

**ENVIRONMENTAL ASSESSMENT FOR
INDUSTRIAL ACTIVITIES BORROW PIT
for
KENNEDY SPACE CENTER**

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**FINAL ENVIRONMENTAL ASSESSMENT FOR
INDUSTRIAL ACTIVITIES BORROW PIT**

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ABBREVIATIONS AND ACRONYMS

ac	acres
BMP	Best Management Practice
C	Celsius
Cal Tech	California Institute of Technology
CO	carbon monoxide
CatEx	Categorically Excluded
CCAFS	Cape Canaveral Air Force Station
cm	centimeters
CNS	Canaveral National Seashore
CO	carbon monoxide
dBA	decibels, A-weighted
DOD	Department of Defense
E	Endangered
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
F	Fahrenheit
FDEP	Florida Department of Environmental Protection
FHWA	Federal Highway Administration
FPL	Florida Power and Light
ft	foot/feet
gal	gallons
GPD	gallons per day
ha	hectares
HAP	hazardous air pollutant
HC	hydrocarbons
ISS	International Space Station
in	inch
IRL	Indian River Lagoon
km	kilometers
KSC	Kennedy Space Center
kV	kilovolt
l	liters
LC	Launch Complex
LPD	liters per day
m	meters
mi	miles
MINWR	Merritt Island National Wildlife Refuge
MIT	Massachusetts Institute of Technology
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOAA	National Oceanographic and Atmospheric Administration

NO ₂	nitrogen dioxide
NPS	National Park Service
NSR	new source review
O ₃	ozone
OSHA	Occupational Safety and Health Administration
PAMS	Permanent Air Monitoring System
Pb	lead
PM-10	10-micron particulates
PSD	prevention of significant deterioration
SHPO	State Historic Preservation Office
SO ₂	sulfur dioxide
SR	State Road, State Route
STP	sewage treatment plant
SWMU	Solid Waste Management Unit
T	Threatened
UMAM	Unified Mitigation Assessment Method
US	United States
USAF	United States Air Force
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

EXECUTIVE SUMMARY

This Environmental Assessment (EA) has been prepared in compliance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S.C. §§ 4321-4370d) and according to the Procedures of Implementation of NEPA for the National Aeronautics and Space Administration (NASA) [Title 14, Code of Federal Regulations, part 1216 subparts 1216.1 and 1216.3].

Purpose and Need

The Space Shuttle Program is scheduled to end in 2010, and NASA operations are expected to greatly decrease thereafter. The John F. Kennedy Space Center (KSC) has been exploring the expansion of facilities that would provide opportunities for increased participation by the commercial sector in supporting the nation's Vision for Space Exploration. The construction of new facilities and infrastructure would require fill materials. The purpose of this EA is to document the potential environmental impacts from the proposed construction and operation of a borrow pit to support these development activities

Proposed Action and No Action Alternatives

The Proposed Action alternative and No Action alternative were analyzed. Under the Proposed Action alternative, a new borrow pit would be constructed on a site at KSC, Florida. The No Action alternative states that development of a borrow pit would not occur.

Affected Environment and Consequences

KSC encompasses nearly 56,451 hectares (ha) [139,490 acres (ac)] on the east coast of central Florida. Approximately 3,035 ha (7,500 ac) of KSC are actively used to support space mission operations, with the remaining lands being managed by the U.S. Fish and Wildlife Service (USFWS) as the Merritt Island National Wildlife Refuge (MINWR) for wildlife habitat. Resources identified that could be impacted by the Proposed Action alternative include infrastructure (transportation, stormwater), air quality, land cover, wildlife, threatened and endangered species, geology and soils, noise, surface and groundwater quality, and land use. Four classifications of environmental impacts were pre-determined, and the resources were evaluated in terms of these classifications: none (no impacts expected); minimal (impacts would not be expected, or are too small to cause any discernable degradation to the environment); minor (impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change, or mitigation measures compensate for potential degradation); or major (impacts could individually or cumulatively be substantial).

Impacts from construction under the Proposed Action alternative were classified as minimal in the categories of infrastructure, land cover, geology and soils, noise, surface water quality, socioeconomics, and land use. Construction would be expected to minimally impact transportation, air, wildlife, threatened and endangered species, and groundwater quality; these effects would be localized and temporary. Mitigation requirements for the loss of impacted vegetation, should they be required, would be planned during the permitting process. Cultural resources would not be impacted by the construction of the proposed borrow pit.

During its operational period, the project would be expected to have a minimal impact on transportation, stormwater, air quality, land cover, threatened species, noise, surface and ground water, socioeconomics and land use. Impacts from operations under the Proposed Action would be minor for geology and soils.

Under the No Action alternative, the only resources potentially affected would be transportation.

The Proposed Action alternative would not be anticipated to produce any consequences related to Environmental Justice.

1.0 INTRODUCTION, PURPOSE, AND NEED

The National Environmental Policy Act of 1969 (NEPA) as amended (42 United States Code [U.S.C.] 4321, *et seq.*), and related regulations and agency policies, direct all federal facilities to consider environmental consequences when planning for, authorizing, and approving federal actions. The National Aeronautics and Space Administration (NASA) is considering a proposed plan to develop a parcel of land for a borrow pit to provide fill materials for commercial ventures on KSC, Florida. This land would be developed as a supporting resource for those commercial activities that have been sanctioned by NASA on KSC lands in support of NASA's overall mission. Such lands would be developed and operated within non-secure areas of KSC in partnership with NASA. This EA is necessary to support NASA's compliance with NEPA, 40 CFR 1500-1508 and any other applicable federal or state environmental laws and regulations.

1.1 Background

NASA was created in 1958 to lead the nation's civilian space exploration and aeronautical technology development activities. It subsequently established a Launch Operations Center in Florida on Merritt Island during the 1960s (Figure 1-1). Today, it continues to operate KSC as the nation's primary federal spaceport for civil space activities. NASA operates the Space Shuttle Program, currently scheduled to retire in 2010, and is engaged in developing new capabilities to implement the Vision for Space Exploration (NASA 2004a). NASA also procures commercial launch services from providers for the launch of agency-developed and operated spacecraft aboard expendable launch vehicles (ELV) from a number of sites, including Cape Canaveral Air Force Station (CCAFS) adjacent to KSC. In addition, according to National Space Policy, NASA has responsibility for actively promoting the development of commercial space ventures. KSC specifically has supported such commercial activities as the Space Exploration Park, and Starfighters program use of the Shuttle Landing Facility (SLF). Some of these activities and expected future initiatives are expected to require construction of facilities on KSC lands leased or otherwise permitted for use to commercial and other outside entities. Such developments may require fill materials.

This EA analyzes the environmental impacts of the Proposed Action: the development and operation of a borrow pit for the use by authorized outside entities to provide fill materials for permitted development activities on KSC lands. In addition, the No Action alternative will be analyzed in terms of the potential environmental consequences that may result if the proposed action is not recommended and fill materials would be obtained off of KSC.

1.2 Purpose and Need

1.2.1 Purpose

NASA's mission is to advance and communicate scientific knowledge and understanding of the earth, the solar system, and the universe; advance human exploration, use, and development of space; and to research, develop, verify, and transfer advanced aeronautics and space technologies. NASA also has the task of promoting and encouraging the development of commercial interests in space and space related industries.

KSC has a unique role in the pursuit of NASA's mission. KSC serves as NASA's launch and primary landing site for the reusable Space Shuttle, the primary launch site for NASA science missions on expendable launch vehicles, and the gateway to the International Space Station for most of its major elements and for continuing missions. In 2004, President Bush unveiled "The Vision for Space Exploration", with its fundamental goal to advance U.S. scientific, security, and economic interests through a robust space exploration program (NASA 2004a).

Some key objectives that KSC implements in this regard are to:

- support development and implementation of the new NASA Vision for long term U.S. exploration activities in space;
- foster new educational opportunities and world-class academic research;
- promote development and use of new technologies that contribute to space exploration and the improvement of life on earth;
- enable privately financed and operated capabilities to strengthen both the governmental and non-governmental use of space; and
- expand access to and use of the capabilities of KSC and offsite space launch and landing sites.

To implement these objectives, KSC identifies excess capacities in its infrastructure, including land and provides the opportunity for commercial and other outside entities to utilize these capacities. Therefore, KSC seeks to provide incentives and appropriate resources to these entities.

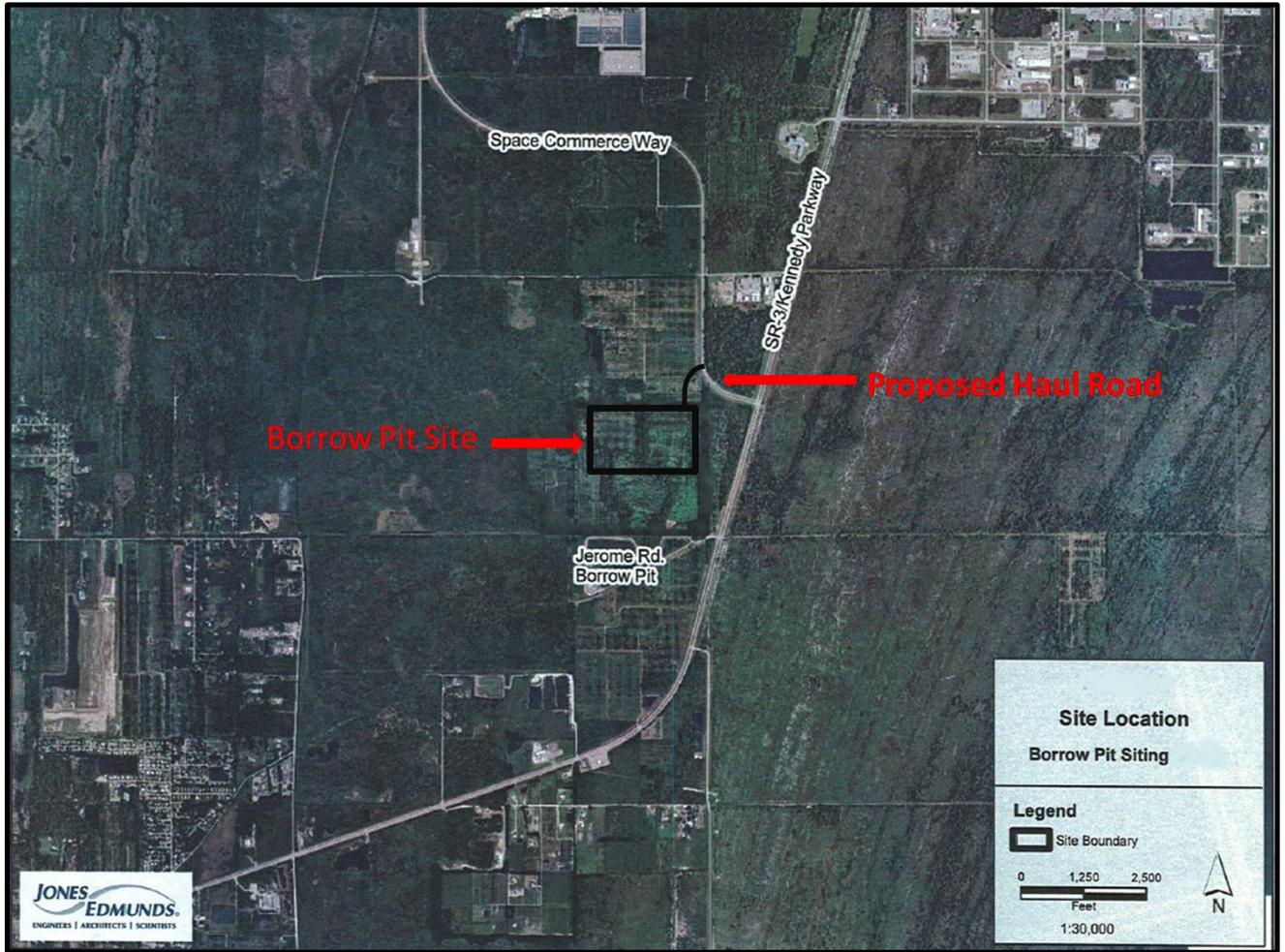
1.2.2 Need for the Action

NASA seeks innovative partnerships with other government and private organizations to help it meet its mission. Many of the land use agreements with these outside organizations will allow them to develop facilities and other infrastructure. Such development will often require the placement of fill materials on the KSC lands to be used. The transportation of such materials from off-site locations can be very expensive and in some cases may be cost prohibitive. Therefore, a location on KSC for these entities to obtain fill materials for use on KSC only, would provide a cost effective option for their development activities.

Figure 1-1. General location of the Proposed Industry Borrow Pit on Kennedy Space Center, Florida



Figure 1-2. View of the proposed KSC Industry Borrow Pit site and Haul Road



2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Chapter 2 describes the Proposed Action and No Action alternatives which were analyzed and are presented in this EA. The Proposed Action alternative is to design and permit the development and operation of an Industry borrow pit on KSC. The No Action alternative states that the development of an Industry borrow pit would not be permitted by NASA and all fill materials would be brought in from off of KSC or be obtained from project specific locations on KSC that have been permitted for use by an outside entity.

2.1 Existing Facilities and Current Uses

The proposed site for the borrow pit is approximately 30 ha [75 ac] and consists primarily of abandoned citrus groves and small, fragmented relict hardwood hammocks and other disturbed forest. Space Commerce Way lies northeast of the site, and provides connectivity to the KSC road system (Figure 1-2). The KSC Visitor Center is located approximately 1.9 kilometers (km) [1.2 miles (mi)] north of this site. In addition, the KSC reclamation yard is approximately 1 kilometer [0.6 (mi)] northeast of the site and Jerome Road borrow pit is approximately 0.5 kilometers (0.3 mi) south of the site.

2.2 Proposed Action

NASA's Proposed Action is intended to provide additional incentives and resources for the development of commercial and non-NASA programmatic development of KSC land capacities. The Proposed Action would allow for the greatest support of new activities aimed at maintaining current space-related business opportunities within the region and attracting new investment in aerospace technologies to KSC.

2.2.1 Development Concept

NASA would establish a location for the development of a borrow pit where outside organizations having a Use Permit, Land Lease or other appropriate agreement with NASA can obtain fill material to develop infrastructure on KSC lands for the purpose of forwarding the NASA mission. Such partnerships may be with a commercial, government or other outside entity.

NASA would design and permit the borrow pit and an associated haul road to connect the proposed borrow pit to Space Commerce Way at the location shown in Figure 1-2. This location supports the most likely areas that would be developed under such agreements, namely those areas outside the security areas of KSC. However, it is possible that such land use agreements could also be located inside the security perimeter, and as such, this borrow pit could also be used to support development at those locations.

2.2.2 Management Concept

The Industry borrow pit would be managed as a resource for those entities that require fill materials on KSC for their development activities. However, NASA would not construct or operate the borrow pit to provide the fill material. Each entity would be required to excavate the materials as needed and to use them only for their construction needs on KSC. No fill materials would be allowed to leave KSC property. The entities would have to bear all the costs of removing the fill from the borrow pit, including the costs of borrow pit activation, operations and closure. There would be strict management practices required for these activities and NASA would provide oversight of the operations. The specifics of these practices would be detailed in the design documentation, the land use permit and any required environmental permits.

2.3 No Action Alternative

Under the No Action alternative, NASA would not design or permit an industrial borrow pit on KSC. Under this alternative, all fill materials that may be required for land use agreements on KSC would come from either the site being developed or from off of KSC.

2.4 Alternatives Considered but Not Brought Forward

2.4.1 Jerome Road Borrow Area

An existing borrow pit lies just south of the Proposed Action area, however, it is currently reserved for future NASA project uses and is not available for use by commercial entities. Therefore, it was not considered a viable alternative for this project.

2.4.2 Other areas on KSC

While there are other lands on KSC property that could be used for this purpose, they are either not in the proximity of the fallow citrus areas being targeted by KSC for commercial use or are within the security restricted zones of the Center, making them more difficult to develop for commercial purposes. Therefore, these areas were deemed not appropriate for further review and are not addressed under this EA.

3.0 Affected Environment

Chapter 3 describes the environmental resources that could potentially be affected by the action alternatives evaluated in this EA. KSC encompasses 56,451 ha (139,490 ac) on the east coast of central Florida (Figure 1-1) and includes uplands, wetlands, estuaries, coastal areas, as well as space launch complexes and associated operational facilities. KSC is the launch site for NASA's Space Shuttle program and is the primary eastern U.S. Shuttle landing site. Approximately 3,035 ha (7,500 ac) of KSC are actively used to support space mission operations; the remaining lands are managed by the USFWS as MINWR and by the National Park Service (NPS) as Canaveral National Seashore (CNS). This unique relationship between space flight and the protection of natural resources is carefully coordinated to ensure that the objectives of both interests are achieved with minimal conflict. This chapter focuses on the environment at the proposed site of the Industry borrow pit.

3.1 Facilities and Infrastructure

While there are over 700 facilities located on KSC with uses ranging from storage of toxic chemicals to launch support to offices, there are no facilities on or in the operational proximity of the Proposed Action alternative site.

3.1.1 Transportation

KSC is serviced by over 340 km (211 mi) of roadways, with 263 km (163 mi) of paved roads and 77 km (48 mi) of unpaved roads. NASA Causeway is the primary entrance and exit for cargo, tourists, and personnel. This four-lane road originates on the mainland in Titusville as State Route (SR) 405 and crosses the Indian River Lagoon (IRL) onto KSC. Once passing through the Industrial Area, the road reduces to two lanes of traffic, crosses over the Banana River, and enters CCAFS. The major north-south artery for KSC is Kennedy Parkway (SR 3). It can be accessed from the north where it intersects with US 1 south of Oak Hill, and from Titusville via SR 406/402. The southernmost entrance and exit for KSC is on SR 3 at north Merritt Island.

The proposed borrow pit site is located south and west of Space Commerce Way, which provides a connection for public traffic between SR 3 and SR 405. There are no paved roads within the Proposed Action alternative site.

3.1.2 Wastewater Treatment

KSC maintains a system of domestic wastewater collection and transmission facilities throughout the center that deliver sanitary wastes to the Cape Canaveral Air Force Station Regional Wastewater Treatment Facility for treatment and disposal. There is no sanitary sewer system at the proposed site.

3.1.3 Electricity and Natural Gas

The electric power distribution system at KSC is a combination of a Florida Power and Light Company (FPL) transmission system and two NASA-owned distribution systems. There are no power systems on the Proposed Action alternative site.

3.1.4 Communications

The KSC Communications System provides a variety of services including: 1) conventional telephone services; 2) transmission of voice data and video; 3) voice data and video services; and 4) operation and maintenance of KSC's cable plant. There are no communications lines on the proposed site.

3.1.5 Potable Water

KSC's potable water is supplied by the City of Cocoa, which obtains its water from artesian wells located west of the St. Johns River in Orange County. Water enters KSC along SR 3 from a 60 centimeter (cm) [24 inch (in)] water main and extends north along SR 3 to the VAB Area. The average demand for water on KSC is 3.8 million liters (l)/day [1 million gallons (gal)/day] (NASA 2003). There are no water distribution systems on the proposed site.

3.1.6 Stormwater

Stormwater currently flows into the ditches on and surrounding the proposed site, while some drains directly into the ground. During periods of very high rainfall, excess water likely also reaches Space Commerce Way stormwater systems located northeast of the proposed site. The location of the Proposed Action alternative was previously managed as an agricultural site and agricultural pumps were used to drain the site during periods of high rainfall. These pumps are currently only used for flood control during large storm events (e.g. hurricane)

3.2 Air Quality

The ambient air quality at KSC is predominantly influenced by daily operations, particularly vehicle traffic, but also utilities fuel combustion, and standard refurbishment and maintenance operations. Other operations occurring infrequently throughout the year, including launches and prescribed fires, also play a role in the quality of air at KSC as episodic events. Air quality at KSC is also influenced by emissions sources outside of KSC, primarily two regional oil-fired power plants located approximately 9.8 km (6 mi) west south west of the Proposed Action alternative site.

A summary of air quality parameters collected from the KSC Permanent Air Monitoring System (PAMS A) facility in 2007 is provided in Appendix 2 (Drese 2007). Primary or secondary air quality standards for ozone (O₃), carbon monoxide (CO), nitrogen dioxide (NO₂), or sulfur dioxide (SO₂) were not exceeded for that period (State and Federal Ambient Air Quality Standards can be found in Appendix 3). The maximum hourly average value for O₃ was 34.9 parts per billion (ppb) in April 2007. The maximum 24-hr average value for SO₂ was 15.9 ppb, in December 2007. The maximum hourly average value for NO₂ was 6.1 ppb in May 2007. The maximum hourly average value for CO was 17.3 ppm in February 2007. Total inhalable 10-micron particulates (PM-10) were monitored historically (1983 – 1989, 1992 – 1999) at the PAMS and two other sites on KSC. During

those times, there was only one exceedance in PM-10; this occurred during the ground clearing for construction of the International Space Station Facility (Drese 2006).

The maximum O₃ value usually occurs in April when the Bermuda High sets up a stagnant weather condition. The maximum CO level was probably the result of either the use of a portable generator, a vehicle motor running in the area, or center-wide controlled burns (NASA 2003). NO₂ and SO₂ emissions are related to fuel combustion by utilities and services and mobile sources. The strong correlation between elevated NO₂ and SO₂ levels and prevailing westerly winds suggest that the power plants to the west of KSC could be the primary source of these emissions (Drese 1985).

3.3 Climate

The climate at KSC is characterized as maritime-tropical with humid summers and mild winters. The area experiences moderate seasonal and daily temperature variations. Average annual temperature is 22° centigrade (C) [71° Fahrenheit (F)] with a minimum monthly average of 13° C (60° F) in January and a maximum of 28° C (81° F) in July. During the summer, the average daily humidity range is 70 to 90 %. The winter is drier with humidity ranges of 55 to 65 % (Mailander 1990).

Prevailing winds during the winter are steered by the jet stream aloft and are typically from the north and west. As the jet stream retreats northward during the spring, the prevailing winds shift and come from the south. During the summer and early fall, as the land-sea temperature difference increases and the Bermuda high-pressure region strengthens, the winds originate predominantly from the south and east.

The central Florida region has the highest number of thunderstorms in the U.S. during the summer months (May – September), and over 70 % of the annual 122 cm (48 in.) of rain occurs in the summer. During thunderstorms, wind gusts of more than 97 km/hr (60 mi./hr.) and rainfall of over 2.5 cm (1.0 in.) often occur in a one-hour period, and there are numerous cloud-to-ground lightning strikes.

3.4 Biological Resources

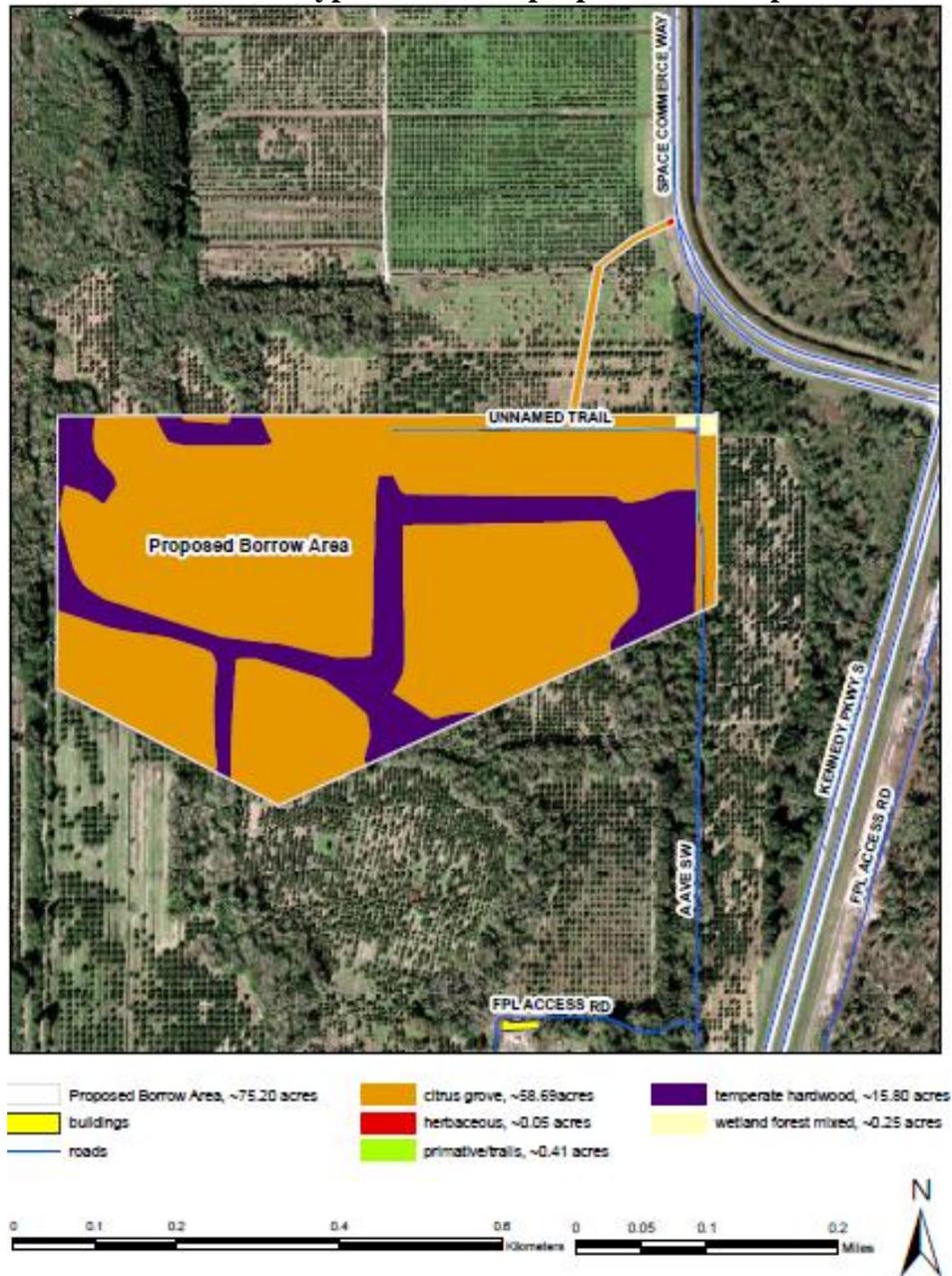
Biological resources on KSC include vegetation, wildlife, and their habitats. Protected species and biodiversity of the area are also considered in this section. The proposed borrow pit site is in an abandoned citrus grove and provides only minimal wildlife habitat for primarily transient, native species.

3.4.1 Land Cover

Land cover is the physical material at the surface of the earth, and includes vegetative communities, asphalt, bare ground, water, etc. For the purposes of this EA, land cover categories were based, in part, on a classification scheme developed for the Florida Land Use, Cover and Forms Classification System (Florida Department of Transportation Surveying and Mapping Thematic Mapping Section 1999) with site specific descriptions of class composition from Schmalzer and Hinkle (1985).

Information regarding the vegetative communities associated with a land cover type can help predict what types of wildlife may utilize a certain land cover as habitat.

Figure 3-1: Land cover types within the proposed borrow pit site boundary.



Most of the land within the project boundary consists of abandoned citrus groves with mesic to hydric hardwood hammock (wetland) areas to the east and west of the grove. There are several bands of forested areas associated with relict agricultural ditches crossing the site (Figure 3-1).

Table 3-1: Land cover types and areas within the proposed site.

Land Cover Type	Hectares	Acres
Citrus	23.5	58
Temperate Hardwood Hammock	6.5	16
Infrastructure - Trails	0.16	0.4
Ruderal - herbaceous	0.04	0.1
Wetland Hardwood Forest/Mixed	0.1	0.25
Total:	30.3	75

3.4.2 Wildlife

In addition to literature reviews and KSC ecological database searches, a pedestrian site survey to assess potential wildlife use was conducted on October 21, 2009.

3.4.2.1 Invertebrates and Fish

There are no standing water areas within the proposed site that are inundated year-round. Therefore it is unlikely that any fish or freshwater invertebrate species are year-round residents of the site. There may be such species use during the wet season, but these do not represent the typical condition of the site.

3.4.2.2 Herpetofauna

Fifty species of reptiles and nineteen species of amphibians (collectively called herptiles) have been documented as occurring on KSC (Seigel et al. 2002). Six of these species are federally protected as Threatened (T) and Endangered (E), some of which will be further discussed in Section 3.5.1.

Three herptile species of the sixty-nine documented are not federally listed, but are protected by the State of Florida. These include the Florida gopher frog (*Rana capito aesopus*), the gopher tortoise (*Gopherus polyphemus*), and the Florida pine snake (*Pituophis melanoleucus mugitis*). The Florida gopher frog and Florida pine snake are uncommon on KSC and little is known about their numbers or distribution. Neither of these two species would be expected to be supported within the current habitats on the proposed site.

Conversely, the gopher tortoise is common, wide-spread, and well studied on KSC. The gopher tortoise inhabits the uplands where it excavates burrows for shelter from weather, climate, predators and fire. Many other vertebrate and invertebrate species also use the tortoise burrows, and for this reason, the tortoise is considered a keystone species. Because gopher tortoises prefer the uplands habitats that are typically used for development, and are often found in previously disturbed areas, conflicts with operations occasionally arise. There is currently no evidence of gopher tortoises on the site and evaluations of the site suggest the area is not suitable for this species (B. Bolt pers. comm., October 2009).

Herptile species likely to be found on the proposed site include some that are typically found in hammocks or can persist in the fallow citrus groves which are being colonized by non-native plant species. Anoles (*Anolis* spp.), various tree frogs (*Hyla* spp.), and five-lined skink (*Eumeces fasciatus*) were documented on the site in 2002 (NASA 2002). In addition, the eastern indigo snake (*Drymarchon couperi*), may be found on the site as its range includes various habitats across KSC (see section 3.5.1.1).

3.4.2.3 Birds

KSC provides habitat for 330 bird species (USGS 2007); nearly 90 species nest on KSC, many of which are year-round residents. There are over 100 species that reside in the area during the winter. The remaining species regularly use KSC lands and waters for brief periods of time, usually during migration. KSC lies within the Atlantic flyway, a major migratory bird corridor that extends from the Arctic coast of Alaska to the mainland of South America. Millions of songbirds, seabirds, birds of prey, and waterfowl follow the Atlantic flyway every fall and spring. Migratory birds are federally protected through the Migratory Bird Treaty Act of 1918, and the list currently contains over 800 species. The hammock areas located east and west of the proposed site are a likely stop-over site for a number of migrating birds during part of each year.

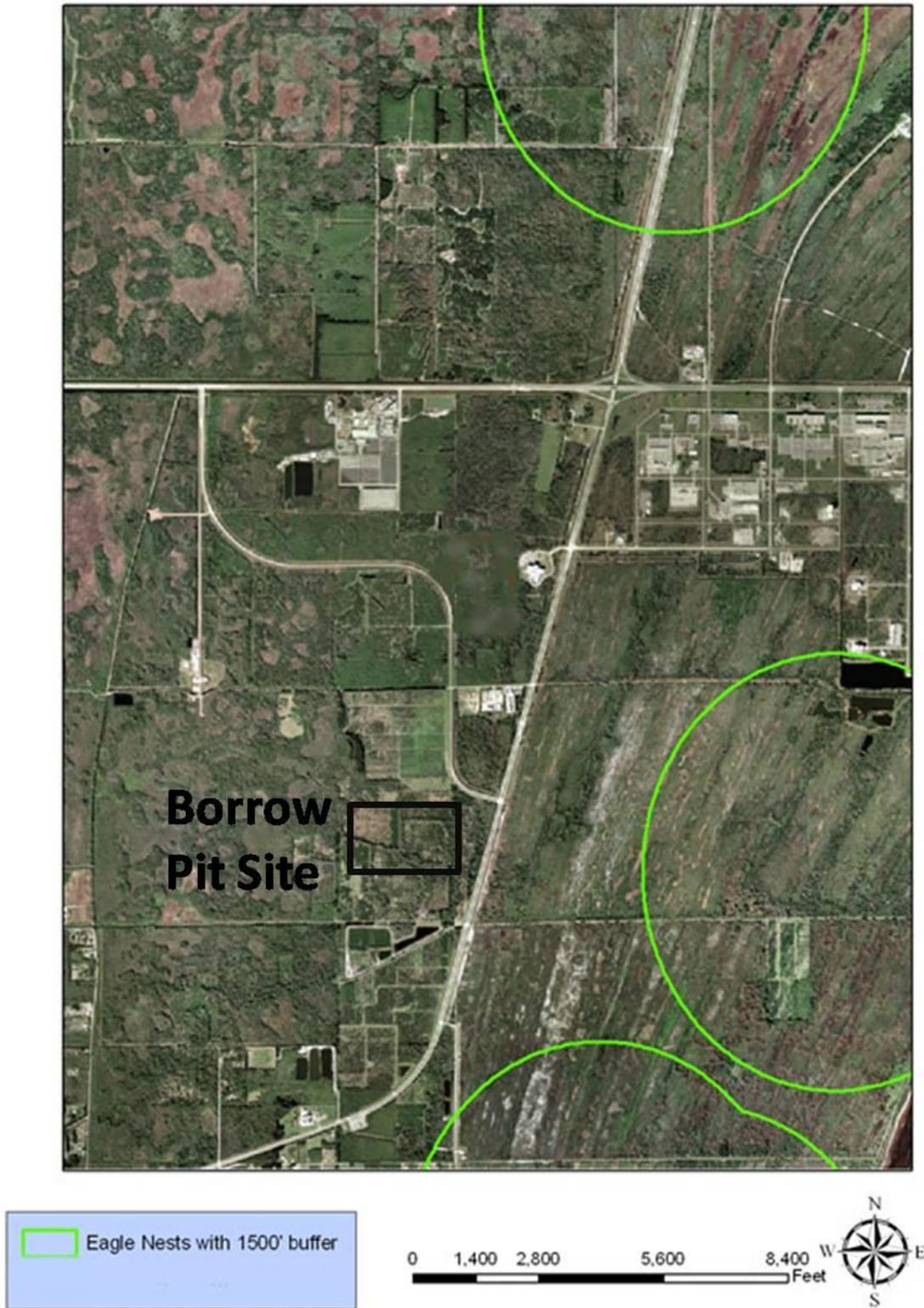
Although monocultures typically do not support a high diversity of birds, citrus groves have the potential to provide useful habitat for some species during various times of the year. At least 20 bird species were shown to utilize a 16 ha (40 ac) grove in central Florida during the fall migration, with species including several neotropical migrants and raptors (Jones 1999). However, few resident birds are supported by citrus groves and these are expected to be habitat generalists such as mockingbirds (*Mimus polyglottos*), doves, and non-native bird species.

KSC supports an annual average of 14 breeding pairs of the southern bald eagle; see Figure 3-2 for 2007/2008 nest sites. Production for the 2004 – 2006 seasons averaged between eight and 14 fledglings (Bolt and Cancro 2006). In Florida, bald eagles generally use mature live pines and pine snags within pine flatwoods habitats. They will also occasionally build nests on man-made towers. KSC offers ideal habitat for bald eagle nesting due to the wide expanse of relatively undisturbed pine flatwoods, and the freshwater and estuarine wetland complex that provides a diversity of excellent foraging habitats (Hardesty and Collopy 1991). The proposed borrow pit site does not provide suitable nesting habitat for bald eagles.

3.4.2.4 Mammals

Thirty species of mammals inhabit KSC lands and waters (Ehrhart 1976). Typical terrestrial species include the opossum (*Didelphis virginiana*), hispid cotton rat (*Sigmodon hispidus*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), and bobcat (*Lynx rufus*). Due to the regional loss of large carnivores such as the Florida panther (*Puma concolor coryi*) and red wolf (*Canis rufus*), the bobcat and otter now hold the position of top mammalian predators on KSC, although coyote (*Canis latrans*), have also been documented. Additionally, the loss of top carnivores and anthropogenic landscape changes have resulted in a proliferation of mid-level predators such as the raccoon. Opportunistic species such as the cotton rat and eastern cottontail rabbit (*Sylvilagus floridanus*) often account for a large portion of the small mammal biomass, rather than habitat-specific species such as

Figure 3-2: Bald eagle nest buffer zones in the vicinity of the proposed site.



the state-listed Florida mouse (*Podomys floridanus*) and the federally protected southeastern beach mouse (*Peromyscus polionotus niveiventris*). At least three species of bats have been documented and they occasionally use facilities as roosts sites. A very large, reproductively active bat roost is located in the bridge on SR 3 where it crosses over SR 405, just inside the KSC security gate. Several thousand bats are thought to use this bridge year-round. Two mammal species common in the waters of the IRL are the Atlantic bottlenosed dolphin (*Tursiops truncatus*) and the West Indian manatee (*Trichechus manatus*).

Mammal species most likely to be found on the proposed site are habitat generalists that are able to utilize disturbed areas. None of these are protected species, but include coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), raccoons, opossums, cotton rats, cottontail rabbits, and non-native mammals such as nine-banded armadillos (*Dasypus novemcinctus*) and feral hogs (*Sus scrofa*). On KSC, hogs are actively trapped and removed through a program managed by MINWR to minimize their detrimental impacts on native communities (USFWS 2007a).

3.5 Threatened and Endangered Species

3.5.1 Listed Wildlife

Sixteen federally-listed wildlife species have been documented on KSC, which is more than on any national wildlife refuge in the continental U.S. Six of these are only incidentally present and do not make important contributions to the area's biota: hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempi*), snail kite (*Rosthrhamus sociabilis*), Audubon's crested caracara (*Polyborus plancus audubonii*), piping plover (*Charadrius melodus*), and roseate tern (*Sterna dougallii*).

The following ten federally listed species occur on KSC either commonly or occasionally (Appendix 5): loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), eastern indigo snake (*Drymarchon couperi*), Atlantic salt marsh snake (*Nerodia clarkii taeniata*), wood stork (*Mycteria americana*), Florida scrub-jay (*Aphelocoma coerulescens*), southeastern beach mouse (*Peromyscus polionotus niveiventris*), and the West Indian manatee (*Trichechus manatus*). The American alligator (*Alligator mississippiensis*) remains on the federally protected list only because it is similar in appearance to another listed species, the American crocodile (*Crocodylus acutus*). Six of the federally listed animals are marine and/or estuarine species and would not be found on the proposed borrow pit site. The southeastern beach mouse is primarily a coastal species, with a small KSC population found on Merritt Island north of the VAB (Provanca et al. 2005). Scrub-jays are also habitat specialists, whose scrub requirements have been extensively surveyed and modeled (Breininger 1981, 1992, Breininger et al. 1991). Potential scrub-jay habitat in the vicinity of the proposed site is depicted in Figure 3-3. Only the indigo snake has a reasonable potential for association with the proposed site.

3.5.1.1 Eastern Indigo Snake

Eastern indigo snakes were federally listed as threatened under the Endangered Species Act in 1978. They are thought to be common on KSC, although actual population numbers are difficult to obtain. Research on home range sizes, habitat use, and trapping methods using radio tagged indigos has been conducted on KSC since the early 1990s (Breininger et al. 2004; Dyer 2004). Eastern indigo

snakes have very large home ranges and use a variety of habitat types that include uplands, wetlands, hammocks, and disturbed areas. Because indigos have large ranges which include various habitats, the proposed site could be utilized by one or more snakes.

3.5.1.2 Woodstork

Drainage ditches that run along and through the citrus groves and the Space Commerce Way stormwater detention ditch adjacent to the site could be used as foraging areas by wood storks at times when water levels are suitable. However the ditches within the grove area are densely vegetated with large Brazilian peppers and Australian pines (*Casuarina* spp.) reducing access to these sources. The site does not contain any suitable nesting areas for wood storks.

3.5.2 Listed Plants

No federally listed plant species have been found on KSC. KSC supports 33 plant species that are protected by the State of Florida, either as threatened, endangered, or commercially exploited (NASA 2002, Schmalzer and Foster 2005).

3.6 Cultural Resources

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reasons. Based on the 2004 cultural resources survey report for the International Space Research Project report (ACI 2003), the current proposed action site lies in an area of KSC which is considered to have a low site location potential for archeological resources. The proposed site is also unlikely to contain any extant historical (pre-1953) resources.

3.7 Geology and Soils

3.7.1 Geology

Geology, geohydrology and soils of KSC were detailed by Schmalzer and Hinkle (1990). Their review described KSC sediments as consisting primarily of marine and lagoonal materials that have accumulated during alternating periods of deposition and erosion since the Eocene. The surface sediments are of Pleistocene and Recent ages. Fluctuating sea levels correlating to alternating glacial and interglacial cycles have shaped the formation of the barrier islands. Merritt Island is an older landscape whose formation may have begun as much as 240,000 years ago, although most of the surface sediments are not that old. Cape Canaveral likely dates from less than 7,000 years before present, as does the barrier strip separating Mosquito Lagoon from the Atlantic Ocean. Deep aquifers beneath KSC are recharged inland but are highly mineralized in the coastal region and interact little with surface vegetation. The surficial aquifer is recharged by local rainfall. Relict dune ridges in the center of Merritt Island are important to its recharge. Discharge is from evapotranspiration, seepage to canals and ditches, seepage into interior wetland swales, and seepage into impoundments, lagoons, and the ocean. This aquifer exists in dynamic equilibrium with rainfall and with the fresh-saline water interface. Freshwater wetlands depend on the integrity of this aquifer, and it provides freshwater discharge to the lagoons and impoundments.

3.7.2 Soils

The soils of KSC are mapped in the soil surveys for Brevard County (Huckle et al. 1974) and Volusia County (Baldwin et al. 1980). Fifty-eight soil series and land types are represented, even though Merritt Island is a relatively young landscape and one formed from coastal plain deposits. The primary source of parent material for KSC soils is sands of mixed terrestrial and biogenic origin. The terrestrial material originated from southern rivers carrying sediments eroded from highly weathered Coastal Plain and Piedmont soils; these sediments are quartzose with low feldspar content (Milliman 1972). These sediments moved south through long-shore transport and may have been reworked repeatedly. The biogenic carbonate fraction of the sand is primarily of mollusk or barnacle origin with lesser contributions of coralline algae and lithoclasts; some may be reworked from offshore deposits of coquina and oolitic limestone (Milliman 1972).

The four basic soil types found on the proposed site are Myakka, Samsula, Copeland and Bradenton (see Table 3-2). The Copeland-Bradenton-Wabasso Complex makes up the dominant soil on the site, accounting for 95 percent of the soils (Figure 3-4). Drainage ditches and bedding made these areas suitable for citrus (USDA 1974). Prior to the modifications made to accommodate citrus production, the naturally-occurring plant communities that would typically be found on these soils include species that can tolerate periodic root inundation.

During the last decade the Florida Research Center for Agricultural Sustainability (FLARES) was under contract to the Merritt Island NWR to utilize the proposed site and other historical citrus groves on KSC as demonstration sites for sustainable and environmentally sound citrus production. Calcium arsenate, used in Florida during the 1950s and 60s on grapefruit groves, has been banned for use on citrus groves for decades. Therefore it is unlikely that it was used on the project site as the area has not been used for grapefruit production. Copper is generally only used on fresh fruit citrus and only two small groves on the northern edge of the site have been used for that purpose. Approved fungicides are also used on fresh fruit citrus crops. Most of the site has been fallow for at least 10 years.

Table 3-2: Soil types and coverage within the proposed site boundary

Soil Type	Hectares	Acres
Anclote	0.12	0.30
Myakka	0.10	0.25
Samsula	1.7	4.2
Copeland	22.96	56.74
Bradenton	5.55	13.71
Total:	30.42	75.20

3.8 Noise

Noise generated at KSC originates from six different sources: 1) launches, 2) Space Shuttle reentry sonic booms, 3) aircraft, 4) industrial operations, 5) construction, and 6) traffic. Noise generated

Figure 3-3: Soils within the proposed site boundary.



above ambient levels by these sources has the potential to adversely affect both wildlife and humans. Some typical values for noise levels from construction and vehicles are shown in Appendix 6.

Baseline noise studies have not been performed directly at the proposed site. However, a noise study performed as part of the Shuttle Landing Facility Environmental Assessment (NASA 2007a) monitored ambient sound levels at various stations on KSC. One of the noise monitoring sites in the 2007 study was located along Swartz Road, approximately 5 km (3.2 miles) north of the Phase 1 site. During the study, noise levels ranged between approximately 50 and 80 dBA, with the highest noise levels corresponding to take-offs and landings of a supersonic F104 aircraft at the Shuttle Landing Facility (Comprehensive Health Services 2007). On a daily basis, noise levels on the proposed site are mostly governed by traffic along Space Commerce Way, while occasional higher noise levels are caused by aircraft operating at the SLF, as well as shuttle and rocket launches on KSC and CCAFS.

3.9 Surface Water Quality

The surface waters in and surrounding KSC are shallow estuarine lagoons and include portions of the Indian River, the Banana River, Mosquito Lagoon, and Banana Creek. The area of Mosquito Lagoon within the KSC boundary and the northernmost portion of the IRL, north of SR 406, are designated by the State as Class II, Shellfish Propagation and Harvesting. All other surface waters at KSC have been designated as Class III, Recreation and Fish and Wildlife Propagation. All surface waters within MINWR are designated as Outstanding Florida Waters as required by Florida Statutes for waters within national wildlife refuges.

NASA, the USFWS, and the St John's Water Management District maintain water quality monitoring stations at surface water sites within and around KSC. The data collected are used for long-term trend analysis to support land use planning and resource management. KSC surface water quality is generally good, with the best water quality being found adjacent to undeveloped areas of the IRL, such as Mosquito Lagoon, and the northernmost portions of the Indian River and Banana River (NASA 2003).

Although some ditches occur on the proposed site, these do not connect to any nearby waterways and are not flooded year-round.

3.10 Groundwater Quality

The State of Florida uses four categories to rate the quality of groundwater in a particular area. The criteria for these categories are based on the degree of protection that should be afforded to that groundwater source, with Class G-I being the most stringent and Class G-IV being the least. The groundwater at KSC is classified as Class G-II, which means that it is a potential potable water source and generally has a total dissolved solids content of less than 10,000 milligrams/liter (parts per million) (NASA 2003).

The subsurface of KSC is comprised of the Surficial Aquifer, the Intermediate Aquifer, and the Floridan Aquifer. Recharge to the Surficial Aquifer system is primarily due to the infiltration of precipitation; however, the quality of water in the aquifer beneath KSC is influenced by the intrusion of saline and brackish surface waters from the Atlantic Ocean and the IRL. This is evident from the high mineral content, principally chlorides, that has been measured in groundwater samples collected during various KSC surveys (Schmalzer et al. 2000).

The proposed borrow pit site lies over the West Plain Subaquifer, a surficial aquifer considered to be fair to poor in terms of its ability to recharge the underlying aquifer systems (Edward E. Clark 1985 & 1987).

3.11 Socioeconomics

KSC is Brevard County's largest single employer and a major source of revenue for the local economy. KSC operations create a chain of economic effects throughout the region. Each job created within Brevard County's space industry is estimated to generate an additional 1.93 jobs within the region (NASA 2003). Other large employers in the county are Patrick Air Force Base, the

Brevard School District, and Health First. Approximately 14,865 personnel were employed at KSC in 2008, a number that includes contractor, construction, tenant, and permanent civil service employees (NASA 2008). On KSC, civil service employees account for approximately 12 % of the total workforce. During the Apollo program. In 1968, KSC recorded a peak population of 25,895, with an estimated one in four workers in Brevard County employed at KSC. Employment levels dropped precipitously following the Apollo program to a historic low in 1976, when a total of 8,441 personnel were employed. Employment levels rose sharply in 1979 when KSC was designated as the launch and operations support center for the Space Shuttle program.

Approximately 50 % of the people at KSC have positions directly related to the Shuttle and payload processing operations. The remaining workforce is employed in ground and base support, unmanned launch programs, crew training, engineering, and administrative positions. The largest concentration of personnel is stationed in the LC 39 Area, and the next largest concentration is in the Industrial Area. Remaining personnel are stationed at various outlying facilities.

3.12 Land Use

Land and open water resources of KSC comprise 56,451 ha (139,490 ac) in Brevard and Volusia Counties, and are located along the east coast of central Florida at 28° 38'N, 80° 42'W (NASA 2003). The majority of the land areas comprising KSC are on the northern part of Merritt Island, which forms a barrier island complex with adjacent Cape Canaveral (NASA 1979). Undeveloped areas, including uplands, wetlands, mosquito control impoundments, and open water areas, comprise approximately 95 % of the total KSC area (NASA 2003). Nearly 40 % of KSC consists of open water, including portions of the Indian River, Banana River, Mosquito Lagoon, and all of Banana Creek (NASA 2003).

KSC was established under NASA jurisdiction for the purpose of implementing the Nation's space program (NASA 2003). NASA maintains operational control over approximately 3,035 ha [7,500 ac] of KSC. Undeveloped operational areas are dedicated safety zones around existing facilities or are reserved for future expansion.

The overall land use and management objectives of NASA and KSC are to maintain the Nation's space mission operations while supporting alternative land uses that are in the Nation's "best interest" under the Space Act (NASA 2003). Towards these ends, KSC developed a Land Use Plan in 1999 and then participated in the development of the Cape Canaveral Spaceport Master Plan, recently updated as the KSC Master Plan, in cooperation with the 45th Space Wing and the Florida Space Authority. These plans provide an overall context for future land uses on KSC while not identifying any specific facility or land development projects. Such future projects will be driven by program changes and management decisions as yet undefined.

The current land use designation of the proposed site is Conservation (KSC Master Plan, 2009). The former citrus operations have ended and the area is currently under the management jurisdiction of the USFWS. However, the USFWS does not currently have the resources to manage this area for natural habitat values and therefore the land has gone fallow and exotic species such as Brazilian Pepper are slowly invading.

4.0 Environmental Consequences

Chapter 4 summarizes the potential impacts the Proposed Action and No Action alternatives could have on environmental resources at KSC. Seventeen resource categories were analyzed (Table 4-1).

4.1 Summary and Status of Impacts

Potential impacts to resources resulting from the implementation of the Proposed and No Action alternatives were identified and placed into one of the following classifications:

- None – no impacts expected
- Minimal - impacts are not expected to be measurable, or are too small to cause any discernable degradation to the environment
- Minor - impacts would be measurable, but not substantial, because the impacted system is capable of absorbing the change, or mitigation measures compensate for potential degradation
- Major - impacts could individually or cumulatively be substantial

4.1.1 No Action Alternative

Under the No Action alternative, development and operation of the borrow pit would not occur at KSC. Activities detailed in the Proposed Action would have to be developed and conducted elsewhere.

4.1.2 Proposed Action

Impacts from the development and operation of the proposed borrow pit are expected to range from none to minor (Table 4-1). A discussion of these impacts follows in Section 4.2.

Table 4-1: Impact Matrix for the proposed the Proposed KSC Industry Borrow Pit.

Resource/Issue		Proposed Action	No Action
Transportation	C*	Minimal	None
	O*	Minimal	Minimal
Waste Water	C	None	None
	O	None	None
Electricity/Natural Gas	C	None	None
	O	None	None
Communications	C	None	None
	O	None	None
Potable/Fire Water	C	None	None
	O	None	None
Stormwater	C	Minimal	None
	O	Minimal	None
Air Quality	C	Minimal	None
	O	Minimal	None

Resource/Issue		Proposed Action	No Action
Biological Resources <i>Land Cover</i>	C	Minimal	None
	O	Minimal	None
Biological Resources <i>Wildlife</i>	C	Minimal	None
	O	Minimal	None
Threatened and Endangered Species	C	Minimal	None
	O	Minimal	None
Cultural Resources	C	None	None
	O	None	None
Geology and Soils	C	Minimal	None
	O	Minimal	None
Noise	C	Minimal	None
	O	Minimal	None
Surface Water Quality	C	Minimal	None
	O	Minimal	None
Ground Water Quality	C	Minimal	None
	O	Minimal	None
Socioeconomics	C	Minimal	None
	O	Minimal	None
Land Use	C	Minimal	None
	O	Minimal	None

* C = impacts from construction

* O = impacts from operations

4.2 Analysis of Impacts from the Proposed Action

4.2.1 Facilities and Infrastructure

Under the Proposed Action, there would be no permanent employees associated with the borrow pit. There could be up to 20 temporary workers on the site during construction and up to 30 temporary workers during peak operation periods. However, there would be no facilities, temporary or permanent to house these workers.

4.2.1.1 Transportation

Construction - The construction activities associated with the development of the borrow pit would take three to six months and involve the clearing and grubbing of the site, the removal of the vegetation and the establishment of the berms and roads around the pit itself. In addition, a small haul road from the site connecting to Space Commerce Way would be constructed (Figure 1-2). All of this activity would occur on the borrow pit site, therefore, other than the mobilization of the equipment to the site and the daily transit of the workers to and from the site, there would be no impact to local transportation routes.

Operation – Operations would involve de-watering, soil excavation and transport of the soil material off of the site to the designated KSC development site. Soils would be moved off of the site to their

final destination elsewhere on KSC via truck. This traffic would have a minimal impact on the KSC road system, and the impacts would be temporary.

4.2.1.2 Wastewater

Construction - During construction, it is likely that portable toilets would be set-up on the site. However, due to the small number of workers on the site, this is not expected to impact existing wastewater systems. Toilets would be serviced by an off site contractor.

Operation – During operations, it is possible that portable toilets may be set-up on the site. However, due to the small number of workers on the site, this is not expected to impact existing wastewater systems.

4.2.1.3 Electricity and Natural Gas

Construction – There is no requirement for electricity or natural gas during construction.

Operation - There is no requirement for electricity or natural gas during operations.

4.2.1.4 Communications

Construction – Only portable phones and radios would be used during construction.

Operation – Only portable phones and radios would be used during operation.

4.2.1.5 Potable/Fire Water

Construction – There would be no requirement for potable water or fire suppression capabilities during construction and operation.

Operation - There would be no requirement for potable water or fire suppression operations during construction and operation.

4.2.1.6 Stormwater

Construction –An Environmental Resource Permit (ERP) from the St. Johns River Water Management District (SJRWMD) would be required prior to start of construction. The stormwater system required to manage runoff would be constructed in accordance with the ERP and details of the stormwater design would be included in that permit. As such, assuming a permitable design, only minimal impacts would be expected.

Operation - Stormwater system operations for the proposed development are expected to have minimal impacts. These areas are likely to provide some habitat, at least during certain times of the year, for wading birds and other wildlife species. Operation of the borrow pit is not expected to generate stormwater pollutants that could be discharged off site. Primary concerns would be related to surface water turbidity within the pit during excavation, but no connection to receiving waters exists and turbid water will settle out in place immediately following excavation activities.

4.2.2 Air Quality

Construction - Site preparation and construction of the proposed borrow pit would produce minimal impacts to the surrounding air quality. Land clearing and other construction would generate airborne particulates from earth moving, as well as hydrocarbon exhaust from heavy equipment and generators. These impacts are expected to be small in scope and of short duration. Best Management Practices (BMP's) would be employed to mitigate for emissions due to earth movement, which would include water spraying for dust control.

Operation – Impacts to air from borrow pit operations would be expected to be similar to those for construction with the addition of the trucks moving off of the site. As with construction, these impacts are expected to be of short duration and small in comparison to the overall traffic loads on KSC roads and would therefore produce only minimal impacts.

4.2.3 Biological Resources

4.2.3.1 Land cover

Construction - Under the Proposed Action, the site encompasses a total of approximately 30 ha (75 ac). The current land cover is fallow citrus groves which would be ultimately converted to open water. This would be accomplished through the removal of the existing vegetative cover, the likely burning of these materials on-site and the excavation of materials to build berms and other control structures for use in the ultimate operation of the borrow pit. Because this land use has already been changed through the determination to no longer maintain the citrus grove activity, the proposed impact is considered minimal.

Operation - Currently the proposed site is fallow and being invaded by non-native plants. The site is not actively managed by MINWR, whose habitat restoration program generally focuses on sites that are less degraded and not in close proximity to KSC developed areas (USFWS 2006). Such unmanaged areas can become vectors for invasive plants and non-native animals, which could impact nearby, more natural areas. Once the borrow pit operations have been completed and all borrow materials have been removed, the site would be mostly open water habitat and would be available for use by waterfowl and other aquatic species. Impacts to land cover would be minimal.

4.2.3.2 Wildlife

Construction - The primary impact expected to wildlife from the Proposed Action would be the loss of terrestrial habitat. However, for most of the species that reside on KSC, such disturbed, heavily impacted habitats are not readily used. This area is expected to continue to degrade and be overtaken by Brazilian Pepper and other invasive/exotic vegetation. The removal of this vegetation will result in the conversion of the area to a construction site during operations and will not be available to wildlife during that time. However, as the existing habitat is not useful for most species, its removal is considered to produce only minimal impacts to wildlife.

Operation – During operations, the borrow pit site could pose minimal hazards to wildlife as there would be operations of heavy equipment and trucks that will be leaving and entering the site. Such operations could result in collisions with wildlife, however, the expected distance between the

borrow pit and the sites that the borrow materials would be deposited is small, within one 1.6 km (1 mi). Such impacts would be considered minimal.

4.2.4 Threatened and Endangered Species

Construction – Twenty-seven federally and state-protected wildlife species documented on KSC are listed in Appendix 5. One of these species, the eastern indigo snake, could potentially occur in the habitat types that would be impacted by the Proposed Action (Table 4-2). This impact is expected to be minimal.

A habitat generalist, the eastern indigo snake has been documented using all of the vegetated habitats present within the Proposed Action alternative, and at least one indigo snake has been documented occurring in the vicinity of the site (NASA 2002). However, the impact to eastern indigos for the loss of 23.14 ha (57.20 ac) of habitat is expected to be minimal. The average home range size for male indigos in Brevard County was 118 ha (291 ac.) and the smallest range recorded was 65 ha (161 ac.) (Legare et al., unpublished data). Average home range for females was 41 ha (101 ac.) and the smallest recorded was 30 ha (74 ac.). The entire acreage that would be developed for the Proposed Action is approximately three-fourths the size of the smallest home range expected for a single indigo snake.

Because of the addition of permanent fresh water and stormwater retention to the area, it is expected that the borrow pit could benefit alligators and water birds.

Gopher tortoises and their burrows were not documented on the site, as would be expected given the area's relatively overgrown characteristics (B. Bolt, pers. comm., October 2009). In addition, most of the nearby surrounding habitats are also not suitable for gopher tortoises, and it is unlikely that they would utilize the proposed site as a foraging area. Still, before any construction would begin, surveys for gopher tortoises and their burrows would be performed, and if found, the tortoises would be captured and relocated to the nearest adjacent suitable habitat in accordance with the KSC Gopher Tortoise Relocation Policy. Impacts from loss of habitat from the proposed borrow pit construction would be classified as minimal.

Operation - During the operational phase of the proposed action, disturbance to wildlife from vehicles and pedestrians are likely to be the primary impacts. However, these impacts are expected to be minimal, as many birds and other wildlife species readily habituate to the presence of cars and people (Whittaker and Knight 1998). There is expected to be some risk of vehicle collisions with wildlife on the proposed site and access road, but posted speed limits are anticipated to be relatively low. In addition, using speed reduction devices and "Give Wildlife A Brake" signs would help further decrease the risk of vehicle-wildlife collisions.

4.2.5 Cultural Resources

Based on previous studies performed on and near this site, the area has been identified as having a low potential for impacts to cultural resources (ACI 2003, NASA 2004b). There are no known archeological or historic properties within the site. Therefore, no impacts to cultural resources are expected.

4.2.6 Geology and Soils

Construction - Any potential impacts to the geology and soils of the proposed borrow pit would be due to site preparation activities. Land clearing and excavation for berms, roads and stormwater management systems would require that the upper layers of the soil strata be removed. This alteration of the site may affect the flow patterns of surface runoff from rainfall events, but would be mitigated by site grading and construction of a suitable stormwater system to contain and treat runoff. Impacts are expected to be minimal.

Operation – The operations activities would involve removing soils from the borrow pit site and transporting them to other areas of KSC. This would produce minor impacts to the geology of the site. However as these materials are common on KSC and because these soils would not be removed from KSC, the overall impacts would be considered minor.

4.2.7 Noise

Construction - Noise generated during the construction phases of the proposed borrow pit would potentially have discernable, but temporary effects on wildlife occurring nearby. Construction noise sources and levels that could be expected on the site are listed in Appendix 6, with the highest levels reaching 111 decibels, A-weighted (dBA). However, construction would take place in areas that already experience noise associated with vehicles using Space Commerce Way. Also, noise attenuation rates are such that at a distance of 120 m (400 ft), between 60 and 75 percent of the noise level has dissipated (Suter 2002). The majority of research related to the effects of noise on wildlife has been conducted on laboratory animals and the results extrapolated (Brown 2001). Some buffering of noise is afforded to wildlife by vegetation, with rates of up to 10 dBA per 100 m (328 ft.) having been demonstrated in vegetated areas (Price et al. 1988). Based on that rate, noise would be expected to carry 300 - 400 m (984 - 1,312 ft) away from the construction sites. Beyond this distance, noise levels would be lower than what has been experimentally shown to have deleterious effects on animals (Brown 2001). Wildlife occurring closer to noise sources would be free to move away or find shelter. There are no wading bird colonies, documented eagle nests (Figure 3-2), or other protected bird species' nesting habitat within 400 m (1,312 ft.) of the site. Therefore, noise impacts are expected to be minimal. Permissible noise exposure limits for humans are established by the Occupational Safety and Health Administration (OSHA). Away from the site, noise levels are expected to be below the OSHA recommended 8-hour time weighted level of 85 dBA (OSHA 2008).

Operation – Noise from operations at the borrow pit would be expected to be similar in nature and scope to those during construction operations. Impacts would also be expected to be similar.

4.2.8 Surface Water Quality

Construction - The construction of the proposed borrow pit would have no to minimal effects on surface water quality given that there are no permanent surface water bodies on or surrounding the proposed site. During land clearing and other site development activities, impacts to surface waters at a distance from the proposed site from erosion and sedimentation would be controlled by using BMPs including maintaining the de-watering discharges on-site through the use of perimeter ditches and berms.

Operation - The operation of the proposed borrow pit would have minimal impacts on the surface water quality to areas surrounding the site. De-watering operations associated with soils excavation would be controlled and water removed from the excavation pit would be maintained on the site in accordance with the CUP that would be obtained prior to the start of construction. Therefore, impacts to surface waters would be none to minimal.

4.2.9 Groundwater Quality

Construction - The groundwater quality at the proposed site is affected by runoff that percolates into the surficial aquifer. Construction at the proposed site could temporarily increase the amounts of sedimentation and pollutants that could migrate into the groundwater system. These impacts would be reduced by employing BMPs and are expected to be minimal.

Operation - The activities associated with the proposed borrow pit are expected to have a minimal effect on groundwater quality. Runoff from operations and de-watering activities would be controlled in accordance with the Consumptive Use Permit (CUP) that would be obtained prior to operations of the borrow pit.

4.2.10 Socioeconomics

Construction - A total of 20 construction workers are expected to be required during construction of the proposed borrow pit site. These would be drawn from the local workforce with an anticipated positive impact to the area's economy. At any one time, KSC employs a relatively large number of construction workers, and this impact to area's socioeconomics and the local workforce would likely be minimal.

Operation - During the operational phase of the proposed action, approximately 30 employees would be periodically employed. These would all be construction workers that would be employed from the local workforce and would represent a minimal positive impact on the local economy.

4.2.11 Land Use

Construction - A relatively small portion of the total acreage of KSC has been developed or designated for NASA operational and industrial use. KSC covers 56,451 ha (139,490 ac) of which 5.4 percent is designated as operational area. The approximately 30 ha (75 ac) of land that would be developed under the Proposed Action would represent less than 0.05 percent of the total area of KSC; this would be considered a minimal impact.

Operation - The operation of the borrow pit would have minimal impacts to the existing land use. Currently the land is no longer being utilized for citrus production, nor are there immediate plans by MINWR to restore the area due to the high cost associated with those efforts. Restoration would be very expensive because the land has lost the majority of its natural biological characteristics and functions due to past land use and the invasion of non-native plants (USFWS 2006).

4.3 No Action Alternative

4.3.1 Facilities and Infrastructure

Under the No Action Alternative, there would be no borrow pit constructed or operated on KSC for use by outside entities developing infrastructure on KSC. For such activities, the required fill materials would have to be acquired either on each specific development site or from sources outside KSC.

In the latter case, all site specific impacts to natural resources would be experienced at the location or locations from which the fill material would be excavated. It is assumed that any such commercial borrow operations would require environmental and operational permits and that the impacts to those sites would be addressed during the project specific environmental review process. However, increased impacts to the regional area would be to air emissions resulting from the increased traffic from those sites.

4.3.1.1 Transportation

Construction - The construction activities associated with the development of off-site borrow operations would already have been completed and therefore there would be no expected impacts associated with this proposed project or projects.

Operation – Impacts associated with the use of off-site borrow operations would result in increased traffic as fill materials were transported to KSC from those sites. This would have a minimal impact on both the KSC and off-site road systems, but would be of temporary duration. The geographical extent of such increased traffic impacts would depend on the various locations from which the fill materials would be obtained.

4.4 Cumulative Impacts

4.4.1 Proposed Action

The anticipated cumulative impacts from the proposed development of the Industry Borrow Pit are related to alteration of the land. The resulting conversion of an unmanaged citrus grove to open water constitutes a land use and land cover change. However, the 30 ha (75 ac) footprint of the Proposed Action alternative is small compared to the 53,416 ha (131,990 ac) of undeveloped habitat on KSC and there are only two other similar facilities currently located on KSC. Therefore, any cumulative impacts to the KSC environment from implementing the Proposed Action alternative are expected to be insignificant.

4.4.2 No Action Alternative

If no action is taken, cumulative impacts are anticipated to be minimal for the local economy in light of the projected workforce level and economic activity. The unrealized job opportunities would also mean a diminished potential level of associated primary and secondary economic benefits to the local economy.

5.0 Environmental Justice

On February 11, 1994, the President of the U.S. signed Executive Order (EO) 12898, entitled, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.” The general purposes of the EO are to: 1) focus the attention of Federal Agencies on the human health and environmental conditions in minority and low-income communities with the goal of achieving environmental justice; 2) foster non-discrimination in Federal programs that substantially affect human health or the environment; and 3) give minority and low income communities greater opportunities for public participation in, and access to, public information on matters relating to human health and the environment. The EO directs federal agencies, including NASA, to develop environmental justice strategies. Further, EO 12898 requires NASA, to the greatest extent practicable and permitted by law, to make the achievement of environmental justice part of NASA’s mission. Disproportionately high adverse human health or environmental effects on minority or low-income populations must be identified and addressed. In response, NASA established an agency-wide strategy, which, in addition to the requirements set forth in the EO, seeks to: 1) minimize administrative burdens; 2) focus on public outreach and involvement; 3) encourage implementation plans tailored to the specific situation at each Center; 4) make each Center responsible for developing its own Environmental Justice Plan; and, 5) consider both normal operations and accidents. KSC has developed a plan to comply with the EO and NASA’s agency-wide strategy.

Neither of the alternatives described in this EA (Proposed Action and No Action) would be expected to produce any consequences related to Environmental Justice. The proposed activities would be implemented within the boundaries of KSC. The closest residential areas are 3.9 km (2.5 mi) south on Merritt Island, and 12 km (7.6 mi) west in Titusville. The closest residential area on north Merritt Island is extremely low density and the distance to the Titusville areas preclude any direct impacts from construction. Operational impacts are expected to be negligible in the residential areas based on data models and surveys. Economic impacts are not expected to adversely affect any particular group. Construction personnel would be drawn from the local workforce and provide economic benefits to the local area.

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8.0 Appendices

Appendix 1: KSC Air Quality Data Summary PAMS A, 2007

Table 3-4. KSC Air Quality Data Summary PAMS A, 2008.

Parameter	Federal [4] and State Standard	Jan	Feb	Mar	Apr	May	June
Ozone (ppb)	Primary 75 (8-HR) [1]**	44.5	52.5	57.3	60.1	62.3	46.2
	Secondary 75 (8-HR-AVG)	46.1 (24.2%)	58.6 (100.0%)	95.2 (94.9%)	62.8 (99.9%)	65.3 (100.0%)	50.5 (100.0%)
Sulfur Dioxide (ppb)	Primary 140 (24-HR) [2,4]	0.0	0.0	0.0	11.3	4.5	3.5
	Secondary 500 (3-HR) [3]	0.0 (0.0%)	0.0 (0.0%)	0.0 (0.0%)	13.9 (92.5%)	6.0 (99.9%)	3.3 (100.0%)
Nitrogen Dioxide (ppb)	(1 HR-AVG)	7.6	17.2	9.1	10.0	6.3	1.6
	50 (ANNUAL-AVG) [3]	0.469 (24.2%)	0.480 (100.0%)	0.453 (94.9%)	0.469 (99.9%)	0.446 (92.1%)	0.413 (62.2%)
Carbon Monoxide (ppm)	35 (HR-AVG) [1]	0.3	0.5	2.2	0.3	0.3	0.6
	9 (8-HR) [2]	0.300 (94.1%)	0.363 (100.0%)	0.788 (94.9%)	0.150 (99.9%)	0.163 (100.0%)	0.200 (100.0%)
Parameter	Federal [4] and State Standard	Jul	Aug	Sept	Oct	Nov	Dec
Ozone (ppb)	Primary 75 (8-HR) [1]**	31.2	46.8	37.7	42.3	34.6	33.8
	Secondary 75 (8-HR-AVG) [1]	36.5 (80.6%)	54.2 (100.0%)	41.5 (97.5%)	49.8 (100.0%)	39.5 (99.2%)	35.2 (76.3%)
Sulfur Dioxide (ppb)	Primary 140 (24-HR) [2, 4]	4.9	2.6	2.9	5.1	4.2	2.7
	Secondary 500 (3-HR) [3]	3.9 (80.6%)	3.7 (100.0%)	1.9 (99.7%)	5.0 (100.0%)	6.0 (100.0%)	2.6 (76.3%)
Nitrogen Dioxide (ppb)	(1 HR-AVG)	7.5	10.4	5.3	5.2	10.1	6.9
	50 (ANNUAL-AVG) [3]	0.460 (54.3%)	0.676 (100.0%)	0.869 (99.6%)	0.523 (100.0%)	0.778 (100.0%)	0.808 (76.3%)
Carbon Monoxide	35 (HR-AVG) [1]	0.9	0.1	0.1	0.2	0.8	0.6
	9 (8-HR) [2]	0.371 (77.0%)	0.100 (99.9%)	0.100 (99.7%)	0.200 (100.0%)	0.600 (100.0%)	0.242 (76.3%)
[1] Maximum hourly average concentration (not to be exceeded more than once per year).							
[2] Maximum time-period average concentration (not to be exceeded more than once per year).							

[3] Annual arithmetic mean.
[4] Federal and State standards are identical except for SO₂; State Primary (24-hour) is 100 ppb.
NOTE:
** The ozone 8-hour standard and the PM 2.5 standards are included for information only. A 1999 federal court ruling blocked implementation of these standards, which EPA proposed in 1997. EPA has asked the U.S. Supreme Court to reconsider that decision.
Twenty-one days are required to yield a valid month.
(%) = Percentage of validation the month.
SOURCES: References 2, 3, 4, and 5.

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Appendix 2: State and Federal Ambient Air Quality Standards

Pollutant	Average Time	State of Florida Standard	Federal Primary Standard	Federal Secondary Standard
Carbon Monoxide	8 hour*	9 ppm (10 mg/m ³)	9 ppm (10 mg/m ³)	
	1 hour*	35 ppm (40 mg/m ³)	35 ppm (40 mg/m ³)	
Lead	Quarterly Arithmetic Mean	1.5 µg/m ³	1.5 µg/m ³	(same as primary)
Nitrogen Dioxide	Annual Arithmetic Mean	0.05 ppm (100 µg/m ³)	0.053 ppm (100 µg/m ³)	(same as primary)
Ozone	1 hour+	0.12 ppm (235 µg/m ³)	0.12 ppm (235 µg/m ³)	(same as primary)
	8 hour^	0.08 ppm (157 µg/m ³)	0.08 ppm (157 µg/m ³)**	(same as primary)
Sulfur Dioxide	Annual Arithmetic Mean	0.02 ppm (60 µg/m ³)	0.03 ppm (80 µg/m ³)	
	24 hour*	0.1 ppm (260 µg/m ³)	0.14 ppm (365 µg/m ³)	
	3 hour*	1300 µg/m ³ (0.5 ppm)		1300 µg/m ³ (0.50 ppm)
Inhalable Particulates (PM-10)	Annual Arithmetic Mean	50 µg/m ³	50 µg/m ³	(same as primary)
	24 hour*	150 µg/m ³	150 µg/m ³	(same as primary)
Particulates (PM-2.5)	Annual Arithmetic Mean		15 µg/m ³ **	(same as primary)
	24 hour		65 µg/m ³ **	(same as primary)
*Not to be exceeded more than once per year. (Parenthetical value is an approximately equivalent concentration.)				
+Not to be exceeded an average of more than one day per year.				
^Maximum 8 hour average concentration. Twenty-one days (70%) are required to yield a valid month. (%) – Percent of valid data for month.				
** The ozone 8 hour standard and the PM-2.5 standards are included for information only. A 1999 Federal court ruling blocked implementation of these standards, which EPA proposed in 1997. EPA has asked the U.S. Supreme Court to reconsider that decision.				
Source: Florida Department of Environmental Regulation (FDER) 1982.				

Appendix 3: KSC Land Cover Types and Areas.

Land cover Type	KSC+MINWR Area (ha/ac.)
Infrastructure - primary	533.5 / 1,318.2
Infrastructure - secondary	202.3 / 499.9
Estuary	12,157.0 / 30,040.7
Water - interior - salt	2,559.4 / 6,324.4
Water - interior - fresh	359.2 / 887.5
Barren land - may be inundated	75.6 / 186.9
Beach	26.1 / 64.6
Ditch	126.6 / 312.9
Marsh - saltwater	3,880.0 / 9,587.7
Marsh - freshwater	2,247.5 / 5,553.7
Mangrove	518.2 / 1,280.5
Wetland scrub-shrub - saltwater	636.3 / 1,572.4
Wetland scrub-shrub - freshwater	1,944.6 / 4,805.3
Wetland coniferous / hardwood forest	611.6 / 1,511.2
Wetland hardwood forest	406.2 / 1,003.9
Ruderal - herbaceous	1,382.6 / 3,416.5
Citrus	705.5 / 1,743.3
Ruderal - woody	461.5 / 1,140.3
Australian pine	32.6 / 80.5
Coastal strand	135.8 / 335.5
Oak scrub	4,990.2 / 12,331.2
Palmetto scrub	1,101.4 / 2,721.5
Pine flatwoods	920.0 / 2,273.5
Upland coniferous forest	72.7 / 179.6
Modified from Schaub 2005	

Appendix 4: State and federally listed wildlife species documented from KSC, Florida.

SCIENTIFIC NAME	COMMON NAME	LEVEL OF PROTECTION	
		FWC	USFWS
Amphibians and Reptiles			
<i>Alligator mississippiensis</i>	American alligator	SSC	T(S/A)
<i>Caretta caretta</i>	Loggerhead sea turtle	T	T
<i>Chelonia mydas</i>	Atlantic green turtle	E	E
<i>Dermochelys coriacea</i>	Leatherback sea turtle	E	E
<i>Drymarchon couperi</i>	Eastern indigo snake	T	T
<i>Gopherus polyphemus</i>	Gopher tortoise	T	-
<i>Nerodia clarkii taeniata</i>	Atlantic saltmarsh snake	T	T
<i>Pituophis melanoleucus mugitus</i>	Florida pine snake	SSC	-
<i>Rana capito aesopus</i>	Florida gopher frog	SSC	-
Birds			
<i>Ajaia ajaja</i>	Roseate spoonbill	SSC	-
<i>Aphelocoma coerulescens</i>	Florida scrub-jay	T	T
<i>Charadrius melodus</i>	Piping plover	T	T
<i>Egretta caerulea</i>	Little blue heron	SSC	-
<i>Egretta rufescens</i>	Reddish egret	SSC	-
<i>Egretta thula</i>	Snowy egret	SSC	-
<i>Egretta tricolor</i>	Tricolored heron	SSC	-
<i>Eudocimus albus</i>	White ibis	SSC	-
<i>Falco peregrinus tundrius</i>	Arctic peregrine falcon	E	-
<i>Falco sparverius paulus</i>	Southeastern American kestrel	T	-
<i>Haliaeetus leucocephalus</i>	Bald eagle	T	-
<i>Mycteria americana</i>	Wood stork	E	E
<i>Pelecanus occidentalis carolinensis</i>	Eastern brown pelican	SSC	-
<i>Rynchops niger</i>	Black skimmer	SSC	-
<i>Sterna antillarum</i>	Least tern	T	-
Mammals			
<i>Peromyscus polionotus niveiventris</i>	Southeastern beach mouse	T	T
<i>Podomys floridanus</i>	Florida mouse	SSC	-
<i>Trichechus manatus</i>	West Indian manatee	E	E
Key: E = endangered, SSC = species of special concern, T = threatened, T(S/A) = threatened due to similarity of appearance			

Appendix 5: Noise levels (in decibels, A-weighted) measured on KSC, Florida.

SOURCE	NOISE LEVEL (Peak)	DISTANCE FROM SOURCE [a]			
		15 m (50 ft.)	30 m (100 ft.)	60 m (200 ft.)	120 m (400 ft.)
Construction					
Heavy Trucks	95	84-89	78-83	72-77	66-71
Pickup Trucks	92	72	66	60	54
Dump Trucks	108	88	82	76	70
Concrete Mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Paver	109	80-89	74-83	68-77	60-71
Generator	96	76	70	64	58
Shovel	111	91	85	79	73
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Caterpillar	103	88	82	76	70
Dragline	105	85	79	73	67
Shovel	110	91-107	85-101	79-95	73-95
Dredging	89	79	73	66	77
Pile Driver	105	95	89	83	77
Ditcher	104	99	93	87	81
Fork Lift	100	95	89	83	77
Vehicles					
Diesel Train	98	80-88	74-82	68-76	62-70
Mack Truck	91	84	78	72	66
Bus	97	82	76	70	54
Compact Auto	90	75-80	69-74	63-68	57-62
Passenger Auto	85	69-76	63-70	57-64	51-68
Motorcycle	110	82	76	70	64
[a] Assume 6 dBA decrease for every doubling of distance. Modified from Suter 2002					