# United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
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January 29, 2007

Colonel Paul L. Grosskruger
District Engineer
U.S. Army Corps of Engineers
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| Service Federal Activity Code: | 41420-2007-FA-0783 |
| Service Consultation Code: | 41420-2007-F-0292 |
| Corps Application No.: | SAJ-1995-5082 (IP-MGH) |
| Date Received: | October 16, 2006 |
| Date of Reinitiation of Formal Consultation: | October 16, 2006 |
| Project: | Davenport Sand Mine |
| Applicant: | Rinker Materials of Florida, Incorporated. |
| County: | Polk |

Dear Colonel Paul L. Grosskruger:

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion (BO) based on our review of the Davenport Sand Mine Project submitted by Rinker Materials of Florida, Inc. located in Polk County Florida and its effects on the sand skink (*Neoseps reynoldsi*), bluetail mole skink (*Eumeces egregius lividus*), and two listed plant species, papery whitlow-wort (*Paranychia chartacea*) and scrub plum (*Prunus geniculata*) in accordance with Section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

This BO is based on information received from the consultant for this project, Biological Research Associates (BRA), Florida Fish and Wildlife Conservation Commission (FWC), the U.S. Army Corps of Engineers (Corps), and the Service. A complete administrative record of this consultation is located at the Service's South Florida Ecological Services Office in Vero Beach, Florida.

CONSULTATION HISTORY

On November 7, 1996, Service staff conducted a field review of the site with the applicant (Standard Sand and Silica Company) and the consultant at the time (Southeastern Environmental Services), but no sand skinks or other listed species were detected. Subsequently, the Corps issued Permit No. 1995-05082 (IP-TA) for the project, and Rinker Materials of Florida, Inc. purchased the property.

On July 19, 2005, Service staff met with representatives of Rinker Materials of Florida, Inc, their environmental consultant and legal counsel (Broad and Cassel) to discuss the project. At the meeting, the Service learned recent field reviews by BRA had detected sand skinks on portions of the future land mine lands. The applicant proposed to avoid impacts to some occupied habitat and to implement certain conservation measures as part of the proposed action, including the preservation of off-site habitat and funding long-term research to benefit the conservation of sand skinks.

On July 26, 2005, the Service received an e-mail from BRA that summarized the relationship of the proposed research program to the minimization requirements of the Act.

On August 12, 2005, the Service responded, indicating the research would assist the agency in understanding how to best avoid and offset impacts to the species and their habitats and would serve as a positive compliment to the habitat protection proposed.

On November 11, 2005, BRA submitted to the Corps, a Biological Assessment report, requesting that the Corps reinitiate formal consultation for the sand skink, bluetail mole skink, papery whitlow-wort and scrub plum.

On November 23, 2005, BRA forwarded copies of the Research Proposed to Benefit the Conservation of Sand Skinks to the Corps and the Service, which had been inadvertently omitted from the original package.

On March 6, 2006, the Corps sent a letter to the Service requesting formal consultation for the sand skink, bluetail mole skink, papery whitlow-wort and scrub plum. The Corps also determined the project "may affect, but is not likely to adversely affect" the Florida scrub-jay and the eastern indigo snake.

On June 1, 2006, the Service responded to the Corps' March 6, 2006, letter requesting clarification of the compensation and minimization measures proposed by the applicant. By the same correspondence, the Service concurred with Corps' "may affect but not likely to adversely affect" determination for the eastern indigo snake.

On June 14, 2006, Service staff met with representatives of BRA and Broad and Cassel to discuss the proposed compensation and minimization measures.

On July 12, 2006, BRA provided a formal response to the Service's June 1, 2006 letter.

On November 22, 2006, BRA provided additional information needed to evaluate this project.

## BIOLOGICAL OPINION

### DESCRIPTION OF THE PROPOSED ACTION

The Corps issued permit 1995-5082 to the applicant, Rinker Materials of Florida, Inc. ("Rinker"), authorizing the mining of 164 acres of wetlands to an average depth of 50 feet below

ground level via hydraulic dredging methods. A total of 11 million cubic yards of material will be excavated if all designated wetlands are mined. The project is located on Highway 17 and 92 North in Sections 15, 16, 22, 23, 24, 25, 26, 27, 34, 35, and 36, Township 26 South, Range 27 East, Polk County, Florida (Figure 1).

The permit expires on December 31, 2002. However, Special Condition 1 states "the permit duration is for the life of the mine, but the permittee is required to submit a mine plan every 5 years to the regulatory division for review". Special condition 2 states, "the 5-year mine plan should include the areas to be mined and the mitigation areas to be created during the 5-year period. Review of the mine plan will include, but not limited to, a reevaluation of site conditions and agency coordination. Upon approval of each mine plan, the construction window will be extended an additional 5 years". On February 14, 2001, the permittee provided the second 5-year plan for mining activities at the project site. The permit has been administratively extended until December 31, 2007.

The Davenport Sand Mine produces sand primarily for construction aggregate and clean fill material. The process of obtaining the sand includes the removal and stockpiling of vegetative cover, topsoil, and overburden used in the reclamation process. The sand in then transported by electric dredge pumps to the washer classification plant where it is scalped of debris and classified according to the desired product size range.

Recently, the environmental consultant for this project inspected the proposed future mine area for gopher tortoises and confirmed that sand skinks and likely the bluetail mole skink were present in the eastern portions of the property. The environmental consultant for this project provided a submittal to the Corps on February 23, 2006, stating that the federally threatened sand skink and bluetail mole skink are present on 464.9 acres of habitat proposed for mining. The agent also stated that two federally listed plant species, papery whitlow-wort (*Paranychia chartacea*) and the scrub-palm (*Prunus geniculata*) are also present on-site.

To minimize impacts to federally listed species the applicant proposes the following conservation measures:

1. Not mining ±102.9 acres of disturbed sandhill on the Davenport Sand Mine that is occupied sand skink habitat, which also may support the bluetail mole skink, eastern indigo snake, papery whitlow-wort and scrub plum.

2. The applicant will survey the areas slated for mining for listed plant species. Individual listed plants will be translocated to an area within 102.9-acre on-site preserve that best meets the ecological characteristics of these plants at their initial location.

3. Placing 173.2-acre parcel of skink habitat under conservation easement or such other similar instrument consistent with the requirements of Section 704.06, Florida Statute in perpetuity, and held by the FWC. The applicant has agreed to provide the Corps and the Service with proof of this transaction within 120 days of issuance of the permit;

4. No development or motorized vehicle use (except for land management and limited hunting) will be allowed on the site;

5. Signs will be erected around the 173.2-acre preservation area, identifying the site as a preserve area and indicating entry is restricted;

6. The applicant will prevent vegetation on the site from becoming overgrown and maintain patches of open, bare sand in the area. The vegetation management plan includes prescribed burns as well as mechanical, manual, and chemical maintenance, as necessary;

7. The site will be maintained free of exotic vegetation by prescribed burning, mechanical, manual, or chemical maintenance; and

8. The applicant will conduct annual monitoring of the vegetation and skinks on and adjacent to the site to assess the success of the on-going management and modify management where needed.

In addition, Rinker in association with Walt Disney World has agreed to fund long-term research to benefit the conservation of listed skinks. Details on these research projects can be found in Appendix 1. This research effort is designed to address a number of species-level and habitat-level recovery actions proposed by the Service (1999) through five independent but related projects:

1. Develop science-based, standardized survey techniques to determine presence/absence and density of sand skinks.

2. Use existing scrub sites at Archbold Biological Station to establish a relationship between burn history and abundance of the sand skink.

3. What are the potential consequences of habitat fragmentation on sand skink metapopulation dynamics?

4. Estimate the current geographic distribution and total population size of sand skinks on public and privately owned conservation lands.

5. Experimental translocation of sand skinks.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The project will result in the construction of a sand mine to support the local construction industry, particularly cinder block and sand for construction aggregate. The presence of the development may result in a variety of indirect and cumulative effects in the project area. The project will provide construction materials to supply further residential and commercial development in the project area and

increase the loss of skink habitat outside of the project area. Consequently, existing sand skink habitat in the project area is threatened by development. However, the extent of the project's effects to surrounding lands is difficult to discern. Therefore, the Service has established an action area for this project that includes the project site and all lands within 5 miles of the project site located in Polk County and the Disney Sand Skink recipient site in Orange County, Florida. The Service believes an action area of this size is sufficiently large enough to capture the majority of indirect and cumulative effects resulting from this project.

## STATUS OF THE SPECIES AND CRITICAL HABITAT RANGE-WIDE

Use of Best Scientific and Commercial Information by the Service

The Service will use the most current and up-to-date scientific and commercial information available. The nature of the scientific process dictates that information is constantly changing and improving as new studies are completed. The scientific method is an iterative process that builds on previous information. As the Service becomes aware of new information, we will ensure it is fully considered in our decisions, evaluations, reviews, and analyses as it relates to the base of scientific knowledge and any publications cited in our documents.

South Florida Multi-Species Recovery Plan (MSRP)

The MSRP (Service 1999) was designed to be a living document and it was designed to be flexible to accommodate the change identified through ongoing and planned research and would be compatible with adaptive management strategies. These principals are set forth in both the transmittal letter from the Secretary of the Interior and in the document itself. As predicted, this is what indeed occurred in the intervening years since the MSRP was published. The Service uses the MSRP in the context it still presents useful information when taken in conjunction with all the new scientific information developed subsequent to its publication.

Species/Critical Habitat Description

Sand Skink

The sand skink is a small, fossorial lizard that occurs on the sandy ridges of interior central Florida from Marion County south to Highlands County. The extant range of the sand skink includes Highlands, Lake, Marion, Orange, Osceola, and Polk Putnam Counties (Christman 1988). Principal populations occur on the Lake Wales (LWR) and Winter Haven Ridges (WHR) in Highlands, Lake, and Polk Counties (Christman 1992a; Mushinsky and McCoy 1991; P. Moler, FWC, personal communication 1998). The sand skink is uncommon on the Mount Dora Ridge (MDR), including sites within the Ocala National Forest (Christman 1970, 1992a). According to the Florida Natural Areas Inventory (FNAI) database updated as of September 2006, there were 132 locality records for the sand skink, including 115 localities on the LWR, four on the WHR and seven on the MDR. FNAI also reports four localities for this species west of the MDR in Lake County and two localities between the LWR and the Lake Hendry Ridge. The modification and destruction of xeric upland communities in central Florida were a primary consideration in listing the sand skink as threatened under the Act in 1987 (52 FR 42662). No critical habitat has been designated for the sand skink.

Recent morphological (Griffith et al. 2000) and molecular studies (Schmitz et al. 2004, Brandley et al. 2005) have demonstrated that the scincid lizard genus *Eumeces,* Weigmann (1834) is paraphyletic and that *Plestiodon,* Dumeril and Bibron (1839) has nomenclatural priority for the American species formally referred to as *Eumeces*, except for those now placed in the genus *Mesoscincus* (Smith 2005). Molecular analysis of ribosomal RNA gene sequences also show that "*Eumeces*" *egreguis* and *Neoseps reynoldsi* are closely related sister species (Schmitz et al. 2004, Brandley et al. 2005). Schmitz et al. (2004) suggested that the amount of genetic differentiation between the two species (5%) is similar to other species of North American skinks and that *Neoseps,* Stejneger (1910) should be synonomised. They argue that sand skinks are a striking example of morphological adaptation for burrowing, where the rate of morpho-ecological change exceeds phylogenetic change.

The sand skink is believed to have evolved on the central LWR and radiated from there (Branch et al. 2003). Analysis of mitochronial DNA (mt DNA) indicates that populations of the sand skink are highly structured with most of the genetic variation partitioned among four lineages: three subpopulations on the LWR characterized by high haplotype diversity and a single, unique haplotype detected only on the MDR (Branch et al. 2003). Under the conventional molecular clock, the 4.5% divergence in sand skinks between these two ridges would represent about a 2-million-year separation; the absence of haplotype diversity on the MDR would suggest that this population was founded by only a few individuals or severely reduced by genetic drift of a small population (Branch et al. 2003).

The sand skink reaches a maximum length of about 5 inches. The tail makes up about half the total body length. The body is shiny and usually gray to grayish-white in color, although the body color may occasionally be light tan. Hatchlings have a wide black band located along each side from the tip of the tail to the snout. This band is reduced in adults and may only occur from the eye to snout on some individuals (Telford 1959). Sand skinks contain a variety of morphological adaptations for a fossorial lifestyle. The legs are vestigial and practically nonfunctional, the eyes are greatly reduced, the external ear openings are reduced or absent (Greer 2002), the snout is wedge-shaped, and the lower jaw is countersunk.

The sand skink is widespread in native xeric uplands with excessively well-drained soils (Service 2002), principally on the ridges listed above at elevations greater than 25 m above mean sea level. Various authors have attempted to characterize optimal sand skink habitat (Telford 1959, Campbell and Christman 1982, Christman 1978, 1992, Service 1993), but McCoy et al. (1999) have argued these notions are "educated guesswork" (Bergman et al. 1993) with little empirical basis. Commonly occupied native habitats include Florida scrub variously described as sand pine scrub, xeric oak scrub, rosemary scrub and scrubby flatwoods, as well as high pine communities that include sandhill, longleaf pine/turkey oak, turkey oak barrens and xeric hammock (see habitat descriptions in Myers 1990 and Service 1999). Coverboard transects extended from scrub or high pine (sandhill) through scrubby flatwoods to pine flatwoods revealed that sand skinks left more tracks in scrub than the other three habitats and did not penetrate further than 40 m into scrubby flatwoods or 20 m into pine flatwoods (Sutton et al. 1999).

McCoy et al. (1999) used trap-out enclosures to measure sand skink densities at seven scrub sites and attempted to rank each area individually based on eight visual characteristics used in the literature (Telford 1959, 1962; Christman 1992; Service 1993) to identify good habitat: root-free, grass-free, patchy bare areas, bare areas with lichens, bare areas with litter, scattered scrubs, open canopy and sunny exposure. None of the individual literature descriptions of optimal habitat (or any combination thereof) accurately predicted the rank order of actual sand skink abundance at these sites, which ranged in density from 125 individuals/ha to 650/ha (Sutton 1996). However, knowledgeable researchers ("experts"), especially as a group, appear to be able to visually sort out the environmental variables important to sand skinks, but had difficulty translating their perceptions into a set of rules that others could use to identify optimal sand skink habitat (McCoy et al. 1999).

Collazos (1998), Hill (1999) and Mushinsky et al. (2001) used grids of pitfall traps and coverboards to quantify the relationship between sand skink density and a suite of environmental variables. These authors found that sand skink relative density was positively correlated with low canopy cover, percent bare ground, amount of loose sand and large sand particle size, but negatively correlated with understory vegetation height, litter cover, small sand particle size, soil moisture, soil temperature and soil composition. In an unburned sandhill site at ABS, Meshaka and Lane (2002) captured significantly more sand skinks in pitfall traps set in openings without shrubs than at sites with moderate to heavy shrub density. Telford (1959) suggested scattered debris and litter provided moisture that was important to support an abundant food supply and nesting sites for sand skinks. Cooper (1953) noted the species was most commonly collected under rotting logs, and Christman (1992a) suggested they nest in these locations.

The trap-out enclosure surveys of Sutton et al. (1999) and Christman (2005) provide evidence hot fires may negatively affect sand skink densities and the species continues to occupy scrub with a closed canopy and thick humus layer, although at lower densities. Also, recent coverboard surveys conducted by permit applicants have shown sand skinks may occupy both actively managed lands such as citrus groves and pine plantations and old field communities (Service files), particularly if these sites are adjacent to patches of native habitat that can serve as a source population for recolonization.

Bluetail mole skink

The bluetail mole skink (*Eumeces egregius*) is a small, fossorial lizard that occupies xeric upland habitats of Florida, Alabama and Georgia (Mount 1963). Five subspecies have been described (Mount 1965), but only the bluetail mole skink (*Eumeces egregius lividus*) is federally listed. It requires open, sandy patches interspersed with sclerophyllous vegetation (Service 1999). The historic and anticipated future modification and destruction of xeric upland communities in central Florida were primary considerations in listing the bluetail mole skink as threatened under the Act in 1987 (52 FR 42662). No critical habitat has been designated for the bluetail mole skink.

Mount (1965) described *Eumeces egregius lividus* largely on the basis of a bright blue tail in juveniles and restricted this subspecies to the southern LWR in Polk and Highlands Counties.

Christman (1978) limited the range of bluetail mole skinks to these two counties, but later added Osceola County to the range, based on the collection of a single bluetailed juvenile just north of the Polk County line on the LWR (Christman 1992, FNAI records). Analysis of mytocondrial DNA (Branch et al. 2003) supports Mount's (1965) hypotheses that bluetail mole skinks from the lower LWR represents the ancestral stock with radiation from there. Genetic analysis also indicates high population structure with limited dispersal in mole skinks among sandy habitats (Branch et al. 2003). Based on conventional estimates of molecular evolutionary clocks, these authors suggest a separation of approximately 4 million years between mole skinks occurring on the two oldest ridges (LWR and MDR), which overlaps the proposed Pliocene origin of scrub habitats (Webb 1990).

The bluetail mole skink reaches a maximum length of about 5 inches, and the tail makes up about half the body length. The body is shiny, and brownish to pink in color, with lighter paired dorsolateral stripes diverging posteriorly (Christman 1978b). Males develop a colorful orange pattern on the sides of the body during breeding season. Juveniles usually have a blue tail (Christman 1992b; P. Moler, FWC, personal communication 1998). Regenerated tails and the tails of older individuals are typically pinkish. The legs are somewhat reduced in size and used only for surface locomotion and not for "swimming" through the sand (Christman 1992b).

A variety of xeric upland communities provide habitat for the bluetail mole skink, including rosemary and oak-dominated scrub, turkey oak barrens, high pine, and xeric hammocks. Areas with few plant roots, open canopies, scattered shrub vegetation, and patches of bare, loose sand provide optimal habitats (Christman 1988, 1992b). Within these habitat types, bluetail mole skinks are typically found under leaves, logs, palmetto fronds, and other ground debris. Shaded areas presumably provide suitable microhabitat conditions for thermoregulation, egg incubation, and foraging (Mount 1963). Bluetail mole skinks tend to be clumped in distribution with variable densities that may approach 25 adults per acre (Christman 1992b). The distribution of bluetail mole skinks appears to be closely linked to the distribution of surface litter and, in turn, suitable microhabitat sites.

Life History

Sand skink

The sand skink is highly adapted for life in the sand. It spends the majority of its time below the surface where it burrows through loose sand in search of food, shelter, and mates. Sand skinks feed on a variety of hard and soft-bodied arthropods that occur below the ground surface. The diet consists largely of beetle larvae and termites (*Prorhinotermes* spp.). Spiders, larval ant lions, lepidopteran larvae, roaches and adult beetles are also eaten (Myers and Telford 1965, Smith 1982).

Sand skinks are most active during the morning and evening in spring and at mid-day in winter, the times when body temperatures can easily be maintained between 28°C-31°C in open sand (Andrews 1994). During the hottest parts of the day, sand skinks move under shrubs to maintain their preferred body temperatures (Andrews 1994) in order to remain active near the surface.

With respect to season, Telford (1959) reported skinks most active from early March through early May, whereas Sutton (1996) found skinks most active from mid-February to late April. Based on monthly sampling of pitfall traps, Ashton and Telford (2006) found that captures peaked in March at Archbold Biological Station (ABS), but in May at Ocala National Forest. All of these authors suggested the spring activity peak was associated with mating. At ABS, Ashton and Telford (2006) noted a secondary peak in August that corresponded with the emergence of hatchling sand skinks. Sand skinks lay two eggs typically in May or early June (Ashton 2005) under logs or debris, approximately 55 days after mating (Telford 1959). The eggs hatch from June through July. Sand skinks first reproduce at 2 years of age and females produce a single clutch in a season, although some individuals reproduce biennially or less frequently (Ashton 2005). Sand skinks can live at least to 10 years of age (Meneken et al. 2005). Most sand skinks move less than 40 m between captures, but some move over 140m in 2 weeks (Mushinsky et al. 2001). Limited dispersal ability has been suggested to explain the relatively high degree of genetic structure within and among sand skink populations (Branch et al. 2003, Reid et al. 2004).

Bluetail mole skink

Bluetail mole skinks are typically found under leaves, logs, palmetto fronds, and other ground debris in a variety of xeric upland communities, including rosemary and oak-dominated scrub, turkey oak barrens, high pine, and xeric hammocks. Foraging activities of the bluetail mole skink are primarily at the soil surface or at shallow depths to 2 inches (Service 1993), usually during the morning or evening. Roaches, crickets, and spiders make up the bulk of the diet (Mount 1963). Their diet is more generalized than that of the fossorial sand skink, which probably reflects their tendency to feed at the surface (Smith 1982). Like sand skinks, mole skinks show an activity peak in spring (Mount 1963, Smith 1982). The reproductive biology of the bluetail mole skink is poorly known. Reproduction is presumably very much like that of the peninsula mole skink, *E.e.onocrepis*, where mating occurs in the fall or winter. In the peninsula mole skink, two to nine eggs are laid in a shallow nest cavity less than 12 inches below the surface. The eggs incubate for 31 to 51 days, during which time the female tends the nest. Individuals probably become reproductively active at 1 year of age (Mount 1963, Christman 1978a).

Population Dynamics

The Service has little information on the population dynamics of sand and bluetail mole skinks within their extant ranges. The skinks' diminutive size and secretive habits make their study difficult. As noted above, sand skinks can reach densities of up to 650 individuals/ha (263/ac) in high quality habitat, particularly on the LWR. Delayed maturity (2 years), a small clutch size (2 eggs) of relatively large eggs, low frequency of reproduction and a long lifespan in sand skinks are life-history traits that also characterize a number of other fossorial lizards that occur in high densities (Ashton 2005). Such character traits may reflect high intra-specific competition and/or predation (Ashton 2005). In contrast, bluetail mole skinks often seem absent or rare on the same LWR study sites where sand skinks are common, and when present, are patchily distributed (Christman 1988, 1992b; Mushinsky and McCoy 1995). Mount (1963) noted peninsula mole skinks also are patchily distributed and mostly occurred on xeric sites greater

than 100 ac (40 ha) in size. Early maturity (1 year in laboratory) and a large clutch size (maximum = 9 eggs) of relatively small eggs (Mount 1963) suggest that the population dynamics of mole skinks are different from sand skinks.

Status and Distribution

Sand skink

*Reason for listing*

The modification and destruction of xeric upland communities in central Florida were a primary consideration in listing the sand skink as threatened under the Act in 1987 (52 FR 42662). By some estimates, as much as 90 percent of the scrub ecosystem has already been lost to residential development and conversion to agriculture, primarily citrus groves (Florida Department of Natural Resources 1991, Kautz 1993). Xeric uplands remaining on private lands are especially vulnerable to destruction because of increasing residential and agricultural pressures.

*Range-wide trends*

Except for a few locations where intensive research has been conducted, limited information about the presence or abundance of sand skinks exists. An extensive 1992 survey in Ocala National Forest (ONF) failed to capture any sand skinks despite placement of traps near historical locations and the capture of a number of other fossorial reptiles. Telford (1992) cited the ephemeral nature of early successional scrub habitats due to dynamic successional changes as an important confounding factor in the evaluation of the sand skink's present status in the Ocala National Forest. However, 24 sand skinks were collected later from ONF for genetic analysis (Branch et al. 2003) and population studies (Ashton and Telford 2006). Additional studies have provided presence/absence information that has been used to determine the extant range of the species (Mushinsky and McCoy 1991, Stout and Corey 1995). However, few long-term monitoring efforts have been undertaken to evaluate the status or trends of sand skinks at these or other sites.

At the time of Federal listing in 1987, FNAI had recorded 31 known sites for the sand skink. By September 2006, 132 localities were known by FNAI. This increase is largely the result of more intensive sampling of scrub habitats in recent years and does not imply that this species is more widespread than originally thought. Of the known locations, 50 (38 percent) occur on public lands or private lands placed under conservation easement, and offer habitat protection. It is likely that continued residential and agricultural development of xeric upland habitat in central Florida has destroyed or degraded habitat containing sand skinks. Approximately 60 to 90 percent of xeric upland communities historically used by sand skinks on the LWR are estimated to have been lost due to development (Christman 1988, Christman and Judd 1990, Kautz 1993, Center for Plant Conservation 1995). More recently, Turner et al. (2006) calculated 12.9 percent of this habitat remains.

Protection of the sand skink from further habitat loss and degradation provides the most important means of ensuring its continued existence. Existing protection of occupied skink habitat consists primarily of private preserves such as Archbold Biological Station, Hendry Ranch, Tiger Creek Preserve, and Saddle Blanket Lakes Scrub Preserve, coupled with publicly owned lands such as Lake Arbuckle State Park and State Forest, Lake Louisa State Park, and Highlands Hammock State Park (Service 1993). Current efforts to expand the system of protected xeric upland communities on the LWR, coupled with implementation of effective land management practices, represent the most likely opportunity for assuring the sand skink's survival (Turner et al. 2006).

It is likely a substantial sand skink population is present on existing private and public conservation lands on the LWR. As of 2003, about 21,597 acres (8,740 ha) of Florida scrub and high pine on the LWR have been protected, which represents almost half of the remaining xeric habitat on this ancient ridge, but only 6.3% of its estimated historic extent (Turner et al. 2006). Sand skinks are present on sites that total 87.4% of the currently protected xeric acreage (Turner et al. 2006), but many of the other conserved sites have not been surveyed adequately. Fourteen trap-out enclosures at seven protected sites with a known burn history on the LWR in Polk and Highlands Counties contained a minimum of 85 sand skinks for a mean density of 152 individuals/ha (61/ac) and one enclosure set in dry flatwoods yielded none (Christman 2005). Fourteen of these sites had burned in the last eight years and the one "rosemary bald" that has not burned for 37 years had 275 sand skinks/ha (110/ac). Five similar enclosures set on unburned xeric sites in Orange and Osceola Counties averaged 385 sand skinks/ha (155/ac) (Sutton 1996). K. Ashton (Personal communication, 2006) sampled skinks with pitfall traps on 12 rosemary scrub sites in Highlands County. Sand skinks were significantly less common in recently burned rosemary scrub, with abundance increasing with time since last fire. Fewer bluetail mole skinks were captured by K. Ashton, but the relationship was similar. Meshaka and Lane (2002) found that both species persisted on a sandhill at ABS that remained unburned for 67 years (1927-1994). The relative abundance of sand skinks decreased over time, but bluetail mole skinks did not.

Recovery of the sand skink also may require rehabilitation of suitable but unoccupied habitat or restoration of potentially suitable habitat. Because sand skinks do not readily disperse, introductions into restored or created unoccupied habitat may be necessary. Sand skinks relocated to two former citrus groves in Orange County have persisted for at least 5 years (Hill 1999, Mushinsky et al. 2001).

Bluetail Mole Skink

*Reason for listing*

The historic and anticipated future modification and destruction of xeric upland communities in central Florida were primary considerations in listing the bluetail mole skink as threatened under the Act in 1987 (52 FR 42662). As stated previously, almost 90 percent of the xeric upland communities on the LWR have already been lost because of habitat destruction and degradation due to residential development and conversion to agriculture, primarily citrus groves (Turner

et al. 2006). Remaining xeric habitat on private lands is especially vulnerable because projections of future human population growth suggest additional demands for residential development within the range of the bluetail mole skink. Campbell and Christman (1982) characterized bluetail mole skinks as colonizers of a patchy, early successional, or disturbed habitat type, which occurs throughout the sandhill, sand pine scrub, and xeric hammock vegetative associations as a result of biological or catastrophic factors. Susceptibility of mature sand pine to windthrow may be an important factor in maintaining bare, sandy microhabitats required by bluetail mole skinks and other scrub endemics (Myers 1990).

*Range-wide trends*

At the time of Federal listing, there were 20 locality records for the bluetail mole skink. Currently, 43 sites are known. The increase in locality records is largely the result of more intensive sampling of scrub habitats in recent years and does not imply that this species is more widespread than originally supposed. Of the known locations, only 13 occur on public land or on private land protected under conservation easement. It is likely continued residential and agricultural development of xeric upland habitat in central Florida has destroyed or degraded extensive tracts of habitat containing the bluetail mole skink. Estimates of habitat loss range from 60 to 90 percent, depending on the xeric community type (Christman 1988, Christman and Judd 1990, Kautz 1993, Center for Plant Conservation 1995).

Bluetail mole skinks are known to be present on sites which total 52.4% of the 21,597 acres (8,740 ha) of Florida scrub and high pine that currently is protected (Turner et al. 2006). However, the extent of potential habitat that is actually occupied is unknown, as is their total population size. As noted above, this species appears to be patchily distributed, even in occupied habitat (Mount 1963, Christman 1992b). Unlike sand skinks, their tracks cannot be easily detected in the sand, and most of the extant scrub sites on the LWR have not been adequately surveyed for bluetail mole skinks, including protected sites.

A range-wide survey of the bluetail mole skink was conducted in 2004-2005 at the study sites listed above by Christman (2005). Only two bluetail mole skinks were observed in the enclosures (mean density = 3.3/ha, 1.3/ac) relative to at least 85 sand skinks (ratio = 1:41). However, the enclosure sample size was small (total area = 0.6 ha, 0.24 ac). Christman (1992) suggested that only one bluetail mole skink is encountered for every 20 sand skinks. Other range-wide pitfall trap data on the LWR revealed a bluetail mole skink to sand skink ratio of 1:1.89 based on 54 total skinks captured in six trap arrays (Christman 1988), 1:4.3 based on 332 total skinks in 58 trap arrays (Mushinsky and McCoy 1991) and 1:2.7 based on 49 total skinks in 31,640 pitfall trap-days (Meshaka and Lane 2002). Mushinsky and McCoy (1991) confirmed that detection rates for bluetail mole skinks increased with sampling effort.

The protection and recovery of bluetail mole skinks will require that habitat loss be stopped and that unoccupied but potentially suitable habitat be restored. The existing protection of the bluetail mole skink includes a number of private and public preserves within the LWR. Current efforts to expand the system of protected xeric upland habitats on the LWR, in concert with implementation of aggressive land management practices, represent the most likely opportunity

for securing the future of this species. Comprehensive land acquisitions that protect areas occupied by the bluetail mole skink include the Service's Lake Wales Ridge National Wildlife Refuge, and the State of Florida's Conservation and Recreation Lands (CARL) Lake Wales Ridge Ecosystem Project (Service 1993).

Papery whitlow-wort

The following discussion is summarized from the MSRP (Service 1999), as well as from recent research publications and monitoring reports. A complete papery whitlow-wort-tree life history discussion may be found in the MSRP. No critical habitat has been designated for the papery whitlow-wort.

**Description** – Papery whitlow-wort is a small mat-forming herb with many bright yellowish-green branches radiating flatly from a taproot (Kral 1983, Small 1933). The stems are 5 to 20 cm (2-8 inches) long and are wiry. The leaf blades are sessile, 1.5 to 3.0 mm (0.06-0.12 inch) long, ovate to triangular-ovate in shape, and strongly revolute. The plant has numerous small cream-colored to greenish flowers (Small 1933, Service 1996) that produce a very thin-walled one-seeded dry fruit that remains intact, functioning as a seed (Kral 1983).

This species consists of two geographically isolated subspecies, with papery whitlow-wort (*Paronychia chartacea* ssp. *chartacea*) in the Florida peninsula (Anderson 1991) and the similar Crystal Lake nailwort (*P. chartacea* ssp. *minima*) in the Florida panhandle. This discussion is limited to the peninsula subspecies.

Papery whitlow-wort is easily identified, especially where it forms large populations in the scrub. However, another species, *Paronychia americana* (American nailwort) is present throughout its range, and has been confused with it.

**Life History** – Flowering and fruiting occur in late summer or fall (Anderson 1991) and the seeds mature in September or October (T. Race, Bok Tower Gardens, personal communication 1996). This species is a short-lived perennial (Anderson 1991 and observations by staff at the Historic Bok Sanctuary). Seed germination is not affected by the allelopathic effects of Florida rosemary (*Ceratiola ericoides*) (Hunter and Menges 2002). Seed germination is during the winter (which is typical for scrub plants), and can be very low during droughts. Biological soil crusts provide the most favorable germination conditions during drought conditions. These crusts develop in the years between fires (Hawkes 2004). Loose sand may also affect germination (Petrů and Menges 2004), as discussed in the next section.

**Population dynamics –** Papery whitlow-wort is most frequently seen in open, sunny gaps in rosemary balds within scrub vegetation (Abrahamson *et al.* 1984, Christman 1988, Menges and Kohfeldt 1995). At Archbold Biological Station, rosemary scrubs are found only on the higher ridges and knolls surrounded by scrubby flatwoods with dense oaks. The main soil types are St. Lucie and Archbold (Abrahamson *et al.* 1984), which are both well-drained white sands (Carter *et al.* 1989). The fire return interval in rosemary scrub can range from 10 to as long as 100 years (Johnson 1982, Myers 1990). Rosemary scrub has rosemary (*Ceratiola ericoides*) and scrub

oaks including Chapman oak (*Quercus chapmannii*), sand live oak (*Q. geminata*), Archbold oak (*Q. inopina*) and occasional sand pine *(Pinus clausa*). The open sandy areas of rosemary scrub contain small herbs and lichens (Abrahamson et al. 1984, Hawkes and Menges 1996). These gaps in the dense vegetation are more persistent in rosemary scrubs than in scrubby flatwoods (Hawkes and Menges 1996).

Papery whitlow-wort has also has been reported from sandhill (high pineland) vegetation in the Walk in the Water tract of LWR State Forest (A. Cox, Florida Division of Forestry, personal communication 2002) and at TNC's Crooked Lake Sandhill Preserve as well as at the Tiger Creek Preserve, where it is confined to disturbed areas and pond margins (B. Pace-Aldana in litt. 2005).

Weekley and Menges (2003a, 2003b, 2004) confirmed the earlier findings of Johnson and Abrahamson (1990) and Ostertag and Menges (1994) that this plant is killed by fire and returns to the vegetation from seed. Johnson and Abrahamson (1990) had found papery whitlow-wort appeared in rosemary balds after fires, even though it had been rare or absent prior to the burn. This strongly indicates papery whitlow-wort maintains seed banks in the soil, waiting for suitable germination conditions. Within about 9 to 12 years after a fire, papery whitlow-wort was displaced by Florida rosemary and reindeer lichens (*Cladonia* and *Cladina*). Quintana-Ascencio and Menges (2000) showed some gap plants, such as snakeroot and Highlands scrub hypericum, disappear relatively quickly after fires. To persist, these plants require large populations consisting of tens of thousands of individuals. Papery whitlow-wort persists longer after fire, which could reduce the population sizes needed for population viability. It also has many large populations over a relatively large geographic range, compared to other LWR endemic plants.

The density of papery whitlow-wort increases in relation to available open space (Hawkes and Menges 1996; Menges and Kohfeldt 1995), so the species is most abundant in disturbed, sandy areas such as road rights-of-way and recently cleared high pine (Abrahamson et al. 1984; Christman 1988; Service 1996). Papery whitlow-wort can become very abundant after a fire or on disturbed sites such as along fire lanes or trails (Service 1996; Johnson and Abrahamson 1990) and is the last of the federally-listed herbaceous scrub plants that are restricted to open areas to suffer local extirpations as open areas become covered by shrubs.

Loose sand affects papery whitlow-wort. According to research by Petrů and Menges (2004) comparing natural bare areas within scrub vegetation to artificially disturbed roadsides, "the demographic responses of the species to sand movements indicate mobile sands create constantly shifting arrays of microsites that can influence post-dispersal seed germination, survival, and growth of Florida scrub herbs. Roadside habitats have more dynamic patterns of sand movement than natural gaps and may alter selection regimes important for demographic variation of endemic Florida scrub plants." This research supports other evidence that roadsides and other artificially disturbed areas may not constitute desirable substitutes for open areas in fire-maintained vegetation.

Management for papery whitlow-wort requires burning regimes that mimic the natural fire cycles of rosemary scrub. Relationships among fire, open space, and plant distributions within a xeric

scrub are complex and need to be studied further (Hawkes and Menges 1996). Management practices for rosemary scrub should include fire at intervals suitable for a variety of plants and animals, rather than at intervals optimized for just a single species (Hawkes and Menges 1996, Quintana-Ascencio et al. 2003).

**Status and distribution –** Papery whitlow-wort occurs in Highlands, Polk, Osceola, Orange, and Lake Counties (Anderson 1991). It is present on the Lake Wales Ridge (Kral 1983) and at least one smaller nearby ridge at the Lake McLeod tract of LWR NWR. It is not present on the Bombing Range Ridge (Avon Park Air Force Range). It is present in essentially all of the LWR scrub conservation lands. Since the last comprehensive survey (Schultz et al. 1999), it has been found in sandhills (high pineland) vegetation at the Walk in Water tract of LWR State Forest (Anne Cox, LWR State Forest, personal communication 2002). It is also present at pond edges and in disturbed areas in sandhills on the Tiger Creek Preserve, owned by TNC (B. Pace-Aldana in litt. 2005).

The northern range limit of papery whitlow-wort is in Lake County, where it occurs on the north side of Lake Louisa at Crooked River Preserve, owned by the Lake County Water Authority. It was possibly present at a nearby site, Schofield Sandhill, which had been proposed for acquisition under the Florida Forever program, but the acquisition proposal did not come to fruition. The only site on conservation lands in Orange County (also at the northern range limit) is the small Shadow Bay Park (formerly Lake Cane-Marsha Park) near where the Florida Turnpike crosses Interstate 4. The species was reported from localities in western Orange County, but the area has since become urbanized, and there are few if any opportunities for setting aside conservation lands in this area. The only papery whitlow-wort site in Osceola County for that has been considered for State acquisition is Lake Davenport, in the northwestern corner of the County. It has not been purchased (Florida Natural Areas Inventory 2005). The southernmost sites on conservation lands are Gould Road (part of the LWR Wildlife and Environmental Area operated by the FWC) and Archbold Biological Station, both in Highlands County south of Lake Placid (Schultz et al. 1999).

During 2003, the State and Archbold Biological Station purchased portions of the McJunkin ranch that bordered the Biological Station's preserve to the west. The recently-acquired land adds more scrub to the LWR Wildlife and Environmental Area and provides a buffer for Archbold.

While FNAI data provide an overall view of the distribution of this species, intensive local inventories add important detail. The LWR State Forest is represented in the FNAI database by nine element occurrences, yet the Forest's Arbuckle tract has 188 records of this plant in its geographic information system database, mostly from a 1988 inventory. Of the 188 records, 23 represented more than 100 individuals (data collected by K. DeLaney, provided by A. Cox, LWR State Forest).

Archbold Biological Station has not monitored this plant because it thrives in fire lanes that usually are not threatened by invasive exotic plants (E. Menges and M. Deyrup, Archbold, personal communication 1995, in Service 1996). However, the propensity of this species to

occupy fire lanes, roadsides, and other artificially disturbed areas is a conservation concern for the papery whitlow-wort, because it tends to be far more abundant in such disturbed areas than within the vegetation itself, and these disturbed areas have different physical characteristics than natural ones, including more sand movement, as noted above (Petrů and Menges 2004).

The papery whitlow-wort occurs in association with several other federally listed species: in scrub, it occurs with Florida bonamia, Highlands scrub hypericum, wireweed, Florida perforate cladonia, snakeroot, and scrub blazing star. Because it is barely present in sandhill (high pineland) vegetation, tending to be found at pond edges, so it is probably not appropriate to say that it shares habitat in this vegetation with pygmy fringe tree, pigeon wings, scrub buckwheat, Britton's beargrass, scrub plum, and Carter's mustard.

Papery whitlow-wort is the most abundant and widespread of the listed LWR scrub and high pineland plants, and it has benefited greatly from acquisition of conservation lands in its range.

**Scrub Plum**

The following discussion is summarized from the MSRP (Service 1999), as well as from recent research publications and monitoring reports. A complete scrub plum life history discussion may be found in the MSRP. No critical habitat has been designated for scrub plum.

**Description** – Scrub plum is a much-branched shrub that can reach 2 m (6 feet) in height, although 0.5 m (1.5 feet) is more typical at sites with frequent fires. It grows from gnarled, half-buried trunks. Its twigs are strongly geniculate (zigzag shaped), while its lateral branches are either short, stubby spur shoots bearing leaves and flowers, or are strongly tapering and spine-like. The bark of old stems is thin, gray, usually lichen-encrusted, and forms small rectangular or square plates. The bark of new shoots is lustrous reddish-brown or purplish and smooth.

The scrub plum's leaves are crowded on the spur shoots (an arrangement typical of the Rosaceae family) and are widely spaced on the normal shoots. The fragrant white flowers of scrub plum are distinctive in being sessile, without flower stalks. They are fragrant, five-petaled, and 11 to 13 mm (0.43 to 0.51 inches) across when open. The flowers have "numerous stamens with conspicuous yellow anthers that are exerted well above the floral cup. Some flowers have a well-developed pistil equal in height to the stamens, while in other flower the pistil is vestigial and nonfunctional" (Archbold Biological Station 2003). The fruit of the scrub plum is an ovoid or ellipsoidal drupe, 12 to 25 mm (0.47 to 0.98 inch) long, and dull reddish or "vaguely peachy" (Archbold Biological Station 2003) in color. It has a thin, bitter flesh and a slightly flattened seed.

Although it is distinctive as the only plum with crooked twigs, scrub plum can be casually mistaken for other scrub and sandhill plants. Several have a similar geniculate, thorny habit of growth, including tough bumelia, hog plum (*Ximenia americana*), Florida ziziphus, and a local hawthorn, a variant of *Crataegus lepida* (Judd and Hall 1984). Hog plum has yellow fruit, straight twigs, and thorns only in the angles of leaf and stem. Florida ziziphus has entire leaf

margins and yellow fruit and is exceedingly rare. Buckthorns have thorns and clustered leaves, but the leaves or twigs are very hairy (FNAI 2000a).

Flowering occurs in January to February, leafing occurs from late February to March, fruit begins to develop in late February and may continue to early May, and seed dispersal is in early May, but germination dates are unknown (Harper 1911; Ward 1979b; C. Weekley, DOF, personal communication, 1998). Archbold Biological Station's plant ecology lab reports that flowering occurs in February to March when the plants are largely leafless. Individuals drop most of their leaves in the winter dry season.

**Life History** – Scrub plum has a very unusual breeding system called andromonoecy, in which male and bisexual flowers are present on the same individual (Weekley and Menges 2001). Scrub plum is believed to be self-incompatible, which would make the services of pollinators essential for fruit set (Weekley 1997). The flowers attract insect visitors. Insects may disseminate the pollen of the scrub plum and birds and possibly mammals disperse the seeds.

The plants add new stems every year, especially after fire (Archbold Biological Station 2003). Fire stimulates growth and flowering; flowering and fruit production gradually declines until the next fire (Menges et al. 2005). Seedlings have not yet been observed in the wild.

Scrub plum prefers dry, sunny, nutrient-poor sites of acidic, entisols (deep, nearly featureless, sand soils). It is most typically associated with oak-dominated scrub and high pine communities. Scrub plum is native to sandhill (high pineland) vegetation and Florida scrub. Sandhill vegetation is usually thought of as having a grassy understory, although the abundance of scrub palmetto and shrubs like scrub plum and pygmy fringe tree at areas like the LWR NWR tract at CC indicate that sandhill on the Ridge may not historically have had the lawn-like appearance of many sandhill sites farther north. Sandhill is subject to low-intensity, frequent fires (every 1 to 5 years). Scrub has shrubby vegetation and is subject to high-intensity, infrequent fires. Fires maintain both habitats. In the absence of frequent fires, high pine vegetation is typically invaded by sand pines and evergreen oaks, eventually becoming upland hardwood forest (Myers 1985). Similarly, scrub may become upland hardwood forest if fire is absent (Myers 1985).

Sandhills plants that can be found in the vicinity of scrub plum include Chickasaw plum (*Prunus angustifolia*), tallowwood (*Ximenia americana*), wiregrasses (*Aristida stricta* var. *beyrichiana* and other species), broomsedges (*Andropogon* spp.), slenderleaf clammyweed (*Polanisia tenuifolia*), and largeflower wireweed (*Polygonella robusta*). The dominant tree is turkey oak, with longleaf pine. Listed species that co-occur with scrub plum in sandhills include pygmy fringe tree, pigeon wings, scrub buckwheat, Britton's beargrass, wide-leaf warea, Carter's mustard, and Florida ziziphus.

**Population Dynamics** – Although scrub plum's historic range was rather extensive compared to other narrowly endemic plants of Florida's central ridges, this species has declined with destruction and fragmentation of its scrub habitat.

Scrub plum plants nearly always resprout after fire (Menges and Kohfeldt 1995; Menges et al. 2005; Weekley and Menges 2001, 2003a, 2003b). Three years after a fire, more than 98 percent of burned plants had survived, though they had lesser height and crown diameter than unburned control plants (Menges et al. 2005). During 10 years of monitoring of 65 scrub plum individuals at TNC's Tiger Creek Preserve, more than 95 percent of the plants resprouted post-fire and regained their pre-burn height and width within 2 years post-fire (TNC 2004). Populations at the Arbuckle and Walk-in-the-Water tracts of LWR State Forest appear stable, but later surveys of the area did not find any seedlings or juveniles.

In 3 years of conducting experimental burning and cutting treatments at CC and collecting demographic data, 903 plants were tagged. Of these, 565 were in burn treatments, of which 454 were burned to some extent in an August 2001 burn; 99.7 percent survived or resprouted. Only three plants "with total consumption of the aboveground parts died" (Menges et al. 2005). As of February 2005, four plants had been killed by prescribed fire and six had died from other causes (Menges et al. 2005). Twelve plants near the study area boundaries were inadvertently damaged during site maintenance in 2004, but are expected to recover (Menges et al. 2005). Archbold Biological Station has carried out germination experiments, but has not yet reported results (Archbold Biological Station 2003).

**Status and Distribution** – Habitat loss due to conversion to agriculture and residential development continues to threaten this species. Removal by plant collectors has been an additional threat that land acquisitions and conservation areas are alleviating. Fire suppression has degraded the habitat required by this species. This species apparently requires periodic fire or other disturbances to maintain suitable habitat.

Scrub plum occurs in three general areas on Florida's central ridges: Lake County, west and southwest of Lake Apopka; the southwest and northwest corners of Orange and Osceola Counties, respectively; and Polk and Highlands Counties, from the City of Lake Wales south to the Highlands County/Glades County border (FNAI 1996c) on the LWR. It is absent from the Bombing Range Ridge of Avon Park Air Force Range.

Scrub plum is present on nearly all conservation lands within its range that have scrub or sandhill vegetation (FNAI 1985; Stout 1982):

- In Lake County, the 120-acre Flat Lake tract of Seminole State Forest southeast of Clermont (Schultz et al. 1999; FNAI 2005), which was purchased by TNC in 1999 (Finkelstein 1999);

- In Polk County, protected sites containing scrub plum exist at the Arbuckle and the Lake Walk-in-the-Water tracts of LWR State Forest, at the Pine Ridge Nature Preserve of Historic Bok Sanctuary, at the Allen David Broussard Catfish Creek Preserve State Park, at TNC's Tiger Creek Preserve, and probably at the Saddle Blanket Lakes Preserve; and In Highlands County, the scrub plum is protected on the CC tract and Apthorpe, Holmes Avenue, Lake Placid, and Gould Road areas of the LWR WEA; the CC and Flamingo Villas tracts of LWR NWR; Archbold Biological Station; and Lake June-in-Winter Scrub State Park.

Information on numbers of plants by site has not been available. The Florida Plant Conservation Program, operated by DOF, commissioned a status survey for scrub plum in late December 2003. Linda Chafin of the FNAI conducted field surveys to relocate and document known populations and seek new populations. Final results are expected to be available in 2005.

SUMMARY

In summary, little information is available to adequately assess the status and population dynamics of the bluetail mole skink. However, the sand skink is relatively widespread in remaining xeric uplands. Both skink species are endemic to central Florida, and are habitat specialists that rely on xeric scrub and high pine habitat for their continued existence. The Papery whitlow-wort occurs in Highlands, Polk, Osceola, Orange, and Lake Counties. It is present on the Lake Wales Ridge and at least one smaller nearby ridge at the Lake McLeod tract of LWR NWR. Papery whitlow-wort is the most abundant and widespread of the listed LWR scrub and high pineland plants, and it has benefited greatly from acquisition of conservation lands in its range. The scrub plum occurs in three general areas on Florida's central ridges: Lake County, west and southwest of Lake Apopka; the southwest and northwest corners of Orange and Osceola Counties, respectively; and Polk and Highlands Counties, from the City of Lake Wales south to the Highlands County/Glades County border (FNAI 1996c) on the LWR. It is absent from the Bombing Range Ridge of Avon Park Air Force Range. Scrub plum is present on nearly all conservation lands within its range that have scrub or sandhill vegetation.

Earlier estimates of scrub habitat loss ranged from 60 to 90 percent, depending on the xeric community type (Christman 1988, Christman and Judd 1990, Kautz 1993, Center for Plant Conservation 1995). Tuner *et al.* (2006) suggested that only 12.9% of the historic upland habitats on the LWR remained as of 2003. Furthermore, the implementation of favorable management practices can create and maintain suitable habitat conditions for both sand and bluetail mole skinks, as well as other xeric upland-dependent species. A number of actions over the last 20 years have resulted in conservation benefits to xeric uplands within the extant range of both species. The State of Florida has acquired xeric upland habitat through the CARL, Save Our Rivers, and other P-2000 acquisition programs. Combined, these land acquisition programs have protected **10,000** acres of xeric uplands (Florida Department of Environmental Protection 1998, South Florida Water Management District 1998). The Service has also acquired portions of several small tracts (totaling **800 acres)** as a component of the LWR National Wildlife Refuge. Finally, private organizations, such as The Nature Conservancy and Archbold Biological Station have bought and currently manage xeric uplands within the LWR.

## ENVIRONMENTAL BASELINE

STATUS OF THE SPECIES/CRITICAL HABITAT WITHIN THE ACTION AREA

Surveys conducted by BRA in the fall of 2004 and spring of 2005 detected sand skinks on the ±464.9 acres of the site, of which ±362.0 acres are proposed for mining (Figure 2). On this site sand skinks occupy habitat classified as longleaf pine (*Pinus palustris*)-Xeric Oak (*Quercus spp.*)and Xeric Oak, most of which was cleared for citrus but never planted in the 1950s. Both Papery whitlow-wort and scrub plum were found on the areas proposed for mining. The Papery whitlow-wort was found in found to be common on the project area.

FACTORS AFFECTING SPECIES HABITAT WITHIN THE ACTION AREA

Sand skinks, bluetail mole skinks and listed plant species are vulnerable within the action area due to the intense development pressures in the region resulting from central Florida's burgeoning human population. The University of Florida's Bureau of Economic and Business Research estimates that Polk County's population is projected to increase from 541,840 in 2005, to 598,978 by 2010.

Sand and bluetail mole skinks appear to occupy essentially all successional stages of Florida scrub and high pine habitats, although their densities seem to vary in response to fire, the degree of open, sandy areas and other variables that are not well understood. Most conservation lands currently are managed to benefit such focal species as the Florida scrub-jay (*Aphelocoma coerulescens*) and the gopher tortoise (*Gopherus polyphemus*), species whose populations require a fire frequency return interval which is much shorter than that of sand skinks and perhaps bluetail mole skinks. This information suggests that conservation lands may need to be managed as a mosaic of habitats to maintain viable populations of xeric-adopted vertebrate species of concern and that unmanaged private lands may be particularly important to listed skink species on the LWR. The occurrence of at least sand skinks on many man-altered xeric sites on the LWR also suggest that these disturbed habitats support viable populations, especially if they are adjacent to patches of native habitat that can serve as a source population for recolonization.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the sand skink, bluetail mole skink, and listed plant species including beneficial effects and interrelated and interdependent actions. As noted above, both species share similar habitat requirements and are presumed to co-occur at the project site. Therefore, the effects of the action are expected to affect the sand skink and the bluetail mole skink in the same manner.

**Factors affecting species habitat within the action area**

This project site contains skink and list scrub plants habitat, and is located within the northern portion of the geographic range of the sand skink and bluetail mole skink on the LWR. The timing of construction for this project, relative to sensitive periods of the skink's and the listed plant's life cycle, is unknown. Skinks currently are found within the proposed construction footprint. The project has a construction build-out of approximately 32 years with about 11 acres of occupied habitat being cleared each year for mining. The disturbance associated with the project will be permanent and will result in a loss of habitat currently available to the skinks and listed plants.

Beneficial Effects – Approximately 173.2 acres of occupied skink and listed scrub plant habitat will be managed and preserved in perpetuity. The Lake Istokpoga Conservation Area is located adjacent to and contiguous with the Lake Wales Ridge Wildlife and Environmental Area in Highlands County, Florida (Figure 3). The preservation area will be placed under a restrictive covenant for the protection of skinks. The following management activities will be undertaken in the conservation area to benefit skinks:

1. Not mining ±102.9 acres of disturbed sandhill on the Davenport Sand Mine that is occupied sand skink habitat, which also may support the bluetail mole skink, eastern indigo snake, papery whitlow-wort and scrub plum;

2. Placing 173.2-acre parcel of skink habitat under conservation easement or such other similar instrument consistent with the requirements of Section 704.06, Florida Statute in perpetuity, and held by the FWC. The applicant has agreed to provide the Corps and the Service with proof of this transaction within 120 days of issuance of the permit;

3. No development or motorized vehicle use (except for land management and limited hunting) will be allowed on the site;

4. Signs will be erected around the 173.2-acre preservation area, identifying the site as a preserve area and indicating entry is restricted;

5. The applicant will prevent vegetation on the site from becoming overgrown and maintain patches of open, bare sand in the area. The vegetation management plan includes prescribed burns as well as mechanical, manual, and chemical maintenance, as necessary;

6. The site will be maintained free of exotic vegetation by prescribed burning, mechanical, manual, or chemical maintenance; and

7. The applicant will conduct annual monitoring of the vegetation and skinks on and adjacent to the site to assess the success of the on-going management and modify management where needed.

In addition, Rinker in association with Walt Disney World has agreed to fund long-term research to benefit the conservation of listed skinks. Details on these research project can be found in Appendix 1. This research effort is designed to address a number of species-level and habitat-level recovery actions proposed by the Service (1999) through five independent but related projects:

1. Develop science-based, standardized survey techniques to determine presence/absence and density of sand skinks.

2. Use existing scrub sites at Archbold Biological Station to establish a relationship between burn history and abundance of the sand skink.

3. What are the potential consequences of habitat fragmentation on sand skink metapopulation dynamics?
4. Estimate the current geographic distribution and total population size of sand skinks on public and privately owned conservation lands.

5. Experimental translocation of sand skinks.

Direct Effects – Direct effects are those effects caused by the proposed action, at the time of construction, and are reasonably certain to occur. The direct effects this project will have on sand skinks, bluetail mole skinks, and listed plants within the action area are discussed below.

The construction of the project will result in the direct loss of 362 acres of habitat for listed skinks and scrub plants. Incidental mortality of skinks and plants due to land clearing and construction activities may also occur. Mechanical preparation of the proposed project site can crush or injure individual skinks and skink eggs, and destroy or degrade occupied and potential habitat and foraging areas. In addition, any clearing activities and/or prescribed fires may adversely affect skinks by causing them to leave the area and possibly miss foraging and mating opportunities. Individual skinks fleeing the area may be more vulnerable to predation. The Service considers this project, as proposed, to represent a threat of disturbance to skinks. In addition, the project will add to the continued fragmentation of skink habitat in the region and result in a small reduction of the geographic distribution of these species. Therefore, the project proposed by Rinker is expected to directly affect skink mortality in the action area. To minimize the effects, Rinker proposes to translocate and monitor for three years ±500 sand skinks to a currently unoccupied and protected upland island of seemingly suitable habitat in Orange County, 17 miles (27 km) to the north. Scrub plants will be killed and the soil seedbank eliminated by the mining practices proposed.

**Interrelated and Interdependent Actions –** An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

**Indirect Effects –** Indirect effects are those effects that result from the proposed action, are later in time, and are reasonably certain to occur. The indirect effects this project will have on skinks within the action area are discussed below.

The construction of the proposed sand mine will provide construction materials to increase the human population in the action area. The increase in the local human population resulting from the project may stimulate further development in the project area such as, road widening and construction of new roadways to accommodate the increase in local traffic and construction of service related facilities (*e.g.*, grocery stores, gas stations, etc.) on privately owned lands in the project vicinity. Such development would result in the conversion of skink habitat to buildings, parking lots, roadways, and other areas unsuitable as skink habitat. The habitat loss resulting from these projects will continue to fragment habitat in the action area and further reduce the geographic range of the species.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Anticipated future county actions in the action area that will adversely affect skink and listed plants habitat include the issuance of county building permits. Permits to construct single-family homes and commercial buildings within the action area are required by Polk County. Many of the construction projects impacting skink habitat in the action area will require both a county building permit and a Corps permit, and will require consultation under section 7 of the Act.

A small proportion of construction projects requiring County building permits will not impact wetlands and will not require a permit from the Corps. In general, these projects will not have a Federal nexus requiring consultation with the Service under the Act. However, applicants obtaining county building permits are not absolved from the prohibition of take of listed species under the Act. Section 10 of the Act provides a means for permitting the incidental take of listed species associated with non Federal actions such as county building permits. In order to obtain an incidental take permit, the applicant must prepare a Habitat Conservation Plan (HCP), acceptable to the Service, describing how impacts to the species will be minimized and compensated for to the greatest extent practicable. In order to be acceptable to the Service, an HCP for a non Federal action affecting federally listed skinks would generally include the enhancement, restoration, or preservation of skink habitat. The Service has considered cumulative effects within the action area, and based on the above discussion, we have not identified any additional cumulative effects beyond those already discussed in the Environmental Baseline.

SUMMARY OF EFFECTS

The Service, based on the above evaluation, believes the project area provides habitat that currently benefits the sand skink, the bluetail mole skink and listed plants. The project will result in the direct loss of 362 acres of skink and listed plant habitat. The project will also add to the continued fragmentation of skink habitat in the region and reduce the geographic distribution of these species. The preservation and long-term management of the 173.2-acre Lake Istokpoga Conservation Area will provide direct benefit to the skink and plant habitat by maintaining the ecological quality of the preserve site and by protecting the land from future development. In addition, Rinker will fund long-term research to benefit the conservation of skinks, including the experimental translocation of ±500 individuals to a protected off-site location.

CONCLUSION

After reviewing the status of the sand skink and bluetail mole skink, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion the construction of the Davenport Sand Mine, as proposed by Rinker, is not likely to jeopardize the continued existence of the sand skink or bluetail mole skink. No critical habitat has been designated for either species, and, therefore, none will be affected.

## INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat

modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of the agency action, is not considered to be prohibited taking under the Act provided such taking is in compliance with the terms and conditions of this incidental take statement.

The terms and conditions described below are nondiscretionary and must be undertaken by the Corps so they become binding conditions of any grant or permit issued to Rinker Materials of Florida, Incorporated as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require Rinker Materials of Florida, Incorporated to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protection coverage of section 7(o)(2) may lapse. In order to monitor the impact of the incidental take, the Corps or US Enterprises must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3).

Section 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plants species. However, limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered plants on non-federal areas in violation of state law or regulations or in the course of any violation of a state criminal trespass law. The State requires permission of private landowners for collecting of state-listed plants from their property. If this project is on private land and the landowner is not the project proponent, in addition to landowner permission, a Florida Department of Agriculture and Consumer Services permit for plants may be needed. To determine if such a permit is necessary or to apply for this permit, contact: Florida Department of Agriculture and Consumer Services, Division of Plant Industry, P.O. Box 147100, Gainesville, Florida 32614-7100, 352-372-3505. http://www.doacs.state.fl.us/onestop/plt/plantinspinst.html

AMOUNT OR EXTENT OF TAKE

The Service anticipates incidental take of sand skinks and bluetail mole skinks associated with the mining of 362 acres of skink occupied habitat. The Service anticipates incidental take of sand skinks and bluetail mole skinks will be difficult to detect and quantify for the following reasons: (1) skink density varies considerably within and between apparently suitable habitat patches; (2) density dependent mechanisms are currently unknown and may be due to territorial requirements, microhabitats, and other unknown environmental influences; (3) individuals have a small body size and spend the majority of their time underground; and (4) finding a dead or impaired specimen is unlikely. However, take of sand skinks and bluetail mole skinks can be anticipated within the 362 acres of skink habitat located in the project footprint due to the mining activities associated with the project. Therefore, the Service believes all individuals occurring

within this 362-acre portion of the project footprint will be incidentally taken. The incidental take is expected to be in the form of harm, injury, or death due to mining activities and/or habitat loss, or disturbance.

REASONABLE AND PRUDENT MEASURES

When providing an incidental take statement, the Service is required to give reasonable and prudent measures it considers necessary or appropriate to minimize the take, along with terms and conditions that must be complied with to implement the reasonable and prudent measures. Furthermore, the Service must also specify procedures to be used to handle or dispose of any individuals taken. The Service believes the following reasonable and prudent measures are necessary and appropriate to reduce take and to minimize the direct and indirect effects of the proposed project on the sand skink and bluetail mole skink, their eggs, their young, or breeding territories:

The applicant shall implement the following conditions:

1. For the duration of the project, the applicant must take all necessary steps to minimize the potential for incidental take of sand and bluetail mole skinks during all mining phases.

2. The applicant must initiate a trapping protocol aimed to capture most of the skinks on areas that will eventually be mined.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implements the reasonable and prudent measure described above and outlines required reporting/monitoring requirements. These terms and conditions are nondiscretionary and as follows:

1. The 173.2-acre parcel of skink habitat will be placed under conservation easement or such other similar instrument consistent with the requirements of Section 704.06, Florida Statute in perpetuity, and held by the FWC. The applicant has agreed to provide the Corps and the Service with proof of this transaction within 120 days of issuance of the permit;

2. No development or motorized vehicle use (except for land management and limited hunting) will be allowed on the site;

3. Signs will be erected around the 173.2-acre preservation area, identifying the site as a preserve area and indicating entry is restricted;

4. The applicant will prevent vegetation on the site from becoming overgrown and maintain patches of open, bare sand in the area. The vegetation management plan includes prescribed burns as well as mechanical, manual, and chemical maintenance, as necessary;

5. The site will be maintained free of exotic vegetation by prescribed burning, mechanical, manual, or chemical maintenance; and

6. The applicant will conduct annual monitoring of the vegetation and skinks on and adjacent to the site to assess the success of the on-going management and modify management where needed.

In addition, Rinker in association with Walt Disney World, has agreed to fund long-term research to benefit the conservation of listed skinks (see Appendix 1). This research effort is designed to address a number of species-level and habitat-level recovery actions proposed by the Service (1999) through five independent but related projects:

1. Develop science-based, standardized survey techniques to determine presence/absence and density of sand skinks.

2. Use existing scrub sites at Archbold Biological Station to establish a relationship between burn history and abundance of the sand skink.

3. What are the potential consequences of habitat fragmentation on sand skink metapopulation dynamics?

4. Estimate the current geographic distribution and total population size of sand skinks on public and privately owned conservation lands.

5. Experimental translocation of sand skinks.

6. Upon locating a dead sand skink or bluetail mole skink specimen, initial notification must be made to the nearest Service Law Enforcement Office (Mr. Vance M. Eaddy; Fish and Wildlife Service; 9549 Koger Blvd., Suite 111; St. Petersburg, Florida 33702; (727-570-5398). Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission; South Region, 3900 Drane Field Road, Lakeland, Florida, 33811-1299; (1-800-282-8002). Care must be taken in handling any dead specimens of proposed or listed species that are found in the project area to preserve the specimen or its remains in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the Act. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to further minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. Our recommendations are listed below:

1. The applicant is encouraged to adopt a policy prohibiting the killing of all reptiles unless physical harm to a human is imminent during project construction.

2. Develop experimental techniques to re-establish sand skinks in historically occupied areas.

3. Investigate techniques to effectively survey for sand skinks.

4. Continue research to better evaluate home range size, age of dispersal, and dispersal distance of the sand skink and bluetail mole skink.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or actions benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

## REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the June 1, 2005, request. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease, pending reinitiation.

If you have any questions, please contact Al Begazo at 772-562-3909, extension 234.

Sincerely yours,

Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Tampa, Florida (Mary Saunders)
FWC, Vero Beach, Florida
District, Orlando, Florida
Service, Atlanta, Georgia (Joe Johnston) electronic copy only

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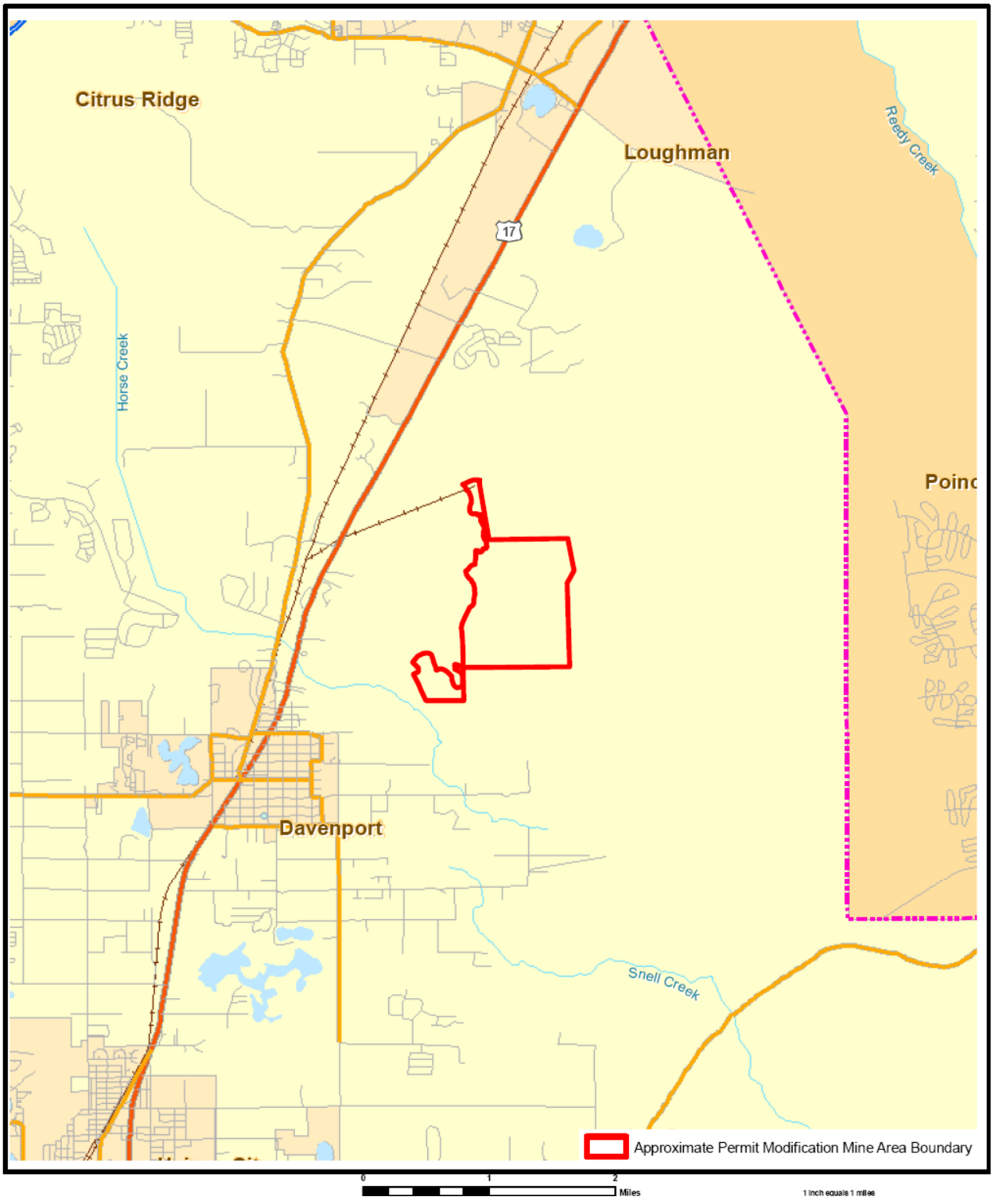


Figure 1. Map showing the location of the Davenport Sand Mine in Polk County.

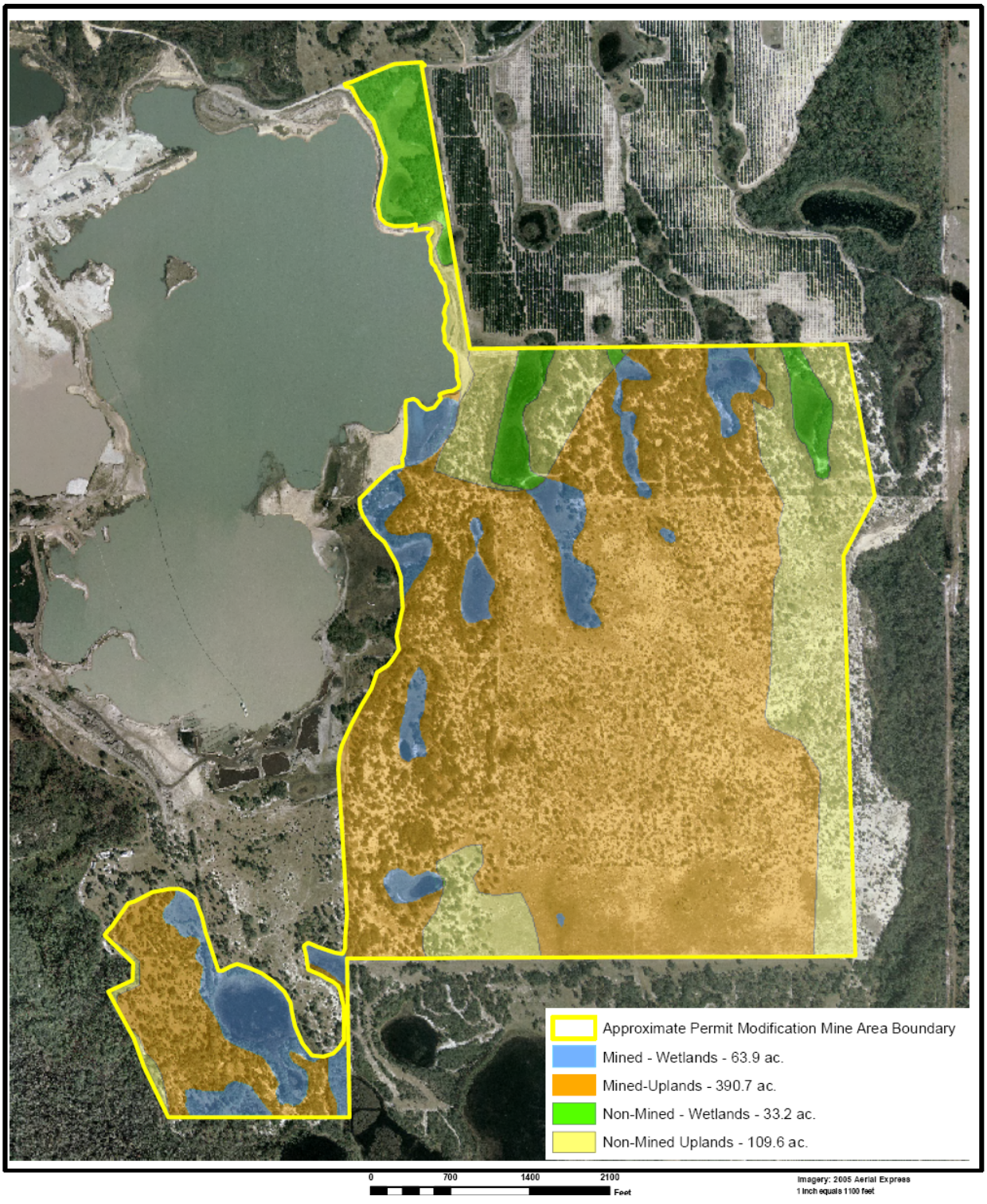


Figure 2. Map of the project parcel showing the areas proposed for mining.

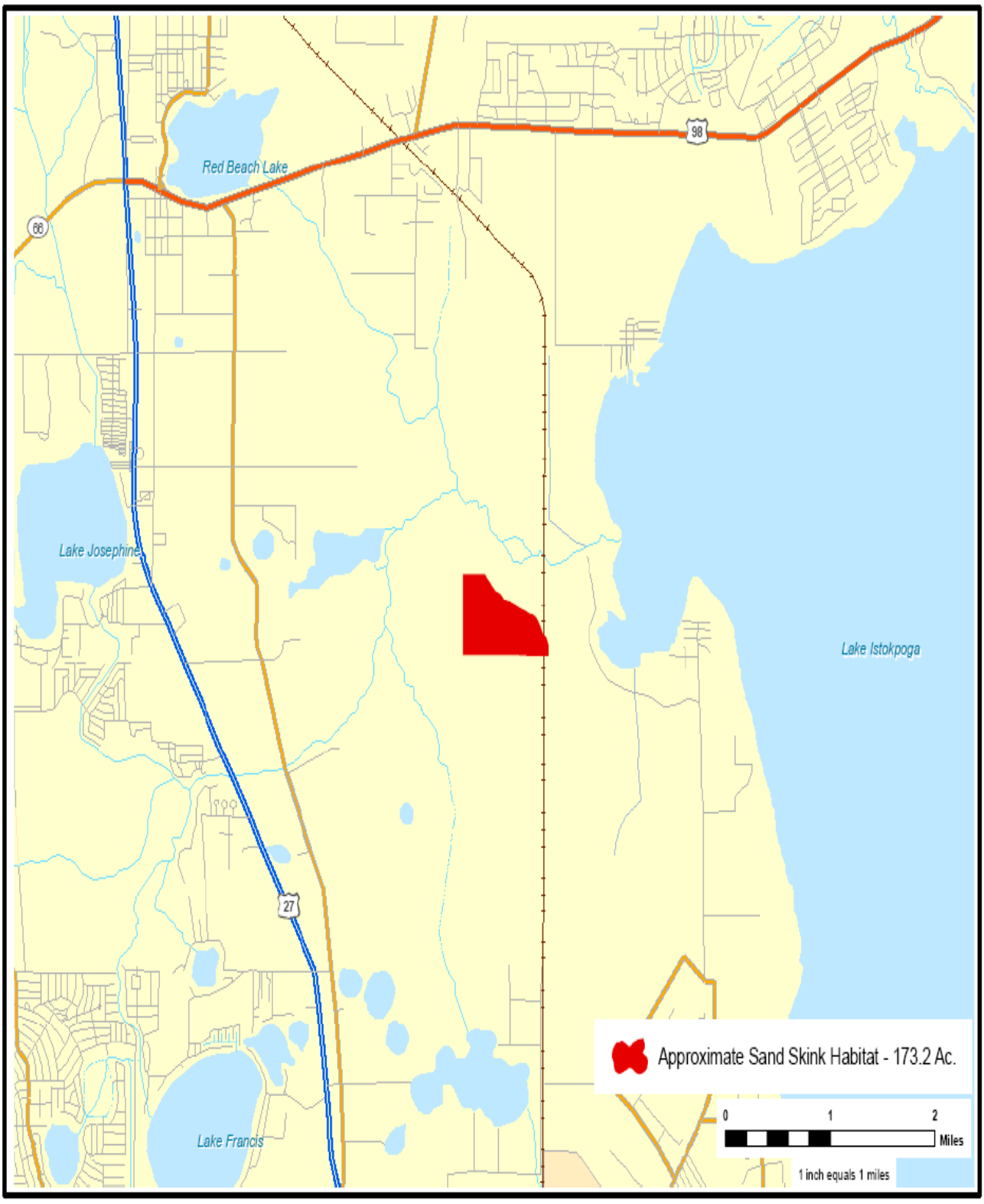


Figure 3. Map showing the location of the Lake Istokpoga Conservation Area.