FINAL ENVIRONMENTAL ASSESSMENT
FOR THE
NASA GLENN RESEARCH CENTER MASTER PLAN, CLEVELAND, OHIO

National Aeronautics and Space Administration
Glenn Research Center
21000 Brookpark Road
Cleveland, OH 44135
December 2008

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ABSTRACT

Lead Agency: National Aeronautics and Space Administration Glenn Research Center

Proposed Action: The Proposed Action at the National Aeronautics and Space Administration (NASA) John H. Glenn Research Center (GRC) for this Draft Environmental Assessment (EA) would be to align the facilities at Lewis Field and Plum Brook Station (PBS) with GRC's overall Mission and to prepare the Center for the future. GRC's Master Plan would strategically position the Center for the President's *Vision for Space Exploration* so that the Center would experience an enduring future. Building upon GRC's extensive capabilities in Aeronautics and Space Research, the Master Plan would facilitate the Center's increasing roles in NASA's space exploration mission. To achieve these goals, the Master Plan proposes to:

- *Provide Facilities that support NASA's Mission,*
- *Provide Flexible, Adaptable Facilities,*
- *Enhance Existing Core Capabilities,*
- *Enhance GRC's Exposure, Image, and Sense of Unity,*
- *Enhance Safety, Health and Security,*
- *Pursue Revitalization by Replacement Strategy, and*
- *Control Facility Costs.*

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Abstract: NASA's final Environmental Assessment for the GRC Master Plan addresses the environmental impacts associated with the Proposed Action and the No-Action Alternative at GRC's two locations: Lewis Field and Plum Brook Station. The environmental impacts of principal concern from implementing the Proposed Action are environmental resources areas that involve affecting air quality, noise, and traffic. The environmental impacts of implementing the GRC Master Plan on other environmental resource areas are also briefly addressed as are the cumulative impacts of the Plan when considered with past, present, and reasonably foreseeable future projects on or near the project sites.

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EXECUTIVE SUMMARY

The National Aeronautics and Space Administration (NASA) Glenn Research Center (GRC) Master Plan Environmental Assessment (EA) has been prepared to assist in the decision-making process in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended [42 United States Code (U.S.C.) §4321 et seq.]; the Council on Environmental Quality (CEQ) Regulations for implementing the procedural provisions of NEPA [40 Code of Federal Regulations (CFR) parts 1500–1508]; NASA's NEPA policy and procedures (14 CFR subpart 1216.3); and NASA Procedural Requirements as outlined in NPR 8580.1, "Implementing the National Environmental Policy Act and Executive Order 12114" dated November 26, 2001. This Final EA considers the environmental impacts from implementing the Proposed Action and the No-Action Alternative. No final action will be taken on this proposal until the decision-making process under NEPA has been completed. Implementation of the GRC Master Plan would not begin until the necessary Federal, State, and local permits and approvals have been obtained.

SUMMARY OF THE PROPOSED ACTION

The Proposed Action at GRC is to align the facilities at Lewis Field and Plum Brook Station (PBS) with GRC's overall Mission and to prepare the Center for the future. Implementing the Master Plan would enhance the functional and aesthetic value of the campus. The proposed Master Plan involves four Phases, implemented over 20 years, and would replace aging buildings in poor condition with new, efficient buildings with improved working environments, better functional relationships, and reduced operating costs.

This EA is based on the approved GRC Master Plan dated August 2007 and best available information to date. The implementation of all features of the GRC Master Plan would be dependent on the plan being reasonable and coinciding with anticipated funding levels. The overall planning schedule for the proposed projects is not absolute. Modification may be made to priorities and specific implementation dates of future facility requirements. Funding availability would be the primary driver of schedule compliance. Additionally, specific facility requirements could change over the life of the plan, especially during the last ten years of implementation. Even with these changes, the overall concept of development is anticipated to remain intact and be implemented when NASA completes compliance with NEPA, Federal, state, and local regulations and approval of state and local permits.

Master planning is an ongoing process. It is possible that the GRC Master Plan might be modified over the next twenty years. GRC will review the Final EA every five years to determine if the plan has changed significantly or if there is new environmental information that would warrant additional environmental review. If appropriate, NASA would consider additional environmental documentation at that time.

NO-ACTION ALTERNATIVE

NEPA requires the No-Action Alternative to be considered. In this EA, the No-Action Alternative would maintain existing operations at GRC. The No-Action Alternative would prevent implementing critical facility modifications at GRC, thus adversely affecting the Center's ability to support future operations.

SUMMARY OF ENVIRONMENTAL IMPACTS

Analysis indicates that there would be no substantial adverse impacts from implementing the Proposed Action; nor there be substantial impacts to the surrounding area.

CUMULATIVE IMPACTS

No substantial cumulative impacts to environmental resources would be anticipated from implementing the Proposed Action.

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COMMON METRIC/BRITISH SYSTEM EQUIVALENTS

Length

1 centimeter (cm) = 0.3937 inch (in)	1 in = 2.54 cm
1 centimeter = 0.0328 foot (ft)	1 ft = 30.48 cm
1 meter (m) = 3.2808 feet	1 ft = 0.3048 m
1 kilometer (km) = 0.6214 mile	1 mi = 1.6093 km

Area

1 square centimeter (cm^2) = 0.1550 square inch (in^2)	1 in^2 = 6.4516 cm^2
1 square meter (m^2) = 10.7639 square feet (ft^2)	1 ft^2 = 0.09290 m^2
1 square kilometer (km^2) = 0.3861 square mile (mi^2)	1 mi^2= 2.5900 km^2
1 hectare (ha) = 2.4710 acres (ac)	1 ac = 0.4047 ha
1 hectare (ha) = 10,000 square meters (m^2)	1 m^2 = .0001 ha

Volume

1 cubic centimeter (cm^3) = 0.0610 cubic inch (in^3)	1 in^3 = 16.3871 cm^3
1 cubic meter (m^3) = 35.3147 cubic feet (ft^3)	1 ft^3 = 0.0283 m^3
1 cubic meter = 1.308 cubic yards (yd^3)	1 yd^3 = 0.76455 m^3
1 liter (l) = 1.0567 quarts (qt)	1 qt = 0.9463264 l
1 liter = 0.2642 gallon (gal)	1 gal = 3.7845 l

Weight

1 gram (g) = 0.0353 ounce (oz)	1 oz = 28.3495 g
1 kilogram (kg) = 2.2046 pounds (lb)	1 lb = 0.4536 kg
1 metric ton (mt) = 1.1023 tons	1 ton = 0.9072 mt

ABBREVIATIONS AND ACRONYMS

A

ac	acre(s)
ACHP	Advisory Council for Historic Preservation
ACM	asbestos containing material
AERL	Aircraft Engine Research Laboratory
ARPA	Archeological Resources Protection Act
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
AWT	Altitude Wind Tunnel

B

BLS	U.S. Bureau of Labor and Statistics
BMP	Best Management Practice

C

°C	degrees Celsius
CAA	Clean Air Act
CBO	Congressional Budget Office
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CHIA	Cleveland Hopkins International Airport
cm	centimeter(s)
CMP	Center Master Plan (Glenn Research)
CO	carbon monoxide
CO_2	carbon dioxide
CTC	Cryogenics Test Complex

D

dBA	decibels (A-weighted)

E

EA	Environmental Assessment
ECDOES	Erie County Department of Environmental Services
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPM	Environmental Programs Manual
ERB	Engine Research Building
ERD	Environmental Resources Document
EUL	Enhanced Use Leasing

F

°F	degrees Fahrenheit

FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FICUN	Federal Interagency Committee on Urban Noise
FPPA	Farmland Protection Policy Act
FR	*Federal Register*
FS	Feasibility Study
FSC	Forest Stewardship Council
ft	feet
ft^2	square feet
ft^3	cubic feet
FTE	Full-Time Equivalent
ft/s	feet per second
FWS	U.S. Fish and Wildlife Service
FY	fiscal year

G

gal	gallon(s)
GFA	gross floor area
gpm	gallons per minute
GRC	Glenn Research Center
GVW	gross vehicle weight

H

ha	hectare(s)
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HPO	Historic Preservation Officer
hr	hour
HTF	Hypersonic Tunnel Facility
HVAC	heating, venting, and air conditioning

I

IAQ	Indoor Air Quality
in	inch(s)
IRT	Icing Research Tunnel

K

kg	kilogram(s)
km	kilometer(s)
km^2	square kilometer(s)
kPa	kilopascal
kV	kilovolt

L

l	liter(s)
lb	pound(s)
LBP	Lead based paint
LEED	Leadership in Energy and Environmental Design
lpm	liters per minute

M

m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)

MERV	Minimum Efficiency Reporting Value
mi	mile(s)
mi^2	square mile(s)
min	minute
MS4	Municipal Separate Storm Sewer System
MVA	Megavolt-ampere

N

NAAQS	National Ambient Air Quality Standards
NACA	National Advisory Committee for Aeronautics
NAGPRA	Native American Graves Protection and Repatriation Act
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NPR	NASA Procedural Requirements
NRHP	National Register of Historic Places

O

O_3	ozone
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OHPO	Ohio Historic Preservation Office
OSHA	Occupational Safety & Health Administration
oz	ounce(s)

P

Pa	pascal(s)
Pb	lead
PBMO	Plum Brook Management Office
PBOW	Plum Brook Ordnance Works
PBRF	Plum Brook Reactor Facility
PBS	Plum Brook Station
PCB	polychlorinated biphenyls
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
ppm	parts per million
psi	pounds per square inch
PSL	Propulsion Systems Laboratory

R

RCL	Research Combustion Lab
RCRA	Resource Conservation and Recovery Act
RETF	Rocket Engine Test Facility
RI	Remedial Investigation
RPZ	Runway Protection Zone

S

s	second(s)
SHED	Safety, Health and Environmental Division
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMACNA	Sheet Metal and Air Conditioning National Contractors Organization
SPF	Space Power Facility
SO_2	sulfur dioxide
SPF	Space Power Facility
STS	space transportation system
SVOC	semi-volatile organic compound
SWMP	Storm Water Management Program
SWP3	Storm Water Pollution Prevention Plan

T

TNT	Trinitrotoluene
tpy	tons per year

U

UMRA	Unfunded Mandates Reform Act
USACE	U.S. Army Corps of Engineers
USBC	U.S. Bureau of the Census
U.S.C.	United States Code

V

v	volts
VMT	vehicle miles traveled
VOC	volatile organic compound

W

WAN	Wide Area Network

Y

yd	yard(s)
yd^3	cubic yard(s)

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1 PURPOSE AND NEED

1.1 INTRODUCTION

This Final Environmental Assessment (EA) for the John H. Glenn Research Center (GRC) Master Plan has been prepared by the National Aeronautics and Space Administration (NASA) to assist in the decision-making process in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended [42 United States Code (U.S.C.) §4321 et seq.]; the Council on Environmental Quality (CEQ) Regulations for implementing the procedural provisions of NEPA (40 CFR parts 1500–1508); and NASA's NEPA policy and procedures [14 Code of Federal Regulations (CFR) subpart 1216.3]. This Draft EA considers the environmental impacts associated with implementation of the Proposed Action and the No-Action Alternative. No final action will be taken on this proposal until the decision-making process under NEPA has been completed. Implementation of the Master Plan would not begin until the necessary Federal, State, and local permits and approvals have been obtained.

1.2 SUMMARY OF THE PROPOSED ACTION

The Proposed Action at GRC is to align the facilities at Lewis Field and Plum Brook Station (PBS) with GRC's overall Mission and to prepare the Center for the future. Implementing the Master Plan would enhance the functional and aesthetic value of the campus. The proposed Master Plan involves four phases, implemented over 20 years, and would replace aging buildings in poor condition with new, efficient buildings with improved working environments, better functional relationships, and reduced operating costs.

Lewis Field is located in western Cuyahoga County, approximately 16 kilometers (km) [10 miles (mi)] southwest of downtown Cleveland. The site borders the Cleveland Hopkins International Airport (CHIA) to the east and to the north and west is the Rocky River Reservation of the Cleveland Metro Parks System, while the southern boundary is adjacent to areas of suburban residential and small commercial development.

Plum Brook Station (PBS) is in west central Erie County, approximately 6 km (4 mi) south of Sandusky, Ohio and 81 km (50 mi) west of Lewis Field. To incorporate exclusion zones for the major test facilities, the site has not been fully developed, and much of the surrounding land use is wooded and agricultural, with some residential areas. The residential areas to the north and northeast have seen increased development, and recreational and light commercial development has increased along Interstate 250.

This Final EA is based on the approved GRC Master Plan dated August 30, 2007 and best available information to date. The implementation of all features of the GRC Master Plan is dependent on the plan being reasonable and coinciding with anticipated funding levels. Master planning is an ongoing process. The overall planning schedule for the proposed projects is not absolute. Modification may be made to priorities and specific implementation dates of future facility requirements. Funding availability would be the primary driver of schedule compliance. Additionally, specific facility requirements could change over the life of the plan, especially during the last ten years of implementation. Even with these potential changes, the overall concept of development should remain intact.

It is possible that the GRC Master Plan might be modified over the next 20 years. GRC will review the Final EA every five years to determine if the plan has changed significantly or if there is new environmental information that would warrant additional environmental review. If necessary, NASA would consider additional environmental documentation at that time.

1.3 PURPOSE AND NEED

The primary purpose of the Master Plan is to align the Center's facilities to support NASA's present and future missions. The GRC Master Plan would strategically position the Center to meet the President's *Vision for Space Exploration* so that the Center will experience an enduring future. Building upon GRC's extensive capabilities in Aeronautics and Space Research, the Master Plan facilitates the Center's increasing roles in NASA's space exploration mission. To achieve these goals, the Master Plan proposes to:

1. Provide a comprehensive presentation of the existing and future facilities needed to meet GRC mission.

2. Explain how those facility assets relate to NASA's present and future mission and how they enable GRC goals and objectives.

3. Integrate with and supports GRC planning and budgeting process.

4. Provide for the environmentally sustainable development of the Center's facilities and infrastructure.

5. Reflect GRC concept for the stewardship of its environmental and cultural resources, thus operating in harmony with the surrounding community.

6. Provide a basis for facility planning coordination with Center-supported program, customers and stakeholders.

7. Illustrate the context of the Center and its interrelationship with its surrounding area, the local community, and national policy.

8. Provide a basis for cooperative planning with local, regional, state, and other governmental organizations (GRC 2008a).

The proposed GRC Master Plan, approved August 30, 2007, would demolish 96,990 square meters (sq. m.) (1,044,000 square feet [sq. ft.]) of existing building space and construct 50,000 sq. m.(538,000 sq. ft.) of new and rehabilitated building space.

1.4 THE ENVIRONMENTAL REVIEW PROCESS

Implementing the Proposed Action requires an environmental evaluation to ensure that potential consequences of the action are identified and addressed prior to project commencement. NEPA mandates the environmental review process and describes the procedures for implementation. This process includes coordination and involvement with the public as well as relevant Federal, State, and local agencies. The resultant EA documents GRC decisions and assessments of potential consequences from the Proposed Action and the No-Action Alternative.

1.4.1 The National Environmental Policy Act and Other Federal and GRC-Specific Applicable Regulations or Guidance

In 1969 Congress passed NEPA, requiring an evaluation of the environmental impacts of any major Federal action. An EA is defined as a "concise public document" that 1) briefly provides sufficient evidence and analyses to determine if an Environmental Impact Statement (EIS) needs to be prepared, 2) aids NASA's compliance with NEPA when an EIS is not necessary; and 3) facilitates preparation of an EIS when necessary (40 CFR 1500-1508).

This EA has been prepared based on NEPA requirements and other applicable regulations or guidance as outlined in the following guidance documents:

- Council on Environmental Quality Regulations For Implementing the National Environmental Policy Act (40 CFR Sections 1500-1508) dated 1 July 1986.
- 29 CFR Part 1910, Occupational Safety and Health Standards.
- CFR Title 40, Protection of the Environment.
- EO 13423 "Strengthening Federal Environmental, Energy, and Transportation Management", dated January 26, 2007.
- NASA Procedural Requirements (NPR) 8580.1, "Implementing the National Environmental Policy Act and Executive Order (EO) 12114," dated November 26, 2001.
- NPR 1600.1 NASA Procedural Requirements. "NASA Security Program Procedural Requirements", dated November 8, 2005.
- NPR 1620.3, NASA Procedural Requirements, "Physical Security Requirements for NASA Facilities and Property", dated February 1, 1993.

1.4.2 Public Involvement

NEPA encourages public involvement in the environmental review process. Initiation of the NEPA process includes notifying interested parties and agencies about the project. The NEPA process directs the Federal agency to address concerns of the general public and interested parties.

The EA will be made available to the public prior to implementation and a final decision on the proposed Master Plan. Comments from interested parties and agencies will be considered.

2 DESCRIPTION OF THE PROPOSED ACTION AND THE NO-ACTION ALTERNATIVE

Chapter 2 describes the Proposed Action in detail and provides a summary of the No-Action Alternative.

2.1 DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action at National Aeronautics and Space Administration (NASA) Glenn Research Center (GRC) is to align the facilities at Lewis Field and Plum Brook Station (PBS) with GRC's overall Mission and to prepare the Center for the future. Implementing the Master Plan would enhance the functional and aesthetic value of the campus. The proposed Master Plan involves four 5-year Phases, implemented over 20 years, and would replace aging buildings in poor condition with new, efficient buildings with improved working environments, better functional relationships, and reduced operating costs.

This EA is based on the approved GRC Master Plan dated August 30, 2007, and on the best available information to date. The implementation of all features of the GRC Master Plan is dependent on the plan being reasonable and coinciding with anticipated funding levels. Master planning is an ongoing process. The overall planning schedule for the proposed projects is not absolute. Modification may be made to priorities and specific implementation dates of future facility requirements. Funding availability would be the primary driver of the schedule. Additionally, specific facility requirements could change over the life of the plan, especially during the last fifteen years of implementation. Even with these potential changes, the overall concept of development should remain intact.

It is possible that the GRC Master Plan might be modified over the next 20 years. GRC will continue to monitor Federal, State and local regulations for changes that would require additional environmental documentation for this Proposed Action. If appropriate, GRC would consider additional environmental documentation at that time.

2.1.1 GRC Master Planning Approach

The master planning effort was an integrated effort led by the GRC Facilities Division. The most prominent contributors were the GRC Center Master Plan (CMP) Working Team and the Steering Committee. The CMP Working Team included members from different offices, representing various interests and duties. The Steering Committee was composed of the members of the GRC Center Director's Strategic Management Team who provided overall guidance, review, and approval actions throughout the planning process. Additionally, in order to fully integrate the process, workshops and interviews were held with various NASA personnel to gain insights into GRC needs to improve facility conditions (GRC 2008a).

The information obtained from the workshops and interview process was used to develop the facility requirements that were transformed into the strategies, concepts, and alternatives that were presented to the CMP Working Team. The CMP Working Team tested and validated the strategies, concepts, and alternatives and formulated recommendations to the Steering Committee for approval action (GRC 2008a).

2.1.2 GRC Dynamics

Fundamental changes occurred at GRC during the course of the planning effort, which had a significant impact on the development of the final Master Plan. The *Vision for Space Exploration* provided GRC with the opportunity to continue as contributor to NASA's future space exploration (GRC 2006). Specifically,

- GRC received significant assignments for the *Vision for Space Exploration*,
- GRC developed a business plan which defined market segments,
- PBS's value as a test and evaluation facility for space-related programs was validated,
- Restructuring of GRC's organization was initiated to be aligned with future missions, and
- Several aeronautics and PBS test facilities were classified as NASA assets.

The existing environment at GRC reflects the age and condition of the facilities, congestion of the facilities at Lewis Field, and the fact that the initial planning of the facility occurred almost seventy years ago when requirements and expectations were very different. The current layout is no longer appropriate and does not address the needs of technological advances and changes in research needs. The Repair-by-Replacement strategy is the approach adopted by the Master Planning participants to address the problems associated with the existing condition of the facilities, the functional relationships at Lewis Field and PBS, and the campus environment (GRC 2006).

2.1.3 Assumptions and Selection Criteria for the GRC Proposed Master Plan

2.1.3.1 Lewis Field

The issues associated with Lewis Field include the age of facilities, cost to operate and maintain facilities, energy consumption, constricted space in the central area, need for additional vehicle parking, increased campus security, and the physical division of campus (Central, West, South and North Areas). These issues influenced the proposed Master Plan to achieve the following opportunities: strong core competencies, unique research and development capabilities, North Area as ideal location for public exposure, benefits of location by airport, partnering opportunities with organizations in northeast Ohio, agency-wide repair by replacement facility program, agency-wide demolition of underutilized facility program, stable and compatible adjacent land use, and West Area land available for future development.

The following baseline assumptions for the next 20-year period at Lewis Field were made during the planning process:

- The Lewis Field workforce will be relatively constant at approximately 3,400 employees,
- GRC will support all NASA Mission Directories Aeronautics, Exploration Systems, Science, and Space Operations,
- GRC's growth and transition will be toward space exploration work,
- GRC will continue to do research across the full range of technology readiness levels,

from basic research through development,

- GRC will pursue new markets in Homeland Security and energy independence,
- Existing core competencies will remain viable, new competencies will emerge,
- NASA Construction of Facilities and Strategic Institutional Investment Program budgets will remain a reliable source for funding GRC's capital investments,
- Aging and outdated facilities and systems that are needed will receive funding for restoration or replacement,
- GRC desires to improve its image by improving the appearance of its campus and facilities,
- Surrounding land use will be stable and will not affect or encroach upon Lewis Field operations,
- No significant environmental or cultural resources problems exist at Lewis Field, and
- GRC will eventually receive expanded authority to lease land and utilize the revenue to offset facility costs.

In support of the Master Plan's purpose, the selection criteria for the Lewis Field concept were identified as the following (GRC 2008a; GRC 2008b):

- Improve the image of the Main Campus at Lewis Field,
- Optimize traffic flow,
- Develop an Aerospace Education Center in a convenient location to Brook Park Road and not on secured land,
- Provide facilities to support NASA's mission and more specifically GRC's Strategic Plan,
- Address flexibility/adaptability,
- Enhance core competencies,
- Enhance internal working relationships,
- Enhance GRC's exposure, image, and sense of unity,
- Enhance safety and security,
- Pursue Repair-by-Replacement strategy1,
- Identify/generate developable land parcels, and
- Control facility cost.

[1] The Repair-by-Replacement strategy refers to internal NASA Construction of Facilities activities. This strategy was developed because it can be more cost-effective to demolish a building and replace it with a new facility, rather than rehabilitating the building.

2.1.3.2 Plum Brook Station

The issues associated with PBS include the need to diminish expense for large facilities and large property, underutilization of existing test facilities; cyclical workflow creates loss in knowledgeable workforce, and uncertainty. Surrounding commercial and residential development activity may have the potential to encroach upon core testing exclusion zones, add pressure from the local community to utilize NASA property, and increase the urgency to remediate the environmental contamination from the previous Army explosives manufacturing. The proposed Master Plan addresses these issues through the following opportunities:

- increased use of unique test facilities,
- increased land available to accommodate additional testing within the core area,
- increased land available to pursue Homeland Security and energy independence opportunities,
- leased buffer zone to offset costs,
- further develop close NASA ties to the local community,
- preserve parcels of land as a natural resource,
- increased convenient access to regional highways, and
- preserve regional interest in a general aviation airport.

The following baseline assumptions for the next 20-year period at PBS were made during the planning process:

- PBS test facilities will have an enduring role in the Vision for Space Exploration,
- Agency corporate shared capability asset program funding will continue to support the major PBS facilities,
- The core workforce will remain relatively constant at approximately 100 employees, with additional staff utilized during periods of increased test activities,
- Aging and outdated facilities and systems that are needed in the future will be restored or replaced,
- PBS will eventually receive expanded authority to lease land and utilize the proceeds to offset facility costs,
- An increased utilization of the test facilities will spread the maintenance costs across multiple customers and reduce the net cost to each program.

In support of the Master Plan's purpose, the selection criteria for the PBS concept were identified as the following (GRC 2008a):

- Develop potential Enhanced Use Leasing (EUL)[2] opportunities,

[2] Enhanced Use Leasing (EUL) is a method for funding construction or renovations on NASA property by allowing a private developer to lease non-excess NASA property, with rent paid by the developer in the form of in-kind services.

- Sustain a functional and contributing PBS,
- Maintain/preserve existing test facilities,
- Maintain existing exclusion/clear zones,
- Reserve area to accommodate future test facilities,
- Implement real property leveraging to reduce costs,
- Maintain a natural, nature-friendly environment, and
- Control facility costs.

2.2 IMPLEMENTING THE PROPOSED ACTION

2.2.1 Specific Description of Proposed Master Plan Activities at Lewis Field

The Lewis Field site covers 132 hectares (ha) [326 acres (ac)] and includes 180 buildings and structures, with 24 major test facilities and over 100 specialized research and development laboratories. The total facility gross area is 278,700 square meters (m^2) (3 million square feet [(ft^2]). Most of Lewis Field is considered fully developed with offices, test facilities, and support facilities, with approximately 53 ha (130 ac) that is undeveloped, including approximately 24.3 ha (60 ac) in the West Area (see Figure 2-1 for a proposed map of Lewis Field). Most of the remaining undeveloped acreage includes land such as the Abram Creek ravine, which is unable to be developed due its steep slopes. The majority of buildings were constructed well over 50 years ago, and the estimated replacement cost of the Lewis Field campus is approximately $2.2 billion based on the 2006 Real Property Report (GRC 2005a; GRC 2008a).

Of the over 180 existing buildings, most are currently classified as in "good" condition; however, this classification does not reflect the capacity of the facility to suit present use, nor does it reflect the increasing costs of maintenance and repair. Additionally, the location of the buildings reflects the old campus layout, which is inefficient and outdated (GRC 2008a).

2.2.1.1 Lewis Field Capital Improvement Projects

The following projects would be built/demolished on the Lewis Field campus, and are presented in an order which reflects their importance and order of construction sequencing[3]. The location of these projects is illustrated in Figure 2-1.

2: The Centralized Office Building would house in one building the integrated project team members working on the Constellation Program; currently housed in older facilities scattered across the Campus. The building would include a conferencing center with an auditorium to enable communications and coordination between GRC and its various partners.

[3] Sequencing of the projects includes project specific to Plum Brook Station and will be discussed in Section 2.2.2.

FIGURE 2-1 PREFERRED SITE CONCEPTUAL PLAN FOR LEWIS FIELD

Source: GRC 2008a

3: The new Maintenance and Warehouse facilities in remote portions of the South and West Areas would replace the existing metal Buildings 84, 137, 104, and 107. This prime location would be prepared for the new Campus Center buildings.

5: The new security project for the Main Gate and the Shipping and Receiving facilities would dramatically improve campus security safety, and functionality in terms of managing the reception, inspection, and flow of vehicles and visitors.

8: The new Aerospace Education Center would replace the Visitor's Center in Building 8 that is difficult for the public to access, and would expand GRC education outreach to the community.

9: The new Operations Support Building would replace Buildings 14 and 21 and strategically locate support activities near the main entrance of the campus. Logistics, technical information, security management, emergency operations, and facilities management functions would be consolidated in this one Operations Support Building.

11: The new Space Flight Navigation and Communication facility in the West Area would replace Building 7 and provide improved space for GRC antenna test facilities.

12: The new Administration building would replace Building 3 and would be located in the heart of the campus within the Campus Center area.

13: The Consolidated Structures and Materials building would replace Buildings 24, 34, and 51 with a smaller, state of the art laboratory facility well suited to current research challenges.

15: The new Employee Services building would replace Building 15 with updated medical services, a cafeteria, and employee amenities.

16: The Research Combustion Lab staging building would consolidate and improve functions so that multiple old buildings in the Building 35 complex may be demolished.

17: The Cedar Point Road project would rebuild and reopen this vital link between the West and Central Areas. A new intersection at the West Area Road would allow traffic to circulate without leaving the campus. Also included would be the rerouting of Guerin Road because of soil stability concerns with the existing roadway.

18: The commons area would complete the Campus Center concept and create a focal point for the campus, with an area of gatherings and opportunities to display aerospace vehicle models.

Figure 2-1 illustrates the location of the capital improvement projects described above. Tables 2-1, 2-2, and 2-3 describe the replacement facilities (new construction), demolition, and net building reduction for the Lewis Field.

TABLE 2-1 LEWIS FIELD REPLACEMENT NEW FACILITIES

Facility	Square Feet
Centralized Office Building	90,000
Maintenance and Warehousing Facilities	64,000
Main Gate Security, Shipping and Receiving Facilities	12,000
Aerospace Education Center	Not available
Operations Support Building	72,000
Space Navigation and Communications Facility	15,000
Administration Building	46,000
Consolidated Materials and Structures Complex	46,000
Employee Service and Cafeteria	46,000
Consolidated RCL Complex	20,000
TOTAL	**411,000**

TABLE 2-2 LEWIS FIELD MAJOR FACILITY DEMOLITION PROJECTS

Facility	Square Feet
Building 500	162,000
Building 501	43,000
Building 300	8,000
Building 3	46,000
Building 24	19,000
Building 34	10,000
Building 51	15,000
Building 21	73,000
Building 84	10,000
Building 104	6,000
Building 107	26,000
Building 137	8,000
Building 14	73,000
Building 28	14,000
Building 15	42,000
Building 8	17,000
Building 35	20,000
Buildings 65 and 66	22,000
TOTAL	**629,000**

TABLE 2-3 LEWIS FIELD BUILDING REDUCTION

Activity	Square Feet
Demolition (deconstruction)	630,000 (21% reduction)
Repair by Replacement (new construction)	410,000 (13 % increase)
Net Building Reduction	220,000 (overall 8 % reduction)

2.2.2 Specific Description of Proposed Master Plan Activities at Plum Brook Station

Plum Brook Station is a 2,612 ha (6,454 ac) test installation site of GRC and features over 170 buildings, structures and other facilities, with four major test facilities. Of the 170 buildings, structures and facilities, 13 buildings are regularly inhabited. Figure 2-2 illustrates the proposed map after implementation of the proposed Master Plan activities at PBS. PBS is not a high density area; however, the four major test facilities require large areas of land to provide safety exclusion zones and noise abatement zones. These are high energy test facilities and for this reason they are located at PBS rather than at Lewis Field.

FIGURE 2-2 PREFERRED SITE CONCEPTUAL PLAN FOR PLUM BROOK STATION

Source: GRC 2008a

2.2.2.1 Plum Brook Station Capital Improvement Projects

The following projects would be built on the Plum Brook campus, and are presented in an order which reflects their importance and order of construction sequencing[4].

1: The Space Power Facility (SPF) has been selected to provide the entire spectrum of environmental testing for the Orion hardware. The SPF would be enhanced with structural dynamic, acoustic, and electromagnetic interference testing capabilities to compliment the existing thermal-vacuum environmental simulation provided within this large and unique facility. Environmental consequences were discussed in the Final Constellation Programmatic Environmental Impact Statement (NASA 2008).

4: The proposed runway and hangar would provide convenient transportation and handling of space flight hardware and would increase the utilization of the unique PBS test facilities. The environmental consequences associated with the proposed runway and hangar will be considered in future environmental documentation.

6: A new Main Gate Entrance would provide a direct connection to the Station from the US Highway 250, eliminating the existing entrance route through residential neighborhoods. The new Scheid Road entrance would be much closer to the main test facilities. The new building would house in one location the security, shipping, and receiving functions presently located across the campus.

7: The B-2 facility would receive upgraded capabilities to prepare for Constellation test requirements. Environmental consequences were discussed in the Final Constellation Programmatic Environmental Impact Statement (NASA 2008).

10: The Roadway and Security improvements project would create direct routes for the transport of the fuel tanker trucks for testing operations. Failing roadways would be repaired, and unnecessary roads would be eliminated. Security gates and fences would be improved along the entire perimeter of the campus.

14: The Consolidated Support Facilities Phase I project would replace the aging maintenance and warehouse buildings with new facilities in a centralized area near the new Main Gate Entrance.

19: The Consolidated Support Facilities Phase II project would continue the work to replace maintenance and warehouse buildings with new structures in the support facilities area.

20: The new Engineering Building would be smaller than the existing Engineering Building it replaces, and would be located near the new Main Gate Entrance and the support facilities.

Figure 2-2 illustrates the proposed capital improvements projects associated with PBS. Tables 2-4, 2-5, and 2-6 describe the replacement facilities (new construction), demolition, and net building reduction for PBS.

[4] Sequencing of the projects includes project specific to Lewis Field previously discussed in Section 2.2.1.

TABLE 2-4 PLUM BROOK STATION REPLACEMENT NEW FACILITIES

Facility	Square Feet
Aircraft Hangar (new)*	60,000
Main Gate Security, Shipping and Receiving Facilities	2,000
Consolidated Support I (Maintenance/Shop)	16,500
Consolidated Support II (Maintenance)	30,000
Engineering	20,000
TOTAL	**128,500**

*Not include in total

TABLE 2-5 PLUM BROOK STATION MAJOR DEMOLITION PROJECTS

Facility	Square Feet
Building 7122	43000
Building 7123	5,800
Building 7131	6,400
Building 7141	58,000
Building 7233	3,000
Building 9201	4,400
Building 9202	4,400
Building 9204	8,000
Building 9207	5,500
Building 9215	14,800
Other Buildings	299,000
TOTAL	**414,000**

TABLE 2-6 PLUM BROOK STATION BUILDING REDUCTION

Activity	Square Feet
Demolition (deconstruction)	414,000 (34 % reduction)
Repair by Replacement (new construction)	128,000 (10 % increase)
Net Building Reduction	286,000 (overall 24 % reduction)

2.3 SUMMARY OF PROJECTS ASSOCIATED WITH THE PROPOSED MASTER PLAN

The activities associated with implementing the Proposed Action include demolition, construction, and/or rehabilitation of approximately 65 buildings at Lewis Field and PBS. This includes demolition of approximately 96,900 m^2 (1,043,000 ft^2) of existing building space and construction of 44,550 m^2 (479,500 ft^2) of new or rehabilitated building space (GRC 2008a).

2.4 TIMEFRAME OF THE PROPOSED GRC MASTER PLAN

Table 2-7 reflects the four, five-year phases of the Proposed Action (GRC 2008a).

TABLE 2-7 PHASES FOR THE PROPOSED TWENTY-YEAR GRC MASTER PLAN

Phase	Timeframe
1	2007 – 2011
2	2012 – 2016
3	2017 – 2021
4	2022 – 2026

2.5 GUIDANCE DOCUMENTS FOR THE GRC PROPOSED MASTER PLAN

In addition to other pertinent documentation, the Proposed Action would have to comply with the GRC Environmental Programs Manual (EPM) (GRC 2008a) if chosen for implementation. Key EPM chapters include:

- Chapter 5 "Management of Hazardous Material, Hazardous Wastes, and Universal Wastes for Reuse, Recycling, or Disposal",
- Chapter 7 "Polychlorinated Biphenyls Policy",
- Chapter 10 "Solid Waste", and
- Chapter 23 "Handling and Disposal of Soil."

2.6 GENERAL PROPOSED MASTER PLAN ACTIVITIES

Demolition

Demolition projects typically can be defined by several general activities, including:

- Assessing and planning (identify hazardous and salvageable/recyclable materials and developing a demolition plan),
- Disconnecting utilities and securing site with fencing,
- Removing hazardous materials and disposing of them properly,
- Removing non-load-bearing components separating salvageable/recyclable materials,
- Demolishing structures,
- Removing and recycling/disposing of structural debris,
- Removing/excavating remaining foundation materials and recycling/disposing of debris, and
- Performing final site cleanup, grading, and site revegetation or preparation for construction.

Construction

Construction projects typically can be defined by several general activities, including:

- Site preparation and excavation,
- Construction of the foundation,
- Construction of the structural components,
- Construction of the shell,
- Completion of the interior spaces, equipment, and utilities, and
- Final grading and landscaping.

Rehabilitation

Rehabilitation typically can be defined by the following general categories:

- Building rehabilitation,
- Building site and access rehabilitation, and
- Utility rehabilitation and installation.

Building rehabilitation involves modifications to existing buildings in which major structural components such as the foundation, structural walls, outer shell, and roof support structure remain mostly intact. Depending on the scope of the project, many other existing components may remain intact. Building rehabilitation could often involve some demolition of building interiors and other components followed by construction/installation of new components and equipment. In general, building rehabilitation would include one or more of the following activities:

- Exterior architectural improvements, such as replacing and/or installing exterior doors, windows, siding, and roof covering,
- Interior space improvements, such as removal/reconstruction of interior walls, doors, ceilings and flooring,
- Replacement of heating, venting, and air conditioning (HVAC) system or equipment,
- Replacement/upgrade of electrical and indoor lighting systems,
- Replacement/upgrade of plumbing system (water and sewer),
- Installation/upgrade of fire alarm and/or fire suppression systems, and
- Installation/upgrade of Communications and Information Technology infrastructure.

2.7 ASSUMPTIONS ASSOCIATED WITH DEMOLITION, CONSTRUCTION, AND/OR REHABILITATION AT GRC LEWIS FIELD AND PBS

The Master Plan facilities work would be performed in accordance with project specifications, Occupational Safety and Health Act (OSHA), Environmental Protection Agency (EPA), and SHED requirements. In addition, if applicable, all project work would be compliant with a contactor or sub-contractor-generated Health and Safety Plan (HASP), Demolition, construction, and/or rehabilitation Plans consistent with the HASP requirements, and daily on-site government or support service contractor inspections and routine Project meetings.

The assumptions associated with demolition, construction and rehabilitation that are of particular relevance to potential environmental impact analysis would be related to land/soil disturbances, dust suppression, storm water management, materials recycling, and hazardous material management. GRC has an extensive database of soil sample analyses for determining contamination in soil. In areas where there are insufficient analyses, new soil samples would be collected to determine proper handling in accordance with GRC EPM Chapter 23, “Handling and Disposal of Soil.” Hazardous materials debris will be handled in accordance with GRC EPM Chapter 5, “Management of Hazardous Materials, Hazardous Wastes, and Universal Wastes for Reuse, Recycling, or Disposal.”

Emergency actions for spills of hazardous materials are addressed in the GRC Emergency Preparedness Plan and the PBS Integrated Contingency Plan. Contractors will be responsible for preparing plans in accordance with all applicable specifications, NASA instructions, and NASA Policy Manuals/Plans.

The specific aspects of how the demolition, construction, and/or rehabilitation contracting would be exercised are not certain. It has not been determined if some of the projects would be occurring at the same time, with the same workforce within each Phase. It is unlikely that tasks requiring similar skilled personnel and equipment could be scheduled such that the same work force and equipment could be rotated between multiple projects. Projects are funded and contracted based on different funding vehicle allocations; therefore, projects would likely employ different contractors. Appendix A of this Draft EA describes assumptions associated with demolition, construction, and/or rehabilitation.

2.8 DESCRIPTION OF OTHER PROPOSED ACTIVITIES

For purposes of completeness, there are additional activities including on-going capital improvement projects at GRC that could occur at the same time as the Proposed Action. These activities are similar in nature and scope to those activities associated with the Proposed Action. These activities are identified in Appendix B. These activities would be addressed under additional NEPA analyses, as necessary. Waste Generator site closures shall be required in specific areas of the facility prior to decommissioning activities per Center policies as stated in the Environmental Program Manual, Chapter 14 – RCRA.

2.9 DESCRIPTION OF FUTURE FORESEEABLE ACTIVITIES

The Master Plan reserves and prepares land as potential sites for future facilities that may be needed by NASA programs. Examples include the Space Flight Test and Verification sites in the West Area of Lewis Field, the Aerospace test sites in the Central Campus of Lewis Field, and the Space Flight Development facility zones reserved in the core of PBS (see Chapter 4, Section 4.3 for further discussion on future reasonably foreseeable activities).

2.10 ALTERNATIVES CONSIDERED BUT ELIMINATED

Lewis Field. As discussed in Section 2.1.2 of this Draft EA, GRC arrived at the preferred alternative by examining five alternative concept strategies to guide the overall direction of Lewis Field. These strategies were the product of the information and data collected during the initial phases of the planning process. The CMP Working Team evaluated these options with further investigations and analysis and decided to adopt the Taylor Road Concept. The Taylor Road Concept would maintain the traditional areas of the campus, provides for additional capabilities, and would promote the development of an organized campus (See Figure 2-1).

Plum Brook Station. Two alternative concept strategies were developed and considered to guide the overall direction of PBS. These strategies were the product of the information and data collected during the initial phases of the planning process. The strategy for increased utilization of PBS was adopted by the CMP Working Team (see Figure 2-2).

2.11 DESCRIPTION OF THE NO-ACTION ALTERNATIVE

Under the No-Action Alternative NASA would not implement the Master Plan. Thus, the potential impacts described in this Draft EA would not occur. However, the No-Action Alternative would result in:

- On-going costly maintenance for outdated facilities,
- Failure to meet the goals outlined in GRC's overall Mission,
- Failure to prepare GRC facilities for the future; and
- Failure to strategically position GRC for implementation of the President's *Vision for Space Exploration* (GRC 2008a).

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3 AFFECTED ENVIRONMENT

Chapter 3 describes the existing conditions at the National Aeronautics and Space Administration (NASA) Glenn Research Center's (GRC) Lewis Field and Plum Brook Station (PBS).

3.1 LEWIS FIELD

Lewis Field is predominantly within the limits of the City of Brook Park, approximately 16 kilometers (km) [10 miles (mi)] southwest of downtown Cleveland (see Figure 3-1) in Cuyahoga County. Lewis Field borders Cleveland Hopkins International Airport (CHIA) to the east and to the north and west is the Rocky River Reservation, a part of the Cleveland Metropolitan Park District. The southern boundary of Lewis Field is adjacent to suburban, single family residences, and a commercial office development (GRC 2005a).

3.1.1 Land Use

Lewis Field encompasses approximately 132 hectares (ha) [326 acres (ac)] of land and contains over 180 buildings, structures, and other facilities that support NASA's wide-array of research, technology, and development programs (see Figure 3-2). Most of Lewis Field is considered fully developed with offices, test facilities, and support facilities; however, approximately 53 ha (130 ac) of Lewis Field that is undeveloped, including 24 ha (60 ac) in the West Area. Most of the remaining undeveloped land includes areas such as the Abram Creek ravine, which cannot to be developed due to its steep slopes (GRC 2005a).

3.1.1.1 Coastal Zone

Ohio has developed a Coastal Zone Management Plan, which has received Federal approval. Lewis Field is not located in the Ohio Coastal Zone (GRC 2008a).

3.1.1.2 Prime and Unique Farmlands

Land within Lewis Field is exempt from considerations of the Farmland Protection Policy Act (FPPA) because the land was purchased for the purpose of redevelopment before August 6, 1984. Therefore the site is not considered prime farmland because it has been committed to urban development, including commercial, industrial, or residential (GRC 2008a).

3.1.2 Climate and Air Quality

3.1.2.1 Climate

The climate at the Lewis Field site is continental in character, but strongly influenced by Lake Erie, located 8 km (5 mi) to the north, which tends to moderate temperature extremes and increase overall precipitation. Summers are warm and humid, with average temperatures of 21° C (70° F), occasionally exceeding 32° C (90° F) but rarely 38° C (100° F). The first frost typically occurs in October. Winters are relatively cold and cloudy, with an average temperature of -1.7° C (29° F) (GRC 2005a).

FIGURE 3-1 LEWIS FIELD LOCATION AND VICINITY MAP

SOURCE: GRC 2008a

FIGURE 3-2 GRC LEWIS FIELD FACILITIES MAP

SOURCE: GRC 2005

Precipitation varies substantially from year to year. Between 1961 and 1990, precipitation averaged 89 centimeters (cm) [35 inches (in)] per year. Some 60 percent of this precipitation falls between April and September. Thunderstorms generally occur from April through August. Snowfall averages 114 cm (45 in) in the vicinity of Lewis Field, but can be double that amount in the areas at the eastern end of the County. Average annual free water surface evaporation for the region is 82.7 cm (32.5 in) (NASA, 2005).

Prevailing winds are from the south to southwest, and westerly winds blowing across the lake can produce a lake effect near the shore. The cooling winds can delay spring in these areas. Winds are more westerly in winter. Some storms originating over Lake Erie can be violent, but tornadoes are rare in the area (NASA, 2005).

3.1.2.2 Air Quality

Air quality at Lewis Field is regulated through the National Ambient Air Quality Standards (NAAQS) promulgated under the Federal Clean Air Act (CAA). Table 3-1 identified the criteria pollutants regulated by the CAA.

TABLE 3-1 SUMMARY AIR QUALITY STANDARDS

Criteria Pollutant	Federal [(a)] and State of Ohio Standards µg/m^3 (ppm) [(c)]	
Carbon Monoxide (CO)		
1-hour Average	40,000 (35)	Primary
8-hour Average	10,000 (9)	Primary
Lead (Pb)		
Quarterly Average	1.5	Both Primary & Secondary
Nitrogen Dioxide (NO_2)		
Annual Arithmetic Mean	100 (0.053)	Both Primary &Secondary
Ozone (O_3)		
1-hour Average	(0.12)	Both Primary & Secondary
8-hour Average (1997 standard)	(0.08)	
8-hour Average (2008 standard)	(0.075)	
Particulate Matter (PM_{10})		
24-hour Average	150	Primary
Particulate Matter ($PM_{2.5}$)		
Annual Arithmetic Mean	15	Both Primary & Secondary
24-hour Average[(b)]	35	
Sulfur Dioxide (SO_2)		
Annual Arithmetic Mean	80 (0.03)	Primary
24-hour Average	365 (0.14)	Primary
3-hour Average	1,300 (0.5)	Secondary

(a) Federal primary standards are levels of air quality necessary, with an adequate margin of safety, to protect the public health. Federal secondary standards are levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
(b) Ohio has not adopted the newly changed 24-hour Average for the Particulate Matter ($PM_{2.5}$).
(c) µg/m3 = micrograms per cubic meter; ppm = parts per million

Lewis Field is classified as a major source of air emissions and operates under a Title V permit. The majority of emissions from Lewis Field result from the combustion of fuels; including, natural gas, #2 fuel oils, and jet fuels. Other sources include air heaters, boilers, and steam

generators. Cuyahoga County is designated as a nonattainment area for the $PM_{2.5}$[1] and the 8-hour Ozone (O_3) standards. Cuyahoga County is also designated as a maintenance area for PM_{10}, carbon monoxide (CO), and sulfur dioxide (SO_2) (NASA 2008)[2].

3.1.3 Water Resources

3.1.3.1 Surface Water

The primary surface water features at Lewis Field are the Rocky River and its tributary, Abram Creek. The Rocky River flows along the western edge of Lewis Field, separating it from the Rocky River Reservation of the Cleveland Metropolitan Park District. After passing Lewis Field, the River flows north and discharges into Lake Erie. Abram Creek begins in a low-lying area south of CHIA and flows through a mixed land use area, crossing the Lewis Field property. It travels approximately 6 km (4 mi) to its confluence with the Rocky River (GRC 2005a).

The Rocky River and Abram Creek are classified as Warmwater Habitats by the Ohio Environmental Protection Agency (OEPA) and portions of the Rocky River are designated as "Seasonal Salmonid" due to the occasional migration of trout. Other use designations for portions of Abram Creek and Rocky River include Primary Contact Recreation (swimming) and Agricultural and Industrial Water Supply. In addition, because the Rocky River flows through the Cleveland Metroparks, it is designated as a State Resource Water in the vicinity of Lewis Field. This designation affords special protection under the State's anti-degradation policy (GRC 2005a).

OEPA has reported that sections of Rocky River and Abram Creek in the vicinity of Lewis Field display signs of environmental degradation and do not meet the warmwater habitat aquatic life use designation. Stream flow patterns indicative of highly urbanized storm flow drainage may be important factors in explaining the degradation of stream biota (GRC 2005a).

Floodplains at Lewis Field occur at Abram Creek. Abram Creek fulfills the criteria for an area of special flood hazard (defined as an area of land that would be inundated by a flood having a one percent chance of occurring in any given year). No other mapped floodplains occur at Lewis Field and no facilities are within the 100-year floodplain. The 500-year floodplain for Lewis Field has not been mapped. Wetlands at Lewis Field have not been officially delineated; however, a study performed in 2002 identified four areas as probable wetlands. No activities currently occur in these four areas. These four areas are scheduled to be filled-in as part of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) landfill capping activities. Under the CERCLA program, GRC submitted an application for a Nationwide Permit No. 38 from U.S. Army Corps of Engineers (USACE) to obtain authorization prior to beginning work. The permit application was submitted to USACE under a separate cover in September 2006 (GRC 2005a).

One of the Great Lakes, Lake Erie, lies 8 km (5 mi) to the north of Lewis Field. It has a surface area of approximately 25,690 square kilometers (km^2) [9,919 square miles (mi^2)]. Lake Erie is an important fresh water fishery, with a combined commercial and sport catch estimated to

[1] $PM_{2.5}$ is defined as particulate matter with a diameter less than or equal to 2.5 microns.
[2] PM_{10} is defined as particulate matter with a diameter less than or equal to 10 microns.

exceed 20 million fish. Lake Erie is also a popular recreational resource for boating and its beaches (GRC 2008a).

Most surface water runoff from Lewis Field flows through the storm sewer system and natural swales to Abram Creek and Rocky River. Although most precipitation is believed to flow overland, several low volume seeps have been observed on the Abram Creek Valley walls after periods of heavy rainfall (GRC 2008a).

Wastewater at Lewis Field is comprised of sanitary, storm water, non-contact and contact cooling, cooling tower blowdown, and miscellaneous process discharge. There are three wastewater collection systems at Lewis Field, including sanitary, storm water, and industrial. The sanitary sewer system discharges by permit to the Southerly Wastewater Treatment Plant of the Northeast Ohio Regional Sewer District. Storm water discharges are regulated under two separate OEPA National Pollutant Discharge Elimination System (NPDES) permits.

OEPA NPDES Permit 3IO0000*GD solely requires the Center to account for all outfalls from the Center and thus the monitoring and sample reporting of a select number of those outfalls (most notably those with the highest flows). SWIM-Ware software is used for reporting purposes.

OEPA NPDES General Permit OHQ000001 establishes Lewis Field as a Non-Traditional Municipal Separate Storm Sewer System (MS4) and further identifies Lewis Field with the Ohio EPA Facility Permit Number: 3GQ00067*AG. This permit also requires the Center to account for all outfalls at Lewis Field, but does not regulate what is discharged from the outfalls by any means of monitoring or sampling.

This permit (3GQ00067*AG) requires Lewis Field to develop and implement the Storm Water Management Program (SWMP) to prevent storm water pollution from occurring at the Center and thus polluted discharges to Abram Creek and Rocky River. This permit, by means of the SWMP, could in the future be required to have established effluent guidelines as the result of installing Best Management Practices (BMPs), since aspects of the SWMP require the documentation showing there is an improvement of storm water discharges due to efforts of the Center's SWMP.

Storm water monitoring has indicated occasional exceedances of chlorine and these findings have been reported to OEPA with no additional action occurring from OEPA. Permit OH 3IO00001*FD contains requirements to monitor and report on chlorine and Lewis Field has installed two operational dechlorination units. The industrial waste system is used primarily for holding and discharging cooling tower blowdown and non-contact cooling water. To avoid overwhelming the sanitary sewer system, when maintenance is performed on the cooling towers, the former Industrial Waste Basins are drained at a measurable rate that is compatible with the capacities of the sanitary sewer system (GRC 2005a).

There are no anticipated revisions to the stormwater system and the combined sewer line discharges with surrounding facilities (e.g. Cleveland Hopkins Airport). The IWS will still be maintained in the same fashion as it is currently used. Permit changes will be pursued with the Ohio EPA Division of Surface Water and the NEORSD due to any realignments or closures of specific lines that will have an affect on current Center discharges.

3.1.3.2 Groundwater

Groundwater is rarely used in the vicinity of Lewis Field. Consequently less information is available for groundwater than surface water. Groundwater at Lewis Field occurs in two distinct lithologic zones, in the shale bedrock and in perched lenses in the overlying unconsolidated materials. These zones are approximately 15 to 76 centimeters (cm) [6 to 30 inches (in)] thick. The zones are thought to be isolated and not to contain significant amounts of groundwater. Groundwater in the unconsolidated zone is expected to discharge to Abram Creek and Rocky River. The groundwater zone within the bedrock is under artesian pressure due to the low hydraulic conductivity of the overlying soils. The recharge rate is estimated to be very slow and the shale bedrock has very low permeability (GRC 2005a).

Only seven permitted drinking water wells are within 6 km (4 mi) of Lewis Field, according to nearby City and Cuyahoga County records and the location of these wells are unknown. An earlier 1969 survey found 200 individuals in the Rocky River Basin who used groundwater for drinking water. Groundwater flow from Lewis Field is toward the adjacent creek and river, which precludes it from contaminating water wells in the vicinity (GRC 2005a).

Groundwater is not used for water supply at Lewis Field. Based upon the CERCLA evaluation of the facility, ground water has not been found to be above any risk-based clean-up standards. No aquifer at Lewis Field has been designated as a sole or principal drinking water source under the Safe Drinking Water Act, nor are there any underground injection wells at Lewis Field (GRC 2005a).

3.1.3.3 Wetlands

There are no activities currently located in wetlands at Lewis Field. It is GRC policy to restore, preserve and protect the natural and beneficial values provided by wetlands. In carrying out this policy GRC avoids adverse impacts associated with the occupancy and modification of wetlands (GRC 2005a).

3.1.4 Ambient Noise

Occupational exposure to noise is regulated by the Occupational Safety and Health Administration (OSHA). The exposure limit for workers is 90 decibels (A-weighted) (dBA) as a maximum daily time-weighted average, but NASA has set a more conservative (high) exposure limit of 85 dBA (GRC 2008a).

Noise generated at Lewis Field is from research operations (wind tunnels and engine test cells); transient noises such as valve releases, aircraft, construction activities, and traffic. The Central Process air system can generate high noise levels from its compressors, exhausters, heaters, chillers, and other equipment. Recent surveys indicate that, with the exception of transient noise spikes, the highest on-lab noise levels measured near operating systems are in the 90-95 dBA range, with a maximum of 102 dBA. Transient peaks in noise levels may occur due to the action of relief valves, vent noise, etc. Aircraft operations can generate maximum environmental noise levels between 80 and 90 dBA in nearby pedestrian areas at Lewis Field. On-site construction generates machinery and vehicular traffic noise.

The NASA policy for occupational noise exposure is found in NASA Procedural Requirement 1800.1B, Chapter 4.9, Environmental Health: Hearing Conservation, NPR 1800.1B (http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_1800_001B_&page_name=Chapter4). Noise issues on campus are referred to the industrial hygienists in SHED, who manage programs in hearing conservation, acoustical and noise control engineering, and community noise control. Hearing protection is provided to all employees exposed to noise levels above 82 dBA and is required in areas where noise levels are above 85 dBA. If hearing protection cannot reduce levels to less than 85 dBA, the worker's time allowed in high-noise areas is restricted to a time-weighted average exposure limit of 85 dBA.

CHIA is the largest noise source in the general vicinity of Lewis Field. Other noise sources include a nearby automotive factory, traffic noise from two major interstate highways, and the I-X Center. The general noise level at Lewis Field is well below the average day/night sound level of CHIA. Noise levels at the Lewis Field fence line are generally below 70 dBA and are primarily attributed to off-site sources (GRC 2005a).

The community noise control program focuses on resolving local noise complaints and instituting appropriate measures as needed. Several noise sources exist in the general vicinity of Lewis Field, the largest among these being CHIA. Lesser sources nearby include a Ford Motor Company factory and traffic noise sources from two major Interstate highways and a large exhibition hall (the I-X Center). The general noise level of Lewis Field is well below the average day/night sound level of CHIA. Noise levels at the Lewis Field fence line are generally below 70 dBA, with much of this noise attributable to off-site sources (GRC 2005a).

3.1.5 Utilities

3.1.5.1 Water Supply

Domestic water is purchased from the City of Cleveland. GRC is supplied through 86 cm (36 in) and 76 cm (30 in) mains at Brookpark Road. The service enters the Central Area through a 61 cm (24 in) and a 41 cm (16 in) feed line to three 31 cm (12 in) meters located in a vault at Brookpark Road. An additional supply enters through a 31 cm (12 in) main reduced to a 20 cm (8 in) meter at Cedar Point Road (GRC 2008a).

Average daily consumption is 3,690,375 liters (l) [975,000 gallons (gal)] from the Brookpark Road source. The Cedar Point Road Source serves as a limited capacity back-up and was last utilized in the summer of 1996. The North Area is served directly from the 20 cm (8 in) supply main on Brookpark Road and has its own 20 cm (8 in) meter. Average daily consumption is near 57,917 l (15,300 gal) for the North Area (GRC 2008a).

3.1.5.2 Electrical Power

Power for Lewis Field is supplied by the local electric utility. The main power supply to Lewis Field is 138,000 volts, three phase. There is a secondary power supply to Lewis Field to act as backup power to cover the institutional loads in the case of a failure in the main power supply.

Electric power is distributed to all facilities and buildings through an internal (to Lewis Field) electric power distribution system. This internal distribution system was designed and

constructed by NASA and NASA has full responsibility for maintaining the system. Power is distributed at Lewis Field at voltages of 13.8 kV, 6.9 kV, 4.16 kV, 2.4 kV, 480v, 208v, and 120v.

Extensive protective relaying is employed to prevent injury to the Lewis Field staff and minimize damage to the electrical distribution system and all research and institutional equipment connect to the system.

Annual power consumption at Lewis Field is 59,000 gigajoules (212,000 megawatts). (GRC 2008e)

3.1.5.3 Emergency Services and Fire Suppression

GRC maintains an Emergency Preparedness Plan which describes response actions to be taken in the event of an emergency. The Plan meets various requirements of the United States Environmental Protection Agency (U.S. EPA), OSHA, the Federal Response Plan, and the NASA Emergency Preparedness Plan (GRC 2008a).

The GRC fire station was closed in April 1996, after an assessment determined that Lewis Field could effectively rely on local emergency response resources. Fire, medical, and hazardous material emergency response are now provided by the adjacent communities of Cleveland, Brook Park, and Fairview Park. Under the current plan, reported incidents are first investigated by former fire fighters who were reassigned or co-assigned to first responder positions at Lewis Field. If deemed necessary, GRC dispatchers call for outside assistance. In an obvious emergency, outside assistance is requested immediately. There is also coordination of emergency services with the City of Brook Park Fire Department and Hazardous Materials Response Team. Lewis Field has an on-site medical facility where employees can be seen for acute injuries and illness or occupational injuries during normal working hours (GRC 2008a).

Federal agencies are directed to provide technical assistance to the Local Emergency Planning Committee in the development of emergency response plans and the fulfillment of community right-to-know responsibilities, if requested, and to the extent practical. GRC has supplied the Local Emergency Response Commission with a list of resources and equipment which can be made available in the event of an emergency (GRC 2008a).

Fire suppression equipment at GRC consists of widely available hand-held fire extinguishers. The hand-held fire extinguishers consist of carbon dioxide (CO_2) and dry chemical (A-B-C) types.

The water distribution system was originally constructed to provide separate fire protection and domestic water supplies. The water reservoir and pumping station installed for the fire protection system are no longer active and have been replaced by the City of Cleveland domestic water source. At this time, the two loops are interconnected and serve as parallel lines in Lewis Field's Central Area multiple loop system. Fire hydrants are well distributed throughout the site and are served by the parallel loops of the domestic water system. The loops are ductile iron and cast iron pipe and are in good condition (GRC 2008a).

3.1.5.4 Natural Gas

The average annual natural gas consumption for GRC from 2000 through 2004 as a whole was 14,868 thousand cubic meters (m^3) [525,075 thousand cubic feet (ft^3)]. Approximately 65 percent was institutional. GRC is provided natural gas by contract, the commodity with Energy Services Provider Group of Baltimore Maryland, and the distribution with Dominion East Ohio Gas Company of Ohio. Service enters the site from a high-pressure main on Brookpark Road through a meter house in the north portion of the Central Area (Building 44) where pressure is reduced to 7.25 kilopascal (kPa) [50 pounds per square inch gauge (psig)]. Metering capability is 19,820 m^3/hr [700,000 ft^3/hour] (GRC 2008a).

The on-site system is a loop through the Central Area with feeders to serve the West and South Areas. The North Area (Building 500 and 501) has a separate meter and reducing station. Gas is available in all sections of the site for domestic uses. The Central Area features the following large special demands, as shown in Table 3-2.

TABLE 3-2 LEWIS FIELD CENTRAL AREA NATURAL GAS DEMAND

Location	Demand (m^3/hr)	Demand (ft^3/hr)
10 X 10 Air Dryers (Building 88)	6,796	240,000
ECRL Air Pre-Heater (Building 99)	2,265	80,000
8 X 6 Air Dryer (Building 57)	4,531	160,000
Steam Generator Plant (Building 12)	1,699	60,000
10 X 10 Supersonic Wind Tunnel Heater	16,140	570,000

SOURCE: GRC 2008a

With the exception of the gas supply for the Steam Generator Plant, the large demands of this group are subject to scheduling. Since the air handling systems of which these facilities are a part must also be scheduled, gas scheduling is also required. This process creates no major operational problems at this time. However, if air capabilities should increase in the future or natural gas supplies should become critical, changes may be required to increase system pressure (GRC 2008a).

The system is primarily constructed of plastic pipe, High Density Polyethylene (HDPE). Some sections are welded carbon steel pipe. All of the system was originally steel but has been mostly replaced with HDPE in recent years. A majority of the system is underground with direct buried valves. A section that connects the Taylor Road main and Walcott Road main via the ERB roof is new carbon steel piping installed in 2005. Much of the HDPE was installed in 2002. The original underground steel distribution system is cathodically protected via a sacrificial anode system. All new steel piping is similarly protected with anodes (GRC 2008a).

3.1.6 Geology and Soils

The area near Lewis Field consists of gently rolling uplands created by glacial outwash. Lewis Field is generally level due to extensive cut-and-fill operations that reclaimed the area from steep drainage swales. These drainage features were filled in with a variety of undifferentiated soils and gravels, construction debris, and industrial and domestic waste (GRC 2005a).

The area surrounding Lewis Field is located on the western flank of the undeformed portion of the Appalachian Basin. The basin contains a southeastward-thickening prism of sandstones, carbonates, shales, and salts that aggregate to a thickness of about 1,980 to 7,010 meters (m) [6,500 to 23,000 feet (ft)]. Bedrock in the immediate vicinity of Lewis Field is composed of the

Cleveland Shale Member of the Ohio Shale. The probability of an earthquake causing structural damage is minimal. The Ohio Shale is fissile, however, and offers differential resistance to applied stresses depending upon the inclination to the direction of stratification (GRC 2005a).

The areas of contamination identified under the State Order will be addressed under the Remedial Action.

3.1.7 Natural Resources

3.1.7.1 Flora

The composition of the original vegetation at the Lewis Field site is unknown, but its nature can be inferred. Lewis Field lies in the Beech-Maple Forest region of the great eastern Deciduous Forest of Eastern North America. This region has been classified as a mixture of Beech Forest, Mixed Oak Forest, Elm-Ash Swamp Forest, and Mixed Mesophytic Forest. At Lewis Field, the uplands probably were dominated a mixture of Beech-Maple and Elm-Ash forests depending on local soil types and hydrology. The Abram Creek gorge provides a microclimate for more northern species and would be classified as a southern pocket of Hemlock-White Pine-Northern Hardwood Forest. Mixed Mesophytic Forest likely was present on the slopes of the gorge. The terrace of Abram Creek is too narrow to support swamp forests or riverine woodlands. The original forest cover was removed probably during the early 1800's, destroying the natural vegetation. The denuded uplands likely were cultivated and/or grazed and subsequent continuing development has prevented the land from reverting to a natural state (SAIC 2002).

Most of the site is now too highly disturbed to support significant numbers of indigenous Ohio plant species. Approximately 53 ha (130 ac) at Lewis Field are considered undeveloped. The gorge of Abram Creek and the tops of the bluffs above the valley are the only areas that retain natural qualities. These areas contain forest communities similar to their original types (SAIC 2002).

Only two known Ohio-listed species, the pigeon grape and the American chestnut, are located at Lewis Field. The American chestnut parent tree died during the winter of 2002; however, three chestnuts have survived from a planting in 2003, and are currently located in the West Area (GRC 2005a).

Lewis Field has no known direct adverse effects on endangered plant species beyond its borders (SAIC 2002).

3.1.7.2 Fauna

Animals that inhabit Lewis Field include those typical of urban areas, including deer. Most common birds include the European starling, house sparrow, American robin, chimney swift, and house finch. Few amphibian species, one reptile, many species of butterflies and moths, and three common bat species have been identified at Lewis Field. The black-throated green warbler was the only species of concern discovered in 2001. It was an isolated individual, unlikely to be nesting at Lewis Field (GRC 2005a).

Lewis Field has no known direct adverse effects on endangered animal species beyond its

borders.

3.1.8 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the Lewis Field regional area, which is defined here as the land area within an 80.5 km (50 mi) radius of Lewis Field which includes portions of Lorain, Medina, Summit, Cuyahoga, Geauga and portions of Lake, Erie, Portage, Huron, Ashland, Wayne, Stark, Trumbull, Ashtabula, Richland, and Ottawa Counties (USCB 2006).

3.1.8.1 Population

The total population within the Lewis Field regional area was approximately 3,410,703 persons in 2000 (see Table 3-3) (USCB 2006). The total population is expected to increase to 3,480,500 persons by 2010 and to 3,544,236 persons by 2020. Similar increases are anticipated in Cuyahoga County where the total population was about 1,393,978 persons in 2000 and is expected to increase to 1,422,505 persons by 2010 and to 1,448,554 persons by 2020 (USCB 2006).

TABLE 3-3 POPULATION OF THE LEWIS FIELD REGIONAL AREA AND CUYAHOGA COUNTY FOR 2000, 2010, AND 2020

Population	Lewis Field Regional Area			Cuyahoga County		
	2000	2010[a]	2020[a]	2000	2010[a]	2020[a]
White	2,757,548	2,759,790	2,753,199	938,863	939,626	937,382
Black or African American	518,370	569,993	623,795	382,634	420,739	460,453
American Indian and Alaska Native	6,513	7,395	8,268	2,529	2,872	3,211
Asian	42,351	56,211	68,982	25,245	33,507	41,120
Native Hawaiian and Other Pacific Islander	692	918	1,127	338	449	551
Some other race	35,093	39,885	44,910	20,962	23,842	26,826
Two or more races	50,136	--	--	23,407	--	--
Hispanic or Latino (of any race)	84,920	106,772	132,868	47,078	59,193	73,660
Total Population	**3,410,703**	**3,480,500**	**3,544,236**	**1,393,978**	**1,422,505**	**1,448,554**
Percent Minority	**19.15**	**20.71**	**22.32**	**32.65**	**33.95**	**35.29**

SOURCE: USBC 2006

a) Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

In 2000, minority race population represented approximately 19 percent of the total population within the Lewis Field regional area and approximately 33 percent of the total population within Cuyahoga County. The Black or African American population was the largest minority group living within the Lewis Field regional area and Cuyahoga County in the year 2000. Between 2000 and 2020, minority race population is expected to increase to 22 percent of the total population within the Lewis Field regional area and approximately 35 percent of the total population within Cuyahoga County. The Black or African American population is estimated to remain the largest resident minority group within the Lewis Field regional area and Cuyahoga County in 2020 (USCB 2006).

3.1.8.2 Economy

GRC, as a whole, contributes significantly to the local, state, and national economies. In the fiscal year of 2003, GRC generated $1,288 million in spending throughout Ohio. Of this, $439 million resulted from direct spending and more than $849 million resulted from indirect and induced spending throughout the regional economy. Lewis Field employs approximately 3,100 civil servants and support contractors. The vast majority of Lewis Field's workforce lives in Cuyahoga County (GRC 2003; GRC 2005a).

Industrial sectors in the Lewis Field regional area that provide significant employment include education, health and social services; manufacturing; retail trade; and professional, scientific, management, administrative, and waste management services. An estimated 2,643,833 people were employed in the Lewis Field regional area in 2000 with an estimated unemployment rate of 5.0 percent. The National and Ohio unemployment rates during the same period were estimated at 5.8 percent and 5.0 percent, respectively. The estimated percent of persons living below the poverty level in 2000 is as follows: 12.4 percent (United States), 10.6 percent (Ohio), 9.9 percent (Lewis Field regional area), and 12.9 percent (Cuyahoga County) (USCB 2006). Persons whose incomes are less than the poverty threshold are defined as low-income persons by CEQ (CEQ 1997).

3.1.9 Cultural Resources

Cultural resources are any prehistoric or historic buildings, structure, object, site, or district considered important to a culture, subculture, or community for scientific, traditional, religious or other purposes. They include historic architectural resources, archaeological resources, and traditional resources. Historic architectural resources include standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Archaeological resources are locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles). Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community.

Historic properties, as defined in the National Historic Preservation Act (NHPA), are significant architectural, archaeological or traditional resources that are either eligible for listing, or listed in, the National Register of Historic Places (NRHP). Individual properties eligible for listing in the NRHP are usually at least 50 years old and are typically of State or local significance. National Historic Landmarks (NHLs) are properties that have been determined by the Secretary of the Interior to be nationally significant in American history and culture. If not already listed on the NRHP, an NHL is automatically added to the Register upon designation. About three percent of Register listings are NHLs.

In addition to individual property listings, a district containing multiple buildings or structures may be eligible for listing. A National Register historic district is a concentration of historic buildings, structures, sites, or objects united historically or aesthetically by plan or physical development.

As a Federal agency and in order to comply with the NHPA, NASA must identify and protect its historic properties and ensure that they are managed and maintained in a way that considers their

historic and cultural values.

3.1.9.1 Historical Setting

The National Advisory Committee for Aeronautics (NACA), the predecessor organization to NASA, was created by President Woodrow Wilson in 1915 to organize American aeronautical research and "to supervise and direct the scientific study of the problems of flight, with a view to their practical solution" (GRC 2005a).

GRC was the third laboratory established by NACA. In 1940, Congress authorized construction of an aircraft engine research laboratory in Cleveland, Ohio. The site was a large field immediately west of the Cleveland Municipal Airport. Originally, bleachers and a parking lot had been built on the field to accommodate the large crowds that came to view the National Air Races that were held at the airport throughout the 1930's. The Federal Government purchased the 81 ha (200 ac) of land for $500 from the City of Cleveland and the bleachers were pulled down to make way for the new laboratory. Initial building plans called for an administration building, a test hangar, an engine research laboratory, a fuels and lubricants building, and an altitude wind tunnel. Plans for a Jet Propulsion Static Laboratory and Icing Research Tunnel were added during the initial phase of construction. Groundbreaking at the Cleveland site was held on January 23, 1941 and the new Aircraft Engine Research Laboratory (AERL) was dedicated in 1943. During World War II, the AERL was involved in "troubleshooting" for both the military and engine manufacturers. Although specifically designed to test piston engines, the post-war mission of the facility focused on research and development of the jet engine. In 1947, the AERL was renamed the Flight Propulsion Research Laboratory to reflect its role in propulsion research; the name was changed again the next year to Lewis Flight Propulsion Laboratory in honor of George W. Lewis, NACA's first Director of Aeronautical Research (GRC 2005a).

In the decade that followed, the facility continued to meet the research needs of the jet age by extending its size and scope. This expansion included:

- building two new wind tunnels,
- building the Materials and Structures Complex,
- building the Rocket Engine Test Facility,
- building the Propulsion Systems Laboratory,
- designing and building a nuclear test reactor (for which NACA acquired the 2,428 ha (6,000 ac) Plum Brook Army Ordnance Works in Sandusky, Ohio); and
- developing liquid hydrogen fuels research (GRC 2005a).

In 1958, when NACA was dissolved and NASA was established, the AERL became part of the foundation of the new Agency and was renamed the NASA Lewis Research Center. The Center undertook additional responsibilities in the fields of research and development in space power technology, launch vehicles and chemical and electric propulsion for space. The Center acquired an additional 56 ha (139 ac) and built the Developmental Engineering Building, the Electric Propulsion Laboratory, the Energy Conversion Laboratory, and the Zero Gravity Research Facility (GRC 2005a).

In 1999, the Center was officially renamed the "NASA Glenn Research Center at Lewis Field," to recognize the contributions and legacy of two men, John H. Glenn and George W. Lewis. Today, GRC consists of 132 ha (326 ac), has 150 buildings, including 31 major research facilities and approximately 3,400 civil and contract employees (GRC 2005a).

3.1.9.2 Architectural Resources

Lewis Field undertook a cultural reconnaissance survey in 1996 to inventory National Register eligible resources in its possession. The survey cites two Lewis Field facilities which have been designated as National Historic Landmarks. The Rocket Engine Test Facility (RETF) was demolished in 2003 to accommodate an airport runway expansion. Its historic impact was documented by GRC as part of the demolition. The Microgravity Research Laboratory (Zero Gravity Facility), Building 110, is also recognized as a National Historic Landmark. As part of the National Park Service 1984 Man in Space thematic nomination, two GRC facilities were designated as NHL (Gray & Pape, Inc., 2008).

In addition to GRC's two NHL's, in 1987, the Icing Research Tunnel (IRT) was named an International Historic Mechanical Engineering Landmark by the American Society of Mechanical Engineers. This facility has a unique heat exchanger and a spray system that simulates natural icing clouds. The facility is the world's largest refrigerated icing tunnel and has been the site of groundbreaking research in aircraft icing phenomena (Gray & Pape, Inc., 2008). In 2007, NASA completed a survey of test facilities nationwide to determine the historic significance due to contributions to the development of the space transportation system (STS). Two facilities at GRC, the 8 X 6 Supersonic Wind Tunnel and the Abe Silverstein Memorial Wind Tunnel (the 10 X 10 Supersonic Wind Tunnel) are considered eligible for listing on the NRHP.

Over the past decade, GRC has made a concerted effort to identify and evaluate additional historic architectural resources. Further surveys were conducted in 2000 and 2002. The survey results have identified a NRHP eligible historic district in the GRC Central Area (Gray & Pape, Inc., 2008).

3.1.9.3 Archaeological Resources

The Archaeological Resources Protection Act (ARPA) preserves and protects resources and sites on Federal and Indian lands by prohibiting the removal, sale, receipt, or interstate transportation of archaeological resources obtained illegally (i.e., without permits) from public or Indian lands. ARPA permits are not required for archaeological work conducted by or on behalf of GRC; however, the specific requirements of ARPA may be addressed in contract documents or other documentation authorizing the work.

For activities on Federal lands, the Native American Graves Protection and Repatriation Act (NAGPRA) requires consultation with "appropriate" Indian tribes or Native Hawaiian organizations prior to the intentional excavation or removal after inadvertent discovery, of several kinds of cultural items, including human remains and objects of cultural patrimony. Native American cultural items include human remains, associated funerary objects, unassociated funerary objects, sacred objects, and cultural patrimony. Native American cultural

items are the property of Native American groups.

While detailed archeological surveys do not exist for the entire site, a 1998 Gray & Pape cultural resources survey of Lewis Field performed an archeological resource predictive model and prepared a sensitivity map. Lewis Field is considered to have a low potential for the presence of intact archeological resources (GRC 2005a; Gray & Pape, Inc., 2008).

One archaeological site has been reported in the vicinity of Building 501. The "Dean Site" (State No. 33 Cu 133) is known from anecdotal reports and is said to have contained relics from the Archaic and Woodland periods. The site is probably no longer extant. In support of the Cleveland Hopkins International Airport Final Environmental Impact Statement, Environment and Archaeology Limited Liability Company undertook a limited Phase I Archaeology Survey at Lewis Field in 1998. The area investigated was the South Area within the area of construction impacts. The survey indicated that no significant or potentially significant archaeological sites are located within that area (GRC 2005a).

A second Phase I Archaeology Survey was performed by Parsons Engineering Science, Inc. (2000). This study investigated areas targeted for facilities relocation due to the proposed airport expansion. A total of 3.65 ha (9.02 ac) at four locations at Lewis Field were subjected to a systematic phase I survey. Excavations at Lewis Field resulted in the identification of two positive shovel test pits within a layer of fill. Consequently, the artifacts recovered from that area are part of a series of fill deposits and lack integrity. No artifacts were recovered throughout the remainder of areas tested at Lewis Field. Consequently, no further archaeological investigations were considered warranted at Lewis Field in conjunction with this project (GRC 2005a).

Additional archaeological investigations were undertaken at the Lewis Field and PBS project areas during November 2002. The additional phase I archaeological field investigations were conducted to support recent changes in project plans. A total of 0.56 ha (1.4 ac) at Lewis Field were surveyed for evidence of cultural materials. No archaeological deposits or other significant cultural remains were encountered during the November 2002 field investigations (GRC 2005a).

3.1.9.4 Traditional Resources

Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Traditional resources have not been identified at Lewis Field.

3.1.10 Hazardous Materials and Waste Handling

Hazardous materials are managed in a safe and proper manner following the requirements and standards prescribed in the following authorities:

- Title 40 CFR, Parts 260-265, Protection of the Environment,
- Title 49 CFR, Department of Transportation, Parts 100-177, Hazardous Materials Definitions,
- NSS/FS 1740.7, August 1977, Safety Standard for Handlers of Hazardous Materials,

- Public Law 94-580, Resource Conservation and Recovery Act,
- Title 40 CFR, Part 61, Subpart M (Asbestos - NESHAPS),
- Title 40 CFR, Part 266, Recycling,
- Title 40 CFR, Part 268, Land Disposal Restrictions,
- Title 40 CFR, Part 273, Universal Wastes,
- Title 40 CFR, Part 279, Used Oil,
- Title 41, CFR, Part 101-42, Utilization and Disposal of Hazardous Material and Certain Categories of Property, and
- NASA Handbook, NHB 4300.1, NASA Personal Property Disposal Manual.

Overall, as part of ongoing activities GRC receives and stores small and large quantities of hazardous materials. GRC is a Large Quantity Hazardous Waste Generator which is defined as a facility that generates more than 998 kilograms (kg) [2,200 pounds (lbs)] of hazardous waste or more than 1.0 kg (2.2 lbs) of acute hazardous wastes per calendar month. All hazardous materials and hazardous wastes are managed in accordance with applicable Federal, State, and Local rules and regulations via the GRC EPM. The EPM contains detailed policies and procedures related to the handling of hazardous materials and hazardous wastes (GRC 2005b).

None of the facilities proposed are located in any known contaminated areas of concern. The only known significant area of contamination is located in the South Area/old landfill and there are no plans to build within the contaminated area. There is a CERCLA Area of Concern within and immediately east of Building 104. This area is under an Ohio EPA clean up Administrative Order and subject to the Bureau of Underground Storage Tank Regulations, a Bureau of the State of Ohio Fire Marshal's office. Regulatory issues will be appropriately addressed during decommissioning and demolition. Some de-icing chemical runoff associated with CHIA is routed through an existing underground drainage system across Lewis Field, but this system is not impacted by implementing the Proposed Action. The consolidated Materials and Structures facility and the replacement Maintenance Facility are the only proposed facilities that may use toxic chemicals, and their project plans address this concern (GRC 2008a).

At Lewis Field, oversight and guidance for the handling storage and disposal of hazardous wastes is provided by the GRC SHED. Hazardous materials and wastes are transferred to Building 215, the Central Chemical Storage Facility, for temporary storage (90-day maximum for materials determined to be a hazardous waste) while a means of reuse, recycling or disposal is determined. Once the determination is made, the SHED arranges for a waste disposal contractor to pick up and deliver the hazardous waste to a disposal facility, as required (GRC 2005b).

3.1.11 Transportation

GRC is served by a transportation system that connects it to local, regional and national points. Interstate Highways 480 and 71 are located within 2.2 km (1.0 mi) and connect GRC regionally and nationally. CHIA is adjacent to GRC and provides easy access via numerous daily flights. Cleveland's network of freeways and local roadways provide quick access to residential areas and business clusters located throughout the metropolitan area. The on-site transportation

system at Lewis Field provides quick, convenient circulation to all points within GRC. All systems are generally in good condition and meet required service levels (GRC 2008a).

The principal arterial road providing access to the main entrance of GRC is Ohio State Highway 17 (Brookpark Road), which parallels Interstate 480 from Ohio State Highway 10 to Interstate 71 along the northern limits of the campus. Brookpark Road carries two lanes of traffic in each direction with a total average daily traffic count of approximately 10,330 vehicles per day near the Main Gate. The primary arterial feeder to Brookpark Road is Interstate 480, which carries an average daily traffic count of approximately 128,710 vehicles. The Interstate 480 (East to West) and Interstate 71 (North to South) interchange is approximately one mile east of the Main Gate (GRC 2008a).

Access to the West Gate is provided via Aerospace Parkway and Cedar Point Road, which intersect at the West Gate. These roadways are not heavily traveled and there is very little public exposure at the West Gate. Cedar Point Road provides alternative routes from GRC to the nearby cities of Brook Park, Olmsted Falls, Olmsted Township, and North Olmsted. The newly constructed Aerospace Parkway provides access to residential neighborhoods south of the Center. Aerospace Parkway connects to I-X Center Drive and Ohio State Highway 237. Traffic through these corridors is minimal (GRC 2008a).

All arterial roads in the vicinity of GRC appear to be in good condition and are currently maintained by local municipalities. Aerospace Parkway is a recently extended four lane concrete road with little current development along its corridor. Cedar Point Road's public section is a two lane asphalt roadway that has been recently improved (GRC 2008a).

Three primary vehicle access points serve Lewis Field's Central and West Campuses. The vehicle access points include three controlled security gates: Main Gate, West Gate and South Gate. The majority of employees and all visitors must access the campus through the Main Gate at Brookpark Road. As currently configured, there are two ingress lanes and two egress lanes, and the current configuration requires truck and automobile traffic to pass through the same gate (GRC 2008a).

The West Gate acts as a secondary secure access point for employees, and is staffed by security personnel. Employees are identified in a similar manner to those at the Main Gate. Truck access and visitor access is not typically allowed through the West Gate. The South gate is rarely utilized, but is a control point to Lewis Field when Cedar Point Road is utilized in special cases or events. This gate would be eliminated when Cedar Point Road becomes an internal circulation route (GRC 2008a).

GRC's on-site civil servant and contractor population totals approximately 3,400 employees, including both Lewis Field and PBS. However, the majority are located at Lewis Field.

The parking capacity at Lewis Field Central Area is approximately 3,050 spaces and is adequate for the number of employees and visitors on campus, although several areas experience poor distribution of parking in relation to employee destinations.

Many of the parking lots are in poor condition, with many areas doubling as truck or heavy equipment routes or staging areas. Most parking lots are asphalt cement surface course laid

directly on sub-soil. Damaged surfaces include potholes and cracks, with many patches. Several parking lots have recently been reconstructed.

3.1.12 Environmental Justice

Executive Order (EO) 12898 (1994), *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands.

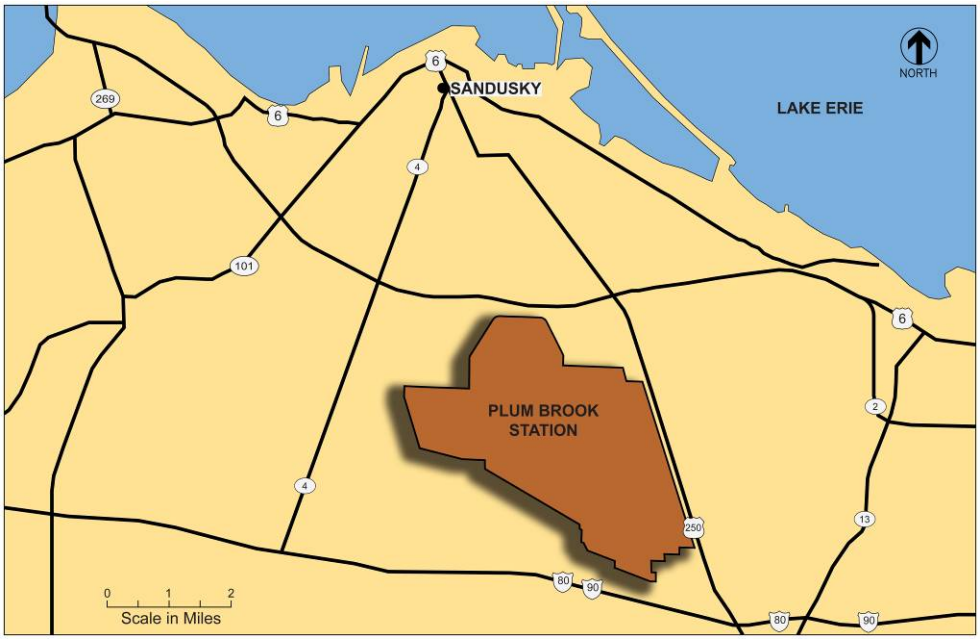
In response to the EO, GRC developed an Environmental Justice Implementation Plan and a Supplement to the Environmental Justice Implementation Plan. GRC updated the Environmental Justice Implementation Plan in 2004 (GRC 2004). The findings of this Plan indicate no evidence of substantial offsite adverse impacts to human health of the environment resulting from present of reasonably foreseeable GRC operations. Further, the analyses found that no minority or low-income populations are, or are likely to be, disproportionately impacted as a result of operations at either site.

3.2 PLUM BROOK STATION

PBS encompasses 2,614 ha (6,454 ac) of rural land, located approximately 6 km (4 mi) south of Sandusky, Ohio (see Figure 3-3). Most of PBS consists of forestland and old fields. The area surrounding PBS is mixed use residential, agricultural, and commercial. PBS houses over 174 buildings and structures; including, offices, mechanical and process equipment areas, test facilities, substations, warehouses, and wastewater treatment facilities. There are four active test facilities at PBS. The Space Power Facility (SPF) and the Spacecraft Propulsion Research Facility (B-2 Facility) are thermo vacuum chambers and are designated Space Flight Systems Facilities. The Hypersonic Tunnel Facility (HTF) is an Aeronautic Research Facility and the Cryogenics Test Complex (CTC) is an Aerospace Technology Facility (GRC 2005a).

The PBS site is operated as a satellite facility (component installation) of GRC and performs various research related to aerospace applications. Use of the site by the Federal Government began in the early 1940's when the U.S. Army established the Plum Brook Ordnance Works (PBOW) for the manufacture of munitions. Munitions production took place throughout the early 1940's, after which buildings and production lines were decontaminated and decommissioned. Ownership of the property subsequently was transferred to NASA and the property was renamed "Plum Brook Station" (GRC 2005a).

FIGURE 3-3 PLUM BROOK STATION LOCATION AND VICINITY MAP



SOURCE: GRC 2008a

3.2.1 Land Use at Plum Brook Station

3.2.1.1 Coastal Zone

Ohio has an approved Coastal Zone Management Plan. Although PBS itself is not located in the Ohio Coastal Zone, the two raw water pumping stations it owns are on the shore of Lake Erie, within the designated Coastal Zone. Both pumping stations are consistent with Ohio's Coastal Zone Management Plan (GRC 2005a).

3.2.1.2 Prime and Unique Farmlands

PBS is sited in an area known for its agricultural productivity and is bordered by farmland, some of which is leased to farmers by NASA. Although much of the native soil was disturbed during the construction of PBOW and later by NASA, there are still vast tracts of native soils which have not been disturbed by modern fertilization techniques and herbicide usage. PBS test facilities require large buffer zones, and therefore development of the property is not expected, although some development could be possible along the U.S. Highway 250 border (GRC 2008a).

3.2.2 Climate and Air Quality

3.2.2.1 Climate

The climate at PBS is continental in character and is influenced by its proximity to Lake Erie. Summers are moderately warm and humid, with average temperatures of 21º C (70º F), and winters are cold and cloudy, with an average temperature of -2º C (28º F). Annual temperature extremes occur typically after late June and in January, with a first frost typically occurring in October. Precipitation averages approximately 89 cm (35 in) per year. Prevailing winds are typically from the south to southwest (GRC 2005a).

3.2.2.2 Air Quality

Air quality at PBS is regulated through the NAAQS promulgated under the CAA (see Table 3-1 for criteria pollutants). PBS is classified as a minor source of air emissions under Title III and Title V of the CAA and is registered under the OEPA Non-Title V Emission Fee (Blue Card) Program in conjunction with a Presumed Inherent Physical Limitation (the inability to discharge air pollutants in quantities that trigger Title V requirements). Sources of air pollutants at PBS, other than mobile sources such as automobiles and construction equipment, include boilers, heaters, research test cells, and other minor sources. Erie County is designated as an attainment area for all NAAQS (GRC 2005a).

3.2.3 Water Resources

3.2.3.1 Surface Water

PBS is located in an area that supports multiple surface water systems that are within the Lake Erie watershed. Eleven streams cross PBS, the largest of which are Pipe Creek, Kuebler Ditch, Ransom Brook, and Plum Brook. Streams generally flow northward and converge into Ransom Creek, Storrs Ditch, Plum Brook, and Sawmill Creek and eventually flow into Lake Erie. Over seventeen isolated ponds and reservoirs are also located on PBS (GRC 2005a).

All surface waters at PBS are classified as Warmwater Habitat by OEPA. Other use designations applicable to PBS streams include Primary Contact Recreation and Agricultural and Industrial Water Supply. Although water quality in the streams that originate or flow through PBS is believed to be generally good, there are two surface water areas at PBS which have been affected by trinitrotoluene (TNT) manufacturing operations in the early 1940's. One of the areas, designated as the Pentolite Road Red Water Pond, is in the process of remediation by USACE as part of the clean-up of the former PBOW. Further remediation of the second area, designated as the West Area Red Water Ponds, which are approximately 3 ha (8 ac) in size, has not been recommended at this time (GRC 2005a).

PBS operates under a NPDES permit (No. OH 2IO0000*2) that specifies wastewater discharge limitations and monitoring requirements for multiple outfall points on PBS. Wastewater discharges at PBS include storm water, non-contact cooling water, cooling tower and boiler blowdown, and sanitary discharges. Domestic sewage is primarily routed to the Erie County Sewage Treatment Works (GRC 2005a). PBS operates one waste water treatment plant located at the Space Power Facility which discharges to Kuebler Ditch and is monitored under the NPDES permit.

Portions of PBS lie within the 100- and 500-year floodplains. However, no PBS facilities remain in the 100-year floodplain. In addition, there are no activities at PBS that are located in either floodplain. Wetlands at PBS have not been officially delineated, and PBS relies on studies to indicate the potential or probable location of a wetland. There are no known activities currently located in wetlands (GRC 2005a).

3.2.3.2 Groundwater

PBS is underlain by an overburden aquifer and limestone and dolomite bedrock aquifer. The bedrock aquifer is overlain by unconsolidated deposits of glacial origin. These unconsolidated deposits comprise the overburden aquifer. The thickness of the overburden aquifer ranges from less than 1.5 m (5 ft) to greater than 8 m (25 ft). Groundwater flow is to the north-northwest towards Lake Erie. The limestone and dolomite aquifer is the primary source of groundwater for Erie County. Although most of the wells surrounding PBS are used for agricultural purposes, a few wells in the vicinity of PBS are used for private and public consumption. No groundwater at PBS is used for private or public consumption, therefore routine groundwater testing is not required (GRC 2005a).

Groundwater at PBS has been contaminated as a result of munitions manufacturing at the former PBOW. Groundwater investigations are being conducted by the USACE in connection with site remediation activities such as the red water ponds. Ongoing groundwater investigations have identified several contaminants; including, nitroaromatics, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals (GRC 2005a).

3.2.3.3 Wetlands

Wetlands at PBS have not been officially delineated, and until this happens PBS must rely on studies which indicated the potential or probable locations of wetlands on site. Eight vegetation formations and thirteen alliances at PBS have been identified as probably wetlands. Past site modifications have included the construction of drainage ditches to prevent the accumulation of standing water, thereby reducing the potential for wetland formation. There are no known activities currently located in wetlands. It is GRC policy to restore, preserve, and protect the natural and beneficial values provided by wetlands. GRC avoids adverse impacts associated with the occupancy and modification of wetlands (GRC 2005a).

3.2.4 Ambient Noise

Sources of noise at PBS include an unpaved airstrip which accommodates light aircraft, transient noise blasts from test facilities, construction activities, and traffic noise. The Army Reserves and the Ohio Air National Guard occasionally discharge pyrotechnic devices at PBS. The nearest public receptor facilities are generally more than 305 m (1,000 ft) from the PBS boundary, and much more distant from the noise source. None of these noise generating activities are significant sources of noise impacts and no noise complaints have been recorded at PBS (GRC 2005a).

3.2.5 Utilities

3.2.5.1 Water Supply

The water supply consists of separate domestic water and raw water supply systems. Domestic water is purchased from the Erie County Department of Environmental Services (ECDOES), which in turn buys treated water from the City of Sandusky. PBS is supplied from a 31 cm (12 in) main coming from the ECDOES 41 cm (16 in) main that runs along Route 250 on the east side of PBS. All service enters through a 20 cm (8 in) meter located at Fox Road and enters

into Plum Brook approximately in the middle of the eastern border. Usage presently averages between 133 and 189 cubic meters per day (m^3/day) [35,000 and 50,000 gallons per day (gal/day)]. Domestic water is used for potable service and supplies 6 building fire sprinkler systems (GRC 2008a).

This 31 cm (12 in) main services all of the buildings on the north and central portions of the Station. On the south end of the Station, the main is piped to an elevated tower. This 567,800 l (150,000 gal) tower is filled by two 473 liters per minute (l/min) [125 gallons per minute (gal/min)] pumps and distributes water to SPF. Water from this tower is used for potable and fire protection (SPF only) uses. In addition, this tower can provide temporary backup water for the rest of PBS if something would occur to the ECDOES main (GRC 2008a).

There are approximately 24,700 m (81,000 ft) of water main in use at the present time. Because of recent upgrade projects, approximately 91,400 m (30,000 ft) have been replaced. An additional 25,908 m (85,000 ft) of inactive main is also available in some areas of the site (GRC 2008a).

Raw water is used for testing, cooling, and fire protection. It is pumped from two intakes in Lake Erie. One source is at Big Island near Sandusky, which pumps water directly to either raw water reservoirs on the site. This raw water system is presently active and its future usage is anticipated to continue. The water is transported to PBS through a 61 cm (24 in) steel main. This station has pumps rated at 3,600 l/min at 30.5 m head (950 Gal/min at 100 ft head) and 1,900 l/min at 30.5 m head (500 gal/min at 100 ft head). The available capacity of the Big Island source could be depleted by a significant growth in the Sandusky water demand. The City owns this intake, while NASA owns the pump station and the service pipe to the Plum Brook site (GRC 2008a).

The second source is the Rye Beach station northeast of the site. This raw water system is presently inactive and is used as a back up system for the Big Island system. The Rye Beach system is being considered as a potential enhanced use leasing (EUL) opportunity in relation to the Erie County water supply system. This source has an intake crib approximately 914 m (3,000 ft) from shore at a depth of 9.1 m (30 ft). The intake line is a 42 in concrete pipe. Water is transported to Plum Brook through a 34 in concrete main and pumped from this source to either reservoir on the site. Flow into Reservoir No. 1 in the northeastern area which has a capacity of 20,817,500 l (5,500,000 gal) is controlled by a level-actuated valve. The level of Reservoir No. 2 in the west portion of the site which has a capacity of 22,700,000 l (6,000,000 gal) is regulated by gravity overflow and gravity back-feed into Reservoir No. 1 (GRC 2008a).

All water distributed to the Station is pumped out of Reservoir No. 1 into a 567,800 l (150,000 gal) elevated tank, which provides water to the Station. Raw water consumption is approximately 3.785 million l/day (1 million gal/day) during periods of high usage. Between 340,900 and 530,000 l (90,000 and 140,000 gal) is used for test cooling uses elsewhere on the site; the remainder is used for air conditioning during summer months (GRC 2008a).

3.2.5.2 Electrical Power

Power for Plum Brook Station is supplied by the local electric utility. The electric power is supplied to Plum Brook Station by two separate 138,000 volt transmission lines. If either of the two 138 kV transmission lines is tripped out because of a fault condition or for maintenance, power to the Station would be continue uninterrupted.

Electric power is distributed to all facilities and buildings through an internal (to Plum Brook Station) electric power distribution system. This internal distribution system was designed and constructed by NASA and NASA has full responsibility for maintaining the system. Power is distributed at Lewis Field at voltages of 13.8 kV, 34.5 kV, 7.2 kV, 2.4 kV, 480V, 208V, and 120V.

Extensive protective relaying is employed to prevent injury to the Plum Brook Station staff and minimize damage to the electrical distribution system and all research and institutional equipment connect to the system. (GRC 2008e)

3.2.5.3 Emergency Services and Fire Suppression

The role of PBS for testing high energy systems requires emergency response, safety and security capabilities to be a critical component of the Station's ability to operate. Proper safety protocols for testing operations are inherent in the fabric of the PBS organization. PBS maintains an emergency preparedness plan and manual. PBS does not have areas of high personnel densities, therefore the enforcement of exclusion zones during test preparation (yellow light) and testing operations (red light) is a critical element of their safety planning. Health, emergency, and fire services are provided by Perkins Township under an informal cooperative agreement. The nearest hospital is in Sandusky, approximately 8 km (5 mi) from PBS. The staff at the PBS Plant Protection Office is trained to administer emergency first aid and CPR for on-site incidents (GRC 2008a).

Fire suppression equipment at PBS consists of widely available hand-held fire extinguishers. The hand-held fire extinguishers consist of CO_2 and dry chemical (A-B-C) types (GRC 2008a).

The Communications Center houses the central computers for comprehensive monitoring and control of Station-wide fire alarm, door control and camera surveillance systems (GRC 2008a).

3.2.5.4 Natural Gas

PBS is supplied with natural gas by Columbia Gas of Ohio, Inc. The company owns a 25 cm (10 in) high pressure 8.7 kPa (60 pounds per square inch [psi]) supply main, which serves PBS from the north and runs the length of Ransom Road in the western part of the site. There is also a 10 cm (4 in) supply main from the north on Columbus Avenue, which supplies the Communication Center and the Engineering Building in the northeast portion of the site (GRC 2008a).

While there is an abandoned gas distribution system on site, most of the currently used piping has been installed since NASA assumed use of the site. Therefore, the on-site system is relatively new and is in good condition. In the areas served by Station 8434, the present demand is nearing capacity (GRC 2008a).

3.2.6 Geology and Soils

PBS is located on land which was once lake bottom formed from glacial melt waters. The area is relatively flat and slopes gently northward. Elevations range from about 191 to 207 m (625 to 680 ft) above sea level. Bedrock in the area consists of carbonates and clastics (sandstones and shales). The depth of the bedrock is highly variable and can range from 0.7 to 7.6 m (2.0 to 25 ft). The probability of an earthquake causing structural damage at PBS is minimal (GRC 2005a).

The area surrounding PBS is known for its agricultural productivity and farmland. Although much of the native soil was disturbed during construction of PBOW and later by NASA, there are still vast tracts of undisturbed native soils at PBS. The soils at PBS are typically light-textured and often sandy with moderate to slightly acid pH. The two primary soil associations that occur at PBS are Arkport-Galen association in the northern and western areas of the site and the Prout association in the southern and eastern areas. These soils are highly variable in thickness and permeability. As a result of past Army activities at the PBS during PBOW operations, the USACE is conducting remediation activities in several areas of soil contamination (GRC 2005a).

3.2.7 Natural Resources

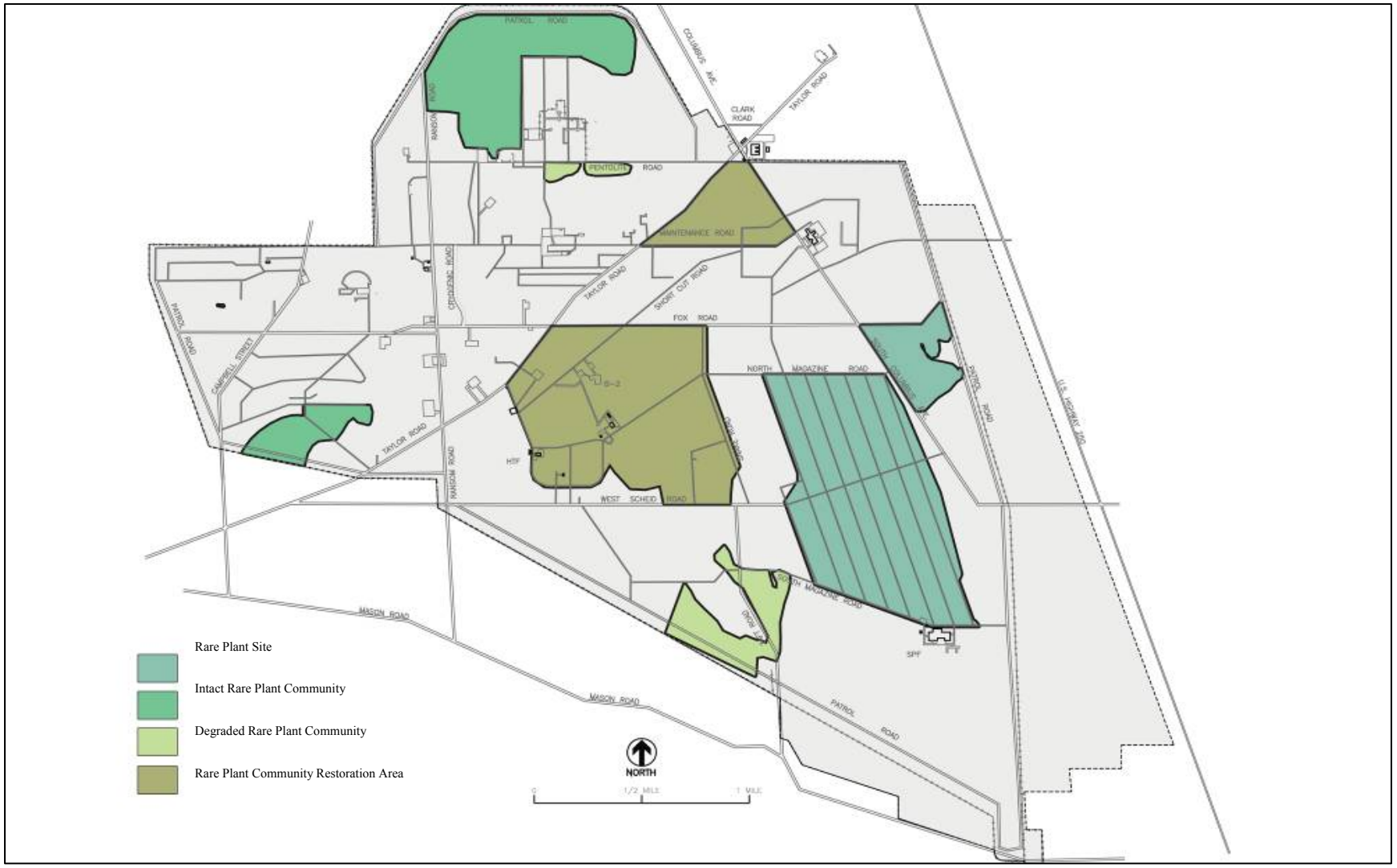
3.2.7.1 Flora

A number of sites at PBS have been identified by both field work and reference to historic data as areas of special ecological or vegetational significance. These include specific sites with identified populations of rare or state-listed plant species. They can be small and local, or somewhat extensive in area. But in all cases their distinguishing characteristic is that they support a growth of rare plants. The loss of any of these sites is likely to mean the irretrievable loss of the local rare plants, many of which are exceptionally rare or state-listed and found nowhere else in the region or state (see Figure 3-4) (GRC 2008a).

The Division of Natural Areas and Preserves conducted a botanical survey of PBS in 1994. During that survey, 327 species of vascular plants were cataloged, of which twelve were listed by the Division as Ohio rare species. The Division of Natural Areas and Preserves was requested to undertake a follow up botanical survey in 2001. The goal of the 2001 survey was to revisit as many of the rare species as possible from the 1994 survey and to enhance the vascular plant catalogue. In 2001, 312 of the species found in 1994 were identified and 219 new additions to the catalogue were made (GRC 2005a).

The Plant Community Survey of 2001, which classified the plants communities according to the Federal Geographic Data Committee Vegetation Classification Standard, focused on the development of baseline vegetation maps with community descriptions for PBS. Plant communities and aquatic habitats were identified, mapped, and described by evaluating existing information (aerial photographs, previous reports, and maps) and field surveys. Volume II: *Protected Species Management Strategy* summarizes the study and mapping of existing plant communities and aquatic habitats at PBS. In addition, it accompanies electronic GIS data layers that portray this information in a spatial database. The SHED manages the GIS database (GRC 2005a).

FIGURE 3-4 PBS RARE PLANT AREAS



SOURCE: GRC 2008a

The historical context of plant communities at PBS is well documented in Volume II: *Plant Community Survey of Protected Species Management Strategy*. The PBS occupies an area that is known to have been an extensive prairie complex prior to the European settlement of the area. Many species that are associated with Ohio prairies were located during both surveys (GRC 2005a).

The state list for plants is maintained by ODNR's Division of Natural Areas and Preserves. Plants listed as "endangered" or "threatened" have legal protection in the State of Ohio. Plants listed as "potentially threatened" do not have legal protection, but their status is being monitored for potentially listing for legal protection. Plants listed as "added" were recently added to Ohio rare plant list, but their designation has not yet been determined. Table 3-4 lists the state-listed plant species that are found at PBS and managed with the 2007 Species Management Plan (SAIC 2002).

TABLE 3-4 STATE-LISTED RARE PLANT SPECIES

Species Scientific Name	Common Name	Date Located
Endangered		
Hypericum gymnanthum	Least St. John's-wort	1994/2001
Threatened		
Carex brevior	Tufted Fescue Sedge	2001
Carex cephaloidea	Thin-leaved Sedge	2001
Carex conoidea	Field Sedge	1994/2001
Gratiola viscidula	Short's Hedge-hyssop	1994/2001
Helianthus mollis	Ashy Sunflower	1994/2001
Juncus greenei	Greene's Rush	2001
Prenanthes aspera	Rough Rattlesnake-root	2001
Potentially Threatened		
Aristida purpurescens	Purple Triple-awned Grass	2001
Baptisia lactea	Prairie False Indigo	1994/2001
Carex alata	Broad-winged Sedge	1994
Hedeoma hispida	Rough Pennyroyal	2001
Hypericum majus	Tall St. John's-wort	1994/2001
Juglans cinerea	Butternut	2001
Panicum boreale	Northern Panic Grass	2001
Rhexia virginica	Virginia Meadow-beauty	1994/2001
Sagittaria rigida	Deer's-tongue Arrowhead	2001
Scleria triglomerata	Tall Nut-rush	1994/2001
Viola lanceolata	Lance-leaved Violet	1994/2001

SOURCE: GRC 2008d

3.2.7.2 Fauna

The state list for animals is maintained by ODNR's Division of Wildlife. Animals listed as "endangered" have legal protection in the State of Ohio. Animals listed as "threatened" or "special interest" do not have legal protection, but their status is being monitored for potentially listing for legal protection. The Ohio Division of Natural Areas and Preserves also maintains a list of rare animals, but their designations do not confer legal status. Animals on this list are included the "special interest" category below. Table 3-5 lists the state-listed animal species that are found at PBS (SAIC 2002).

TABLE 3-5 STATE-LISTED ANIMAL SPECIES

Scientific Name	Common Name	Date Located
State-Endangered		
Cistothorus platensis	Sedge Wren	2002[1]
Spartiniphaga inops	Spartina Borer Moth	2001
State-Threatened		
Bartramia longicauda	Upland Sandpiper	1994
Bulbulcus ibis	Cattle Egret	1994/2001[2]
Haliaceetus leucocephalus	Bald Eagle	2002
Nycticorax nyctcrax	Black-crowned Night Heron	1994/2001
State-Special Interest/Concern		
Elaphe vulpine gloydi	Eastern Fox Snake	1994/2001
Opheodrys vernalis	Smooth Greensnake	1994/2001
Emydoidea bladinigii	Blanding's Turtle	1994
Dendroica discolor	Black-throated Green Warbler	1994/2001
Oporonrnis philadelphia	Mourning Warbler	2001
Camerodius albus	Great Egret	1994/2001
Rallus linicola	Virginia Rail	2001

SOURCE: SAIC 2002

[1] Proposed to be added to Special Interest/Concern in 2002.

[2] Proposed to be added to endangered list in 2002.

Animals censused at PBS during the 2001 ODNR surveys included birds, amphibians, reptiles, fish, lepidoptera, and bats. A total of 125 bird species were identified during the 2001 summer birding season at the PBS. This total includes 11 species that were considered to be late migrants through the area and 7 species which were classified as visitors only. A general analysis of the results shows very little change in the species diversity on the station since the 1994 survey (GRC 2005a).

In 2001 amphibians and/or reptiles were recorded from 116 localities in PBS. There were 15 localities from 1994 where animals were no longer found, but animals were found at 29 new locations. Twenty-one species have been found including two salamanders, six frogs, one lizard, five turtles, and seven snakes. Two new native species, the milk snake and blue-tail skink were found as well as an introduced species, the red-eared slider. The gray tree frog has been deleted from the list. In addition the area lies within the range of nineteen other species and it is possible that one or more of these may yet be discovered here (GRC 2005a).

During the fish survey in 1993, 3,028 individuals, representing 13 species and one hybrid were collected, compared to 2,156 individuals, representing 15 species and one hybrid collected in 2001. The small, intermittent nature of the streams in the study area coupled with extensive channel modifications and habitat degradations have resulted in lower species diversity than would be found in more pristine headwater streams of similar size. With the exception of the brook stickleback, all the species captured in this study were common species statewide, exhibiting high degrees of tolerance to habitat and water quality degradations. A small population of sticklebacks was discovered in a small, shallow pool below a culvert in one of the tributary ditches feeding into Pipe Creek in 1993. This population was still there in 2001 (GRC 2005a).

In a 1994 summer survey of PBS, 41 species of butterflies were recorded. During the summer of 2001, 53 species of butterflies were recorded. Three species observed in 1994 were not seen in 2001. However, fourteen species not recorded in 1994 were found in 2001. The number of species recorded from Erie County has increased from 59 to 70 (GRC 2005a).

After an extensive survey of PBS during the summer of 2001, a total of 450 species of moths were recorded. A previous survey in 1994 recorded 385 species of moths. Of the moths collected in 2001, six species are listed as uncommon, three species are rare, and three species are of special interest. One species on the ODNR "Ohio's Endangered Wildlife List" was recorded (GRC 2005a).

In 2002 a pair of nesting Bald Eagles were located West of Ransom Road in the vicinity of Reservoir #2. These eagles have returned each year since.

Distribution, diversity and relative abundance of the Chiropterans (bats) at PBS were studied from April through September 2001. Methodology included visual and acoustical surveying of the grounds and buildings, the mist netting of wooded, riparian and open sites and radio tracking selected bats within the Station. Eight species of bats totaling 238 were captured at 17 of the 21 mist net sites at PBS. There was no evidence of the Indiana bat. Several maternity colonies were located utilized by three different species (GRC 2005a).

3.2.8 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the PBS regional area. The PBS regional area is defined here as the land area within an 80.5 km (50 mi) radius of PBS which includes portions of Ottawa, Sandusky, Seneca, Erie, Huron, Lorain, and portions of Medina, Ashland, Richland, Crawford, Lucas, Wood, Hancock, Wyandot, Morrow, Wayne, and Cuyahoga Counties (USCB 2006).

3.2.8.1 Population

The total population within the PBS regional area was approximately 1,716,478 persons in 2000 (see Table 3-6) (USCB 2006). The total population is expected to increase to 1,751,604 persons by 2010 and to 1,783,680 persons by 2020. Similar increases are anticipated in Erie County where the total population was about 79,551 persons in 2000 and is expected to increase to 81,179 persons by 2010 and to 82,666 persons by 2020 (USCB 2006).

In 2000, minority race population represented approximately 10 percent of the total population within the PBS regional area and approximately 11 percent of the total population within Erie County. The Black or African American population was the largest minority group living within the PBS regional area and Erie County in the year 2000. Between 2000 and 2020, minority race population is expected to increase to 14 percent of the total population within the PBS regional area and approximately 15 percent of the total population within Erie County. The Black or African American population is estimated to be the most numerous resident minority group within the PBS regional area and Erie County in 2020 (USCB 2006).

TABLE 3-6 POPULATION OF THE PBS REGIONAL AREA AND ERIE COUNTY FOR 2000, 2010, AND 2020

Population	PBS Regional Area			Erie County		
	2000	2010[a]	2020[a]	2000	2010[a]	2020[a]
White	1,537,283	1,538,533	1,534,859	70,514	70,571	70,403
Black or African American	94,718	104,151	113,982	6,876	7,571	8,274
American Indian and Alaska Native	3,970	4,508	5,040	164	186	208
Asian	16,951	22,498	27,610	298	396	485
Native Hawaiian and Other Pacific Islander	413	548	673	4	5	7
Some other race	33,727	38,332	43,161	420	477	537
Two or more races	29,416	--	--	1,275	--	--
Hispanic or Latino (of any race)	78,873	99,169	123,407	1,664	2,092	2,604
Total Population	**1,716,478**	**1,751,604**	**1,783,680**	**79,551**	**81,179**	**82,666**
Percent Minority	**10.44**	**12.16**	**13.95**	**11.36**	**13.07**	**14.83**

SOURCE: USBC 2006

(a) Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.
Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

3.2.8.2 Economy

GRC, as a whole, contributes significantly to the local, state, and national economies. In the fiscal year of 2003, GRC generated $1,288 million in spending throughout Ohio. Of this, $439 million resulted from direct spending and more than $849 million resulted from indirect and induced spending throughout the regional economy (GRC 2003). PBS employs approximately 26 civil servants and 104 contractors. The vast majority of the PBS workforce lives in Erie County (GRC 2005a).

Industrial sectors in the PBS regional area that provide significant employment in include education, health and social services; manufacturing; retail trade; and professional, scientific, management, administrative, and waste management services. An estimated 1,326,232 people were employed in the PBS regional area in 2000 with an estimated unemployment rate of 4.6 percent. The National and Ohio unemployment rates during the same period were estimated at 5.8 percent and 5.0 percent, respectively. The estimated percent of persons living below the poverty level in 2000 is as follows: 12.4 percent (United States), 10.6 percent (Ohio), 9.1 percent (PBS regional area), and 8.1 percent (Erie County) (USBC 2006). Persons whose incomes are less than the poverty threshold are defined as low-income persons by CEQ (CEQ 1997).

3.2.9 Cultural Resources

See Section 3.1.9 for a general discussion about cultural resources.

3.2.9.1 Historical Setting

The history of PBS dates to 1938, when the War Department acquired about 9,000 acres of land to construct PBOW. The plant produced munitions, such as TNT, until the end of World War II. After the war, the plant closed and the site remained idle until 1956 when NACA obtained 202 ha (500 ac) for construction of a nuclear research reactor. The Reactor Facility, designed to study the effects of radiation on materials used in space flight, was the first of fifteen test facilities eventually built by NACA and its successor agency, NASA, at PBS. By 1963, NASA had acquired the entire 3,642 ha (9,000 ac) site at PBS for these additional facilities

(GRC 2005a).

In 1973, after successfully completing the Apollo moon program, congressional budget constraints caused NASA to defer many of its research and development programs and to cease operations at several research facilities. The major test facilities at PBS were placed in standby mode, capable of being reactivated for future use. Smaller facilities were not maintained, and some were dismantled. The Plum Brook Reactor Facility (PBRF) was shut down and all the nuclear fuel removed and shipped off-site for disposal or reuse. NASA placed the facility in a storage mode and conducted strict oversight and ongoing environmental monitoring around the reactor. NASA plans to completely decommission PBRF by 2011, enabling this area to be safely reused (GRC 2005a).

3.2.9.2 Architectural Resources

In 2002, Gray & Pape, Inc., was retained by SAIC to conduct a phase I architecture survey at PBS. The Area of Potential Effect for the project included all NASA or General Services Administration owned or leased structures located within and adjacent to PBS (GRC 2005a).

Two of the facilities at PBS have been previously documented as eligible and not eligible for landmark status. The two facilities are the B-2 Facility and PBRF. The B-2 facility is an NHL (listed in 1984). PBS's B-2 Facility is the world's only facility capable of testing full-scale upper-stage launch vehicles and rocket engines under simulated high-altitude conditions. The engine or vehicle can be exposed for indefinite periods to low pressures, low-background temperatures, and dynamic solar heating, simulating the environment the hardware would encounter during orbital or interplanetary travel (GRC 2005a).

The PBRF was determined not eligible for listing in the NHRP. NASA has completed documentation for historical purposes of the Reactor Facility through a three-year contract with History Enterprises, Inc. (GRC 2005a).

The Phase I architecture survey for the PBS project was conducted in April 2002. The survey documented and photographed 265 buildings. These buildings or complexes are summarized on 72 Ohio Historic Inventory forms. As a result of this survey, Gray & Pape recommended that the SPF is potentially eligible to the NHRP. SPF houses the world's largest space environment simulation chamber, measuring 30.5 m (100 ft) in diameter by 37.2 m (122 ft) high. The facility was designed and constructed to test both nuclear and non-nuclear space hardware in a simulated low-Earth-orbit environment. Some of the test programs that have been performed at the facility include high-energy experiments, rocket-fairing separation tests, Mars lander system tests, and International Space Station hardware tests (GRC 2005a).

3.2.9.3 Archaeological Resources

In 2002, Gray & Pape, Inc., was retained by SAIC to develop a model for predicting the archaeological sensitivity of NASA's 2,590 ha (6,400 ac) at PBS. The Area of Potential Effect for the project included all NASA-owned or -leased land located within and adjacent to the Station (GRC 2005a).

The following text is an edited excerpt from *Predictive Model and Ground-Truthing Survey of*

Prehistoric and Historic Archaeological Resources at the NASA Plum Brook Station (Gray & Pape, Inc. 2002).

> *A number of archaeological investigations have occurred near the project area, including a Phase I survey along U.S. Route 250 (Skinner et al. 1981), sections of a Phase I survey relating to modifications to Interstate 80 (Bush et al. 1981), Phase I and II investigations of two parcels of NASA-owned land (Blank 1984), Phase I investigations of NASA-owned excess property (Pratt and Croninger 1981), Phase I investigations of several discrete areas near K Site (Stevens andKohring 2000), and sections of a Phase I Literature review conducted for a cable alignment that was proposed to run south of the facility (Skinner et al. 1988). The previous research indicates that the extensive prehistoric use of the landscape from the Archaic through Woodland periods centered on the extraction of Pipe Creek chert and its modification into usable implements.*
>
> *Work by Blank (1984) consisted of Phase I investigations in two discrete areas and the results of his investigations included the documentation of 28 previously unknown prehistoric sites, all of which appeared to be small-scale workshops or campsites. No assignment to a temporal affiliation was possible.*
>
> *The third survey within NASA-owned land consisted of Phase I, which discovered two isolated finds (33Er490 and 33Er492) and one site (33Er489) that consisted of two flakes. These sites were assessed as not eligible for listing in the NRHP.*

3.2.9.4 Traditional Resources

Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Traditional resources have not been identified at PBS (GRC 2005a).

3.2.10 Hazardous Materials and Waste

Overall, as part of ongoing activities GRC receives and stores small and large quantities of hazardous materials. GRC is also a Large Quantity Hazardous Waste Generator which is defined as a facility that generates more than 998 kg (2,200 lbs) of hazardous waste or more than 1.0 kg (2.2 lbs) of acute hazardous wastes per calendar month. All hazardous materials and hazardous wastes are managed in accordance with applicable Federal, State, and Local rules and regulations via the GRC EPM. The EPM contains detailed policies and procedures related to the handling of hazardous materials and hazardous wastes (GRC 2005b).

At PBS the Plum Brook Management Office (PBMO) coordinates the transfer of the hazardous materials and wastes to Building 9206 for temporary storage (90-day maximum for materials determined to be a hazardous waste) while a means of reuse, recycling or disposal is determined. Once the determination is made, the GRC Waste Management Office arranges for a waste disposal contractor to pick up and deliver the hazardous waste to a disposal facility, as required (GRC 2005b).

See Section 3.1.10 for a general discussion of hazardous materials and waste management at PBS.

3.2.11 Transportation

The network of existing regional roads and highways are adequate to support PBS operations. The Sandusky area does not have commercial airline service but CHIA is located 50 miles to the east and conveniently serves this need. There are two items of concern for transportation requirements. First, a more direct access route to PBS from nearby highways would be very desirable. Second, in order for PBS to fulfill its true potential there is a need to conveniently and economical transport large test items to PBS from other national locations (GRC 2008a).

PBS is located just north of Interstate 80 and 90, just west of US Highway 250 and just south of State Highway 2 (see Figure 3-3). The close proximity of PBS to this network of highways provides excellent local and regional access to PBS. The interstate system of highways between Sandusky and Cleveland essentially provides "door-to-door" travel between Lewis Field and PBS. CHIA, combined with a one hour trip on the Interstate provides convenient air travel to PBS (GRC 2008a).

3.2.12 Environmental Justice

See Section 3.1.12 for a general discussion about environmental justice.

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4 ENVIRONMENTAL CONSEQUENCES

This Chapter describes the potential environmental consequences of implementing the proposed Master Plan at the National Aeronautics and Space Administration's (NASA) Glenn Research Center (GRC). This chapter also addresses the No Action Alternative.

The environmental consequences described in this chapter are primarily focused on the first five years of implementing the proposed Master Plan beginning late 2008 – early 2009. Where, practicable environmental consequences are addressed in general mostly for demolition, and construction, and some rehabilitation, and for specific projects.

It should be noted that for new construction, GRC has established a general goal of meeting many of the requirements of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System established by the U.S. Green Building Council. Specifically, GRC has established the goal of obtaining Silver Certification (33-38 credit points out of 69 total points) for its major construction projects wherever feasible. While it is not certain exactly which of the LEED New Construction and Major Renovations requirements would be achieved for each project, it is assumed that the many LEED related Silver goals would be met for nearly all of the major construction projects. Appendix A, Section A.1.2 details some of the specific goals and requirements.

GRC will evaluate the environmental consequences provided in this Draft Environmental Assessment (EA) every five years. Where, appropriate additional environmental documentation would be considered.

4.1 IMPLEMENTING THE PROPOSED ACTION AT LEWIS FIELD

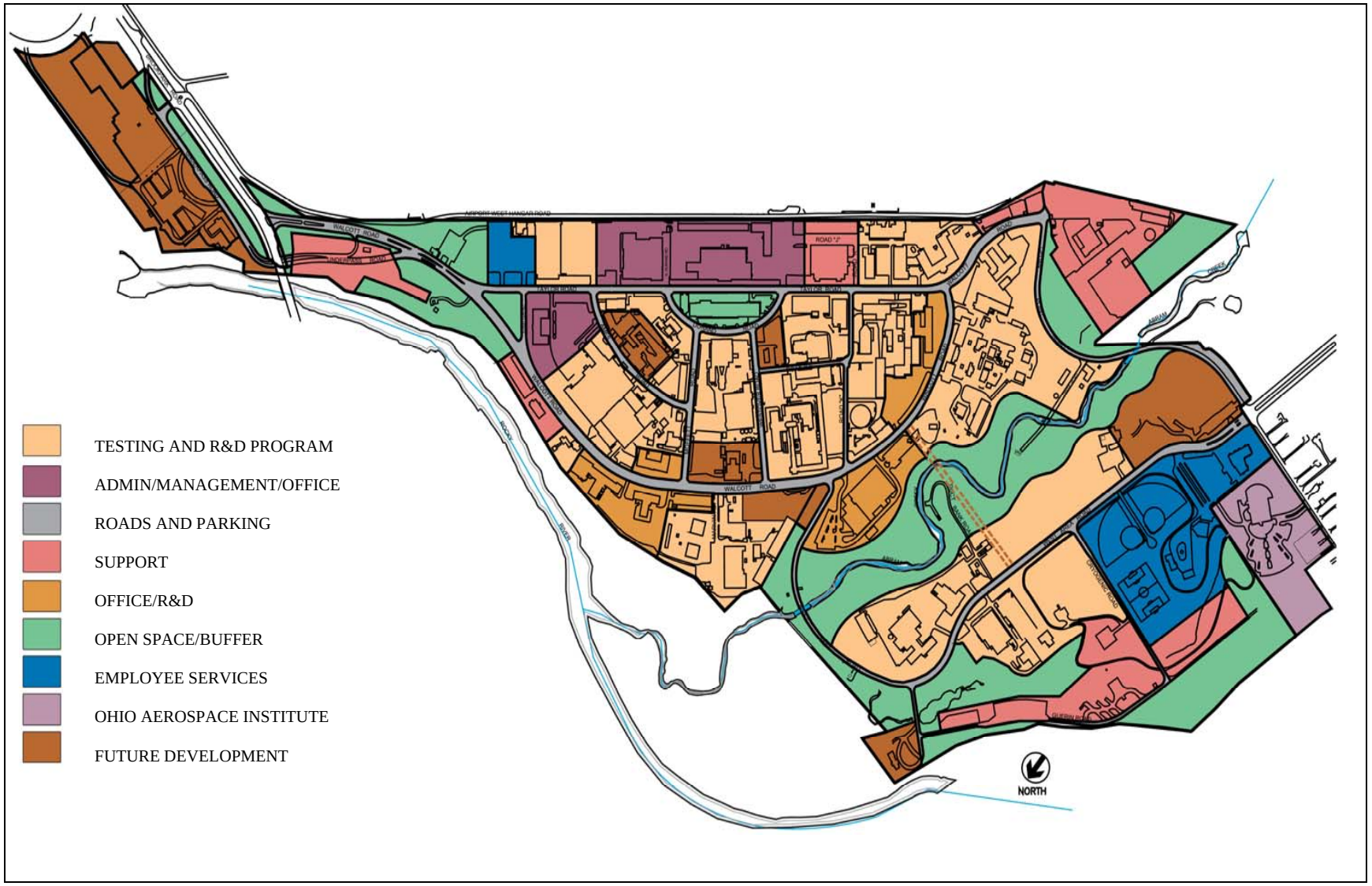
This Section describes the potential environmental consequences of implementing the Master Plan at Lewis Field.

4.1.1 Land Use

No adverse impact to land use is anticipated. Overall, beneficial impacts to land use would result in a more cohesive and campus-like setting at Lewis Field. The current development strategy supports sustainable land use through maintaining existing development density; ensuring that development fits within the local planning framework; maximizing open space acreage on campus; and continued development of pedestrian corridors and pathways. Figure 4-1 shows the proposed land use plan at Lewis Field.

On-site Demolition, Construction, and/or Rehabilitation Impacts. In general, no long-term impacts would be anticipated to adjacent on-site facilities and no disturbance would be expected to previously undeveloped areas. Approximately 80 percent of Lewis Field is bordered by the Cleveland Hopkins International Airport (CHIA) or the adjacent Metroparks to the north, south and east; therefore, no impacts to adjacent land use is anticipated. The West Area is adjacent to a residential neighborhood. To minimize potential impacts from demolition, construction and rehabilitation activities in this area, contractors would work only between 7:30 AM and 4:30 PM (GRC 2008a).

FIGURE 4-1 PROPOSED LAND USE PLAN FOR LEWIS FIELD



SOURCE: GRC 2008a

During demolition and construction, occupants of adjacent on-site buildings scheduled for demolition or new construction would be impacted; however, these impacts would be temporary and intermittent. Additionally, there would be on-site inconveniences from modified parking and pedestrian patterns, and from high intermittent and general increased background noise. NASA C-185 form would be used at GRC for crane permitting for construction that involves notifying the Cleveland Hopkins International Airport Tower when the crane height exceeds allowable limits of seventy-five feet.

Operational Impacts. The types of facilities proposed at Lewis Field are similar in use, function, and density as the current facilities.

4.1.2 Air Quality

No long-term adverse impact to air quality is anticipated.

Short-term impacts may be related to construction equipment emissions, fugitive dust emissions from construction and demolition activities, photochemically reactive volatile organic compounds (VOC) emissions from curing asphalt concrete, and increased use of vehicles from any extended commutes of contract workers.

On-site Demolition, Construction, and/or Rehabilitation Impacts. Air quality impacts from demolition and construction activities include increased dust and airborne particulates caused by grading, filling, removal, and other demolition activities. Dust from demolition and construction activities would not be expected to significantly contribute to ambient concentrations of suspended particulate matter. Demolition and construction contractor(s) would have to comply with the regulations requiring all reasonable precautions be taken to minimize fugitive dust emissions. Dust impacts would be minimized through standard dust control measures such as watering. After demolition and construction are complete, dust levels are expected to return to near existing conditions. Air quality impacts may also result from emissions from demolition and construction equipment, and possibly from traffic stopped at intersecting roadways or on potential detour routes. Air quality impacts may also result from the VOC emissions released from curing asphalt concrete used the construction of roadways and parking lots. These impacts are expected to be temporary.

As indicated in Chapter 3, Section 3.1.2.2, Cuyahoga County is designated as a nonattainment area for $PM_{2.5}$ and 8-hour ozone (O_3) standards (moderate non-attainment), and maintenance for PM_{10}, carbon monoxide (CO) and sulfur dioxide (SO_2). Table 4-1 provides the estimated worst-case direct and indirect emissions based on the information provided in Chapter 2 (see Appendix C for derivation of the estimated direct and indirect emissions). A General Conformity Applicability Analysis was completed for the demolition and construction activities (see Appendix C for the analysis).

Emissions associated with demolition activities would be relatively short term, intermittent, and would end with the completion of the demolition activities. Impacts would be imperceptible relative to background variations.

Demolition and construction equipment are identified in Appendix A and Table 4-2. Operating

this equipment is a source of nitrogen oxides, Particulate Matter ($PM_{2.5}$) and odorous gases. However, taken over the lifetime of the project the impact of these emissions would be minimal.

TABLE 4-1 ESTIMATED DIRECT AND INDIRECT EMISSIONS FOR DEMOLITION AND CONSTRUCTION ACTIVITIES AT LEWIS FIELD*

Summary Air Emission Estimates								
Facility	**Period**	**Activity**	**De Minimus Levels (tons/year)**					
			CO	**VOC**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**
			100	**100**	**100**	**100**	***	**100**
			Emissions (tons)					
			CO	**VOC**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Lewis Field Worst-case	2007 through 2011	Construction	36.41	11.39	167.42	1.37	11.89	11.89
		Demolition	5.76	1.11	5.55	0.05	2.17	2.17
		Paving	5.13	1.42	16.54	1.02	0.86	0.86
		5-Year Total	**47.30**	**13.93**	**189.52**	**2.44**	**14.91**	**14.91**
		Average for 1 Year	**9.46**	**2.79**	**37.90**	**0.49**	**2.98**	**2.98**
		Maximum Year**	**18.92**	**5.57**	**75.81**	**0.97**	**5.97**	**5.97**

* Assumes a worst-case where all work will occur in the first 5 year period (Phase 1)
** Assumes pace of construction/demolition/paving for any one year would not exceed twice the average pace over the five year period.
*** In attainment.

It is possible that the existing structures to be demolished contain asbestos containing material (ACM), lead based paint (LBP), and possibly mercury. Contractors would have to comply with applicable Federal, State, and local regulations, for handling these materials. Lewis Field has existing plans for the handling of ACM, LBP, polychlorinated biphenyls (PCBs) and mercury (GRC 2005b, GRC 2005d).

Demolition and construction equipment and material hauling could affect traffic flow in a project area. Scheduling haul traffic during off-peak times (e.g., between 9:00 AM and 4:00 PM) would minimize effects on traffic and indirect increases in traffic-related emissions. Traffic from demolition and construction workers is not expected to substantially increase idle emissions on-site.

Operational Impacts. Implementing the Proposed Action at Lewis Field would not have any substantial impacts to operational air emissions; however, any new or modified air pollution sources would require evaluation for air permits. The types of facilities being constructed or rehabilitated are similar in use and function as the existing buildings, and the number of employee vehicle trips would remain the same.

Mitigation Measures. The objective of reasonably available control measures is to prevent particulate matter from becoming airborne. GRC would follow the reasonably available control measures contained within the Ohio Administrative Code 3745-17-08, *Restriction of emission of fugitive dust*. Practices that will be included in contract specifications are:

- All work done shall be in accordance with all Federal, State, and local environmental regulations, and the NASA GRC Environmental Programs Manual. The emitted air pollutants including VOCs are expected to be de minimus requiring no air permit.
- Use of water or non-toxic chemicals to control dust around material stockpiles during demolition, construction, grading of roads, or clearing of land,

- Enclose material stockpiles when the use of water or chemicals is not sufficient to prevent particulate matter from becoming airborne,
- Install and use hoods, fans, and fabric filters to enclose, contain, capture, and vent particulates from dusty materials where appropriate,

TABLE 4-2 GRC CANDIDATE EQUIPMENT LIST AND NOISE LEVELS

Equipment	Mode	dBA[1] at 125 feet (ft)	dBA at 550 ft	dBA at 1,025 ft	dBA at 1,515 ft	Utilization Rate
Forklift	Idle	63	50	45	41	0.1
	Full	69	56	51	47	0.1
	Moving	91	78	73	69	0.2
Dump Truck	Idle	70	57	52	48	0.25
	Full	71	58	53	49	0.25
	Moving	74	61	56	52	0.5
Backhoe	Idle	62	49	44	40	0.25
	Full	71	58	53	49	0.25
	Moving	77	64	59	55	0.5
Steel Roller	Idle	61	48	43	39	0.25
	Full	66	53	48	44	0.25
	Moving	83	70	65	61	0.5
Excavator	Idle	62	49	44	40	0.25
	Full	66	53	48	44	0.25
	Moving	72	59	54	50	0.5
Dozer	Idle	63	50	45	41	0.25
	Full	74	61	56	52	0.25
	Moving	81	68	63	59	0.5
Front-end Loader	Idle	60	47	42	38	0.25
	Full	62	49	44	40	0.25
	Moving	68	55	50	46	0.5
Scraper	Idle	67	54	49	45	0.25
	Full	80	67	62	58	0.25
	Moving	84	71	66	62	0.5
Bobcat	Idle	60	47	42	38	0.25
	Full	65	52	47	43	0.25
	Moving	79	66	61	57	0.5
Grader	Idle	63	50	45	41	0.25
	Full	68	55	50	46	0.25
	Moving	78	65	60	56	0.5
Sweeper	Idle	64	51	46	42	0.25
	Full	76	63	58	54	0.25
	Moving	85	72	67	63	0.5
Tractor-Trailer	Idle	67	54	49	45	0.25
	Full	78	65	60	56	0.25
	Moving	77	64	59	55	0.5
M35	Idle	66	53	48	44	0.25
	Full	83	70	65	61	0.25

[1] Decibel (A-weighted) (dbA)

Equipment	Mode	dBA[1] at 125 feet (ft)	dBA at 550 ft	dBA at 1,025 ft	dBA at 1,515 ft	Utilization Rate
	Moving	87	74	69	65	0.5
60Kw Generator	Full	76	63	58	54	1
Light Car	Full	76	63	58	54	1
BAT12 (air pressure generator)	Full	77	64	59	55	1

- Provide adequate containment during sandblasting or other similar operations,
- Cover open-bodied trucks that transport materials likely to become airborne, and
- Promptly remove dirt or other material from paved streets that could become airborne.

4.1.3 Water Resources

No adverse impact to surface or groundwater is anticipated.

4.1.3.1 Surface Water

Demolition, construction, and/or rehabilitation activities would not have adverse impacts on surface water at Lewis Field if these activities comply with EPM practices and Best Management Practices (BMPs) and Best Pollution Prevention Practices. Utilization of BMPs would minimize the effects of demolition, construction, and/or rehabilitation activities.

On-site Demolition, Construction, and/or Rehabilitation Impacts. Demolition, construction, and/or rehabilitation projects disturbing areas of 0.4 hectares (ha) [1.0 acres (ac)] or larger in size require a Storm Water Pollution Prevention Plan (SWP3). Upon approval a Notice of Intent (NOI) would have to be submitted to the Ohio Environmental Protection Agency (OEPA). The SWP3 requires time frames when soil would be restabilized after being disturbed, the type of stabilization to be used, conduct and record weekly storm event inspections, and provide timely maintenance necessary to keep the BMPs working properly until the site reaches 70 percent stabilization. The SWP3 plan would address in detail BMPs employed to control erosion and sediment loss at the project site. Minimum BMPs or Best Pollution Practices to be used would include the following projects: construction site entrances, silt fencing, storm drain protection, straw mulching and reseeding of bare surfaces as soon as possible. Several post-project BMPs may include the use of permeable pavers and bio-retention areas such as rain gardens. Use of these types of BMPs would result in an increase of permeable surface area at Lewis Field and allow for greater infiltration of rain into the soil and consequently reduce storm water runoff and pollution.

Operational Impacts. Current and historical National Pollutant Discharge Elimination System-(NPDES) permitted discharges from GRC appear to have minimal impact on the water quality of the Rocky River. This was confirmed by a study, which found no significant differences in the biological communities upstream and downstream from the CHIA. Lewis Field storm water discharges are bracketed by and often mingled with those from CHIA. The GRC Environmental Justice Implementation Plan concluded there was "...no reasonable likelihood of substantial off-site water quality impacts from normal operations [and there is] ... no reasonable likelihood of significant impacts to water quality from present or past actions [of solid and hazardous waste

programs]" (GRC 2005a).

4.1.3.2 Groundwater

Groundwater is not used for water supply at Lewis Field, and is rarely used in the vicinity of Lewis Field. There are only seven permitted drinking water wells within 6 km (4 mi) of Lewis Field and these wells would not be impacted by the Proposed Action.

Based on the 20-year Master Plan, GRC would be mindful of trends in the NPDES samples and would evaluate the need for future groundwater mitigation. GRC will continue to monitor state and local regulations for changes that would require additional environmental documentation for this Proposed Action.

4.1.3.3 Wetlands

On-site Demolition, Construction, and/or Rehabilitation Impacts. No construction is proposed in significant wetland areas. The upgrade of Cedar Point Road across Abram Creek at the southern property boundary of Lewis Field may have a temporary effect on a small area of wetlands associated with the Abram Creek. Some other small wetland areas, such as the area west of Building 333, may exist in minor draws or ditches, but no substantial wetland areas are anticipated to be impacted. (GRC 2008).

Operational Impacts. Upon completion of the proposed Master Plan, no substantial operational impacts to wetlands would be expected.

4.1.4 Ambient Noise

No substantial long-term impacts to ambient noise levels is anticipated

On-site Demolition, Construction, and/or Rehabilitation Impacts. The proposed work at Lewis Field would be accomplished by various types of motorized equipment over a 20-year time period, affecting a large number of structures and paved surfaces identified in Chapter 2, Section 2.3. Table 4-2 lists the proposed equipment and associated noise levels while implementing the Proposed Action at Lewis Field. Given the large number of individual structures and sites, along with the variety of equipment typically used for demolition and construction projects, a noise assessment was performed (see Appendix D for the Noise analysis).

The noise emission model for heavy equipment was distributed over relatively flat terrain and simplified without losing precision. The assessment remained sufficient to characterize noise impacts in terms of annoyance potential.

The operating hours and modes of operation for each type of equipment have not been determined, and therefore the noise analysis was assessed using a generic series of demolition and construction activities based on typical sites. The assessment derived a noise template and location that could be applied to a single site or several adjacent sites, resulting in a reasonable estimate of the upper limit of the extent of the hourly equivalent sound level [Leq(h)] of 65 and 75 dBA noise contours associated with the project. See Appendix D for the specific methodology used in the noise analysis for this Draft EA.

The positioning of the Lewis Field noise template over candidate demolition and construction sites at Lewis Field reveals no instance where the Federal Highway Administration (FHWA) noise criteria indicate the need to consider noise abatement. FHWA noise criteria were selected because FHWA is the only Federal agency that has criteria that specifically apply to construction equipment.

The West Area of Lewis Field has a residential neighborhood located approximately 201 meters (m) (660 ft) from the closest activity associated with implementing the Proposed Action. As indicated in the noise analysis in Appendix D, all activities fall within the "acceptable" noise levels for residential areas.

In general the types of facilities being constructed or rehabilitated are similar in use and function as the existing buildings, and the noise footprint would not increase.

Operational Impacts. Upon completion of the Master Plan, noise levels would e expected to return to current ambient levels.

Mitigation Measures. In the interest of the residential community, Lewis Field would limit demolition construction and rehabilitation activities between the hours of 7:30 AM and 4:30 PM in the West Area.

4.1.5 Utilities

No anticipated long-term burdens would be placed on utilities by implementing the Proposed Action.

4.1.5.1 Water Supply

On-site Demolition, Construction, and/or Rehabilitation Impacts – Domestic and Raw Water. On-site demolition, construction, and/or rehabilitation activities would result in a marginal increase in water use due to the increased number of construction workers at the site and the implementation of dust controls, equipment washing, and site cleanup. It is expected that the increase in water use by the additional workers would be small compared to overall facility water use. Potable water use by employees adds up to approximately 12 percent of water use at Lewis Field. The remaining water use supports the normal operations. It is estimated that no more than 150 contractors would be engaged in these activities at any one time. Thus, these activities would add less than one percent to the typical facility daytime workforce of 3,500 existing NASA and contractor personnel. The increase in workforce related water use is expected to be lower than the percent increase cited since, in the case of demolition and construction, portable toilets would be utilized for sanitary waste disposal.

Dust suppression and other demolition and construction site uses would generally be performed using water from tanker trucks filled from local hydrants. The increase in water use for these purposes would be intermittent and in the case of dust suppression would be limited to construction traffic areas and localized demolition areas.

Operational Impacts. Current average daily water use is 3,748,300 liters (l) [990,300 gallons (gal)]. Previous efforts and planned water system rehabilitation efforts have and would improve the water distribution system. A continuing water conservation program has reduced consumption. Extension of a supply main has increased pressure in the Southwest portion of the Central Area and completion of the West Area loop has improved flow and reliability in that section of the site. GRC intends to make every effort to comply with or exceed the goals of Executive Order (EO) 13423 (January 2007) that has established National Federal Agency goal of reducing water consumption intensity by 2 percent annually through 2015. Due to the continuing water conservation program and implementation of green building technologies and practices, new facilities that are replacing existing facilities are expected to consume less water. Since the Proposed Action involves demolishing more building area than is replaced through construction, operational water usage is expected to decline. No increase in water use is anticipated over the course of the Master Plan (GRC 2008a).

4.1.5.2 Electrical Power

On-site Demolition, Construction, and/or Rehabilitation Impacts. For demolition and construction, in most cases, on-site generators provided by the contractors would provide power for any high power demanding equipment. Demand created by temporary hookups, such as office trailers, would be small compared to the demand of the existing facilities. Most rehabilitation activities would either involve similar demolition and/or construction activities or would be of such a scope that power consumption over existing demand would be small.

Operational Impacts. Three hundred and seventy megavolt-amperes (MVA) (or 360 megawatts) of 552 MVA of the normal source line transmission capacity is contractually available for GRC's use. Demand for institutional use makes up 21 megawatts of the total load. All other loading is considered excess demand. No substantial increase in power use is anticipated over the course of the Master Plan.

Mitigation Measures. Operation of test equipment that have high power requirements would be scheduled such that their cumulative demand do not exceed the contractual limit nor create impacts during periods of high regional power demands.

Due to the continuing energy conservation program, the addition of on-site renewable energy sources such as solar power, and implementation of green building technologies and practices, new facilities that are replacing exiting facilities are expected to consume less electricity. GRC intends to make every effort to comply with or exceed the goals of Executive Order (EO) 13423 that has established National Federal Agency goal of increasing energy efficiency with a corresponding reduction in energy intensity by 30 percent by 2015. This reduced demand should more than offset any increase in demand due to the addition of new facilities,

4.1.5.3 Emergency Services and Fire Suppression

On-site Demolition, Construction, and/or Rehabilitation Impacts. The need for emergency services is related to the number of personnel working at the site. As noted earlier it is estimated that the maximum number of on-site contractor personnel at any one time should not exceed 150 contractors. The contractors would have the primary responsibility for ensuring worker safety and would be responsible for ensuring that the GRC Emergency Preparedness Plan procedures

are followed by contractor personnel. In the event of an injury or accident, the existing GRC Emergency Preparedness Plan and on-site and off-site resources should prove adequate to provide emergency response, on-site treatment, or evacuation. No additional equipment or personnel or modification of the emergency procedures are anticipated.

Operational Impacts. Given that, as currently planned, the project would not substantially increase the number of on-site personnel, the GRC Emergency Preparedness Plan and on-site and off-site resources should continue to prove adequate to provide emergency response, on-site treatment, or evacuation. As part of the projects' building rehabilitation efforts, existing building fire alarm and suppression systems that are old or outdated would be replaced and upgraded. All new construction would include state-of-the-art alarm and fire suppression systems and would comply with all applicable local and Federal building codes.

4.1.5.4 Natural Gas

On-site Demolition, Construction, and/or Rehabilitation Impacts. It is anticipated that any demolition, construction, or rehabilitation would not require use of the natural gas supply. Any contractor gas requirements would be supplied through use of compressed gas containers from off-site.

Operational Impacts. Lewis Field has a metering capability of 9,800 cubic meters per hour (m^3/hr) [700,000 cubic feet per hour (ft^3/hr)]. The demand for natural gas including all test equipment is 31,430 m^3/hr (1,110,000 ft^3/hr). With the exception of the gas requirement of 1,700 m^3/hr (60,000 ft^3/hr) for the Steam Generator Plant, the large demands of the test equipment are subject to scheduling. Since the air handling systems of which these facilities are a part must also be scheduled, gas scheduling is a component of the schedule determination. Implementation of the proposed Master Plan would not anticipate any operational problem with the current remodeling process.

4.1.6 Geology and Soils

No adverse impact to geology or soils is anticipated.

On-site Demolition, Construction, and/or Rehabilitation Impacts. All areas within the Proposed Action have been previously disturbed. It is anticipated that building foundations would be excavated to a maximum of 1.52 m (5 ft) deep with spread footers. The handling of excavated soils would be performed according to the Demolition Design Work Plan, which would be consistent with applicable sections of the GRC EPM and relevant local, State, and Federal requirements. If contaminated soils were determined to be present on site, the contaminated soil would be properly managed according to the EPM. A "Soil Determination Checklist, Form C-133" and "Site Specific Work Plan (for Contaminated Waste Soils Operations)" would be prepared by GRC prior to removal of contaminated soils, and for the entire project, a "Site Specific Health and Safety Plan" would be prepared by the Contractor. All borrowed fill and backfill material would be tested for the presence of contaminants. Contaminated materials would be rejected and disposed of off-site (GRC 2005d).

Soil grading would not substantially alter existing soil conditions at Lewis Field because these areas have been previously disturbed. To minimize impacts, dust and soil erosion control

measures would be implemented.

Operational Impacts. Implementing the proposed Master Plan would not involve substantially different operational activities than currently exists at Lewis Field. No anticipated impacts to geology and soils would be expected during operation of activities of the proposed Master Plan.

4.1.7 Natural Resources

No adverse impacts to natural resources are anticipated. Most of Lewis Field is highly disturbed and currently does not support significant numbers of indigenous Ohio plant species. Lewis Field has no known adverse effects on endangered species beyond its borders.

Lewis Field will comply with Presidential Memorandum *Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds*. Lewis Field would use regionally native plants and employ landscaping practices and technologies that would conserve water and prevent pollution. The GRC Facilities Division will consult with GRC Safety, Health and Environmental Division on the selection of landscaping plants and technologies that conserve water and prevent pollution.

4.1.7.1 Flora

Two State-listed potentially threatened plant species, the pigeon grape and the American chestnut, are found at Lewis Field. Neither species are located near any potential areas associated with the Proposed Action. Three American chestnuts are located in the West Area, away from any Master Plan activities, and the pigeon grape is located within a section of Lewis Field that is native forest and would not be impacted by Master Plan activities (SAIC 2002).

4.1.7.2 Fauna

The state list for animals is maintained by the Ohio Department of Natural Resources (ODNR) Division of Wildlife and categorizes listed animals into three categories: 1) animals listed as "endangered" have legal protection in the State of Ohio; 2) animals listed as "threatened" or 3) "special interest" do not have legal protection, but their status is being monitored for potentially listing for legal protection. The Division of Natural Areas and Preserves also maintains a list of rare animals, but their designations do not confer legal status (SAIC 2002).

No Federally-listed endangered or threatened animal species were observed during a survey conducted in 2001 (SAIC 2002).

4.1.8 Socioeconomics

No adverse impact to socioeconomic is anticipated.

4.1.8.1 Population

On-site Demolition, Construction, and/or Rehabilitation Impacts. The impact of demolition, construction, and/or rehabilitation workers (approximately 25 workers for demolition, 100

workers for construction, and 25 workers for rehabilitation) would have a negligible impact on the surrounding population. Currently, approximately 2,000 civil servants and approximately 1,100 contractors work at Lewis Field. The addition of 150 construction workers would add less than 5 percent to the existing workforce.

Operational Impacts. No substantial change would be expected in the number of GRC site personnel as a result of the Proposed Action and no discernible impact to employment levels within Cuyahoga County would be expected.

4.1.8.2 Economy

On-site Demolition, Construction, and/or Rehabilitation Impacts. The demolition of the buildings at Lewis Field would eliminate deferred maintenance costs for outdated and vacant buildings. It is not anticipated that implementation of the MP would increase the need for off-site infrastructure and public services.

Operational Impacts. Implementing the Proposed Action at Lewis Field would provide improved flexibility and adaptability by grouping buildings at the new Campus Center; enhanced core capabilities by co-locating research facilities; enhanced safety and security with a new Main Gate and Campus Center; and reduced maintenance and operating costs through the Repair-by-Replacement program for outdated buildings.

4.1.9 Cultural Resources

No adverse impacts to cultural resources are anticipated. There are no known architectural, archeological, or traditional resources located at Lewis Field that would be impacted by implementing the Proposed Action.

4.1.9.1 Architectural Resources

There are no known architectural resources located at Lewis Field that would be impacted by implementing the Proposed Action.

4.1.9.2 Archaeological Resources

On-site Demolition, Construction, and/or Rehabilitation Impacts. No known archaeological sites exist at or near Lewis Field. In addition, the proposed demolition, construction, or rehabilitation activities would involve soil disturbance in previously disturbed areas. As such, no impacts to archaeological resources would be anticipated as a result of the Proposed Action.

However, a Gray and Pape Inc. survey performed in 2001 designated an area near the Main Gate project as having archeologically sensitive areas (Gray and Pape, 2006). GRC will perform shovel pit tests to confirm or deny the presence of archeological artifacts. The results of these shovel test pits are pending. The results will determine whether a consultation with the State Historic Preservation Office would be required under Section 106 of the State Historic Preservation Act.

In the event that archaeological resources are unexpectedly discovered while implementing the Proposed Action, the procedures outlined in Chapter 5, Section 5.5 of the Draft GRC Cultural

Resource Management Plan, *Protocol for Unanticipated Discovery of Archeological Materials,* will be implemented. The protocol includes the following:

- If any member of a construction, maintenance, or other work crew believes that he or she has discovered an archaeological resource, all work adjacent to the discovery will stop and the work supervisor will be immediately notified. The area of work stoppage will be determined in consultation with the Historic Preservation Officer (HPO) and will be adequate to provide for the security, protection, and integrity of the cultural materials.
- The work supervisor will take appropriate steps to protect the discovery site and summon the HPO. At a minimum, the immediate area of the discovery site will be secured. Vehicles, equipment, and unauthorized personnel will not be permitted to traverse the discovery site. Work in the immediate area will not be re-started until treatment of the discovery has been completed.
- The HPO, or their designee, will determine whether the discovery is potentially eligible for listing in the National Register of Historic Places (NRHP).
- If the discovery appears to be eligible for listing in the NRHP, the HPO will immediately contact the Ohio Historic Preservation Office (OHPO) to seek consultation regarding appropriate treatment.
- If the Ohio Historic Preservation Office (OHPO) determines that the discovery is an eligible prehistoric or historic resource, GRC will consult with the OHPO to determine appropriate treatment of the find. Treatment measures may include mapping, photography, limited subsurface investigations, sample collection, or other activities.
- The HPO will prepare a report on the methods and results of the treatment measures within four months of completion of the measures. The report will be addressed to the OHPO. GRC will provide a review copy of the draft report to the OHPO, who will be afforded a 30-day review period. Upon receipt of review comments, GRC will provide a copy of the final report to the OHPO that addresses all review comments.

In the event that human remains are encountered while implementing the Proposed Action, construction, or rehabilitation activities, the procedures outlined in Chapter 5, Section 5.6 of the GRC Cultural Resource Management Plan, *Protocol for Treatment of Human Remains,* will be implemented. The protocol includes the following:

- All ground disturbing activity within 9 m (30 ft) of the remains will be halted immediately.
- GRC staff or contracted archaeologist will be immediately contacted and will assume responsibility for assuring that this protocol is followed.
- All skeletal material will be left in place until a designated professional archaeologist, biological anthropologist, or medical examiner directs its removal.
- The appropriate county Medical Examiner's Office and Sheriff’s Office will be contacted immediately and asked to determine whether the remains are part of a

potential crime scene. A biological anthropologist may be required to determine whether the remains are of Native American ancestry.

- The OHPO will be contacted by telephone and informed of the discovery. The OHPO will be kept informed of all discussions regarding the remains until their final status is resolved.
- The listed, federally recognized Tribes for the area will be contacted. Representatives of these groups will be invited to be present during the professional inspection of the remains.
- If the professional determines the remains to be Native American, the interests of the Tribes become paramount.
- If the remains are determined to be Native American, no analyses – beyond inventory will be performed without written consent of the Tribes.
- The remains will not be transported off site, except to protect them from imminent damage.
- The remains will not be transported beyond the borders of the state of Ohio without written consent from the OHPO.
- After consultation with OHPO, NASA will contact the most representative Tribe and properly transfer the remains to a place designated by the Tribe.
- If the professional determines the remains to be non-Native American, NASA shall attempt to contact relatives. If it is not possible to contact relatives, NASA shall consult with the Cuyahoga County Coroner to determine the proper place for reburial.
- The location of reburials will be noted on planning maps to prevent future disturbance. These maps will not be available to the public.

4.1.9.3 Traditional Resources

No adverse impacts to traditional resources would occur as a result of the Proposed Action as there are no traditional resources located at Lewis Field.

4.1.10 Hazardous Materials Handling and Waste Disposal

No adverse impact from hazardous materials handling and waste disposal is anticipated.

4.1.10.1 Hazardous Material Use and Handling

Construction, Demolition, and Rehabilitation Impacts. Hazardous materials possibly including paints, thinners, sealants, adhesives, solvents, and fuel may be used during on-site construction, demolition, and rehabilitation activities. GRC has protocols and procedures to handle materials of such nature. Contractors will follow the Hazard Communication Policy of 29 CFR 1926.59, Hazard Communication Standard for Construction.

Mitigation Measures. The following measures would be implemented to minimize human exposure and release of hazardous substances as a result of use and handling:

- Where possible, use of hazardous products would be minimized through substitution with non-hazardous or low-hazardous material containing products such as low volatile organic compounds (VOC) or low VOC-emitting materials including paints and coatings, adhesives and sealants.
- Contractors are required to address the possibility of environmental emergencies such as hazardous construction material spills in their Health and Safety Plans.
- Hazardous materials would be stored under cover with secondary containment.
- Unused products and containers would be collected and transported off-site for proper disposal.
- Unused products and containers will be disposed of as waste or reused as appropriate, or collected and transported off-site for proper disposal.
- Have available an accurate listing of all chemicals that are brought on-site with the most current MSDSs.
- Prior to all shipments, provide Chemical Management with an accurate listing, storage location, and quantity of the chemicals along with the most recent MSDSs.

With these measures in-place and in conjunction with the applicable GRC EPM policies and procedures, impacts from on-site use and handling of hazardous materials would be minimized.

Waste minimization is an ongoing policy of GRC. The policy includes reduction in the amount of hazardous materials (chemical reduction) used, to reuse, recycle, and disposal as a hazardous waste. It is GRC policy that special attention is given to the management of hazardous materials no longer required for ongoing institutional operations, research programs, or related activities (GRC 2005b). GRC's contractors involved in activities that require the management of chemicals would be responsible for preparing a HASP. SHED would be responsible for reviewing and approving this plan.

Operational Impacts. As described in the GRC EPM, GRC currently operates an effective program to ensure the proper, handling, storage, and disposal of hazardous materials and hazardous wastes. Given that the current effective management practices would be applied to any additional hazardous materials used and handled as a result of the Proposed Action, no impacts from operational hazardous material use and handling are anticipated.

4.1.10.2 Hazardous Waste Handling and Disposal

Demolition, Construction, and/or Rehabilitation Impacts. The project would address the safe removal and disposal of demolition materials containing hazardous substances (e.g., ACM, lead, PCBs, solvents) including hazardous soils and other materials disturbed during demolition and excavation activities.

If there is a particularly hazardous structure, the Facilities Division would request sampling from the Safety, Health, and Environmental Division. The results of the sampling would be put into the specifications along with any diagrams. These would then be bundled with any of the

traditional disciplines (civil, electrical, mechanical, and structural engineering) and sent out as a total project. The contractor would then be required to submit a Site Specific Health and Safety Plan.

Due to the age of the facilities and past activities, many of the existing facilities include building materials and equipment containing such hazardous substances as ACM, lead, LBP, PCBs, and mercury. In addition, adjacent soils may contain organic and metal contaminants. During both complete building demolition projects and the partial demolition associated with many rehabilitation/renovation projects, such materials may be disturbed and, if not initially segregated and removed, can contaminate the non-hazardous components of the demolition wastes or be released to the environment. Additionally, certain wastes, such as ACM, could become airborne, if proper controls are not implemented.

Mitigation Measures. GRC's Best Management Practices (BMP) to minimize or reduce the potential consequences from hazardous materials would include:

- After buildings are assessed for historical potential, they would be inspected for materials containing hazardous materials (e.g., ACM, radioactive material, mercury, lead, and PCBs). Buildings with laboratories would have sink traps removed and be checked for mercury and lab hoods would be removed or surveyed.
- Building components and structures containing hazardous materials would be dismantled and decommissioned where necessary.
- Hazardous materials would be segregated and transported in compliance with all applicable regulations.
- Constituents of excavation spoils, as well as water generated during dewatering, would be characterized and would be disposed of according to applicable regulations.
- Any tanks (underground or aboveground storage tanks, including dispensers, piping, and fill-ports), including those that are unearthed during excavation activities, would be removed/closed in accordance with all applicable Federal and State regulations.
- BMPs for dust suppression such as keeping structures wet during demolition would be implemented.
- Regular air quality monitoring, would be performed as needed, under the direction of a certified industrial hygienist to make sure the air levels are safe during demolition.

In addition, ACM and chlorofluorocarbons (CFCs) would be handled only by trained personnel with State certification or licensing. The GRC SHED would provide guidance and oversight for waste management, reuse, and final disposal of all impacted materials and to maintain compliance with the EPM (GRC 2005b).

As a result of implementation of these measures in conjunction with the applicable GRC EPM policies and procedures, no substantial impacts would be expected from hazardous waste as a result of demolition, construction, and/or rehabilitation activities.

Operational Impacts. As described in the EPM, GRC currently operates an effective program to ensure the proper, handling, storage, and disposal of hazardous materials and hazardous

wastes. It is not expected that any new types of hazardous wastes (i.e., types of materials not currently generated on-site) would be generated as part of implementing the Proposed Action. Additionally, GRC's ongoing policy of waste minimization, should over time result in reductions in the quantities of hazardous wastes generated on-site. Given that the current effective management practices would be applied to any additional hazardous materials generated and disposed as a result of the Proposed Action, no impacts from operational hazardous waste generation and disposal would be anticipated.

4.1.11 Transportation

No adverse impact to transportation is anticipated.

4.1.11.1 Traffic

Currently the on-site NASA and contractor employee workforce at GRC is approximately 3,400 employees. The Proposed Action does not include any plans to substantially increase the total workforce on-site. The vehicle access points at Lewis Field include three controlled security gates: Main Gate, West Gate and South Gate. The majority of employees and all visitors must access the campus through the Main Gate at Brookpark Road. Access at the other gates is limited and therefore, traffic associated with these entrance locations is not discussed in detail below.

The Proposed Action that may affect traffic flow and volume include: the substantial modifications and security improvements to the Main Gate entrance, the additional traffic resulting from demolition, construction, and/or rehabilitation contractor employees entering and leaving the site, and the relocation of the Building 500 and 501 offices to a site within the secure main campus area requiring employees and contractor staff to pass through the new security gate. The construction intersection of Taylor and Stratton Roads would be implemented in two separate pieces in order to minimize impacts to traffic and circulation (NASA 2008a).

Demolition, Construction, and/or Rehabilitation Traffic Impacts. It is estimated that total personnel simultaneously working on-site on demolition, construction and rehabilitation projects would be 150 workers at any given time. If it is assumed that every contractor employee would drive a light-duty gasoline powered vehicle to the site, and then on any day up to 150 additional vehicles may pass through the Main Gate every morning and evening for a total of up to 300 trips. This estimate represents a relatively small (3 percent) increase in traffic volume for Brookpark Road which carries two lanes of traffic in each direction with a total average daily traffic count of approximately 10,330 vehicles per day (vehicles/day) near the Main Gate. There may be some additional contractor employee traffic during the midday lunch period but it is likely that many workers would bring their lunch or use the NASA cafeteria, and so mid-day contractor traffic would be anticipated to be minimal. There would also be an increase in truck and equipment traffic as a result of delivery of materials and removal of debris resulting from the demolition, construction, and/or rehabilitation activities. All loads will have either bills of lading or manifests prior to leaving the facility. Truck traffic for equipment would be episodic and dispersed over time. Truck traffic for construction materials coming on-site and demolition debris off-site could at times approach the rate of ten trucks per hour. All truck traffic would be scheduled and routed to minimize impact on local traffic.

As a general rule the threshold volume for capacity for a main road is 6,000 vehicles/day per lane, while the threshold volume at which congestion occurs is 8,000 vehicles/day per lane. Given that the total per lane vehicle traffic volume is approximately 2,600 vehicles/day for Brookpark Road, the additional volume would be less then the threshold of 6,000 vehicles/day even when including the addition of the heavy construction and demolition truck traffic (UCB 2007).

A more likely issue would be the potential for congestion annoyance and traffic backing up during peak traffic hours at the Main Gate, particularly if the planned Main Gate improvements were not in-place. This would cause a short-term delay for employees, contractors and visitors entering Lewis Field. Currently, the peak hour traffic count for vehicles entering the site during the morning is 500 vehicles per hour (vehicles/hr). The evening peak hour rate is 452 vehicles/hr (GRC 2006).

The relocation of the Building 500 and 501 offices to an area inside the Main Gate is estimated to increase the peak hour traffic through the new Main Gate by 169 vehicles/hr (39 percent) in the morning without the addition of contractor traffic. While it is possible that under the worst conditions, the addition of 150 contractor vehicles could result in an additional 30 percent increase during this peak hour if they were all to arrive at that time, it is likely that there would be only a modest increase in peak hour traffic since the contractor has an earlier work schedule starting at 7:00AM, compared to 7:30 AM for NASA personnel. Should this actually become a problem the contractor work schedule would be adjusted. However, as described below the Main Gate improvements should help mitigate any congestion problems at the Main Gate as this was an important design requirement.

Operational Impacts. The Proposed Action includes relocating the Building 500 and 501 offices to a site within the secure main campus area requiring them to pass through the new security gate. This however would not affect traffic volumes coming into the site such as at the intersection at Walcott Road and Brookpark Road since the occupants of the current Building 500 and 501 locations must currently use this intersection to access the underpass roadway. Rather, this increased traffic could impact the Main Gate and the intersection of Taylor and Stratton Road.

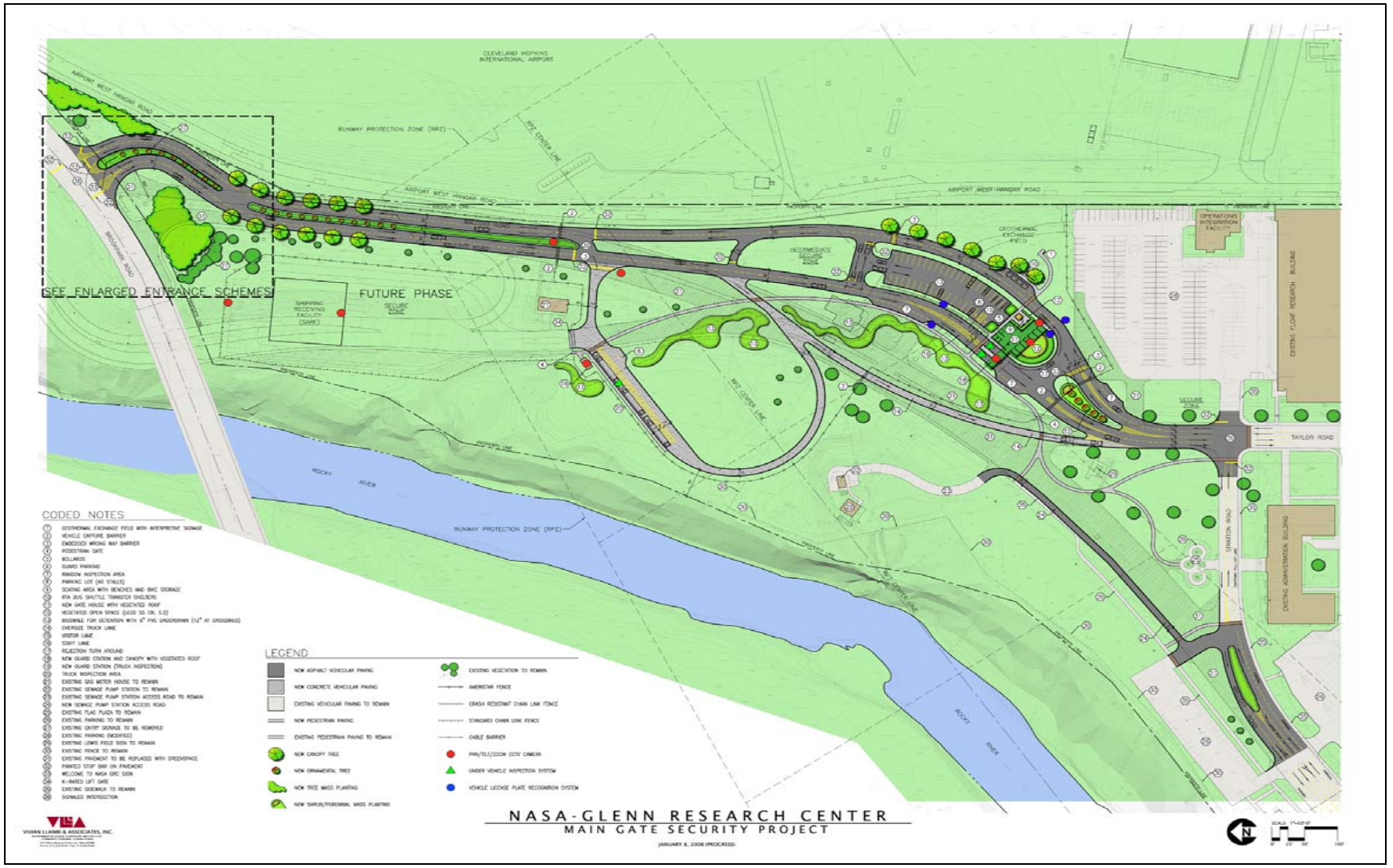
Mitigation Measures. One of the projects to be completed early in the Proposed Action is the modifications to the Lewis Field Main Gate. Figure 4-2 presents the Conceptual Site Plan for the preferred Main Gate Security Project at Lewis Field. The modifications to the Main Gate will be designed to increase security and improve safety. The Main Gate modifications and improvements include:

- The Walcott Road intersection with Brookpark Road would be reconstructed to create entry and exit lanes that are more perpendicular to Brookpark Road improving the ease and safety of vehicle turning movements.
- Walcott Road is merged into Taylor Road to make Taylor Road the new campus Primary Traffic Distribution Artery.
- The Gate House would be relocated farther away from the entrance to just outside the south boundary of the runway protection zone (RPZ) on an island that separates inbound Walcott Road traffic from outbound traffic.

- The visitor parking lot would be located within the island before the Gate House to allow easy vehicular entry and exit and safe visitor pedestrian access. Only one access is provided at the north end of the visitor parking lot per a safety driven decision by NASA.
- The Guard Station and the Main Gates would be also relocated outside the RPZ adjacent to the Gate House.
- A new Truck Inspection Loop would be located slightly remote from the Gate House on the west side of Walcott to allow trucks to exit to the right without crossing other traffic. Trucks exit early from Walcott Road traffic to reduce congestion.
- A new Shipping and Receiving Facility would be constructed on the west side of Walcott beyond the Truck Inspection Loop just outside the north boundary of the RPZ.

The new Main Gate project would substantially improve traffic flow entering Lewis Field, and the relocation of Shipping and Receiving facilities would reduce the number of trucks entering the campus. The placement of the visitors parking area outside the Main Gate would eliminate the need for visitor vehicles to approach the Main Gate providing temporary parking outside the gate for visitors seeking a facility pass. The intersection of Walcott and Taylor Roads would be reconfigured as part of the new Main Gate project, and would result in more organized traffic flow and would emphasize Taylor Road as the primary campus street. Cedar Point Road at the south end of campus would be improved and partially realigned to provide an additional internal circulation route between the Central and West Areas. This improvement would provide better access for truck and heavy load traffic than currently afforded by the West Area Road crossing of Abram Creek. Cedar Point Road would also be upgraded, as it provides a direct route from the West Area to CHIA facilities. This direct route is important for transporting large space vehicle assemblies.

FIGURE 4-2 CONCEPTUAL SITE PLAN FOR THE PREFERRED MAIN GATE SECURITY PROJECT AT LEWIS FIELD



SOURCE: 2008c

4.1.11.2 Parking

Demolition, Construction, and/or Rehabilitation Impacts. The estimated total number of contractor personnel requirements at any given time would be 100 workers for construction, 25 workers for demolition, and 25 workers for rehabilitation. Each of these activities would occur at different times and locations and in some cases; the total contractor parking requirements would apply to different locations. Assuming each contractor employee drove a single vehicle to the site, parking for demolition and rehabilitation projects at most locations should be accommodated using existing parking spaces. At demolition and construction sites, accommodations for vehicle parking would be an integral part of the construction project plans which would include temporary parking space if necessary.

Operational Impacts. The closure of Buildings 500 and 501 would require the relocation of approximately 400 spaces to the Central Area. This issue, as well as the need to remove snow and ice from street parking areas in inclement weather, stresses the parking situation on campus. Additional spaces would be lost if the required security standoff were strictly enforced. Parking areas are currently located in very close proximity to buildings, with many spaced directly at the buildings with little separation. The current security standard requires available parking located at least 9.1 m (30 ft) from the building at lowest threat levels, with a preferred clear unobstructed zone of 23 m (75 ft).

The parking arrangements at the Lewis Field Central Area require some adjustment to accommodate the revised building layout proposed in the Master Plan, and to reduce parking deficiencies that exist. The Central Area presently has approximately 3,099 available parking spaces; approximately 385 of these spaces are on-street parking. Overall, these spaces can accommodate the existing and future parking demands. Although the total number of spaces would be sufficient, their location does not always coincide with the locale for parking. In most cases implementing the Master Plan would significantly improve the distribution of parking spaces to meet demand. Additionally, the planned demolition of specific buildings provides opportunities to meet current and future parking demands. New parking provided as part of the planned Campus Center, the Center Operations Building, and consolidation of Materials and Structures laboratories would improve parking distribution within areas where deficiencies occur.

The demolition of the PSL Cells No. 1 and 2 (PSL 1 & 2), Buildings 65 and 66, is currently underway. The existing parking area to the north of PSL 1 & 2 will be repaired. There is also currently a design project to extend parking areas on the former PSL 1 & 2 site with future lab bus stops as an option in the design.

Two areas that require attention are Building 77 and Building 142, both of which are located along Walcott Road and experience similar conditions that limit parking expansion adjacent to the building. The rear of each building is positioned near the Abram Creek and Rocky River ravine and has very limited buildable space to the rear or sides of the building. The areas across Walcott Road from these buildings have major test facilities that restrict the availability of any expansion parking area. The area to the south of Building 6 affords an opportunity for some parking expansion for Building 77, and the area south of the West Area is accommodated by existing parking requirements. Any new facility built in the West Area would provide for a

corresponding increase in parking capacity.

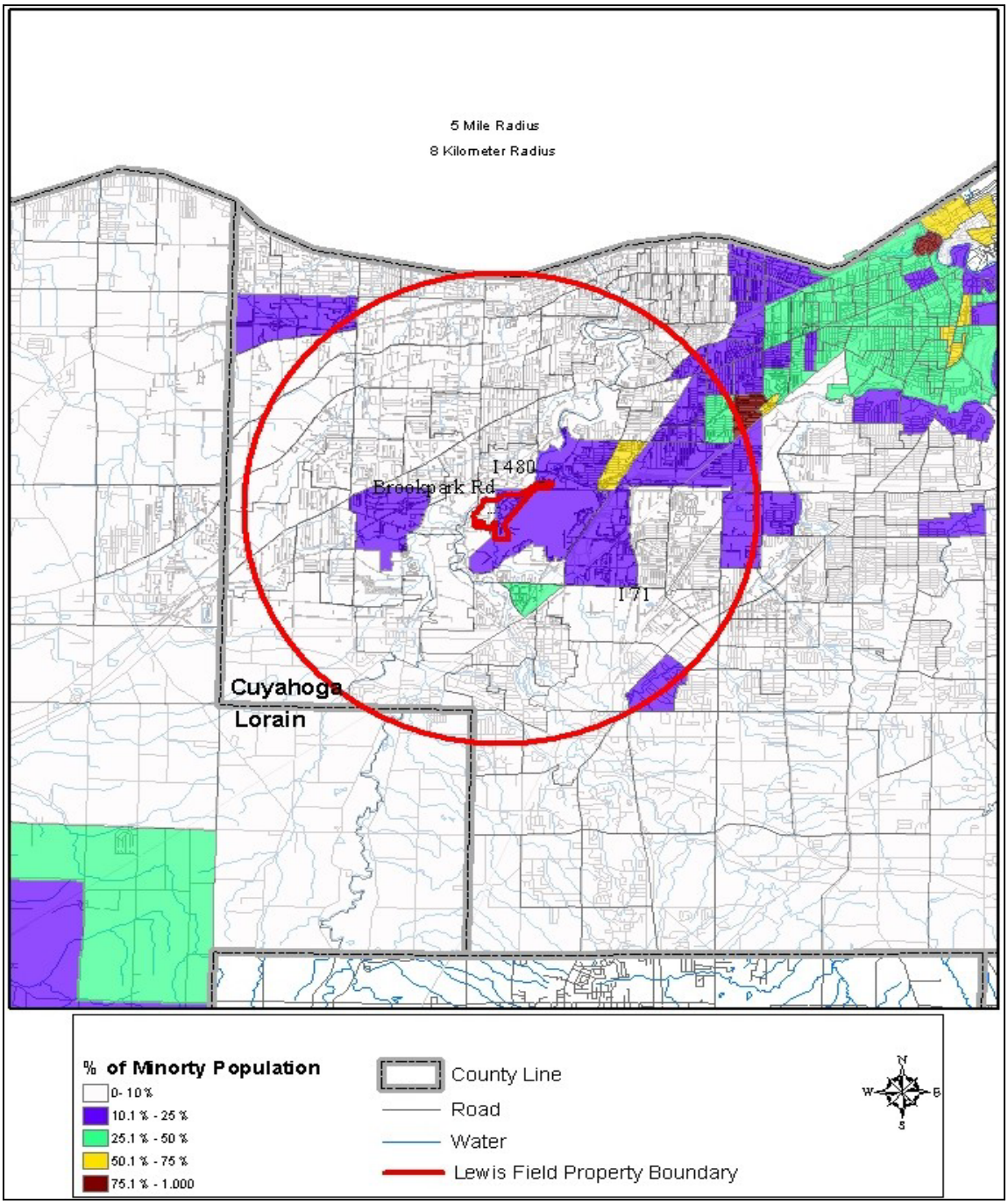
4.1.12 Environmental Justice

No adverse impact to environmental justice is anticipated.

In response to EO 12898 (1994) *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, GRC developed an Environmental Justice Implementation Plan and a Supplement to the Environmental Justice Implementation Plan. Five Census tracts were identified within an 8 km (5 mi) region of influence [the area consistent with Council on Environmental Quality's (CEQ) criteria for identifying minority and low-income populations]. GRC's plan concluded that "no substantial or disproportionate environmental impacts are currently experienced by any community at GRC". GRC updated the Environmental Justice Implementation Plan in 2004 (EO 1994; GRC 2008a).

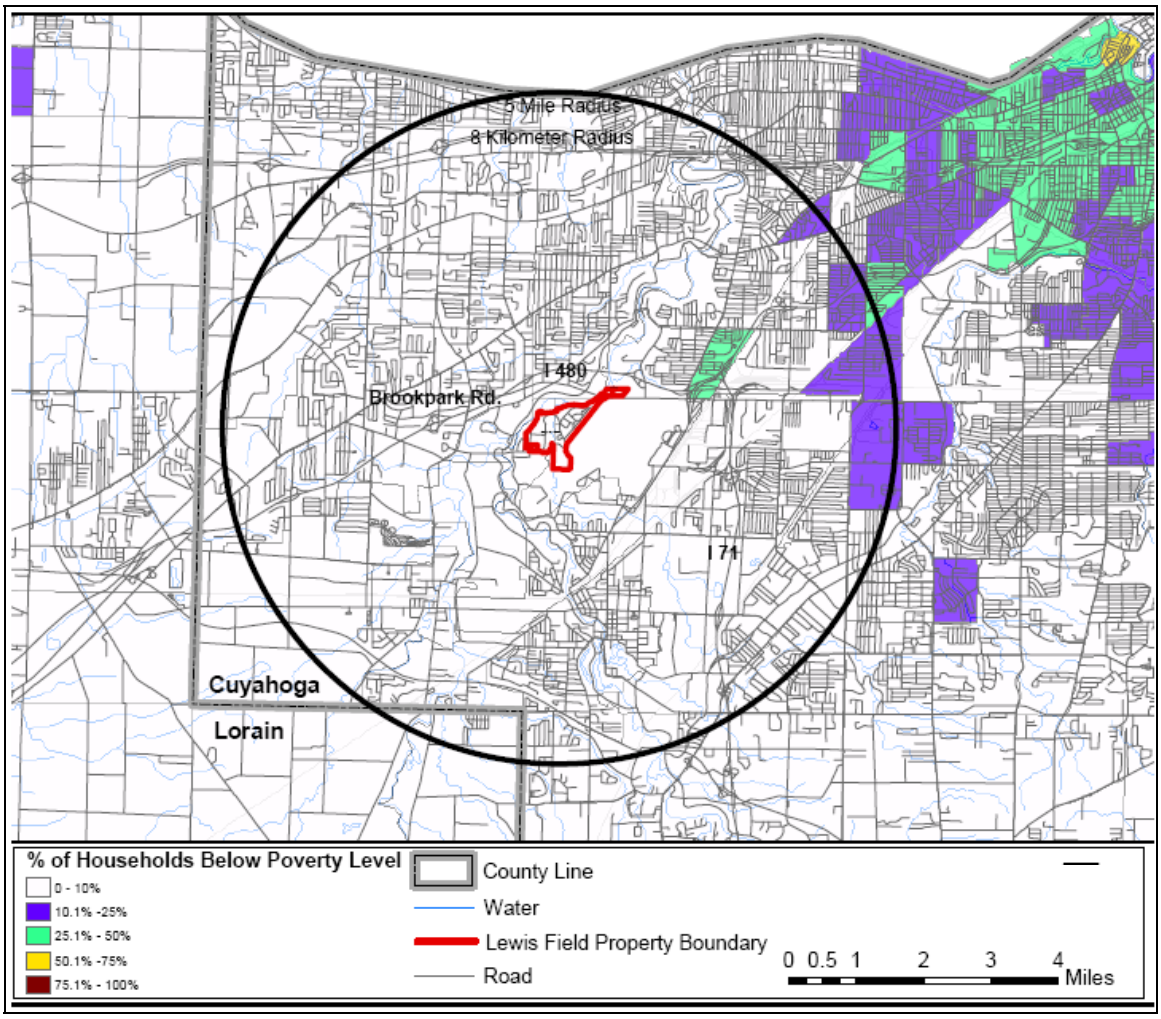
The Proposed Action of implementing the Master Plan would not disproportionately impact minority or low-income populations. Figure 4-3 provides the region of influence for possible minority areas near the Lewis Field based on the 2000 census data. Figure 4-4 provides possible low-income areas near Lewis Field based on the 2000 census data (GRC 2005a).

FIGURE 4-3 POSSIBLE MINORITY AREAS NEAR LEWIS FIELD BASED ON 2000 CENSUS



SOURCE: GRC 2005a

FIGURE 4-4 POSSIBLE LOW-INCOME AREAS NEAR LEWIS FIELD BASED ON 2000 CENSUS



SOURCE: GRC 2005a

The proposed projects would not be near any low income or minority populations. The proposed maintenance facility would be near existing residential land. This proposed project is located in the southwest corner of the Lewis Field campus. A 91.4 m-wide (300 ft-wide) buffer, on Lewis Field property, would be preserved to separate the maintenance function from the residential development. Plantings would be employed to screen the view of the maintenance facility. No significant noise, or emissions would be associated with the facility and all access would be through Lewis Field. Aboveground oxygen and hydrogen fuel tanks currently at this location would be moved to the South Area, near Buildings 208 and 215. They would be double wall tanks with containment and would not present a hazard to the adjacent property. A storm water detention facility is proposed to be located within the buffer zone (GRC 2005a).

4.2 IMPLEMENTING THE PROPOSED ACTION AT PLUM BROOK STATION

This section describes the potential environmental consequences of implementing the Master Plan at PBS.

4.2.1 Land Use

No adverse impact to land use is anticipated. The current development strategy supports sustainable land use through maintaining existing development density; ensuring that development fits within the local planning framework, and retaining, protecting and preserving all buffer areas that are located along PBS borders. Figure 4-5 illustrates the proposed land uses on PBS. No long-term impacts would be anticipated to adjacent on-site facilities or to surrounding land use.

On-site Demolition, Construction, and/or Rehabilitation Impacts. In general, no long-term impacts would be anticipated to adjacent on-site facilities and no disturbance would be expected to previously undeveloped areas. During demolition, occupants of adjacent on-site buildings scheduled for demolition would be impacted; even these impacts would be temporary and intermittent. Additionally, there would be on-site inconveniences from modified parking and pedestrian patterns, and from high intermittent and general background noise. During construction, there would be on-site inconveniences from modified parking and pedestrian patterns to high intermittent and general background noise.

Operational Impacts The types of facilities proposed at PBS are similar in use, function, and density as the current facilities.

4.2.2 Air Quality

No long-term impacts in air quality is anticipated

Short-term impacts may be related to construction equipment emissions, fugitive dust emissions from construction and demolition activities, and increased use of vehicles from any extended commutes of the contractors. See Section 4.1.2 for a general discussion about air emissions.

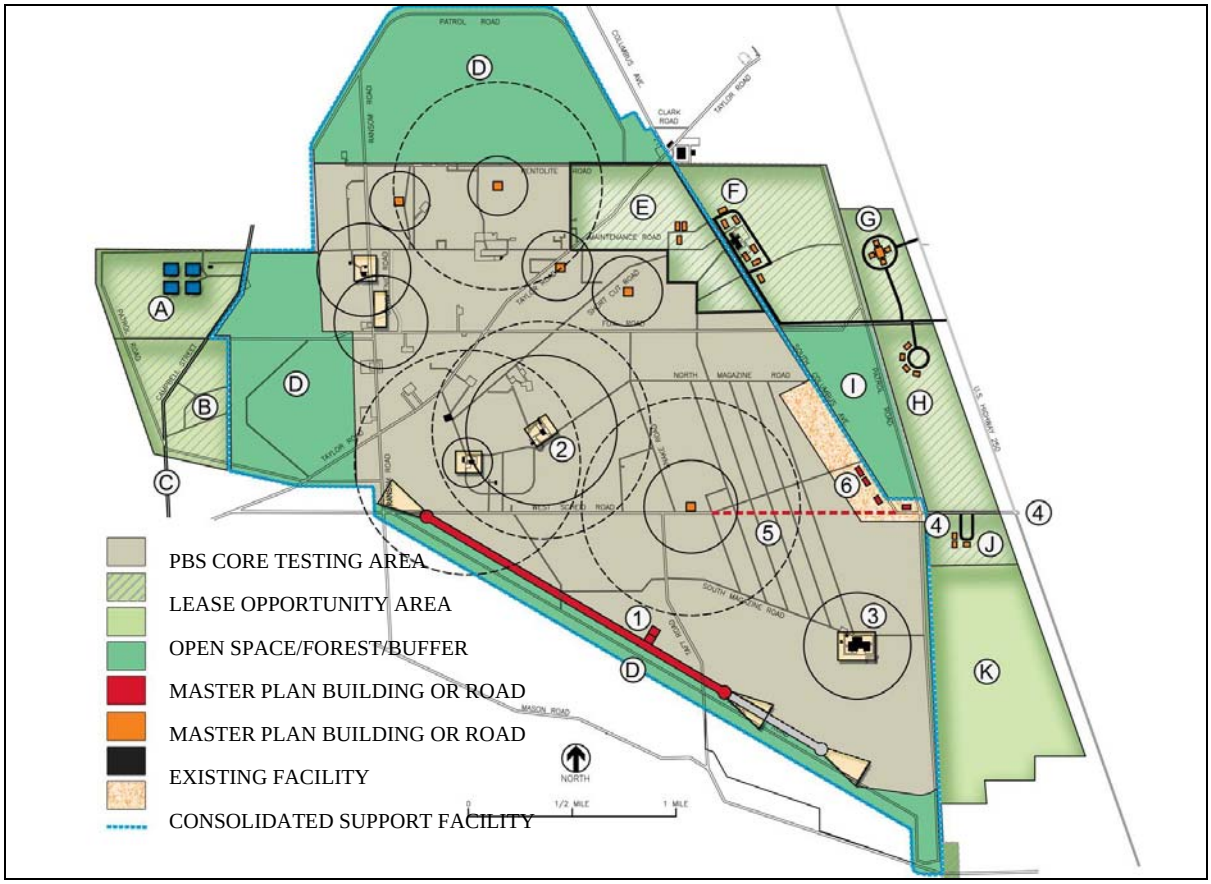
On-site Demolition, Construction, and/or Rehabilitation Impacts. As indicated in Section 3.2.2.2, Erie County is designated as an attainment area for all criteria pollutants. Emissions associated with demolition and construction activities would be relatively short term, intermittent, and would end with the completion of the demolition activities. Impacts are expected to be imperceptible relative to background variations.

Table 4-3 provides the estimated worst-case direct and indirect emissions based on the information provided in Chapter 2 (see Appendix C for derivation of the estimated direct and indirect emissions). A General Conformity Applicability Analysis was not completed for the demolition and construction activities.

Operational Impacts. Implementing the Proposed Action at PBS would not have any impacts to operational air emissions. The types of facilities being constructed or rehabilitated are similar in use and function as the existing buildings, and the number of vehicle trips from employees would remain the same.

Mitigation Measures. See Section 4.1.2 for mitigation measures that would also be performed at PBS.

FIGURE 4-5 LAND USE AT PLUM BROOK STATION



SOURCE: GRC 2008a

TABLE 4-3 ESTIMATED DIRECT AND INDIRECT EMISSIONS FOR DEMOLITION AND CONSTRUCTION ACTIVITIES AT PLUM BROOK STATION

Summary Air Emission Estimates								
Facility	**Period**	**Activity**	**De Minimus Levels (tons/year)**					
			CO	**VOC**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**
			100	**100**	**100**	**100**		**100**
			Emissions (tons)					
			CO	**VOC**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Plum Brook Station Worst-case	2007 through 2011	Construction	11.38	3.56	52.35	0.43	3.72	3.72
		Demolition	3.79	0.73	3.65	0.03	1.43	1.43
		Paving	2.42	0.73	5.87	0.45	0.41	0.41
		5-Year Total	**17.60**	**5.02**	**61.87**	**0.90**	**5.56**	**5.56**
		Average for 1 Year	**3.52**	**1.00**	**12.37**	**0.18**	**1.11**	**1.11**
		Maximum Year**	**7.04**	**2.01**	**24.75**	**0.36**	**2.22**	**2.22**

*Assumes a worst-case where all work will occur in the first 5 year period (Phase 1)
**Assumes pace of construction/demolition/paving for any one year would not exceed twice the average pace over the five year period.

4.2.3 Water Resources

No adverse impact to water resources or ground water is anticipated.

4.2.3.1 Surface Water

Demolition, construction, and/or rehabilitation activities would not have adverse impacts on surface water at PBS if these activities comply with EPM practices and BMPs. Utilization of BMPs would reduce the negative effects of demolition, construction, and/or rehabilitation activities.

On-site Demolition, Construction, and/or Rehabilitation Impacts. Demolition, construction and rehabilitation plan projects of 0.4 ha (1.0 ac) or larger in size require a SWP3, which is subsequently submitted to OEPA. The SWP3 requires time frames when soil would be restabilized after being disturbed, the type of stabilization used, conduct weekly storm event inspections, and provide the maintenance necessary to keep the BMPs working properly until the site reaches 70 percent stabilization. The SWP3 plan would spell out in detail BMPs employed control erosion and sediment loss at the construction site. Minimum BMPs to be used would include the following projects: construction site entrances, silt fencing, storm drain protection, straw mulching and reseeding of bare surfaces as soon as possible. Several post-demolition BMPs to be used would include the use of permeable pavers and bio-retention areas such as rain gardens. Use of these BMPs would result in an increase of permeable surface area at GRC. This would allow for greater infiltration of rain into the soil and consequently reduce storm water runoff and pollution.

Operational Impacts. The GRC Environmental Justice Implementation Plan concluded there was "...no reasonable likelihood of substantial off-site water quality impacts from normal operations [and there is] ... no reasonable likelihood of significant impacts to water quality from present or past actions [of solid and hazardous waste programs]" (GRC 2005a).

4.2.3.2 Groundwater

No groundwater at PBS is used for drinking water. There are no injection wells on site. Routine groundwater monitoring is not required.

4.2.3.3 Wetlands

On-site Demolition, Construction, and/or Rehabilitation Impacts. Although wetlands at PBS have not been officially delineated, there are studies that indicate the potential or probable locations of wetlands on site. Eight vegetation formations and thirteen alliances at PBS have been identified as probable wetlands. Past site modifications have included the construction of drainage ditches to prevent the accumulation of standing water, thereby reducing the potential for wetland formation. There are no known activities currently located in wetlands. It is GRC policy to restore, preserve, and protect the natural and beneficial values provided by wetlands. GRC avoids adverse impacts associated with the occupancy and modification of wetlands. (GRC 2008a). Implementation of the Master Plan at PBS would not likely impact wetlands.

Operational Impacts. There are no proposed activities that would impact wetlands at PBS upon completion of the Master Plan.

4.2.4 Ambient Noise

No long-term impact to ambient noise is anticipated. See Section 4.1.4 for a general discussion about ambient noise.

On-site Demolition, Construction, and/or Rehabilitation Impacts. The positioning of the GRC noise template over candidate demolition and construction sites at PBS reveals no instance where the FHWA noise criteria indicate the possible need to consider noise abatement. There would be no adverse impact from demolition or construction projects considered within the GRC Master Plan at PBS.

Operational Impacts. Implementing the Proposed Action at PBS would not have substantial impacts to operational ambient noise. The types of facilities being constructed or rehabilitated are similar in use and function as the existing buildings, and the noise footprint would not increase.

Noise issues on PBS are referred to the Noise Exposure Management Team in the GRC Safety, Health, and Environmental Division (SHED), which manages programs in hearing conservation, acoustical and noise control engineering, and community noise control. Hearing protection is provided to all employees exposed to noise levels above 82 dBA and is required in areas where noise levels are above 85 dBA. If hearing protection cannot reduce levels to less than 85 dBA, the worker's time allowed in high-noise areas would be restricted to a time-weighted average exposure limit of 85 dBA.

4.2.5 Utilities

No anticipated long-term burdens would be placed on utilities by implementing the proposed action.

4.2.5.1 Water Supply

On-site Demolition, Construction, and/or Rehabilitation Impacts – Domestic and Raw Water. On-site demolition, construction, and/or rehabilitation activities would result in a marginal increase in water use due to the increased number of workers at the site and the implementation of dust controls, equipment washing, and site cleanup. It is expected that the increase in water use by the additional workers would be small compared to overall facility water use. It is estimated that no more than 100 workers would be engaged in these activities at any one time. While these activities may nearly double the typical facility daytime workforce, the expected water usage rate would not be substantial. The increase in workforce related water use is expected to be lower than the typical daily employee usage percent increase cited since, in the case of demolition and construction, portable toilets would be utilized for sanitary waste disposal.

Dust suppression and other demolition and construction site uses would generally be performed using water from tanker trucks filled from local hydrants. Water for many of these purposes could be withdrawn from the raw water system. The increase in water use for these purposes would be intermittent and in the case of dust suppression would be limited to construction traffic areas and localized demolition areas.

Operational Impacts – Domestic Water. Daily water use presently averages between 133 and 189 cubic meters per day (m^3/day) [35,000 and 50,000 gallons per day (gal/day)]. The planned water service system improvements include a second connection to a 31 cm (12 in) main at the southern end of PBS. This would allow for the elimination of the 567,800 l (150,000 gal water tower). No substantial increase in water use would be anticipated over the course of implementing Master Plan at PBS (GRC 2008a).

Operational Impacts – Raw Water. The Big Island raw water source has pumps rated at 3,600 liters per minute (l/min) at 30.5 m head [950 gallons per minute (gal/min) at 100 ft head] and 1,900 l/min at 30.5 m head (500 gal/min at 100 ft head). While there is some concern that the available capacity of the Big Island source could be depleted by a significant growth in the Sandusky water demand, PBS also maintains the currently inactive Rye Beach station as a backup source. This source could be reactivated should additional capacity be required or if the available capacity from Big Island should diminish due to an increase in the water requirements of Sandusky City.

4.2.5.2 Electrical Power

On-site Demolition, Construction, and/or Rehabilitation Impacts. For demolition and construction, in most cases, on-site generators provided by the contractors would provide power for any high power demanding equipment. Demand created by temporary hookups such as office trailers would be small compared to the demand of the existing facilities. Most rehabilitation activities would either involve similar demolition and/or construction activities or would be of such a scope that power consumption over existing demand would be small.

Operational Impacts. Several sources of renewable energy are being investigated as possible means to supply electrical power for PBS. These sources would assist GRC in the effort to comply with the renewable energy requirements of the 2005 Energy Act. Wind data is being collected and analyzed at PBS by the Green Energy Ohio organization to determine the feasibility of wind-generated power at an adjacent location. The results of this investigation would be available to PBS and would be used to propose wind generation, if feasible. The wind turbines would likely be located on PBS property adjacent to Highway 250, exposed to public view and in the buffer area designated for renewable energy development facilities. Another possible source of energy generation could involve the use of landfill gas which would be piped to PBS from a nearby Erie County landfill. Once on site, the gas would fuel a generator to supply electrical power for PBS.

Mitigation Measures: See Section 4.1.5.2 for similar mitigation discussion.

The Master Plan would primarily involve the demolition of many obsolete existing structures and the replacement or rehabilitation of other existing structures. At present none of the planned new buildings would result in a substantial increase in electric power demand. However, in the event that such future demand increases should occur, the power system is designed to accommodate loads up to 2 MVA at 7200 volts (v), 3 to 40 MVA at 34.5 kilovolts (kV), and 50 to 100 MVA at the 138 kV source. The existing two 138 kV lines have an available capacity of up to 200 MVA. Loads in excess of 200 MVA would probably necessitate adding more 138 kV lines or supplying loads at 34.5 kV. The Ohio Edison Company has constructed a 34.5 kV line just south of the Station that could be tapped if needed. The main substation is located and

designed for incremental expansion as future programs may require. The design layout provides for the addition of one new power transformer and the possibility of adding one new 138 kV and four additional 34.5 kV feeder breakers (GRC 2008a).

4.2.5.3 Emergency Services and Fire Suppression

On-site Demolition, Construction, and/or Rehabilitation Impacts. The need for emergency services is related to the number of personnel working at the site. As noted earlier it is estimated that the maximum number of on-site contractor personnel at any one time should not exceed 100 workers. The contractor would have the primary responsibility for ensuring worker safety and would be responsible for ensuring that the GRC Emergency Preparedness Plan procedures are followed by contractor personnel. In the event of an injury or accident, the existing PBS Emergency Preparedness Plan and on-site and off-site resources should prove adequate to provide emergency response, on-site treatment, or evacuation. No additional equipment or personnel or modification of the emergency procedures are anticipated.

Operational Impacts. Given that, as currently planned, the project would not substantially increase the number of on-site personnel, current informal cooperative agreement with the Perkins Township should be adequate to provide health, emergency, and fire services. The existing staff at the PBS Plant Protection Office is trained to administer emergency first aid and CPR for on-site incidents (GRC 2008a).

As part of the projects building rehabilitation efforts, existing building fire alarm and suppression systems that are old or outdated are being replaced and upgraded. All new construction would include state-of-the-art alarm and fire suppression systems and would comply with all applicable local and national building codes.

4.2.5.4 Natural Gas

On-site Demolition, Construction, and/or Rehabilitation Impacts. It is not anticipated that any demolition, construction, or rehabilitation would require use of the utility natural gas supply. Any contractor gas requirements would be supplied through use of compressed gas containers from off-site.

Operational Impacts. At present none of the planned new buildings would result in a substantial increase in the natural gas demand.

4.2.6 Geology and Soils

No adverse impact to geology or soils is anticipated.

4.2.7 Natural Resources

There are no anticipated environmental consequences to natural resources by implementing the Proposed Action at PBS.

4.2.7.1 Flora

Eight core sites containing areas of special vegetative significance were identified in a 2001

survey as priority areas for management. These include specific sites with identified populations of rare or state-listed species that support growth or can be restored to support growth. The loss of these sites would likely mean the irretrievable loss of local rare plants, many of which are exceptionally rare or state-listed and found nowhere else in the region or state (see Chapter 3, Section 3.2.7.1 for a map of the rare plant sites and a Table 3-4 of the rare plants).

4.2.7.2 Fauna

No Federally-listed endangered or threatened species were observed during the 2001 survey. PBS is located within the range of the Indiana bat, a Federally-listed endangered species. Bat surveys were conducted during 2001 and no Indiana bats were observed. Two state-listed endangered species were observed during the 2001 survey. The state-endangered sedge wren was observed in both the 1994 and 2001 surveys. A single spartina borer moth, a state-endangered moth species, was collected during 2001. Three state-threatened species and seven special interest species have been observed at PBS (SAIC 2002).

On-site Demolition, Construction, and/or Rehabilitation Impacts. Both Building 3331 and 3311 are in a rare plant site and demolishing these buildings could impact the rare plants at this site. The rare plant in this area is the potentially threatened Lanced-leaved Violet. By definition, this species could become threatened in Ohio if it is subjected to continued or increased stress. Any impacts to this species will be mitigated by measures outlined in the 2007 Species Management Plan.

Although the new Main Gate House and the PBS Support Area would be located in a rare plant site with two potentially threatened species (the Virginia Meadow-Beauty and Lance-leaved Violet), construction of these structures is not anticipated to affect these species. The Least St. John's Wort, an endangered species, is also located in this area. Any impacts to this species will be mitigated by measures outlined in the 2007 Species Management Plan.

4.2.8 Socioeconomics

No adverse impact to socioeconomics is anticipated.

4.2.8.1 Population

On-site demolition, construction, and/or rehabilitation impacts. The impact of the contract workers (approximately 50 workers for demolition, 25 workers for construction, and 25 workers for rehabilitation) would have a negligible effect on the local economy. Currently, approximately 100 NASA employees work at PBS and approximately 30 government workers from other government agencies work in leased building space at PBS.

Operation Impacts. No change would be expected in the number of GRC site personnel as a result of the Proposed Action and no discernible impact to employment levels within Erie County would be expected.

4.2.8.2 Economy

On-site demolition, construction, and/or rehabilitation impacts. The demolition of the buildings at PBS would eliminate deferred maintenance costs for outdated and vacant buildings. The construction and rehabilitation activities would provide increased utilization of core research test facilities by improving the facility layout; enhanced safety and security with a new Main Gate; reduced maintenance and operating costs through the Repair-by-Replacement program for outdated buildings; and increased income for GRC through enhanced use leasing (EUL) potential.

Enhanced Leasing Potential. Senate Bill 2541 NASA Authorization Act of 2004, a*s ordered reported by the Senate Committee on Commerce, Science, and Transportation on September 22, 2004* would authorize appropriations for NASA activities for fiscal years 2005 through 2009. Assuming appropriation of the specified amounts, the Congressional Budget Office (CBO) estimates that implementing S. 2541 would cost $78 billion over the 2005-2009 period.

The bill also would authorize the NASA to enter into EUL agreements at four NASA centers. CBO expects that this authority would allow NASA to acquire new facilities through the use of third-party financing on behalf of the federal government. Therefore, the use of such authority should be reflected in the federal budget as additional direct spending.

S. 2541 contains no intergovernmental or private-sector mandates as defined by the Unfunded Mandates Reform Act (UMRA) and would impose no costs on state, local, or Tribal governments. GRC is examining the possibility of utilizing EUL opportunities to afford growth at PBS. For purposes of this EA, it is assumed that GRC would be one of the four Centers approved to take advantage of EUL funding.

As provided in the GRC Master Plan dated February 2007, the EUL development opportunities at PBS are designated in two distinct zones. One zone is on the east side 364 ha (900 ac) and the other is on the west 121 ha (300 ac).

The western zone would be offered for local government use. The south portion of the 121 ha (300 ac) tract could be developed as park or recreation areas and the northern part of the tract could be used for an Erie County water treatment plant. The County has expressed an interest in using PBS's existing raw water supply system in order to address growing County water demand. Erie County would lease and maintain PBS's Rye Beach pump and transmission pipeline. To complete this concept, the County would also lease acreage to build a water treatment facility near the terminus of the Rye Beach pipeline. The Rye Beach system and six miles of transmission pipeline is a valuable piece of infrastructure that is under utilized.

Within the east area, a variety of development activities could be accommodated. The U.S. Highway 250 proximity to the east area is approximately two-and-a-half miles in length. The area north of Fox Road is envisioned for office park development, and the establishment for space theme attraction that would educate visitors about the living routines and challenges of a lunar and Mars environment. Other tourism attractions in the immediate vicinity of this location will contribute to the exposure of the space attraction. The area between Fox Road and Scheid Road is proposed as an area for private research and development activities associated with renewable energy development. The area immediately south of Sheid Road would be reserved as an area for NASA contractors to locate. The extreme lower portion of the EUL east zone would most likely continue to be leased for farming activities (GRC 2008a).

4.2.9 Cultural Resources

No adverse impacts to cultural resources are anticipated.

4.2.9.1 Architectural Resources

There are no known architectural resources located at PBS that would be impacted by implementing the Proposed Action.

4.2.9.2 Archaeological Resources

The incomplete status of archaeological survey at PBS represents a particular cultural resources management challenge for GRC. A predictive model for archaeological resources was developed in 2002, and limited archaeological survey and testing has taken place in association with specific projects and undertakings, but the majority of the 2,995 ha (7,400 ac) property has not been systematically surveyed for archaeological resources. The cost required to systematically survey the entire property is prohibitively expensive, and there are no plans to conduct such a survey. Instead, survey and testing will continue to be conducted for individual projects based upon a comparison of the project area with the predictive model. The level of survey and testing required for any particular project will depend upon the amount of ground disturbance anticipated for the project and the predicted archaeological sensitivity of the project area. Procedures for determining the required level of survey and testing are detailed the *Cultural Resources Management Plan for NASA Glenn Research Center at Lewis Field and Plum Brook Station* (Gray & Pape, Inc., 2008).

In the event that archaeological resources are unexpectedly discovered while implementing the Proposed Action, the procedures outlined in Chapter 5, Section 5.5 of the GRC Cultural Resource Management Plan, *Protocol for Unanticipated Discovery of Archeological Materials,* will be implemented (See Section 4.1.9.2 for more details).

In the event that human remains are encountered while implementing the Proposed Action, construction, or rehabilitation activities, the procedures outlined in Chapter 5, Section 5.6 of the GRC Cultural Resource Management Plan, *Protocol for Treatment of Human Remains,* will be implemented.

4.2.9.3 Traditional Resources

No impacts to traditional resources would occur as a result of the Proposed Action since there are no traditional resources located at PBS.

4.2.10 Hazardous Materials Handling and Waste Disposal

No adverse impact from hazardous materials handling and waste disposal is anticipated.

4.2.10.1 Hazardous Material Use and Handling

Construction, Demolition, and Rehabilitation Impacts. Impacts from these activities would

be similar to those discussed in Section 4.1.10.1.

Mitigation Measures. See Section 4.1.10.1.

Operational Impacts. The operational impacts would be similar to those addressed in Section 4.1.10.1.

4.2.10.2 Hazardous Waste Handling and Disposal

The project would address the safe removal and disposal of demolition materials containing hazardous substances (e.g., ACM, lead, PCBs, solvents) including hazardous soils and other materials disturbed during demolition and excavation activities (See Section 4.1.10.2).

Removal of contaminated building structures, equipment and soil would be accomplished by means of an approved Demolition Design Work Plan or a Renovation Work Plan, which would be consistent with applicable GRC EPM policies, Federal, State and local requirements, and best construction management practices.

Mitigation Measures: See Section 4.1.10.2 for mitigation measures also applicable to PBS.

Due to the age of the facilities and past activities, many of the existing facilities include building materials and equipment containing such hazardous substances as ACM, lead, LBP, PCBs, and mercury. In addition, adjacent soils may contain organic and metal contaminants. During both complete building demolition projects and the partial demolition associated with many rehabilitation/renovation projects, such materials may be disturbed and, if not initially segregated and removed, can contaminate the non-hazardous components of the demolition wastes or be released to the environment. Additionally, certain wastes, such as ACM, could become airborne, if proper controls are not implemented.

Operational Impacts. As described in the EPM, GRC currently operates an effective program to ensure the proper, handling, storage, and disposal of hazardous materials and hazardous wastes. The operational impacts would be similar to those described in Section 4.1.10.2.

4.2.11 Transportation

No adverse impact to transportation is anticipated.

4.2.11.1 Traffic

The total number of on-site NASA and contractor employees is approximately 130. This site is spread out over a large area and as a result traffic congestion in general, is not an issue at PBS. The existing main entrance on Taylor Road however, is located such that traffic entering and exiting the site must pass through a residential area. The Proposed Action includes plans to construct an entirely new Main Gate house and access roadway with direct access to US Highway 250.

Demolition, Construction, and/or Rehabilitation Traffic Impacts. It is estimated that total personnel simultaneously working on-site on demolition, construction and rehabilitation projects would be 100 workers at a given time. If we assumed that every contractor employee would

drive a light-duty gasoline powered vehicle to the site, then an estimated 100 additional vehicles may pass through the Main Gate every morning and evening for a total of possible 230 worker trips. This estimate represents a relatively small increase in traffic on the access roadways. There would also be an increase in truck and equipment traffic as a result of delivery of materials and removal of debris resulting from the demolition, construction, and/or rehabilitation activities. Such truck traffic, especially heavy equipment, would be episodic and would be scheduled and routed to minimize impact on local traffic if necessary. No substantial impact on local traffic is anticipated.

Operational Impacts. The main purpose of the Proposed Action would be to increase the utilization of the major test facilities. This may result in an increase in the transporting of space flight hardware and fuels for testing operations. However, such increased traffic would be episodic and the impacts on the adjacent residential community would be mitigated by proposed roadway and access improvements. Therefore, no impacts are anticipated.

Mitigation Measures. One of the first projects to be completed would be the construction of the new Main Gate and access roadway. This location provides very direct access to U.S. Highway 250, which is a major arterial route and eliminates the need for PBS traffic to traverse residential neighborhoods. The new location of the main entrance would also improve access to the test facilities by having a more centralized location. Local on-site roads connecting the main entrance to the main test area are indicated to be improved to support the transporting of space flight hardware and fuels for testing operations. The Master Plan also proposes that a new engineering building, shop and warehouse space would be constructed, and relocated near the new main entrance in order to improve management and logistics capabilities.

4.2.11.2 Parking

The estimated total number of contractor personnel requirements at any given time would be 50 workers for construction, 25 workers for demolition, and 25 workers for rehabilitation. Each of these activities would occur at different times and locations, and in some cases the total contractor parking requirements would apply to different locations. Assuming each contractor employee drove a single vehicle to the site, parking for demolition and rehabilitation projects at most locations should be accommodated using existing parking spaces. At demolition and construction sites, accommodations for vehicle parking would be an integral part of the construction project plans which would include temporary parking space if necessary.

Operational Impacts. Existing parking facilities are adequate for on-site staff. No operational impacts on parking would be anticipated since the Proposed Action is focused on demolition of outdated facilities with the total building area planned for demolition exceeding the total construction area. Any new facility built would provide for a corresponding increase in parking capacity.

4.2.12 Environmental Justice

No adverse impact to environmental justice is anticipated

The Proposed Action of implementing the Master Plan would not disproportionately impact minority or low-income populations. Figure 4-6 provides the region of influence for possible

minority areas near PBS based on the 2000 census data and for Figure 4-7 provides possible low-income areas near PBS based on the 2000 census data.

4.3 CUMULATIVE IMPACTS AT LEWIS FIELD AND PLUM BROOK STATION

Many of the projects associated with implementing the GRC Master Plan involve construction, demolition, and some rehabilitation activities. It is assumed that these activities would have a very limited impact on any of the environmental resource discussions that follow for Lewis Field and PBS. In addition, the Construction of Facilities projects detailed in Appendix B also involve mostly rehabilitation activities. It would be assumed that in the event any of the Construction of Facilities projects would indicate a potential for environmental impact, additional environmental documentation would be considered at that time.

For purposes of evaluating cumulative impacts, the region of influence for potential study is defined as an approximate 80 km (50 mi) radius from Lewis Field and PBS. Because the two locations are greater than 80 km (50 mi) apart, the cumulative impacts will be considered independently.

4.3.1 Lewis Field

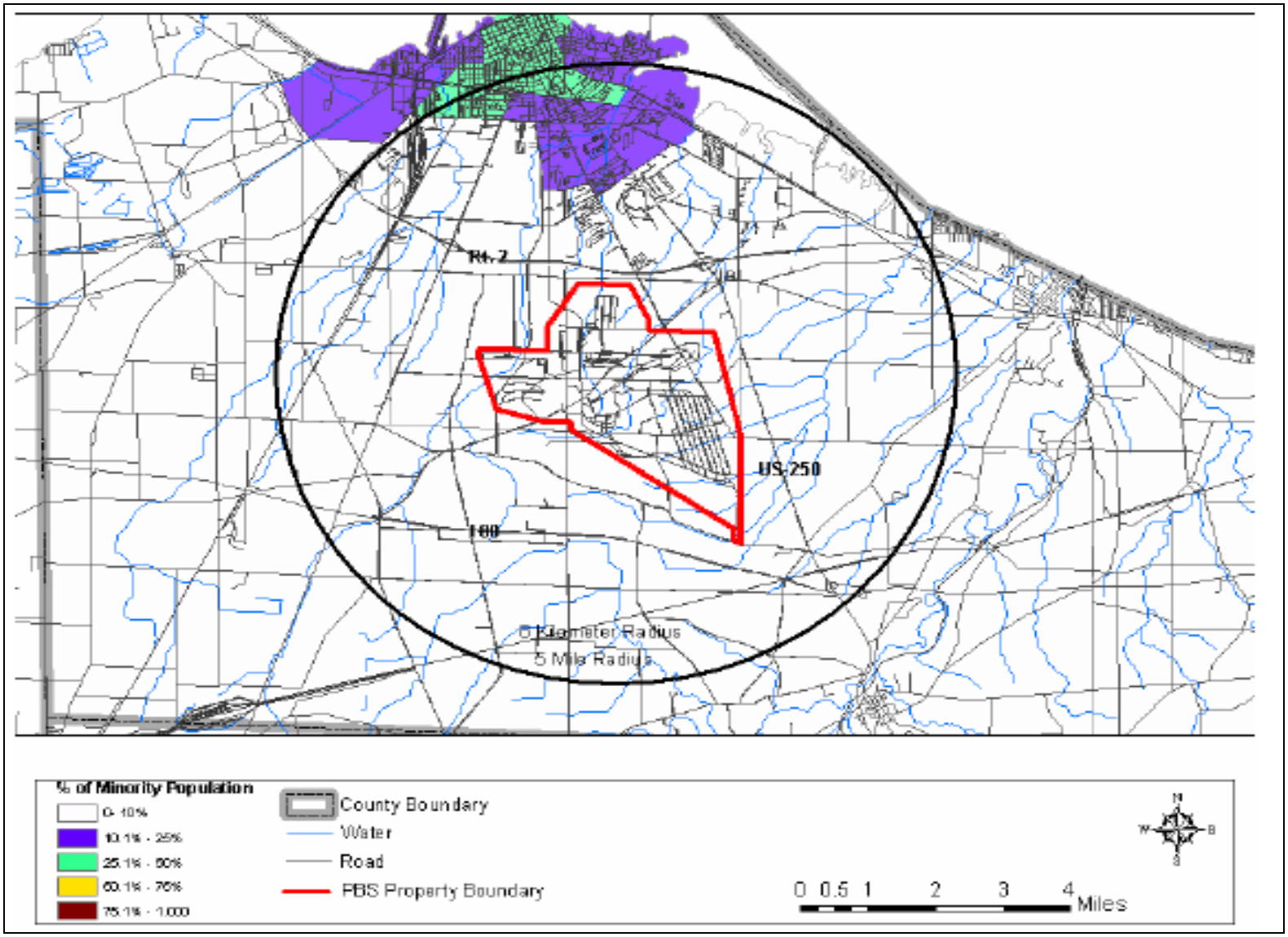
Chapter 3 of this EA defines the state of the environmental resource (i.e., establishes impacts from past and present activities) at Lewis Field and PBS. Reasonably foreseeable activities known for Lewis Field would include:

- Construction of Facilities projects identified in Appendix B,
- Continuing development in the City of Cleveland,
- Cleveland Hopkins International Airport Improvements (CHIA EIS, July 14, 2000),
- Capping the landfill in the South Area of Lewis Field, and
- Demolition of the Altitude Wind Tunnel (AWT; Building 7) and the Propulsion Systems Laboratory (PSL; Building 65, 66, and 67) (NASA 2007).

Past and present activities have had a minor continuing impact on air quality. Lewis Field is classified as a major source for air emissions and operates under a Title V permit. Reasonably foreseeable future activities would have similar minor continuing impacts. The demolition and construction activities would employ mitigation measures and would have a small incremental impact on air quality. Overall, the cumulative impacts to air quality would be small.

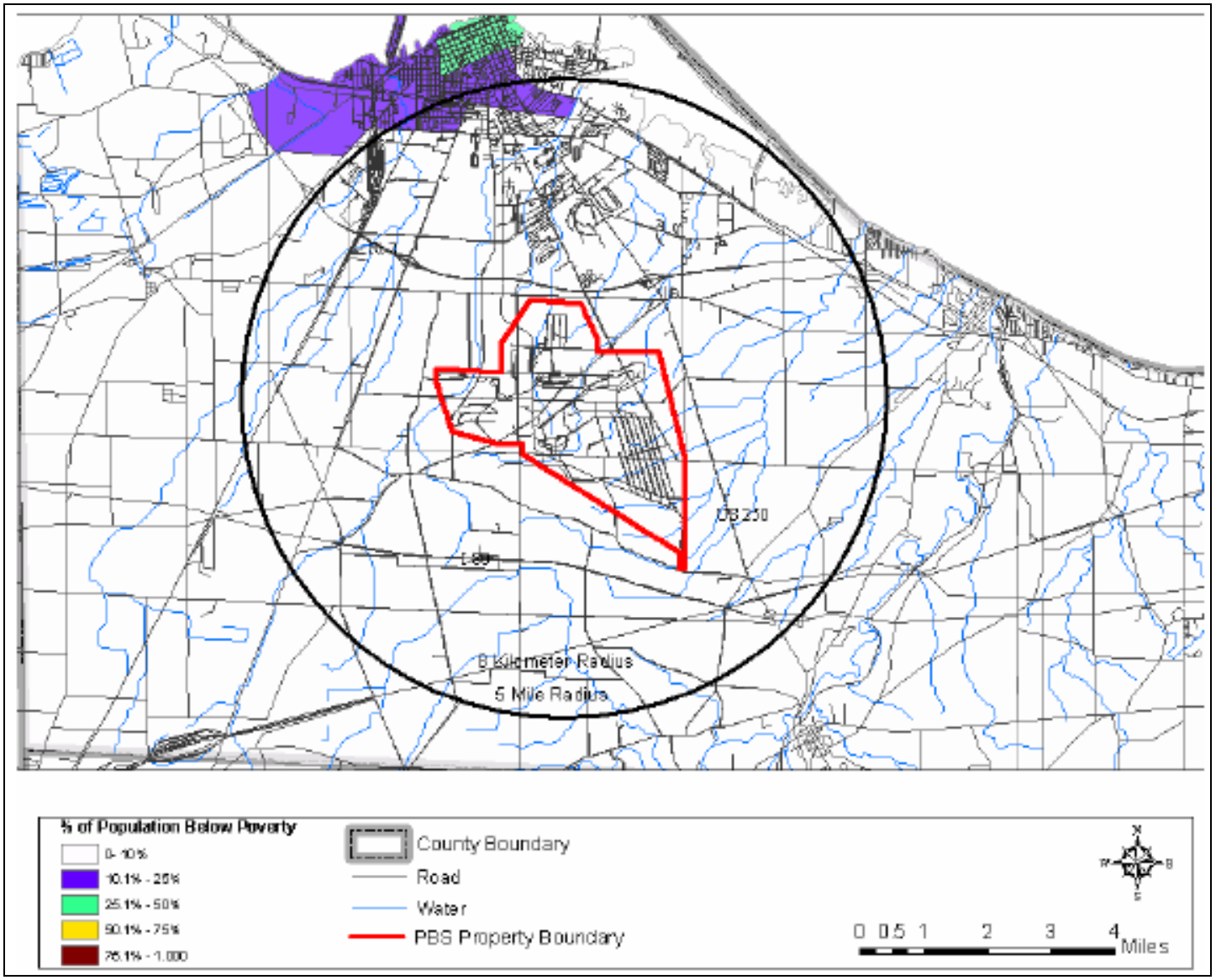
The impact of past, present, and reasonably foreseeable future activities on the hydrologic system is generally small including the construction and demolition activities at Lewis Field. The cumulative impact on hydrology and water quality would be eligible.

FIGURE 4-6 POSSIBLE MINORITY AREAS NEAR PLUM BROOK STATION BASED ON 2000 CENSUS



SOURCE: GRC 2005a

FIGURE 4-7 POSSIBLE LOW-INCOME AREAS NEAR PLUM BROOK STATION BASED ON 2000 CENSUS



SOURCE: GRC 2005a

The impact from past, present, and reasonably foreseeable future activities on ambient noise would be generally small. The construction and demolition projects would have a small, but temporary incremental impact. Overall noise conditions at Lewis Field would not be substantially impacted.

The impact of past and present activities on geology and soils has been substantial; however, the impact of foreseeable future activities is anticipated to be small as Lewis Field is considered at disturbed area. The demolition and construction activities associated with the Proposed Action would add an eligible incremental impact.

From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on biological resources would be insignificant.

Lewis Field is currently in an urbanized area with CHIA on its east border. This massive airport prevents the migration of many species into Lewis Field (GRC 2005a).

Only small numbers of workers would be involved in the Proposed Action at any one time. Therefore, small incremental socioeconomic impact would be expected from implementing the Proposed Action.

From a cumulative perspective, the impact of past and present activities on the cultural resources at Lewis Field is small and not significant. None of the buildings proposed for, rehabilitation or demolition have been deemed eligible for listing on the NRHP. The incremental impacts to cultural resources would be small and eligible.

Waste generation and disposal resulting from the Proposed Action are expected to be considerable; however generation and disposal would be occurring over a 20-year period and would not substantially effect any associated operations or disposal sites. Therefore, the Proposed Action is not expected to result in any cumulatively substantial impacts.

The incremental impact on transportation from the construction and demolition activities would be small, in large part because of the main gate being moved and traffic patterns would be changing beneficially.

4.3.2 Plum Brook Station

Reasonably foreseeable activities for PBS would include:

- New construction and/or modification of the Spacecraft Propulsion Research Facility (known as the B-2 Facility) and associated buildings (Building 3211) (Constellation PEIS/Record of Environmental Consideration for the construction activities). The B-2 Facility is an NHL and is registered on the NRHP.
- New seismic floor and acoustic chamber for the Space Power Facility (SPF) – Disassembly Area (Building 1411) (Constellation PEIS/Record of Environmental Consideration for the construction activities). SPF has been determined to be eligible for inclusion into the NRHP.
- Potential runway improvements (lengthening the runway), enlarging the hangar

space, facilitating the transport of test hardware, and improving the ferrying capabilities.

Additionally, lease opportunities (EUL) at PBS might involve:

- Erie County Water Treatment Plant
- County Parkland
- Campbell Street reforms
- Land Bank Conservation areas
- Federal/Homeland Security development
- Office Park development
- Space Theme tourist attraction/Space Camp
- Energy Independence Partner development
- Prairie Grass Conservation
- Space Flight Contractor Office/Manufacturing
- Agricultural Lease, eventual Partner Development

Nearby PBS, a commercial water park is being considered, in addition to two pumping stations at Rye Beach and Big Island. Perkin County Water Plant is considering improvements (modernizing the facility).

Past and present activities have had a very minor continuing impact on air quality. PBS is located in an attainment area and reasonably foreseeable future activities would have minor contributions to air quality impacts. The potential construction and proposed demolition activities would employ mitigation measures over the 20-year period and would have a very small incremental impact to air quality. Overall, the cumulative impacts to air quality would be small.

The impact of past, present, and reasonably foreseeable future activities on the hydrologic system is generally small including the proposed construction and demolition activities at PBS. The cumulative impact on hydrology and water quality is not substantial.

The impact of noise from past, present, and reasonably foreseeable future activities is generally small. The proposed construction and demolition projects would have a small, but temporary incremental impact. Overall noise conditions at PBS would not be substantially impacted.

The impact of past and present activities on geology and soils has been substantial; however, the impact of foreseeable future activities is anticipated to be small. The proposed construction and demolition activities associated with the Proposed Action would add a small and not substantial incremental impact.

From a cumulative perspective, the impact of past, present, and reasonably foreseeable future activities on biological resources would be negligible.

Only small numbers of workers would be involved in the Proposed Action at any one time.

Therefore, small incremental socioeconomic impacts would be expected from implementing the Proposed Action.

From a cumulative perspective, the impact of past and present activities on the cultural resources at PBS is not significant. The alterations to the B-2 Facility and SPF would not impact the footprint of the buildings or the overall theme of the buildings. The overall cumulative impact would not be substantial.

Waste generation and disposal resulting from the Proposed Action are expected to be considerable; however generation and disposal would be occurring over a 20-year period and would not substantially affect any associated operations or disposal sites. Therefore, implementation of the activities PBS would not be expected to result in any cumulatively substantial impacts.

The incremental impact on transportation from the potential construction and proposed demolition activities would be small, in large part because of the main gate being moved and traffic patterns beneficially changing.

4.3.3 Cumulative Impacts Summary

The potential incremental impacts from implementing the Proposed Action would not be expected to contribute substantially to any cumulative impacts at Lewis Field and PBS over the 20-year timeframe.

4.4 NO-ACTION ALTERNATIVE

Under the No-Action Alternative NASA would not implement the GRC Master Plan. Thus, the potential impacts associated with the Proposed Action described in this Draft EA would not occur. However, the No-Action Alternative would result in:

- On-going costly maintenance for outdated facilities,
- Failure to meet the goals outlined in GRC's overall Mission,
- Failure to prepare GRC facilities for the future; and
- Failure to strategically position GRC for implementation of the President's *Vision for Space Exploration* (GRC 2008a).

5 AGENCIES AND PERSONS CONSULTED

5.1 FEDERAL, STATE, AND LOCAL AGENCIES AND ORGANIZATIONS

FEDERAL AGENCIES

Advisory Council on Historic Preservation

National Park Service

STATE AGENCIES

Cleveland Metroparks

Ohio State Historic Preservation Office:
Ms. Rachel M. Tooker, State Historic Preservation Officer

Ohio Environmental Protection Agency SWDO:
Ms. Bonnie Buthker, Division of Emergency and Remedial Response/Federal Facilities

Ohio Environmental Protection Agency NEDO:
Ms. Nancy Zikimanis, Superfund/Emergency Response

Ohio Environmental Protection Agency NEDO:
Mr. Archie Lunsey, Superfund/Emergency Response

Ohio Department of Transportation:
Mr. Jim Gates, Office of Environmental Services

COUNTY AND CITY OFFICES

Mayor of Brook Park, Ohio

Mayor of Cleveland, Ohio

Mayor of Fairview Park, Ohio

Mayor of North Olmsted, Ohio

Cleveland City Planning Commission, Cleveland, Ohio

Board of Erie County Commissioners

Erie Regional Planning Commission, Erie County

LOCAL ORGANIZATIONS

NASA Retirees, Cleveland, Ohio

Western Reserve Historic Society, Cleveland, Ohio

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APPENDIX A

ASSUMPTIONS ASSOCIATED WITH DEMOLITION, CONSTRUCTION, AND/OR REHABILITATION AT GRC LEWIS FIELD AND PLUM BROOK STATION

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APPENDIX A

ASSUMPTIONS ASSOCIATED WITH DEMOLITION, CONSTRUCTION, AND/OR REHABILITATION AT GRC LEWIS FIELD AND PLUM BROOK STATION

A.1 ASSUMPTIONS ASSOCIATED WITH DEMOLITION, CONSTRUCTION, AND REHABILITATION

This Environmental Assessment (EA) for the National Aeronautics and Space Administration's (NASA) John H. Glenn Research Center (GRC) Master Plan is based on the Center Master Plan finalized on August 30, 2007. The implementation of all features of the GRC Master Plan would be dependent on the plan being reasonable and coinciding with anticipated funding levels. The overall planning schedule for the proposed projects is not absolute, and therefore the following assumptions were derived to outline the scope of the project based on typical demolition, construction, and rehabilitation activities. The scope of this project would not involve atypical or extraordinary activities; therefore, these assumptions would adequately capture the full scope of the project.

A.1.1 Description of Demolition Assumptions

For purposes of evaluating impacts, it is assumed that typical concurrent demolition projects could have only a small number of contracted workers (approximately 25 workers at Lewis Field and 25 workers at the Plum Brook Station [PBS]) that would be involved in the demolition actions at any one time.

Lewis Field and PBS demolition projects would have a superintendent on-site during demolition hours. A normal shift at each site would be between 7:00 AM and 6:00 PM, with some weekend scheduling. Workers commuting to the project sites would generate minor increases in vehicle trips per day on Lewis Field, PBS, and local roadways. Parking would be available at both Lewis Field and PBS.

Based on demolition contract requirements, the on-site contractors would keep all debris and scrap material picked up in a timely manner and maintain good housekeeping practices for containing and handling debris and scrap material. The contractor would not be permitted to store debris and scrap material onsite. Contract workers would follow established haul routes, speed limits, and procedures to minimize peak hour traffic congestion, and any special procedures related to public safety. In addition, the contractor would implement dust, wheel wash-off, and soil erosion control measures. All soils leaving Lewis Field or PBS must be weighed. Concrete and reinforced concrete would be recycled. Contractors are required to develop and submit their own Storm Water Pollution Prevention Plan (SWP3) to the Safety, Health, and Environmental Division (SHED) when the project is of 1 acre or larger.

The demolition equipment would vary depending on the scope of project and activities being performed at any given time. Demolition equipment is anticipated to include, but is not limited to the following:

- Excavator w/ attachments
- Backhoe loader
- Hydraulic shears
- Man lifts
- Cutting equipment
- Off-highway truck
- Water tanker
- Skid steer loader - fork lift
- Concrete crusher
- Heavy lift crane
- Portable air compressor
- Jack hammers
- Roll off - dump truck

A.1.2 Description of the Construction Assumptions

Effective planning is essential for the successful execution of a project. Those involved with the design and execution of construction would consider the environmental impact of the job, the successful scheduling, budgeting, site safety, availability of materials, logistics, inconvenience to the public caused by construction delays, preparing tender documents, etc.

It is probable that some of the construction projects would be occurring at the same time within each phase using the same construction workforce. The most efficient manner to perform the work is to have tasks requiring similar skilled personnel and equipment be scheduled such that the same work force and equipment can be rotated between multiple projects. However, due to the manner in which projects are funded and contracted, different projects may employ different contractors. Given this uncertainty, for purposes of evaluating impacts, it is assumed that all concurrent construction projects would have a steady state of a variety of NASA personnel and contracted workers (approximately 100 workers at Lewis Field and 50 workers at PBS) would be involved in the construction actions at any one time. As stated in the Description of Demolition Assumptions above, both Lewis Field and PBS would have a superintendent on-site during construction hours between 7:00 AM and 6:00 PM.

Construction materials are anticipated to include, but are not limited to, the following:

- Concrete/cement
- Steel
- Stone
- Glass
- Straw-bales (for temporary soil stabilization, landscaping and other temporary conditions)
- Wood including lumber and timber
- Aluminum
- Composite materials
- Drywall
- Brick (kiln oven-baked clay)

- Compacted soils
- Slipform stone
- Rubber
- Structural insulated panel (composite)
- Adhesives and sealants
- Wiring and controls
- HVAC equipment
- Aggregate (composite)
- Asphalt
- Plastics
- Paints and coatings
- Metal pipes and conduit
- Lamps and fixtures
- Sediment and erosion controls

The construction equipment would vary depending on the scope of project and activities being performed at any given time. Construction equipment is anticipated to include the following:

- Portable generators
- Bulldozers
- Motor grader
- Heavy lift crane
- 36 meter boom
- Water tanker
- Portable air compressor
- Roll off - dump truck
- Hydroseeder
- Refueling vehicles
- Excavators with attachments
- Skid steer loader - forklift
- Backhoe loader
- Concrete pumper
- Concrete truck
- Man lifts
- Off-Highway truck
- Asphalt paver
- Vibratory roller (asphalt)
- Large concrete saws

A.1.3 Description of the Rehabilitation Assumptions

The specific aspects of how the rehabilitation contracting would be exercised are not certain. It is likely that some of the rehabilitation projects would be occurring at the same time with the same workforce within each Phase. Tasks requiring similar skilled personnel and equipment could be scheduled such that the same work force and equipment can be rotated between multiple projects. However, due to the manner in which projects are funded and contracted, different projects may employ different contractors. Given this uncertainty, for purposes of evaluating impacts, it is assumed that typical concurrent rehabilitation projects would have only a small number of contracted workers (approximately 25 workers at Lewis Field and 25 workers

at PBS) involved in the rehabilitation actions at any one time. Both Lewis Field and PBS would have a superintendent on-site during construction hours. A normal shift at each site would be between 7:00 AM and 6:00 PM, with some weekend scheduling. Workers commuting to the project sites would generate minor increases in vehicle trips per day on Lewis Field, PBS and local roadways. Parking would be available at both Lewis Field and PBS.

Building Rehabilitation. Building rehabilitation involves many of the activities related to both demolition and construction but typically on a smaller scale resulting in fewer and/or smaller scale impacts. Those assumptions for demolition and construction activities that are relevant would also apply to rehabilitation projects. In general site disturbances would be minimal.

Building Site and Access Rehabilitation. Rehabilitation of the building site and access, such as roadways, can include removal/replacement of parking lots, sidewalks, curbing, and/or access roadways, including associated storm water drainage systems. Those assumptions for demolition and construction activities that are relevant would also apply to building site and access rehabilitation activities.

Utility Rehabilitation and Installation. Utility rehabilitation can include relocation and/or replacement of underground utilities either buried or conveyed through tunnels and aboveground electric service and substations. Underground utilities include service air, water, sanitary and storm sewer systems, natural gas lines, and high voltage electric service. Steam piping is conveyed through insulated pipes contained within tunnels and covered trenches. Rehabilitation of underground utilities may include excavation. Repairs to tunnels may include concrete structural repairs. Installation of new utility service or rerouting of existing utilities may include vegetation clearing and excavation for underground utilities. Those assumptions for demolition and construction activities that are relevant would also apply to utility rehabilitation and installation activities.

GENERAL DEMOLITION ASSUMPTIONS RELATED TO THE ENVIRONMENT

The following general assumptions related to the environment apply to all demolition projects:

- No wetlands would be impacted during demolition activities.
- Existing riparian buffers would not be disturbed.
- Removal of existing trees, shrubs, and natural vegetation would be minimized.
- All projects that would be of 0.4 hectare (ha) [1.0 acre (ac)] or more in size, which includes staging areas and off site soil stockpile locations, must submit a Notice of Intent (NOI) to OEPA, produce a SWP3, and meet all of the OEPA Construction General Permit requirements.
- Demolition area would be fenced to control access by people and wildlife.
- Buildings scheduled for demolition would be inspected for materials containing hazardous materials [e.g., asbestos containing material (ACM, radioactive, mercury, lead, polychlorinated biphenlys (PCBs)]. Buildings with laboratories would have sink traps removed and be checked for mercury and lab hoods would be removed or surveyed.

- Equipment, fixtures, and materials would be salvaged for reuse whenever viable.
- Building components and structures containing hazardous materials would be dismantled and decommissioned where necessary.
- Hazardous materials would be segregated and transported offsite for recycling or proper disposal and would be collected, stored and transported in a manner that prevents release to air, water, ground, or roadways.
- Constituents of excavation spoils, as well as water generated during dewatering, would be characterized and would be managed in accordance with the GRC Environmental Programs Manual (EPM), Chapter 3, "Water Pollution Control" and Chapter 23, "Handing, Reuse, and Disposal of Soil."
- Any tanks (underground or aboveground storage tanks, including dispensers, piping, and fill-ports), including those are unearthed during excavation activities, would be removed/closed in accordance with all applicable Federal and State regulations.
- No explosives would be used in demolition activities.
- Best Management Practices (BMPs) for dust suppression such as keeping structure wet during demolition would be implemented.
- Regular air quality monitoring, as needed, under the direction of a certified industrial hygienist to make sure the air levels are safe would be conducted during demolition.
- Transport of solid wastes offsite would be scheduled and routed to minimize impact on local communities and traffic.
- An SWP3 and associated BMPs in compliance with National Pollution Discharge Elimination System (NPDES) requirements would be prepared and implemented by the contractor if required.
- Contractors are required to address the possibility of environmental emergencies in their Health and Safety Plans. The Health and Safety Plan is required to be submitted and approved by SHED prior to work commencement.
- Contaminated storm water would be collected and transported offsite for treatment/disposal.
- Waste concrete would be washed-out to a designated concrete washout facility.
- Noise generating activities would be scheduled to minimize impact on the adjacent communities and onsite NASA personnel.
- Contractors would comply with applicable state and local noise restrictions.
- Contractor personnel would utilize proper safety procedures and personal protective equipment.
- Contractors would be required to conform to all applicable federal, state, and local regulatory requirements.

A.2.1 General Demolition Assumptions Associated with Recycling

The recycling of demolition materials is both an important goal of GRC and also a major component of the Leadership in Energy and Environmental Design (LEED) certification requirements. As such, the following are the minimum demolition recycling goals that are expected to be achieved. While these are considered as the overall minimum recycling rates for each major category, higher recycling rates could be achieved for certain easily segregated materials.

- A minimum of 75 percent of non-hazardous solid waste such as wood, drywall, concrete, asphalt, dirt, brick, and other rubble would be segregated and recycled onsite or transported offsite to a construction materials recycler.
- A minimum of 75 percent of all non-hazardous scrap metal waste including aluminum would be segregated and transported offsite for recycling.
- Equipment, fixtures, and materials would be salvaged for reuse whenever viable, and
- Uncontaminated soils would be reused or retained at Lewis Field or PBS, respectively.

A.3 DESCRIPTION OF THE CONSTRUCTION ASSUMPTIONS

The goals and assumptions described here apply to all construction projects. GRC has established a general goal of meeting many of the requirements of the LEED Green Building Rating System established by the U.S. Green Building Council. Specifically, GRC has established the goal of obtaining Silver Certification (33-38 credit points out of 69 total points) for its major construction projects wherever feasible. While it is not certain exactly which of the LEED New Construction and Major Renovations requirements would be achieved for each project, it is assumed that the following LEED related goals would be met for nearly all of the major construction projects.

- A SWP3 and associated BMPs in compliance with NPDES requirements would be prepared and implemented if required.
- Would not develop buildings, hardscape, roads or parking areas on portions of sites that meet any one of the following:
  - Previously undeveloped land whose elevation is lower than 1.5 m (5 ft) above the elevation of the 100-year flood as defined by Federal Emergency Management Agency (FEMA).
  - Land that is specifically identified as habitat for any species on Federal or State threatened or endangered lists.
  - Within 30.5 m (100 ft) of any wetlands as defined by United States Code of Federal Regulations (CFR) 40, Parts 230-233 and Part 22, and isolated wetlands or areas of special concern identified by state or local rule, OR within setback distances from wetlands prescribed in state or local regulations, as defined by local or state rule or law, whichever is more stringent.

- Previously undeveloped land that is within 15.2 m (50 ft) of a water body, defined as seas, lakes, rivers, streams and tributaries which support or could support fish, recreation or industrial use, consistent with the terminology of the Clean Water Act.

- Buildings would be located within 1/4-mile of one or more stops for two or more public or campus bus lines usable by building occupants.
- For office-type buildings, would provide secure bicycle racks and/or storage [within 200 yards (yds) of a building entrance] for 5 percent or more of all building users (measured at peak periods), and, provide shower and changing facilities in the building, or within 200 yds of a building entrance, for 0.5 percent of Full-Time Equivalent (FTE) occupants.
- Would implement storm water management technologies and BMPs including storm water retention basins and low impact development technologies such as pervious pavement or bio-retention to prevent the post-development peak discharge rate and quantity from exceeding the pre-development peak discharge rate and quantity for the one- and two-year 24-hour design storms and limit disruption and pollution of natural water flows by managing storm water runoff.
- Would develop a Construction Waste Management Plan for every project.
- Would use roofing materials having a high Solar Reflectance Index for a minimum of 75 percent of the roof surface.
- Would minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction, and reduce development impact on nocturnal environments.
- Would limit or eliminate the use of potable water, or other natural surface or subsurface water resources available on or near the project site, for landscape irrigation.
- Would employ strategies that in aggregate use 20 percent less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements.
- Would use building materials that are produced locally to avoid energy use and pollution generated from transportation. Would use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 805 km (500 mi) of the project site for a minimum of 20 percent (based on cost) of the total materials value.
- Would use construction materials containing recycled content in accordance with accepted standards. The project would use a minimum of 50 percent of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria, for wood building components. These components include, but are not limited to, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.
- Would use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 20

percent (based on cost) of the total value of the materials in the project. Note: Pre-consumer recycle material is waste recovered during product manufacture.

- Would design the building envelope, HVAC, lighting, and other systems to maximize energy performance.
- For new buildings, would specify new HVAC equipment in the base building that uses no chlorofluorocarbon (CFC) refrigerants. When reusing existing HVAC systems, would conduct an inventory to identify equipment that uses CFC refrigerants and provide a replacement schedule for these refrigerants.
- Would use on-site renewable energy systems to offset building energy cost (e.g., solar energy).
- Would select refrigerants and HVAC&R that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming.
- Would develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:
  - During construction, meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3.
  - Protect stored on-site or installed absorptive materials from moisture damage.
  - If permanently installed air handlers are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return air grill, as determined by American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 52.2-1999. Replace all filtration media immediately prior to occupancy.
- Would provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics and metals.
- Would use low VOC emitting materials including paints and coatings, adhesives and sealants, and carpeting.
- Composite wood and agrifiber products used on the interior of the building shall contain no added urea-formaldehyde resins.
- Would meet the minimum requirements of Sections 4 through 7 of ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality. Mechanical ventilation systems shall be designed using the Ventilation Rate Procedure or the applicable local code, whichever is more stringent. Naturally ventilated buildings shall comply with ASHRAE 62.1-2004, paragraph 5.1.
- Would prohibit smoking in the building and locate any exterior designated smoking areas at least 7.6 m (25 ft) away from entries, outdoor air intakes and operable windows.

A.4 GENERAL CONSTRUCTION-RELATED ENVIRONMENTAL ASSUMPTIONS

The following general assumptions apply to all construction projects:

- No wetlands would be impacted during construction activities.
- Existing riparian buffers would not be disturbed.
- Removal of existing trees, shrubs and natural vegetation would be minimized.
- Vegetation that cannot be saved by relocation would be chipped and used as mulch whenever feasible.
- Cleared and disturbed areas would be minimized. Where possible, the footprint of construction activities would be limited to existing impervious surfaces plus the land necessary for utility and equipment access.
- All projects that would be of 0.4 hectare (ha) [1.0 acre (ac)] or more in size, which includes staging areas and off site soil stockpile locations, must submit a NOI to OEPA, produce a SWP3, and meet all of the OEPA Construction General Permit requirements.
- Cleared areas would be re-vegetated as soon as possible. Guidelines on re-stabilizing dormant yet disturbed areas are detailed in the OEPA Construction General Permit and would be addressed in the contractor's SWP3.
- Construction area would be fenced to control access by people and wildlife.
- Any tanks (underground or aboveground storage tanks, including dispensers, piping, and fill-ports) unearthed during excavation activities, would be removed/closed in accordance with all applicable federal and state regulations.
- BMPs for dust suppression such as keeping soil wet during construction would be implemented.
- Transport of construction equipment, materials, and wastes would be scheduled and routed to minimize impact on local communities and traffic.
- Contractors are required to address the possibility of environmental emergencies such as hazardous construction material spills in their Health and Safety Plans. The Health and Safety Plan is required to be submitted and approved by SHED.
- Hazardous construction materials would be stored under cover with secondary containment.
- Excavated soil would be managed in accordance with the GRC EPM, Chapter 23, "Handling and Disposal of Soil."
- Contaminated storm water would be collected and treated offsite.
- Noise generating activities would be scheduled to minimize impact on the adjacent communities and onsite NASA personnel.
- All contractors would comply with applicable state and local noise restrictions.

- Construction materials would be stored properly to reduce the amount of waste caused by damage or exposure to the elements.
- When possible, the project would use building materials that have minimal packaging to avoid the generation of excessive packaging waste.
- Excess materials (including vegetative and plant materials) would be salvaged for reuse whenever viable.
- Contractor personnel would utilize proper safety procedures and personal protective equipment.
- Contractors would be required to conform to all applicable federal, state, and local regulatory requirements.

A.5 ASSUMPTIONS FOR ALL BUILDING REHABILITATION

Building rehabilitation involves many of the activities related to both demolition and construction but typically on a smaller scale resulting in fewer and/or smaller scale impacts. Those assumptions for demolition and construction activities that are relevant will also apply to rehabilitation projects. In general site disturbances would be minimal.

A.5.1 Building Site and Access Rehabilitation

Rehabilitation of the building site and access, such as roadways, can include removal/replacement of parking lots, sidewalks, curbing, and/or access roadways, including associated storm water drainage systems. Those assumptions for demolition and construction activities that are relevant will also apply to building site and access rehabilitation activities. Of particular relevance are the assumptions related to land disturbances, dust suppression, soil erosion, storm water management, and materials recycling. GRC has an extensive database of environment soil samples to determine contamination in soils. In areas where environmental soil samples have not been collected to adequately characterize the soils, new soil samples will be collected to determine proper handling.

A.5.2 Utility Rehabilitation and Installation

Utility rehabilitation can include relocation and/or replacement of underground utilities either buried or conveyed through tunnels and aboveground electric service and substations. Underground utilities include natural gas, service water, sewer, and electric service. Steam piping is conveyed through insulated pipes contained within tunnels and covered trenches. Rehabilitation of underground utilities may include excavation. Repairs to tunnels may include concrete structural repairs. Installation of new utility service or rerouting of existing utilities may include vegetation clearing and also excavation for underground utilities. Those assumptions for demolition and construction activities that are relevant will also apply to utility rehabilitation and installation activities. Of particular relevance are the assumptions related to land disturbances, dust suppression, soil erosion, storm water management, materials recycling, and hazardous material management.

APPENDIX B

CONSTRUCTION OF FACILITIES ASSOCIATED WITH OTHER GRC ACTIVITIES

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APPENDIX B

CONSTRUCTION OF FACILITIES ASSOCIATED WITH OTHER GRC ACTIVITIES

B.1 CONSTRUCTION OF FACILITIES TABLES

The following tables describe the on-going capital improvement projects that could occur at the same time as the Proposed Action. These activities are similar in nature and scope to those activities associated with the Proposed Action. Building numbers for Tables B-1 through B-4 were not provided due to security concerns.

TABLE B-1 LEWIS FIELD OTHER PROPOSED ACTIVITIES, PHASE 1

LEWIS FIELD – Construction of Facilities					
PHASE 1 : 2007 – 2011					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation[1]**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues[2]**
	Refrigeration Building	R	24,225 (2,251)	2009	Low
	Cooling Tower	R	N/A	2011	Low
	Steam Plant	R	12,444 (1,156)	03/15/08 - 08/15/09	Medium (ACM)
	Substation B	R	1,288 (120)	07/15/07 - 05/15/07	High (PCBs)
	Electric Propulsion Research	R	52,250 (4,854)	07/15/07 - 05/15/08	Low
	Compressor and Turbine Research Facility	R	104,246 (9,685)	2010	Low
	Power Substation	R	N/A	07/15/07 - 05/15/07 & 2010	High (PCBs)
	Fabrication Shop Addition	C	54,411 (5,055)	2009, 2011	Low
	Wind Tunnel Complex Building	R	21,804 (2,026)	2010	Low
	PSL Cooling Tower	R	N/A	2011	Low

[1] D = Demolition, C = Construction, R = Rehabilitation

[2] Note that these are estimates of the relative potential for encountering problems concerning hazardous materials. Potential problems can include: finding large quantities, worker exposure, and past and present release/dispersal of contaminants, more specifically:

- **Low**: Hazardous materials encountered would be low in volume/toxicity or readily separated, contained and disposed with minimal exposure.
- **Medium**: Potential for encountering hazardous materials is uncertain. If encountered, hazardous materials will likely be contained within equipment components or embedded in construction materials such as LBP or ACM.
- **High**: High potential for encountering one or more of the following:
  - Substantial quantities of hazardous materials;
  - Present a substantial risk for worker exposure; and/or
  - Involve contamination of building materials and/or soils with highly toxic substances.

LEWIS FIELD – Construction of Facilities					
PHASE 1 : 2007 – 2011					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation[1]**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues[2]**
	Power Substation	R	N/A	2011	Medium (potential hazardous materials associated with electrical systems - PCBs)
	Supersonic Wind Tunnel Complex Building	R	N/A	2010	Low
	Cooling Tower	R	N/A	2011	Low
	Supersonic Wind Tunnel Complex Building	R	9,961 (925)	2010	Low
	PSL Engine Testing Building	R	45,192 (4,199)	04/15/08 - 03/15/10 & 2011	Low-Medium (Heating system ACM)
	PSL Cooling Tower	R	2,128 (198)	2011	Low
	Aero Acoustic Propulsion Lab	R	2,928 (272)	2010	Low
	Substation A	R	N/A	2010	Low
	Management Conference Building	R	75,598 (7,023)	2010	Medium (boiler ACM)
	Service Shed for H2 and O2 Areas	D	400 (37)	2009	High (Potential hazardous materials associated with service of mechanical systems and ACM)
	Photovoltaic Array/STF Control Center	D	16,680 (1,550)	2009	Medium (potential hazardous materials associated with electrical systems - PCBs)
	Power systems Facility	R	32,478 (3,017)	2007-2008	Medium (potential hazardous materials associated with electrical systems - PCBs)
	Underground Communication System	R	N/A	2011	Low

LEWIS FIELD – Construction of Facilities					
PHASE 1 : 2007 – 2011					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation[1]**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues[2]**
	Sewer System	R	N/A	2009-2010	Low
	Bridge	D	N/A	2010	Low
	Utility Tunnel	R	N/A	07/15/07 - 05/15/08	Low
	Parking Lots	R	N/A	05/15/07 - 04/15/08	Low
	Parking Lots	R	N/A	03/15/08 - 08/15/09	Low
	Sanitary Storm Sewers	R	N/A	04/15/08 - 03/15/10	Low
Misc.		R	N/A	2011	Low

TABLE B-2 LEWIS FIELD OTHER PROPOSED ACTIVITIES, PHASE 2

LEWIS FIELD – Construction of Facilities					
PHASE 2: 2012 – 2016					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues**
	Compressor and Turbine Research Facility	R	104,246 (9,685)	2012	Low
	Propulsion System Laboratory	R	87,590 (8,137)	2012, 2014	Low or Medium (if replacing existing O/W separator)
	Power Substation	R	N/A	2012 - 2014	Medium (potential hazardous materials associated with electrical systems - PCBs)
	Instrument Research Laboratory	R	99,509 (9,245)	2012	Low
	Supersonic Wind Tunnel Complex Building	R	83,810 (7,786)	2012	Low
	Liquid Metals Power Laboratory	R	9,682 (900)	2013	High (Potential use of hazardous materials in mechanical systems)

LEWIS FIELD – Construction of Facilities					
PHASE 2: 2012 – 2016					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues**
	Part of PSL Complex	R	5,680 528)	2014	High (Potential use of hazardous materials in mechanical systems)
	PSL Engine Testing Building	C	45,192 (4,198)	2014	Low
	Fuel Cell Testing Facility	R	4,955 (460)	2013	Medium (potential hazardous materials associated with electrical systems - PCBs)
	New Security Fencing	R	N/A	2012	Low
	Sewer System	R	N/A	2013	Low
	Storm and IWS Sewer System	R	N/A	2014	Low
	Misc.- various institutional buildings	R	N/A	2012, 2014	Low
	Misc.- various institutional buildings including Wind Tunnel Complex	R	N/A	2013	Low

TABLE B-3 PLUM BROOK STATION OTHER PROPOSED ACTIVITIES, PHASE 1

PLUM BROOK STATION – Construction of Facilities					
PHASE 1: 2007 – 2011					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues**
	Space Power Facility	R	139,358 (12,947)	2009; 2007-2008	Low
	Raw Water System	R	336 (31)	2009	Low
	Natural Gas and Utility System	R	N/A	2011	Low
	High Voltage System	R	N/A	2010	Medium (potential hazardous materials associated with electrical systems - PCBs)

PLUM BROOK STATION – Construction of Facilities					
PHASE 1: 2007 – 2011					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues**
	Underground Communications Infrastructure	R	N/A	2011	Low

TABLE B-4 PLUM BROOK STATION OTHER PROPOSED ACTIVITIES, PHASE 2

PLUM BROOK STATION – Construction of Facilities					
PHASE 2: 2012 – 2016					
Building	**Current or Future Use**	**Demolition, Construction or Rehabilitation**	**Square Footage (Square Meters)**	**Proposed Activity Dates**	**Special Environmental Issues**
	Perimeter Security Fencing	R	N/A	2013	Low

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APPENDIX C

BASIS FOR AIR EMISSION CALCULATIONS AND GENERAL CONFORMITY APPLICABILITY ANALYSIS

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APPENDIX C

BASIS FOR AIR EMISSION CALCULATIONS AND GENERAL CONFORMITY APPLICABILITY ANALYSIS

Implementing the Proposed Action at the National Aeronautics and Space Administration (NASA) Glenn Research Center (GRC) would include the following activities:

- Demolition
- Construction
- Rehabilitation

C.1 ASSUMPTIONS FOR DERIVING AIR EMISSION ESTIMATES

C.1.1 Demolition and Construction

As of publication of this Environmental Assessment (EA), the demolition and construction schedules were not fully finalized; therefore, a worst-case scenario was evaluated. The worst-case consisted of developing total air emission estimates for the total amount of construction and demolition planned to occur during the entire 20 year period and assuming it would all occur in the first five years (phase 1). From this five-year total, average annual values were developed along with one-year maximum values which represent the worst-case year within that five year period. This maximum value assumes that all activities would occur in the first five years and the pace of the proposed demolition and construction for any one year would not exceed twice the average pace during the this period.

The methodology uses the gross floor area (GFA) of the buildings to be demolished and constructed as the basis for deriving the air emission estimates. In addition, the air emissions generated as a result of paving new roadways and re-paving existing roadways and parking lots were estimated. Estimated pavement quantities were unknown and therefore, it was assumed that the new pavement area would be directly related to the GFA of new building construction. Additional pavement area was added using estimates of pavement area for the new Main Gate projects at both Lewis Field and Plum Brook Station (PBS). Direct and indirect emissions from the operation of the newly constructed buildings were not included in this estimate. Direct emissions would be emissions from operating the building would be emissions from combustion for heating and emergency generator operation. Indirect emissions would include emissions from electrical generating plants due to the increased electrical load caused by the building. Since there is no expected increase in plant personnel, it is expected that there would be no increase in operational emissions.

C.1.1.1 Rehabilitation

Estimating emissions for the proposed rehabilitation activities was difficult since these activities can range from updating the fire alarm and fire suppression system to rehabilitation of building interiors and exterior components. The air emissions of rehabilitation activities involve photochemically reactive Volatile Organic Compound (VOC) emissions from architectural coatings and are not accounted for because they are expected to be minor.

C.2 METHODOLOGY FOR DERIVING AIR EMISSION ESTIMATES

C.2.1 Demolition

Demolition emissions were calculated using a two-step process. First, the total GFA square footage of the buildings to be demolished for the Master Plan was converted to ft^3 by multiplying the individual building footprint by an estimated floor height of 10 ft. The resulting building volume was multiplied by an emissions factor for PM_{10} (See Table C-1 for emission factors). This provided an estimated amount of PM_{10} emissions for demolition. A conservative (high) estimate was used to determine PM_{10} by assuming all PM_{10} would be emitted as $PM_{2.5}$. Emission factors for Government Office Complex in Table C-1 were used for calculation purposes.

TABLE C-1 SCREENING TABLE FOR ESTIMATING TOTAL CONSTRUCTION EMISSIONS[1]

Land Use	Unit of Measure	Emission Factors (lbs/construction period)				
		VOC	CO	NOx		PM_{10}
RESIDENTIAL						
Single Family Housing	1000 ft^2 GFA	23.66	75.62	347.74		24.69
Apartments	1000 ft^2 GFA	21.97	70.22	322.9		22.93
Condominiums	1000 ft^2 GFA	21.3	68.06	312.97		22.22
Mobile Homes	1000 ft^2 GFA	21.3	68.06	312.97		22.22
EDUCATIONAL						
Schools	1000 ft^2 GFA	46.99	150.16	690.52		49.03
COMMERCIAL						
Business Park	1000 ft^2 GFA	55.44	177.17	814.72		57.85
Day Care Center	1000 ft^2 GFA	31.87	101.55	466.97		33.16
Discount Store	1000 ft^2 GFA	31.78	101.55	466.97		33.16
Fast Food	1000 ft^2 GFA	31.78	101.55	466.97		33.16
Government Office Complex	1000 ft^2 GFA	55.44	177.17	814.72		57.85
Hardware Store	1000 ft^2 GFA	31.78	101.55	466.97		33.16
Hotel	1000 ft^2 GFA	41.58	132.87	611.04		43.39
Medical Office	1000 ft^2 GFA	55.44	177.17	814.72		57.85
Motel	1000 ft^2 GFA	41.58	132.87	611.04		43.39
Movie Theater	1000 ft^2 GFA	31.78	101.55	466.97		33.16
Office	1000 ft^2 GFA	55.44	177.17	814.72		57.85
Resort Hotel	1000 ft^2 GFA	41.58	132.87	611.04		43.39
Restaurant	1000 ft^2 GFA	31.78	101.55	466.97		33.16
Shopping Center	1000 ft^2 GFA	31.78	101.55	466.97		33.16
Supermarket	1000 ft^2 GFA	31.78	101.55	466.97		33.16
INDUSTRIAL						
General Industrial	1000 ft^2 GFA	32.79	104.79	481.88		34.22

Note: to convert ft^2 to m^2, multiply ft^2 by 0.09. To convert lbs to kg, multiply lbs by 0.45.

Comment [LW1]: Delete empty column.

The second step involved calculating the emissions from dump trucks that would be used to haul debris from the job site. To complete this, the total estimated building volume was converted to square yards (yd^3). By using the un-demolished building volume as the total debris volume, this

[1] SCAQMD CEQA Air Quality Handbook, April 1993, Table 9-1, page 9/19; includes on-site construction equipment and worker's travel

results in a conservative estimate for the purposes of debris hauling; however, it ensures that buildings with floor heights greater than 10 ft and debris from foundations are accounted for. The estimated debris volume was divided by an estimated average dump truck volume of 10 yd^3 to obtain the number of truck loads required to remove the construction debris from the site. An estimated 20 mi per round trip was used to determine the total amount of mileage necessary to remove the construction debris. This assumption may also be conservative in that it assumes that debris that could be recycled would be hauled off-site for recycling. At this time it is not certain what portion of demolition debris would be recycled on- or off-site.

The amount of mileage was multiplied by an emission factor (See Table C-1) (Jagielski and O'Brien, 1994) for each air pollutant for heavy-duty diesel-powered vehicles with a gross vehicle weight (GVW) greater than 3,864 kg (8,500 lbs). Fugitive emissions from demolition and hauling of debris were then added together, resulting in emissions in grams, which was then converted to tons. Vehicle emission factors for SO_X were derived assuming diesel fuel sulfur content of 500 ppm (0.05 percent) and a gasoline sulfur content of 80 ppm (0.008 percent) (Chevron b; Chevron a). Screening factors for estimating construction PM_{10} for fugitive dust per vehicle miles traveled (VMT) is provided in Table C-2.

TABLE C-2 SCREENING TABLE FOR ESTIMATING CONSTRUCTION PM_{10} EMISSIONS – FUGITIVE DUST[2]

Land Use	Unit of Measure	Emission Factors (lb/day)
UNPAVED ROADS		
Passenger Vehicles	VMT	5.56
Trucks	VMT	23
PAVED ROADS		
Passenger Vehicles	VMT	0.33
Trucks	VMT	2
DEMOLITION	Ft^3	0.00042
GRADING	ac/day	55
ASBESTOS	Ft^3	0.00006

The grading emission factor is lbs/day per acre/day. Multiply the EF by ac/day to get emissions in lbs/day.

C.2.2 Construction

Construction emissions were calculated summing the total GFA of the buildings to be constructed and then multiplying by a construction emissions factor for each of the five air pollutants (CO, VOC, NO_X, SO_2, and PM_{10}). Air emissions are based on factors applied to the GFA which were derived for "Government Office Complex" type construction projects (SCAQMD 1993). The emission factors for this category are equal to or greater than any other category including "General Industrial." These factors include on-site construction equipment and worker's travel emissions.

SO_2 emissions, which are not included in Table C-1, are derived assuming that the ratio of NO_X/SO_2 generation is the same as that for "heavy-duty diesel-powered vehicles with GVW greater than 3,864 kg (8,500 lbs)." The result is the estimated emission increase due to construction.

[2] SCAQMD CEQA Air Quality Handbook, April 1993, Table 9-2, page 9-20

C.2.3 Paving

The area of new pavement for access road and parking improvement was assumed to be twice the total GFA of building construction. The estimated total area to be paved was divided by the assumed daily paving rate of 185.8 m^2 (2,000 ft^2) to estimate the number of days that a paving crew and equipment would need to be used on the site. Each paving Project was assumed to include one bulldozer that would operate 8 hr/day, and two diesel-powered asphalt pavers and two vibratory rollers that would each operate 8 hr/day. The total operating hours of each piece of equipment was determined by multiplying the daily rate by the total number of days. This value was then multiplied by air emission factors for each piece of equipment for each of the five air pollutants (SCAQMD 1993). This calculation results in the pounds of emissions per construction period which are then converted to tons.

To determine the emissions from dump trucks importing paving materials, the volume of paving materials was calculated by multiplying the total area of new pavement by an assumed paving depth of 15 cm (6 in) and then doubled to include an aggregate base depth of 15 cm (6 in). The volume of materials being hauled to the site is then divided by an estimated truck capacity of 8 m^2 10 (yd^3) to estimate the number of total trips required to haul material to the site. The total trips were multiplied by an estimated 32 km (20 mi) per round trip to obtain the amount of total miles required to haul all the paving materials. The emissions per year for hauling paving materials to the site are then calculated using grams per mile emission factors from Jagielski and O'Brien, 1994 and then by multiplying by the total miles traveled and then converting grams into tons.

VOC emissions from the curing of the asphalt concrete are also estimated. This estimate assumes the asphalt concrete mixture is medium-cure with 35 percent diluent resulting in an estimate that 20 percent would evaporate as VOCs (EPA 1979). The sum of all of the above components is the total emissions to complete the paving work.

C.3 GENERAL CONFORMITY APPLICABILITY ANALYSIS

C.3.1 Introduction

The Clean Air Act (CAA) contains legislation that mandates the general conformity rule to ensure that Federal actions in non-attainment and maintenance areas do not interfere with a state's timely attainment of the National Ambient Air Quality Standards (NAAQS). The general conformity rule divides the air conformity process into two distinct areas: applicability analysis and conformity determination. The applicability analysis process requires Federal agencies to determine if their proposed action(s) would increase emissions of criteria pollutants above preset threshold levels (40 CFR §93.153). These threshold rates vary depending on severity of the non-attainment and geographic location. Section 176(c) of the CAA contains legislations for the general conformity rule and prohibits Federal agencies from conducting, supporting, or approving actions that do not conform to an approved State Implementation Plan (SIP).

The general conformity rule established this applicability and conformity determination process. Generally,

1. Determine whether a Proposed Action is specifically exempted. The demolition activities at GRC are not exempt.

2. Determine whether all or part of the Proposed Action is presumed to conform. The rule allows NASA to create special categories of actions, based on past experience, that presumptively do not result in nonconforming emissions or emissions exceeding certain threshold *de minimis* amount. *De minimis* is defined as so small as to be negligible or insignificant. If an action has less than *de minimis* emissions, a conformity determination is not required. NASA has not defined any exempt categories.

3. Determine whether the Proposed Action can be excluded as a *de minimis* project and is not regionally significant. If the action does not qualify for an exemption or presumptive category, then NASA must determine if the action can be excluded as a *de minimis* project. The agency must also determine if the action is or is not regionally significant. To find the answer to this step NASA must calculate the total actual annual direct and indirect emissions for each non-attainment pollutant resulting from the demolition and construction activities. If the total actual emission increase in tons per year (tpy) is below the *de minimis* thresholds listed in Table C-3, the action is exempted from further analysis unless it is considered regionally significant. Emissions from the Proposed Action are considered not regionally significant if the projected emissions would be less than 10 percent of the total non-attainment pollutant emissions published in the SIP for the area where the action would occur. If the emissions from the demolition and construction activities are considered to be *de minimis* and not regionally significant, no further analysis is required.

TABLE C-3 CONFORMITY DE MINIMIS THRESHOLDS

Non-Attainment Area Designation	*De minimis* Thresholds (tpy)
Ozone 8-hr (Moderate)	
VOCs	100
NOx	100
Particulate Matter ($PM_{2.5}$)	
Direct Emissions	100
SO_2	100
NO_x (unless determined not to be a significant precursor)	100
VOC or ammonia (if determined to be significant precursors)	100
Carbon Monoxide (Maintenance)	100
Sulfur Dioxide (SO_2) (Maintenance)	100

For purposes of this Appendix, because PBS is in attainment, a general conformity applicability analysis is not necessary. The remainder of this Section addresses only Lewis Field.

C.3.2 *De Minimis* Emissions and Applicability Thresholds

De minimis emissions are total direct and indirect emissions of a criteria pollutant caused by a Federal action in a non-attainment or maintenance area at rates less than specified applicability thresholds.

The Proposed Action (demolition, construction and rehabilitation of facilities at Lewis Field) would be occurring in non-attainment areas for the 8-hr ozone and the $PM_{2.5}$ standards and in maintenance for CO and SO_2.

The conformity applicability analysis for ozone precursors examined two aspects of the demolition activities:

- On-site demolition, construction, rehabilitation, loading, and vehicle activity
- Worker vehicle travel

An emissions estimate was prepared for the ozone precursors due to the non-attainment status of the Cleveland area.

Demolition and construction activities were estimated for several years duration and assumed that the demolition and construction activities would occur simultaneously. The emissions for construction were based on emissions estimates from the South Coast Air Quality Management District (SCAQMD) California Environmental Quality Act (CEQA) guidance and are applicable here.

C.4.1 Emissions Estimate

The assumptions above were used to estimate the maximum yearly emissions. As shown in Table C-4, the estimates of total annual emissions from the implementation of the Master Plan at Lewis Field are below *de minimis* thresholds. These amounts are less than the U.S. EPA conformity thresholds of 100 tpy, and are not regionally significant since the emissions are less than 10 percent of the basin-wide emissions.

TABLE C-4 ESTIMATED DIRECT AND INDIRECT EMISSIONS

Summary Air Emission Estimates								
Facility & Phase	**Period**	**Activity**	**De minimis Levels (tpy)**					
			CO	**VOC**	**NOx**	**SOx**	**PM_{10}**	**$PM_{2.5}$**
			100	**100**	**100**	**100**		**100**
			Emissions (tons)					
			CO	**VOC**	**NOx**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Lewis Field Worst-case	2007 through 2011	Construction	36.41	11.39	167.42	1.37	11.89	11.89
		Demolition	5.76	1.11	5.55	0.05	2.17	2.17
		Paving	5.13	1.42	16.54	1.02	0.86	0.86
		5-Year Total	**47.30**	**13.93**	**189.52**	**2.44**	**14.91**	**14.91**
		Average for 1 Year	**9.46**	**2.79**	**37.90**	**0.49**	**2.98**	**2.98**
		Maximum Year**	**18.92**	**5.57**	**75.81**	**0.97**	**5.97**	**5.97**

*Assumes a worst-case where all work would occur in the first 5 year period (Phase 1)
**Assumes pace of construction/demolition/paving for any one year would not exceed twice the average pace over the five year period.

	VOC	CO	NO_x	PM	SO_x
Basin Emissions	61,909[1]	64,212[2]	83,009[1]	397.8[3]	478.3[3]
10% of Basin Emissions	**6,191**	**6,421**	**8,301**	**39.8**	**47.8**

[1] VOC and NO_x emissions estimate from 61 FR 20458 are 338.3 tons per day (tpd) and 453.6 tpd respectively over the April to October ozone season (183 days) for 2006.

[2] CO emissions estimate from 59 FR 5332 is 246.97 tpd for 1992. Annual emissions estimate assumes 260 days per year.

[3] PM and SOx emission estimates were back-calculated from VOC mobile emissions from 61 FR 20458 for 2006 assuming a VOC emission factor from EDMS 4.11 MOBILE5A using a 35 mph average speed and all system defaults.

References

Chevron(a). http://www.chevron.com/prodserv/fuels/bulletin/phase2rfg/char.shtml. July 25, 2007.

Chevron(b). http://www.chevron.com/products/prodserv/fuels/bulletin/diesel/L2_3_5_fs.htm. July 25, 2007.

EPA 1979. Environmental Protection Agency Compilation of Air Pollution Emission Factors, Volume I: Stationary Point and Area Source (AP-42), Section 4.2 "Asphalt Paving Operations," July 1979, and Table 4.5-1, "Evaporative VOC Emissions from Cutback Asphalts as a Function of Diluent Content and Cutback Asphalt Type," July 1979.

Jagielski, K. and O'Brien, J. 1994 – Calculations Methods for Criteria Air Pollution Emission Inventories, USAF, Armstrong Laboratory, AL/OE-TR-1994-0049. Brooks AFB.

South Coast Air Quality Management District (SCAQMD), 1993, California Environmental Quality Act Air Quality Handbook. 21865 E. Copley Drive, Diamond Bar, CA 91765.

APPENDIX D

GRC NOISE IMPACT ASSESSMENT FOR PROPOSED DEMOLITION, CONSTRUCTION, AND/OR REHABILITATION PROJECTS

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APPENDIX D

GRC NOISE IMPACT ASSESSMENT FOR PROPOSED DEMOLITION AND CONSTRUCTION PROJECTS

D.1 INTRODUCTION

This report documents the assessment of construction and demolition noise for projects planned at Lewis Field and Plum Brook Station (PBS) at the National Aeronautics and Space Administration's (NASA) Glenn Research Center (GRC). The proposed work will be accomplished by a various types of motorized equipment over a twenty-year time period, affecting a large number of structures and paved surfaces.

Given the large number of individual structures and sites along with the variety of equipment typically employed in demolition and construction projects, the assessment may seem complex from an acoustics perspective. However, the modeling of noise emissions from heavy equipment distributed over relatively flat terrain can be simplified without losing precision sufficient to characterize noise impacts in terms of annoyance potential.

At this point in the planning process, the specific operating hours and modes of operation for each type of equipment have not been identified, and therefore it is necessary to make the assessment one of a "generic series" of demolition and construction activities based on typical sites. In this manner the assessment derives a noise template and location of that can be applied to a single site or several adjacent sites resulting in a reasonable estimate of the upper limit of the extent of the hourly equivalent sound level [Leq(h)] 65 and 75 decibels (A-weighted) (dBA) noise contours associated with the project. Documentation in the References was used to prepare Appendix D.

D.2 METHODOLOGY

After selecting the appropriate noise metrics for the project, the assessment process first identified and verified the noise emissions of a large set of construction equipment, by applying typical utilization rates for each type for different modes of operation. The emission levels, modes, and utilization rates were then acoustically combined to generate the "Fleet Noise Level" for this typical mix of vehicles and machinery, retaining the ability to differentiate between the demolition mix and the construction mix. This made it possible to distribute the machinery across a typical site so that the distance from the equipment to points from 30.5 to 182.9 meters (m) [100 to 600 feet (ft)] from the site perimeter could be used to propagate the Fleet Noise Level and evaluate noise levels adjacent to the site for a demolition phase and a construction phase.

D.2.1 Metrics

The Leq(h) metric was selected as the most useful and appropriate measure of noise effects for the Proposed Action. Leq(h) is defined as the time-integrated average sound level for a one-hour period that has the same acoustic energy as all of the time varying events occurring over the same time period. In this manner, the demolition and construction noise levels are assessed for

the effects that a one hour dose of noise is likely to have during the peak hour of operational activity on the typical site. As discussed below under the criteria heading, the Leq(h) metric applied in this way is basically a one-hour snapshot of conditions when demolition or construction activity is at its peak. This peak operating period may in fact only last for an hour or it may persist for many hours, depending on the size of the task at hand and the equipment available at the time.

D.2.2 Equipment

Table D-1 depicts the noise levels for 47 types of equipment applicable to the proposed demolition and construction activities. The levels are specific with respect to the mode of operation (idle, moving or full throttle) and four reference distances ranging from 38.1 to 461.8 m (125 to 1,515 ft).

D.2.3 Utilization

The last column of Table D-1 indicates for each type of equipment the proportion of the time during working hours that each equipment type is at idle, moving or full throttle. These proportional values are referenced to a value of one and are percent values if multiplied by 1,000. The ratios do not total 1.0 in all cases as there is no entry when the equipment is not in use.

D.2.4 Fleet Noise Level

The aforementioned fleet noise level is essentially the acoustic average of the utilization-adjusted set of the 47 equipment types in Table D-1. In simpler terms, it is the noise level of the average piece of equipment at a distance of 38.1 m (125 ft), where the average reflects modes of operation and noise level. The calculated fleet noise level is Leq(h) 73.2 dBA at 38.1 m (125 ft).

D.2.5 Propagation template

Table D-2 outlines the recommended noise levels for various land uses, as determined by the Federal Highway Administration (FHWA). Figure D-1 depicts the noise level as propagated from a typical construction or demolition site out to a distance 182.9 m (600 ft) from the site perimeter, where Table D-3 lists the noise template data used for Figure D-1. A noise level of Leq(h) 67 dBA extends about 58.8 m (193 ft) from the perimeter of the construction site and 81.3 m (267 ft) for the demolition site. The rate of noise attenuation in air follows the "acoustical spreading" rule, or 6 dBA per doubling of distance *for each individual source*.

Propagation from multiple noise sources across an entire site involves the accumulation of noise energy at fixed reference points from varying source distances. The resulting combined site noise levels decay at about 4.6 dBA for each doubling of distance.

TABLE D-1 GRC CANDIDATE EQUIPMENT LIST AND NOISE LEVELS

Equipment	Mode	dBA at 125 ft	dBA at 550 ft	dBA at 1,025 ft	dBA at 1,515 ft	Utilization Rate
Forklift	Idle	63	50	45	41	0.1
	Full	69	56	51	47	0.1
	Moving	91	78	73	69	0.2
Dump Truck	Idle	70	57	52	48	0.25
	Full	71	58	53	49	0.25
	Moving	74	61	56	52	0.5
Backhoe	Idle	62	49	44	40	0.25
	Full	71	58	53	49	0.25
	Moving	77	64	59	55	0.5
Steel Roller	Idle	61	48	43	39	0.25
	Full	66	53	48	44	0.25
	Moving	83	70	65	61	0.5
Excavator	Idle	62	49	44	40	0.25
	Full	66	53	48	44	0.25
	Moving	72	59	54	50	0.5
Dozer	Idle	63	50	45	41	0.25
	Full	74	61	56	52	0.25
	Moving	81	68	63	59	0.5
Front-end Loader	Idle	60	47	42	38	0.25
	Full	62	49	44	40	0.25
	Moving	68	55	50	46	0.5
Scraper	Idle	67	54	49	45	0.25
	Full	80	67	62	58	0.25
	Moving	84	71	66	62	0.5
Bobcat	Idle	60	47	42	38	0.25
	Full	65	52	47	43	0.25
	Moving	79	66	61	57	0.5
Grader	Idle	63	50	45	41	0.25
	Full	68	55	50	46	0.25
	Moving	78	65	60	56	0.5
Sweeper	Idle	64	51	46	42	0.25
	Full	76	63	58	54	0.25
	Moving	85	72	67	63	0.5
Tractor-Trailer	Idle	67	54	49	45	0.25
	Full	78	65	60	56	0.25
	Moving	77	64	59	55	0.5
M35	Idle	66	53	48	44	0.25
	Full	83	70	65	61	0.25
	Moving	87	74	69	65	0.5
60Kw Generator	Full	76	63	58	54	1
Light Car	Full	76	63	58	54	1
BAT12	Full	77	64	59	55	1

Note: To convert from feet to meters, multiply feet by 0.3.

TABLE D-2 GRC NOISE IMPACT ASSESSMENT FOR DEMOLITION AND CONSTRUCTION ACTIVITIES

Recommended Land Use for L_{dn}-Based Noise Level			
Land Use	**Noise Level**		
	(L_{dn} < 65)	**(L_{dn} 65-75)**	**(L_{dn} > 75)**
Residential	Acceptable	Generally unacceptable(2)	Unacceptable
Manufacturing	Acceptable	Acceptable	Acceptable(3)
Transportation communication, and utilities	Acceptable	Acceptable	Acceptable
Trade	Acceptable	Acceptable	Acceptable(3)
Public services	Acceptable	Generally unacceptable(2)	Unacceptable
Cultural, recreational, and entertainment	Acceptable	Generally unacceptable(2)	Unacceptable
Agricultural	Acceptable	Acceptable	Acceptable
Livestock farming and animal breeding	Acceptable	Acceptable	Unacceptable

[1] L_{dn} is the dBA level averaged over a 24-hour period. Ldnmr criteria are identical to Ldn criteria

FIGURE D-1 GRC NOISE TEMPLATE

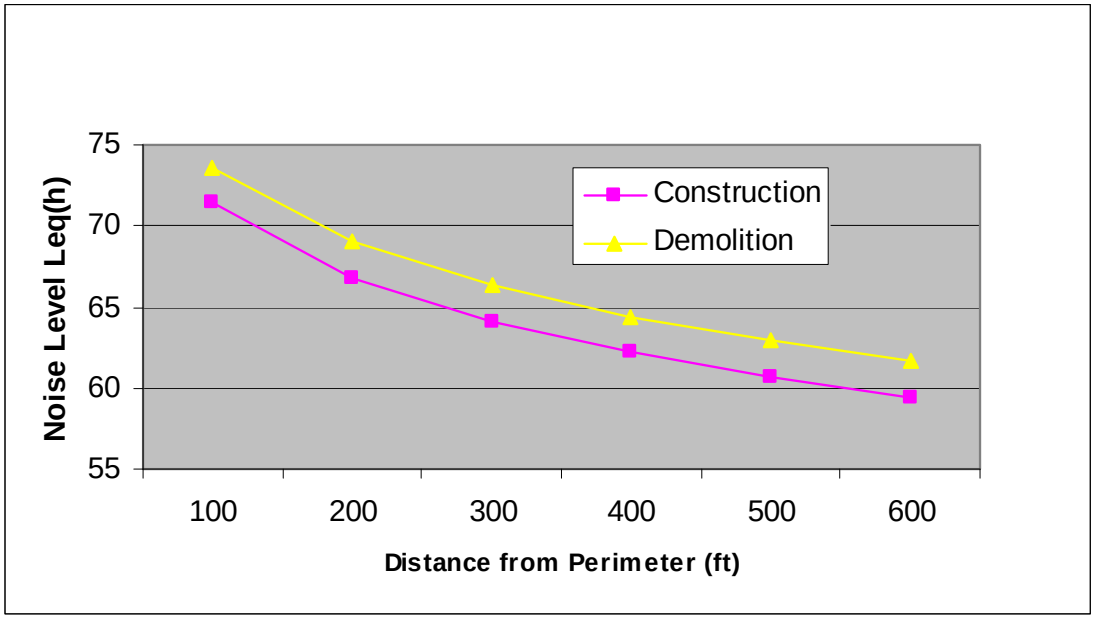

TABLE D-3 GRC NOISE TEMPLATE DATA FOR FIGURE D-1

Distance	Construction	Demolition
100	71.40666	73.63666
200	66.76173	68.99173
300	64.10216	66.33216
400	62.19094	64.42094
500	60.67985	62.90985
600	59.42144	61.65144

D.2.6 Criteria

Table D-4 presents criteria provided by FHWA guidance for the identification of highway traffic noise impacts contained in Code of Federal Regulations (CFR) 23, Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise."

TABLE D-4 NOISE ABATEMENT CRITERIA

Activity Category	$L_{eq(h)}$ (dBA)	Description of Activity
A	57 (Exterior)	Land on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	---	Undeveloped lands.
E	52 (Interior)*	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

These noise impact criteria are used to assess the need for programs and projects to apply noise abatement techniques to control highway traffic and construction noise.

D.3 Findings

D.3.1 Lewis Field

The positioning of the GRC noise template over candidate demolition and construction sites at Lewis Field reveals no instance where the FHWA noise criteria indicate the need to consider noise abatement. There is no adverse impact from demolition or construction projects considered within the GRC Master Plan.

D.3.2 Plum Brook Station

The positioning of the GRC noise template over candidate demolition and construction sites at PBS reveals no instance where the FHWA noise criteria indicate the need to consider noise abatement. There is no adverse impact from demolition or construction projects considered within the GRC Master Plan.

References

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AR 200-1, 23 April 1990, Environmental Protection and Enhancement.

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KAFB, 1997 *Environmental Assessment for Red Horse Training Annex at Kelly Air Force Base, San Antonio, Texas*. U.S. Army Corps of Engineers, Fort Worth Texas (March 1999).

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U.S. Environmental Protection Agency (EPA). Impact Characterization of Noise Including Implications of Identifying and Achieving Levels of Cumulative Noise Exposure. EPA Report NTID 73.4 (1973).

APPENDIX E

LEWIS FIELD AND PLUM BROOK STATION BUILDING DESCRIPTIONS

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APPENDIX E

LEWIS FIELD AND PLUM BROOK STATION BUILDING DESCRIPTIONS

E.1 BUILDINGS

The following describes the buildings that would be demolished, constructed or rehabilitated as part of the GRC Master Plan. Building-specific site preparations for the proposed activities for each building at Lewis Field and Plum Brook Station (PBS) are described in detail, below. The data for these buildings was compiled from the GRC Master Plan, the *Ohio Historic Building Inventories of NASA Lewis Research Center*, and NASA Facility Project Briefs (GRC 2008a; OHS various; NASA 2007).

E.1.1 Lewis Field

Building 3 (1942[1]) would be demolished and replaced with a new 4,273 m^2 (46,000 ft^2) Administration Building.

Building 8 (1943) would be rehabilitated to include the installation of a smoke/fire detection and alarm system, and then would be replaced with the Aerospace Education Center.

Building 14 (1943) is the Model Fabrication and Instrument Facility and would be demolished in preparation for the new Employee Services Center. The building has a concrete foundation, blonde brick exterior, and a built-up flat roof.

Building 15 (1943) would be demolished after the new Employee Services facility is complete.

Building 18-2 (1944) was part of the air dryer system for the Altitude Wind Tunnel (AWT) and would be completely demolished. This building is brick and contains a gas compressor which has never been used. There is a potential for lead-based paint (LBP).

Building 20 (1965) is the South Gate House and would be completely demolished. This building is half glass and half brick. There is potential for asbestos-containing material (ACM) and LBP.

Building 21 (1944) would be completely demolished after completion of the new Center Operations Building. This building is constructed from blonde face brick and concrete block. There is a potential for ACM and LBP.

Buildings 24 (1943), 34 (1946), and all of Building 51 (1949) would be demolished and replaced with a single 4,181 m^2 (45,000 ft^2) new facility, the Consolidated Materials & Structures Facility (see Table 2-4 for an overview of Phase 3 activities at Lewis Field).

[1] Dates represent the building's built-date, as taken from the Ohio Historic Inventory. Data was collected for the various buildings at various different dates.

This building has underground storage tanks that may need to be addressed if this building is demolished.

Building 28 (1944) is the Logistics Management building, which would be demolished and the foundation removed. The building was originally a chemical barrel storage area and there is potential for low-level contamination in the soils. The building has potential for ACM and LBP.

Building 31 (1946) is the Emergency Water Reservoir and would be demolished. This building is equipped with a 1,135,623 liter (l) [300,000 gallon (gal)] underground reservoir and a 5,678 liters per minute (lpm) [1,500 gallons per minute (gpm)] pump. The underground reservoir would be demolished and backfilled with appropriate clean material compatible for parking lots and roadways.

Part of Building 35 (1945) would be demolished and replaced with a single 1,858 m^2 (20,000 ft^2) new facility, the Research Combustion Lab (RCL).

Building 81 (1953) is the Engine Research Building (ERB) Spray Cooler building. This building and associated infrastructure would be demolished. The building is constructed from concrete block and a steel frame, with a concrete foundation. There is a potential for LBP and ACM.

Buildings 84 (1951), 104 (1956) and 137 (1974) are part of the Technical Services Complex; Building 84 is a storage facility; Building 104 is a garage with gasoline pumps located nearby; and Building 137 is a Warehouse (No. 2). All three buildings have potential for LBP, and Building 104 has potential for ACM. Building 104 contains gas pumps and underground fuel storage tanks, which are currently active. A leak detection system was installed 12 years ago and the site was remediated when the tanks were replaced. There may be some residual low-level hydrocarbon contamination. This complex would be replaced with parking lots for the new Lewis Field Administrative Center.

Building 98 (1945) is the Engine Components Research Lab Annex. The building and associated infrastructure would be demolished, including foundations 0.9 m (3 ft) below grade. The building is constructed from concrete block with a concrete foundation. There is potential for ACM and LBP.

Building 99 (1958) contains the ERB combustion air heater. The building and associated infrastructure would be demolished, including foundations 0.9 m (3 ft) below grade. The building is constructed from concrete block with a concrete foundation. There is potential for ACM and LBP.

Building 107 (1964) is the Maintenance and Repair Building and would be demolished and repaired by replacement with the Maintenance Warehouse Facility West Area, which is a single 5,946 m^2 (64,000 ft^2) facility.

Building 108 (1964), the Main Gate Security House, is currently not in compliance with NASA security requirements (NASA NPR 1600.1 and NPR 1620.3). Subsequently, the

building would be replaced with a new Main Gate Security Building and Building 108 would be demolished upon completion of the new Main Gate Security Building (NPR 2005; NPR 1993).

Buildings 135 (1973) and 140 (1977) would be demolished.

Building 139 (1976) is the Communications Satellite Station and would be demolished. The building consists of a control room which is located in a temporary trailer, on a concrete pad and five separate satellite dishes. There is potential for polychlorinated biphenyls (PCBs) and LBP.

Building 322 (1988) is the Wide Area Network (WAN) Gateway Building. The building would be demolished and the associated infrastructure would be relocated to Building 142. The building is constructed from prefabricated steel with a concrete foundation and bowed metal roof. There is a potential for hazardous materials associated with mechanical systems and testing equipment; however, the construction date is after RCRA, suggesting proper handling of hazardous materials.

Buildings 500 (1964), and 501 (1965) would be demolished and replaced with a Conference Center and the Centralized Office Building, which would comprise 5,946 m^2 (64,000 ft^2) of office space and 1,487 m^2 (16,000 ft^2) for an auditorium. Closing of these buildings would permit the closure and subsequent demolition of the Underpass Road section and bridge that connects the North and Central Areas of the campus. The removal of this roadway would eliminate a costly maintenance item.

E.1.2 Plum Brook Station

Buildings 2131, 2231 (1960), 2531 (1960), 2331 (1960), 2812 (1958), 3111 (1961), and 3311 (1964) would be demolished.

Building 7141 (1964) would be rehabilitated.

Building 7121 (1943) would be demolished and replaced with a new Maintenance Shop (see Table 2-9 for an overview of Phase 4 activities at PBS).

Building 7233 (1960) would be demolished or renovated as a communications hub/equipment building.

Building 9101 (1942) is comprised of approximately twelve ordnance storage bunkers that would be demolished for the relocation/extension of Scheid Road.

Building 9205 (1943), 9207 (1943) and 9209 (1943) would be demolished and replaced with a new 1,858 m^2 (20,000 ft^2) Warehouse (see Table 2-8 for an overview of Phase 3 activities at PBS).

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