SCWI-8500-0026-ENV Rev. C
November 2012

National Aeronautics and
Space Administration

John C. Stennis Space Center
Stennis Space Center, MS
39529-6000

COMPLIANCE IS MANDATORY

John C. Stennis Space Center
Environmental Resources Document

RELEASED - Printed documents may be obsolete; validate prior to use.

This document was prepared under the Stennis Space Center (SSC) Facility Operating Services Contract for the NASA/SSC Center Operations and Support Directorate in support of the SSC Environmental Management System (EMS).

Approval/Concurrence

Original Signed by David K. Lorance 11/21/2012

NASA/SSC Environmental Officer Date

Document History Log

Change/ Revision	Change Date	Originator/ Phone	Description
Basic	12.9.2005	Wendy Robinson 8-2752	Initial release.
A	01.31.2006	Wendy Robinson 8-2752	Changed the effective date to January 31, 2006 throughout the document. Changed the review date to January 31, 2011 to reflect 5 years from the effective date throughout the document. Changed the word "revise" date to "review" date in the header throughout the document. Page i – Added signature section above Document History Log. Page ii - Changed telephone number of contact agency to 2584.
B	10.03.2008	Jenette Gordon 8-1416	Reviewed and redlined all sections to reflect regulatory changes per media. The section for Natural Resources was rewritten to incorporate the SSC Integrated Natural Resource Management Plan requirements. Additionally, the effective date was changed to May 30, 2008 throughout the document along with the review date to May 30, 2013 to reflect 5 years from the effective date throughout the document.
C	11.21.2012	Wendy Robinson 8-2752	Incorporation of Area 9 information, added section 2.4.4 for Climate Change and section 13.12 for Encroachment plus required updated information throughout the document.

RELEASED - Printed documents may be obsolete; validate prior to use.

ENVIRONMENTAL RESOURCES DOCUMENT FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION JOHN C. STENNIS SPACE CENTER HANCOCK COUNTY, MISSISSIPPI

November 2012

Prepared by:

Jacobs Technology
Safety and Mission Assurance Office

Contact:
John C. Stennis Space Center
Environmental Officer, RA02
228-688-2004

RELEASED - Printed documents may be obsolete; validate prior to use.

Table of Contents

1.0 Description of Center 9
1.1 Location 9
1.2 History 9
1.3 Organizations within the Fee Area 11
1.3.1 NASA 12
1.3.2 Naval Meteorological and Oceanography Command 16
1.3.3 Naval Research Laboratory 16
1.3.4 Area 9 (formerly Mississippi Army Ammunition Plant Industrial Complex) 16
1.3.5 National Data Buoy Center 16
1.3.6 Mississippi Laboratories of the Southeast Fisheries Center 16
1.3.7 United States Geological Survey 17
1.3.8 Environmental Protection Agency 18
1.3.9 Technology Transfer Offices 18
1.3.10 Mississippi Space Commerce Initiative 18
1.3.11 Naval Special Warfare Group 4: NAVSCIATTS, SBT22, and Detachment SSC 18
1.3.12 Rolls-Royce 19
1.3.13 NASA Shared Services Center 19
1.3.14 Navy Exchange Service Command (NEXCOM) 19
1.3.15 DOE Strategic Petroleum Reserve 19
1.3.16 Entech (Power Dynamics) 20
1.3.17 Government Printing Office 20
1.3.18 Pratt & Whitney Rocketdyne 20
1.3.19 National Center for Critical Information Processing and Storage (NCCIPS) 20
1.3.20 Navy Human Resources Service Center, Southeast 20
1.4 References 21
2.0 Air Resources 22
2.1 Regulatory Framework 22
2.2 Meteorology 23
2.3 SSC Air Quality 25
2.4 SSC Air Pollution Sources 26
2.4.1 Criteria Pollutants 26
2.4.2 Toxic Air Pollutants 26
2.4.3 Ozone-Depleting Substances 26
2.4.4 Climate Change and Greenhouse Gas (GHG) Emissions 27
2.5 Major Environmental Considerations for Proposed Actions 28
2.6 References 29
3.0 Water Resources 30
3.1 Water Supplies 30
3.1.1 Surface Waters 30
3.1.2 Groundwater 32
3.1.3. Storm Water 33
3.2 Water Quality 33
3.2.1 Programs to Preserve Water Quality 34
3.2.2 Mississippi Programs to Preserve Water Quality 34
3.2.3 Wild and Scenic Rivers 39
3.2.4 Drinking Water 39
3.2.5 Wastewater 40
3.3 CERCLA Sites 40
3.3.1 Groundwater Remediation Sites 40
3.3.2 SSC Landfill 41
3.4 Major Environmental Considerations for Proposed Action 41
3.5 References 50
4.0 Land Resources 51

4.1 Geology and Topography 51
4.2 Seismicity and Structure 51
4.3 Soils 52
4.3.1 Description 52
4.4 Land Use 56
4.4.1 Hancock County 56
4.4.2 Buffer Zone 56
4.4.3 Fee Area 57
4.5 Wetlands and Floodplains 57
4.5.1 Regulatory Overview 57
4.5.2 Wetlands 60
4.5.3 Floodplains 61
4.5.4 Wetlands at SSC 64
4.5.5 Mitigation for Wetlands Permit Compliance 64
4.6 Major Environmental Considerations for Proposed Actions 65
4.7 References 68
5.0 Aquatic and Biotic Resources 69
5.1 Project Notification Under the Fish and Wildlife Conservation Act 69
5.2 Fish and Wildlife Coordination Act 69
5.3 Flora 70
5.4 Aquatic Fauna 71
5.5 Terrestrial Fauna 72
5.6 Habitat Evaluation 74
5.7 Major Environmental Considerations for Proposed Actions 74
5.8 References 74
6.0 Endangered and Threatened Species 76
6.1 Endangered Species Act 76
6.2 Flora 76
6.3 Fauna 81
6.3.1 Wildlife species that have ranges which include SSC 81
6.4 Animal Control Procedures and Monitoring at SSC 89
6.5 Major Environmental Considerations for Proposed Actions 90
6.6 Memberships 90
6.7 References 90
7.0 Solid and Hazardous Waste Generation, Treatment, Storage and Disposal 92
7.1 Nonhazardous Solid Waste 93
7.1.1 Generation 93
7.1.2 Disposal in the Fee Area 93
7.1.3 Disposal in the Buffer Zone 95
7.2 Hazardous Waste 95
7.2.1 Generation 96
7.2.2 Treatment, Storage and Disposal 96
7.3 Waste Minimization, Recycling, and Sustainable Acquisition 98
7.4 CERCLA Hazardous Material Release Reporting 99
7.4.1 Regulatory Requirements 99
7.4.2 SSC Release Reporting 99
7.4.3CERCLA Investigation Activities 101
7.5 Major Environmental Considerations for Proposed Actions 102
7.6 Memberships 102
7.7 References 103
8.0 Toxic Substances 104
8.1 Polychlorinated Biphenyl's (PCB's) 104
8.2 Asbestos 104
8.3 Other TSCA-Regulated Substances 106

8.4 Major Environmental Considerations for Proposed Actions 106
8.5 References 106
9.0 Insecticides and Herbicides 107
9.1 Regulatory Overview 107
9.2 Insecticides and Herbicides at SSC 107
9.3 Major Environmental Considerations for Proposed Actions 108
9.4 References 108
10.0 Radioactive Materials and Non-ionizing Radiation 112
10.1 Ionizing Radiation Sources 112
10.2 Non-ionizing Radiation Sources 112
10.3 Major Environmental Considerations for Proposed Actions 113
10.4 References 113
11.0 Aboveground and Underground Storage Tanks 114
11.1 Regulatory Overview 114
11.1.1 Underground Storage Tank Regulations 114
11.1.2 Aboveground Storage Tank Regulations 114
11.2 Inventory of Aboveground and Underground Storage Tanks 115
11.3 Monitoring of Tank Systems 115
11.4 Major Environmental Considerations for Proposed Action 116
11.5 References 116
12.0 Historic, Archaeological, and Cultural Resources 127
12.1 Regulatory Overview 127
12.2 Prehistory and History of SSC Area 129
12.3 Previous Cultural Resources Studies 130
12.4 Properties Listed on the National Register of Historic Places 134
12.4.1 Rocket Propulsion Test Complex 134
12.4.2 Gainesville 137
12.4.3 Logtown 137
12.4.4 Other 138
12.4.5 Era Man in Space Structures 138
12.4.6 Acoustic Buffer Zone 138
12.4.7 Area 9 139
12.5 Major Environmental Considerations for Proposed Actions 139
12.6 References 141
13.0 Economic, Population, Transportation and Employment Factors 142
13.1 Economic Impact 142
13.2 Population 142
13.3 Employment 143
13.4 Income 144
13.5 Housing 146
13.6 Law Enforcement 146
13.7 Fire Protection 146
13.8 Schools 148
13.9 Health Services 149
13.10 Health Care Facilities 150
13.11 Environmental Justice Strategy 150
13.12 Encroachment 152
13.13 Utilities 154
13.13.1 Potable Water 154
13.13.2 Industrial Water 154
13.13.3 Telecommunications 154
13.13.4 Electrical 155
13.13.5 Helium 156
13.13.6 Hydrogen 156

13.13.7 High Pressure Air 157
13.13.8 Nitrogen 157
13.13.9 Oxygen 158
13.13.10 Natural Gas 158
13.13.11 Transportation 158
13.13.12 Water Transportation 159
13.14 Major Environmental Considerations for Proposed Actions 159
13.15 References 160
14.0 Noise and Vibration 161
14.1 Background Noise Levels 161
14.2 Rocket Engine Testing Noise and Vibration 161
14.2.1 Saturn Era F-1 Engines 162
14.2.2 Space Shuttle Main Engines 162
14.2.3 A-3 Test Stand Altitude Testing 162
14.3 Vibration 163
14.4 Major Environmental Considerations for Proposed Actions 163
14.5 References 168
15.0 Natural Resources 169
15.1 Management Goals and Objectives 170
15.2 Goals 170
15.3 Major Environmental Considerations for Proposed Actions 171
15.4 References 171
16.0 Major Environmental Considerations for Proposed Actions 172
16.1 Air Resources 172
16.2 Water Resources 172
16.3 Land Resources 173
16.4 Aquatic and Biotic Resources 173
16.5 Threatened and Endangered Species 173
16.6 Solid and Hazardous Waste Management 173
16.7 Toxic Substances 174
16.8 Insecticides and Herbicides 175
16.9 Radioactive Materials and Non-ionizing Radiation 175
16.10 Aboveground and Underground Storage Tanks 175
16.11 Historic, Archaeological, and Cultural Resources 176
16.12 Economic, Population, Transportation, and Employment Factors 176
16.13 Noise and Vibration 176
16.14 Natural Resources 177
Appendix A Plant Species Documented at SSC 178
Appendix B Fish and Wildlife Species Documented at SSC 206
Appendix C Aquatic Species Documented at SSC 219
Appendix D Terrestrial Species Documented at SSC 225
Appendix E Wildlife Inventories and Habitat Evaluation at Stennis Space Center, Mississippi 237
Appendix F Ioning Source Inventory at SSC 259

List of Figures

Figure 1-1 Vicinity Map of Stennis Space Center 11
Figure 1-2 John C. Stennis Space Center Building Map 12
Figure 3-1 Surface Water Bodies and Monitoring Locations in the Vicinity of SSC. 31
Figure 3-2 Potable Water Sources 35
Figure 3-3 NPDES Outfall Locations 49
Figure 4-1 Soil Types in the SSC Fee Area 53
Figure 4-2 Land Use in the SSC Fee Area 59
Figure 4-3 SSC Floodplains 63

RELEASED - Printed documents may be obsolete; validate prior to use.

Figure 4-4 Wetlands at SSC 67
Figure 7-1 Solid Waste Landfill at SSC 94
Figure 11-1 Approximate Storage Tank Locations 124
Figure 12-1 SSC Archaeological Site Map 135
Figure 12-2 National Historic Landmarks at SSC 136
Figure 14-1 A-Weighted Sound Pressure Level 164
Figure 14-2 Overall Sound Pressure Level 165
Figure 14-3 A3 Overall Sound Pressure Level/Acoustics Measurement & Prediction 166
Figure 14-4 A3 A-Weighted Sound Pressure Level/Acoustics Measurement & Prediction 167

List of Tables

Table 1-1 Major Facilities at Stennis Space Center 13
Table 2-1 National and State Ambient Air Quality Standards 25
Table 3-1 SSC Well Use Permits 36
Table 3-2 Potable Water Use in 2011 (Groundwater) 37
Table 3-3 pH of Natural Surface Waters at SSC 38
Table 3-4 Classification of Water Bodies in the SSC Area 42
Table 3-5 State of Mississippi Water Quality Criteria for Surface Waters 42
Table 3-6 Effluent Limitations and Monitoring Requirements for Domestic Wastewater Outfall No. 001 43
Table 3-7 Effluent Limitations and Monitoring Requirements for Domestic Wastewater Outfall No. 002 44
Table 3-8 Effluent Limitations and Monthly Requirements for Domestic Wastewater Outfalls No. 008 & 010 45
Table 3-9 Effluent Limitations and Monitoring for Outfall 011 46
Table 3-10 Effluent Limitations and Monitoring for Area 9 Outfall 002 47
Table 3-11 Water Monitoring Parameters 48
Table 4-1 Soil Characteristics 54
Table 4-2 Wetlands Permits at SSC 65
Table 6-1 Louisiana "Special Concern" Plants 78
Table 6-2 Mississippi "Special Concern" Plants 80
Table 6-3 Louisiana "Special Concern" Animals 85
Table 6-4 Mississippi "Special Concern" Animals 86
Table 6-5 Mississippi and Louisiana Threatened and Endangered Species List 87
Table 7-1 RCRA ID Numbers and Status for NASA and Resident Agencies at SSC 97
Table 7-2 FY 2007 SSC Non-Hazardous Solid Waste Recycling 100
Table 9-1 Insecticide/Herbicide Usage at SSC for 2011 109
Table 11-1 Aboveground Storage Tank Inventory-Bulk Storage Tanks 117
Table 11-2 Aboveground Storage Tank Inventory-Diesel Generator Belly Tanks 119
Table 11-3 Mobile Tanks, Mobile Generators and Operational Equipment 122
Table 11-4 Underground Storage Tank Inventory 123
Table 11-5 Pressure Vessel Inventory (excluding high pressure air vessels) 125
Table 12-1 SSC Historic Resources, Management Actions 128
Table 12-2 Era Man in Space Structures 140
Table 13-1 SSC Distribution of Personnel 143
Table 13-2 Population 143
Table 13-3 SSC Manpower 145
Table 13-4 Per Capita Income (2006-2010) 145
Table 13-5 Distribution of Law Enforcement Personnel 147
Table 13-6 Public Schools 148
Table 13-7 Health Care Facilities (2012) 151

RELEASED - Printed documents may be obsolete; validate prior to use.

1.0 Description of Center

1.1 Location

The NASA John C. Stennis Space Center (SSC) is located near the Gulf of Mexico in western Hancock County, Mississippi, approximately 89 kilometers (55 miles) northeast of New Orleans, Louisiana and approximately 58 kilometers (36 miles) west of Biloxi/Gulfport, Mississippi. The facility is situated 30.38 north latitude and 89.60 west longitude at its center point (1). In May 1962, the Federal government acquired approximately 56 square kilometers (13,800 acres) that constitute the "Fee Area", or confines within the gates of SSC. Within this area, NASA along with numerous Federal and State agencies has constructed administrative, research, remote sensing, and propulsion testing facilities. The latter activity is restricted to NASA and is the major function of the Center (Figure 1-1). The facility has been designated NASA's Lead Center for testing of large propulsion systems for current and future generation space vehicles.

Rocket testing operations necessitated development of a "Buffer Zone" for safety and acoustic considerations. A perpetual restrictive easement on 506 square kilometers (125,001 acres) was acquired, which extends six miles in all directions of the Fee Area. The majority of the Buffer Zone is located in Hancock County, Mississippi, although portions extend into Pearl River County, Mississippi and St. Tammany Parish, Louisiana. The region is bounded on the east and west by the Pearl River and Jourdan River watersheds, respectively. At present, the government owns 30.6 square kilometers (6,808 acres) of the Buffer Zone with the remainder being held by individuals or corporations. Provisions of the restrictive easement prohibit maintenance or construction of dwellings and other buildings suitable for human habitation. Predominant land use in the Buffer Zone includes sand and gravel mining, timber production, raising livestock, and recreational pursuits such as hunting and fishing.

Several communities are situated just outside the Buffer Zone including Pearlington, Waveland, Bay St. Louis, Kiln, and Picayune, Mississippi as well as Slidell and Pearl River, Louisiana. There are 12.1 kilometers (7.5 miles) of canals inside the fee area available to transport material within SSC. The SSC canal system links to the East Pearl River through a canal lock system. The East Pearl River links SSC to the national waterway transportation system. It is 33.8 kilometers (21 miles) from the main canal to the Gulf Intracoastal Waterway. The canal system provides a means of transporting large rocket engines, propellants and other heavy equipment and materials to and from the facility.

1.2 History

SSC was constructed between 1963 and 1966 to perform development and acceptance testing for large liquid propellant rocket systems in support of the U.S. Space Program. The facility was named the Mississippi Test Facility (MTF) and later the National Space Technology Laboratories (NSTL). In May 1988 President Reagan re-named the facility the John C. Stennis

Space Center in honor of Senator John C. Stennis of Mississippi. Senator Stennis was instrumental in the establishment of the facility in the early 1960s. The designation is notable in that it elevated SSC to the status of a "field center," as opposed to its former role under the direction of the George C. Marshall Space Flight Center, Huntsville, Alabama.

Figure1-1 Vicinity Map of Stennis Space Center

From April 1966 until the early 70's, SSC was responsible for the static testing of the first and second stages of the Apollo Saturn V rocket. Three test stands (A-1, A-2, and B-1/B-2) were constructed for that purpose. During the interim period between the Apollo and Space Shuttle Programs, SSC experienced significant growth. Numerous federal and state agencies along with several universities established operations at the Center. Coincident with this expansion was the return of rocket engine testing. The first test of the Space Shuttle Main Engine (SSME) was conducted in May 1975. Existing Test Stands were modified to accommodate testing of individual engines as well as clusters of three.

When the Space Shuttle Program ended in 2010, SSC was well positioned to continue its mission as lead center for the development and testing of rocket propulsion systems, such as the Space Launch System (SLS), Heavy-Lift Launch Vehicle and Orion Multi-Purpose Crew Vehicle, which will transport materials and crew to the International Space Station and to destinations beyond low-earth orbit. SSC's capabilities were expanded with the design and construction of the A-3 Test Stand, to test Orion J2xX rocket engines at simulated upper atmospheric conditions.

First operational in the early 1990's for testing of small propulsion system components, the Component Test Facility has evolved into a major test facility, which is referred to as the E-Test Complex. This area consists of three active Test Stands (E-1, E-2, and E-3), which were built in the 1990s. A fourth Test Stand (E-4) was built in 2000 for test firing of larger propulsion system components and engines; but it is currently inactive. These Test Stands have various capabilities, including infrastructure for testing rocket motors and components with fuels such as liquid hydrogen, rocket propellant-1, jet propellant-8 and hybrids. Oxidizers that have been used for testing include liquid oxygen, gaseous oxygen, and hydrogen peroxide.

Modernization and refurbishment of the A-1, A-2 and the B-1/B-2 Test Stands are ongoing to accommodate new propulsion system configurations and systems, as well as commercial systems, such as the Pratt Whitney/Rockedyne-RS-68 engine.

1.3 Organizations within the Fee Area

The buildings at SSC are shown in Figure 1-2. In addition to NASA and its support contractors, there are numerous resident agencies at SSC. Since 1976 the Center has facilitated the establishment of outside operations involving federal and state agencies. On July 1, 2011, facilities in the Mississippi Army Ammunition Plant (MSAAP), which is now referred to as Area 9 of the Fee Area, north of the original SSC main complex of test stands, test support facilities and administrative offices, became the responsibility of NASA/SSC. Descriptions of various organizations and facilities within the SSC Fee Area are provided in the subsections following Table 1-1 (2, 3, 4, 5).

1.3.1 NASA

In keeping with its designation as NASA's lead Center for rocket propulsion test activities, SSC has been assigned to develop the capabilities to test the propulsion systems hardware for new space vehicles.

SSC's primary mission is to test and prove the flight worthiness of space vehicle propulsion system engines. Engines are "hot fired" in various simulated flight profiles, to determine their flight worthiness. The resultant data are analyzed to ensure that engine performance is acceptable and that required thrust will be delivered in the critical period of ascent. In addition, SSC continues to perform developmental tests on new flight hardware and propellants to improve performance and reduce costs. Facilities that support the test stands include test control centers, data acquisition facilities, a cryogenic propellant facility, an electrical power generating plant, a high-pressure gas facility, a component processing facility, a 7-mile manmade navigation canal and locks system, and a high pressure water facility, which includes a 66 million gallon water storage reservoir.

Figure 1-2 Major Facilities at Stennis Space Center

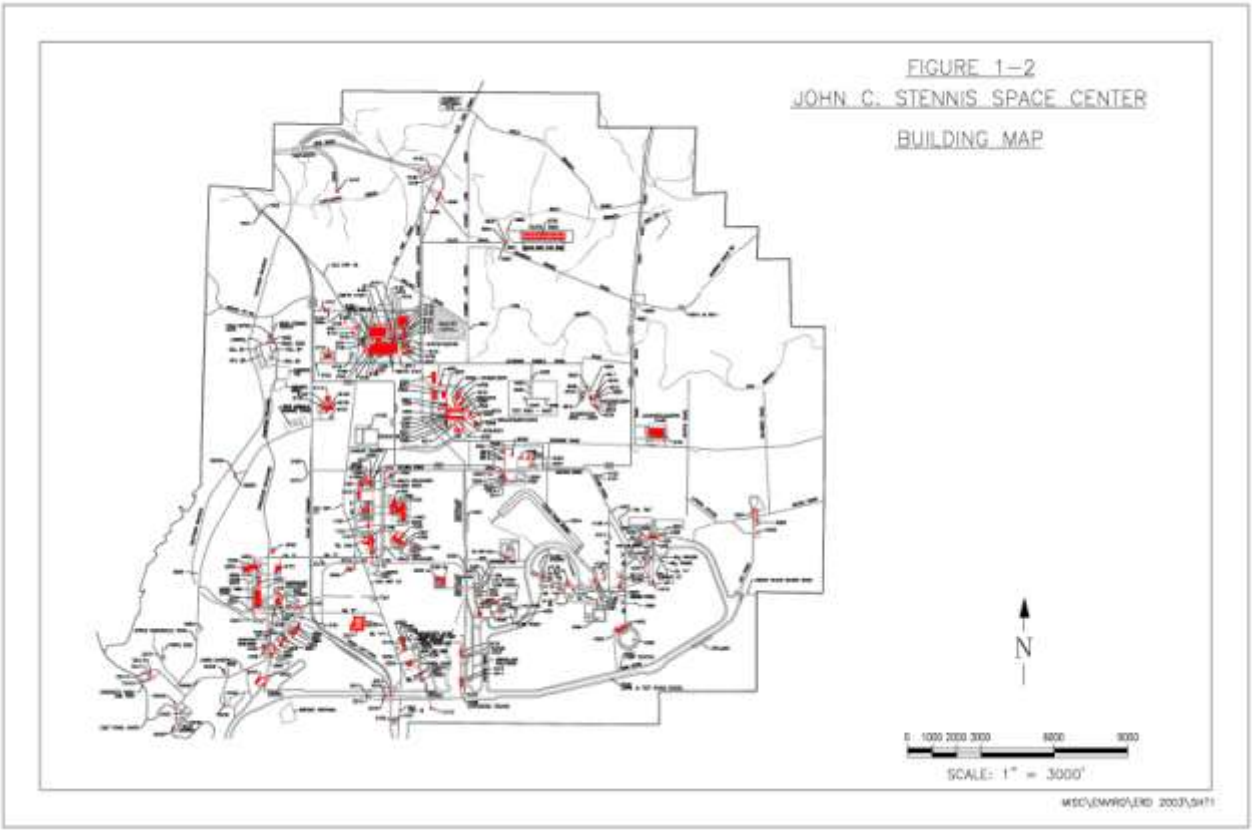


Table 1-1 Major Facilities at Stennis Space Center

Building No.	Building Name	Occupant	Description
1000, 1001	Data Handling Center	Naval Oceanographic Office	Office space
1002, 1003	Oceanography, Navy Computer Program Operations Center, Navy Administrative Support	Naval Oceanographic Office Naval Research Laboratory	Computer-plotter facilities for data storage, analysis, warfare support,; Hydrographics contingent, offices and the Navy Maury Library
1005	Ocean Science Laboratory	Naval Research Laboratory	Offices, Naval research laboratories
1007-1009	Ocean Research Laboratory	Naval Research Laboratory	Offices, laboratories
1020	University of Southern Miss.	USM Marine Sciences	Office space, classroom and lab
1021	Science & Technology Center	Mississippi State University, National Coastal Data Development Center, National Marine Fisheries	Offices, laboratory, classroom, conference rooms
1100	Administration	NASA National Data Buoy Center Naval Oceanographic Office Commander, Naval MOC	Office space for 1,430, cafeteria, credit union, post office, medical clinic, retail shops
1103	Mississippi Technology Transfer Center	Environmental Protection Agency -Gulf of Mexico Program Office Mississippi Enterprise for Technology Center of Higher Learning	Automation and Robotics Application Center, Federal Laboratory Consortium, Southeast Regional Clearinghouse
1105	Laboratory	Environmental Protection Agency Environmental Chemistry Laboratory Photographic Processing University of Southern Mississippi NASA/FOS	Laboratory analysis of marine, biological, geological, biochemical, environmental (toxic wastes, pesticides) samples; office space, conference rooms, photographic, video and graphic arts service.
1110	Computer Center	NASA/ITSC	Computer services
1111	NASA Shared Services Center (NSSC)	NASA	Offices and conference rooms
1200	Auditorium	Visitor and Education Programs	Office space and first floor exhibits
2101	Hydroscience Center	United States Geological Survey	Office, lab, storage; electrical, electronic, mechanical equipment; supplies and materials for design and construction of instruments/equipment
2124	Stennis Mini-Mart	Concessionaires	Convenience mini-mart and gasoline retailer
2201-2205	Maintenance, Repair and Fabrication Shops	NASA/FOS	Industrial space, office space, various craft shops (i.e. weld and machine shops, high bay)
2204	Warehouse	NASA/FOS	Office space with some shops
2600 – 2609, and various buildings in Area 9	NAVSCIATTS Complex, Special Boat Team Unit 22, and Det SSC	Navy	Technical training and educations facilities; barracks, administration, galley; Navy Seals Boat 22 Ops

Building No.	Building Name	Occupant	Description
3202, 3203, 3205	Oceanographic, System Test and Development	National Data Buoy Center	Data buoy operations; industrial area, data terminal area, electronics repair, technical data repository, electronic communications
4995	Data Acquisition Facility	NASA	Analog and digital recording systems and office space; data recording facility for static engine testing
5100	Lockheed Martin Building	Lockheed Martin	Manufacture and assembly of spacecraft components and materials; research & development programs such as space-based laser
8000	Fire Department Medical Clinic Security Engineering	Paragon Security FOS Contractor	Emergency response for fire, explosion, medical and spill/release of hazardous chemicals, engineering services, and security operations
8100	Instrumentation Laboratory	Naval Oceanographic and Atmospheric Laboratory NASA/LSC	NAVAIDS Lab, computer maintenance, exhibits production, quality assurance, machine shop, fabrication, optics lab, environmental laboratory
8101	Radiographic Lab	NASA/FOS Contractor	Nondestructive radiography and tests for flaws and weaknesses in components and hardware
8110	Calibration Laboratory	NASA/LSC	Electronic equipment repair, calibration, fabrication, pressure lab, liquid flow calibration lab.
8120	Atmospheric Calibration Equipment	NASA	Calibration under simulated atmospheric conditions, wind tunnel, solar radiation lab, vibration lab, environmental lab.
9101	Building 9101	Government Printing Office Pratt Whitney Rocketdyne Entech/Power Dynamics	Office, warehouse, ,machine shop, fabrication and service areas
9110	Navy Human Resources Service Center	Navy	Offices, conference rooms, cafeteria (contractor operated)
9134	Naval Oceanography Warehouse	Naval Oceanographic Office	Warehouse, Systems Readiness
9307	Oceans Project Department	Naval Oceanographic Office	Offices
9322	Naval Oceanography Warehouse	Naval Oceanographic Office	Warehouse, Systems Readiness
9325	National Center for Critical Information Processing and Storage (NCCIPS)	NASA	Data services facility serving multiple Federal Agencies, providing the infrastructure necessary for secure processing of critical Federal information.
9355	DOE Strategic Petroleum Reserve	DOE SPR Continuity of Operations	Warehousing, supplies, industrial area, and administrative areas

RELEASED - Printed documents may be obsolete; validate prior to use.

Building No.	Building Name	Occupant	Description
TEST OPERATIONS			
3305	High Pressure Gas Facility	NASA/TOC	High pressure gases for the test complexes
4001, 4008	E-2 Test Complex -- 2 cells	NASA	High temperature tests on materials for hypersonic aircraft; cryogenics composites and vessels
4050	E-1Test Complex – 3 cells	NASA	Twenty thousand square meter (five acre) site with test control center, component preparation building, ultra high pressure gas generation and storage; support systems for data acquisition and propellant venting, flare studies, barge facility, earthen berms for blast protection – used to test hybrid rocket motor with liquid hydrogen and hydrocarbon fuels, high flow rate ultra high pressure gases and high pressure cryogenic fluids; engine exhaust plume analysis and test design/ evaluation
4070	E-3 Test Stand	NASA	Small hybrid / liquid motor tests with experimental propellants, such as hydrogen peroxide
4120, 4122, 4110	"A" Test Complex A-1 and A-2 Test Stands and test control center	NASA/TOC/Pratt Whitney-Rocketdyne	Two single position test stands, test control center, observation bunkers and support systems for high pressure gas (air, helium, nitrogen), water, electrical, and propellants (liquid oxygen, liquid hydrogen)
4200, 4210	"B" Test Complex and test control center One Test Stand, Two Positions (B-1, B-2)	NASA/TOC/Pratt Whitney-Rocketdyne	One dual position test stand, test control center, machine shop. High pressure gas includes air, helium, nitrogen. Docking and transfer for liquid propellant barges.
4400	High Pressure Water	NASA/TOC	Power and deluge water for the A and B test complexes
5008	H-1 Test Complex	Rolls Royce	Commercial gas turbine jet engine testing
8306	Engineering Operations	NASA	Offices and conference room

As part of SSC's Center Operations Directorate, NASA Environmental Management has the responsibility for permitting, compliance, and monitoring NASA activities and many of the resident agency activities that may affect the environment (6). NASA Environmental Management consists of an Environmental Officer and five Environmental Specialists who direct the activities of facility, energy and technical support to contractors working to ensure that NASA's environmental goals are met. Site-wide environmental and industrial hygiene programs were initiated in 1991 in an effort to facilitate environmental compliance by tenant agencies (7, 8). The programs include environmental and industrial hygiene support services that are provided by NASA to tenant agencies as part of the shared-pool operations. However, NASA does not accept responsibility for tenant or non-NASA contractor compliance.

1.3.2 Naval Meteorological and Oceanography Command

The Naval Meteorology and Oceanography Command's mission is to collect, interpret and apply data and information for safety at sea, strategic and tactical warfare, and weapons system design, development and deployment. The command provides meteorological, oceanographic, and mapping, charting and geodesy services to increase the effectiveness of the Navy in both peacetime and in war.

1.3.3 Naval Research Laboratory

The Naval Research Laboratory (NRL), formerly the Naval Oceanographic and Atmospheric Research Laboratory (NOARL), was established at SSC in October 1989 to function as the principal Naval laboratory performing oceanographic and atmospheric environmental research. NRL occupies research, computation, laboratory, administrative, and warehouse facilities at SSC. NRL also administers several large antennas to receive oceanographic and meteorological satellite data, a Magnetic Observatory, a Pattern Analysis Laboratory, a Map Data Formatting Facility, a water wave channel, and numerous laboratories for acoustic and optical oceanographic instrumentation, analysis and testing.

1.3.4 Area 9 (formerly Mississippi Army Ammunition Plant Industrial Complex)

Located in the northern portion of SSC, the Mississippi Army Ammunition Plant (MSAAP) was once used to manufacture sophisticated munitions. The plant consisted of three manufacturing complexes including the Projectile Metal Parts area, the Cargo Metal Parts area, and the Load Assemble and Pack area. This facility was deactivated by the U. S. Congress and in 1992 was reopened as an industrial complex to commercial enterprise. It became a thriving industrial park catering to both high-tech and industrial tenants, as well as various U.S. Navy activities. On July 1, 2011, control and responsibilities for the facilities that comprised the MSAAP were returned to NASA SSC, and is now identified as Area 9.

Major facilities located in Area 9 are occupied by DOE Strategic Petroleum Reserve, Entech (Power Dynamics), the Government Printing Office, PWR, NCCIPS, the Navy (Meteorological and Oceanography Command, Human Resources Service Center, SBT-22, and NAVSCIATTS). In addition to the major facilities, the following occupants are also located in Area 9: BOE-TEL Company, Cingular/AT&T, Da Kitchen, Omni Technologies, and Qinetiq.

1.3.5 National Data Buoy Center

The National Data Buoy Center (NDBC), part of the National Weather Service, is an agency within the National Oceanic and Atmospheric Administration (NOAA) and is supported by personnel and ships of the U.S. Coast Guard. NDBC operates automated observation systems that measure environmental conditions from remote pelagic and coastal areas. These measurements support the requirements of NOAA and other programs and are used for forecasting, public advisories and warnings, and in climate and research programs.

Environmental measurements are made by a network of moored buoys and land stations deployed in the Atlantic and Pacific Oceans, the Great Lakes, the Gulf of Mexico and the Bering Sea. Each buoy is designed to perform in the specific conditions it will encounter, whether located within a few miles of the coast or in the deep waters of the ocean. Many of these buoys are returned to SSC for refurbishment.

1.3.6 Mississippi Laboratories of the Southeast Fisheries Center

Partially headquartered at SSC, the Mississippi Laboratories of the Southeast Fisheries Center provides information for assessment, management and conservation of living marine resources in the Gulf of Mexico, Caribbean Sea, and South Atlantic Ocean. The Mississippi Laboratories are a component of NOAA and the National Marine Fisheries Service (NMFS). Efforts are directed at identifying and resolving problems associated with the commercial fishing industry. Recently, Mississippi Laboratories has developed instrumentation for monitoring fish behavior as well as methods for using satellite imagery for tracking endangered species and mapping environmental conditions.

1.3.7 United States Geological Survey

The U.S. Geological Survey (USGS) is the principal Federal agency responsible for collecting, analyzing and archiving hydrologic data for managing the nation's water resources. USGS facilities at SSC include the Hydrologic Instrumentation facility, the Office of Surface Water and the Earth Science Information Center. The Hydrologic Instrumentation Facility has the responsibility for the design, testing, calibration, repair and distribution of all USGS hydrologic instruments. The Office of Surface Water provides technical coordination for surface water problems. Presently this office is involved in the development of computer software to be used for modeling surface water dispersion scenarios. The Earth Science Information Center provides

the public with information on all types of cartographic products such as topographic maps, aerial photographs, satellite images and digital map products of the United States. Information is also available on geologic maps and reports, water supply data and Earth science publications of the USGS.

1.3.8 Environmental Protection Agency

Under the jurisdiction of the Environmental Protection Agency's (EPA's) Office of Pesticides Programs, the Environmental Chemistry Laboratory (ECL) is involved with the analysis of pesticide deposition in human and environmental samples. Using state-of-the art technology, the ECL gathers data that is used for monitoring and regulating pesticides in the environment.
The EPA Gulf of Mexico Program (GOMP) is also located at SSC. The GOMP is an intergovernmental effort to develop a comprehensive management plan for future protection of the Gulf environment. Representatives from government and private organizations from the five Gulf States are working on management issues for natural resources in the Gulf. The ultimate goal of the project is to successfully balance human activities and preservation of the environment.

1.3.9 Technology Transfer Offices

The Mississippi Enterprise for Technology and the Louisiana Technology Transfer Office use both State and NASA resources to develop economic and technical advantages for private businesses, State agencies, and educational concerns. These offices identify and support the dissemination of technology developed at SSC as well as other Federal laboratories. They are involved in a broad range of research and technology projects including the development of remote sensing technology, Earth Science Research and data systems.

1.3.10 Mississippi Space Commerce Initiative

The Mississippi Space Commerce Initiative has established a close working relationship between NASA, universities, and private concerns to facilitate development of commercial applications for remotely sensed data. Such applications are used to improve land use and resource management; for example, computer models were developed to assess crop vitality.

1.3.11 Naval Special Warfare Group 4: NAVSCIATTS, SBT-22, and Detachment SSC

Naval Special Warfare (NSW) Group 4 oversees three subordinate units at Stennis Space Center, including the Naval Small Craft Instruction and Technical Training School (NAVSCIATTS), Detachment Stennis Space Center (DET Stennis), and Special Boat Team 22 (SBT-22).

The Naval Small Craft Instruction and Technical Training School is responsible for small craft maintenance, and riverine and coastal training for foreign friendly and allied military students.

Originally located in the Panama Canal Zone, NAVSCIATTS relocated to Stennis Space Center in 1999 to take advantage of some of the finest riverine and coastal training areas in the world, located at and around SSC.

Detachment Stennis Space Center's mission is to enhance the operational proficiency of riverine task units, through training in NSW Maritime Operations and Basic Ground Skills. In addition, DET Stennis manages, coordinates, and safely operates the Small Arms Range Complex and the Western Maneuver Area, which allows for live-fire training.

Special Boat Team Unit 22 is the only command in the Department of Defense specifically designated to conduct special operations in riverine environments. Detachments are capable of performing all mission-essential tasks to conduct unit-level naval special warfare operations and support other special operations forces.

1.3.12 Rolls-Royce

Rolls-Royce North America occupies the H-1 Test Stand site for research into gas turbine jet engine performance, fan behavior, thrust reverser operation, and noise. Their SSC facilities provide Rolls-Royce North America with the capabilities and facilities to test their manufactured engines within the United States.

1.3.13 NASA Shared Services Center

The NASA Shared Services Center (NSSC) is an innovative public-private partnership between NASA, the States of Mississippi and Louisiana, and a service provider, Computer Sciences Corporation (CSC). NSSC offers high-quality support services to NASA in the areas of financial management, human resources, information technology and procurement.

1.3.14 Navy Exchange Service Command (NEXCOM)

NEXCOM's mission is to provide quality goods and services to active duty, reservists, retirees and their families and supporting Navy quality of life programs through Navy Morale, Welfare and Recreation (MWR). NEXCOM facilities at Stennis Space Center include a Mini-Mart and pay-at-the-pump gas and diesel service station and auto repair.

1.3.15 DOE Strategic Petroleum Reserve

The DOE Strategic Petroleum Reserve established this warehouse and emergency operations facility at Stennis Space Center to ensure continuity of operations in case of an emergency at the New Orleans project management office.

1.3.16 Entech (Power Dynamics)

Power Dynamics operates a full service design and manufacturing facility at Area 9, providing high quality, close tolerance custom metal fabrication, certified welding and precision machining to a broad spectrum of industries. Power Dynamics facilities at Area 9 include office spaces, and warehouse, machine shop, fabrication and service areas.

1.3.17 Government Printing Office

The US Government Printing Office operates a secure production facility in Building 9110, producing blank passport books.

1.3.18 Pratt & Whitney Rocketdyne

Pratt & Whitney Rocketdyne operations at Stennis involve the design, testing and fabrication of advanced propulsion and energy systems.

1.3.19 National Center for Critical Information Processing and Storage (NCCIPS)

NCCIPS is a NASA-managed, shared data services facility serving multiple Federal Agencies, and provides the robust electrical, cooling and bandwidth infrastructure necessary to support the secure processing of critical Federal information.

1.3.20 Navy Human Resources Service Center, Southeast

The Navy Human Resources Service Center (HRSC) Southeast is one of the seven service centers that provides human resources management support to over 300 Naval, Marine Corps, and Army activities in the Southeast Region. The center services ten southeastern states, encompassing Texas, Oklahoma, Louisiana, Arkansas, Tennessee, Mississippi, Alabama, Georgia, South Carolina, Florida, and two Caribbean bases in Puerto Rico and Guantanamo Bay, Cuba. The HRSC Southeast employs approximately 155 people and provides staffing, recruitment, classification, processing, training labor relations, and equal employment opportunity for approximately 27,000 Department of Navy (DON) civilian employees.

1.4 References

1. World Geodetic System (reference) 84 lat/long coordinate system.

2. NASA, 1988, Survey of Real Property, Stennis Space Center.

3. Real Estate Report, Study of Buffer Zone for NASA at Stennis Space Center, MS, 1999, prepared by U.S. Army District, Mobile, AL.

4. NASA, 2005, Environmental Assessment Rolls-Royce Center of Excellence

5. NASA, 2005, Environmental Assessment NASA Shared Services Center

6. NASA, 1980, Implementing Provisions of the National Environmental Policy Act.

7. NASA, 1991, Site-Wide Environmental Program Plan, Stennis Space Center.

8. NASA, 1991, Site-Wide Industrial Hygiene Program Plan, Stennis Space Center.

RELEASED - Printed documents may be obsolete; validate prior to use.

2.0 Air Resources

2.1 Regulatory Framework

Air quality in the United States is governed by the Clean Air Act (CAA) and the Clean Air Act Amendments (CAAA) of 1970, 1977, and 1990. Under the CAA, the U.S. Environmental Protection Agency (EPA) is the federal agency responsible for creating and enforcing national air quality regulations. The CAA allows the EPA to delegate the authority to implement federal environmental programs to the States upon review and approval of the State Implementation Plan (SIP), an enforceable plan developed at the state level that explains how the state will comply with air quality standards established under the CAA.

The EPA has approved Mississippi's SIP and has delegated Mississippi the authority to implement and enforce the new source performance standards (NSPS), national emission standards for hazardous air pollutants (NESHAP), and prevention of significant deterioration (PSD) programs, as incorporated and adopted by reference by the Mississippi Commission on Environmental Quality in APC-S-1 and APC-S-5 of the State's Air Emission Regulations. In addition, the federal Acid Rain Program Permit Regulations of Title IV and the Operating Permit Regulations in Title V of the CAA are adopted by reference in APC-S-7 and APC-S-6 of the State's Air Emission Regulations, respectively.

Emissions associated with rocket test activities exceed the thresholds established for criteria pollutants in Title V of the CAA. Therefore, the facility is classified as a major source subject to Title V Operating Permit requirements. In addition, any modification to the facility must be evaluated to determine applicability of PSD permitting regulations. In the event the increase in emissions is greater than or equal to the established significance levels or if the source is located within 100 km of a Class I area and the impact would be greater than 1 $\mu g/m^3$ (24-hour average) in the Class I area, further evaluation is required. The nearest PSD Class I area is the Breton National Wildlife Area in Louisiana, which is located approximately 80 km from the test stand areas.

Major sources and modifications are required to undergo the following analyses under PSD review for each air pollutant emitted in significant quantities:

- A control technology analysis;
- An air quality impacts analysis; and
- An additional impacts analysis.

In addition to these analyses, a new source must also be reviewed with respect to Good Engineering Practice (GEP) stack height regulations, New Source Performance Standards (NSPS), and any state emission standards.

The facility currently operates under Air Pollution Control Title V Permit to Operate Number 1000-00005 issued by MDEQ on November 17, 2003, and the Air Pollution Control Permit and Prevention of Significant Deterioration issued by MDEQ on August 6, 2007. An application for renewal of the current Title V Operating Permit was submitted to MDEQ in April 2008, and is pending issuance.

The CAA also requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. NAAQS have been established for six criteria pollutants, including particle pollution (often referred to as particulate matter or PM); ground-level ozone (O_3); carbon monoxide (CO); sulfur oxides, measured as sulfur dioxide (SO_2); nitrogen oxides (NO_x); and lead (Pb), as shown in Table 2-1. The federal primary and secondary ambient air quality standards as promulgated in 40 CFR Part 50 have been adopted by reference in Mississippi State Regulation APC-S-4. Hancock County currently meets all air quality standards and is designated as an "attainment" area.

2.2 Meteorology

The climate of SSC is designated as Cfa, or humid subtropical climate, based on the Köppen-Geiger system of climate classification. This classification system uses six letters to divide the world into six major climate regions based on average annual precipitation, average monthly precipitation, and average monthly temperature. The Cfa or humid subtropical climate has mild winters, hot muggy summers, and frequent thunderstorms.

The average annual temperature at SSC is about 19° centigrade (C) (66° Fahrenheit [F]). Average seasonal temperatures are 12° C (53° F) in the winter; 18° C (65° F) in the spring; 26° C (79° F) in the summer; and 18° C (64° F) in the fall. During June through August approximately 65% of the days have maximum temperatures exceeding 35° C (95° F) and ground level relative humidity greater than 70%. Cold weather occurs predominantly between mid-December and March, with the coldest weather generally occurring in January and February. Extended periods of freezing temperatures are rare.

On the average, there are only 84 clear days per year. For the rest of the year it is typically partly cloudy 114 days and cloudy 167 days. Sunshine occurs approximately 58% of the possible hours. It is frequently foggy from mid-October to May. Heavy fogs limiting surface visibility to one-fourth mile or less occur on an average of 42 days per year, usually during late night and early morning hours.

Rainfall averages about 1.5 meters (60 inches) per year but varies by plus or minus 0.5 meters (20 inches) per year. There is no clear pattern of rainfall distribution throughout the year..

Prevailing surface winds are from the south and southeast through two thirds of the year and from the north for the rest of the year while upper level winds generally prevail from the west and southwest. Northern winds normally occur from August through February. The hurricane

(tropical cyclone) season runs from June to November. Cyclone intensity ranges from weak to large and intense with maximum wind speeds approaching 320 kilometers (200 miles) per hour. The Gulf Coast averages one tropical cyclone per year; approximately two thirds of these are of hurricane force with winds greater than 119-kilometers (74 miles) per hour. Only a fraction of the hurricane-force cyclones cause severe damage to the areas along the Gulf Coast

Onsite meteorological data is collected for NASA by the U.S. Army Corps of Engineers using a Davis Instruments system at the NASA Natural Resources Complex. The data is available upon request.

Table 2-1
National and State Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide	primary	8-hour	9 ppm	Not to be exceeded more than once per year
		1-hour	35 ppm	
Lead	primary and secondary	Rolling 3 month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide	primary	1-hour	100 ppb	98th percentile, averaged over 3 years
	primary and secondary	Annual	53 ppb	Annual Mean
Ozone	primary and secondary	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$ primary and secondary	Annual	15 µg/m^3	annual mean, averaged over 3 years
		24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10} primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide	primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Note: Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, and micrograms per cubic meter of air (µg/m^3).

Sources:
40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards
Mississippi Air Emission Regulation APC-S-4

2.3 SSC Air Quality

SSC is considered to be in a rural area for air quality and will probably remain so due to NASA's restrictive easement surrounding the facility. The ambient air quality of Mississippi is currently considered in attainment for particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), and Nitrogen Oxides (NO_x), and lead (Pb). However, attainment designations may change in the future due to weather patterns and coastal population growth.

RELEASED - Printed documents may be obsolete; validate prior to use.

SSC has maintained compliance with its Title V permit issued in November 2003, and is in compliance with all federal and state emission regulations as outlined in the Title V permit.

2.4 SSC Air Pollution Sources

All air pollution sources associated with rocket test activities are listed in the Title V Operating Permit. Total emissions from these sources are calculated on an annual basis for submission to the MDEQ as the Fee Summary Report. This report is used by the State to determine the fee SSC is required to pay to the State for tons of emissions per year. A spreadsheet is used to compile data required for calculation of air emissions.

In addition, NASA also operates a 400 kW natural gas-fired emergency use generator used to support wastewater treatment operations located within Area 9, the area previously referred to as as the Mississippi Army Ammunition Plant (MSAAP). NASA resumed ownership of the MSAAP property on July 1, 2011, and is responsible for providing oversight of tenant hosting, facility operations, and maintenance of current and future outleases.

2.4.1 Criteria Pollutants

Air emission sources are authorized in the Title V Operating Permit issued in November 2003 and the Prevention of Significant Deterioration Permit issued in August 2007. These sources include diesel-burning equipment, fuel storage and dispensing operations, painting operations, abrasive blast operations, rocket testing and flare stacks. Emissions associated with the 400 kw generator located within Area 9 meet the criteria for exemption from air permitting requirements; however, the generator/engine is subject to federal air quality regulations, including NSPS and NESHAPs.

2.4.2 Toxic Air Pollutants

Toxic air pollutants are emitted from fugitive and point sources. Emissions associated with rocket test activities are below major source thresholds and as such NASA SSC is considered an area source under the federal NESHAP regulations, as promulgated in 40 CFR Part 61 and Part 63.

2.4.3 Ozone-Depleting Substances

Following the 1987 United States ratification of the "Montreal Protocol on Substances that Deplete the Ozone Layer" and the 1988 EPA limitation on chlorofluorocarbon and Halon production, SSC has taken an aggressive approach to ensure compliance with Title VI of the Clean Air Act Amendments, which requires a phase-out of the production of ozone-depleting

substances (ODSs), such as chlorofluorocarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, and hydrochlorofluorocarbons (HCFCs). In addition to implementation of an Ozone-Depleting Substances (ODSs) Phase-Out Plan, which was last revised in September 2011, NASA SSC has also developed a long-range refrigerant management program, which includes administrative controls to minimize emissions of ODSs (e.g., leak detection, recordkeeping, recovery and recycling); the use of ozone-friendly alternatives; technician training and certification; equipment design and procurement restrictions; and planned chiller replacement. A computerized database system (Compliance Suite Refrigerant Compliance Management Software) is maintained to aid in controlling the refrigerant inventory, tracking refrigerant usage, and generating reports for management and recordkeeping requirements.

2.4.4 Climate Change and Greenhouse Gas (GHG) Emissions

GHGs are gases in the Earth's atmosphere that prevent heat from escaping into space, resulting in climate change as the Earth's surface temperature increases above past levels. GHGs result primarily from the combustion of fossil fuels, and include carbon dioxide (CO_2), methane(CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride(SF_6). Executive Order (EO) 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, requires federal agencies to inventory and report direct and indirect emissions of GHGs, including those associated with fuel consumption and the purchase of electricity. In addition, facilities with stationary combustion sources must determine applicability of the Environmental Protection Agency's Greenhouse Gas Reporting Program, as promulgated in 40 CFR Part 98, which requires reporting from facilities that emit 25,000 metric tons CO_2 -equivalent (CO_2 e) or more per year from stationary source fuel combustion. Applicability is based on annual fuel consumption and is evaluated by SSC annually.

Ongoing efforts to reduce GHG emissions resulting from Center activities include implementation of energy-efficient infrastructure; use of innovative approaches and renewable energy; and identification of new strategies to minimize GHG emissions across operations. In addition to mitigating GHG emissions, the effects of climate change (e.g., increased temperature, changes in timing and volume of precipitation, ecological effects, and sea-level rise) must also be considered. For example, drainage culverts may need to be resized to accommodate more intense rainfall events.

In October 2012, SSC hosted a workshop to evaluate the potential effects of climate change in the future at SSC and surrounding communities. Over one-hundred persons were in attendance, which consisted of representatives from NASA Headquarters, NASA Field Centers, federal and state agencies, academia, local government entities, and other stakeholders from the surrounding communities.

2.5 Major Environmental Considerations for Proposed Actions

When developing new projects at SSC, air pollution issues are identified through the Preliminary Environmental Survey (PES) SSC Form # 696M. Under the State of Mississippi's Air Pollution Control Regulations and the Federal Clean Air Act Amendments, it is the responsibility of the facility to apply for, and receive authorization to construct and/or operate any source of dust, fumes, mist, smoke, particulate matter, vapor, or gas. Potential emissions of any compound must be evaluated in order to determine the appropriate State and/or federal notification, permitting and/or emission control requirements. To avoid delays associated with regulatory and/or permitting requirements, consideration of the associated air quality impacts must be coordinated through NASA Environmental Management at the beginning of any project-planning phase. In addition, alternatives should be evaluated for projects requiring the use of CFCs, halons, asbestos, lead, polychlorinated biphenyls and/or products tinted with pigments of lead, cadmium, chromium VI, and their oxides, or formulated with hazardous air pollutants, including formaldehyde, halogenated solvents, mercury or mercury compounds.

2.6 References

1. 40 CFR Part 50, National Ambient Air Quality Standards.

2. Mississippi Department of Environmental Quality, Office of Pollution Control, Mississippi Air Quality Regulations.

3. NASA, 2011 Ozone-Depleting Substances (ODSs) Phase-Out Plan .

4. NASA, 2008 Title V Operating Permit Renewal Application for the John C. Stennis Space Center, Mississippi.

5. NASA, 2003 Title V Operating Permit for the John C. Stennis Space Center, Mississippi.

6. NASA, 2007 Prevention of Significant Deterioration Permit for the John. C. Stennis Space Center, Mississippi.

7. National Climactic Data Center

RELEASED - Printed documents may be obsolete; validate prior to use.

3.0 Water Resources

3.1 Water Supplies

SSC water supplies include groundwater for drinking, sanitation, fire protection, industrial uses and surface water for rocket testing cooling and standby fire protection.

3.1.1 Surface Waters

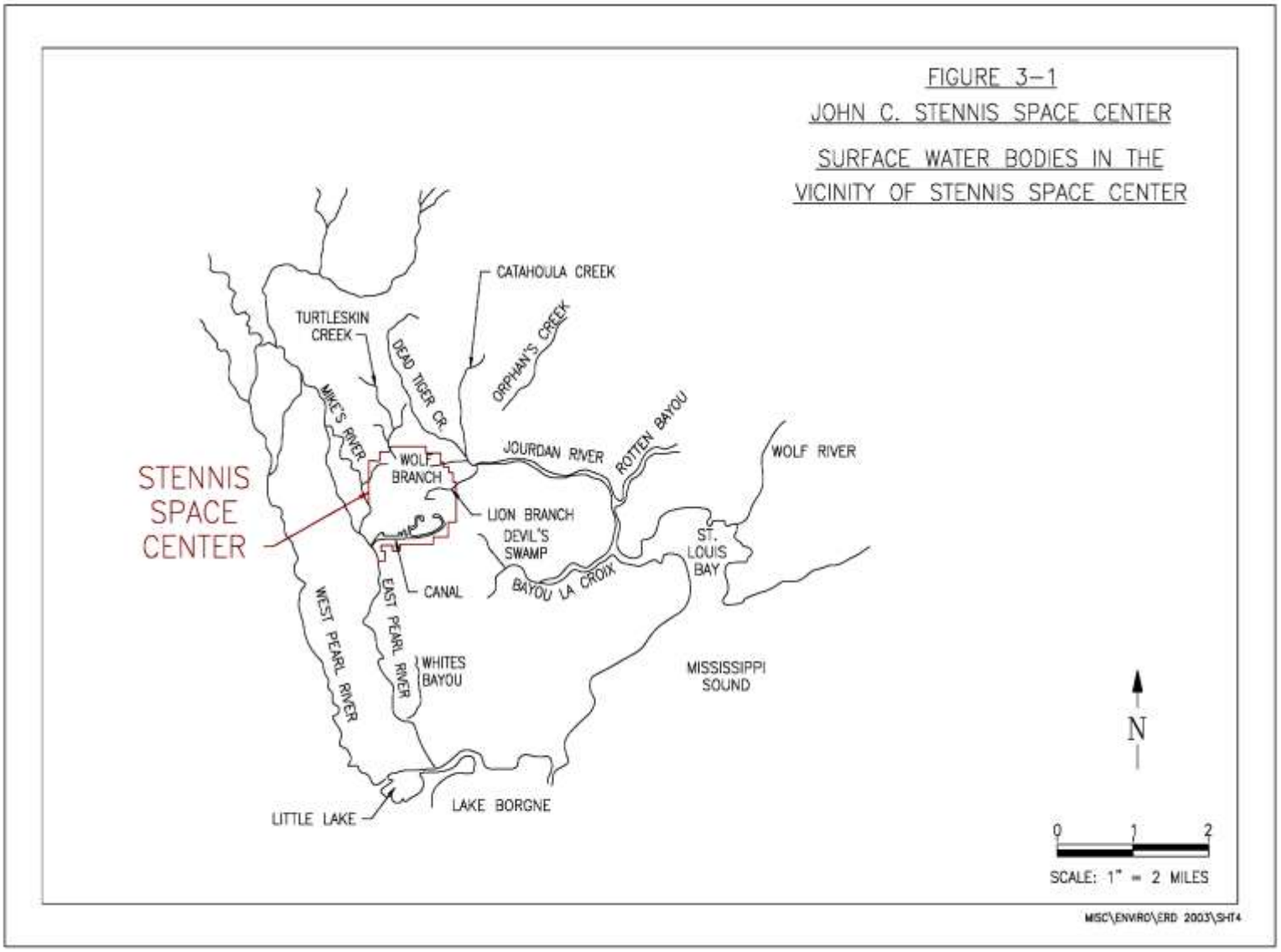
The SSC facility is located in the southwestern part of Hancock County, Mississippi. A Buffer Zone around the Fee Area is located in Hancock and Pearl River counties in Mississippi and St. Tammany Parish, Louisiana. The East Pearl River flows along the southwest boundary of the Fee Area and the Jourdan River flows in a southeasterly direction through the eastern portion of the Buffer Zone. Tributaries that drain the Fee Area and are hydraulically connected to these two rivers are Mikes River and Turtleskin Creek in the East Pearl River Basin, and the Lion and Wolf branches of Catahoula Creek in the Jourdan River Basin. Approximately 13.7 kilometers (8.5 miles) of constructed canals in the Fee Area are also connected through locks to the East Pearl River (Figure 3-1).

The East Pearl River system is one of Mississippi's principal rivers, draining an approximate area of 22,688 square kilometers (8,760 square miles). The river divides into distinct channels west of Picayune, Mississippi where the main stream is known as the West Pearl River. The East Pearl River is formed by a confluence of Hobolochitto Creek and Farrs Slough, and forms the boundary between Mississippi and Louisiana. The East Pearl River drains to Lake Borgne and eventually to the Mississippi Sound. The ten year, seven day average low flow for the West Pearl River is 49.6 cubic meters per second (1,750 cubic feet per second [cfs]). The flow for the East Pearl River is 2.3 cubic meters per second (80 cfs) (1). During flood stage, the floodplain carrying both channels is utilized. In addition, both channels are subject to saltwater intrusion.

Dead Tiger Creek and Catahoula Creek form the Jourdan River System in the northeast portion of Hancock County, Mississippi. The Lion and Wolf branches are intermittent streams that drain the eastern section of the Buffer Zone. The Jourdan River drains to the Bay of St. Louis and eventually to the Mississippi Sound. No long-term statistics for stream flow are available; however, maximum and minimum flows for the Catahoula Creek range from 450 cubic meters per second (16,000 cfs) to 0.23 cubic meters per second (8.2 cfs). Saltwater intrusion from the Mississippi Sound also takes place in the Jourdan River System. The southeastern portion of SSC drains into the main access canal. The canal is connected to the East Pearl River through a lock system. A spillway and overflow of the canal drains into Devils Swamp which discharges into Bayou LaCroix and the Bay of St. Louis to the Mississippi Sound.

The State of Mississippi classifies the Pearl and the Jourdan Rivers as suitable for recreation. The Pearl River extends through the Buffer Zone and the Jourdan River from the confluence of Catahoula Creek to the Bay of St. Louis; both are designated Inventory Rivers under the Wild

and Scenic Rivers Act. Mike's River and the Lion and Wolf branches are designated as supporting fish and wildlife.



SSC holds a permit (MS-SW-02432) to divert or withdraw for beneficial use from the public waters of the State of Mississippi (2). The permit was reissued 4/12/2010 and expires 4/12/2020 covers an inlet and pumps that withdraw water from the East Pearl River into the elevated portion of the facility's Access Canal. The Access Canal provides a source of water for emergency fire suppression and rocket test stand deflector cooling.

3.1.2 Groundwater

Several aquifers can be traced through Hancock County. The area is underlain by fresh water-bearing, southward-tipping sands of the Miocene and Pliocene ages. Within these fresh water-bearing sands, one unconfined aquifer is found near the surface with ten or more confined aquifers at depth. The fresh water-bearing zone is 600 to 900 meters (2,000 to 3,000 feet) thick in the area. Individual aquifers range from 30 to 140 meters (100 to 450 feet) in thickness, with most measurements closer to 30 meters. The sequence of alternating sands and discontinuous clay layers, creating the confining nature of the deeper aquifers, is part of the Coastal Lowlands Aquifer System or the Southeastern Coastal Plain System. Groundwater at SSC is soft, containing sodium bicarbonate and exhibiting a high pH (above 8). Concentrations of chlorides range from 13 to 16 ppm and iron content is less than 0.3 ppm. Solids content does not exceed 315 ppm (3). The aquifers have plentiful, almost untapped supplies of fresh water.

Water for potable and industrial use at SSC is supplied through ten large capacity wells onsite (Figure 3-2). Well permit numbers, well use, well depth, normal discharge, and maximum permit discharge are listed in Table 3-1 (4).

Potable Water - SSC maintains a community, non-transient potable water system and holds a permit with Mississippi Department of Health (PWS# MS0230015). Under this permit, SSC operates/maintains six wells supply potable water to the facility, including Area 9 (PWS # MS0230052). The well depths range from 688 feet to 1,530 feet (210 meters to 466 meters) with a natural flow of 1,100 to 2,500 gallons per minute (4,164 to 9,463 liters/minute). Potable water averages 826,198 liters (218,282 gallons) of water per day annually. Table 3-2 indicates average potable water use per month based on NASA's 2011 Ground Water Usage Report (6).

The potable water wells and associated pumps, chlorinators, three elevated storage tanks, automatic controls, and a distribution system supply the support and test areas with water for drinking, sanitation, and fire protection.

The elevated tanks supply water to the system and maintain system pressure at 457 to 492 kilograms per square meter (62 to 72 pounds/square inch gauge [psig]). Chlorination operates in conjunction with booster pumps, adding chlorine to the water while the pumps are operating. The water supply is sampled monthly on a staggered schedule, and analyzed in accordance with the federal and state requirements.

Industrial Water - Presently, the Access Canal is the primary source of industrial water at the facility. Three industrial wells are maintained as a backup system for the surface water withdrawal system. These wells range in depth from 672 to 1,873 feet (205 to 571 meters) and are capable of producing 28 million liters (7.5 million gallons) of water per ten hour period and 68 million liters (18 million gallons) per day. Industrial water is used for deluge water for the test stands, cooling water, and fire control.

3.1.3. Storm Water

Storm water discharges from SSC are authorized in accordance with Mississippi Water Pollution Control General NPDES Permit MS0021610. On December 26, 2001, SSC submitted a Baseline Notice of Intent (BNOI) for coverage under the MDEQ General Baseline Permit, which allows storm water associated with industrial activity to be discharged into state waters. However, since SSC had already obtained an individual NPDES permit, MDEQ added the storm water requirements to the current NPDES permit instead of issuing General Baseline permit coverage.

At various times, construction activities at SSC require permit coverage under Mississippi's Construction General Permit. All constructionsites consisting of one acre or more require such coverage. Constructionsites of less than one acre should also abide by good engineering practices to minimize erosion that could affect the quality of storm water discharge from the site.

3.2 Water Quality

Background surface water quality information is limited; however, discharge stations are maintained by the U.S. Geological Survey (USGS) on the Pearl River approximately 40 kilometers (25 miles) northwest of the Fee Area. A USGS monitoring station on the West Pearl River also measures flow and is located approximately 11.3 kilometers (seven miles) west of the Fee Area. The surface waters in the streams of the area are generally suitable for most uses. USGS analyses indicate that the water in freshwater streams is generally soft and slightly acidic (5.0 to 7.0 pH units), with low concentrations of dissolved solids (1). Dissolved solids concentrations are less than 100 mg/L and hardness is usually less than 50 mg/L. Amounts of dissolved oxygen are usually greater than 4 mg/L. Dissolved solids concentrations increase in the Pearl and Jourdan Rivers with the movement of saltwater during high tide. Water quality in the Fee Area is similar to the regional surface water quality with the following exceptions:

- Water is slightly alkaline in the canal, between 7.0 and 8.0 pH units
- Dissolved solids concentrations range between 60 and 120 mg/L (1).

SSC has also established data for the East Pearl/Mike's River through surface water sampling. Table 3-3 provides pH results from discretionary sampling during 2007.

3.2.1 Programs to Preserve Water Quality

Each State is required to adopt water quality standards under the Federal Water Pollution Control Act, as amended by the Clean Water Act (CWA) of 1977, reauthorized in 1987. These standards are established based on the use and values of waters for public water supplies, propagation of fish and wildlife, recreation, agriculture, industry, and navigation. Federal standards and guidelines have also been established for the protection of aquatic life and protection of human health through consumptive pathways. Standards for potable water have been established under the Safe Drinking Water Act.

3.2.2 Mississippi Programs to Preserve Water Quality

The State of Mississippi has jurisdiction for programs to improve water quality. Mississippi water pollution control laws are contained in the Mississippi Air and Water Pollution Control Act, Title 49, Conservation and Ecology, Chapter 17, Pollution of Waters, Streams and Air. Water Quality criteria appear in Mississippi Water Quality Criteria for Intrastate, Interstate and Coastal Waters (6). Wastewater permit regulations are included in the Mississippi Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) permits, Underground Injection Control (UIC) permits, State permits, Water Quality Based Effluent Limitations and Water Quality Certification, Mississippi Department of Environmental Quality, Office of Pollution Control (7). Mississippi has adopted water quality standards contained in Title 49 - Conservation and Ecology, Chapter 17, titled "Mississippi Safe Drinking Water Law of 1976."

These Mississippi water standards apply to "waters of the state" which include all streams, lakes, ponds, impounding weirs, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, situated wholly or partially within or bordering upon the state, and such coastal waters as are within the jurisdiction of the State. Classification of water bodies in the SSC area are given in Table 3-4. Quantitative water quality criteria corresponding to the State of Mississippi Stream Classifications for Surface Waters in the SSC area are provided in Table 3-5 (8).

The State issues permits for discharge to surface waters under the NPDES program (9, 10). These permits are renewed at five year intervals. SSC holds permit number MS0021610, which was reissued September 29, 2010, and Permit MS0040797 issued October 13, 2009. These permits are for surface water discharges and are for the following outfalls:

Domestic (sanitary) wastewater from Outfalls numbered 001, 002, 008, and 010.
Rocket Testing Deluge Water and Test Stand Rain Sump Water, Outfall number 011.
Domestic (sanitary) wastewater from Outfall 002 at Area 9.

The effluent limitations, schedule of compliance, and monitoring requirements are specified in Tables 3-6, 3-7, 3-8, 3-9 and 3-10 (9, 10). Sewage treatment systems at SSC consist of five (5) permitted treatment facilities and sixty six (66) lift stations.

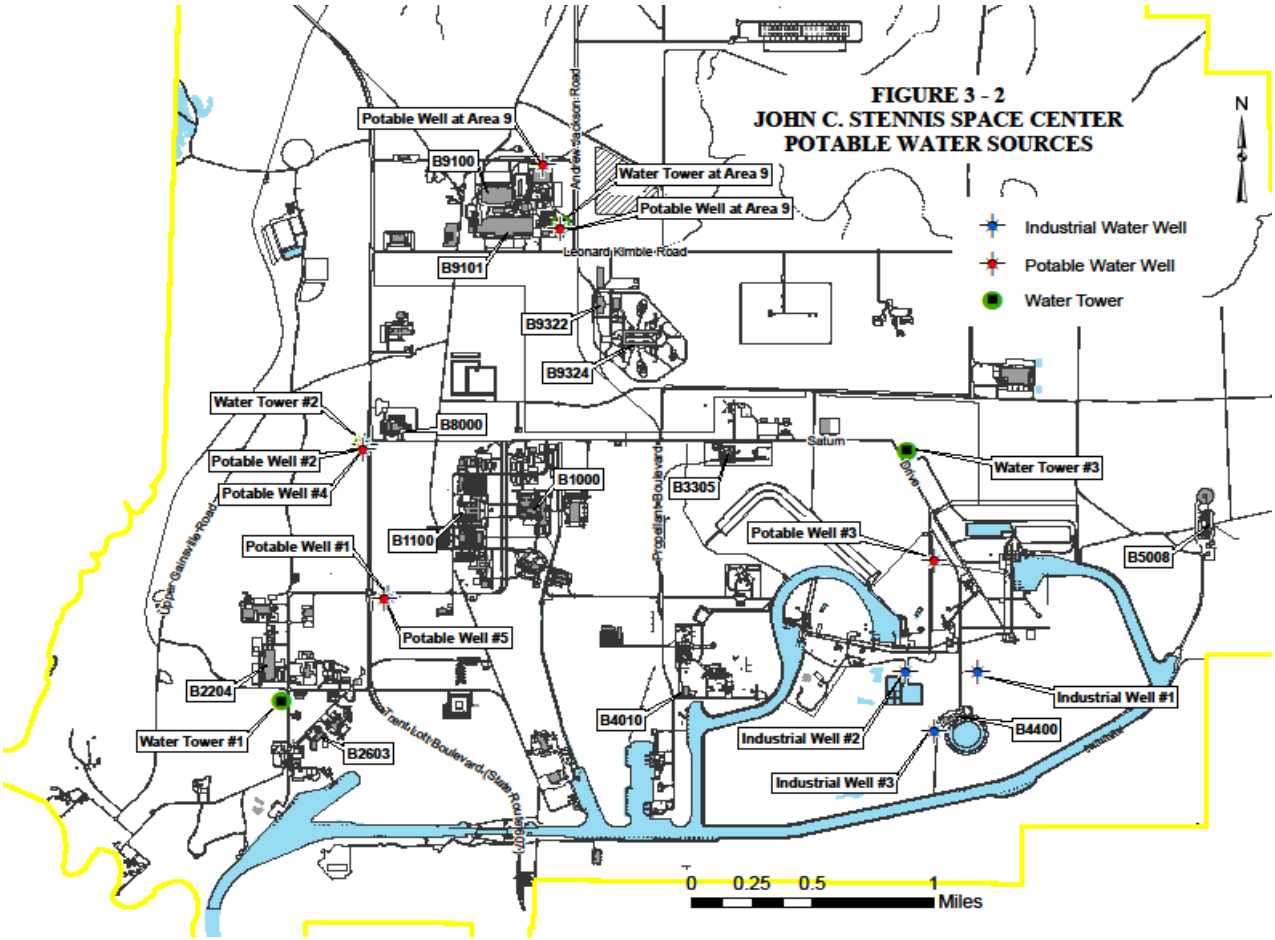


Table 3-1
SSC Well Use Permits

Well #	Permit No.	Well Use	Depth		Normal Discharge	Maximum permitted discharge rate
			Meters	Feet	Million Gal/Day	Gal/ Min
	MSGW01907	Industrial Water Well 1 [1]	571	1,873	0.003 [2]	3,500
	MSGW01908	Industrial Water Well 2 [1]	517	1,695	0.003 [2]	5,000
	MSGW01909	Industrial Water Well 3 [1]	205	672	0.003 [2]	5,000
1	MSGW01910	Drinking Water Well 1 [1]	465	1,524	0	600
2	MSGW01911	Drinking Water Well 2[3]	451	1,481	0	0
3	MSGW01912	Drinking Water Well 3 [1]	437	1,434	0.01	700
4	MSGW16593	Drinking Water Well 4 [4]	449	1474	0.35	600
5	MSGW16620	Drinking Water Well 5 [5]	458	1504	0.35	600
#2	MSGW02614	Drinking Water Well Area 9/#2	207	680	0.03	1200
#1	MSGW02615	Drinking Water Well Area 9/#1	210	688	0.03	1200

1 Well maintained in a standby mode
2 Based on using 1Mgal/year for maintenance
3 Well was abandoned on 10/22/09; replaced by Drinking Water Well #4
4 Replaced Well #2
5 Replaced Well # 1

Table 3-2
Monthly Withdrawal (gals/day)
Potable Water Usage in 2011 (groundwater)

	Well #4	Well #5	Area 9 Well #1	Area 9 Well #2
January	5,282,000	4,934,000	299,000	955,000
February	5,054,000	4,755,000	306,000	624,000
March	4,666,000	4,264,000	271,000	701,000
April	5,052,000	4,803,000	316,000	579,000
May	5,253,000	4,473,000	417,000	776,000
June	5,338,000	5,639,000	324,000	888,000
July	5,471,000	5,464,000	370,000	608,000
August	6,505,000	6,456,000	269,000	732,000
September	5,583,000	5,540,000	281,000	812,000
October	4,578,000	4,504,000	356,000	865,000
November	5,377,000	5,064,000	326,000	716,000
December	3,885,000	3,734,000	467,000	729,000

** Wells reported are those which supply potable water to the site. Wells #1 and #3 are maintained in standby mode.
Source:NASA, 2011, Ground Water Usage Report, Stennis Space Center.

Table 3-3
pH of Natural Surface Waters at SSC

Date	E. Pearl River North of SSC	E. Pearl River South of SSC	Army Ditch at SSC
2/2/2011			6.74
4/12/2011	6.2	6.32	
5/4/2011			7.89
8/16/2011	6.57	6.69	7.19
11/2/2011			7.42

Source: SSC discretionary monitoring data from calendar year 2011, SSC's Environmental Laboratory

RELEASED - Printed documents may be obsolete; validate prior to use.

3.2.3 Wild and Scenic Rivers

The Wild and Scenic Rivers Act (16 U.S.C. § 1271 et seq.) establishes requirements for water resource projects affecting wild, scenic, or recreational rivers within the National Wild and Scenic Rivers System, as well as rivers designated on the National Rivers Inventory to be studied for inclusion in the National System. The protective restrictions under the Act mostly apply to Federal agencies; however, private projects that require Federal agency approval or permits may also be affected.

The Act applies to construction of water resources projects that would have direct and adverse effects on the free-flowing, scenic, and natural values of a river on the National System or National Rivers Inventory. The Act also covers indirect effects from construction of water resources projects below or above rivers or their tributaries that are in the National System or under study on the National Rivers Inventory, such as a dam on a tributary or development on adjacent shorelines. If a project would affect the free-flow characteristic of a designated river or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area, such activities must minimize adverse impacts and consult with the National Park Service and the Department of Agriculture.

Many rivers across the country were declared eligible for studies that would determine their right to protection under the Act. Later, several additional rivers were identified by the National Park Service for these studies. These rivers, known as Inventory Rivers, are not strictly protected under the Act. Inventory Rivers are protected by guidelines issued in 1980 by the Council on Environmental Quality (CEQ). The CEQ guidelines recommend that Federal agencies consider the effect significant Federal actions may have upon Inventory Rivers.

The Pearl River, extending through the Buffer Zone and the Jourdan River from the confluence of Catahoula Creek to the Bay of St. Louis, is both designated Inventory Rivers. The Jourdan River, located approximately 8 kilometers (5 miles) east of Stennis Space Center, has been identified as having significant recreational and archaeological resources. The Pearl River, used for SSC barge traffic, has been identified as having numerous endangered, threatened and rare species (see Section 6.0), and as being an excellent example of a large Gulf Coastal Plain river with extensive swamplands.

3.2.4 Drinking Water

A summary of parameters monitored at SSC for potable water and wastewater is given in Table 3-11. Drinking water samples are obtained throughout the facility on a monthly basis and coordinated weekly/quarterly with the Mississippi Department of Health.

RELEASED - Printed documents may be obsolete; validate prior to use.

3.2.5 Wastewater

Discharges of wastewater are monitored to meet NPDES permit conditions (9, 10), and NASA maintains a surface water quality monitoring program in the Fee Area. NPDES sampling locations are given in Figure 3-3.

3.3 CERCLA Sites

3.3.1 Groundwater Remediation Sites

In 1990 SSC began the investigation of 40 areas where potential spills, releases, and disposal incidents have occurred, and as a result of that effort, NASA is conducting active groundwater remediation at seven CERCLA sites. The seven cleanup sites are referred to as Cleanup Areas A - G. Two of the cleanup sites, Areas A and F, are in post-remediation. Area H has been identified as a potential cleanup site. Area I was accepted as a “no further action” site by the Mississippi Department of Environmental Quality (MDEQ) in May 2007.

To ensure consideration of land usage within the Fee Area, clean up areas will be identified in the NASA Master Plan and Geographic Information System (GIS) layer to restrict shallow ground water usage as well as promote additional review from Environmental Management.

The remedy at Area A includes barrier walls for source containment and a passive treatment wall for contaminated groundwater. The passive treatment wall cleans shallow groundwater as it flows through the treatment gates. The groundwater, which is contaminated with very low levels of dioxin and TCE, is guided as it flows through the treatment gates to degrade the contaminants. An engineered cap and barrier walls were installed around the contaminant source to provide containment.

The remedy at Areas B- E and G includes pump and treat followed by natural attenuation for contaminated groundwater. Groundwater pump and treatment units have been installed at Areas B, C, D, and E. Contaminated groundwater from Area G is extracted and transported to the unit located at Area E for treatment. Numerous shallow extraction wells are used to withdraw water from the near-surface aquifers for the pump and treat remediation effort. The groundwater is contaminated with volatile organic compounds including trichloroethene (TCE) and vinyl chloride. The treatment systems break down the contaminants using carbon filtration and/or ultraviolet oxidation to reduce contaminant levels to clean-up standards. The treated water is then released to SSC's sanitary sewer system.

In the fall of 2011 NASA completed a remedial investigation at an additional site, a PCB release site near B3202. The PCB site was determined to have localized contamination and will undergo remediation in the 2012/2013 timeframe. The remedy for the PCB site will include the removal

and proper disposal of contaminated soil. The need to conduct groundwater remediation will be evaluated after soil/source removal activities.

Hundreds of groundwater monitoring wells have been installed at the various CERCLA sites as part of the investigative process at SSC. Groundwater at the active remediation sites is monitored to evaluate the effectiveness of remediation, and long-term monitoring may be conducted for up to 25 years at some sites. When deemed necessary NASA will close all wells that will not be used for long-term monitoring efforts in the CERCLA program.

3.3.2 SSC Landfill

NASA monitors and evaluates groundwater quality for the entire landfill site in accordance with the Groundwater Monitoring System Plan (Plan) dated March 2007, which was submitted to MDEQ for approval (11). The Plan is designed to monitor the quality of shallow groundwater at the landfill, specifically in the area of the active cells (Cells 3 and 4) and inactive cells (Cells 1 and 2). SSC's landfill is a long-term monitoring site. Reports are provided to the MDEQ on a semi-annual basis in accordance with SSC's Solid Waste Permit.

The current groundwater monitoring system is comprised of the following wells: 02-03MW, 02-04MW, 02-05MW, 02-13MW, 02-20MW, 02-21aMW, 02-22MW, 02-23MW, 02-24MW, 02-25MW, 02-26MW, 02-27MW, 02-28MW, and 02-29MW. Depth to groundwater, pH, conductivity and temperature are measured each sampling event. Groundwater samples are analyzed for the constituents listed in 40 CFR 258, Appendix I, plus herbicides and pesticides on Table 2 in the Plan.

3.4 Major Environmental Considerations for Proposed Action

Erosion of surface soils during construction, and land clearing for construction on the site needs to be addressed. Soil erosion could increase the turbidity, suspended solids and color of the receiving waters. In addition, effluent discharges from testing, construction, and manufacturing result in surface water quality impacts. Potentially affected surface waters should be monitored analytically to determine impact on surface waters. All construction and testing operations must be coordinated through NASA Environmental Management so that environmental impacts can be properly assessed.

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 3-4
Classification of Water Bodies in the SSC Area

Water Body	From	To	Classification
Pearl River	Byram Bridge	Mississippi Sound	Recreation
Jourdan River	Confluence of Dead Tiger and Catahoula Creek	Highway 43	Recreation
Jourdan River	Highway 43	Bay of St. Louis	Recreation
Bay of St. Louis	Harrison-Hancock Counties		Shellfish Harvesting

Table 3-5
State of Mississippi Water Quality Criteria for Surface Waters

Water Quality Parameters	Recreation	Shellfish Harvesting
Fecal Coliform	Fecal coliform shall not exceed a geometric mean of 200 per 100 ml nor shall more than ten percent (10%) of the sample examined during any month exceed 400 per 100 ml.	The median fecal coliform MPN (most probable number) of the water shall not exceed 14 per 100, and not more than 10% of the samples shall exceed an MPN of 43 per 100.
Specific Conductance	There shall be no substances added to increase the conductivity above 1000 microhos/cm for fresh water streams.	Not Applicable
Dissolved Solids	There shall be no substances added to the water to cause the dissolved solids to exceed 750 mg/l as a monthly average value, nor exceed 1500 mg/l at any time for freshwater streams.	Not Applicable
pH	The normal pH of the waters shall be 6.0 to 8.5 and shall not be caused to vary more than 1.0 unit; however, should background pH be outside the limits, it shall not be changed more than 1.0 units	Same
Temperature	The maximum temperature rise above natural temperatures shall not exceed 5° F in streams, lakes and reservoirs nor shall the maximum water temperature exceed 90° F.	The discharge of any heated waste into any coastal or estuarine waters shall not raise temperatures more than 4° F above natural during the period October through May, nor more than 1.5° F above natural for the months June through September.
Dissolved Oxygen	Dissolved oxygen concentrations shall be maintained at a daily average of not less than 5.0 mg/l with an instantaneous minimum of not less than 4.0 mg/l in streams, estuaries and in tidally affected portions of streams, and in the epilimnion.	Same
Toxic Substances, Color, Taste and Odor Producing substances	Waters will be free from objectionable sludge deposits, floating debris, oil, and scum from discharges. It will also be free from materials from discharges producing color, odor, taste, total suspended solids or other conditions that create a nuisance. Toxic substances will not exceed levels causing toxicity to aquatic life or pose a treat to human health	Same

Source: State of Mississippi, 2010, Water Quality Criteria for Intrastate, Interstate and Coastal Waters

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 3-6
Effluent Limitations and
Monitoring Requirements for Domestic Wastewater Outfall - No. 001

Effluent Characteristics	**Effluent Limitations - Daily Max**	**Effluent Limitations - Monthly Average**	**Monitoring Requirements - Frequency**	**Monitoring Requirements - Sample Type**
Flow (MGD)	Report	Report	Bimonthly	Totalizer
BOD5	15 mg/l	10 mg/l	Bimonthly	24-hour composite
TSS	45 mg/l	30 mg/l	Bimonthly	24-hour composite
Fecal Coliform Geometric Mean	400/100 ml	200/100 ml	Bimonthly	Grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored twice per month with a grab sample of the effluent.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

The discharge shall not cause the occurrence of a visible sheen on the surface of the receiving waters.

Samples taken in compliance with the monitoring requirements specified in this permit shall be taken at the nearest point after final treatment but prior to mixing with the receiving stream or as otherwise specified in the procedure.

Source: State of Mississippi, 2010, NPDES Permit #MSR0021610

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 3-7
Effluent Limitations and
Monitoring Requirements for Domestic Wastewater Outfall - No. 002

Effluent Characteristics	**Effluent Limitations - Daily Max**	**Effluent Limitations - Monthly Average**	**Monitoring Requirements - Frequency**	**Monitoring Requirements - Sample Type**
Flow (MGD)	Report	Report	Bimonthly	Totalizer
BOD5	15 mg/l	10 mg/l	Bimonthly	24-hour composite
TSS	45 mg/l	30 mg/l	Bimonthly	24-hour composite
Fecal Coliform Geometric Mean	400/100 ml	200/100 ml	Bimonthly	Grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored twice per month with a grab sample of the effluent.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

The discharge shall not cause the occurrence of a visible sheen on the surface of the receiving waters.

Samples taken in compliance with the monitoring requirements specified in this permit shall be taken at the nearest point after final treatment but prior to mixing with the receiving stream or as otherwise specified in the procedure.
Source: State of Mississippi, 2010, NPDES Permit # MS0021610

Table 3-8
Effluent Limitations and Monitoring Requirements for
Domestic Wastewater Outfalls No. 008 and 010

Effluent Characteristics	**Effluent Limitations - Yearly Max**	**Effluent Limitations - Yearly Average**	**Monitoring Requirements - Frequency**	**Monitoring Requirements- Sample Type**
Flow (MGD)	Report	Report	Once/Year	Instantaneous
BOD5	45 mg/l	30 mg/l	Once/Year	Grab
TSS	45 mg/l	30 mg/l	Once/Year	Grab
Fecal Coliform Geometric Mean	400/100 ml	200/100 ml	Once/Year	Grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per year with a grab sample of the effluent.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

The discharge shall not cause the occurrence of a visible sheen on the surface of the receiving waters.

Samples taken in compliance with the monitoring requirements specified in this permit shall be taken at the nearest point after final treatment but prior to mixing with the receiving stream or as otherwise specified in the procedure.
Source: State of Mississippi, 2010, NPDES Permit # MS0021610

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 3-9

Effluent Limitations and Monitoring for Outfall 011

Effluent Characteristics	**Effluent Limitations - Yearly Max**	**Effluent Limitations - Yearly Average**	**Monitoring Requirements - Frequency**	**Monitoring Requirements- Sample Type**
Flow (MGD)	Report	Report	Twice/month	Estimation
TSS	45 mg/l	30 mg/l	Twice/month	Grab
Oil and Grease	15 mg/l	10 mg/l	Twice/month	Grab

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored twice per month with a grab sample of the effluent.

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 3-10
Effluent Limitations and Monitoring for Area 9 Outfall 002

Effluent Characteristics	Effluent Limitations - Monthly Max	Effluent Limitations - Monthly Average	Effluent Limitation – Quality Conc.	Monitoring Requirements - Frequency	Monitoring Requirements- Sample Type
Flow (MGD)	Report	Report		Weekly	Instantaneous Sampling
TSS	45 mg/l	30 mg/l		Monthly	Grab
Oxygen, Dissolved			6.0 mg/l Minimum	Monthly	Grab
Oxygen, Demand 5 day	15 mg/l	10 mg/l		Monthly	24 hour composite
Fecal coliform	400 # of colonies/100ml	200 # of colonies/100ml		Monthly	Grab
Ammonia Nitrogen, Total	3 mg/l	2 mg/l		Monthly	24 hour composite
pH			6.0 minimum 9.0 maximum	Monthly	Grab

There shall be no discharge of floating solids or visible foam in other than trace amounts.

The discharge shall not cause the occurrence of a visible sheen on the surface of the receiving waters.

Samples taken in compliance with the monitoring requirements specified in this permit shall be taken at the nearest point after final treatment but prior to mixing with the receiving stream or as otherwise specified in the procedure.

Source: State of Mississippi, 2009, NPDES Permit # MS0040797

Table 3-11
Water Monitoring Parameters

Potable Water	Wastewater
Temperature	Flow Rate
Total Coliform	pH
Residual Cl	Biochemical Oxygen Demand (BOD)
pH	Total Suspended Solids (TSS)
Biochemical Oxygen Demand (BOD)	Fecal Coliform
Total Suspended Solids (TSS)	
Total Dissolved Solids (TDS)	
Total Kjeldahl Nitrogen (TKN)	Total Dissolved Solids (TDS)
TP	Total Kjeldahl Nitrogen (TKN)
NO3	TP
SO4	NH3
Fl	Metals I
Cl	Conductivity
Turbidity	Total Organic Carbon (TOC)
Metals I	
Metal II	
BNAE	
THM	
VOC	
TOC	
Chlorine Dioxide	
Chloramine	
Haloacetic Acids	
Bromide	
Nitrate	
Phosphate	
Chlorate	
Chlorite	
Bromate	

RELEASED - Printed documents may be obsolete; validate prior to use.

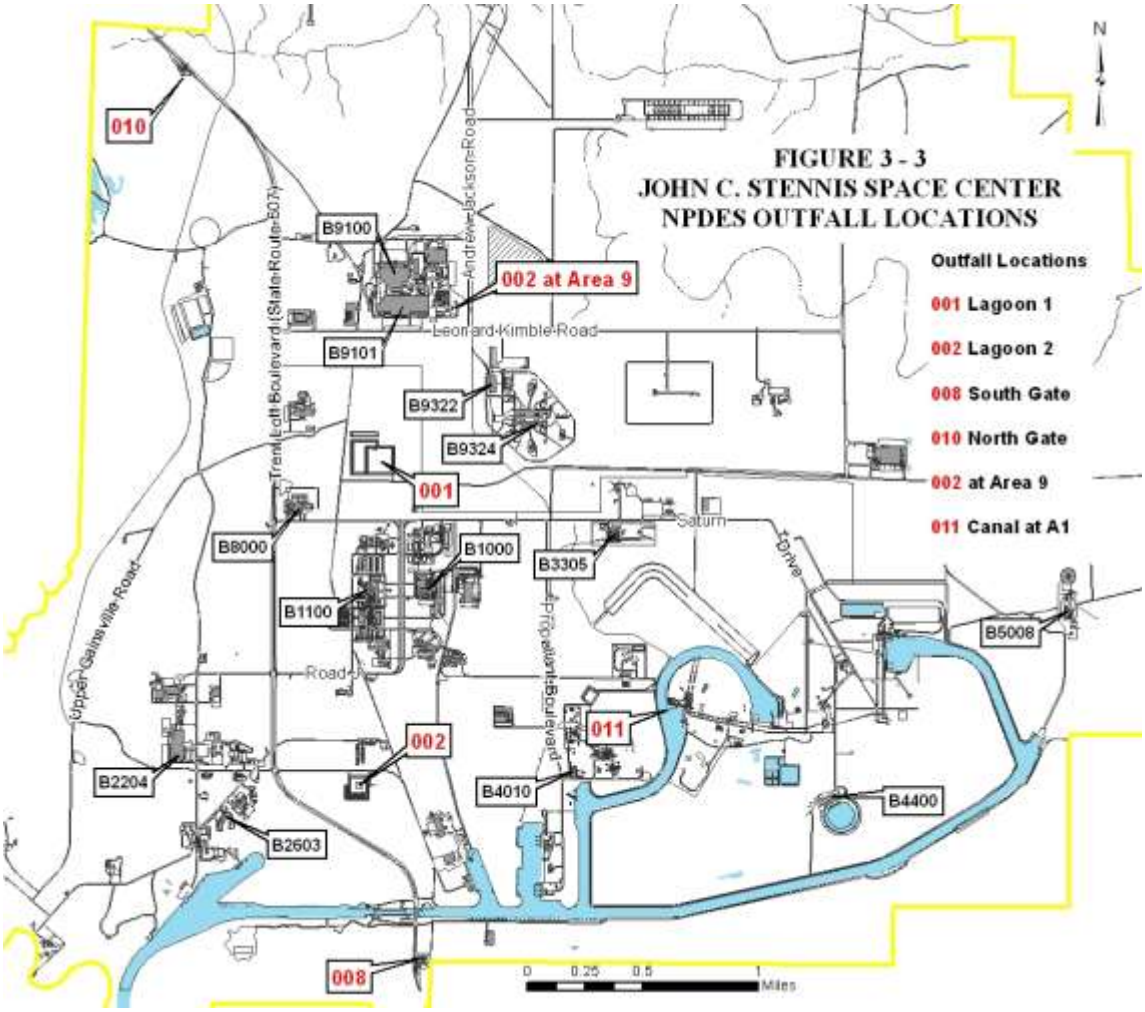


FIGURE 3 - 3
JOHN C. STENNIS SPACE CENTER
NPDES OUTFALL LOCATIONS
Outfall Locations
001 Lagoon 1
002 Lagoon 2
008 South Gate
010 North Gate
002 at Area 9
011 Canal at A1
N
010
B9100
002 at Area 9
B9101
B9322
B9324
001
B8000
B1000
B3305
B1100
B5008
002
011
B2204
B4010
B4400
B2603
008
Leonard Kimble Road
Andrew Jackson Road
Trent Lott Boulevard (State Route 607)
Upper Gainesville Road
Road
Saturn
Drive
Propellant Boulevard
0 0.25 0.5 1
Miles

3.5 References

1. NASA, 1992, Environmental Resource Document, Inventory Summaries for John C. Stennis Space Center.

2. State of Mississippi, 2010, Permit to Divert or Withdraw for Beneficial Use the Public Waters Permit #MS-SW-02432.

3. Newcome, R., Jr., 1967, Development of Groundwater Supplies at Mississippi Test Facility, Hancock County, Mississippi, Geological Survey Water Supply Paper 1839-H, pp. H3-H27.

4. NASA, 2011, MDEQ Well Use Permits, Stennis Space Center.

5. NASA, 2011, Ground Water Usage Report, Stennis Space Center.

6. State of Mississippi, 1966, Mississippi Air and Water Pollution Control Act, Title 49, Conservation and Ecology, Chapter 17, Pollution of Waters, Streams, and Air.

7. State of Mississippi, 1995, Wastewater Regulations for National Pollutant Discharge Elimination System (NPDES) Permits, Underground Injection Control (UIC) Permits, State Permits, Water Quality Based Effluent Limitations and Water Quality Certification.

8. State of Mississippi, 1995, State of Mississippi Water Quality Criteria for Intrastate, Interstate and Coastal Waters.

9. State of Mississippi, 2010, Water Pollution Control Permit # MS00216210.

10. State of Mississippi, Water Pollution Control Permit # MS0040797.

11. NASA, 2007, Groundwater Monitoring Plan, Stennis Space Center.

RELEASED - Printed documents may be obsolete; validate prior to use.

4.0 Land Resources

4.1 Geology and Topography

SSC lies in the Lower Coastal Plain Physiographic Province of Mississippi, with the Buffer Zone surrounding the Fee Area extending into the Pine Hills Province. The site is underlain by a thick sequence of sedimentary deposits dipping to the south and west. Holocene (or Recent Age) alluvium, quaternary coastal deposits, and the Citronelle Formation of the Pliocene Age occur at the surface. Strata ranges from unconsolidated alluvium and coastal deposits, sands, gravels, and clays to sediments varying from clays to gravels. Bedrock is thought to be as much as 3,000 to 3,700 meters (10,000 to 12,000 feet) below the surface (1).

The Lower Coastal Plain is a low flat area; elevations increase gradually from sea level to slightly higher elevations in the northern highlands of the Province. Southern areas of the Province are primarily marshlands. North to south trending elevated ridges are the major topographic features. Land surface elevation ranges from 3 to 27 meters (10 to 90 feet) above sea level, and local relief is negligible. Elevations along major watercourses and along the coast reach a maximum of approximately 27 meters (90 feet) in the northern part of the Province. The elevations of the Buffer Zone range from approximately 1.5 meters (5 feet) in the southwest section to approximately 21 meters (70 feet) in the northeast. Fee Area elevations range from approximately 1.5 to 9.1 meters (5 to 30 feet) above mean sea level.

The topography of the Pine Hills Province is generally level or rolling hills. Heavy forestations of pine occur in parts of the Province. Major topographic features of the area are ridges with relief of 9.1 to 150 meters (30 to 500 feet), including some crests of 165 meters (540 feet) between watercourses, which flow to the southeast and the southwest (2).

4.2 Seismicity and Structure

SSC lies on the eastern edge of the Mississippi Embayment, an area of geologic subsidence and known faulting and seismic activity further north in Missouri. SSC is considered to be under low to moderate danger from earthquakes. The facility is listed in seismic zone 0 by the Uniform Building Code, which indicates no specific design considerations. Two of the largest earthquakes recorded near the site were in 1975, 2.9 Richter magnitude earthquake and in 1955, Modified Mercalli (MM) intensity V earthquake. Both earthquakes were located approximately 40 kilometers (25 miles) from SSC (3).

4.3 Soils

4.3.1 Description

A soil survey is an inventory and evaluation of soils. Information from a soil survey can be used for management of crops, pasture, woodland, building sites, sanitary facilities, highways and other transportation systems, parks and other recreational facilities, and wildlife habitat. It can be used to help prevent construction failures caused by unfavorable properties (4). The Hancock County, Mississippi Soil Survey indicates the soils in the Fee Area are dominated by Atmore silt loam (At), Escambia loam (Es), and Smithton fine sandy loam (St, Su). The Atmore accounts for approximately 37% of SSC site soils (5,207 square feet), the Escambia for approximately 13% (1,827 square feet), and the Smithton for approximately 12% (1,660 square feet). These soils are generally composed of poorly to somewhat poorly drained silty and loamy soils. They are generally acidic with other significant characteristics of wetness, high organic matter, and weathered clay mineralogy. Table 4-1 summarizes the characteristics of the major soil types found at SSC. A map of soil types present in the SSC Fee Area is included as Figure 4-1. Some soils around building complexes have been modified through fill and man-made drainage. For detailed site-specific information, soil borings with sampling may be necessary.

The Atmore soil is poorly suited to row crops and has severe limitations on urban uses such as sanitary landfills, sewage lagoons, and septic tanks due to wetness. Typically, the surface layer is very dark silt loam about 0.13 meters (5 inches) thick. The subsurface layer is a dark grayish-brown silt loam and goes to a depth of approximately 0.41 meters (16 inches). The soil is strongly or very strongly acidic throughout. Permeability is moderate in the upper part of the subsoil and moderately slow in the lower part. Runoff is slow, and the erosion hazard is slight. Small areas of Escambia, Harleston (HlA), Smithton, and Plummer (Pe) are mapped with the Atmore (4).

FIGURE 4 - 1
JOHN C. STENNIS SPACE CENTER
SOIL TYPES AT SSC

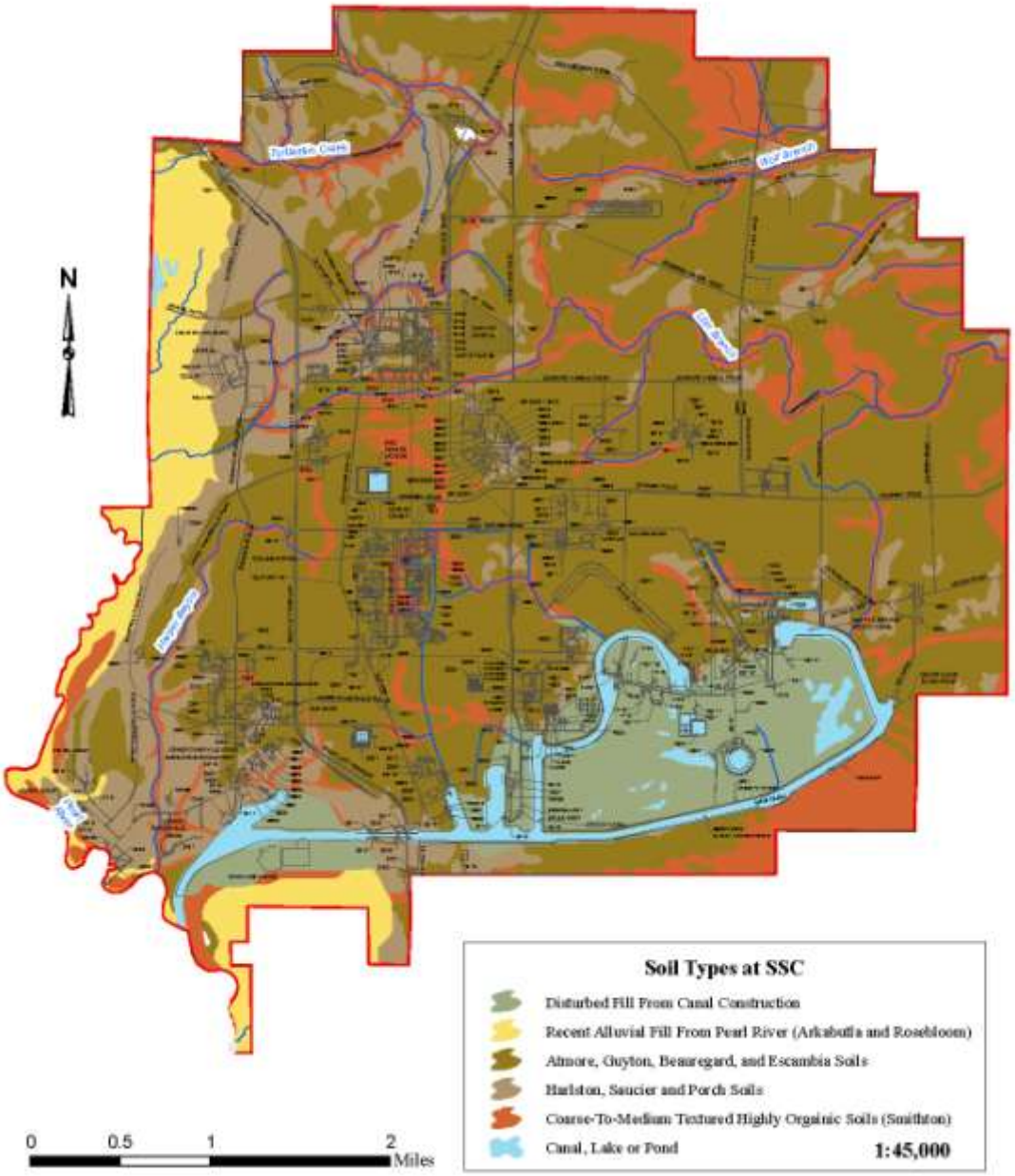


Table 4-1
Soil Characteristics

Soil Type	%	Texture	Depth, meters (inches)	Permeability	Limitations
Atmore (At)	37.25	Silt Loam (upper) Silty Clay Loam (lower)	1.52 (60)	Moderate (upper) Moderately Slow (lower)	Severe limitations for urban use due to wetness.
Escambia (Es)	13.07	Loam (upper) Clay Loam (lower)	1.52 (60)	Moderate (upper) Slow (lower)	Moderate limitations for urban use, severe limitations for septic tank fields.
Smithton (St, Su)	11.88	Fine Sandy Loam Throughout	1.52 (60)	Moderately Slow	Severe limitations due to wetness.
Harleston (Hl)	9.85	Fine Sandy Loam (upper) Sandy Clay Loam (lower)	1.52 (60)	Moderate	Moderate limitations for urban use.
Arkabutla-Rosebloom (AR)	5.83	Silt Loam (upper) Silty Clay Loam (lower)	1.52 (60)	Moderately Slow	Severe limitations due to flooding and wetness.
Saucier (Sa)	3.6	Fine Sandy Loam (upper) Clay Loam (lower)	1.52 (60)	Moderate (upper) Slow (lower)	Moderate limitations for urban use.
Guyton (Gu)	3.36	Silt Loam (upper) Silty Clay Loam (lower)	1.60 (63)	Slow	Severe limitations for urban use due to wetness.
Poarch (Po)	1.79	Fine Sandy Loam	1.52 (60)	Moderate (upper) Moderately Slow (lower)	Moderate limitations due to wetness.
Beauregard (Be)	1.59	Silt Loam	1.52 (60)	Moderately Slow	Severe limitations for urban use due to wetness.

Source: Smith W., Nichols, P., Jr., and Walton, L., 1981, Soil Survey of Hancock County, Mississippi, United States Department of Agriculture.

Smithton fine sandy loam is associated with floodplains, drainage ways, stream terraces, and densely forested wet flats. Therefore, the presence of excessive wet conditions and flooding poses limitations for crop, pasture and urban use.

The surface layer of the soil is very dark grayish-brown fine sandy loam about 0.05 meters (2 inches) thick. The subsurface layer is grayish-brown fine sandy loam to a depth of approximately 0.20 meters (8 inches). The upper part of the subsoil is a light brownish-gray fine, sandy loam with brownish mottles, and extends to a depth of approximately 1.24 meters (49 inches). The Smithton soils are also highly organic and have a high risk of corrosion to uncoated metal and concrete. Permeability is moderately slow and the available water capacity is medium. Runoff is very slow and erosion hazard is slight. The soil has severe limitations for urban use (urban use includes development) because of flooding and wetness. Small areas of Atmore, Harleston, Guyton (Gu), and Plummer soils are mapped with the Smithton soil (4).

The Escambia loam is a poorly drained soil found on low upland ridges. The surface layer is approximately 0.18 meters (7 inches) thick. The upper 0.10 meters (4 inches) are very dark gray, and the lower 0.08 meters (3 inches) are dark gray. The subsurface layer is grayish-brown loam to a depth of about 0.36 meters (14 inches). The soil is strongly acidic with moderate to slow permeability. The soil is suited to crops and pasture with appropriate management of seasonable wetness, but has limited urban use. Included with this soil for mapping purposes are small areas of Atmore, Guyton, Harleston, Poarch, and Saucier soils. The Guyton, Harleston, and Saucier soils have severe to moderate limitations for urban use due to potential for flooding and wetness of the soils. A water table at the 0.30 to 0.76 meter (1 to 2.5 foot) depth exists in these soils approximately four months of the year, and they may be flooded periodically. Erosion potential is slight due to the low relief of the area and cohesiveness of the soils (4).

In addition to the aforementioned soils, Arkabutla-Rosebloom and Beauregard soil types are found in the Fee Area. The Arkabutla-Rosebloom association is found mostly on the flood plains of the Pearl River and consists of poorly drained silty soils. Use of these soils for agriculture and urban applications is limited due to wetness and flooding (4).

The Poarch fine sandy loams are found on upland ridges and side slopes. The soils are generally well drained with moderately slow permeability. Urban uses are limited due to wetness (4).

Beauregard soils are found on low upland ridges where slopes range from zero to one percent. The soil is well drained with moderately slow permeability. The soil is well suited to corn and soybean crops but has severe limitations for urban use due to wetness (4).

Sulfaquepts soils are also found in areas of fill along beaches and marshes and at sites within SSC. These soils are variable in texture and range from sand to silty clay and clay. The surface layer is strongly acidic, but the subsoil is variable in reaction. These soils contain sulfur (4).

The remainder of the soils in the Fee Area also have strong to moderate acidity, moderate to moderately slow permeability, moderate to high available water capacity, slow to medium runoff, and slight to moderate erosion potential. These soils are associated with moderate restrictions for urban use, are typically good for woodland and pasture, and are fair to good for crops with good management (4).

4.4 Land Use

4.4.1 Hancock County

The Fee Area and Buffer Zone at SSC occupy approximately 36 percent of the Hancock County land base. Land uses outside the Buffer Zone vary. Urban areas interspersed with open spaces, such as coastal wetlands, are scattered along the coast. The northern half of the county is primarily commercial forestry and cropland. Recreational areas are scattered along open bodies of water and institutional and industrial land uses occupy areas of the Buffer Zone perimeter. Hancock County has a comprehensive plan; however, it does not affect the status of SSC's Buffer Zone and Fee Area. The areas within city limits have zoning regulations in place.

4.4.2 Buffer Zone

The SSC Buffer Zone is under NASA control through a perpetual easement prohibiting the maintenance or construction of buildings suitable for human habitation. The purpose of the Buffer Zone is to provide an acoustical and safety protection zone for NASA testing operations.

The majority of the land within the Buffer Zone is used for commercial pine forests. Besides commercial forestry, other uses within the Buffer Zone include wildlife management areas, nature preserves, cattle grazing, limited cropland, and small mineral operations. McLeod Park and Stennis International Airport are areas classified for special or unique land use within and along the perimeter of the Buffer Zone. McLeod Park is a 1.72 square kilometer (426 acre) recreational facility along the banks of the Jourdan River. The park is operated by Hancock County and is open throughout the year for public camping and day use. Stennis International Airport is a county-run airfield located partially within the Buffer Zone. In addition, there is a small industrial park located adjacent to the airfield.

The Mississippi Department of Marine Resources administers the Mississippi Coastal Program. The program is intended to protect coastal wetlands, and the jurisdiction of the program extends to those wetlands affected by tidal influence.

SSC received approval in May 1996 from the U.S. Army Corps of Engineers (COE) to mine sand and clay from a 0.0405 square kilometer (10 acre) area. This mining operation complies with The Mississippi Surface Mining and Reclamation Act and Mississippi Air and Water Pollution Law, which regulates disposal of wastewater generated from mining operations. In January 1992, SSC received permission to move mineable materials from one part of NASA property to other parts without a mining permit, as long as the material remained on NASA property.

4.4.3 Fee Area

The SSC Facilities Master Plan, which is updated on an on-going basis, establishes controls and criteria to guide future growth and development within the Fee Area. The plan is used as a general planning tool to guide orderly site growth and expansion and not as a detailed outline for design purposes.

SSC contains several small areas that would be classified as Prime and Unique Farmland according to Federal regulations under the Farmland Protection Policy Act. However, the regulations preclude the designation of land that is already in or committed to urban development as prime farmland. The definition of lands committed to urban development includes dedicated facilities such as SSC, where a comprehensive land use plan has been adopted and the land is committed to nonagricultural uses.

General land use in the SSC Fee Area is illustrated in Figure 4 -2 (5). Refer to Section 7.0 for detailed information regarding active and inactive landfill and waste disposal areas, and CERCLA investigation areas.

4.5 Wetlands and Floodplains

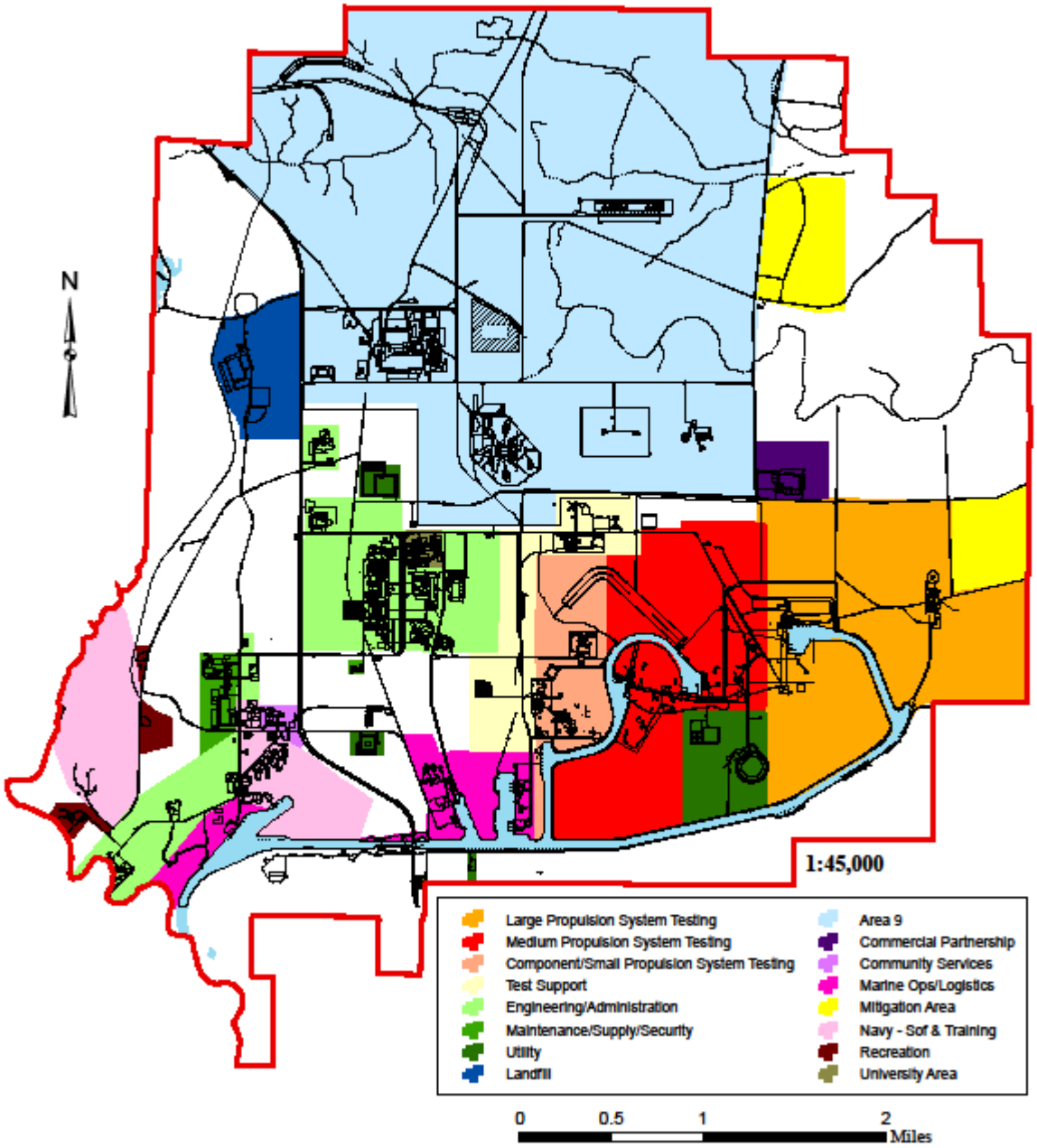
The SSC facility straddles the watersheds of two rivers, the East Pearl River on the western Fee Area boundary and the Jourdan River on the Eastern Fee Area boundary. Some tributaries at the facility flow west to Harper Bayou and eventually drain into the East Pearl River. Other tributaries flow east into Catahoula Creek, with some intermittent streams flowing south into Devil's Swamp. Catahoula Creek and Devil's Swamp both eventually drain into the Jourdan River. The Pearl River empties into Lake Borgne, while the Jourdan River drains into the Bay of St. Louis. Both Lake Borgne and the Bay of St. Louis discharge into the Mississippi Sound.

4.5.1 Regulatory Overview

Several Federal laws, including the Coastal Zone Management Act of 1972 and Executive Orders 11988 and 11990, pertain to activities conducted on floodplains or in wetland areas.

Coastal Zone Management Act of 1972 - The Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.) was enacted, in part, to "preserve, protect, develop, and where possible to restore and enhance, the resources of the Nation's coastal zone for this and succeeding generations," and to encourage and assist the states in the "development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and aesthetic values as well as the needs for compatible economic development." EPA regulations on implementation of the National Environmental Policy Act (NEPA) procedures [40 C.F.R. § 6.30(d)] require all federal activities in coastal areas to be consistent with approved State coastal zone management programs to the maximum extent possible. If a federal agency activity significantly affects a coastal zone area where the State has an approved coastal zone management program, a consistency determination must be obtained. Portions of Bayou LaCroix, Mulatto Bayou and the Pearl River in the Buffer Zone are designated as below the watermark of ordinary high tides.

FIGURE 4 - 2
JOHN C. STENNIS SPACE CENTER
LAND USE IN THE SSC FEE AREA



The State of Mississippi has an approved coastal zone management program contained in Mississippi Code, Title 49, Conservation and Ecology, Chapter 27 - Coastal Wetlands Protection Law and Mississippi Department of Wildlife Conservation, Department of Marine Resources, Chapter 8 - Mississippi Coastal Program Rules, Regulations, Guidelines and Procedures. The administering agency for the program is the Department of Marine Resources, a subdivision of the Mississippi Department of Wildlife Conservation.

Executive Orders 11988 - Floodplain Management, requires federal agencies to evaluate the potential effects of their activities in a floodplain and to avoid, to the extent possible, any adverse effects of development in a floodplain. EPA's Statement of Procedures on Floodplain Management and Wetlands Protection requires that agencies determine whether assessment will be completed and included as part of the environmental assessment or environmental impact statement.

Executive Order 11990 - Protection of Wetlands, requires each federal agency to "take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities." Federal agencies are also required to avoid support of new construction in wetlands if a practical alternative exists.

EPA's Statement of Procedures on Floodplain Management and Wetlands Protection requires agencies to determine if a proposed activity will be in or will affect wetlands and, if so, the agency must complete a floodplain/wetlands assessment to be included in the environmental assessment or environmental impact statement.

4.5.2 Wetlands

The Federal Manual for Identifying and Delineating Jurisdictional Wetlands was produced to describe technical criteria, field indicators and other sources of information, and methods to identify and delineate jurisdictional wetlands in the United States. The manual was reviewed and approved by an interagency committee composed of four federal agencies involved in wetlands identification and delineation. These agencies are the COE, U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), and U.S. Fish and Wildlife Service (USFWS). COE and EPA are responsible for making jurisdictional determinations of wetlands regulated under Section 404 of the Clean Water Act. USFWS reviews wetlands permits issued by COE to provide comments on the environmental impacts of the proposed work. USFWS also conducted a survey of wetlands in the United States and produced a series of National Wetlands Inventory maps. The USDA Soil Conservation Service, predecessor to the NRCS, became more involved in wetlands

RELEASED - Printed documents may be obsolete; validate prior to use.

determinations through provisions of the Food Security Act of 1985, which states that producers who receive Department of Agriculture benefits must not drain, fill, or otherwise alter the water table of a wetland after December 23, 1985.

Definitions - EPA and COE, in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands, define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include “swamps, marshes, bogs and similar areas" (6). Wetland vegetation includes plants that require saturated soils to survive and plants that gain a competitive advantage under prolonged wet soil conditions.

In the Federal Manual, USFWS defines wetlands as lands that are "transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year." This definition includes both vegetated and non-vegetated wetlands. Non-vegetated wetlands include mud flats, sand flats, rocky shores, gravel beaches, and sand bars.

NRCS defines wetlands as "areas that have a predominance of hydric soils and that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions, except lands in Alaska identified as having a high potential for agricultural development and a predominance of permafrost soils."

Except for the USFWS inclusion of non-vegetated areas and the NRCS exemption for Alaska, the wetlands definitions are all very similar and include three basic elements for identifying and delineating wetlands. These three elements are wetlands hydrology, hydrophytic vegetation, and hydric soils.

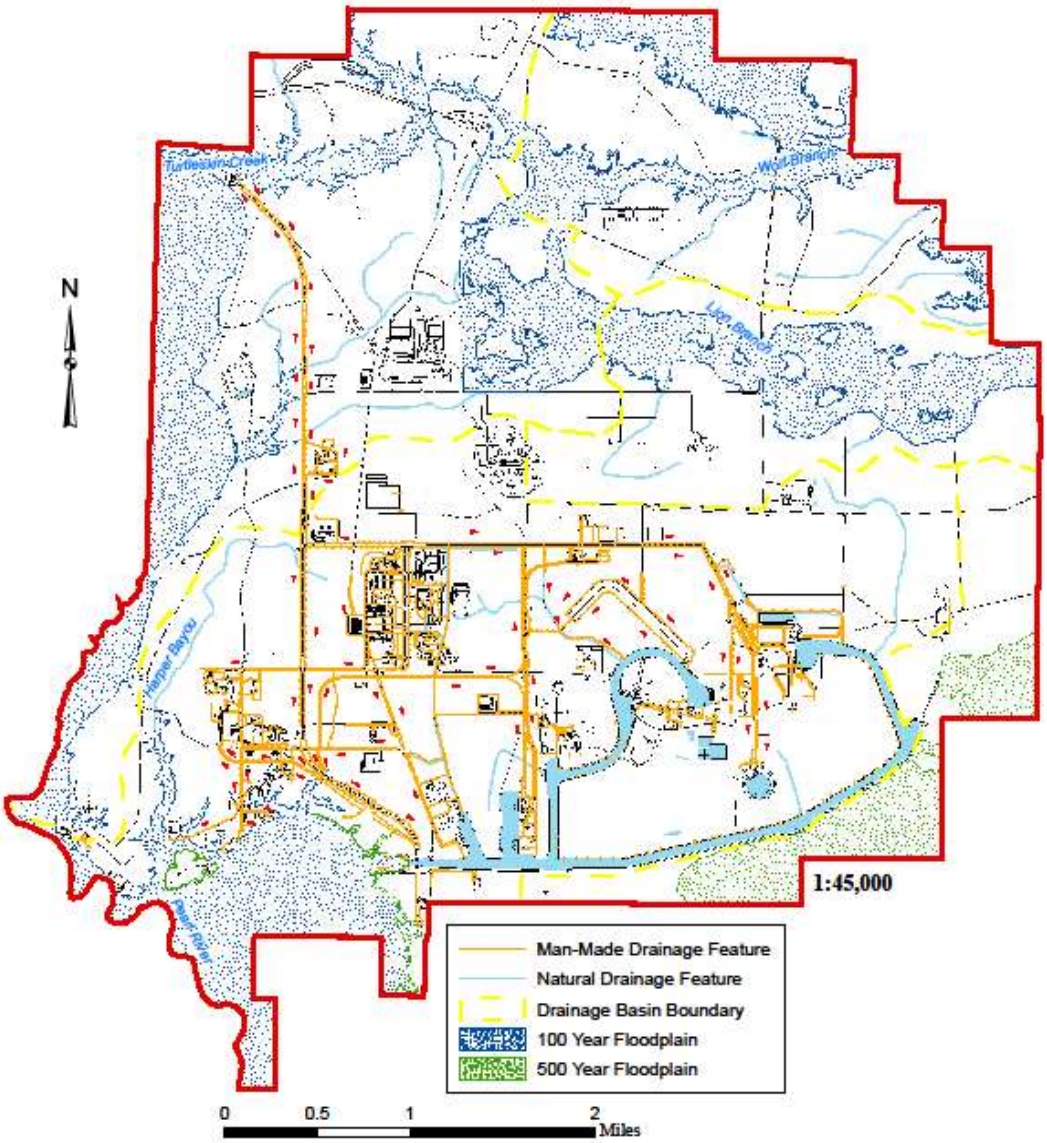
4.5.3 Floodplains

The documented floodplains at SSC include a 100-year floodplain along the East Pearl River at the western edge of the Fee Area, and 100-year floodplains along the Wolf Branch and along the Lion Branch of Catahoula Creek in the northeast portion of the Fee Area. A floodplain is defined as "the lowland and relatively flat area adjoining inland and coastal waters and other flood prone areas such as offshore islands, including, at a minimum, that area subject to a one

percent or greater chance of flooding in any given year". A 100-year floodplain is defined as a floodplain with a one percent or greater chance of flooding in any given year. The majority of SSC is in an area of minimal flooding. A map showing the locations of these floodplains is included as Figure 4-3.

RELEASED - Printed documents may be obsolete; validate prior to use.

FIGURE 4 - 3
JOHN C. STENNIS SPACE CENTER
FLOOD PLAINS AT SSC



4.5.4 Wetlands at SSC

Like most of the soils in the Gulf Coast region of Mississippi and Louisiana, the majority of the soils found in the Fee Area and the Buffer Zone of the SSC facility are hydric or hydric inclusions. In general, NRCS considers soils hydric if the soil is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil. The dominant soils found at SSC are Atmore silt loam, Guyton silt loam, Smithton fine sandy loam, and Escambia loam. Escambia loam areas were designated jurisdictional wetlands by the EPA in a 1990 delineation. Atmore silt loam, Guyton silt loam, and Smithton fine sandy loam are classified as hydric by NRCS.

Ecological surveys and descriptions of vegetation at SSC indicate that hydrophytic vegetation is commonly found at the facility. Hydrophytic vegetation is generally defined as plants that grow in water or soil or on some other substrate that is at least periodically deficient in oxygen as a result of excessive water content.

As a result of the wetlands hydrology found at and around SSC and the presence of hydric soils and hydrophytic vegetation, a large portion of both the Fee Area and Buffer Zone are considered jurisdictional wetlands by the COE. A map showing the potential wetlands at SSC, including those areas delineated by a COE survey conducted in June 1991 as non-wetland, is included as Figure 4-4.

4.5.5 Mitigation for Wetlands Permit Compliance

SSC maintains six areas to provide for wetland mitigation to compensate for the filling of jurisdictional wetlands during construction activities in the Fee Area (7). These areas are referred to as the Pearlington Mitigation area (Phases I, II, and III), Component Test Facility (CTF) project area, Advanced Solid Rocket Motor (ASRM) project area, and Energetic Materials Testing Facility (EMTF) area. A summary of wetlands permits for SSC is given in Table 4-2.

In June 2000, the General Permit was re-issued to SSC by the COE, Vicksburg District for regulated site activities that involve clearing and filling of lands considered jurisdictional wetlands. Under this permit, NASA evaluates impacted wetlands areas by using the Charleston Method. This method involves calculating compensatory mitigation credit factors that are charged against the “Mitigation Bank”. This permit is a five year permit that will be renewed in June 2015.

The establishment of the Pearlington Phases I, II, and III areas and the Energetic Materials Testing Facility (EMTF) area is described in the Final Mitigation Plan. The Pearlington areas were chosen because of their similarity in physiographic and floristic character to the area that will be impacted, and because there is a minimal likelihood that future human disturbance will

negatively impact the site. At the Pearlington and EMTF areas, a pine savannah ecosystem is being reestablished. The Hardwood Enhancement Site (HES opened with Pearlington, Phase I was abandoned and credits reversed on May 4, 2006.)

The CTF mitigation area is a Hardwood Mitigation area that was planted to encourage a bottomland hardwood habitat. The ASRM mitigation area was originally planted as a Hardwood Mitigation area, but has since been converted to a pine savannah.

Vegetation monitoring is being conducted in all mitigation areas in accordance with specific instructions. This vegetation monitoring determines whether the prescribed performance standards are being attained and allows the plan to be modified to meet these standards, if necessary.

4.6 Major Environmental Considerations for Proposed Actions

Because of a large percentage of the SSC facility that has been delineated as wetlands by the COE, any proposed development at the facility will likely require a Wetlands Permit and must be coordinated with NASA Environmental Management.

Table 4-2
Wetlands Permits at SSC

Permit No.	***Project***	***Wetland Mitigation Area***
CELMK-OD-FE14-10R31-17	ASRM	132 acres
CELMK-OD-FE14-10R31-14	CTF	2.75 acres
CELMK-OD-FE14-GPD-53 (Vicksburg District)	General Permit (Pearlington Phase I and 15 ac Hardwood Enhancement Area)	130 acres
CELMK-OD-FE14-GPD-53 (Vicksburg District)	Renewed General Permit (Pearlington Phase II, III and EMTF)	3168 credits

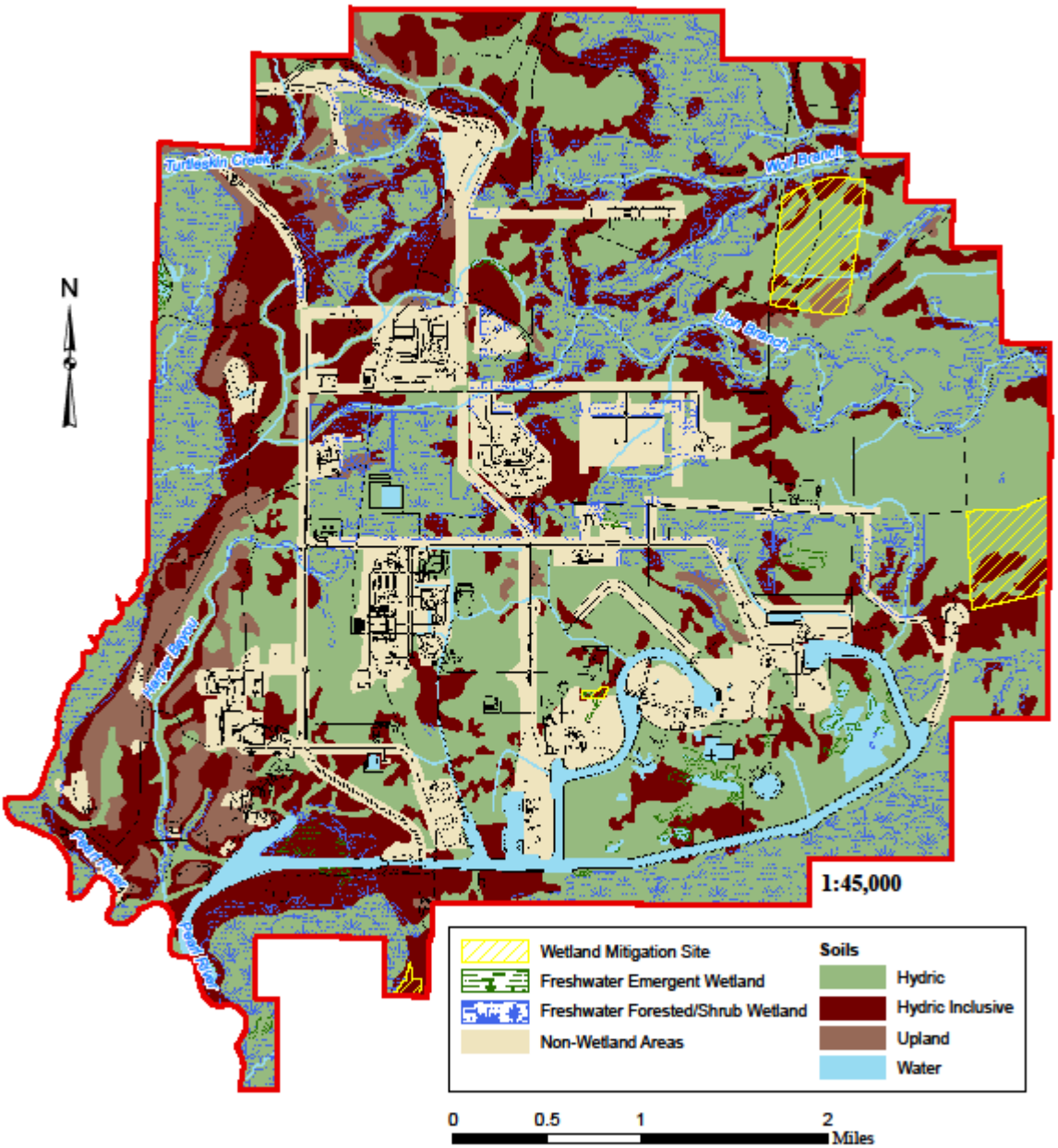
Sources: SSC NASA Environmental Management, Permit Documents

Figure 4-4 is a planning level wetland delineation that was reviewed, modified, and approved by the COE, Vicksburg District. This map is used by NASA Environmental Management to determine the need for further wetland delineation by the Corps and it forms the basis of wetland permit applications.

At the present time, there is little development in the documented floodplains at SSC. Any future development must be coordinated through NASA Environmental Management and must be designed to avoid those floodplains, if at all possible. If no alternative exists to avoid development within a floodplain, a floodplain/wetlands assessment must be included with the environmental assessment or environmental impact statement.

Contamination of soil could result from accidental spills, testing, or regular operations at the facility. Facility construction exposing soil could result in erosion or failure of the soils under excessive bearing pressure. Subsurface utilities and equipment are subject to corrosion due to the corrosive soils located throughout the site.

FIGURE 4 - 4
JOHN C. STENNIS SPACE CENTER
WETLAND SOIL GROUPS AT SSC



Testing at the site could cause soil erosion and exhaust residue could be deposited on the soils. In the event of accidental explosion or manufacturing failure, contamination could be spread over a large area, contaminating the soils and surface water. Ongoing monitoring is conducted to identify and mitigate contaminated soils. All construction and testing operations must be coordinated through NASA Environmental Management so that environmental impacts can be properly assessed.

4.7 References

1. Ebasco, 1989, Final Environmental Impact Statement, Space Shuttle Advanced Solid Rocket Motor Program.

2. Federal Emergency Management Agency, 1987, Flood Insurance Rate Map, Hancock County, Mississippi, Panel 125 of 195.

3. Mr. Mike Bograd, Mississippi Department of Environmental Quality-Office of Geology, Jackson, Mississippi, (601) 961-5528.

4. Smith, W., Nichols, P., Jr., and Walton, L., 1981, Soil Survey of Hancock County, Mississippi, United States Department of Agriculture.

5. SSC Facilities Master Plan.

6. Federal Interagency Committee for Wetland Delineation, 1989, Federal Manual for Identifying and Delineating Jurisdictional Wetlands, U.S. Army Corps of Engineers, U. S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture Soil Conservation Service, Washington, D.C., Cooperative Technical Publication.

7. Golden, D. H. and K. Lehr, 2000. Mitigation plan for Pearlington Wetland Mitigation Area, Phase III, John C. Stennis Space Center, Mississippi, General Permit CELMK-OD-FE 14-GPD-53 US ARMY Corps of Engineers, Vicksburg District. NASA Environmental Office, John C. Stennis Space Center, MS.

5.0 Aquatic and Biotic Resources

5.1 Project Notification Under the Fish and Wildlife Conservation Act

In the Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 et seq.), Congress declared, "fish and wildlife are of ecological, aesthetic, cultural, recreational, economic, and scientific value to the Nation." The purpose of the Act is "to provide financial and technical assistance to the States for the development, revision, and implementation of conservation plans and programs for non-game fish and wildlife; and to encourage all Federal departments and agencies to utilize their statutory and administrative authority...to conserve and to promote conservation of non-game fish and wildlife and their habitats." The Act authorizes the chief executive officer of any appropriate Federal department or agency to loan personnel and equipment, share appropriate scientific knowledge or information, and provide other appropriate assistance to a State for the purpose of developing or revising conservation plans. In the State of Mississippi, wildlife conservation plans are administered by the Mississippi Department of Wildlife Conservation.

5.2 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S.C. 661-666c) was enacted by Congress to ensure that wildlife conservation would receive equal consideration and be coordinated with water resource development projects. Under this Act, "whenever the waters of any stream or other body of water are impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purposes by any department or agency of the United States", provisions must be made for the "conservation, maintenance, and management of wildlife resources." Wildlife resources "include birds, fishes, mammals, and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent." The Fish and Wildlife Coordination Act is administered by the Department of Interior through the U.S. Fish and Wildlife Service (USFWS).

EPA regulations on implementation of the National Environmental Policy Act (NEPA) procedures {40 C.F.R. § 6.302(g)} require any Federal agency involved in activities that will result in control or modification of any natural body of water to consult with USFWS and the appropriate State agency to determine the "measures necessary to mitigate, prevent and compensate for project-related losses of wildlife resources and to enhance the resources." The reports and recommendation of the wildlife agencies must be incorporated into the environmental assessment or the environmental impact statement.

RELEASED - Printed documents may be obsolete; validate prior to use.

5.3 Flora

Four major plant community types have been identified within the SSC area (7). These community types, generally identified by the predominant type of vegetation, are:

- Pine Flatwoods
- Bottomland hardwood
- Pitcher plant bogs and swamps
- Grasslands and marshes

Pine Flatwoods account for the majority of the vegetation in the undeveloped portions of SSC and in the surrounding Buffer Zone. The dominant species in these communities is slash pine interspersed with some cypress, loblolly pine, swamp tupelo, red maple, and sweet gum. Oak species occur in locations that are more elevated with better drainage. The understory in these communities includes holly species, sweet bay gallberry, yaupon, wax myrtle, grasses, and cane (13).

Bottomland hardwood communities occur in low, poorly-drained soils, which may have standing or slowly moving water. The dominant species in these communities are black gum, swamp tupelo, and pond cypress. The understory includes ash species, black willow, red maple, titi, poison ivy, honeysuckle, and grapes. Very few grass or forb (herbs other than grass) species occur in these communities.

Pitcher plant bogs are unique to the coastal plain of the southeastern United States and occur in low-lying, poorly-drained areas with acidic soil. The few mature trees, if any are present, are generally cypress or longleaf pine species. These communities occur where the area is burned regularly, which prevents transition to forest or bottomland hardwood-type communities. Prominent herbaceous species in pitcher plant bogs include orchids, sundews, pitcher plants, pipeworts, and yellow-eyed grass.

Grasslands often occur in disturbed areas where the land has been cleared for construction or burned. The most common grass species in the SSC area include broomsedges and panic grasses. Other plants occurring in grassland communities include cane and rushes. In low, wet areas, pipeworts, milkworts, and sedges may occur, while in drier grasslands, throughworts, rabbit tobacco, and goldenrod may be found (13).

Results of the 1995 ecological risk assessment survey indicated that the western Fee Area is dominated by forested cover types, which most commonly include pine, cypress-gum swamps, mixed pine and hardwoods, and bottomland hardwoods. The remaining area consists of grass, shrubby edge, and open brush. Most of the forests within the study area are wetlands. Stands observed in the western Fee Area contained the following: loblolly pine, longleaf pine, slash pine, black willow, water oak, southern red oak, post oak, laurel oak, black gum, sweet gum, American sycamore, red maple, red bay, sweet bay, and pond cypress, We have both species American holly, cucumber tree, big leaf magnolia, black cherry, hickories, and yellow poplar (16).

Also observed during the 1995 survey were multiflora rose, crab grass, rough hawksbeard, lyre-leaved sage, wild geranium, star anise, titi, wax myrtle, sedges, sphagnum moss, yellow pitcher plants, yellow-topped butterweed, dog fennel, spiny thistle, hawk's beard, and southern dewberry.

A qualitative survey of aquatic macrophytes was conducted in aquatic habitats during the 1995 survey (16). Aquatic macrophytes observed in the aquatic habitats of the study area include soft rush, rice-cut grass, pickerelweed, spike rush, bur reed, knotweed, arrow arum, mud plantain, pennywort, watermeal, duckweed, water lily, marsh seedbox, parrot feather, bladderwort, water hyssop, narrow leaf pondweed, low water milfoil, and two leaf water milfoil.

A list of flora species found at the SSC facility during several ecological studies is included as Appendix A (13, 16).

5.4 Aquatic Fauna

The topography at SSC is generally low and flat with low gradient streams. Aquatic habitats present at the facility include the Pearl River, man-made access canals, lakes, ponds, borrow pits, drainage ditches, shallow swamps, marshes, and small creeks. Aquatic fauna include fish, as well as some amphibians and reptiles.

Surveys of the fish and benthic communities were conducted during the 1995 ecological survey of an unnamed tributary to Harper Bayou, the Pearl River and associated floodplains, Mikes River floodplain, and a drainage ditch to Harper Bayou and associated wetlands. Benthic invertebrates collected during the survey included mayfly nymphs, dragonfly and damselfly nymphs, aquatic beetles, fish fly larvae, caddisfly larvae, riffle beetle larvae, water boatmen, water striders, midge larvae, amphipods, freshwater scuds, isopods, aquatic oligiocheates, freshwater snails, freshwater shrimp, freshwater mites, aquatic annelids, fingernail clams, Asian clams, and crayfish. Twenty fish species were encountered during the 1995 survey (16). Overall, the taxa collected during the 1995 survey represented typical warm water species similar in composition and structure to those observed in other similar habitats at SSC during the 1988

survey. An ecological survey of some of the streams at SSC, performed in 1992, documented a total of 39 fish species. The streams surveyed included the East Pearl River and Mikes River. In a 1988 survey of the Pearl River, man-made access canals, marshes, and small creeks of SSC (particularly Lion Branch and Wolf Branch), 44 fish species were encountered. The fish species identified in the 1995 survey are listed in Appendix B. The fish species identified in the 1988 survey are listed in Appendix C.

Several species of sport fish have been identified at SSC, which is inclusive of mullet, yellow bass, blue catfish, bluegill, and largemouth bass in the East Pearl; and spotted gar, threadfin shad, and longear sunfish in Mikes River. Most of the species identified, including all of the sport fish, were present in the SSC access canals. A few species including pirate perch, banded pygmy sunfish, flyer, lake chubsucker, grass pickerel, green sunfish, and black bullhead were found only in Wolf Branch or Lion Branch where the water flow is sluggish and cannot support fish species requiring moving water.

5.5 Terrestrial Fauna

Because of the number of diverse terrestrial habitats at SSC, including grasslands, forests, and wetland areas, a number of terrestrial animal species are found. The ecological surveys conducted in 1991, 1994, and 1995 documented several species of amphibians, reptiles, mammals, and birds that occur in terrestrial habitats (8, 9, 10, 16).

A total of 22 amphibians were documented in the west Fee Area during the 1994 and 1995 surveys (9, 10, 16). Twenty-five species of amphibians, consisting of 20 species of frogs and toads and six salamanders, were found at SSC during surveys conducted in 1991 and 1994 (8, 9, 10). A list of amphibians documented at SSC during the 1994 and 1995 surveys is included in Appendix B. A list of amphibians documented during the other surveys is included as Appendix C.

Any species of amphibian capable of inhabiting poorly drained lowlands with a vegetative cover of pine and mixed hardwood is likely to be found at SSC. Frog and toad species likely to inhabit SSC, but not found during the 1991 and 1994 surveys, include *Pseudacris ornata*, *Rana capito*, *Rana heckscheri*, and *Scaphiopus holbrooki*. Salamander species likely to be found at SSC, but undocumented to date, include *Ambystoma maculatum, Ambystoma talpoideum, Ambystoma texanum, Desmognathus auriculatus, Desmognathus fuscus, Eurycea cirrigera, Hemidactylum scutatum, Pseudotriton ruber, Pseudotriton montanus,* and *Siren intermedia*.

A total of 33 terrestrial and aquatic reptiles were documented in the west Fee Area during the 1994 and 1995 surveys (9, 10, 16). The 1991 and 1994 ecological studies documented 18 species of terrestrial reptiles (8, 9, 10). These included 14 species of snakes, six of lizards, and the alligator. A list of aquatic and terrestrial reptiles documented at SSC during the 1994 and

1995 surveys is included in Appendix B. A list of aquatic reptiles documented at SSC during the 1988 and 1991 surveys is included as Appendix C. A list of terrestrial reptiles documented at SSC during the 1988 and 1991 surveys is included in Appendix D.

Reptile species not documented at the SSC facility, but likely to occur there because of habitat preference and range, include eastern worm snakes, scarlet snakes, Mississippi ring neck snakes, southern hognose snakes, mole snakes, scarlet king snakes, pine woods snake, Gulf Coast ribbon snakes, eastern garter snakes, rough earth snakes, smooth earth snakes, eastern coral snakes, eastern diamondback rattlesnakes, canebrake rattlesnakes, eastern glass lizards, slender glass lizards, and Mediterranean geckos. Aquatic snake species not documented at SSC, but with ranges and habitat preferences that make them likely to occur at SSC include mud snakes, rainbow snakes, and midland water snakes. Turtle species known to inhabit the Pearl River wetlands of Hancock County and, therefore, likely to be present at SSC include *Graptemys kohnii, Kinosternon carinatum, Kinosternon minor,* and *Apalone spinifera*.

A total of 25 mammals were documented in the west Fee Area during the 1994 and 1995 surveys (9, 10, 16). Thirty-five species of mammals including one bat were documented at the SSC facility during the ecological surveys conducted in 1991 and 1994. (It should be noted, though, that these studies emphasized land mammals, and the 1994 study was conducted only during the summer months.) The list of mammals documented at SSC appears in Appendix D.

Mammal species that are likely to occur at SSC, but were not documented by these studies, include least shrews, Mississippi Myotis bats, eastern pipistrel bats, big brown bats, hoary bats, eastern yellow bats, Seminole bats, evening bats, eastern big-eared bats, Mexican free-tail bats, southern flying squirrels, fulvous harvest mice, pine voles, Norway rats, black rats, gray fox, long-tail weasels, and minks.

A total of 63 birds were documented in the west Fee Area during the 1994 and 1995 surveys (9, 10, 16). During an ecological survey conducted in March through May of 1988, incidental observations of birds at SSC were recorded (7). During the 1991 survey, walking surveys were conducted from January through June to document bird species present at SSC. A survey of the birds of SSC, which was conducted in 1994, combines information gathered in 1991 and 1994. These ecological surveys also documented birds that use the SSC facility for nesting. A total of 142 birds species were documented by the two surveys, with 87 of these species nesting at SSC (8). Another survey of the birds of SSC was performed in 2001 - 2002 by the Forest and Wildlife Research Center of Mississippi State University. A list of birds documented at SSC appears in Appendices D and E.

5.6 Habitat Evaluation

Comprehensive reports on habitat evaluation and a spotlight count survey and management approaches for white-tail deer at SSC was performed by the Forest and Wildlife Research Center of Mississippi State University in 2001 – 2002 and 2003. These reports are included as Appendices E and F.

5.7 Major Environmental Considerations for Proposed Actions

All construction and testing operations must be coordinated through NASA Environmental Management so that environmental impacts can be properly assessed. Any major project undertaken at SSC should include an evaluation of impacts to flora and fauna and biotic habitats. Projects should be designed to promote conservation of flora and fauna and biotic habitats consistent with the conservation plans established by the Department of Wildlife, Fisheries, and Parks (DWFP). Threatened and endangered species are further discussed in Section 6.0 of this Environmental Resources Document.

5.8 References

1. Amos, W.H., and Amos, S.H., undated, The Audubon Society Nature Guides, Atlantic and Gulf Coasts, New York, N.Y., Alfred A. Knopf, Inc., 670 p.

2. Cobb, B., 1963, A Field Guide to the Ferns and Their Related Families of Northeastern and Central North America, Boston, Mass., Houghton Mifflin Company, 281 p.

3. Conant, R., and Collins, J.T., 1991, A Field Guide to Reptiles and Amphibians, Eastern and Central North America, Boston, Mass., Houghton Mifflin Company, 450 p.

4. Duncan, W.H., and Duncan M.B., 1988, Trees of the Southeastern United Sates, Athens, Ga., The University of Georgia Press, 322 p.

5. Duncan, W.H., and Foote, L.E., 1975, Wildflowers of the Southeastern United States, Athens, Ga., The University of Georgia Press, 296 p.

6. Ebasco, 1989, Final Environmental Impact Statement, Space Shuttle Advanced Solid Rocket Motor Program.

7. Esher, R.J., and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, NSTL Station, Miss., Mississippi State University Research Center.

8. Keiser, E.D., and Lago, P.K., 1991, Survey of the Amphibians, Reptiles, Birds, and Mammals on the 3,000 Acre Stennis Space Center ASRM Site Final Report, University, Miss., University of Mississippi, 185 p.

9. Keiser, E.D., 1994, A Summer Survey of Amphibians, Reptiles, and Mammals within Designated Western Acreage of the Stennis Space Center, Hancock County, Mississippi: Final Report, University, Miss., University of Mississippi.

10. Lago, P.K., 1994, Survey of the Birds and Selected Insects of the Stennis Space Center, Hancock County, Mississippi: Final Report, University of Mississippi.

11. Niering, W.A., undated, The Audubon Society Nature Guides, Wetland New York, N.Y., Alfred A. Knopf, Inc., 638 p.

12. Petrides, G.A., 1972, A Field Guide to Trees and Shrubs, Boston, Mass., Houghton Mifflin Company, 428 p.

13. Smith, R.M., 1989, Wild Plants of America, New York, N.Y., John Wiley & Sons, Inc., 267 p.

14. Tiner, Jr., R.W., 1987, A Field Guide to Coastal Wetland Plants of the Northeastern United States, Amherst, Mass., The University of Massachusetts Press, 285 p.

15. Wooten, J.W., 1990, A Fall Botanical Survey of a Portion of the National Aeronautics and Space Administration Installation Stennis Space Center Mississippi, 120 p.

16. Foster Wheeler Environmental Corp., Final Ecological Risk Assessment, Stennis Space Center, April, 1996.

17. Jones, J., and Taylor, J., 2002, Wildlife Inventories and Habitat Evaluation at Stennis Space Center, Mississippi 2001- 2002, 26 p.

18. Jones, J., and Grebner, D., 2003, Spotlight Count Surveys and Management Approaches for White-tailed Deer at Stennis Space Center, Mississippi, 45 p.

6.0 Endangered and Threatened Species

6.1 Endangered Species Act

The Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) was enacted "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species." The term endangered species applies to "any species which is in danger of extinction throughout all or a significant portion of its range." A threatened species is "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Secretary of Interior in conjunction with the Secretary of Commerce makes determination of threatened and endangered species.

A species may be designated either threatened or endangered because of any of the following factors:

- Current or threatened destruction, modification, or curtailment of its habitat or range
- Over utilization of the species for commercial, recreational, scientific, or educational purposes
- Disease or predation
- Inadequacy of existing regulations
- Other natural or manmade factors affecting continued existence of the species

Section 7 of the Endangered Species Act requires Federal agencies to ensure that any action authorized, funded, or carried out by the agency "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species." The regulations require consultations with United States Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service if any listed species or their habitat may be affected by any agency activity.

6.2 Flora

Currently, 142 plant species that occur in the site area (Hancock County, and/or St. Tammany Parish) are ranked by the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) (1), and the Louisiana Department of Wildlife and Fisheries (LDWF)(2). These plants are listed as

"special concern" because they are known or suspected to occur in low numbers. State ranks are assigned by each state's Natural Heritage Program, which may result in a variance of species ranking from state to state. The lists of "special concern" species were obtained from the Mississippi Natural Heritage Program and the Louisiana Natural Heritage Program and are shown on Tables 6-1 and 6-2. State ranks are based on factual information of a species occurrence.

The Louisiana Quillwort (*Isoetes louisianensis*) is the only plant species in the site area that is listed as endangered by the United States Fish and Wildlife Service (3) and critical imperiled by the LDWFP. Its habitat includes sand and gravel beach bars in small to medium sized blackwater streams of riparian/bayhead forest communities. A total of fifty-two species listed are critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it vulnerable to extirpation.

None of the surveys conducted in the early 1990's and 1998 by Dr. Jean Wooten, revealed any evidence of recent existence of Louisiana Quillwort (*Isoetes louisianensis)* (12).

Table 6-1 Louisiana "Special Concern" Plants

Scientific Name	State Common Name	State Rank
CHRYSOPSIS GOSSYPINA SSP HYSSOPIFOLIA	A GOLDEN ASTER	S1
PTEROGLOSSASPIS ECRISTATA	A WILD COCO	S2
OBOVARIA UNICOLOR	ALABAMA HICKORYNUT	S1
BAYHEAD SWAMP	BAYHEAD SWAMP	S3
CALOPOGON BARBATUS	BEARDED GRASS-PINK	S1
CHASMANTHIUM ORNITHORHYNCHUM	BIRD-BILL SPIKEGRASS	S2
MAYACA FLUVIATILIS	BOG MOSS	S2
BOTTOMLAND HARDWOOD FOREST	BOTTOMLAND HARDWOOD FOREST	S4
CLIFTONIA MONOPHYLLA	BUCKWHEAT-TREE	S1
SCIRPUS ETUBERCULATUS	BULRUSH	S1
RHYNCHOSPORA CHAPMANII	CHAPMAN BEAKRUSH	S2
RHYNCHOSPORA CILIARIS	CILIATE BEAKRUSH	S1?
POTAMOGETON PERFOLIATUS	CLASPING-LEAF PONDWEED	S1
TOFIELDIA RACEMOSA	COASTAL FALSE-ASPHODEL	S2S3
COASTAL LIVE OAK-HACKBERRY FOREST	COASTAL LIVE OAK-HACKBERRY FOREST	S1S2
AGALINIS APHYLLA	COASTAL PLAIN FALSE-FOXGLOVE	S1
SALIX CAROLINIANA	COASTAL PLAIN WILLOW	S1
JUSTICIA AMERICANA	COMMON WATER-WILLOW	S1?
PHYSOSTEGIA CORRELLII	CORRELL'S FALSE DRAGON-HEAD	S1
CAREX DECOMPOSITA	CYPRESS-KNEE SEDGE	S1
CYPRESS-TUPELO SWAMP	CYPRESS-TUPELO SWAMP	S4
ILEX CASSINE	DAHOON HOLLY	S?
ZIGADENUS LEIMANTHOIDES	DEATH CAMUS	S1
TRICHOMANES PETERSII	DWARF FILMY-FERN	S2
QUERCUS MINIMA	DWARF LIVE OAK	S?
EASTERN LONGLEAF PINE SAVANNAH	EASTERN LONGLEAF PINE SAVANNAH	S1
ELLIPTIO CRASSIDENS	ELEPHANT-EAR	S2S3
CHAMAELIRIUM LUTEUM	FAIRY WAND	S2S3
LYCOPODIELLA CERNUA	FERN	S2
MACRANTHERA FLAMMEA	FLAME FLOWER	S2
RHYNCHOSPORA COMPRESSA	FLAT-FRUIT BEAKRUSH	S1S2
AGALINIS LINIFOLIA	FLAX-LEAF FALSE-FOXGLOVE	S1
FRESHWATER MARSH	FRESHWATER MARSH	S3S4
XYRIS FIMBRIATA	FRINGED YELLOW-EYED GRASS	S4
COREOPSIS NUDATA	GEORGIA TICKSEED	S1S2
LOPHIOLA AUREA	GOLDEN CREST	S2S3
HARDWOOD SLOPE FOREST	HARDWOOD SLOPE FOREST	S3
SIUM SUAVE	HEMLOCK WATER-PARSNIP	S2
POLYGALA HOOKERI	HOOKER MILKWORT	S1
INTERMEDIATE MARSH	INTERMEDIATE MARSH	S3S4
LUPINUS VILLOSUS	LADY LUPINE	S2
ISOTRIA VERTICILLATA	LARGE WHORLED POGONIA	S2S3
SABATIA MACROPHYLLA	LARGE-LEAVED ROSE GENTIAN	S2S3
COELORACHIS TESSELLATA	LATTION JOINT GRASS	S?
CIRSIUM LECONTEI	LECONT'S THISTLE	S?
RHYNCHOSPORA SCIRPOIDES	LONG-BEAKED BALDRUSH	S1
ISOETES LOUISIANENSIS	LOUISIANA QUILLWORT	S1
SELAGINELLA LUDOVICIANA	LOUISIANA SPIKEMOSS	S1
CALOPOGON MULTIFLORUS	MANY-FLOWERED GRASS-PINK	S1
ASCLEPIAS MICHAUXII	MICHAUX MILKWEED	S2

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 6-1(continued) Louisiana "Special Concern" Plants

RHYNCHOSPORA MILIACEA	MILLET BEAKRUSH	S2
ANDROPOGON MOHRII	MOHR BLUESTEM	S?
ILEX MYRTIFOLIA	MYRTLE HOLLY	S2S3
NATIONAL CHAMPION TREE	NATIONAL CHAMPION TREE	
RUELLIA NOCTIFLORA	NIGHT-FLOWERING WILD-PETUNIA	S1
BURMANNIA BIFLORA	NORTHERN BURMANNIA	S2
SCLERIA LITHOSPERMA	NUT-RUSH	S1?
MYRICA INODORA	ODORLESS BAYBERRY	S1S2
OLD GROWTH LONGLEAF PINE	OLD GROWTH LONGLEAF PINE	
CALOPOGON PALLIDUS	PALE GRASS-PINK	S1S2
PARONYCHIA ERECTA VAR CORYMBOSA	PARONYCHIA CORYMBOSA	SE
SARRACENIA PSITTACINA	PARROT PITCHERPLANT	S3
PINE FLATWOODS	PINE FLATWOODS	S3
PINE SAVANNAH	PINE SAVANNAH	S2S3
STIPULICIDA SETACEA	PINELAND SCALY-PINK	SE
UTRICULARIA PURPUREA	PURPLE BLADDERWORT	S?
AGALINIS FILICAULIS	PURPLE FALSE-FOXGLOVE	S1
CROTALARIA PURSHII	RATTLEBOX	S3S4
RIPARIAN FOREST	RIPARIAN FOREST	S3S4
PODOSTEMUM CERATOPHYLLUM	RIVERWEED	S1
SABATIA ARENICOLA	SAND ROSE-GENTIAN	S1
ILEX AMELANCHIER	SARVIS HOLLY	S2
RHYNCHOSPORA DEBILIS	SAVANNAH BEAKRUSH	S1?
SERENOA REPENS	SAW PALMETTO	S1
OENOTHERA HUMIFUSA	SEA BEACH EVENING PRIMROSE	S?
UNIOLA PANICULATA	SEA OATS	S2
HELENIUM BREVIFOLIUM	SHORTLEAF SNEEZEWEED	S1
SLASH PINE/POST OAK	SLASH PINE/POST OAK	S3S4
SLASH PINE-CYPRESS/HARDWOOD FOREST	SLASH PINE-CYPRESS/HARDWOOD FOREST	S2S3
LIATRIS TENUIS	SLENDER GAY-FEATHER	S1
CROTALARIA BREVIDENS	SLENDER LEAF RATTLE BOX	SE
ELEOCHARIS ELONGATA	SLIM SPIKE-RUSH	S1?
PANICUM TENERUM	SOUTHEASTERN PANIC GRASS	S1S2
UTRICULARIA JUNCEA	SOUTHERN BLADDERWORT	S?
LILIUM CATESBAEI	SOUTHERN RED LILY	S1
DROSERA INTERMEDIA	SPOON-LEAVED SUNDEW	S2
RHYNCHOSPORA DIVERGENS	SPREADING BEAKRUSH	S1
CLEISTES DIVARICATA	SPREADING POGONIA	S1
LYCOPODIELLA CERNUA VAR CERNUA	STAGHORN CLUBMOSS	S2
SUBMERGENT VASCULAR VEGETATION (ESTUARINE)	SUBMERGENT VASCULAR VEGETATION (ESTUARINE)	S1S2
DULICHIUM ARUNDINACEUM	THREE-WAY SEDGE	S?
UPLAND LONGLEAF PINE FOREST	UPLAND LONGLEAF PINE FOREST	S3
WATERBIRD NESTING COLONY	WATERBIRD NESTING COLONY	
FUIRENA SIMPLEX	WESTERN UMBRELLA-GRASS	S?
BARTONIA VERNA	WHITE SCREWSTEM	S4?
PLATANTHERA BLEPHARIGLOTTIS VAR CONSPICUA	WHITE-FRINGE ORCHIS	S1
PINGUICULA LUTEA	YELLOW BUTTERWORT	S2
PLATANTHERA INTEGRA	YELLOW FRINGELESS ORCHID	S2S3
EASTERN HILLSIDE SEEPAGE BOG		

Table 6-2 Mississippi "Special Concern" Plants

Scientific Name	State Common Name	State Rank
CHAMAECYPARIS THYOIDES	ATLANTIC WHITE CEDAR	S2
CALOPOGON BARBATUS	BEARDED GRASS-PINK	S2S3
HIBISCUS COCCINEUS	BRILLANT HIBISCUS	S2
LILAEOPSIS CAROLINENSIS	CAROLINA LILAEOPSIS	S2S3
RHYNCHOSPORA STENOPHYLLA	CHAPMAN BEAKRUSH	S1?
PINGUICULA PLANIFOLIA	CHAPMAN'S BUTTERWORT	S2
PHYSALIS ANGUSTIFOLIA	COAST GROUND-CHERRY	S3S4
CAREX EXILIS	COAST SEDGE	S2
AGALINIS APHYLLA	COASTAL PLAIN FALSE-FOXGLOVE	S2S3
AMSONIA LUDOVICIANA	CREOLE PHLOX	SH
RHYNCHOSPORA CURTISSII	CURTISS'S BEAKRUSH	S1
XYRIS DRUMMONDII	DRUMMOND'S YELLOW-EYED GRASS	S2
MACRANTHERA FLAMMEA	FLAME FLOWER	S3?
COREOPSIS NUDATA	GEORGIA TICKSEED	S1S2
SPIRANTHES LONGILABRIS	GIANT SPIRAL LADIES'-TRESSES	S2S3
EPIDENDRUM CONOPSEUM	GREEN-FLY ORCHID	S2
XYRIS SCABRIFOLIA	HARPER'S YELLOW-EYED GRASS	S1S2
VACCINIUM ASHEI	HIGHBUSH BLUEBERRY	S1S2
POLYGALA HOOKERI	HOOKER'S MILKWORT	S1S2
ILEX AMELANCHIER	JUNEBERRY HOLLY	S3
RHYNCHOSPORA MACRA	LARGE BEAKRUSH	S3
GORDONIA LASIANTHUS	LOBLOLLY BAY	S3S4
CALOPOGON MULTIFLORUS	MANY-FLOWER GRASS-PINK	S1
ERYNGIUM AQUATICUM	MARSH ERYNGO	S1
ILEX MYRTIFOLIA	MYRTLE HOLLY	S3S4
PANICUM NUDICAULE	NAKED-STEMMED PANIC GRASS	S2
RUELLIA NOCTIFLORA	NIGHT-FLOWERING RUELLIA	S2
BURMANNIA BIFLORA	NORTHERN BURMANNIA	S3S4
RUELLIA PEDUNCULATA SSP PINETORUM	PINE BARREN RUELLIA	S3
LACHNOCAULON DIGYNUM	PINELAND BOGBUTTON	S2
UTRICULARIA PURPUREA	PURPLE BLADDERWORT	S2S3
PHASEOLUS SINUATUS	SANDHILL BEAN	S1S2
ELEOCHARIS ELONGATA	SLIM SPIKE-RUSH	S1
EULOPHIA ECRISTATA	SMOOTH-LIPPED EULOPHIA	S1S2
PINGUICULA PRIMULIFLORA	SOUTHERN BUTTERWORT	S3
JUNIPERUS SILICICOLA	SOUTHERN RED CEDAR	S2
CLEISTES DIVARICATA	SPREADING POGONIA	S3
ERIOCAULON TEXENSE	TEXAS PIPEWORT	S2S3
AGALINIS FILICAULIS	THIN STEMMED FALSE-FOXGLOVE	S2?
SAGERETIA MINUTIFLORA	TINY-LEAVED BUCKTHORN	S2
MELANTHIUM VIRGINICUM	VIRGINIA BUNCHFLOWER	S2S3
PLATANTHERA INTEGRA	YELLOW FRINGELESS ORCHID	S3S4
SYNGONANTHUS FLAVIDULUS	YELLOW PIPEWORT	S2?

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 6-1and 6-2 (continued) "Special Concern" Plants

(1) Plants receive no formal legal protection by state law in Mississippi other than that provided for in trespass laws.
(2) State status/ranks are assigned by each state's Natural Heritage Program. State information was obtained from the Louisiana Natural Heritage Program and the Mississippi Natural Heritage Program. The State lists for Mississippi and Louisiana include more species than the Federal endangered and threatened species list.

STATE RANK

S1 Critically imperiled because of extreme rarity (5 or fewer occurrences) or because of some factor(s) making it especially vulnerable to extirpation.
S2 Imperiled because of rarity (6 to 20 occurrences) or because of some factor(s) making it very vulnerable to extirpation.
S3 Rare and uncommon (21 to 100 occurrences).
S4 Apparently secure (more than 101 occurrences).
S5 Demonstrably secure in state (1000+).
SH Of historical occurrence but no recent records verified within the last 20 years, and suspected to be still extant.

6.3 Fauna

Seventy-two animal species are listed as "special concern" by either the MDWFP and/or LDWF and have ranges that include Hancock County and/or St. Tammany parish (1,2). These "special concern" species are listed on Tables 6-3 and 6-4. All species that are listed as either **endangered** or **threatened** by the MDWFP and/or the LDWF are listed on Table 6-5. Their federal status is also indicated. The italicized species are listed as endangered or threatened for Hancock County and St. Tammany Parish by the USFWS.

6.3.1 Wildlife species that have ranges which include SSC

The following ranked and listed wildlife species have ranges which include SSC: Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), eastern indigo snake (*Drymarchon corais couperi*), Florida panther (*Felis concolor coryi*), gopher tortoise (*Gopherus polyphemus*), bald eagle (*Haliaeetus leucocephalus*), red-cocked woodpecker (*Picoides borealis*), and American peregrine falcon (*Falco peregrinus*)(1).

The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), a subspecies of the Atlantic sturgeon, is listed as threatened by USFWS and LDWF, and endangered by MDWFP. The ecological survey

conducted in 1988 documented sturgeon in the Pearl River, where the sturgeon apparently inhabits the deep pools. A long, V-shaped snout, a blue to black colored back, and rows of scutes along the back and sides, identifies the Gulf sturgeon. The range of the Atlantic sturgeon is along the Atlantic coast from Labrador, Newfoundland to northeast Florida and along the Gulf coast from Tampa Bay, Florida to Lake Pontchartrain, Louisiana. The Gulf sturgeon is found in the Gulf coast portion of this range. Sturgeons inhabit shallow waters along the continental shelf and are also found in coastal rivers (10).

The eastern indigo snake (*Drymarchon corais couperi*) is listed as threatened by USFWS and endangered by MDWFP. The eastern indigo snake is a large snake, 1.5 to 2.1 meters (60 to 84 inches) in length, and is a shiny bluish-black color with smooth scales. The snake feeds on small mammals, birds, frogs, and snakes and is usually found in large, unsettled areas. The historical range of the eastern indigo snake is from southeastern Georgia south to the Florida Keys and west to extreme southeastern Mississippi. Although this historical range does not include Hancock County, government agencies released some of these snakes in the 1980's in Harrison and Marion Counties in Mississippi. In the late 1990's, intensive searches found no indigo snakes and no direct evidence of their presence. But there are some possible suitable habitats. (11).

The Florida panther (*Felis concolor coryi*) is listed as endangered by USFWS, MDWFP, and LDWF. Although the ecological surveys conducted at SSC have not documented the occurrence of Florida panthers at the facility and no conclusive physical evidence of panthers has been found to date, several eyewitness accounts of panther sightings within the SSC Fee Area and Buffer Zone have been reported. The head and body of the panther average 1.1 to 1.4 meters (42 to 54 inches) in length, the tail is about 0.76 to 0.9 meters (30 to 36 inches) long, and the average height at the shoulders is 0.66 to 0.79 meters (26 to 31 inches). The color of the Florida panther varies from tawny to grey, with dark brown or black on the tip of the tail, the back of the ears, and the sides of the nose. The panther feeds primarily on deer, but will also hunt rabbits, mice, and birds. The panther is solitary, mostly nocturnal, and seldom seen. It occurs mostly in wilderness areas of forest or swamp, with a range from southern Florida along the Gulf of Mexico coast to eastern Louisiana (4).

The gopher tortoise (*Gopherus polyphemus*) is classified as threatened by USFWS and LDWF, and endangered by MDWFP. A small population of gopher tortoises has been documented in the Buffer Zone at the north edge of the SSC Fee Area, just outside the north gate, by the ecological surveys conducted in 1988, 1991, and 1994. Keiser observed a gopher tortoise and its burrow in the central portion of the western Fee Area during a survey in 1994 (10). Gopher tortoises have also been reported in other locations throughout the northern and northeastern areas of the Buffer Zone. During the 1998 surveys of the simple fee area, the only evidence for the existence of the gopher tortoise was one definite burrow, one possible burrow and a single adult gopher tortoise repeatedly sighted in 1994. It is presently believed that gopher tortoises are either absent as site residents or present in very small numbers where habitats may be suitable. The gopher tortoise

ranges in size from 0.15 to 0.24 meters (6 to 9.5 inches), and has broad, unwebbed feet and an unhinged plastron. The gopher tortoise occurs in sandy regions where it can burrow into tunnels. These tunnels slope downward from the surface, level off underground, and may be up to 10.7 meters (35 feet) long. The tortoises emerge from the burrows daily to feed on grass, leaves, fruit, and berries. The gopher tortoise occurs in sandy regions of the coastal plain from extreme southern South Carolina to extreme eastern Louisiana and most of Florida (6,11).

The bald eagle (*Haliaeetus leucocephalus*) is classified as threatened by USFWS and endangered by MDWFP and LDWF. The bald eagle was sighted at SSC in surveys conducted in 1994 and 1991, along the Pearl River and on Endeavor Boulevard, respectively (10). It is a very large bird with a wingspan of 2.1 to 2.4 meters (7 to 8 feet) and is identified by its white head and white tail. The range of the eagle is from Alaska and Canada to the southern United States. The eagle is usually found along coasts, rivers, and large lakes. The known nesting range of the bald eagle extends into southern Alabama and has been expanding in recent years as far as Georgia (6).

The red-cocked woodpecker (*Picoides Borealis*) is classified by endangered by the USFWS, MDWFP and LDWF. Red-cocked woodpeckers (RCW) are endemic to the southeastern U.S., where they are tied to old-growth pine forests. Populations of this species historically occurred in roughly the southern half of Mississippi. The species has failed to appear in any of the recent surveys (11).

The American Peregrine Falcon (*Falco peregrinus*) was delisted in August 1999, by the USFWS, but is still listed as endangered/threatened by MDWFP and LDWF. The historic breeding range of the species covered much of North America from coast to coast but the use of pesticides has all but extirpated Peregrines from the eastern portion of their range. A few Peregrines migrate through the eastern U.S., wintering along the Gulf Coast and farther south. During recent surveys, no Peregrines were seen. The occurrence of Peregrines at SSC would best be described as incidental and irregular (11).

Foster Wheeler Environmental Corp conducted an ecological risk assessment survey in western portions of the Fee Area at SSC in 1995. The assessment was conducted at the Sanitary Landfill (Site 002), Recreation Disposal Area (Site 006), Air Force Disposal/Pesticide Operations Area (Site 007), and Building 2205 Combined Sites (Site 011). Several ranked and listed animal species were observed at SSC during the 1995 surveys, or sightings were referenced in the assessment report. These species included American alligator (*Alligator mississipiensis*) in corridors between sites in 1994 and at Site 002 in 1995; gopher tortoise (*Gopherus polyphemus*) at Site 007 in1994; ringed sawback/map turtle (*Graptemys oculifera*) at Sites 002, 006, and 007 in 1994; alligator snapping turtle (*Macroclemys temminckii*) in corridors between sites in 1994; and Louisiana black bear (*Urus americanus luteolus*) at Site 006 in 1994 (10).

None of the surveys conducted during the 1990's revealed evidence of recent existence of the Gopher tortoise (*Gopherus polyphemus*), eastern indigo snake (*Drymarchon corais couperi*), Red-cocked woodpecker (*Picoides Borealis),* American Peregrine Falcon (*Falco peregrinus*), and Louisiana black bear (*Urus americanus luteolus*) in the Fee Area. Although the surveys found no listed species within the Fee Area, marginally suitable habitat for several species exists, such as the gopher tortoises, eastern indigo snakes, and black bear. (13).

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 6-3 Louisiana "Special Concern" Animals

Scientific Name	**State Common Name**	State Rank
FALLICAMBARUS ORYKTES	A CRAWFISH	S2S3
PROCAMBARUS SHERMANI	A CRAWFISH	S2
ALOSA ALABAMAE	ALABAMA SHAD	S1
MACROCLEMYS TEMMINCKII	ALLIGATOR SNAPPING TURTLE	S3
ELANOIDES FORFICATUS	AMERICAN SWALLOW-TAILED KITE	S1S2B
AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW	S3
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	S2N,S3B
CYCLEPTUS ELONGATUS	BLUE SUCKER	S2S3
NOTROPIS WELAKA	BLUENOSE SHINER	S1S2
ACCIPITER COOPERII	COOPER'S HAWK	S2B,S3N
CRYSTALLARIA ASPRELLA	CRYSTAL DARTER	S2S3
MALACLEMYS TERRAPIN	DIAMONDBACK TERRAPIN	S2
RANA CAPITO SEVOSA	DUSKY GOPHER FROG	SH
MICRURUS FULVIUS FULVIUS	EASTERN CORAL SNAKE	S2
OPHISAURUS VENTRALIS	EASTERN GLASS LIZARD	S3
REITHRODONTOMYS HUMULIS	EASTERN HARVEST MOUSE	S3S4
AMBYSTOMA TIGRINUM	EASTERN TIGER SALAMANDER	S1
FUSCONAIA EBENA	EBONYSHELL	S3
FELIS CONCOLOR CORYI	FLORIDA PANTHER	SH
HEMIDACTYLIUM SCUTATUM	FOUR-TOED SALAMANDER	S1
NOTURUS MUNITUS	FRECKLEBELLY MADTOM	S2S3
PERCINA LENTICULA	FRECKLED DARTER	S1
GOPHERUS POLYPHEMUS	GOPHER TORTOISE	S1
PSEUDOTRITON MONTANUS	GULF COAST MUD SALAMANDER	S1
ACIPENSER OXYRINCHUS DESOTOI	GULF STURGEON	S1S2
POTAMILUS INFLATUS	INFLATED HEELSPLITTER	S1
URSUS AMERICANUS LUTEOLUS	LOUISIANA BLACK BEAR	S2
TRICHECHUS MANATUS	MANATEE	SZN
LAMPROPELTIS CALLIGASTER RHOMBOMACULATA	MOLE KINGSNAKE	S1S2
PSEUDACRIS ORNATA	ORNATE CHORUS FROG	S1
PANDION HALIAETUS	OSPREY	S2B,S3N
POLYODON SPATHULA	PADDLEFISH	S3
GRAPTEMYS GIBBONSI	PASCAGOULA MAP TURTLE	S3
PERCINA AURORA	PEARL DARTER	SH
RHADINAEA FLAVILATA	PINE WOODS SNAKE	S1
FARANCIA ERYTROGRAMMA	RAINBOW SNAKE	S2
PICOIDES BOREALIS	RED-COCKADED WOODPECKER	S2
PROCAMBARUS BIVITTATUS	RIBBON CRAWFISH	S1S2
GRAPTEMYS OCULIFERA	RINGED MAP TURTLE	S2
MOXOSTOMA CARINATUM	RIVER REDHORSE	S1S3
LAMPSILIS ORNATA	SOUTHERN POCKETBOOK	S?
AMPHIUMA MEANS	TWO-TOED AMPHIUMA	S3S4

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 6-4 Mississippi "Special Concern" Animals

Scientific Name	State Common Name	State Rank
ALOSA ALAMABAE	ALABAMA SHAD	S1
AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW	S3?B,SZN
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	S1B,S2N
EUPHYES BAYENSIS	BAY ST. LOUIS SKIPPER	S1
ICTIOBUS NIGER	BLACK BUFFALO	S3
NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON	S3?B,SZN
PTERONOTROPIS WELAKA	BLUENOSE SHINER	S3
CRYSTALLARIA ASPRELLA	CRYSTAL DARTER	S1
MICRURUS FULVIUS	EASTERN CORAL SNAKE	S3S4
DRYMARCHON CORAIS COUPERI	EASTERN INDIGO SNAKE	S1
FELIS CONCOLOR CORYI	FLORIDA PANTHER	SH
GOPHERUS POLYPHEMUS	GOPHER TORTOISE	S2
THAMNOPHIS PROXIMUS ORARIUS	GULF COAST RIBBON SNAKE	S?
BUFO VALLICEPS	GULF COAST TOAD	S3
REGINA RIGIDA SINICOLA	GULF CRAYFISH SNAKE	S3?
NERODIA CLARKII CLARKII	GULF SALT MARSH SNAKE	S2?
ACIPENSER OXYRINCHUS DESOTOI	GULF STURGEON	S1
NOTROPIS CHALYBAEUS	IRONCOLOR SHINER	S2
HETERANDRIA FORMOSA	LEAST KILLIFISH	S3
FALCO COLUMBARIUS	MERLIN	SZN
MALACLEMYS TERRAPIN PILEATA	MISSISSIPPI DIAMONDBACK TERRAPIN	S2
ANAS FULVIGULA	MOTTLED DUCK	S3B,S4N
PSEUDOTRITON MONTANUS	MUD SALAMANDER	S2S3
POLYODON SPATHULA	PADDLEFISH	S3
RHADINAEA FLAVILATA	PINE WOODS SNAKE	S3?
CORYNORHINUS RAFINESQUII	RAFINESQUE'S BIG-EARED BAT	S3?B,S3?N
FARANCIA ERYTROGRAMMA	RAINBOW SNAKE	S2
RANA HECKSCHERI	RIVER FROG	S1
STERNA MAXIMA	ROYAL TERN	S1B,S4N
FUNDULUS JENKINSI	SALTMARSH TOPMINNOW	S3
TYRANNUS FORFICATUS	SCISSOR-TAILED FLYCATCHER	SAB,SAN
GASTROCOPTA PELLUCIDA	SLIM SNAGGLETOOTH	S?
HETERODON SIMUS	SOUTHERN HOGNOSE SNAKE	SH
PLEGADIS CHIHI	WHITE-FACED IBIS	SZN

STATE RANK

S1 Critically imperiled because of extreme rarity (5 or fewer occurrences) or because of some factor(s) making it especially vulnerable to extirpation.
S2 Imperiled because of rarity (6 to 20 occurrences) or because of some factor(s) making it very vulnerable to extirpation.
S3 Rare and uncommon (21 to 100 occurrences).
S4 Apparently secure (more than 101 occurrences).
S5 Demonstrably secure in state (1000+).
SH Of historical occurrence but no recent records verified within the last 20 years, and suspected to be still extant.

(B or N may be used as a qualifier of numeric ranks and indicating whether the occurrence is breeding or non-breeding)

Table 6-5 Mississippi and Louisiana Threatened and Endangered Species List

		FEDERAL
SPECIES NAME	**COMMON NAME**	**STATUS**
BIVALVIA		
ACTINONAIAS LIGAMENTINA	MUCKET	
CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK	
ELLIPTIO ARCTATA	DELICATE SPIKE	
ELLIPTIO DILATATA	SPIKE	
EPIOBLASMA BREVIDENS	CUMBERLANDIAN COMBSHELL	LE
EPIOBLASMA PENITA	SOUTHERN COMBSHELL	LE
EPIOBLASMA TRIQUETRA	SNUFFBOX	
LAMPSILIS PEROVALIS	ORANGE-NACRE MUCKET	LT
LEXINGTONIA DOLABELLOIDES	SLABSIDE PEARLYMUSSEL	C
MARGARITIFERA HEMBELI	LOUISIANA PEARLSHELL	LT
MEDIONIDUS ACUTISSIMUS	ALABAMA MOCCASINSHELL	LT
PLETHOBASUS CYPHYUS	SHEEPNOSE	
PLEUROBEMA CURTUM	BLACK CLUBSHELL	LE
PLEUROBEMA DECISUM	SOUTHERN CLUBSHELL	LE
PLEUROBEMA MARSHALLI	FLAT PIGTOE	LE
PLEUROBEMA PEROVATUM	OVATE CLUBSHELL	LE
PLEUROBEMA RUBRUM	PYRAMID PIGTOE	
PLEUROBEMA TAITIANUM	HEAVY PIGTOE	LE
POTAMILUS CAPAX	FAT POCKETBOOK	LE
POTAMILUS INFLATUS	*INFLATED HEELSPLITTER*	*LT*
PTYCHOBRANCHUS FASCIOLARIS	KIDNEYSHELL	
QUADRULA CYLINDRICA CYLINDRICA	RABBITSFOOT	
QUADRULA METANEVRA	MONKEYFACE	
QUADRULA STAPES	STIRRUPSHELL	LE
MALACOSTRACA		
FALLICAMBARUS GORDONI	CAMP SHELBY BURROWING	C
INSECTA		
NICROPHORUS AMERICANUS	AMERICAN BURYING BEETLE	LE
OSTEICHTHYES		
ACIPENSER OXYRINCHUS DESOTOI	*GULF STURGEON*	*LT*
CRYSTALLARIA ASPRELLA	CRYSTAL DARTER	
ETHEOSTOMA BLENNIOIDES	GREENSIDE DARTER	
ETHEOSTOMA RUBRUM	BAYOU DARTER	LT
NOTROPIS BOOPS	BIGEYE SHINER	
NOTROPIS CHALYBAEUS	IRONCOLOR SHINER	
NOTURUS EXILIS	SLENDER MADTOM	
NOTURUS MUNITUS	FRECKLEBELLY MADTOM	
NOTURUS STIGMOSUS	NORTHERN MADTOM	
PERCINA AURORA	PEARL DARTER	C
PERCINA PHOXOCEPHALA	SLENDERHEAD DARTER	
PHENACOBIUS MIRABILIS	SUCKERMOUTH MINNOW	
PHOXINUS ERYTHROGASTER	SOUTHERN REDBELLY DACE	
SCAPHIRHYNCHUS ALBUS	PALLID STURGEON	LE
SCAPHIRHYNCHUS SUTTKUSI	ALABAMA STURGEON	PE

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 6-5 (continued) Mississippi and Louisiana Threatened and Endangered Species List

AMPHIBIA		
AMPHIUMA PHOLETER	ONE-TOED AMPHIUMA	
ANEIDES AENEUS	GREEN SALAMANDER	
EURYCEA LUCIFUGA	CAVE SALAMANDER	
GYRINOPHILUS PORPHYRITICUS	SPRING SALAMANDER	
RANA CAPITO SEVOSA	MISSISSIPPI GOPHER FROG	PE
REPTILIA		
CARETTA CARETTA	*LOGGERHEAD; CABEZON*	*LT*
CHELONIA MYDAS	*GREEN TURTLE*	*(LE-LT)*
DERMOCHELYS CORIACEA	LEATHERBACK; TINGLAR	LE
DRYMARCHON CORAIS COUPERI	EASTERN INDIGO SNAKE	LT
ERETMOCHELYS IMBRICATA	HAWKSBILL; CAREY	LE
FARANCIA ERYTROGRAMMA	RAINBOW SNAKE	
GOPHERUS POLYPHEMUS	*GOPHER TORTOISE*	LT
GRAPTEMYS FLAVIMACULATA	YELLOW-BLOTCHED MAP TURTLE	LT
GRAPTEMYS NIGRINODA	BLACK-KNOBBED MAP TURTLE	
GRAPTEMYS OCULIFERA	*RINGED MAP TURTLE*	*LT*
HETERODON SIMUS	SOUTHERN HOGNOSE SNAKE	
LEPIDOCHELYS KEMPII	*KEMP'S OR ATLANTIC RIDLEY*	*LE*
PITUOPHIS MELANOLEUCUS LODINGI	BLACK PINE SNAKE	C
PSEUDEMYS ALABAMENSIS	ALABAMA REDBELLY TURTLE	LE
AVES		
CAMPEPHILUS PRINCIPALIS	IVORY-BILLED WOODPECKER	LE
CHARADRIUS ALEXANDRINUS	SNOWY PLOVER	(PS)
CHARADRIUS MELODUS	*PIPING PLOVER*	*(LE-LT)*
FALCO PEREGRINUS	PEREGRINE FALCON	Delisted
GRUS AMERICANA	WHOOPING CRANE	LE
GRUS CANADENSIS PULLA	MISSISSIPPI SANDHILL CRANE	LE
HALIAEETUS LEUCOCEPHALUS	*BALD EAGLE*	LT
MYCTERIA AMERICANA	WOOD STORK	(PS)
NUMENIUS BOREALIS	ESKIMO CURLEW	LE
PELECANUS OCCIDENTALIS	*BROWN PELICAN*	LT
PICOIDES BOREALIS	RED-COCKADED WOODPECKER	LE
STERNA ANTILLARUM ATHALASSOS	*INTERIOR LEAST TERN*	*(PS)*
THRYOMANES BEWICKII	BEWICK'S WREN	
TYMPANUCHUS CUPIDO ATTWATERI	ATTWAATER'S GREATER PRAIRIE CHICKEN	LE
VERMIVORA BACHMANII	BACHMAN'S WARBLER	LE
MAMMALIA		
BALAENOPTERA MUSCULUS	BLUE WHALE	LE
BALAENOPTERA PHYSALUS	FINBACK WHALE	LE
BALAENOPTERA BOREALIS	SEI WHALE	LE
PHYSETER MACROCEPHALUS	SPERM WHALE	LE
FELIS CONCOLOR CORYI	FLORIDA PANTHER	LE
MYOTIS GRISESCENS	GRAY MYOTIS	LE
MYOTIS SODALIS	INDIANA OR SOCIAL MYOTIS	LE
TRICHECHUS MANATUS	MANATEE	LE
URSUS AMERICANUS	BLACK BEAR	*LT*

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 6-5 (continued) Mississippi and Louisiana Threatened and Endangered Species List

PTERIDOPHYTA		
ISOETES LOUISIANENSIS	*LOUISIANA QUILLWORTQ*	*LE*
DICOTYLEDONEAE		
APIOS PRICEANA	PRICE'S POTATO BEAN	LE
LINDERA MELISSIFOLIA	PONDBERRY SPICEBUSH	LE
SCHWALBEA AMERICANA	AMERICAN CHAFFSEED	LE

STATUS CODES

LE ENDANGERED. A species that is in danger of extinction throughout all or a significant portion of its range.

LT THREATENED. A species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

C2 CANDIDATE CATEGORY 2. Species for which information now in possession of the U.S. Fish and Wildlife Service indicates that proposing to list as an endangered or threatened species is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.

3C SUBCATEGORY 3C. Species that are now considered to be more abundant and/or widespread than previously thought, and/or not subject to any identifiable threat.

NS NO STATUS.

6.4 Animal Control Procedures and Monitoring at SSC

In an effort to prevent injury to SSC employees and visitors, SSC has established procedures regarding the control of alligators, abandoned and injured wildlife, domestic pets, rodents, birds and bats, panthers, and bears (8). These procedures include the following:

- Do not feed the alligators.
- Contact the Natural Resource Management Team (NRMT) operated by the Laboratory Service Contract (LSC) contractor if abandoned, injured wildlife and nuisance animals are found.
- Contact Site Security if domestic pets are found.
- Contact the Trouble Desk if rodents, birds, and bats are found.

A procedure for panther/bear sightings was also established. Panther sightings are to be reported to the NRMT contractor. A poster and a record form to be completed when a panther is sighted have been circulated throughout the facility. When a sighting is reported, laboratory personnel attempt to collect hard evidence, such as tracks or fur, in the vicinity of the reported sighting. Additional efforts concerning the Florida panther and other species, such as the Louisiana black

RELEASED - Printed documents may be obsolete; validate prior to use.

bear, are coordinated with U.S. Fish and Wildlife Service. SSC tracks sightings of the Florida panther, the Louisiana black bear, and other species through a telephone "hotline" established for that purpose.

6.5 Major Environmental Considerations for Proposed Actions

There is a significant number of threatened, endangered, and ranked species with ranges that include SSC. Therefore, any development at the facility should include a survey for any species listed or ranked by USFWS or MDWFP that are likely to occur in the SSC area. A team of wildlife biologists and scientists from Mississippi State University completed a site-wide survey for threatened and endangered species in 2008, reporting no conclusive sightings. Under normal circumstances this survey will be repeated every five (5) years. Once a listed species is identified, the appropriate State or Federal agency should be consulted regarding any activity that could affect the habitat of that species. All construction and testing operations must be coordinated through the NASA Environmental Office so that environmental impacts can be properly assessed.

6.6 Memberships

NASA is a member of the Black Bear Conservation Committee. This committee represents the combined efforts of numerous agencies, companies, organizations, and universities, which share a strong commitment to black bear restoration and management (5). In addition, NASA is a member of the Hancock Chamber Environmental Committee, which fosters government and industry collaboration and cooperation within Hancock County.

6.7 References

1. Mississippi Natural Heritage Program, March, 2002, species lists, Museum of Natural Science, Mississippi Dept. of Wildlife, Fisheries, and Parks, Jackson, MS.

2. Louisiana Natural Heritage Program, March 2002, species lists, Dept. of Wildlife and Fisheries, Baton Rouge, LA.

3. United States Fish and Wildlife Service, March 2002, species lists.

4. Burt, W.H., and Grossenheider, R.P., 1980, A Field Guide to the Mammals of North America North of Mexico, Boston, Mass., Houghton Mifflin Company.

5. Conant, R., and Collins, J.T., 1991, A Field Guild to Reptiles and Amphibians, Eastern and Central North America, Boston, Mass., Houghton Mifflin Company.

6. Peterson, R. T., 1980, A Field Guide to the Birds of Eastern and Central North America, Boston, Mass., Houghton Mifflin Company.

7. Magee, Ronald G., NASA letter dated Nov. 3, 1995 regarding animal control procedures.

8. Black Bear Management Handbook for Louisiana, Mississippi, southern Arkansas, and east Texas, Second Edition, August, 1996.

9. Page, L.M., and Burr, B.M., 1991, A Field Guide to Freshwater Fishes of North America North of Mexico, Boston, Mass., Houghton Mifflin Company.

10. Foster Wheeler Environmental Corp., 1996, Final Ecological Risk Assessment, Stennis Space Center.

11. Dr. P.K. Lago and Dr. E.D. Keiser, Survey of Five Endangered Animal Species at the Stennis Space Center, Hancock County, Mississippi, Final Report, August 5, 1998.

12. Dr. Jean Wooten, PhD, letter to Ronald G. Magee of NASA, dated April 21, 1998 regarding survey results.

13. Mr. Curtis B. James, United States Department of Interior, Fish and Wildlife Service, letter to Ronald G. Magee of NASA, dated February 23, 1998.

14. Golden, D. H. and K. Lehr, 2008, Animal Control Procedures at Stennis Space Center. NASA Environmental Office, Stennis Space Center, MS.

15. U.S. Army Corp of Engineers, 2009, Final Report on Threatened and Endangered Species Surveys on Stennis

7.0 Solid and Hazardous Waste Generation, Treatment, Storage and Disposal

The Resource Conservation and Recovery Act (RCRA) was enacted to regulate all aspects of solid and hazardous waste management from generation to ultimate disposal. The Mississippi Department of Environmental Quality (MDEQ) administers nonhazardous and hazardous waste programs, as well as the waste reduction/waste minimization program.

SSC generates solid and hazardous waste from its research, development operations, laboratories, instrument repair, and operations and maintenance functions. SSC generates solid waste consisting of household-type wastes and nonhazardous industrial waste, which are disposed of onsite in a State-permitted solid waste landfill. SSC also generates hazardous waste, which is transported off-site for treatment, storage, and disposal. NASA maintains large quantity generator (LQG) status under RCRA subtitle C for generating hazardous waste and having it transported off site for treatment, storage or disposal (1). Eight agencies at SSC have small quantity generator (SQG) status, six of which are classified as "Conditionally Exempt". The SQGs include the Naval Oceanographic Office (NAVO); the Naval Research Labs (NRL); the National Oceanographic and Atmospheric Administration National Data Buoy Center (NOAA/NDBC); the University of Southern Mississippi Center for Marine Sciences (USM); the United States Geologic Survey (USGS); the Environmental Protection Agency (EPA); the Special Boat Team 22 (SBT-22) (2); and Rolls Royce

SSC complies with MDEQ requirements for waste minimization. SSC maintains on-going recycling programs and identifies hazardous materials for which less hazardous substitutes are available.

Section 313 of the Emergency Planning and Community Right-to-know Act (EPCRA) requires annual reporting of toxic chemical releases on EPA Form R and Section 312 requires annual reporting of the maximum storage quantities. TRI reporting for CY 2010 indicated that SSC did not exceed chemical activity thresholds which would require reporting of releases (3).or waste management activities. The EPA and the LEPC were sent a letter regarding SSC's reporting status for Tier II for CY 2011.

In 1990 SSC began investigating areas where potential spills, releases, and disposal incidents have occurred. These areas were investigated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) (4). Section 120 of CERCLA as amended by SARA mandated that EPA establish a "docket", or listing, of Federal facilities where hazardous waste has been generated and/or stored, treated or disposed of in the past. Although NASA SSC is not a CERCLA facility, the investigations were a voluntary effort by NASA to determine the impacts at SSC caused by historical releases.

7.1 Nonhazardous Solid Waste

RCRA defines the term "solid waste" to mean "any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility, and other discarded material." The key word in this definition is "discarded," which EPA has construed to cover certain materials that are used, reused, recycled, or reclaimed. Federal guidelines for Land Disposal of Solid Waste are given in 40 CFR §241. The State of Mississippi adopted Nonhazardous Waste Management Regulations on September 23, 1993.

7.1.1 Generation

Nonhazardous wastes generated at SSC (which are not segregated for recycling) are collected in dumpster-type containers located at buildings throughout the Fee Area. The contents of the containers are transported to the on ite sanitary landfill for disposal. Nonhazardous solid waste is not shipped offsite for disposal; however, offsite contractors handle the recycling of some paper products.

7.1.2 Disposal in the Fee Area

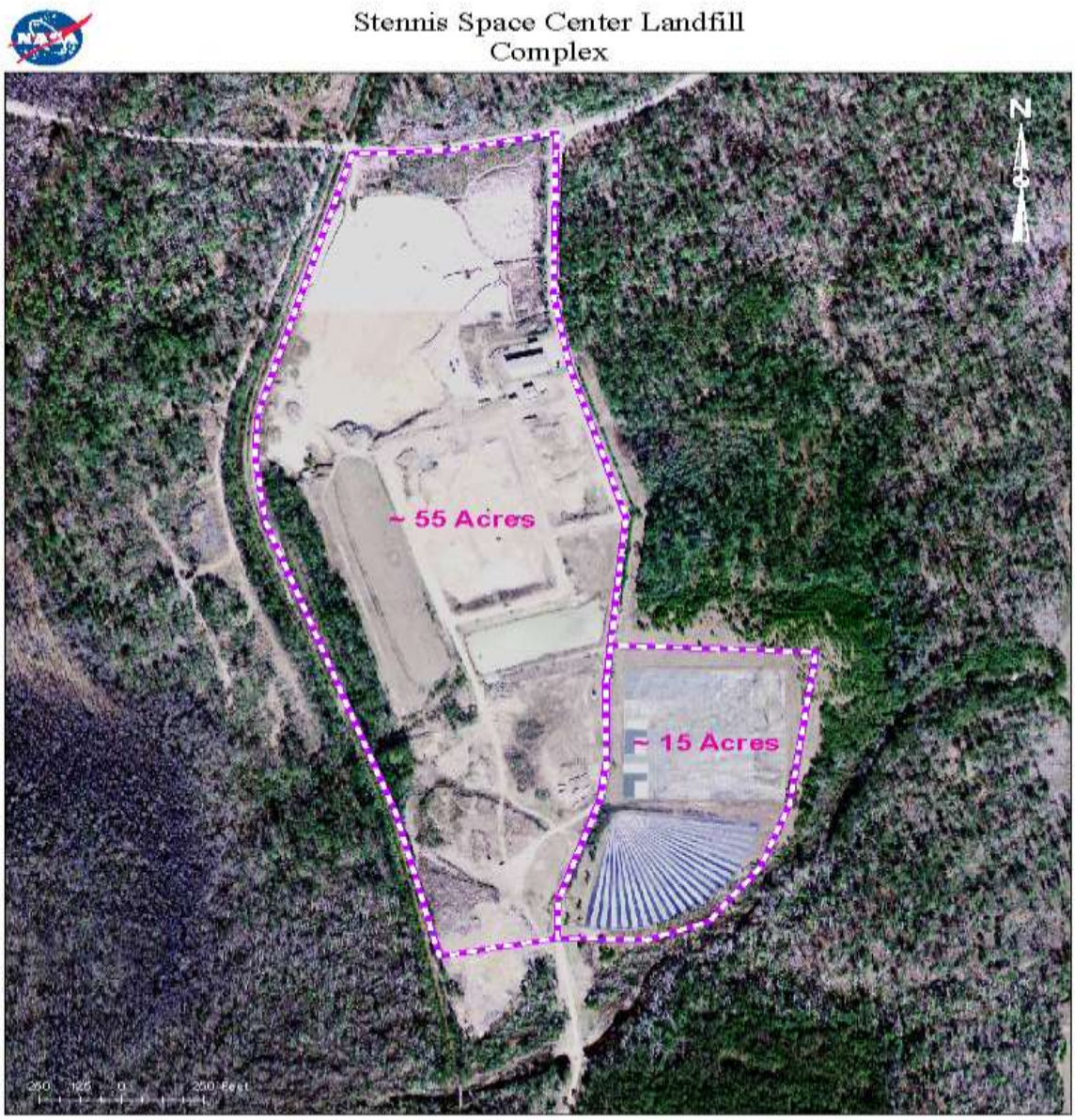
Solid waste generated within the Fee Area at SSC is disposed onsite in a sanitary landfill under the authority of Permit # SW02401B0376, issued by the Mississippi Department of Environmental Quality (MDEQ)(5). The landfill receives onsite garbage and nonhazardous industrial waste. The 2011 average quantity of solid wastes accepted for disposal in the landfill was approximately 102,383 lbs per month 6, 7). The current permit was issued in February 2005 and remains in effect until January 2015.

The landfill includes two unlined cells (Cells 1 and 2), which cover approximately a five acre area. The closure and capping of these cells were completed in 1998. Two new cells (Cells 3 and 4) were opened in September 1996. The latter cells have a composite liner system, leachate collection and treatment system, and storm water pond, which satisfy the requirements in the 1993 State of Mississippi Nonhazardous Waste Regulations. The total area of Cells 3 and 4 is approximately nine acres. Cell 3 is the primary cell which handles all material except asbestos containing materials. Cell 4 is the second smaller cell that is used to dispose of asbestos containing materials and other materials when the larger cell is not accessible.

There is also a closed landfill (Permit # SW02401A0358) that is situated southeast of the current landfill. This inactive landfill was closed in accordance with the Mississippi Nonhazardous Waste Management Regulations. Groundwater is monitored semiannually per the SSC Groundwater Monitoring Plan.

SSC's Landfill Area is shown on Figure 7-1.

Figure 7-1



SSC maintains four permitted Class II rubbish disposal sites. Three of these sites are for harvested vegetation from the three SSC wastewater treatment lagoons. Plant harvesting is dependent on growth rates but usually occurs twice per year. The fourth rubbish site is located in

the vicinity of the permitted solid waste landfill for the disposal of asphalt, stone, brick, mortar, and natural vegetative materials.

7.1.3 Disposal in the Buffer Zone

Two closed landfill sites are located in the Buffer Zone, the Catahoula Landfill and the Pearl River County Landfill. The Catahoula Landfill is a 28.5 acre (0.12 square kilometer) site located on lands owned by NASA in Section 3, Township 7 South, Range 15 West, Hancock County, Mississippi. An undated paper issued by NASA gives the date for the Catahoula Landfill's original permit to operate as September 1977 (8). This paper mentions an Environmental Assessment (EA) that was completed in 1977 by the Mobile District, U.S. Army Corps of Engineers with a Finding of No Significant Impact (FONSI) for the site. The site had always been operated by Hancock County, and NASA never contributed waste material to the landfill (8). The landfill was permitted for operation in October 1981, and permitting was discontinued in December 1988. The closure plan for this landfill was issued in February 1989 and five groundwater monitoring wells were installed at that time (9).

The Pearl River County Landfill operated in the Buffer Zone on tract # 4756. According to an undated paper issued by NASA, the site appears to have opened in the late 1970s without obtaining a permit (6). The Mississippi Board of Health gave the City of Picayune approval to operate the landfill as an area fill in 1978. The site was operated initially by the City of Picayune and subsequently by Pearl River County. An EA for expansion of the landfill conducted by the Mobile District, U.S. Army Corps of Engineers was made final on February 5, 1981, and resulted in a FONSI (10). The expansion studied for this EA was never implemented. The area used comprises approximately 8 acres (0.03 square kilometers) and operated as a trash or rubbish fill (inert materials only) and as a transfer facility for household garbage. NASA never contributed any materials to the site (11). This landfill was permitted as a rubbish fill area and was closed in 1992. The Mississippi Department of Environmental Quality does not require a closure plan for this site.

7.2 Hazardous Waste

Subtitle C of RCRA regulates the generation, transport, treatment, storage, and disposal of hazardous wastes. The RCRA hazardous waste management program regulates materials defined as "hazardous waste." RCRA defines "hazardous waste" as a subset of the broader category of "solid waste". Therefore, a material cannot be a RCRA hazardous waste unless it is first a RCRA solid waste. In this regard, a solid waste will be deemed a hazardous waste if it meets the definition of a hazardous waste in 40 CFR 261.

The regulations for treatment, storage, disposal and transportation of hazardous waste are administered by the Mississippi Department of Environmental Quality (MDEQ).

7.2.1 Generation

All hazardous waste generators at SSC are subject to the RCRA requirements in 40 CFR § 262. NASA is the only classified large quantity generator (LQG) at SSC. Eight resident agencies are classified as small quantity generators (SQGs) some of which may be conditionally exempt and maintain their own EPA identification numbers. Table 7-1 summarizes the RCRA identification numbers and status for NASA and resident agencies at SSC. NASA will continue to assist in the reporting of information to EPA, but NASA will not be responsible for RCRA compliance for its resident agencies. The following information illustrates the types of hazardous wastes generated at SSC.

Hazardous Waste Generation Processes - The following processes or activities generate hazardous wastes at SSC:

- Research/development and analytical testing generate wastes such as spent solvents, reaction products, unused or expired reagents, acids, bases, and test sample wastes.
- Facility maintenance generates a variety of materials including paints, solvents, and spent abrasive blast material that may contain heavy metals such as lead.
- Construction generates a variety of wastes including spent solvents, acids and bases, paint waste with heavy metals such as lead, ignitable wastes and vehicle maintenance wastes.
- Aerospace testing, cleaning, and maintenance generate spent cleaning solutions, dyes, and photographic wastes.
- Equipment cleaning/degreasing generates alkaline cleaners, nitric acid, and trichloroethylene.
- Photographic processes generate various process bath wastes.

7.2.2 Treatment, Storage and Disposal

Hazardous wastes generated at SSC are managed according to the RCRA pre-transport requirements at 40 CFR 262.34. All hazardous wastes placed in the accumulation area must be

shipped offsite for treatment, storage, or disposal within 90 days from the start date of accumulation (satellite accumulation areas are not subject to the 90 day rule). Annually, NASA conducts independent audits of at least two of the treatment, storage, and disposal (TSD) facilities it uses. A list of the TSD facilities used by NASA is available from NASA Environmental Management.

Table 7-1
RCRA ID Numbers and Status for
NASA and Resident Agencies at SSC

ID Numbers	Generator	Status	Building
MS6801200001	U.S. Geological Survey	Conditionally Exempt SQG	2101
MS2800090001	NASA John C. Stennis Space Center	LQG	1100
MS6171624640	Naval Oceanographic Office	SQG	1002A
MS0000444745	USM Center for Marine Sciences	Conditionally Exempt SQG	1103
MS5171624641	Naval Research Lab	Conditionally Exempt SQG	1000
MS7801200000	U.S. Environmental Protection Agency	Conditionally Exempt SQG	1105
MS2130500000	NOAA National Data Buoy Center	Conditionally Exempt SQG	3202, 3203, 3205
MSR000004929	Special Boat Team 22	SQG	B2606
MSR000104414	Rolls Royce	Conditionally Exempt SQG	B5000

RELEASED - Printed documents may be obsolete; validate prior to use.

7.3 Waste Minimization, Recycling, and Sustainable Acquisition

The Biennial Reporting System is a national system that collects data on the generation management, and minimization of hazardous activities. This system captures detailed information and data on the generation of hazardous waste from LQGs and waste management practices from treatment, storage, and disposal facilities (TSDs). Data for the previous year's hazardous waste activities is reported on even years by facilities to the State and EPA.

Also, the State of Mississippi does require all transporters, SQG, LQG, and TSD facilities to submit an annual report to the State on an annual basis.

Two requirements designed to help implement the national "waste minimization" policy: first, § 3002(a)(6) requires hazardous waste generators, Report, to identify efforts undertaken to reduce the volume and toxicity of hazardous waste generated and to report on the actual changes in volume and toxicity of waste achieved. In the second provision, RCRA § 3002(b), Congress required that all generators provide the following certifications on each hazardous waste manifest:

- The generator "has a program in place" to reduce the volume, quantity, and toxicity of the waste covered by the manifest; the degree of these reductions will be determined by the generator based on economic practicality.

- The method of waste management proposed in the manifest is the most practical method currently available to the generator for minimizing the present and future threat to human health and the environment occasioned by the waste.

- Generators making the required certification must ensure that they do, in fact, have a waste minimization program in place or risk potential enforcement consequences for false certification.

SSC has a waste minimization program which involves hazardous product substitution, waste stream segregation, material handling improvement, alterations in production scheduling, affirmative procurement of EPA designated items made from recycled materials, and increased recycling activities. SSC presently recycles aluminum, ballasts (non-PCB), batteries (all types), cardboard, Freon, fluorescent bulbs/lamps, mixed paper, aluminum cans/plastic, oil filters, scrap metal, tires, toner cartridges, and used oil. Substitution of less toxic or non-hazardous materials has been an effective practice at SSC to reduce inventories of hazardous chemicals. SSC's compliance with EO13423 and NPG 8830.1 included the implementation in 2002 of an on-line purchase request and order process that alerts requestors and buyers of the requirement to procure EPA designated items that contain stipulated quantities of recycled materials. This

system also provides an on-line process to obtain an approved Affirmative Procurement Waiver, when one of the four EO justifications that allow for exceptions is applicable.

Stennis Space Center recycles office/copier paper, cardboard, toner cartridges through paper recyclers. Other materials such as metals, plastics, oils, and batteries are handled through other brokers at no or minimal cost to SSC. The amount of nonhazardous solid waste recycled by SSC for FY 2011 is summarized in Table 7-2.

7.4 CERCLA Hazardous Material Release Reporting

7.4.1 Regulatory Requirements

Hazardous material release reporting is required for contractors and resident agencies at SSC under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or commonly known as Superfund) and under the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986. CERCLA requires hazardous substance releases exceeding certain threshold values to be reported. Executive Order #12580 requires Federal facilities to comply with the contents of the law.

7.4.2 SSC Release Reporting

Emergency response requirements under the CERCLA apply to the operation of SSC. Under CERCLA, NASA, the resident agencies, and the contractors at SSC are responsible for reporting releases of reportable quantities (RQ) of hazardous substances to the National Response Center within 24 hours. Reportable quantities are specified on a constituent-by-constituent basis in 40 CFR 302.4.

SSC implements this program through NASA's Emergency Management Plan (SPLN 1040-0006). This plan includes procedures for various types of emergencies including one for fires and explosions and one for spills of oil and hazardous substances. The plan was revised in April 2012 and is written to meet OSHA, EPA, and NASA requirements, including the procedures to report accidental spills of hazardous chemicals and toxic substances in excess of RQs listed at 40 CFR 302.4.

Table 7-2

FY 2011 SSC Non-Hazardous Solid Waste Recycling

Site/Material/Comments	Quantity	Units	Revenue	Cost to Recycle
Aluminum Cans	1,201.0	lbs	$0.00	$18,000.00
Batteries, All Types	16,187.0	lbs	$3,420.00	$0.00
Carbon, Activated	11,500.0	lbs	$0.00	$0.00
Cardboard	240,191.0	lbs	$0.00	$18,000.00
Cement and Concrete	2,755,100.0	lbs	$0.00	$0.00
Cooking Oil/Grease	10,574.0	lbs	$0.00	$0.00
Electronics (scrap property material content only)	845.0	lbs	$0.00	$0.00
Electronics (scrap property material content only)	845.0	lbs	$0.00	$0.00
Fluorescent Lamps (1.25 lbs. per)	6,861.0	units	$0.00	$0.00
Glass	1,050.0	lbs	$0.00	$18,000.00
Lumber	33,500.0	lbs	$0.00	$0.00
Lumber	33,500.0	lbs	$0.00	$0.00
Mixed Paper	538,227.0	lbs	$0.00	$31,809.00
Oil Filters	400.0	lbs	$0.00	$0.00
Plastic	3,974.0	lbs	$0.00	$18,000.00
Scrap Metal	717,600.0	lbs	$0.00	$0.00
Scrap Metal	717,600.0	lbs	$0.00	$0.00
Tires (25 lbs. per)	39.0	units	$0.00	$0.00
Toner Cartridges (1.5 lbs per)	1,070.0	units	$0.00	$0.00
Used Oil	8,787.0	gals	$0.00	$0.00
SSC Totals:	5,163,746.3	lbs	$3,420.00	$103,809.00

NASA/SSC has complied with annual reporting requirements of SARA. NASA has not submitted MSDSs to the LEPC (per their request), but chemical listing was provided. MSDSs are made available to the SSC Fire Department.

Toxic chemical releases and reporting of the quantities of listed chemicals transferred off-site are reported by SSC as required by Section 313 of EPCRA Toxic Release Inventory (TRI). This information is submitted on EPA Forms A and R annually by July 1, as applicable. This reporting is required to provide the public with information on the release of toxic substances to the environment in the reporting year. Facilities must report the quantities of both routine and accidental releases of listed chemicals, if the substance usage exceeds the reportable quantity as specified in 40 CFR 302.4.

Section 312 of EPCRA (Tier II) requires reporting of the maximum quantities of listed chemicals stored onsite during the reporting year, if the threshold quantities are exceeded. SSC's 2007 EPCRA report listed Diesel Fuel #2, Gasoline, Liquid Hydrogen, Liquid Oxygen, Sodium Hydroxide, Hydrogen Peroxide (35%), Sulfuric Acid, Nitric Acid, Chlorine, and lead.

7.4.3 CERCLA Investigation Activities

In 1990 SSC began the investigation of 40 areas where potential spills, releases, and disposal incidents have occurred, and more-recently completed a remedial investigation at a PCB release site (Fall 2011). These areas were investigated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA). Section 120 of CERCLA as amended by SARA mandated that EPA establish a "docket", or listing, of Federal facilities where hazardous waste has been generated and/or stored, treated or disposed of in the past. SSC is not a CERCLA facility but the investigations were a voluntary effort by NASA to determine the impacts at SSC caused by historical releases.

Under the CERCLA site investigation process, the first step involved conducting a Preliminary Assessment (PA) to determine whether or not further investigation was warranted. Forty sites were reviewed in the PA. Twenty-six of the sites were found to be clean or to have localized contamination. In the latter case, NASA conducted cleanup activities and disposed of contaminated materials at approved facilities. Cleanup activities included the closure of numerous rock/reed treatment systems and neutralization pits. Aboveground storage tanks were also replaced with state-of-the-art systems.

Of the forty sites originally identified, 31 were declared No Further Action (NFA) sites, one is a long-term monitoring (LTM) site, seven are cleanup sites, and one is a potential cleanup site. The seven cleanup sites are referred to as Cleanup Areas A-G. Two of the cleanup sites, Areas A and F, are in post-remediation. Area H has been identified as a potential cleanup site. Area I was

accepted as an NFA site by the Mississippi Department of Environmental Quality (MDEQ) in May 2007. The PCB site was determined to have localized contamination and will undergo remediation in the 2012/2013 timeframe.

The remedy at Area A includes barrier walls for source containment and a passive treatment wall for contaminated groundwater. The remedy at Areas B-E and G includes pump and treat followed by natural attenuation for contaminated groundwater (12). Groundwater pump and treatment units have been installed at Areas B, C, D, and E. Contaminated groundwater from Area G is extracted and transported to the unit located at Area E for treatment. The remedy for the PCB site will include the removal and proper disposal of contaminated soil. The need to conduct groundwater remediation will be evaluated after soil/source removal activities.

Results of the investigations completed at Area H are contained in the final Remedial Investigation (RI) and Feasibility Study (FS) reports dated April 2003 and October 2003, respectively. The draft Proposed Plan has been prepared for Area H which states that groundwater pump and treatment is the preferred remediation alternative. NASA prepared a Fact Sheet in August 2004 to present information regarding Areas H and I and to solicit public comment regarding the findings and proposals for these areas.

NASA held a comprehensive 5-year review with MDEQ regulators regarding the status of the cleanup sites in November 2007. As a result of the 2007 review and follow-up discussion with MDEQ, NASA proposed changes to the remediation program. These changes were reflected in SSC's Long-Term and Operational and Monitoring Plan dated October 2010, which was submitted to and approved by MDEQ. The next review was conducted in November 2012, during which the status of cleanup sites were reviewed and recommendations were presented for evaluation by MDEQ for the overall remediation program, where appropriate.

7.5 Major Environmental Considerations for Proposed Actions

All construction and testing operations must be coordinated through NASA Environmental Management so that environmental impacts can be properly assessed. Contact with NASA Environmental Management is encouraged to ensure that no proposed actions jeopardize compliance with NEPA or any other environmental regulations. Additionally, contact should be made with NASA Environmental Management for assistance in making any environmental determinations.

7.6 Memberships

The NASA Environmental Officer is a member of the Hancock County Local Emergency Planning Committee.

7.7 References

1. NASA, SSC, 2011 Hazardous Waste Report for Stennis Space Center, USEPA Form 1C.

2. Special Boat Team 22, SSC, 2012 Hazardous Waste Report, USEPA Form.

3. NASA, SSC, 2010 Toxic Release Inventory Report, dated June 15, 2011.
4. Preliminary Assessment for SSC, Hancock County, MS, Vols. I and II, 11/90.

5. Mississippi Department of Environmental Quality, 2005 Solid Waste Management Permit No. SW02401B0376.

6. NASA, SSC, 2011 Solid Waste (Non-Commercial, Solid Waste Landfill Contour Survey, Rubbish Reports).

7. NASA, SSC, 2011 Landfill Log Summary.

8. NASA, undated, Buffer Zone Hancock County Site History.

9. Compton Engineering, P.A., 1989, Closure Plan for the Catahoula Landfill.

10. Mobile District Corps of Engineers, 1988, Environmental Assessment, Pearl River County Landfill.

11. NASA, undated, Buffer Zone Pearl River County Site History.

12. NASA, CERCLA Community Relations Plan, 2011.

8.0 Toxic Substances

The Toxic Substances Control Act (TSCA) was enacted to protect human health and the environment by regulating chemicals used in commerce and newly developed chemicals. Under TSCA, EPA places controls on chemical manufacture, distribution, use, and disposal. Included in TSCA are a variety of requirements to control the manufacture, distribution in commerce, use, and disposal of specific chemical substances or mixtures. At SSC, TSCA's primary applicability relates to the decontamination and disposal of PCB-contaminated electrical equipment, and the removal and disposal of asbestos insulating materials and chlorofluorocarbons.

8.1 Polychlorinated Biphenyl's (PCB's)

In March 1989 SSC implemented a program to reduce the use of PCBs onsite, and in 1993 accomplished this by retro filling PCB transformers with non-PCB electrical insulating oil. The PCB fluids were disposed of per regulatory guidance. The retro filled transformers were then re-sampled to verify that the PCB content was less than 500 ppm, and to ensure compliance with EPA regulations.

Due to the minimal load on the transformers and the slow leaching of PCBs trapped inside the transformer coils, the PCB content of the retro filled transformers has increased over time. There are currently 6 pad-mounted PCB transformers in use at SSC that have a PCB content of 500 parts per million (ppm) or greater (retro filled transformers were sampled again in 2000). In accordance with regulatory requirements, SSC conducts inspections of these PCB transformers, and develops an annual PCB status report which is reported to EPA. Our procedures will continue to require the testing of these transformers prior to disposal as they are removed from service.

All pole-mounted transformers with a PCB content of 50 ppm or greater have been removed.

Fluorescent lighting fixtures equipped with PCB-containing ballasts are replaced upon failure with non-PCB ballasts. They are disposed in accordance with state and federal regulations.

8.2 Asbestos

This program is intended to serve as an operations and maintenance plan for managing asbestos in place by monitoring and maintaining its condition, ensuring proper cleanup of fibers previously released, and preventing further release. On-going monitoring in Buildings 1000, 1100, 1200, 2101 and 2201 have shown that the measured concentration of asbestos is less than the 0.01 fibers per cubic centimeter (cc) using Phase Contrast Microscopy. Any fiber counts

above 0.01 fibers/cc were confirmed to be asbestos free using Transmission Electron Microscopy. The current OSHA standard for asbestos workers is 0.10 fibers per cubic centimeter of air.

Asbestos Containing Material (ACM) was used at SSC for fire protection and thermal insulation. ACM used for fire protection is usually spray-applied in a thin layer over building structural components including structural steel in I-beams and corrugated steel decking. Thermal insulation is usually found as a toweled-on thermal insulation found primarily in mechanical equipment rooms covering pipes, ductwork, and air handling equipment. Frequently, straight runs of pipe are insulated with fiberglass, with the elbows, tees, and valves having ACM insulation. Rarely would building occupants encounter ACM.

Surfacing materials, such as fireproofing, have been found above ceiling tile in labs, offices, and hallways in Buildings 1000, 1100, 1200, 2101, and 2201. Debris and small pieces of asbestos insulation, which have accumulated over the years since these buildings were constructed, are visible on the topside of ceiling tiles (1). In 1998 a floor tile survey was completed that identified areas where asbestos containing floor tile is located at SSC.

An initial inspection and assessment of the condition of ACM in the mechanical equipment rooms in Buildings 1000, 1100, 1105, 1110, 1200, 1201, 2101, 2105, 2201, 2204, 2205, 2421, 2423, 2424, 3101, 3202, 3203, 3204, 3305, 4110, 4120, 4122, 4210, 4220, 4400, 4995, 7001, 8100, 8110, 8130, and 8201 was completed in 1990. The mechanical rooms are being re-evaluated starting with buildings in the on-going monitoring program. ACM has been removed from some of the mechanical rooms since the 1990 survey. Asbestos information for each building can be reviewed at the following website:
http://odyssey.ssc.nasa.gov/environmental/asbestos.htm

The Asbestos Hazard Control Plan provides for:

- Notification of all persons affected by the presence of ACM
- On-going reports of changes in ACM condition by service workers
- Air monitoring to establish baseline conditions, in conjunction with visual re-inspection (air monitoring is conducted annually in the five buildings with the fireproofing surfacing material)
- Corrective action based on detection of ACM damage or deterioration

Control has been established on all work that could disturb ACM. Operations and maintenance work practices have been established, including worker health and safety training and protection,

recordkeeping of all documents related to asbestos management, and approval procedures for operations and maintenance activities in areas where ACM may be disturbed.

When renovation, demolition, or deterioration requires the removal of asbestos-containing surface material or thermal system insulation, the work is performed by a licensed asbestos abatement contractor in accordance with state and federal regulations. All removed asbestos is disposed of in SSC's onsite non-hazardous solid waste landfill as approved by the MDEQ.

8.3 Other TSCA-Regulated Substances

In addition to PCBs and asbestos, EPA currently regulates chlorofluorocarbons (CFCs) under its TSCA authority. CFCs and their planned phase out are discussed in Section 2.0 (Air Resources) as well as other air toxic pollutants. Lead is discussed in Section 7.0 (Solid & Hazardous Waste Generation, Treat, Storage and Disposal). No other substances regulated under TSCA are known to be present at SSC at this time.

8.4 Major Environmental Considerations for Proposed Actions

The following are regulatory considerations for proposed projects involving chemical substances that are regulated under TSCA:

- Will any new action result in the use or disturbance of PCBs, asbestos, or other substances regulated under TSCA at SSC?

- Will any new action impact areas at SSC already identified as having PCB's or ACM present?

If any of these considerations apply to a proposed project, NASA Environmental Management should be contacted to provide assistance in making these determinations and discuss measures needed to ensure TSCA compliance. All construction and testing operations must be coordinated through NASA Environmental Management to properly address environmental impacts.

8.5 References

1. NASA, 2011, SCWI-8500-0019-ENV (Asbestos Hazard Control Plan).

9.0 Insecticides and Herbicides

9.1 Regulatory Overview

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates use, storage, delivery, and disposal of insecticides and herbicides. FIFRA outlines registration requirements for pesticide producers, establishes certification requirements for pesticide applicators, and directs EPA to set regulations for the acceptance of certain pesticides and recommended procedures for the disposal and storage of pesticides and pesticide containers. The EPA regulations are listed in 40 C.F.R. § 165. In addition to FIFRA, the Federal Food, Drug, and Cosmetic Act, the Mississippi Pesticide Application Law of 1975, and regulations enforced by the Mississippi Department of Agriculture and Commerce, Division of Plant Industry apply to insecticide and herbicide operations at SSC.

Presently, SSC utilizes the services of an offsite contractor for most insecticide and herbicide treatment operations at the facility. Pest and vegetation control is maintained with minimal amounts of insecticides and herbicides stored onsite. The offsite subcontractor utilizes the proactive Integrated Pest Management Approach, which is designed to minimize chemical usage. The subcontractor is responsible for managing these chemicals, waste handling and offsite waste disposal.

9.2 Insecticides and Herbicides at SSC

Pesticides include substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. The targeted pests for SSC are inclusive of, but not limited to, the following: flies, mosquitoes, gnats, roaches, fleas, spiders, termites, carpet beetles, fire ants, crickets, millipedes, annual and perennial grasses, invasive species, and broadleaf weeds. Insecticides and herbicides are applied using a variety of methods, including pressurized spraying, aerosol spraying and manual placement. Table 9-1 summarizes the 2012 insecticide and herbicide usage at SSC. Since the SSC Pesticide Program is subcontracted to offsite companies, limited work is performed by onsite personnel. SSC has a large Buffer Zone, which is mostly wetlands/swamps, that provides a breeding area for mosquitoes. Support for treatment is obtained through the Hancock County Mosquito Control Commission and the St. Tammany Mosquito Abatement District. The Hancock County Mosquito Control Commission also reports on light traps that are strategically located within the SSC Fee Area to aid in mosquito control efforts for the facility.

9.3 Major Environmental Considerations for Proposed Actions

NASA Environmental Management shall be contacted regarding any proposed actions that would alter the planned use of chemicals stored onsite, involve an increased application rate or introduce a new pesticide.

9.4 References

1. SSC Pesticide Usage Report, 2012.

Table 9-1
Insecticide/Herbicide Usage at SSC for 2011

Insecticide/ Herbicide	Use	Application Method	Rate of Use	Usage Months	Areas to be Avoided	Applicationsites
221L Residual Insecticide						
Altosid Pellets (S)Methoprene	Rats and mice	Bait	2.5-10 lbs/acre	Jan - Dec	Fish habitat	Ditches and ponds near buildings
Avert (Avermecin Bla and B16)	Nymph and adult roaches	Hand duster	1 bait placement per 100 square feet	Jan - Dec	Food and utensil storage/dining areas	Offices, warehouses, labs, and cafeterias
CB-80 Extra (Pyrethrins)	Roaches, ants, spiders, flies, wasps	Aerosol	2-10 seconds per 1000 cubic ft	Jan - Dec	Food or food processing equipment	Offices, warehouse, food and non-food handling areas
Contrac Blox (Bromadiolone)	Rats and mice	Hand placement	15 to 30 feet placement	Jan - Dec	Fish, habitat, and wildlife	Inside and outside of buildings
Cy-kick (Cyfluthrin)	Roaches, ants, spiders	Aerosol crack and crevice	Three or one linear foot per second	Jan - Dec	Fish habitat, food, or food contact surfaces	Food storage areas, offices, warehouse
Demand CS (Lamba-cyhalothrin)	Roaches and ants	Pressure Sprayer	1-gallon spray mix per 1000 square feet	Jan - Dec	Fish habitat, food or food contact surfaces	Food storage areas, offices, warehouse
Diuron 4L	Annual and perennial grasses, broadleaf weeds	Pressure Sprayer	4 – 8 quarts per acre	Jan - Dec	Aquatic Systems	Pipe lines, shell areas, parking lots
Drione (Pyrethrins)	Roaches, ants, silverfish, fleas, and lice	Hand duster	16 ounces/ 1000 square feet	Jan - Dec	Crack and crevice treatment only in cafeteria areas. Exposure to food and utensils	Offices, warehouses, and cafeterias
EcoPcoJet (Eugenol)	Wasps, yellow jackets, hornets and spiders	Aerosol	Spray nest or web until wet	Jan - Dec	Water, food, feed	Perimeter of buildings
EF 300 (Rosemary, Sesame)	Ornamentals and turf grasses	Pressure Sprayer	36 – 96 ounces per 100 gallons	Jan - Dec	Water, where surface water is present, intertidal areas	Lagoonswater hyacinth

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 9-1 (continued)

Insecticide/ Herbicide	Use	Application Method	Rate of Use	Usage Months	Areas to be Avoided	Applicationsites
Exciter (Pyrethrine)	Mosquitoes, small flies, roaches & spiders	ULV, Hand sprayer	1 ounce per 1000 cu. ft.	Jan - Dec	Streams, rivers and canals	Building warehouse areas
Gourmet Gel Ant Bait (Disodium Octoborate Tetrahydrate)	Ants	Bait tube, Syringe	0.25 oz per bait placement	Jan - Dec	Feed and food	Food storage areas, offices and warehouse
Kontrol 4-4 (Permethrin)	Black flies, midges and mosquitoes	ULV Aerosol	4.1 – 16.3 oz. Per minute at 10 mph	Jan - Dec	Streams, rivers, canals and processing equipment	Grounds and roads around buildings
Max-Force (Fipronil)	Adult roaches	Hand placement on surface material	4 to 6 bait trays per 100 sq. ft.	Jan - Dec	Personnel and food	Offices, labs, and cafeterias
Maxforce Gel (Hydramethylnon)	Roaches	Manual placement	Bait gun	Jan - Dec	Avoid contact with skin or clothing	Offices, warehouse, cafeteria, labs
Microcare (Pyrethrins)	Ants, spiders, and flies	Aerosol	1 linear foot/second	Jan - Dec	Food and utensils	Offices, labs, cafeteria
Polaris (Imazapyr)	Annual and perennial grasses, broadleaf weeds	Pressure sprayer	1.5 – 6 pints per acre	Jan - Dec	Aquatic Systems and crop areas	Pipe lines, shell areas, parking lots
Precor 2000 (Methoprene, permethrin)	Fleas and ticks	Aerosol	16 oz can to 2000 square feet	Jan - Dec	People or pets, contact surfaces	Offices and warehouse
ProControl II Total Release Fogger (Pyrethrins)	Roaches, ants, spiders, gnats	Aerosol	6 oz can treats 5000 cu. ft.	Jan - Dec	Fish habitat, food or food contact surfaces	Food storage areas, offices, warehouse
PT 221L (Cyhalothrin)	Roaches, ants, spiders	Aersol crack and crevice	One second product crack and crevice	Jan - Dec	Fish habitat, food or food contacting surfaces	Food storage areas, offices, warehouse
Purge III (Pyrethrins)	Flies, gnats, mosquitoes	Aerosol	52 mg metered every 15 min. per 6000 cubic ft.	Jan - Dec	Fish habitat, food or food contact surfaces	Food storage areas, offices, and warehouse
Razor (Isopropylamine)	Annual and perennial grasses and broadleaf weeds	Pressure Sprayer	2/3 – 6 ½ oz/gal per 1000 sq.ft.	Mar - Dec	Aquatic systems and crop areas	Edge of buildings, pipelines and mowing obstacles
Reward Aquatic and Noncrop (Diquat)	Annual and perennial grasses, weeds	Pressure Sprayer	1 to 2 quarts per 100 gallons	Feb - Sep	Animals	Around buildings, edges, poles and pipelines, non-food and food preparations

Table 9-1 (continued)

Insecticide/ Herbicide	Use	Application Method	Rate of Use	Usage Months	Areas to be Avoided	Applicationsites
Sahara (Imazapyr, Diuron)	Annual and perennial grasses and broadleaf weeds	Pressure Sprayer	7 – 19 lbs. per acre	Jan - Dec	Aquatic systems and crop areas	Pipelines, shell areas, parking lots
Sentricon Recruit II (Hexaflumuron)	Termites	Bait Station	10 to 20 feet apart where active termites found	Jan - Dec	Low areas near ponds, springs and other water sources	Offices, labs, buildings
Stingray Wasp and Hornet Spray (Permethrin)	Roaches, ants, spiders, flies and wasps	Aerosol	2 – 10 seconds per spot	Jan - Dec	Water, food or feed	Perimeter of buildings, cracks and crevices
Sun Par 107 Mineral Oil	Black flies, midges, mosquitoes	ULV Aerosol	0.00175/0.007 lbs per acre	Jan - Dec	Streams, rivers, canals and processing equipment	Grounds and road around buildings
Suspend SC (Deltamethrin)	Roaches and ants	Pressure Sprayer	17.5-39 fluid oz/acre	Jan - Dec	Fish habitat, food or food contact surfaces	Food storage areas, offices, warehouse
Talon G (Brodifacoum)	Mice	Pellets	1/4 to 1 lb of bait/ infested area	Jan - Dec	Personnel and food	Food storage areas, offices, warehouses
Talstar One (Bifenthrin)	Ants, spiders, mites, fleas	Pressure Sprayer	1 gal spray mix/1000 square feet	Jan - Dec	Fish, habitat, and aquatic invertebrates or blooming crops	Site wide as needed
Talstar PL Granular (Bifenthrin)	Ants	Ground/granules	50-200 lbs/acre	Jan - Dec	Aquatic areas	Lawn areas
Termidor	Termites	Pressure Sprayer	4 gals to 10 linear ft	Jan - Dec	People or pets and contact surfaces	Foundation of buildings, wall voids, brick/block
ULD BP-300 (Pyrethrin)	Mosquitoes, flies, roaches	Spray mist, ULV Microgen	8.3oz per acre	Jan - Dec	Streams, rivers, canals	25 sq miles of developed and undevelopedPine/Hardwood forest
Weedestroy AM 40 Amine Salt (Dimethylamine Salt)	Annual and perennial grasses and broadleaf weeds	Pressure Sprayer	1 – 4 pints per acre	Mar - Dec	Aquatic Systems, crop areas	Edge of buildings, pipelines, mowing obstacles

10.0 Radioactive Materials and Non-ionizing Radiation

Human exposure to ionizing radiation results from naturally occurring radioactive materials, from radionuclides introduced into the environment by man (nuclear power, weapons testing, etc.), and from cosmic radiation. The route of exposure may be either external, as in the case of cosmic radiation, or internal via inhalation or ingestion of radionuclides. Specific levels of exposure are a function of many variables, including location, altitude, nuclide concentration in the soil, food consumption, and recreational habits. Annual wholebody radiation at SSC is estimated to be about 330 millirem, based on location and measurements typical of the southern United States. Regulations under the Occupational Safety and Health Act (OSHA) define radiation areas and high radiation areas for the work place (29 CFR 1910.1096). Since Mississippi is an agreement state, SSC is deemed in compliance as long as it meets the Mississippi Board of Health regulations, Part 801-Radiation. Radiation areas are based on a major portion of the body being exposed to a radiation dose in excess of five millirem per hour or in excess of 100 millirem per five consecutive days. High radiation areas are accessible areas where a major portion of the body could receive a radiation dose in excess of 100 millirem per hour. The above doses are not averaged; they refer to exposure in any one-hour or block of days.

For non-ionizing radiation, OSHA established a radiation protection guide for normal environmental conditions and for incident electromagnetic energy of frequencies from 10 MHz to 100 GHz (29 CFR 1910.97). This radiation protection guide is 10 milliwatts per square centimeter, as averaged over any possible 0.1 hour period.

10.1 Ionizing Radiation Sources

An inventory of all ionizing radiation sources and audits is located in the SSC FOS contract Industrial Hygiene Office. The NASA/SSC Radiation Safety Coordinator (RSC) and Radiation Safety Offices (RSO's) for each of the tenants and contractors with radiation sources onsite monitor these sources and maintain compliance with state permitting requirements. The FOS contractor holds a Mississippi license to perform industrial radiography, and the Laboratory Support contractor (LSC) maintains licenses required for chemical and laboratory equipment that contains radioactive sources. SSC’s most current radioactive source inventory is included as Appendix F.

10.2 Non-ionizing Radiation Sources

The non-ionizing radiation sources at SSC are microwave ovens and antennas, located throughout the facility. A non-ionizing radiation baseline survey was conducted during the last quarter of 1999.

10.3 Major Environmental Considerations for Proposed Actions

The following are considerations for new ionizing and non-ionizing radiation sources that may be required for proposed projects.

- Will any new action result in the need for any new source of ionizing radiation to be used onsite?
- Will any new action result in the need for any new source of non-ionizing radiation to be used onsite?

Positive response to either of these two questions requires immediate contact with NASA Environmental Management to ensure that no action jeopardizes compliance with NEPA, NRC, or State regulations. All construction and testing operations must be coordinated through NASA Environmental Management so that environmental impacts can be properly assessed.

10.4 References

NASA Radioactive Source Inventory, Stennis Space Center, 2012.

11.0 Aboveground and Underground Storage Tanks

11.1 Regulatory Overview

11.1.1 Underground Storage Tank Regulations

The federal regulations have jurisdiction over specific underground storage tanks (USTs) storing regulated substances with volumes greater than 110 gallons [40 C.F.R. § 280]). EPA's UST regulations, published in 1988, are designed to protect the environment by requiring UST owners to reduce the risk of a release by providing methods to detect releases quickly and by providing a program for fast spill cleanup. The Mississippi Department of Environmental Quality (MDEQ) has adopted the federal UST program and is the administering agency for the USTs at SSC. NASA Environmental Management strongly recommends use of double-wall systems (tank & piping) for SSC USTs. When Mississippi adopted the federal program, the state added a certification requirement for tank installers, repairers, and removers.

Once a suspected release is detected, a chain of reporting requirements is initiated, beginning with notification of the implementing agency within 24 hours. These reporting requirements lead the tank's owner through site investigation to eventual spill cleanup. In the event of a release, the procedures used at SSC are contained in the Environmental Integrated Contingency Plan (EICP), SCWI-8500-0020-ENV (1).

The Mississippi State Department of Health oversees the State's Source Water Assessment Program (SWAP). The purpose of the SWAP is to protect public water systems from potential contaminant sources. One aspect of water protection is the placement of UST systems relative to potable groundwater wells. NASA Stennis Space Center (SSC) follows guidelines set forth by SWAP as Best Management practice for new UST installation projects, and requires that new UST locations installations be at least 500-feet from potable groundwater wells at SSC.

11.1.2 Aboveground Storage Tank Regulations

Federal Spill Prevention, Control and Countermeasure (SPCC) regulations apply to non-transportation related facilities engaged in drilling, producing, gathering, storing, processing, refining, transferring, distributing, or consuming oil and oil products. These regulations cover facilities that could reasonably be expected to discharge oil in large enough quantities to violate water quality standards or leave a sheen on the navigable waters of the United States or adjoining shorelines (40 C.F.R. § 112). These regulations apply to those aboveground storage tanks

(ASTs) with a collective capacity of greater than 1,320 gallons and single containers with a capacity of 55 gallons or more. SSC has a number of tanks to which these regulations apply.

The Federal Oil Pollution Prevention regulations require preparation and implementation of SPCC plans. Under the guidelines for preparation of an SPCC plan, the regulations present minimum requirements for spill prevention, including appropriate containment and diversionary equipment for the protection of navigable waters (40 C.F.R. § 112). SSC maintains an SPCC plan as part of the EICP (1).

11.2 Inventory of Aboveground and Underground Storage Tanks

SSC has aboveground and underground bulk storage tanks. Aboveground storage tanks (ASTs) are listed in Table 11-1. Portable generator belly tanks, which are regulated like bulk storage ASTs, are listed in Table 11-2. Partial listings of mobile tanks, mobile generators and oil containing operational equipment are provided in Table 11-3. Complete lists of these items, and their locations, are identified in the EICP (1). Underground storage tanks (USTs) are listed in Table 11-4. Oil/water separators are listed for reference in Tables 11-1 and 11-4. SSC also has numerous oil containing transformers, which are identified in the EICP (1). The approximate locations of ASTs, USTs, portable diesel generator belly tanks, and oil/water separators are shown in Figure 11-1.

SSC has identified thirty-seven (37) ASTs, six (6) USTs and thirty-two (32) portable generator belly tanks under NASA's control that are subject to federal regulations. USTs are registered with the Mississippi UST program (40 C.F.R. § 112 and § 280). Three additional USTs are located onsite at Building 2124, the gas station/mini-mart, which is operated by Navy Exchange (NEXCOM) personnel. NASA is responsible for the compliance of B2124 USTs.

The replacement and/or upgrade of USTs at SSC was initiated in July 1992. Currently, SSC has upgraded all UST's and AST's to meet or exceed the regulatory standards.

In addition to the USTs and ASTs, there are bulk compressed gas storage tanks at SSC. Table 11-5 lists the locations and contents of the vessels. Propane tanks are not included on Table 11-5; however, an inventory of onsite propane tanks is included in the EICP (1). The propane tanks are enclosed non-vented sources that do not have emissions and are not regulated by state or federal air emissions standards.

11.3 Monitoring of Tank Systems

Underground storage tanks are double walled with double walled piping and equipped with leak detection systems consisting of either groundwater monitoring wells and/or electronic leak

detection systems. Aboveground storage tanks are double-walled with interstitial space leak detection systems. Tanks located at Buildings 1000, 2107, 2201, and 4400 are tied into SSC's 24-hour electronic monitoring system. Tank alarms are monitored by the Energy Management Control System (EMCS) office, which is operated by the Facility Operating Service Contractor.

11.4 Major Environmental Considerations for Proposed Action

Plans for the installation of a new storage tank or for the re-activation of an unused storage tank shall be coordinated through NASA/SSC Environmental Management, to ensure the proposed tank system design complies with applicable regulatory requirements. Empty or out of service tanks shall be evaluated for closure or physical removal. Construction and testing for the installation, re-activation, closure or removal any storage tank must be coordinated through NASA/SSC Environmental Management, to ensure that environmental impacts are properly assessed. Coordination shall be ensured by utilization of the Preliminary Environmental Survey (PES), form SSC-696M .

11.5 References

1. NASA. 2012: SSC Environmental Integrated Contingency Plan (EICP) and Spill Prevention, Control and Countermeasures (SPCC) Plan, SCWI-8500-0020-ENV.

Table 11-1
Aboveground Storage Tank Inventory – Bulk Storage Tanks (and Oil/Water Separators, for reference)

Location Identification	Tank Number	Material Stored	Capacity (gals)	Construction	Piping Material	Year Installed
1000-NAVOCEANO	96A10375	Diesel	2000	Doublewall Steel	Doublewall Steel	1995
1011-NAVOCEANO	Serial No. 22288	Diesel	15,000	Doublewall Steel	Doublewall Steel	2009
1201-Communications	96A10383 1201-ANV-807-F)	Diesel	250	Doublewall Steel	Doublewall Steel	
2107-Fuel Storage Farm	96A10394 96A10393 00977532 00977351 00975175 96A10395 96A10387	Diesel Diesel Diesel Diesel Biodiesel O/W Separator Feeder Tank O/W Separator Reservoir	25,000 25,000 20,000 10,000 8000 500 1000	Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Fiberglass	Steel Steel Steel Steel Steel Steel Fiberglass	1995 1995 2008 2008 2002 1994 1994
2600-Special Boat 22	Not Numbered Not Numbered	Gasoline Use Oil/Diesel	500 1000	Con-Vault Cement Con-Vault Cement	Steel Steel	
3219-Vehicle Service (lube and oil change) and Repair	0980882	O/W Separator Reservoir	150 (estimated)	Steel inside steel containment	PVC	2008
3305-High Pressure Gas	00970937 00963876	O/W Separator Feeder Tank O/W Separator Reservoir	2000 700	Doublewall Steel Steel in containment	Steel	
4007-E2 Test Complex	00975793 (V-499-JP)	JP-8 Jet Fuel	2000	Doublewall Steel	Steel	2011 (Refurbished)
4070-E3 Test Complex	00975792	RP-1	15,000	Doublewall Steel	Steel	2000
4400-High Pressure Water	96A10404 96A10405 00977348 00977349 97A10410 96A10411	Diesel Diesel Diesel Diesel Diesel Diesel	25,000 25,000 20,000 20,000 2000 2000	Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel	Steel Steel Steel Steel Steel Steel	1995 1995 2008 2008 1993 1993

Source: NASA SCWI-8500-0020-ENV (2012 Draft), SSC Environmental Integrated Contingency Plan (EICP)/Spill Prevention Control and Countermeasures (SPCC) Plan

Table 11-1

Aboveground Storage Tank Inventory

Location Identification	Tank Number	Material Stored	Capacity (gals)	Construction	Piping Material	Year Installed
4400-High Pressure Water	00975796	Lubricating Oil	6000	Doublewall Steel	Steel	1993
	96A10412	Used Oil	3000	Doublewall Steel	Steel	1993
	96A10396	O/W Separator Reservoir	1500	Steel	Steel	1993
	96A10406	Diesel	300	Steel	Steel	
	96A10407	Diesel	300	Steel	Steel	
	96A10408	Diesel	300	Steel	Steel	
	96A10409	Diesel	300	Steel	Steel	
	00975760	Oil Storage	400	Steel	Steel	
	00975761	Oil Storage	400	Steel	Steel	
	00975762	Oil Storage	400	Steel	Steel	
	00975763	Oil Storage	400	Steel	Steel	
5004-Rolls Royce	Not Numbered	Jet A-1 Fuel	45,000	Doublewall Steel	Steel	2007
	Not Numbered	Jet A-1 Fuel	45,000	Doublewall Steel	Steel	2007
	Not Numbered	Jet A-1 Fuel	45,000	Doublewall Steel	Steel	2011
	Not Numbered	Jet A-1 Fuel	18,000	Doublewall Steel	Steel	2007
	Not Numbered	Diesel	1000	Doublewall Steel	Steel	2007
	Not Numbered	Diesel	500	Doublewall Steel	Steel	2011
9104-Power Dynamics	Not Numbered	Diesel	500	Caron Steel inside steel containment		
911-Da Kitchen	Not Numbered	Diesel	2000	Con-Vault Cement	Doublewall	
9114-Vehicle Maintenance	MSAAP 028328	Diesel	200	Carbon Steel		
9124-Water Tower #2 Pump	MSAAP 029274	Diesel	180	Carbon Steel		
9310-NCCIPS	#1 UL No. P9736393	Diesel	25,000	Doublewall Steel	Doublewall Steel	2008
	#2 UL No. P9736392	Diesel	25,000	Doublewall Steel	Doublewall Steel	2008
	#3 UL No. R-490052	Diesel	25,000	Doublewall Steel	Doublewall Steel	2010

Table 11-1

Aboveground Storage Tank Inventory

Location Identification	Tank Number	Material Stored	Capacity (gals)	Construction	Piping Material	Year Installed
9322-NAVO Ocean Projects	N. Side: NASA 001826 S. Side: Not Numbered	Diesel Diesel	2000 150	Doublewall Steel Doublewall Steel	Doublewall Steel Doublewall Steel	
9355-DOE Petroleum Equipment Reserves	Not Numbered LT-1 (1125536)	Diesel Used Oil	1500 1000	Doublewall Steel Con-Vault		
9607-Navy Igloo Bunkers	PNL-MPZ9-14	Diesel	4000	Doublewall Steel	Doublewall Steel	

Source: NASA SCWI-8500-0020-ENV (2012 Draft), SSC Environmental Integrated Contingency Plan (EICP)/Spill Prevention Control and Countermeasures (SPCC) Plan

Table 11-2

Aboveground Storage Tank Inventory - Diesel Generator Belly Tanks

Location Identification	Tank Number	Material Stored	Capacity (gals)	Construction	Piping Material	Year Installed
1000-NAVO Office	1000-AN-V802-FO	Diesel	1000	Doublewall Steel		1992
1011-Navy (3 units inside)	1-44570, 2-44574, 3-44564	Diesel	150 each	Steel within steel containment		2008
1021-Mississippi State Univ.	Not numbered	Diesel	1570	Doublewall Steel		2011
1022-USM	00973381	Diesel	300	Steel	Steel	
1029-USM Oceanographics	0981616	Diesel	150	Doublewall Steel		2010
1032-Navy Warehouse	00977885	Diesel	5000	Doublewall Steel		
1104-Chiller Bldg (3 units)	110327, 110309, 110328	Diesel	1500 each	Doublewall Steel		
1110-Data Engineering Support.	NASA 2252275	Diesel	500	Doublewall Steel		
1111-NASA Shared Services Cntr.	00977474	Diesel	1270	Doublewall Steel		
1200-Auditorium	00974853	Diesel	85	Doublewall Steel		

Table 11-2
Aboveground Storage Tank Inventory - Diesel Generator Belly Tanks

Location Identification	Tank Number	Material	Capacity (gals)	Construction	Piping Material	Year Installed
1201-Communications	110330	Diesel	600	Doublewall Steel		
2105-Heavy Equipment Maint.	RZ01112 not numbered (3 staged units)	Diesel Diesel	91 200	Doublewall Steel Doublewall Steel	N/A N/A	N/A N/A
2201-Electrical Shop	00975752	Diesel	612	Doublewall Steel		
2204-Warehouse	110332	Diesel	600	Doublewall Steel		
2416-SBT22 Boat Wash-down	Not numbered	Diesel	396	Doublewall Steel		
2601-SBT22	Not numbered	Diesel	214	Doublewall Steel		
2602-SBT22	Not numbered	Diesel	1377	Doublewall Steel		
2603-SBT22	Not numbered	Diesel	1377	Doublewall Steel		
2609-SBT22	Not numbered	Diesel	818	Doublewall Steel		
3304-SSC Records Center	110355	Diesel	600	Doublewall Steel		
3305-High Pressure Gas	NL110-308	Diesel	1500	Doublewall Steel		
5008-Rolls Royce	CAT00000EG4C0116 400DSED/2158467	Diesel Diesel	460 900	Steel Steel		

Source: NASA SCWI-8500-0020-ENV (2012 Draft), SSC Environmental Integrated Contingency Plan (EICP)/Spill Prevention Control and Countermeasures (SPCC) Plan

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 11-2
Aboveground Storage Tank Inventory - Diesel Generator Belly Tanks

Location Identification	Tank Number	Material Stored	Capacity (gals)	Construction	Piping Material	Year Installed
5012-Rolls Royce (crosswind blower)	CAT 3500 / 25Z06242	Diesel	500	Doublewall Steel	N/A	
8000-Emergency Operations Cntr	00977680 (nor th unit) 00977681	Diesel	2000 2000	Doublewall Steel Doublewall Steel	Doublewall Steel Doublewall Steel	2009 2009
9121-Qinetiq Admin. Offices	MSAAP 034150	Diesel	200	Steel	Steel	
9322-Navy Special Projects	NASA Property 116822	Diesel	2000	Doublewall Steel	Doublewall Steel	
9156-NCCIPS	#1 Kohler 2MG #2 Kohler 2MG #3 Kohler 2MG #4 Kohler 2MG #5 Kohler 2MG #6 Kohler 2MG #6 Kohler 3.3MG	Diesel Diesel Diesel Diesel Diesel Diesel Diesel	4200 4200 4200 4200 4200 4200 5200	Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel	Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel Doublewall Steel	05/2006 05/2006 11/2006 07/2007 07/2007 07/2007 08/2010
9607-Navy Igloo Bunkers	Caterpillar 5858600114	Diesel	2500	Doublewall Steel	Doublewall Steel	2009

Source: NASA SCWI-8500-0020-ENV (2012 Draft), SSC Environmental Integrated Contingency Plan (EICP)/Spill Prevention Control and Countermeasures (SPCC) Plan

Table 11-3

Mobile Tanks, Mobile Generators and Operational Equipment

Location Identification	Equipment Description	Material	Related Equipment	Capacity (gals)	Construction
2105-Heavy Equipment	Mobile Tank	Used Oil	none	500	Steel
	Mobile Tank	Used Oil	none	500	Steel
	Portable Generator	Diesel	none	300	Steel
	Portable Generator	Diesel	Generator	300	Steel
	Mobile Tank	Diesel	Flat bed truck	500	Steel
	Mobile Tank	Diesel	Flat bed truck	500	Steel
	Mobile Tank	Gasoline	Flat bed truck	500	Steel
	Metal Drum	Motor Oil	Service Truck	50	Steel
	Metal Drum	Grease	Service Truck	30	Steel
	Metal Drum	Used Oil	Service Truck	30	Steel
	Inner Tank	Diesel	Fuel Tanker Truck	1000	Steel
	Inner Tank	Diesel	Fuel Tanker Truck	1000	Steel
	Inner Tank	Gasoline	Fuel Tanker Truck	500	Steel
	2-wheeled generator hitch units (4)	Diesel	none	100	Steel
	4-wheeled generator hitch units (4)	Diesel	none	200	Steel
2202-HVAC Storage	2-wheeled generator hitch units (2)	Diesel	none	80	Steel
	4-wheeled generator hitch units (4)	Diesel	none	100	Steel
2210-Hazardous Waste Accumulation Area	500-gallon mobile tank	Used Oil	none	500	Steel
	500-gallon mobile tank	Used Oil	none	500	Steel
4007/4050-E1/E2 Complex	Mobile Tank	RP-1 Jet Fuel	None	500	Steel
	Mobile Tank	JP-8 Jet Fuel	none	500	Steel
5004-Rolls Royce	Mobile Tank	Diesel	Crosswind Blower	500	Steel
	Mobile Tank	Diesel	Crosswind Blower	500	Steel
9114-Vehicle Maintenance	Mobile Tank	Diesel	Flatbed with	1029	Steel
	Mobile Tank	Diesel	Generator	500	Steel
	Mobile Tank		Flatbed Trailer	200	Steel
			2-wheel caisson		

Source: NASA SCWI-8500-0020-ENV (2012 Draft), SSC Environmental Integrated Contingency Plan (EICP)/Spill Prevention Control and Countermeasures (SPCC) Plan

Table 11-4

Underground Storage Tank Inventory (and Oil/Water Separators, for reference)

Status	Building ID	Tank No.	Material Stored	Capacity (Gallons)	Construction Material	Piping Material	Year Installed	Monitoring Wells
Active	* 2124 NEX Minimart	A B C	Gasoline Gasoline Diesel	10,000 15,000 10,000	All three tanks are doublewall fiberglass reinforced plastic		All three tanks installed 2008	
Oil/Water Separator	2416		Oily Water and Used Oil					
Active	2201-Maintenance Repair/Fab Shop	96A10368 96A10369 96A10367	Gasoline Gasoline Ethanol	8000 8000 8000	Doublewall Fiberglass (All 3)	Doublewall Steel (All 3)	1992 1992 1992	Yes (4)
Oil/Water Separator	Auto Detailing north of 3204	0981901	Oily Water Used Oil				2009	
Active Inactive	4050 E-1 Test Complex	T13 (v-465-rp) T14 (emi01ntad)	RP-1 JP-8 (empty)	20,000 10,000	Composite Steel/Urethane w/Epoxy inner lining Composite Steel/Urethane w/Epoxy inner lining	Stainless Steel Stainless Steel	2005 2006	Yes Yes
Active	8000-EOC	T12	Diesel	15.000	Fiberglass reinforced plastic	Doublewall	2009	Yes
Oil/Water Separator	8000-EOC		Oily Water and Used Oil					2009

Source: NASA SCWI-8500-0020-ENV (2012 Draft), SSC Environmental Integrated Contingency Plan (EICP)/Spill Prevention Control and Countermeasures (SPCC) Plan
* Reporting requirements done independently of NASA/SSC.

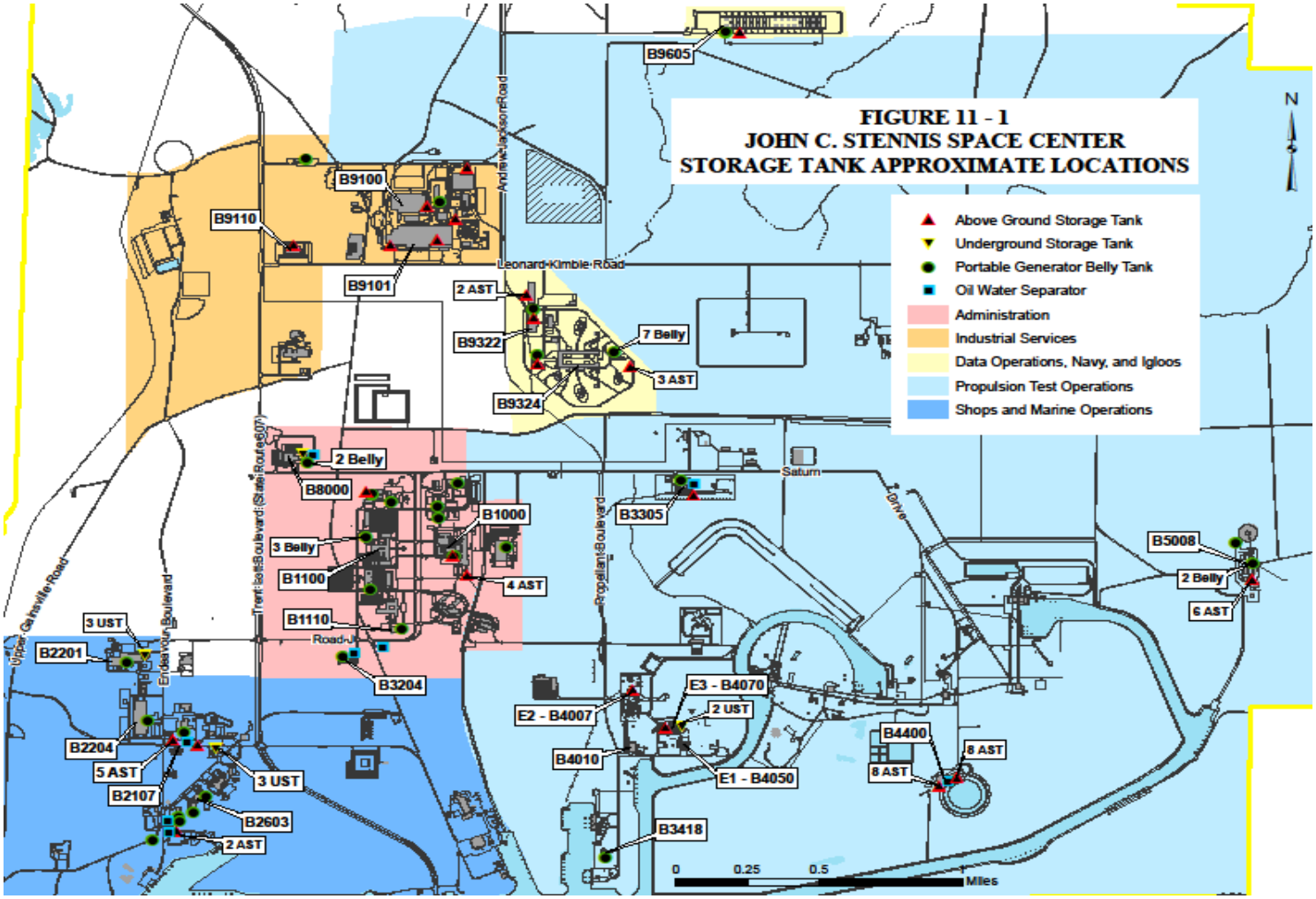


FIGURE 11 - 1
JOHN C. STENNIS SPACE CENTER
STORAGE TANK APPROXIMATE LOCATIONS
Above Ground Storage Tank
Underground Storage Tank
Portable Generator Belly Tank
Oil Water Separator
Administration
Industrial Services
Data Operations, Navy, and Igloos
Propulsion Test Operations
Shops and Marine Operations
N
B9605
B9100
B9110
B9101
2 AST
B9322
7 Belly
3 AST
B9324
2 Belly
B8000
B1000
3 Belly
B1100
4 AST
B1110
B3204
B3305
B5008
2 Belly
6 AST
3 UST
B2201
B2204
5 AST
B2107
3 UST
B2603
2 AST
E3 - B4070
2 UST
E2 - B4007
B4010
E1 - B4050
B4400
8 AST
8 AST
B3418
0
0.25
0.5
Miles
Leonard Kimble Road
Andrew Jackson Road
Trent Lott Boulevard (State Route 607)
Propellant Boulevard
Saturn
Drive
Upper Gainesville Road
Endeavour Boulevard
Road

Table 11-5
Pressure Vessel Inventory
(excluding high pressure air vessels)
(number of vessels at some locations may vary)

Building	Number of Vessels	Contents
1105-Environmental Laboratory	1	nitrogen
2205-Repair and Fabrication Shop	3 2	nitrogen helium
2312-Water Well & Pump House #2	5	chlorine
3305-High Pressure Gas Facility	2 4 2 7	hydrogen nitrogen oxygen helium
3306-Hydrogen Compressor Shelter	1	hydrogen
3309-Liquid Nitrogen Tank (West)	1	nitrogen
3310-Helium Tank	1	helium
3311-Helium Tank	1	helium
3312-Water Well & Pump House #1	5	chlorine
3407-Liquid Hydrogen Control (Praxair)	1	hydrogen
3408-Oxygen Barges Hydrogen Barges	3 3 6	nitrogen hydrogen oxygen
3410-High Pressure Gas Oxygen Tank	1	oxygen
3414-Liquid Oxygen Storage Facility	1	oxygen
3415-Hydrogen Transfer Facility	1	hydrogen
3416-Liquid Oxygen Storage	1	oxygen
4001-High Heat Flux Facility	2 2 3	oxygen nitrogen hydrogen
4010-E Test Complex Operations	12	empty/not in use

Building	Number of Vessels	Contents
4120-Test Stand A-1	8 5 1 1	nitrogen hydrogen oxygen empty/not in use
4122-Test Stand A-2	1 1 1	oxygen hydrogen empty/not in use
4220/4221-B1/B2 Test Stand Complex	4 4 1 1	nitrogen hydrogen oxygen helium
9101-Pratt Whitney Rocket Engine Assembly	10 10	helium nitrogen
9114-Vehicle Maintenance	1 1	helium oxygen
9166-Metal Fabrication	10	oxygen

RELEASED - Printed documents may be obsolete; validate prior to use.

12.0 Historic, Archaeological, and Cultural Resources

12.1 Regulatory Overview

U.S. Environmental Protection Agency (EPA) regulations 40 C.F.R. § 6, 40 FR 16814 Subpart C of the National Environmental Policy Act (NEPA) procedures, "Coordination with Other Environmental Review and Consultation Requirements," states that NEPA is subject to the requirements of the Historic Sites Act of 1935, the National Historic Preservation Act (NHPA) of 1966, the Archaeological and Historic Preservation Act, and Executive Order (EO) 13287, entitled Preserve America. This EO was signed by President George Bush on March 3. 2003. This document 1) encourages federal agencies to work with local communities to promote heritage tourism, and where possible increase public access to sites; 2) mandates federal agency stewardship of historic properties under their management by identifying and maintaining them and 3) increases federal agency's responsibilities that are already mandated by Section 106 regulations, 36 C.F.R. § 800, (Protection of Historic Properties, incorporating amendments effective August 5, 2004) of NHPA The review procedures of these statutes and orders are independent of NEPA requirements.

Section 100(a)(2) of the National Historic Preservation Act (16 U.S.C. 470 et seq.) was amended in 1992 to require that Federal agencies establish a historic preservation program for the identification and protection of historic properties under their jurisdiction, and ensure that such properties are managed and maintained in a way that considers their historic and cultural values.

In 2010, NASA Environmental Management updated its Historic Preservation Plan, which shall now be referred to as the Integrated Cultural Resources Management Plan (ICRMP). The ICRMP compiles the management actions of Stennis Space Center's historic resources and provides management for future historic resources. NASA's historic properties compliance status at SSC is fully discussed in the SSC ICRMP, which shall be updated no later than every five years.

The SSC ICRMP discusses specific short term and long term management actions required by Federal laws and regulations for the proper protection and stewardship of identified historic properties at SSC. A survey of the Gainesville Site was completed resulting in Gainesville being nominated to the National Register for Historic Places (NRHP) (7). Table 12-1 discusses the historic resources located at SSC, their status according to the NRHP, and the proposed or effective management actions regarding these sites.

The SSC ICRMP will ensure the effective management and protection of the cultural resources located within the Fee Area and Buffer Zone that may qualify under the terms of the 1990 Native

American Graves Protection and Repatriation Act (NAGPRA) in addition to qualifying under the federal, state and local statutes related to cultural resources.

Table 12 - 1
SSC Historic Resources, Management Actions

SITE	NRHP STATUS	MANAGEMENT ACTIONS
Rocket Propulsion Test Stands	National Historic Landmark	• Submittal of configuration changes report to Mississippi State Historic Preservation Office • Annual summary to National Council of State Historic Preservation Officers and Advisory Council of Historic Places
Gainesville	Nominated to National Register	• Quarterly monitoring and completion of inspection summaries • Annual submission of inspection summaries to Mississippi State Historic Preservation Office
Logtown	Potentially eligible	• Ground testing of fee owned lands to determine National Register eligibility • Quarterly monitoring and completion of inspection summaries • Annual submission of inspection summaries to Mississippi State Historic Preservation Office
Era Man in Space Structures (Bldgs. 2101, 1100, 3204, 3305, 2204, 3203, 3201, 2201, 1201, 4995, 1200, 3202, 1105, 4400, 2205, 2203, 1110, 8201, and 2105)	Potentially eligible in the year 2013	• Formal NRHP review will be conducted at the 50 year threshold or the year 2013 • As built, original construction plans for these structures will be archived by SSC if available • Descriptions of original, past, and present functions of each structure will be compiled by SSC and archived
Acoustic Buffer Zone	Case by case determinations	Case by case determinations for archaeological survey of easement lands

RELEASED - Printed documents may be obsolete; validate prior to use.

12.2 Prehistory and History of SSC Area

The following discussion is taken from a 1988 cultural resources investigation of SSC conducted by the Mobile District of the U.S. Army Corps of Engineers (COE).

The term Paleo-Indian refers to those prehistoric populations which inhabited North America from the end of the Pleistocene era (10,000 BC) through the early part of the Holocene era (6,000 BC). The population during the early Paleo-Indian times in the area of the present day SSC is generally viewed as consisting of small groups of wide-ranging nomads following herds of megafauna, such as mammoth. They lived in small campsites and left few traces of their occupation. As the species of big game became extinct, a shift to dependence on local flora and fauna occurred.

In the Archaic period (6,000 BC - 2,000 BC), warmer temperatures fostered a rise in the level of the sea and climatic changes, which resulted in different floral and faunal communities. Human subsistence patterns shifted toward a greater dependence on the wide variety of woodland and riverine resources. Settlements became more permanent and inhabitants took advantage of diverse resources, creating specialized artifacts. A greater variety of projectile point forms occur, while other tools such as knives and scrapers remain almost unchanged.

The on-set of the Post-Archaic is generally associated with the appearance of the bow and arrow, pottery making, agricultural and, to some extent, mound building. The Mississippian period (AD 1000 - AD 1700), the last major prehistoric culture in North America, is considered by many to represent the highest prehistoric civilization in eastern North America. The combination of traits such as status burials, large scale agriculture and massive mound construction suggests that Mississippian society was less egalitarian than previous cultures (5).

Prior to European settlement, the lower Pearl River area around SSC was inhabited by Indians of the Muskhogean group (the Acolapissa, the Choctaw, the Pensacola, and the Tangipahoa) and the Siouan group (the Biloxi). European exploration of the area took place from about 1500 to 1699, when the first European settlement in the area was established at Biloxi, in what is now Mississippi, by Pierre Le Moyne Sieur d'Iberville, a Frenchman. The French occupied the region until 1763, when the Treaty of Paris was signed, and Spain ceded Louisiana east of the Mississippi River to Great Britain. The colony of West Florida was established along the Gulf Coast with all lands north of the colony considered Indian Territory.

In 1779, Spain declared war on Great Britain and once again gained control of land east of the Mississippi River, including the colony of West Florida. The Spanish were liberal in granting land to settlers, giving grants at no cost to anyone who lived on and cultivated a reasonable amount of land for at least three years. By 1810, most of the inhabitants of West Florida were Americans or English, who revolted against the Spanish in the West Florida Rebellion of 1810.

Following this rebellion, all of the Pearl River belonged to the United States. In 1817, Mississippi became a state, with the Pearl River designated as the boundary between Mississippi and Louisiana.

During the early 1800s, settlement in the region occurred mostly along the Pearl River. Cotton became the most important cash crop, with growers along the river sending the cotton on flat boats to the gins at Gainesville and Pearlington. In the mid-1830s, logging began in the region and sawmills were built at Gainesville, Logtown, and Pearlington. By the late 1800s, cotton had declined in importance, and lumber became a major industry with Pearlington being one of the largest lumber centers in the United States. Although most of the major sawmills in the area closed in the early 1900s, logging remained an important industry in the area around SSC. A large portion of the land in the Buffer Zone is currently harvested for timber.

Because of the importance of the Pearl River to transportation, the area around SSC was used extensively by confederate troops and ships during the Civil War. Prior to the Civil War, in 1814 Andrew Jackson and his troops may have camped near Gainesville during their march to the Battle of New Orleans (5).

12.3 Previous Cultural Resources Studies

In 1988 the COE conducted an archaeological survey of the proposed Advanced Solid Rocket Motor (ASRM) site and three proposed sites for relocation of the Hazards Test Range. An archaeological reconnaissance was also conducted on all other land within the SSC Fee Area. The survey found that, historically, the land at SSC has been severely disturbed by timber harvesting and the associated naval stores industry during the late nineteenth and early twentieth centuries. More recently, the land was disturbed by the construction of the facility during the 1960s, making it unlikely that undisturbed archaeological sites would be found (5).

No archaeological resources were found at any of the four locations included in the archaeological survey. Because all of the locations are in low elevations away from the Pearl River floodplain and border shallow, intermittent drainages, no archaeological resources were anticipated.

The COE completed a reconnaissance of the remainder of the Fee Area to determine if archaeological resources were present or could reasonably be predicted in the areas of SSC not yet surveyed. Staff determined from the reconnaissance that only those areas bordering the Pearl River floodplain had potential for the presence of archeological resources, and a pedestrian survey of this area was conducted. No evidence of prehistoric or aboriginal sites was found in any of the areas examined. Based on these findings, COE concluded that within the Fee Area, only the town site of Gainesville would require future archaeological considerations if land-disturbing activities were proposed for that area (4).

Prior to the 1988 survey and reconnaissance, three archaeological sites bordering the Pearl River floodplain had been identified at SSC. The Mississippi Department of Historic Preservation as

22 Ha 530, 22 Ha 531, and 22 Ha 580 identified these three sites. Site 22 Ha 530 is located north of the Gainesville site along the Southern Railroad line; site 22 Ha 531 is located just north of the north entrance gate of the facility; and site 22 Ha 580 is north of the Gainesville site along a dirt trail. No information regarding the age or cultural affiliation of these sites is available. Although COE examined each of these three sites during the 1988 investigation, no archaeological materials were located.

When SSC and the Buffer Zone were established in 1961, four towns existed in what is now the Buffer Zone, and one town was located in what is now the Fee Area. The towns of Napoleon, Santa Rosa, Logtown, and Westonia were logging towns located in the Buffer Zone, and Gainesville was a logging town located in the Fee Area. When NASA acquired the Fee Area and the restrictive easement in the Buffer Zone, most of the buildings in these towns were removed.

The 1988 COE investigation found six buildings in the Fee Area that predated NASA acquisition of the Fee Area (5). Only one of the buildings, known as the White Church, was over fifty years old; because of termite damage, the original structure was removed. According to the COE, none of the six structures had characteristics that would make them eligible for the National Register of Historical Places.

In 1989 COE conducted two historic properties investigations that included 39 areas within the Buffer Zone owned by NASA (4). The investigations focused on historical house sites, churches, schools, and cemeteries indicated on U.S. Geological Survey quadrangle maps. A few areas adjacent to the Pearl and Jourdan Rivers with potential for prehistoric archaeological resources were also examined. One previously recorded archaeological site, 22 Ha 579, could not be relocated during these investigations.

No significant archeological sites or historic structures were identified as a result of these surveys. In many cases, the COE could find no physical evidence of the structures indicated on the quadrangle maps. All of the house sites examined dated from the twentieth century and appear to warrant no further investigations.

Based on the three surveys of NASA-owned properties conducted by COE in the Fee Area and Buffer Zone, COE made the following recommendations:

- Because virtually all of the high potential areas for archaeological resources have been examined, no further historic properties investigations are necessary, with the exception of the historic sites of Gainesville and Logtown.

- Any ground-disturbing activities to be conducted by NASA on easement properties in the Buffer Zone should be coordinated with the Mississippi State Historic Preservation Officer.

- Prior to any ground-disturbing activities in the historic sites of Gainesville and Logtown, in depth literature and archival studies should be completed, including a detailed history of each town, historic photographs, and maps showing the development of the towns through time.

NASA conducted an archival search (Phase I testing) and ground survey (Phase II testing) of the townsite of Gainesville and its surroundings in 1994. The town of Gainesville was incorporated in 1846 and served as the Hancock County Seat until the Gainesville courthouse burned down in 1853. Historical research, an archaeological survey, and an excavation were performed in this assessment to verify the original location of the courthouse square. A ground survey and shovel testing were conducted over most of the Gainesville area to search for evidence of prehistoric and historic occupation. During the excavation of test units within the believed courthouse square, portions of a brick foundation were uncovered. This foundation, which was composed of handmade bricks similar to those manufactured in the early 1800's, was sufficiently preserved to distinguish three of the four supposed walls. The shovel testing conducted along the Pearl River frontage revealed pottery and lithic artifacts possibly indicative of a Woodland period occupation at the Gainesville area. The final report on this project was published in July 1996 (6).

The excavated brick foundations of the Hancock County Courthouse Square in Gainesville provided sufficient evidence of the existence of the courthouse structure, and nomination of this site to the NRHP has been accomplished.

In the middle 1990s cultural resources investigations were conducted at the two major townsites located within the SSC facility Fee area and the Acoustical Buffer Zone. The first of these was an archaeological survey of the Gainesville courthouse and surrounding town (Jones et al. 1996). Intact architectural features and other deposits led to Gainesville's nomination to the NRHP. The MS SHPO acknowledged this nomination effort in their 1997 response to submittal of the archaeology report (10).

In 1998 the SSC HPO conducted a survey of three NASA- owned parcels within the Logtown town tract, prior to a controlled burn (Giardino et al. 1998). This investigation covered small areas of the town site west of the community cemetery. No significant archaeological deposits were encountered during this study (Giardino et al. 1998). While determining that studied portions of the tract were ineligible for the NRHP, the MS SHPO recognized that "unrecorded cultural resources may be encountered during construction" (10).

In August 2006 the SSC Environmental Management prepared an Environmental Assessment (EA) for proposed construction and operation of a NASA SSC visitor/education center. The

proposed location was the southwest corner of Exit 2 on Interstate 10 along Mississippi State Route 607, within the SSC Acoustical Buffer Zone. The EA referred to the Mobile District's 1988 surveys of the SSC Fee Area and Acoustical Buffer Zone (USACE 1988a and 1988b), indicating "that the SSC area was too disturbed to be historically significant" (NASA 2006:13). In a September 2006 review response, the MS SHPO concurred with the majority of the EA findings, but required that SSC follow "published *Archaeological Guidelines* that a qualified archaeologist be onsite to monitor [land clearing and excavation]" (10).

In 2007 the Mississippi Department of Marine Resources (MDMR; Biloxi) proposed two projects requiring MS SHPO review. In February, MDMR requested a cultural resources assessment for proposed tree removal from a portion of the SSC Canal. After reviewing submitted information, the MS SHPO concurred with NASA's determination that no known cultural resources would be affected by the project (see Appendix D). In October, MDMR requested a cultural resources assessment for proposed construction of a bulkhead and mooring dolphins along the SSC Access Canal. The MS SHPO concurred with NASA's determination that no known cultural resources would be affected (10).

Also in 2007 the USACE, Mobile District completed cultural resources reconnaissance survey of 25 acres for the proposed A3 Test Stand (Giliberti 2007). The USACE archaeologist found no cultural resources within the survey tract; while the proposed construction would be in the view shed of the Rocket Propulsion Test Complex NHL; see below), Giliberti (2007:i) it was recommended that the project would "have no effect on the test stand complex since it is compatible with the existing structures, purpose, and operation." (10).

The SSC Environmental Management Staff presented two requests for cultural resources assessment to the MS SHPO in 2008. In March, the Environmental Officer requested review for proposed removal and replacement of an existing concrete deluge water flume at the A-1 Test Stand. The MS SHPO determined that "no cultural resources listed in or eligible for listing in the National Register of Historic Places are likely to be affected" by this project (see Appendix D). An August submittal for approval of proposed construction of an electrical power substation at SSC resulted in a MS SHPO request for a referenced cultural resources survey (10).

In the summer of 2008 Earth Search, Inc. conducted a cultural resources survey for the proposed widening of a seven-mile (192.74 acres) segment of Mississippi State Route 607, south of Interstate 59, primarily in Hancock County (Yakubik et al. 2008). The majority of the project corridor passes through the SSC Acoustical Buffer Zone and the southern end of the corridor is within SSC. The survey found seven new archaeological sites, three isolated finds, and one 50+ year old structure. The single potentially eligible archaeological site (22HA670; a Coles Creek/Late Coles Creek site) is inside SSC, but was to be avoided by recommended widening of the highway on the opposite side (Yakubik et al. 2008:7-1) (10).

In February 2009 Brockington and Associates, Inc. conducted a cultural resource reconnaissance survey of four individual land tracts (totaling 21.1 hectares), located in the southwest portion of SSC (RabbySmith 2009a). The survey tracts are potentially subject to future development associated with SSC operations. Pedestrian survey and limited subsurface testing of the project areas found no evidence of significant cultural resources and no further archaeological investigations were recommended (10).

In February 2012 NASA SSC personnel supported by onsite contractors conducted a cultural resource reconnaissance survey of approximately 8 hectares (20 acres) located in the eastern portion of the SSC Fee Area in southwest Hancock County, Mississippi. The surveyed tract is the proposed location of a new test stand and associated facilities that will be constructed by Rolls Royce for engine testing. The present investigation of proposed development tract found surface conditions, topography, and soil associations typically not affiliated with past human settlement. Pedestrian survey coupled with limited subsurface testing of the project area found no evidence of significant cultural resources. No further archaeological investigations are recommended for these tracts (11).Figure 12-1 has an an Archaeological Site map for SSC.

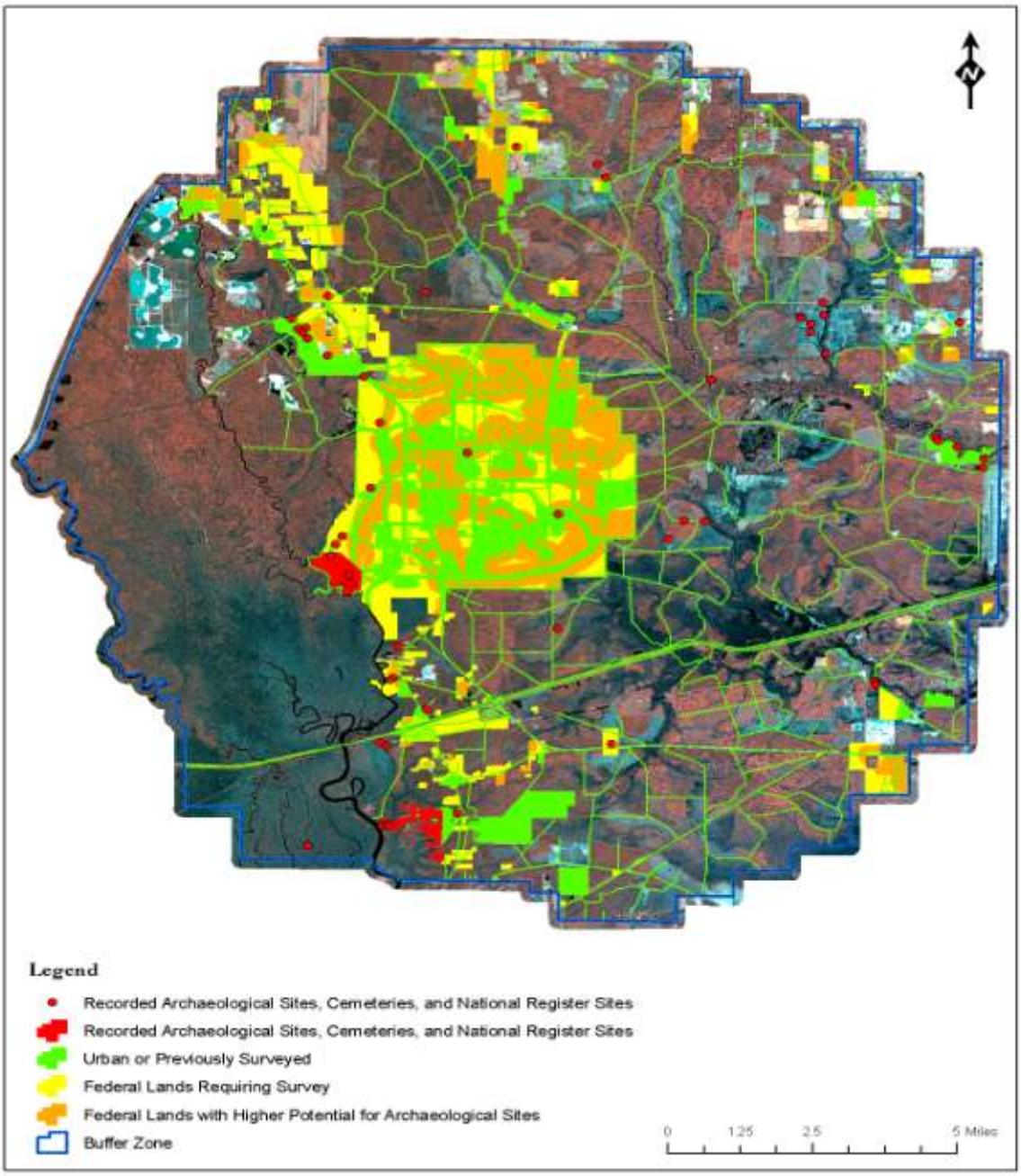
12.4 Properties Listed on the National Register of Historic Places

12.4.1 Rocket Propulsion Test Complex

Three test stands at SSC, the A-1 Rocket Propulsion Test Complex (Building 4120), the A-2 Rocket Propulsion Test Complex (Building 4122), and the B-1/B-2 Rocket Propulsion Test Complex, (Building 4220), have been designated as National Historic Landmarks and appear on the National Register of Historic Places (NRHP) (1). These Test Stands and associated control centers have been designated because of their importance in the testing of Saturn rockets, and the importance of the Saturn rocket in landing men on the moon. A map showing the location of these test stands is included as Figure 12-2.

Normally, such properties have restrictions concerning modification of original structures. However, since the Test Complex was nominated because of its contributions to the Man-in-Space era, and since that function is still in effect today, certain exceptions were granted. These exceptions were outlined in a Programmatic Agreement (PA) signed by NASA, the National Conference of State Historic Preservation Officers (NCSHPO), and the Advisory Council on Historic Preservation (ACHP) on September 20, 1989. Activities to the Testing Complex including demolition, dismantling, relocation, or removal of significant elements that contribute to the National Landmark status require consultation with the MSHPO. Activities that do not affect the characteristics of the Test Complex such as replacing historic hardware, modifications to the original facilities, or new construction compatible with the purpose of the facility shall be mitigated as outlined in the PA.

Figure 12-1
SSC Archaeological Site Map



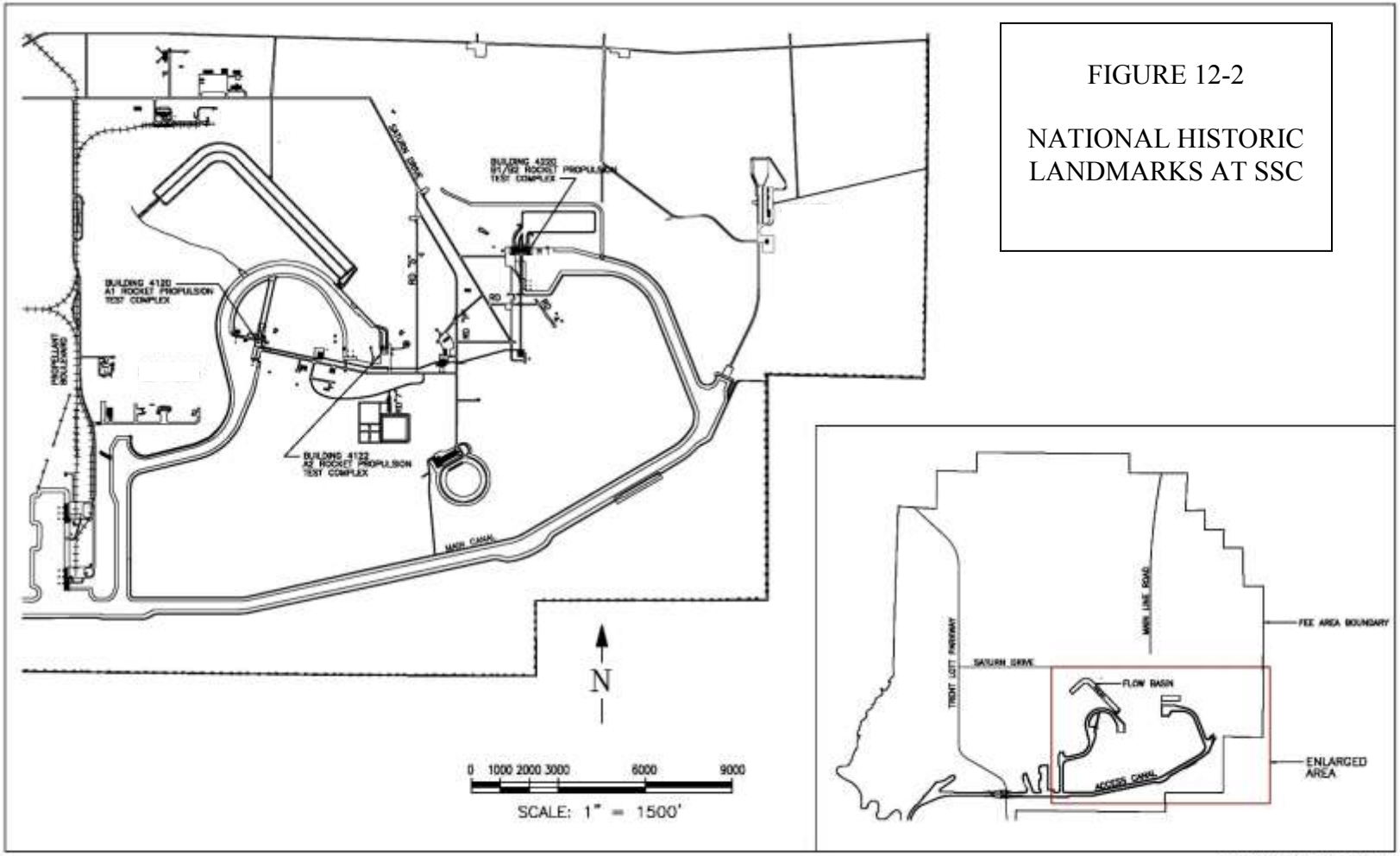


FIGURE 12-2

NATIONAL HISTORIC LANDMARKS AT SSC

MISC\ENVIRO\ERD 2003\SHT10

12.4.2 Gainesville

An area delineated by a plat of Gainesville, bounded by Fraizer Street, Blackman Street, Smyth Street, and the East Pearl River has been determined to be eligible for listing in the NRHP and has been nominated. Future activities that may endanger the remaining integrity of the Gainesville Site will require the completion of a Phase II archaeological survey prior to any disturbance in the area. The impact of such activities will be assessed following the guidelines set by federal and state legislation as enforced by the Mississippi Department of Archives and History and reflected in the SSC ICRMP. NASA will ensure that professional archaeologists are involved in any design reviews related to projects in the designated area. By involving archaeologists in the pre-construction phase of any project, alternate sites or the resources needed to complete Phase II surveys and research can be planned by NASA, prior to any disturbance of the area. Through these steps, SSC will fully comply with the interest of the legislation dealing with historic preservation.

The area around Harper's Bayou was only briefly surveyed during this project. Its location near Gainesville, on high land near the Pearl River, suggests that the area on either bank of the bayou may have higher than the normal probability of preserved prehistoric and historic remains. Consequently, it is recommended that the Phase I survey initiated in the Harper Bayou area during this project, be completed prior to the disturbance of the area due to new construction. At this time, sufficient information is not available from this locality to ascertain whether this area should be part of the National Historic Property area.

12.4.3 Logtown

Even though NASA has no plans to develop any of the Fee owned areas within Logtown, Federal laws and regulations require that SSC eventually evaluate those areas in terms of National Register criteria and, ultimately, formally nominated the site if any of the criteria are met. NASA owned land in Logtown is presently under evaluation, with results expected within the next year.

Should SSC under the terms of its easement become involved in any licensing of activities on easement lands within the townsite of Logtown, archaeological testing and potential avoidance or mitigation will be required by SSC of any proponent of the activity.

12.4.4 Other

Two new sites located on federal property owned by NASA were identified and included in the 2003 update/revision of the Historic Preservation Plan. In 2009 USCOE conducted additional field investigations during the development of the ICRMP that replaced the 2003 Historic Preservation Plan. Those sites are Napoleon, the first European settlement in Hancock County and the area along Bayou LaCroix known to have been occupied by the Southern Band of the Choctaw Nation.

Future activities that may endanger the remaining integrity of the Gainesville, Logtown, Napoleon and those areas defined along the Bayou LaCroix site will require the completion of a cultural resource management survey prior to any disturbance in these areas. The impact of such activities will be assessed per the guidelines established by federal and state requirements as reflected in the ICRMP.

12.4.5 Era Man in Space Structures

At the June 30, 1994 meeting with the Chief Architectural Historian for the Mississippi SHPO, discussions were held regarding the possibility of modifying the National Historic Landmark nomination for the Rocket Propulsion Test Complex to include several support buildings. However, in keeping with the decisions of the original National Park Service nomination and the PA for the Rocket Propulsion Test Complex, NASA/SSC feels that these and all other 1963-1967 SSC buildings should be evaluated for National Register eligibility when they meet the 50 year threshold or the year 2013. A listing of these structures can be found in Table 12 - 1.

12.4.6 Acoustic Buffer Zone

In 1989, the Army Corps of Engineers made recommendations regarding archaeological surveys of easement lands in the SSC Buffer Zone, outside of the townsite of Logtown. These recommendations require consultation with the Mississippi SHPO should activities be proposed by or authorized by SSC. Such consultation may or may not result in the requirement for archaeological surveys by the proponent of the action.

12.4.7 Area 9

Area 9 Acquisition Stennis Space Center took ownership of Area 9 the formerly known Mississippi Army Ammunition Plant (MSAAP) on July 1, 2011. Area 9 creased munitions production in the early 1990's and in 2005 the Base Realignment and Closure Commission (BRAC) directed the closure of the facility (9). An Environmental Impact Statement (EIS) was completed prior to the property being leased to the Army in 1976. The EIS found that there were no direct or indirect effects on historic or archaeological resources within the boundaries of Area 9 (8). Furthermore, a survey conducted by a qualified archaeologist revealed no archaeological resources (8). This statement has been reconfirmed by consultation with the SSC Historic Preservation Officer. All new construction must still be coordinated through NASA Environmental Management so that potential cultural impacts can be properly assessed on a case by case basis.

12.5 Major Environmental Considerations for Proposed Actions

Before initiating new projects, especially projects that will require new construction, the impacts of the project on existing cultural resources should be considered. Once disturbed, the value of many historic and archaeological sites is lost. Because of their inclusion in the NRHP, the three Test Stands require special consideration. Any modifications to these structures may initiate a Section 106 review to ensure that their historical value is protected. Also, any activity in the Gainesville area must be fully coordinated as outlined in Section 12.4.2. All construction and testing operations must be coordinated through Environmental Management so that environmental impacts can be properly assessed. SSC construction contracts will contain language-requiring notification of the Contracting Officer of any potential archaeological finds discovered during construction. A Preliminary Environmental Survey (PES), form SSC-696M, must be completed by any proponent of an action at SSC and submitted to NASA Environmental Management for consideration.

Table 12 – 2 Era Man in Space Structures

BUILDING	YEAR OF COMPLETION
2101	1964
1100	1965
3204	1965
3305	1965
4120	1967
2204	1964,1966
3203	1966
3201	1966
2201	1964
1201	1964
4110	1965
4995	1965
1200	1965
3202	1965
1105	1965
4400	1966
2205	1965
2203	1965
1110	1965
7002	1966
7001	1966
3102	1966
3101	1966
8201	1965
2105	1967

Era Man in Space Structures (Source: NASA/SSC Central Engineering Files)

12.6 References

1. Butowsky, Harry A., 1984, National Park Service, Division of History, National Register of Historic Places Inventory Nomination Forum.

2. NASA, undated, Employee Handbook, John C. Stennis Space Center.

3. NASA, 2003, Historic Preservation Plan, John C. Stennis Space Center.

4. U.S. Army Corps of Engineers, Mobile District, 1989, Historic Properties Investigations, Fee Owned Lands in the Acoustic Buffer Zone, Hancock County, Mississippi, for National Aeronautics and Space Administration at John C. Stennis Space Center.

5. U.S. Army Corps of Engineers, Mobile District, 1988, Cultural Resources Investigations for National Aeronautics and Space Administration at National Space Technology Laboratories, NSTL, Mississippi.

6. Jones III, Robert and Callie Hall, 1996, Cultural Resources Survey of the Gainesville Courthouse and Surrounding Town - Final Report, for the National Aeronautics and Space Administration at John C. Stennis Space Center.

7. National Register of Historic Places Registration Form for the Gainesville Townsite, 1997.

8. Dalton, Dalton, Little, Newport, 1977, Environmental Impact Assessment for National Space Technology Labortories.

9. U.. Army BRAC 2005 Site Investigation Report, Mississippi Army Ammunition Plant, 2008

10. NASA, 2011, Integrated Cultural Resources Management Plan, John C. Stennis Space Center.

11. Giardino, Marco J., 2012, Phase I Cultural Resources Report, Rolls Royce Proposed Test Stand, John. C Stennis Space Center.

13.0 Economic, Population, Transportation and Employment Factors

The economic study area includes a one-hour commuting radius (80 kilometer or 50 mile) from SSC. The area includes Hancock, Harrison, and Pearl River Counties in Mississippi and St. Tammany and Washington Parishes in Louisiana. Of the five county areas, Hancock, Harrison, Pearl River, and St. Tammany provide most of the work force to SSC.

Mississippi cities within the area are Picayune, Poplarville, Long Beach, Waveland, Pass Christian, Bay St. Louis, Gulfport, and Biloxi. Louisiana cities include Slidell, Covington, Mandeville, and Bogalusa. The areas vary from rural in Washington Parish to urban along the Gulf Coast.

13.1 Economic Impact

According to a conservative estimate by Dr. Charles A. Campbell, Professor of Economics, Mississippi State University, the reduction of employment for the local area if Stennis Space Center had not been in operation in 2011 would be 24, 295 jobs. A similar conservative estimate indicates that personnel income would have been reduced by more than $1.14 billion, and retail sales would have been reduced by more than $686 million. It is also estimated that Stennis Space Center has a tax revenue impact on local government revenues of $122 million (1).

13.2 Population

Population along the central Gulf coast is concentrated in the New Orleans, Louisiana and Mobile, Alabama metropolitan areas. The SSC area is located between these cities. Total population in the four county/parish areas grew by 10.2 percent between 2000 and 2010. Distribution of SSC employees within area counties/parishes is provided in Table 13-1. According to the 2010 census data for Hancock County, MS, Harrison County, MS, Pearl River County, MS, St. Tammany Parish, LA, and Washington Parish, LA, population growth was observed during the 10-year period from 2000 to 2010 with the exception of Harrison County (see Table 13-2). It is assumed that changes in population are most probably due to the introduction of the casino gambling industry on the Mississippi Gulf Coast and to relocation of people due to the effects of Hurricane Katrina (2005).

RELEASED - Printed documents may be obsolete; validate prior to use.

13.3 Employment

SSC has employed as many as 6,000 people during the 1960s; however, there were 5,177 employees as of April 2012. This number includes NASA (including NASA Shared Services Center), NASA contractors, Area 9 personnel, and all resident agencies and organizations. SSC is currently home to a number of governmental, military, and industrial agencies and contractors. These include operations of the Department of Defense, Department of Commerce, Department of Interior, EPA, General Services Administration (GSA), Government Printing Office (GPO), State of Mississippi, State of Louisiana, Institute for Technology Development, and eight major industrial contractors. A breakdown SSC manpower as of April 2012 is shown in Table 13-3.

Table 13-1
SSC Distribution of Personnel

County/Parish	Percentage
Hancock	20%
Harrison	18%
Pearl River	27%
Other, MS	5%
St. Tammany	23%
Other, LA	5%
Other	2%

Source: NASA SSC Community Impact, 2011.

Table 13-2
Population

County/Parish	2000	2010	Percent Change
Hancock	42,967	43,929	+2.2
Harrison	189,601	187,105	-1.3
Pearl River	48,621	55,834	+14.8
St. Tammany	191,268	233,740	+22.2
Washington	43,926	47,168	+7.4
Total	516,383	567,776	+10

Sources: Population Estimates Program, Population Division, U.S. Bureau of the Census, Washington, DC 20233 (http://quickfacts.census.gov/qfd). July 2012.

RELEASED - Printed documents may be obsolete; validate prior to use.

Employees at SSC are mainly scientists, engineers, and technicians. Scientific and technical employees make up 30 percent of the workforce at SSC; with business and professional people at 25 percent; technicians, crafts, and production employees at 25 percent; clerical at 8 percent; and other at 12 percent. Most employees have earned advanced educational degrees: 4% Doctorates, 15% Master's, 31% Bachelor's, and 50% Associate's degrees and other (2).

13.4 Income

The national average per capita income (in inflation-adjusted dollars) in 2005 was $25,035, and in 2010 was $26,059, indicating an increase of 4.1%. The 2010 per capita personal income in the five-county/parish area around SSC was below the 2010 national averages of $26,059 (inflation-adjusted) and $27,334 (non inflation-adjusted), except for St. Tammany Parish, LA. Table 13-4 shows the per capita income and the percent of the national average for each county/parish around SSC (3).

In Hancock County, MS, the most common industries for males were construction (19%), public administration (8%), arts/entertainment/recreation (7%), accommodation/food services (5%), professional/scientific/technical services (5%), transportation equipment (4%), and educational services (3%); for females were health care (13%), educational services (12%), arts/entertainment/recreation (10%), accommodation/food services (10%), professional/scientific/technical services (6%), public administration (5%), and department/general merchandise stores (5%). In Harrison County, MS, the most common industries for males were construction (14%), agriculture/forestry/fishing/hunting (3%), mining/quarrying/oil and gas extraction (1.5%), food (2%), and beverage/tobacco products/textile mills/textile products (<1%); for females were construction (1.4%), food (1%), agriculture/forestry/fishing/hunting (0.6%), apparel (0.3%), textiles mills/textile products (0.3%), mining/quarrying/oil and gas extraction (0.15%) and beverage/tobacco products (<0.1%). In Pearl River County, MS, the most common industries for males were construction (17%), public administration (7%), mining/quarrying/oil and gas extraction (5%), transportation equipment (4%), truck transportation (4%), repair and maintenance (4%), and educational services (4%); for females were health care (19%), educational services (15%), accommodation/food services (8%), professional/scientific/technical services (5%), public administration (5%), food/beverage stores (5%), and department/general merchandise stores (4%). In St. Tammany Parish, LA, the most common industries for males were construction (16%), mining/quarrying/oil and gas extraction (6%), agriculture/forestry/fishing/hunting (1.5%), food (<1%), and beverages/tobacco products (<1%); for females were construction (1.6%), mining/quarrying/oil and gas extraction (0.8%), food (0.6%), agriculture/forestry/fishing/hunting (0.2%), textile mills/textile products (0.1%), apparel (0.1%), and beverage/tobacco products (<0.1%). In Washington Parish, LA, the most common industries for males were construction (16%), paper (9%), public administration (7%), mining/quarrying, oil and gas extraction (7%),

agriculture/forestry/fishing/hunting (5%), health care (5%), and educational services (4%); for females were health care (19%), educational services (16%), accommodation/food services (9%), public administration (5%), finance/insurance (5%), food/beverage stores (5%), and social assistance (4%) (4).

Table 13-3
SSC Manpower

Employers	Numbers of Employees
NASA/NASA Contractors	2,135
Department of Defense Department of Navy and Contractors Department of Army and Contractors	 1,621 2
Department of Commerce and Contractors	215
Department of Interior	57
Other Resident Federal Agencies	55
Other Residents	364
9000 complex	728
Total	5,177

Source: NASA SSC Strength Report, April 2012

Table 13-4
Per Capita Income
(2006-2010)

Location	Per Capita Income ($) (non inflation-adjusted)	Percent of National Average
Hancock County	21,935	80%
Harrison County	22,880	84%
Pearl River County	20,014	73%
St. Tammany Parish	29,282	107%
Washington Parish	17,120	63%

Source: U.S. Census Bureau (http://quickfacts.census.gov/qfd), 2010

RELEASED - Printed documents may be obsolete; validate prior to use.

13.5 Housing

The number of dwellings, including mobile homes, in the five-county/parish study area was 102,943 in 1970. In 1980 there were 141,295 private housing units in the study area, of which 122,548 were occupied, resulting in a 13 percent vacancy rate. Between 1980 and 1986 an additional 25,970 units were authorized by building permits, resulting in a total of 167,265 units in 1986. According to the Census data in 1990, 2000, and 2010, the total housing units were 175,777, 207,038, and 247,440 respectively.

13.6 Law Enforcement

Each county/parish and all major cities in the area are currently serviced by law enforcement agencies. Sheriff departments and the urban areas service rural areas by city police departments. A list of law enforcement agencies is provided in Table 13-5.

13.7 Fire Protection

Fire protection at SSC is provided on a 24 hour per day, year round basis for all areas and activities in the Fee Area. Other services are fire prevention inspections; stand-by duty for liquid oxygen (LOX) and liquid hydrogen (LH_2) transfers, explosive and engine tests, basic and refresher fire-fighting training for full-time firemen and officers, and assistance to the contractor in establishing fire-fighting training programs to qualify their personnel in the use of fire-fighting equipment.

In addition, SSC has mutual aid agreements with landowner corporations in the Buffer Zone and in several nearby municipalities (see list below) whereby the fire fighting organizations of each agree to lend equipment and personnel to one another when the need for assistance arises.

- Diamondhead, Mississippi
- St. Tammany Parish, Louisiana
- Bay St. Louis, Mississippi
- Gulfport, Mississippi
- Pass Christian, Mississippi
- Picayune, Mississippi
- Waveland, Mississippi
- International Paper

Table 13-5
Distribution of Law Enforcement Personnel

Location	Number Patrolmen (full and part time)
Hancock County (Rural)	80
Bay St. Louis	14
Waveland	8
Harrison County (Rural)	32
Gulfport	108
Long Beach	40
Pass Christian	Not Available
Biloxi	122
Pearl River (Rural)	21
Picayune	43
Poplarville	25
St. Tammany Parish (Rural)	30
Covington	36
Slidell	80
Mandeville	18
Pearl River	20
Washington Parish (Rural)	20
Bogalusa	11
Franklinton	36
Angie	3

Sources: 2012, POLICE DEPARTMENTS FOR:

Hancock County (rural), MS 228-466-6900

Waveland, MS 228-467-3669

Bay St. Louis, MS 228-467-9222

Harrison County (rural), MS 228-865-7092/896-3000 (HR)

Biloxi, MS 228-435-6100

RELEASED - Printed documents may be obsolete; validate prior to use.

Gulfport, MS	228-868-5900
Long Beach, MS	228-863-7292
Pass Christian, MS	228-452-3310
Pearl River, MS So. District	601-403-2300
Pearl River, MS No. District	601-916-1996
Picayune, MS	601-798-7411
Poplarville, MS	601-795-4447
St. Tammany Parish (rural), LA	985-809-8200
Covington, LA	985-892-8500
Slidell, LA	985-643-3131
Mandeville, LA	985-626-9711
Pearl River, LA	985-863-5711
Washington Parish (rural), LA	985-839-3434
Bogalusa, LA	985-732-3611
Franklinton, LA	985-839-4474
Angie, LA	985-986-2444

13.8 Schools

Table 13-6 shows the number of public schools and school enrollment for each of the five-county/parish areas.

Table 13-6
Public Schools

LA Schools-Location	Number of Schools	Enrollment (2011)
City of Bogalusa	8	2157
St. Tammany	55	37508
Washington	14	5463

Sources: St. Tammany School Board, 2012
LA Department of Education, 2012

MS Schools-Location	Number of Schools	Enrollment (2011)
Bay St. Louis	4	1797
Hancock County	7	4459
Harrison County	22	13828
Long Beach	5	2877
Pass Christian	4	1637
Pearl River	4	3102
Picayune	10	3550
Poplarville	4	2108

Sources: MS Department of Education, 2012
http://www.education.com/schoolfinder/us/mississippi/

13.9 Health Services

A medical clinic is located at SSC, which provides industrial medical services to government and contractor personnel at SSC. The clinic provides an Occupational Medicine Program to promote and maintain an optimum state of health in the work environment for all employees. The following services are provided for personnel assigned to SSC (5, 6):

- Medical care of occupational injury and illness, consisting of emergency and limited diagnostic care of employees who are injured or become ill in the course of their employment.
- Preventive medicine oriented toward minimizing the loss of human resources due to injury or illness.
- Works closely with Industrial Hygiene and Safety to reduce potential hazards in the work place.
- Physical examinations for employees as required by the agency, department, or company in accord with applicable policies and established occupational medicine standards.
- Preventative health education and health maintenance education promoted by personal conferences, pamphlets, posters, and SSC communication media.

- Acute medical care of non-occupational (personal) injury and illness, diagnosis, and treatment. While non-occupational injury or illness is not the primary responsibility of the medical clinic, medical care will be provided in the case of an emergency to prevent loss of life or limb or to relieve suffering until the patient can be placed under the care of a personal physician. First aid treatment will be provided if the condition is not serious enough to require the attention of a personal physician or if treatment will enable the employee to complete the current work shift, and referrals are made as indicated.

The medical program is designed to satisfy all obligations under the provisions of the Mississippi Workmen's Compensation Law and/or the Office of Workers' Compensation programs of the United States Department of Labor.

13.10 Health Care Facilities

In addition to the medical facility at SSC, there are 20 hospitals in the five county/parish area providing 1912 beds for patient care (Table 13-7). In addition to these public primary care facilities, there are numerous specialty facilities (i.e. mental health facilities, nursing homes, and physician-run clinics in the area).

13.11 Environmental Justice Strategy

On February 11, 1994, two Executive Orders were issued to integrate Environmental Justice issues and concerns into all of NASA's programs, policies, and activities. In accordance with these Orders and NASA Headquarters directive, Stennis Space Center developed an Environmental Justice Implementation Plan (7). The SSC Environmental Justice Implementation Plan will take into account the activities conducted at SSC and their environmental impacts, its organizational structure and existing processes, the nature of the surrounding community and the most effective means of communication with external stakeholders. More specifically, the SSC Environmental Justice Plan Implementation will achieve the following goals:

- Identify existing activities and programs that may have a potential environmental effect within a 5 to 10 mile radius of the Buffer Zone

- Determine the nature, level, and geographic distribution of potential environmental impacts caused by Center activities and programs

- Identify minority populations and/or low-income populations and/or minority populations that may be adversely affected by the Center's impact on the environment

- Identify environmental impacts on these low-income populations and/or minority populations as a result of the Center's activities

- Determine which existing activities and programs have a disproportionately high adverse human health or environmental effect on minority populations and/ or low income populations

- Develop prudent measures for eliminating or mitigating, to the extent practicable, the disproportionately high adverse human health or environmental effects on such populations of existing activities

- While developing the measures to eliminate or mitigate existing Environmental Justice concerns, communicate the situation to the affected populations and seek their input

- Adapt the Center's NEPA process to ensure that, when required by NEPA, Environmental Justice concerns are addressed in each Environmental Assessment and Environmental Impact Statement (EIS), prepared for proposed new projects, programs, and activities; where the Center determines that the proposal has no Environmental Justice implications, the basis for that finding will be presented

- Communicate identified problem areas to affected communities and develop a corrective action plan for implementation which reduces/eliminates adverse effects; hold public information meetings with community leaders and the general public to gain stakeholder feedback

- Assess the effectiveness of emergency response plans and the adequacy of resources to enforce crisis management procedures for the protection of minority populations and/or low-income populations.

Table 13-7
Health Care Facilities (2012)

Area Louisiana Hospitals		
Location/Parish	Number of Public Hospitals	Number of Beds
St. Tammany	4	742
Washington	3	213

Source: State of Louisiana, Department of Health and Hospitals, 2012
http://www.stph.org/content/History.htm
http://www.slidellmemorial.org/AboutSMH
http://www.ochsner.org/news/story/ochsner_medical_center_north_shore_recognition_from_the_joint_commission/
http://www.lakeviewregional.com/career-center/

RELEASED - Printed documents may be obsolete; validate prior to use.

Area Mississippi Hospitals		
Location/County	Number of Public Hospitals	Number of Beds
Hancock	1	47
Harrison	9	791
Pearl River	2	119

Source: MS Department of Health Hancock County 2007 Health Profiles
MS Department of Health Harrison County 2007 Health Profiles
MS Department of Health Pearl River County 2007 Health Profiles

13.12 Encroachment

Based upon an Encroachment Risk Assessment Workshop held at Stennis Space Center (SSC) on August 7-8, 2007, and the issuance of further guidelines from NASA Headquarters on sustainability and recapitalization of an aging infrastructure, the master development strategy was re-evaluated by a specific Steering Committee. The workshop conservation guidance as well as recapitalization guidance had major influences on the Steering Committee's work as it evaluated the risk associated with development on the Center as it related to the Center's ability to meet mission requirements for NASA. The intent of the workshop was to identify current and future encroachment risks to the future operation of SSC. For this use, the term "encroachment" encompasses a broader range of risks than the conventional concept relating to real estate competition such as development to the fence line. More broadly applied, this encroachment study looked at any type of resource limitation that affected the Center's ability to accomplish its NASA mission.

Care should be taken to reserve areas on the Center where future test stands may be sited, where impacts from acoustical vibrations would require more substantial construction, and where future support facilities may need to be located to support future propulsion test needs. The control of potential encroachments will be paramount.

The Buffer Zone provides a needed protection to the surrounding communities for noise associated rocket engine testing. As structural damage may occur at 115 to 120 dB noise range, it is critical that SSC maintain the integrity of the Buffer Zone from encroachment. Examples of how representative noise contours from our B1/B2 Test Stand and the A3 Test Stand are dependent on maintaining the Buffer Zone integrity.

Having an uninhabited Buffer Zone surrounding the Fee Area and having over half the land in the Fee Area undeveloped, places the need or probability for expansion of SSC outside its present borders as very low. However, we have acquired small parcels in the Buffer Zone

when needed and, we have no reason to expect that we have a problem acquiring property inside the buffer zone if the need arises, with the exception of the following three large landowners:

- Wetlands Solutions, Inc. – They have placed conservation easements on their land as it is being converted into a wetland mitigation bank. They own most of the land on the southern border of the SSC Fee Area.
- US Navy – The US Navy has purchased some land on the western border of the Fee Area that is used as a live-fire gun range for training of Navy personnel.
- Louisiana Department of Wildlife and Fisheries – This state agency has created a wildlife management area that consumes much of the western portion of the Buffer Zone but it is highly unlikely that NASA would ever need to expand the Fee Area across the East Pearl River in this direction.

In addition to addressing the imbalance in appropriate work space, there are some workplace safety considerations that need to be addressed inside the Propulsion Test Operations Area. There are several locations inside the Propulsion Test Operations Area that are not suitable for offices and shops of personnel who support test operations. There needs to be a realignment of work spaces inside the entire Propulsion Test Operations Area to the perimeter of the Test Area. This will necessitate the relocation of more administrative-type personnel and shop support personnel to newly developed facilities located along the edge of the Propulsion Test Operations Area or consolidated into the Administration Area with like functions.

Since assuming responsibility of Area 9 on July 1, 2011, NASA is now afforded the opportunity to expand operations for industrial, commercial and data services, which offsets encroachment issues regarding the NASA mission.

Additionally, rising energy costs or a trained workforce shortfall could affect the Center's ability to carry out its mission responsibilities. The participants developed 23 risk statements with potential mitigation options. The top issues identified were:

- Providing proper siting and design of new buildings and infrastructure that will minimize impact on rocket testing
- Providing adequate supply of propellants, pressurants and critical components, warehousing, transportation
- Coordinating primary and tenant missions in placement of structures, information technology, communication, etc.
- Maintaining integrity of Buffer Zone
- Emphasising redundancies and/or hardening to minimize impact on rocket testing and overall mission with accountability requirements

Based on the sustainability and recapitalization guidance, the Steering Committee felt that there was a need to expand the scope of the update of the master plan to also look at ways to reduce horizontal infrastructure costs, identify where the repair by replacement was warranted to meet efficiency goals, and identify a strategy of recapitalization for buildings to meet future needs, in addition to the items listed above.

13.13 Utilities

13.13.1 Potable Water

Two deep wells and two elevated storage tanks on the base side supply water to the support and test areas. A third elevated tank in the test area is backed up with a booster pump to increase water pressure to the test area. Water supplied by this system is used for drinking, sanitation, and fire protection.

The elevated tanks supply water to the system and maintain system pressure at 4.6 to 5.1 kilograms per square centimeter (65 to 72 pounds/square inch gauge (psig)). Chlorination operates in conjunction with booster pumps, adding a chlorine solution to the water while the pumps are operating. The water supply is sampled regularly for chlorine and contaminant content to meet state and local requirements.

Three-way hydrants for building and storage area fire protection are designed to have a water flow of 5,700 liters per minute (1,500 gallons per minute) for a four hour period at 1.4 kilograms per square centimeter (20 psig) minimum pressure.

Fire hydrants are located according to the recommendations of the National Board of Fire Underwriters to meet fire protection requirements. Hydrants provide fire protection for every 2800 cubic meters (100,000 cubic feet) of open storage.

13.13.2 Industrial Water

A High Pressure Industrial Water (HPIW) system furnishes water to the test complexes to cool the test stand flame deflectors and provide fire deluge protection on the test stands. Currently, SSC is conserving groundwater by obtaining water from the canal for deluge water. It also furnishes water for fire protection of the propellant barges at the test stands.

13.13.3 Telecommunications

SSC has several telecommunication systems which support the institutional facility as well as the test complex.

Institutional

- ***Telephone System*** - SSC's PointSpan M6880 telephone system is a powerful enterprise communications and call center platform. With a unique single platform design, scalability, and reliable disaster tolerant features, this system continues to meet SSC's mission-critical communications needs. SSC's PointSpan telephone system has 18,512 available ports with over 14,000 in actual use.

- ***Trunked Radio System*** – Radio services are supported by a Motorola Smartnet Trunk Radio System. This system currently supports approximately 800 handheld radios used by the security office, fire department, emergency operations, facility maintenance, and test operations.

- ***Emergency Notification System*** - The SSC Emergency Notification System includes 8 Whelen Giant Voice speaker systems strategically located across the SSC campus so that any personnel outside can hear the announcements. The most common announcements are for weather related events such lightning alerts and all clears. The system is activated by the dispatcher who can select pre-recorded announcements or can make a live announcement using a microphone.

Test Complex

- ***PA System*** - The PA System is a test complex communications system. The system is used to page individuals, make announcements, issue aural signals for safety coordination in the test complexes, and inform and advise personnel of pending or existing hazardous conditions.

  Operational Intercom - Two-way voice communication within each test complex and the administration facility is provided by the Operational Intercom System. This system contains 19 channels common to all administrative stations. A main console permits channel hookup as necessary, and trunk lines permit the extension of the console for site-wide communication.

13.13.4 Electrical

Dual overhead 115 KV transmission lines normally supply electricity to SSC. The lines are owned and operated by the Mississippi Power Company, and an alternate power service is available from the Louisiana Power and Light Company.

13.13.5 Helium

Helium is primarily used for servicing the test articles to minimize stratification of liquid oxygen (LOX) in run tanks, and to pressurize the propellant tanks. The helium system at SSC provides and distributes refined helium gas at 320 kilograms per square centimeter (4,500 psig) to the test complexes. Compressed gaseous helium is received via tube bank trailer at the High Pressure Gas Facility (HPGF). The helium is then transferred either to low pressure storage spheres, to the compressors, or directly into the site distribution system through the system valving.

13.13.6 Hydrogen

The liquid hydrogen (LH_2) system provides for barge unloading, storage, and distribution of large quantities of LH_2, the fuel used for testing. The LH_2 is brought to SSC on trailers and loaded onto barges at the CRYO facility for use at test complexes. Barge and associated equipment capabilities are as follows:

- Three 910,000-liter (240,000-gallon) (usable volume) barges with storage and transfer capabilities.
- A nitrogen pressure controlled system at 53 kilograms per square centimeter (750 psig), which supplies control gas for operations of all barge mounted valves.
- A Water Deluge System which provides fire protection for the LH_2 barges and accessories.
- Interface with the main LH_2 fill, hydrogen vent, control and instrumentation, electric power, ground connection, gaseous nitrogen, and deluge water systems.

Docking facilities for two LH_2 barges are available at each "A" Test Stand, with the distribution system necessary for LH_2 transfer from the barge to the run tank, and for defueling the tank.

The gaseous hydrogen provides and distributes hydrogen gas at 210 kilograms per square centimeter (3000 psig) to the test complex. The system consists of LH_2 storage and vaporization equipment and a distribution system to convey filtered hydrogen gas to the test complexes.

LH_2 is delivered to the High-Pressure Gas Facility by trailer truck and transferred to storage. The liquid is stored in a 190,000-liter (50,000-gallon) tank. Two pump vaporizer units generate hydrogen gas. The high-pressure hydrogen gas is then pumped to the test complexes using either of two cryogenic pumps. Vented gas is discharged into a flare stack header onto a flare stack and burned.

Gaseous nitrogen and helium are provided for purging hydrogen lines and high-pressure pumps.

13.13.7 High Pressure Air

The high-pressure air system provides and distributes filtered air to the test complexes, the engineering area, the propellant storage area, and the maintenance area. The system consists of compressors and purifiers located in the Central Compressor Building at the High-Pressure Gas Facility, a facility-wide distribution system, and high-pressure storage containers.

The air compressors draw air from outside the building through an oil-bath filter. All three (3) compressors are equipped with intercoolers, which use cooling tower water. Automatic controls are provided on each compressor for protection against excessive pressure, temperature, and vibration. Coolers and scrubbers, ahead of the purifiers, remove most of the oil from the air, and filters placed after the purifiers complete the conditioning operation.

The average daily use since activation of the Main Propulsion Test Article (MPTA) Complex has been 1,130,130 scf/day. The storage at the test complexes and the combined pumping capacity of the compressors are expected to meet all present program requirements.

13.13.8 Nitrogen

The purpose of the nitrogen system is to generate and distribute missile-quality nitrogen gas at 302 kilograms per square centimeter (4,300 psig) to the test complexes; to service areas for environmental test and control; to maintain an inert atmosphere; and to purge and pressurize propellant tanks, lines, power control valves, and instruments.

Nitrogen gas is generated at the site from liquid nitrogen, which is received at the HPGF by tank trailer. Gas is delivered to the various test and service areas through an underground distribution system and is stored in high-pressure gas containers.

In addition to the liquid nitrogen used for the generation of gas, an amount equal to less than 3 percent of the total site consumption is used for test purposes at the Electronics,

Instrumentation, and Materials Laboratory and the Repair and Fabrication Shop. Nitrogen gas is required at the propellant dock area for purging, operation of valve controls, and fire suppression.

13.13.9 Oxygen

The oxygen system provides storage and transfer capabilities for large quantities of the LOX used as the oxidizer in various tests. The LOX system consists of the Transfer Facility located at the Cryogenic Propellant Dock, five 360,000 liter (95,000 gallon) LOX transfer barges, the "B" Test Complex LOX Dock and Transfer Facility, and the "A" Test Complex LOX Dock and Transfer Facility.

LOX is delivered to the land-based transfer system at the Cryogenic Propellant Storage Facility by tank truck. Barge mounted pumps transfer LOX from the barges through the transfer system directly into the test stand LOX tank. LOX may be returned to the barge.

13.13.10 Natural Gas

Natural gas is purchased from Sage which uses the Gulfsouth Pipeline Company's pipeline. The gas is supplied to SSC facilities through 13 kilometers (eight miles) of 0.15-, 0.20-, and 0.25-meter (6-, 8-, and 10-inch) pipeline and 3.2 kilometers (two miles) of 0.03-meter (1-inch) branch line. A pressure reducing and metering system supplies the gas to SSC at 2.8 kilograms per square centimeter (40 psig).

Magnesium anodes, buried at intervals along the pipeline, provide protection against corrosion of the piping system. Gas enters the Site Natural Gas System at the north boundary of the Fee Area through a main supply valve to an odorizing station where a liquid odorant is added to the gas.

Natural gas is used as fuel for emergency back-up generators, HVAC boilers, water heaters, flare stacks, and for laboratory use in the Engineering and Administration Building and the Environmental Laboratory.

13.13.11 Transportation

Interstates 10 and 59, US Highway 90 and Mississippi Highway 607 serve the SSC area. Interstate 10 is the primary corridor linking Biloxi, Gulfport, Bay St. Louis, and other coastal cities with New Orleans. It is located approximately 5 kilometers (3 miles) south of SSC. Interstate 59 joins Interstate 10 near Slidell, Louisiana and extends northeastward to

Hattiesburg, Mississippi and on into Alabama, passing about 8 kilometers (five miles) from the northwestern corner of SSC. Direct access to and through SSC from I-10 and I-59 is provided by Mississippi Highway 607. The highway is closed to the general public within the Fee Area and checkpoints exist at both entrances to SSC. Highway 607 connects with US 90 approximately 14.5 kilometers (9 miles) southeast of SSC.

13.13.12 Water Transportation

Approximately 13.7 kilometers (8.5 miles) of canals inside the Fee Area is available for use to transport material into SSC. Currently, large volumes of propellants and heavy cargo are transported via roadway but the canal system is available as utilized during the earlier years of . Main and secondary canals provide water access to several storage areas and the "A" and "B" Test Stands.

The East Pearl River links SSC to the national waterway transportation system. It is 33.8 kilometers (21 miles) from the main canal entrance along the East Pearl River to the Gulf Intracoastal Waterway. The Gulf Intracoastal Waterway connects with the Mississippi River system approximately 105 kilometers (65 miles) west of the Pearl River mouth.

13.14 Major Environmental Considerations for Proposed Actions

Construction and testing efforts at the Center could potentially increase population slightly in the area. The increase may adversely impact the Center's waste disposal, sewer system, and groundwater supply. Increased traffic from commuter and construction vehicles could potentially damage the local roads. In addition, increased transportation of facility materials could also have noticeable effects with congestion on roads and waterways. A potential for more accidents could exist due to an increase in traffic.

The surrounding schools, health services, law enforcement, and fire protection would also feel the effects of a population increase. As a result of Hurricane Katrina the departments that are already understaffed would be further compromised.

Increased solid waste generated by additional employees and their families would only be a fraction of current generation. However, landfills in the area are very limited. Proposed actions must be coordinated with NASA Environmental Management to assess impacts in these areas.

13.15 References

1. NASA. 2011 Economic Impact Fact Sheet, January 12, 2012.

2. Office of External Affairs, 2012

3. 2010 U.S. Census Bureau (http://quickfacts.census.gov/qfd

4. http://www.city-data.com (Hancock County, Harrison County, Pearl River County, St. Tammany Parish, Washington Parish), 2009

5. FOSC Medical Clinic personnel, 2012

6. NASA. 2007. NPR 1800.1B, Occupational Health Program Procedures

7. Environmental Justice Implementation Plan, SPLN-8500-0071

8. NASA, 2007, John C. Stennis Space Center Draft Facilities Master Plan

9. NASA, 2010, SPLN 8500-0002, Energy Efficiency and Water Conservation 5-year Plan

14.0 Noise and Vibration

Due to the nature of static rocket engine testing, noise and, to a smaller extent, vibrations have always been issues at SSC. The land area required for the Fee Area and the Buffer Zone was calculated based upon acoustic environment calculations made for the NOVA first stage rocket engine. NASA determined that it was necessary to purchase all land within a 125 dB acoustical boundary and to prohibit human habitation within a 110 dB acoustical boundary. There are no environmental federal, state or local regulations limiting noise in the vicinity of SSC.

Observed sound levels are affected by many factors, including the location of major receptors, topography, and meteorological conditions. Sound intensity attenuates with distance from the source, so the impact of the sound generated is greatly affected by the distance from the source to the receptor. Since the land surrounding SSC is basically flat, the effects of terrain on propagating sound waves is usually ignored in sound analyses performed at SSC. Meteorological conditions, however, can have a great effect on sound wave intensity. Acoustic focusing can be caused when the speed of sound increases with altitude due to certain wind speeds and temperature profiles. When this occurs, sound waves are refracted and combine with the sound wave traveling along the ground. This may cause higher noise levels at a given distance than would normally be expected.

14.1 Background Noise Levels

Background noise levels at SSC are normally low occurring only from constructionsites and traffic. Other occasional noise occurs at the NASA High Pressure Industrial Water Facility with the operation of generators and pumps for power and deluge water during rocket testing activities, at the Rolls Royce commercial facility that tests jet engines, at the E-Test Stand Complex for rocket component testing and for the Naval training center. The noise from these four facilities is not noticeable at most locations at SSC and has no impact on the local community

14.2 Rocket Engine Testing Noise and Vibration

Noise created by static rocket engine testing may affect the local communities for short periods of time. Rocket engine tests normally do not last for more than 10 minutes. Predictions of the noise levels from rocket engine testing are made of the sound pressure level for the decibel A-weighted (dBA) scale and for the decibel (dB) Overall Sound Pressure Level (OASPL). The A-weighted scale is used to account for the hearing range of the human ear.

This adjusted sound pressure accounts for the insensitivity of the human ear to low frequencies. The OASPL accounts for low frequency noise or rumble that can cause vibration in buildings.

For comparison, common noise levels that account for the hearing range of the human ear are provided below:

dBA Level	Source
70	Normal street traffic
90	Lawn mower
100	Loud music
140	Thunder

14.2.1 Saturn Era F-1 Engines

Saturn Era F-1 engines and five engine clusters were tested at SSC in the mid 1960's to early 1970's. Each engine could produce thrust exceeding 1.5 million pounds (Mlb) or 6.7 million newtons (MN). The noise was directed to the north due to the orientation of the test stands. The predicted maximum noise levels outside of the Buffer Zone were 77dBA and 112 dB. During this program NASA logged 160 complaints, of which 57 resulted in formal administrative claims to NASA. Eighteen of the complaints resulted in financial settlements. The chance of structural damage was estimated to be less than 0.2 percent or less than two claims per thousand households. NASA has determined by experience that structural damage claims do not normally occur at less than 110 dB.

14.2.2 Space Shuttle Main Engines

The Space Shuttle Main Engine is capable of 0.35 Mlb (1.5MN) of thrust. This is considered a small engine that produces noise at 60 dBA and 96 db at the edge of the Buffer Zone. The sound is audible, but the level on humans would not be significant. No structural complaints have been received by NASA.

14.2.3 A-3 Test Stand Altitude Testing

The A-3 Test Stand will be the location for testing the J-2X engine at simulated altitude of approximately 30,480 m (100,000 ft). Noise that would be produced from testing the J-2X engine and the two stages of steam ejectors on the A-3 Test Stand would be similar to the noise generated by Space Shuttle Main Engine tests that frequently occur at SSC. The J-2X engine is capable of 0.30 Mlb (1.3MN) of thrust. Maximum potential test firings are projected to include two full duration tests per month. Each test operation would be 650 seconds, for a collective

total test firing schedule of 15,600 seconds per year. The test stand will direct noise to the south east.

Predictions of the noise levels have been made using two different computer models. One early prediction projected the dBA at the edge of the Buffer Zone to be approximately 77 dBA. The OASPL estimated sound generation would be approximately 96 dB. The results of this computer model prediction are provided in Figure 14-1 and 14-2. The second prediction projected the dBA at nearby communities would not exceed 84 dBA and OASPL at 100 db. These results are shown in Figures 14-3 and 14-4.

14.3 Vibration

Due to the soil conditions at SSC, the facility and surrounding areas are susceptible to acoustic-seismic effects. However, years of testing the Saturn V rocket motor showed that the effect from rocket test firings is limited to swaying and falling objects. The greatest concern from seismic effects caused by operations at SSC is the falling of objects in occupied buildings due to the slight swaying induced by seismic vibrations.

14.4 Major Environmental Considerations for Proposed Actions

Over the years of rocket testing at SSC, NASA has developed procedures to manage the effects of project-generated noise. A critical element of the noise management procedures is an estimation of noise level prior to commencement of noise generating activities. Any proposed action that may generate significant amounts of noise should estimate the effect and develop a program to manage the noise. The Facilities Master Plan should be consulted to ensure that noise sources are located away from the more densely populated areas of the site to protect the low ambient noise levels.

While seismic effects have been minimal at SSC, the potential for damage to property exists. Vibrations caused by proposed actions should also be evaluated to determine what, if any, effect the action will have on SSC and the surrounding communities.

Noise can be mitigated by the use of personal protective equipment onsite. For local communities, the date of rocket tests can be announced in local newspapers and signs can be placed along Interstate 10 to warn of high noise levels.

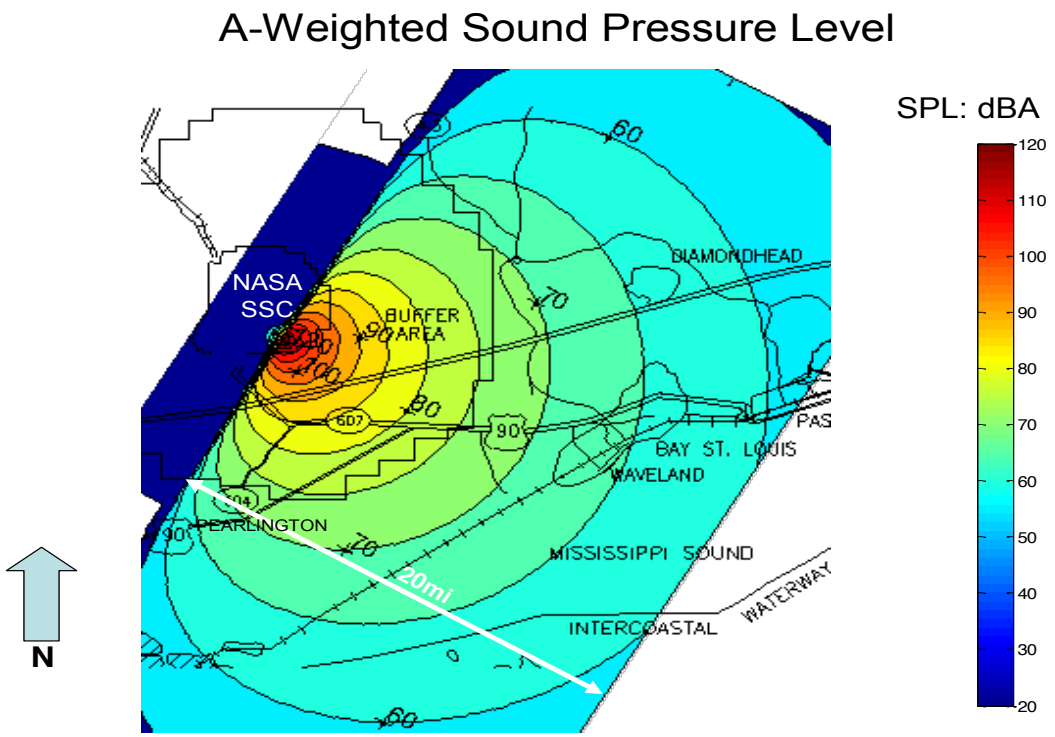


Figure 14-1 A-Weighted Sound Pressure Level Prediction (Joseph Yen, 2007)

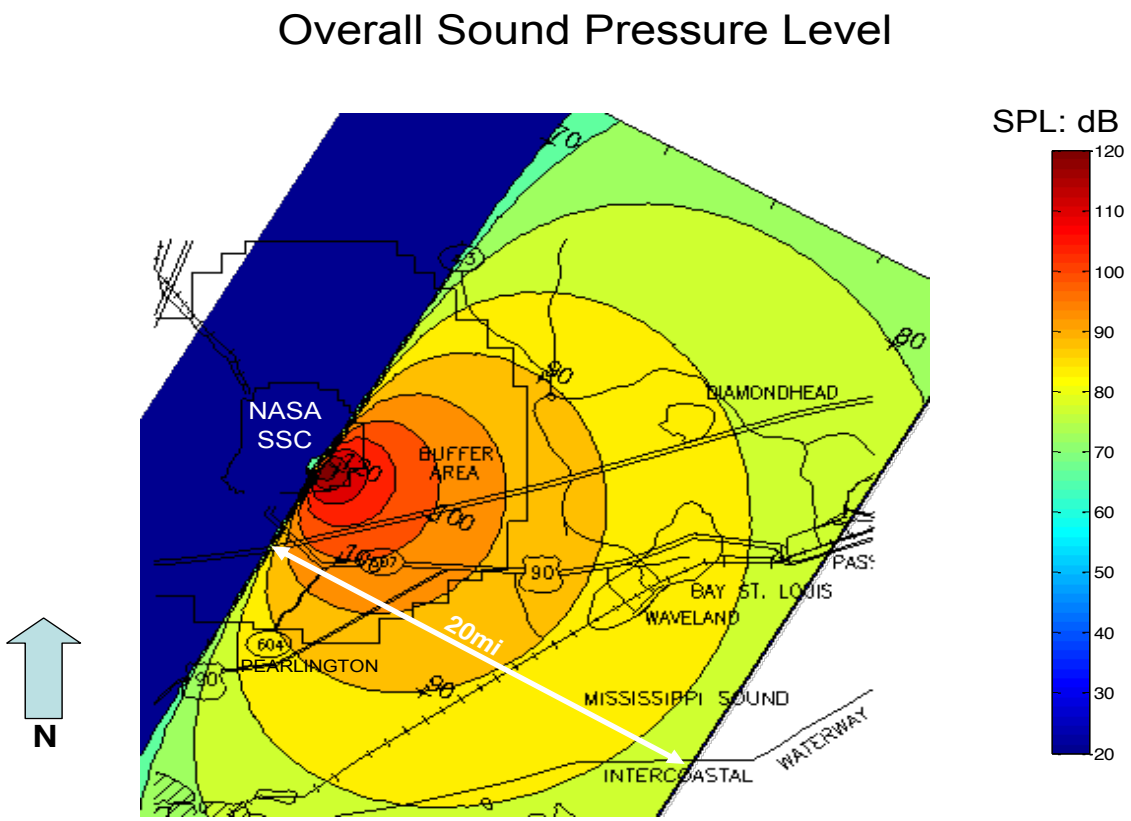


Figure 14-2 Overall Sound Pressure Level Prediction (Joseph Yen, 2007)

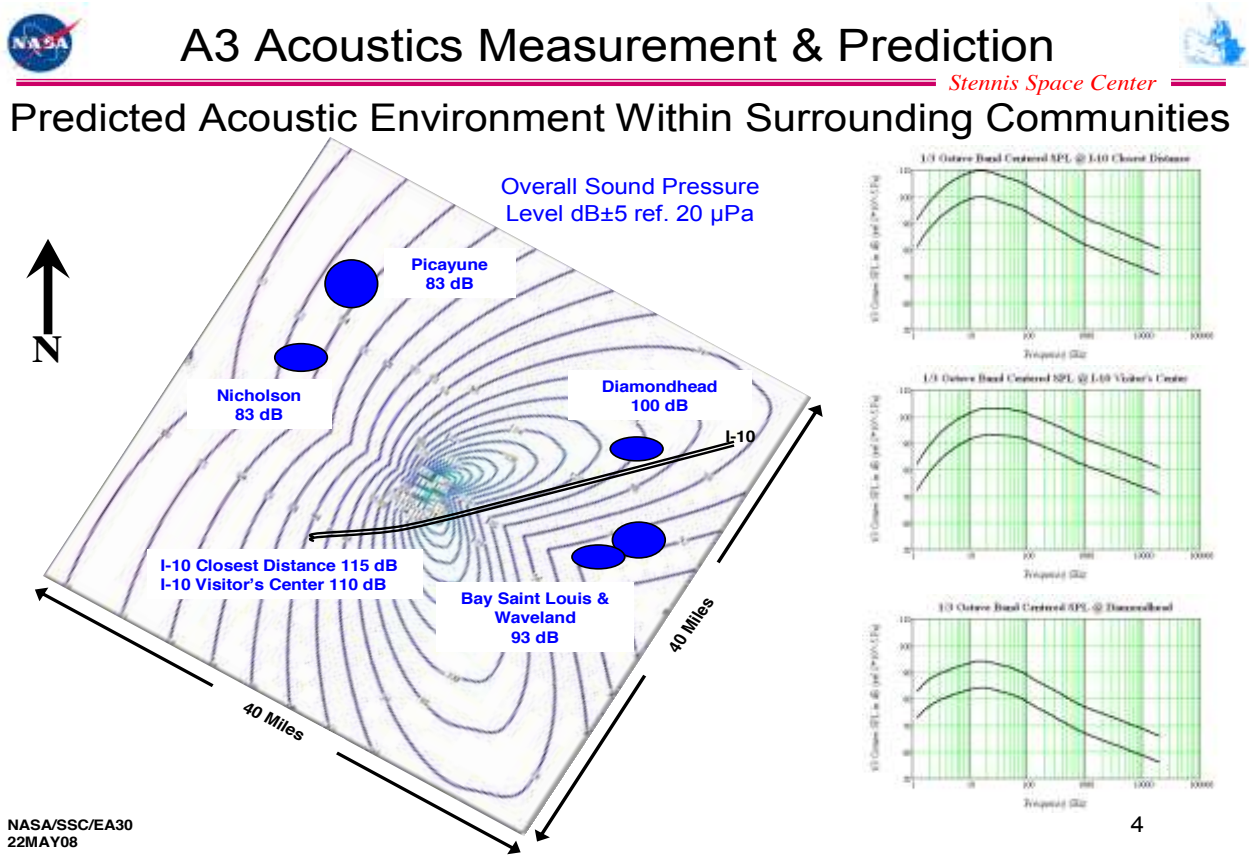


Figure 14-3 Overall Sound Pressure Level (Jody Woods, 2008)

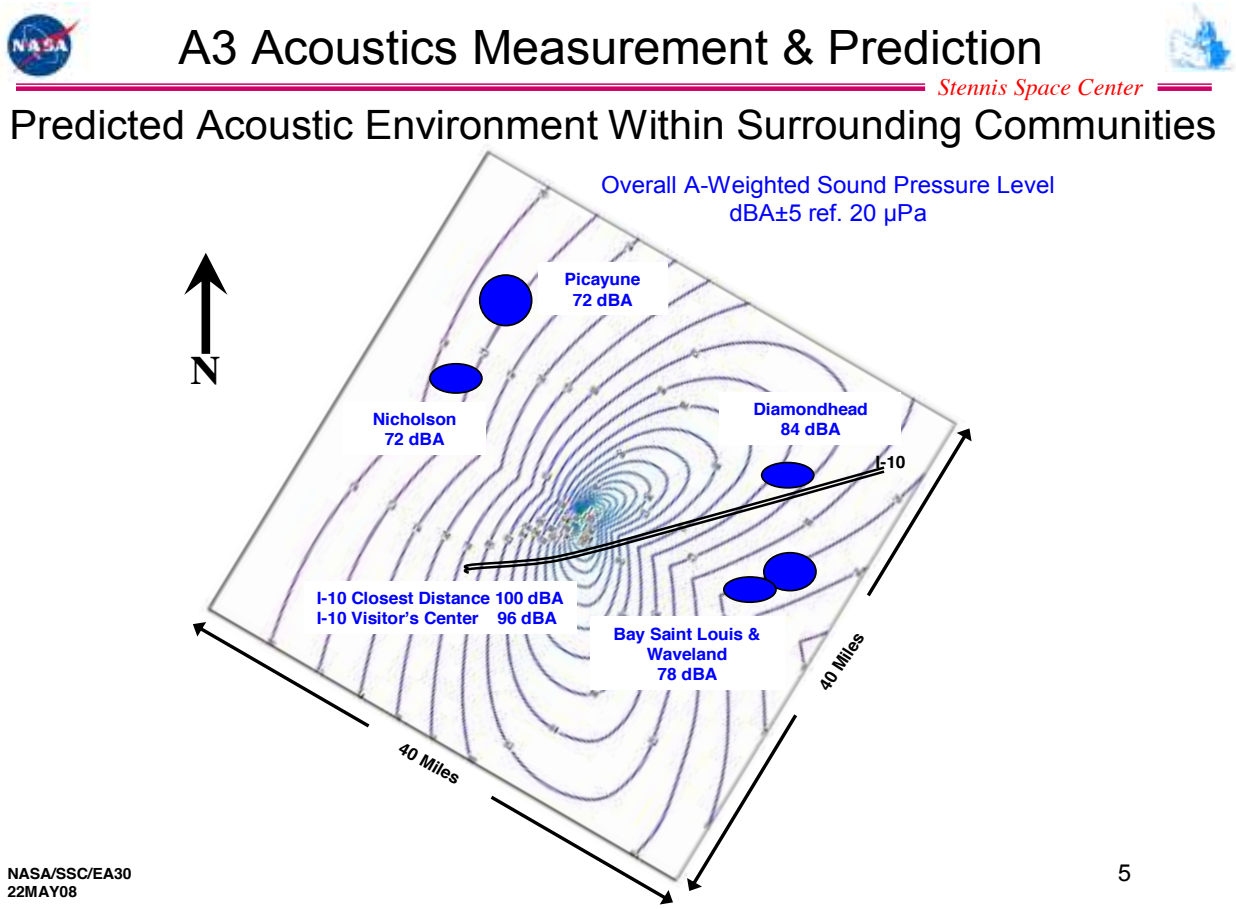


Figure 14-4 A-Weighted Sound Pressure Level (Jody Woods, 2008)

14.5 References

NASA. 1972. Environmental Statement for the George C. Marshall Space Flight Center and Mississippi Test Facility.

NASA. 1993. Space Transportation Main Engine Environmental Assessment.

NASA. 1997. Final Environmental Impact Statement of Engine Technology Support for NASA's Advanced Space Transportation Program.

NASA. 2007. Environmental Assessment for the Construction and Operation of the Constellation Program A-3 Test Stand.

Woods, Jody. 2008. A-3 Test Stand Acoustic Environment Prediction.

Yen, Joseph. 2007. A-3 Test Stand Sound Pressure Levels.

15.0 Natural Resources

Stennis Space Center (SSC) has developed an Integrated Natural Resource Management Plan (INRMP), which is intended to promote an ecosystem management approach to natural resource management that will balance mission requirements with ecological concerns, multiple use and sustained yield of resources on 15,968 acres of SSC land base. Multiple objectives are identified to aid natural resource professionals in managing for timber production, wildlife and biological diversity, rare species conservation, and wetland protection. The importance and mission of the NASA/SSC facility and the necessary impacts of this facility on the surrounding environment are taken into consideration in this plan.

This INRMP seeks to integrate effective conservation of natural resources with the mission of the SSC, Mississippi. The SSC land base is located in the lower Gulf Coastal Plains region of southwestern Mississippi. Approximately 9,446 acres of this land are designated controlled access areas and consist of testing facilities, laboratories, offices, and other operational facilities. The other 6,522 acres are primarily forested land scattered within the large acoustical easement area that surrounds the Center's test facility. This area is utilized for grazing, mining, timber production, farming, and recreational purposes. The INRMP is developed primarily for the Fee Area of SSC; however, due to ecosystem and landscape management approaches discussed in this plan, conservation and management is intended to positively affect privately owned Buffer Zones indirectly. The Fee Area of SSC supports a variety of wetland and terrestrial ecosystems, including bottomland hardwood, riparian, mixed upland, upland hardwood, and upland pine forests; temporary and permanent wetlands, wet pine savannahs, marshes, streams and rivers and associated backwaters. These ecosystems support diverse faunal and floral associations, forest resources, and water resources that important to SSC economically and ecologically.

Natural resource management at SSC focuses on the following approaches:

1) Forestry practices that produce revenue, maintain forest health, compliment ecosystem restoration, and protect and enhances wildlife habitat through even age in pine forests, uneven age forest management in mixed pine-hardwood forests, prescribed burning, and protection of riparian and sensitive forest ecosystems;

2) Conservation of and management for protection of rare, protected species, native biodiversity, rare ecosystem restoration, conservation of nongame migrant and resident birds, and protection of alluvial floodplain forests and wetlands;

3) Resolution and reduction of human-wildlife conflicts through habitat management, relocation of animals, nest box placement, and human education;

4) Landscaping with native plants to reduce grounds maintenance costs;

5) Wetland mitigation of impact wetland acreages, protection floodplain and riparian wetlands, and restoration of wet pine savannahs and forested wetlands;

6) Control of introduction and spread of non-native pest plants and animals.

The INRMP is written to comply with federal and state requirements that address renewable natural resource management, wildlife and fisheries conservation, and water and air quality protection. Therefore, this INRMP addresses natural resource management that is anticipated to enhance the mission of NASA over a 10-year period. The listing of requirements are as follows: Executive Order 13148 - Greening the Government through Leadership in Environmental Management, NPD 8500.1 - NASA Environmental Management, NPG 8553.1 - NASA Environmental Management System, and NPG 8580.1 - Implementing the National Environmental Policy Act and Executive Order 12114.

15.1 Management Goals and Objectives

The INRMP establishes a rationale for managing natural resources to support the military mission, while protecting and restoring the biodiversity of Gulf Coastal Plains ecosystems located on the SSC facility. This INRMP also lays out a practical annual work plan for monitoring and implementation.

15.2 Goals

The overall goal of the SSC INRMP is to ensure that land is available in the future to support NASA's mission and maintain ecosystem integrity by protecting native biological diversity on the land presently entrusted to its care. Therefore, this Plan adopts the following broad goals which will be delineated as more specific objectives in each management section.

1. Support NASA's mission while protecting and enhancing natural resources for multiple use, sustained yield, and biological diversity using an ecosystem management approach.

2. Develop and implement a proactive approach to natural resource management that exceeds that required for compliance with all applicable Executive orders, Federal and State laws and regulations.

3. Build relationships with other agencies and the public to enhance the Center's public image, obtaining recognition for accomplishments in natural resource stewardship, and encouraging the

use of similar approaches through demonstration projects that educate the public and advance effective conservation of renewable natural resources.

15.3 Major Environmental Considerations for Proposed Actions

All projects that have the potential to affect current landscape, wildlife, forested areas, and recreational areas must be coordinated through NASA Environmental Management so that potential impacts can be properly assessed. Contact with NASA Environmental Management is encouraged to ensure that proposed actions comply with the SSC Integrated Natural Resources Management Plan (INRMP).

15.4 References

1. 2007, NASA SSC Draft Master Plan

2. 2004, NASA SSC Integrated Natural Resource Management Plan

16.0 Major Environmental Considerations for Proposed Actions

All construction, rocket testing, and operations that may potentially impact environmental media, such as air, water, land, aquatic and biotic resources, endangered and threatened species, historic and cultural resources, and surrounding communities (as identified in the NASA Environmental Justice Implementation Plan) must be coordinated through NASA Environmental Management. Consideration is also given to projects that could involve Affirmative Procurement and Recycling activities. All proposed actions for SSC environmental media and Environmental Justice considerations incorporate the use of the Preliminary Environmental Survey (PES), form SSC-696M.

16.1 Air Resources

When developing new projects at SSC, air pollution issues are considered. Proposed activities are evaluated during the project planning process in order to determine the associated potential to emit regulated air pollutants and to identify applicable air quality regulations and/or permitting requirements. Under the State of Mississippi's Air Pollution Control Regulations and the Federal Clean Air Act Amendments, it is the responsibility of the facility to apply for, and receive authorization to construct and/or operate any source of dust, fumes, mist, smoke, particulate matter, vapor, or gas.

To avoid delays associated with regulatory and/or permitting requirements, air emissions and associated regulatory impacts must be considered at the beginning of any project-planning phase. In addition, alternatives should be evaluated for projects requiring the use of CFCs, halons, asbestos, lead, polychlorinated biphenyls and/or products tinted with pigments of lead, cadmium, chromium VI, and their oxides, or formulated with hazardous air pollutants, including formaldehyde, halogenated solvents, mercury or mercury compounds.

16.2 Water Resources

Erosion of surface soils during construction and land clearing projects needs to be addressed as follows. Any project impacting greater than one acre requires a stormwater permit and pollution prevention plan. Other activities impacting less than one acre should follow best-management practices for erosion protection. Soil erosion could increase the turbidity, suspended solids, and color of the receiving waters. In addition, effluent discharges from testing, construction, and manufacturing result in surface water quality impacts. Potentially affected surface waters should be monitored analytically to determine impact.

16.3 Land Resources

A large percentage of the SSC facility has been determined to be potential wetlands. . Therefore any proposed development at the facility will likely require a wetlands authorization and must be coordinated with NASA Environmental Management.

Future development should also be designed to avoid floodplains. If no alternative exists to development within a floodplain, a floodplain/wetlands assessment must be included with the environmental assessment or environmental impact statement.

Contamination of soil could result from accidental spills, testing, or regular operations at the facility. Facility construction exposing soil could result in erosion or failure of the soils under excessive bearing pressure. Subsurface utilities and equipment are subject to corrosion due to the corrosive soils located throughout the site.

16.4 Aquatic and Biotic Resources

Any major project undertaken at SSC should include an evaluation of impacts to flora and fauna habitats. Projects should be designed to promote conservation of biotic habitats consistent with the conservation plans established by the Mississippi Department of Wildlife Conservation and the SSC Integrated Natural Resources Management Plan.

16.5 Threatened and Endangered Species

There are a significant number of threatened, endangered, and ranked species with ranges overlapping the SSC Fee Area and Buffer Zone within diverse habitats. Therefore, any development at the facility should include a survey for any species listed or ranked by USFWS or MDWFP that are likely to occur in the SSC area. Once a listed species is identified, the appropriate state or federal agency should be consulted regarding any activity that could affect the habitat of that species.

16.6 Solid and Hazardous Waste Management

The following is a summary of regulatory considerations for solid and hazardous waste management. Contact with NASA Environmental Management is encouraged to ensure that proposed actions do not jeopardize compliance with NEPA, RCRA, EPCRA, or CERCLA

regulations. Additionally, contact should be made with NASA Environmental Management for assistance in making any of these determinations.

- Will any new action under consideration result in changes to currently used methods for treating, storing, or disposing of solid waste or result in changes in quantity of waste generated or types of wastes generated?

- If new solid wastes will be generated, are these solid wastes excluded under 40 CFR, Section 261.4?

- Assuming that any new solid waste to be generated is not excluded, is the new solid waste a hazardous waste under RCRA? Refer to 40 CFR, Sections 261.20-261.24 for hazardous waste defined by hazardous characteristics (ignitability, corrosivity, reactivity, or toxicity).

- Will the project recycle materials, change either the volume or type of materials recycled, or change the methods used for recycling? Has it been determined whether these materials to be recycled are solid or hazardous waste regulated under RCRA and whether this activity must be reported to EPA or to the State?

- Does any new activity have impact on any site that has been or is being investigated under the CERCLA program?

- Will any new activity result in the need for additional reporting under SARA and EPCRA?

Refer to SCWI-8500-0003-ENV, Sustainable Acquisitions Plan for instructions regarding the procurement of a chemical or hazardous material. Anyone ordering a chemical or a product that contains a chemical shall submit an MSDS for approval per this instruction. The SSC Hazard Communication Standard Program and the SSC personnel training requirements are in place to ensure that emergency response and reporting and notification requirements are met.

16.7 Toxic Substances

The following are regulatory considerations for proposed projects involving chemical substances that are regulated under TSCA:

- Will any new action result in the use or disturbance of PCBs, asbestos-containing material (ACM), lead or other substances regulated under TSCA at SSC? If so, is the new action considered research and development activity?

- Will any new action impact areas at SSC already identified as having PCBs, ACM or lead present?

If any of these considerations apply to the proposed project, then NASA Environmental Management should be contacted to discuss any measures needed to ensure NEPA and TSCA compliance.

16.8 Insecticides and Herbicides

If any proposed action would alter the planned use of chemicals to be stored onsite, NASA Environmental Management shall be contacted. Additionally, if a proposed action involves increased application of pesticides at SSC or application of a new pesticide, then NASA Environmental Management shall be contacted.

16.9 Radioactive Materials and Non-ionizing Radiation

The following are considerations for new ionizing and non-ionizing radiation sources that may be required for proposed projects.

- Will any new action result in the need for any new source of ionizing radiation to be used onsite?

- Will any new action result in the need for any new source of non-ionizing radiation to be used onsite?

Positive response to either of these two questions requires immediate contact with NASA Environmental Management to ensure that no action jeopardizes compliance with NEPA, NRC, or State regulations.

16.10 Aboveground and Underground Storage Tanks

Plans for the installation of any new storage tanks or for the re-activation of an existing unused storage tank should be coordinated through NASA Environmental Management to determine whether the proposed tank system designs meet all existing storage tank regulations. Also, any out of service or empty tanks should be evaluated for closure. The UST regulations contain requirements for underground tank closure.

16.11 Historic, Archaeological, and Cultural Resources

Before initiating new projects, especially projects that will require new construction, the impacts of the project on existing cultural resources should be considered. Once disturbed, the value of many historic and archaeological sites is lost. A Phase I survey by a professional archaeologist is required for projects within the Gainesville area due to its nomination to the National Register of Historic Places (NRHP). Logtown, Napoleon, Westonia, and Santa Rosa are other areas of high historic potential within the Stennis bufferzone. SSC construction contracts will contain language-requiring notification of the Contracting Officer of any potential archaeological finds discovered during construction. Because of their inclusion as National Landmarks, the three test stands require special consideration. Any modification to these structures may initiate a Section 106 review to ensure that their historical value is protected and notification of any changes must be given to the National Park Service Landmarks Office. In the next 1-5 years buildings at Stennis will begin to turn 50 years old, the threshold for a structure to be deemed historic. All buildings at Stennis over 50 years old will need to be assessed for their historic value. Special attention will be given to Building 1200 as it is widely regarded as an important piece of Stennis History

16.12 Economic, Population, Transportation, and Employment Factors

It is anticipated that future plans at the facility will increase population slightly in the area. This in turn will impact site waste disposal, sewer systems, and groundwater usage.

Increased traffic from commuter and construction vehicles could potentially strain the local roads. In addition, increased transportation of facility materials could also have noticeable effects with congestion on roads and waterways. A potential for more accidents could exist due to an increase in traffic.

Schools, health services, law enforcement, and fire protection would also feel the effects of a population increase. Departments that are already understaffed would be further strained.

SSC's Environmental Justice Implementation Plan has been blended into normal business practices. The demographic data for the SSC area, which was obtained during the development of the Environmental Justice Implementation Plan, will be utilized for identifying areas that require environmental justice considerations for future projects.

16.13 Noise and Vibration

Over the years of rocket testing at SSC, NASA has developed procedures to manage the effects of project-generated noise. A critical element of the noise management procedures is an estimation of

noise level prior to commencement of noise generating activities. NASA Engineering has computer models for noise level prediction based upon various conditions. Any proposed action that may generate significant amounts of noise should be evaluated for effects on surrounding facilities and develop a program to manage the noise. The Facilities Master Plan should be consulted to ensure that proposed facilities, NASA actions, tenant actions and any other continuous noise sources are located away from the more densely populated areas of the site to protect low ambient noise levels.

While seismic effects have been minimal at SSC, the potential for damage to property exists. Vibrations caused by proposed actions should also be evaluated to determine what, if any, effect the action will have on SSC and surrounding communities.

16.14 Natural Resources

All projects that have the potential to affect current landscape, wildlife, forested areas, and recreational areas must be coordinated through NASA Environmental Management so that potential impacts can be properly assessed. Contact with NASA Environmental Management is encouraged to ensure that proposed actions comply with the SSC Integrated Natural Resources Management Plan (INRMP).

Appendix A

Plant Species Documented at SSC

RELEASED - Printed documents may be obsolete; validate prior to use.

Aquatic macrophytes observed at SSC during 1995 ecological risk assessment survey (Sites 002, 006, 007, and 011)

Common Name	Scientific Name	Floral Form
Soft Rush	*Juncus effusus*	Emergent
Rice-cut Grass	*Leesia oryzoides*	Emergent
Pickerelweed	*Pontederia cordata*	Emergent
Spike Rush	*Eleocharis sp.*	Emergent/Submergent
Burreed	*Sparganium sp.*	Emergent
Knotweed	*Polygonum sp.*	Emergent
Arrow Arum	*Peltandra sp.*	Emergent
Mud Plaintain	*Heterathera sp.*	Emergent
Floating Pennywort	*Hydrocotyle ranunculoides*	Floating
Watermeal	*Wolffia sp.*	Floating
Duckweed	*Lemna sp.*	Floating
Water Lily	*Nymphaea sp.*	Floating
Marsh Seedbox	*Lugwidgia palustris*	Submergent
Parrot Feather	*Myriophyllum brasiliense*	Submergent
Bladderwort	*Utricularia sp.*	Submergent
Water Hyssop	*Macullamia rotundifoila*	Submergent
Narrow Leaf Pondweed	*Potamogeton sp.*	Submergent
Low Water Milfoil	*Myriophyllum humile*	Submergent
Two Leaf Water Milfoil	*Myriophyllum heterophyllum*	Submergent

Source: Final Ecological Risk Asssessment, SSC, Foster Wheeler Environmental Corp., 4/96

Terrestrial flora species observed during 1995 ecological risk assessment survey

Scientific Name	Common Name
Acer rubrum	Red Maple
Andropogon glomeratus	Lowland Broomsedge
Andropogon virginicus	Broomsedge
Apocynum androsaemifolium	Spreading Dogbane
Artemisia sp.	Wormwood
Aster sp.	*Aster*
Aulacomnium palustre	Moss
Balduina uniflora	Bald Sunflower
Bignonia capreolate	Cross Vine
Botrychium sp.	Grape Fern
Callicarpa americana	American Beauty Berry
Carex sp.	Sedge
Carya sp.	Hickory
Catalpa bignoniodes	Southern Catalpa
Chaptalia tomentosa	Sunbonnet
Cirsium horridulum	Spiny Thistle
Clematis sp.	Clematis
Clethra alnifollia	Sweet Pepperbush
Cornus florida	Flowering Dogwood
Crepis capillaris	Hawk's Beard
Cyperus retrorsus	Umbrella Sedge
Cryllia racemiflora	Titi
Digitaria sanguinalis	Crab Grass

RELEASED - Printed documents may be obsolete; validate prior to use.

Terrestrial flora species observed during 1995 ecological risk assessment survey (Cont.)

Scientific Name	Common Name
Drosera brevifolia	Dwarf Sundew
Eleocharis sp.	Spikerush
Elephantopus tomentosus	Elephant's Foot
Erigeron annus	Daisey Fleabone
Eupatorium capillitolium	Yankeewee
Fagus grandifolia	American Beech
Gaylussacia sp.	Huckleberry
Gelsemium sempervirens	Yellow-Jessamine
Geranium carolinianum	Wild Geranium
Gratiola neglecta	Clammy Hedge-Nyssop
Halesia diptera	Silver Bell
Hamamelis virginiana	Witch Hazel
Haexastylis arifolia	Wild Ginger
Hieracium scabrum	Rough Hawksbeard
Hypericum sp.	St. John's-wort
Ilex coriacea	Tall Gallberry
Ilex decidua	Deciduous Holly
Ilex glabra	Low Gallberry
Ilex opaca	American Holly
Ilex vomitoria	Yaupon
Illicium floridanum	Star Anise
Iris sp.	Iris

Terrestrial flora species observed during 1995 ecological risk assessment survey (Cont.)

Scientific Name	Common Name
Juncus effusus	Soft Rush
Juncus marginatus	Grass-leaf Rush
Liquidambar styricaflua	Sweetgum
Liriodendrom tulipifera	Tulip Tree
Lonicera japonica	Japanese Honeysuckle
Lotus corniculatus	Bird'sfoot Treefoil
Lycopodium sp.	Clubmoss
Lygodium palmatus	Japanese Climbing Fern
Lyonia lucida	Fetterbush
Magnolia acuminata	Cucumber Tree
Magnolia grandiflora	Southern Magnolia
Magnolia macrophylla	Big Leaf Magnolia
Magnolia virginiana	Sweet Bay
Medicago lupilina	Black Medic
Mentha arvensis	Wild Mint
Mitchella repens	Partridge Berry
Myrica cerifera	Waxmyrtle
Nothoscordum bivalve	False garlic
Nyssa sylvatica	Black Gum
Obolaria virginica	Pennywort
Onoclea sensibilis	Sensitive Fern
Osmunda cinnamomea	Cinnamon Fern

RELEASED - Printed documents may be obsolete; validate prior to use.

Terrestrial flora species observed during 1995 ecological risk assessment survey (Cont.)

Scientific Name	Common Name
Quercus virginiana	Live Oak
Rhododendron canescens	Wild Azalea
Rhododendron viscosum	Swamp Azalea
Rhus radicans	Poison Ivy
Rosa laevigata	Cherokee Rose
Rosa multiflora	Multiflora Rose
Rubus sp.	Blackberry
Rubus trivialis	Southern Dewberry
Sabal minor	Blue-stem Palmetto
Sagittaria sp.	Arrowhead
Salix nigra	Black Willow
Salvia lyrata	Lyre-leaved Sage
Sarracenia alata	Yellow Pitcher Plant
Scirpus sp.	Sedge
Senecio glabellus	Yellow-topped Butterweed
Smilax bona-nox	Bullbrier Greenbrier
Smilax sp.	Greenbrier
Smilax walteri	Red-berried Greenbrier
Solidago sp.	Goldenrod
Sonchus asper	Sow Thistle
Sphagnum sp.	Sphagnum
Symplocus tinctoria	Sweetleaf

RELEASED - Printed documents may be obsolete; validate prior to use.

Terrestrial flora species observed during 1995 ecological risk assessment survey (Cont.)

Scientific Name	Common Name
Quercus virginiana	Live Oak
Rhododendron canescens	Wild Azalea
Rhododendron viscosum	Swamp Azalea
Rhus radicans	Poison Ivy
Rosa laevigata	Cherokee Rose
Rosa multiflora	Multiflora Rose
Rubus sp.	Blackberry
Rubus trivialis	Southern Dewberry
Sabal minor	Blue-stem Palmetto
Sagittaria sp.	Arrowhead
Salix nigra	Black Willow
Salvia lyrata	Lyre-leaved Sage
Sarracenia alata	Yellow Pitcher Plant
Scirpus sp.	Sedge
Senecio glabellus	Yellow-topped Butterweed
Smilax bona-nox	Bullbrier Greenbrier
Smilax sp.	Greenbrier
Smilax walteri	Red-berried Greenbrier
Solidago sp.	Goldenrod
Sonchus asper	Sow Thistle
Sphagnum sp.	Sphagnum
Symplocus tinctoria	Sweetleaf

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC

Scientific Name	Common Name
Justicia americana	Water Willow
Acer rubrum	Red Maple
Echinodorus cordifolius	Creeping Burhead
Sagittaria calycina	Arrowhead
Sagittaria graminea	Grass-Leaved Arrowhead
Sagitarria lancifolia	Duck Potato
Alternanthera philoxeroides	Alligator Weed
Hypoxis leptocarpa	Swamp Stargrass
Rhus copallina	Dwarf Sumac
Rhus radicans	Poison Ivy
Rhus vernix	Poison Sumac
Centella asiatica	
Eryngium integrifolium	Eryngo
Eryngium yuccifolium	Rattlesnake Master
Hydrocotyle umbellata	Water Pennywort
Lilaeopsis sp.	Lilaeopsis
Oxypolis filiformis	Water Dropwort
Ilex ambigua	Largeleaf Holly
Ilex amelanchier	Juneberry Holly
Ilex coriacea	Large Gallberry
Ilex decidua	Possum Haw
Ilex glabra	Gallberry
Ilex myrtifolia	Myrtle-Leaf Holly
Ilex opaca	American Holly
Ilex vomitoria	Yaupon
Trachelospermum difforme	Climbing Dogbane
Aralia spinosa	Hercules Club

Terrestrial flora species observed during 1995 ecological risk assessment survey (Cont.)

Scientific Name	Common Name
Taxodium distichum	Bald Cypress
Teraxacum officinale	Dandelion
Thelypteris palustris	Marsh Fern
Trifolium sp.	Clover
Utricularia gibba	Humped Bladderwort
Vaccinium angustifolium	Lowbush Blueberry
Vaccinium elliotti	Elliot Blueberry
Vaccinium sp.	Blueberry
Valerianella olitoria	Corn salad
Viburnum sp.	Viburnum
Vicia angnitifolia	Narrow-leaved Vetch
Viola hirsutula	Southern Wood Violet
Viola primuliflua	Primrose Leaved Violet
Viburnum dentatum	Southern Arrowwood
Vitis sp.	Grape
Woodwardia areolata	Netted Chain Fern
Zigadenus glaberrimus	Southern Camas

Source: Final Ecological Risk Assessment, SSC, Foster Wheeler Environmental Corp., 4/96

Plant Species Documented at SSC

Scientific Name	Common Name
Justicia americana	Water Willow
Acer rubrum	Red Maple
Echinodorus cordifolius	Creeping Burhead
Sagittaria calycina	Arrowhead
Sagittaria graminea	Grass-Leaved Arrowhead
Sagitarria lancifolia	Duck Potato
Alternanthera philoxeroides	Alligator Weed
Hypoxis leptocarpa	Swamp Stargrass
Rhus copallina	Dwarf Sumac
Rhus radicans	Poison Ivy
Rhus vernix	Poison Sumac
Centella asiatica	
Eryngium integrifolium	Eryngo
Eryngium yuccifolium	Rattlesnake Master
Hydrocotyle umbellata	Water Pennywort
Lilaeopsis sp.	Lilaeopsis
Oxypolis filiformis	Water Dropwort
Ilex ambigua	Largeleaf Holly
Ilex amelanchier	Juneberry Holly
Ilex coriacea	Large Gallberry
Ilex decidua	Possum Haw
Ilex glabra	Gallberry
Ilex myrtifolia	Myrtle-Leaf Holly
Ilex opaca	American Holly
Ilex vomitoria	Yaupon
Trachelospermum difforme	Climbing Dogbane
Aralia spinosa	Hercules Club

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Sabal minor	Bluestem
Sabal palmetto	Cabbage Palm
Serenoa repens	Saw Palmetto
Asclepias lanceolata	Red Milkweed
Asclepias longifolia	Weak-Stemmed Milkweed
Thelypteris palustris	Marsh Fern
Ambrosia artemisiifolia	Ragweed
Arnoglossum ovatum	
Aster adnatus	Aster
Aster paludosus	Aster
Aster pilosus	Bushy Aster
Aster tortifolius	Aster
Baccharis halimifolia	Sea Myrtle
Balduina uniflora	Annual Bladuina
Bidens laevis	Bur Marigold
Bidens mitis	Beggar Tick
Bigelowia nudata	Rayless Goldenrod
Boltonia asteroides	Boltonia
Carphephorus odoratissimus	Deer Tongue
Carphephorus pseudolistris	
Chaptalia tomentosa	Sunbonnets
Chondrophora nudata	Rayless Goldenrod
Chrysopsis graminifolia	
Cirsium horridulum	Yellow Thistle
Conoclinum coelistinum	Pink Eupatorium
Coreopsis auriculata	Eared Coreopsis
Coreopsis lanceolata	Tickseed

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Coreopsis tinctoria	Calliopsis
Eclipta alba	No common name listed
Elephantopus elatus	Elephant's Foot
Elephantopus nudatus	Elephant's Foot
Erechtites hieracefolia	Fireweed
Erigeron canadensis	Horseweed
Erigeron philadelphicus	Philadelphia Fleabane
Erigeron vernus	Fleabane
Eupatorium capillifolium	Dog Fennel
Eupatorium coelestinum	Mistflower
Eupatorium leucolepis	Throughwort
Eupatorium rotundafolium	Throughwort
Eupatorium semiserratum	Throughwort
Gnaphalium obtusifolium	Rabbit Tobacco
Helenium amarum	Bitterweed
Helenium pinnatifidum	Sneezeweed
Helenium vernale	Spring Helenium
Helianthus angustifolius	Sunflower
Helianthus heterophyllus	Sunflower
Helianthus radula	Sunflower
Heiracium gronovil	Hawkweed
Heterotheca adenolepis	Grass-Leaved Golden Aster
Heterotheca mariana	Golden Aster
Heterotheca nervosa	Golden Aster
Krigia oppositifolia	Dandelion
Liatris earlei	Blazing Star
Liatris gracilis	Blazing Star

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Liatris graminifolia	Blazing Star
Mikania scandens	Climbing Hempweed
Pluchea foetida	Marsh Fleabane
Pluchea rosea	March Fleabane
Pyrrhopappus carolinianus	False Dandelion
Solidago altissima	Field Goldenrod
Solidago fistulosa	Goldenrod
Solidago gigantea	Goldenrod
Solidago tenuifolia	Goldenrod
Stokesia laevis	
Trilisia odoratissima	Vanilla Plant
Azolla caroliniana	Mosquito Fern
Betula nigra	Birch
Carpinus caroliniana	Blue Beech
Bignonia capreolata	Cross Vine
Campsis radicans	Trumpet Creeper
Catalpa bignonioides	Common Catalpa
Lepidium virginicum	Pepper Grass
Brasenia schreberi	Watershield
Cabomba caroliniana	Fanwort
Opuntia pusilla	Prickly Pear Cactus
Lobelia brevifolia	Lobelia
Lobelia floridana	Lobelia
Lobelia puberula	Purple Lobelia
Lonicera japonica	Japanese Honeysuckle
Sambucus canadensis	Elderberry
Viburnum dentatum	Southern Arrowood

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Viburnum nudum	Possum Haw
Viburnum rufidulum	Rusty Haw
Cerastium glomeratum	Mouse-Eared Chickweed
Cerastium nutans	Chickweed
Sagina decumbens	
Clethra alnifolia	Sweet Pepper Bush
Cuscata compacta	Dodder Vine
Dichondra carolinensis	
Ipomoea pandurata	Wild Potato Vine
Ipomoea quamoclit	Red Morning Glory
Jacquemontia tamnifolia	Jacquemontia
Cornus florida	Flowering Dogwood
Cornus stricta	Swamp Dogwood
Juniperus virginiana	Red Cedar
Carex folliculata	Sedge
Carex gigantea	Sedge
Carex glaucesens	Sedge
Carex louisianica	Sedge
Carex lurida	Sedge
Cyperus globulosus	Galingale
Cyperus odoratus	Fragrant Galingale
Cyperus pseudovegetus	Sedge
Dichromena colorata	White-Top Sedge
Dichromena latifolia	White-Top Sedge
Eleocharis cellulosa	Spike Rush
Eleocharis equisetoides	Spike Rush
Eleocharis macrocarpa	Spike Rush

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Eleocharis olivaceae	Spike Rush
Eleocharis quadrangulata	Square-Stemmed Spike Rush
Eleocharis tuberculosa	Spike Rush
Fimbristylis tomentosa	Marsh Sedge
Fuirena breviseta	Umbrella Grass
Fuirena squarrosa	Umbrella Grass
Rhyncospora cephalantha	Beak Rush
Rhyncospora chapmanii	Beak Rush
Rhyncospora ciliaris	Beak Rush
Rhyncospora compressa	Beak Rush
Rhyncospora corniculata	Beak Rush
Rhyncospora elliottii	Beak Rush
Rhyncospora filifolia	Beak Rush
Rhyncospora gracilenta	Beak Rush
Rhyncospora plumosa	Beak Rush
Scirpus californicus	Bulrush
Scirpus cyperinus	Bulrush
Scleria reticularis	Nut Rush
Scleria triglomerata	Nut Rush
Drosera capillaris	Sundew
Cyrilla racemiflora	Titi
Equisetum hyemale	Rough Horsetail
Diospyros virginiana	Persimmon
Cliftonia monophylla	
Gaylussacia dumosa	Dwarf Huckleberry
Gaylussacia mosiera	Huckleberry
Leucothoe axillaris	Dog Hobble

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Leucothoe racemosa	Fetterbush
Lyonia ferruginea	Rusty Lyonia
Lyonia ligustrina	Male Berry
Lyonia lucida	Fetterbush
Oxydendrum arboreum	Sourwood
Rhododendron serrulatum	Toothed Azalea
Rhododendron viscosum	Swamp Azalea
Vaccinium arboreum	Sparkleberry
Vaccinium darrowii	Farkleberry
Vaccinium elliottii	Elliott Blueberry
Vaccinium fuscatum	Blueberry
Vaccinium stamineum	Tall Deerberry
Eriocaulon compressum	Pipewort
Eriocaulon dacangulare	Pipewort
Lachnocaulon anceps	Bog Buttons
Acalypha gracilens	
Acalypha rhomboidea	
Croton capitatus	
Croton glandulosus	
Euphorbia corollata	Flowering Spurge
Euphorbia maculata	Eyebane
Euphorbia prostrata	Prostrate Spurge
Sapium sebiferum	Popcorn Tree
Sebastiana ligustrina	
Tragia urens	
Aeschynomene indica	Sensitive-joint-vetch
Albizia julibrissim	Mimosa

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Amorpha fruticosa	False Indigo
Apios americana	Ground Nut
Cassia fasciculata	Partridge Pea
Centrosema virginianum	Butterfly Pea
Crotalaria angulata	Rattlebox
Crotalaria sagittalis	Rabbit Bells
Crotalaria spectabilis	Showy Crotalaria
Desmodium rotundifolium	Beggar Lice
Erythrina herbacea	Cardinal Spear
Lespedeza cuneata	Bush Clover
Lespedeza striata	Japanese Clover
Rhynchosia reniformis	Dollar Weed
Robinia pseudoacacia	Black Locust
Strophostyles umbellata	Wild Bean
Tephrosia florida	Hoary Pea
Vigna luteola	
Castanea alnifolia	Trailing Chinquapin
Castanea pumila	Coastal Chinquapin
Fagus grandifolia	American Beech
Quercus alba	White Oak
Quercus falcata	Southern Red Oak
Quercus hemisphaerica	Darlington Oak
Quercus laurifolia	Laurel Oak
Quercus marilandica	Blackjack Oak
Quercus nigra	Water Oak
Quercus phellos	Willow Oak
Quercus stellata	Post Oak

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Quercus virginiana	Live Oak
Bartonia paniculata	Screw Stem
Sabatia brachiata	Rose Pink Sabatia
Sabatia campanulata	Narrow-Leaved Sabatia
Sabatia gentianoides	Upland Sabatia
Sabatia stellaris	Narrow-Leaved Sabatia
Geranium carolinianum	Carolina Cranesbill
Lachnanthes caroliniana	Redroot
Lophiola americana	Gold Crest
Myriophyllum pinnatum	Green Parrot-Feather
Proserpinaca pectinata	Mermaid Weed
Hamamelis virginiana	Witch Hazel
Liquidambar styraciflua	Sweetgum
Vallisneria americana	Eelgrass
Limnobium spongia	Frog's Bit
Hypericum brachyphyllum	St. John's Wort
Hypericum cistifolium	St. John's Wort
Hypericum crux-andreae	St. John's Wort
Hypericum denticulatum	St. John's Wort
Hypericum distifolium	St. John's Wort
Hypericum galioides	St. John's Wort
Hypericum gentianoides	Pineweed
Hypericum hypercoides	St. Andrew's Cross
Hypericum myrtifolium	
Hypericum nitidum	
Hypericum prolificum	
Hypericum stans	

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Illicium floridanum	St. Peter's Wort
Sissyrinchium albidum	Blue-Eyed Grass
Juncus biflorus	Rush
Juncus coriaceus	Rush
Juncus dichotomus	Rush
Juncus effusus	Soft Rush
Juncus marginatus	Rush
Juncus polycephalus	Rush
Juncus repens	Rush
Juncus roemerianus	Needle Rush
Juncus tenuis	Rush
Juncus validus	Rush
Carya aquatica	Water Hickory
Carya illinoensis	Pecan
Dracocephalum virginianum	Obedient Plant
Hyptis alata	Musky Mint
Lycopus rubellus	Horehound
Monarda punctata	Horse Mint
Salvia coccinea	Bee Balm
Salvia lyrata	Sage
Scutellaria intergrofloia	Skullcap
Trichostema dichotomum	Blue Curls
Persea borbonia	Red Bay
Persea palustris	Swamp Red Bay
Sassafras albidum	Sassafras
Lemna valdiviana	Duckweed
Pinguicula lutea	Yellow Butterwort

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Hibiscus aculeatus	Swamp Mallow
Sida rhombifolia	Indian Hemp
Rhexia alifanus	Smooth Meadow Beauty
Rhexia lutea	Yellow Meadow Beauty
Rhexia mariana	Pale Meadow Beauty
Rhexia petiolata	Yellow Meadow Beauty
Rhexia virginica	Common Meadow Beauty
Morus rubra	Red Mulberry
Myrica cerifera	Wax Myrtle
Myrica heterophylla	Black Bayberry
Najas guadalupensis	Bushy Pondweed
Nymphaea odorata	Water Lily
Nuphar luteum	Spatter Dock
Nyssa aquatica	Tupelo Gum
Nyssa biflora	Black Gum
Nyssa sylvatica	Tupelo
Fraxiinus caroliniana	Carolina Ash
Fraxinus pennsylvanica	Green Ash
Ligustrum sinense	Privet
Osmanthus americanus	Wild Olive
Ludwigia alternifolia	Primrose
Ludwigia decurrens	Primrose Willow
Ludwigia glandulosa	Primrose
Ludwigia hirtella	Primrose
Ludwigia leptocarpa	Primrose
Ludwigia linearis	False Loosestrife
Ludwigia maritima	Primrose

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Ludwigia octovalvis	Primrose
Ludwigia palustris	Marsh Purslane
Ludwigia pilosa	Primrose
Calopogon barbatus	Bearded Grass Pink
Calopogon pallidus	Pale Grass Pink
Calopogon pulchellus	Grass Pink
Calopogon tuberosus	Grass Pink
Cleistes divaricata	Rosebud Orchid
Habernaria ciliaris	Yellow-Fringed Orchid
Habenaria repens	Water Spider Orchid
Platanthera cristata	Crested Fringed Orchid
Pogonia ophioglossoides	Rose Pogonia
Spiranthes vernalis	Spring Ladies' Tresses
Osmunda cinnamomea	Cinnamon Fern
Osmunda regalis	Royal Fern
Phytolacca americana	Pokeweed
Pinus echinata	Shortleaf Pine
Pinus elliottii	Slash Pine
Pinus glabra	Spruce Pine
Pinus palustris	Longleaf Pine
Pinus taeda	Loblolly Pine
Plantago major	Plantain
Plantago virginica	Hoary Plantain
Plantanus occidentalis	Sycamore
Andropogon geradii	Bluestem
Andropogon glomeratus	Broomsedge
Andropogon scoparius	Little Bluestem

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Andropogon tener	Beardgrass
Andropogon virginicus	Broomsedge
Anthaenantia rufa	
Aristida affinis	Three Awn Grass
Aristida purpurescens	Three Awn Grass
Aristida stricta	Wire Grass
Aristida virgata	
Arundinaria gigantea	Cane
Chasmanthium laxum	
Chasmanthium nitidum	Spikegrass/Spanglegrass
Ctenium aromaticum	Toothache Grass
Dactyloctenium aegyptium	
Digitaria adscendens	Crabgrass
Digitaria sanguinalis	Crabgrass
Echinochloa colonum	Jungle Rice
Echiniochloa crusgalli	Barnyard Grass
Eragrostis refracta	Lovegrass
Eragostis spectabilis	Tumble-grass
Eremochloa ophiuroides	
Erianthus giganteus	Plumegrass
Hydrochloa carolinensis	
Leersia hexandra	Cutgrass
Manisuris rugosa	Jointgrasses
Muhlenbergia expansa	Muhly
Oplismenus setarius	Wood Grass
Panicum aciculare	Panic Grass
Panicum citiatum	Panic Grass

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Panicum consanguineum	Panic Grass
Panicum dichotomum	Panic Grass
Panicum lancearium	Panic Grass
Panicum longifolium	Panic Grass
Panicum anceps	Panic Grass
Panicum scabriusculum	Panic Grass
Panicum tenue	Switch Grass
Panicum verrucosum	Switch Grass
Panicum virgatum	Switch Grass
Paspalum floridanum	
Paspalum notatum	Bahia Grass
Paspalum praecox	
Paspalum urvillei	Vasey Grass
Poa sp.	Blue Grass
Polypogon monspeliensis	Rabbitfoot Grass
Stenotaphrum secundatum	St. Augustine Grass
Tridens ambiguus	Sandgrasses
Tridens strictus	Sandgrasses
Uniola laxa	Sea Oats
Uniola orinthorlyncum	Sea Oats
Polygala chamanii	Milkwort
Polygala cruciata	Drum Heads
Polygala cymosa	Tall Milkwort
Polygala lutea	Yellow Milkwort
Polygala nana	Low Bachelors Button
Polygala polygama	Large-Flowered Polygala
Polygala ramosa	Short Milkwort

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Panicum consanguineum	Panic Grass
Panicum dichotomum	Panic Grass
Panicum lancearium	Panic Grass
Panicum longifolium	Panic Grass
Panicum anceps	Panic Grass
Panicum scabriusculum	Panic Grass
Panicum tenue	Switch Grass
Panicum verrucosum	Switch Grass
Panicum virgatum	Switch Grass
Paspalum floridanum	
Paspalum notatum	Bahia Grass
Paspalum praecox	
Paspalum urvillei	Vasey Grass
Poa sp.	Blue Grass
Polypogon monspeliensis	Rabbitfoot Grass
Stenotaphrum secundatum	St. Augustine Grass
Tridens ambiguus	Sandgrasses
Tridens strictus	Sandgrasses
Uniola laxa	Sea Oats
Uniola orinthorlyncum	Sea Oats
Polygala chamanii	Milkwort
Polygala cruciata	Drum Heads
Polygala cymosa	Tall Milkwort
Polygala lutea	Yellow Milkwort
Polygala nana	Low Bachelors Button
Polygala polygama	Large-Flowered Polygala
Polygala ramosa	Short Milkwort

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Polygala racemase	Milkwort
Brunnichia ovata	Buckwheat Vine
Polygonum hydropiperoides	Water Pepper
Polygonum punctatum	Smartweed
Onoclea sensibilis	Sensitive Fern
Polypodium polypodioides	Resurrection Fern
Pteridium aquilinum	Bracken Fern
Woodwardia areolata	Netted Chain Fern
Woodwardia virginia	Virginia Chain Fern
Pontederia cordata	Pickerel Weed
Potamogeton nodosus	Pondweed
Samolus parviflorus	Water Pimpernel
Clematis crispa	Leather Flower
Clematis virginiana	Leather Flower
Ranunculus sceleratus	Celery-Leaf Buttercup
Berchemia scandens	Rattan Vine
Ceanothus americanus	New Jersey Tea
Aronia arbutifolia	Red Chokeberry
Crataegus marshallii	Parsley Hawthorn
Crataegus aestivalis	May Haw
Crataegus spathulata	Hawthorn
Malus angustifolius	Crabapple
Prunus serotina	Black Cherry
Pyrus communis	Pear
Rosa sp.	Rose
Rubus argutus	Highbush Blackberry
Rubus trivialis	Dewbery

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Cephalanthus occidentalis	Button Bush
Diodia teres	Button Weed
Diodia virginiana	Button Weed
Hedyotis boscii	Bluets
Houstonia caerulea	Bluets
Houstonia pusilla	Bluets
Mitchella repens	Partridge Berry
Olenlandia uniflora	
Richardia scabra	Mexican Clover
Populus deltoides	Common Cottonwood
Salix nigra	Black Willow
Drocera intermedia	Sundew
Sarracenia alata	Trumpet Pitcher Plant
Sarracenia flava	Trumpet Pitcher Plant
Sarracenia psittacina	Parrot Pitcher Plant
Saururus cernuus	Lizard's Tail
Itea virginica	Virginia Willow
Lygodium japonicum	Japanese Climbing Fern
Agalinis fasciculata	Gerardia
Agalinis linifolia	Gerardia
Agalinis tenuifolia	Gerardia
Bacopa monnieri	Smooth Water Hyssop
Bachneria floridana	Bluehearts
Buchnera americana	Bluehearts
Lindernia anagallidea	False Pimpernel
Mecardonia acuminata	
Micranthemum umbrosum	

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Smilax glauca	Wild Sarsaparilla
Smilax laurifolia	Laurel Greenbriar
Smilax pumila	Greenbriar
Smilax smallii	Greenbriar
Smilax walteri	Redberry Greenbriar
Solanum carolinense	Horse Nettle
Sparganium amercanum	Bur-Read
Melochia corchorifolia	Chocolate Weed
Styrax americana	American Snowbell
Styrax grandifolia	Storax
Symplocus tinctoria	Sweetleaf
Taxodium ascendens	Pond Cypress
Taxodium distichum	Bald Cypress
Chara braunii	
Typha latifolia	Cattail
Planera aquatica	
Boehmeria cylindrica	False Nettle
Valerianella radiata	Corn Salad
Callicarpa americana	American Beauty Berry
Lantana ovatifolia	
Lippia nodiflora	Lippia
Phyla nodiflora	
Verbena braziliensis	
Verbena tenuisecta	Moss Verbena
Viola primulifolia	Primrose-Leaved Violet
Ampelopsis arborea	Pepper Vine
Parthenocissus quinquefolia	Virginia Creeper

RELEASED - Printed documents may be obsolete; validate prior to use.

Plant Species Documented at SSC (Continued)

Scientific Name	Common Name
Vitis aestivalis	Summer Grape
Vitis labrusca	Fox Grape
Vitis rotundifolia	Muscadine
Xyris ambigua	Yellow-Eyed Grass
Xyris caroliniana	Yellow-Eyed Grass
Xyris jupacai	Yellow-Eyed Grass
Xyris stricta	Yellow-Eyed Grass

Sources: Cobb, B., 1963, A Field guide to the Ferns and Their Related Families of Northeastern and Central North America, Boston, Mass., Houghton Mifflin Company.

Duncan, W.H., and Foote, L.E., 1975, Wildflowers of the Southeastern United States, Athens, Ga., The University of Georgia Press.

Esher, R.J. and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, Stennis Space Center, Miss., Mississippi State University Research Center.

Petrides, G.A., 1972, A Field Guide to Coastal Wetland Plants of the Northeastern United Sates, Amherst, Mass., The University of Massachusetts Press.

Woosen, J.W., 1990, A Fall Botanical Survey of a Portion of the National Aeronautics and Space Administration Installation Stennis Space Center, Mississippi.

Appendix B

Fish and Wildlife Species Documented at SSC

During 1995 Ecological Risk Assessment Survey

RELEASED - Printed documents may be obsolete; validate prior to use.

Fish Species Documented during 1995 ecological risk assessment survey
(Sites 002, 006, and 011)

Common Name	Scientific Name
Bluegill Sunfish	*Lepomis macrochirus*
Green Sunfish	*Lepomis cyanellus*
Longear Sunfish	*Lepomis megalotis*
Redear Sunfish	*Lepomis microlophus*
Blackspotted Topminnow	*Fundulus olivaceus*
Blackstriped Topminnow	*Fundulus chrysotus*
Brook Silverside	*Labidesthes sicculus*
Emerald Shiner	*Notropis athedrinoides*
Rosefin Shiner	*Notropis ardens*
Mosquitofish	*Gambusia affinis*
Least Killifish	*Hjeterandria formosa*
Redfin Pickerel	*Esox americanus americanus*
Sharpfin Chubsucker	*Erimyzon tenuis*
Creek Chubsucker	*Erimyzon oblongus*
Spotted Gar	*Lepisosteus oculatis*
Threadfin Shad	*Dorosoma petenense*
Yellow Bullhead	*Ictalurus natalis*
Largemouth Bass	*Micropterus salmoides*
Hogchoker	*Trinectes maculatus*

Source: Final Ecological Risk Assessment, SSC, Foster Wheeler Environmental Corp., 4/96

RELEASED - Printed documents may be obsolete; validate prior to use.

Wildlife Species Documented during 1995 ecological risk assessment survey

Site 002

SCIENTIFIC NAME	COMMON NAME	1994[1]	1995[2]
Amphibians			
Eurycea longicauda	Longtail Salamander	x	
Plethodon mississippi	Mississippi Slimy Salamander	x	
Rana catesbeiana	Bullfrog	x	x
Rana clamitans	Green Frog		x
Hyla sp.	Treefrog		x
Hyla avivoca	Bird-Voiced Treefrog	x	
Hyla chrysoscelis	Cope's Gray Treefrog	x	
Hyla cinerea	Green Treefrog	x	
Hyla femoralis	Pine Woods Treefrog	x	
Hyla gratiosa	Barking Treefrog	x	
Hyla squirella	Squirrel Treefrog	x	
Acris sp.	Cricket Frog	x	
Pseudacris crucifer	Spring Peeper	x	
Pseudacris triseriata	Western Chorus Frog	x	
Bufo quercicus	Oak Toad	x	
Bufo terrestris	Southern Toad	x	
Bufo woodhousei	Fowler's Toad	x	
Reptiles			
Alligator mississippiensis	American Alligator		x
Chelydra serpentina	Florida Snapping Turtle		x
Trachemyes scripta	Slider	x	x
Apalone spinifera	Spiny Softshell	x	x
Terrapene carolina major	Gulf Coast Box Turtle		x
Terrapene carolina triunguis	Three Toed Box Turtle		x
Pseudemys concinna	River Cooter	x	
Pseudemys sp.	Cooter	x	
Anolis carolinensis	Green Anole	x	x
Sceloporus undulatus	Fence Lizard	x	x
Scincella lateralis	Ground Skink	x	x
Eumeces laticeps	Broad-Headed Skink	(?)	
Coluber constrictor	Black Racer		x
Thamnophis sauritus	Eastern Ribbon Snake		x
Agkistrodon piscivorus	Cottonmouth	x	x
Nerodia erythrogaster	Plainbelly Water Snake	x	
Birds			
Tribe cairinini	Wood Duck		x
Cathartes aura	Turkey Vulture		x

RELEASED - Printed documents may be obsolete; validate prior to use.

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 002 (cont.)

Birds cont'd			
Meleagris gallopavo	Wild Turkey		x
Ardea herodias	Great Blue Heron		x
Elanoides mississippiensis	Mississippi Kite	x	
Charadrius vociferus	Killdeer		x
Melanerpes carolinus	Red-bellied Woodpecker	x	x
Picoides pubescens	Downy Woodpecker	x	
Dryocopus pileatus	Pileated Woodpecker	x	
Hirundo rustica	Barn Swallow		x
Corvus brachyrhynchos	American Crow	x	
Corvus ossifragus	Fish Crow		x
Cyanocitta cristata	Blue Jay	x	
Parus carolinensis	Carolina Chickadee	x	x
Thryothorus ludovicianus	Carolina Wren		x
Parus bicolor	Tufted Titmouse	x	
Sitta pusilla	Brown-Headed Nuthatch	x	
Mimus polyglottos	Northern Mockingbird		x
Dumetella carolinensis	Gray Catbird		x
Vireo griseus	White-eyed Vireo	x	x
Vireo olivaceus	Red-eyed Vireo		x
Dendroica pinus	Pine Warbler	x	x
Wilsonia citrina	Hooded Warbler	x	
Geothlypis trichas	Common Yellowthroat		x
Cardinalis cardinalis	Northern Cardinal	x	x
Cardvelis tristis	American Goldfinch		x
Piranga rubra	Summer Tanager	x	
Hylocicla mustelina	Wood Thrush	x	
Polioptila caerulea	Blue-Gray Gnatcatcher	x	
Mammals			
Sciurus niger	Fox Squirrel		x
Castor canadensis	American Beaver	x	x
Lutra canadensis	River Otter	x	
Canis familiaris	Domestic Dog		x
Canis latrans	Coyote	x	
Odocoileus virginianus	White-tailed Deer	x	x
Procyon lotor	Raccoon	x	x
Felis concolor coryi	Florida Panther		
Felis rufus	Bobcat	x	
Dasypus novemcinctus	Nine-Banded Armadillo	x	

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 002 (cont.)

Mammals cont'd			
Didelphis virginiana	Virginia Opossum	x	
Myocaster coypus	Nutria	x	
Scalopus aquaticus	Eastern Mole	x	
Neotoma floridana	Eastern Woodrat	x	
Peromyscus gossypinus	Cotton Mouse	x	
Sylvilagus sp.	Rabbit	x	

[1] Observed during 1994 Spring (Lago, 1994) and Summer (Keiser, 1994) Surveys
[2] Observed during 1995 Spring Site Characterization for Ecological Risk Assessment

RELEASED - Printed documents may be obsolete; validate prior to use.

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 006

SCIENTIFIC NAME	COMMON NAME	1994[1]	1995[2]
Amphibians			
Amphiuma means	Two-toed Amphiuma	x	
Eurycea longicauda	Longtail Salamander	x	
Rana catesbeiana	Bullfrog	x	x
Rana clamitans	Green Frog	x	
Rana utricularia	Southern Leopard Frog	x	
Hyla avivoca	Bird-Voiced Treefrog	x	
Hyla chrysoscelis	Cope's Gray Treefrog	x	
Hyla cinerea	Green Treefrog	x	
Hyla femoralis	Pine Woods Treefrog	x	
Hyla squirella	Squirrel Treefrog	x	
Acris sp.	Cricket Frog	x	
Pseudacris crucifer	Spring Peeper	x	
Bufo terrestris	Southern Toad	x	
Bufo valliceps	Gulf Coast Toad	x	
Bufo woodhousei	Fowler's Toad	x	
Gastrophryne carolinensis	Eastern Narrowmouth Toad	x	
Reptiles			
Scincella lateralis	Ground Skink	x	x
Agkistrodon piscivorus	Cottonmouth		x
Agkistrodon contortrix	Copperhead	x	
Coluber constrictor	Black Racer	x	
Elaphe obsoleta	Black Rat Snake	x	
Nerodia cyclopion	Mississippi Green Water Snake		
Nerodia erythrogaster	Plainbelly Water Snake	x	
Nerodia fasciata	Southern Water Snake	x	
Nerodia rhombifer	Diamondback Water Snake	x	
Opheodrys aestivus	Rough Green Snake	x	
Chelydra serpentina	Florida Snapping Turtle	x	
Graptemys oculifera	Ringed Map Turtle	x	
Terrapene carolina	Box Turtle	x	
Pseudemys floridana	Cooter	x	
Pseudemys sp.	Cooter	x	
Trachemyes scripta	Slider	x	
Birds			
Casmerodius albus	Common Egret		x
Bubulcus ibis	Cattle Egret		x
Butorides striatus	Green Heron	x	x

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 006 (cont.)

Birds cont'd			
Strix varia	Barred Owl	x	x
Buteo platypterus	Broad-Winged Hawk	x	
Chaetura pelagica	Chimney Swift	x	x
Melanerpes carolinus	Red-bellied Woodpecker	x	x
Melanerpes erythrocephalus	Red-headed Woodpecker		x
Dryocopus pileatus	Pileated Woodpecker	x	
Picoides pubescens	Downy Woodpecker	x	
Corvus ossifragus	Fish Crow	x	
Corvus brachyrhynchos	American Crow	x	x
Parus carolinensis	Carolina Chickadee	x	x
Parus bicolor	Tufted Titmouse	x	x
Dendroica caerulescens	Black-throated Blue Warbler		x
Dendroica pinus	Pine Warbler	x	x
Dendroica dominica	Yellow-Throated Warbler	x	
Protonotaria citrea	Prothonotary Warbler	x	
Wilsonia citrina	Hooded Warbler	x	
Cardinalis cardinalis	Northern Cardinal	x	x
Polioptila caerulea	Blue-Gray Gnatcatcher	x	
Vireo griseus	White-eyed Vireo	x	
Vireo olivaceus	Red-eyed Vireo	x	
Vireo flavifrons	Yellow-Throated Vireo	x	
Parula americana	Northern Parula	x	
Piranga rubra	Summer Tanager	x	
Elanoides mississippiensis	Mississippi Kite	x	
Mammals			
Odocoileus virginianus	White-tailed Deer	x	
Canis latrans	Coyote	x	
Ursus americanus luteolus	Louisiana Black Bear	x	
Blarina carolinensis	Southern Short-Tailed Shrew	x	
Sylvilagus aquaticus	Swamp Rabbit		x
Castor canadensis	American Beaver	x	
Procyon lotor	Raccoon	x	
Myocaster coypus	Nutria		x
Dasypus novemcinctus	Nine-Banded Armadillo	x	
Sciurus niger	Fox Squirrel	x	
Neotoma floridana	Eastern Woodrat	x	
Peromyscus gossypinus	Cotton Mouse	x	
Vulpes vulpes	Red Fox	(?)	

[1] Observed during 1994 Spring (Lago, 1994) and Summer (Keiser, 1994) Surveys
[2] Observed during 1995 Spring Site Characterization for Ecological Risk Assessment

RELEASED - Printed documents may be obsolete; validate prior to use.

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 007

SCIENTIFIC NAME	COMMON NAME	1994[1]	1995[2]
Amphibians			
Eurycea longicauda	Longtail Salamander	x	
Eurycea quadridigitata	Dwarf Salamander	x	
Plethodon mississippi	Mississippi Slimy Salamander	x	
Acris sp.	Cricket Frog	x	
Rana catesbeiana	Bullfrog	x	x
Rana clamitans	Green Frog	x	
Rana utricularia	Southern Leopard Frog	x	
Hyla sp.	Treefrog		x
Hyla avivoca	Bird-Voiced Treefrog	x	
Hyla chrysoscelis	Cope's Gray Treefrog	x	
Hyla cinerea	Green Treefrog	x	
Hyla femoralis	Pine Woods Treefrog	x	
Hyla squirella	Squirrel Treefrog	x	
Pseudacris crucifer	Spring Peeper	x	
Pseudacris triseriata	Western Chorus Frog	x	
Bufo terrestris	Southern Toad	x	x
Bufo woodhousei	Fowler's Toad	x	
Reptiles			
Terrapene carolina	Box Turtle	x	
Gopherus polyphemus	Gopher Tortoise	x	
Anolis carolinensis	Green Anole	x	x
Sceloporus undulatus	Fence Lizard	x	x
Scincella lateralis	Ground Skink	x	x
Coluber constrictor	Black Racer		x
Elaphe obsoleta	Black Rat Snake		x
Lampropeltis getula holbrooki	Speckled King Snake		x
Agkistrodon piscivorus	Cottonmouth		x
Diadophis punctatus	Ringneck Snake	x	
Heterodon platyrhinos	Eastern Hognose Snake	x	
Birds			
Coragyps atratus	Black Vulture		x
Melanerpes carolinus	Red-bellied Woodpecker	x	x
Picoides pubescens	Downy Woodpecker	x	
Dryocopus pileatus	Pileated Woodpecker	x	
Myiarchus crinitus	Great-Crested Flycatcher	x	
Cyanocitta cristata	Blue Jay	x	x
Parus bicolor	Tufted Titmouse	x	x
Dendroica pinus	Pine Warbler	x	x
Vireo griseus	White-eyed Vireo		x

RELEASED - Printed documents may be obsolete; validate prior to use.

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 007 (cont.)

Birds cont'd			
Cardinalis cardinalis	Northern Cardinal	x	x
Corvus brachyrhynchos	American Crow	x	
Piranga rubra	Summer Tanager	x	
Mammals			
Sciurus carolinensis	Gray Squirrel	x	x
Sciurus niger	Fox Squirrel	x	
Mephitis sp.	Skunk		x
Odocoileus virginianus	White-tailed Deer	x	x
Dasypus novemcinctus	Nine-Banded Armadillo	x	
Didelphis virginiana	Virginia Opossum	x	
Procyon lotor	Raccoon	x	
Sus scrofa	Wild Pig	(?)	
Sylvilagus sp.	Rabbit	x	

[1] Observed during 1994 Spring (Lago, 1994) and Summer (Keiser, 1994) Surveys
[2] Observed during 1995 Spring Site Characterization for Ecological Risk Assessment

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 011

SCIENTIFIC NAME	COMMON NAME	1994[1]	1995[2]
Amphibians			
Acris gryllus	Southern Cricket Frog		x
Acris sp.	Cricket Frog	x	
Hyla avivoca	Bird-Voiced Treefrog	x	
Hyla chrysoscelis	Cope's Gray Treefrog	x	
Hyla cinerea	Green Treefrog	x	
Hyla squirella	Squirrel Treefrog	x	
Pseudacris crucifer	Spring Peeper	x	
Pseudacris triseriata	Western Chorus Frog	x	
Bufo terrestris	Southern Toad		x
Bufo valliceps	Gulf Coast Toad	x	
Bufo woodhousei	Fowler's Toad	x	
Rana utricularia	Southern Leopard Frog	x	x
Rana catesbeiana	Bullfrog		x
Rana clamitans	Green Frog	x	
Reptiles			
Eumeces anthracinus pluvialis	Coal Skink		x
Scincella lateralis	Ground Skink		x
Elaphe obsoleta	Black Rat Snake		x
Coluber constrictor	Black Racer	x	
Nerodia erythrogaster	Plainbelly Water Snake	x	
Birds			
Egretta thula	Snowy Egret		x
Egretta tricolor	Louisania Heron		x
Charadrius vociferus	Killdeer		x
Chaetura pelagica	Chimney Swift		x
Ceryle alcyon	Belted King Fisher		x
Melanerpes carolinus	Red-bellied Woodpecker		x
Stelgidopteryx serripennis	Rough-winged Swallow		x
Progne subis	Purple Martin	x	x
Corvus brachyrhynchos	American Crow	x	x
Parus carolinensis	Carolina Chickadee		x
Parus bicolor	Tufted Titmouse	x	x
Mimus polyglottos	Northern Mockingbird	x	x
Sialia sialis	Eastern Bluebird		x
Cyanocitta cristata	Blue Jay	x	
Regulus calendula	Ruby-crowned Kinglet		x
Dendroica caerulescens	Black-throated Blue Warbler		x

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Site 011 (cont.)

Birds cont'd			
Dendroica pinus	Pine Warbler		x
Cardinalis cardinalis	Northern Cardinal	x	x
Pipilo erythrophthalmus	Rufous-sided Towhee		x
Sitta pusilla	Brown-Headed Nuthatch	x	
Mimus polyglottos	Northern Mockingbird	x	
Tyrannus tyrannus	Eastern Kingbird	x	
Sturnus vulgaris	European Starling	x	
Myiarchus crinitus	Great-Crested Flycatcher	x	
Mammals			
Ondatra zibethicus	Muskrat		x
Mephitis sp.	Skunk		x
Procyon lotor	Raccoon		x
Odocoileus virginianus	White-tailed Deer	x	x
Dasypus novemcinctus	Nine-Banded Armadillo	x	
Felis catus	Domestic Cat	x	

1. Observed during 1994 Spring (Lago, 1994) and Summer (Keiser, 1994) Surveys
2. Observed during 1995 Spring Site Characterization for Ecological Risk Assessment

RELEASED - Printed documents may be obsolete; validate prior to use.

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Corridors Between Sites

SCIENTIFIC NAME	COMMON NAME	1994[1]	1995[2]
Amphibians			
Notophthalmus viridescens	Eastern Newt	x	
Reptiles			
Alligator mississippiensis	American Alligator	x	
Deirochelys reticularia	Chicken Turtle	x	
Kinosternon subrubrum	Eastern Mud Turtle	x	
Macroclemys temmincki	Alligator Snapping Turtle	x	
Eumeces fasciatus	Five-Lined Skink	x	
Ophisaurus ventralis	Eastern Glass Lizard	x	
Lampropeltis getula	Common Kingsnake	x	
Regina rigida	Glossy Crayfish Snake	x	
Birds			
Ardea herodias	Great Blue Heron	x	
Buteo platypterus	Broad-Winged Hawk	x	
Nycticorax violaceus	Yellow-Crowned Night Heron	x	
Strix varia	Barred Owl	x	
Meleagris gallopavo	Wild Turkey	x	
Coccyzus americanus	Yellow-Billed Cuckoo	x	
Caprimulgus carolinensis	Chuck-Will's Widow	x	
Colinus virginianus	Northern Bobwhite	x	
Chaetura pelagica	Chimney Swift	x	
Colaptes auratus	Northern Flicker	x	
Dryocopus pileatus	Pileated Woodpecker	x	
Melanerpes carolinus	Red-bellied Woodpecker	x	
Picoides pubescens	Downy Woodpecker	x	
Agelaius phoeniceus	Red-Winged Blackbird	x	
Guiraca caerulea	Blue Grosbeak	x	
Corvus brachyrhynchos	American Crow	x	
Corvus ossifragus	Fish Crow	x	
Cyanocitta cristata	Blue Jay	x	
Parus bicolor	Tufted Titmouse	x	
Thyrothorus ludovicianus	Carolina Wren	x	
Polioptila caerulea	Blue-Gray Gnatcatcher	x	
Myiarchus crinitus	Great-Crested Flycatcher	x	
Empidonax virescens	Acadian Flycatcher	x	
Vireo griseus	White-eyed Vireo	x	
Vireo olivaceus	Red-eyed Vireo	x	
Vireo flavifrons	Yellow-Throated Vireo	x	
Dendroica pinus	Pine Warbler	x	
Wilsonia citrina	Hooded Warbler	x	

RELEASED - Printed documents may be obsolete; validate prior to use.

Wildlife Species Documented during 1995 ecological risk assessment survey (cont.)

Corridors Between Sites (cont.)

Protonotaria citrea	Prothonotary Warbler	x	
Cardinalis cardinalis	Northern Cardinal	x	
Parula americana	Northern Parula	x	
Geothlypis trichas	Common Yellowthroat	x	
Pipilo erythrophthalmus	Rufous-sided Towhee	x	
Sialia sialis	Eastern Bluebird	x	
Piranga rubra	Summer Tanager	x	
Hylocicla mustelina	Wood Thrush	x	
Passerina cyanea	Indigo Bunting	x	
Progne subis	Purple Martin	x	
Mimus polyglottos	Northern Mockingbird	x	
Toxostoma rufum	Brown Thrasher	x	
Parus carolinensis	Carolina Chickadee	x	
Tyrannus tyrannus	Eastern Kingbird	x	
Mammals			
Mephitis mephitis	Striped Skunk	x	
Sylvilagus aquaticus	Swamp Rabbit	x	

[1] Observed during 1994 Spring (Lago, 1994) and Summer (Keiser, 1994) Surveys
[2] Observed during 1995 Spring Site Characterization for Ecological Risk Assessment

Appendix C

Aquatic Species Documented at SSC

RELEASED - Printed documents may be obsolete; validate prior to use.

Fish Species Documented at SSC in 1988 Survey

Scientific Name	Common Name
Pearl River	
Acipenser oxyrhynchus	Atlantic Sturgeon
Alosa chrysochloris	Slipjack Herring
Fundulus notatus	Blackstriped Topminnow
Fundulus olivaceus	Blackspotted Topminnow
Gambusia affinus	Mosquitofish
Heterandria formosa	Least Killifish
Ictalurus furcatus	Blue Catfish
Ictalurus punctatus	Channel Catfish
Labidesthes sicculus	Brook Silverside
Lepisosteus oculatus	Spotted Gar
Ictiobus niger	Black Buffalo
Lepomis macrochirus	Bluegill
Lepomis megalotis	Longear Sunfish
Lepomis microlophus	Redear Sunfish
Micropterus salmoides	Largemouth Bass
Mugil cephalus	Striped Mullet
Notropis texanus	Weed Shiner
Notropis venustus	Blacktail Shiner
Pogonis cromis	Black Drum
Strongylura marina	Atlantic Needlefish
Trinectes maculatus	Hogchoker
Access Canals	
Archosargus probatocephalus	Sheepshead
Dorosoma cepedianum	Gizzard Shad
Esox niger	Chain Pickerel
Fundulus chrysotus	Golden Topminnow

Fish Species Documented at SSC in 1988 Survey (Continued)

Scientific Name	Common Name
Gambusia affinis	Mosquitofish
Hererandria formosa	Least Killifish
Ictalurus furcatus	Blue Catfish
Ictalurus punctatus	Channel Catfish
Lepisosteus oculatus	Spotted Gar
Lepisosteus osseus	Longnose Gar
Lepomis macrochirus	Bluegill
Lepomis marginatus	Dollar Sunfish
Lepomis microlophus	Redear Sunfish
Lepomis punctatus	Spotted Sunfish
Micropterus salmoides	Largemouth Bass
Minytrema melonops	Spotted Sucker
Morone mississippiensis	Yellow Bass
Mugil cephalus	Striped Mullet
Pomaxis annularis	White Crappie
Pomaxis nigromaculatus	Black Crappie
Lion Branch and Wolf Branch	
Aphredoderus sayanus	Pirate Perch
Centrarchus macropterus	Flyer
Elassoma zonatum	Banded Pygmy Sunfish
Erimyzon sucetta	Lake Chubsucker
Esox americanus	Grass Pickerel
Fundulus notti	Starhead Topminnow
Gambusia affinis	Mosquitofish
Ictalurus melas	Black Bullhead
Lepomis cyanellus	Green Sunfish
Lepomis gulosus	Warmouth

RELEASED - Printed documents may be obsolete; validate prior to use.

Fish Species Documented at SSC in 1988 Survey (Continued)

Scientific Name	Common Name
Lepomis macrochirus	Bluegill
Lepomis marginatus	Dollar Sunfish
Notemigonus crysoleucus	Golden Shiner
Pteronotropis welaka	Bluenose Shiner
Aphredoderus sayanus	Pirate Perch
Elassoma zonatum	Banded Pigmy Sunfish
Erimyzon tenuis	Sharpfin Chubsucker
Esox americanus	Grass Pickerel
Fundulus chrysotus	Golden Topminnow
Lepomis gulosus	Warmouth
Lepomis marginatus	Dollar Sunfish
Location Near Pumphouse for SSME Test Complex	
Etheostoma fusiforme barratti	Swamp Darter
Fundulus chrysotus	Golden Topminnow
Gambusia affinis	Mosquitofish
Heterandria formosa	Least Killifish
Lepomis glyosus	Warmouth
Lepomis macrochirus	Bluegill
Lepomis marginatus	Dollar Sunfish
Lepomis microlophus	Redear Sunfish
Micropterus salmoides	Largemouth Bass

Source: Esher, R.J. and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, Stennis Space Center, Miss., Mississippi State University Research Center.

RELEASED - Printed documents may be obsolete; validate prior to use.

Amphibian Species Documented at SSC

Scientific Name	Common Name
Frogs and Toads	
Acris crepitans crepitans	Northern Cricket Frog
Acris gryllus	Southern Cricket Frog
Bufo quercicus	Oak Toad
Bufo terrestris	Southern Toad
Bufo valliceps	Gulf Coast Toad
Bufo woodhousei	Woodhouse's Toad
Gastrophryne carolinensis	Eastern Narrowmouth Toad
Hyla avivoca	Bird-Voiced Treefrog
Hyla chrysoscelis	Gray Treefrog
Hyla cinerea	Green Treefrog
Hyla femoralis	Pine Woods Treefrog
Hyla gratiosa	Barking Treefrog
Hyla squirella	Squirrel Treefrog
Pseudacris crucifer	Spring Peeper
Pseudacris triseriata	Western Chorus Frog
Rana catesbeiana	Bullfrog
Rana clamitans clamitans	Bronze Frog
Rana clamitans melanota	Green Frog
Rana grylio	Pip Frog
Rana utricularia	Southern Leopard Frog
Salamanders	
Ambystoma opacum	Marbled Salamander
Amphiuma means	Two-Toed Amphiuma
Eurycea longicauda	Long-Tailed Salamander
Notopthalmus viridescens	Central Newt
Plethodon glutinosus	Slimy Salamanderu

Source: Esher, R.J. and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, Stennis Space Center, Miss., Mississippi State University Research Center.

Keiser, E.D., and Lago, P.K., 1991, Survey of the Amphibians, Reptiles, Birds, and Mammals on the 3,000 Acre Stennis Space Center ASRM Site Final Report, University, Miss., University of Mississippi.

RELEASED - Printed documents may be obsolete; validate prior to use.

Aquatic Reptile Species Documented at SSC

Scientific Name	Common Name
Turtles	
Apalone sp.	Softshelled Turtles
Chelydra serpentina	Common Snapping Turtle
Deirochelys reticularia	Chicken Turtle
Gopherus polyphemus	Gopher Tortoise
Graptemys sp.	Map Turtle
Kinosternon subrubrum	Mud Turtle
Kinosternon odoratum	Stinkpot Turtle
Pseudemys concinna	Eastern River Cooter
Terrapene carolina	Gulf Coast Box Turtle
Trachemys scripta elegans	Red-Eared Slider
Trachemys scripta scripta	Yellow-Bellied Slider
Snakes	
Agkistrodon piscivorus	Eastern Cottonmouth
Nerodia erythrogaster	Yellowbelly Water Snake
Nerodia fasciata confluens	Broad-Banded Water Snake
Nerodia fasciata fasciata	Banded Water Snake
Nerodia rhombifera	Diamondback Water Snake
Regina rigida sinicola	Gulf Crayfish Snake

Source: Esher, R.J. and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, Stennis Space Center, Miss., Mississippi State University Research Center.

Keiser, E.D., and Lago, P.K., 1991, Survey of the Amphibians, Reptiles, Birds, and Mammals on the 3,000 Acre Stennis Space Center ASRM Site Final Report, University, Miss., University of Mississippi.

RELEASED - Printed documents may be obsolete; validate prior to use.

Appendix D

Terrestrial Species Documented at SSC

RELEASED - Printed documents may be obsolete; validate prior to use.

Terrestrial Reptile Species Documented at SSC

Scientific Name	Common Name
Snakes	
Agkistrodon contortrix	Southern Copperhead
Coluber constrictor	Southern Black Rager
Elaphe guttata	Corn Snake
Elaphe obsoleta	Gray Rat Snake
Heterodon platyrhinos	Eastern Hognose Snake
Lampropeltis getula	Speckled Kingsnake
Opheodrys aestivus	Rough Green Snake
Sistrurus miliarius	Dusky Pigmy Rattlesnake
Storeria dekayi	Midland Brown Snake
Storeria occipitamaculata	Red-Bellied Snake
Thamnophis sauritus	Eastern Ribbon Snake
Lizards	
Anolis carolinensis	Green Anole
Eumeces fasciatus	Five-Lined Skink
Eumeces inexpectatus	Southeastern Five-Lined Skink
Eumeces laticeps	Broad-Headed Skink
Scincella lateralis	Ground Skink
Sceloporus undulatus	Fence Lizard
Crocodilians	
Alligator mississippiensis	American Alligator

Sources: Esher, R.J. and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, Stennis Space Center, Miss., Mississippi State University Research Center.

Keiser, E.D. and Lago, P.K., 1991, Survey of the Amphibians, Reptiles, Birds, and Mammals on the 3,000 Acre Stennis Space Center ASRM Site Final Report, University, Miss., University of Mississippi.

RELEASED - Printed documents may be obsolete; validate prior to use.

Mammal Species Documented at SSC

Scientific Name	Common Name
Blarina carolinensis	Southern Short-Tailed Shrew
Canis familiaris	Domestic Dog
Canis latrans	Coyote
Castor canadensis	Beaver
Dasypus novemcinctus	Nine-Banded Armadillo
Didelphis virginiana	Common Opossum
Felis catus	Domestic Cat
Felis rufus	Bobcat
Lasiurus borealis	Red Bat
Lutra canadensis	River Otter
Mephitis mephitis	Striped Skunk
Mus musculus	House Mouse
Myocaster coypus	Nutria
Neotoma floridana	Eastern Wood Rat
Ochrotomys nuttali	Golden Mouse
Odocoileus virginianus	White-Tailed Deer
Ondatra zibethecus	Muskrat
Oryzomys palustris	Rice Rat
Peromyscus gossypinus	Cotton Rat
Peromyscus leucopus	White-Footed Mouse
Procyron lotor	Raccoon
Reithrodontomys humulis	Eastern Harvest Mouse
Scalopus aquaticus	Eastern Mole
Sciurus carolinensis	Gray Squirrel
Sciurus niger	Fox Squirrel
Sigmodon hispidus	Cotton Rat
Sorex longirostris	Southeastern Shrew

RELEASED - Printed documents may be obsolete; validate prior to use.

Mammal Species Documented at SSC (Continued)

Scientific Name	Common Name
Spilogale putorius	Spotted Skunk
Sus scrofa	Domestic Pig
Sylvilagus aquaticus	Swamp Rabbit
Sylvilagus floridanus	Eastern Cottontail
Ursus americanus	Black Bear
Vulpes fulva	Red Fox

Sources: Esher, R.J. and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, Stennis Space Center, Miss., Mississippi State University Research Center.

Keiser, E.D. and Lago, P.K., 1991, Survey of the Amphibians, Reptiles, Birds, and Mammals on the 3,000 Acre Stennis Space Center ASRM Site Final Report, University, Miss., University of Mississippi.

Bird Species Documented at SSC

Scientific Name	Common Name	Occurrence	Abundance
*Podilymbus podiceps**	Pied-Billed Grebe	Permanent	Common
*Podiceps auritus**	Horned Grebe	Winter	Uncommon
*Phalacrocorax auritus**	Double-Crested Cormorant	Permanent	Uncommon
Anhinga anhinga	Anhinga	Permanent	Rare
*Ardea herodias**	Great Blue Heron	Permanent	Uncommon
*Butorides striatus**	Green-Backed Heron	Spring/Summer	Uncommon
Egretta caerulea	Little Blue Heron	Permanent	Uncommon
Bubulcus ibis	Cattle Egret	Spring	Rare
*Casmerodius albus**	Great Egret	Permanent	Common
*Egretta thula**	Snowy Egret	Winter	Common
Egretta rufescens	Reddish Egret	Spring	Rare
Egretta tricolor	Tricolored Heron	Permanent	Rare
Nycticorax nycticorax	Black-Crowned Night Heron	Winter	Rare
Ixobrychus exilis	Least Bittern	Spring	Uncommon
Eudocimus albus	White Ibis	Spring	Rare
*Anas platyrhynchos**	Mallard	Permanent	Uncommon
*Anas rubripes**	American Black Duck	Permanent	Rare
Anas fulvigula	Mottled Duck	Summer/Fall	Rare
*Nycticorax violaceus**	Yellow-Crowned Night Heron	Spring	Rare
*Anas strepera**	Gadwall	Winter	Rare
Anas acuta	Common Pintail	Winter	Rare
*Anas discors**	Blue-Winged Teal	Spring	Uncommon
Anas clypeata	Northern Shoveler	Winter	Rare

RELEASED - Printed documents may be obsolete; validate prior to use.

Birds Species Documented at SSC (Continued)

Scientific Name	Common Name	Occurrence	Abundance
*Aix sponsa**	Wood Duck	Summer	Common
Aythya collaris	Ring-Necked Duck	Winter	Common
Aythya affinis	Lesser Scaup	Winter	Uncommon
Mergus serrator	Red-Breasted Merganser	Winter	Rare
*Cathartes aura**	Turkey Vulture	Permanent	Uncommon
*Coraglypus atratus**	Black Vulture	Permanent	Uncommon
Accipter striatus	Sharp-Shinned Hawk	Winter	Rare
Accipter cooperii	Copper's Hawk	Permanent	Rare
*Buteo jamaicensis**	Red-Tailed Hawk	Permanent	Rare
*Buteo lineatus**	Red-Shouldered Hawk	Permanent	Rare
Circus cyaneus	Northern Harrier	Winter	Rare
Haliaeetus leucocephalus	Bald Eagle	Permanent	Rare
*Pandion haliaetus**	Osprey	Permanent	Rare
*Falco sparverius**	American Kestrel	Permanent	Rare
Buteo platypterus	Broad-Winged Hawk	Summer	Uncommon
Pandion haliaetus	American Swallow-Tailed Kite	Summer	Uncommon
*Colinus virginianus**	Northern Bobwhite	Permanent	Common
*Meleagris gallopavo**	Wild Turkey	Permanent	Common
*Rallus elegans**	King Rail	Permanent	Rare
Rallus longirostris	Clapper Rail	Winter	Rare
Porozana carolina	Sora	Winter	Rare
*Gallinula chloropus**	Common Gallinule	Permanent	Common
Porphyrula martinica	Purple Gallinule	Summer	Rare

RELEASED - Printed documents may be obsolete; validate prior to use.

Birds Species Documented at SSC (Continued)

Scientific Name	Common Name	Occurrence	Abundance
*Fulica americana**	American Coot	Winter	Common
*Charadrius vociferus**	Killdeer	Permanent	Uncommon
Bartramia longicauda	Upland Sandpiper	Winter	Rare
Tringa melanoleuca	Greater Yellowlegs	Winter	Rare
Tringa flavipes	Lesser Yellowlegs	Winter	Rare
Tringa solitaria	Solitary Sandpiper	Winter	Rare
Actitus cacularia	Spotted Sandpiper	Permanent	Rare
Gallinago gallinago	Common Snipe	Winter	Uncommon
Larus delawarensis	Ring-Billed Gull	Permanent	Rare
*Larus atricilla**	Laughing Gull	Permanent	Rare
Sternaa antillarum	Least Tern	Summer	Rare
Sterna caspia	Caspian Tern	Permanent	Rare
*Columba livia**	Rock Dove	Permanent	Uncommon
*Zenaida macroura**	Mourning Dove	Permanent	Uncommon
*Coccyzus americanus**	Yellow-Billed Cuckoo	Summer	Common
Otus asio	Eastern Screech Owl	Permanent	Rare
*Strix varia**	Barred Owl	Permanent	Uncommon
Caprimulgus carolinensis	Chuck-Will's Widow	Summer	Uncommon
*Chordeiles monor**	Common Nighthawk	Summer	Uncommon
*Chaetura pelagica**	Chimney Swift	Summer	Common
*Archilocus colubris**	Ruby-Throated Hummingbird	Spring	Uncommon
*Ceryle alcyon**	Belted Kingfisher	Permanent	Uncommon
*Caloptes auratus**	Northern Flicker	Permanent	Uncommon

Birds Species Documented at SSC (Continued)

Scientific Name	Common Name	Occurrence	Abundance
*Dryocopus pileatus**	Pileated Woodpecker	Permanent	Uncommon
*Melanerpes carolina**	Red-Bellied Woodpecker	Pecker	Common
*Melanerpes erythrocephalus**	Red-Headed Woodpecker	Permanent	Rare
Sphyrapicus varius	Yellow-Bellied Sapsucker	Winter	Rare
*Picoides villosus**	Hairy Woodpecker	Permanent	Rare
*Picoides pubescens**	Downy Woodpecker	Permanent	Common
*Tyrannus tyrannus**	Eastern Kingbird	Summer	Common
*Myiarchus crinitus**	Great-Crested Flycatcher	Summer	Common
Sayornis phoebe	Eastern Phoebe	Winter	Uncommon
*Tachycineta bicolor**	Tree Swallow	Winter	Common
Stelgydopterix serripennis	Norther Rough-Winged Swallow	Summer	Common
*Hirundo rustica**	Barn Swallow	Summer	Uncommon
*Progne subis**	Purple Martin	Summer	Uncommon
*Cyanocitta cristata**	Blue Jay	Permanent	Common
Corvus brachyrhynhos	American Crow	Permanent	Common
*Corvus ossifragus**	Fish Crow	Spring/Summer	Rare
*Parus carolinensis**	Carolina Chickadee	Permanent	Common
*Parus bicolor**	Tufted Titmouse	Permanent	Common
*Sitta pusilla**	Brown-Headed Nuthatch	Permanent	Uncommon
Troglodytes aedon	House Wren	Winter	Rare
*Thyrothorus ludovicianus**	Carolina Wren	Permanent	Common
Cistothorus platensis	Sedge Wren	Winter	Rare

RELEASED - Printed documents may be obsolete; validate prior to use.

Birds Species Documented at SSC (Continued)

Scientific Name	Common Name	Occurrence	Abundance
*Mimus polyglottus**	Nothern Mockingbird	Permanent	Uncommon
*Dumetella carolinensis**	Gray Catbird	Permanent	Uncommon
*Toxostoma rufum**	Brown Thrasher	Permanent	Common
Turdus migratorius	American Robin	Winter	Common
*Hylocicla mustelina**	Wood Thrush	Summer	Uncommon
Catharus guttatus	Hermit Thrush	Winter	Rare
Catharus minimus	Gray-Cheeked Thrush	Winter	Rare
*Sialia caerulea**	Eastern Bluebird	Permanent	Common
*Polioptila caerulea**	Blue-Gray Gnatcatcher	Permanent	Uncommon
Regulus satrapa	Golden-Crowned Kinglet	Winter	Rare
*Regulus calendula**	Ruby-Crowned Kinglet	Winter	Common
Bombycilla cedrorum	Cedar Waxwing	Winter	Uncommon
*Lanius ludovicianus**	Loggerhead Shrike	Permanent	Uncommon
*Sturnus vulgaris**	European Starling	Permanent	Common
*Vireo griseus**	White-Eyed Vireo	Permanent	Common
*Vireo flavifrons**	Yellow-Throated Vireo	Spring	Common
Vireo solitarius	Solitary Vireo	Winter	Rare
*Vireo olivaceus**	Red-Eyed Vireo	Spring	Uncommon
*Protonotaria citrea**	Prothonotary Warbler	Summer	Rare
*Parula americana**	Nothern Parula	Summer	Common
*Dendroica coronata**	Yellow-Rumped Warbler	Winter	Common

RELEASED - Printed documents may be obsolete; validate prior to use.

Birds Species Documented at SSC (Continued)

Scientific Name	Common Name	Occurrence	Abundance
*Dendroica pinus**	Pine Warbler	Permanent	Common
*Dencdroica discolor**	Prairie Warbler	Summer	Uncommon
Dendroica palmarum	Palm Warbler	Winter	Rare
*Dendroica dominica**	Yellow-Throated Warbler	Summer	Rare
*Geothlypis tricas**	Common Yellowthroat	Permanent	Uncommon
*Icteria virens**	Yellow-Breasted Chat	Summer	Common
*Wilsonia citrina**	Hooded Warbler	Summer	Uncommon
Vermivora pinus	Blue-Winged Warbler	Winter	Rare
*Sternella magna**	Eastern Meadowlark	Permanent	Uncommon
*Agelaius phoeniceus**	Red-Winged Blackbird	Permanent	Uncommon
*Icterius spurius**	Orchard Oriole	Summer	Uncommon
*Quiscalus major**	Boat-Tailed Grackle	Spring	Uncommon
*Quiscalus quiscula**	Common Grackle	Permanent	Uncommon
*Molothrus ater**	Brown-Headed Cowbird	Permanent	Uncommon
*Piranga rubra**	Summer Tanager	Summer	Rare
*Cardinalis cardinalis**	Nothern Cardinal	Permanent	Common
*Guiraca caerulea**	Blue Grosbeak	Summer	Uncommon
Pheucticus ludovicaianus	Rose-Breasted Grosbeak	Winter	Rare
Passerina cyanea	Indigo Bunting	Summer	Rare
Carduelis tristis	American Goldfinch	Winter	Uncommon
*Pipilo erythrophthalmus**	Rufous-sided Towhee	Permanent	Common

Birds Species Documented at SSC (Continued)

Scientific Name	Common Name	Occurrence	Abundance
*Dendroica pinus**	Pine Warbler	Permanent	Common
*Dencdroica discolor**	Prairie Warbler	Summer	Uncommon
Dendroica palmarum	Palm Warbler	Winter	Rare
*Dendroica dominica**	Yellow-Throated Warbler	Summer	Rare
*Geothlypis tricas**	Common Yellowthroat	Permanent	Uncommon
*Icteria virens**	Yellow-Breasted Chat	Summer	Common
*Wilsonia citrina**	Hooded Warbler	Summer	Uncommon
Vermivora pinus	Blue-Winged Warbler	Winter	Rare
*Sternella magna**	Eastern Meadowlark	Permanent	Uncommon
*Agelaius phoeniceus**	Red-Winged Blackbird	Permanent	Uncommon
*Icterius spurius**	Orchard Oriole	Summer	Uncommon
*Quiscalus major**	Boat-Tailed Grackle	Spring	Uncommon
*Quiscalus quiscula**	Common Grackle	Permanent	Uncommon
*Molothrus ater**	Brown-Headed Cowbird	Permanent	Uncommon
*Piranga rubra**	Summer Tanager	Summer	Rare
*Cardinalis cardinalis**	Nothern Cardinal	Permanent	Common
*Guiraca caerulea**	Blue Grosbeak	Summer	Uncommon
Pheucticus ludovicaianus	Rose-Breasted Grosbeak	Winter	Rare
Passerina cyanea	Indigo Bunting	Summer	Rare
Carduelis tristis	American Goldfinch	Winter	Uncommon
*Pipilo erythrophthalmus**	Rufous-sided Towhee	Permanent	Common

Birds Species Documented at SSC (Continued)

Scientific Name	Common Name	Occurrence	Abundance
*Aimophilo aestivalis**	Bachman's Sparrow	Permanent	Uncommon
Junco hymalis	Dark-Eyed Junco	Winter	Common
Spizella passerina	Chipping Sparrow	Winter	Rare
Zonotrichia albicollis	White-Throated Sparrow	Winter	Uncommon
*Melospiza georgiana**	Swamp Sparrow	Winter	Common
Melospiza melodia	Song Sparrow	Winter	Uncommon

*Species nests at SSC

Sources: Esher, R.J. and Bradshaw, D.K., 1988, An Ecological Survey of the SSC Area Potentially Impacted by an Advanced Solid Rocket Motor Manufacturing and Test Facility, Stennis Space Center, Miss., Mississippi State University Research Center.
Keiser, E.D. and Lago, P.K., 1991, Survey of the Amphibians, Reptiles, Birds, and Mammals on the 3,000 Acre Stennis Space Center ASRM Site Final Report, University, Miss., University of Mississippi.
Peterson, R.T., 1980, A Field Guide to the Birds, Boston, Mass., Houghton Mifflin Company.

RELEASED - Printed documents may be obsolete; validate prior to use.

Appendix E

Wildlife Inventories and Habitat Evaluation at Stennis Space Center, Mississippi
2001 – 2002

submitted by

Dr. Jeanne Jones, Associate Professor

Dr. Jimmy Taylor, Research Assistant

Russell Singleton, Wildlife Technician

Phillip Hanberry, Wildlife Technician

Sabrina Clark, Wildlife Technician

Forest and Wildlife Research Center

Mississippi State University

April 2002

In cooperation with the Department of Forestry

Forest and Wildlife Research Center

Mississippi State University

RELEASED - Printed documents may be obsolete; validate prior to use.

Introduction

Inventories to determine abundance, distribution, and species richness of selected wildlife species were conducted at Stennis Space Center (SSC), Mississippi from March 2001 through March 2002. This biological monitoring and inventory is a component of the forest and wildlife diversity study being conducted for SSC by the Department of Forestry and the Department of Wildlife and Fisheries of Mississippi State University. To date, surveys for white-tailed deer (*Odocoileus virginianus*), bird species richness, and vegetation composition at bird survey points have been completed. Wildlife inventory information will be used to integrate wildlife conservation and recreation with forest management on the land base and to develop baseline data on bird and deer populations for use in monitoring biological communities over time.

Spotlight Surveys for White-tailed Deer

Spotlight surveys were conducted during March 2001 and February and March 2002 along 10 routes at SSC, Mississippi to establish baseline data on the abundance of white-tailed deer. Although spotlight surveys were planned for December 2001 through March 2002, surveys were actually conducted during February and March due to increased security needs at SSC following terrorist events of September 2001. Spotlight surveys were conducted at night using high intensity beam spotlights. All deer observed were recorded and classified according to general age class (fawn and adults) and sex (Tables 1, 2, and 3). Because spotlight surveys were conducted in late winter/early spring after many bucks may have shed their antlers, the number of does recorded may be overestimated, because antlerless deer were classified as does. Based on this year's data, sex ratios of observed deer were estimated at 7:93 (7% bucks and 93% does). Young of year deer were categorized as fawns and represented 6.3% of the observed deer (Table 1). The mean number of deer ranged from 0.2 deer/mile on Canal Strip to 7.1 deer/mile on Main Line Road. Highest numbers of deer were observed along Main Line Road, Saturn Drive, Trent Lott Drive, and Old Highway 43. Due to deer numbers detected, potential for vehicle-deer strike are highest along these routes.

Significantly fewer deer were recorded during 2002 survey period, as compared to 2001. The mean number of deer ranged from 0 deer/mile on several routes including Sewage Lagoon and Upper Gainesville in February and Lower Gainesville in March to 4.4 deer/mile on Main Line Road in February. Routes that exhibited the highest number of deer in February 2002 included Main Line Road,Trent Lott South, and Saturn Drive. Routes that exhibited the highest number of deer during March 2002 were Trent Lott South and Upper Gainesville, Saturn Drive, and Old Highway Although fewer deer were detected in 2002 than in 2001, buck:doe ratios were still dominated by does. Does comprised 90% or more of the surveyed population during the two-year survey period. However, our counts may be biased in favor of does due to the secrecy of bucks, subsequent lower visibility, and observer error in recognizing spike bucks from a distance. Additionally, as previously mentioned, February and March surveys were conducted when some bucks may have shed their antlers. However, even if a 10% to 15% bias is assumed toward a higher number of does, doe composition would comprise from 70%-75% to 85%-89% of the installation herd. Although 50:50 sex ratios are difficult to attain and maintain, sex ratios

approaching this ratio are desired in a well managed deer herd. Harvest of does is generally a method of attaining a more balanced sex ratio. Increasing harvest pressure on does over a number of years could lower the proportion of does to bucks in the population and reduce deer population growth at SSC. High doe numbers relative to bucks will cause late breeding in the herd, later born fawns and younger deer during the onset of the next year's hunting season, and high reproduction that may increase deer numbers above the habitat's carrying capacity. High concentrations of deer over time may increase the potential for the outbreak of epizootic diseases, such as epizootic hemorrhagic disease (Davidson and Nettles 1988). Additionally, high deer densities may negatively impact hardwood regeneration, pine regeneration, vegetation diversity, midstory structure, and habitat quality for many other wildlife species, such as songbirds and upland gamebirds.

The following goals are recommended for SSC deer herd management:

1) Limit deer-vehicle collisions along highly traveled installation roadways;
2) Maintain a healthy deer herd and limit the incidence of epizootic disease outbreaks (i.e. blue tongue, tuberculosis, anthrax, hoof and mouth disease);
3) Create a sex ratio closer to 50:50 by increasing harvest of mature does;
4) Provide a recreational use resource for wildlife recreationists;
5) Maintain a database of hunter harvest data, spotlight counts, and spring health check data to determine population and health trends in the RSA deer population;
6) Limit deer impacts to ornamental plantings, forest regeneration, planting hardwood seedlings, native plant diversity, and game/nongame bird food plants.

Primary recommendations advanced to attain these goals are as follows:

1) Continue spotlight counts along permanently-established routes and maintain a database of annually collected spotlight count data to compare deer population trends over time.
2) Implement a health check program of SSC deer each year in cooperation with wildlife biologists from the Mississippi Department of Wildlife, Fisheries, and Parks. For these health checks, deer are generally harvested during early spring (March). Parameters to be collected on harvested deer should include age, lactation, fetal counts and age, body fat, body weight, and evidence of disease.
3) Consider and study the feasibility of implementing a controlled deer harvest of mature does in areas of high deer densities through implementation of primitive weapons seasons, such as bow/arrow and black powder weapons. Careful planning of hunting seasons and hunter access is necessary due to security and safety requirements at SSC.
4) If harvests are allowed at SSC, the following information should be collected and maintained in a database for determining deer herd demographics over time.
    a) dressed and live body weight
    b) lactation status (does)
    c) antler characteristics (bucks)

d) age class

Determining Deer Population Trends

Several methods in combination are required to ascertain deer herd health and population status. Estimates of deer relative abundance, trends in age structure and recruitment, and deer herd health can be obtained using spotlight counts, analysis of hunter harvest data if harvest is implemented, and a deer health check, respectively. A deer health check should be conducted in March through authorized harvest of a minimum of 10 does. This check is recommended primarily to ascertain lactation rates, in utero-fetal counts, and approximate time of conception. This information can provide important information about herd recruitment potential and effects of existing buck-doe ratios prior to the next hunting season. The Mississippi Department of Wildlife, Fisheries, and Parks should be contacted to organize and implement these health checks.

Although analysis of harvest data does not provide a direct population estimate, hunter harvest data can be useful in monitoring herd health over time. Summary and analysis of the aforementioned parameters within age classes allows biologists to determine the general physical condition of deer on the land base and provides clues concerning deer numbers and habitat carrying capacity. Slight shifts in body condition from year to year can indicate subtle changes and generally should not cause concern. However, if declines in body weight, lactation rates, and antler size are observed over several years, deer densities may be exceeding habitat carrying capacity.

The best age class for determining herd health is the 1.5 year-old age class, because at this age the deer are actively growing and are sensitive to food shortages and low food quality. The range of live body weights desired for bucks and does in the Lower Gulf Coastal Plain and Coastal Flatwoods Soil Resource Areas of Mississippi is provided in Mississippi Deer Data Report published by the Mississippi Department of Wildlife, Fisheries, and Parks. Weights of 1.5 year old bucks on lands in these soil resource areas where quality deer management has been implemented averaged from 98 lbs. to 115 lbs. live weight from 1991 through 1999; whereas, average live weights of 1.5-year old does ranged from 76 lbs. to 91 lbs. Currently, limited information is available on body weights of deer inhabiting SSC. However, if hunter harvest or health checks are implemented, body weight information should be collected on each harvested deer.

Lactation rates detected in harvested does are another parameter that can impart information on herd reproduction and recruitment. In general, 1.5 year old does may exhibit lactation rates ranging from 10 to 25% in a growing herd; 2.5 year old does generally exhibit higher rates ranging from approximately 50% to 60%, and 3.5 year old does generally have lactation rate greater than 60% (MDWFP 2000). Lower than normal lactation rates in does may indicate that reproduction is declining in a deer herd. Declines in herd reproduction may be due to a number of factors; however, when deer populations exceed the habitat's carrying capacity,

reproduction and natality rates may decline due to limited food resources, reduced habitat quality, and lower doe health status.

Differences in lactation rates from year to year may be a function of sample size; however, if analysis of lactation rates over the hunting seasons reveal a trend toward lower lactation rates and production of fewer offspring. Additionally, evidence of lactation tends to become less visible from September to January. This information is important in interpreting lactation data since does collected late (December and January) in the hunting season may no show physical evidence of lactation despite having nursed fawns during the previous breeding season. Therefore, does harvested within the same time periods should be compared when assessing year to year trends in lactation rates. Harvest of does during the fall through the winter and inspection for lactation is necessary to evaluate trends in reproduction. Additionally, spring health checks are needed to determine specific conception dates for unborn fawns.

The number of deer detected was greatest during 2001. The number of deer observed during the 2002 was significantly fewer than observed numbers in 2001. Reasons for fewer deer being detected in 2002 are as follows:

1) Deer population levels in 2002 were lower than in 2001
2) Deer were less visible along roads and in roadside habitats during 2002 due to increased disturbance along roads or increased food supplies in forest interiors. Inspection of habitat in forests yielded no evidence of increased food supplies in 2002 over 2001.
3) Limited access to test areas. Selected routes included portions of test areas where deer were generally concentrated in high numbers. Increased security in 2002 limited spotlight surveys in these areas.

Despite lower numbers detected in 2002, the number of young-of-year deer was very low and does numbers still comprised over 80% of the sampled population. However, it is important to note that detection of fawns and bucks may be under estimated in our sample due to the timing of spotlight surveys. However, detected bucks still retained both antlers at the time of our 2001 and 2002 surveys, and fawns or young –of-year deer were discernable in 2001. Based on this, we believe that fawns were limited in 2002 and does still comprised at least 70% of the population instead of the recommended 50%. The limited number of young-of-year deer, the dominance of does in the population, and the lower number of deer suggest that the SSC deer herd may be exceeding habitat carrying capacity and exhibiting slower reproduction rates. Additional surveys in future years should detect trends in deer herd population levels. In addition to spotlight surveys, we recommend a deer health check to investigate lactation rates, doe pregnancy rates, fetus conception dates, and deer demographics and health status (age class, body weight, and percent body fat).

Table 1. Results of deer spotlight count surveys conducted at NASA Stennis Space Center, Mississippi during March 2001.

Transect Number	Number of Miles	Road/Route Name	Survey Date	Number of Deer		
				Fawns	Does	Bucks (Antler Points)
1	1.0 mile	Trent Lott Dr.	3-6-01	0	3	0
1	1.0 miles	Trent Lott	3-7-01	0	6	0
1	1.0 mile	Trent Lott	3-8-01	0	11	0
Total					20	0
Mean					6.7	0
Deer/mile					6.7	0
2	0.8 miles	Main Line	3-6-01	0	11	0
2	0.8 miles	Main Line Rd	3-7-01	0	6	0
2	0.8 miles	Main Line	3-8-01	0	0	0
Total					17	0
Mean					5.7	0
Deer/mile					7.1	0
3	2.1 miles	Upper Gainsville	3-6-01	0	1	0
3	2.1 miles	Upper Gainsville	3-7-01	0	2	0
3	2.1 miles	Upper Gainsville	3-8-01	0	4	0
Total					7	0
Mean					2.3	0
Deer/mile					1.1	0
4	1.1 miles	Lower Gainsville	3-6-01	0	1	0
4	1.1 miles	Lower Gainsville	3-7-01	0	2	0
4	1.1 miles	Lower Gainsville	3-8-01	0	2	0
Total					5	0
Mean					1.7	0
Deer/mile					1.6	0
5	2.25 miles	Trent Lott South	3-6-01	0	6	0
5	2.25 miles	Trent Lott South	3-7-01	0	10	0
5	2.25 miles	Trent Lott South	3-8-01	0	10	0
Total					26	0
Mean					8.7	0
Deer/mile					3.8	0

Table 1. (continued)

Transect Number	Number of Miles	Road/Route Name	Survey Date	Number of Deer		
				Fawns	Does	Bucks (Antler Points)
6	.75 miles	Sewage Lagoon	3-6-01	0	2	0
6	.75 miles	Sewage Lagoon	3-7-01	0	0	0
6	.75 miles	Sewer Lagoon	3-8-01	0	0	0
Total					2	0
Mean					0.7	0
Deer/mile					0.9	0
7	3.0 miles	Saturn Dr.	3-6-01	2	15	2 (6-points)
7	3.0 miles	Saturn Dr.	3-7-01	0	13	2 (6-points)
7	3.0 miles	Saturn Dr.	3-8-01	5	28	2 (6-points)
Total				7	56	6
Mean				2.3	18.7	2
Deer/mile				0.8	6.2	0.7
8	2.3 miles	ASRM	3-6-01	0	0	0
8	2.3 miles	ASRM	3-7-01	0	1	0
8	2.3 miles	ASRM	3-8-01	0	8	0
Total					9	0
Mean					3	0
Deer/mile					1.3	0
9	1.9 miles	Old Hwy. 43	3-6-01	0	9	0
9	1.9 miles	Old Hwy. 43	3-7-01	0	11	1 (6-points) 1 spike
9	1.9 miles	Old Hwy 43	3-8-01	4	16	0
Total				4	36	2
Mean				1.3	12	0.7
Deer/mile				0.7	6.3	0.4
10	1.8 miles	Canal Strip	3-6-01	0	1	0
10	1.8 miles	Canal Strip	3-7-01	0	0	0
10	1.8 miles	Canal Strip	3-8-01	0	0	0
Total				0	1	0
Mean				0	0.3	0
Deer/mile				0	0.2	0

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 2. Results of deer spotlight count surveys conducted at NASA Stennis Space Center, Mississippi during February 2002.

Transect Number	Number of Miles	Road/Route Name	Survey Date	Number of Deer		
				Fawns	Does	Bucks (Antler Points)
1	1.0 mile	Trent Lott Dr.	2-22-02	0	0	1 (4-points)
1	1.0 miles	Trent Lott Dr.	2-23-02	0	2	1 (4-points)
Total				0	2	1 (4-points)
Mean				0	1	0.5
Deer/mile				0	1	0.5
2	0.8 miles	Main Line	2-22-02	0	3	
2	0.8 miles	Main Line Rd	2-23-02	0	4	0
Total				0	7	0
Mean				0	3.5	0
Deer/mile				0	4.4	0
3	2.1 miles	Upper Gainsville	2-22-02	0	0	0
3	2.1 miles	Upper Gainsville	2-23-02	0	0	0
Total				0	0	0
Mean				0	0	0
Deer/mile				0	0	0
4	1.1 miles	Lower Gainsville	2-22-02	0	0	0
4	1.1 miles	Lower Gainsville	2-23-02	0	1	0
Total				0	1	0
Mean				0	0.5	0
Deer/mile				0	0.5	0
5	2.25 miles	Trent Lott South	2-22-02	0	6	0
5	2.25 miles	Trent Lott South	2-23-02	0	3	0
Total				0	9	0
Mean				0	4.5	0
Deer/mile				0	2	0
6	.75 miles	Sewer Lagoon	2-22-02	0	0	0
6	.75 miles	Sewer Lagoon	2-23-02	0	0	0
Total				0	0	0
Mean				0	0	0
Deer/mile				0	0	0
7	3.0 miles	Saturn Dr.	3-6-01	0	4	1 (8-points)
7	3.0 miles	Saturn Dr.	3-7-01	0	7	1 (8-points)
Total				0	11	1 (same buck both nights)
Mean				0	5.5	1
Deer/mile				0	1.8	0.34

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 2. (continued)

Transect Number	Number of Miles	Road/Route Name	Survey Date	Number of Deer		
				Fawns	*Does*	*Bucks* **(Antler Points)**
8	2.3 miles	ASRM	2-22-02	0	2	0
8	2.3 miles	ASRM	2-23-02	0	6	0
Total				0	8	0
Mean				0	4	0
Deer/mile				0	1.7	0
9	1.9 miles	Old Hwy. 43	2-22-02	0	1	0
9	1.9 miles	Old Hwy. 43	2-23-02	0	3	0
Total				0	4	0
Mean				0	2	0
Deer/mile				0	1.1	0
10	1.8 miles	Canal Strip	2-22-02	0	2	0
10	1.8 miles	Canal Strip	2-23-02	0	0	0
Total				0	2	0
Mean				0	1	0
Deer/mile				0	0.6	0

RELEASED - Printed documents may be obsolete; validate prior to use.

Table 3. Results of deer spotlight count surveys conducted at NASA Stennis Space Center, Mississippi during March 2002.

Transect Number	Number of Miles	Road/Route Name	Survey Date	Number of Deer		
				Fawns	Does	Bucks (Antler Points)
1	1.0 mile	Trent Lott Dr.	3-1-01	0	0	0
1	1.0 miles	Trent Lott	3-2-01	0	0	0
1	1.0 mile	Trent Lott	3-2-01	0	3	0
Total				0	3	0
Mean				0	1	0
Deer/mile				0	1	0
2	0.8 miles	Main Line	3-1-01	0	0	0
2	0.8 miles	Main Line Rd	3-2-01	0	0	0
2	0.8 miles	Main Line	3-3-01	0	2	0
Total				0	2	0
Mean				0	0.7	0
Deer/mile				0	0.8	0
3	2.1 miles	Upper Gainsville	3-1-01	0	0	0
3	2.1 miles	Upper Gainsville	3-2-01	0	8	1 (6-points)
3	2.1 miles	Upper Gainsville	3-3-01	0	0	0
Total					8	1
Mean					2.7	0.33
Deer/mile					1.3	0.22
4	1.1 miles	Lower Gainsville	3-1-01	0	0	0
4	1.1 miles	Lower Gainsville	3-2-01	0	0	0
4	1.1 miles	Lower Gainsville	3-3-01	0	0	
Total				0	0	0
Mean				0	0	0
Deer/mile				0	0	0
5	2.25 miles	Trent Lott South	3-1-01	0	2	0
5	2.25 miles	Trent Lott South	3-2-01	0	4	0
5	2.25 miles	Trent Lott South	3-3-01	0	5	0
Total				0	11	0
Mean				0	3.4	0
Deer/mile				0	1.63	0

Table 3. (continued)

Transect Number	Number of Miles	Road/Route Name	Survey Date	Number of Deer		
				Fawns	Does	Bucks (Antler Points)
6	.75 miles	Sewage Lagoon	3-1-01	0	1	1 (6-points)
6	.75 miles	Sewage Lagoon	3-2-01	1	1	0
6	.75 miles	Sewage Lagoon	3-3-01	1	1	0
Total				2	3	1
Mean				0.7	1	0.33
Deer/mile				0.9	1.33	0.44
7	3.0 miles	Saturn Dr.	3-1-01	0	0	0
7	3.0 miles	Saturn Dr.	3-2-01	0	4	0
7	3.0 miles	Saturn Dr.	3-3-01	0	3	0
Total				0	7	0
Mean				0	2.3	0
Deer/mile				0	0.8	0
8	2.3 miles	ASRM	3-1-01	0	0	0
8	2.3 miles	ASRM	3-2-01	0	0	0
8	2.3 miles	ASRM	3-3-01	0	0	0
Total					0	0
Mean					0	0
Deer/mile					0	0
9	1.9 miles	Old Hwy. 43	3-1-01	0	2	0
9	1.9 miles	Old Hwy. 43	3-2-01	0	1	0
9	1.9 miles	Old Hwy 43	3-3-01	0	3	0
Total				0	6	0
Mean				0	2	0
Deer/mile				0	1.1	0
10	1.8 miles	Canal Strip	3-1-01	0	0	0
10	1.8 miles	Canal Strip	3-2-01	0	0	0
10	1.8 miles	Canal Strip	3-3-01	0	0	0
Total				0	0	0
Mean				0	0	0
Deer/mile				0	0	0

RELEASED - Printed documents may be obsolete; validate prior to use.

Bird Inventory

Methods

We used the random selection feature in the ArcView GIS Animal Movement extension to select 100 monitoring points from an existing database of forestry inventory plots throughout SSC (Hooge and Eichenlaub 1997). Point count stations were randomly selected within major forest-habitat types identified during the forest inventory conducted by MSU forestry staff in winter-spring 2001. The 3 major forest types (pine, pine-hardwood, and hardwood) were further categorized by 2 size major classes (pulpwood and sawtimber). Points were ground-truthed to ensure that each was representative of a single habitat type. Point count stations were required to be at least 50 m from the edge of the featured habitat type; therefore, some randomly selected points did not meet this criteria and were not sampled due to the potential influence of adjacent habitat types on detected bird communities. Inaccessibility prohibited sampling north of the fee area.

Fifty-six points were retained within the fee area and 7 were retained in restorationsites south of the fee area, for a total of 63 point count stations selected for sampling.
We conducted standardized 10-minute, fixed radius point counts during May, 2001. All birds seen or heard within a 100-m radius around each point center were recorded (Ralph et al. 1995). Point count surveys were completed within the first 3 hours after sunrise. Each point was visited once from 1-8 May 2001. Point count stations were placed at a minimum distance of $\geq$250 meters apart to ensure independence of observations (Ralph et al. 1995).

We quantified total bird abundance as the total number of birds of all species detected/point, and reported species richness as the total number of bird species observed/point. Additionally, we grouped points within the same habitat type to report species richness across timber size classes. Bird numbers and species richness within major habitat types are indicated in Table 4. A total of 56 species of birds were identified during the May 2001 surveys. The most common species of birds occurring on most habitats of SSC were Northern Cardinals, American Crows, Tufted Titmice, Yellow-breasted Chats, White-eyed Vireos, and Red-bellied Woodpeckers.

A number of birds with Partners-in-Flight (PIF) scores of 18 or greater occurred on SSC. Partners-in-Flight (PIF) is an international-national conservation cooperative including professional avian biologists and natural resource planners from state and federal agencies and non-governmental organizations. This organization addresses bird conservation, monitoring of birds populations, and bird population status. Concern scores are assigned to birds by PIF based on population status and trends. Higher conservation scores reflect species population declines on a local, regional, or global basis and emphasize greater conservation needs. Species with 19 or greater PIF scores found on SSC included Acadian Flycatcher, Brown-headed Nuthatch, Carolina Chickadee, Eastern Kingbird, Eastern Meadowlark, Fish Crow, Field Sparrow, Gray Catbird, Great-creasted Flycatcher, Hooded Warbler, Kentucky Warbler, Northern Bobwhite, Northern Parula, Pine Warbler, Prothonotary Warbler, Red-bellied Woodpecker, Summer

Tanager, Swainson's Warbler, White-eyed Vireo, Wood Thrush, Yellow-billed Cuckoo, Yellow-throated Warbler, and Yellow-throated Vireo. Habitat evaluation and analysis was conducted to provide habitat use criteria and conservation approaches for these species and species associates. This information will be used to develop bird conservation recommendations that will be integrated with forestry management at SSC.

The highest bird species richness was recorded in mature pine forests with a total of 46 species being detected. Detection of a higher species richness may be due, in part, to the greater number of point count stations in this habitat type. However, many mature pine forests at SSC exhibit diverse habitat conditions. Understory conditions range from a dominance of herbaceous understory to a dominance of midstory shrub and vine species (Table 6). Grassland species, such as the Northern Bobwhite were found in these habitats; whereas, midstory foragers and nesters, such as White-eyed Vireos, Northern Cardinals, and Yellow-breasted Chats, were common in areas with abundant shrubs and woody vines, especially near bayhead and seepage habitats.

Additionally, wetlands and pine savannah habitats located within mature pine forest contributed to the overall bird diversity of this habitat type, because of the microhabitat effects of wetlands on plant communities and habitat diversity within pine forests. Bird species, such as Purple Gallinules herons and egrets, were found in pine forest due to the presence of wetlands, specifically. Additionally, species that would usually inhabit mature pine forests, such as Pine Warblers, Chipping Sparrows and Brown-headed Nuthatches, were recorded in moist soil, savannah sites dominated by a herbaceous understory and pine overstory. Birds that were most abundant ($\geq$ 5 recorded) in mature pine forests included Northern Bobwhite Quail, American Crow, Fish Crow, Mourning Dove, Brown-headed Nuthatch, Carolina Wren, Eastern Towhee, Indigo Bunting, Northern Mockingbird, Red-bellied Woodpecker, Pileated Woodpecker, Northern Cardinal, Pine Warbler, White-eyed Vireo, Red-eyed Vireo, Tufted Titmouse, Yellow-billed Cuckoo, and Yellow-breasted Chat. Of these species, Northern Bobwhite Quail, Brown-headed Nuthatch, Fish Crow, Red-bellied Woodpecker, and Pine Warbler have high conservation concern due to declining population trends.

Mature pine-hardwood forests supported at total of 33 species during our surveys. The most abundant birds ($\geq$ 5 sightings) in mature pine-hardwood habitats were American Crows, Bluejays, Carolina Chickadees, Carolina Wrens, Cedar Waxwings, Eastern Towhees, Hooded Warblers, Northern Cardinals, Pine Warblers, Red-bellied Woodpeckers, Tufted Titmice, White-eyed Vireos, and Yellow-breasted Chats. Of these species, Pine Warblers, Red-bellied Woodpeckers, White-eyed Vireos, and Hooded Warblers are birds of conservation concern due to declining regional populations. Three Wood Thrushes, which are of high conservation concern, were recorded only mature pine-hardwood habitat at SSC. Pine-hardwood forest types were dominated by oak-hickory-pine in the overstory and evergreen shrubs and woody vines in the midstory and understory, including *Myrica* spp, *Ilex* spp., *Vaccinium* spp., *Calicarpa americana*, *Rhus* spp., *Trachelospermum* sp., *Berchemia scandens*, and *Smilax* spp. (Table 6).

A total of 27 species were recorded in mature hardwood forests. Most abundant birds ($\geq$ 5 sightings) included Carolina Wren, Great-crested Flycatcher, Northern Cardinal, Northern

Parula, Pileated Woodpecker, Prothonotary Warbler, Red-bellied Woodpecker, Red-eyed Vireo, Tufted Titmouse, Yellow-billed Cuckoo, and Yellow-throated Vireo. Although mature hardwood forests did not support the highest species richness of the habitat types surveyed, these forests supported the greatest number of neotropical migrant and resident species that are of conservation concern due to declining populations. Of the twenty-seven species detected, fourteen species were of high conservation concern and included Acadian Flycatcher, Great-crested Flycatcher, Hooded Warbler, Kentucky Warbler, Northern Parula, Pine Warbler, Prothonotary Warbler, Red-bellied Woodpecker, Red-headed Woodpecker, Summer Tanager, Yellow-billed Cuckoo, Yellow-throated Vireo, and Yellow-throated Warbler.

Mature hardwood forests at SSC are located primarily in floodplains and along moist watersheds. These forests are characterized by moist soils with abundant leaf litter and downed wood, an overstory of oak-hickory (*Quercus-Carya*) on well-drained sites and tupelo-bald cypress (*Nyssa-Taxodium*) in wetlands and magnolia along wetland edges. The midstory of these forests consists of interspersed soft-mast producing shrubs, such as *Vaccinium* spp., and woody vines (*Smilax* spp, *Vitis* spp., *Ampelopsis arborea*, and *Rhus* spp.) and evergreen trees and shrubs (*Magnolia, Persea, Vaccinium, Cliftonia, and Ilex*) along seepage bayheads and small creeks (Table 6). Abundant soft mast producing shrubs and vines, leaf litter and deadwood conditions that support invertebrates, and forest composition, age, and structure produce quality habitat conditions for deep forest dwelling birds, many of which are neotropical migrants. These forests will be protected from forest fragmentation during forest management to maintain the habitat quality and species richness of deep forest-dwelling neotropical migrant birds.

Younger age class forest that exhibited pulpwood size trees exhibited a range in number of species found. Young pine forests exhibited thirty bird species with Brown-headed Nuthatches, Bluejays, Eastern Towhees, American Crows, Brown Thrashers, Northern Bobwhites, and Northern Cardinals being the most abundant birds in this forest type. Twelve of the birds found in young pine stands have PIF conservation concern scores of eighteen or greater and include Brown-headed Nuthatch, Eastern Kingbird, Eastern Meadowlark, Fish Crow, Great-crested Flycatcher, Northern Bobwhite Quail, Pine Warbler, Red-bellied Woodpecker, Red-headed Woodpecker, White-eyed Vireo, Wood Thrush, and Yellow-billed Cuckoo. Many areas in this habitat type are dominated by dense understory and midstory comprised of gallberry and yaupon (*Ilex* spp.) (Table 6). In moist soil areas, pitcher plants and club moss (*Sarracenia* spp. and *Lycopodium*) are present indicating the remnants of wet pine savannah habitats. Thinning of pines and use of prescribed fire in these areas could restore wet pine savannah habitat structure, restore rare plant communities, and benefit rare bird species, such as Henslow's Sparrow. This management would also benefit Brown-headed Nuthatches and Northern Bobwhite Quail, birds with high PIF concern scores. Ongoing forest management planning incorporates this restoration approach in selected areas of this forest type.

Bird species richness found in young hardwood and mixed pine-hardwood forests was characterized by 24 and 22 species, respectively. Of the forest types surveyed, these types represented the lower number of sites sampled with 5 and 6 sites being sampled, respectively.

The size and shape of stands limited the number of sample sites that could be placed in these areas. Therefore, lower bird species richness may be a result of this lower sampling intensity. Cavity trees and standing snags were common to these habitats. Therefore, Red-bellied Woodpeckers and Tufted Titmice, both cavity nesters, were frequently recorded in these areas. Midstory conditions common to young pine forests also exist in young mixed pine-hardwood forests. Midstory structure in these forests attracts midstory nesters and foragers, such as Northern Cardinals and Yellow-billed Cuckoos. Of the younger forest types surveyed, young hardwoods supported the highest number of Acadian Flycatchers around seepages, streams, and bayheads. Young forest stands at SSC supported nineteen bird species with PIF conservation scores 18 or greater.

Summary

Bird species richness and habitat information will be used in the development of the forest management plan that will seek to integrate forest commodities production with conservation of biological diversity and forest aesthetics. Recommendations will be formulated and included in forest stand prescriptions to accomplish the following conservation goals: 1) protect mature hardwood forests from fragmentation, 2) restore wet pine savannah and longleaf ecosystems in selected areas, and 3) produce or maintain high quality habitat for native birds and other wildlife species indigenous to SSC. Examples of preliminary recommendations are listed in Table 5.

Table 4. Total number of birds listed by species detected in point count surveys in six forested habitat types at Stennis Space Center, Mississippi during May 2001.

Bird Species	Hardwood Sawtimber N[a]=10	Pine-Hardwood Sawtimber N=11	Pine Sawtimber N=20	Hardwood Pulpwood N=5	Pine Hardwood (Pulpwood) N=6	Young Pine (Pulpwood) N=11	Total Number of Birds
Acadian Flycatcher[b]	4	2	1	3	1		11
American Crow	3	9	30	3	4	5	54
Barred Owl	1		2				3
Barn Swallow						3	3
Blue-gray Gnatcatcher	2	3	1	3	3	1	13
Brown-headed Nuthatch[b]			6	2		13	21
Bluejay		7	3	2	2	9	23
Brown Thrasher[b]		4	3	1			8
Carolina Chickadee[b]		7	3		2		12
Carolina Wren	7	8	11	2	3	2	33
Cedar Waxwing		8					8
Chipping Sparrow		2	2			1	5
Common Yellowthroat			3				3
Eastern Kingbird[b]			1			3	4
Eastern Meadowlark[b]			2			5	7
Eastern Towhee		8	12	2	1	9	32
Eastern Wild Turkey	3		1				4
Fish Crow[b]		3	8			1	12
Field Sparrow[b]		2	1				12
Gray Catbird[b]			2				2
Great Blue Heron			1				1
Great-crested Flycatcher[b]	6		2	2	3	2	15
Great Egret	1						1
Hooded Warbler[b]	1	5					6
Indigo Bunting		2	5			1	8
Kentucky Warbler[b]	4	1	2		1		8

Table 4. (continued)

Bird Species	Hardwood (Sawtimber) N[a]=10	Pine-Hardwood (Sawtimber) N=11	Pine (Sawtimber) N=20	Hardwood (Pulpwood) N=5	Pine Hardwood (Pulpwood) N=6	Young Pine (Pulpwood) N=11	Total Number of Birds
Mourning Dove			6			3	9
Little Blue Heron	1		1				2
Northern Bobwhite[b]		2	9	2	2	6	21
Northern Cardinal	12	9	19	9	2	6	57
Northern Flicker			2			1	3
Northern Mockingbird		1	7			1	9
Northern Parula[b]	15	3	3	3	8		32
Pine Warbler[b]	1	10	11	1	2	5	30
Pileated Woodpecker	6	2	6	2	4	1	21
Prothonotary Warbler[b]	18	1	2	2	6		29
Prairie Warbler[b]		1	1				2
Purple Gallinule			1				
Red-bellied Woodpecker[b]	13	7	18	3	8	9	58
Red-eyed Vireo	15	2	6	3	6	1	33
Red-headed Woodpecker[b]	1		1	2		1	5
Red-shouldered Hawk	3	1	1	1			6
Ruby-throated Hummingbird	1						1
Red-winged Blackbird			5			2	7
Summer Tanager[b]	1						1
Swainson's Warbler[b]		1					1
Tufted Titmouse	10	9	13	9	4	6	51

Table 4. (continued)

White-eyed Vireo[b]		13	19	4	1	6	43
Wood Thrush[b]		3				2	5
Yellow-breasted Chat	3	18	23	2		10	56
Yellow-billed Cuckoo[b]	5	1	6	2	1	1	16
Yellow-throated Vireo[b]	8		1		1		2
Yellow-throated Warbler[b]	3		1	1			5
Unknown Bird		3	2		1	2	8
Total Species	27	33	46	24	22	30	56

[a] N represents number of point counts within the habitat type

[b] Bird species has a Partners-in Flight concern rating of 18 or greater indicating conservation concern due to population declines globally and within the geographic distribution range.

Table 5. Non-game birds featured at Stennis Space Center, listed with general habitat types and recommended management

Species Associations	Habitat Type/Requirements	Recommended Management
Henslow Sparrow Bachmann's Sparrow Brown-headed Nuthatch	Longleaf pine – grass ecotype Mature pine forests (<70 BA), Wet pine savannahs with herbaceous ground cover and limited midstory	Use prescribed fire in pine stands and wetland savannahs. Restoration of longleaf pine and growing season burns in selected areas Selective harvest mature pine to 50 - 65 BA
Prairie Warbler Yellow-breasted Chat Orchard Oriole Rufous-sided Towhee Field Sparrow Indigo Bunting Catbird Hooded Warbler Northern Cardinal	Shrub-sapling habitat Midstory (shrubs/saplings) in forests Shrub/vine dominated ecotones and forests	Reduce mowing under forests Small group selection, shelterwood and seed tree cuts Retention of shrub communities along field and road edges
Pine Warbler Carolina Chickadee Eastern Wood Peewee Red-headed Woodpecker Northern Parula Tufted Titmouse Red-bellied Woodpecker Wood Thrush Hooded Warbler White-eyed Vireo Red-eyed Vireo	Pine, pine-hardwood, hardwood forests with living cavity trees and snags	3-5 year prescribed burns in pines Retention of snags and cavity trees Uneven age forest management with older classes being retained (>70 years for hardwoods)
Wood Thrush Acadian Flycatcher Great-crested Flycatcher Pileated Woodpecker Yellow-billed Cuckoo Hooded Warbler Prothonotary Warbler Swainson's Warbler Blue-gray Gnatcatcher Red-eyed Vireo Barred, Screech Owls Great-horned Owl Herons/Egrets, Gallinules Belted Kingfisher Yellow-throated Vireo Yellow-throated Warbler	Mature bottomland hardwoods and riparian hardwoods with midstory and switch can thickets, wetlands with cavity trees, snags and shrub cover Bottomland hardwoods Beaver and floodplain wetlands	Limit forest fragmentation Allow forests to mature (>70 years) Harvest through single tree selection Retain switch cane thickets, cavity trees and snags Retain soft mast producing shrubs and vines Maintain forest SMZ's of >100 foot widths on each side of streams Protect wetland vegetation Allow cypress, gum, oaks to reach >70 years of age

Table 5. (continued)

Species Associations	Habitat Type/Requirements	Recommended Management
Blue Grosbeak Fox Sparrow American Goldfinch Eastern Bluebird Loggerhead Shrike Eastern Meadowlark Northern Cardinal Northern Mockingbird	Seasonally mown fields and roadsides Maintained areas landscaped with native or horticultural soft mast-producing trees, shrubs and vines Areas should have nesting cavities or nest boxes available Native food and cover plants in unmown areas along roads or at forest edges	Limit mowing along selected roads, field edges, under forests, and in clear zones to develop shrub ecotones Landscape with native and horticultural plants that provide food and cover Retain cavity trees and snags Maintain nest box program for shrikes and bluebirds
American Kestrel Chuck-will's Widow Eastern Bluebirds Field Sparrow Loggerhead Shrike Dickcissel Northern Bobwhite Quail Mourning Dove' Eastern Meadowlark Indigo Bunting	Unmown old fields and roadside ecotones near forest edges Shrub and vine ecotones along forest – opening interfaces	Maintain fields and roadsides in herbaceous plant cover Retain snags and cavity trees Retain pickweed, elderberry, blackberry and plum thickets

Geographic Information System Database

A spatial data layer of all sampled points was created for the SSC Geographic Information System (GIS) using ArcView GIS 3.2a. Each bird count station (n = 63) represents a unique point within a point theme. A relational database containing the spring point count data (species detected, richness, and total abundance) was joined to the point theme using the *join* function in ArcView GIS. Natural resource managers may utilize the layer to obtain information about the 2001 spring inventory by using the *query* tool in ArcView GIS (i.e., *Where were prothonotary warblers detected*? or *Which points had more than 10 species*?). Subsequent point count data and point-specific vegetation characteristics will be added to the GIS as data are collected.

Habitat Measurements

Habitat evaluation was conducted at each bird survey point to assess major overstory, midstory, and understory vegetation characteristics using two different survey methods. One assessment was conducted at the time of the bird survey using ocular estimate of dominant (> 50% coverage) and codominant (20% to < 50% coverage) of major plant genera in overstory and midstory within the 50 m radius of the bird survey point. During summer and fall months of 2001, two 67-meter line intercepts were randomly established within 20 meters of each bird survey point and assessed for percent coverage of vegetation. Vegetation was identified at least to genus and was grouped according to the growth form categories: understory - herbaceous, woody vines, and shrubs (vegetation of 1 meter in height or less); midstory – shrubs, woody vines, and small trees (vegetation of greater than 1 meter to 3 meters in height), and overstory – trees of greater than 3 meters in height. Vegetation data collected includes percent cover of overstory, midstory and understory plants, species richness, and species composition. Percent coverage of vegetation for bird survey points is listed in Table 6. A habitat database is being developed in Arc View linking this habitat data with basal area and forest stand composition data collected during the forest inventory. Additionally, habitat data from each of the bird survey points is being linked to bird species and abundance data. This data will be used to determine habitat conditions that support bird species assemblages, to identify key habitats that support birds with high PIF conservation scores, to prioritize areas for ecological restoration or bird watching, and to monitor bird and plant community responses to forest management activities. This effort will be an integral part of the natural resource management plan that will be developed for SSC.

Literature Cited

Ralph, C. J., S. Droege, and J. R. Sauer. 1995. Managing and monitoring birds using point counts: standards and applications. Pages 161-168 *in* Ralph, C. J. J. R. Sauer, and S. Droege, editors. Monitoring bird populations by point counts. Gen. Tech. Rep. PSW-GTR-149. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture.

Hooge, P. N. and B. Eichenlaub. 1997. Animal movement extension to arcview. Ver. 1.1. Alaska Biological Science Center, U.S. Geological Survey, Anchorage, AK. USA.

Mississippi Department of Wildlife, Fisheries, and Parks. 2001. Mississippi Deer Data, 1999-2000 Deer Program Report. Mississippi Department of Wildlife, Fisheries, and Parks, Jackson, MS. 86pp.

Appendix F

RELEASED - Printed documents may be obsolete; validate prior to use.

FY 2012

IONIZING SOURCE INVENTORY

STENNIS SPACE CENTER

Jacobs FOSC Safety

9/25/12

Date

John D. Lindsay

FOSC Health Physicist

RELEASED - Printed documents may be obsolete; validate prior to use.

A2R

ARSO - Rick Ross 228-688-2353

Source	Activity	Serial #	Disposal	Hazard	Building Location
Ni-63	15 millicuries	U0773	NA	Limited	8100 / Rm 112N
Ni-63	15 millicuries	U0776	NA	Limited	8100 / Rm 112N
Ni-63	15 millicuries	U12289	NA	Limited	8100 / Rm 112N
Ni-63	15 millicuries	U12290	NA	Limited	8100 / Rm 112N
Cd-109	5 millicuries	GG 930	NA	Limited	8100 / Rm 128A
Fe-55	40 millicuries	7033 LG	NA	Limited	8100 / Rm 128A
Cd-109	10 millicuries	GG 403	NA	Limited	8100 / Rm 128A
Ba-133	10 microcuries	BDR8100 BT907	NA	Limited	8100 / Rm 128A
Cs-137	140 millicuries	S1002	NA	Limited	8110 / Rm 120D

EPA

ARSO – Tripp Boone 228-688-2242

Permit Number	Source	Activity	Type of Use	Disposal	Hazard	Building Location
07-28762-01	Nickel 63 (Sealed source)	10 at 15 mC each	Analytical Equipment (9 in active use and 1 in storage in Room D412A)	Return to Manufacturer	Minimal - Class IV IAEA/DOT	1105

CLINIC

ARSO – Sue Smith 228-688-1392

Permit Number	Source	KV Range	Type of Use	Disposal	Hazard	Building Location
MS 23-2-0001	Radiographic Unit	40-150	Medical X-rays	N/A	Limited	B-8000

NAVO

ARSO - Randy Rogers -- 228-688-5642

Permit Number	Source	Activity	Type of Use	Disposal	Hazard	Building Location
23-62306-B2NP	Cesium	10 Millicuries	Geological/Sediment Density Measurements in Multisensor Core Logger (MSCL)	NRC approved facility authorized to receive and dispose of radioactive material.	Limited	1003, Room 25A
N/A	X-ray cabinet	130 kV	Faxitron Cabinet X-ray Machine	N/A	X-ray	1003 Room 25A

FOSC NDE

ARSO – Mike Theriot – 228-688-3723

Isotope Type	Building	Curies	Manufacturer	Model Number	Source Serial Number
U-238	8101	0.02 Ci	SSC	Proto Type	27810
Co-60	8101	14.0 Ci	AMERSHAM	424-14	2653
Ir-192	8101	96.8 Ci	QSA GLOBAL INC.	424-9	84327B
Ir-192	8101	45.0 Ci	QSA GLOBAL INC.	424-9	83268B
Am-241	8101	30 mCi	AEA TECHNOLOGY	AMCL	5030CW
Co-57	8101	3.9 uCi	AMERSHAM	CTR-8100	BX726
Fe-55	8101	50 uCi	AMERSHAM	IER-15510	CE883
Ni-63	8101	12.1 mCi	AMERSHAM	NBR-02160	CP650
Cs-137	8101	4.8 nCi	AMERSHAM	CDR00160/1	CP649
Co-60	8101	4.2 nCi	AMERSHAM	CKR00160/1	CP652
Cl-36	8101	4.9 nCI	AMERSHAM	CIR00160/1	CP653
Am-241	8101	4.9 nCi	AMERSHAM	AMR-04160	CP648
Tc-99	8101	5.0 nCi	AMERSHAM	TCR-02160	CP651
Ra-226	8101	5.7 nCi	ISOTOPE PRODUCTS	AF-226	P-693
Th-230	8101	8.6 nCi	THOMPSON-NIELSON	89th 220 1047	S-8710
Cs-137	8101	500 mCi	ISOTOPE PRODUCTS	Cs7-PO4-A	027/06
Sc-75	8101	9.7 Ci	QSA GLOBAL INC.	A424-25W	SB3048

RELEASED - Printed documents may be obsolete; validate prior to use.

FOSC NDE (continued)

X-Ray Type	Location	KV Range	Manufacturer	Model Number	Serial Number
Andrex	8101	160	ANDREX	CP-490	6040
Andrex	8101	160	ANDREX	CP-490	6025
National Imaging	8101	70	National Imaging	69005A	028800081
Feinfocus	8101	160	Feinfocus	FCU-015-020	6700-00002-0179
Vidisco	8101	270 kVP	Vidisco	XRS-3	1224
Comet	8101	225	Comet	MXR-225/22	58-1579

Naval Research Laboratory

ARSO – Lou Calehuff- 228-688-4568

Permit Number	Source	Activity	Type of Use	Disposal	Hazard	Building Location
08-00173-E1NP	Cs-137-123	7.49 millicuries	Ocean Bottom Core Structure Analysis	N/A	Limited	Building 1005, Room B-14
08-00173-E1NP	Cs-137-148	9.97 millicuries	Ocean Bottom Core Structure Analysis	N/A	Limited	Building 1005, Room B-14
08-00173-B1NP	Cs-137-111	13.16 microcuries	Instrument check source	N/A	Limited	Building 1005, Room B-14

Source	Strength	Location
EM-021 Jeol 3010 Transmission Electron Microscope	300 kV	B1005, Rm D-10
EM-019 Hitachi H-600 Electron Microscope	100 kV	B1005, Rm D-10L
EM-023 Electroscan E30 Scanning Electron Microscope	30 kV	B1009, Rm B115
EM-032 Electroscan E30 Scanning Electron Microscope	30 kV	B1009, Rm B115
EM-040 Electroscan E30 Scanning Electron Microscope	30 kV	B1009, Rm B115
X-Ray-204 Faxitron Model No. 43855C	130 kV	B1005, Rm B-10
X-Ray-202 CT Core Analytical Machine	2250 kV	B1005, Rm B-19
X-Ray-205 Micromeretics Sedigraph III 5120	13.6 kV	B1005, Rm B-12

University of Southern Mississippi Department of Marine Science

ARSO– Merritt Tuel- 228-688-1180

Permit Number	Source	Activity	Type of Use	Disposal	Hazard	Building Location
MS-976-01	Carbon-14	60.63 Millicuries	Productivity measurements	N/A	Limited	Building 1022, Room 120
MS-976-01	Hydrogen-3	0.96 Millicuries	Productivity measurements	N/A	Limited	Building 1022, Room 120
MS-976-01	Polonium-209	420 dpm	Productivity measurements	N/A	Limited	Building 1022, Room 120