay (*Persea palustris*), and sweetbay (*Magnolia virginiana*).

#### 3.2.5.12.11 Live Oak (427)

The Ona site contains 1242.1 acres classified as live oak hammock, 239.8 of which are considered wetlands according to the USACE.

#### 3.2.5.12.12 Hardwood-Conifer Mixed (434)

Of the 1,058.1 acres classified as hardwood-conifer mixed, 281.6 acres are considered USACE jurisdictional wetlands.

#### 3.2.5.12.13 Mixed Hardwoods (438)

Mixed hardwoods comprise 28.7 acres of the Ona site, 1.5 of which are considered jurisdictional wetlands by the USACE.

#### 3.2.5.12.14 Spoil Areas (743)

The Ona site contains 13.4 acres classified as spoil areas surrounding excavated cattle ponds. Of these acres, 0.1 acre is considered jurisdictional wetlands by the USACE.

## 3.3 FISH AND WILDLIFE RESOURCES

The Ona site currently supports a wildlife population that is representative of pasture and native rangeland, forests, and wetlands in west-central Florida. The status of wildlife and aquatic biota resources on the property was assessed through field surveys, literature reviews, and research of previously conducted studies.

### 3.3.1 Wildlife

The field documentation of wildlife species currently inhabiting the Ona site surveys were conducted in accordance with workplans developed for the site as part of the project scoping for the CDA. These workplans were approved by the USFWS and the FFWCC, and are the same as that used for the threatened and endangered species surveys discussed in Section 3.4.

Table 3.3-1 provides a summary of amphibians, reptiles, birds, and mammals observed on the Ona site during the spring, summer, and fall 1998 surveys. In addition, the onsite habitat and season in which each species was observed is reported.

Small mammal trapping at the Ona site yielded five species, which commonly occur in this region. Although Florida mice were captured and marked, no recaptures were made, indicating their local population is larger than the total trap results shown. Table 3.3-2 depicts the species and numbers captured.

During aerial surveys at the Ona site, two wading bird nesting sites were located as identified in Table 3.3-3 and shown on Figure 3.3-1. Results of the pit trapping effort (100 trap-days) at the Ona site are shown in Table 3.3-4.

### 3.3.2 Aquatic Biota

#### *3.3.2.1 Methods*

Phytoplankton, zooplankton, benthic macroinvertebrates, and fish were sampled within Brushy and Oak Creeks in conjunction with the 1980 MCC Hardee County Phosphate Mine EIS, which includes much of the same area as the proposed Ona site. Six aquatic biota sampling stations were established during the 1980 study, three each in both Brushy and Oak Creeks as shown on Figure 3.3-2. The MCC property did not include Horse Creek; therefore, no aquatic sampling of Horse Creek was conducted in 1980 in association with the MCC EIS (USEPA, 1981a).

In 1999, Biological Research Associates (BRA) conducted additional aquatic surveys in conjunction with preparation of the CDA. Benthic macroinvertebrates and algae were sampled once in the wet season (Summer) and once in the dry season (Winter) within each creek on the project site. Sampling sites were located at the Roberts Road Bridge over the West Fork of Horse Creek (SW-1); on Horse Creek at the exit of the IMC Fort

Green mine (SW-2); at the SR 64 bridge over Horse Creek (SW-3); on Brushy Creek near the southern Section 11 crossing (SW- 4); at the CR 663 bridge over Oak Creek (SW-7), and; at the SR 64 bridge over Hickory Creek (SW-8) (Figure 3.3-2).

#### 3.3.2.1.1 Phytoplankton - 1980

Phytoplankton was collected by pumping ten liters (L) from the water column (surface to near the bottom) at each station into a container and subsampling two replicate one-liter samples from the container. Samples were preserved with 40 milliliter (ml) of formalin, returned to the laboratory, allowed to settle, and the supernatant was removed. Specimens were identified to the lowest practical taxon and were enumerated using the inverted microscope method with a plankton chamber. Species diversity was calculated with the Shannon-Weiner index.

#### 3.3.2.1.2 Phytoplankton - 1999

A grab sample was collected from each station on March 3 and August 24, 1999. Samples were collected just below the water surface and phytoplankton were enumerated (number [#] cells/square centimeter [$cm^2$]) and taxonomically identified to the lowest possible level using epifluorescence microscopy. Calculated metrics included the number of taxa, percent contribution of dominant taxa, ratio of diatom abundance to diatom + blue-green algae abundance, percentage of blue-green algae, percentage of green algae, and percentage of diatoms. A portion of the grab sample was analyzed for phytoplankton chlorophyll-a.

#### 3.3.2.1.3 Zooplankton – 1980

Zooplankton samples were collected by pumping 100 liters of water at each station through a 75-micron (μm) mesh plankton net. The concentrated sample was then transferred to a plastic bottle and formalin added to prepare a ten percent solution. Two replicate subsamples were collected from each sample for identification and enumeration. Species identification and enumeration were conducted with a Sedgwick-Rafter counting chamber at magnifications of 40 times (X) and 100X. Species diversity was calculated with the Shannon-Weiner Index.

#### 3.3.2.1.4 Benthic Macroinvertebrates 1980

Benthic macroinvertebrates were sampled both quantitatively with Ponar dredges and qualitatively with drift nets. At each sampling station, two replicate Ponar dredges were collected near each stream bank and in the center of the stream channel, for six quantitative samples collected at each sampling station. Qualitative samples of benthic macroinvertebrates were collected with 24-hour drift net samples. Both quantitative and qualitative samples were transferred to plastic bottles with ten percent formalin and transported to the laboratory, where the samples were stained with rose bengal. Following staining, organisms were separated from detritus, preserved in a solution of 70 percent ethanol with glycerin, identified to species, and enumerated. Equitability values were calculated using the Lloyd-Ghelardi Index and species diversity values were calculated using the Shannon-Weiner Index.

#### 3.3.2.1.5 Benthic Macroinvertebrates 1999

Quantitative sampling of benthic macroinvertebrates was conducted using three Hester-Dendy artificial substrate samplers deployed at each sampling station. Hester-Dendy samplers were deployed on February 3 and again on July 26. Samplers were retrieved following a 28-day incubation period and macroinvertebrates from two samplers at each station were composited for taxonomic analysis. The third sampler at each site was deployed as a contingency against loss or damage of a sampler during incubation. Calculated metrics included the number of taxa, number of individuals, Florida Index, Shannon-Weiner diversity, percent contribution of dominant taxa, EPT Index, Florida Stream Condition Index (SCI), and the percentage of organisms by major taxonomic and feeding groups.

Qualitative sampling of benthic macroinvertebrates was conducted using dip nets according to the "20 sweeps" method recommended by FDEP (1996). Twenty half-meter sweeps were made at each station on February 3 and August 23, divided among the principal microhabitat types (sandy substrate, gravel, undercut banks, emergent vegetation, roots and snags). Samples were composited in the field, and subsampled in the laboratory for taxonomic analysis. Calculated metrics included the suite of parameters discussed above for Hester-Dendy samples.

#### 3.3.2.1.6 Fish – 1980

Fish sampling was conducted with the following equipment:

- six-foot x 125-foot bag seine with a net mesh of ½ inch and a bag mesh of 1/8 inch;
- six-foot x 40-foot beach seine with 3/8 inch mesh; and,
- 150-foot gill net consisting of ten 15-foot panels with mesh sizes varying from ½ inch to four inches.

Fish were collected using the beach seine to block the downstream end of the stream segment being sampled, and then seining the width of the stream with a bag seine. The gill net was placed at two stations within Brushy Creek and two stations within Oak Creek for one 24-hour period each. Fish were either identified and enumerated in the field or preserved in ten percent formalin for laboratory identification.

### 3.3.2.2 Sampling Results

When comparing the results of aquatic biological sampling results between 1980 and 1999, the different sampling methodologies and flow conditions should be taken into account. Direct comparison of results may not be appropriate, but general trends may be identified. Rainfall data collected at the NOAA weather station in Wauchula, Florida indicated that the Ona area experienced below average rainfall in both 1980 and 1999.

#### 3.3.2.2.1 Phytoplankton - 1980

During April 1980, phytoplankton was collected from three stations each in Brushy and Oak Creeks. Phytoplankton densities were high at all stations, averaging 527,667 and 804,000 cells per liter (cells/liter) in Brushy Creek and Oak Creek, respectively (Table 3.3-5). Dominant groups collected were green algae (C*hlorophyta*) and diatoms (*Bacillariophyceae*), with euglenoids (*Euglenophyta*), blue-greens (*Cyanophyta*), and pyrrophytes (*Pyrrophyta*).

Diatoms, specifically *Navicula sp.* and *Cyclotella sp.*, were dominant in Brushy Creek, while green algae and diatoms were co-dominant in Oak Creek. In Oak Creek, the most common species of green algae were *Chlorella sp., Scenedesmus sp.*, and *Palmodictyon sp.* Species diversity values were very similar among all of the stations sampled in both creeks, ranging from 3.43 to 4.0.

#### 3.3.2.2.2 Phytoplankton – 1999

The total number of phytoplankton taxa collected averaged 28 during the winter (range: 20 to 34) and 35 during the summer (range: 22 to 78). Although the average number of taxa collected during the summer was higher, greater numbers of taxa were collected during the winter at four of the six sampling stations (Table 3.3-6). Phytoplankton densities were reported on an areal number per square centimeter ($\#/cm^2$) rather than volumetric number per cubic centimeter ($\#/cm^3$) basis, with averages of 5,832 cells per square centimeter ($cells/cm^2$) (range: 1,141 to 13,438) collected during the winter and 14,045 $cells/cm^2$ (range: 5,731 to 31,174) collected during the summer.

The phytoplankton community was dominated by blue-green algae during both sampling events, comprising between 64.4 and 99.3 percent of all phytoplankton in the winter and 92.4 to 99.0 percent in the summer. Green algae ranged from zero to 2.1 percent of all phytoplankton in the winter and 0.1 to 4.1 percent in the summer. Diatoms comprised 0.2 to 5.8 percent in the winter and 0.3 to 2.1 percent in the summer. There were no readily discernable community differences observed between the winter and summer sampling events at any of the sampling stations.

The method of cell observation used for the 1999 samples, epifluorescence microscopy, uses ultraviolet light to illuminate the microscope field, which causes pigment molecules in algal cells to fluoresce, making even small cells clearly visible to the taxonomist. The 1980-phytoplankton samples were identified with traditional light microscopy, making the identification and enumeration of small blue-green algae cells difficult. Therefore, the large number of blue-green algae cells measured in 1999 most likely does not represent a significant increase from conditions found in 1980. It is important to realize that a comparable magnitude of small cells may also have been present in historical samples, but simply was not observed.

Chlorophyll-a concentrations were very low during both the summer and winter sampling periods, as is expected in tannic low-order streams. During the winter, no chlorophyll-a was detected at three of the six sampling stations (SW-1, 2, and 3), while the remaining three stations ranged from 1.5 to 30 milligrams/cubic meter ($mg/m^3$). During the summer, no chlorophyll-a was detected at station SW-2, while the remaining five stations ranged from 1.1 to 4.2 $mg/m^3$.

Comparison of the 1980 results with 1999 results indicates no significant change with respect to the number of taxa collected. During 1980, between 23 and 37 taxa were collected, while 1999 sampling resulted in 20 to 34 taxa collected with one exception. Seventy-eight taxa were collected at station SW-4 in July 1999. The different methodology of cell observation utilized in 1999 samples (epifluorescence microscopy) resulted in a greater number of blue-green taxa compared with 1980 results.

#### 3.3.2.2.3 Zooplankton - 1980

The biological survey conducted in April 1980 included the collection of zooplankton from three stations each in Brushy and Oak Creeks. The mean density of total zooplankton collected ranged from four to 36 individuals/liter, dominated by two major taxa, the crustacean order Copepoda (*Copepods*) and the phylum Rotatoria (*Rotifers*) (Table 3.3-7). Copepods (primarily immature *Nauplii*) and rotifers comprised an average of approximately 96 percent of the total zooplankton collected.

Zooplankton densities ranged from four to ten individuals/liter in Oak Creek, and nine to 36 individuals/liter in Brushy Creek. Higher densities of zooplankton in Brushy Creek were attributed to relatively large numbers of rotifers and copepods collected at station B-1 (22 and 13 individuals/liter, respectively). Diversity values were similar for both creeks, ranging from 2.88 to 3.85 in Brushy Creek and 2.61 to 3.97 in Oak Creek. These values are similar to those considered typical of non-polluted aquatic systems.

#### 3.3.2.2.4 Benthic Macroinvertebrates - 1980

At three locations within each sampling station, two replicate Ponar dredges were collected for identification and enumeration of benthic macroinvertebrates. At each sampling station, samples were collected near both banks and in the center of the stream channel. Macroinvertebrate density ranged from $1,614/m^2$ to $8,137/m^2$, dominated by freshwater worms (*Oligochaetes*), which comprised approximately 57 percent of the total density (Table 3.3-8). Other dominant taxa included midges (*Chironomidae*), and fingernail clams (*Sphaeriidae*).

The most common species of oligochaetes collected were of the genus *Limnodrilus*, while the most common species of midges were of the genera *Polypedilum, Tanytarsus, and Chironomus*. With few exceptions, the macroinvertebrate communities in the two creeks were similar. Both streams were dominated by oligochaetes, although Oak Creek contained larger populations of chironomus midges and fingernail clams (*Sphaeriidae*) when compared to Brushy Creek. Overall, densities ranged from 1,614 to 8,137/m$^2$ in Brushy Creek, and 2,161 to 4,838/m$^2$ in Oak Creek. Species diversity values were relatively high for both creeks, ranging from 2.9 to 3.7 in Brushy Creek and 3.1 to 3.4 in Oak Creek. These values are similar to those measured in non-polluted aquatic systems.

Drift net samples collected after 24-hour deployment contained similar species assemblages as Ponar dredge samples, but few numbers of individuals. Total number of individuals collected ranged from 18 to 326 and 40 to 363 in Brushy and Oak Creeks, respectively. The low number of organisms collected in drift nets was attributed to the low stream velocity and the dominance of oligochaete worms, which typically do not drift in stream currents.

#### 3.3.2.2.5 Benthic Macroinvertebrates – 1999

Hester-Dendy samples from the winter sampling event produced a greater number of taxa, ranging from 23 (SW-8) to 42 (SW-1) with a mean of 31, compared to the summer sampling event, which ranged from five (SW-1) to 13 (SW-4 and SW-8) and averaged ten taxa (Table 3.3-9). The number of individual macroinvertebrates similarly was greater during the winter sampling event, with an average of 185 and a range of 82 (SW-8) to 419 (SW-1), compared to the summer sampling event average of 76 and range from 12 (SW-3) to 155 (SW-4). The lower values reported from summer samples were attributed to the considerably higher stream gauge at all stations, which essentially "diluted" the number of colonizing invertebrates per unit volume of water.

Higher streamflow and correspondingly lower numbers of individuals and taxa collected during the summer resulted in low values for the ecological indices of species diversity, Florida Index, and ephemeroptera + plecoptera + trichoptera (EPT) taxa. Species diversity values ranged from 3.50 (SW-4) to 4.09 (SW-3) in the winter and 1.47 (SW-1) to 2.86 (SW-3) in the summer. Winter Florida Index values ranged from four (SW-4) to 28 (SW-3) and summer Florida Index values ranged from zero (SW-1 and SW-8) to seven (SW-2). EPT indices were also greater in the winter, ranging from one (SW-4) to ten (SW-2), compared to summer values, ranging from zero (SW-1, 7, and 8) to three (SW-3).

Similar results were obtained with qualitative dip net samples, with a greater number of taxa collected during the winter sampling event (Table 3.3-10). Taxa during the winter ranged from 25 (SW-1) to 53 (SW-2) with a mean of 36, while summer taxa ranged from ten (SW-1) to 30 (SW-4) with a mean of 21. The decrease in number of taxa collected during the summer sampling was attributed to increased streamflow. The total number of individuals collected during the summer was lower, with the exception of stations SW-4 and SW-7. The total number of individuals collected during the winter event ranged from 282 (SW-4) to 1278 (SW-2) with a mean of 667, while during the summer event the total number of individuals ranged from 97 (SW-3) to 736 (SW-8) with a mean of 401.

As the case with Hester-Dendy samples, ecological indices of species diversity, the Florida Index, and EPT taxa were greater during the winter sampling event. Shannon-Weiner species diversity values ranged from 2.66 (SW-1) to 5.01 (SW-2) in the winter and from 1.37 (SW-1) to 4.33 (SW-4) in the summer. The winter Florida Index values ranged from 5.0 (SW-4 and 8) to 25.0 (SW-2), while the summer Florida Index values ranged from two (SW-1 and 7) to 15.0 (SW-2). The EPT index was also higher in the winter, ranging from two (SW-4 and 8) to 10.0 (SW-2), while the summer values ranged from two (SW-1, 7, and 8) to 6.0 (SW-2).

The FDEP's Florida SCI uses a combination of seven metrics to calculate an overall SCI value, and is to be used with dip net sampling. The metrics include the number of taxa, number of EPT taxa, number of chironomidae taxa, percent dominant taxon, percent dipterans, Florida Index value, and percent Filterers. An SCI score of one, three, or five is attributed to each metric and the resulting total of metric scores reflects the biological stream condition. For summer sampling in peninsular Florida, a score of 19 or lower indicates some degree of impairment, while a score of 20-31 indicates "good" or "very good" conditions. In winter, a score of 20 or lower indicates impairment, while a score of 21-33 is indicative of unimpaired systems.

Overall, SCI values calculated from winter samples ranged from 23 to 29, while summer values ranged from 19 to 29. Using the SCI criteria, all of the sampling stations exhibited "good" or "very good" conditions during both winter and summer sampling, with the exception of station SW-1, located at the Roberts Road bridge over the West Fork of Horse Creek. While the sample collected in February 1999 at SW-1 resulted in an SCI score of 25, the July 1999 SCI value was 19, just below the criteria for a classification of "good".

#### 3.3.2.2.6 Fish - 1980

Twenty-nine species of fish representing 11 families were collected from the aquatic biota sampling stations on Brushy and Oak Creeks during August 1980. The dominant species collected from both creeks were the mosquito fish (*Gambusia holbrooki*) and least killifish (*Heterandria formosa*), which comprised over 90 percent of the total number of fish collected (Table 3.3-11). The mosquito fish and least killifish, members of the family livebearers (*Poeciliidae*), occur in virtually all of Florida's lakes and streams. They are tolerant of fluctuating water levels, low dissolved oxygen, and a wide range of pH conditions.

In Brushy Creek, 26 species of fish were collected, representing 11 families: gar (*Lepisosteidae*), bowfin (*Amiidae*), minnows (*Cyprinidae*), suckers (*Catostomida*), catfish (*Ictaluridae*), topminnows (*Cyprinodontidae*), livebearers (*Poeciliidae*), silversides (*Atherinidae*), sunfish (*Centrarchidae*), darters and perch (*Percidae*), and the exotic family walking catfish (*Clariidae*). The mosquito fish and least killifish were collected at all stations and comprised 55 percent and 38 percent of all fish collected in Brushy Creek, respectively. Forage fish, including shiners, topminnows, brook silverside (*Labidesthes sicculus*), the bluespotted pygmy sunfish (*Enneacanthus gloriosus*), and swamp darter (*Etheostoma fusiforme*) comprised approximately two percent of all fish collected from Brushy Creek. Fish of recreational importance comprised approximately three percent of all fish collected in Brushy Creek and included largemouth bass (*Micropterus salmoides*), yellow bullhead (*Ictalurus natalis*), bluegill (*Lepomis macrochirus*), redear sunfish (*L. microlophus*), spotted sunfish (*L. punctatus*), and warmouth (*L. gulosus*). Greater numbers of carnivorous fish were collected at the downstream stations B-2 and B-3, attributed to more stable conditions of stream flow and temperature when compared to the upstream station B-1.

Nineteen species of fish were collected from Oak Creek, representing eight families: gar (*Lepisosteidae*), bowfin (*Amiidae*), suckers (*Catostomidae*), catfish (*Ictaluridae*), topminnows (*Cyprinodontidae*), livebearers (*Poeciliidae*), sunfish (*Centrarchidae*), and darters and perch (*Percidae*). As was the case in Brushy Creek, mosquitofish and least killifish were the dominant species, comprising 75 percent and 16 percent of all fish collected, respectively. Fish of recreational importance comprised 5.5 percent of the total catch, represented by the same species of sunfish collected in Brushy Creek in addition to the brown bullhead (*Ictalurus nebulosus*). The upstream station on Oak Creek experiences greater water level fluctuations when compared to the downstream stations, which was reflected in the low number of species collected from station O-1. Only those species capable of withstanding extreme water fluctuations were collected, including mosquito fish, least killifish, and the seminole killifish (*Fundulus seminolis*).

## 3.4 THREATENED AND ENDANGERED SPECIES

The Ona site currently supports a limited number of plant and animal species that are considered under federal and Florida law to be endangered, threatened, or of special concern. The Florida Natural Areas Inventory (1997) data records and the Florida Department of Agriculture and Consumer Services' (FDACS) *Notes on Florida's Endangered and Threatened Plants* (Coile, 1998) were consulted to determine federal and state listed species of plants that have the potential to occur within Hardee, Manatee, and DeSoto counties. Table 3.4-1 shows 26 species of federal and state listed plants that potentially occur at the Ona site and includes the status of listed plant species together with habitat preferences, appropriate onsite habitats, and likelihood of occurrence on the Ona site.

A similar search was conducted to evaluate the potential for the Ona site to support federal and state listed wildlife species. This was based upon the Florida Natural Areas Inventory and USFWS records, previous studies conducted at the site, and the presence of suitable habitat for federal and state listed wildlife species. Table 3.4-2 shows the federal and state listed species of wildlife that could potentially occur at the Ona site.

All site surveys were conducted in accordance with workplans developed for the site as part of the project scoping for the CDA. These workplans were approved by the USFWS and the FFWCC.

### 3.4.1 Threatened and Endangered Plants

#### *3.4.1.1 Methods*

Unlike listed wildlife species, no federal or Florida regulatory agency has published or otherwise offered specific recommendations on the methodologies or techniques to be used to survey large tracts of land for the presence of listed plant species. IMC employed botanical experts who prepared a listed plant survey scope and methodology document incorporating comments from regulatory agencies and public interest groups. This document was submitted with the wildlife workplan for the CDA, and listed plant surveys were conducted at the Ona site in 1998.

Sampling for listed plant species was conducted in the spring, summer, and fall seasons. All habitat types including ruderal habitats such as ditches and pastures were surveyed, while habitats known to harbor listed species, including xeric scrubs, wet flatwoods, and swamps, were given special emphasis during the field effort. Figure 3.4-1 shows pedestrian transects that were covered from spring 1998 through fall 1999. Additional listed plant observations were recorded during upland community assessments, FLUCFCS mapping efforts, and wetland surveys. These records were used to supplement the formal field surveys for listed species.

Formal listed plant species field surveys were performed in April - May 1998, July 1998, and October-November 1998. When a listed species was encountered, its location was recorded on a one inch = 200 feet scale aerial photograph. This data was then entered into a GIS database. Records from the intensive surveys were computerized and entered into a GIS map database used to create Figure 3.4-2.

During the limited field reconnaissance conducted as part of the EIS in December 2000, reported locations of listed plant species were re-visited to verify the presence of listed plant species. While each listed species was not observed during this limited field reconnaissance, the continued presence of suitable habitat was verified, and therefore the results of the 1998-1999 listed plant surveys were determined to be accurate and applicable.

### *3.4.1.2 Survey Results*

Of the 26 federal and state listed plant species with the potential to occur in Hardee, Manatee, and DeSoto counties, no federally-listed plant species were observed on the site. Eight state listed plants were observed in habitats onsite. Figure 3.4-2 illustrates the locations where these species were observed. The following paragraphs describe the state listed plants found on the site.

#### 3.4.1.2.1 Florida Butterfly Orchid (Encyclia tampensis)

Florida butterfly orchids are epiphytic plants (air plants) that grow on trunks and branches of hardwoods (mostly live oaks) and cypress trees. The plants have dark green pseudobulbs up to seven centimeters (cm) long with one to three linear, elliptic glabrous, narrow leaves up to 40 cm long. The inflorescence (flowering part of the plant) consists of numerous yellowish-brown flowers with a three-lobed whitish lip having a magenta spot or stripe (Coile, 1998). The plant can be found blooming during different seasons throughout the year, but predominantly in April and May. It occurs sporadically throughout peninsular Florida.

Florida butterfly orchid is listed as a commercially exploited species by FDACS. Although somewhat rare throughout the State of Florida, the orchid is typically abundant where found. On the Ona site, there are several populations of Florida butterfly orchids growing in mixed hardwood swamps and hydric/mesic hammocks along the forested floodplain reaches of Horse Creek and Brushy Creek and at other sporadic forested habitat locations across the site (IMC, 2002).

#### 3.4.1.2.2 Nodding Pinweed (Lechea cernua)

This small silvery strigose, pubescent perennial herb is branched near its' base and can grow up to 60 cm tall. The small alternate leaves are elliptic to ovate in shape. The flowers, which are small, numerous and clustered, bloom in the summer and fall (Coile, 1998). Nodding pinweed is endemic to the scrublands of central Florida. It is listed as threatened by FDACS.

Nodding pinweed was found at two locations on the Ona site. One location was along the western property boundary of a xeric oak scrub located in the "no-mine area of conservation interest" in area 2, Section 31, Township 34 South, Range 23 East, which is not proposed for mining. The other location was at the southern edge of another xeric oak scrub situated to the east of Horse Creek in Section 16, Township 34 South, Range 23 East (IMC, 2002). Both populations consisted of only a few individuals.

#### 3.4.1.2.3 Cinnamon Fern (Osmunda cinnamomea)

This terrestrial fern has erect, pinnately compound fronds up to 1.5 meters (m) tall. The fertile fronds are separate and with clusters of cinnamon-colored sporangia (Coile, 1998). These ferns grow in swamps and marshes throughout Florida. Cinnamon fern is listed as a commercially exploited species by FDACS. Cinnamon Fern was found throughout the swamps on the property in large localized populations.

#### 3.4.1.2.4 Royal Fern (Osmunda regalis L. var. spectabilis)

Royal fern is a very common fern associated with swamps and marshes throughout Florida. The fronds are up to 1.5 m tall and typically arranged in large tussocks. The blades of the fronds are twice-pinnate and spreading. The spore-bearing pinnae are located on the tips of the fronds (Coile, 1998). Royal fern is listed as a commercially exploited species by FDACS. Royal fern was found in relatively moderate-sized populations throughout the swamps on the property (IMC, 2002).

#### 3.4.1.2.5 Leafless Beaked Orchid (Stenorrhynchos lanceolatus)

Leafless beaked orchid is listed as a threatened species by FDACS. This terrestrial orchid grows up to 60 cm tall from fleshy, thickened roots. The four to six oblong-oblanceolate to lanceolate shaped, basal leaves may disappear at flowering. The eight to 15 cm long inflorescences can have up to 30 reddish or deep crimson flowers accentuated by long and beaked columns (Coile, 1998). These orchids grow in open pastures, roadsides, oak hammocks, wet pine flatwoods, and on sandhills virtually throughout Florida. Outside Florida, leafless beaked orchids are distributed throughout Mexico, Central and South America, the West Indies, and the Bahama Islands. Blooming occurs from April through July.

Only one small population (a few individuals) of leafless beaked orchid was discovered at the Ona site growing along the roadside at the edge of a xeric oak scrub system located in the northwestern corner of the site in Section 9, Township 24 South, Range 23 East (IMC, 2002).

#### 3.4.1.2.6 Cardinal Air Plant (Tillandsia fasciculata)

This epiphytic bromeliad has large rosettes of grayish green leaves up to 60 cm long. The inflorescence is a fasciculate of numerous spikes with yellow to rose purple flora bracts and violet petals. This bromeliad mostly occurs in hammocks, cypress swamps, and pinelands. Cardinal air plant occurs throughout central and south Florida and blooms in the fall. It is also distributed throughout the West Indies, Mexico, and Central and South America. Although frequent within preferred habitats, the cardinal air plant is listed as an endangered species by FDACS because the larvae of the *Metamasius callizona*, a weevil, tunnel through the plants base, destroying the plant (Frank, 1999).

Cardinal air plant was found throughout the swamps and hammocks onsite, but in relatively smaller populations than the giant air plant (IMC, 2002).

#### 3.4.1.2.7 Giant Air Plant (Tillandsia utriculata)

This pale green, erect epiphytic bromeliad has numerous leaves arranged in a large urn-shaped rosette. The inflorescence is a large, branching rachis with ivory white flowers. The fruit is a cylindrical capsule. After flowering, the plant dies. Large plants often fall to the ground and continue to grow and reproduce normally. It blooms in the late summer and fall.

This bromeliad grows in hammocks, cypress swamps, and pinelands throughout Florida. It is also distributed in West Indies, Mexico, and Central and South America. Although quite common, the giant air plant is listed as endangered by FDACS. The endangered status of the species is mostly due to the *Metamasius callizona* weevil whose larvae tunnel through the plant base (Frank, 1999). Giant air plant was found in relatively large populations throughout the hammocks and swamps onsite (IMC, 2002).

#### 3.4.1.2.8 Wild Coco or Giant Orchid (Pteroglossapsis ecristata)

This large terrestrial orchid grows to 1.7 m tall, and has two to four linear-lanceolate leaves at the base (Coile, 1998). Flowers are three-lobed, yellowish, flushed with magenta, in a raceme of up to 30 flowers. Wild coco grows in pine rockland, upland hardwood forest, scrubby flatwoods, mesic flatwoods, and sandhills in Mexico and Florida. In Florida, it is often found in disturbed xeric communities, on spoil, and in well-drained pastures. This orchid is present throughout most of peninsular Florida and typically blooms in the summer and early fall. This orchid is listed a threatened by FDACS.

This orchid was found at one location on the Ona site in a pasture adjacent to a dirt trail in Section 19, Township 34 South, Range 23 East, east of Horse Creek (IMC, 2002).

## 3.4.2 Threatened and Endangered Wildlife

### *3.4.2.1 Methods*

Surveys for listed wildlife species on the Ona site were performed in accordance with the approved wildlife workplan based upon FFWCC's (formerly Florida Freshwater Fish and Game Commission) Wildlife Methodology Guidelines (1988). Recommendations and comments offered by Ms. Deborah Manz of the USFWS and Mr. James Beever of FFWCC, were incorporated into the revised document, which was reviewed and approved by the AWG and PWG.

Listed wildlife species surveys were conducted in the spring, summer, and fall of 1998. Two teams were used for all of the surveys. Each team consisted of one senior ecologist and one biologist. Over 1,300 hours of field surveys were conducted. In addition, a special survey was conducted in the summer of 1999 by Dr. Reed Bowman of the Archbold Biological Station to further evaluate the potential for red-cockaded woodpecker (RCW) populations to exist on the Ona site. The results of Dr. Bowman's survey are presented in Appendix 12-2 of IMC's CDA.

Wildlife surveys conducted in 1998 included helicopter fly-overs on April 2, 14, and 30, l998. Ground surveys were performed: May 4 through 22, August 10 through 21, October 19 through 30, and November 16 through 18, 1998. Ground surveys consisted of pedestrian and vehicular surveys, small mammal trapping, and pit-trapping for reptiles and amphibians. Figure 3.4-1 shows the pedestrian and vehicular transects, small mammal trapping transects, and locations of pit traps. All species observed were recorded on one-inch equals 200 feet scale aerial photography and entered into the GIS database used to generate Figure 3.3-1.

#### 3.4.2.1.1 Spring 1998 Wildlife Methodologies

Spring surveys of wildlife utilization and for the presence of listed species were conducted on the Ona site from May 4 through May 22, 1998.

Spring surveys implemented the methodologies of the USFWS and FFWCC approved wildlife survey workplan. The surveys included helicopter fly-overs on April 2, 14, and 30, 1998; pedestrian and vehicular surveys of all upland habitats; spot census surveys of all wetlands larger than ten acres; and pedestrian surveys of all forested wetlands. As proposed in the wildlife survey workplan, small mammal trapping was conducted at the 11 transects on the Ona site where suitable habitat existed.

Wading birds were surveyed for nesting and rookeries in all wetlands during the April 2, 14, and 30, 1998, aerial surveys, supplemented by the wetland spot census efforts. Pedestrian transect surveys of forested wetlands, with emphasis on riverine systems, were used to determine the presence of limpkins. Spot and aerial surveys of herbaceous wetlands were used to detect round-tailed muskrats.

Three aerial surveys and repetitive pedestrian surveys of upland areas were used to determine the presence of bald eagle nests. No bald eagle nests were identified on the Ona site (IMC, 2002).

Upland pedestrian transects in all portions of each site were used to determine the presence, or lack thereof, of red-cockaded woodpeckers and their cavities, burrowing owls, southeastern American kestrels, Florida grasshopper sparrows, Florida scrub jays, and Audubon's caracara. The pedestrian transects achieved well over 15 percent visual coverage of all upland habitats using the method of diminishing quarters. The pedestrian transects were supplemented by vehicular transects in open areas (e.g., pasture) to determine the presence of burrowing owls, Florida grasshopper sparrows, and caracara.

Call surveys for Florida scrub jays were conducted in representative Type I, II, and III habitat using recordings of territorial scolding shortly after sunrise. Recorded call tapes from the Archbold Biological Station were used to survey scrub jays in xeric habitats on the Ona site. In addition to call surveys, observations for scrub jays were included during pedestrian wildlife surveys. Locations, dates, and times of all scrub jay call surveys are listed in Table 3.4-3. No scrub jays were heard or seen during any of the surveys onsite (IMC, 2002).

Call surveys were also used for herptofauna after rain events and recorded call surveys were used for gopher frogs. Gopher frogs are typically found in xeric, upland habitats, particularly longleaf pine-turkey oak sandhill associations, which often support dense populations of gopher tortoises (Moler, 1992). They also occur in pine flatwoods, sand pine scrub, and xeric hammocks. Gopher frogs were surveyed using pit-traps and recorded calls. Recorded call surveys for herpetofauna were conducted in these habitats with the largest density of gopher tortoise burrows during the spring, summer, and fall surveys, especially after rain events.

Small mammal trapping was conducted in potential Florida mouse habitat, including xeric oak, oak hammock, pine flatwoods (drier sites only), and shrub/brushland at the transect locations depicted on Figure 3.4-1. Live traps baited with unsalted sunflower seeds or rolled oats were placed along each transect to achieve the 200 trap-nights per 50 acres density specified by FFWCC. Each transect was checked twice daily during four consecutive 24-hour periods. All captured Florida mice were marked to prevent counting them more than once if they were recaptured and released. A total of 2,200 trap-nights were completed at Ona.

#### 3.4.2.1.2 Summer 1998 Wildlife Methodologies

Summer surveys of wildlife utilization and for the presence of listed species were conducted on August 10 through 21, 1998.

Summer surveys implemented the methodologies of the USFWS and FFWCC approved wildlife survey workplan. Pedestrian transects, spot surveys, and vehicular surveys were conducted on all portions of the site. Surveys were repeated in those habitats likely to harbor listed species. Because potential woodpecker starter holes were observed, surveys were again conducted by pedestrian transects through all pine flatwoods onsite to search for evidence of red-cockaded woodpeckers. Call surveys for amphibians were utilized near wetland areas, especially after rainfall events.

#### 3.4.2.1.3 Fall 1998 Wildlife Methodologies

Fall surveys of wildlife utilization and for the presence of listed species were conducted on the Ona site from October 19 through 30, and November 16 through 18, 1998, using the methodologies in the USFWS and FFWCC approved wildlife workplan.

Pedestrian transects, spot surveys, and vehicular surveys were conducted over all portions of the site and surveys were repeated in habitats likely to harbor listed species. Vehicular and pedestrian transects were conducted repeatedly in appropriate habitats for the presence of burrowing owls, Florida black bear, and peregrine falcons, in particular. Due to the presence of potential woodpecker starter holes, surveys were again conducted by pedestrian transects through all pine flatwoods onsite to search for evidence of red-cockaded woodpeckers. Recorded call surveys were again conducted in all appropriate habitat types for scrub jays (Table 3.4-3). Call surveys for amphibians were utilized near wetland areas, especially after rainfall events. In addition, pit trapping with drift fences was employed in areas of highest gopher tortoise burrow density. A total effort of 100 pit-trap days was conducted.

All species observed were recorded by location on aerial photographs unless they were species observed commonly over the site (e.g., wading birds). Field notes correlated the species and locations observed with information about the habitat type, behavioral observations, and any special notes about the observation.

#### 3.4.2.1.4 Anecdotal Observations

Any observations of listed species were noted during the performance of the WRAP evaluations, upland community assessments, FLUCFCS mapping efforts, wetland jurisdictional determination, and agency tours. These anecdotal observations are also shown on Figure 3.3-1. During the limited field reconnaissance conducted in December 2000 as part of the EIS, observation of threatened or endangered wildlife species were limited to one gopher tortoise and several burrows. No additional wildlife surveys were conducted during the December 2000 field reconnaissance.

### *3.4.2.2 Results*

Table 3.4-4 presents the listed species observed on the Ona site during the spring, summer, and fall 1998 surveys. The locations of all listed species observations are shown on Figure 3.3-1.

Aerial surveys at Ona located no eagle nests, although four individual eagles were observed onsite. No scrub jays were found inhabiting the site. Evidence of southeastern American kestrel was not observed on the Ona site or along roadways traveling to and from Ona during spring or summer surveys. However, numerous kestrels were observed in the fall, most likely all migrants.

No active RCW cavities or birds were observed on the Ona site, although one potential abandoned cavity tree was observed. Dr. Reed Bowman's supplemental study reached similar conclusions.

No Florida pine snakes (*Pituophis melanoleucus sayi*) were observed or captured in pit traps at the Ona site. The Florida pine snake often resides below the soil surface in pocket gopher and/or gopher tortoise burrows, increasing the difficulty of direct observations. This species is found in xeric habitats, including longleaf pine-xerophytic oak woodlands, sand pine scrub, pine flatwoods on well-drained soils, and old fields on former sandhill sites (Moler, 1992). The area of preferred habitat is limited to less than 1,000 acres, or approximately five percent of the Ona site. Following is a discussion for each listed species present on the Ona site:

#### 3.4.2.2.1 American Alligator (*Alligator mississippiensis*)

The American alligator is federally-listed as threatened due to its similarity in appearance to the American crocodile, which is an endangered species. The alligator is state-listed as a species of special concern. Although a listed species, the alligator is found in freshwater habitats throughout Florida. Individuals were observed in open water habitats (cattle ponds, ditches) on the site. Horse Creek, Brushy Creek, Oak Creek, and Hickory Creek, offer migration routes for the alligator to offsite habitat. There are sufficient ponds, wetlands and streams in the area to sustain the population.

#### 3.4.2.2.2 Eastern Indigo Snake (*Drymarchon corais couperi*)

The eastern indigo snake is listed as threatened on both the federal and state list. As shown on Figure 3.3-1, indigo snakes were observed infrequently at several locations in the 1998 and 1999 field efforts.

According to the latest information published by the USFWS (1999), the eastern indigo snake utilizes a mosaic of habitats found on the Ona site, including pine flatwoods, scrubby flatwoods, hardwood hammock, edges of freshwater marshes, hydric hammocks, rangeland, and agricultural fields. These habitats comprise approximately 10,000 acres of the Ona site. Estimates of preferred habitat for the eastern indigo snake on site range from 5,000 to the entire 10,000 acres of potential habitat. According to the USFWS, the average home ranges of adult eastern indigo snakes are 200 acres and 50 acres for males and females, respectively. Based on these averages and IMC's pre-mining surveys and relocations to date, a reasonable estimate of the size of the population at the Ona site is between ten and 50 individuals.

#### 3.4.2.2.3 Bald Eagle (*Haliaeetus leucocephalus*)

The bald eagle is listed as threatened on both the federal and state lists, though it is proposed for delisting by the USFWS. The bald eagle typically nests in live pine or cypress trees. No nests are currently known onsite (IMC, 2002). One individual was observed perched in a tree in a pasture, while three individuals (two mature, one immature) were repeatedly observed along Brushy Creek in the fall.

#### 3.4.2.2.4 Woodstork (*Mycteria mycteria*)

The woodstork is listed as endangered on both the federal and state lists. This bird is often found nesting and feeding in flocks. During the seasonal surveys, groups of birds were observed foraging on the site. Woodstorks prefer forested cypress wetlands for nesting. No evidence of any rookeries onsite or in the adjacent area was observed in the seasonal surveys or helicopter flights.

#### 3.4.2.2.5 Florida Panther (*Felis concolor coryi*)

The Florida panther is currently listed as endangered on both the federal and state lists. The Florida panther has not been confirmed on the Ona site, although two possible observations were made during field surveys. A track was observed on the western side of Brushy Creek by a USFWS panther biologist while touring the site with IMC. The track was cast in plaster, but could not be positively identified as a Florida Panther. A large cat was reportedly sighted near the Mount Zion Church, outside of the project boundary, but no tracks or photographs were obtained. Radio-telemetry data supplied by FFWCC reported a radio-tagged panther was in central Florida at these times although the data did not show the cat to be in the Ona vicinity.

#### 3.4.2.2.6 Arctic Peregrine Falcon (*Falco peregrinus tundrius*)

The Arctic peregrine falcon has been removed from the federal list, but is being monitored. The falcon is listed by the state as endangered. This species was observed onsite by a biologist team during the winter WRAP evaluations. This species is migratory and forage in the open pasture areas. The species is usually observed hunting in open habitats.

#### 3.4.2.2.7 Southeastern American Kestrel (*Falco sparverius paulus*)

The southeastern American kestrel is a state-listed threatened species. Kestrels were commonly observed in open habitats on all portions of the Ona site. However, since surveys conducted during the summer did not observe any kestrels, it appears that the birds observed were not the southeastern subspecies, but rather the common migrants. The kestrel hunts over open areas, therefore, the palmetto rangeland and improved pasture that dominate the Ona site would provide ample habitat for this bird.

#### 3.4.2.2.8 Gopher Tortoise (*Gopherus polyphemus*)

The gopher tortoise is a state-listed species of special concern that is found in well-drained, sandy soils characteristic of xeric habitats in Florida. During seasonal surveys, burrows and tortoises were locally common in xeric oak, sand pine, oak hammock, and palmetto rangeland communities on the Ona site.

#### 3.4.2.2.9 Florida Gopher Frog (*Rana capito*)

The Florida gopher frog is a state-listed species of special concern. Florida gopher frogs are gopher tortoise commensals utilizing burrows and are frequently found in xeric, sandhill, and pineland communities. Three individuals were captured in pit traps onsite during the field surveys, and released unharmed.

#### 3.4.2.2.10 Burrowing Owl (*Speotyto cunicularia*)

The burrowing owl is a state-listed species of special concern. This unique ground-nesting owl prefers well-drained, sandy ground with little or no tall growing vegetation. Three probable areas of burrows were observed during the seasonal surveys in the central portion of the site. Two entrances were observed at each burrow location. No burrowing owls were directly observed. Much of the adjacent land is improved pasture, prime habitat for the burrowing owl.

#### 3.4.2.2.11 Florida Sandhill Crane (*Grus canadensis pratensis*)

Florida sandhill cranes are listed by the state as threatened. They prefer to use wet prairies, pastures, and shallow marshes. Sandhills were frequently seen on, flying over, or heard on or near the Ona site during the seasonal surveys. No active nests were observed during any of the ground or aerial surveys. Adjacent lands contain numerous marshes and uplands, which provide habitat for the sandhill cranes.

#### 3.4.2.2.12 Little Blue Heron (*Egretta caerula*)

Little blue herons are listed by the state species of special concern, and are not commonly observed onsite in the seasonal surveys. Individual species were observed in some of the marshes, cattle ponds, and drainages onsite. The one nesting colony is located in an area that would not be disturbed (Section 31).

#### 3.4.2.2.13 White Ibis (*Eudocimus albus*)

The white ibis is a state species of special concern. White ibis flocks were commonly observed foraging onsite during the seasonal surveys. Small and large groups, as well as individual birds, were observed feeding onsite. No nesting colonies were found onsite or nearby offsite, although ibis were roosting in the two wading bird colonies found onsite.

#### 3.4.2.2.14 Snowy Egret (*Egretta thula*)

Snowy egrets are a state species of special concern and nest in inland and coastal colonies throughout peninsular Florida, but less frequently in west central Florida than elsewhere on the peninsula. Similar to other wading bird species, snowy egrets feed in a variety of shallow marshes, edges of swamps or ponds, flooded ditches, and along stream banks. During the seasonal surveys, limited numbers of snowy egrets were observed foraging on the site and a few were nesting in one of the rookeries onsite. Adjacent lands contain numerous wetlands suitable for foraging.

#### 3.4.2.2.15 Tri-Colored Heron (*Egretta tricolor*)

The tri-colored heron is a state species of special concern and nests principally in estuarine habitats but can also nest in woody vegetation over standing water. Similar to other wading bird species, tri-colored herons feed in a variety of shallow marshes, edges of swamps or ponds, flooded ditches, and along stream banks. Suitable habitat exists for feeding in the marshes onsite and offsite. Tri-colored herons were observed foraging, but not nesting, onsite during the surveys.

#### 3.4.2.2.16 Sherman's Fox Squirrel (*Sciurus niger shermani*)

Sherman's fox squirrel is a state-listed species of special concern. Habitat preference for this mammal is typically sandhill communities (longleaf pine/turkey oak associations) and woodland pastures (FLUCFCS code 213). Individuals were observed throughout the oaks/pastures and flatwoods onsite.

#### 3.4.2.2.17 Florida Mouse (*Podomys floridanus*)

The Florida mouse is a state-listed species of special concern. Florida mice inhabit sand pine scrub in early successional stages as well as longleaf pine/turkey oak and other xeric communities, all of which have well-drained sandy soils. Onsite habitat is principally located along the Horse Creek drainage basin in the western part of the mine property. Individuals were live-trapped and released without harm.

#### 3.4.2.2.18 Round-Tailed Muskrat (*Neofiber alleni*)

Round-tailed muskrats are a rare species, although they are not currently listed. Muskrats typically inhabit shallow emergent marshes, especially herbaceous systems with dense stands of maidencane *(Panicum hemitomon)* and pickerelweed *(Pontederia lanceolata)*. Habitat is available both onsite and offsite in the numerous marshes that exist in western Hardee County. Evidence of characteristic dome-shaped grass houses was observed in some of the marshes onsite during the field surveys.

#### 3.4.2.2.19 Roseate Spoonbill (*Ajaja ajaja*)

The roseate spoonbill is a state-listed species of special concern. One individual roseate spoonbill was observed flying over the Ona site, but no individuals were observed foraging or roosting on the site.

##### 3.4.2.2.20 Other Species

In addition to the federal- and state-listed species, local conservationists specifically asked IMC to address other species of concern to them, including some bird species of regional importance, which occur or have the potential to occur onsite. They are:

| | |
|---|---|
| American kestrel | *Falco sparverius* |
| Swallow-tailed kite | *Elanoides forficatus* |
| Caerulean warbler | *Dendroica cerulea* |
| Palm warbler | *Dendroica palmarum* |
| Prairie warbler | *Dendroica discolor* |
| Yellow-billed cuckoo | *Coccyzus americanus* |
| Gray catbird | *Dumetella carolinensis* |
| Ground dove | *Columbina passerina* |
| Field sparrow | *Spizella pusilla* |
| Bachman's sparrow | *Aimophila aestivalis* |
| Loggerhead shrike | *lanius ludovicianus* |
| Redheaded woodpecker | *Melenerpes erythrocephalus* |
| American bittern | *Botaurus lentiginosus* |

All of these 13 species, except the field sparrow and caerulean warbler were observed onsite at Ona. The field sparrow could occur in open pasture or grassy or shrub habitats onsite. The caerulean warbler is a migrant to this region and could occur in hardwood swamp habitats onsite. The remaining 11 species are common to the region, and commonly observed on the Ona site. These species utilize primarily pine flatwoods or forested wetlands, except for the American bittern, which prefers marsh habitat.

Two wading bird colonies were observed during spring 1998 aerial surveys of the Ona site. One colony, south of SR 64, contained listed species (little blue herons, snowy egrets, and white ibis), while the other colony, located north of SR 64, contained great egrets, great blue herons and no listed species (IMC, 2002).

## 3.5 SURFACE WATER HYDROLOGY

### 3.5.1 Regional Description

#### *3.5.1.1 Basin Parameters*

With the exception of a small area (approximately eight acres), the proposed Ona site is located within the Peace River basin. The Peace River is situated in Polk, Hardee, DeSoto, and smaller portions of Charlotte, Glades, Highlands, Hillsborough, Manatee, and Sarasota Counties as shown on Figure 3.5-1 (USEPA, 1978). The drainage basin of the Peace River is approximately 2,403 square miles (Fernald and Purdum, 1998), and is the largest drainage system in Hardee County. The Peace River flows in a southerly direction about 120 miles from its source in central Polk County to its exit into Charlotte Harbor. Downstream of the confluence of the Peace River and Horse Creek, the river is used for municipal supply by the Peace River – Manasota Water Supply Authority (PRMWSA) (for more details see Section 3.5.1.3.) The surface water flows from the Ona site drain into two major drainage basins. The site area drains either into Horse Creek and its tributaries or into tributaries of the Peace River, which are located in Hardee County. Horse Creek discharges into the Peace River in southern DeSoto County, which drains into the Charlotte Harbor. The location of the Ona site within the Peace River Basin is shown on Figure 3.5-1.

Charlotte Harbor is a shallow coastal plain estuary with an open surface area of approximately 270 square miles (SWFWMD, 2000a). The watershed that drains into Charlotte Harbor is approximately 3,360 square miles (SWFWMD, 2000a). Therefore, the Peace River drainage basin represents approximately 70 percent of the area that drains into Charlotte Harbor.

The USGS maintains a gauging station on Horse Creek at SR 64 (station #02297155), which is approximately 31 miles upstream from the confluence with the Peace River and is shown as station #1 on Figure 3.5-1. This location is at the southern property boundary of the Ona site. The drainage area above the gauging station at SR 64 is 42 square miles and the average discharge for the period from 1977 through 2000 is 30.0 cubic feet per second (cfs). The median discharge is 6.5 cfs and there is zero discharge for several days each year (165 days total for the period of record).

The USGS also maintains a gauging station on Horse Creek at SR 72 (station #02297310), which is ten miles upstream from the confluence with the Peace River, shown as station #2 on Figure 3.5-1. The drainage area above this gauging station is 218 square miles. The average discharge for the period from 1977 through 2000 is 170.2 cfs. The median discharge is 42 cfs and there is zero discharge for several days each year (32 days total for the period of record).

The USGS reported that discharge in the Peace River at Zolfo Springs (station #02295637) averaged 490.6 cfs for the period from 1977 through 2000. The location of this station is shown as station #3 on Figure 3.5-1. The median discharge at Zolfo Springs is 256 cfs and no zero discharge days were recorded for the period of record. The drainage area above Zolfo Springs is 826 square miles. The USGS reported that discharge in the Peace River at Arcadia (station #02296750) averaged 842.2 cfs for the period from 1977 through 2000. The location of the Arcadia station is shown as station #4 on Figure 3.5-1. The median discharge at Arcadia is 381 cfs and there are no days of zero discharge recorded for the period of record. According to the USGS, the drainage area above Arcadia on the Peace River is approximately 1367 square miles.

The closest long-term rainfall station to the proposed Ona Mine is in Hardee County at Wauchula, which is northeast of the Ona site. The minimum annual rainfall on record is 29.1 inches, which occurred in 2000. The maximum annual rainfall on record is 83.5 inches, which occurred in 1953. The long-term average precipitation (1933-2000) for this station is 52.91 in/yr. However, for the period from 1941 through 1970, the rainfall averaged 54.6 in/yr and for the period 1971 through 2000, the rainfall averaged about 50.7 in/yr. Figure 3.5-2 presents departures in inches of rainfall from long term average for the Wauchula station.

Figure 3.5-3 shows a 30-year moving average of rainfall and streamflow. The rainfall was collected at five stations throughout the Peace River basin. The stream flow is the result of the discharge in inches at the USGS station at Arcadia. This figure illustrates the relationship between rainfall and flow in the Peace River basin. As shown in Figure 3.5-3, the 30-year average of rainfall has gradually fallen since the 1970's. Furthermore, the streamflow in the Peace River has also fallen over this period. The plot indicates that the streamflow and rainfall follow a similar pattern of variation, suggesting that there is a direct relationship between the two parameters.

Phosphate mining has occurred in the Horse Creek basin since 1978. The effects of the phosphate mining on the streamflow in the creek have been analyzed and are included in a detailed cumulative impact assessment in Section 4.26.5. The results indicate that no significant difference in streamflow has occurred between drainage basins studied with phosphate mining versus those with no phosphate mining.

### *3.5.1.2 Regional Water Budget Analysis*

Historical hydrological data for some of the major tributaries to the Peace River in Hardee County are presented in Table 3.5-1. Horse Creek, West Fork Horse Creek, Brushy Creek, Oak Creek, and Hickory Creek pass through portions of the Ona site. Although the rainfall and streamflow data collected during the different periods vary significantly, the estimated ET falls within a narrow range: 38.3 to 42.7 in/yr. These values are consistent with the average ET of 39 in/yr reported by other investigators for the central Florida region (Cherry et al., 1970). The ET is the difference between rainfall and streamflow after the deep recharge has been subtracted. Deep recharge is the movement of groundwater from the water table aquifer to the underlying IAS and FAS.

Because the water in wetlands is available for plant transpiration and surface evaporation for longer periods during the year than it is in the uplands, the average ET is higher for wetland vegetation than upland vegetation. Previous studies by other investigators have indicated that average ET for wetland vegetation is between 90 and 100 percent of lake evaporation (Ardaman & Associates, 1988; German, 1999). Lake evaporation in the area of the proposed Ona Mine is estimated by the USGS to be about 50 in/yr (Visher and

Hughes, 1975). As such, a range of riparian ET would vary from 45 in/yr to 50 in/yr, in the Peace River basin.

The regional rainfall can be seen to vary between 29 and 84 inches with an average of approximately 53 in/yr at the Wauchula station. The published values of runoff are between ten to 15 in/yr for the central phosphate area and near 11.6 in/yr for the Peace River drainage basin (Fernald and Purdum, 1998). The USGS data for the Arcadia station shows the average flow for the Peace River Basin as 10.6 in/yr (USGS, 2001a). The published values for groundwater outflows for Horse Creek are in the range of 3.6 to 8.7 in/yr as reported by USGS (Lewelling, 1997).

Stewart (1980) reported that no recharge occurs along the Peace River in Hardee County, and reported that areas of very low recharge (zero to two in/yr) to the FAS occur in other areas of the county. Ryder (1985) simulated values of recharge and upward leakage from the UFA system using a two-layered, steady state, digital model. Ryder reported that areas of very low recharge (zero to two in/yr) occur in Hardee and northwestern DeSoto County.

#### *3.5.1.3 Surface Water Use*

The PRMWSA withdraws surface water for public supply downstream of the proposed mine area. The PRMWSA has a water use permit to withdraw an average of 32.7 mgd from the Peace River at Fort Ogden. One of the conditions in the PRMWSA water use permit (#2010420.02) states that the PRMWSA may not divert any water from the Peace River if the previous average daily discharge from the Arcadia station (USGS Station #02296750) is less than 130 cfs. Another condition is that the PRMWSA shall not divert an amount greater than ten percent of the previous daily discharge value and the diversion amount shall not exceed the difference between the measured value and 130 cfs. A discharge of 130 cfs at the Arcadia station is exceeded approximately 88 percent of the time. In order for the PRMWSA to withdraw their permitted average capacity of 32.7 mgd a discharge of 505 cfs must occur the previous day. This discharge occurs approximately 45 percent of the time based on data collected at the USGS station at Arcadia from the period from 1931 through 2000.

As part of the Peace River Comprehensive Watershed Management Plan, an assessment of streamflow reductions in the Upper Peace River Basin is being conducted. The results of this assessment will be used to prioritize sub-basins for pursuing streamflow restoration and to establish minimum flows in the upper Peace River. The SWFWMD has also scheduled 2002 and 2003 to establish minimum discharges for the middle Peace River and lower Peace River estuary, respectively. The minimum flows for the middle Peace River will account for the flow needs of the freshwater ecosystems associated with the non-tidal reaches of the river below Zolfo Springs (SWFWMD, 2001b). The minimum flows for the lower Peace River estuary and shell Creek will account for the total Peace River freshwater flow requirements of the estuary. Based on the studies future withdrawals will be assessed for impacts to the ecosystems in the immediate area as well as impacts to estuary minimum discharge requirements. Both localized and downstream effects will be considered for minimum flows for tributaries in the Peace River watershed.

## 3.5.2 Site Specific Description

### *3.5.2.1 Basin Description*

A comparison of the long-term rainfall presented in Figure 3.5-2 indicates that over the past 30 years, the average rainfall is approximately four inches below the previous 30-year period. Therefore, cumulatively the recent 30-year period received approximately 118 inches less rainfall than the previous 30-year average. The average rainfall for the 1991-2000 period was approximately the same (52.6 inches) as the long-term average (52.9 inches). However, the period was influenced by extreme variability. Except for 1996, the period of 1991 through 1998 were above average years and averaged almost five inches above the long-term average. However, the 1999 through 2000 period averaged 18 inches below the long-term average. In the entire period of record for this station from 1933 to 2000, the rainfall for 2000 set a new record low with less than 30 inches of total rainfall. This has resulted in a greater groundwater contribution for this period of streamflow with onsite tributaries experiencing extended periods of no flow. The cumulative effects of the 30-year drought on streamflow (see Figure 3.5-3) are discussed in Section 3.5.1.1.

Figure 3.5-4 presents the drainage areas for the individual watersheds that drain the Ona site. As shown on Figure 3.5-4, the primary watersheds that drain the site are Horse Creek, West Fork Horse Creek, Brushy Creek, Brady Branch, Oak and Hickory Creeks. Horse Creek, West Fork Horse Creek, Brushy Creek and Brady Branch are all part of the Horse Creek drainage basin and drain the western two-thirds of the Ona site. From west to east, Oak and Hickory Creeks are tributaries to the Peace River that drain the eastern one-third of the property. The primary watershed divide, between Horse Creek Basin and Peace Rive Basin, is located approximately one mile west of the north-south Fort Green-Ona Road. In addition, areas of Brushy Creek and Brady Branch exchange flood flows with Oak and Hickory watersheds. Portions of the following descriptions of the different on-site streams were taken from Appendix 14-4 of the CDA.

#### 3.5.2.1.1 <u>Horse Creek</u>

Horse Creek, with a drainage area of approximately 42 square miles at the USGS Station #02297155, (Horse Creek at Myakka Head), is a tributary of the Peace River. The stream is deeply and narrowly incised, and has an average stream slope within the Ona site of approximately nine feet per mile.

#### 3.5.2.1.2 West Fork Horse Creek

The West Fork Horse Creek drains an area of 13.3 square miles into Horse Creek, just upstream of the Horse Creek crossing of SR 64. Approximately fifty percent of the watershed is in Manatee County. The headwaters of the West Fork Horse Creek and some parts of the lower portion of the creek were altered by human activities. These alterations were accomplished in the mid 1900s to accelerate the drainage. The portion of the creek on the Ona site is mainly in its natural state except for some localized alterations. The average stream slope within the Ona site is approximately 9.8 feet per mile.

#### 3.5.2.1.3 Brushy Creek

Brushy Creek drains 48 square miles and is a tributary to Horse Creek. The confluence of Brushy Creek with Horse Creek occurs just downstream of Horse Creek Prairie, approximately five miles south of SR 64. Approximately 26 square miles of the Brushy Creek basin drains onto the project site. Brushy Creek receives inflows from Brady Branch south of SR 64. The stream has a broad, shallow cross-section, with an average stream slope within the Ona site of 2.1 feet per mile. Some agricultural development has occurred within the watershed, primarily consisting of citrus and improved pasture. A number of natural shallow water storage areas also occur within the watershed.

#### 3.5.2.1.4 Brady Branch

Brady Branch is a tributary to Brushy Creek. This watershed covers 3.2 square miles and receives overflows from Oak Creek at several locations along its course. The upper portion of the Brady Branch watershed is comprised of depressional areas, interconnected by natural topographic saddles and a few manmade ditches. Stormwater runoff from the Brady Branch watershed is conveyed beneath SR 64 through three sets of culverts, and then through a fairly well defined stream and a series of depressional areas to Brushy Creek.

#### 3.5.2.1.5 Oak Creek

Oak Creek is a tributary to the Peace River with a significant overflow to Brushy Creek. Its watershed covers approximately 23.5 square miles. Upstream of CR 663, the Oak Creek watershed is ten square miles in area, with an average stream slope within the Ona site of 1.3 feet per mile. Lower Oak Creek (south of SR 64) is essentially a manmade ditch system passing through a series of natural depressions. Within one mile upstream of the CR 663 crossing, a western popoff ditch system diverts flows, which are ultimately carried to Brushy Creek just south of the Brushy Creek-Brady Branch confluence. During significant rainfall events, Oak Creek spills over to Brady Branch at several locations both north and south of SR 64. Oak Creek also receives inflow from Hickory Creek during significant storm events.

#### 3.5.2.1.6 Hickory Creek

Hickory Creek is a 7.4 square mile tributary to the Peace River, with its confluence occurring approximately three miles south of SR 64. The portion of the Hickory Creek watershed at the south edge of the Ona site is 2.5 square miles in area and has an average stream slope within the Ona site of 5.1 feet per mile. Some parts of the lower portion of the Hickory Creek were altered by human activities. These alterations were primarily to accelerate the drainage.

IMC and other consultants observed these streams during various site visits between 1997 and 1999 to be dry or having little flow due to the prolonged drought in the area during the period of observation. The average stream slopes were calculated through GIS, using the stream elevations at the Ona site boundaries and the stream length on the Ona site.

### *3.5.2.2 Site-Specific Water Budget Analysis*

#### 3.5.2.2.1 Water Budget

The average monthly annual water balance as presented in the CDA (including subsequent Additional Information submittals) estimated that the rainfall contribution to the water budget would be 50.75 in/yr, and that the water uses were: 1) total ET at 38 in/yr; 2) deep recharge at one in/yr; and 3) runoff from the site at 11.75 in/yr (IMC, 2002). This model was based on a 21-year simulation using existing rainfall data collected at the Wauchula weather station between January 1974 and December 1994 as a reasonable estimate of future rainfall at Ona. An average value of 47.5 in/yr was used for riparian wetland ET in the model. Using an estimated total ET of 39.5 in/yr for the Horse Creek drainage basin above Arcadia, which is based on long-term monitoring, the percentage of hydric soils (wetlands) and upland coverages were calculated using USDA soil coverages. The percentage of hydric soils (wetlands) in the basin is approximately 24 percent of land cover, while the coverage for uplands was 76 percent of the Horse Creek basin. An estimated ET of 47.5 in/yr (from the 21-year simulation described above) for riparian vegetation along the creek was used in the calculation of an average upland ET. This calculated value is shown to be approximately 37 in/yr in order to obtain an overall 39.5 in/yr for the Horse Creek drainage basin (IMC, 2002).

The model presented in the CDA was calibrated by adjusting the evaporative zone depth until the model calculated upland ET was equal to the upland ET (approximately 37 in/yr as described above) that was estimated from a mass balance of the long-term flow of Horse Creek at Arcadia, and by adjusting the pan coefficient used in the spreadsheet model until the modeled average annual ET was equal to the average annual ET estimated for the riparian wetlands in the Horse Creek basin (47.5 in/yr from 21-year simulation). The model was verified by comparing the pre-mining predicted average and monthly discharges with the measured average and monthly discharges at the USGS gauging station on Horse Creek at Myakka Head (USGS Station #02297155). The model was verified by comparing the predicted groundwater outflows with the groundwater outflows for Horse Creek as reported by USGS of 3.6 to 8.7 in/yr (Lewelling, 1997). The average annual water budget based on monthly modeling for pre-mining conditions is presented in Table 3.5-2. These values are based on the average monthly catchment area for the mining schedule at Ona and Fort Green mines.

The total (natural) ET value used in the average monthly annual water balance model (38 in/yr) presented in the CDA compares favorably with published values of ET ranging from 38.3 to 42.7 in/yr (Section 3.5.1.2) and with values ranging from 37.7 to 40.2 in/yr collected from data for project site vicinity (see Table 3.5-3). The deep recharge value used in the model has been estimated as one in/yr, which is comparable to published values as presented in Section 3.7.2.1 of this document (IMC, 2002).

The hydrologic evaluation presented in the CDA indicates that the average annual runoff from a given drainage basin depends on the relative areas of wetlands and uplands on that property (IMC, 2002). Based on the relationship between surface water discharge and groundwater outflow to the surface water system, the analyses indicate the magnitude of the baseflow is also a function of the relative areas of uplands and wetlands in the basin as they would utilize different amounts of rainfall. The value of runoff from the site (11.5 in/yr) used in the average monthly water balance in the CDA (IMC, 2002) compares favorably with published values of 11.6 in/yr for the Peace River drainage basin and between ten to 15 in/yr for the central phosphate area (Fernald and Purdum, 1998).

#### 3.5.2.2.2 Baseline Modeling

To provide a baseline for determining the potential on-site impacts of mining and reclamation on surface water discharge, including baseflow from the Ona site, a daily analysis was performed in the CDA to estimate the contribution of direct surface runoff and groundwater outflow for the major drainage basins on the mine property (IMC, 2002). The analysis involved using daily rainfall records for a 19-year period to calculate surface water runoff, ET, groundwater outflow, deep recharge, the change in groundwater/wetland storage and surface water runoff from wetlands on a daily basis. The 19-year rainfall data used to simulate the pre-mining and post-reclamation basin outflow values was the 1980 to 1998 rainfall record for Wauchula, Florida. The amount of rainfall used in the model may have been part of a longer drought, but this possible drought does not affect the results generated from the model. Both the pre-mining and post-reclamation simulations used the same rainfall data, that allows for a direct comparison of any potential effects due to the mining activities.

Surface water runoff from the upland areas was calculated using the Soil Conservation Service's (SCS [now Natural Resources Conservation Service {NRCS}) curve-number methodology with soil storage determined from the analysis. The upland evapotranspiration was calculated using a modified Penman methodology for this model. Groundwater outflow from the uplands was calculated using Darcy's Law with the Dupuit-Forcheimer assumption. The procedures are described in detail in the engineering documentation for the Hydrologic Evaluation of Landfill Performance (HELP) model (Schroeder et al, 1994). Daily discharge from the wetland systems analysis that drain the property was calculated using a spreadsheet model to solve the following two equations:

*Change in Wetland Storage = Rainfall + Upland Runoff + Groundwater Inflow - Riparian Evapotranspiration - Deep Recharge*

*Discharge (if greater than zero) = Starting Storage + Change in Storage - Available Storage*

The first equation indicates that given the contributions to the wetland system from different input and output sources a net change in storage would occur. The estimated change in storage from the net inflow and outflow balance would either create a discharge or a reduction in the storage capacity within the wetland system. Only when a discharge occurred was baseflow calculated as the difference between groundwater inflow and riparian evapotranspiration.

The results of the modeling are presented in Table 3.5-3. The values presented in Table 3.5-3 were calculated only for the reaches of the subject streams that pass through the Ona site. The outflow quantities were calculated for 13 locations for the pre-mining topography and land use, of which eight critical locations are presented in Table 3.5-3. The model incorporated the estimated average annual discharge contribution from the pre-mining watershed above the Ona site for each of the modeled basins. The off-site discharges were estimated based on the land area of the watershed draining onto the Ona site. The Brushy Creek watershed had an offsite contributing drainage area of 14.75 square miles, which contributed an estimated 12.4 cfs of total discharge to the model. The offsite contribution to the Horse Creek discharge was 20.7 square miles, which contributed an estimated 17.4 cfs of total discharge to the model. The West Fork Horse Creek had 13.3 square miles draining onto the Ona site, which contributed 11.1 cfs to the total discharge of the creek. The Oak Creek contributed 1.4 cfs of total creek discharge from 1.7 square miles of off-site drainage area. Both Brady and Hickory Creeks did not have any offsite contributions to the Ona site model as their respective watersheds are contained within the Ona site boundary.

### *3.5.2.3 Data Collection/Analysis*

As part of the CDA process, IMC installed continuous water level recorders and staff gauges to establish surface water gauging stations. Continuous recorders and staff gauges were installed in 1999 on Horse, Brushy, Oak, Hickory and West Fork Horse Creeks. In addition, continuous rain gauge recorders were installed in 1999 on the West Fork of Horse Creek and on Hickory Creek, also as part of the CDA process. The locations of the surface water gauging stations and the rain gauges are shown on Figure 3.5-5. The results of the stage-discharge field measurements for the Ona stations are presented in Table 3.5-4. The results of the rainfall monitoring for the period between 1995 and 2001 for the Ona site are provided in Table 3.5-5. The average daily discharges at Station SW-3 (USGS station #02297155) for the surface water sampling period between 1998 and 2001 are presented in Figure 3.5-6. This figure includes the average discharge for this station based on historical USGS data. The results of the USGS discharge monitoring at station SW-3 indicate that the discharge was below normal throughout most of the Ona site surface water sampling period (1998-2001) because of below normal rainfall. As part of the EIS data evaluation procedures, surface water stations were observed in December 2000. In December 2000, due to the drought observed in southern Florida, the only stream with discharge was at station SW-1. The discharge at station SW-1 was estimated to be 0.1 cfs.

#### *3.5.2.4 Floodplain Analysis*

Pre-development flood-prone areas were studied in the CDA by first reviewing the Federal Emergency Management Agency (FEMA) Federal Insurance Rate Maps (FIRM) for Hardee County, Community Panel Numbers 12049C 0150C and 12049C 0275C (1988) for West Fork Horse Creek and Horse Creek, and Community Panel Numbers 12049C 0175C and 12049C 0300C (1988) for Brushy Creek and Oak Creek. The stream area, including the West Fork Horse Creek, Horse Creek, Brushy Creek and Oak Creek, is identified on these maps as primarily Zone A. Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in a Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations (BFE) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply. Brushy Creek near SR 64 is identified as Zone X. Zone X are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

Ardaman & Associates, Inc. prepared a study to determine the extent of pre-development flooding for primary surface water conveyance systems within the Ona site located within Township 34 south, Ranges 23 and 24 East and Township 35 South, Range 24 East in west Hardee County. The results of the investigation are presented in the report entitled: “Flood Evaluations for IMC-Agrico Company Ona Mine Tract, Hardee County, Florida”

(Ardaman & Associates, 1998), which was accepted by FDEP as adequate (see letter dated August 10, 1999 in Appendix C). The report contains computed 2-year, 25-year and 100-year flood elevations along West Fork Horse Creek, Horse Creek, Brushy Creek and Oak Creek. The document summarizes data collected and analytical methodologies used to evaluate hydrologic and hydraulic conditions throughout the contributing drainage areas. The methods used in the study and the results of the analysis are summarized below.

The Hydrologic Engineering Center – River Analysis System (HEC-RAS) computer program, developed by the USACE, was used for calculating flood level elevations in the backwater analysis along Horse Creek and West Fork Horse Creek. The methodology used to calculate peak discharges along the Horse and West Fork Horse Creeks for the HEC-RAS evaluation was developed using the 1982 report entitled, "Technique for Estimating Magnitude and Frequency of Floods on Natural-Flow Streams in Florida", prepared by W. C. Bridges of the USGS. The use of two models was necessary due to the differences in model capabilities.

A hydro-meteorological methodology, using The Aquarium Software Model CHAN for Hydrodynamic Routing (CHAN), was selected for calculating flood level elevations along Brushy and Oak Creeks. This approach was used in this portion of the property because of the recognition that complex interconnections among the Brushy, Brady, Oak and Hickory Creek watersheds could not be adequately accounted for in the steady-state, gradually varied flow model methodology incorporated in HEC-RAS. The CHAN model was used to generate runoff hydrographs for basins and perform hydrodynamic routings of that runoff through a surface water conveyance system comprised of lakes, ponds, channels, and drainage structures. It also features extensive import capability for the incorporation of GIS coverage data during model construction. The interconnected model of Brady Branch and Brushy, Oak and Hickory Creeks, contained more than 200 nodes interconnected by more than 200 reaches. A number of those reach elements cross major watershed divides, allowing simulation of inter-basin flow.

Cross-section locations and pre-mining floodplains for the study area are provided on Figure 3.5-7 and others based on the Ardaman & Associates report. Tables 3.5-6 and 3.5-7 summarize the flood level elevations at each cross-section. Table 3.5-6 summarizes the HEC-RAS results for Horse Creek and West Fork Horse Creek and Table 3.5-7 summarizes the CHAN results for Brushy and Oak Creeks.

## 3.6 SURFACE WATER QUALITY

### 3.6.1 Regional Description – Quality

The Ona site is drained primarily by Horse Creek and tributaries of the Peace River. Horse Creek is Class III surface water until the northern border of Section 14, Township 38

South, Range 23 East. Thereafter, Horse Creek is classified as a Class I surface water. The location where the Horse Creek changes from Class III surface water to Class I water is approximately 1.5 miles south of the USGS gauging station #02297310 at SR 72. Class I surface waters are designated for use as potable water supplies. Horse Creek and the Peace River are used for municipal supply by the PRMWSA. Peace River drains into Charlotte Harbor, which is part of the National Estuary Program and is Class II surface water designated for shellfish propagation and harvesting. Class III waters are designated for recreation use and for propagation and maintenance of a healthy, well-balanced population of fish and wildlife.

Outstanding Florida Waters (OFWs) are defined as waters designated by the Environmental Regulation Commission as worthy of special protection because of their natural attributes. The following areas are a partial list of the OFWs within the Peace River drainage basin starting from the headwaters to the Charlotte Harbor: 1) Payne Creek State Historic Site; 2) Highlands Hammock State Park; 3) Gasparilla Sound-Charlotte Harbor State Aquatic Preserve; and 4) Charlotte Harbor State Reserve. The SWFWMD GIS coverage provides a complete list of the areas classified as OFWs as shown on Figure 3.6-1. However, only some segments of Charlotte Harbor are legally designated as OFWs.

The following section presents a brief discussion of the regional water quality of Horse Creek and the Peace River. Figure 3.5-1 shows the location of the Ona site within the Peace River basin as well as the location of the USGS surface water stations.

### *3.6.1.1 Horse Creek*

The west portion of the IMC Ona site is located in the upper Horse Creek sub-basin. Near the Ona site, data has been collected by CF Industries (CF) during 1981, MCC during 1976 and by the USGS at station #02297155. Further downstream near Arcadia, extensive water quality data have been collected by the USGS at station #02297310. A comparative summary of water quality changes along the length of Horse Creek is presented from various sources for three time-periods. Although collected at different times and during different flow conditions, these data are useful for the assessment of general similarities, differences, and changes within the basin both temporally (over time) and spatially (with regard to location).

#### 3.6.1.1.1 <u>1962-1981 Monitoring</u>

A summary of water quality changes compiled from previous monitoring studies from 1976 through 1981 is presented in Table 3.6-1. Although some minor differences are observed, the two upstream stations (CF Headwaters and MCC-2) have similar water quality (USEPA, 1988). The water quality at these stations differs from those downstream at the Arcadia station. In general, dissolved material in the water increases from upstream stations to the downstream stations, as is observed for alkalinity, conductivity, sulfate, and total phosphate.

The USGS has maintained a water quality station on Horse Creek near Arcadia (station #02297310) since 1962. The drainage area above this station is approximately 218 square miles. Table 3.6-2 contains a summary of the water quality observations made at this site for the period from 1962 through 1980. The following observations were made from the water quality summary for Horse Creek near Arcadia from the CF EIS study (USEPA, 1988). The mean alkalinity was generally low (38.3 milligrams per liter [mg/L] as Calcium Carbonate [$CaCO_3$]), even the low to moderate color levels (124 Platinum Cobalt Units [PCU]) could produce acidic conditions. Nitrogen levels were low. However, nitrate-nitrite was moderate to high, indicating fertilizer input from leached groundwater or runoff. Waters were generally well oxygenated, with a dissolved oxygen (DO) average of 7.0 mg/L and a biochemical oxygen demand (BOD) average of 1.0 mg/L. Dissolved ions were moderate. Specific conductivity averaged 255 micro mhos per centimeter at 25$^{o}$C ($\mu$mhos/cm).

#### 3.6.1.1.2 1993-1995 Monitoring

The USGS conducted a baseline study of the Horse Creek basin from October 1992 to February 1995 to assess the hydrologic and water-quality conditions. Their findings were reported in a Water-Resources Investigation Report #97-4077 published in 1997. The only land development that was identified was cattle and citrus production and limited areas of mining.

The report indicated that the rainfall in 1993 and 1994 in the Horse Creek basin was eight and 31 percent, respectively, above the 30-year long-term average based on the two closest NOAA stations (Wauchula and Fort Green). The station at Horse Creek near Arcadia (drainage area of 218 square miles [sq. mi.]) had no zero discharge days, which was the lowest number with zero days from any station during the study. The Brushy Creek station (drainage area of 47.8 sq. mi.) had the highest number of zero discharge days with 113. A low number of zero discharge days in a small basin such as Horse Creek indicated that the groundwater levels were sufficiently high to contribute to streamflow. During the two-year study, the two USGS stations, Horse Creek near Myakka Head and Horse Creek at Arcadia, had mean annual runoff values similar to their historical conditions. The maximum instantaneous peak discharge occurred during thunderstorms (September 14 to 18, 1994), which resulted in a gauged discharge of 4,180 cfs at the Horse Creek near Arcadia station.

The results of the monitoring are presented in Table 3.6-3. The study reported that based on constituent concentrations in water samples from the daily discharge stations, concentrations generally are lower in the upper three sub-basins, (Horse Creek - Myakka

Head, West Fork Horse Creek and Brushy Creek) than in the lower sub-basin (Horse Creek near Arcadia). Typically, concentrations were highest for nutrients at Brushy Creek.

#### 3.6.1.1.3 1998-1999 Monitoring

The USGS maintained water quality monitoring stations on Horse Creek at SR 64 and Horse Creek near Arcadia during the 1998 to 1999 water years. A summary of the range of values measured at these stations is presented in Table 3.6-4. The mean annual flow during the monitoring year was 68 percent (20.4 cfs) and 66 percent (126 cfs) of the long-term means for the Horse Creek at Myakka Head and Arcadia stations, respectfully. The results of the monitoring show that the upstream station water chemistry differs significantly from the downstream station at Arcadia, similar to the earlier monitoring period. The recent data indicate a significant increase in specific conductance, calcium, magnesium, potassium, sulfate, total dissolved solids, and strontium from upstream to downstream. A moderate increase was observed for chloride, fluoride, nitrate-nitrite, and organic nitrogen at the downstream station. A slight decrease in color was observed downstream.

#### 3.6.1.1.4 Comparison of Different Time Periods

The water quality differed the least from upstream to downstream during the 1993 to 1995 monitoring. This monitoring period also had above-average rainfall and corresponding streamflow. Therefore, the groundwater influence on the results was less than for the other monitoring periods. The 1998-1999 water years represent a period of below normal rainfall and, therefore, a greater groundwater contribution. The Arcadia station is in an area of artesian flow from the IAS and UFA. The results of that influence are reflected in the more pronounced water quality differences during periods of low flow. These records suggest that lower quality groundwater is combining with the surface water to decrease the overall water quality in the creek.

Phosphate mining has occurred in the Horse Creek basin since 1978. The effects of the phosphate mining on the water quality have been analyzed and are included in a detailed cumulative impact assessment in Section 4.26.6. The results indicate that no significant changes in water quality have occurred between drainage basins with phosphate mining versus drainage basins without mining.

### *3.6.1.2 Peace River*

Over the past 50 years, water quality data in the Peace River have been collected by USGS at Zolfo Springs and Arcadia. The Zolfo Springs and Arcadia stations are located upstream and downstream of the tributaries draining the Ona site, respectively.

Table 3.6-5 shows a summary of the water quality data for Zolfo Springs and Arcadia stations from August 1951 to September 1999, organized by decade. The following observations were made from the water quality summary of this 49-year period. Waters in the Peace River at Zolfo Springs had low to moderate color levels, high conductivity, and high phosphate levels. The pH averaged slightly in the basic range. Dissolved solids were high at the Zolfo station, with average Total Dissolved Solids (TDS) concentrations of around 200 mg/L. Specific conductance averaged around 350 μmhos/cm. Nitrogen was low in the river; however, nitrate-nitrite was high, indicating fertilizer input from agricultural operations through groundwater or runoff. Total phosphate was high in the 1970's and decreased thereafter. Dissolved oxygen was observed at moderate levels, averaging around 7.0 to 7.5 mg/L, and BOD was generally low, averaging 1.5 mg/L.

Water quality has also been monitored by the USGS on the Peace River near Arcadia, at a station located about 33 miles downstream of the Zolfo Springs station. Water quality for the same period at this station was similar to that observed at Zolfo Springs. These similarities may be observed in the comparison of the two stations, shown in Table 3.6-5.

## 3.6.2 Site-Specific Description - Quality

### *3.6.2.1 1976 Monitoring*

Except for the West Fork of Horse Creek, MCC collected water quality data for the baseline studies during 1976 on all streams recently monitored by IMC for the Ona site. The purpose of the 1976 baseline surface water quality monitoring was to document existing aquatic environmental conditions on the MCC property. This section presents and explains the results of the six months of stream water quality monitoring from December 1975 through May 1976. Except for some changes in land use from unimproved pasture to improved pasture since the time of the MCC monitoring, most land uses have not changed. Therefore, the assessments made relative to the land use during the previous study are relevant to the present Ona site.

The 1976 dry season water quality data for surface waters on the Ona site, was typical of surface waters in the central Florida area (USEPA, 1981a). In general, the streams in the region originate in freshwater marshes occupying depressional areas adjacent to the streams. These marshes provide habitat for a large variety of wetland vegetation. Both growth and decay of vegetation take place in the marshes at any period of time. Waters draining from the marshes into the streams generally contain high concentrations of humic materials resulting from decay of vegetation. This humic material is acidic, being a natural organic (weak) acid, and highly colored with a brown tint. Therefore, the water is highly colored, mildly acidic, and contains relatively high levels of dissolved organic carbon. Turbidity of the water was low since the streams were slow-moving, draining areas of low topography, and occupying generally broad channels resulting in low flow rates. This allowed much of the suspended particulate matter to settle out.

The marshes are a habitat rich in a variety of flora and fauna. These organisms dominate water chemistry. Those organisms that most influence the chemical characteristics of the water are the heterotrophic (oxygen consuming) organisms, which feed on the decaying vegetable matter, emergent vegetation, and submerged vegetation. The heterotrophic organisms consume detrital organic matter, simultaneously consuming oxygen and releasing carbon dioxide throughout the day and night. Submerged vegetation produce oxygen during the day when exposed to sunlight (photosynthesis) and, like the heterotrophic organisms, consume oxygen at night. Emergent aquatic vegetation has a less direct effect on the water since the photosynthetic and respiration processes exchange gases directly with the atmosphere. However, emergent plants provide attachment for a rich growth of *Periphyton* (primarily filamentous algae on the submerged stems) that may exceed the rate of metabolism, and therefore gas exchange, of the other vegetative types.

A review of the streams transecting the property, with the exception of Hickory Creek which had been sampled only once due to a lack of flow and Oak Creek, that had received sporadic discharges of pumped groundwater, allows some generalizations to be drawn regarding their natural differences and similarities in water quality. Based on computed means for the six-month period, Horse Creek was similar to Brushy Creek in conductivity, alkalinity, total solids, fluoride, sulfate, ortho and total phosphorus, and ammonia despite differences in their geomorphology. Only organic loading as indicated by Total Organic Carbon (TOC) and organic nitrogen differed significantly. This is attributed to the lesser importance of herbaceous marshes in the surface drainage system upstream of Horse Creek.

Table 3.6-6 is a summary of the monthly data collected from 1976 through 1978 for streams on or near the Ona site. Only flowing waters had been sampled. With the exception of Horse Creek, all streams near the property were seasonally intermittent, receding into discrete pools during the dry season or drying completely and exposing bottom sediment. Included is a Farmland Hydro station, which was nearest to the Ona site.

Discharge was observed in Hickory Creek for the first time in May 1976 in response to accelerating rainfall prior to the summer's wet season. However, Brushy Creek remained in pools and Oak Creek continued to recede after the cessation of groundwater discharge. The contrast in flow conditions of Hickory Creek on the eastern side of the property and Brushy and Oak Creeks west of Hickory Creek is explained by the differences in their watersheds. Brushy Creek and Oak Creek have their sources in contiguous networks of herbaceous marshes. These marshes are capable of absorbing sudden inputs of rainwater and surface runoff, thereby smoothing the fluctuations in flow between rainfall events. Hickory Creek is not buffered by adjacent wetlands, producing heavy flows after rainfall events.

### *3.6.2.2 1998-2001 Monitoring*

Site-specific surface water quality samples were collected in conjunction with the preparation of the CDA. Samples were collected at eight stations as shown in Figure 3.6-2 and analyzed for the list of parameters in Table 3.6-7.

As part of the EIS site review, a field survey was conducted in mid-December 2000. As part of the survey, stream characteristics and vegetation cover, which may affect water quality of the streams, were observed to compare the findings of previous onsite studies of stream characteristics and water quality during the 1998-2000 monitoring period. In addition, maps from previous studies have been compared with the current maps showing similar information to assess the level of change. With the exception of some large areas of palmetto rangeland that have been converted to improved pasture, most land use/land cover on the Ona site is generally the same as descriptions found in previous studies. The following description of the Ona site has been prepared based on onsite review for the EIS and previous studies conducted.

The Ona site lies within two surface water drainage systems. Hickory Creek, Oak Creek, and their tributaries, which flow southeast into the Peace River, drain the east side of the property. Horse Creek and its tributaries, primarily Brushy Creek and West Fork Horse Creek, drain the west side of the property. The natural landscape is currently a mixture of improved pasture surrounded by native vegetation in the form of rangeland, upland forest, and herbaceous and forested wetlands. Cattle graze in many areas of the property. Small plots of land are devoted to vegetable crops. Large tracts are in improved pasture, introducing a complex network of drainage and irrigation canals to the natural system. Approximately 40 percent of the land has been improved to support agricultural operations and 20 percent is covered with wetland vegetation, leaving 40 percent of the land as native uplands.

The upper reaches of Brushy Creek have been lightly channelized, reducing the natural contact between stream and marsh. The bottom of this channel is shallow and mostly sandy. The surrounding floodplain forest is primarily mesic or hydric hammock interspersed with depressional or backwater areas. Oaks demarcate the transition from marsh to upland pasture.

Downstream Brushy Creek is considerably larger, deeper, and more winding. Backwater marshes here are not clearly defined, but a floodplain is suggested by patches of otherwise isolated marsh plants.

The banks of Horse Creek are high and nearly vertical in places. On the average, flow velocities are higher than in other creeks on or near the property. The floodplain along Horse Creek is very narrow, suggesting this incised stream overflows infrequently. The vegetation is primarily oak forest with a saw palmetto understory. Although depressional marsh and swamp forest communities are present, they are not as abundant as in the eastern two-thirds of the Ona site. A few native uplands remain, most having been cleared for pasture.

Oak Creek has been dredged and channelized from its emergence from an herbaceous marsh from about 1,000 feet north of SR 64 to it's exiting the property, where it becomes shallower. This enlarged channel size, relative to flow, has resulted in stagnation.

Hickory Creek is a shallow channel with gently sloping banks lined with scattered shrubs and surrounded by pasture. A pool was found near the exit of Hickory Creek from the Ona site that has historically served as a refuge for fish and aquatic macroinvertebrates when flows cease during the dry season.

Table 3.6-7 is a summary of the range of water quality parameters measured during the 1998-2001 monitoring near the Ona site. The ranges reported represent surface water samples taken from streams only when water was flowing. Many of the streams had no flow during the dry season.

The results of the comparison of stream characteristics and vegetation cover on the Ona site indicate conditions to be primarily the same as observed during previous studies. Water quality conditions vary over time because of a number of factors, but some general observations can be made for the periods studied, such as the surface water streams of the Ona site are slightly acidic, slightly colored, and low in alkalinity and soft.

#### 3.6.2.2.1 Temperature

The temperature of surface waters ranged from 9.2 degrees (°) Celcius (C) (48.6°F) in the winter to 29.8°C (85.6°F) in the summer. Typical temperature values for natural systems vary between 19 and 28°C for Florida streams with a median value of 23°C (FDEP, 2000). There is no Class III surface water quality standard for temperature.

#### 3.6.2.2.2 Dissolved Oxygen

Natural DO concentrations in Horse Creek ranged from 2.7 mg/L to 8.3 mg/L. Brushy Creek had natural DO values ranging from 1.6 to 5.9 mg/L. Lower levels were observed in the smaller tributaries, Hickory Creek and Oak Creek. The range in these tributaries was 0.2 mg/L to 7.0 mg/L. The measured natural DO concentrations at the sampling stations were below the State of Florida Class III water quality criterion of 5.0 mg/L at least one month during the sampling period. These low DO values are probably a result of biological respiration in the marsh areas surrounding these streams which consume DO (particularly during the nighttime hours), respiration associated with organic deposits within the stream channel itself, and limited oxygen diffusion into the water column due to slow-moving streams and/or the presence of an aquatic vegetation cover on the surface. Expected concentrations of DO in Florida streams typically vary between 3.1 to 8.0 mg/L with a median value of 5.8 mg/L (FDEP, 2000).

#### 3.6.2.2.3 pH

The range of pH observed in the larger streams (Horse Creek and Brushy Creek) was 5.04 to 7.42. The smaller creeks (Hickory Creek and Oak Creek) ranged from 5.06 to 6.88. State water quality criteria include a pH range of 6.0 to 8.5. The lower values for the smaller streams can be attributed to organic acids entering these streams from the marshes. Organic acids are a natural product of decaying vegetation. The Class III surface water quality standard is between 6.0 and 8.5 units. Typical pH values for natural stream systems vary between 6.1 to 7.9 units with a median value of 7.1 (FDEP, 2000).

#### 3.6.2.2.4 Specific Conductance

The measured specific conductance of the streams was within the range of 47 to 388 µmhos/cm. The variation in specific conductance of a stream is probably indicative of the relative proportion of surface runoff of low conductivity and groundwater discharge of high conductivity that comprises the streamflow at the time it is sampled. The measured conductivity values were less than one-third of the Class III surface water quality standard of 1,275 µmhos/cm. Typical ranges of conductivity for natural systems can vary between 100 to 1,300 µmhos/cm for fresh waters with a median value of 335 µmhos/cm (FDEP, 2000).

#### 3.6.2.2.5 Fecal coliform

The concentration of this coliform organism is indicative of the presence of wastes from warm-blooded animals in the waterways. Measured concentrations ranged from two to 900 most probable number of organisms per 100 ml (Most Probable Number [MPN]/100 ml), with a site average of 203 MPN/100 ml. This indicates that wastes from the cattle grazing on the property are entering the surface waters. Typical ranges of fecal coliform in natural Florida streams vary between ten and 960 organisms per 100 ml with a median value of 75 organisms per 100 ml (FDEP, 2000).

#### 3.6.2.2.6 Biochemical and Chemical Oxygen Demand (BOD & COD)

The measured BOD concentrations, which ranged from 1.0 to 1.9 mg/L, are typical of natural waters. The expected range of BOD in natural Florida streams vary between 0.8 to 5.1 mg/L with a median value of 1.5 mg/L (FDEP, 2000). These data do not indicate that the BOD levels are reducing the oxygen levels. The chemical oxygen demand mean was 92.3 mg/L for all the stations. This is above the median value of 45 mg/L for Florida streams but is within the expected range of 16 to 146 mg/L (FDEP, 2000). There is no evidence that this is related to any point source of pollution. It likely reflects natural conditions, probably photochemical breakdown of organic color. The Class III surface water criteria for BOD is to not cause DO to be depressed below the 5.0 mg/L criteria and there are no Class III criteria for COD.

#### 3.6.2.2.7 Alkalinity

Alkalinity is a measurement of the capacity of water to neutralize acids. This provides an indication of the capability of water to maintain a stable pH. The alkalinity ranges from 6.0 to 37 mg/L as $CaCO_3$ for the onsite streams. The alkalinity present is in the form of bicarbonate alkalinity resulting from bicarbonate present in the water, which has the capacity of neutralizing acids. Typical values in Florida streams range from 13 to 150 mg/L with a median value of 75 mg/L (FDEP, 2000). The variability appears to reflect the relative proportion of groundwater to surface runoff in the stream at the time of sampling. The depressed concentrations are natural conditions and reflect the local geology.

#### 3.6.2.2.8 Turbidity

Turbidity is a measurement of the optical properties of a water sample that cause light to be scattered (USGS, 2001a). Turbidity is caused by suspended and colloidal material in water. Turbidity values ranged from 0.72 to 16.4 Nephelometric Turbidity Units (NTU), this represents waters of high clarity. The Class III standard is 29 NTU's above background levels. In natural streams in Florida, turbidity values range from 1.5 to 21 Jackson Turbidity Units (JTU), with a median value of five JTU. According to the USGS the NTU and JTU are roughly equivalent (USGS, 2002).

#### 3.6.2.2.9 Color

Sources of color in water can include metallic ions, humic and fulvic acids from humus and peat materials, plankton, dissolved plant components and industrial waste (American Water Works Association [AWWA], 1990). The natural color of many Florida surface waters is high, resulting from tannic acids contributed by decaying marsh vegetation. Typical values range from 21 to 235 PCUs with a median of 71 for Florida streams (FDEP, 2000). The results of the sampling near the Ona site, 50 to 900 PCU, with an average of 248 PCU, are slightly elevated compared to typical streams. The elevated values of color are due to natural conditions of the streams on the Ona site. There is no Class III surface water quality standard for color.

#### 3.6.2.2.10 Total Suspended Solids and Total Dissolved Solids

TSS range from 2.0 to 26.0 mg/L, with a median value of seven mg/L for Florida streams (FDEP, 2000). Concentrations of TSS are low (1.0 to 29.0 mg/L, 2.8 mg/L average) for the waters near the Ona site, which is typical of waters of low turbidity. Typical TDS concentrations can range from below 500 mg/L for surface waters of good quality to 2,000 mg/L for waters of fair quality (Fernald and Patton, 1984). The results of the sampling near the Ona site varied between 65 to 365 mg/L, with an average of 157 mg/L, these results are low are moderately high, representing dissolved minerals in the water. The Ona site is a mature vegetated area with little land disturbance at this time, as evidenced by the low levels of turbidity and total suspended solids. There are no Class III surface water quality standards for either TSS or TDS. However, as a comparison the average values of TDS are well below the Class I (potable water supply) surface water quality standard of 500 mg/L.

#### 3.6.2.2.11 Sulfate

Observed sulfate concentrations of 1.0 to 76.0 mg/L are low to moderate for natural waters. Sulfate concentration influences the rate of hydrogen sulfide ($H_2S$) production in stagnant waters. There is no Class III surface water quality standard.

#### 3.6.2.2.12 Nutrients

Phosphorus and nitrogen are macronutrients that typically influence the natural productivity of surface waters. Excessive nutrient levels (eutrophication) can lead to degradation of water quality due to overproduction of algae and other aquatic plants. The streams on the Ona site have generous amounts of both phosphorus and nitrogen.

Nitrogen is largely organic nitrogen with a few elevated nitrate/nitrite concentrations. The nitrogen comes from both natural sources and from agricultural activities (grazing) on the site. Total nitrogen concentrations were measured between 0.4 to 4.9 mg/L with an average of 1.6 mg/L for the streams near the Ona site. The site concentrations of total nitrogen compared favorably with typical streams in Florida, which have a range of 0.5 to 2.7 mg/L with a median value of 1.2 mg/L (FDEP, 2000).

Orthophosphates are most readily available for stimulation of aquatic plant growth. Sampling near the Ona site shows that orthophosphate concentrations were between 0.14 to 1.25 mg/L and that the total phosphate concentrations (including all chemical forms) were between 0.15 to 1.32 mg/L. Typical streams in Florida range from 0.02 to 0.89 mg/L with a median of 0.09 mg/L of total phosphate (FDEP, 2000). The total phosphate concentrations near the Ona site are high for natural waters. However, the phosphorus is largely in soluble form and reflects enhanced phosphorus concentrations in the local geology. This would be expected from streams draining an area noted for economically important phosphate deposits.

Ammonia, another readily available plant nutrient, was measured at less than 0.03 to 0.4 mg of Nitrogen per liter. Ammonia probably originates with decomposition of organic matter in the marshes. The higher concentrations would support excessive algae and other plant growth when other conditions (e.g., flow, light, temperature, etc.) are suitable.

The streams near the Ona site had a range of nitrogen to phosphorus (N/P) ratio of 0.45 to 8.7, with an average ratio of 3:2. The FDEP developed a nutrient index based on nitrogen and phosphorus concentrations and the limiting nutrient concept. This concept states that algal growth is limited by the availability of nutrient that is least abundant in the environment. The stream systems near the Ona site are nitrogen limited, as the nitrogen to phosphorus ratio is less than ten. Streams that are nitrogen limited are typical, as "most marine waters have an N/P ratio of less than five" (Masters, 1998). Since nitrogen is the limiting nutrient in the streams near the Ona site, and since the average concentrations of nitrogen sampled in the streams was near the median value for Florida streams, no excessive amounts of algae were expected (see chlorophyll). There are no Class III water quality standards for nutrient levels in surface waters.

#### 3.6.2.2.13 Fluoride

This inorganic constituent of natural waters can be a hazard when found in excessive levels in drinking waters or waters used by livestock. The State of Florida specifies a maximum of 1.5 mg/L for drinking waters. Natural concentrations of the waters sampled ranged from 0.03 to 0.62 mg/L, with an average concentration of 0.32 mg/L. Typical values of fluoride concentrations for Florida streams vary from 0.1 to 0.8 mg/L with a median value of 0.2 mg/L (FDEP, 2000). Fluoride is commonly found in phosphate rock. The fluoride concentrations are well below the Class III standard of 10.0 mg/L, but are slightly elevated relative to overall Florida levels.

#### 3.6.2.2.14 Chlorophyll and Pheophytin

"Chlorophyll-a is a primary photosynthetic pigment in all oxygen-evolving photosynthetic organisms" (Lee, 2000). The concentrations of chlorophyll-a can be utilized in assessing the amounts of planktonic algae present in the streams. Chlorophyll levels near the Ona site varied from one to 16 micrograms/liter (μg/L), with an average of 2.5 μg/L. Typical Florida streams have a range between one and 30 μg/L, with a median value of 6.0 μg/L (FDEP, 2000). Despite the elevated nutrient concentrations, chlorophyll levels are well below the Florida median. Pheophytin-a is a direct by-product of the breakdown of chlorophyll (Lee, 2000). Pheophytin-a to chlorophyll-a ratios are typically 3:1. The low chlorophyll levels, pheophytin to chlorophyll ratios, total organic carbon concentrations, elevated color levels, and depressed dissolved oxygen concentrations are all linked.

#### 3.6.2.2.15 Radioactivity

The range of Gross Alpha concentrations in the streams near the Ona site varied between 1.0 and 4.8 picocuries per liter (pCi/L), with an average value of 1.7 pCi/L. The Gross Alpha Class III water quality standard is 15 pCi/L. The Radium concentrations (both

Radium 226 and 228) in the streams near the Ona site varied between 0.5 and 1.5 pCi/L, with an average of 0.9 pCi/L. Radium concentrations (both Radium 226 and 228) were well below the Class III standard of 5.0 pCi/L.

##### 3.6.2.2.16 Other

Some amount of oil and grease was detected in most of the stream samples. Given the rather gross nature of the test method, it is impossible to state with any certainty the nature of the substances detected.

##### 3.6.2.2.17 Summary

The streams on the Ona site are heterotrophic systems (respiration in the streams outweighs photosynthesis). Most of the organic matter is produced outside of the streams and delivered to the streams rather than being produced in the streams. Although an abundance of nutrients are available, the water color, heavy canopy, and cyclic nature of the flow regime all work to prevent the development of standing vegetation in the streams.

## 3.7 HYDROGEOLOGY

### 3.7.1 Geology

The geology at the Ona site and in Hardee County consists of thick sequences of carbonate rock overlain by sand, gravel and clay deposits, which control the movement and occurrence of groundwater. In general, the various rock units dip to the south and form a wedge of water-bearing units that thicken to the southwest beneath Hardee County.

The fresh-water bearing units under the site are approximately 1,500 feet thick. Below these depths, persistent evaporite deposits occur, which fill the pore spaces, restricting groundwater flow and increasing the salinity (reducing groundwater quality). The hydrogeologic description in this EIS is focused on the lithologic units above this depth.

The formations that comprise the fresh-water bearing hydrogeologic framework at the Ona site are, in descending order, the surficial deposits of the Pleistocene to recent age; the Peace River and Arcadia Formations of Miocene Age; the Suwannee Limestone of Oligocene age; and the Ocala Group and Avon Park Formation of Eocene age. These units were deposited in shallow seas during interglacial periods. Additional processes of physical and chemical weathering have formed the landscape of Hardee County as it is today.

Figure 3.7-1 illustrates the regional geologic setting near the Ona site. The undifferentiated surficial deposits of Pleistocene to recent age consist of sand, silty sand, clayey sand, some hardpan, and organic soils. The general lithology is mostly fine sand, inter-bedded with clayey and silty sands, marl, and shell. The thickness of the surficial soils varies from 20 to 45 feet.

The Peace River Formation consists of inter-bedded layers of clayey, phosphatic sand and gravel, claystone, limestone, and clay. These deposits contain more carbonate and clastic materials than the surficial deposits. The limestone and phosphatic sand layers can have relatively high hydraulic conductivities. The phosphorite-rich clastic portion of the Peace River Formation, i.e., the Bone Valley Member, is mined for phosphate and is locally referred to as "matrix." The matrix is typically less than 40 feet thick.

The lowermost portions of the Peace River Formation and the undifferentiated Arcadia Formation consist of beds of sandy, clayey, and phosphatic limestone and dolomite, and sandy to granular phosphatic marl and clay with a combined thickness of 150 to 200 feet.

In the western half of Hardee County, a limestone layer with sporadic sand and clay beds (the Tampa Member), and an inter-bedded layer of sands and clays (the Nocatee Member), forms the base of the Arcadia Formation. The Tampa Member has less phosphate than the limestone in the undifferentiated Arcadia. The top of the Tampa Member occurs about 200 feet below National Geodetic Vertical Datum (NGVD). The combined thickness of the Tampa and Nocatee members is greater than 100 feet.

The Suwannee Limestone is a granular fossiliferous limestone with beds of crystalline dolomite. The top of the Suwannee Limestone occurs about 350 feet below NGVD. The thickness ranges from 100 to over 250 feet within the county. The thickest portion is in the southwestern part of the county.

The Ocala Group is composed of chalky fossiliferous limestone, which grades into granular limestone and dolomite in the lower section. The top of the Ocala occurs about 600 feet below NGVD and the thickness ranges from 200 to 300 feet.

The Avon Park Formation consists of limestone interbedded with hard brown dolomite. Evaporite deposits occur in the lower part of the Avon Park and restrict groundwater movement and quality. The top of the Avon Park occurs about 800 feet below NGVD, and has a thickness of about 400 feet.

## 3.7.2 Groundwater Quality

### *3.7.2.1 Regional Description*

#### 3.7.2.1.1 <u>Surficial Aquifer System</u>

The SAS is the uppermost hydrogeologic unit. It is contiguous with the land surface and is comprised of unconsolidated clastic deposits, including the phosphate matrix. The SAS is generally unconfined; however, lenses of sand and marl may be semi-confined locally. The depth to the water table is generally less than seven feet below land surface, but can range from the land surface in wetlands to as much as 15 feet below land surface in the higher elevation uplands. The water table fluctuates seasonally within a five to ten-foot range. Lowest levels occur in April or May, while highest levels occur during the wet season into September.

The water quality in the SAS is generally acceptable for potable use in Hardee County. Concentrations of the major ions are low. Only iron and color affect the quality of the groundwater. These parameters are usually highest in areas with wetland features.

Hundreds of small wells tap the SAS in Hardee County, however, only a few of them on the Ona site. Most of the wells in Hardee County are two-inch diameter and are used for domestic, lawn-irrigation or livestock watering purposes. The average transmissivity of the SAS is estimated to be approximately 1,000 square feet per day based on an average hydraulic conductivity of 15 feet per day and a saturated thickness of 65 feet.

The lithology of the Ona site typically consists of a layer of surficial sands twenty to thirty feet thick underlain by clayey and sandy clay material. The clayey and sandy clay layers are generally on the order of sixty to eighty-five feet thick. Beneath this layer is the top of the first water bearing unit of the IAS (at 78 to 125 feet bgs).

#### 3.7.2.1.2 Intermediate Aquifer System

The IAS includes the water-bearing and confining units between the SAS and FAS. The IAS is considered a leaky-confined aquifer (Wilson, 1977). The principal water-producing unit of the IAS is the Tampa Member limestone; however, several other water-bearing units provide water for domestic supply. The IAS contains water under confined conditions. The thickness of the IAS ranges from 300 to 400 feet in the project area.

The elevation of the potentiometric surface of the primary producing zone of the IAS generally ranges from approximately 12 to 60 feet above NGVD near the Ona site. Groundwater flow direction is toward the west. In general, groundwater quality in the IAS is within potable standards.

Hundreds of wells tap the IAS in Hardee County. Most of the wells are used for domestic, irrigation and livestock watering purposes. There are also municipal wells that tap the IAS. Most well yields typically range from 50 to 500 gpm, and the wells are completed as open holes in the limestone formations.

#### 3.7.2.1.3 Upper Floridan Aquifer

The UFA system is the most productive aquifer system in Hardee County. This aquifer system is composed of a thick stratified sequence of limestone and dolomite. The top layer of the UFA is a limestone defined as the first persistent rock of early Miocene age, or older, below which clay confining beds do not occur. This surface generally coincides with the lower part of the Tampa Member of the Arcadia Formation if the Nocatee Member is thin or absent or the top of the Suwannee Limestone. The elevation of the top of the UFA ranges from approximately 300 feet below NGVD to approximately 400 feet below NGVD. Its thickness averages approximately 1,500 feet in Hardee County.

The potentiometric surface of the UFA system near the Ona site ranges from approximately ten to 57 feet above NGVD. The regional flow direction of the groundwater is towards the southwest.

Groundwater in the UFA system is generally more mineralized than water from the surficial and IAS. The major ions generally meet potable use limits in much of Hardee County. Major ion concentrations in the UFA system generally increase towards the southwest and with depth.

#### 3.7.2.1.4 Floridan Aquifer System Water Use

Many hundreds of wells tap the UFA system in Hardee County. Many of these wells are open to both the IAS and UFA. In most areas, the UFA yields supplies that are suitable in quality and quantity for irrigation purposes. Wells developed in the UFA yield large quantities of water, often in excess of 1,000 gallons per minute.

According to the SWFWMD's Estimated Water Use report for year 1999, an average of approximately 1.4 billion gallons of freshwater are withdrawn each day within the district (SWFWMD, 2001a). Public Supply water use was the largest category withdrawing on average 42 percent of total freshwater use. Agricultural use followed with 40 percent; Mining/Dewatering withdrew eight percent; Industrial/Commercial withdrew five percent; and Recreational/Aesthetics withdrew five percent on a district wide basis.

Mining/Dewatering uses in the SWFWMD accounted for 107 mgd in 1999 (SWFWMD, 2001a). Groundwater uses were approximately 55 mgd and surface water uses were 52 mgd. Phosphate mining water use in the district was approximately 34 mgd (SWFWMD, 2001a). Phosphate mining accounted for 2.5 percent of total water usage in the district in 1999.

Hardee County withdrew approximately 70 mgd that accounted for approximately five percent of district totals (SWFWMD, 2001a). Agricultural water use accounted for approximately 91 percent; Mining/Dewatering six percent; and Public Supply accounted for 2.4 percent of county water use.

#### 3.7.2.1.5 Recharge and Discharge

There have been several investigations of recharge and discharge to aquifer systems in Hardee County. Stewart (1980) of the USGS utilized the vertical hydraulic conductivity and thickness of the overlying confining units and regional water balance analyses to calculate recharge rates to the UFA system. Stewart reported that no recharge occurs along the Peace River, and that areas of very low recharge (zero to two in/yr) to the FAS occur in other areas of the county.

Ryder (1985) of the USGS simulated values of recharge and upward leakage from the UFA system using a two-layered, steady state, digital model. Ryder reports that areas of very low recharge (zero to two in/yr) occur in Hardee and northwestern DeSoto County.

Wilson and Gerhart (1982) of the USGS reported areas of recharge and discharge to the UFA using a two-dimensional digital model that included Hardee County. They concluded that discharge from the UFA system occurs along the Peace River Valley and southward into DeSoto County.

For the analyses in this EIS and to be consistent with the analyses presented in the CDA, the average recharge to the UFA system (Deep Recharge) is assumed to be one in/yr.

#### *3.7.2.2 Site-Specific Description*

The hydrologic conditions of the Ona site were initially evaluated by P.E. LaMoreaux and Associates in 1976 for MCC. This extensive one-year water resources investigation included drilling five test wells into the FAS, one monitor well in the IAS, and several monitor wells in the SAS. A suite of comprehensive aquifer pumping tests was conducted on these wells. The well test area was in Section 20, Township 34 South, Range 24 East, approximately 1.5 miles northeast of the proposed Ona plant site.

Review of the drilling data indicates surficial deposits to an elevation of 20 feet below NGVD, the IAS to an elevation of 420 feet below NGVD and the bottom of the UFA at 1,000 feet below NGVD. Water table elevation maps for May and July 1976 are included in a LaMoreaux & Associates report dated October 1976.

The SWFWMD has maintained continuous water level recorders on SAS, IAS, and FAS system monitor wells (Regional Observation Monitor-Well Program [ROMP] Site #31) near the Ona site since 1976. The well installation, lithologic profile and geophysical logs are available from SWFWMD. The ROMP 31 cluster is located on the west side of CR 663 approximately 1.9 miles south of the proposed Ona Mine (one mile south of the Ona site). The water level elevations for the three wells are presented on Figure 3.7-2.

Four additional monitoring well clusters were drilled on the property in 1999. These wells are screened in the overburden and matrix zones of the SAS and in the first permeable zone encountered at the top of the IAS. The wells were installed at the locations shown on Figure 3.7-3. Well installation and lithologic logs for all wells are included in a report prepared by Environmental Consulting & Technology Inc. (ECT) dated March 1999. Water level elevations for these wells are provided in Table 3.7-1 and are shown on Figure

3.7-4 (a-d). Additional site-specific water table monitoring information would be developed for Ona as the monitoring progresses. Rainfall information is being concurrently collected to correlate to the observed changes in water table elevations. The water table varies seasonally as indicated by the data shown for these stations. The water table is highest during the period of July through October. During the drier months of March through May, the water table is at the lowest level. Seasonal levels vary from at or near the surface to an average of about five feet bgs. Well logs for the deepest cluster wells (e.g., wells Ona-1, Ona-4, Ona-7, and Ona-10) are shown in Figures 3.7-5 a/b, 3.7-6 a/b, 3.7-7 a/b, and 3.7-8 a/b, respectively. The logs show that the first permeable zone in the IAS varies in depth from approximately 125 feet bgs on the west side of the property (Ona-1 and Ona-4) to approximately 78 feet bgs on the east side of the Ona site (Ona-10). The log for the centrally located well (Ona-7) indicated that the first permeable zone in the IAS is approximately 95 feet bgs.

Slug tests were conducted on all 12 of the monitor wells to estimate the hydraulic conductivity of each lithologic zone being monitored (i.e., the SAS, the ore zone (matrix), and the upper portion of the IAS). The Ona wells were tested on August 27, 1999. A rising-head slug test (rapid removal of water from the well) was conducted on all SAS and ore zone wells at Ona (e.g., wells Ona-2, Ona-3, Ona-5, Ona-6, Ona-8, Ona-9, Ona-11, and Ona-12). The IAS wells at Ona site required a falling-head slug test (rapid introduction of water to the well) due to the depth of the static water level in wells Ona-1, Ona-4, Ona-7, and Ona-10.

The following parameters from each well tested were used to calculate the hydraulic conductivity via the Bouwer and Rice method:

a. the radius of the well casing (in feet);
b. the porosity of the sand pack surrounding the well screen;
c. the radius of the well borehead (in feet);
d. the height of the static water level above the bottom of the well;
e. the height of the static water level in the well above the base of the aquifer (when known), and;
f. the saturated length of the well screen.

These parameters for the individual wells are presented in Table 3.7-2.

A summary of the aquifer system characteristics is presented in Table 3.7-3; the parameters are based upon tests performed on and near to the mine site as reported by the SWFWMD. This database includes information from aquifer performance tests on the Ona site by former owners and the adjacent Farmland-Hydro L.P. (FHLP/Cargill) Hardee

County mine site. The results of the slug tests performed at or near the Ona site within the matrix and the SAS are presented in Figure 3.7-9.

In addition to the monitor well clusters, IMC has also installed monitoring wells on transects perpendicular to Horse, Brushy, Hickory and Oak Creeks. The locations of transects are shown on Figure 3.5-5 and well numbers are identified on Figure 3.7-3. Water level profiles along each of the four transects are provided on Figures 3.7-10 (a-d). These wells were used to verify the baseflow model developed as part of the CDA.

## 3.7.3 Groundwater Quality

### *3.7.3.1 Regional Description*

Geochemical studies have been conducted in the region to relate the chemical constituents in the groundwater with geological formations. The chemical composition of groundwater is dependent on the interaction of the water with the weathering and erosion of soils, the gases within the atmosphere, chemical reactions occurring below land surface and cultural effects (pollutants). The amounts of dissolved minerals within the groundwater depend upon several factors such as chemical and physical composition of the material, temperature, duration, pressure and water composition.

Groundwater quality data were collected as part of a USGS Water-Resources Investigation (Lewelling, 1997) on the Horse Creek Basin as presented in Table 3.7-4. During the USGS study (1993-1995) eight surficial aquifer wells were sampled bi-annually for water quality parameters. The water samples were analyzed for the following chemical parameters: major dissolved ions, alkalinity, dissolved solids, strontium, silica, nutrients (nitrogen and phosphorus species), and color. The collection of field values of pH and specific conductance occurred at sampling events. Local rainwater and groundwater samples were analyzed for chloride concentrations from rainfall gages near the well locations and from the eight surficial aquifer wells. The study concluded that the groundwater in the SAS in the Horse Creek basin has relatively low specific conductance, alkalinity, and dissolved solids concentrations. The study also concluded that there was no evidence of trends in the remaining parameters, and that the values from the different wells were similar. The study also found an area in DeSoto County that had elevated concentrations of dissolved solids, magnesium, sodium, potassium, chloride, and specific conductance, which may indicate an upward flow of groundwater from the lower confined IAS.

The following description of groundwater quality of the FAS in Hardee and DeSoto Counties is extracted from the USEPA EIS:

> "*Within the Floridan aquifer system, dissolved-solids concentrations generally increase from northern Hardee County towards southern DeSoto*

*County and also with increase in depth. Concentrations exceeding 500 milligrams per liter occur in the upper part of the aquifer in southeastern and southwestern DeSoto County, in the lower Floridan aquifer, along the Peace River, in the southern part of Hardee County, and in all of DeSoto County. The water temperature generally increases from northern Hardee to southwestern DeSoto County, as well as with depth. The water underlying Hardee and DeSoto Counties is generally hard because of the predominance of calcium- and magnesium-rich limestone and dolomite in the matrix. Generally, water from the upper Floridan aquifer is moderately hard to hard (61 to 180 milligrams per liter) in northern Hardee County, increasing in hardness toward southern DeSoto County where the water is very hard (exceeding 500 milligrams per liter). Within the lower Flower aquifer, the only moderately hard to hard water occurs in the northeast corner of Hardee County, with hardness increasing toward the southwest.*

*Sulfate concentrations in Hardee and DeSoto Counties generally increase with depth. Most is probably derived from the solution of gypsum and anhydrite (calcium-sulfate minerals) found in the lower Floridan aquifer. In the upper Floridan aquifer, concentrations generally increase from north Hardee to Southwest DeSoto. Southwest of Arcadia, concentrations range from 100 to more than 250 milligrams per liter. Only in the northern half of Hardee County does the water from the lower Floridan aquifer contain less than 100 milligrams per liter of sulfate. A zone exhibiting more than 250 mg/L extends across southernmost Hardee County, northern DeSoto County, and southward along the Peace River valley, with the water in most of southern DeSoto County containing less sulfate (101-250 milligrams per liter).*

*Chloride concentrations in the Floridan aquifer in Hardee and DeSoto counties generally are less than 50 milligrams per liter although in areas south of Arcadia they range from 50 to 250 milligrams per liter and near the Sarasota-DeSoto county line exceed 250 milligrams per liter. Concentrations of fluoride in the Floridan aquifer underlying the two counties form a concentric pattern, increasing toward the center. In both the upper and lower Floridan aquifers, concentrations are 0.8 milligrams per liter or less only along the periphery of Hardee and DeSoto counties (except along the western boundary where concentrations are higher). In much of the central area along the Hardee-DeSoto county line, aquifer concentrations in the upper Floridan aquifer exceed 1.4 milligrams per liter (and some exceed 2.0 milligrams per liter). In the lower Floridan aquifer, concentrations exceeding 1.4 milligrams per liter are restricted to western*

> *DeSoto County. The principal source of fluoride in Hardee and DeSoto counties is fluorapatite, a mineral restricted to rocks of the upper Floridan aquifer and younger deposits. Fluorapatite is the principal source mineral of phosphate in the land-pebble district of central Florida"* (USEPA, 1078).

### *3.7.3.2 Site-Specific Description*

#### 3.7.3.2.1 <u>1976 Monitoring</u>

Groundwater samples representing the SAS and the FAS were collected in 1976 during the MCC EIS study, which consists of the eastern two-thirds of the Ona site. The results from the analyses of these samples are shown in Table 3.7-5.

The results show that there is dissimilarity in water quality between the SAS and the underlying FAS. The SAS has a total dissolved salts concentration of less than 100 mg/L, and has the same relationship among the various ionic species as the water in the FAS. However, the SAS has a lower concentration of ionic species (USEPA, 1978).

The FAS is characterized by the presence of calcium bicarbonate in the water. The ratios of the equivalent amounts of calcium and magnesium ions are almost identical except in the UFA where water is high in magnesium, bicarbonate and chloride. The ratios among the dissolved ionic constituents of the total concentration of the dissolved ionic species of water from various production zones within the lower Floridan aquifer (LFA) are almost identical. The most prominent characteristic is the increase in sulfate ions and the decrease in chlorides with depth to the Ocala and Avon Park Limestone zone of the LFA. The differences in chemical characteristics between water in the UFA and the LFA suggests that the UFA and LFA may be recharged by waters received from different sources and are hydrologically separated. In addition, the increase in sulfate ions with depth is related to the dissolution of gypsum and anhydrite minerals occurring in the LFA.

It is hypothesized that much of the radioactivity detected in water samples from the UFA during the 1976 MCC EIS study was a result of the presence of uranium compounds with the phosphorite of the Hawthorn Formation (USEPA, 1978). Radium-226 was not detected in large amounts in the LFA. This indicates the clays of the Tampa Limestone are effective as a confining bed in the study area.

The radium in concentrations in the groundwater samples collected during the 1976 MCC EIS study represents the expected concentrations from the various aquifers. The range in Radium-226 concentration in the groundwater samples from the various aquifers in 1976 was 0.91 to 7.29 pCi/L. The maximum level of radiation as Radium-226 was 7.29 and was detected in groundwater samples collected from the SAS (USEPA, 1981a). The SAS geometric mean value of Radium-226 detected during the MCC aquifer testing program and the baseline monitoring were 3.2 pCi/L and 1.7 pCi/L, respectively (USEPA, 1981a).

The overall geometric mean was calculated to be 2.2 pCi/L (USEPA, 1981a). The analyses of Radium-226 were performed as part of the MCC Technical Support Document (TSD) and the MCC EIS. It was noted in the MCC TSD that:

> *"These means are somewhat higher than the mean for unmined mineralized areas [0.22 pCi/L], although 12 of 13 reported values are within the typical range for these areas [0.05 to 22.0 pCi/L]"* (USEPA, 1981a).

It was hypothesized in the MCC TSD that the elevated radium concentration above the typical range for the area may have been related to the elevated radium concentrations near the leach zone of the matrix (USEPA, 1981a).

Chapter 62-550 of the F.A.C. (2000) limits the concentration of naturally occurring radionuclides in drinking water to 5.0 pCi/L for Radium-226 and Radium-228 combined. It was also stated in the MCC TSD that:

> "*radium-226 concentrations in drinking water samples from wells taping [tapping] the surficial aquifer were all below the USEPA Drinking Water Standard of 5.0 pCi/liter [picocurries per liter]"* (USEPA, 1981a)

#### 3.7.3.2.2 1998-1999 Monitoring

The quality of the groundwater in the SAS is generally good as determined by the groundwater monitoring conducted by IMC during the CDA process. Table 3.7-6 presents a summary of water quality data from current and past investigations on or near the Ona site. The only water quality problems with the surficial groundwater are the presence of nuisance concentrations of iron and color and some elevated levels of radionuclides. As part of the baseline monitoring program, radiological samples were collected to define existing concentrations of radioactivity in the groundwater. Groundwater samples collected from monitoring wells were analyzed to determine the Radium-226 concentrations on the site. The measurements indicated an average SAS concentration of 0.96 pCi/L. The concentration of dissolved Radium-226 in central Florida groundwater has been the subject of numerous previous studies. Data obtained in programs conducted by the USEPA and USGS indicate that the average Radium-226 concentration is highest in the UFA (2.86 pCi/L) and about an order of magnitude less in the SAS (0.22 pCi/L) (USEPA, 1981a). The concentration in the single sample taken from the UFA in a previous onsite study for MCC indicated a concentration of 7.05 pCi/L, while site data for the LFA ranged between 1.11 and 1.8 pCi/L.

The IAS is the primary supply for domestic water supply. As shown in Table 3.7-6, the quality of groundwater in the IAS is also generally good. Water quality from the uppermost permeable zone of the IAS for wells Ona-1, Ona-4, Ona-7 and Ona-10, is shown in Table 3.7-7. The only water quality problems are localized elevated concentrations of dissolved solids, sulfates and radionuclides. The results of monitoring on the Ona site at each cluster well are shown in Table 3.7-7.

Table 3.7-6 also shows the quality of groundwater in the UFA system is good in the Ona site area. The FAS data were analyzed from samples collected from a Farmland Hydro well, which is southeast of the Ona site. A USEPA study of groundwater in Florida in 1973 indicated that the radium content of water varies substantially throughout the state. Typical surface water values are low, coastal deep wells and shallow wells are frequently elevated, as are many inland shallow wells remote from the phosphate-mining district. The USEPA study resulted in many community water supply wells along the coast converting to a higher level of treatment to remove radium prior to distribution.

## 3.8 TOPOGRAPHY AND SOILS

### 3.8.1 Topography

Figure 3.8-1 illustrates the existing topography on the Ona site using two-foot contours. The topography varies from 132 feet NGVD in the northeastern section of the Ona site to 67 feet NGVD in the central southern area. Low topographic relief characterizes the central and eastern portions of the site. The highest topographic relief characterizes the western portion, namely Horse Creek. Stream slopes average approximately nine to ten feet per mile in Horse Creek and West Fork Horse Creek to 1.3 foot per mile in Oak Creek.

### 3.8.2 Soils

#### *3.8.2.1 Description of Soils*

Table 3.8-1 presents the description of each soil name shown on Figure 3.8-2. This information has been transcribed verbatim from the Hardee County Soil Survey (SCS, 1984). Based on the soil classification system, 39 soil series have been recognized and mapped by SCS on the Ona site. Lithologically, the site soils are predominantly fine acid sands with low natural fertility. Hydrologically, the soils are predominantly poorly drained, have high permeabilities (particularly in the top horizon), and moderate to high runoff potential. The erosion potential at the site is somewhat low due to low relief and extensive existing ground cover.

General agricultural capability of site soils (with a high level of management) falls into Classes three through seven, and have severe to very severe limitations for agricultural development. Currently, the principle agricultural land use of the site is pasture and improved pasture. A study of existing soils in the phosphate mining area stated the following:

> *"…The vast majority of Florida topsoils are acid sand that are low in natural fertility and have poor retention capacities for water and applied nutrients.*

> *Florida's productive agriculture is based not on the productivity of its soils but rather on specialized uses of these soils made possible by Florida's favorable climate"* (Zellars-Williams, 1980).

A comparison of the soil properties classified nine of ten common central Florida soils as poor relative to their importance for use as topsoil and one of the ten soils as fair. The primary reason for the poor rating was that the soils are too sandy.

Engineering characteristics of the site soils are determined primarily by soil drainage and flooding potential. Strength and settlement properties of the sandy soils are acceptable; however, the mucks and mucky soils present foundation restrictions for structures. In general, moderate to severe restrictions are indicated for sanitary facilities and building site development for soils in their natural conditions that are poorly drained. These restrictions are derived from the soil wetness, ponding, seepage, and slow percolation (USEPA, 1981a).

### *3.8.2.2 Prime and Unique Farmland Soils*

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, livestock, timber, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and/or labor. Prime farmland does not include land already in or committed to urban development or water storage. Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops. Citrus is an example of such crops (NRCS, 2001).

The purpose of the Farmland Protection Policy Act (FPPA) is to minimize the extent to which the action taken by federal agencies contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. The NRCS is the agency primarily responsible for implementing the FPPA. If a federal action would result in the conversion of prime or unique farmland to a non-agricultural use, Form AD-1006 must be completed by the federal agency and submitted to NRCS.

Hardee County has no prime farmland soils (SCS, 1984; Richards, 2002). However, any land in Hardee County that is in citrus production is considered unique farmland (Richards, 2002). There are 209.2 acres on the Ona site that are currently in citrus production. The results of coordination with the NRCS are described in Section 4.8.

### *3.8.2.3 Sinkhole Potential*

According to the USGS, the Ona site is located in an area that has a low probability of sinkhole occurrence. Figure 3.8-3 illustrates that the ± 300-foot thick zone of inter-bedded clay, marl, dolomite, and sands shown as the confining bed/IAS in Figure 3.7-1 (Section 3.7) reduces the leakage and aquifer recharge coefficients sufficiently to significantly reduce the potential for limestone dissolution that cause sinkhole development and the corresponding subsidence. In 1976, P.E. LaMoreaux and Associates, Inc. investigated onsite documentation of the lack of sinkhole potential in the 1970's as part of the MCC DRI preparation and the groundwater hydrology assessment performed in support of the SWFWMD Consumptive (Water) Use Permit application. These efforts included drilling and geophysical logging of wells MCC-187 through MCC-191, Ona-520, Ona-522, and Ona-524 through Ona-527. Dr. LaMoreaux concluded that sinkhole formation beneath the site is improbable.

As part of the MCC EIS, the USEPA analyzed the potential for site-specific sinkhole to develop. The EIS reported:

> *"The MCC property is located in an area of Florida where sinkholes are unlikely to occur due to the thickness of clastic sediment overlying limestone and a high potentiometric surface (Vernon and others, 1972). Additional studies at the MCC property (P.E. LaMoreaux and Associates, 1976) provide the following evidence that active sinkholes are unlikely to occur: 1) air photos, taken in 1942 and 1972, were compared for pond formation and found to be essentially unchanged; 2) no relationship between surficial depressions and remotely sensed lineaments was discovered; 3) ground studies of terrain features showed no indication of sinkholes features; and 4) examination of infrared aerial photographs showed no indication of active or incipient sinkhole activity. Evidence indicates that the shallow surface depressions found on the property are the result of the solution and slumping of thin beds of calcareous materials or limestone lenses within the overburden and phosphate ore matrix. These depressions are not the result of large scale karstic development in the bedrock limestone"* (USEPA, 1981a).

In addition to the previous investigations, a study of historic sinkhole activity within a given area, such as west central Florida, was prepared to aid in quantifying the relative risk between sites located in Hardee County and nearby Counties by using a simple classification system such as shown in Table 3.8-2. A list of reported sinkhole occurrences in the west-central Florida region between 1955 and 2000 was compiled from the following sources:

- Polk County Civil Defense
- Lakeland Ledger
- Florida Sinkhole Research Institute

- Southwest Florida Water Management District
- Ardaman project files

A plot of the SWFWMD sinkhole occurrence as of July 2000 is shown on Figure 3.8-4. The nearest reported sinkhole is located approximately four miles northeast of the Ona site. The annual frequency for sinkhole development at the Ona site is less than 0.001 sinkholes per square mile. Based on the above referenced studies, the Ona area has an extremely low potential for sinkhole occurrence.

### *3.8.2.4 Unique Geologic Features*

As part of the baseline studies of the site for the CDA, the site was reviewed for the presence of unique geological features. With the exception of the presence of commercially recoverable phosphate deposits, the site does not contain any other unique geological features such as sand dunes, bluffs, springs, steepheads, etc. With regards to seeps within the region, seepage wetlands are common along steep or incised stream channel banks. Since every riparian wetland receives groundwater inflow from the adjacent upland, these wetland seepage features are not considered geologically unique.

### *3.8.2.5 Radiation in Soils*

#### 3.8.2.5.1 Regional Description

Soils contain uranium, radium, and a number of other radioactive elements derived from uranium. Uranium-238 is the parent of a chain of radioactive materials known as the Uranium Series. Uranium-238 decays to thorium-234 and this process of radioactive decay continues through 13 different radionuclides until a stable isotope (lead-206) is reached. Each different radionuclide exhibits different radiological characteristics, including different types and energies of radiation, half-life, and metabolic characteristics. These differences result in different potentials for radiation dose to humans.

From a potential health effect standpoint, the key members of the Uranium Series are Radium-226 and radon-222. Radium-226 is generally recognized as the indicator radionuclide for potential radiological impacts from the phosphate industry. This is because of its long half-life and the types of radiation it emits. Radon-222, the immediate decay product of Radium-226, is a inert gas that can seep through soils and enter structures constructed on those soils providing the potential for its decay products (known as radon progeny) to build up in some structures. Polonium-210, one of the decay products of radon-222, has been detected in elevated concentrations in the phosphate district and can be of concern because of the type of radiation it emits. All of these radioactive materials are known to cause adverse health effects at high concentrations. However, the concentrations of these radionuclides that have been observed in the central

Florida phosphate district are close to normal background levels and lower than concentrations that are known to cause adverse health effects.

The Department of Health through the Bureau of Radiation Control (BRC) performs the most comprehensive monitoring program of phosphate mining radiation impacts. IMC (and the other mining companies) provide the BRC with maps depicting areas that would be mined and reclaimed at six-month intervals. The BRC takes soil, air, and water samples from the land both before and after the mining occurs and measures the radiation levels.

Quantities of radioactive materials in the environment are typically expressed in picocuries (pCi). A picocurie is one millionth of a millionth of a curie; the curie is the standard unit for measuring the quantity of radioactive materials. Concentrations of radionuclides in solid environmental materials, such as soil, are typically expressed as picocuries per gram (pCi/g). While the different members of the Uranium Series emit different types of radiation (such as alpha particles, beta particles, and gamma rays), the type of radiation most easily detected with a survey meter is gamma radiation, which is measured in the environment in microRoentgens per hour (µR/hr). The Florida Statewide Radiation study by a private consulting company called GEOMET and published by FIPR in 1987 gives a background value for the state of Florida to be 6.0 µR/hr. Typical range for background radiation as measured by the BRC in 1996-1997 monitoring varied between 4.7 and 5.3 µR/hr. The BRC took measurements of over 5,000 locations on pre-mined land at an elevation of three feet above ground surface.

Radon is part of background terrestrial radiation exposure. Radon-222 is a colorless, odorless, and tasteless inert gas, but it is radioactive and emits low levels of alpha radiation. Radon is a direct byproduct of the natural radioactive decay of Uranium-238. Based on results of the USEPA model, radon is responsible for 54 percent of the average radiation exposure rates in the US. Radon-222 has a half-life of 3.8 days (Chang, 1998). The earth's soils constantly emit radon. The more minerals that contain traces of uranium that exist in the soils, the more radon would be emitted. The source mineral can be granite, sedimentary shell and marl or phosphate rock.

Due to the well-known association of naturally enhanced radioactivity with phosphate rock and other types of mineralized soil, radon levels have been examined in Florida since the middle 1970's, based on the earliest findings of the USEPA, the Florida Department of Health and Rehabilitative Services (FDHRS), and university conducted studies.

Table 3.8-3 summarizes the typical concentrations of Radium-226 in phosphate ore and in various products and by-products of the beneficiation process (USEPA, 1975; Roessler, 1979). The concentrations can vary from those listed, but these levels are typical for central Florida. Human health issues related to radiation and phosphate mining are discussed in Section 4.17 of this EIS.

#### 3.8.2.5.2 Site Specific Description

The central and eastern two-thirds of the Ona site were formerly owned by MCC. An EIS was conducted on the MCC portion of the site in 1977. The MCC reported radiological baseline monitoring data that was collected to define existing concentrations of radioactivity in soils. The results of the study indicated the depth-weighted mean Radium-226 concentrations of subsurface materials at the central and eastern portions of the Ona site (in units of pCi/g dry) are: 1.0, upper layer of overburden; 4.0, overburden (surface to top of leach zone); 23.9, leach zone (where it exists); 6.2, overburden (surface to matrix); and 5.5, matrix (USEPA, 1981a).

Ambient (natural) external gamma radiation exposure is derived from cosmic and soil (external terrestrial) sources. Each of these sources usually provides equal exposure. Based on field measurements from the MCC study, external terrestrial radiation was estimated to be 1.8 μR/hr at the mine site.

In October 2000, IMC conducted a sampling of the Ona site to characterize at the sample points the levels of gamma radiation, Radium-226 concentrations in the upper six feet, and Radon-222 emanation rates from the surface. Ten locations were sampled in accordance with the BRC protocol. Four of these locations were selected based on their proximity to the existing clusters of monitoring wells, while the other six locations were selected to provide a cross-section of the mine site.

The results of the gamma radiation sampling at the sample locations were 5.0 μR/hr. The radon flux average is 0.077 picocurries per square meter per second (pCi/m$^2$s) that had a range from 0.02 to 0.4 pCi/m$^2$s with a second highest value of 0.09 pCi/m$^2$s. The soil Radium-226 results ranged from 0.07 to 10.4pCi/g. The results of soil Radium-226 results are presented in Table 3.8-4. Table 3.8-4 presents the results from samples at the ten locations and their respective concentrations at one-foot intervals and presents the averages and standard deviations for each one-foot interval for the ten sample points.

Table 3.8-5 presents a summary of the pre-mining levels of radioactivity collected by the BRC between July 1995 and June 1998 and the results from the IMC sampling. The sample results for soil radium in sample point number four and five may indicate the presence of mineralized soil close to the surface (ECT, 2000 [Appendix C]).

No radiation standards have been adopted which regulate the parameters that BRC is measuring. However, some criteria do exist which can be used as benchmarks to evaluate the significance of the levels that have been measured. The Florida Department of Health (F.A.C. Chapter 64E-5.1001, 1997) has adopted environmental radiation standards that limit the gamma radiation level inside a building to 20 μR/hr and the indoor radon progeny concentrations to 0.02 Working Levels (which corresponds approximately to 4.0 pCi/L of radon). Since both of these standards apply inside a building, they do not apply to reclaimed lands. In addition, radon is only a concern indoors, where its decay products can build up; radon is not considered to be a concern outdoors.

No standards have been adopted to regulate soil Radium-226 concentrations or soil radon flux. However, the National Council on Radiation Protection and Measurements (NCRPM) has recommended a guide of 40 pCi/g of Radium-226 as a concentration to be evaluated for agricultural land use (NCRPM, 1984).

#### 3.8.2.5.3 Summary

The radiation background levels shown are typical for Florida; however, in the case of gamma radiation in other areas, background levels of hundreds of μR/hr are not uncommon. While the pre-mining radon flux (emissions from the soil surface) is substantially higher than the background levels it is still below the indoor reference criterion of four pCi/L. This is indicative of the rapid dispersion of radon once it leaves the ground surface and a major reason that radon is not considered to be an outdoor concern. This is also indicative of why radon flux has not been regulated. The pre-mining soil Radium level is higher than the background level, but well below the agricultural guideline.

## 3.9 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

### 3.9.1 Hazardous and Toxic Waste

Recent historic use of the Ona site has been primarily for agricultural or silvicultural purposes (old row crop areas, citrus, and cattle grazing on improved and unimproved pasture). The predominant agricultural use is cattle ranching, and the remaining native vegetative cover has been historically used for that purpose. Forty percent of the Ona site has been converted into unimproved, improved, or woodland pasture or hay fields to support the cattle ranching operations. In addition, numerous cattle watering ponds have been dug, totaling 20.2 acres, to support the ranching. The second most dominant use of the site is citrus groves, which occupy 209 acres.

Figure 3.2-1 in Section 3.2, shows several residential structures on the Ona site that housed former owners of the property. In addition, approximately 25 acres of private roads traverse the site. However, all of these land uses support the predominant agricultural use of the site.

No toxic wastes exist at or would be generated at the Ona site. There are currently no industrial facilities on the Ona site. Since IMC has not identified any existing hazardous waste within the mine site, no background data has been collected. IMC's standard procedures are to conduct an environmental audit of a site, once the site is permitted, but prior to starting mining activities.

### 3.9.2 Radioactive Waste

The land on the Ona site is mainly used as improved rangeland, and there have been no sources of radioactive waste identified on the property. As such, no baseline data was collected as part of this EIS.

The soils in this region contain naturally occurring uranium and its daughter products (see Section 3.8.2.4 Radiation in Soils, for a detailed discussion).

## 3.10 AIR QUALITY

The major industrial sources of pollutants in the region are electrical utilities and the phosphate industry. Among the primary pollutants associated with the phosphate industry are particulate matter (PM), sulfur dioxide, and fluoride. At phosphate mines, particulate matter emissions, mostly in the form of fugitive dust, are generated by land clearing, earth moving, material handling, and reclamation activities, as well as by the movement of heavy equipment.

### 3.10.1 Ambient Air Quality

The existing applicable national and Florida National Ambient Air Quality Standards (NAAQS) are presented in Table 3.10-1. The NAAQS have been promulgated for sulfur dioxide ($SO_2$), nitrogen dioxide ($NO_2$), PM with an aerodynamic diameter of ten microns ($PM_{10}$), carbon monoxide (CO), ozone ($O_3$), and lead. Primary NAAQS were promulgated to protect the public health, and secondary NAAQS were promulgated to protect the public welfare from any known or anticipated adverse effects associated with the presence of pollutants in the ambient air. Areas of the country in violation of NAAQS are designated as nonattainment areas, and new sources planned in or near these areas may be subjected air permitting standards that are more stringent.

Hardee County is classified as an attainment area for all criteria pollutants. Adjacent counties are also classified as attainment areas for all criteria pollutants. There are no designated nonattainment areas in Florida. However, there are several maintenance areas near Hardee County, which were previously designated as nonattainment. These include Hillsborough and Pinellas counties, classified as a maintenance area for ozone; a portion of Hillsborough County, classified as a maintenance area for lead; and a portion of Hillsborough County, classified as a maintenance area for PM.

Hardee County is classified by FDEP as in attainment with all NAAQS established by the Federal Clean Air Act (CAA). Historical air quality data collected over the past 25 years adjacent to active mining operations in Polk and Hillsborough Counties shows no reported violations of these NAAQS's.

### 3.10.2 Temperature

The closest temperature monitoring station to the Ona site is the weather station in Wauchula. The recorded mean monthly temperatures at this station are presented in Table 3.10-2. The recorded mean annual temperature for the period between 1961 and 1990 is approximately 73°F with monthly average temperature varying from a low of approximately 62°F during January to a high of approximately 82°F during August.

The Wauchula monitoring station primarily monitors temperature and rainfall. The closest meteorological station to the Ona site that provides complete surface meteorological data (i.e., precipitation, wind speed, temperature, humidity, dew point temperature, atmospheric pressure, percent sunshine, total sunshine, and average sky cover) is the National Weather Service station located at Tampa International Airport (TIA). This weather station is approximately 50 miles to the northwest of the proposed Ona Mine. The National Weather Service has recorded weather observations at this location for more than 50 years.

In addition to temperature data for the Wauchula station, Table 3.10-2 also provides the recorded monthly temperatures for the National Weather Service station located at TIA. The records indicate that the mean annual temperature is approximately 73°F with mean monthly temperatures varying from a maximum of 82°F to a minimum of 60°F. The extreme temperature records for the period between 1947 and 1997 range from a low of 18°F in 1962 to a record high of 99°F in 1985. The data shows little difference in temperatures between the Wauchula and TIA stations.

### 3.10.3 Wind

The closest wind monitoring stations to the site are located in Tampa and Orlando, which are approximately 50 miles northwest and 75 miles northeast of the Ona site, respectively. These stations along with the site lie entirely within the trade wind belt. The predominant wind direction for the Tampa station, which is within 20 miles of the Gulf of Mexico, is from the northeast. Whereas, the winds measured at the Orlando station are predominantly from the north, east or south depending on the seasonal variations within the year. Because of its proximity to these stations, the project site would probably exhibit a combination of both Orlando and Tampa wind characteristics.

The Tampa area lies entirely within the trade wind belt (i.e., below 30 degrees North latitude), resulting in predominant winds from the east. However, because of the location of the Gulf of Mexico, moderate to strong late afternoon sea breezes occur on days with strong land heating, producing local onshore winds (i.e., wind with a westerly component).

A summary of the average wind speeds for each season and throughout the year, including calm conditions, is presented in Table 3.10-3 as measured at the TIA. The anemometer sensor at TIA is located 22 feet above ground surface (ags). Figure 3.10-1 shows an annual wind rose for the TIA weather station. The predominant wind direction is from the northeast.

The Orlando area is also below 30 degrees North of Latitude. The winds are predominantly from the north, east or south depending on the seasonal variations within the year. Figure 3.10-2 shows a wind rose for the Orlando weather station. Table 3.10-4 shows a summary of the wind directions and calm conditions as measured at the Orlando International Airport (OIA). The anemometer sensor at OIA is located at 33 feet ags.

The increase in anemometer height between TIA and OIA (22 feet ags and 33 feet ags, respectively) likely contributes to a higher average annual measured wind speed at OIA (8.7 miles per hour [mph]) as compared to TIA (7.2 mph). An increase in wind speed results in fewer observed calm wind conditions at OIA.

### 3.10.4 Atmosphere Stability

Atmospheric stability is a measure of the atmosphere's capability to disperse pollutants. During the daytime with strong insolation, the atmosphere can disperse pollutants very quickly for a relatively short period. This condition is very unstable and generally occurs infrequently during the year. During the nighttime under clear skies and light wind speeds, the atmosphere is considered stable with minimal potential to disperse pollutants. Under moderate to high wind speeds, pollutants are dispersed at moderate rates under neutral conditions, which are generally more prevalent throughout the year and can occur any time throughout the day.

The seasonal and annual average occurrences of atmospheric stability classes from 1991 through 1995 are shown in Table 3.10-5 for the TIA and in Table 3.10-6 for the OIA.

During the summer months at the TIA, unstable conditions occur approximately 38 percent of the time due to strong insolation, whereas unstable conditions occurs only 16 percent of the time in the winter months. Neutral stability occurs most frequently during the winter months due to the higher wind speeds and lower temperatures in this season. The occurrence of stable conditions is nearly uniform throughout the year, with a maximum occurrence of approximately 45 percent in the fall.

During the summer months at the OIA, unstable conditions occur approximately 31 percent of the time due to strong insolation, whereas unstable stability occurs only approximately 11 percent of the time in the winter months. Neutral stability occurs most frequently during the winter months due to the higher wind speeds and lower temperatures in this season. The occurrence of stable conditions is nearly uniform throughout the year, with a maximum occurrence of approximately 39 percent in the fall.

The occurrences of the various types of atmospheric stability at the Ona site would be a combination of both TIA and OIA conditions. However, as both locations present the same general trends the same trends can be expected at the Ona site.

## 3.11 NOISE

The term "noise" is the sound pressure level human ears experience. When noise is experienced intentionally it is considered desirable, and when experienced unintentionally, noise is considered undesirable. Noise is measured in decibels using an "A" weighted scale (dBA), which is the measurement that most closely correlates the absolute sound pressure level to the human experience of noise, as measured by our ears. Absent receptors, noise is of no concern; however, there are receptors adjacent to the Ona site. These receptors include residences, two churches, and a school within a one-mile radius of the property boundaries.

No quantitative federal or state regulations directly regulate environmental noise levels, associated from the operation mine. Federal agencies have produced several guidelines for nuisance noise levels; all of these levels focus upon the noise level at receiving (or receptor) residential areas. The USEPA and the U.S. Federal Highway Administration recommend levels of 55 dBA in residential areas, meaning that the level of noise could be higher at the site of the noise generating activity. For this reason, the U.S. Department of Health and Human Services defines as acceptable noise levels of 65 dBA for new federally subsidized housing projects. In contrast, the U.S. Occupational Safety and Health Administration requires employees to implement hearing conservation plans that ensure workers are not exposed to noise levels in excess of 90 dBA on an eight-hour time weighted average basis.

These federal guidelines suggest that residential (or ambient) noise levels of less than 55 dBA at the receptor site are desirable and that levels above 65 dBA are undesirable. Thousands of noise measurements nationwide have documented that typical suburban residential areas experience noise levels of 40 dBA at night and 50 to 65 dBA during the day; similar levels are likely in the Ona Rural Center Community (IMC, 2002). People who choose to live along highways, such as SR 64, experience average daytime noise levels of about 60 dBA. Measurements in the interior of the Ona site would likely range between 30 and 40 dBA.

## 3.12 SOCIOECONOMIC

The socioeconomic elements described in this section include demographics, employment, income, community services (including transportation), resources, recreation, public finance, and environmental justice. Socioeconomic aspects of the existing environment also include land use, aesthetics, and cultural resources. The term “Region” relative to this study includes Polk, Hardee, Hillsborough, Manatee, Sarasota, Charlotte and DeSoto Counties. These counties are defined in the Areawide EIS (USEPA, 1978). These counties were grouped together because of the presence of phosphate reserves and the affects that phosphate mining may have on the socioeconomic character of these counties. The local area is defined as Hardee County.

### 3.12.1 Demographics

The Ona site is located in the unincorporated western portion of Hardee County, Florida. The population for the state of Florida in 1990 was 12,937,926 and in 2000 it was 15,982,378 (a 20 percent increase). In 1990 Hardee County's population was reported as 19,499 and in 2000 it was 26,938 (an increase of 28 percent) (US Bureau of Census [US Census], 2001a; American Fact Finder [AFF], 2001a). This growth rate in Hardee County was underestimated in earlier projections using 1990 US Census data. However, at the time of writing this document not all levels of the 2000 US Census data was available. Projections based on the 2000 US Census were limited also. Because of this limited availability, 1990 and 2000 census data will be discussed at varying levels in this section.

In 1999, the University of Florida Bureau of Economic and Business Research (2000) projected Hardee County's population to increase to 23,900 by 2009. This population growth equated to a two percent annual growth rate. Further, it was projected that Hardee County would continue to grow at comparable rates in the years beyond the projections. A population of between 33,000 and 35,000 would be expected by 2020 in Hardee County. However, as indicated by the difference of 7,439 people in the census data for Hardee County and what was previously projected, the growth rate for the county has been greater than anticipated. The Florida Statistical Abstract (2001) projects Hardee County's population to rise to 31,700 by 2010. This would indicate a continued growth period for the county.

Hardee County contained 6,391 households in 1990 at an average size of 2.95 persons per household (Bureau of Economic and Business Research, 1992). Housing in Hardee County was primarily owner-occupied and single-family structures, the majority of which have been constructed since 1960. In 1990, the median value of an owner-occupied home was $40,300, which was below the state median of $77,100 (US Census, 2001b). The 2000 US Census reported that Hardee County had 8,166 households with an average size of 3.06 persons. Again, the more recent available data would indicate a much stronger growth period for the county than anticipated.

The proposed project is near the community of Ona, a low-density residential population area with limited commercial and community services. There are no incorporated municipalities and no other communities within five miles of the Ona site except for Fort Green Springs, located four miles to the north of Ona (US Census, 2001a). Table 3.12-1 lists a comparison of 1990 and 2000 census populations. The 2000 US Census population data for the nearest incorporated municipalities are listed below:

- Zolfo Springs is seven miles to the east, with a 2000 population of 1,641;
- Wauchula is eight miles to the northeast, with a 2000 population of 4,363; and,
- Bowling Green is 12 miles to the north-northeast, with a 2000 population of 2,892.

Additional unincorporated communities located near the Ona site include:

- Ona is within the southeastern quadrant of the Ona site;
- Fort Green is six miles to the north of the Ona site;
- Limestone is eight miles to the south; and,
- Lily is eight miles to the south-southeast.

### 3.12.2 Employment and Income

The CFRPC's Strategic Regional Policy Plan (SRPP) (1997) is a planning document that describes a long-range guide for the development of CFRPC's region (Region), and identifies the economic setting of the planning region. According to this document, Hardee County is a leading producer of citrus, farm crops, beef, and phosphate. The SRPP indicates the following regional economic trends:

- Because of its location between Tampa and Orlando, overall economic activity in the Region is, for the most part, driven by activity in Polk County;
- In-migration of retirees is increasing demand for expansion in retail and service sectors;
- Loss of high paying jobs is occurring in manufacturing and mining sections, while an increase in lower paying service industry jobs is taking place; and
- An influx of farm workers is occurring, which is affecting the demand for permanent residency.

Phosphate mining and fertilizer manufacturing activities in central Florida are a significant part of the Region's industrial base. Employment characteristics include the direct employment of almost 8,000 people, and employment of up to 40,000 others in related second and third tier supporting businesses, most of whom enjoy wages that far exceed the average Florida per capita income of $23,285 (IMC, 2002). IMC's current payroll of more than $9.57 million paid to 350 people at the existing Fort Green Mine is significant as a standalone enterprise, and provides a per capita income that exceeds the statewide average by 17 percent (IMC, 2002).

The 1992 Florida Statistical Abstract shows Hardee County's labor force totaled 9,368 in 1991, an increase of 9.7 percent from a 1989 labor force of 8,536. This percentage increase was higher than the statewide labor force increase of 3.8 percent. The 1991 count represents 3.9 percent of the central Florida Region's total labor force. Yet, Hardee County had the highest unemployment rate in the Region (10.5 percent) and had the sixth highest unemployment rate of the 67 counties in Florida in 1991. Twenty-two percent of the existing Fort Green Mine workforces are residents of Hardee County (IMC, 2002).

There is a perception that mining local property eliminates opportunities for more productive uses that would generate more jobs and economic benefits to the community (IMC, 2002). However, studies conducted on mined lands in Polk and Hillsborough Counties have shown that reclaimed land, specifically clay settling ponds, can be used for both traditional and non-traditional agricultural uses (IMC, 2002). Conclusions of the Florida Institute of Phosphate Research, Polk County, and The Institute of Food and Agricultural Science extension at the University of Florida state that the potential agricultural productivity of reclaimed settling areas is superior to the current conditions at the Ona site (pine flat woods). As discussed in the IMC Additional Information Submittal, March 2001, clay settling ponds are proving to provide land for large scale production of many row crops, ornamental trees, turf grass, grain, citrus, alfalfa hay and energy biomass crops. However, they are mostly used for improved pasture because infrastructure is in place for cattle production, and is not available for other agricultural products. Additionally, economics are not conducive to development, and as such, mills for grain and soybeans are not in place and transportation costs are a disadvantage. Peak demand for many common, large-scale production crops occurs during the area’s peak season for freezing temperatures. Another obstacle to crop production is the competition from vegetable farming in Mexico. In addition to agricultural uses, reclaimed mined lands are being developed for landfills and large, mixed-use developments.

### 3.12.3 Community Services

The local area is characterized as rural although the community of Ona is situated in the southeast quadrant of the Ona site. The local area community services are described below.

#### *3.12.3.1 Law Enforcement*

The Hardee County Sheriff’s Department provides law enforcement service for Ona and is located in Wauchula, which is approximately eight miles from Ona (Hardee County, 2001b). Law enforcement units can reach Ona from anywhere in the county within 15 to 20 minutes. The Sheriff’s Department has approximately 80 personnel.

### 3.12.3.2 Fire

Ona is served by the Wauchula Fire Department, which serves all of Hardee County. Response time to Ona is approximately ten to 12 minutes. The Wauchula Fire Department has three engines, a tanker, and 22 personnel who work in three shifts (Hardee County, 2001b).

### 3.12.3.3 School Districts

There are no schools in Ona. An elementary school is located in Zolfo Springs (seven miles to the east) and elementary, junior and senior high schools are located in Wauchula (eight miles to the northeast) (Hardee County, 2001b). Some children may attend school in other surrounding communities.

### 3.12.3.4 Churches

There are four churches located in Ona. Residents may also attend churches in nearby communities or municipalities (Hardee County, 2001b).

### 3.12.3.5 Medical Facilities

There are no medical facilities in Ona. The nearest medical facility is Florida Hospital in Wauchula (Hardee County, 2001b).

### 3.12.3.6 Social Service Agencies

There are no social service agencies with offices in Ona. The nearest social service resources are in Wauchula (Hardee County, 2001b).

### 3.12.3.7 Community Centers

A Young Men's Christian Association (YMCA), located in Wauchula, is the closest community center to Ona (Hardee County, 2001b).

### 3.12.3.8 Recreation

Pioneer Park is a Hardee County park located approximately six miles east of Ona near Zolfo Springs. The park consists of 20-acres along the Peace River, and offers swimming, fishing, camping, and fossil hunting. The park includes Pioneer Park Animal Refuge and Museum, which is a small refuge with several animals, including a bear, cougar, deer, raccoon, fox, and skunk. The animal refuge and park recently constructed improved natural enclosures for the animals. The park attracts approximately 200,000 visitors during the Pioneer Festival, the week of February 28 each year. An additional 10,000 people use the park the rest of the year. No other recreational parks are located near Ona, according to Hardee County.

Payne's Creek State Park is located approximately ten miles north of Ona (IMC, 2002) and 0.5 mile east of Bowling Green (Florida State Parks, March 2002). Visitors to this park can enjoy picnicking, fishing, and nature study. There are exhibits in the visitor's center that depict Seminole Indians and white settlers at the fort and trading posts that once stood near the park's location.

There are no existing regionally significant parks, green ways, preserves, or conservation lands located on or adjacent to the Ona site.

### *3.12.3.9 Public Utilities*

There are no municipal water supplies or sewer services provided near the Ona site. Residents in the area acquire potable water through private groundwater wells and use onsite septic systems. The nearest landfill for solid waste is located near Wauchula, near of the intersection of US 17 and Main Street (Hardee County, 2001b).

There are currently two electric power plants in Hardee County. Both are located near of CR 663 and the Polk County line. Three additional power plants are scheduled for completion during the next few years (Hardee County, 2001b). A natural gas pipeline runs along CR 663 for the entire length of Hardee County. However, there are no structures associated with it, only monitoring points, valves, etc. (Hardee County, 2001b).

### *3.12.3.10 Transportation*

People within the Region rely almost exclusively on private vehicles to travel within and outside of the area. The emphasis for regional transportation is placed on the highway and road systems (IMC, 2002). The highway system provides the key connection between other transportation systems such as rail and air.

Transportation resources currently present near the Ona site consist of SR 64, CR 663, and Albritton, Post Plant, and Vandolah Roads. With the exception of the Fort Green-Ona Road (CR 663), which is scheduled for improvements, all of these transportation resources are in good condition. The regional highways and roads currently provide LOS that exceed state, regional, and local minimum acceptable LOS (Table 3.12-2).

### *3.12.3.11 Roadways*

The existing conditions of the regionally important roadways within the project study area are listed in Table 3.12-2, and shown on Figure 3.12-1. The table contains the roadway segment, the year when traffic count was collected, the annual average daily traffic (AADT), K-Factor (peak hour factor, the proportion of vehicles traveling during the peak-hour, expressed as a decimal), D-Factor (directional split factor; the proportion of vehicles traveling in the peak direction during the peak hour, expressed as a decimal), and Design Hour Volume (Highway Capacity Manual, 2000). Additionally, the roadway segment lengths, number of lanes, number of signals, adopted LOS, adopted service volume, and the existing LOS are shown in the table. Hardee, Manatee, and Polk Counties, and FDOT conducted the traffic counts. As shown in Table 3.12-2, all the regionally significant roadways operated at acceptable LOS in 1999.

Historic traffic counts were utilized to determine the growth rates within the transportation impact study area. The growth rates were calculated using the method of least squares. Table 3.12-3 summarizes the annual growth rates (three to five Year Data). Florida Standard Urban Transportation Model Structure (FSUTMS) traffic projections were obtained from FDOT for the year 2020. The FSUTMS model assumed traffic diversions from CR 665 to CR 663. Based on the travel demand model run, the 2020 Peak Season Weekday Average Daily Traffic (PSWADT) data were obtained. The PSWADT data were converted to AADT conditions using the Model Output Conversions Factor of 0.88 for all the roadways except SR 37. For SR 37, the Model Output Conversions Factor was 0.91. The 2020 AADTs were compared to the existing AADTs to obtain the growth rates based on the model data. The FSUTMS growth rates are summarized in Table 3.12-4.

### *3.12.3.12 Airports*

The Wauchula Municipal Airport is the only municipal airport near the Ona site located adjacent to the eastern mine boundary in Sections 14 and 23, Township 34 South, Range 24 East (IMC, 2002; and FAA Miami Sectional Aeronautical Chart, 2001).

Four private airports are located in the study area (FAA, 2001). Frierson Grove Airport is approximately 13 miles south of Ona; Gardner Airport is approximately 12 miles southeast of Ona; Griffins Peace Airport is approximately seven miles southeast of Ona; and Myakka Head Airport is approximately 12 miles southwest of Ona.

### *3.12.3.13 Railroads*

The CSX Transportation, Inc. has a rail line that runs generally north-south and bisects the Ona site on the eastern side intersecting SR 62 and the community of Ona. A rail siding is also located in Ona (IMC, 2002).

### *3.12.3.14 Community Cohesion*

The community of Ona is encompassed in the southeast quadrant of the Ona site. The community is centered at the intersection of SR 62 and CR 663 (Fort Green-Ona Road). Single-family residential development and churches are located primarily in the northeast and southeast quadrants of Ona (Figure 3.12-2). A few commercial buildings occupy the northwest quadrant of the community. The southwest quadrant of Ona is occupied by industrial uses and a few residences are located along Post Plant Road.

### 3.12.4 Public Finance, Tax Base and Revenues

A significant portion of Hardee County's economy is based on agriculture (specifically citrus and cattle), and mining. Revenues for the county include taxes, impact fees, state funds, charges for services, fines and forfeits, transfers and other sources (Florida Statistical Abstract, 2000).

Revenue for Hardee County is similar to the State of Florida (Table 3.12-5). In 1996-1997, Hardee County received approximately ten percent of total county revenue from Federal Grants, charges for services, and fines/forfeits. The remaining 90 percent of revenues were somewhat equally divided between taxes and impact fees, state and other government funds, and other sources and transfers. The percentage breakout for the State of Florida is similar with the exception of service charges and other state or government funds. There the State of Florida receives approximately 29 percent of revenues from charges for services and approximately eight percent from other state or government funds. Table 3.12-6 presents a summary of the Hardee County Property Appraiser's office records for the Ona site. The table shows that the current net appraised value per acre is $127.01, including all structures and other appraised improvements. At the 1999 tax rate of 19.138 mils, the 20,784-acre site produces an ad valorem tax revenue of $50,518.66.

### 3.12.5 Environmental Justice

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* promotes and supports equitable environmental protection to people and communities, regardless of their race, ethnicity, or economic status. Under this EO, federal agencies are to consider the potential impacts of a proposed project on minority and low-income communities. Consistent with this EO, the following demographic and income data has been developed to provide the baseline characterization of the Ona site vicinity (Figure 3.12-3).

At the time, this document was written not all levels of data were available to the public for the 2000 US Census. The available data required for this section includes population, household numbers and average household size for the state of Florida and Hardee County. Only 1990 US Census data were available for the income levels, Census Tracts and Block Groups. Taking this into consideration, and to keep the comparisons from being incomplete or confusing, only 1990 US Census data has been used in the following discussion.

The 1990 US Census provides data to identify the location of both racial minority population concentrations and low-income population concentrations. 1990 data were compiled for Florida, Hardee County, individual Census Tracts, and Block Groups included within, and adjacent to the boundary of the proposed project (Table 3.12-7). Calculations were performed for a Focus Area that included areas within and adjacent to the Ona site. For baseline comparisons, Florida had a 1990 minority population of 29.1 percent, with a 1990 median income of $32,212 for families and $27,483 for households. Within Hardee County, the 1990 minority population component (28.8 percent) was similar to the state's minority population. The county's 1990 median family and household incomes were lower ($24,327 and $22,065, respectively).

#### *3.12.5.1 Population*

The Ona site is located within Census Tract 9703, Block Group 5 and Census Tract 9704, Block Group 5 (Figure 3.12-4). These areas are not densely populated and land use is mostly agricultural. The 1990 estimated percentage of minorities in the immediate project vicinity, as determined by the "Focus Areas" (composed of estimated percentages of the two block groups identified above) was a lower percentage of minorities than average for the county or state. The 1990 Florida minority population was 29.1 percent, while Hardee County's 1990 minority population was 28.8 percent. The 1990 percent minority population of the two census tracts, which comprise the Ona site and adjacent areas, was 31.5 percent. However, the estimated minority population for the Focus Area was approximately 16 percent.

#### *3.12.5.2 Income*

The 1990 Median income levels for the two census tracts were not significantly higher or lower than Hardee County. Hardee County fell below the state median income levels. The estimated average family income for the Focus Area was higher than both census tracts and the county. However, the county, census tract, and block group 1990 median income levels were above poverty thresholds. Even though the 1990 median income levels of the census tracts were relatively low, the Focus Area could be considered slightly above average for the county and the immediate vicinity of the project. Statewide, 1990 family incomes averaged $32,212 while Hardee County averaged $24,327. The 1990 family income for the two census tracts, which comprise the mine site, Ona, and adjacent areas, was $23,997. The 1990 Household income statistics were $27,483 and $22,065 for the state and county respectively. Household incomes for the two census tracts averaged $21,803 and the estimated Focus Area household incomes averaged $21,851.

### 3.12.6 Land Use

The characterization of land use is provided on a regional, local, and site-specific basis. The region is defined as the central Florida Region, which includes Polk, Hardee, Highlands, Okeechobee, and DeSoto Counties. The local area is defined as Hardee County.

The Ona site is located totally within Hardee County, Florida (Figure 3.12-4). Hardee County is situated in the southern portion of the central Florida phosphate region. Population and most of the urban-related economic activity in the region has occurred along the Gulf Coast or along Interstate 4. A number of municipalities, including Plant City, Lakeland, Auburndale, and Winter Haven have developed along the northern periphery of the phosphate region. The central and southern portions of the region are dominated by agricultural land use and silviculture. Residential and commercial development is relatively sparse. The population centers within Hardee County are found along the Peace River Valley and include the municipalities of Bowling Green, Wauchula, and Zolfo Springs (US Census, 2001a).

The Ona site is traversed in a general north-south direction by CR 663 (Fort Green/Ona Road) and by SR 64 running east-west along the southern portion of the Ona site. The proposed Ona site encompasses the community of Ona (Map Supply, 2000).

As discussed previously, the Ona site lies between the IMC Fort Green Southern Reserves property located on the northwest property line; the CF Industries Hardee Phosphate Complex situated along the north property line; and the proposed FHLP/Cargill Hardee County Mine along the south and southeast property line. The IMC Fort Green Mine and the CF Industries mines are currently active. The FHLP/Cargill mine is in the permitting stage. Figure 3.12-5 illustrates the regional location of these parcels and the 20,676 acres that would comprise the Ona Mine.

The purchase of the Ona site includes a requirement for IMC to return up to 17,015 acres to the previous owners upon completion of mining and reclamation (IMC, 2002). The tracts to be conveyed to the previous private owners are illustrated on Figure 3.12-6. In addition, the contractual agreements allow the previous owners to retain control of the surface land use for agricultural activities until IMC needs the land for mining operations.

### *3.12.6.1 Surrounding Land Use*

Existing land use surrounding the Ona site is shown on Figure 3.12-2. Land use generally includes agricultural, mining and silvicultural uses (IMC, 2002). A few residences are scattered along the periphery of the mine and in the community of Ona (Figure 3.12-2). The Wauchula Municipal airport is located adjacent to the eastern Ona site boundary. The airport is located in Sections 14 and 23, Township 34 South, Range 24 East (IMC, 2002).

### *3.12.6.2 Ona Site Specific Land Use*

Much of the Ona site has been used for agricultural or silvicultural purposes throughout its recent history (IMC, 2002). The existing use of the land is primarily agricultural (old row crop areas, citrus, and cattle grazing on improved and unimproved pasture), and these activities would continue until within one or two years of scheduled mining (IMC, 2002).

This EIS does not address the impacts of the agricultural activities that would occur in the interim period, as they would not substantially change from what currently exists. The agricultural activities are expected to continue in accordance with current regulations.

The predominant agricultural use on the site is cattle ranching. The remaining native vegetative cover has been historically used for cattle ranching. Forty percent of the Ona site has been converted into unimproved, improved, or woodland pasture or hay fields to support these cattle ranching operations (IMC, 2002). In addition, more than 100 cattle watering ponds have been dug totaling 20.2 acres to support ranching. The second most prominent existing use is of citrus groves, which occupy 209 acres.

As shown on Figure 3.2-1 in Section 3.2, there are several residential structures on the Ona site that were used by former owners of the property, and approximately 25 acres of private roads that traverse the Ona site (IMC, 2002). However, all of these land uses support the overriding agricultural use.

Note that public rights-of-way for SR 64, and Fort Green-Ona, Albritton, Post Plant, and Vandolah Roads lie adjacent to, but outside the Ona site boundary, as does the community of Ona.

#### *3.12.6.3 Future Land Use*

The Southwest Florida Regional Planning Council (SWFRPC) 2010 Future Land Use Map (Figure 3.12-7) shows the projected land use around the Ona site to be predominately agricultural to the north, east, and west of the site, and agricultural and mining to the south (SWFRPC, 2002). There is also a small amount of commercial land use north of the site. The rural community of Ona within the Ona site is designated as the Rural Center by Hardee County, and is projected to remain that classification (Hardee County, 1992). The future land use in the area is similar to current land use.

## 3.13 AESTHETIC RESOURCES

The Ona site does not contain nor is it adjacent to any outstanding views or designated scenic areas (USDA Forest Service, 2002). The Ona site is surrounded on three sides by properties that IMC, C.F. Industries, Nu-Gulf Industries (in Manatee County), and FHLP/Cargill are mining or propose to mine in the future (Figure 3.12-5).

The Ona site is currently a mixture of pasture, upland and wetland rangeland, and forest as seen from the adjacent roadways and aerial viewpoints. Large, contiguous natural systems are present along the floodplain of Brushy Creek and north of the community of Ona. Views of existing mining facilities include mine development north of SR 64 along the western boundary of the Ona site. The visual aspects of the existing mining facilities are limited to draglines.

The existing topography of the site is generally level and consequently no vistas are enhanced by a change in relief. The most significant water resources in the project area are small streams. The Ona site area does not contain any views along the lakes.

Since the majority of the area is rural, trees dominate the horizon. However, substantial disturbance of native vegetation and invasion by exotic plants has occurred. Also prevalent along SR 64 and CR 663 are electric transmission lines, which exceed 100 feet in height above ground level.

Potential viewers of the Ona Mine are those within the Ona community and those who use the existing highways with a view of the Ona Mine from the roadways. These potential viewers include commuters traveling along SR 64 and CR 663 and a few tourists traveling along SR 64.

## 3.14 RECREATIONAL RESOURCES

There are no regionally significant parks, green ways, preserves, or conservation lands located on or adjacent to the Ona site (IMC, 2002). IMC has a documented history record of donating reclaimed lands in Polk and Hardee Counties that have, or may, become key components of the county park systems.

With the exception of the Horse Creek flood plain, no part of the Ona site has been identified as high priority areas of interest for acquisition (IMC, 2002). Portions of the Ona site fall within the Florida Greenways, the Nature Conservancy Area of Conservation Interest, FDEP, Integrated Habitat Network, and FFWCC, Strategic Habitat Conservation Areas; but these designations do not necessarily translate into Conservation and Recreation Lands, Florida Forever, or Save Our Rivers acquisition priority (IMC, 2002).

## 3.15 HISTORIC PROPERTIES

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to assess the possible effects of their undertakings on historic properties, and to establish a process of consultation with representatives of Native American Tribes, and with the SHPO at the Florida Department of State, Division of Historic Resources (DHR). Consultation with representatives of the Seminole and Miccosukee Tribes has been initiated. While consultation with the Florida SHPO had been previously initiated, this EIS document serves as the formal Section 106 consultation for the Proposed Action.

The Proposed Action and its alternatives could affect historic properties. Historic properties assessed as part of this EIS include pre-historic and historic archaeological sites and historic structures.

The Area of Potential Effect (APE) is defined as the geographic area within which an action may cause a change in the character or use of historic properties, if such properties exist (Advisory Council on Historic Preservation, 1986). For purposes of this EIS, the APE is the Ona site for archaeological resources, and the site and its visually accessible surroundings for historic structures (Figure 3.15-1).

### 3.15.1 Surveys Conducted

The entire Ona site has been surveyed and all but one archaeological site has been determined by the SHPO to not be eligible for listing in the National Register of Historic Places (NRHP) (see letters in Appendix C. An overview of the surveys conducted is presented below:

1. The original survey of the MCC tract documented by the report of Milanich, Marrinan & Martinez (MMM) dated December 10, 1975. The SHPO letter dated February 11, 1981, concluded that only site 8Hr5 (location shown on Figure 3.15-1) was potentially eligible for listing in the NRHP.
2. Site 8HR5 was excavated by Piper Archaeological Research [PAR], as described in their report dated July 1982. This report concluded that site 8HR5 had been mitigated and that no further protection of the site was required. The SHPO concurred with this conclusion in their letter dated May 15, 2000 (Appendix C).
3. The northwest area of the Ona site that was not studied by MMM (1975), was surveyed and described in the Southeastern Archaeological Research Inc. (SAR) report dated August 1999. This study found three historic structures and 23 archaeological sites, none of which were determined to be eligible for listing in the NRHP. The letter from the SHPO confirming the findings is dated October 26, 1999.
4. In the area surveyed by the above referenced 1999 study, there were two out-parcels that IMC subsequently obtained agreements with the land owner to include in the application. These two parcels were surveyed by SAR and described in the report dated October 1999. The report concluded that these two parcels did not contain any sites that were eligible for listing in the NRHP. The letter from the SHPO confirming the findings is dated December 17, 1999.
5. In the detailed review of the original MCC study, it was noted that there were several small parcels scattered around the Ona site that had not been surveyed. These parcels were surveyed by SAR and described in a report dated March 2000. Two new sites were found, neither of which were considered eligible for listing in the NRHP. The letter from the SHPO confirming the findings was received in June 2000.
6. A re-survey of the MCC tract was conducted by Janus Research in November-December of 2000. IMC's voluntary re-survey revealed 22 newly recorded

archaeological resources, plus one previously recorded resource (8HR6). Only one site (8HR779) was considered potentially eligible for listing in the NRHP (see Figure 3.15-1). In their letter dated March 14, 2001, the SHPO concurred with Janus' conclusion that additional research be conducted at this site (see Appendix C). IMC proposes to conduct Phase II testing to determine the eligibility of site 8HR779. If the site were determined eligible, IMC would proceed with data recovery from this site to mitigate any impact and obtain release from the SHPO.

The historic structures survey identified eight previously unrecorded resources. The SHPO concurred that none of these resources are considered significant (letter dated March 14, 2001, Appendix C).

Two cemeteries were reported to be in the re-survey area. Neither of the cemeteries could be confirmed or denied. No further work is recommended for either of the cemeteries. IMC would follow the recommendation of the re-survey report to implement a notification policy for all work in the area where the cemeteries were reported to be. IMC would also note the potential location on the mine plans and be vigilant to observe for any possible remains while conducting the earth moving in these two areas.

The recommendation of this survey was sent to SHPO on February 5, 2001. Response from the SHPO confirmed the report's recommendation.

### 3.15.2 Conclusions and Recommendations

Figure 3.15-1 shows the areas studied by the various investigators, the locations where specific investigative methodologies were employed, and on behalf of IMC or any sites that were identified. More detailed site locations are not provided in order to protect the resource from unauthorized excavation. Sites that were identified, but determined to not be eligible for listing in the NRHP, are shown for information purposes.

The SHPO has concurred that none of the historic structures identified on the site are eligible for listing on the NRHP. Therefore, no additional research is required (see SHPO letters in Appendix C).

Although several archaeological sites were identified during the conduct of numerous surveys, only two of these sites were considered eligible for listing in the NRHP. Site 8HR5 is an aboriginal site (8Hr5) that has been scientifically mitigated (i.e., excavated) to the satisfaction of the SHPO (letter dated May 15, 2000, Appendix C) (PAR, 1982).

Site (8hr779) was identified and considered potentially eligible for listing in the NRHP (SAR, 1999). The SHPO concurred in their letter dated March 14, 2001, and therefore additional research is required for this site. IMC would conduct Phase II testing to determine the eligibility of site 8HR779 for listing in the NRHP. If the site were determined eligible, IMC would proceed with data recovery from this site to mitigate any impact and to obtain release from the SHPO. These activities and coordination under Section 106 of the NHPA would be completed prior to conducting any ground-disturbing activities in the area (IMC, 2002).

In the event that previously unidentified historic properties or human remains are found during earth disturbing activities, IMC would follow procedures established in their notification policy (IMC, 2002).