National Institutes of Health
Animal Center
Dickerson, Maryland

Master Plan
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US Department of Health and Human Services
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Division of Facilities Planning

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Master Planning and Associated Studies for NIH Facilities
Order No. HHSN 29200012

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Prepared For:

Division of Facilities Planning

Office of Research Facilities Development and Operations

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Structure of the Document

This document describes the proposed Master Plan, the premises that led to its development, and its implementation recommendations. The document is organized into fourteen sections, including an Executive Summary and Appendix, as follows:

1. **Executive Summary**. The goals and highlights of the Plan are described, with a summary of architecture, landscape, circulation, utility frameworks and recommended implementation phasing.
2. **Introduction**. This section describes the purpose, scope and goals of this Plan. The Master Plan process is outlined. Briefs of related studies and compendium documents are also provided.
3. **Regional Analysis**. An overview of the region is provided. Demographic and socioeconomic comparisons of the region to the larger geographies are presented. Jurisdictional authorities and applicable regulations and plans are described.
4. **NIHAC Campus and Facilities**. A history of campus development is provided. Current organizational overview, including NIH Institutes and Centers that are associated with the campus, are noted and their roles described.
5. **The Natural Environment**. The natural features of the site are analyzed for their influence on planning and relevant design parameters. Regulatory requirements are also noted.
6. **The Built Environment**. An inventory of current facilities identifies space type and use for the campus buildings. Major buildings are analyzed in terms of physical conditions as well as functional and operational issues.
7. **Transportation, Circulation and Site Security**. The transportation networks serving the immediate area as well as the region are described. Campus access as well as campus circulation and parking issues are identified. Security infrastructure and deficiencies are noted.
8. **Site Utility Infrastructure**. Existing utility infrastructure, available capacities, deficiencies, and planned improvements are noted.
9. **Space Program for the Master Plan**. The space program section describes the components and space requirements on which the Master Plan is based. The programmatic requirements were developed using current standards and the evaluation of NIHAC's current facilities.
10. **Master Plan Development**. The Master Plan objectives, requirements and site considerations were developed into campus development concepts and, subsequently, into alternative layouts of the NIH-preferred approach. These are shown in this section.
11. **NIHAC Campus Master Plan.** The Master Plan key concepts and development components are presented. The plan recommends approaches to architectural development, engineering and utilities, landscaping development, and parking and circulation.
12. **Phasing and Implementation Plan.** The Master Plan growth and improvements are envisioned as incremental development, and this section recommends phases for renovations, new buildings and site improvements. Although four phases are outlined, there is considerable implementation flexibility.
13. **Design Guidelines.** The design guidelines define important basic principles of organization and design that are central to the Master Plan and the realization of NIH goals. Guidelines are presented for circulation and connectivity, campus character, flexible facilities and landscape architecture.
14. **Appendices.** The Appendices provide an outline of a selection of the applicable codes and regulations, a summarized table noting the NIHAC Temporary Buildings and their key characteristics, an existing campus site plan (11"x17") and the proposed master plan (11"x17") for the campus.

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1. Executive Summary

The National Institutes of Health Animal Center (NIHAC) in Dickerson, Maryland, is a rural site of over 500 acres, located approximately 4.5 miles west of Poolesville, in Dickerson, Maryland. It was developed on former farmland site, retaining the farm's pastureland, streams and wooded areas. The campus houses animals used by various Institutes of the National Institutes of Health (NIH) in their research programs.

The campus is home to both behavioral research and animal holding programs. The Division of Veterinary Resources (DVR) supports NIH research through the procurement, housing, quarantine and care of animals used by the NIH Institutes in the Washington DC area. DVR-managed facilities are located primarily in the north section of the NIHAC campus. The Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) leads the behavioral research program and operates the associated animal housing facilities on the south section of the campus. Several other NIH Institutes use their animal care services. Key among them are the National Institute of Allergy and Infectious Diseases (NIAID), the National Cancer Institute (NCI) and the National Institute of Mental Health (NIMH). Currently, animal species on the campus range from large animals, to monkeys, to mice, but strategic planning by NIH's Facility Working Group and its appointed Animal Requirements Sub-Committee (ARSC) anticipates that this campus will house primarily non-human primates in the future with a limited number of large animals and mice.

NIH is an agency of the Department of Health and Human Services (HHS), which is the federal government's lead department in medical and behavioral science research. HHS requires that a physical master plan be developed for each NIH site, reflecting both the anticipated special needs of the user groups and the impact of their activities on the surrounding community. The master plans are used to define needed physical facilities and to advance the agency's mission-related goals.

The NIHAC Campus Master Plan was commissioned in response to institutional policy, but reflects a real need for new and renovated facilities to replace aging and temporary buildings and to properly support changing research programs and care for anticipated growth in animal population.

1.1 Vision for the Master Plan

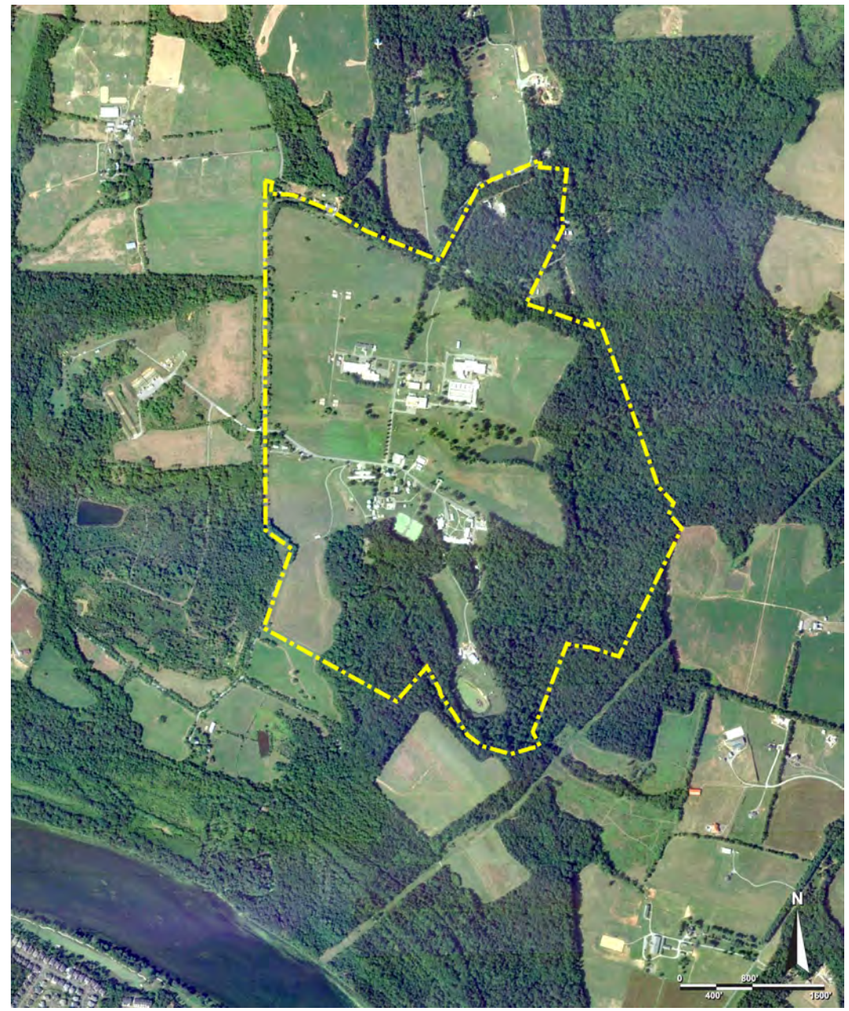
The Master Plan reflects NIH's vision for the physical development of the NIHAC campus and for a flexible strategy for implementation. NIH is ever evolving, and needs flexible, integrative and collaborative support spaces to effectively promote scientific research. The vision for the campus development was discussed with NIH representatives, and it forms the basis for the planning approach and recommendations. A summary of this campus vision is the following:

- The Master Plan recognizes that the NIHAC campus is an integral part of NIH research that takes place in Bethesda and other sites in the greater Washington DC Metropolitan Area. Its campus development seeks to optimize its value as an animal research support resource in an efficient and complementary way.
- The Master Plan creates a framework for growth and change that is flexible and can adapt to the dynamic nature of NIH research, changes in technology, procedures and regulations, and the dependence on annual funding.
- The Master Plan seeks the most appropriate land and facility use for the campus, recognizing the rural location, the infrastructure constraints, the natural features and the existing facilities.
- The Master Plan anticipates an environmentally responsible approach to land use and operations.

1.2 The Master Plan: Highlights

The Master Plan was developed in concert with NIH's Facility Working Group and its appointed Animal Requirements Sub-Committee (ARSC), as well as the resident campus Institutes and the Office of Research Facilities. The Master Plan addresses the goals of the NIH for the NIHAC campus, the research programs anticipated and the current site and building condition. But a master plan is a living document, and must be adaptable to change, which might include new priorities, altered mission or circumstances and funding realities.

Exhibit 1.1: Aerial Photo of the Campus



The Master Plan for the NIHAC campus would upgrade the physical facilities by replacing aging and deteriorating buildings and infrastructure with more functional, energy efficient buildings. The plan would accommodate the anticipated growth in animal population and its shift to more non-human primates, which are expected to increase by approximately 67%[1]. The plan provides a framework to realize the goals of creating a coherent campus with appropriate facilities for research and animal care needs, and a campus that emphasizes functional relationships and collaboration, employee support needs and sustainable practices. Developed from analysis and evaluation of alternatives, the Master Plan clusters new construction on the north portion of the site. This takes advantage of level terrain, proximity to existing animal holding buildings, Central Utility Plant capacity and the utility infrastructure already in

1 Percentage increase includes NHPs in the proposed Breeding Colony

place.
Highlights of the Master Plan are the following:

- **Campus as a place.** The buildings would be clustered around a central green, to create a campus-like setting with a coherent organization. The building entries would face a central loop drive, for better wayfinding for campus visitors.
- **State-of-the-art animal facilities.** Adaptable animal holding facilities would replace those inefficient or underutilized facilities that were built for one species, and the animal housing capacity would be increased to accommodate projected growth. Supportive research and procedure rooms would be co-located to minimize transport of animals.
- **Support for researchers.** Imaging and diagnostic facilities are a priority component, expanding the capability on campus for efficient procedures and sampling—tests that currently require animal transport to Bethesda. This would be both more efficient and less stressful for the animals. Also, researchers from Bethesda would be able to better utilize NIHAC.
- **Energy efficiency.** NIH has made a significant investment in a recently built Central Utility Plant and infrastructure on the north campus, which would now serve the new research and animal holding buildings. Consolidation would phase out inefficient heating/cooling systems on individual buildings.
- **Flexible, incremental growth.** The plan allows buildings to be added incrementally, as needed and when funded, while being linked to an established circulation and service structure. The building arrangement would permit expansion beyond the anticipated need of the current plan as need arises.
- **Better buildings.** Aging and inefficient buildings would be phased out, including temporary buildings and trailers that house scientific programs.
- **Water conservation.** Additional water conserving measures and improvements to the potable water, gray water and sewage treatment systems are recommended, to keep the campus within its permitted levels over this 20-year period.
- **Consolidated operations.** Although behavioral research programs and animal holding would have separate facilities, their co-location would encourage collaboration and interaction. All major buildings on the north campus would be physically linked, allowing sharing of resources and free movement between buildings.
- **New breeding colony.** A location has been identified for a proposed breeding colony which is intended to be energy self-sufficient.
- **Improved security.** The Master Plan would meet NIH policies for screening incoming vehicles and protecting the staff and resident animals. New entrance screening facilities, access controls, repaired fencing and a secondary emergency exit road are proposed.
- **Staff support.** The very limited employee support spaces would be augmented to make the campus a comfortable place to work. Key components would be a shelter-in-place for unexpected overnight stays, a data center, changing and shower facilities for animal staff, eating and conference facilities.
- **Rural character.** The campus would keep the open rural landscape character, even with the Master Plan implementation. Sites that previously held buildings are reused, views are maintained, trees, streams and pastureland are not interrupted.
- **Natural and sustainable campus.** The plan emphasizes landscape stewardship, restoration of natural plantings, and stormwater management practices.

Exhibit 1.2: Existing Campus Plan

Facilities managed by DVR

B100	Animal Facility
B102	Animal Facility
B103	Animal Facility
B104	Animal Facility
B127	Animal Facility
B128	Animal Facility
B131	Storage Building
T1	Animal Barn
T11	Storage Shed
T12	Loafing Shed
T13	Warehouse
T15	Storage Building
T16	Storage Building
T2	Animal Barn
T20	Storage Shed
T22	Storage Building
T5	Storage Shed
T8	Abandoned-Office
W107-ST8	Storage Building
WT19-WT20	Storage Shed

Facilities managed by NICHD

TR112A	Office
B110	Office/Animal Lab
B110A	Animal Facility
B111	Office/Animal Lab
B112	Office/Animal Facility
B130	Storage Building
B132	Animal Facility
T18	Abandoned
T24A	Storage
T25, 25A-C	Storage
TR110	Abandoned-Office
TR130A	Office/Storage
TR18A	Office
TR18B	Office
TR24B	Office

Facilities managed by ORF

B101	Original CUP (not in use)
B101A	CUP
B107	Wastewater Treatment Plant
T10	Garage
T14	Warehouse
T19	Storage Shed

Other facilities

B115, B115.1	Security
B116	Residential
B117	Residential
T11A	Residential
T21	Residential
T6	Residential
T7	Storage Shed

1.3 The Master Plan

The core concept for the Master Plan is the consolidation of facilities for behavioral research and centralized animal holding facilities on the north campus, creating opportunities for collaboration, sharing resources and easy pedestrian connections. The consolidation brings the new buildings into proximity to Building 101A, the Central Utility Plant (CUP), improving efficiency for both energy and maintenance.

The Master Plan evolved from studies of existing conditions, site and regional analyses, building evaluations and program needs. Aging buildings and infrastructure were key drivers. Many of the buildings are in poor physical condition, and temporary buildings and trailers continue to be used for critical research functions. Animal space configurations are often inflexible, designed for one specific animal species and difficult to adapt to the changing mix of animals used in research today. NIH put a significant investment into a new Central Utility Plant in 2003, but extending it to serve the south campus behavioral research buildings was not considered cost effective.

A. Key Campus Development Facilities

a. *Entrance Security and Gateway Center*. A new building and reconfigured entrance and vehicle screening areas would be built at the Elmer School Road entrance to the campus. The drivers are better and more efficient visitor screening and the replacement of the two trailers that now serve as the security administration.

b. *Shared Imaging and Diagnostics Facility*. A new building would provide clinical support for both behavioral research and animal holding programs, including imaging facilities, procedure rooms and diagnostic labs. The primary drivers are more efficient and timely procedures. For imaging and certain procedures today, animals must be transported to Bethesda, resulting in lost staff time, temporary holding at Bethesda and animal stress. Additionally, it has been difficult to analyze certain samples within their prescribed timeframes.

c. *Behavioral Research Facility*. A new building would replace the several existing behavioral research buildings on the south campus with modern, flexible animal spaces, procedure and support rooms, and office space for researchers. The primary driver is the replacement of aging, inappropriate and fragmented buildings. The replacement would provide flexible housing, research and support space and accommodate modest growth.

d. *Multi-Species Animal Holding Facility*. NIHAC at Poolesville is expected to increase its animal population over the next years, primarily housing of non-human primates. The primary drivers are the increase in the animal capacity requirement and the provision of flexible multi-species housing that can adapt to changing research needs over time. The building would include animal holding and procedure rooms, office space, warehouse and other support areas.

e. B102 A-*wing Renovation*. One wing of Building B102 would be renovated into flexible animal housing, for the expected holding of non-human primates. The primary driver is the underutilization of this wing because it was designed for a single animal species not often used in research today. A preliminary design for this renovation has been completed.

f. *Breeding Colony*. A new outdoor area is proposed for the breeding of non-human primates. The driver is anticipated improved efficiency, quality and cost effectiveness by reducing the use of contract breeding facilities. The colony would have a fenced open space supported by a shelter and observation post.

g. *Field Habitat*-B132 *Addition*. A small facility for observation and work space would be added at the field habitat, replacing a trailer that is in poor condition.

Other Building Improvements. Based on operational review of the animal care facilities, building improvements and small additions are recommended for B102 and B103. Additionally, energy efficiency upgrades are recommended for the remaining buildings.

Building Demolition. Buildings that are abandoned or underutilized and in poor condition would be demolished in Phase 1. Outmoded buildings would be demolished after replacement.

Exhibit 1.3: Proposed Master Plan

B. Other Campus Development Facilities

North of Club Hollow Road is a 23 acre parcel of NIHAC property, which is separated from the main campus both physically and functionally. The parcel is mostly woodlands with steep terrain. The Master Plan would conserve the woods and stream, and the several small buildings on this parcel would continue to be used for institutional storage and support.

C. Circulation

The circulation plan maintains the main entrance and the existing South Drive and Center Drive. Additional drives and parking are phased in to serve the new buildings when constructed. Vehicular traffic and parking demand would shift to the north campus with the consolidation of research and animal facilities. In parallel, traffic and parking demand would significantly diminish in the south. With this shift, the low volume of traffic is not expected to burden the existing on-campus drives. Parking spaces would increase by approximately 50%, from 141 to 217 spaces, accommodating the current shortfall and a modest staff increase, and allowing for better flow within the lots. The entrance and screening area at Elmer School Road would be modified to create separate lanes for employees and for the screening of commercial and visitor vehicles.

Trip generation to/from the property is projected to increase slightly with the added employees, but the volume would remain very low and "A" level of service in all directions would be maintained.

D. Landscape

The landscape approach is based on environmental stewardship, increasing biodiversity and introducing harmonious new landscape elements that enhance the campus's rural character. A new landscape feature, the campus green, would be introduced as the organizing element of the north campus. The design would contrast with the agricultural landscape, incorporating shade and flowering trees, pedestrian paths and seating areas. Perennial and evergreen plantings would screen the views of Central Utility Plant equipment and loading docks. Campus-wide environmental strategies include reducing landscape maintenance needs, restoring wildlife habitats, and implementing stormwater management practices. Meadow would replace unused grazing land, reducing pastures from 102 to 70 acres.

E. Infrastructure and Site Utilities

The Master Plan addresses the two pressing issues of energy and water efficiency, responding to current performance issues and anticipated requirements for both regulations and campus development.

Energy efficiency would be improved with the replacement of aging and energy inefficient buildings with modern buildings and systems that utilize the services of the Central Utility Plant (CUP). To date, the CUP has not served the heating and cooling needs of many of the buildings because of their locations. Consolidation on the north campus would allow the CUP to service these buildings and to operate at a more optimal level.

The 20-year development is expected to increase potable water use to the maximum allowed by state permit if current practices are continued, and without improvements, the NIHAC will have little or no margin of safety. A 20% improvement in water use has been targeted in the Master Plan, based on strategies to increase gray water use, reduce equipment water use and continue to reduce transmission losses. More detailed studies are recommended, including the following immediate actions:

- Steam and chilled water building load analysis with a target energy reduction of 20%
- Comprehensive analysis of the Wastewater Treatment Plant (WTP) to determine the remaining life and optimum approach to increase capacity to 150,000 gallons/day
- Building water analysis, with a target reduction in potable water use of 15%; and reduction of future steam loads by 20% to reduce the corresponding steam make-up rate
- Trace and document all current gray water use
- After completion of the studies: reduce cooling tower blow down through scale inhibitor and/or tertiary filtration of gray water; redirect storm water discharge from the sanitary sewer system

1.4 Master Plan Development Summary

The proposed 20-Year Master Plan total campus development is 474,000 gross square feet (GSF) of space comprised of 245,000 GSF of new space and 229,000 GSF of existing space retained. Approximately 61% of the new space would support anticipated growth and the remaining 39% would account for replacement of outmoded facilities and inefficiencies in retained facilities. Chapter 9 highlights the strategies of retaining buildings that are in good physical condition and replacing those that are not.

Exhibit 1.4: Twenty Year Projection Summary

	20-YEAR MASTER PLAN PROJECTIONS					IMPLEMENTATION PHASES			
	Existing Facilities GSF	Demolition GSF	Retained Facilities GSF	New Construction GSF	20-Year Total GSF	1	2	3	4
	A	B	C=A-B	D	C+D				
NEW BUILDINGS									
Animal Holding Facility				103,100	**103,100**				new
Behavioral Research Facility				80,800	**80,800**			new	
Shared Imaging and Diagnostics Facility				43,400	**43,400**		new		
Breeding Colony				4,200	**4,200**		new		
Entrance Security				1,400	**1,400**		new		
EXISTING BUILDINGS									
Animal Holding & Support (DVR mgmt)	238,490	75,229	163,261	11,300	**174,561**	addition			demo
Behavioral Research & Support (NICHD mgmt)	48,281	43,246	5,035	900	**5,935**	addition		demo	
Utility, Support, Security Facilities	68,590	12,544	56,046		**56,046**	demo			
Residential	6,246	1,752	4,494		**4,494**	demo			
TOTAL PROJECTED SPACE	**361,607**	**132,771**	**228,836**	**245,100**	**473,936**				
PROJECTED POPULATION	Number				**Number**				
NIH Personnel	199				**212**		✓	✓	✓
Non-Human Primates	2,360				**3,945**		✓	✓	✓
Mice	1,400				**200**				
Large Animals	100				**100**				

Notes: 1. Animal Holding in Phase 1 is a renovation of B102 Wing A.
2. The term Buildings includes temporary structures and trailers.
3. The Projected Population for NHP includes the 150 NHPs in the proposed Breeding Colony.
4. Does not include program provisions for specialized breeding.

1.5 Master Plan Implementation

The Master Plan is a look into the future and a structured plan to build and renovate facilities to meet anticipated needs. Twenty years is the timeframe for the Master Plan implementation, and the changes have been prioritized and organized into four development phases.

The Master Plan is designed to accept gradual changes and to appear complete at the end of each phase or significant addition. The sequence of building additions locates the first priority new building near the existing buildings on the north campus, B102 and B103. Successive buildings are added in this pattern and connected to the previous one for more efficient movement of animals and equipment.

1. Phase 1 would implement projects and initiatives that have been in the NIH planning phases. These include the renovation of B102 A-wing animal holding building, a research space addition to the B132 habitat building, the demolition of underutilized/vacant buildings, the installation of additional fuel tanks and security upgrades for loading dock access and perimeter fencing. Landscape improvements would be initiated in Phase 1, especially those that reduce maintenance such as returning unneeded pastures to meadow.

2. Phase 2 would add a shared animal Imaging and Diagnostics Facility, which is the stated priority need of the program groups utilizing the NIHAC at Poolesville. The central campus green would be developed, visual buffers added and the North Drive relocated to meet security regulations. After detailed study during Phase 1, upgrades to the potable water, grey water and sanitary sewer systems would be implemented. Both the new Entrance Security and Gateway Center and the Breeding Colony are included in Phase 2, although their timing is independent of the other Phase 2 development.

3. Phase 3 would establish the consolidation of the research and animal holding functions by relocating the Behavioral Research Facility on the north campus, replacing the outmoded and aging buildings to the south. After their replacement, the existing south campus facilities would be demolished and the natural landscape restored.

4. Phase 4 would enclose the fourth side of the campus green by adding animal holding facilities designed to accommodate the anticipated growth in animal programs administered by DVR.

The purpose of this Master Plan is to define the real property assets that would support the execution of the programs housed at the NIH Animal Center, near Poolesville, Maryland, and to guide new development within the campus, in support of the mission of the National Institutes of Health. Realization of the Master Plan at any given time will depend on HHS and NIH priorities, governmental policy decisions, as well as budgetary considerations. The Master Plan does not represent the pre-approval of any individual facilities project nor the pre-approval of the particular needs of specific programs to be accommodated on the campus. The Master Plan is, therefore, designed as a flexible framework and a guide for the orderly future development of the campus, if and as it occurs.

Exhibit 1.5: Implementation Summary

	Phase 1	Phase 2	Phase 3	Phase 4	Total
NEW BUILDINGS	0	49,000 GSF	80,800 GSF	103,100 GSF	232,900 GSF
ADDITIONS	12,200 GSF	0	0	0	12,200 GSF
DEMOLITION	(89,845) GSF	(606) GSF	(38,471) GSF	(3,849) GSF	(132,771) GSF
SUBTOTAL	(77,645) GSF	48,394 GSF	42,329 GSF	99,251 GSF	112,329 GSF
MAJOR RENOVATIONS	15,100 GSF	0	0	0	15,100 GSF
OTHER KEY ACTIONS	· B102 loading dock · Security upgrades · Landscape buffers · Pasture reduction · New fuel tanks · Water saving strategies	· Connecting corridors · Move North Drive · Parking, loading dock · Vehicle screening area · Vernal pool · Wastewater wetland · Relocate electrical svc. · Gray water upgrade	· Parking, loading dock · Security gates · Campus green · Pasture reduction · Plant south landscape · Upgrade Wastewater Treatment Plant (WTP)	· Add east-west road · Parking, loading dock · Security gates · Stormwater mgmt.	

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2. Introduction

2.1 Background

The National Institutes of Health Animal Center (NIHAC) is set on a 513 acre campus located in rural Montgomery County, Maryland near the Potomac River. The campus, located about 30 miles northwest of the National Institutes of Health (NIH) Bethesda Campus, serves two distinct purposes:

- Provide animal housing and care support for NIH institutes conducting research using animal models; this service is provided by NIH's Division of Veterinary Resources (DVR); and,
- Provide a shared animal research facility primarily focusing on behavioral research; this effort is currently led by Eunice Kennedy Shriver National Institute of Child Health & Human Development (NICHD)

The site was acquired by NIH in 1960 to relocate animals from a rental farm in central Montgomery County. Over the 5 decades of ownership, NIH has developed less than 5% of the site for its buildings and facilities[1]. Campus development has generally followed the frameworks set forth in the Master Plans of 1960, 1969 and 1996. In 2009, NIH tasked Metropolitan Architects and Planners, Inc. (MAP) and its consultants to prepare an updated Campus Master Plan to address its needs and functions for the next 20 years.

2.2 Intent and Purpose

The U.S. Department of Health and Human Services (HHS), the parent agency of NIH, considers the Master Plan an integral part of broader, long term planning efforts. It requires Master Plans for all of its campuses and installation sites comprising two or more independent buildings or activities. HHS' operating divisions are required to update Master Plans every five years (or less) to determine and coordinate site improvements as well as to guide orderly, comprehensive physical development to improve functioning and appearance. Within NIH, Master Plans aid the Office of Research Facilities (ORF) in its decision-making while accommodating changing circumstances and agency priorities.

Many NIHAC buildings are aging and no longer optimal for research, animal care or animal housing. These facilities are in need of repair, improvement or replacement. Over 16% of the campus space is housed in temporary structures and trailers[2]. Additional space is needed to satisfy a current shortfall in research facilities and a projected increase in Non-Human Primate (NHP) capacity[3]. To accomplish its mission at NIHAC, it is imperative that NIH has an updated campus Master Plan that addresses issues of growth, resource use, utilities, transportation, and environment. The Master Plan is also expected identify the best use of the NIHAC given the constraints and development objectives of NIH.

Exhibit 2.1: NIHAC Existing Site Plan

1 *Refer to* Section 5.1 Current Land Use
2 *Refer to* Exhibit 6.11: Summary of Buildings Considered Acceptable, Needing Overhaul/Phase Out and Replacement/Demolition *for a breakdown of Permanent Buildings, Temporary Buildings and Trailers*
3 *Refer to* Section 9.3C Projected Animal Requirements for NIHAC

2.3 Authorization and Applicability

The NIH Animal Center Master Plan and its accompanying documents are prepared in accordance with applicable HHS, local and Federal statutes and requirements. Section 3-1 of HHS Facilities Program Manual (Volume I) sets forth the policy, procedures, guidance and information, and reporting requirements for HHS' operating divisions for facility master planning. It also lists the laws and regulations applicable to the master planning process as it applies to the HHS facilities planning program. The list includes:

- National Environmental Policy Act of 1969 (42 USC 4321 et seq.);
- Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR parts 1500-1508);
- National Historic Preservation Act of 1966 (16 USC 470 et. seq.) and Implementation Procedures Contained in Federal Register Vol. 35, No. 23, February 3, 1970, Department of the Interior, National Park Service "National Register of Historic Places" ;
- Executive Order 12372, "Intergovernmental Review of Federal Programs," Amended April 8, 1983
- Uniform Relocation Assistance and Land Acquisition Policies Act of 1970 (42 USC 4601 et seq.)
- National Capital Planning Commission (NCPC)—"Master Plan Submission Requirements"

Federal agencies within the Regional District of Montgomery County are also within the purview of the Mandatory Referral Review of the Planning Board. The Montgomery Planning Board is part of the Maryland-National Capital Park and Planning Commission (M-NCPPC).

2.4 Master Plan Goals

NIH has set the following primary goals for the NIHAC Master Plan:

- Establish a comprehensive and coordinated framework for the physical development of the NIHAC campus that results in an appropriate scale, density, and character for the site and which satisfactorily addresses the infrastructure constraints that presently limit growth on the campus;
- Identify the optimal use of the NIHAC recognizing that the current campus may provide opportunities for public/private initiatives that could contribute either directly or indirectly to enhancing the NIH research enterprise;
- Achieve a physical framework of development sites, open space, transportation/circulation systems, and utility supports that ensures appropriate campus and facility utilization, functional land use, and efficient accommodation of future program requirements; (Note that private initiatives, even on public property, must go through a development review process in Montgomery County.)
- Develop a campus plan that contains sustainable design components consistent with HHS' and NIH's sustainability goals.

In addition, NIH's goal is to also address the Federal Real Property Performance Measures[4] that include:

- Mission Dependency
- Condition Index
- Utilization Index
- Operations and Maintenance Cost
- Construction Program Metrics
- Daily Decision-Making Metrics

4 Federal Executive Order 12237 *Federal Real Property Asset Management*

2.5 Process and Methodology

The Master Plan development process as envisioned by NIH comprises a multi-phase process. The first phase, Phase 1A, involved an update and assessment of existing utilities infrastructure at NIHAC. The documentation and findings were included as a separate compendium. Phase 1B through Phase 5 covers the development of the physical master plan for the campus and the associated Environmental Impact Statement (EIS). The five phases leading to the development of the Campus Master Plan and the EIS are:

- Phase 1A: Update and assessment of existing utilities infrastructure
- Phase 1B: Data collection and concept development
- Phase 2: Alternatives development
- Phase 3: Preliminary Draft and Draft Master Plan development
- Phase 4: Preliminary Draft and Draft EIS development
- Phase 5: Preliminary Final and Final Master Plan and EIS development

NIH's operations at NIHAC involve a number of NIH institutes and centers. In order to adequately capture the issues and concerns of all the stakeholders, it was essential that a highly interactive and inclusive process was followed. The consultant team worked closely with NIH's Office of Research Facilities (ORF) to obtain background and existing facilities information from the operating ICs at NIHAC. Future requirements were provided by both the facility operators (DVR and NICHD) as well as the end users (primary researchers and animal program directors). The Animal Requirements Sub-Committee (ARSC) appointed by NIH's Facility Working Group (FWG) provided direction and guidance for the Master Plan. Representatives from ORF and the Office of Research Services (ORS) provided the technical and resource related guidance for the Plan.

The following provides an overview of the key steps leading to the draft Master Plan development:

A. Existing Facilities Documentation

The 1996 Master Plan and EIS provided a background for the NIHAC site and facilities. However, the campus has since undergone changes in organization, function, as well as facilities in an effort to keep up with evolving animal care, housing and behavioral research needs. An existing conditions documentation was prepared by:

- Conducting walkthroughs of campus facilities and documenting observations regarding operations and functions;
- Conducting interviews and meetings with the facility managers;
- Obtaining detailed facility functions, conditions, operations from facility managers through questionnaires;
- Reviewing Asset Detail Report for facilities provided by NIH; and,
- Preparing a current inventory of facilities documenting by space type and area

B. Future Requirements

Projections for future campus needs was based on the assessment of several factors:

- Current deficiencies were found in existing facilities in terms of physical conditions, operational issues, and spatial adequacy. Buildings were classified for potential retention, overhaul/phaseout, and demolition.
- Animal Capacity and Requirements Survey was conducted by ARSC identifying implications for NIHAC. Allocations for NIHAC were estimated based on projected requirements for the Bethesda area and available capacities in existing and planned facilities;
- Future demand was projected for animal holding, care and procedure space as well as

personnel space based on the projected needs for each IC that operates or has animals at NIHAC; Information was obtained from Animal Program Directors/primary researchers using questionnaires and interviews;

- Condition and capacity of existing infrastructure and utilities were evaluated; NIH staff at the Central Utility Plant (CUP) and the Wastewater Treatment Plant (WTP) were consulted.
- The collected data was analyzed and used to prepare a campus-wide program of requirements that formed the basis for the Master Plan development options.

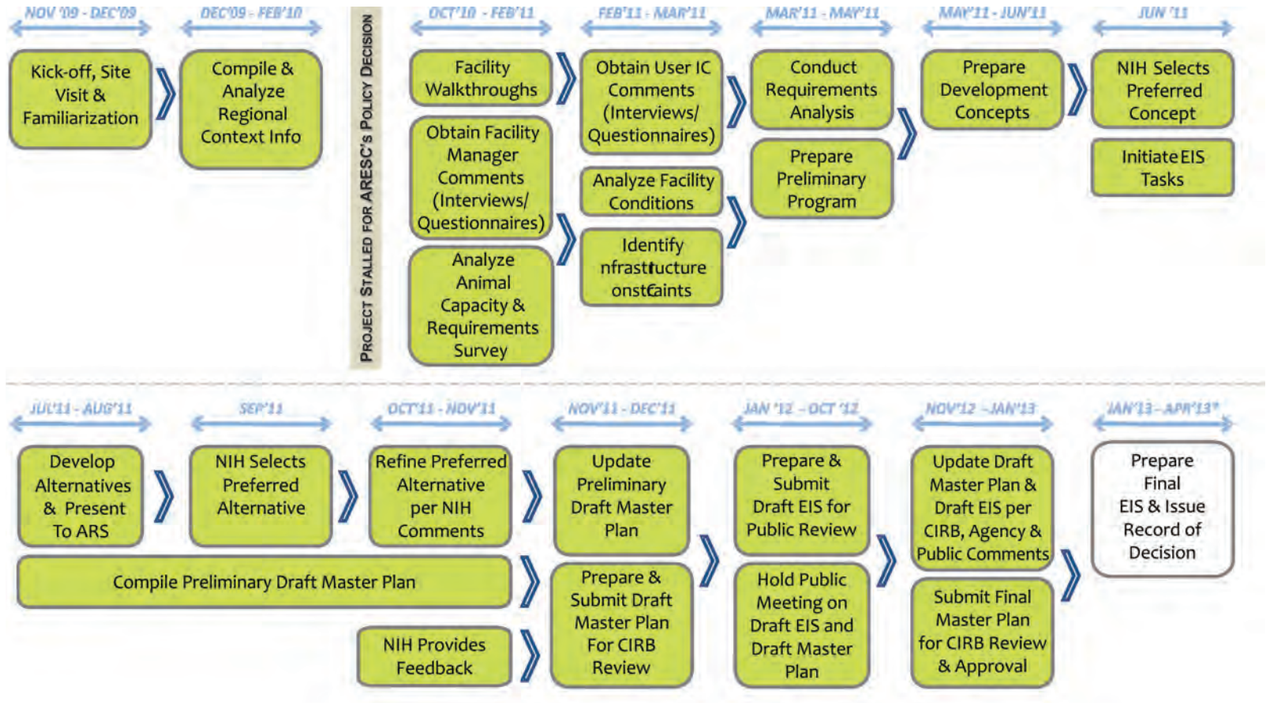
C. Development framework

The future development framework was finalized through a three-step process:

- Three concepts were presented to the ARSC as well as the ORF and ORS representatives, which led to the identification of the preferred concept;
- Three variations of the preferred concept, termed "alternatives", were prepared and presented to the ARSC and ORF/ORS representatives; a preferred "Alternative" was selected;
- The preferred alternative was subsequently modified based on comments received from NIH and formed the basis for the proposed future development framework that comprise this draft Master Plan. The various elements of the framework were further defined and delineated in this document

Exhibit 2.2 provides a timeline of the key steps in the Master Plan development process.

Exhibit 2.2: Master Plan Process



*Tentative

2.6 Related Studies and Compendia

A. Market Feasibility Study (Final Draft, December 2009)

Prior to the initiation of the Master Plan process, NIH tasked Jones Lang LaSalle (JLL) to conduct a study to explore "non-NIH reuse of undeveloped land at NIHAC". JLL evaluated physical and legal compatibility of commercial and renewable energy uses for the undeveloped portions of the campus. The study concluded that sale of transferable development rights (TDRs) combined with a ground source heat pump system and/or a solar PV system was the best re-use option for NIH.

B. Update and Assessment of Existing Utilities Infrastructure at NIH Animal Center, Poolesville (December 15, 2011)

As indicated before, this study comprises Phase 1A of the NIHAC Master Plan. The documentation and findings are included in an independent separate volume.

C. Environmental Impact Statement (EIS)

An Environmental Impact Statement (EIS) is being finalized to serve as a compendium to this Master Plan document.

3. Regional Analysis

In developing a Master Plan, regional and local contextual factors are important considerations. Future development of the site would be influenced by its regional surroundings, and the site development, in turn, might affect the region. The following regional and local factors are explored in the context of the Master Plan:

- The Socioeconomic and Institutional Environment: population, major employers, and education and cultural institutions;
- The Regulatory Environment: governing jurisdictions, comprehensive plans, zoning and other regulations;
- The Built Environment: land use and nearby commercial and residential developments; and
- The Natural Environment: geology, topography, hydrology, vegetation, and climate

3.1 Regional Overview

The NIHAC Campus is located on the western edge of Montgomery County, less than a mile from the Potomac River. It is in the Agricultural Reserve for Montgomery County, which covers 93,000 acres. It is situated within the Upper Section of the Piedmont Plateau Physiographic Province[1], east of the Appalachian Mountains, on the coastal plain towards the Chesapeake Bay. The site's streams and wetlands are the headwaters for the rivers headed to the Chesapeake Bay. Pollution control from runoff is most effective at the headwaters and any prevention on campus will significantly help reduce water pollution in the Bay.

The campus is part of the National Capital Region (NCR) that was established by the National Capital Planning Act of 1952. The NCR includes the District of Columbia, Montgomery and Prince George's counties in Maryland, Arlington, Fairfax, Loudoun and Prince William counties in Virginia, as well as cities within the boundaries of the included counties of Maryland and Virginia.

The site is set in a region known for its productive farmland, gentle slopes, and connection to the Chesapeake Bay. This region is also known for its unchecked growth and severe traffic delays owing to over-development. The regional development pattern is influenced by a wide range of factors - the presence of the nation's capital, the highway system serving the area, and the natural features such as the Potomac River. Montgomery County, the primary jurisdictional authority for the site, has well established planning controls to promote sensible and smart development in the area.

The NCR is subject to constant growth pressures given its regional and national significance. The strong presence of Federal Agencies provides a permanent engine of economic growth. From 1970 to 1990, the population of the Washington region increased by 35.5 percent, while the urbanized land (houses, shopping centers, office buildings, parking lots, etc.) increased by 95.7 percent[2].

This development pressure put valuable farmlands at risk. The pressure on the area surrounding the NIHAC is greater compared to the rest of the NCR as it lies in a "favored corridor" where investment and wealth tend to be concentrated[3,4]. Highway development in the vicinity has further enhanced the growth pressure. I-270, which runs in a northwesterly direction through Montgomery County, is approximately 15 miles east of the NIHAC campus. The recently completed Inter-County Connector (ICC), MD200, connects I-270 and I-370 to I-95.

Exhibit 3.1: Washington-Baltimore-Northern Virginia Regional Map

1 *Maryland Geographical Survey*, "A *Brief Description of the Geology of Maryland*," *January* 2001.
2 The Brookings Institution, A *Region Divided, The State of Growth in Greater Washington*, D.C. (1999)
3 *Retrieved from Radical Cartography Website at: http://www.radicalcartography.net/?cityincome |Retrieved December* 2009|
4 *Christopher* B. *Leinberger, The Option of Urbanism: Investing in a New American Dream* (Island Press, 2007)

A. Socioeconomic and Demographic Characteristics of the Region

Data from the US Census Bureau's decennial census have primarily been used to build a demographic and socioeconomic profile for the surrounding area of the site and comparing it to larger geographies.

1. Census 2010 findings on Montgomery County and larger geographies[5]

Population and housing characteristics data at the County, State and National levels, are noted in Exhibit 3.2.

The percentage of the 65 years and older population has increased from the 2000 levels by a percentage point for the County and the State, and by over half a percentage point for the Nation. The percentage of children below 5 years of age has declined by approximately a third of a percentage point at the County, State and National levels. The non-white population percentage in Montgomery County has increased by 7.3 percentage points, higher than the increase for Maryland (5.8) and the Nation (2.8%).

Montgomery County had a 12.3% increase in the number of housing units from 2000 to 2010, compared to 10.9% for the State. Vacancy rates increased by two percentage points within the County. This is higher than the State (+1.6 percentage point) but lower than the Nation (+2.4 percentage point) within the same period. The percentage of renter occupied housing units went up slightly (by about 1 percentage point) in the County, State as well as the Nation.

2. Findings on NIHAC and Surrounding Area from Census 2000 data[6]

The immediate area around the NIHAC campus, as defined by the US Census Bureau's ZIP Code Tabulation Area (ZCTA) , has a population of 1,848 per the 2000 decennial census. The 61.6 square miles area within the 20842 Zip Code had a population density of 30 per square mile and a housing density of 12.1 units/square mile. The 2000 census median age of 43.1 was higher than that of Montgomery County (36.8), the State of Maryland (36) and the nation (35.3), as is the percentage of people over the age of 65 years. Minorities constituted 13.7% of the population compared to 35.2% for the County, 36% for the State and 24.9% for the nation. The average household size was marginally higher at 2.64 compared to the State's 2.61 and the nation's 2.59 but below the County's 2.66.

Montgomery County's 25 years or older population had 54.6% with a bachelor's degree or higher education in 2000. That was significantly higher than Maryland's 31.4% and the nation's 24.4%, the same figure for NIHAC's surrounding area was 42.1%. The percentage of foreign born population in this area (3.8%) was much lower than the County's 26.7% or even the State's 9.8% and the nation's 11.1%.

Participation in labor force was 69%, higher than that of the State and the Nation but marginally lower than the County's 70.7%. The median household income of $89,120 and the per capita income of $42,276 were higher than the County's and the State's and approximately double the Nation's median values. Individuals below poverty level constituted 6.5% of the population, lower than the Maryland's 8.5% and the national rate of 12.4%, but slightly higher than Montgomery County's 5.4%.

Vacancy in housing units was low at 6.2% though not as low as the County's 3%. Median value for single-family owner occupied homes was $257,100 in 2000, 76% higher than the State's and 2.15 times that of the Nation's.

5 Source: The figures are as per the 2010 decennial census from the US Census Bureau
6 Source: The figures are as per the 2000 decennial census from the US Census Bureau

Exhibit 3.2: Comparison of Demographic, Socioeconomic, and Housing Characteristics: 2000–2010

	NIHAC/Surrounding Area		Montgomery County				Maryland				United States	
	2000		2000		2010		2000		2010		2000	2010
	Number	%	Number	%	Number	%	Number	%	Number	%	%/Number	%/Number
GENERAL CHARACTERISTICS												
Total population	1,848	100.0	873,341	100.0	971,777	100.0	5,296,486	100.0	5,773,552	100.0	100.00	100.0
Male	931	50.4	418,622	47.9	466,402	48.0	2,557,794	48.3	2,791,762	48.4	49.10	49.2
Female	917	49.6	454,719	52.1	505,375	52.0	2,738,692	51.7	2,981,790	51.6	50.90	50.8
Median age (years)	43.1	NA	36.8	NA	38.5	NA	36	NA	38.0	NA	35.3	NA
Under 5 years	107	5.8	60,173	6.9	63,732	6.6	353,393	6.7	364,488	6.3	6.80	6.5
18 years and over	1,426	77.2	651,583	74.6	738,247	76.0	3,940,314	74.4	4,420,588	76.6	74.30	76.0
65 years and over	256	13.9	98,157	11.2	119,769	12.3	599,307	11.3	707,642	12.3	12.40	13.0
One race	1,815	98.2	843,224	96.6	933,132	96.0	5,192,899	98.0	5,608,844	97.1	97.60	97.1
White	1,595	86.3	565,719	64.8	558,358	57.5	3,391,308	64.0	3,359,284	58.2	75.10	72.4
Black or African American	181	9.8	132,256	15.1	167,315	17.2	1,477,411	27.9	1,700,298	29.4	12.30	12.6
American Indian and Alaska Native	3	0.2	2,544	0.3	3,639	0.4	15,423	0.3	20,420	0.4	0.90	0.9
Asian	17	0.9	98,651	11.3	135,451	13.9	210,929	4.0	318,853	5.5	3.60	4.8
Native Hawaiian & Other Pacific Islander	0	0.0	412	0.0	522	0.1	2,303	0.0	3,157	0.1	0.10	0.2
Some other race	19	1.0	43,642	5.0	67,847	7.0	95,525	1.8	206,832	3.6	5.50	6.2
Two or more races	33	1.8	30,117	3.4	38,645	4.0	103,587	2.0	164,708	2.9	2.40	2.9
Hispanic or Latino (of any race)	55	3.0	100,604	11.5	165,398	17.0	227,916	4.3	470,632	8.2	12.50	16.3
Household population	1,848	100.0	863,910	98.9	962,877	99.1	5,162,430	97.5	5,635,177	97.6	97.20	97.4
Group quarters population	0	0.0	9,431	1.1	8,900	0.9	134,056	2.5	138,375	2.4	2.80	2.6
Average household size	2.64	NA	2.66	NA	2.70	NA	2.61	NA	2.65	NA	2.59	2.63
HOUSING CHARACTERISTICS												
Total housing units	747	1.0	334,632	100.0	375,905	100.0	2,145,283	100.0	2,378,814	100.0	100.00	100.0
Occupied housing units	701	0.9	324,565	97.0	357,086	95.0	1,980,859	92.3	2,156,411	90.7	91.00	88.6
Owner-occupied housing units	558	0.8	223,017	68.7	241,465	67.6	1,341,751	67.7	1,455,775	67.5	66.20	65.1
Renter-occupied housing units	143	0.2	101,548	31.3	115,621	32.4	639,108	32.3	700,636	32.5	33.80	34.9
Vacant housing units	46	0.1	10,067	3.0	18,819	5.0	164,424	7.7	222,403	9.3	9.00	11.4
Single-family owner-occupied homes	313	NA	191,551	NA	241,208	NA	1,178,779	NA	1,574,305	NA	–	79,051,519
Median value (dollars)	257,100	NA	221,800	NA	447,200	NA	146,000	NA	301,400	NA	119,600	179,900
With a mortgage (dollars)	1,528	NA	1,634	NA	–	NA	1,296	NA	–	NA	1,088	–
Not mortgaged (dollars)	408	NA	448	NA	–	NA	333	NA	–	NA	295	–
SOCIAL CHARACTERISTICS												
Population 25 years and over	1,475	–	594,034	–	669,675	–	3,495,595	–	3,870,122	–	–	204,170,795
High school graduate or higher	1,275	86.4	536,558	90.3	606,209	90.6	2,930,509	83.8	3,412,531	88.1	80.40	85.6
Bachelor's degree or higher	621	42.1	324,080	54.6	378,044	56.5	1,099,360	31.4	1,398,324	36.1	24.40	28.2
Civilian veterans (civilian population 18 years+)	277	17.6	64,501	9.9	48,749	6.6	524,230	13.4	431,690	9.8	12.70	9.3
Disability status (population 5 years+)	394	20.8	107,808	13.4	–	–	854,345	17.6	–	–	19.30	–
Foreign born	73	3.8	232,996	26.7	317,498	32.2	518,315	9.8	803,695	13.9	11.10	12.9
Male, Now married, except separated (15 years+)	507	63.1	197,614	61.3	207,798	56.1	1,110,118	56.3	1,120,545	50.2	56.70	50.50
Female, Now married, except separated (15 years+)	539	63.9	198,692	54.5	207,971	50.4	1,087,740	49.7	1,106,236	45.3	52.10	47.10
Speak a language other than English at home (5 Years+)	141	7.4	256,778	31.6	358,528,	39.3	622,714	12.6	894,474	16.5	17.90	20.6
ECONOMIC CHARACTERISTICS												
In labor force (population 16 years +)	1,115	69.0	477,123	70.7	567,748	73.8	2,769,525	67.8	3,194,678	69.5	63.90	64.4
Mean travel time to work in minutes (workers 16 years +)	35.1	NA	32.8	NA	34.0	NA	31.2	NA	31.8	NA	25.5	25.3
Median household income in 1999 (dollars)	89,120	NA	71,551	NA	89,155	NA	52,868	NA	68,854	NA	41,994	50,046
Median family income in 1999 (dollars)	94,527	NA	84,035	NA	108,828	NA	61,876	NA	83,137	NA	50,046	60,609
Per capita income in 1999 (dollars)	42,276	NA	35,684	NA	44,829	NA	25,614	NA	33,772	NA	21,587	26,059
Families below poverty level	19	3.5	8,428	3.7	12,031	4.9	83,232	6.1	94,509	6.6	9.20	11.3
Individuals below poverty level	126	6.5	47,024	5.4	75,168	7.7	438,676	8.5	572,812	9.9	12.40	15.3

Notes:

1. For the purposes of this comparison, "Surrounding Area" consists of the area within the ZIP Code of 20842.
2. Limited data is available at this time at the ZIP Code level.
3. "NA" implies "Not Applicable."
4. "-" implies data not available
5. Two sets of data were used; the 2010 Decennial Census Data and the American Community Survey 1 year Estimates; this accounts for differences and apparent discrepancies in the numbers provided in this table.

3. Population and Housing Estimates: 2001 - 2009

The US Census Bureau publishes intercensal estimates for population and housing. Data collected periodically on births, deaths, Federal tax returns, Medicare enrollment, and immigration, are used to update the decennial census base counts. Estimates are used in Federal funding allocations, in setting the levels of national surveys, and in monitoring recent demographic changes. For planning purposes, estimates help identify trends in population and housing, which the decennial snapshots are unable to provide.

Population Estimates from 2001 through 2009 indicate that while population generally increased in successive years for all the geographies compared (the County, the State and the Nation), the rate of growth has slowed towards the end of the decade (See Exhibit 3.3).

Housing estimates from 2001 through 2009 show a similar trend. While housing units keep increasing over the years, the rate of increase shows a decline in the last few years. Although the rates of growth vary from the County to the State to the Nation, the general trend is similar.

4. Population Projections[7]

The US Census Bureau publishes population projections at the County level. Projections are available up to 2030. The populations for the County, State and Nation continue the trend seen in the estimates. While populations keep on increasing, the rates of increase show decline over the next 20 years. The decline is steeper for the County when compared to Maryland and the overall United States.

Exhibit 3.3: Comparison of Population Estimates[7]

Geographic Area	2001	2002	2003	2004	2005	2006	2007	2008	2009
United States	285,081,556	287,803,914	290,045,739	122,824,501	295,753,151	298,593,212	301,579,895	304,374,846	307,006,550
Maryland	5,375,033	5,439,913	5,496,708	2,250,775	5,582520	5,612,196	5,634,242	5,658,655	5,699,478
Montgomery County	893,275	906,145	920,965	353,277	928,916	935,168	941,491	953,685	971,600

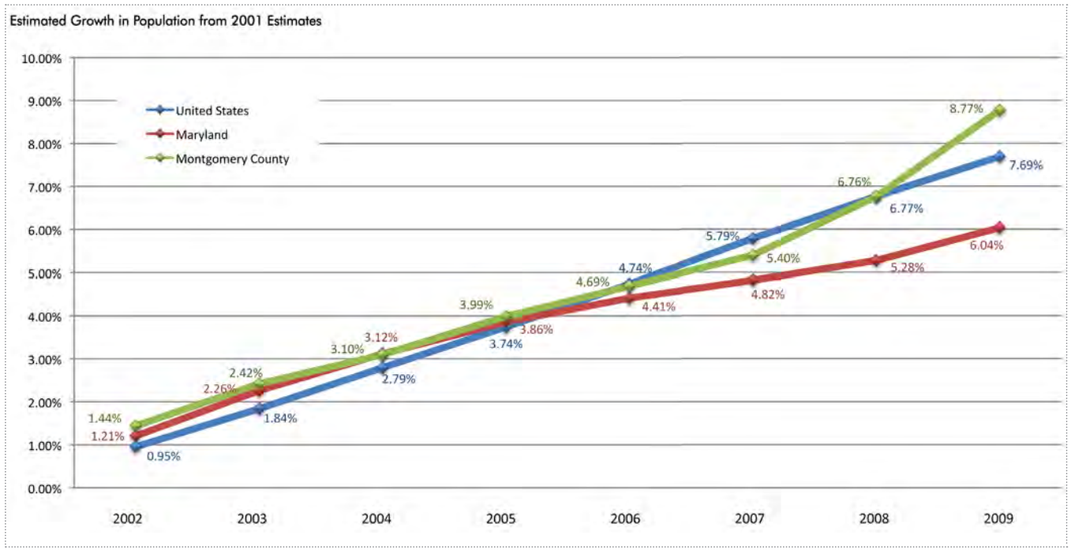


Exhibit 3.4: Comparison of Housing Estimates[7]

Geographic Area	2001	2002	2003	2004	2005	2006	2007	2008	2009
United States	117,905,005	119,456,206	121,076,837	122,824,501	124,711,041	126,500,212	128,132,164	129,313,137	129,969,653
Maryland	2,176,196	2,201,240	2,225,806	2,250,775	2,273,608	2,299,774	2,318,513	2,332,382	2,341,194
Montgomery County	340,170	344,889	349,361	353,277	356,600	359,657	362,121	364,891	365,792

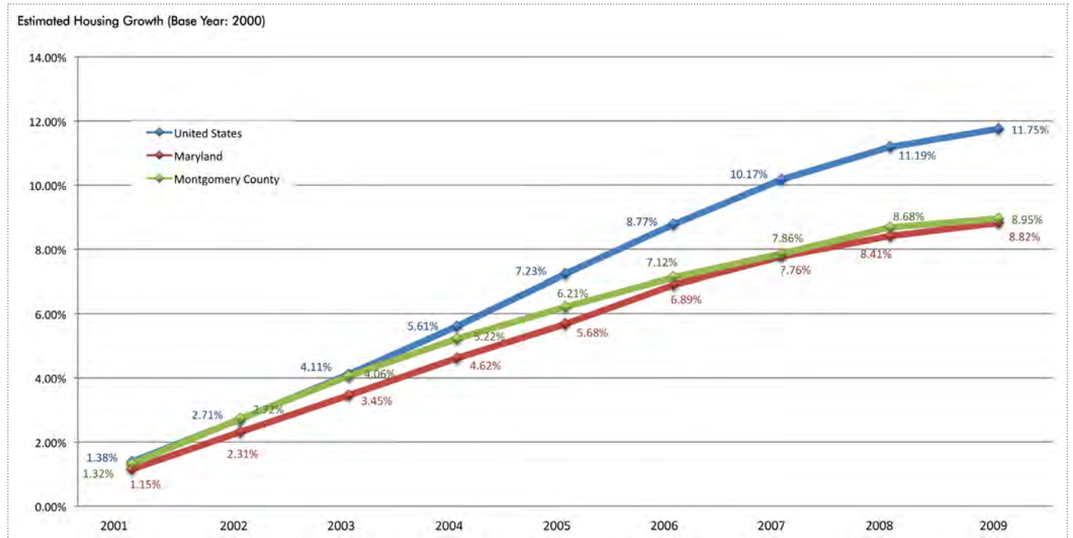
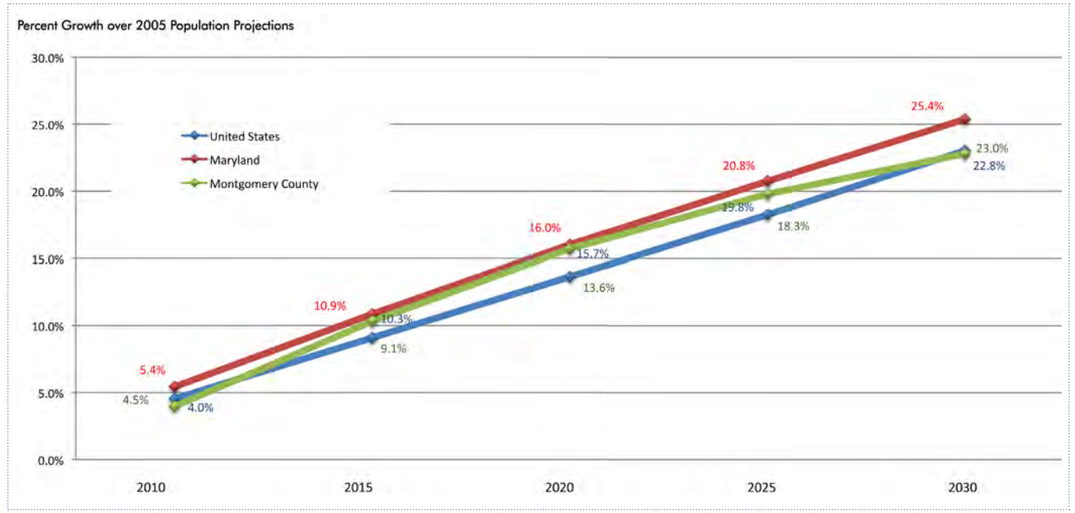


Exhibit 3.5: Comparison of Population Projections

Geographic Area	2005	2010	2015	2020	2025	2030
United States	295,507,1346	308,935,581	322,365,787	355,804,546	349,439,199	363,584,435
Maryland	5,600,563	5,904,970	6,208,392	6,497,626	6,762,732	7,022,251
Montgomery County	929,100	966,000	1,025,000	1,075,000	1,113,000	1,141,000



7 Sources: U.S. *Census Bureau, Population Division, Interim State Population Projections, 2005; and, Montgomery County Planning Department, Research and Technology Center, April* 2009.

B. Institutional Context of the Region

The metropolitan Washington DC area is home to a number of world class educational institutions. The Consortium of Universities of the Washington Metropolitan Area, a nonprofit organization, is a collective of 14 area educational institutions. Enrollment in the member institutions exceeded 155,000 students in 2010-2011. Outside the consortium, several universities have satellite campuses in the NCR. Approximately 19 corporations with annual revenues exceeding $5 billion are headquartered in the NCR. Other institutions contributing to the region includes a host of think-tanks, policy institutes and non-profit organizations.

3.2 Regional Planning Organizations and Jurisdictions

A number of local government entities operate in the region providing planning and development guidance, promoting economic development, administering transportation and infrastructure development and providing intergovernmental cooperation.

A. Metropolitan Washington Council of Governments (WMCOG)

An independent, non-profit association founded in 1957, WMCOG helped develop regional solutions to issues such as environment, affordable housing, growth and development, public health, child welfare, public safety, homeland security, and transportation. It comprises 21 units of local government, members of the Maryland and Virginia legislatures, and the US Congress[8].

The organization's policies are set through three boards: the Board of Directors; the National Capital Region Transportation Planning Board; and, the Metropolitan Washington Air Quality Committee. WMCOG publishes a region-wide strategic plan to create a more livable, sustainable, accessible and prosperous National Capital Region.

The NIHAC Campus is part of Montgomery County, a member jurisdiction of WMCOG.

B. National Capital Planning Commission (NCPC)

In 1924, the US Congress established the National Capital Park Commission to ensure the implementation of the McMillan Plan. In 1952, the US Congress passed the National Capital Planning Act which resulted in the creation of NCPC as the central planning agency for the federal government in the NCR and tasked it to preserve the region's important natural and historic features. The 1973 District of Columbia Home Rule Act delegated the District's planning responsibility to the city's mayor. However, NCPC's role as the central planning agency for federal land and buildings in the National Capital Region remained, along with an advisory role to the District for certain land use decisions. NCPC participates in several committees of the WMCOG and is a nonvoting member of the independent Transportation Planning Board. The 12 member Commission performs a slew of tasks including developing a comprehensive plan for the NCR, reviewing federal developments and projects, and preparing the Federal Capital Improvements Program.

The Comprehensive Plan for the National Capital Region (The Comp Plan) guides planning and development in the NCR. It has two components – the Federal and District Elements. The Federal Elements are prepared by the NCPC and include:

- Transportation
- Federal Workplace: Location, Impact and Community
- Parks and Open Space
- Federal Environment
- Foreign Missions and International Organizations
- Visitors
- Preservation and Historic Features

Federal projects that are reviewed include master plans, development plans, and individual site and building projects. In the case of master plans, conformity with the Commission's Comprehensive Plan is of particular focus for NCPC.

The NIH Animal Center Campus Master Plan will be reviewed by NCPC. This review will be coordinated by NIH's Office of Research Facilities, Division of Facilities Planning.

Exhibit 3.6: Planning Organizations and Jurisdictions

8 Retrieved from MWCOG Website at: http://www.mwcog.org/about/ [Retrieved December 2009]

C. Maryland-National Capital Park and Planning Commission (M-NCPPC)

The Maryland-National Capital Park and Planning Commission was formed in 1927 by the State to acquire, develop, maintain and administer a regional system of parks within Montgomery and Prince George's Counties. It also provides land use planning for the physical development of the two counties. The Commission is also responsible for the public recreation program in Prince George's County. The Commission work closely with four departments: Montgomery Department of Parks, Montgomery Planning Department, Prince George's Department of Parks & Recreation, and Prince George's Planning Department. The initial conception of M-NCPPC was based on a vision of holistic planning for growth, and protecting important and critical open spaces in a bi-county fashion. The mission of M-NCPPC is to improve the quality of life for its citizenry through three pillars[9]:

- Manage physical growth and plan communities,
- Protect and steward natural, cultural and historic resources,
- Provide leisure and recreational experiences.

Federal government projects are subject to mandatory referral and approval of the M-NCPPC per Section 7-112 of the Regional District Act, Mandatory referrals and approval procedures after adoption of master plan and highways. However, it is actually the Montgomery County Planning Board that performs the duties of the Commission with regards to the review and approval.

The Master Plan is subject to the mandatory referral and approval by the Montgomery County Planning Board.

D. The Town of Poolesville

Although the Town does not have any formal jurisdictional authority over the campus, it is the closest location for off-campus resources. It is also the nearest "place" as defined by the US Census Bureau with respect to the Campus.

About 4 miles east of the campus and 30 miles from Washington, DC, Poolesville is a historic community incorporated by the state of Maryland named after John and Joseph Poole who settled in the area in 1760. Poolesville grew incrementally over the years and the town center is currently a mix of architectural styles, lot sizes and development densities. This area saw a lot of activity during the Civil War era, being occupied by both armies[10].

The Town of Poolesville has morphed from an agricultural town to a bedroom community. There is a strong desire to preserve and promote its historical heritage within the town center as well as the outlying areas. The Town's historical legacy – farming – is still going strong owing to its location within Montgomery County's Agricultural Reserve. Several natural and historical sites of interests are located in close proximity to Poolesville; to the north are National Battlefields, Sugarloaf Mountain and to the south and west are the historic White's Ferry and the Chesapeake and Ohio Canal National Historical Park (C&O Canal NHP).

The Town's Master Plan, adopted in February, 2005, focuses on establishing itself as a "weekend destination" for history enthusiasts. A strong desire to maintain a small town feel is evident, as is the intent of protecting and enhancing the historic qualities. To that end, the Plan recommends implementing a historic main streetscape plan within the town center, establishing aesthetic guidelines for new development and encouraging restoration of historic structures[11]. Other important elements include maintaining proper infrastructure and school system to maintain a high quality of life for its residents, maintain a connected park and recreation system, and instituting a well head protecting program to protect local water sources, while protecting the rural character of the town[11].

9 Retrieved from M-NCPPC Website at: http://www.mncppc.org/About_M-NCPPC/Our_Mission.html [Retrieved December 2009]

10 Charles W. Elgin, Sr., "Brief History of Poolesville," http://www.ci.poolesville.md.us/history/brief.html.

11 Retrieved from Poolesville Town Hall Website at: http://www.ci.poolesville.md.us/Draft%20Master-Plan/Master%20Plan-body.htm [Retrieved December 2009]

3.3 Local Plans and Requirements

The NIHAC Campus, owing to its federal ownership, is generally exempt from local regulations and plans. The federal government, through the General Services Administration (GSA) has instituted the "Good Neighbor Program" to ensure quality work environments for the employees of Federal agencies by helping to revitalize the nation's communities[12]. Executive Order 12072 also requires that "Federal facilities and Federal use of space in urban areas shall serve to strengthen the Nation's cities and to make them attractive places to live and work. Such Federal space shall conserve existing urban resources and encourage the development and redevelopment of cities".

Section 3.2 outlines the jurisdictions and their respective authorities vis-a-vis the planning and future development of the NIHAC Campus. It is important to review the local plans and requirements to ensure that the future campus development is not in conflict with their principles.

A. Montgomery County Comprehensive Plan – "Wedges and Corridors"

The Montgomery County Master Plan titled "On Wedges and Corridors" was first published in 1964. This document is still in effect today with updates in 1969 and 1993. It identifies the County's proximity to the National Capital Region and steers future development that takes advantage of its physical relationship to that regional center. It divides the county into four development areas and each one has a specific planning directive regarding development.

- ***Urban Ring*:** This area includes the closest neighborhoods to Washington DC and the beltway. The 1993 update recommends a denser, walkable urban development along mass transit centers. It promotes infill development in and around established neighborhoods and protecting environmentally sensitive areas.
- ***I-270 Corridor*:** Most of the development in this Corridor is relatively new and built in a suburban pattern featuring collector roads and cul-de-sacs. The plan suggests concentrating future development in the Corridor near transit centers and making them compact, mixed-use and pedestrian-friendly. A majority of the suburban neighborhoods built in the past 20 years are exclusively residential, separated from transit, and not mutually interlinked. The plan suggests increasing road connectivity as well as pedestrian and bicycle linkages among these neighborhoods.
- ***Suburban Communities*:** Generally characterized by moderate density land uses along major arteries. These areas are transit serviceable and have increasing transportation options. Typically these areas consist of suburban residential neighborhoods and distinct development centers attracting both public and private investments. Recommendations for these communities in the plan focus on establishing community identities, expanding transportation choices, and increasing interconnectivity among residential areas and green infrastructure.
- ***Residential Wedge*:** The residential neighborhoods within this category predominantly feature one to two acre lots with occasional small pockets of compact residential developments and commercial retail. Availability of public infrastructure is limited. Parks and recreational centers in this area serve as buffers between the Agricultural Wedge (see below) and denser neighborhoods. The future of the Residential Wedge will be critical as the need to balance future housing demands while protecting the rural character of this area plays out.
- ***Agricultural Wedge*:** A central feature of Montgomery County's 1968 General Plan, as well as its recent updates, is the Agricultural Reserve. Covering about 93,000 acres with 577 farms and 350 horticultural enterprises, it occupies over 29 percent of the County's land area[13]. Transfer of Development Rights (TDR) has been successfully implemented in this area to ensure that the land and farming activity are preserved in perpetuity.

12 Source: GSA Public Buildings Service Publication" GSA's Good Neighbor Policy"

13 *Montgomery County Department of Economic Development: Agricultural Services - Boards/Committee*, Retrieved from Montgomery County Website at: http://www.montgomerycountymd.gov/agstmpl.asp?url=/Content/DED/AgServices/agfacts.asp [Retrieved January 2010]

The NIHAC Campus is located within the Agricultural Wedge. The site was acquired primarily to house and provide care for farm animals. Over time, the mix of animals has changed, but the campus continues to house farm animals, and retains a rural character with low profile buildings and large swaths of pastures typical of the area.

Exhibit 3.7: Montgomery County Wedges and Corridors

B. Zoning in the Vicinity of the NIHAC Campus

The NIHAC site lies located within the Rural Density Transfer (RDT) Zone of the Martinsburg Planning Area (No. 16). The current use of the property, which is primarily housing and care of animals, complies with the stated purpose of this zone. The intent of the RDT, as noted in County Code, is to promote agriculture as the primary land use. The zone would typically have large contiguous properties suitable for agricultural and related uses. Transfer of development rights from properties in this zone to properties in designated receiving areas is permitted. Depending on interpretation, animal housing and care uses are permitted on this zone either by right or as special exceptions[14].

The Transfer of Development Rights (TDR) program was launched in the early 1980s with a pilot project in the community of Olney. Since the beginning, prices for TDRs have fluctuated greatly over the years, peaking in 2006 at $42,000 per excess TDR. The Draft Market Feasibility Study found that TDR prices were at $7,500 per excess TDR at the time of the study and concluded that a TDR was considerably less attractive compared to other options evaluated from NIH's standpoint.[15].

C. Montgomery County Green Building Requirements

The Montgomery County Council has approved legislation in 2006 requiring certain "green building" features for public and private construction within its jurisdiction. The Council requires a LEED Certified Silver rating for county-built, non-residential buildings. Private non-residential or multifamily buildings are required to receive a LEED Certified rating. LEED Certification is a national benchmark for the design, construction and operation developed by the US Green Building Council (USGBC).

3.4 Land Use and Development

In Montgomery County, there is more acreage devoted to single-family residential development than to Agricultural Reserve[16]. Single-family areas account for 97.5% of the County's residentially zoned property[17]. As the county grows in the future, more pressure will be applied onto its remaining land resources. Only 4% (approximately 14,000 acres) of County land zoned for development remains undeveloped which will be even less when environmentally sensitive areas are discounted[17]. As indicated before, the population of the County is projected to grow in the future, and therefore the growth has to be strategized. Growth pressure also means stress on infrastructure and increase in supporting uses. The new focus is to promote infill development along transportation corridors instead of continuing the past development practice of large lot single family detached housing on pristine land. Encouraging mixed use development will also reduce per capita vehicle miles traveled (VMT).

A. General Land Uses in the Vicinity of the Site

Montgomery County has had considerable success in preserving open space and agricultural land in the face of the inevitable economic pressure for development in the Washington Region. Two important factors are: the County's long-standing policies in favor of land acquisition for parkland and conservation; and, its support for maintaining agriculture as a viable and productive industry. The area around the NIHAC campus is within the County's 93,000-acre Agricultural Reserve, which has an average farm size of 121 acres[17].

The Broad Run Flood Plain to the south and east of the NIHAC site is wooded while the upland areas are predominately agricultural land. The Chesapeake and Ohio Canal National Historical Park (C&O Canal NHP) to the south of the campus follows along the Potomac River. It is primarily wooded and used for recreation such as hiking and biking. The C&O Canal NHP has developed a master plan for the park. Because of the park's adjacency, its goal and strategies should be reviewed if NIH initiates any construction/perimeter enhancement along their boundary.

The property immediately west of the NIHAC site is used as a firing range by the Montgomery County Police Department.

The nearest concentration of residential neighborhoods and commercial retail is in and around the Town of Poolesville. The Town has experienced considerable residential growth and is expected to continue an expansion of its single-family neighborhoods. The commercial development is restricted to a few small shopping centers and does not include big-box retailers.

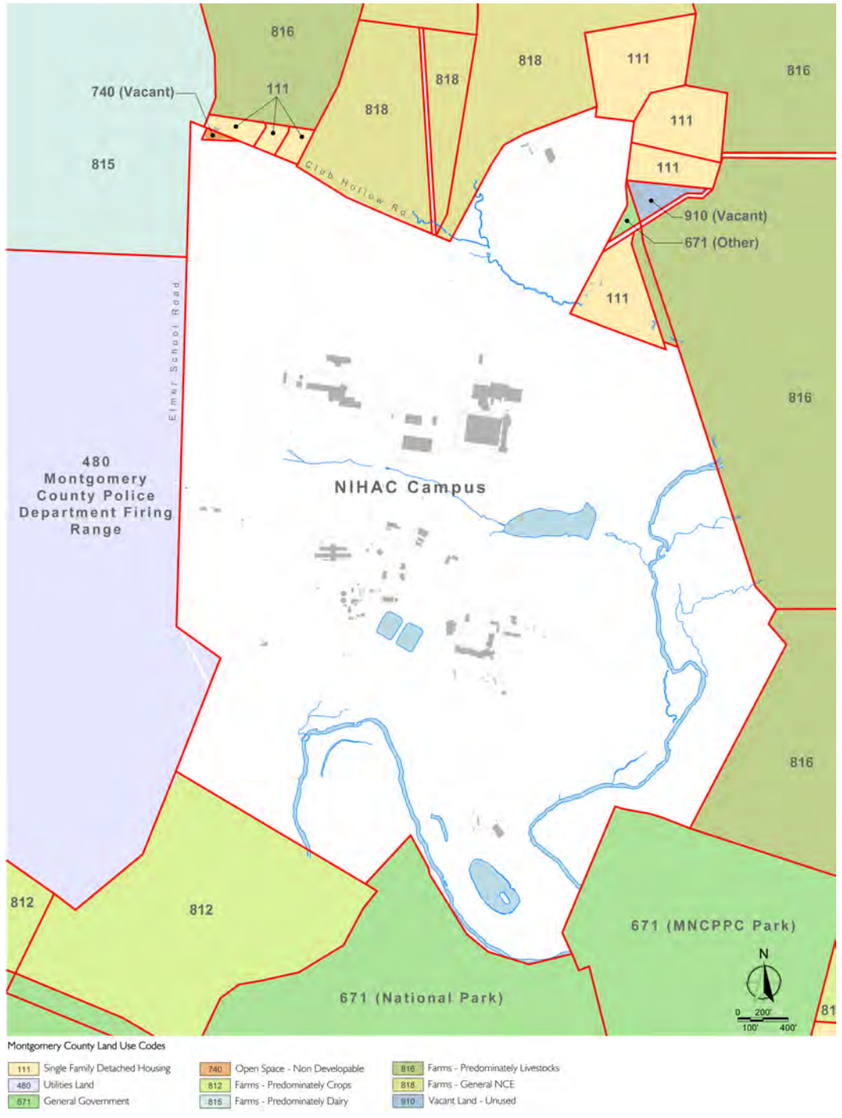
14 *American Legal Publishing - Online Library*, Retrieved from American Legal Publishing Website at: http://www.amlegal.com/nxt/gateway.dll?f=templates&fn=default.htm&vid=amlegal:montgomeryco_md_mc [Retrieved December 2009]

15 Draft Market Feasibility Study and Report prepared by Jones Lang LaSalle, dated December 16, 2010. Note that TDR prices have since increased. Per M-NCPPC, TDR prices were $22,000 excess TDR based on a sale in June 2012.

16 Montgomery County Planning Department, *Reducing Our Footprint - Planning Board Draft 2009-2011 Growth Policy.*

17 Erin Grayson, Tina Schneider, and Joshua Sloan, "A *Zoning Rewrite Team Green Paper: Initial ideas for discussion and testing to create a simpler ordinance based on sustainability and quality of place.*," M-NCPPC, October 13, 2009.

Exhibit 3.8: Land Uses in the Vicinity of the Site



B. Major Commercial and Retail Centers

In Montgomery County, the number of jobs is expected to increase by 166,200 by 2030, approximately a 33% increase. Regionally, 1 million additional jobs are predicted. This is a 32% increase[18]. The County intends to follow its Corridors and Wedges Plan established in 1964 to focus new development along transportation corridors. Maryland Route 355/I-270 Corridor is a historic travel and trade route that links communities in Montgomery County from Washington, D.C. to Frederick County. Over the past 30 years the corridor has been successful in attracting advanced technology and biotechnology industries, regional shopping centers and cultural destinations. A sector plan recommends adding more residential density near existing transit facilities to improve the land use balance along the MD 355/I-270 Corridor[19].

The NIHAC campus is located west of and less than 25 miles from this corridor. A market study conducted by Thomas Point Associates for the Town of Poolesville indicates that the best retail opportunities are restaurants, certain specialty retail shops, and business services.[20] The market area defined for this study was a 15 mile radius from the center of the Town of Poolesville and included NIHAC. The market area had 9,815 residents at the time of the study (2006) and was expected to grow at a rate higher than the Montgomery County average, to about 10,608 residents[21].

C. Subdivision Plans

Within three miles of the NIHAC campus, there are eight subdivision projects approved by the Montgomery County Planning Board that are active. Seven of these projects are for Single Family Detached Housing Units covering over 1,120 acres and totaling 31 units. The eighth project is for a "General/Professional" development on a 5.94 acre property.

Exhibit 3.9: List of approved subdivision projects within 3 miles of NIHAC[22]

Project Name	Location	Parcel Size (acres)	Development Type
American Satellite	Elmer School Rd, 3000 F S of White's Ferry Rd	5.94	Other: General/ Professional
Edward'S Ferry Property	NW Quad, Int. of Edwards Ferry Rd & W. Offutt Rd	185.29	Single Family Detached
Haimovioz Property	Mt. Nebo Rd, 370 F S of Offutt Rd	10.75	Single Family Detached
Harold M. Keshishian Property	Edwards Ferry Rd, 700 F NE of River Rd	166.62	Single Family Detached
Potomac Valley Turf Farm	E Mt. Nebo Rd, 800 F N of River Rd	20.4	Single Family Detached
Robert Thomassen Property	Mt. Nebo Rd, 3500 F S of Offutt Rd	24	Single Family Detached
Stoney Springs	On West Offutt Rd, NW, SW & SE of Mt Nebo Rd.	704.49	Single Family Detached
Trundle Road	NE Quad, Int. of Trundle Rd & Club Hollow Rd	10.48	Single Family Detached

D. Parks, Open Space and Recreation

Western Montgomery County where the NIHAC site is located has a number of parks under different ownerships including the US government, the State of Maryland, Montgomery County and the Town of Poolesville. Between Poolesville and Germantown a series of parks including Hoyles Mill Conservation Park, Seneca Creek State Park, Dry Seneca Creek Park, and McKee-Beshers Wildlife Management Areas lie perpendicular from the C&O Canal NHP, providing a linear greenway that can be used for recreation and animal habitat preservation.

Within a four mile radius of the NIHAC site there are two existing parks that show up in Montgomery County's map system[22] - US National Park Service's Chesapeake & Ohio Canal National Historical Park; and, Montgomery County's Broad Run Stream Park.

18 Montgomery County Planning Department, *Reducing Our Footprint - Planning Board Draft* 2009-2011 *Growth Policy*.

19 Montgomery County Planning Department, *Guiding the Future of the* MD 355/I-270 *Corridor*, January 2008

20 Retrieved from the Economic Development Section of the Town of Poolesville Website at: http://www.poolesville.com/EconomicDevelopment.html [Retrieved December 2009]

21 Retrieved from the Market Study on the Town of Poolesville Website at: http://www.poolesville.com/Market%20Study.html [Retrieved December 2009]

22 Based on the details of a query returned by http://www.mcmaps.org

The Chesapeake & Ohio Canal National Historical Park extends 184.5 miles along the Potomac River from Georgetown in the District of Columbia to Cumberland, Maryland[23]. It covers a total of 19,587 acres[23] of which 4,034 acres fall within the boundaries of Montgomery County, Maryland[24]. About 85% of the Park lies under the 100-year floodplain of the Potomac River. The Park includes the Maryland side of the Potomac Gorge, known for its biological diversity. The Park is home to more than 200 federal and state rare, threatened, and endangered species[23].

Broad Run Stream Valley Park is a 103 acre property listed under the County's Legacy Open Spaces[26]. Stream Valley Parks are the foundation of the park system, extending as greenways throughout the urban areas and into the countryside. M-NCPPC plans to acquire lands along Broad Run to create a linear greenway. The County considers the land along Broad Run be ecologically significant as they contain large tracts of riparian forest[25].

A third park named Limestone CP, about 107 acres in size and marked as proposed, also features in the list of parks within 3 miles of NIHAC[22]. Very little information was available from the County's website on this proposed park. M-NCPPC's publication "2005 *Land Preservation, Parks, and Recreation Plan – A Parks Recreation Open Space Plan for Montgomery County, Maryland*" lists a "Limestone Ecological Corridor" under Legacy Open Spaces[26], about 100 acres in area, which seems to refer to the same property. Its significance, as the publication notes, lies in the diversity of vegetation supported by the limestone bedrock and resulting soils. It also states that there are several wetlands on that property and that it is adjacent to the federally owned parkland that connects to the C&O Canal NHP.

E. Bikeways and Trails

The C&O Canal NHP's historic towpath is a 185 mile gravel-surfaced trail along the northside of the Potomac River through the C&O Canal NHP. It is connected to the Great Allegheny Passage (GAP) at Cumberland, Maryland. The GAP runs 132 miles to the outskirts of Pittsburgh, completing an uninterrupted stretch of 317 miles of trails.

Montgomery County classifies bikeways into four categories:

- Shared Use Path – Asphalt/concrete path, 8'-10' wide, separated from motorized road, to be shared with joggers, pedestrians, skaters, etc.,
- Bicycle Lane – Marked/striped, 4'-6' lane within roadway, in each direction, exclusively for bicyclists
- Signed Shared Roadway: Roadway open to both bicyclists and motorists – has wide curb lanes, paved bike-able shoulders.
- Dual Bikeways – Roadways with a combination of Shared Use Path and Bike Lanes or Shared Use Path and Shared Roadways

The County's Master Plan of Bikeways shows three Signed Shared Roadway routes in the vicinity of the NIHAC Campus. These are:

- River Road between Edwards Ferry Road and White's Ferry Road
- White's Ferry Road between River Road and West Willard Road
- Westerly Road between Edwards Ferry Road and West Willard Road

These three segments form a triangular loop that connects to the C&O Canal Towpath.

23 State of the Parks – Chesapeake and Ohio Canal National Historic Park - A Resource Assessment. Published by the National Parks Conservation Association.

24 The acreage within Montgomery County is based on the details of the query returned by http://www.mcmaps.org

25 Brenda Sandberg and Dominic Quattrocchi, Memorandum to Montgomery County Planning Board, *Legacy Open Space Recommendations for New Sites: Recommend the addition of seven sites to Legacy Open Space*, November 9, 2007.

26 The Legacy Open Space program is funded by the CIP, state grants and private and municipal contributions. Over $38 million has been committed to the preservation of twenty-one sites totaling over 3000 acres. Several Legacy Open Space sites have been protected by parkland dedication through the development process, as well.

3.5 Natural Features

A. Land Forms and Geology

The NIHAC site is located on the eastern part of the Piedmont physiographic province which is made up of hard, crystalline igneous and metamorphic rocks. Bedrock in the eastern part of the Piedmont consists of schist, gneiss, gabbro, and other highly metamorphosed sedimentary and igneous rocks of probable volcanic origin[27]. The mostly clay to moderately fertile soils along with the County's geographic position between a northern and subtropical zone supports diverse species and ecological niches. Its unique make-up can sustain many species typical of central Canada as well as species found in the bayou swamps of Louisiana.

Structurally, the site is within a trough-like basin known as the Culpeper basin, which extends southward from New Jersey to central Virginia. Basins like the Culpeper basin are actually rifts formed in the land when the supercontinent Pangea was breaking apart. These rifts became sea floors like the Atlantic Ocean, or filled in with dirt over the years to become basins[28]. The sediments that formed the red bedrock material existing in the Basin were deposited during the late Triassic to the early Jurassic Periods. The bedrock of the Culpeper basin consists chiefly of arkosic inter bedded siltstone, shale, and sandstone of the New Oxford formation. The sedimentary rocks are a motley mix, including arkose, red siltstones, and lake deposits including siltstones and anoxic black shales. Conglomerates are also found in the Culpeper basin. Conglomerates are sediments from different source areas that have been deposited into the basin and then become rock over time.

The stratigraphic thickness of the New Oxford formation may exceed 2,000 feet although the exact thickness is unknown since few wells in the region penetrate the entire depth. There is a diabase dike. A diabase is molten rock that welled-up from the earth's core millions of years ago. In this case, the molten rock filled a long, wide fracture in the sedimentary rock that runs between Dickerson and Beallsville, then west of Poolesville to the Potomac River[29]. This diabase acts as a dam, separating the groundwater on either side of it. For the NIHAC site, it could be beneficial in preventing possible ground water contamination from the County Resource Recovery Facility in Dickerson, Maryland[29]. The diabase also limits the land area which could recharge the watershed, limiting the amount of water that can be extracted.

B. Topography and Hydrology

The Piedmont topography is characterized by rolling hills and low valleys with abundant streams, wetlands, and groundwater. There are over 1,500 miles of open streams within Montgomery County alone, providing vital habitat for aquatics and wildlife. Wetlands are present throughout the region and provide essential functions including water quality protection, flood flow attenuation, nutrient removal, groundwater recharge, climate change mitigation, and wildlife habitat.

The greater Poolesville area has a groundwater system called a "fractured rock aquifer" where the ground water is collected in cracks and fractures which the well intercepts[30]. Most of the aquifers in this area are composed of rock which does not hold water. Water extraction is dependent on the number of cracks and fractures. Once water is taken from the cracks and fractures then there is little to replace it until the next precipitation event[30]. During the winter and spring months there is ample precipitation and the groundwater is recharged from surface seepage and the water levels in the well increase. During summer months the water levels typically decrease[30].

Broad Run approaches the site from the east along a westward coursing reach. It then meanders along the eastern and southern boundaries of the NIHAC site. Three small tributaries

27 Maryland Geographical Survey, "A Brief Description of the Geology of Maryland," January 2001.

28 NOVA *Geoblog: Wester conglomerates, Culpeper Basin*, Retrieved from Norther Virginia Community College Website at: http://www.nvcc.edu/home/cbentley/geoblog/2008/05/western-conglomerates-culpeper-basin.html, (Retrieved February 2010).

29 *Poolesville Water Supply*, Retrieved from the City of Poolesville Website at: http://www.ci.poolesville.md.us/Draft%20Master-Plan/water%20supply.htm, (Retrieved February 2010).

from the north and northwest converge to join Broad Run outside the northeast corner of the NIHAC site. A separate small intermittent stream rises in a spring about 500 feet east of Elmer School Road and flows across NIHAC to a reservoir before emptying into Broad Run. The C&O Canal NHP has an historic aqueduct/culvert on Broad Run, which may need to be protected if area storm surges increase.

There are three major watersheds west of the Town of Poolesville in western Montgomery County – Potomac Direct, Broad Run, and Horsepen Branch. The NIHAC campus is located entirely within the Broad Run watershed, and all surface water from the NIHAC campus eventually finds its way into Broad Run. This includes all storm water runoff on the site, as well as secondary treated sewage effluent. Since the majority of the water entering Broad Run is surface drainage from precipitation, storm events create surges in the water level.

C. Chesapeake Bay and Water Quality

Development of the Washington Region continues to influence the water quality of the Chesapeake Bay, the largest estuary in the United States. The primary sources of degradation to the Bay are erosion and runoff exacerbated by construction practices, the prevalence of impervious surfaces, untreated storm water runoff, as well as removal of vegetation. Improving the water quality of the Bay remains an important goal in local, regional and national governments. Policies are in place to help establish low-impact development practices aimed at reducing negative impacts of development on water quality such as providing buffers along wetlands and streams to remove nutrients and sediment before they enter the water system.

D. Vegetation[30]

Before the arrival of the settlers in 1634, the entire State of Maryland was covered by forests of oak, tulip-poplar, eastern hemlock, beech, loblolly pine, white pine and American chestnut. The Native Americans along the Chesapeake Bay and its tributaries were the first users of the forest, clearing and burning small areas for farming and berry production. The settlers found these forests to be a rich source of lumber and fuel, and soon started farming tobacco, wheat and corn clearing large sections of the forests.

Forest clearing reached its peak in the mid-1800's. Over the next half a century, better farming techniques and a population shift to urban areas and to the western states allowed some of the cleared areas to revegetate. The abandoned agricultural, cut-over, or burned lands started being covered by grasses and brambles, and then shrubs and small trees, gradually developing into the forests of present today. While the original forests were primarily composed of hardwoods, today, conifers are more abundant than they once were due to planting programs, natural succession, and scientific forest management.

Western Montgomery County has large swaths of forested areas interspersing the farmlands in its agricultural preserve that are of similar composition. The main threats to the forests today are excess nutrients from wastewater, agricultural land, and developed land; sediment runoff from farms, construction sites, and other lands; and elevated levels of toxic chemicals.

E. Climate

In warmer months, the average temperature is 73.1 degree Fahrenheit and the average temperature is 34.2 degree Fahrenheit during the colder months of the year. In the summer the average daily maximum temperature can reach into the low 100s during the day.

Precipitation in the Washington Region remains fairly constant throughout the year, the peak period being the months of July through October. Average yearly precipitation in Montgomery County is approximately 43 inches. On an average, Montgomery County enjoys 201 sunny days per year.

30 Source: Maryland Forest Resource Assessment, 2010. Maryland Department of Natural Resources Forest Service.

Exhibit 3.10: Monthly Temperature, Precipitation and Prevailing Wind Chart[31, 32]

Month	Avg. High (degF)	Avg. Low (degF)	Record High (degF)	Record Low (degF)	Avg. Precipitation (inches)	Prevailing Wind Data		
						Direction	Mean Speed (MPH)	Peak Gust (MPH)
January	44	27	78	-21	2.96	WNW	10	53
February	48	27	81	-8	2.48	NW	10	51
March	57	34	90	7	3.56	WNW	11	58
April	67	43	97	15	3.51	WNW	11	54
May	77	53	99	29	4.33	W	9	55
June	84	62	107	39	3.70	WNW	8	46
July	88	66	109	45	3.77	W	8	68
August	87	64	108	41	3.67	W	8	55
September	80	56	108	41	3.67	S	8	45
October	69	45	98	19	3.50	NW	9	47
November	58	37	86	8	3.58	WNW	9	64
December	47	28	81	-5	3.01	WNW	9	77

31 Source: weather.msn.com
32 Source: Climatic Data for the United States, National Climatic Data Center.

4.

NIHAC Campus and Facilities

4.1 History of Campus Planning and Development

A. Land Acquisition and the 1960 Master Plan[1]

The current campus, which was a dairy farm, was acquired by NIH in 1960 for $146,689 to relocate its animals from a rented farm in central Montgomery County. The acquisition was made in two installments - 499 acres in May, 1960 and an additional 13 acres in April, 1967[2]. The Poolesville Animal Farm, as it was originally called, provided NIH adequate inexpensive land not too far from the Bethesda Campus. The 513 acre property is comprised of a 23 acre wooded lot north of Club Hollow Road and a 490 acre piece to the south of the road consisting of a mix of developable land, pastures and wooded areas. NIH intended to use the campus primarily to house farm animals used in its studies. The campus also provided supplemental space for the overflow quarantine of cats and dogs from the Bethesda campus.

Initial site development included erosion control by planting trees along the steep slopes and preparing the pastures for grazing use. The 1960 Plan recognized future expansion of the facility would include additional animal care functions, such as support for behavioral research. Water needs for the entire facility were assessed at 50 gallon per minute and a combination of wells on site and water from Broad Run was proposed as potential sources. A storage reservoir, stream intake structure, Wastewater Treatment Plant (WTP) and elevated storage tank were planned for the campus.

In 1963, a construction program was initiated to provide permanent buildings and associated facilities costing $18 million. The first phase was completed in May 1965 and included a farm animal building (building B100 on the adjacent map), a kennel building (B102), and a central utility plant (B101), water, sewers, electric power, steam, chilled water, and paved access road. Two dwellings were also constructed for resident personnel (B117 and B116).

B. The 1969 Master Plan[1]

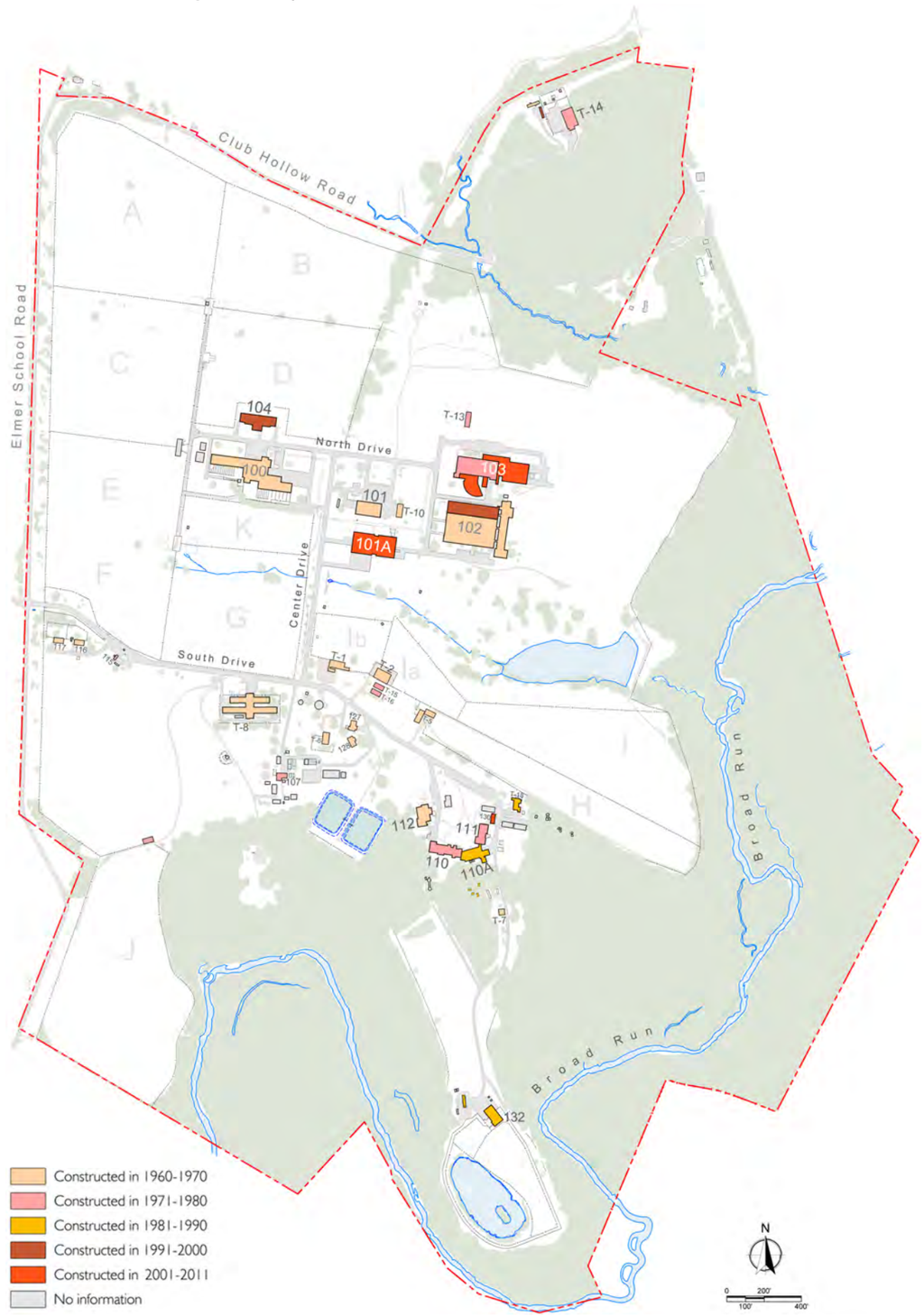
The 1969 Master Plan proposed expansion of the campus buildings and a new sewage treatment facility. In the years that followed, the site was developed to include 14 permanent and temporary structures, fenced grazing areas, and a waterfowl habitat was in the development. A building for research holding, as well as quarantine and conditioning of non-human primates, was completed in May 1971. Also finished were buildings being used by the National Institute of Mental Health for its Laboratory of Brain Evolution and Behavior. The permanent buildings included animal care facilities (buildings B100 and B102), a virus isolation facility and residential dwellings. Campus utilities included a power plant, deep wells, and a water tower. Approximately 30 employees were stationed at the campus.

The physical arrangement of the campus organized the larger, laboratory buildings in a cluster in the northern area of the campus where there was more developable land, and organized animal areas in the southern portion of the campus where the area was more quiet and suitable for animal study. In many cases, expansion was accomplished with temporary structures, which were deemed adequate to satisfy NIH demands.

1 Sources: The 1996 Master Plan for NIH Animal Center Poolesville.
NIH Almanac (1995–1996). Retrieved from: http://www.nih.gov/about/almanac/archive/96_Almanac/chapt6/toc.htm, Retrieved on: November 23, 2011

2 Source: Real Property and Facilities records on Acquisition of Land obtained from the National Institutes of Health

Exhibit 4.1: NIHAC Development History



C. The 1996 Master Plan & Environmental Impact Statement (EIS)

The 1996 Master Plan was commissioned to replace the 1969 Plan. It reflected the moderate changes in the campus and charted the growth and development of the campus for the 20 years that would follow, in 5, 10 and 20 year increments. This Master Plan was premised upon planning for development only to the extent necessary to accommodate the needs of the Institute and Centers on the site. The ability of the local services to support such development and its conformity with Montgomery County's Agricultural Reserve Planning District was also considered.

The Plan identified the desire of the researchers at NIHAC to increase the critical scientific mass by adding scientific assays and sabbatical programs; however, it concluded that the environmental and infrastructure constraints of the site offered limited opportunities to move additional functions from the Bethesda campus. The recommended approach was to modernize and enhance the research and animal functions already present at the site, and provide a supportive environment for the on-site NIH personnel.

The guiding principles identified in the Plan included: preservation of the open space, agricultural land and woodlands; protection of the environmentally sensitive areas of the site; limiting new development to low-profile buildings within or near the existing building clusters, following the existing orthogonal orientations; naturally screening sensitive buildings; enhancing the central stream valley and reservoir for recreation; and, increasing connectivity between the north and south side buildings.

The Full Time Equivalent employee population of the campus was projected to decrease initially from the 1993 baseline population of 135 to 114, and then, as planned programs progress, the population was expected to increase up to 157, an increase of 16% over the 1993 baseline.

The Plan proposed an increase in the developed area from 21.1 to 24.5 acres. It recommended additional build-out of 100,000 gsf over the existing inventory of 250,000 gsf, which included a proposed 40,000 gsf animal facility, a 5,000 gsf imaging facility and an 11,000 gsf expansion of the existing power plant.

D. Development since the 1996 Master Plan

The 1996 Master Plan notes many projects under construction or planned for implementation. The projects that were already in various stages of construction included the conversion of T26 to Building 132; Building 104, the small ungulate facility; and additions to buildings 102 and 103. The planned projects were: renovation of the HVAC system for Building 100; upgrades to the Wastewater Treatment Plant (WTP) to increase capacity; expansion of the Central Utility Plant; replacement of the water tower; and additions to Building 103. In addition, new projects were proposed in the Plan, as follows:

- A 40,000 gsf Animal Facility
- A 1,000 gsf addition and renovations to Buildings B127-128 ;
- A 400 sf addition to B110-110A-111 for a break room and storage;
- A 5,000 gsf MRI/Spectroscopy facility;
- Replacement of buildings T8, T13, TR18A and TR18B; and,
- A new entry guard station

Since then some of the previously planned projects, Master Plan proposals, and new projects have been implemented. The following are the key ones:

- ***Additions and modifications to* B103**: This building went through a series of renovations since 1996. The additions include administrative spaces, the East Wing and the indoor habitat area completed in 2005. Other smaller projects include a cold box installation for NIA (1998), and minor modifications to the animal rooms and office spaces (2008-09).
- ***Additions to* B102**: The C-wing was added in 1996 along with a new office suite. A cage wash addition was constructed in 1997.
- ***New Central Utility Plant***: Instead of expanding the existing CUP as initially planned, NIH decided to construct a new 44,000 gsf Central Utility Plant and approximately 1,500 linear feet of utility tunnels.
- ***Modification of* B104**: Renovations were made to the building, originally designed for ungulate holding, to facilitate housing of non-human primates.
- ***Conversion of the* B130**: The Greenhouse was converted to an unconditioned storage facility, primarily for cage storage. The glass was replaced with steel and the height was increased to include a loft to store smaller equipment and enrichment items.
- ***Penthouse added to* B132**: A penthouse was added to the front part of the building to house 3 stacked Air Handling Units (AHUs) and circulation pumps to provide HVAC redundancy.

E. Planned Projects

There are very few major projects that are currently being implemented or in planning stages for NIHAC. They are as follows:

- **B102-*Wing A Renovation***: This project is currently at the 65% design stage. It proposes to convert the kennels in Wing A to non-human primate holding and ancillary spaces, at an estimated cost of $14 Million. This 15,100 sf renovation will add approximately 6,375 sf of animal holding space and 1,575 sf of procedure and treatment space. It will also have cage wash facilities, administrative spaces, labs, other support spaces and a new loading dock and receiving area.
- ***Entrance* Security (B115)**: The entrance security building is aging and in poor condition. A temporary trailer has been located near the building but is not yet ready for occupancy. The security personnel continue to operate from the old building.

4.2 Animal Use and Care at NIH and NIHAC

Twenty-four of the 30 NIH Institutes and Centers (ICs) use animals in their intramural research programs (See Exhibit 4.2). Each of those Institutes has an Animal Care and Use Committee (ACUC). The Animal Program Director (APD), a senior veterinarian, is responsible for directing the animal program. In conducting their research, the scientific staff, ACUCs and APDs are responsible to the Institute. The Office of Animal Care and Use (OACU) provides oversight and programmatic assistance on behalf of the NIH.

NIH has three different mechanisms of administering animal care programs for its Institutes and Centers (ICs):

- The "centralized programs" are administered through the Office of Research Services, Department of Veterinary Resources (DVR), where all facilities are operated by DVR; ICs can use DVR services on a per-diem basis; per-diems are set by DVR and include all overhead. ICs, if required, can also occupy space in a DVR facility, but the operational responsibilities remain with DVR and the ICs pay rent to DVR for space usage, which also includes operational charges.
- The "shared facilities program" usually has multiple ICs sharing a facility for their animal research needs through an interagency agreement. One of the ICs takes the role of lead

facility operator, and the ICs sharing the facility contribute based on the space occupied. The composition of the ICs in shared facilities may change over time. The animal research in such facilities is more often than not of a collaborative nature;

- The remaining programs are "IC specific" and are administered independently by each IC;

The NIHAC Campus at Poolesville has two separate animal care programs:

- A shared facility currently led by the National Institute of Child Health and Human Development (NICHD) with services used by the National Institute of Mental Health (NIMH), and the National Cancer Institute (NCI) in the south side of the campus; and,
- DVR's animal care facilities on the north side.

A. The South Side

NICHD is currently the lead organization in the shared facilities in the south side of the campus and occupies 56% of the south side buildings. It is responsible for the day-to-day operations of the shared facilities. The focus on the south campus is non-human-primates (NHP) although there is also a small rodent colony. Other Institutes occupy facility space here and pay a cost-reimbursement fee for the space and the day-to-day operations of the buildings and animal care. Fees to occupy space are based upon the facility budget and include utilities; accommodation for animals including their food, bedding and provisions; personnel support; veterinary care and medicines; and, security. IC-specific research support or requests may be conducted for an additional fee.

The National Institute on Alcohol Abuse and Alcoholism (NIAAA) used to be one of the ICs occupying approximately 15% of the shared facilities until it decided to close down its primate program at NIHAC; currently, its occupancy in NIHAC is limited to one trailer on the campus. Both NCI and NIMH are shared facility users.

The animal functions in the shared facilities include behavioral research, breeding, holding, testing and procedures, labs, surgery, sterilization, and storage. Animals in the facility consist of several non-human primates species (NHP) such as marmosets, rhesus, patas and cebus monkeys as well as some small rodents. NHPs are housed in cages and also in social groups with outdoor/semi-outdoor runs. The shared facility also includes a 5 acre outdoor natural habitat area.

B. The North Side

DVR manages several buildings on the northern side of the campus. It also has a mouse quarantine facility in the twin buildings of B127 and B128 on the southern side of campus. DVR is a support organization that is responsible for the procurement and quarantine of all research animals as well as the provision of animal holding and care services. DVR operates on a full cost recovery basis with established rates targeted towards recovering all costs of operation.

Other Institutes occupy facility space in the north campus buildings but pay a fee to DVR towards the day-to-day operations of the buildings and animal care. These institutes include the National Institute on Aging (NIA), the National Heart, Lung and Blood Institute (NHLBI), the National Institute of Allergy and Infectious Diseases (NIAID), the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), and the National Cancer Institute (NCI).

Current animals cared for in the north campus include non-human primates, quarantined mice, and a small number of horses, cows, sheep, pigs and dogs.

The North Parcel (north of Club Hollow Road)

South Campus Facilities (field habitat area is not shown)

North Campus Facilities

Exhibit 4.2: NIH Organizations with Animal Care and Use Programs[3]

Note: Dark boxes represent organizations with animal care and use programs.

3 Source: ("NIH OACU—NIH Components that use Animals," n.d.)

4.3 NIH Organizations Operating at NIHAC

Several NIH organizations utilize NIHAC for their animal programs in different ways. The following provides brief descriptions of these organizations and a summary of their activities at NIHAC.

A. Department of Veterinary Resources (DVR)

DVR provides facility management services, housing and husbandry, veterinary and critical care, quarantine, enrichment, and nutrition to NIH Institutes with animal programs at NIHAC and Bethesda. It provides housing for several species of rodents, rabbits, primates, carnivores, and ungulates. Animals are housed in conventional, specific pathogen free (SPF), or hazard containment environments.

DVR also provides support services such as Bacteriology, Critical Care, Diagnostics Testing, Genetic Repository, Health Surveillance, Pathology, Pharmacy, Molecular Microbiology, Mouse Phenotyping, Rederivation, Cryopreservation, Surgery and Radiology.

B. National Institute of Child Health and Human Development (NICHD)

NICHD was initially established to investigate the broad aspects of human development, as a means of understanding developmental disabilities. Over time, its scope has increased to include research on all stages of human development. NICHD's Division of Intramural Research (DIR) occupies several facilities including those at NIHAC, Bethesda and leased facilities in Rockville in Maryland.

At NIHAC, NICHD's Laboratory of Comparative Ethology conducts a program focused on basic bio-behavioral research investigating cognitive, social-emotional, and biological development in non-human primates and humans[4].

The Research Animal Management Branch (RAMB) under NICHD-DIR provides animal research support services to NICHD investigators and represents the interests of the NICHD on all aspects of animal research, its programs, units, and sections. At NIHAC, RAMB provides these services to all of the participants of the shared services program.

C. The National Institute of Mental Health (NIMH)

NIMH's mission is to transform the understanding and treatment of mental illnesses through basic and clinical research, paving the way for prevention, recovery and cure. Scientists at NIMH's Intramural Research Programs (DIRP) conduct research ranging from studies into mechanisms of normal brain function to clinical investigations into the diagnosis, treatment and prevention of mental illness. The Institute's clinical branches and basic neuroscience laboratories are located on the NIH's campus in Bethesda, Maryland.

NIMH currently has 3 programs at NIHAC:

- The Gensat transgenic mice project: This project which essentially studies transgenic mice, has approximately 600 cages in the south side facilities, but is expected to be relocated to Bethesda in 2012.
- Research conducted by the Primate core: Also located at the south side, it uses marmosets and rhesus monkeys for behavioral studies. This program is currently being relocated to Bethesda.
- Quarantine of NHPs: Holding space is provided by DVR for quarantine of NHPs when they arrive from NIMH's breeding facility in South Carolina. This is expected to continue in the foreseeable future.

4 Annual Report of the Division of Intramural Research. Retrieved from: http://2006annualreport.nichd.nih.gov/lce.htm , December 5, 2011

D. National Institute of Allergy and Infectious Diseases (NIAID)

NIAID conducts and supports basic and applied research to better understand, treat, and ultimately prevent infectious, immunologic, and allergic diseases. The scope of the NIAID research portfolio has expanded considerably in recent years in response to new challenges such as bioterrorism and emerging and re-emerging infectious diseases including AIDS, SARS, West Nile virus, malaria, tuberculosis, and the increase in asthma prevalence among children.

NIAID's operations at NIHAC are carried out by three groups:

- **NIAID *Division of Intramural Research* (DIR)**: NIAID-DIR occupies holding space in DVR facilities for quarantine as well as routine holding. It has dedicated procedure spaces and dedicated SPECT and X-ray imaging equipment in DVR space.
- **NIAID *Vaccine Research Center* (VRC)**: NIAID- VRC currently holds non-human primates (primarily macaques) at NIHAC in DVR's facilities for immunogenicity and protection studies. In addition to holding, DVR facilities are used by NIAID-VRC for immunization studies.
- **NIAID-*Division of Clinical Research*, *Integrated Research Facility* (DCR-IRF):** NIAID-DCR-IRF currently uses the DVR facilities for quarantine, conditioning and holding of macaques prior to their assignment to experimental protocols. To a lesser extent, they conduct ABSL2 procedures for non-human primates (NHP) in support of infectious disease research program.

E. National Cancer Institute (NCI)

NCI is the Federal Government's principal agency for cancer research and training, information dissemination and incorporation of state-of-the-art cancer treatments into clinical practice. The NCI's Intramural Faculties and Working Groups include an Animal Models Faculty which fosters high-quality cutting-edge research with respect to the creation and use of mice and other animal models of cancer and related disorders. NCI also has a Laboratory Animal Sciences Program (LASP), which provides animal care and support at the NCI-Frederick and NCI-Bethesda campuses.

NCI currently conducts vaccine studies and antiretroviral drug studies with non-human primates housed in the DVR facilities at NIHAC. Its current usage of NIHAC facilities for this purpose is relatively low; most of its primate studies are conducted at two contract facilities and on the Bethesda campus. NCI also breeds patas monkeys in the shared program led by NICHD as a part of a study that involves both pregnant animals and the infants.

F. National Institute on Aging (NIA)

NIA leads a broad scientific effort to understand the nature of aging and to extend the healthy, active years of life. Its mission is to provide leadership in aging research, training, health information dissemination, and other programs relevant to aging and older people.

NIA's current research at NIHAC includes nutrition-oriented studies and behavioral studies, which take place over extended time periods. NIA's studies depend on procedure rooms, the availability of anesthesia and 24-hour monitoring. In addition, some studies are terminal and utilize a necropsy room. All of NIA's spaces at NIHAC are located in DVR's facilities.

G. National Heart Lung and Blood Institute (NHLBI)

NHLBI provides global leadership in research, training, and education to promote the prevention and treatment of heart, lung, and blood diseases and enhance the health of all individuals so that they can live longer and more fulfilling lives. NHLBI stimulates basic discoveries about the causes of disease, enables the translation of basic discoveries into clinical practice, fosters training and mentoring of emerging scientists and physicians, and communicates research advances to the public.

NHLBI currently houses healthy new animals including pigs, dogs and non-human primates (baboons, monkeys, macaques) in DVR managed facilities. NHLBI also uses DVR facilities for long term housing of rhesus monkeys pre and post bone marrow transplant and gene therapy at NIHAC. Certain procedures are conducted at these facilities, such as collection of blood samples and bone marrow collection from pigs. NHLBI quarantines pigs, dogs and NHP at NIHAC.

H. Other Institutes and Agencies

As indicated before, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) used to be part of the shared facilities in the south side. However, it is currently in the process of winding down its program at NIHAC.

In the past, the United States Food and Drug Administration (FDA) has used DVRs services to house horses at NIHAC, which typically requires a large amount of outdoor space per animal. Currently, FDA does not have any animal housed with DVR.

NIH Office of Research Facilities (ORF) is responsible for handling the building and site utility infrastructure on the site including but not limited to the Central Utility Plant (CUP) and the Wastewater Treatment Plant (WTP).

Exhibit 4.3: Summary of NIH ICs Operating at NIHAC

IC	North Side		South Side	
	Building	Activity	Building	Activity
NICHD	104	Research space	110	Procedure spaces (surgery, necropsy, etc.)
			110A	Breeding & holding of NHPs (capuchins, marmosets, etc.)
			112	Breeding, nursery & holding for NHPs (rhesus) Procedure spaces; behavioral research spaces
			132	Holding spaces for rhesus monkeys; outdoor field habitat
NCI	102	NHP holding (macaques); some shared procedure space	112	Breeding, holding, & research of NHPs (patas monkeys);
NHLBI	102	Holding spaces for dogs		
	103	NHP holding (squirrel monkeys, etc.); some shared procedure space		
NIA	102	Research space		
	103	Research space; NHP Holding		
NIAID	102	Research space; NHP Holding; single photon imaging		
	103	NHP holding		
NIMH			110	Labs & setup rooms for transgenic studies
			110A	Holding spaces for transgenic marmosets; holding spaces for transgenic mice
			111	Labs & procedure rooms for transgenic mice study
			112	Holding spaces for NHPs (rhesus monkeys)

5.

The Natural Environment

The development potential of the NIHAC site is a function of the opportunities and constraints offered by the natural environment as well as the nature of the built environment of the campus. These opportunities and constraints were explored and analyzed before the development concepts were prepared. This Chapter reviews the land use and covers the natural environment. The built environment is covered separately in Chapter 6. The natural environment of the site includes the form of the land (topography and slope), the vegetation on the site, and site hydrology including drainage, streams, water bodies and wetlands.

5.1 Overview of the Campus Land Use

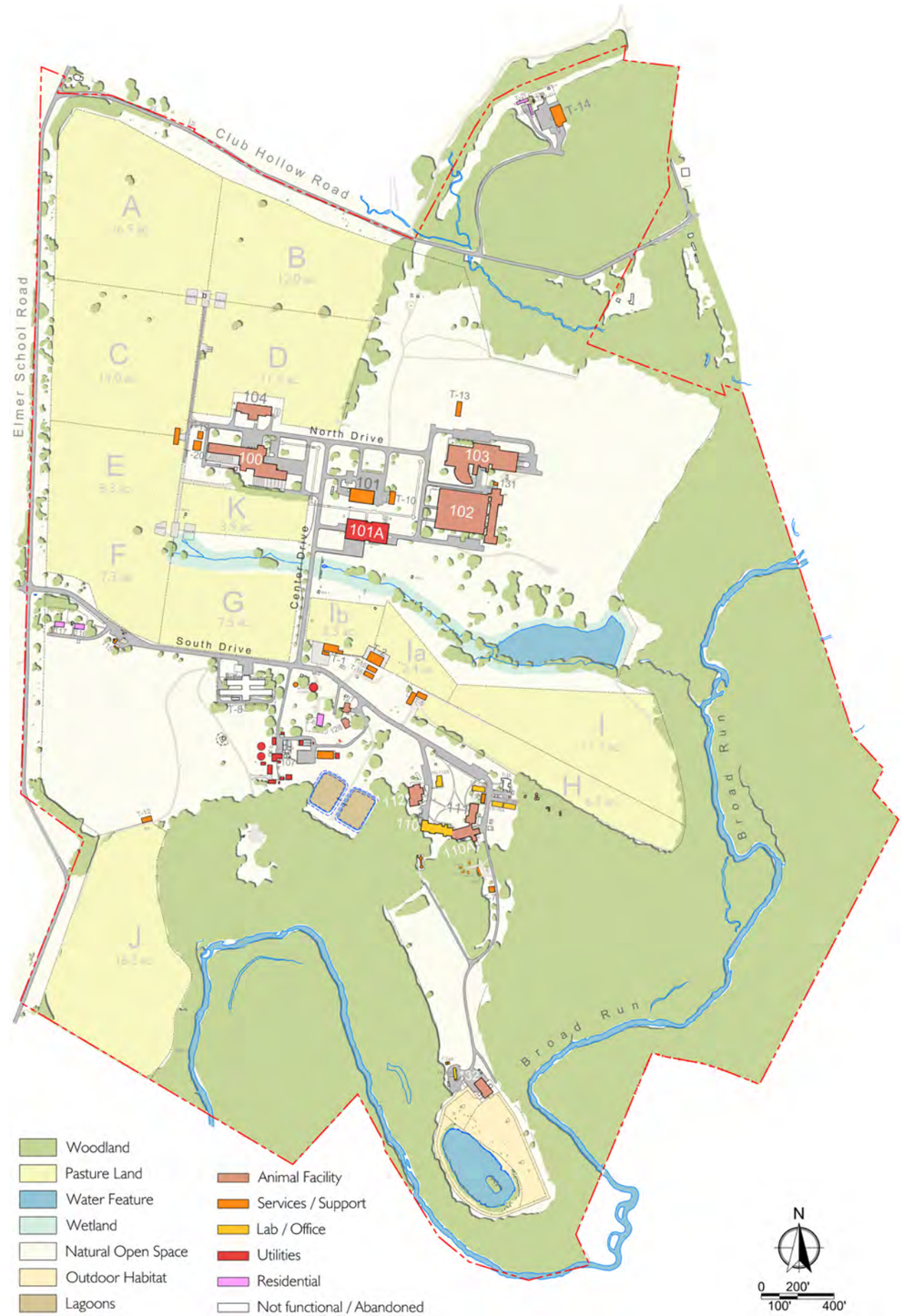
The NIHAC site measures approximately 6,800 feet from north to south and 4,900 feet in the east-west direction. It is bordered by Elmer School Road on the west side and by Club Hollow Road, partially, on the north side. Club Hollow Road splits the NIHAC site leaving a 23 acre portion on the north separated from the main 490 acre campus. Adjacent properties to the western boundary of the site include a Montgomery County Police Department Firing Range. The southern boundary of the site is bordered by the Chesapeake and Ohio Canal National Historical Park (C&O Canal NHP) and a State park (See Exhibit 3.8).

Less than 5% of the site is developed and buildings comprise less than a third of the development footprint. Wooded forest areas including the streams and Broad Run comprise 215 acres of the site with natural open spaces and pastures (including areas within the setbacks) covering another 265 acres. Besides Broad Runs and the streams, other water features on the site includes a 3 acre reservoir and a pond within the outdoor habitat area. There are two lagoons covering 1.3 acres that store wastewater. Paved areas including roads and parking spaces comprise 11.5 acres or approximately 2.3% of the site.

Exhibit 5.1: Existing Land Use

	Acres	%
UNDEVELOPED AREAS	**489**	**95.3**
Natural Open Space	127.0	24.8
Setback, Easement	17.6	3.4
Pasture Land	120.0	23.4
Outdoor Habitat (with pond)	6.9	1.3
Reservoir (lake)	3.0	0.6
Forest (with stream)	214.5	41.8
DEVELOPED AREAS	**24**	**4.7**
Buildings	7.9	1.5
Paved Roads	11.0	2.2
Unpaved Roads	3.3	0.6
Parking	0.5	0.1
Lagoons	1.3	0.3
TOTAL	**513.0**	**100**

Exhibit 5.2: Existing Land Use Map



5.2 Topography

Much like the surrounding areas of the Montgomery County Agricultural Reserve, the NIHAC campus is characterized by a landscape that has sporadic forested areas and gently rolling pastures. There are both uplands and low lands where water collects which contribute to the undulating topography of the campus.

A significant feature of the NIHAC site is Broad Run. It is part of a larger riparian system with tributaries which cross the northern portion of the site near where Club Hollow Road crosses the site. Broad Run is directly tied to the low-lying elevations of the site which are prone to seasonal flooding.

A. Elevation

The highest elevation on the NIHAC site is just below 100 feet above the mean sea level and is located near the northwest corner of the property where Club Hollow Road intersects Elmer School Road. This marks one corner of the plateau characterized by the higher elevations of the site, running the entire frontage of Elmer School Road. The terrain gently slopes downward towards the east in the direction of Broad Run. The elevated area continues toward the east and is divided by a large swale running east-west along the center of the site. This swale runs into a reservoir on the east side of the campus and collects on-site runoff to drain, eventually, into Broad Run. The swale creates two bluffs - north and south. These bluffs are roughly the same elevation. There are steep slopes on the sides of the bluffs leading to the lower elevations of the site. The majority of the existing development of the NIHAC campus is located on these bluffs.

A View of the Stormwater Swale Looking East from Center Drive

Exhibit 5.3: Elevation

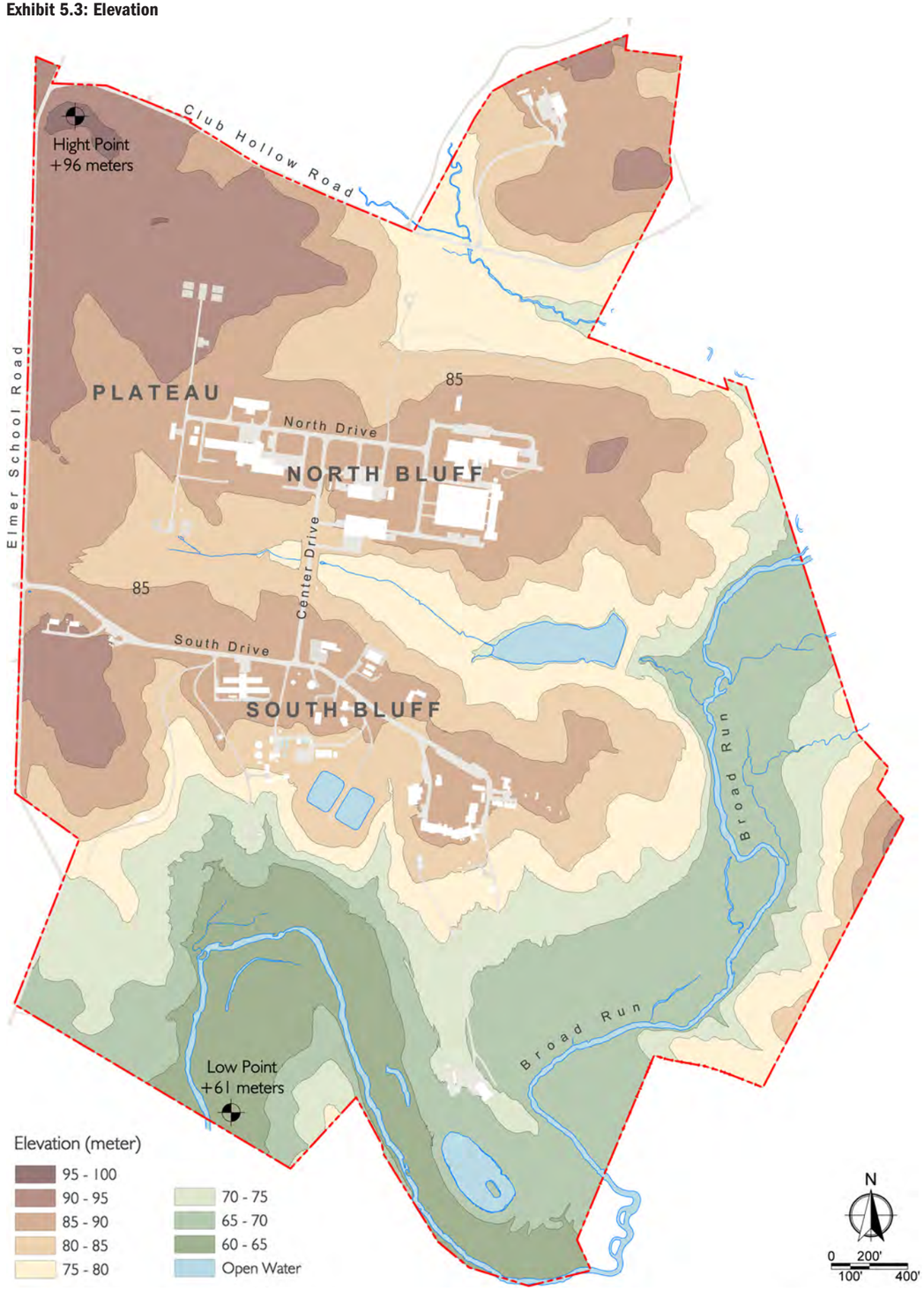
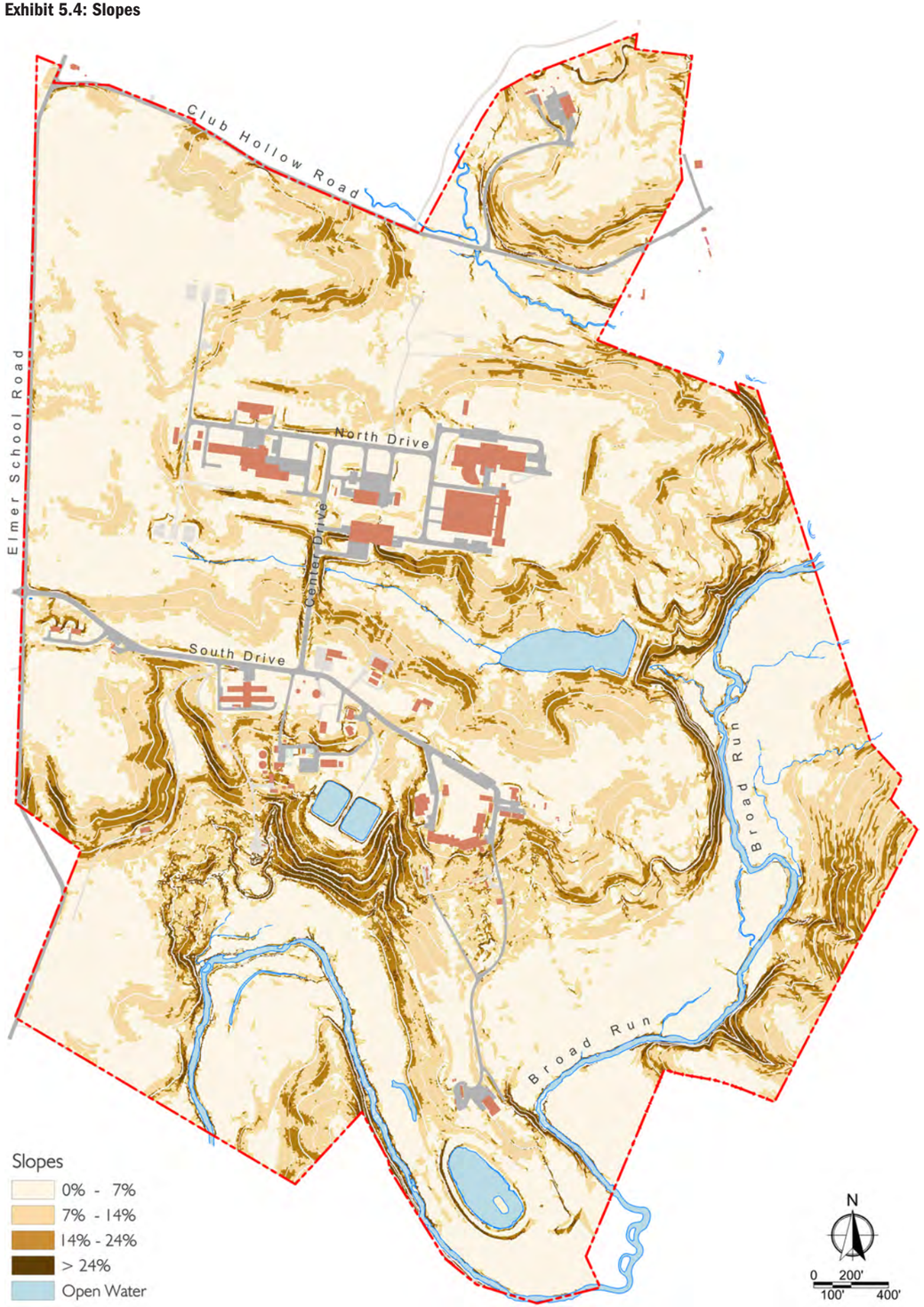


Exhibit 5.4: Slopes



B. Slopes

The contours within the site were analyzed to determine the steepness of the slopes and to identify potential buildable areas that would require minimal grading and would have the least potential for soil erosion. A band of steep slopes bisect the site into two distinct areas: the higher elevated areas to the west and north; and, the lower elevated areas to the east and south. Most of slopes on the site face south and east. The plateau and the two bluffs contain gentler slopes thus making them more conducive to development. The two bluffs are where the north and south developments are located. The plateau has the pastures for the grazing of large animals.

The land adjacent to Broad Run is also favorable to development in terms of slopes; but these lands are within the flood plain. They are also separated from the other portions of the site by steep slopes and therefore difficult to connect. Most of the areas featuring steep slopes are forested.

Looking North from Center Drive and North Drive Intersection

5.3 Ecological Habitats and Vegetation

A. Vegetation

Natural vegetation on the NIHAC campus can be classified into four categories: pastures, hardwoods, evergreens, and riparian hardwoods. These categories were determined by analyzing digital aerial photographs of the site.

- Pastures are the large swaths of grassy areas. The large animals on the campus graze on these lands. These areas are typically mowed twice a year during the warmer months.
- The deciduous vegetation typically comprising hardwood species, can be identified from the bare gray areas in the aerial photographs. These trees shed their leaves in the fall. Majority of the trees on the site are hardwood.
- The masses of darker green areas are typically evergreen trees which retain their color year round.
- The riparian hardwood areas are those hardwood trees that are prone and adapted to seasonal flooding. The wooded areas in the lower elevations and flat topography adjacent to Broad Run can be expected to be riparian hardwoods.

The forested area on the site is part of a larger, contiguous forest that the County has identified as a prime ecological resource for threatened, endangered species. The County intends to acquire additional properties along Broad Run to complete a linear ecological greenway. The large expanse of forested areas on site help filter storm water runoff from the site and keep the water in Broad Run cool making it favorable for native species.

The evergreen trees on site are confined to a few patches and seem to be planted for screening rather than natural growth. The cultivated vegetation on the site includes both specimen trees and shrubs. Specimen trees are scattered throughout the campus, clustered as a hedgerow along Elmer School Road and Club Hollow Road. They are also placed between buildings, along parking areas and along the vehicular drives.

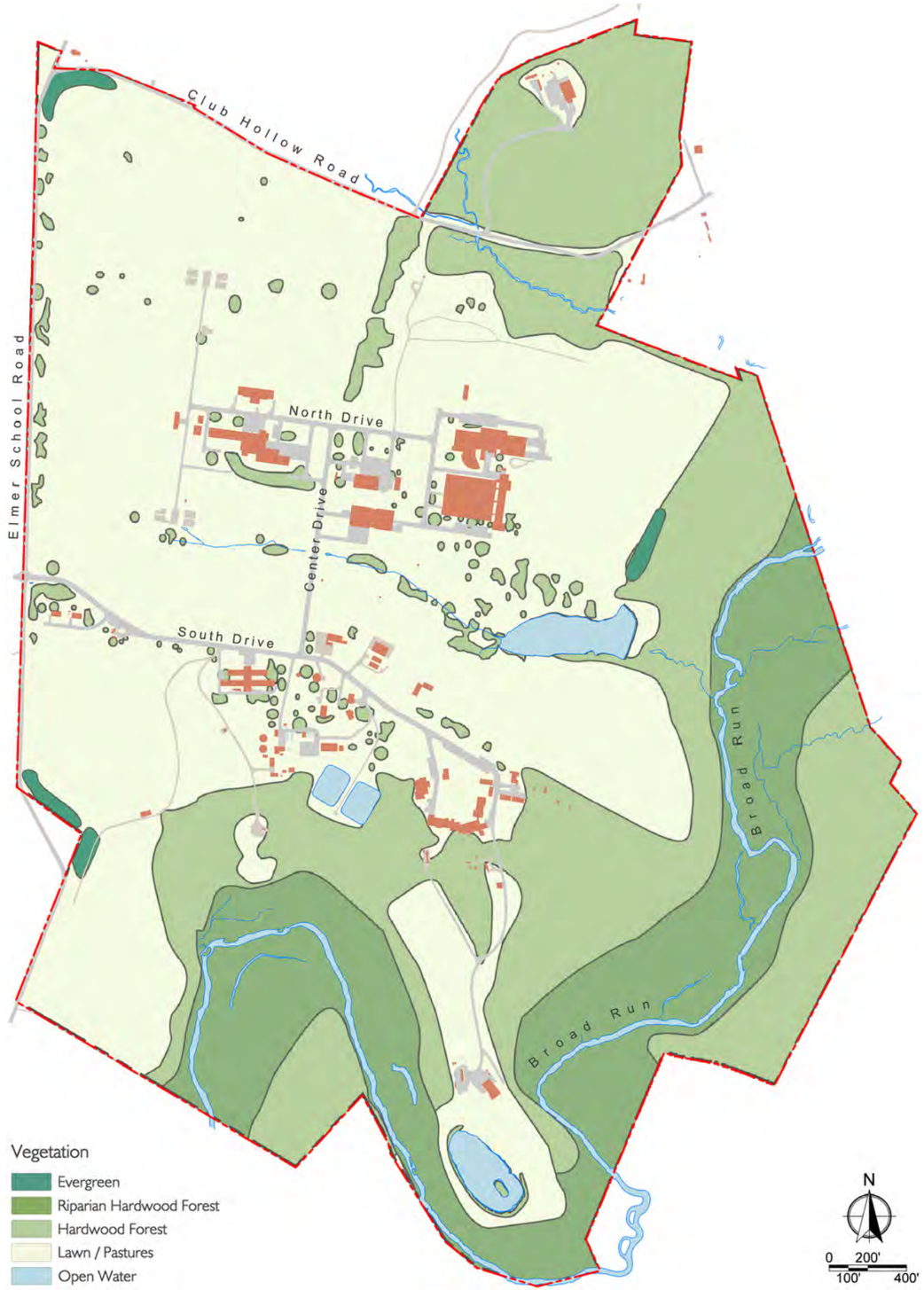
The large expanses of fields and forests on the NIHAC campus fits in well with the rural and farm character of the Agricultural Preserve.

B. Fauna

The fauna found on the NIHAC site varies by the distinct vegetation communities. The large areas of pasture land, coupled with the tracts of forested areas lend themselves to serving animal types that can take advantages of each. Some animal species prefer to live on these edge conditions where they can forage for food in the open meadows and find protection in the forests. Such animals include deer and turkeys.

Large wooded areas along streams such as Broad Run provide critical habitat for some rare migratory bird species. In addition, these forested stream buffers provide corridors for wildlife and connections between larger habitat areas[1]. The Broad Run watershed was monitored in 1996 and was determined to be in healthy condition. At that time, seventeen species of fish were found in the lower Broad Run including large-mouth bass and five species of sunfish. A caddisfly (*Ochrotrichia sp.*) was found in this watershed that had not been identified elsewhere in the County[2]. Campus staff indicted that the other animals on the site include coyotes, turkeys, deer and fox.

Exhibit 5.5: Vegetation



1 *Biodiversity Indicators*, Retrieved from Montgomery County Website at: http://www.montgomerycountymd.gov/deptmpl.asp?url=/content/dep/assessment/biodiversity.asp, (Retrieved January 2010).

2 *Broad Run Watershed*, Retrieved from Montgomery County Website at: http://www.montgomerycountymd.gov/deptmpl.asp?url=/content/dep/csps/watersheds/csps/html/brun.asp, (Retrieved January 2010).

5.4 Soils

A. Geology

Geologically, the area that includes the NIHAC site is known as the New Oxford Formation which is part of the Newark Group formed in the Triassic age[3]. This formation is characterized by red, maroon and gray sandstone laminated with small amounts of shale and basal conglomerate[4].

Terrace gravel has been located near the upper northwest corner of the site. It is an alluvial formation left over from an earlier floodplain or shoreline.

The soils map (Exhibit 5.6) was prepared from a Soil Survey for Montgomery County by the United States Department of Agriculture with other Federal agencies, State agencies and local agencies. The Natural Resources Conservation Service (NRCS) leads the Federal portion of the National Cooperative Soil Survey. The soils map is broken into various types.

The New Oxford Formation of the Newark Group can be characterized by its thin layer of soil (two to five feet) which implies that events on the soil surface can easily contaminate the underground water supply[5]. Croom and Bucks soils are found in the higher elevated areas of the site which includes the plateau and the two bluffs. The slopes on the site are predominantly Penn silt loam. Elk silt loam, Bowmansville-Melvin silt loams, Delanco silt loam and Rowland silt loams cover most of the Broad Run stream bottom and floodplains.

Exhibit 5.6: Soil Types and Characteristics

Soil Types	Slopes	Characteristics
Beltsville silt loam	0 - 8 Percent	Moderately well drained
Bowmansville-Melvin silt loams	0 - 2 Percent	Occasionally flooded, poorly drained
Bucks silt loam	0 - 8 Percent	Well drained
Croom and Bucks soils	3 -15 Percent	Well drained
Croton silt loam	0 - 3 Percent	Poorly drained
Delanco silt loam	0 - 3 Percent	Occasionally flooded
Elk silt loam	0 - 3 Percent	Occasionally flooded, well drained
Penn silt loam	3 - 25 Percent	Well drained
Readington silt loam	0 - 8 Percent	Moderately well drained
Rowland silt loam	0 - 3 Percent	Occasionally flooded, moderately well drained

3 *Geologic Maps of Maryland: Montgomery County*, Retrieved from the Website of the Maryland Geological Survey's Website at: http://www.mgs.md.gov/esic/geo/mon.html, (Retrieved February 2010).

4 *Geologic Maps of Maryland: Rocks of the South Mountain Anticlinorium and Frederick Valley*, Retrieved from the Website of the Maryland Geological Survey's Website at: http://www.mgs.md.gov/esic/geo/lgsmfv.html#no, (Retrieved February 2010).

5 *Poolesville Water Supply*, Retrieved from the City of Poolesville Website at: http://www.ci.poolesville.md.us/Draft%20Master-Plan/water%20supply.htm, (Retrieved February 2010).

Exhibit 5.7: Soils

B. Farmland Designation

The soils around the NIHAC site are also categorized by the Natural Resources Conservation Service (NRCS) to help identify land which has soils that are suitable farmland. The classifications *Prime Farmland* and *Farmland of Statewide Significance* are used to aid decision makers whether land should be preserved for agricultural purposes.

The Farmland Protect Policy Act is put in place to minimize the impact by the federal government of permanently developing important farmland[6]. It also describes the three categories of farmland found on the NIHAC site:

a. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary. Prime farmland includes land that possesses the above characteristics but is being used currently to produce live stock and timber. It does not include land already in or committed to urban development or water storage;

b. Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables; and

c. Farmland, other than prime or unique farmland, that is of statewide or local importance for the production of food feed, fiber, forage, or oilseed crops, as determined by the appropriate State or unit of local government agency or agencies, and that the Secretary determines should be considered as farmland for the purposes of this subtitle;

On the NIHAC site, prime farmland is located in the north parcel (north of Club Hollow Road), north of the north bluff and on the southern portion of the site along Broad Run. Soils of statewide significance are located throughout the whole site. The areas of no farmland significance are found in small portions of the Penn silt loam, all areas of the Croton silt loam, and Readington silt loam.

5.5 Hydrology, Watersheds, Floodplains, and Wetlands

A. Subsurface Hydrology

The site is part of the groundwater system called a "fractured rock aquifer" where the ground water is collected in cracks and fractures[7]. Most of the aquifers within the system are composed of rock that does not hold water. Therefore, water extraction is dependent on availability of cracks and fractures to locate wells. Once water is taken from the cracks, it decreases the water pressures in the fractures immediately near it. In this type of underground water system, water extractions are limited to allow appropriate recharge. Potable water for the site is collected from the five on-site wells that intercept these aquifers. The Maryland Department of the Environment (MDE) restrict water extraction for the site given the nature of the subsurface hydrology.

B. Surface Hydrology

Broad Run approaches the site from the east along a westward coursing reach. It then meanders along the eastern and southern boundaries of the NIHAC site. Three small tributaries from the north and northwest converge through successive confluences to join Broad Run outside the northeast corner of the NIHAC site. A separate small intermittent stream rises in a spring about 500 feet east of Elmer School Road and flows across NIHAC to a reservoir before emptying into Broad Run. The tributaries of Broad Run and the intermittent stream divide the NIHAC site into distinct topographic areas.

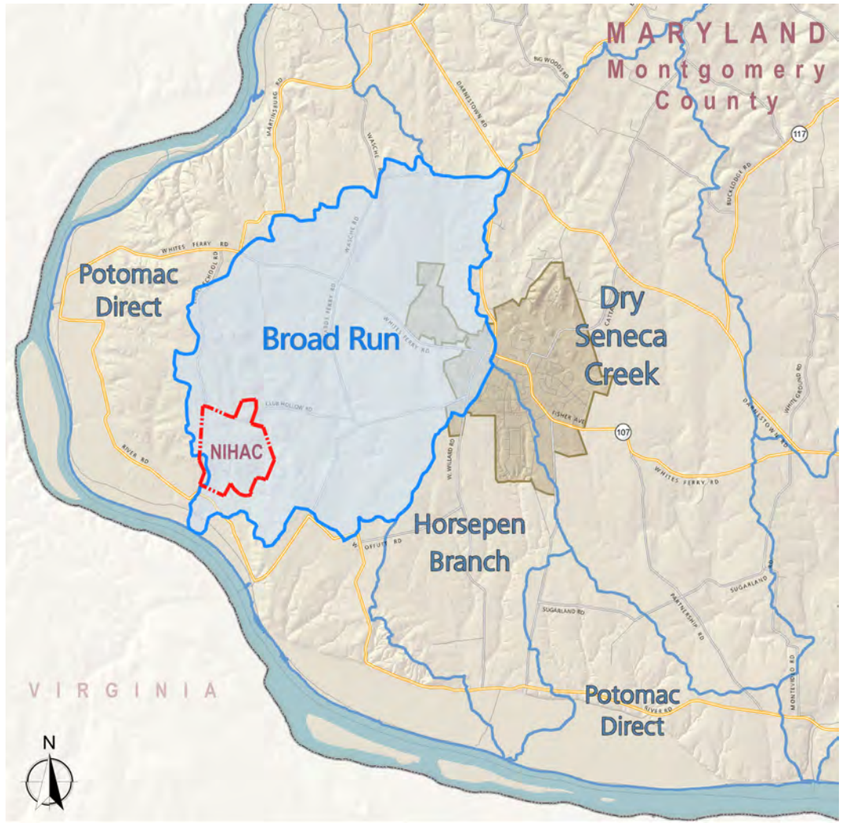
The reservoir located between the two bluffs and the outdoor animal habitat pond in the southern portion of the site were both constructed after NIH acquired the property. The reservoir was initially constructed to supplement the water needs of the campus; however, the wells on the site have been the only source of potable water for the campus to date. The reservoir currently serves emergency source of water for fire-fighting needs.

There are also two lagoons on the site that store wastewater for the Wastewater Treatment Plant (WTP).

C. Watersheds

The NIHAC campus is located entirely within the Broad Run watershed. All surface water from the NIHAC campus eventually drains into Broad Run. This includes storm water runoff from the site as well as secondary treated sewage effluent. The catchment area for the watershed also includes agricultural land outside the campus including farms and pastures and a large portion of the developed area within the Town of Poolesville. The majority of the water entering Broad Run is surface drainage from precipitation events resulting in surges in the water level when such events occur.

Exhibit 5.8: Watershed[8]



6 FPPA_*Law*, Retrieved from NRCS Website at: http://www.nrcs.usda.gov/programs/fppa/pdf_files/FPPA_Law.pdf, (Retrieved January 2010).

7 *Poolesville Water Supply*, Retrieved from the City of Poolesville Website at: http://www.ci.poolesville.md.us/Draft%20Master-Plan/water%20supply.htm, (Retrieved February 2010).

8 Source: The Maryland-National Park and Planning Commission

D. Floodplains

Federal Emergency Management Agency (FEMA) maps indicate that there are both 500-year and 100-year floodplains on the NIHAC campus. A 100-year storm event could flood the immediate area adjacent to the Broad Run stream bed. A 500-year storm event would cause the nearby rivers and streams to rise over their banks. The Potomac River would force water up Broad Run, past its banks well into the NIHAC site. In such an event the east-west swale that runs between the two bluffs would be flooded. The northern tributary of Broad Run along Club Hollow Road would also be flooded.

E. Wetlands[9]

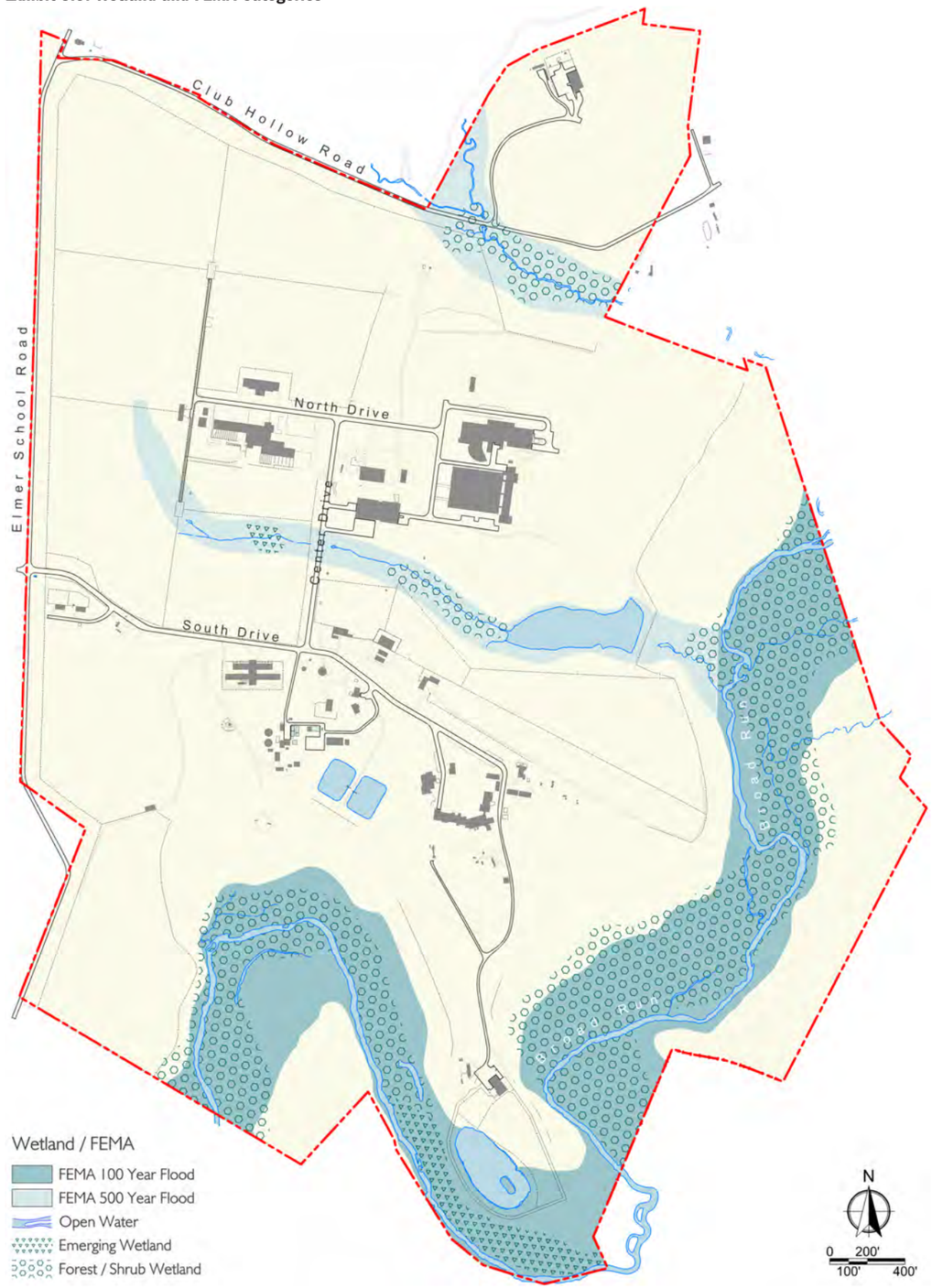
The U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (USEPA) define jurisdictional wetlands as areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR, Part 328.3). USACE regulates development in jurisdictional wetlands pursuant to Section 404 of the CWA (33 CFR, Parts 320-330). Identification and delineation of jurisdictional wetlands is based on three parameters:

- Hydrophytic vegetation – Macrophytic plant life growing in water or on a substrate that is periodically deficient of oxygen as a result of excessive water content. The National List of Plant Species that Occur in Wetlands: Northeast (Region 1) (USFWS, 1988) provides an indicator status for many of the plant species found in Maryland.
- Hydric soils - A soil that formed under saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.
- Wetland hydrology - Permanent or periodic inundation or soil saturation to the surface for sufficient duration during the growing season to support hydrophytic vegetation.

There are two types of wetlands found on the NIHAC site - woodland wetlands found along Broad Run, and emergent wetlands[10]. Wooded wetlands consist of woody, forest tree species which are adapted to wet soils as well as woody shrub species in the understory accustomed to the same condition. Emergent wetlands are dominated by grasses, sedges, rushes forbs and other rooted, water-tolerant herbaceous plants.

The Drainage Swale and Reservoir from Center Drive

Exhibit 5.9: Wetland and FEMA Categories[11]



9 Further investigations will be carried out as part of the EIS process regarding the presence of wetlands on the site.

10 *National Wetlands Inventory*, Retrieved from US Fish and Wildlife Service Website at: http://www.fws.gov/wetlands/data/Mapper.html, (Retrieved February 2010).

11 *National Wetlands Inventory*, Retrieved from US Fish and Wildlife Service Website at: http://www.fws.gov/wetlands/data/Mapper.html, (Retrieved February 2010).

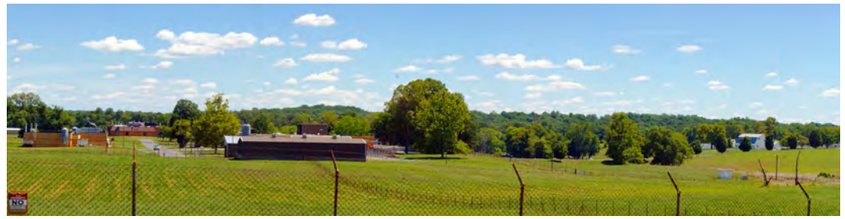
5.6 Views and Landscape Character

The NIHAC campus development is harmonious with the Agricultural Preserve which surrounds it. Similar to the neighboring properties, the NIHAC has large tracts of forest and pasture land with low lying mostly one-story buildings used to house animals. There are three main landscape areas that give the NIHAC campus an identity:

- ***The pastures***: The pasture areas are in the northwest and western areas of the campus. They are primarily along Elmer School Road and the Club Hollow Road. They tend to dominate the views into the campus from these roads.
- ***The forests***: The forested areas of the NIHAC site are located along the east side of the campus in low-lying areas adjacent to Broad Run and on steep slopes. These areas are hard to access and therefore remain undeveloped.
- ***The drainage swale***: The swale separates the northern and southern sides of the campus. Its primary function is to drain water to the reservoir and ultimately to Broad Run. It offers a pleasing view to the campus buildings.

5.7 Historic Landscape

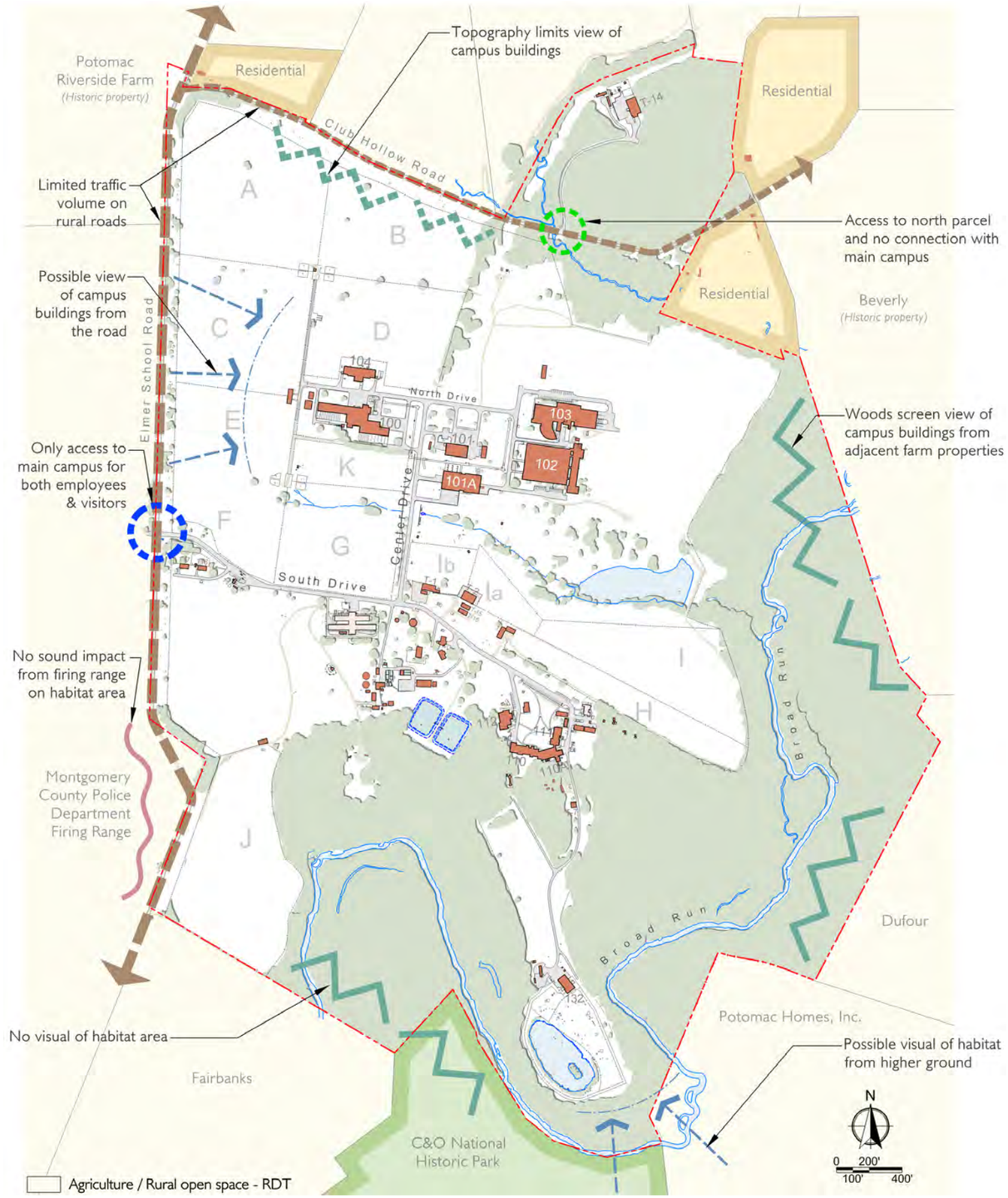
The campus has a few historic landscape elements, of which the most significant is an allée of trees on the north section of the campus that aligns with Center Drive, remnants of a rural tree-lined road. The other feature of significance is the outdoor field habitat in the southern tip of the campus, which is probably the oldest, if not unique, in this region.



View of the Campus from Club Hollow Road

View of the Campus from Elmer School Road

Exhibit 5.10: Views and Character



6.

The Built Environment

6.1 Introduction

The NIHAC campus contains over fifty permanent and temporary buildings that support the NIH Animal Center mission. These buildings represent a wide spectrum of uses that range from animal holding, animal support and research, loafing sheds, animal barns, maintenance and storage buildings, utility buildings and residences for personnel assigned to the center. The ages of these buildings ranges from pre-1960s to the recently completed Building 101A in 2003. Except for this Central Utility Plant and Building 112, all of the existing buildings are single story utilitarian structures with character appropriate for rural sites.

NIH classifies buildings on the site as permanent and temporary based on construction criteria. Of the entire space inventory of about 361,600 gsf, about 84% or 304,000 gsf is designated as permanent with the remaining comprising of temporary buildings and trailers. DVR controls 65% of the spaces with NICHD and other institutes occupying about 13% and the remaining buildings mostly comprised of utility structures.

6.2 Existing Buildings, Locations and Organizational Control

The natural features within the site create two large bluffs north and south of a swale that runs east west and is 600 to 1000 feet wide with a reservoir on the east. Exhibit 6.1 shows the buildings on the North Bluff –which include buildings 100 and 104 that are west of Center Drive and buildings 101, 101A, 102 and 103 on the east. Except for building 101A, the recently constructed Central Utility Plant, and building 101, the now abandoned plant, all the permanent buildings are controlled by DVR.

Buildings 110,110A, 111, and 112 on the South Bluff are under NICHD's control while Buildings 127 and 128 are under DVR's control. The Wastewater Treatment Plant area (Building 107 and the surrounding structures) as well as the other ancillary buildings are controlled by ORF. Exhibit 6.2 shows a complete listing of the buildings, controlling agency, uses, year of construction and square footages.

Exhibit 6.1: Key Plan for the Campus Facilities

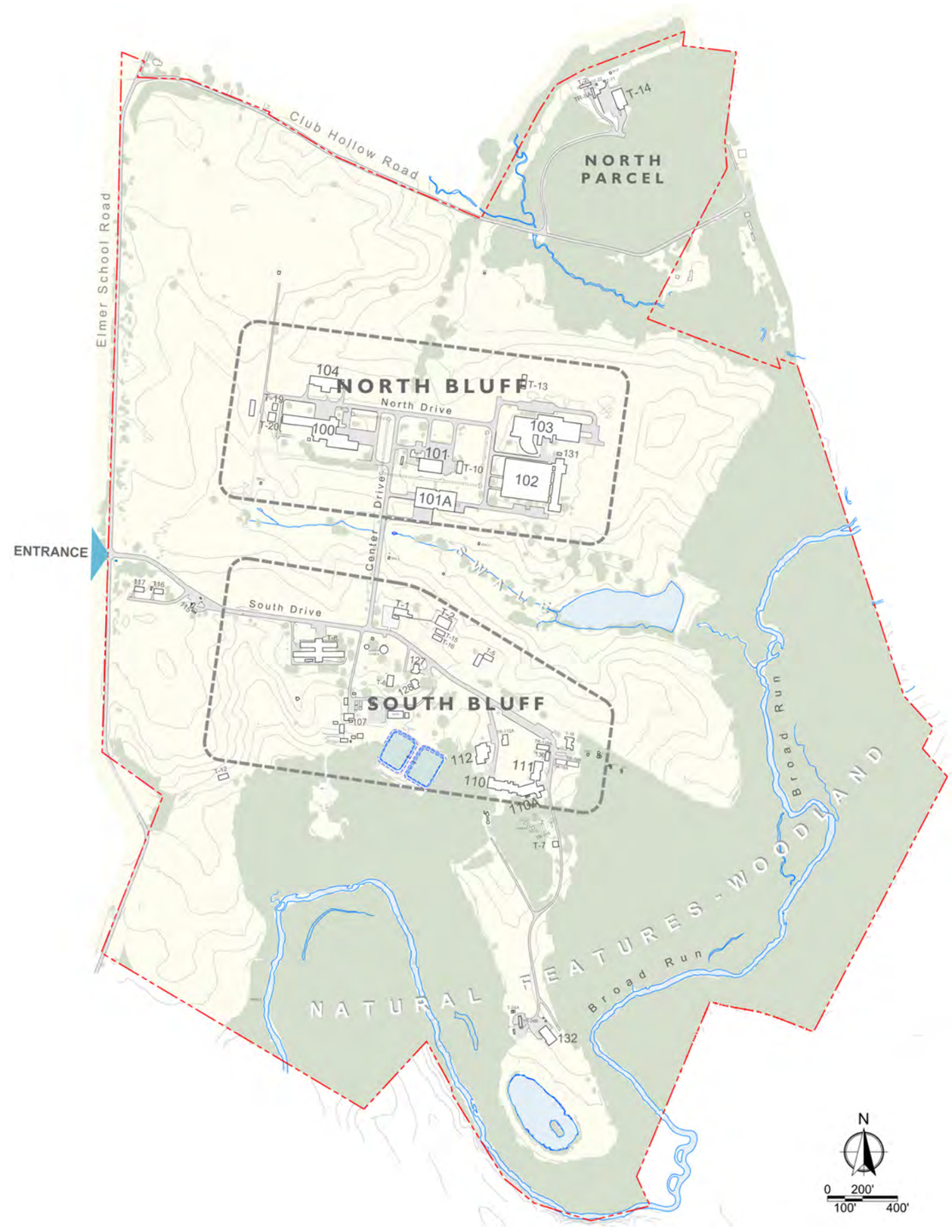


Exhibit 6.2: List of Permanent and Temporary Buildings

Building	Managed By	Primary Use	Construction Year[A]	GSF	Semi-Outdoor	GSF with Semi-Outdoor	FCI[H]
B100	DVR	Animal Facility	1967	35,055	31,352	66,407	0.04
B101	ORF	Old CUP; Storage	1967	9,822		9,822	57.22
B101A	ORF	CUP	2003[B]	44,315		44,315	0.00
B102	DVR	Animal Facility	1967	63,244	14,575	77,819	0.06
B103	DVR	Animal Facility	1972	90,543	1,880	92,423	0.20
B104	DVR	Animal Facility	1995[B]	12,081		12,081	0.01
B107	ORF	Wastewater Treatment Plant (WTP)	1972	1,870		1,870	0.19
B107.x[C]	ORF	Wastewater Treatment Plant (WTP)	Unknown	3,699		3,699	NA
B110	NICHD	Office/Animal Lab	1972	7,758		7,758	0.27
B110A	NICHD	Animal Facility	1988	8,104		8,104	0.22
B111	NICHD	Office/Animal Lab	1972	4,627		4,627	0.32
B112	NICHD	Office/Animal Facility	1972	9,458	3,162	12,620	0.20
B115	Other	Security	1968	387		387	2.77
B115.1[D]	Other	Security	Unknown	219		219	NA
B116	Other	Residential	1974	1,478		1,478	0.24
B117	Other	Residential	1974	1,497		1,497	0.24
B127	DVR	Animal Facility	1967	1,650		1,650	0.38
B128	DVR	Animal Facility	1967	1,848		1,848	0.33
B130	NICHD	Storage Bldg.	2010[E]	1,128		1,128	1.04
B131	DVR	Storage Bldg.	1977	351		351	0.66
B132	NICHD	Animal Facility	1989[B]	5,035		5,035	0.40
T1	DVR	Animal Barn	Pre-1960	4,760		4,760	NA
T2	DVR	Animal Barn	Pre-1960	4,346		4,346	NA
T5	DVR	Storage Shed	Pre-1960[G]		3,325	3,325	NA
T6	Other	Residential	Pre-1960	1,519		1,519	NA
T7	Other	Storage Shed	Pre-1960		822	822	NA
T8	DVR	Abandoned-Office	1961	19,294		19,294	NA
T10	ORF	Garage	1968	2,116		2,116	NA
T11	DVR	Storage Shed	1967	89		89	NA
T11A	Other	Residential	Unknown	719		719	NA
T12	DVR	Loafing Shed	1975		1,512	1,512	NA
T13	DVR	Equipment Shed	1975	2,151		2,151	NA
T14	ORF	Warehouse	1979	6,162		6,162	NA
T15	DVR	Storage Bldg.	1978	1,355		1,355	NA
T16	DVR	Storage Bldg.	1978	1,355		1,355	NA
T18	NICHD	Abandoned	1983	2,334		2,334	NA
T19	ORF	Storage Shed	1980		1,157	1,157	NA
T20	DVR	Storage Shed	1980		2,199	2,199	NA
T21	Other	Residential	Unknown	1,033		1,033	NA
T22	DVR	Storage Bldg.	Unknown	97		97	NA
T24A	NICHD	Storage	Unknown	278		278	NA
T25, 25A-C	NICHD	Storage	Unknown	680		680	NA
TR18A	NICHD	Office	Unknown	1,666		1,666	NA
TR18B	NICHD	Office	Unknown	1,829		1,829	NA
TR24B	NICHD	Office	Unknown	938		938	NA
TR110	NICHD	Abandoned-Office	Unknown	545		545	NA
TR112A	NIAAA	Office	Unknown	1,943		1,943	NA
TR130A	NICHD	Office/Storage	Unknown	1,958		1,958	NA
W107-ST8[F]	DVR	Storage Bldg.	Unknown	271		271	NA
WT19-WT20[F]	DVR	Storage Shed	Unknown		2,479	2,479	NA
GRAND TOTAL				361,607	62,463	424,070	NA

Notes:

General: Where conflicts exist on the construction year, it is assumed that the 2009 Asset Detail Report year supersedes the information reported by the facility managers, and the 1996 Master Plan supersedes all other information, unless otherwise noted. The square footages indicated are based on measurements from CAD files obtained from NIH. Where CAD files do not exist, outlines were prepared from aerial photographs and matched with other sources to obtain the best estimate.

A. Construction year has been noted as per the 1996 Master Plan document, unless otherwise noted.

B. Construction year noted from the 2009 Asset Detail Report prepared by VFA, Inc.

C. The B107.x represents the five ancillary buildings in the Wastewater Treatment Plant (WTP) complex. This is not an official NIH designation. It has been used to serve as a reference within this document. The square footages shown are the totals for all five buildings.

D. This building is a temporary structure intended to serve as a swing space for the security building (115). The 115.1 designation is not assigned by NIH. It has been used to serve as a reference within this document.

E. This building was originally constructed in 1968 as a greenhouse. In 2010, the building was reconstructed on the same foundation and converted into an unconditioned storage building. This information was provided by NICHD Facilities Manager.

F. This is not an official NIH designation. It has been used to serve as a reference within this document.

G. This building seems to have been extensively renovated in recent years.

H. FCI represent Facility Condition Index. The indices shown here were obtained from 2009 Asset Detail Report prepared by VFA Inc. Indices were not calculated for temporray buildings or trailers.

6.3 Functional and Conditional Analysis

The master planning team conducted a comprehensive survey of the existing buildings to analyze the conditions and functional suitability of the facilities to meet the requirements of various programs. The 2009 Asset Detail Report, prepared by VFA. Inc. was provided by NIH. It documented shortcomings of the facilities. A Facility Condition Index (FCI) was assigned to each of the permanent buildings that reflected its physical condition. The planning team observed that although many of the buildings were in acceptable physical condition, their configurations and infrastructure make them incapable of efficiently supporting current operations and functions. The following sections summarize the findings on the major buildings on the campus, by managing entities.

A. DVR - Managed Buildings

Building 100: This building is also known as the Farm Animal Building. It has approximately 35,000 gsf of built area and approximately 31,300 gsf of outdoor runs. It is a single story structure consisting of a combination of load bearing concrete masonry units, steel columns, open web joists and metal deck on exposed steel beams. It has a flat roof. The exterior walls are brick veneer with CMU backup. It has aluminum sash, single pane windows and hollow metal doors.

The building consists of two wings of outdoor covered stalls and a central hub with indoor conditioned pens and support functions. The support functions include an office, lockers, break/shelter-in-place, two separate receiving bays, locker rooms, feed storage, cage storage, surgery suite, treatment lab, x-ray, necropsy, cold storage and a large animal treatment room.

This building, operated by DVR, was originally built for housing large animals requiring runs. Accordingly, a large portion of the building is unconditioned. The physical condition of the building is deemed "optimal" by NIH. However, the need to house large animals is minimal while there is a strong need to house non-human primates. The current design of the building is not conducive to housing primates, and retrofitting it for NHP holding will require renovations.

Conclusion: DVR is currently using this building for NHP housing and intends to continue this use into the foreseeable future. However, the building, originally designed for large animals, requires extensive renovation and modifications to achieve operational and functional efficiency.

Building 104: This is a 12,000 gsf single story building, also referred to as the Ungulate Building. It has a flat concrete roof on masonry load bearing walls with parapet on all sides except the rear (north). The walls are brick veneer with concrete masonry unit (CMU) backup. The corridor has some open areas that are enclosed with chain link fence, and have an insulated panel fascia running along the top. The aluminum sash windows have insulated glazing, and the doors are of hollow metal construction.

The building has a central corridor with three large animal holding rooms on one side and restrooms, laboratory, feed storage and mechanical rooms on the other. There are two front doors - one serving as the main building entrance, and the other leading to the mechanical spaces. There is also an overhead door for deliveries. The roof-top air handling units (AHUs) are visible upon approaching the building.

Conclusion: Physically the building is in fair condition with some aging components that are at the end of their useful lives. The building was constructed specifically for ungulates and is not optimal for NHP housing. A disproportionately large area is dedicated to swing space and unused mechanical space. Storage space is limited and there is no dedicated loading dock for animals. The building does not have required support spaces such as food preparation, treatment, gowning, etc. There is no cage washer in this building and cages are hand-washed. Accordingly, this building cannot be deemed optimal for NHP housing in its current configuration.

Exhibit 6.3: Buildings 100 and 104

Buildings 104 and 100, Looking South

Building 104
Short term:
- Needs cage wash, cold storage and better security

Near long term:
- Replace/convert existing structure to multi-species housing

Building 100
Short term:
- Lack of environmental controls render some of the space unusable
- needs better security

Near long term:
- Replace/convert existing structure to multi-species housing

Legend:
Animal Housing
- Animal Holding Spaces
- Outdoor Spaces
- Animal Research Facility Support
- Animal Research Labs
- Animal Storage

Office / Office Support
- Office Spaces
- Office Support Spaces
- Other Support Spaces

- General Storage
- Building Support Spaces
- Circulation

Building 102: This building is also known as the Kennel Building. It is an older building that has undergone additions and renovations over time. The single story structure has 63,200 gsf of interior space along with 14,500 gsf of outdoor and semi-outdoor runs. It has metal frame structure wrapped in brick veneer walls with concrete masonry unit (CMU) back-up. It has a flat built-up roofing system over most of the building and a pitched standing seam aluminum panel roof over the office area. The office areas have aluminum sash insulated double paned windows with brick sills and the rest of the administrative and support areas have aluminum sash clerestorey windows.

The building is used as an animal holding, support and research facility. The E shaped building has three animal holding wings, Wing A is for dogs, Wing B for pigs and Wing C for monkeys. Wings A and B have double-loaded corridor with indoor/outdoor runs and Wing C is a single-loaded alternating animal holding rooms (AHRs) and outdoor space. The support area contains animal, office and support functions serviced from a double-loaded corridor. The south end has the main entrance, office and staff areas and the north end has the receiving area and lab support spaces. The building also has animal labs, a surgical suite, ICU, clinic with lab, X-ray, and positron emission tomography (PET) scan.

Conclusion: Originally, the building was specifically designed for kennels. The C-Wing was renovated to allow NHP housing. Preliminary designs have been prepared for renovating the A-wing for NHP housing as well. The other functions in the building in terms of procedure space, support space, labs and office space make it viable for retention and renovation.

Building 103: This single story building, also referred to as the Primate Unit, has a 90,500 gsf interior and 1,900 sf of runs and semi-outdoor space. It has metal deck roofing on exposed steel frame. The roof is flat on the rectangular portion of the building and sloped on the fan-shaped atrium addition. The exterior walls are typically brick veneer with CMU back-up. The windows are metal sash throughout, with double pane insulated glazing in the more recent additions. The fan-shaped addition has a glazed enclosure. The main entrance doors on the north are fully glazed with aluminum frames. The doors throughout are fiberglass reinforced plastic (FRP) in metal frames with vision panes, some with transoms.

The building has two parallel double-loaded corridors. The offices areas are located at the center of the building, by the main entrance. The animal labs and support spaces are also centrally located. The fan-shaped 2002 addition holds NHPs in group housing.

Conclusion: Physically the building is in fair condition with some aging components that are at the end of their useful lives. Functionally, the building use is optimal except for certain areas. The group housing enclosures are not optimal and the research observation area is oversized, underused, and difficult to adapt for animal housing. Overall the building is deemed viable for retention and renovation.

Exhibit 6.4: Buildings 102 and 103

Buildings 103 and 102, Looking South

Building 103
Short term:
- Inadequate HVAC, cage wash and security

Near long term:
- Make habitat area more efficient
- add functional loading dock
- upgrade/enlarge locker room areas

Building 102

Short term:
- A- and B- wings need new ceilings
- several areas have inappropriate air infiltration
- needs access control (using keycards)

Near long term:
- Renovate A& C wings
- Add functional loading docks
- upgrade locker room areas
- renovate office areas

Legend:
Animal Housing
- Animal Holding Spaces
- Outdoor Spaces
- Animal Research Facility Support
- Animal Research Labs
- Animal Storage

Office / Office Support
- Office Spaces
- Office Support Spaces
- Other Support Spaces

- General Storage
- Building Support Spaces
- Circulation

Building 127 & 128: These twin buildings function as rodent quarantine facilities. They are respectively 1,700 gsf and 1,800 gsf in size. These steel frame buildings have metal panel exterior walls. Entrances are through vestibules with storefront windows made of insulated glazing. The buildings have metal roof decks supported on steel purlins.

The interiors consist of painted gypsum wall board (GWB) ceilings and walls and epoxy flooring in the animal and restroom areas. The doors are hollow metal. A third of both the buildings is comprised of mechanical space. Building 127 has two rooms housing isolators, a work room with additional isolators and a laundry. Building 128 has a large room containing isolators and an office.

Conclusion: These buildings have inefficient building systems, and have walls and roofs that need to be renewed.

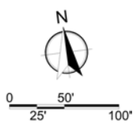
Exhibit 6.5: Buildings 127 and 128

Buildings 127 and 128, Looking West.

Buildings 127 and 128
Replace both buildings with a single efficient building for rodent quarantine to include cage wash facility.

Building 132 (far right)
Short Term:
- The small sheds are inadequate to store cages; heat & humidity cannot be adequately provided; emergency generator switches fail often

Near Long-Term:
- Indoor functions can be consolidated with with110A and 112 if needed



B. NICHD Managed Buildings

Building 132: This a single story building developed in three phases totaling 5,035 gsf contains NHP holding and support spaces. Located adjacent to the field habitat, it has animal holding rooms (AHR) that open to the habitat. The structure consists of masonry bearing walls supporting a metal roof deck on purlins on the two ends and a wooden deck on wood truss at the center. The windows are aluminum sash with insulated glazing. The interiors are painted concrete masonry unit (CMU) walls and gypsum wallboard (GWB) ceilings. Doors are fiber reinforced plastic (FRP) in metal frames, with some exterior doors having vision glass. Flooring is typically vinyl composition tile (VCT) in the offices, and epoxy in animal holding and support spaces. The restrooms have ceramic tile finishes.

The building has three blocks divided by two, parallel double-loaded corridors. The support block containing treatment, isolation and an indoor AHR, is at the north end. The indoor/outdoor AHRs are at the center and south.

Conclusion: Building 132 is in an acceptable condition and adequately supports the animal functions that it houses. It is unique in its association with the field habit, making it improbable for relocation or replacement.

Exhibit 6.6: Building 132

Building 132 and the Outdoor NHP Habitat Looking East.

Building 110: This 7,800 gsf building in the south campus has a low-pitched metal roof deck on masonry load bearing walls. The eaves vary in distance from the ridge, creating varying room sizes and wall heights. The gable ends are masonry walls and the eave walls are wood siding with strip windows along the center. The interiors are painted concrete masonry unit (CMU) walls, suspended acoustic ceilings, metal doors and mostly vinyl composition tile (VCT) flooring. The library has carpet flooring and restrooms have ceramic tiles.

The building has a double-loaded corridor. The centrally positioned main entrance leads to this corridor. The mechanical and receiving areas are at the west end and an interior connection to Building 110A is at the east end. The building houses a histology lab and three rooms for slide evaluation and cataloguing.

Conclusion: This is an old building, which serves critical animal care functions such as the survival surgery suite, animal procedure rooms, a wet lab and a necropsy room. Even though periodic renovations have been made over the last 40-50 years, the building is less than optimal in serving the current functions.

Building 110A: This 8,100 gsf building is internally connected to Building s 110 and 111. It has a pitched metal roof system bearing on masonry walls. The front facade of the building has storefront windows. All the other exterior walls are concrete masonry unit (CMU) finished in stucco. The doors are fiberglass reinforced plastic (FRP) in metal frames. The interiors are painted CMU walls, hollow metal doors with vision panels, sand finish epoxy floors in the animal areas, acoustic ceilings in the corridors, and gypsum wall board (GWB) ceilings in the animal holding rooms.

The HVAC system has been recently renovated for 100% redundancy and zoned humidification control.

The building has a peripheral corridor connected to Buildings 110 and 111 and a central double-loaded corridor serving the animal holding and support rooms. The peripheral corridor has an aluminum and glass storefront windows. It has a single door entry on the westernmost bay. There is a receiving dock at the east end of the building, adjacent to cage storage and wash.

Conclusion: This building is newer compared to 110 and 111. However the animal spaces are not optimal. The renovated HVAC system is certainly a welcome improvement. However the layout of the building provides little latitude in improving the configuration of the animal housing areas.

Building 111: This building, which is internally connected to Building 110A, is approximately 4,600 gsf. It has a low-pitched metal roof deck on masonry bearing walls. The gable ends are brick veneer walls and the eave walls are clad in wood siding with fixed, single pane, aluminum sash windows. The exterior doors are hollow metal with vision panels in painted metal frames. The interiors are painted concrete masonry unit (CMU) walls, suspended acoustic ceilings or painted metal deck and hollow metal doors. It has vinyl composition tile (VCT) flooring in the corridor and offices, sand finish epoxy in the laboratories and ceramic tile in the restrooms.

The building has a central double-loaded corridor, with main entrance, rest rooms and break room at the center, and mechanical and receiving areas at the south end. The corridor is connected to building 110A at the south end, and has an exit door at the north end. The building houses animal procedure and testing rooms such as surgery, euthanasia, and other bench top procedures in support of the animal research.

Conclusion: Similar to Building 110 in terms of age, this building barely supports its current functions. It shows signs of aging. The spaces are inadequate, non-modular and inefficient providing little flexibility in meeting evolving animal support requirements.

Building 112: This is a two-story building with 9,500 gsf of indoor space and 3,200 gsf of semi-outdoor spaces. The indoor portion of the building has a corrugated metal panel pitched roof and painted metal wall panels with aluminum sash windows and metal doors. The interiors have painted CMU walls on the first floor and a combination of gypsum wall board (GWB) interior on exterior walls and demountable metal panel partitions on the second floor. Ceilings have acoustic tiles (ACT) on administrative and holding areas and GWB ceilings in procedure and cage wash rooms. Doors are hollow metal frames on the 2nd floor and fiberglass reinforced plastic (FRP) with vision glass on the first floor. Flooring is vinyl composition tile (VCT) or carpet in the offices; epoxy in animal holding and procedure rooms; and, ceramic tile floor in the restrooms.

The outdoor holding area is screened by wire mesh at the building's perimeter and roofed by translucent corrugated fiberglass panels. This area is enclosed with Plexiglas panels when outdoor temperature drops below 50°F, and heated with blast heaters from each end.

Building circulation is configured in a "T" shape with a double loaded corridor. Indoor NHP housing and support spaces are directly adjacent to the corridor, while the outdoor holding area wraps the building in an "L" shape from northwest to south.

Conclusion: This aging building appears to be a farm building which was retrofitted by NIH for NHP holding. The layout of the building and configuration of the spaces are not optimal. Animal support spaces in the facility are inadequate and the building systems are not efficient.

Building 130: This was a greenhouse until its transformation into an unconditioned storage building in 2010. It is a single story structure with a mezzanine measuring about 1,100 gsf. The reconstruction retained the original slab and foundation walls. A steel frame with corrugated metal panels and a gable roof with metal and translucent panels was installed.

On the interiors, the structure of the walls and ceilings is exposed. The floor is concrete and at the ground level and steel grating at the mezzanine.

Conclusion: This building, although unconditioned, provides a much needed enclosed storage space to the south campus facilities.

Exhibit 6.7: Buildings 110, 110A, 111, 112 and 130

Building 110
- Need more space & special power for freezers
- 50+ year old HVAC needs redundancy

Building 110A
- Some inadequacy in electrical service
- inflexible in terms of usage

Building 111
- Power problems
- Original HVAC (1963) needs replacing

Building 112
- All rooms occupied 100%, all the time
- need more space
- 1st floor vivarium chiller has problems
- No humidifiers

Building 130
- Used for unconditioned storage
- recently renovated and does not need any urgent renovations/upgrades

The Behavioral Research Cluster Looking South Including Buildings 110, 110A, 111, 112, 130, TR112A, TR130A, T18, TR18A *and* TR18B

C. Utility and Security Buildings

Building 101: The original Central Utility Plant, built in the late 1960s, is a 10,000 gsf structure. It consists of masonry load bearing walls and a structural steel frame. The external walls are brick veneer with CMU back-up. The doors are hollow metal and the windows are aluminum sash with single pane glazing. The building has two sets of interior stairs but no elevators.

This rectangular building houses abandoned offices and heating and cooling equipment from the building's former use as the Central Utility Plant. The south façade, which is visible upon approaching the North Campus, is fully glazed, contrasting with the other three brick facades with metal overhead doors. The building is surrounded on the other 3 sides by unused paved area over twice the size of the building footprint. There are two 50,000 gallon underground fuel tanks to the north of the building that are currently in use.

The exterior windows, roofing, drainage, doors and brick veneer envelope are aged, and/or beyond rated/useful life. At present the building is not in use except for about 1,200 sf of storage space.

Conclusion- This building is past its useful life. Retrofitting for other uses would not be cost effective. Demolition is recommended.

Building 101A: The three story, 44,300 gsf new Central Utility Plant (CUP) is one of the newest structure on the campus. It has a steel-framed structure with cast-in-place concrete floors on metal deck, and a flat built-up roofing system. The exterior walls are brick veneer with concrete masonry unit (CMU) back-up. The doors are typically hollow metal and the windows are aluminum sash with double pane insulated glazing.

The CUP houses three chillers, four boilers, four diesel emergency generators, and areas for pumps, switch gear and major piping, connecting to a utility tunnel. The CUP has room for a additional utility equipment. The 1,500 foot utility tunnel serves the major north campus buildings including Buildings 100, 102, 103, and 1 04. A control room with a viewing window oversees the chiller room below. The CUP also has some office space for the ORF personnel working on the site.

Conclusion: The CUP is relatively new building in very good condition with equipment that is consistent with current technology. It also has room to accommodate additional utility equipment. While it was sized to serve the entire campus, it only serves the north (in terms of heating and cooling) as its distribution tunnels do not extend to the south side.

Exhibit 6.8: Buildings 101 and 101A

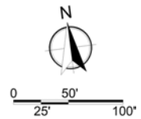
The Original and the Current Central Utility Plants Looking North

Building 101
Can be vacated and reused for unconditioned storage with minimal changes to building envelope; Or, can be demolished altogether

Building 101A
Relatively recently built (2003) to replace B101; adjacent parking needs to be removed from the building for security reasons

Building 115 (far right)
Near term:
- Building needs replacement space

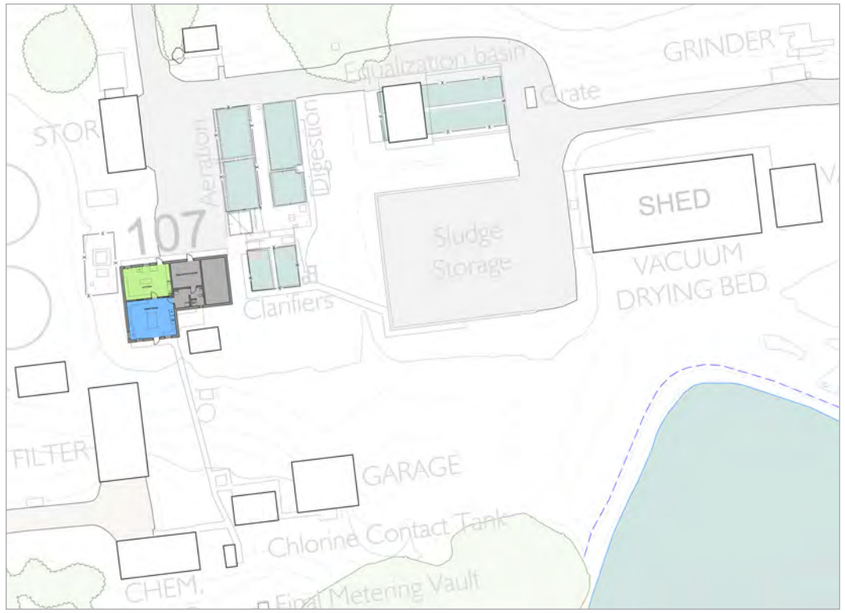
Long Term:
- security building should be equipped for better screening capability for visitors as well as commercial vehicles



Building 107: This 1,900 gsf building contains the office for the Wastewater Treatment Plant (WTP) and a water testing lab. There are about 12 other ancillary buildings and structures around it to support the water treatment functions. Building 107 is a flat roofed concrete structure with painted concrete masonry unit (CMU) interior walls, acoustic ceiling tile (ACT) and vinyl composition (VCT) floors.

Conclusion: This is building currently serves its purpose; however it shows signs of aging. Short of replacement, the building should be considered for renovation in the near future.

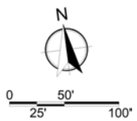
Exhibit 6.9: Building 107



The Wastewater Treatment Plant (WTP) Area Looking North

Building 107
Near term:
- Building will need renovation and upgrade

Long Term:
- storage area for dried waste needs a shed to prevent being washed down
- the water Wastewater Treatment Plant (WTP) in general needs major upgrades



Building 115: This 387 gsf building contains the administrative space for NIHAC's campus security. It is a wooden frame building with a flat roof. The walls are wood siding. are aluminum frame with single-pane glazing and the exterior door is hollow metal. The windows and doors appear to be original to the building.

The interiors have acoustic ceiling tiles (ACT) and plywood panel wall surfaces. The flooring is a combination of carpet or vinyl composition tile (VCT). Doors are hollow core wood.

The building houses an office, a bathroom and a control room. Heating, ventilation and air conditioning (HVAC) equipment is located in an outdoor shed

Conclusion: This building is in poor condition and needs replacement. NIH has plans for its replacement and a temporary unit has already been installed next to it,to serve as a swing space.

Exhibit 6.10: Building 115

Building 115, the Original Security Building and the Replacement Trailer Looking East

6.4 Other Buildings, Temporary Structures and Trailers

The campus has two identical residential buildings, Building 116 and 117. These buildings, originally built in 1974, were renovated in 2001. The campus also has several temporary structures (denoted as T- buildings) and trailers (denoted as TR- buildings). These buildings were not included in the Asset Detail Reports and formal physical condition assessments, although many contain essential office and support spaces. For the purpose of the Master Plan, observations made during the facility walkthroughs and feedback received from the facility managers have been used to assess their conditions. A synopsis of the Temporary Buildings and Structures is provided as an appendix.

6.5 Historic Assets

The NIHAC property was used as a dairy farm until it was purchased by NIH in 1960. A second farmstead dating from the nineteenth century or earlier may have existed on the north portion of the campus. Deed research and oral history indicate that a sawmill was present in the early twentieth century. It also speculated that a slave graveyard may also exist somewhere on the campus. However, this speculation has not been substantiated by archeological surveys and historical research.

Following acquisition of the property, NIH demolished some of the structures associated with the dairy farm. A total of four farm structures remain: the dairy barn (T-1), loafing shed (T-2), caretaker's cottage (T-6), and an implement shed (T-7). In addition, T-5 used to be an old goat shed probably dating back to the late 1950s or early 1960s. But, it seems to have been extensively renovated from its original condition.

All other structures currently on the campus were constructed by NIH after acquisition of the property. Some of these structures are known to be older than or approaching 50 years of age. In accordance with the National Historic Preservation Act, NIH is currently evaluating these properties and landscape features determine whether they may be eligible for inclusion in the Register. NIH's determinations of eligibility will be submitted to the Maryland Historical Trust for their review.

Poole House (Building T6) Looking West

6.6 Conclusions on Future Use of Facilities

The campus facilities vary widely in physical condition. However, in almost all cases they are less than optimal in terms of the functions they support. Based on the general assessment of the physical and functional conditions, the buildings were categorized into the following:

- Acceptable
- Requires Overhaul or Phasing Out
- Appropriate for Replacement /Demolitions

Exhibit 6.11 indicates the buildings in each category and the total square footages by managing organizations. As evident from the table, about two thirds of the buildings, although much less efficient compared to new state-of-the-art facilities, are in acceptable condition. About 10% should be demolished or replaced and the remaining 24% should be overhauled or phased out.

A. Considerations for DVR Managed Facilities

The primary issue with DVR's facilities is that, regardless of their physical condition, from a functional and operational perspective the buildings are not optimal. These buildings were designed to hold specific species of animals. As research evolves and animal models change, the demand for types and quantities of animals change. Retrofitting species-specific animal facilities requires substantial investments. Even then, the retrofitted facilities are intrinsically not energy and resource efficient. This is the case for even the most recently constructed DVR animal facility, Building 104, which was originally built for ungulates and is now being used to house primates.

In terms of planning strategy, it is best to identify the buildings that are viable for retention based on their current use, physical condition, functional condition, and the viability of reuse with acceptable renovations and retrofits.

B. Considerations for NICHD Managed Facilities

The NICHD operated animal buildings are old buildings, not specifically designed for animal housing. Building 112, which houses animal holding, a nursery, behavioral research spaces, procedure spaces and cage washers, was originally a farm building that has been incrementally modified to meet the current functional needs. The 110-110A-111 group of connected building are able to support the current functional needs but cannot be considered either optimal or efficient. The only exception is Building 132 which was converted from a temporary building (T26), but has had substantial modification and reconstruction to support its current housing and field habitat shelter functions. It currently operates at acceptable levels and can be expected to do so in the foreseeable future.

Many of the support functions such as office, storage, shelter-in-place, etc. functions for the south campus are housed in temporary buildings and trailers. These buildings required minimal capital investment but in terms of lifecycle costs, they cannot be justified. Majority of them are at the end of their rated useful lives.

If efficiency and maintenance costs are primary considerations, the NICHD facilities with the exception of Building 132 offer a compelling case for replacement.

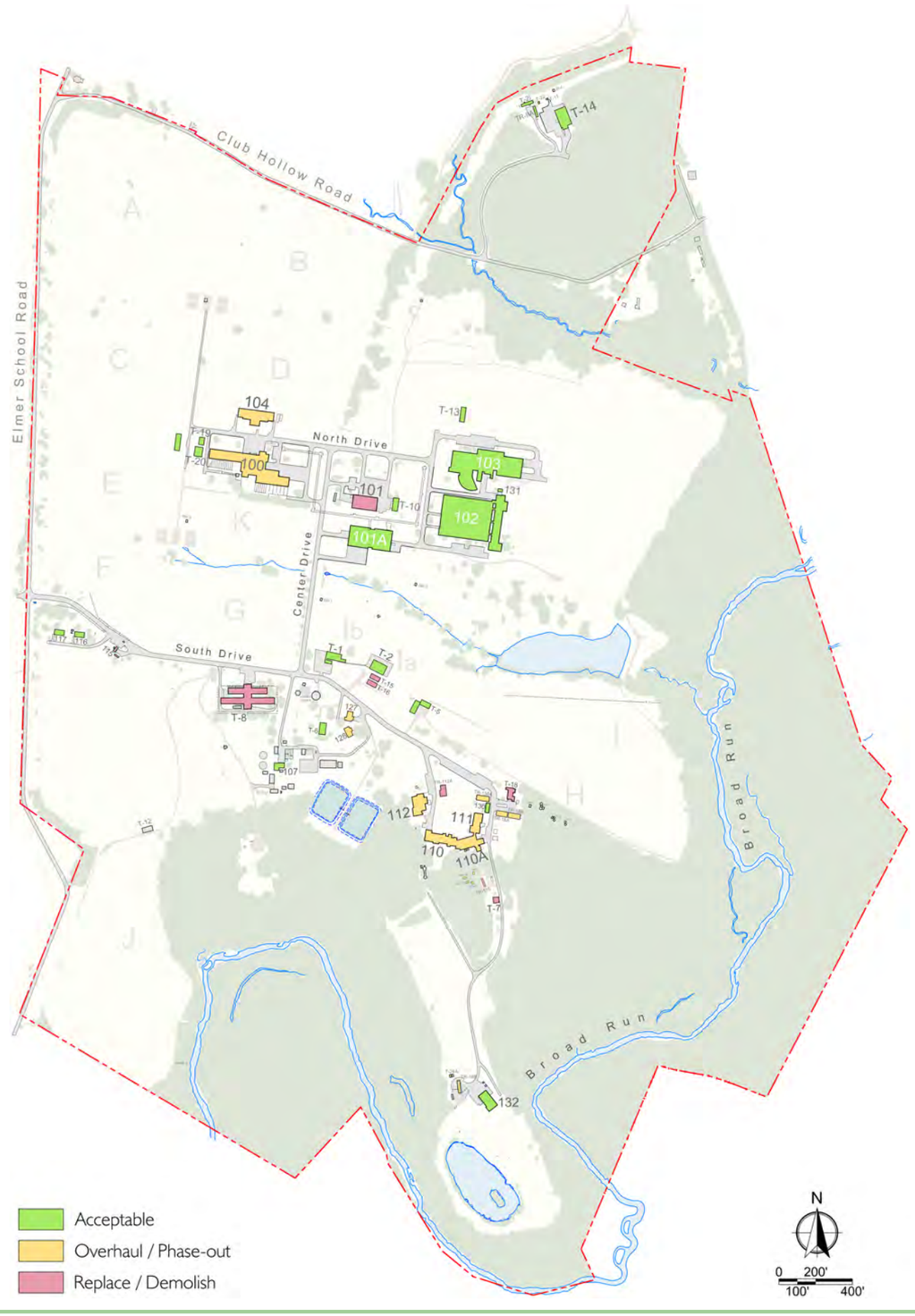
Exhibit 6.11: Summary of Buildings Considered Acceptable, Needing Overhaul/Phase Out and Replacement/Demolition

MANAGED BY	TYPE OF BUILDING	Acceptable		Overhaul/Phase-out		Replace/Demolish		TOTAL
		Buildings	GSF	Buildings	GSF	Buildings	GSF	TOTAL
DVR	Permanent Buildings	B102, B103, B131	154,138	B100, B104, 127, 128	50,634		–	**204,772**
	Temporary Buildings	T1,T2, W107-ST8, T22, T15, T16, T11	12,273		–	T8	19,294	**31,567**
	DVR TOTAL		**166,411**		**50,634**		**19,294**	**236,339**
NICHD	Permanent Buildings	B132, B130	6,163	B110, B110A, B111, B112	29,947			**36,110**
	Temporary Buildings			T24A, T25, T25A-C	958	T18	2,334	**3,292**
	Trailers			TR18A, TR18B, TR24B, TR130A	6391	TR110	545	**6,936**
	NICHD TOTAL		**6,163**		**37,296**		**2,879**	**46,338**
NIAAA	Trailers					TR112A	1,943	**1,943**
ORF	Permanent Buildings	B101A, B107*	49,884			B101	9,822	**59,706**
	Temporary Buildings	T10, T13, T14	10,429					**10,429**
	ORF TOTAL		**60,313**		–		**9,822**	**70,135**
Other	Permanent Buildings	B116, B117	2,975			B115**	606	**3,581**
	Temporary Buildings	T6, T11A, T21	3,271					**3,271**
	Other TOTAL		**6,246**		**–**		**606**	**6,852**
TOTAL	Permanent Buildings		213,160		80,581		10,428	**304,169**
	Temporary Buildings		25,973		958		21,628	**48,559**
	Trailers		–		6,391		2,488	**8,879**
	GRAND TOTAL		**239,133**		**87,930**		**34,544**	**361,607**

*B107 includes B107 as well as ancillary buildings

**B115 includes the temporary swing space structure

Exhibit 6.12: Plan Showing Buildings Considered Acceptable, Needing Overhaul/Phase Out and Replacement/Demolition



7.

Transportation, Circulation and Site Security

7.1 Regional Transportation Infrastructure

Transportation systems play an important role in the growth and development of a region. Access to the campus and connectivity to the other NIH campuses in the region is an important factor in deciding the future mission and operation of the campus. Changes and improvements to the regional transportation network may also have an impact on the future of the campus.

A. Regional and National Air Networks

There are three major airports in the region: Washington Dulles International Airport, Baltimore-Washington International Thurgood Marshall Airport, and the Ronald Reagan Washington National Airport.

Dulles International Airport, the largest of the region's airports, is located in Dulles, Virginia, only 12 miles from NIHAC in terms of geodesic distance. But access to the airport from the campus is limited because of the Potomac River. Commuting distance is approximately an hour using the ferry service at Whites Ferry, and upwards of 90 minutes via I-270 and the Capital Beltway. Dulles Airport operates over 1,000 daily flights involving 12 US carriers and over two dozen international carriers to 80 domestic and 40 international destinations.

The Baltimore-Washington International Thurgood Marshall Airport (BWI) is located about 43 miles from the NIHAC campus. It has an average of 760 flights per day serving over 20 million passengers a year.

The Ronald Reagan Washington National Airport (DCA) is located 30 miles from NIHAC and is the closest airport to Washington, DC, and the Bethesda campus. The airport serves over 18 million passengers annually, with an average of 750 flights per day on 12 U.S. carriers.

B. Rail Service

The nearest intercity rail service nodes are the Amtrak stations in Rockville (approximately 25 miles) and Union Station in Washington, DC (approximately 40 miles).

Maryland Area Regional Commuter Train Service (MARC) is operated by the Maryland Transit Administration (MTA). The MARC rail line has two stations on the Brunswick Line that are within 10 miles of the campus. The Brunswick Line operates from Union Station in the District of Columbia through Montgomery County and then splits to end at Frederick in Frederick County, and Martinsburg in West Virginia. The closest stations from the NIHAC site are Dickerson at 6.5 miles and Barnesville at 7.5 miles. The MARC trains run during the weekdays between 5 am and 9 am in the mornings and 1:45 pm and 9 pm in the afternoon. They do not run on weekends.

The Washington Metropolitan Area Transit Authority operates Metrorail in the greater Washington DC area. The closest station to the NIHAC site is Shady Grove on the red line, about 25 miles away. It can also be accessed from Poolesville using the Ride On bus service (Route 76).

Exhibit 7.1: Regional Transportation Infrastructure

C. Bus Service

Currently there are no bus services in the vicinity of the site. The nearest available bus service is the "Ride On" service in the Town of Poolesville. Montgomery County Department of Public Works and Transportation operates this local bus service covering over 75 routes within the County. Route 76 connects Poolesville to the Shady Grove Metro Station on week days. This route has many stops along Wooten Avenue in Poolesville but does not extend to the NIHAC site.

The Maryland Transit Administration (MTA) operates commuter busses. The closest route is 991 running between Hagerstown in Washington County and Rock Springs Business Park in Montgomery County. It travels through Frederick and through Shady Grove where it connects to the Metrorail. There are currently no transit connections to this line from either Poolesville or the NIHAC campus.

The Washington Metropolitan Transit Authority operated the Metrobus system which covers the District of Columbia, Maryland and Virginia. It does not have bus routes that connect to Poolesville or to the NIHAC Campus. The closest WMATA bus routes are at Shady Grove and Lakeforest Mall in Gaithersburg, both about 25 miles from the Campus.

Intercity bus service is available from private operators including Greyhound and Peter Pan from neighboring cities such as Frederick, Silver Spring, and the District of Columbia.

D. Ferry Service

The White's Ferry cable ferry operates as an alternative for private vehicles to cross the Potomac River between Poolesville, Maryland and Leesburg, Virginia. The ferry only allows approximately 20-24 vehicles and takes slightly under 10 minutes to load, cross the river and unload vehicles. The ferry could be considered a transit location as passengers of the ferry regularly meet at one side of the ferry to travel in one vehicle to commute to the other side.

Exhibit 7.2 shows the Ride-On and White's Ferry transit locations.

E. State and National Highway Network

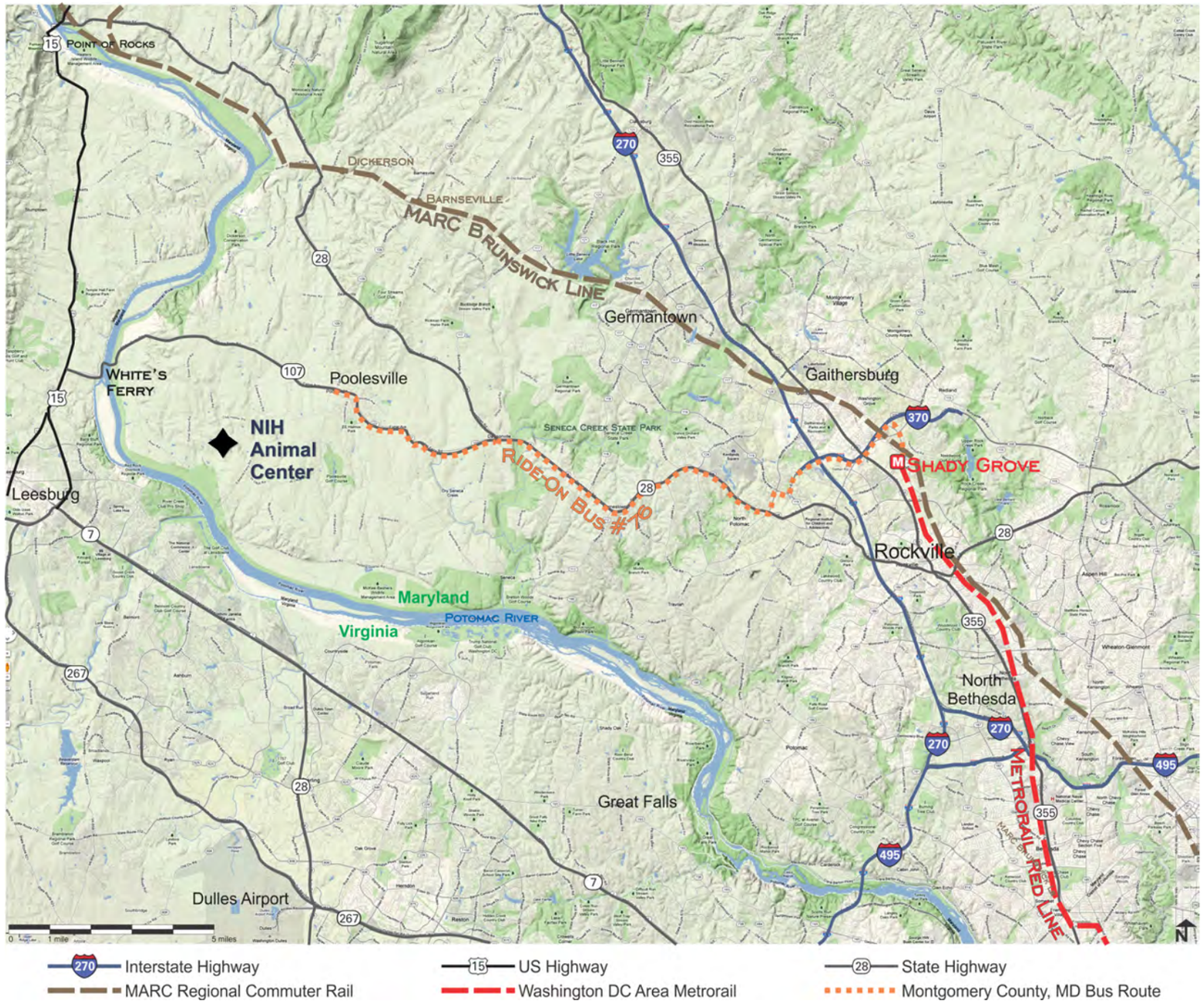
Highways have had a strong influence on the development pattern of the greater Washington DC area.

The Capital Beltway (I-495), the major transportation artery for the entire region, regularly exceeds its planned daily volume. The Capital Beltway stretches approximately 15 miles in Virginia and approximately 16 miles in Maryland. Annual Average Daily Traffic (AADT) on this interstate varies from a low of 138,025 near Oakmont, Maryland, to a high of 250,325 near Greenbelt, Maryland. The Beltway interchanges have been magnets for commercial and residential development in Maryland and Virginia.

The Dwight D. Eisenhower Memorial Highway (I-270), also known as the Washington National Pike, is a 35 mile auxiliary interstate highway connecting Frederick to the Beltway. AADT on various segments of this interstate ranges from a low of 71,675 between MD-80 and MD-85 in Frederick County to a high of 258,975 between MD-189 (Falls Road) and MD-28 (Rockville Center) in Montgomery County.

I-270 is 25 miles from the campus, making it the closest interstate. It can be accessed through a network of local and state roads.

Exhibit 7.2: Site Location and Transit Operations



F. Local Road Network

Elmer School Road runs along the west side of the NIHAC Campus. The primary entrance to the Campus is from Elmer School Road. Club Hollow Road runs along the north side splitting the North Parcel from the rest of the Campus. The access to the North Parcel is from Club Hollow Road. The state road nearest to the Campus is MD-107 which is due north and directly connected to Elmer School Road. MD-107 leads to MD-28 to the east through the Town of Poolesville, which in turn leads to I-270 near Rockville. MD-107 also leads to MD-109 near Poolesville, which connects to I-270 further north, near Hyattstown. It is also possible to connect to I-495 further south through River Road (MD-190).

G. Road Jurisdiction and Programs

There are four different agencies that maintain the roads in Montgomery County[1]. The Maryland State Highway Administration (MSHA) maintains all the state Interstate highways such as I-495, I-270 and I-370 and state roads that have MD- route numbers. State roads near the NIH site include MD-109, MD-107, MD- 28, and MD-190. Municipalities such as Poolesville maintain their own roads within their own jurisdictional boundaries while private roads are maintained by local homeowners associations. Montgomery County Division of Highway Services (DHS) is responsible for maintaining all remaining roads in the county including the immediate roads surrounding the NIHAC site.

The DHS maintained roads around Poolesville and the NIHAC site are designated as "rustic roads." The Rustic Roads Program provides a process for evaluating, protecting, and enhancing these scenic roadways[2]. These roads are among one hundred others across the County, typically within the agricultural reserve, highlighting the rural characteristics of the reserves. River Road (MD-190), which is to the south of the NIHAC site, runs parallel with the Potomac River and is designated an "exceptional rustic road" for the pleasing rural sites abutting it. The county has expressed an interest in preserving its character in perpetuity.

H. Planned Improvements

Many highway planning studies were done in the past which could have affected growth and development in the area immediately surrounding the NIHAC campus. The Washington Outer Beltway was conceived in the 1960s to build a second ring around Washington DC. The plan was discarded in the 1980s. However, rights-of-way were still set aside and segments of that plan were undertaken such as the Inter-County Connector (ICC) and the Montrose Parkway[3].

In neighboring Prince George's County, a recent transportation plan is recommending highway improvements to existing highways and a highway extension in the southern portion of the County with a possible connection to the ICC in the north[4]. These improvements are also in line with the Outer Beltway plan.

The Washington Bypass Studies that looked at building two bypasses on the western and eastern side of Washington DC travelling from Interstate 95 or 70 also could have impacted the NIHAC Campus. The project did not move forward because of criticism that it would not reduce traffic congestion on the Beltway, and would merely improve connectivity to the Dulles Airport and the Port of Baltimore at a considerable expense[5].

Despite the potential development pressures from planned highway projects, the County's intent to maintain the agricultural preserve and the natural landscape surrounding the NIHAC campus seem resilient. Its "Wedges and Corridors" plan, limiting one dwelling unit per 25 acres within the zone and enacting a successful transfer of development rights (TDRs) program are expected to retain the character of the area into the foreseeable future.

1 Montgomery County, MD - Departments and Agencies, Retrieved from Montgomery County Website at: http://www.montgomerycountymd.gov/hwytmpl.asp?url=/content/dot/highway/Hwy_MainLinkPg/CountyRoadMain.asp [Retrieved January 2010]

2 Montgomery Planning: Rustic Roads, Retrieved from M-NCPPC Website at: http://www.montgomeryplanning.org/community/plan_areas/rural_area/rustic_roads.shtm [Retrieved January 2010]

3 Retrieved from Greater Greater Washington Website at: http://greatergreaterwashington.org/post.cgi?id=1535. [Retrieved December 2009]

4 Retrieved from Greater Greater Washington Website at: http://greatergreaterwashington.org/month.cgi?month=01&year=2009. [Retrieved December 2009]

5 Scott Kozel, "Washington Bypass Studies," http://www.roadstothefuture.com/Wash_Bypass.html.

7.2 Site Access and Circulation

As indicated before, the site is located in western Montgomery County, Maryland, a rural area which is quite different from the urban and suburban areas of the County along the I-270 and I-495 corridors. Most properties in this section of the County consist of farmland or open space, and the local roads are typically one lane in each direction.

A. Site Access and Circulation

The access to the NIH site is located on Elmer School Road. It serves both employees and visitors and is controlled by a security booth that shelters the staff responsible for validating identification of all persons entering the site. The South Drive, which is the main entrance drive, is the primary east-west connector road, which divides the site into two sections, a northern and a southern plateau. The Drive extends further east and south, terminating at the outdoor field habitat. The northern plateau is accessed from Center Drive, a north-south roadway extending from South Drive.

B. Vehicular Circulation

After entering the site, private vehicles can travel directly to campus facilities utilizing South Drive and Center Drive and minor roads leading from them. The internal roadways generally consist of 22 to 24 feet, two-way, non-striped single lane roads with stop-sign control at intersections. Most buildings on the south side access parking lots and loading areas directly from South Drive. The buildings and parking lots on the north side utilize connector roads off of Center Drive. Private vehicle capacity constraints are very rare due to the low number of trips occurring on the site.

In addition to private vehicles for employees and visitors, there are occasional larger commercial vehicles for trash and recycling services, deliveries and other operations. As with personal vehicles, these vehicles must enter the site via the security gate at Elmer School Road and are screened. While the personal vehicles do not appear to have any complications traveling along the site, the larger vehicles may have challenges accessing certain areas due to the narrow roadway widths.

C. Pedestrian Circulation

Pedestrian activity is low, given the sprawling nature of the site. There are very few sidewalks on the site and the greater site is not topographically conducive to pedestrian activities. While walking between nearby buildings is easy, there is some steep terrain between building clusters. The cluster of buildings 110, 110A, 111 and 112 has sidewalks between the parking area along South Drive and these buildings, which facilitates pedestrian activity.

D. Bicycle Circulation

As with pedestrian circulation on the site, there is little bicycle accomodation, with no bicycle lanes on campus. Based on the Montgomery County Bikeway Map, there are no dedicated on-street bicycle lanes within a 5-mile radius of the site. However, bicycles do share the local roadways with automobiles.

Exhibit 7.3: Site Circulation

7.3 Parking

A. Parking Supply and Demand

On-site parking for the Campus consists of parking lots adjacent to each of the building clusters. These parking locations generally have fewer than 10 spaces with some exceptions, such as near buildings 102, 103 and 110. Overall, the site provides a total of approximately 120 striped parking spaces as shown on Exhibits 7.4 and 7.5. During site visits, the striped spaces were completely occupied in several areas. While several vehicles parking on non-designated areas, such as grass or un-striped pavement, other parking areas within the campus were nearly empty. This indicates the existing parking supply for the campus is not distributed appropriately across the site.

In addition to striped parking lots, there are several areas that could accommodate up to 21 additional vehicles. Based on observations, the peak demand is 134 spaces.

B. Parking Utilization

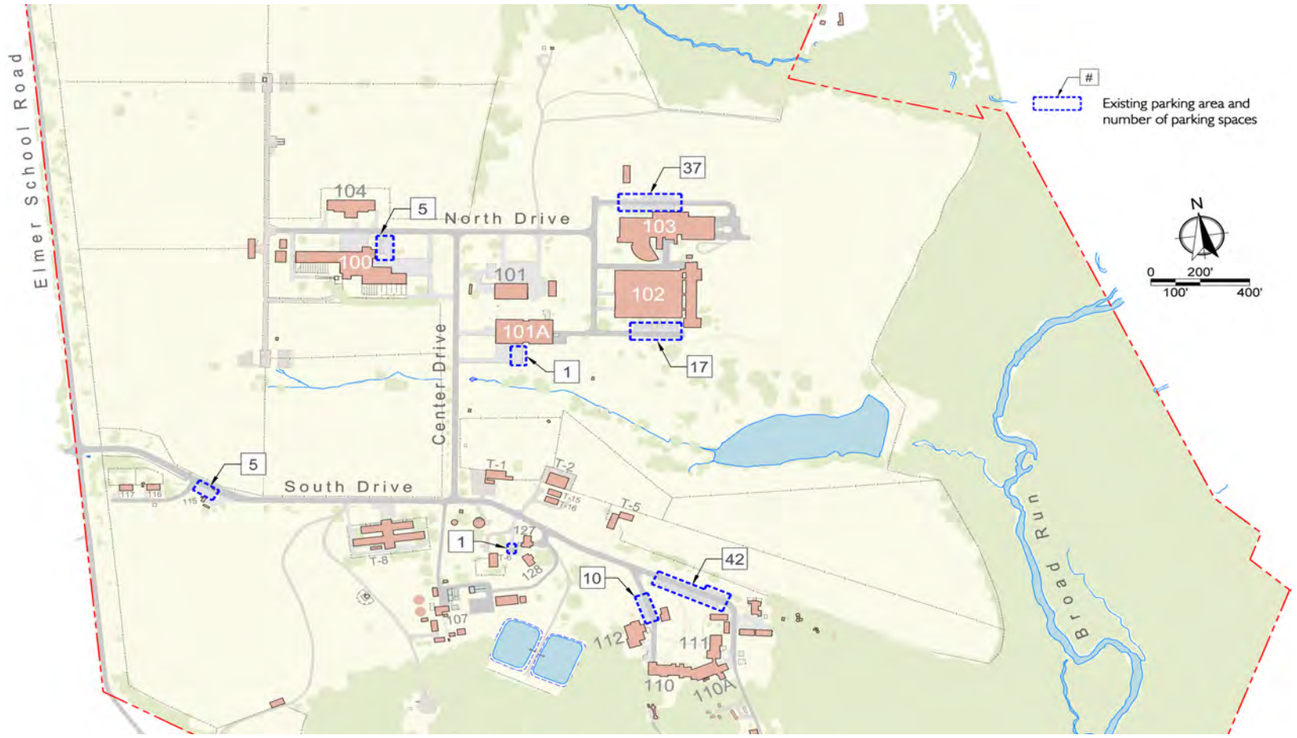
Based on the peak demand of 134 spaces, the site currently realizes a parking demand of approximately 0.67 spaces per person. The existing parking demands and the parking demand ratio are shown on Exhibit 7.4. This ratio is lower than expected for a site distant from non-auto modes of transportation. It is anticipated that 8-hour work schedules requiring a small staff on-site 24 hours a day limits the total number of staff on site at any given period of time.

Exhibit 7.4: Parking Supply and Demand

Building	Staff	Supply	Existing Demand	Notes
STRIPED SPACES				
102	18	17	27	10 non-designed parked vehicles*
103	39	37	37	
127-128	1	1	1	
100	5	7	7	
104	5	-	-	
110 Complex	79	52	54	2 non-designed parked vehicles*
TR24	3	-	-	
102-103	-	-	-	
101A	47	1	1	
Security	2	5	7	2 non-designed parked vehicles*
Subtotal	199	120	134	
NON-STRIPED				
101	-	6	-	
101A	-	15	-	
Subtotal	-	21	-	
Total	**199**	**141**	**134**	
Parking Ratio (spaces/person)			**0.67**	

*Non-designated parking includes vehicles parked in grass or un-striped paved areas

Exhibit 7.5: Parking Supply and Distribution



7.4 Building Connectivity

Building connectivity in the campus is limited. Throughout the NIH site, there are clusters of several small temporary buildings and trailers and larger individual buildings. Each of the clusters and larger buildings is separate and removed from the others. Given this lack of connectivity and the interactive nature of the work on campus, there is a perceived need for regular vehicle and pedestrian travel from one building to another.

7.5 Existing Conditions Analysis

To evaluate the transportation network serving the existing NIHAC site, capacity analyses were conducted at four (4) separate external intersections in the site area. Capacity analyses of the internal intersections were not conducted, because it was determined that there is no internal capacity constraints given the limited volumes realized on the internal campus network.

On-site intersections used by both private and commercial vehicles were assessed to confirm they provide adequate roadway and intersection widths to accommodate all vehicle types.

A. Data Collection

Turning movement traffic counts were conducted on Wednesday, November 9, 2011 at the four (4) intersections (see Exhibit 7.6) during the peak periods of 6:30 – 9:30 AM and 4:00 – 7:00 PM. In addition to the peak period turning movement counts, a field reconnaissance was conducted for documenting area speed limits, lane utilization and intersection operations (see Exhibit 7.7). Based on the collected data, it was concluded that during the morning and evening peak periods, the highest number of vehicle trips in the vicinity of the site occurred between 6:30 – 7:30 AM and 4:00 – 5:00 PM, respectively (see Exhibit 7.7).

B. NIHAC Staffing Levels

On the NIHAC campus there are a total of 199 staff members including secretarial, research, animal housing and care and security personnel. However, on any given day, the total number of staff on site at any given time does not reach this level as there are several part-time, contractors, and interns who do not report to the NIHAC campus on a daily basis.

C. Trip Generation

Based on the turning movement counts collected, the total number of trips during both the AM and PM peak was extrapolated. During the AM and PM peak period, there were only 51 and 18 vehicle trips in and out of the main entrance respectively. NIHAC staff work varying shifts, and some staff stay on-site overnight, both of which keep the trips low in the AM and PM. peak periods. All of these trips were shown to enter and exit from/to the north along Elmer School Road.

Exhibit 7.6: Study Area Intersections

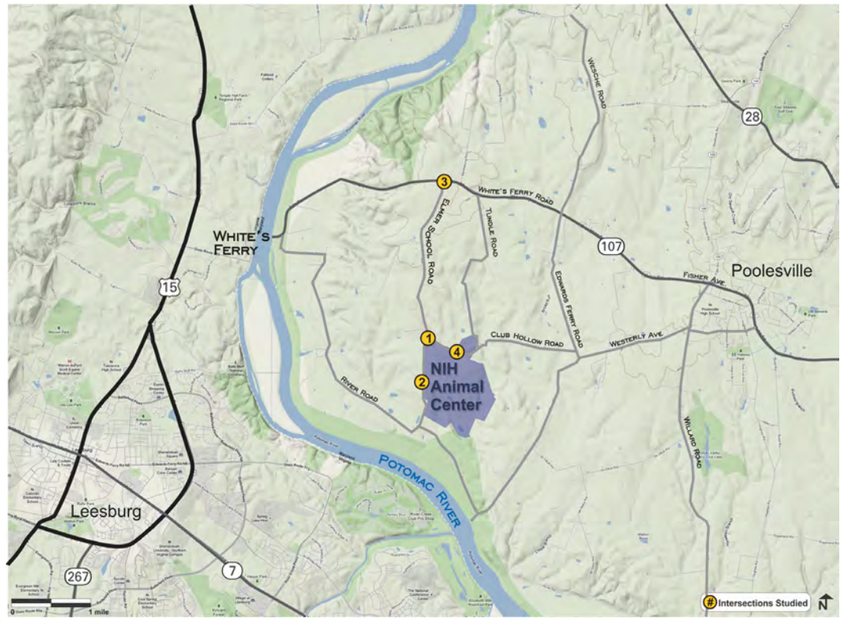
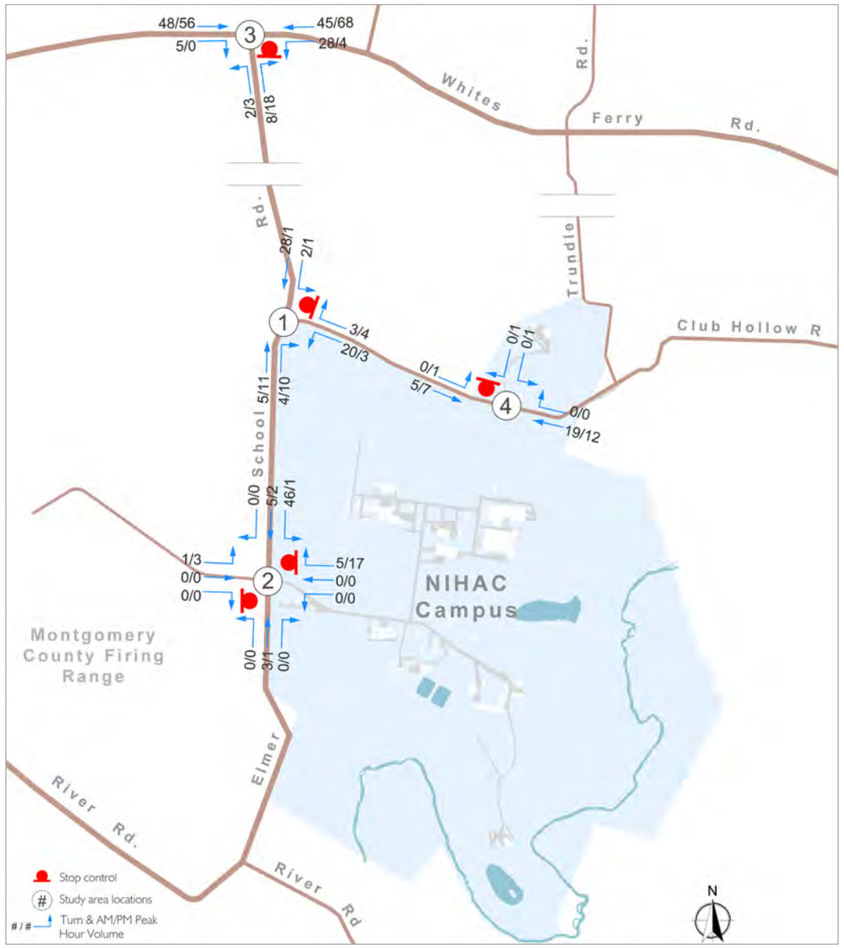


Exhibit 7.7: Existing Lane Use and Traffic Control



Note: Not to scale

D. Lane Utilization and Traffic Control

While collecting turning movement counts at the study area intersections, lane utilization and traffic control information was also documented. Each of the studied intersections operates as single lane, two-way roadways. All of the minor approaches at each intersection are controlled by stop signs, while the major approaches operate under free flow conditions (See Exhibit 7.7).

E. Capacity Analysis

By using the peak hour traffic volumes and the lane utilization and traffic controls, capacity analyses for each of the study area intersections was completed. This analysis utilized the Highway Capacity Manual (HCM) capacity analysis methodology included within the Synchro, Version 7.0 software. Given the extremely low traffic volumes in the area, each of the study intersections currently operate at acceptable levels of service during both the AM and PM peak periods. These results are shown on Exhibit 7.8.

Exhibit 7.8: Peak Period Capacity Analysis Summary

Intersection	Approach	Future Conditions			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
1. Elmer School Rd & Club Hollow Rd.	Westbound	8.8	A	8.5	A
	Southbound left	0.5	A	3.6	A
2. Elmer School Rd. & NIH Entrance/ Montgomery Co. Police Range	Eastbound	9.3	A	8.7	A
	Westbound	8.3	A	8.4	A
	Northbound left	0	A	0	A
	Southbound left	6.6	A	2.4	A
3. Elmer School Rd. & Whites Ferry Rd.	Northbound	8.8	A	8.8	A
	Westbound left	2.9	A	0.4	A
4. Government Driveway & Club Hollow Rd.	Southbound	0	A	8.5	A
	Eastbound left	0	A	0.9	A

7.6 Security operations

A. Entrance Security

When accessing the site, every individual is required to go through a detailed security screening. The complexity of the screening is based on the status of the individual (i.e. NIH employee or visitor) and time of the day. Below is a description of the security process:

- NIH Employees arriving between 6:00 AM and 6:00 PM are required to provide proper NIH identification only.
- NIH Employees arriving between 6:00 PM and 6:00 AM are required to provide government issued identification (such as a valid Driver's License) and state the purpose of their visit. The attending security person documents the vehicle make, model, and license plate number. A brief visual vehicle inspection is conducted.
- Non-NIH employees are required to provide government issued identification and state the purpose of their visit, regardless of the time of the day. The attending security person documents the vehicle make, model, and license plate number. A brief visual vehicle inspection is conducted.

These operations are conducted at the site entrance checkpoint. This is a single lane entrance with no opportunity for employees to bypass a lengthy queue. This queue typically extends to a maximum of 5 to 6 vehicles at peak periods with an average wait time of approximately 2-3 minutes per vehicle.

B. Site Security Monitoring

Security personnel travel on the various roadways and along the property perimeter to ensure the site is secure and to prevent potentially dangerous activities. The monitoring is done in all-terrain vehicles because there is no dedicated travel path along the perimeter fence. When near structures and roadways, they will utilize the existing road surfaces and operate as a standard passenger vehicle.

C. Site Security Issues and Concerns

Campus security is administered by the Division of Physical Security Management (DPSM) under the Office of Research Services (ORS). Issues were identified during a site visit that was attended by NIH's Security and Emergency Response staff, representatives from the Office of Research Facilities (ORF) and facility personnel from NICHD and DVR. The following were deemed to be primary concerns:

1. Secondary Access to the Site

The site currently has a single access point. A secondary access is considered good site planning practice particularly to facilitate egress and/or access to the site by emergency vehicles in the event that the main entrance becomes inoperable. A full service access was considered; although convenient, it was not included in the Master Plan because of staffing concerns. It was concluded that the second access point would best serve as an emergency only access to the site. Club Hollow is the preferred frontage for the emergency access point because it is removed from the Elmer School Road entrance and does not introduce a roadway through campus pastureland.

2. Enhance entrance security

The entrance security infrastructure and layout serving NIHAC are minimal. The single lane entrance holds up incoming traffic when security screenings are conducted. It was concluded that modifications to the entrance security would improve security operations.

3. Unsecured access to the residences near the entrance

There are two residences near the main entrance that are owned by NIH and used by NIH staff. The access road to the residences branch out from the entrance drive before the security checkpoint, allowing access to federal property without security screening. The perimeter fence also stops near the residences providing possible access to the site without clearing security. It was determined that the entrance security reconfiguration should also address this issue.

4. Perimeter fence near outdoor habitat

The outdoor habitat is located at the southern tip of the campus. The adjoining property is part of Chesapeake and Ohio Canal National Historical Park (C&O Canal NHP). This campus perimeter is wooded with portions that are under water for a good part of the year. Maintaining the perimeter fence in this location has been challenging for NIH since fast flowing water pushes it down. A permanent and effective solution requires an in-depth study and cannot be adequately addressed within the scope of the Master Plan. Accordingly, it was concluded that the issue will be noted in the Master Plan and its early solution would be recommended in the implementation plan.

5. Security requirements for parking lots and loading docks

NIH's policies and practices with regards to its facilities have changed substantially in the last ten years. Therefore, the current facilities are not in compliance with the latest security requirements in terms of location, configuration and access to parking lots and loading docks. It was recommended that the newer buildings consider these factors in the locating and orienting newer facilities. In addition, to extent possible, parking for the Central Utility Plant be relocated to allow minimum setbacks given it is the one of the most critical infrastructure on the campus. Also, to the extent possible, access controls should be incorporated at the loading docks for the buildings that are retained in the Master Plan.

8. Site Utility Infrastructure

8.1 Overview

Initial plans for the utility infrastructure for the Campus were prepared soon after the acquisition of the site by NIH in 1960[1]. Recognizing the need for future expansion of the facility to include additional animal care functions and associated water needs, a combination of wells and water from Broad Run was identified as potential sources[1]. A storage reservoir, stream intake structure, a Wastewater Treatment Plant (WTP) and an elevated storage tank were planned for the campus. By the completion of the first phase in 1965, a central utility plant as well as necessary water, sewers, electric power, steam, chilled water, and paved access road were all in place[1]. The successive phases augmented the site infrastructure to keep up with the expansion of the facility.

The utility infrastructure for the campus was built around the Central Utility Plant (CUP), Wastewater Treatment Plant (WTP), and the site's potable water system.

The CUP (Building 101) was planned to provide steam, chilled water, and emergency power to the campus and also house the electrical switchgear and ancillary equipment for distributing the incoming feed from the electricity provider. Accordingly, it was located near the center of the campus. The 1996 Plan recommended a substantial expansion of the old CUP. However, NIH decided to replace the old CUP with a new one, and add utility tunnels to serve the buildings on the north plateau (100, 104, 102 and 103). During the discussions with on-site NIH personnel, it was indicated that the south side buildings were also planned to be served by the CUP, and it was sized accordingly. However, extending the tunnels to the south has not been implemented. At present, the south side buildings are served by independent HVAC systems. The CUP only provides emergency power to these buildings.

The WTP is located on the south side of the campus. It was planned to treat the wastewater before disposing the effluent, as well as to produce gray water for offsetting the use of limited availability of potable water in the Campus. Currently three buildings on the north plateau are connected to the gray water distribution system—Buildings 101A, 104 and 103.

The potable water system essentially consists of 5 wells, four of which are located in the main parcel, and one in the north parcel. The four wells on the main campus are connected to the water tower, from which water is supplied to the rest of the campus.

Other site utilities include the storm water system and the communication infrastructure.

8.2 Central Utility Plant

The new 44,000 gsf Central Utility Plant (Building 101A) and utility tunnels were constructed in 2003 to replace the old CUP (Building 101). It provides steam and chilled water to approximately 250,000 gsf of building facilities located on the north half of the site. The new CUP and the tunnels are consistent with current technology in regards to reliability and efficiency and have significant remaining life. There are three chillers and four boilers within the utility plant with space allocated for an additional chiller and boiler. The CUP also houses the electrical switchgears for the incoming electrical feed from Allegheny Power Company, the power provider, and generators providing emergency power to the entire campus.

The CUP also includes office space for the operators and a control room for monitoring all the equipment.

1 Source: 1996 Master Plan and EIS

Exhibit 8.1: Existing Utilities

A. Steam and Chilled Water Production

The current cooling and heating loads of the plant were developed based upon data presented in the 2011 "Update and Assessment of Existing Utilities Infrastructure at NIH Animal Center Poolesville, MD" (referred to in this report as the 2011 Utility Infrastructure Assessment), conversations with plant operators, and unitary load factors. The peak cooling and heating loads were estimated to be 1,130 tons of refrigeration (tons) and 35,000 pounds of steam per hour (pph) of boiler output, respectively. According to the operators only one unit is needed for either the steam or cooling system to support the peak load requirements.

The total and firm capacities of the systems were also calculated. The total capacity represents the sum of all the generation units installed within the plant. The firm capacity is the system output without the availability of the largest single generation unit. It is an industry standard that the system firm capacity be maintained above the peak load of the system to achieve an adequate level of reliability. The firm capacities for the heating and cooling systems are presented below.

Exhibit 8.2: Firm Capacities for the Heating and Cooling Systems

Unit No.	Heating Capacity (pph)	Cooling Capacity (tons)
1	37,300	1,200
2	37,300	1,200
3	15,000	1,200
4	15,000	–
Total Capacity	104,600	3,600
Single Largest Unit	37,300	1,200
Firm Capacity	67,300	2,400

There are two vaulted underground fuel storage tanks to support the CUP. Each tank can store 50,000 gallons of fuel oil. Although these are underground, since they are vaulted they are considered Above-ground Storage Tanks (ASTs) from operational and regulatory perspectives.

B. Steam and Chilled Water Distribution

The utility tunnel installed with the Central Utility Plant facilitates the distribution of steam and chilled water piping to Buildings 100, 102, 103 and 104. This infrastructure is in excellent condition with adequate room for expansion, if necessary. The main chilled water flows through a 16-inch diameter set of supply and return lines that leave the plant and split into two sets of 12-inch diameter mains. Based upon a maximum piping velocity for welded steel of 12 feet per second (fps) and a 10°F (- 12°C) system temperature differential, the existing 16-inch main distribution line can support a cooling load of approximately 2,700 tons. The 12-inch diameter mains can support approximately 1,400 tons each. The conclusion that the existing distribution has significant additional capacity is consistent with the 2011 Utility Infrastructure Assessment.

Similarly, the steam distribution system includes a 16-inch diameter main leaving the plant which branches into two 12-inch mains. Based upon a maximum steam velocity of 12,000 feet per minute (fpm) the 16-inch main at a supply pressure of 100 pounds per square inch [gauge] (psig) is capable of supporting a load of approximately 200,000 pph. The 12-inch mains can support approximately 130,000 pph each.

C. Electrical System

The site is provided with electric power from Allegheny Power Company at a voltage of 12.47 kilovolts (kV). The on-site infrastructure consisting of the utility feeder and switchgear are sized to support a load significantly higher than the recorded 2,791 kilowatts (kW) peak demand noted in the 2011 Utility Infrastructure Assessment. The Allegheny Power Company reviewed the incoming services and concluded that the system could support a 50% increase in peak load[2].

The on-site emergency power system consists primarily of four 1,450 kW engine generators in Building 101A to back up the CUP. In addition, individual building specific generators are available for the major south campus buildings. For the CUP emergency power, assuming one standby unit, the output of three engine generators would be approximately 4,350 kW which is over 50% greater than the existing peak load of 2,791 kW.

The unitary load factors for the chilled water and heating systems were developed based on current coverage and loading. The existing loads on the CUP appear to be higher than an expected range for the area and the characteristics of the facilities served. Based upon the current system loading, the existing facilities appear to be significantly inefficient and do not derive any benefits from heat recovery systems. The existing CUP appears to have adequate capacity to support existing and future load requirements.

Exhibit 8.3: Unitary Load Calculations

System	Peak Load	Area served	Unitary	Expected Range*
Chilled water	1,130 tons	249,000 gsf	220 gsf/ton	250–300 gsf/ton
Steam	35,000 pph	249,000 gsf	140 Btu/hr/gsf	50–80 Btu/hr/gsf

*The expected range is an engineering opinion based upon an animal holding space with some ancillary support space.

8.3 Wastewater Treatment Plant (WTP)

The potable, non-potable and sanitary treatment systems functions are dependent upon one another. Potable water is supplied to the site where it is used and discharged to the sanitary system. Sanitary collection is treated at the Wastewater Treatment Plant (WTP) and a portion is recycled to the system for non-potable use. The sanitary flow that is not recycled is discharged as effluent.

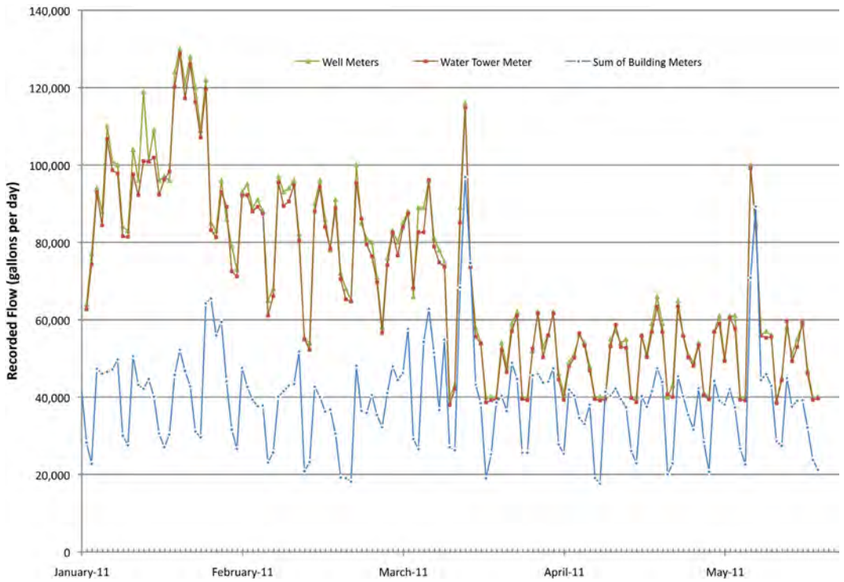
The system currently has the following restrictions or limitations:

- Maximum Daily Well use Permitted: 90,000 gpd
- Wastewater Treatment Plant (WTP) Processing Capability: Approximately 120,000 gpd[3]
- Maximum Effluent Discharge Permitted: 100,000 gpd

A generalized schematic of the operation is presented in Exhibit 8.6.

2 Source: Teleconference with Jeff Thompson on September 8, 2011
3 The design capacity is 100,000 gpd

Exhibit 8.4: Summary of Potable Water Usage January 2011–May, 2011



A. Potable Water

The entire site is supplied potable water from five wells. Four of the five wells are located on the main campus, and are connected to the on-site water tower. The fifth well is on the north parcel and serves that portion of the site. The use of one of the well heads (Well 1) was discontinued in 2005 and replaced by a new well head (Well 1A).

The potable water is distributed to all the buildings on the main campus from the water tower.

According to the 2011 Utility Infrastructure Assessment, the current Maryland Department of the Environment (MDE) permit restricts water extraction from the wells to 90,000 gallons per day (gpd). Potable water usage for early 2011 is shown in Exhibit 8.4. Water usage records from January 2011 through May 2011 indicate a typical daily water consumption of 50,000 to 60,000 gallons per day as shown in Exhibit 8.4. This repair project is still in progress and daily water withdrawal rates is expected to undergo further reductions in the future.

For planning purposes an existing peak day usage of 60,000 gpd with an estimated 10,000 gpd transmission loss rate was used. Recent building meter data was used to divide potable water use into the following three categories:

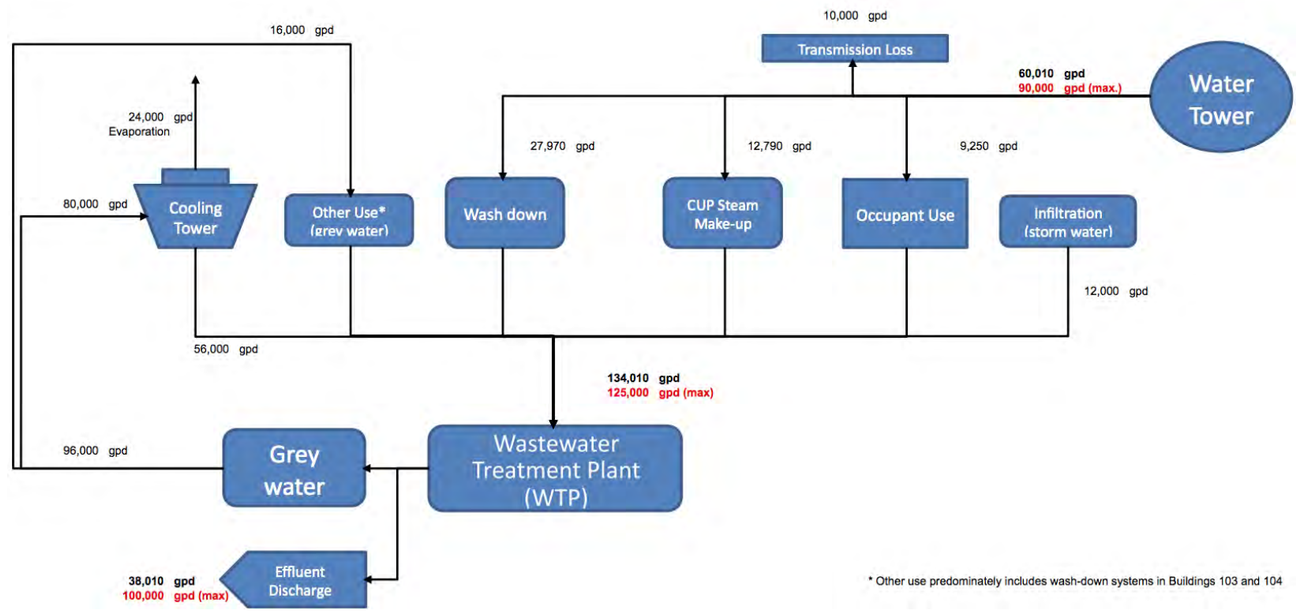
- water used by the occupants including human and non-human primates;
- water used for wash down of existing animal facilities; and
- make-up water for the campus steam system

A summary of the potable water usage is presented in Exhibit 8.5.

Exhibit 8.5: Summary of Potable Water Usage Data

Building No.	Type	Non-coincident Peak Day Meter Data (gpd)												Coincident Peak (gpd)		
		Aug 2010	Sept 2010	Oct 2010	Nov 2010	Dec 2010	Jan 2011	Feb 2011	Mar 2011	Apr 2011	May 2011	Average	% of Total	Total	CUP Make-up	Occupant & Wash down
101A	CUP	25,575	23,757	20,415	22,383	35,673	25,720	27,522	18,717	17,475	15,512	23,275	25.6%	12,790	12,790	
100	Animal Facility	1,866	2,190	3,787	466	1,318	796	766	628	997	873	1,369	1.5%	750		750
104	Animal Facility	1,436	1,876	1,423	1,418	15,716	1,550	11,689	3,900	1,587	1,671	4,227	4.6%	2,320		2,320
110	Office/Animal Lab	688	2,712	804	746	21,947	2,685	539	403	570	2,800	3,389	3.7%	1,860		1,860
110A	Animal Facility	34,389	4,346	4,672	4,930	5,456	9,882	5,609	4,834	5,728	4,691	8,454	9.3%	4,650		4,650
111	Animal Facility	173	222	114	153	109	129	178	182	117	1,119	250	0.3%	140		140
112	Animal Facility	2,098	3,191	6,130	3,259	6,864	3,877	2,745	6,564	7,878	6,733	4,934	5.4%	2,710		2,710
T-18	Office	69	4	–	–	–	–	–	–	–	–	7	0.0%	–		–
127	Animal Facility	5,363	1,089	760	692	717	24,329	542	243	233	339	3,431	3.8%	1,890		1,890
128	Animal Facility	238	1,109	1,186	2,511	2,381	2,321	1,766	1,592	1,503	854	1,546	1.7%	850		850
102	Animal Facility	34,334	39,187	21,240	32,975	12,480	5,578	4,796	25,000	8,337	7,621	19,155	21.1%	10,530		10,530
102-2	Animal Facility	3,388	3,936	686	685	724	950	1,370	–	–	–	1,174	1.3%	650		650
103	Animal Facility	18,971	19,705	14,103	12,796	15,502	13,070	11,650	14,468	17,822	15,925	15,401	16.9%	8,460		8,460
103-2	Animal Facility	3,943	4,792	4,167	3,585	3,369	3,299	2,818	–	–	–	2,597	2.9%	1,430		1,430
132	Habitat Shelter	881	9,946	864	1,059	731	802	1,101	800	906	735	1,783	2.0%	980		980
Building Total		–	–	–	–	–	–	–	–	–	–	**90,991**	–	**50,010**	**12,790**	**37,220**
Transmission Losses		–	–	–	–	–	–	–	–	–	–	–	–	10,000	–	
Total Demand		–	–	–	–	–	–	–	–	–	–	–	–	**60,010**	–	

Exhibit 8.6: Site Water System – General Schematic (Existing Summer Use)



B. Non-potable Water

Gray water (non-potable) is supplied to the campus through a separate system of pipes. Gray water is the discharge water after treatment at the on-site Wastewater Treatment Plant (WTP). The majority of the gray water is used at the CUP for condenser water make-up in the cooling towers. The gray water system has two storage tanks which can hold 250,000 gallons of water each.

Based upon meters at each building for potable water and estimates for gray water use, an approximate breakdown of building water usage was developed. According to the 2011 Utility Infrastructure Assessment the non-potable (gray water) peak flow was estimated to be approximately 96,000 gpd of which the study estimates 80,000 gpd is being supplied to the CUP. This flow was estimated based upon a peak day cooling load of 22,800 ton-hours and a condenser water make-up rate of 3.5%. Typically 1% of the make-up water is used to replace the water evaporated and an additional 1% is supplied to replace (blow down) water that is removed to maintain the desired level of Total Dissolved Solids (TDS). For the CUP, a 2.5% blow down rate was used, based upon a high level of TDS. According to the operators the high level of TDS in the gray water system requires the cooling towers to have a more frequent blow down cycle than a typical cooling tower. The more frequent blow down cycle results in the higher than normal make-up water rate. High levels of TDS can cause scale build-up on the piping and equipment of the condenser water system. The blow down flow is returned to the Wastewater Treatment Plant (WTP).

The 8-inch PVC piping for the gray water system has a capacity similar to the 1.24 million gpd capacity of the 8-inch ductile iron main potable water line per the 2011 Utility Infrastructure Assessment. The condition of the piping, however, is unknown.

C. Sanitary Sewer Collection and the Wastewater Treatment Plant (WTP)

The facility has an on-site Wastewater Treatment Plant (WTP) which is currently at (and sometimes beyond) its capacity with the current development on the campus. The design capacity of the plant is approximately 100,000 gpd based upon the nitrification units. Redundancy provided by the small nitrification basin and lagoons will support a plant process rate of approximately 120,000 gpd. When the collection rate exceeds the available capacity, flow is diverted to one of two 1.4 million gallon lagoons used for temporary storage.

At times, the capacity of the plant is exceeded when the cooling towers are operating near peak and/or rain events occur. Blow down from the cooling towers at the CUP generates a significant load and on a peak day, it is estimated to be 56,000 gpd (80,000 gpd make-up rate with a 24,000 gpd evaporation rate). When that coincides with wash downs of large animal areas in the animal buildings, the total flow to the plant gets significantly impacted. In addition, it was reported that the roof leaders of several north campus buildings including 104, 101, and the pre-expansion portions of 102 connect to the sanitary system. It is possible that this design of connecting the roof leaders to the sanitary was for the purposes of creating additional gray water, but it is currently an unnecessary load on the system.

The collection piping was estimated to have a collection capacity of 1.24 million gpd according to the 2011 Utility Infrastructure Assessment.

8.4 Storm Water System

The storm water system consists of a network of reinforced concrete pipes, some plastic pipes and natural and concrete stormwater ditches. There is a drainage swale that runs east-west along the middle of the site, leading to a reservoir near the eastern boundary of the property. Drainage from the north side buildings 103, 102 and 101A is subject to pretreatment in stormwater management facilities before it is discharged into the drainage swale. Drainage from buildings 101 and 104 flows into the swale through a series of culverts and drainage ditches. Building 107 and ancillary WTP buildings drain into the swale to the south of the buildings. Most of the other south campus buildings drain into the stream network.

8.5 Data and Communications

The Campus has fiber network connectivity for internet and phone service. The current 6Mbit/s connectivity to the Bethesda Campus is slated for an upgrade to DS3 signal level, increasing it to 45Mbit/s. The primary ductbank is located in the CUP, and has a 4 hour uninterrupted power supply (UPS) back-up. All the buildings have single/multimode copper cabling connections capable of supporting 10 gigabit bandwidths, with available spare capacity. The system does not have redundancy as it consists of a single hub. The individual buildings only have a connection box and not proper intermediate distribution frames (IDFs). The distribution cabling within the buildings are aged resulting in slow connectivity.

9. Space Program for the Master Plan

The space program is an instrument to determine area requirements by space types for master planning purposes. It has been used to define the space needs for NIH's mission at NIHAC. The program for the Master Plan has been projected for five phases (current need and Phases 1 through 4) spanning 20 years. The short-term space projections are usually the most accurate; nevertheless, the longer term projections in this Master Plan will create a framework for incremental growth over time.

9.1 Summary of the Optimal Program

The "Optimal Program", as explained in Section 9.2, is developed by applying guidelines and standards to project requirements without consideration for limitations in existing facilities. In other words, if brand new facilities were built to accommodate NIH's needs at NIHAC, the space identified in the Optimal Program could reasonably accommodate that.

The current need as identified in the Optimal Program is about 273,700 gross square feet (gsf), about 87,900 gsf less than current space inventory of 361,600 gsf. This difference is due to inefficiencies and the distributed organization of the facilities. Over the 20 year planning horizon, the projected space need is 424,400 gsf, an increase of 150,700 gsf over the current need and 62,800 gsf over the actual current inventory.

The increase in space requirement as projected in the program is primarily a result of an increase in the animal population, particularly non-human primates, to be accommodated at NIHAC. This anticipated need impacts not only the animal holding and care spaces, but the associated procedure spaces. It will require a marginal increase in employee population, office space and organizational support spaces.

Animal Support and Research Support space needs are projected to undergo substantial increases to support an approximately 67% increase in the NHP requirement over the planning horizon. Office, organizational support and employee support space needs are projected to increase by approximately 46%. This is to address the current inadequacy in office spaces and support spaces, a majority of which is housed in temporary structures and trailers at present. Storage areas, currently scattered throughout the campus in small temporary sheds are proposed to be consolidated into a shared centralized storage facility. The entrance security is proposed to be enhanced to enable appropriate visitor and vehicle screening capabilities. Utilities, infrastructure support area requirements are expected to remain at their current levels as are residential uses.

Exhibit 9.1: Summary of the Optimal Program for NIHAC*

	Current Need	Phase 1	Phase 2	Phase 3	Phase 4
Animal Holding/Care	145,741	179,240	198,923	222,532	248,009
Research Support	29,174	37,037	41,263	46,447	51,857
Office/Employee Support	35,923	44,059	46,824	50,372	52,530
Shared Centralized Storage	–	8,400	8,400	8,400	8,400
Security	606	1,320	1,320	1,320	1,320
Central Utilities/Maintenance	56,046	56,046	56,046	56,046	56,046
Residential	6,246	6,246	6,246	6,246	6,246
TOTAL	273,736	332,348	359,022	391,364	424,408

*All numbers are in Gross Square Feet (GSF) and do not include semi-outdoor runs, loafing sheds, outdoor animal areas or field storage sheds. Subsequent phases show cumulative figures.

9.2 Space Program Methodology

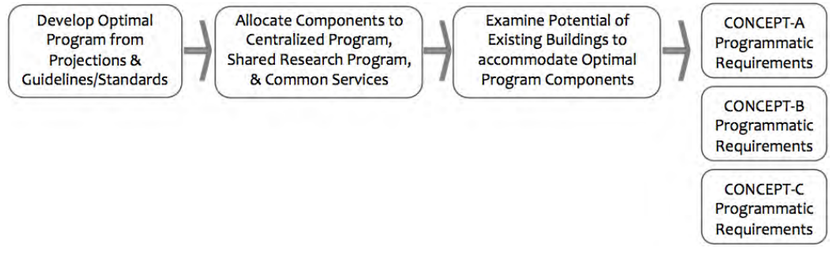
In a typical programming exercise, current space requirements are assessed based on program needs and then compared to available spaces to determine shortfall or excess. Future requirements are projected and current shortfall is added (or, in case of excess, subtracted) to form the basis for a master plan. In case of the NIHAC Master Plan, the typical programming methodology was deemed inappropriate. Both current space requirements as well as the shortfall determination were complicated due to several factors, the most important being:

- Inefficiency and lack of flexibility in current facilities: Most of the existing facilities are old and inefficient from functional and operational standpoints. Many of the existing animal areas are species-specific and are not conducive to supporting the demand for changing animal mix. Judging purely by physical condition, some of these facilities are sound. Therefore, it is not reasonable to replace all these facilities. Instead, for optimal utilization, these facilities can potentially be reorganized and/or expanded. While such reorganization and expansions will improve functionality and possibly efficiency, those buildings will still not be as functional or efficient as newly constructed facilities.
- Potential for having common facilities: Currently none of the animal support, staff, and staff support spaces serve both the centralized programs and the shared programs. However, based on the user and institute interviews, there is a desire to share some of the support services to make the campus more efficient.

To account for these factors, a different approach was adopted for the space program for NIHAC (See Exhibit 9.2). First, an "Optimal Program" was prepared based on assessed current requirements as well as future 5-year, 10-year, 15-year and 20-year requirements. This Optimal Program is based solely on animal and staff projections and applicable standards and guidelines without considering functional, operational and efficiency limitations in existing facilities. These requirements were then allocated to the Centralized Program (currently managed by DVR), the Shared Research Program (currently led by NICHD) and potential Common Facilities (currently none). In the second step, all major existing buildings were examined to determine their ability to accommodate components of the Optimal Program with minimal reorganization and/or additions. Remaining components formed the basis for new facilities. Thus, the Optimal Program and the existing building analysis collectively formed the programmatic basis for each of the three Master Plan development concepts.

Each Master Plan Concept pursued a different approach regarding retention of existing facilities and locating potential new facilities. Accordingly, three different sets of programmatic requirements were developed for the three Concepts.

Exhibit 9.2: Space Program Methodolog



9.3 Development of the Optimal Program

Information collected from a multitude of sources was analyzed for the identifying the requirements in four key areas: Animal Holding, Care, and Research Spaces; Personnel and Organizational Support Spaces; Employee Support and Other Support Spaces; and, Infrastructure Spaces.

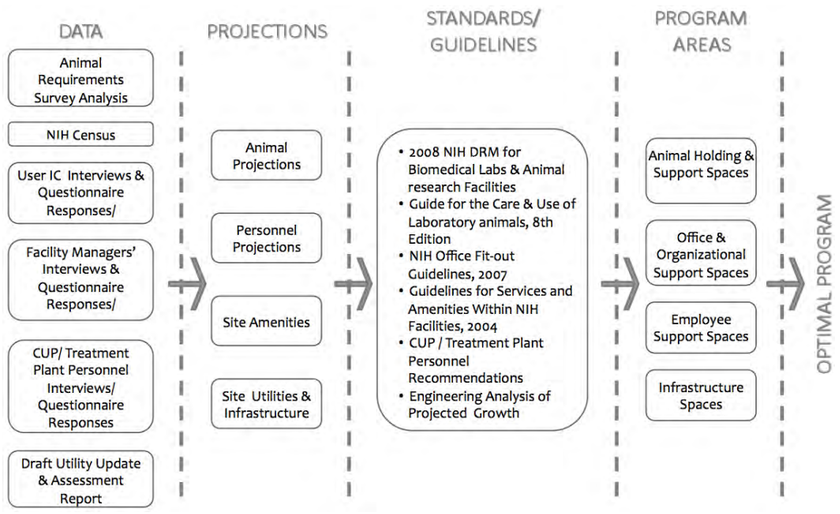
Animal Holding, Care, and Research Spaces were primarily based upon an analysis of the Animal Requirements and Capacity Survey conducted by the NIH Animal Research Subcommittee (ARSC) in late 2010. Recommendations of the ARSC, input from the Institutes currently having animals in NIHAC, and comments from the facility managers at NIHAC were taken into account to determine the Animal Holding, Care, and Research Space requirements.

Current employee counts, including facility support staff, were obtained from NIH and checked against personnel counts provided by the ICs operating at NIHAC. Personnel projections were provided by each of the ICs through questionnaire responses. Where appropriate, additional personnel were included based on animal projections considering acceptable animal spaces to care personnel ratios.

Employee support space provisions were primarily based on NIH's guidelines. However, these provisions were adjusted for the unique location of the campus given that the nearest off-campus provisions are available in downtown Poolesville, about 4 miles away.

The draft report titled "Update and Assessment of Existing Utilities Infrastructure at NIH Animal Center" was the primary source on existing conditions of utilities. The findings were checked against information collected from NIH facilities staff at the Central Utility Plant (CUP) and the Wastewater Treatment Plant (WTP) regarding capacity, conditions, loads, and planned improvements. Requirements for infrastructure expansion and enhancements were estimated for projected space requirements for Animal Holding, Care, and Research spaces; Personnel and Personnel Support spaces; and, Amenities and Other Support spaces. Exhibit 9.3 outlines the process for the Optimal Program development.

Exhibit 9.3: The Optimal Program Development Process



A. Animal Requirements & Capacity Survey

In 2004, NIH published a study titled "Animal Facilities Strategic Planning Study of Animal Facility Capacity and Projected Requirements". Capacities were standardized to mouse cage equivalents for rodents and small animals and non-human primate cage equivalents for caged large animals. Open runs were also included. The results were bench marked and used for projecting requirements for 2005, 2008, 2014 and 2020 for the Bethesda area.

When the NIHAC Master Plan was kicked off in 2009, NIH determined that a reassessment of the needs for animal facilities was imperative. Accordingly, NIH management decided to assess the current status and projected needs of its animal research care programs nationwide to make associated policy decisions. In 2010, the ARSC was formed by NIH's Facility Working Group (FWG) to primarily "document NIH's current, and project future NIH animal requirements"[1]. The ARSC decided to conduct a survey to update the 2004 study and June 1, 2010 was determined as the snapshot date for the survey. The objective of the survey was to document available capacity (by animal type) in all NIH animal facilities nationwide and project animal requirements (by animal type) and location for each IC for 2015, 2020, 2025 and 2030.

The collected data was compiled by ORF staff. The capacity data was broken down by campus and building; but, the requirements data was provided for larger areas which included multiple campuses. The capacity and requirements data for the Bethesda Area (summarized in Exhibits 9.4 and 9.5 respectively) informed the space program for NIHAC. The following conclusions were drawn for the Bethesda Area from the capacity and requirements data:

- Large Animals capacity exceeds projected requirement. The excess capacity should be converted to higher need.
- NHP requirements projected for the Bethesda Area will exceed capacity by 2017.
- Rodent requirements can be supported in the Bethesda Area until 2020 when the rodent capacities in leased facilities with expiring leases will need to be accommodated on the Bethesda Campus or in new leased space.

After reviewing the survey results and findings, the ARSC made the following preliminary recommendations for the Bethesda Area facilities:

- Accommodate projected NHP requirements in the Bethesda Area on the Bethesda campus and NIHAC. NHPs undergoing surgical intervention and imaging will be housed on the Bethesda campus. NIHAC facilities are to be used for behavioral studies, housing between interventional studies and vaccine studies. Contract NHP breeding colonies are not to be brought to NIHAC.
- Large animal capacities are to be maintained for 60 animals on the Bethesda Campus and 100 animals on NIHAC campus; remaining capacities on each campus are to be converted to other uses.
- Rodents facilities at Bethesda are to be used for research and breeding. Rodent facilities at NIHAC are to be used for quarantine.

Exhibit 9.4: ARSC Survey - Summary of Capacity by Animal Type for the Bethesda Area[1]

	Large Animals	Rodents	NHP Caged	NHP Grouped	NHP Total
POOLESVILLE					
NIHAC 100	26				
NIHAC 102	200		274		274
NIHAC 103			1,638	352	1,990
NIHAC 104			80	80	160
NIHAC 110A		640	150	25	175
NIHAC 112			84	120	204
NIHAC 127		150			
NIHAC 128		220			
NIHAC 132			20	200	220
Subtotal	**226**	**1,010**	**2,246**	**777**	**3,023**
OTHER BETHESDA AREA					
Bethesda Campus Rockville Pike, Bethesda, MD	138	174,483	1,468		1,468
5510 Nicholson Ln North Bethesda, MD			450		450
9600 Medical center Dr Rockville MD		6,500	100		100
Research Boulevard Rockville, MD			25		25
12441 Parklawn Dr (TB II) Rockville, MD		4,960			
12735 Twbrk Pkwy (TB III) Rockville, MD		3,694			
5 Research Court Rockville, MD		3,700	60		60
5625 Fishers Lane Rockville, MD		8,906			
Subtotal	**138**	**202,243**	**2,103**		**2,103**
GRAND TOTAL	**364**	**203,253**	**4,349**	**777**	**5,126**

Exhibit 9.5: ARSC Survey—Summary of Projected Requirements by Animal Type for the Bethesda Area[2]

YEAR	Large Animals	Rodents	NHP Caged	NHP Grouped	NHP Total
2010	105	175,809	3,686	972	4,658
2015	120	183,181	3,714	1,694	5,408
2020	135	195,226	4,018	1,730	5,748
2025	150	206,218	4,413	1,767	6,180
2030	165	214,193	4,848	1,807	6,655

1 The numbers represented here are summarized from the adjusted survey results reviewed and agreed to by ORF.

B. Institute and Facility User Inputs

The requirements identified in the ARSC Survey were for the entire Bethesda Area for each Institute. To identify requirements specific to NIHAC, information was gathered from each Institute having animals in NIHAC through questionnaires and interviews. Information on current research, future research trends vis-a-vis animal use and implications for NIHAC were collected. Potential improvements, enhancements and technology needed for future campus uses impacting space and infrastructure were covered. The following are some of the common threads in these interviews:

A. Expect animal increase
- Growth in both routine/quarantine holding and in research program housing
- Non-human primates expected to dominate

B. Configure flexible facilities
- Respond to the dynamic nature of research
- Accommodate variety in species, apportionment, separation, and containment

C. Add clinical support - imaging facilities, procedure rooms, diagnostic labs, and freezers

D. Provide adequate and appropriate procedure & facility support spaces
- Improve ratio of procedure/ facility support to animal holding spaces
- Improve proximity between housing and procedure as well as housing and support

E. Upgrade infrastructure - HVAC capability, IT connectivity, and energy efficiency

F. Recognize influence of funding

G. Keep investigators' laboratories on the Bethesda campus

Facility user inputs were gathered from facility managers through observations during walkthroughs, interview sessions and questionnaires. This information covered functional and operational issues, potential of sharing facilities, physical conditions, deficiencies, and needs and priorities from a user's perspective. Campus-wide and building specific issues were captured separately.

Exhibit 9.6: Animal Counts Recorded at NIHAC for February 2011

Building	NHP	Rodent	Swine	Bovine	Equine	Canine	Sheep
100			17	1			8
102	152					21	
103	986						
104	104						
110A	129	958					
112	200						
127*		102					
128*		102					
132	172						
T-1			9				
T-2					6		
Campus Total	**1,743**	**1,162**	**26**	**1**	**6**	**21**	**8**

*Animal counts reported were cage equivalents. 34 cages translated to a count of 102 based on 3 mice per cage

Exhibit 9.7: Summary of IC interviews

NIA	Current Research:	Nutritional & behavioral studies with NHP
	Future Research:	Same program and animal capacity
	Facility Implications:	• Additional procedure/support rooms – meet shortfall • Additional behavior lab – meet shortfall • New shared imaging / research lab – improve program • Additional office space – meet shortfall + growth
NHLBI	Current Research:	• Housing for rhesus: pre/post bone marrow transplant & gene therapy • Quarantine/ housing of pigs, dogs, NHP
	Future Research:	Same program and animal capacity
	Facility Implications:	• Retain existing procedure room • New shared imaging / research lab – improve program • New hoteling office space – accommodate visiting IC personnel
NIMH	Current Research:	• Quarantine/holding for NHP core • Transgenic mice program • Behavioral studies on rhesus & marmosets
	Future Research:	• Quarantine/holding program to remain unchanged • Transgenic mice program to end in 2 years • Behavioral studies to return to Bethesda
	Facility Implications:	• Existing space for mice program & behavioral studies no longer needed • Office space no longer needed (NIMH staff on campus) • New shared imaging / research lab – improve program • Potential for NHP breeding program if cost effective, replacing southern program
NIAID-VRC	Current Research:	Animal holding (NHP) for vaccination, immune response & challenge studies
	Future Research:	Same program; expanded capacity by approximately 5%
	Facility Implications:	• Additional holding & related procedure space – for expansion • New hoteling office space – accommodate visiting IC personnel • Potential for NHP breeding program if cost effective, replacing southern program
NIAID-DCR	Current Research:	• Quarantine, conditioning & holding of NHP • ABSL-2 infectious disease research on NHPs
	Future Research:	• Quarantine/holding program to expand (20-40 paired macaques to 40-60) • ABSL-2 research to increase; would like to include ABSL-3 work
	Facility Implications:	• Additional holding space – accommodate expansion • Additional procedure/support rooms – meet shortfall and expansion • New ABSL-3 facilities – not to be added based on ARS direction • New shared imaging and telemetry – improve program • Additional office space – meet shortfall
NIAID-DIR	Current Research:	• Quarantine & holding of variety of NHPs • Infectious disease research on NHPs • Quarantine & holding of large animal – e.g., horses, dogs
	Future Research:	• NHP Quarantine & holding to expand • Infectious disease research highly variable, expected to increase • Same large animal program with lower numbers
	Facility Implications:	• Additional holding space – meet shortfall and expansion; increase housing flexibility– accommodate variety in species/research direction • Additional procedure/lab/support rooms – meet shortfall and expansion • New shared imaging / research lab – improve program • Additional office space – meet shortfall • Potential for specialized mouse breeding – reduce/eliminate expensive contract services
NCI	Current Research:	• Breeding of Patas monkeys; holding of Rhesus on DVR side • Vaccine & antiviral drug studies on Patas
	Future Research:	• Interest in a breeding colony producing 35 rhesus NHP per year • Holding of Rhesus to expand – new protocols / possibly relocate contract use • Drug studies to expand if cost effective compared to contract facilities
	Facility Implications:	• Additional rhesus NHP holding space – meet expansion/relocation • Additional procedure/surgical/support rooms – meet possible relocation from contract • New shared imaging / research lab – improve program • New hoteling office space – accommodate visiting IC personnel • Potential breeding colony for rhesus if cost effective
NICHD	Current Research:	• Breeding, nursery, housing for several NHP species • Field habitat for NHPs • Behavioral and cognitive development studies of NHPs
	Future Research:	• Breeding and housing program expected to grow modestly • Same research studies, with modest growth
	Facility Implications:	• Improved breeding, nursery & housing – maintain quality care • Improved procedure/support rooms – meet shortfall and quality • Consolidate storage – meet shortfall & locational issues • New shared imaging and tissue storage – improve program • Additional office space – meet shortfall and growth
DVR	Current Research:	Quarantine of incoming animals for various IC research programs
	Future Research:	Same mission, with expected growth and shift in animal species
	Facility Implications:	• Convert under-utilized space to multi-species housing – increase capacity/quality • Replacement of aging buildings and inefficient systems – improve efficiency/quality • New lab space, procedure rooms, offices – support on-site use by ICs • New warehouse, loading dock, truck dock, other support – improve DVR operations • Upgrade site & building infrastructure and equipment – improve operations & safety

C. Animal Projections for NIHAC

The ARSC survey projected requirements for the entire Bethesda Area which included the NIH Main Campus, NIHAC and other contract and leased facilities in the Rockville-Bethesda Area. Projecting animal population specifically for NIHAC was therefore dependent on several factors including:

- Change in capacity at the main campus due to planned replacement of old and construction of new facilities (for example, the Building D study)3;
- How the changes in requirements and capacities are handled with respect to their allocation among the available owned, leased and contract spaces; and
- The operational, functional and budgetary nuances that each Institute has to consider in deciding where to keep their research animals

When the user ICs were interviewed, the above mentioned factors were discussed at length with regard to the challenges and opportunities at NIHAC.

The projected requirements for the various types of animals were determined by reconciling the information from the ARSC Survey data, discussions and deliberations at the ARSC meetings, and the IC user inputs from the questionnaires and interviews. The following outlines the primary considerations in determining the projections for the various animal groups.

1. Non-Human Primate Population

Currently NHPs are housed either in cages or in groups. Projections for caged and grouped NHPs were identified separately.

Caged NHPs in the Bethesda Area, at present, are housed on the Bethesda Campus and NIHAC, as well as in several leased and contract facilities. The ARSC recommended that NIH should plan on accommodating all NHPs in the Bethesda Campus and NIHAC in the future. Even with the added caged NHP capacity that the Building D implementation may offer, additional capacity will be required by 2025. The projected caged NHP requirements for NIHAC include the required additional capacity.

Exhibit 9.8: Determination of Caged NHP housing requirement at NIHAC

Year	Bethesda Area Requirements	Bethesda Campus Capacity	Bethesda Area Other Capacity*	Increased Capacity from Building D	Requirement for NIHAC	Current NIHAC Capacity	Additional Capacity Needed
2010	3,686	1,468	635		1,583	2,246	0
2015	3,714	1,468		434	1,812	2,246	0
2020	4,018	1,468		434	2,116	2,246	0
2025	4,413	1,468		434	2,511	2,246	265
2030	4,848	1,468		434	2,946	2,246	700

* Leased facilities

Grouped NHPs in the Bethesda Area are currently housed only at NIHAC. The 2010 requirement for grouped NHPs in the Bethesda Area based on the ARSC survey results is more than double the existing capacity at NIHAC. For the purpose of the Master Plan, the rate of increase in grouped NHP housing requirements from the survey results were applied to the current capacity at NIHAC to determine projections for corresponding 2015, 2020, 2025, and 2030 .

Exhibit 9.9: Determination of Grouped NHP Housing Requirement at NIHAC

Year	ARSC Survey Bethesda Area Requirements	Percentage Change	Projected NIHAC Demand	Additional Capacity Needed*
2010	1,694		777	
2015	1,694	0.00%	794	17
2020	1,730	2.13%	812	35
2025	1,767	2.14%	831	54
2030	1,807	2.26%	849	72

*Additional capacity needed over the base capacity of 777.

2. Large Animal Population

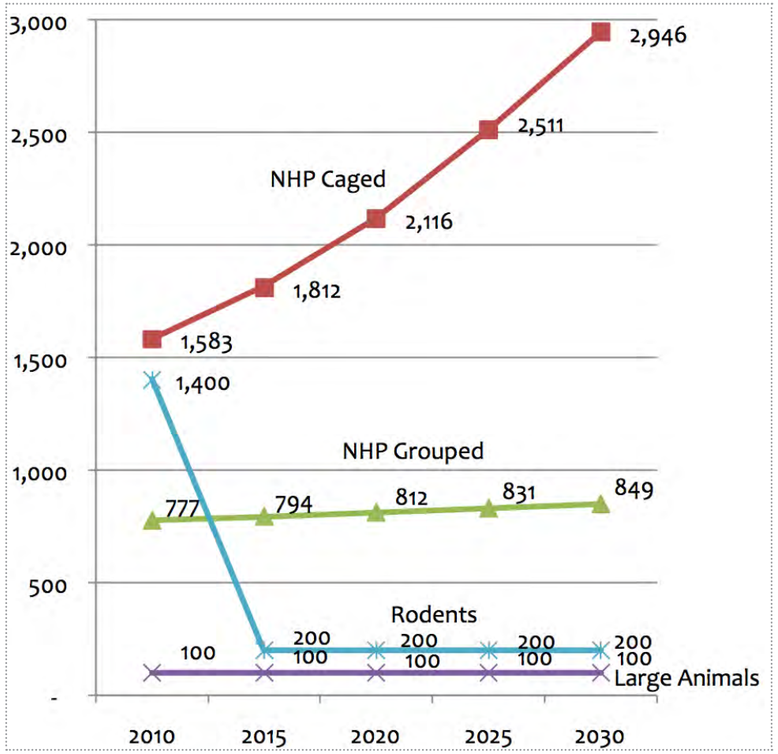
The requirement for large animals with runs was projected to grow from 105 in 2010 to 165 in 2030. The current capacities at the main campus and NIHAC are respectively 138 and 226. ARSC recommended that large animal capacities are to be maintained for 60 animals in the Bethesda Campus and 100 animals in NIHAC and that remaining capacities in each campus are to be converted to other uses. Accordingly, it was determined that the projected requirement for large animal housing at NIHAC will remain flat at 100 throughout the planning horizon.

3. Rodent Population

The NIHAC campus currently provides quarantine for mice in Buildings 127 and 128, and the ARSC recommended it to continue. Conversations with DVR staff led to the conclusion that the volumes fluctuate but stays consistently below 200 and the current facilities have proved to be adequate. NIMH's transgenic mice program has about 1,000 mice in Building 110A. The program is anticipated to phase out in the next year and was not considered in the projection.

Exhibit 9.10: Animal Projections for NIHAC*

Year	2010	2015	2020	2025	2030
NHP Caged	1,583	1,812	2,116	2,511	2,946
NHP Grouped	777	794	812	831	849
Rodents	1,400	200	200	200	200
Large Animals	100	100	100	100	100



* The NHP projections do not include the 150 primates that will be part of the proposed Breeding Colony (see Section 9.3 F.1)

D. Personnel Projections for NIHAC

The current employee count and future projections were developed from three separate sources: NIH Census for NIHAC for years FY2005 and FY2010; personnel information furnished by the ICs in their respective questionnaire responses; and, information furnished by the on-campus facility personnel. For planning purposes, the highest figure has been considered for the analysis where the numbers conflicted. Additional personnel were included based on the animal projections and acceptable ratios for animal care staff to animal housing. Exhibit 9.11 indicates the personnel projections for the NIHAC campus for the planning horizon.

Exhibit 9.11: Personnel Projections for NIHAC, By IC

	2010	2015	2020	2025	2030
NICHD	56	58	58	59	59
NIMH	17				
NCI	2	2	2	2	2
NIAAA	7				
Additional Support Staff – NICHD*		2	3	4	7
DVR	45	45	45	45	45
NIA	9	10	10	10	10
NIAID	14	16	16	19	19
Additional Support Staff – DVR*		5	9	13	21
ORF/AUX	49	49	49	49	49
TOTAL PERSONNEL	**199**	**187**	**192**	**201**	**212**

*The estimates for the additional staff were based on acceptable ratios of care staff and animal housing provided.

E. Program Assumptions & Bases

To determine the program space requirements, several space standards and guidelines were applied to the projected animal and personnel projections. The following lists some of these standards and guidelines.

- Animal holding spaces: These spaces are based on 2008 NIH *Design Requirements Manual for Biomedical Laboratories* (NIH-DRM) and also *Animal Research Facilities and Guide for the Care and Use of Laboratory Animals, 8th Edition* (ARF-Guide). Keeping with industry standards, the program has been adjusted for 75% occupancy for all types of animal housing. To the extent possible animal holding rooms have been made modular to allow for flexibility in terms of holding (e.g., group housing versus caged housing) as well as species, as desired by the facility users.
- Research and animal care support: Requirements for these spaces are based on appropriate ratios to Animal Housing.
- Breeding colony (see Section 9.3.F.1): The outdoor enclosures as well as shelters are based on industry standards as well as the level of space provided within the current field habitat.
- Office requirements: These spaces are generated for personnel and support space utilization per NIH guidelines.
- Utility and infrastructure: Utility and infrastructure spaces have been estimated based on current sizes, projected future loads, and expansion needs derived from unitary load calculations for current facilities.
- Net to gross area factors of 1.8 has been used for all Animal Holding/Care and immediate research and animal support spaces. For all other spaces including shared research support areas, office, organizational support and employee support spaces, a factor of 1.2 has been used.

F. Space Requirements for Animal Holding and Care Spaces

The animal holding spaces (Exhibit 9.12) were calculated from the *Animal Projections for NIHAC* (Exhibit 9.10). The animal care spaces are based on animal holding spaces using acceptable ratios per guides, standards and current practices at NIHAC.

During the interviews, it was stated that given the changing mix of animal species, modular flexible holding rooms are preferred. A 16' x 24' (approximately 385 sf) module was

considered optimal given the species mix and current practices at NIHAC.

For all animal holding as well as care spaces, the 20 year requirements were identified and subsequently prorated to identify 5-, 10-, 15- year requirements. Immediate needs were determined based on assessments of current operational and functional requirements and deficiencies.

1. Animal Holding Rooms

- Caged NHP holding rooms: NIHAC currently houses caged NHPs in singles as well as pairs. A typical module housing 4 racks with 4 cages per rack can accommodate 16 singly housed NHPs or 32 NHPs in pairs. Considering an average of 24 NHPs to a room, 123 rooms are required to house the projected 2,950 caged NHPs. Assuming a maximum of 75% occupancy, 164 rooms are required.

- Grouped NHP holding rooms: Based on standards, the typical module can house up to 25 NHPs (at 15.4 net square feet/NHP). The projected 850 grouped NHPs will require 34 rooms, and at 75% occupancy, the total number of rooms required is 45.

- NHP isolation rooms: To accommodate primates with medical conditions requiring isolation, 8 rooms, 130 net square feet (nsf) each are also included in the program in addition to the caged and grouped NHP rooms.

- NHP breeding colony: A breeding colony of 150 monkeys has been included in this program. This breeding colony was requested by specific ICs and is in addition to the grouped NHP requirements projected for the program. The shelter space requirements however will be similar to the grouped monkeys – a 385 nsf room is anticipated to house 25 animals. However these shelters are expected to require minimal temperature and humidity conditioning.

- Large animals: The projected number of large animal runs at NIHAC is 100. Large animals vary from dogs that require less than 24 nsf per animal to cattle and horses requiring up to 144 nsf per animal. For the purpose of this program, 100 nsf per animal for 100 animals have been estimated.

- Rodents: The only rodent requirement will be the quarantine facility. Currently, space dedicated for housing quarantine rodents is approximately 1,400 nsf, with 37 standard isolators each capable of holding 10 cages. However, larger isolators can hold up to 30 cages4. Based on DVR's requirements, two 700 nsf quarantine units have been included in the program. A total of 3,850 nsf (equal to 10 rooms of 385 nsf each) has been included in the program as potential specialized breeding and holding space for mice. If the specialized mice breeding function is not required, these rooms can serve as additional holding space for mice used in the main campus and/or for overflow NHP housing at NIHAC.

2. Animal Food and Equipment Spaces

These spaces have been estimated based on a combination of current distribution, utilization and applicable standards.

- Dry Food and Bedding Storage: Per the NIH DRM requirements, ideal unit area for food and bedding is 120 nsf. The current spaces in the campus vary from 65 nsf to 314 nsf. During inclement weather conditions, the shipment of food and bedding typically get delayed because of the NIHAC's location and the road conditions. Considering such issues, the program provides a typical unit of 250 nsf. The total number of such units is estimated at 9 for the entire campus.

- Cold food storage: The DRM does not provide any specific unit area requirement. Keeping with industry standards, a 100 nsf unit size has been utilized and based on current utilization, 5 units are included.

- Hay storage: Hay consumption varies by type of animal. Sheep, horses and cows consume between 4 pounds and 30 pounds of hay. Based on the February 2011 animal counts, about a quarter of the large animals consume hay. Assuming an average consumption of 13 to 14 pounds daily and a 6 month non-grazing season, the storage requirement for hay is approximately 60,750 pounds. A typical bale of 1,000 pound bale hay requires approximately 24 nsf. Accordingly, two 744 nsf hay storage areas have been included, each capable of storing up to 31 bales, or about 31,000 pounds. Hay is not produced on-site.

- Diet preparation rooms: There are 5 dedicated diet preparation rooms on the campus ranging from 60 nsf to 160 nsf in size. These rooms appear to serve their functions well. The NIH DRM recommended unit size of 80 nsf has been used in the program and based on current utilization and distribution, 9 units are estimated.

- Animal equipment and supplies storage: These spaces primarily include incidental storage spaces for cages, equipment and supplies as well as repair spaces. The NIH DRM recommended unit cage storage space size is 406 nsf. The campus facilities currently do not have enough incidental storage within the buildings. Accordingly, small satellite buildings and storage sheds are used to store cage, equipment and supplies. Considering current utilization and need, it is projected that 25 units of 400 nsf cage and equipment storage spaces are required in 2030. In addition, two repair shops, 200 nsf each have been included in the program to serve the centralized program and the shared research program.

3. Decontamination Spaces

These spaces include autoclaves, clean and dirty cage wash facilities, sterilization equipment rooms and laundry rooms. Similar to the animal food and equipment spaces, these rooms are also based on a combination of current distribution, utilization and applicable standards.

- Autoclaves: These facilities encompass a broad category of cleaning and sterilization equipment but do not include cage / rack washing facilities. Sizes vary, but a unit area of 300 nsf can support large pit-mounted autoclaves. A total of 4 such units are projected for 2030. Fractional units may be used to house smaller autoclaves.

- Clean and Dirty Cage Wash Spaces: These spaces vary in size and efficiency in the current campus facilities. From current utilization, it appears that the clean and dirty cage wash spaces in the more efficient facilities on campus are of equal size and approximately 800 nsf each. The program estimates 7 pairs of clean and dirty cage wash facilities for 2030.

- Sterilization rooms: The program projects 3 sterilization rooms, 80 nsf each, to house animal holding room floor cleaning and vapor sterilization equipment.

- Laundry facilities: Laundry areas are required for clean linens used in gowning areas, surgical suites, clinical areas, imaging suites procedure rooms and testing laboratories. The NIH DRM suggests a laundry room unit area size of 150 nsf. Current utilization indicates a future requirement of 7 laundry facilities.

4. Care Staff Spaces

These spaces are provided within or in close proximity to the animal housing spaces with appropriate separation as required by applicable codes and guidelines. Such spaces include Ante Rooms for animal housing areas, Gowning Areas, Locker Rooms and Break Rooms.

- Ante rooms: Currently, there are about 27 ante rooms, typically 80 nsf each, provided for NHP group housing across the campus. Since no ABSL-3 facilities are planned, this requirement is not expected to grow. Therefore the program retains ante rooms at their current levels.

- Gowning areas: A typical gowning area is about 35 nsf and provides space for storing and donning gowns, coats, goggles, hair nets, boots and beard covers. Depending upon the circulation pattern within a building, 1-2 gowning areas are sufficient. There are currently 8 formal or makeshift gowning areas throughout the campus. Based on expansion of existing inadequate gowning areas and addition of new ones, 16 gowning areas are projected for 2030.

- Break rooms: There are four dedicated break rooms in the campus varying in size from 171 nsf to 482 nsf. The program includes 7 break rooms of 350 nsf each averaging the sizes of the current break rooms.
- Locker rooms: Currently the campus has 11 staff locker rooms ranging from approximately 80 nsf to about 700 nsf. The average size is about 250 nsf for each locker room and 500 nsf for a typical locker pair (men's + women's). Distribution within the campus as well as allocation of locker space between the sexes is not uniform. It is anticipated that by 2030, there will be a need for at least nine locker pairs or about 18 units.

Exhibit 9.12: Program Allocation of Animal Holding and Care Spaces for 2030

	Unit Area (NSF)	No.	Centralized Programs	Shared Programs	Unassigned	Total (NSF)
ANIMAL HOLDING ROOMS						
Caged NHP	385	164	121	43		63,140
Grouped NHP	385	45	25	20		17,325
Isolation	130	8	5	3		1,040
Breeding colony (shelter)	385	6			6	2,310
Large animals	100	100	100			10,000
Rodent quarantine	700	2	2			1,400
Rodent housing	385	10	10			3,850
FOOD & EQUIPMENT SPACES						
Dry food & bedding	250	9	6	3		2,250
Cold food	100	5	4	1		500
Hay storage	744	2	2			1,488
Diet prep rooms	80	9	6	3		720
Equipment/supplies storage	400	25	15	10		10,000
Workshop	200	2	1	1		400
DECONTAMINATION SPACES						
Autoclaves	300	4	3	1		1,200
Cage wash spaces	1,600	7	5	2		11,200
Sterilization rooms	80	3	2	1		240
Laundry Facilities	150	7	5	2		1,050
CARE STAFF SPACES						
Ante rooms	80	27	18	9		2,160
Gowning areas	35	16	12	4		560
Break rooms	350	7	5	2		2,450
Locker rooms	250	18	12	6		4,500
TOTAL						**137,783**

G. Space Requirements for Research Support Spaces

The interviews with the Institutes Leadership and the facility managers concurred that research support spaces are inadequate and current need exceeds the current availability. Estimates for 2030 were developed based on interviews with the Institutes leadership and facility managers and prorated for 2015, 2020 and 2025 based on animal increase on the campus. Immediate needs were assessed based on current operational and functional requirements and deficiencies.

1. Lab / Testing Space:

These spaces include procedure rooms, behavioral labs/ observation spaces, wet labs, dry labs and freezer/instrumentation rooms.

- Procedure Rooms, as recommended by NIH DRM are to be provided at the rate of one 242 nsf room per four small animal holding rooms. The comparable ratio in existing facilities is one per eight. Based on discussions with operations staff, one procedure room per six animal holdings rooms (AHRs) has been allocated for the centralized programs. For the shared programs, the allocation ratio is one to eight since the procedural needs are comparatively less. A total of 34 procedure rooms are estimated.
- Behavioral Labs and Observation Spaces are provided for the shared research program only. Although the centralized program currently has observation spaces, these spaces are seldom used. The NIH DRM recommends 242 nsf behavioral labs. The projection for 2030 is 14 which include behavioral testing labs as well as observation spaces.
- Wet Lab specifications in the DRM are 11' x 33' modules. There are seven wet lab module equivalents in the campus at present. It appears that at least two more labs are needed to support current demand. Projecting wet lab needs to increase at the same rate as animal housing spaces, the 2030 requirements are estimated at 16. Based on a combination of functional need and animal population the program allocates eight wet labs for the centralized programs, four for the shared research programs and four common labs.
- Dry Labs are typically used for research using microscopy, electronic instrumentation, computing/data processing. The DRM does not specify any sizes for dry labs. For the purposes of this program a 70 nsf module has been used. Currently 256 nsf space is dedicated to dry lab research. DVR has indicated an immediate need for at least two units, bringing up the current need to a seven module equivalent. Assuming the proportionate increase in need to be the same as animal holding spaces, future requirements are estimated at 12 units. Based on a combination of functional need and animal population the program allocates six dry labs for the centralized programs, four for the shared research programs and two common labs.
- Freezer/Instrument Rooms are assumed to be 187 nsf each, capable of holding six 5'x3' chest freezers. There is an immediate need for one more freezer room and a total of eight rooms by 2030. Considering functional need and animal population distribution, four rooms are allocated to the centralized programs and two each to the shared research programs and common facilities.

2. Surgical Space

The NIH DRM specifies unit spaces for all the components in a typical surgery suite. The surgery suites at NIHAC, however, do not have all these component spaces separately. The DRM recommends a 679 nsf surgery suite with a 200 nsf Operating Area, 120 nsf Post-op Area, and 359 nsf dedicated to Surgery Supply, Prep Area and Scrub Area.

Currently there are five functional surgery suites at NIHAC, and currently there is a need for at least one more. The program includes two additional surgery suites (a total of eight) for the campus for 2030, given the increase in animals.

Considering current usage and utilization of the support space (Surgery Supply, Prep Area and Scrub Area) in the campus, 260 nsf appears to be adequate. For the purpose of the program, a typical surgery suite is estimated at 580 nsf with 200 nsf Operating Area,

120 nsf Post-op Area, and 260 nsf support area. For efficiency, it is possible to have a larger surgery support area shared by two units with independent Operating and Post-op Areas. Distribution of the surgery suites are based on functional needs. In the program four suites are allocated to the centralized programs, two for the shared programs and two for common use.

3. Imaging Space

The need for having expanded imaging capability at the NIHAC campus has been discussed and reiterated during the interviews and discussions with the Institutes as well as the facility managers. The 1996 Master Plan recommended an imaging facility on the campus which is yet to be constructed. Current availability of imaging on the campus is limited to four X-ray facilities and one PET (Positron Emission Tomography) facility. A general need for improvement and accessibility to imaging facilities on the campus and a particular need for structural MRI (Magnetic Resonance Imaging) capability has been expressed by NIH.

- X-ray: The NIH DRM recommends a 247 nsf unit area for X-ray facilities. None of the campus X-ray facilities are deemed ideal by the users. The current need for the campus is estimated at four units and an additional unit is proposed by 2030. Two X-ray facilities each are allocated in the program for the centralized and shared research programs with one for common use.
- CT/SPECT/PET: There is a PET facility on the campus that is 500 nsf. The DRM does not offer any specifics on Computed Tomography/ Single-photon Emission Computed Tomography/ Positron Emission Tomography (CT/SPECT/PET). The program assumes one additional imaging unit of this type by 2030. The new unit is assigned to common facilities in the program.
- MRI: Given the amount of space required for pumps and cryogen storage associated with MRI, a total unit area requirement of 1,000 nsf has been assumed for the facility. One unit has been included in the program for 2030. To ensure optimal use, it has been allocated as a common resource.
- Endoscopy: Endoscopy capabilities were requested by the Institutes on the NIHAC campus. Assuming an area requirement similar to that of procedure spaces, a unit area of 250 nsf has been utilized in the program. One such lab is anticipated during the planning horizon. Similar to the MRI facility, this has been allocated as a common resource.

4. Diagnostics/Pathology

The campus does not have diagnostic facilities or pharmacies on the campus, although a need for these spaces is evident from the interviews with the Institutes. Pathological facilities are available for both the shared research and centralized programs, but are deemed inadequate by the facility users.

- Diagnostics: The NIH DRM recommended unit area for diagnostic labs is 140 nsf. For programming purposes a current requirement of 4 units and two additional units in the future is proposed. Based on the input received during the interviews, it appears the diagnostic labs are best allocated as common resource.
- Pathology: The NIH DRM recommends130 nsf necropsy facilities. NIHAC has four necropsy facilities of varying sizes totaling about 680 nsf. The program identifies a current need for 6 necropsy units and an additional two units by 2030. Based on functional needs and animal population, four necropsy rooms are allocated to the centralized programs, two to the shared research program and two for common use.
- Pharmacy: The NIH DRM recommends 270 nsf area allotment for pharmacies. Current need is assessed at one unit with one additional unit by 2030. The program assumes this to be a common resource.

Exhibit 9.13: Program Allocation of Research Support Space for 2030

	Unit Area (NSF)	No.	Centralized Programs	Shared Programs	Common	Total (NSF)
Lab/Testing Space						
Procedure Rooms	242	34	26	8		8,228
Behavioral Labs	242	14		14		3,388
Wet Labs	362	16	8	4	4	5,792
Dry Labs	70	12	6	4	2	840
Freezer/Instrument Rooms	187	8	4	2	2	1,496
Surgical Space	580	8	4	2	2	4,640
Imaging Space						
X-ray	247	5	2	2	1	1,235
CT/PET/SPECT	500	2	1		1	1,000
MRI	1,000	1			1	1,000
Endoscopy	250	1			1	250
Diagnostics/Pathology						
Diagnostics	140	6			6	840
Pathology	130	8	4	2	2	1,040
Pharmacy	270	2			2	540
TOTAL						**30,289**

H. Space Requirements for Office, Organizational Support and Employee Support Spaces

The space requirements for the office and organizational support services for the campus were estimated separately for the shared research program and the centralized program. No allocation were made for ORF personnel assigned to the CUP and the Wastewater Treatment Plant, as these facilities already include the necessary office and organizational support spaces. Office and organizational support estimates were determined for immediate, 5-, 10-, 15- and 20 year time frames based on campus personnel projections.

Office spaces comprising enclosed offices and workstations are estimated at 110 nsf per person. Organizational support spaces include:

- Receptions: A 300 nsf reception each for the centralized program and the shared research program.
- Conference Rooms: Three conference rooms each for the centralized program and the shared research program. The conference rooms, 160 nsf each, should be configured such that they can be combined to form a larger conference space if needed.
- Break rooms: Two break rooms each in the centralized program and the shared research program. These break rooms, 200 nsf each should be located within the administrative areas and are in addition to the care staff break rooms provided within or adjacent to the animal housing areas.
- Copy/Print Rooms: Two copy/print rooms each for the program and the shared research program. Each copy room is sized at 150 nsf.
- Distributed filing: Distributed filing has been allocated at one 5 nsf footprint filing cabinet for every two employees, rounded upwards for each IC.
- LAN Rooms: LAN rooms are estimated at 100 nsf each. Four LAN rooms each are allocated to the centralized programs

- Circulation: A 45% circulation factor has been added to the office and organizational support spaces.

The employee support spaces are intended for the common use of centralized program and the shared research program. These spaces include:

- Conference facility: The conference facility is anticipated to serve the entire campus providing a much needed space for seminars, workshops and training. It could also serve as a shelter-in-place as and when needed. Designed for a maximum capacity of 50 persons in theater format, it should be configured for division into smaller conference spaces using retractable walls. Along with breakout areas and ancillary spaces, the conference facility is estimated at 1,500 nsf.
- Shelter-in-place: Given the 24x7 nature of the campus and potential of the campus be inaccessible during inclement weather conditions, a shelter-in-place facility is necessity. The current provisions are inadequate. The proposed 2,000 nsf shelter-in-place, along with the conference center is anticipated to serve this critical function.
- Data Center/Server Rooms: The status of the Information Technology infrastructure on the campus was discussed with NIH's Center for Information Technology (CIT). Based on the discussions a 1,300 nsf space has been included in the program to accommodate communication, network and server equipment.
- Loading Docks: Many of the current buildings are short on loading docks. Keeping with industry standards, it is recommended that separate loading docks are maintained for animal functions and non-animal functions. For the purpose of the program, 6 loading docks, 675 nsf each, are estimated.
- Fitness Room: The campus currently has a fitness room in Building T8. However, this building is practically abandoned and the fitness room is not used. A fitness room has been included into the program to accommodate exercise bikes, treadmills, cross trainers, compact gym systems. Ancillary spaces such as rest rooms, lockers, etc., are also anticipated. The total space estimated is 800 nsf.
- Lunch Room/Vending Area: The nearest off-campus food service locations are in the Town of Poolesville, about four miles away. There is a need to have large lunch room with adequate vending machines to meet the food service needs for the campus. The proposed program includes a 1,000 nsf space with lunch-type seating and vending machines.
- Circulation: A 10% factor has been included in the program to account for internal circulation for the employee support spaces.

Employee support space needs were initially identified for 2030. Subsequently, the intermediate 5-year projections were determined primarily considering employee as well as animal population increase over the respective time frames. None of the employee support spaces were perceived to be an immediate requirement.

Exhibit 9.14: Program Estimates for Office, Organizational Support and Employee Support Spaces for 2030

	Personnel	Office (NSF)	Org. Support (NSF)	Emp. Support (NSF)	Circ. (NSF)	Total (NSF)
OFFICE & ORGANIZATIONAL SUPPORT						
Shared Research Program	68	7,480	2,055		4,291	13,826
Centralized Program	144	10,450	2,125		5,659	18,234
EMPLOYEE SUPPORT						
Conference Facility				1,500	150	1,650
Shelter-in-place				2,000	200	2,200
Data Center/Server Rooms				1,300	130	1,430
Loading Docks				4,050	405	4,455
Fitness Room				800	80	880
Lunch Room/Vending Area				1,000	100	1,100
TOTAL	**212**	**17,930**	**4,180**	**10,650**	**11,015**	**43,775**

I. Space Requirements for Shared Centralized Storage

Besides the incidental storage provided to support the animal functions, the campus needs a centralized storage facility. Currently portions of the old CUP (Building 101), storage sheds and temporary buildings serve this need. The program proposes consolidation of these distributed storage spaces into a shared centralized storage. Based on a review of existing spaces, it is estimated that a 7,000 nsf facility should be adequate to support this function. The program assumes that the centralized storage will be required by 2015 as the temporary sheds and structures currently serving the need are phased out.

J. Space Requirements for Security

The entrance security currently comprises of a security booth and an old security trailer which houses most of the administrative functions for the security. The trailer is in poor physical condition. A replacement trailer has been placed to relocate the security office. The program proposes a revamped security for the campus which will have appropriate office functions as well as screening and badging facilities for the visitors. The program allocates 1,320 nsf for this function. It is assumed that the security facility would be required as new animal facilities are constructed. Accordingly, it is shown as a requirement in 2015.

K. Space Requirements for Central Utilities and Maintenance

The Central Utilities and Maintenance functions are anticipated to be adequate for the campus. While components of the Wastewater Treatment Plant are expected to undergo renovation, the administrative office in the Building 107 and the Central Utilities Plant (Building 101A) are not expected to undergo any expansions. For the purpose of this program, the Central Utilities and Maintenance area allocations are maintained at the current levels.

L. Space Requirements for Residential Uses

The program proposes to maintain the residential uses at their current level.

Exhibit 9.15: Expanded Summary of the Optimal Program [subsequent phases show net change]

			Space Growth Projections				
	Existing	**Current Need**	**Phase 1**	**Phase 2**	**Phase 3**	**Phase 4**	**Total Program**
NICHD+ICs							
Animal Holding/Care	7,468 nsf	17,648 nsf	8,692 nsf	2,953 nsf	4,070 nsf	3,512 nsf	36,875 nsf
Research Support	6,730 nsf	5,637 nsf	1,035 nsf	747 nsf	1,031 nsf	890 nsf	9,340 nsf
Office/Org. Support	13,530 nsf	16,110 nsf	-3,270 nsf	167 nsf	326 nsf	493 nsf	13,826 nsf
Storage/Other[2]	4,432 nsf						
SUBTOTAL NSF[1]	32,160 nsf	39,395 nsf	6,457 nsf	3,867 nsf	5,427 nsf	4,895 nsf	60,041 nsf
SUBTOTAL GSF[1]	**48,281 gsf**	**61,245 gsf**	**13,585 gsf**	**6,860 gsf**	**9,573 gsf**	**8,515 gsf**	**99,778 gsf**
DVR							
Animal Housing/ Care	67,538 nsf	63,319 nsf	7,609 nsf	7,982 nsf	9,046 nsf	10,642 nsf	98,598 nsf
Research Support	16,946 nsf	10,571 nsf	-363 nsf	1,148 nsf	1,302 nsf	1,532 nsf	14,190 nsf
Office/Org. Support	28,028 nsf	13,826 nsf	1,305 nsf	652 nsf	1,146 nsf	1,305 nsf	18,234 nsf
Storage/Other[2]	9,089 nsf						
SUBTOTAL NSF[1]	121,601 nsf	87,716 nsf	8,551 nsf	9,782 nsf	11,494 nsf	13,479 nsf	131,022 nsf
SUBTOTAL GSF[1]	**238,490 gsf**	**149,593 gsf**	**14,609 gsf**	**17,216 gsf**	**20,002 gsf**	**23,479 gsf**	**224,899 gsf**
UNASSIGNED							
Breeding Colony Shelter			2,310 nsf				2,310 nsf
			4,158 gsf				**4,158 gsf**
SHARED							
Shared Centralized Storage			7,000 nsf				7,000 nsf
Research Support			5,544 nsf	679 nsf	821 nsf	875 nsf	7,919 nsf
Employee Support			8,745 nsf	1,485 nsf	1,485 nsf		11,715 nsf
SUBTOTAL NSF			21,289 nsf	2,164 nsf	2,306 nsf	875 nsf	26,634 nsf
SUBTOTAL GSF			**25,547 gsf**	**2,597 gsf**	**2,767 gsf**	**1,050 gsf**	**31,961 gsf**
OTHER							
Security	606 gsf	606 gsf	714 gsf				1,320 gsf
Central Utilities/ Maintenance	67,984 gsf	56,046 gsf					56,046 gsf
Residential	6,246 gsf	4,494 gsf					4,494 gsf
SUBTOTAL GSF	**74,836 gsf**	**61,146 gsf**	**714 gsf**				**61,860 gsf**
GRAND TOTAL GSF	**361,607 gsf**	**271,984 gsf**	**58,612 gsf**	**26,674 gsf**	**32,342 gsf**	**33,044 gsf**	**422,656 gsf**

General:

- It is expected that NIMH will terminate its transgenic mice program by 2015; hence the decrease in staff and office/support space in Phase 1 for NICHD+ICs
- GSF is based on a 1.8 net to gross factor for Animal Holding/Care spaces and associated Research Support, and 1.2 for other spaces including Shared Research Support

1 NSF/GSF includes square footage for abandoned buildings; NSF/GSF does not include Semi-Outdoor Runs or Storage

2 Storage and other support areas for DVR and NICHD have been moved to Shared.

9.4 Concept Development and the Optimal Program

Three development concepts were considered – Independent (A), Consolidated (B), and Independent + Shared Nucleus (C) as described in Chapter 10. The Independent concept focused on retaining the current fabric of the campus with minimum intervention. The Consolidated as well as Independent + Shared Nucleus concepts considered a relatively higher degree of intervention and had similar programmatic requirements. In all the concepts, the utilities and residential components, for the most part, remained at current levels.

Each concept adopted a different approach in spatial organization of the key functions on the campus, retention plan for the existing facilities, and utility connections. Once these broad characteristics were identified, a combination of proposed new facilities and retained facilities (with some renovations and additions to improve their functions and operations) were devised to meet the requirements of the Optimal Program. After the spatial organization and retention plans were identified, possible accommodation of program components within the retained buildings was examined. As can be expected, the final buildout square footages exceeded the Optimal Program square footages owing to the inherent inefficiencies of the retained buildings.

Exhibit 9.16 below demonstrates this exercise for the Consolidated Concept that was selected as the preferred concept by NIH.

Exhibit 9.16: Comparison of the Optimal Program and the Provisions of the Preferred Consolidated Concept*

		Shared Research Program (NICHD + ICs)	Centralized Program (DVR)	Common Facilities	Unassigned	Security	Utilities	Residential	TOTAL	Remarks
A.	Optimal Program Requirement	99,778	224,899	31,961	4,158	1,320	56,046	4,494	422,656	This is the optimal space requirement if a brand new facility were to be built
B.	Proposed New Facilities	92,200	103,100	32,000	4,200	1,400			232,900	This represents new construction proposed in the preferred concept
C.	Existing Facilities Retained	5,035	163,261				56,046	4,494	228,836	These facilities are in acceptable condition and are proposed to be retained in the preferred concept
D.	Additions to Existing Facilities	900	12,200						12,200	These additions are proposed to be made in the retained facilities to improve function and operation
E.	Total Buildout (B+C+D)	97,235	278,561	32,000	4,200	1,400	56,046	4,494	473,936	Total built out exceeds Optimal Program Requirement due to existing inefficiencies in retained facilities

*All numbers are gross square feet

This is for common use of NICHD, ICs, & DVR

It has not been decided which organization will manage this component

These facilities remain largely unchanged. The Master Plan optimizes the existing utilities. NIH intends to retain the residential component, for the most part, at current levels

10. Master Plan Development

The Master Plan development began with the NIH goals for the campus, and took shape based on the projected space needs and the detailed evaluation of the existing conditions of the site, infrastructure and buildings. Site concepts and layout alternatives were explored and evaluated by the design team in concert with NIH ORF staff and the ARSC. The chosen approach became the Master Plan.

10.1 Master Plan Objectives

The Master Plan objectives were developed in concert with NIH leadership, the resident campus Institutes and the Office of Research Facilities (ORF), based on research directives, space and facility analysis. The objectives are consistent with the recommendations of NIH's Facility Working Group and their appointed Subcommittee.

A. Enhance the Campus Organization

- Welcome visitors and project a positive atmosphere and understanding of NIH's animal husbandry.
- Encourage staff collaboration and sharing of technical resources.

B. Provide Appropriate Facilities for Animal and Scientific Needs

- Expand the capacity of the NIHAC campus as an animal support facility for the greater Washington DC Metropolitan area, with an emphasis on housing non-human primates for quarantine, breeding, and research. Rodents and large animal would be housed in smaller numbers for breeding and quarantine.
- Increase the ratio of procedure rooms and support to animal holding, to improve the quality and efficiency of care. Specifically, provide additional and improved imaging, clinical support and sample storage facilities, to reduce the transport of animals to Bethesda for these services.
- Enhance enrichment opportunities for the campus animals and add a new NHP breeding colony.

C. Build-in Flexibility To Respond to Changing Research

- Develop animal housing that can be configured for multiple species.
- Configure housing modules that can be easily transformed to accommodate different assignments, required separations and changing containment status.
- Develop shared animal imaging and support facilities when possible, to maximize long-term utility.

D. Increase Employee Support Areas on Campus

- Establish basic staff support areas, such as places to eat, shower and change, meet and exercise. Because of the remote location of the campus, a well-equipped shelter-in-place is necessary for weather emergencies.
- Increase the office space available to staff, and include "hoteling" office space to accommodate and encourage visiting NIH personnel.

E. Address Aging Buildings and Inadequate Infrastructure

- Create an implementation plan to replace or renovate the buildings that are in deteriorating physical condition or have configurations that no longer support the current housing or research programs. Replace the needed temporary buildings and trailers.
- Replace or upgrade the heating, ventilation and air conditioning systems, and improve their adaptability.
- Reduce the usage rate of potable water, using a combination of strategies that include the review of campus uses, the reduction of transmission losses and the maximization of gray water usage. Introduction of reverse osmosis treatment could allow the greater use of gray water for cage washing and cleaning.
- Expand automated cage washing capabilities across the campus.
- Improve the in-building information technology (IT) infrastructure, to better support the transmission of scientific information, research and telecommunications.

F. Create a More Sustainable Campus

- Improve the energy efficiency of the existing campus buildings and prioritize energy conservation when building new facilities.
- Plan for the possible future incorporation of a solar panel array, as recommended in the 2009 Market Feasibility Study by Jones Lang LaSalle.
- Anticipate that new development and site improvements will incorporate an environmentally-sensitive approach and follow best practices.

G. Be a Good Property Steward

- Preserve the site's natural features and consider its environmental characteristics when adding buildings or changing land use. The site has stands of hardwood trees, streams, wetlands, steep slopes and prime farmland that should be protected.
- Identify and protect historical and cultural resources on the campus. Several buildings may meet the criteria of the National Register of Historic Places, such as the original farm's barn and attached silo, the adjacent loafing shed, the caretaker's cottage and some landscape features. This identification is currently under review by NIH.
- Manage building assets in accordance with the Federal Real Property Performance Measures, assessing their condition, utilization and performance on an ongoing basis.

10.2 Federal Real Property Performance Measures

The Department of Health and Human Services (HHS) follows a series of performance measures to manage and evaluate their real property assets, in compliance with Federal Executive Order 13327 *Federal Real Property Asset Management*. These performance measures assist HHS in categorizing building assets, both owned and leased, and in prioritizing actions of operations, maintenance and construction. These *Real Property Performance Measures* were utilized in the development of the NIHAC Master Plan, and will apply to future implementation decisions. The Measures include the following:

Mission Dependency. This measure identifies the value of each facility to the mission of NIH. The facilities at NIHAC are all mission-dependent, except for the several residential buildings on the property and several unused buildings. The Master Plan retains or replaces all mission-dependent buildings, as well as some of the residences. The unused buildings would be disposed of as unneeded assets. These are all mission non-dependent, and would be demolished. The primary mission of the campus is to provide appropriate and adequate research, animal housing and care facilities – and adapt to changes as necessary. The Master Plan supports this mission by providing flexible and modular housing spaces, adaptable to change. Also, phasing and implementation recommendations avoid down-time in the animal facilities; new facilities are built before existing are demolished. Implementation also considers minimal impact to existing animal spaces, and no perceptible impact to behavioral research during construction.

Condition Index. This measure assesses and rates the physical condition of each facility. NIH provided an Asset Detail Report which assigned a Condition Index to all the permanent campus buildings. The Condition Index is the ratio of repair needs to asset value. The indices were used in the review of buildings to retain, replace and repair. Renovations were proposed to improve the Condition Indices of retained buildings. The building evaluations considered the Condition Index, as well as factors of space efficiency and configuration: see Chapter 6: The Built Environment.

Utilization Index. This measure benchmarks space use and square footage against HHS standards. HHS has no benchmark standards for animal facility utilization at this time. The Master Plan proposes the replacement or renovation of existing inefficient facilities with new ones that would follow HHS and NIH guidelines and other accepted industry standards. Overall utilization on campus is expected to improve.

Operations and Maintenance Cost. This measure identifies facilities that operate most/least efficiently. The master planning process reviews the operating efficiency of building systems as part of the evaluation process, but does not formally gather costs covered in this measure

(e.g., cleaning, landscaping, repairs, as well as utilities). Reducing these costs is one of the major goals of the Master Plan, and to that end the following are proposed: phasing-out inefficient buildings; replacing buildings in poor condition; demolishing unused and abandoned buildings; repairing infrastructure deficiencies in the water supply system; broadening gray water use by improving its quality; and upgrading the Wastewater Treatment Plant (WTP). One of the key strategies is the replacement of old buildings served by independent HVAC systems with new ones that would be served by the efficient central utility plant.

Construction Program Metrics. This measure tracks changes in project scope, schedule and cost.

Daily Decision-Making Metrics. This measure is a checklist reporting compliance to these measures.

The two above measures are not applicable to master plans, but would be considered for individual projects as they are implemented.

10.3 Master Plan Framework

The setting and site for NIHAC near Poolesville is rural in character, with open fields and gentle slopes. Pastures, woodlands and streams characterize the unbuilt land on the NIH property. A large central swale, which drains rainwater to Broad Run, divides the campus into a designated "north" campus and "south" campus. Maintaining this rural character was an important goal of the Master Plan.

With the Master Plan implementation, the north would become the research and animal care heart of the campus, as behavioral research facilities are relocated there from the south. The north campus would be where most employees would be located. The south would remain an infrastructure support area, as well as the location for two outdoor areas for non-human primates. This reorganization takes place over the 20 year phased implementation of the Master Plan.

One factor in the Master Plan development was the need for replacing aging and/or inappropriate buildings and trailers with flexible facilities that meet the requirements of research and the standards of animal care. Another factor was the site's physical characteristics and the locations of buildings that would remain. These physical considerations and NIH research requirements were key in choosing to consolidate development on the north campus, near the existing buildings. The site area is relatively flat, partially developed and away from the flood plain and wetlands. Consolidating research and animal care encourages collaboration, sharing of resources and efficient use of the campus utility infrastructure.

A. Considerations on the North Campus

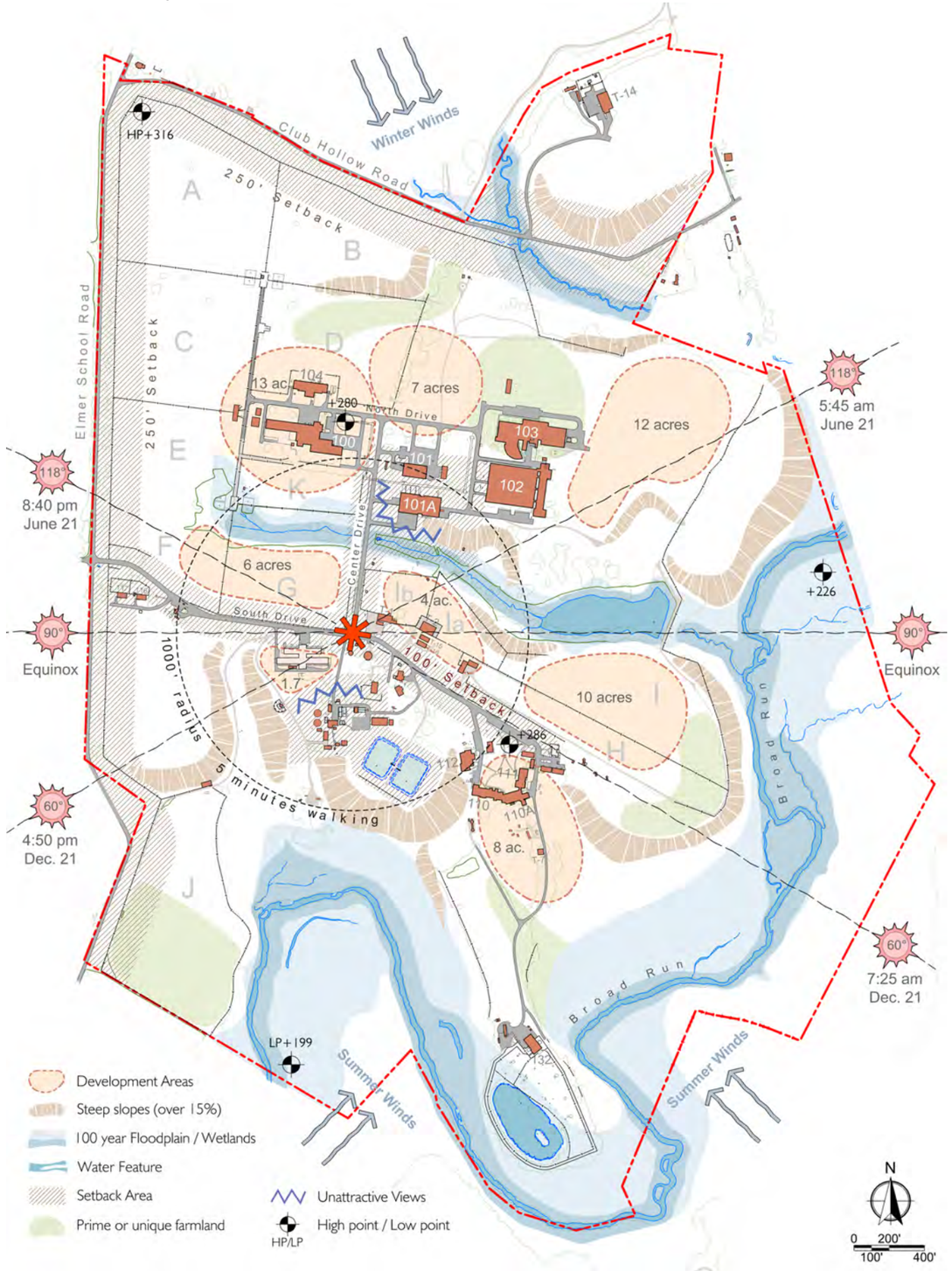
On the north campus, characteristics that shaped the Master Plan concept include the following:

Topography. The previously developed area of the north campus is relatively flat, and with the phased demolition of Building 100 and 104, construction can take place with minimal disturbance of natural features. Beyond North Drive, the undeveloped land slopes gradually down to the east. The available developed land and the topography were an opportunity for the Master Plan, suggesting that development hug the North Drive and follow the topography to minimize any cut/fill of the land.

Utilities. The existing power plant has the capacity to serve the planned development, and a generous utility tunnel serves the existing buildings. There is an opportunity to utilize this tunnel to connect the new buildings, extending the services as necessary. Currently, the tunnel and services branch both east and west from the central utility plant. Connecting these branches into a utility loop would improve efficiency and provide redundancy in case of partial failure.

Fuel Storage. North of the CUP are several below-grade fuel storage tanks; see exhibit 10.2. They will remain in their current location and the Master Plan will maintain access throughout the phases. Additional fuel tanks are planned, and their location is shown to the southwest; see Exhibit 11.1.

Exhibit 10.1: Site Analysis



Orientation of the Existing Buildings. Buildings B102 and B103 are important animal holding facilities. Built at separate times, their entrances and staff office locations were not coordinated, and they essentially "face away" from each other. This is a challenge in creating a unified and collaborative campus, and the Master Plan emphasizes their linkage with the new development.

Views. The Master Plan strives not to interrupt the views from the surrounding roads. This constraint is not difficult to achieve if new buildings were to be located within the precinct of current development, kept to one or two stories and screened by landscaping. Internal views are equally important. The Master Plan considered the view of visitors arriving at the campus, as well as staff from their work areas.

Security Considerations. NIH security policy controls the access and separates the travel and parking areas of unscreened vehicles from buildings. The Master Plan incorporates the vehicle setbacks and access controls for the new buildings, and modifies existing encroachments where practical.

B. Considerations on the South Campus

The south campus remains an important part of the Plan, even as many behavioral research functions move to new buildings on the north. The existing buildings and features shaped the approach to this areas, including the following:

Existing Resources. The Wastewater Treatment Plant (WTP) forms the core of a service zone at the base of Center Drive. In the Master Plan, this cluster of facilities remains, and the plant is upgraded for extended life and capacity. In addition, the existing field habitat would receive new support facilities adjacent to the current location.

Cultural History. A few of the buildings on the south campus are original to the farm, such as the barn and the caretaker's cottage. These buildings enhance the character of the campus, and would be retained as support facilities. Some buildings may meet the criteria of the National Register of Historic Places.

Cleared Land. A breeding colony for non-human primates is planned, and the Master Plan locates it on land that does not require clearing of trees or intrusion into wetlands.

Exhibit 10.2: Campus Considerations

10.4 Master Planning

The NIHAC campus has facilities spread out over the former farmland. The initial Master Plan concepts viewed the entire site for the best approach for future campus operations and the best use of resources. Three campus-wide concepts were developed, exploring different campus organizations, using the same projected program for new and renovated facilities.

A. Master Plan Concepts

These three campus plan concepts were developed, exploring different approaches to meeting the Master Plan goals and accommodating the future program. Each concept solved the same problems and accommodated the same functional elements, but in differing ways and different locations. The concepts were reviewed with NIH's Facility Working Group and their appointed Sub-committee, and evaluated against facility, functional and implementation factors, including the following: accommodation of research, support and staff activities; flexibility; energy and maintenance efficiency; campus character and image; and potential implementation costs. The concepts each retained the same existing infrastructure and buildings. The concepts were:

- *Consolidation Concept* clusters Behavioral Research and Animal Holding facilities on the north campus.
- *Independent Concept* builds upon the current campus organization and building structure, modernizing and adding facilities as needed.
- *Independent + Shared Nucleus Concept* retains the current campus organization, replaces the Behavioral Research facilities, expands Animal Holding facilities and adds a shared research support facility.

The space program was developed to "optimal" space requirements, which is the space that would be needed if an entirely new campus and buildings were developed. When existing buildings are retained, they are often inefficient and therefore more square footage is needed to accommodate the same functions. The Master Plan retains some buildings and therefore, the full build-out would be greater than the "optimal." The campus-wide Concepts retained different existing buildings, so accommodating the same functions resulted in different total square footages.

Selected Concept — Consolidation

The new facilities for Research and Animal Holding are consolidated in the north campus, keeping the facilities under their respective management and coordinating their locations with existing buildings B102 and B103 and the central utility plant. Buildings form a clustered campus setting, creating opportunities for a landscaped "village green" and easy pedestrian connections. The inefficient buildings are replaced, and the remaining buildings modernized as needed. A shared support, diagnostic and imaging building is added in close relationship to the research buildings.

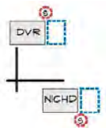
The concept was selected by ARSC, with input from ORF staff, and was based on the evaluation and review of the advantages and disadvantages of this concept. Key reasons for the selection were:

- Co-location of the facilities encourages collaboration and sharing of resources
- The consolidation brings the new buildings into proximity to the central utility plant, which has the capacity to service the proposed program. This is more efficient for both energy use and maintenance.
- Separate Animal Holding and Behavioral Research space management can be maintained within the north campus precinct
- The clustering of buildings can create a coherent campus setting for visitors and staff
- The concept replaces inefficient and aging buildings, allowing for flexible and state-of-the-art facilities.
- There is less disturbance to the site's natural features because some new construction can take place on the sites of demolished buildings B100 and B104.
- Construction can be accomplished with minimum disruption to current operations.

Exhibit 10.3: Selected Concept: Consolidation

Other Concepts Evaluated

Concept — Independent

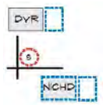


The campus organization and the clusters of buildings remain the same as the existing campus in this concept, with Behavioral Research in the south and Animal Holding primarily in the north. Most of the existing buildings are retained, and they are modernized and expanded to accommodate shortfall and functional issues . New buildings for offices, animal holding, and employee amenities are added to each cluster to meet future needs. Several of the inefficient buildings, notably B100 and B104, are renovated and adapted to house non-human primates.

There would be little change in the campus organization and the rural, farm-like atmosphere of the campus, even with the introduction of new structures. The concept reuses the campus architectural resources, minimizing demolition. This approach emphasizes the distinct identities of the centralized programs and shared research progrsm and allows each to expand/ renovate at its own pace.

However, the inefficient facilities, less flexible configuration and distribution of animal holding and support space would remain because of existing building reuse, even with modernization. Improvements to energy use and infrastructure would be more difficult to accomplish, suggesting package solutions rather than an extension from utility plant for the south campus buildings. There would be an estimated 30% premium in energy use over the Consolidation Concept. The concept suggest gradual implementation of smaller projects, which would require careful phased planning to minimize disruption to operations and stress on animals.

Concept — Independent + Shared Nucleus



This Concept retains the north and south clusters, similar to the Independent Concept, and creates a shared diagnostic and imaging facility equidistant from each. Inefficient and deteriorating Behavioral Research buildings are replaced along South Drive, together with buildings for offices and animal holding shortfall and growth. New Animal Holding buildings are added to the north campus to accommodate growth, and Buildings B102 and B103 are modernized and expanded to meet current needs.

The distinct program management identities are retained, but they are drawn together physically and symbolically with the shared new services building. Upon arrival, the new shared services building becomes the first visual image of modern, improved research support, before the road branches north and south, Much of the animal housing and support would be in new facilities, creating more flexibility. Although the facilities in the south cluster are far from the utility plant, their new construction would have energy efficient systems.

However, the separate locations require walking/transport for staff amenities as well as animal imaging and diagnostic s, and so are less convenient and collaborative. There is the potential for disturbance to behavioral research operations during construction, which would need careful planning to minimize. Even with new facilities, there is an estimated 10% premium in energy use over the Independent Concept.

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Exhibit 10.4: Concept — Independent

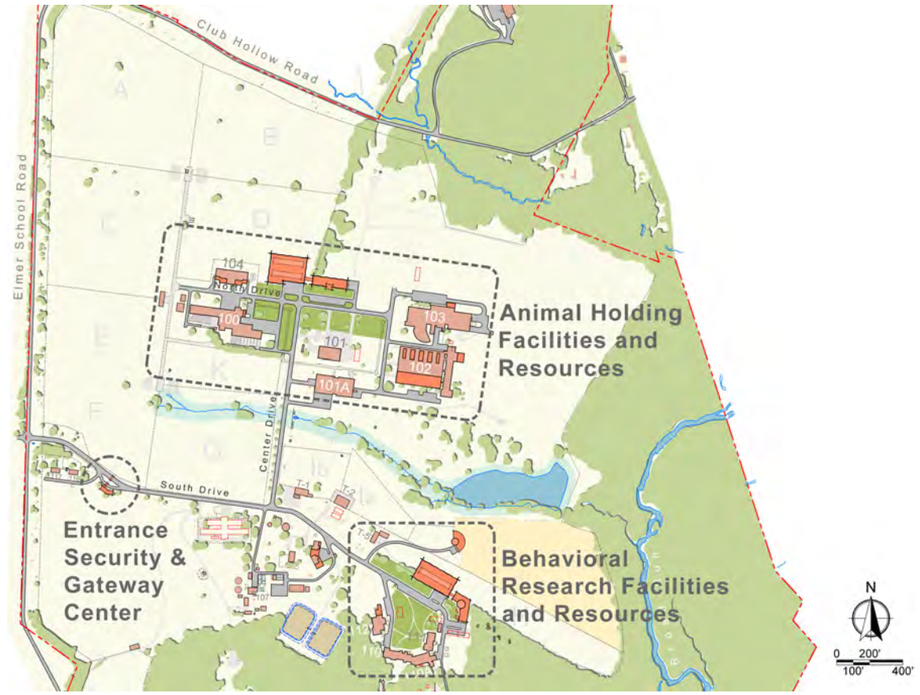


Exhibit 10.5: Concept — Independent + Shared Nucleus

B. North Campus Alternatives

The Preferred Concept: Consolidation was further explored with the development of Alternative building location and massing studies for the north campus consolidation. While the basic approach was the same, each alternative presented different relationships between buildings, building organization, massing and landscape settings. A summary of key alternatives:

Alternative 1

Alternative 1 organizes three new buildings—Behavioral Research facilities, Animal Holding facilities, and shared Imaging, Diagnostic and Support facilities around a central landscaped green space. The new buildings and buildings B102 and B103 are envisioned as a series of pavilions facing a park-like green and giving it animation and visual interest.

Exhibit 10.6: Alternative 1

Alternative 2

Alternative 2 clusters the three new buildings in a compact arrangement to the west and close to buildings B102 and B103. The "front doors" of the new buildings are adjacent for easy orientation and collaboration. Open views of the farmland form the common green space.

Exhibit 10.7: Alternative 2

Alternative 3

Alternative 3 creates flexible modules of research and support space along a continuous circulation spine. Modules are added and assigned to Behavioral Research and Animal Holding as needed. Modules are connected and would be near or be directly adjacent to the neighboring module.

Exhibit 10.8: Alternative 3

Alternative 1 was selected by ARSC as the preferred approach. Key reasons for its selection were the following:

- Flexibility in the size and shape of future buildings
- Relationship between new and existing buildings most likely to encourage staff interaction
- Accomodation of future growth beyond the Master Plan (enhanced in Master Plan)
- Campus green shared equally by staff of existing and new buildings
- Configuration promoting easy wayfinding

Modifications in response to phasing priorities and connections strategies were made, and the resulting plan became the basis for the master plan framework.

11.

NIHAC Campus Master Plan

The Master Plan for NIHAC is a flexible framework for growth and incremental change over the next twenty years. The Plan fulfills the objectives of optimizing NIHAC's value as an animal research resource for NIH's Bethesda area programs. It updates animal care and research facilities, replaces aging buildings and infrastructure, establishes basic employee amenities and emphasizes efficient operations. As with any institution, NIH's needs and construction depend on funding, the direction of scientific research and agency-wide priorities. The Plan's organization and architectural concepts remain valid even if the current projections of staffing, animal population and facility requirements vary.

The plan consolidates the research, animal care and support facilities on the northern section of the campus, retaining buildings in good condition and fully utilizing the central utility plant and infrastructure in place. Aging, deteriorating and inappropriate buildings are phased out. On the southern campus, existing resources in good condition are retained and upgraded to current standards. Direction is provided in four areas:

- Campus development and architectural approach
- Engineering and utilities
- Landscape development
- Parking and circulation

11.1 Campus Development and Architectural Approach

A. Master Plan Components

1. New Construction, Additions and Renovation

a. Entrance Security and Gateway Center. Reception and screening facility for visitors, with support space for the NIH security personnel.

b. Shared Imaging and Diagnostic Facility. Clinical support for researchers, with imaging, procedure rooms, labs and support. Key staff support spaces, including a data center and shelter–in-place, would be included.

c. Behavioral Research Facility. Flexible animal housing and research space with procedure rooms, cage-wash, staff support and related services. The facilities would be used for behavioral research, replacing aging facilities and accommodating a serious space shortfall, in light of the projected increase in research.

d. Multi-Species Animal Holding Facility. Flexible animal housing with staff offices and support facilities that would accommodate a projected increase in animal population and replace inappropriate facilities. Procedure rooms, cage-wash, staff support and related services would be included.

e. B102 A Wing Renovation. Building B102 A Wing is proposed to be renovated from large animal runs into animal holding appropriate for non-human primates.

f. Breeding Colony. New breeding colony for non-human primates, with shelter, observation post and open acreage.

g. Addition to Building 132. An addition to the existing habitat to provide an observation area.

Miscellaneous additions and improvements. Improvements to B102 and B103 to upgrade outmoded animal procedure/space.

Exhibit 11.1: The Campus Master Plan

2. Buildings to Remain

Some of the larger buildings currently in use would remain under the Master Plan. They all require some upgrading to modern energy and water efficiency standards and ongoing maintenance.

- Building B102 – DVR animal holding (renovation of Wing A noted above)
- Building B103 – DVR animal holding
- Building B101A – ORF Central Utility Plant (CUP)
- Building B107 – ORF wastewater treatment plant
- Building B132 – NICHD behavioral research shelter and habitat
- Building T14 on NIH campus extension north of Club Hollow Road

Other smaller buildings to remain:

- DVR Facilities – T1, T2, T12, T20, T22, T5, W107-ST8, WT19-WT20
- ORF Facilities – T14, T19,
- Other Facilities – B116, B117, T6

3. Buildings to be Demolished

NIH generally observes a policy of demolishing unutilized facilities if funds are available and no potential benefits are foreseen for moth-balling such facilities. In the Master Plan, new, flexible facilities would replace the functions of certain aging and inefficient facilities, which would then be demolished.

- NICHD buildings on the south campus; B110, B110A, B-111, B-112, B-130, TR18A, TR18B, T24A, T25, T25A-C, TR130A and TR24B
- DVR animal housing and support buildings on the north campus; B-100, B-104, B131, T11, T13, T15, and T16
- DVR mouse housing on the south campus; B-127, B-128
- Security: 115 and 115.1

Other buildings to be demolished because they are dilapidated, underutilized, or planned for phase out:

- DVR Facilities – T8
- NICHD Facilities – T18 and TR110
- NIAAA Trailer – 112A
- ORF Facilities – B101 and T10
- Other Facilities – T7, T11A, T21

Exhibit 11.2: Development Summary

Area	Existing SF	Removed SF	Added SF	Master Plan SF	% Change	Developed Acres
Buildings	361,607	(132,771)	245,100	473,936	31.1%	–
Site Coverage						
Building Footprint	341,000	(156,372)	228,730	413,358	21.2%	–
Paved Roads	479,200	(105,000)	92,800	467,000	(2.5%)	–
Gravel Roads	143,700	(39,700)	18,700	122,700	(14.6%)	–
Surface Parking	21,800	(20,600)	54,400	55,600	155.0%	–
TOTAL SITE COVERAGE	985,700	(321,672)	394,630	1,058,658	7.4%	24.30

Exhibit 11.3: A Model of the Campus Master Plan

B. Key Concepts of the Plan

The Master Plan emphasizes quality research and animal care, efficient operations and a pleasant place to work. Key concepts include:

1. *Campus Green*. Development is organized around a central landscaped green, which forms the campus focus as well as an employee amenity. Building entrances and offices would face the green for orientation and a pleasant view. Variety in the design expression of these entrances and office modules would give scale and character to the campus. Landscaping of the campus green would include seating, trees for shade and visual interest, and screening of the CUP's mechanical equipment and the parking.

2. *State-of-the-Art Animal Facilities*. Flexibility and multi-species animal housing are two characteristics of state-of-the-art animal facilities. The current NIHAC suffers from a lack of both, unfortunately. The obsolescence of several campus buildings resulted from both their physical condition and their species-specific configuration, designed for animals that are not as extensively utilized in research as they used to be. The new animal and laboratory facilities would support a wide range of animal species and research protocols. A more in-depth description of state-of-the-art animal facilities is included later.

3. *Shared Imaging and Diagnostic Facility*. The first stated priorities of NIHAC personnel for improved facilities were added diagnostic procedure rooms and imaging capabilities.

The reason was three-fold: a) reduce time, money and trauma to the animals from transporting them to the Bethesda campus for procedures; b) ensure the quality and timeliness of tests and sampling; and c) improve the convenience and efficiency for Institute researchers from Bethesda and the surrounding region who house their animals at NIHAC. The Plan has incorporated a building location convenient for shared access and recommends its implementation as the first new building.

4. *Building Connectivity*. Physically connecting the buildings, both old and new, emerged as an important objective. The plan includes enclosed, daylit corridors linking each building. This would encourage staff interaction and improve the efficiency of animal movement. Animals are moved from their housing to procedure rooms (or Bethesda) for testing and sampling, a process that now primarily utilizes automobile transport. Connecting the existing buildings B102 and B103 is very important to NIHAC personnel. A split-grade connection between B103 and the new Shared Imaging and Diagnostics Facility is recommended in the Master Plan, passing under the north-south roadway between them. Beginning near the B103 entrance, a corridor would slope very gently down to the roadway (1 in 20 slope), then slope up to first floor level at the new building. The grading of the roadway may need to be increased slightly.

5. *Employee Support*. Support areas for employees are very limited, and those that exist are scattered among several trailers and temporary buildings. New support spaces would include conference rooms, shower/changing rooms, a lunch room and an exercise room. These spaces could be phased in with the development projects over the twenty years. Phase 1 priority support spaces are a data center and shelter-in-place.

6. *New Breeding Colony*. A breeding colony is proposed for non-human primates, with an enclosed shelter, observation post and fenced open space. Because the energy needs are modest and the location is removed from existing services, the shelter would be environmentally friendly and self-sufficient for its power and heating, utilizing solar panels and/or ground source heat pump technology.

7. *Entrance Security and Gateway Center.* A new entrance and security pavilion would support security personnel, replacing the two existing trailers. The entrance and roadway would be restructured for better security by providing a pull-off area for vehicle screening, and reconfiguration of the driveways to the two on-campus residences near the entrance. Other security upgrades would include a strategy for controlling access to the various loading docks, vehicle setbacks and the repair and reinforcement of the perimeter fencing.

8. *Utility Efficiency*. NIH has a significant investment in the recently built CUP and the utility tunnels that carry services to buildings on the north campus. These were constructed with enough capacity to support the planned 20-year growth. Utilizing the CUP and increasing overall energy efficiency were key drivers in the selection of this Master Plan approach. New development would tie into the existing utility services, eventually linking the branched utility lines into a complete utility loop. At full build-out, this would provide redundancy in service delivery and would be more efficient.

9. *Circulation Stability*. Circulation patterns and major drives are not changed, except where required to meet NIH security setback requirements. This strategy was chosen to minimize disturbance to the landscape and disruption during phased construction. New roadways should retain the characteristics of the existing, allowing drainage to natural swales instead of edging the roadways with curbs and gutters. New roadways, loading docks and parking would be added as needed by the individual projects. One change to the existing road network is the shifting of the North Drive closer to the CUP. This is necessary to create a 100' setback from the proposed new buildings; this shift is more desirable than locating the buildings further north, which would compromise proximity and the building connectivity. Currently, there is a singular entrance to the campus, from Elmer School Road to the east. The Plan recommends an access road to Club Hollow Road to be used in an emergency or closure of the main entrance. Because it is not planned for regular use, it is shown as a gravel road. The design for this second entrance should be sensitive to any environmental impacts and coordinated with Montgomery County Department of Transportation (MCDOT) as well as and the Rustic Roads Advisory Committee.

10. *Natural and Sustainable Campus*. The campus has a charming rural character and lovely views across the central swale toward the woods. The Master Plan emphasizes the protection of these natural features by the consolidation of built elements and the restoration of natural landscaping to areas of pastureland that are no longer needed and areas where demolition occurs. A natural environment welcoming to staff would be created with the campus green's trees and ornamental planting. Sustainable design approaches emphasized by the Master Plan include energy and water efficiency and the use of natural light to illuminate and enliven the staff offices, work areas and amenity spaces.

11. *Flexible Incremental Growth*. The Master Plan is a framework and guide for future development. As a dynamic agency, NIH's growth depends on the direction of scientific work, funding availability and agency-wide priorities. The Plan is flexible in its components, program and timing. Building projects are identified based on today's priorities, but the plan remains valid as changes occur. The guiding principles of buildings clustered around a green, connectivity and shared services can still be maintained.

C. Determination of Proposed Facility Components

The space requirements that were not accommodated in existing buildings retained in the Master Plan became the program components for new buildings. While the space requirements were developed by type of space and NIH assignment, they were then grouped into logical building programs based on users, phased need and space adjacencies. The proposed space for the Imaging and Diagnostic Facility is a grouping of space requirements for NIH's Shared Research Program and Common Facilities, based on the following:

- The shared Imaging and Diagnostic Facility is proposed for Phase 2, and will bring priority research space on-line before the proposed Behavioral Research Facility is built.
- When the Behavioral Research Facility is built in Phase 3, it would be adjacent to the shared Imaging and Diagnostic Facility and physically connected.
- These grouping propose reasonable building sizes for each phase, and avoid disparity in the relative footprints of adjacent facilities.

Exhibit 11.4: Determination of Proposed New Facilities

Programs NIH	Components	Space Requirements		New Groupings		Proposed Buildings
		NSF	GSF	NSF	GSF	
Shared Research Program[1]	Animal Facilities	33,469	60,300	33,469	60,300	Behavioral Research Facility
	Research	9,340	16,800	3,000	5,400	
	Office	12,576	15,100	12,576	15,100	
Centralized Program[2]	Animal Facilities	35,936	64,700	35,936	64,700	Multi-Species Animal Holding Facility
	Research	14,190	25,500	14,190	25,500	
	Office	10,734	12,900	10,734	12,900	
Common Facilities	Imaging/ Diagnostics	7919	9,500	14,259	20,900	Imaging and Diagnostics Facility
	Storage	7000	8,400	7000	8,400	
	Staff Support	11,715	14,100	11,715	14,100	
Unassigned	Animal Facility	2,310	4,200	2,310	4,200	Breeding Colony
Other	Security		1,400		1,400	Entrance Security
Total Space			232,900		232,900	TOTALSPACE

1 Managed by NICHD at this time
2 Managed by DVR at this time

D. Land Use Zones

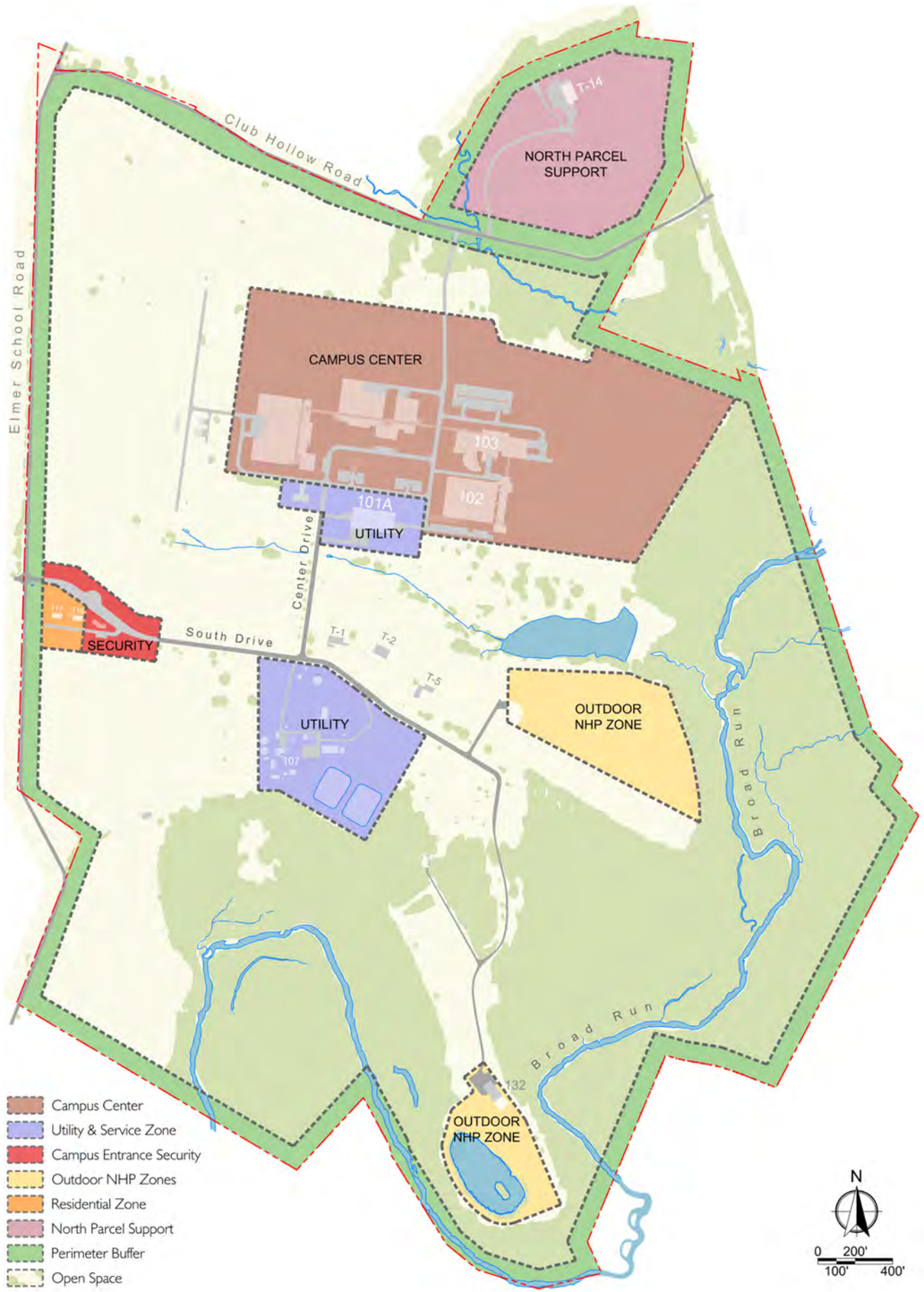
The land use plan establishes functional zones within the campus to organize the program. It directs future development while responding to existing building adjacencies, natural features, neighboring influences and the anticipated nature of future facilities. The land use plan for the campus is based on the following principles:

- Consolidation of research and animal care facilities
- Outdoor areas for non-human primates that require privacy and minimal disturbance
- Reuse and maintenance of viable utilities and services
- Preservation of open space and natural features
- Good neighbor policy

The following are the Land Use Zones proposed:

1. *Campus Center.* The campus center zone defines the heart of the research and animal holding activities at NIHAC, and would include the existing buildings currently managed by DVR and the planned new research and animal buildings. This zone would not only accommodate the growth anticipated for the 20-year plan, but would allow for adjacent future facilities. The campus center zone is the working base for most of the NIHAC staff and is characterized by pedestrian-friendly, landscaped areas; research and animal care buildings; employee support areas and parking. One area of the Campus Center zone is designated for possible solar panel installation; this is located on open land to the west of the buildings, and visually buffered from the property lines.
2. *Outdoor NHP Zones*. The field habitat and the proposed breeding colony are designated areas for outdoor, natural habitat for non-human primates. These zones are fenced, with shelters for the animals and observation posts for the researchers and animal care personnel. Protection of the animals and privacy from daily human activities on campus characterize their location surrounded by open space.
3. *Utility and Service Zone*. The existing campus Wastewater Treatment Plant (WTP), holding ponds, sludge storage, facility support and storage buildings form the core of one utility and service zone. The second zone is defined by the existing CUP. These zones require separation from the research and animal areas, and protection from intrusion. Plant upgrades and expansion recommended in the Master Plan would be within these zones.
4. *Entrance and Primary Circulation*. A zone is designated at the entrance along Elmer School Road for campus security screening, which would be reconfigured under the Master Plan. A goal of the Master Plan is to physically separate this zone from the adjacent residential area. The primary campus circulation of Center Drive and South Drive is not expected to change and would be part of this zone.
5. *Perimeter Buffer.* The landscape at the perimeter of the campus abuts two County roads and parkland. NIH would retain a buffer zone along the roads both for security and for preserving the agricultural character of the campus. The property line at the east and south of the campus borders existing and proposed M-NCPPC park developments and the Chesapeake and Ohio Canal National Historical Park (C&O Canal NHP). The perimeter buffer is needed for security and to help define the park limits for the public. The perimeter buffer is defined by fencing, some of which requires replacement as part of this Master Plan.
6. *Residential Zone*. Along Elmer School Road, there are two residences that house NIH staff. The residential zone would be separated from the entrance road in the Master Plan, to maintain campus security. No additional residences are anticipated.
7. *North Parcel Support*. A 23-acre parcel is located north of Club Hollow Road, separated physically and functionally from the main campus. Currently there is a warehouse and a few temporary buildings and trailers. The structures that are not being used extensively will be removed. This zone is characterized by woods and steep slopes and has been designated for continued support use.
8. *Open Space*. The open space zone encompasses several landscape environments including agricultural landscape with rolling hills and forested wetland of the Potomac River Valley, some of which are characterized by environmentally sensitive features such as flood plain or steep slopes. These form a common zone in the Master Plan, because the goal is to preserve these environments from development and enhance their natural characteristics and bio-diversity.

Exhibit 11.5: Proposed Campus Land Use Zones



E. State of the Art Animal Facilities

A state of the art laboratory animal facility can be defined in terms of its flexibility, efficiency, ability to support research, environmental health and security.

1. *Flexibility*. Flexible facilities are defined in terms of versatility, adaptability, interchangeability and expandability. A versatile facility is able to accommodate a wide range of species and research protocols without requiring significant building alteration. One factor is the capability to regulate room temperature, humidity and light levels over a broad range. Another is sizing the animal holding rooms to accommodate a variety of caging systems, configurations and relationships to research support.

   An adaptable facility is one in which the potential need for building alterations is foreseen and accommodated during the building's initial design. For example, an adaptable animal holding room design might allow subdividing partitions to be installed to separate research protocols.

   Interchangeability supports versatility. It provides the ability to alter the use of a particular room. For example, a holding space may later be used as a procedure room. At a smaller scale, changing the type of air filtration or caging used may allow for housing of a different animal species.

   Finally, state of the art animal holding facilities are designed to be easily expanded, without taking the existing facility off-line. Both site selection and initial layout play key roles in the ease of future expansion. Designing the original building in a repeatable module facilitates its expansion by allowing temporary shutdown of areas adjacent to construction while the remainder of the facility functions.

2. E*fficiency*. The efficiency of an animal holding facility derives from worker efficiency and resource use. The facility should be programmed to support efficient work flows and protocols. Animal care and staff support spaces should allow logical, efficient movement of staff, animals and materials with minimum noise and disruption to research. Although often considered low priority, adequate support space greatly improves efficiency including general storage, food storage and preparation, separate docks for the loading/unloading of animals and supplies, cage repair and cage storage.

   For resource efficiency, state of the art animal facilities should minimize energy consumption for climatization and water use for cleaning. Automatic watering devices, high efficiency cage washing systems and autoclaves can contribute to the facility's water efficiency. Ventilated cage racks, heat recovery systems and proper zoning of air movement can dramatically reduce the number of air changes required and the associated cost of conditioning the air in animal holding facilities.

3. *Research Support*. Over the past 20 years, emphasis in animal research has shifted away from whole animal physiological studies toward mechanistic studies at the cellular and sub cellular levels. As a result, there has been a corresponding shift away from the large animal species toward less expensive animal models such as mice. However, state of the art facilities must be constructed to accommodate a variety of animal species because translational studies or new research areas often require the use of larger animal models. NIHAC has planned future emphasis on non-human primates.

   Where whole animal models are used, researchers often focus on the function of specific organs or cells within an organ, and these studies often require non-invasive measures obtained via advanced imaging equipment. Today's animal holding facilities support this with proximate access to MRI, PET and radiological imaging equipment. For large animal species, the use of less invasive whole animal or organ imaging is critical to avoid procedural impacts on experimental outcomes.

   In the past, research support spaces were limited mainly to procedure and surgical spaces. In addition to those spaces, today's studies of animal tissues at the cellular and molecular level often require immediate access to laboratory spaces with specialized equipment, sample storage capabilities and freezer rooms, ICU units with adjacent multiple isolators or holding rooms are also increasingly required.

   When planning facilities, 24 hour access to animals for sampling or other experimental manipulations should be considered.

4. E*nvironmental Health*. The environmental health of new animal holding facilities includes the physical and emotional well-being of the animals, animal care staff and researchers. Minimization of allergens via air filtration is critical. Interstitial spaces allow repairs and maintenance of critical equipment without disruption of animals or research protocols. Natural light and exterior views for primates, when not prohibited by experimental protocols, are also beneficial to animal health and well-being. Durable, corrosion resistant materials, such as stainless steel and FRP, allow easy cleaning without frequent painting. Enrichment devices and access to the outdoors, where appropriate, should be considered for physical and psychological benefit. Caging arrangements that allow social bonding also improve the environment for primates and other social species. Staff break areas should provide a restful and rejuvenating environment.

5. S*ecurity*. Security must consider the safety of animals, their caretakers and researchers. Animals must be protected from predators, harmful biological agents and, in some cases, each other. To this end, holding rooms need tight-fitting entrances; and other openings, such as drains, must close. Holding rooms should provide adequate distance between animal cages and human passersby to prevent injury. Although not proposed in this master plan, if biological agents were to be used in this campus, as in a BSL-3 facility, proper pressurization in holding room and adjacent spaces, and the use of anterooms, is critical to protect from the spread of pathogens. Secondary enclosures and swing spaces are important to allow safe cleaning of group housing spaces.

   Animals and their caretakers must be protected from those who wish to undermine animal research through violent means. Controlled access via card readers and surveillance of those entering the building is important security procedures.

11.2 Landscape Plan

A. Landscape Setting

The campus is located within the Northern Piedmont Triassic Lowlands ecoregion and the Potomac River Valley. Physical features of the campus are characteristic of the surrounding historic, agricultural landscape. They include the rolling hills that descend into the forested wetlands of the Potomac River Valley and the natural, central swale that divides the northern section of the site from the southern section of the site. The facilities fit well into the local agricultural setting, as buildings are centralized within the campus. The fence lines, roads and open pastures complement the area's agricultural topography and associated rural views. The original farm buildings are well maintained. Although biodiversity within the site has been compromised by centuries of crop specific landscape maintenance and historic drainage techniques, its natural environment offers several opportunities for restoring diverse wildlife habitats and could be utilized as a regional seed source for missing pioneer species.

B. Landscape Master Plan Approach

The landscape approach in the Master Plan aims to increase local biodiversity by reducing carbon based maintenance activities within the campus, collecting stormwater to prevent agricultural runoff from entering the Potomac River. The plan also introduces new landscape elements that harmonize with existing historical landscape patterns, protect agricultural views, restore wildlife habitats and create visually rich, and seasonally appealing, landscape. These elements are described in more detail below. Note that all proposed improvements, if and when implemented, will need to be in compliance with applicable regulatory requirements.

C. Landscape Master Plan Elements

1. *Hedgerow Buffers*. The hedgerow buffers would limit both visibility of, and physical access to, service areas and the primate breeding facility. Additionally, the hedgerow buffers would reintroduce native, primary succession habitat that has been lost to traditional agricultural practices, and provide seasonal, attractive plantings. The hedgerow buffers would be aligned to complement the diagonal geometry of the agricultural landscape and encourage drainage in the Triassic shrink/swell soils.

2. *Pastures*. The projected future animal requirements of the NIH facility indicate a reduction in the amount of space needed for pastures. The projected need is a total of approximately 70 acres. As a result of this reduction, the existing pasture fences would be relocated and former pastures would become part of the proposed meadow restoration project. The pastures that are identified for preservation are central to the site, as well as easily accessible to, and visible from, the original farm buildings. The pastures would be generally maintained by grazing and/or mowing.

3. *Meadow Restoration*. Open land that will not be used for pastures would be restored to meadows. Several techniques can be utilized to manage the meadow restoration process, including reducing mowing schedules and performing prescribed burns.

4. *Evergreen Tree Planting*. Evergreen trees would be located in the areas between the hedgerow buffers and the proposed, new facilities to screen taller structures from adjacent roadways.

Exhibit 11.6: Proposed Campus Landscape Plan

5. *Campus Green*. The proposed campus facilities would be oriented around a central green. Upon entering the central green, the landscape would change dramatically, exhibiting a contextual shift from surrounding evergreen trees to intimate shade and flowering trees. The angular geometry associated with the surrounding agricultural landscape would loosen into sweeping arcs that would define the interconnected walkways between the new buildings. Of note is a proposed, large, single arc of low perennial and tree plantings that would create a new circular walk and seating area. The campus green would extend above the relocated roadway, incorporating similar arcs of perennial and tree planting, connecting pathways and seating areas. Associated benches, night lighting and other park like amenities would embellish the Campus Green.

6. *Vernal Pools*. The restoration of vernal pools along the central drainage spine would enhance the campus' biodiversity, as well as augment local efforts to protect and increase amphibian habitat in the region. Reestablishing vernal pools would be accomplished by carefully positioning logs, brush and plant material to facilitate ponding associated with the Triassic Lowland soils, during rainy seasons.

7. *Stormwater Management*. The natural swale proposed for vernal pool restoration currently accepts stormwater runoff from adjacent paving, structures and pastures. To protect the water quality in both the vernal pools and water downstream, vegetated swales with check dams are proposed. Roof water from retained and/or newly constructed facilities are proposed to be collected in localized cisterns for reuse. This would reduce stormwater runoff and provide supplemental gray water for incidental applications such as irrigation.

Exhibit 11.7: Proposed Campus Center

11.3 Parking and Circulation Plan

The planned future improvements at the NIH campus consolidate activities and facilities on the north campus. These improvements would also incorporate various modifications to the parking layout, security entrance, access points and various other transportation improvements to the network.

Based on the findings of the transportation and circulation analysis, the proposed Master Plan for NIHAC would not have a significant impact on the external transportation network surrounding the site. The modifications proposed in parking and circulation in the campus are expected to better serve the development by improving the overall transportation network.

A. Campus Circulation

The final build-out of the Master Plan would include changes to the campus circulation, security and parking areas, developed in phases to parallel construction.

1. Entrance Security Area

In discussions with NIH on the existing security procedures, it was communicated that, during peak periods, as many as 5-6 vehicles are queued at the security entrance awaiting authorization onto the NIH site. In order to ensure proper screening is completed for each vehicle, while also allowing vehicles entry to the NIH site, a redesign of the security area should account for two separate entrances — one for employees allowing an expedited entrance, and one for visitors requiring thorough screening. The entrance should also provide a rejection area suitable for both passenger vehicles and large tractor trailers. The driveway serving the existing residential units along South Drive should not be adversely impacted by this modification. This design is shown in Exhibit 11.10 - Parking Details.

2. Parking Demand

The NCPC Comprehensive Plan encourages the use of public transportation and designates federal facility parking ratios based on availability and proximity to public transportation. According to the Plan, the NIHAC's parking goals should be a ratio of 0.67 spaces per staff member, based on its location outside of the District, Arlington County and Old Town Alexandria, and beyond 2,000 feet from a Metrorail station. This Master Plan recommends a more generous parking ratio based on several factors:

- The site is very rural, located in an agricultural area with no public transportation available within several miles of the campus.
- All staff arrive by car, work in shifts and are often required to extend their shifts or remain overnight in inclement weather conditions. This, and the fact that staff members come from scattered communities, make car-pooling impractical.
- The planned facilities are expected to draw researchers from both Bethesda and other regional NIH facilities to conduct their procedures at NIHAC, rather than moving the animals to Bethesda. Some will come by a scheduled van from Bethesda, but there is not van service from other facilities at this time and many researchers will come by car because of the schedule requirements of their procedures.
- There are a limited number of visitors to NIHAC each day, and they typically arrive by car.
- In addition to personal vehicles, NIHAC has several government vehicles to park.

The proposed number of parking spaces is 194 for staff plus an additional 24 to allow for shift overlap, NIH vehicles, visitors and distribution among buildings – for a total of 218 spaces. The parking ratio for staff would be 0.81 spaces per position. Although this ratio is higher than the NCPC policies, the population on the site is limited and NCPC requirements do not call for a full Transportation Management Plan to demonstrate the need.

The Master Plan would be implemented in several phases, and the parking lots constructed to serve the new facilities as they are phased in. Therefore, the parking demand has been determined by building/cluster of buildings, by phase.

Exhibit 11.8: Parking Demand

Building	Staff[1] Number	Staff Parking Demand	Parking Proposed
B102	18	27	33
B103	39	37	–
Imaging & Diagnostic	15	20	124
Behavioral Research	75	54	–
Animal Holding	39	26	–
B101A	49	22	53
Breeding Habitat	2	1	1
Entrance Security	2	7	7
TOTAL	239	194	218
Parking ratio: space/person		0.81	

1. This includes the projected personnel (212) in all shifts and limited number of visiting NIH personnel.

This per-building parking demand was compared to the proposed layout of the Master Plan to ensure that adequate parking was provided in each area, and at each phase. The parking areas shown in the plan have been adjusted to provide the total number of spaces needed to serve each building or building clusters, and to encourage adequate flow within each parking area.

3. Parking Supply

Based on the site's future parking demand, an appropriately sized parking area has been provided to serve each building cluster. These parking areas, as sized and configured, will ensure proper utilization and flow. These parking spaces are broken down as follows:

- *Parking Lot 1 (serves Entrance Security and Gateway Center)*: Parking will be required for the security staff, located off South Drive, near the security office. Existing parking for this area is shown as a total of 5 spaces; however, it was communicated that at a minimum there are always 4 security personnel on staff at all times. Given that these personnel have personal vehicles as well as security vehicles, this parking area was assumed to increase in size. This would require a parking supply of approximately 7 spaces.
- *Parking Lot 2 (serves Building 102)*: In the Master Plan, this parking area would be oriented in a similar manner as currently designed, but would be expanded to incorporate a total of 33 parking spaces, including 1 handicapped space.
- *Parking Lot 3, serves Building B103, Imaging & Diagnostic Facility (Building B), and Behavioral Research Facility (Building C)*: Ultimately, this parking area would be constructed in a currently undeveloped area just north of Building B103 and east of the proposed Diagnostic & Imaging Facility. It could be constructed in separate phases as each proposed building is erected. The Master Plan demand for this parking area would be 124 spaces in the final build-out.
- *Parking Lot 4, serves Building B101A and Multi-Species Animal Holding Facility (Building D)*: This lot is proposed where the existing Building 101 and trailers are located—in the southern end of the proposed campus green. The parking area would be divided into two sections, to frame the Campus Green and allow for a meaningful landscaped area. Initially, this area would need to accommodate the demand of only Building 101A. Ultimately, the demand of the Animal Holding Facility would also be served by this dual parking area. Combined demand realized for both buildings would require a parking supply of approximately 53 spaces.
- *Existing Lots*. There are several existing parking areas associated with campus buildings that are remaining in place, notably the Wastewater Treatment Plant (WTP), the barn and the field habitat. These parking areas would remain unchanged. Where buildings are being demolished, the existing paved areas would be removed and returned to natural landscaping.

- *Parking Structure.* The NCPC Comprehensive Plan policy encourages federal agencies to construct structures for parking, in the interest of efficient land use and urban design. One of the goals of NIHAC is to maintain the rural, farm-like character of the campus by keeping buildings low. In addition, the parking would be added gradually over a number of years, as individual facilities are added to the campus. These factors make a parking structure impractical for the Master Plan.

The parking need changes with the phased build-out. Phased parking demand for the new lots is shown in Exhibit 11.9. Additionally, Exhibit 11.10 shows the preferred design for each of these facilities, which would provide the most efficient points of egress/ingress and flow.

4. Loading

For each new building, loading areas are proposed to accommodate various deliveries. Each of the new loading areas would require two dedicated sections protected from cross-contamination. Therefore, a minimum of two loading berths for each would be constructed. Also, each loading bay is required to accommodate a full size tractor trailer. Because of this requirement, the loading berths should be designed to facilitate the necessary turning maneuvers. A detailed maneuverability analysis for large vehicles will be required when formal design for these parking areas begins.

5. Emergency Access Road

An emergency access would be provided in Phase 2 of the Master Plan. The exact location of this connection has not been determined, because there are several wetlands and topographical constraints in the area which would need further study. Given that this is not intended for regular inbound traffic at any time, the security element at this gate would not need to be as extensive as that at the main entrance. Also, construction of this access point is not anticipated to have a dramatic impact on the existing external road network around the site, nor the internal campus road network, given the low traffic volumes around and within the campus. A detailed analysis of feasible options for the location and delineation of this emergency access road is recommended. Associated impacts should be carefully evaluated before finalizing a design. The design of this access road will need to be coordinated with MCDOT, Fire and Rescue Service, and the Rustic Roads Advisory Committee.

6. Intersection Geometry

With Master Plan development and the addition of several loading berths, more heavy vehicle traffic on the north campus should be expected. While generally these vehicles consist of smaller single unit vehicles making deliveries and garbage disposal trucks, sometimes larger vehicles will travel along the site roadways. Intersection geometry modifications may be required in order to accommodate these large vehicles, including ensuring stop bar locations and intersection corner radii that support these turning maneuvers. These maneuvers would be analyzed when the Master Plan implementation begins.

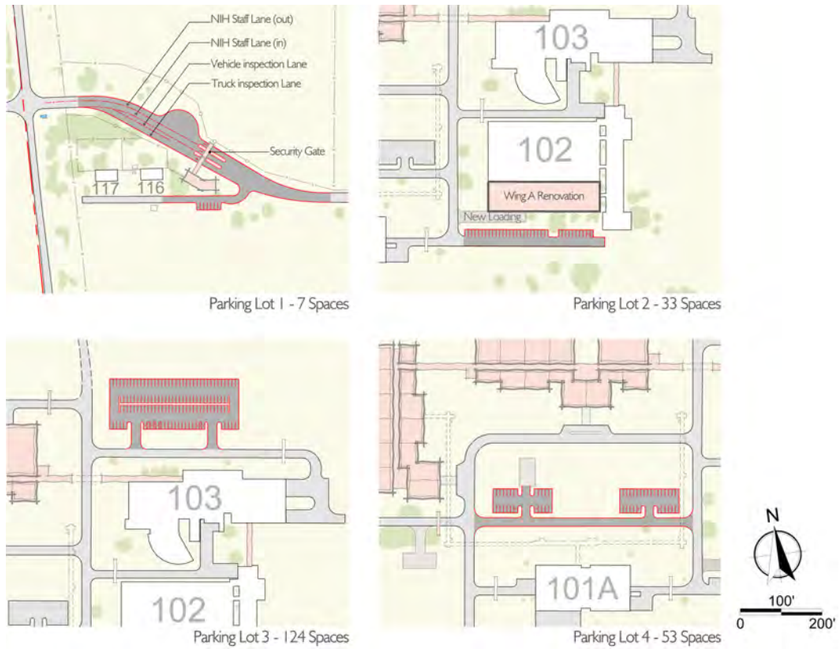
B. Parking and Circulation Plan Phasing

The Master Plan development occurs in a sequential order that maintains transportation efficiency throughout the network while also incorporating the needs of the site.

Phase 1. Phase 1 of the Master Plan would demolish existing structures that are currently not heavily utilized and upgrade some areas of the site. Some of the upgrades would include a new loading access for a new wing in Building 102; installation of additional fuel tanks; and the security fence. To accommodate the additional parking demand for Building 102 and Building 101A, various parking areas would need to be expanded, as well as any necessary roadway infrastructure discussed above will need to be added.

Exhibit 11.9: Parking Distribution Plan

Exhibit 11.10: Parking details



Phase 2. The second phase of development would involve the most significant construction for access, consisting of the Shared Imaging and Diagnostics facility and the new breeding colony. A split-grade crossing would link the new building and Building 103, and parking in the area is expanded to accommodate the extra demand. The overall road network would not be modified, but one change would be the relocation of the North Drive south, closer to the CUP, creating the required 100' security setback from the planned building locations. During Phase 2, the existing security entrance would be improved to allow for more efficient flow and separating access to the residential units. While the security area is being modified, there would be the potential for some significant delays if emphasis is not placed on traffic control during peak periods, and a traffic control plan should be prepared. The proposed breeding colony is not anticipated to have any impact on the transportation network. The Club Hollow Road emergency access would be constructed during this phase.

Phase 3. This phase would continue to expand the development program north along Center Drive by constructing the proposed Behavioral Research Facility. As with Phases 1 and 2, the parking for the additional development would be accommodated with expanded parking area proximate to the building. Parking areas demolished on the south campus would be returned to native planting.

Phase 4. The final phase of the Master Plan redevelopment would construct a new Multi-Species Animal Holding Facility (Building D), an enclosed connecting walkway, and parking to serve the added demand. The parking areas within the campus green would be expanded to accommodate the demand from the Animal Holding building.

C. Site Trip Generation

The number of anticipated peak hour trips for the proposed Master Plan was developed using field data collected during the peak period which included turning movement counts. As indicated previously, the site generated 51 AM peak hour trips (46 inbound, 5 outbound) and 18 PM peak hour trips (1 inbound, 17 outbound). NIHAC staff work varying shifts, and some staff stay on-site overnight, both of which keep the trips low in the AM and PM. peak periods. Assuming these peak hour patterns for the site and an existing staffing of 199 individuals, the future staffing for NIH was estimated by linearly increasing the existing peak hour site trips. Based on this methodology, the future trip generation for NIH is estimated at 61 AM peak hour trips and 22 PM peak hour trips, as shown on Exhibit 11.11. This represents an increase of 10 AM peak hour trips and 4 PM peak hour trips.

Exhibit 11.11: Total Future Site Trip Generation

		AM Peak			PM Peak		
		In	Out	Total	In	Out	Total
Existing Staffing	199 Employees	46	5	51	1	17	18
Proposed Staffing*	239 Employees	55	6	61	1	21	22
DIFFERENCE		9	1	10	0	4	4

* Includes an additional 27 visiting NIH staff. pers

For purposes of analyzing the future network, these additional trips were applied to the network, assuming the existing directional distribution discussed previously that shows all of the site traffic to enter and exit from/to the north along Elmer School Road. The total future peak hour traffic volumes incorporating additional site trips onto the existing volumes are shown on Exhibit 11.12.

D. Total Future Capacity Analysis

By using the total future peak hour traffic volumes and the existing lane utilization and traffic control shown on the previous exhibits, capacity analyses for each of the study area intersections was completed. Because of the existing conditions and the extremely low traffic volumes in the area, each of the study intersections are expected to operate at acceptable levels during both the AM and PM peak periods. These results are shown in Exhibit 11.13.

Exhibit 11.12: Total Future Peak Hour Traffic Volumes

Note: Not to scale

Exhibit 11.13: Total Future Peak Period Capacity Analysis Summary

Intersection	Approach	Future Conditions			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
1. Elmer School Rd & Club Hollow Rd.	Westbound	8.8	A	8.5	A
	Southbound left	0.4	A	3.6	A
2. Elmer School Rd. & NIH Entrance/ Montgomery Co. Police Range	Eastbound	9.5	A	8.8	A
	Westbound	8.4	A	8.4	A
	Northbound left	0	A	0	A
	Southbound left	6.7	A	2.4	A
3. Elmer School Rd. & Whites Ferry Rd.	Northbound	8.8	A	8.8	A
	Westbound left	2.6	A	0.4	A
4. Government Driveway & Club Hollow Rd.	Southbound	0	A	8.5	A
	Eastbound left	0	A	0.9	A

11.4 Engineering and Site Utilities

Today, energy and water use on the campus are not operating efficiently, and a Master Plan goal has been to improve performance while accommodating the anticipated growth. Replacement of aging and energy inefficient buildings would be one strategy and fully utilizing the capacity of the recently-built central utility plant another. Both of these measures are incorporated into the Master Plan.

A. Heating and Cooling Systems

Master Plan development on the NIHAC campus is concentrated on the north campus, which is served by central services that include steam and chilled water from the central utility plant (CUP), Building B101A. This plant and its distribution tunnels, built in 2003, utilize current technology and have the capacity to support the planned 20-year development of research and animal holding facilities. Under the Master Plan, all major facilities will be supplied with chilled water and steam from the central plant, a strategy based on the projected future loads developed from projected square footage and unitary load factors.

The Master Plan proposes two new facilities that would not be located on the north campus; the proposed entrance security (Gateway Center) located along Elmer School Road, and the proposed shelter for the proposed non-human primate breeding colony located on the southern campus. Both of these proposed facilities would have energy efficient dedicated mechanical systems. It is recommended that the proposed breeding colony shelter utilize alternate energy sources to generate both heat and electricity. The demands of the shelter are modest, with a winter temperature requirement of approximately 55°F. Ground-source heat pump systems should be considered. In general, none of the existing or proposed buildings on the south campus would be connected to the CUP, because preliminary evaluation of extending the services from the CUP was found to be costly and inefficient.

B. Electrical System

Allegheny Power Company provides electric power to the existing site at a voltage of 12.47kV. The on-site infrastructure, consisting of the utility feeder and switchgear, are sized to support a load significantly higher than the recorded 2,791 kw peak demand noted in the *Update and Assessment of Existing Utility Infrastructure at* NIH *Animal Center, Poolesville, Maryland* (2011). The Allegheny Power Company reviewed the incoming services and concluded that the system could support a 50% increase in peak load, sufficient to support the planned development. Incoming service from the north would need to be relocated when building construction begins.

The on-site emergency power system consists of four 1,450 kW engine generators located in Building 101A. Assuming one standby unit, the output of three engine generators would be approximately 4,350 kW, which is approximately 50% greater than the existing peak load of 2,791 kW and is considered adequate capacity to support the future development. Two additional fuel tanks have been planned for FY 2012 installation, to increase the capacity of the emergency generators to 30 days instead of the current 15 days.

Exhibit 11.14: Summary of Utility Loads and Requirements for Steam, Chilled Water and Electric

Utility System	Existing							Future		Recommendations
	Area Served		Peak Load	Unitary Load	Peak Load Source	Total Plant Capacity (Note 1)	Plant Firm Capacity (Note 2)	Area Served (nsf)	Peak Load	
	Gross (gsf)	Net (nsf)								
Steam Plant	293,000	89,000	34,640 pph	389 B/hr/nsf	Unitary Loads and confirmed by fuel use (note 2)	104,600 pph	67,300 pph	336,500	47,320 pph	Add two additional 50,000 gallon fuel oil storage tanks to increase storage time from approximately 8 days to 11 days under future load conditions
Chilled Water Plant	293,000	89,000	1,130 tons	79 nsf/ton	Unitary Loads and confirmed by Operators	3,600 tons	2,400 tons	336,500	1,600 tons	Based upon the existing building systems the unitary load is 90 nsf per ton. This is too energy intensive based on current standards. Future design should include systems such as heat recovery to reduce the future load by a minimum 50%.
Electric	420,000	170,000	2,791 kw	16.4 w/nsf	2011 Utility Infrastructure Assessment / Metered Demand (June 2010)	–	–	229,800	3,840 kw	A 50% increase in load can be supported by the incoming service (per AEP)
Emergency Power	420,000	170,000	2,791 kw	16.4 w/nsf	Based upon peak site electric demand	5,800 kw	4,350 kw	229,800	3,840 kw	None

Notes:

1. Firm Capacity Based Upon the Following

STEAM:		CHILLED WATER		EMERGENCY POWER	
Boiler 1	37,300 pph	Chiller 1	1,200 tons	Generator 1	1,450 kw
Boiler 2	37,300 pph	Chiller 2	1,200 tons	Generator 2	1,450 kw
Boiler 3	15,000 pph	Chiller 3	1,200 tons	Generator 3	1,450 kw
Boiler 4	15,000 pph			Generator 4	1,450 kw
Total	104,600 pph	Total	3,600 tons	Total	5,800 kw
Largest Unit	(37,300) pph	Largest Unit	(1,200) tons	Largest Unit	(1,450) kw
Firm	67,300 pph	Firm	2,400 tons	Firm	4,350 kw

Electrical Firm Capacity Based upon review from AEP.

2. Peak Steam Load based upon building unitary loads was confirmed versus fuel records (below):

Gallons	Approx. Energy	Total Steam (assuming 80% boiler efficiency)	Degree Days (Washington DC)	Peak Load	Boiler Load (5 F Min. OA Temp)
Dec 2008	67,074	9,055,000 Mbtu	7,244,000 lbs.	759	24,000 pph
Jan 2009	72,973	9,851,000 Mbtu	7,880,800 lbs.	1,028	19,000 pph
Feb 2009	54,446	7,350,000 Mbtu	5,880,000 lbs.	698	21,000 pph
Dec 2009	103,094	13,918,000 Mbtu	11,134,400 lbs.	835	33,000 pph
Jan 2010	113,155	15,276,000 Mbtu	12,220,800 lbs.	914	33,000 pph

C. Potable Water

The campus potable water is supplied from five on-campus wells, from which water is pumped to a water tower. Water consumption and its conservation have been one of the key considerations in this Master Plan. The amount of water drawn from the wells is limited by permit, the Maryland State Water Appropriation Permit. A rigorous program consisting of comprehensive metering, transmission loss detection and repair has resulted in a 40% reduction water appropriation need for the campus.

The Master Plan projects an increase in campus population for both people and animals; the future demand for water has been estimated based on the increase in staff and non-human primates (NHP), with a negligible increase anticipated from the mouse population. The projected water usage has been based upon usage corresponding to the current site populations and metered water usage.

Exhibit 11.15: Projections for Occupant Use and Wash-downs – 20 Year Plan

	Total Number	Usage Rate gallons/day	Water Load gallons/day
Staff	212	10	2,100
NHP Caged	2,329	4	9,300
NHP Group	460	4	1,800
NHP Outdoors	225	6	1,400
Large Animal	24	10	200
Cage Wash-down	2,329	21	48,000
TOTAL			62,800

Other water usage factors were also estimated. NIH anticipates that transmission loss would be negligible in the future. The make-up rate for the steam system would increase consistently with the projected 37% load increase to the CUP. For planning purposes, a 20% factor of safety was also included. Estimate of future requirements:

Occupants and wash-down	62,800 gallons/day
Mechanical – CUP make-up	17,500 gallons/day
Total	80,300 gallons/day
With 20% Safety Factor	96,400 gallons/day

Based upon current system operation and a 20% factor of safety, the projected future load for potable water is 7% higher than site limitation of 90,000 gpd, without implementation of any water use reduction measures. The Master Plan considered reductions in water demand through efforts to capture and reuse rainwater for the newly constructed buildings as well as existing buildings and/or advanced treatment of the gray water to increase the potential use. These considerations were further reviewed in conjunction with the non-potable water and treatment plant evaluation.

The Master Plan recommends reductions in the peak flow demand onsite (which includes a 20% factor of safety) as follows:

- Water conservation measures to reduce projected future potable water use by at least 15%; and,
- Reduction of future steam loads through energy conservation and heat recovery by at least 20% to reduce the corresponding steam make-up rate

If these recommendations and associated reduction goals are not implemented, then future expansion of the site under this option would be limited by the potable water demand. The proposed recommendations are necessary to maintain future water demand below the 90,000 gpd limit.

A more detailed study of the CUP to determine the potential to reduce the potable water usage is a recommended. If the existing 12,790 gallons per day (gpd) of potable water use metered at the CUP is for steam system make-up, then that would equate to approximately 107,000 pounds of steam per day or 4,500 pounds of steam per hour (13% make-up rate for the steam system). A detailed analysis would be needed to determine the appropriate makeup rate for the steam system.

The potable water is primary source for fire suppression for the site. The wells that are the primary source of potable water in the campus have an average flow rate of approximately 100 gallons per minute (gpm). The on-site water storage tank where the water from the wells is stored has a total storage volume of 350,000 gallons. As new buildings are constructed the fire suppression requirements of each building will need to be evaluated and addressed. The water flow for fire suppression will vary depending upon the future building type and design. A flow requirement for typical building system with an automatic sprinkler system and standpipes is 1,000 gpm for a duration of 30 minutes according to National Fire Protection Association (NFPA) 14. If two hydrants were included at 250 gpm each, the total flow would 1,500 gpm for 30 minutes. This results in a total storage volume of 45,000 gallons. These requirements can be increased by the authority having jurisdiction, so actual flow calculations will need to be reviewed for future building designs.

It is also possible that the site may have some Ordinary Hazard Group 2 sprinkler systems which would include stables or barn type structures. Under this scenario the following flows are required per NFPA 13:

- 1,500 square feet at 0.15 gpm/sf = 300 gpm for sprinklers
- plus 500 gpm for a combined inside and outside hose stream

The combined flow of 800 gpm is required for up to 120 minutes. This would result in 96,000 gallons of fire flow. The system would be size based upon the higher demand of the two scenarios (typical building and Ordinary Hazard Group 2), not the combined total. Therefore, the 350,000 gallon on-site water storage tank should be adequate to support the typical fire needs of the site from a general planning perspective.

Exhibit 11.16: Potable Water System Summary

	Existing		Future Projections	
	Current gallons/day	Target[2] gallons/day	Current Practices gallons/day	Target gallons/day
Staff and Animals	9,250	7,900	14,800	12,600
Water for Wash-down	27,970	25,200	48,000	43,200
Steam System Make-up	12,790	10,000	17,500	14,000
Transmission Loss	10,000	–	–	–
20% Safety Factor	–	–	16,100	14,000
TOTAL	60,010	43,100	96,400	83,800

Notes: 1. Current permit limitation is 90,000 gallons per day.

2. Target values are based on the following water use reductions, using gray water and other strategies
   Improved wash-down equipment and efficiency (10% reduction)
   Reducing steam system make-up rates to ~12%
   Reducing transmission losses to 0%

D. Non-Potable Water

Non-potable, or gray water, is supplied to the campus through a separate system of pipes. Gray water is the discharge water after treatment at the on-site sewage treatment facility. Currently, the majority of the gray water produced on site is used at the CUP for condenser water make-up in the cooling towers. According to the operators the total dissolved solids (TDS) in the gray water system may cause excessive blow down rates in the cooling towers. High levels of TDS can cause scale build-up on the piping and equipment of the condenser water system.

With the Master Plan development on the north campus, the make-up water rate for the cooling tower system would increase approximately 42%, based upon the projected increase in the future cooling load. This does not consider any additional treatment to address the TDS level of the gray water system. Either reducing the TDS levels through a tertiary filtering system or mitigating the scale build-up on the condenser water piping system with a scale inhibiting system would potentially reduce future make-up requirements as noted below:

- *Tertiary Filtration System*: Adding a tertiary filtration system, such as a reverse osmosis system, would lower the TDS of the gray water, which may also allow gray water use for steam system make-up and wash down requirements. The issue associated with the reverse osmosis filtration system is the typical 50% rejection rate of the system flow. For example, if 100,000 gpd flows through the reverse osmosis filtration, approximately 50,000 gpd would be usable and 50,000 gpd would be rejected back to the treatment plant. This additional load on the treatment plant as well as potential increase in the effluent discharged has to be considered before installing a reverse osmosis filtering system.
- *Scale Inhibitor System*. Adding a system to inhibit scale build-up on the CUP piping would only achieve a reduction in the gray water need. Reducing potable water usage would also be required, so that potable water use would not exceed the 90,000 gpd limit and the site winter discharge would not exceed the 100,000 gpd permit maximum.

The potential effects of these two options, adding tertiary filters and scale inhibitors, are compared in Exhibit 11.18. The resulting flows are based upon the assumption that the required water reduction efforts will be implemented to maintain site demand below the 90,000 gpd limit. Note that the tertiary filtration system was evaluated for two supply alternatives. The first alternative includes the wash down and utility make-up from the potable water supply. This results in a smaller load (127,000 gpd) on the WTP. The second alternative assumes the wash down and make-up water supplied from the gray water system (post filtration). This alternative significantly reduces the well water demand to 15,100 gpd; however, the WTP treatment capacity is increased to 265,900 gpd.

With the addition of the scale inhibitor the resulting flow to the waste treatment plant will be approximately 127,000 gpd. While this exceeds the current limitations of the plant; upgrades to the plant can implemented to reach the 150,000 gpd capacity potential. The recommended approach for water conservation and enhancements to the non-potable water system is summarized in Exhibit 11.19.

Exhibit 11.17: Projected Cooling Tower Make-up Requirements

	Evaporation	Blow-down	Total Flow
	gallons/day	gallons/day	gallons/day
Existing	24,000	56,000	80,000
Future – No treatment	34,000	79,000	112,000
Future – Tertiary Filters	34,000	34,000	68,000
Future – Scale Inhibitor	34,000	34,000	68,000

Exhibit 11.18: Summary of Potable, Non Potable and Sanitary System Operation – Existing and Future

Water Usage Category	Status Quo for Cooling Tower Make-up						with Scale Inhibitor						with Tertiary (RO) Filtration					
	Existing			Future			Future (w/recommended water conservation measures)			with proposed recommendations			Wash down and make-up from potable water			Wash down and make-up from grey water		
	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)
Occupant Use	9,250	–	9,250	14,800	–	14,800	12,600	–	12,600	12,600	–	12,600	12,600	–	12,600	12,600	–	12,600
Wash Down	27,970	–	27,970	48,000	–	48,000	43,200	–	43,200	43,200	–	43,200	43,200	–	43,200	–	43,200	43,200
Cup Steam Make-up	12,790	–	12,790	17,500	–	17,500	14,500	–	14,000	14,000	–	14,000	14,000	–	14,000	–	14,000	14,000
Transmission Losses	10,000	–	–	10,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Factor of Safety (20%)	–	–	–	*16,100*	–	*16,100*	*14,000*	–	*14,000*	*14,000*	–	*14,000*	*14,000*	–	*14,000*	*2,500*	*11,400*	*13,900*
Infiltration	–	–	12,000	–	–	12,000	–	–	–	–	–	–	–	–	–	–	–	–
Cooling Tower Blow down	–	56,000	56,000	–	79,000	79,000	–	63,000	63,000	–	27,200	27,200	–	27,200	27,200	–	27,200	27,200
Cooling Tower evaporation	–	24,000	–	–	34,000	–	–	27,200	–	–	27,200	–	–	27,200	–	–	27,200	–
RO Filter Rejection / backwash	–	–	–	–	–	–	–	–	–	–	–	–	–	70,400	70,400	–	139,000	139,000
Miscellaneous Use (gray water)	–	16,000	16,000	–	16,000	16,000	–	16,000	16,000	–	16,000	16,000	–	16,000	16,000	–	16,000	16,000
TOTAL POTABLE[1] (90,000 GPD MAX)	60,010	–	–	96,400	–	–	83,800	–	–	83,800	–	–	83,800	–	–	15,100	–	–
TOTAL SANITARY[2] (120,000 GPD EX. CAP.)	–	–	134,010	–	–	203,400	–	–	162,800	–	–	127,000	–	–	197,400	–	–	265,900
TOTAL GRAY WATER		96,000			129,000			106,000			70,400			140,800			278,000	
EFFLUENT DISCHARGE			38,010			74,400			56,600			56,600			56,600			–

Notes:

1. 90,000 gpd maximum permitted
2. 100,000 gpd design capacity and 120,000 gpd operating capacity

Future Flows based upon the following								Recommended Conservation Reductions
Occupant	Staff	212	x	10	gpd per	=	2,100 gpd	15%
	NHP Caged	2,329	x	4	gpd per	=	9,300 gpd	15%
	NHP Group	460	x	4	gpd per	=	1,800 gpd	15%
	NHP Outdoors	225	x	6	gpd per	=	1,400 gpd	15%
	Large Animal	24	x	10	gpd per	=	200 gpd	15%
Wash down	NHP	2,329	x	21	gpd per	=	48,000 gpd	10%
CUP Steam		37%	Increase based on load					
							Steam System	20%
Cooling Tower Evaporation		42%	Increase based on load					
							Cooling Tower Blow Down	20%

Exceeds current capacity of existing Treatment Plant (120,000 gpd). Maximum Treatment Plant Capacity assumed to be 150,000 gpd (with upgrades).

Exceeds Maximum Capacity / Limitations

Exhibit 11.19: Required Water Reduction Programs Needed for Option of Adding a Scale Inhibitor System at the Central Energy Plant

Water Usage Category	Existing			Future (Status Quo)			Recommended Approach			Recommendations
	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	Potable (gpd)	Non-potable (gpd)	To Sanitary (gpd)	
Occupant Use	7,420	–	7,420	14,800	–	14,800	12,600	–	12,600	15% flow reduction
Wash Down	27,970	–	27,970	48,000	–	48,000	43,200	–	43,200	
Cup Steam Make-up	12,790	–	12,790	17,500	–	17,500	14,000	–	14,000	Reduce future steam loads by 20% through heat recovery, etc...
Transmission Losses	10,000	–	–	–	–	–	–	–	–	Complete transmission loss detection and repair program
Factor of Safety (20%)	–	–	–	*16,100*	–	*16,100*	*14,000*	–	*14,000*	
Infiltration	–	–	12,000	–	–	12,000	–	–	–	Remove storm water infiltration and redirect for re-use
Cooling Tower Blow down	–	56,000	56,000	–	79,000	79,000	–	27,200	27,200	Add scale inhibiting system
Cooling Tower evaporation	–	24,000	–	–	34,000	–	–	27,200	–	Reduce future cooling loads by 20% through heat recovery, etc...
RO Filter Rejection	–	–	–	–	–	–	–	–	–	
Miscellaneous Use (gray water)	–	16,000	16,000	–	16,000	16,000	–	16,000	16,000	Track and determine if conservation measures can be applied.
TOTAL POTABLE[1]	58,180	–	–	96,400	–	–	83,800	–	–	
TOTAL SANITARY[2]	–	–	132,180	–	–	203,400	–	–	127,000	Add additional filter to increase plant capacity
TOTAL GRAY WATER	–	96,000	(96,000)	–	129,000	(129,000)	–	70,400	(70,400)	
Effluent Discharge (summer)	–	–	36,180	–	–	76,400	–	–	56,600	
Effluent Discharge (winter)	–	–	60,180	–	–	108,400	–	–	83,800	

Exceeds current capacity of existing Treatment Plant (120,000 gpd). Maximum Treatment Plant Capacity assumed to be 150,000 gpd (with upgrades).

Exceeds Maximum Capacity / Limitations

E. Sanitary Collection and Treatment

The campus Wastewater Treatment Plant (WTP) is at, or beyond, its capacity with the current development on the site. Although the design capacity of the WTP is 100,000 gpd, currently the plant can process approximately 120,000 gpd. While the plant is approximately 40 years old a significant upgrade occurred in the early 1990's (approximately 20 years ago). An additional upgrade or replacement will be needed over the next 10 to 20 years. This would significantly reduce the water demand and discharge from the site to below 40,000 gallons per day. A full detailed assessment of the treatment plant is needed to accurately assess remaining life and determine the optimum approach to upgrade the system to support a future flow of approximately 127,000 gpd.

Adding a tertiary filtration system for cooling tower make-up is a viable alternative to the scale inhibitor (see section 11.4D); however, this would significantly increase the load on the WTP to a minimum of approximately 197,400 gpd and therefore require a major upgrade or replacement of the current WTP. It should be noted that with the RO filtration system the gray water uses can be expanded to support other functions such as wash down procedures. For this analysis the wash down flow was assumed to come from the potable water system to reduce the impact on the WTP. However, if future potable water demands increase beyond the anticipated projections, the RO filtration system will provide the site with the flexibility of shifting some of the process flow from the potable water supply to the gray water supply. This would increase the required WTP capacity to approximately 270,000 gpd. Under all future scenarios the effluent discharge would increase to a maximum of approximately 56,600 gpd which is well below the maximum effluent discharge permitted of 100,000 gpd.

The design of future facilities would include water conservation measures and should reduce site demand to a level within the current system capacity. A detailed evaluation of the existing WTP to assess the remaining life and optimum approach to increasing capacity to 150,000 gpd should be commissioned immediately. Original documentation indicates the capacity of the current system could be increased 150,000 gpd with equipment upgrades which needs to be confirmed.

However, if the water conservation measures are not implemented or the actual building designs result in greater than anticipated flows, then a major WTP upgrade/ replacement to increase process capacity to 270,00 gpd and support a site RO filtration system will be needed in Phase 3 of the Master Plan.

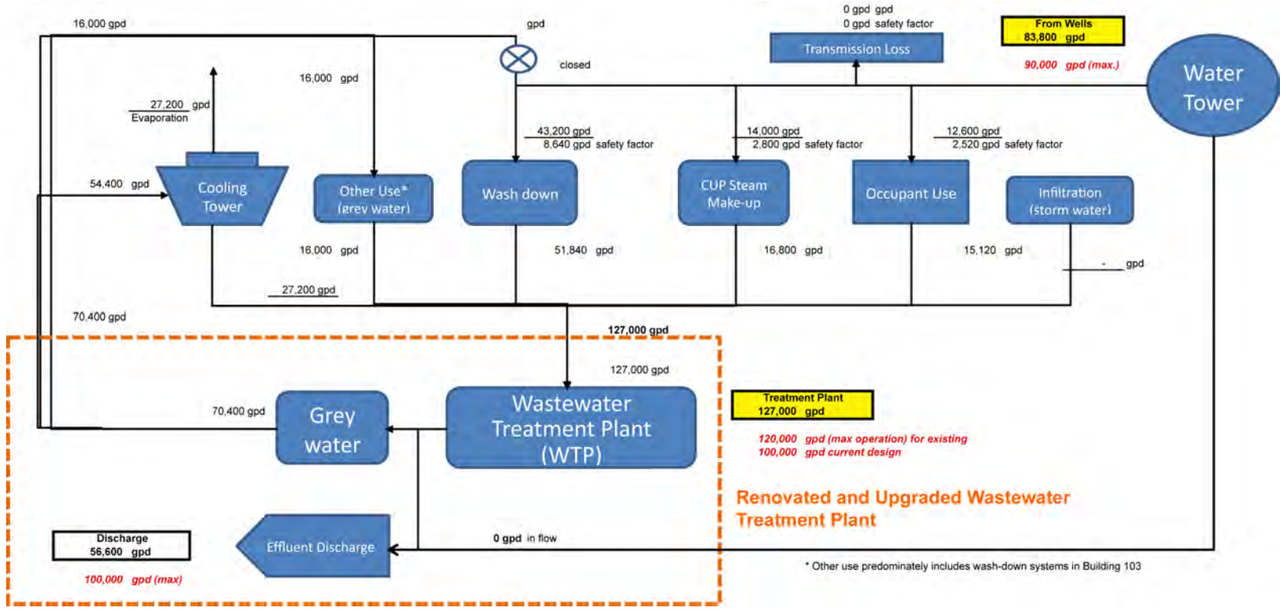
The Master Plan also recommends that a shed be built over the drying bed for sanitary sludge. It is currently open to the elements.

F. Stormwater

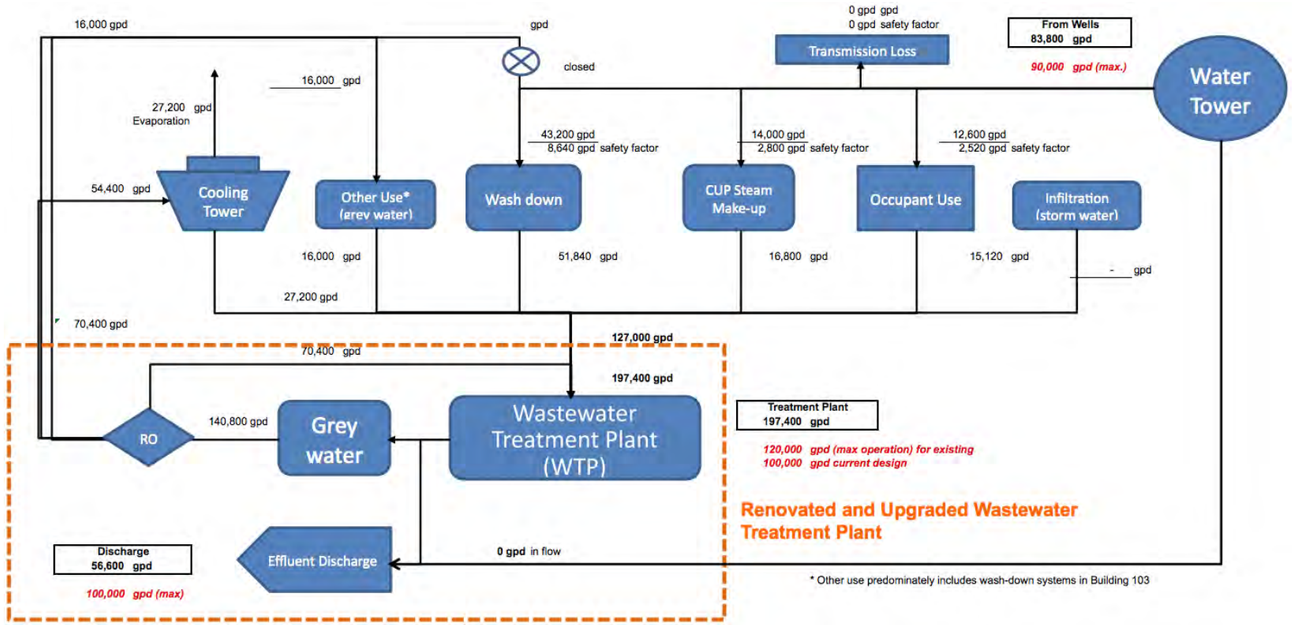
Stormwater is controlled in the developed areas of the campus through a series of closed storm drain systems and open swales. Most of the stormwater from the developed areas flows to a large wet pond in the central campus swale. The pond allows all the runoff to be controlled prior to being discharged to the Potomac River. There appears to be adequate capacity in this system for the planned development. Best management practices for controlling this run-off are described in the Landscape section.

Exhibit 11.20: Schematics for System Flow Options

With All Water Conservation Efforts and RO Filter for Tower Make-up



All Water Conservation Efforts and Scale Inhibitor for Cooling Tower Make-up



11.5 Security Plan

The location of the NIHAC campus is advantageous for providing a secure environment for NIH employees, animals and facilities. The site has one limited and controlled access point and a large land area that allows setbacks along Elmer School Road and Club Hollow Road. It also allows visual screening of campus facilities from the outside, facilitated by the existing stands of trees. On the south and east, the campus borders wooded parkland. A perimeter fence runs along all sides of the property.

Security requirements for government facilities have changed in the past several years, so a security plan and upgrade strategy for the campus are an important part of the Master Plan. Five recommendations have been included in the Master Plan.

1. *Entrance Security and Gateway Center.* The very limited security facilities at the campus entrance compromise the efficiency of security operations and the screening of commercial vehicles and visitors. Reconfiguration of the roadways and replacement of the security trailers with a permanent security facility are proposed in the Master Plan. The single entrance lane would be replaced by two lanes, one for expedited employee entrance and one for screening of commercial and visitor vehicles. Included would be an area to pull off a vehicle for further inspection. The entrance modifications would also reroute the fencing and entrance drives to the two adjacent NIH residences, so that their vehicles would also pass through NIH security.

2. *Vehicle separation*. NIH policy requires that roads and parking areas be separated from buildings by a minimum of 100 feet where possible. In the Master Plan, that distance has been maintained relative to the new buildings. Some of the parking lots would not be removed, but restriping and introducing buffers should be implemented. Roads closer than 100' to existing buildings would not be moved. A combined entrance pavilion for the new Shared Imaging and Diagnostics facility (Building A) and the Behavioral Research facility (Building C) is shown closer to the road with a pedestrian drop-off for the handicapped. It is anticipated that this pavilion would be hardened for security. A similar arrangement is expected for the Multi-Species Animal Holding Facility (Building D).

3. *Access control at loading docks*. Loading areas at each building do allow vehicles to park directly adjacent to NIH buildings. Access to these docks must be limited to only those vehicles that have been screened by security. The method being considered by NIH is the installation of access control barriers at each loading dock drive, to be operated by a key card issued by security personnel after screening. Locations for these barriers have been shown on the plan. Barriers are also recommended to the existing parking area adjacent to the CUP.

4. *Perimeter fence repair.* The perimeter fences have fallen into disrepair, especially along the southern boundary with the existing and proposed parks. Maintenance of the fence in this location has been difficult because of its wooded location, and accumulation of standing water in the area. Both fence repair and visual screening are important in this location in order to protect the animals living in the nearby field habitat from intrusion or harassment. Design of the permanent fencing solution would need to consider the uneven terrain, standing water in certain areas, groups of mature trees, proximity of public paths in the parks and possible vandalism.

5. *Emergency Access*. An emergency access for the campus is proposed, to augment the single campus access point at Elmer School Road. This entrance would be used by emergency vehicles if the main entrance were blocked. The roadway would lead from the north campus circulation to Club Hollow Road to the north, although the final alignment would require further study. The proposed road would be unpaved/gravel, in response to low traffic volume.

11.6 Sustainable Design Plan

A. Master Plan Approach

The Master Plan incorporates sustainable design and energy efficiency as core principles. The campus development approach incorporates environmentally-responsible strategies into the plan and the building design guidelines. Key are the following site-specific strategies:

- *Daylighting*. Organize the buildings to maximize the use of natural light for illumination and occupant comfort. This strategy applies specifically to the staff areas, including offices, support and the corridors within the animal facilities. Introducing natural light into the animal housing areas will depend on NIH research objectives at the time of building design.
- *Energy Efficiency*. Improve the energy efficiency of the campus facilities, meeting the NIH stated goal of a 30% energy reduction by 2015, at a minimum. The Master Plan incorporates several energy efficiency measures, including: extension of of the utility service from the CUP to each new building; making the new habitat structure self-sufficient for energy use; upgrades to the HVAC and lighting systems of the existing buildings; investigation of alternative energy sources and geothermal for buildings not connected to the utility plant; clustering of functions within each building (e.g., office space) to allow the most efficient HVAC system design and distribution. The plan also recommends that future building designs include high performance lighting, environmental systems and envelope design.
- *Water efficiency*. Keep water use within the levels allowed by State permit, even with the projected growth in animal population and employees. The NIH goal is a 16% reduction in potable water use by 2015 and 26% by 2020. Control of transmission loss has been effective in reducing the current usage by about 40% of the maximum. An increase in the use of gray water is recommended in the plan, facilitated by upgrades to the sewage treatment facility that will improve the gray water quality for broader applications.
- *Stormwater Management*. Utilize strategies to ensure stormwater quality and quality control, including landscape "best management strategies" and low impact development (LID) strategies, such as swales and plantings that increase ground water recharge rather than runoff. Allow run-off from roadways to flow directly into natural swales, without curbs or gutters. All stormwater strategies must comply with regulatory requirements, including Executive Order 13508 - *Strategy for Protecting and Restoring the Chesapeake Bay Watershed*.
- *Vehicle-trip Reduction*. Reduce the number of vehicle trips both on-site and off. The planned program would add research support facilities, including imaging, surgery and procedure rooms that are intended to reduce the transference of animals from the NIHAC campus to the Bethesda campus. On a campus level, the consolidation of facilities in the north campus cluster and the protected pedestrian/service connections between buildings would reduce the number of vehicle trips within the campus. The inclusion of employee eating areas and other support spaces would reduce daytime off-campus trips.
- *Adaptive Reuse*. Utilize existing buildings that are in good condition, and renovate them as needed for flexible research facilities and support. For example, Building 103 would be renovated to adapt to the housing requirements for non-human primates.
- *Heat Gain and Wind Moderation*. Moderate the solar heat gain on the buildings through glazing selection and orientation, envelope and roof design and screening with vegetation. The prevailing wind comes from the northwest in the winter and the southwest in the summer. The new campus green and pedestrian paths would be sheltered by buildings and with hedgerow screens and trees.
- *Landscape Stewardship*. Minimize the disturbance of landscape features when new buildings, roads and pathways are constructed. The Master Plan concentrates new development on sites that have already held the buildings B100 and B104 and nearby paved areas. Any unused demolition area would be restored to a natural landscape. Buildings would be located on relatively flat land, following the contours to minimize cut and fill. Although the plan does not show construction on the site area where sludge had been dumped in previous years, any future use of this area should include its clean-up. Woodlands would be protected, as well as water bodies and wetlands. The campus extension, north of Club Hollow Road, would remain as woodlands without further development.
- *Appropriate Planting*. Augment the tree cover to moderate temperatures, shade the buildings, enhance stormwater management and absorb pollutants. The new campus green should be planted with native or adapted species for easy maintenance and to reduce fertilizer and pesticide use. Minimize water-dependent landscapes and water intensive plantings that require irrigation – irrigate with rainwater/gray water where needed. Introduction of hedgerows and native planting to areas cleared for agriculture would restore local habitats and create seasonal visual interest.
- *Renewable energy*. Consideration of renewable energy technology is recommended for two levels of implementation. First, the plan recommends the use of solar technology for the planned non-human primate breeding habitat. This facility should be energy-independent, because the energy demands would be light and the facility is not near existing utility services. A second consideration should be the introduction of a solar panel field to the east of Building 103, for serving the north campus buildings. An initial feasibility was studied by Jones Lang LaSalle, but additional economic analysis should be conducted in light of this Master Plan and its phasing. This analysis should also consider the potential for incorporating solar panels on the rooftops/facades of buildings or canopies.
- *Resource Conservation*. The Master Plan includes some renovation and demolition of obsolete facilities. Recycling of construction and demolition materials should be implemented.

B. Current Sustainable Design Policies

In support of the National Institutes of Health's mission to apply knowledge to "extend healthy life", the Master Plan promotes an integrated view of sustainability, incorporating Federal policies, guidelines and directives and going beyond minimum standards toward creative environmental strategies.

The Master Plan integrates sustainability policies outlined by HHS and referencing other Federal sustainability regulations. Included are: the 2011 HHS *Sustainable Buildings Plan*; the HHS *Strategic Sustainability Performance Plan*, the *Energy Policy Act of* 2005 (EPAct 2005), Executive order 13423 (EO 13423), *Energy Independence and Security Act of* 2007 (EISA 2007) and EO 13514. These current regulations may change in the future, and each project would be designed to meet the sustainability regulations in place at that time.

The HHS *Strategic Sustainability Performance Plan* (SSPP) is the framework for the Department's overall sustainability program. The HHS *Sustainable Buildings Plan* (SBP) summarizes the Department's program for incorporating sustainable measures into its building assets. The SBP supplements SSPP, and reflects the requirements of Executive Order (EO) 13514. Key provisions of EO 13514 include the following:

- *Guiding Principles*. The 2006 *Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding Guiding Principles* are included in the NIH Design Requirements Manual. The Principles are: Employ Integrated Design Principles; Optimize Energy Performance; Protect and Conserve Water; Enhance Indoor Environmental Quality; and Reduce Environmental Impact of Materials. Refer to the NIH Design Requirements Manual Section 1-10: Sustainable Design for further guidance.
- *Certification and Guidelines*. All construction projects and major renovation projects shall incorporate the *Guiding Principles* into their planning, design, construction, operation, maintenance, and decommissioning processes. Construction projects under the scope of this policy, which have a total project cost equal to or greater than $10 million, shall also obtain a third party certification that meets the requirements of a multi-attribute green building standard or rating system developed by an ANSI-accredited organization. Under this policy, HHS includes major renovation/alteration projects that have a total project cost greater than or equal to $10 million and/or impacting 40% or more of overall floor area.

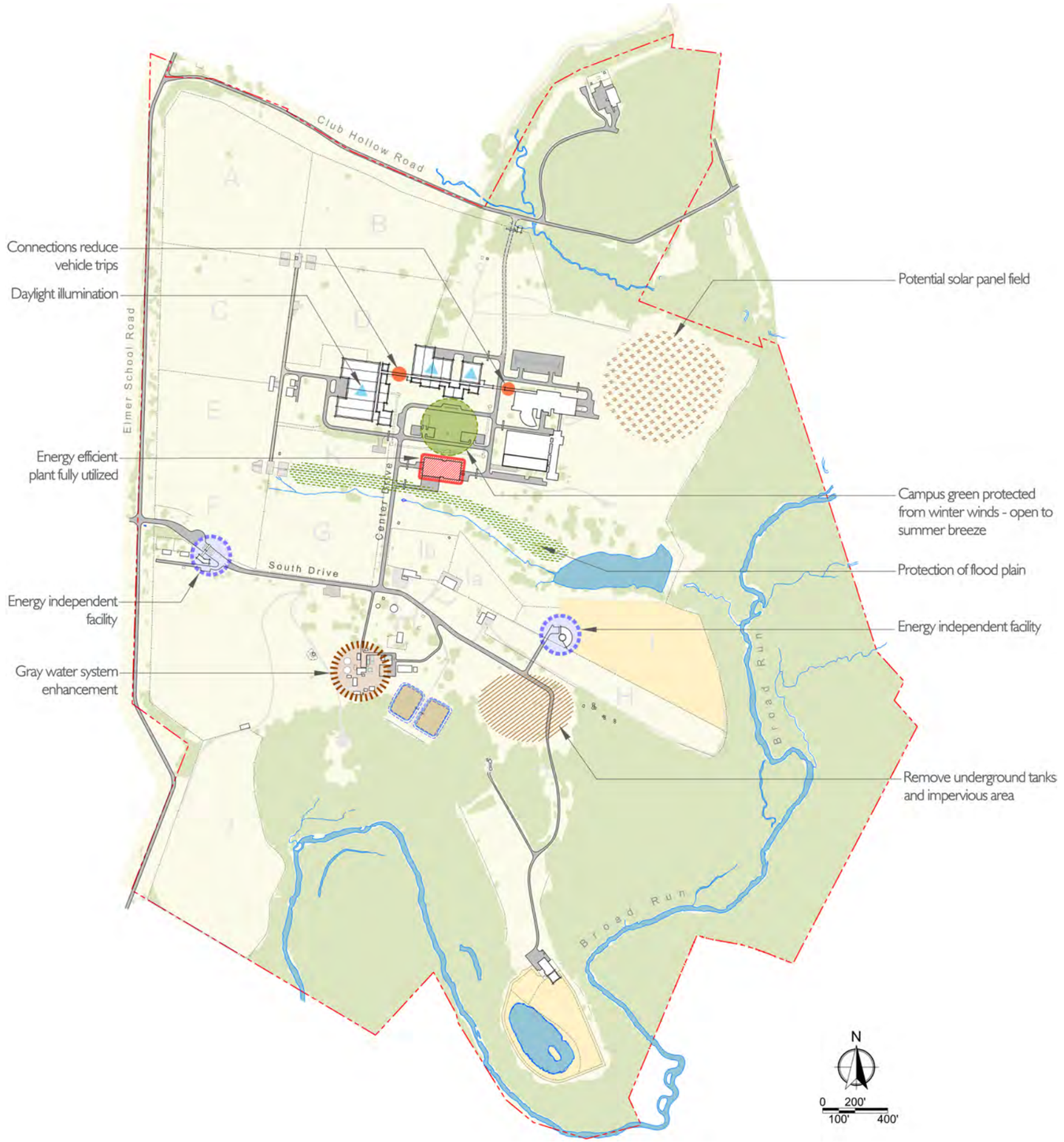
- *Zero-net Energy*. Every new federal building for which planning is initiated in 2020 or later shall be designed to achieve zero-net energy by 2030, with interim targets each 5 years. A zero-net energy building is defined as "a building that is designed, constructed and operated to require a greatly reduced quantity of energy to operate, meet the balance of energy needs from sources of energy that do not produce greenhouse gases, and therefore result in no net emissions of greenhouse gases while being economically viable." This reduction in fossil-fuel-generated energy consumption is to be compared to a similar building in fiscal year 2003.
- *Stormwater*. Site development and planning for construction projects, and major renovations shall be in accordance with "Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects" under Section 438 of the *Energy Independence and Security Act*, EPA document number EPA 841-B-09-001, dated December 2009. This stormwater guidance document implements Section 438 of the *Energy Independence and Security Act* (EISA) of 2007 and EO 13514 Section 14. The document provides a step-by-step framework that will help federal agencies maintain pre-development site hydrology by retaining rainfall on-site through infiltration, evaporation/transpiration, and re-use to the same extent as occurred prior to development.
- *Assessment*. All existing buildings shall be assessed for compliance with the *Guiding Principles* to ensure that HHS is moving towards 100 percent compliance. At least 15 percent of the applicable HHS building inventory, owned and direct leases over 5,000 gross square feet, must incorporate the sustainable buildings practices in the *Guiding Principles* by FY 2015.
- *Existing Building Improvements*. All improvement, repair and maintenance projects in existing buildings not defined as new construction or major renovation (above) shall incorporate the *Guiding Principles* to the maximum extent feasible.
- *Historic Buildings*. HHS components shall ensure that rehabilitation of federally owned historic buildings utilizes best practices and technologies to promote long-term viability. Rehabilitation work shall be in accordance with HHS *Program Manual Volume* I, Section 3-3, EO 13287 Preserve America and Section 110 of the *National Historic Preservation Act* (NHPA), HHS *Facilities Program Manual, Volume* 2, Section 5-1 (adaptive reuse guidance), and the *Guiding Principles* where possible, provided the modifications meet the *Secretary of Interior's Standards for the Treatment of Historic Properties*.
- *Water Conservation*. Water conservation in Federal buildings is mandated by EO 13514. Beginning FY 2008, water consumption should be reduced through life-cycle cost-effective measures by 2 percent annually relative to the FY 2007 baseline. The reduction efforts shall continue to year 2020 or total 26 percent by the end of fiscal year 2020. An additional mandate included in EO 13423 by the Department of Energy, is the auditing and reporting of water consumption in at least 10 percent of facility square footage annually.

C. Building Rating Systems

Certification by a third-party is required for the large construction or renovation projects described above, and encouraged for others. Certification by either LEED and Green Globes is acceptable. LEED, developed by the United States Green Building Council, and Green Globes, developed by the Green Building Initiative, are both programs to assess building performance and meet broad sustainability goals. They differ in their assessment procedures and emphasis on specific areas of sustainability. Both programs are updated regularly, and current standards should be reviewed with each construction or renovation project.

Labs21 is a separate standards program that addresses laboratory buildings and animal facilities. Labs for the 21st Century (Labs21) was created as a partnership between the US Environmental Protection Agency, the US Department of Energy, and the International Institute for Sustainable Laboratories, and seeks to improve energy efficiency and environmental performance of the nation's labs on a voluntary basis (Labs21, 2008). This program bridges the gap in current implementation strategies (i.e., Green Globes, LEED) for sustainable design associated with laboratories. The Master Plan recommends that Labs21 be used as a means to design and evaluate the performance of sustainable animal and laboratory facilities.

Exhibit 11.21: Sustainable Design Plan



12.

Phasing and Implementation Plan

12.1 Implementation Planning

The Master Plan is a look into the future and a structured plan to build and renovate facilities in order to meet anticipated needs. Twenty years is the timeframe for this NIHAC Master Plan, and the changes have been prioritized and structured into four development phases. As with any institution, NIH's program growth and construction are dependent on many factors – e.g. funding, direction of scientific research, NIH mission and agency-wide priorities. The Master Plan therefore, needs to be thought of as living document, setting a framework that remains flexible and sensitive to the timing and composition of specific projects. The phasing of the plan is organized to meet the following implementation goals:

- Space and functional needs are prioritized to first address missing components and deteriorating buildings, followed by facility needs triggered by growth in the animal programs/population.
- The plan is able to accept variations in timing and project groupings
- Phasing is organized to minimize disruption inherent in the chosen consolidated plan
- The Master Plan appears "complete" at the end of each phase or significant addition.

The purpose of the Master Plan is to guide future development; it does not represent the pre-approval of any individual facilities project nor the particular needs of specific programs to be accommodated on the campus. The financing of each project and program must be addressed within the annual HHS budget processes and the HHS Capital Investment Review Board mechanisms. Furthermore, the Master Plan is not a commitment from the agency to build these facilities within a specific timeframe, i.e., the 20-year framework set forth in this document. Implementation of these plans requires that funding be available and that NIH's research commitment remains the same. Sometimes a twenty-year Master Plan becomes a thirty-year plan, yet the facilities do finally get built, and the framework for this development remains valid.

Exhibit 12.1: Composite Phasing Plan[1]

1 Buildings that are demolished are not shown in this plan. They are shown in the individual phasing plans.

Exhibit 12.2: NIHAC Master Plan – Phasing Summary

	Phase 1	Phase 2	Phase 3	Phase 4
Buildings	• Renovate B102: A Wing renovation + other building improvements • Addition to B132	• Construct Diagnostic/ Imaging Building • Builid connections to B103 & B102 • Make improvements to B103	• Construct Behavioral Research Facility • Build connection to Diagnostics/ Imaging Facility	• Construct Animal Holding Facility • Build Connection to Behavioral Research
	phasing independent ←	• Breeding Colony • Entrance /Security	*phasing independent* →	
	• Demolish B-101 • Demolish various trailers and temporary buildings. After B102 A-wing renovation, review demo of B100 & B104		After construction: • Demolish NICHD building on the south campus	• Demolish B127/128
Roadways	• Add loading area and modify parking at B102	• Relocate North Drive • Modify road for B103 connection • Add parking & loading • Add emergency access road	• Add surface parking • Extend loading area	• Add east-west roadway to access parking • Add surface parking • Add loading area
	• Repair/replace security fencing • Add security gate at B101A for vehicles	• Add security gates at various loading docks • Modify access and vehicle screening at Elmer School Road	• Add security gates at new loading	• Add security gates at new loading
Landscape	• Introduce buffers to B101A and around B100 site • Clear paving at campus green, begin planting	• Develop campus green • Introduce allee of trees at main circulation corridors • Create wastewater wetland at south • Add buffer planting	• Add park-like amenities & plantings to campus green • Add buffer planting at new buildings	• Add buffer planting at new buildings • Complete stormwater management strategies
Utilities	• Add fuel storage tank • Implement water saving strategies	• Relocate electrical service • Gray water upgrade	• Extend campus utilities to new construction • Upgrade or replace Wastewater Treatment Plant (WTP)	• Complete Master Plan utility loop

12.2 Phase 1

The first phase consolidates a number of projects and initiatives that have already been in planning stages. These measures include the demolition of unused and underutilized buildings, and the B102 renovation for which there is a preliminary design in place.

A. Components

There are eight key components in this phase:

- Wing A of Building B102 would be renovated for flexible animal housing, with occupancy planned for non-human primates. A new loading dock would be added and the parking modified at Building B102. Several building improvements to B102 would be completed at the same time.
- The central campus green development would begin when Building 101, adjacent T10 and paving north of Building 101 are demolished, first planting trees to screen Building 101A and its outdoor equipment.
- Planned fuel storage tanks would be added, serving the CUP.
- Security would be upgraded. Security access controls would be added to B101A and B102 and B103 loading dock driveways. Campus fencing would be repaired and replaced as needed.
- A small addition to B132 would be built, allowing the demolition of the adjacent trailer.
- Unused building T8 would be demolished, retaining the vehicle fuel pumps and re-landscaping the area.
- Other unused/underused trailers and temporary buildings would be demolished.
- Comprehensive utility analyses would target specific energy and water use reduction strategies.

Optional components

- Demolition of Buildings 100 and104 and adjacent paving. After the renovation of A Wing, these buildings could be demolished if they are no longer needed. However, they may be retained for auxiliary use to support research programs in place at the time.

B. Order of Implementation

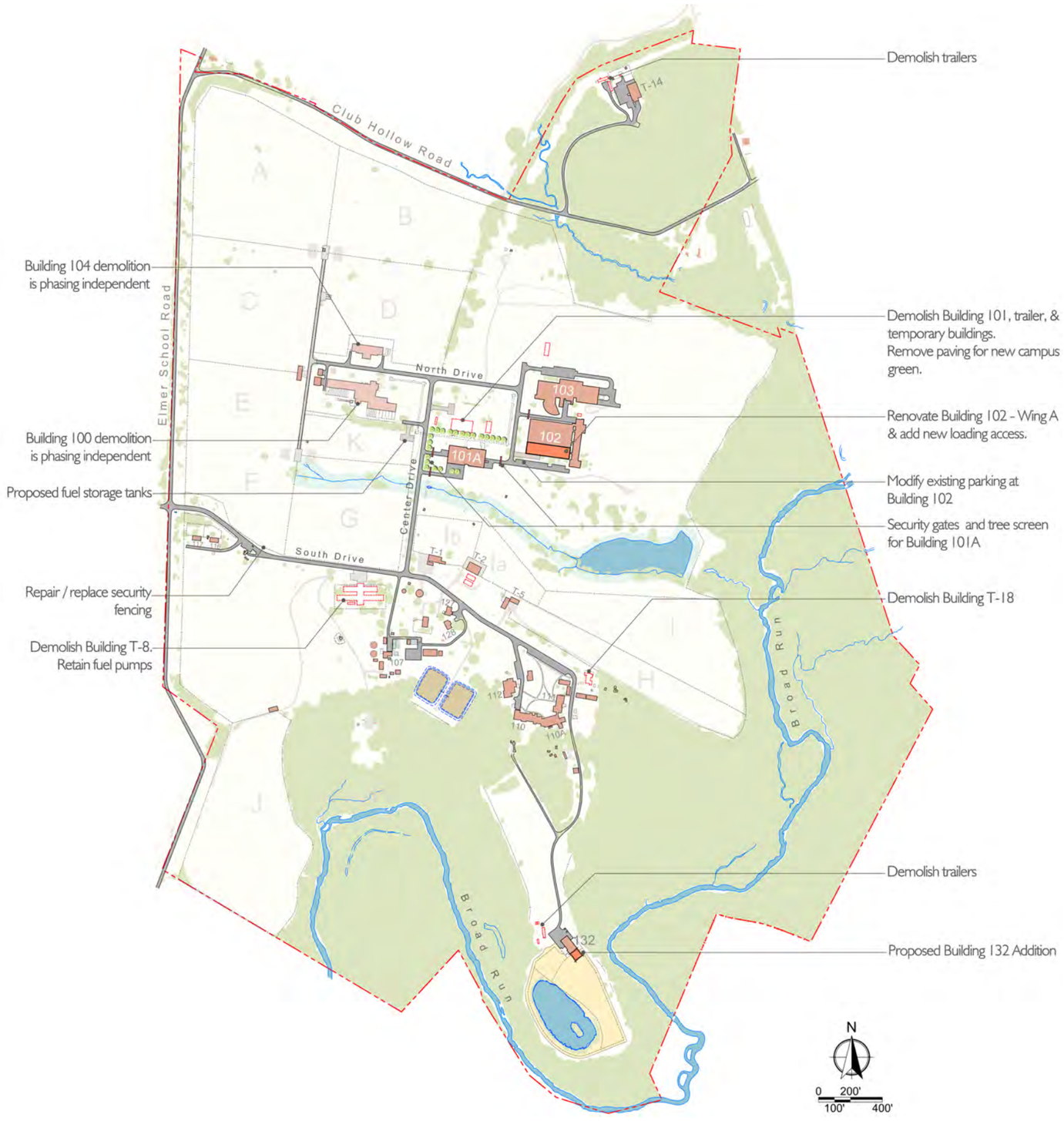
Each action can be initiated independently, and in any order. Combining all the Phase 1 construction into one project would be more efficient for the contractor(s), and could shorten the period of campus disruption.

C. Disruption

Wing A is integral to the animal housing portion of Building 102, and its renovation is potentially disruptive to both the animals and the facility operations. The wing can be separated physically from the rest of the building, and isolated for dust and system contamination. However, noise, vibration and odors may require special mitigation or the temporary relocation of animals from the adjacent wing during construction. Construction of the new driveway and loading dock may temporarily interrupt the traffic flow and employee parking at Building 102.

The demolition components, security upgrades and fuel tank installation will cause only localized and temporary disruption, which can be contained by physical barriers.

Exhibit 12.3: Phase 1 Plan



12.3 Phase 2

The second phase addresses a priority need for an on-campus Shared Imaging and Diagnostics facility with the construction of common services and connection to the existing Building 103.

A. Components

There are seven key components in this phase:

- Shared Imaging and Diagnostics facility, with an access-controlled loading dock would be built.
- Enclosed connection between the new Shared Imaging and Diagnostics facility and Building 103 would be added. Proposed is a grade separated connection, requiring a minor slope elevation modification of the road between the buildings.
- North Drive would be relocated to the south to allow the Shared Imaging and Diagnostics facility ready connection with B103, while maintaining the required 100' setback.
- Parking would be added to the north of Building 103
- Enclosed connection between Buildings 102 and 103 would be created. Improvements to B103 would be done at the same time.
- Campus green development would continue; the main drive would be lined with an allee of trees for highlight and shade.
- Emergency Access road to Club Hollow Road would be established.

Optional components

- Non-human primates breeding colony shelter and fenced enclave. The Master Plan includes this component in Phase 2, but it should be built when NIH programs require it.
- Entrance security/visitor center. The center is shown in this phase, but should be built when security policy and available funding dictate.

B. Order of Implementation

The Shared Imaging and Diagnostics facility and its connection to Building 103 should be constructed at the same time, to achieve the desired economy and efficiency of operations. Relocation of the North Drive should be done first, while the existing North Drive can remain in place. The connection between B102 and B103 increases this efficiency, so it should be part of the same project. The added parking will be required when the new building comes on line. Development of the campus green could be an ongoing, seasonal project. The breeding colony and the security entrance are both independent projects and could proceed in any order.

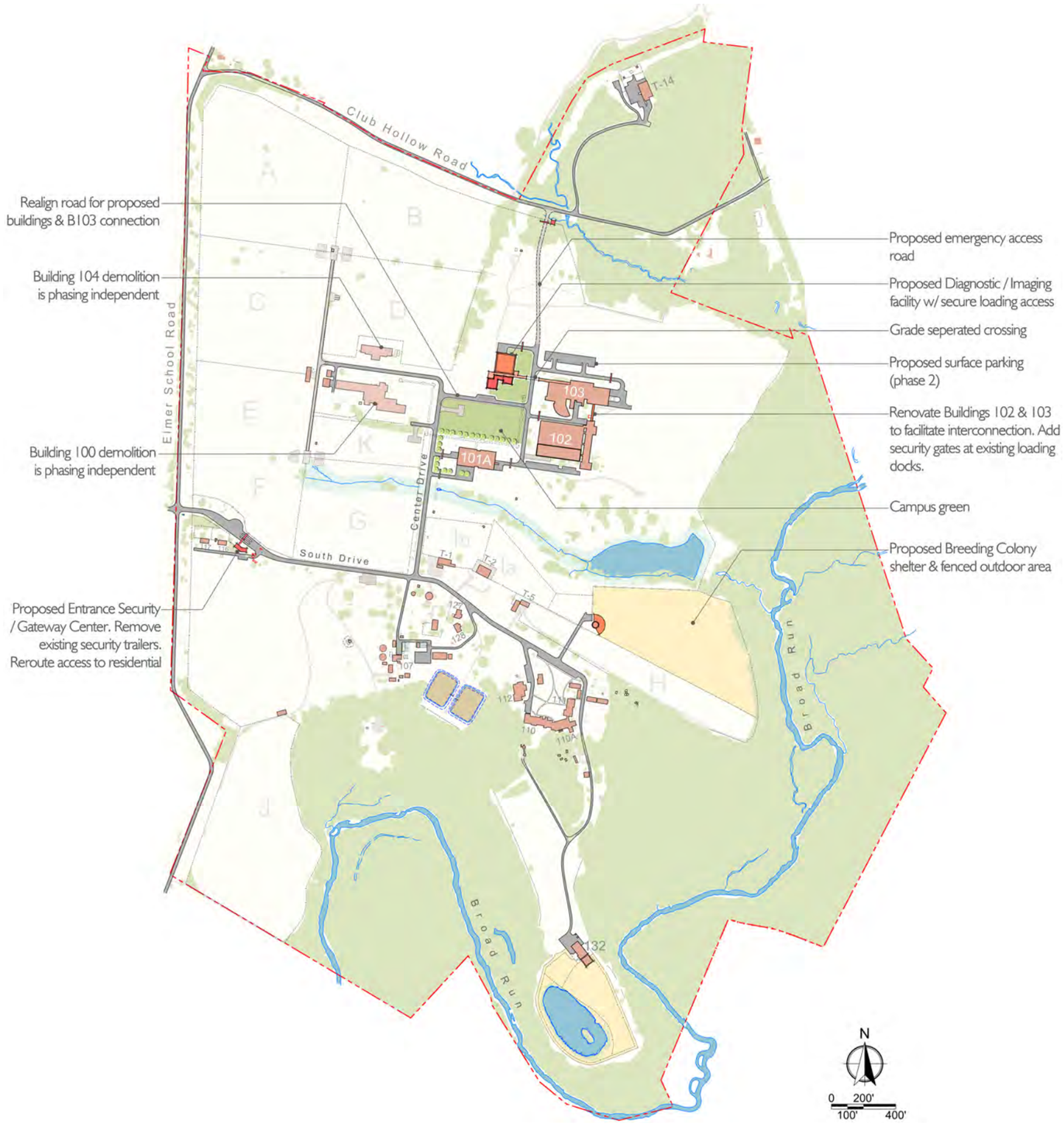
C. Disruption

The new building construction site can be separated from the normal operations of the campus and is unlikely to cause any significant disruption to vehicle and pedestrian movement, except a minor rerouting of the service drive that goes to Well 5. However, the incoming electrical service to the campus will need rerouting, which will require careful planning to avoid interruption.

Construction of the connection to Building 102 will temporarily disrupt vehicle traffic to the current 102 parking and the eastern-most loading dock of Building 103. The duration of road construction should not be long, and temporary parking elsewhere on campus should be used. Building 103 has a second loading dock, which could be used for this period of time. The connection would link into Building 103 at one area of the north façade, and require minor renovation within the building.

Construction for the planned new entrance security facilities at Elmer School Road would require that temporary circulation at the entrance be established in order to not interrupt access and screening procedures.

Exhibit 12.4: Phase 2 Plan



12.4 Phase 3

The third phase establishes the consolidated campus by building a Behavioral Research facility to replace the outmoded, failing buildings on the south campus.

A. Components

There are six key components in this phase:

- Behavioral Research facility would be constructed.
- Enclosed connection would be made between the new facilities and the adjacent Shared Imaging and Diagnostics facility. This connection would be a shared entry pavilion, with security hardening so that it could be located close to the road.
- Parking would be added to the lot north of Building 103, if the total requirement were not built in Phase 2.
- Buildings 110, 110A, 111, 112 and other support buildings (former behavioral research program) would be demolished.
- Final design of the campus green would be completed with the addition of park-like amenities for the staff, flowering trees and perennial planting.
- WTP replacement or major upgrade of components would be implemented.

B. Order of Implementation

The new Behavioral Research facility and its connection to the Shared Imaging and Diagnostics facility must be constructed at the same time, to achieve the desired economy and efficiency of operations. Additional parking would be required when the building comes on line.

The existing behavioral research buildings and parking on the south campus would be demolished when the Behavioral Research facility is complete. The research activities, administered by NICHD, would move into the new facilities.

C. Disruption

The building site for the new Behavioral Research facility can be isolated from the pedestrian and vehicular operations of the campus to minimize disruption. However, construction of the enclosed pedestrian link would temporarily disturb the function of the Shared Imaging and Diagnostics facility as it is connected. Noise and vibration would need to be monitored to mitigate any effect on the adjacent animals or imaging equipment. Access for the new loading dock is planned to be an extension of the adjacent loading area, and so might disrupt vehicular traffic during grading and paving.

Exhibit 12.5: Phase 3 Plan

12.5 Phase 4

The fourth phase encloses the fourth side of the campus green by adding animal holding facilities to accommodate growth in the animal programs currently administered by DVR.

A. Components

There are six key components in this phase:

- Multi-Species Animal Holding Facility is constructed.
- Enclosed connection would be made between the new facility and the adjacent Behavioral Research building.
- Parking would be added to southern edge of the campus green, along with an east-west access road diverting most vehicular traffic from the North Drive.
- A new access road would be constructed, linking Center Drive to the loading dock of the new building with controlled vehicular access. This road would be connected to the west utility drive.
- Landscape concept would be completed, including buffer planting screening new buildings, pasture fencing and stormwater management strategies
- With the completion of the Multi-Species Animal Holding Facility, the utility loop would be completed.

Optional components

- If Buildings 100 and 104 were not demolished in Phase 1, that must be done in this phase.

B. Order of Implementation

The site for the new Animal Holding facility must be cleared of Buildings 100 and 104 and the related parking and roadways before this phase of construction can begin.

The anticipated twenty-year animal holding need would be accommodated in Phase 1 (A Wing renovation) and in Phase 4, as shown. The actual rate of growth may indicate that the Animal Holding of Phase 4 should be built in two sub-phases, which could be accomplished easily.

The new Animal Holding building and its connection to the Behavioral Research building should be constructed at the same time, to allow the efficient movement of animals. Additional parking will be required when the building comes on line.

C. Disruption

The building site for the Animal Holding facility is removed from the other operating buildings, and should not cause significant disruption to movement or operations. Connecting the enclosed walkway to the Animal Research building may disturb the animals for a short period of time.

If the housing facilities are constructed in two sub-phases, special measures will be required in the second sub-phase to avoid disrupting the environment of the adjacent animals. An outdoor run between the two housing areas would reduce the impact.

Exhibit 12.6: Phase 4 Plan

New construction

Occupants move to new faciiity before demolition of existing facility

Exhibit 12.7: Comprehensive Phasing Schedule		GSF	PHASE-1		PHASE-2		PHASE-3		PHASE-4	
NEW CONSTRUCTION										
Behavioral Research Facility (NICHD+)	Animal Facility	80,800					80,800			
	Research									
	Office Facility									
Multi-Species Animal Holding Facility (DVR)	Animal Facility	103,100							103,100	
	Research									
	Office Facility									
Imaging and Diagnostics Facility	Imaging / Diagnostics	43,400			43,400					
	Storage									
	Staff Support									
Breeding Colony	Animal Facility[B]	4,200			4,200					
Entrance Security	Entrance Security & Gateway Center[B]	1,400			1,400					
	TOTAL	232,900				49,000		80,800		103,100
ADDITIONS										
DVR	B102	11,300	11,300							
DVR	B103	900	900							
	TOTAL	12,200		12,200		-				-
DEMOLITIONS										
NICHD+	B110, B110A, B111, & B112, B130	(31,075)						(38,471)		
	NIAAA Trailer (112A)	(1,943)								
	Trailers (TR18A, TR18B, & TR130A)	(5,453)								
	TR24B (Trailer) & Sheds (T25, T25A-C)	(1,896)		(1,896)						
DVR	B100[A]	(35,055)		(47,136)						
	B104[A]	(12,081)								
	B127 & B128	(3,849)								(3,849)
	Sheds & Others (B 131, T11, T13, T15 &T16)	(4,950)		(4,950)						
ORF	Old CUP (B101)	(9,822)	(11,938)							
	Garage & shed (T10 & T7)	(2,116)								
Security	Two trailers	(606)				(606)				
Residential	Two trailers (T11A & T21)	(1,752)	(1,752)							
Abandoned- DVR	T8	(19,294)	(22,173)							
Abandoned- NICHD	T18, TR110	(2,879)								
	TOTAL	(132,771)		(89,845)		(606)		(38,471)		(3,849)
MAJOR RENOVATIONS										
DVR	B102 A-Wing Renovation	15,100	15,100							
RETAINED FACILTIES										
NICHD+	B132	5,035								
DVR	B102 & B103	153,787								
	T1, T2, T5, T12, T20, T22, W107-ST8 & WT19-WT20	9,474								
ORF	B101 A	44,315								
	T14 & T19	6,162								
	Wastewater Treatment Plant (107*)	5,569								
Residential	B116, B117 & T6	4,494								
	TOTAL	228,836								
	NET	473,936		(77,645)		48,394		42,329		99,251
	CUMULATIVE Current Inventory: 361,607 gsf			283,962		332,356		374,685		473,936

A. These buildings can be moth-balled until such time as grading work needs to be done for new construction on their footprint.
B. As mentioned elsewhere, the Breeding Colony and the Entrance Security & Gateway Center are phasing independent, but shown in Phase 2

13.

Design Guidelines

The Master Plan, as a physical framework for development, was formed around core design and organization principles that address the goals for a future NIHAC. The ARSC selected a physical Master Plan concept that created a sense of place, met their functional goals and added flexibility for growth and change. The design guidelines focus on the key characteristics that would maintain those opportunities.

The illustrative plan (Exhibit 11.1) indicates the preferred Master Plan growth, but recognizes that there needs to be flexibility in its implementation; the design guidelines are the tools that anchor the design principles and address both functional and aesthetic issues.

These guidelines are intended to provide enough specificity to ensure the creation of a family of related buildings and open spaces, yet provide enough flexibility to allow designers creative latitude in responding to aesthetic and programmatic issues. Although many architects and landscape architects resist the constraints of guidelines, these guidelines are intended to set a framework by highlighting the key elements that met NIH objectives, shaped the Master Plan and led to the selection of the final concept. The designers will shape each building and site improvement to meet the program and focus at the time of implementation. These design guidelines cover several different design elements:

- Circulation and Connectivity
- Campus Character
- Flexible Facilities
- Landscape Architecture

The guidelines developed here are specific to the NIHAC campus, and are intended to supplement the NIH *Design Policy and Guidelines*, which provides extensive recommendations for NIH building design. In 2002 NIH also undertook a "Sustainable Design Initiative" (SDI) for the Bethesda campus. These documents, and subsequent NIH directives, are expected to be companions to the NIHAC Master Plan, and must be consulted as new projects are undertaken.

13.1 Circulation and Connections

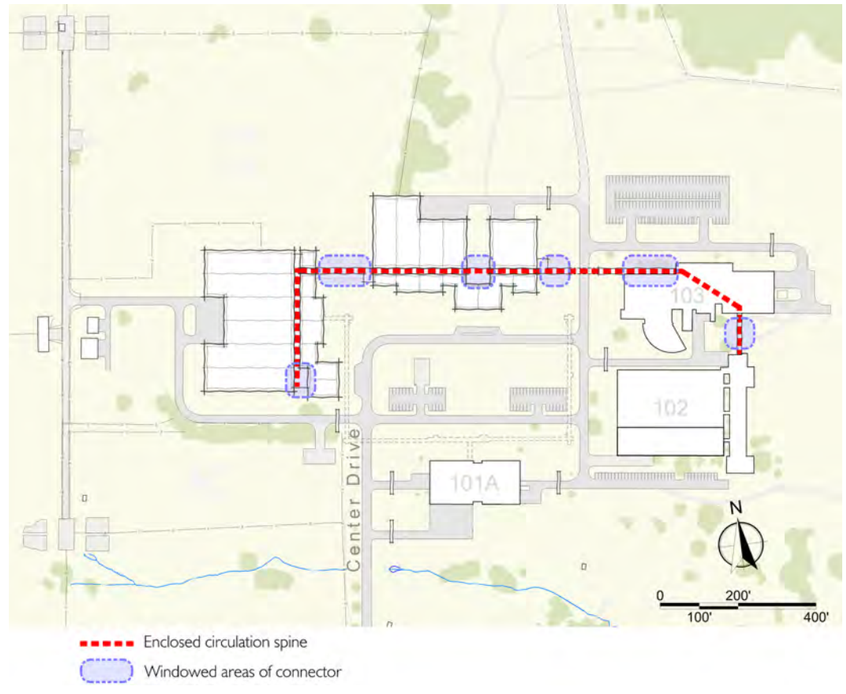
A. Building Circulation

The purpose of the building circulation guidelines is to organize movement through the campus buildings in a way that supports efficiency and a sense of orientation, as well as encourages interaction and sharing of resources.

The Master Plan is organized so that each research and animal care building on the north campus would be linked into a continuous circulation spine. This spine would serve both as a pedestrian link and a protected passage in which to move animals without needing to load them into vans.

- Existing buildings B102 and B103 are important links in the circulation spine, and the connection should not be broken at the existing N-S road. A grade-separated connection is shown, sloping gently down from the entrance to B102, passing beneath the road and up to the proposed Shared Imaging/Diagnostic Facility.
- Although shown as a straight line in this diagram, the circulation spine should be articulated in its design, to break down the scale and monotony of a continuous hallway.
- Daylight should be introduced to the circulation path, utilizing skylights, windows and views to the outside where possible.

Exhibit 13.1: Connection

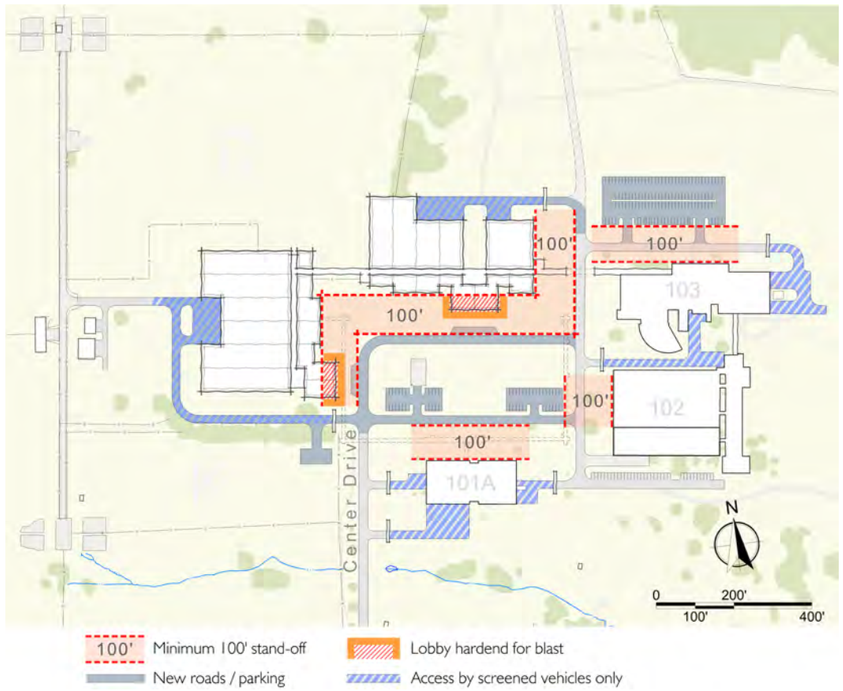


B. Security Standoffs

NIH policies call for new buildings to be set back from roadways and parking areas unless all vehicles are screened by security personnel. Following the current NIH *Design Guidelines for Owned Facilities*, an unscreened-vehicle standoff of 100' from roadways and parking is planned for the new buildings.

- The main body of each building should be located100' from parking and passing roadways, except at specific entrances where accessible drop-offs would be provided. At these entrances, the building lobbies would be hardened for blast resistance, as specified in the NIH *Design Guidelines for Owned Facilities*.
- Roadways and parking that are currently closer than 100' from existing buildings have not been changed. Mitigating measures, such as bollards may be provided.
- Delivery and loading dock areas would only admit access to those vehicles that have been screened by security personnel. Gateway access points have been located on the Master Plan, to be coordinated with the planned security system. Access to parking around the CUP would be handled in the same way.
- Security protocols change over time, and a building and campus review should be conducted when a facility/facilities is/are constructed.

Exhibit 13.2: Security Stand-offs



C. Parking Guidelines

Parking for employees and visitors would be provided in surface lots located convenient to building entrances. The new parking lots have been located consistent with Master Plan objectives and compliant with the security standoff of 100' currently in effect. Accessible parking for people with disabilities should be located as close to the campus buildings as permitted. The parking lots are an important part of daily experience on campus and the guidelines emphasize well organized parking and pedestrian walkways, shading and visual screening. Specifically these features:

- A high percentage of tree cover should be utilized to shade vehicles and reduce the heat island effect of large paved areas.
- Light colored paving should be used whenever practical.
- Best management and low impact development practices for localized stormwater management should be incorporated.
- Pedestrian circulation through the parking lots should have dedicated walkways.

D. Roadways

Three new roadways have been proposed in the Master Plan: a new parking-access and service road, the relocation of the North Drive and an emergency exit road to Club Hollow Road.

- Two-lane roads with grass shoulders are consistent with the other roadways on the NIHAC campus and should be used for the new parking-access road and the North Drive expansion. This road would be constructed of two, 10- to 12-foot lanes in an undivided section, with grassy shoulders and drainage swales. Where needed, intersections and curb radii along these roads should be constructed to accommodate the wide turning movements of heavy vehicles.
- Delivery and loading dock access roads are intended for services vehicles and truck access. These roads should be constructed with a pavement section of twenty-four feet with grassy shoulders. The loading dock area should allow for the maneuverability of a WB-50 (55' foot) articulated truck.
- The new road from the main campus to Club Hollow is intended for emergency use, and a permeable road surface, such as gravel, is proposed. It should be 12 feet wide.
- The relocated North Drive passes through the Campus Green, and it would be desirable to limit truck traffic and deliveries on this road. Delivery vehicles should be directed to use the parking-access and service road immediately north of B-101, with signage or other means.

E. Utility Connections

For Master Plan growth, the existing central utility plant would serve the new buildings on the north campus. Currently, service is supplied through two utility tunnels branching east and west from the CUP. As service is extended to the new buildings, a utility loop should be established so that the tunnels do not dead-end and there is opportunity for service back-up and redundancy.

13.2 Campus Character

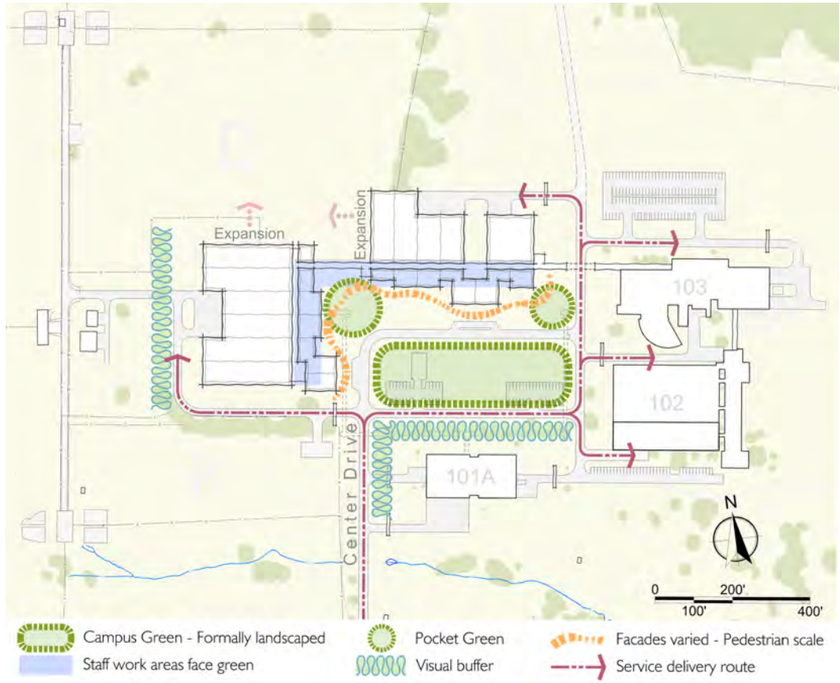
A. Building Organization

The central campus green is one of the organizing elements of the Master Plan's north campus, with the new and old buildings clustered around it. The goals of this organization are three-fold: to enhance collaboration of research and animal care personnel; to increase efficiency and operational flexibility; and to animate the campus and engage the staff.

- Personnel-oriented spaces – offices, workrooms, conference – should face the campus green. Staff should be able to enjoy the landscaped view and have visual contact with the other facilities.
- Delivery and service vehicles should be directed away from the green to the rear of each building.

- The main building entrances for both staff and visitors should face the green and be convenient to parking. These lobbies should be easily identifiable and welcoming to visitors, with vehicle drop-offs compliant with security requirements.
- The research and animal housing units may be visually repetitive, so orientation cues within and between buildings is especially important.

Exhibit 13.3: Campus Character



B. Campus Scale

To create a sense of place, there needs to be an appropriate scale to the buildings and their relationship within the campus. Given the projected program for the campus, one-story buildings are anticipated and the following design guidelines recommended:

- Facades, especially those facing the north campus green, should reflect human scale in their rhythm of elements, proportions, materials and detail, relating to passing pedestrians and views from other buildings. Some of the planned buildings would have long facades facing the campus green, and these should be articulated into smaller segments and demonstrate visual variety. As an illustration, the Master Plan shows them as a series of pavilions facing the green.
- The distance between buildings surrounding the "quad" should not be too big, in order to maintain an intimacy and sense of connection. The NIH-required stand-off from the existing and relocated roads define the maximum distance recommended.
- The landscaping of the central green should create a "campus feel" within the heart of the north campus. There should be a layering of open space and planting, so that there are places for relaxing, outdoor dining and recreation.
- Building heights on the north campus should be constrained by the heights of the existing buildings, to maintain the rural character and respond to community concerns. The planned buildings are anticipated to be one-story in height and no more than 30 feet from the adjacent grade which is the height of the proposed B102 A-Wing elevation.

C. Daylight and Windows

Welcoming daylight into the buildings is highly encouraged, both for employee well-being and energy savings, with the following recommendations:

- Generous windows are assumed for the personnel-oriented spaces such as offices and workrooms. High vertical window dimensions, paired with high ceilings are preferred, to maximize the daylight penetration. Windows should be appropriately shaded for their orientation to prevent glare.
- Windows, roof monitors and/or skylights should be used to illuminate circulation areas and space within the animal facilities used primarily by staff.
- The introduction of daylight into the research and animal housing areas should be discussed in depth when specific facilities are planned. Research protocols are sometimes sensitive to light-and-dark periods, and will determine the daylight approach.
- High performance glazing with high visual transmittance should be used.
- Daylight should be the primary illumination of the new breeding habitat building. One goal of this structure is to be energy independent of the campus systems.
- The new security center should incorporate windows and daylight to the maximum extent permitted within its security protocols. Take advantage of its southern façade for locating windows directed away from vehicular traffic and inspection areas.

D. Community Face

Being a good neighbor and maintaining the rural character of the NIHAC campus are major goals of the Master Plan. The projected facilities are located well away from the roadways and anticipated growth is not extensive.

- Open space should remain the buffer between NIHAC buildings and the property lines.
- Buildings that could be seen from the public roads, such as the planned Multi-Species Animal Housing, should be screened from view with trees and native vegetation.
- The new security center and entrance should not be visually obtrusive or call attention to itself by lighting, materials or location. The Master Plan places this new building "behind" the existing residences relative to Elmer School Road.
- Full cut-off luminaires should be used for any exterior lighting, shielding the night sky from light pollution. Energy conserving fixtures should be used, with solar power lighting suggested.
- Residents of both new and existing outdoor non-human primate habitats should be protected from potential harassment from adjacent public land, with a fence and visual barrier.

13.3 Flexible Facilities

NIH representatives stressed on the need for flexibility. Over time, research and animal models change, and species specific housing become challenging to retrofit. Accordingly, simple and flexible building envelopes are preferred, supporting facilities that can accommodate a range of research and animal models over time. A modular approach is recommended for the proposed buildings that can adapt as the procedures and research evolve.

A. Multi-Species Animal Housing

Flexible animal housing is capable of housing a variety of species and research protocols without significant building alteration. This is especially important given the NIHAC experience in retrofitting species-specific housing.

- Animal holding rooms should be able to accommodate a variety of caging systems, configurations and relationships to research support spaces. A module of 16'x24' has been used for a typical animal holding room of 384 net square feet.
- Building mechanical systems should be zoned and easily controllable. Room temperature, humidity and light levels should be capable of supporting a broad range of animal types.
- The potential for building alterations should be recognized and planned for during the design. Considerations might include the future separation of a space for varying research protocols, environmental requirements for adjacent rooms, updating or relocation of equipment, etc.
- Procedure and other support areas should be incorporated for convenient access. Outdoor and semi-outdoor spaces for animals should be integrated into the design of the animal holding areas.

B. Expansion Zone

The Master Plan lays out a framework for growth and change anticipated for the next twenty years, based on planning of NIH today. Beyond, or even during that time, the NIHAC may need other facilities not anticipated at this time. The Master Plan has been organized to allow further expansion without disrupting the plan concept.

An expansion zone is designated west of the Behavioral Research Facility, which would allow either that facility or the Multi-Species Animal Housing (or both) to expand with a modular approach. A secondary location would be the parking lot north of B102, which could accommodate a new facility that would link into circulation spine of the campus.

13.4 Landscape Architecture

The intent of the Master Plan is to create a wildlife habitat as an approach in designing and managing a rural landscape. The location in the historic agricultural landscape of the Northern Piedmont in the Potomac River Valley offer cues to restoration of species-diverse grasslands and hedgerows. The predominant poorly-drained soils of the Triassic Lowlands Ecoregion allow the creation of vernal pools and forested wetlands necessary for the survival of important species.

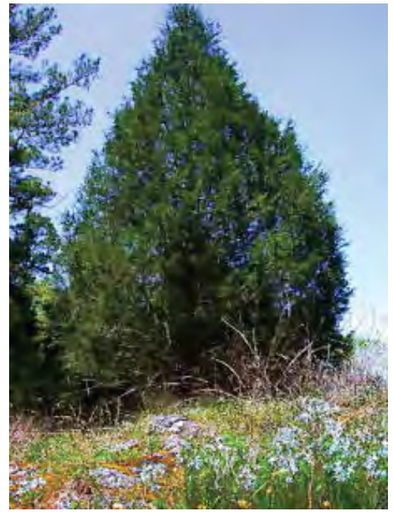
A. Landscape Planting

The recommended Master Plan plantings were selected to restore wildlife habitat, create visual interest and screen the community's view of buildings and NIH habitats.

- Pastures that are no longer needed should be restored to meadows, which would improve the local habitat and help screen services areas
- Hedgerows should be planted as buffers to visibility and physical access to service areas and the breeding habitat. The hedgerows should be densely planted informal mixes of native evergreen and deciduous trees, shrubs, perennials and grasses, and be aligned to complement the diagonal geometry of the landscape and encourage drainage. Suggested species include: Virginia Cedar. American Beautyberry, American Persimmon, Rosa Carolina Sumac species and other native perennials.
- Evergreen trees should be located between the hedgerow buffers and buildings to screen them from view.
- The Campus Green plantings should be dramatically different in character from the open rural farmstead of the rest of the campus. The atmosphere should be inviting and intimate, with shade trees, perennial plantings, mown grass, connecting walkways, benches and other park-like amenities.

Exhibit 13.4: Landscape Plantings

Mown path in meadow



Evergreen Trees: Virginia Cedar

Buffer Hedgerows Elevation: includes a mix of evergreen and deciduous woody material as well as a mix of native grasses and forbs.

Native perennials

Rosa Carolina for hips and flowers

Sumac species

American Beautyberry

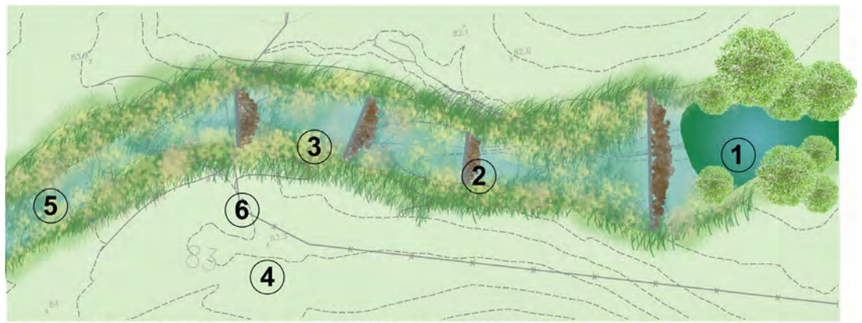
B. Stormwater Management

Best management practices and low impact development strategies should be employed to filter stormwater runoff. The Master Plan recommends the introduction of:

- *Intermittent stream buffer*: The central intermittent stream and constructed pond currently serve as a buffer to Broad Run and the Potomac River from on-site runoff. This system will be enhanced through the establishment of a Maryland Bald Cypress habitat at the immediate edge of the stream and at the pond margin. This protective stream buffer of trees, shrubs, grasses and forbs will hold water and create a more diverse biome, incorporating the existing bird boxes.
- *Vernal pools*: Augmented in the Broad Run forested wetland, the pools should be accomplished by carefully positioning logs, brush and plant material that will facilitate ponding during rainy seasons.
- *Bioswales*: Constructed vegetated swales with check dams. The vegetated swales and check dams will be used to control the runoff from pastures and parking lots. These facilities are located such that they will protect all downstream emergent habitat from runoff-associated impacts.

Exhibit 13.5: Stormwater Management

Vernal Pool Section. Vernal pools should be constructed and enhanced where appropriate.

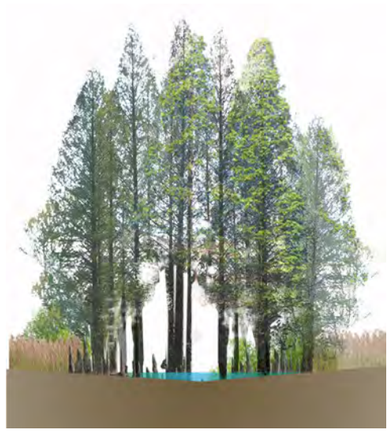


① Intermittent Stream - Cypress Forest
② Check Dam
③ Bio-filter Plantings
④ Pasture
⑤ Proposed Contours
⑥ Fence

Bio-swales with checkdams sized to handle runoff from pastures and parking lots.

Vernal pool in spring

Newly constructed vernal pool.



Cypress habitat

14.

Appendices

Appendix A: Applicable Codes and Regulations

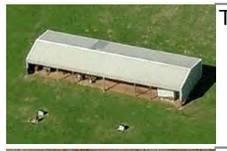
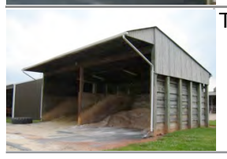
The following provides a list of applicable codes and regulations pertaining to the Master Plan and/or the Master Plan proposed developments. This is not an exhaustive list and there may be other codes and/or regulations that may apply for new developments. Compliance and coordination will need to be ensured during the implementation of individual components of the Master Plan.

Recommending Agency	Jurisdiction/Administering Agency	Regulation/Code/ Explanation	Action Required
United States Department of Health and Human Services (HHS), Office for Facilities Management and Policy (OFMP)	United States Department of Health and Human Services (HHS)	HHS Sustainability Buildings Plan: http://www.hhs.gov/asa/ofmp/about/index.html	General Compliance
United States Department of Health and Human Services (HHS), Office for Facilities Management and Policy (OFMP)	United States Department of Health and Human Services (HHS)	HHS Strategic Sustainability Performance Plan (SSPP): http://www.hhs.gov/about/sustanability/2011plan_summary.html	General Compliance
United States Department of Health and Human Services (HHS), Office for Facilities Management and Policy (OFMP)	United States Department of Health and Human Services (HHS)	Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings: construction, major renovation, repair or alteration of Federal Buildings	General Compliance
United States Department of Health and Human Services (HHS), Office for Facilities Management and Policy (OFMP)	United States Department of Health and Human Services (HHS)	Principles for Sustainable Federal Location Decision	General Compliance
United States Department of Health and Human Services (HHS), Office for Facilities Management and Policy (OFMP)	United States Department of Health and Human Services (HHS)	National Environmental Policy Act (NEPA), HHS GAM 30, HHS Facilities Program Manual and NIH procedures.	Coordination & Compliance
United States Department of Health and Human Services (HHS), Office for Facilities Management and Policy (OFMP)	United States Department of Health and Human Services (HHS)	HHS Strategic Sustainability Performance Plan (SSPP) water goals: a) Reduce potable water use intensity by at least 20% by FY20; b)Reduce industrial, landscaping and agricultural water use by at least 20% by FY20; c) Identify and implement water reuse strategies; d) Achieve objectives established by the EPA in Stormwater Guidance for Federal Facilities	General Compliance
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	Petroleum Storage Tanks: Any above ground or underground petroleum storage tanks, which may be utilized, must be installed and maintained in accordance with applicable State and federal laws and regulations. Underground storage tanks must be registered and the installation must be conducted and performed by a contractor certified to install underground storage tanks by the Land Management Administration in accordance with COMAR 26.1. 0. Contact the Oil Control Program at (41 0) 537-3442 for additional information.	General Compliance
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	Petroleum Storage Tanks: If the proposed project involves demolition- Any above ground or underground petroleum storage tanks that may be on site must have contents and tanks along with any contamination removed. Please contact the Oil Control Program at (41 0) 537-3442 for additional information.	General Compliance
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	Disposal of Solid Waste: Any solid waste including construction, demolition and land clearing debris, generated from the subject project, must be properly disposed of at a permitted solid waste acceptance facility, or recycled if possible. Contact the Solid Waste Program at (410) 537-3315 for additional information regarding solid waste activities and contact the Waste Diversion and Utilization Program at (410) 537-3314 for additional information regarding recycling activities.	General Compliance
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	Hazardous Waste Disposal: The Waste Diversion and Utilization Program should be contacted directly at (410) 537-3314 by those facilities which generate or propose to generate or handle hazardous wastes to ensure these activities are being conducted in compliance with applicable State and federal laws and regulations. The Program should also be contacted prior to construction activities to ensure that the treatment, storage or disposal of hazardous wastes and low-level radioactive wastes at the facility will be conducted in compliance with applicable State and federal laws and regulations.	General Compliance

Recommending Agency	Jurisdiction/Administering Agency	Regulation/Code/ Explanation	Action Required
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	Lead Paint Abatement: C30Any contract specifying lead paint abatement must comply with Code of Maryland Regulations (COMAR) 26.16.01- Accreditation and Training for Lead Paint Abatement Services. If a prope1iy was built before 1950 and will be used as rental housing, then compliance with COMAR 26.16.02- Reduction of Lead Risk in Housing; and Environment Article Title 6, Subtitle 8, is required. Additional guidance regarding projects where lead paint may be encountered can be obtained by contacting the Environmental Lead Division at (4 I0) 537-3825.	General Compliance
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	The proposed project may involve rehabilitation, redevelopment, revitalization, or property acquisition of commercial, industrial property. Accordingly, MDE's Brownfields Site Assessment and Voluntary Cleanup Programs (VCP) may provide valuable assistance. These programs involve environmental site assessment in accordance with accepted industry and financial institution standards for property transfer. For specific information about these programs and eligibility, please contact the Land Restoration Program at (410) 537-3437.	Information only
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	Asbestos in structure: If asbestos is present in any portion of the structure that will be renovated /demolished, then the applicant should contact the Community Environmental Services Program, Air and Radiation Management Administration at (410) 537-3215 to learn about the State's requirements for asbestos handling.	General Compliance
Maryland Department of the Environment (MDE)	Maryland Department of the Environment (MDE)	Installation of equipment producing emissions: If boilers or other equipment capable of producing emissions are installed as a result of this project, the applicant is requested to obtain a permit to construct from MDE's Air and Radiation Management Administration for this equipment, unless the applicant determines that a permit for this equipment is not required under State regulations pertaining to Permits, Approvals, and Registration (CO MAR 26. 11 .02.).	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Clean Air Act (CAA) of 1970 as amended	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Clean Water Act (CWA) of 1977 as amended	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Archaeological Resources Protection Act (ARPA) of 1979	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Endangered Species Act of 1973	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Section 5 of the National Capital Planning Act of 1952	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Resource Conservation and Recovery Act (RCRA) of 1976	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	National Energy Conservation Policy Act of 1978	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Noise Control Act of 1972	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Archaeological and Historic Preservation Act (AHPA) of 1974	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Energy Independence and Security Act of 2007	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	36 CFR Part 800 - Protection of Historic Properties	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	32 CFR Part 229 - Protection of Archaeological Resources: Uniform Regulations	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	40 CFR 6, 51, and 93 - Conformity of General Federal Actions to State or Federal Implementation Plans	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	33 CFR 320-330 - US Army Corps of Engineers	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	40 CFR Parts 300 through 3999 - Hazardous Substance Regulations	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	or Archeology and Historic Preservation	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Comprehensive Plan for the National Capital: Federal Elements	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Executive Order 11593 - Protection and Enhancement of the Cultural Environment	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	Executive Order 13508 - Strategy for Protecting a Restoring the Chesapeake Bay Watershed [Especially PART 5 – REDUCE WATER POLLUTION FROM FEDERAL LANDS AND FACILITIES - Sec. 501 and Sec. 502]	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	National Capital Planning Act. Section 8. Amendments or Modifications to Master Plans	General Compliance
National Capital Planning Commission (NCPC)	Federal Government	National Capital Planning Act. Section 9. Review and Updating of Master Plans	General Compliance
National Park Service (NPS)	Federal Government	Federal agencies are required to comply with the Energy Independence and Security Act of 2007 (EISA)	General Compliance

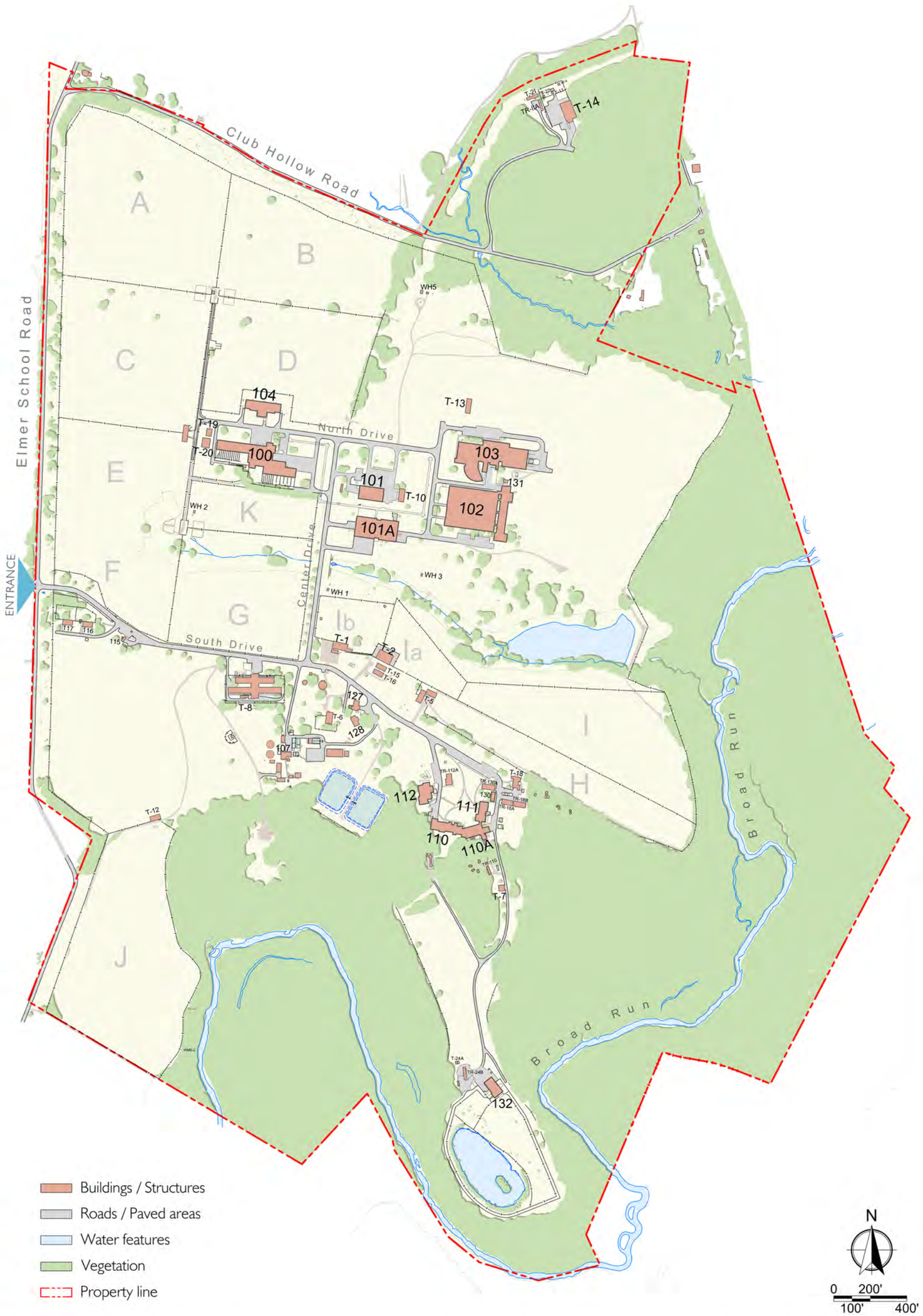
Appendix B: NIHAC Temporary Buildings

Building Photo	Building Name	Managed By	Gross Square Feet	Year Built	Physical Description	Current Uses	Issues: Operational/Functional MEP/Other
	T-1 The Barn	DVR	4,760	Pre-1960	• Standing seam metal roof • Gambrel roof on barn • Gable roof on attached structures	• Used as animal barn; • Contains pig stalls; • Houses feed storage; • Has a small office space	• Floor, feed troughs, wall covering and wooden sliding doors need replacement; nominated for AFPAB funding • Building requires routine maintenance
	T-2	DVR	4,346	Pre-1960	• Corrugated metal roof • Mostly wooden structure with some CMU walls • Asymmetrical gable roof	• Used as an animal barn; • Contains horse stalls;	• No known issues
	T-5	DVR	3,325	Pre-1960 Recent renovation	• Semi open L-shaped structure • Metal siding • Metal roof	• Used primarily for hay storage	• Recently renovated; no known issues
	T-6 Poole House	Other	1,519	Pre-1960	• Dutch hip roof with front porch • Standing seam metal roof • Light green exterior paint	• Currently not in use • Formerly residential	• Needs major renovations before it can be used • Has been considered for office use; may have code related issues for such use
	T-7	Other	822	Pre-1960	• Wooden structure • Metal Roof	• Implement storage shed	• Until recently used for storage of ground equipment • Currently not in use
	T-8	DVR	19,294	1961	• CMU walls • Gable roof	• One of the first buildings built by NIH • Currently vacant	• Not usable in its current state • Slated for demolition
	T-10	ORF	2,116	1968	• Gable roof • Overhead doors	• Serves as a garage for the Central Utility Plant	• No known issues
	T-11	DVR	89	1967	• Flat roof	• Utility Shed	• No known issues
	TR-11A	Other	719	Unknown	• Single wide trailer	• Residential	• No known issues

Building Photo	Building Name	Managed By	Gross Square Feet	Year Built	Physical Description	Current Uses	Issues: Operational/Functional MEP/Other
	T-12	DVR	1,512	1975	• Gable roof • Semi open	• Loafing shed	• No known issues
	T-13	DVR	2,151	1975	• Gable roof • Semi open	• DVR equipment shed	• No known issues
	T-14	ORS	6,162	1979	• Gable roof • Metal siding	• Warehouse	• No known issues
	T-15	DVR	1,355	1976	• Gable roof	• DVR storage	• No known issues besides routine maintenance
	T-16	DVR	1,355	1978	• Gable roof	• DVR storage	• No known issues besides routine maintenance
	TR-18A	NICHD	1,666	Unknown	• Modular construction	• Research staff Offices	• Needs extensive renovation for continued use; • Plumbing in particular needs upgrade
	TR-18B	NICHD	1,829	Unknown	• Modular construction	• Research staff offices and bench labs	• Needs extensive renovation • Plumbing needs upgrade. • Insufficient electrical power for HVAC and computers during summer season.
	T-19	ORF	1,157	1980	• Wooden frame construction • Metal roof	• Sand & salt storage	• No known issues

Building Photo	Building Name	Managed By	Gross Square Feet	Year Built	Physical Description	Current Uses	Issues: Operational/Functional MEP/Other
	WT19-WT20	DVR	2,479	Unknown	• Gable metal roof	• Storage	• No known issues
	T-20	DVR	2,199	Unknown	• Gable metal roof	• Storage	• No known issues
	T-21	Other	1,033	1967	• Single-wide trailer	• Residential	• No known issues
	T-22	DVR	97	Unknown	• Wooden storage shed	• Storage	• No known issues
	T-24A	NICHD	278	Unknown	• Wooden storage shed	• Storage	• No known issues
	TR-24B	NICHD /LCE	938	1984	• Modular construction	• Research Staff Offices	• Needs routine maintenance • Leaks found in the water pipes serving this structure
	T-25	NICHD	170	Unknown	• Wooden storage shed	• Storage	• No known issues
	T-25A	NICHD	170	Unknown	• Wooden storage shed	• Storage	• No known issues
	T-25B	NICHD	170	Unknown	• Wooden storage shed	• Storage	• No known issues

Building Photo	Building Name	Managed By	Gross Square Feet	Year Built	Physical Description	Current Uses	Issues: Operational/Functional MEP/Other
	T-25C	NICHD	170	Unknown	• Wooden storage shed	• Storage	• No known issues
	TR-110	NICHD	545	Unknown	• Single-wide trailer	• Storage	• Not in use, to be removed
	TR-112A	NIAAA	1,943	Unknown	• Modular construction	• Research Staff Offices	• Needs routine maintenance • Plumbing needs upgrade
	TR-130A	NICHD	1,958	Unknown	• Modular construction	• Office/Warehouse houses the following: two offices, break/lunch/training room, two locker rooms, laundry, disposable protective garments, and warehouse for veterinary, cleaning and office supplies	• Needs routine maintenance • Plumbing needs upgrade • Leaks in walls due to failed roof and window seals • Insufficient electrical power to run appliances


Club Hollow Road
Elmer School Road
ENTRANCE
North Drive
South Drive
Center Drive
Broad Run
Broad Run
A
B
C
D
E
F
G
H
I
J
K
Ia
Ib
100
101
101A
102
103
104
107
110
110A
111
112
127
128
131
132
T-1
T-2
T-5
T-6
T-7
T-8
T-10
T-12
T-13
T-14
T-15
T-16
T-18
T-19
T-20
WH 1
WH 2
WH 3
WH5
115
116
117
Buildings / Structures
Roads / Paved areas
Water features
Vegetation
Property line
N
0
200'
100'
400'

Facilities managed by DVR

B100	Animal Facility
B102	Animal Facility
B103	Animal Facility
B104	Animal Facility
B127	Animal Facility
B128	Animal Facility
B131	Storage Building
T1	Animal Barn
T11	Storage Shed
T12	Loafing Shed
T13	Warehouse
T15	Storage Building
T16	Storage Building
T2	Animal Barn
T20	Storage Shed
T22	Storage Building
T5	Storage Shed
T8	Abandoned-Office
W107-ST8	Storage Building
WT19-WT20	Storage Shed

Facilities managed by NICHD

TR112A	Office
B110	Office/Animal Lab
B110A	Animal Facility
B111	Office/Animal Lab
B112	Office/Animal Facility
B130	Storage Building
B132	Animal Facility
T18	Abandoned
T24A	Storage
T25, 25A-C	Storage
TR110	Abandoned-Office
TR130A	Office/Storage
TR18A	Office
TR18B	Office
TR24B	Office

Facilities managed by ORF

B101	Original CUP
B101A	CUP
B107	Wastewater Treatment Plant
T10	Garage
T14	Warehouse
T19	Storage Shed

Other facilities

B115, B115.1	Security
B116	Residential
B117	Residential
T11A	Residential
T21	Residential
T6	Residential
T7	Storage Shed


Club Hollow Road
Elmer School Road
Center Drive
South Drive
Broad Run
Broad Run
103
102
101A
107
132
T-14
A
B
C
D
E
F
G
I
L
a Entrance Security & Gateway Center
b Imaging and Diagnostics Facility
c Behavioral Research Facility
d Multi Species Animal Holding Facility
e B102 A-wing Renovation
f Breeding Colony
g B132 Addition
h Emergency Access
i Fuel Tanks
Existing Buildings to remain
New Construction / Renovation
Buildings to be demolished
N
0 200'
100' 400'

Metropolitan Architects & Planners, Inc.
Alexandria, VA

Gruzen Samton LLP
New York, NY

iDesign Solutions, LLC
Pontiac, MI

Eastern Research Group, Inc.
Chantilly, VA

RMF Engineering
Baltimore, MD

Gorove/Slade
Washington, DC

Rhodeside & Harwell, Inc.
Alexandria, VA